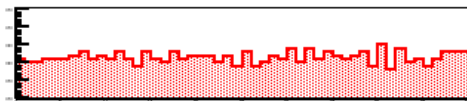
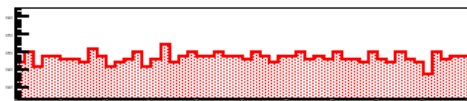
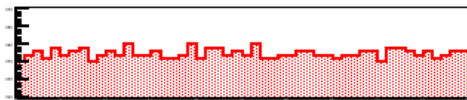
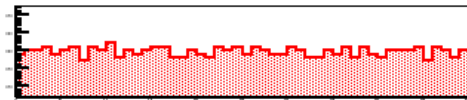
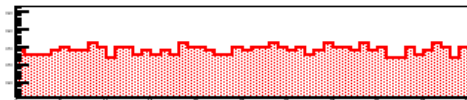
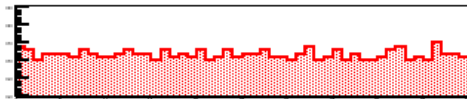
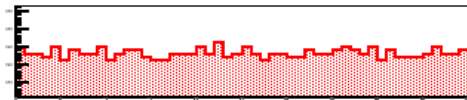
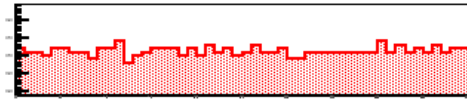
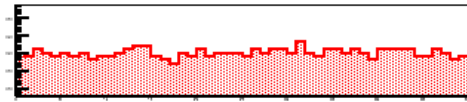


BCAL Simulation

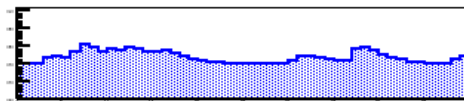
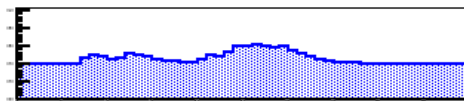
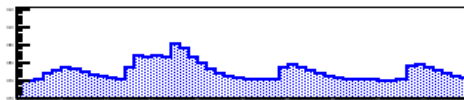
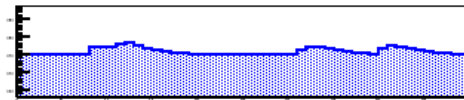
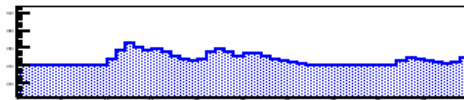
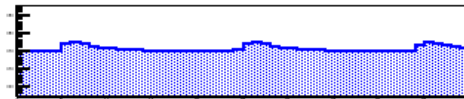
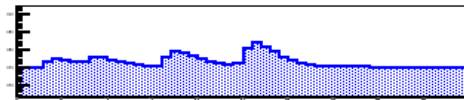
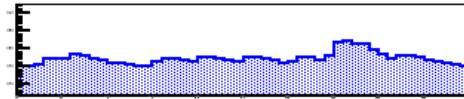
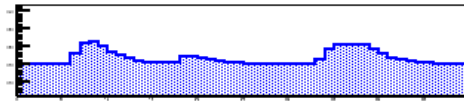
David Lawrence JLab

Sept. 18, 2012

fADC250 Real



Simulated



Sampled Waveforms

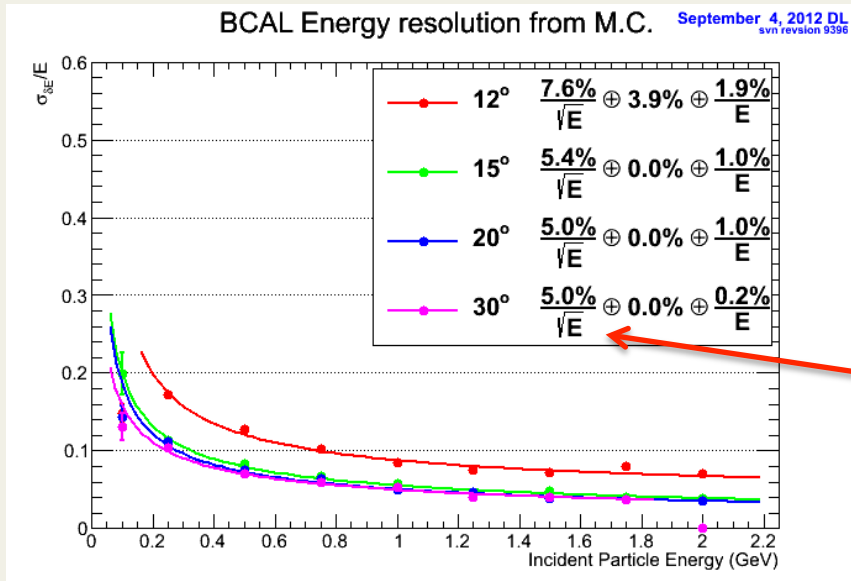
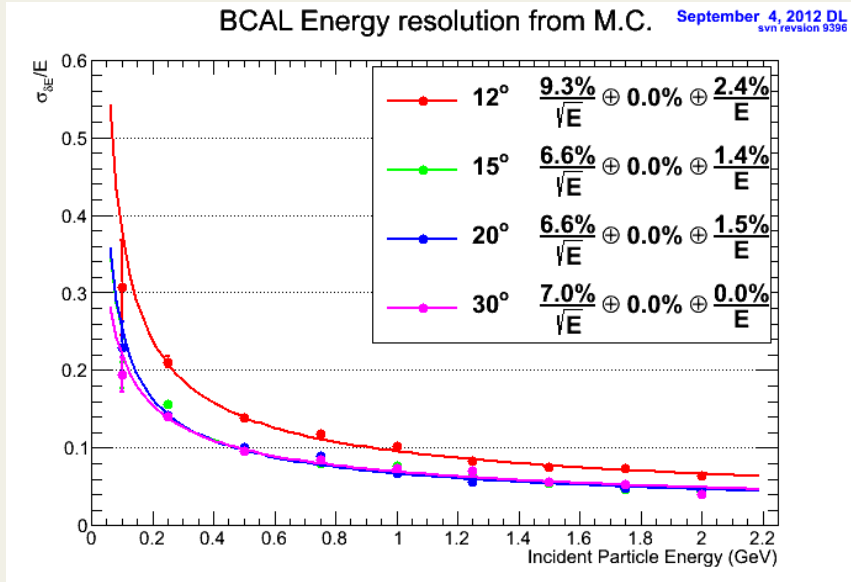
- These show examples of no-signal electronic waveforms as sampled by a fADC250
- Plots on the left are from mini-BCAL test data (actual data from a fADC250 module with SiPMs)
- Plots on right are from simulated data (converted into fADC counts and 4ns bins)
- Y-axis range is approx. 6mV

Shown two weeks ago....

Energy Resolution

With dark hits and 4mV threshold

- $\sim 0.9 \text{ mV/MeV}$ for ADC leg
- Fits appear good by eye when floor term fixed at 1.3%

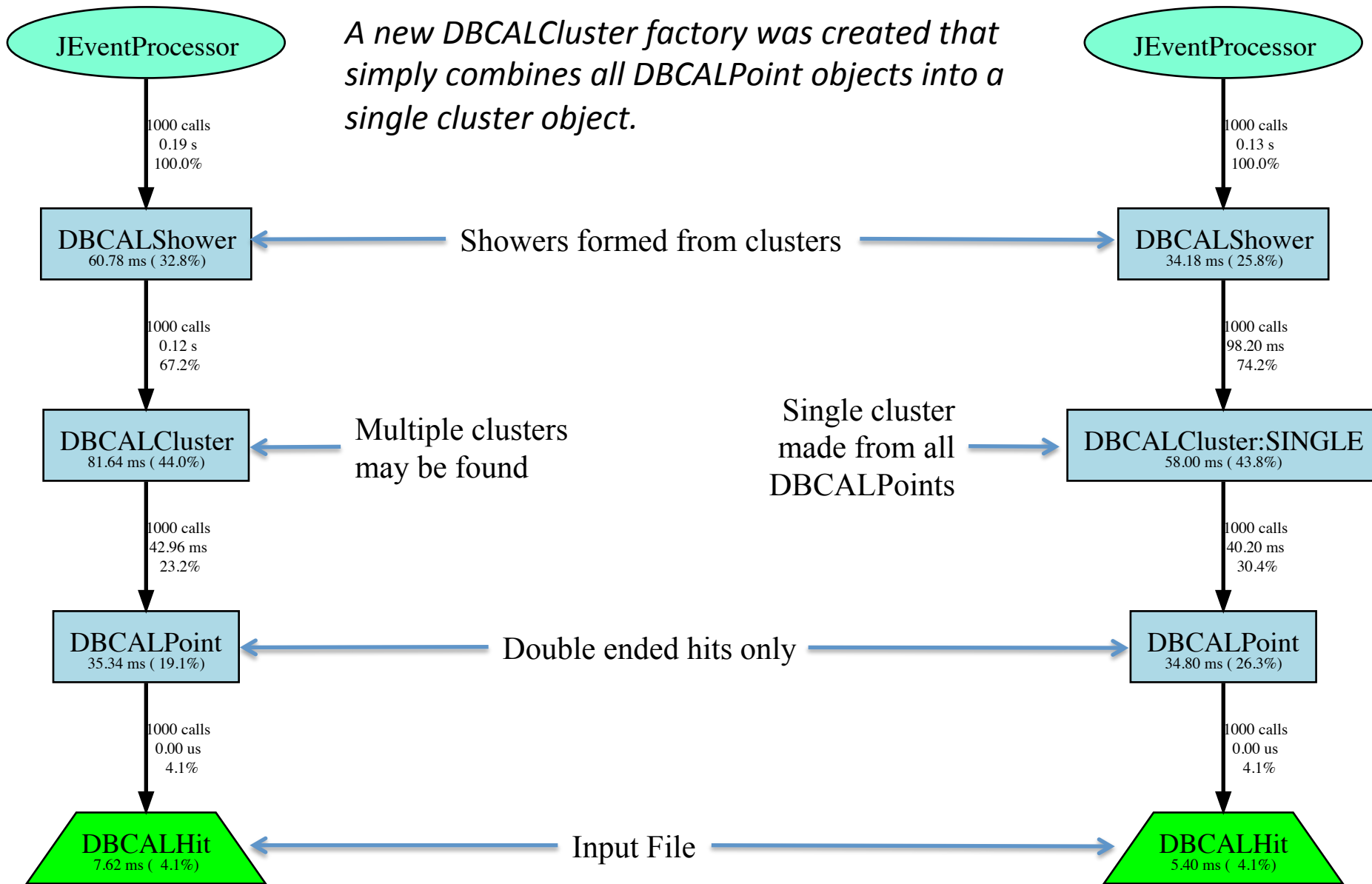


Without dark hits and 0.001mV threshold

Input resolution for $1/\sqrt{E}$ term was 4.2% !

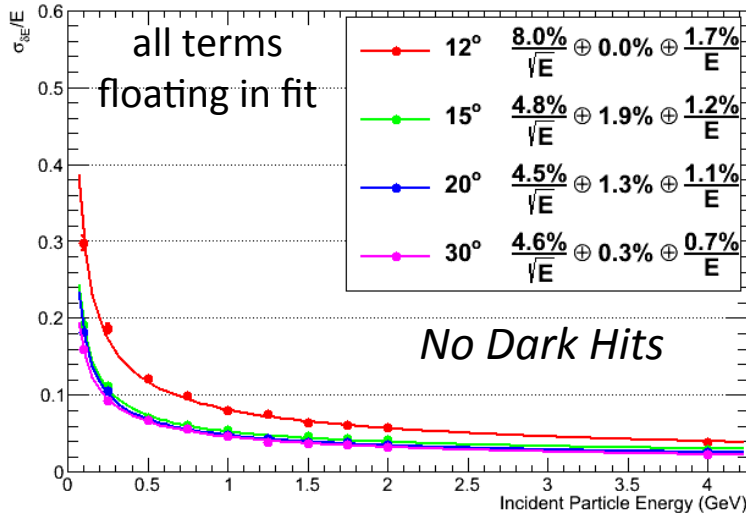
Simple Clusterizer

A new DBCALCluster factory was created that simply combines all DBCALPoint objects into a single cluster object.

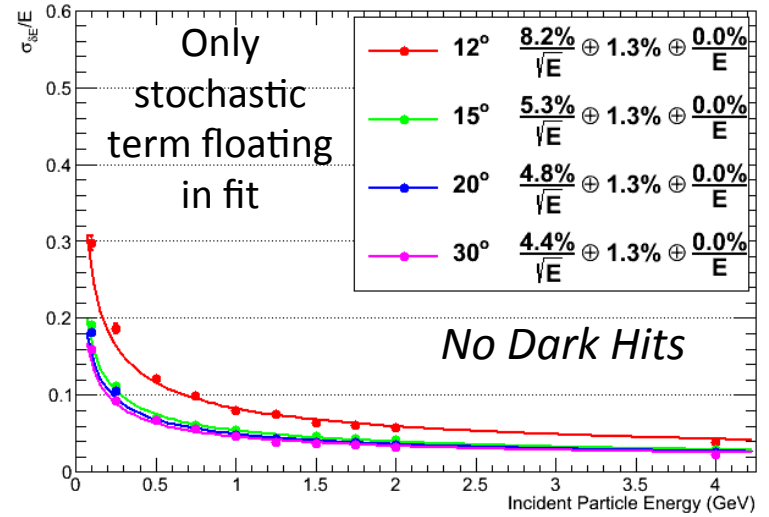


DBCALCluster:SINGLE in action

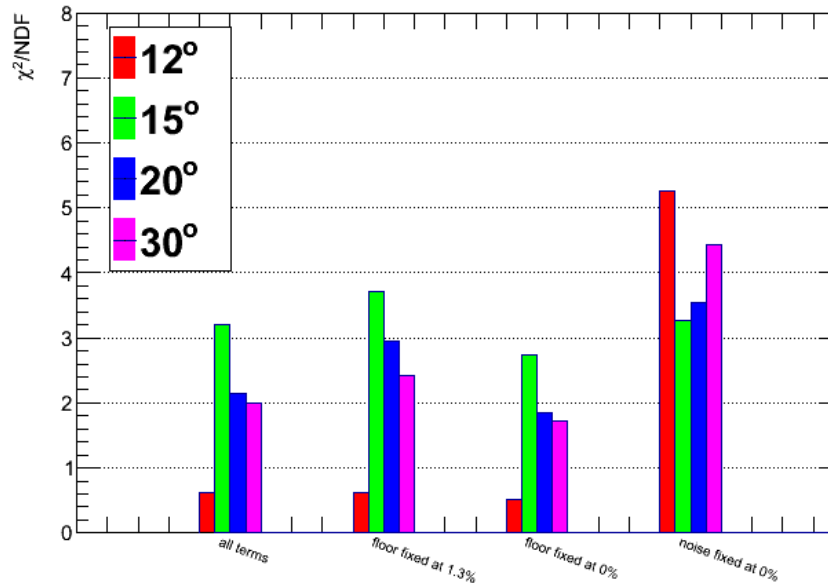
BCAL Energy resolution from M.C. September 7, 2012 DL svn revision 9396



BCAL Energy resolution from M.C. September 7, 2012 DL svn revision 9396



χ^2 /NDF in BCAL Energy Resolution Fits September 7, 2012 DL svn revision 9396



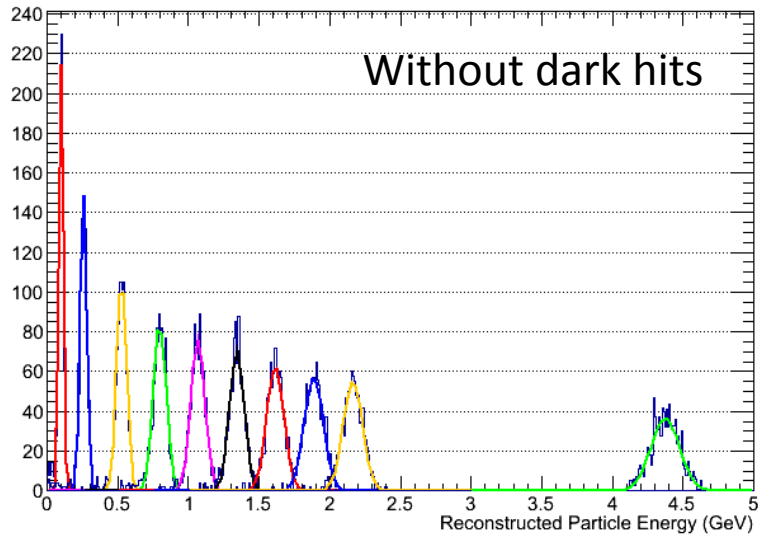
Fixing noise term at zero increases χ^2

Fits are insensitive to floor term

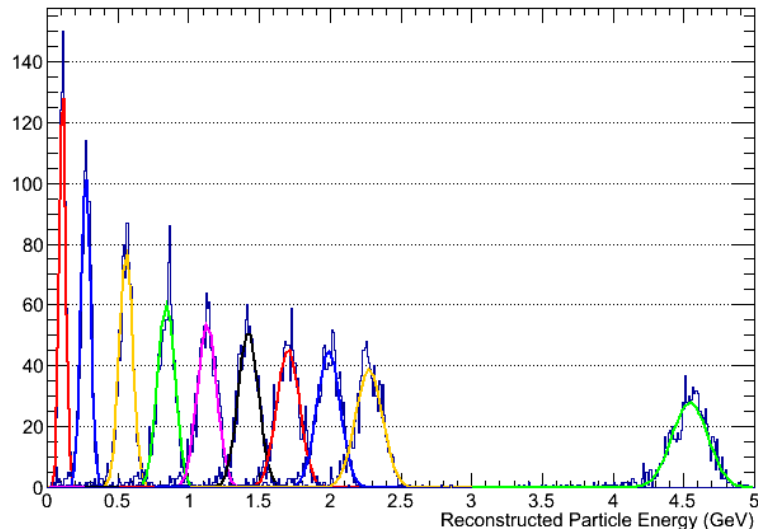
Fitting for resolution

BCAL Energy resolution from M.C. September 11, 2012 DL svn revision 9396

Without dark hits

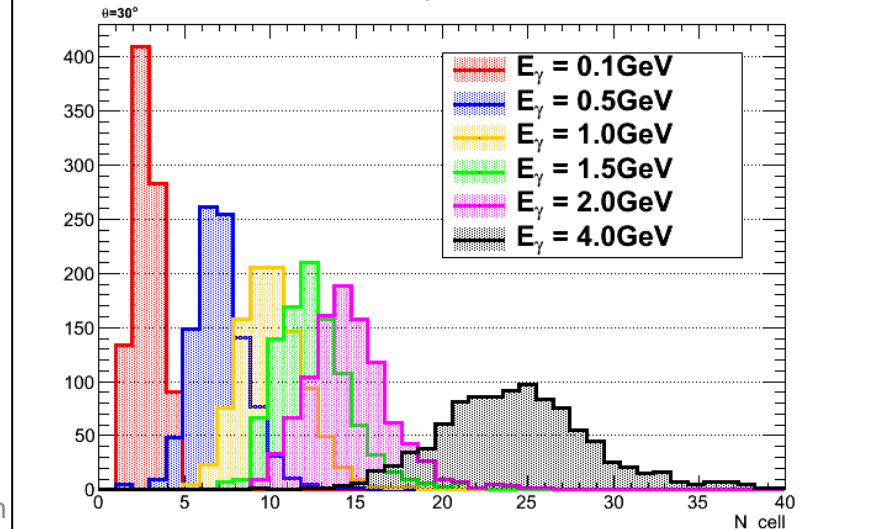


BCAL Energy resolution from M.C. September 11, 2012 DL svn revision 9396



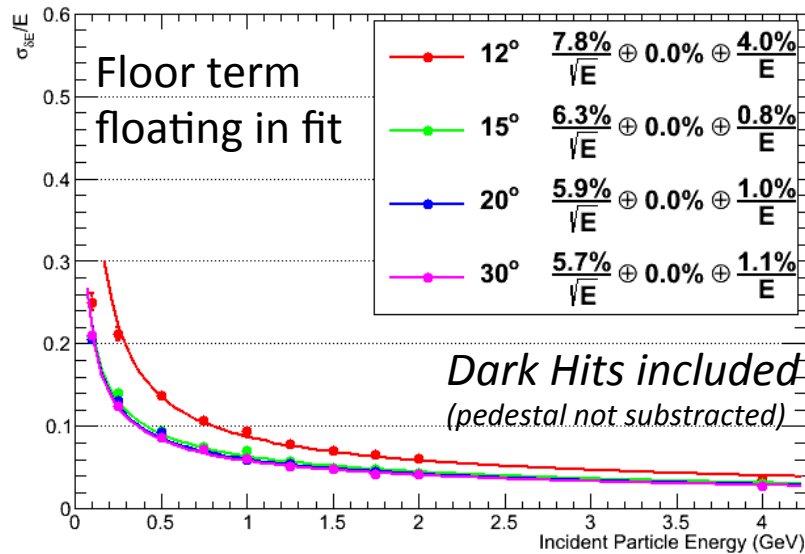
- Rough calibration constant hardwired in DBCALPoint to convert from fADC counts to GeV
 - Not checked in at the moment since it would break existing default simulation mode
- Multiple sets of mono-energetic photons simulated and reconstructed
- Reconstructed peak fit to Gaussian
- σ over mean of fit determines resolution
 - Mean of fit is too large by amount proportional to number of cells due to dark hits
 - σ/E is too small, but in energy dependent way

Number of cells per DBCAL Shower September 11, 2012 DL svn revision 9396



Energy Resolutions

BCAL Energy resolution from M.C. September 11, 2012 DL
svn revision 9396

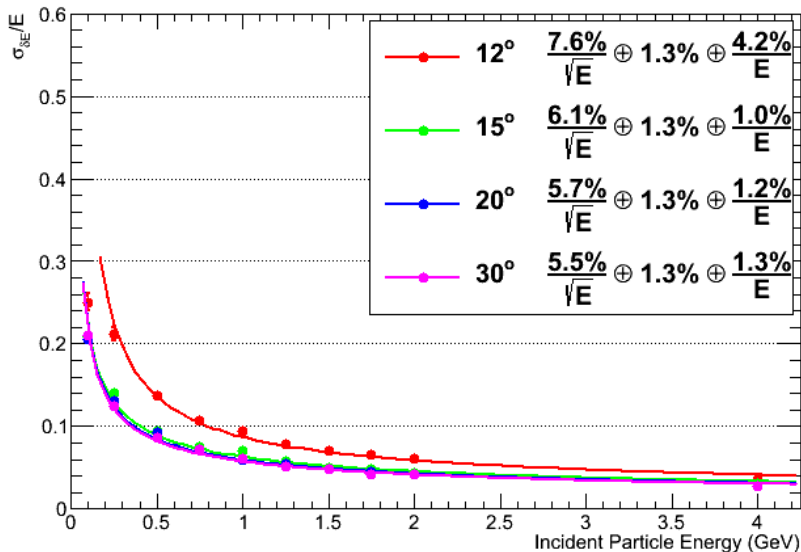


These are slightly better than reality since the dark hits pedestals are subtracted, causing σ/E to be smaller than it would otherwise be.

This effect should be roughly $120\text{MeV}/4\text{GeV} = 3\%$ of the values shown:

e.g. $5.5\%/\sqrt{E} \rightarrow 5.7\%/\sqrt{E}$

BCAL Energy resolution from M.C. September 11, 2012 DL
svn revision 9396



Reconstruction will need to subtract dark hits pedestals from individual readout channels

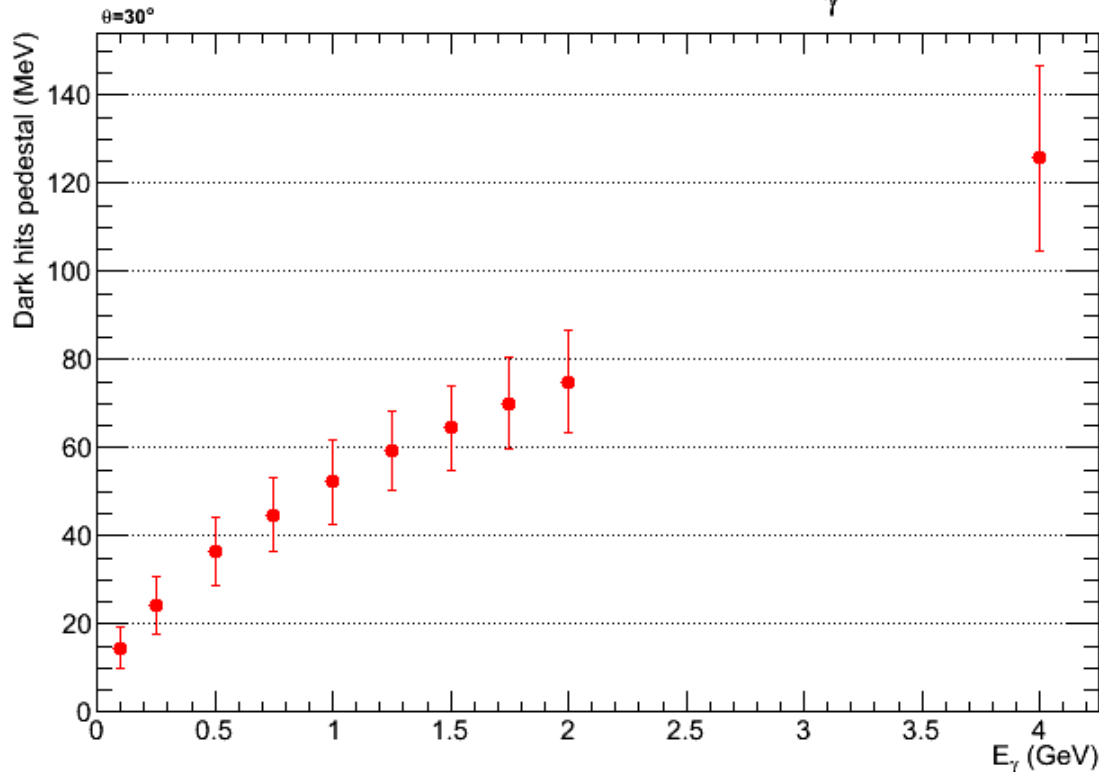
Summary

- Energy resolutions understood (fairly well)
- Ready to make time spectrum method default in sim-recon
- Need improved sampling fluctuation functions
- Reconstruction will need more work
 - Clusterizer
 - Dark hits pedestal
 - Timewalk corrections

Pedestal shift due to dark hits

Dark hits pedestal vs. E_γ

September 11, 2012 DL
svn revision 9396



- Integration window: 200ns
- Dark hit rate: 17.6MHz
- Cross-talk: 15.7%
- darkhitMeV_per_hit=2.72
- Attenuation: ~ 0.522
(to downstream end)

The mean and sigma of the points plotted here come from fitting the number of cells hit. The number of cells contributing to the shower will be known so that width does not contribute to the resolution directly. Because this plot is a little misleading, it was moved to backups.