ATLAS Progress Report (part I)

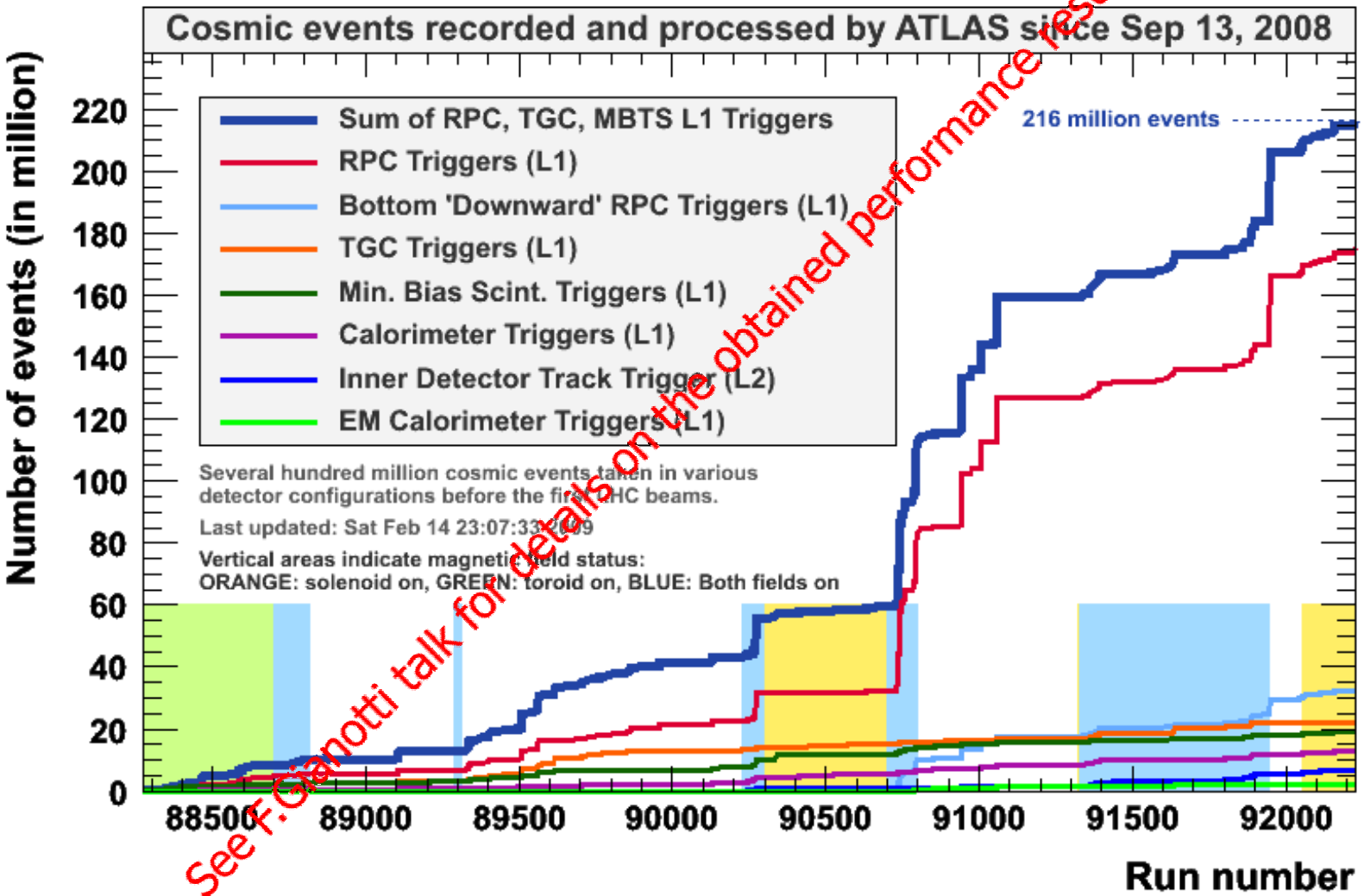
CERN-RRB-2009-021

28th April 2009

What happened after that?

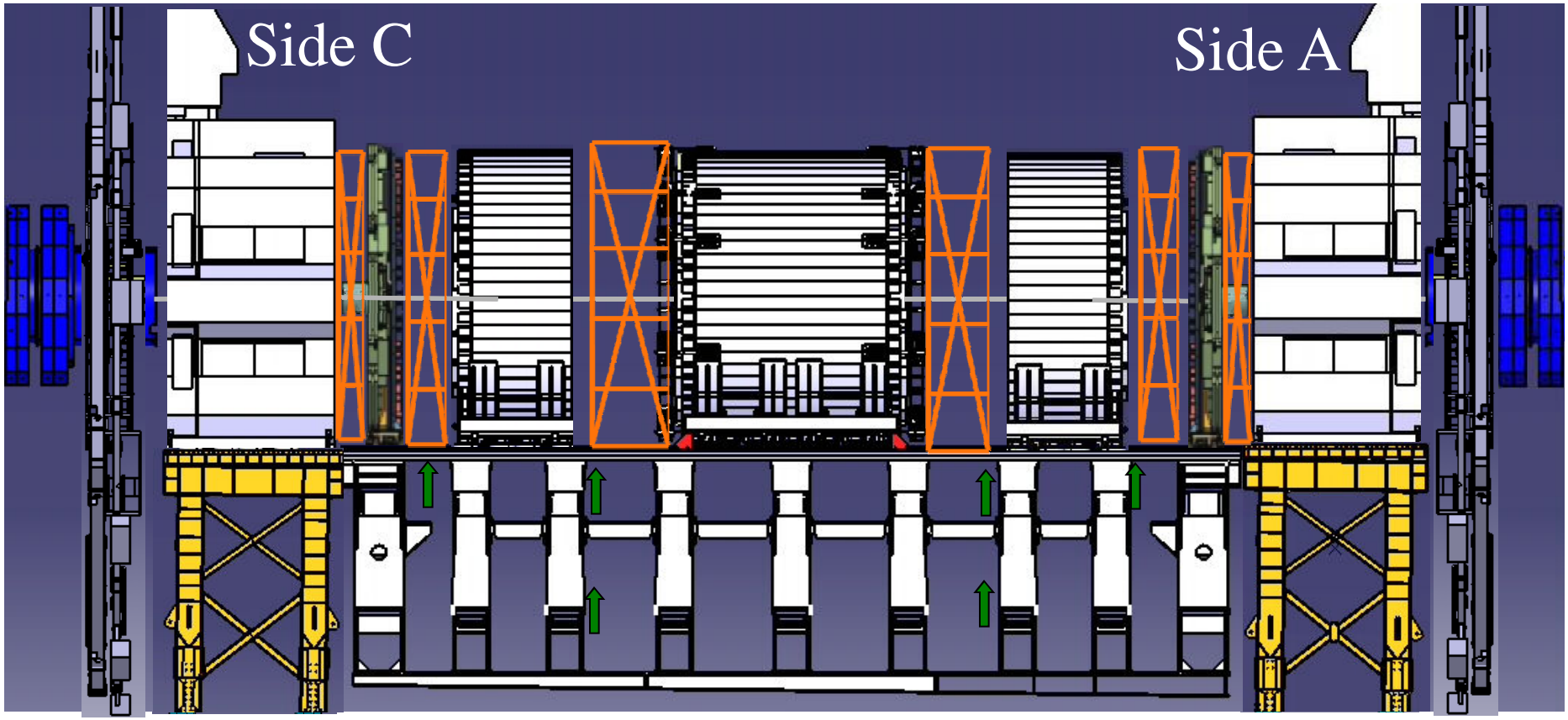
What happened after September 19th ?

- ✓ All systems asked for an exhaustive cosmics combined run with the entire detector active (including Pixel, SCT and the evaporative ID cooling system)
- ✓ The detector was fully operational !



What happened after September 19th ?

- ✓ Mid November the decision was to open, access the inside and start our first full shutdown period
- ✓ Detector was in full open configuration by mid December 2008



Shutdown activities (~250 individual work packages)

- Known problems fixing (3 examples: LAr LV, ID cooling plant, Muon wheels optical fibers)

- Regular maintenance activities (Infrastructure like electrical power, cooling towers and primary cooling water, services, safety systems like sniffers and emergency panels, access systems, ….) …. All done in the frame work of an overall CERN planning, some required the detector fully switched off

- Consolidation & first upgrades for nominal Luminosity

→ Critical issues to be solved in the next future :

- LAr LVPS

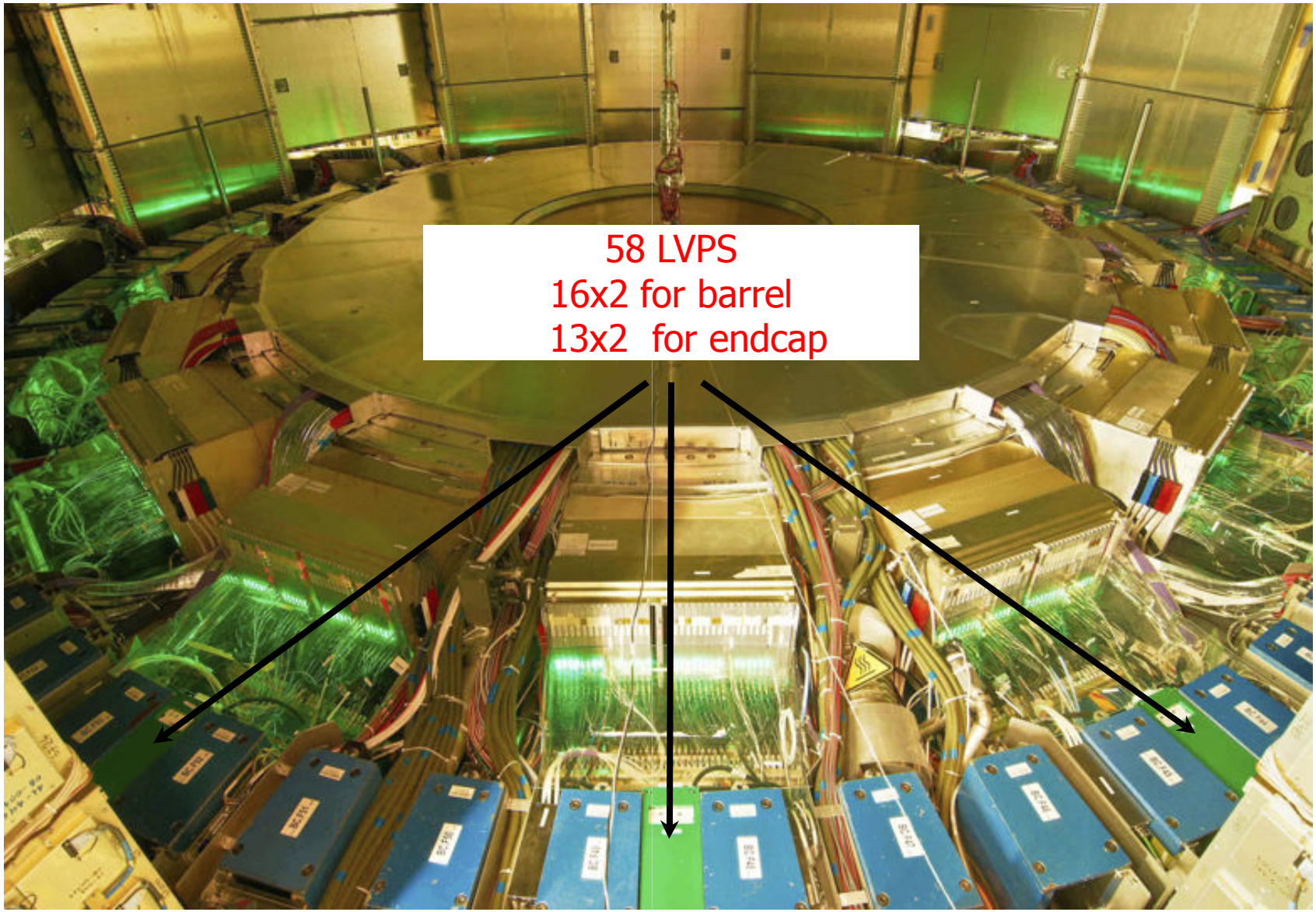
- ID evaporative cooling plant

Shutdown 08/09 problems fixing

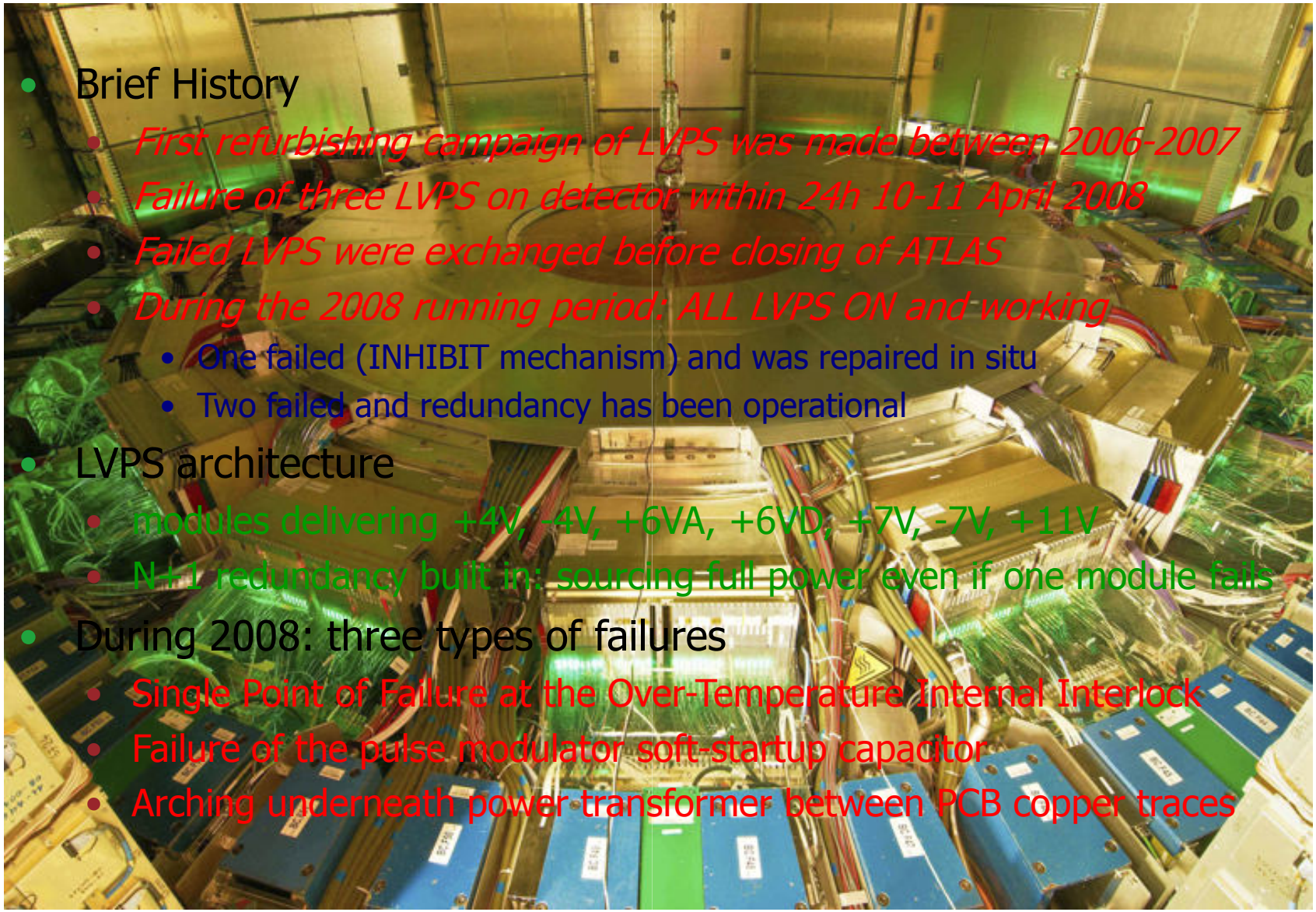
- ✓ Fix various electronics/LV problems on the calorimeters
- ✓ Consolidation work on the ID cooling and environment gas systems (fix some loops if possible, fix/improve distribution racks, thermal analysis at the level of the ID end plate, fix some optical readout problems,…)
- ✓ Turn on and check the Small Wheels chambers, in particular TGCs, access possible damages, change few EIL4 broken TGC chambers
- ✓ Fix as much as possible all gas leaks in the RPC and MDT chambers (1 tower was problematic), finish barrel hardware commissioning for RPCs
- ✓ Change to RADHARD the optical fibers in the MDT wheels, this requires opening the wheels.
- ✓ Fix small problems in electronics front end systems (FEB in the LAr, Drawers in the Tiles, CSM boards in the Muons, Optical links in the SCT,….)

Goal : bring known problems from % to ‰ where possible

Low Voltage power supplies for the LAr

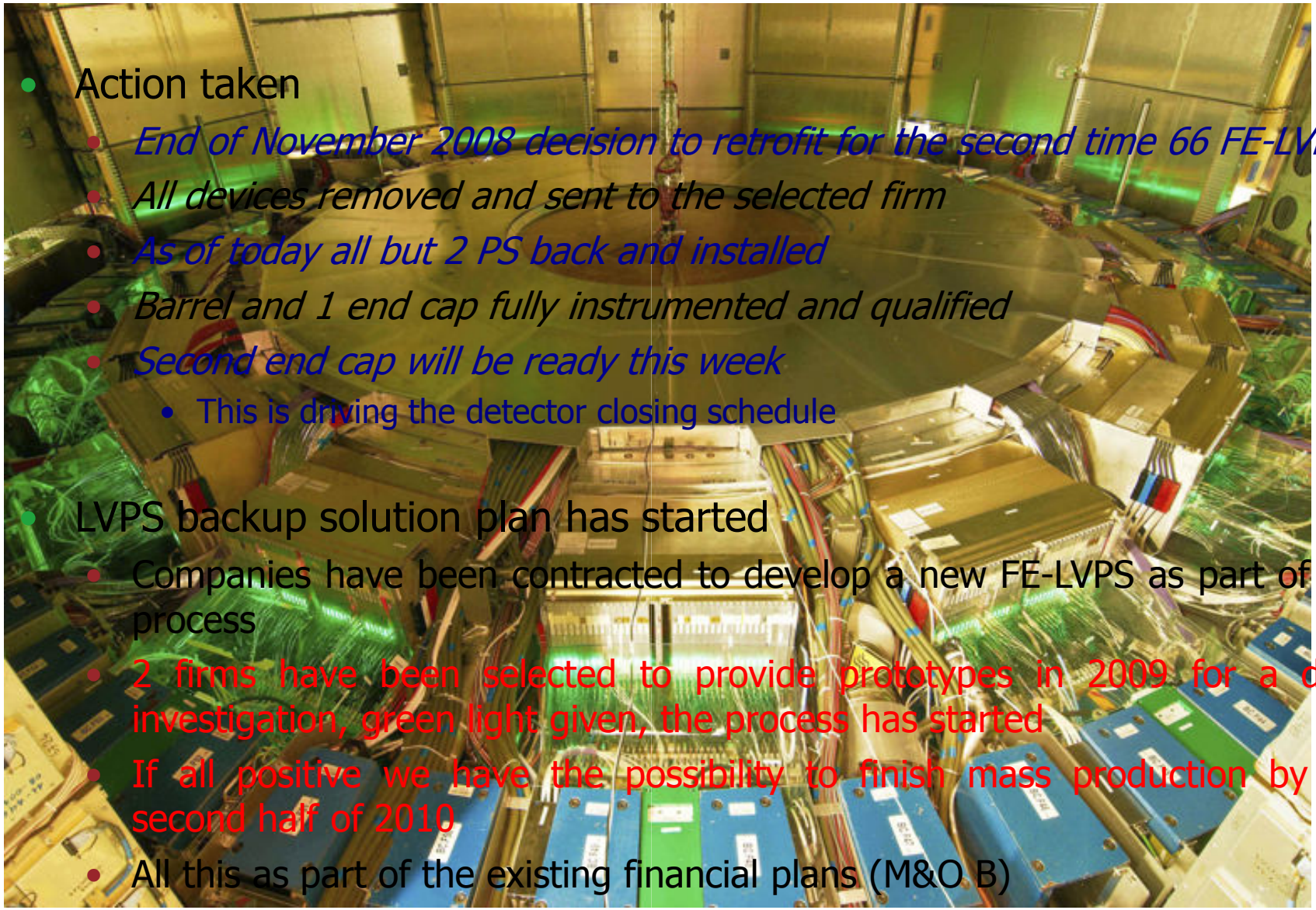


Low Voltage power supplies for the LAr



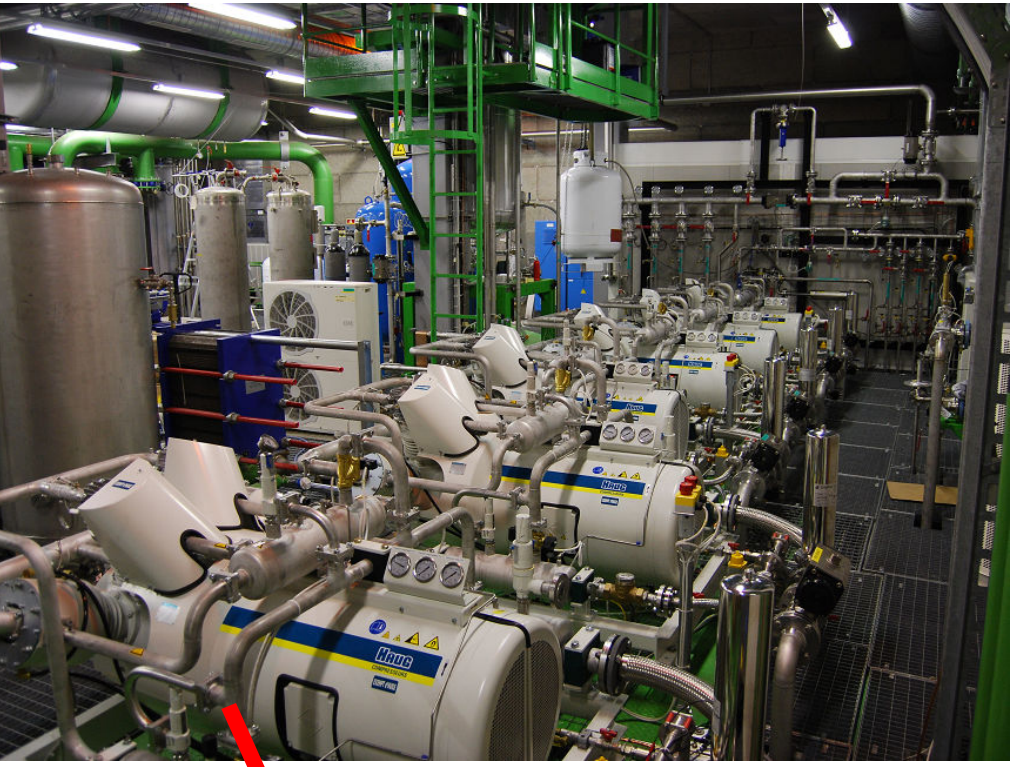
- Brief History
  - *First refurbishing campaign of LVPS was made between 2006-2007*
  - *Failure of three LVPS on detector within 24h 10-11 April 2008*
  - *Failed LVPS were exchanged before closing of ATLAS*
  - *During the 2008 running period: ALL LVPS ON and working*
    - One failed (INHIBIT mechanism) and was repaired in situ
    - Two failed and redundancy has been operational
- LVPS architecture
  - modules delivering +4V, -4V, +6VA, +6VD, +7V, -7V, +11V
  - N+1 redundancy built in: sourcing full power even if one module fails
- During 2008: three types of failures
  - Single Point of Failure at the Over-Temperature Internal Interlock
  - Failure of the pulse modulator soft-startup capacitor
  - Arching underneath power transformer between PCB copper traces

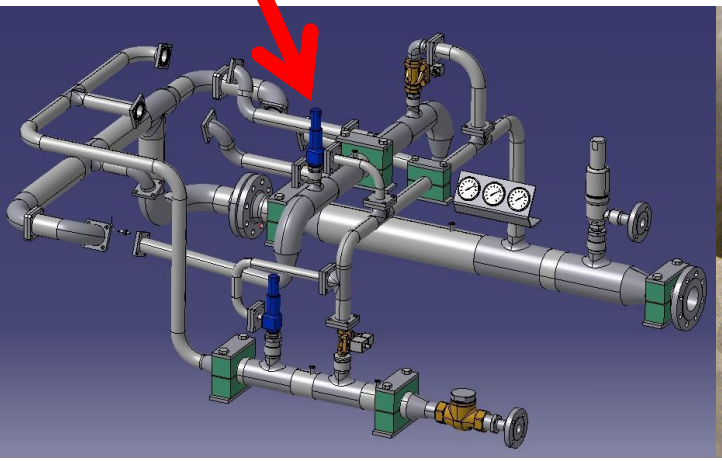
Low Voltage power supplies for the LAr

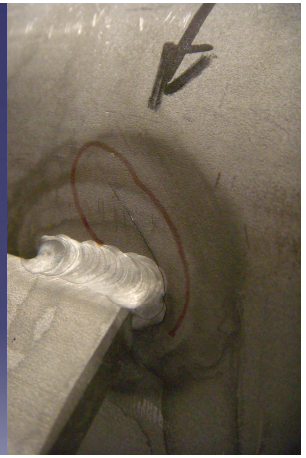


- Action taken
  - *End of November 2008 decision to retrofit for the second time 66 FE-LVPS*
  - *All devices removed and sent to the selected firm*
  - *As of today all but 2 PS back and installed*
  - *Barrel and 1 end cap fully instrumented and qualified*
  - *Second end cap will be ready this week*
    - This is driving the detector closing schedule
- LVPS backup solution plan has started
  - Companies have been contracted to develop a new FE-LVPS as part of this process
  - 2 firms have been selected to provide prototypes in 2009 for a deep investigation, green light given, the process has started
  - If all positive we have the possibility to finish mass production by the second half of 2010
  - All this as part of the existing financial plans (M&O B)

ID evaporative cooling plant (compressors)

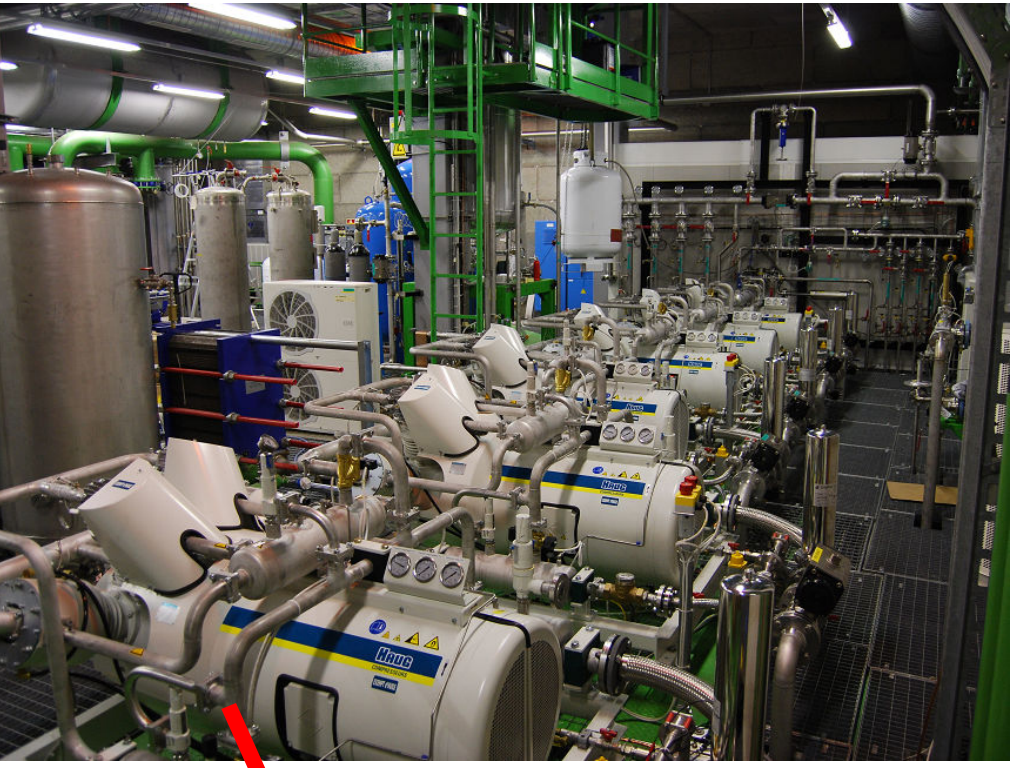


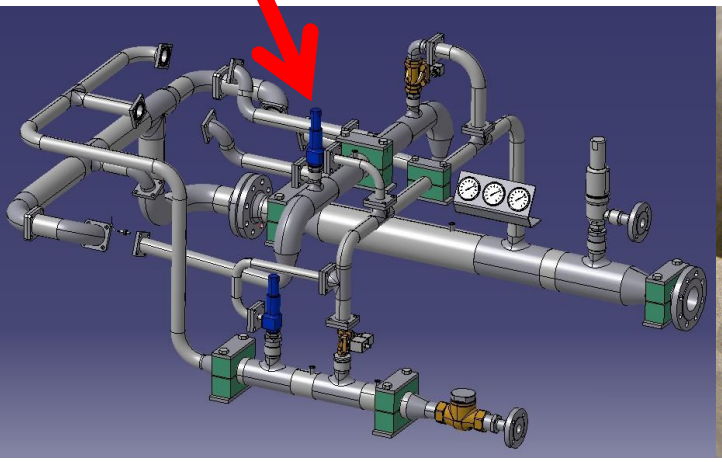


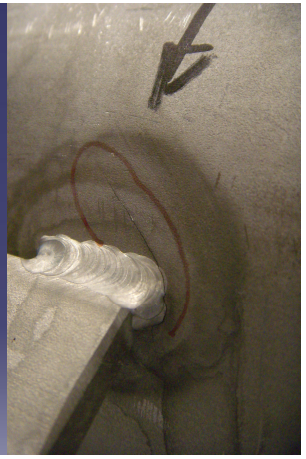


- ✓From end of July to beginning of November the installation has been running for 96% of the time for an overall of 2.629 hours
- ✓Major events occurred in October (after ~2000 h): four cracks on compressor collectors. The system was kept operational under strict surveillance to keep the ID cosmic runs operational
- ✓The mechanical problems where associated to stress due to vibration & excitation of pipes and collectors by pressure oscillations of the gas at the rotational frequencies
- ✓All compressors were send back to the producer for a major rework of the piping and their welding, after a major review of the piping geometry and their welding qualification

ID evaporative cooling plant (compressors)





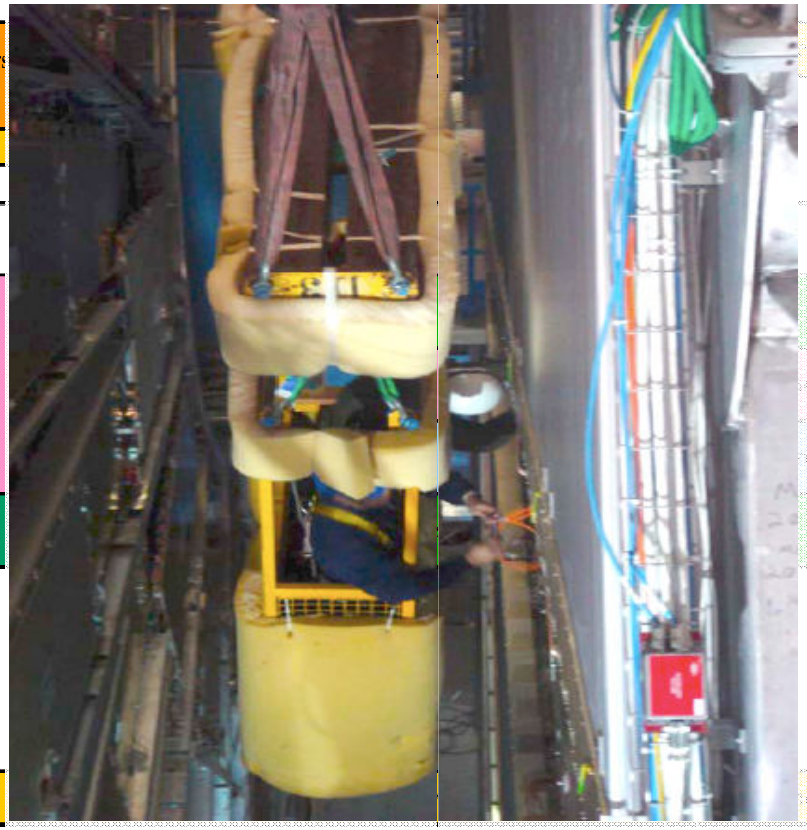


- ✓4/7 compressors are back in place, reinstalled and operational. The system will be put in operation in the next few days
- ✓At the same time we have work on the distribution racks in the main cavern to allow a better functionality and more modularity in the operation. Mid May all this will be operational again and the ID can restart

- ✓The cooling compressor plant represents a clear single point of failure, very complex to operate. its reliability is unpredictable
- ✓We plan to R&D, design and then implement a new plant using a different technology, it will take 2-3 years of work. We will come back in October with more detailed plans

Big Wheels MDT readout fibers

	Oct '08					Nov '08				Dec '08				Jan '09					Feb '09				Mar '09				April '09			
	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Side C	BW, EO, Lucid in commissioning mode			BW-C open for fibers repair																									
				no n-pentane																									
	Lucid + EO fix																												
Barrel	SW-TGC-A commissioning					All barrel in commissioning mode																							
	SW-TGC-C commissioning			open barrel A																									
Side A	Lucid + EO fix			JF to surface	ECT-A out																								
	BW, EO, Lucid in commissioning mode																												
Magnets	Toroids +Sol on			Sol on																									
HS	restricted access																												



Some batches of fibers were found not to be radiation resistant as required, this in 2007.

The decision, defined by production time and the need to close the detector was to replace later these fibers, before going to nominal luminosity (4 weeks operation per side)

We opened the big wheels side C in 2 steps and we used a special basket … it went quite well and fast … fibers replaced, all possible repairs done … next step in 2 weeks on side A

Consolidation : single points of failure

- ✓ We have done an analysis of all possible single points of failure in order to establish a plan
- ✓ Example : racks cooling mixed water, necessary to keep all readout racks in the various caverns operational. We have doubled the main distribution pump, with a full redundant system
- ✓ We have spotted several of these cases, where necessary we have added redundancy. This in particular for all what concerns pumps, vacuum valves, critical control systems, magnets and cryogenics infrastructure, ….
- ✓ Next step is to understand what is necessary to keep critical systems operational even during yearly maintenance periods or unexpected events (isolation vacuum, ID cooling, environmental gases, critical HVs, ……)

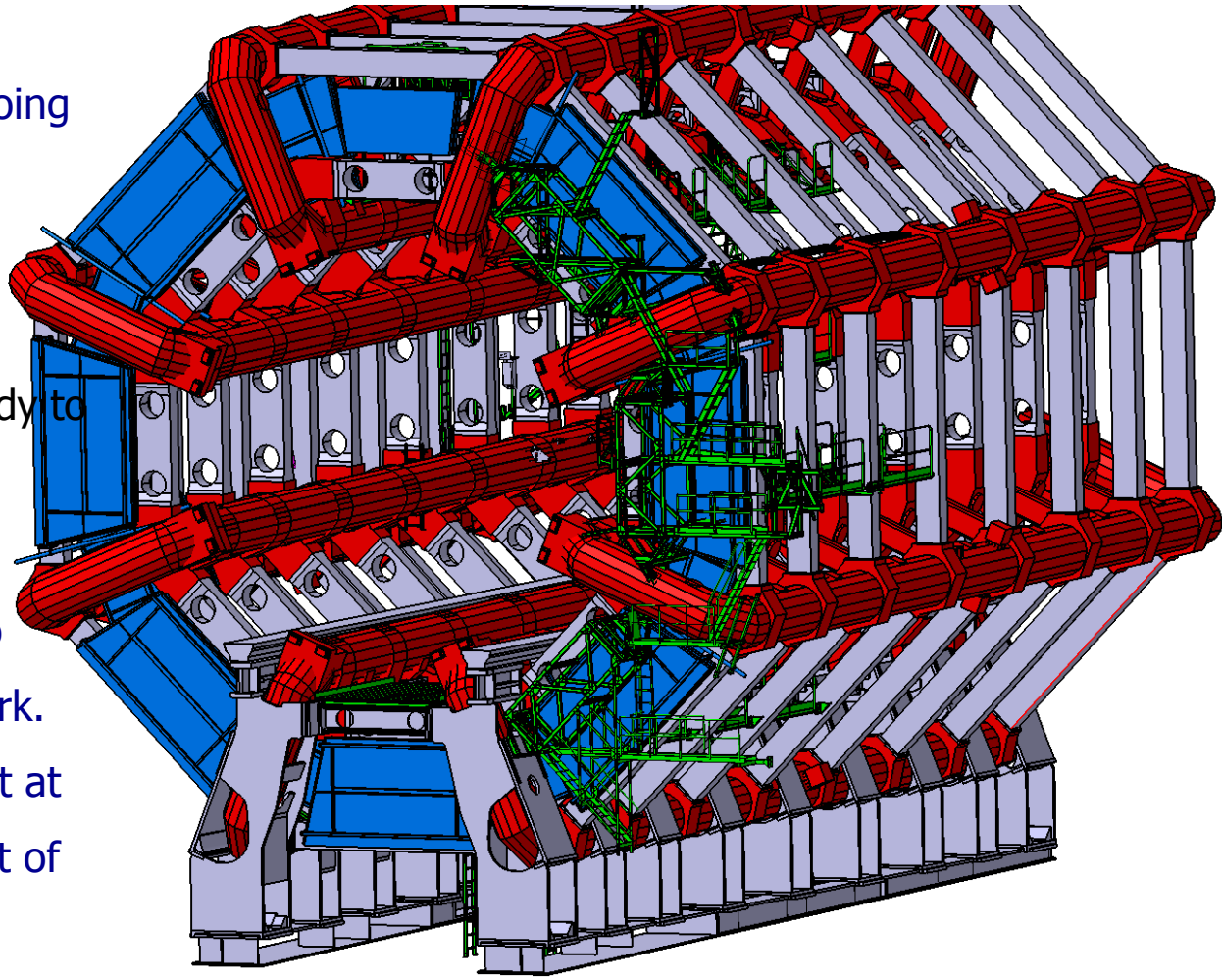
EE muon chambers

- ✓ a ring of precision chambers in the barrel (EE chambers) were staged, with the idea to implement it inside the detector before going to nominal Luminosity (plan of staging)

- ✓ All these chambers were constructed and moved to CERN in 2008, ready to be integrated, qualified and installed

- ✓ We decided to use this long shutdown to anticipate by one year the installation work. We plan to install before closing in August at least 7 out of the 16 assemblies and most of the support structures

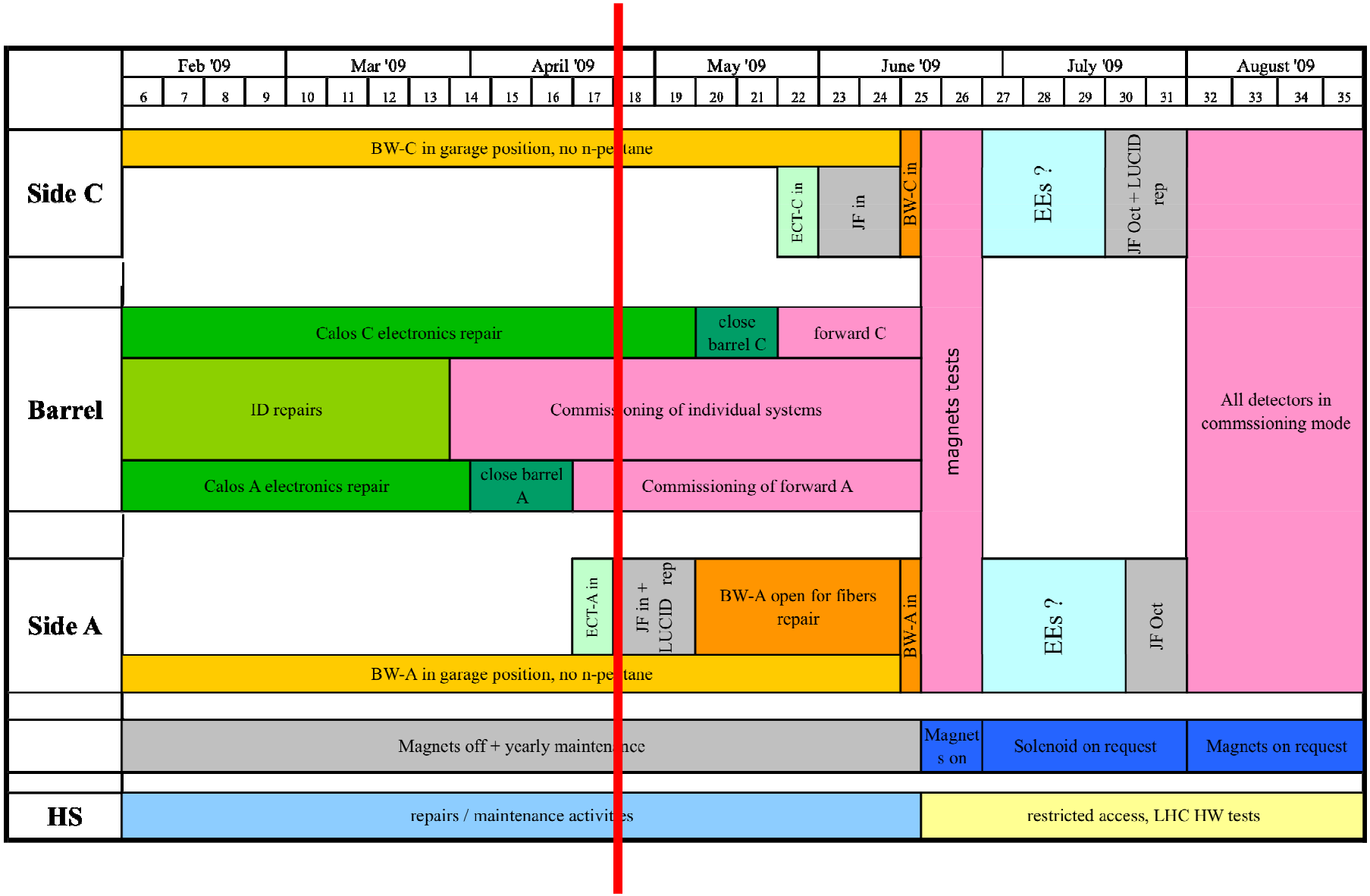
- ✓ This has required a lot of engineering work and material preparation

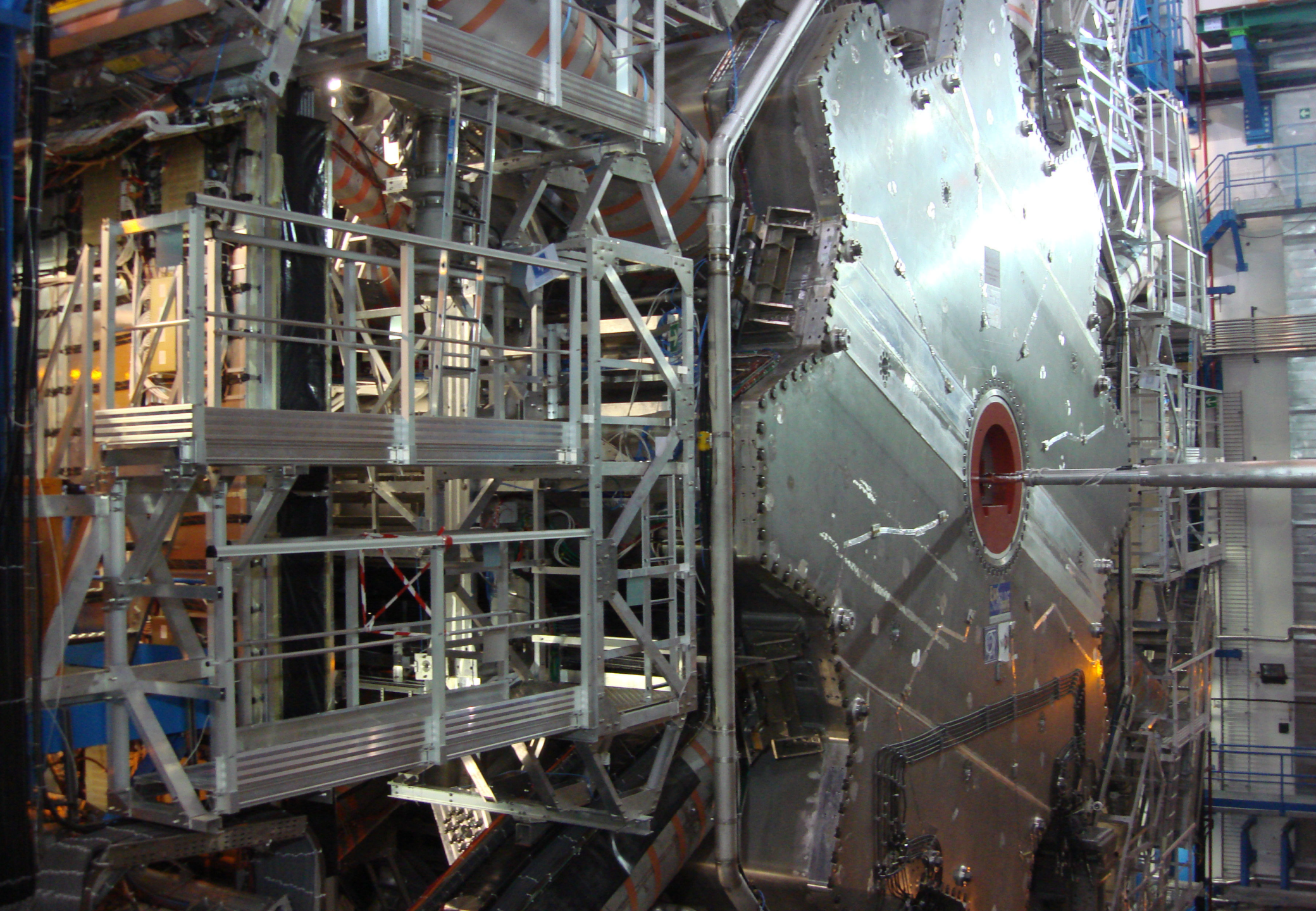


next few months Shutdown Schedule

ATLAS shutdown '08/'09 schedule v. 10.5

27 March 2009

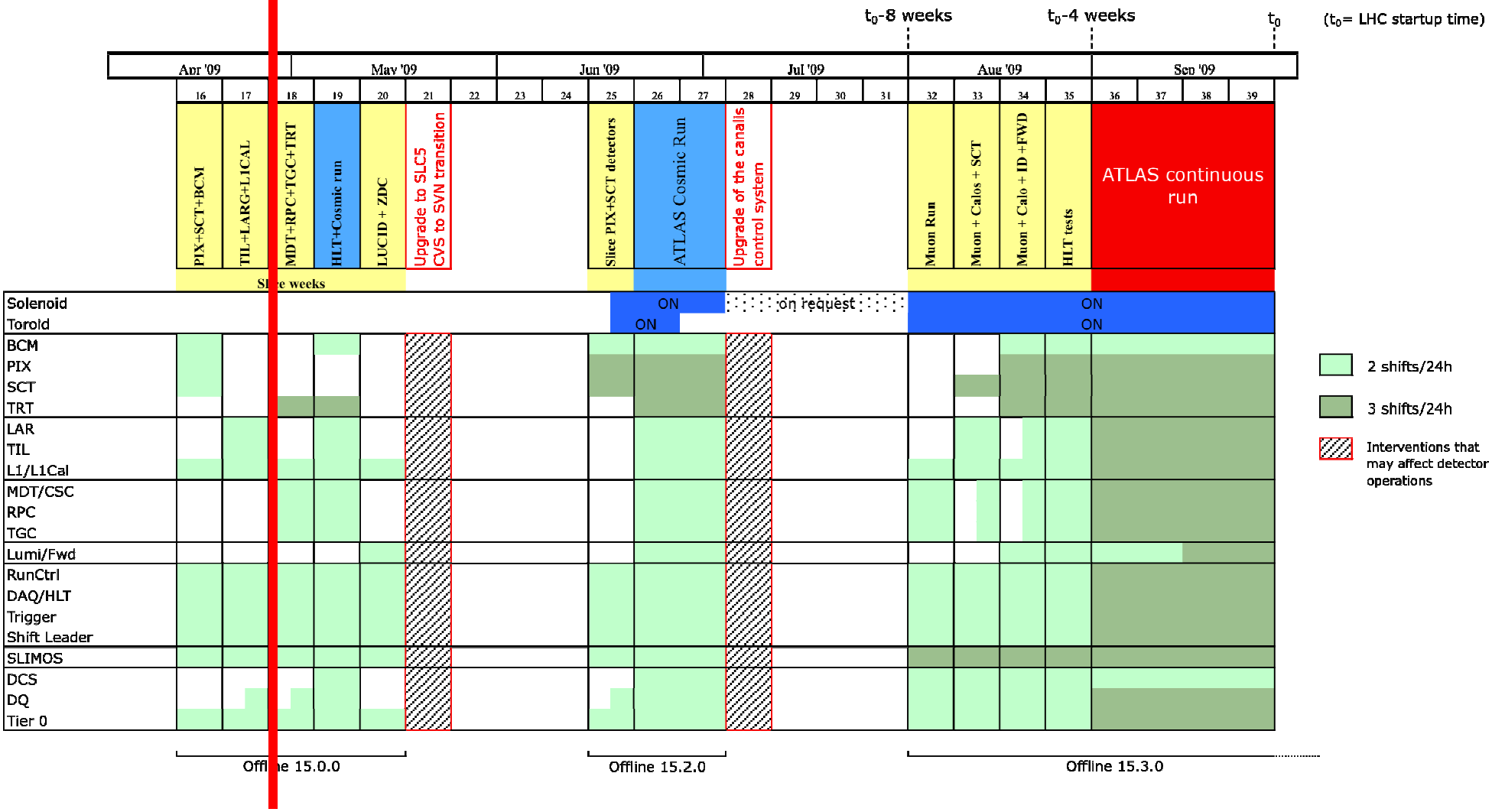




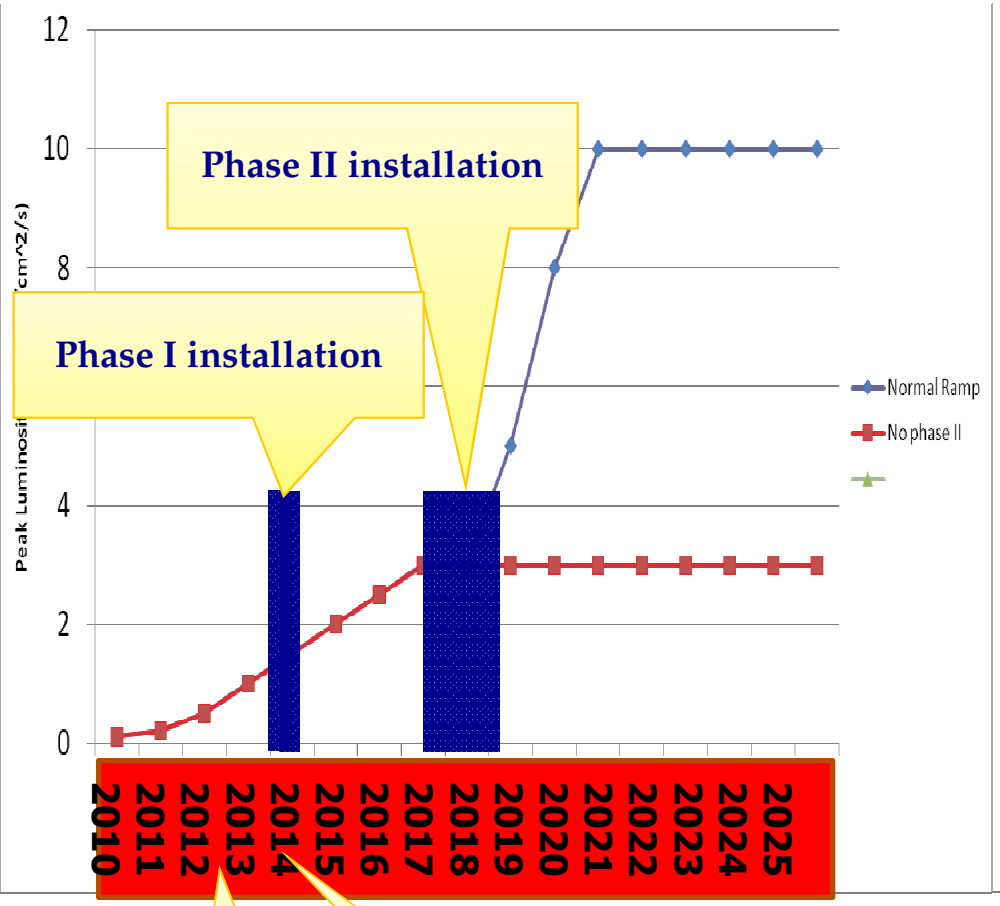
Plans to get the detector fully operational for October

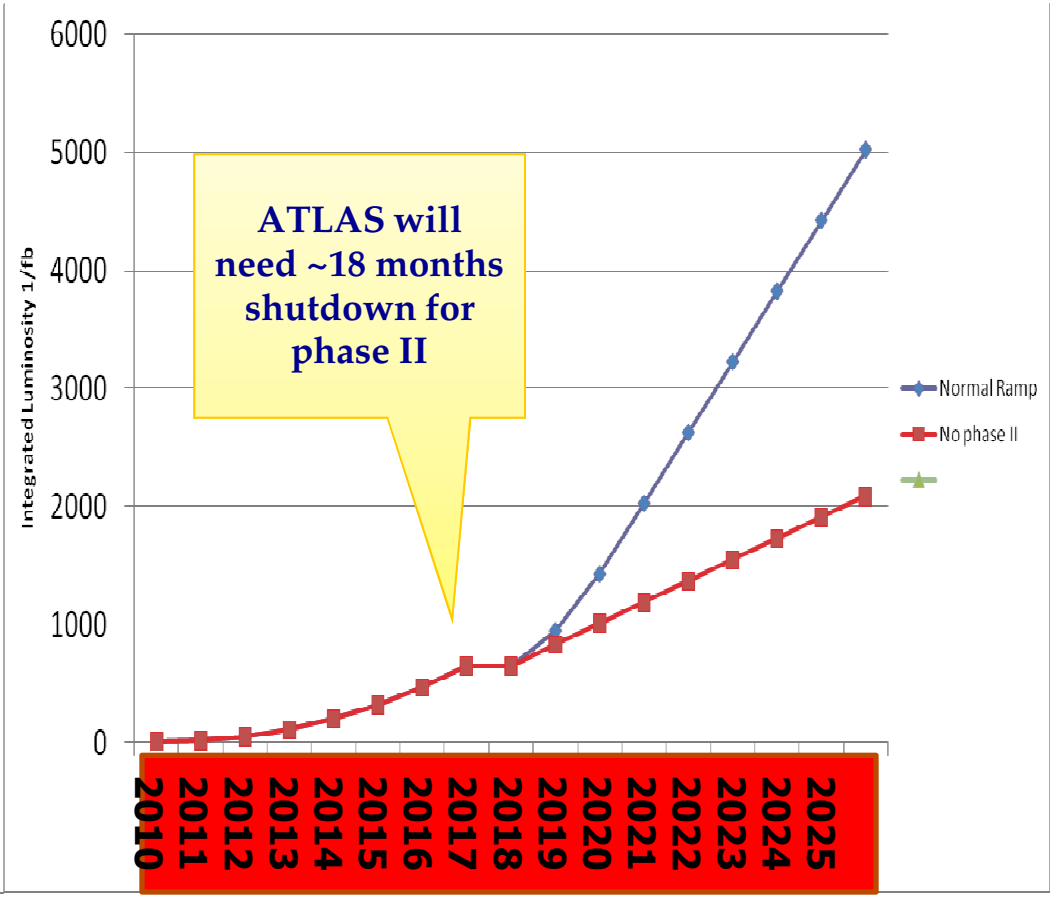
April 8, 2009

Run Coordination
Schedule for 2009 Combined Runs
version 1.4



Luminosity Upgrade in 2 phases





Collimation

Linac4 + IR upgrade phase 1

Phase I

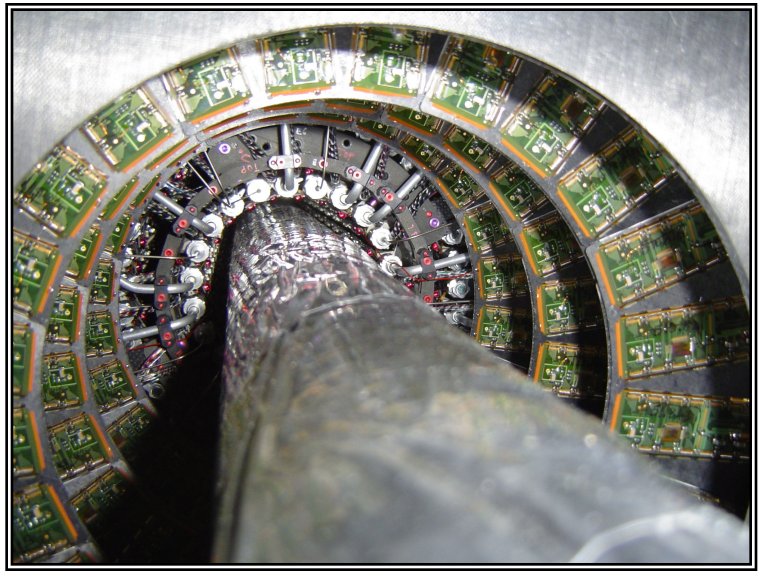
- ✓ Insertable b layer : add a new 4th pixel layer near to a new beam pipe (smaller radius)
  - *new project structure defined (PL: G. Darbo, TC: H. Pernegger)*
  - *2009 write TDR, main editors appointed*
  - *2010-11 start procurement*
  - *install during shutdown 2013/14 (8 months)*
- ✓ Upgrade the steel beam pipe to an Aluminum one (or Be or Al-Be), in order to reduce activation (ALARA) and backgrounds in the muon spectrometer
- ✓ Improve various shielding elements (a new shielding on the end cap toroid, new moderator wall between UX15 and USA15, ….) …. staged items
- ✓ Install in the muon spectrometer a new ring (EE chambers) …. Starting now, should be done by 2011 …. staged item

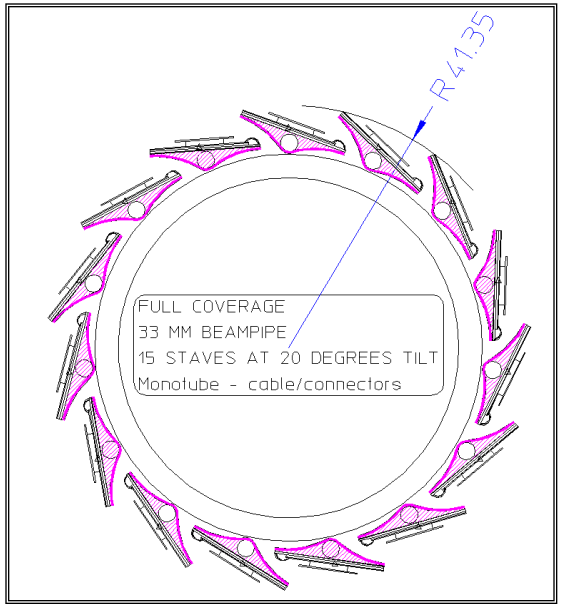
Phase I (upgrade & consolidation)

- ✓ Upgrade the CSC region in the muon small wheel with new/more detectors ? … might be rebuild part of JD wheel too …. planning and discussions just started
- ✓ Rebuild LAr low voltage PS …. probably already in 2010
- ✓ Rebuild a new ID evaporative cooling plant (external) …. starting now
- ✓ Consolidate several infrastructure components (no single point of failure, fix bugs, optimize maintenance, ….)
- ✓ Optimize/upgrade TAS shielding/aperture to couple with the new LHC triplets (large aperture)

Pixel insertable b-layer

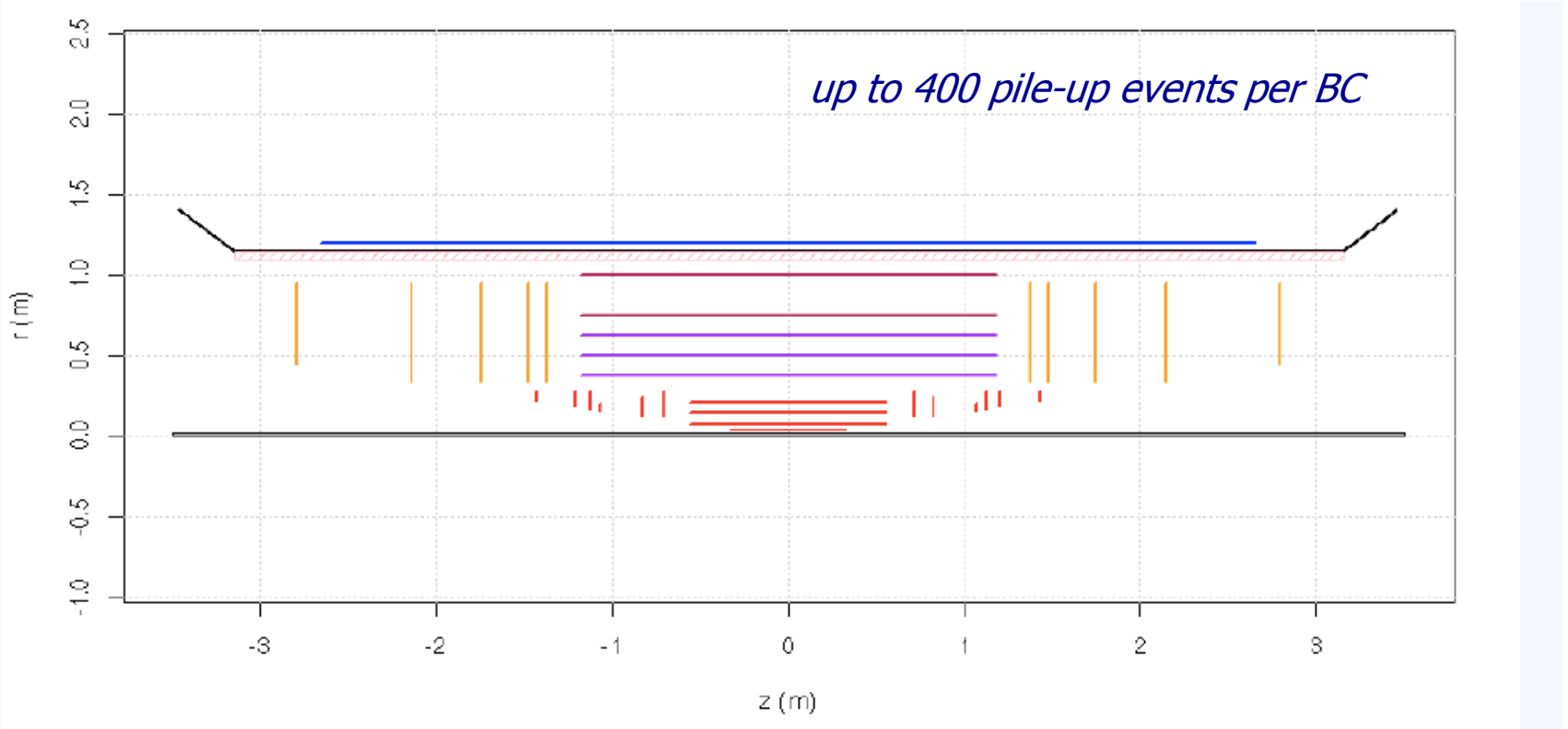
- ✓ Strategy worked out in an internal task force mandated by the Executive Board (2008)
- ✓ Now ready to define the project technically. In the next 8 months we will write and submit for approval to the LHCC a technical Design Report
- ✓ The Collaboration Board has just nominated a Project Leader, with the mandate to propose and implement a project structure, to get this device installed and operational by 2014
- ✓ We plan to prepare a MOU between the various participating institutions in the same time frame of the TDR. It could be presented for the first time in one year





Phase II upgrade (intL > 1000 fb^{-1})

- ✓ We will need for sure a new Inner Detector
- ✓ Collaboration very active with a well structured upgrade organization (steering group, various working groups, R&D projects follow up, upgrade Project Office)
- ✓ Last Collaboration Upgrade week (February 2009) …. 232 presentations, 29 sessions
- ✓ We plan to prepare and submit a LOI (letter of intent) in 1 year time, where the project will technically be further detailed, with a better budget, schedule and organization planning. We plan for at least 18 months installation activities starting in 2018



Phase II fields of activity

- ✓ Inner Detector : define layout, design, components strategy (staves, front end electronics, …), central mechanical and electronics integration, prototyping, production and assembly organization, installation/qualification process, new cooling plants, new powering strategy. We aim for a completely new ID by 2018

- ✓ Calorimeters : new front/ back end electronics and PS. LAr forward might need a full redesign or a new readout implementation, new cryo cooling, probably we will need to open and act on the end cap cryostats in situ

- ✓ Muon spectrometer : new trigger chambers in the forward region, one additional trigger layer in the barrel too, new gas strategy, new readout electronics. All this is still not fully defined …. We are just starting the discussion process inside the collaboration … we hope the installation process can be distributed outside the main peak of 18 months

- ✓ Trigger/DAQ : we might need a ID LVL1 trigger, DAQ will evolve with time and with the new requirements coming from the detector

- ✓ Shielding : all shielding will need to be revised and probably the forward one re-designed to cope with a factor 10 more BG. Probably Be pipe in the entire detector.

Detector Summary

- ✓ During first beam we managed to turn on everything, time it in and get a very comprehensive picture of the entire detector. After that we had several weeks of data taking with cosmic events and good statistics
- ✓ In November we entered our first shutdown period with a detector in its open configuration. All went according to plans. We have take the occasion to fix several know problems, to do the yearly maintenance and already do some consolidation work scheduled for later. We have plans for solving a few critical issues like LAr PS and the ID cooling plant, which need all our attention
- ✓ We plan to have the detector fully operational again for late summer (August/September) and ready for beam
- ✓ The ATLAS community is already deeply involved in making plans for the detector upgrade. Phase I upgrade will have to start soon to meet the installation period in 2013. For phase II, we decided to better define the project through a LOI that we plan to submit in spring 2010