Emittance Preservation of BCMS Beams

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Thanks OP!
SPS Measurements

- Emittance measurements:
  - Flatbottom: bunch by bunch emittance measurements with 48 and 96 BCMS bunches

1.8 um Hor. and 1.2 um Vert. (second 48 batch worse)
SPS Measurements

• Emittance measurements:
  – Flatbottom: bunch by bunch emittance measurements with 48 and 96 BCMS bunches
  – Flattop: average emittance measurements with 48 bunches sent to LHC (4 batched in total) ➜ no emittance growth observed in the SPS from injection to flattop.
  – Quite large (up to 30%) emittance variations inside the batches
LHC Measurements

MD consisting of 3 fills

5127 : $2 \times 12 + 4 \times 48$ bunches

5128 : $12 + 48 + 2 \times 96$ bunches

5129 : $12 + 48 + 3 \times 96$ bunches

Sudden Emittance Blow Up observed only on few bunches, when injecting the last 48 train bunches.

Sudden Emittance Blow Up observed on most of the bunches, when “faking” an injection (empty kick). 20-30 minutes waiting time between injections.

No sudden Emittance Blow Up observed. A few minutes between injections.

G. Trad
No evident Emittance Step correlated with injections. Except for very few bunches (5-10 bunches):
Emittance step only in the Horizontal plane
The blowup is seen to be independent of the bunch brightness but strictly correlated with its position in the train.
Empty kick repeated with and without injection cleaning and no effect observed.

No sudden blow up in the V plane, however evolution (B2V) shows a dependency on the total number of bunches present in the machine.
Same steps as during previous fill with empty kicks, with and without injection cleaning.
Shorter waiting time between injections.
Chromaticity lowered by 5 units twice and empty kick with/without injection cleaning.
One additional 96 bunches injected.
No evident Emittance Step correlated with injections.

However, some BU observed in the V plane on some bunches to be investigated.

G. Trad
225 ns vs 250 ns batch spacing

F. Velotti
Conclusions

- BCMS beam provided by injectors show significant variations between bunches
- No blowup could be measured in the SPS
- Emittance blowup in H and V x2 faster than IBS predictions (Geroge’s slides LMC 27/07/2016)
- Jumps in H emittance were observed but not systematic or reproducible correlation with HW (MKI pulse, injection cleaning, etc...)
- Bunches at the end of the batch seem to be more affected
- Injections with 225 ns instead of 250 ns batch spacing do not show significant differences.
- Need further understanding before repeating the MD.
LHC Measurements

- Quite large emittance variations inside the batches