

LHC Collimation Review, May 30-31, 2013

Indico page: <https://indico.cern.ch/event/251588>

Introduction:

In the frame of the LHC upgrades towards the High Luminosity LHC (HL-LHC), the improvement of the LHC collimation system is a critical aspect. The review has the main scope of assessing the needs of new collimators in the LHC cold dispersion suppressors for the operation beyond LS2.

Charge to the review panel:

The committee should look into the various aspects of the presented upgrade baseline and advise in particular on the need to pursue R&D on 11T dipoles for a possible installation in the LHC for LS2.

- Are the assumptions for performance reach estimates appropriate and adequately addressed
- Is the present upgrade strategy appropriate in view of being able to take a decision in 2015
- Is there any aspect that has been overlooked?

A final report should be produced and delivered to Steve Myers and Stefano Redaelli.

Reviewers

M. Seidel (PSI) [chairman]
G. Apollinari (FNAL)
W. Fischer (BNL)
M. Nesi (ATLAS)
R. Schmidt (CERN/ESS)
C. Omet (GSI)

Review agenda:

S1: Introduction to present collimation system and scope of the review

- **L. Rossi: The HL-LHC timeline**
 - Present the latest upgrade scenario towards HL-LHC
 - Introduce timeline for LS2 and LS3, with appropriate caveats
 - Define the key parameters for the operation after LS2 and LS3, like total beam intensity, peak luminosity and yearly integrated luminosity
 - Recall upgrade goals / plans for each LS
- **S. Redaelli: Introduction to collimation in the dispersion suppressor**
 - Short introduction to present collimation system
 - Introduce the basic concepts on the limitations in the DS (cleaning + physics IRs)
 - Where did we stand in 2011 (review on IR3 combined cleaning), what has changed (new quench tests, losses during cycle, ...)
 - Explain the agenda of the review and the mandate: what need to done until 2015 in order to take a decision after 6-8 months of operation at > 6.5 TeV.
 - New assumptions - why we do not talk about IR3 anymore.
 - Table with the IR's possible concerned by DS upgrade, and respective time line
 - Present the system upgrades already taking place in LS1

- **R. Losito: Present LHC collimator**
 - Collimator design features, including controls aspects
 - Discuss collimator lifetime: Oliver's talk at CWG + Stefano's paper at IPAC13
 - Present the results of inspections of collimators in the tunnel, if available
 - Recall basic maintenance plan and expected collimator lifetime
 - > *Very basic introduction to the reviewers not familiar with the system with*

S2: Estimated performance reach of present LHC collimation for 7 TeV

- **B. Salvachua: Cleaning performance**
 - Introduction of cleaning measurements and recap of 2010-2013 performance
 - Detailed statistics of fill losses: comparison 2011-2012
 - Define new baseline assumption for lifetime and cleaning (plot by Elena?)
 - Performance reach using also quench limit scaling from 4 TeV quench tests
 - Try to estimate total doses on the magnets for future operation (consider peak location from sixtrack+fluka simulations), using IPAC13 paper results
 - Also cover cleaning for ion beams (change of BLM thresholds in 2013 at 4 TeV)
- **N. Mounet: Impedance**
 - Review limitations up to 4 TeV with "tight" collimator settings
 - Review measurements of collimator impedance
 - Strategy for the restart after LS1
 - Improvements from metallic secondary collimators
 - Mention impedance issues for the TCT collimators and TCLD?
 - Baseline: achieve nominal 6/7 sigma setting at the end of post-LS1 operation
- **R. Bruce: Setting limits and beta* reach**
 - Basic message: why it is important to keep the option for DS collimation in IR7?
 - Introduce settings and gain from BPM design, with evolution 2010-13
 - Define a preliminary baseline for the evolution after LS1
 - Trade-off between tighter settings and number of dumps from losses
- **A. Marsili: Collimation cleaning with ATS optics for HL-LHC**
 - Introduce briefly the ATS optics for HL-LHC
 - Show the cleaning with ATS optics and no DS collimation
 - Are the TCLD locations for standard optics suitable for protecting the DS with ATS?
 - Do DS collimators cure efficiently also losses in the arcs with large beta functions?
 - Show results of cleaning with DS in IR7 and 11T dipoles for standard optics
 - Same questions for the physics debris losses in IR1/5
- **J. Jowett: DS collimation heavy-ion operation**
 - Review mechanisms for ion losses
 - Present limitations: review operational experience up to 4 TeV (IR7 + experiments)
 - Focus on need for cryo collimators in the DS of IR2 for the ALICE upgrade
 - Put it in the context of the luminosity plans for other experiments (IR1/5 at lower lumi!)
 - Give estimates of total doses expected on the cold magnets without DS collimators

- **E. Skordis: Energy deposition simulations for quench tests**
 - Detailed simulations of the 4 TeV quench test
 - Comparison of SixTrack/FLUKA simulations against BLM measurements
 - Real kJ in the coils versus BLM reading
 - Energy deposition in the critical magnets
 - Best-guess of 6.5 TeV loss distribution for cleaning limiting locations
 - Can we comment on the differences for ion beam losses in IR7 or in the experiments?
- **A. Verweij: Quench form magnet studies**
 - Analysis based on the SixTrack/FLUKA of quench test
 - How close we really were to the quench limits? (Using energy distribution at 4 TeV)
 - How this results scale to 7 TeV powering levels? (Using energy distributions at 7 TeV)
 - Quote factor with respect to Note 44
- **M. Sapinski: Quench limits in faster time ranges**
 - Brief overview of other quench tests: do we expect collimation limitations for faster losses?

S3 : Status DS collimation (in collision points and cleaning insertions):

- **L. Bottura: What do we need to decide now to have Nb₃Sn 11T dipoles in LS2?**
 - Magnets point of view: can we be ready in 2018?
 - Time between decision to install 11T dipoles and feasible installation date
 - Plans for a possible production of 4 to 8 11 T dipoles by 2018
- **M. Karppinen: Status of 11 T dipole program**
 - Review present status
 - Were are we with the field quality? How many IR's could be equipped?
 - Represent also point of view of US
 - Heat loads: doses compatible with operation of these magnets? Linked to FLUKA talk.
- **V. Parma: Cryogenics design choices and integration issues**
 - Recent developments and final design choice: "warm" vs "cold" collimator
 - Integration issues and feasibility in the different IRs: IR1/2/5/3/7
 - What needs to be done until 2015?
 - Can/should we still keep open to option of moving magnets around in DS's?
 - Review issues for different IRs: Is it worth in all cases betting on the 11T dipoles?
- **A. Bertarelli: Status of the TCLD collimator design**
 - Review TCLD collimator design and potential issues
 - Agreed baseline for QTC prototype tests at cold
 - What do we need to do until 2015? Goals and plans of prototyping phase
 - Are there any issues for a production in LS2?
 - Production: in-house vs industry
 - See with Vittorio how to split topics: same questions for cryostat production
- **G. Steel: Heat load scenarios and protection levels for ions**
 - Recap. previous results for proton operation IR3/7
 - Recap. previous results for ion operation IR3/7
 - New results based on ABP ion team in IR2

- Parametric study for DS collimators in IR2: length and material
- Gain factor from DS collimator in IR2 (ions)

S4 : Collimation upgrade plans beyond DS collimation

- **S. Redaelli: Collimation upgrade plans**
 - What are the alternatives to the 11 T dipole solution?
 - Present baseline for studies on crystals and hollow e-lens
 - Introduce overall scope of collimation project upgrades (as in Chamonix2012)
 - Review overall plans within EuCARD, HiLumi and US-LARP studies
 - Recall studies on collimator remote handling
 - Material studies for fast failures and high doses