

Summary of the ATOP days 2009

Session 2

“Accelerator Hardware and Controls”

Conveners: S. Deghaye, Th. Zickler

Topics of Session 2

“Accelerator Hardware and Controls”

Status and prospects of PS magnet consolidation program (D. Tommasini)

Status and prospects of SPS magnet consolidation program (J. Bauche)

Beam instrumentation throughout the accelerator complex (J.J. Gras)

Accelerator Controls Renovation Project “ACCOR” (M. Vanden Eynden)

The new PS MPS Regulation System (Q. King)

Status and prospects of PS magnet consolidation program (D. Tommasini)

PS Main Magnet Refurbishment – Status

- **51 installed units + 4 spare units refurbished**
- **Phase 1 completed**

PS Main Magnet Refurbishment – Findings

- in general dielectric insulation coils-to-ground appears very reliable
- **degradation of PFW insulation and connections**
- **problem of loose laminations** still affects several units
- **shutdown preventive maintenance** limits problems during runs
- phase II may not be needed if the machine has to be operated for just 10 more years
- **Spare situation for bus bars? Impact in case of failure (water leak)?**

Status and prospects of PS magnet consolidation program (D. Tommasini)

Proposed actions on PS main units

Considering that :

- the PS shall operate for 10 more years
- the most critical magnets have already been treated in phase I
- we have one spare magnet of each type and replacing a magnet takes few days
- any “typical” fault is repairable except PFW
- time to manufacture new PFW is long

It was proposed to :

- **launch the manufacture of 50 sets of PFW** (~ 3 MCHF, 2 years)
- **continue annual inspections** and be ready to reconsider the strategy at any time
- **continue machine study to find out how many PFW can fail before the PS has to be stopped**

Status and prospects of PS magnet consolidation program (D. Tommasini)

Other machines on the injection way to the LHC

- **Spare situation** for Booster TL, Linac 3, Ion Beam TL, LEIR **needs to be improved**
- It was proposed to **produce** either complete **magnets or spare coils** for the most critical magnet types
- **The investigation on spare situation should be extended to all machines and experimental areas and a priority list with cost estimate and schedule should be prepared**

Status and prospects of SPS magnet consolidation program (J. Bauche)

Auxiliary Magnets and Equipment

- Several **issues** in auxiliary magnets could perturb the operation of LHC
- Inspections on auxiliary magnets have shown **no major reliability issue**
- The goal is to have **at least one operational and tested spare** for each magnet type ASAP
- Breakdown of auxiliary equipment (water hoses, bus bars, water cooled cables , installation vehicles) could perturb the accelerator operation
- **Risk score for such an event can be kept low** if appropriate actions are undertaken / pursued
- **Corrective actions** for this equipment is in progress or foreseen (e.g. global replacement of the rubber water hoses in the whole SPS complex
- **Prepare a priority list with cost estimate and schedule to be considered in the Consolidation project planning**

Status and prospects of SPS magnet consolidation program (J. Bauche)

SPS Main Magnets – Erosion Issues

Dipoles - Lintott coils (2/3 of MBBs):

- Consolidation program over the 3 last Shut downs
- **255 Installed magnets of this type and all spares refurbished**

Dipoles - Alsthom coils (1/3 of MBBs + all MBAs):

- Also erosion induced water leaks , but much lower rate
- **Leaks appear in non conform manifolds** (damaged or deformed tubes)
- **Consolidation** (like for Lintott) will become necessary
- Non conform manifolds on 24 magnets found and **replaced**

Quadrupoles

- **Erosion induced water leaks** occurred at the end of run 2008
- Phenomenon is currently being studied
- Following the results, a **consolidation** could become necessary soon

Status and prospects of SPS magnet consolidation program (J. Bauche)

SPS Main Magnets – Fatigue Issues

- **Broken shim fixation and longitudinal coil displacement** on several dipoles discovered this shutdown and currently being studied
- Possible cause: Run in 2008 at 450 GeV/c (Problem already occurred between 1980 and 2000)
- **Consequences:** Degradation of field quality and damage of coil insulation leading to short-circuits
- **Repair** broken pole shims (if possible) before SPS restart
- **Study consolidation strategy** for shim fixation and coil retainers and **implement** next SD

A mitigation strategy for the splitter corrosion problem in North area and a possible replacement of these magnets to be urgently studied

Beam instrumentation throughout the accelerator complex (J. J. Gras)

PS Booster: new for start-up

- **Fast current transformer in TL:** new acquisition electronics installed on 3 systems
- **Orbit system upgrade:** Both planes of existing BPM now cabled; prototype MPX installed for software upgrade and testing; **20 MPX in production to be installed mid March**
- **All BLMs tested and calibrated**
- **Fast wire scanners:** All re-calibrated with renovated HW and SW

ISOLDE: new for start-up & during run

- **New tape station installed:** new FESA front end software with BI Expert application
- **ISOLDE integrators for RP:** now fully integrated in BCT front end SW
- **Fast current transformer electronics:** renovation will include ISOLDE watch dog
- **ISOLDE needle scanners:** mechanical design should be reviewed

REX: plans for 2009 run

- **Instrumentation control hardware:** replacement during run

Beam instrumentation throughout the accelerator complex (J. J. Gras)

PS: new for start-up & during run

- **New PS Orbit System:** Existing CODD + ABS remains primary system for 2009 start-up; new SW system available in parallel for commissioning; swap as soon as YASP is configured and operational; **remaining CODD issues (triggering) to be checked**
- **Fast wire scanners:** All re-calibrated with renovated HW and SW
- **Injection line SEM grid SW:** upgraded based on LEIR version; **for TT2, it will be prepared but only deployed if CO manages to integrate them in YASP**
- **2 new BTVs installed on TT2**
- **Fast current transformer:** new acquisition electronics installed on 1 system in parallel with old one.
- **All BLMs have been tested and calibrated**
- **6 turn transformer renovation:** system will be ready for test this Summer
- **PUs in TT2 should be made available for PS (timing)**

Beam instrumentation throughout the accelerator complex (J. J. Gras)

AD: new for start-up & during run

- **Replacement of PMT** for emittance measurement based on scrapers
- **The current Schottky system** will remain as is in 2009
- **Dogleg MTV:** sensitivity issue will be looked at

CTF3: new for start-up & during run

- **2 New BTVs installed in TL2**
- **Station “Mars”:** recurrent problem with readout solved by LAPP; **FE-software problems still under investigation**

Linac3/LEIR: new for start-up & during run

- **Front end software upgrade to FESA 2.10**
- EN/STI took over responsibility for collimators and scrapers
- **LEIR tune measurement** based on the BBQ system
- **Fast current transformers electronics:** plan to upgrade
- **LEIR IPM:** will remain controlled via remote desktop

Beam instrumentation throughout the accelerator complex (J. J. Gras)

SPS: new for start-up & during run

- **TI2/8 additional BPM planes and pick-ups**: TI8 operational for start-up; **TI2 upgrade planned for next real SD**
- **BWS software interface upgrade**: broken wires replaced; as agreed in APC, no electronics renovation this shutdown but plans to change old front end software to mimic; **BWS 517 hardware problem still to be investigated**
- **BCTDC in Point 1 exchanged**
- **BPM interlock prototypes**: will be tested during 2009
- **MIL1553 BTV electronics**: replacement to be done end of 2009

SPS: pending issues:

- SPS IPM electronics and camera: **not operational this year**; upgrade to be done next shutdown
- Replaced cables in BA2 (BLM and BPM): **still to be checked**
- **Ring BPMs: offset problem to be addressed (full renovation or additional attenuators)**

Accelerator Controls Renovation Project

(M. Vanden Eynden)

Workshop Dec, 2008

Scope of work includes the Front-End Hardware Platforms, Generic Front-End Hardware Modules, FESA Framework, Front-End software and InCA

Main Outcome:

- Motivations largely shared by equipment groups and OP
- Equipment groups provided clear figures in terms of equipment inventory, priorities for renovation and available resources
- AD, CTF, REX-ISOLDE are included
- Renovation Time scale : 2009-2011
- Management asks to put in place a Project in order to clarify the operational objectives, provide clear budget estimates and start the renovation

Accelerator Controls Renovation Project

(M. Vanden Eynden)

Roadmap for 2009

Organization

- Q1 2009 : Get CO3 Committee in place
- Balance the outcome from the workshop with the new LHC planning
- Define a first roadmap and agreement on budget lines

Technology Development

- Until Q4 2009 : Continue design and validation of new generic hardware and software controls solutions on front-End Level and Inca

Accelerator Controls Renovation Project

(M. Vanden Eynden)

Roadmap for 2009

Validation and integration with Equipment Groups

- Q1-Q2 2009 : Provide new technology and dedicated test facilities
- Start first specific FESA application prototypes

Operational objectives

- Front-End Level
 - Define first set of realistic operational deployment objectives
- Inca Level
 - Test version of YASP → start-up 2009
 - Wire scanner application → start-up 2009
 - 1st version of the Function editor → mid-09
 - Infrastructure for newly developed applications → ongoing

Accelerator Controls Renovation Project

(M. Vanden Eynden)

Conclusions

- **ACCOR Organization almost in place**
- **New LHC schedule** has clearly an **impact on the operational objectives** of the ACCOR project
 - Continuous LHC software support will be required
 - Longer support for existing hardware systems will be required, as field modifications will be limited
 - Use non LHC-filling periods to test Inca
 - Use non-LHC injectors for first Front-end hardware validations?
- Few operational deployments must take place in 2009 in order to validate the solutions

The new PS MPS Regulation System (Q. King)

Motivation to change the regulation system

- Existing electronics are “fragile” and have performance limitations due to B-dot control
- Creating new cycles is a “black-art” and takes time away from production of physics beams
- New POPS converter is coming and will need new electronics
- Opportunity to upgrade the controls electronics for the MPS and to then use the same electronics for the POPS when it is installed
- In case of failure the B-dot regulation system is still there → no risk trying!

The new PS MPS Regulation System (Q. King)

Features of the new system

- PPPL Cycle Reference Function Definition: Complete function is very compact
- Real-time read-out of all signals is not possible → Acquisition is on request and by user
- Data can be acquired using the FGCspy interface or via properties available through JAPC
- Field regulation instead of Bdot regulation (challenging)
- Event Warning Checks
- Field Current Voltage Warning Checks
- Post Mortem Logging

The new PS MPS Regulation System (Q. King)

Summary

- The new system is showing **promising results**
- The software and operator tools are **ready**
- The integration of the new electronics with the old MPS is proceeding but minor **outstanding issues** (e.g. incompatibility between new electronics and the thyristor bypass circuit) to be solved
- More testing is required to achieve the regulation performance target
- The Bdot system will be maintained and will be available if the new system doesn't work reliably – switch over takes ~ 1 hour