DT Involvement in CO_2 cooling

09th December 2021

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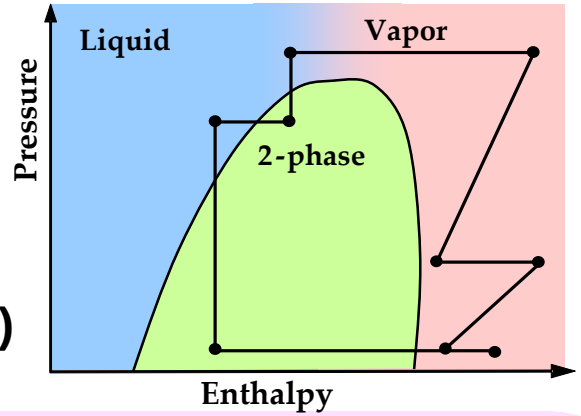
on behalf of DT-FS

EP-DT
Detector Technologies

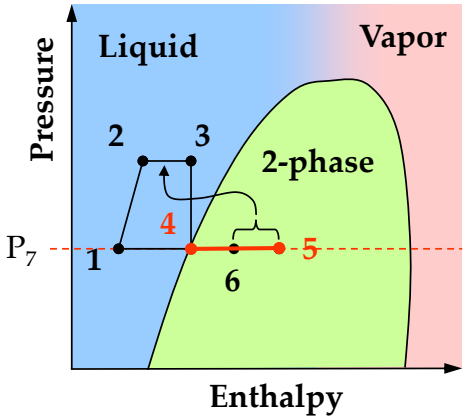
CO_2 Cooling road to ATLAS & CMS Phase II systems



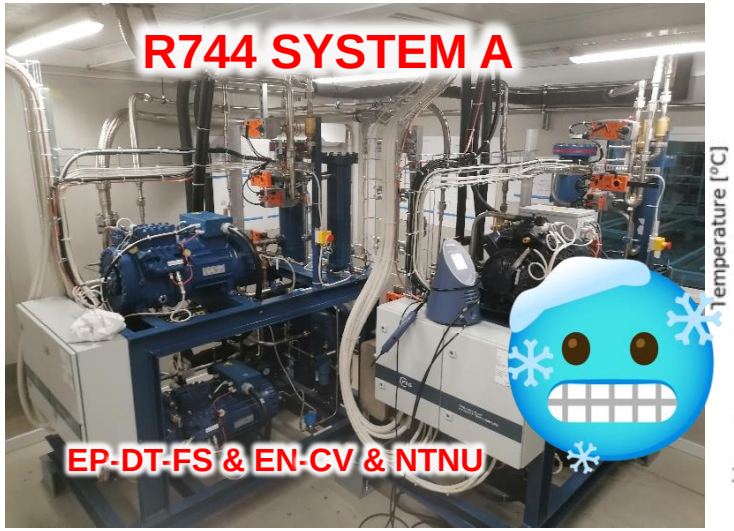
Hosted in a dedicated lab in bldg. 153, DEMO is a full scale prototype conceived to test the full cooling chain"

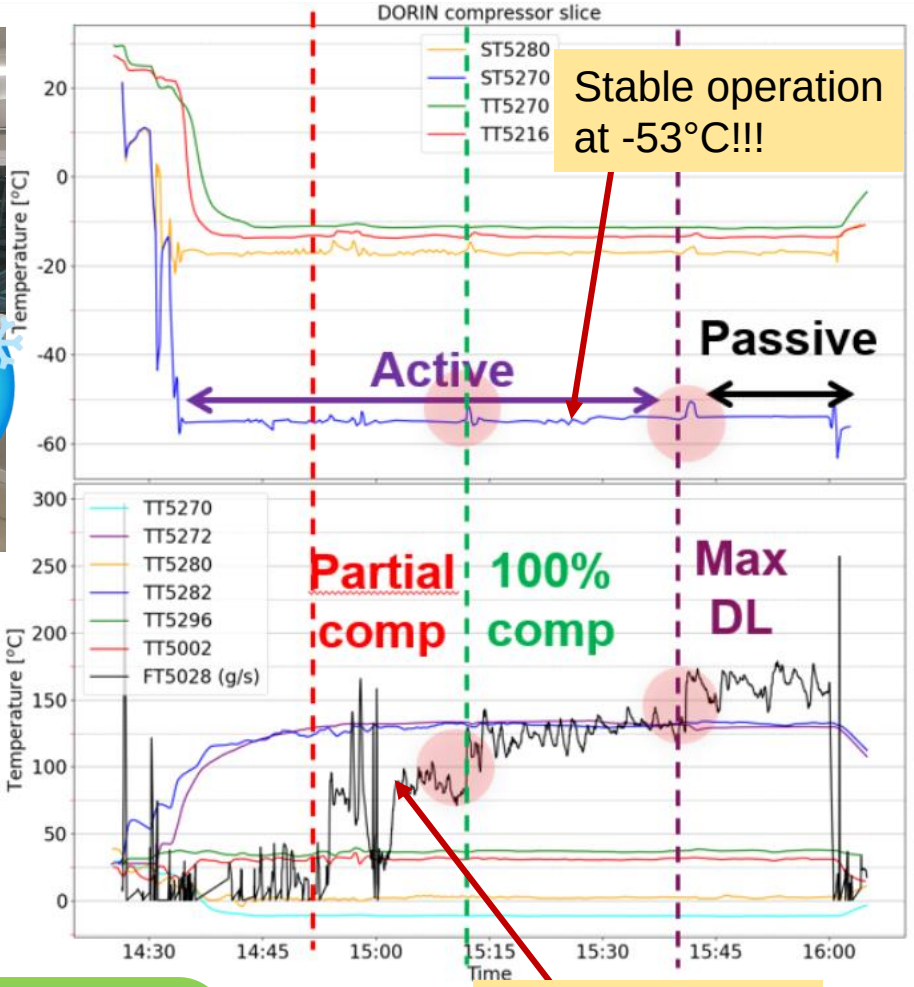
DEMO R744 (System A)

DEMO 2PACL



First R744 Primary chiller at CERN





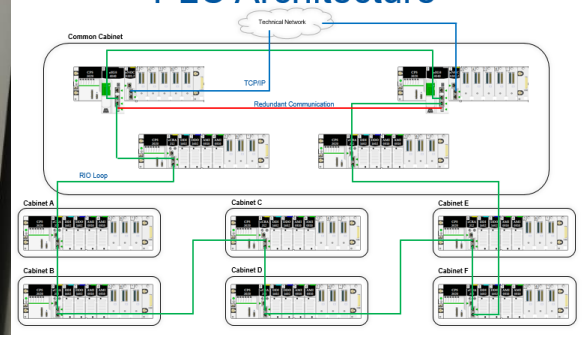
First ever trans-critical R744 (CO2) chiller designed at CERN – Record low operational temperature achieved

Process concept fully validated for both HW and controls. System is ready for operation with 2PACL DEMO.

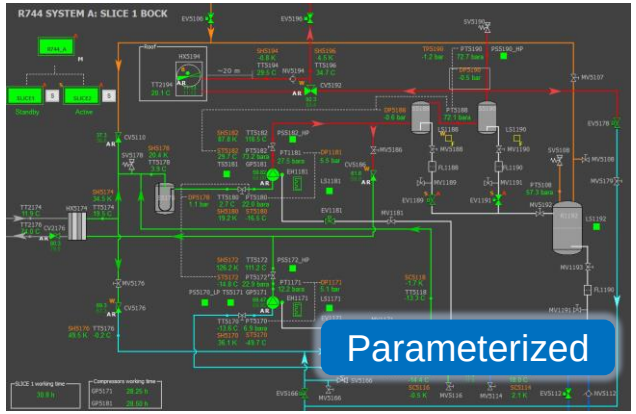
Prototype for Phase II systems of ATLAS and CMS.

$CO_2 \leftrightarrow$ R744

PLC Architecture

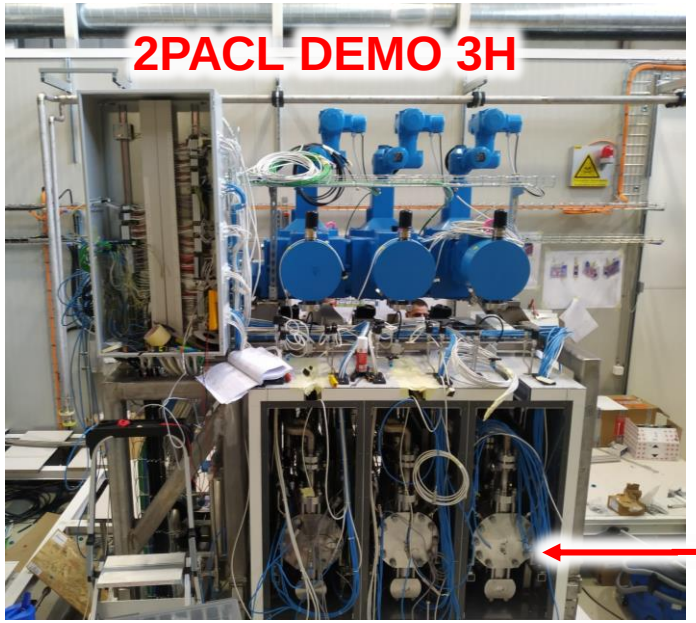


Schneider M580 Redundant PLC used for control. First tests of PLC components and control architecture for future Primary and 2PACL cooling systems



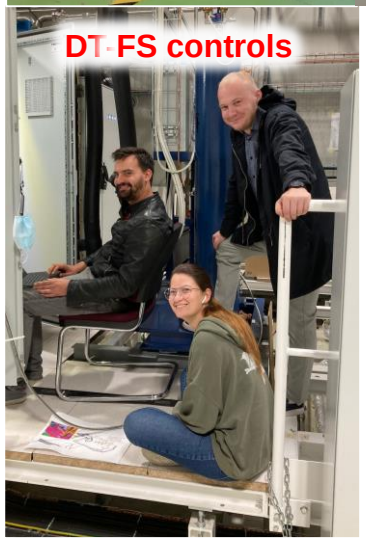
Parameterized UI panels are first steps in efficient software production for multiple plant system of Phase II upgrades.

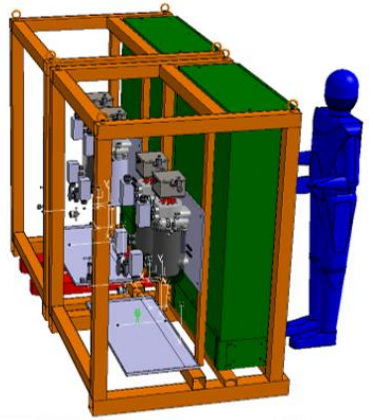
DEMO 2PACL prototypes



DEMO 3HEAD Plant is installed in B153. Frame, pump and cold box are assembled. Cabling is finished. Commissioning is very well advanced.

DEMO 1HEAD Plant construction outsourced in order to gain experience for the final production. Plant being completed and expected for delivery this year.





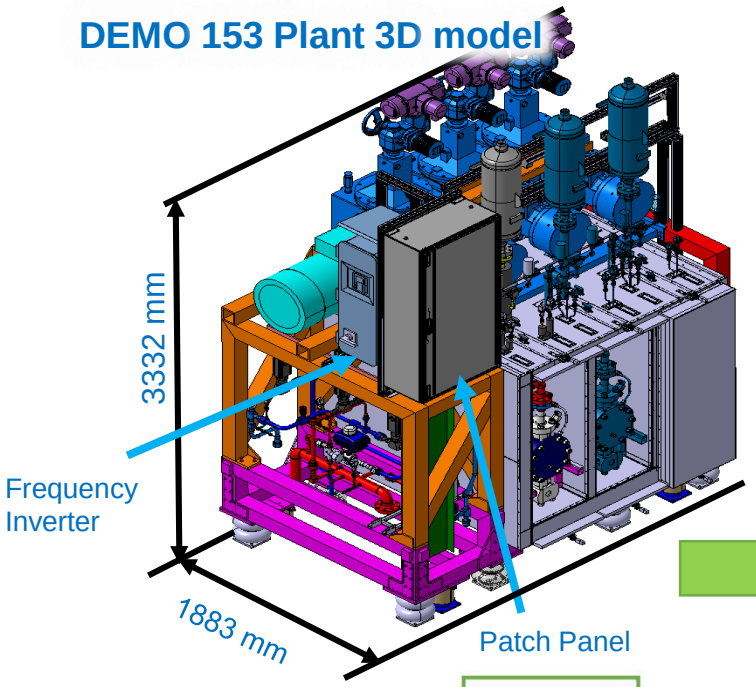
DEMO Dummy Load

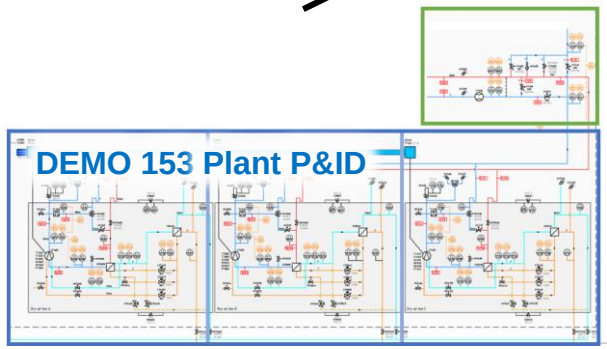
DEMO pre-production unit for Phase II upgrade. System works following traditional 2PACL principle, but the large scale brings new technical and operational challenges.

DEMO Dummy Load 50kW x2 build for DEMO and will serve for Final systems performance commissioning at ATLAS and CMS.

2PACL design optimization and integration works

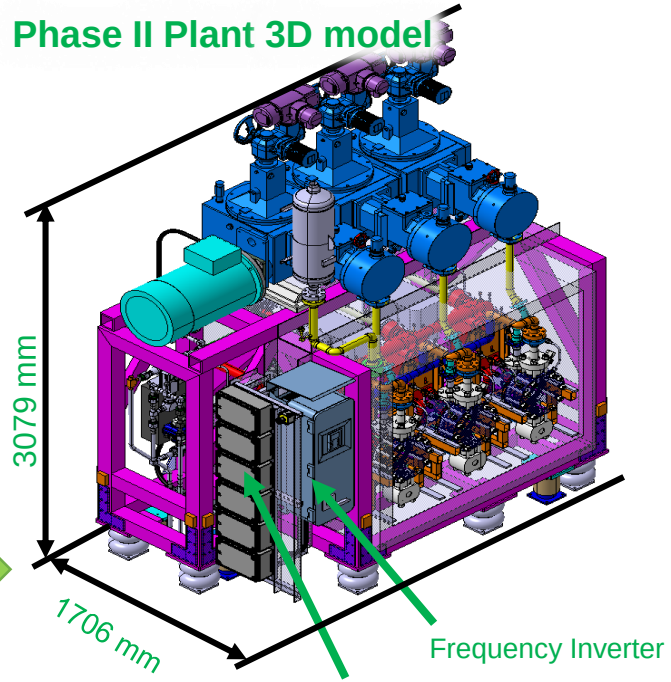
DEMO 153 Plant 3D model

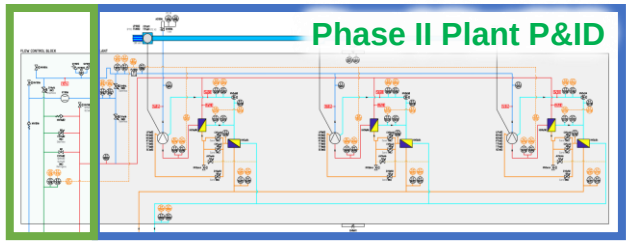




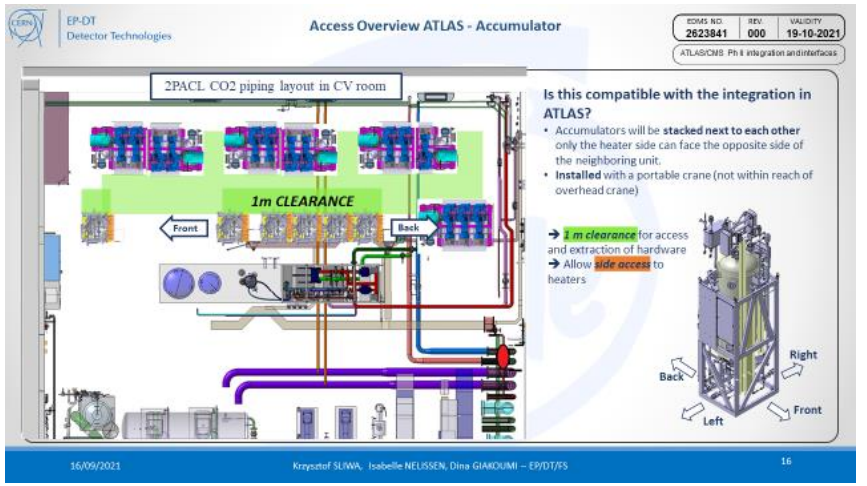
DEMO 153 Plant well equipped with instrumentation for detailed process analyses.

Phase II Plant 3D model

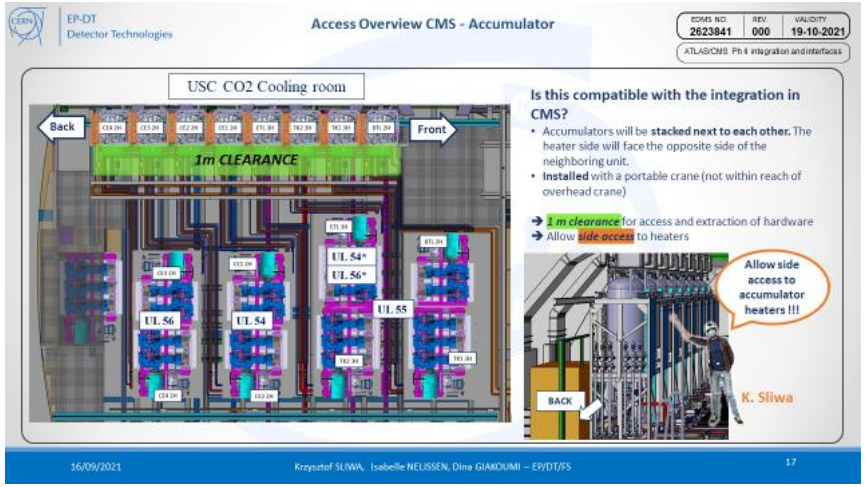




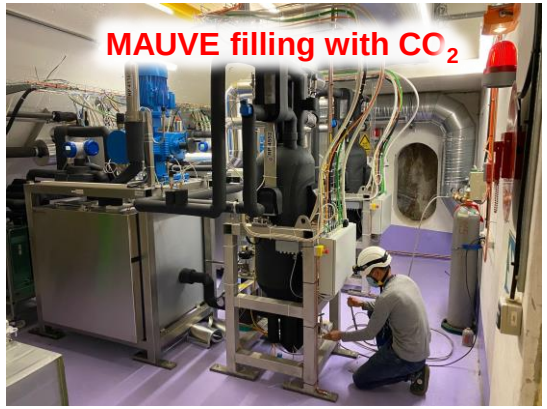
Redesigned Plant with size decreased and lowered amount of instrumentation - simplifies installation and decreases the cost of manufacturing.



Document detailing installation, assembly and maintenance operations of 2PACL units prepared by EP-DT-FS. Shared with ATLAS and CMS integration teams.

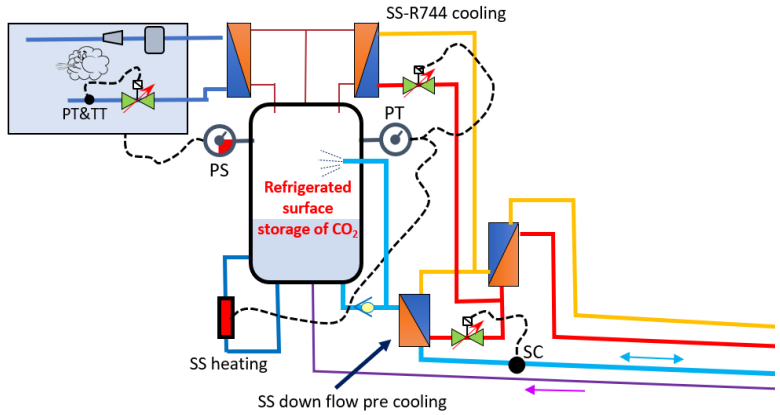


LHCb 2PACL, CMS & TIF & SurfaceStorage last steps to operation

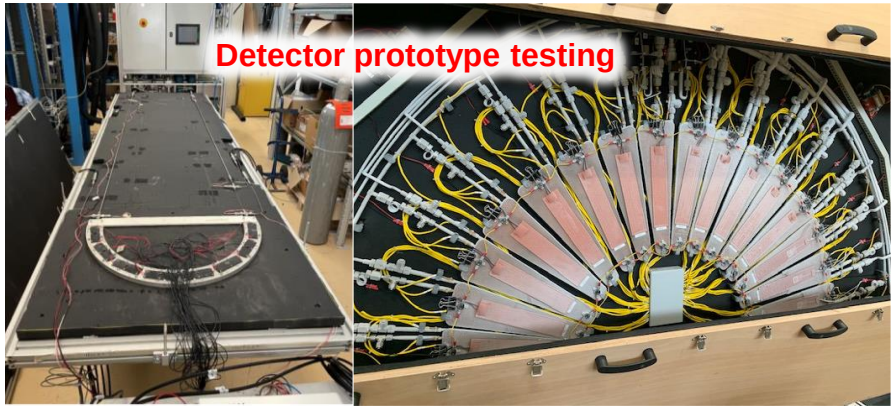


MAUVE LHCb VELO&UT is operating and performance commissioning is completed with backup chiller. Waiting for Primary Chiller to be fully operational. VELO distribution is operational and for connection of VELO detector.

CMS Tracker Integration Facility TIF has been successfully relocated from clean room to new platform. New primary chiller and distribution lines are installed.

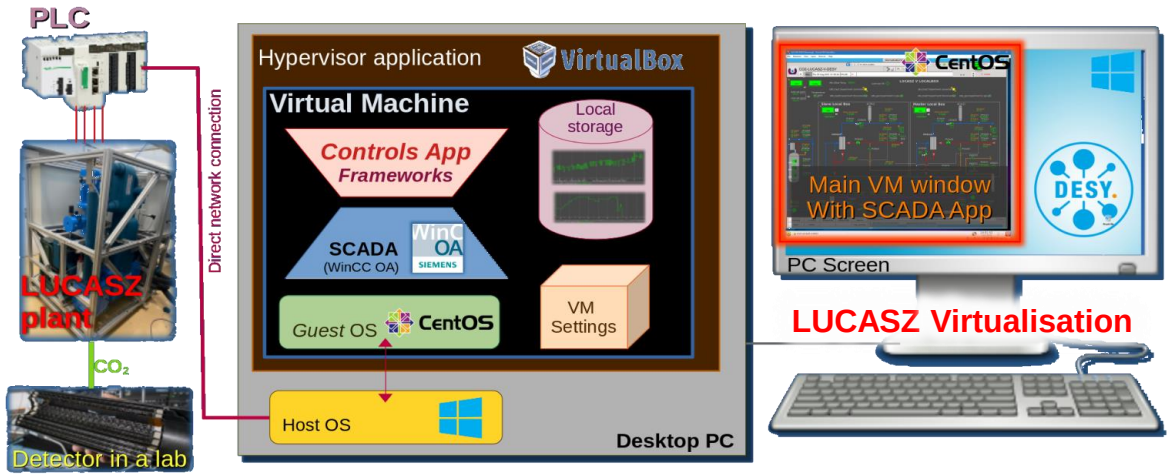


Surface Storage module recently installed B180 is connected to Baby-DEMO, ready for operation and tests the new approach of external CO_2 storage – full volume not in accumulator. Aim of this exercise is to confirm the concept and define the correct accumulator volume.



ATLAS detector prototypes testing at Baby-DEMO for Strip EC, Strip Barrel, Pixel Outer Barrel, Pixel EC, HGTD Demonstrator

LUCASZ systems ATLAS Institutes & Virtualisation



NEW kid in DT ATLAS cooling systems family: LUCASZ CO2 unit commissioned at CERN serving detector testing.

4x LUCASZ systems built at DESY under EP-DT guidance for CERN, DESY, Nikhef and Frascati.

All but CERN one equipped with Virtual Box solution for off site UNICOS based control application thanks to collaboration with BE-ICS. Another use for USA – Cornell (CMS).

- Fully functional SCADA for detector cooling operation
- Rapid to deploy and maintain
  - by local IT staff or users with no controls-specific knowledge
  - easy updates, backups, disaster-recovery
- Secure and independent from lab's infrastructure (h/w, operating system, network)
- Reusable self-contained images
- Generally applicable concept