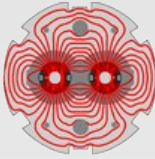


How did the LHC access system perform in 2009

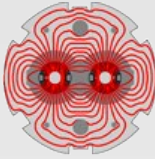
L. Ponce

On behalf of the OP team

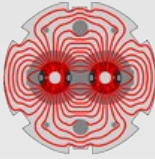
And a special thanks to all the volunteers who helped giving access



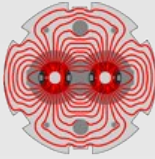
- Some preliminary remarks
- Status and major issues of:
 - Hardware
 - LASS : LHC Access **Safety** system
 - MAD : Material Access Device
 - LACS : LHC Access **Control** system
- Interlocking with the power converter
- Some organizational problems



- Detailed status presented by M. Gruwé at the LMC on 30th September 2009
- No Safety problem (**LHC Access Safety System** reliable), but efficiency problem for beam time
- A lot of problems/disturbances, but not the same level of priority according to the exploitation status of the machine
- As the access in the experimental caverns is managed by their own CCR, not presenting feedback here, sorry!

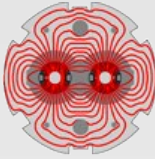


- **During shut-down:**
 - **GENERAL** mode : biometry and access list LHC-TNL
 - **During powering phase 1:**
 - **RESTRICTED** mode : biometry and access list LHC-TNL + Access granted by CCC, with a key
 - Applied only in the tunnel zone
 - **During powering phase 2:**
 - **RESTRICTED** mode + **PATROLS** according to the access matrix
 - **During beam operation :**
 - **CLOSED** mode : the whole machine + experiments patrolled
- ➔ Note: Access mode independent from the patrol status and from the doors status



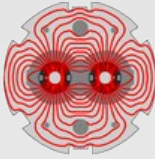
- **Mechanical problems on MAD, PAD, doors:**
 - People blocked in the PAD, door not opening or not closing properly,...
 - After 2 maintenance campaigns, most of the problems solved
 - But seems to have some systematic location: UJ16, PM25...
 - Problems generally reported to OP by users and followed by GS/ASE via ODM system:
 - No real feedback, so repetition of ODM

- **Impact in 2009:**
 - Mainly a problem during the HWC period, after a long shut-down



- **Key distributor:**
 - Problem to give key back due to:
 - Hardware problem on the key token
 - communication problem
 - New version of the software deployed improved the situation
 - But still a lot of mechanical problems
 - Faulty token slots (any key can be put back in) require the change of the distributor to be solved
 - New distributor available : to be installed everywhere?

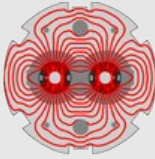
- **Impact in 2009:**
 - cannot come back from access mode to beam mode.



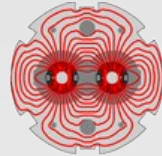
- **Simultaneous opening of both PAD doors:**
 - Happened during standard entry procedure, causing drop of the patrols
 - New software implemented by GS/ASE in few weeks
 - Deployed just on time for beam operation

- Still some case of patrol drops when standard passage through the PAD:
 - due to another reason (contacts problem)?
 - But still same consequence on the patrol...

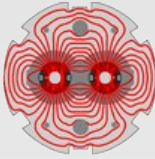
- **Impact in 2009:**
 - need to re-patrol after access
 - seen mainly during powering phase 2 (~ 20 cases)



- Only few changes since 2008 operation, validated by the successful DSO tests
- Big improvement is the SPS-LHC Safety chain connection:
 - No more false evacuation signals in LHCb
- Modification of point 5 sectorization for HW needs:
 - OK after few problems of logic to be transferred in the LACS
- Only one loss of patrol during beam operation in ATLAS cavern:
 - Drop of box in the SSA system (ATLAS dedicated system)
 - Problem followed by GS/ASE, tests done end of December
 - No feedback



- Personal detection in the Material Access Device (so well called MAD) is an on-going issue since 2008
- New software and hardware based on high resolution movement detection has been investigated and deployed all along the year (only PM45 installed during powering phase 2)
- **Impact in 2009:**
 - Before the new software deployed, obvious violation of the rule
 - After first setting of parameters in PM45, system was still too easily to violate and not deployed everywhere
 - Compensatory measures (MAD guarding by OP) had to be taken for beginning of operation (~ 1 week)
 - Then sensitivity was strongly increased and deployed everywhere
 - Compensatory measures lifted provided that consolidation continues



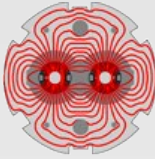
- **Impact in 2010:**

- Users faced a lot of trouble to pass the material:

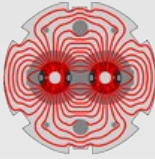
- Some false triggers of the obstruction detection due to bad image reference
 - Micro-movement detected :material stabilization, melting snow, flexibles...

- **Problem still not solved:**

- Better monitoring of the system status needed
 - Need a lot of efforts and follow-up from GS/ASE (see R. Nunes'talk in this session) to optimize the parameters

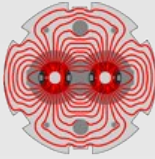


- Main issue for operation due to very slow and not optimized application
- **Access mode** were used to control **activities** during HWC, heavy load on the system:
 - An average of 200 keys taken per day
 - With peak period of requests all around the machine
- Several version deployed and tested during the year, but not with satisfactory results:
 - Had to come back to a previous version because stability degraded too much



- **New features in 2009:**

- “Chenillard” to sequentially distribute all the keys,
 - Avoiding to block an access point when faulty token
- Filtering of key requests per access point
 - Avoiding to give key to the wrong place
- Most of mis-behaviour due to communications problems has been solved
 - Avoiding mixing the keys when given back



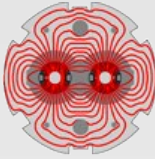
- **Remaining issues :**

- Recorder problems (in few access points) : no video
- Delays in access request transmission longer than time-out :
- Crash of the application
- Quality of the audio connection
- ALICE delegation instability

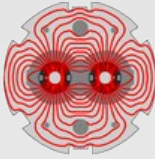
- No safety issue but a lot of delay in access proceeding

- **Features needed:**

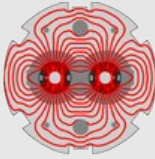
- Improve display of total person in underground area at the surface level
- Avoid switching of video and intercom on double PAD access points



- **Need a more efficient LACS application :**
 - To allow multiple key distribution for a group (35 persons at the same PAD)
 - To allow handling different points in parallel (while the 35 are going through)
- **Need some modifications in situ to avoid people leaving with the key:**
 - Opening of the key distributor independent of which SAS is used for double PADs access point
 - Use the token in the exit procedure
 - feasibility?
- **Proposal for short term solution:**
 - Unlink the intercom switching from the key distribution
 - Develop a real multi-view application, see T. Hakulinen's talk



- Problem of the gateway between LACS and LASS
- Consequence:
 - change of mode not transmitted, impossible to give a key
 - No real safety problem, but real mess, especially when people circulate through inter-site doors or during patrols
- Happened at least 3 times:
 - Procedure to recover has been well improved but...
 - But problem with the redundancy of the system to be sorted out as it is critical for the availability of the system

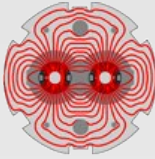


➤ **Principle:**

- In addition of the existing procedure
- Prevent powering above the phase 1 current limit when people are in zone
- Stop the Power Converters of the concerned area when people are entering a zone

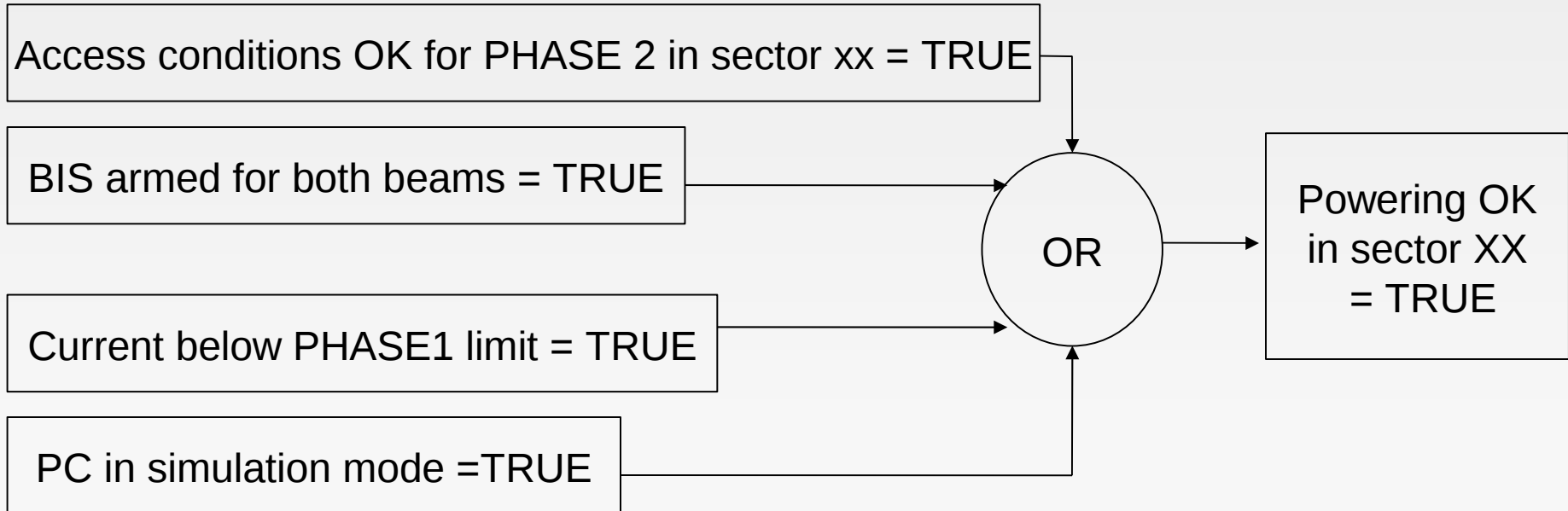
➤ **Implementation :**

- use the Software Interlock System to generate the logic (between the access conditions and the current read in the PCs) and to send commands to the power converters via the PIC
- Action : in case conditions are not met, a Global remove PC permit of the sector is sent to the PIC, which causes a Slow Power Abort

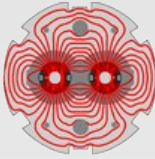


➤ Logic used in 2009:

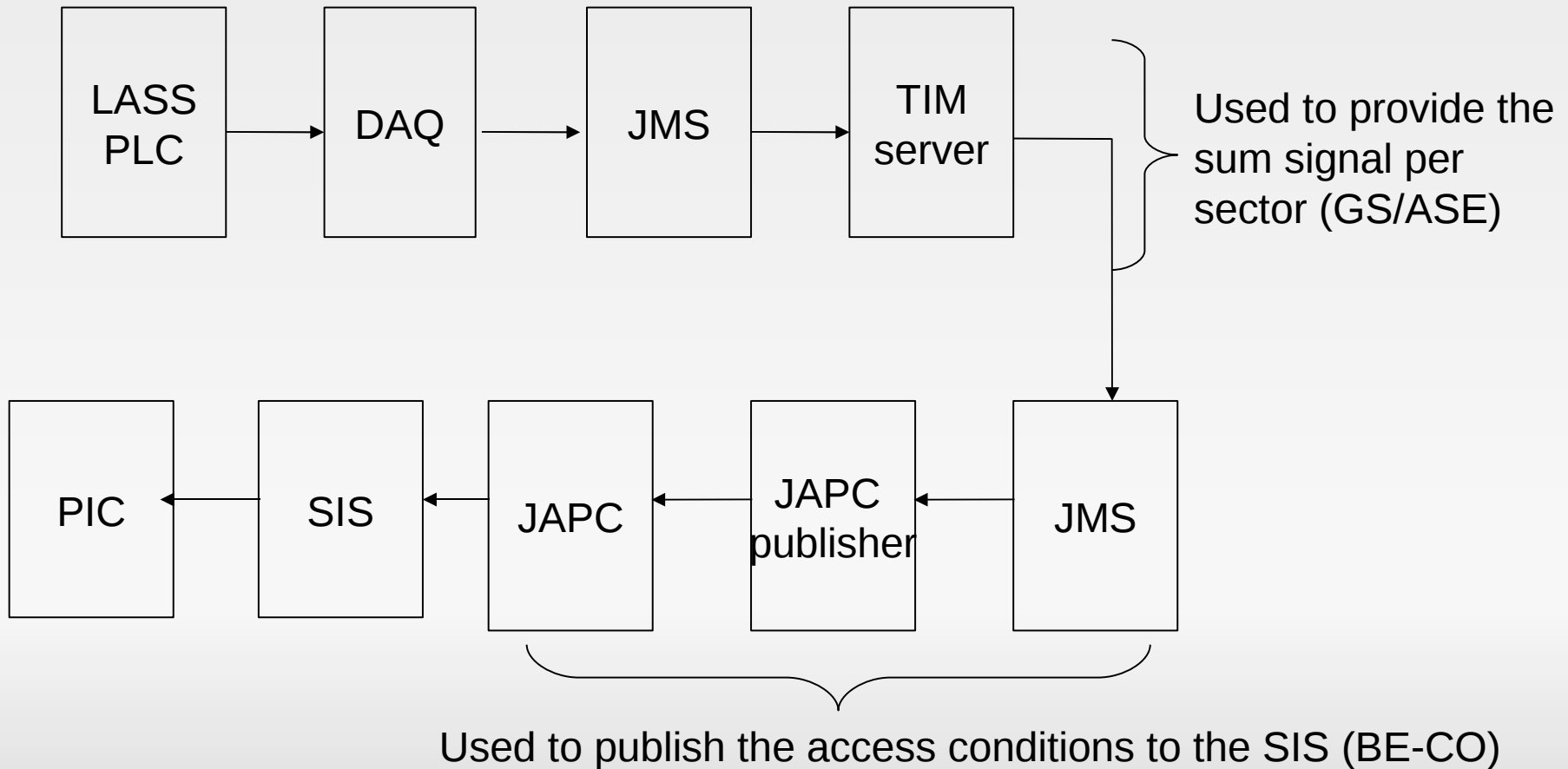
- One powering permit per sector : 8 independent signals
- Constantly running since March 2009

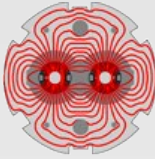


- 1 of the 4 signals TRUE give a TRUE permit
- Powering OK FALSE trigger the removal of PC permit

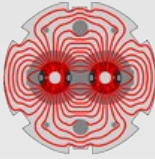


- long chain of different softwares to connect the signals:

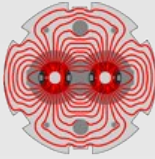




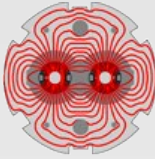
- **The interlock always worked as expected:**
 - Fail-safe: in case one element is missing, condition is FALSE
- Couple of cases where the interlock rightly aborted powering tests done in the wrong phase
- **Availability problem in 2009:**
 - 1 day of downtime during HWC due to major TIM crash
 - 2 switches off of the whole LHC during beam operation due to an overloaded (by BLM data) JMS broker
- **The beam was never dumped because of the interlock:**
 - BIC loop status entry to activate the interlock only when beam not in the machine
 - But was activated as soon as the beam was dumped ...



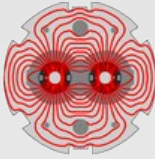
- **Modifications for increased reliability during beam operation in 2010 :**
 - Replace the BIC loop status by the reading of the LASS status in the BIS to avoid switch off of PCs when LHC in BEAM ON mode
- **Possible improvements:**
 - Shorten the software chain by including the JAPC publisher in the TIM server
 - Make JMS more reliable
 - Move towards a HW link between the LASS signals and the powering interlock controller for a long term solution



- The access matrix for powering phase 2 assumed that some ventilations doors are closed, some are opened.
- Big effort done to display the status in the CCC:
 - ALARMS
 - View in the TIM viewer tool used by OP/TI, not so much in LHC
- Improvements for 2010 :
 - Include them in the software interlock?
 - For a longer term, to be included in the Safety System?



- Improved strap procedures :
 - Manipulation still delicate and risky
 - But new procedure in place worked well
- Management of the access via generic ADIs (more in 2010)
- Circulation through the inter-site doors is also an on-going discussion since the first passage in RESTRICTED mode:
 - Clear procedure to be established
 - Problem of people follow-up : one can enter in point 4 and go almost to point 7 without being traced by the LACS.
 - See J. Coupard and M. Tavlet's talks in this session



- Golden period for operation of the access system is during beam operation
- Most of the problems appear during massive access period!
 - During the shut-down: hardware problems, MAD
 - During the powering tests: constraints on circulation, long waiting time due to single passage procedure
 - Important issue with the faulty token to be followed-up
- Modification of the access console is needed to increase efficiency
- The software interlock is a short term solution, a more reliable one (hardware) has to be implemented on a longer term