Report from the GTOCC Tel.Con. August 1, 2000.

Attending:

Sandro Brez (for R. Bellazzini), Toby Burnett, Seth Digel, Berrie Giebels, Eduardo do Couto e Silva, Richard Dubois, Jose Hernando, Neil Johnson, Robert Johnson, Steve Ritz, Hartmut Sadrozinski, Peter Michelson

1. Clarification

Peter Michelson corrected some misconception about the scope of this study group.

a. The study is in response to worries in the GLAST SWG that our instrument has been optimized for high energy and might miss an opportunity at low energy (<100MeV).
b. We have proposed an instrument and it has been peer-reviewed and accepted. We believe that our AO proposal essentially is sound and thus our study will confine itself to identifying areas where we can expect improvement. Potentially this will lead to a situation where we have to make a compromise looking at several performance metrics. This is not a de-scope, and will be bound by the SRD. Our design goal of having good PSF and large Aeff at both low and high energy seems to be best attained by having two sections: one with thin converters and one with thick converters. We will continue to pursue this, with identical towers and uniform planes across the tracker.
   A layout proposed by H. Mayer-Hasselwander with a different philisophy was discussed briefly and rejected based on the ground rules given and considerations of logistic problems with non-identical towers.

2. AO Layout

The AO layout of the TKR has 2 sections:

FRONT with 12 layers with 2.5% convertors
BACK with 4 layers with 25% converters
We have 2 additional layers for trigger purposes.
(N.B. Every tray adds about 1.3% RL
due to Si sensors, face sheets and hexel core)

3. Issues

The following issues with the GLAST AO TKR Layout were agreed to:

b. Gamma's converting in the front-section, which is optimized for low-energy response, have to traverse the 1.0 RL back section. This leads to systematic uncertainty in the low energy response (<200MeV): i.e. trigger efficiency, track reconstruction, CR rejection, energy determination.

b. The back section with 25%RL converters requires special engineering care due to the CTE mismatch of the thick converters made from lead/tungsten and the silicon detectors. There is no show stopper, and should not drive the tracker layout, but considerable engineering resources will be needed to design the trays with thick converters. The present solution for the trays with thick converters has Tungsten as converters instead of lead, with a projected mass penalty of about 6%(TBR).

c. The BTEM data will most likely not cover the low end of the spectrum reliably. Initial information indicates that the tagger has a very poor energy resolution at low photon energies. Thus we still have to rely on MC simulations to understand the TKR response. The response of the BTEM back section at >100MeV is an important input to the final decision on the tracker layout, and has to be pursued vigorously.

d. There was an unspecific plea to simplify the event topology by reducing the amount of converter in the tracker. It was perceived that the on-board computing would be easier with thinner converters.

4. Plan of Work

a. Analyze the AO layout for low energy response with special attention to a subset of photons converting in the last layers. This is mostly calorimeter work, and N. Johnson, B. Giebels and Co will work on this. The performance metrics of the TKR should be reestablished at lower energy.

b. Select a variant of the AO layout and do a full reconstruction and compare with AO layout. In order to find out if we are in a minimum with the AO layout, it was proposed to distribute the material more evenly.

EL (for "Even layout") layout
12 x-y layers with 3.5% converters (up from 2.5%)
4 x-y layers with 12% radiators (down from 25%)
2 x-y layers without converters.

A variant to the EL layout was advanced, and could be tried after we find that the EL layout gives encouraging results. Potentially we might get better resolution at high energy due to the longer lever arm, and have also an "optimized" low energy section. The field of view might be slightly compromised.

ELP ("EL prime") Layout
10 x-y layers with 3.5% converters
4 x-y layers with 12% converters
2 x-y layers with 3.5% converters
2 x-y layers without converters.

We will not attempt to redo the C.R. rejection, assuming that we will increase the material in the active volume.

c. MC Simulation:
(Toby Burnett in Charge)
It was agreed to base the study on the AO GLASTsim program. All runs will be submitted through T. Burnett or his designate. Remember to scale down the effective area by about 10% due to layout changes in the silicon detectors (from 9.5cm^2 to 8.95cm^2). The AO proposal numbers have already part of this scaling performed (6%). We agreed to leave the pitch the same (208um). For a final evaluation of the performance of a design proposal, we will adjusted the

dimension to the actual values. We decided to adjust the energy cut-off in the tracker from 500keV to 100keV (TBR at the request of E. de Couto e Silva). The MC runs can start essentially now and will be validated with "Merit" runs. T. Burnett, R. Dubois, N. Johnson and J. Hernando will review the variables in IRF files and make sure that the MC simulations can be used to get reliable energy corrections.

Parameters for simulation runs:

Angles: 5 deg, 35, 50deg, 60deg (TBR, suggestion by S. Digel).
Energies 20,30,50,100,200MeV, 1GeV, 10GeV, 100GeV
Also 1/E^2 spectrum >20MeV, all angles

d. Science Simulation
S. Digel will do evaluation of new layout(s) using the figures of merit used in his and Jay's note from May 2000. He will send around the URL for the study. We are interested in SNR below 100MeV, and the galactic diffuse (T. Burnett and S. Ritz) including the "pion bump" a la Hunter et al (1997).
P. Michelson and S. Digel should give some guidance as what effective area, PSF and energy resolution is needed at what energy for GLAST LAT low energy science (<200MeV). Note that at 20MeV, the expected 68% containment angle PSF68 is of the order 15deg.

e. Reconstruction, Performance numbers
J. Hernando will lead the tracker effort, with help from M. Hirayama (part time) and students. Interference with the BTEM analysis was noted and has to be resolved carefully.
Neil Johnson will coordinate the calorimeter analysis, mainly investigating corrections to the energy measurement, using among others tracker information. This work will start also right now.

f. Trigger, Calorimeter only Photons etc
It was not clear how relevant this is to the study. The idea of triggering only on 2 in a row reduces our noise occupancy margin. The potential use of a trigger with mixed input from tracker and calorimeter was frowned upon.
Calorimeter-only- trigger have much less importance at larger angles than at normal incidence.

Next Tel Meeting:
Monday, August 21, possibly at 8am PDT, depending on European partners.

Agenda

Review of response for photons in last thick layer of AO layout:
Energy resolution, PSF68, effective area
Results from the EL layout

Glimpse at the ELP layout (?).