Beam Test Plan - SLAC
End Station A
Secondary Beams

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GLAST Collaboration Meeting
Available Beam

Max Primary Beam: 120 pps 48 GeV e-

Power cost + BaBar implies for most of our run a primary beam of:

30 pps 28 GeV e-

A-line momentum selects a secondary beam of:

(target= profile mon + vac flange)

e+ (100%) (1 to ~20 Gev)

(target= Be)

e+(50%), π+(50%), p(.04%), K+(.01%) (1 to ~20 Gev)

Δp/p ~ 1%  Δθ/θ ~ 10^{-4}  spot diam ~1 cm  one pulse~10 ps
The SLAC Test Plan

1 Month:

1) Calibrate the CsI energy response (various positions and angles)
   Mono-energetic photons from the Van de Graaff (17.6 MeV)
   Tagged photons (50 MeV to 1000 MeV) (from 1 and 4 GeV e+)
   Single mono-energetic positrons (1 to 40 GeV),
   Linac pulses containing multiple positrons (eg: 7 x 40 = 280 GeV).

2) Measure the Bremsstrahlung beam $\gamma$ spectrum with the Calibration Unit.
   Externally trigger CU on every beam pulse
   20 GeV positron beam with 3% radiator
   CsI calorimeter (already calibrated) bins the $\gamma$s in $\pm$25% energy bins.
   (eg: 040, 0.60, 0.90, 1.35, 2.03, 3.04, 4.56, 6.83, 1.02, 1.54, 2.31, 3.46, 5.19, 7.78, 11.7, 17.5 GeV)
   Variety of positions and angles
   Compare to GLAST MC (energy spect and PSF) for e+ radiating in radiator.
   Tagger magnet sweeps the <20 GeV positron beam into the dump
   Simultaneously tags a limited range of photons (16-17 GeV).

3) Tag photons at a few different energies (just for backup)
   9 GeV e+ (Differential Brems subtraction) 5-6 GeV tagged $\gamma$
   11 GeV e+ (Tagged g at CU sweet spot) 7-8 GeV tagged $\gamma$
   18 GeV e+ (Differential Brems subtraction) 14-15 GeV tagged $\gamma$

1 Month:

4) 200 K protons (13 GeV) at a variety of positions and angles (~20 K per position)

~50 GLAST collaborators took shifts

SLAC End Station A
e+, γ = 1 month
hadrons= 1 month

194 um pitch SSDs (228 um now)
33 cm x 33 cm trays (38 x 38 now)

This is also the same tower flown in the balloon. BFEM=BTEM
Beam Test ’99 – Apparatus Pictures
The A-line was set to 20 GeV. The mean e+/pulse was varied between 15 to 30.
Fig. 17. PSF at 0° incident angle for 68% containment for three different radiators for 3.5 GeV (squares) and 5 GeV (circles) photons in the data.

Fig. 18. PSF at 0° incident angle for 68% containment radius as a function of the reconstructed energy for both front and back sections of the tracker. Data points have been corrected for the thickness of the radiator in the beam line (see text).
Beamtest ’99 - Particle Identification

0.02 < P < 5 GeV/c  pi, k, p do not work Cherenkov. Tell pi, k, p apart by TOF.
5 < P < 17 GeV/c  k, p do not work Cherenkov. Tell k, p apart by TOF. ← 13.5 GeV/c
17 < P < 33 GeV/c  p do not work Cherenkov.

TOF [nsec] difference wrt electrons for protons (red), kaons (blue), pions (purple)

[ns] wrt elec
Δtof$_{j,3}$
Δtof$_{j,2}$
Δtof$_{j,1}$
points$_{i}$

13.5 GeV/c

.0044 protons/pulse

e+  pion  kaon  proton

[MeV/c] thresholds
Conclusions

1) A SLAC beam test will approximately be a repeat of the 1 Tower Beam Test ’99 except with 2 ½ real flight like towers and electronics.

2) The highest single e+ into the Cal will be ~40 GeV. Energies up to 300 GeV will be multiple e+ per pulse and will have to be compared to a multiple e+ MC.

3) There will still only be 200 K protons (13 GeV/c) after 1 months data.

4) A SLAC run would be ~Oct-Nov, 2006 with setup during Spring+Summer.
<table>
<thead>
<tr>
<th>SLAC</th>
<th>PS (T9)</th>
<th>SPS (H4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Calib with e+</strong></td>
<td>1-40 Gev (100% e+)</td>
<td>1 Gev (70% e)</td>
</tr>
<tr>
<td></td>
<td>-600 Gev (mult e+)</td>
<td>5 Gev (10% e)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15 Gev (0% e)</td>
</tr>
<tr>
<td><strong>Brems γ</strong></td>
<td>.01 - 20 Gev</td>
<td>.01 - ~5 Gev</td>
</tr>
<tr>
<td><strong>Tagged γ</strong></td>
<td>.05 – 20 Gev</td>
<td>.05 - ~20 Gev</td>
</tr>
<tr>
<td><strong>Protons</strong></td>
<td>200 K</td>
<td>~10^8</td>
</tr>
<tr>
<td></td>
<td>30 x .0044= .01 Hz</td>
<td>Can saturate trig</td>
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<tr>
<td></td>
<td>13 Gev/c</td>
<td>→15 Gev/c</td>
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SLAC: Few protons, no high random rate, multi e for high energy
PS+SPS: Beam purity(?), need two experiments to cover energy range