

## Accelerator Complex Status

### End week 49 (Monday 12 December 2016)

Monday morning December 12<sup>th</sup> at 5:00 all remaining proton beam were stopped. All ion beams were stopped at 06:00.  
The 2016 physics run has now fully ended.

#### TI (Jesper Nielsen)

To come soon.

#### LINAC2 (Richard Scrivens):

To come soon.

#### LINAC3 (Richard Scrivens):

To come soon.

#### LEIR (Django Manglunki):

A quiet last week for LEIR, delivering only the EARLY beam for the North Area fixed target programme.

The week-end was a bit less quiet, as Friday 9/12 in the evening a problem developed on RF cavity CRF41, which necessitated the intervention of the RF power specialist to restore the balance of the two amplifier tubes. On Saturday 10/12 from 11:00 to ~16:00 there was no beam from Linac3 because of a broken filament in one of the source ovens.

Reference measurements and archives were taken by Jerome, Alex & Maria Elena on Sunday 11/12 in order to ease the machine restart with Pb in 2018.

The beam was stopped and the machine uncoupled at 6:00 on Monday 12/12.

The machine will stay on for magnet tests during the week.

#### PSB (Jean-Francois Comblin):

This last week of the Booster was very quiet.

We had very few downtime: 45 minutes to change an electronic card on the ring 4 distributor, and 1h intervention on the Linac, to change a Frank James tube on buncher 1.

Due to limitations from RP, only a few cycles per super cycle were available for physics and MDs.

We delivered LHC 25ns (single bunch) for HiRadMat, LHCINDIV for Awake and standard beam to AD (the only high intensity beam allowed).

A few last minutes MDs took place until Friday 6pm.

The machine quietly stopped at 5AM this Monday morning.

#### PS (Heiko Damerou):

The PS had a very good final week with a beam availability of about 94%, already keeping into account the 6h stop of Linac3 on Saturday.

A failure of a corrector magnet power converter on Monday night did not cause any beam losses and was repaired on Tuesday. During the very last night of beam operation the RF specialist for the 10 MHz cavities had to repair two accelerating stations (1h30 downtime).

On Thursday the 12 bunch LHC-type beam with 25 ns spacing has been prepared with nominal intensity for the HiRadMat run the same day.

Single bunch proton beams were delivered for MDs as scheduled until Friday afternoon and all beams were cut on Monday morning (protons at 5h00 and ions at 6h00).

### **AD (Bertrand Lefort):**

The AD had a smooth week and the little amount of down-times was mostly related to the PS septum/cavities issues.

### **SPS (Karel Cornelis):**

Week 49 was devoted to North Area ion physics and the AWAKE physics run.

On Monday the fixed target ion beam at 30AGeV/c has been stopped for setting up of the one at 150AGeV/c (380ZGeV/c). The energy switch took a bit longer than previous times, mainly due to issues with the North Area bend limitation (had to be precisely limited to 390 AGeV/c for the LOKN) and issues with the steering of TT20. Nevertheless, the beam was delivered to the North Area experiments on Tuesday as planned.

About two hours of downtime were accumulated after the dedicated MDs on Wednesday (test of fixed harmonic on LHC ion cycle, emittance growth with protons in coast), because a faulty connector tripped the MSI and in addition some issues with the RF firmware were encountered, which had been temporarily modified during the MD. Later in the evening the fixed target beam was lost frequently at the end of the intermediated plateau due to a perturbation on the phase loop signal. This issue could not be solved by the RF specialist during the night, so on Thursday he switched to the phase loop pick-up 2, which significantly improved the situation. The problem was fully resolved on Friday after reducing the phase loop gain during the initial part of the recapture. More than 6 hours downtime were accumulated on Saturday due to the Linac3 source.

Beam was sent to HiRadMat on Thursday for testing saturation effects on BTV screens.

AWAKE started taking beam on Thursday evening. Apart from minor issues with BPMs in TT41 on Thursday and with the extraction BIS on Sunday the beam could be delivered as requested. On Sunday evening AWAKE reported about first observations of the self-modulation instability.

The 2016 run ended on Monday morning.

## **AWAKE (Edda Gschwendtner):**

The data taking run for AWAKE is ending in a few minutes, and it was a great success. Thanks to the huge effort of the dedicated team, all systems were installed and operational in time for the last days of running of the SPS. We had the usual ups and downs and struggles with equipment and understanding what we were seeing, but this night brought clear evidence for the SMI !

Below an announcement that was sent to the CERN management, This was a fantastic and intense period, and I can say from witnessing first-hand how well everyone worked together that we have an excellent and incredibly competent team.

The AWAKE Collaboration observed the strong modulation of high-energy proton bunches in plasma during the final week of CERN accelerator running this year, signaling the generation of very strong electromagnetic fields. This is a major milestone towards the goal of using the proton-driven plasma wakefield technique to accelerate electrons. This exciting development, the culmination of three years of an intense preparation phase, opens a new era of particle accelerator development at CERN and worldwide.

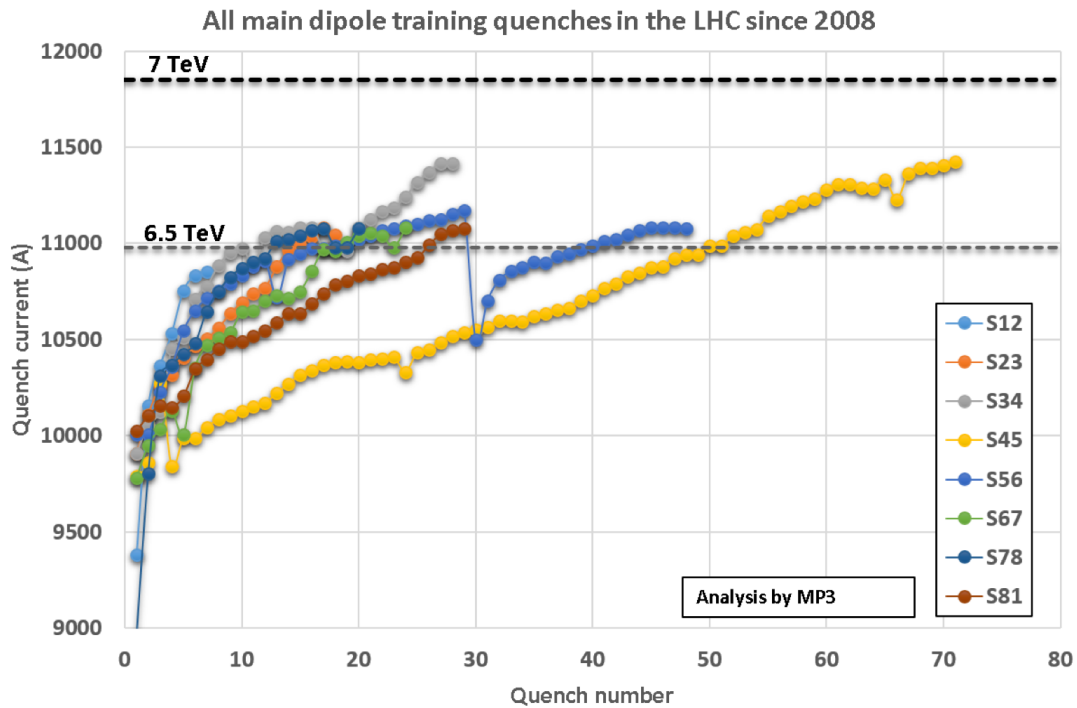
It has long been known that plasmas are capable of supporting very strong electric fields. The challenge for researchers is to understand the best way to take advantage of this capability to build high energy but much smaller scale accelerators than is possible today. Several groups worldwide have observed the acceleration of electrons either in the wake of a laser pulse or an electron bunch. The results from AWAKE are the first ever demonstration of strong wakefields driven by a proton bunch. This result is of particular interest because of the huge energy carried by the proton bunches. Achieving the acceleration of electrons using this large stored energy via proton-driven plasma wakefield acceleration would be a great step in accelerator science. The plans of the AWAKE Collaboration are to study the proton bunch modulation in detail in 2017, and then start on a program of demonstrating the acceleration of electrons in the wake of the proton bunch. Demonstration of GV/m scale accelerating gradients for electrons is planned until Long Shutdown 2 of the LHC at the end of 2018. The results achieved last week are the first step in this ambitious and exciting project.

## **LHC:**

The last week was spend on training the magnet in sectors 3-4 and 4-5 to 7 TeV. Initially both sectors advanced well, although with small steps only.

In the night of Thursday to Friday at 2:10 a triple quench in sector 3-4 at 11415A (6.74 TeV), caused a short circuit at the level of the half-moon of the magnet C12L4 diode. This stopped temporarily the magnet training campaign in sector 3-4.

The training in sector 4-5 continued over the weekend, with the most recent quench in sector 4-5 at 11431 A (6.75 TeV).



During the Monday morning meeting it was confirmed, by X-ray photos that debris in the half-moon of the diode box causes the short circuit. The plan is to apply the same method as use in March 2015 to 'blow' the short circuit. The magnet training campaign needs to be stopped by Wednesday night after which a normal power cycle will be applied. On Thursday the emptying the sectors before the Christmas break.