

Minutes FOM #15, 20.04.2021

Chair: R. Steerenberg

List of participants: Albert M., Albright S., Alemany R., Amarill M., Antoine A., Antoniou F., Asvesta F., Bartosik H., Bellodi G., Biancacci N., Bojtar L., Bozzolan M., Burnet J. P., Di Castro M., Cettour S., Chapuis D., Damerau H., Delrieux M., Desquiens V., Dyks L., Fadakis E., Findlay A., Froeschl R., Di Giovanni G. P., Gourber-Pace M., Haase M., Hanke K., Hans O., Huschauer A., Johnston K., Kain V., Karpov I., Kuchler D., Lang T., Lasheen A., Lozano M., Mahner E., Mataguez S., Matheson E., Mcfarlane D., Mikulec B., Papotti G., Pedrosa F., Pereira L., Perrault S., Pittet S., Ponce L., Praena J., Pruneaux C., Rae B., Roncarolo F., Rumolo G., Salvant B., Schwarz P., Siesling E., Simon P., Somoza J. A. F., Steerenberg R., Tecker F., Timeo L., Velotti F. M., Vollaire J., Woolley B., Zevi della Porta G.

Slides: <https://indico.cern.ch/event/1020416/>

Agenda

1. Approval of minutes & follow-up of actions
2. Reports from Accelerators & Facilities
3. Injectors Technical Stop Updates & Schedule
4. Short-term Injectors Schedule Outlook
5. AOB

1. Approval of minutes & follow-up of actions

- No comments on minutes from last week
- No actions from last week

2. Reports from Accelerators & Facilities

a) TI (C. Pruneaux)

- Good week with few events
- AOB: SY-EPC foresee stop of compensator MEQ59 for afternoon / end of day Wednesday 21.04. Objective: update cooling software for SVC on Thursday, followed by tests. Restart compensator Thursday before midday. Calls to CCC will be made before stop, and before re-powering. Checks with PSB, ISOLDE, AD, cryo piquet will be made to ensure all is fine.

Comments / questions:

- *B. Mikulec:* Linac4 source has to be off for that. Interventions on source planned for Wednesday 21.04. Will also need to restart source as soon as possible after since it needs time to stabilize. Coordinate with source specialists to minimize delays / perturbation. *C. Pruneaux:* What are timing constraints? *B. Mikulec:* check with J. B. Lallement. *L. Timeo:* if possible, stop compensator tomorrow before 17:00. For restart: more complicated, need to check with each other. *R. Steerenberg:* can EPC do the stop early Wednesday, run update, and restart early Thursday to minimize perturbation of Linac4 source restart? *C. Pruneaux:* need to check with EPC.
- *E-mail C. Pruneaux:* not possible to switch off compensator before Wednesday 17:00.
- *Alternative proposal (e-mail exchange L. Timeo):* source and RF will be switched off Wednesday morning by 08:45 and SY-EPC can disconnect compensator from 09:00. Once done, EPC able to do work even if some Linac4 equipment restarted (J. B. Lallement wants to restart plasma Wednesday asap, even before 17:00). For compensator reconnect Thursday: EPC should contact J. B. Lallement and L. Timeo to make source safe.
- *E. Siesling:* What are implications for cryo? *C. Pruneaux:* Normally none, but cryo piquets are informed. When voltage put back there can be small perturbation on grid. Previous time completely transparent.

b) Linac4 (B. Mikulec)

- Last week excellent with availability 99.7 %
- Only 3 rf restarts: CCDTL1, PIMS11 PLC, and RFQ reset after vacuum spike

- Special activities:
 - o Fine tuning of energy matching with PSB (now using optimized analysis). MDs planned to understand potential drifts, systematic errors, etc.
 - o Profile measurements in LBE: currently analyzed by ABP. Purpose: tails observed in V for LHC25 – do they originate from Linac4 already or to what extent do they change?

c) PSB (F. Asvesta)

- Last week's availability 81.6 % not so great, with most issues appearing during weekend.
- Nevertheless: destination availability (to PS) nearly 95 %. Reason: main fault only affected one ring, the other 3 could still be used.
- Main faults:
 - o PSB extraction BIC: bypass on extraction kicker had not been removed after LS2; so even if beam permit at fault, kicker still pulsing: now removed and major event report under preparation.
 - o R1 extraction kicker: crate was exchanged.
 - o Weekend: many POPS-B trips starting Saturday afternoon. Coming from spare converter on one of quads: bypassed for now but to be checked during TS. Thereafter, POPS-B tripped again due to bending magnet in R3. Off all night, access on Sunday to replace flowmeter. Sunday evening: problem with injection septum: faulty electro-valve, coil needed to be changed. Thanks to all experts who worked during weekend.
- Activities: lots of progress during week
 - o ISOLDE: first setup: can accelerate and extract 750e10 p in R1, R3. Other rings not far behind, but some more losses to look into.
 - o TOF: improvements on longitudinal characteristics, orbit, extraction
 - o LHC25: work on higher-intensity variant under preparation
 - o MTE: new settings from experts copied to operational user -> very high intensities possible (600e10 p per ring), and V emittance 3 – 3.5 um, without tails.
 - o Other studies: loss maps and resonance compensation (interplay of corrector magnets), stripping foil characterization (emittance), LIU WS (comparison new vs. old devices, define operational settings).
- Plan this week:
 - o Measurements to study ring and extraction BPMs to understand jitter problems; discuss with experts concerning timing of published data.
 - o Energy matching: readjustments for all users; follow up with more systematic measurements.
 - o BE.BSW14L4: extraction bumper not pulsing consistently for 2 GeV cycles, affecting extraction trajectory. Experts working on permanent solution.
 - o TS: multiple interventions planned
 - o Continue operational beam setups (ISOLDE, AD, LHC25)
 - o POPS-B: work on regulation, detailed plan for next steps ready

Comments / questions:

- *A. Antoine:* what happened with BIC is worrying. Procedure needs to be put in place to avoid that in future. *B. Mikulec:* preparing major event report: how can we better follow-up on status of bypasses. Define procedure so everyone is aware what bypasses are still in place.
- *D. Chapuis:* received request concerning BT-BHZ10 in PSB (extraction) for TS. Related to sl. 2: "Spare converter on quads: ..."? *S. Pittet:* yes, need to change connectors there. *D. Chapuis:* suggestion to use the EIS-F test mode instead of bypassing the interlock. This can be put in place from the CCC and will not require any special procedure. *S. Pittet* will contact equipment responsible. *R. Steerenberg:* needs to be followed-up by PSB OP team.
- *F. Pedrosa:* question to *D. Chapuis:* do we risk to trigger beam imminent warning during this operation as we are in test mode? *D. Chapuis:* no worries there especially since Linac4 is off. System allows such interventions.
- *R. Steerenberg:* when will it be in test mode and when back? *D. Chapuis:* test mode must be over when Linac4 comes back. *R. Steerenberg:* Would ideally be finished on Wednesday. From *S. Pittet* in chat: *F. Daligault* confirms that BHZ10 intervention can be done Wednesday afternoon.

d) ISOLDE (M. Lozano)

- Successful week: Continued HRS RFQ commissioning (found working configuration for continuing and bunching modes with good transmission); some time to do stable beam tuning for users; HRS frontend conditioning done, now holding nominal voltage; HIE-ISOLDE SRF cavities filled with liquid He. Conditioning continues. Currently at 3 MV/m for CM3 and CM4. CM1 and CM2 will continue next week.
- One issue: lack of ventilation in HT room: PSU overheating. Intervention required to raise temperature interlock threshold. Ventilation will be back end of next week.
- Almost ready for protons.

Comments / questions:

- *R. Steerenberg:* issue with ventilation temporary? *M. Lozano:* yes. Was planned maintenance of the system, but did not expect issues with overheating PSUs.

e) PS (F. Tecker)

- Beam instability (H) on LHC25: due to desynchronization of pole face windings with main field. Once resolved, continued beam setup: optimized injection, low-energy orbit, losses, and chromaticity.
- With 2x double splitting at FT, developed high losses at extraction combined with vacuum rise all along machine: must be e-cloud effect. Started scrubbing with high-intensity beam last Thursday. Ongoing.
- Internal dump: TDI48 validated up to 1250e10 p. TDI47: cannot use right now, has flowmeter issue. Will be checked during TS.
- WS: managed to perform measurements for LHC25#72b at injection and flat top. Clear difference between 1st and 2nd batch due to space charge. Qualitative behavior also reflected at flat top. As expected, but verify if numbers are accurate.
- Work in progress
 - o Tests on DFAs to check acquisitions, PPM behavior and different limits of system
 - o POPS: still in degraded mode; will be switched back during TS
 - o Ready to send MTE core (5e11 p) to SPS on Thursday
 - o LHCIndiv ready with TT2 trajectory as desired by SPS
- Found open door to PS external fenced off area. Intrusion by someone in possession of key during operation without informing OP. Also, gas bottle found inside zone. Zone was patrolled, closed, sealed. RP confirmed bottle would not be turned into radioactive waste if beam restarts. Remove bottle during TS and file internal accident report.
- This week
 - o BC: continue with high intensity scrubbing until TS.
 - o TS activities: Thursday 08:00 – 09:00: magnet tests for fringe fields, requires special permit; visual and RP inspection at high loss points; 80 MHz fast tuner test; vacuum sublimation to improve vacuum pressures.
- Weekly coordinator: Heiko Damerau
- Daily BC meeting now at 8:45 AM

Comments / questions:

- *F. Pedrosa:* knew that gas bottle was in supervised area. Leftover from Linac3 ventilation works. Supposed to be removed during HC, but never had opportunity. Not clear who opened door, but there should be CCTV. Make request to access video footage. *R. Steerenberg:* already in progress; *C. Gaignant (BE-DSO)* is in contact with D. Constant.
- *R. Steerenberg:* WS results very nice. *F. Tecker:* need to verify, maybe in some places dispersion not yet taken into account correctly.
- *R. Fernandez:* concerning magnet tests: require PS main magnets pulsing. *F. Tecker:* already aware of this and taken into account in planning.
- *E. Mahner:* surprised about pressure rise in PS due to e-cloud. In the past, saw pressure rise only briefly (few ms) just before extraction. Pumping speed was good enough to return to baseline. Do you have additional losses? *F. Tecker:* losses may contribute, but also see rise just before extraction during double-double splitting and bunch rotation to have very short bunches. For scrubbing: final bunch rotation off, but some adiabatic bunch shortening to control pressure rise. *E. Mahner:* in past, base pressure 3e-9 mbar. E-cloud would show with 4 x 72b, pressure up to 3e-8 mbar, but always back to

baseline. *F. Tecker*: do not have steady rise either. Does recover, but hit interlocks in beginning that tripped cavities.

- *J. A. F. Somoza*: see it in all rings. As soon as beam is gone pressure recovers. Also see improvement over time / conditioning effect. Looks like e-cloud. *E. Mahner*: sublimation only necessary for preparation for heavy ions? *J. A. F. Somoza*: want to gain some pumping speed and gain margin to interlock thresholds. Over past week already see improvement factor ~ 5 in most places.
- *G. Rumolo* to *E. Mahner*: what we see is not surprising. Machine completely opened during LS2, so SEY of surface now higher. As are result, can observe e-cloud as soon as we have 25 ns structure of beam. Some numbers: chambers of main magnet units, SEY threshold ~ 1.7 . Guess that SEY now $\sim 2.0 \dots 2.1$: to scrub down to 1.7 is easy task; no need to have high dose. But in PS will take time, because e-cloud only seen for very short time, several ms per BP of LHC25. Also see conditioning. Everything looks consistent with e-cloud.
- *E. Mahner*: what about clearing electrodes? *A. Huschauer*: 1) Agreed to keep equipment, but now controls and power removed during LS2. Do we still have possibility to read out pickup signals? 2) Initially sufficient to have 25 ns structure to create vacuum spike. Slowly introduced adiabatic bunch shortening. Since 2 days can go to nominal bunch length before rotation. Another clear sign that related to e-cloud. 3) initial vacuum worse than it used to be in previous years due to all the interventions at injection / extraction septa. Generally, we are close to interlock thresholds.
- *J. A. F. Somoza*: comment on equipment: check during TS. Thinks nothing was removed yet. *A. Huschauer*: thinks everything was removed. *J. A. F. Somoza*: Cabling still there.
- *F. Pedrosa*: thinks equipment in B355 still in rack. *J. A. F. Somoza*: if yes, should not be extremely difficult to put back. *R. Steerenberg*: discuss offline and see if we can make use of it.

f) ELENA / AD (*L. Ponce*)

- ELENA transfer line commissioning
 - o Beam quickly made it to end of line
 - o One monitor mounted with twice V grid rather than H / V. To be seen what to do.
 - o Quad connection in LLNE02 corrected
 - o Hope to send beam in LLNE02 line this week to start BC before bake-out
- ELENA ring commissioning
 - o Work on acceleration / deceleration cycle and e-cooler studies
 - o B-train setting up: adjust low-field marker level; high-field probe to be adjusted. Observation of cycle-to-cycle history
 - o FGC start cycle trigger problem reported few weeks ago; hard to debug, but now believed to be fixed: new FGC version deployed.
- AD
 - o Stochastic cooling kicker repaired: now at nominal water pressure
 - o DSP test, HW permit signed for main magnets
 - o No expert available to start EPC test: everything delayed by ~ 1 week
 - o E-cooler test ongoing to check e-beam performance and decide on gun exchange

Comments / questions:

- *R. Steerenberg*: concerning AD HC – there is still plenty of reserve time? *L. Ponce*: reserve time was kept to install plexi protection. Can only be done after EPC and magnet tests. Schedule starts to be tight. Due to TS this week in injectors, difficult to get hold of people.

g) SPS (*V. Kain*)

- 1 day of beam in SPS last week (12.04.) as foreseen in schedule
 - o Reached first milestone: established circulating beam.
 - o Various new systems: complex interlocking system, but had been tested very thoroughly beforehand, and was completely transparent during first day already.
 - o Synchronization with PS, however not with WR2RF (tests ongoing today to see if that is resolved): instead used frequency generator for PS.
 - o Once understood wrong current in BHZ (see last week's report): explored new injection geometry: no dogleg; 13 mm bump at injection point. Also worked very well.

- Issue with main switches of MKP module. Repaired during afternoon. Once fixed, established circulating beam quickly. Mainly thanks to new ALPS system which worked very well. With FIFO mode: established trajectory, injection oscillation correction, orbit at 0 ms.
- Programmed beam dump
- Lots of diagnostics also used to get to this stage (tune correction, mountain range, etc.)
- Rest of week: RF HC, to get cavity controller and WR2RF working (distribution of frequency)
- This week
 - Preparation of RF system
 - Test SBDS in COAST (soft start as in LHC injection kickers. Conditioning lost after some time. Can work around it for COAST mode): success.
 - BEQ1 Compensator test planned for 20.04. afternoon: 4 h. Mains will have to be pulsing, but should be transparent. Still reduces duty cycle for RF commissioning to some extent.
 - TS: RP will remove vetoes at 8 AM.
 - After TS: aim to have beam back Thursday evening
 - Beam types: LHC INDIV, if time allows: MTE core ~5e11.
 - RF capture: start Friday morning if everything goes well

Comments / questions:

- *R. Steerenberg:* nice to see all systems working well and making good use of little beam time had so far. Concerning soft start issue for dump kicker – is this temporary? *V. Kain:* issue going to be there until end of year, until we would replace vertical dump kicker. No real issue in the end as it takes just 400 s to recondition.

h) AWAKE (*G. Zevi della Porta*)

- Last week's report: person stuck in elevator: did Fire Brigade (FB) take long time to respond? No: person waited long time to call FB in first place. Took less than 30 min for FB to get there. M. Albert comments in chat: took actually ~15' as reported during last TIOC.
- Began laser experiments studying behavior of ionizing laser pulse going through Rb vapor source when laser frequency on/off resonance.
- Vapor source needs high thermal stability: 3 failed control thermal probes on vapor source; cause unknown. Need to replace before going to higher temperatures. Contractor in UK notified, will provide remote support to do the intervention during W16. Potentially an important issue.
- Laser / DAQ: final setup of all diagnostics experiments completed. DAQ scripts implemented in collaboration with Wigner Research Center for Physics team (remote support).
- Laser: experiments with Rb vapor started. Only at low Rb density due to broken temperature sensors.
- Next week: replace temperature probes to start experiments with higher Rb density in W17.

i) LINAC3 (*G. Bellodi*)

- Restarted last Tuesday (13.04.) after 2-week stop to replace source plasma chamber to StSt.
- Restart delayed by interlock on source cooling flow. Too high return pressure. Temporary fix: increase input pressure. CV confirmed problem: intervention on LEIR water station during TS tomorrow to reduce return pressure in circuit.
- Activities last week
 - First beam extracted Wednesday afternoon, after HV conditioning and slow voltage ramp-up to avoid sparking.
 - Stripping foil exchange last Friday
 - Noise observed on SEMgrid under investigation by SY-BI
 - Debuncher cavity restart problem under investigation
 - First test of Linac3 energy measurement application. Works well, just needs some final tuning.

Comments / questions:

- *D. Kuchler:* why no warning/logging of return pressure in water circuit? Went from nominal 2 bars to 3 bars, so significant change. *M. Amarill:* not much data available. Will reduce only by about 0.5 - 0.7 bars in return line, but will also reduce inlet pressure by same amount to keep same delta P. Could have been caused by works during LS2. *D. Kuchler:* logging would be useful. Spent a lot of time on

looking for the issue in the wrong place (replaced plasma chamber). *M. Amarill*: there is not much data as it is an old station. Increased supervision in the station. *R. Steerenberg*: follow-up closely together (BE-ABP & EN-CV) during the TS and converge on this issue offline. *M. Amarill*: will check tomorrow and see what to do about it.

j) nTOF (*J. Praena*)

- Target installation finished, target is in place, and will soon have beam.

k) CLEAR (*L. Dyks*)

- Successful week with stable beam and decent transport
- Provided beam to two experiments: 1) testing Cherenkov detectors for AWAKE; 2) testing BLMs with optical fibers. Measurements continuing this week.

l) East Area, North Area, HiRadMat

- Nothing to report

3. Injectors Technical Stop Updates & Schedule

- *F. Pedrosa*: have received some additional requests, but nothing critical that OP is not aware of. No need to prepare additional presentation.
- *R. Steerenberg*:
 - o Cool down: stop beam Wednesday 21.04. at 01:30 (high intensity, > 200e10 charges/cycle) and at 05:30 (low intensity, < 200e10 charges/cycle). Since in commissioning with more losses, taking more time for cool-down may be justified.
 - o RP survey in all machines: Wednesday at 07:30
 - o Start TS: Wednesday at 08:00: L4, PSB, PS, SPS
 - o End TS:
 - Thursday at 12:00: L4, PSB, PS SWY
 - Thursday at 17:00: PS, SPS
 - o L4, PSB, PS SWY can already prepare Thursday afternoon to then be ready to deliver beam to SPS in the evening.
- *F. Pedrosa*: for PS D. Bodart's magnet tests start at 08:00. Access to all people should be only at 09:30. All agreed with specialists. *R. Steerenberg*: confirms that actual TS in the PS will start around 09:30.
- *S. Albright*: to confirm for PSB, units on high / low intensity beams for cool down: is it charges per cycle or charges per ring? *R. Froeschl*: confirms it is per cycle.

4. Short-term Injectors Schedule Outlook

- TS Wednesday and Thursday
- Continue BC on Thursday 22.04. after TS (17:00): SPS will initially take LHCIndiv and MTE-core beams.
- During W17: provide 5-turn MTE beam (5e12 p) to SPS.
- W18: Nominal MTE beam to PS.

5. AOB

- No AOB