Minutes of 7^{th} Collimation Upgrade Specification Meeting

Participants: C. Adorisio (CA), H. Allain (HA), B. Auchamnn (BA), R. Bruce (RB), A. Bertarelli (AB), R. Bruce (RB), M. Karppinen (MK), L. Lari (LL), A. Marsili (AM) (scientific secretary), J. Molson (remote), V. Parma (VP), S. Redaelli (SR) (chairman), M. Serluca (remote), Francesco,

1 11 T dipole status (M. Karppinen)

1.1 Summary of the presentation

MK presented the current status of the design of the future 11 dipoles. They are Nb_3Sn 11 T magnets which are $^2/_3$ shorter than the TiNb 8.33 T magnets. They might be installed in the Dispersion Suppressors to create additional space for collimators (possibly cryogenic) while being compatible with the LHC lattice. This design represents an alternative to the initial baseline to move quadrupoles while keeping 15 m-long dipoles. The installation of these magnets could happen already for the long shutdown 2, in 2018.

MK presented the different assembly options for these new magnets and the additional collimator. The present baseline is a magnet – collimator – magnet layout to replace the 15 m 8 T dipole *(cf. ColUSM2)*

The 11 T dipoles are built in collaboration with Fermilab. MK presented all the challenges met during the last year and a half. This included the packing of the Nb_3Sn cable, more delicate than with TiNb; the production quality as nearly been achieved. Other issues include the saturation of the iron at a field of 11.21 T, and the coil magnetization. The goal is to have a full-scale prototype by 2014.

Two different coil concepts have been designed: one in Fermilab, with integrated poles, which presented more radial shimming than previously thought; and one from CERN, with a pole-loading design.

Then, MK presented the production and assembly of the coils. The coils are pressed, clamped and wielded. Some dimensional distortions are not yet understood. The size of the prototype is limited by the size of the test bench: 6 m. Several tests will be performed on this prototype. Different activities and milestones for both the Fermilab and the CERN coil concepts were presented.

1.2 Discussion

VP inquired about any horizontal testing: they are not foreseen. It will have to be requested in advance.

SR pointed out that the limitations of the current system must be understood, and checked for matching the Hi-Lumi requirements: in particular, which IR might require the new dipoles with higher priority.

2 Preliminary field quality and quench margins (B. Auchmann

2.1 Summary of the presentation

BA presented the different coil designs conceived to optimize the field errors. One of the main concerns is the coil saturation. Different orders of field errors were considered: quadrupole (b2), sextupole (b3), up to b9. The impact of these errors on the beam dynamic is being evaluated (B. Holzer with optics team).

One of the main issues is the magnetization of the coil and the persistent currents in the coil. This could be solved with passive shims, but they are not effective at injection and reduce the aperture. The coils are also sensitive to non-magnetic material changes because of the mechanical compression.

Another issue is the Eddy currents, which are current loops created when the superconducting cables get connected by cross-over of small resistance. This has an effect as high as 4% on the transfer function, which is huge.

Different quench heater were studied and the first conclusion is that these coils are hard to quench. The temperature margin is between 4 and 14 K.

Overall, the design is well advanced and there are no major problems.

2.2 Discussion

SR pointed out that from an operation point of view, even the first order of field error (b2) has a negligible effect because there is not much change in tune. Some field maps were requested.

3 11 T magnets thermal model (Hervé Allain)

3.1 Summary of the presentation

HA gave a short presentation about the thermal model of the magnets. He presented the simulation parameters. The considered head load corresponds to 1.5 W/m.

HA presented transversal cuts of the coils for the heat per volume (W/m^3), the temperature increase following the flux lines and in the coil. The ring-shaped space around the coils is safe to cope with quench overpressure.

4 Next meeting

The next meeting will be held on:
22nd June 2012, 16:00–17:30.
Room: 874-1-011 (above CCC).

Tentative agenda:
Aurelien Marsili Preliminary multi-turn simulations of the ATS optics