End-of-Year summary

LIU-SPS BD WG meeting 19.12.2019
Meetings in 2019

- 10 meetings
- Main topics:
  - Transverse and longitudinal beam instabilities
  - 200 MHz RF upgrade
  - Ions
  - Fixed target beam
- This year winners
  - (9 talks) Markus Schwarz
  - (3 talks) Carlo Zannini, Patrick Kramer, ...
- Minutes: thanks a lot to Markus

Many thanks to all participants and speakers!
Challenges for 2019 (from last year talk)

✓ HOM damping and **tuning** of the 200 MHz TWC during LS2
✓ Quality control of impedance reduction (VF shielding) in the tunnel
✓ Beam losses **at the beginning of ramp** (full bucket due to PS bunch distribution), feasibility of smaller injected bunches
✓ Longitudinal beam stability on flat bottom and **during ramp**
✓ **Stabilisation** of ion beam and slip-stacking
✓ **Controlled emittance blow-up for protons and especially ions** (intensity effects and bunch-by-bunch difference)
Challenges for 2019 (from last year talk)

- Horizontal stability with LIU intensity - source to be identified to prepare mitigation strategy and future actions
- Bunch-by-bunch coherent tune shifts with LIU intensity and impact on damper operation (wide tune acceptance, Laslett corrections, ...)
- Emittance preservation: operation with -0.21 space charge tune shift (LIU BCMS) on top of bunch-by-bunch tune shifts from impedance
- Preparation for re-start
Achievements (1/2)

- Baseline HOM damping in 3- and 4-section cavities achieved
- Instability thresholds on flat top simulated with 4 LHC batches
- Identification and studies of the 915 MHz HOM
- Single bunch thresholds - agreement of simulations with measurements using updated SPS impedance model
- Impedance reduction due to layout optimisation
- Longitudinal instability at the injection plateau due to 200 MHz impedance
- Study of effect of fundamental frequency shift in 200 MHz RF system
- Study of the impact of installing 200 MHz cavities for eSPS
Achievements (2/2)

- Development and validation of SPS multi-bunch impedance model and PyHeadTail simulation model
- Reproduced horizontal multi-bunch instability – limits as function of chromaticity and octupole settings in good agreement with measurements
- Defined required 915 MHz HOM damping for transverse stability
- Refined studies of emittance growth due to quadrupole power converter ripple
- Preparation of SPS optics model with LIU upgrades including layout checks in preparation for post-LS2 operation
PhD thesis defended in 2019

• **Danilo Quartullo** - Jan 2019 at Sapienza University, Rome - *award to the best PhD student* in scientific departments (physics, mathematics, chemistry, ...)

• **Joel Repond** – Aug 2019 at EPFL, Lausanne

• **Jaimie Mitchell** – Sep 2019 at Lancaster University, UK
Challenges for 2020 (1/2)

• Operational algorithms for
  • Optimum 800 MHz voltage & phase program
  • Controlled emittance blow-up

• Simulations of 4(x72) LHC batches:
  • Losses with FB included
  • Stability during ramp
  • Emittance BUP with phase loop & new noise generation (as in PSB)

• Simulations of LHC ions during the whole SPS cycle
• Realistic model of 915 MHz HOM and damping scheme
• Measurements of the 200 MHz cavities in the tunnel
Challenges for 2020 (2/2)

• Bunch-by-bunch coherent tune shifts with LIU intensity
  • Impact on damper operation (wide tune acceptance, Laslett corrections, ...)
  • Optimum working point

• Emittance preservation: operation with -0.21 space charge tune shift (LIU BCMS) on top of bunch-by-bunch tune shifts from impedance

• Preparation for beam commissioning and intensity ramp-up after LS2, including reference measurements
Happy New Year!

Successful completion of LS2!