

# Accelerator Complex Status

## End week 9 (Monday 7 March 2022)

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### Technical Infrastructure (Jesper Nielsen):

Statistics:

- Over 8'000 alarms.
- 723 phone calls (519 incoming, 204 outgoing).
- 84 ODM created.

Events worth mentioning:

- Mon 28.02, Trip of SVC in LHC8, happened due to a false manipulation during a maintenance. Also, UPS EBS21/A82 in North Area out of service. It's an old UPS that cannot easily be repaired, all users are aware.
- Wed. 02.03, Another faulty battery pack detected during visual inspection in UPS EBS11/63. Battery is cracked. Redundancy is assured by EBS1/63 until repair can be done.

Details: <https://wikis.cern.ch/display/TIOP/2022/03/07/TI+week+summary,+Week+9>

### LINAC 4 (Federico Roncarolo)

About 98% availability for LN4.

Three main events caused down-time:

- **Wed 02-Mar (~20min) : MEBT sector valves closed** (exit of RFQ <--> DTL1 entrance).
  - Valves closure perfectly correlated to vacuum spike detected in the sector and chopper trip.
  - No other correlation found so-far (looked at BCT signals, source parameters, RFQ and MEBT RF).
- **Fri 04-Mar (~60min): assessment of the source 2MHz RF power saturation level** (required LEPT beam stopper IN → no beam in the LINAC)
  - The LN4 source delivered and is delivering very stable 35mA pulses.
  - To achieve this: the RF amplifier gain and the LEPT gas pressure had to be tuned few times in order to correct beam intensity ripples at the end of the pulse).
    - The cause could be the RF amplifier ageing (tbc)
    - discussions are ongoing on how to closely monitor/assess the amplifier saturation level, with minor/acceptable impacts on LN4 availability.
- **Sat 06-Mar (~90min): DTL1 fault.**
  - Restart required RF piquet intervention. Fault source not clear yet.

### PS Booster (Foteini Asvesta):

The PSB availability was **91%**, dominated by the access on Monday.

The week started with a **day long access** (8-18h30) on Monday to **realign the BSW.1L1.1 and 3 quadrupoles**. The access went as planned **and measurements with beam** later during the week **confirmed** the positive outcome as the BSW leakage correction corresponds to only 0.3 mrad roll angle misalignment (compared to 12.5 mrad before the realignment) while the horizontal and vertical RMS orbits in all rings have been improved. Under these conditions the injection steering has been refined and the horizontal orbit has been corrected using only the special bending magnets while the vertical one didn't need correction at this stage. The settings have been propagated to all operational users.

During the week there were significant improvements on the setting up of all **operational beams** in particular:

**LHCINDIV & MTE** : regularly taken by the PS; energy matching with the PS: BField at flat top was decreased by 6 G (change propagated in all 2 GeV users).

**AD** : 400e10 ppr extracted in all rings; still some work and fine tuning needed in particular on flat top stability.

**TOF** : new variant prepared with low intensity (200e10) and high vertical emittance (6-8 um) as requested from the PS for studies on the transfer line to nTOF.

**LHC** : beam setup up to 220e10 ppr extracted; further improvements expected in terms of brightness from b-beating correction and refinement of the resonance compensation schemes; measurements of the b-beating have been conducted this week both during the collapse of the injection chicane and along the cycle.

**ISOLDE** : preparation of all ISOLDE variants (ISOGPS, ISOHRS, STAGISOGPS, STAGISOHRS); extraction was redesigned as the use of the ring correctors affected the TFB system and led to an instability at the end of flat top; **first beam to ISOLDE on Friday afternoon**; reference measurements were taken during the weekend for the trajectory on the BTY line; during the weekend issues appeared on BTY. QFO108 and BTY.DVT212 which will need to be followed up on Monday when the first line service will be available.

On Friday, during the 1h stop for the LINAC4 source, there was a **new release concerning RF timing**, which should solve several synchronization issues for the extraction, and an **intervention on POPS-B** to connect an oscilloscope in order to monitor the QFOs as four faults this week seemed to be related to an instability in their input filter capacitors.

Finally, a fault on the BI3.DHZ70, which required the experts' intervention, was causing interlocks on the H0H- monitor. Other minor issues on the TFB system and the R1 BCT were successfully resolved by the experts, while work is ongoing on the stray field compensation of the PS.

#### **ISOLDE (Miguel Lozano):**

It is been a very busy and successful week at ISOLDE.

DSO tests on Tuesday that went pretty well followed by some stable beam tuning to VITO from HRS and to RC4 and LA1 from GPS from a plasma target on Wednesday.

Double target change on Wednesday. SEMGRID target installed on GPS in preparation for the first protons of the year.

On Friday we started preparing the RF warm tests and the RF DSO tests and solved some problems with the Anode power supply at the HRS frontend.

At the end of the day we got our **first protons to Isolde**. Unfortunately, there were some problems at the BTY line during the weekend that will be addressed today before continuing with the proton beam setup at the Booster side.

#### **PS (Denis Cotte):**

Good progress was made, in particular on LHCINDIV and different flavors of MTE beams.

Monday was almost without beam and focused on interventions in the machine and remaining tests form HW tests period. (Deployment of a new version of FGC62, new FESA class version for DFAs, replacement of faulty C10 amplifiers, work on C40/80MHz, ...). First beam already the week before proved extremely useful to schedule these interventions.

Tuesday, the phasing of the 200MHz cavities took place successfully. The first energy matching with the Booster has been done on ring 3 and was then checked with the 4 rings. A problem with TT2

SEMFIL fits when a wire does not give data has been observed and was solved by the end of the week by BI expert.

Optics tables at injection have been homogenized for LHCINDIV, SFTPRO and TOF users.

Wednesday, the phasing of the 40/80MHz cavities took place successfully. Bunch rotation on LHCINDIV was implemented. Basic setup of MTE (core only) and LHC25 (injection, triple splitting) beams started. A new version of the BLM Vistar has been deployed in the CCC. A first series of measurements carried out this week shows us that the noise present on the first BLMs of TT2 in 2021 has practically disappeared thanks to many improvements implemented by BI during the YETS. Min/Max values for TT2 DFAs have been tested successfully.

Thursday, we found a broken digitizers on WCM03 following a power cycling, it requires a replacement. KFA71 module 11 and 12 were not well synchronized with other modules, ABT solved the problem in the evening.

Synchro with SPS tested on LHCINDIV cycle. Kick response in BTP highlighted a logical device for DHZ10 not linked with the hardware. Finally, several tests on the MTE extraction took place to better understand the individual effect of each of the kickers used to extract the beam.

Friday, final polishing of the first beams that the SPS will take on Monday (LHCINDIV and MTE core). Preliminary tests to pulse 40/80MHz cavities on LHC25 multi-bunches.

Lots of progress on MTE full version (4 islands + core):

- with very nice shadowing between TPS15/SMH16.
- losses in SS14 reduced with BFA9P (vacuum chamber represents a horizontal aperture restriction during fast bump around MU13)
- fine delay between KFA13 and KFA21 correctly adjusted
- high 200 MHz component reestablished.

During the weekend we continued the adjustments of the MTE beams at higher intensity. A new TOF version (low intensity, large emittance) has also been tested and measured with the new wirescanner application.

Still remains a strange MRP on certain users.

PFW (FNP) regulation with high Bdot to be improved today. (B field compensation).

#### PS - East Area ( ):

YETS.

#### AD - ELENA (Laurette Ponce):

##### **AD:**

- 1 week delay expected for the closure of AD ring due to delay in the bake-out of sector 1A and the reconnection of the kicker to be done afterwards.

##### **ELENA:**

- Source operation restarted with the new HV transformer.
- beam successfully sent on the newly installed BTV118
- beam permit signed for Hminus, waiting for the completion of the injection kicker to have circulating beam in ELENA.
- HW tests on-going in the meantime and couple of issues identified:
  - issue with data publication of the FGC under investigation by EPC: the workaround deployed by timing system during the YETS is not working, so another solution is under test

- e-cooler ON, but produced electron current not yet nominal, under investigation by BI colleagues
- installation of STEP profile monitor successful and removal of 1 as spare completed, vacuum sector under pumping.

#### SPS (Stephane Cettour Cavé, Johan Dalla-Costa and James Ridewood):

- Magnet MBB43270 vacuum leak discovered Wednesday evening. Vacuum detection Wednesday evening and magnet change Thursday during the day.
- During magnet change a defective vacuum sectorisation valve (42301) was found and changed, extending the vacuum intervention up to Friday morning. DSO tests had to be somewhat reorganised to avoid a loss of time.
- During DSO tests a small water leak was identified on QD62110 on the purger. Magnet experts intervened Friday lunchtime.
- Terminating resistor found damaged on MKDV 3. Replaced Friday lunchtime.
- BI experts investigated eRects of power converters on slow extraction instruments BSI spill. 2 power supplies (LSE22402 and MPLH21995) potentially causing some minor noise. BI experts in parallel attempt to better shield/earth their equipment. Course of action regarding power supplies TBC.
- RF low level confirms all 200 and 800MHz cavities now ready at nominal and cavity phasing done. Only fine tuning with the beam remains in theory. Beam control is also ready for the first beam.
- DSO tests for SPS ring, TT20, TT40 and TT60 extraction and north transfer completed OK. Beam permit for SPS ring validated. TEDs blocked IN at TT20, TT40 and TT60 to ensure safety of downstream areas.
- BPM problem with fibre and power supply issue in TI2 resolved by BI Tuesday.
- RF power FESA class arrived late Friday afternoon leaving some SIS interlock subscription issues. Experts working to resolve asap.
- Ready to inject first beams Monday, as foreseen.

#### SPS North Area ():

YETS.

#### AWAKE (Giovanni Zevi Della Porta):

Laser and electrons back online

##### **Laser:**

- Intervention by external manufacturer brought our laser back online, with a brand new control system
- Both UV and IR alignments were off, but we were able to recover the beams using only the final motorized mirrors
- Took data for alignment studies (simultaneous on main line and virtual line)

##### **Electrons:**

- Started right away as soon as we had UV on the cathode
- Observed electron beam on newly installed BTV
- Observed electron beam on streak camera using recently re-aligned upstream optics
- Took data to test a quantum RL algorithm for trajectory optimization

##### **Access:**

- Some disruptions (but no patrol loss) due to DSO tests in TAG42

- One patrol loss due on March 1 due to TAG41 being put in closed mode (as a result of RBI.81607 and 410010 being put back in chain) while an internal door was open
- One patrol loss due on March 3 to token-handling at PAD (similar to token-handling patrol lost on Feb 25)

- **Magnets:** 2 magnets disconnected in preparation for bringing them to the surface in week 10

**Plan for week 10:** Start of 2-week intervention to modify beamline in two places in preparation for April installation of High Frequency BPM an Integrating Current Transformer.

**LINAC 3 ():**

YETS.

**LEIR ():**

YETS.

**CLEAR ():**

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**LHC (Jörg Wenninger & LHC Coordination webpage):**

S12	S23	S34	S45	S56	S67	S78	S81
Phase 2	Phase 1	Phase 2	Phase 2	Phase 2	Phase 2	Phase 2	Phase 2
77 / 11950 A	0 / 0 A	71 / 11950 A	87 / 11950 A	76 / 11600 A	62 / 11600 A	21 / 11600 A	55 / 11600

RF DSO tests passed on Monday, start of RF conditioning (with 4 weeks delay).

Almost all powering tests finished in the phase 2 sectors (all but S23), a few isolated tests and issues (60A resistances) to be fixed or completed. RB quenches during the recommissioning: S56 after 40 minutes on FT, heater induced quench in S67 when opening second energy extraction (200 mV board re-installed on one RB as cure).