CU Plan
(how do we allocate the run time during the beam test in 2004?)

Outline
• Overview of the Beam Test Plan
• Beam Types Table
• Performance Plots (AO) with proposed points
• Impact points

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Beam test Plan
(LAT-TD-440)

• MC validation (emphasis is on off-axis performance)
  – Energy range
  – Energy resolution (use positrons and photons)
  – Effective Area (can use tagged and untagged beams)
  – Single Photon Angular Resolution (watch out for multiple photon contamination !)
  – Background rejection (CAL+TKR only)

• Hardware validation
  – Time accuracy
  – Dead time
<table>
<thead>
<tr>
<th></th>
<th>Positrons</th>
<th>Photons</th>
<th>Photons</th>
<th>Protons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Energy (Van de Graaff)</td>
<td>Low Energy (tagged)</td>
<td>High Energy (untagged)</td>
<td>tagged</td>
</tr>
<tr>
<td><strong>Beam Energy</strong></td>
<td>1, 2, 5, 10, 30, 45 GeV</td>
<td>17.6 MeV</td>
<td>20 MeV to 1 GeV</td>
<td>20 MeV to 30 GeV</td>
</tr>
<tr>
<td><strong>Inclination Angles</strong></td>
<td>0, 30, 55, 70</td>
<td>2π</td>
<td>0, 30, 55, 70</td>
<td>0, 30, 55, 70</td>
</tr>
<tr>
<td><strong>Azimuth angles</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Impact positions on LAT</strong></td>
<td>TBD (3)</td>
<td>TBD</td>
<td>TBD (3)</td>
<td>TBD (3)</td>
</tr>
<tr>
<td><strong>XY positions @ normal incidence</strong></td>
<td>TBD (64)</td>
<td>TBD</td>
<td>TBD (6)</td>
<td>TBD (6)</td>
</tr>
<tr>
<td><strong>Number of generated particles per configuration</strong></td>
<td>5000</td>
<td>~500,000</td>
<td>5000 for each energy bin with 50% width</td>
<td>10,000 for each energy bin with 50% width</td>
</tr>
<tr>
<td><strong>Run time allocated</strong></td>
<td>6 days</td>
<td>5.5 days</td>
<td>2 days</td>
<td>10 days</td>
</tr>
</tbody>
</table>
| **Assumptions** | 30 Hz (1 e/pulse) \(\varepsilon_{\text{acc}} = 50\%\) \(\text{Set up time} / E = 6 \text{ h}\) | 1 Hz @source \(\text{Reconstructed rate} \sim 0.01 \text{ Hz}\) | 30 Hz (e) \((0.025 \text{ photons/pulse/En}
|ergy bin}) \(\varepsilon_{\text{acc}} = 50\%\) \(\text{Set up time} / E = 6 \text{ h}\) | 30 Hz (1 e/pulse) \((0.013 \text{ photons/pulse/En}
|ergy bin}) \(\varepsilon_{\text{acc}} = 50\%\) \(\text{Set up time} / E = 6 \text{ h}\) | 30 Hz (0.0044 protons/pulse) \(\varepsilon_{\text{acc}} = 58\%\) \(\text{Same performance as BTEM99/00}\) |
Energy Resolution

- VdG photon
- Tagged photon
- Untagged photon (not useful here)
- Positron

Use 7 points to validate the MC
0.02, 0.05, 0.07, 0.2, 1, 10, 20 GeV

Proposed points are overlayed on the AO plot just to guide the eye

Energy Resolution $\sigma_E/E$ vs. Energy

Compare resolution from photons and positrons

Energy (GeV)
Angular Resolution

- VdG photon
- Tagged photon
- Untagged photon
- Positron

Use 7 points to validate the MC:
0.02, 0.05, 0.07, 0.2, 1, 10, 20 GeV
Number of Reconstructed Photons
( obtain Effective Area using MC)

- VdG photon
- Tagged photon
- Untagged photon
- Positron

Use 7 points to validate the MC
0.02, 0.05, 0.07, 0.2, 1, 10, 20 GeV

Proposed points are overlayed on the AO plot just to guide the eye.
- **30 deg** – is **NOT** in the Beam test Plan but we should include it in case we realize our trigger/reconstruction efficiencies are too low at the largest angle. Also one needs more points for the Field of View.
- **55 deg** – where half of our effective area is
- **80 deg** – need a large angle to check efficiencies

<table>
<thead>
<tr>
<th>Point Spread Function (PSF)</th>
<th>Effective Area (A)</th>
<th>Field of View (FOV)</th>
<th>Energy resolution (E)</th>
<th>Energy loss in the tracker (L)</th>
<th>Backsplash (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 deg</td>
<td>20 MeV</td>
<td>50 MeV</td>
<td>200 MeV</td>
<td>1 GeV</td>
<td>10 GeV</td>
</tr>
<tr>
<td>30 deg</td>
<td>A, PSF, E, L</td>
<td>A, PSF, E, L</td>
<td>A, PSF, E, L</td>
<td>A, PSF, E, L</td>
<td>A, PSF, E, L</td>
</tr>
<tr>
<td>80 deg</td>
<td>A, PSF, E, L</td>
<td>A, PSF, E, L</td>
<td>A, PSF, E, L</td>
<td>A, PSF, E, L</td>
<td>A, PSF, E, L</td>
</tr>
</tbody>
</table>
Impact points
(No azimuth angles are necessary due to LAT symmetry)

0 deg
• Center of tower
• Edge of tower
• Crack between towers (may not be useful for higher energies since CAL gaps are large)

30 deg
• Center of tower
• Crack between towers
• Before Thick W layers (~midway through the tower)

55 deg
• Center of tower
• Crack between towers
• Before Thick W layers (~midway through the tower)

70 deg
• TKR trigger (at least)
• CAL Trigger only

Do we want to shoot from the back as well (180 deg)?