

Managing the FAIR Control System Development

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The FAIR Project



Facility for Antiproton
and Ion Research at GSI



- Presently under construction (to be completed 2019)
- Major extension to the present GSI accelerator complex

International project: 10 partners signed Convention (Oct 2012)

Total investment 1 B€ (2005 prices)

Financed by joint international effort: Germany 70%, international partners 30%

Countries contribute in-kind and in cash

Several accelerators to be built

FAIR start version: 4 accelerators + 2 machine-line sections (SFRS, pbar-Target)
and several km of beamlines

Overall Project Management

Considering

- Substantial scope of the FAIR project
- Technical & organisational complexity
- High financial investments
- Risks (technical, financial, schedule)

German funding agency (BMBF) and FAIR Council required:

- Professional Project Management
- Adequate project lead and organisational structure

FAIR@GSI Project Organisation

To fully focus on the construction of FAIR
GSI was completely reorganized in 2012

- Project Division FAIR@GSI was formed (550 staff of 1100 total)
- Project Leader (PL) appointed / Project Division Leader
- Staff was redirected from Research to Accelerator

Matrix-like project organisation was introduced
and line management was aligned as much as possible (project divisions)

- Project Leader (PL) with strong mandate
- Machine Project Leaders (MPL)
 - 7 accelerators or accelerator-like sections
 - Sub-project leaders, organize respective machine
- Work Package Leaders (WPL)
 - About 100 technical subsystems
 - Assigned to the respective machines

Project Organisation: Controls

Specific situation for Controls

- Accelerator Control System was declared in-kind contribution of the FAIR host-lab, GSI (+20% in-kind Slovenia)
- Presently 50 staff in Controls Department
- Wide scope



Only one integrated control system for the whole facility (FAIR & GSI)

⇒ Controls is considered orthogonal aspect (no matrix)

In respect of Project Organization, Management and Planning

- Control system is considered a „Common System“
- Considered an „Accelerator-line“ machine project with MPL

Controls Workpackages



Controls Subproject Organisation

- Controls Project Leader (MPL)
- WPLs for subprojects (wide scope, even beyond Controls)

Machine Controls Coordinators (MCC)

- meetings and communication is usually organized „per machine“
- Serves as contact person for all matters concerning specific machine
- Organizes activity for respective machine within controls group

Other In-kind Contributions to Controls

Significant in-kind contribution to the Control system from Slovenia (20%)

Slovenian consortium, Controls part led by Cosylab

- Responsibility for the total system is with GSI (system design, specifications)
- Control system sub-projects with clearly defined interfaces (e.g. alarm system, interlock system, vacuum control system, hardware development, ...)



Ingredients for success story so far:

- Slovenian Controls project manager/developer is permanently at GSI, interacts with development team
- Regular Jour-Fixe meetings (weekly)
- Have clearly defined by Detailed Specifications, however: better review specs shortly before start of a new subproject
- Always be aware: commercial partner...

Integrated Project Planning

Integrated Project Planning group

- Installed for professional management of time schedules & resources
- Generate reports for PL and directorate

Planning

- Planning done with MS Project 2010 Server Edition
- Plans are loaded with resources (budget, generic manpower)
- 3rd party products to link plans and link to SAP
- Presently about 250 linked MS project plans

Introduction was a heavy burden (training, debugging tools, etc.)

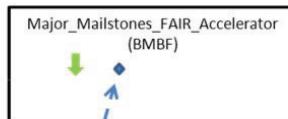
Plans need to be weekly updated by WPL and MPL

Plan aggregation by Integrated Project Planning Group

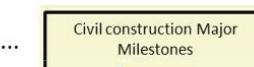
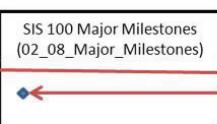
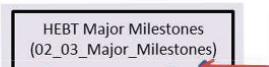
Linked Project Plans

Master Schedule (1 Plan)

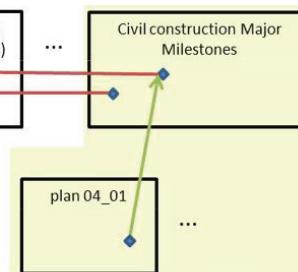
Level 1



Level 2



Level 3



Major Milestone Plans

- One per FAIR machine
- Or major techn. subsystem
- Civil construction milestones
- About 12 plans

Milestones Links

- Hard links
- Soft links
- No wild cross links, rules!

Detailed Plans

- About 250 plans, mainly per WP
- 11 for Controls

Project Planning for Controls

Integrated Project Planning

- Complex development may lead to too high complexity during planning
- For full project span (2019/2020) high level of uncertainties from other major plans, e.g. civil construction, changes in machine priorities, etc.

Approach:

- Keep integrated project planning complexity as low as possible
- Follow iterative approach

Development of the control system is done in iteration cycles

⇒ Introduction of a **Release Chain**

- Two major Releases per year considered optimal
- Fixed due-dates
- Adapt content / objectives to the overall FAIR machine schedule
- Derive milestones for links from the Release chain

Release Chain



ready for installation
ready for test operation
ready for beam operation

Detailed Planning

Vorprojename	Priority	Dauer	Arbeitsaufwand	Anfang	Fertig stellen	Ressourcenamen	Vorgänge
RF		0 Tage	0 Tage	Fr 02.10.15	Fr 02.10.15		
Development cycle 5		139 Tage?	2.982,4 Arbeitsstunden	Fr 05.10.14	Fr 03.04.15		5
= WPI Software (API, FE+SV)		139 Tage?	1.315,4 Arbeitsstunden	Fr 05.10.14	Fr 03.04.15		
- Central Design, General Activities		139 Tage?	198 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		
GCT Controls Core Team: General activities		139 Tage?	47 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15	Hermann,Fitzek,Krause,Hechler[80%]	
GSI/FAIR technical team: General discussions (Bar)		139 Tage?	103 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15	Bär	
GSI/FAIR technical System Integration for FAIR (Technical concept) [Bfr]		139 Tage?	103 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15	Bar,Fitzek	
Milestone Proposal for SIS-15, HE/CR/C-S integration worked out		0 Tage	0 Tage	Fr 03.04.15	Fr 03.04.15		
Machine controls coordination (SIS100, ST, SFRS, C, plm, HEST, HESR)		139 Tage?	30 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15	Fitzek,Rüller,Hermann,Amet,Hechler	
Milestone: Conceptual Design SFRS-Controls completed		139 Tage?	30 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		
Design & Architecture of CS-DAQ, SOS, etc.		139 Tage?	3 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		
= FE		139 Tage?	366 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		5
- FESA CoreFramework activities		40 Tage?	85 Arbeitsstunden	Mo 05.10.14	Fr 28.11.14		
Refine multiplexing (data storage, selectors, multiplexing context, limb)	1	20 Tage?	20 Arbeitsstunden	Mo 05.10.14	Fr 31.10.14	Hechler[80%],Matthes,Schwein[50%]	
Integration of Alarm System	2	10 Tage?	10 Arbeitsstunden	Mo 05.10.14	Fr 17.10.14	Schwein[50%]	
FESA validation (reference, installation, for GSI and exten)	2	21 Tage?	21 Arbeitsstunden	Mo 05.10.14	Fr 26.10.14	Matthes,Schwein[50%]	
FPGA developments	2	45 Tage?	45 Arbeitsstunden	Mo 05.10.14	Fr 26.11.14	Matthes,Schwein[50%]	
- FESA Class Developments (including commissioning)		139 Tage?	219 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		
General FESA support for class developers & General class development coordination effort		130 Tage?	15 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15	Schwein[50%],Matthes,Krause	
Extend equipment adapter classes (FE integration package)		7,14 Tage?	10 Arbeitsstunden	Mo 05.10.14	Mo 15.10.14	Kainberger,Weibel[70%]	
FESA class diverse power supply (Krause, MSL, MLT, Weibel)	1	29 Tage?	29 Arbeitsstunden	Mo 05.10.14	Fr 10.11.14	Weibel[70%]	
FESA class diverse magnet never supply (Krause)	2	4,29 Tage?	5 Arbeitsstunden	Mo 05.10.14	Fr 10.10.14	Weibel[70%]	
FESA class CRV/RND inst-RC (RFQ, toucher) [Hechler]	1	22,73 Tage?	20 Arbeitsstunden	Mo 05.10.14	Fr 10.11.14	Hechler[80%]	
FESA class CRV/RND bumper (Matthes)	1	20 Tage?	20 Arbeitsstunden	Mo 05.10.14	Fr 10.10.14	Matthes	
FESA class CRV/RND electrostatic quide [Krause]	1	12 Tage?	12 Arbeitsstunden	Mo 05.10.14	Fr 21.10.14	Krause	
FESA class Diaphragm cooling (Krause, Kainberger, FESI, FESI, FESI) [Pfeil]	2	30 Tage?	30 Arbeitsstunden	Mo 05.10.14	Fr 28.10.14	Pfeil	
FESA class Diaphragm cooling (Krause, FESI, FESI, FESI, FESI, FESI) [Krause]	1	26,87 Tage?	26,87 Arbeitsstunden	Mo 05.10.14	Di 11.11.14	Krause,Hechler[75%]	
FESA class Diaphragm cooling (Krause, FESI, FESI, FESI, FESI, FESI) [Krause]	2	10 Tage?	10 Arbeitsstunden	Mo 05.10.14	Fr 17.10.14	Krause,Matthes	
Take over of Slovenian in-kind developments (FESA classes)		130 Tage?	25 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15	Kainberger,Matthes,Schwein[50%],Krause	
Support for existing FESA classes (update to new FESA-visions, refinement)		7,14 Tage?	30 Arbeitsstunden	Mo 05.10.14	Mo 15.10.14	Kainberger,Matthes,Schwein[50%],Krause	
- FE Installation and Commissioning		7,14 Tage?	30 Arbeitsstunden	Mo 05.10.14	Mo 15.10.14	Kainberger,Matthes,Pfeil,Viecht[70%]	
Installation of first beamline components (CRYRING, commissioning devices)	1	5 Tage?	5 Arbeitsstunden	Mo 05.10.14	Fr 10.10.14	Kainberger,Matthes,Pfeil,Viecht[70%]	
Commissioning Mini-CS / CDAv-CR, remote support	1	1 Tage?	1 Arbeitsstunden	Mo 05.10.14	Mo 06.10.14		
- Other FAIR-relevant Activities		130 Tage?	21 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		
FE: Unspecific FAIR technical design & discussions		130 Tage?	21 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15	Krause,Kainberger,Hechler[80%],Matthes	
Quotient of number of tasks per developer (present CS)	2	2 Arbeitsstunden	2 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15	Krause,Kainberger,Hechler[80%],Matthes	
= SV		139 Tage?	274 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		
- Services and Middleware		35 Tage?	97 Arbeitsstunden	Fr 05.10.14	Fr 25.11.14		
- Databases and Nomenclatures		58 Tage?	160 Arbeitsstunden	Fr 05.10.14	Fr 12.12.14		
CERN schemas of LSA & FESA DB: Integration and validation		58 Tage?	13 Arbeitsstunden	Mo 05.10.14	Mo 27.10.14	Stüller[80%],Rapp,Rüller,Matthes	
FESA and LSA DB: Integration and validation		15 Tage?	15 Arbeitsstunden	Mo 05.10.14	Fr 20.10.14	Stüller[80%],Rapp,Rüller,Matthes	
Config. FESA and LSA		40 Tage?	12 Arbeitsstunden	Mo 05.10.14	Fr 31.10.14	Stüller[80%],Rapp,Rüller,Matthes	
FESA and LSA Error and logger Framework		8 Tage?	8 Arbeitsstunden	Mo 05.10.14	Fr 28.11.14	Krause	
LSA & FESA DB provide DB for production environment, install and validation]		20 Tage?	20 Arbeitsstunden	Mo 05.10.14	Fr 31.10.14	Krause	
Beamlines and devices for CRYRING in OpenDB		50 Tage?	50 Arbeitsstunden	Mo 05.10.14	Fr 12.12.14	Krause	
Beamlines and devices for FESI in OpenDB		13 Tage?	13 Arbeitsstunden	Mo 05.10.14	Fr 09.11.14	Jülicher,Fitzek,Müller,Stüller[50%]	
FE: Full conceptual design for FAIR databases (LSA00, OpenDB, FESAD0, FEDB, ControlsDB)	1	2,7 Tage?	3 Arbeitsstunden	Mo 05.10.14	Do 09.10.14	Jülicher,Fitzek,Müller,Stüller[50%]	
Internal CR		139 Tage?	17 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		
= Other FAIR-relevant Activities		139 Tage?	403,5 Arbeitsstunden	Mo 05.10.14	Fr 03.04.15		5
- Mini-CS Developments		10 Tage?	8 Arbeitsstunden	Mo 05.10.14	Fr 17.10.14		
Application: Control program for proton source, extended functionality (continuation from R2)	2	5 Tage?	5 Arbeitsstunden	Mo 05.10.14	Fr 17.10.14		
Application: Control program for proton source, integration of Chopper	3	13 Tage?	13 Arbeitsstunden	Mo 05.10.14	Fr 17.10.14	Grasmück[50%]	
Control Room Application: Control program for proton source, extending functionality (continuation from R2)		100 Tage?	202 Arbeitsstunden	Mo 05.10.14	Fr 26.02.15		
Control Room Applications: Technical support Mini-CS applications	2	6 Tage?	3 Arbeitsstunden	Mo 05.10.14	Mo 13.10.14	Grasmück[50%]	

Detailed Planning

- One Release ahead (longer periode not realistic)
- Loaded with named resources
- Work of every activity is estimated
- Overload of resources can be avoided

Present plan: ~250 activities for 50 developers

Tracking of progress allows project steering,
e.g. priorities, move functions to later releases, etc.
All developers report on activities (weekly)
Plan shall be always adapted to „real life“

Testing

CRYRING

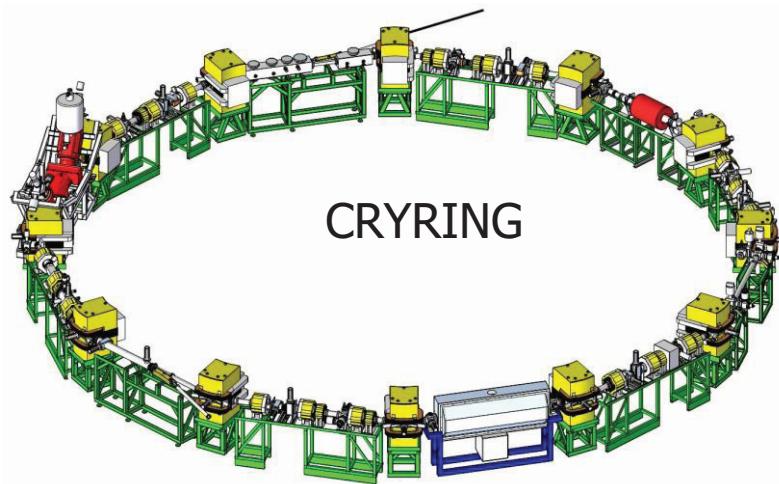
Swedish in-kind contribution heavy ion storage ring presently under installation at GSI

Test ground for the new control system

- test and validate technical concepts
- Early deployment, gaining experience under real conditions
- identify design imitations

and also

- validate our project management structures and tools (planning)



Thank you for your attention



GSI with FAIR construction site today

Conclusions

- Large projects need adequate structure and project management
 - Control system development for a new facility is a large project...
- Time effort for project management and planning is always underestimated
- Planning and reporting of progress is essential,
without overview no project steering is possible
- Avoid too high complexity in project planning
 - For long timescales, fixed Release chain seems a reasonable solution
 - Fits well to the iterative development cycles
 - Detailed planning no more than 1 year ahead possible