The new Prévessin Data Centre (PDC) at CERN

2024 CERN openlab Technical Workshop

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Agenda

Project goal and timelines

Organization and roles

Architecture overview

IT rooms

Cooling and heat recovery
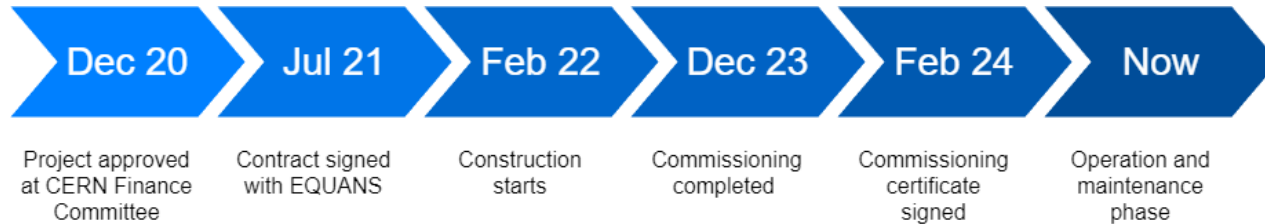
Monitoring dashboard of one IT room

Conclusion

Project goal and timelines

PDC needed to provide computing needs of HL-LHC, which are expected to be ten times higher than today

PDC hosts servers for physics data processing and "business continuity / disaster recovery" infrastructure

MDC (Meyrin Data Centre) will continue to run in parallel, with a particular focus on data storage

| Dec 20	Jul 21	Feb 22	Dec 23	Feb 24	Now
Project approved at CERN Finance Committee	Contract signed with EQUANS	Construction starts	Commissioning completed	Commissioning certificate signed	Operation and maintenance phase

Organization and roles

The approach has been for a turn-key DC solution:

→ Based on *functional* specifications

→ Including *10-years* operation and maintenance

The project follows the *FIDIC Gold Book standard* for project design, build and operation

CERN specific exceptions to the above:

→ *EN-EL* is responsible for the provision and maintenance of the *HV systems*

→ *EN-AA* is responsible for the operation and maintenance of the *safety systems* (smoke detection and evacuation, video surveillance and access control)
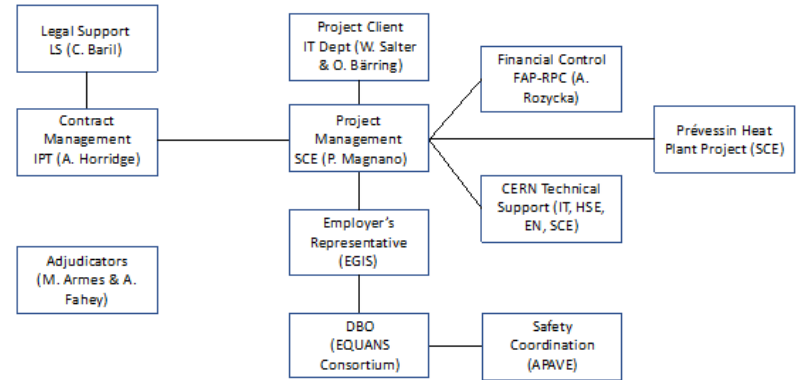
Architecture overview

Total power of **12 MW**:
- → 4 MW per floor
- → 1st phase (now) has 2nd floor only
- → 2nd phase (HL-LHC) will add 1st floor
- → 3rd phase will add ground floor

Total of **6 IT rooms**:
- → 2 per floor
- → 2 MW per room

90 racks per IT room:
- → 78 server racks
- → 12 network racks

Ground print of **2,250 m²**:
- → 70m * 37m * 19m

Located in front of the CERN Control Centre (CCC)

Total surface of **6,400 m²**:
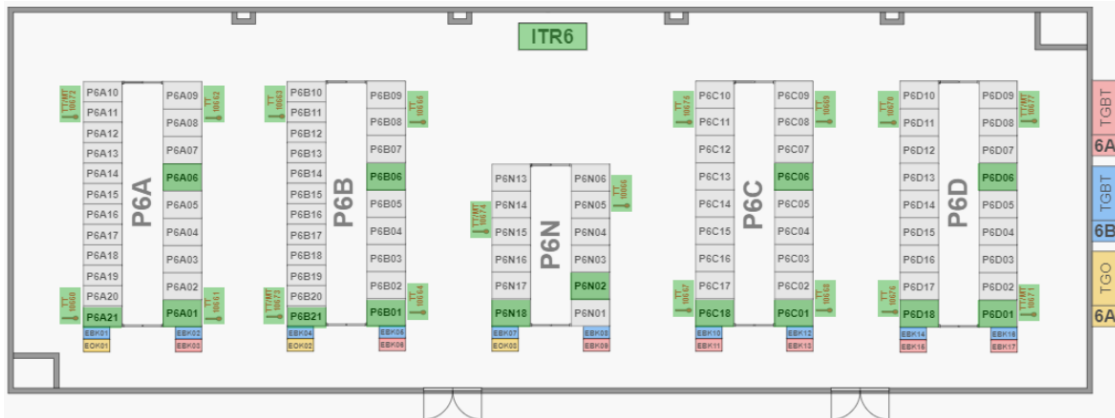- → **2,100 m²** for IT rooms

IT rooms (1)

Each room contains:
  → 1 network pod (center)
  → 4 server pods

Pods are powered by *two separate feeds*:
  → 1 without UPS (25kW/rack)
  → 1 with *partial* UPS coverage (20%, 12kW/rack)

Non-UPS racks are for *batch* workers
UPS racks are for *BCDR* and *services*
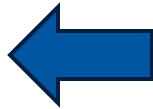

UPS covers for micro-cuts (<~ 15 seconds)

After that, covers only for clean automated shutdown of connected capacity

  → *UPS is not designed to cover for extended outages!* ←

IT rooms (2)

Rear view of a rack:
→ Hot air *inside* pod
→ 1 PDU per feed
→ IPMI (green)
→ Data (white)

Front of servers facing *outside* pod

Cooling and heat recovery (1)

For 1st phase: **4 * 2 MW** Jaeggi dry coolers on the roof

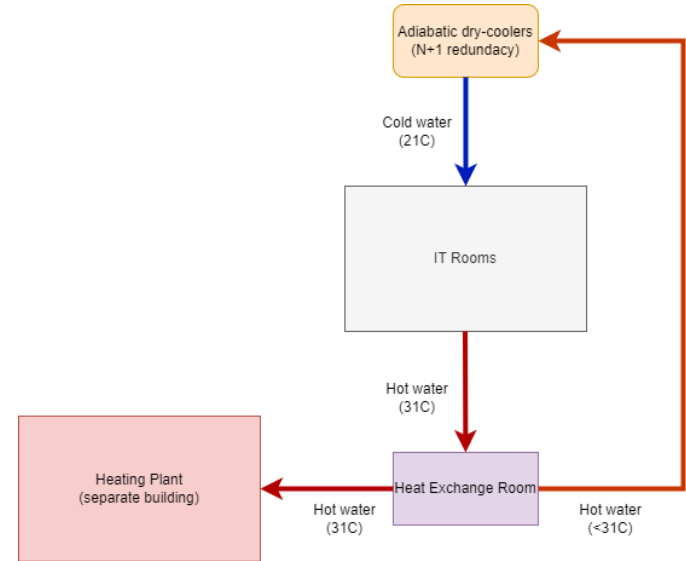→ **N+1** redundancy

→ 1 for technical areas (non-IT rooms)

For each new phase:

→ **2 * 2 MW** additional dry coolers to be installed

→ All piping work already done

Starting from **20ºC** outside temperature:

→ Dry coolers in adiabatic mode with water recycling
to improve WUE

→ **PDC designed for a PUE target of 1.1 (max 1.15 contractually)** ←

Adiabatic dry-coolers
(N+1 redundancy)

Cold water
(21C)

IT Rooms

Hot water
(31C)

Heating Plant
(separate building)

Heat Exchange Room

Hot water
(31C)

Hot water
(<31C)

Cooling and heat recovery (2)

One 2MW dry-cooler on a truck

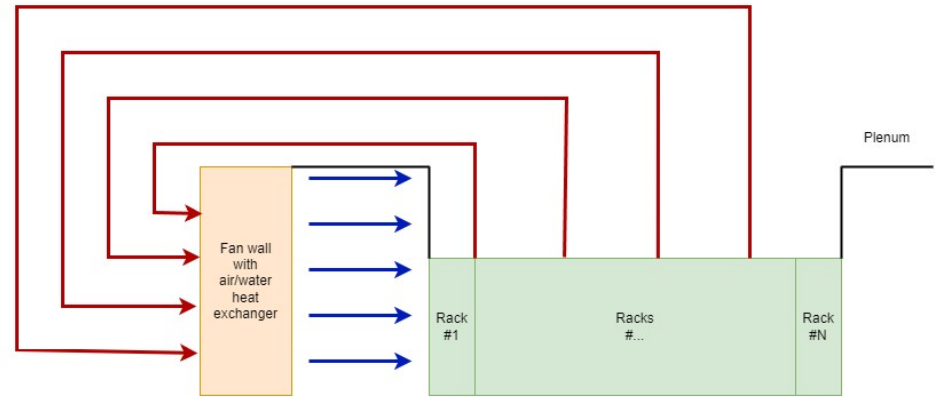Two 2MW dry-coolers on the roof

Cooling and heat recovery (3)

Each IT room is equipped with large fan-walls:

→ *5 * 500kW* fan-walls made by Schneider

→ fan-walls operate in *N+1* redundancy mode

→ largest fan-walls in Europe

Air circulates in a closed loop

Inlet temperature:

→ *25ºC* on average

→ can go up to *32ºC* in hot periods

Air-flow in the IT rooms (lateral view)

Cooling and heat recovery (4)

One half-fan module being moved

Fan walls being installed

Cooling and heat recovery (5)

Hot water from IT rooms arrive in the heat recovery room

For 1st phase, **$3MW$** will be transferred to the heating plant via **$2 * 1.5\ MW$** water/water heat exchangers

For 2nd phase, **$4MW$** in total will be transferred to the heating plant via one additional water/water heat exchanger of **$1MW$**

This recuperated energy will heat the buildings on the CERN Prévessin site

Monitoring dashboard of one IT room

Conclusion

PDC to provide computing capacity for HL-LHC:
   → 1st phase is **4 MW,** 2nd phase is **8 MW** and 3rd phase is **12 MW**
   → Turn-key solution with a **10-years** operations and maintenance included

Project carried out **on-time** with a particular focus on **energy efficiency** (**1.1 < PUE < 1.15**)
4MW of energy recuperated to heat CERN buildings on the Prévessin site

PDC powered by two separate power feeds
   → One without UPS
   → One with 20% on UPS coverage

> **→Technical building, unfortunately no visits are possible←**