

ANKA EPICS Status Report

EPICS Collaboration meeting, CEA Saclay 2014 Igor Kriznar, Sebastian Marching, Nigel Smale

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The ANKA

The ANKA accelerator complex consists:

- 53 MeV microtron
- 500 MeV booster synchrotron
- 2.5 GeV storage ring
- The injector has a repetition rate of 1 Hz and the booster current is about 5 mA.
- up to 200 mA at 500 MeV and then ramped to 2.5 GeV.
- The lifetime of the stored beam at 2.5 GeV is 16 hours for 150 mA.



ANKA Control System Big Picture



Constantly evolving situation



History of recent changes



Highlights

- CSS Alarm system successfully in operation since beginning of 2014
- Archive data saved in Cassandra database
- No beam loss over the last year by EPICS or CSS, but there is new hardware too.
- All done within 1,5 FTE/Year plus outsourcing
- Other larger milestones
 - 07.2014 CATACT wiggler is controlled with EPICS, collaborative work with BINP
 - 06.2014 demonstrated LLRF, done in half a day as EPICS is used on DIMTEL.
 - 01.2014 Further power supply cabinets replaced with Delta, extraction line, all on EPICS/CSS.
 - 10.2013 DIMTEL BBB went into operation. Installed within hours mostly due to the EPICS compatibility.
 - 07.2013 Applied new naming convention for EPICS PVs
 - 07.2013 Agilent ION pump controllers now in CSS, work outsourced to Cosylab
 - 07.2013 Replaced bunch of power supplies with Delta 110A 66V SMS66-AR-110. Now EPICS.
 - 07.2013 IMAGE/Darsbury wiggler closed and beam aligned EPICS control.
 - 03.2013 New video switch integrated in EPICS.
 - 03.2013 Cassandra Archiving database commissioned
 - 01.2013 Host names and DNS change, private network
 - 12.2012 EOS goes into vaccuum. EPICS, etc. from PSI
 - 07.2012 NANO/Darlsbury wiggler part one goes into operation with EPICS control.
 - 06.2012 Switched over to private network
 - 01.2012 Switched over to Libera for orbit correction, now all epics

EPICA at ANKA in Numbers



- Cassandra Archiver PVs: 2450 + 1360 + 6156 + 1735 = 11701
- CSS BEAST Alarm PVs: **737**
- loCs
 - IOC Device drivers
 - No. of devices: 131
 - No. of PVs: 5878
 - Soft record PVs in Java Application server: 459
 - EPICS meta server, converts ACS PS PVs to mandatory PS format
 - No. of PS devices: 117
 - No. of PS PVs: 3978
 - Various dedicated alarm IOC PVs
 - No. of devices: 130
 - No. of PVs: 2108
 - Integrated PLC device
 - No. of devices: 2
 - No. of PV's: 184
- All together: 12507 PVs

ANKA Alarm with CSS/BEAST 1/2



- Quality comes before quantity!
 - Adding all alarm sources or PVs into the alarming system does not provide a functional alarm system.
 - We add only relevant and filtered alarm sources not to loose trust of operators.
- There are two main rules for a functional alarm system:
 - System should provide only alarms to which operator must react.
 - Alarm system must not provide to operator more alarms that operator can handle.
- Most alarm sources conditioned/filtered by machine operation state
 - Host ping: Makes periodic network ping
 - System Process Watchdog: Runs on Windows or Linux computer, can intercept Java Error s on Windows servers.
 - Status Check: Monitors PVs with bitset value, alarm if bits matches on or off bit-masks.
 - State Watchdog: A PV value must be reset in regular intervals by some remote process.
 - Summary Alarm: Listens to one or more PVs, sums their alarms, and forwards them further if machine operation state allows.
 - alarm sums of a sub-tree in the BEAST alarm hierarchy three.
 - Value Diff Check: Check value difference between set-point and read-back of a power supply. All power supplies are included.

ANKA Alarm with CSS/BEAST 2/2



- If all is well, everything should be green
 - even during the shutdown

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Cassandra Archiver at ANKA



- CSS/BEAST/DataBrowser with own archiving engine to Cassandra DB
- Cluster of three nodes three more to be installed soon.
- Replication factor of three (same piece of data is store on three nodes).
 - Failure of one complete node can be handled without affecting the database service.
- Currently archiving 11,700 channels.
- Has been running for ~18 months, current net amount of data ~1.2 TB and growing...
- Benefits of NoSQL Cassandra
 - Can distribute data over a virtually unlimited number of nodes.
 - Scales linearly.
 - Much faster than RDB archiver.
 - High availability through replication.



Trying to Make It Easy for Operators



Two distinct user types

- Machine operators: a stable and a predictable environment, go through an reliable procedure which should give a reproducible end result.
- Experts and scientists (students): vague procedures, all options open and tools available, tools or procedures during work, not used again.
- ... in addition
 - No full-time operators, they primary work in engineering and technical departments
 - Operators are active in control room during injection time twice a day for approx. one hour, morning and evening, individual operator active time about 10 hours in two months
 - Long period in which changes are accepted or feedback provided
- As consequence:
 - Intuitive, simplistic, predictable, standardized GUI design
 - Different panels or sets of panels of the same application or device for different users
 - operation oriented panel organization in CSS
 - Standardized components and tools for same kind of devices

Operator's Desktop Concept 1/2





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Operator's Desktop Concept 2/2



- One CSS application instance per computer screen, full-screen mode, applications/tools/device panels in tabs.
- Distribution bundles with well controlled execution environment
 - Distribution channels in Subversion
 - distribution tools, version control with logging, rollback
 - Mostly one-way commit&update procedure, only one local base copy
 - Channels/bundles: Servers, ACS clients, PVSS, CSS clients (ANKA-Clients)
- Mains ANKA-Clients bundle
 - Common Launcher, CSS main panels, Alarming (CSS) panel, Archiving (CSS) panel, CSS Development, BeanInfo, special CSS panels
 - Own Workspace for each CSS shortcut
 - For production CSS instances Workspace is reverted to template
 - Two branches in SVN: main (production), work (development)

Standardized CSS BOY Components



Standardized GUI components for same type of device or operations

- device model, actual capabilities might be vary
- 📒 require standard PV names
- Devices of same type displayed in same widgets and OPI files, device prefix of PV delivered with macro
- Channel (PV) Naming Convention (<Domain>:<Location>:<Device Type>:<[<Name>-]Number>:<Property>)
- Device Type Convention
 - Common, mandatory for all
 - <Prefix>:Status:ErrorSum
 - Status LED, Alarm system
 - General recommendations:
 - cmd: commands (pref:Cmd:On, pref:Cmd:Off)
 - Info: information about the device. (pref:Info:IDN)
 - status: status of the device
 (pref:Status:ErrorSum)
 - Device Type Mandatory
 - Example Wiggler: Cmd:Abort , Cmd:Close, Cmd:Open, Info:Beamline, Position:Closed, Position:Open, Position:Setpoint, Position:Readback, Status:Closed, Status:Moving, Status:Open

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Status bit error ON/OFF	
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Field with MAJOR alarm	
Field with INVALID alarm or disconnected	
Value different from last actual	
Value is updated manually	
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Conclusion



- Three year ago there were no EPICS PVs in operation
- We were easily integrating different components due to active community
- Effort still in progress
 - Majority of PS to be upgraded or integrated
 - Including ramping PS
 - Low level RF
 - A lot of odd single unit devices



Thank you for your attention!

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