# ANKA EPICS Status Report

EPICS Collaboration meeting, CEA Saclay 2014
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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.

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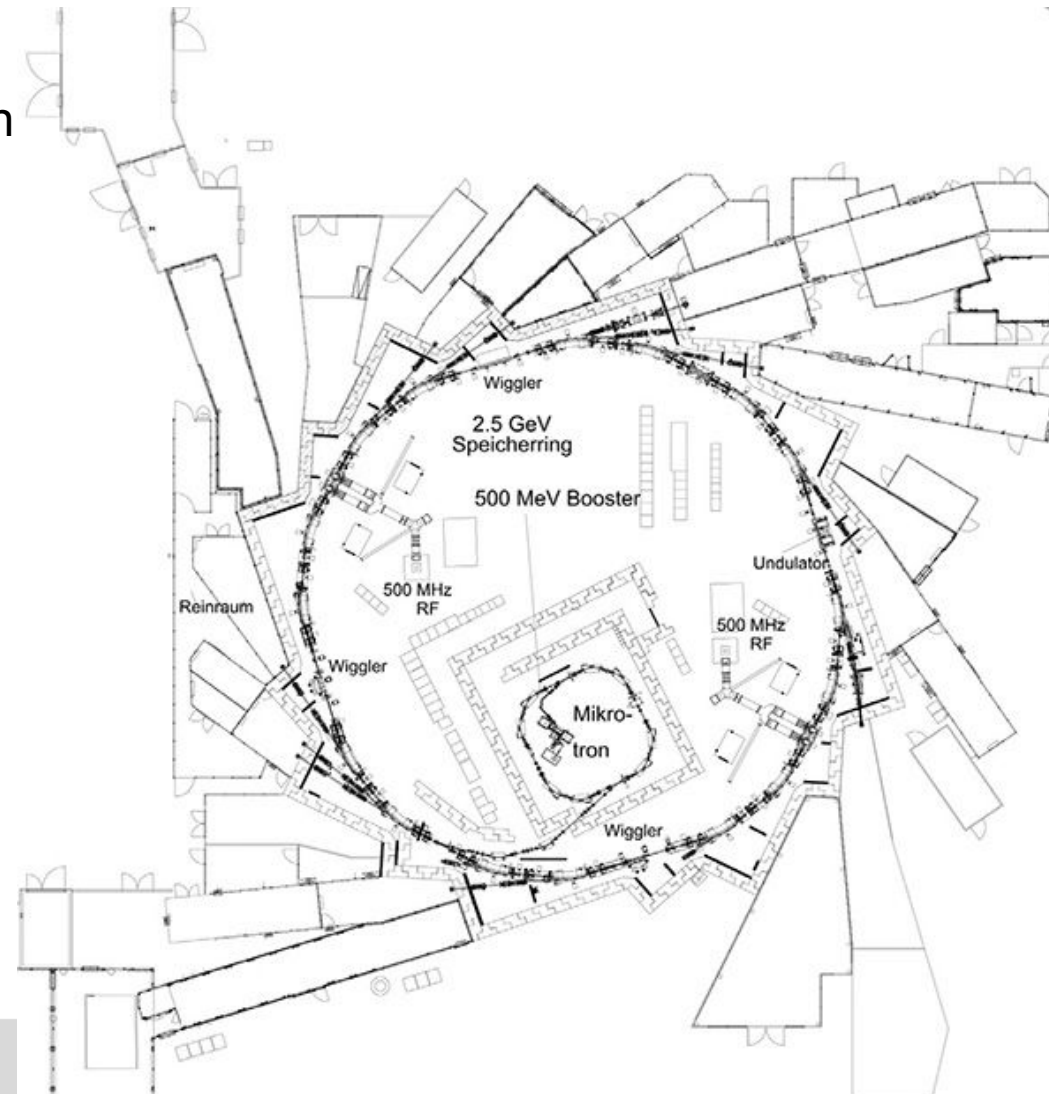
ANKA Control System Big Picture

- Constantly evolving situation

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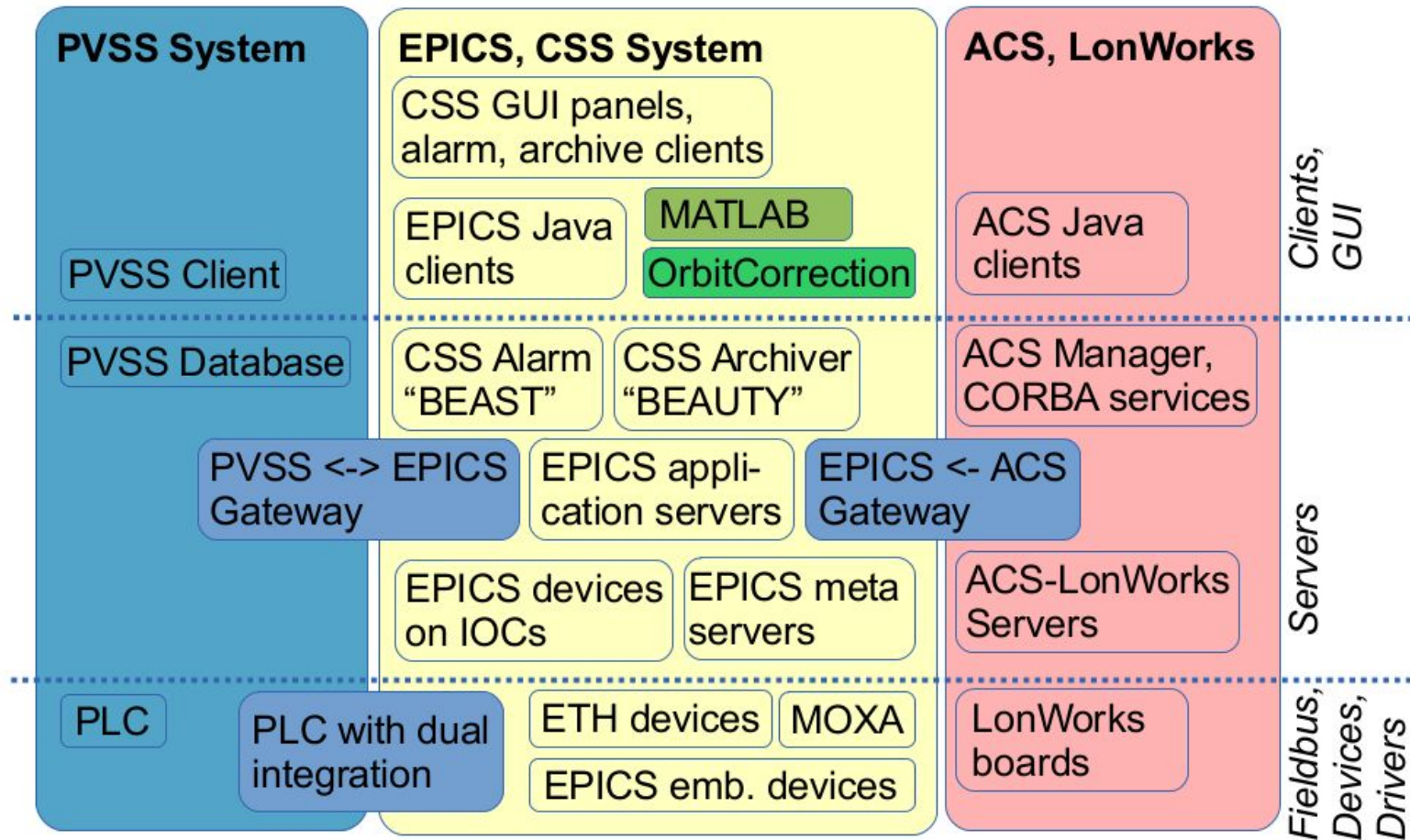
History of recent changes

- 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
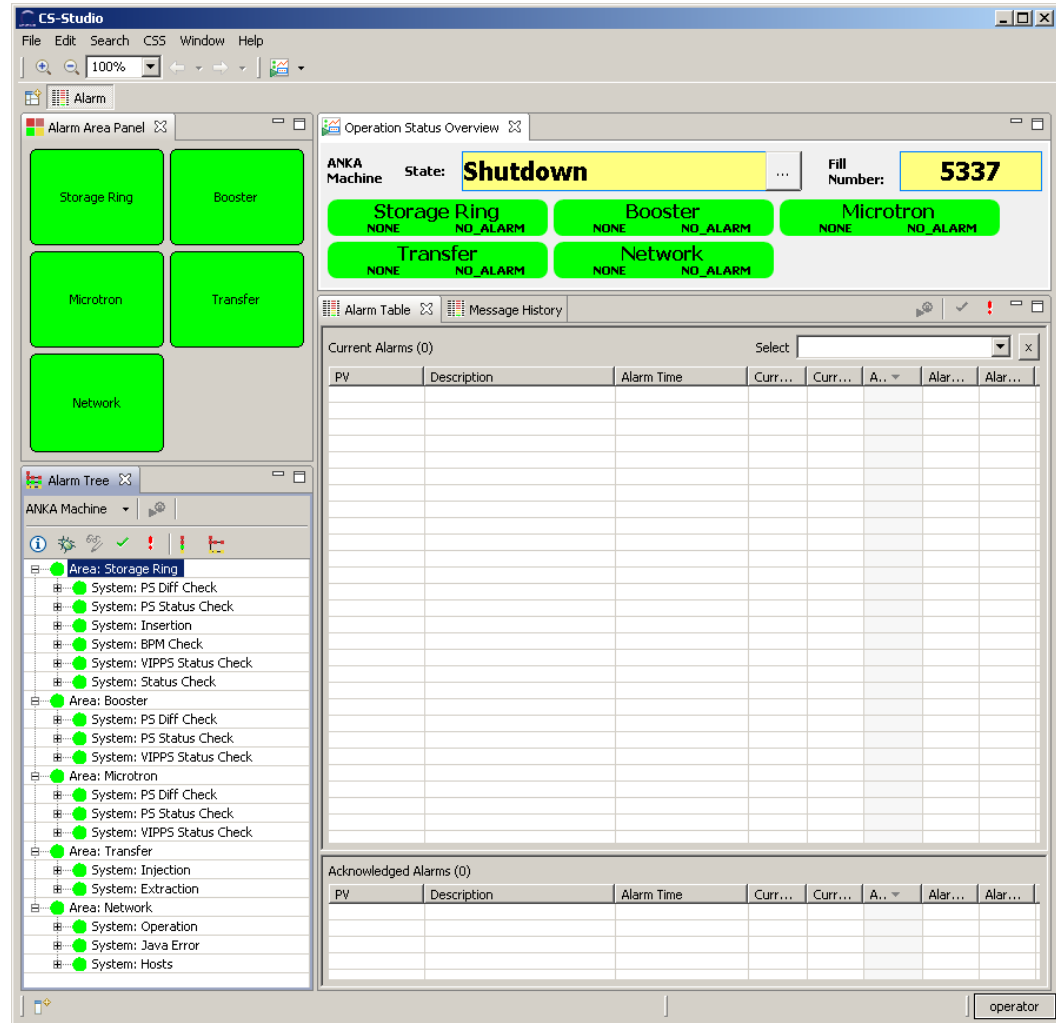
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EPICA at ANKA in Numbers

- Cassandra Archiver PVs: 2450 + 1360 + 6156 + 1735 = **11701**
- CSS BEAST Alarm PVs: **737**
- IOCs
  - 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

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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.

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ANKA Alarm with CSS/BEAST 2/2

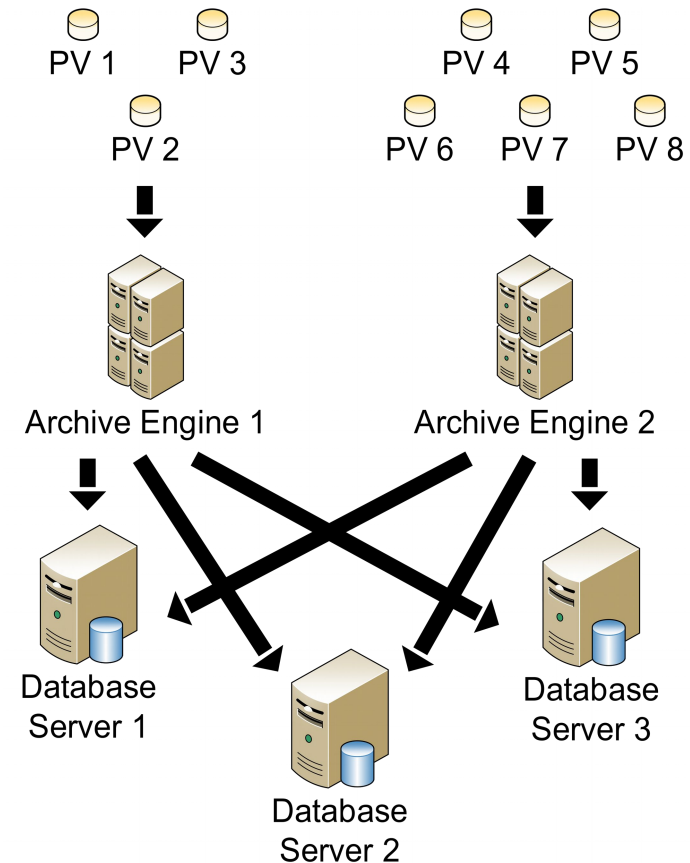- If all is well, everything should be green
  - even during the shutdown
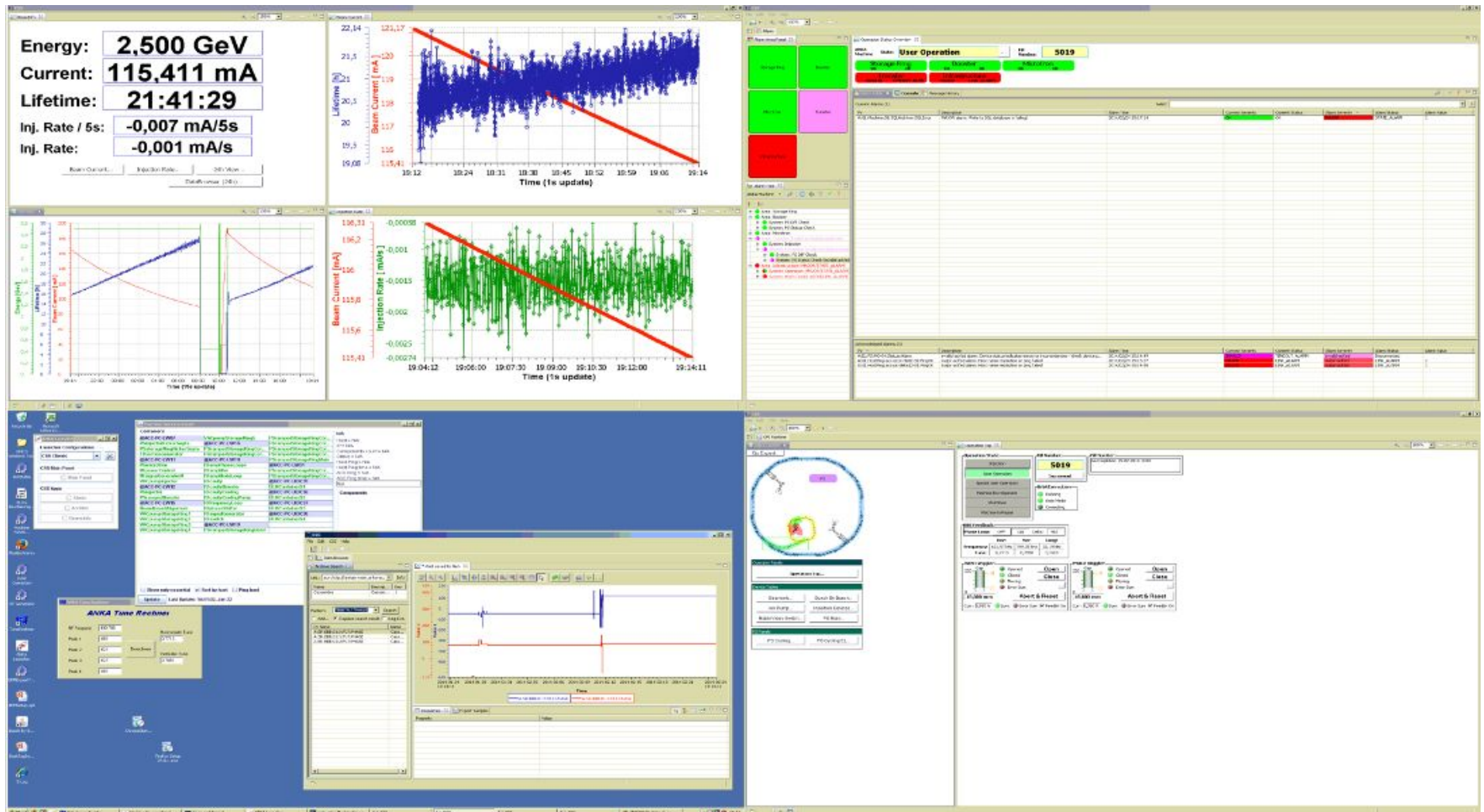
Cassandra Archiver at ANKA

- 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.

PV 1   PV 3   PV 4   PV 5

PV 2   PV 6   PV 7   PV 8

Archive Engine 1   Archive Engine 2

Database Server 1

Database Server 2

Database Server 3

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

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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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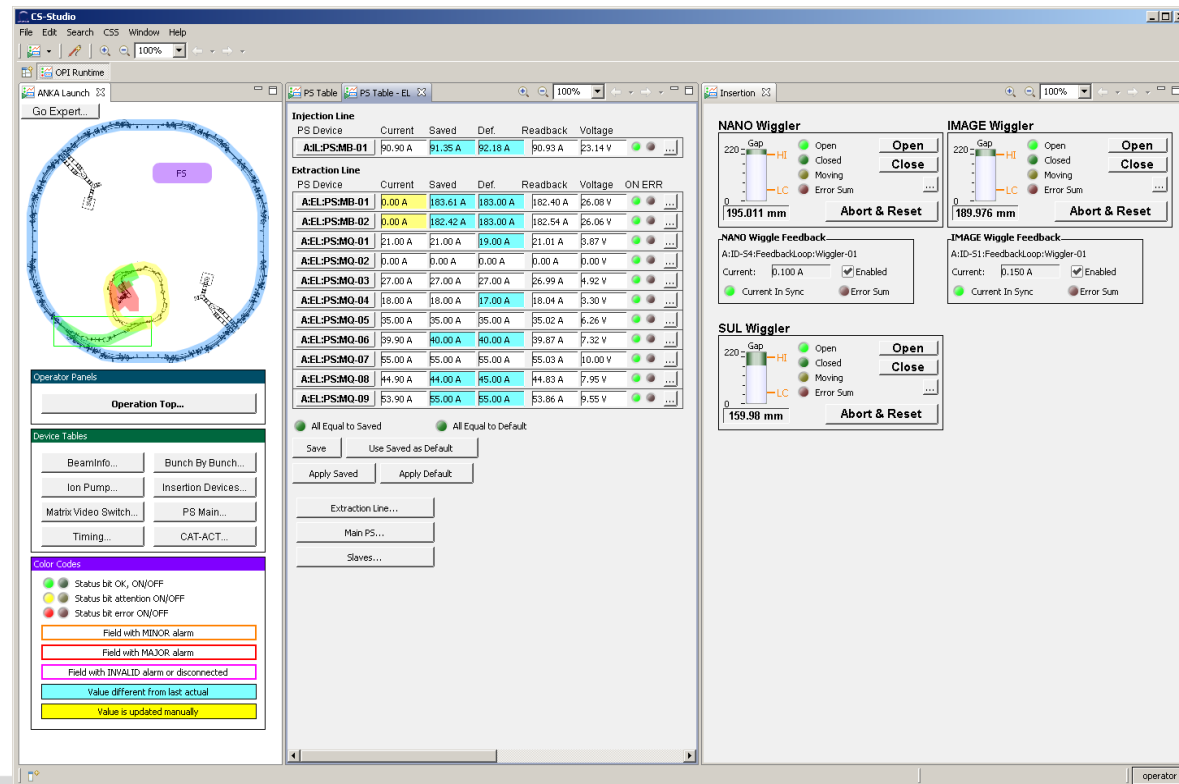
Conclusion

- 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

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Thank you for your attention!

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