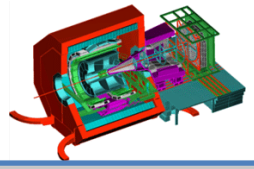
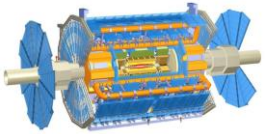
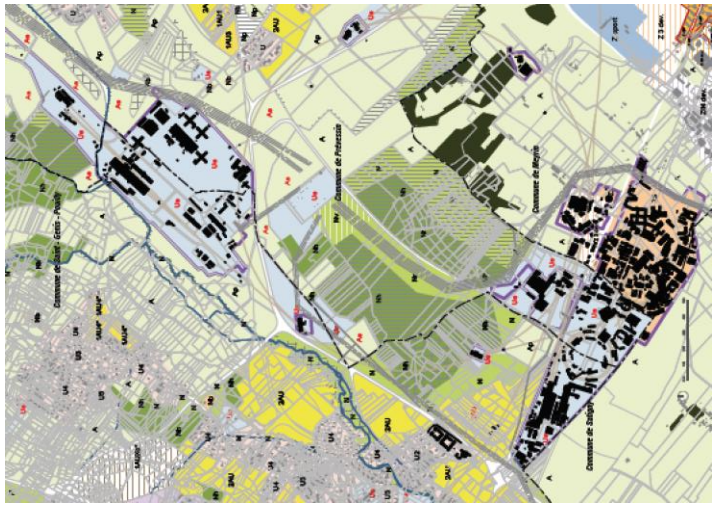



INFRASTRUCTURE CHANGES AND UPGRADES

Presented by: Fernando Baltasar dos Santos Pedrosa in the name of the four LHC experiments


SPACE



- No specific CERN budget to cover all needs
- For new PH buildings, the PH management is already looking the possibility to create “burotel-style” offices in these buildings
- Idea to change strategy on space allocation (similar to building 42)
- New members = new needs (conference support over night, car renting after 18:00, …)
- There is recognition from CERN and PH that the LHC experiments need infrastructure on site and cannot depend of the Meyrin + Prevessin sites or barracks
- With the HL-LHC time-line in mind is important to have a precise idea of the needs from the experiments as soon as possible (budget justification)

Contribution from: Achille Petrilli

Power Network

- A study has already been done concerning the power needs for the HL-LHC (common infrastructure to all CERN);
- The CERN electrical infrastructure goes over continuous consolidation taking into account future needs;
- The radiation levels can have a direct impact on the UPS systems and on the 48V networks used to control all the power distribution infrastructure;
- If the radiation levels reach the levels seen on the SPS today we will have serious problems with all the power network cables and non-metallic components;

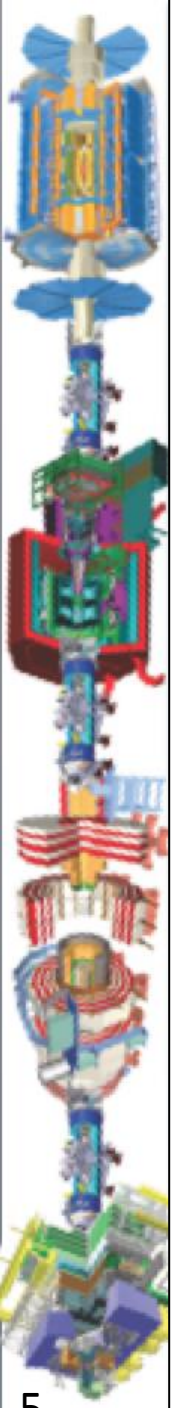
- Most of the optical fibers used today in the electrical network controls may present problems when exposed to high level of radiation;
- More detailed radiation studies are needed to better estimate the consequences.

Contribution from: Francois Duval

Cooling & Ventilation

- All the components of the ventilation systems for the LHC and experiments will need to be refurbished in a timeframe up to 2040;
- Changes on the ventilation units will imply always a restriction of underground access;
- Maintenance on the chilled water plants or cooling towers will have an impact on the treatment of the air;
- There is an huge number of installations on the surface dedicated to small buildings or circuits that will also need consolidation and resources;
- As far the ventilation functional requirements are kept, most of the modifications are considered on the consolidation program;
- New rules = new restrictions = new safety action matrices = complex action systems integrated in the ventilation control systems or other systems to treat them;

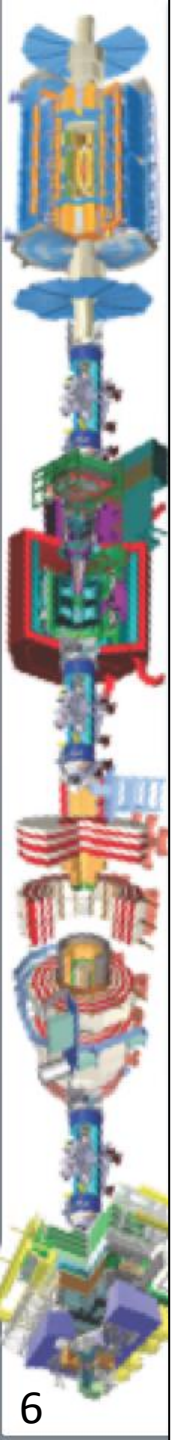
Contribution from: Mauro Nonis



Cooling & Ventilation

- The ventilation units placed inside the experimental caverns will probably need to be moved to the surface;
- An increase of radiation levels could imply to put the ventilation systems on close loops (LHCb and ALICE);
- Putting the systems on close loops implies a more complicate water reject management (condensed water with tritium);
- The maintenance frequency may need to increase due to radioactive pollution of the filters;
- Some ventilation ducts run over conventional buildings, and if the ducts have to be sealed, additional space has to be found around them or new routing;
- An increase of the radiation levels may create problems on the cabling and non-metallic parts of the ventilation systems;
- There is very little cooling margin in the 4 LHC experiments;

Contribution from: Mauro Nonis



Cooling & Ventilation

- A small increase on cooling needs could be accommodate with local changes, but a major increase will imply new infrastructure, new pipes from the surface to underground and new space underground;
- Some normal steel pipes are still used for critical systems like Fire Brigade and mixed water supply, but is extremely difficult to change them because some parts are inaccessible, so new space maybe needed;
- The cooling towers concrete (except ATLAS and CMS) will have to be re-done between 2020 and 2030;
- Some consolidation plans had already been moved to LS2 and LS3 due to resources constrains, so include new projects on LSs is not simple and is almost impossible to do major changes in 2 experiments at the same time in the same LS;
- Just for reference the modification from LEP to LHC took 9 years ;
- If the LS detector cooling restrictions increase, then the limit of projects that can be included, decrease due to the fact the same resources are used to install the parallel installation;

Contribution from: Mauro Nonis

Lifts and lifting equipment

- LHCb is still using a overhead crane from LEP times;
- Some experiments have only one underground crane, so a more demanding LS periods could change the needs;
- The lifts situation is more critical than the cranes and EN-HE is already looking the possibility to integrate this in the consolidation budget for LS – major constrain for underground access;
- The lift or crane control equipment + cabling is not radiation hardened, so an increase of radiation levels may have a major impact on this equipment;
- The ATLAS UX lifts are one example of things that could be affected by an increase of radiation levels;
- More detailed radiation studies are needed to better estimate the consequences.

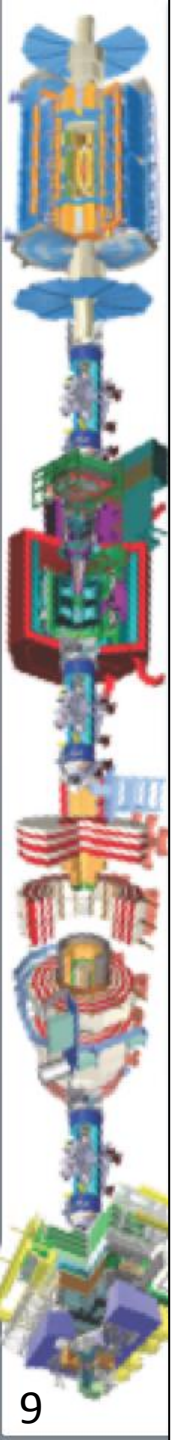
Contribution from: Ingo Ruehl

Access Control System

- The LHC access system was built to have a 20 years lifetime, but due to market constrains it is going over constant modifications what removes the lifetime constrain as far the principal stays the same;
- New maintenance strategy is under development to be able to maintain the LHC Access Control System (LACS) part of the system out of TSs;
- Some new requirements could be integrated (operational dosimetry, tracking of people underground, …) on the actual access system, but detailed studies are needed;
- Create and manage small temporary access zones (simple controlled, controlled, …) is possible already using the actual system;

- Some parts of the system may need to be moved due to the radiation levels;
- As far it is accepted that some conditions from the LHC Access Safety System (LASS) are masked during the LSs, it is possible to do most of the maintenance activities without access interruptions.

Contribution from: Rui Nunes



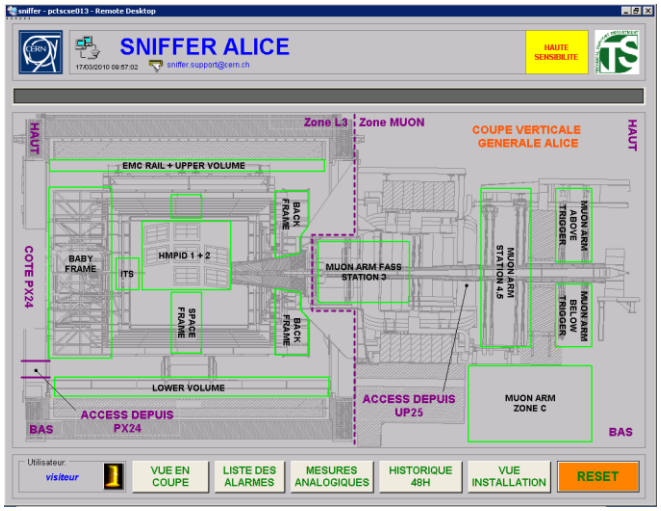
Alarm Transmission System

- The CERN Safety Alarm Monitoring (CSAM) system is based on Schneider technology which will reach the theoretical lifetime in 2028;
- If the alarm philosophy is the same, this system could last for the duration of the HL-LHC project after standard upgrades (replace the PLCs);
- It is foreseen to do a complete review of the system before the LS2, so it would be important to have a clear view of the needs (synoptic views,…);
- The actual system has 1800 HW alarms, 20200 SW alarms and 150000 system variables but it still have significant room to increase the number of alarms;
- Integrating complex systems like Radiation Monitoring System for the Environment and Safety (RAMSES) is not in the scope of the project – Some link could be done if needed as far they still two independent systems;
- Most of the CSAM components are on the surface, but the link between the different detection centrals and CSAM could be affected by an increase of the radiation levels;
- Replacing the PLCs implies losing the redundancy, but not the system.

Contribution from: Silvia Grau

Detection Systems

- The smoke and gas detection centrals as well as the emergency evacuation central will reach their theoretical lifetime between 2019 and 2021;
- Smoke + gas detection centrals will be replaced 50% in LS2 and 50% in LS3 (1 or 2 weeks interruption) – compensatory measures have to be foreseen and maybe some work limitations;



- Emergency central replacement would ideally happen during the RUN period when there are no workers underground;
- An increase of radiation levels in the LHC service areas would oblige to move some centrals to the surface and probably a change of detection technology – detailed studies are needed to evaluate the real impact;
- The optical fibers used to interlink the evacuation centrals and to apply the evacuation matrices can be affected by the radiation levels;
- An increase of radiation will imply higher As Low As Reasonable Achievable (ALARA) levels for the maintenance work, more preparation and longer maintenance periods;

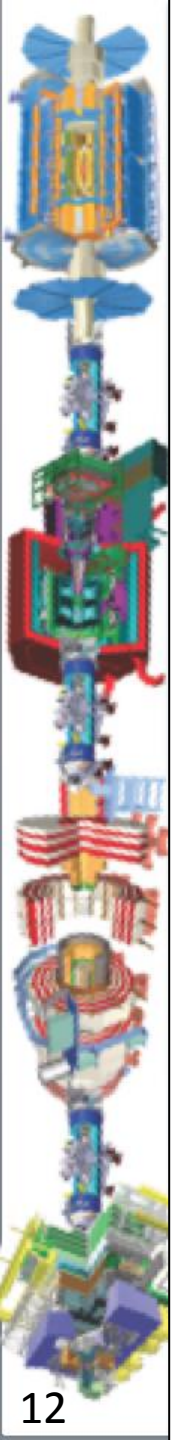
Contribution from: Silvia Grau

IT infrastructure

- The link between the sites and the computer center in Meyrin is done via 2x4x10Gb links running on the surface, so no impact foreseen due to radiation levels;

- Continuous changes due to the life time of 4/5 years of the computers, disks, tapes, …
- None of the GSM, network equipment or general purpose fibers are radiation hardened;
- The physical UTP cables are coming to the end of their “official” lifetime for all sites, so IT is starting to consider what the plan should be to replace them and when (some questions on how it shall be the interplay between the fixed and wireless network);
- The lack of space and the long time it takes to install new fiber infrastructure, if needed, across the site is one of the biggest problems.

Contribution from: Bernd Panzer-Steindel and David Foster



Conclusion

- A considerable part of the modifications required are already included in the consolidation projects;
- Increase of radiation levels is a fundamental parameter for most of the systems and can have a major consequences, so detailed studies are needed and as soon the best;
- There are some revisions of the different systems foreseen, so an involvement of the experiments in these revisions would be a great advantage;
- For some infrastructure subjects the resources and additional space are two very limiting subjects – special attention to be taken on the upgrade to not increase the constrains or needs;
- Having a clear idea on how the collaborations will evolve and the additional space required as soon as possible, would be essential for PH.
- A lot of infrastructure modifications imply a restriction on underground access during LSs, so they shall be studied carefully to integrate as much as this activities out of the LS periods.