

Proposed Modifications to Monte Carlo Output

(Motivated by wish list presented by Bill Atwood to C&A Group)

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Bill's Wish List

- Record the x,y,z location where the incoming trajectory hits the LAT (first surface)
- Compute `AcdActiveDist3D` for incoming trajectory
 - Eric Charles currently does this by projecting from the information in the incoming `McParticle`
 - But: does not account for any processes before ACD
- Compute the ratio of hits in the tracker that were caused by positrons, electrons or gammas to all hits in the tracker
 - M_e : number TKR clusters which "belong" to track in question

Proposed Solution:

McTrajectory's and Relational Tables

- McTrajectory records each G4 step of particle from its creation to destruction
 - e.g. Will give exact position at entry to LAT
 - Exists already: if running Simulation, McTrajectory used to draw particle track through LAT in Fred display
 - Not saved to PDS: if read back then event display from McParticle start/end points
- Relational Tables
 - Tie all the pieces together
 - McParticles to McTrajectory's
 - McTrajectory points to McPositionHits or McIntegratingHits

Proposed Modifications I

- McTrajectory for each McParticle
 - Store to PDS
 - Means fewer McTrajectory's if pruning!
- More information in McTrajectory
 - Energy at each point
 - Volume identifier at each point
- Relational Tables
 - Update to version in TkrRecon (fixes some issues due to singly linked list, does not need to be a "DataObject")
 - McTrajectory points to McPositionHits/McIntegratingHits, McParticles to McTrajectory's, etc.
 - Ultimately, for example, to Tkr Clusters
 - Write Relational Table info to PDS

Proposed Modifications II

- Pruning schemes:
 - "Minimal" (default mode)
 - Keep incoming particle and its immediate daughters
 - For Gammas, this is the primary electron-positron pair
 - For charged particles, include an energy cutoff to save only energetic daughters (since, for some particles, there can be many)
 - "N Generations"
 - Keep up to n generations of daughters of the incoming particle
 - Charged particles with energy cutoff
 - "Unlimited"
 - Well, up to a maximum number of particles/trajectories to keep from crashing Gleam!

Proposed Modifications III

- FRED Event Display:
 - Using relational tables, draw McPositionHits and McIntegratingHits as children of McTrajectory that created them
 - McPositionHits/McIntegratingHits that are "orphans" (because pruning schemes kill their associated McParticles/McTrajectory's) drawn in "standard" fashion
- Finally, fix a memory leak
 - We currently don't clean up the G4 trajectories at the end of an event...

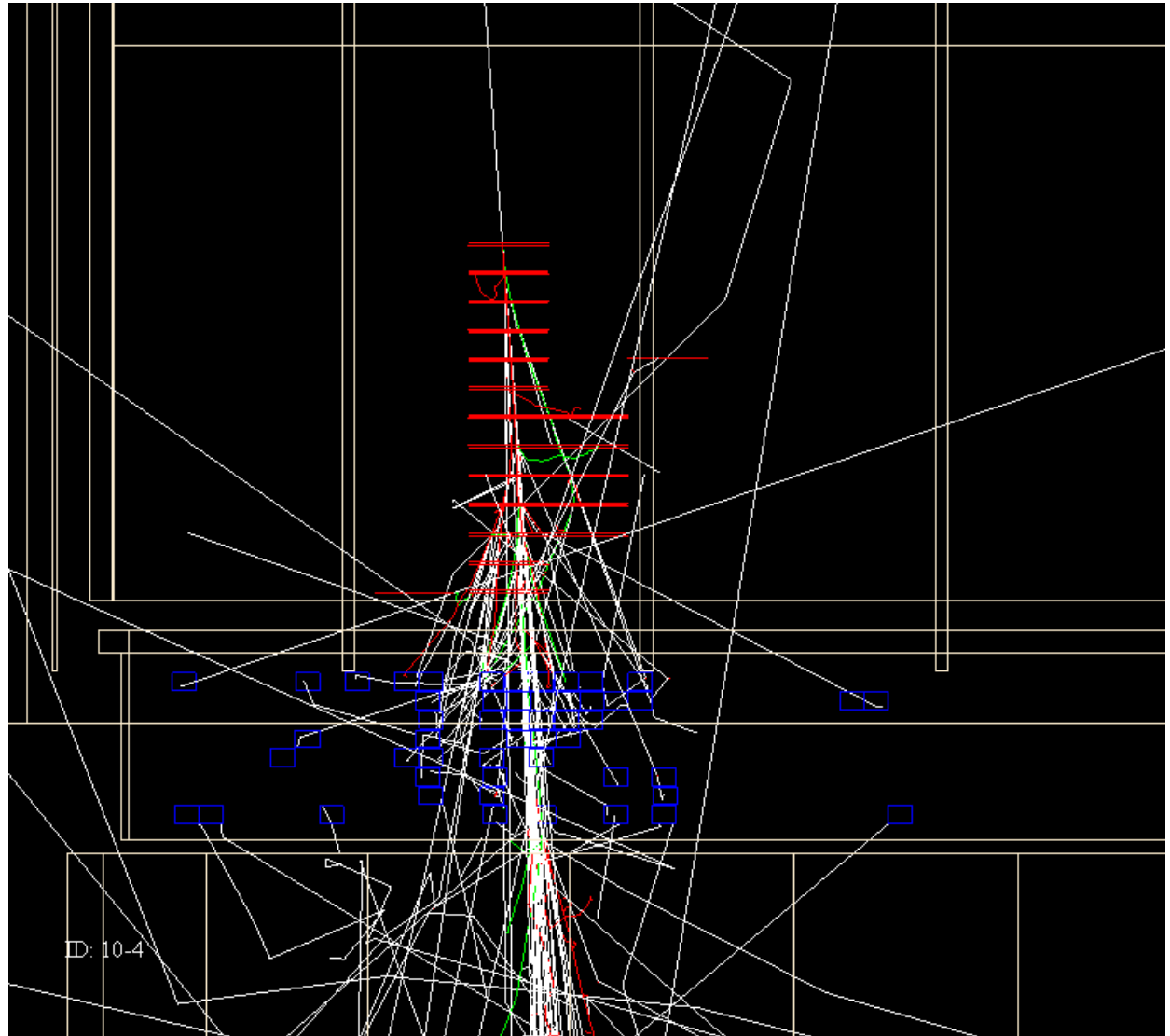
Just One Small Problem...

- Writing McTrajectory's and relational table info will:
 - Increase the disk space needed for the AllGamma datasets...
 - Hopefully offset by the decrease in disk space needed for background events (if we apply a low energy cutoff to the pruning scheme...)
- Need to output to disk to preserve the "reproduce ntuple from PDS" edict
- Will provide estimate when Root IO part done

Examples

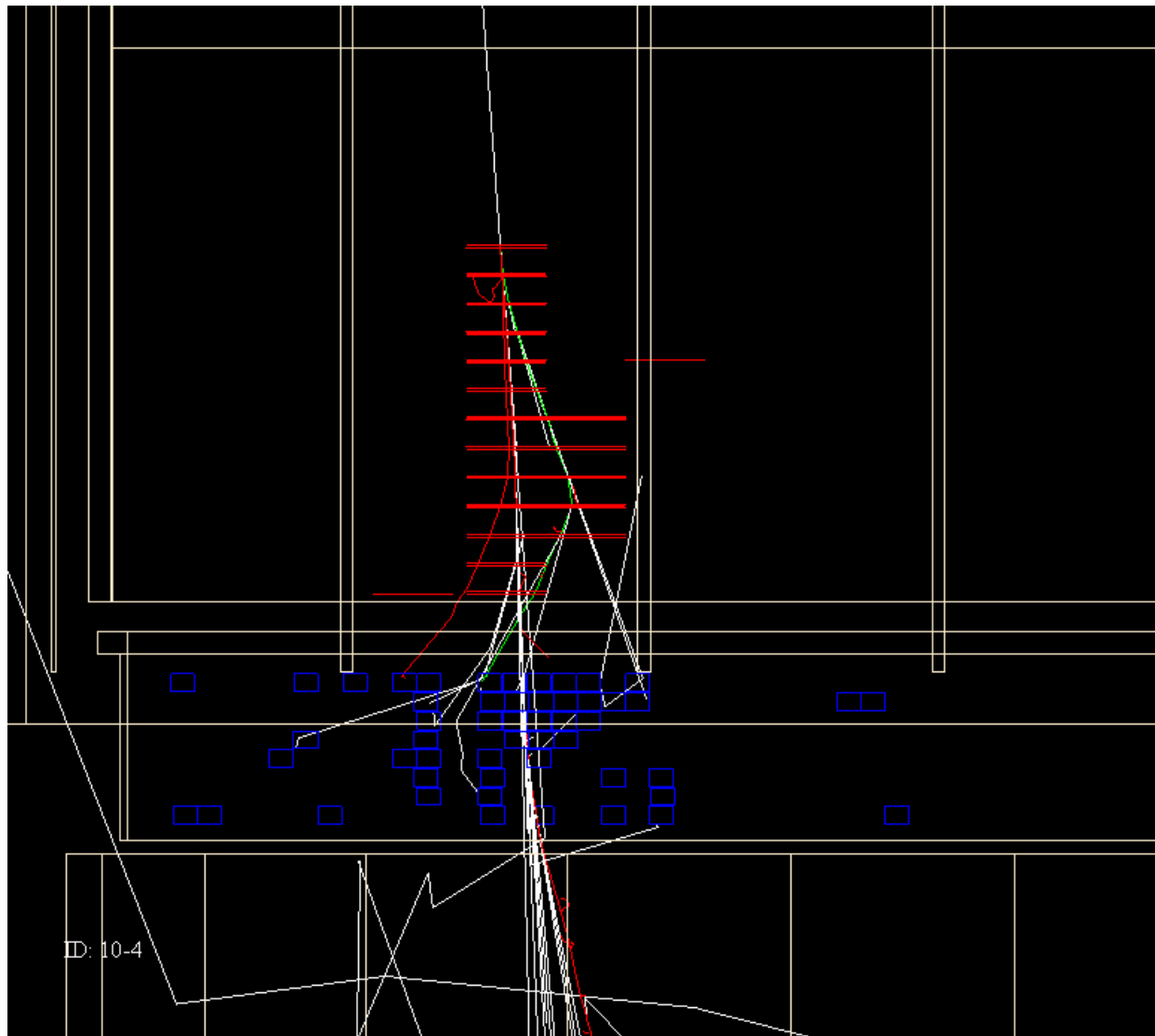
"Full Tree" mode:
displays all
McParticle/McTrajectory's
in event (up to some
very very large cutoff).

For display, this is the
"standard" mode when
running Fred with
simulation, though we
don't currently keep all
(any) of the
McTrajectory's



Examples

"N Generations" mode: In this display we are keeping 3 generations of McParticle/McTrajectory's in the event. A bit more detail for viewing but still too much stuff for output to PDS in production running.

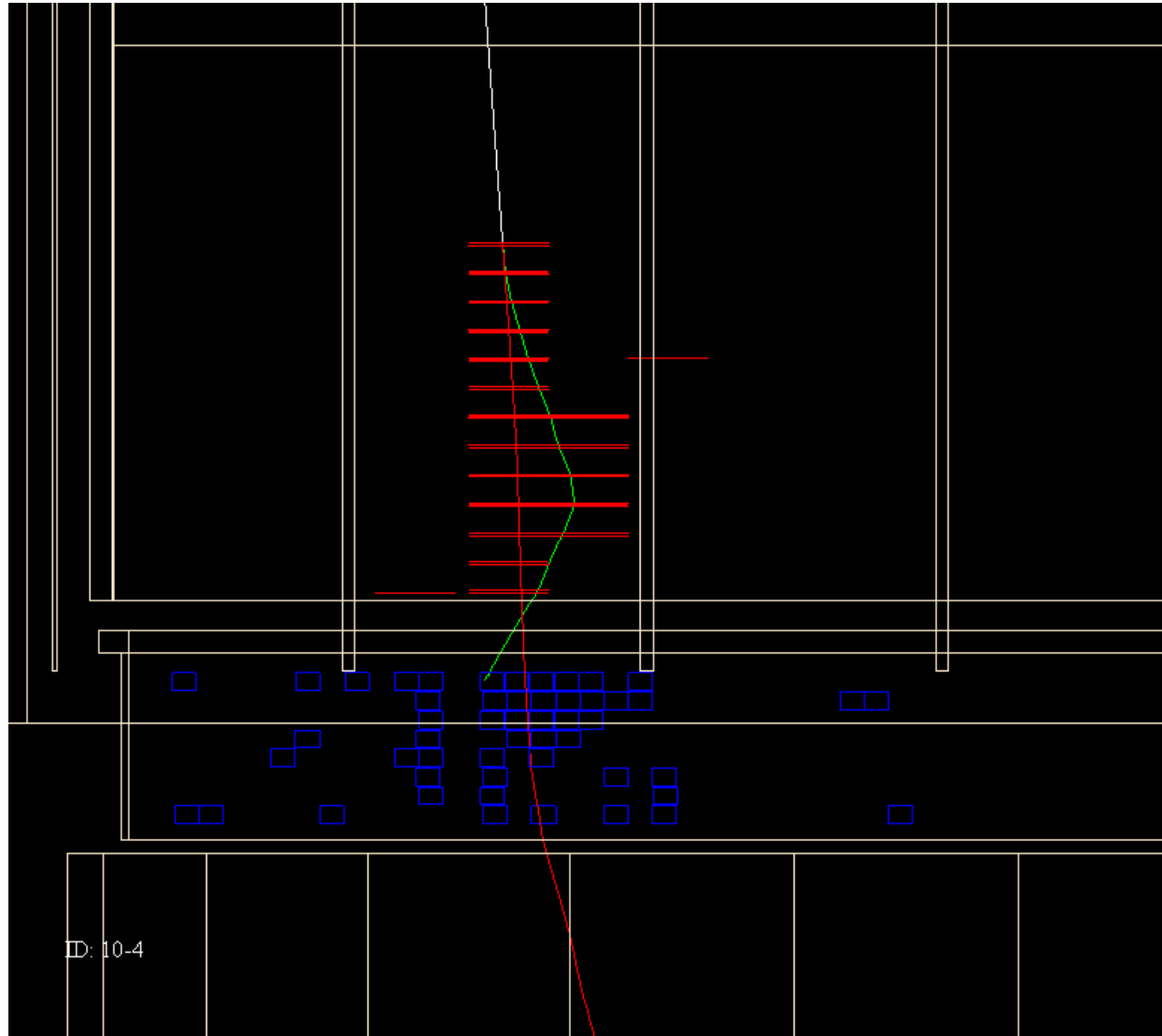


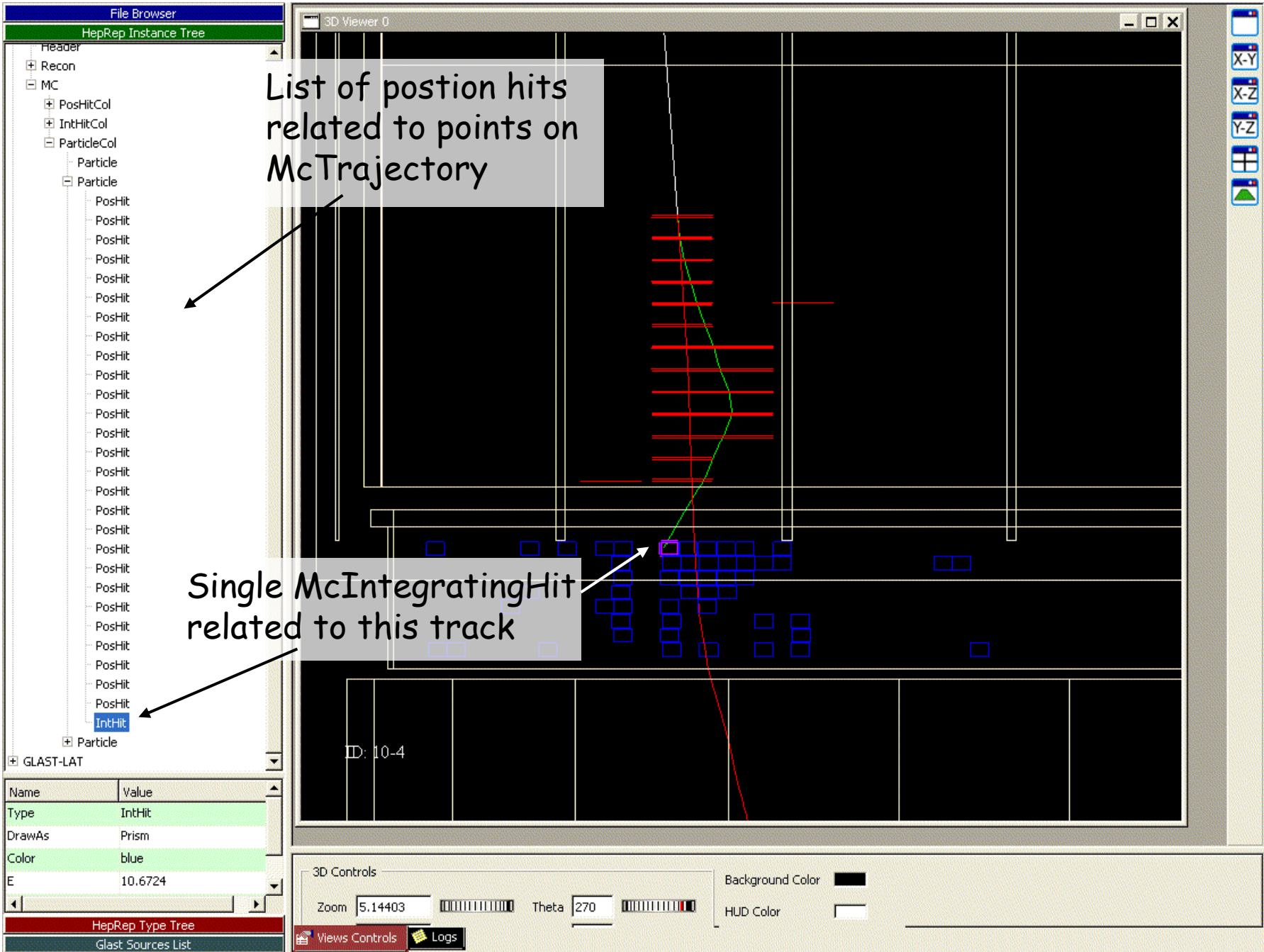
Examples

“Minimal” mode: This mode keeps only the incoming particle and its immediate daughters.

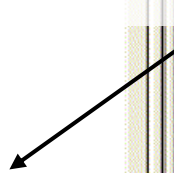
For a gamma this is (mostly) 3 particles: the gamma (white line) and the resulting electron/positron pair (the red and green lines)

For charged particles this would include a low energy cut to ignore the numerous low energy delta rays





List of position hits related to points on McTrajectory



Single McIntegratingHit related to this track



Name	Value
Type	IntHit
DrawAs	Prism
Color	blue

HepRep Type Tree
Glast Sources List

3D Controls

Zoom: 5.14403 Theta: 270

Background Color: [Black swatch] HUD Color: [White swatch]

Views Controls Logs

File Browser

HepRep Instance Tree

- Event-6
 - Header
 - Recon
 - MC
 - PosHitCol
 - IntHitCol
 - ParticleCol
 - Particle
 - Particle
 - Particle
 - Particle
 - Particle
 - Particle
 - Particle
 - Particle
 - Particle
 - GLAST-LAT

Name	Value

HepRep Type Tree

Glast Sources List

3D Viewer 0

Muon, "Minimal" prune mode with 0.75 MeV low energy cutoff (now only 9 McParticle daughters)

ID: 10-6

3D Controls

Zoom: 5.14403 Theta: 270

Background Color: HUD Color:

Views Controls Logs

Next Steps

- More direct JO control of pruning options
- Root Input/Output of McTrajectory's
- Root Input/Output of MC relational tables
- Update McToolBox to use this information to relate to Tkr Clusters (should be fairly simple at this stage)
- Complete Bill's wish list
 - Update ACD active distance calculation
 - Hit counting in the tracker
- Side Benefit: Associating MC Tracks to McIntegratingHits also now available (for free)