

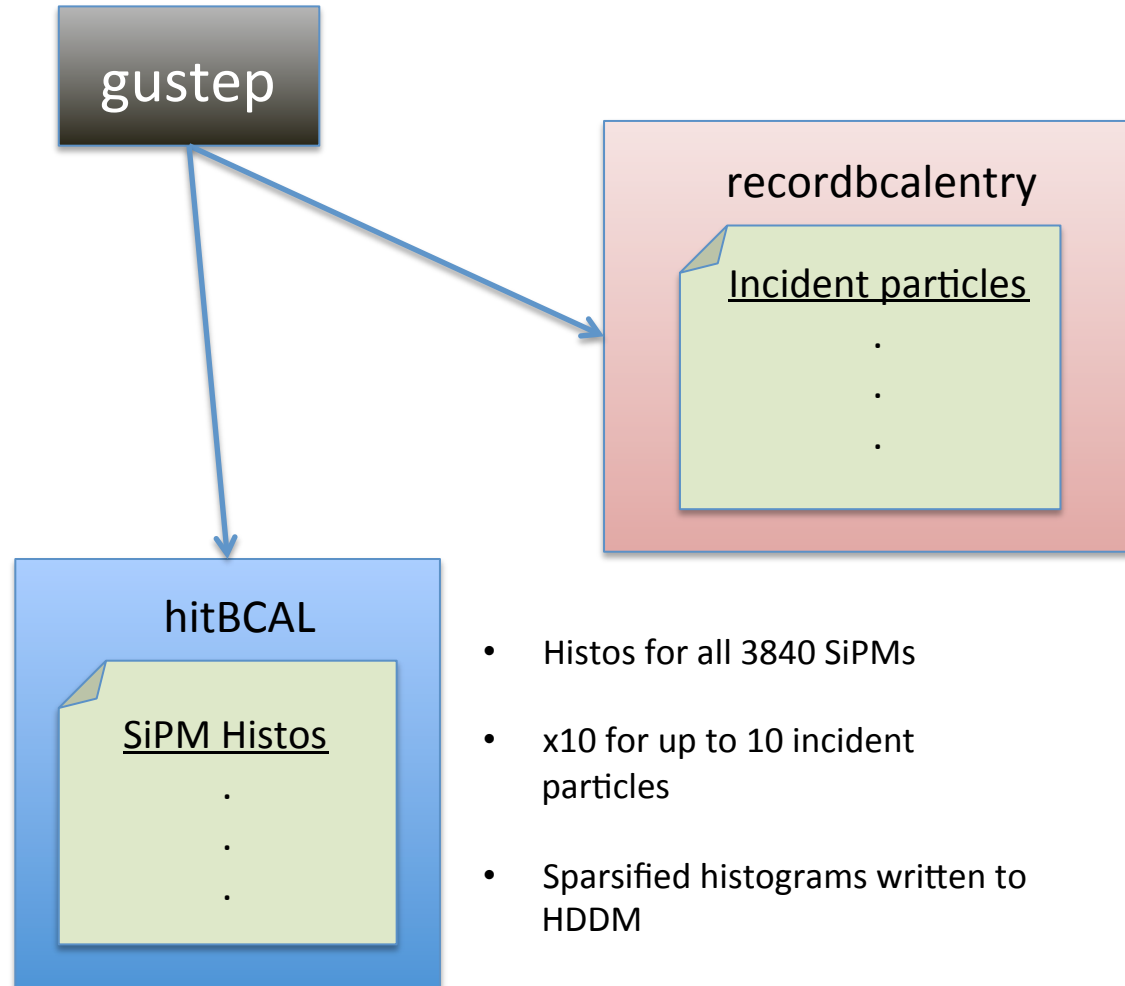
BCALsimulation status

David Lawrence JLab

7/17/2012

hdgeant

hdgeant modified to record the full timing spectrum of the (attenuated) energy seen by each SiPM. Multiple spectra are kept and associated with different incident particles



- Up to 10 incident particles are recorded
- Called when particle is entering an inner BCAL layer
- Position, momentum, particle type
- Not within 30cm in Z or 200mrad in ϕ
- Must have total energy > 10 MeV

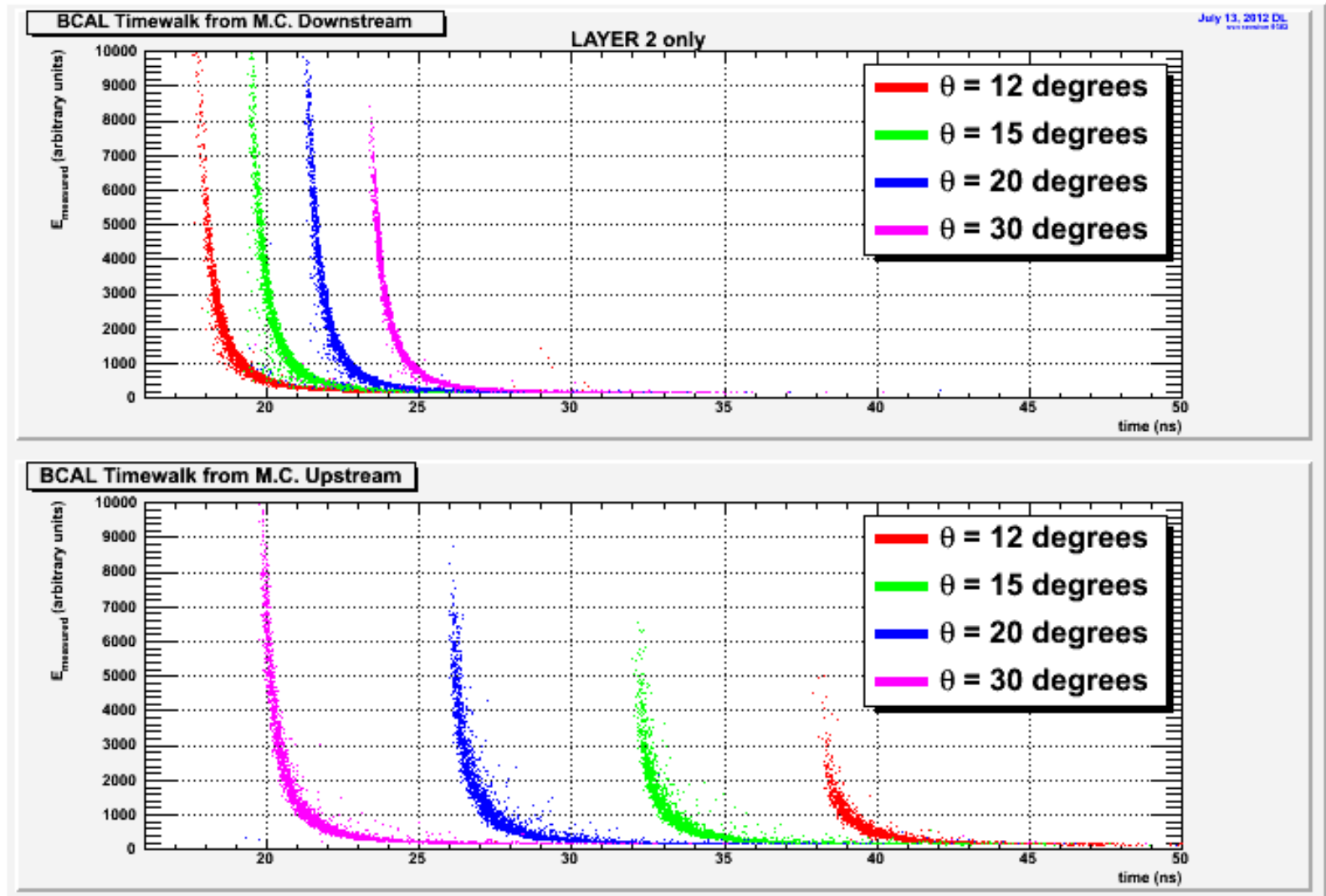
- Histos for all 3840 SiPMs
- x10 for up to 10 incident particles
- Sparsified histograms written to HDDM

mcsmeas

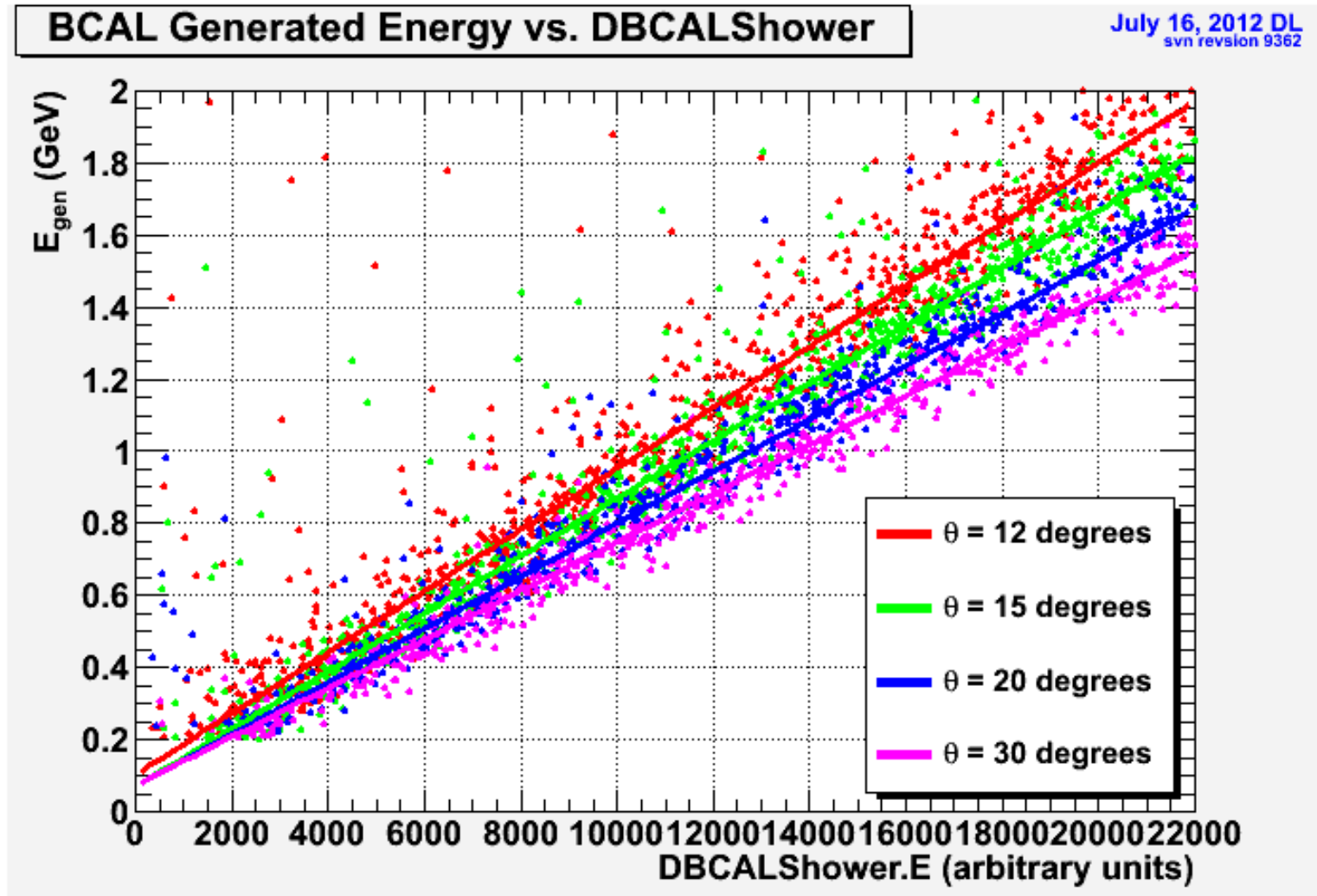
Spectra are read in and the following effects applied:

- Sampling fluctuations
 - Previously based on deposited energy only
 - Will be changed to use incident particle parameters
- Poisson statistics applied to Nphoto-electrons
- SiPM timing jitter
 - (600ps FWHM)
- Dark hits (includes cross-talk)
 - GlueX-doc-1754
- Convolution with electronic pulse shape
 - Derived from scope capture of pulse caused by fast laser
- Application of threshold crossing
 - Linear interpolation between bins surrounding threshold crossing point

Timewalk



Generated Energy vs. Reconstructed Shower Energy



Resources

hdgeant additional* system memory usage

$$(3840 \text{ SiPMs})(10 \text{ incident particles})(4000 \text{ bins})(16 \text{ bytes/bin}) = 2.3\text{GB}$$



48modules x 4sectors x 10layers x 2 ends



400ns ÷ 0.1ns/bin



Content and x-values (doubles)
(Possible to reduce this by a factor of 4)

Event processing rate for single BCAL photon events reduced:

- ÷ 2 for hdgeant
- ÷ 4 for mcsmeas

File Sizes

sizes in kB

| angle | unsmeared | | | smeared | | |
|-------|-----------|-------|-------|---------|-------|-------|
| | spectra | cell | ratio | spectra | cell | ratio |
| 12 | 18040 | 13814 | 131% | 20214 | 19192 | 105% |
| 15 | 16890 | 12151 | 139% | 19062 | 17656 | 108% |
| 20 | 14386 | 9593 | 150% | 16634 | 14964 | 111% |
| 30 | 11382 | 6397 | 178% | 12662 | 10999 | 115% |

**Everything else uses only ~330MB*

Issues

- Far too many incident particles are being identified in PYTHIA events (sometimes a few hundred)
- Memory usage is too high and needs to be reduced
- Time need to be separated into different places and resolutions (fADC and TDC)
- Sampling smearing based on incident particle parameters needs to be applied