ESTB Beam Parameters
These slides are adapted from the following presentation:

ESTB End Station Test Beam Design, Performance, Infrastructure, Status

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ESTB 2012 Users Meeting, SLAC
August 23, 2012
# ESTB parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>ESA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>2-15 GeV</td>
</tr>
<tr>
<td>Repetition Rate</td>
<td>5 Hz</td>
</tr>
<tr>
<td>Charge per pulse</td>
<td>0.35 nC</td>
</tr>
<tr>
<td>Energy spread, $\sigma_E/E$</td>
<td>0.02%</td>
</tr>
<tr>
<td>Bunch length rms</td>
<td>100 $\mu$m</td>
</tr>
<tr>
<td>Emittance rms $(\gamma \varepsilon_x, \gamma \varepsilon_y)$</td>
<td>$(4, 1) \times 10^{-6}$ m-rad</td>
</tr>
<tr>
<td>Spot size at waist $(\sigma_{x,y})$</td>
<td>$&lt; 10$ $\mu$m</td>
</tr>
<tr>
<td>Drift Space available for experimental apparatus</td>
<td>60 m</td>
</tr>
<tr>
<td>Transverse space available for experimental apparatus</td>
<td>$5 \times 5$ m</td>
</tr>
</tbody>
</table>
LCLS and ESA

We use pulsed magnets in the beam switchyard to send the LCLS beam into ESA.
LCLS beam parameters and range

- **LCLS beam**
  - Energy: 2.5 – 15 GeV
  - Repetition rate: 120 Hz
  - Beam current: up to 350 pC
    - 40-150 pC preferred by LCLS Users
  - Beam availability ~95%!
ESTB parameters

• ESTB beam
  – We kick the LCLS beam into ESA @ 5 Hz
  – Primary beam 2.5 -15 GeV
    • The beam energy is determined by LCLS Users
    • $< 1.5 \times 10^9 \text{ e-/pulse} = 250 \text{ pC}$
  – We can also provide clean secondary electrons
    • From 2 GeV to 15 GeV, 0.1/pulse to $10^9 \text{ e-/pulse}$

  – If LCLS experiments don’t need full 120 Hz rate, the remaining beam is directed to ESTB, increasing the rate > 5 Hz
ESTB goals: Primary e- beam operations

ESTB can operated in several modes. In full beam operation mode:

- A full intensity, high energy e- beam can be delivered to ESA
- The beam is brought to a focus in the middle of ESA

$\sigma_z \sim 100\mu m$, ten times larger than LCLS due to large bend angle in the A-line.
ESTB goals: Secondary e- beam

Primary beam can be directed onto a target:

• Secondary e- are momentum-selected
• Transported to ESA and focused to small spots
• Adjusting 2 existing collimators, it is possible to provide secondary beams up to incident energy and down to 1 single particle/pulse.
LCLS beam energy can vary

Number of days LCLS was operating at a given beam energy during April - July 2012