Preliminary results on Data-MC comparison

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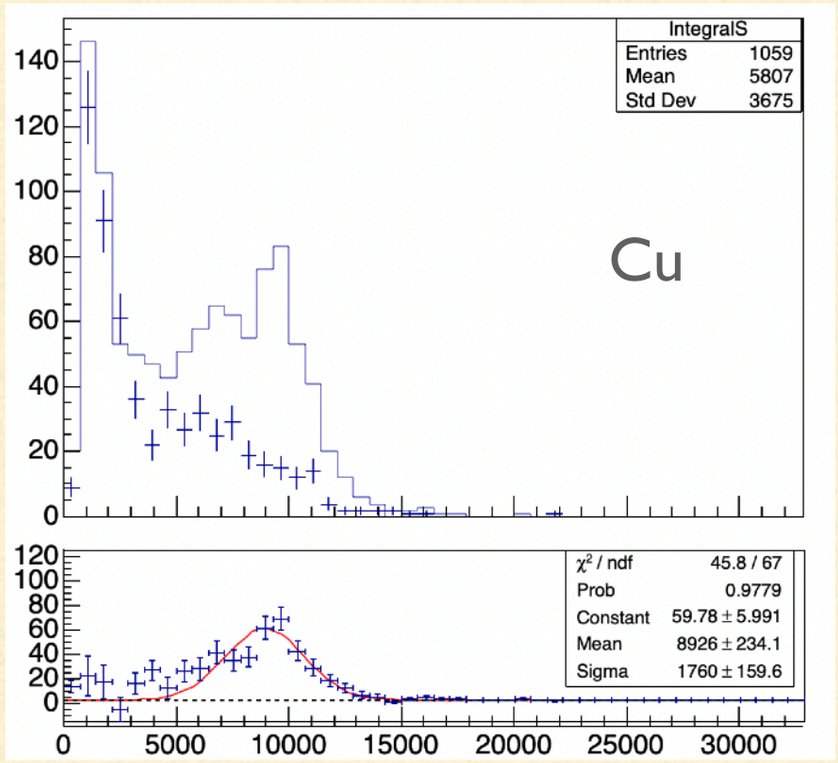
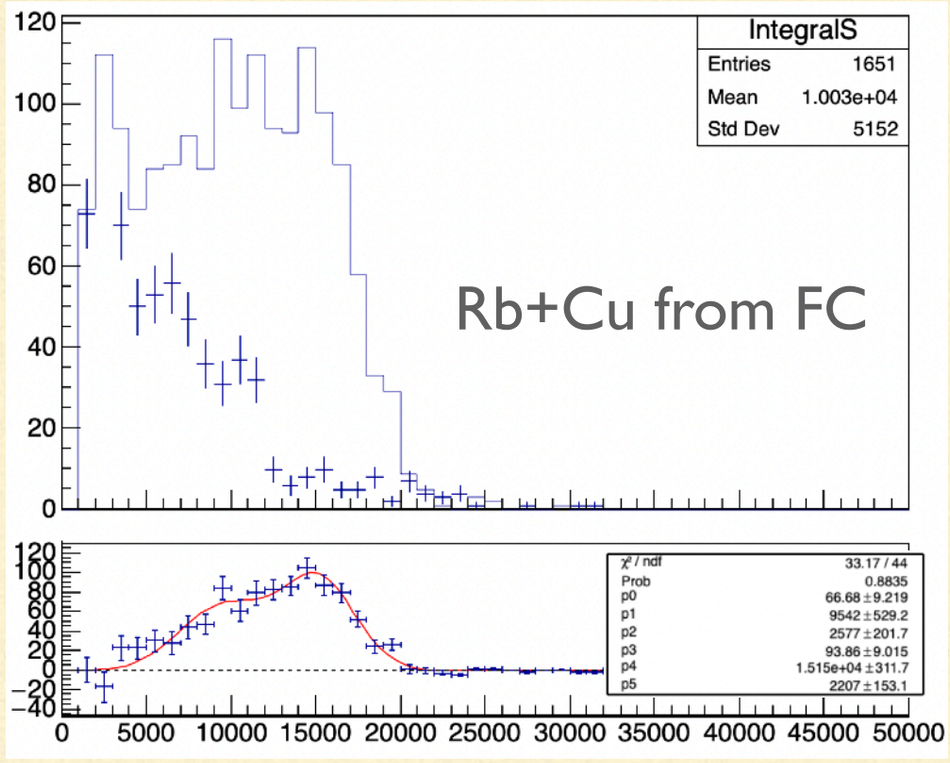
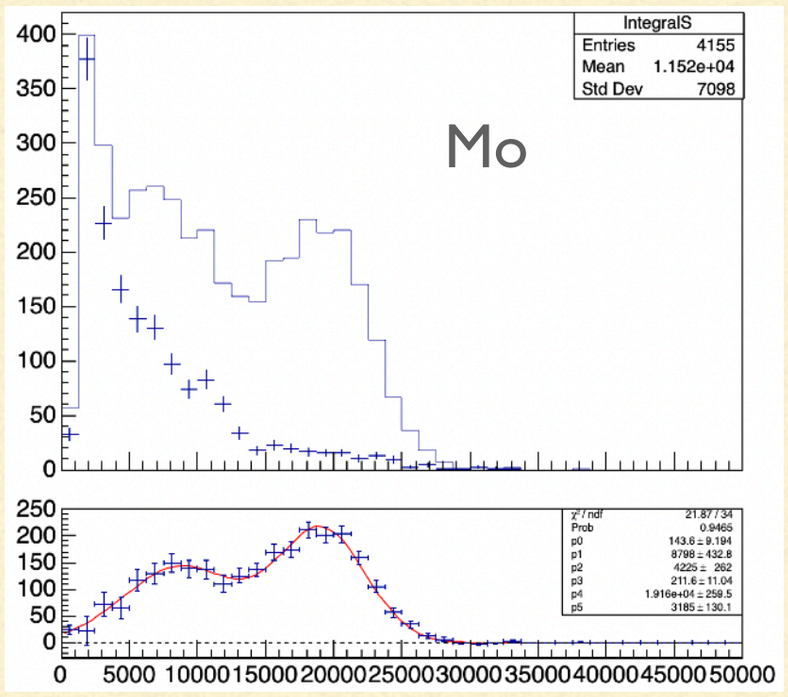
Data background subtracted

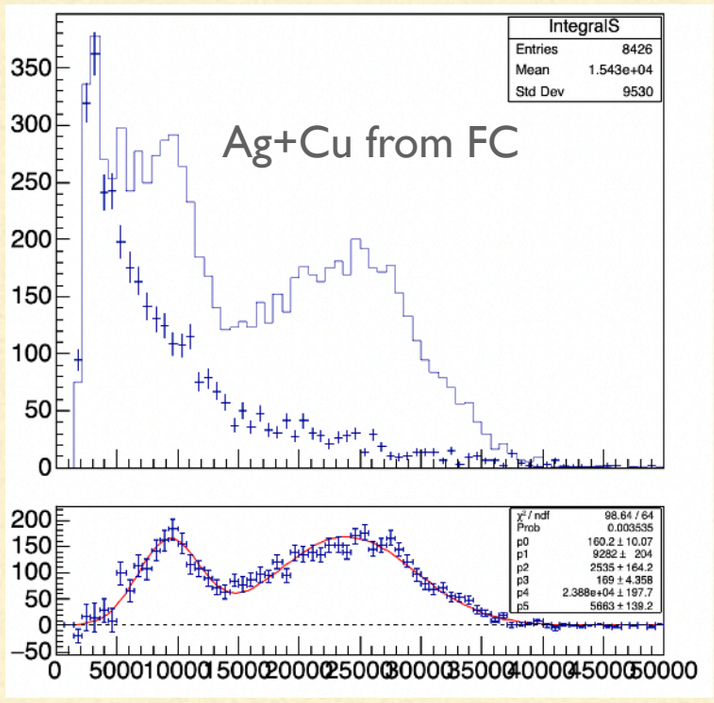
- Stringent selection based on simulation (100% eff.) in order to have an as pure as possible electron sample

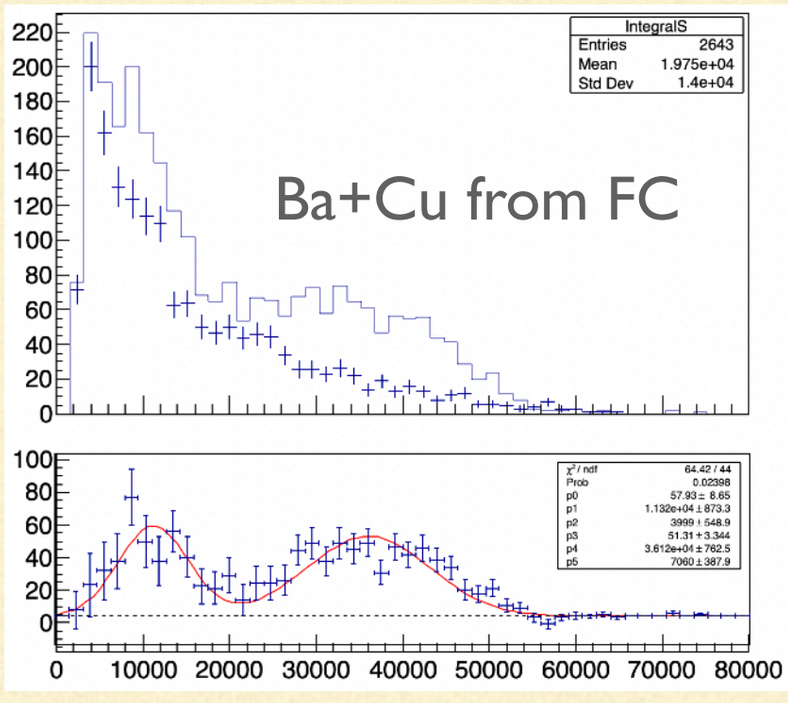
- Selection on:
  - X/Ymean in [700-1600]
  - Lenght
  - Width/lenght
  - Size
  - TGausMean
  - TGausSigma



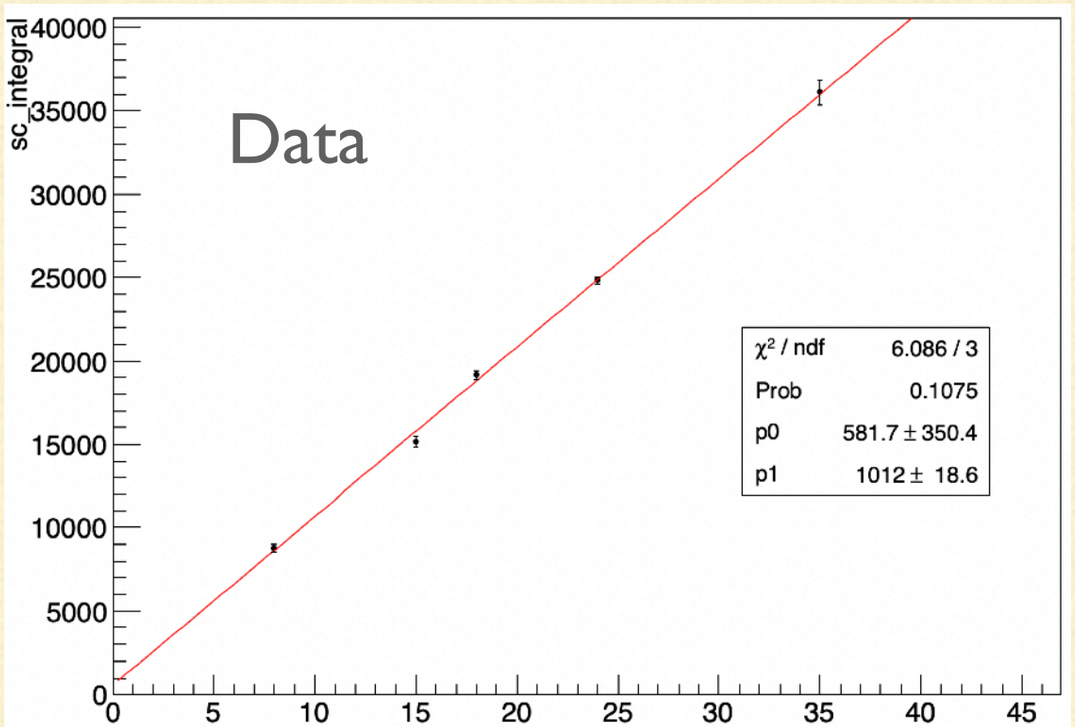


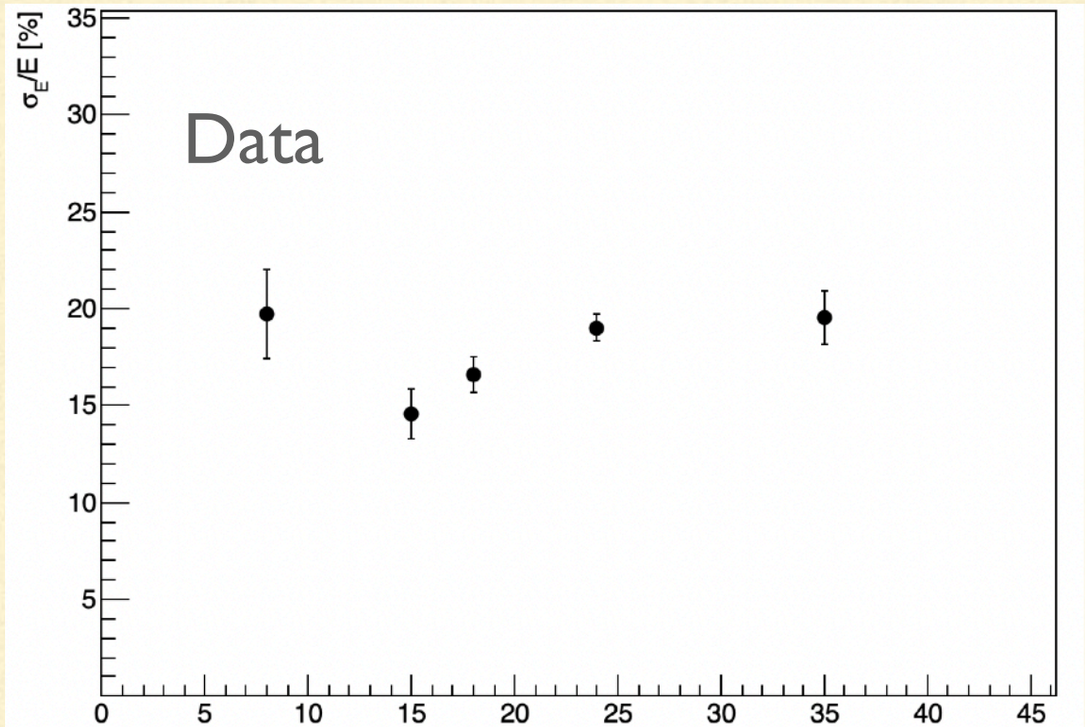


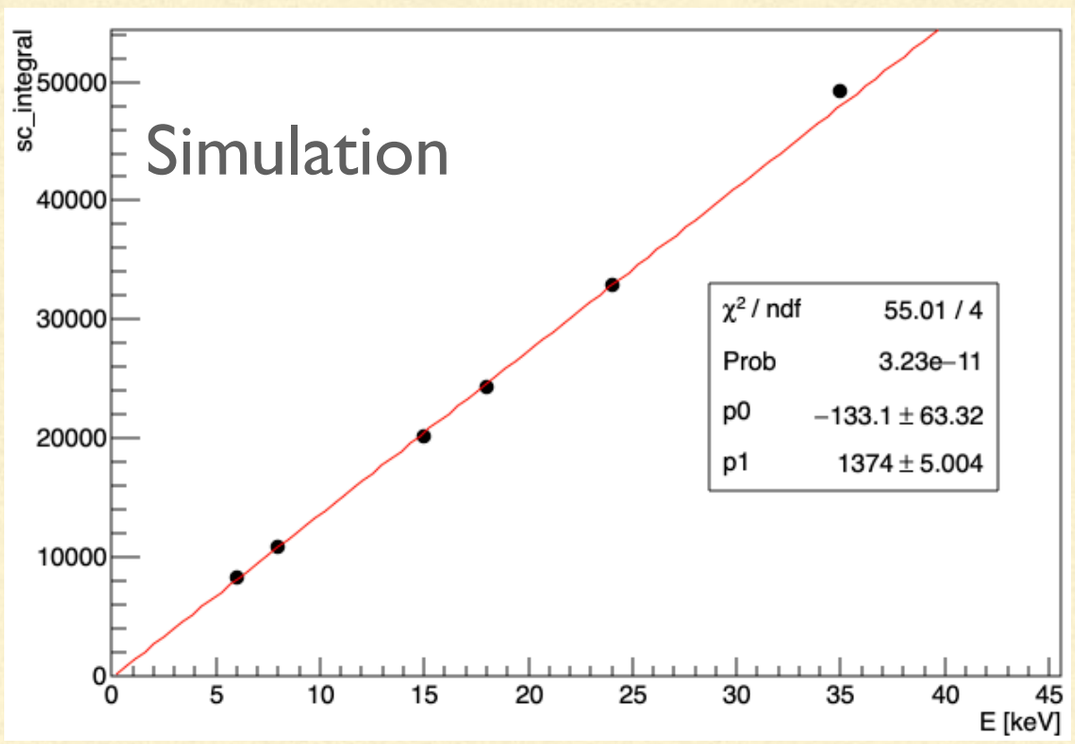


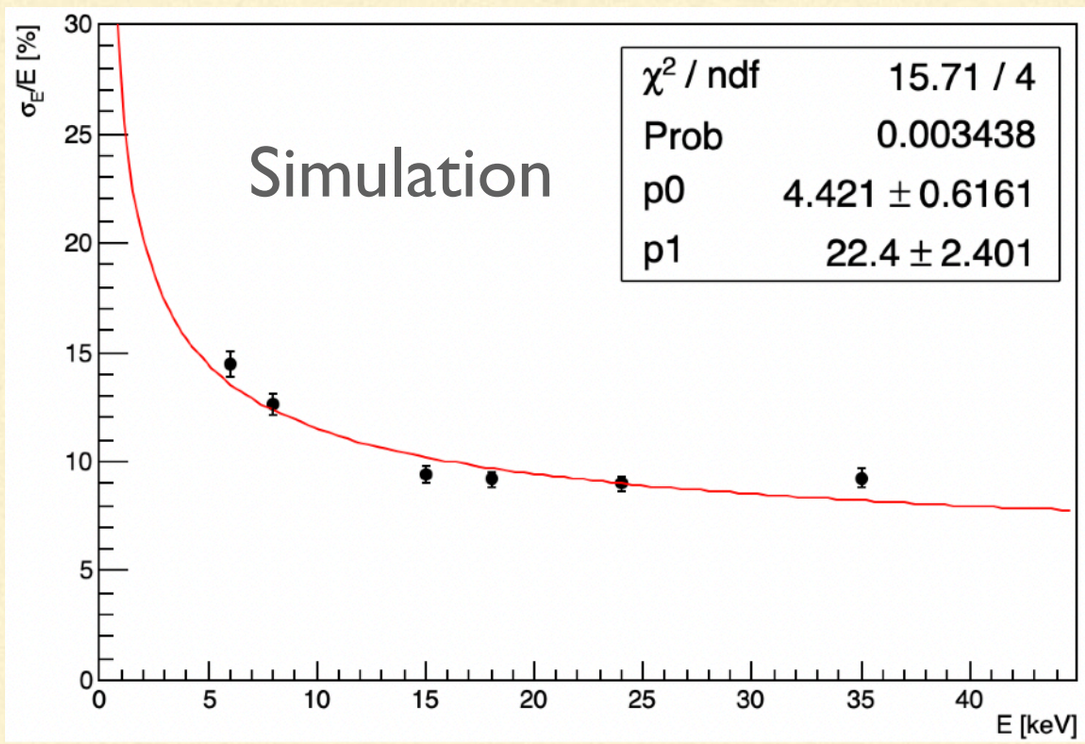


Linearity and Energy resolution comparison









Shape variables from Atul

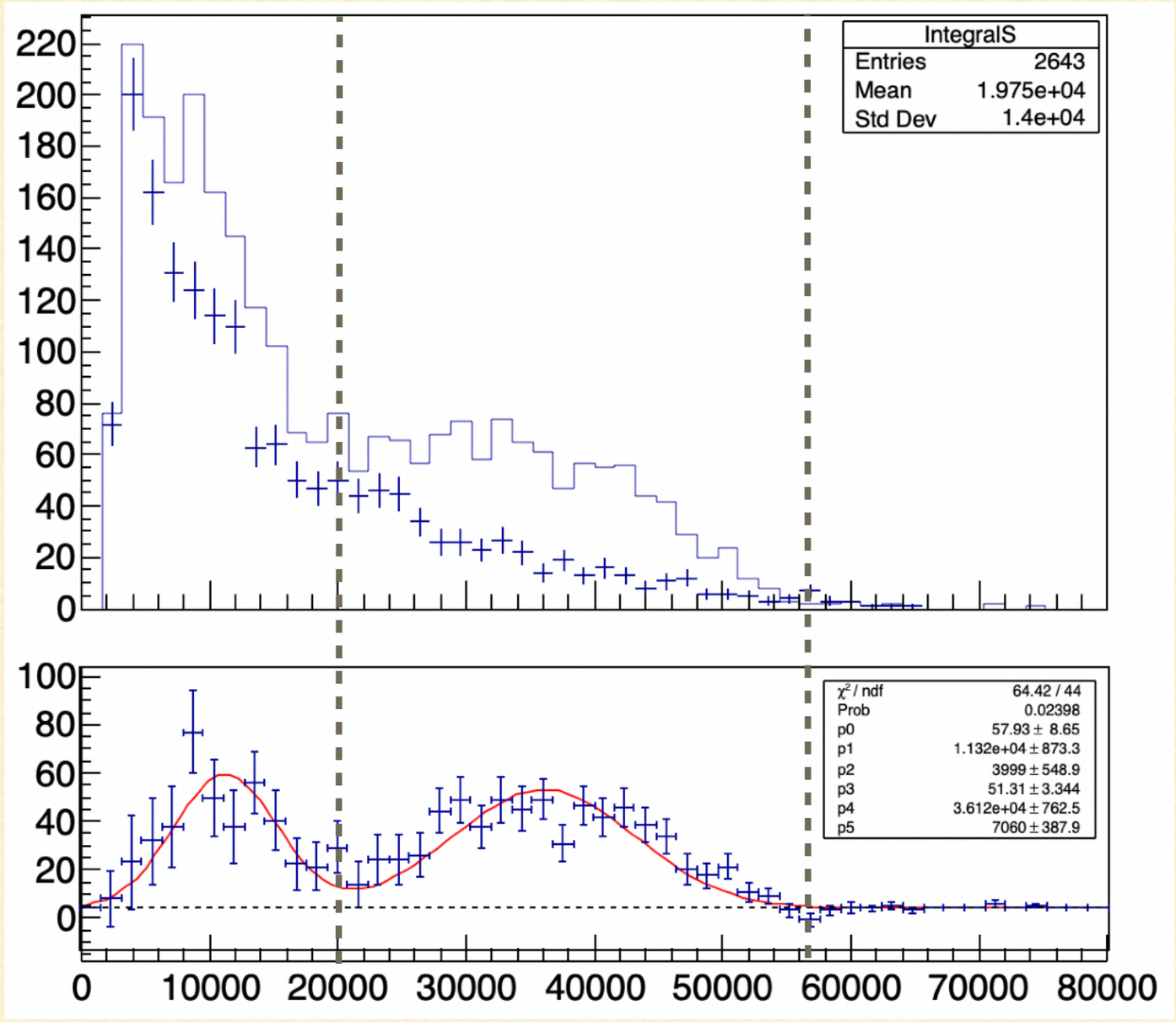
- Preliminary comparison made on Barium data

- "Pure" electron sample from Barium selected using:

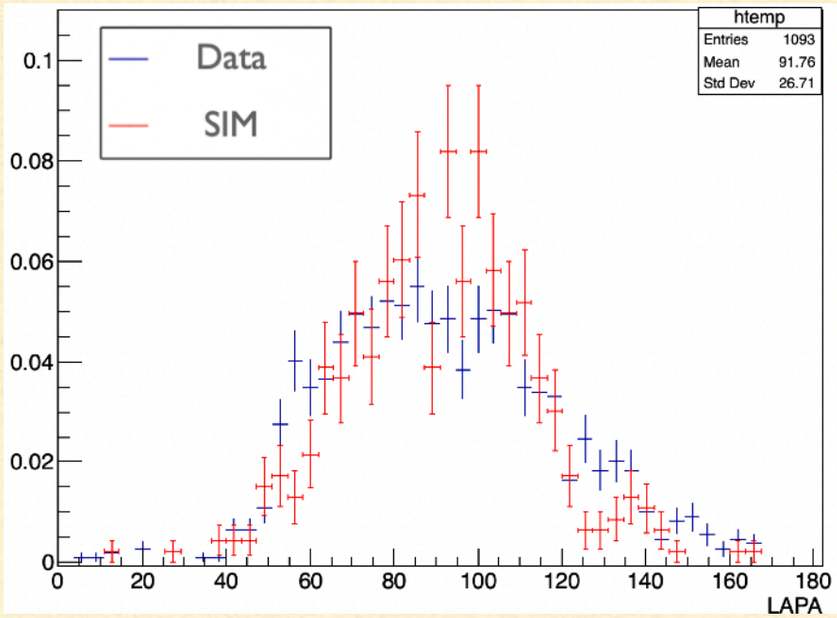
```
S_xmean[j]>700 && S_xmean[j]<1600 &&
S_ymean[j]>700 && S_ymean[j]<1600 &&
S_length[j]>30 && S_length[j]<170 &&
S_width[j]/S_length[j]>0.3 && S_size[j]>900
&& S_size[j]<4500 && S_tgaussmean[j]>5 &&
S_tgaussmean[j]<40 && S_tgausssigma[j]>2 &&
S_tgausssigma[j]<14
```

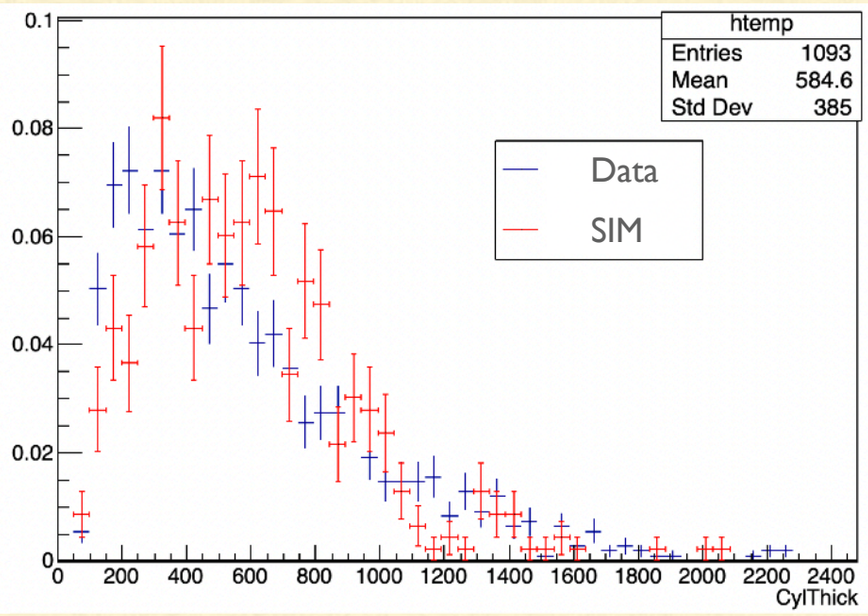
+

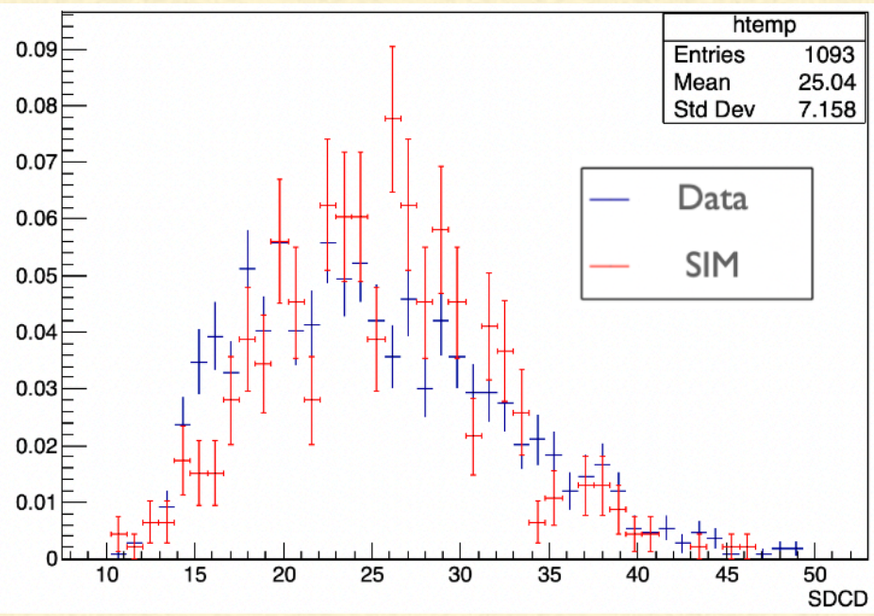
Selection within the Barium peak

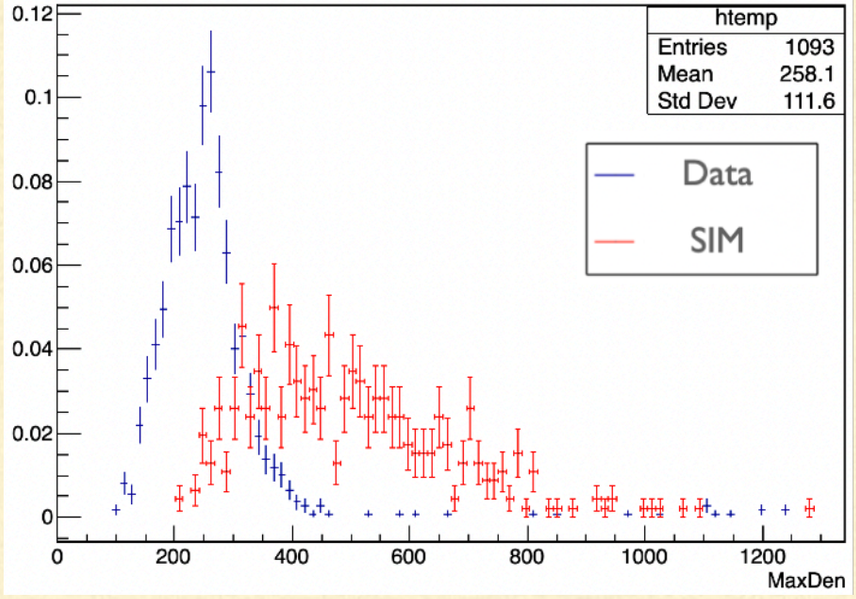


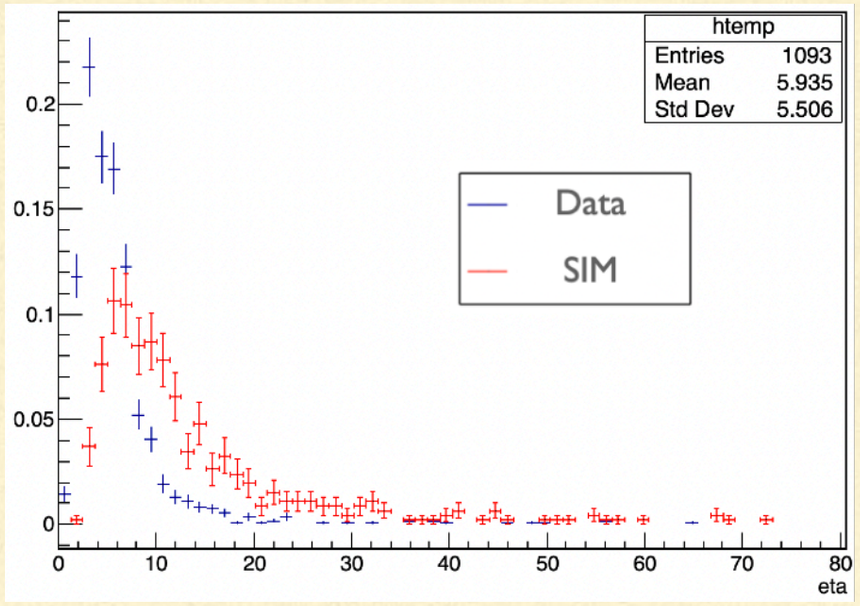
Shape variables from Atul comparison

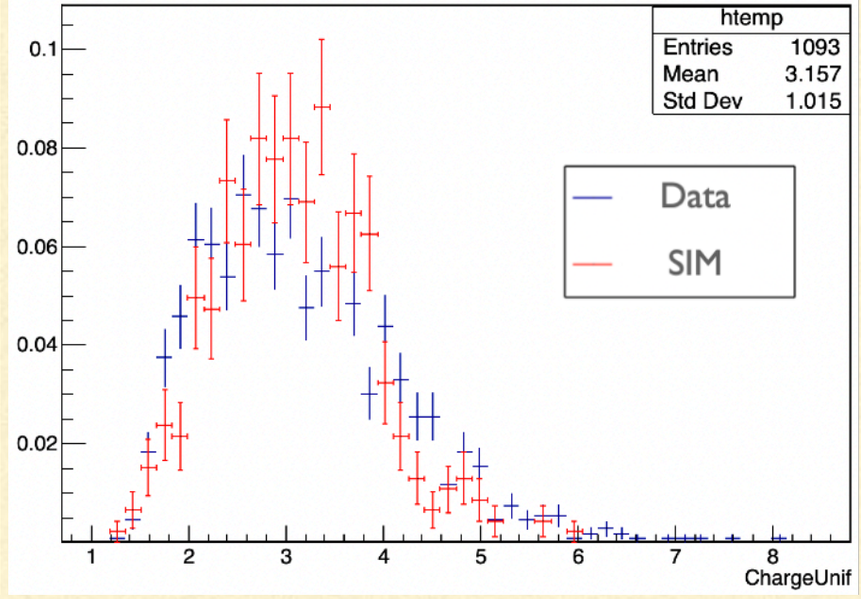




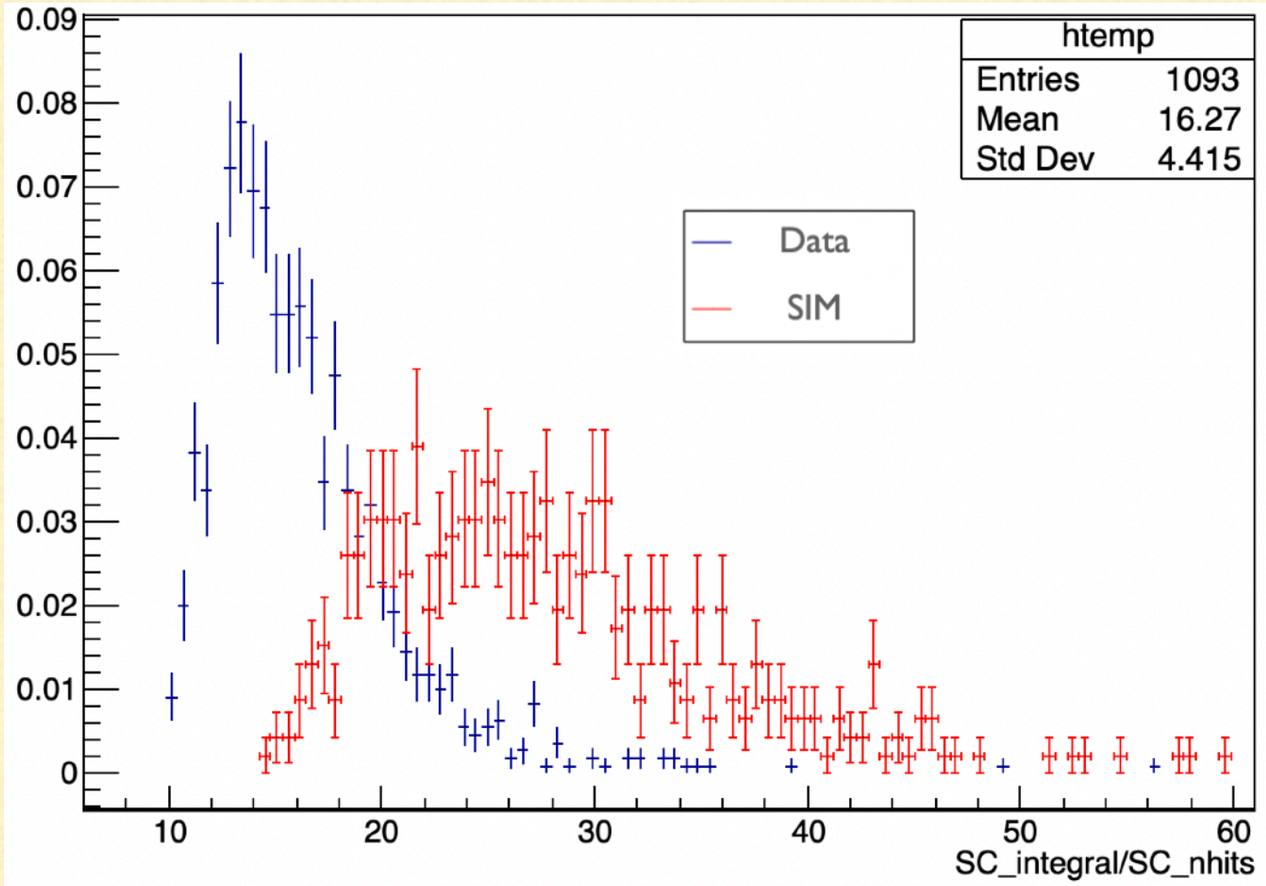


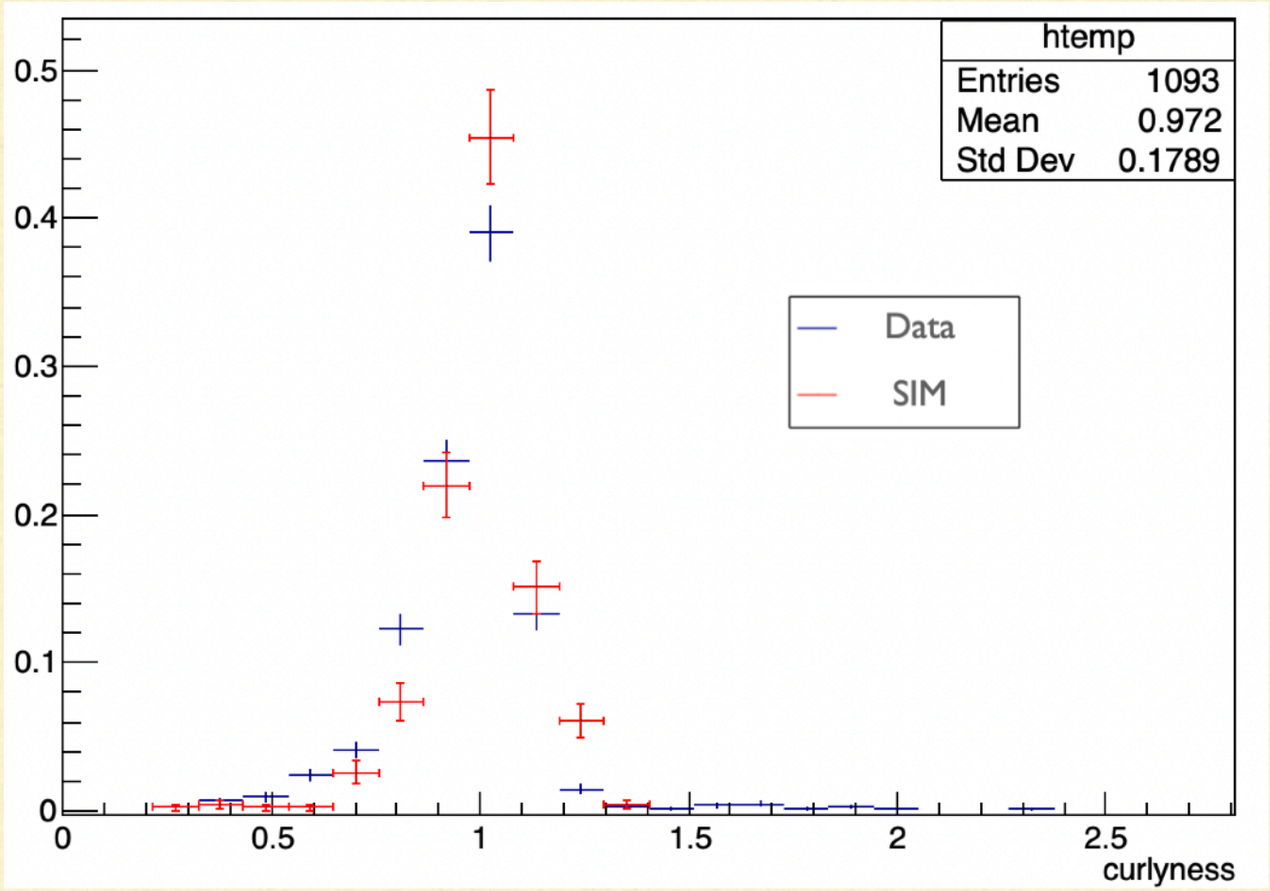






Shape variables from Atul on Barium

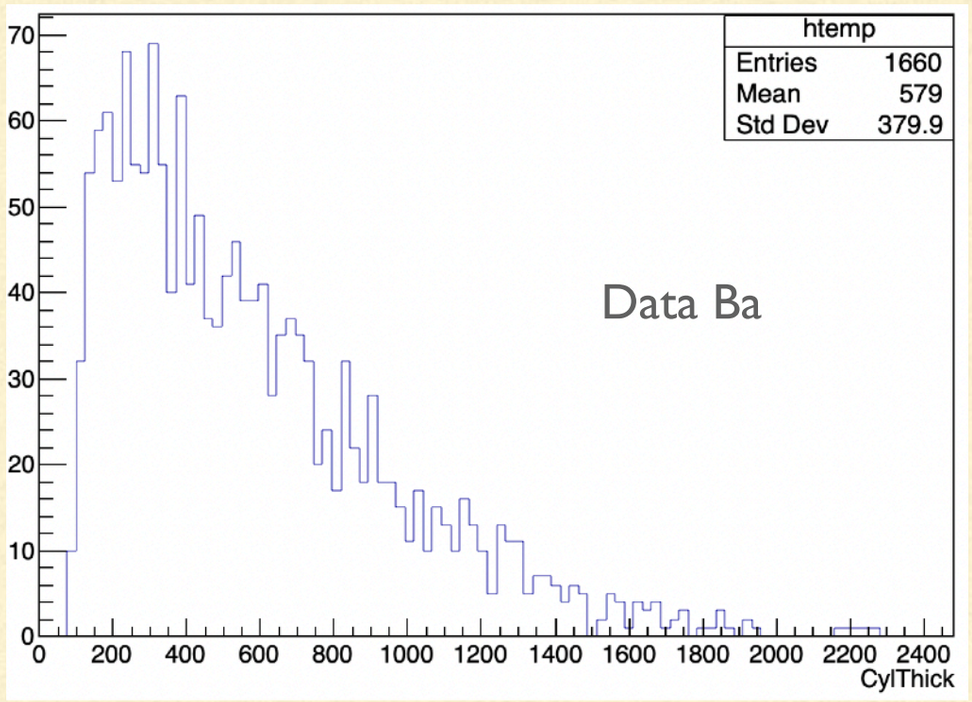


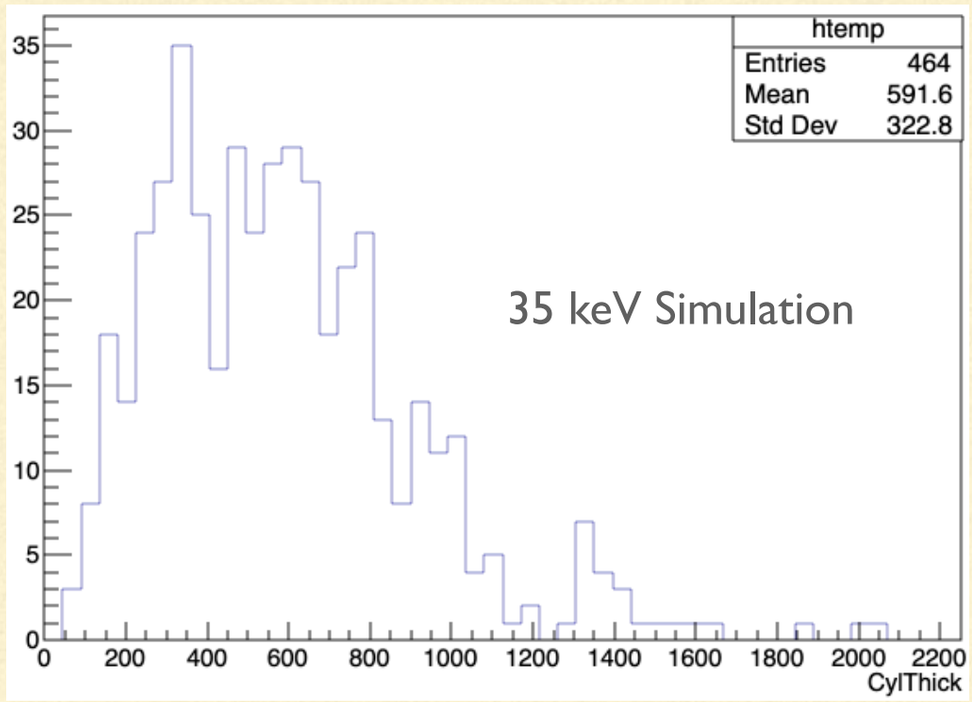


Shape variables in agreement between data and MC

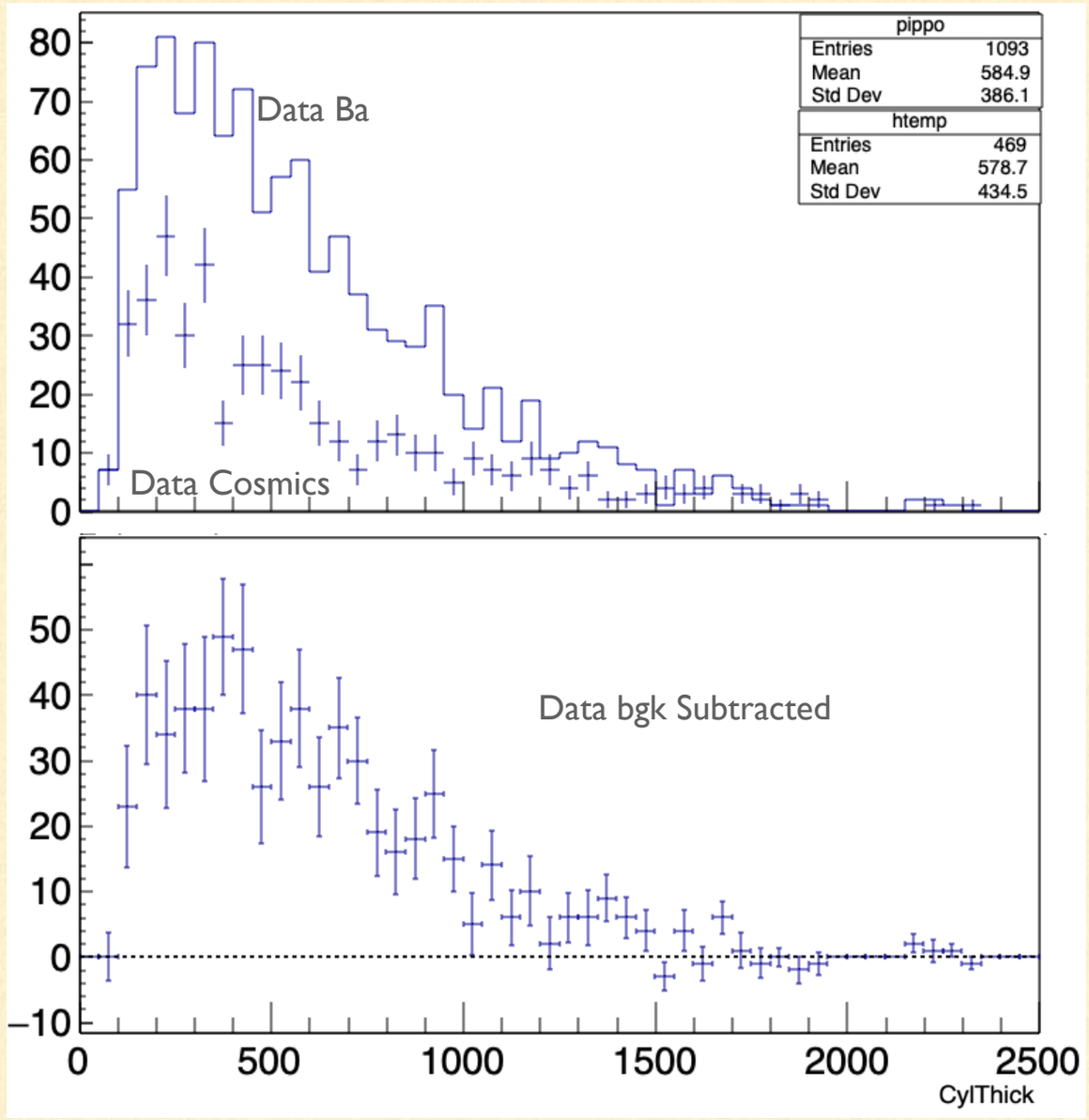
Disagreement in energy distribution along the track

Shape variables from Atul on Barium bgk subtaction



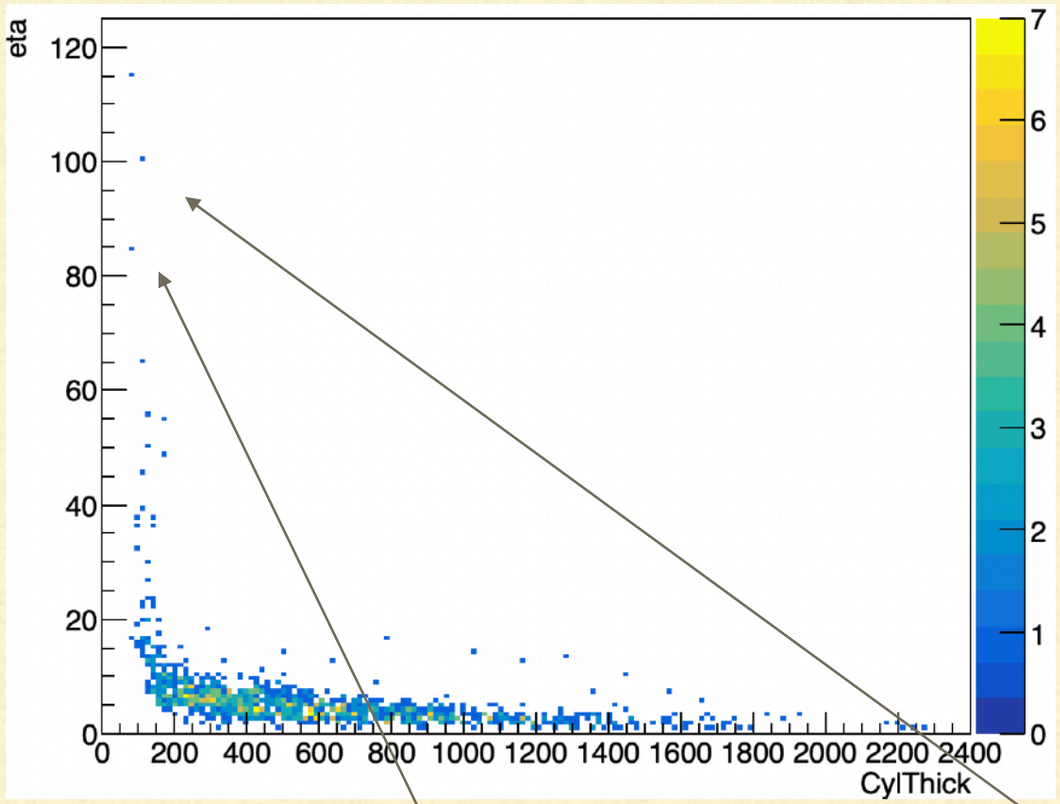


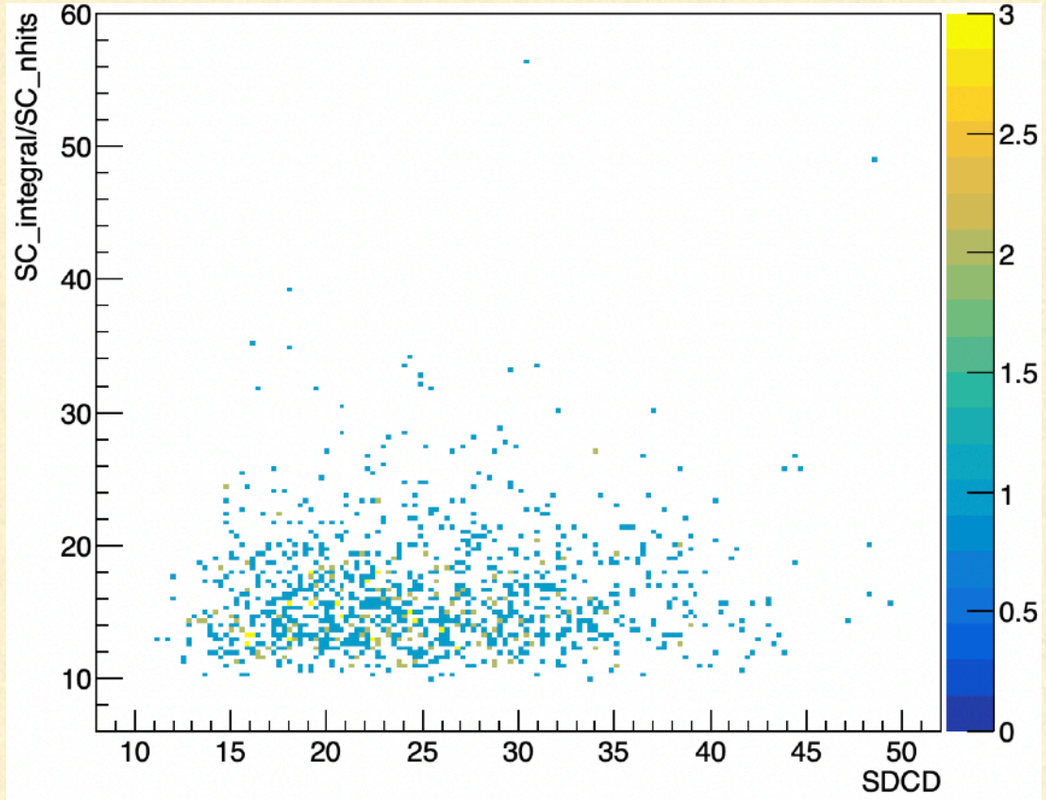
Normalization to the same number of images
Same selection as before

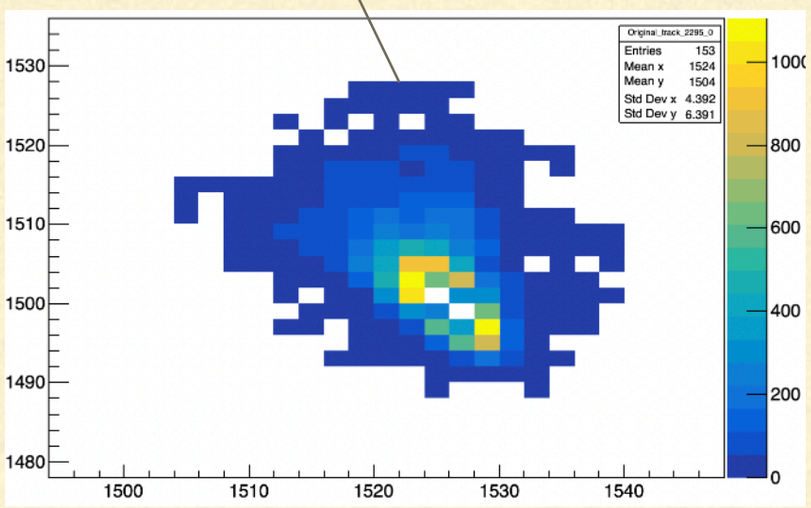


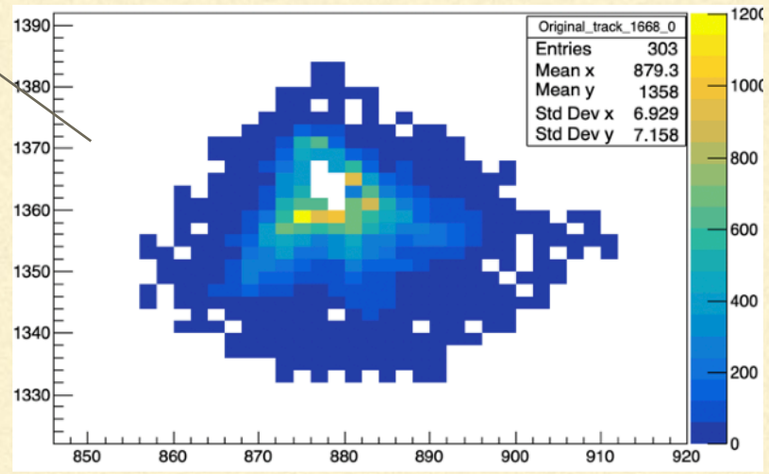
Simulation seems to be not so far from data

Shape variables from Atul on Barium bgk subtaction

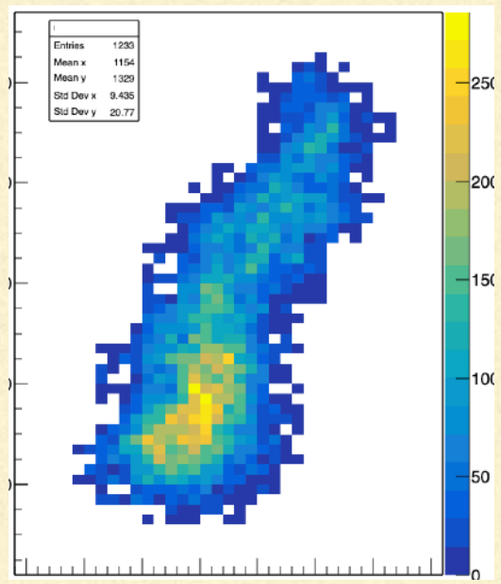


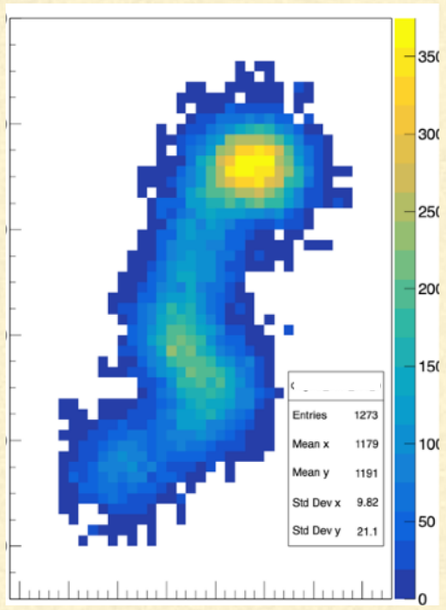


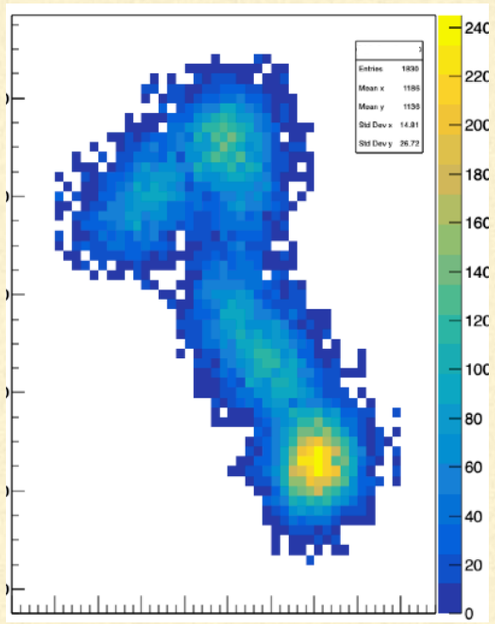


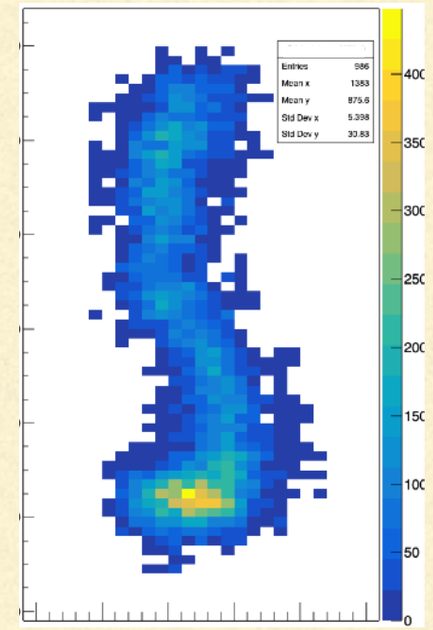


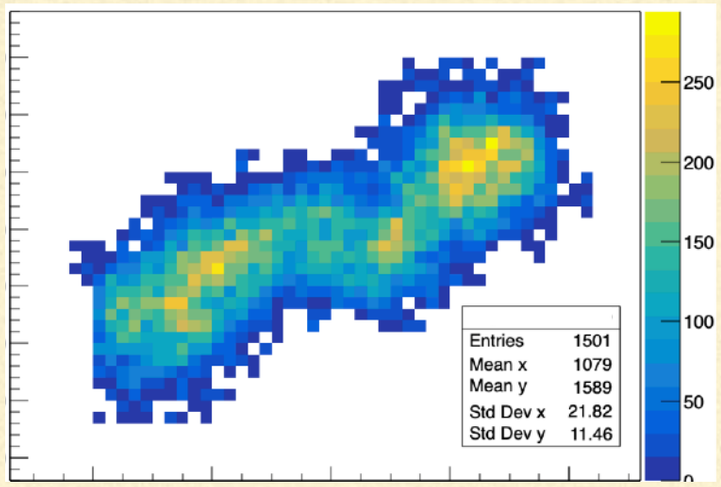
Data or smulation?

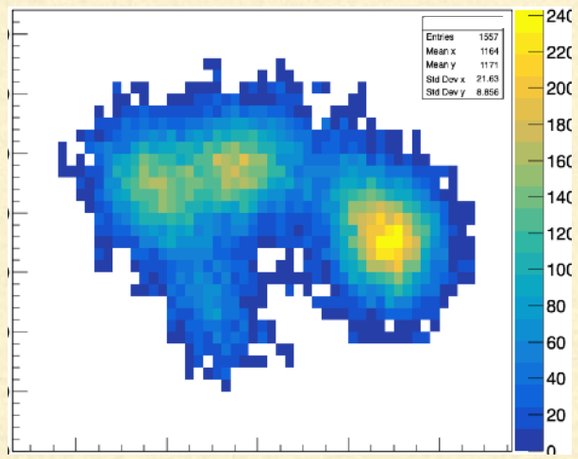


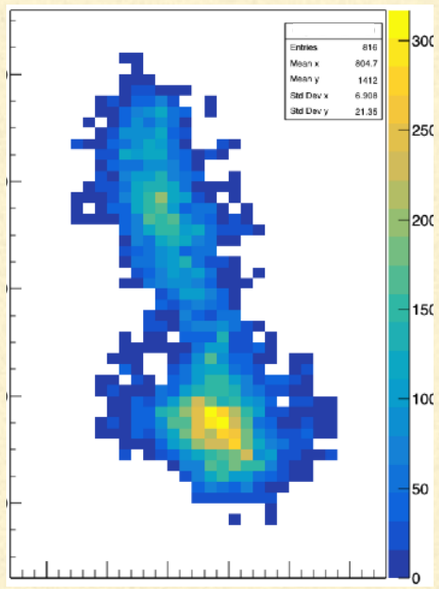


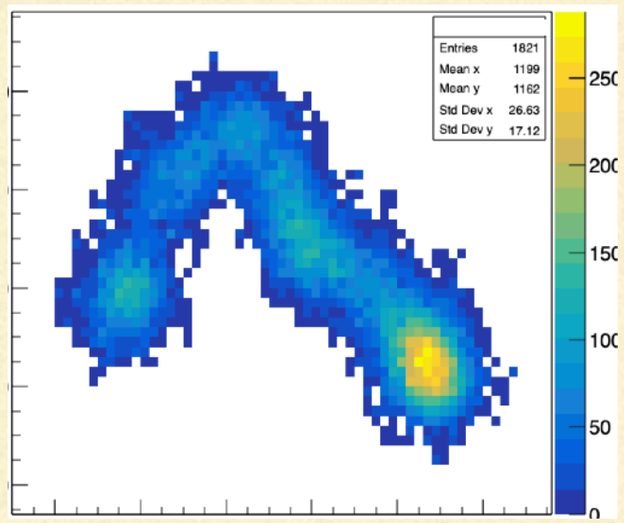




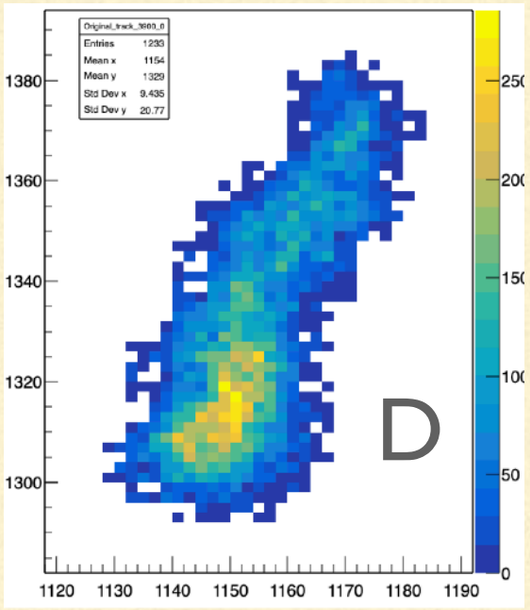


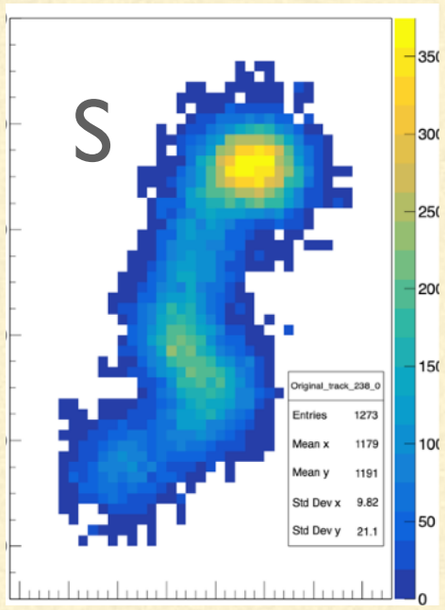


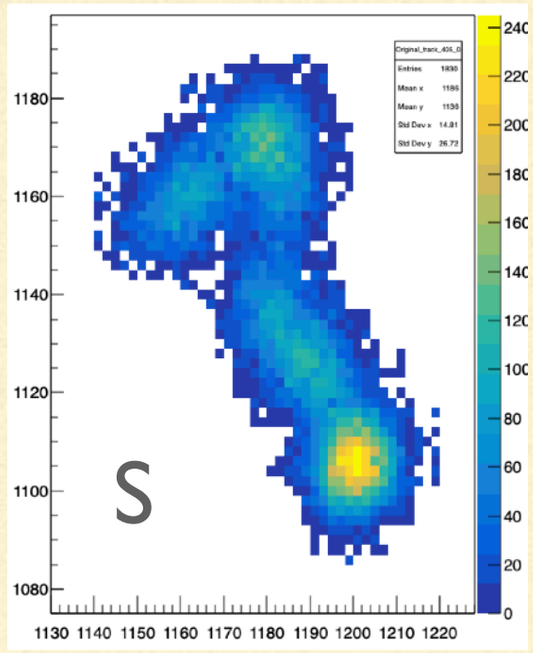


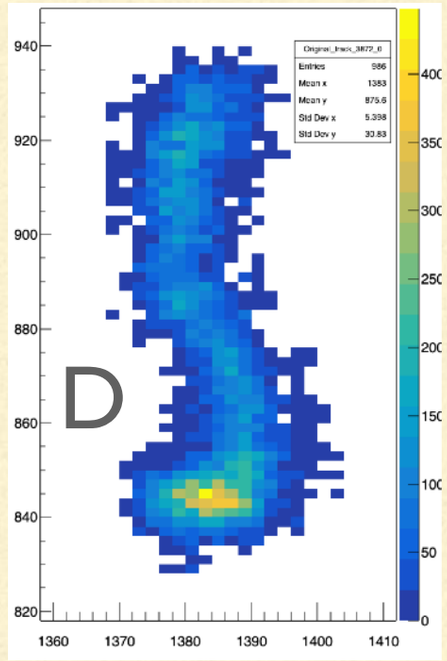


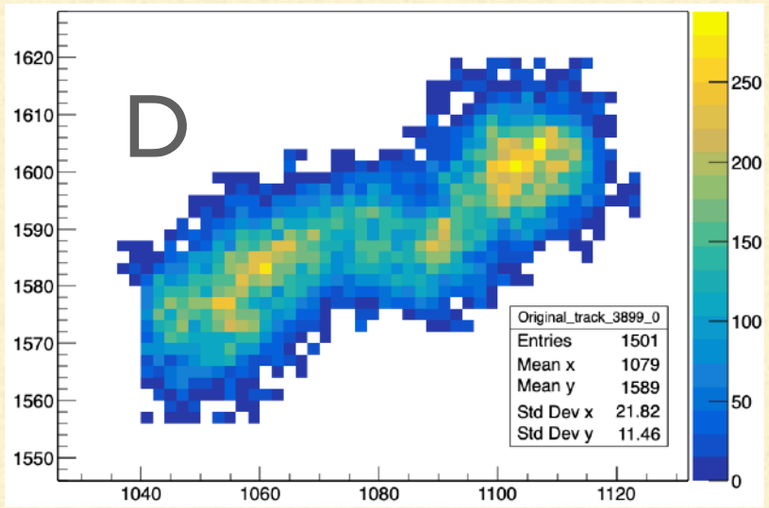
Data or smulation?

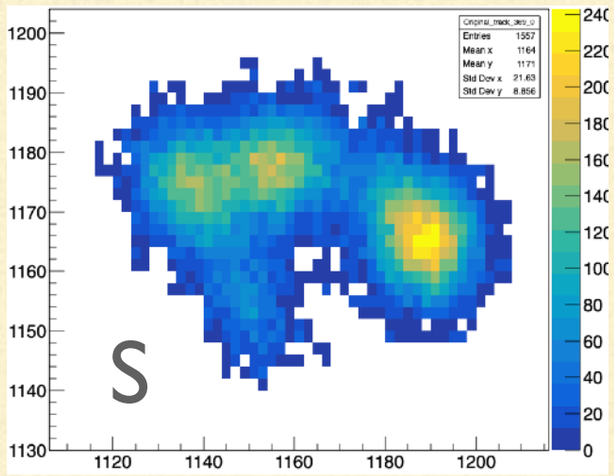


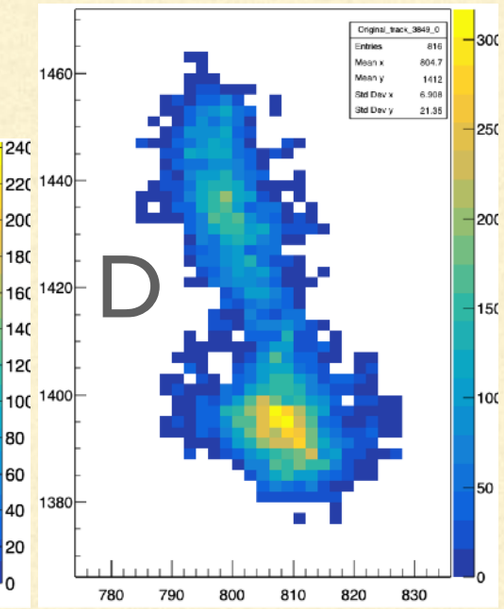


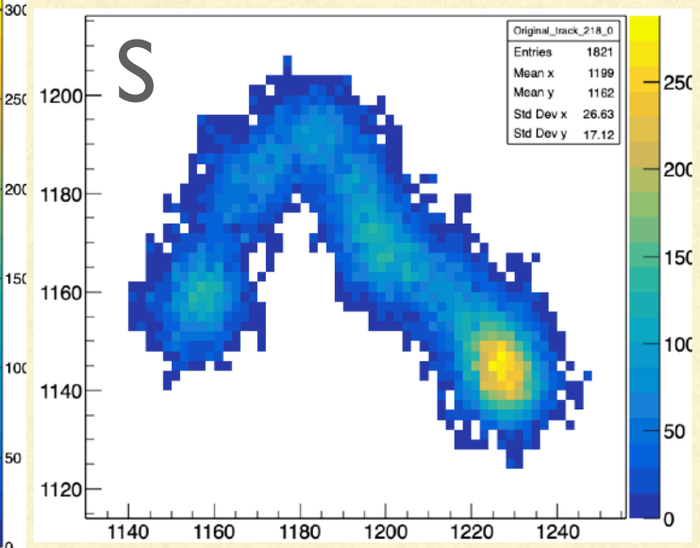












Backup

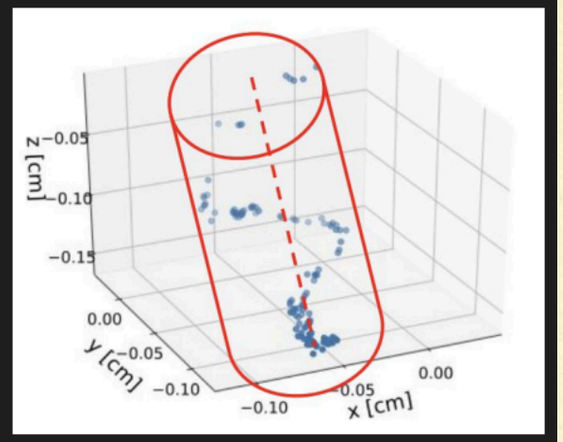
Observables

Observables for recoil identification in gas TPCs
arXiv:2012.13649v1

- Standard Deviation of Charge Distribution (SDCD):

$$SDCD = \sqrt{\frac{\sum_{i=1}^{N}(\mathbf{r_i} - \bar{\mathbf{r}})^2}{N}}.$$

- Charge Uniformity (ChargeUnif):
  - For each point within the charge distribution, find the average distance to all other points.
  - ChargeUnif is standard deviation of values computed in step 1.
- Maximum Density (MaxDen):
  - MaxDen is the value of most intense pixel. (After rebinning)
- Cylindrical Thickness (CylThick):
  - For each charge , calculate the squared distance from the principal axis.
  - CylThick is the sum of all squared distances.



Source: Majd Ghrear presentation in Physics and Analysis meeting

Observables

- Length Along Principal Axis (LAPA):
  - Project all the points in the charge distribution on to the principal axis.
  - LAPA is the difference between maximum and minimum projected value.
- eta:
  - MaxDen divided by length (found by skeletonization)
- Light Density:
  - Ratio of sc_integral over sc_nhits
- Skeleton length (thin_track):
  - Length in pixels found by thinning
- Slimness:
  - Ratio of sc_width over sc_length

GEM-based TPC with CCD Imaging for Directional Dark Matter Detection
arXiv:1510.02170v3