

What's behind an Accelerator-Control System?

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WECOMA04

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Outline

> Introduction

- DESY's profile changed
- Impact on Control System Group

> Different views onto an accelerator-control system

- Operator view
- Control system group view
- Meta-control system view

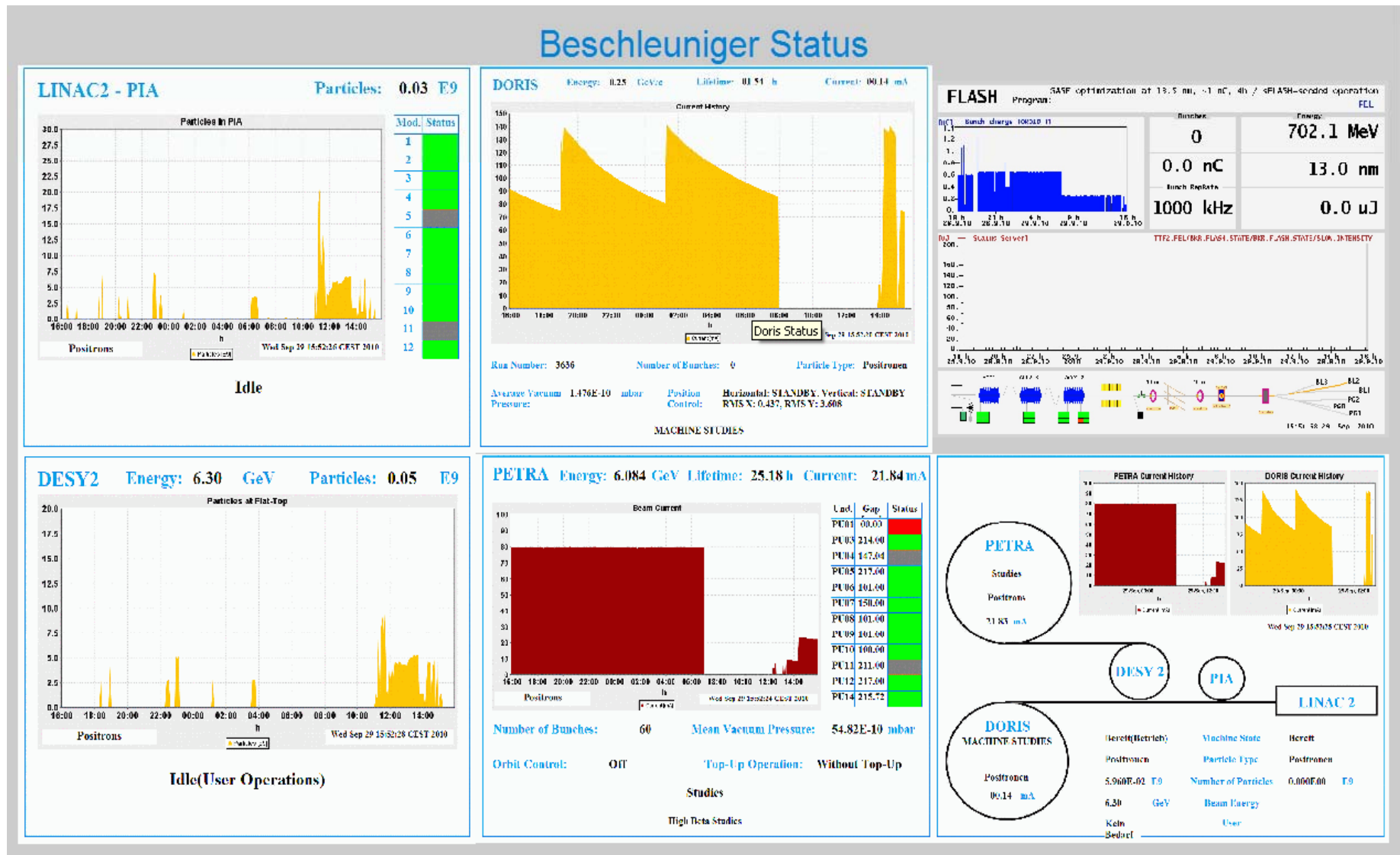
> Meta-control system

> Conclusion



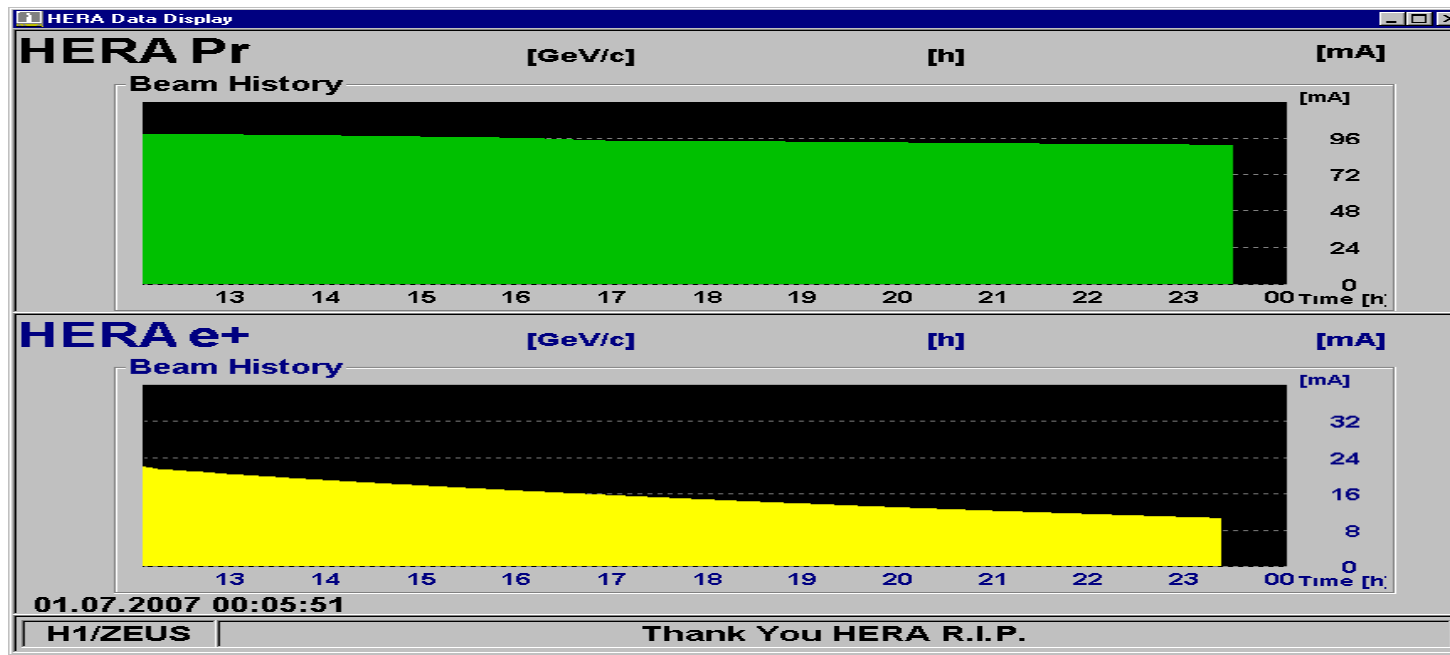
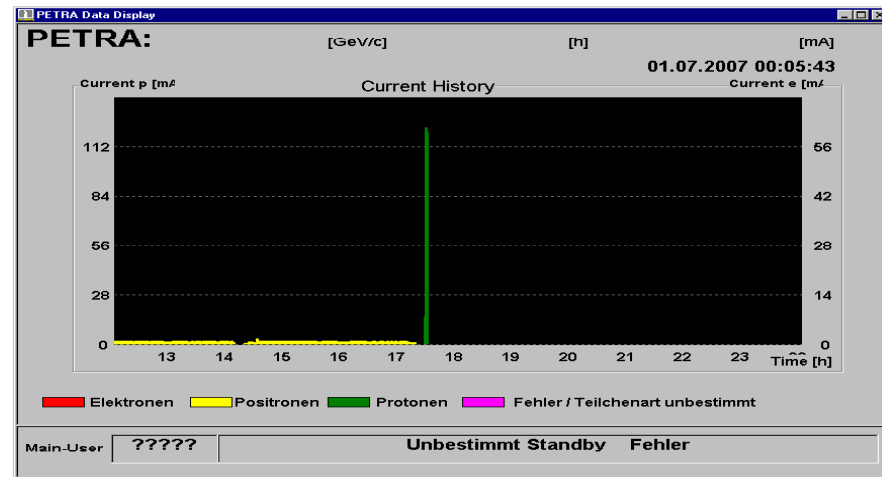
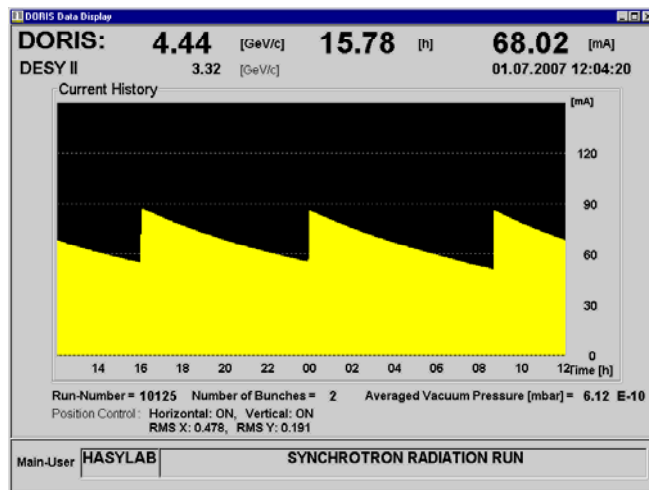
Introduction

DESY's Current Accelerators



Introduction

Situation till June 30 2007



Introduction

Changes

- > Proton-lepton collider HERA II switched off in 2007
- > Light sources
 - Ring accelerators DORIS III PETRA III
need preaccelerators LINAC II, PIA, DESY II
 - Free electron laser FLASH II
- > Top-up operation PETRA III interleaved with DORIS III refill every 8 hours
- > Cramped schedule of the beam line experiments.
Required beamtime : day(s)
HEP-Experiments : years



Introduction

Impact of Changes

- > MCS -the machine control group at DESY- has built, maintains and improves the control systems of all current DESY-accelerators
- > The job is:
Support of reliable operation of the accelerator in all its different operational phases with as few interruptions as possible
- > Now:
An unperceived control system failure is now more unlikely than in the days of HEP-Experiments.



Operator View DESY 1964



Operator View (Console)

DESY 2010

DORIS III
Operator
Console



Operator View (Console)

DESY 2010

- > Technical implementation differ a lot from control system to control system
- > The look and feel is not much different.

FLASH

- Apple Mac Pro hosted
- Mac OS
- C++, JAVA, Labview, Matlab



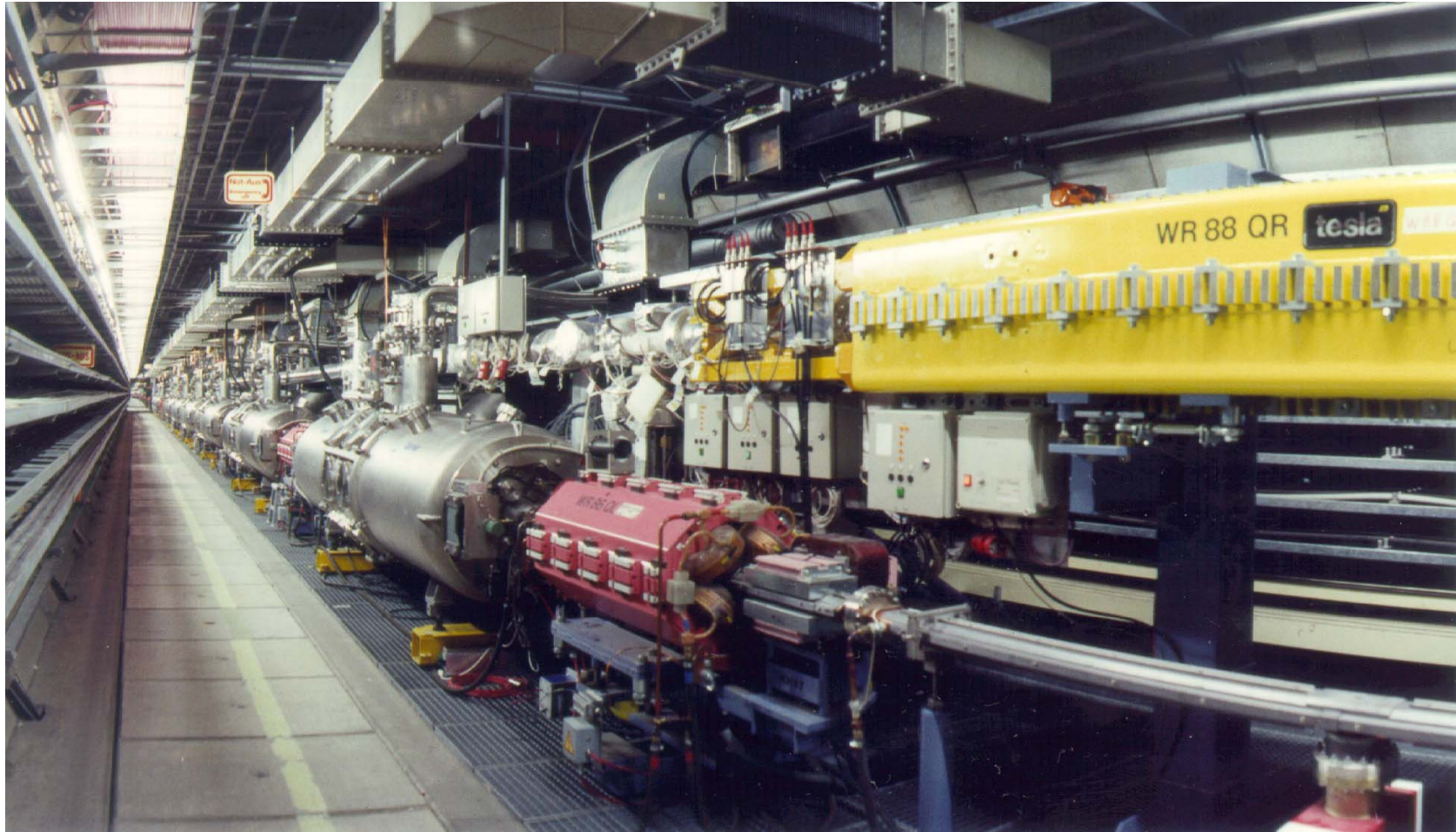
PETRA III

- Standard home PC hosted
- Windows XP
- JAVA, Labview, Matlab, Visual Basic



Operator View (Accelerator)

DESY 2007



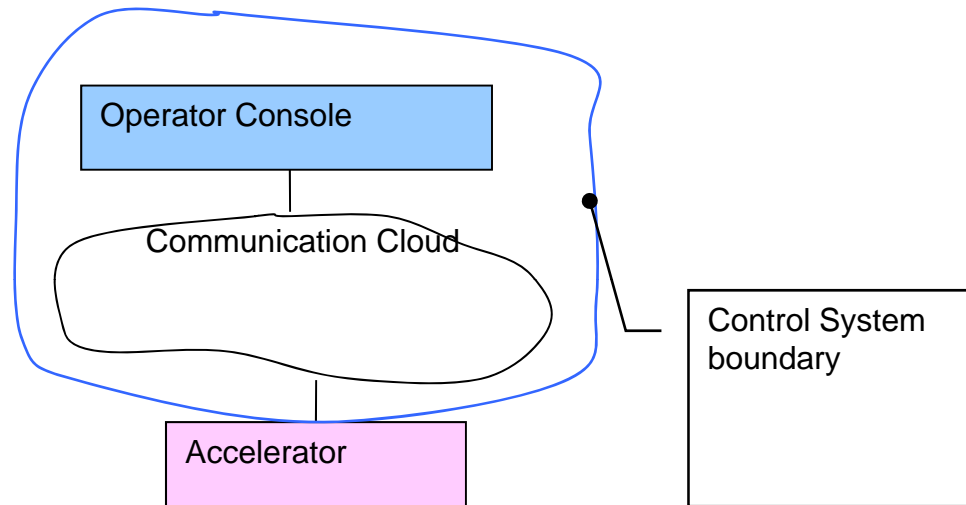
Operator View Communication Cloud

- > Something allowing communication between the operator console and the accelerator ('communication cloud')



Operator View Simple Diagram

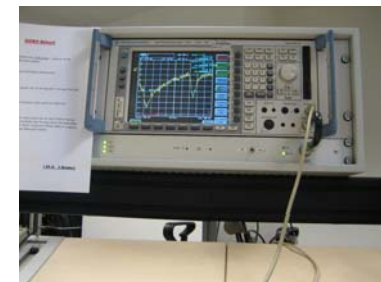
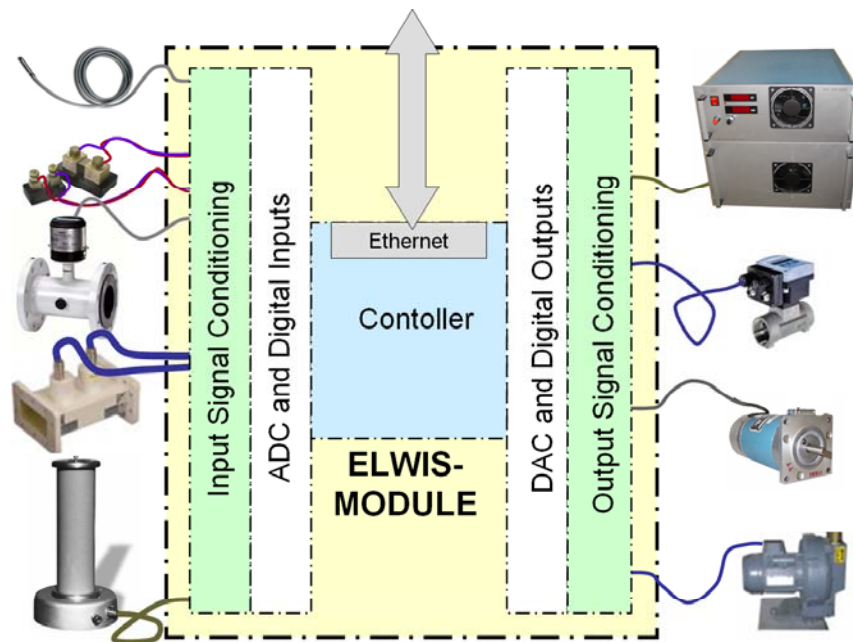
- > What belongs and does not belong to the control system is defined in different ways by different people.
- > All major subsystems interfaced to the control system.



Control System Group View

Building Blocks

- > Computers
- > Networks, field buses
- > Diagnostic systems
- > Turnkey systems e.g. ELWIS RF-control



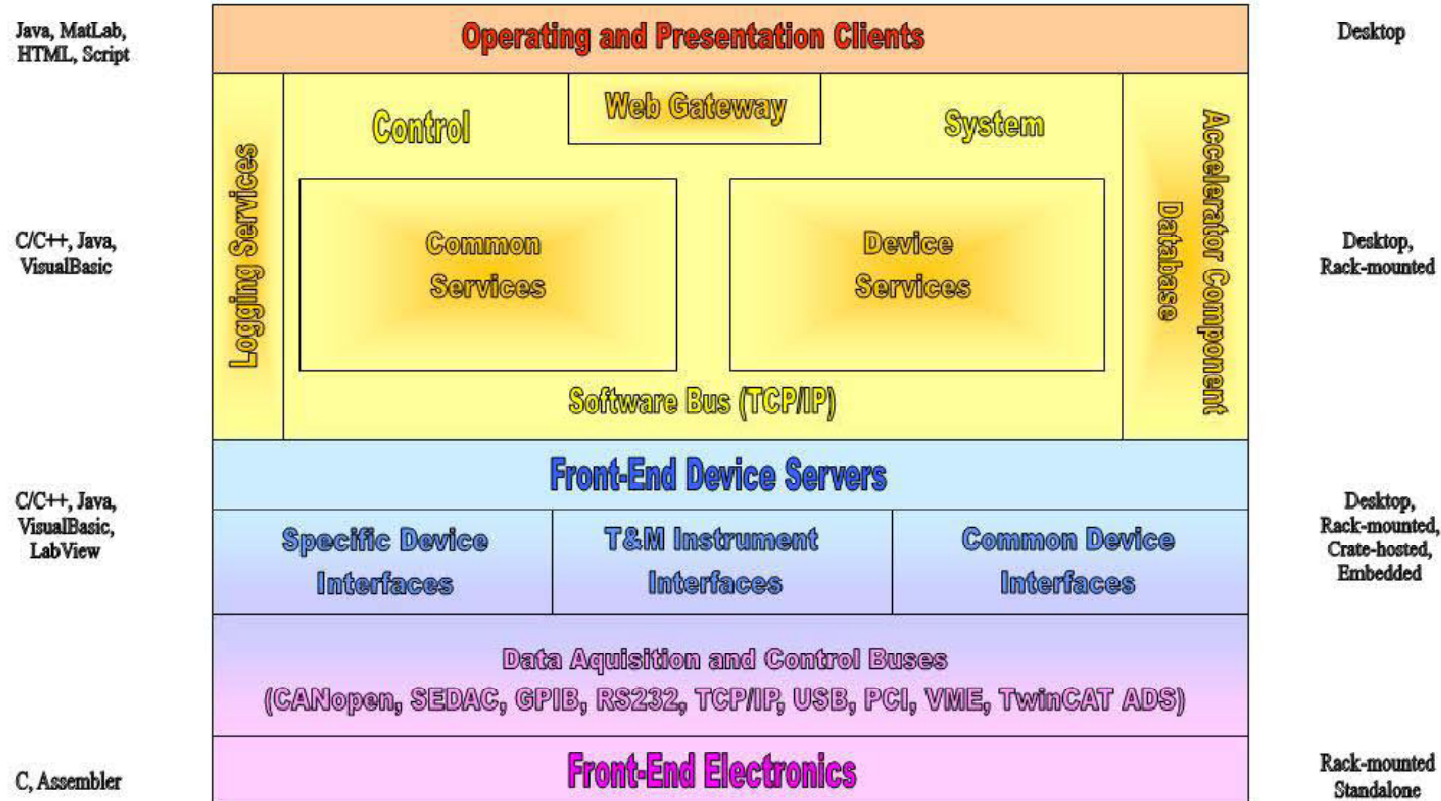
Control System Group View Architecture

- > Web-Sites
- > Buzzwords (CDI, MCA, jDDD, Control system ..)
 - Term 'Control system' meanings:
 - (1) A system controlling an accelerator, e.g. 'The control system for PETRA III'
 - (2) A name for a set of tools providing communication protocols and services which make for efficient client and server applications; e.g. TINE, DOOCS, EPICS, TANGO
 - I will use meaning (1)
- > Diagrams of Architecture



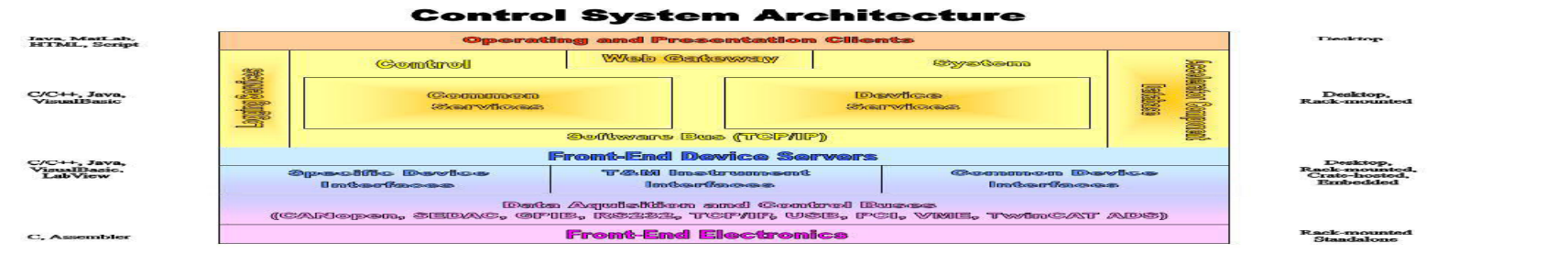
Control System Group View Architecture

Control System Architecture



Control System Group View Architecture

Reality is too complex to be reduced to a diagram



- > Daily operational needs require minor or major improvements, redesigning a certain feature. Pragmatic solutions not foreseen in the tool-sets.
- > There are old systems that cannot be upgraded.
- > The control system has to be able to cope with failures and unforeseen situations.
- > The technical and personal environment of the control system changes.
- > Process of system installation, maintenance operations, changes required during the lifetime of the accelerator (e.g. when hard- or software is replaced) not shown.
- > Purely pragmatic modifications might lead to a situation in which the diagram no longer represents reality.
- > Lack of meta-control system



Meta Control System

Features

- > Fault detection and repair
- > Control systems central database
- > Application deployment
- > Application programming policies
- > Maintenance strategies
- > Defence against attacks
- > Monitoring the system
- > Integration into Campus IT-Infrastructure
- > Observation of hard- and software life cycles in relation to the accelerator's lifetime
- > Choice of adequate hard- and software-solutions
- > Preserving approved concepts



Meta Control System

Fault detection and repair

- > “Fault Identification in Accelerator Control”, Proceedings of PCaPAC 2005, Hayama, Japan
- > Improved e.g:
 - Spare PCs for each type of Windows host
 - Approved procedure

Defekten Device-Server-PC ersetzen

Voraussetzungen

1. Der Name des defekten PCs, auf dem Etikett am PC, beginnt mit **AccXpD2, AccXpL2, AccXpDo, AccXpTt, AccXpPe** oder **AccXpCs** und ist in der PC Liste unter Kapitel 3 nicht **rot** gekennzeichnet. **Rot** gekennzeichnete PCs müssen speziell behandelt werden.

Ersatz-PC für den defekten PC besorgen

1. Defekten PC ausschalten, aus dem Rack ausbauen, Anschlüsse merken!
2. Ersatz-PCs, nach Hardware und Beschleuniger-ID (**L2, D2, Do, Pe, Tt, Cs**) unterschieden, befinden sich in Raum 30/102 Rack SPR-1 und Rack SPR-2.
3. Ersatz-PC ausschalten und an Stelle des defekten PCs einbauen. Auf die richtigen Anschlüsse achten!
4. PC einschalten, beim Booten durch Drücken der *Shift*-Taste das Autologon unterbinden.
5. Login als Mitglied der Gruppe der lokalen Administratoren (z.B. kuehl, seebach).
6. Das Verzeichnis **<Name des Ersatz PCs>** unter S:\user\groups\mca\4all\intern\xApps\Computer\Linac, \Desy, \Doris, \Petra, \Ttf bzw. \Common löschen.
7. Das Verzeichnis **<Name des defekten PCs>** unter S:\user\groups\mca\4all\intern\xApps\Computer\Linac, \Desy, \Doris, \Petra, \Ttf bzw. \Common umbenennen in **<Name des Ersatz PCs>**.
8. insctmgr.cmd unter S:\services\ControlSystem\xApps\controls\bin\tools\Acc-PCs aufrufen, 'auto device do **<Password>**' eingeben und über die *Enter*-Taste ausführen.
9. Eventuell SedUsb-Treiber über 'Found New Hardware Wizard' gemäß der Anleitung unter ReadMe.txt installieren.
10. Nach Logoff erfolgt automatisches Login.
11. Meldung über die Aktion an R. Schmitz oder U. Lauströer.

Ende !

Meta Control System

Application deployment





> Build and Deploy

- Buildfile: [\win.desy.de\home\labudda\My Documents\My Eclipse Workspace\Locator\Build.xml](#)
Test (Evaluation):
- incrementVersion:
- Packaging:
- jnlpCreate:
- signPackage:
- deployConsoleApp:
 - [copy] Copying 2 files to `\\mcalaunch.desy.de\webapps$\test\common\info`
 - [echo] Jnlp verfuegbar unter
 - [echo] <http://mcalaunch.desy.de/webapps/test/common/info/locator.jnlp>
 - [delete]
Deleting directory `C:\DOCUME~1\labudda\LOCALS~1\Temp\~CommonBuild653335179locator`
- BUILD SUCCESSFUL
- Total time: 1 minute 25 seconds

> [Offline Tool checking JNLP-Files](#)



Network error counters


NetworkErrorCounters





Datei
Editieren
Optionen
Hilfe

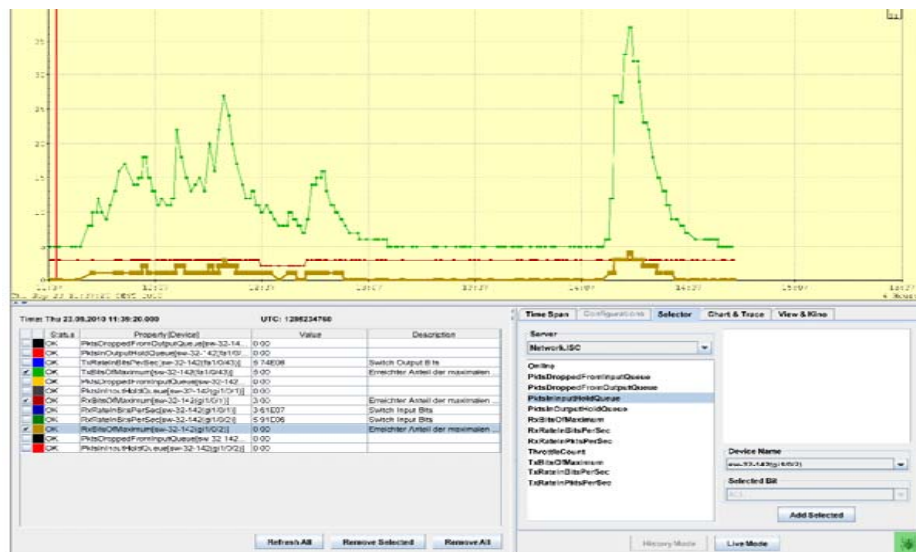
Netzwerk Fehlerzaehler

☒ **Spalten ohne Fehler verbergen**
☒ **Zeilen ohne Fehler verbergen**

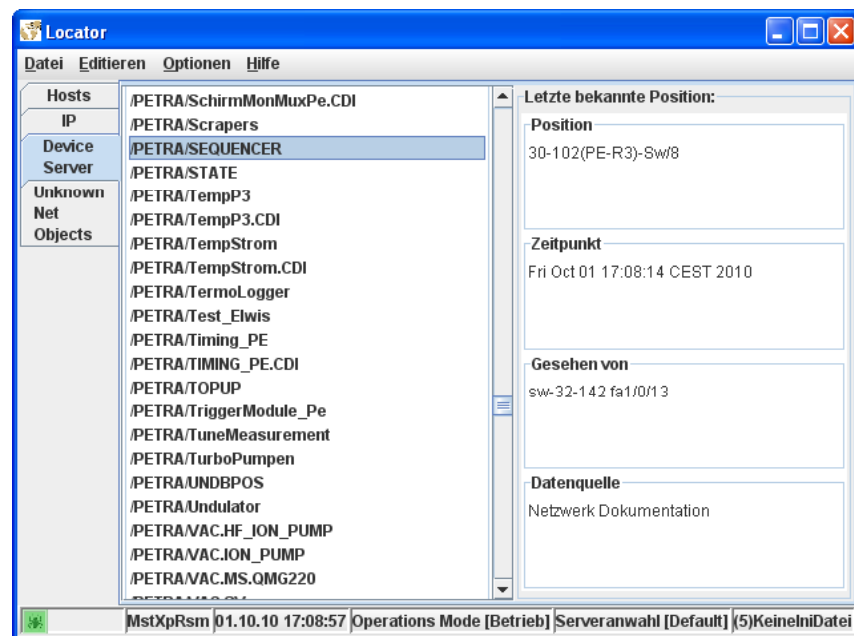
Ports	AlignErr	FCSErr	LateCol	MultiCol	RcvErr	SingleCol
SW-32-129(fa1/0/2)	0	1	0	0	1	0
SW-32-129(fa1/0/3)	0	4	0	0	4	0
SW-32-129(fa1/0/7)	3076	4190	0	0	7266	0
SW-32-129(fa1/0/20)	8	0	0	0	14	0
SW-32-129(fa1/0/21)	0	147	0	0	148	0
SW-32-129(fa1/0/27)	0	0	0	25	0	33
SW-32-129(fa1/0/30)	1	0	0	0	4	0
SW-32-129(fa1/0/31)	0	3	0	0	4	0
SW-32-129(fa1/0/32)	3	1	0	0	5	0
SW-32-129(fa1/0/33)	4	1	0	0	8	0
SW-32-129(fa1/0/34)	16	1	0	0	27	0
SW-32-129(fa1/0/35)	0	0	0	2804735	0	8962068
SW-32-129(fa1/0/36)	0	0	0	3238221	0	12470823
SW-32-129(fa1/0/37)	6	0	0	0	6	0
SW-32-129(fa1/0/38)	6	0	0	0	9	0
SW-32-129(fa1/0/39)	1	2	0	0	5	0
SW-32-129(fa1/0/40)	0	0	0	373	0	1060
SW-32-129(fa1/0/47)	44	5	0	0	85	0
SW-32-130(fa1/0/1)	0	0	0	0	1	0
SW-32-130(fa1/0/6)	0	1	0	0	2	0
SW-32-131(fa1/0/6)	0	0	0	0	0	0
SW-32-131(fa1/0/7)	0	0	0	0	2	0
SW-32-132(fa1/0/14)	0	0	0	0	1	0
SW-32-138(fa1/0/4)	0	2	0	0	2	0
SW-32-138(fa1/0/17)	0	22	0	0	23	0
SW-32-138(fa1/0/23)	3	1	0	0	6	0
SW-32-138(fa1/0/36)	0	0	0	0	1	0
SW-32-142(fa1/0/38)	0	0	0	6776	0	6943

Start: Fri Oct 01 17:17:28 CEST 2010


MstXpRsm
01.10.10 17:18:06
Operations Mode [Betrieb]
Serveranwahl [Default]
(5)KeineInDiDatei



Locator service



Bandwidth usage at 2 selected switch ports



Meta Control System

Preserving Approved Concepts

- > Control system summary reports
 - System restarts ([in 1992](#)) ([today](#))
partly view of system hosts if different OS
 - Network Overview ([in 1992](#)) ([today](#))



Meta Control System

Preserving Approved Concepts

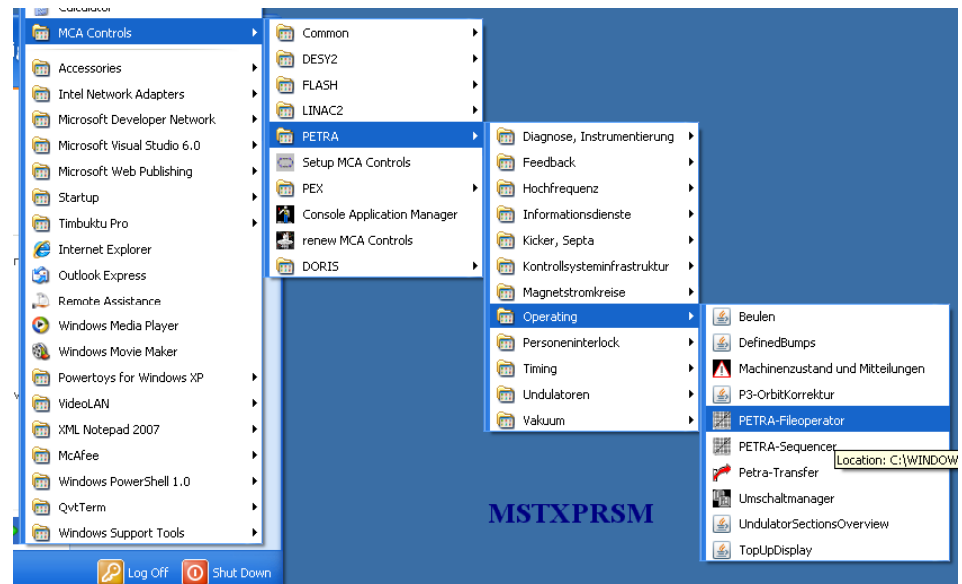
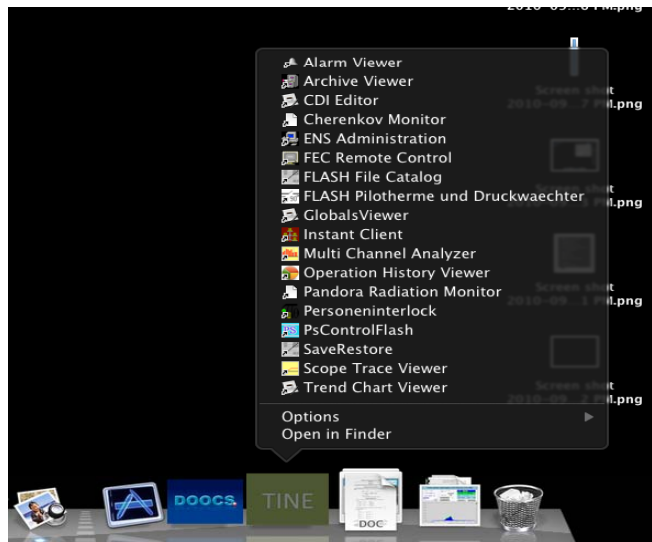
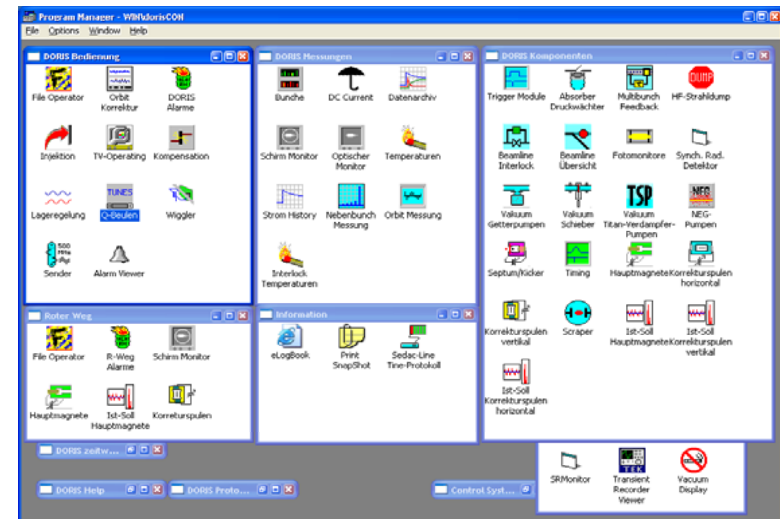
> Control system summary reports

- System restarts ([in 1992](#)) ([today](#))
partly view of system hosts if different OS
- Network Overview ([in 1992](#)) ([today](#))

> Application Launching

- Operating System Features

Program Manager in Windows 3.11
Start Menu Windows
Docks Mac OS

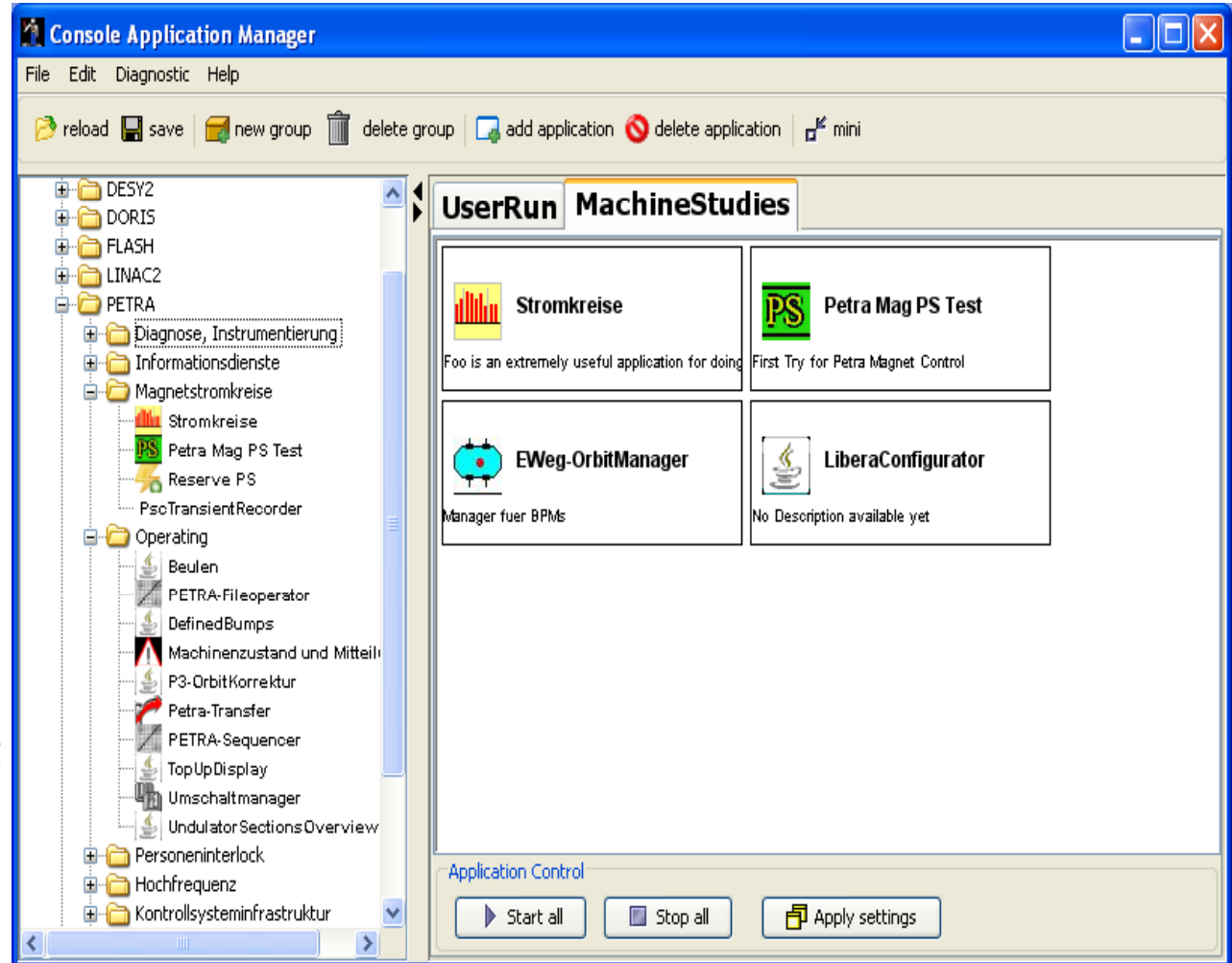


Meta Control System

Preserving Approved Concepts

> Application Launching

- ❖ Operating system independent
- ❖ JMX-based (Java Management Extension) implementation with additional support for non Java Applications
- ❖ automates starts and stops of grouped applications
- ❖ re-applies recently set applications windows attributes



Conclusion

Control System

- > Both the computer with the supporting technology and the control system group are essential to an accelerator's success
- > The control systems group jobs:
 - support the reliable operation of an accelerator in all its different operational phases with as few interruptions
 - formulating and activating the concepts, policies etc. of the meta-control system
- > Each accelerator has a Control System of its own
- > If the meta-control systems are made identical, one control group can be responsible for more than one accelerator-control system:
DORIS III and PETRA III are technically quite different, but the meta-control system are the same -> same control system group
- > The meta-control system is the tool for the great unification of different control systems..



Conclusion

Meta-Control System

- > Keep the concepts etc. of meta-control system alive among people which hold the control system together.
- > Defend the control-system against various quick fix pseudo solutions by applying meta-control system policies. This prevents the control system from running into chaos.
- > Indeed the control system people are the custodians of the meta-control system



What's behind an Accelerator Control System?



The Control System Group!

