Updated power deposition simulations for DS collimators in IR7

E. Skordis and the FLUKA team

input from R. Bruce and the collimation team
Talk Overview

• Past study
• Simulation setup
• Results
• Conclusion
Past study

Introduction

- Predictions of power density in dispersion suppressor (DS) magnets are presented
- Comparison of present layout with a layout including DS collimators (TCLDs)
- Considered integration option: MB → 11T dipole + TCLD + 11T dipole
- Two case studies:

<table>
<thead>
<tr>
<th>Operation:</th>
<th>DS next to IR2</th>
<th>DS next to IR7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat load due to:</td>
<td>Pb@2.76 TeV/u</td>
<td>p@7 TeV</td>
</tr>
<tr>
<td></td>
<td>ion collision debris → secondary beams with changed rigidity due to EM processes</td>
<td>collimation leakage → off-momentum protons mainly due to single diffr. scattering</td>
</tr>
<tr>
<td>Considered layout:</td>
<td>1 × (11T + TCLD + 11T) (in DS cell 10)</td>
<td>2 × (11T + TCLD + 11T) (in DS cells 8 &amp; 10)</td>
</tr>
</tbody>
</table>

For reference, see also previous talks/publications:
Simuation Setup

Studies of power deposition in DS magnets (next to IR7): layout and collimator settings

- p@7 TeV, beam 2
- Nominal optics
- Only horizontal losses considered
- Studied layouts (DS left of IR7):
  - Present layout vs 1 DS collimator
  - vs layout with 2 DS collimators (cells 8&10) – see illustration
- Studied options:
  - Relaxed Collimator settings
    - TCLD: 65cm jaws
- All results presented in following are normalized to 0.2 h beam lifetime ($4.5 \times 10^{11}$ p/sec lost)

<table>
<thead>
<tr>
<th>TCP7</th>
<th>TCS7</th>
<th>TCLA7</th>
<th>TLD</th>
<th>TCSG6</th>
<th>TCDQ6</th>
<th>TCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>relaxed</td>
<td>7.0</td>
<td>10.3</td>
<td>13.0</td>
<td>13.0</td>
<td>11.0</td>
<td>11.6</td>
</tr>
</tbody>
</table>

Table: settings in 3.5 μm·rad emittance, as shown in [1]

Magnet coils peak power deposition (radial average)
Present layout 0 DS collimators

Main Dipoles

Main Quadrupoles

Past Study Value: 20mW/cm³
Magnet coils peak power deposition (radial average)

Present layout 1 DS collimators

Beam 2

Past Study Value: 2.5 mW/cm³
Magnet coils peak power deposition (radial average)
Present layout 2 DS collimators

Past Study Value: 2.5 mW/cm³
Conclusions

• Inermet jaw active length reduction to 65cm does not jeopardize the TCLD protection role
• In the presence of the TCLD, the downstream 11T dipole becomes a hot spot, still rather below the expected Nb₃Sn quench limit
• The TCLD in cell 10 does not imply a significant cold power density reduction
Backup slides
Values are normalised to the signal of the BLM at the TCP.C (Horizontal) for SIXTRACK OLD and TCP.D(Skew) for the NEW and Coupling due to better absolute agreement.