News on the TMCI and SPS transverse impedance

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Agenda

- Transverse motion of an SPS bunch in 2\textsuperscript{nd} RF
- Including the 800 MHz cavities in the SPS impedance model
- Next steps
Transverse motion of an SPS bunch in 2nd RF

- Parameters:
  - Initial momentum spread (2 sigma): 0.00107
  - Initial bunch length: 0.3 m
  - Main RF  2 MV
  - 2nd RF voltage 500 kV in bunch shortening mode (linear ramp between 1000 and 2000 turns)
  - SPS model (beam pipe, BPHs, BPVs, kickers, 200 MHz RF system)
$V_{2nd \, RF} = 500 \text{ kV}$  (bunch lengthening)

$V_{2nd \, RF} = 0 \text{ kV}$

$V_{2nd \, RF} = 500 \text{ kV}$  (bunch shortening)
2nd RF system

- 800 MHz system seems to make things worse with these parameters
- However, oscillations are seen on the bunch length… to be studied…

Longitudinal bunch profile

Bunch length

- number f turns

bunch length in m

0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16

0 2000 4000 6000 8000 10000

-1.5 -1 -0.5 0 0.5 1 1.5

Lns(2.54256s)
Import of 800 MHz cavities

2 ACL cavities of 3 sections (11 cells per section + transition cell)
Wakes
impedance
Vertical mode spectrum

Without 800 MHz

With 800 MHz
Vertical tune shifts

Without 800 MHz

\[ [\text{ZHelm}] = 14.6447 \, \text{MOhm/m} - \text{Tune shift} = -0.0107 \]

With 800 MHz

\[ [\text{ZHelm}] = 14.807 \, \text{MOhm/m} - \text{Tune shift} = -0.01082 \]
Next steps

• Implement features in Headtail
  – feedback based on work by J Thomson, J Byrd, W. Hofle, G. Rumolo
  – Longitudinal impedance from the wake table

• Import new elements
  – Pumping ports (Olav)
  – ZS, MSE…
  – Improvements of kicker models (Carlo)