Abstract
In its currently-envisioned initial stage, the Compact Linear Collider (CLIC) will collide beams with a 380 GeV center of mass energy. To maintain the luminosity within a few percent of the design value, beam stability at the interaction point (IP) must be controlled at the sub-nanometer level. To help achieve such control, use of an intra-pulse IP feedback system is planned. With CLIC’s very short bunch spacing of 0.5 ns, and nominal pulse duration of 176 ns, this feedback system presents a significant technical challenge. Furthermore, as part of a study to optimize the design of the beam delivery system (BDS), several $L^*$ configurations have been studied. In this paper, we will review the IP feedback simulations for the 380 GeV machine for two $L^*$ configurations, and compare luminosity recovery performance with that of the original $L^*$ configuration in the 3 TeV machine.

Introduction

- Current plans for CLIC involve phased commissioning with lower-energy lattice for 380 GeV collision energy.
- Previous studies focused on a BDS lattice designed for a 3 TeV collision energy.
- New BDS designs have two $L^*$ configurations: 4.3 m, 6 m.
- Previous ground motion (GM) studies of 3 TeV machine performed for both 380 GeV designs.
- Intratrain IP feedback system used to correct perturbations from GM.

Previous Study

- Last study (Resta-López, 2010) focused on 4 GM models; A, B, C, and K.
  - Only model C plots shown.
  - PLACET and GUINEA-PIG used for simulation studies.
  - 3 TeV collision energy.
  - Train length = 156 ns.
  - Gain scan performed using 100 random seeds of GM.
  - Luminosity recovery plotted for single seed using best gain value.

Current Study

- Focused on 5 GM models; A, B, C, D (also called B10), and K.
  - Only model C plots shown.
  - LinSim framework of PLACET and GUINEA-PIG used for simulation studies.
  - 380 GeV collision energy.
  - Train length = 176 ns.
  - Gain scan performed using 100 random seeds of GM.
  - Luminosity recovery plotted for average luminosity from 100 random seeds using the best gain value.
  - Shaded error bands represent the error on the mean.

Results and Future Work

- Initial studies completed for all 5 GM models.
  - Model C plots shown.
  - All results summarized in table below.
- For $L^* = 4.3$ m, luminosity recovery same or better for 380 GeV.
- For $L^* = 6$ m, luminosity recovery similar to 3 TeV study results.
  - 380 GeV achieves as good or better results than 3 TeV.
  - Appears to be best overall results for all GM models.
- Simulation occasionally overcorrects, causing slight reduction in luminosity.
  - Looking for solutions to stop corrections at maximum luminosity.
- For future:
  - Looking at more complex systems, including more errors.
  - Applying ground motion to two independent beamlines.
  - Alternative algorithms for the IP feedback system.
- Please see proceedings for references.

<table>
<thead>
<tr>
<th>GM Model</th>
<th>$L^*$ = 4.3 m (2010)</th>
<th>380 GeV</th>
<th>380 GeV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L*</td>
<td>$\Delta L/L$</td>
<td>$\Delta L/L$</td>
</tr>
<tr>
<td>A</td>
<td>4.3 m</td>
<td>$\leq 0.11$</td>
<td>$\leq 0.11$</td>
</tr>
<tr>
<td>B</td>
<td>4.3 m</td>
<td>$\leq 0.3$</td>
<td>$\leq 0.3$</td>
</tr>
<tr>
<td>C</td>
<td>4.3 m</td>
<td>$\leq 0.45$</td>
<td>$\leq 0.42$</td>
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<tr>
<td>D</td>
<td>6 m</td>
<td>$\leq 0.9$</td>
<td>$\leq 0.6$</td>
</tr>
<tr>
<td>K</td>
<td>35 %</td>
<td>$\leq 20$</td>
<td>$\leq 18$</td>
</tr>
</tbody>
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