Minutes of the 13th Collimation Upgrade Specification Meeting

Participants: A. Bertarelli (AB), L. Lari (LL), A. Marsili (AM) (scientific secretary), N. Mounet (NM), V. Previtali (VP) (Fermilab), B. Yee Randon (BYR), S. Redaelli (SR) (chairman), B. Salvachua (BS).
Remote: R. J. Barlow (RJB) (Huddersfield University), A. Faus (AF), T. Markiewicz (TM), J. Molson (JM), M. Serluca (MSe).

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1 LARP Rotatable Collimator Prototype Status (T. Markiewicz)

Slides are available at this link.

1.1 Summary of the presentation

TM presented the current status of the rotatable collimator currently developed by LARP. The jaws are made of a cylindrical mandrel with a spiral groove, in which a shaft made of molybdenum and *Glidcop* (a copper alloy) is inserted. The previous status report was presented in June 2012. At this time, both shafts and mandrels were brazed and ready. Some problems had arose before that, when winding the first of the two mandrels: an excess of braze material connected the shat to the mandrel, which introduced a bend in the mandrel. This is now understood and has been fixed and corrected. AB inquired if this is still the case. TM answered that both these issues were corrected and checked, and the lack of connection can be checked visually.

These problems were solved by squeezing and applying a tension to the tube during the wind. The tube now lies below the top of the grooves. An extra difficulty comes from the fact that the tube had to be bend in a "U shape" at one end. The next step was to add another layer of copper on the coils for protection, and braze the mandrel.

TM explained that the base plates of the tubing stubs could be recovered, and can be used again. He presented a possible design for a vacuum tank weld joint that would permit multiple accesses to the interior.

In conclusion, all elements needed to assemble the rotating collimator are now available at SLAC. This could take place in December.

1.2 Discussion

SR commented that this is a very good progress that the jaws are nearly ready, and asked how much time would be needed until the prototype delivery. TM answered that it could take place in roughly 3 months. SR commented that it would be good to converge on a time for the delivery, in order to have a guideline, and come to a proposal by the Frascati workshop. TM answered that he will send the documents [**action: TM**].

AB asked if the delivered collimators will have the step motors installed. TM answered that the team already has the stand for the collimator with the motors. They will ship the fully mounted system. AB asked if CERN will be able to use the collimator as such straight

away. TM answered positively, and added that the CERN team will also be able to look at it into more details and perform more tests.

AB warned that the shaft inserted in the mandrel might have many trapped volumes, which could lead to a lot of out-gassing in vacuum.

2 HL LHC collimator scenarios:impedance considerations (N. Mounet)

Slides are available at this link.

2.1 Summary of the presentation

NM presented the relative contributions of the different collimator types to the total impedance model of the LHC in function of the frequency, for the real and imaginary parts of the impedance. In both cases, the primary and secondary collimators, made of graphite, account for more than 80% of the total impedance.

For further studies, four cases must be considered: two material configurations (new one: material of current secondaries replaced by molybdenum alloy) for two settings configurations (relaxed or nominal).

2.2 Discussion

NM pointed out that these high values of impedance will be an issue. Out of these four cases, only one actually lowers the total impedance (metallic secondaries and relaxed settings). SR answered that these are "extreme" cases, and that acceptable values of impedance can be achieved more easily.

SR asked if the TCLAs would be added, knowing that their contribution is 10 to 15% of the total. NM confirmed.

AB told that a comparative study of the different materials was performed a couple of years ago. NM said that it will be taken into account.

3 Merlin status and plans (R. J. Barlow)

Slides are available at this link.

3.1 Summary of the presentation

RJB presented the four aspects of Merlin that are still under development. The first aspect is the modeling of the diffractive proton scattering, which can have an effect on the beam. This comes from experimental data, and a corresponding paper will be published. The second aspect is the development of a "soft scattering" model, which is still under development and needs benchmarking against SixTrack and measured LHC loss maps.

Then RJM presented the last release of Merlin (4.1), including some new options and abilities such as the reading from "twiss" files, and the included aperture calculations. Finally, the last point was the use of Merlin for LHC studies, for comparisons with the measurements,

the simulations for current and future perfect machine, to study the effect of different errors and future LHC instruments (crab cavities, hollow e^- beam, crystal collimation). Any known physical effect could theoretically be added to Merlin.

3.2 Discussion

SR asked for comparisons between SixTrack and Merlin for a standard case, which has been done and will be done again. He suggested that the effect of the scattering should be studied, as well as the ATS loss maps. RJB answered that the ATS is under study, and someone is working on the crab cavities, but wasn't available on that day.

JM specified that some important SixTrack issues were fixed in Merlin.

4 IFIC contribution to WP5

Slides are available at this link.

4.1 Summary of the presentation

AF presented the different tasks with which the IFIC in Valencia is involved. This includes studies of collimation efficiency, a possible upgrade of the tertiary collimators, and non-linear optics for collimation. It also includes asynchronous dump studies (with LL) for nominal and HL optics, which require modifications of the SixTrack code.

4.2 Discussion

LL specified that the asynchronous dump studies are being benchmarked against beam data at 4 TeV. More corss-checks will be done later.