Subject of the MD:

Studies on beam-beam effect for the LHC upgrade: beam-beam compensation with a wire and Early Separation Scheme.

Date of the MD:

25 August 2008 (12-18), 26 August 2008 (8-18), 29 August 2008 (8-18), 1 September 2008 (8-18), 3 September 2008 (8-18).

Did you have the required machine/beam conditions for your MD?:

Yes, we worked we the MD1 cycle in the flat top at 37 GeV/c with 12 bunches, 25 ns time separation, ~ 2e10 ppb.

What were the problems encountered?:

1. On the 29 August there for three times the beam was off for intervention on the machine: each stop lasts at least 30 min; 2. On the 3 September around 17:00 the main power supplies of SPS tripped for a thunderstorm; 3. The BBQ did not work properly (we tried to use it for measuring the chromaticity).

Current results:

25-08: Experiment setup; 26-08:We performed a compensation tune scan and a compensation current scan: we confirmed that the optimum current on the second wire for having compensation is 210A for its nominal position and the compensation shows a significant tune dependence; 29-08: power loss scan (distance scan at three different tunes): there is a significant dependence of the losses from the tunes; 01-09: Current scan at LHC tunes at 5, 6,7, 9.5 sigma: the losses at 5 sigma are a significantly higher than the 6 sigma separation; considering the SPS case as calibration (but ignoring its single encounter at 3.5 sigma) it seems (preliminary result) that LHC could not work with more than 4 encounters at 5 sigma; 03-09: We performed a tune scan with 250A at 5 sigma losses can vary by more that one order of magnitude with changing the vertical tune; from the chromaticity scan at 250A and 50A we can conclude that chromaticity has not a significant impact on a time scale of a few seconds (.3125 .285) seems the best tune in SPS for the long range beam-beam effect: it seems quite far from the expected LHC optimum tune for the head-on beam-beam effect. We performed a distance scan at the optimum tunes and checked the noise level of the measurements.

Next steps:

The optimal compensation being obtained with a discrepancy by 20% on wire current, the transverse position of the (moving) compensator should be suspected. Compensation of an incorrect position by a weaker excitation current is liable to produce features such as the observed puzzling tune dependence of the compensation. The position of the compensator should be investigated to obtain identical perturbation to the beam by the 2 wires excited at the same current level. The tune scan in compensation mode should then be reproduced. We have to post process the acquired data and plan a tracking campaign using this data to benchmark the simulations. A proposal for an implementation of the wire in LHC will be studied with parameters compatible with the observations in these MD. For the D0 at 14 m, the minimum separation will be increased from 5 to 6 sigma. More refined analysis is needed to assess the possibility of reducing to 5.5 sigma or less.

New requirements:

It would be extremely useful to check the effect the compensation and the reduced encounter distance on a longer flat top to see if the loss that we observed are a steady state phenomenon or a transient. It would be interesting to do the next experiments with the same mechanical aperture limitation (now it is a function of the wire position): a collimator a 5 sigma. To obtain longer lifetimes, higher energy would be a great advantage. We shall investigate the availability of two stronger orbit correctors (those of the SppS) to work at higher energies. To implement a remote control system for the moveable wire would be useful too.