

112th Meeting of the LHC Collimation Study Group

March 1, 2010

Present: R. Assmann (chairman), A. Rossi (scientific secretary), D. Wollmann, R. Bruce, H. Day, S. Roesler, A. Bertarelli, J. Jowett, L. Keller (SLAC), S. Lundgren (SLAC), J.C. Smith (SLAC), T. Markiewicz (SLAC), E. Metral, A. Burov (Fermilab), K. Kershaw, J-Ph. Tock, F. Caspers, A. Ryazanov, Y.I. Levinsen, L. Xiao (SLAC).
Excused: FLUKA team.

1 Comments to the minutes

No comments to the previous minutes.

2 Agenda of this meeting

1. Regular collimation status reports:
 - a) Hardware and tunnel activities, if any
 - b) Remote and beam commissioning
 - c) Phase II activities at CERN
 - d) Phase II activities at SLAC
 - e) Cryo-collimators
 - f) FLUKA work
2. Special reports :
 - a) Round the table collection of collimator beam test proposals for 2010 – R. Assmann, BE/ABP
– L. Xiao (SLAC)
 - b) Trapped Modes simulations

3 List of actions from this meeting

Action	People	Deadline
Establish the impedance budget for the Phase II collimators	E. Metral	
Heat distribution due to trapped modes.	SLAC	

(Complete list at <http://lhc-collimation.web.cern.ch/lhc-collimation/action.htm>)

The next meeting will be on March 1st.

Minutes of the meeting

1 Regular collimation status reports

1.1 Hardware and tunnel activities (R. Assmann on behalf of O. Aberle EN/STI)

- No hardware problem during beam restart.

1.2 FLUKA (F. Cerutti EN/STI – by mail)

- The issue of direct proton losses on the warm magnets is basically completed, bringing to the preliminary conclusion (to be confirmed quite soon) that they are not expected to significantly contribute to the peak dose on the coil insulator, due to the low percentage of lost protons leaving the aperture (compared to the amount of losses in the collimators). The dose values from this source term are roughly two orders of magnitude less than those quoted in my presentation of last November (page 7). So, at this stage, I would not encourage you to rerun Collimation simulations to score the missing losses on the passive absorbers.
- We are now moving to the cold section peak power calculations on the basis of your 3.5TeV loss maps implementing the agreed single diffractive flagging.
- In case a presentation putting together these two main topics (and the outcome of our aperture model checking) is preferred, Ketil might be able to deliver it not at the next, but at the following meeting (in one month from now). Otherwise, in 15 days from now he could report on warm direct loss results only.

1.3 Phase II activities at CERN (A. Bertarelli, EN/MME)

- Alessandro reported that the meeting on material radiation hardness for Phase II collimators – in the frame of the EuCARD/ColMat collaboration – took place (see <https://espace.cern.ch/Collimators/default.aspx> for more details).
Good progress has been made on Copper/Diamond. A work plan for the prototyping has been laid out and will be presented in the next Collimation Study WG meeting (15th of March). A prototype with BPM will be ready by the end of summer 2010, while a full collimator to be tested in HiRadMat is foreseen for 2012.

1.4 Cryo-collimators installation (J-Ph. Tock TE/MSC)

- R. Assmann said that L. Rossi expressed skepticism about a possible installation in 2012, given the already intense activity during that shut-down period. Ralph asked everyone to continue the study and give some quantitative estimates, both in term of feasibility and for the budget, for the management to take a decision, by the end of March.
- Ralph reiterated the plan, saying that the installation in 2012 should as late as possible, just before the machine is closed for beam restart.
- Ralph asked K. Kershaw who is working on remote handling, but no one is doing it at the moment.
- J-Ph. Tock asked if a decision has been taken on the working temperature of the cryo-collimators, since this makes a big difference in the overall project. Ralph replied that this cannot be defined yet, and that we should leave the margin for both solutions.
- A. Bertarelli stated that the goal of 2012 is quite tight, and Ralph replied that he would like to aim at that date so to be ready when it will be necessary for the beam operations. If we relax not, we may not manage by 2014 either.
- Next CWG, Jean-Philippe will present the cryo-collimator installation plan as shown at L. Rossi's task force.
- A. Bertarelli asked confirmation of the base-line layout: 120 mm transverse and 6 m longitudinal shift in the Q7-Q11 elements?
- Jean-Philippe said that the 6 m will be divided in 3 m between Q10 and Q11, which could be slightly increased in necessary, and 3m between Q7 and Q8, which cannot be modified, because are already at the limit of the integration.

- Alessandro affirmed that unless we go for a ‘standard’ solution of a warm collimator with C/W transitions, it will be impossible to have anything ready in 2012. Even for this solution, the C/W transitions must be shorter than the existing ones, and will need R&D studies.
- Ralph said that maybe we could think of staging the work, i.e. rearrange the DS region during the 2012 shut-down, and install the collimators only in 2014, if this does not imply too much overhead.
- Ralph also stated that we are now thinking of installing only IR3 to start with, with combined betatron and momentum cleaning. J. Jowett commented that also IR2 must be of priority, and Ralph promised to add one line about it in the MTP.

1.5 Phase II activities at SLAC (J.C. Smith) – see slides

- The collimator Phase II starts to take shape.
- A full set of drawings has been sent to CERN (R.W.A. and A.B.)
- A. Bertarelli asked to be informed before they proceed to welding.
- Alessandro asked the thickness of the RF mode suppressors, and Jeff promised an answer by next meeting.

2 Special topics

2.1 Round Table discussion on MD programs (R. Assmann BE/ABP)

R. Assmann asked for proposals on beam measurements. The deadline for the SPS MD program is the 10th of March. For LHC Ralph asked 3 periods of 8 h each.

2.2 Trapped Mode Analysis of the SLAC Rotatable Collimator Design for the LHC Phase II Upgrade (L. Xiao SLAC) – see slides

L. Xiao presented her measurements on Trapped Mode with Rotatable Collimators:

- She measured both longitudinal and transverse trapped modes.
- At the moment the “LHC design” is different from the “SPS design” for which the transition is mechanically simpler. The SPS design has a circular tank with the same diameter as the rectangular long side. The current SPS design has transition with thin and narrow EM foils on the sides, while the LHC design is provided with flat large plates (see slides).
- For fully inserted jaws (2mm gap), the longitudinal R/Q value is similar but the Q value is larger in the circular tank at low frequencies probably because the circular tank works more like a cavity.
- With fully retracted jaws (42 mm gap), the R/Q value is larger than for inserted jaws and the E_z component of the electric field in the transition regions along the beam path is about 10 times larger.
- The trend is reversed for transverse modes.

Ralph commented that this is consistent with what we find for 2 beams collimators.

J. Smith said that transverse modes are quasi-independent of the tank geometry, but they vary with the gap size. One would win opening the collimators further.

Ralph stated that we cannot relax the requirements on collimator settings.

- The E_z component with fully inserted jaws increases from 0.01 to 0.17 going from LHC to SPS design, while the E_y components are comparable
- SLAC proposes to increase the width of the EM foils.

F. Caspers suggested to check what happens if there is no EM foil at all, to simulate the case of a bad contact.

Ralph stated that some constraints in the collimator design come from the cooling capacity. Jeff replies that 700 W (estimated with the thin foil) mainly to the tank, do not represent a problem. Only few mW are expected to heat the foil. No cooling is foreseen. The resistance to heat, including while rotating the jaws, will be tested during bake-out. Ralph requested a detail study on where the heat goes to avoid future surprises. A. Bertarelli pointed out that heat on flanges may be critical and should be looked at.

Elias is asked to establish the impedance budget for the Phase II collimators.

Fritz asked how the EM foils are fixed, and SLAC replied that they are clamped to the collimator tank on one side, and attached to the jaw via the bearings which allow some sliding.