

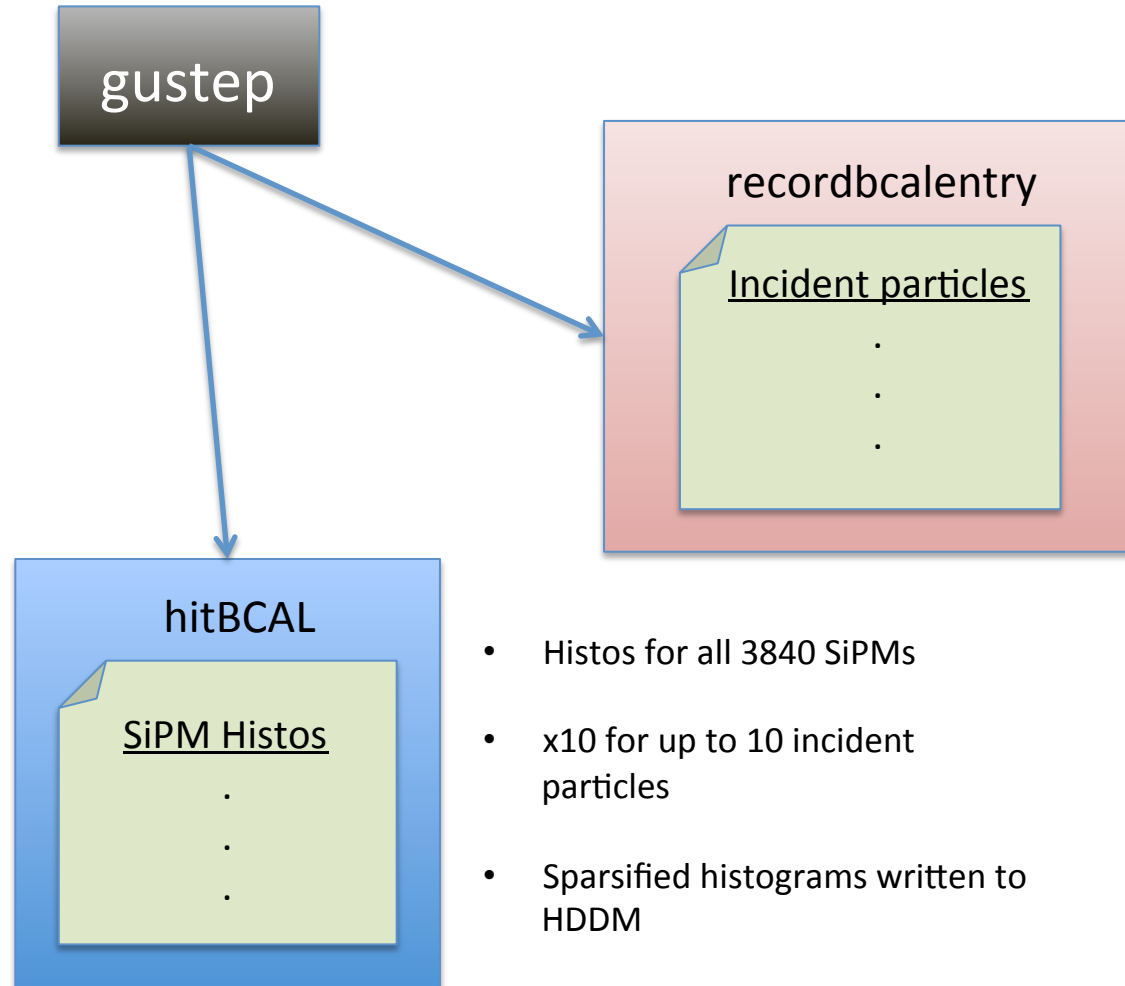
BCAL simulation status

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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



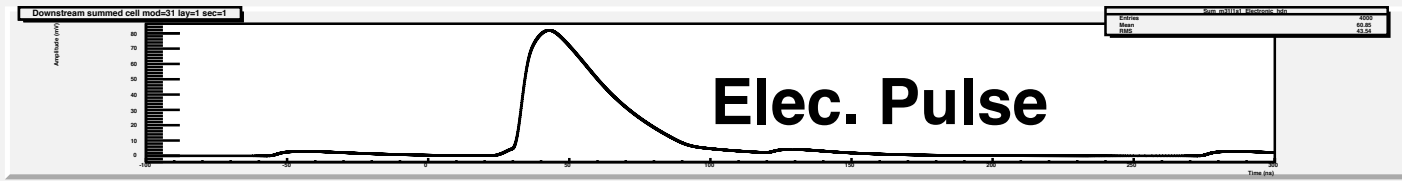
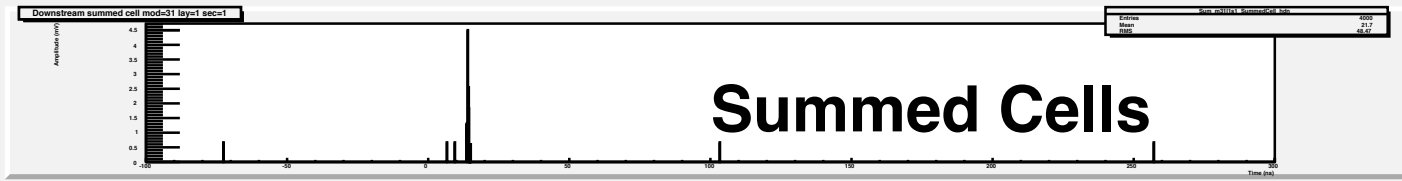
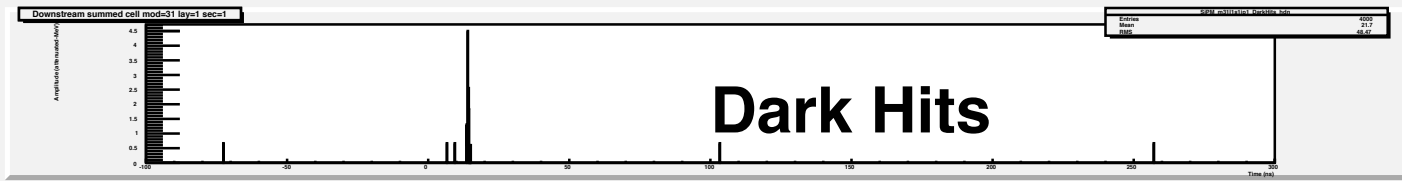
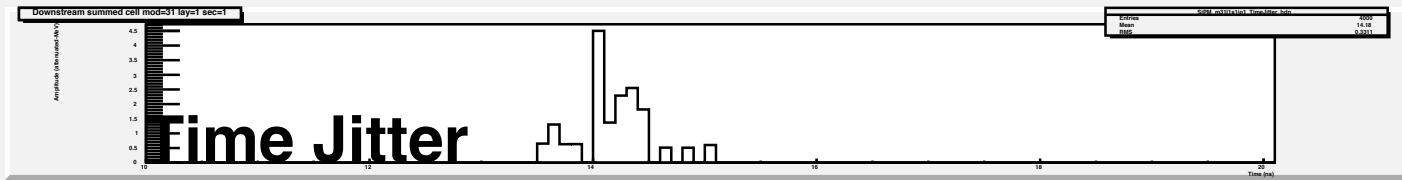
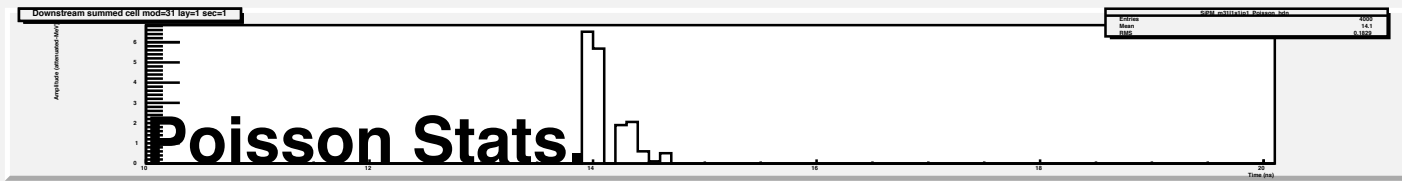
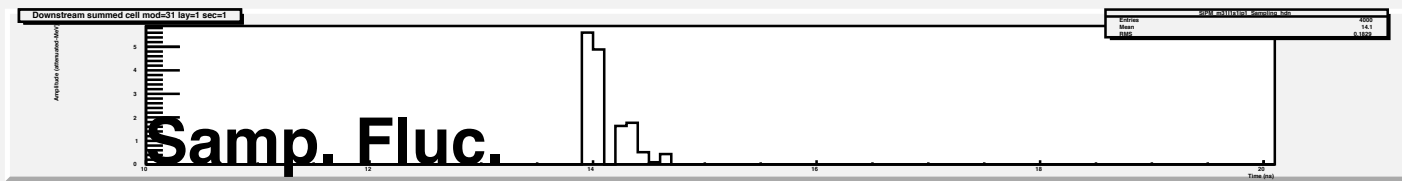
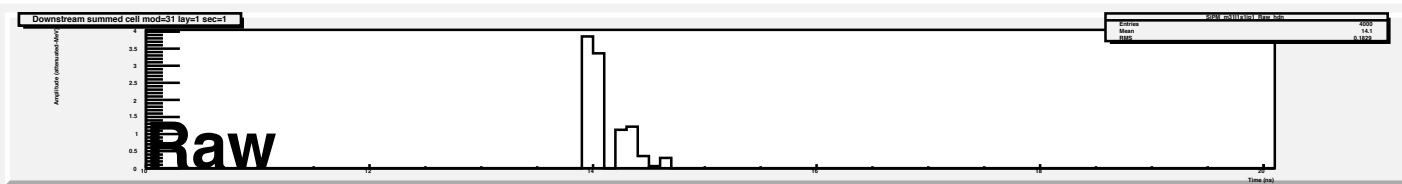
- Up to 10 incident particles are recorded
- Called when particle is entering an inner BCAL layer
- Position, momentum, particle type
- Not within 30cm in Z or 200mrad in ϕ
- Must have total energy > 10 MeV

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

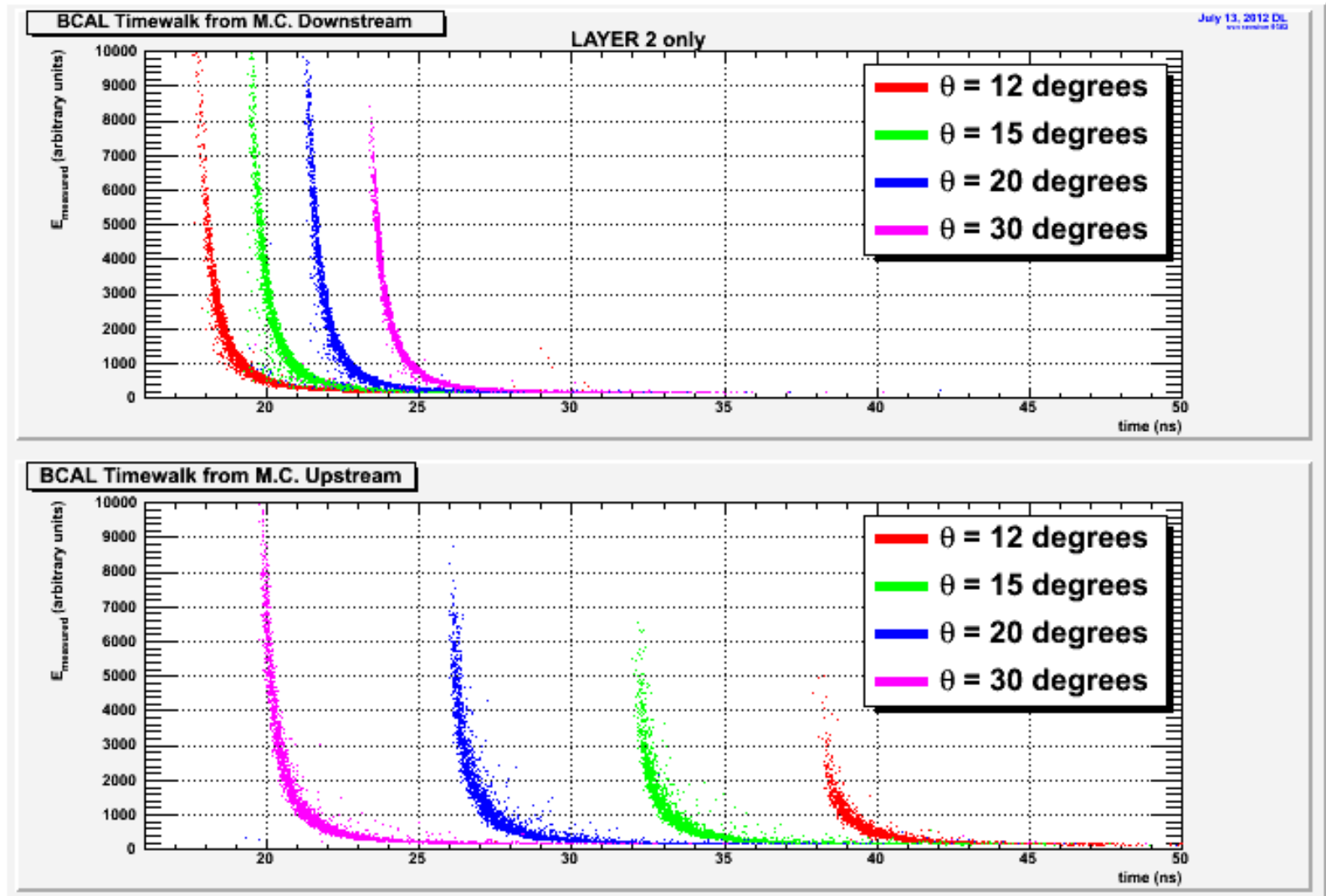
mcsmeas

Spectra are read in and the following effects applied:

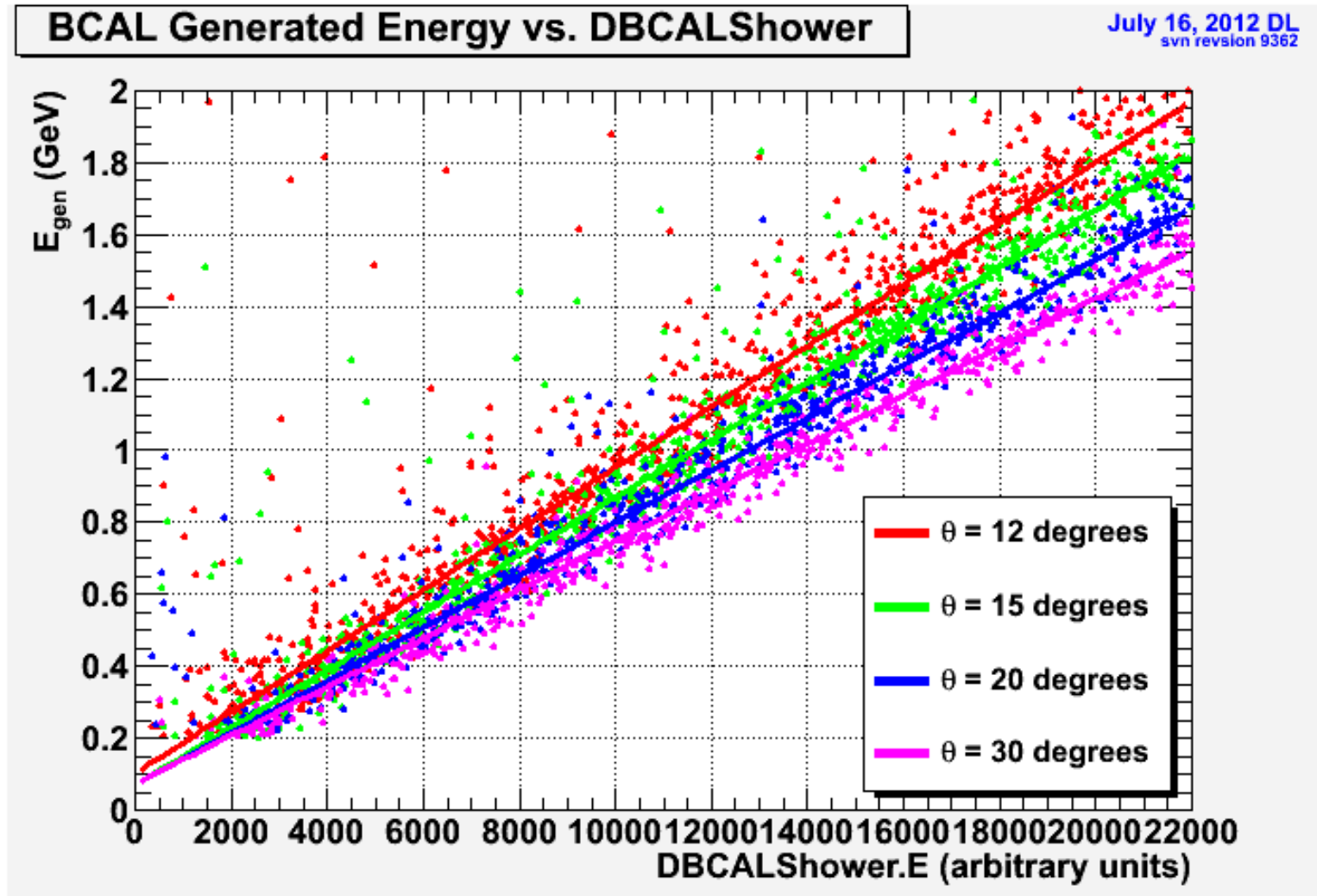
- Sampling fluctuations
 - Previously based on deposited energy only
 - Will be changed to use incident particle parameters
- Poisson statistics applied to Nphoto-electrons
- SiPM timing jitter
 - (600ps FWHM)
- Dark hits (includes cross-talk)
 - GlueX-doc-1754
- Convolution with electronic pulse shape
 - 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:

- Negligible for hdgeant
- ÷ 4 for mcsmeas, for single thread (only 20% slower for 4 threads)

File Sizes

sizes in kB

angle	unsmeared spectra	unsmeared cell	ratio	smeared spectra	smeared 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