Minutes of the 16th Collimation Upgrade Specification Meeting

Participants: C. Adorisio (CA), R. Bruce (RB), F. Galluccio (FG), L. Lari (LL), A. Lechner (AL), A. Marsili (AM) (scientific secretary), D. Mirarchi (DM), E. Quaranta (EQ), S. Redaelli (SR) (chairman),
Remote: H. Rafique (HR).

Indico event here.

1 Studies for possible Crystal Layout at the LHC (D. Mirarchi)

Slides are available here.

1.1 Summary of the presentation

DM presented the simulations of the possible locations for the installation of crystals (for collimation) in the LHC. Their reliability in collimating proton and ion beams has already been demonstrated in the SPS.

The tests in the LHC would be performed at low intensity, for different energies and planes. DM has studied different locations for the installation of the crystals in the LHC. The best positions are the ones where the α twiss function is zero, meaning that the particles with highest displacement would have no angle; the crystal alignment would then be only dependent on beam energy, and only linear movement would be required from the crystals during the ramp. The location would also have to be at $\sim 90^\circ$ phase advance with the considered secondary collimator. These ideal conditions can not be met with the present optics. The next best positions currently considered are just after the existing primaries (cell 6L7), and in cell 4L7.

These studies are done by calculating the trajectories of the channeled beam (particles deflected by the crystals) for different possible longitudinal crystal positions, and finding which gives the highest impact parameter on the secondary. DM presented the results for two locations and two energies (injection and top energy), comparing the trajectories of the channeled beam to the beam envelop (expressed in numbers of nominal sigmas).

One of the key parameter for these studies is the impact parameter in the crystal, which affects the proportion of the beam being deflected. The value closest to the experimental data was selected by considering a first-turn efficiency as realistic as possible. A first validation of the simulations was done by benchmarking the channeled beam spot size measured during UA9 tests at the SPS with Medipix detectors.

Then, the complete loss maps were performed for three cases: without the crystal collimators, with the usual collimation chain; with the crystal collimator and just one secondary collimator absorbing the deflected beam, and all other secondaries open; and with the crystal collimators and the full collimation chain. At 7 TeV, both longitudinal positions showed an improvement in cleaning efficiency of a factor 10. This is not the case at 450 GeV, but some improvement could be done with the impact parameter.

In conclusion, to scenarios for possible location of the crystal collimators were studied: The position after the existing primaries lead to improvements in impedance, and in cleaning only

at 7 TeV; whereas the position in cell 4 shows improvements in cleaning also at 450 GeV, but not in impedance.

1.2 Discussion

RB pointed out that in this case, the considered particle impacting the crystals have a angle of zero at the impact position. If it is a location where $\alpha \neq 0$, then the particles of highest displacement would also have an angle. SR answered that this case is actually taken into account by the use of the matrix formalism for the particle tracking.

2 A. O. B.

SR announced that a joint WP2/WP5 workshop during the Frascati meeting will be organized with S. Fartoukh. The rest of the agenda for the collimation sessions remains unchanged.