Minutes of 3rd Collimation Upgrade Specification Meeting

Participants: F. Cerutti (FC), J. Jowett (JJ), L. Lari (LL), S. Redaelli (SR) (Chairman), B. Salvachua Ferrando (BS), M. Schaumann (MS).
From Fermilab: N. Mokhov (NM).
From SLAC: T. Markiewicz (TM).
Excused: R.W. Assmann, A. Bertarelli, R. Bruce, F. Caspers, A. Dallocchio, A. Rossi, D. Wollmann.

1 Comments to the minutes

F. Cerutti commented on the quoted quench limits by RA at the previous meeting. The quoted factor 3 between quench limit at 3.5 TeV and 7 TeV cannot in his opinion include the cumulative effects from beam energy and reduced margins from reduced current in the magnets. FC commented that at the June review, a tentative factor of 3 reduction of the quench limit from 3.5 TeV to 7 TeV was reported in V. Boccone's presentation according to preliminary estimates by P.P. Granieri and E. Todesco. This only takes into account the higher magnet current. Margins for different proton losses for the two cases must be taken into account in addition. **Action for RA and collimation team:** clarify assumtions for extrapolation of system performance at higher beam energies.

2 Follow up of actions from last meeting

- SR and M. Sapinski checked the losses in the dispersion suppressors (DSs) of the interaction regions during standard physics fills and compared them with the maximum loss rated achieved in the DS of IR7 during proton and ion quench tests. The comparison in the 1.3 s integration time indicates that for protons we are factors 800–1000 below what was achieved during the quench tests whether for ions this factor in only about 100. The situation is therefore more critical for ions. It should be noted that, since we did not quench, there is still some additional margins.
  The aspects related to magnet lifetime are not yet addressed.

- BS has worked further on lifetime calculations from the BLM data. Her results will be followed up within the Collimation Study Group.

3 FLUKA distributions of IP products (F. Cerutti)

Slides available at this link.

3.1 Summary of the presentation

FC presented the distributions of products from collisions at 3.5 Tev and 7 TeV as calculated from FLUKA. The DPMJET3 event generator integrated in FLUKA is used. Simulations consider only inelastic head–on interactions. The elastic scattering is not implemented yet but this can be done easily. FC provided the formulas to recompute the distributions in the

beam coordinate system. The crossing angles and the initial transverse beam distributions at the IPs must be added separately. This convention was agreed between FC and SR to be able to produce in a flexible way SixTrack tracking inputs: the kicks in X and Y planes and the energy errors have to be added to standard IP beam distributions and to be used as inputs for tracking studies with different conditions of crossing angles and optics in the different IPs (see also next talk).

FC also showed some preliminary distributions for Pb–Pb collisions. This take into account for the moment only nuclear inelastic contribution and not yet electromagnetic dissociation. Compared to the proton collisions, the statistics is more limited because FC experienced crash problems with the fluka server due to the large amount of IP products. FC also stated that the cross sections should be reviewed in detail.

3.2 Discussion

SR stated that this inputs will be used for SixTrack tracking studies. He proposed to agree on a format and to put this data in a web repositiry for future reference (**Action: SR+FC**). Appropriate momentum cuts will have to be applied to focus on what is relevant for the multi–turn tracking (initial focus will be put on what goes throught the TAS).

JJ asked why the Pb^{207} is produced less than the Pb^{206}. FC replied that he will check the cross sections for the different collision processes.

JJ also asked whether it is possible to separate the hadroninc contribution from the electro–magnetic contribution. FC replied that this is the case.

4 Status of multi–turn tracking of IP products (S. Redaelli)

Slides available at this link.

4.1 Summary of the presentation

SR presented single– and multi–turn simulations with SixTrack of IP products. The simulations are based on the standard SixTrack version for collimator studies. Initial distributions can be generated for different conditions in the different IPs. The lattice then contains all the collimators so the tracking will take into account the full system. SR pointed out that to have quantitative estimated and comparisons to beam data, initial distributions from beam–beam collisions should be used (see previous talk). On the other hand, the systematic studies of limiting locations for DS layout optimization can use *ad–hoc* distributions. For example, he considered zero transverse amplitude particles with different momentum errors to see the main loss locations. He also checked how the loss locations and the effective momentum cut change as a function of the initial transverse particle distributions. The simulations also include an interface with the loss maps program BeamLossPattern. SR showed some examples and qualitative comparisons with real beam data at 3.5 TeV.

SR pointed out that simulations and semi–analytical models of the momentum cuts in IP1/2/5 indicate a basic difference between IP1/5 and IP2. In all cases the arc acceptance just below 1 %. On the other hand, in the DS of IP1/5 there are two different locations at Q9 and Q11 with different cuts of about 1.8 % and 0.8 % whereas in IP2 a single location at the Q10 shields already the whole arc with a momentum cut of about 1.2 %. This might

indicated that one single DS collimator might be sufficient in IP2 whereas in IP1/5 a layout with two collimators might be more optimized. This figures are bases on a linear model and must be refined by detailed tracking. Qualitatively, these results are also found in the measurements during physics fills.

4.2 Discussion

FC pointed out that a code that combines FLUKA and SIXTRACK is available that could also be used for these studies.

JJ commented that similar studies were done in the past for the ions. The losses in the DS were estimated by considering "beam" with different off-momentum errors, representing the collision products of different species. The simulations did not therefore use programs like ICOSIM or FLUKA for detailed cross section simulations.

NM commented that it is important to have the possibility to run scattering programs all around the ring to achieve a precise understanding of the loss ma distributions. SR replied that for multi–turn simulations the exeperience with the design of the collimation system proved that it is useful to separate energy deposition studies from tracking simulations to profit of both codes.

5 Next meeting

The next meeting will be held on
March 9th, 2012, 15:30–17:00.
Room: 6-R-018.

Tentative agenda:

B. Auchmann	11 T dipole design
M. Serluca	Status of tracking simulations with Merlin