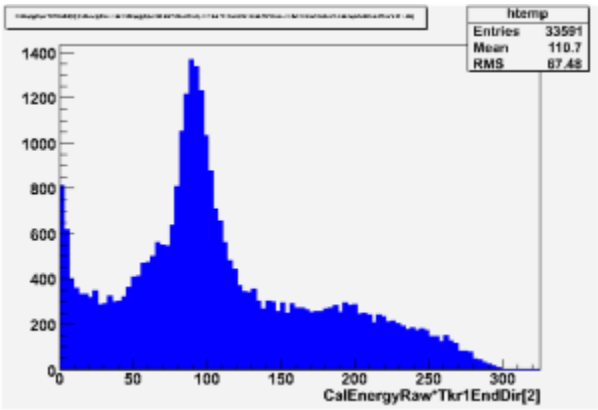
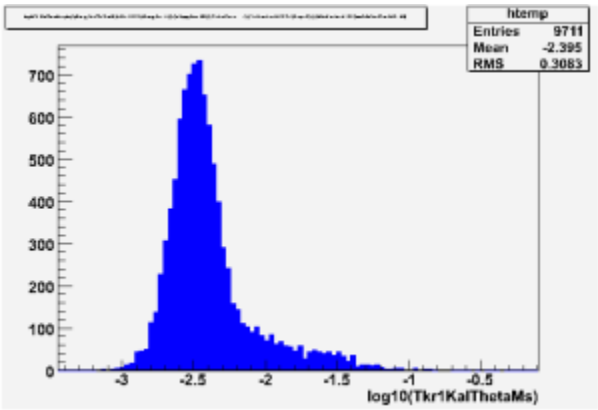
Update on calorimeter energy scale calibration with protons

Following the suggestion of Bill Atwood I've added the selection of relativistic protons by cutting on log10(Tkr1KalThetaMs), similar to what was done earlier by Fred Piron.
But I tried to chose the cut value in a proper way. I've selected protons from the peak on the histogram CalEnergyRaw*Tkr1EndDir[2]:

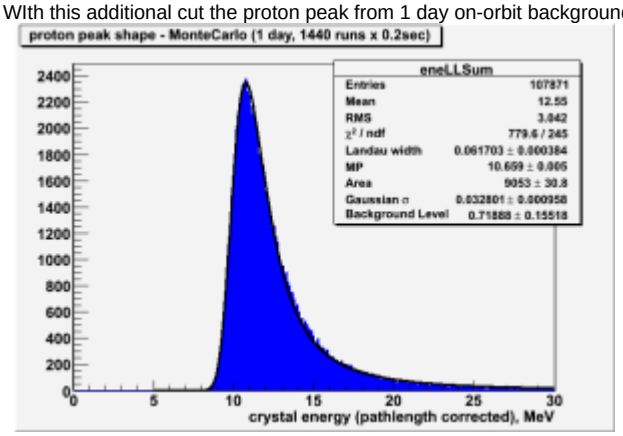


For these "good protons" with abs(CalEnergyRaw*Tkr1EndDir[2]-90)<15 I've made a histogram of log10(Tkr1KalThetaMs):

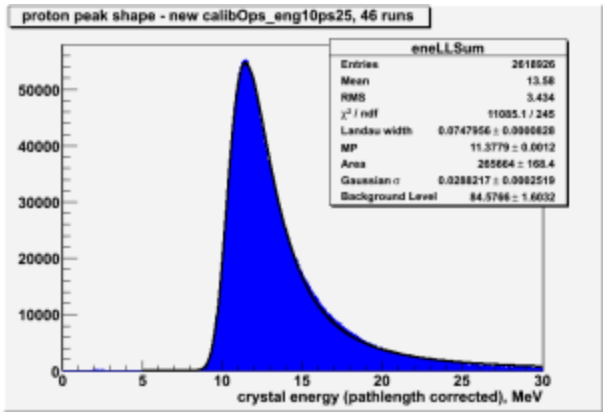


Based on the above plot I've chosen the cut log10(Tkr1KalThetaMs) > -2.2, which is different form what recommended by Fred Piron (cut at -3).

WIth this additional cut the proton peak from 1 day on-orbit background simulation has the following shape:



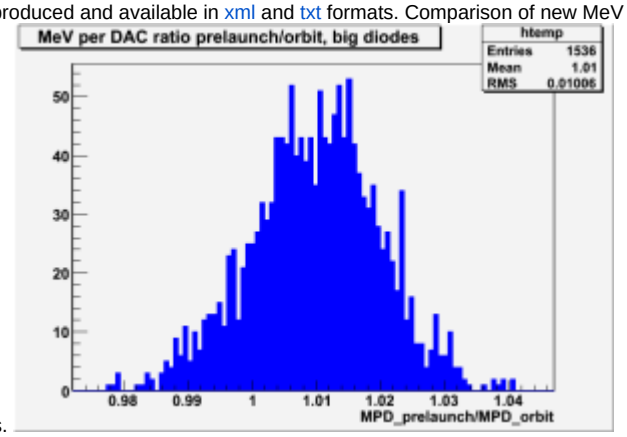
Fit doesn't have fixed parameters (both gaussian and landau width are free parameters).
The similar plot for new calibOps_eng10ps25 (46 runs) has very similar shape:

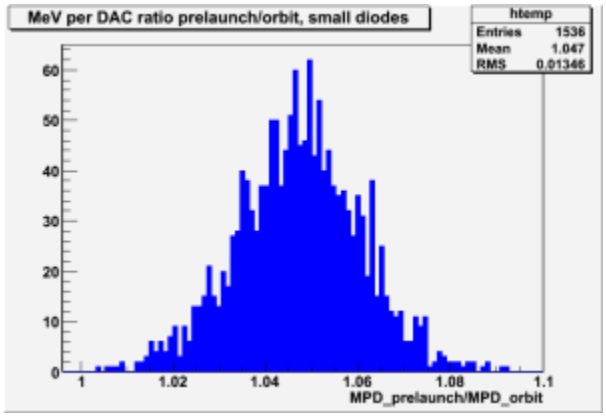


The only difference with Monte Carlo is the difference in ratio Landau width to Landau peak: 0.074 for data, 0.061 for Monte Carlo, but this difference is much smaller than for ground muons and could be improved after we'll do the simulation with correct MIP filter configuration and verify the proton spectrum. Why we had so big discrepancy for ground muons ? (Geant4 problem ? Wrong spectrum at low muon energies ?).

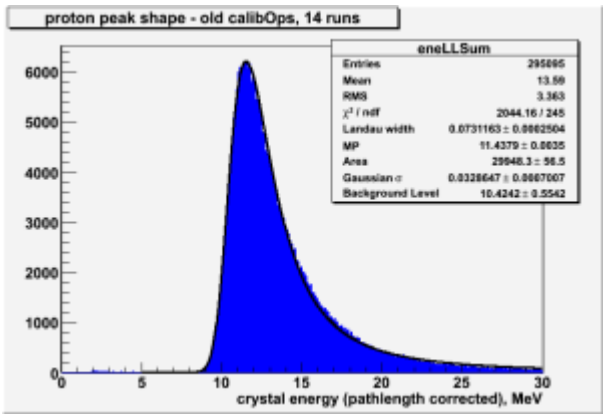
Then I fixed Gausian and Landau relative width at the values obtained for data and used MPV from Monte Carlo as true value for calibration.

Calibration constants (MeV per DAC) are already produced and available in xml and txt formats. Comparison of new MeV per DAC coefficients with prelaunch calibration is show on the next two plots.





The pre-launch MPD coefficients are bigger than ones defined on orbit, by ~1% for big diodes (low energies) and by 5% for small diodes (high energies > 1 GeV per crystal). The use of pre-launch MPD coefficients for event reconstruction leads to the overestimation of the CAL energy. I suspect that the reason for this problem is the systematic errors in the preamp nonlinearity measured by charge injection calibration - I'll try to check this using the LEX1-HEX8 correlation.
The following plot shows the proton peak shape and position for old set of 14 runs of calibOps configuration.



The widths is very close to the new calibOps runs, peak position is lower then for the new calibration by ~0.5%, which gives the estimation of gain increase over 2 weeks.