

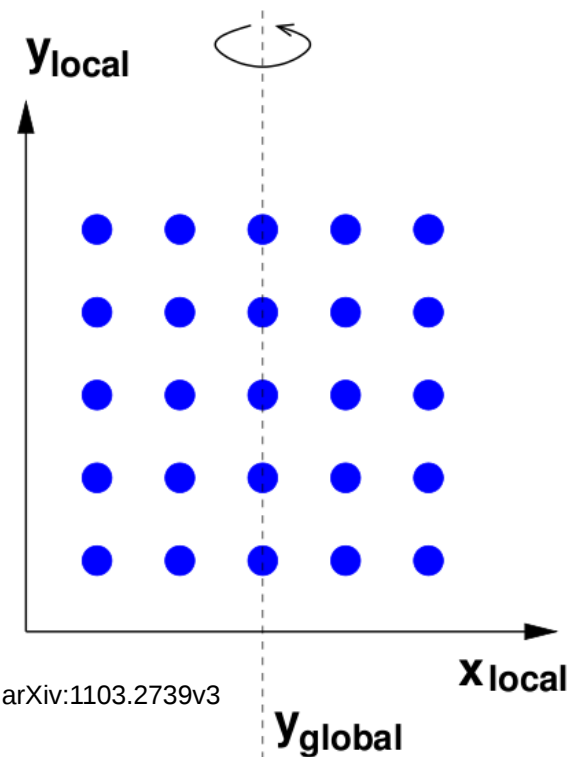
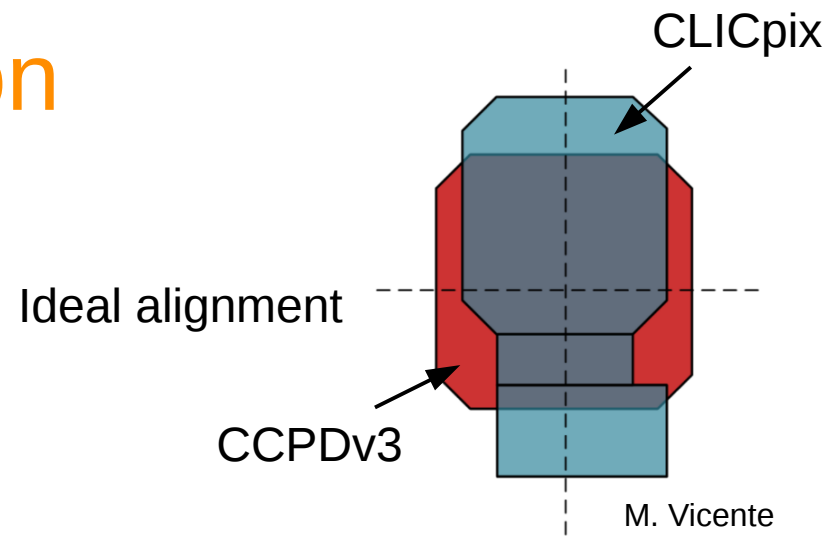
Update on analysis of CCPDv3 + CLICpix rotation scans

Matthew Buckland, Daniel Hynds

Vertex Meeting
14th September 2016

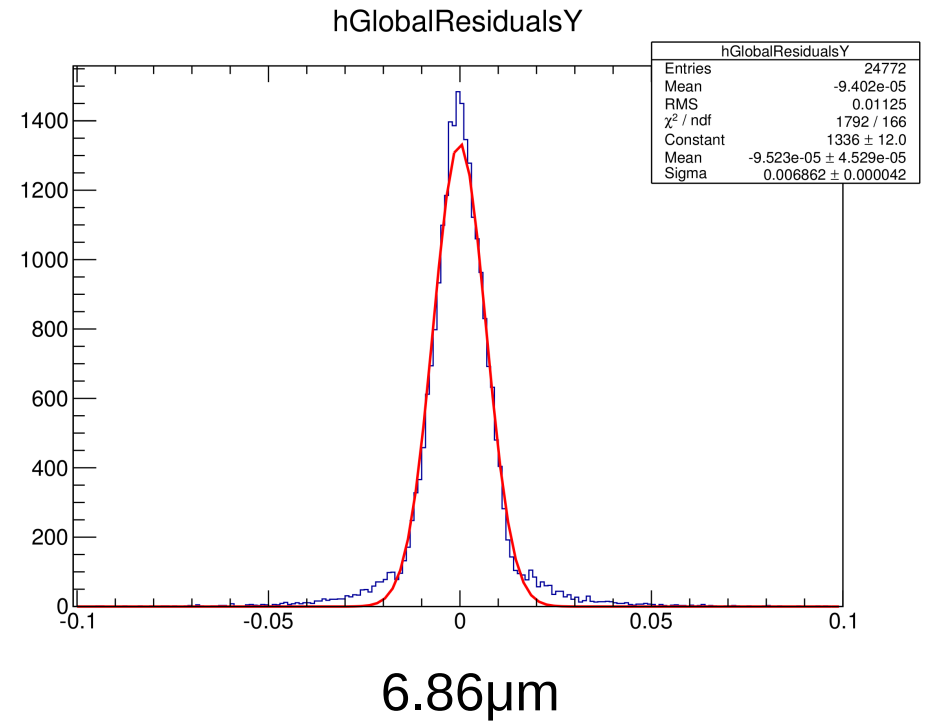
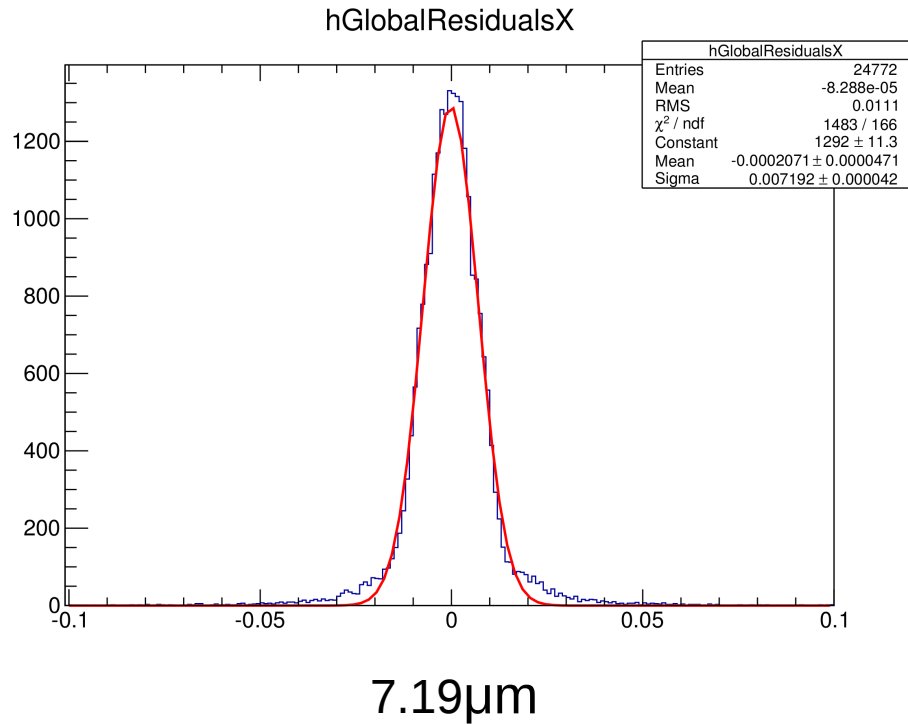
Introduction

- Test beam data from 2015
- HV-CMOS assemblies
- Looked at SET13 ideal alignment for different angles 0-80, only show 0-45
- THL 1020 for all scans
- Data taken using the EUDAT telescope at SPS
- Rotated about Y
- Analysed the data using the tbAnalysis code created by Daniel



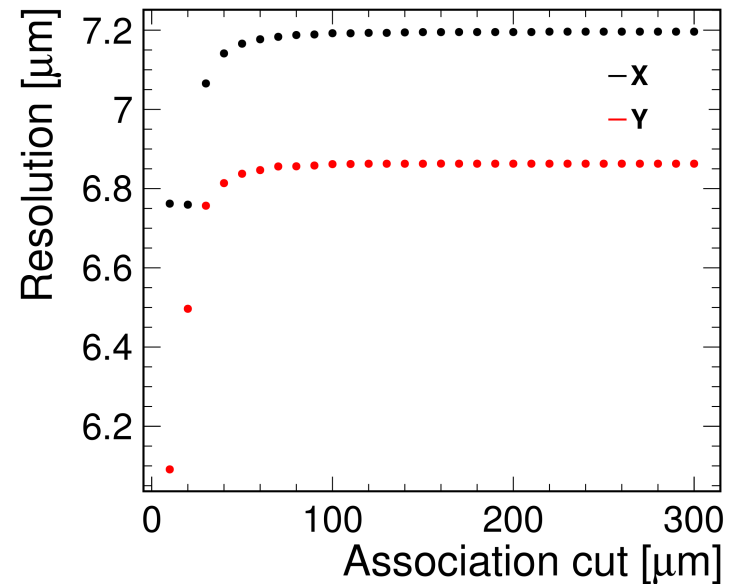
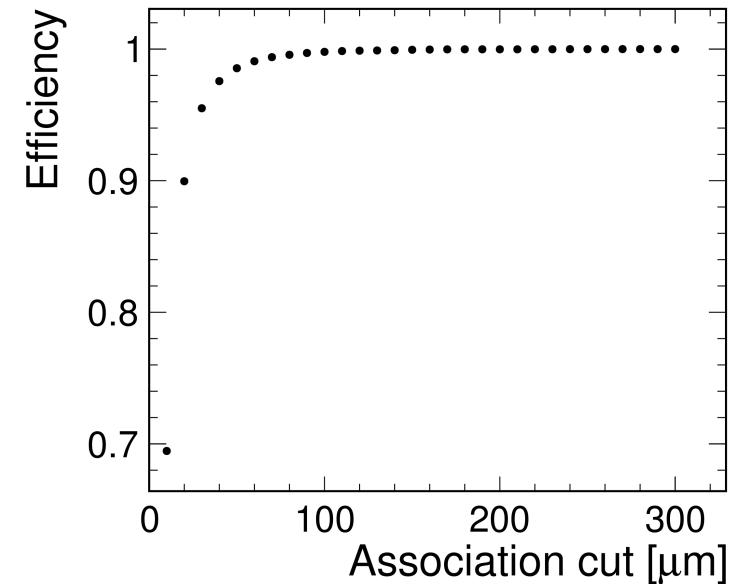
Global residuals

- Cluster global X minus associated track global X
- 0 deg



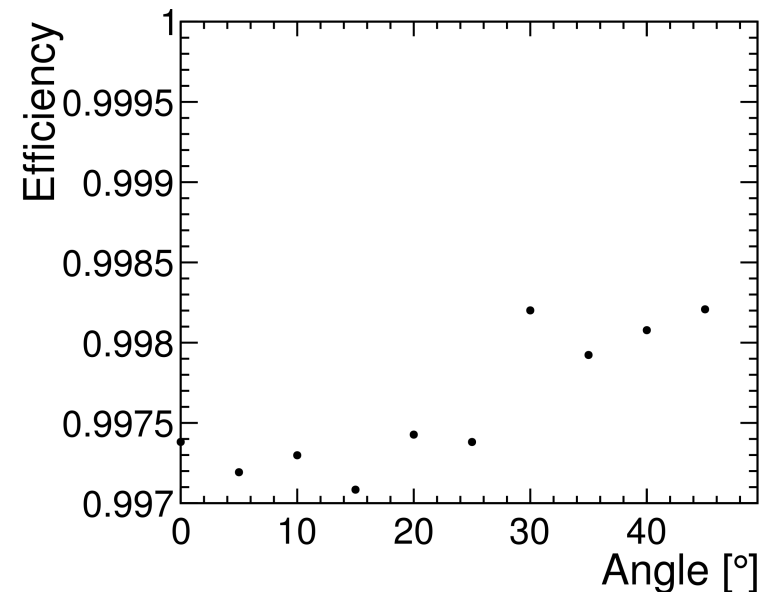
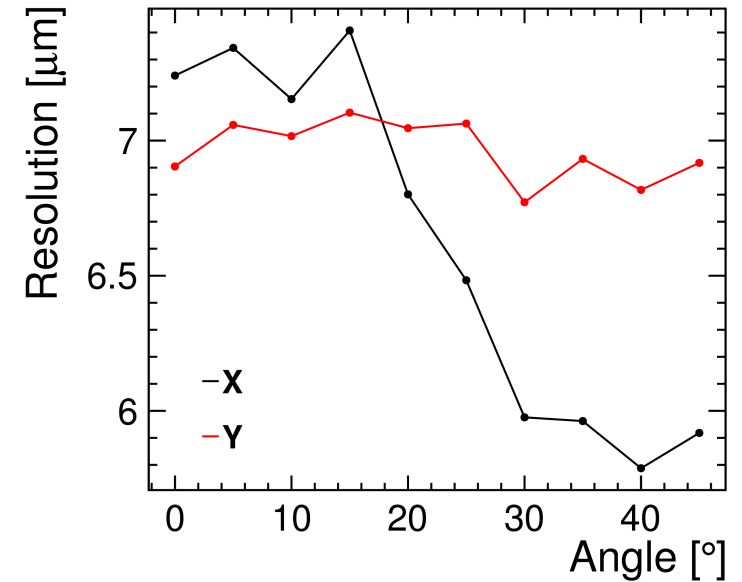
Association cut

- For a cluster to be associated with a track it must be less than the cut in x and y
- Varied this value for run 11263, 0 deg
- If cut value is less than $50\mu\text{m}$, efficiency starts to drop dramatically
- Same trend is also seen for the resolution
- For analysis chose $100\mu\text{m}$



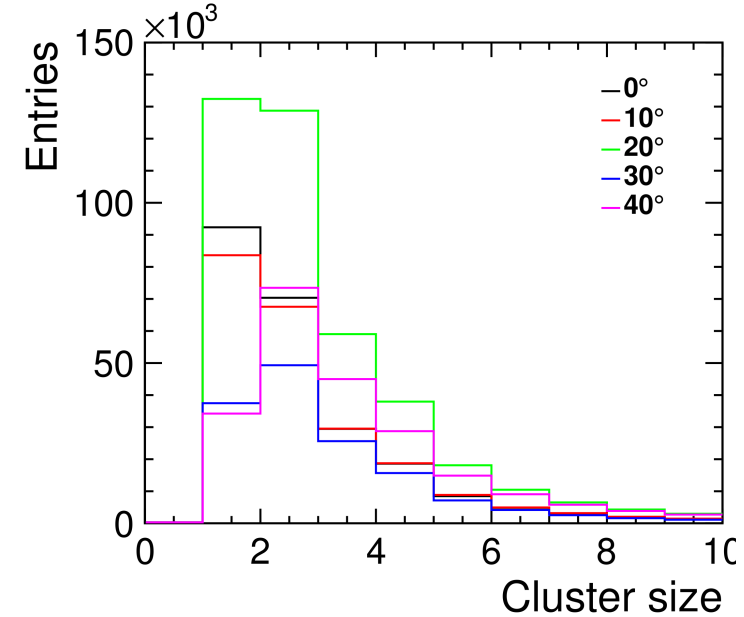
Angular variation

- Y resolution stays roughly the same
- X resolution generally improves as angle increases
- The efficiency also generally improves with angle
- However the improvement is minimal



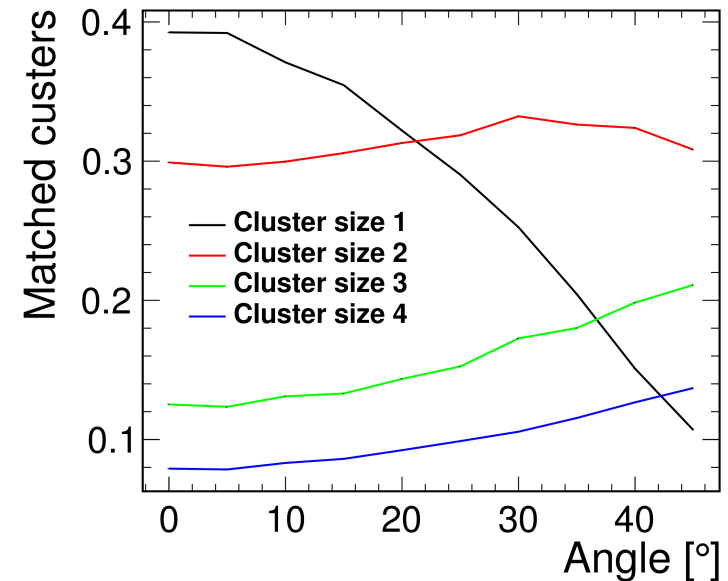
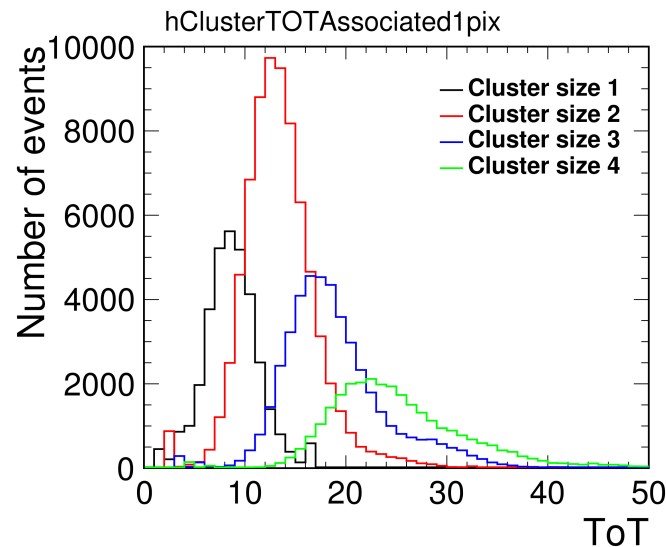
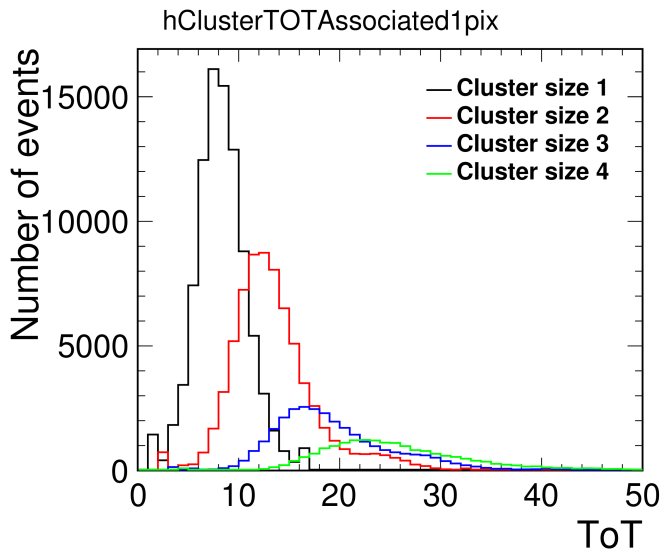
Cluster properties

- At 0 deg mainly get cluster size 1
- As angle increases the number of larger clusters increases
- After 30 deg cluster size 2 dominates



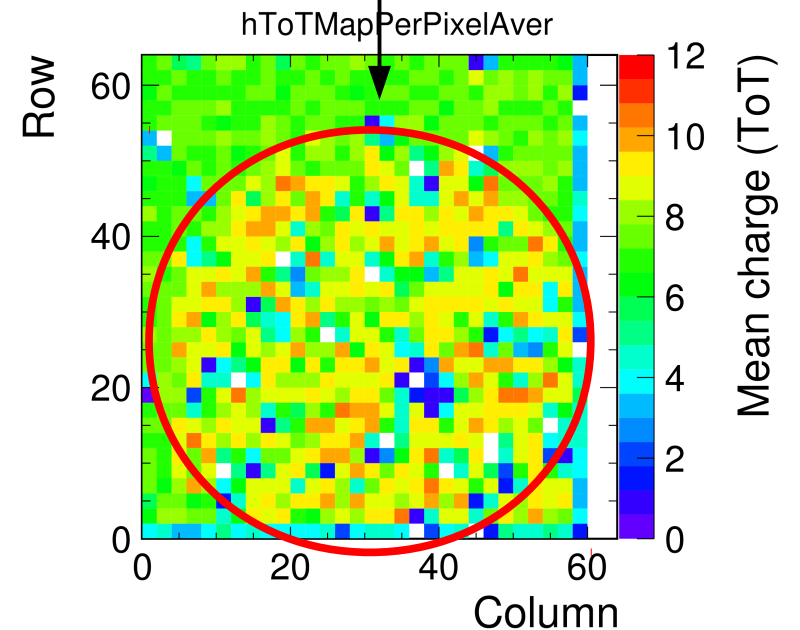
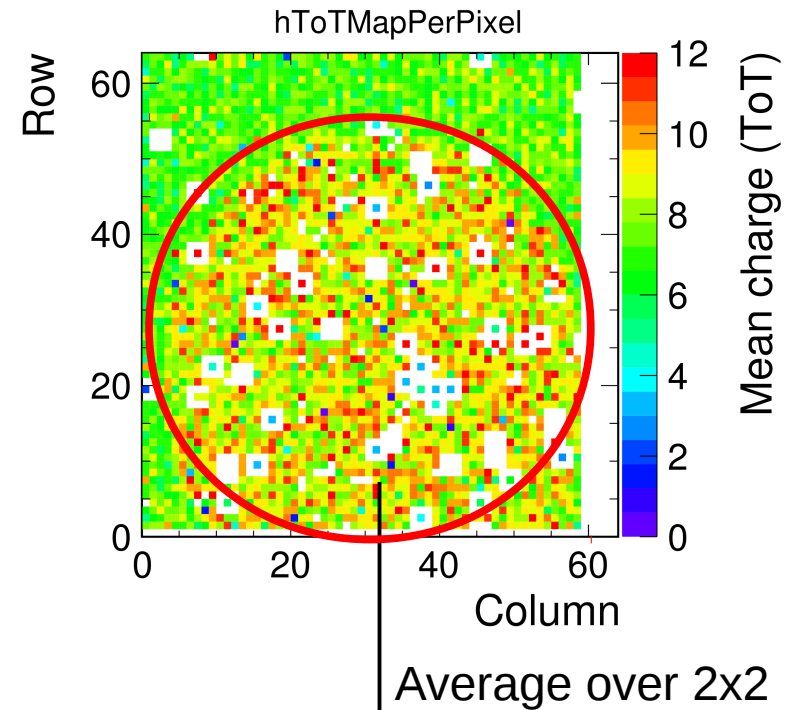
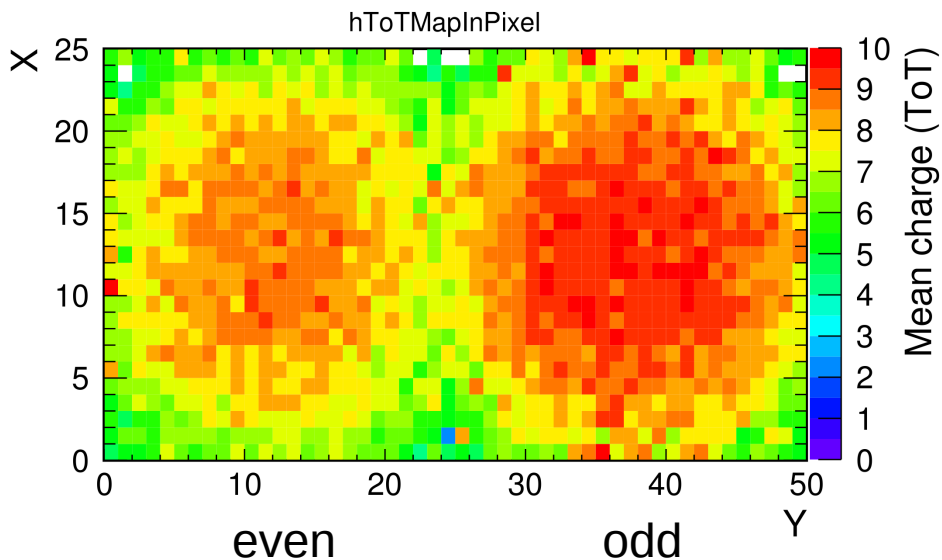
0 deg

40 deg



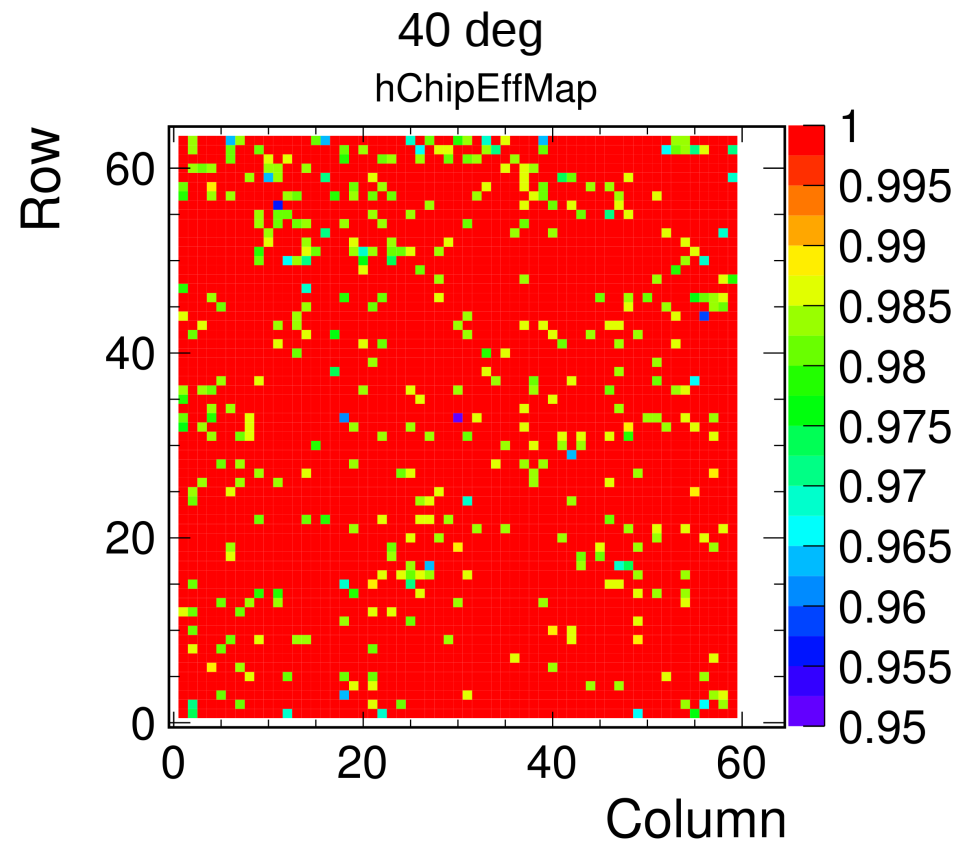
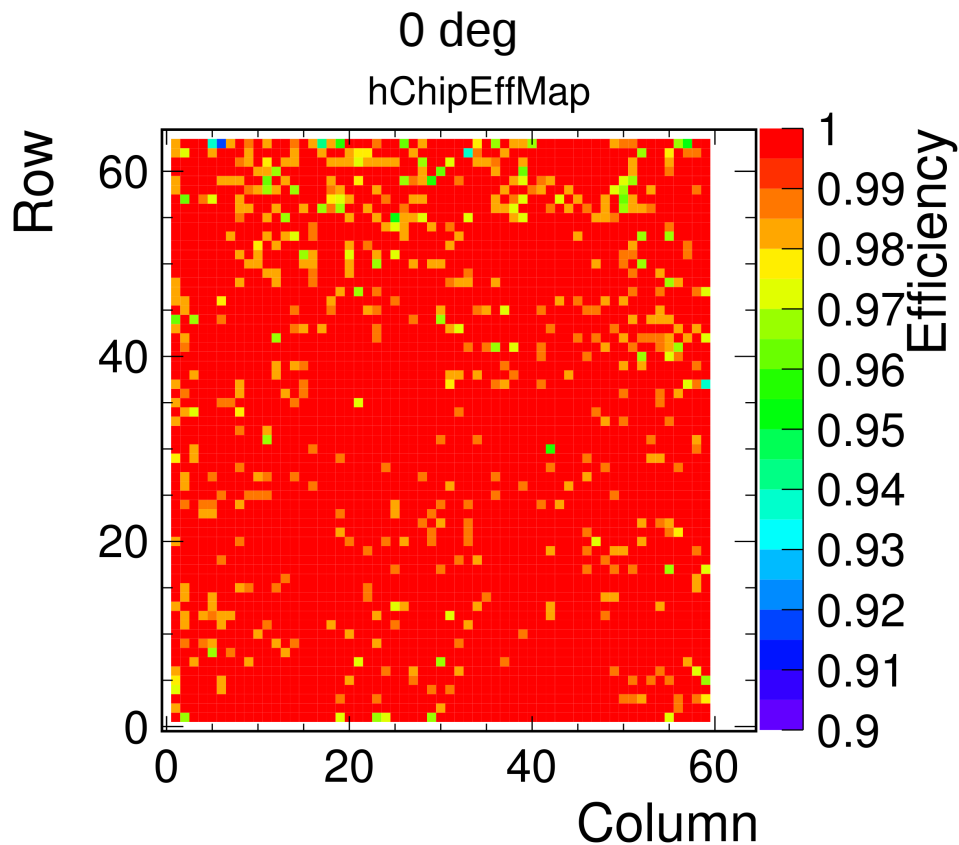
ToT spread

- Masked the last 4 columns and first row
- See the same areas of higher ToT as S. Green did
- Again this is possibly due to the glueing process and the distribution of the glue
- The odd columns have higher ToT values throughout the pixel



Chip efficiency maps

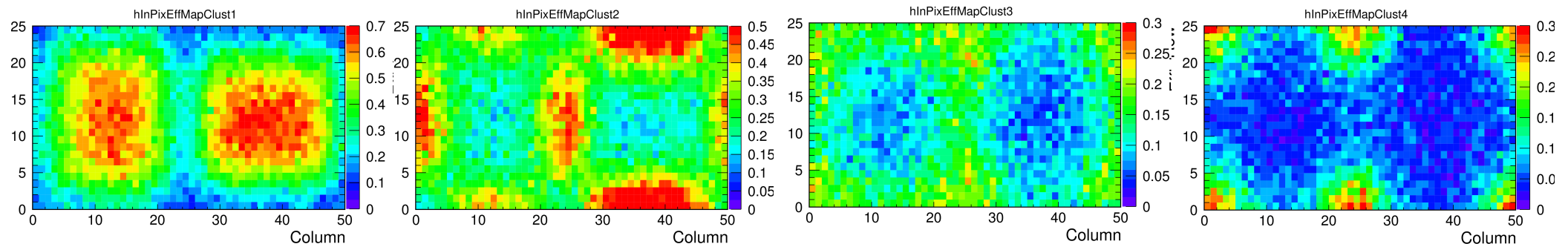
- Overall high efficiencies $> 99.7\%$
- Concentration of inefficiency are outside the glue for 0 deg
- Fairly even spread of inefficient pixels at 40 deg



In pixel cluster spread

- See the standard pattern at 0 deg for odd and even columns (even on the left odd on the right)
- Skewed pattern in the column direction at 40 deg

0 deg



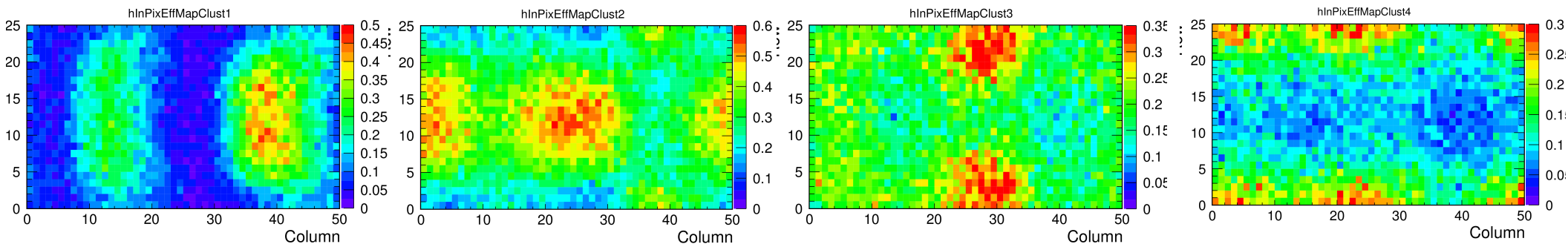
1

2

40 deg

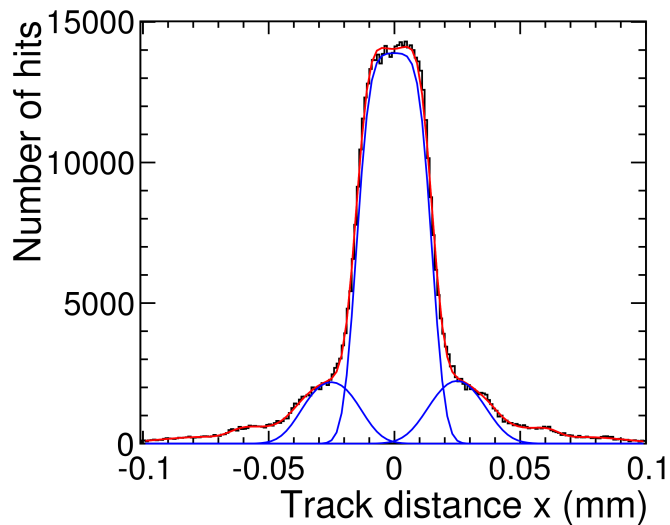
3

4

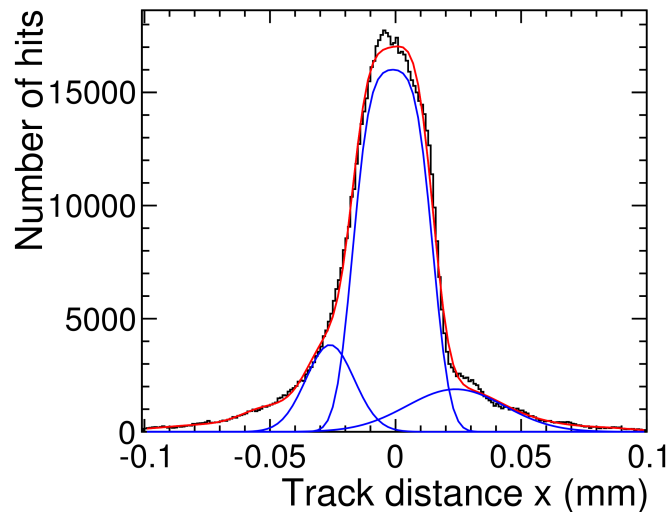
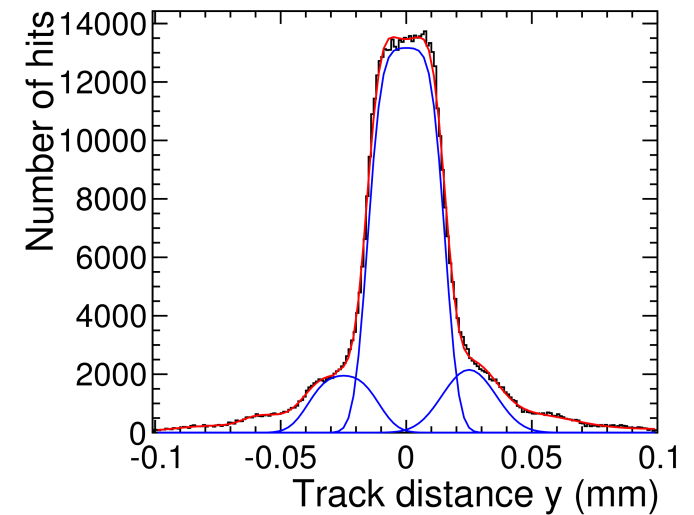


Pixel response

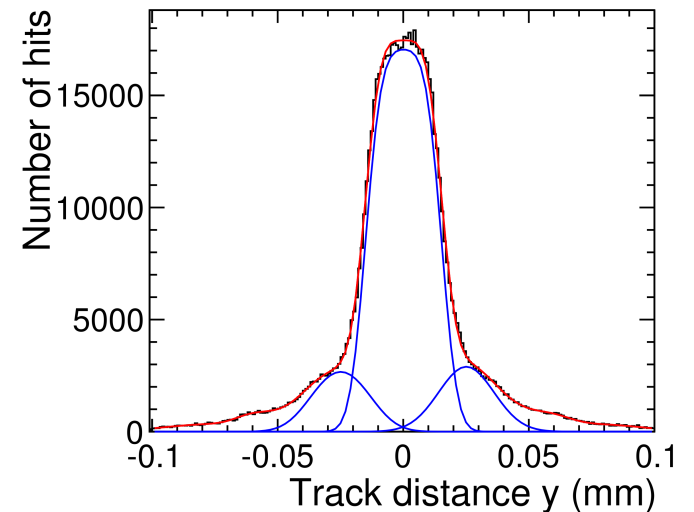
- Global pixel position in cluster minus global track position
- At 0 deg some cross coupling in x and y, roughly the same in both directions
- Due to the rotations the x response is biased towards one side



0 deg

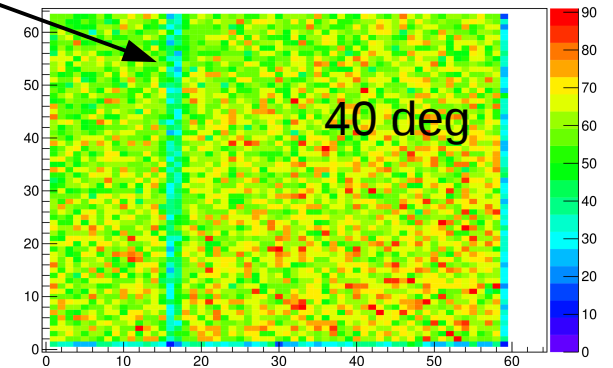
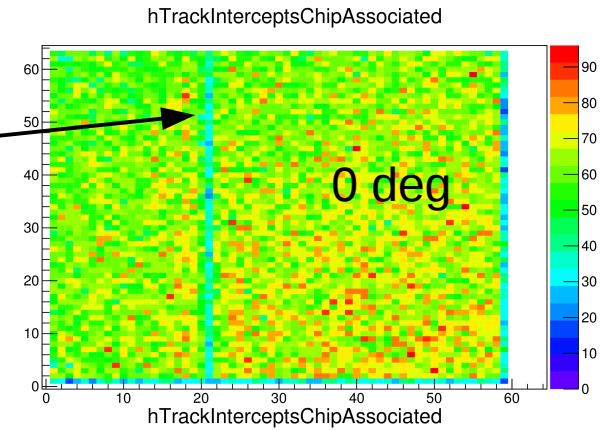


40 deg

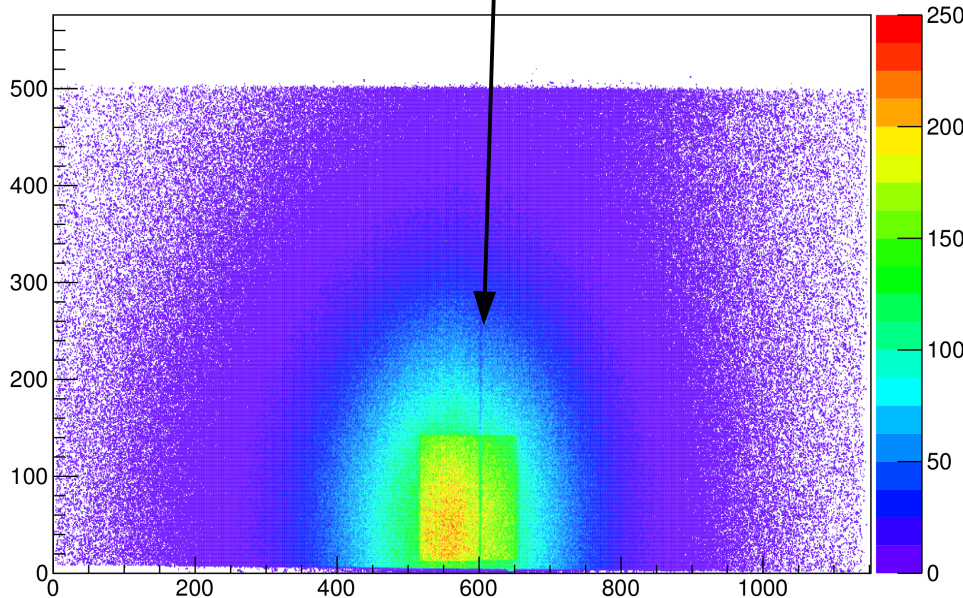


Strange column

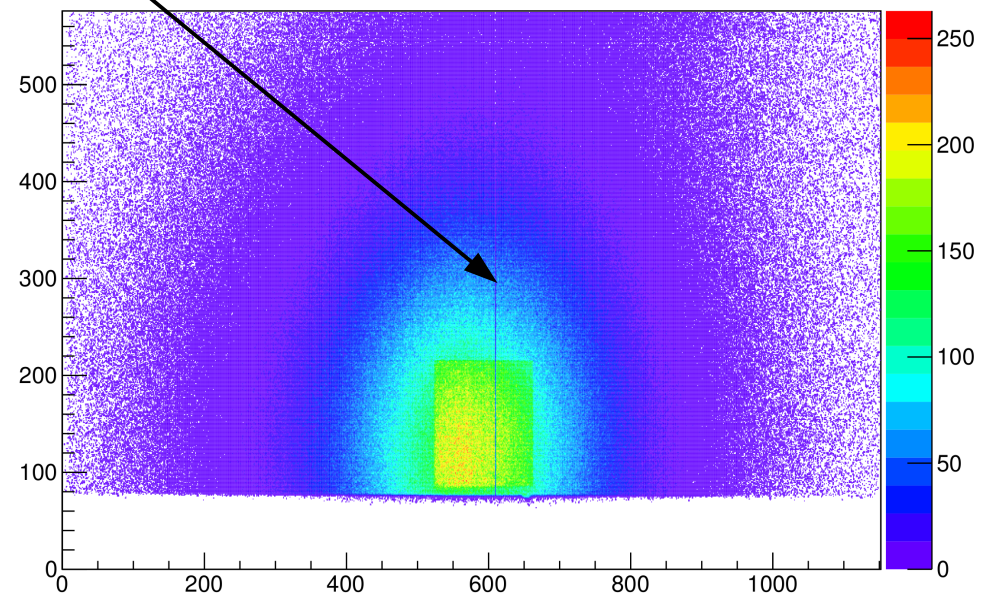
- See a column with low signal going through DUT, seen at all angles
- Becomes larger with angle and at a lower column value
- Also see something similar on all the telescope planes



hHitPixelsMim-osa00



hHitPixelsMim-osa04



Eta correction

- If column width is > 1
- Choose two adjacent column pixels with the highest combined signal

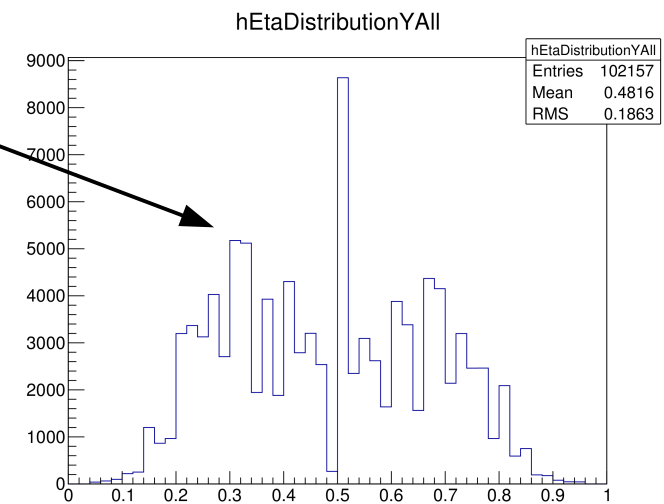
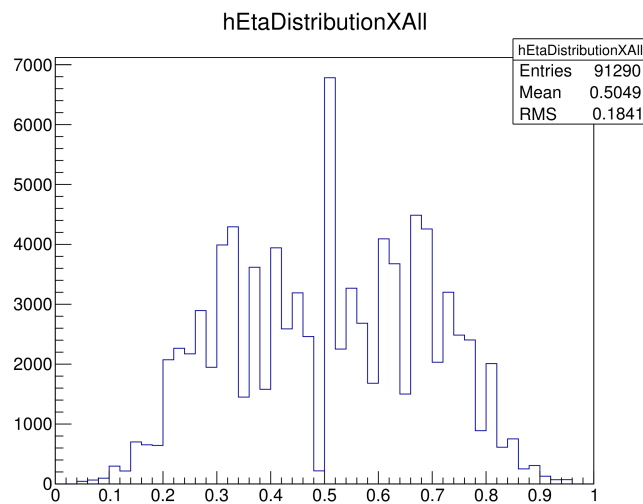
$$\eta = \frac{S_R}{S_L + S_R} \longrightarrow f(\eta) = \frac{\int_0^\eta \frac{dN}{d\eta'} d\eta'}{\int_0^1 \frac{dN}{d\eta'} d\eta'} \longrightarrow x = x_L + f(\eta)P$$

S. Straulino et al.: Spatial resolution..., Nucl. Instr. And Meth. A 556 (2006) 100–114

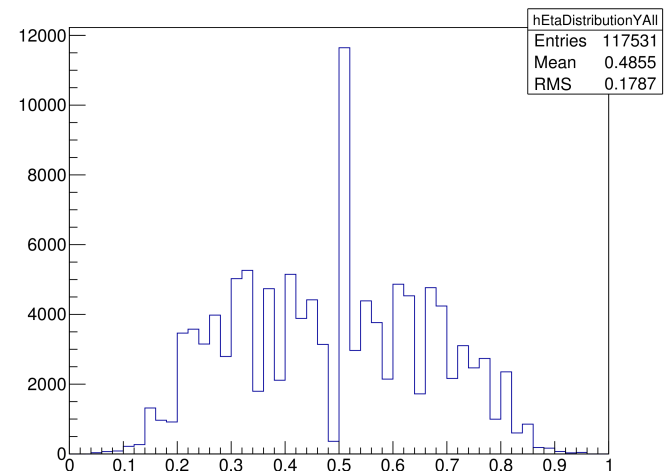
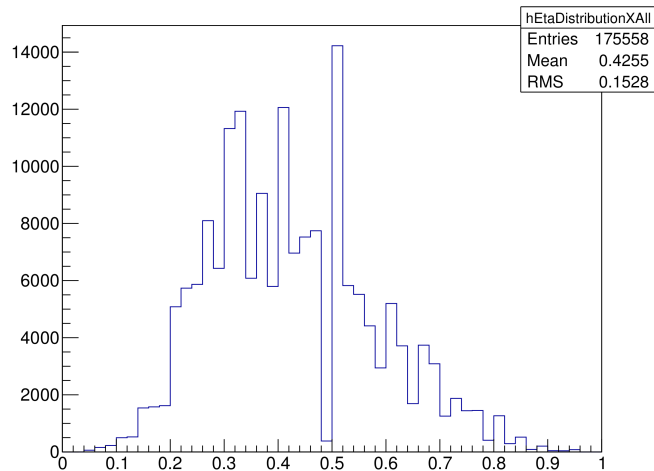
- Need to analysis run to obtain eta plots then re-run the analysis to apply the correction
- Perform this procedure in both column (x) and row (y) direction

Eta correction

- Peaks are away from 0 and 1 meaning capacitive coupling
- Peak at 0.5 indicates particle passes in-between pixels
- See the same structure as the pixel response plots, coupling is similar in both directions
- Left peak is slightly higher for Y, coupling due to misalignment?



0 deg



40 deg

Future work

- Continue to analyse all the data, up to 80 deg
- Mask areas with the low ToT
- Apply eta correction
- Compare results to TCAD data