

Conclusions

During the last three MDs of 2002 the nominal longitudinal parameters of the LHC beam were obtained at 450 GeV for 4 batches in the ring:

- bunch intensity 1.1×10^{11} ,
- length (4σ) 1.6 ns,
- emittance (2σ) 0.6 eVs.

(for these bunch parameters and 50 MeV energy error allowed phase error in LHC is ± 250 ps)

This was possible due to

- commissioning of new hardware, mainly improved feedback, feedforward and bunch to bunch damping systems using the 200 MHz cavities,
- bringing the 800 MHz RF system into operation as a Landau cavity,
- introducing controlled emittance blow-up on the flat bottom (mismatched injection) and during the ramp (phase modulation of the 800 MHz voltage or pink noise on the 200 MHz voltage amplitude)

Plans for 2003

- To improve [feedback around the 800 MHz](#) RF system for better control of beam loading compensation.
- To have [programmable frequency](#) of bunch excitation during ramp to eliminate particle losses.
- To try and identify [the source](#) of “high energy” instability.