"SIMPLE" TRANSVERSE BEAM BRIGHTNESS INCREASE BY A FACTOR 2 FROM PSB? => 3-BATCH INJECTION INSTEAD OF 2

NOMINAL 25 ns IN PS

- 4b + 2b = 6b from PSB on h7 (~ 1.6E12 p/b) within ~ 2.5 μm
- Bunch length ~ 180 ns in 327 ns RF bucket (long. emitt. ~ 1.3 eVs)
- 6b × 3 = 18b on h21 at inj.
- Acceleration on h21
- 18b × 2 × 2 = 72b on h84 at ext.
- Cycle lasts 3.6 s and we have to wait ~ 1.2 s at inj.
- The nominal 25 ns beam is not yet at the space charge limit
  - Where is the space charge limit?
  - Could also play with RF voltage and/or longitudinal profile (flattening it) to reduce SC => New limit?

NEW 25 ns SCHEME?

- 3 × 4b = 12b from PSB on h14 (~ 0.8E12 p/b) within ~ 2.5 / 2 ~ 1.2 μm and ~ ½ nominal long. emitt.?
- Bunch length ~ 70 ns? (limited by PSB recombination kickers' rise times of ~ 95 ns) in 327 / 2 = 163.5 ns RF bucket => SC more critical by 180 / 70 = 2.5 at PS injection => Several ways to reduce it (see later)
- 2-bunch merging to have 6b on h7 and come back to the nominal scheme => Then same thing as usual
- Cycle lasts 4.8 s (+ 33%) and we have to wait ~ 2.4 s at inj. => Check in detail the time needed for the 2-bunch merging
- Could consider some options to try and reduce the cycle length if needed

NEW 50 ns SCHEME?

- 3 × 4b = 12b from PSB on h14 (~ 0.4E12 p/b) within ~ 2.5 / 4 ~ 0.6 μm
- Then, same things as for the 25 ns scheme

ISSUES?

- Production of required bunch length at PSB extraction (assumed to be ~ 70 ns for PSB recombination kickers' rise times):
  - Can we do that? => Does not seem impossible at first sight and is being followed up by AlanF at the moment (will do some tests in the PSB) => Certainly with re-bucketing in h2 (with only 1 bunch)
- SC at PS injection => Could be fought by
  - Playing on the longitudinal profile (flattening it in the PSB?)
  - Increasing the bunch length in the PS (matched/unmatched?)
  - Increasing the PSB extraction energy between 1.4 and 2 GeV (Gain factor ~ 1.6 at max.)
  - If not enough, could slightly lower the transverse beam brightness in the PSB (but then we would gain less than a factor 2!)
- ?

THANKS

- GianluigiA, MassimoG, OliverB, RendeS, SteveH, HeikoD, BettinaM, AlanF, GiovanniR, ChristianC
- RolandG's talk at the OMCM2011's workshop