Accelerator Complex Status

End week 26 (Monday 5 July 2021)

Technical Infrastructure (Ronan Ledru):

Statistics:

- Slightly more than 10'000 alarms.
- 765 phone calls (484 incoming, 281 outgoing).
- 133 ODM created.

Events worth mentioning:

- Mon. 28.06, During the maintenance of the Primary Water (from the CT2 to the BA82), the Raw Water of BA82 was accidentally closed. The piquet has been called at the end of the evening to restart the system.
- Tue. 29.06,
    - Fire alarm in building 2009. The bearings of the ventilation UACV3-00058 are broken and create some smoke. Ventilation has been stopped.
    - AD Beam stop because of a ventilation swap between UAEF-00015 and UAEF-00016. This interlock was not known by EN-CV.
- Thu. 01.07, Smoke on the UPS EBS13/A3. A member of SY-RF saw some smoke from the UPS, he called directly EN-EL who ask to push the AUE (Equipment Emergency Stop). The intervention was so quick that the Fire alarm was not triggered. Presently the circuit is secured through another UPS until repair, most likely by Friday.
- Fri. 02.07,
    - Fire alarm in SCX5. The alarm was related to a forklift battery which short-circuited when being disconnected.
    - 5 cm of water in the gallery of building 100. A green pipe was leaking from the 100/S-475. The leak has been temporary fixed

Details: https://wikis.cern.ch/display/TIOP/2021/07/04/TI+week+summary%2C+Week+26

LINAC 4 (Eva Gousiou):

The Linac4 availability has been **99.5%** this week, with several uninterrupted days.
The 46min total fault duration has been mainly due to:

1. A **PIMS1112** trip that required on-site surface intervention. The current diagnosis is bad contacts on the control cable of the klystron ion pump; an intervention is foreseen tomorrow morning to further investigate the cable connections [Fault duration: 26 min]
2. A **Chopper** trip; we have been having few of those the last couple of months and the experts suspect the Chopper Driver Unit hardware and will work on that after the SPS priorities [Fault duration: 4 min]
3. A **RFQ** issue; this happened last night and is still under investigation [Fault duration: 16 min].

PS Booster (Alan Findlay):

A good week for the PSB, with over 98% availability for our users. We have no major issues to report, with the machine working as we would wish.

The small number of faults we had were the usual resets of power convertors or very short beam stops from L4. ISOLDE had 45 minutes without beam on Sunday evening when the Firstline was required to come on site to fixBTY.QFO122.

MD's continued to minimize the losses on the ISOLDE cycle.

The TOF beam was reworked by Simon and Alex upon a request by the PS RF crew. The updated request was for 2.5eVs with 180ns bunch length, which they achieved with the longitudinal blow up during the cycle and cavity voltage at extraction.

ISOLDE (Emiliano Piselli):

Low energy beamlines:

GPS:

Stable beam tuning on Tuesday and Wednesday. On Wednesday morning an intervention from SY-ABT HT specialist was necessary to repair an electric contact inside the HT oil tank.
Proton beam scan and yield measurements (SY-STI) on Wednesday afternoon and radioactive beam to the users from the evening.
Experiment is running fine, but 3 interventions were necessary from my side:

1. On Friday early morning (at 5h20): vacuum valve closed, and users could not open it again. After checking vacuum in the neighboring sectors, I have opened it again. The closing of that valve was due to a vacuum spike.
2. On Friday early morning (at 7h00): many power supplies were still off after the vacuum issue. I have reset all of them and checked transmission with stable beam before giving back beam to the users.
3. On Saturday morning (at 1h00): all the electrostatic elements in isolde hall were off. After having contacted SY-EPC control piquet and first line piquet, we have discovered that 2 of that power supplies were broken and they have caused a general failure of the main power circuit breaker. We spent quite a lot of time to identify which one was broken. Once replaced the broken devices I have check stable beam transmission from the target to the experiment and at 4h30 users could take back beam.

HRS

MEDICIS target irradiation ongoing till Thursday morning. Stable beam tuning for next week users from the front-end trough the RFQ done on Friday.

HieIsolde-Rex

- The third phasing of the superconducting cavities was completed using 40Ar12+ after the gradient of several cavities was reduced to improve the stability. Precise energy and energy spread measurements were done.
- The Ar beam was used to recommission the XT02 line. SY-BI (E.Bravin & J.Tassan) have intervened on Friday to check an issue with a FCup voltage repeller. This week we have organized an intervention to exchange a broken cable inside the diagnostic box.
- A new set-up using 22Ne7+ was prepared in preparation for the first beam delivery to the users
- The stability of the SRF cavities at the new gradients was monitored during the week. Unfortunately, two cavities in CM2 are still tripping once every one or two hours. So, we may need to bypass this cavities all together and rephase the linac one more time.
- We also started preparing the slow extraction set-up for the 22Ne7+ beam. Although, some additional work will need to be done this week.

PS (Denis Cotte):

Une très bonne semaine pour la machine PS avec une disponibilité des faisceaux qui dépasse 97% dans AFT. Tout au long de la semaine la machine PS a fourni le faisceau AD sur une large gamme d'intensité jusqu'à atteindre l'intensité nominale.
Côté SPS, les faisceaux SFTPRO-MTE-5tours-200e10, LHCPILOT/LHCINDIV et le LHC25#72 bunches ont été fournis sans problème majeur.

L'arrêt le plus important cette semaine était dû à la dump interne 48 qui restait bloquée dans la chambre à vide dans la nuit de Jeudi à Vendredi avec pour conséquence environ 1h20 d'arrêt faisceau dans le PS.
Concernant le "Beam Commissioning", cette semaine a été très intéressante pour les faisceaux TOF et MTE.
Sur TOF :

- La fourniture depuis le PSBooster d'un version plus grande en émittance longitudinale avec environ 2.5eVs
- La revue des settings RF à l'injection,
- La réduction du tune verticale sur le palier basse energie

ont permis d'atteindre Vendredi après-midi l'intensité nominale de 800 à 900e10 sur ce faisceau avec des pertes raisonnables.
Sur MTE :

- La mesure du Wire Scanner avec ilots ainsi que les fits des mesures sont disponibles depuis un script python,
- L'optimisation du passage de la transition,
- La réduction de la pente du ONO55,

ont permis d'atteindre une intensité de 1.2e13. Les pertes restent importante au-dessus de cette limite et sont toujours en cours d'investigation.
A plusieurs reprise cette semaine, des mesures comparatives d'émittances avec BGI et avec le WireScanner donnaient des résultats cohérents sur différents faisceaux.
Jeudi, des tests de pilotage des alimentations de la zone T9 de la zone EST ont été effectués avec succès. Pour pouvoir piloter ces alimentations, la création d'un nouvel accélérateur zone, de beam processes et le redémarrage du serveur INCA PS fut nécessaire.
Ce week-end, plusieurs mesures d'émittances ont été effectuées.
La version haute intensité du faisceau LHC25ns à 2e11 ppb donnait des émittances transverses d'environ 2 mm.mrad dans les deux plans.
Des études sur le point de fonctionnement sont en cours sur :

- Le faisceau EAST et l'effet des PFW, QSE et XSE.
- Un faisceau MD et l'effet de différentes pentes sur le champs principale des "Main Unit Magnet" du PS.

AD (Laurette Ponce):
AD target:

- New target inserted on Monday, intensity increased to nominal on Wednesday
- Performed FTA and DI steering to improve transmission and reduce radiation level inside AD ring
- Rough setting of horn and target alignement

AR ring:

- Performed first injection into AD on Wednesday
- First check of instrumentation: Schottky signal available, BCCCA available, but some issues with the momemtum reading and data publication
- Beam circulating on the injection plateau, intensity a factor 2 to 3 lower than nominal
- Problem with the synthetic Btrain algorithm fixed on Friday afternoon
- Started setting-up of C10 cavity: fixed problem with the FESA class (device declared obsolete), control of the phase is OK, problem with the control of the amplitude.

ELENA (Laurette Pnce):

- Hminus operation resumed on Wednesday after ion switch reconditioning and profile monitors electronics re-installation
- Check profiles for the new grids installed
- Test of multi injection after fixing problem of multi triggering of FGCs.

SPS (Kevin Li):

Week 26 has been an impressive week in terms of both discoveries as well as sorting out of issues; a lot of follow-up work has emerged from this. Beam time has been sparse. The main goal of the week has been steering beam to the NA targets in order to provide the beamlines with beams for their setting up. The other longer standing item was to get the HiRadMat beams ready for 4 x 72 bunches at flat top. The latter activity is at the same time linked to scrubbing and longitudinal beam stability studies, which are currently the main limitation for high intensity LHC-type beams at flat top. The kicker conditioning is now pretty much under control for the obtainable intensities.

Up to the end of the week, steering to the targets was not completed due to a long series of complications which will be detailed below, when going through the week. On the other hand, HiRadMat has been set up as good as currently possible, reaching a bit more than 1.1e1 ppb with 288 bunches at flat top with the kickers showing good conditioning such that they are now no longer limiting for this intensity. The HiRadMat cycle has been used throughout the week to condition the MKDs at top energy and to push the intensity of the 25 ns beams. For the most part of the week, the focus was set on probing the intensity limits with a single batch of 72 bunches. Longitudinal instabilities appear at high energies and the 800 MHz is required to keep the beam stable; different voltage programs were tried to try and improve beam stability; in this configuration, up to 1.35e11 ppb can be brought stably to flat top. Running at 4 batches of 72 bunches, the intensity needs to be reduced to about 1.1e11 ppb for the beams to remain stable. Additional feedback systems (longitudinal damper, feed-forward) will likely be required to get beyond this intensity limit. Over the weekend, the HiRadMat cycles was played continuously with all 4 batches at top energy, dumping at a high duty-cycle to complete the last step of the TIDVG conditioning (continuous dump of 288 bunches).

As for the steering to targets, taking beam had to be shared with providing access for the NA beamlines maintenance; several leaks and other problems had been detected and needed to be fixed in the NA beamlines. The last fixes had only gotten ready by Thursday evening; up to then, essentially during all days of the week, the morning was reserved for access in the NA beamlines and beam was taken only later in the afternoon, to set up steering to the targets. The latter has been additionally impeded by several issues linked to the available instrumentation in the beamlines. Several updates in the beam instrumentation controls system had required an update of our steering software which could be done thanks to the support of the steering application expert. By Wednesday most signals were understood, apart from the ones obtained by the BSMs before the targets; investigating together with BI experts, it was then decided to go for an access on Thursday morning to investigate on-site. It turned out that the motor stand-by current configuration of the BSMs had been removed which detains the BSMs to move into their reference positions. This was fixed but could unfortunately not yet be tested as, simultaneously during this access period, during the works in the NA, it was discovered that none of the TBIU/D ion pumps was running and that the TBIs were under a very poor vacuum. In preparation for the necessary access, beams were no longer extracted in order not to further activate the already very hot zone. After some struggle for finding a team responsible for these devices, SY-STI took the lead and organized together with TE-VSC, SY-BI and BE-OP an access to pump down the TBIs in order to be able to turn back on the ions pumps. Pumping went slower than foreseen and had to be continued all along the weekend, such that for the remainder of the week the fixed target beam could not yet be taken back to continue setting up steering to the targets.

Following, a chronology of other issues that suppressed most of last week's beam time during working hours:

- Monday: coming out of the weekend, a fault on the MKDV kicker switches prevented any dump at flat top; repair of the MKDV SS kicker switch stack had to be done on Monday; the replacement is a tedious intervention and requires the full day; access finished around 17:00 in the evening;

- Tuesday: HiRadMat beam taken early in the morning with RF investigating beam quality, no major issues were found apart from some sporadic voltage clamping; at 11:00 an RF upgrade was done (power card and CC firmware with patch); recovery from the upgrade took until 23:00; shortly after, the FEC linked to extraction bumpers and septa in LSS2 could no longer be restarted; extraction bumper elements remained an unknown state, no team could be identified to resolve the issue; therefore, beam could not be taken back until Wednesday, next morning;
- Wednesday: recovery from FEC crash; for the rest of the day we actually had beam! Did HiRadMat ramp-up and took fixed target beam to investigate signals;
- Thursday: access for NA beamlines and BSMs; discovery of TBI vacuum issues; beam could not be taken back for extraction, instead start preparing for vacuum intervention on TBIs on Friday morning;
- Friday: access for pumping of TBIs to start as of 10:30; pumping continued all day and had to be carried on over the weekend;

Additional activities that were carried out with low intensity or low energy beams throughout the week: revisited phasing of 800 MHz cavities, voltage calibration measurements, "sweep" scrubbing using comb-bumps to attack unscrubbed regions in the machines, setting up of the transverse damper to operate using vector sum on SFTPRO beam for enhanced stability.

AWAKE ():

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LINAC 3 (Rolf Wegner):

- Linac3 was running very well. The source delivered a stable beam with good intensity. The source is still supplied by the lead filling from 3 June (more than 4 weeks already).
- Beam has been delivered to LEIR since Monday afternoon (28 June).
- Some issues were solved:
    - The ITF.BHZ13 power converter was repaired on Monday until the afternoon and completed just on time for beam request from LEIR.
    - EPC produced and tested spare CPU cards for the BHZ13 power converter. 3 spares are available now.
    - The source tripped twice and could be remotely restarted.
- Regular beam energy measurements were taken in arrangement with LEIR.

LEIR (Reyes Alemany):

We could bring the beam down to the transfer lines and inject into the machine, but we have spent the rest of the week trying to get circulating beam without success. We have been threading the beam using corrector bumps, but hardly we managed to get to sector 3. With some settings, we could get to the schottky (sector 4) and the BPM11, which is before the injection point, which more or less completes a turn, but never accumulation. As the beam is injected during the 70 turns, the beam is lost.

We have also scanned the Brho and asked Linac 3 to change the energy, because initially was low.

Despite all the efforts, we do not manage to thread the beam. We are not sure if there is an obstacle, but we do not think so or some other problem, which might be an obvious one when we find it.

CLEAR (Roberto Corsini):

This week was dedicated to the measure of radiation induced damage on SRAMs and diodes, by sending an intense beam (20nC – 10Hz) on aluminium targets for neutron production.

Cherenkov button BPM tests were also resumed. In addition some beam time was used to test a new prototype of micro-Beam Profile Monitors (IRRAD). A failure of the plasma lens chamber

turbo pump group, likely due to high radiation level, was observed.
As programmed, the beam has been stopped on the 30th of June for mandatory works on the access control system.
The full report can be found as usual here: https://indico.cern.ch/event/1051298/

LHC (Jörg Wenninger & LHC Powering Test webpage):

S12	S23	S34	S45	S56	S67	S78	S81
Completed Sector @ 20K	Warm up for repair	Completed	Completed	Training	Phase 2	Room T	Phase 2 Sector @ 20K
77 / 11950 A	29 / 11538 A	71 / 11950 A	87 / 11950 A	72 / 11600 A		69 / 11585 A	

S67 in powering phase 2, S56 reached target current of 11600 A but quench after a few seconds. S56 training blocked because the magnet (C17L6) that quenched at 11600 A had its 3rd quench of this campaign, requiring a MP3 review. No powering tests over the weekend.