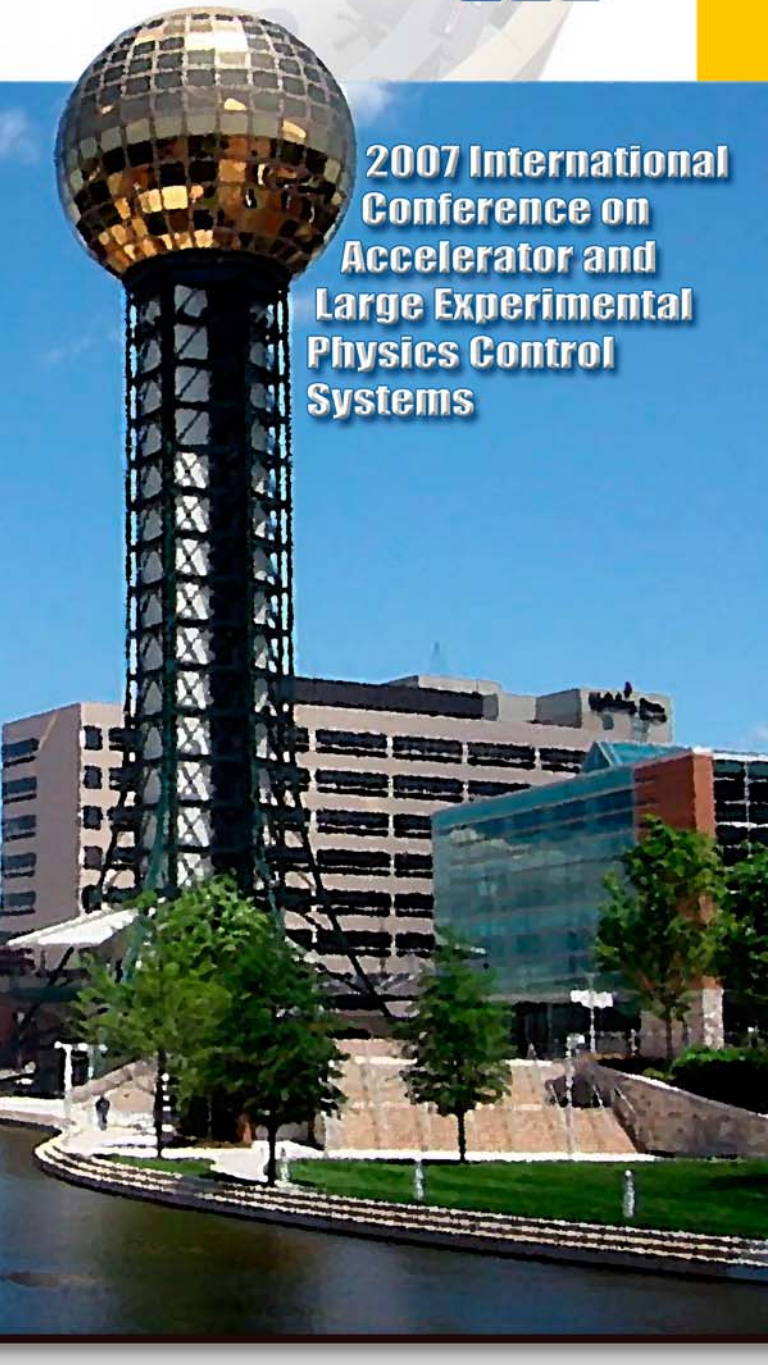
ICALEPCS '07



2007 International Conference on Accelerator and Large Experimental Physics Control Systems

October 15-19, 2007

Knoxville Convention Center
Knoxville, Tennessee, USA

neutrons.ornl.gov/icalepcs07/

Hosted by:

Oak Ridge National Laboratory/Spallation Neutron Source
managed by UT-Battelle, LLC, under
contract DE-AC05-00OR22725 for the U.S. Department of Energy

Thomas Jefferson National Accelerator Facility
managed by Jefferson Science Associates, LLC,
for the U.S. Department of Energy

Acknowledgments

The ICALEPCS07 Organizing Committee, Scientific Program Committee, and Local Organizing Committee would like to acknowledge and thank the following for their sponsorship and support:

American Physical Society
Association of Asia Pacific Physical Societies
European Physical Society
Institute of Electrical and Electronics
    Engineers, Nuclear and Plasma Science
    Society
Oak Ridge National Laboratory
    Spallation Neutron Source
Thomas Jefferson National Accelerator Facility
U.S. Department of Energy

Contents

Welcome!

On behalf of the International Organizing Committee, the Program Committee, and the Local Organizing Committee, it is my pleasure to welcome all delegates to this, the eleventh in the series of ICALEPCS conferences. Judging by the number and range of abstracts submitted, we can expect an exciting week. Technology develops faster in our field than in most others, and the role of control systems in an ever-expanding range of large experimental physics applications is even more critical to their success. We will be hearing about a lot of these developments and applications in the week ahead. I hope many of you will come to Oak Ridge National Laboratory on Saturday to visit the completed Spallation Neutron Source, as well as "Jaguar"—the world's second fastest computer (and fastest available for open science applications).

At the same time it is my personal pleasure as someone "not from around here" to welcome you to East Tennessee, a land of ancient hills and extensive waterways—lakes, rivers, and white water—and of friendly people, great cooking, the famous southern drawl, and bluegrass music. I hope some of you will take time to visit the region, admire the fall colors, and learn why so many who come here remain for a lifetime.

Thanks to everyone who has worked so hard on the organization of this conference. It is now up to you the delegates to make it a success by taking this biennial opportunity to share ideas with an international community, renew acquaintances, initiate collaborations, and foster the continued exciting growth of our field.

Enjoy!

Dave Gurd, ORNL/SNS
ICALEPCS 2007 Conference Chair

Key Contacts

Dave Gurd (ORNL/SNS), Conference & Local Organizing Committee Chair
Karen White (JLab), Program Chair
Lori Lane (ORNL/SNS), Conference Coordinator

Local Organizing Committee

Dave Gurd, Chair
Lori Lane, Conference Coordinator
Angie Beach, Conference Services
Bill DeVan, Posters
Lorie Hickey, Treasurer
Charlie Horak, Publications, Proceedings, and Web Services
Muriel Johnson, Conference Administrator
Lori Love, Registration
Bridgitte Mase, Information Technology
Jeff Patton, Database Administrator
Herb Strong, Industrial Exhibits
Paul Wright, Tours

International Organizing Committee

D. Gurd, ORNL/SNS, Chair
R. Baer, GSI
G. Bassato, LNL
E. Bjorklund, LANL
D. Bulfone, ELETTRA
M. Clausen, DESY
S. Dasgupta, VECC
K. Gillies, Gemini
A. Gotz, ESRF
J. Gournay, CEA
N. Kanaya, University of Ibaraki
I. Ko POSTECH
I. Kohler, NAC-TLABS
K. Kurihara, JAEA
S. Lackey, FNAL
E. Lecorché, GANIL
J. Lister, EPFL-CRPP
S. Liu, Shanghai Light Source

J. MacLean, ANL
M. Mouat, TRIUMF
R. Müller, BESSY
J. Navratil, CTU
G. Neu, IPP
N. Nguyen, NRC
R. Patil, BARC
J. Piton, LNLS
R. Pose, JINR
G. Raffi, ESO
F. Saint-Laurent, Tore Supra
W. Salter, CERN
H. Schmickler, CERN
V. Schmidt, IGI
M. Serio, LNF
H. Shoaee, SLAC
J. Skelly, BNL
R. Tanaka, SPring-8
P. Van Arsdall, LLNL/NIF
D. Vermeulen, PSI
N. Yamamoto, KEK/JParc
J. Zhao, IHEP

Program Committee

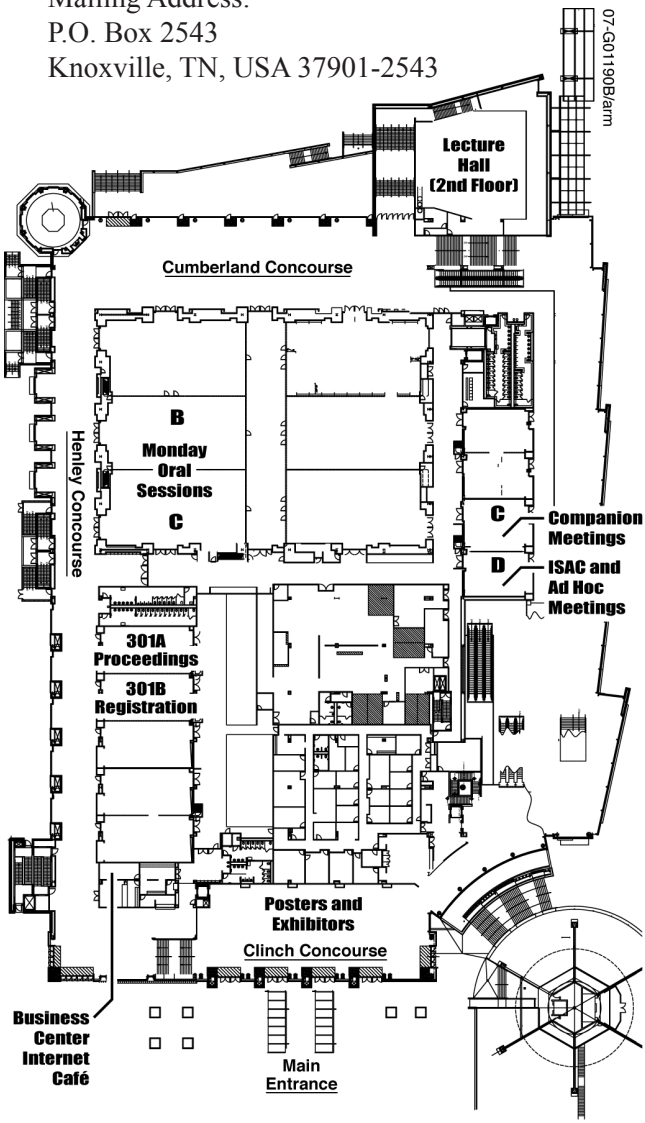
K. White, JLab, Chair
M. Bickley, JLab
E. Bjorklund, LANL
D. Bulfone, ELETTRA
M. Clausen, DESY
J. Galambos, ORNL/SNS
A. Gotz, ESRF
D. Gurd, ORNL/SNS
M. Heron, Diamond
L. Hoff, BNL
I. Ko, POSTECH
S. Lackey, FNAL
S. Lueders, CERN
J. Maclean, ANL
A. Mezger, PSI
M. Mouat, TRIUMF
R. Müller, BESSY
G. Raffi, ESO
Y. Roblin, JLab

W. Salter, CERN
C. Saunders, ANL
H. Schmickler, CERN
J. Skelly, BNL
T. Straumann, SLAC
R. Tanaka, SPring-8
N. Yamamoto, KEK
J. Zhao, IHEP

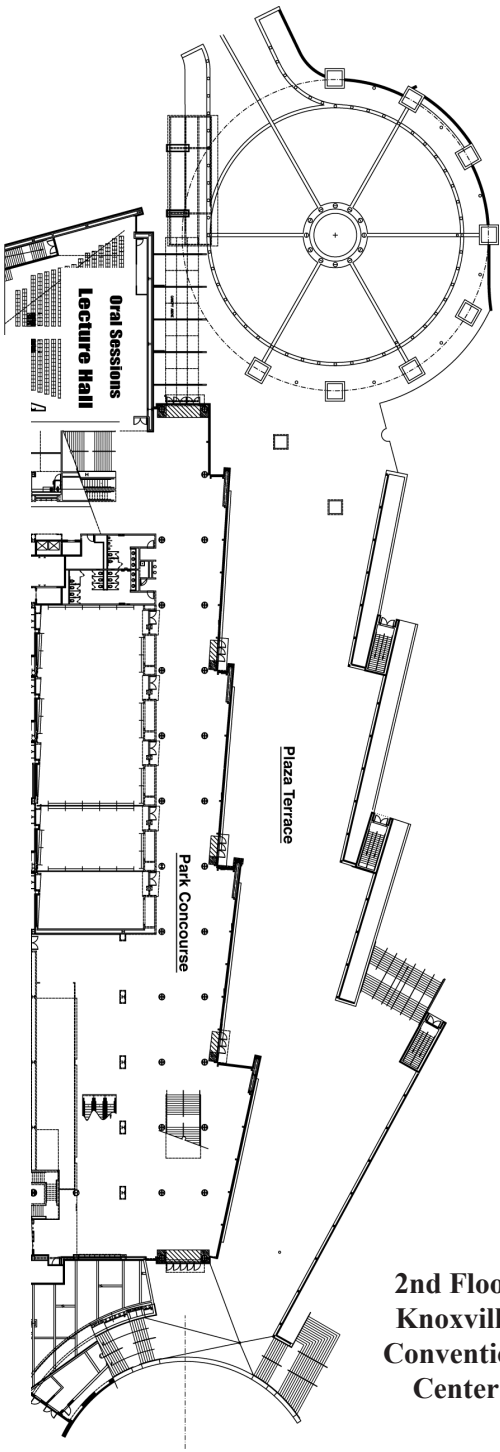
Venue

Knoxville Convention Center (KCC)
www.kccsmg.com
701 Henley Street
Knoxville, TN, USA 37902
Phone: 865.KCC-KNOX (522.5669)
Fax: 865.329.0422

Mailing Address:
P.O. Box 2543
Knoxville, TN, USA 37901-2543



3rd Floor Knoxville Convention Center



2nd Floor Knoxville Convention Center

Transportation During the Conference

The Knoxville Trolley Service will provide free transportation to and from downtown hotels, restaurants, and the KCC. A schedule is provided in your conference bag. More details and schedules are available online at www.ci.knoxville.tn.us/kat/web%20pages/Trolley/Trolley_Map.asp.

In addition, public buses run in the downtown and surrounding areas. For more information see www.ci.knoxville.tn.us/kat/web%20pages/home.asp. Limited taxi service is also available in the downtown area.

Registration

On Sunday, registration will be in the Crowne Plaza Hotel lobby. Starting on Monday, registration will be located in Room 301B of the KCC. Hours are:

Sunday	4:30 p.m. - 7:30 p.m.
Monday	8:00 a.m. - 5:00 p.m.
Tuesday	8:00 a.m. - 5:00 p.m.
Wednesday	8:00 a.m. - 5:00 p.m.
Thursday	8:00 a.m. - 5:00 p.m.

A message board is located near the registration desk.

Your registration fee includes attendance at all technical sessions of the conference, the conference guidebook, and one copy of the proceedings on CD-ROM. Registration also includes the welcome reception, coffee breaks, continental breakfasts, and Wednesday banquet. All receptions and the conference banquet are being sponsored by nonfederal sources.

The fee for registration after August 15 is $650 U.S. dollars. For participants whose registration fees have not been paid in full, payment may be made at the registration desk by credit card,

check, or cash. Students and retirees can register for $50.

Attendees are required to wear their badges at all ICALEPCS07 events.

Internet Café

For those without their own laptops, a small e-mail room is located in the Business Center on the 3rd floor. It contains laptops, a black and white printer, and wireless access. Hours are:

Monday	8:00 a.m. - 6:00 p.m.
Tuesday	8:00 a.m. - 6:00 p.m.
Wednesday	8:00 a.m. - 6:00 p.m.
Thursday	8:00 a.m. - 6:00 p.m.
Friday	8:00 a.m. - 1:00 p.m.

In addition, free wireless access is available throughout the KCC and the Crowne Plaza Hotel.

The Internet Café also includes an area where speakers can preview/test their presentations. Please note that all speakers must give their presentations with the computer systems set up in Ballrooms B and C and the Lecture Hall. Use of individual laptops cannot be accommodated.

Proceedings Office

The Proceedings Office is located in Room 301A. Editorial staff will process papers before and during the conference.

The paper submission deadline was Monday, October 8. Authors are requested to come by the Proceedings Office to check on their papers via the electronic status board that will be located outside the Proceedings Office. Authors are also requested to bring a hard copy of their paper to the Proceedings Office upon arrival at the conference.

Proceedings Office hours:

Monday	8:00 a.m. - 6:00 p.m.
Tuesday	8:00 a.m. - 6:00 p.m.
Wednesday	8:00 a.m. - 6:00 p.m.
Thursday	8:00 a.m. - 6:00 p.m.
Friday	8:00 a.m. - 12:00 p.m.

The conference proceedings will be published on CD-ROM and on the Joint Accelerator Conferences Web Site (JACoW): accelconf.web.cern.ch/accelconf/.

Industrial Exhibitors and Sponsors

Set up for industrial exhibits begins at 8:00 a.m., Monday, October 15.

Exhibitors and sponsors registered at press time

CAEN Technologies, Inc.
Cosylab
Creative Electronic Systems
Holman's and Hewlett-Packard
HYTEC, Inc.
Instrumentation Technologies
National Instruments
Tektronix, Inc.
WAGO Corp.
ZTEC, Inc.

Security and Insurance

Participants are asked not to leave their belongings unattended and to wear their conference badges at all ICALEPCS07 events. The conference organizers cannot accept liability for personal injuries sustained or for loss or damage to participants' (or companions') personal property during the conference.

Special Events

Sunday Welcome Reception

A welcome reception will be held at the Crowne Plaza Hotel from 6:30 to 8:30 p.m. All registrants are invited to attend.

Wednesday Banquet

The conference banquet will be at 6:30 p.m. at The Foundry (two blocks from the KCC).

Dinner will be accompanied by local bluegrass music. After dinner, Alex Zucker will speak on "The Evolution of Large Research Machines at ORNL."

Companion Programs

Information about places of interest in the community are available on the conference venue page at neutrons.ornl.gov/conf/icalepcs07/venue.shtml.

In addition, an informal meeting for companions will be held every morning in Room 300C from 8:30 to 10:00 a.m. Coffee will be available.

Just a few of the activities in the area during ICALEPCS07 week (*within walking distance):

*Every night but Tuesday
Barley's Tap Room and Pizzeria
Live music

October 12, 8:00 p.m.
Dismembered Tennesseans (Dave's favorite)
Laurel Theater
Bluegrass

*October 15, 17, 12:00 noon
Blue Plate Special
301 Gay Street
Live music

October 17, 18, 19, 20
Major Barbara
By George Bernard Shaw
Clarence Brown Theater

*October 17, 7:30 p.m.
Guster
Bijou Theater
Pop music trio, humor

*October 18, 19, 8:00 p.m.
Knoxville Symphony Orchestra
Tennessee Theater
Wagner, Strauss, Schubert

*October 18, dusk
"To Kill A Mockingbird" (1962)
Free movies on Market Square
Preshow entertainment at 6:00

*October 19, 8:00 p.m.
Henry Cho
Bijou Theater
Standup comedy

*October 19, 5:30 p.m.
Slow Blind Hill
Knoxville Museum of Art
(Jazz—CD release party)

October 19
Ice Bears vs Winston-Salem
Civic Coliseum
Ice hockey

October 20
Clyde Davenport
Laurel Theater
Bluegrass

*October 21, 8:00 p.m.
Belly Dance Superstars
Bijou Theater

Scientific Program

The schedule included herein details the scientific program with the program code, title, and authors of each paper (only publicly available information will be discussed). Full texts of the abstracts are included here.

Oral Sessions

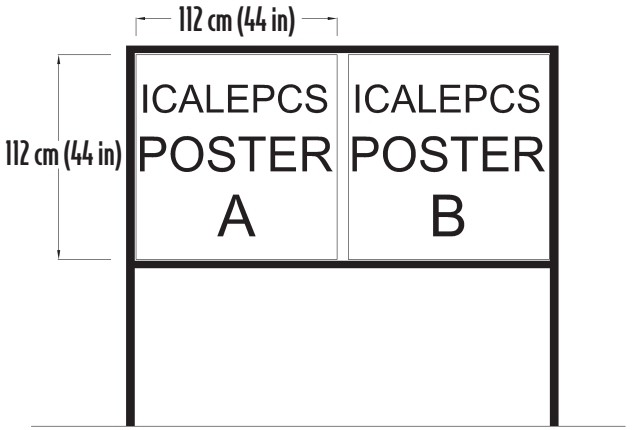
Monday oral presentations will be in Ballrooms B and C on the 3rd floor. Tuesday through Friday sessions will be in the 2nd floor Lecture Hall. A preview/testing area is available for speakers in the Internet Café (Business Center, 3rd floor). *Please note that all speakers must give their presentations from the computer systems set up in Ballrooms B and C and the Lecture Hall. Use of individual laptops cannot be accommodated.*

Poster Sessions

All poster sessions will be in the Clinch Concourse.

Because of space constraints, posters will be displayed two per board, one on the "A" side and one on the "B" side (see illustration on next page). The usable area on each half of the poster board is 112 x 112 cm (roughly 44 x 44 inches). An ANSI E-size (44 x 34 inches) poster will fit in this space. An ISO A1-size (84.1 x 59.4 cm) poster will also fit but will not fully use the available space.

To minimize congestion in the poster area, authors for posters assigned to the "A" side of a poster board are asked to stand by their poster for the first 45 minutes of the session. Authors for posters assigned to the "B" side will then man their posters for the second 45 minutes of the session. Your poster/paper number indicates whether you're assigned to the "A" (TPPA, WPPA, RPPA) or "B" (TPPB, WPPB, RPPB) half of the session.



Poster board layout and size allowances.

So that posters can be viewed throughout the day, authors are encouraged to mount their posters before the morning plenary session and to leave them up until after the final session of the day. Posters must be removed after the final session to avoid being discarded. Push pins will be available for mounting posters.

Authors are reminded that no contributions are accepted for publication only. Any paper accepted for presentation that is not presented at the conference will be excluded from the proceedings.

The Scientific Program Committee reserves the right to refuse papers for publication that have not been properly presented or staffed in the poster sessions. Manuscripts of contributions to the proceedings (or enlargements of them) are not considered to be posters, and papers presented in this way will not be accepted for publication.

Prizes (with a Tennessee flavor) will be awarded to the best posters.

Identification of Contributions

The date, presentation type, time of day, and sequence for each contribution in the program can be easily identified from the program code, which is composed as follows:

- The first letter indicates the day: M, T, W, R, F.
- The second letter indicates presentation type: O for oral, P for poster.
- The third letter indicates time of day: A for a.m., P for p.m.
- For oral presentations, the fourth letter indicates the chronological order of the sessions. For poster sessions, "A" indicates presentation during the first half of the session, and "B" indicates presentation during the second half.

Summary Schedule

	Saturday	Sunday	Monday	Tuesday
8:00			Registration	Poster Preview: Breakfast Provided
8:30		Breakfast	Breakfast	Special Invited
9:00	Satellite Meetings: EPICS (Crowne Plaza)	Satellite Meetings: EPICS TANGO Cyber-Security (Crowne Plaza)	Welcome	Status Reports
9:30			Special Invited	
10:20				Coffee
10:30			Coffee	
10:50				Status Reports
11:00			Status Reports	
12:30			Lunch	Lunch
2:00			Major Challenges	Data & Info. Mgmt
3:10			Coffee	Coffee & Poster Session
3:40			Software Technology	
4:30		Registration (Crowne Plaza)		
4:40				Control System Evolution
6:30-9:30		Welcome Reception		

	Wednesday	Thursday	Friday	Saturday
8:00	Poster Preview: Breakfast Provided	Poster Preview: Breakfast Provided	Breakfast	
8:30	Special Invited	Special Invited	Special Invited	
9:00	Integration of Industrial Systems	Process Tuning, Modeling, Automation, & Synchronization	Hardware Technology	ORNL Tour
9:50			Coffee	
10:20			Hardware Technology	
10:30	Coffee	Coffee		
11:00	Operational Tools	Eng. Processes, Project Management and Collaboration		
11:20			Lunch & Round Table Discussion	
12:30	Lunch			
12:40		Lunch		
12:50			Control System Evolution	
2:00	Software Technology	Data & Information Management		
2:50			Coffee	
3:10		Coffee & Poster Session		
3:20			Closing Remarks	
3:50	Coffee & Poster Session			
4:40		Operational Tools		
6:30	Banquet			

Monday, October 15

9:00-10:30 Oral Session MOAA

Special Invited
Chairs: David Gurd and Karen White
Ballrooms B and C

9:00 Welcome and Opening Remarks
9:30 Accelerators: The Final Frontier?
Ken Peach
10:00 It's All About Time: Applying Patterns of Time Using Time Elements
James Truchard

10:30-11:00 Coffee Break

11:00-12:30 Oral Session MOAB

Status Reports
Chairs: Mike Mouat and Daniele Bulfone
Ballrooms B and C

11:00 The Status of the LHC Controls System Shortly Before Injection of Beam
Pierre Charrue
11:30 Status Report of the LMJ (Laser Megajoule) Control System
Jean Paul Arnoul
12:00 Trends in Software for Large Astronomy Projects
Gianluca Chiozzi

12:30-2:00 Lunch Break

2:00-3:10 Oral Session MOPA

Major Challenges
Chairs: Sharon Lackey and Stefan Lueders
Ballrooms B and C

2:00 Summary of the Control System Cyber-Security (CS)2/HEP Workshop
Stefan Lueders
2:30 LHC@FNAL – A New Remote Operations Center at Fermilab
James Patrick
2:50 Machine Protection and Advanced Plasma Control in TORE SUPRA Tokamak
Francois Saint-Laurent

3:10-3:40 Coffee Break

3:40-5:30 Oral Session MOPB

Software Technology
Chairs: Matthias Clausen and Joe Skelly
Ballrooms B and C

3:40 Grid and Component Technologies in Physics Applications
Svetlana Shasharina
4:10 XAL Status
Thomas Pelaia
4:30 Control System Studio (CSS)
Jan Hatje
4:50 Remote Operations of an Accelerator Using the Grid
Milan Prica
5:10 "jddd": A Java DOOCS Data Display for the XFEL
Elke Sombrowski

Tuesday, October 16

8:30-10:30 Oral Session TOAA

Special Invited; Status Reports
Chairs: Daniele Bulfone and In Soo Ko
Lecture Hall

8:30 Spirit and Opportunity: The Great Surface Exploration of Mars Keeps Going
John Callas

9:00 Status of the Control System for HICAT at an Advanced Stage of Commissioning: Functions, Restrictions, and Experiences
Tibor Fleck

9:20 Status of the X-Ray FEL Control System at SPring-8
Toru Fukui

9:40 Status of the FLASH Free Electron Laser Control System
Kay Rehlich

10:00 Implementation, Commissioning, and Current Status of the Diamond Light Source Control System
Mark Heron

10:20-10:50 Coffee Break

10:50-12:30 Oral Session TOAB

Status Reports
Chairs: In Soo Ko and Mike Mouat
Lecture Hall

10:50 The New FAIR Accelerator Complex at GSI: Project, Controls Challenges, and First Steps
Ralph C. Baer

11:10 Current Status of the Control System for J-PARC Accelerator Complex
Hiroshi Yoshikawa

11:30 ALICE Controls System – Ready for LHC Operation
Lennart Stig Jirden
11:50 The LIGO Detectors Controls
Daniel Sigg
12:10 The Status of Virgo
Franco Carbognani

12:30-2:00 Lunch Break

2:00-3:10 Oral Session TOPA

Data and Information Management
Chairs: Noboru Yamamoto and Andy Gotz
Lecture Hall

2:00 Data Management at JET with a Look Forward to ITER
Jonathan William Farthing
2:30 Information and Data Management Systems for Indus-2
Pravin Fatnani
2:50 The IRMIS Universal Component-Type Model
Donald Dohan

3:10-4:40 Coffee and Poster Sessions

3:10-3:55 Tuesday Poster Session TPPA

Software Technology
Clinch Concourse

3:55-4:40 Tuesday Poster Session TPPB

Integration of Industrial Systems; Status Reports
Clinch Concourse

4:40-6:00 Oral Session TOPB

Control System Evolution
Chairs: Eric Bjorklund and Jiju Zhao
Lecture Hall

4:40 Upgrade Program of the PSI High Intensity Cyclotron
Timo Korhonen

5:00 Improvement of Tore Supra Real Time Processing Capability Using Remote PCs
Philippe Moreau

5:20 The Evolution of the ELETTRA Control System
Claudio Scafuri

5:40 Control System of the KEKB Accelerator Complex
Kazuro Furukawa

Wednesday, October 17

8:30-10:30 Oral Session WOAA

Special Invited; Integration of Industrial Systems
Chairs: Wayne Salter and Mark Heron
Lecture Hall

8:30 The ILC Control System
John Carwardine
9:00 Outsourcing, Insourcing, and Integration of Control Systems in the Australian Synchrotron
Richard Farnsworth
9:30 LHC Cryogenics Control System: Integration of the Industrial Controls (UNICOS) and Front-End Software Architecture (FESA) Applications
Enrique Blanco
9:50 Vista Controls' Vsystem at the ISIS Pulsed Neutron Source
Bob Mannix
10:10 Stepper Motor Control, PLC vs VME
William Strong

10:30-11:00 Coffee Break

11:00-12:30 Oral Session WOAB

Operational Tools
Chairs: Matthew Bickley and Roland Müller
Lecture Hall

11:00 Operational Tools at the Stanford Linear Accelerator Center
Greg White
11:30 CAD Model and Visual Assisted Control System for NIF Target Area Positioners
Ephraim Tekle

11:50 Development of Accelerator Management Systems with GIS
Akihiro Yamashita
12:10 Web-Based Electronic Operation Log System – Zlog System
Kenzi Yoshii

12:30-2:00 Lunch Break

2:00-3:50 Oral Session WOPA

Software Technology
Chairs: Joe Skelly and Claude Saunders
Lecture Hall

2:00 Future of CORBA in Distributed Real-Time and Embedded Systems
Douglas Craig Schmidt
2:30 JavaIOC - A Java EPICS Input/Output Controller
Martin Richard Kraimer
2:50 LHC Software Architecture [LSA] – Evolution Toward LHC Beam Commissioning
Grzegorz Kruk
3:10 Front-End Software Architecture
Michel Arruat
3:30 Evolution of Visual DCT
Jaka Bobnar

3:50-4:35 Wednesday Poster Session WPPA

Control System Evolution
Clinch Concourse

4:35-5:20 Wednesday Poster Session WPPB

Hardware Technology; Major Challenges
Clinch Concourse

6:30 Conference Banquet: The Foundry

Alex Zucker will speak on "The Evolution of Large Research Machines at ORNL."

Thursday, October 18

8:30-10:30 Oral Session ROAA

Special Invited; Process Tuning, Modeling, Automation, and Synchronization
Chairs: Yves Roblin and John Galambos
Lecture Hall

8:30 Status of the ITER CODAC Conceptual Design
Jo Lister
9:00 Automatic Alignment System for the National Ignition Facility
Karl Child Wilhelmsen
9:30 Injection, Ramping, and Extraction Timing for the Duke Booster
Steven M. Hartman
9:50 XAL Online Model Enhancements for J-PARC Commissioning and Operation
Christopher K. Allen
10:10 An Approach to Stabilizing Large Telescopes for Stellar Interferometry
Nicola Di Lieto

10:30-11:00 Coffee Break

11:00-12:40 Oral Session ROAB

Engineering Processes; Project Management and Collaboration
Chairs: John Maclean and Gianni Raffi
Lecture Hall

11:00 Software Engineering Processes Used to Develop the National Ignition Facility Integrated Computer Control System
Arthur Peter Ludwigsen
11:30 Software Development and Testing: Approach and Challenges in a Distributed HEP Collaboration
Doris Burckhart-Chromek

12:00 Software Integration and Test Techniques in a Large Distributed Project: Evolution, Process Improvement, Results
Paola Sivera

12:20 Experience of Developing BEPCII Control System
Jijiu Zhao

12:40-2:00 Lunch Break

2:00-3:10 Oral Session ROPA

Data and Information Management
Chairs: Andy Gotz and Noboru Yamamoto
Lecture Hall

2:00 Lessons Learned from the SNS Relational Database
John David Purcell

2:30 The High-Performance Database Archiver for the LHC Experiments
Manuel Gonzalez-Berges

2:50 ANTARES Slow Control Status
Jean-Michel Gallone

3:10-3:55 Thursday Poster Session RPPA

Process Tuning, Modeling, Automation, and Synchronization; Data and Information Management
Clinch Concourse

3:55-4:40 Thursday Poster Session RPPB

Engineering Processes, Project Management Collaboration; Operational Tools
Clinch Concourse

4:40-6:10 Oral Session ROPB

Operational Tools

Chairs: Roland Müller and Anton Mezger

Lecture Hall

4:40 Using Sequencing to Improve Operational Efficiency and Reliability
Ted D'Ottavio

5:10 Control System Studio Applications
Kay-Uwe Kasemir

5:30 Drag and Drop Display & Builder
Timofei Borisovich Bolshakov

5:50 Beam Commissioning Software and Database for J-PARC LINAC
Hiroyuki Sako

Friday, October 19

8:30-9:50 Oral Session FOAA

Special Invited; Hardware Technology
Chairs: Ryotaro Tanaka and Till Straumann
Lecture Hall

8:30 A Review of Automated Diagnosis Techniques and the Hybrid Diagnosis Engine (HyDE)
Sriram Narasimhan

9:00 Timing and LLRF System of Japanese X-FEL to Realize a Few Tenths of Femto-Seconds' Stability
Yuji Otake

9:30 The CERN LHC Central Timing, a Vertical Slice
Julian Howard Lewis

9:50-10:20 Coffee Break

10:20-11:20 Oral Session FOAB

Hardware Technology
Chairs: Till Straumann and Ryotaro Tanaka
Lecture Hall

10:20 Imaging System Integration at the SNS
Thomas Shea

10:40 Digital Phase Control System for SSRF Linac
Chongxian Yin

11:00 Ethernet-Based Embedded IOC for FEL Control Systems
Jianxun Yan

11:20-12:50 Lunch and Round Table Discussion: Controls Failure Modes

Moderators: Claude Saunders and Larry Hoff

12:50-2:50 Oral Session FOPA

Control System Evolution
Chairs: Jijiu Zhao and Eric Bjorklund
Lecture Hall

12:50 The Future of TANGO
Andrew Gotz
1:20 EPICS – Future Plans
Matthias R. Clausen
1:50 The TINE Control System, Overview and Status
Philip Duval
2:10 Elements of Control System Longevity
Stephen Lewis
2:30 EPICS to TANGO Translator
Rok Sabjan

2:50-3:20 Coffee Break

3:20 Oral Session FOPB

Closing Remarks
Announcements Regarding
ICALEPCS 2009 and 2011
Chairs: Dave Gurd and Karen White
Lecture Hall

Saturday, October 20

9:00 Tour of ORNL and SNS

Monday Oral Session, MOAA
Ballrooms B and C, 9:00 a.m.
Session Chair: David Gurd, ORNL/SNS
Karen White, JLab

9:00 **Welcome and Announcements**

9:30 **MOAA01 – Accelerators: The Final Frontier?**
Ken Peach (JAI, Oxford)
Particle accelerators at the high-energy frontier are essential to the exploration of the deep structure of the material universe around us. The new technologies required to achieve the highest energies also find application in other fields of science. The lecture will discuss the scientific motivation for the development of these new accelerator technologies and the applications that might result.

10:00 **MOAA02 – It's All About Time: Applying Patterns of Time Using Time Elements**
James Truchard (National Instruments Switzerland, Ennetbaden), Hall Talmadge Martin (New Affiliation Request Pending)
Diverse control and measurement applications from mobile-phone testing to process optimization to distributed sonic arrays all use one of a small set of common patterns of time. By understanding these patterns of time, the underlying time elements, and the application of time technologies, engineers and scientists can develop more precise, flexible systems with less effort and time. Time is a critical component in many control and measurement systems, yet the challenges presented by most development tools and integration options make it difficult to incorporate timing.

Monday Oral Session, MOAB
Ballrooms B and C, 11:00 a.m.
Session Chairs: Mike Mouat, TRIUMF
Daniele Bulfone, ELETTRA

11:00 **MOAB01 – The Status of the LHC Controls System Shortly Before Injection of Beam**
Pierre Charrue (CERN, Geneva)
At the time of the ICALEPCS 2007 conference, the LHC main accelerator will be close to its final state of installation, and major components will have passed the so-called "hardware commissioning." In this paper the requirements and the main components of the LHC control system will be described very briefly. Out of its classical 3-tier architecture, those solutions will be presented, which correspond to major development work done here at CERN. Focus will be given to the present status of these developments and to lessons learned in the past months.

11:30 **MOAB02 – Status Report of the LMJ (Laser Megajoule) Control System**
Patrick Betremieux, Jean Paul Arnoul, Jean Jacques Dupas (CEA, Bruyères-le-Châtel), Franck Pierre Signol (CESTA, Le Barp)
The French Commissariat à l'Énergie Atomique (CEA) is currently building the Laser MegaJoule (LMJ), a 240-beam laser facility, at the CEA Laboratory CESTA near Bordeaux. LMJ will be a cornerstone of CEA's "Programme Simulation," the French Stockpile Stewardship Program. LMJ is designed to deliver about 2 MJ of 0.35 μm light to targets for high energy density physics experiments, including fusion experiments. LMJ technological choices were validated with the Ligne d'Intégration Laser (LIL), a scale 1 prototype of one LMJ bundle, built at CEA/CESTA. Plasma experiments started at the end of 2004 on LIL. The construc-

tion of the LMJ building itself started in March 2003. An important milestone was successfully achieved in November 2006 with the introduction of the target chamber into the building. LMJ will be gradually commissioned from 2011 and will then begin an experimental program toward fusion. The presentation discusses LIL experience feedback, transverse requirements intended to ultimately federate control packages from different contractors, strategy for developing the Centralized Supervisory Controls, and process for computer control system global integration.

12:00 **MOAB03 – Trends in Software for Large Astronomy Projects**
Gianluca Chiozzi, Anders Wallander (ESO, Garching bei Muenchen), David Silva (AURA/ Thirty Meter Telescope, Pasadena/CA), Bret Goodrich, Steve Wampler (Advanced Technology Solar Telescope, Tucson), Kim Gillies (Gemini Observatory, Tucson, AZ), German Schumacher (National Optical Astronomy Observatories, La Serena, Chile), Jimmy Johnson, Kevin McCann (W.M. Keck Observatory, Kamuela)
The current 8-10M ground-based telescopes require complex real-time control systems that are large, distributed, fault-tolerant, integrated, and heterogeneous. New challenges are on the horizon with new instruments, AO, laser guide stars, and the next generation of even larger telescopes. These projects are characterized by increasing complexity, where requirements cannot be met in isolation due to the high coupling between the components in the control and acquisition chain. Additionally, the high cost for the observing time imposes very challenging requirements in terms of system reliability and observing efficiency. The challenges presented by the next generation of telescopes go beyond a matter of scale and may even require a change in paradigm. Although our focus is on control systems, it is essential to keep in mind that this is just one of the several subsystems integrated

in the whole observatory end-to-end operation. In this paper we show how the astronomical community is responding to these challenges in the software arena. We analyze the evolution in control system architecture and software infrastructure, looking into the future for these two generations of projects.

Monday Oral Session, MOPA
Ballrooms B and C, 2:00 p.m.
Session Chairs: Sharon Lackey, FermiLab
Stefan Lueders, CERN

2:00 **MOPA01 – Summary of the Control System Cyber-Security (CS)2/HEP Workshop**
Stefan Lueders (CERN, Geneva)
Over the last few years, modern accelerator and experiment control systems are based more and more on common-off-the-shelf products (VME crates, PLCs, SCADA, etc.), on Windows or Linux PCs, and on communication infrastructures using Ethernet and TCP/IP. Despite the benefits coming with this (r)evolution, new vulnerabilities are inherited, too: Worms and viruses spread within seconds via the Ethernet cable, and attackers are becoming interested in control systems. Unfortunately, control PCs cannot be patched as fast as office PCs. Even worse, vulnerability scans at CERN using standard IT tools have shown that commercial automation systems lack fundamental security precautions: Some systems crashed during the scan, others could easily be stopped or their process data be altered. The (CS)2/HEP workshop to be held the weekend before ICALEPCS'07 is intended to present, share, and discuss countermeasures deployed in HEP laboratories in order to secure control systems. This presentation will give a summary overview of the solution planned, deployed and the experience gained.

2:30 **MOPA02 – LHC@FNAL – A New Remote Operations Center at Fermilab**
Elvin Robert Harms, Erik Gottschalk, Suzanne Renee Gysin, Kaori Maeshima, Patricia McBride, Elliott McCrory, Anna Jean Slaughter (Fermilab, Batavia, Illinois)
Commissioning the LHC accelerator and experiments will be a vital part of the worldwide high-energy physics program beginning in 2007. A remote operations center, LHC@FNAL, has been built at Fermilab to make it easier for accelerator scientists and experimentalists working in North America to help commission and participate in operations of the LHC and experiments. We report on the evolution of this center from concept through construction and early use. We also present details of its controls system, management, and expected future use.

Operated by Fermi Research Alliance, LLC, under Contract No. DE-AC02-07CH11359 with the United States Department of Energy.

2:50 **MOPA03 – Machine Protection and Advanced Plasma Control in TORE SUPRA Tokamak**
Francois Saint-Laurent, Sylvain Bremond, Jerome Bucalossi, Gilles Martin, Philippe Moreau (EURATOM-CEA, St Paul Lez Durance)
A tokamak is a complex device combining many sub-systems. All of them must have high reliability and robustness to operate together. A subsystem includes its own safety protections and a more integrated level of protection to ensure the safety of the full device. Moreover, plasma operation with several megawatts of additional injected power requires a highly reliable and performing control because uncontrolled plasma displacements and off-normal events could seriously damage the in-vessel components. Such an integrated control system is installed on Tore Supra. It can develop an alternative plasma op-

eration strategy when margins to technological sub-system limits become too small. The control switches to more and more degraded modes, from the nominal one to a fast plasma shutdown. When sub-system limits are nearly reached, the system tries to balance the loads over less solicited parts. Then a modification of the plasma parameters is performed to preserve the plasma discharge in a degraded mode. The third step is a soft and controlled plasma shutdown, including a stopping of additional heating systems. When loads are closed to be uncontrolled, a fast plasma shutdown is initiated.

Monday Oral Session, MOPB
Ballrooms B and C, 3:40 p.m.
Session Chairs: Matthias R. Clausen, DESY
Joe Skelly, BNL

3:40 **MOPB01 – Grid and Component Technologies in Physics Applications**
Svetlana Shasharina (Tech-X, Boulder, Colorado)
Physics experiments and simulations grow in size and complexity. Examples are the existing HEP/NP experiments and upcoming challenges of SNS, LHC, ILC, and ITER. Managing the experimental data is an extremely complex activity. Physics simulations now attempt full modeling of various phenomena and whole experimental devices, such as in fusion integrated and space weather modeling. Recent advances in computer science, such as Grids and Components, address the challenges faced by applications. In science, Globus and Common Component Architecture (CCA) became commonly used tools for these technologies. Globus allows creating a grid—computers trusting each other and a group of users who can then submit jobs and move data. CCA expresses connectivity of the simulations elements in dif-

ferent languages as "components," objects with in and out "ports." CCA "frameworks" combine components into simulation and can swap components sharing ports. CCA accommodates high-performance and distributed applications. We will present our work with Globus and CCA in HEP/NP and fusion, share the lessons learned, and evaluate the ease of using these technologies and the value added.

4:10 **MOPB02 – XAL Status**
Thomas Pelaia, Sarah M. Cousineau, John Galambos, Jeffrey Alan Holmes, Andrei P. Shishlo, Yan Zhang (ORNL, Oak Ridge, Tennessee), Christopher K. Allen (LANL, Los Alamos, New Mexico), Alexander P. Zhukov (RAS/INR, Moscow), Chungming Paul Chu (SLAC, Menlo Park, California)
XAL is a Java framework for developing accelerator physics applications for the commissioning and operation of the Spallation Neutron Source. It was designed to be extensible and has evolved to support ongoing accelerator operations. In particular, the on-line model and applications have been extended to support the Ring. Core XAL design features eased the extension from Linac to Ring support and in some cases made it transparent. We discuss the recent advances and future directions in XAL and the current efforts to open the project to broader collaboration.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

4:30 **MOPB03 – Control System Studio (CSS)**
Jan Hatje, Matthias R. Clausen, Christian Gerke (DESY, Hamburg)
Most applications for the control system EPICS are developed for UNIX and X-Windows. They are independent from each other, have a different look and feel, and it is difficult to exchange data.

To solve these problems the Control System Studio (CSS) is under development. CSS is a common platform for new control system applications and provides developers with management infrastructure and a centralized connection to external data sources like JDBC-databases, JMS-, LDAP-servers, etc. CSS defines interfaces to avoid dependencies on special implementations. This design makes sure that an application can easily be integrated or exchanged. Another important feature is the accessibility of data through all applications via CSS-data types defined in CSS. The Data Access Layer (DAL) assures the transparent access to any control system protocol. Thus CSS is not only a platform for EPICS but for any control system that implements the DAL. The intension to modularize CSS and run it on any operating system lead to the decision to use the Eclipse RCP based on the OSGi technology. Technically CSS is a set of essential core-plugins and application plugins selected by the user.

4:50 **MOPB04 – Remote Operations of an Accelerator Using the Grid**
Roberto Pugliese, Milan Prica (ELETTRA, Basovizza, Trieste)
The GRIDCC* is a three-year project funded by the European Commission. Its goal is integrating instruments and sensors with the traditional Grid resources. The GRIDCC middleware is being designed bearing in mind use cases from a very diverse set of applications, and as the result, the GRIDCC architecture provides access to the instruments in as generic a way as possible. GRIDCC is also developing an adaptable user interface and a mechanism for executing complex workflows in order to increase both the usability and the usefulness of the system. The new middleware is incorporated into significant applications that will allow the software validation in terms both of functionality and quality of service. The pilot application this paper focuses on is applying GRIDCC to support Remote Op-

erations of the ELETTRA synchrotron radiation facility. We describe the results of implementing via GRIDCC complex workflows involved in the both routine operations and troubleshooting scenarios. In particular, the implementation of an orbit correction feedback shows the level of integration of instruments and traditional Grid resources which can be reached using the GRIDCC middleware.

* http://www.gridcc.org.

European Commission (FP6 IST-511382).

5:10 **MOPB05 – "jddd": A Java DOOCS Data Display for the XFEL**

Elke Sombrowski, Anna Petrosyan, Kay Rehlich, Patrick Tege (DESY, Hamburg)

The X-ray Free-Electron Laser (XFEL) is a new accelerator currently under construction at DESY. It will be a powerful X-ray source for many scientific disciplines ranging from physics, chemistry, and biology to material sciences, geophysics, and medical diagnostics. The commissioning is planned in 2014, and the preparation of the control system was started. The XFEL makes high demands on the control system and its user interface. For this reason jddd, a new Java Data Display program for the Distributed Object-Oriented Control System (DOOCS) has been developed. jddd is a graphical editor for designing and running control panels. The editor's functionality is similar to standard IDEs like NetBeans or Eclipse. Complex control panels can easily be created without programming. jddd offers all components needed for control panel design. The Components are reusable Java Beans like labels, buttons, plots, and complex dynamic components as Switches. The jddd panel structure is stored in an xml format. jddd is a further development of the DOOCS data display (ddd) program. For compatibility reasons the old ddd storage format can be converted to the new jddd xml format.

Tuesday Oral Session, TOAA
2nd Floor Lecture Hall, 8:30 a.m.
Session Chairs: Daniele Bulfone, ELETTRA
In Soo Ko, PAL

8:30 **TOAA01 – Spirit and Opportunity: The Great Surface Exploration of Mars Keeps Going**
John Callas (Jet Propulsion Laboratory, Pasadena, California)
For over three Earth years, two intrepid robotic explorers, Spirit and Opportunity, have been successfully conducting field geology day after day on Mars at two distinct locations on the surface. Originally designed for a 90-Martian day mission, the rovers have exceeded that requirement by a factor of 12 and show no signs of stopping. As the rovers move, each day becomes a brand new mission with new sights and new geology to explore. Both rovers have made significant discoveries in understanding the Red Planet, but great adventures still lie ahead for each rover.

The Mars Exploration Rover Project is managed by the Jet Propulsion Laboratory, California Institute of Technology, for the National Aeronautics and Space Administration.

9:00 **TOAA02 – Status of the Control System for HICAT at an Advanced Stage of Commissioning: Functions, Restrictions, and Experiences**
Tibor Fleck, Ralph C. Baer, Marcus Schwickert (GSI, Darmstadt)
One and a half years after installation of the first components, much progress has been made in commissioning of the accelerator for the clinic in Heidelberg. In the final state it is designed to produce different kinds of heavy ions with energies up to 450 MeV/u to treat about 1000 tumor

patients a year at three therapy rooms. Presently the specified parameter space for patient treatment is filled to meet the correct combinations of energies, beam foci, and intensities for the therapy. In this contribution we will first shortly describe the concept of the control system which was designed by GSI but developed by an all-industrial partner who furthermore delivered the front-end control units and has another contract with Siemens Medical Solutions to meet the requirements at the interface to the therapy control system. We will mainly focus on its abilities and experiences with it: different kinds of beam requests, time accuracy, real-time analysis, assurance of consistent device data, offline-diagnostics and the beam diagnostic systems. We also report on known restrictions and the concept to securely provide different operation modes for accelerator adjustment or patient treatment.

9:20 **TOAA03 – Status of the X-Ray FEL Control System at SPring-8**

Toru Fukui (RIKEN Spring-8, Hyogo), Toko Hirono, Naoyasu Hosoda, Miho Ishii, Takemasa Masuda, Toru Ohata, Masao Takeuchi, Ryotaro Tanaka, Akihiro Yamashita (JASRI/SPring-8, Hyogo-ken), Masanobu Kitamura, Hirokazu Maesaka, Yuji Otake, Katsutoshi Shirasawa (RIKEN Spring-8 Harima, Hyogo)

The X-ray FEL project at SPring-8 aims to build an X-ray lasing facility, which will generate brilliant coherent X-ray beams with wavelength of below 0.1nm. A combination of short-period in-vacuum undulators and an 8GeV high-gradient C-band linear accelerator makes the machine compact enough to fit into the SPring-8 1km-long beamline space. The machine commissioning will be started by March 2011. We designed the control system for the new machine based on the present SCSS test accelerator, which employs the MADOCA framework. The control system is based on the so-called “standard model” and composed of Linux-based operator

consoles, database servers, Gigabit Ethernet, VMEbus system, and so on. The control system, also, has a synchronized data-taking scheme to achieve beam-based optics tuning. Most of the device control part is installed in water-cooled 19in. racks together with RF devices for temperature control, which guarantees stable RF phase control. This paper gives an overview of the project and describes the design of the control system. In addition, we briefly report the status of the SCSS test accelerator operated as a VUV-FEL user facility.

9:40 **TOAA04 – Status of the FLASH Free Electron Laser Control System**
Kay Rehlich (DESY, Hamburg)
FLASH (Free electron LASer in Hamburg) is the first facility based on the 1.3GHz superconducting cavity technology. It is a test bed for this technology to prepare future accelerators like the XFEL and ILC. Since 2005 FLASH has run as a reliable FEL source for user experiments. The control system DOOCS (Distributed Object-Oriented Control System) provides the required full bunch resolution of the diagnostics. A fast DAQ (Data AQuisition system) has successfully been integrated to support slow feedback, diagnostics, and data recording for both the linac operation and the user experiments. The control system will be slowly upgraded to implement the further requirements for the XFEL.

10:00 **TOAA05 – Implementation, Commissioning, and Current Status of the Diamond Light Source Control System**
Mark Heron, Michael Abbott, Keith Baker, Tom Cobb, Peter Denison, Paul Gibbons, Ian John Gillingham, Angelos Gonias, Paul Hamadyk, Simon Lay, Pete Leicester, Matthew Pearson, Ulrik Pederson, Nick Rees, Austen Rose, James Rowland, Emma Shepherd, Stephen John Singleton, Isa Uzun (Diamond, Oxfordshire), Steven Hunt (AHB, Meisterschwanden), Andy Foster

(OSL, Cambridge), Pete Owens (STFC/DL, Daresbury, Warrington, Cheshire)
Starting with the Linac in 2005, the commissioning of the Diamond Light Source accelerators and photon beamlines, together with their related control systems, progressed to an aggressive program such that as of early in 2007, the facility was available for first users with a suite of beamlines and experiment stations. The implementation and commissioning of the control system to meet the overall project objectives are presented. The current status of the control system, including ongoing developments for electron-beam orbit stability and future photon beamline requirements, are also described.

Tuesday Oral Session, TOAB
2nd Floor Lecture Hall, 10:50 a.m.
Session Chairs: In Soo Ko, PAL
Mike Mouat, TRIUMF

10:50 **TOAB01 – The New FAIR Accelerator Complex at GSI: Project, Controls Challenges, and First Steps**
Ralph C. Baer, Udo Krause, Wolfgang Panschow, Volker R.W. Schaa, Wolfgang Schiebel, Petra Schuett (GSI, Darmstadt)
An international Facility for Antiproton and Ion Research (FAIR) was proposed by GSI in 2001 and is currently under development. This new accelerator complex will be a significant extension to the existing GSI accelerator chain and will provide a range of particle beams from protons and antiprotons to ion beams of all elements up to uranium, as well as secondary beams of short-lived rare isotope beams. The central parts of the FAIR facility are a superconducting double-ring synchrotron and a system of storage rings. This presentation covers the status and scope of the FAIR project and its technical and

organizational challenges, in particular in respect to the accelerator control system. As many parts of the new FAIR facility will be independently developed as in-kind contributions by international FAIR partner institutes, one significant point is integration and interface management. Among many other aspects, one important technical consideration is a high degree of parallel beam operation for the different research programs that imposes ambitious demands on the timing and cycle management system. We will discuss first steps towards a new FAIR control system.

11:10 **TOAB02 – Current Status of the Control System for J-PARC Accelerator Complex**
Hiroshi Yoshikawa (KEK/JAEA, Ibaraki-Ken), Noboru Yamamoto, Norihiko Kamikubota, Tadahiko Katoh, Takahiro Matsumoto, Hidetoshi Nakagawa, Jun-Ichi Odagiri, Yasunori Takeuchi (KEK, Ibaraki), Shigenobu Motohashi, Makoto Takagi, Susumu Yoshida (Kanto Information Service (KIS), Accelerator Group, Ibaraki)
J-PARC accelerator complex consists of a proton linac (LINAC), > a Rapid Cycle Synchrotron (RCS), and a Main Ring synchrotron (MR). The commissioning of LINAC already started in November 2006, while the commissioning of Main Ring synchrotron (MR) is scheduled in May 2008. Most of the machine components of MR have been installed in the tunnel. Introduction of electronic modules and wiring will be made by the end of 2007. For the control of MR, the J-PARC accelerator control network was extended to include the MR related parts in March 2007. IOC computers (VME-bus computers) for MR will be introduced in 2007. In addition, more server computers for application development will be also introduced in 2007. This paper reports the status of development for the J-PARC MR control system.

11:30 **TOAB03 – ALICE Controls System – Ready for LHC Operation**

Lennart Stig Jirden, Andre Augustinus, Marco Boccioli, Peter Chochula, Giacinto De Cataldo, Svetozar Kapusta, Peter Rosinsky, Cesar Turcado, Lionel Wallet (CERN, Geneva), Giacinto De Cataldo [on leave], Michele Nitti (INFN-Bari, Bari)

ALICE is one of the four LHC experiments presently being built at CERN and due to start operations by the end of 2007. The experiment is being built by a very large worldwide collaboration; about 1000 collaborators and 85 institutes are participating. The construction and operation of the experiment pose many technical and managerial problems, and this also applies to the design, implementation, and operation of the control system. The control system is technically challenging, representing a major increase in terms of size and complexity with respect to previous-generation systems, and the managerial issues are of prime importance due to the widely scattered contributions. This paper is intended to give an overview of the status of the control system. It will describe the overall structure and give some examples of chosen controls solutions, and it will highlight how technical and managerial challenges have been met. The paper will also describe how the various subsystems are integrated to form a coherent control system, and it will finally give some hints on the first experiences and an outlook of the forthcoming operation.

11:50 **TOAB04 – The LIGO Detectors Controls**

Daniel Sigg (LIGO Hanford Observatory, Richland)

All three LIGO detectors have reached their design sensitivities. A sky-averaged detection range (SNR > 8) of more than 15 Mpc for inspiral binary neutron stars with masses of 1.4 Msol has been achieved with the two 4 km

instruments. The fifth LIGO science started in November 2006 and more than 300 days of coincidence data has been collected so far. The feedback controls system is a major component to make LIGO work and its performance has been crucial to achieve the present sensitivity.

12:10 **TOAB05 – The Status of Virgo**
Franco Carbognani (EGO, Pisa)
Virgo is the largest gravitational wave detector in Europe. The detector, built by a French–Italian collaboration, is located near Pisa (Italy) and is based on a laser interferometer with 3-km-long arms. It aims at the detection of gravitational waves emitted by galactic and extragalactic sources such as pulsars, supernovae, and the coalescences of binary black holes and neutron stars in a frequency window comprised between 10 Hz and a few kHz. Since 2003 the detector has been going through its commissioning phase, and the first long observing run is planned to start in May 2007. The present status of the experiment and its foreseen upgrades are described in this article.

Franco Carbognani is the corresponding author on behalf of the Virgo Collaboration.

Tuesday Oral Session, TOPA
2nd Floor Lecture Hall, 2:00 p.m.
Session Chairs: Noboru Yamamoto, KEK
Andy Gotz, ESRF

2:00 **TOPA01 – Data Management at JET with a Look Forward to ITER**
Jonathan William Farthing, Adrian Capel, Nick cook, Mark Edwards, Eric Jones, Richard Layne, Darren McDonald, Martin Wheatley (UKAEA Culham, Culham, Abingdon, Oxon), Jo Lister (ITER, St Paul lez Durance),

Martin Greenwald (MIT/PSFC, Cambridge, Massachusetts)
Since the first JET pulse in 1983, the raw data collected per ~40s of plasma discharge (pulse) has roughly followed a Moore's Law-like doubling every 2 years. Today we collect up to ~10GB per pulse, and the total data collected over ~70,000 pulses amounts to ~35TB. Enhancements to JET should result in ~60GB per pulse being collected by 2010. An ongoing challenge is to maintain the pulse repetition rate, data access times, and data security. The mass data store provides storage, archiving, and also the data access methods. JET, like most fusion experiments, provides an MDSplus (http://www.mdsplus.org) access layer on top of its own client-server access. Although ITER will also be a pulsed experiment, the discharge will be ~300-5000s in duration. Data storage and analysis must hence be performed exclusively in real time. The ITER conceptual design proposes a continuous timeline for access to all project data. The JET mass data store will be described together with the planned upgrades required to cater for the increases in data at the end of 2009. The functional requirements for the ITER mass storage system will be described based on the current status of the ITER conceptual design.

2:30 **TOPA02 – Information and Data Management Systems for Indus-2**
Bakshi Sanjai Kumar Srivastava, Rajesh Kumar Agrawal, Pravin Fatnani, Bhavna Nitin Merh (RRCAT, Indore (M.P.))
Managing the information and data for any of today's accelerator machines is an extremely important aspect and a very significant contributor to the overall machine performance, especially from the point of view of its evaluation, diagnostics, and evolution. Data storage, information presentation, and ways to enhance day-to-day operations help greatly in improving the machine operations and achieving better

performance. At RRCAT, we have implemented a system for data management and web-based information retrieval and presentation. Live machine status monitoring, machine history data query, fault information management, electronic logbook, etc. are the modules that have been developed and deployed. These have greatly enhanced the effective use of the available machine data. The paper takes a stock of the overall scenario and highlights user experiences.

2:50 **TOPA03 – The IRMIS Universal Component-Type Model**

Donald Dohan (ANL, Argonne, Illinois)

The IRMIS toolkit provides a relational description of the accelerator/facility hardware and how it is assembled. To create this relational model, the APS site infrastructure was successively partitioned until a set of familiar, "unit-replaceable" components was reached. These items were grouped into a set of component types, each characterized by the type's function, form factor, etc. No accelerator "role" was assigned to the components, resulting in a universal set of component types applicable to any laboratory or facility. This paper discusses the development of the universal component-type model. Extension of the component types to include port definitions and signal-handling capabilities will be discussed. This signal-handling aspect provides the primary mechanism for relating control system software to accelerator hardware. The schema is being extended to include references to the device support for EPICS-supported component types. This suggests a new approach to EPICS database configuration in which the user, after selecting a particular hardware component, is provided with links to the support software to be used in building the EPICS application.

Work supported by U.S. Department of Energy, Office of Sciences, Office of Basic Energy Sciences, under Contract No. DE-AC02-06-CH11357.

Tuesday Poster Session, TPPA
Clinch Concourse, 3:10-3:55 p.m.

TPPA01 – Control System Design Using LabVIEW Object-Oriented Programming
Dietrich Hans Beck, Holger Brand (GSI, Darmstadt)
Starting with version 8.20, the graphical programming language LabVIEW has been extended to object-oriented programming (LVOOP). This paper comprises a design study investigating the helpfulness of LVOOP for developing LabVIEW-based control systems. Moreover, the possible integration of such a control system into a mixed environment is demonstrated. Conventional object-oriented programs with text-based languages, as C++ or Java, typically declare an object as a pointer in the heap. Later on, objects are addressed "by reference." However, LabVIEW is using the paradigm of dataflow, and LVOOP follows this line. Consequently, objects can only be addressed "by value." This has fundamental consequences, since many existing object-oriented design patterns cannot be used. Within this work, a couple of dataflow design patterns that are useful for programming with LVOOP have been invented. A prototype system has been set up, demonstrating the advantages and disadvantages of this approach. Furthermore, it is easily possible to integrate a control system based on LVOOP into a mixed environment using DIM (www.cern.ch/dim) as a communication layer.

TPPA03 – Software Factory Techniques Applied to Process Control at CERN
Mathias Dutour (CERN, Geneva)
The LHC requires constant monitoring and control of large quantities of parameters to guar-

antee operational conditions. For this purpose a methodology called UNICOS was implemented to standardize the design of process control applications. To further accelerate the development of these applications, we migrated our existing UNICOS tooling suite toward a software factory in charge of assembling project, domain, and technical information seamlessly into deployable PLC–SCADA systems. This software factory delivers consistently high quality by reducing human error and repetitive tasks and adapts to user specifications in a cost-efficient way. Hence, this production tool is designed to hide the PLC and SCADA platforms, enabling the experts to focus on the business model rather than specific syntax. Based on industry standards, this production tool along with the UNICOS methodology provides a modular environment meant to support process control experts to develop their solutions quickly. This article presents the user requirements and chosen approach. Then the focus moves to the benefits of the selected architecture and finishes with the results and a vision for the future.

LHC: Large Hadron Collider, UNICOS: UNified Industrial Control Systems, PLC: Programmable Logic Controller, SCADA: Supervisory Control And Data Acquisition, Terms: Process control, software engineering.

CERN: European Organization for Nuclear Research.

TPPA04 – Role-Based Access Control for the Accelerator Control System at CERN
Suzanne Renee Gysin, Schumann Carl, Andrey Petrov (Fermilab, Batavia, Illinois), Pierre Charrue, Wojciech Gajewski, Verena Kain, Krzysztof Kostro, Grzegorz Kruk, Stephen Page (CERN, Geneva)
Given the significant dangers of LHC operations, access control to the accelerator controls

system is required. This paper describes the requirements, design, and implementation of Role-Based Access Control (RBAC) for the LHC and injectors controls systems. It is an overview of the two main components of RBAC: authentication and authorization, and the tools needed to manage access control data. We begin by stating the main requirements of RBAC and then describe the architecture and its implementation. RBAC is developed by LAFS a collaboration between CERN and Fermilab.

TPPA05 – Control of Acquisition and Cluster-Based Online Processing of GRETINA Data
Carl Lionberger, Mario Cromaz (LBNL, Berkeley, California)
The GRETINA gamma ray tracking detector will acquire data from 112 digitizer modules in 28 VME crates. The data will be distributed to a cluster of on the order of 100 computer servers for the computation-intensive initial processing steps which will be run concurrently with data acquisition. A slow-controls system based on EPICS controls all aspects of data acquisition and this online processing. On the cluster, EPICS controls not only when processing is occurring but which processing programs are running on which nodes and where their inputs and outputs are directed. The EPICS State Notation Language is used extensively both in the VME and cluster environments.

TPPA06 – EPICS-Based Control System for Beam Diagnostics of J-PARC LINAC
Guobao Shen (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken)
A commercial measurement instrumentation (WE7000) is used at J-PARC LINAC, to measure beam current from SCT (Slow Current Transformer), beam energy from FCT (Fast Current Transformer), beam position from BPM (Beam Position Monitor), beam size from WSM (Wire Scanner Monitor), or beam loss from

BLM (Beam Loss Monitor). The WE7000 is a module-type measurement station, and supports network-based data transmission and communication. A control system has been developed under EPICS framework for the beam diagnostic system to control all WE stations. A waveform signal from a SCT, a FCT, a BPM, a WSM, or a BLM is digitized in a WE7000 station and sent to an EPICS IOC. All signal voltages are calculated inside IOC from a raw digital count. Some physical variables are calculated from the signal voltages including beam current, beam position, and beam phase and beam energy. An EPCIS device driver was reutilized for the data acquisition. The GUI applications for data displays have been developed by using EPICS extensions tools. The current status is reported in this paper about the beam diagnostic system control.

TPPA07 – The Development Plan of XAL for CSNS

Quan Gan, ChunHong Wang (IHEP Beijing, Beijing), Chungming Paul Chu (SLAC, Menlo Park, California)

For the similarities between the China Spallation Neutron Source (CSNS) and the U.S. Spallation Neutron Source (SNS), the software framework used at SNS, XAL, is a natural choice for the CSNS. Some codes of XAL must be rewritten since RCS of CSNS is different from the accumulated ring of SNS. In addition, a Java-based industrial standard Eclipse framework is proven as matured software architecture. The Eclipse rich client platform (RCP) provides improved user experience. This paper introduces the development plan of XAL for CSNS physics application and some collaboration work about merging XAL into Eclipse. Some converted XAL applications will also be shown.

TPPA08 – Java Swing-Based Plotting Package Residing Within XAL

Andrei P. Shishlo, Thomas Pelaia (ORNL, Oak Ridge, Tennessee), Chungming Paul Chu (SLAC, Menlo Park, California)
A Java swing-based data plotting package residing within the XAL framework is presented. The data types are described that can be used for charts, bar charts, and color-surface plots. The algorithms, performance, interactive capabilities, limitations, and the best usage practices of this plotting package are discussed.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

TPPA09 – XAL Application Framework and Bricks GUI Builder
Thomas Pelaia (ORNL, Oak Ridge, Tennessee)
The XAL Application Framework is a framework for rapidly developing document-based Java applications with a common look and feel along with many built-in user interface behaviors. The Bricks GUI builder consists of a modern application and framework for rapidly building user interfaces in support of true Model-View-Controller compliant Java applications. Bricks along with the XAL Application Framework allows developers to rapidly create quality applications. These technologies are described here along with a description of existing applications that use these technologies at the Spallation Neutron Source.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

TPPA10 – Development of Photon Beamline and Motion Control Software at Diamond Light Source
Nick Rees, Peter Denison (Diamond, Oxfordshire)

Diamond Light Source has opened its first eight photon beamlines to the user community this year. We have developed the control software for the beamlines in parallel, adopting a common set of standards, tools, and designs across all beamlines. At the core of the control system is the EPICS toolset and the widespread use of the Delta Tau PMAC motion controller. The latter is a complex, but flexible controller that has met our needs both for simple and complex systems. We describe how we have developed the standard EPICS software for this controller so that we can use the existing EPICS interfaces, but also enables us to use the more advanced features of the controller.

TPPA11 – CMW Controls Middleware at CERN – Evolution and Experience
IKrzysztof Kostro, Wojciech Gajewski, Joel Lauener (CERN, Geneva)
CMW (Controls MiddleWare) equipment servers were first deployed at CERN in 2001. Since then its use has proliferated so that virtually any equipment at CERN can be accessed via the CMW. The connectivity has been extended so that interfaces are available from industrial systems, LabView, and from experiments. Recent evolutions include an improved flow control for subscriptions, role-based access control and performance enhancements. The underlying CORBA implementation has been replaced as well. This paper describes these improvements with the special focus on subscription functionality and performance and on the scalability of CMW.

TPPA12 – User Authentication for Role-Based Access Control
Andrey Petrov, Schumann Carl, Suzanne Renee Gysin (Fermilab, Batavia, Illinois)
User authentication is part of the Role-Based Access Control (RBAC) project for accelerator controls at CERN. It was designed by a collabo-

ration between CERN and Fermilab. Its function is to create, distribute, and manage digital credentials for the users. We had to consider many constraints dictated by existing security policies, complexity of the control system, and diversity of the used software. This paper describes the general design and implementations of the authentication mechanism in Java and C++. We also give an overview of its major features, such as Single Sign-On, credential renewal, and Role Picker.

TPPA13 – High-level Application Framework for LCLS

Chungming Paul Chu, Sergei Chevtsov, Diane Fairley, Christopher Larrieu, Deborah Rogind, Greg White, Michael Zelazny (SLAC, Menlo Park, California)

A framework for high-level accelerator application software has been planned for the Linac Coherent Light Source (LCLS). The framework is based on plug-in technology developed by the Eclipse open-source project. Many existing functionalities provided by Eclipse are available to high-level applications written within this framework. The framework contains static data storage, configuration, and dynamic data connectivity, as well as modeling through XAL and MAD. Additionally, because the framework is Eclipse-based, it is highly compatible with any other Eclipse plug-ins, such as Control System Studio. The entire infrastructure of the software framework will be presented. Applications and plug-ins based on the framework are also presented.

Work supported by Department of Energy contract DE-ACO3-76SFOO5 15.

TPPA14 – Scope-Embedded IOC Development in SSRF

Yongbin Leng, Yongzhong Chen, Zhichu Chen, Dekang Liu, Weimin Zhou (SINAP, Shanghai)

The dozen of wide-band beam diagnostics sensors such as integration current transformer, faraday cup, and wall current monitors were used in SSRF(Shanghai Synchrtron Radiation Facility) Linac and transport line to measure bunch shape and charge. Few hundreds MHz bandwidth required very high speed digitizer like digital sampling scope. On the other hand SSRF control system was built on EPICS platform. So Windows PC based Tektronics scope, which equipped with TekVISA interface, Shared Memory IOCcore EPICS interface, and Labview application was chosen to do this data acquisition. The details of software design and the performance evaluation results for TDS7104 and DPO7054 will be described in this paper.

TPPA15 – QTango: A Library for Easy Tango-Based GUIs Development

Juhao Wu, Paul Emma, R. Clive Field (SLAC, Menlo Park, California)

Qt (by Trolltech) is the framework adopted for the development of graphical applications at Elettra. A new library, named QTango, has been developed to ease the integration of Qt and the Tango control system. QTango provides a set of custom widgets and a multithreaded infrastructure that manages the communication of the graphical clients with the device servers. This paper describes the structure of the library, the developed widgets, and the tools provided to both the experienced and the novice software writers.

TPPA16 – Development of the Software Tools Using Python for EPICS-Based Control System

Tatsuro Nakamura, Kazuro Furukawa, Jun-Ichi Odagiri, Noboru Yamamoto (KEK, Ibaraki)

In the commissioning phase of accelerators, many application programs are built and modified frequently by nonexpert programmers. Scripting language such as Python is suitable for such quick development. Since EPICS

Channel Access interface library in Python was developed in KEKB accelerator control system, many programs has been written in Python. We have been developing, providing some tools and libraries for Python programming. Some of the recent developments in KEK are reported, and possible applications are also discussed.

TPPA17 – The ACOP Family of Beans: A Framework Independent Approach

Jaka Bobnar, Igor Kriznar (Cosylab, Ljubljana), Piotr Karol Bartkiewicz, Philip Duval, Wu Hong Gong (DESY, Hamburg)

The current ACOP (Advanced Component Oriented Programming)* controls set has now been expanded to include a wide variety of graphical java beans, which simultaneously act as displayers of control system data. Besides the original ACOP Chart, the set of ACOP beans also includes a Label, Slider, Table, Gauge, Wheel, and image control, along with an invisible Transport bean, which is itself embedded in the ACOP GUI beans. The new ACOP beans all offer design-time browsing of the control system to expedite data end-point selection. Optionally a developer can choose to connect and render the incoming data automatically, obviating the need for writing code. The developer can either forgo this option or choose to override the generated code with his own, allowing for rich client development. At the same time a user can browse and add or change the control system endpoints at run-time. If the application is using the Component Object Manager (COMA)** then all visual aspects of the application can be edited at run-time, allowing for simple client development. This scenario is independent of a framework, and the developer is free to choose the IDE of choice.

* http://acop.desy.de

** "The Run-Time Customization of Java Rich Clients with the COMA Class," P. Bartkiewicz, et al., these proceedings.

TPPA18 – Application of a Virtualization Technology to VME Controllers
Takemasa Masuda, Toru Ohata (JASRI/SPring-8, Hyogo-ken), Toru Fukui (RIKEN Spring-8, Hyogo)
The SPring-8 control framework MADOCA employs client-server architecture based on Sun RPC (Remote Procedure Call) for device control. An RPC server process named Equipment Manager (EM) is running on each VME controller operated by Solaris. It executes control commands from client applications one by one. As a simple approach to parallel (exactly concurrent) execution of the EM process, we apply the virtualization technology of Solaris Containers to VME controllers. Solaris Containers virtualizes operating system environment within the OS level. It consumes little disk space (~30 MB) to add a new virtual host. All the virtual hosts can access devices on the VME bus through a real host. We don't need to modify the MADOCA framework and device drivers at all to run the EM process on the virtual host. Therefore, we can easily apply the virtualization technology to the VME controllers which don't have enough disk space. The technology allows us not only to consolidate but also to logically partition the deployed VME controller. We will report some applications of Solaris Containers to the VME controllers, in particular from the viewpoint of the system performance and management.

TPPA19 – The Run-Time Customization of Java-Rich Clients with the COMA Class
Piotr Karol Bartkiewicz, Reinhard Bacher, Philip Duval (DESY, Hamburg)
In this report we present the Container Object MAnager (COMA) class for Java applcations, designed for use in rich, simple, or hybrid applications. This class considerably enhances the Graphical User Interface (GUI) flexibility and extends the application's data presentation capabilities. It allows run-time configuration of size,

position, and other visual properties of all GUI components. Furthermore, new GUI components such as ACOP* controls can be added by drag-and-drop at run time to the existing application, providing additional access to control system resources. The set of all applied changes made at run time can be saved to an XML configuration file, which in turn can be reapplied by the COMA class upon a restart of the application. In this manner, the COMA class affords the possibility of allowing users in general and operators in particular to apply their own extentions to existing applications. Similarly, starting from an empty COMA frame, a simple application can be easily created at run time without using a framework, IDE, etc. This paper describes the implementation of the Coma class and presents its benefits when used in connection with the ACOP beans.

* "The Acop Family of Beans: A Framework Independent Approach," J. Bobnar, et al., these proceedings.

TPPA20 – Canone – A Highly-Interactive Web-Based Control System Interface

Miha Pelko, Klemen Zagar (Cosylab, Ljubljana), Lucio Zambon (ELETTRA, Basovizza, Trieste), Anthony Green (University of Cambridge, Cambridge)

In the recent years, usability of web applications has significantly improved, approaching that of rich desktop applications. Example applications are numerous, e.g., many different web applications from Google. The enabling driver for these developments is the AJAX (Asynchronous JavaScript and XML) architecture. Canone, originally a PHP web interface for Tango control system developed at Elettra, is one of the first attempts of long-distance interaction with the control system via Web. Users with suitable privileges can create panels consisting of various graphical widgets for monitoring and control of

the process variables of the control system online. Recently, Canone was extended to interact with a control system through an abstract DAL (Data Access Layer) interface, making it applicable to EPICS and TINE as well. Also, the latest release of Canone comes with drag'n'drop functionality for creating the panels, making the framework even easier to use. This article discusses the general issues of the web-based interaction with the control system such as security, usability, network traffic and scalability, and presents the approach taken by Canone.

TPPA21 – MDSplus Real-Time Data Access in RTAI

Gabriele Manduchi, Adriano Luchetta (Consorzio RFX, Padova)

The MDSplus package is widely used in Nuclear Fusion research for data acquisition and management. Recent extensions of the system provide useful features for real-time applications, such as the possibility of locking selected data items in memory and real-time notification. The real-time extensions of MDSplus have been implemented as a set of C++ classes and can be easily ported to any target architecture by developing a few adapter classes. The real-time data access layer of MDSplus is currently available for Windows, Linux, VxWorks and RTAI. In particular, the RTAI platform is very promising in this context because it allows the co-existence of offline, non-real-time tasks with real-time ones. It is hence possible to devise an architecture where real-time functionality is handled by a few selected tasks using the real-time data access layer of MDSplus, whereas background, non-real-time activity is carried out by "traditional" Linux tasks. This organization may be of interest for the next generation of fusion devices with long-duration discharges, during which the system has to provide feedback control in real time and to sustain continuous data acquisition and storage.

TPPA22 – Standard Device Control via PVSS Object Libraries in ALICE

Lionel Wallet, Andre Augustinus, Peter Chochula, Lennart Stig Jirden (CERN, Geneva)

The device control in the LHC experiments is based on OPC servers and PVSS SCADA systems. A software framework enables the user to set up his PVSS project for the different devices used. To achieve a homogeneous operational environment for the ALICE experiment, these devices need to be controlled thought standard interfaces. PVSS panels act as the upper control layer and should allow for full control of the devices. The PVSS object-oriented feature has allowed the development of device Object Libraries. The Object Libraries have two main advantages. On one hand, they ease the operator task thanks to the introduced standardization of the various device control panels. On the other hand, they reduce the developer's job as only basic software knowledge is required to set up a control application for a standard device. This paper will describe the device control architecture including PVSS, software framework, and OPC server. It will describe the Object Libraries developed for some devices, and it will explain how the Object Libraries integrate tools in the ALICE controls environment, such as Finite State Machines, access control, and trending.

ALICE (A Large Ion Collider Experiment)LHC (Large Hadron Collider)OPC (Ole for Process Control)SCADA (Supervisory Control And Data Acquisition)

TPPA24 – Beyond Abeans

Igor Kriznar, Jaka Bobnar (Cosylab, Ljubljana), Matthias R. Clausen, Philip Duval, Wu Hong Gong (DESY, Hamburg), Guenther Froehlich (GSI, Darmstadt)

Java Abeans libraries were successfully started in 1999 as part of ANKA control system. The goal was to provide a universal solution for

building high level control system applications in Java for any control system. The arrival of Java 1.5 in 2005 was an excellent opportunity to review Abeans and CosyBeans (GUI components and widgets part of Abeans). Cosylab has put experience and new features of Java 1.5 into new projects which superseded what has been done so far by Cosylab. The key element for success of the projects is the collaboration between different laboratories. The CosyBeans components have found their usefulness as a base for development of ACOP GUI components for TINE at DESY. Similarly Abeans' non-visual libraries were replaced by DAL (Data Access Library) and CSS (Control System Studio) projects developed in collaboration with DESY. DAL was also successfully used at GSI, Darmstadt, to model device layer on top of middle-ware CORBA layer. New Java applications were build with DAL and renewed CosyBeans components and are already used in commissioning of new beamline at GSI.

TPPA25 – Scripting vs Programming: An Application Developer's Perspective
Sergei Chevtsov, Greg White, Michael Zelazny (SLAC, Menlo Park, California)
We discuss our approach to writing high-quality beam analysis applications with rich Graphical User Interfaces (GUIs) for the Linear Coherent Light Source (LCLS) project at SLAC. The choice of Matlab as our environment is contrasted with the more traditional development of complex software in a programming language, such as Java. Some benefits and disadvantages of scripting and programming languages are illustrated on the basis of our practical experiences with similar physics applications. Specific findings are discussed from the developer's point of view, and general suggestions are made for when an application should be written in a programming rather than in a scripting language.

Work supported by Department of Energy contract DE-ACO3-76SFOO5 15.

TPPA26 – User Interface Framework for the National Ignition Facility (NIF) Control System

John Fisher (LLNL, Livermore, California), Greg Bowers, Robert Carey, Stephanie Daveler, Kelley Herndon Ford, Lawrence Lagin, Christopher Lambert, Ming-Yan (Jessica) Mauvais, Eric Stout, Susan West (LLNL, Livermore)

A user interface (UI) framework supports the development of graphical operator controls for the National Ignition Facility (NIF) Integrated Computer Control System (ICCS). The framework simplifies UI coding and ensures consistency for system operators across all NIF subsystems. A comprehensive, layered collection of UIs provides interaction with service-level frameworks, shot automation, and subsystem-specific devices. All user interfaces are written in Java and employ CORBA to interface to other ICCS components. Developers use the framework to compose two major types of user interfaces for broad-views and control panels. Broad-views provide a visual representation of NIF beamlines through interactive schematic drawings. Control panels present status and control at the device level. The UI framework provides a suite of display components that standardize user interaction through data entry behaviors, common connection and threading mechanisms, and a common appearance. With these components, developers can address pattern usability issues in the facility when needed. The UI framework helps developers create consistent and easy-to-understand user interfaces for NIF operators.

TPPA28 – PLC-Based Beam-Charge Interlock System for Radiation Safety at the KEKB Injector Linac

Eiichi Kadokura, Kazuro Furukawa, Masanori Satoh, Tsuyoshi Suwada (KEK, Ibaraki)
A new PLC-based beam-charge interlock system is under development for radiation safety at the KEKB injector linac. This system restricts a prescribed amount of integrated beam charges passing through at several locations along the linac for machine protection, and it also monitors the amount of integrated beam charges injecting to four different storage rings (KEKB e+ & e- storage rings, PF, PF-AR) at the linac beam switchyard. The beam charges delivered from an electron gun are measured with the PLC-based beam-charge interlock system. This system comprises wall-current monitors, beam-charge integration circuits, and a PLC-based control system. This system generates and sends beam abort signals directly to another radiation safety control system with hard-wire cables when the amount of the integrated beam charges is beyond the prescribed threshold level. In this report we describe the new design of the PLC-based beam-charge interlock system, and especially several software developments and performances implemented on the PLC are described.

TPPA29 – Interfacing of Peripheral Systems to EPICS Using Shared Memory

Evgeniy Tikhomolov, Rolf Keitel (TRIUMF, Vancouver)
Interfacing of peripheral control and data acquisition systems to an EPICS-based control system is a common problem. At the ISAC radioactive beam facility, both Linux-based and Windows-based systems were integrated using the “soft” IOC, which became available in EPICS release 3.14. For Linux systems, shared memory device support was implemented using standard Linux functions. For Windows-based RF control systems, the “soft” IOC runs as a separate application, which uses shared memory for data exchange with the RF control applications. A set of DLLs exposes an API for use by the application

programmer. Additional features include alarm conditions for read-back updates, watchdogs for each running application, and test channels.

TPPA30 – Channel Access Clients on the Microsoft Windows Platform

G. Cox, Adrian Oates (STFC/DL, Daresbury, Warrington, Cheshire), Brian Martlew (STFC/DL/SRD, Daresbury, Warrington, Cheshire)

The control system for the Energy Recovery Linac Prototype (ERLP) under construction at Daresbury uses EPICS and vxWorks on VME64x. The client software in use during the commissioning of the accelerator is based on PC consoles running Red Hat 9. Synoptic displays and engineering panels are created using the Extensible Display Manager (EDM) and other standard EPICS extension software is used for archival and alarm handling. The Synchrotron Radiation Source (SRS) control system uses a bespoke control system with client software on PC consoles running Microsoft Windows. We would like to employ a similar approach for the operational client software on ERLP with Channel Access clients running on Microsoft Windows PC consoles. However, the Microsoft Visual Studio development tools and ActiveX/COM technologies used for creating client side software on the SRS control system are now outdated and have been superseded by the .NET framework and associated developer tools. This paper discusses the different options currently available for developing Channel Access clients on the Microsoft Windows platform, along with progress in creating Channel Access clients for the .NET framework.

TPPA31 – Redundant EPICS IOC in PC-based Unix-like Environment

Artem Kazakov (GUAS/AS, Ibaraki), Matthias R. Clausen, Gongfa Liu, Bernd Schoeneburg (DESY, Hamburg), Kazuro Furukawa (KEK, Ibaraki)

Redundant EPICS IOC is being actively developed at DESY in order to achieve high availability. Current development focuses on VME vxWorks environment for cryogenics controls. However, many facilities use PC-architecture and unix-like systems as Linux and FreeBSD. These facilities require high availability and redundancy as well. So this paper will describe the implementation of EPICS redundant IOC in PC-based environment with Linux and FreeBSD. This work will be done by porting Redundancy Monitor Task (RMT) and Continuous Control Executive (CCE). RMT is responsible to make a decision when to fail-over; it is rather independent and may be used in a wide range of applications. In the future it can be employed in caGateway to add redundancy. CCE is aimed to synchronize two RSRV-based IOC servers.

TPPA32 – LivEPICS: EPICS Official Distribution Made in LNL
Mauro Giacchini (INFN/LNL, Legnaro, Padova)
EPICS* distributions – analogous to a Linux distribution, are collections of EPICS software that have been proven to work together. It is much quicker to download and install a distribution than it would be to obtain all of the individual pieces and install them separately. LivEPICS** distribution contains binaries from EPICS Base, various extensions, and source code.

*EPICS official web site: http://www.aps.anl.gov/epics/distributions/index.php
** M.Giacchini., PCaPAC Workshop 2006 poster. http://conferences.jlab.org/pcapac/talks/poster/Giacchini.pdf.

Tuesday Poster Session, TPPB
Clinch Concourse, 3:55-4:40 p.m.

TPPB01 – The PHELIX Control System Based on CS-Framework 3.0

Holger Brand, Dietrich Hans Beck, Stefan GÃtte (GSI, Darmstadt), Maximilian Kugler (H_DA, Darmstadt)

The Petawatt High Energy Laser for Ion eXperiments, http://www.gsi.de/forschung/phelix/index_e.html, will offer the unique combination of a high-current, high-energy (GeV/u) heavy-ion beam with a powerful laser beam thus providing the opportunity to investigate a variety of fundamental science issues in the field of atomic physics, nuclear physics, and plasma physics. The PHELIX Control System (PCS) is based on the CS framework, http://wiki.gsi.de/cgi-bin/view/CSframework/WebHome. About 35 additional classes were developed for the PCS and ~250 objects are running distributed on 13 PCs publishing ~10000 process variables. The PCS has been upgraded to version 3.0 recently. In CS 3.0 the entire communication layer has been changed to DIM (Distributed Information Management), which is a light weight protocol for inter-process communication based on TCP/IP, http://www.cern.ch/dim. The PCS was redesigned to make use and profit from the concept of named services. Clients may receive information from a service (observer pattern) or may send a command to a server (command pattern). By these means the implementation of the PCS behaviour with hierarchical state machines was eased.

TPPB02 – The Insulating Vacuum Control System for the SNS Superconducting Linac

Xiaosong Geng, Peter Ladd, Derrick Williams (ORNL, Oak Ridge, Tennessee)

The cold section of the Linac of the Spallation Neutron Source (SNS) consists of 81 superconducting radio frequency cavities installed in 23 cryomodule each containing either 3 or 4 cavities. During initial operation helium leaks were experienced in some cryomodules requir-

ing them to be actively pumped to maintain this pressure. An Insulating Vacuum System (IVS) was designed and installed for this purpose. A EPICS-based IVS control system is implemented. Allen-Bradley PLCs are used to provide interlocks and control for turbo pump stations and gate valves. Digi PortServer is used to interface with the vacuum controller via serial communication. This paper provides an overview of the control system of the IVS and experience of the serial interfaces.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

TPPB03 – Construction and Operation of the SCADA-based Centralized Monitoring System for All Front Ends and Beamlines at BSRF

Shenshou Xiong, Yinglei Tan (Beijing Synchrotron Radiation Laboratory, Beijing)

The BEPCII was operated for synchrotron radiation beamlines and experimental stations for the first time in December of 2006. At present, all the new EPSs (Equipment Protection Systems) are PLC-based equipment protection and control and (Supervisory Control And Data Acquisition) SCADA-based centralized monitoring systems. All PLC-based EPSs are used to communicate with the same centralized monitoring computer to monitor a variety of parameters from all the EPS systems. The monitoring computer runs the SCADA software with its own web server, providing a web-browse function. The SCADA graphical HMI interfaces are used to display a few overall views of all front-end equipment operation status (such as operation status of masks and valves, real-time vacuum data displays and cooling-water interlocks, etc.) and the further detailed information for each EPS in a different popup window. The system lets operators develop predictive maintenance procedures to

avoid unscheduled downtime and allows operators to manage operation of all the EPSs more effectively. The design and operation of the system are described in this paper.

TPPB04 – Applications of OPC at BEPC
Hui Juan Xu, Jijiu Zhao (IHEP Beijing, Beijing)
The run-time data and machine parameters of the BEPC is distributed over different platforms and stored with different softwares. Some is stored in various SCADA logging files, and some is stored in the EPICS archiver files. Now the EPICS data are stored in Oracle. No general method was provided to access these data. The OPC technology can solve this problem. Originally based on Microsoft's OLE COM (component object model) and DCOM (distributed component object model) technologies, the specification defined a standard set of objects, interfaces, and methods for use in process control and manufacturing automation applications to facilitate interoperability. We have developed EPICS/OPC Server and Oracle/OPC Server. With the help of these two servers and SCADA OPC Servers, it's easy to get the data mentioned above on a Windows system. This paper describes the development of the two OPC servers and OPC applications at BEPC.

TPPB05 – Cryogenic Control System of BEPCII
Gang Li, Kejuan Yue, Jijiu Zhao (IHEP Beijing, Beijing)
A cryogenic system for the superconducting RF cavity (SRFC), superconducting solenoid magnet (SSM), and superconducting quadrupole magnet (SCQ) has been designed and installed in the Beijing Electron-Positron Collider (BEPCII). The cryogenic control system is a fully automatic system using PLCs and EPICS IOCs and consists of three components. One is the Siemens PLC system for compressor control, another is the AB-PLC system for cryogenic

equipment control, and they are integrated into the high-level EPICS system. The functions of cryogenic control include process control, PID control loops, real-time data access and data restore, alarm handler, and human–machine interface. The control system can also be automatically recovered from emergency. This paper will describe the BEPCII cryogenic control system, data communication between S7-PLC and EPICS IOCs, and how to integrate the flow control and the low-level interlock with the AB-PLC system and EPICS.

TPPB06 – The MIRI Imager Ground Support Equipment Control System Based on PCs
Francoise Gougnaud, Denis Arranger, Philippe De Antoni, Gilles Andre Durand, Dominique Eppelle, Alain Goetschy, Yves Lussignol, Pierre Mattei (CEA, Gif-sur-Yvette)
The James Web Space Telescope (JWST) is the successor of Hubble in the infrared. Our division, Dapnia, is in charge of the design and completion of the optomechanical part of the imager called MIRIM, one instrument of JWST, and of its test bench called the Ground Support Equipment (GSE). This GSE consists of a warm telescope simulator, of a model (identical to the flight model) of the imager, of a cryostat to cool the imager down to its operating temperature, and of an infrared detector (1024x1024 pixels). The telescope simulator is composed of several optical components to control (hexapod, 8 motors table, etc.). The major part of the hardware architecture for the control of the IR detector and the telescope simulator is based on PCs and COTS boards. This paper describes the software development and its specificities. ESO software (IRACE and BOB) and EPICS are associated to complete the operator interface. The cryostat control is our homemade supervision system for cryogenics systems based on PLCs, on the WorldFIP Fieldbus network, and on an industrial XPe PC. The tests of the different subsystems

have started, and the whole test bench will be operational in summer 2007.

TPPB07 – First Steps Towards the New Spiral2 Project Control System

Eric Lecorche, Stephane Cuzon, Dominique Touchard (GANIL, Caen), Daniel Bogard, Francoise Gougnaud, Jean-François Gournay, Yves Lussignol, Pierre Mattei (CEA, Gif-sur-Yvette), Stephane Avner, Philippe Graehling, Jerome Hosselet, Chaker Maazouzi, Christian Olivetto (IPHC, Strasbourg Cedex 2)

The Spiral2 project at Ganil aims to produce rare ion beams using a uranium carbide target fission process. The accelerator consists of an RFQ followed by a superconducting cavity linac and is designed to provide high-intensity primary beams (deuterons, protons, or heavy ions). The accelerator should be commissioned by the end of 2011, and the first exotic beams are planned for one year later. The control system will be a result of collaboration between several institutes, among which is the Saclay Dapnia division, which has good experience and knowledge with EPICS. Because of its widely used functionalities, EPICS has been chosen as the basic framework for the accelerator control, and people from the other laboratories belonging to the collaboration are progressively acquiring their first experiences with it. The paper first explains the organization of the collaboration, then it describes the basic hardware and software choices for the project. Some preliminary implementations are therefore given. As the project is still in its beginning phase, the paper ends by listing some questions not yet resolved for the control system definition and remaining open to discussion.

TPPB08 – Present Status of SSRF Control System

Dekang Liu, Liren Shen (SINAP, Shanghai)

A permanent magnet (PM) ECR ion source and

fShanghai Synchrotron Radiation Facility is a third-generation light source with 150MeV LINAC, 3.5Gev booster, and storage ring. The SSRF control system is a hierarchical standard accelerator control system based on EPICS. The VME 64X system and PLCs are used for various low-level device controls and interlock systems. Serial device servers connect serial devices and instrumentation to the Ethernet. All control subsystems are under construction. The hardware and software system development environment has been set up. Most of the subsystem models, such as the digital power supply control and event timing systems, have been set up and are being tested with devices on schedule. The high-level physical application environment has been set up and undergone online testing of device control using MatLab with Accelerator Toolbox and a middle layer. A set of tools (e.g., configuration tools and an alarm handler) has been set up for the center's database. An enhanced distributed archive engine has been created to store data using native XML data type with XML schema for data storage. Various testing results of the control systems for SSRF equipment will be described in this paper.

TPPB09 – The ALICE Transition Radiation Detector Control System

Jorge Mercado (Heidelberg University, Heidelberg)

The ALICE experiment at the LHC incorporates a transition radiation detector (TRD) designed to provide electron identification in the central barrel at momenta in excess of 2 GeV/c as well as fast (6 us) triggering capability for high transverse momentum (pt > 3 GeV/c) processes. It consists of 540 gas detectors and about 1.2 million electronics readout channels that are digitized during the 2 us drift time by the front-end electronics (FEEs) designed in full custom for on-detector operation. The TRD detector control system (DCS) back end is fully implemented as

a detector-oriented hierarchy of objects behaving as finite state machines (FSMs). PVSS II is used as the SCADA system. The front-end part is composed of a 3-layer software architecture with a distributed information management (DIM) server running on an embedded Linux on-detector system pool (about 550 servers) and the so-called InterComLayer interfacing the DIM client in PVSS as well as the configuration database. The DCS also monitors and controls several hundreds of low- and high-voltage channels, among many other parameters. The layout of the system and status on installation and commissioning are presented.

TPPB10 – Target Diagnostic Instrument-Based Controls Framework for the National Ignition Facility (NIF)

Randy Shelton, James Kamperschroer, Jarom Nelson, Dennis O'Brien (LLNL, Livermore)

The extreme physics of targets shocked by NIF's 192-beam laser are observed by a diverse suite of diagnostics including optical backscatter, time-integrated and gated X-ray sensors, and laser velocity interferometry. Diagnostics for fusion ignition are being planned. Many diagnostics are developed at other sites, but ad hoc controls could prove costly or unreliable. The instrument-based controls (IBC) framework facilitates development and eases integration. Each diagnostic typically uses an ensemble of electronic instruments attached to sensors, digitizers, and other devices. Each individual instrument is interfaced to a low-cost WindowsXP processor and Java application. Instruments are aggregated as needed in the supervisory system to form the integrated diagnostic. Java framework software provides data management, control services, and operator GUIs. IBCs are reusable by replication and configured for specific diagnostics in XML. Advantages include small application codes, easy testing, and better reliability. Collaborators save costs by reusing IBCs. This talk discusses

target diagnostic instrumentation used on NIF and presents the IBC architecture and framework.

This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.

TPPB11 – Status of Control System for RIKEN RI-Beam Factory

Misaki Komiyama, Masaki Fujimaki, Masayuki Kase (RIKEN/RARF/CC, Saitama), Akito Uchiyama (SHI Accelerator Service ltd., Tokyo)

The control system of the RIKEN RI-Beam Factory (RIBF) is based on the Experimental Physics and Industrial Control System (EPICS). To control magnet power supplies of cyclotrons and their beam transport lines, we are using VME and CAMAC as I/O Controllers (IOCs) depending on a kind of their interface boards. To control beam-diagnostic equipment and vacuum systems, small single-board computers mounted with Linux are used as IOCs. Other devices of cyclotrons like RF are controlled by PCs, which are independent systems from EPICS. These details will be reported. Furthermore, we will report about the RIBF beam interlock system using Melsec PLCs. We started beam commissioning of RIBF in July 2006 and succeeded in extracting uranium beam from the Superconducting Ring Cyclotron (SRC), which is the last of the multi-stage accelerators of the RIBF, on March 23, 2007.

TPPB13 – The Detector Control System for the Electromagnetic Calorimeter of the CMS Experiment at LHC

Predrag Milenovic (ETH, Zürich; VINCA, Belgrade), Robert Gomez-Reino, Radek Ofierzynski (CERN, Geneva), Angela Brett, Guenther Dissertori, Georgi Leshev, Thomas Punz (ETH,

Zürich), Serguei Zelepoukine (ETH, Zürich; IHEP Protvino, Protvino, Moscow Region), Alexandre Inyakin (IHEP Protvino, Protvino, Moscow Region), Diogo Di Calafiori (UERJ, Rio de Janeiro), Peter Adzic (VINCA, Belgrade), Dragoslav Jovanovic, Jovan Puzovic (VINCA, Belgrade; Faculty of Physics, Belgrade)
The successful achievement of many physics goals of the CMS experiment required the design of an electromagnetic calorimeter (ECAL) with an excellent energy and angular resolution. The choice of the scintillating crystals, photodetectors, and front-end readout electronics of the ECAL has been made according to these criteria. However, certain characteristics of the chosen components imposed challenging constraints on the design of the ECAL, such as the need for rigorous temperature and high voltage stability. For this reason an ECAL Detector Control System (DCS) had to be carefully designed. In this presentation we describe the main DCS design objectives, the detailed specifications, and the final layout of the system. Emphasis is put on the system implementation and its specifc hardware and software solutions. The latest results from final system prototype tests in the 2006 ECAL test-beam program, as well as the system installation and commissioning at the CMS experimental construction site, are also discussed.

"Swiss National Science Foundation, SCOPES programme;" "Ministry of science and environmental protection, Serbia;" "Swiss Agency for development and corporation, Switzerland."

TPPB14 – Status of the ALBA Control System

David Fernandez-Carreiras [ALBA, Bellaterra (Cerdanyola del Vallès)]
This paper describes the progress in the design of the control system for the machine and beamlines. Solutions for interfacing devices, networking, interlocks, diagnostics, etc., are pre-

sented. Most call for tenders for the machine are placed, and hardware and software choices have been adopted. Alba uses Tango as the toolkit for building the control system. Device servers are mostly written in C++ and Python. Clients are mostly Java (ATK) and Python (+Qt). Different technologies have been chosen for the different subsystems, i.e., PLCs and distributed I/O for the Equipment Protection System, safety PLCs for the Personnel Safety System, event-driven timing system, Ethernet for the power supplies, etc. The actual status of both hardware and software is given, and the plans for the future are presented.

TPPB15 – The CSNS Controls Plan
ChunHong Wang (IHEP Beijing, Beijing)
The China Spallation Neutron Source (CSNS) is an accelerator-based high-power project currently under planning in China. For the similarities between the CSNS and the U.S. Spallation Neutron Source (SNS), the SNS control framework will be used as a model for the machine controls. And the software framework used at SNS, XAL, is a natural choice for the CSNS. This paper provides a controls overview and progress. Also, the technical plan, schedule, and personnel plan are discussed.

TPPB16 – Preliminary Design of the Control System for the Micro-Gravity Experiment Facility at MGLAB
Noriichi Kanaya (Ibaraki University, Ibaraki)
A control system has been designed as a preliminary prototype control system for the micro-gravity experiment facility at Micro-Gravity Laboratory of Japan (MGLAB) where varieties of micro-gravity drop experiments, such as biology, metallography, phytopathology and chemistry, are carried out by putting a payload capsule loading a few sets of experiment equipment into a deep vacuum mine-shaft (approximately 150m in depth) providing a free fall state, i.e. the

micro-gravity condition as a first step towards outer-space experiments by space craft. In addition to a number of motors, vacuum pumps, pressure gauges and power supplies, there are mechanical systems to manipulate the payload capsule and 'excavating' machine to hoist it up to the ground level for a next experiment. The system employs a 100MHz-computer network and a wireless LAN boarded on the 'falling' payload capsule to control and to acquire experimental data. We have preliminarily designed and implemented the system in Java on Linux. The results of the preliminary control system are discussed in this paper.

TPPB17 – 1.8 GeV Synchrotron Radiation Beamlines and Their Distributed Control System at Tohoku Synchrotron Radiation Facility (TSRF)

Noriichi Kanaya (Ibaraki University, Ibaraki), Shoji Suzuki (Tohoku University, Sendai)

A distributed control system has been developed for fifty synchrotron radiation beamlines for the 1.8 GeV storage ring at Tohoku Synchrotron Radiation Facility (TSRF), Tohoku University. The fifty synchrotron radiation beamlines are to be operated for soft X-ray optics/microscopy, lithography, and biomaterial research experiments. The system is composed of outlying computers and operator consoles connected to a network. Each beamline is controlled by its own outlying computer in acc
ordance with physics experimental requirements. The control system protects ultra-high vacuum components of the beamline and the storage ring by closing valves/shutters in case of a vacuum failure. The control scheme for the synchrotron radiation beamlines at TSRF are discussed in this paper.

TPPB18 – Present Status of VEPP-5 Control System

Dmitry Bolkhovityanov, Alexander Antonov,

Roman Evgenievich Kuskov (BINP SB RAS, Novosibirsk)

As VEPP-5 moves to commissioning, its control system—CX—becomes more mature. CX is a distributed, networked control system based on a 3-layer "standard model." It has been used for VEPP-5 control since 2000; most hardware is CAMAC and CAN-bus. Currently most control programs have switched to modular plugin-based architecture, which significantly eases development of applications and enhances the whole control system integration. Large-data-size control hardware (such as digital oscilloscopes and CCD-cameras) is fully supported by CX now. E-logbook is currently being deployed, both as a web application and with direct support in control programs. GIS technology is being introduced to the control system, which opens many interesting possibilities.

TPPB19 – A GUI Builder Environment Based on LabVIEW for the Virgo Project

Franco Carbognani, Bernhard Lopez, Daniel Sentenac (EGO, Pisa)

The Virgo project consists of a suspended Michelson Interferometer with two 3-km-long arms aiming to detect gravitational wave signals from cosmic sources. In order to support the ongoing Virgo commissioning activities and facilitate the transition to full operational mode, the need for new, quickly built, flexible, and graphically rich Graphical User Interfaces (GUI) arose. The challenge was to set up a GUI building environment able to deal with those requirements and to smoothly integrate it with the existing distributed control software framework. We have been able to fulfill these requirements by using LabVIEW and by enhancing its functionalities within three main components: a LabVIEW interface to the Virgo control framework, similarly to what has been done for other frameworks such as EPICS or Tango;*,** a common functions library; and a common building blocks.

This GUI building environment required an initial effort of customization by establishing the right methodology and implementing the basic components, but has enabled the building of new GUIs with a high level of flexibility and maintainability.

*D. Thompson and W. Blokland, "A Shared Memory Interface between LabVIEW and EPICS," ICALEPCS 2003.
**J-M Chaize et al., The ESRF Tango Control System Status, ICALEPCS 2001.

European Gravitational Observatory (EGO)

TPPB20 – SSRF Beam Instrumentations System

Yongbin Leng, Jie Chen, Yongzhong Chen, Zhichu Chen, Dekang Liu, Kairong Ye, Chongxian Yin, Jun Yu, Luyang Yu, Renxian Yuan, Guobi Zhao, Weimin Zhou, Yi Zou (SINAP, Shanghai)

SSRF is equipped with various beam instrumentations, in which the Linac part has been working well since the start of the commissioning this year, and the booster and storage ring parts are still under implementation and commissioning. The commercial products were adopted to build this system as much as possible. The all-in-one electron beam position monitor processor, Libera, was used for whole facility to provide single-pass, first-turn, turn-by-turn, COD, and fast application beam position data. The Bergoz NPCT175 parametric current transformers were used for DC current measurement in the booster and storage ring. The various optical beam diagnostic systems, such as synchrotron radiation interferometers for precise beam-size measurement, the fast gated camera, and the bunch length monitor will be equipped in the dedicated diagnostics beam line. Data acquisition for beam instrumentation system should be a part of control system, developed on an EPICS platform. There are three kinds of Input

Output Controllers (IOCs) used in diagnostics: VxWorks-based VME IOCs, Linux-based Libera IOCs, and Windows-based PC IOCs.

TPPB21 – SSRF Injector Diagnostics System Commissioning

Yongzhong Chen, Jie Chen, Zhichu Chen, Yongbin Leng, Yingbing Yan, Weimin Zhou, Yi Zou (SINAP, Shanghai)

This paper presents the beam diagnostics layout for the SSRF (Shanghai Synchrotron Radiation Facility) Injector, which includes the 150MeV LINAC and booster (3.5GeV) and beam transport lines. The different beam diagnostics monitors for beam current, beam position, and beam profile are briefly described. The beam diagnostics data acquisition architecture is introduced. Commissioning results for the 150MeV LINAC are presented. The commissioning status of the booster is described in this paper.

TPPB22 – Design of the Control and Data Acquisition System for the Neutron Spin Echo Spectrometer at the Spallation Neutron Source

Harald Kleines, Michael Butzek, Matthias Drochner, Peter Kaemmerling, Tadeusz Kozielewski, Michael Monkenbusch, Michael Ohl, Frank Suxdorf (FZJ, Jülich)

The Jülich Centre for Neutron Science (JCNS) is constructing a new "best-of-class" Neutron Spin Echo Spectrometer (NSE) at the Spallation Neutron Source (SNS) in Oak Ridge. Using superconducting precession coils, energy resolutions of 0.7 neV can be achieved with the new instrument, which will start commissioning in autumn 2008. Recently, JCNS constructed an NSE at its branch lab at the FRM-II reactor in Garching. This so-called JNSE is in its commissioning phase now, and its control and data acquisition system is based on the "Jülich-Munich Standard." The "Jülich-Munich Standard" includes the TACO control system developed by the ESRF and the extensive use of industrial-

type front-end equipment, e.g., PLCs, fieldbus systems (PROFIBUS DP), or remote I/Os. Since there are a lot of components and structures that are common for both instruments, the same technology shall be used for the SNS-NSE, of course. On the other hand, local SNS standards have to be supported since the SNS-NSE shall fit into the DAQ-infrastructure of the SNS, e.g., regarding data formats, interface to the timing system, or the ability to include local sample environments.

TPPB23 – LHC Powering Circuit Overview: A Mixed Industrial and Classic Accelerator Control Application

Frederic Bernard, HERVE MILCENT, Stephen Page (CERN, Geneva)

Three control systems are involved in the powering of the LHC magnets: QPSs (Quench Protection Systems), PICs (Powering Interlock Controllers), and PCs (Power Converters). They have been developed and managed by different teams. The requirements were different; in particular, each system has its own expert software. The starting of the LHC hardware commissioning has shown that a single access point should make the tests easier. Therefore, a new application has been designed to get the powering circuit information from the three expert softwares. It shows synthetic information, through homogenous graphical interfaces, from various sources: PLCs (Programmable Logic Controllers) and WorldFIP agents via FESA (Front-End Software Architecture) and via gateways. Furthermore, this application has been developed for later use. During the LHC operation, it will provide powering circuit overview. This document describes the powering circuit overview application based on an industrial SCADA (Supervisory Control and Data Acquisition) system named PVSS with the UNICOS (Unified Industrial Control System) framework. It also explains its integration into the LHC accelerator control infrastructure.

TPPB24 – Status of Control System for Indus-2

Pravin Fatnani, Rajesh Kumar Agrawal, Kirti G. Barpande, Amit Chauhan, Sampa Gangopadhyay, Pankaj Gothwal, Ashesh Mangaldas Gupta, Musuku Janardhan, Nitin Lulani, Bhavna Nitin Merh, Kutubuddin Saifee, M Seema, Yogendra M Sheth, Bakshi Sanjai Kumar Srivastava, Rishipal Yadav (RRCAT, Indore (M.P.)), Ashok Francis, Vijay Kumar Gupta, Jai Prakash Jidee, Samresh Kar, Hemant Kumar, Sanjai Kumar, Vijay C. Parate, Prashant G. Pawanarkar, Archana Prabhu, T. V. Satheesan, Harish Vaishnav (RRCAT, Indore)

Indus-2 is a 2.5 GeV, 300 mA Synchrotron Radiation Source under commissioning at Raja Ramanna Centre for Advanced Technology (RRCAT), Indore, India. The control system employs SCADA (PVSS) for control application developent and deployment, Labview for utility services control and other general applications, Java and Web technologies for easy data access and presentation over the campus, Matlab for orbit control, extensive parameter database, and VME hardware infrastructure, essentially developed and done in-house. The control system has grown from strength to strength since first operations, about two years back. Employing about 80 equipment control stations distributed all over and networked using Profibus, the system distinguishes itself as a large indigenous development effort and covers all essential aspects of control requirements of the machine presently and continues to grow rapidly. The paper describes the control system architecture in brief, its evolution, and various important and useful services added in the course of the past two years. We conclude with the overall experience and the plans for the future.

TPPB25 – SPARC-CS: The SPARC Control System

Giampiero Di Pirro, Marco Bellaveglia, Daniele Filippetto, Elisabetta Pace (INFN/LNF, Frascati (Roma)), Luciano Catani, Alessandro Cianchi (INFN-Roma II, Roma)

We describe the control system for the new Frascati injector project (SPARC). The injector starts operation in fall 2007, and at that time the control system must be fully operative and integrate all tools to help the machine operation. To allow a fast development of the control system, we made some choices: (1) Labview as developing system due to its diffusion in the Frascati labs and being a standard-de-facto in the acquisition software; (2) GigaBit Ethernet as interconnection bus in order to have sufficient bandwidth for data exchange; and (3) PCs as front-end CPUs and operator console because they have enough computing power. In 2006 a first operation of the control system, during the SPARC gun test performed with the e-meter diagnostic apparatus, allowed us to test the architecture of the control system both from the hardware and software points of view. All control applications for magnetic elements, vacuum equipment, RF cavities, and some diagnostics have been developed and debugged online. An automatic process stores in a database operating information both periodically and on data change. Information can be sent automatically or manually to our e-logbook.

TPPB26 – Progress of EPICS Implementation in Control Systems of VEC and SCC

Anindya Roy, Tanushyam Bhattacharjee, Rajendra Balkrishna Bhole, Niraj Chaddha, Sarbajit Pal, Umashankar Panda (DAE/VECC, Calcutta)

The main control systems of the room temperature (K-130) and superconducting (K-500) cyclotron consist of magnet power supply (MPS), vacuum, beam diagnostics, beamline

instrumentation control, and cryogenic delivery system. These systems are redesigned using EPICS for better operation of the machine and maintenance. Many EPICS drivers and tools have been developed, tested, and integrated with these systems. Simultaneous control of the many MPS process parameters and the response time of beam dynamics are two major factors in an MPS control system. This is achieved by developing an EPICS driver for an Ethernet-to-serial converter that sets and controls several commercial MPSs having serial connectivity. Supervisory control of the cryogen delivery system is developed by integrating an EPICS MODBUS-TCP driver, which communicates with a master PLC responsible for process synchronization of individual subsystem (e.g., cold box, gas management system, and liquid nitrogen system). The criticality of design and implementation of EPICS-based supports and tools to achieve desired goals and experience synchronizing a large number of operational parameters are described in this paper.

TPPB27 – The New Control System for the Future Low-Emittance Light Source PETRA 3 at DESY: Sprinting to the Finish
Reinhard Bacher (DESY, Hamburg)
At DESY the existing high-energy physics booster synchrotron PETRA 2 will be transformed into a third-generation light source (PETRA 3). In addition, the technical systems and components of the pre-accelerators LINAC 2 and DESY 2 will be improved. Within the scope of this project, the control system and the front-end electronics will be upgraded. Besides a report on the current project's status, the paper emphasizes the basic conceptual ideas and discusses their implications and how they lead to novel features and development tools.

TPPB28 – Conceptual Design of the Control and Data Acquisition Systems of the ITER Neutral Beam Injector and Associated Test Facility

Adriano Luchetta, Gabriele Manduchi (Consorzio RFX, Padova)

ITER is a joint international research and development project aiming to demonstrate the scientific and technical feasibility of fusion power. The ITER Neutral Beam Injector (NBI, negative D2 ion source, 1MV acceleration voltage, 40A ion current, 16.5MW beam power, 1 hour continuous operation) is a major component of ITER and will be supported by a dedicated test facility (NBTF). The NBI and the NBTF are being designed with the goal to have one injector fully operational on the ITER device in 2016. The two items need separate, but closely interacting, control and data acquisition systems (CDAs). The NBI CDA system will manage the NBI device and will be installed at the ITER site; the NBTF CDA system will manage the test facility and in particular will enable extensive scientific exploitation of the NBI before its final installation at the ITER site. The paper reports on the design activity for both CDA systems, including the definition of the system requirements, the functional system structure, and the preliminary system architecture.

TPPB29 – The OPC-Based System at SNS: An EPICS Supplement

Marnelli Martinez, Randall Wood (ORNL, Oak Ridge, Tennessee)

The Power Monitoring System at the Spallation Neutron Source (SNS) is a Windows-based system using OLE for Process Control (OPC) technology. It is employed as the primary vehicle to monitor the entire SNS Electrical Distribution System. This OPC-based system gathers real-time data, via the system's OPC server, directly from the electrical devices: substations, generators, and Uninterruptible Power Supply (UPS)

units. Thereupon, the OPC-EPICS softIOC interface reads and sends the data from the OPC server to EPICS, the primary control system of SNS. This interface provides a scheme for real-time power data to be shared by both systems. Unfortunately, it engenders obscure anomalies that include data inaccuracy and update inconsistency in EPICS. Nevertheless, the OPC system supplements the EPICS system with user-friendly applications—besides the ability to compare real-time and archived data between the two systems—that enable performance monitoring and analysis with ease. The OPC-based system at SNS is a complimentary system to EPICS.

TPPB30 – How to Use a SCADA for High-Level Application Development on a Large-Scale Basis in a Scientific Environment

Katy Saintin, Alain Buteau, Vincent Hardion, Majid Ounsy (SOLEIL, Gif-sur-Yvette)

For high-level applications development, SOLEIL adopted GlobalSCREEN, a professional Java SCADA, developed by the ORDINAL company.* This environment enables end users to quickly build user-friendly GUIs without writing any Java code and by drag-dropping reusable graphical components developed by the software control team. These components are made up on top of the ATK** library, which provides a rich set of graphical widgets, including scientific data visualization tools, and already encapsulating communication with the Tango software bus. This way, SOLEIL can allow its users to lay out their supervisory applications with a homogenous look and feel and benefit (as they are natively provided by GlobalSCREEN) from functionalities such as access right management, web access, and remote administration at a minimal development cost. An original organization has been set up to deal with this collaborative work between "pure software developers" and "occasional" supervision applications developers. The work organization, the software archi-

tecture, and the design of the whole system will be presented, as well as the current status of deployment at SOLEIL for accelerators and for beamlines.

*http://www.ordinal.fr/
**Application Tango Toolkit

TPPB31 – Status of the SOLEIL Software Control System

Alain Buteau, Brigitte Gagey, Nicolas Leclercq, Majid Ounsy (SOLEIL, Gif-sur-Yvette)

The SOLEIL synchrotron light source is based on a 2.75 GeV electron storage ring that was commissioned in 2006 at Saint Aubin, France. The first 10 beamlines are currently commissioned, and regular user operation is planned for summer 2007. SOLEIL is also the first 100% TANGO-controlled facility. Originally developed at the ESRF, the object-oriented TANGO Control Framework is now the core component of a close collaboration between four synchrotron facilities: ESRF, SOLEIL, ELETTRA, and ALBA. The SOLEIL control system is an example of the TANGO capability of federating heterogeneous off-the-shelf technologies into a coherent whole on the basis of a single concept: the device. The aim of the presentation is to provide an overview of the "Service-Oriented Architecture," which is now routinely used for the control of both the SOLEIL accelerators and beamlines. The ubiquity of the TANGO services will be illustrated on both server and client sides of the control system architecture. The main software subsystems will be presented. We will conclude with a feedback report by presenting some figures and statistics about the control system's stability after its first year of operation.

TPPB32 – EPICS at the Synchrotron Radiation Source DELTA

Ulf Berges, Sven Doering (DELTA, Dortmund)

Since 1999 the control system at the synchrotron radiation source DELTA, located at the University of Dortmund, Germany, has operated under EPICS. The change from a nonstandard, handmade system to EPICS has been made stepwise till 2001. Since 2002 the first two beamlines in the soft X-ray region are also operated under EPICS to benefit from the easy communication with the accelerator control system. A complete plane-grating-monochromator-beamline (PGM-beamline U55) with its experiment is operated under EPICS, including the stepper motors and device readout. A toroidal-grating-monochromator-beamline (TGM-beamline) has been completely changed from an old system into EPICS control system. At both beamlines new photon-bpm-readout systems under a LINUX-PC and EPICS from the company ENZ are tested. Also a compact stepper motor driver unit with a small LINUX-PC has succesfully been developed in this cooperation. DELTA works as a test facility for these new developments. The easy and fast exchange of the necessary data with the machine control system is an advantage as is the benefit from the EPICS community.

TPPB33 – Spallation Neutron Source Cryogenic Control System

William Strong, Pamela Gurd (ORNL, Oak Ridge, Tennessee)

The Spallation Neutron Source Cryogenic System provides 2.1 K liquid helium for the Linac superconducting cavities. This system and its associated controls were brought online very quickly and have operated reliably for more than 2 years. Most signals are monitored and outputs are controlled by Programmable Logic Controllers. System coordination and most PID control loops (approximately 250 of them) are performed by EPICS IOCs. The combination of

PLCs and VME IOCs has proven very efficient, flexible, and reliable. This paper will provide details on the design, implementation, and operation of the cryogenic control system.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

TPPB34 – ISAC Control System Update
Rolf Keitel, Daryl Bishop, Don Dale, Travis Howland, Hubert Hui, Kevin Langton, Mike LeRoss, Rod Nussbaumer, Christopher Gerald Payne, Klara Pelzer, Jane E Richards, William Roberts, Evgeniy Tikhomolov, Graham Waters (TRIUMF, Vancouver)
At the ISAC radioactive beam facility, the superconducting Linac was commissioned, and several experimental beam lines were added. The paper will describe the additions to the EPICS-based control system, issues with integration of third-party systems, as well as integration of accelerator controls with experiment controls.

TPPB35 – The Control System for the TITAN Experiment at ISAC
Don Dale, Travis Howland, Hubert Hui, Rolf Keitel, Kevin Langton, Mike LeRoss, Rod Nussbaumer, Klara Pelzer, Jane E Richards, William Roberts, Evgeniy Tikhomolov (TRIUMF, Vancouver)
The TITAN experiment at the ISAC radioactive beam facility consists of an RF cooler system, a Magnetic Penning Trap (MPET), and an Electron Beam Ion Trap (EBIT). These three systems may run together or independently. This paper describes the EPICS-based TITAN control system, which was modeled after the ISAC control system to facilitate integration. Both software and hardware configurations will be described, with emphasis on pulsed diagnostics and the pulse distribution system for synchronizing the traps in different operation modes.

TPPB36 – Controls for the ILC Test Areas at Fermilab

Dennis J. Nicklaus, Sharon Louise Lackey, Luciano Piccoli, Ron Rechenmacher, David Geoffrey savage, Margaret Votava (Fermilab, Batavia, Illinois)

We present the status of the controls efforts for the International Linear Collider (ILC) Test Areas at Fermilab. Several different test areas for ILC accelerating cavities and cryo modules are being constructed at Fermilab, including a Vertical Test Stand, Horizontal Test Stand, Coupler Conditioning area, and a test beamline at the Fermilab NML building. We discuss the progress, plans, and challenges for these various facilities.

TPPB37 – Status of the MLS Control System

Ralph Lange, Thomas Birke, Reiner Daum, Silvio Ehlert, Dieter Faulbaum, Benjamin Franksen, Ralf Hartmann, Bernhard Kuner, Patrick Laux, Roland Müller, Ingo Müller, Joachim Rahn, Harald Rüdiger, Dennis Thorn (BESSY GmbH, Berlin)

The Physikalisch-Technische Bundesanstalt (PTB), the German national metrology institute, has set up in close cooperation with BESSY a low-energy electron storage ring next to the BESSY II site. The new storage ring, named "Metrology Light Source" (MLS), is mainly dedicated to metrology and technological developments in the UV and VUV spectral range. Its commissioning started in March 2007. The MLS control system is based on the Experimental Physics and Industrial Control System (EPICS) toolkit. Design and implementation choices guided by the experiences with the BESSY II control system have been flanked by other techniques and new approaches where needed and appropriate. The presentation introduces the MLS and discusses design and implementation of its control system.

Funded by the Bundesministerium für Wirtschaft (BMWi).

TPPB38 – Status of the ERLP Control System

Brian Martlew, Steve Davis, Andy Duggan, Alan Quigley, Ralph Rotheroe (STFC/DL/ SRD, Daresbury, Warrington, Cheshire), G. Cox, Adrian Oates (STFC/DL, Daresbury, Warrington, Cheshire)

The Energy Recovery Linac Prototype (ERLP) is a 35 Mev superconducting linac currently being commissioned at Daresbury Laboratory. Its purpose is to demonstrate the technology necessary to design and build a 600 Mev energy recovery linac (4GLS), which, together with a suite of XUV, VUV, and IR FELs, can be used to undertake pump-probe experiments to investigate dynamic systems. The ERLP control system is based on EPICS, VME64x hardware, and the vxWorks operating system. Status control and interlock protection are handled by a Daresbury-designed CANbus system that has been tightly integrated into EPICS. Construction and commissioning of ERLP have taken place in parallel, and this introduced a number of problems in the planning and implementation of the control system. This paper describes the ERLP control system and disusses the successes and difficulties encountered during the early phases of commissioning. Plans are already in place to extend the control system to cover EMMA, a novel, non-scaling, fixed-field alternating gradient (FFAG) accelerator that will be added to ERLP in 2008/9.

TPPB39 – Experiences with an Industrial Control System: Traceability of Specifications, Commissioning Support, and Conclusions from the HICAT Project

Tibor Fleck, Ralph C. Baer, Marcus Schwickert, Udo Weinrich (GSI, Darmstadt)

While the accelerator for HICAT was designed by GSI, most components and systems were

supplied by industrial partners. Despite thorough and detailed specifications for the control system, the concept allowed a rather high degree of freedom for the industrial partner regarding the implementation. The challenge of this combination established a good understanding of the necessary functionalities by our industrial partner. First, we describe the process of implementation starting with the specifications made, sum up the tracing of the development, and show how we ensured proper functionality ab inito and necessary steps since then. Second, we describe problems ranging from software bugs to demands regarding acceptance tests for other components and state how we managed to solve these problems with our industrial partner on a short timescale. Last, we show what can be learned from our experiences. In particular we discuss where it is more efficient to describe all necessary physical dependencies to the industrial partner instead of defining a proper interface where the programming can be done by accelerator experts and concentrate on areas that led to problems with the time schedule.

TPPB40 – The ATLAS TILECAL Detector Control System

Joao Pina, Agostinho Gomes (LIP, Lisboa), Giorgi Arabidze (CERN, Geneva), Mohamed Ouchrif (Université Blaise Pascal, Clermont-Ferrand)

TILECAL is the barrel hadronic calorimeter of the ATLAS detector. The main task of the TILECAL Detector Control System (DCS) is to enable the coherent and safe operation of the detector. All actions initiated by the operator and all errors, warnings, and alarms concerning the hardware of the detector are handled by DCS. Most of the components were already produced and installed in the detector. The SCADA software used is PVSS from the Austrian company ETM. The TILECAL main DCS systems are the low- voltage power supply system, high-voltage

distribution system, and cooling of the electronics. All functional blocks can run autonomously. The DCS for the TILECAL is divided in four sectors all identical in the logical point of view, two for the extended barrel regions and two the central region. Each sector is composed by one cooling, HV and LV partition. All these systems are now being implemented and some are already in use for the TILECAL tests and certification. The integration with the global ATLAS DCS system is done by an FSM based on CERN SMI++ which is already in use since December of 2006.

TPPB41 – NSLS II Control System Overview
Leo Bob Dalesio (SLAC, Menlo Park, California)
The NSLS II is a new light source to be built at Brookhaven National Laboratory. The control system tools will be started this year. Technical areas of interest to improve productivity, maintainability, and performance, include Relational Database tools to support all aspects of the project, online Bbam modelling, intelligent distributed device controllers, and engineering and operation tools. We will discuss our goals and projects to make progress in these areas.

DoE

TPPB42 – The Selection, Development, and Application of PLC Solutions for the Diamond Light Source
Simon Lay, Paul Amos, Mark Heron, Mike McClory, Hugo Shiers (Diamond, Oxfordshire)
Diamond Light Source set out to address a wide range of control system requirements, from process control to interlocking with a minimum number of PLC types. This resulted in standardization of PLCs from just two manufacturers. Siemens was chosen for high-end process control and Omron for a variety of other applications, including interlocking and protection.

These were then applied to a large number of applications, which have been addressed wherever possible using standard solutions. The details of this approach, and solutions managed through it, including procurement of turnkey systems by industry, and how future obsolescence is being addressed are all described.

Tuesday Oral Session, TOPB
2nd Floor Lecture Hall, 4:40-6:00 p.m.
Session Chairs: Eric Bjorklund, LANL
Jijiu Zhao, IHAP

4:40 **TOPB01 – Upgrade Program of the PSI High Intensity Cyclotron**
Timo Korhonen, Damir Anicic, Anton Mezger, Detlef Vermeulen (PSI, Villigen)
The PSI 590-MeV Cyclotron is already more than 30 years in operation. However, it still holds the world record in continuous beam power. There is an active experiment program being pursued, and new experiments are planned and being built. In addition, the beam intensity is being upgraded by 50%. The control system has been through several incremental upgrades. However, the new requirements and other developments at PSI (other accelerator facilities) force again an upgrade. This time the whole architecture of the system is to be changed. The controls hardware architecture will be changed and the underlying software will move to EPICS. All this has to happen without compromising the operation schedule. In the upgrade program we are planning to benefit from several new developments, both in-house and together with the community. The central technologies to be used will be presented. The issue of how to tackle the somewhat contradictory goals of upgrading on the fly will be discussed.

5:00 **TOPB02 – Improvement of Tore Supra Real Time Processing Capability Using Remote PCs**

Philippe Moreau, Bernard Guillerminet, Fabrice Leroux, Diego Molina, Nathalie Ravenel (EURATOM-CEA, St Paul Lez Durance)

The Tore Supra tokamak is the largest superconducting magnetic fusion facility. Its real time measurements and control system is designed to deal with continuous acquisition during the plasma discharge, fast acquisition (sampling frequency up to 4 GHz) and Real Time (RT) data processing. The simultaneous control of an increasing number of plasma parameters aiming at tokamak operations in a fully steady state regime makes fast acquisitions and RT data processing more and more demanding. The Tore Supra Data Acquisition System (DAS) is based mainly on VME bus acquisition units using Lynx OS 3.1 as operating system. Some units are not able any more to handle in parallel the data flow rate (about 100ko/s increasing up to 6Mo/s during fast acquisition phase) and the RT processing. Furthermore, the time delay between two fast acquisition phases must be reduced to be able to catch fast plasma events. To cope with these needs, the data processing capability has been enhanced while preserving the existing acquisition system. A new DAS layer containing Linux-PC has been implemented. The link between the Lynx-OS layer and the Linux layer is ensured by a 100-Mbps Ethernet link.

5:20 **TOPB03 – The Evolution of the ELETTRA Control System**

Claudio Scafuri, Lorenzo Pivetta (ELETTRA, Basovizza, Trieste)

The evolution of the ELETTRA control system is presented by focusing on the major technical upgrades. The ElETTRA control system has been in operation since 1993. The original control system architecture was based on a three layer design. A field bus connected the low

level computers used to interface the accelerator devices whilst a ten megabit shared Ethernet network linked the middle layer computers to the servers and operator workstations. A first control system upgrade started in 1998 in order to dismiss the field bus and to provide more computing power. A couple of years later a major rework of the network infrastructure was carried out with the introduction of a switched Ethernet architecture. Starting from 2003, in view of the construction of a new booster injector for the storage ring and of the FERMI@elettra free electron laser, new control system hardware and software platforms have been selected. Driven by the additional necessity of cutting development and maintenance costs, the Tango control system has been adopted. The tools developed in order to effectively manage the integration and coexistence of the legacy and new control system are described.

5:40 **TOPB04 – Control System of the KEKB Accelerator Complex**

Kazuro Furukawa, Atsuyoshi Akiyama, Norihiko Kamikubota, Tatsuro Nakamura, Jun-Ichi Odagiri, Masanori Satoh, Tsuyoshi Suwada, Noboru Yamamoto (KEK, Ibaraki)

The KEKB asymmetric electron-positron collider complex consists of 8-GeV Linac, high-energy and low-energy rings. Some of the resources were inherited from the previous TRISTAN project, and also they are shared with Photon Factory and PF-AR light sources. In order to realize the long lifespan of the system de-facto and international standard technologies were employed since the early stage, which have been efficiently operated. Several gateway methods were implemented to integrate heterogeneous sub-systems, which are gradually converted into EPICS. Scripting languages are employed for higher-level applications. The ever-evolving control system has enabled flexible and reliable beam operations at KEKB throughout the long period.

Wednesday Oral Session, WOAA
2nd Floor Lecture Hall, 8:30 a.m.
Session Chairs: Wayne Salter, CERN
Mark Heron, Diamond

8:30 **WOAA01 – The ILC Control System**
John Carwardine, Frank Lenkszus, Claude William Saunders (ANL, Argonne, Illinois), Stefan Simrock (DESY, Hamburg), Patricia McBride, Margaret Votava (Fermilab, Batavia, Illinois), Shinichiro Michizono (KEK, Ibaraki), Raymond Sverre Larsen (SLAC, Menlo Park, California)
Since the last ICALEPCS, a small multi-region team has developed a reference design model for the ILC Control System as part of the ILC Global Design Effort. The scale and performance parameters of the ILC accelerator require new thinking in regards to control system design. Technical challenges include the large number of accelerator systems to be controlled, the large scale of the accelerator facility, the high degree of automation needed during accelerator operations, and control system equipment requiring "Five Nines" availability. The R&D path for high availability touches the control system hardware, software, and overall architecture, and extends beyond traditional interfaces into the accelerator technical systems. Software considerations for HA include fault detection through exhaustive out-of-band monitoring and automatic state migration to redundant systems, while the telecom industry's emerging ATCA standard—conceived, specified, and designed for High Availability—is being evaluated for suitability for ILC front-end electronics. Parallels will be drawn with control system challenges facing the ITER CODAC team.

Work in the U.S. is supported by the U.S. Department of Energy under contract Nos.

DE-AC02-06CH11357, DE-AC02-76CH03000, and DE-AC02-76SF00515.

9:00 **WOAA02 – Outsourcing, Insourcing, and Integration of Control Systems in the Australian Synchrotron**
Richard Farnsworth (ASP, Clayton, Victoria)
The Australian Synchrotron was built in less than four years and under budget with many subsystems outsourced. This presentation discussed some of the issues involved. It discusses the reasons for outsourcing, the approach taken, and some of the technical issues involved, including open source versus proprietary software, testing, training, collaboration, and source control. The importance of a solid engineering approach, specification, interface, systems design, and in-house ability are discussed. A discussion of engineering standards, both hardware and software, is presented. A balance of the positive and negative elements of the approach is put forward, and some suggestions for future projects run on similar lines are made.

9:30 **WOAA03 – LHC Cryogenics Control System: Integration of the Industrial Controls (UNICOS) and Front-End Software Architecture (FESA) Applications**
Enrique Blanco, Philippe Gayet (CERN, Geneva)
The LHC cryogenics control system is based on the CERN Industrial framework UNICOS (Unified Industrial Control System). UNICOS covers aspects related to both the SCADA (Supervisory Control and Data Acquisition) and the PLCs (Programmable Logic Controllers). The LHC cryogenic instrumentation must deal with the hostile radiation environment present in the accelerator tunnel preventing the use of off-the-shelves sensor signal conditioners. The conditioners are then realized with rad hard components connected to the control system through a WordlFIP fieldbus. A custom application using a

FESA (Front-End Software Architecture) framework has been developed in an industrial PC, the standard CERN solution for WorldFIP interfacing. The solution adopted is based on custom generators that allow rapid prototyping of the control system by minimizing the human intervention at the configuration time and ensuring an error-free application deployment. This document depicts the control system architecture, the usage of custom generators within large systems, and the integration of the software applications with a classical industrial controls architecture application.

9:50 **WOAA04 – Vista Controls' Vsystem at the ISIS Pulsed Neutron Source**
Bob Mannix (STFC/RAL/ISIS, Chilton, Didcot, Oxon)
The conflicting requirements and needs for a small controls team and the development and support of increasingly complex software tools may indicate a commercial SCADA solution for many facilities, even quite large ones. The experience over some years of such a solution (Vista Controls' Vsystem) for a world-leading, accelerator-based, pulsed neutron source, and its advantages and disadvantages, are discussed.

10:10 **WOAA05 – Stepper Motor Control, PLC vs VME**
William Strong, Pamela Gurd (ORNL, Oak Ridge, Tennessee)
Traditionally, EPICS-based accelerator control systems have used VME-based motion control modules to interface with stepper motors. For systems that include some Programmable Logic Controllers (PLCs), there is an option for using PLC-based stepper motor interface modules. As with all control system choices, there are trade-offs. This paper will delineate some of the pros and cons of both methods of interfacing with stepper motors.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

Wednesday Oral Session, WOAB
2nd Floor Lecture Hall, 11:00 a.m.
Session Chairs: Matthew Bickley, JLab
Roland Müeller, BESSY

11:00 **WOAB01 – Operational Tools at the Stanford Linear Accelerator Center**
Greg White, Sergei Chevtsov, Chungming Paul Chu, Diane Fairley, Christopher Larrieu, Deborah Rogind, Hamid Shoaee, Mark Woodley, Michael Zelazny (SLAC, Menlo Park, California)
The operational tools at SLAC have been in continuous development for 20 years. These include a highly developed orbit correction package, an automatic bump maker, orbit fitting, lattice diagnostics, beta-matching and phase advance calculator, a macro recording facility, "Correlation Plots," which is a facility for conducting small ad-hoc experiments, plus a number of others. All of these use a global online modeling database system, and they are all integrated into a single interactive application program, so they interoperate seamlessly. In this talk I'll review these tools, and contrast them with systems we have recently developed which focus on support for accelerator physics conducted directly from numerical analysis packages such as Matlab, or from physicists' own small specialized programs. Lastly, our plans to rewrite all of these operational tools using modern software tools and infrastructure, and how we bridge old systems to new, will be presented.

Work supported by Department of Energy contract DE-ACO3-76SFOO5 15.

11:30 **WOAB02 – CAD Model and Visual Assisted Control System for NIF Target Area Positioners**

Ephraim Tekle, Timothy Paik, Eric Wilson (LLNL, Livermore)

The National Ignition Facility (NIF) contains precision motion control systems that reach up to 6 meters into the target chamber for handling targets and diagnostics. Systems include the target positioner, an alignment sensor, and diagnostic manipulators. Experiments require a variety of arrangements near chamber center to be aligned to an accuracy of 10 micrometers. These devices are some of the largest in NIF, and they require careful monitoring and control in three dimensions to prevent interferences. Alignment techniques such as viewing target markers and cross-chamber telescopes are employed. Positioner alignment is a human-control process incorporating real-time video feedback on the user interface. The system provides efficient, flexible controls while also coordinating all positioner movements. This is accomplished through advanced video-control integration incorporating remote position sensing and real-time analysis of a CAD model of target chamber devices. This talk discusses the control system design, the method used to integrate existing mechanical CAD models, and the offline test laboratory used to verify proper operation of the integrated control system.

This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.

11:50 **WOAB03 – Development of Accelerator Management Systems with GIS**

Akihiro Yamashita, Yasuhide Ishizawa (JASRI/SPring-8, Hyogo-ken)

We have been developing accelerator management systems for SPring-8 on Geographic Information System (GIS). Those systems are, in short, “Google maps for accelerators”. Users enjoy interactive accelerator maps on web browsers with zooming, panning, ruler, image overlay and multi-layer display features. We applied an open-source GIS, MapServer, for the systems. We have build two web-based systems on MapServer. Accelerator inventory management system displays equipment locations on the map reading data from a relational database. It displays not only locations of equipment but also detailed attributes by clicking symbols on the interactive map. Users also can enter their own data or upload their own files from the web browser to store into the database. Another SCSS alarm system displays real-time alarm locations on the map. The alarm database build on the MADOCA system serves real-time and static data for alarm display. We will show mechanism and development of those systems in the paper.

12:10 **WOAB04 – Web-Based Electronic Operation Log System – Zlog System**
Kenzi Yoshii, Takuya Nakamura, Sumito Shimomura (MELCO SC, Tsukuba), Kazuro Furukawa, Tatsuro Nakamura, Takashi Obina, Masanori Satoh, Noboru Yamamoto (KEK, Ibaraki)
A Zope-based electronic operation logging system, named Zlog system, has been used since January 2004 at the KEKB and PF-AR accelerator facilities at KEK. Zope* is a Web content management system, which is based on several open source software components like Python and Postgresql. It enabled us to develop our Zlog in a short period, because the Zope system includes a development framework for Web application server. Zlog was introduced also to J-PARC/KEK-JAEA and RIBF/RIKEN, based on the experiences at KEKB and PF-AR. Zlog was proved to be quite portable even under different computer architectures. Zlog at KEKB

accumulates about 1.5 million event entries so far, and images taken during the operation can be stored and viewed as well with entries. In this paper, we describe the present status and component details of the Zlog system.

* http://www.zope.org/

Wednesday Oral Session, WOPA
2nd Floor Lecture Hall, 2:00 p.m.
Session Chairs: Joe Skelly, BNL
Claude Saunders, ANL

2:00 **WOPA01 – Future of CORBA in Distributed Real-Time and Embedded Systems**
Douglas Craig Schmidt (Vanderbilt University, Nashville, Tennessee)
CORBA is being used as the middleware infrastructure for many large-scale communication systems, particularly mission-critical distributed real-time and embedded (DRE) systems. Now that CORBA has passed its 15th birthday, software architects must evaluate its continued use as software architectures and technologies evolve. Is it still the middleware of choice for DRE systems? Other asynchronous message-oriented middleware (MOM) technologies are being used by emerging Service-Oriented Architectures (SOA) and enterprise systems. Given these industry trends, how can existing CORBA enabled applications best integrate with overarching enterprise information systems. At the embedded end of the DRE spectrum, will the recent completion of the CORBA/e (embedded) standard and FPGA- and DSP-based ORBs push CORBA further into the software/hardware domain for high performance, highly reliability DRE systems intelligent sensors? Are the platform- and language-independent features of CORBA still important requirements of existing

and future large DRE systems? This talk explores these and other questions about the use of CORBA in DRE system architectures.

2:30 **WOPA02 – JavaIOC - A Java EPICS Input/Output Controller**
Martin Richard Kraimer (Osseo)
EPICS is a set of Open Source software tools, libraries, and applications developed collaboratively and used worldwide to create distributed soft real-time control systems for scientific instruments such as particle accelerators, telescopes, and other large scientific experiments. An IOC (Input/Output Controller) is a network node that controls and/or monitors a collection of devices. An IOC contains a memory resident real-time database. The real-time database has a set of "smart" records. Each record is an instance on a record of a particular type. JavaIOC is a JAVA implementation of an EPICS IOC. It has many similarities to a Version 3 EPICS IOC, but extends the data types to support structures and arrays.

2:50 **WOPA03 – LHC Software Architecture [LSA] – Evolution Toward LHC Beam Commissioning**
Grzegorz Kruk, Mike Lamont, Lionel Mestre, Wojciech Sliwinski (CERN, Geneva)
The LHC Software Architecture (LSA) project will provide homogenous application software to operate the Super Proton Synchrotron accelerator (SPS), its transfer lines, and the LHC (Large Hadron Collider). It has been already successfully used in 2005 and 2006 to operate the Low Energy Ion Ring accelerator (LEIR), SPS and LHC transfer lines, replacing the existing old software. This paper presents an overview of the architecture, the status of current development and future plans. The system is entirely written in Java and it is using the Spring Framework, an open-source lightweight container for Java platform, taking advantage of dependency injec-

tion (DI), aspect oriented programming (AOP) and provided services like transactions or remote access. Additionally, all LSA applications can run in 2-tier mode as well as in 3-tier mode; thus the system joins benefits of 3-tier architecture with ease of development and testability of 2-tier applications. Today, the architecture of the system is very stable. Nevertheless, there are still several areas where the current domain model needs to be extended in order to satisfy requirements of LHC operation.

3:10 **WOPA04 – Front-End Software Architecture**

Michel Arruat, Leandro Fernandez, Stephen Jackson, Frank Locci, Jean-Luc Nougaret, Maciej Peryt, Anastasiya Radeva, Marc Vanden Eynden (CERN, Geneva)

CERN's Accelerator Controls group launched a project in 2003 to develop the new CERN accelerator Real-Time Front-End Software Architecture (FESA) for the LHC and its injectors. In this paper, we would like to report the status of this project, at the eve of the LHC start-up. After describing the main concepts of this real-time Object Oriented Software Framework, we will present how we have capitalized on this technical choice by showing the flexibility through the new functionalities recently introduced such as Transactions, Diagnostics, Monitoring, Management of LHC Critical Settings, and Communication with PLC devices. We will depict the methodology we have put in place to manage the growing community of developers and the start of a collaboration with GSI. To conclude we will present the extensions foreseen in the short term.

3:30 **WOPA05 – Evolution of Visual DCT**

Jaka Bobnar, Matej Sekoranja, Igor Verstovsek (Cosylab, Ljubljana)

Visual DCT (Visual Database Configuration Tool) became the most advanced and popular graphical EPICS database configuration tool for

creating, editing and debugging EPICS databases. EPICS is a widely used control system based on a real-time database configured via ASCII files. The most recent development achievements in Eclipse IDE, which is also a RCP application portable to many operating systems since it is written in Java, brought another perspective to development of Visual DCT. Using Eclipse GEF (Graphical Editing Framework) for graphical features and EMF (Eclipse Modeling Framework) for database code generation makes it possible for Visual DCT to become a part of the Eclipse IDE. Using Eclipse as the framework for application automatically adds common features as plug-in support, debugging tools and many others. In addition, Visual DCT could be used as a part of the CSS (Control System Studio) allowing easy handling of EPICS databases using MB3 (mouse button 3) and drag and drop functionalities.

Wednesday Poster Session, WPPA
Clinch Concourse, 3:50-4:35 p.m.

WPPA01 – A Novel PXI-Based Data Acquisition and Control System for Stretched Wire Magnetic Measurements for the LHC Magnets: An Operation Team Proposal
Amit Tikaria (BARC, Mumbai), Vinod Chohan, Kevin Priestnall (CERN, Geneva)
The SSW system developed by Fermilab, USA, has been the main device heavily used since 2004 at CERN for certain required measurements of all the LHC Quadrupole assemblies as well as certain measurements for the LHC Dipoles. All these structures also include various small and large corrector magnets. A novel system is proposed, based on three years of operational experience in testing the LHC Magnets on a round-the-clock basis. A single stretched wire

system is based on the wire cutting the magnetic flux, producing the electrical potential signal. Presently this signal is integrated with a VME-based data acquisition system and is used to analyse the magnetic field. The acquisition and control is currently done via a SUN workstation communicating between different devices with different buses and using different protocols. The new system would use a PXI based data acquisition system with an embedded controller; the different devices are replaced by PXI-based data acquisition and control cards using a single bus protocol and on one chassis. The use of windows based application software would enhance the user friendliness, with overall costs of the order of 10 KCHF.

WPPA02 – Conceptural Design of the TPS control system

Changhor Kuo, Jenny Chen, Kuo-Tung Hsu, Chii-Jung Wang (NSRRC, Hsinchu)

Baseline design of the Taiwan photon Source (TPS) control system of NSRRC is proposed. The control system design is based on EPICS toolkits due to it has large user base in synchrotron light source around the world. Guidelines for hardware platform and operating system choice will be addressed. The standard hardware interface driver is developing and testing now. The asynchronous driver of EPICS will be applied to be the most of standard hardware interface. The expected control system for TPS will provide versatile environments for machine commissioning, operation, and research. The open architecture led machine upgrade or modify without toil. Fewer efforts for machine maintenance are essential. Performance and reliability of the control system will be guarantee form the design phase. Design consideration will be summary in this report.

WPPA04 – OASIS Evolution

Stephane Deghaye, Lajos Bojtar, Cedric CHARRONDIERE, Yury Alekseevich Georgievskiy, Frank Christian Peters, Ilya Zharinov (CERN, Geneva)

OASIS, the Open Analogue Signal Information System, was fully deployed in 2006 and now allows observation of more than 1900 analogue signals in the CERN accelerator complex. Our first operational experience in 2005 indicated that, for performance reasons, a change in the technology used to access the database was needed. Further experience throughout 2006 showed that an even bigger move was required in order to keep the system easy to maintain and improve. Initially based on the J2EE Enterprise Java Beans (EJB) and Java Messaging Service (JMS), the OASIS server was tightly coupled to OC4J, the Oracle's EJB container, and SonicMQ, a JMS broker. The upgrade to the latest version of these products being unnecessary complex and the architectural constrains being major drawbacks of the EJBs, it was decided to move completely away from those. The paper presents the new server architecture based on open-source products – Spring, ActiveMQ & Hibernate. It also presents the improvements done to the user request processing in order to reduce drastically the response time. Finally, the concept of Virtual Signal is introduced along with the new scalability constraint it brings into the system.

WPPA05 – The LANSCE Timing System Upgrade

Mandi S. Meidlinger, John Bierwagen, Steve Bricker, Chris Compton, Terry L. Grimm, Walter Hartung, Matthew John Johnson, John Popielarski, Laura Saxton, Richard York (NSCL, East Lansing, Michigan), Evgeny Zaplatin (FZJ, Jülich)

As part of a planned upgrade project for the Los Alamos Neutron Science Center (LANSCE) accelerator, we are considering replacing

our current timing system, which distributes each timing signal on its own dedicated wire, with a more modern event-driven system. This paradigm shift in how timing signals are generated and distributed presents several challenges that must be overcome if we are to preserve our current operational capabilities. This paper will discuss some of the problems and possible solutions involved with migrating to an event system. It will also discuss some recent enhancements to the Micro Research, Finland (MRF) event system that will help us accomplish our goal.

WPPA06 – An Embedded EPICS Controller Based on Ethernet/Serial Box

Geyang Jiang, Liren Shen (SSRF, Shanghai)

The control system of SSRF takes the Ethernet as backbone. All kinds of serial devices such as vacuum pumps are connected to Linux IOCs via a kind of Ethernet/serial box made by Moxa company. In the preresearch stage of SSRF, the old model of this Ethernet/serial box was only a simple Ethernet/serial protocol converter which was functioned by firmware. Aim to this, we have developed several kinds of EPICS device drivers based on NetDev for our serial devices. Recently, Moxa company has upgraded the converter by replacing old arm9 CPU with a more powerful Intel Xscale CPU. It supports Monta Vista Linux as its embedded OS, also cross-compiler is provided to make further development available. Since we have decided to use the new model of converter in our facility finally, we manage to port EPICS IOC core on Monta Vista Linux and implement the same function on the new converter as old one's to avoid modifying existent EPICS device driver. By these, the dedicated Linux IOC can be omitted and the whole system can be more efficient and expandable. Details of the necessary integration work and initial operation experience will be discussed in this paper.

WPPA07 – The Control System of the Harmonic Double Sided Microtron at MAMI
Hans-Joachim Kreidel, Marco Dehn (IKP, Mainz)
The MAMI electron accelerator cascade of three Racetrack Microtrons (RTMs) has been upgraded by a 4th stage, a Harmonic Double Sided Microtron (HDSM), raising the output energy from 855MeV to 1.5GeV. The control system for this worldwide unique machine has been built by extending and updating the well proven system of the three RTMs in use described at the ICALEPCS'99.* To accomplish this, software to control a couple of new devices had to be implemented, the operator interface was rebuilt and new PC-based VME-front-end computers were developed. To supply the large number of return path correction magnets, a new type of multi-channel power supplies were developed in-house. A new system for digitizing the signals of the rf-position monitors on the two linac axes has been constructed to improve the automatic beam position optimisation in the RTMs and to enable it in the HDSM.

*Proceedings of ICALEPCS'99, page 645.
Supported by Deutsche Forschungsgemeinschaft, SFB 443.

WPPA08 – EPICS-based Control of Beam Monitors of the J-PARC Main Ring
Jun-Ichi Odagiri, Atsuyoshi Akiyama, Kazuro Furukawa, Yoshinori Hashimoto, Norihiko Kamikubota, Tadahiko Katoh, Hidetoshi Nakagawa, Makoto Tobiyama, Takeshi Toyama, Noboru Yamamoto (KEK, Ibaraki), Takao Iitsuka, Shigenobu Motohashi, Makoto Takagi, Susumu Yoshida (Kanto Information Service (KIS), Accelerator Group, Ibaraki)
A control system for different types of beam monitors of the J-PARC Main Ring has been designed and implemented based on Experimental Physics and Industrial Control System (EPICS). All of the devices, such as PLCs, data loggers,

and oscilloscopes are connected to the Input/ Output Controllers (IOCs) through Ethernet as the only field-bus in the system. This design feature allowed us to realize a considerable amount of the reduction of the cost in developing and maintaining the system, as well as flexibility in the configuration of the devices being controlled and monitored by the IOCs. This paper describes the details of the design and performance of the EPICS/Ethernet-based control system of beam monitors of the J-PARC Main Ring.

WPPA09 – Development of Embedded System for Running EPICS IOC by Using Linux and a Single Board Computer

Akito Uchiyama (SHI Accelerator Service ltd., Tokyo), Masayuki Kase, Misaki Komiyama (RIKEN/RARF/CC, Saitama)

We constructed a control system based on the Experimental Physics and Industrial Control System (EPICS) for the RIKEN RI-beam Factory (RIBF) project. Nowadays, the PC-based EPICS Input Output Controller (IOC) is used in many laboratories because it is available for use on the Linux x86 platform since EPICS was upgraded to version R3.14. If the number of PC-based IOC increases, the probability of trouble rises dramatically. Consequently, it is difficult to supply reliable hardware. Furthermore, if a lot of desktop PCs are used for running IOC only, it is very hard to maintain it. The purpose of this development is to give the high durability system for running IOC computer and the ability for all accelerator operators to maintain it easily. We expect we can solve the problems described above using a diskless and fanless embedded single board computer (SBC) for running IOC and managing IOC in the fileserver collectively. For this reason, we developed a compact and simple Linux distribution specialized for running IOC and introduced IOC, which is installed in the SBC, into RIBF control system. In our

contribution, we report this system and present the status in detail.

WPPA10 – Study of Portability of VLT Instrumentation Software to ACS
Roberto Cirami, Paolo Santin (INAF-OAT, Trieste), Gianluca Chiozzi, Antonio Longinotti (ESO, Garching bei Muenchen)
The Very Large Telescope (VLT) will remain in operation most probably for at least two more decades. Being the software technology currently used at the VLT and more than one decade old, the maintanability of such a complex system might become a critical issue. The ALMA Common Software (ACS) is based on newer technology. Following this consideration, one of the obvious options to improve the maintainability of the VLT Software would be to port it, or parts of it, to ACS. This would allow optimizing maintenance resources for both VLT and ALMA Software, eventually making available resources for new ESO projects, such as E-ELT. Because of operational constraints, this can only be achieved gradually, possibly starting with new VLT sub-systems. In the year 2004 a pilot project has been started to study the effort needed to replace standard components of the VLT Instrumentation Software with ACS based ones. Starting from a simple instrument created from the VLT Template Instrument and entirely based on the VLTSW, we have replaced the core of the Observation Software (OS) with an ACS based equivalent. The purpose of this paper is to summarize the work done and draw some conclusions.

WPPA11 – The LANSCE Control System Linux Operator Console
Gary Carr (LANL, Los Alamos, New Mexico)
The LANSCE Control System (LCS) controls the Los Alamos Neutron Science Center LINAC and Proton Storage Ring from a series of operator consoles in two control rooms. The opera-

tor consoles have recently been upgraded to modern Intel hardware running Red Hat Linux, and EPICS 3.14.8. An LCS operator console is a physical location with a single keyboard and mouse that controls one to six graphics displays. A special captive account, lcsoper, is logged into each console. A console will always display one or more "treepm" menus, a color CRT, one or more "touch panels", and one or more Tek 4014 xterm windows. A console usually has one or more sets of "knobs", and one or more printers associated with it. Software run from a console is aware that it is running at a console, and is aware of the hardware and software resources available at the console. Application programs running at a console typically maintain console specific configuration information.

United States Department of Energy.

WPPA12 – The STAR Slow Control System - Upgrade Status

Yury Gorbunov, Jennie Burns, Michael Cherney, Jiro Fujita, William Waggoner (Creighton University, Omaha, NE)

The STAR (Solenoidal Tracker At RHIC) experiment located at Brookhaven National Laboratory has been studying relativistic heavy ion collisions since it began operation in the summer of 2000. An EPICS-based hardware controls system monitors the detector's 40000 operating parameters. The system I/O control uses VME processors and PCs to communicate with sub-system based sensors over a variety of field busses. The system also includes interfaces to the accelerator and magnet control systems, an archiver with CGI web based interface and C++ based communication between STAR online system, run control and hardware controls and their associated databases. An upgrade project is underway. This involves the migration of 60% of the I/O control from the aging VME processors to PC's. The host system has been transferred

from Sun OS to Scientific Linux and some of the VME boards were replaced with "softIOC" applications. The experience gained with the current setup will be discussed, and upgrade plans and progress will be outlined.

WPPA13 – Upgrades of Corrector Power Supplies for Pohang Light Source

In Soo Ko, Ki Man Ha, Jung Yun Huang, Seong-Hun Jeong, Heung-Sik Kang, Sung-Chul Kim, Jae Hak Seo (PAL, Pohang, Kyungbuk)

There are 70 vertical and 70 horizontal correctors for Pohang Light Source. Until 2003, power supplies for these correctors were based on 1980's technology, so the global orbit feedback system was not possible with poor 12-bit resolution. In 2003, a task force team was assembled to develop new power supplies with BESSY type ADC cards. By Summer 2004, two vertical correctors in each lattice were connected with new power supplies, and the global orbit feedback was available within the accuracy of 5 microns. However, this replacement was not enough to satisfy the beam stability requirement of 2 microns for PLS. We have launched another power supply design based on all digital technology. This attempt was completed within a year, and 80 units were assembled in house. Currently, the global orbit feedback system is running successfully with new digital power supplies and the compensation of chamber motion due to the thermal load by using digital displacement transducers attached on each BPMs.

WPPA14 – Rejuvenation of a Measuring System for High-Energy-Accelerator Magnets

Noriichi Kanaya, Mika Masuzawa, Noboru Yamamoto (Ibaraki University, Ibaraki)

A measuring system has been developed for magnetic fields of magnets, including bending magnets and families of Quadrupole magnets and Sextupole magnets for large high energy accelerators. Recent large accelerators have to

employ high quality magnets keeping within a given accuracy of magnetic fields, typically less than that in the order of ten to the minus four (10E-4). In addition, each of the magnetic center and harmonics components of a magnet has to be guaranteed prior to actual installation into an accelerator. The previous measuring system in use cannot achieve the aforementioned requirements since it has employed an early version of EPICS more than a half decade ago. We have rejuvenated measuring system using the latest version of EPICS (v.3.x) on Linux (kernel 2.6). Furthermore, we have implemented additional algorithm to satisfy the requirements. As a result, we have improved the performance of the system to measure the distribution of magnetic fields for a given magnet as well as to control the elevation/tilt of the workbench for the magnet. The rejuvenation of the new measuring system for high-energy-accelerator magnets is discussed in this paper.

WPPA15 – Use of a Three-Layer Control System for Non-Destructive Beam Probe Monitor

Dmitry Bolkhovityanov, Dmitriy Malyutin, Aleksander Starostenko (BINP SB RAS, Novosibirsk)

The non-destructive beam probe is based on the scanning of a thin electron beam within the energy range 20-100 kV in the electromagnetic field of an intensive relativistic bunch. A CCD-camera is used to view the beam "image." Initially the facility was controlled by a standalone application. This was dictated mainly by specifics of a CCD-camera and digital oscilloscopes, which are required for tuning. Now, when CCD-camera and digital oscilloscopes are fully supported by a CX networked control system (based on the 3-layer model), the standalone application was replaced by a CX-based set of programs. This enables remote operation, with several applications running in parallel. Additionally, this

architecture allows use of scripting facilities to automate various routine tasks, which previously had to be done by hand.

WPPA16 – Upgrade of BPM Data Acquisition System Using Reflective Memory in PLS
Jin Won Lee, Jinhyuk Choi, Heung-Sik Kang, Eun-Hee Lee, Jong Chel Yoon (PAL, Pohang, Kyungbuk)
We upgraded the BPM data acquisition system of the PLS 2.5-Gev storage ring with the use of RFM (Reflective Memory). Our present BPM data acquisition system is based on EPICS VME IOC. It uses an analog-to-digital converter with 16-bit resolution and a 100-KHz conversion rate to digitize BPM raw electric signals. To get better position data from the digitized raw BPM data, we developed BPM data-averaging software utilizing RFM. With this averaging software, we could average 4000 samples of raw BPM data with the refresh rate of 2 seconds and get much better position data compared with the previous one. We installed data-averaging software and reflective memory modules into 12 local BPM IOCs for the routine operation. We are also planning to develop a fast global feedback system using RFM to improve beam quality in the near future.

WPPA17 – Spectra Acquisition System for the LNL ECR Ion Source
Stefania Canella, Alessio Galatà, Emanuele Sattin (INFN/LNL, Legnaro, Padova)
Since beginning 2006 the LNL ECR ion source on a 350-kV high-voltage platform must to supply reliable and stable beams for the operation of a linear accelerators complex: the superconducting PIAVE injector and the superconducting linear accelerator ALPI. At the end of 2006 a new spectra acquisition system was put into operation for the ECRIS setup and beam periodic checks. The previously used spectra acquisition system was running only on a local scope on the

high-voltage platform while the new system was required to work both on the local and on the remote control computer in the console room. To achieve this goal a set of new devices had to be integrated in the standard remote control system. New software modules had also to be developed and integrated in the existent and working control system. An important goal of this upgrade was to assembly a tool that may be easily installed, used and maintained on different computer platforms (Linux and Windows PCs) and that may cope with future changes in the hardware devices to be used for spectra acquisition. Here a survey of this new facility is given.

WPPA18 – A Virtualization of Operator Consoles on Beamline Control System

Toru Ohata, Miho Ishii, Masahiko Kodera, Masao Takeuchi (JASRI/SPring-8, Hyogo-ken), Toru Fukui (RIKEN Spring-8, Hyogo)

We introduced the virtualization technology to more than 50 workstations in SPring-8 beamlines to reduce into 8 servers. The virtualization technology is a hot topic for server computing. It enables to consolidate a lot of computers to a few host computers. We presented the experiment of introduction of the virtualization technology at previous ICALEPCS conference. In SPring-8, about 50 beamlines are in operation. Each beamline had one workstation for an operator console to avoid interference from other beamline operation. The virtualization technology reduces hardware and maintenance costs while ensuring independency of a computing environment in each beamline. This paper describes the process and the result of the migration to the virtualization environment. In addition, we show changes of a topological network configuration for the virtualization environment.

WPPA19 – Status of the DELTA Control System

Detlev Schirmer (DELTA, Dortmund)

Since the change-over to EPICS in 2001, further developments in soft- and hardware and continuous improvements concerning the control system infrastructure as well as the accelerator modeling have been performed. A set of new applications like a bunch filling pattern control and a revised Q-value measuring software have been established. Furthermore, a new WEB-server including a content management system has been installed. The complete EPICS data logging and the electronic shift book entries are now managed by a MySQL database. Necessary preparations for automatic machine operation (manless control room) are in process. This article summarizes the activities during the last years and plans for the future.

WPPA20 –Successful Applications of a Low-Cost Embedded IOC in a Free Electron Laser
Daniel Sexton, Richard Evans, Pavel Evtushenko, Al Grippo, Kevin Jordan, Steven Wesley Moore, Jianxun Yan (Jefferson Lab, Newport News, Virginia)
At the JLAB Free Electron Laser (FEL) in Newport News, VA we recognized a change in the way instrumentation and controls systems can be implemented. By implementing an embedded IOC into our instrumentation and controls systems each system has a dedicated IOC for that specific application. This gives us the capabilities of developing isolated stand-alone systems that require power, TCP/IP communication, and hardware I/O. By using an embedded IOC for individual systems the need for expensive signal cables and external I/O crates (VME, CAMAC, PCI, etc.) can both be eliminated.
We have developed numerous carrier modules around the concept of an embedded processor. Several of these carrier modules include our Embedded BPM Electronics and a 3U General Purpose Processor Card. Other carrier modules include Video/AMS Controls, Beam Loss Monitors (BLM) Interface, and Timer Cards. The

hardware design of these carrier modules and specific applications that utilize the Single Board IOC (SBIOC) will be detailed in this paper.

Authored by Jefferson Science Associates, LLC, under U.S. DOE Contract No. DE-AC05-06OR23177.

WPPA21 – DOOCS Camera Interface
Gerhard Grygiel, Vladimir Rybnikov (DESY, Hamburg)
The Free Electron Laser in Hamburg (FLASH), with its complex accelerator diagnostics and user experiments, requires a lot of different cameras for both the operation and the experiments. A common interface for simple USB cameras, for fire-wire cameras, and for high-resolution cameras with, for example, multiple "regions of interest" was developed. This system integrates the various camera types in a transparent way into the control system DOOCS. In addition, the cameras are connected to a fast data acquisition system (DAQ). The DAQ provides the synchronization with other diagnostics, online processing of the images, and a long time archiving.

WPPA22 – Real-Time Measurement and Control at JET – Status 2007
Robert Felton, Tim Budd, Filippo Sartori (EFDA-JET, Abingdon, Oxon)
The Joint European Tokamak (JET) is a large machine for experiments on fusion plasmas. Many of the experiments use real-time measurements and controls to establish and/or maintain specific plasma conditions. Each Instrument (Diagnostic or Heating/Fueling/Magnet) is connected to a network. The number of systems has now grown to over thirty, and new systems are being planned for the future. Since some of the systems are used to control critical parameters of the JET plasma, we are improving the availability, reliability, and maintainability of the facility. We must ensure that systems check their mes-

sage structures against a central Data Dictionary at build-time and run-time and secondly that the systems check their input data streams are alive before, during, and after a JET pulse. Thirdly, a test data generator facility is being added so that systems can be validated in situ. Finally, we are developing high-level control configuration tools. From all of these, we identify some general principles that are applicable to the next-generation machines.

This work was carried out within the framework of the European Fusion Development Agreement and funded partly by the United Kingdom Engineering and Physical Sciences Research Council and by EURATOM.

WPPA23 – The Design of the Control Application for J-PARC 3GeV RCS

Masato Kawase, Hiroki Takahashi (JAEA/ J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Tatsuya Ishiyama (KEK/JAEA, Ibaraki-Ken), Takahiro Suzuki (MELCO SC, Tsukuba), Makoto Sugimoto (Mitsubishi Electric Control Software Corp, Kobe), Shiori Sawa (Total Saport System Corp., Naka-gun, Ibaraki)

Dielectric loaded wakefield structures have A J-PARC 3GeV RCS accelerator composition equipments and ring control have to control safety and smoothness. The design of this system is advanced for safety and high-integrity operation. In the case of trouble happened, J-PARC accelerator system have “Machine Protection System (MPS)” to beam stop quickly. This system stops the beam and protects damage from making the radiation instead of protecting the accelerator composition equipments. Therefore, accelerator composition equipments is mounted a logic to secure themselves. It is important to implement logic to operate safely while using this logic implemented these accelerator composition equipments. In this thesis, it explains the design and the development situation.

WPPA24 – EPICS CA Enhancements for LANSCE Timed and Flavored Data

Jeffrey Owen Hill (LANL, Los Alamos, New Mexico)

Currently the subscription update event queue in the EPICS server is capable of carrying event payloads consisting always of the channel's value, time stamp, and alarm state. The complexity of the LANSCE macro pulse beam gates requires unique capabilities within the LANSCE control system - which is currently only partly based on an EPICS core. Upgrade designs specify a 100% EPICS based system, but this has evolved new requirements for enhanced capabilities within EPICS. Specifically, EPICS Channel Access (CA) clients need to dynamically specify the LANSCE macro pulse beam gate combinatorial (LANSCE Flavored Data), and the timing offsets (LANSCE Timed Data), to be viewed when they subscribe. EPICS upgrades in progress fulfilling these requirements, including generic software interfaces accommodating site specific event queue payloads and client specified subscription update filters, will be described.

Work supported by U.S. Department of Energy under contract DE-AC52-06NA25396.

WPPA25 – Remote Monitoring System for Current Transformers and Beam Position Monitors of PEFP

In-Seok Hong, Yong-Sub Cho, Han-Sung Kim, Hyeok-Jung Kwon, Young-Gi Song (KAERI, Daejon), Jin Won Lee (PAL, Pohang, Kyungbuk)

PEFP (Proton Engineering Frontier Project) in Korean proton linear accelerator program has a diagnostic system with current transformers and beam position monitors. Prototype of current transformer(CT) and beam position monitor(BPPM) were made and tested successfully in tools of the beam diagnostic systems. We are preparing to monitor remotely signals from the diagnostic system. Remote monitoring

system is based on VME system with EPICS environments. For fast digitizing the analog signals VME ADC Input Output Board (VTR812/10) are used to meet the various needs of beam diagnosis device. EPICS channel access and drivers have been programmed in VME CPU to operate the Input output controller(IOC) and interface operators. Operator console and data storage have been implemented with EDM and channel archiver as well.

This work was supported by the 21C Frontier R&D program of Korea Ministry of Science and Technology.

WPPA26 – The Hardware and Software of the Data Acquisition System at MLF/J-PARC

Takeshi Nakatani, Masatoshi Arai (JAEA/ J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Suguru Muto, Toshiya Otomo, Setsuo Satoh, Yoshiji Yasu (KEK, Ibaraki)

A lot of neutron and muon experimental instruments covering the field from the fundamental science to the applied science in the Material and Life Science Facility (MLF)/Japan-Proton Accelerator Research Complex (J-PARC) are going to be constructed. As each and every instrument is expected to generate massive data (several tens of gigabytes per hour), we have considered new technology to deal with these data. To satisfy this demand, we decided to adopt the new hardware and software technologies developed in KEK for the data acquisition system of these instruments. The new hardware technology is "SiTCP," which is the data-acquisition-specific Ethernet interface, and the new software technology is "DAQ middleware," which is based on the Robot Technology (RT) middleware. Using these technologies, we will construct the network distributed data acquisition system. Because this data acquisition system is flexible and scalable, we can easily extend the capacity of the system to keep in step with the increase in

the proton intensity of J-PARC. In this presentation, we show the details of this data acquisition system.

WPPA27 – Commissioning TRIUMF'S 2C Solid Target Facility

Michael Mouat, Imelda Aguilar, Erwin Klassen, Ka Sing Lee, David Pearce, Juan Pon, Tony Tateyama, Priscilla Yogendran (TRIUMF, Vancouver)

The upgraded Beamline 2C Solid Target Facility was recently commissioned at TRIUMF. The original facility has run successfully producing radioisotopes since 1989. To improve reliability and maintainability, and to allow increased incident beam currents, an upgrade project was established. The basic functionality was retained but changes were made in a number of areas such as aspects of the control system and physical components in the beamline. The reasons for upgrading this facility, the process and results of the commissioning, and the lessons learned are discussed.

WPPA28 – Ubiquitous Tango

Andrew Gotz (ESRF, Grenoble), Claudio Scafuri (ELETTRA, Basovizza, Trieste)

Tango is a control system based on the device server concept. It is currently being actively developed by 4 (soon 5) institutes, 3 of which are new institutes. This alone is a good reason that Tango integrates the latest developments in control systems evolution. One of the evolutions in computing is ubiquitous computing. Ubiquitous computing in control systems means integrating computers and intelligence into every aspect of the control system. This paper will present how Tango has been integrated into a wide variety of embedded systems from FPGAs, Gumstix, Liberas, and even PS3s (if my boss would buy me one).

WPPA29 – Status of the Control System for ILCTA Cryogenic Complex at Fermilab

Vladimir Sirotenko, R. Bossert, A. Klebaner, Sharon Louise Lackey, Daniel J. Markley, A. Martinez, Barry Norris, Liujin Pei, Richard L. Schmitt, William Soyars (Fermilab, Batavia, Illinois)

One of the basic components of the ILC Test Area (ILCTA) is a greatly distributed cryogenic system. Part of it is already operational at Fermilab's Meson Detector Building (ILCTA MDB), and another part is still under construction at New Muon Lab (ILCTA NML), where the ILCTA accelerator will be located. To control and monitor ILCTA cryogenic utilities, a sophisticated multilayer control system has been developed. At the lower levels we use process automation system APACS+ nodes with PLCs as the field-level interfaces to most I/O. Then on the higher level, EPICS (Experimental Physics and Industrial Control System) coupled to the APACS+ servers through OPC technology is used to provide remote access to the cryogenic devices. User interfaces such as graphical chart displays with control loops, real-time strip plots, historical data archiving, and alarm tools have been deployed using the various extensions of EPICS.

WPPA30 – Detector Control System of BESIII

Xihui Chen (New Affiliation Request Pending)

In the upgrade project of Beijing Electron Positron Collider (BEPC)II, a novel DCS(Detector Control System) for the Beijing Spectrometer (BES)III is developed. In the system, nearly 7000 data points covering dozens of physical parameters need monitoring or control. The upper system is mainly developed by LabVIEW and OPC. The lower system mainly used Embedded system, MCU, and PLC, etc. These technologies reduced the cost greatly without any lose in system functions or performance. This paper

will give a detailed introduction to the system architecture and advanced technologies we used or invented.

WPPA31 – Status of a Versatile Video System at PITZ, Petra 3, and EMBL

Stefan Weisse, Gunter Trowitzsch (DESY Zeuthen, Zeuthen), Philip Duval (DESY, Hamburg)

The market for industrial vision components is evolving towards GigE Vision (Gigabit Ethernet vision standard). In recent years, the usage of TV systems/optical readout at accelerator facilities has been increasing. The Video System at PITZ, originated in the year 2001, has overcome a huge evolution over the last years. Being real-time capable, lossless capable, versatile, well-documented, interoperable, and designed with the user's perspective in mind, use cases at Petra 3 and EMBL at DESY Hamburg have been implemented to great success. The wide use range spans from robotics to live monitoring up to precise measurements. The submission will show the hardware and software structure, components used, current status as well as a perspective for future work.

WPPA32 – Replacement of the Remote Device Access Layer in the GSI Control System

Udo Krause, Ludwig Hechler, Klaus Höppner, Peter Kainberger, Gudrun Schwarz (GSI, Darmstadt)

The GSI control system was based on special types of front-end VME boards that are no longer available. Because of the tight coupling between controls software and the underlying hardware integration of recent boards, it was avoided for a long time but cannot be postponed any longer. Instead of porting the existing rigid code to a new platform, a foreward-looking approach was preferred: The communication layers were rebuilt from scratch using CORBA instead of the

former proprietary networking protocol. While the middle layers are exchanged completely, the front-end implementation still reuses the old device-specific code, and the operations-level applications can be kept unchanged. This was achieved by carefully attaching the new software to the remaining parts, requiring in several areas elaborate implementations to provide the former functionality. The new components now go into operation. We will report on the experience with the renovation project.

WPPA33 – Console System Using Thin Client for the J-PARC Accelerator

Stefan Simrock, Valeri Ayvazyan, Alexander Susumu Yoshida, Takao Iitsuka, Shigenobu Motohashi, Makoto Takagi (Kanto Information Service (KIS), Accelerator Group, Ibaraki), Norihiko Kamikubota, Tadahiko Katoh, Hidetoshi Nakagawa, Jun-Ichi Odagiri, Noboru Yamamoto (KEK, Ibaraki)

An accelerator console system, based on a commercial thin client, has been developed for J-PARC accelerator operation and software development. Using thin client terminals, we expect a higher reliability and longer life-cycle due to more robust hardware (i.e., diskless and fanless configuration) than standard PCs. All of the console terminals share a common development/operation environment. We introduced LDAP (Lightweight Directory Access Protocol) for user authentication and NFS (Network File System) to provide users with standard tools and environment (EPICS tools, Java SDK, and so on) with standard directory structures. We have used the console system for beam commissioning and software development in the J-PARC. This paper describes early experiences with them.

WPPA34 – Extended Application Fields for the Renovated GSI Control System

Klaus Höppner, Ludwig Hechler, Klaudia Herlo, Peter Kainberger, Udo Krause, Solveigh Matthies (GSI, Darmstadt)

The current GSI control system uses a very monolithic approach that made it difficult to extend the system to other than the original platforms (VME front ends and OpenVMS on the application level). For the present renovation project of the communication layers, flexibility was a major design criterion. Front-end and application levels are connected via CORBA middleware, giving free choice for using various system architectures and programming languages on both levels. While most of the current front-end software will be ported to the existing VME front-end environment, now running Linux, the new system can integrate devices running on various architectures and operating systems into the new GSI control system. To model equipment functionality as independently as possible, generating adapter code from a well-defined XML description of device models is now under development. This will make the task of porting the existing 65 device models (including around 3000 properties) to the new modular approach easier. We will present the current state of this project and future plans.

WPPA35 – The SNS Front End Control System Upgrade

William R. DeVan, Xiaosong Geng (ORNL, Oak Ridge, Tennessee)

The Spallation Neutron Source Front End (FE) is comprised of a 35-70 mA volume H-source, a multi-element electrostatic LEBT including chopping and steering, a 402.5MHz RFQ with low output emittance, and a 2.5MeV MEBT that also includes chopping. The original control system was designed and built by LBNL during 2000-2002 and commissioned at SNS in 2003. The FE control system design occurred early in the project and preceded finalization of SNS control system standards. The system was implemented based on Allen-Bradley VMEBus Remote I/O Scanners and PLC5s with Flex I/O interfaced via Remote I/O communication. The

FE control system is now being upgraded to comply with the SNS standard PLC implementation and to improve reliability and maintainability. Details on the upgrade will be presented in this paper.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

WPPA36 – A Prototype of the Power Supply Control with RTEMS

HaoLi Shi (IHEP Beijing, Beijing)

The success of digital feedback with synchroThe power supply control system of BEPCII (Beijing Electron Positron Collider II) is based on vxWorks. The system applies PSC/PSI structure just like SNS does, and it is running well. Considering EPICS3.14 has already supported RTEMS and NSLS/SLAC have successful experience on RTEMS development on MVME5500/MVME6100, we also want to study RTEMS and develop the application for CSNS control system. We are trying to build a prototype of power supply control with RTEMS and verify its feasibility of the control system based on RTEMS. Up to now we have successfully downloaded the kernel of RTEMS, EPICS databases, and some application programs of small size into the target MVME5500. Next step, we will modify some PSC/PSI drivers to get them to run on RTEMS so that power supplies can be controlled using RTEMS with PSC/PSI structure. The paper describes the progress of RTEMS study and its applications in power supply control.

WPPA37 – Developing SMS Mobile System for the PLS Control System

Jong Chel Yoon, Jinhyuk Choi, Heung-Sik Kang, Byoung Ryul Park (PAL, Pohang, Kyungbuk)

Control of the pulsed RF cavity fields in the The PLS SMS mobile system is based on Linux PC platform. The SMS mobile system is equipped

with a wireless SMS(Simple Message Service) interface giving an opportunity to use fault alarm interlock system. It was developed as a network-based distributed real-time control system composed of several subsystems (EP-ICS IOC and PLC system). The mobile system sends simple message of fault trip signal to users' mobile devices with fault tag address and immediately sends warning or alert messages to mobile devices, or remote users are real-time monitoring the device fault states by mobile devices. Control systems can be set remotely by mobile devices in emergency situation. In order to provide suitable actions against system fault, SMS Mobile System will enable system administrator to promptly access, monitor and control the system whenever users want and wherever users are, by utilizing wireless Internet and mobile devices. This paper presents the Mobile SMS system for PLS Control System.

Wednesday Poster Session, WPPB
Clinch Concourse, 4:35-5:20 p.m.

WPPB01 – CTF3 Beam Position Monitor Acquisition System

Stephane Deghaye (CERN, Geneva), Louis Bellier, Jean Nicolas Jacquemier (IN2P3-LAPP, Annecy-le-Vieux)

The CLIC Test Facility 3 (CTF3) is an R&D machine being built to validate concepts that will be used for the Compact Linear Collider (CLIC). Because CTF3 is an instrumentation-intensive machine, a considerable amount of money is put into the acquisition hardware and high-quality cables used to bring the instrument signals to the digitalization crates with as little degradation as possible. The main idea of this new approach is to reduce the distance between the signal source and the A/D conversion, reducing the cost of the

cabling. To achieve that, we have developed a radiation hard front-end that we install directly into the accelerator tunnel. This front-end deals with the digitalization of the signals after an analog buffering. Afterwards, the data are sent to a computer through the SPECS field bus. Finally, the digitalized signals are made available to the operation crew thanks to a server implementing the OASIS (Open Analogue Signal Information System) interfaces in the CERN Front-End Software Architecture (FESA). After a presentation of this low-cost solution to BPM acquisition, the paper gives the results of the first integration tests performed in the CTF3 machine.

WPPB02 – The LHC Central Timing Hardware Implementation

Pablo Alvarez, Julian Howard Lewis, Javier Serrano (CERN, Geneva)

The LHC central timing requirements are very different from those of the injector chain. Not only is machine's safety and reliability critical, but there are other important differences that have forced a new approach. Unlike the injector chain, the LHC processes cannot be usefully broken up into basic time periods and cycles; rather, they are independent, asynchronous, and of arbitrary duration. This paper presents the hardware and low-level software solutions we adopted and the technologies we used to implement them—in particular, the use of reflective memory, reliable use of the global positioning system as a precise time reference, redundancy, transmission-time calibration, safe beam parameter distribution, and the multitasking event generation hardware we developed to control the LHC machine processes.

WPPB03 – Software Interlocks System

Jakub Pawel Wozniak, Vito Baggiolini, David Garcia Quintas, Jorg Wenninger (CERN, Geneva)

In the year 2006, a first operational version of a new Java-based Software Interlock System (SIS) was introduced to protect parts of the SPS (Super Proton Synchrotron) complex, mainly CNGS (CERN Neutrinos to Gran Sasso), TI8 (SPS transfer line), and for some areas of the SPS ring. SIS protects the machine through surveillance and by analyzing the state of various key devices and dumping or inhibiting the beam if a potentially dangerous situation occurs. Being a part of the machine protection, it shall gradually replace the old SPS Software Interlock System (SSIS) and reach the final operational state targeting LHC (Large Hadron Collider) in Q4 2007. The system, which was designed with the use of modern, state-of-the-art technologies, proved to be highly successful and very reliable from the very beginning of its existence. Its relatively simple and very open architecture allows for fast and easy configuration and extension to meet the demanding requirements of the forthcoming LHC era.

WPPB04 – Convergence Computer–Communication Technologies for Advanced High-Performance Control Systems

Viacheslav Ivanovich Vinogradov (RAS/INR, Moscow)

Based on analysis of advanced computer and communication system architectures, a future control system approach is proposed and discussed in this paper. Convergence computer and communication technologies are moving to high-performance modular system architectures on the basis of high-speed switched interconnections. Multicore processors become more perspective ways to high-performance systems, and traditional parallel bus system architectures are extended by higher-speed serial switched interconnections. Compact modular system on the base of passive 3-4 slots PCI bas with fast switch network interconnection are described as examples of a modern, scalable control system

solution, which can be compatible extended to advanced system architecture on the basis of new technologies (ATCA, Micro TCA). Kombi wired and wireless subnets can be used as effective platforms also for large experimental physics control systems and complex computer automation in an experimental area with human interactions inside systems by IP-phones.

WPPB05 – Timing System for the FIR Linac
Byoung Ryul Park, Myung-Hwan Chun, Heung-Sik Kang, Do Tae Kim (PAL, Pohang, Kyungbuk)
PAL is constructing a coherent FIR (Far-Infrared Radiation) source using a 60-MeV S-band electron linac which includes a photocathode RF-gun. The Spectra-Physics "Tsunami" laser system for the RF-gun, which has an oscillation frequency of 79.3333 MHz, should be synchronized to the 2.856-GHz RF system which consists of a solid-state amplifier and a 60-MW klystron. The timing system for the linac will use a 36th harmonics of photo-diode signal obtained at the output of the laser oscillator to generate the minimum jitter 2.856-GHz RF signal. The timing system will provide trigger signals for the laser amplifier at 1020 Hz, the laser pulse slicer at 30 Hz, and the modulator and solid-state amplifier at 30 Hz. The reference clock and trigger signals in the timing system must have low jitter to provide a very stable synchronization of smaller than 150fs jitter between the laser system and the RF system. In this paper the performance of the timing system will be discussed.

WPPB06 – Synchronization System of Synchrotron SOLEIL
Jean-Paul Ricaud (SOLEIL, Gif-sur-Yvette)
To bring electrons from the LINAC to the storage ring, much equipment must be triggered synchronously to the beam. The timing system provides the time base needed for this purpose. More than a simple clocks distribution system, it is a real network, broadcasting clocks and

data all over the synchrotron. Data are used to send events to equipment: for example, injection of electrons inside the booster, extraction of electrons from the booster to the storage ring, or even triggering diagnostic equipment. The timing system is made up of a standalone CENTRAL system and several cPCI LOCAL boards. The CENTRAL system provides clocks and data and broadcasts them to the LOCAL boards through an optical fiber network. LOCAL boards are placed close to the equipment, and they provide delayed signals to trigger them. These delays can be precisely adjusted by the user, making the equipment synchronous with the electron beam. After a brief explanation of our needs, the presentation describes the timing systems (architecture, performance, etc.) used at SOLEIL. It also describes the results after a year of use: the good, the bad, and the truth (well, maybe).

WPPB07 – Supervisory Control Scheme for Trim Coil Power Supplies of Superconducting Cyclotron

Biswajit Sarkar, Samit Bandyopadhyay, CHAMELIDHAR DATTA, Debranjan Sarkar (DAE/VECC, Calcutta)

The K–500 superconducting cyclotron at this Centre has 18 numbers of trim coils. Each of these coils are energized to different levels using current-regulated precision power supplies to produce the desired magnetic field profile for proper beam dynamics. Each power supply is equipped with a serial communication interface and an intelligent controller that can communicate with a remote host using ASCII strings following a command-response protocol. For the convenience of the operators, a supervisory control software with an elaborate graphical user interface has been developed. Whenever an operator changes a power supply setting using this interface, the software dispatches appropriate directive commands to the intended power supply.

Monitoring commands are, however, issued at periodic intervals and the updated status is displayed on the front end. The power supplies are logically grouped into three groups of six each. All power supplies in a group are connected in a multidrop fashion using RS-485 link. This link is then connected to an Ethernet switch using an Ethernet-to-Serial data converter. This enables the power supplies to be operated and monitored over the control network.

WPPB08 – Role-Based Authorization in Equipment Access at CERN

Krzysztof Kostro, Wojciech Gajewski (CERN, Geneva), Suzanne Renee Gysin (Fermilab, Batavia, Illinois)

Given the significant dangers of LHC operations, Role-Based Access Control (RBAC) is designed to protect from accidental and unauthorized access to the LHC and injector equipment. Role-Based Authorization is part of this approach. It has been implemented in the Controls Middleware (CMW) infrastructure so that access to equipment can be restricted according to Access Rules defined jointly by the equipment and operation groups. This paper describes the authorization mechanism, the definition and management of Access Rules and the implementation of this mechanism within the CMW.

WPPB09 – Power Supply Control System for the Electromagnetic Elements of the Storage Ring "NESTOR" Linac

Victor Boriskin, Sergey Romanovsky, Alexander Sarvilov, Antonina Savchenko, Dmitriy Stepin, Galina Tsebenko (NSC/KIPT, Kharkov), Alexander Chepurnov, Igor Gribov (MSU, Moscow), Alexander Shamarin (Marathon Ltd., Moscow)

Due to the creation of the source of the X-rays based on the use of the Compton laser radiation scattering on the relativistic electrons, it was necessary to develop an electron storage

ring and accelerator-injector with beam energy 60-100 MeV* for it. The control system of the power supply for the electron linac magnetic system is described in the paper. Programming direct-current sources are equipped by intellectual controllers with CAN-bus interface. The software structure is described. The current source test results are given.

*Ayzatskiy M.I., et al., "The electron injector for linac of the 'NESTOR' storage ring // Problems of atomic science and technology." Ser. "Nuclear Physics Investigation," 2(46), 2006, pp.94–96.

WPPB10 – Virtually There: The Control Room of the Future

Roberto Pugliese (ELETTRA, Basovizza, Trieste)

Imagine the ILC is up and running. Electrons and positrons collide happily, and scientists are taking data. Suddenly there's a problem with one of the laser wires. All experts are at a meeting on a different continent, but the problem needs to be fixed immediately. Difficult? Not when there's a Global Accelerator Network Multipurpose Virtual Lab (GANMVL) in place. High-speed, high-resolution cameras would allow the faraway experts to look at the fault, a web-based portal would let them access the controls and tools of the system with a simple "single-sign-on" procedure. However, the virtual lab is not just about remote operation. In principle it is already possible to run a control room remotely. This system is radically different in that it takes into account the human aspect of teamwork around the world. The implications of a working virtual control room are enormous. It might revolutionise virtual collaboration in completely different areas. The paper presents the GANMVL tool and the results of the evaluation of the Virtual Lab in production environment and real operations.

*http://www.eurotev.org/, “European Design Study Towards a Global TeV Linear Collider.”
**http://www.linearcollider.org/cms/, “International linear collider.”

EC - EUROTeV - 011899.

WPPB11 – 130-MHz, 16-Bit Four-Channel Digitizer

Karen Dayle Kotturi, Ron Akre (SLAC, Menlo Park, California)

The PAD (Phase and Amplitude Detector) was designed to digitize high-speed analog input data with large dynamic range. Because of its high speed and high resolution processing capability, it has been useful to applications beyond measuring phase and amplitude of RF signals and klystron beam voltages. These applications include beam-position monitors, bunch-length monitors, and beam-charge monitors. The digitizer used is the Linear Technologies LTC2208. It was the first 16-bit digitizer chip on the market capable of running at 119MHz; it is specified to run up to 130MHz. For each channel, the 16-bit digitized signal from the LTC2208 is clocked into a 64k sample FIFO. Commercial FIFOs are available that store up to 256k samples in the same package. The data are then read from the FIFO into the Arcturus Coldfire uCDIMM. A CPLD is used to handle triggering, resetting the FIFO, interfacing the Coldfire processor to the 4 FIFOs, and interrupting the Coldfire processor. The processor runs RTEMS version 4.7 and EPICS 3.14.8.2. There is an optional add-on available that attaches to the QSPI port on the PAD for reading 8 slow, 24-bit analog signals.

Department of Energy.

WPPB12 – Image Processing at NSLS

Shuchen Kate Feng, Peter Siddons (BNL, Upton, Long Island, New York)

An inexpensive yet high-performance image processing system has been implemented at the National Synchrotron Light Source (NSLS) utilizing a low-cost firewire camera, EPICS and the in-house written RTEMS-mvme5500 Board Support Package. The BSP, EPICS/RTEMS software and firewire drivers demonstrate nearly a real-time TV video effect for the 1024x768x8-bit mode at 30 frames per second of data transfer, while triggering EPICS display at 30 Hz simultaneously. The high end image processing system at the NSLS was designed for the LCLS XAMPS detector. The original specification of the detector array was a 1024x1024x14bit image triggered at 120 Hz combined with a fast data storage to meet 252 MegaBytes/sec of data rate. A fast SBC was chosen to be interfaced with a FPGA based PMC and Fibre Channel storage system. This cost-effective prototype will function efficiently and reliably as a data acquisition system for the implementation of the XAMPS detector developed at the NSLS. Modern software technology had cut our cost of the hardware/software, and excellent performance.

Department of Energy

WPPB13 – Development of Flexible and Logic-Reconfigurable VME Board

Toko Hirono, T. Kudo, Toru Ohata (JASRI/SPring-8, Hyogo-ken)

We developed a logic-reconfigurable VME board with high flexibility. The board has two parts, a base board and two IO daughter boards. The base board has a field programmable gate arrays (FPGA) chip for execution of user logic, such as a digital low-pass filter or calculation of the median of a spot image. Users can install their logics into the FPGA via VME bus. The IO daughter boards are simple IO modules such as analog inputs/outputs (AIOs) or digital inputs/outputs (DIOs). The data from the IO board is sent to the base board and processed there.

As the IO daughter board is separated physically, the user can customize the VME board by choosing daughter boards and does not need to develop whole device. We have developed DIO, AIO, and Camera Link interface as the IO daughter board. In the presentation, design concept and implementation of this VME board are shown with some applications.

WPPB14 – Development of a Signal Processing Board for Spill Digital Servo System for Proton Synchrotron

Hidetoshi Nakagawa, Toshikazu Adachi, Hikaru Sato, Hirohiko Someya, Masahito Tomizawa (KEK, Ibaraki), Takeshi Ichikawa, Koh-ichi Mochiki (Musasi Institute of Technology, Tokyo), Koji Noda (NIRS, Chiba-shi)

A prototype data processing board for a digital spill control system has been made. The system is considered to be used to control proton beams in 50-GeV synchrotron rings of J-PARC. The prototype circuit board consists of four ADCs, two FPGAs, a DSP, memories, and four DACs. The four inputs of the processing board are assumed to be an intensity signal of the proton beam in the accelerator rings, a digital gate signal that indicates the duration of beam extraction, a spill signal that shows the intensity of the extracted proton beam, and a reserved signal. The resolution and maximum sampling speed of the ADC are 16 bit and 2.5 Msps, respectively. One of the FPGAs is Vartex-2 1000-4C, and a real-time power spectrum analyzer will be implemented. It analyzes the spill signal every 1ms or shorter period. The analyzed result reflects optimum parameters used in spill control by servo. The DSP takes charge of these digital servo processing. The DACs with 16-bit resolution drive control signals for magnet currents. The system has another FPGA for communication between the processing board and network. MicroBlase CPU core is implemented, and uCLinux is installed to use EPICS.

WPPB15 – Beyond PCs: Accelerator Controls on Programmable Logic

Mark Plesko (Cosylab, Ljubljana)

The large number of gates in modern FPGAs including processor cores allows implementation of complex designs, including a core implementing Java byte-code as the instruction set. Instruments based on FPGA technology are composed only of digital parts and are totally configurable. Based on experience gained on our products (a delay generators producing sub-nanosecond signals and function generators producing arbitrary functions of length in the order of minutes) and on our research projects (a prototype hardware platform for real-time Java, where Java runtime is the operating system and there is no need for Linux), I will speculate about possible future scenarios: A combination of an FPGA processor core and custom logic will provide all control tasks, slow and hard real-time, while keeping our convenient development environment for software such as Eclipse. I will illustrate my claims with designs for tasks such as low-latency PID controllers running at several dozen MHz, sub-nanosecond resolution timing, motion control, and a versatile I/O controller—all implemented in real-time Java and on exactly the same hardware, just with different connectors.

WPPB16 – Implementation of the Low-Level RF System for the PLS Storage Ring

In-Ha Yu, Myung-Hwan Chun, Maeng Hyo Jeong, Do Tae Kim, Hong-Jip Park, In Soo Park (PAL, Pohang, Kyungbuk)

The Pohang Light Source (PLS) RF system consists of four independent RF stations, and each station drives each RF cavity. The RF stations provide the RF power with a 75kW klystron amplifier system. In 2.5GeV operation, the RF cavity dissipation should remain constant through the entire range of operating beam current from 0 to 190mA at 2.5GeV. The low-level

RF system is used to control cavity field amplitude within ± 1% and relative phase within ± 1°. The low-level RF system has been improved to gradually achieve better system stability through implementations, such as the better performance module development using recent component basis on analog technique and the operation optimization with the control parameter change of the RF amplitude and phase feedback loop. In this paper, the results of the improvement of this system will be presented with the performance test results.

WPPB17 – ScientiFIP: The Long-Term Support of the WorldFIP Fieldbus for Scientific Applications

Raymond Brun, Reiner Denz, Gonzalo Fernandez Penacoba, Alain Georges Gagnaire, Quentin King, Frank Locci, julien palluel, Javier Serrano, Marc Vanden Eynden (CERN, Geneva)

The WorldFIP real-time fieldbus is extensively used at CERN for the control of mission-critical LHC systems such as power converters, quench protection, and cryogenics. Unfortunately, on the horizon in 2010, the FIP market will be uncertain due to the presence of a large diversity of new fieldbuses. Since this date is incompatible with the LHC lifetime, alternative technologies such as RT-Ethernet were studied, in parallel with an evaluation of a complete WorldFIP in-sourcing and reengineering. This paper summarizes the key technical features required by CERN, the outcome of our RT-Ethernet investigations, and finally the software and hardware aspects linked to the in-sourcing of the WorldFIP technology as our choice to ensure the reliable operation of LHC beyond 2010.

WPPB18 – Customizable Motion Control Solution Supporting Large Distances

Joze Dedic, Jaka Bobnar, Igor Kriznar (Cosylab, Ljubljana), Ralph C. Baer, Guenther Froehlich, Klaudia Herlo, Udo Krause, Marcus Schwickert (GSI, Darmstadt)

Motion control solutions for controlling a movement of motorized mechanical subsystems for accelerators, telescopes or similar spatially distributed systems require high degree of flexibility regarding the use and connectivity. One platform should fit different applications and provide cost effective solutions. A connection to the control system (CS) is required on one side, while on the other side a connection to a variety of motors, position encoders and other feedback devices must be provided. In case of more complex mechanics, an advanced kinematics control is essential to provide features such as motion tuning, interpolation and controlled acceleration. An embedded computer is used for SW-flexibility and CS-support. Motion control capabilities are provided by separate HW; programmable multi axis controller. Signal adaptation for a direct connection of the equipment is managed by an interface board. Easy installation and debugging is provided by low-level local control; front panel switches and indicators, RS232 or direct keyboard and monitor access. An advanced approach is required in case of a larger distance between the motor controller and the motors with position encoders.

WPPB19 – Magnet Power Supply Controls for Indus-2

Yogendra M. Sheth, Rajesh Kumar Agrawal, Amit Chauhan, Pravin Fatnani, Kutubuddin Saifee, M. Seema [RRCAT, Indore (M.P.)], Ashok Francis, Jai Prakash Jidee, Archana Prabhu, T. V. Satheesan (RRCAT, Indore)

The control system for the power supplies of Indus-2 Synchrotron Radiation Source is the largest control subsystem with challenging demands. Controlling about 200 magnet power supplies of different types and stabilities feeding to about 315 magnets, the system provides stable and accurately controlled reference voltages to power supplies for setting currents into magnets. The accuracies and stabilities provided by the

control system (best case = better than 50 PPM) make it different from a conventional industrial control system. In addition, the control system provides the special function of synchronous ramping of all magnet currents for increasing the electron beam energy without affecting the machine optics. Cycling of all the magnet power supplies is also supported to minimize the remnant field effects over beam. The control system performs all such and other similar tasks with the required flexibility. The paper describes the scheme, implementation issues, and experiences during the last two years of operations.

WPPB20 – Extended MicroIOC Family (LOCO)

Shinichiro Michizono, Shozo Anami, Zhigao Matjaz Kobal, Damjan Golob, Robert Kovacic, Miha Pelko, Mark Plesko, Aljaz Podborsek (Cosylab, Ljubljana)

MicroIOC is an affordable, compact, embedded computer designed for controlling and monitoring of devices via a control system (EPICS, ACS, and TANGO are supported). Devices can be connected to microIOC via Ethernet, serial, GPIB, other ports, or directly with digital or analog inputs and outputs, which makes microIOC a perfect candidate for a platform that integrates devices into your control system. Already over 90 microIOCs are installed in 18 labs over the world. LOgarithmic COnverter (LOCO) is a specialized microIOC used as a high-voltage power-supply distribution system for vacuum ion pumps. A single high-voltage power-supply controller can be used for delivering power to multiple ion pumps. A highly-accurate logarithmic-scale current measurement is provided on each pump, enabling an affordable and reliable pressure measurement ranging from 10-12 to 10-4 mbar.

WPPB21 – Integration of CANopen-Based Controllers with TINE Control System for PETRA 3

Piotr Karol Bartkiewicz, Thomas Delfs, Steve Williamson Herb, Bernd Pawlowski (DESY, Hamburg)
For PETRA III, the high-brilliance third-generation light source being built now at DESY in Hamburg, Germany, we have established a new hardware development standard for controller designs. It includes communication on the fieldbus level, hardware interfacing to fieldbuses, and a communication application software layer for device firmware. The CAN bus and CANopen protocol were chosen as a primary fieldbus standard, and three branches of generic CANopen-compliant interfacing modules were designed for rapid controller hardware development. For fieldbus management, configuration, and integration with the TINE control system,* the generic TICOM (TINE-Based CANopen Manager) software was written. This document gives an overview of our fieldbus hardware development standard and of the key features of TICOM. It also describes the first applications built on top of the standard.

*http://tine.desy.de.

WPPB22 – Redundancy for EPICS IOCs
Matthias R. Clausen, Gongfa Liu, Bernd Schoeneburg (DESY, Hamburg), Leo Bob Dalesio (SLAC, Menlo Park, California)
High availability is driving the reliability demands for today's control systems. Commercial control systems are tackling these requirements by redundant implementations of major components. Design and implementation of redundant Input Output Controllers (IOCs) for EPICS will open new control regimes also for the EPICS collaboration. The origin of this development is the new XFEL project at DESY. The demands on the availability for the machine uptime are extremely high (99.8%) and can only be achieved if all the utility supplies are permanently available 24/7. This paper will describe

the implementation of redundant EPICS IOCs at DESY that shall replace the existing redundant commercial systems for cryogenic controls. Special technical solutions are necessary to synchronize continuous control process databases (e.g., PID). Synchronization of sequence programs demands similar technical solutions. All of these update mechanisms must be supervised by a redundancy monitor task (RMT) that implements a hard-coded expert system that has to fulfill the essential failover criteria: A failover may only occur if the new state is providing more reliable operations than the current state.

WPPB23 – Measured Performance of the Diamond Timing System

Yuri Chernousko, Angelos Gonias, Mark Heron (Diamond, Oxfordshire), Jukka Tapio Pietarinen (MRF, Helsinki)

The Diamond timing system is the latest-generation development of the design, principles, and technologies currently implemented in the Advanced Photon Source and Swiss Light Source timing systems. It provides the ability to generate reference events, distribute them over a fiber-optic network, and decode and process them at the equipment to be controlled. The Diamond timing system has now been operational for over a year. The systematic characterization of the installed system, to understand the performance, and the results of these measurements are presented.

WPPB24 – High Dynamic Range Current Measurements with Machine Protection

Dave H. Thompson, Dirk Alan Bartkoski, Craig Deibele, Coles Sibley (ORNL, Oak Ridge, Tennessee)

At the SNS a beam current measurement technique called CHuMPS (Chopper Machine Protection System) has been developed that is fast, has a large dynamic range, and is droop-free. Combined with the LEBT chopper control-

ler, a beam in gap measurement is possible that can accurately measure the beam in the chopper gaps. The beam in gap measurement can then provide machine protection in the case of chopper failure. The same application can also measure waste beam from the ring injection stripper foil and provide fast protection from stripper foil failure.

SNS is managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. Department of Energy.

WPPB25 – Realization of a Custom-Designed FPGA-Based Embedded Controller

Freddy Severino, Margaret Harvey, Thomas Hayes, Lawrence T. Hoff, Roger C. Lee, Kevin Smith (BNL, Upton, Long Island, New York)

As part of the low-level RF (LLRF) upgrade project at Brookhaven National Laboratory's Collider-Accelerator Department (BNL C-AD), we have recently developed and tested a prototype high-performance embedded controller. This controller is a custom-designed PMC module employing a Xilinx V4FX60 FPGA with a PowerPC405 embedded processor and a wide variety of onboard peripherals (DDR2 SDRAM, FLASH, Ethernet, PCI, multi-gigabit serial transceivers, etc.). The controller is capable of running either an embedded version of LINUX or VxWorks, the standard operating system for RHIC front-end computers (FECs). We have successfully demonstrated functionality of this controller as a standard RHIC FEC and tested all onboard peripherals. We now have the ability to develop complex, custom digital controllers within the framework of the standard RHIC control system infrastructure. This paper will describe various aspects of this development effort, including the basic hardware, functional capabilities, development environment, kernel and system integration, and plans for further development.

Work performed under Contract Number DE-AC02-98CH10886 under the auspices of the U.S. Department of Energy.

WPPB26 – An EPICS IOC Running Under RTEMS, Based on a Highly Flexible FPGA Design, Using an Off-the-Shelf Xilinx Virtex-4 Board

Richard J. Michta (BNL, Upton, Long Island, New York)

The Xilinx Virtex-4 FX-12 Mini-Module is a high-performance and low-cost, small footprint (30X65mm), FPGA-based module with JTAG programmability that offers many powerful integrated capabilities. The module has a PowerPC core, 100 MHz system clock, 10/100/1000 Ethernet chipset, Broadcom (BCM5461) on-module transceiver and Tri-Mode EMAC core, 32Mx16 DDR SDRAM ram, 2Mx16 flash, 4Mx16 platform flash, and 2x32 I/O headers providing 2.5/3.3 volt LVDS and single-ended digital I/O capabilities. The Real-Time Operating System for Multiprocessor Systems (RTEMS) was ported to this module, and the EPICS (Experimental Physics and Industrial Control System) was built using the GNU GCC cross-complier for the PowerPC Gen405 BSP to run a test IOC application on this module. The Mini-Module combined with the above suite of software affords a compact high-performance target platform that provides ease of configurability in the hardware and software sense. Standardization on the use of these versatile building blocks can aid in simplifying embedded systems designs and also allow a greater maintainability offered through their inherent flexibility for the implementation of embedded device controllers.

WPPB27 – Image Acquisition with CameraLinkTM Digital Camera and PMC CameraLinkTM Interface under RTEMS

Sheng Peng (SLAC, Menlo Park, California)

In the Laser Launch System, Injection Line, LINAC of LCLS, a number of screens (Laser Stabilization, YAG, and OTR) will be used to acquire information about the transverse beam distribution. CameraLinkTM cameras have been selected for their industrial standard, highest bandwidth, easy sync to external event, and noise-free image transmission. The CameraLink-TM to Fiber converter is also used as extension cord to reach up to 300 meters. The PMC CameraLinkTM Interface can be attached to Motorola Single Board Computer. The preliminary RTEMS support is developed.

WPPB28 – Remote Operation of Large-Scale Fusion Experiments

David Paul Schissel (GA, San Diego, California), Martin Greenwald (MIT/PSFC, Cambridge, Massachusetts)

This paper examines the past, present, and future remote operation of large-scale fusion experiments by large, geographically dispersed teams. The fusion community has considerable experience placing remote collaboration tools in the hands of real users. Tools to remotely view operations and control selected instrumentation and analysis tasks were in use as early as 1992 and full remote operation of an entire tokamak experiment was demonstrated in 1996. Today's experiments invariable involve a mix of local and remote researchers, with sessions routinely led from remote institutions. Currently, the National Fusion Collaboratory Project has created a FusionGrid for secure remote computations and has placed collaborative tools into operating control rooms. Looking toward the future, ITER will be the next major step in the international program. Fusion experiments put a premium on near real-time interactions with data and among members of the team and though ITER will generate more data than current experiments, the greatest challenge will be the provisioning of systems for analyzing, visualizing and assimilat-

ing data to support distributed decision making during ITER operation.

Work supported by the U.S. Department of Energy SciDAC program and at General Atomics under Cooperative Agreement No. DE-FC02-01-ER25455.

WPPB29 – LCLS Beam-Position Monitor Data Acquisition System

Till Straumann, Ron Akre, Ronald G. Johnson, Karen Dayle Kotturi, Patrick Krejcik, Evgeny Medvedko, Jeff Olsen, Steve Smith (SLAC, Menlo Park, California)

In order to determine the transversal LCLS beam position from the signals induced by the beam in four stripline pickup electrodes, the BPM electronics have to process four concurrent short RF pulses with a dynamic range > 60dB. An analog front end conditions the signals for subsequent acquisition with a waveform digitizer and also provides a calibration tone that can be injected into the system in order to compensate for gain variations and drift. Timing of the calibration pulser and switches, as well as control of various programmable attenuators, is provided by an FPGA. Because no COTS waveform digitizer with the desired performance (>14bit, ≥119MSPS) was available, the PAD digitizer (see separate contribution) was selected. It turned out that the combination of a waveform digitizer with a low-end embedded CPU running a real-time OS (RTEMS) and control system (EPICS) is extremely flexible and could very easily be customized for our application. However, in order to meet the BPM real-time needs (readings in < 1ms), a second Ethernet interface was added to the PAD so that waveforms can be shipped, circumventing the ordinary TCP/IP stack on a dedicated link.

Department of Energy

WPPB30 – Cybersecurity and User Accountability in the C-AD Control System
John Morris, Roger Katz (BNL, Upton, Long Island, New York)
A heightened awareness of cybersecurity has led to a review of the procedures that ensure user accountability for actions performed on the computers of the Collider-Accelerator Department (C-AD)Control System. Control system consoles are shared by multiple users in control rooms throughout the C-AD complex. A significant challenge has been the establishment of procedures that securely control and monitor access to these shared consoles without impeding accelerator operations. This paper provides an overview of C-AD cybersecurity strategies with an emphasis on recent enhancements in user authentication and tracking methods.

Work performed under auspices of the U.S. Department of Energy under Contract No. DE-AC02-98CH10886 with Brookhaven Science Associates, LLC.

WPPB31 – Secure Remote Operation of Light Source Beamline Controls with FreeNX
Zhijian Yin, Peter Siddons (BNL, Upton, Long Island, New York)
In light source beamlines, there are times when remote operations from users are desired. This becomes challenging, considering cybersecurity has been dramatically tightened throughout many facilities. Remote X-windows display to Unix/Linux workstations at the facilities, either with straight x-traffic or tunneling through ssh (ssh -XC), is quite slow over long distance, thus not quite suitable for remote control/operations. We implemented a solution that employs the open source FreeNX technology. With its efficient compression technology, the bandwidth usage is quite small and the response time from long distance is very impressive. The setup we have, involves a freenx server configured on the

linux workstation at the facility and free downloadable clients (Windows, Mac, Linux) at the remote site to connect to the freenx servers. All traffic are tunneled through ssh, and special keys can be used to further security. The response time is so good that remote operations are routinely performed. We believe this technology can have great implications for other facilities, including those for the high energy physics community.

Department of Energy

WPPB32 – Cyber Security in ALICE

Peter Chochula (CERN, Geneva)

In the design of the control system for the ALICE experiment much emphasis has been put on cyber security. The control system operates on a dedicated network isolated from the campus network and remote access is only granted via a set of Windows Server 2003 machines configured as application gateways. The operator consoles are also separated from the control system by means of a cluster of terminal servers. Computer virtualization techniques are deployed to grant time-restricted access for sensitive tasks such as control system modifications. This paper will describe the global access control architecture and the policy and operational rules defined. The role-based authorization schema will also be described as well as the tools implemented to achieve this task. The authentication based on smartcard certificates will also be discussed.

WPPB33 – Fast Timing and Control Systems at KEK 8-GeV Linac

Kazuro Furukawa, Masanori Satoh, Tsuyoshi Suwada (KEK, Ibaraki), Artem Kazakov (GUAS/AS, Ibaraki)

The 8GeV Linac at KEK provides electrons and positrons to Photon Factory (PF) and B-Factory (KEKB). Quasi top-up injections have been considered both for PF and KEKB rings in order to

improve the injection efficiency and the stability. Fast beam-switching mechanisms are being implemented, upgrading the timing and control systems. While the present system provides precise timing signals for 150 devices, many of the signals will be dynamically switched using an event system. A new scheme has been developed and tested to enable double-fold synchronization between rf signals. Fast controls of low-level rf, beam instrumentation, a kicker, a gun, and beam operation parameters will also be upgraded.

WPPB34 – Information Technology Security at the Advanced Photon Source

Juan BarKenneth Sidorowicz, William McDowell (ANL, Argonne, Illinois)

The proliferation of "bot" nets, phishing schemes, denial-of-service attacks, root kits, and other cyber attack schemes designed to capture a system or network creates a climate of worry for system administrators, especially for those managing accelerator and large experimental-physics facilities as they are very public targets. This paper will describe the steps being taken at the Advanced Photon Source (APS) to protect the infrastructure of the overall network with emphasis on security for the APS control system.

Work supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CG11357.

WPPB35 – Current Cyber Security Projects within CEBA

Leon Clancy, Brad Cumbia (JLAB, Newport News)

This Poster will describe the current projects within CEBA to enhance Cyber Security with respect to maintaining full control of the CEBA through its computing systems, including IOCs, low level controllers, network elements, UNIX systems for high level control, and Microsoft OS

desktops for general purpose access. The poster will cover the efforts of the System Administration team known as ACE to strictly control and maintain the configuration of all systems and network elements on the CEBA controls network; out-of-band management of the IOCs using secure protocols and console I/O logging; use of Channel Access Gateways to limit outside access to IOCs; and several other security enhancements.

Authored by Jefferson Science Associates, LLC under U.S. DOE Contract No. DE-AC05-06OR23177.

WPPB36 – Ripple Diagnostics on BESSY Power Supplies

Ingo Müller, Thomas Birke, Tobias Schneegans (BESSY GmbH, Berlin)

Keeping the ripple of power-supply currents within the specification limits is crucial for the beam stability of the BESSY storage ring. Malfunctioning or aged electronic devices cause an increase of output ripple over the years. This increase is hardly noticed by the operator or operation analysis because the slow integrating AD converters for the current readbacks filter out the ripple. Furthermore, it is almost impossible to find the connection between certain beam movements or beam noise and the faulty power supply causing it. To improve this situation, ripple information for every power supply is required within the control system. The latest series of the CAN bus-connected power-supply interface cards used at BESSY provide an additional fast AD converter. With a sampling frequency of 83.5kHz, this ADC samples ripple information over one period of the mains voltage. The results are transferred over the CAN bus to the EPICS-based control system and can be processed in the usual ways. Using this setup, even temporarily increased ripple can be detected without complex measurement methods.

Funded by the Bundesministerium für Bildung und Forschung (BMBF) and the Land Berlin.

WPPB37 – Fast BPM DAQ System Using Windows Oscilloscope-based EPICS IOC

Masanori Satoh (KEK, Ibaraki)

The non-destructive beam position monitor (BPM) is an indispensable diagnostic tool for the stable beam operation. In the KEK linac, approximately nineteen BPMs with the strip-line type electrodes are used for the beam orbit measurement and orbit feedback. In addition, some of them are also used for the beam energy feedback loops. The current DAQ system consists of the digital oscilloscopes and the VME computers. They are connected with the GPIB, and a signal from each electrode is analyzed with a predetermined response function once per second by a VME computer that is connected to the upper-layer control servers via Ethernet. The KEKB injector linac is planned to be upgraded to perform the simultaneous injection for 4-rings. In this operation mode, a fast DAQ system is strongly required. In the current system, maximum DAQ rate is strictly limited by the oscilloscope performance, and it should be improved for the 50-Hz measurement. For these reasons, we made the decision to replace the current DAQ system with the fast digital oscilloscope. In this paper, we will present the system description of the new DAQ system, and the detailed result of the performance test will be presented.

WPPB38 – Computing and Network Infrastructure for Controls (CNIC)

Stefan Lueders (CERN, Geneva)

Over the last few years, modern accelerator and experiment control systems are based more and more on common-off-the-shelf products (VME crates, PLCs, SCADA, etc.), on Windows or Linux PCs, and on communication infrastructures using Ethernet and TCP/IP. Despite the benefits

coming with this (r)evolution, new vulnerabilities are inherited, too: Worms and viruses spread within seconds via the Ethernet cable, and attackers are becoming interested in control systems. Unfortunately, control PCs cannot be patched as fast as office PCs. Even worse, vulnerability scans at CERN using standard IT tools have shown that commercial automation systems lack fundamental security precautions: some systems crashed during the scan, others could easily be stopped or their process data be altered. During the two years following the presentation of the CNIC security policy at ICALEPCS'2005, a "defense-in-depth" approach has been applied to protect CERN's control systems. This presentation will give a review of its thorough implementation and its deployment. Particularly, measures to secure the controls network and tools for user-driven management of Windows and Linux control PCs will be discussed.

Thursday Oral Session, ROAA
2nd Floor Lecture Hall, 8:30 a.m.
Session Chairs: Yves Raymond Roblin, JLab
John Galambos, ORNL/SNS

8:30 **ROAA01 – Status of the ITER CODAC-Conceptual Design**

Jo Lister (ITER, St Paul lez Durance), Izuru Yonekawa (JAEA/NAKA, Ibaraki-ken), Martin Greenwald (MIT/PSFC, Cambridge, Massachusetts), Jonathan William Farthing (UKAEA Culham, Culham, Abingdon, Oxon)

Since the last ICALEPCS conference, a number of issues have been studied in the conceptual design of the ITER Control, Data Access, and Communication Systems. Almost all of the technical challenges have seen workable approaches selected. The conceptual design will be reviewed in 2007, before starting the preliminary engineering design. One software component that

does not have a clear solution is the execution of data-driven schedules to operate the installation at multiple levels, from daily program management to plasma feedback control. Recent developments in workflow products might be useful. The present conceptual weakness is not having found a satisfactory "universal" description of the I&C design process for the "self-description" of the 100 procured Plant Systems. A vital CODAC design feature is to operate the full plant on the basis of imported "self-description" data, which necessarily includes the process description in each Plant System. The targeted formal link between 3-D design, process design, and process control has not yet been created. Some of the strawman designs meeting the technical requirements will be mentioned in detail.

9:00 **ROAA02 – Automatic Alignment System for the National Ignition Facility**
Karl Child Wilhelmsen, Abdul Awwal, Sidney Ferguson, Benjamin Horowitz, Victoria Miller Kamm, Charles Allen Reynolds (LLNL, Livermore)
The Automatic Alignment System for the National Ignition Facility (NIF) is a large-scale parallel system that directs all 192 laser beams along the 300-m optical path to a 50-micron focus at target chamber in less than 30 minutes. The system commands 9,000 stepping motors to adjust mirrors and other optics. Twenty-two control loops per beamline request image processing services from a dedicated Linux cluster running Interactive Data Language tools that analyze high-resolution images of the beam and references. Process leveling assures the computational load is evenly spread. Algorithms also estimate measurement accuracy and reject off-normal images. One challenge to rapid alignment of beams in parallel is efficient coordination of shared devices, such as sensors that monitor multiple beams. Contention for shared resources is managed by the Component

Mediation System, which precludes deadlocks and optimizes device motions using a hierarchical component structure. A reservation service provided by the software framework prevents interference from competing automated controls or the actions of system operators. The design, architecture and performance of the system will be discussed.

This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.

9:30 **ROAA03 – Injection, Ramping, and Extraction Timing for the Duke Booster**
Steven M. Hartman, Stepan F. Mikhailov, Victor Popov, Y. K. Wu (FEL/Duke University, Durham, North Carolina), Grigory Yakovlevich Kurkin (BINP SB RAS, Novosibirsk)
A booster synchrotron capable of ramping from 0.25 to 1.2 GeV was recently commissioned at Duke University as part of the High Intensity Gamma Source upgrade. The triggering and timing system uses a combination of software logic and triggers, digital delay generators, and hardware synchronizers to coordinate the linac injector, booster synchrotron and electron storage ring. The injection system has been commissioned with a short pulse photo-injector linac into a single booster RF bucket and to two booster buckets separated by about half the circumference. It has also been commissioned with a long electron pulse from the injection linac into all 19 buckets. The extraction system, combined with short pulse kickers, can extract any of the booster's 19 electron bunches in to any of the storage ring's 64 bunches. Ramping is controlled by programmable VME based waveform generators triggered from the timing system. The system offers flexibility for commissioning and operations and provides a simple interface to the operator.

Supported by U.S. DOE grant #DE-FG02-01-ER41175.

9:50 **ROAA04 – XAL Online Model Enhancements for J-PARC Commissioning and Operation**

Christopher K. Allen (LANL, Los Alamos, New Mexico), Tomohiro Ohkawa, Hiroyuki Sako, Guobao Shen (JAEA, Ibaraki-ken), Masanori Ikegami (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Akira Ueno (JAEA/LINAC, Ibaraki-ken), Hiroshi Ikeda (Visual Information Center, Inc., Ibaraki-ken)

The XAL application development environment has been installed as a part of the control system for the Japan Proton Accelerator Research Complex (J-PARC) in Tokai, Japan. XAL was initially developed at SNS and has been described at length in previous conference proceedings (e.g., Chu et. al. APAC07, Galambos et. al. PAC05, etc.). We outline the upgrades and enhancements to the XAL online model necessary for accurate simulation of the J-PARC linac. For example, we have added permanent magnet quadrupoles and additional space charge capabilities such as off-centered and rotated beams and bending magnets with space charge. In addition significant architectural refactoring was performed in order to incorporate the current, and past, upgrades into a robust framework capable of supporting future control operations. The architecture and design of XAL is as important as its function, as such, we also focus upon the revised architecture and how it supports a component-based, software engineering approach.

Work supported JAEA and by a KEK foreign visiting researcher grant.

10:10 **ROAA05 – An Approach to Stabilizing Large Telescopes for Stellar Interferometry**

Nicola Di Lieto, Johannes Sahlmann, Anders Wallander (ESO, Garching bei Muenchen),

Gautam Vasisht (ESO, Garching bei Muenchen; Jet Propulsion Laboratory, Pasadena, California)

In stellar interferometry fringe-tracking is a method of stabilizing the Optical Pathlength Difference (OPD) from the observed astronomical source to the instrument detector via different telescopes in an interferometric array. At the ESO VLT Interferometer, which includes four 8.2 m class Unit Telescopes (UTs), stabilization to better than a tenth of the observing wavelength is required in order to improve the quality and sensitivity of fringe measurements on the interferometer's scientific instruments. Unfortunately, fast mechanical vibrations due to myriad sources in the observatory infrastructure couple to UT support structure and propagate to the large telescope mirrors. The mirror motions are fast and large (typically about a wavelength) and must be compensated for in real time. We have implemented a scheme to measure the accelerations imparted to the primary, secondary, and tertiary mirrors of the UTs via a grid of suitably placed accelerometers. The measured accelerations, coupled with a simple geometric model, are converted to optical pathlengths and canceled by a wideband feed-forward compensation to a downstream optical delay line.

Thursday Oral Session, ROAB
2nd Floor Lecture Hall, 11:00 a.m.
Session Chairs: John Maclean, ANL
Gianni Raffi, ESO

11:00 **ROAB01 – Software Engineering Processes Used to Develop the National Ignition Facility Integrated Computer Control System**
Arthur Peter Ludwigsen, Robert Carey, Robert Demaret, Lawrence Lagin, Uma Reddi, Paul Van Arsdall (LLNL, Livermore)

The National Ignition Facility (NIF) at Lawrence Livermore National Laboratory is a 192-beam laser facility for high-energy density physics experiments. NIF is operated by the Integrated Computer Control System (ICCS), which is comprised of 60,000 devices deployed on 850 computers. Software is constructed from an object-oriented framework based on CORBA distribution. ICCS is 85% complete, with over 1.5 million lines of verified code now deployed online. Success of this large-scale project was keyed to early adoption of rigorous software engineering practices, including architecture, code design, configuration management, product integration, and formal verification testing. Verification testing is performed in a dedicated test facility following developer integration. These processes are augmented by an overarching quality assurance program featuring assessment of quality metrics and corrective actions. Engineering processes are formally documented, and releases are managed by a change control board. This talk discusses software engineering and results obtained for the NIF control system.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

11:30 **ROAB02 – Software Development and Testing: Approach and Challenges in a Distributed HEP Collaboration**
Doris Burckhart-Chromek (CERN, Geneva)
In the development of the ATLAS Trigger and Data Acquisition (TDAQ) software, the iterative waterfall model, evolutionary process management, formal software inspection, as well as lightweight review techniques are applied. The long preparation phase with a geographically widespread team required that the standard techniques be adapted to this HEP environment. Special emphasis is given to the testing process.

Unit tests and check targets in nightly project builds form the basis for the subsequent software project release testing. The integrated software is then run on computing farms that give further opportunity for gaining experience, fault finding, and acquiring ideas for improvement. Dedicated tests on a farm of up to 1000 nodes address the large-scale aspect of the project. Integration test activities on the experimental site include the special purpose-built event readout hardware. Deployment in detector commissioning starts the countdown towards running the final ATLAS experiment. These activities aim at understanding and completing the complex system, but also help in forming a team whose members have a variety of expertise, working cultures, and professional backgrounds.

12:00 **ROAB03 – Software Integration and Test Techniques in a Large Distributed Project: Evolution, Process Improvement, Results**

Paola Sivera, Moreno Pasquato (ESO, Garching bei Muenchen)

The Atacama Large Millimeter Array (ALMA) is a radio telescope that is being built in Chile. The software development for the project is committed to the Computing Integrated Product Team, (IPT) which has the responsibility of realizing an end-to-end software system consisting of different subsystems, each one with specified development areas. Within the Computing IPT, the Integration and Test subsystem has the role of collecting the software produced, build it and test it and preparing releases. In this paper, the complexity of the software integration and test tasks is analyzed and the problems due to the high geographical distribution of the developers and the variety of software features to be integrated are highlighted. Different implemented techniques are discussed, among them the use of a common development framework (the ALMA Common Software or ACS), the use of standard

development hardware and the organization of the developers work in Function Based Team (FBT). Frequent automatic builds and regression tests repeated regularly on so called Standard Test Environments (STE) are also routinely used. Advantages, benefits and shortcomings of the adopted solutions are presented.

12:20 **ROAB04 – Experience of Developing BEPCII Control System**

Jijiu Zhao (IHEP Beijing, Beijing)

The project of upgrading the Beijing Electron Positron Collider (BEPC) to the BEPCII was started in autumn of 2001, and the goal is to reach a higher luminosity, 1*1033cm-2s-1. The first beams were stored in the Storage Ring in November 2006, and the e+/e- beams successfully collided in March 2007, which is an important milestone of the BEPCII. The BEPCII control system has rebuilt with the "standard mode" and EPICS, which has 20,000 channels and about 30 VME IOCs for equipment control and high-level applications. The control system was put into operation in November 2007, and the system development has followed its schedule and finished on time. In the past few years, we went through the design stage, R&D stage, system development, testing, and installation and commissioning stages. This paper describes experiences and lessons of design and developing the system, including the design considerations, selection of standard hardware and software, building of the development environment, and what we have done in the user requirement, R&D, and other stages. The paper also discusses project management issues, such as interface definition, collaborations, people training, and so on.

Thursday Oral Session, ROPA
2nd Floor Lecture Hall, 2:00 p.m.
Session Chairs: Andy, Gotz, ESRF
Noboru Yamamoto, KEK

2:00 **ROPA01 – Lessons Learned from the SNS Relational Database**
John David Purcell, Ekaterina Danilova, Jeff Patton (ORNL, Oak Ridge, Tennessee)
The Spallation Neutron Source Project relies heavily on many different applications that require and depend on the SNS integrated relational database. Although many of the projects undertaken have been successful, the majority of time and energy spent on producing products has resulted in opportunities lost. The percentage of time lost or wasted has been very similar to that of software development projects everywhere. At the SNS the variety of factors that have influenced these projects can be traced to some specific areas: management support, project deadlines, user expectations, graphical user interfaces, and the database itself. This paper presents a look at the factors that have helped make different projects a success and factors that have led to less favorable results.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

2:30 **ROPA02 – The High-Performance Database Archiver for the LHC Experiments**
Manuel Gonzalez-Berges (CERN, Geneva)
Each of the Large Hadron Collider (LHC) experiments will be controlled by a large distributed system built with the SCADA tool PVSS. There will be about 150 computers and millions of input/output channels per experiment. The values read from the hardware, alarms generated,

and user actions will be archived for the physics analysis and for the debugging of the control system itself. Although the original PVSS implementation of a database archiver was appropriate for standard industrial use, the performance was not enough. A collaboration was set up between CERN and ETM, the company that develops PVSS. Changes in the architecture and several optimizations were made and tested in a system of a comparable size to the final ones. As a result we have been able to improve the performance by more than one order of magnitude, and what is more important, we now have a scalable architecture based on the Oracle clustering technology (Real Application Cluster or RAC). This architecture can deal with the requirements for insertion rate, data querying, and manageability of the high volume of data (e.g., an insertion rate of > 150,000 changes/s was achieved with a 6-node RAC cluster).

2:50 **ROPA03 – ANTARES Slow Control Status**

Jean-Michel Gallone (IPHC, Strasbourg Cedex 2)

ANTARES is a neutrino telescope project based on strings of Cerenkov detectors in deep sea. These detectors are spread over a volume of 1 km3 at a depth of about 2 km in the Mediterranean Sea near Toulon. About 400 of such detectors are now operational, as well as a large variety of instruments that need a reliable and accurate embedded slow control system. Based on Commodity Off-the-Shelf (COTS) low-power integrated processors and industry standards such as Ethernet and ModBus, the foreseen system is expected to run for 3 years without any direct access to the hardware. We present the system architecture and some performance figures. The slow control system stores the state of the system at any time in a database. This state may be analyzed by technical staff in charge of the maintenance, physicists to check the setup

of the experiment, or the data acquisition system for saving experimental conditions. The main functions of the slow control system are to give a record of the state of the whole system, to set the value of a parameter of a physical device, to modify the value of a parameter of a physical device, and to set up the initial values of the physical devices.

Thursday Poster Session, RPPA
Clinch Concourse, 3:10-3:55 p.m.

RPPA01 – Software Management of the LHC Detector Control Systems
Fernando Varela (CERN, Geneva)
The control systems of each of the LHC experiments contain on the order of 150 computers running the back-end applications that are based on the PVSS SCADA package and the Joint Controls Project (JCOP) Framework. These inter-cooperating controls applications are being developed by different groups all around the world and have to be integrated by the experiments' central controls teams. These applications will have to be maintained and eventually upgraded during the lifetime of the LHC experiments, ~20 years. This paper presents the centralized software management strategy based on the JCOP framework installation tool, a central repository shared by the different controls applications and an external database that holds the overall system configuration. The framework installation tool allows installation of software components in the sub-detector PVSS applications and eases integration of different parts of a control system. The information stored in the system configuration database can also be used by the installation tool to restore a computer in the event of failure. The central repository pro-

vides versioning of the various software components integrating the control system.

RPPA02 – Linac RF Feed-forward development at TLS

Kuo Hwa Hu, Kuo-Tung Hsu, Jiing-Yi Hwang, Demi Lee, Ke-Kang Lin, Chunyi Wu (NSRRC, Hsinchu)

Performance of an electron linear accelerator is very important for synchrotron light source operation. Its performance in amplitude and phase of the RF field will decide the quality of extract beam. The RF feed-forward control is helpful to fixed amplitude and phase constant and keeps on stable beam extract. Design consideration and details of the implementation will be summary in this report.

RPPA03 – The LHC Functional Layout Database as Foundation of the Controls System

Pascal Le Roux, Ronny Billen, Julien Mariethoz (CERN, Geneva)

For the design, construction, integration, and installation of the LHC, the LHC Layout database manages the information on the functional positions of the components of the LHC. Since January 2005, the scope of this database has been extended to include all electronics racks in the tunnel, underground areas, and surface buildings. This description of the accelerator and the installed controls topology is now used as the foundation for the online operational databases, namely for controls configuration and operational settings. This paper will sketch the scope of the Layout database and explain the details of data propagation towards the respective controls data consumers. The question whether this approach is applicable to the rest of the accelerator complex at CERN will be addressed as well..

RPPA04 – Automating the Configuration of the Control Systems of the LHC Experiments

Francisca Calheiros, Piotr Golonka, Fernando Varela (CERN, Geneva)

The supervisory layer of the Large Hadron Collider (LHC) experiments is based on the PVSS SCADA tool and the Joint Control Project (JCOP) framework. This controls framework includes a Finite State Machine (FSM) toolkit, which allows operation of the control systems according to a well-defined set of states and commands. During the FSM transitions of the detectors, it will be required to reconfigure parts of the control systems. All configuration parameters of the devices integrated into the control system are stored in the so-called configuration database. In this paper the JCOP FSM-Configuration database tool is presented. This tool represents a common solution for the four LHC experiments to ensure the availability of all configuration data required for a given type of run of the experiment, in the PVSS subdetector control applications. The implementation strategy chosen is discussed in the paper. This approach enables the standalone operation of different partitions of the detectors simultaneously while ensuring independent data handling. Preliminary performance results of the tool are also presented in this paper.

RPPA05 – Priority-Driven Digitizer Readout for GRETINA

Carl Lionberger, Mario Cromaz (LBNL, Berkeley, California)

Control of the pulsed RF cavity fields in the GRETINA will acquire gamma-ray energy data from custom VME-base digitizers, each with 10 input channels. Several such modules are used to acquire data from a single crystal and the data from each crystal must be merged into a timestamp-ordered stream. Not all channels are always digitized but the merge cannot be considered complete at a given timestamp until all

available data have been inserted. Modules accumulate data in 1-MB FIFOs that are most efficiently read out when half-full but may be read out in smaller amounts. The poster describes software that uses information from the ongoing merge process to decide when to read out modules that are less than half-full and provides the sort with timestamp-based indications of no more data available when appropriate.

RPPA06 – Construction and Application of Database for CSNS

Quan Gan, ChunHong Wang (IHEP Beijing, Beijing), Chungming Paul Chu (SLAC, Menlo Park, California)

The database of the China Spallation Neutron Source (CSNS) is designed to store machine parameters, magnet measurement data, survey and alignment data, control-system configuration data, equipment historical data, e-logbook, and so on. It will also provide project management quality assurance, error impact analysis, and assembly assistance including sorting. This paper introduces the construction and application of the database for CSNS. Details such as name rules, database model and schema, interface of import and export data, and database maintenance will be presented.

RPPA07 – Advanced Data Analyses System for the Worldwide Space Environmental Viewing and Analysis Network (SEVAN)

Ashot A. Chilingarian (YerPhI, Yerevan), Suren A. Chilingarian (FZ Karlsruhe, Karlsruhe)

The Advanced Data Analyses System (ADAS) is designed as a distributed network of the uniform components connected by means of web service interfaces. The units connected by ADAS are particle detectors equipped with modern electronics monitoring changing fluxes of the cosmic rays. For the timely and reliable forecasting of the severe conditions of the space weather, we need uninterruptable operation of the whole

network and online treatment of the data from remote detectors. The main component of the ADAS is a Unified Readout and Control Server (URCS) controlling the underlying electronics by means of the detector-specific drivers and making a preliminary analysis of the online data. Then, the data are made available for other system components by means of the web service interfaces. The interface provides remote structured access to the current and archived data and facilitates cooperation with remote system components, giving a chance to correlate the data collected by detectors of the SEVAN network worldwide.

RPPA08 – OracleArchiver –Integration Between EPICS and ORACLE

Anindya Roy, Tanushyam Bhattacharjee, Rajendra Balkrishna Bhole, Niraj Chaddha, Sarbajit Pal (DAE/VECC, Calcutta)

The successful operation of different subsystems, e.g., Cryogenic, Cryogen Delivery, Magnet Power Supply, Vacuum, ECR, Beam Diagnostic and Low Conductivity Water Systems of Superconducting Cyclotron (K500), demands a well-configured data-logging, archiving, and historic-analysis facility for a massive number of control parameters along with an online failure-analysis facility of every system. EPICS is used as development architecture of the control system of these systems, with ORACLE used as the database for the large amount of relational data management. This combination requires integration between EPICS and the ORACLE server. For this purpose, OracleArchiver as an EPICS Extension is developed for data logging and archiving of control parameters into ORACLE database. This extension also provides a web-based tool for online monitoring of control parameters and historic analysis of archived data. This paper describes the software architecture and implementations, as well as how to configure it for any other EPICS-based control system as a

utility along with examples and web-page views and experiences of using it in SCC.

RPPA09 – Fault Diagnosis and Performance Evaluation for Dragon-I Based on Radial Basis Function Neural Network

Xinglin Yang, Jin Li, Huacen Wang (CAEP/IFP, Mainyang, Sichuan)

The Dragon-I facility is a high-current linear induction accelerator (LIA) at CAEP of China. Because of its complicacy, it is difficult to evaluate and predict its performance. This paper presents a method which combines wavelet packet transform (WPT) and radial basis function neural network (RBF) to build a fault diagnosis and performance evaluation system in order to improve reliability of Dragon I. The signal characteristics vectors which serve as inputs of RBF are extracted based on energy parameters of WPT. Such vectors well present the temporal and steady features of LIA's pulsed signal, and reduce data dimentions effectively. We use the nearest neighbor clustering algorithm to train RBF network in supervised mode. We built three prototype systems: the fault diagnosis for accelerating cell, the trend classification for the beam current and the multinetwork jointed inference for beam current transmission. Initial results show that these systems have given good performances.

RPPA10 – Status of the Diamond Fast Orbit Feedback System

James Rowland, Michael Abbott, John Anthony Dobbing, Mark Heron, Guenther Rehm, Isa Uzun (Diamond, Oxfordshire)

We present the development of transverse orbit stability control at Diamond. We discuss the low latency feedback loop required to effectively suppress high-frequency noise, which informs the choice of network topology and processing units. We explore the use of the field-programmable gate array in the Libera beam position

monitor as a communication controller and the vector unit of the PowerPC G4 in the compensator. System models and results from preliminary tests on the machine are shown.

RPPA11 – MultiController: An Object Programming Approach to Introduce Advanced Control Algorithms for the GCS Large-Scale Project

Sebastien Pierre Cabaret, Artem Burmyakov (CERN, Geneva)

The GCS* project team at CERN uses a Model-Driven Approach with a Framework—UNICOS (UNified Industrial COntrol System)—based on PLC** and SCADA*** technologies. The first UNICOS versions were able to provide a PID**** controller, whereas the Gas Systems required more advanced control strategies. The MultiController is a new UNICOS object that provides the following advanced control algorithms: Smith Predictor, PFC (Predictive Function Control), RST, and GPC (Global Predictive Control). Its design is based on a monolithic entity with a global structure definition able to capture the desired set of parameters of any specific control algorithm proposed by the object. The SCADA system—PVSS—supervises the MultiController operation. It gives the user a wide choice of features through the MultiController object interface, including a recipe mechanism: the GCS experts are able to capture sets of relevant advanced control algorithm parameters to reuse them later. Starting by exposing the MultiController object design and implementation for a PVSS and Schneider PLC solution, this paper finishes by highlighting the benefits of the MultiController with the GCS applications.

*Gas Control System
**Programming Language Controller
***Supervisory Control And Data Acquisition
****Proportional Integrative Derivative

RPPA12 – Process Control: Object-Oriented Model for Offline Data

Christian Gerke, Matthias R. Clausen, Jan Hatje (DESY, Hamburg)

Process control systems are primarily designed to handle online real-time data. But once the system has to be maintained over years of continuous operation, the aspects of asset management (e.g., spare parts) and reengineering (e.g., loading process computers and field bus processors with consistent data after modification of instrumentation) become more and more important. One way to get the necessary information is data mining in the running system. The other possibility is to collect all relevant information in a database from the beginning and build up configuration files from there. For the cryogenic systems in the XFEL, the planned x-ray free electron laser facility at DESY in Hamburg, Germany, EPICS will be used as the process control software. This talk will present the status of the development of our device database, which is to hold the offline data. We have chosen an approach representing the instrumentation and field bus components as objects in Java. The objects are made persistent in an Oracle database using Hibernate. The user interface will be implemented as a plugin to the control system studio CSS based on Eclipse.

RPPA13 – The Electrical Power Project at SNS

Ekaterina Danilova, Marnelli Martinez, John David Purcell (ORNL, Oak Ridge, Tennessee)

The Electrical Power Project consists of recording data on all power-distribution devices necessary to SNS operations and how they are connected, assigning a valid name to each device and describing it, along with loading this information and the relationships into the SNS Oracle database. Interactive web-based applications allow users to display and easily update power-related data. In the case of planned elec-

trical outages, a complete list of affected devices (including beam-line devices) will be available to controls, diagnostics, and other groups in advance. The power-tree information can be used to help diagnose electrical problems of any specific device. Fast access to device characteristics and relations from any web browser will help technical personnel quickly identify hazards and prevent electrical accidents, thereby ensuring SNS electrical safety. The project was completed by a special task team containing individuals from different groups. The paper covers the project history, QA issues, technology used, and current status.

RPPA14 – Java Tool Framework for Automation of Hardware Commissioning and Maintenance Procedures

Joyce Ho (LLNL, Livermore, California)

The National Ignition Facility (NIF) is a 192-beam laser system designed to study high energy density physics. Each beam line contains a variety of line replaceable units (LRUs) that include optics, stepping motors, sensors and other devices to control and diagnose the laser. During commissioning or subsequent maintenance of the laser, LRUs undergo a qualification process using the Integrated Computer Control System (ICCS) to verify and calibrate the equipment. The commissioning processes are both repetitive and tedious using remote manual computer controls, making them ideal candidates for software automation. Maintenance and Commissioning Tool (MCT) software was developed to improve the efficiency of the qualification process. The tools are implemented in Java, leveraging ICCS services and CORBA to communicate with the control devices. The framework provides easy-to-use mechanisms for handling configuration data, task execution, task progress reporting, and generation of commissioning test reports. The tool framework design and application examples will be discussed.

This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.

RPPA15 – Initial Performance Results of the APS P0 Feedback System

Nicholas P. Di Monte, Eric Norum, Chihyuan Yao (ANL, Argonne, Illinois)

The Advanced Photon Source electron beam exhibits transverse instability when a large amount of charge is present in a single bunch. The P0 feedback system stabilizes the transverse motion of the beam under these circumstances. The initial requirement was to stabilize a single bunch of electrons in the horizontal plane. By implementing the stabilizer in an FPGA and using the parallel processing capabilities provided by this hardware, it is possible to stabilize 324 bunches per turn in both the horizontal and vertical planes. The stabilizer consists of 648 32-tap finite impulse response filters. This paper discusses the challenges in achieving this performance and some issues in interfacing to a Coldfire IOC running RTEMS. Initial test results of the system response are presented.

Work supported by U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.

RPPA16 – Energy Ramping in BEPCII

ChunHong Wang, Jia Liu, HaoLi Shi, JinCan Wang, XiaoLi Wang, YouHeng Wang, Zhuo Zhao (IHEP Beijing, Beijing)

The magnet power supply ramping synchronously is a fundamental procedure of the energy ramping of the BEPCII storage ring. The BEPCII has been put into synchrotron radiation operation (SR) (2.5GeV) research for 2 months after beams were successfully running in the

Storage Ring with good beam performance. A software-based synchronization of the DAC setting on the power supplies is developed to achieve the relative magnet power supplies in the synchrotron ring ramped to the designed current synchronously. This paper introduces the schemes developed to perform energy ramping in the BEPCII storage ring and reports on the result of the operation carried out so far.

RPPA17 – A Physics-Based Approach for Magnet Control in a Booster and Storage Ring

Steven M. Hartman, Stepan F. Mikhailov, Y. K. Wu (FEL/Duke University, Durham, North Carolina)

At Duke University, a booster synchrotron was recently commissioned as part of the HIGS upgrade. For the ramping magnet power supply controls, we followed an approach previously implemented for the Duke Storage Ring controls. The high-level operator interface is presented in terms of the physics quantities of the accelerator, i.e., the effective focusing strength of the magnets. This approach allows for a tighter integration of the control system with physics modeling programs and facilitates machine studies. The approach also simplifies operations of the accelerators by presenting an interface nearly independent of machine energy. For the booster, nonlinearities of the magnets, a result of its extremely compact footprint, are incorporated in to the low-level software while providing a high level of machine tunability. For the storage ring, feed forward compensations built on the effective strength of the magnets simplify tuning of the machine over a wide range of electron beam energies or wiggler settings. This approach provides for a good match to the diverse operational modes supported by the Duke Storage Ring.

Supported by US DoE grant #DE-FG02-01-ER41175 and by US AFOSR MFEL grant #FA9550-04-01-0086.

RPPA18 – The Reduction of Probability of Occurrence of Phase Oscillations in Multi-Bunch Mode in VEPP-4M Collider by Stabilization of Temperature of RF-Cavities

Ivan Ivanovich Morozov, Valery Mikhailovich Tsukanov, Askold A Volkov (BINP SB RAS, Novosibirsk)

Temperature variation of RF-cavities is the main reason for phase oscillations' appearance in case of multi-bunch mode because it leads to a change of their geometrical sizes and provides undesirable cavity modes. The analysis of temperature is carried out by a microcontroller connected to a Linux computer by means of a USB interface. An ADAM-4022T Serial Base Dual Loops PID Controller is used for high-precision stabilization. PID control has allowed essentially improved accuracy of stabilization of temperature. The temperature variation is 0.1 degrees centigrade in the 24 to 38 degrees centigrade range. That has led to a decrease in probability of occurrence of phase oscillations.

RPPA19 – Photon Diagnostic Station for TAC IR-FEL Test Facility

Ilhan Tapan (UU, Bursa)

The Turkic Accelerator Center (TAC) project has been accepted by Turkish government. According to this project, a linac-based infrared oscillator free electron laser (FEL) will be constructed as a TAC test facility by the end of 2010. Planning work has been ongoing for the firt FEL facility building in Turkey. Both 20- and 40-MeV electron energies will be used to obtain infrared photons in the wavelength region of 1 to 100 micrometers. The IR FEL photons generated by two undulators will be transported through the respestive two photon beam lines to the experimental hall, where they are fed in to eight experimental station. Photon diagnostic station will be located in the experimental hall to measure the properties of the photon beam.

In this work, the performance of the designed IR-FEL photon diagnostic station for the TAC test facility has been discussed.recent tests on a prototype cryomodule.

RPPA20 – A Fast Global Orbit Feedback for the ELETTRA Storage Ring

Marco Lonza, Daniele Bulfone, Vincenzo Forchi', Giulio Gaio, Lorenzo Pivetta (ELETTRA, Basovizza, Trieste)

A fast global orbit feedback using digital Beam Position Monitor (BPM) detectors has been installed and commissioned at Elettra. The system uses 96 BPMs and 82 steerer magnets to correct closed orbit errors at a 10-kHz repetition rate. The feedback processing is performed by twelve VME stations equipped with commercial CPU boards running the Linux operating system with real-time extension and connected to each other by a low-latency fiber optic network. The system is fully controlled by a Tango based control system. A number of diagnostic and visualization software tools have been developed to easily operate the feedback and detect anomalous sources of orbit distortion. The operational experience and the achieved results are presented. Plans for further improvements of orbit stability are also discussed.

RPPA21 – Application of a Free GIS in VEPP-5 Control System

Alexander Antonov, Dmitry Bolkhovityanov (BINP SB RAS, Novosibirsk)

Geographic Information Systems (GIS) look very promising for use at an accelerator complex. Their application can include equipment inventory system, automatic generation of visual control screens, and so on. Use of a GIS typically requires two parts: (a) the geo-data storage and display system and (b) data input and editing system. And these parts are usually implemented by different software packages. VEPP-5 traditionally uses free software, so we made a

survey of what free GIS tools and systems are available. Free GIS tools haven't yet reached the same state of maturity as commercial ones, so the choice is neither unambiguous nor trivial. The ways to use GIS for equipment accounting and automatic generation of control screens are currently studied, and use of GIS for alarm management and integration with e-logbook is being examined.

RPPA22 – Control of Duration and Time Uniformity of Beam Extracted from a Synchrotron

Yuriy Bashmakov, Vladislav Karpov (LPI, Moscow)

At the slow extraction of particles from a synchrotron, the law of time variation of the intensity of extracted beam is primarily determined by the velocity of approach of the frequency of the betatron oscillations to the resonance value. The functional dependence of the required form of a changing of the exciting currents in the quadrupole lenses or in the pole face gradient windings as the function of the beam particles distributions on the amplitudes of betatron and synchrotron oscillations is considered. The basic controlling parameters and the influence of the errors of control on the effectiveness of the work of the slow extraction system are discussed. The optimum algorithm of controlling actions according to the feedback principle is examined.

RPPA23 – Initial Design of a Global Fast Orbit System for the ALBA Synchrotron

David Beltran, Marc Munoz [ALBA, Bellaterra (Cerdanyola del Vallès)]

This paper presents the initial design of the Global Fast Orbit Feedback (FOFB) system for the ALBA Storage Ring. The FOFB system is designed to reach a submicron stability of the electron beam working at frequencies of at least 100 Hz. It compensates the small perturbations produced by vibrations, electromagnetic noise

and changes in the gap or phase of the insertion devices, etc. A description of the model is shown. The different subsystems have been identified and modeled: the BPM processor, the iron lamination and the vacuum chamber. The power converter supplies for the correctors play an important role in the system, and they have been designed (strength, resolution, bandwidth, voltage output) accordingly with the FOFB requirements. We have also studied the latency of the system (communication network, processing times). The orbit correction is computed by a PID controller. The simulations of the closed loop response show a damping of the perturbation between 0 and 100 Hz, although the system also introduces a small amplification of the noise just after this bandwidth.Finally the paper presents the initial design of the hardware architecture of the FOFB system.

RPPA24 – SPARC-GIS

Giampiero Di Pirro, Elisabetta Pace [INFN/ LNF, Frascati (Roma)]

SPARC, the new Frascati injector project, will start its operation in fall 2007. It will operate in a hall 36 meters width and 15 meters length, but several devices that allow it to work are placed in two other floors. Furthermore, the control room and the computing room are in a fourth floor. Hundreds of devices (hardware controls, CPUs, ionization chambers, etc.) are spread in these rooms. The usage of a GIS-based system seems to be very interesting in order to know where devices are, what they are (hardware model, release, configuration, etc.), and their status. An interface with our PostgreSQL-based database would be also very helpful. Furthermore, the development of such a GIS tool for SPARC would be really important for the SPARX accelerator that will be built in the next few years in the Torvergata (Roma) area and that will have a larger building.

RPPA25 – The Data Acquisition System (DAQ) of the FLASH Facility

Raimund Kammering, Kay Rehlich, Vladimir Rybnikov (DESY, Hamburg)

Nowadays the photon science experiments and the machines providing these photon beams produce enormous amounts of data. To capture the data from the photon science experiments and from the machine itself, we developed a novel Data AcQusition (DAQ) system for the FLASH (Free electron LASer in Hamburg) facility. Meanwhile the system is not only fully integrated into the DOOCS control system, but is also the core for a number of essential machine-related feedback loops and monitoring tasks. A central DAQ server records and stores the data of more than 900 channels with 1-MHz up to 2-GHz sampling and several images from the photon science experiments with a typical frame rate of 5 Hz. On this server all data are synchronized on a bunch basis which makes this the perfect location to attach, e.g., high-level feedbacks and calculations. An overview of the architecture of the DAQ system and its interconnections within the complex of the FLASH facility together with the status of the DAQ system and possible future extensions/applications will be given.

RPPA26 – Database for Control System of J-PARC 3GeV RCS

Hiroki Takahashi, Yuko Kato, Masato Kawase, Hironao Sakaki, Hiroyuki Sako, Hiroshi Yoshikawa (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Shin-pei Fukuta (MELCO SC, Tsukuba), Makoto Sugimoto (Mitsubishi Electric Control Software Corp, Kobe), Shiori Sawa (Total Support Systems Corporation, Tokai-mura, Naka-gun, Ibaraki)

The Control System of J-PARC 3GeV RCS is configured based on Database, which is comprised of Component Data Management DB (Component DB) and Data Acquisition DB

(Operation DB. Component DB was developed mainly to manage the data on accelerator components and to generate EPICS records automatically using the data. Presently we are testing the reliability of DB application software at Linac operation. Later most Linac EPICS records are generated from DB, and we are able to operate Linac with very few problems. Operation DB collects the two kinds of data. One is EPICS records data, and the other is synchronized data. Now we are testing the reliability of application software for EPICS records data collection, and we have confirmed that EPICS record data are corrected with very few problems. Later Linac EPICS records data are inserted in Operation DB from Linac Operation start. On the other hand, application software for synchronized data collection is now being developed, and we will test the reliability of this application software from comprehensive information on RCS operation. We report on the status of development for Database for Control System of J-PARC 3GeV RCS.

RPPA27 – Status of the TANGO Archiving System

Sandra PIERRE-JOSEPH ZEPHIR, Alain Buteau, Majid Ounsy (SOLEIL, Gif-sur-Yvette)

This poster will give a detailed status of the major functionality delivered as a Tango service: the archiving service. The goal of this service is to maintain the archive history of thousands of accelerators or beamline control parameters in order to be able to correlate signals or to get snapshots of the system at different times and to compare them. For this aim, three database services have been developed and fully integrated in Tango: an historical database with an archiving frequency up to 0.1 Hz, a short-term database providing a few hours retention but with higher archiving frequency (up to 10 HZ), and finally a snapshotting database. These services are available to end users through two graphical user interfaces: Mambo (for data extraction/

visualization from historical and temporary databases) and Bensikin (for snapshots management). The software architecture and design of the whole system will be presented, as well as the current status of the deployment at SOLEIL.

RPPA28 – SDA Time Intervals

Timofei Borisovich Bolshakov, Jerry Cai, Elliott McCrory, Dennis J. Nicklaus (Fermilab, Batavia, Illinois)

SDA (Sequenced Data Acquisition) Time Intervals is a hierarchical logging system for describing complex large-scale repeated processes. SDA has been used extensively at Fermilab* for fine tuning during the Tevatron Collider Run II. SDA Time Intervals is a new system born during discussions between CERN and FNAL about routinely recording relevant data for the LHC. Its main advantages are extremly low maintenance and good integration with traditional "flat" dataloggers. The Time Intervals (TI) system records the time of key events during a process and relates these events to the data that the traditional datalogger archives. From the point of view of the application program, any number of datalogging systems can be refactored into human-understandable time intervals.

*SDA-based diagnostic and analysis tools for Collider Run II.T.B. Bolshakov, P. Lebrun, S. Panacek, V. Papadimitriou, J. Slaughter, A. Xiao. Proceedings of PAC 05, Knoxville, Tennessee, May 2005.

Fermi National Accelerator Laboratory (Fermilab) is operated by Fermi Research Alliance, LLC, for the U.S. Department of Energy under contract DE-AC02-07CH11359.

RPPA29 – A Feed-Forward Procedure to Counteract Orbit Distortions and Photon Beam Displacements from Insertion Device Operation at the SLS

Jan Chrin, Thomas Schmidt, Andreas Streun, Dirk Zimoch (PSI, Villigen)
Insertion devices of various types provide light of high brilliance to experimenters at the SLS beamlines. Changes in the photon energy and polarization by movement of the ID gap and phase shift, however, cause orbit distortions that result in a displacement of the photon beam in both angle and position at the beamline. A feed-forward correction scheme has been developed to quantify and precisely correct these effects using designated correctors local to the photon source. The corrector settings are determined using an orbit configuration consisting of 73 digital BPMs and associated correctors; recently commissioned X-ray BPMs located at the beam-line front-end are also included in the correction algorithmn and serve to constrain the photon beam to its specified position. The feed-forward table is finally implemented at the local proces-sor level and applied at a rate of 10 Hz. A photon pointing stability at the sub-microradian level is achieved. The entire gap scan, feed-forward generation and subsequent verification can now be completed within 15 to 60 minutes depending on the complexity of the ID. The methodology of the procedure and high-level software frame-work is described.

RPPA30 – Drift Compensation for the SNS Laserwire

Willem Blokland, Alan Matthews Barker, Warren Grice (ORNL, Oak Ridge, Tennessee)
The Spallation Neutron Source (SNS) uses a laserwire to measure the transverse profiles in the Super Conduction Linac (SCL). The laser is located in a service building downstream from the SCL. Mirrors direct the laser light to a specific location to interact with the ion beam. Because of the long travel length of the light, up to 300 feet, minor mirror movements become large enough at the down stream station that the drift over time must be corrected. In this paper

we describe how we correct for the drift and present our results.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

RPPA31 – The SPEAR-3 Fast Transverse Orbit Feedback

Till Straumann, Andrei Terebilo (SLAC, Menlo Park, California)

A Fast Orbit Feedback (FOFB) with a closed-loop bandwidth of ~80 Hz was designed for stabilizing the electron beam in the SPEAR-3 3rd generation electron storage ring. It is implemented as a distributed system with 21 computers performing orbit acquisition, feedback algorithm and corrector steering. A dedicated point-to-point network (employing ethernet hardware) is used to provide real-time critical communication paths for the FOFB. Orbit readings are acquired by and propagated from 2 remote processors to a central computer where they are transformed into "pseudo eigen-space" where the system response matrix is diagonal (standard SVD technique). A PI control algorithm runs in this diagonal space so that the loop dynamics can be tuned for each singular value individually. A vector of corrections is broadcast to 18 power-supply controllers which transform it into current corrections in a distributed fashion. All computers run the RTEMS real-time OS so that a total processing latency/dead-time < 1 ms at a update rate of 4 kHz can be achieved. At a lower priority, standard control system tasks (using EPICS) are running for controls and monitoring purposes.

Department of Energy.

RPPA33 – Search for a Reliable Storage Architecture for RHIC

Severino Binello, Roger Katz, John Morris (BNL, Upton, Long Island, New York)

Software used to operate the Relativistic Heavy Ion Collider (RHIC) resides on one operational RAID storage system. This storage system is also used to store data that reflects the status and recent history of accelerator operations. Failure of this system interrupts the operation of the accelerator as backup systems are brought online. In order to increase the reliability of this critical control system component, the storage system architecture has been upgraded to use Storage Area Network (SAN) technology and to introduce redundant components and redundant storage paths. This paper describes the evolution of the storage system, the contributions to reliability that each additional feature has provided, further improvements that are being considered, and real-life experience with the current system.

Work performed under auspices of the U.S. Department of Energy under Contract No. DE-AC02-98CH10886 with Brookhaven Science Associates, LLC.

RPPA34 –VME Reliability Monitor Board with Embedded EPICS

Kazuro Furukawa, Atsuyoshi Akiyama, Tatsuro Nakamura, Masanori Satoh, Noboru Yamamoto (KEK, Ibaraki)

Field computers are the most important components in the control systems. Since the KEKB linac and rings are continuously operated, the failure in the control system may affect the physics experiments that are carried in those downstream rings. Thus, we have carefully maintained the reliability of the system by the routine inspection through online monitors with reliability monitor boards. Those VME boards are called RAS boards (reliability, availability, and serviceability) and provide information on healthiness of the VME systems. However, their dedicated wiring became an issue. In order to solve the situation we developed a network connected reliability (RAS) board. It monitors the

temperature, power voltages and the fan status of the VME chassis, and provides access to the VME reset, eight TTL input/output signals and four RS232C serial lines as well. That information is exchanged over Ethernet and TCP/IP. It is driven by a real-time OS or Linux on board, and embedded EPICS IOC software is being developed. The board is expected to improve further the robustness of the control system.

RPPA35 – The DIAMON Project – Monitoring and Diagnostics for the CERN Controls Infrastructure

Pierre Charrue, Mark Buttner, Joel Lauener, Katarina Sigerud, Maciej Sobczak, Niall Stapley (CERN, Geneva)

The CERN accelerators' controls infrastructure spans over large geographical distances and accesses a big diversity of equipment. In order to ensure smooth beam operation, efficient monitoring and diagnostic tools are required by the operators, presenting the state of the infrastructure and offering guidance for the first line support. The DIAMON project intends to deploy software monitoring agents in the controls infrastructure, each agent running predefined local tests and sending its result to a central service. A highly configurable graphical interface will exploit these results and present the current state of the controls infrastructure. Diagnostic facilities to get further details on a problem and first aid to repair it will also be provided. This paper will describe the DIAMON project's scope and objectives as well as the user requirements. Also presented will be the system architecture and the first operational version.

RPPA36 – Handling Large Amounts of Data in ALICE

Peter Chochula, Andre Augustinus, Lennart Stig Jirden, Svetozar Kapusta (CERN, Geneva)

The amount of control data to be handled by the ALICE experiment at CERN is by a magnitude larger than in previous-generation experiments. Some 18 detectors, 130 subsystems, and 100,000 control channels need to be configured, controlled, and archived in normal operation. During the configuration phase several Gigabytes of data are written to devices, and during stable operations some 1,000 values per second are written to archival. The peak load for the archival is estimated to 150,000 changes/s. Data is also continuously exchanged with several external systems, and the system should be able to operate unattended and fully independent from any external resources. Much care has been taken in the design to fulfill the requirements, and this report will describe the solutions implemented. The data flow and the various components will be described as well as the data exchange mechanisms and the interfaces to the external systems. Some emphasis will also be given to data reduction and filtering mechanisms that have been implemented in order to keep the archive within maintainable margins.

RPPA37 – Experiences: Configuration Management with a Generic RDB Data-Model

Thomas Birke, Bernhard Kuner (BESSY GmbH, Berlin)

A new RDB data-model has been introduced at BESSY to enable a more generic approach to store and handle configuration data. Stored data ranges from global hardware-structure and -information through building logical hierarchies to configuration information for monitoring applications as well as signal-level information. This information is used to configure the front-end computers as well as the generic and higher-

level tools like alarm-handler and archiver. New applications at BESSY are developed with this generic RDB data-model in mind. First experiences with real-life applications as well as a set of tools for entering, maintenance, and retrieval of configuration data are described in this paper.

RPPA38 – Fast Orbit Feedback System Upgrade in TLS

Pei-Chen Chiu, Jenny Chen, Kuo-Tung Hsu, Kuo Hwa Hu, Changhor Kuo (NSRRC, Hsinchu)

We present progress on fiber-optic based systems Orbit feedback system of the Taiwan Light Source (TLS) has been deployed for a decade. The loop bandwidth was limited by existing hardware. The system cannot remove perturbation caused by fast source. To improve orbit feedback performance, BPM system and corrector power supply are planned to upgrade within a couples of years. New digital BPM electronics will enhance functionality of the BPM system and replace analogy type BPM but due to limited resource, the BPM system will be a mixed type at this moment. The corrector power-supply is also replaced by high performance switching type power supply with wide bandwidth in the same time. It is expected that our upgrade will significantly improve performance of fast orbit feedback.

RPPA39 – Accelerator Trouble Ticket

Alice Camiletti, Carmen Bravo, Giovanni Mazzitelli, Roberto Tonus (INFN/LNF, Frascati (Roma))

The DAFNE Accelerator complex, a 1020-MeV center of mass lepton collider for Phi particle production, consists of a linear accelerator, a damping ring, nearly 180 m of transfer lines, two storage rings that intersect in two points, a test beam area providing e+/e- and photos (BTF) on demand, and three synchrotron light lines (DAFNE-L). The complexity of the machine and subsystem pushed us to develop a system for

logging, archiving, and making statistics and history of the DAFNE accelerator and experimental user's faults, warnings, news, and general setup information. The Accelerator Trouble Ticket is a web tool (PHP, MySQL, and email based), that allows for complete handling and sharing of all the accelerator information with the scientific, technical, and service staff; it also allows experimental users easy access via the World Wide Web. The architecture and implementation of the system and the ease of exportation and configuration for any accelerator complex is presented, along with examples of products and results obtained from the first year of operation at the DAFNE accelerator.

Thursday Poster Session, RPPB
Clinch Concourse, 3:55-4:40 p.m.

RPPB01 – The CERN Control Centre: Setting Standards for the XXIst Century
Django Manglunki, Pierre Charrue (CERN, Geneva)
After a 15-month construction period, the CERN Control Centre (CCC) began operating on February 1st, 2006. The CCC now controls all of CERN's accelerators, technical infrastructure, and cryogenics plants. In addition, most LHC experiments as well as other scientific laboratories throughout the world, are adopting some of its design options (furniture, layout, colours, ...) for their own control rooms. This paper presents the main ideas behind the ergonomic choices.

RPPB03 – Alarms Configuration Management
Peter Sollander, Robin Martini, Katarina Sigerud, Niall Stapley (CERN, Geneva)
The LHC alarm service, LASER, is the alarm tool used by the operators for the accelerators

and the technical services at CERN. To ensure that the alarms displayed are known and understood by the operators, each alarm should go through a well-defined procedure from its definition to being accepted in operation. In this paper we describe the workflow to define alarms for the technical services at CERN. We describe the different stages of the workflow like equipment definition, alarm information specification, control system configuration, test, and final acceptance in operation. We also describe the tools available to support each stage and the actors involved. Although the use of a strict workflow will limit the number of alarms that arrive to LASER and ensure that they are useful for operations, for a large complex like CERN there are still potentially many alarms displayed at one time. Therefore the LASER tool provides facilities for the operators to manage and reduce the list of alarms displayed. The most important of these facilities are described, together with other important services like automatic GSM and/or e-mail notification and alarm system monitoring.

RPPB04 – SNS Logbook

Thomas Pelaia, Mario Giannella, Brad Horn, Jeff Patton (ORNL, Oak Ridge, Tennessee)

An electronic logbook has been developed for the Spallation Neutron Source. This logbook serves as a means of chronologically recording daily operations activities and experiences and communicating them to appropriate groups. The logbook is database-driven and integrates into our existing database schema. The interface to the logbook is web-based and works with most modern web browsers on the major platforms. Additionally, a Java package provides a simple mechanism to post entries from within our XAL applications.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

RPPB05 – Applying Agile Project Management for Accelerator Controls Software

Wojciech Sliwinski, Niall Stapley (CERN, Geneva)

Developing accelerator controls software is a challenging task requiring not only a thorough knowledge of the different aspects of particle accelerator operations, but also application of good development practices and robust project management tools. Thus, there was a demand for a complete environment for both developing and deploying accelerator controls software, as well as the tools to manage the whole software life cycle. As an outcome, a versatile development process was formulated, covering the controls software life cycle from the inception phase up to the release and deployment of the deliverables. A development environment was created providing management tools that standardize the common infrastructure for all the concerned projects; help to organize work within project teams; ease the process of versioning and releasing; and provide an easy integration of the test procedures and quality assurance reports. Change management and issue tracking are integrated with the development process and supported by the dedicated tools. This approach was successfully applied for all the new controls software for LEIR, SPS, LHC, injection lines, and CNGS extraction.

RPPB06 – Device Control Tool for CEBAF Beam Diagnostics Software

Pavel Chevtsov (Jefferson Lab, Newport News, Virginia)

By continuously monitoring the beam quality in the CEBAF accelerator, a variety of beam diagnostics software created at Jefferson Lab makes a significant contribution to very high availability of the machine for nuclear physics experiments. The interface between this software and beam instrumentation hardware components

is provided by a device control tool, which is optimized for beam diagnostics tasks. As a part of the device/driver development framework at Jefferson Lab, this tool is very easy to support and extend to integrate new beam instrumentation devices. All device control functions are based on the configuration (ASCII text) files that completely define the used hardware interface standards (CAMAC, VME, RS-232, GPIB) and communication protocols. The paper presents the main elements of the device control tool for beam diagnostics software at Jefferson Lab.

Notice: Authored by Jefferson Science Associates, LLC under U.S. DOE Contract No. DE-AC05-06OR23177.

RPPB07 – Digital Low-Level RF Control Using Non-IQ Sampling

Hengjie Ma, Mark Stuart Champion (ORNL, Oak Ridge, Tennessee), Lawrence Doolittle (LBNL, Berkeley, California)

The success of digital feedback with synchronous IQ sampling for cavity field control in recent accelerator projects make this LLRF control scheme a popular choice. This short-period synchronous sampling does not, however, average out well-known defects in modern ADC and DAC hardware. That limits the achievable control precision for digital IQ LLRF controllers, while demands for precision are increasing for future accelerators such as International Linear Collider. For this reason, a collaborative effort is developing a digital LLRF control evaluation platform to experiment using coherent sampling with much longer synchronous periods, on the order of the cavity closed-loop bandwidth. This exercise will develop and test the hardware and software needed to meet greater future RF control challenges.

RPPB08 – The Development of Detector Alignment Monitoring System for the ALICE ITS

Jiro Fujita, Michael Cherney, Yury Gorbunov, Robert P. Thomen (Creighton University, Omaha, NE), Thomas John Humanic, Bjorn S. Nilsen, Jeremiah Schley, David Trusdale (Ohio State University)

A real-time detector alignment monitoring system has been developed by using commodity USB cameras, spherical mirrors, and laser beams introduced via a single mode fiber. An innovative control and online analysis software has been developed by using the OpenCV (Open Computer Vision) library & PVSS (Prozessvisualisierungs- und Steuerungssystem). This system is being installed in the ALICE detector to monitor the position of ALICE's Inner Tracking System subdetector. The operational principle and software implementation will be described.

This work is supported by the Office of Science, U.S. Department of Energy and the National Science Foundation.

RPPB09 – Browsing Your Control System – Plugging In to Channel Access

John David Purcell, Willem Blokland, Thomas Pelaia, Madhan Sundaram, Ernest Williams (ORNL, Oak Ridge, Tennessee)

Web browsers have become an easy way to view and manipulate the data contained within EPICS process variables. WebCA is currently an internet plugin that empowers your web browser as an EPICS channel access client. Future enhancements will lead to control system independence allowing use with systems like TANGO, TINE, and others. The PHP EPICS Module allows developers to use the web server to create web pages, which gives users the ability to observer EPICS process variables. With these two tools, the power of the web browser can be leveraged. Browsers can be used to complement efforts

within a control room, to view control pages through a channel access gateway, or as a tool that allows users to process live data and publish the results. These technologies are discussed along with the different implementations at the Spallation Neutron Source.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

RPPB10 – Use of E-Logbook in VEPP-5 Control System

Roman Evgenievich Kuskov, Dmitry Bolkhovityanov (BINP SB RAS, Novosibirsk)

An electronic logbook (e-logbook) becomes a must for large experimental facilities not only during operation, but also at building and commissionning stages (where VEPP-5 is now). Unfortunately, the "market" of such products is almost nonexistent. So, the choice is narrow: either use some other lab's software (adapting it for local needs) or create your own one from scratch. We have chosen the former way and picked DOOCS e-logbook from DESY. Main changes concerned localization (since Russian uses cyrillic letters, not latin) and data feeding mechanism (due to different model of logging from applications). Integration with GIS and alarm system is being examined.

RPPB11 – EPICS CA Gateway Employment in the BEPCII

Xianghao Huang, ChunHong Wang, YouHeng Wang, Zhuo Zhao (IHEP Beijing, Beijing)

The control network of the BEPCII is divided into two separate different subnets. In order to access IOC PVs between the separate subnets as well as IOC PVs from the campus network, we adopt EPICS CA gateway in the BEPCII network. This paper describes the EPICS CA gateway employment and network management in the BEPCII.

RPPB12 – Operation Tools of the ASDEX Upgrade Tokamak

Gregor Neu, Karl Behler, Helmut Blank, Annedore Buhler, Roland Merkel, Gerhard Raupp, Wolfgang Treutterer, Dietrich Zasche, Thomas Zehetbauer (MPI/IPP, Garching)

Operating a tokamak such as ASDEX Upgrade is a complex task which involves numerous personnel, like experiment leaders, system engineers, and technical operators. A multitude of tools exist, that support the staff involved in operation. Editors help to design and assemble valid parameter configurations for diagnostics, and control and actuator systems. Run control tools are used to check for resource availability, to set operation modes, to select specific configurations for these systems, and synchronize and automatically sequence activities among all systems required for the execution of discharges. Monitor, logging and analysis tools help to understand the behaviour of systems and plasma. We present the operation model and some of the tools currently in use at ASDEX Upgrade, and give an overview of the activities under way to improve our tool suite, and effectively increase operational performance.

RPPB13 – The First Stage of the Post Mortem Analysis Software Used for the Hardware Commissioning of the LHC

Alessandro Raimondo, Boris Khomenko, Dmitriy Kudryavtsev, Hubert Reymond, Adriaan Rijllart, Nikolai Trofimov (CERN, Geneva)

After a failure during the operation of the LHC, leading to a beam abort or a power abort, a coherent set of so called “Post Mortem” information will be collected from the various subsystems to analyze the causes of failure. To be able to understand the failure before resuming LHC operation, the collected information needs to be analysed within a few minutes and this requires a highly automated analysis system. To develop the Postm Mortem Analysis software, we use

a staged approach by providing self-contained software modules, first for the individual systems, such as the Quench Protection System, the Power Converter and the Power Interlock Controller, and second for the hardware commissioning when these systems will interact. All of these modules are made using LabVIEW and form the building blocks of the final Post Mortem Analysis software. A large part of the code developed over the last years for the quality test of the LHC magnets has been reused, profiting from the similarity of the algorithms. This paper describes the present state and the additional stages needed to build the final system.

RPPB14 – Systematic Production of Beamline and Other Turnkey Control Systems

Gasper Pajor, Andrej Kosrmlj, Igor Verstovsek, Klemen Zagar (Cosylab, Ljubljana)

Turnkey oriented accelerator control system production is often quite complex and challenging. It involves software development as well as substantial project management effort and, almost always, an on-site installation. Most of the labs have developed solutions that to some extent support such processes, but are tailored to the lab's particular needs and environment. We could not recycle these solutions, as we had to keep the choices open for defining the naming convention and choosing the operating system, platform, and even the control system. Based on our experience with control systems, we have defined a complete set of processes that prescribe the highest level of quality and efficiency in all the project segments. To implement these processes, we have developed a number of tools for composing, configuring, and deploying the control system software. Use of these tools enforces strict version control and traceability, enables centralized configuration of the system, and largely reduces the possibility of human errors. These tools also enable us to reuse well-

tested building blocks, leaving us more time for system-wide quality assurance.

RPPB15 – PManagement System Tailored to Research Institutes

Igor Verstovsek, Jernej Kamenik, Mark Plesko (Cosylab, Ljubljana)

As with all disciplines, project management has a set of rules that must be followed and a set of recommendations that make work easier. But as in all engineering, there is no single magical formula or equation, no matter how much managers and physicists alike would love to have it. We present a working solution tailored to academic projects that requires only a minimum of effort and discipline and results in huge benefits, which will be presented in this article. Commercially available project management tools are not suited to manage the diversity of work in research institutes. We have therefore adopted a set of open source tools, implemented some custom additions, and integrated the tools into a coherent product to suit our purpose. It enables developers to track their work and communicate effectively, project managers to monitor progress of individual projects, and management to supervise critical parameters of the company at any time. In the article, the experiences gained by using the system are presented. As it has turned out in practice, the product is also ideal for research institutes, as is demonstrated by its use in control groups of DESY and ANKA.

RPPB16 – SPARCbook: A New Electronic Book

Elisabetta Pace [INFN/LNF, Frascati (Roma)]

Many electronic books exist for logging the activity of an accelerator, but all of them are basically a translation of a paper book in an electronic format, with some extra features coming from the usage of a database for storing the information. SPARCbook is based on PostgreSQL, an open source database. A new, nice

GUI has been developed for manually inserting data (both text and pictures) in the logbook and retrieving the old information, using several filters like date, author, or type of information. This GUI has been developed using HTML, PHP, and JavaScript, and it is quite similar to GUIs of already existing electronic logbooks. The peculiarity of SPARCbook is that it is also possible to insert information in the book from the control system of the accelerator, automatically or after a human decision. The SPARC control system is a distributed system, developed using LabVIEW, based on PCs and real-time CPUs. Information, tables, and graphs can be submitted from each CPU and from the central control system to SPARCbook making a query to PostgreSQL via TCP. That makes the system really powerful because any commercial CPU has TCP capability.

RPPB17 – Administration of Control Systems at the Advanced Photon Source Using Applications Organizing Index

Deborah Eileen Reeder Quock, Ned D. Arnold (ANL, Argonne, Illinois)

Applications Organizing Index (AOI) is a relational database tool that has been implemented at the Advanced Photon Source (APS) to aid in the management of more than 600 unique control system applications. AOI provides control system developers an intuitive view of and navigation links to the components that make up a single control system such as source code files, operator displays, process variables, work history notes, programmable components, validation procedures, drawings, and more. The foundation for the Applications Organizing Index tool is the collaborative effort between several Experimental Physics and Industrial Control System (EPICS) sites to build the common relational database schema for documenting large and complex particle accelerator control systems, Integrated Relational Model of Installed Systems

(IRMIS). This paper describes the evolution of AOI as it became populated with APS control systems component data and as users' requests for new features of AOI became apparent.

Work supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.

RPPB18 – Test Controller Infrastructure for Manual and Automated Verification of Software for the National Ignition Facility (NIF) Control System

Jason Scott Zielinski (LLNL, Livermore, California)

The NIF Integrated Computer Control System (ICCS) is a large-scale distributed system with 60,000 control points and 850 computers. The software engineering team delivers updates throughout the year to deliver new functionality for commissioning activities and automated shots. In 2006 there were 48 software releases, including 29 full releases and 19 patches resulting in a code base of 1.4 MSLOC. To ensure the quality of the delivered software, thousands of manual and automated regression and verification tests are performed on the code and GUIs using a Test Controller infrastructure developed by the test group. The infrastructure manages test case inventory, test planning, automated and manual test execution, and generation of test reports. A web browser interface provides test services, searchable test results and dynamic status reports to users. The Test Controller manages the three-stage quality control process of integration, offline and online testing, which assesses and assures the quality of each release. This talk will present the requirements, design and results of this comprehensive software testing infrastructure.

This work was performed under the auspices of the U.S. Department of Energy by the

University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-ENG-48.

RPPB19 – Electron Bunch Length Measurement for LCLS at SLAC

Michael Zelazny, Stephanie Allison, Sergei Chevtsov, Paul Emma, Karen Dayle Kotturi, Henrik Loos, Sheng Peng, Deborah Rogind, Till Straumann (SLAC, Menlo Park, California)

At Stanford Linear Accelerator Center (SLAC) a Bunch Length Measurement system has been developed to measure the length of the electron bunch for its new Linac Coherent Light Source (LCLS). This destructive measurement uses a transverse-mounted RF deflector (TCAV) to vertically streak the electron beam and an image taken with an insertable screen and a camera. The device control software was implemented with the Experimental Physics and Industrial Control System (EPICS) toolkit. The analysis software was implemented in Matlab using the EPICS/Channel Access Interface for Scilab and Matlab (labCA). This architecture allowed engineers and physicists to develop and integrate their control and analysis without duplication of effort.

Work supported by Department of Energy contract DE-ACO3-76SFOO5 15.

RPPB20 – A Graphical Sequencer for SOLEIL Beamlines Acquisitions

Gwenaelle Abeille, Alain Buteau, Majid Ounsy (SOLEIL, Gif-sur-Yvette)

Addressing batch processing and sequencing needs are fundamentals for daily beamlines operation. The SOLEIL control software group offers two solutions. Firstly, the Python scripting environment, for which a dedicated Tango binding is available, has been proved to be powerful, but is limited to scientists with good programming skills. Secondly, we pro-

vide the PASSERELLE software, developed by the ISENCIA* company and based on the PTOLEMY** framework. In this environment, sequences can be designed graphically by drag and drop components called actors (representing elementary tasks). The process execution can be easily "programmed" by defining graphically the data flow between actors. Upon this framework, an existing generic GUI application allows users to configure and execute the sequences. A dedicated GUI application can also be provided on demand to give the beam line's end user an easy-to-use acquisition application. The work organization, the software architecture and design of the whole system will be presented, as well as the current status of deployment on SOLEIL beamlines.
*http://www.isencia.com/main/web/init** http://ptolemy.eecs.berkeley.edu/ptolemyII/index.htm

RPPB21 – Finite State Machines for Integration and Control in ALICE
Giacinto De Cataldo, Andre Augustinus, Marco Boccioli, Peter Chochula, Lennart Stig Jirden (CERN, Geneva)
From the control point of view a physics experiment can be seen as a vast hierarchy of systems and subsystems with an experiment control node at the top and single atomic control channels at the bottom. In the case of the ALICE experiment at CERN the many systems and subsystems are being built by many engineers and physicists in different institutes around the world. The integration of the various parts to form a homogeneous system enabling coherent automatic control can therefore be seen as a major challenge. A distributed PVSS SCADA system complemented with a device and system modeling schema based on finite state machines has been used to achieve this. This paper will describe the schema and the tools and components that have been developed at CERN and it will show how this has been implemented and

used in Alice. The efforts of standardizing the state diagrams for different types of devices and systems at different levels will be described and some detailed examples will be shown. The Alice graphics user interface integrating both the FSM control hierarchy and the PVSS monitoring will also be described.

RPPB22 – Tracking Accelerator Settings
Ted D'Ottavio, Wenge Fu, Daniel P. Ottavio (BNL, Upton, Long Island, New York)
Recording setting changes within an accelerator facility provides information that can be used to answer questions about when, why, and how changes were made to some accelerator system. This can be very useful during normal operations, but can also aid with security concerns and in detecting unusual software behavior. The Set History System (SHS) is a new client/server system developed at the Collider-Accelerator Department of Brookhaven National Laboratory to provide these capabilities. The SHS has been operational for over two years and currently stores about 100K settings per day into a commercial database management system. The SHS system consists of a server written in Java, client tools written in both Java and C++, and a web interface for querying the database of setting changes. The design of the SHS focuses on performance, portability, and a minimal impact on database resources. In this paper, we present an overview of the system design along with benchmark results showing the performance and reliability of the SHS over the last year.

Work performed under the auspices of the U.S. Department of Energy.

RPPB23 – SCORE – A Save, Compare, and Restore Application for Snapshoting Machine Settings
John Galambos (ORNL, Oak Ridge, Tennessee)

SCORE is an application used to snapshot machine settings. Features include sorting by systems and subsystems, comparing live values with saved values, and database storage of the information. The compare feature is useful for diagnosing problems, and the restore feature is useful in recovering good beam tune. Features of the application and performance experience with respect to data base retrieval and live comparison will be discussed.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

RPPB24 – Processing and Visualization of EPICS Data with MATLAB Applications
Evgeniy Tikhomolov (TRIUMF, Vancouver)
The J-PARC linac provides 181-MeV proton beam to the following 3-GeV rapid-cycling synchrotron at the first phase. This linac requires twenty-four RF systems (20 klystrons and 4 solid-state amplifiers), which operate at a 620-us pulse width, 50-Hz repetition rate and 324-MHz frequency. The installation of the RF systems was almost completed and the test operation was started. The present status and the performance of the Low Level RF system and the RF Reference distribution system will be reported.

RPPB25 – Live Capfast Schematics in the ISAC Control System
Rod Nussbaumer (TRIUMF, Vancouver)
The Capfast schematic editor is used to design EPICS IOC runtime databases in the EPICS-based control system of the ISAC radioactive beam facility. This graphical tool provides a view of the database with strong visual cues about the functional behavior of the database elements and their interrelationships, modularity, and hierarchy. The EDM display manager tool is used for the Human-Machine-Interface, providing a graphical view of the accelerator state to

machine operators. This paper describes a new tool, Sch2Edl, which combines some of the functionality of Capfast and EDM. Sch2Edl creates a view of the runtime database in a format geared toward the system developer/tester/debugger. Sch2Edl is a perl script that translates a set of Capfast schematic files into a corresponding set of EDM screens. The visual representation of the runtime database on the EDM display is nearly identical to the static Capfast views and hierarchies, but incorporates the display of real-time data. This allows software developers to examine and modify some aspects of a working runtime database in an environment that is rich in visual information.

RPPB26 – The New Soft-IOC-Based Alarm Handler at the Spallation Neutron Source
Pamela Gurd, Gregory S. Lawson, John Munro, William Strong, Ernest Williams (ORNL, Oak Ridge, Tennessee)
The standard EPICS alarm handler tool (ALH) does not integrate well with other EPICS client applications. At SNS, we wanted the ability to incorporate alarm summaries and alarm controls such as masks and resets into screens in the display manager as well as the ability to call display screens from alarm screens. To achieve these aims, we built a soft-IOC-based alarm handler that runs in Linux soft IOCs. A set of scripts builds EPICS databases, display manager screens, and startup scripts for standard Linux soft IOCs from old style (ALH) or .xml configuration files. With this new tool the summaries, masks and latch status can be incorporated into other EPICS client applications. In this paper we describe our experience building and using the soft-IOC-based alarm handler everywhere that alarms are defined in the SNS control system.

SNS is managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. Department of Energy.

RPPB27 – A Proposed Alarm Handling System Management Plan for SNS with Application to Target Control System

John Munro, Ron Evans Battle, Ekaterina Danilova, Robert L. Sangrey, Ernest Williams (ORNL, Oak Ridge, Tennessee)

We have developed a set of requirements for an SNS alarm handling system and have applied these to the control system for the SNS liquid mercury target to gain experience with an implementation first on a limited scale before applying them to the whole accelerator. This implementation is based on the EPICS alarm handler ALH. The requirements address such topics as alarm classification, priorities, types of warning, hierarchies, and management under different modes of target operation. Alarms are currently organized by system and subsystem. Target control systems considered in the examples here include the Hg loop, three light-water and one heavy-water cooling loops. Modifications to ALH include addition of "drag and drop" capabilities for individual PVs and drop-down lists of selectable actions. One such action provides access to the alarm response procedures required for a process variable that shows an alarm. Alarm and operator action log files are maintained separately from instances of ALH launched for operator displays. Database reporting tools have been developed to aid analysis of data in these files. Examples of the use of our tools and features will be presented.

ORNL/SNS is managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.

RPPB28 – BESSY Control System Administration and Analysis Tools

Ralph Lange, Thomas Birke, Dieter Faulbaum, Dietmar Herrendörfer, Peter Stange (BESSY GmbH, Berlin)

The BESSY II storage ring has been in continuous operation for more than 8 years. With BESSY's new projects and facilities requiring an increasing amount of attention, maintaining the BESSY II control system's high reliability and availability with less effort has become an important task. A set of professional noncommercial tools has been introduced. These tools are combined to detect and track errors, support system administration, and allow an efficient analysis and maintenance of the control system's hardware, software, and configuration. The paper discusses problems and difficulties encountered, and presents the selected approaches and tools as well as the gained experiences.

Funded by the Bundesministerium für Bildung und Forschung (BMBF) and the Land Berlin.

RPPB29 – Requirements and Coherent Realization of the HICAT Control System Functionality for Tests, Commissioning, and Operation

Tibor Fleck, Ralph C. Baer, Marcus Schwickert (GSI, Darmstadt)

The control system for the HICAT project comprises several rather different functionalities for the whole range of demands starting from tests of single components up to the specified operation mode where the accelerator has to deliver a beam of high-energy ions with requested energy, focus and intensity for tumor treatment. We outline the concept and realization of this system which is capable of fulfilling all those needs within the implemented functions and GUIs. The range of functionality spans from test environments and trace-possibilities for single front-end controllers up to complete integrity tests of the whole accelerator for the designed operation mode. For example, for commissioning of the LINAC division the control system utilizes a 5Hz mode while typical synchrotron cycles last for several seconds and can be used with

similar adjustments. In normal operation mode diagnostics like beam current are only evaluated at special times in a cycle, but it is possible to monitor and record these data at high sampling rates in a continuous mode over several hours. Furthermore it is possible to accomplish long-term stability tests of single components during normal operation.

RPPB30 – The SNS Central Control Room, Design, and Operational Experience

George W. Dodson (ORNL, Oak Ridge, Tennessee)

The SNS Central Control Room has been in use since 2005. A review of the design and construction will be presented along with the operating experience and lessons learned to date. Comparisons to other accelerator Central Control Rooms will also be presented.

RPPB31 – Distributed Timing Diagnostic Applications

Paul Kennerley, Ioan Kozsar, Julian Howard Lewis, Javier Serrano (CERN, Geneva)

The CERN timing system delivers events to the accelerator complex via a distribution network to receiver modules located around the laboratory. These modules generate pulses for nearby equipment and interrupts for the local host. Despite careful planning, hardware failure and human error can lead to anomalies within the control system. Diagnosing such errors requires a formal description of the logical and topological timing layout. This paper describes the design and implementation of a suite of timing diagnostic software applications that allow users to quickly diagnose and remedy faults within the CERN timing system.

RPPB32 – A MySql-based Data Archiver: Preliminary Results

Matthew H. Bickley, Chris Slominski (Jefferson Lab, Newport News, Virginia)

Following an evaluation of the archival requirements of the Jefferson Laboratory accelerator's user community, a prototyping effort was executed to determine if an archiver based on mySql had sufficient functionality to meet those requirements. This approach was chosen because an archiver based on a relational database enables the development effort to focus on data acquisiti and management, letting the database take care of storage, indexing and data consistency. It was clear from the prototype effort that there were no performance impediments to successful implementation of a final system. With our performance concerns addressed, the lab undertook the design and development of an operational system. The system is in its operational testi phase now. This paper discusses the archiver system requirements, some of th design choices and their rationale, and presents the acquisition, storage and retrieval performance levels achieved with the system.

RPPB33 – A MySql-based Data Archiver: Preliminary Results

Pascal Verdier, Andrew Gotz (ESRF, Grenoble)

Tango is an object-oriented control system toolkit based on CORBA initially developed at the ESRF. It is now also developed and used by Soleil, Elettra, Alba and some labs. This poster explains how the vacuum system (pressures and temperatures), composed by more than one thousand devices, is controlled. It shows how to display the device measurements, how diagnostics on measurement evolutions are done and displayed, how it tries to foresee possible problems, and how these measurements are stored with sophisticated criteria.

Thursday Oral Session, ROPB
2nd Floor Lecture Hall, 4:40 p.m.
Session Chairs: Roland Müeller, BESSY GmbH
Anton Mezger, PSI

4:40 **ROPB01 – Using Sequencing to Improve Operational Efficiency and Reliability**
Ted D'Ottavio, Jennifer Niedziela (BNL, Upton, Long Island, New York)
Operation of an accelerator requires the efficient and reproducible execution of many different types of procedures. Some procedures, like beam acceleration, magnet quench recovery, and species switching can be quite complex. To improve accelerator reliability and efficiency, automated execution of procedures is required. Creation of a single robust sequencing application permits the streamlining of this process and offers many benefits in sequence creation, editing, and control. In this paper, we present key features of a sequencer application commissioned at the Collider-Accelerator Department of Brookhaven National Laboratory during the 2007 run. Included is a categorization of the different types of sequences in use, a discussion of the features considered desirable in a good sequencer, and a description of the tools created to aid in sequence construction and diagnosis. Finally, highlights from our operational experience are presented, with emphasis on Operations control of the sequencer, and the alignment of sequence construction with existing operational paradigms.

Work performed under the auspices of the U.S. Department of Energy.

5:10 **ROPB02 – Control System Studio Applications**

Kay-Uwe Kasemir (ORNL, Oak Ridge, Tennessee)
Control System Studio (CSS) is a recently started effort for implementing control system related applications, primarily targeting the operator interface, based on current software technologies (JAVA and Eclipse), with a special emphasis on interoperability. We present initial versions of several CSS applications, their features, and how the Eclipse and CSS frameworks helped or complicated their development.

5:30 **ROPB03 – Drag and Drop Display & Builder**
Timofei Borisovich Bolshakov, Andrey Petrov (Fermilab, Batavia, Illinois)
The "Drag and Drop Display & Builder" system is a component-oriented system that is designed to allow users to create visual representations of data received from data acquisition systems. It is an upgrade of a synoptic display mechanism used in Fermilab since 2002*. Components can be graphically arranged and logically interconnected in the web-startable Project Builder. Projects can be lightweight AJAX and SVG based web pages, or they can be started as Java applications. The system may be used to control equipment if started as a Java application. The new version was initiated as a response to discussions between the LHC Controls Group and Fermilab.
*Synoptic Display — A client-server system for graphical data representation, ICALEPCS 2003, Gyenongju.

Fermilab is operated by Fermi Research Alliance, LLC., under Contract No. DE-AC02-07-CH11359 with the U.S. Department of Energy.

5:50 **ROPB04 – Beam Commissioning Software and Database for J-PARC LINAC**
Hiroyuki Sako (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Hironao Sakaki,

Guobao Shen, Hiroki Takahashi, Hiroshi Yoshikawa (JAEA, Ibaraki-ken), Christopher K. Allen (LANL, Los Alamos, New Mexico), Hiroshi Ikeda (Visual Information Center, Inc., Ibaraki-ken)

A beam commissioning software system based on a relational database (RDB) has been developed for the J-PARC LINAC. We developed two high-level software frameworks, JCE and XAL. JCE (Java Commissioning Environment) based on a scripting language SAD script has been developed in Java with device control, monitoring, online modelling and data analysis functions. XAL has been developed initially by SNS and developed for J-PARC. A commissioning database system has been developed to configure commonly these two frameworks, for model geometry, EPICS control, and calibration parameters. A server for unit conversion of magnet power supplies has also developed for the commissioning software. Commissioning applications for RF tuning, transverse matching, orbit correction, beam-based calibration, beam monitor controls have been developed using the two frameworks and successfully applied for beam tuning. We report on the status of development for the commissioning software system.

Friday Oral Session, FOAA
2nd Floor Lecture Hall, 8:30 a.m.
Session Chairs: Ryotaro Tanaka, JASRI/SPring-8
Till Straumann, SLAC/SSRL

8:30 **FOAA01 – A Review of Automated Diagnosis Techniques and the Hybrid Diagnosis Engine (HyDE)**

Sriram Narasimhan (UARC, Moffet Field)

Automated diagnosis deals with techniques to determine the cause of any abnormal or unexpected behavior of physical systems. The key issue is that inferences have to be made from

the limited sensor information available from the system. Some major categories of diagnostic technologies are rule-based systems, case-based reasoning systems, data-drive learning systems, and model-based reasoning systems among others. In this paper we will briefly introduce these categories and then focus on model-based reasoning. We will present the Hybrid Diagnosis Engine (HyDE) developed at the NASA Ames Research Center and its application to real problems.

9:00 **FOAA02 – Timing and LLRF System of Japanese X-FEL to Realize a Few Tenths of Femto-Seconds' Stability**
Yuji Otake, Hirokazu Maesaka, Tsumoru Shintake (RIKEN Spring-8 Harima, Hyogo), Toru Fukui, Naoyasu Hosoda, Toru Ohata, Takashi Ohshima (JASRI/SPring-8, Hyogo-ken)
At SPring-8, the construction of a 5712-MHz linac and undulators as a light source for XFEL is in progress. There are two parts of the linac in accordance with requirements of phase accuracy to realize a stable SASE generation. One is a crest acceleration part using a sinusoidal wave. The other is an off-crest part that corresponds to a bunch compressor giving an energy chirp to a beam bunch. To generate the stable SASE, the beam energy stability of 10-4 is required. To obtain this stability, the accuracy of sub-picoseconds is required in the crest part, and several ten femto-seconds are necessary in the off-crest part. The requirement in the crest part was achieved by rf control instruments based on an electronic circuit in the SCSS prototype accelerator. However, realizing the several ten femto-seconds accuracy is almost impossible by the present electronic circuit technology. Therefore, for overcoming this fact, we employed laser technology. In this paper, we describe a system based on IQ control technology to obtain sub-picoseconds accuracy and an optical signal distribution system using an optical comb

generator that could realize several ten femto-seconds accuracy.

9:30 **FOAA03 – The CERN LHC Central Timing, a Vertical Slice**
Julian Howard Lewis, Pablo Alvarez, Jean-Claude Bau, Stephane Deghaye, Ioan Kozsar, Javier Serrano (CERN, Geneva)
The design of the LHC central timing system depends strongly on the requirements for a Collider-type machine. The accelerators in the LHC injector chain cycle in sequences, each accelerator providing beam to the next as the energy increases. This has led to a timing system in which time is divided into cycles of differing characteristics. The LHC timing requirements are completely different, there are no cycles, and machine events are linked to machine processes such as injection, ramping, squeezing, physics, etc. These processes are modelled as event tables that can be played independently; the system must also provide facilities to send asynchronous events for punctual equipment synchronization and a real-time channel to broadcast machine information such as the beam type and its energy. This paper describes the implementation of the LHC timing system and also gives details on the synchronization in the LHC injector chain that manufactures various beams for LHC.

Friday Oral Session, FOAB
2nd Floor Lecture Hall, 10:20 a.m.
Session Chairs: Till Straumann, SLAC/SSRL
Ryotaro Tanaka, JASRI/SPring-8

10:20 **FOAB01 – Imaging System Integration at the SNS**
Thomas Shea, Willem Blokland, Kathleen Conner Goetz, Thomas Pelaia (ORNL, Oak Ridge, Tennessee)

Over the past several years, a variety of imaging systems have been deployed at Oak Ridge National Laboratory's (ORNL's) Spallation Neutron Source (SNS). The systems have supported accelerator instrumentation, neutron beam measurement, target commissioning, and laser diagnostics. For each application, performance requirements drove the choice of camera technology, and this naturally led to a variety of interfaces. This paper will describe the experience gained during the integration and operation of these systems. Several challenges will be highlighted, including algorithms for quantitative measurements, correlation with other accelerator data, real-time video distribution, and storage of large data sets. Although heterogeneous systems must continue to be deployed to meet imaging needs, some common tools and technologies have been identified and are expected to enhance system integration efforts.

This work is supported by the U.S. Department of Energy.

10:40 **FOAB02 – Digital Phase Control System for SSRF Linac**

Chongxian Yin, Dekang Liu, Luyang Yu (SINAP, Shanghai)

SSRF 150MeV linac includes two klystrons and two solid power amplifers, which drive two klystrons, respectively. The accelerating section is constant gradient accelerating structure, and its working frequency is 2998MHz, six times the storage ring RF frequency. In order to reach the requirement for the RF phase stability (±1 degree), the full digital phase control system, which includes RF front-end, AD, DA, and FPGA, is designed. FPGA, the key for phase control system, contains digital I/Q demoulator (phase detector), digital I/Q modulator (phase shifter), and control algorithms. Klystron forward signal is down converted to IF (12.5MHz), which is detected by ADC with 50MHz clock.

Digital I/Q is generated by ADC sampling data and then sent to control algorithms in FPGA. After processed by control algorithms, digital I/Q is converted to IF by DAC (50MHz). IF signal from DAC output is up converted to RF and sent to solid RF power amplifer. With the aid of FPGA, the whole period of closed-loop is about 80ns, and delay of closed-loop is less than 600ns. The test results of digital phase control system are presented in this paper.

11:00 **FOAB03 – Ethernet-Based Embedded IOC for FEL Control Systems**

Jianxun Yan, Al Grippo, Kevin Jordan, Steven Wesley Moore, Daniel Sexton (Jefferson Lab, Newport News, Virginia)

An Ethernet-based embedded Input Output Controller (IOC) has been developed as part of an upgrade to the control system for the Free Electron Laser Project at Jefferson Lab. Currently most of the FEL systems are controlled, configured, and monitored using a central VME bus-based configuration. These crate-based systems are limited in growth and usually interleave multiple systems. In order to accommodate incremental system growth and lower channel costs, we developed a standalone system, an Ethernet-based embedded controller called the Single Board IOC (SBIOC). The SBIOC is a module that integrates an Altera FPGA and the Arcturus uCdimm Coldfire 5282 Microcontroller daughter card into one module, which can be easily configured for different kinds of I/O devices. The microcontroller is a complete System-on-Module, including highly integrated functional blocks. A real-time operating system, RTEMS, is cross-compiled with EPICS, allowing us to download the RTEMS kernel, IOC device supports, and databases into the microcontroller. This embedded IOC system has the features of a low-cost IOC, free open source RTOS, plug-and-play-like ease of installation, and flexibility.

Authored by Jefferson Science Associates, LLC, under U.S. DOE Contract No. DE-AC05-06-OR23177.

Lunch and Round Table Discussion:
Controls Failure Modes
11:20-12:50
Moderators: Claude Saunders, ANL
Larry Hoff, BNL

Friday Oral Session, FOPA
2nd Floor Lecture Hall, 12:50 p.m.
Session Chairs: Jijiu Zhao, IHEP
Eric Bjorklund, LANL

12:50 **FOPA01 – The Future of TANGO**
Andrew Gotz, Jean-Michel Chaize, Jens Meyer (ESRF, Grenoble), David Fernandez-Carreiras, Jorg Klora (ALBA, Bellaterra (Cerdanyola del Vallès)), Marco Lonza, Claudio Scafuri (ELETTRA, Basovizza, Trieste), Alain Buteau, Majid Ounsy (SOLEIL, Gif-sur-Yvette)
Tango is a control system based on the device server concept. It is currently being actively developed by 4 (soon 5) institutes, 3 of which are new institutes. In October 2006 the Tango community met in the French Alps to discuss the future evolution of Tango. This paper summarizes the fruits of this meeting. It presents the different areas Tango will concentrate on for the next 5 years. Some of the main topics concern services, beamline control, embedded systems on FPGA, 64-bit support, scalability for large systems, faster boot performance,

enhanced Python and Java support for servers, more model-driven development, and integrated workbench-like applications. The aim is to keep on adding batteries to Tango so that it remains a modern, powerful control system that satisfies not only the needs of light-source facilities but other communities too.

1:20 **FOPA02 – EPICS – Future Plans**
Matthias R. Clausen (DESY, Hamburg), Martin Richard Kraimer (ANL, Argonne, Illinois), Jeffrey Owen Hill (LANL, Los Alamos, New Mexico), Kay-Uwe Kasemir (ORNL, Oak Ridge, Tennessee), Timo Korhonen (PSI, Villigen), Leo Bob Dalesio (SLAC, Menlo Park, California)
Over the last two decades EPICS has evolved from a basic set of control applications created for the Ground Test Accelerator to a rich and reliable control system framework installed in more than 120 locations worldwide. The continuous development of EPICS is supported by the worldwide collaboration and coordinated by a set of major laboratories. This procedure ensures continuous quality checking and thus leads to stable production versions. The clear separation of the robust core software on the Input Output Controllers (IOCs) from the channel access protocol and the applications running on workstations and servers allows nearly independent software developments on all three levels. This paper will describe the new developments on the IOC side, which will increase the robustness by adding redundancy or will improve the management and the functionality. This includes the vision of a new Java-based IOC. The support for new data types will bring more flexibility to the channel access protocol. New developments on the application side are clearly indicating that Java and Eclipse (e.g., Control System Studio – CSS, XAL and others) will form the basis for many future applications.

1:50 **FOPA03 – The TINE Control System, Overview and Status**

Philip Duval, Piotr Karol Bartkiewicz, Honggong Wu (DESY, Hamburg), Stefan Weisse (DESY Zeuthen, Zeuthen)

TINE (Three-fold Integrated Networking Environment) has been the Control System in use at HERA for some time, plays a major role in the Pre-accelerators at DESY, DORIS, FLASH, PITZ (Zeuthen), EMBL-Hamburg, GKSS-Hamburg, PF Beamline (KEK), and is the designated control system for the new third-generation light source PETRA3. TINE has always emphasized both performance and flexibility. For instance, using the multicast capabilities of TINE, state-of-the-art, near real-time video transmission is possible. At the same time, developers have a large toolkit and variety of software solutions at their disposal, and in general on their favorite platform and programming language. Code-generation wizards are available for rapid development of TINE servers, whereas intelligent GUI components such as ACOP(*) aid in the development of either "rich" or "simple" client applications. The most recent major release brought with it a bundle of new features and improvements. We give here an overview of the TINE control system in general, what's new in particular, and focus on those features not available in other mainstream control systems, such as EPICS or TANGO.

* "The Acop Family of Beans: A Framework Independent Approach", J. Bobnar, et. al., these proceedings.

2:10 **FOPA04 – Elements of Control System Longevity**

Stephen Lewis (SLAC, Menlo Park, California)

What are the essential architectural elements that are likely to give any particular approach to building controls systems a long tenure? Many

aspects can easily be identified by their negative value, such as dependence on particular language(s), operating systems, or particular board/bus technologies. In addition, localizing the human expertise to one sponsoring institution, or even to a specialized controls community, can limit the lifetime. I will argue here that the fundamental positive aspect that gives the greatest endurance is "decoupling, decoupling, decoupling." The principle of decoupling applies in both large and small contexts, both technical and social. I will attempt to show that among the key contributors to achieving this desired state are very stable, very narrow "intellectual" bottlenecks (realized as wire protocols or APIs) at appropriate levels; no requirement for centralized entities (both physical and social); and a high degree of asynchronous communication.

2:30 **FOPA05 – EPICS to TANGO Translator**
Rok Stefanic, Rok Sabjan (Cosylab, Ljubljana), Laurent Geoffroy (Maatel, Voreppe)
We were faced with a problem of integrating an XY diffractometer device into an EPICS control system, where the integration into the Tango control system (TANGO Device Server) already existed. We have developed a generic TANGO-to-EPICS translator, which provides the EPICS control system with an interface to an existing TANGO Device Server. An EPICS Asyn driver is used for handling the communication trough library, which is based on the CORBA protocol. The interface provides a generic way for executing commands with different data types as arguments. Attribute manipulation for all major TANGO data types is supported.

Friday Oral Session, FOPB
2nd Floor Lecture Hall, 3:20 p.m.
Session Chairs: David Gurd, ORNL/SNS
Karen White, JLab

3:20 **Closing Remarks and Future ICALEPCS Announcements**

EPS EPCS

AAPPS

IEEE

OAK RIDGE National Laboratory

SNS

Jefferson Lab

07-G01187/arm