Influence of 11T dipole alignment on collimation cleaning for ions

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• In LS2, assembly of two 11T dipoles and one TCLD collimator to be installed in cell 8 L/R of IR7 to catch dispersive losses

• 11T magnets straight – curved nominal orbit not centered in aperture

• If distance beam-aperture is reduced just upstream of the TCLD, where dispersion is already large, additional losses could occur
Introduction

• If the orbit in the 11 T dipole is centered at the extremities, then the sagitta produces a maximum offset at the centre of the dipole.

• The sagitta moves the orbit towards the outside of the ring and this can be simulated by moving the aperture model at that location towards the centre of the ring.
11T dipole - Ion case

• SixTrack-Fluka coupling for heavy ions used to study betatron cleaning for B1H of HL-LHC v1.2 with Pb ions
• Offset represented as an aperture shift over the entire dipole
• Max offset: 2.6 mm offset due to sagitta in magnet + drifts, with orbit centered at the extremities
  • See talk F. Savary in Alignment WG 21/2/2018
• Offsets considered are 2.6 mm and 5 mm
Results – B1H

Losses around the ring

\[ \eta \text{ (1/m)} \]

\[ s \text{ (m)} \]

01/06/2018

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Results – B1H

Zoom in IR7

B1H

$11T$ losses

$TCLD$

$DS$ losses

BEAM

$\eta \ (1/m)$

$s \ (m)$

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Aperture offset effect

No offset

2.6 mm offset

5 mm offset

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Aperture offset effect

No offset

2.6 mm offset

5 mm offset

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Aperture impacts over entire dipole

No offset
Aperture impacts over entire dipole

5 mm offset
Conclusions

• Sagitta moving orbit towards the outside of the ring increases loss of fragments with \( \frac{dp}{p} > 0 \), but because the majority of fragments have \( \frac{dp}{p} < 0 \) there is a net reduction of losses in simulations.

• The solution where the orbit is centered at the extremities gives equivalent or better losses for ions, since the negative \( \frac{dp}{p} \) particles come further away from the aperture.