



**ELENA:  
Commissioning meeting**

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**1 INTRODUCTION**

The minutes of the previous meeting were approved.

**2 RECENT BEAM PROGRESS**

Maybe one of the best 2 week period in a long time.

Results with H- beam :

- The source was very stable.
- Orbit corrections and kick response measurements has worked with only 2E6 H- but still not understood polarity/sign convention issue
- Influence on beam position on BTV118 by overhead crane has been observed
- BBQ tune measurements tested with beam excitation, looks promising!
- Gbar extraction using the fast deflectors were commissioned. The beam has been seen on first SEM. There are still issues with readout.
- Lifetime estimations at 85 keV is in the second(s) range
- RF: phase and radial loop was set-up

Results with Pbars :

- Bunch to bucket RF LL has been set-up and is operational.
- BBQ tunes, clean H and V signals (with excitation) at injection plateau + part of ramp.
- Coherent oscillations at injection have been reduced with new program.
- After initial QFND scan, (some) beam makes it down to (almost) 100 keV without any beam cooling !

For both type of beams :

- Nice beam profiles have been seen using the scraper system.
- Septum has been reconfigured to PPM.
- New B-Train calibration (see after).

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### 3 E-COOLER STATUS

The E-cooler has been installed in the ELENA ring. After alignment, the vacuum system has been closed up. Alignment is not absolute but not only to the valves. There is a 10mm vertical tilt that still need to be corrected. The reason for this misalignment is that there were no alignment references in this part.

Next steps are:

- To pump out and to leak-test.
- To Bakeout (next week).
- To install the Expansion Coil.
- To cable and connect the cooling water.
- To close up the shielding around the toroids.
- To install the Orbit Correctors.
- To install the ELENA correctors.
- To make sure that all the power supply are installed before the restart.

### 4 B-TRAIN

M. Buzio reminds that due to the gating used to detect the NMR pulse, this has to be set by hand according to the cycle length. If the Cycle length is changed, the gating has to be adjusted accordingly by the B-train specialists.

- OP system has been calibrated according to nominal values for PBMD2 cycles in September  $\Rightarrow$  3 mm radial offset need to be applied.
- SP system is being used in the shadow of normal operation (mostly ...) to test the new absolute calibration.

During the YETS, it has be planned to do a laser tracker survey with P. Bestmann (EN/ACE) of the relative position of the fluxmeter in the magnet gap (not possible before due to water pump-induced vibrations !) will be performed. The objective is to determine the geometrical offset w.r.t. theoretical beam path (gain factor due to large quadrupole ( $\sim 2$  G/mm @ 274 A) to be calibrated out).

It is also foreseen to:

- Complete the analysis of the in-situ absolute calibration, including extrapolation from 200 A/s (test) to 119 A/s ramps and error propagation.
- Preliminary indications: the currently distributed OP chain seems to be underestimating the peak field by about 20 G (TBC)
- We propose to update and try the new calibration coefficients at restart
- B-train functionality that will need to be updated and tested in 2018:

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- PPM FESA properties
- Automatic field polarity switching
- Simultaneous use of low and high markers
- Implementation of the new PT2026 (fast pulsed-wave NMR) as DC-mode marker - new in-built drift correction algorithm for long plateaus.

## 5 FEW CRUCIAL STEPS FOR THE NEXT ELENA RUN

P. Belochitskii says that the EC performances are very important and the following key aspects have to be quantified:

- Cooling speed, equilibrium emittances (important for experiments)
- Effect of toroid kicks (linear kick affects on acceptance, orbit bump around cooler, linear coupling, nonlinear reduces machine acceptance)
- How well orbit bump works ?
- Are cooler solenoids aligned properly? Can it be seen with variation of the magnetic field
- Are beam position monitors inside of cooler usable? (very useful for cooling optimization, and generally for orbit in machine)
- Does orbit bump around cooler work as expected? If not, what's wrong (calibration of related correctors or BPM's, something else)
- Does cooler introduce extra coupling into the machine ?

Another really important question that has to be addressed is what is the optimal momentum for intermediate plateau with first cooling?

In the same way, many beam dynamic question have to be answered:

- Study of working diagram at extraction energy (one bunch, no bunch rotation). The aim is to identify the most dangerous (not space charge driven) resonances. Can we cross them without losses in the tune range  $2.33 < Q_x < 2.46$ ,  $1.33 < Q_y < 1.46$ ? What is the optimal WP for deceleration?
- Are resonances enhanced with cooler on? Does cooler introduce extra resonances?
- Could we run ELENA with sextupoles off? Is machine sensitive to sextupole settings, especially at low energies?
- Vacuum in ELENA. Beam lifetime at injection energy, at intermediate plateau and at extraction energy
- Stray fields effect on circulated beam (not easy to prove). Do they affect on orbit? How much? Could one correct this effect with orbit correction system? Is local correction possible?
- Do we see nonlinear effects of stray fields? Do they shrink machine acceptance?



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Another less critical, but yet important issues are :

- Why both the horizontal and the vertical orbits are 3 to 4 times bigger than expected (estimation in design report)? Is something wrong with installation of quadrupoles? Is this due to stray fields?
- Linear coupling, seen with orbit measurements, looks stronger than expected. Misalignment errors? Stray fields? Is coupling stronger at smaller energies?
- What is the emittance of injected beam? How reproducible is it from shot to shot?
- How big is difference between emittance of beam extracted from AD and emittance of beam circulated in ELENA?
- Working point to be defined...

## 6 AOB

F. Butin reminds that we will need soon H- beam at 100keV. B. Lefort & C. Carli have to speak again to D. Aguglia to get a clear time estimation for the delivery of the new transformer.