GLAST LAT Performance Testing

Hartmut F.-W. Sadrozinski 5/8/01

It seems to be clear that it will be hard to have all the performance testing done in the SLAC ESA beam line with the LAT calibration unit, consisting of 4 qualification and flight towers.
The approach taken in the following is to divide up the energy range and the performance to be tested into those which can be done in the SLAC ESA beam line with the LAT towers, and others which can't. In addition, an effort is made to understand if some of the testing can be done with engineering models, either existing or under construction, which would allow to gain some schedule margin.
The following Table 1 shows possible scenarios and incorporates some constraints:

LAT flight or calibration towers will not be moved from SLAC
Beam tests will be done with the calibration unit (4 towers) or engineering models
The entire LAT will be tested with C.R. muons during I&T.

Table 1 Scenario's for GLAST LAT Beam Tests

Test #	Performance Tested	Energy Range	Where	What beam	Which Instrument	When
1	PSF68, PSF95, Aeff, TOT,	100 MeV – 10 GeV	SLAC ESA Tagged or coherent	e^+, γ	4 LAT calibration towers	Before I&T
2	Hadron Rejection	500MeV(?), 13GeV	SLAC ESA	p	4 LAT cal. towers	Before I&T
3	High Energy E correction	50 - 300 GeV	CERN FNAL?	e^+, γ	EM	2002
4	PSF68, PSF95, Aeff,	20 MeV	SLAC VdGraff	γ	BFEM or 1 LAT tower	2002 2003/4
5	Dead Time Trigger, DAQ studies	Few GeV	SLAC Bldg 33	C.R. μ	LAT 1-16 towers	During I&T

Discussion of issues:

1) PSF68 etc at 100 MeV – 10GeV

This is the heart of the testing. Very important to test inter-tower events. SLAC will cover the energy range most important for GLAST science.
Issues: Tagged beam or coherent beam. Might be a question of schedule risk.
Even if tagged beam is chosen, one has to start working on the beam test now: in the analysis of the 1999 beam test data, the tagging energy information was not used. This has to be remedied.

2) Hadron Rejection

Should be done with 4 calibration towers, (best in the 2x2 configuration?). If the hadron rejection is factorized between the ACD efficiency and the rejection achieved by pattern recognition with the rest of the LAT, the number of events using the secondary proton beam seems to be sufficient. One question is if we could get lower energy protons (~1GeV?) in addition to 13GeV.

The goals and desired results of a LAT hadron test should still be investigated. The 1999 BTEM data should be analyzed to optimize the usefulness of a future proton beam test.

3) High Energy Photon and Electron beams E > 50 GeV

This test is to establish the energy correction for longitudinal leakage. Given that the corrections at normal incidence are largest, this could be done with one tower only with moderate angles. The EM model (with a few tracker layers or other active devices to tag the conversion depth) should be adequate.

4) Low energy Aeff and energy resolution E < 100MeV

Here we are interested in issues depending on the depth of the instrument, this time the tracker. A one tower test with moderate angles should be sufficient. (For field of view studies, we might need a 4 tower configuration). For low energy photons, the X-tal Ball Van de Graff could be used (14-17MeV photons). This is instrument is quite well understood by LAT personnel and fairly moveable. One could imagine installing the accelerator in the clean room or close by and using one of the early calibration towers. Another, non-SLAC source of low-energy photons is the FEL, which would mean that one would consider using the BFEM.

5) C.R. Muons

A telescope for C.R. muons will allow many tests during integration. It should allow to tag good tracks, which the LAT has to reconstruct in various conditions of trigger rate and data volume. The efficiency of C.R. reconstruction can be tested during the gradual integration of towers. The advantage of using a C.R. muon telescope during the I&T phase has been discussed in a previous note.