The Second Workshop
Precision Astronomy with Fully Depleted CCDs

CCD Characterisation with Cosmic Rays

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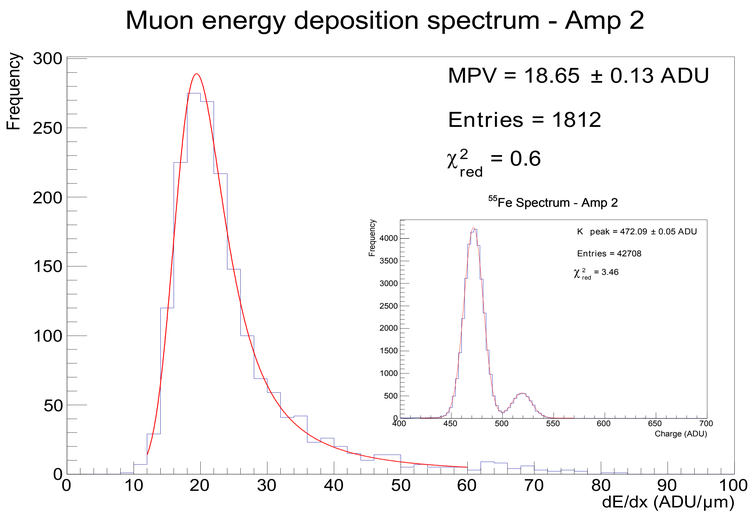
Gain Calibration

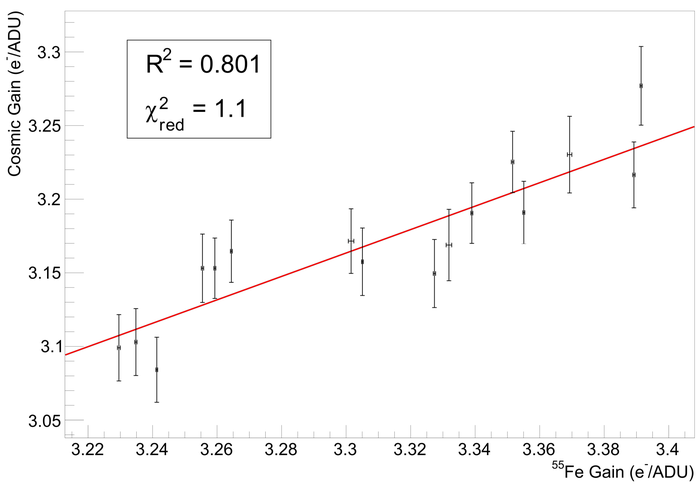
Cosmic ray muons can be used to measure gain without the need for placing radioisotopes inside the cryo-system, allowing gain to be monitored in-situ.

Energy is deposited stochastically, but with a most-probable amplitude per unit length given by the Landau distribution.

By fitting this energy deposition spectrum an absolute gain measurement can be made.

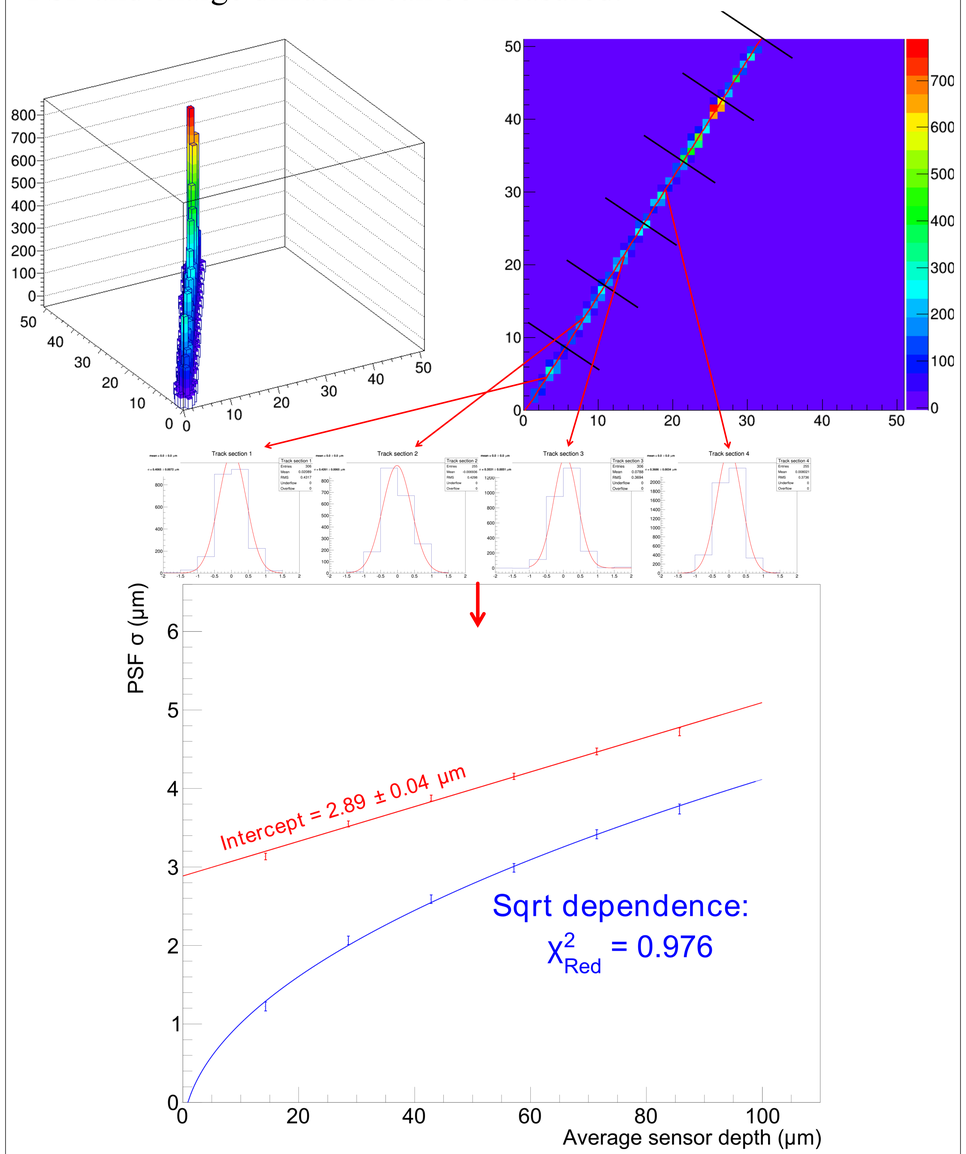


Good correlation is found between cosmic ray and ^{55}Fe results.



PSF Measurement

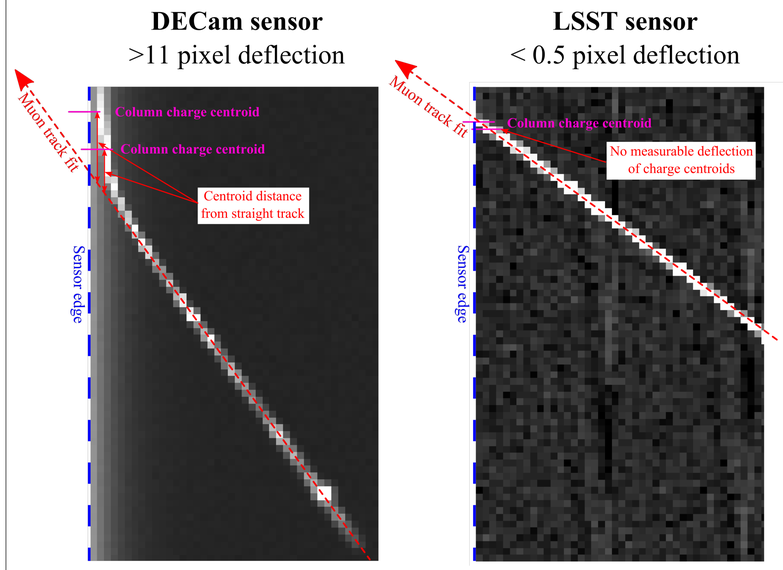
A cosmic ray will deposit energy over a very small cross-sectional area. By examining the evolution of the width of the track as a function of energy deposition depth in the sensor, the PSF and charge diffusion can be measured.



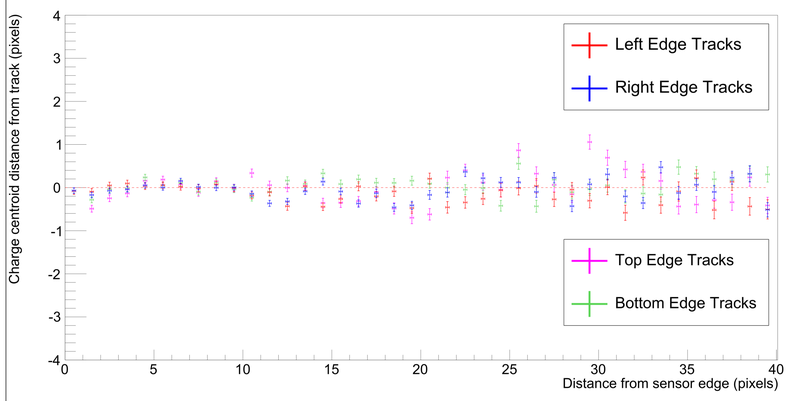
The y-intercept of 2.89μm corresponds exactly to $\frac{pixel\ size}{\sqrt{12}}$, the intrinsic resolution of the pixel detector. Subtracting this in quadrature shows the $\sqrt{d}$ dependence arising from the diffusion of charge carriers, and allows calculation of the diffusion coefficient.

Edge Distortion

Cosmic ray muon tracks are very straight. Lateral field effects and edge distortions can therefore be probed by looking at the deviation from a perfect straight line with respect to position on the sensor.



Plotting the distance from the column's charge centroid to the track for LSST sensors shows negligible track bending on all sensor sides.



This analysis is a work in progress. A comparison of LSST and DECam sensor performance will follow.

Acknowledgements

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