Analysis of the DEPFET detector test beam data

taken at SPS in 2008/2009
with the use of the Ilcsoft Marlin processor package EUTelescope

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Belle II PXD/DEPFET Meeting
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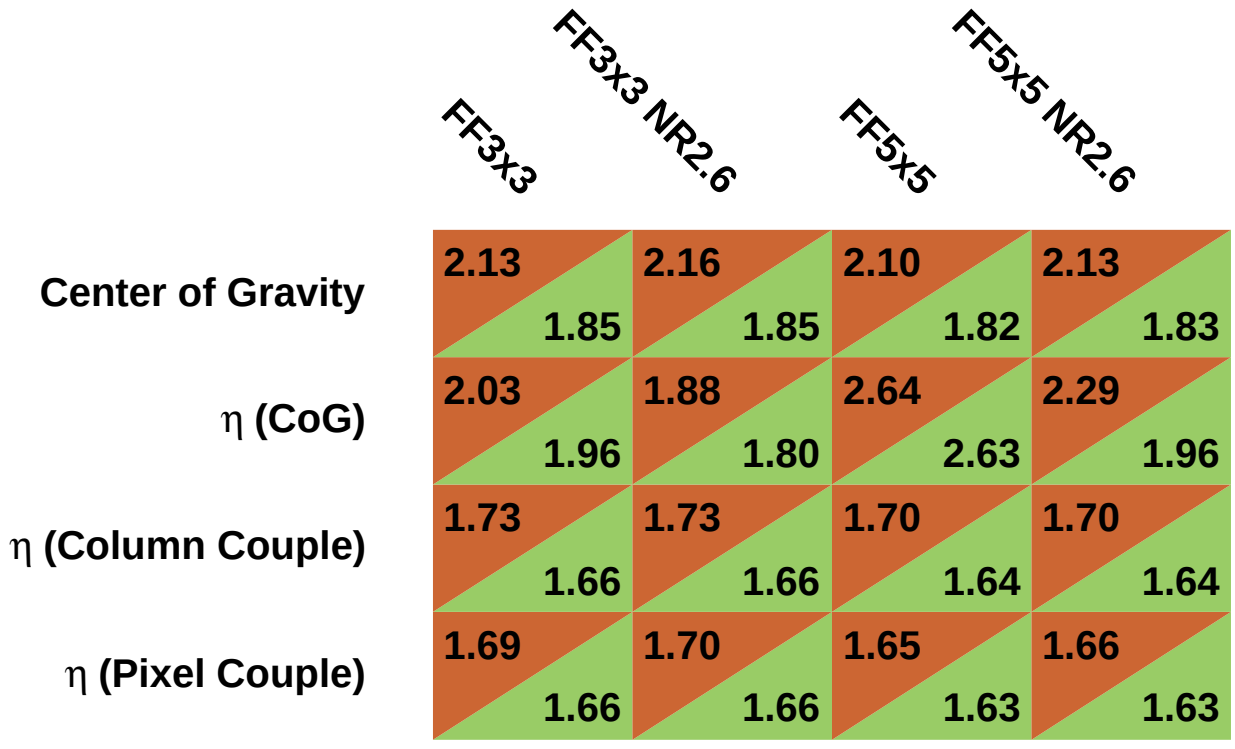
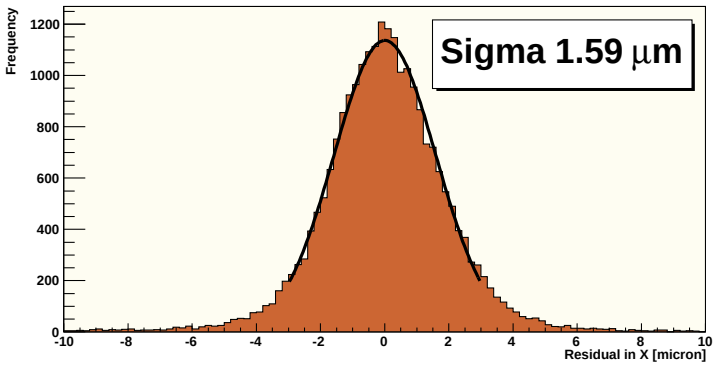
Comparing Algorithms

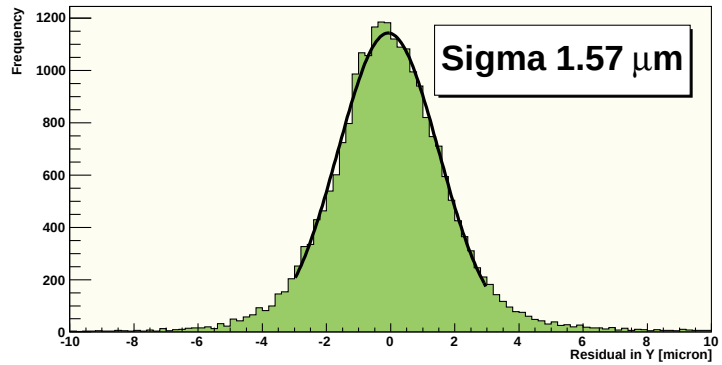


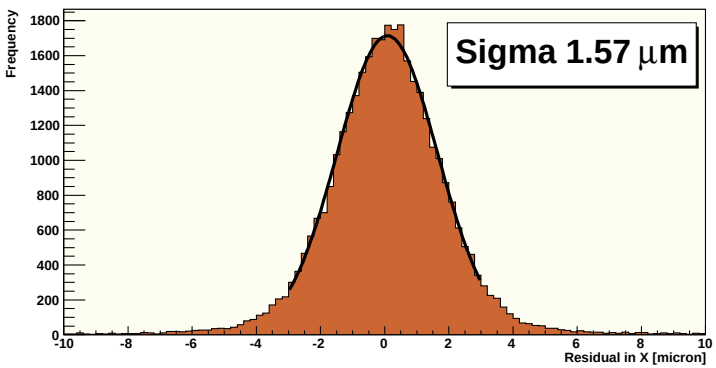
The matrix chart displays the residuals for x (red) and y (green) in dependence of the clustering procedure and the hit reconstruction algorithm in μm.

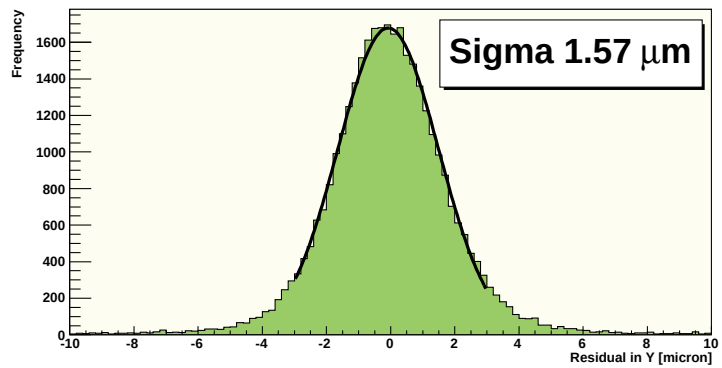
FF = Full Frame; NR2.6 = Noise Reject at 2.6 Sigma

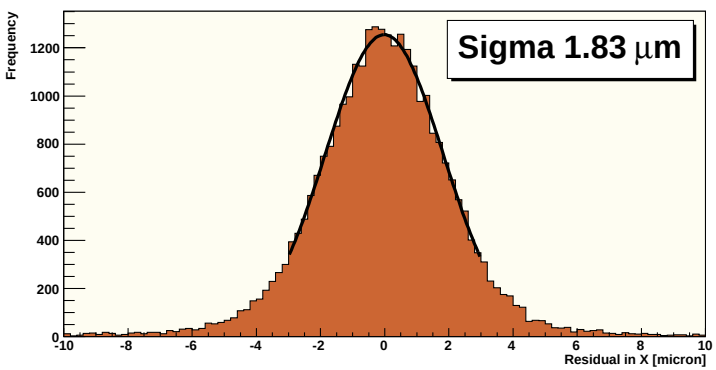
Residuals TB2009

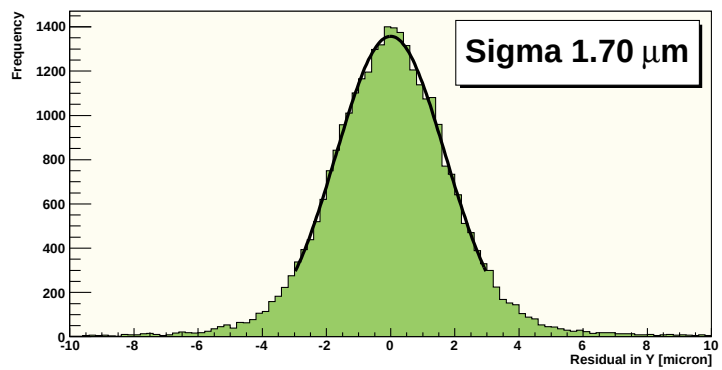






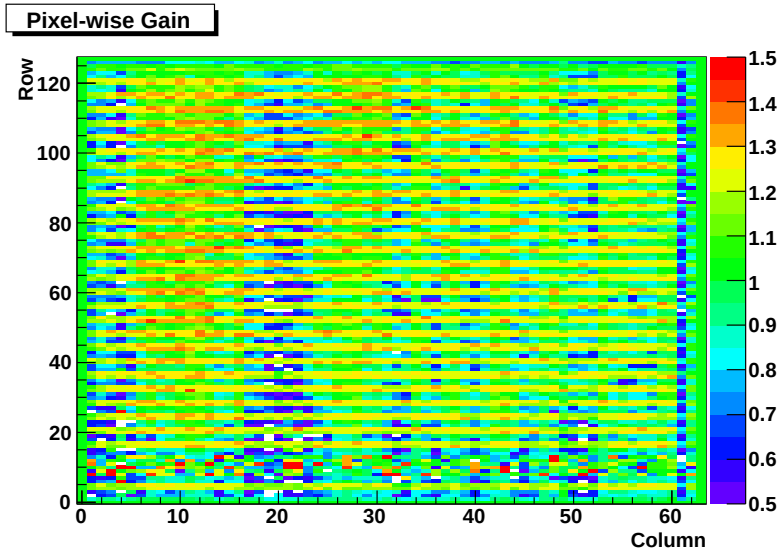


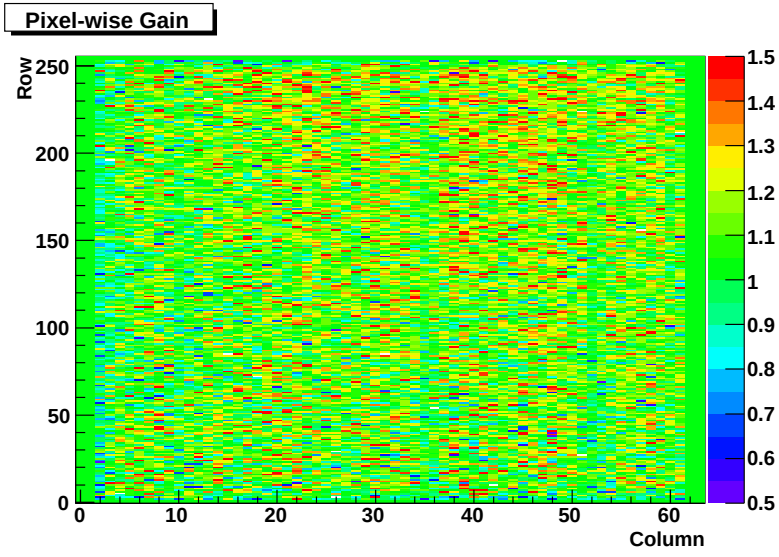


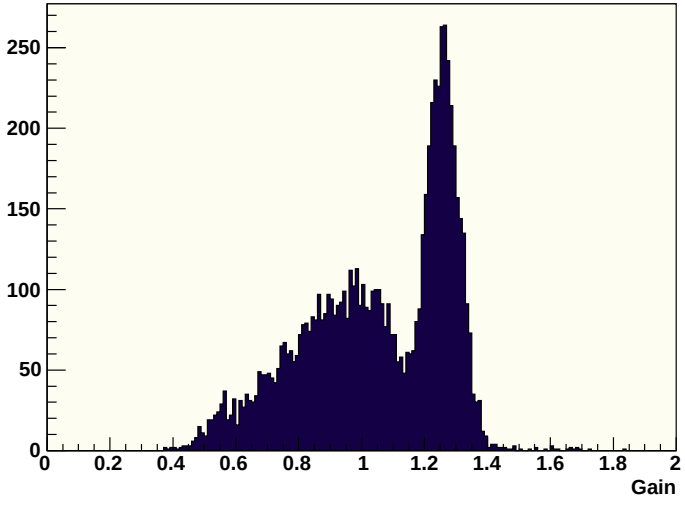


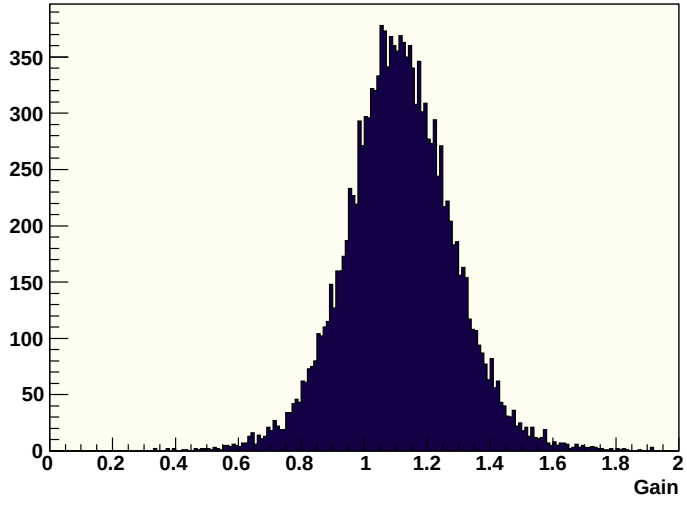
Residuals in x and y of H3.0.04, H3.0.07 and H3.0.01. Telescope and DUT hits reconstructed with eta px couple algorithm.

Gainmodulation





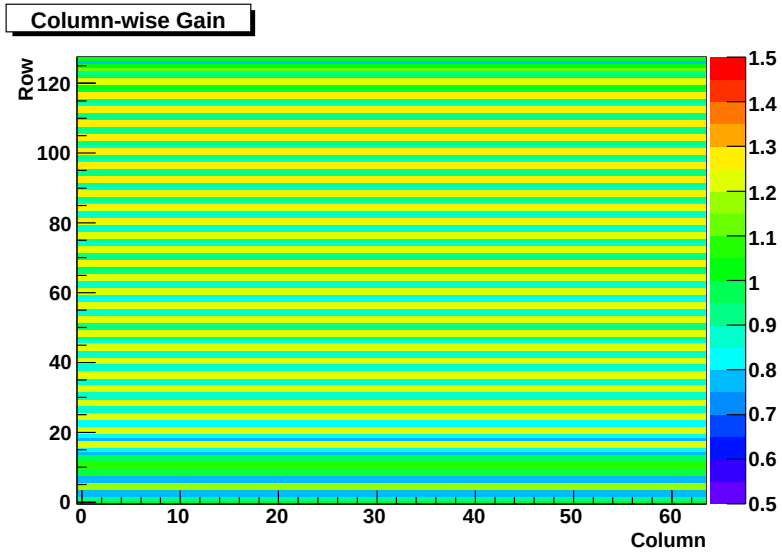


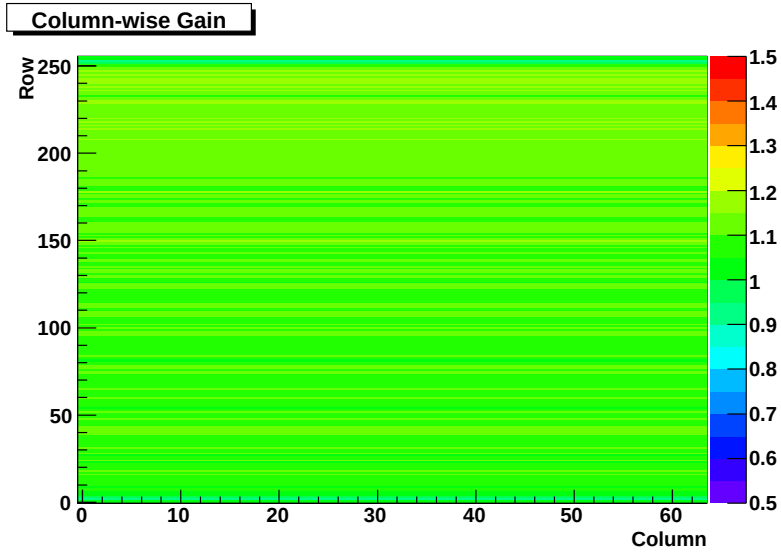


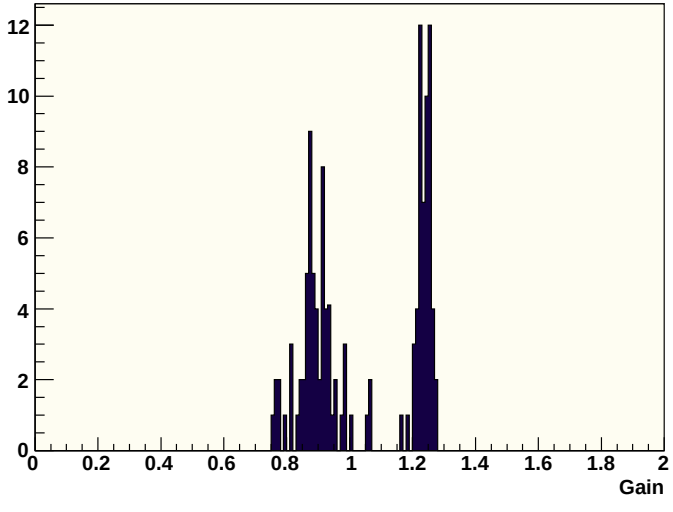
Telescope Mod4 of TB2008

DUT H3.0.04 of TB2009

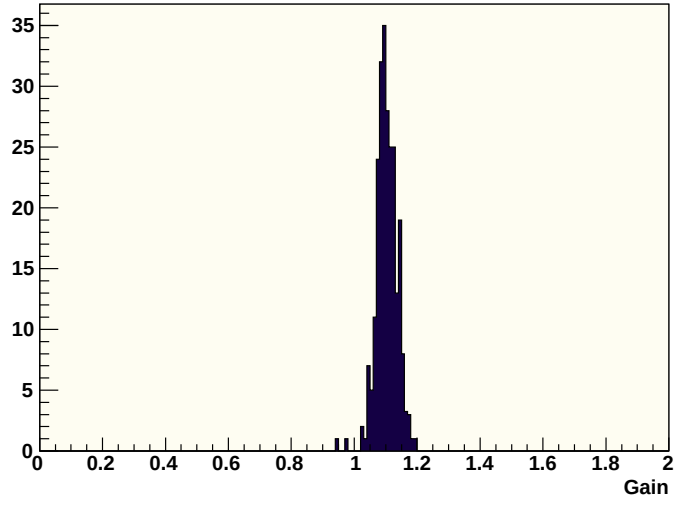
Gainmodulation





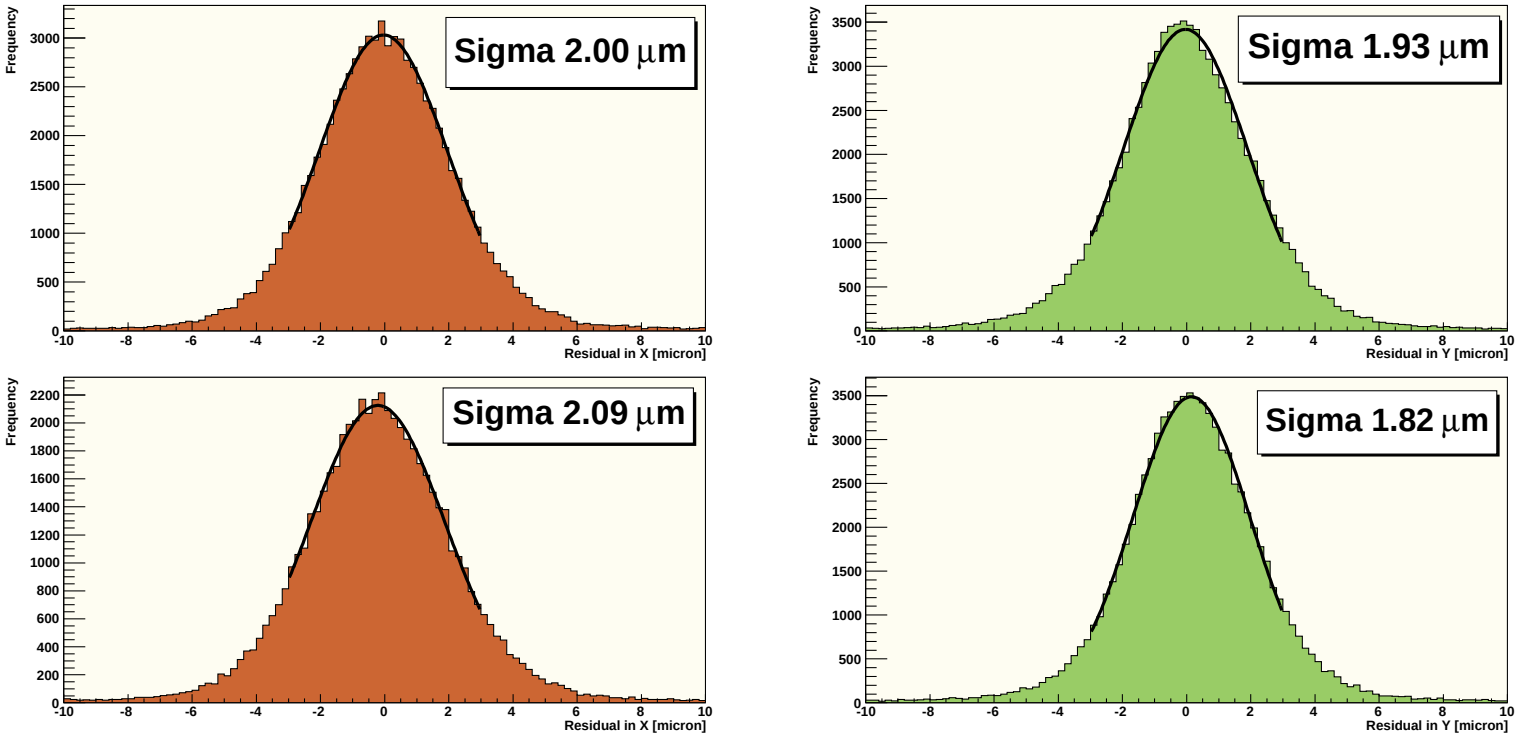


Telescope Mod4 of TB2008



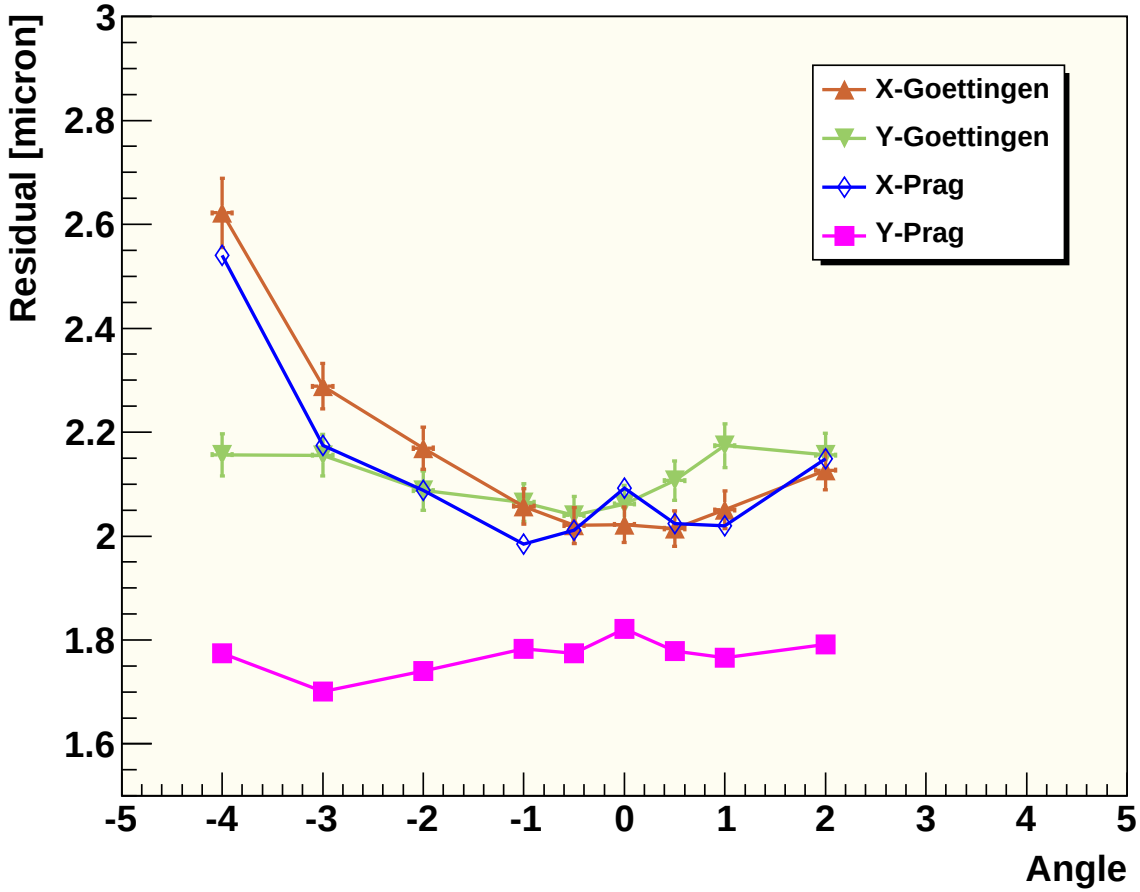
DUT H3.0.04 of TB2009

Residuals TB2008



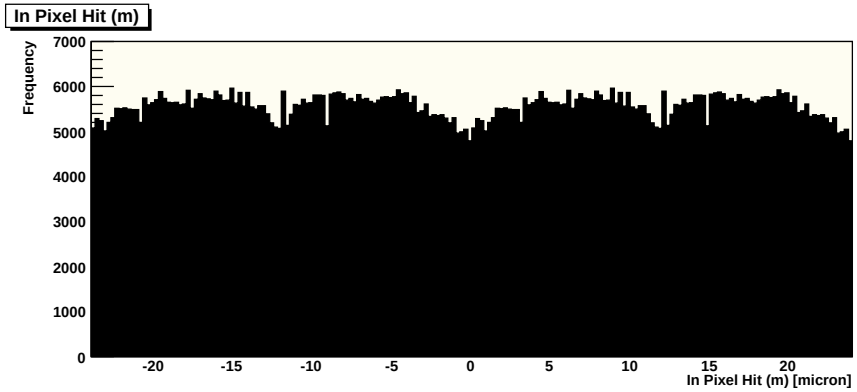
Residuals in x and y of TB2008 DUT mod3 with and without gain correction. The plots on the top represents the data processing without correcting for gain variation. The two bottom plots displays the residuals of the same dataset after row- and column-wise gain correction. Telescope and DUT hits reconstructed with eta px couple algorithm.

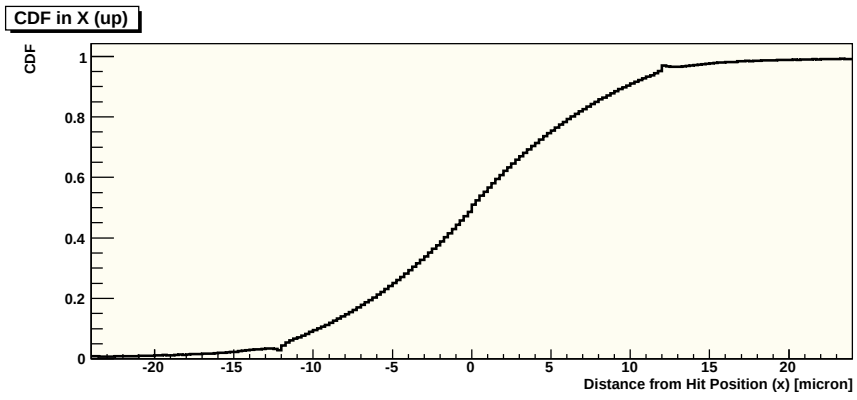
Angular Scan

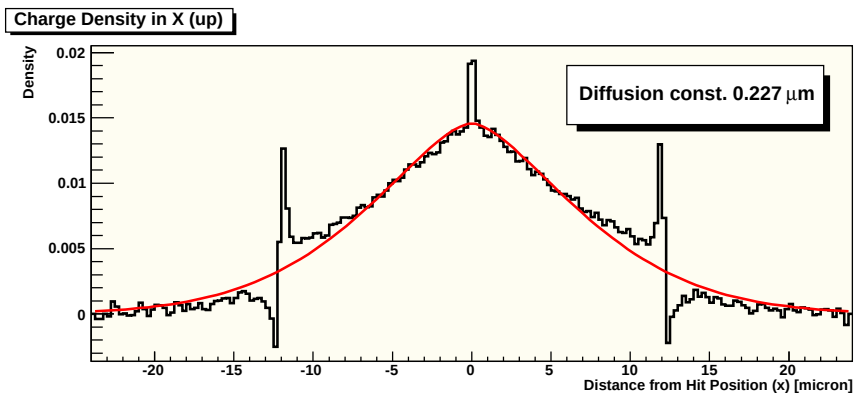


Comparison of the angular scan of TB08. Plotted is the analysis done in Prague and Goettingen. The deviation in y is a result of the gain modulation that is corrected for in the analysis of the Prag group.

Surface Charge







Calculation of the surface charge cloud of DUT mod3 of Run1318.

$$
\begin{aligned}
S_L &:= \int_{-\infty}^{-p/2} \rho(x-m)\,\mathrm{d}x \\
&= P(p/2-m) \\
S_U &:= \int_{p/2}^{\infty} \rho(x-m)\,\mathrm{d}x \\
&= 1-P(-p/2-m)
\end{aligned}
$$

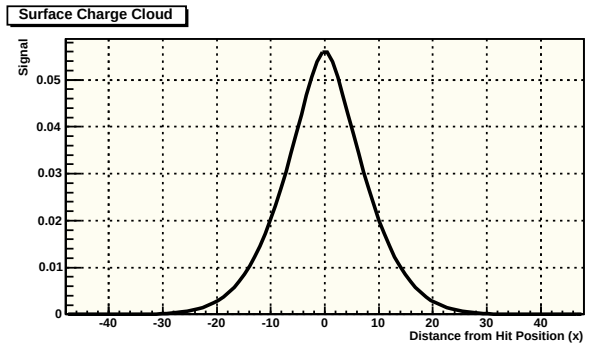
Measurable:

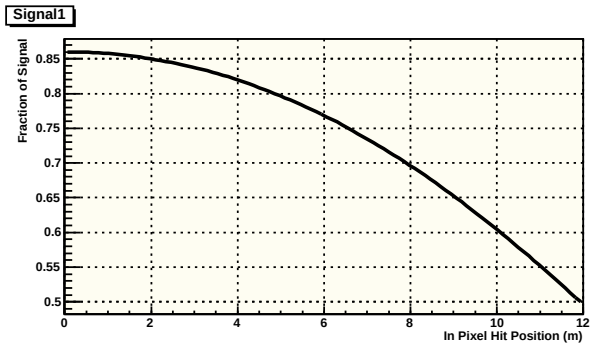
$$S_L : \{-p, 0\} \rightarrow \left\{0, \frac{1}{2}\right\}$$

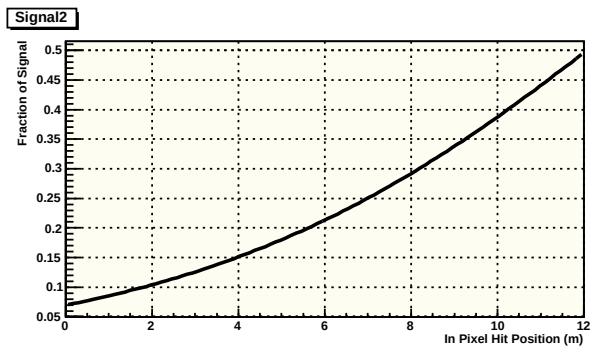
$$S_U : \{0, p\} \rightarrow \left\{\frac{1}{2}, 1\right\}$$

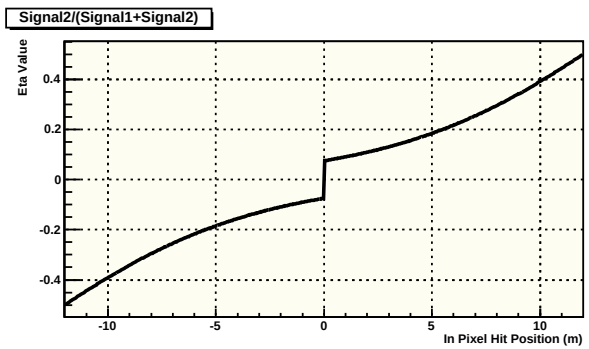
Average Charge Density $\rho(x)$; Cumulative Charge Distribution $P(x)$; In Pixel Hit m; Distance from Hit x; Pixel Pitch p

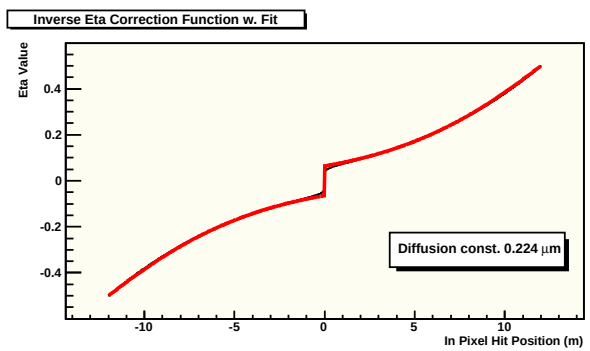
Fitting the Eta Distribution to Data

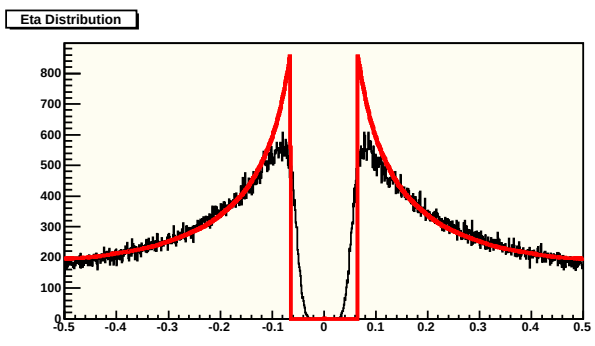








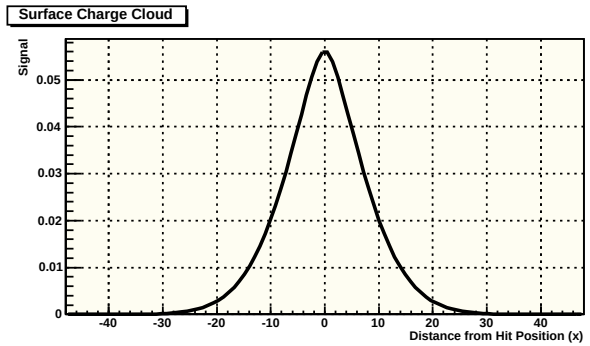


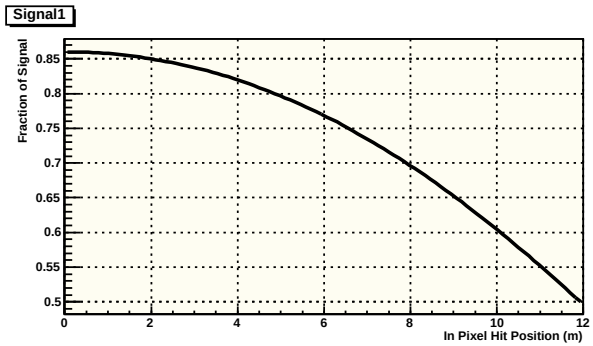


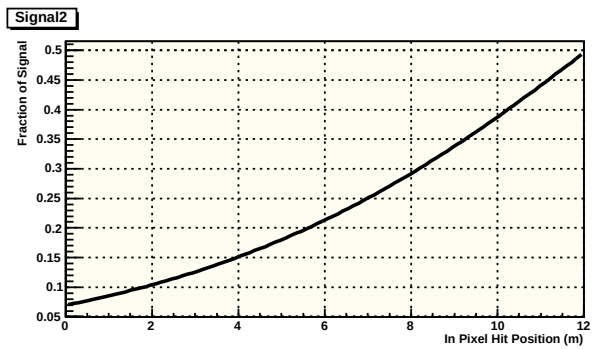
Fit of a theoretical eta distribution to the measured data (TB08 Run1318 mod3).

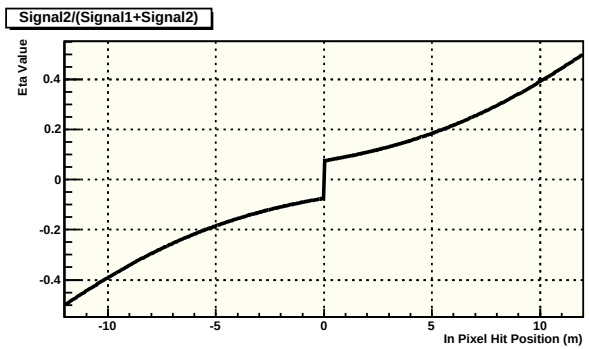
In the model the diffusion spread is proportional to $\sqrt{z}$.

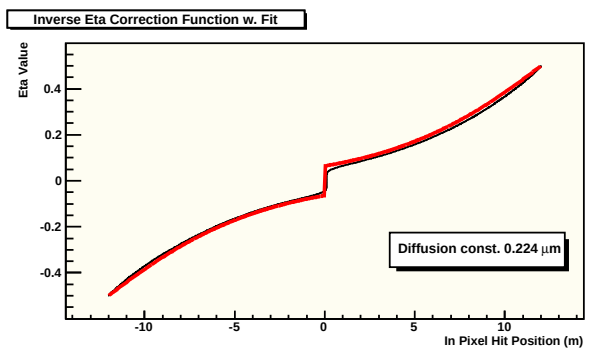
Fitting the Eta Distribution to MC

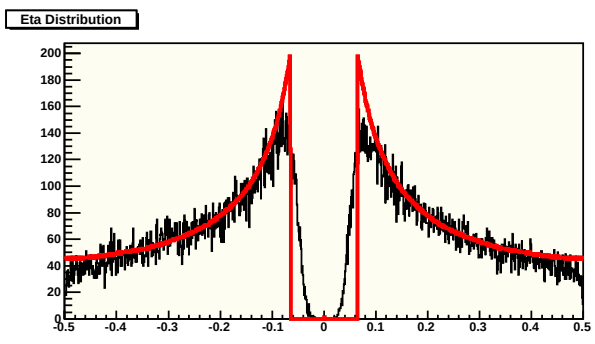






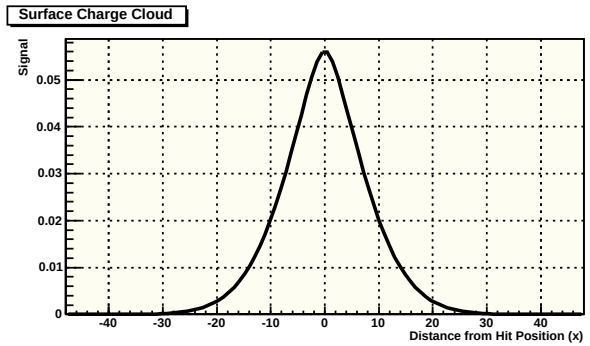


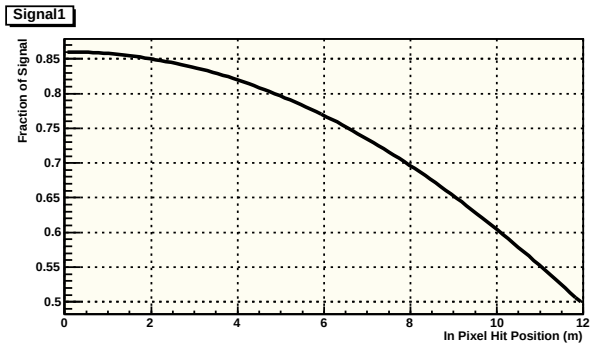


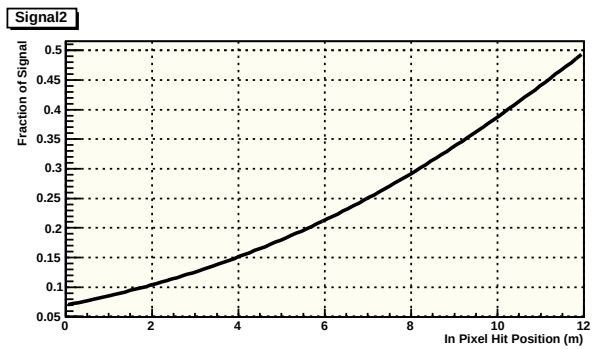


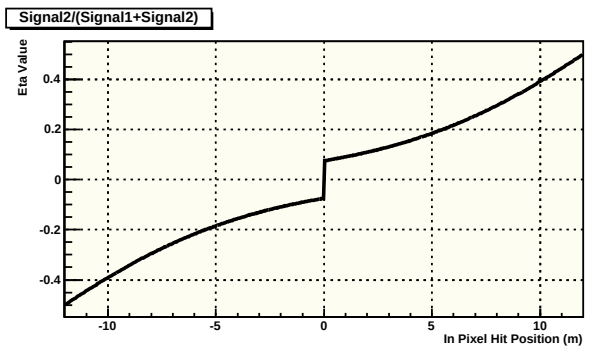
Comparison of a theoretical eta distribution to the digitizer montecarlo. The extracted diffusion constant ($0.224\mu m$) differs from the constant set in the digitizer ($0.25\mu m$).

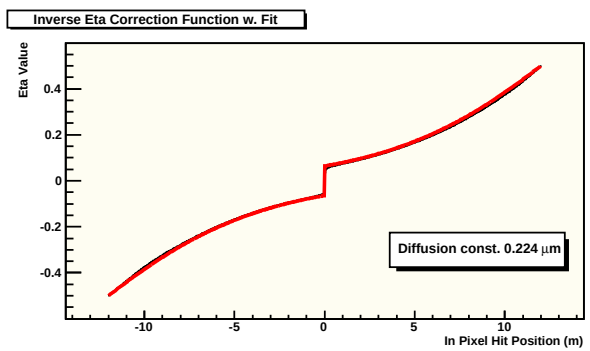
Fitting the Eta Distribution to MC

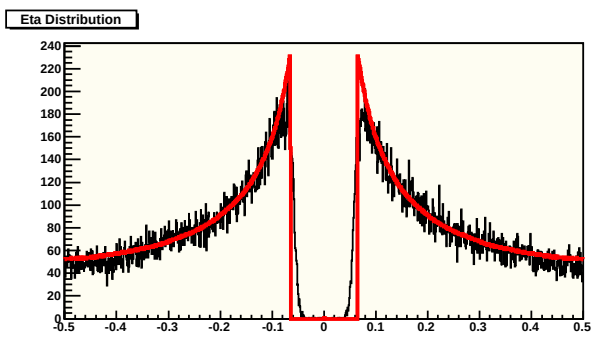






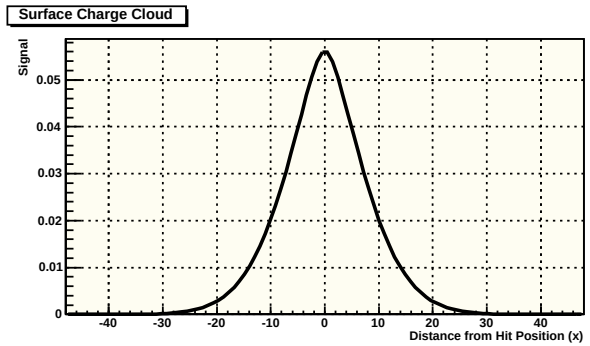


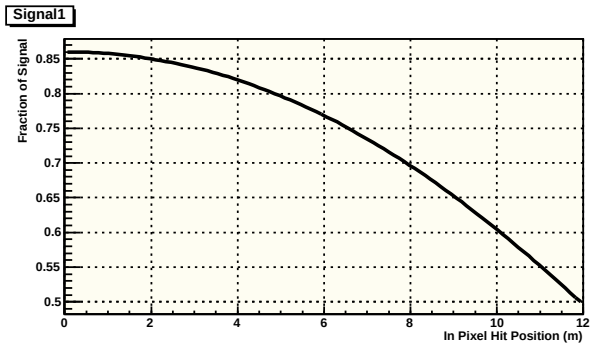


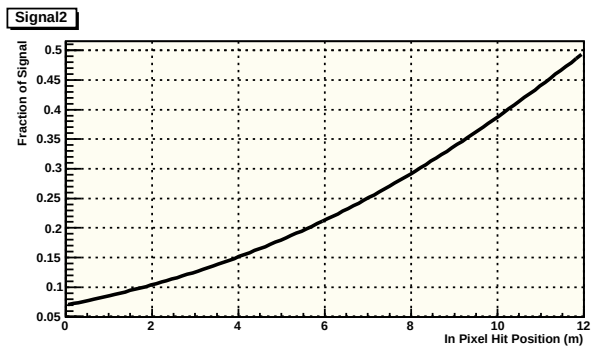


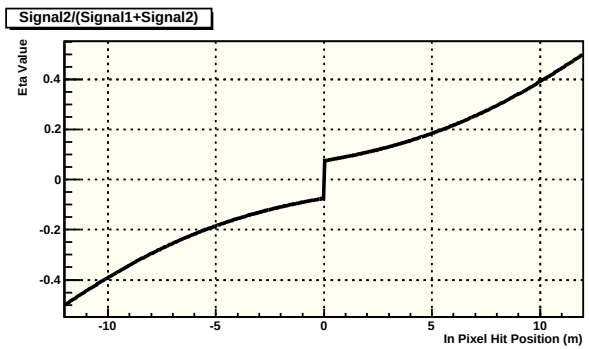
Comparison of a theoretical eta distribution to the digitizer montecarlo with no noise. The extracted diffusion constant ($0.224\mu m$) differs from the constant set in the digitizer ($0.25\mu m$).

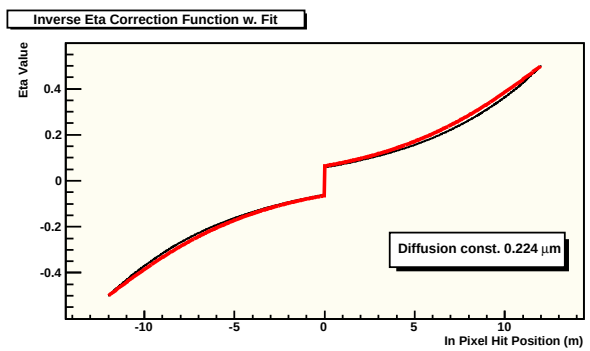
Fitting the Eta Distribution to MC

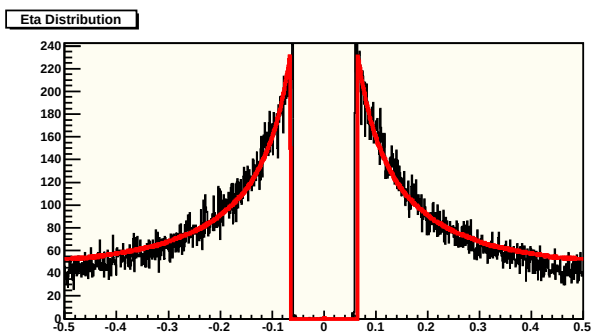






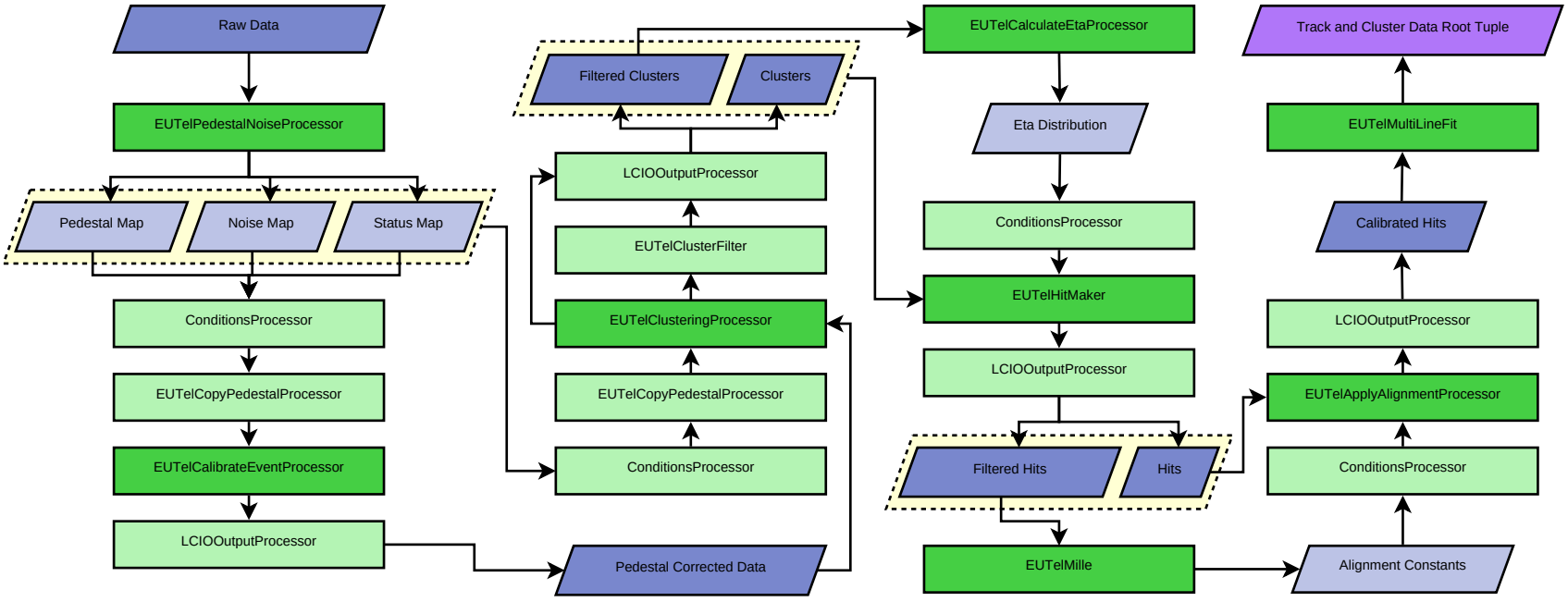






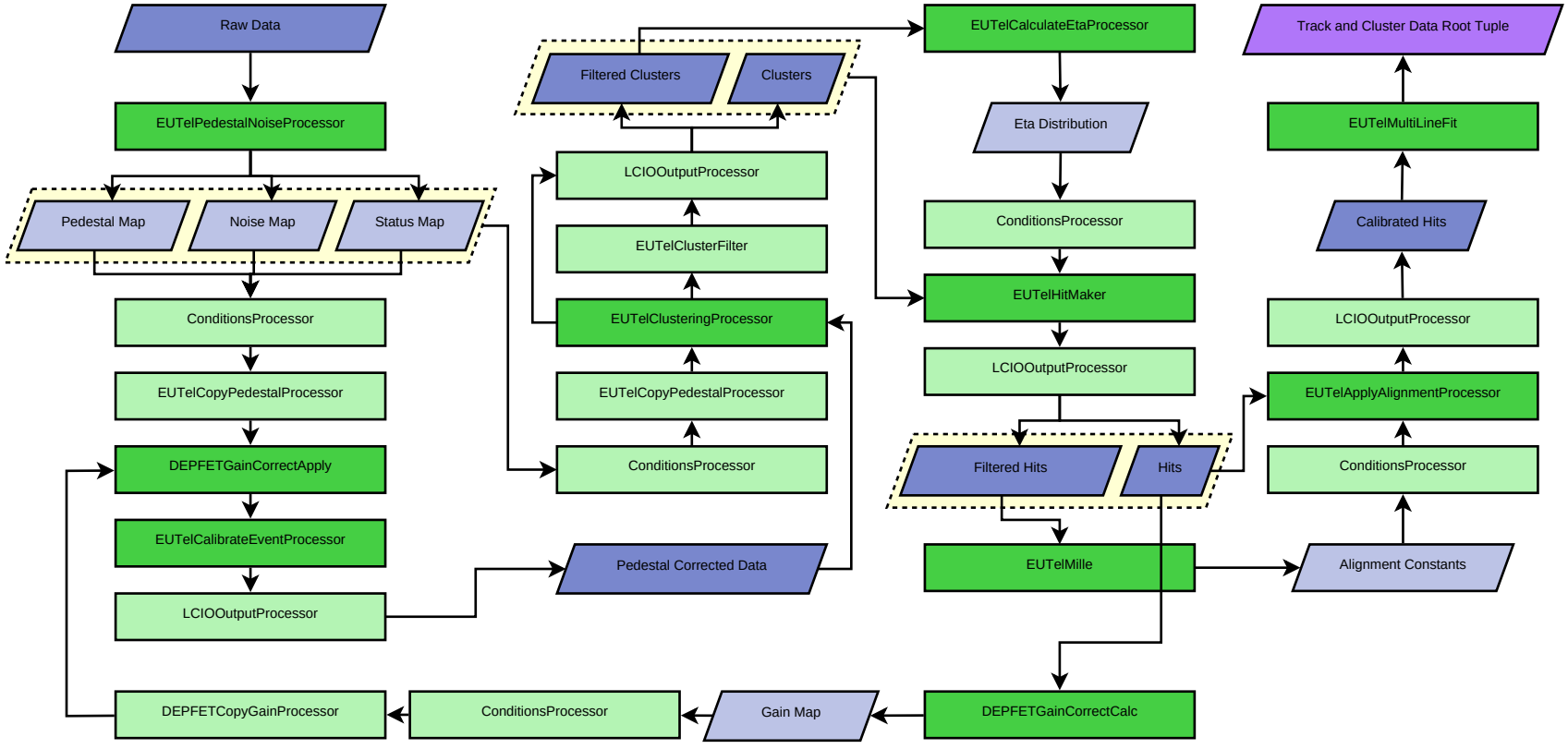
Comparison of a theoretical eta distribution to the digitizer montecarlo with no noise and no fluctuations in the charge deposition. The extracted diffusion constant ($0.224\mu m$) still differs from the constant set in the digitizer ($0.25\mu m$).

Analysis Flow



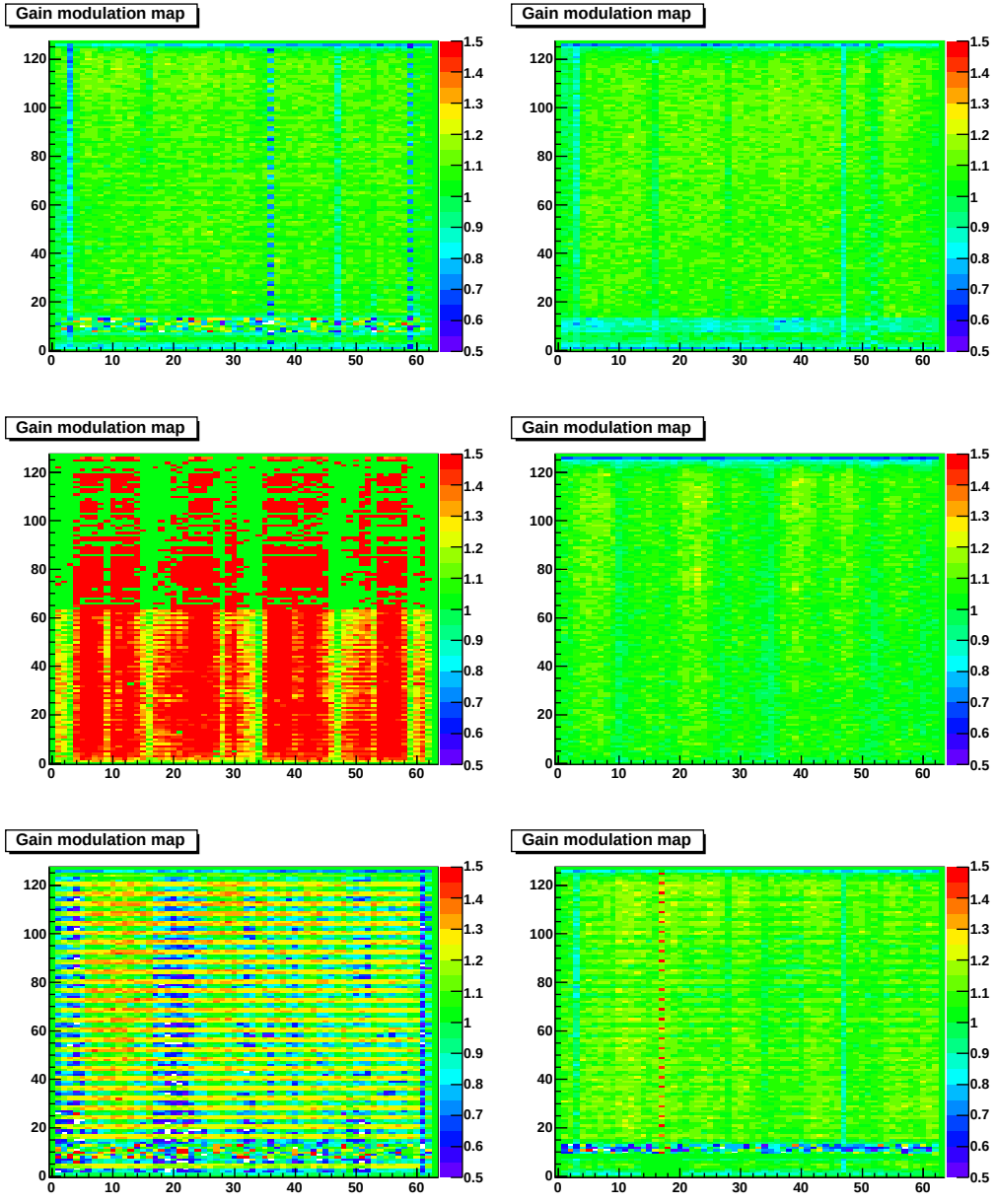
Flowchart displaying the basic flow of the analysis chain. For clarity of presentation the "AIDA Processor" and the root files produced along the way are not drawn.

Analysis Flow



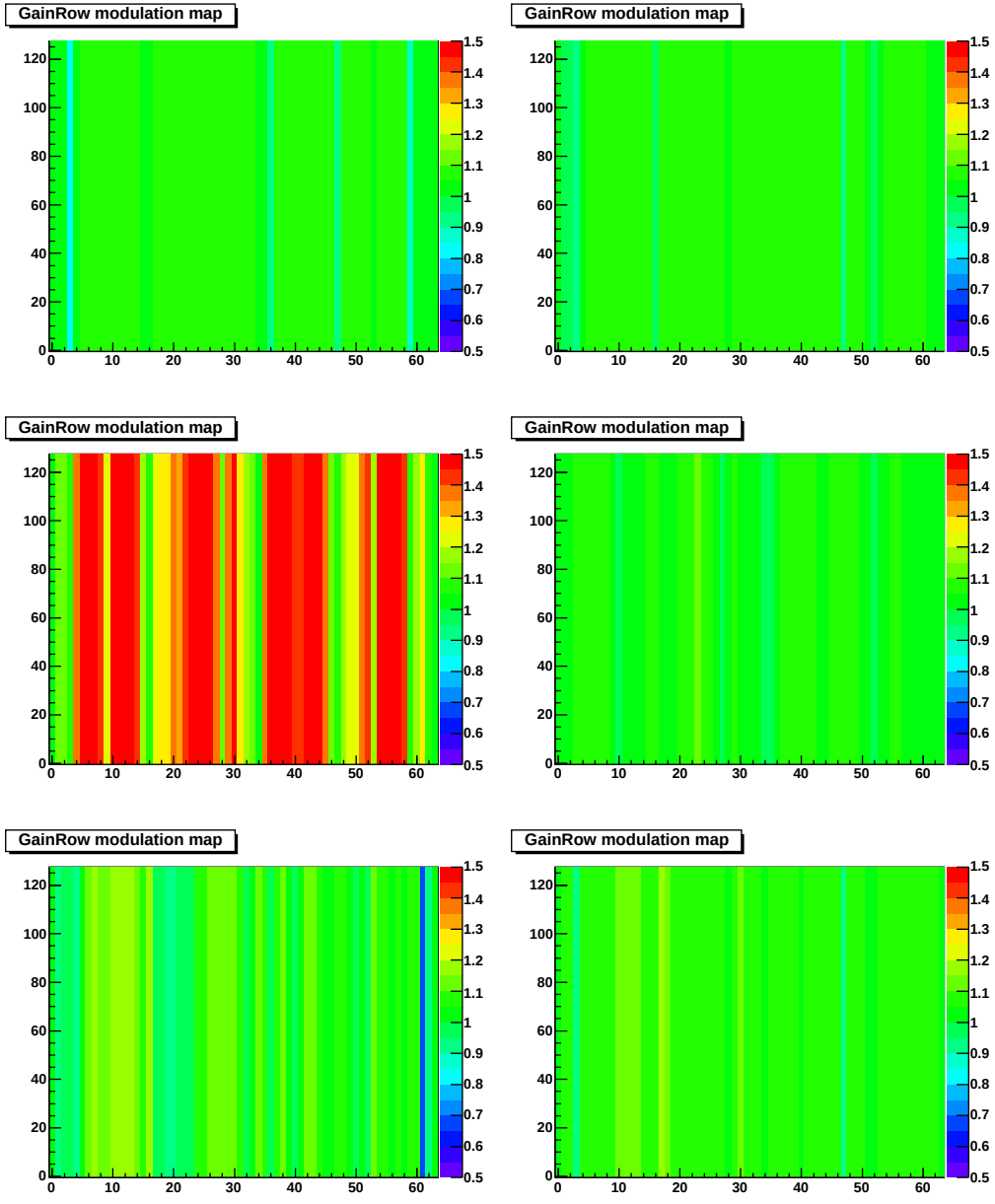
Flowchart displaying the basic flow of the analysis chain including gain correction. For clarity of presentation the “AIDA Processor” and the root files produced along the way are not drawn.

Gain Pixel Map TB08



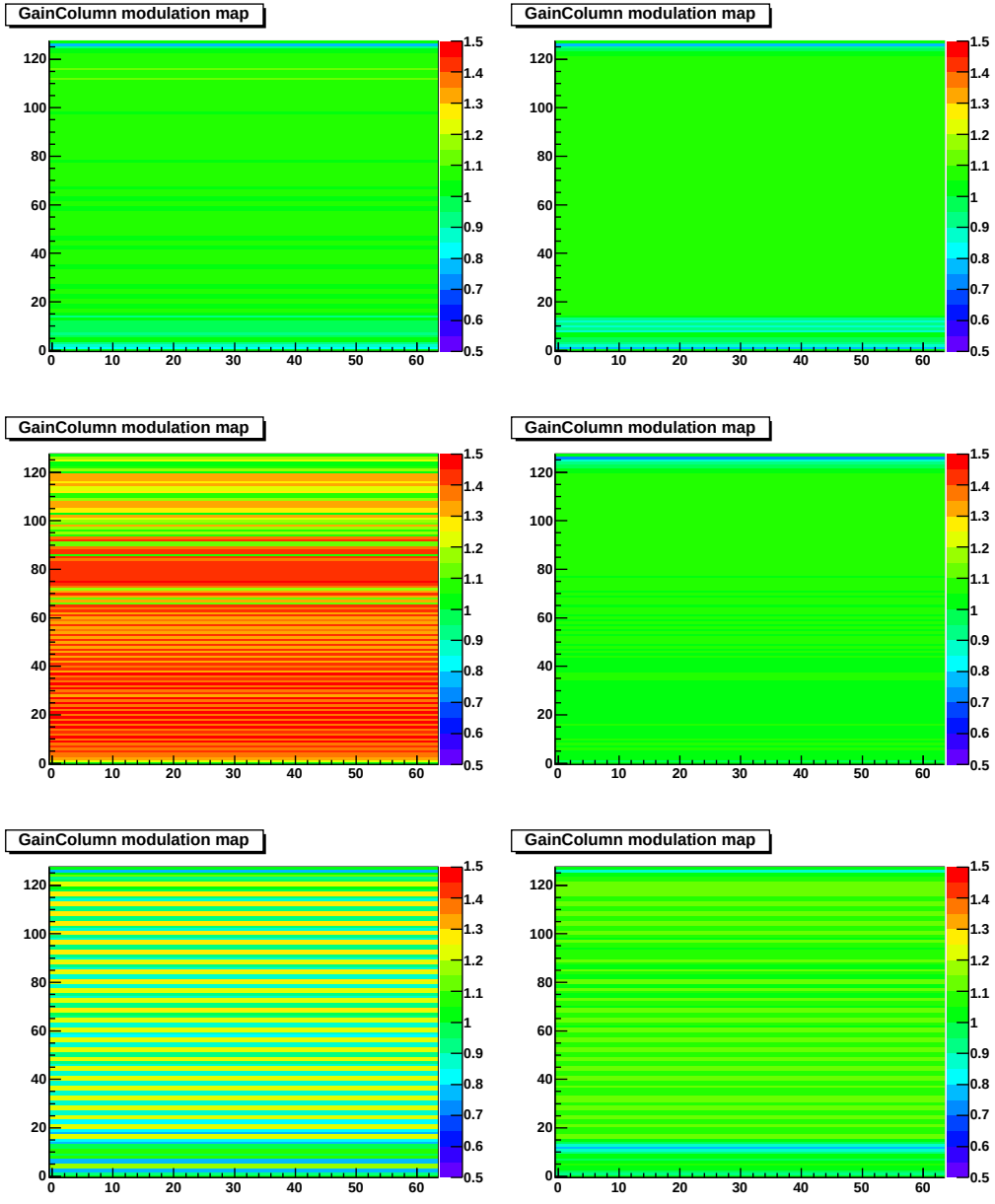
Gain modulation calculated from average of seedpixel of Run1318 TB08.

Gain Row Map TB08



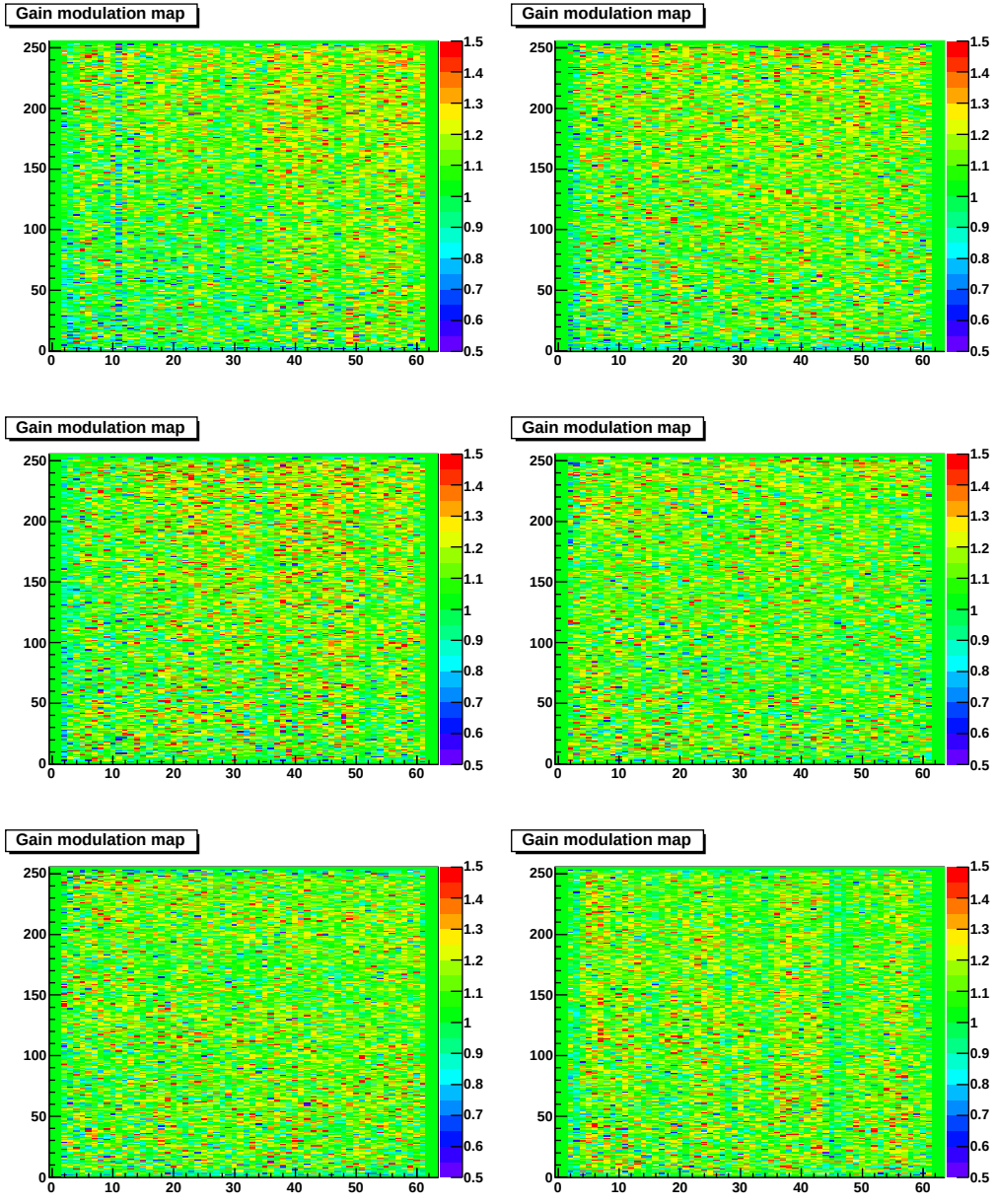
Gain modulation calculated from seed of Run1318 TB08 and averaged over the columns.

Gain Column Map TB08



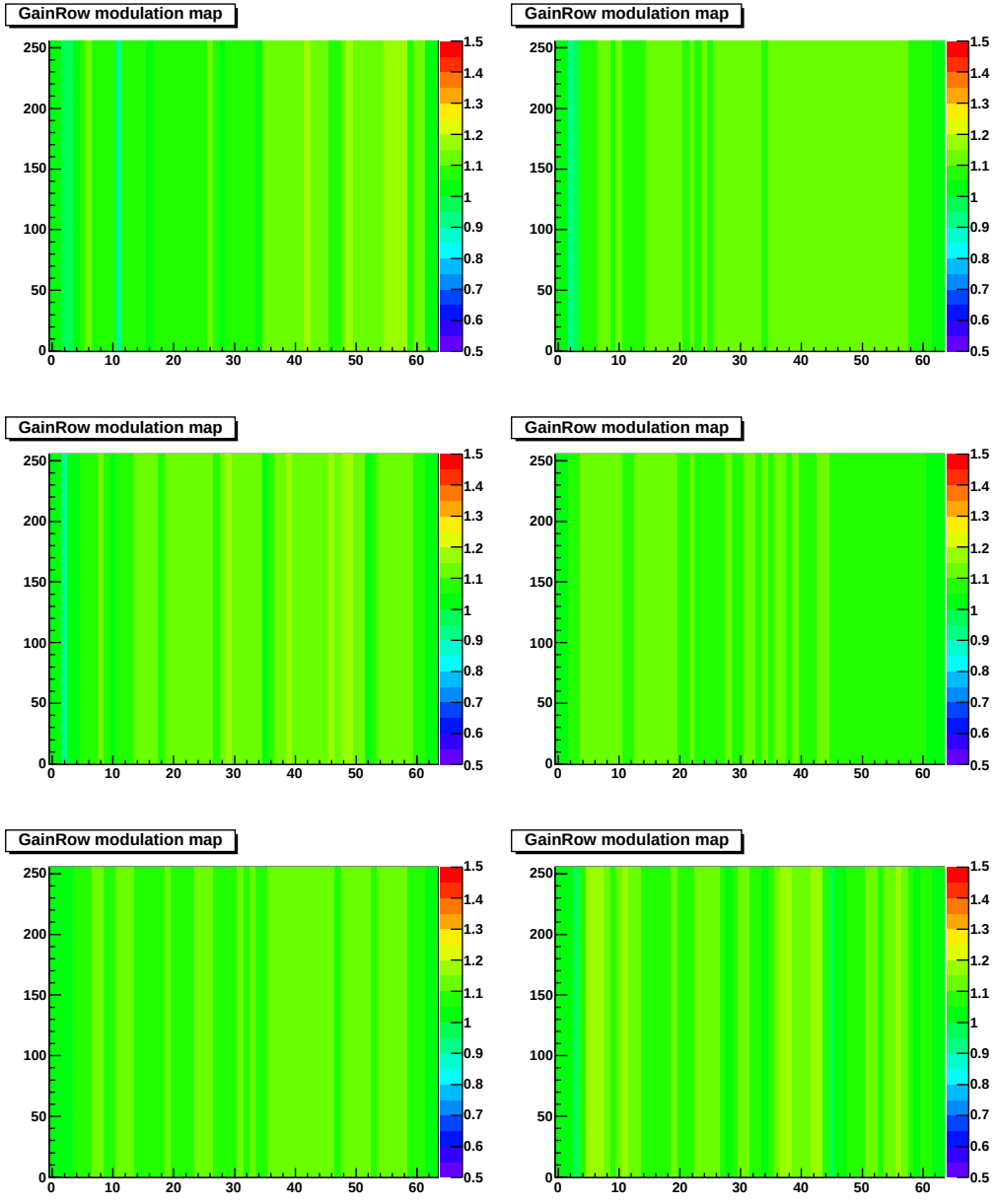
Gain modulation calculated from seed of Run1318 TB08 and averaged over the rows.

Gain Pixel Map TB09



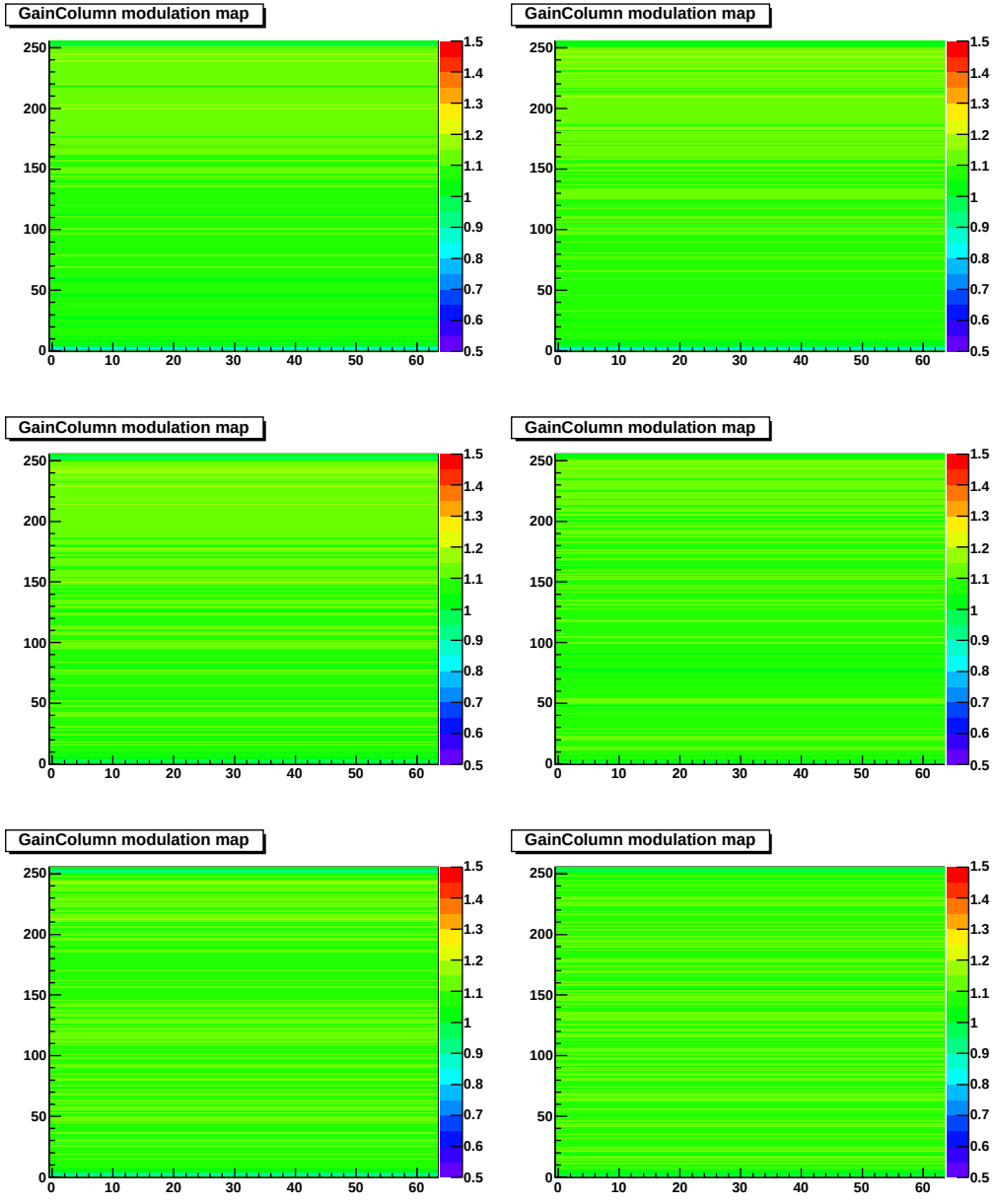
Gain modulation calculated from average of seedpixel of Run2169 TB09.

Gain Row Map TB09



Gain modulation calculated from seed of Run2169 TB09 and averaged over the columns.

Gain Column Map TB09



Gain modulation calculated from seed of Run2169 TB09 and averaged over the rows.