Discussion on the Report from the Collimation Review

Consequences for our work (my point of view)

R. Assmann

Remarks

- Not a complete review of all statements. ➔ See report at collimation project web site for reference!
- Review was a very good success supporting the direction and decisions in our work!
- Here list a few major points with impact for our work! (“our homework”)

Hardware choices

Choice of carbon-carbon explicitly confirmed. ITER and BNL: Prefer over Graphite for robustness!

➔ Send order for carbon-carbon material!

Copper coating is discouraged (what happens in case of peel-off)?

➔ No copper coating?

NEG coating might not resist to radiation

➔ Study radiation resistance of NEG coating (AT/VAC, TS)

Springs in the jaws are essential for functioning of system but might be vulnerable to deterioration (observed in nuclear power stations):

➔ Estimate equilibrium temperature and radiation resistance of springs in collimator jaws.

Reliability study is required, given the large number of components, the hostile environment (radiation, Ozone, …) and the downtime related to each repair. Worry about lubrication and erosion!

➔ Start reliability study including tests on MTBF on critical components! (“we lost 1/8 motors for our LHC prototypes with unknown reasons”)

Recommendation to not use Copper pipes for cooling but other more erosion resistant materials, like Glidcop.

➔ Study is already ongoing for different material.

Non-uniform energy deposition in the vacuum flanges could result in warping and vacuum leaks!

➔ Test set-up by AT/VAC. Experimental tests will be difficult! Estimate energy deposition in flanges for different beam loss situations (beam loss is asymmetric)!

Reduced carbon thickness should be investigated:
➔ Has been done in the past: Excluded!

Radiation resistance of Carbon-carbon. Recommend radiation tests and collaboration with BNL/FNAL in addition to work with Kurchatov Institute.

➔ Start collaboration with BNL/FNAL (send samples for radiation tests).

➔ Send sample of collimator jaws after TT40 robustness test to Kurchatov Institute and/or elsewhere.

Detection of jaw damage is required.

➔ Extensive test is being prepared for TT40 robustness test (accelerometers and microphone).

Don’t believe claims from industry on radiation hardness of motors but do tests before purchase!

➔ To be defined! No test program in place (only relying on old LEP motors).

Some motors are not accessible (located on second beam and facing to tunnel wall). Optimize their location to allow for replacement.

➔ Discuss in CDM!

Proper material properties characterization program is required.

➔ Samples had been sent and results received (some surprises). AB.

Check for macroscopic effects in TT40 tests (sputtering, chemical erosion, debris, dust, …).

➔ Include in list of our tests after beam impact.

Accelerator Physics

Worries about beam loss behavior on short timescales:

➔ DESY proposes collaboration on this topic. Start collaboration!

Proposal for thin target below depth of primary collimators from DESY.

➔ No hardware change would be required, as scrapers are already in our design. Study this possibility!

Put more focus on experimental background. Tertiary collimators address this issue already in our design:

➔ no change of concept or decisions!
➔ Start detailed simulations on beam-induced beam loss in exp. insertions!

Set-up and optimization procedure for low current is supported. However, it is predicted that separate high current set-up is required (at start of each fill?).

➔ No obvious solution for this (risk of quench at high current limits flexibility of collimator settings). Studies to be done…

Safety factors to be listed.

➔ No safety factors but review all results!?

Machine protection of the LHC caused many worries!

➔ Clarify role of collimation system for machine protection!

➔ Separate review on machine protection system (RS).

Impedance: Study additional methods of improving beam stability in the LHC.

➔ Communicate to Francesco.

Impedance: Beam and wire measurements of uncoated jaws recommended.

➔ Under way (prototype 1 with SPS beam – prototype 3 with wire).

Develop plan for positioning algorithms.

➔ Under way in ABP (GRD, SR, RA).

Use a more detailed model for the quench limit!

➔ Proton loss maps more precise now, but how to convert into fraction of quench limit? Contact various colleagues!

Energy deposition

See before in hardware section for additional issues!

Detailed energy deposition results for IR7 are needed:

➔ Studies are ongoing!

For estimation of radiation damage extract dpa information from FLUKA.

➔ Modify FLUKA to get dpa.

Production of Tritium in the cooling water?

➔ Markus or Stefan?

Other concerns

Start production soon. Get carbon-carbon material now. Consider more than one vendor. Keep vendor of CC in the loop from the start.

➔ Being addressed now!