Planning for DC2:
Pointing/livetime history
Background sources

Toby Burnett

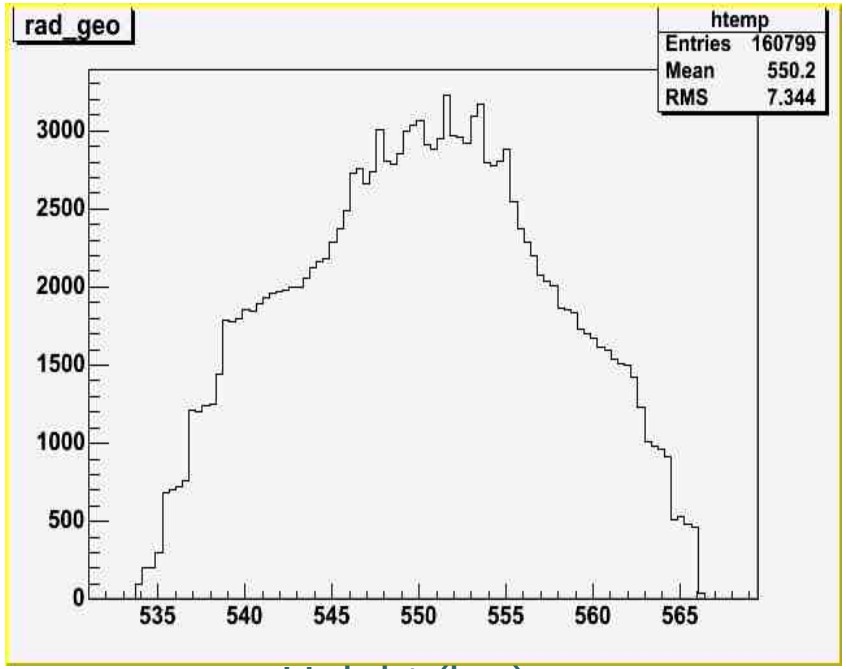
Processing phases for DC2

- Create pointing history ✓
- Generate “incoming particles”
  - Background: sample from triggers passing filter
  - Signal: diffuse+AGN+GRB+pulsars+… ✓
- Generate digis and FT2 pointing/livetime history
  - This is also needed for flight software validation
- Reconstruct tracks, filter to create FT1 photon list

The new pointing file

Generated by Julie using Stoneking code

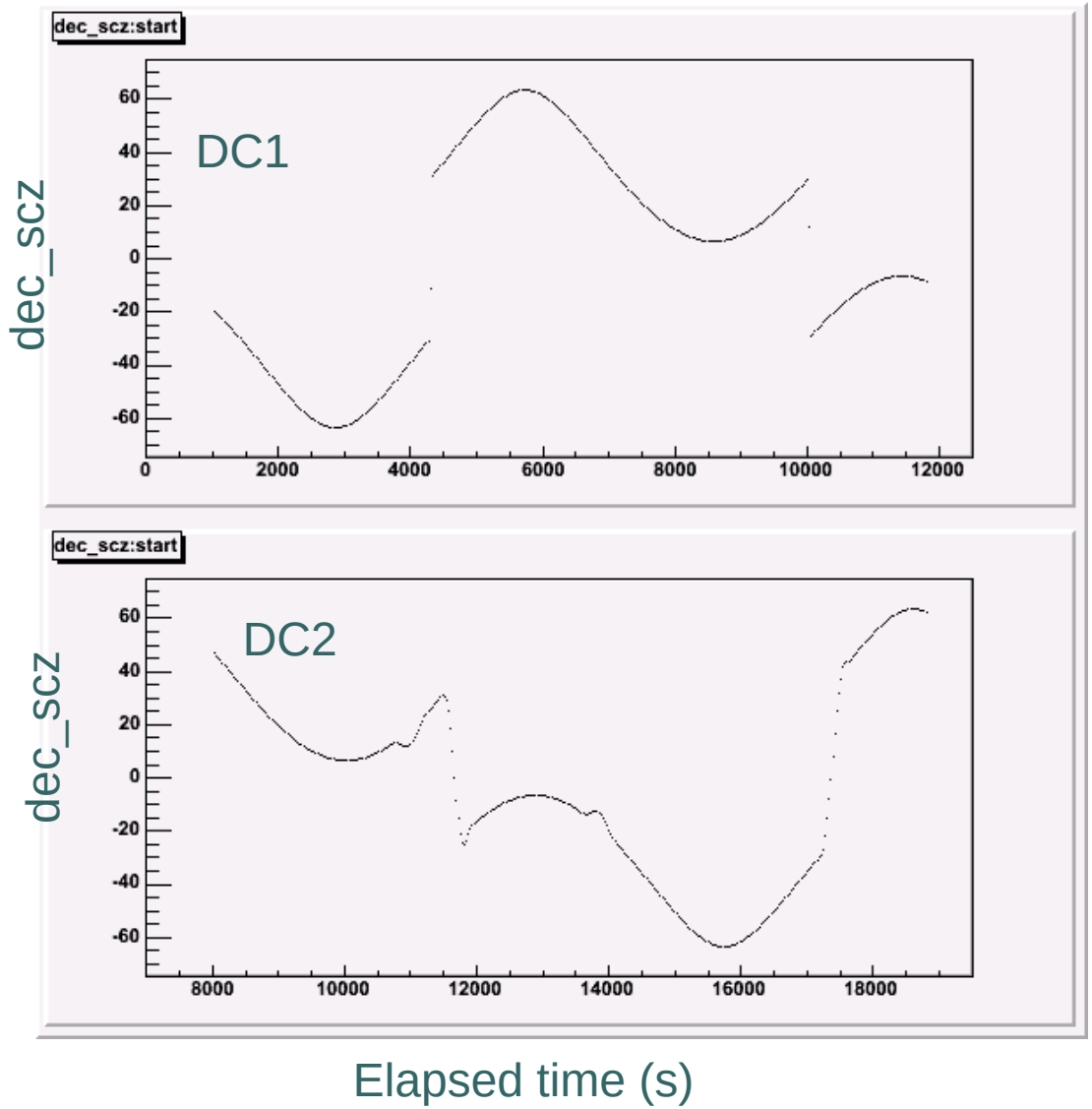
- launch 01-may-07 00:00 UT.
- 161041 entries from 7000 to 4838400 s, 30s intervals (56 days)
- Issue with height: column is not valid, see value computed from orbit, Earth shape



Slewing

Improvements:

- Realistic slewing rate
- Sun avoidance



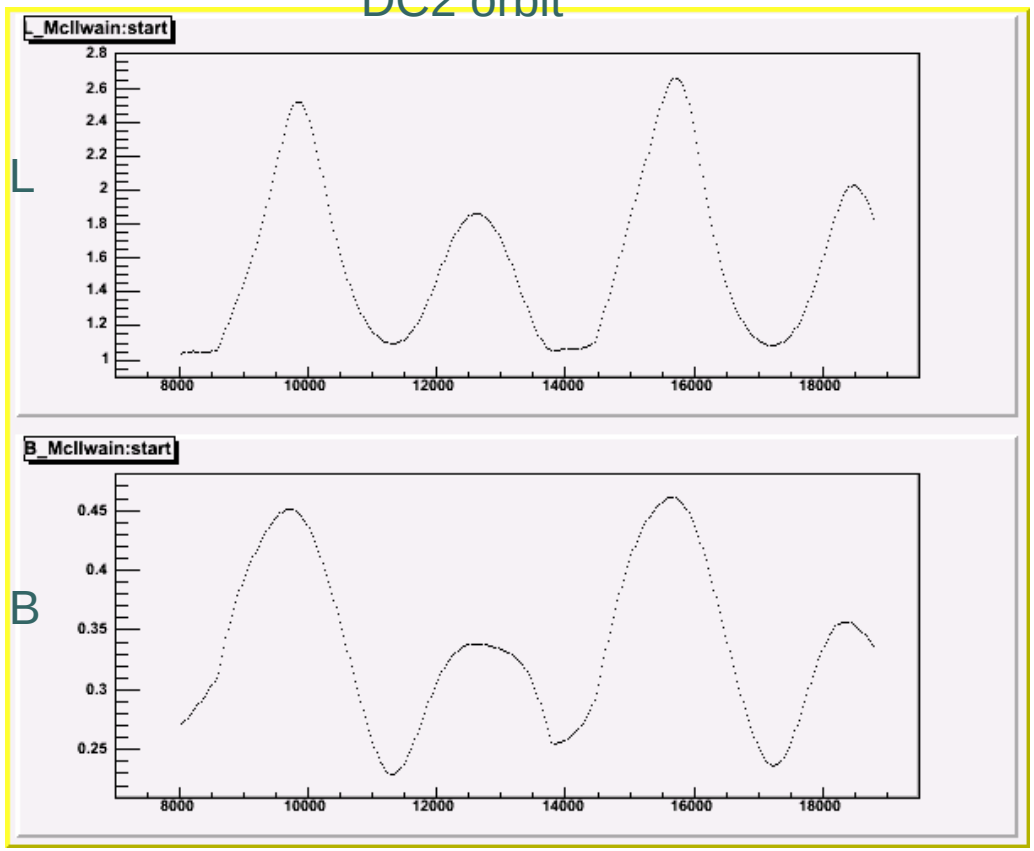
Code support for history, exposure

- Gleam/basicOptions.txt
  - Create a *branch* for ticking Clock particles with ExposureAlg
- FluxSvc/FluxAlg:
  - Detect Clocks, send them to the other branch
  - Add S/C pointing info for current particle (Ptxxx) to a ROOT tree, default “MeritTuple”.
- FluxSvc/ExposureAlg
  - Add S/C pointing info to “pointing_history” ROOT tree for each clock tick. (FT2 format)

Earth environment info, from Pat Nolan

- astro/EarthCoordinate:
  - S/C height, calculated using Earth oblateness
  - Geomagnetic quantities B, L, geo_lat, geo_lon. [from table assembled by Pat Nolan]
- astro/GPS:
  - Singleton that maintains S/C position, attitude info, current time
  - Now use EarthCoordinate object to return above

DC2 orbit



Elapsed time

Background particle flux, from T. Mizuno et al. **astro-ph/0406684**

Cosmic-Ray Background Flux Model based on a Gamma-Ray Large-Area Space Telescope Balloon Flight Engineering Model

Authors: T. Mizuno, T. Kamae, G. Godfrey, T. Handa, D. J. Thompson, D. Lauben, Y. Fukazawa, M. Ozaki

Astrophys.J. 614 (2004) 1113-1123

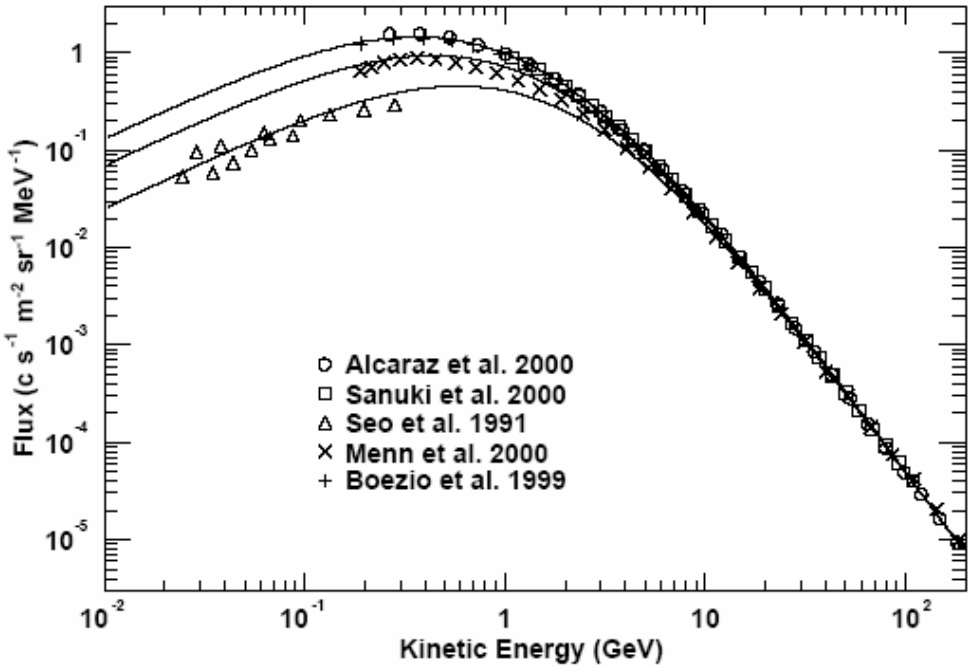
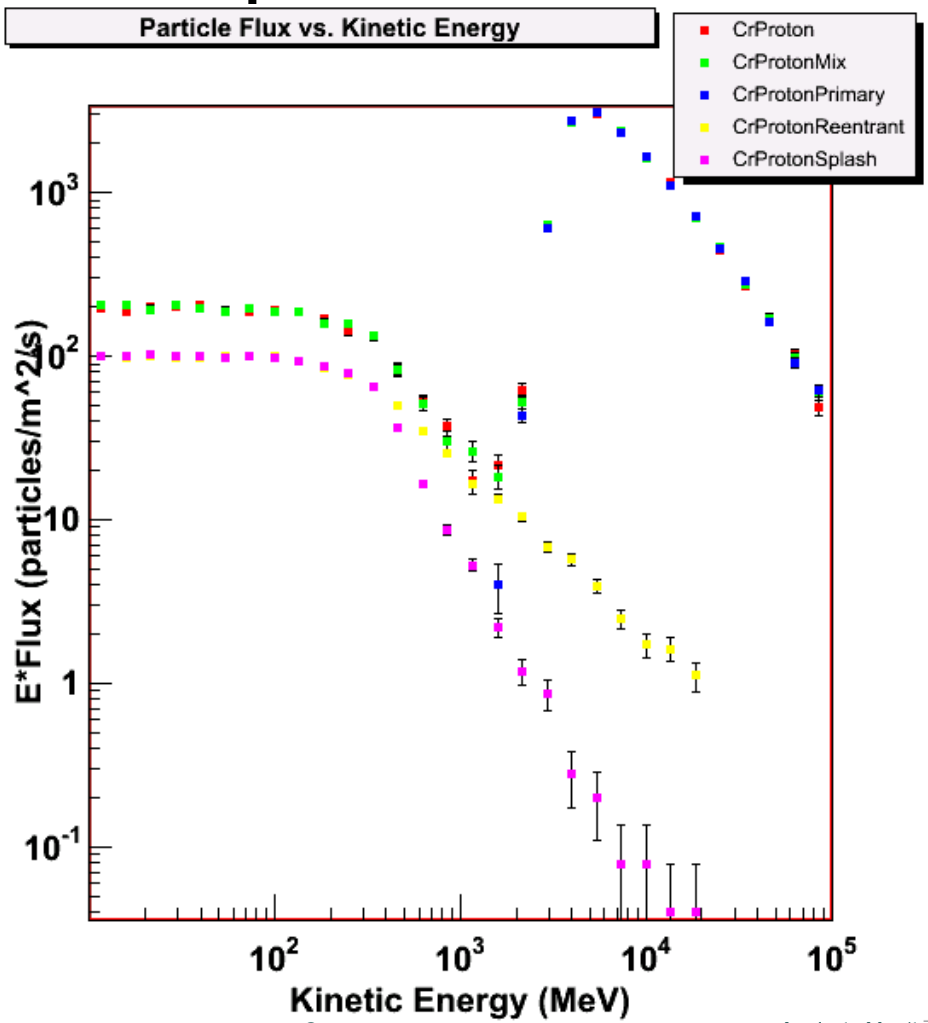


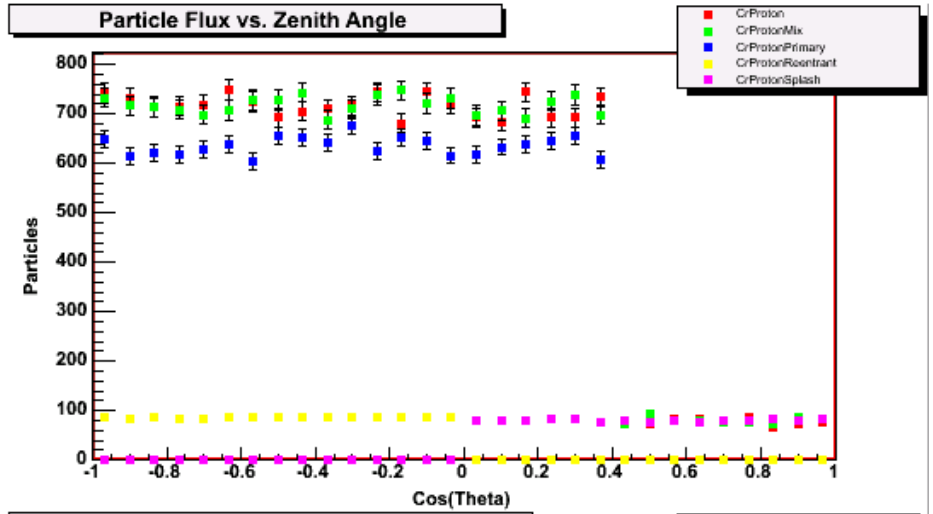
Fig. 2.— A compilation of measured primary proton spectra in high geomagnetic latitude region. Three lines are our model functions (equation 2) with ϕ=650 MV (upper line), 800 MV (middle line), and 1100 MV(lower line).

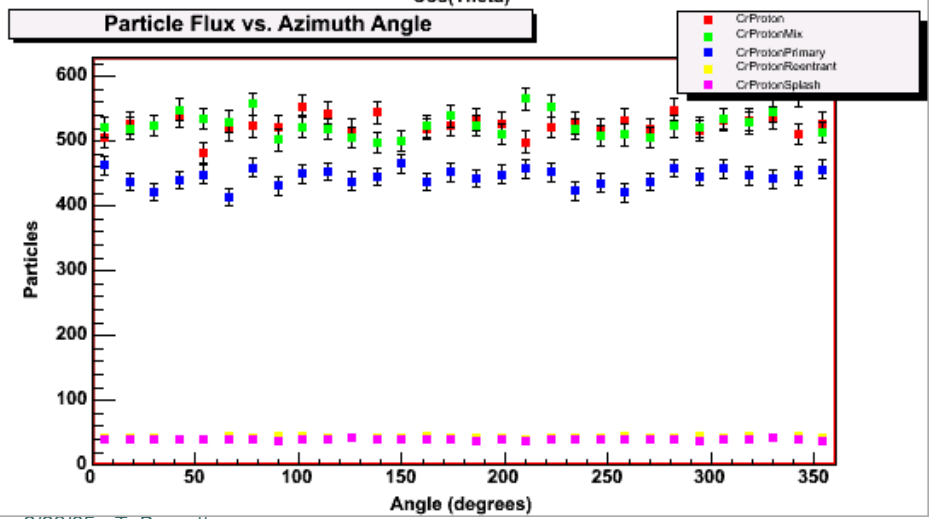
The package *CRflux*

- Written by T. Mizuno, based on Geant4 "particle gun" used in balloon simulations. Defines fluxes for:
  - Protons, incident and albedo
  - He nucleii
  - Gammas
  - Electrons and positrons
- No E-W effect, angular dependence of secondaries
- Extended to be compatible with Gleam flux model, accept external determination of S/C location, and altitude (instead of above Palestine, TX)
- Never actually used in Gleam, no real tests
- Recently updated to GLAST standards with (some) doxygenization

CRflux: rootplots





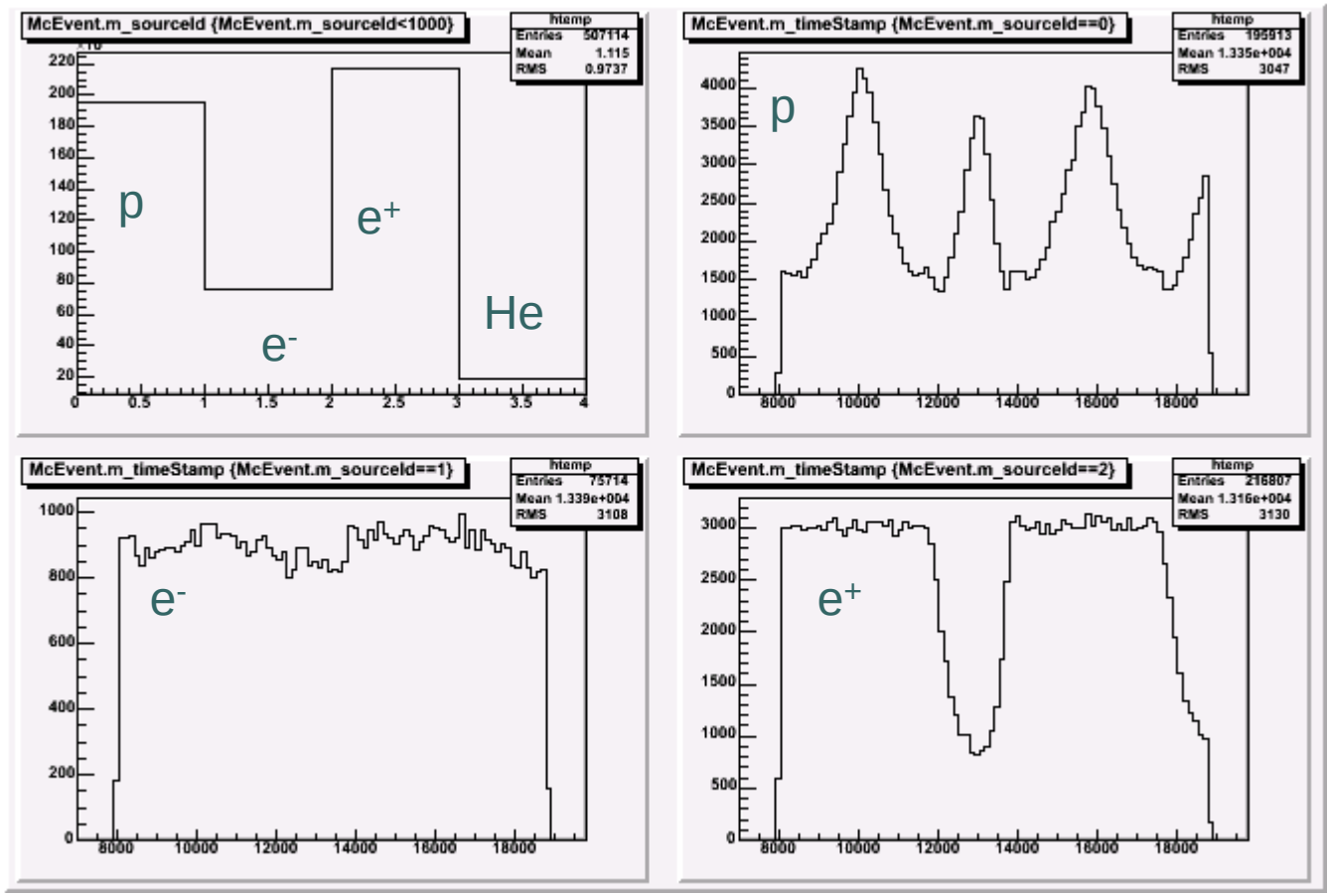


Technique to measure rates

- Set up job to generate incoming particles, using DC2 pointing history.
- Set cross sectional area to 0.006 m^2 so rates are 1/1000 of nominal.
- Define background flux candidate
  - CrTotalMix = proton+electron+positron+He from CRflux
    - Note: don't use gammas since flux is down to 1 MeV, rate much too high
  - albedo_gamma_total (from PDR: Dirk's is not ready)
- Create root files with history and mcRoot
  - Rates are just histograms of event id's.
- Result, for 10800 s (2 orbits)

Source	counts
proton	112551
electron	75325
positron	198007
alpha	10657
gamma	396540

CRflux rates



Elapsed time

Status: very incomplete

- Need reality check for rates, rigidity dependence
  - This is *not* the same code that was used to generate the plots in Mizuno et al.
  - Compare with PDR fluxes
- There is no E-W effect built in for the primary cutoff. (Igor V. has a better model)
- No angular dependence of secondary fluxes (not measured by AMS)
- Dirk's much better gamma model has to be validated and inserted
- The livetime "hook" needs to be added so that when a DC2 entry is created, the accumulated dead time can be subtracted from the live time.