

Data Acquisition, Monitoring, Control and Safety Systems for Experiments

June 22, 2017



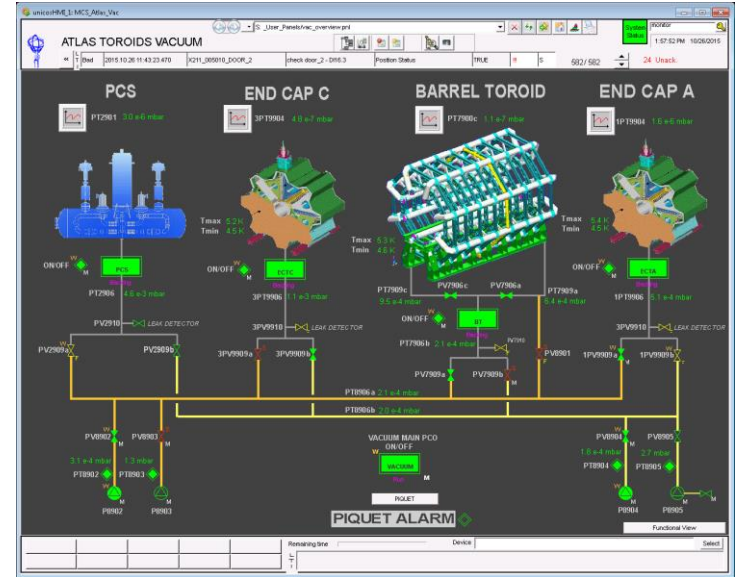
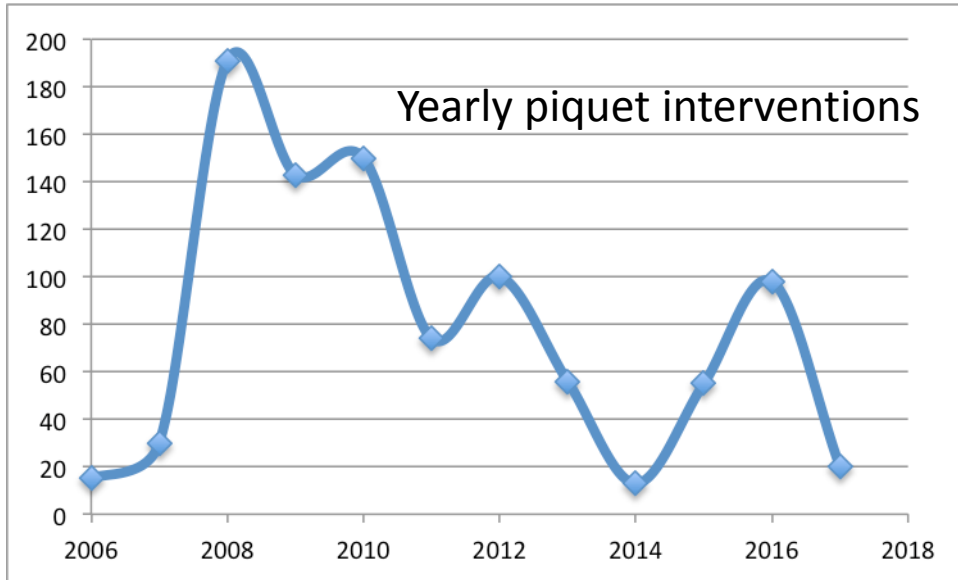
Outline

- Field of expertise
- Controlling and measuring magnets
- Safety systems for experiments and facilities
- Detector & detector infrastructure control
- Data Acquisition for experiments

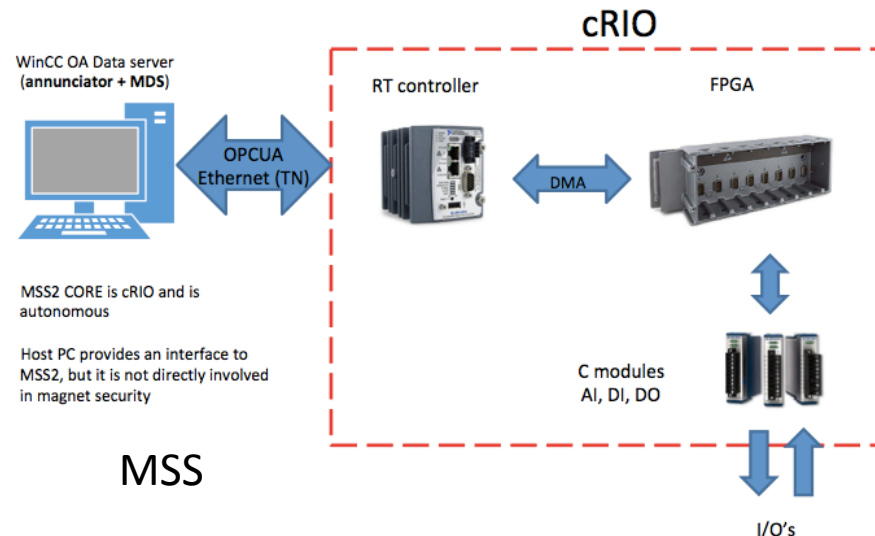
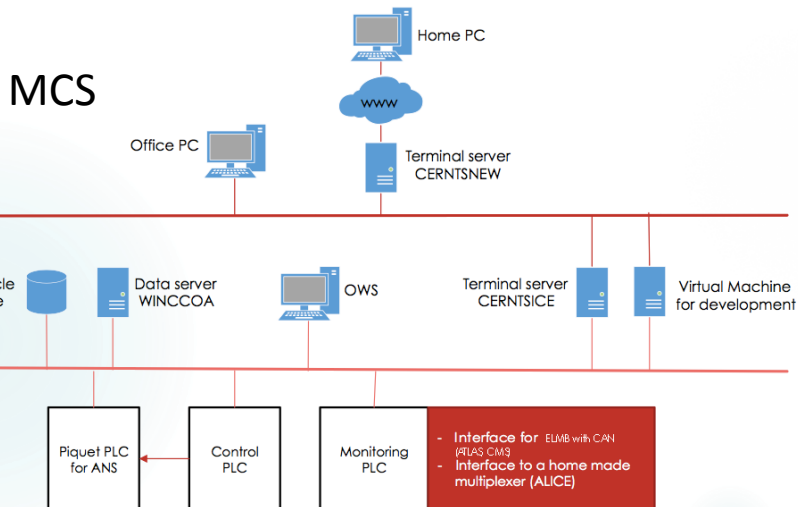
Our Field of Expertise

- Design, develop, build, deploy, maintain and operate control and safety systems for experiments
=> hardware and software
 - Electro-mechanical knowhow
 - Control technologies
 - CERN software frameworks (JCOP, UNICOS)
- Make precise magnetic field measurements
 - Hardware, DAQ, analysis software
- Design, develop, build, deploy, maintain and operate data acquisition systems for experiments
=> hardware and software
 - Networking and computer architectures knowhow
 - High performance computing and I/O, control
 - CERN software frameworks (JCOP, UNICOS) and tools (monitoring, FTS, databases, ...)

Magnets Control Project



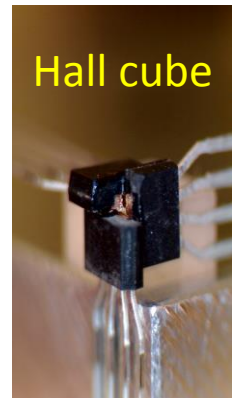
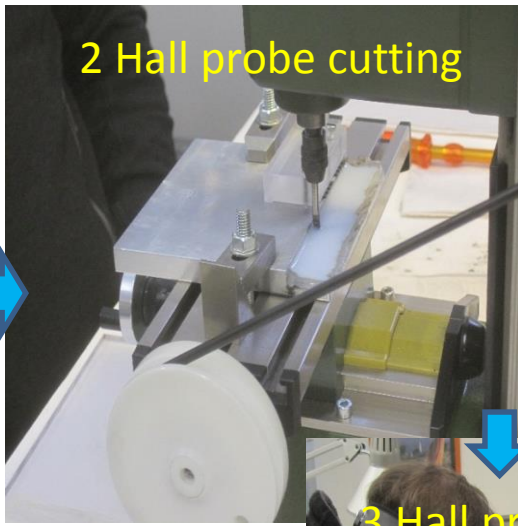
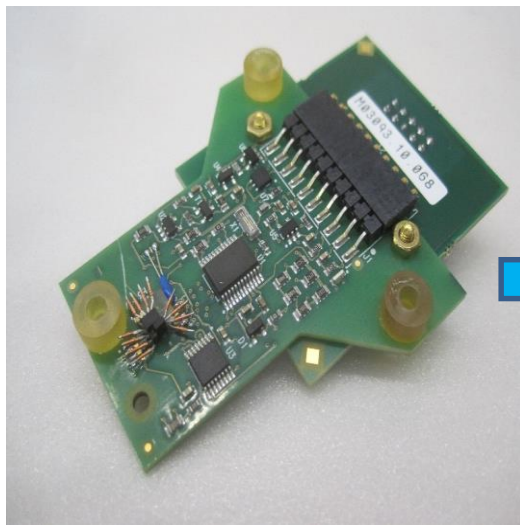
- Piquet service for MCP and DSS since 2006



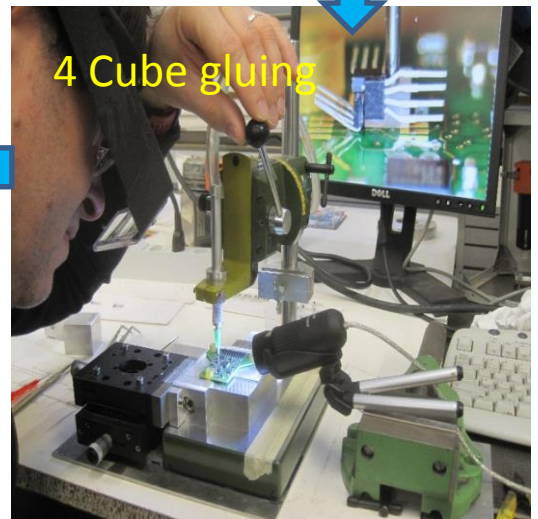
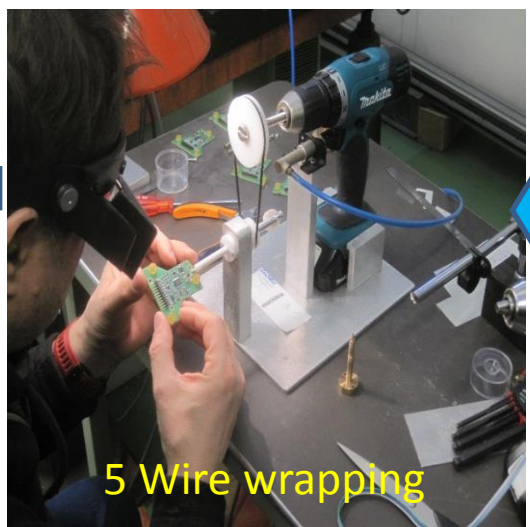
Magnetic Field Measurements

- Measuring benches
 - General purpose benches:
 - Cylindrical, Cartesian pneumatic, large volume
 - 3D scanner for small magnets
 - Dedicated benches: LHCb, MICE, AMS
- 3D B-sensor system
 - calibrated in three dimensions
 - assembly line for “mass” production
 - Max field 2.5 Tesla
 - Precision ± 0.2 mT in B_x, B_y, B_z , 0.05 mm in x, y, z
 - DAQ system with software
- Field calculation
 - FEM programs, most recent: COMPASS SM2 scaling to unmeasured current value.
- Coil winding
 - Warm and superconducting coils, e.g. LHCb, AEGIS, LHC BE-BI-BL
- EP-DT Magnet park
 - Distribution and maintenance of EP-DT magnet park
- Service area
 - Test area and equipment for experiments





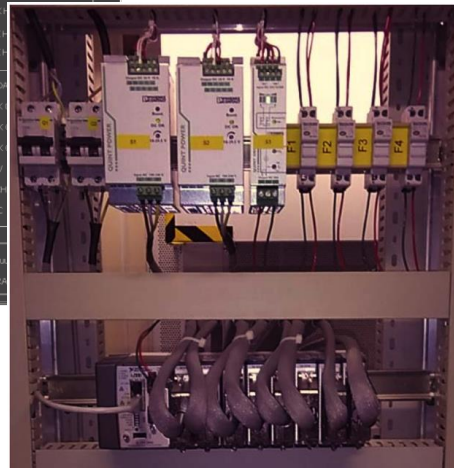
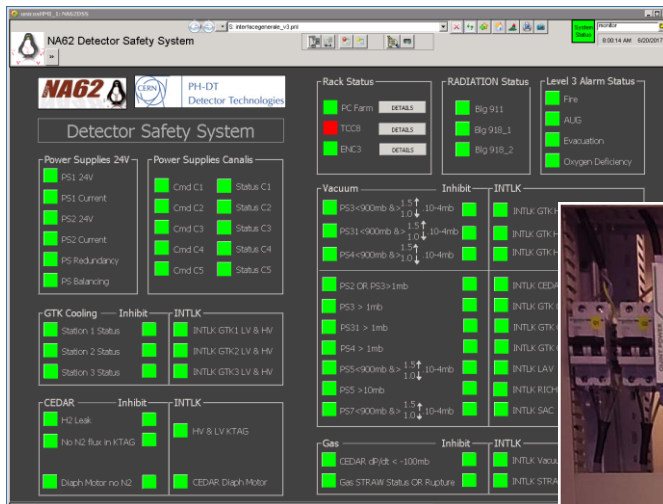
Semi automatic assembly line for B-sensors



Safety Systems for Experiments and Facilities

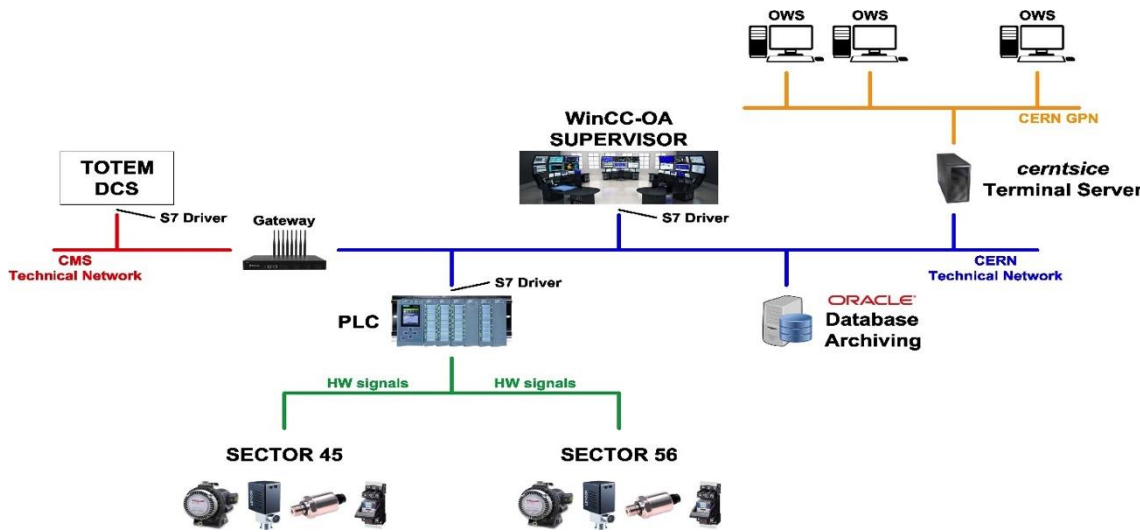
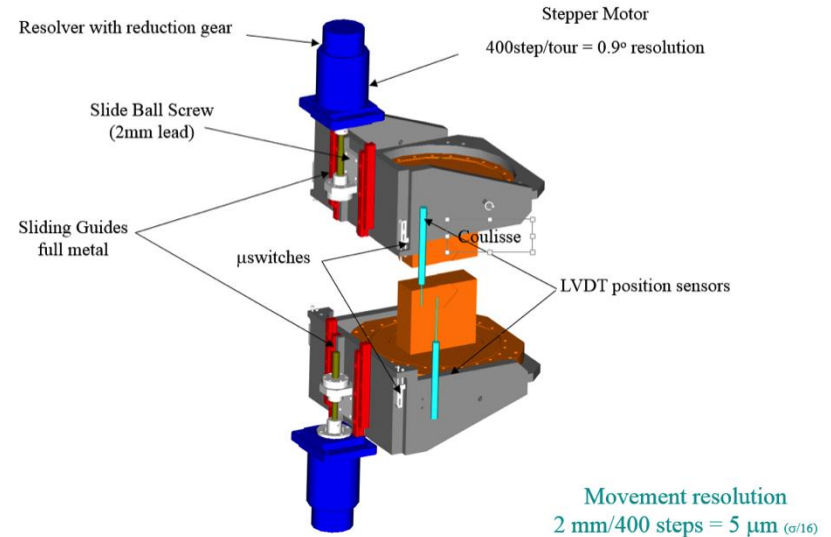
Expertise gained during development of MSS systems has been transferred to other safety systems

- NA62, ProtoDUNE, GIF++, Neutrino Platform...
- Systems using cRIO or PLC technologies



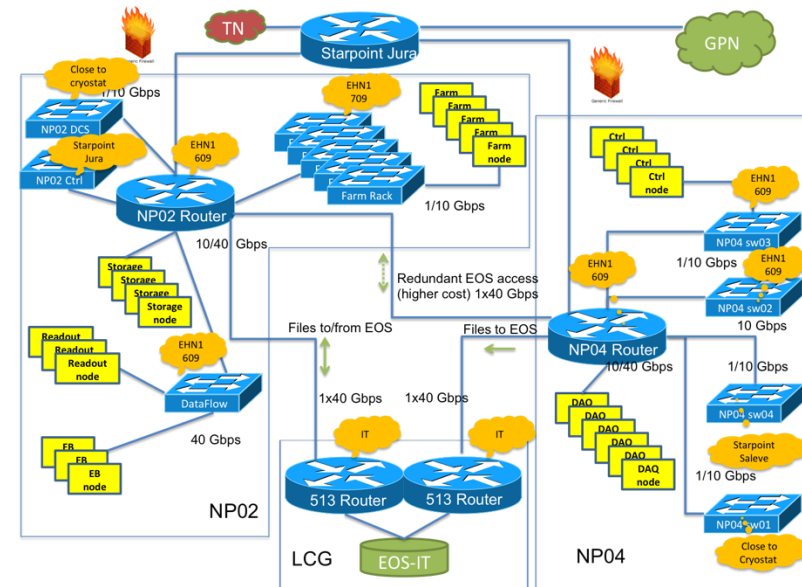
Detectors (Infrastructure) Control

- Expertise in precise movement control
 - Test benches, roman pots, LHCb VELO, ATLAS beam pipe alignment
- Vacuum/cooling control systems
 - Roman pots, CMS, ...
- Temperature maps
 - ALICE, ProtoDUNE, ATLAS
- Slow control for the 2 ProtoDUNE experiments
 - Temperature, pressure, purity, HV, LV, ...



Data Acquisition for Experiments

- Support to and upgrade of existing systems (NA62)
- Design, development, deployment (NP04)
- R&D (ATLAS, SHIP)



Trigger Flow

L0 **1628060** from LOTP

L1 in **1582452** out **216692** of which 63840 SP 31645 AP

L1 data **216692** REQUESTED

L2 in **216355** out **216355** of which 63736 SP

Merger in **216355** out **216355** AP

out **216355**

Primitives Count

CHOD	2.39e+07
RICH	1.95e+07
LAV	3.39e+06
MUV	2.25e+07
NCHOD	2.30e+07
TALK	0.08e+00
LKR	3.99e+06

Exp. scalars

QX	9.02e+06
Q1-OR	1.11e+07
MUV1 OR MUV2	0.00e+00
MUV3	1.12e+07
RHOD	5.56e+05
IRC	2.90e+06
CHANTI	3.30e+00
ECN3_008	0.00e+00
ECN3_009	0.00e+00
ECN3_010	0.00e+00
ECN3_011	0.00e+00
ECN3_012	0.00e+00
ARGONNION	5.67e+08

Run Info

Run Type: Run_2016_KAON

Start Time: 2016.10.29 12:27:46.833

End Time: [blank]

Beam Type: [blank]

Periodic1: [blank]

Periodic2: [blank]

Shift crew: [blank]

StartRun Comment: [blank]

EndRun Comment: [blank]

RunNumber: 6673

Burst #: 708

Burst State: [blank]

PCFarm

Detector	MEPs/Producer	Lost	Choke/Errors
DOTP	203507	0	0
KTAG	201399	0	0
GTK	216473	0	0
CHANTI	203498	0	0
LAV	203502	0	0
STRAW	203418	0	0
RICH	203501	0	0
CHOD	203500	0	0
LKR	216691	0	0
IRC_SAC	203499	0	0
MUV1	216687	0	0
MUV2	216692	0	0
MUV3	203506	0	0
HAC	203502	0	0

Beam Infos

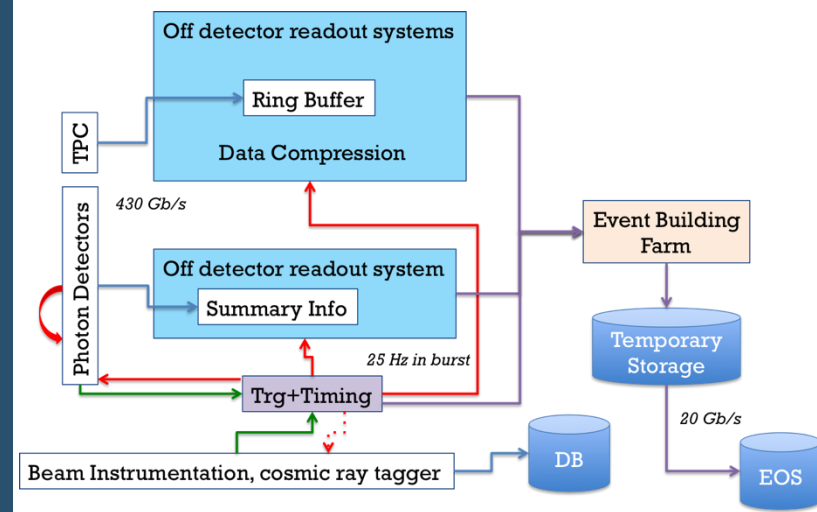
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T10 Intensity [e^-11]: 12.5800

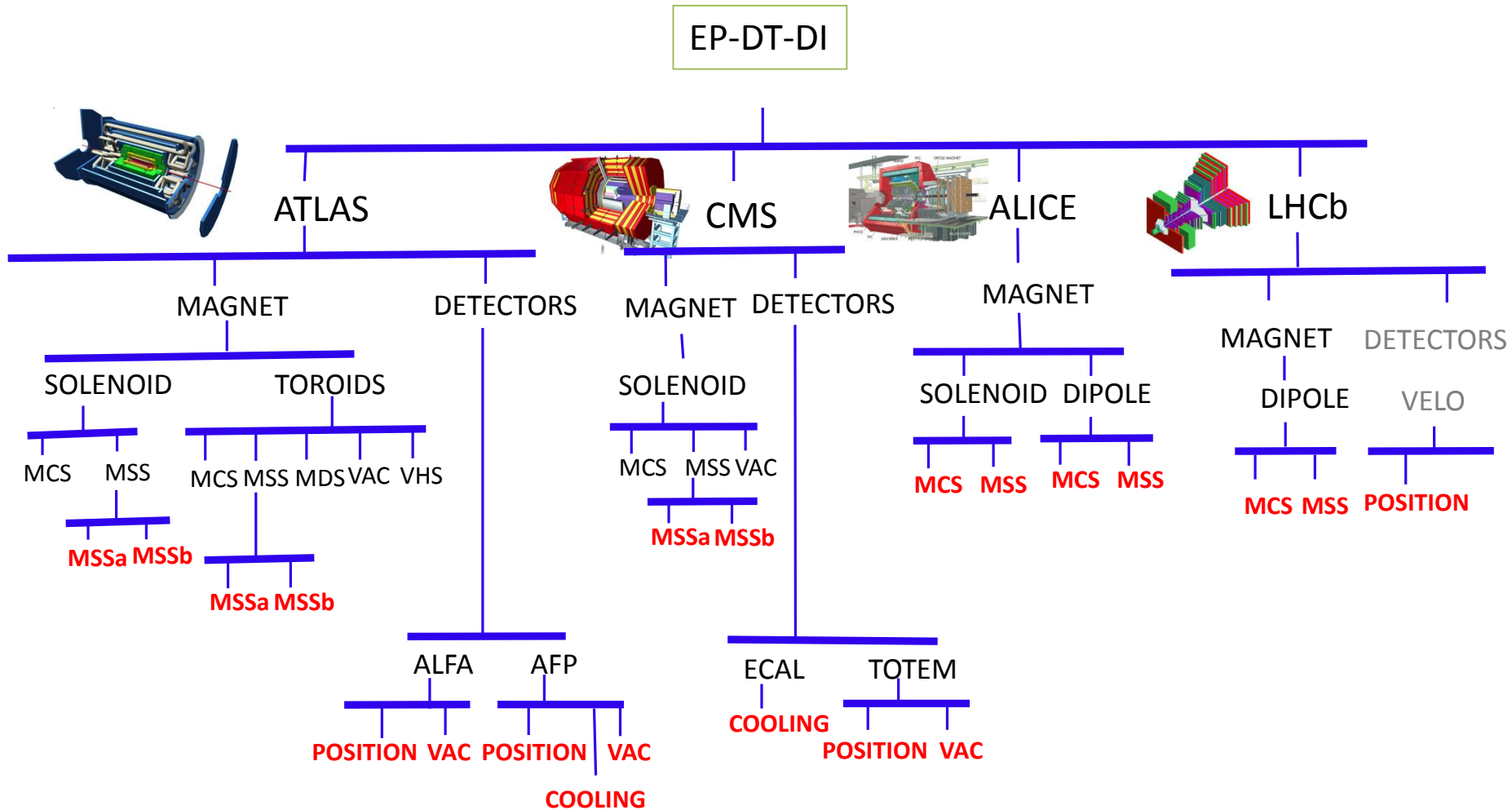
T10 Symmetry: 0.0001

Merger

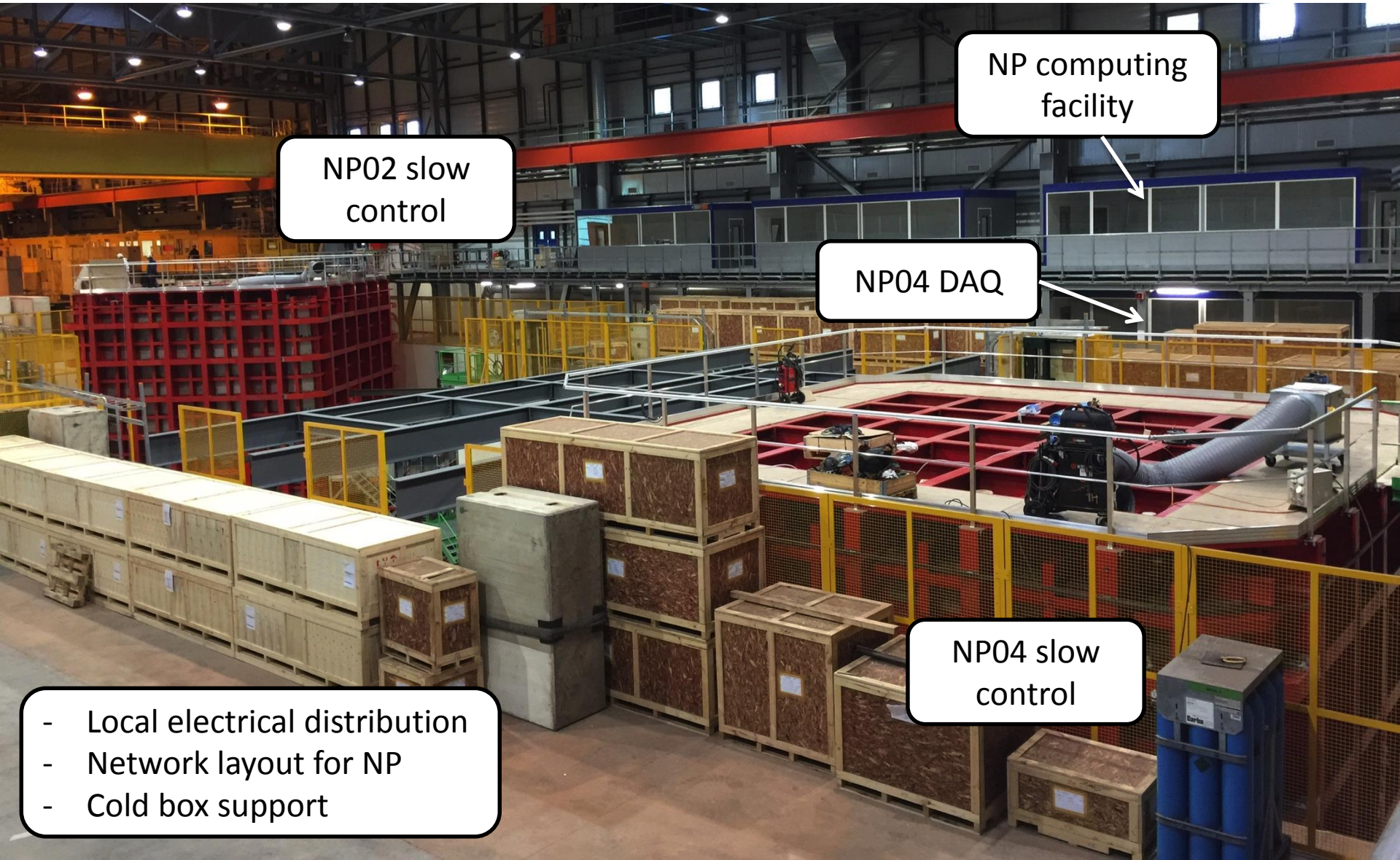
Merger	Proc. Burst	# Events	Evts. Burst-1	Disk Space
Merger1	708	216355	213617	81%
Merger2	708	209717	209717	18%
Merger3	707	234367	234367	82%



Supported LHC Control Systems



Neutrino Platform Support



NP02 slow control

NP computing facility

NP04 DAQ

NP04 slow control

- Local electrical distribution
- Network layout for NP
- Cold box support

Summary and Outlook

- Years long experience in control and measurements of experimental magnets
 - Support to LHC experiments
 - Unique know-how in magnetic measurements of large aperture magnets
- In depth knowledge of detector control and data acquisition
 - Aim at pulling these two domains closer together
- Ability and flexibility to support both very large installations as well as smaller experiments
 - Reuse of technologies
- Time for our own R&D allows to
 - Deploy sound solutions rapidly and cost effectively
 - Develop in-house expertise for offering good support