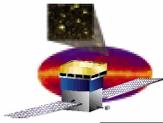


Elements of beam test plan

Benoit Lott
Jan 24 , 2006



Experimental goals

Different areas are to be investigated at CERN:

1. PSF
 2. Effective Area
 3. Energy reconstruction
 4. Backsplash
 5. Hadronic shower
 6. Background rejection
 7. Benchmarking of GEANT4
 8. Characterization of Trigger/Timing...
- + Calibration

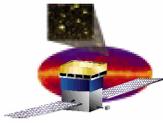
“Tuning” of the Monte-Carlo simulations:

- modeling of physical processes

ex: selection of a model for hadronic interactions
test of the range cut-off parameter (δ electrons)

- description of the detector response

geometry, calibration, non-linearity, limitations in the electronics...



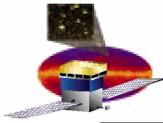
<i>ITEM</i>	<i>Distributions</i>	<i>Beam configuration</i>	<i>Target Precision</i>
TKR cluster sizes	TKR cluster sizes by layer	Positrons (few GeV) and/or tagged gammas (100 MeV, few GeV) at normal incidence and off-axis (~30 degrees)	1%
TKR pulse durations	TOT by layer	Positrons (few GeV) and tagged photons (100 MeV, 1 GeV, 10 GeV) at normal incidence and off-axis (~30 degrees)	5%
CAL nuclear counter effect (direct energy deposition in diodes)	Energy centroid position relative to true particle impact position	Positrons (few GeV or higher) at normal incidence and off axis (~ 30 degrees)	10%
CAL energy topologies	#hit xtals relative to energy centroid and track axis; energy deposition per layer.	Positrons or tagged gammas (100 MeV, few GeV, >10 GeV); side-incident and normal-incident protons	5%
TKR track topologies	Hit distributions at the track vertex; distributions of hits around tracks (inside and outside "roads")	Tagged gammas (100 MeV, few GeV, >10 GeV); at normal incidence and off-axis (~30 deg); protons at normal incidence and off-axis (~30 deg).	1%
TKR-CAL matching	Difference of track projection and CAL energy centroid	Positrons or tagged gammas (100 MeV, few GeV) at normal incidence and off-axis (~30 degrees); side-incident protons	2%
Low energy particle range-outs	Z location of track starts and stops, # tracks, TOT for stubs; fraction of L1Ts produced.	Side-incident protons.	2%
PSF	PSF distribution and 68% and 95% containment values	Tagged gammas (normal incidence and off-axis ~30 degrees)	1%
Systematic photon reconstruction effects (offsets, efficiencies)	Mean reconstructed direction; number of reconstructed photon events compared with tagged rates.	Tagged gammas at 100 MeV and a few GeV, at normal incidence, 5 deg, 30 deg, and 60 deg.	5% on efficiencies
Photon energy reconstruction	Reconstructed energy distributions	Tagged gammas at 100 MeV, normal incidence and at 30 deg, at a few incident positions to explore gaps. Positrons at a few GeV and at >100 GeV effective at normal incidence and at 30 degrees, at a few incident positions to explore gaps.	5%

from
 LAT Beam Test
 Rationale
 (LAT-TD-02152-02)
 S.Ritz, B. Atwood,
 E. do Couto e Silva,
 G. Godfrey

“low-level”
 parameters

“end-to-end”
 parameters

+ backslash, characterization of electronics, tests of G4...



Contributions to precision

- **statistics**

...after cuts! In principle, should not be a factor (but that's theory).

- **uncertainty on the beam characteristics, resolution of the spectrometer**

example: 2.5% energy resolution for the spectrometer at PS;

This is relative to the *electron energy*, not the *tagged gamma-ray* one.

For a 1 GeV electron, this energy resolution translates into

$\sigma = 25/100 = 25\%$ for a 100 MeV gamma-ray in coincidence.

- **uncertainty in calibration**

example: CAL will be **calibrated with MIPS**, then the calibration will be extrapolated to higher ranges (using data in overlapping regions of ADC).

Maintaining a **precision better than of a few %** all the way up to the **10s of GeV** domain is not easy (but feasible).

- **pile-up (i.e. multi-particle events) effects**

At PS, about **10% of the events** will have 2 photons with $E > 50$ MeV, most often seen as one photon with the sum energy. This will create a tail in the PSF distribution in the **high-energy** bin.

- **effect of contamination** (electrons in hadron beam and vice-versa)
distortion of distributions