

# Minutes FOM #21, 01.06.2021

Chair: F. Tecker

**List of participants:** Albert M., Albright S., Antoine A., Antoniou F., Asvesta F., Bartosik H., Bellodi G., Biancacci N., Bilko K., Bojtar L., Bracco C., Comblin J. F., Cotte D., Damerau H., Deleval S., Delrieux M., Di Giovanni G. P., Dos Santos F. B., Fadakis E., Fernandez R., Findlay A., Froeschl R., Garcia M. E. A., Gilardi A., Gourber-Pace M., Gousiou E., Haase M., Hofle W., Johnston K., Kain V., Korysko P., Lallement J. B., Lang T., Lasheen A., Li K., Lozano M., Madysa N., Mahner E., Mataguez S., Matheson E., Mcfarlane D., Mikulec B., Newborough A., Nielsen J., Nuiry F. X., Papotti G., Pereira L., Piselli E., Pittet S., Ponce L., Praena J., Rae B., Ramberger S., Roncarolo F., Rothe S., Salvant B., Scrivens R., Simon P., Sjobaek K. N., Skowronski P. K., Somoza J. A. F., Tecker F., Vollaire J., Wegner R., Wetton C., W. Yu, Zamantzas C., Zevi della Porta G.

**Slides:** <https://indico.cern.ch/event/1020422/>

## Agenda

1. Approval of minutes & follow-up of actions
2. Reports from Accelerators & Facilities
3. Short-term Injectors Schedule Outlook

### 1. Approval of minutes & follow-up of actions

- Two open actions from previous meeting
  - o Action 1 (*R. Steerenberg*): bring up issue of spare transformer for Linac4 to IEFC team for longer term follow-up. This has been done.
  - o Action 2 (*M. Pace*): Follow-up on incompletely executed Makerules: meeting planned for Thursday this week with settings management working group.

### 2. Reports from Accelerators & Facilities

#### a) TI (*J. Nielsen*)

- **Thursday 27.05.: BEQ1 compensator tripped** on water cooling failure which interlocked SPS. Looked like cooling problem, but was actually due to intended flow reduction (while SPS is stopped, regulation valves on SIG supply close, tripping BEQ1 as it sees low water flow on primary cooling circuit). TIOC looking into it to either change thresholds or propose interlock based on water temperature on secondary side.
- **Friday 28.05.: Electrical perturbation** (-12 % for 70 ms). Transient fault from EDF on a 400 kV line. 2 small impacts: SPS dump down and all cavities down in PS. The latter: work ongoing to make cavities more robust against such glitches.

#### b) Linac4 (*G. Bellodi*)

- Excellent week: 99.5 % availability.
- Scheduled stop on Thursday 27.05. for requested interventions (VME crate exchange, klystron FESA class update, FGC module exchange on source RF amplifier). No beam for ~5 h.
- Minor interruptions due to a few converter and one DTL1 modulator trips.

#### c) PSB (*F. Antoniou*)

- Excellent week as well with availability: 95.4 %.
- **Main faults: 1) POPSB trip** with ~1h 40' downtime. Occurred after restart of machine with new POPSB regulation for BR23 (currents in six legs of power converter getting unbalanced). **2) H0/Hm dump** interlocks, mainly affecting R2 and R3. Not related to injection losses or observations on foils. Not yet understood, but now doing continuous monitoring of these interlocks. **3) Problem with simulated B-train** (1 incident). ALARM in LASER was set up but did not work as expected, investigations ongoing.
- **Main activities:**
  - o **1) POPSB:** new regulation on BR23 combined with optimization done on BR13 (19.05.) provides significant improvement of tune oscillations at injection ([see slide 7](#)). Next: beta-beating

correction. **2) MTE beam optimization** of ring-to-ring bunch length differences after PS request. Continuing work on transverse emittance optimization. **3) AD beam:** synchro settings adjusted to correct observed jitter in bunch spacing in PS.

- **Beam successfully sent to ISOLDE:** 1) steering in BTY line based on optics model for first time (now in good state and very useful). 2) Vacuum issue on GPS front end gave saturated signals on target SEMGRIDs, now resolved; 3) V offset on SEMGRID target of ~5 mm, explained by known vertical offset of 4.2 mm between BTY line and SEMGRID center; 4) high losses at specific BLM in BTY line, resolved by recalculating new optics; 5) Reference measurements taken for low and high intensities and different optics.
- Plan: **1) Continue ISOLDE commissioning** (HRS optics); **2) MTE beam:** optimize ring-to-ring transverse emittance differences; **3) LHC25 beam:** beta-beating measurements and correction.
- Big thank you to B. Mikulec who is moving from the PSB to the PS team.

#### d) ISOLDE (*E. Piselli*)

- **Low energy beam lines:**
  - **Protons on GPS** since Tuesday 25.05.: **1) PSB took measurements with new BTY optics** for different beam types and focal settings; **2) Using new movable SEMGRID target** placed on GPS front end
  - **SEMGRID vacuum status:** When starting SEMGRID measurements there was a confusion about the vacuum status in the GPS Front End sector GPS10. From OP side it was assumed to be pumped with the command sent but the target had not been clamped and the shutter/valve was still closed meaning the pumping process had never started. The assumption by ISO OP that the Front End was under vacuum was wrong. After the FE sector GPS10 was pumped the signals from the SEMGRID were correct and PSB could proceed with their measurements. A meeting was held with PSB and BI to summarize the situation.
  - SEMGRID target moved onto HRS front end today to finalize tests for upcoming run.
  - GPS fix display showing some faulty status after LS2 interlock changes. Work ongoing by BE-CO.
  - Isolde HRS RFQ beam tuning to improve efficiency with higher mass: very good results obtained.
  - New tape-station detector installed by SY-STI and SY-BI.
- **Hie-Isolde-Rex**
  - Last week: **1) Fixed broken FGC PSU** in HEBT line XT02; **2) Fixed problem with count rate functionality** of silicon detector at Hie-Isolde; **3) Started cavities phasing:** different energy measurements performed. **4) REX 7GAP3 RF amplifier:** few capacitors on controller card burned at start up – big replacement campaign initialized. **5) Faulty cryo interlock:** led to stop of cryo coldbox. Cryo piquet intervened and reconnected coldbox to cryo modules. Study ongoing to see if such events can be reduced. **6) SRF cavities in CM1, CM2, and CM4:** temperature rose above 10 K, causing loss of SC state. Expert to assess impact in coming days.

#### Comments / questions:

- *J. A. F. Somoza:* 1) was not aware of SEMGRID vacuum problem. 2) Delivering signal to front end control of vacuum pump, and should not be able to send beam to target. Not clear what happened there. Must check if specific signal not used or overridden. *F. Roncarolo:* took several days to discover that there was no vacuum at SEMGRID. Calls to experts reassured that vacuum monitoring OK, but there was no interlock. *E. Piselli:* Not aware of this, to be checked with PSB. *J. A. F. Somoza:* There is an interlock, but likely only inhibiting target heating. Since there was no heating, beam was allowed to be sent. (J. Vollaire also commented via chat: SEMGRID not cooled / heated). *F. Roncarolo/ F. Tecker:* do post-mortem to see what went wrong (*meeting between PSB and BI already took place, text above has been updated*).
- *F. Tecker:* what is the time scale for capacitor replacement in RF amplifiers? *S. Ramberger:* Out of 5 RF amps (+ 1 spare), 2 have already been repaired. Those that have not yet been replaced are not in operation yet. Will also be fixed shortly.

#### e) PS (*D. Cotte*)

- Availability: 96.5 %
- Main reasons for downtime: **1) access on Thursday 25.05.;** **2) power line glitch** mentioned by TI.

- Activities:
  - o **Loss map measurements:** first results to compare to before LS2. Investigate impact of H and V BGI magnets on resonance excitation. V BGI84 confirmed to excite skew sextupole resonances  $3Q_y = 19$  and  $2Q_x + Q_y = 19$ . H BGI82 confirmed to excite sextupole resonance  $Q_x + 2Q_y = 19$ . Plan: repeat measurements with resonance compensation.
  - o **TT2 BLMs:** investigating noise sources during Thursday access. Switching OFF power converters in TT2 not reducing noise, instead found correlation with elements LTB.QNO40 and LTB.QNO60.
  - o **Beam setting up: 1) LHC multi-bunch:** constant bucket area from injection2 to C1435 (3.3 GeV/c). Emittance measurements to be done. **2) AD user:** a) checked PSB-PS transfer; b) acceleration and batch compression; **To do:** a) RF work to optimize injection and transition crossing; b) optimize extraction; c) need to get from  $1E10$  p to  $1.5E10$  p.
- Control issues: **1) LSA cycle cloning:** observed problems with too long setting history, fixed. **2) Inconsistent settings when trimming ejection timing:** trim history not updated, see <https://issues.cern.ch/browse/APS-8964>
- **Summary of beams:** *1) operational:* SFTPRO core, LHCPROBE, LHCINDIV, LHC25 (72b), LHC25 (12 b or 24 b), LHC25 BCMS; *2) Setting up:* SFTPRO 5-turn extraction (intensity increase), AD, TOF ([details on slide 8](#)).
- **Plan for this week: 1) repair C20-92** during access Tuesday 01.06.; **2) Intensity increase on SFTPRO; 3) Deliver LHC 25 ns beam to SPS; 4) continue setting up AD beam; 5) Improve wire scanner control.**
- Supervisor: F. Tecker

#### Comments / questions:

- *R. Scrivens:* concerning loss maps – are resonances a problem for operation? *D. Cotte:* it was a problem, get quite often close to resonance lines and see impact on beam. LHC beam at flat top is also affected at times. BGI82 was already in operation in 2018, did not notice significant losses back then. BGI84 new since LS2. *F. Tecker:* compensation is in place: managed to remove losses completely. Did not yet check emittances, still to be verified. *H. Bartosik:* is it foreseen that tune goes up so high? *D. Cotte:* Yes, PFW current generated by polynomial. Usually tune (in V) goes up to 6.3 with these generated PFW, approaching third order resonance. *H. Bartosik:* losses observed even at high energy? *D. Cotte:* Yes. Correct  $Q_v$  down with high-level knob when approaching 6.33 clearing the losses.

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

- **ELENA: 1) Test multi-RF segment functionality:** for pbar operation and AD; **2) fixed bugs and missing settings; 3) Servoloop stability issue:** LLRF experts working on it. **4) Work on electron beam orbit adjustment** on intermediate plateau. **5) Continue test of automatic injection setting-up** algorithm developed for Linac4.
- **AD (still in HWC): 1) Installation plastic covers** still ongoing; **2) Injection septum strip-line insulation refurbishment; 3) Injection kicker:** short-circuit inside vacuum (1 module not operational); test of nominal operation with 5 out of 6 modules ongoing. **4) AD target:** put in special permit for dogleg powering tests.
- Issues: **1) FGC\_93:** electrostatic correctors in transfer line regularly tripping – problem identified and to be resolved this week; **2) HV source trips** since last Thursday, lost vacuum gauge on Friday, repair ongoing.
- ELENA Hminus operation stops on 7<sup>th</sup> June for 2 weeks.

#### g) SPS (G. Papotti)

- **Achievements:**
  - o **pLHC:** 12 bunches circulating up to end of flat bottom: vacuum activity seen since first shots. Scrubbing started this week.
  - o **pFT:** 1) ZS aligned and crystals aligned (also using optimizers); 2) Friday: took full MTE beam
  - o **RF:** 1) LLRF pFT radial position jitter solved; 2) AWAKE rephasing improved; 3) preparation of 800 MHz; 4) cavity conditioning on AWAKE cycle now with automatic software (mostly limited by cavity 1); 5) Transverse damper set up on LHCPILLOT, HIRADMT2, and SFTPRO1 before taking full MTE.
  - o **BI:** 1) wire scanner showing first results; 2) miniscans GUI working; 3) improvements with SEMs; 4) still missing: BSI, work is ongoing in the tunnel today.

- **Other:** 1) Bucket 1 aligned for all beams (pFT and pLHC); 2) QF / QD noise improved; 3) Automatic Laslett tune correction works OK.
- **Main issues: 1) BA3 circuit breaker trips:** ALPS not available in R3 (access needed); **2) Long stop Thursday 27.05. for Linac4:** profited for accesses and interventions. Suffered from other faults as well that day.

*Comments / questions:*

- *F. Roncarolo:* Concerning BSI missing: is this new? *G. Papotti:* No, E. Effinger went in last week and is working on it also today. It is required for optimization of the noise. *C. Zamantzas:* confirms it is the fast BSI. Currently a BI team is working on it. Might be instrument itself rather than electronics, to be seen. *G. Papotti:* keep coordinator (K. Li) updated on that work, it has high priority this week.
- *F. Tecker:* SPS access today until 1 PM.

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

- **Last week:**
  - **Electron beam:** commissioned new optics and used it for measurements of energy / charge loss in plasma for different e- beams. Setting up for wakefield diagnostic tests.
  - **UV laser:** compressor improvements increased e- beam charge (max. charge now 700 pC).
  - **Access system:** patrol broke when person took token and put it back immediately before entering TAG41. Investigating why RadVeto did not switch off automatically after end of p beam mode.
  - **Plasma wakefield diagnostic:** set up and aligned. Observe light when laser travels in Rb vapor. Currently: no visible difference between laser + Rb vs. laser + Rb + e-.
- **This week:** beginning of access periods (2-3 weeks).
- **Plan W22 /23:** PXI upgrade, pulling network cables, laser motor replacement, vacuum opening down stream of vapor source. **W24:** vacuum opening for potential Rb recycling.
- Taking advantage of additional p beam time from SPS.

**i) LINAC3 (R. Scrivens)**

- **Last week:**
  - **Change to oxygen beam:** measure neutron production with oxygen, to assess requirements for shielding Linac3 and LEIR for LHC oxygen run coming in a few years. Very high O2+ produced. Different targets were tested and results are in line with expectations, further analysis ongoing.
  - Keep oxygen permit also for this week to perform measurements of **transmission into ITFS line** before going back to Pb operation.
  - **Refilled Pb oven**, trying with 'recycled Pb'
  - **Issues: 1) Source vacuum gauges switched off unexpectedly**, reason unknown; **2) RFQ amplifier failure** likely due to internal timing card. Several components failed, was repaired Monday morning. **3) document for ABP control rooms** (<https://edms.cern.ch/document/2568448/>).
- **W20:** pulsing source at 100 ms vs. 150 ms (*see slide 4*). Main outcome: stability just as good in 150 ms compared to 100 ms mode. Will likely test 150 ms mode with LEIR later this year.

**j) LEIR (C. Wetton)**

- **Chronicle:** Since W42 last year: Magnet renovation (containing wooden parts): had faced issues in the past to restart those magnets. This has been completed in W16. Lines under vacuum and starting bake out by W19. W20/21: found large vacuum leak causing stop of bake-out. Leak found on 20.05. and concerned part replaced. Restarting bake-out on 24.05. Started NEG activation yesterday.
- **HWC:** 1) FGC3 magnet commissioning following control electronics upgrade. 2) due to issues found during bake-out proposed HWC with magnets had to be postponed till bake out ends. However, start HWC of elements not affected by bake-out in parallel: ETL.BHN20, e-cooler, and kickers.
- **Last week:** 1) All condemnations for required PSU and PC removed. 2) Commissioning of power converter for ETL. BHN20 started. 3) Inspections of kickers and e-cooler took place.
- **This week:** continue HWC: 1) NEG activation started and going OK; 2) cooldown could be completed by tomorrow; 3) equipment experts should be able to remove bakeout heaters starting Thursday.

**k) CLEAR (A. Gilardi)**

- No major issues to report, everything is going well: 1) did some experiments for AWAKE and CLIC accelerating structures; 2) testing new system using Arduino to control.

**l) nTOF, East Area, HiRadMat (J. Praena)**

- **nTOF:** continuing with commissioning of target cooling station and work on neutron lines. Everything according to schedule. Investigating vacuum leak.
- **Others:** nothing to report.

**3. Short-term Injectors Schedule Outlook**

- This week: 1) LINAC3 started with oxygen beam; 2) Scrubbing started in SPS, so far injected up to 24 b, hoping to reach 72 b by end of the week.
- W23: AD beam to PS (low-intensity version already used).

*Minutes by M. Schenk*