*Stefano Redaelli, 20-03-2006*

# 67th Meeting of the LHC Collimation Working Group, March 20, 2006

*Present:* Oliver Aberle, Ralph Assmann (chairman), Chiara Bracco, Markus Brugger, Bernd Dehning, Alfredo Ferrari, Matteo Magistris, Manfred Mayer, Suitbert Ramberger, Stefano Redaelli (scientific secretary), Guillaume Robert-Demolaize, Maceij Sobczak, Mario Santana-Leitner, Thomas Weiler, Thijs Wijnands, Vasilis Vlachoudis.

## 1 Status of FLUKA simulations (M. Santana)

See slides at http://www.cern.ch/lhc-collimation/files/MSantana_2006-03-20.pdf

M. Santana reviewed the latest FLUKA studies carried out since the last report at the collimation working group (October 10th, 2005). Details can be found in his transparencies. The IR7 layout has been frozen and contains now **active absorbers (TCLA))** to reduce the deposited doses in superconducting magnets and **passive absorbers** to reduce the integrated dose to the warm magnets (notably, D3 and Q4). Latest simulations include the **60 cm long TCP's**, as they were proposed in the collimation working group meeting of June 13th, 2005. In addition, the contribution of the **tertiary beam halo** is now also taken into account.

It was pointed out that the proposed final system meets on paper the LHC requirements in all respects (cleaning performance, quench limits, lifetime of warm magnets, ...). A. Ferrari reminded that some safety factor should be accounted for. But nevertheless the achieved result is remarkable.

In addition, the **cross-talk between different BLM** has been computed by taking into account the final BLM configuration that was worked out by the BLM and VAC teams. The maximum cross-talk is of the order of 70 % and is less than what was calculated for IR3.

There are a few open issue that require further follow-up:

1) The deposited energy in the MQ10 is of the order of 2 mW/cm3, which is only a factor 2 lower than the assumed quench limit.

2) The simulations have been carried out only with vertical and horizontal halos, not yet with the skew halo. Previous studies showed that the skew halo is less critical but nevertheless simulations should be re-done also for this case.

3) Losses in the warm quadrupoles are below the assumed limits but large, in particular for the vertical halo case. This issues could only be faced by building longer passive absorbers.

4) The radiation doses in the MQW pipes are up to 50 MGy/y. This is an issue for the survival of the bake-out system.

## 2 Discussion and plan for future work

Based on the presented status and on matters arising, the collimation working group went through the list of future studies to be carried out. This list is available on our web page:
`http://lhc-collimation.web.cern.ch/lhc-collimation/action.htm`
The list is also appended to these minutes. It was agreed that the list will be circulated at the people concerned for comments. Another iteration will be needed to **set priorities** to the list of future studies.

# 3 A.O.B.

- R. Assmann announced that the Phase II collimation package has officially been approved by the AB department. The Phase II study concerns the development of advanced TCS designs to overcome the intensity limitations due to the high impedance of the carbon-based design. This does not include studies of crystal-based collimation, which concern instead the replacement of TCP's.
- An issue concerning the activation of the cooling water of the IR7 shielding was brought up by M. Bona. This is being followed up by the people concerned.
- Due to luck of time and resources, the proposed shielding walls could not be prepared for IR7. Instead, it was proposed to include 4 powerful ventilation fans. It is expected that they can induce a large noise (sound levels up to 110-120 db). The effect on the beam should be understood.

**The next meeting will be April 3rd, 2006.**

*Stefano Redaelli, 20-03-2006*

**Action Items:**

- Energy deposition studies with skew halo (ABP collimation team).
- Understand the differences between IR3 and IR7 (less absorbers are required for IR3). I. Bayshev should be invited to report to the collimation working group (R. Assmann, J.B. Jeanneret, IPHE colleagues).
- Setup FLUKA simulations for IR3 and MARS simulation to cross-check the simulations results (FLUKA and IPHE teams).
- What are the implications of having large deposited energy in the various equipments (follow-up with various concerned equipment owners).
- Cooling required for TCLAP?
- Implications of the new IR7 layout for the bake-out system (R. Assmann → AT-VAC).
- Energy deposition at IR7 at injection energy (FLUKA team).
- Final position of the passive absorbers in the model (FLUKA team should use the final values worked out by S. Chemli for the latest optics version).
- B. Dehning: Check the hot spot in the coil of superconducting magnets and the total integrated heat deposition in the SC coils (FLUKA team).
- Write reports on the latest energy deposition studies (FLUKA team).
- Finalization of the energy deposition studies for the BLM system. Is the provided information sufficient ? (BLM team and FLUKA team).
- Failure scenario at 7 TeV. Outputs of calculations by A. Presland, who have left CERN last February, should be used as an input for mechanical calculations (A. Bertarelli).
- Report on tolerance for Ozone production at IR7 (O. Aberle).
- Energy balance. What is the energy that escapes from IR7 through the beam pipe? (BLM team and FLUKA team).
- Energy deposition studies for various commissioning scenarios, with reduced collimator availability (FLUKA team using inputs from ABP collimation team, C. Bracco).
- Compare deposited energy from IR7 collimator with the local proton losses, as simulated within the ABP studies (ABP and FLUKA teams).
- Collect the available information of quench limits for steady losses and produce an "s-dependent" quench limit curve (ABP and FLUKA teams).
- Phase II collimation studies. Scaling of cleaning performance and total deposited energy versus TCS materials (ABP and FLUKA teams).
- Halo load on the TCDQ (ABP and FLUKA teams + B. Goddard).
- Halo load on the TDI (ABP and FLUKA teams).
- Failure scenarios at injection energy (ABP and FLUKA teams).
- Follow-up of SPS and TT40 tests with beam (everybody).

- R&D studies on crystal: optics, effect of full beam impacts on the crystal. Where is the energy of channeled particles lost? (ABP and FLUKA teams).
- Define thresholds for damage level and deformation on the collimator BLM's, in particular for Tungsten collimators (FLUKA and BLM teams).