Data Challenge II


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Steering Committee

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Data Challenges

- A series of end-to-end studies:
  - Produce 1 day; one month; three months of simulated LAT data, release this to the collaboration for science analysis.

- Drives instrument performance studies, exercises detector simulation software.

- Science input – include in the simulation science/astrophysical features we expect to see in the GLAST gamma-ray sky, verify that the analysis tools can find them.

- Tests data servers, user level documentation and more...

- DC1. Modest goals. 1 simulated day.
- DC2, start beginning of CY06. More ambitious goals. Encourage further development, based on lessons from DC1. One simulated month.
- DC3, in CY07. Support for flight science production.
DC Components

- Focal point for many threads
  - Orbit, rocking, pointing history
  - Plausible model of the sky
  - Event Reconstruction
  - Background rejection and event selection
  - Instrument Response Functions
  - Data formats for input to high level tools
  - First look at major science tools – Likelihood, Observation Simulator
  - Generation of datasets
  - Populate and exercise data servers at GSSC & SLAC
  - Code distribution on windows and linux

- Involve new users from across the collaboration

Teamwork!
The road to updated instrument performance analysis – lots of work and progress by lots of people!

Coordinated by the Calibration and analysis group.

• Updated detector simulation to a more realistic detector: dead strips, variable cal gains and thresholds etc.
• Revamped (and improved!) tracker and calorimeter reconstruction software
• Updated background model
• Adopted more realistic orbit and attitude profile
• Updated SAA definition integrated into software
Simulation and Event Reconstruction - 2

- Generate a sequence of successively larger datasets.
  - Iteratively find bugs, refine analysis etc.
  - Generate 100 M background events Aug 31, Sept 8
  - Generate 1B background events Sept 22
  - Final background rejection and event classification analysis complete by Nov 15.
  - Nov 15: Start generating DC2 data: 30 days of a gamma-ray sky + 1B background events.
    - Sample from the residual (i.e. post analysis cuts) background event to create one months worth of residual background.
- Taken a first look at DC2 era performance using these data.
- Started studies of IRF parameterisation.
The Simulated DC1 Sky

Extragalactic diffuse

Galactic diffuse

Fiddling 3C273/279

EGRET 3EG

Our Sky

Julie McEnery
• Taking a step into the unknown!
• One month of LAT data will provide the deepest image of GeV sky ever seen.
• Science model of the sky needs to be more detailed (and imaginative) than for DC1
What is new?

- Sky model needs to be (and will be) much more detailed than the model used for DC1.
  - Greater range of source classes.
  - More detailed models of source behaviour (variable AGN, periodic pulsars...).
  - Refined luminosity distributions and source locations.
  - Updated diffuse Galactic emission model.
  - Possible hardware failures/glitches (i.e. you cannot assume a perfect detector).
  - More detailed orbit/attitude profile and include effect of SAA.
- With a richer sky model, and more mature science tools we anticipate that there will be many detailed and innovative analyses of the DC2 data – there will be lots to discover.
  - Some of this is explicitly listed as a DC2 goal – eg producing a catalog, making AGN lightcurves.
  - Analyses could include additional variability analysis, periodicity analyses, studies of source localisation and studies of extended sources and more.
New Key Source Property - Variability

**Pulsars** (Razzano, Harding)

Vela phase as observed by EGRET (Kanbach et al. 1994)

**Active Galaxies** (Chiang, Tosti)

Input to simulation

Vela phase obtained from simulated LAT data

**Dayscale AGN flare**

**LAT simulation**

**New Key Source Property**
Gamma-Ray Bursts – include GBM

Omodei, Band

Joint spectral fit using xspec

BGO

NaI(6)

LAT
Updated Galactic Diffuse Model

- Maps produced using GALPROP can be used by the GLAST simulation code.
- Some artifacts are present in early iterations, the models are being improved and refined.
Science Tools

• Science Tools
  – Continue to improve and be refined.
  – Tested and exercised (along with elements of the sky model) in a series of “checkouts”.
  – These tools are all part of the Standard Analysis Environment (SAE). You may find it necessary to develop additional analysis software.
Upcoming Events

- Extended/Open science tools checkout starting at the beginning of September.
  - Not technically part of DC2.
  - Opportunity for people to be come acquainted with the science tools, help test the sky-model and provide feedback on the data servers and documentation (more later)
- DC2: kickoff meeting in January followed by a closeout meeting 2-3 months later.
  - Large(ish) meeting to encourage maximum collaboration participation in DC2.
  - Unveil final sky simulation data.
  - Describe instrument performance
  - Describe science tools and how to use them.
  - (at closeout) discuss results and lessons learned.
Extended Science Tools Checkout

- Generate at least a month of data using the observation simulator (gammas only, no need for updated response functions).
- Use a sky model to the highest level of detail that we know.
  - Except that the source locations might not be realistic (this will be a lot of work to implement well, so it is best to avoid duplicating it).
- The answers (i.e. MC truth) will be provided at the start so that users can verify that the source properties are simulated correctly and the analysis working correctly.
- The data will be served from the GSSC data server.
- Tutorials on how to use the tools and access the data will be held tomorrow.
Mailing list and webpage


- A new mailing list has been set up for DC2 related communications. Please sign up to the DC2 mailing list for updates and announcements.
High Level DC2 Schedule

- DC2 kickoff mid-Jan (TBD)
- Test, ingest into data servers*, Test (~21 days)
- Catalog/quicklook analysis
- IRF visualisation sensitivity estimator
- Science Tools*
- IRFs (finish Dec 15)

**Documentation**

- Generate Sky Data, SC data interleave bkg, root->fits (~21 days)
- Dec 5

**Sky Model*\, Orbit, SAA*\,**

- Nov 15 Instrument performance analysis complete
- develop background interleave method

- Gen big (1B) bkg dataset (start Sept 22)
- Gen 10% bkg/allgamma dataset (start Sept 8)
- Gen 10% bkg/allgamma dataset (start Aug 18)

**Recon improvements Cal TDS rewrite etc.**

**Onboard filter**

**Background model**

Preliminary background rejection etc is anticipated to be ready by mid/end of Sept. This will allow work on IRFs and background interleave to begin in earnest.
Summary

• Preparations for the second data challenge are progressing well.
• Many aspects of the preparations are being worked on in parallel by many people.
• Current focus is generating the large datasets needed for the next round of instrument performance studies.
• Please join the DC2 mailing list (http://www-glast.stanford.edu/cgi-prot/maillist.pl)
• On track for kickoff (release of the final “blind” dataset) in late January 2006.