

# Magnet and Detector activities

On behalf of the Detector Interface (DT-DI) section

# Magnet Control Project

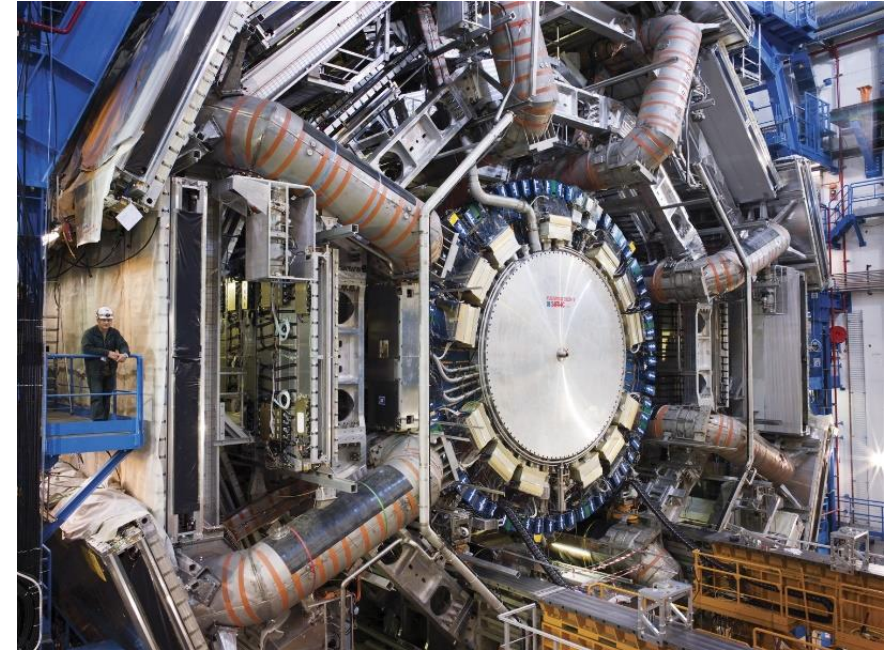
LHC experiments:

- ATLAS Toroid (+vacuum)
- ATLAS Solenoid
- LHCb Dipole
- CMS Solenoid (+vacuum)
- ALICE Dipole
- ALICE Solenoid

Non-LHC experiments:

- COMPASS
- VTX 1&2
- Morpurgo
- M1
- AEGIS

Upgrade of the Magnet Control Systems (MCS) for all experiments. Preventive and corrective maintenance - instrumentation, safety and diagnostic systems, vacuum, heaters, batteries.



**M1**

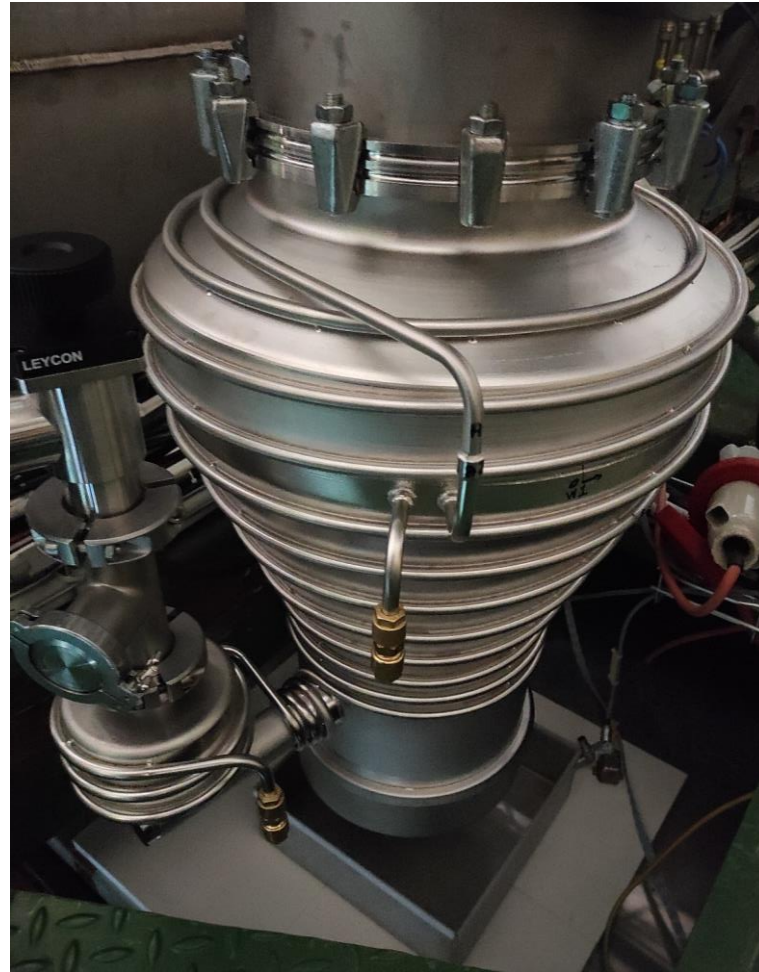


**Morpurgo**



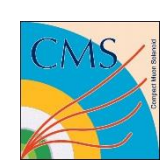
# Magnet Control Project

## CMS Solenoid – Vacuum System



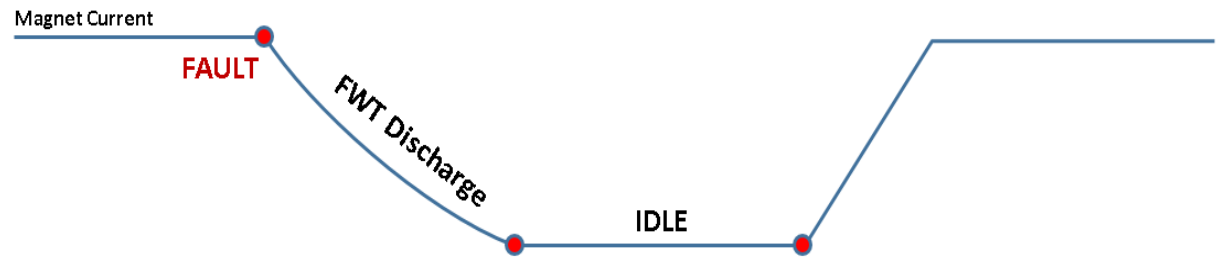
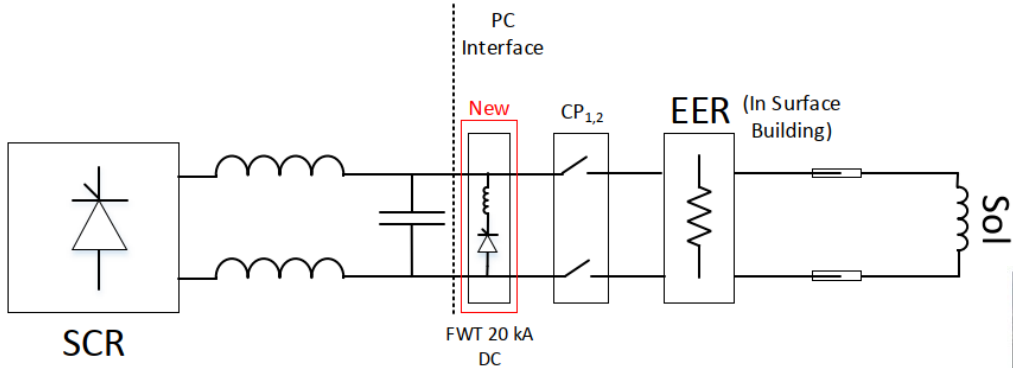
- New diffusion pumps
- New\* primary pumps
- New sensors (pressure & temperature)
- New valves
- New software
- New WinCC OA server





# Magnet Control Project

## CMS Solenoid – Free Wheel Thyristor



TE-EPC Piquet Reconnects PC

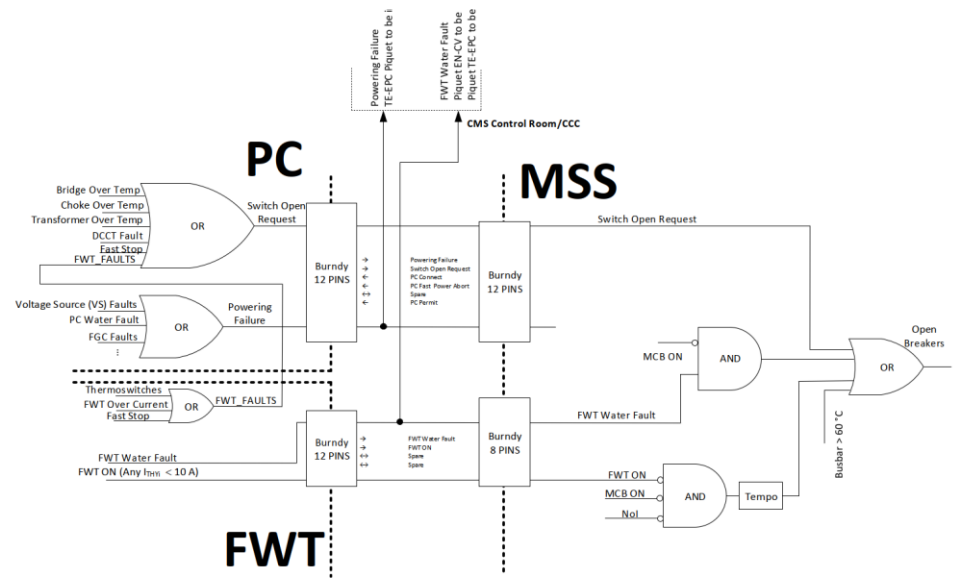
CMS Shift Leader Authorises Ramp Up, CMS Magnet Operator Starts Ramp



Magnet and Detector activities



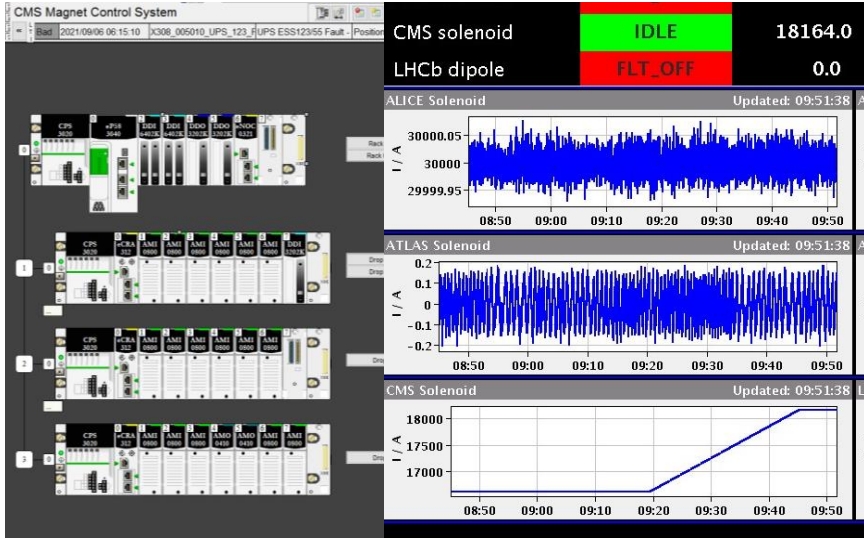
EP-DT Group Meeting



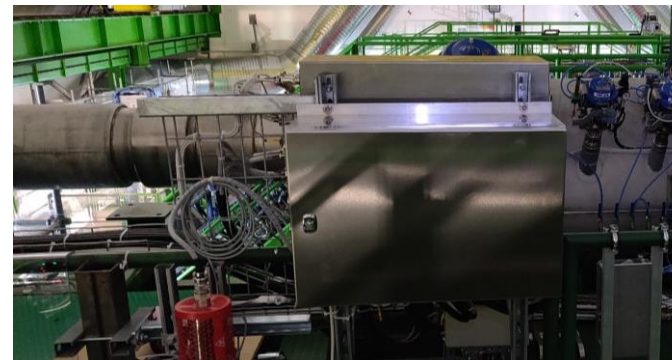
9<sup>th</sup> December 2021

# Magnet Control Project

## CMS Solenoid Control & Safety system



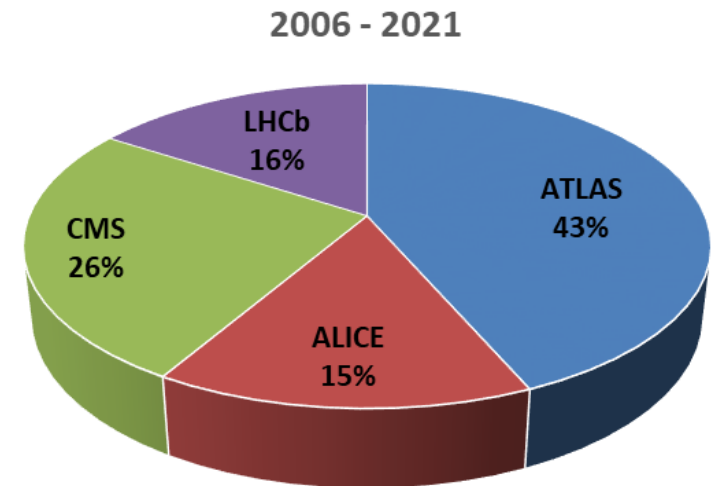
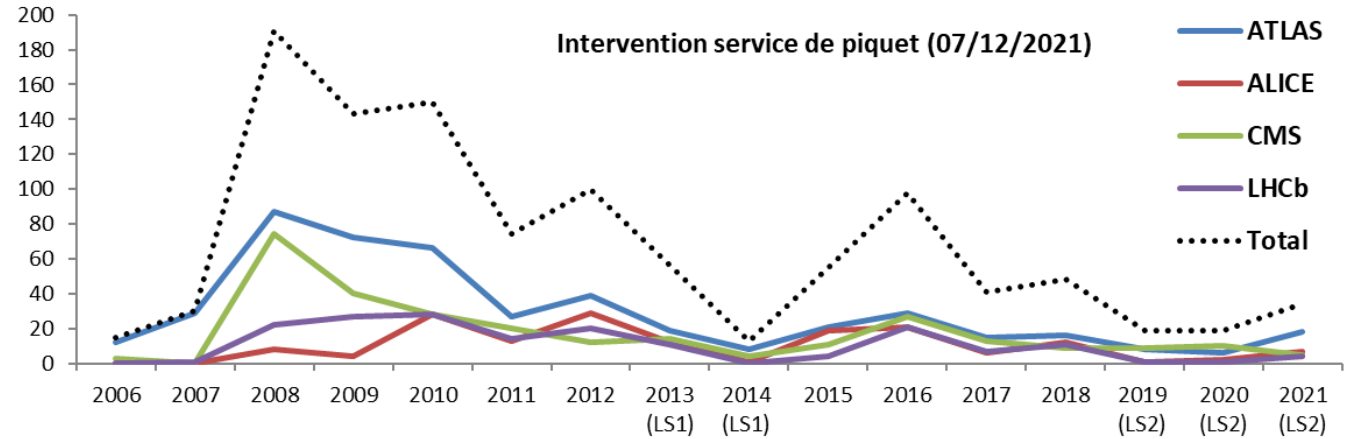
- Magnet Warm-up & cool down
- Vacuum system reparation & upgrade
- Magnet Control & Safety systems upgrade
- Introduction of the Free Wheel Thyristor
- Magnetic Field Monitoring System upgrade



# MCP/DSS Piquet

Agreement (since 2006) between LHC experiments and EP-DT for a 24/7 on-call service (experimental magnets and the central Detector Safety System hardware), as well as maintenance and operations of the magnets controls and safety systems.

- 1086 interventions (2006 – 2021)
  - Average 68 interventions per year
  - 1.3 intervention per week
- During the LS2:
- 72 interventions
  - 0.5 intervention per week
- 8 piquet members
  - 4 persons - second-line support



Magnet and Detector activities

EP-DT Group Meeting

9<sup>th</sup> December 2021

# Electromechanical & software support

Support for all experiments



Magnet and Detector activities



EP-DT Group Meeting



9<sup>th</sup> December 2021



2021/10

# Magnetic Measurement

The EP-DT magnetic measurement team is dedicated operates the mapping of experimental magnetic fields

## 2021 Activities

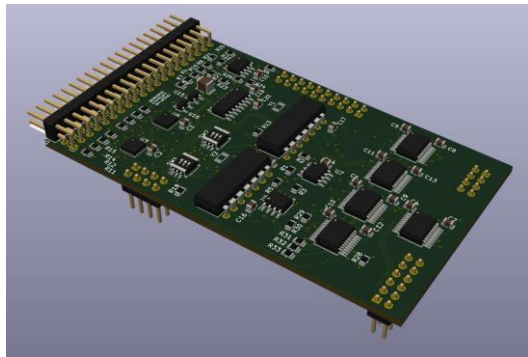
- Remapping of the LHCb dipole + 2 RICH Stations
- Completed assembly and calibration of 160+ 3D Hall probes (new design)
- Summer student project to reimplement the calibration procedure conceived by F. Bergsma (<https://cds.cern.ch/record/2781963?ln=en>)
- Refurbishment of the Magnetic Mapping area in B. 168 (Floor, walls, cooling station, powering)

## 2022 foreseen campaigns:

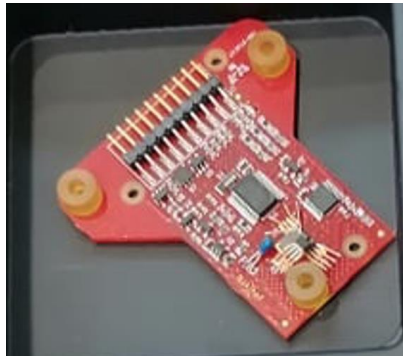
- Mapping of the MPD solenoid at NICA (Dubna)
  - Mapper completed, awaiting solenoid commissioning
- Mapping of the sPHENIX solenoid at BNL
  - Planning ongoing
  - ATLAS Bench Adaptation to sPHENIX bore



Installation of LHCb mapping bench



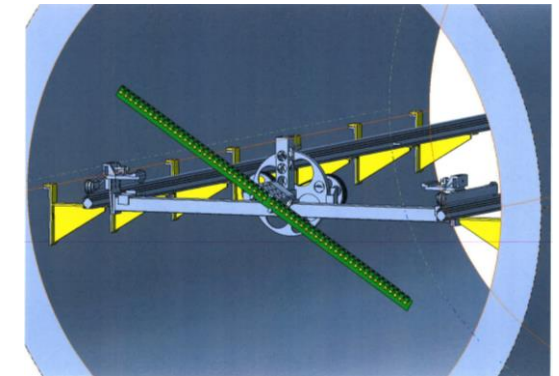
Motor control card prototype



New 3D Hall Probe card

## Other ongoing activities

- Electronics redesign for mapping benches automation
- Re-implementation of software and hardware tools for sensor readout and calibration



MPD Mapper



# Magnetic Measurement



**Magnet and Detector activities**



**EP-DT Group Meeting**

**9<sup>th</sup> December 2021**

# EP Magnet Working group

*“The goal of the EP Working Group on experimental magnets is to build up and to maintain an expertise group capable to operate all present experimental (EP) magnet systems at CERN. The expertise should include magnet measurements and controls, safety, cryo and vacuum systems.”*

EP-ADO: Philippe Benoit, Matthias Mentink and Alexey Dudarev;

EP-CMX: Benoit Cure;

EP-DT: Hans Danielsson, Laurent Deront, Raphael Dumps, Francois Garnier, Nicola Pacifico, Maciej Ostrega, Xavier Pons, Sylvain Ravat.

The main activities of the Working Group are the following:

- maintenance and operation of the ATLAS and CMS superconducting magnet systems;
- maintenance of the warm magnets of ALICE and LHCb;
- provide expertise for other magnets of EP, in particular the superconducting systems, as well as for detector magnets that are currently not in use and stored;
- participate in R&D and the study, design, test, prototyping and construction of magnets for future experiments;
- maintain and expand magnet design knowledge and techniques as well as magnetic field, forces and stress calculations;
- foster the collaboration with other laboratories and institutes.

*Mandate for an EP Experimental Magnet Working Group – November 2020*

# Thank you for your attention

DT workshops/facilities

B108 evaporator control system

B168 operation of the magnetic measurements area

GIF++

NA62 DSS

NA62 Trigger & DAQ

NA61 VTX magnets safety system

NA61 DAQ

COMPASS / AMBER

Magnets

Cooling for tracker

TPC DSS

DAQ

Aegis Magnet Safety System

CLOUD Slow Control System

Solenoid magnet (MCS and MSS)

Dipole magnet (MCS and MSS)

ITS Detector Safety System

Morpurgo Magnet Safety System

M1 Vacuum, MCS and MSS

FASER DAQ & electromechanical support

Solenoid Magnet (MCS, MSS and MDS)

Solenoid Vacuum

TOTEM

ECAL H4 Test Beam Area

ECAL Cooling Control System

LHC

ALICE

SPS

ATLAS

LHCb

PS

ALFA Roman Pots

AFP Roman Pots

Central Solenoid magnet (MCS, MSS and MDS)

Toroids magnet (MCS, MSS and MDS)

Toroids vacuum and safety Heater Systems

Vacuum system (ITK & CO2 cooling)

ITK miniDCS

Magnet test b.180

Neutrino Platform

NP02 & NP04 DCS

NP02 & NP04 Coldboxes

ProtoDUNE & DUNE Trigger & DAQ

Electronic logbooks

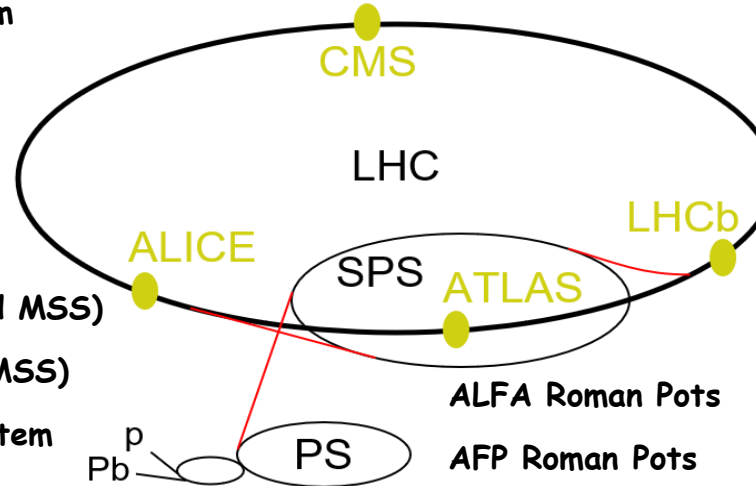
Dipole magnet (MCS and MSS)

SciFi (Vacuum, Flowcells, CPS)

VELO Safety System

VELO Position Control system

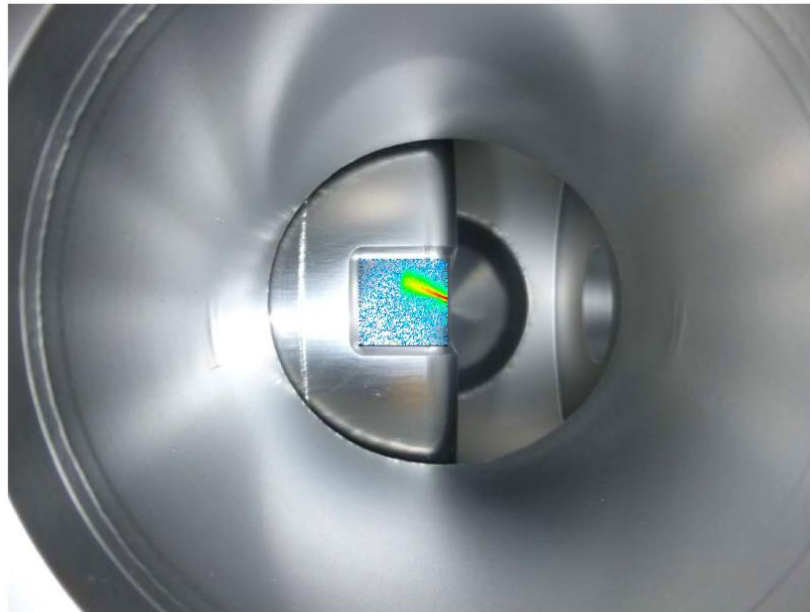
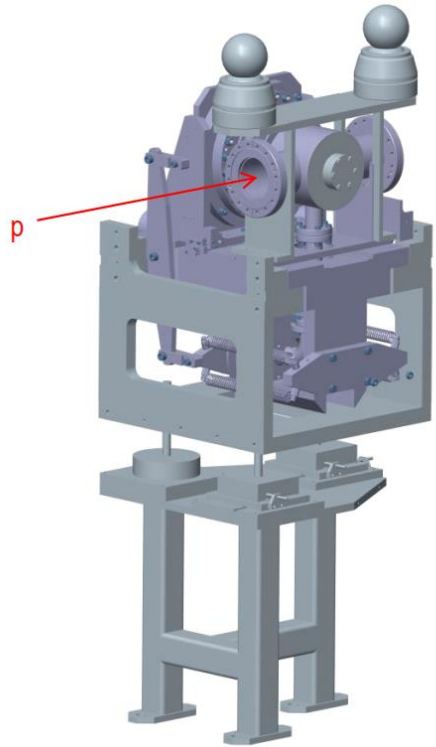
UT Services assembly and installation



Backup

# Detector Control System

## The TOTEM, ALFA and AFP Roman Pots



DT-DI is maintaining the position control system of 40

Roman Pots for the TOTEM, ALFA and AFP detectors.

Allowing to positioning the Roman Pots up to 400  $\mu\text{m}$

from the LHC beam with a high resolution  $\sim 5 \mu\text{m}$

Assuring the safety conditions by connecting them to

the LCH Beam Dump Interlock

DT-DI is also supporting auxiliary system like the

secondary vacuum and cooling systems of those

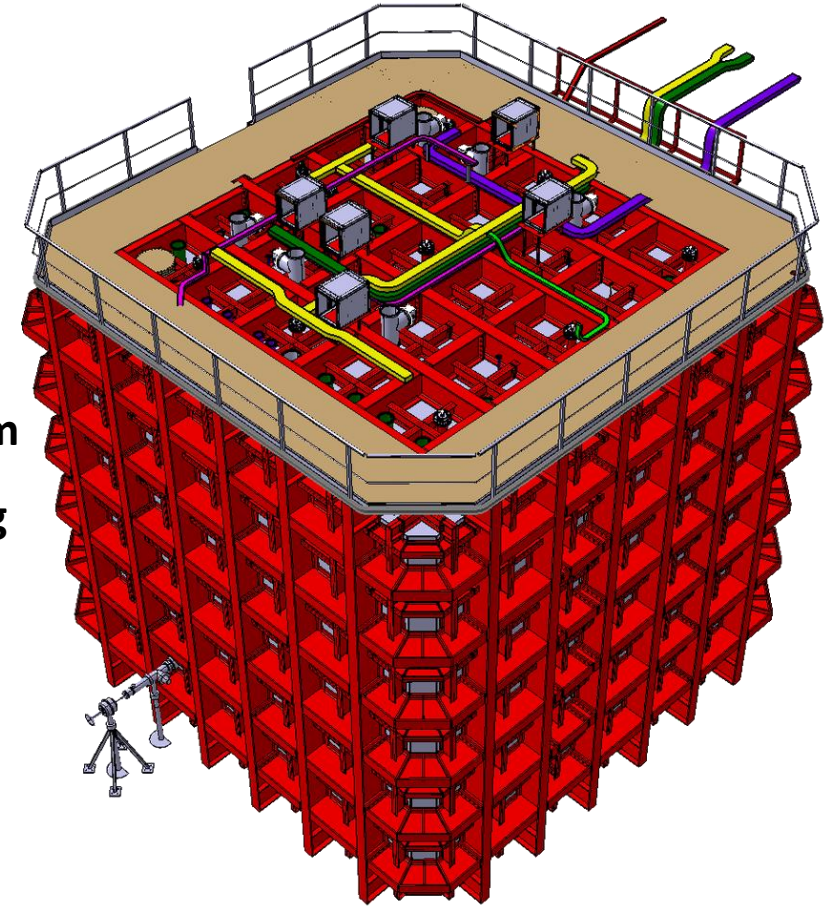
detectors

# Detector Control System

## The protoDUNE Single Phase (NP04) experiment

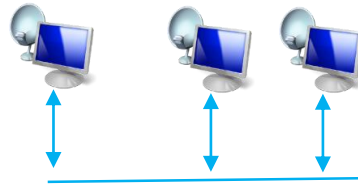


- DCS
- DAQ RACK Control
- Ground Impedance Monitor
- Single Phase Slow Controls
- Strain Gauges Monitoring System
- Temperature Profiles Monitoring
- Ground Plane HV Monitoring
- Heinzinger 300 kV Power Supply
- Purity Monitor
- Caen Power Supply



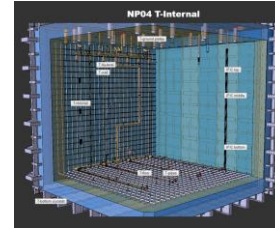
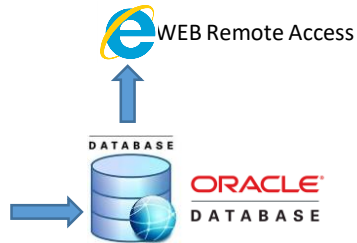
# Detector Control System

Remote Access. Multiple session UI

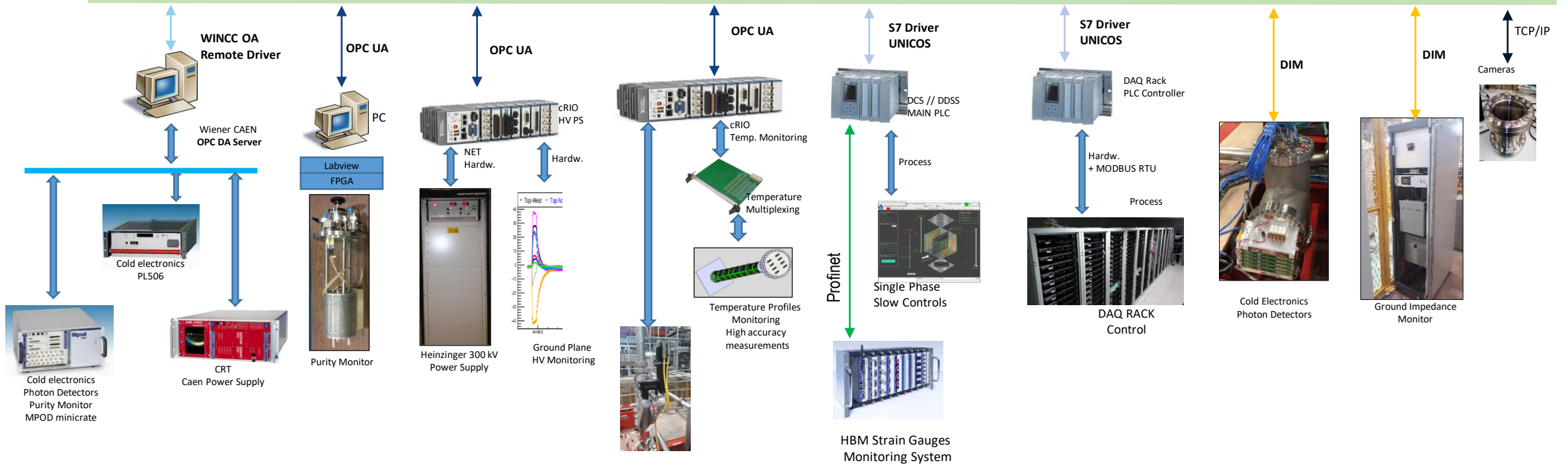


WinCC  
OA  
SIEMENS

CERN MAIN  
WINCC OA  
SCADA  
DATA SERVER



CERN Neutrino Platform Detector Network



# Magnet Control Project

## Non-LHC magnets:

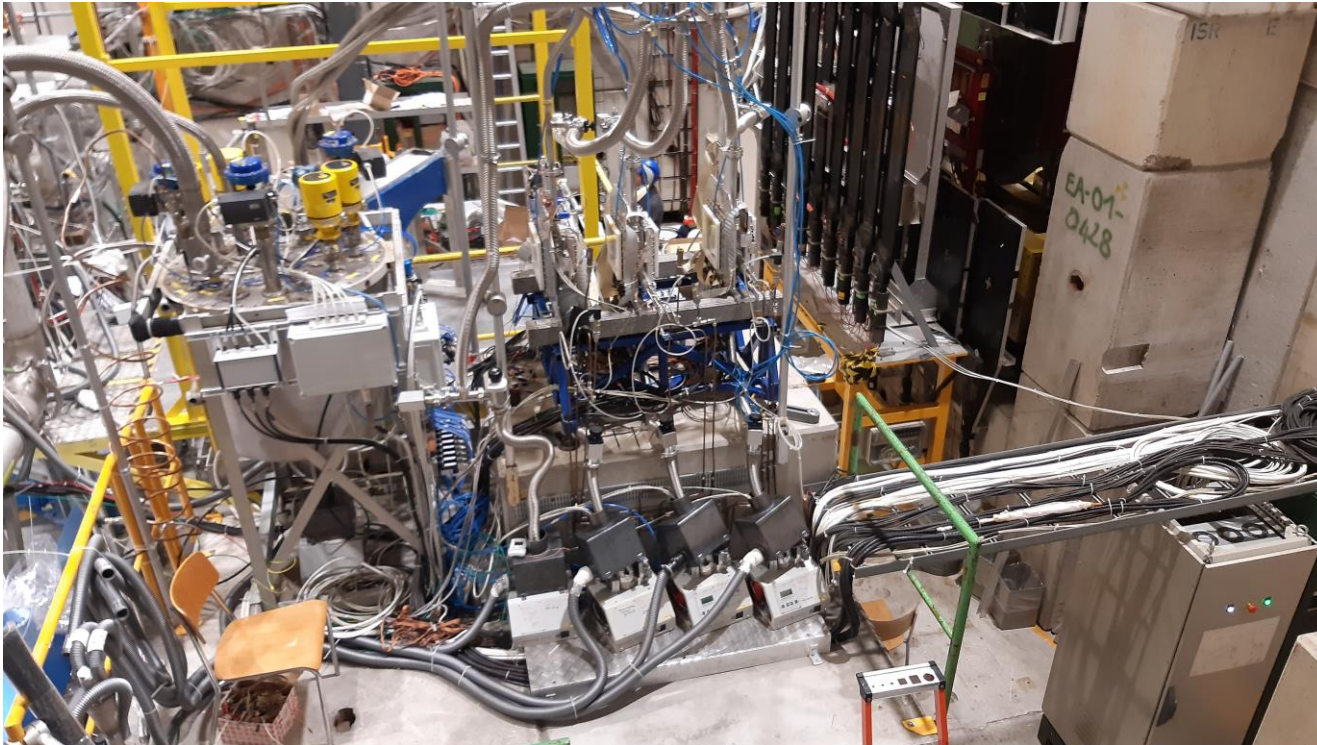
- COMPASS
- VTX 1&2
- Morpurgo
- M1
- AEGIS



**Morpurgo**

**M1**

  
AEGIS EXPERIMENT



**Magnet and Detector activities**

**EP-DT Group Meeting**

**9<sup>th</sup> December 2021**



# Magnet Control Project

**CMS Solenoid – Vacuum System**

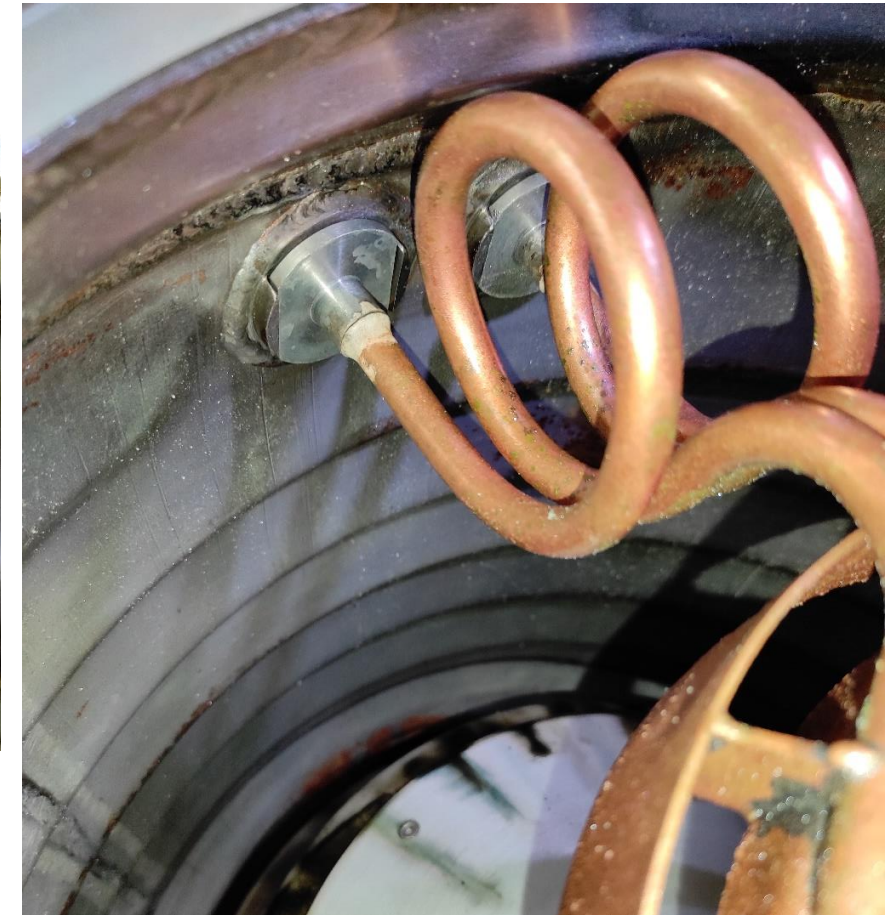
Diffusion pump failure -> Water leak inside the vacuum -> Magnet Warm-up -> Vacuum system reparation & upgrade -> Commissioning & restart -> Magnet cool down



**Magnet and Detector activities**



**EP-DT Group Meeting**



**9<sup>th</sup> December 2021**

# Magnet Control Project



**Magnet and Detector activities**



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**9<sup>th</sup> December 2021**

