PREFACE

INTRODUCTION

ICALEPCS'99, the seventh biennial International Conference on Accelerator and Large Experimental Physics Control Systems, was held in Trieste, Italy, from the 4th to the 8th of October 1999, hosted by Sincrotrone Trieste. It took place at the "Stazione Marittima", a building recently restored as the Congress Centre of the city which was originally inaugurated in 1936 when the ship "Vulcania" built by the "Italia-Span Company" undertook her maiden trip on the North America route.

ICALEPCS'99 was organised by Sincrotrone Trieste and co-organised by the European Physical Society's (EPS) Interdivisional Group on Experimental Physics Control Systems (EPCS) and the Istituto Nazionale di Fisica Nucleare (INFN). The event was chaired jointly by Daniele Bulfone of Sincrotrone Trieste and Axel Daneels of CERN. A committee from Sincrotrone Trieste and an external company "the office" endorsed the local organisation.

Almost 400 control specialists from 32 different countries covering Africa, America, Asia and Europe and representing 116 organisations (scientific institutes and industries) came together in this prestigious building to exchange their views on the latest developments and new trends in control systems for accelerators and large Experimental Physics facilities. In the spirit of extending participation to the Conference, 38 participants coming from industrially emerging nations were given financial support to partially/totally cover participation expenses including hotel and living subsidy, travel costs and Conference fee.

The series of ICALEPCS conferences started twelve years ago in 1987 in Villars-sur-Ollon, in Switzerland. The idea of holding a regular series of Conferences in the field of controls for Experimental Physics facilities was launched by the European Physical Society's (EPS) Interdivisional Group on Experimental Physics Control Systems (EPCS). It was actually triggered by some earlier initiatives, which commenced in Berlin (EPS Conference on Computing in Accelerator Design and Operation, September 1983), followed by two specific workshops on accelerator control systems in 1985 at BNL (Brookhaven, USA) and LANL (Los Alamos, USA).

The ICALEPCS circle around the world: in 1989 the Conference was held in Vancouver hosted by TRIUMF, the 1991 event was held in Tsukuba hosted by KEK, in 1993 it was hosted by the HMI in Berlin, in 1995 it was held in Chicago hosted by Fermilab and the APS of ANL, in 1997 by the IHEP in Beijing. Over the years the Conferences saw the number of participants growing as well as the number of Institutes and countries.

Daniele Bulfone welcomed the participants and invited Riccardo Illy, Mayor of the city of Trieste and Axel Daneels to open the Conference.

While Riccardo Illy gave an economical, cultural and political overview of Trieste, Axel Daneels presented a short summary of twenty centuries of history of the region of Trieste. At the crossroad of east and west where in history people from all horizons met, Trieste, the old *Tergeste* or *Tergestum* as the ancient Romans called the city, was a perfect place for the ICALEPCS and fitted completely with the spirit of our series of International Conferences on Accelerator and Large Experimental Physics Control Systems. Following its rich cultural tradition, in modern times Trieste has become a strong centre of scientific activity hosting Sincrotrone Trieste with its third generation synchrotron radiation source ELETTRA, the Abdus Salam International Centre for Theoretical Physics (ICTP), the Scuola Internazionale Superiore di Studi Avanzati (SISSA), the University of Trieste and the AREA Science Park.

Gianni Raffi from the European Southern Observatory (ESO) wrapped up the Conference by highlighting its salient technical aspects.

ICALEPCS'99 SPONSORS

ICALEPCS'99 benefited from the support of a number of sponsors. The main sponsors were Hewlett-Packard, the European Commission - DG XII, Telecom Italia, the Abdus Salam International Centre for Theoretical Physics (ICTP), Sincrotrone Trieste, Friul Computer, NT Nuove Tecnologie, Assicurazioni Generali, Banca Commerciale Italiana, Istituto Nazionale di Fisica Nucleare (INFN). Other sponsors were Regione Autonoma Friuli-Venezia Giulia, Banca Nazionale del Lavoro, Linea Gialla and Cassa di Risparmio di Trieste.

The Conference was held under the auspices of the Area Science Park, Association of Asian Pacific Physics Societies (AAPPS), Consiglio Nazionale delle Ricerche (CNR), Commissariato del Governo nella Regione Friuli–Venezia Giulia, Comune di Trieste, European Commission - DG XII, Ente per le Nuove tecnologie, l'Energia e

l'Ambiente (ENEA), European Physical Society (EPS), International Centre for Science and High Technology (ICS–UNIDO), the Abdus Salam International Centre for Theoretical Physics (ICTP), Nuclear and Plasma Sciences Society of the IEEE (IEEE-NPSS), International Federation of Automatic Control (IFAC), International Federation for Information Processing (IFIP), Jozef Stefan Institut, Provincia di Trieste, Regione Autonoma Friuli-Venezia Giulia, Società Italiana di Fisica (SIF), Scuola Internazionale Superiore di Studi Avanzati (SISSA), Università degli Studi di Trieste.

Thanks go also to Alitalia, Azienda di Promozione Turistica - Trieste, Azienda Regionale per la Promozione Turistica, Cassa di Risparmio di Udine e Pordenone, Fondazione Teatro Comunale G. Verdi and Lloyd Adriatico.

THE ICALEPCS'99 SCIENTIFIC PROGRAMME

General Overview

The scientific and technical programme of ICALEPCS'99 covered the field of controls of particle accelerators, detectors, telescopes, nuclear fusion devices, nuclear reactors, etc. Traditionally dominated by the particle accelerators, ICALEPCS'99 saw many contributions also from the plasma physics, astronomical and particle detectors community.

All aspects, hardware and software, of Experimental Physics control systems were considered. ICALEPCS'99 concentrated more specifically on how controls can contribute to the overall success of an Experimental Physics project. With this objective in mind, different technology and engineering issues were studied. State-of-the-art software and hardware technology were reviewed in terms of the possibilities they offer to deal with systems of increasing complexity and sophistication within restricted budgets and human resources.

In the software domain several applications were described that are based on Windows NT, on the Common Object Request Broker Architecture (CORBA) as distributed programming model and on Java as programming language. Noteworthy is the growing spread of Windows 98/NT followed closely by Linux, which are together now competing with the more traditional UNIX platforms. Distribution of systems as well as requirements relating to remote observation lead to the application of WWW related technologies.

Beside the Experimental Physics and Industrial Control System (EPICS) which is particularly popular as a framework and set of tools for developing control system software both in the US and some non US laboratories, commercial Supervisory Controls and Data Acquisition (SCADA) systems are now penetrating the Experimental Physics "market" as well. They prove to be effective and efficient in controlling infrastructure systems (vacuum, cryogenics, cooling, ventilation, access control, etc.) and also for the control of Experimental Physics processes proper, such as some small to medium size particle detectors. In the wake of SCADA systems, technologies such as OLE for Process Controls (OPC) and SoftPLC are being taken into greater consideration.

In the hardware domain there is an increasing use of commercial Programmable Logic Controllers (PLC) connected to devices via fieldbuses, and of the Peripheral Component Interconnect (PCI) and its related standards.

Networks are being re-engineered using 100 Mbit/s Ethernet with GigaEthernet backbones, while the Asynchronous Transfer Mode (ATM) is also considered to be candidate technology for the long distance communication of time-critical accelerator data. Furthermore, the complexity and sophistication of the Experimental Physics processes lead to the introduction of ever more complex feedback systems often relying on measurements that need high data rates. Such high performance feedback systems may require sampling rates as high as hundreds of MHz and the use of state-of-the-art Digital Signal Processors (DSP).

The frequently unappreciated engineering and management aspects of control systems were also highlighted. The weight of maintenance and adaptation costs in software projects were discussed. In the context of more elaborate systems and reduced resources, and considering the progress demonstrated by industry in keeping proper control on the lifecycle of software development, project management and engineering have started to win their spurs in today's Experimental Physics world as well. Particular attention was paid to requirements engineering and emphasis was given on sharing experiences and techniques in these fields. Application of solutions from the industrial world were also presented and discussed.

The Conference Scientific Programme involved *ex cathedra* invited oral contributions, oral contributions and poster presentations, four tutorials and a round-table discussion. Two pre-Conference workshops were also organised.

Oral and Poster Presentations

On the basis of the abstracts that were received, the Programme Committee defined nine topical sessions. These were organised into thirteen oral session "slots" of about ninety-five minutes each and three poster sessions. Parallel oral sessions were limited to Tuesday and Wednesday morning only; overlaps between oral and poster sessions on the same topic were avoided.

Status Reports

The oral and poster presentations of this session covered a variety of control and data acquisition projects of new Experimental Physics facilities that are either at the stage of a technical proposal or being constructed. It also covered installations that reached a mature level of operation but are considered for re-engineering.

Of the accelerator facility reports the Swiss Light Source (SLS) that is being built at the Paul Scherrer Institute in Villigen (Switzerland) and the Spallation Neutron Source (SNS) to be built in Oak Ridge (USA) were given.

Controls of experiments, typically particle detectors, involve different components. There is the so-called "slow controls" that is responsible for "slowly varying" parameters such as temperatures, power supply voltages or currents, vacuum pressures, etc. These parameters vary at a rather low frequency, but are characterised by the large number of input/output points. In addition there is the "detector control" or "run control" that is in charge of the front-end hardware and of the detector calibration. Eventually there is the actual Data Acquisition System (DAQ) that collects all the data on the occurrence of an event and that has to reconstruct the phenomenon that has happened in order to extract data that may be significant for physics. Experiments that were discussed in terms of their different control components were the ATLAS experiment, one of the four large LHC experiments at CERN, the RHIC STAR experiment at Brookhaven National Laboratory (USA) and the HERA-B at DESY (Hamburg).

Noteworthy is CERN's endeavour to design a common control system framework for all four detectors, ALICE, ATLAS, CMS and LHCb that will be installed in the LHC machine and that are scheduled to start operation in 2005.

As an illustration of more specific reports we note the new integrated control system of the accelerators at the Institute of High Energy Physics (IHEP) in Protvino (Russia), the design of the control system for the KSTAR superconducting tokamak in Korea, the control system of the LNLS synchrotron radiation source in Campinas (Brazil), to name just a few. Many more reports were presented of projects in the fields of particle accelerators, medical therapy and thermonuclear fusion world-wide.

Project Engineering and Management

The importance of engineering in general, the use of engineering standards and the need for project management practices were explained at length in this session.

It was recognised that control projects often suffer from poor engineering, management and planning. This should be no surprise as project engineering and management has much of a "multi-variable" system involving product-people-process-technology. The complexity of this "multi-variable" system is enhanced by the fact that one of the variables concerns "people". Whereas technical difficulties generally have solutions, human problems are far more delicate.

Those attending this session were warned of mistakes to avoid and given valuable tips for improving productivity, reliability (for example by applying configuration control, and using procedures and automatic tests to improve the quality of the delivered system) and team motivation.

Examples were also given of modern, industrial style, project management practices that were applied for the development of control software for accelerators and telescopes, as well as in industry. Such practices proved to be a determining factor in the successful commissioning and operation of any modern project, including control systems. It was again stressed, however, that inadequate requirements and bad time estimates put a heavy mortgage on the design, development and maintenance of control systems for Experimental Physics facilities too.

Selecting and Integrating Industrial Systems in Experimental Physics Controls

Industrial systems, hardware and software, are increasingly used for the control of sub-systems needed by Experimental Physics facilities.

SCADA systems in particular have demonstrated their effectiveness for controlling systems such as cryogenics, vacuum, personnel access, etc. They are now also being analysed in the light of their possible use for accelerators and large particle detectors. Besides technical aspects, these systems tend to impose standardisation (SCADA abide to most industrial software and hardware standards) while closely following the evolution of the

technology. These products run mostly on NT and contribute to its adoption also in Experimental Physics controls.

Those who prefer "laboratory made" systems but who are also constrained by budget cuts can take advantage of "Software Sharing", of which EPICS and CDEV (Common Device) are striking examples.

In the field of hardware, CAMAC is still around and represents a massive investment that is difficult to replace. Although new systems are often based on VME and PCI for the more complex devices such as instrumentation, other devices (typically power supplies, vacuum valves and pumps, temperature and pressure probes, etc.) are more and more interfaced through PLCs which are connected to PCs by industrial fieldbuses. PLCs are reliable, cost effective and provide a significant level of local intelligence which can be used already at the front-end layer.

There is, however, a vast choice of industrial systems on the market, most of which cannot fulfil all the needs of the Experimental Physics controls community. Strict selection criteria must be defined in order to identify the most suitable systems.

Under the pressure of restricted resources, with individual in-house developments minimised in favour of buying industrial systems, the task of Experimental Physics control specialists is steadily moving to the level of the integration of these industrial products into an overall comprehensive and consistent control system.

Software: Configuration and Databases

The successful implementation of today's control systems and the subsequent successful operation of the associated Experimental Physics facility depend heavily on the availability and integration of numerous categories of data and information throughout its lifecycle. Most control systems are nowadays built within a framework of industrial off-the-shelf components (hardware and software), standards and generic applications. In the design and implementation phase access is needed to engineering and manufacturing data, technical documents, naming conventions as well as layout information. For operation, trouble shooting and maintenance, information related to run-time configuration, device settings, feedback and alarm parameters, logging of all signals that might help in identifying the source of degraded performance, archived data as well as for example cabling listings, are indispensable.

This session thus emphasised the crucial role played by well-integrated centralised data repositories. Presentations focused on configuration management using databases containing reference data as well as on the archiving and retrieving of diagnostic data.

Controls are indeed no longer stand alone systems but rather part of a web which ties physics to other areas, both technical and administrative, of the organisation in a so-called Computer Integrated Manufacturing (CIM) environment. Databases are the logically central repository not only of operational information but also for administration. Their reliability and scalability are considered of paramount importance.

Software: Object-Oriented Technologies

Object-Oriented technology simplifies the development of fully encapsulated components in a distributed environment. It should thus be no surprise that this technology found its way into Experimental Physics controls as well.

The most recent results based on the Object-Oriented software techniques were reviewed with an emphasis on the development of Application Programming Interfaces (API), graphical tools for building high-level control software, as well as on the performance that can be reached by software developed with this approach.

The main features of object-orientation are the encapsulation of the object specific characteristics (static attributes and functions), the inheritance of these characteristics to all members of the same and derived classes and polymorphism (a derived class can redefine the behaviour of its inherited functions). These features make this technique popular to develop systems involving complex components – or objects – in hierarchical structures with an increased level of abstraction.

Development of Object-Oriented systems tend to be driven by "use cases", with the Unified Modeling Language (UML) as a standard design and analysis language. Use cases are claimed to provide an effective way to capture system requirements and a good base for requirement tracing throughout the whole development life cycle, from the design documents to system testing. Several papers as well as a tutorial addressed this technique.

Software: Distributed Computing Software

The Distributed Computing Software session covered innovations in many areas of controls, from accelerators to large physics detectors, from astronomy to fusion and medical applications. It gave opportunity to learn about

technologies in distributed computing like for example Java, CORBA, the WWW and more.

Examples were given of distributed Object-Oriented control systems, many of which are based on CORBA and CDEV. DYNACORE deserved special attention. It is a European Union (EU) funded project that aims at developing a tele-operation system which can be easily adapted and optimized for a particular instrument. It uses a component-based Object-Oriented approach where CORBA ensures the high level infrastructure for the interaction of the components. The client software relies on Java applets. The system is used for the remote operation of large plasma physics experiments and telescopes.

The use of WWW based techniques for remote participation to experiments and platform-independent access to data archives was illustrated for the case of JET and LHC equipment test data.

Hardware Technologies

Advances in the performance and functionality of digital technology together with its decreasing cost allow considering ever more sophisticated applications to improve the performance of Experimental Physics equipment hardware.

A new generation of power supplies in particular is taking advantage of the available digital technology through the use of embedded DSP controllers, digital generation of high stability, high precision reference signals, real-time algorithms for regulation.

Digital techniques are also more and more adopted for the measurements of the accelerator beam parameters and often require high precision and high sampling rates.

Of particular concern are timing systems. Telescopes as well as tokamaks and accelerators require high stability, high precision and highly flexible timing systems, both event timing and counter-based systems.

Modern control systems are highly distributed and thus rely heavily on the performance of the underlying networks. Increasing demand for more information exchange between the nodes of the network pushes laboratories to upgrade their networks which, although state-of-the-art when the system was designed, are now superseded by considerably more advanced technologies.

Issues related to personnel safety systems and radiation-damage problems of Commercial-Off-The-Shelf (COTS) electronic equipment were also given due consideration.

Process Tuning and Feedback Systems

Many interesting feedback systems from different fields of Experimental Physics were presented. They exploit state-of-the-art technology for measuring sensors, processing of algorithms and actuators.

A typical example is that of tokamaks where the discharge of the plasma has increased in duration from fractions of seconds to several seconds. Fast and intelligent feedback controls are requested to obtain the basic plasma performance.

Similarly, particle accelerators and storage rings pushing the limits of achievable operation need to control the orbit and energy of their particles so as to avoid undesirable fluctuations. The problem becomes even more challenging when it comes to control coupled oscillations between particle bunches. There we enter into the domain of bandwidths as wide as 250 MHz and massive sampling rates in the order of 500 Msamples/s.

A different aspect of feedback controls is described for the airborne Neutrino Oscillations with Telescope during the Total Eclipse (NOTTE) experiment, which was carried out during the total eclipse in August 1999 by a group of Italian and Romanian scientists. A number of algorithms were studied to reach an efficient feedback system to compensate for the perturbations induced by the flying aircraft on the measurement devices that it carries.

Evolution of a Control System: Maintenance, Upgrading, Re-Engineering

Computer technology evolves very rapidly when compared to the lifecycle of most Experimental Physics facilities. This situation provides many opportunities for the upgrade or more fundamental re-engineering of the control systems of these facilities, both for improving their performance or to avoid becoming obsolete. A side effect is, of course, the impact on maintenance.

It is interesting to note that several re-engineering projects introduced PCs at different levels of the control system architecture. They run NT or Linux, whose popularity is growing.

Control systems also evolve to integrate "intelligent systems" that prove to be useful for example in fault detection, where advanced techniques such as neural networks, fuzzy logic or even Multi Agent Systems (MAS) are applied.

Along these lines one also witnesses a clear migration of more and more intelligence within the controlled devices, hence allowing the higher level controls to perform the more complex activities by delegating the detailed functionality to the front-end processors.

Tutorials

Use Cases for Requirements Capture and Tracing, G. Chiozzi (ESO, Germany)

Because of the intrinsically experimental nature of the facilities it is difficult, not to say impossible, to get a precise set of specifications that have to be fulfilled by the control system. It is therefore hard to verify whether a design will cope with the requirements. A "recipe" called "use cases" has been put in place at least to verify whether the proposed design will be able to perform the key functions. In simple terms, the use cases approach advocates to walk through the design documents together with the customer and to verify the functions that will be executed and the path taken by the data when specific operations are performed on the process. Use cases allow not only to capture functional requirements but also to trace them during the whole development life cycle, to final tests. Requirements agreed with the customer are expressed in a format simple enough to be understood by all parties involved, but at the same time sufficiently formal to be directly verifiable at the final acceptance tests.

The adoption of UML provides the support of a uniform and consistent visual language in which to express the results of the development phases of the control system.

Network Technology, G. Montessoro (Univ. of Udine, Italy)

The evolution of network technology is extremely rapid, especially when compared to the lifetime of Experimental Physics facilities. Therefore the choice of an appropriate network technology is strategically important. In the field of Local Area Networks in particular, a switched Ethernet configuration is generally the best choice. High speed switches, supported by reliably structured cabling systems, overcome the limits of shared 10 Mbit/s Ethernet providing dedicated full-duplex 10 or 100 Mbit/s interconnections. GigaEthernet is used for switch-to-switch links. Layer 3 switches are now entering the market and allow the execution of IP level routing algorithms at the speed of layer 2 switches.

These fast IP LANs will support future convergence between data and voice. "Quality of Service" obtained by emerging additional protocols will provide an even better transport for multi-media traffic.

Introduction to Java, J.P. Forestier (Societe OSYX, France)

After considering the rapid growth of Java since the beginning of the nineties, this tutorial introduced the main characteristics of Java: Object-Oriented features, portability, multithread support, robustness and security. It also gave an overview of Java applications, applets and servlets.

A large set of Java libraries and tools exists nowadays. These provide an effective environment for the development of Graphical User Interfaces, distributed object architectures and databases interacting software. Whereas Java includes all the necessary APIs for developing real-time programs, a number of real-time Java-compatible virtual machines has just started appearing on the market.

Introduction to OPC (OLE for Process Control), F. Iwanitz (Softing GmbH, Germany)

OPC is a software standard designed by the OPC Foundation to provide factory automation applications with easy access to industrial plant floor data through a robust high-speed communication infrastructure. This goes along the lines of the charter that states that the objective of the OPC Foundation is:

"To develop an open and inter-operable interface standard, based upon the functional requirements of OLE/COM and DCOM technology, that fosters greater interoperability between automation/control applications, field systems/devices, and business office applications."

The OPC Foundation has a large number of members from all over the world. These members are not only SCADA developers but include also major manufacturers of process controllers and hardware devices.

At the heart of the OPC specification is a client–server model where the OPC server provides a standard interface to the OPC objects, allowing client applications to control devices and to manage device data in a generic fashion. After the introduction on the origin of OPC, the model, capabilities and limitations of the standard were outlined. Client and server implementations were shown and performance, networking and security issues were discussed.

Round-table Discussion on Prospective Directions in Controls in Geographically Distributed Collaborations

Starting from the consideration that world-wide collaborations have become common in all fields of Experimental Physics (accelerators, astronomical observatories, fusion facilities, etc…), the discussion chaired by J.W. Humphrey (SLAC, USA) concentrated on the management of projects and of software in particular developed by distributed teams and on the experience with the available technologies for long distance interaction. Experiences were presented from the European Southern Observatory (Gianni Raffi (ESO, Germany)), the large high energy physics experiments of CERN (Helfried Burckhart (CERN, Switzerland)), BaBar (Ric Claus (SLAC, USA)), the Joint European Torus (Jonathan Farthing (JET, UK)) and the Spallation Neutron Source (Dave Gurd (LANL, USA)) whose control system is being developed by a collaboration of five laboratories (Oak Ridge National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Los Alamos National Laboratory and the Lawrence Berkeley National Laboratory).

Pre-Conference Workshops

Two pre-Conference workshops on EPICS and SOftware SHaring (SOSH) were organised within the scope of ICALEPCS'99.

Workshop on EPICS

The two-day workshop on EPICS, the Experimental Physics and Industrial Control System's software tool-kit, was organised by Matthias Clausen of DESY, Germany. EPICS was initiated by LANL (Los Alamos) and ANL (Argonne) and is continuously being enhanced by a collaboration of computer scientists in different Experimental Physics laboratories world-wide.

EPICS is used in more than one hundred installations all over the world. Following the tradition of holding an EPICS workshop in conjunction with ICALEPCS it was possible for newcomers to learn about EPICS and meet many of the members of the EPICS collaboration. In the spirit of the collaboration, EPICS users were able to discuss with the developers and give input for new developments, thus contributing to the overall success. The two days focussed on the following subjects:

- Introduction into EPICS and status reports from several installations.
- New developments in the creation of EPICS databases from Oracle and new sequencing and archiving tools.
- Support for new hardware.
- Upgrading for Y2K.
- EPICS on Linux and Windows NT.
- Porting EPICS core to other operating systems.
- News from channel access.
- New implementations in Java.

Workshop on SOftware SHaring (SOSH) '99

One of the objectives of the EPCS Group when it was created at the turn of 1985-1986 was to foster collaboration between specialists in Experimental Physics control. A striking result of such collaboration is the sharing of software.

SOSH'99, organised by W. A. Watson of TJNAF, USA, continued a series of workshops aimed at exploring ways to improve the sharing of valuable software within the accelerator and detector controls community.

This one-day workshop on SOSH was held under the auspices of ICALEPCS'99. It included technical presentations on Java components developed within the community as well as discussions on standardisation. This year particular emphasis was placed on the sharing of Java components and packages, as a consequence of the fact that a large fraction of our community has recently made a serious move to use Java together with the same base libraries (Java class libraries). In addition to that, Java encourages component oriented development in the form of cohesive packages, Java Beans and enterprise Java Beans, it integrates with widely adopted databases and can be used to develop both CORBA clients and servers (to support integration with non-Java components).

Among those who have made strong moves into Java are CERN, Fermilab, Jefferson Lab and the Swiss Light Source. In many cases these Java developments have a flavour similar to previous local control systems, but the

potential for moving toward each other (and towards enhanced software sharing) has never been stronger than with the emergence of a language which is built on portability and reuse.

THE ICALEPCS'99 INDUSTRIAL PROGRAMME

The Conference Industrial Programme included an industrial exhibition and parallel sessions for topical industrial seminars on state-of-the-art developments in technology that were of relevance to the subjects handled during the Conference.

Industrial Seminars

A. Moore of Hewlett-Packard Italiana (Cernusco S/N, Milano, Italy) gave an overview of Hewlett-Packard's strategy in technical computing showing how their computers will evolve towards 1.2 GHz machines by 2001.

V. Di Cianni of VSystems (Alpignano, Italy) explained how to get remote sensor data using Fibre Channel and distribute them with Raceway. F. Cerruti described how to debug PCI/PMC systems.

M. Weymann of Creative Electronic Systems (Petit-Lancy, Switzerland) presented the use of scalable multi–processor systems to balance a system's CPU and input/output capacity.

M. Porrega of Cabletron Systems (Milano Fiori, Assago, Italy) discussed network traffic accounting.

F. Porcari explained the impact of science on the development of products by his company Lucent Technologies (Milano, Italy).

Directly relating to the Experimental Physics world was P. Marshall's (Hytech Electronics (Reading, UK)) presentation on VME64x in accelerator control systems, while G. Endendijk of INCAA Computers (Apeldoorn, The Netherlands) gave an overview of his company achievements in the field of data acquisition and control systems over 25 years.

There were also seminars on compact PCI in instrumentation by R. Siagri of EuroTech (Amaro, Udine, Italy) and on neural network systems for instrumentation by A. Sartori of NeuriCam (Trento, Italy).

Industrial Exhibition

The industrial exhibition gave several advanced high technology companies the opportunity to demonstrate their latest products. Among these companies were Creative Electronic Systems (Petit-Lancy, Switzerland), Lucent Technologies (Milano, Italy), EuroTech (Amaro, Udine, Italy), NeuriCam (Trento, Italy), INCAA Computers (Apeldoorn, The Netherlands), VSystems (Alpignano, Italy), Cabletron Systems (Milano Fiori, Assago, Italy), Hytech Electronics (Reading, United Kingdom).

SATELLITE MEETINGS

A number of satellite meetings were held in parallel with the Conference.

The *Board of the EPS Interdivisional Group on Experimental Physics Control Systems (EPCS),* chaired by Guy Baribaud (CERN, Switzerland), held a closed meeting on October 4th.

On October the 5th, Gianni Raffi (ESO, Germany) organised a discussion on *Trends in Control Systems of Astronomical Telescopes.* This small session focussed on the control of astronomical telescopes, discussed the actual trends in matters of computers, middleware and methodologies. Concerning the computer platforms one can foresee some movement away from the traditional Unix workstations towards PCs (based on NT or Linux) also for large projects, although this is currently visible only on instruments like at CFH, Galileo. As far as middleware is concerned, also in astronomy there is a community that uses EPICS (for example Keck, Gemini). VxWorks (with or without EPICS) is the prevailing real-time operating system in large projects. However there is a trend in the more recent projects to move away from traditional middleware layers. CORBA is being proposed for new large telescope projects, like SOFIA, GTC and ALMA. Finally, when discussing methodologies it was noted that there are projects, although still a minority, where formal methods for software developments are applied. The UML together with Object-Oriented technology are being adopted right now to a few telescope control projects like GTC, VLT/VLTI. These methodologies are given extending attention.

The *ICALEPCS'99 International Scientific Advisory Committee (ISAC)* met on October the 6th, chaired by Daniele Bulfone (Sincrotrone Trieste, Italy) and Axel Daneels (CERN, Switzerland).

PRIZES

EPCS Prize

During this Conference, the EPS-EPCS prize was awarded for the very first time. From the several candidates that were presented, the EPCS Board eventually decided to award the EPS-EPCS prize, amounting to 2000 Euros, to Thijs Wijnands (CERN, Switzerland) for his contribution to *An Advanced Plasma Control System for TORE SUPRA*.

The prize was awarded by Guy Baribaud (CERN, Switzerland), current Chairman of the EPS Interdivisional Group on Experimental Physics Control Systems (EPCS), during the Conference banquet at the "Villa Manin": a grand setting for a great prize.

Best Poster Prizes

A novelty for ICALEPCS was the awarding of prizes for the best posters. Six prizes were granted, i.e. two per poster-day.

A team of referees chaired by G. Raupp (Max-Planck-Inst., Germany) and consisting of J. Carwardine (ANL, USA), R. Muller (Bessy, Germany), J. Zhao (IHEP, China), R. Pose (JINR, Russia), T. Katoh (KEK, Japan) were given the task to evaluate the posters on the basis not only of their technical interest, the conciseness and quality of the presentation but also on their "look and feel".

The winners were:

- F. Biancat Marchet, ESO, München; B. Gustafsson, ESO, München; P. Gutierrez, ESO Paranal, Chile, *The VLT Time Reference System: A Microsecond-Accurate Time/Synchronization Bus for Distributed Control Systems*
- B. Denis, CERN, Geneva; P. Malacarne, CERN, Geneva; Ch. Mugnier, CERN, Geneva; J. Varas, GTD, Barcelona, *The New Control and Interlock System for the SPS Main Power Converters*
- E. Plouviez, ESRF, Grenoble; J. M. Koch, ESRF, Grenoble; F. Uberto, ESRF, Grenoble, *A Fast Global Feedback System to Correct the Beam Position Deviation in the ESRF Storage Ring*
- C.H. Kuo, SRRC, Hsinchu; J. Chen, SRRC, Hsinchu; K.T. Hsu, SRRC, Hsinchu; C.J. Wang, SRRC, Hsinchu, *Orbit Control and it's Strategic in Taiwan Light Source*
- P. Charrue, CERN, Geneva; B. Denis, CERN, Geneva; M. Jonker, CERN, Geneva; M. Vanden Eynden, CERN, Geneva, *Upgrading the SPS Operational Software for the LHC Era - The SPS-2001 Software Project*
- E. Hatziangeli, CERN, Geneva; R. Bartolome, CERN, Geneva; A. Bragg, CERN, Geneva; P. Ninin, CERN, Geneva; J. Patino, CERN, Geneva; H. Sobczak, CERN, Geneva, *A Common Software Configuration Management System for CERN SPS and LEP Accelerators and Technical Services*

SOCIAL PROGRAMME AND VISITS

A get-acquainted welcome cocktail was offered to all participants on the Sunday evening, 3rd of October.

There was a Gala Concert organised for ICALEPCS'99, to which also the citizens of Trieste were invited, in the City Opera House G. Verdi. Under the direction of M.o Paolo Pessina, the Croatian Symphony Orchestra of Zagreb interpreted Ludwig van Beethoven's "Triple Concerto" Op.56 and the Symphony Nº3 Op.55, better known as the "Eroica".

A Conference Banquet, featuring typical north Italian delicacies such as San Daniele ham, Montasio cheese dumplings, chocolate mousse with pear sauce, and liquors from Friuli was offered by Hewlett-Packard in the "Villa Manin", the largest and most beautiful Venetian villa in the region.

There was also a one-day guided Conference Tour to Venice. The visit included the Piazza S. Marco, the Cathedral, the Palazzo Ducale as well as a walk along the picturesque canals. While strolling through the antique and winding streets of the city, participants still exchanged views and ideas on controls. Will future ever tell how many brilliant ideas the picturesque beauty of Venice has inspired?

Finally there was also a tour of ELETTRA, one of the brightest synchrotron light sources in the world, and its Laboratories.

The programme for accompanying guests proposed a mix of cultural visits to historical places like Aquileia and Grado, to monuments, museums and palaces in Trieste, an introduction to the Romanic and Roman art as well as to the Italian Renaissance. Those more interested in the natural beauties surrounding Trieste were given the opportunity to visit the "Grotta Gigante", one of Europe's largest caves. Finally, guests were also given the chance to hear about the local cuisine that blends Italian and Austrian tastes.

ACKNOWLEDGEMENTS

We gratefully acknowledge the Local Organizing Committee and the many people of Sincrotrone Trieste who have been involved in ICALEPCS'99 and have made this Conference such a technically and culturally remarkable event. Thanks also go to the staff of "the office" for their professional skill.

The Editorial Team deserves a special applause for having succeeded to produce the ICALEPCS'99 Proceedings on the WWW (http://www.elettra.trieste.it/ICALEPCS99) in as little as twenty days after the closure of the Conference: a genuine record!

We also acknowledge all of the members of the International Scientific Advisory Committee, the Programme Committee and the session chairpersons for their valuable contribution to the scientific programme of the Conference.

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We like to stress in particular Hewlett-Packard's continued commitment and support to the EPS-EPCS group and its activities since its foundation in 1985-1986.

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