

BCAL Simulation

David Lawrence JLab

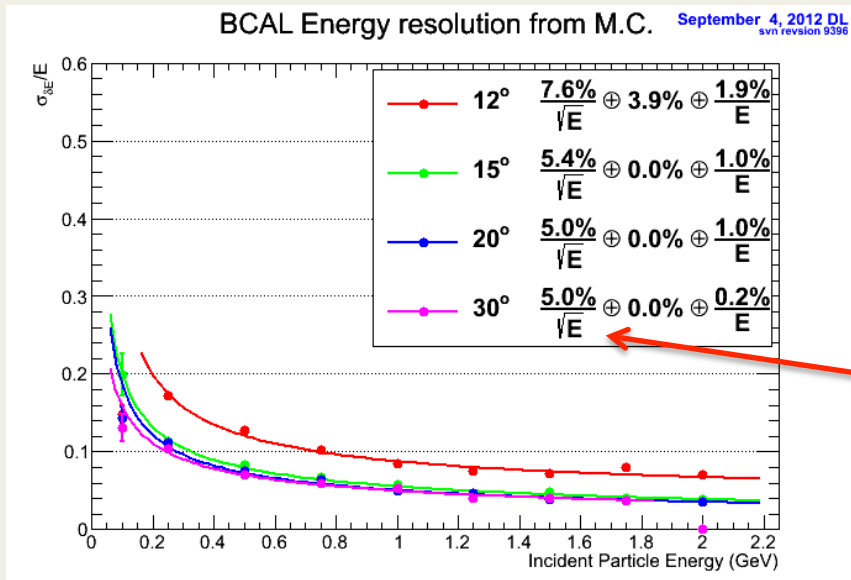
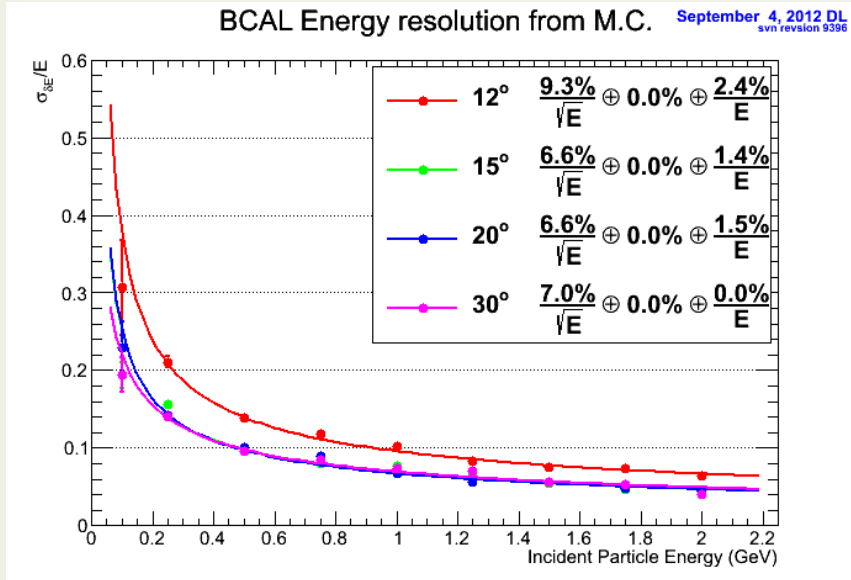
Sept. 11, 2012

Shown last week....

Energy Resolution

With dark hits and 4mV threshold

- ~ 0.9 mV/MeV for ADC leg
- Fits appear good by eye when floor term fixed at 1.3%

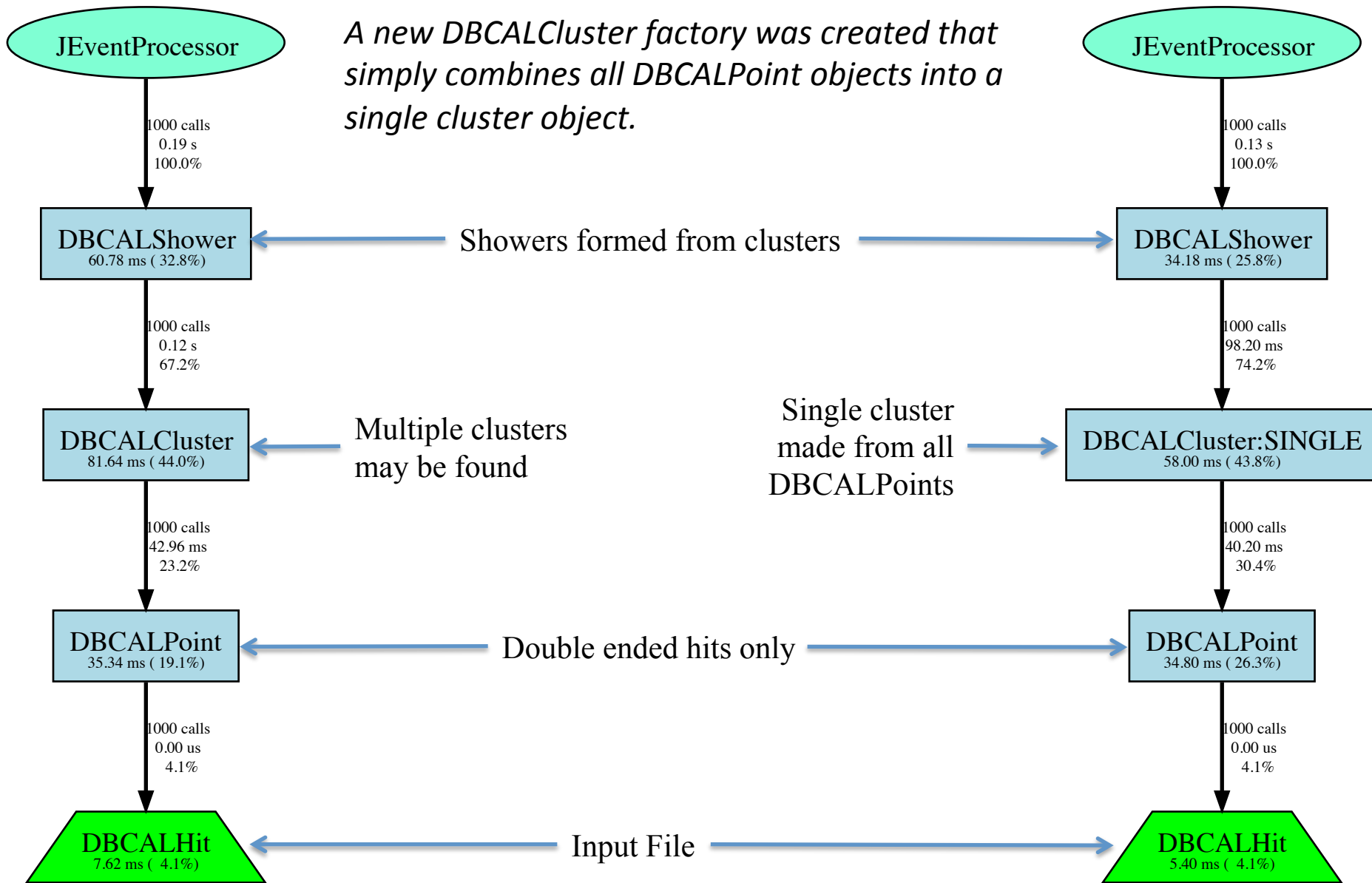


Without dark hits and 0.001mV threshold

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

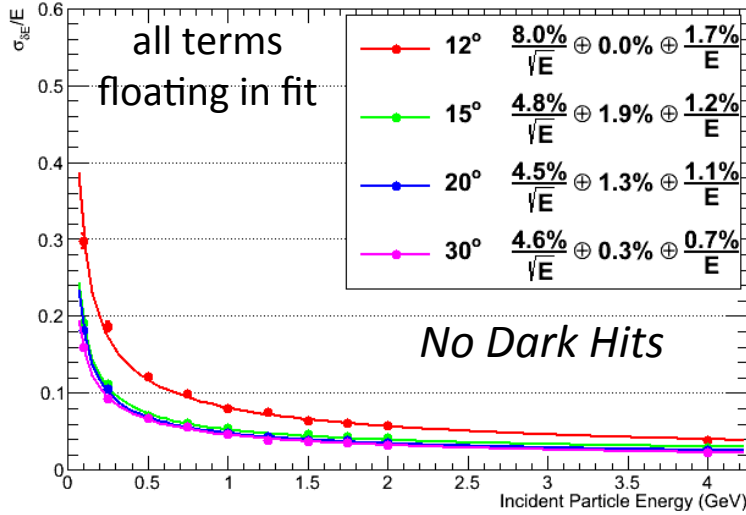
Simple Clusterizer

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

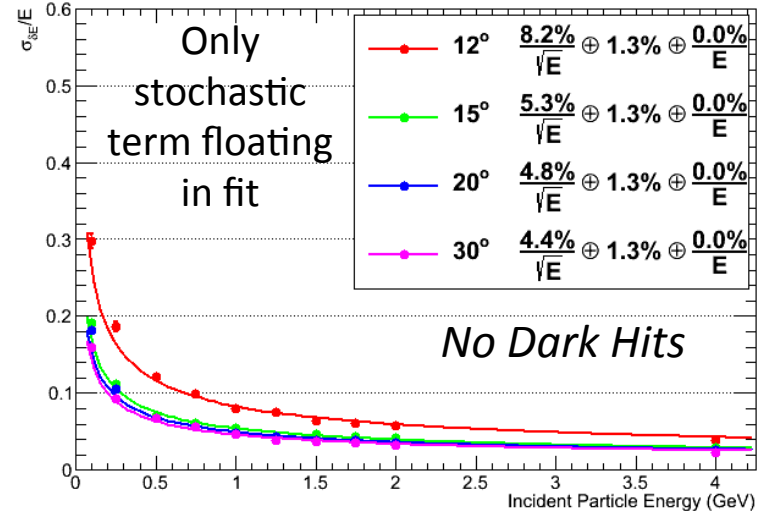


DBCALCluster:SINGLE in action

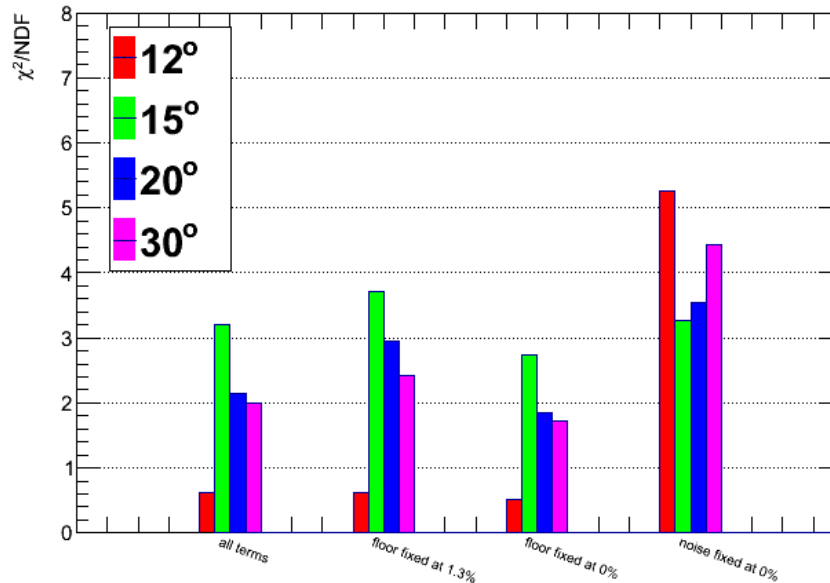
BCAL Energy resolution from M.C. September 7, 2012 DL svn revision 9396



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



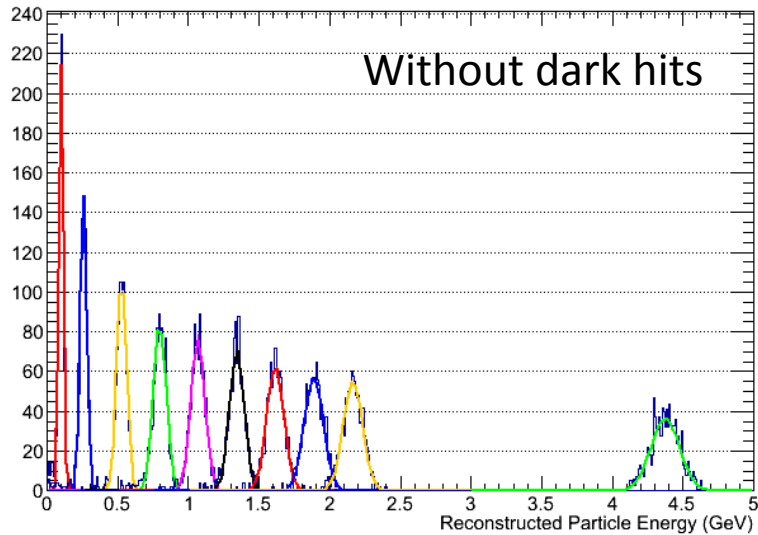
adding noise term at zero energy increases χ^2

fits are insensitive to noise term

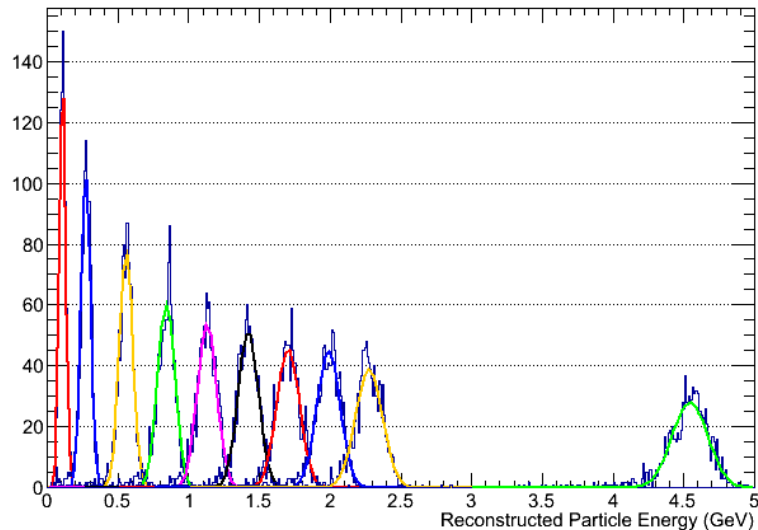
Fitting for resolution

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

Without dark hits

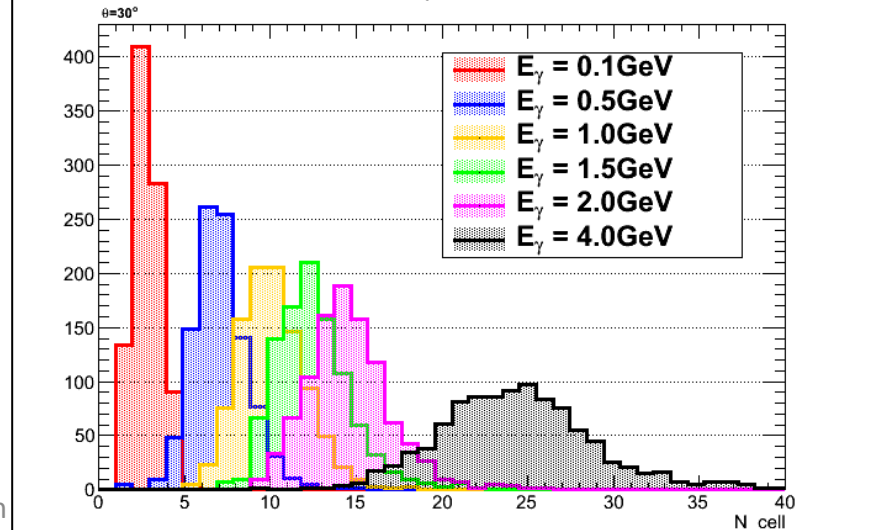


BCAL Energy resolution from M.C. September 11, 2012 DL svn revision 9396



- 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

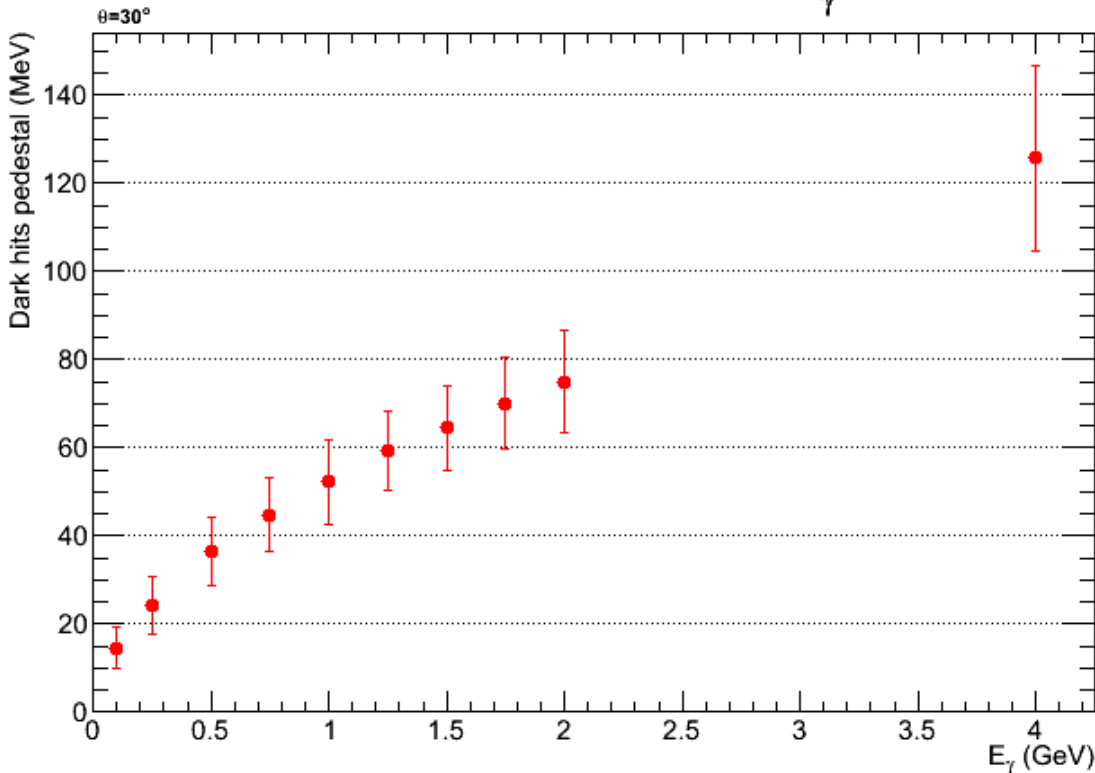
Number of cells per DBCAL Shower September 11, 2012 DL svn revision 9396



Pedestal shift due to dark hits

Dark hits pedestal vs. E_γ

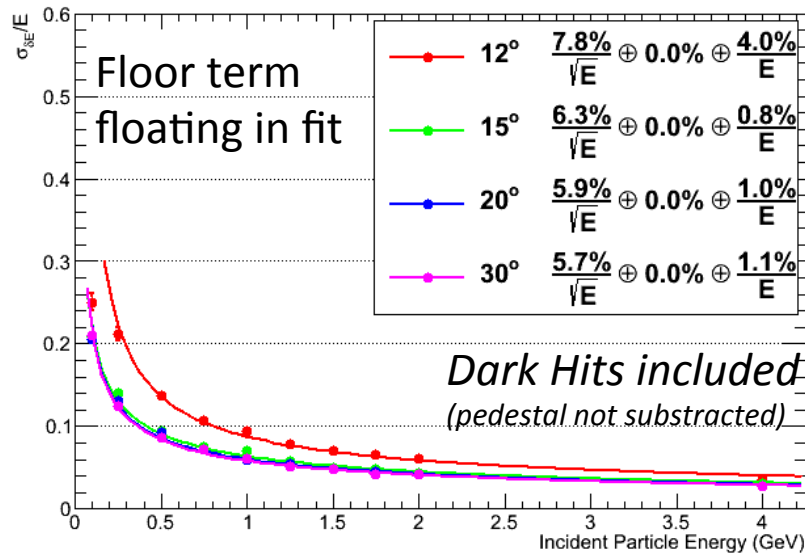
September 11, 2012 DL
svn revision 9396



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

Energy Resolutions

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

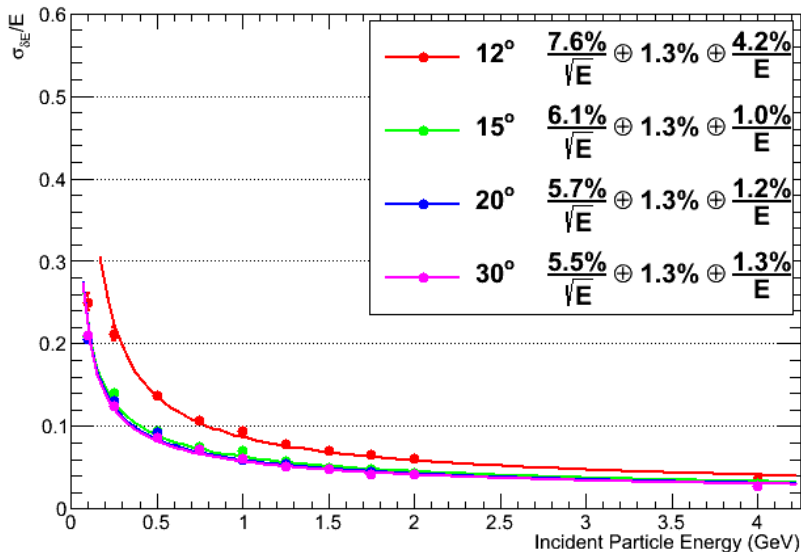


These are slightly better than reality since the dark hits pedestals are subtracted, causing s/E to be smaller than it would otherwise be.

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
- Timing distributions need to be looked at (fADC and TDC)
- Reconstruction will need more work
 - Clusterizer
 - Dark hits pedestal