EN-CV during LS1:

Upgrade, Consolidation, Maintenance, Operation

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Chamonix 2012 – LHC performance Workshop

On behalf of EN/CV Group

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General view CV interventions in LS1

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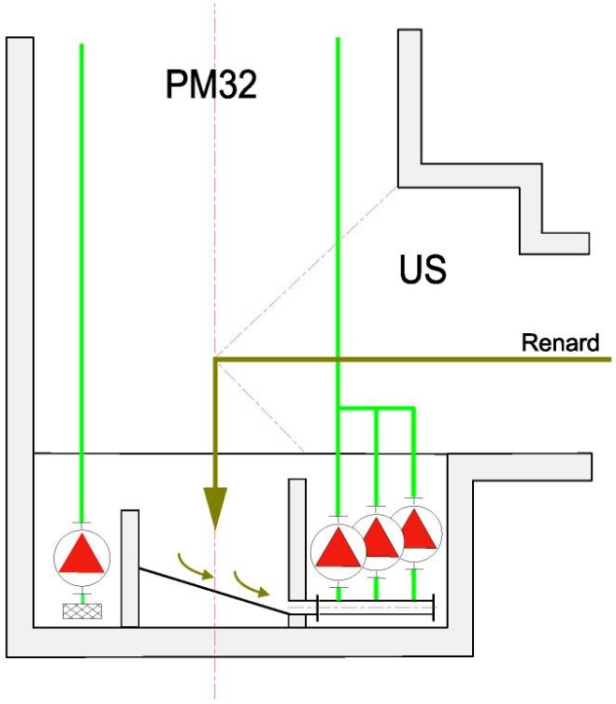
Operation, Maintenance, Commissioning

PM32 Raising system



Issue:

- Very old installation, need urgent refurbishing (control system obsolete, no spare parts)
- Avoid build up of sand.
- Plant presently accessible only during technical stops.
- If system fails → level 3 alarm triggers within 12 minutes, overflow after 3 additional minutes.

Action:

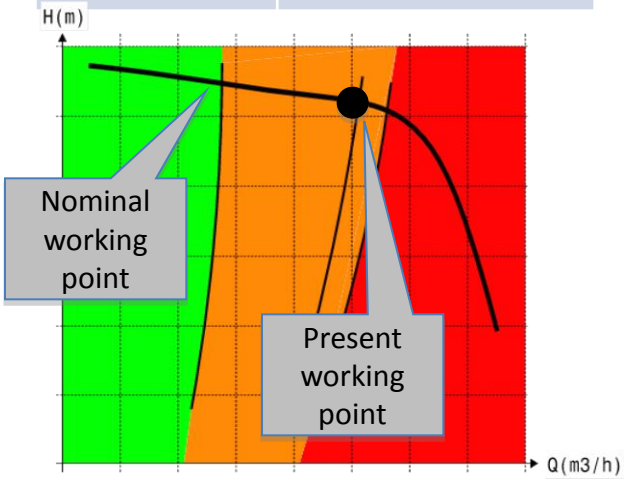
- Three new dry pumps (1+2 stand by duty).
- Replace the electrical and control cubicles.
- Modify the inclination of the bottom of the pit
- Keep the two existing back up pumps (operational during works)
- Each pump will still be supplied by three power sources: General services network / Pays de Gex / Secure network.

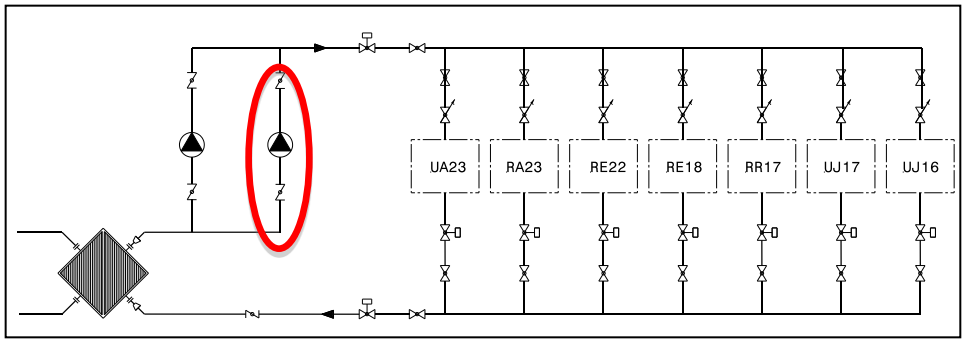
Planning:

- Work: 3 months, from February 2013.
- 1 MCHF

Pumps replacement in UWs

Sector	Present additional flow
Sector 1-2	30 %
Sector 2-3	18 %
Sector 3-4	38 %
Sector 4-5	9 %
Sector 5-6	18 %
Sector 7-8	25 %
Sector 8-1	17 %





- All sector pumps (but 6-7) run at an excessive flow wrt nominal conditions (9 to 38%).
- Sectors 2-3 and 5-6: additional flow rate increase of 4% → stop for thermal protection on motor.
- No requests to increase flow rate in any sector (except collimators).

Action

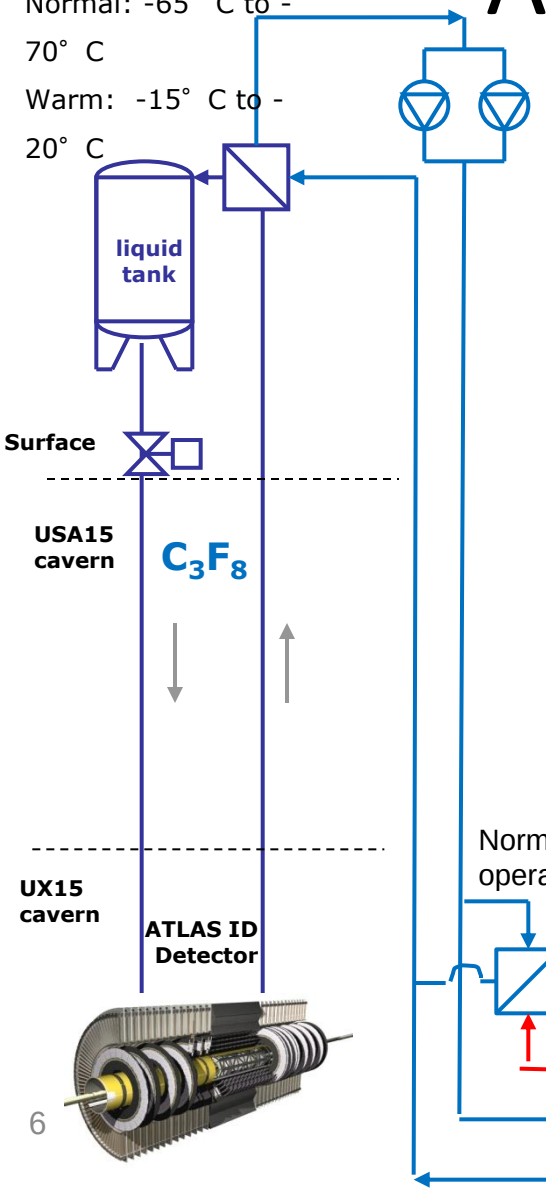
- New spare pump or replacement of existing + spare with new model.
- No piping modification.

Planning:

- Work duration: 2 months
- During work no cooling for UPS in REs

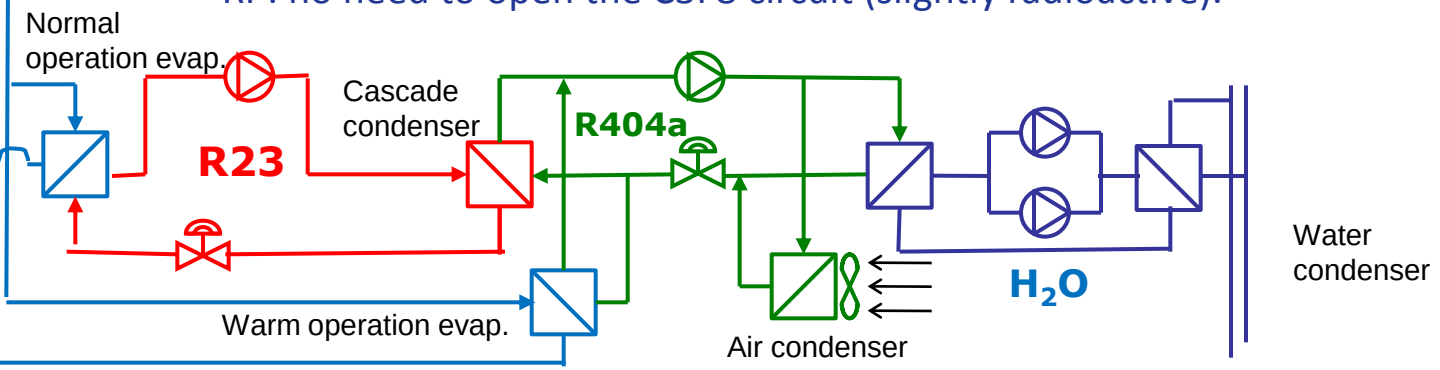
ATLAS Thermosiphon

C6F14 brine circuit
Normal: -65° C to -70° C
Warm: -15° C to -20° C

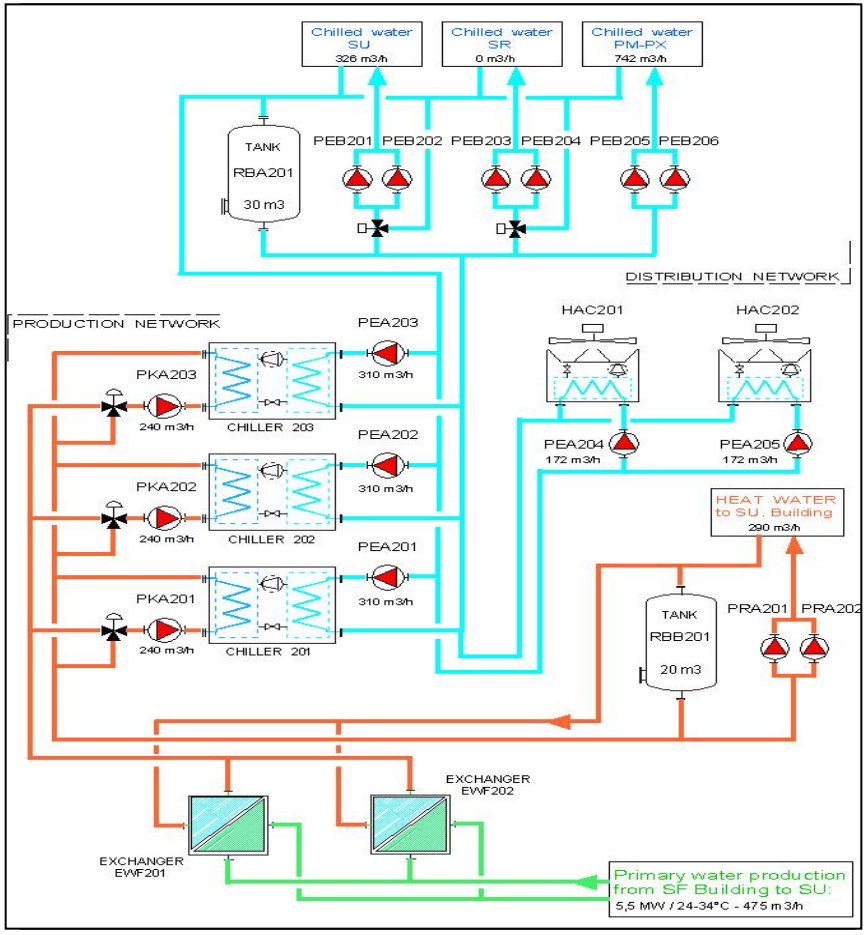


Issue:

- increase reliability
  - no active components on the main circuit
  - no risk of pollution
  - redundancy of existing compressors kept
  - air condenser for warm operation (no cooling towers)
  - large inertia: the system can suffer short power cuts. Time constant to be tested (1 minute to 1 hour).
- reduce maintenance (overall)
  - presently maintenance on compressors /2 months: 3 days, 10 kCHF
- safety & environment:
  - no vibration: leak risk avoided (40 CHF/kg, GWP 8000)
  - RP: no need to open the C3F8 circuit (slightly radioactive).



Chilled water - Point 2



Issue:

- Chilled water cooling does not match existing needs when external temperature around 32° C.
  - Temperature kept only for air supply in UX25, LHC tunnel, counting room PX24.
- No back up chiller is available unless no dehumidification needed, e.g. winter period.

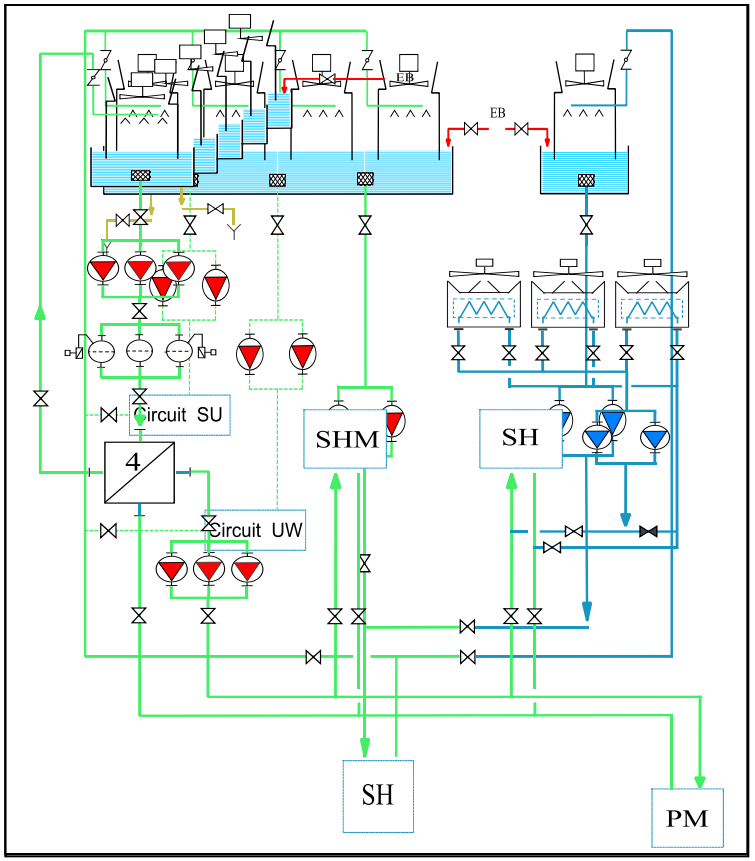
Action:

- Increase available power and restore redundancy of chilled water station.
- Adapt distribution circuit to the increased flow rates: pumps and pipeline (including in PM shaft).

Planning

- Work duration 1year:
- Preparation work starting in 2012.
- Downtime of the station for 2 months (surface) and 6 months (underground).

Back up for the primary cooling for cryo



Issue:

- Maintain the cooling of cryogenic equipment during maintenance and cleaning of the cooling towers at point 1, 4, 6 and 8 (legal constraint).
- Solve issue on Christmas 2014: – no stop.
- Improve of maintenance:
  - Full maintenance (3 weeks vs. 4 days).
  - Equipment and safety test on CV plant.

Action:

- Additional cooling tower 6 MW + 2 pumps.

Planning:

- Work phase: 2 months/Point.
- Cooling plant stopped during connection and commissioning: 2 weeks/Point.
- 3.6 MCHF.

ATLAS	Magnets, ID, DSS, DCS	1.5 MW tbc
Pt 4, Pt 6, Pt 8	Cryogenics	6 MW

CCR HVAC Upgrade

Issue

- Guarantee a high level of operational continuity in particular in case of power cut.
- Upgrade the cooling system to cope with existing and future needs.
- Separate chilled water plant from BA3.
- Minimize the shutdowns to exceptional situation.

Action:

- New station in bldg 874: 4 AHU, 2 chillers, 2 hydraulic networks, 1 buffer tank.
- New water cooled racks circuit.

Work:

- Around 1 year.
- Difficult work phasing to ensure the availability of the plant as long as possible
- Downtime of CCC cooling: 1 month.

Operation, maintenance and tests

- Several installations shall continue being operated throughout LS1 (see next slide).
- Intervention requests (drain/fill of circuits, flushing etc.) must be notified asap to be included in the detailed planning.
- Preventive maintenance interventions shall be made at the beginning of LS1 and before powering tests:
  - Extended maintenance (PHE opening, Doucet filters, one way valves…)
- CV needs to perform functional tests in order to ensure the functionality of the installations during operation:
  - Safety tests.
  - Valves manipulation (e.g: in concrete floor)
  - Degraded mode scenario (ventilation systems)
- During maintenance and tests, the availability of CV services shall be affected.

CV services available during LS1 in LHC

- No requests for CV during LS1 have been made (except CAST).

- CV will ensure only essential services:
  - Ventilation of underground and surface premises (tunnel, experimental areas, buildings…) but not the ones dedicated to specific equipment.
  - Chilled water only for ventilation purposes.
  - Compressed air.
  - Raising systems.
  - Drinking water supplies.
  - Fire hydrants network.
  - Ventilation in REs.

- Temporary stop of these installations might take place according to modification work or maintenance interventions to be performed.

Commissioning

Commissioning of CV and users' equipment requires a massive work for CV staff (e.g.: 137 connections in sector 1-2).

Previous experience at the end of the LHC installation project, shows that the commissioning phase might encounter difficulties that would impact on the duration of the activity:

- Continuous balancing of cooling circuits.
- Air management in underground areas (open tunnel configuration).
- Balancing of pressure difference between different areas.
- Flushing (clogging of filters on sector cooling circuits).
- Work coordination in case the circuits have to be drained to avoid damages on equipment (e.g.: current leads).

Final considerations

- CV involvement during LS1 is at the maximum of its capabilities in terms of workforce, it will be impossible to take into consideration new requests later in the year.
- Preparation of LS1 has to be completed by September 2012 (most important bids), therefore bids to be sent out in May!
- LS1 work start already in 2012 where possible
- General and detailed planning of work in each Point will represent a key factor of success (downtime period in each plant).
- Prolonged operation without maintenance during 2014 and 2015 will represent additional stress on installations, therefore it will be important to schedule maintenance intervention in 2014 whenever possible.

Thank you for your attention