HL-LHC optics follow-up

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Open actions

- D2 field quality.
- TAN and collimator design for neutral protection.
- Phase advance MKD-TCT in IR5 Beam 2.
- Optics transitions.
- Matching section apertures.
- Q5 magnet types for IR1, IR5, IR6.
- BPM number and locations.
- Large beta* IR1 and IR5 optics.
- Tolerances for power converter ripple.
- BPM resolution, orbit corrector transfer function accuracy for IP/crab orbit feedback and optics measurements.
- Additional sextupole in Q10.

Status

- First energy deposition studies [1], showed substantial dose deposition in D2, Q4, Q5 (crab cavity impact is under study). Mitigation strategies are going in this prioritized list:
  - reduce slightly TAN aperture counting on better alignment tolerances (mind background vs protection issues for the incoming beam e.g. implement asymmetric left-right design);
  - introduce W protection in D2, Q4, Q5;
  - redesign D1-D2 dogleg to increase circulating beam - neutrals separation;
  - review crossing angle specifications (prefer flat beta* also with crab cavities).
- Critical MKD-TCT Phase advance: squeezed optics have a 15 degree tunability when changing total phase advance at the cost of Q5 strength and beta blowup in Q4-Q5 at 1 km. Mitigations: design with large aperture margins, change of the phase advances if possible through the transitions and/or adding TCT in Q4, Q5 in IR1 and IR5.

[1] L. Esposito 13/8/2013 WP2 Task Leader Meeting

Status (2)

- Optics transition under study, still confirming at least 90% of MQYL strength required (exceeding available strength of MQY at 200T/m).
- 11 m and 17 m large beta* injection optics found for former HL-LHC triplet layout, they needs strong Q5, in particular when smooth triplet strength transitions are forced.
- For Q5 a MQYL type has been proposed and a MQY at 200T/m or two MQYY (HLLHC baseline for Q4) have been offered. MQY solution may be barely sufficient for shielding and strength, MQYY comfortably fulfils both needs.
- D2 field quality could be improved by iron shaping [2] and should be improved according to the first simulations [3].

[2] E. Todesco, 13/8/2013, WP2 Task Leader Meeting

[3] M. Giovannozzi 27/8/2013 WP2 Task Leader Meeting

Status (3)

- BPM (see R. Jones), W shielding confirmed compatible. Confirm all locations since most of the measurements are done with single bunches and gating is possible for pac-man bunches.
- BPM and orbit corrector dynamic transfer function tolerances to be studied.
- Sub ppm power converter ripple needed due to an order of magnitude increase of $\int k\beta$ in the triplets.
- Assumed 0.5 mm triplet alignment tolerances to specify MCBX strengths.
- Additional MS in Q10. Alternative: bypass a sextupole at the cost of 20% ATS arc blow-up at constant beta* (or loss of 20% beta*). 7 man-year to build new coils? Are there alternatives?