# Minutes of 21st Collimation Upgrade Specification Meeting, 12th of April 2013

**Participants:** R. Bruce (RB), L. Esposito (LE), J. Jowett (JJ), L. Lari (LL), A. Marsili (AM) (scientific secretary), D. Mirarchi (DM), E. Quaranta (EQ), S. Redaelli (SR) (chairman). **Remote:**

Indico event here.

# 1 Update on TCL debris simulations (A. Marsili)

Slides are available here (pdf).

## 1.1 Summary of the presentation

AM presented the comparison of the SixTrack debris simulations with the FLUKA simulations. In the second part of the presentation, the comparison between the debris tracking at 4 TeV and the corresponding measurements in the LHC.

The debris tracking simulations were performed with the standard optics at 7 TeV, including the modification taking place during LS1. The initial particle distribution was generated from simulations of collision products from the FLUKA team (F Cerutti). The goal was to test the effect of the longitudinal position of a TCL around IP1 and IP5, as presented by LE in Nov. 2012 in Frascati.

Both results are presented in number of proton lost per metre per second (p/m/s). AM gave the normalisation factors from the SixTrack impacts to the p/m/s for the simulated case. The cases simulated in IR5 are: no TCL, TCL in cell 4, TCL in cell 5 (in both cases at $10\,\sigma$).

The results are qualitatively similar, with the different peaks being reproduced in the same location with the same order (in p/m/s). Qualitative differences include higher peaks at the interconnections (which are explained by the different binning); slightly higher values for the peak in cell 11; smaller values of the shoulder in cell 8 before the maximum in Q8 for the case with no TCL. Another difference is in the TCL5 case: the peaks does not start at the same longitudinal position and has a different shape. Some of these differences (especially the last two) could be explain by differences in the optics, or in the longitudinal position of the collimators, in places where the dispersion varies quickly.

AM also presented the same results for IR1, which shows better agreement in places (shoulder in cell 8 of the peak with TCL, shape of the peak in cell 9 with the TCL5); but also extra differences, such as a much smaller peak in cell 13 for all cases.

The simulated TCL5 scans at 4 TeV are an attempt to reproduce the measures performed in the LHC. These measures were taken during collisions. The TCL were moved from their nominal setting of $10\,\sigma$ up to $60\,\sigma$. The LHC loss maps for the two extreme cases were presented, as well as the ratio.

Then, the results of the simulations for the same cases were shown. The shape is similar, and the effect of the TCL stop at the beginning of cell 9. However, the losses at the TCL increase more in simulation than in measurements when TCL is out, and the losses downstream decrease more in simulation than in measurements when the TCL is out.

This could be due to offsets in the BLM signals, and more generally the fact that the BLMs are detecting complex secondary showers that are difficult to reproduce.

### 1.2 Discussion

The possible origins of the difference between the SixTrack and FLUKA results were discussed. It was agreed that LE should send his optics input file to AM for comparison [**Action: LE, AM**].

## 2 Ion impact distributions on DS collimators in IP2 (M. Schaumann, J. Jowett)

Slides are available in pdf or pptx.

### 2.1 Summary of the presentation

The point of this presentation (prepared by MS, presented by JJ) was to give the distribution of impacts on the jaw of a collimator installed in the Dispersion Suppressor downstream of IP2.

Different products of the ion collisions in IP2 have different charges and masses (beam rigidities) and behave as secondary beams in the LHC. Some would be lost in the DS, and an extra collimator could protect the element. An on-line interactive model is available to show the trajectories of the different secondary beams.

The new optics sequence was created by replacing the first dipole of cell 10 by two 11 T dipoles and a collimator, the front plane of the collimator being at $s = 356.27\,m$. The point is to see if the secondary beams can be intercepted. MS calculated the distribution particles at the IP, and then propagated them to the collimator using MADX, for the different rigidities of the secondary beams, including the variations of energy.

These distribution of impacts can then be used as inputs for FLUKA simulations. Then, there will be a need for FLUKA models of the jaws and the particle interactions.

In conclusion, the distribution of impacts on a new collimator around IP2, for the products of ion collisions for one of the secondary beams, have been calculated. They will be used as inputs for FLUKA simulations of the collimator jaws. Further work includes different collimator settings, and other possible positions of the collimator.

### 2.2 Discussion

SR asked who did the implementation of the 11 T dipoles and collimator in the sequence: this was achieved by MS.

SR stated that the focus must be on proceeding with FLUKA simulations with a simple jaw, for the Collimation Review. Further work could include simulations with no collimator; and later, a parametric study in FLUKA for different secondary beams, jaw lengths, and materials.

SR pointed out that the first FLUKA simulations only consider a jaw alone in the universe, which could see a diminution factor for an ion beam.

It was decided that MS could prepare some of the files presented to be uploaded on the Collimation Upgrade Specification website.