Minutes of the HSC section

39th meeting on Monday 16/03/2015 (14:00, 6/R-012)

HSC members: Olav Berrig (OB), Christian Carli (CC), Elias Metral (EM), Giovanni Rumolo (GR), Frank Schmidt (FS), Elena Wildner (EW), Elena Benedetto (EB), Michael Bodendorfer (MB), Kevin Li (KL), Tatiana Pieloni (TP), Benoit Salvant (BS), Guido Sterbini (GS), Daria Astapovich (DA), Meghan McAteer (MM), Nicolas Mounet (NM), Carlo Zannini (CZ), Nicolo Biancacci (NB), Alexander Huschauer (AH), Giovanni Iadarola (GI), Adrian Oeftiger (AO), Serena Persichelli (SP), Tatiana Rijoff (TR), Letizia Ventura (LV), Claudia Tambasco (CT), Magdalena Kowalska (MK), Andrea Passarelli (AP), Annalisa Romano (AR), Michael Schenk (MS), Vincenzo Forte (VF), Danilo Banfi (DB), Javier Barranco (JB), Joseph Kuczerowski (JK), Aaron Paul Axford (APA), Malte Titze (MT), Francesco Paciolla (FP), Mario Stefan Beck (MSB), Stefan Hegglin (SH), Alpo Valimaa (AM).


1) Newcomers / visitors
   - The 4 new TECH announced 2 weeks ago have been introduced to the whole section. Again welcome to all of you!

2) Comments on the minutes of the previous 38th meeting + Actions
   - No comment.

3) General infos
   - No particular comment.
   - SL meeting:
     - ABP info meeting last week with nice talks from GuidoS and KevinL.
   - Impedance and e-cloud meetings this morning.
4) Brief performance reports for the different machines

- PSB (ElenaB)

- A good week for our wee machines with no serious problems to report, which makes us happy. The week was spent continuing the setting up of the ISOLDE beam, and slow progress was made. We now easily have 3.2E13 available from the 4 rings, with them all having very similar performance. We can push this to 3.4E13 presently, but would like a little further margin so continue to seek improvement. The Linac current is still a little weak after the cathode change (we saw ~140mA at the end of the week), so we're hopeful this will also give us a boost as it climbs. Otherwise plenty of work to keep the beams within spec.

- PS (GuidoS)

- It was a good week for the PS. Ions were delivered smoothly. The protons setup is still continuing in particular on the longitudinal plane for the doublet beams. A lot of good progresses in understanding and resolving the single bunch longitudinal instability in the LHC flat bottom was done. Studies on the MTE oscillation are progressing: the possible culprit of the oscillation could be related to the 5 kHz line on the PFW (see picture of the week: http://elogbook.cern.ch/elogbook/attach_viewer.jsp?attach_id=1415743). After the TS, investigations (with the new WS firmware) will continue on that direction.

- SPS (BenoitS and HannesB)

- SPS had a pretty good week. After the LHC sector test, last weekend, the only users of the SPS were the north area experiments, taking Ar- ions. The energy of the Ar beam was changed on Tuesday from 42.2 ZGeV (proton equivalent) to 66.6 ZGeV (proton equivalent), which is the fourth energy, out of six, programmed for NA61. The change over went smooth and on Tuesday evening the beam was ready for data taking by NA61. The only problem occurred in the beginning of the week, when the SPS was off for about 4 hours on Monday, due to problems with the MPS. Protons were taken from time to time on the pilot cycle, in order to check some minor problems that were revealed during the sector test, such as phase oscillations detected by the BQM at extraction.

- LHC (EliasM and BenoitS)

- LMC => Wednesday 25/03/15 might be the D-day!

- Recommendation made by TatianaP last Tuesday at the LBOC concerning the Xing angles. Also LOF > 0 and chroma of ~ + 3.

=> To be finalized during the next HSC meeting to see all our predictions and then we will prepare tables of parameters to be used at injection / ramp / flat-top / squeeze / collision process / stable beams.
- TatianaP mentioned the issue of the Xing angle of IP8 => Jorg proposed to reduce it to have more margin (90% of the max.), which was approved by the beam-beam team.

- LEIR (MichaelB)

- The machine was overall stable. The PS stray-field compensator works and mitigates the shot-to-shot variance of LEIR to some degree. Precise measurements with larger statistics sets are needed and will be provided to quantify the effect of the new PS stray-field compensator. There is still shot-to-shot fluctuation which is not cured by the PS stray-field compensator yet. This is shown by the need to optimize the super cycle in order to maximize the LEIR extracted intensity. Further investigation is pending. The gain of the transverse feedback damper has been adjusted from -12dB to -13dB by Django last week, Friday to mitigate and stabilize the beam loss at extraction. We don't know yet what the cause for this loss was. Most likely it is an interplay of the transverse feedback damper system and the Pantech frequency steering and/or the PS synchronization. A. Blas has asked for a table of betatron phase advance from TWD pickup and TWD kicker, in order to adjust the gain of the TWD system as a function of the LEIR machine tune. I am working on this. I have informed A. Blas about the problems we have with the LEIR model and its inability to reproduce correctly the tune (dQx = 0.05, dQy = 0.1), nor the chromaticity (vertical chromat. wrong sign).


We stopped last time at slide 10.

MichelM proposes to solve the heat equation in 3 D as he has doubts that the available codes do this well.

We work here with power densities and not with particles, for which super Gaussians are better than Gaussian.

He chose 4 cm not to be not too close to the foil but also not too far as well.

Slide 13: According to M. Plum from SNS, the temperature of the foil shouldn’t go beyond 2300 degrees as after that we can have sublimation, holes, etc. and the foil is not safe anymore.

Every particle will hit the foil ~5 times in ~700-800 turns.

In summary, the pseudo-painting scenario built is presumably based on a realistic enough approach as it delivers peak temperature differences between H− linac spots and combined H− with H+ comparable to that of other studies. Particle tracking code PyORBIT would certainly be a good choice to benchmark the foil heat modelling study presented here:

- Small changes in the parameters may make big differences in the results,
- Peak allowable foil temperature seems to be kept below ~2300 K.
5) Normal Form including Beam-Beam and/or Space Charge in MAD-X (FrankS): https://espace.cern.ch/be-dep/ABP/HSC/Meetings/HSC_16.03.15_fs.pptx

FrankS raised the “provocative” question: Are our tune footprints okay?

FrankS made first a brief review of the Normal Form (he will go into more details in the future during a SC meeting): Normal Form is a transformation from the laboratory frame into a Normal Space in which phase space deformation are removed and the dynamics only depend on the action. This transformation allows determining the non-linear terms of the system: detuning with amplitude and resonance driving terms.

I think on the last equation of Slide 4, there should be a + in the exponential.

The Normal Form does not converge when an unstable fix-point is being approached. That is a limitation but it is unavoidable.

FrankS then discussed the Normal Form for LHC with octupoles only, beam-beam only and octupoles + beam-beam. Comparing the tune footprints from MADX, sixtrack and Normal Form, he concluded that the BB/SC tune footprints should actually be done with respect to the proper non-linear invariants (and not the linear ones). This can be done via Normal Form or “averaging” the amplitudes in phase space.

TatianaP asked what should be used close to resonances. FrankS answered not the Normal Form => One should use the tracking but one should average over the different angles.

The location of the DA and NormalForm tools is: http://frs.web.cern.ch/frs/Source/other_tools/sussix/.

Everton will come next month: all the tools are there and then they will present the space charge tune footprints at LHC injection.

6) Actions to be taken for the next meeting

- List of all actions: https://espace.cern.ch/be-dep/ABP/HSC/SitePages/Actions.aspx.

7) Miscellaneous

- The next (40th) meeting will take place on 23/03/2015 => Agenda:

  1) General info and follow-up (EliasM)

  2) Brief performance reports for the different machines (PSB, PS, SPS, LHC and LEIR)

  3) Summary of 1-beam and 2-beam stability predictions for LHC in 2015, from injection till collision (All people involved)
- Important events and dates for HSC: https://espace.cern.ch/be-dep/ABP/HSC/SitePages/EventsAndDates.aspx.

- Preliminary agendas for the next meetings: https://espace.cern.ch/be-dep/ABP/HSC/SitePages/MinutesOfMeetings.aspx.


Minutes by E. Metral, 29/03/2015.