



**Injectors Re-commissioning Working Group
Minutes**

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1 LAST MEETING MINUTES

The minutes of last meeting have been approved. Link to the minutes: <https://indico.cern.ch/event/378032/>

2 PS REPORT (MARC):

Many hardware modifications took place during LS1 in the PS machine and related experimental zones. Controls changes impacted on all equipment: new timings, function generators, new front-ends, renovated FESA classes,...

Before start-up with beam time was allocated to re-commission equipment and controls:

- 6 weeks HW tests for equipment groups under EN-MEF responsibility.
 - daily 8:30 morning meetings in Meyrin
 - Tests on site:
 - Aux PC tests: should not need remote control, as often difficult to do
 - Polarity checks: still polarity errors found with beam afterwards
Comment by Marc: OP has to be involved for polarity specification
 - POPS: needs PS to be closed and patrolled
 - Alignment. Alignment issues found afterwards.
 - Tests from CCC:
 - Test of new access system
 - Check menus in CCM, launch and check applications
 - Program some cycles to start working on timings
- Cold check-out under OP responsibility (4 weeks)
 - PS has check lists for all power supplies with typical functions, rise times,... A full test programme is defined. For test to be effective however controls need to be full available.
 - Dry runs were carried out by controls: programme and results were never communicated. Effectiveness of these dry runs is not clear.
 - The main applications are tested during that period: OASIS, beam instruments, timings, tune measurement, bunch shape measurement, tomoscope

Main issues affecting test period:

- CO configuration tools missing (CCDB to LSA)
- Many issues were encountered with ppm behaviour of the new FESA class of PowM1553 class. Only one person with all the expertise was available AND startup was during his holiday period.
- Patrols were frequently lost due to the normal teething problems with the new access system

Despite numerous issues beam start-up was on time:

- First injection 1 day earlier (19th of June) than in schedule,
- Start-up of EAST hall physics on time (14th of July)
- Beam to nTOF 1 week earlier than planned (24th of July).



Main issues affecting beam commissioning:

- External conditions for beam stoppers not connected —> several shots dumped on TT2 beam stopper. This should have been noticed during check-out period.
- Polarity inversions: 1 weekend lost
- Orbits and trajectory measurements for changing harmonics not working: again only 1 specialist that knows the system well.
- SEM grids with mixed wires
- YASP got “wrong” data from the orbit system due to inconsistency of monitor names in LSA optics and real monitor names. YASP was however used for alignment and produced wrong alignment proposal as a consequence.

Marc’s summary and recommendations:

- New access system led to delays and complications (patrols lost frequently etc.)
- Polarity checks should be improved
- Power supplies should be controlled locally for magnet patrols (as often controls system not yet available at that stage)
- Realignment calculation methods should not be changed after a long shutdown
- Cycling and PPM should be given special attention (adds a lot of complexity) for testing. Many checks were carried out with a single cycle in the supercycle. Issues only occurred with more cycles in the supercycle.
- Cold check-out and dry runs were not as efficient, because of controls system readiness
- Even with checklists checkout with beam is the true probe

Comments:

- Jose-Luis: to check that cycles are executed correctly and synchronously e.g. for FGCs an independent observation method to check for example correct timings should be made available. An additional independent signal needs to be compared to the signal under test (e.g. BCT for FGC on OASIS)
- Jose-Luis: Dry runs - should be better coordinated with OP. The dry runs in the PS were CO dry runs.
- Verena: Is there one person who is responsible for the optics and interface with INCA, that also knows all the layers well enough? - Yes.
This person needs to ensure the consistency of elements in the machine with what is defined in the DB.
- Checklists: YASP configuration not on checklist. Bettina: also configuration for other application should be added. Sergio: could there be a common basic checklist for generic applications like YASP?
- Verena: Beam stopper test missing on checklist

3 LHC REPORT (DELPHINE):

Many systems were upgraded in the LHC during LS1. Also, changes in the LHC-OP personnel happened.

Phase in LHC at the end of shutdown:

- Individual system test by experts are essential + Dry runs in the LHC = Test campaigns of operational use-cases by the OP team from the ccc
- Dedicated machine checkout period between end of LS1 and start of beam commissioning

In parallel to both activities: commissioning of SC magnet circuits (5 months for all circuits); specific for LHC

Delphine explained LHC dry runs in more detail:



- System tests from the ccc by the OP team with the help of the equipment experts. They are frequently present in the control room.
- Tests of several systems together with all interfaces. (Sometimes interfaces have to be simulated)
- Operational control environment needs to be in place early for the tests; specified core applications that have to work

Examples of LHC dry runs at the end LS1:

- RF synchro with SPS and frequency ramp
- Handshakes with experiments and transmission of beam modes
- Beam dump reliability run
- Collimator sequences and functions
- Continuous interlock system tests (HW + SW)

Intermediate Milestones of dry runs: Transfer line tests, sector test

Final machine checkout was about two weeks before beam; coordinated by 2 persons with daily morning meetings in ccc.

Delphine's recommendations for possible improvements:

- Only one team coordinating dry runs and machine checkout. During LS1 two separate teams looked after these activities.
- Follow-up by OP of new system implementations should be improved
- Need to respect also the equipment team priorities
- Lots of access needed until the last moment, which reduces commissioning efficiency.

Comments:

- Bettina: Was there a person responsible to organize the commissioning and dry runs? - Yes, 2 persons.
- Jose-Luis: Were there many LSA and FESA class changes? – The philosophy did not change, mainly 'internal' modifications; most of the interfaces stayed the same. For FESA classes usually the experts define the changes, but there might be modification requests from OP.

4 PLAN OF ACTIONS (VERENA)

Status: Reviewed startup of LS1 of all machines except PSB and ISOLDE (next meeting). Résumé: injector start-up worked well despite many problems. Common issues have been noted all along the meetings.

Next step: come up with a strategy for improvements

- Organisation and responsibilities:
 - How to deal with modifications?
 - Involve machine responsible (OP-ABP) during specification phase
 - If possible, staged deployment of different features followed by dry runs 'long' before end of stop
 - If possible, introduce a test mode in equipment for realistic testing without beam (have to make sure that the simulation mode is off during beam commissioning...)
 - Re-definition of phases and responsibilities: propose 2 phases
 - Possible new phase 'Machine preparation for beam': 2 activities in parallel: HW testing by equipment experts followed straight away by dry runs with operational software from the ccc. Preparation of



- applications, setting, cycles, optics, test drive, triggering, timings etc.
- Beam commissioning
- How to organise?
 - Need early coordination meetings together with or after technical stop coordination meetings
 - Test plan must be communicated and negotiated with the equipment teams
 - One responsible from OP/ABP per machine
 - Progress tracking: perhaps propose a report every month about the status with copy to the hierarchy/IEFC
 - Should global coordination meetings take place?
 - To deal with machine priorities for equipment expert interventions
 - Test of machine interfaces

What we should work on for the next stage:

- Skeleton list of tests per machine to be prepared by the machine representatives
- What to test and how (in big lines...)
- Is there a special order of tests?
- Prioritise list of control service readiness
- Enforce certain additional HW tests (based on experience in the past), e.g. polarity checks
- Verena, Bettina and Bertrand will prepare an example skeleton

Comments: Should invite as well EN-MEF and equipment experts for some of the upcoming meetings.

How deep should the involvement of the OP/ABP responsables for hardware/controls modifications be? Do they have to be aware of all changes? (ECRs are not necessarily always written...)

Next meeting: 16th of April with PSB and ISOLDE reports.