Rate Performance of ME0 GEM Detectors in Test Beam

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Student Summer Session 2023

About Me

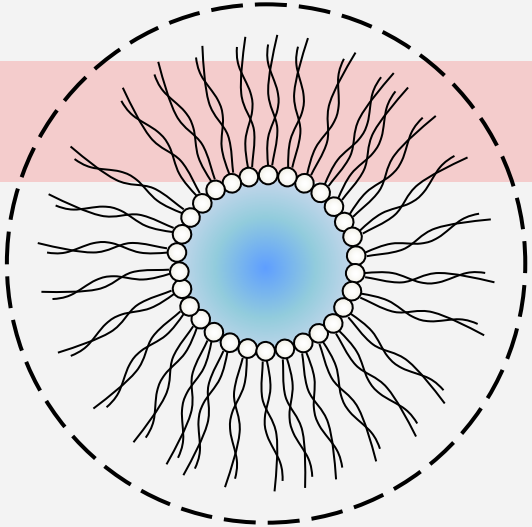
Nicholas Kurth

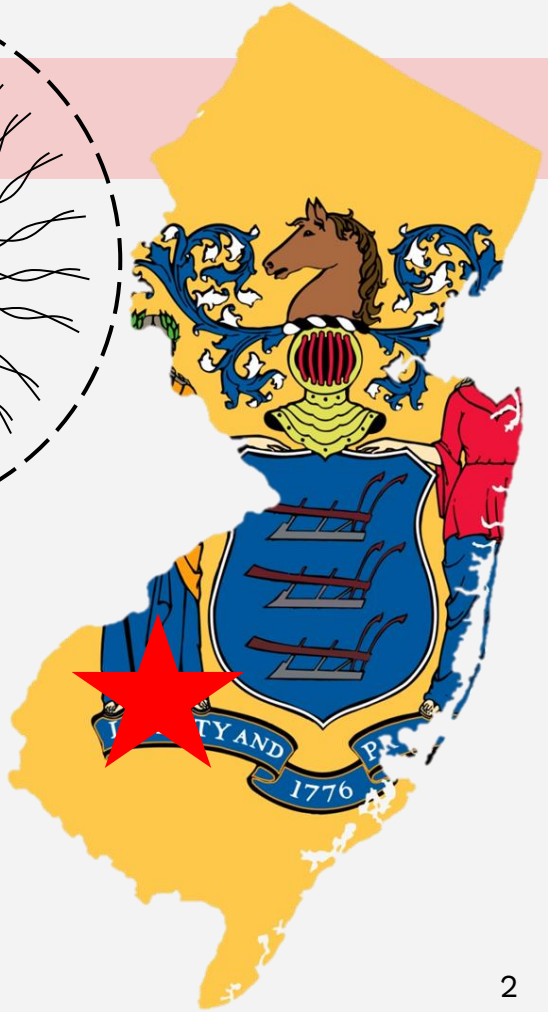
Education:

- Rowan University, Glassboro, NJ
- Physics, Bachelors of Science
- Research biophysics and reverse micelle

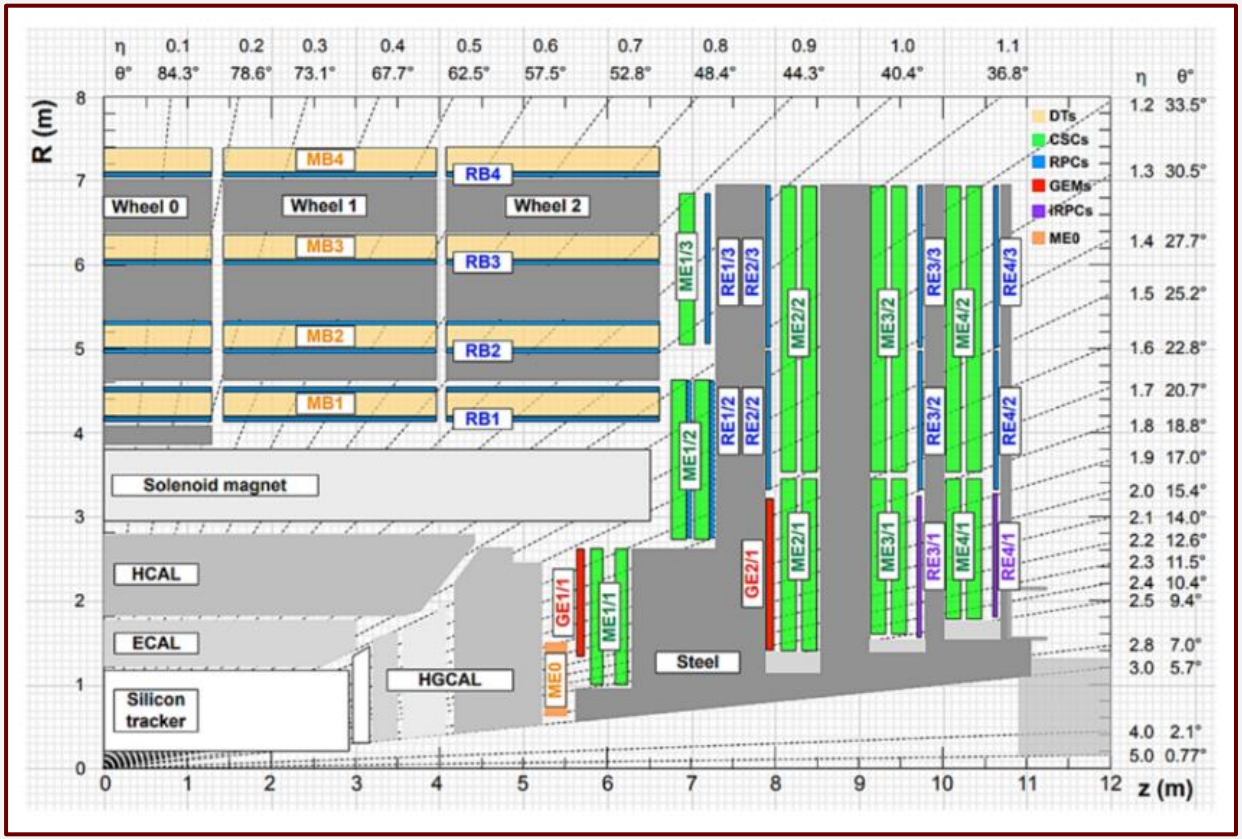
CERN Summer Student:

- June 10th to August 13th
- Work with CMS on the performance of **GEM detectors**

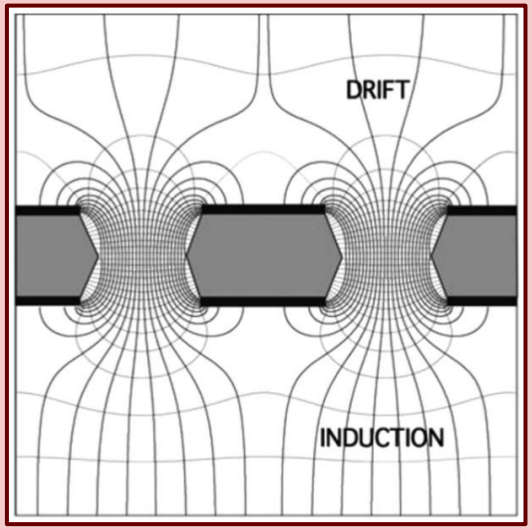


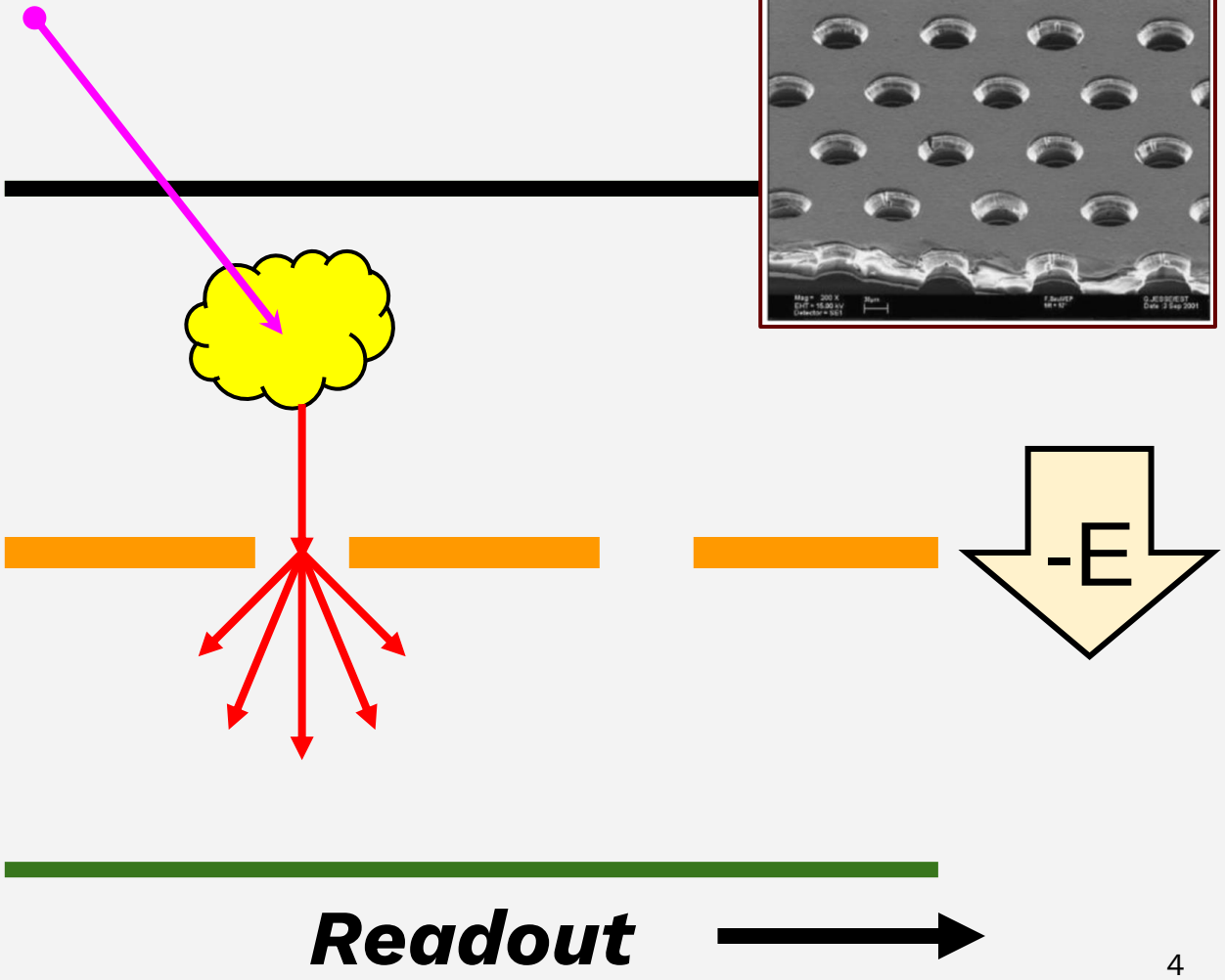


GEMs & CMS

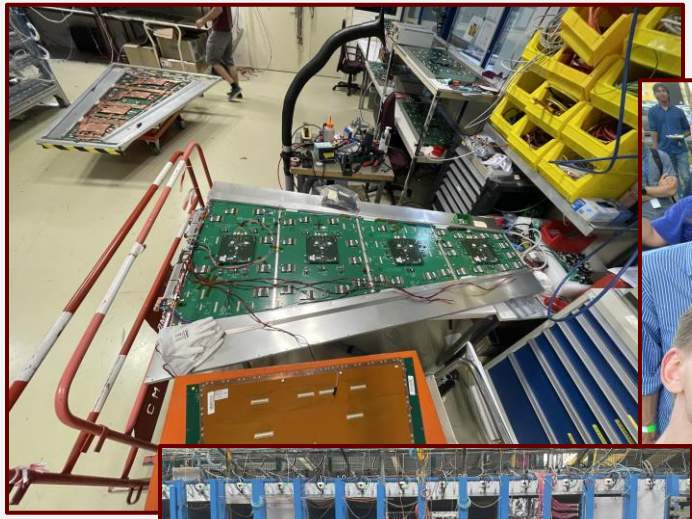

η 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1
θ° 84.3° 78.6° 73.1° 67.7° 62.5° 57.5° 52.8° 48.4° 44.3° 40.4° 36.8°
η θ°
1.2 33.5°
1.3 30.5°
1.4 27.7°
1.5 25.2°
1.6 22.8°
1.7 20.7°
1.8 18.8°
1.9 17.0°
2.0 15.4°
2.1 14.0°
2.2 12.6°
2.3 11.5°
2.4 10.4°
2.5 9.4°
2.8 7.0°
3.0 5.7°
4.0 2.1°
5.0 0.77°
R (m)
z (m)
DTs
CSCs
RPCs
GEMs
iRPCs
ME0
MB4
MB3
MB2
MB1
RB4
RB3
RB2
RB1
Wheel 0
Wheel 1
Wheel 2
Solenoid magnet
HCAL
ECAL
Silicon tracker
HGCAL
Steel
ME1/3
ME1/2
ME1/1
GE1/1
ME0
GE2/1
RE1/3
RE2/3
RE1/2
RE2/2
ME2/2
ME2/1
ME3/2
ME3/1
RE3/3
RE3/2
RE3/1
ME4/2
ME4/1
RE4/3
RE4/2
RE4/1

GEM Basics



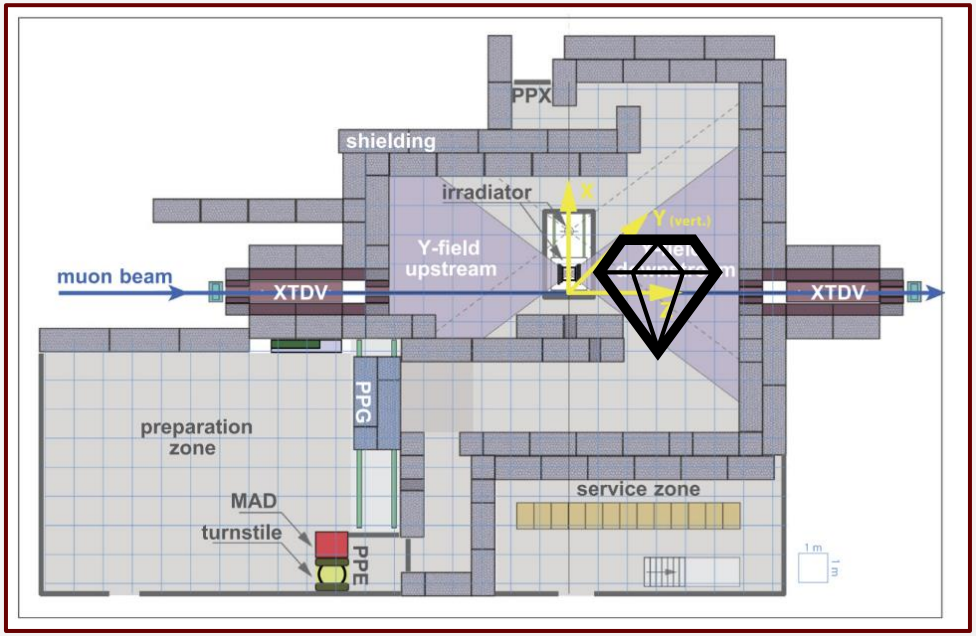


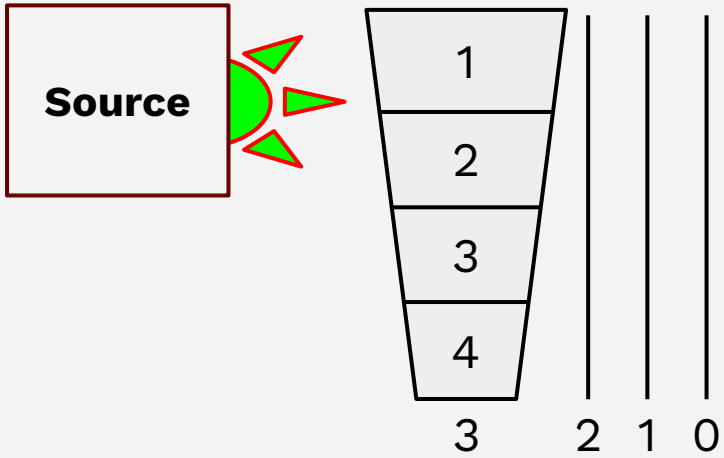
GEM Lab



Research Project

Evaluate the rate performance of ME0 GEM detectors within the GIF++ test beam

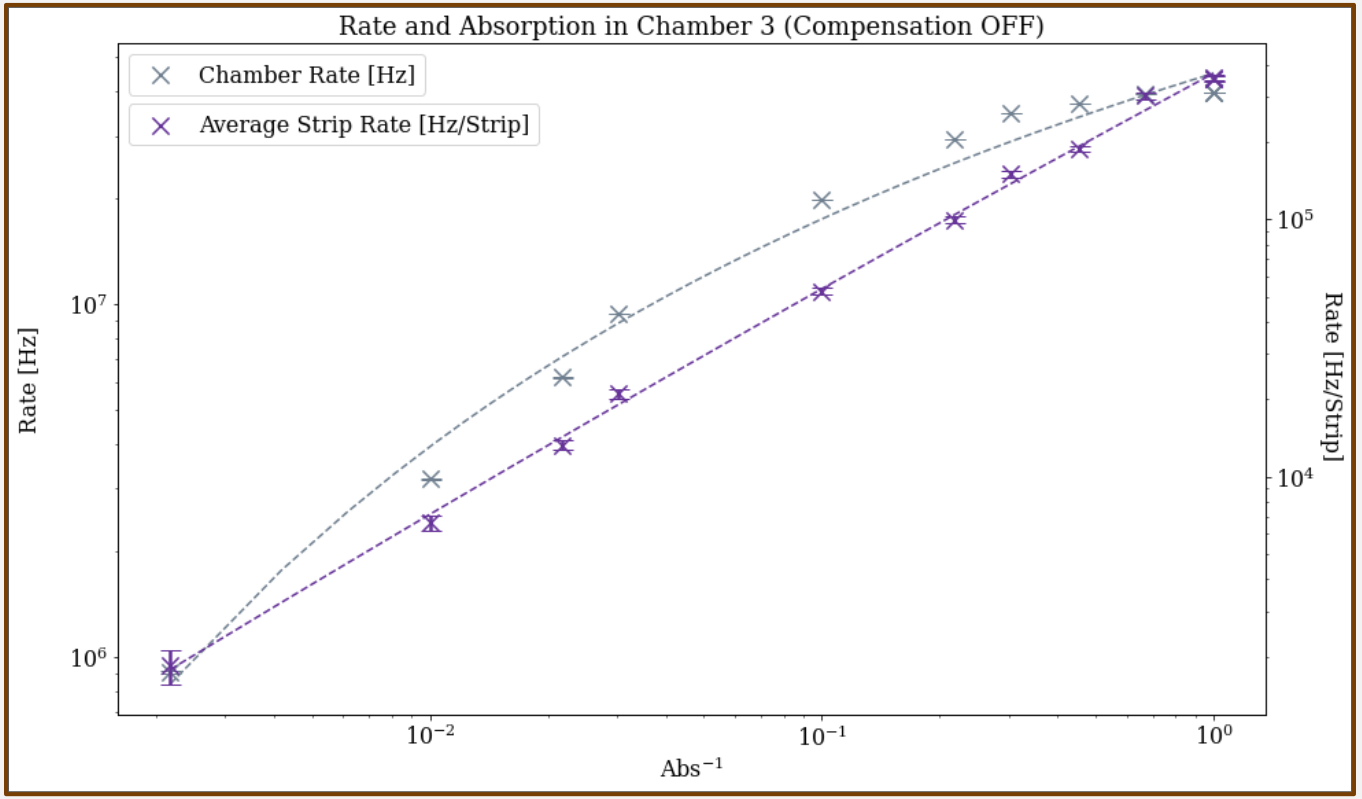




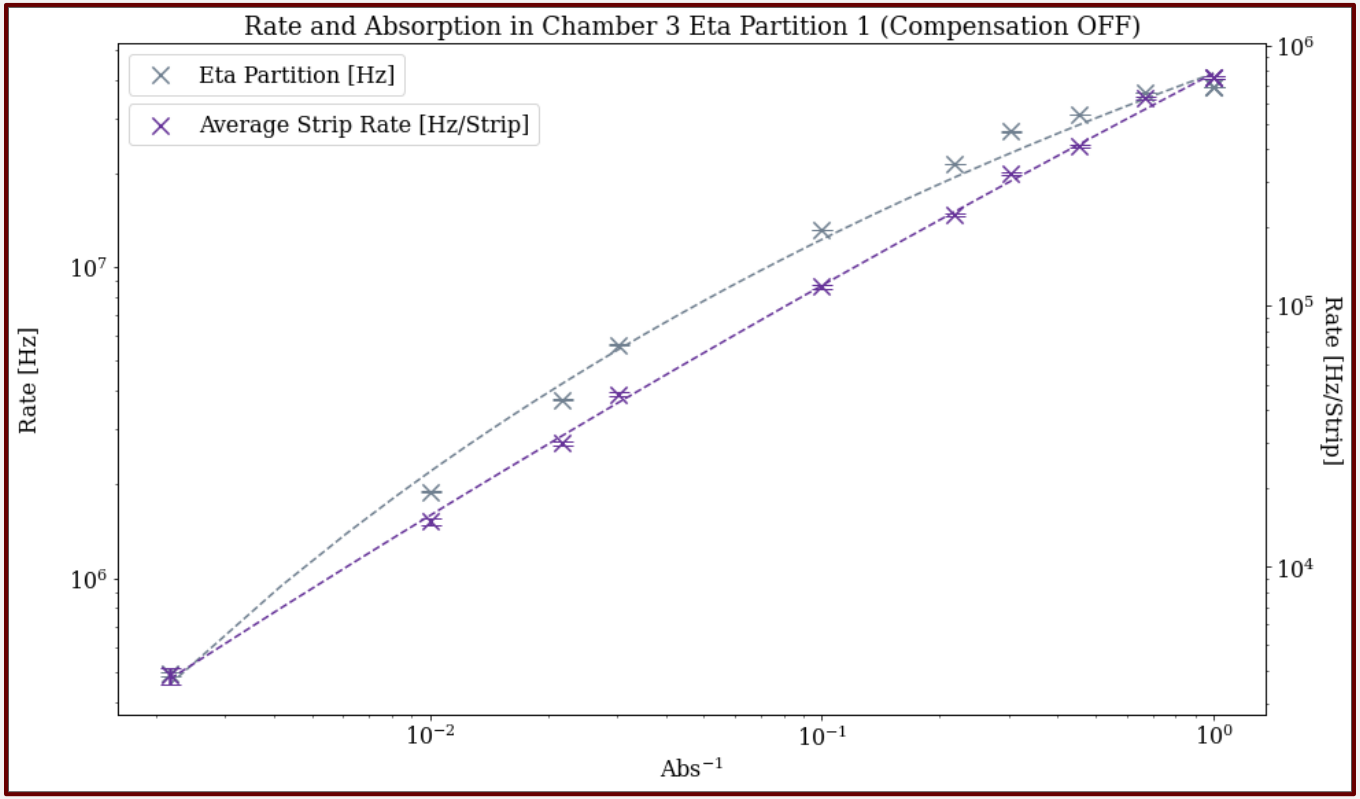
Results — Rate per Chamber, Eta, & Strip

Everything follows our expectations

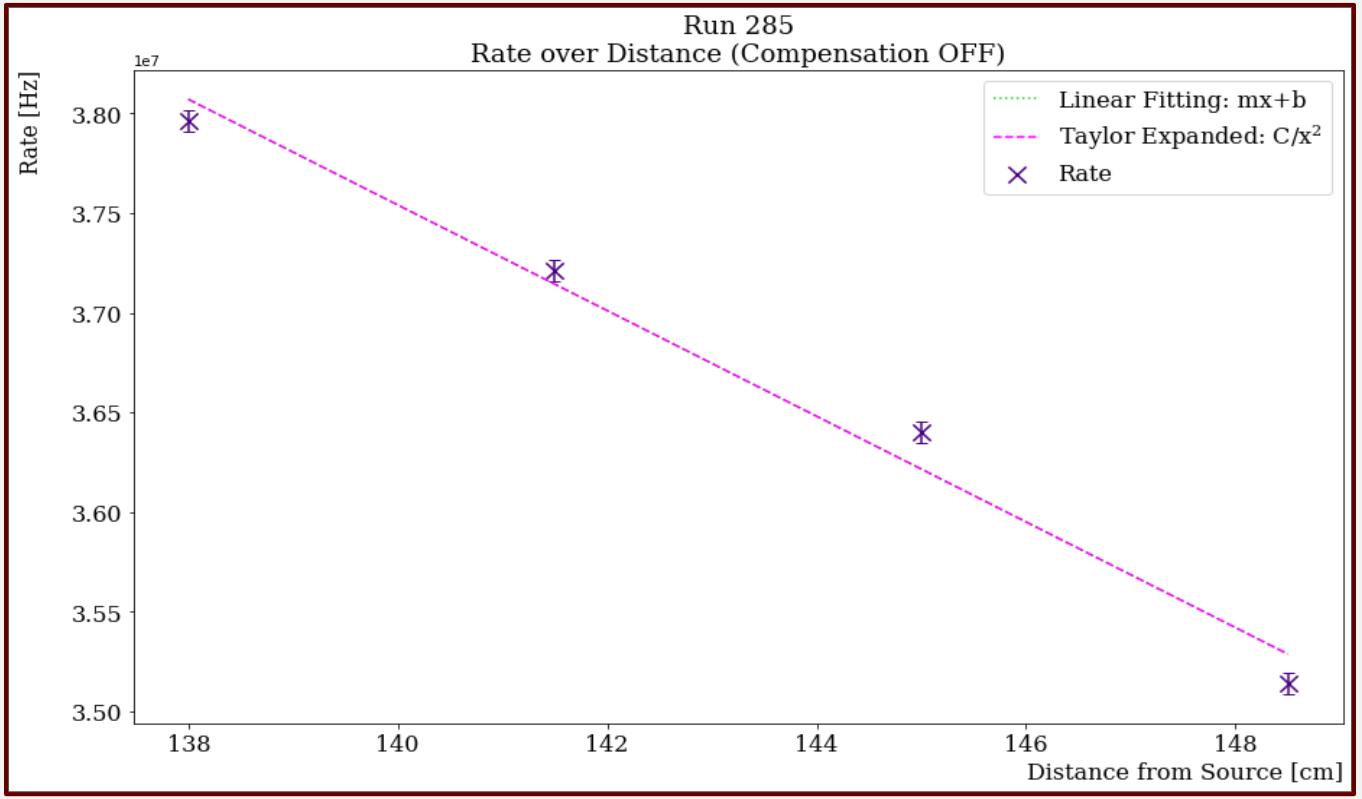
Results — Rate vs. Attenuation



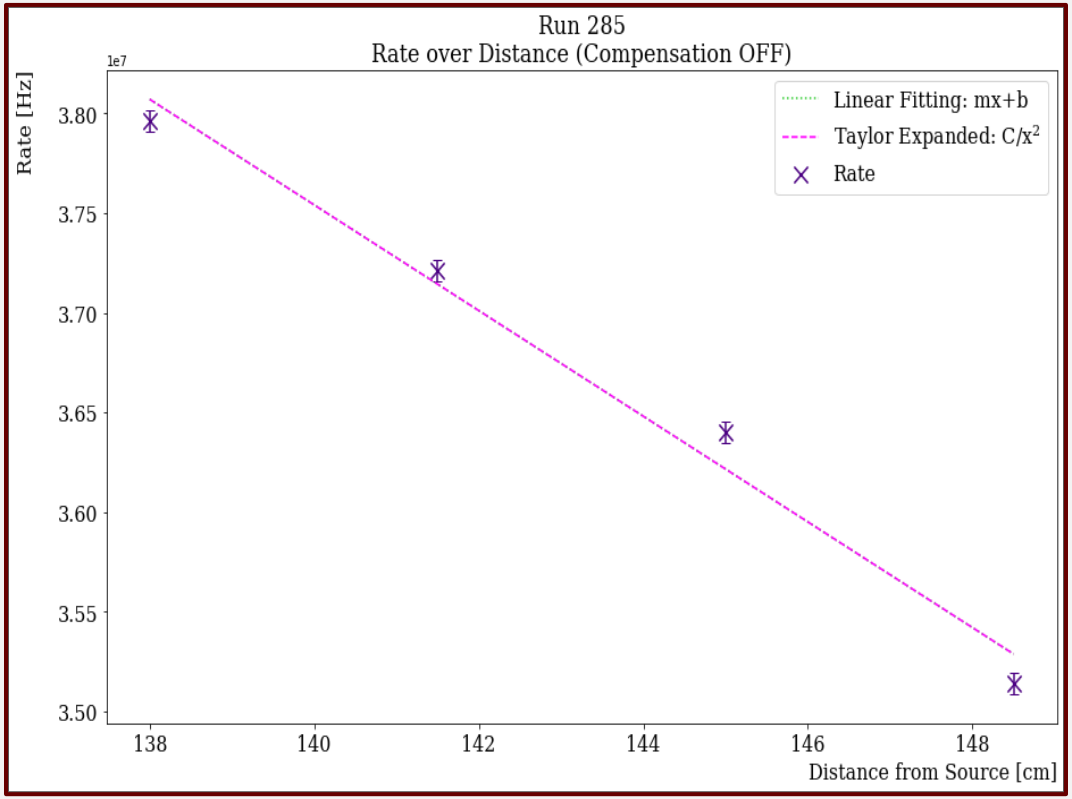
Results — Rate vs. Attenuation



Results — Rate vs. Distance



Results — Rate vs. Distance

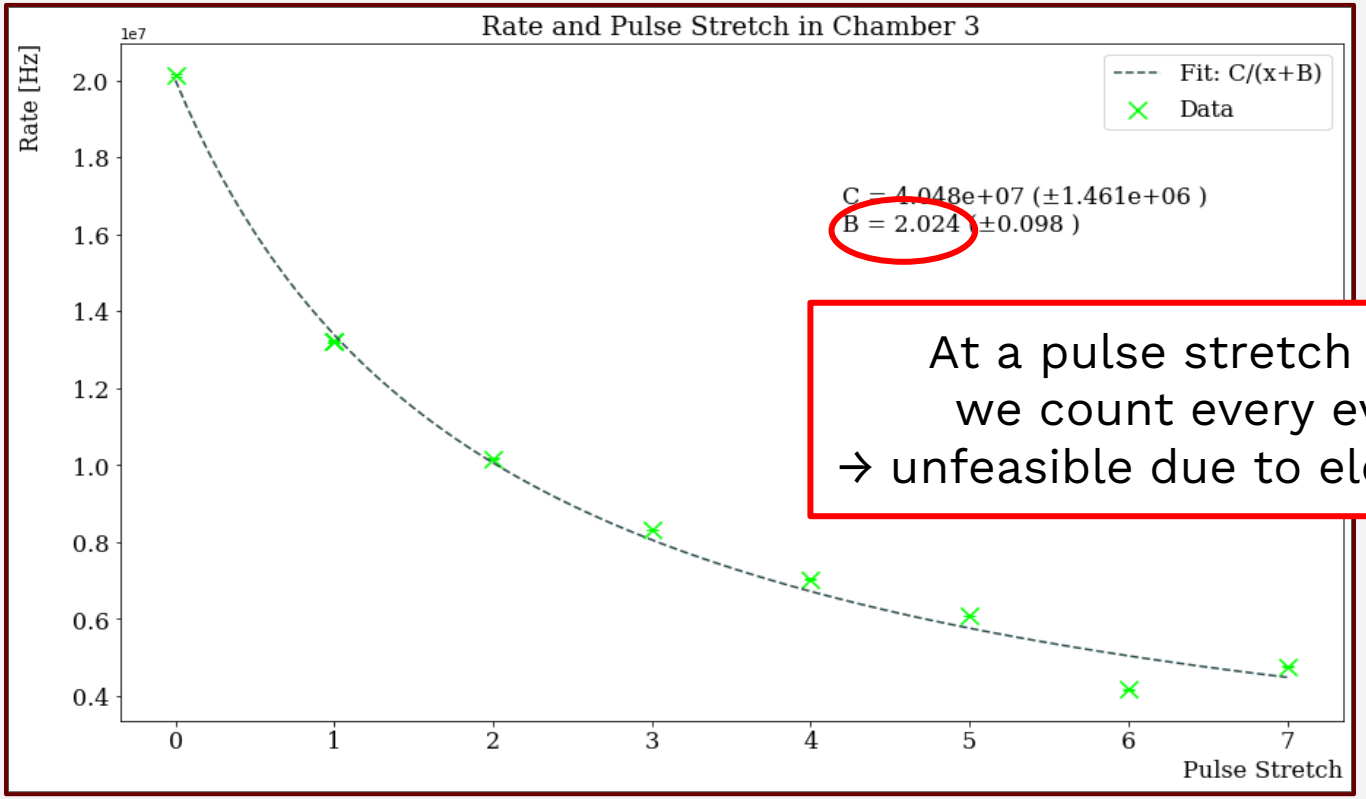


$$\frac{C}{x^2}$$

When Taylor Expanded around b (b>>0)

$$\frac{C}{b^2} - \frac{2C(x-b)}{b^3} + \frac{3C(x-b)^2}{b^4} - \frac{4C(x-b)^3}{b^5} + \cdots$$

Results — Rate vs. Pulse Stretch



At a pulse stretch of -1,
we count every event
→ unfeasible due to electronics

Conclusion

The results of the test beam show that the ME0 GEM detectors are following the expected rate performance

Future Work

- Determine the spatial resolution using test beam data
- Determine the efficiency of the detectors
- Optimize and streamline all analysis code

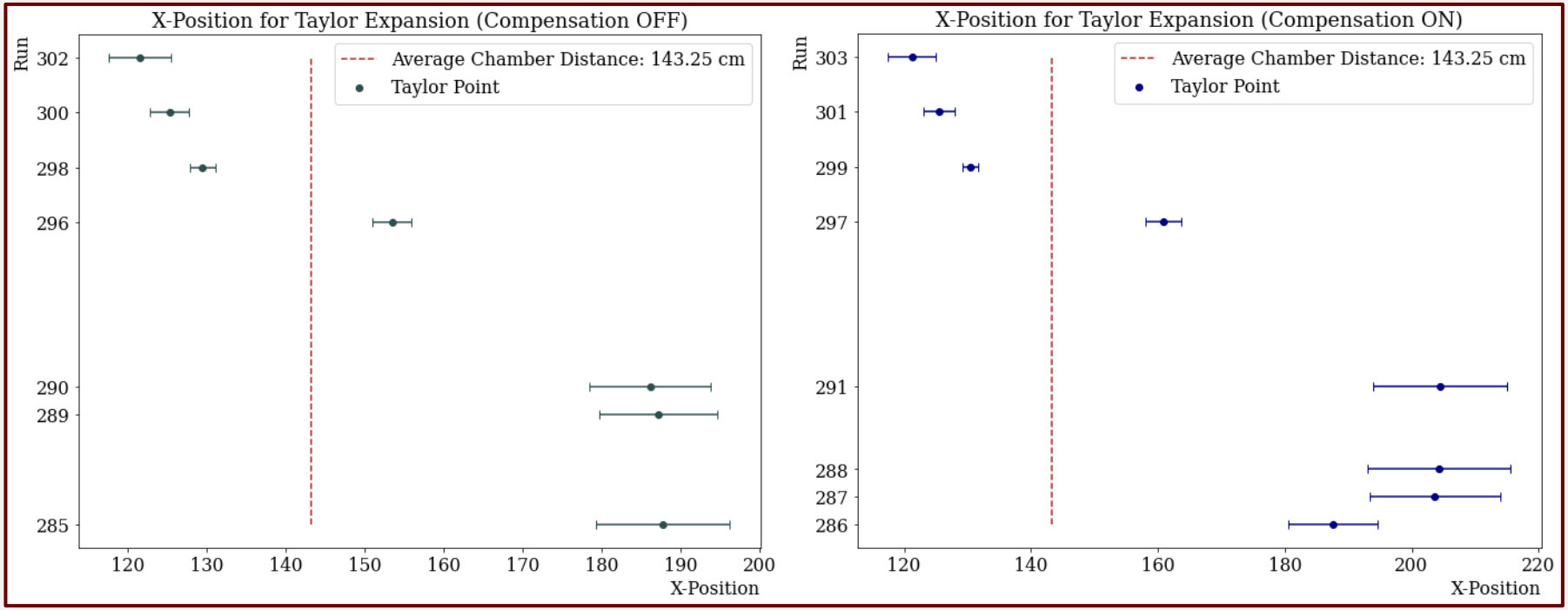
Rate Performance of ME0 GEM Detectors in Test Beam

Questions?

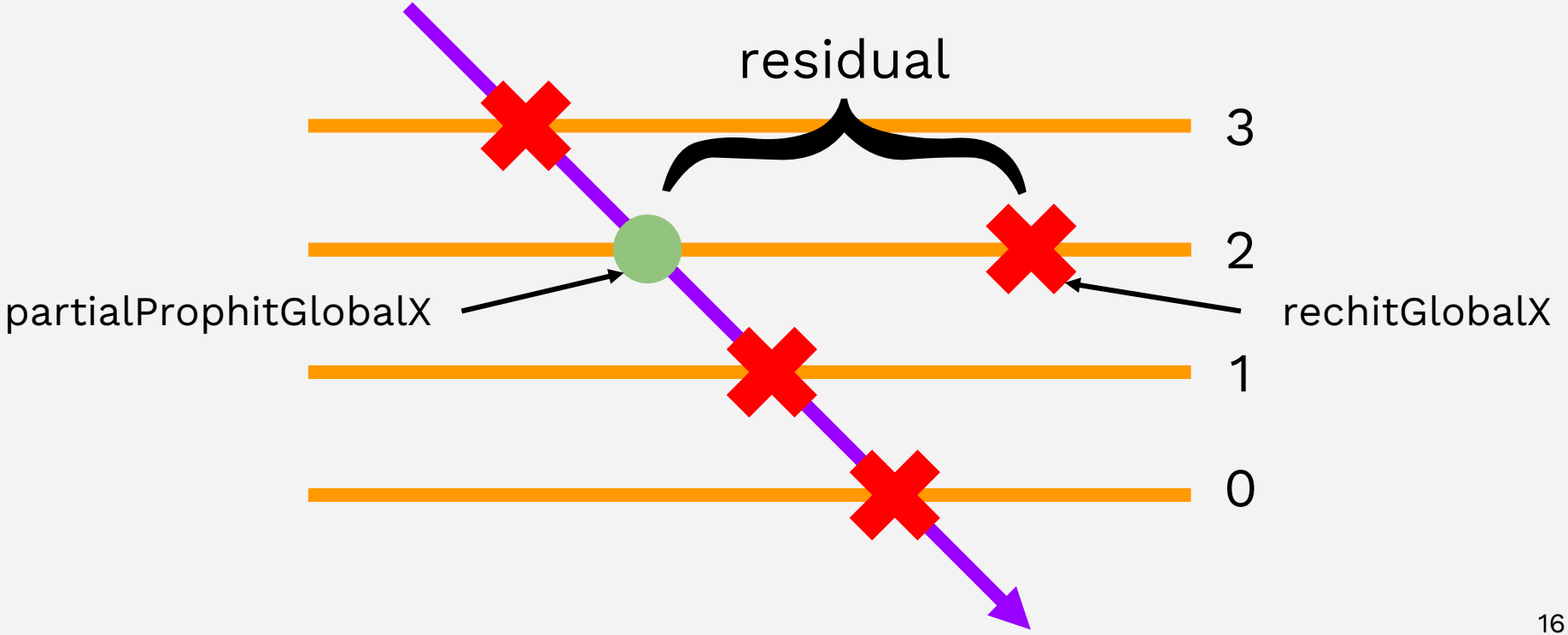
Contact: kurthn42@students.rowan.edu

Results — Rate vs. Distance

Backup

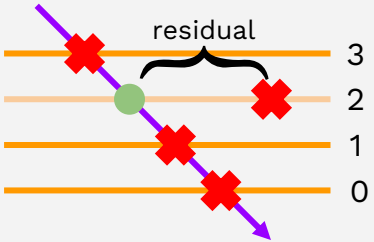


rechitGlobalX vs. partialProphitGlobalX



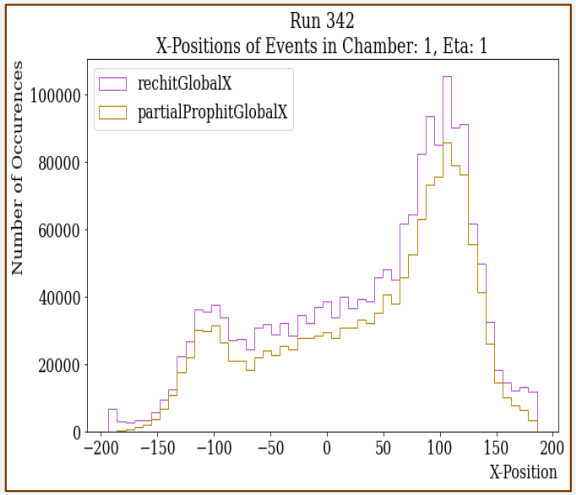
Results — Spatial Resolution & Efficiency

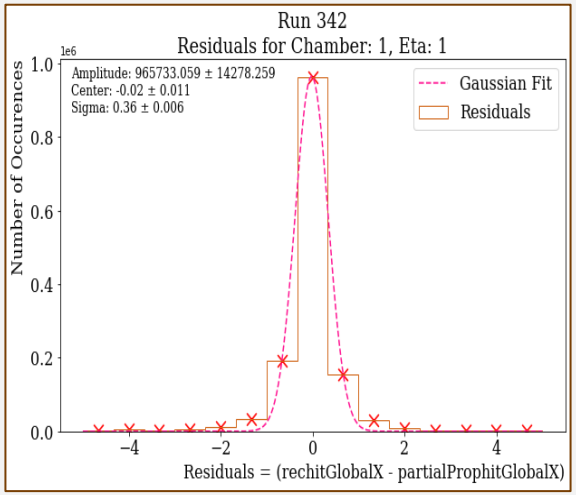
Backup

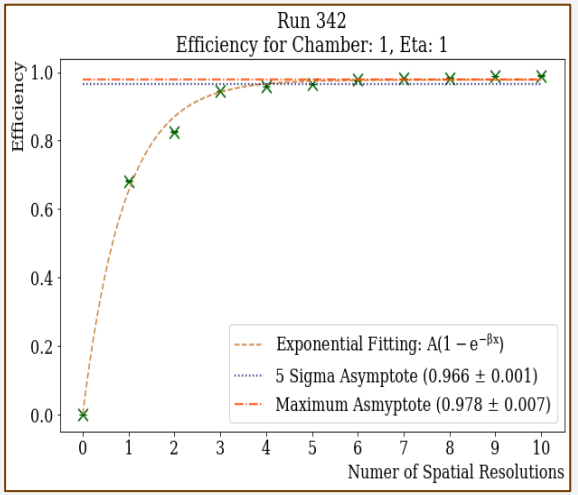


Spatial Resolution

Efficiency







Results — Spatial Resolution

Backup