

Status of CAL crystal light asymmetry calibration

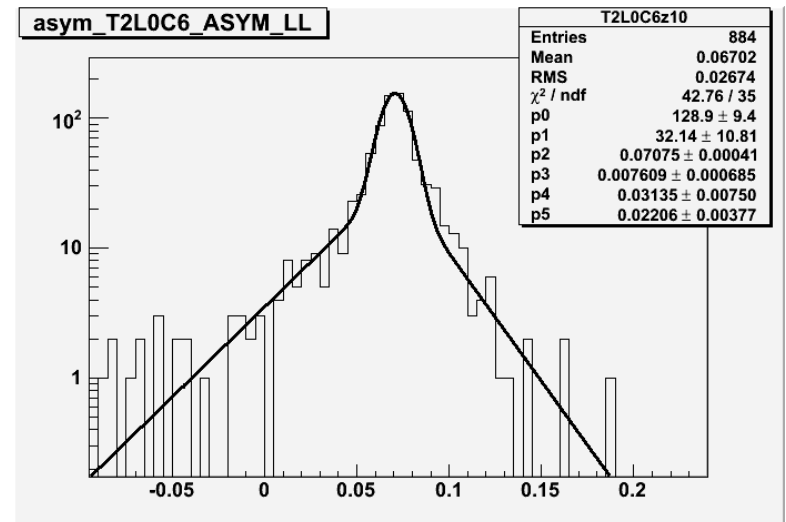
A.Chekhtman

Improvements in asymmetry calibration procedure: event selection

- Selection of GCR tracks in previously used procedure included requirements on distance from crystal end > 30 mm on both top and bottom surfaces of a crystal.
 - Because of broad angular distribution this caused non-uniform population and position bias in crystal segments 1 and 10
 - This problem was partly fixed in 2008 for on-orbit procedure by subtracting linear function of longitudinal position from asymmetry (with the same slope for all crystals)
 - Now this selection is removed
 - To avoid the effects residual nonuniformity (due to trigger logic) we subtract individual linear function for each crystal (defined from existing calibration)

Improvements in asymmetry calibration procedure: fitting function

- The asymmetry histograms have significant tails, to get reasonable fit the simple gaussian was replaced by gaussian with two exponential tails
- For small diodes the bin size was too big – now it is the same as for large diodes
- For the small diodes the tail parameters are now taken from the fit for large diodes of the same crystal and fixed.

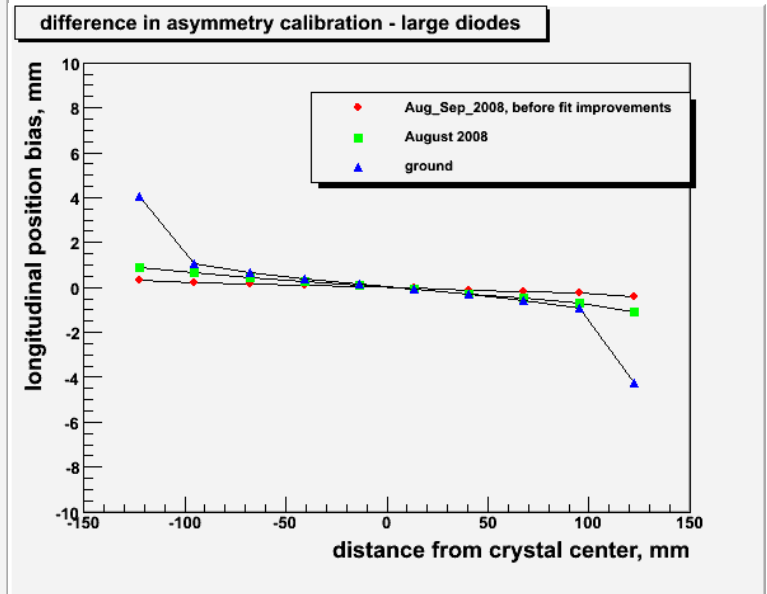
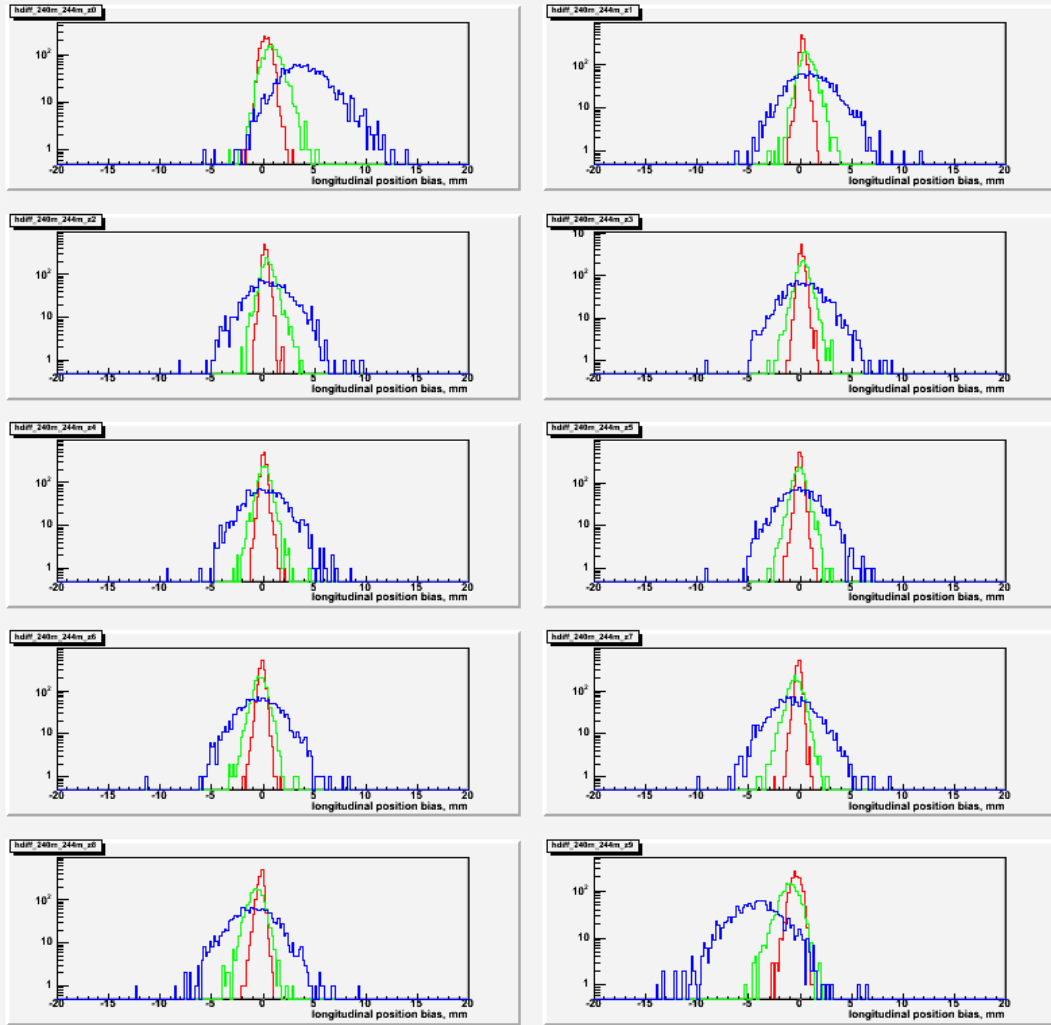


Available CAL asymmetry calibrations

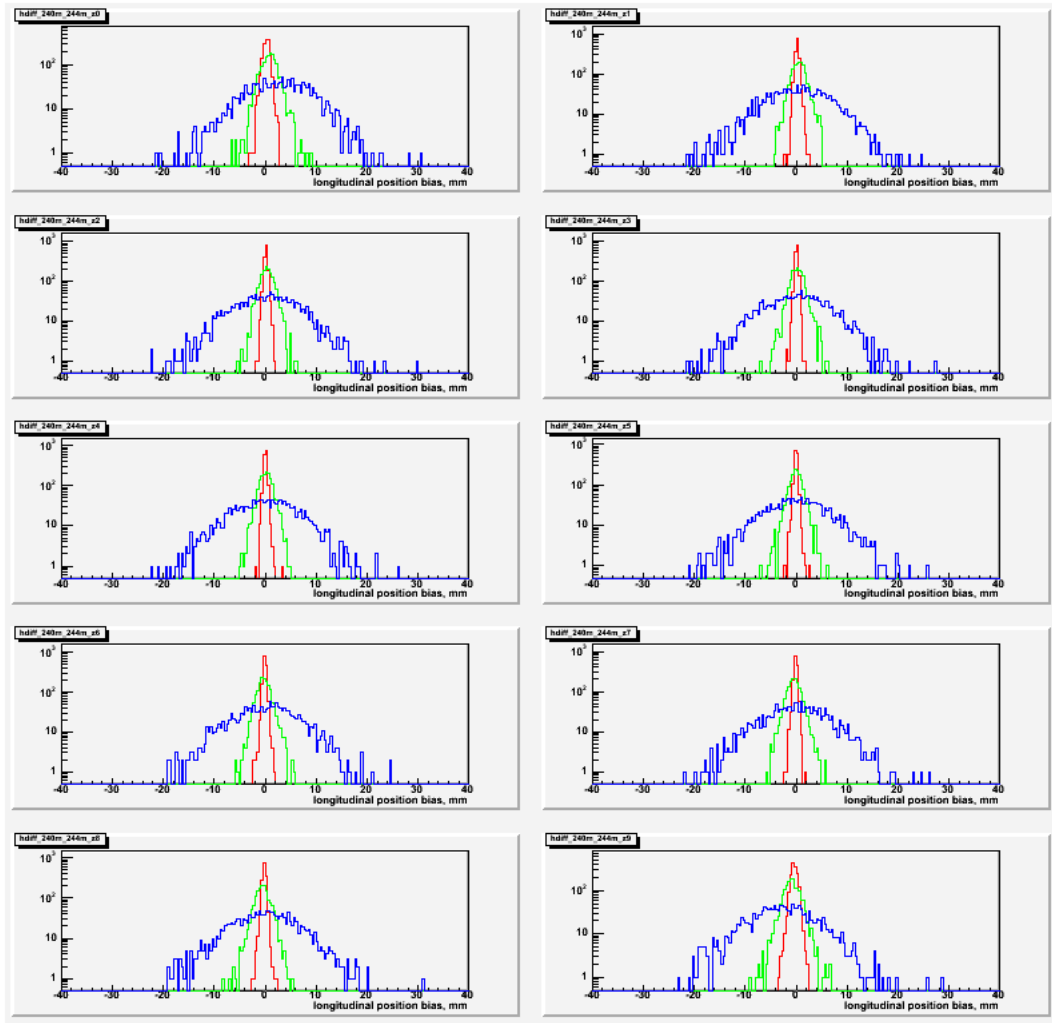
- Ground muons:
 - Used so far for event processing
- On-orbit August 2008 – produced in 2008 from runs collected between launch and August 14, 2008 (500 runs – including LEO)
 - Existing event selection and fitting function
 - Limited number of events in bottom CAL layer.
- On-orbit for the first year: 6 calibration files for 6 Ms (~2 months) each
 - Two versions: with and without improvements in event selections and fitting.

Effect of improvements (large diodes)

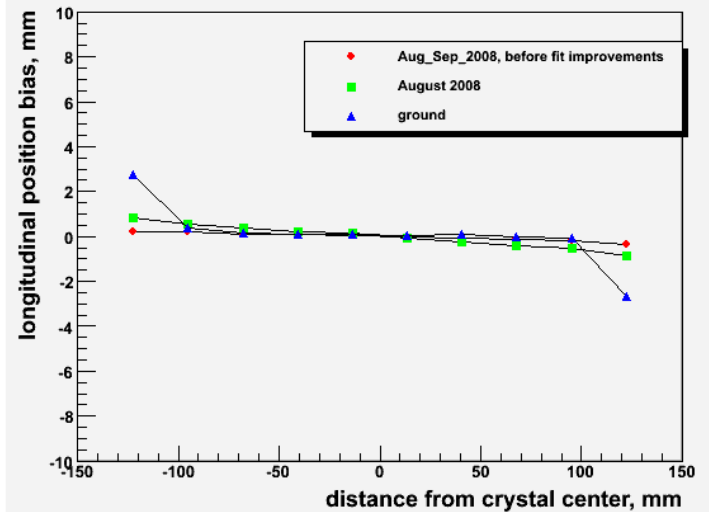
- Final version of calibration for August-September 2008 is compared with previous versions – for large diodes



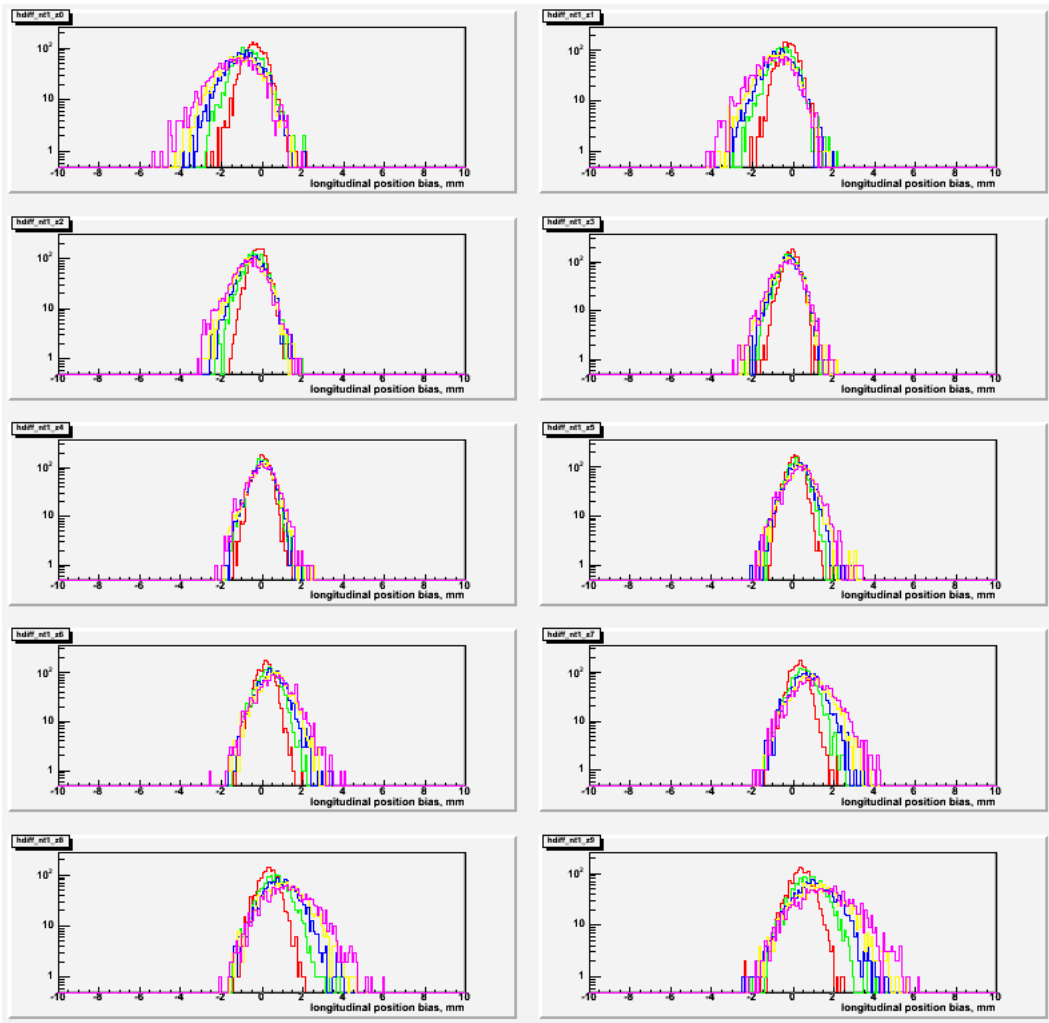
Effect of improvements (small diodes)



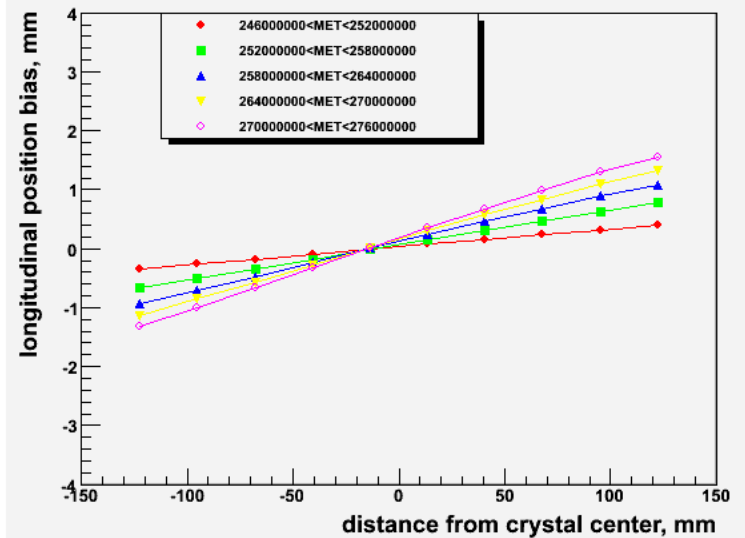
difference in asymmetry calibration - small diodes



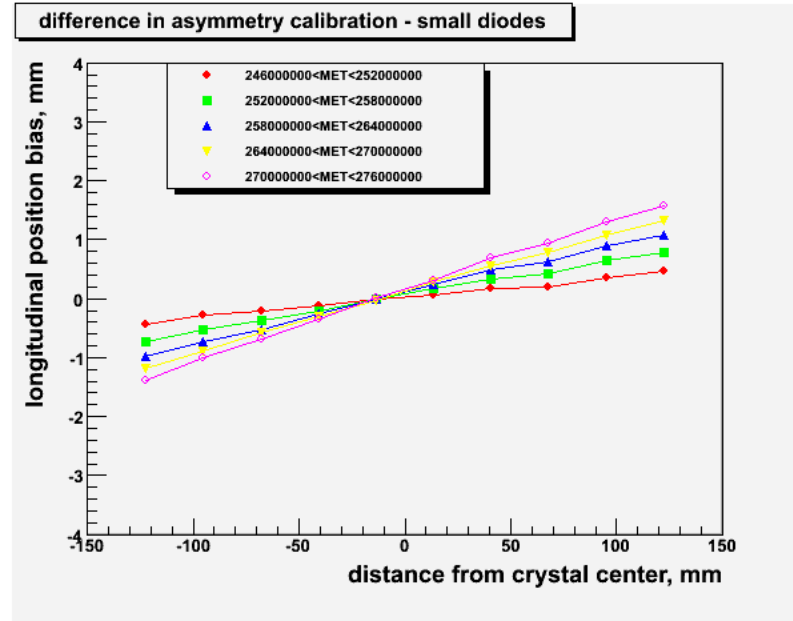
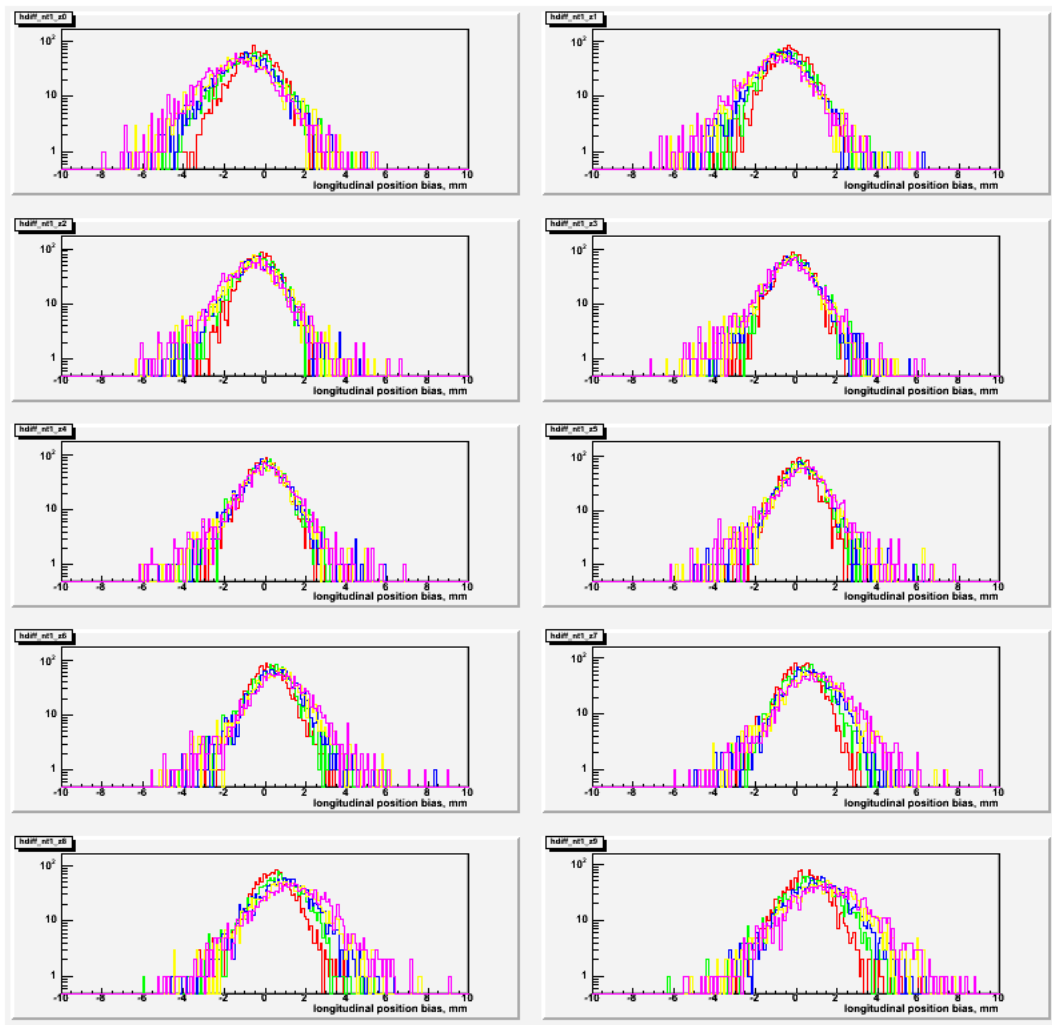
Time evolution (large diodes)



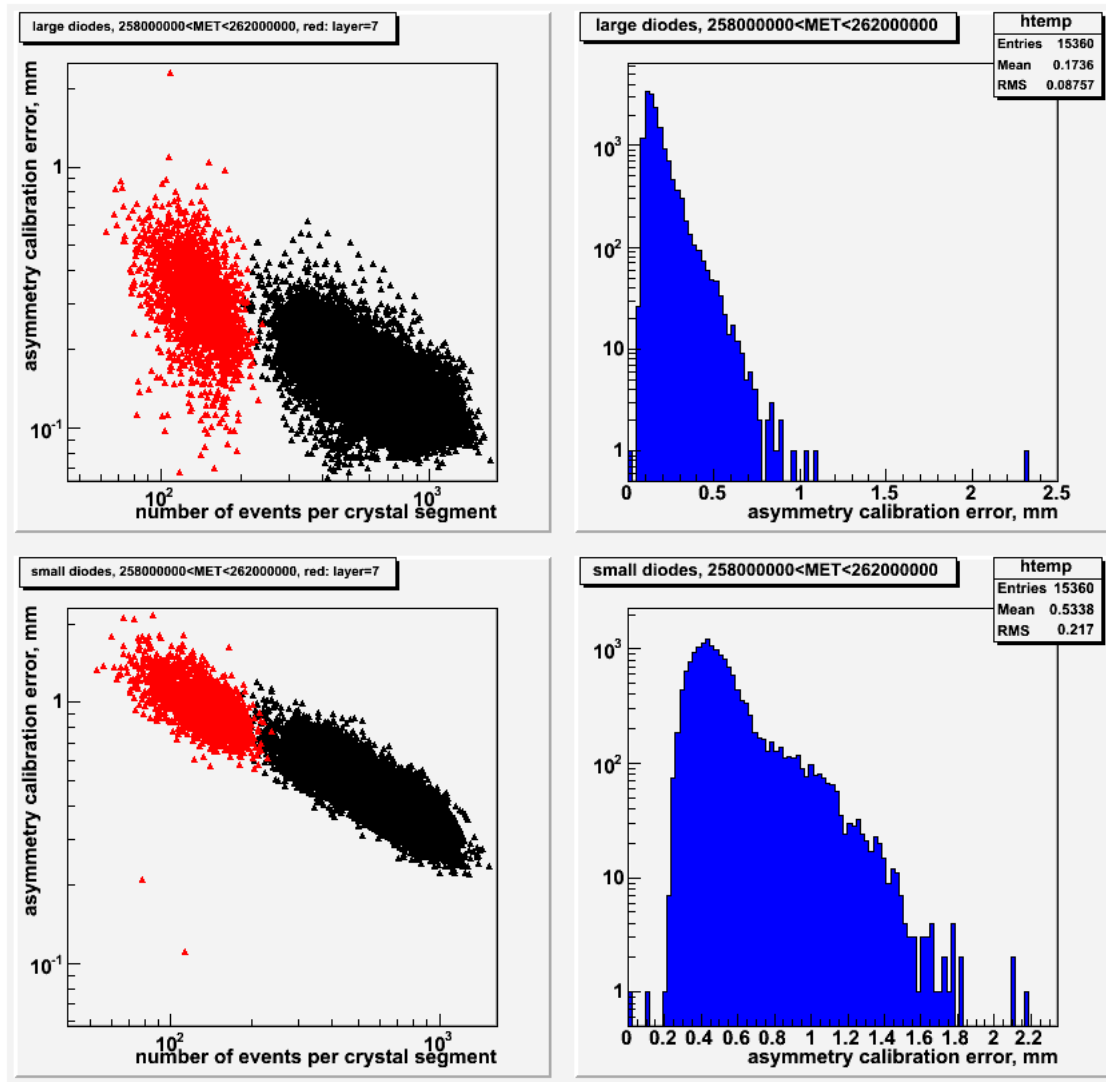
difference in asymmetry calibration - large diodes



Time evolution (small diodes)



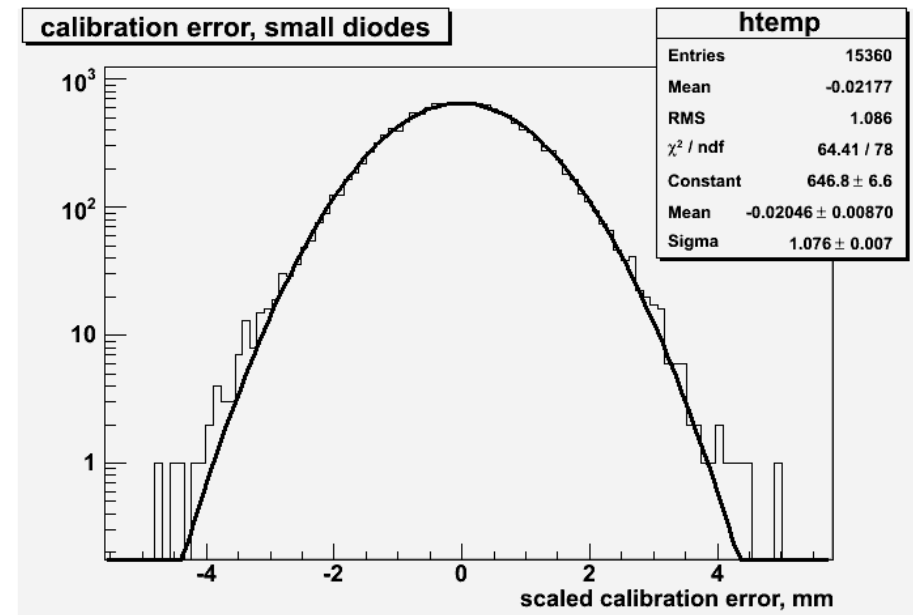
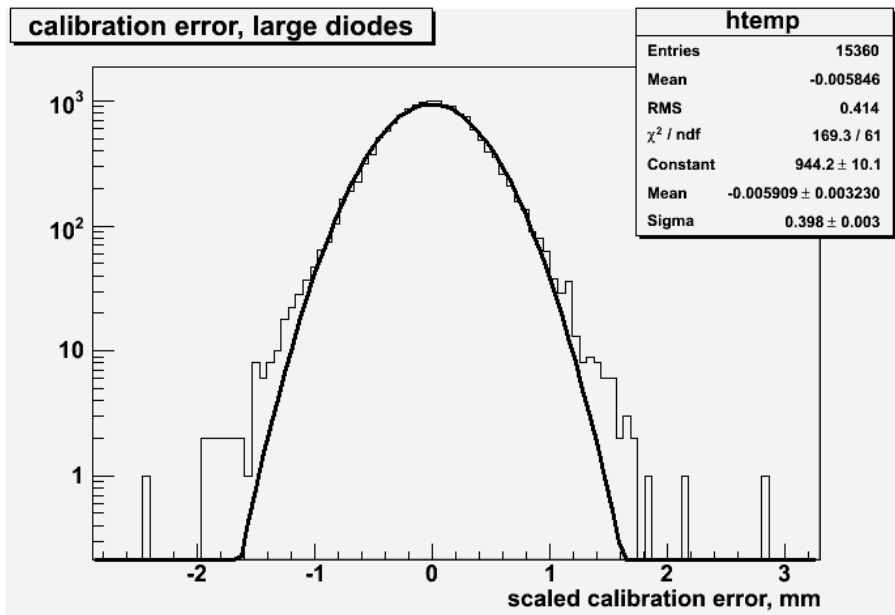
Calibration errors – from the fit



- Left plots show the asymmetry calibration errors vs number of events per crystal segment
 - Red points correspond to crystals in bottom layer
 - Errors depend on number of events as $1/\sqrt{N}$

Calibration errors – from comparison of independent calibrations

- To get reasonable estimation of calibration errors I've compared the calibration coefficient for each crystal in period 3 with the average of the same crystal of periods 2 and 4 (to suppress time evolution)
- As the error is proportional to $1/\sqrt{N}$, the following plots shows the errors scaled to $N=100$
- Scaled error is ~ 0.4 mm for large diodes and ~ 1.1 mm for small diodes
- Based these errors, the calibration files with additional spread have been generated
 - To be used at event generation stage during MC simulation



Conclusion

- On-orbit CAL asymmetry calibration with improved procedure allows to get calibration error down to 1-2 mm.
- The calibration files for the 2-nd year will be generated when GCR files will be generated (requires data reprocessing)