CAL M&S Team Status

May 15, 2015

K. Yoshida on behalf of the M&S Team

CAL Simulation

- A summary (an Excel file under caletgs2:~yosui/Dist) of the benchmark simulation data sets will be updated in the near future (Y.Akaike).

- Brian Rauch (WashU) has completed a large suite of UHE CR runs using Cosmos7.645/Epics7.165 and CALET CAD model Rev21.

- FLUKA, Epics, G4 simulation benchmarks. Normal incidence protons and electrons at 10, 100, 1000, 10000 GeV/n. Comparison of TASC and IMC response. (C.Checchia, L. Pacini)

- Further validation and debug of CALET CAD model implemented in G4 simulation. (L. Pacini & N. Mori)

Instrument Performance: Particle Identification

- Application of data mining techniques (Mahalanobis-Taguchi method, Boosted Decision Tree) for e/p separation is ongoing (K.Yoshida).

- Aaron Worley continues development of MVA-based e/p separation studies. An initial result: a proton rejection of ~5×10^3 - 10^4 with electron energy 1 GeV - 1 TeV against proton energy 1 TeV - 10 TeV.

- About 1.2×10^6 protons have been generated with Epics 9.165 in the energy range 1-100 TeV with E^{-1} spectrum, and within the CALET acceptance. Analyses based on consecutive selection cuts and Boosted Decision Trees, respectively, are ongoing. Comparison between FLUKA and Epics results will be presented at the TIM (F. Palma)

Status of e/p separation studies based on Epics using LSU HPC data (John Krizmanic)

CALET Epics Configuration:
- Epics9.161, Cosmos7.644, CALET CAD Model Rev 15.
- Dpmjet3 hadronic interaction model.
- Events thrown over partial sphere up to 110° zenith angle.
- All thrown events recorded, no pre-selection. Allows for complete data set.
- Events generated in decades of energy, E^{-1} spectra.

Energy Bin	Protons Thrown	Electrons Thrown	Analyzed here
10 – 100 GeV	6.1e6	4e6	
100 – 1000 GeV	43.0e6	4e6	p 7e6; e 0.5e6
1 – 10 TeV	43.0e6	4e6	p 6e6; e 0.5e6
10 – 30 TeV		1e6	
10 – 100 TeV	27.9e6		
100 – 1000 TeV	0.6e6		

Event selection: as a starting point, use Paolo's selection criteria he used for the FLUKA-based analysis he presented at the last CALET TIM.

Instrument Performance: Particle tracking

- Gamma-ray tracking procedure with background particle rejection has been investigated (T.Niita, Y.Akaike).

- Improvement of the proton tracking efficiency (<80%) in the high energy region above 10 TeV is under study (M.Ichimura).

- Amir Javaid (LSU) continues the development of a particle tracking algorithm for CALET based upon 'kriging'.

- Development of algorithms based on IMC for particle tracking, search for the first interaction point of nuclei, and charge identification by multiple dE/dx measurements. (P. Brogi, P. Maestro)

Observation Performance I

- Point Spread Function for gamma-ray observations are under investigation (T.Niita, Y.Akaike).

- A conversion program from CALET Level-2 format to FITS format will be developed after the agreement of the Level-2 format (M.Mori).

- Nick Cannady (LSU) has constructed CALET exposure maps based upon years worth of CALET data using Fermi diffuse and point-source gamma-ray models. Nick and Alex Moiseev (GSFC) have been discussing the specifics of using Fermi models in CALET analysis.

Observation Performance II

- Theoretical study of electron+positron and gamma-ray observations from Kaluza-Klein dark matter is ongoing (M.Mori, work with S.Tsuchida).

- Estimation of Solar modulation (11yr period) of cosmic-ray proton is under study (S.Miyake).

- Study of sidereal anisotropy and count rate estimation is ongoing (K.Munakata).

- Brian Rauch (WashU) continues to model the heavy nuclei energy spectra that CALET will measures with its full acceptance geometry for the geomagnetic rigidities seen on the ISS orbit.

Other Items

- An on-orbit calibration method by using protons and heliums has been developed by T.Niita.

  ➢ Presenting data analysis depending on Geomagnetic latitude

- CALET on-orbit Calibration Studies: Amir Javaid (LSU) presented the results of his study at the 2015 APS April meeting. Currently he is working on understanding differences between his analysis with the results of the Japanese calibration analysis.

- Development of sw tools to analyze CAL & COM volumes of 1-day long L1 simulated data recently distributed by Asaoka-san. (N. Mori, P.Maestro)

- Calibration of TASC with electron beam test data and comparison with simulation is going to be finalized for ICRC poster. Study of TASC response with ion beam data is underway. (G. Bigongiari)