COOLING AND VENTILATION AT CERN

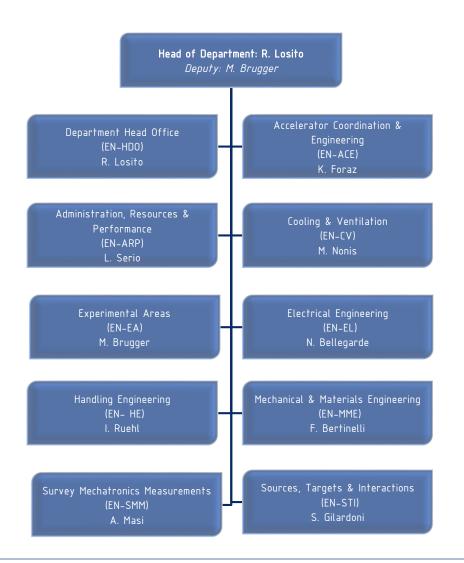
CERN-CLS Meeting

Cooling & Ventilation Group M. Nonis – 18th October 2019





Engineering Department



- Operation
 - Infrastructure
 - Accelerators
 - Experimental Areas
- Projects
 - Consolidation
 - Upgrades
 - New facilities
 - Design & Manufacturing
- Studies



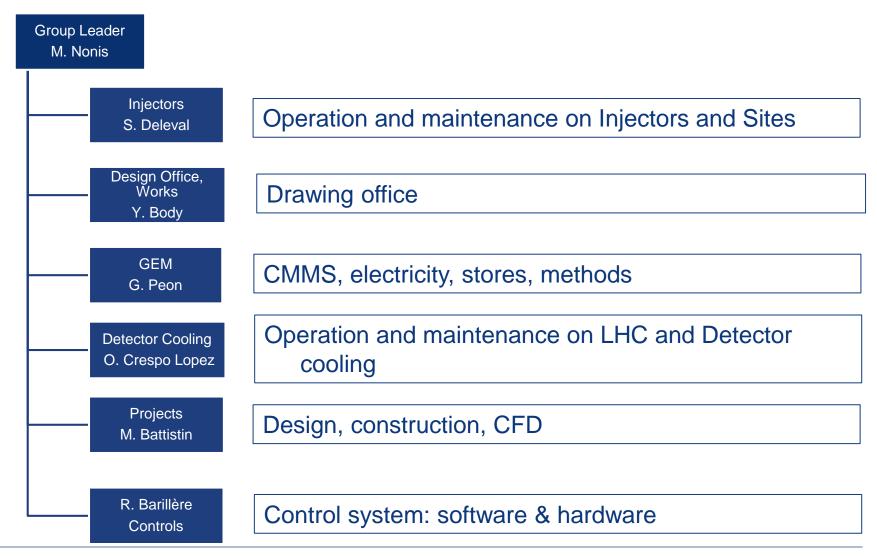


Cooling and Ventilation Group: mandate

- Operation and maintenance of water cooling, compressed air, sumps, ventilation and air conditioning plants in the technical areas (for accelerators, Experiments, computing center) and special system for detector cooling:
 - continuous improvement of plants reliability and availability
 - methods,
 - cost reduction.
- Project management:
 - Design and construction of new plants,
 - Upgrade, modification of existing plants,
 - Consolidation of old/obsolete plants.
- CFD simulation (mainly cooling systems for detectors)



Cooling and Ventilation Group Organizzazione







Installations



Compressed air production and distribution.

Water cooling (accelerators, experimental areas, computing center, laboratories);

Water network and fire fighting;

Supms and drainage pumping systems.



Power and control cubicles for CV plants.

Ventilation, air conditioning for underground and technical buildings:

- Caverns, tunnel;
- Industrial halls, control rooms, laboratories, clean rooms.





Cooling Plants

Equivalent to a small town of 25'000 inhabitants, 6% Geneva Canton. Annual consumption reduced by 40% in last 8 yrs.

Cooling towers (450 MW)

Chilled water station: 6-12°C (73 MW)

Cooling station (raw water, demineralized water, C₃F₈, C₆F₁₄)

Pipework

Water distribution network: 3 stations

Water consumption (peak)

27

41

150

800 km

5'400 m³/h

1'260 m³/h



















Impianti ventilazione, distribuzione fluidi

HVAC 1'500 units

from 2'000 to 120'000 m3/h per unit

Fire fighting systems 800 points

Compressed air 14 stations

distribution network 200 km

Demineralised water production 20 m3/h - 0.1 µS/cm







Detector cooling

30 systems for ATLAS-CMS-ALICE-LHCb-TOTEM

- $-70 \div +20$ ° C / 0.2 ÷ 90 bar
- Water, perfluorocarbons (PFC), Novec
- Radiation tolerance Dielectricity materials compatibility







Buildings under CV responsibility





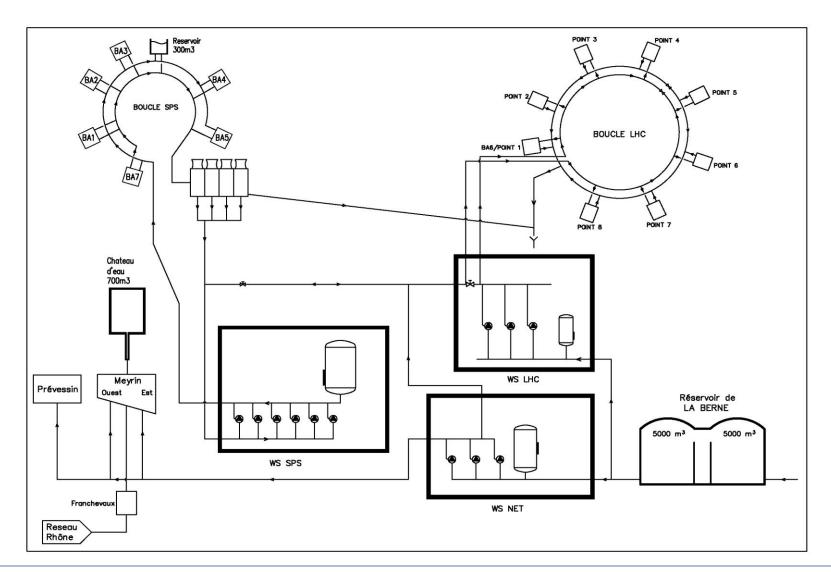
Meyrin: 131 bldgs - 25 barracks

Prevessin: 45 bldgs - 24 barracks

LHC & SPS Points: 220 bldgs - 116 barracks



Water network distribution







SF₆ Cooling tower water distribution from SF6 Maximal cooling capacity: 57 MW Nominal used: 22.4 MW; 24-34°C; 1925 m3/h *********** ********** ********** *********** uuuuuu ······ mmmm * * SU₆ **UW65** 4.6 MW; 24-34°C; 4.4 MW; 24-34°C; 379 m3/h 396 m3/h **Primary Water for** SHM6 6.3 MW; 540 m³/h SH6, 6.3 MW; 540 m³/h SD6 0.3 MW: 30 m³/h 0.5 MW; 40 m³/h US65, UX65 Cooling tower Back up 13.4 MW; 1150 m³/h **Total** 6 MW; 25-34.5 °C; 540 m3/h mmmm * with back up pump

LHC cooling

Primary and secondary side: N+1 redundancy

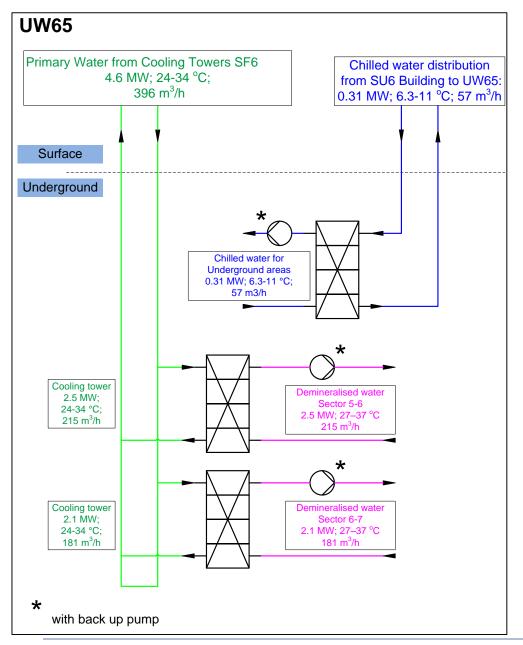
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SU₆ Chilled water production in SU6 SU SR PM-PX SX 3.4 MW; 6.3–11 °C; 620 m³/h 0.05 MW: 2 MW; 0.05 MW; 0.31 MW; 6.3-11 °C 6.3-11 °C; 6.3-11 °C 6.3-11 °C: 9 m3/h 9 m³/h 362 m³/h 57 m³/h 0.7 MW; 5-11 °C 100 m³/h 1.3 MW; 6.7-11 °C 260 m³/h 1.4 MW; 6.4-11 °C 260 m³/h Glycol Chilled Water for HVAC SU6 0.3 MW;1-7 °C 43 m³/h Glycol Chilled Water for HVAC SU6 0.3 MW;1-7 °C 43 m³/h SU HOT WATER DISTRIBUTION Cooling towers 4.4 MW; 24-34 °C; 379 m³/h with back up pump ENGINEERING DEFARTMENT

LHC Chilled water

Primary and secondary side:
N+1 redundancy

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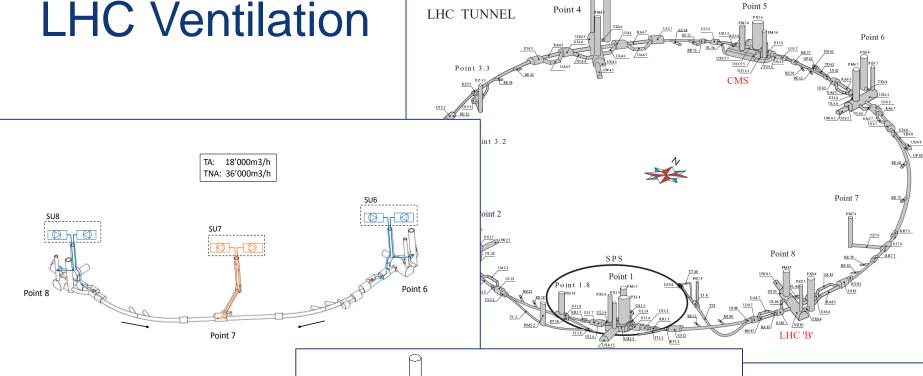
LHC underground

Primary and secondary side:
N+1 redundancy

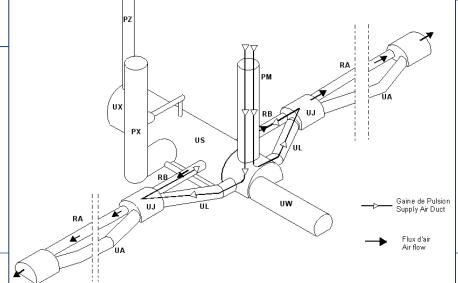




LHC Ventilation



AHU: N+1 redundancy







PS ventilation

