Stefano Redaelli, 11-03-2009

99th Meeting of the LHC Collimation Working Group, March 2nd, 2009

Present: Oliver Aberle, Fanny Arnold-Malandain, Ralph Assmann (chairman), Vincent Baglin, Giulia Bellodi, Alessandro Bertarelli, Chiara Bracco, Francesco Cerutti, Alessandro Dallocchio, Bernd Dehning, Alfredo Ferrari, Hitomi Ikeda, Christoph Kurfuerst, John Jowett, Aurélien Marsili, Valentina Previtali, Stefano Redaelli (scientific secretary), Federico Roncarolo, Adriana Rossi, Mariusz Sapinski, George Smirnov, Vasilis Vlachoudis.

Comments to the minutes

No comments to the previous minutes.

Agenda of this meeting

- Organization of the Phase II review (R. Assmann)
- FLUKA studies with cryo-collimators (V. Vlachoudis)
- Ion collimation performance during energy ramp (G. Bellodi)
- New temperature sensors in IP3 and IP7 (F. Arnold-Malandain)

List of actions from this meeting

Action	People	Deadline
FLUKA simulations of reference case for losses without cryo-collimators	FLUKA team	Before review
Comprative studies for different materials of cryo-collimator	FLUKA team	Before review
Ion simulations with cryo-collimators (particle tracking + energy deposition)	G. Bellodi, FLUKA team	Before review
Temperature sensor locations: additional requirements for ions?	Ion team	2 weeks

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

The next meeting will be March 16th, 2009.
Provisional agenda (**http://lhc-collimation.web.cern.ch/lhc-collimation/**):
R. Assmann: Overview of Phase II collimation solutions
T. Markiewicz: Update on Rotatable Collimator Design
J. Smith: Integration of a Hollow Electron Lens Scraper into the LHC Collimation System

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Minutes of the meeting

1 Tentative programme of Phase II collimation review (R. Assmann)

R. Assmann presented the overall structure of the Phase II collimation review that will be held at CERN on April 2nd and 3rd, 2009. Ralph reviewed the programme of the meeting, the draft mandate to the committee, the overall time-line and proposed solutions for the Phase II and the tentative agenda. Ralph asked feedback an all the above.
A. Bertarelli asked if we should propose a clear schedule to the review committee. R. Assmann said that he will discuss a possible time-line in his wrap-up talk. On the other hand, with all the implications that the collimation upgrade has (machine performance, radiation aspects, machine layout changes, etc.), the overall time scale should be decided as a strategic management solution and not presented as our request.
A. Bertarelli commented that in his opinion CERN must participate extensively to the design of the cryogenic collimators. The design constraints that will steer the GSI design are different (vacuum optimization ad not loss optimization) and therefore CERN should be driving the key design choices.
S. Redaelli asked what is expected exactly as an input from the LHC experiments. R. Assmann replied that we should give to them the chance of expressing their requests from the experiment and to included them in the upgrade scenario for collimation system. For example, there are some conflicts between the tertiary collimator in IP2 and the wished of the detectors.
B. Dehning asked how controls aspects of new alignment system with integrated BLMs will be addressed. R. Assmann replied that a prototype will be built and tested at the SPS. A collaboration with a German University (WHICH ONE?) has been set-up for detailed EM calculations. S. Redaelli commented that the present alignment strategy and possible implementations of the automatic alignment system should bementioned at the review.

R. Assmann commented that further comments should be sent directly to him within the couple of weeks at the latest.

2 FLUKA studies with cryo-collimators (V. Vlachoudis)

V. Vlachoudis presented preliminary results of energy deposition on the cryogenics collimators. The input beam losses were provided by T. Weiler with an improved statistics (35 million particles were tracked by using the GRID system). Simulations used the modified optics with moved magnets in the dispersion suppressor region. The cryo-collimator is modelled as a 1m long Cu block and gets approximately 60-80 W, while keeping the magnets downstream below quench limits. The first results are then encouraging because the prove, indeed, that this solution is effective.
R. Assmann suggested that for the review, he reference case that compares losses with and without cryo-collimator should also be performed with the same case study, in order to show explicitly what we can gain. S. Redaelli commented that a new tracking campaign should be launched to track in detail the particles that in the present case are lost at the cryo-collimator.
V. Vlachoudis in collaboration with T. Weiler performed a comparison between the scattering routine in FLUKA and in `SixTrack` with particular emphasis on the single-diffractive events.

It is found that the `SixTrack` routine is underestimating the losses by about a factor 2-4 depending on the range of the energy errors (see plots at pages 10-12).
R. Assmann commented that we should conservative and always take the worst estimated. On the other hand, specifically for the review, it is important to show the improvement that is granted by the new layout and this can done by using one code only, i.e. FLUKA because this gives worst estimates.
J. Jowett commented that we need to repeat these studies also for ions. A. Ferrari said that it should be possible to achieve the results in a reasonable time provided that the beam losses are provided in the same format as for protons. The feasibility of that will be looked at by G. Bellodi (**Action**).
After a discussion triggered by A. Bertarelli, it was concluded that it would be nice to perform comparative studies for different materials of the cryo-collimator (**Action** for the FLUKA team).
B. Dehning commented that we should look also at the quench performance if the superconducting correctors and not only at the main magnets. The correctors are not included in the model for the moment.

3 Additional temperature sensors in IR3 and IR7 (F. Arnold-Malandain)

F. Arnold-Malandain presented proposed locations for new temperature sensors in the warm straight sections IR3 and IR7. A total of about 300 additional sensors can be added for measurements in areas that are not equipped for the moment (flanges, beam pipes, warm magnets, ...). The proposed locations were established in collaboration with the collimation team (R. Assmann, S. Redaelli) and the FLUKA team (M. Brugger). The new sensors will be used to monitor possible asymmetric heating of flanges and to benchmark the predictions of tracking and energy deposition simulations.
In response to questions by A. Bertarelli and R. Assmann, V. Baglin clarified that these sensors will be installed on the outer side of the vacuum chambers and that the acquisition frequency will be up to about 1 Hz.
J. John asked if the locations were optimized by taking into account ion losses. S. Redaelli clarified that the new sensors are installed only in the warm region, typically close to collimators, and not in the dispersion suppressor. Therefore, the proposed locations should cover well also ion losses. The ion team should check the lists in details and propose additional locations if required (**Action**).
The draft proposal is available for comments on our web page (Summary Excel file; PDF file of IR3; PDF file of IR7). Everybody concerned was asked to have a look at these tables, which will be **approved at the next meeting** of March 16th, 2009.

4 Ion collimation performance during energy ramp (G. Bellodi)

G. Bellodi presented the collimation Phase I performance for ions during the energy ramp. Five energy points along the ramp were considered. The operational case of "rigid" retraction of the TCSG's with respect to the TCP's while the TCP's are kept at 6 sigma and scaled with the energy.
Going up in energy the losses tend to become more "discrete": they are focused in shorter and shorter bins. Still, the largest loss peaks remain concentrated on the dispersion suppressor in IP7, therefore the proposed locations of BLMs should cover all the cases. The losses exceed the quench limits at about 1.7 TeV (for nominal ion intensities and beam lifetime of 12 minutes).

R. Assmann suggested that also the case of optimum settings - TCSG at 7 sigmas scaled with beam energy - should be considered. It would also be interesting to consider explicitly the 5 TeV case.

5 A.O.B.

A new PhD student in BI-BLM team, Aurélien Marsili, introduced himself and his activity to the collimation team. Aurélien has just started a PhD thesis with the title "Identification of LHC beam loss mechanisms - A deterministic treatment of loss patterns". The team welcomed him.
As a first request to the team, A. Marsili asked if there are simulations on the beam-induced quenches that could be used as inputs for his studies. S. Redaelli commented that these quenches did not involve the collimators because in both cases the beam was lost in the aperture directly without interacting with the collimators. On the other hand, we have data about losses at the collimators in IP3 and IP7 but preliminary analysis by T. Boehlen suggested that they cannot be used for absolute estimates because the pilot bunches lost in a single passage were enough to quench the 40 μs acquisition.

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