MINUTES

LIU-SPS BD WG  
MEETING No. 02/19

21 February 2019

Present: H. Timko, A. Lasheen, G. Papotti, M. Schwarz, E. Shaposhnikova, H. Damerau, A. Farricker, J. Repond, I. Karpov, W. Höfle, T. Bohl, K. Iliakis, A. Huschauer, M. Giovannozzi, C. Vollinger, M. Vadai, C. Zannini

# Matter Arising and Follow-up of Actions

* **N. Nasresfahani**: Study the possibility to use the new coupler design to replace all existing 630 MHz HOM couplers
* **M. Schwarz**: Include the momentum acceptance limitation in simulations.
* **M. Schwarz**: Is it possible to understand if the instability observed with the radial-loop is real or only related to numerical problems?
* For the slip-stacking cycle, determined the aperture needed for the collimation system.
* A list of the key moments in the various cycles (slip-stacking!) is necessary to adjust the design of the collimation system.
* Measurements of the beta beating to include optics errors in simulation of the collimation system.
* Check the impedance of the new collimation system.
* **M. Schwarz**: Quadrupole oscillations are observed at flat bottom with the feedforward activated. Study where this is coming from.
* **A. Farricker**: Check with C. Zannini for the discrepancy in MKEs impedance.
* Calculate the maximum voltage in the 800 MHz RF system due to power limitations and beam-loading.
* **C.** **Vollinger:** Check how many cross section step-like changes are in the SPS
* **M. Schwarz:** Organize meeting to discuss issues with bunch length measurements
* **T. Argyropoulos:** Include intensity effects in emittance calculations

**New:**

# General News

**Elena:** Our study group was asked to look also at non-LHC beams.

# Presentations

## **MTE Beam With Gaps. Observations of 2018-11-09 – T. Bohl**

* **Elena:** History: In the past, beam was cut, which led to losses; then islands in phasespace were created and MTE (multi-turn-extraction) reduced losses; but still continuous beam, which lead to losses at kickers; a gap was introduced to reduce losses

Measurements were done on 2018-11-09 between 9:15 and 10:30

* **Massimo:** time window was due to constraints imposed by physics run

Creation of small intentional gaps also leads to spikes.

* **Elena:** Why are gaps between beams of different size?
  + **Thomas:** Due to kicker rise time to reduce losses
* **Wolfgang:** Why is a gap between core and islands?
  + **Alexander H.**: due to rise time of kicker
  + **Massimo:** for core you need extra kicker (with short rise time), but changing kicker would have cost millions;
* **Elena:** Why can the spikes not be observed in the PS?
  + **Heiko:** The spikes can be observed in the transfer line, but not in the PS

Fluctuations in peak-to-peak power are caused by the one-turn delay feedback (OTFB) compensating the beam loading (would be absent for homogenously filled ring).

* **Heiko:** Do peaks in peak power come from spikes?
  + **Thomas:** Even without gaps, you have modulation

The introduction of a gap leads to losses.

* **Elena:** Since we are not limited by power, new OTFB won’t help
  + **Thomas:** One would have to look at voltage in the cavity; OTFB does not ask for power to compensate for something it does not see (depends on bandwidth)

Discussion:

* **Elena:** Biggest contribution seems to come from intensity in spikes; the origin of which is not understood
* **Massimo:** in PS everything looks smooth, but in SPS we observed irregular bunch profiles;
* **Wolfgang:** Does this mean that islands have longitudinal structure?
  + **Massimo:** yes

**Giulia:** Did you get feedback from experiments?

**Alexander H. :** not yet

## **BLonD-MPI: Distributed Longitudinal Beam Dynamics Simulations – K. Iliakis**

In the MPI-version, each worker executes the script; each worker has its own subset of the beam; workers need to share the beam profile but then compute induced voltage individually

* **Elena:** Why is induced voltage not computed globally?
  + **Konstantinos:** because we try to minimize communications between workers

Speed-up factors of 100 can be achieved (simulation time of 2 days reduced to 30 minutes)

Approximate computing (like updating the profile only every few turns) might increase speed-up even further, but the tradeoff in accuracy needs to be studied on a case-by-case basis

* **Elena:** This time should be compared to synchrotron period
  + **Helga:** We are working on automating this

## **Post-LS2 flat-bottom simulations in Q20 and Q22 optics – M. Schwarz**

Stability of beam with 48 bunches in post-LS2 SPS in Q20 and Q22 optics was studied for 800 MHz cavity ‘off’ and at 10%.

No strong instability (increase of mean bunch length) was found in all cases, but individual bunches become unstable; in Q20 this can be cured by using the 800 MHz cavity at 10%; in Q22 this is not possible for the lowest emittance case

* **Elena:** you should also investigate this for 72 bunches

# Next Meeting 21 March 2019

Minutes written by M. Schwarz