

Charge sharing result reviewed

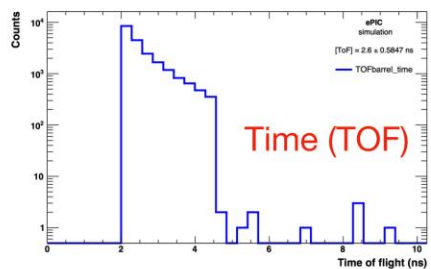
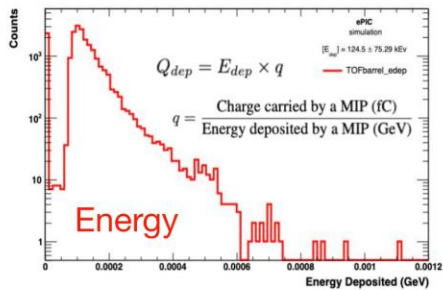
Chun Yuen Tsang, Souvik Paul, Prithwish Tribedy

(Greatly exaggerated) charge spearing Pulse shape (Courtesy Prithwish Tribedy)

Energy & time to Peak (ADC) & TOA (TDC)

Event Generation & Transport:

- 250k μ^- particles
- $0 \text{ GeV} \leq p \leq 30 \text{ GeV}$
- $0^\circ \leq \Theta \leq 180^\circ$



GEANT input:

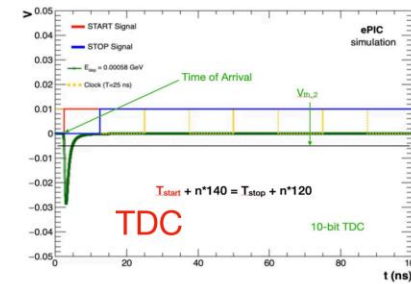
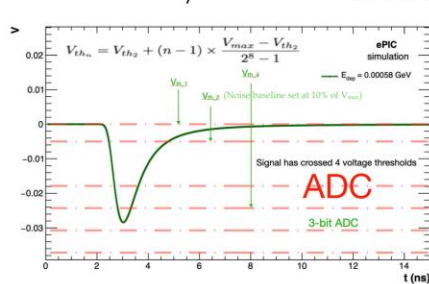
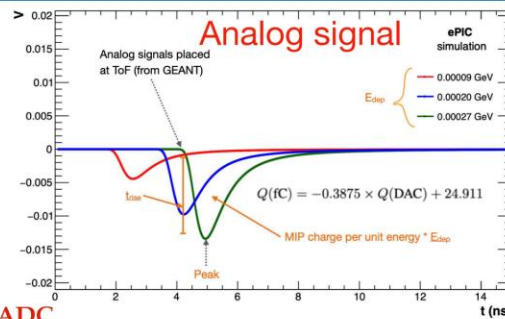
- Q_{dep} : Area under analog signal
- Analog signals placed at ToF

Data-driven input:

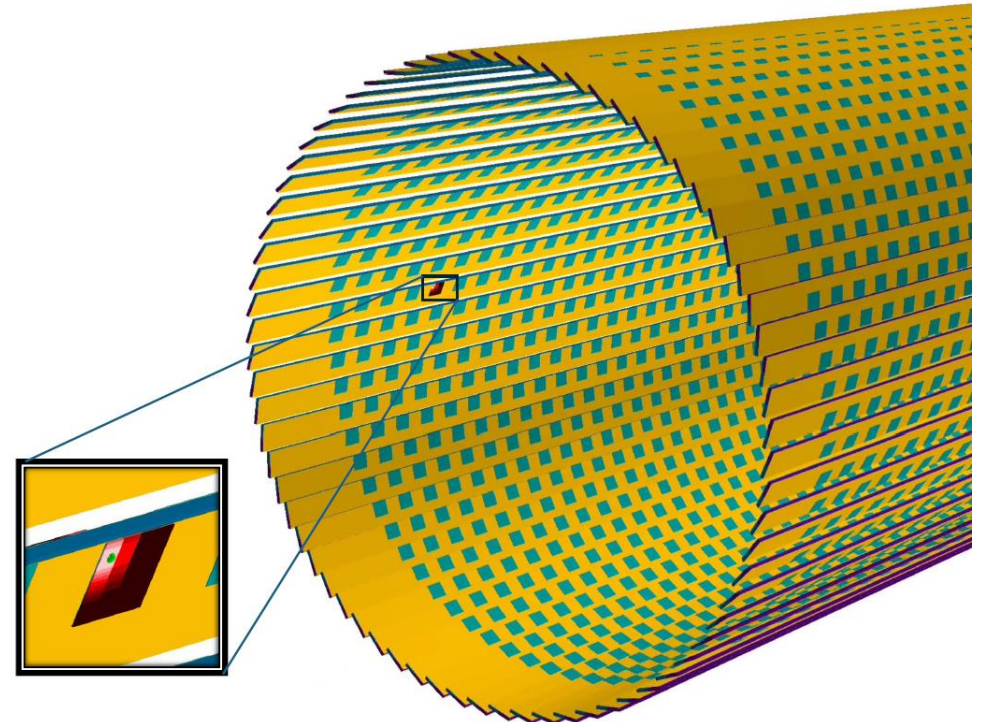
- Analog signal parameterized by Landau distribution
- Risetime $\sim 450 \text{ ps}$
- Shape width $\sim 294 \text{ ps}$

Voltage thresholds \rightarrow **8-bit ADC**

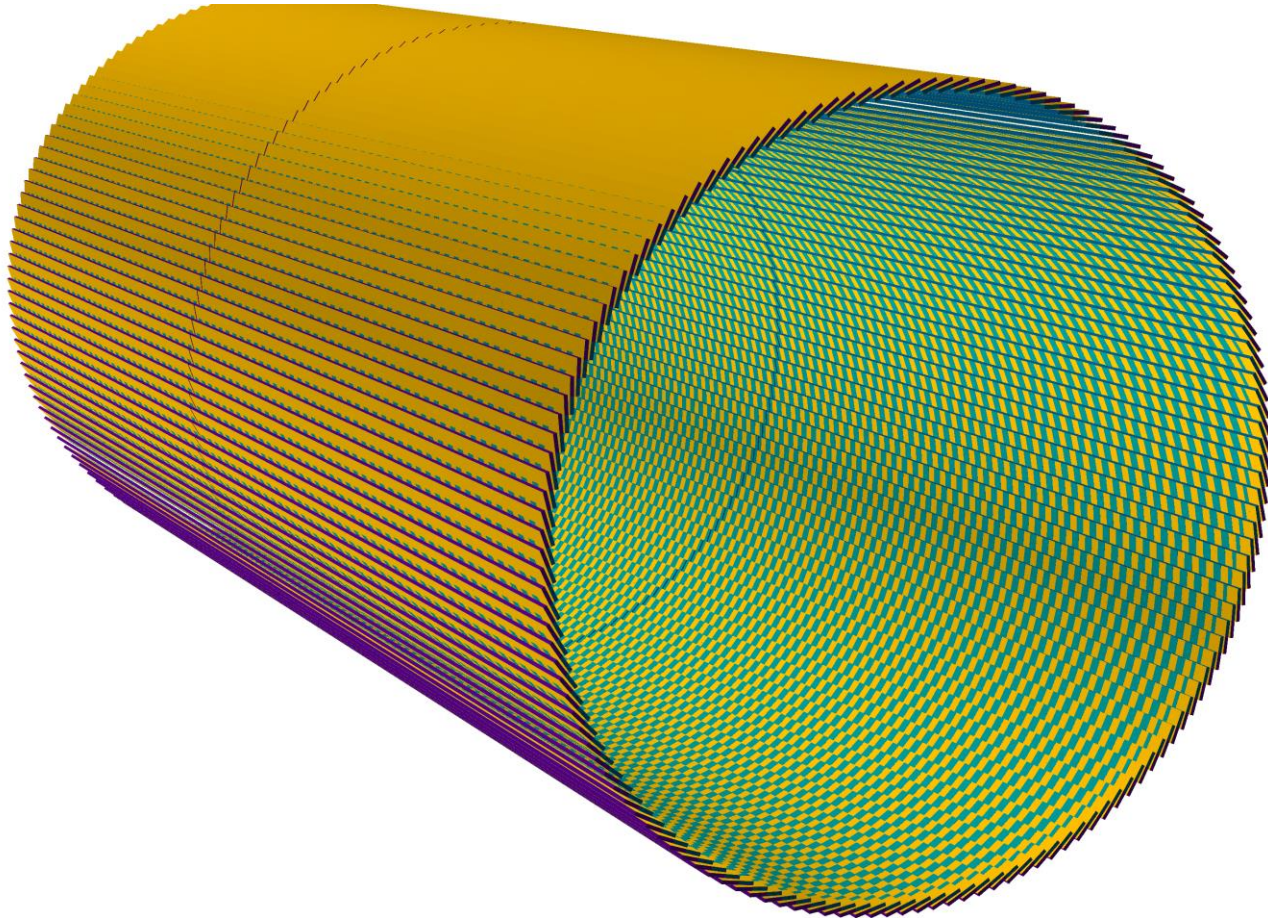
CLK + START/STOP \rightarrow **10-bit TDC**



Energy Deposited \rightarrow Charge \rightarrow Peak of Signal \rightarrow ADC
Time of Flight + Rise Time \rightarrow Time of Arrival \rightarrow TDC



New geometry

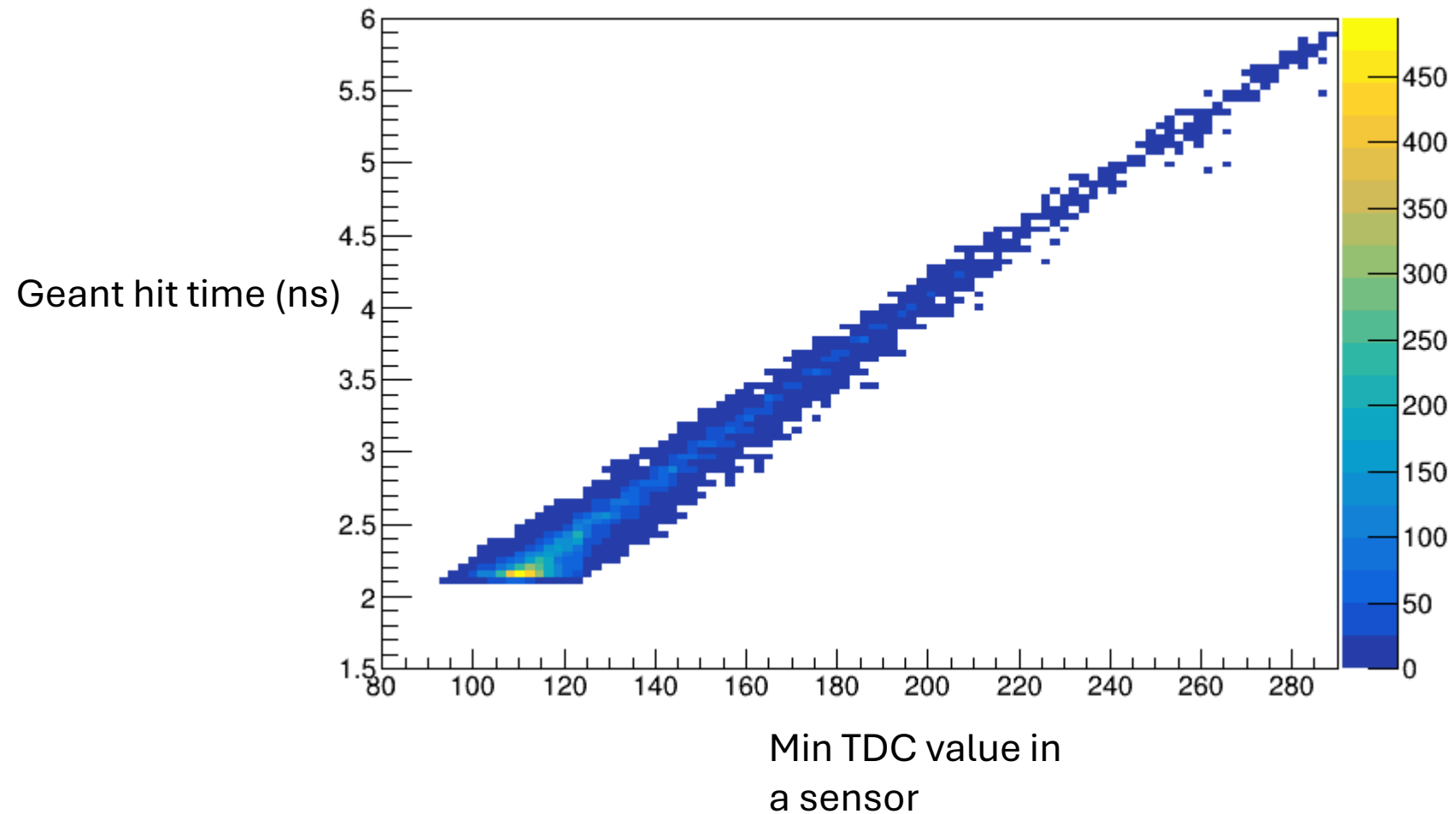


- More sensors than before.
- Gap in the middle for support ring.
- Sensor dimension = 3.2x2 cm
- Strips = 64x2
- Sensors on both sides.

Simulation parameters

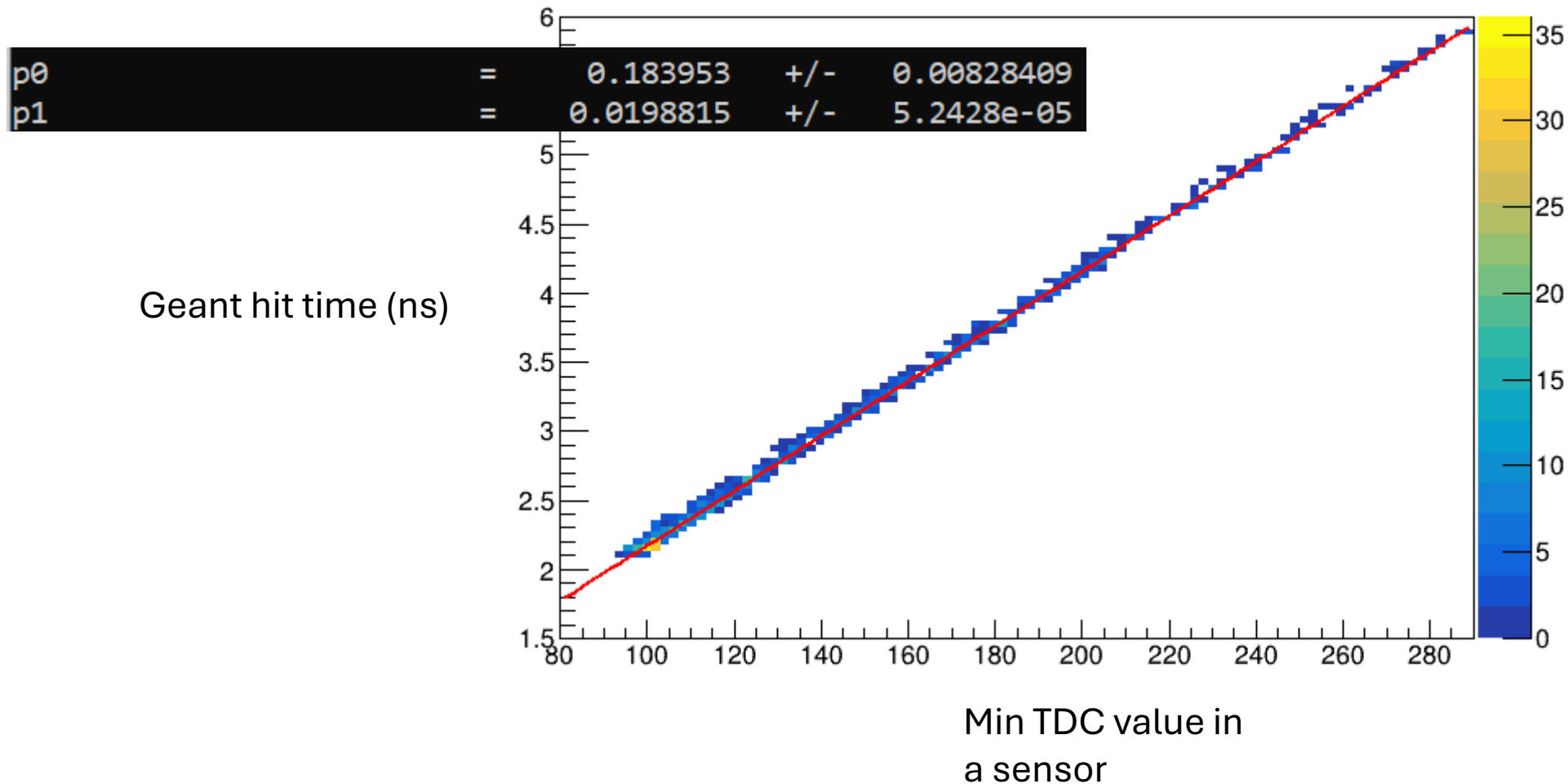
- 1 Mu- per event.
- Only count events with just 1 geant hit
 - Don't want to deal with hit matching for simplicity.
- Gain = 80.
- Nsigmax = 0.1 cm. (x direction has 64 rows in a sensor)
- Nsigmay = 0.5 cm. (y direction has 2 columns in a sensor, i.e. beam direction)
 - Charge sharing follows 2D Gaussian.
- rise time = 0.45 ns.
- Edep when ADC value is 256 = $1e-4$ GeV.
- Threshold (for TDC) = $1e-5$ GeV.
- Sensor thickness = 0.3 mm

Min. TDC in a sensor vs Geant hit time

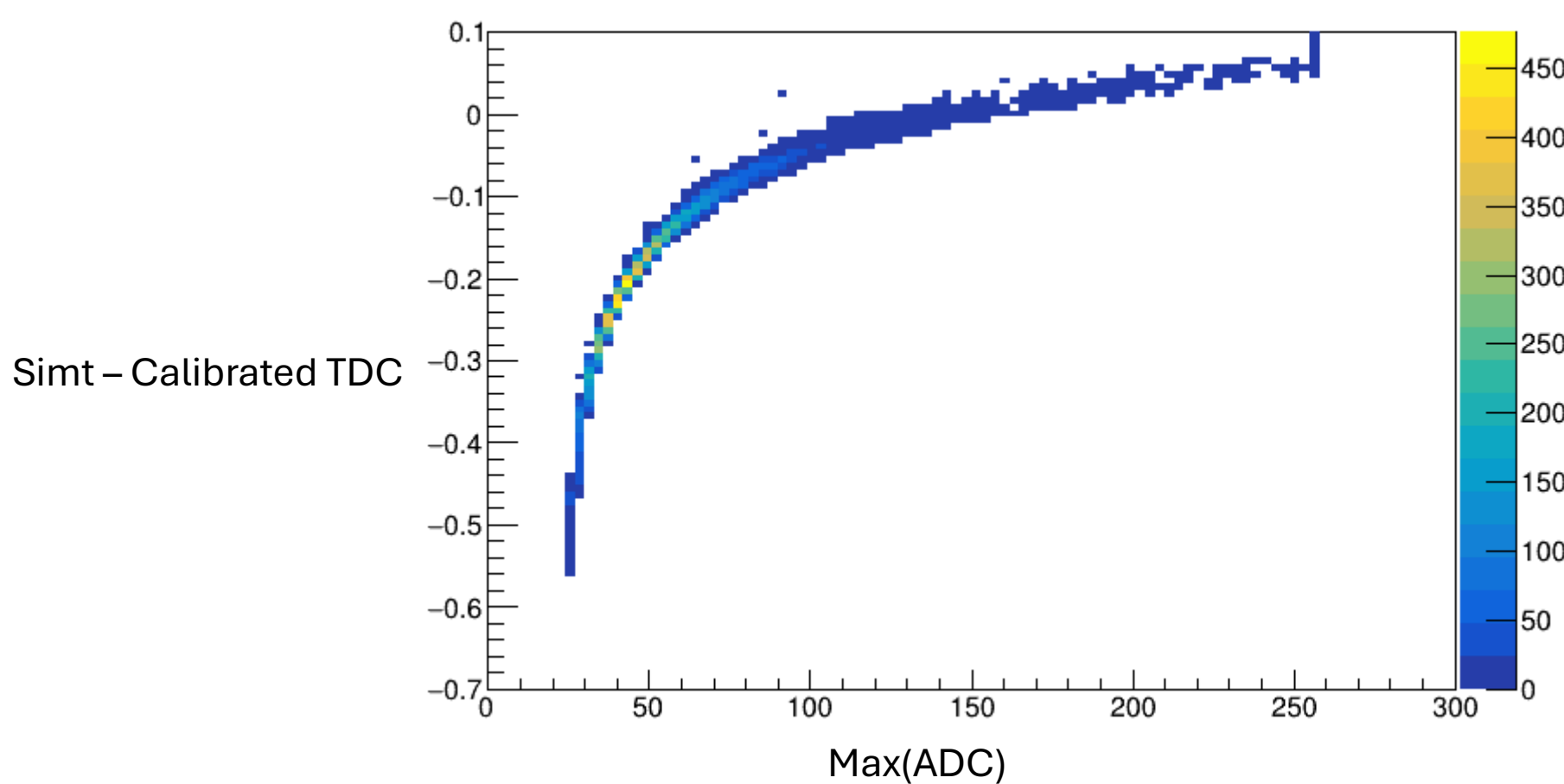


Min. TDC in a sensor vs Geant hit time

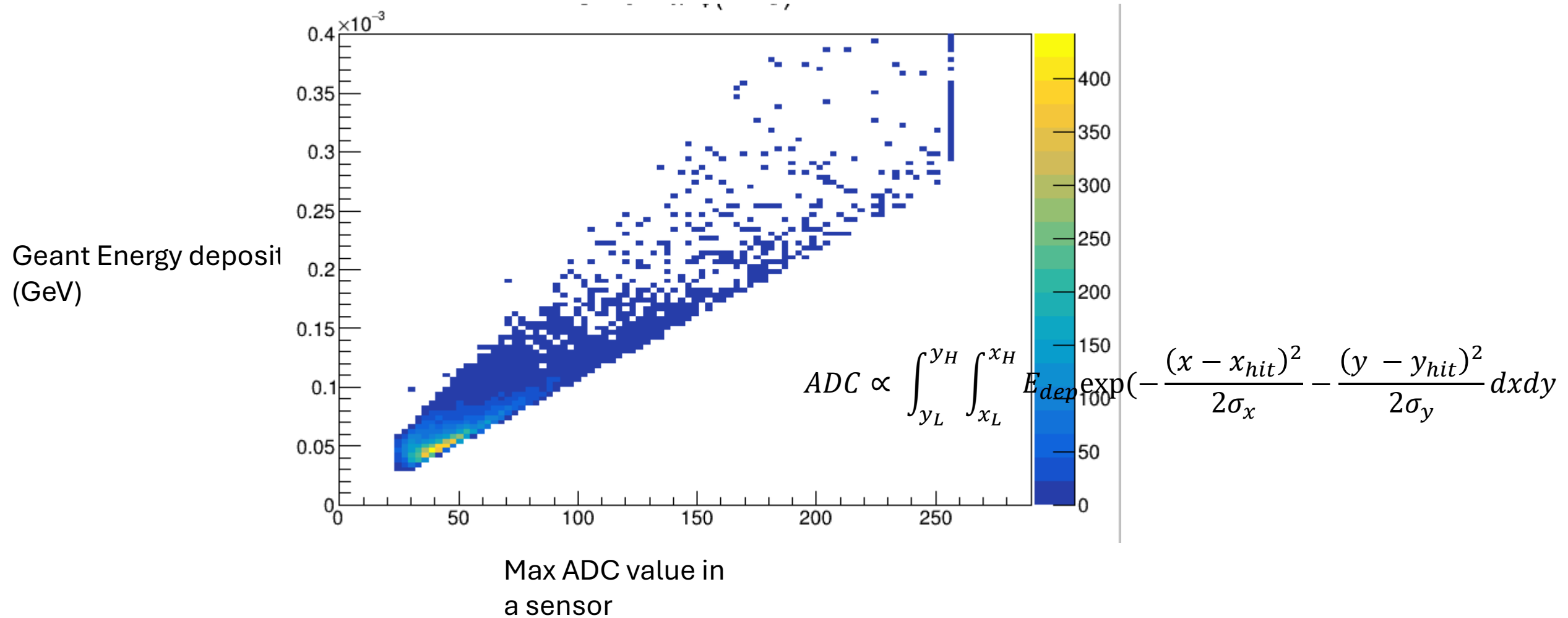
Only for hits with $\text{Max}(\text{ADC}) > 100$



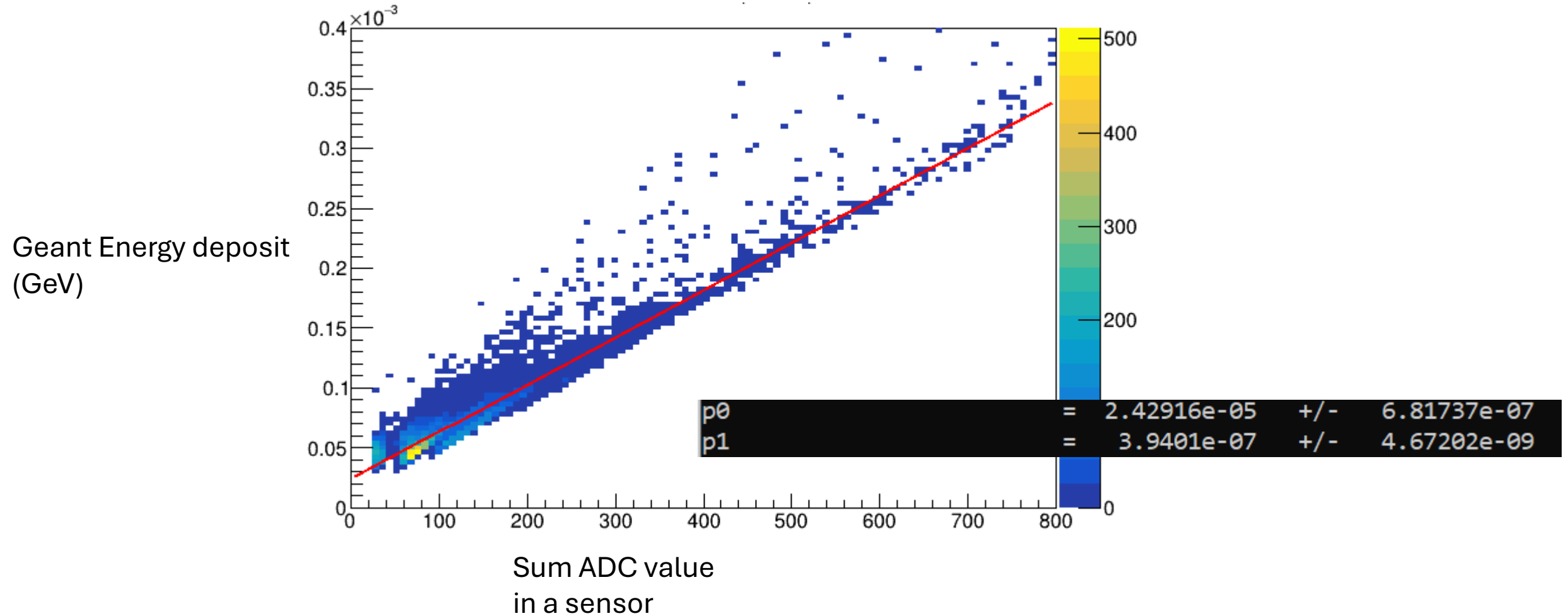
Simt – Calibrated TDC vs Max(ADC)



Max. ADC height in a sensor vs Geant energy deposition



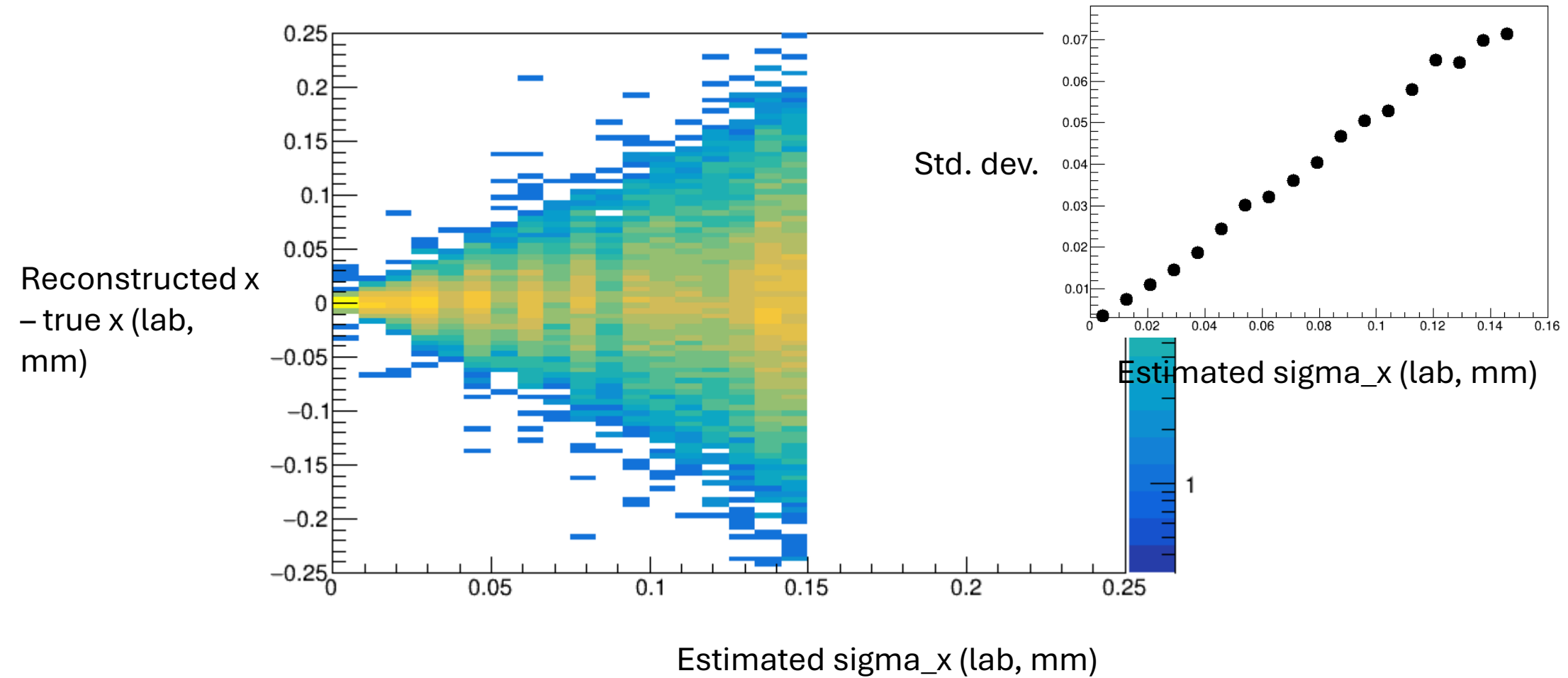
Sum. ADC height in a sensor vs Geant energy deposition



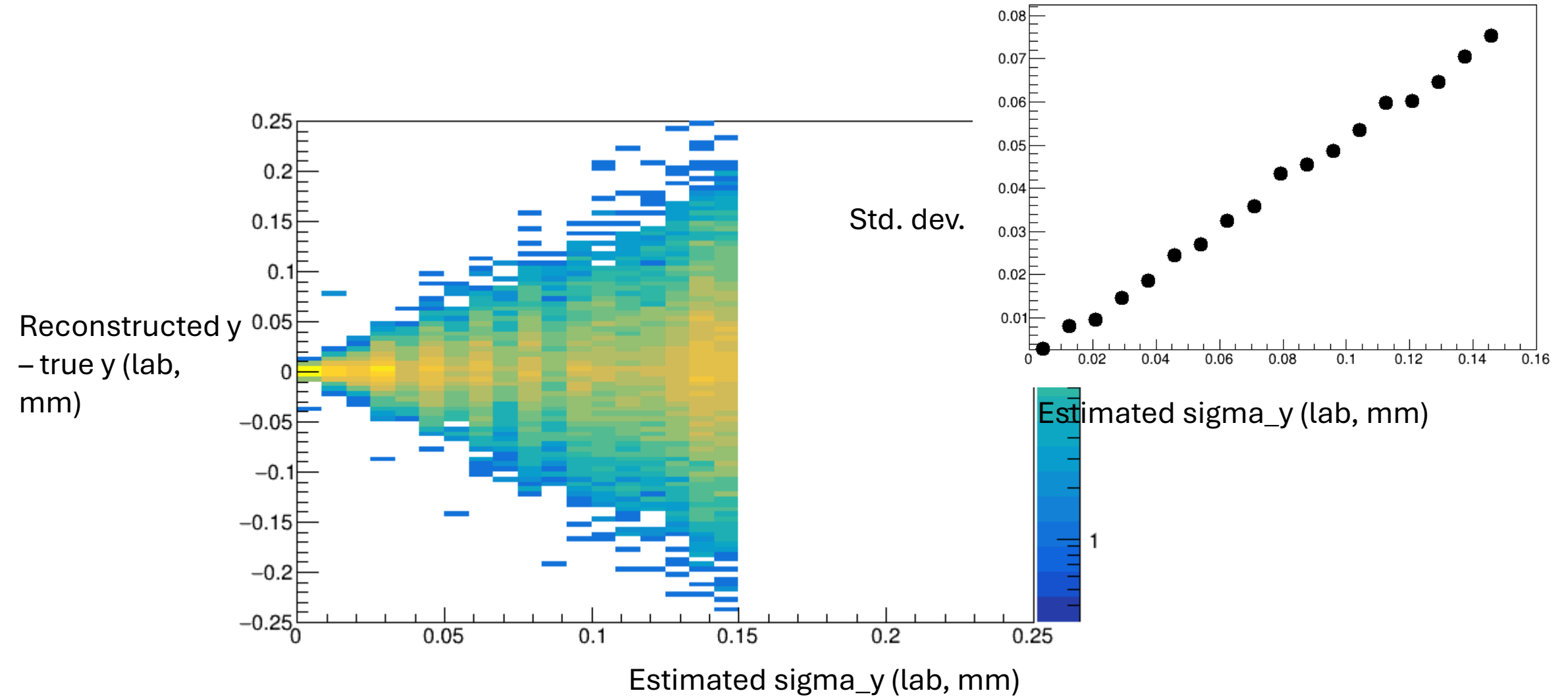
Estimation of hit point resolution

- Reconstruction = simple weighted ADC average.
- $\text{Sigma}_x = \text{cell x-length} / \sqrt{12}$
- $\text{Sigma}_y = \text{cell y-length} / \sqrt{12}$
- Since hit spread to multiple strip, real resolution should be better.
- Note: Must rotate from sensor local frame to lab frame.

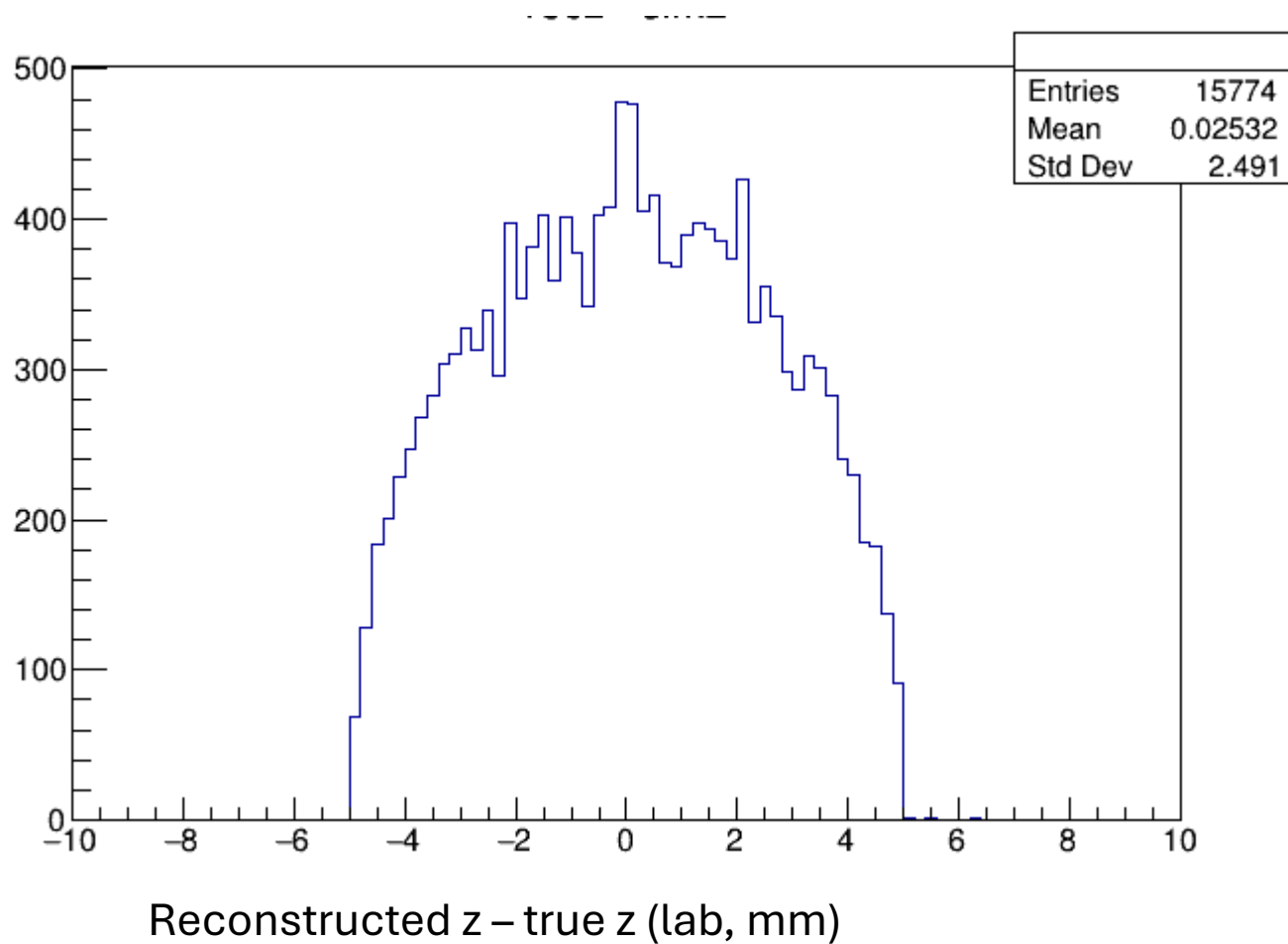
Resolution check



Resolution check



Resolution check



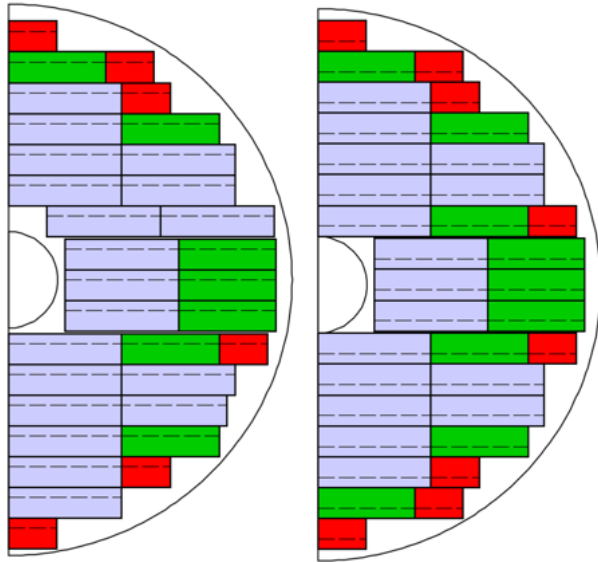
Estimated σ_z (lab, mm) =
2.887 mm

Z-axis is not rotated, 2.887
mm = 1 cm/sqrt(12)

TBD: ETOF Courtesy: Wei Li

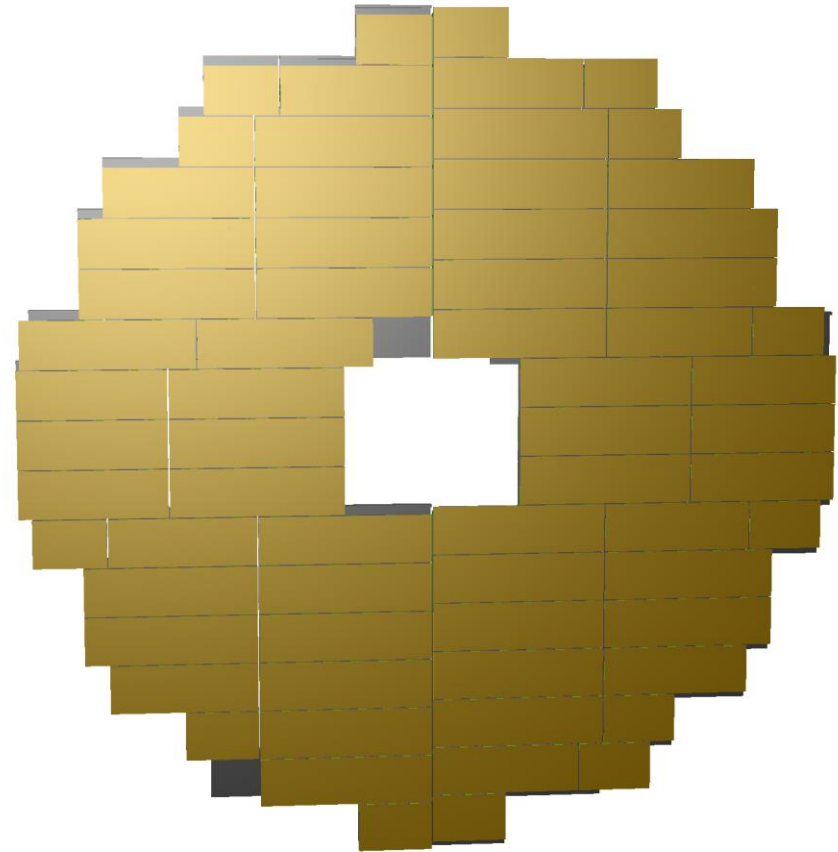
FTOF Layout (x-y view): **v09272024**

Row	modules	RB3	RB6	RB7	All RBs
1	3	1	0	0	1
2	9	1	1	0	2
3	10	1	0	1	2
4	13	0	1	1	2
5	14	0	0	2	2
6	14	0	0	2	2
7	14	0	1	1	2
8	13	0	1	1	2
9	13	0	1	1	2
10	13	0	1	1	2
11	16	1	1	1	3
12	14	0	0	2	2
13	14	0	0	2	2
14	13	0	1	1	2
15	10	1	0	1	2
16	7	0	0	1	1
17	3	1	0	0	1
Sum	193	6	8	18	32

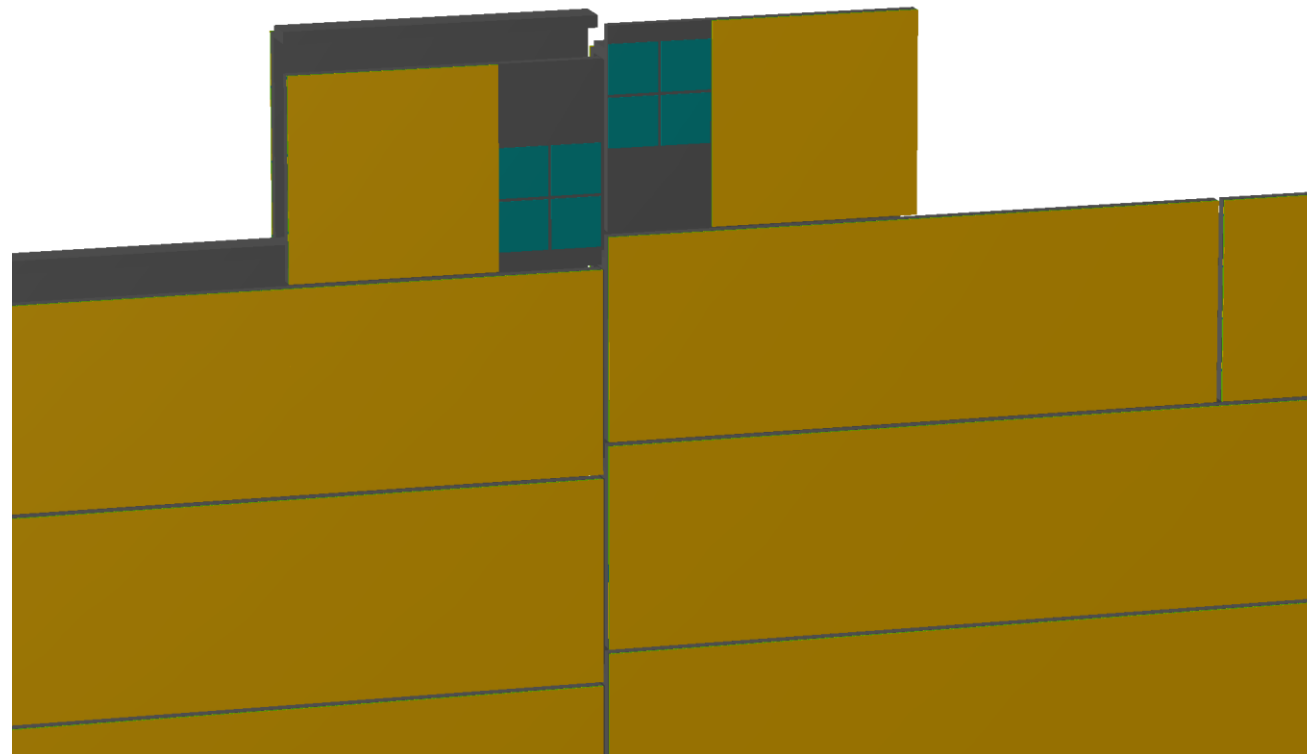


Row	modules	RB3	RB6
1	3	1	0
2	9	1	1
3	10	1	0
4	13	0	1
5	14	0	0
6	14	0	0
7	16	1	1
8	13	0	1
9	13	0	1
10	13	0	1
11	16	1	1
12	14	0	0
13	14	0	0
14	13	0	1
15	10	1	0
16	9	1	1
17	3	1	0
Sum	197	8	9

Total number of modules: $(193+197)*2 = 780$
 Total number of service hybrids: $(32+34)*2 = 132$



PCB taken off



Next steps

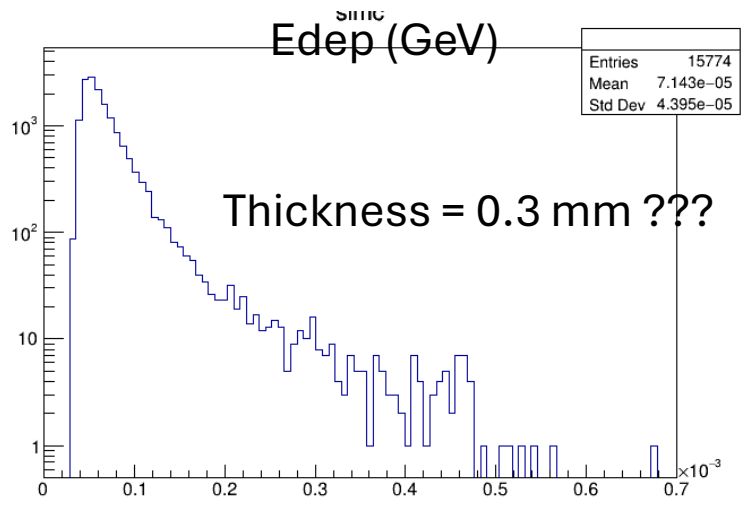
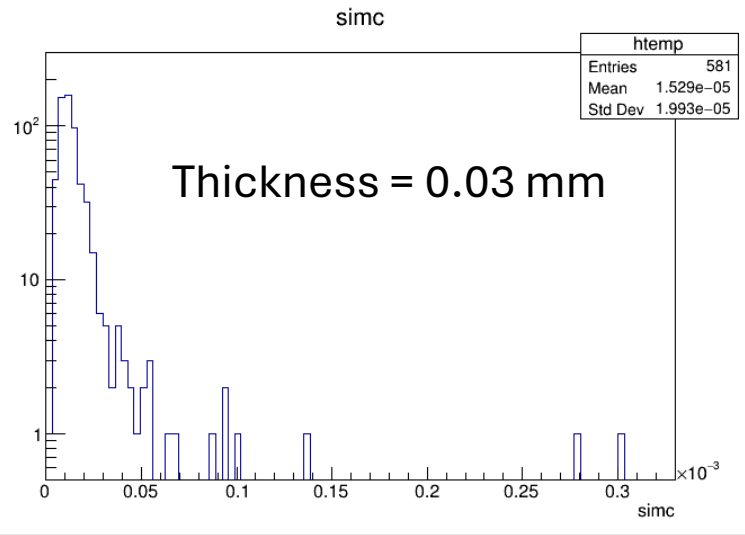
- Noise, amplitude correction, more accurate clusterization.

Backup

Simulation parameters

- 1 Mu- per event.
- $0.2 < |p| < 30$ GeV.
- Uniform theta, phi.
- Only count events with just 1 geant hit
 - Don't want to deal with hit matching for simplicity.
- Sensor thickness: 0.3 mm
- Nevents = 1000.

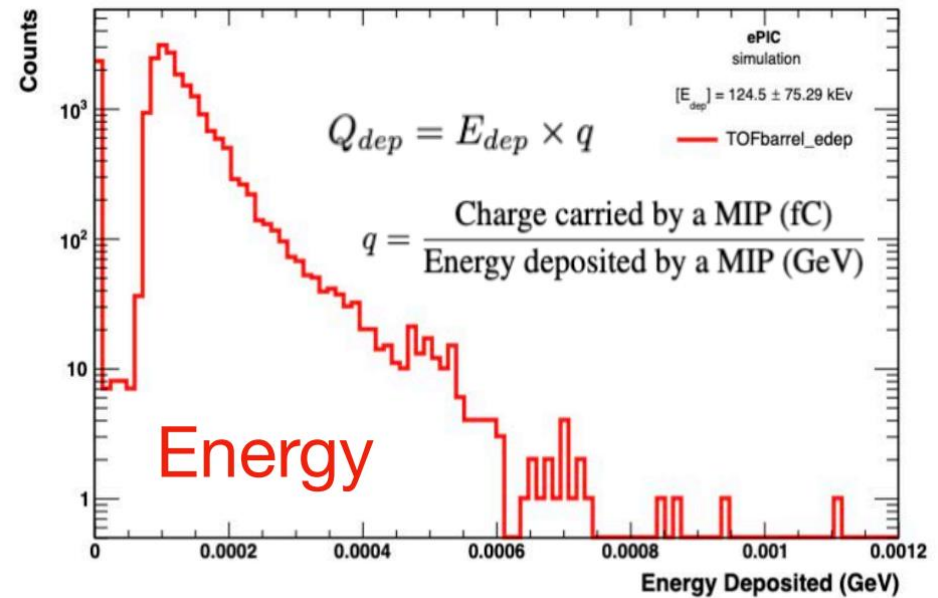
Sanity check: Geant4 Edep on sensors



EIC collaboration
meeting

Event Generation & Transport:

- 250k μ^- particles
- $0 \text{ GeV} \leq p \leq 30 \text{ GeV}$
- $0^\circ \leq \Theta \leq 180^\circ$



Cooling pipe

