PANDA Detector Control System Status

2015 at a glance

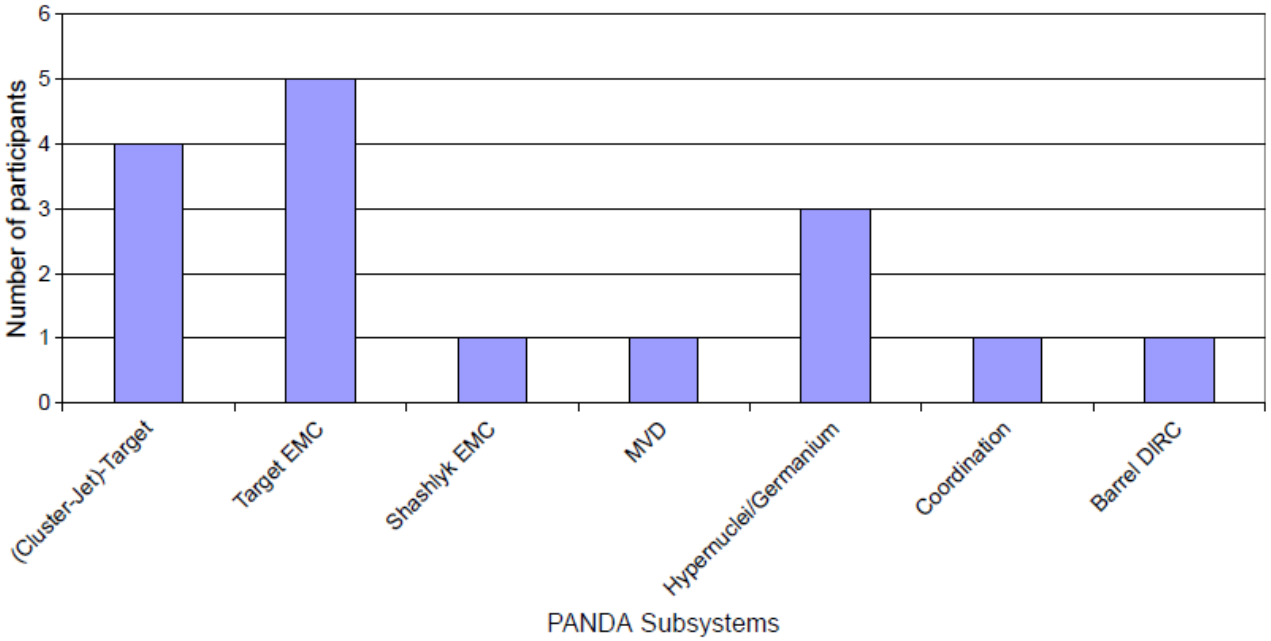
- (DCS Status Dec. 2014 @ Jülich Collaboration Meeting)
- 23-25 February, ***EPICS hands-on tutorial*** at Helmholtz-Institute Mainz
- ***PANDA DCS Software Repository*** for Linux Debian
- ***Three DCS sessions***: March (Giessen), June (Uppsala), December (Vienna)

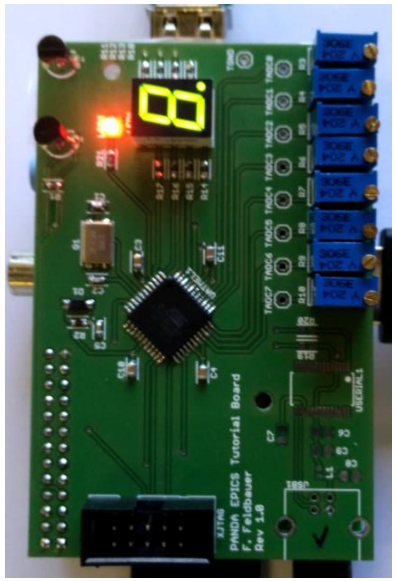
  - March – 4 contrib. (Technical design, MVD, …);
  - June – 2 contrib. (EPICS snmp driver; LUMI FSM);
  - Dec. – 4 contrib, (EMC, HYP. Setup, Gateway, HESR sw. interf.)

EPICS hands-on tutorial (23-25 February 2015)

Organizers and tutors: Tobias Triffterer and Florian Feldbauer

- **16 participants;**
- hands-on a RPi + Tutorial board;
- Compilation and installation of EPICS and support modules;
- Create an Epics IOC and PV database;
- Usage of StreamDevice to communicate via serial port.





PANDA DCS Software Repository for Linux Debian

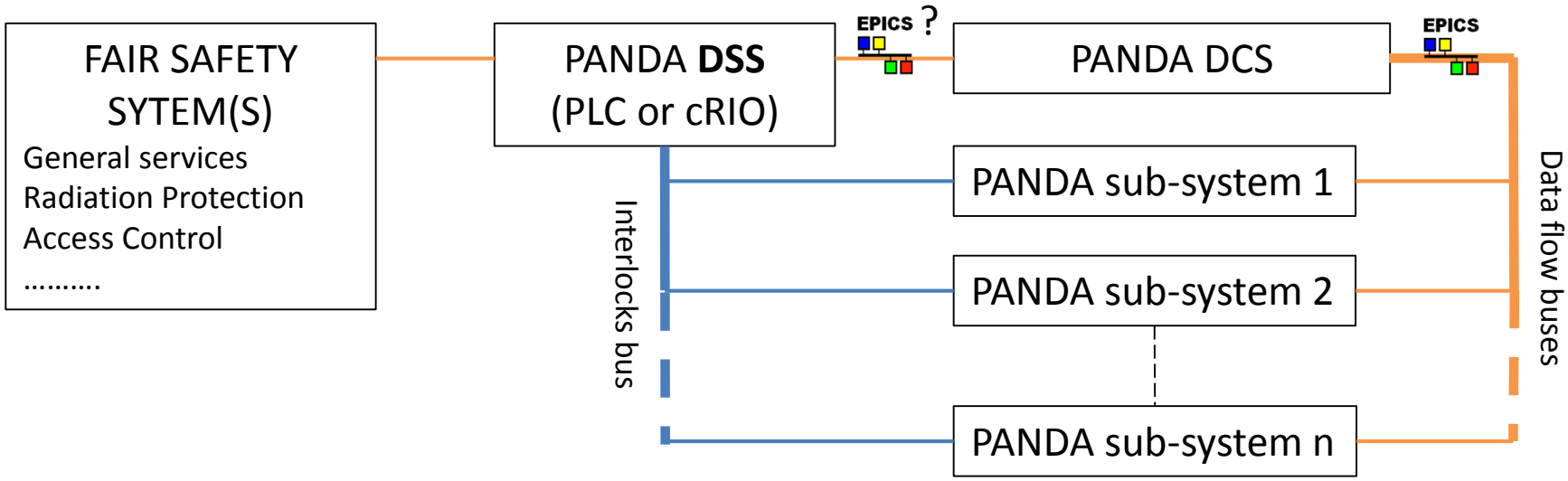
- Created and maintained by Florian Feldbauer;
- To simplify maintainability of EPICS installations:

  - EPICS distribution and support modules: epics-base, asynDriver, SEQ, streamDevice, devsnmp, cagateway;
- drvAsynCan: EPICS device support module for Rpi + CANbus (ISEG EHS/EDS high voltage modules, Wiener VME crates, PANDA THMP board, PANDA-EMC light pulser, TMCM142 1-axis stepper controller/driver);
- Repository available for amd64, i386 and armhf (Rpi/Beaglebone SBC's);

- *http://panda-service.gsi.de/repo/*

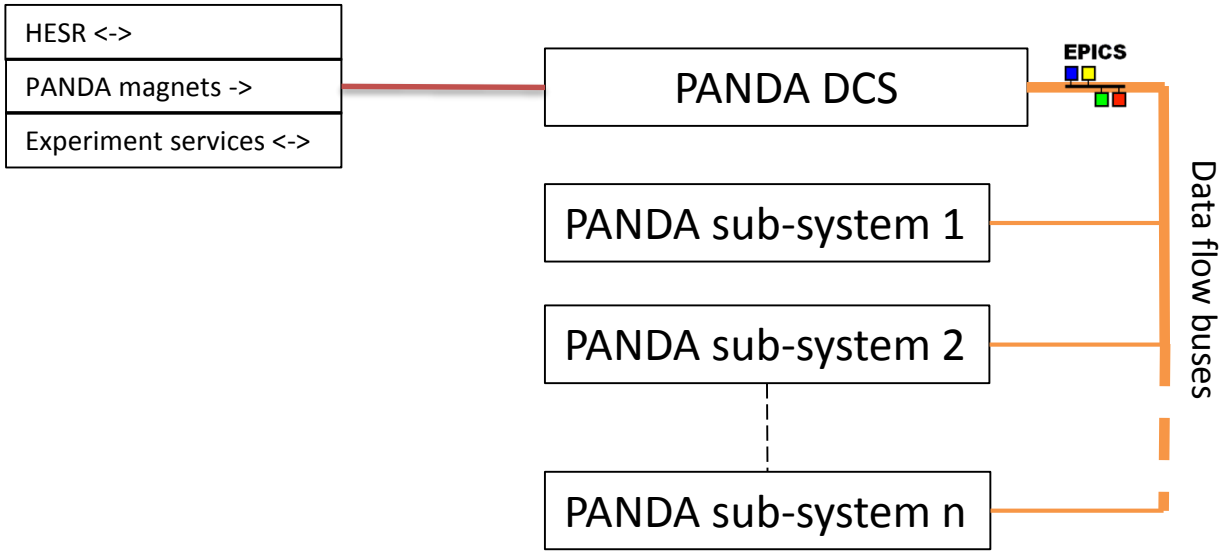
PANDA DCS (& Class 1 External Control Systems)

- Mainly **designed to monitor, control and configure** the hardware components of **PANDA experimental setup**;
- **Not considered to provide personnel protection**;
- Operate independently of **PANDA Detector Safety System (**?!) ;
- **Complementary** to other **FAIR Safety System(s)**.



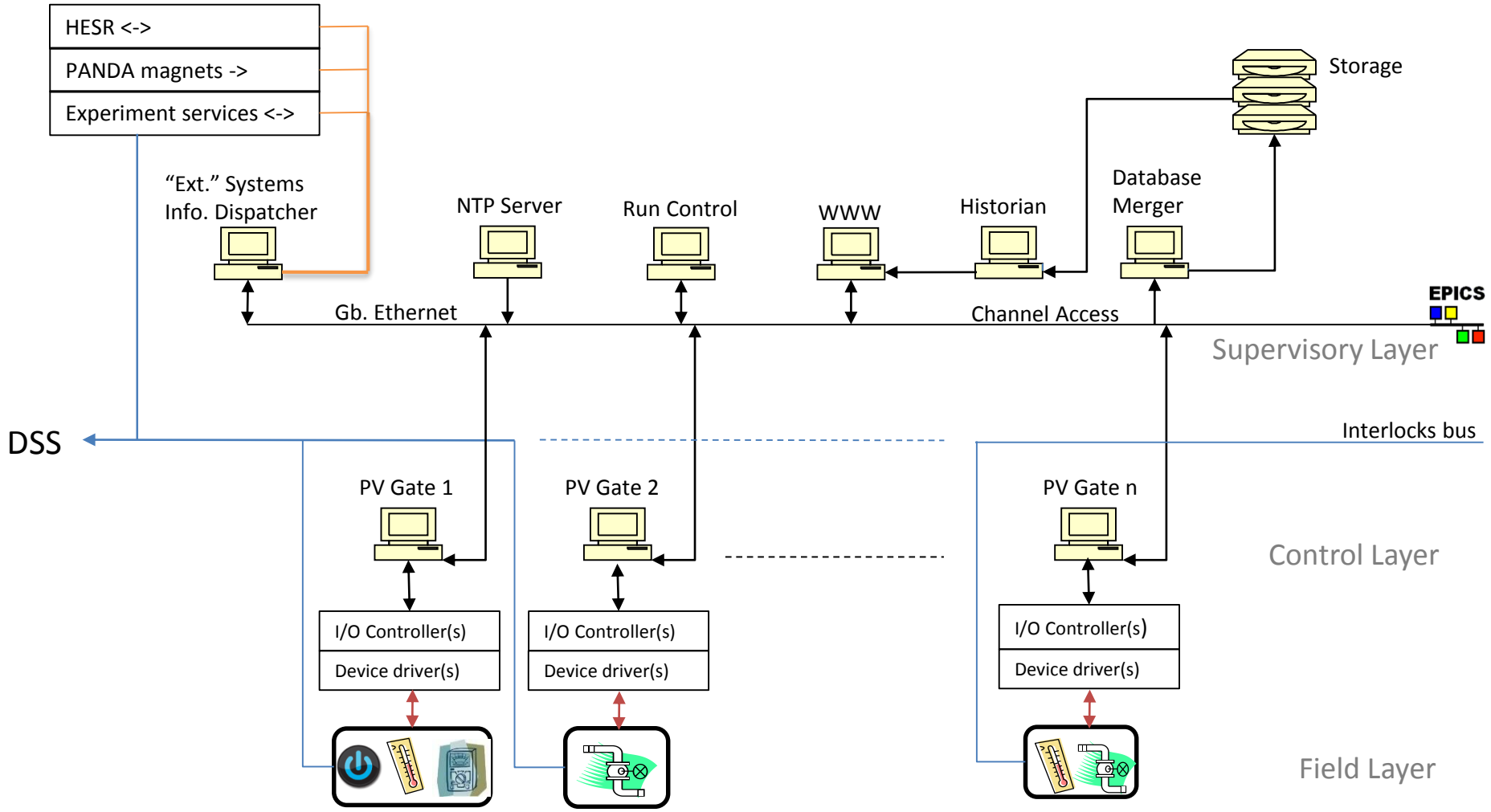
PANDA DCS (& Class II External Control Systems)

PANDA Magnets and (probably some) Services are delivered with Autonomous Supervisory Control System >> treated as “external”



Need to add an PANDA DCS “external” systems information dispatcher (preferably Linux workstation)

PANDA DCS Layers



PANDA DCS interface with HESR

HESR can be treated as **CLASS I system** >> **during injection and beam development** can turn into a **major safety issue** for some PANDA sub-systems (MVD, LUMI) <=> FAST Beam dump request (HW ?)

HESR < = > LUMI – luminosity & background; detector position control & firmware;

< = > PANDA MAGNETS !?

< = > PANDA TARGET(S) ? (we need a feedback loop ?)

< = background levels from other PANDA sub-detectors;

HESR status = > filling, ramping, tuning, stable beams available to **ALL PANDA** sub-systems;

HESR beam parameters => current, energy, etc available to **ALL PANDA** sub-systems.

We need to plan **a dedicated interface with HESR at the DCS Supervisory level acting** also as an i**nformation dispatcher for ALL PANDA sub-systems**.

PANDA DCS (software) interface with HESR

FAIR Control System:

- Frontend System Architecture (FESA) framework developed at CERN (LHC) to control part of accelerator equipment ;
- UNICOS CERN framework - WinCC OA (former PVSS) to control vacuum and cryogenic equipment.

No software support for EPICS CA inside WinCC OA or vice-versa

DIM - Distributed Information Management client/server communication system can be used as a bridge between the two SCADA;

PVSS-DIM toolkit - Latest release 20r8 (22.01.2015);

EPICS-DIM interface

- caDIMInterface (GSI- H.Brand 2006);
- Latest release (2010 ?) by P. Zumbruch (GSI);
- Unsuccessful runtime on Epics 3.14.12 – more support needed

EPICS <-> WinCC OA strings exchange via 2 TCP sockets

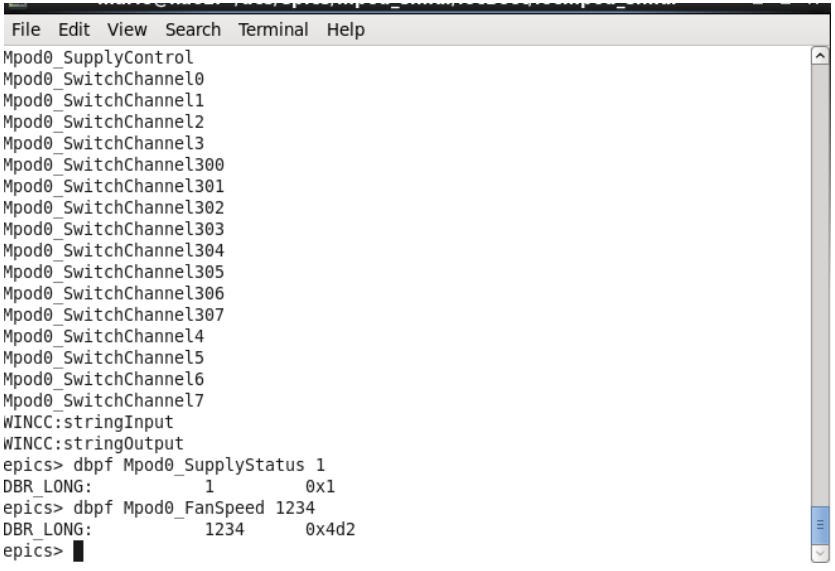
EPICS IOC TCP socket client/server

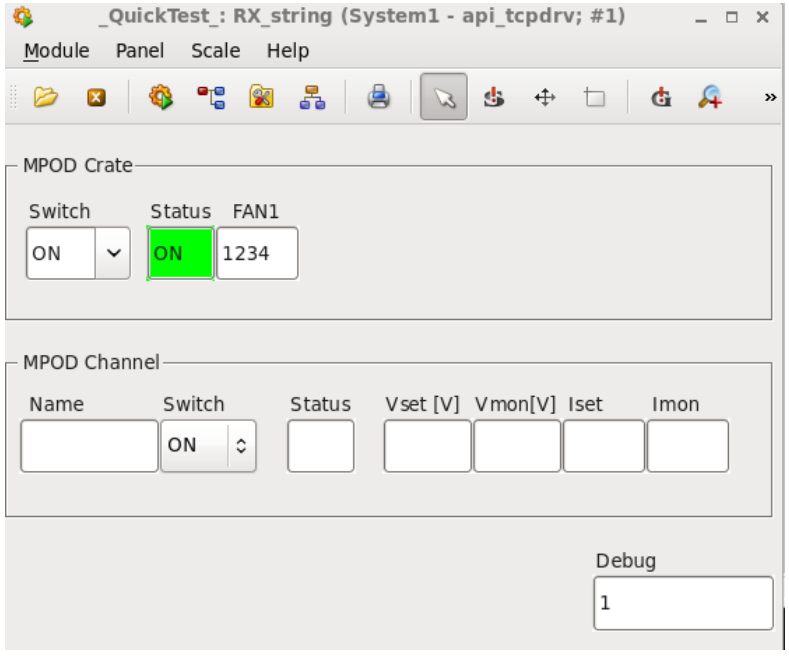
- Beaglebone Black SBC with Debian Linux;
- EPICS, asyndriver, sequencer, streamdevice, scalcout;

WinCC OA API TCP driver project

- TCP communication protocol sources
- TCP String to PVSS DataPoint conversion;
- Needs some fine-tuning “to talk” with EPICS 3.14.12 on RHEL 6 flavors.

Functional software prototype @ IFIN-HH:





PANDA DCS Finite States

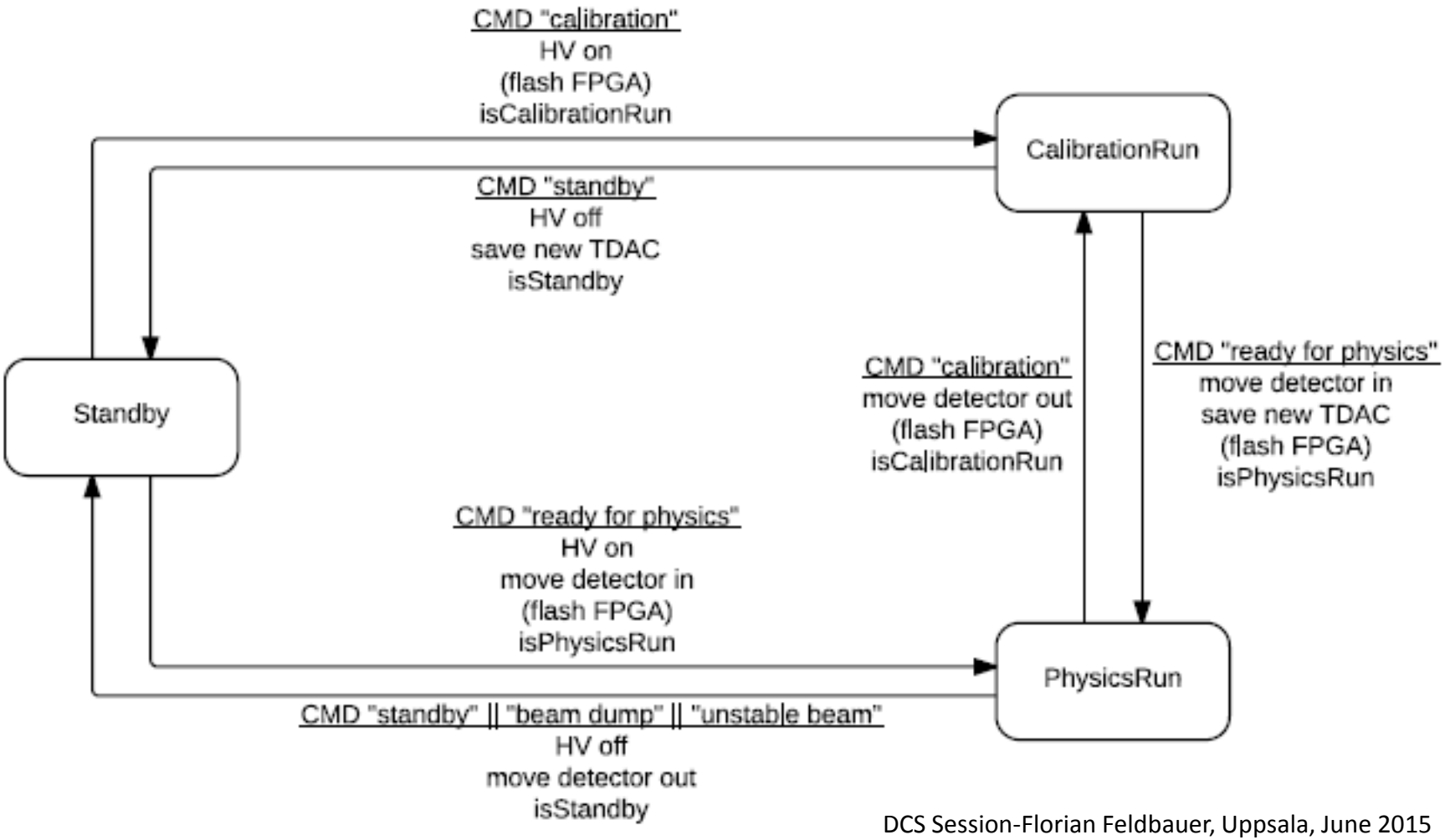
- *Simple commands* sent from the Supervisory Layer to PANDA sub-systems should trigger well defined actions directing to the transition of the sub-system from one steady state to a different steady state

Eq.: *Get ready for physics* (HV up, detector moving, etc)
Go to safe mode (HV down, detector moving, etc)
Calibration (……..)
Shutdown (…….)

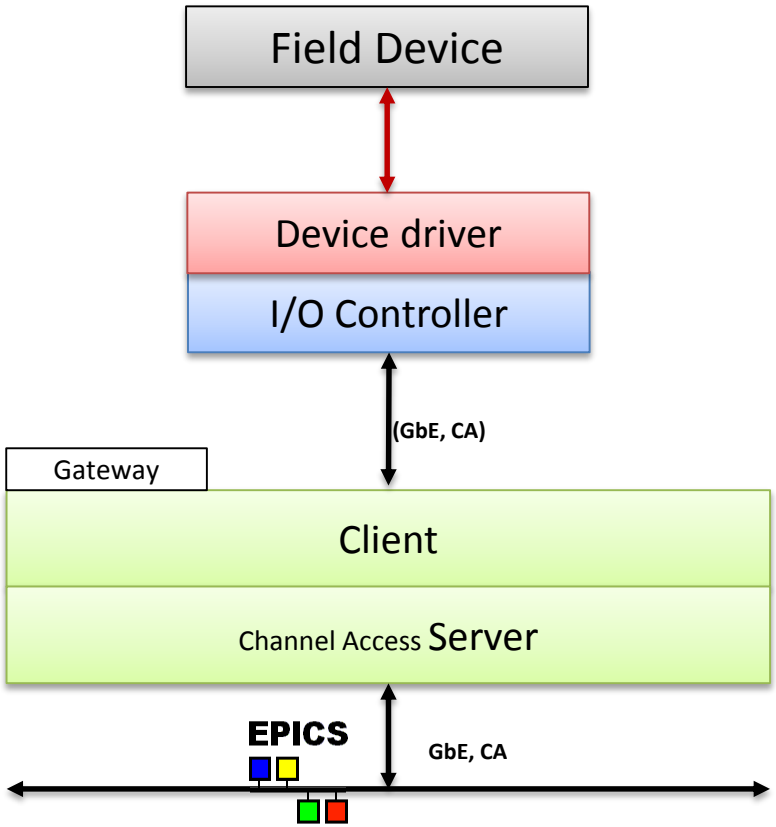
- HESR states should also trigger well defined actions
  Stable beams (…..)
  Beam dump (…….)
  Unstable beam (…..)
  Machine development (……)

FSM model for the PANDA Luminosity Detector

Four operational steady states: Standby, PhysicsRun, Calibration, Shutdown



Process Variable Gateway



Gateway: Linux server with at least 2 NIC, EPICS 3.14 & PV Gateway 2.0;

- Reduces the load on critical IOCs;
- Provides convenient access from one subnet to another;
- Provides extensive additional access security.

PANDA DCS Session 2013

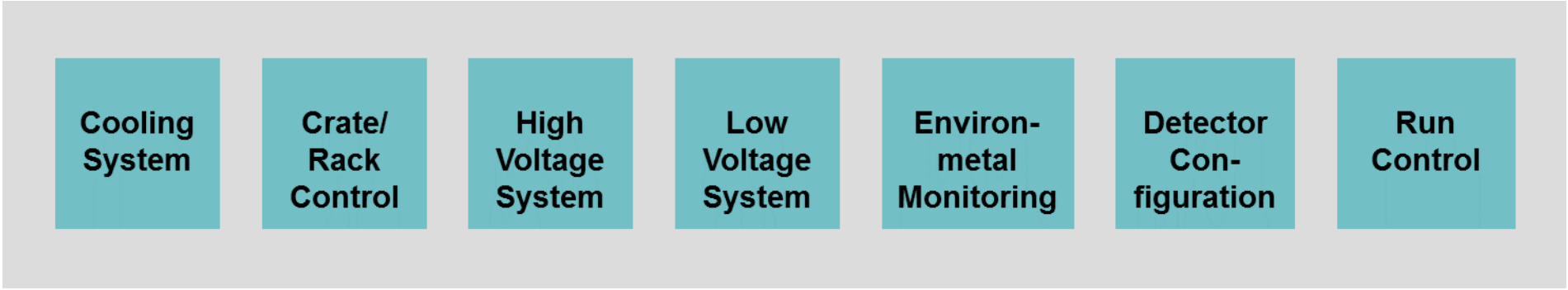
Latest PANDA DCS Session (30.11.2015)

- Configuration of PV Gateway Release 2.0.6;
- Description of CA Security concepts.

DCS sub-systems developers are invited to follow Florian's slides and set-up a gateway to supervisory level.

New PANDA sub-systems defined their DCS requirements

MVD – Harald Kleines, March 2015 DCS session



- Ethernet for power supplies, crate control
- GBT-SCA (indirectly via MicroTCA backplane) for detector configuration, run control and environmental monitoring
- PROFINET to PLC for Cooling system, environmental monitoring

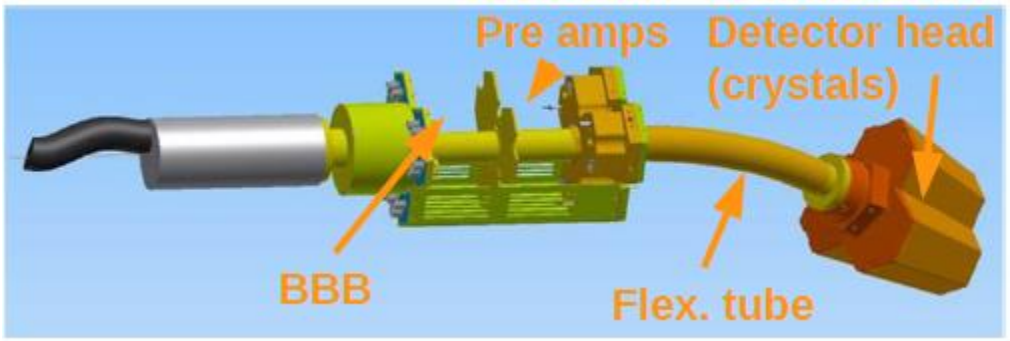
Number of FTEs in 2015: ca. 0.2 (from ZEA-2 for PLC design)

New PANDA sub-systems defined their DCS requirements

Hypernuclear setup – Marcell Steinen, 30.11. 2015 DCS session

Controls devided into three components

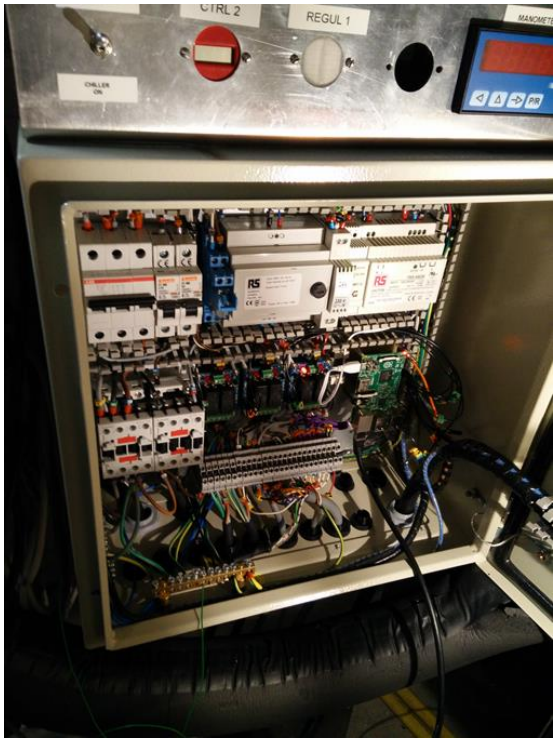
- Primary target: motion control with piezo motors and actuators (bachelor thesis in progress);
- Secondary target: same Si detectors as MVD (common DCS solution);
- PANDA Germanium array (PANGEA): Beaglebone SBC as IOC to control bias voltages, temperatures, preamp. configuration.



Controls for the EMC cooling system prototype

Tobias Triffterer, 30.11. 2015 DCS session

- Cooling system intended to be used for testing of the Forward Endcap EMC;
- Capable of cooling the complete endcap and one barrel slice;
- Cooling system for the complete EMC: Scaled-up version of this system.



- Raspberry Pi in the cooler control panel;
- Relais connected to its GPIOs;
- USB-RS485 adapters connected to USB;
- Control of pump, flow meter, chiller;

- All important safety precautions hard-wired => a failure in pumping or flow will cause immediate shutdown of chiller

Some DCS open questions for 2016

Supervisory layer:

- Interface with the HESR (WinCC OA, DIM, …);
- DCS Database: commercial or open source (?), common with DAQ (?);
- Interface with PANDA magnets and external services unknown;
- Information exchanged between Target-Lumi-HESR.

Control layer:

- EPICS IOC based on ARM SBC (Rpi and BBB) implemented by many sub-systems (radiation hardness testing needed);
- Cluster Jet Target LabView cRIO ⇔ EPICS prototype;

DCS design:

- Decision on the Detector Safety System;
- Decision on the Experiment Run Control System.