Review of the needs for a hollow e-lens for the HL-LHC

Mandate and Charges

Mandate of the Review:

Following the experience of the 2016 LHC operation, this review aims to discuss the need and potential benefits of an active halo depletion system for the HL-LHC and give a recommendation for adopting it into the HL-LHC baseline.

The scope of this review is to examine the two initial motivations (loss spikes during operation and machine protection aspects for operation with Crab Cavities), to evaluate the needs in view of the recent project re-scoping and to compare the projected needs with the operational experience from the LHC during Run I and Run II.

Following the close-out by the review chair, the committee is required to compile a short report with findings, comments and recommendations within one month. The report will be delivered to Lucio Rossi, HL-LHC Project leader.

We invite the review panel members to comment on the proposed draft program of the review and to recommend additional topics and presentations if these can be beneficial for the review.

Members of the Review Panel:

Rob Appleby (UNIMAN)
Wolfram Fischer (BNL)
Mike Lamont (CERN)
Katsunobu Oide (CERN)
Rudiger Schmidt (CERN, Chair)
Mike Seidel (PSI)

Organiser: Oliver Brüning (CERN)

Dates: 6th-7th October 2016

Place: CERN, TE Auditorium (30-7-018)

Preliminary Programme:

The review is scheduled on two days, organized as follows (general lines):

Thursday 6th October:

<u>Introduction Session:</u>

- 1) Overview and introduction including an outline of the existing installation options, optics conditions, infrastructure requirements (cryo, power) and timeline (planning need for the technical design etc.).

<u>Session on operational experience and extrapolation to HL-LHC parameters</u>:

- 2) Loss and lifetime observations during the 'Dynamic LHC' Cycle (ramp, squeeze and adjust) and their extrapolation to HL-LHC parameters.

- 3) Loss and lifetime observations during the 'Static' Cycle (stable beam) and their extrapolation to HL-LHC parameters.

- 4) Loss and lifetime observations during the 'Special' Cycles (MD studies and end of fill studies) and their extrapolation to HL-LHC parameters.

- 5) Observations and measurements on the impact of earthquakes and cultural noise on the LHC operation and their extrapolation to HL-LHC parameters.

- 6) Operational experience from the Tevatron and RHIC and their extrapolation to the HL-LHC.

<u>Session on HL-LHC system specifics:</u>

- 7) RF overview of the Crab Cavity system for HL-LHC with presentation on potential failure modes and summary of the KEK operation experience.

- 8) Machine protection requirements for HL-LHC and failure modes.

- 9) Alternative methods for halo depletion (damper and tune modulation) and comparison of their performance / reliability to that of a hollow electron lens.

- 10) Potential performance reach for the HL-LHC in case of a depleted beam halo.

    ==> Approximately 10 presentations a 30 min plus 15 min for questions gives ca. 7.5 hours of presentations that could fit into one day of presentation. Plus

half a day for the review committee for additional questions and report preparation and the second half of the second day for the review closeout.

Friday 7th October:

- Morning: Closed session of the review with potential additional Q&A
- Afternoon: Close-out