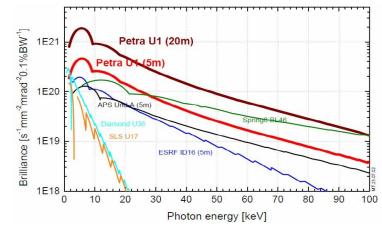
Commissioning of the New Control System for the PETRA3 Accelerator Complex at DESY

> Reinhard Bacher Deutsches Elektronen-Synchrotron DESY Hamburg, Germany

PETRA 3 Light Source

- High-brilliance 3rd-generation light source
- Storage ring: E = 6 GeV, I = 100 mA, $\epsilon_{transverse} = 1 \text{ mm mrad}$
- 14 undulator beam lines operated by HASYLAB, EMBL and GKSS
- Fully remodelled and upgraded between summer 2007 and spring 2009
- First positron beam: April 13th 2009
- First x-ray beam: July 17th 2009
- Start of user beam operation: January 2010





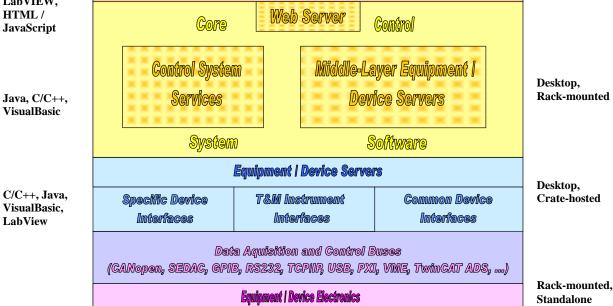
Outline

- Control System Task
 - Basic Design Decisions
 - Collaborative Responsibilities
 - Control System Statistics
 - Project Management Details
- Specific Controls Items
 - The TINE Software Suite
 - Beam-Position System Integration
 - TINE General Purpose Applications
 - Web2c Light-Weight Internet Applications
 - Console Application Manager

Basic Design Decisions

- Radical revision of the outdated control systems of PETRA and the electron/ positron pre-accelerators LINAC 2 and DESY 2
 - Application software (→ Java, C/C++, MATLAB, LabVIEW)
 - Core control system software (\rightarrow TINE)
 - Data acquisition systems (→ PXI)
 - Equipment electronics $(\rightarrow CAN, Ethernet, TwinCAT)$ C/C++, Java, VisualBasic, LabView
 - Network (\rightarrow TCP/IP)
 - Computing infrastructure (→ Windows, Linux)





Control System Architecture

Operating and Presentation Clients

Desktop

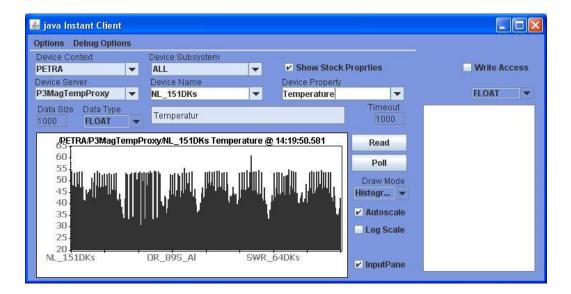
Collaborative Responsibilities

- Tasks have been partially handled jointly by
 - Accelerator controls group:
 - Control room, middle-layer and equipment server applications
 - Core control system software and associated services
 - Computing infrastructure and developer tools
 - Technical equipment groups:
 - Equipment server applications
 - Accelerator physics group:
 - High-level beam physics applications
 - Off-line analysis tools
- Not covered: Beamline equipment and experiment control

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Control System Statistics

- Applications:
 - Client: > 200
 - Server: > 100
- Nodes:
 - Network: > 300
 - Fieldbus: O(10³)
- TINE control points: O(10⁵)



- Allocated man-power (2005 2009): \approx 100 man-years
- Investment cost (2005 2009): ≈ 1 M€

Project Management Details

- Work breakdown structure:
 - mid-sized tasks, resource-loaded
 - continuously refined and updated
- Meetings:
 - weekly team meetings
 - quarterly individual meetings with each team member
 - to assign / reassign tasks
 - to iterate / review tasks
 - problem-oriented team meetings
 - customer meetings ("wish lists")
- Standardized, semi-automated work processes ("best-practice"):
 - application build & deployment
 - code generation
 - interfacing equipment electronics

TINE Software Suite

Threefold Integrated Network Environment (TINE): → THP034

- **Release:** 4.1 available from http://tine.desy.de
- **Multi-platform:** runs on Win32/64, Linux, Unix, MACOS, VxWorks, NIOS
- Multi-architecture: data exchange via client-server, publisher-subscriber, broadcast and multicast communication
- Multi-protocol: supports UDP, TCP/IP and IPX transport protocols
- Kernel: in C and Java
- **API / Bindings:** provided for Java, VisualBasic, C/C++, LabView, Agilent(HP)Vee, MATLAB, Python, .NET and command line interface for scripting
- **Name service:** with plug-and-play automated server registration and user access control
- **Integrated central services:** data filtering and archiving, event handling, alarm filtering and archiving, central message processing and archiving
- Connectivity to other control systems: embedded in DOOCS and EPICS, gateway to TANGO
- Integrated video capability: scheduled transmission in multicast mode → MOD003

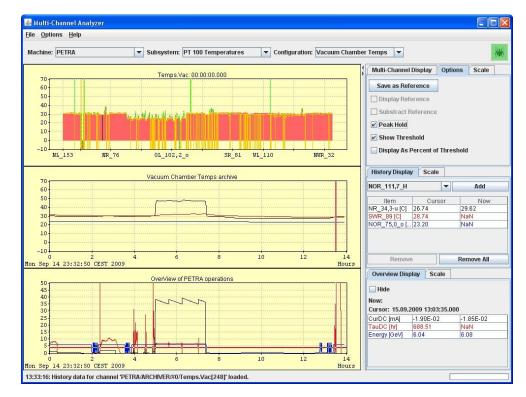
Beam-Position System Integration

- Large-scale distributed system
 - 228 Libera Brilliance BPM modules (Instrumentation Technologies, Slovenia),
 - real internet appliances, communication through the generic Libera Control System Programming Interface (CSPI)
 - n to 1 client server controls topology, all BPM modules are supervised by 1 heavily multi-threaded gateway middle-layer server
 - specific procedures established for remote software installing / updating, restarting and rebooting

\rightarrow WEP073

TINE General Purpose Applications

- "Rich-client" Java client
 applications for the central
 control system services
 - Archive Viewer, Event Archive Viewer, Multi-Channel Analyzer, Transient Recorder Viewer
 - Alarm Viewer
 - Scope Trace Viewer
 - Operation History Viewer
 - Viewers for configuration management and remote control
- Implemented by Cosylab, Slovenia

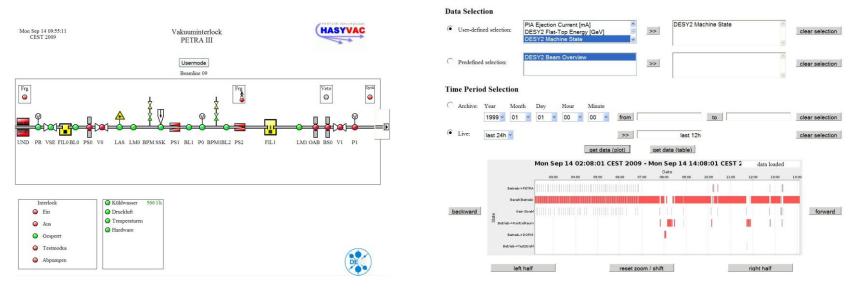


 \rightarrow TUP034

Web2c Light-Weight Internet Applications

• Web2cToolkit:

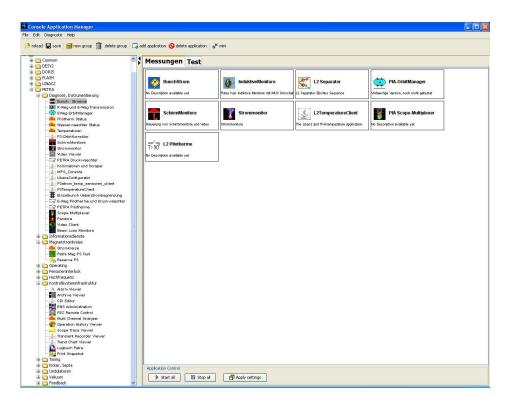
- Framework for internet control system applications
 - Connectors for all major control systems (TINE, DOOCS, EPICS, TANGO)
- \rightarrow THP110
- Connectors for video streams (RTP/JPEG, TINE embedded video/JPEG)
- Customer-specific, browser-hosted, interactive and graphical clients:
 - Synoptic display viewer (Web2c)
 - Graphical synoptic display editor (Web2cEditor)
 - Archive viewer (Web2cArchiveViewer)



MOB004, ICALEPCS 2009

Console Application Manager

- JMX-based management tool with additional support for non-Java applications
 - configurable launching pad for operator's applications
 - combines applications to task-specific groups
 - automates starting and stopping of grouped or single applications
 - re-applies screen attributes of applications (size and position)
 - preserves operator's preferences



\rightarrow TUP018