Massachusetts Institute of Technology

Overview of Analysis Topics

Ethan Cline

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Intro

- Where are we?
- Where are we going?
- How do we get there?
- Is there light at the end of the tunnel?

Just entering the tunnel

What is Everyone (Students and Postdocs) Working on?

- GEM Analysis
  - Manju, Dulitha, Ryan, Ethan
- Trigger Analysis
  - Dean, Logan, Win
- Tracking Analysis
  - Mahmoud, Win, Ethan
- Simulation/Reconstruction*
  - Xavier, Sid, Win, Dean, Evan, Laura
- Event Generators*
  - Laura, Win
- Physics Calibration Analysis
  - Sid, Win, Ethan
- Moller Scattering*
  - Ethan
- Coincidence Search
  - Win

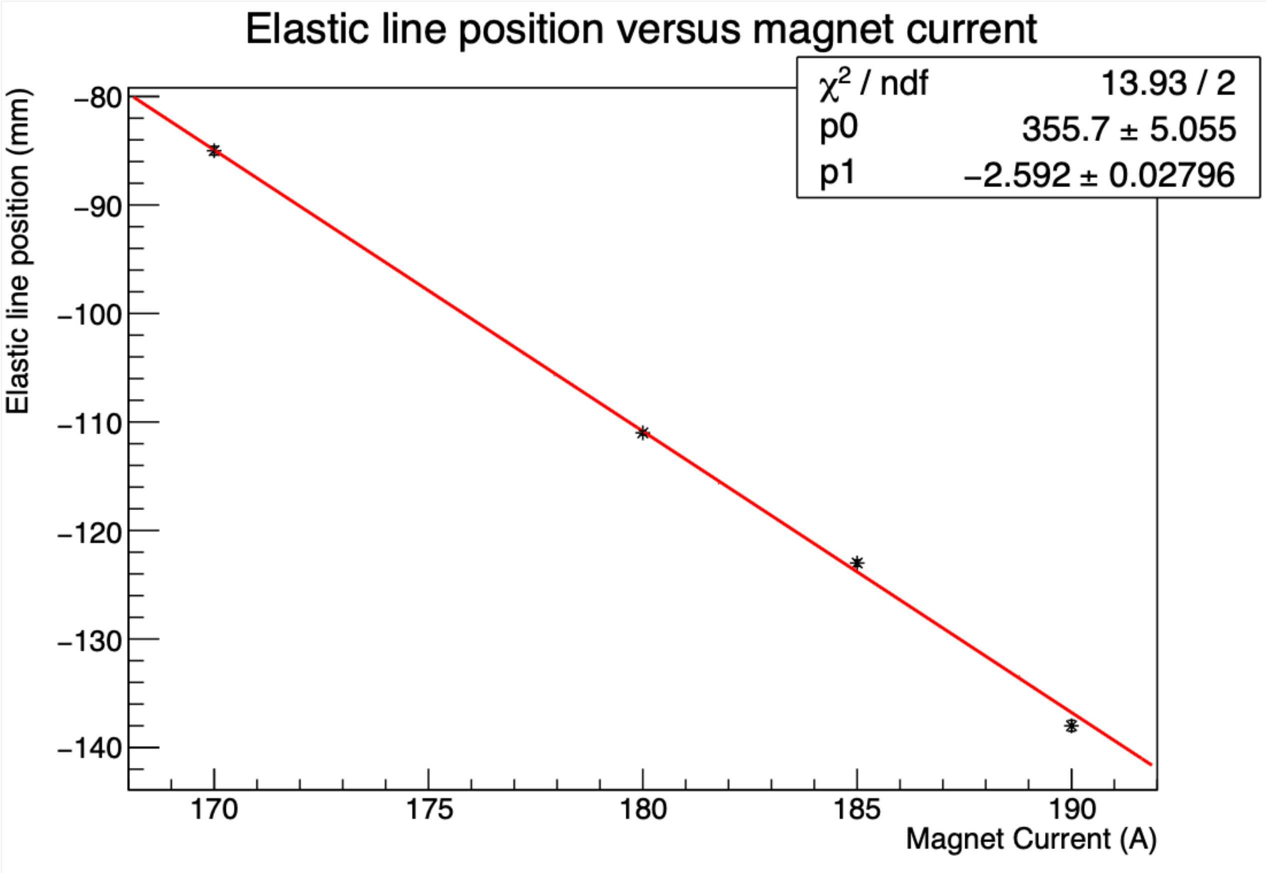
*Can result in a paper with data/simulation currently in hand

Papers

- Simulation/Reconstruction (Win)
- Event Generators (Laura)
- Moller Scattering (Ethan)
- Experiment Technical (Doug) (Break out different detectors?)
    - GEMs?
    - Triggers?
    - Spectrometers?
- E-Linac commissioning (Hui Wen)
    - This requires additional measurements on the e-linac side
- Positron Production (Win???)
    - Unlikely to have anything significant
    - Background dominated

Where are we short?

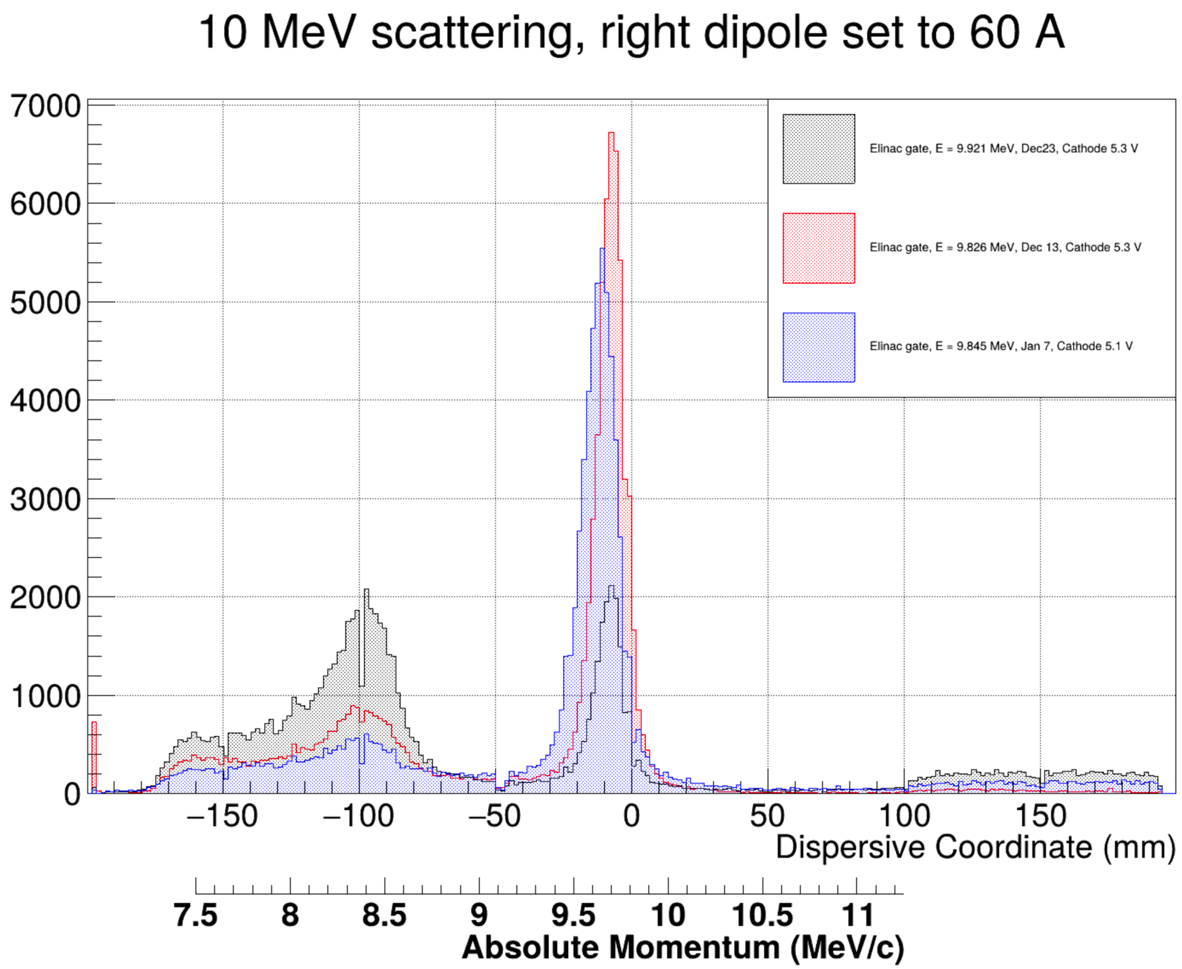
- **Physics calibration is the "mid-level" analysis where we are short on personnel**
- **This will change as low-level detector analysis finalized**
- **Really need checks of magnet linearity, search for inelastic C-states**
  - **Apparent offset in elastic peak position between simulation and data**



24 MeV beam. Taken before background reduced to "manageable" production rate. Only extant plot of magnet linearity.

We Want Physics Papers

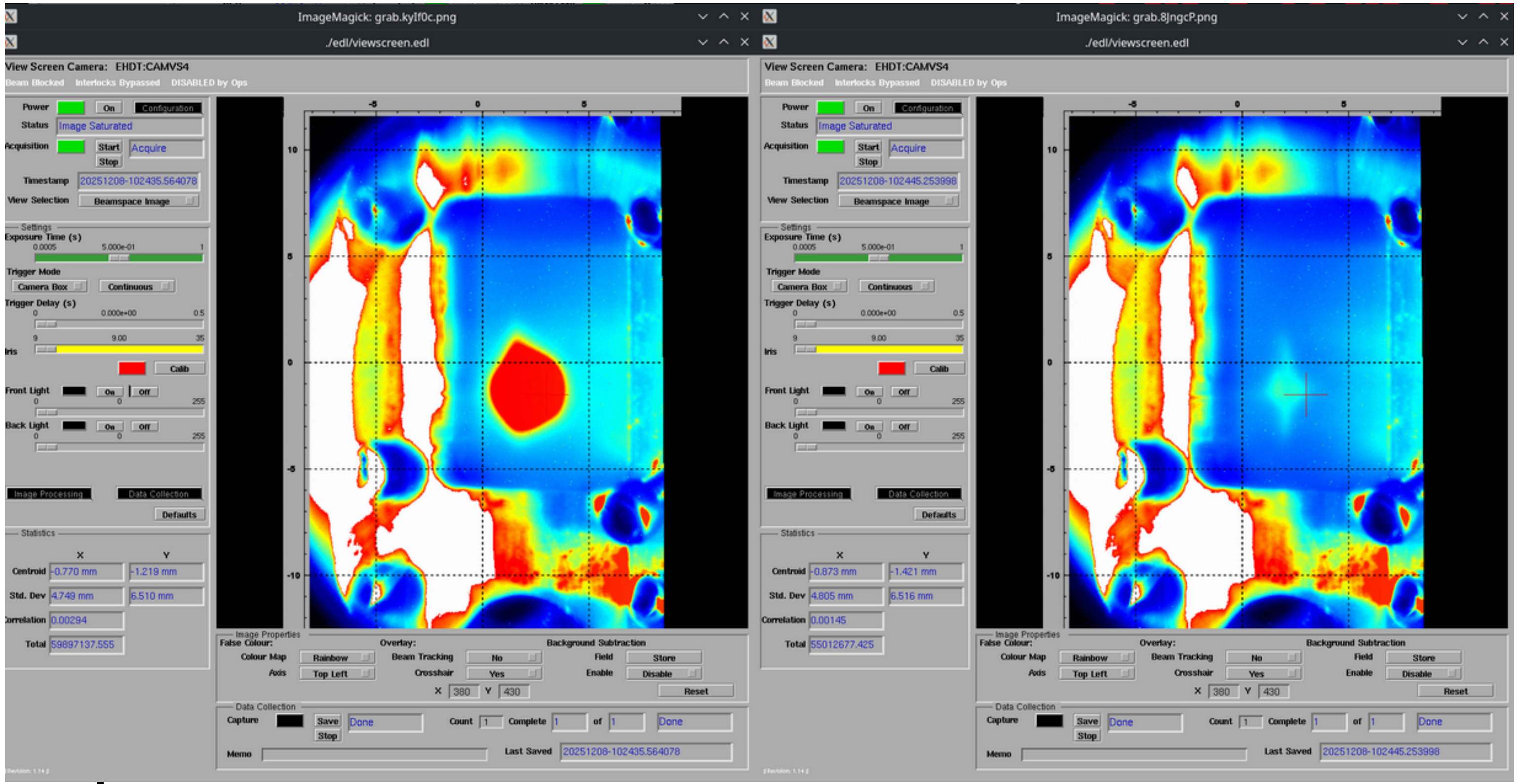
- **Before we can think about cross sections we need to understand detector performance**
  - **GEM clustering algorithm needs work**
  - **Trigger in-time hits need to be identified**
  - **Overall efficiency of detectors needs to be determined**
- **Detector alignment needs to be finalized**
- **Decision on determination of beam current**
- **Do we actually have data that can be used to identify radiative Moller events?**



Background in elastic scattering. Extends down to 0 MeV. Can we model this well for Moller?

What do we Know About the Beam?

- Beam spot size?
  - Can measure
  - Tails uncertain
- Dark current suppressed
  - Still exists in “good” beam
- REMINDER!
  - Beam current unknown at low current



Beam spot and dark current.

Dark Current?

- **Beam spot size?**
  - **Can measure**
  - **Tails uncertain**
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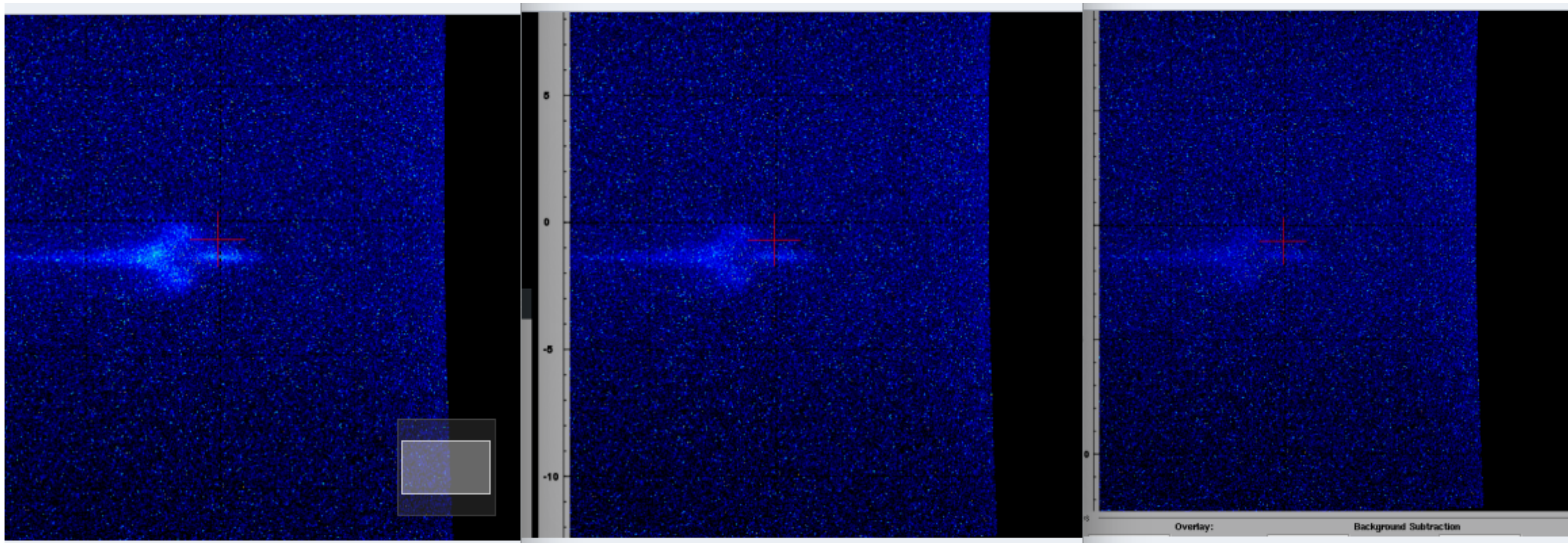
- **REMINDER!**
  - **Beam current unknown at low current**

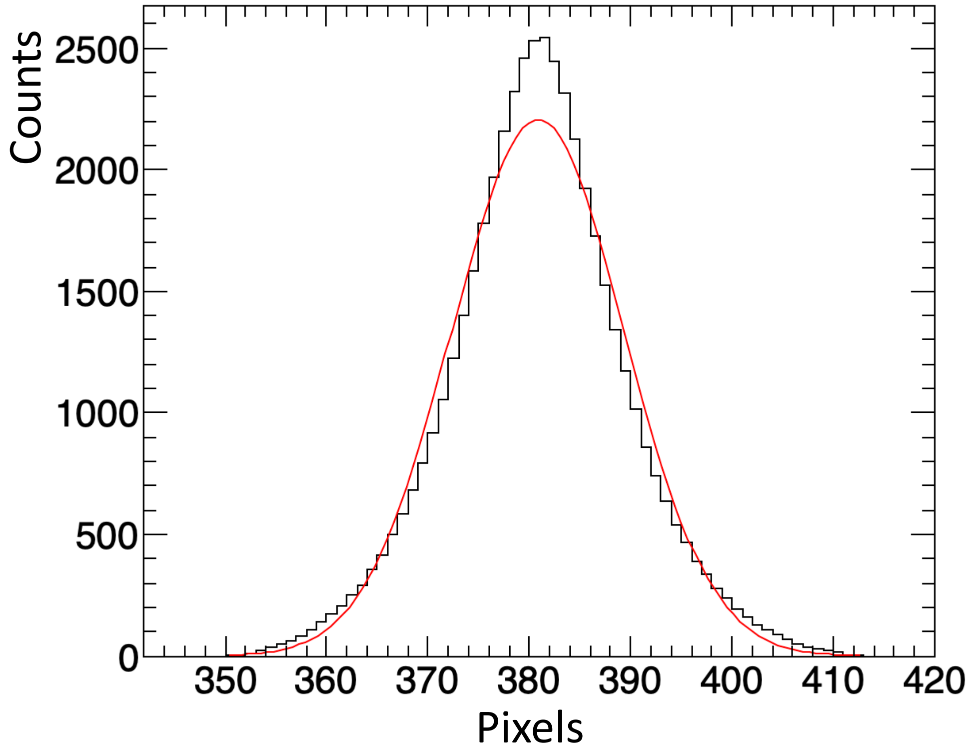


Beam spot as function of cathode temp. Tail to low momentum. Picture taken on view screen between 10 MeV and 30 MeV cavities.

We Need to Understand Our Beam

- **Beam spot discrepancy**
  - **2RMS spot calculated to be**
    - **1.4(3) mm in x**
    - **1.1(2) mm in y**
  - **2RMS spot predicted to be**
    - **0.1 mm in x (yes factor 10 off)**
    - **1.1 mm in y**
- **Our TRANSOPTR model of the beam line does not reflect reality**
  - **How does this impact our knowledge of other beam parameters?**

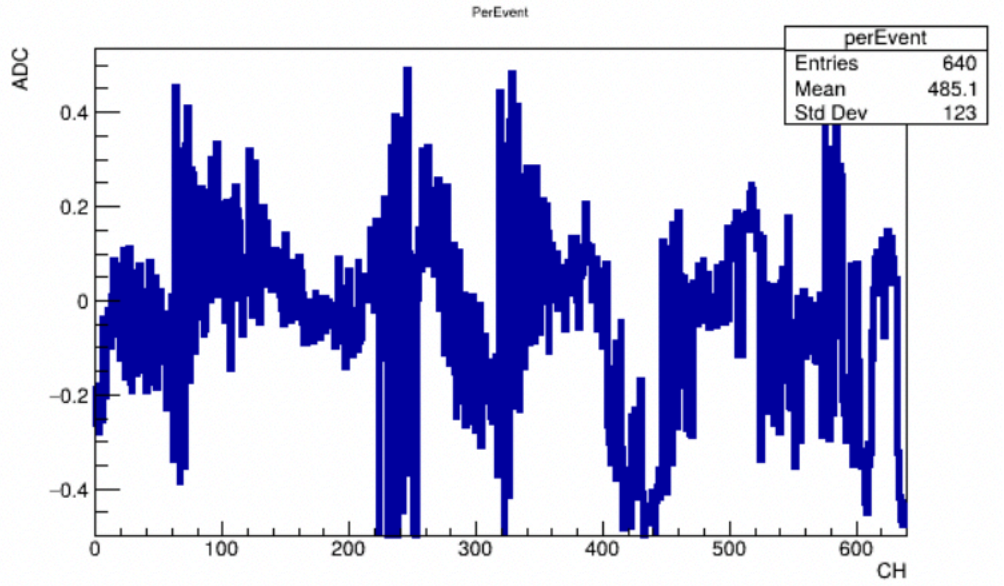
From discussion between Kate and Hui Wen



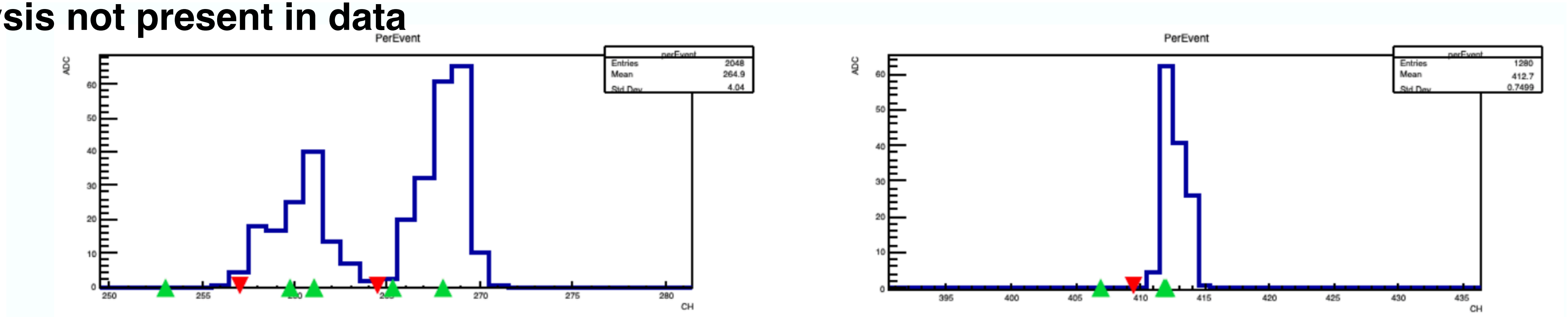
Beam spot on DL view screen. Red line is gaussian fit.

We Need to Understand Our Detectors

- **Have model for cluster shape in dispersive coordinate for GEMs, but data so noise we cannot calibrate it**
  - **This means our cluster finder is inefficient**
- **Need to characterize and understand noise in GEMs**
- **Lingering details regarding extra channels in analysis not present in data**



Events often look noisy



Looks like two clusters but is only one

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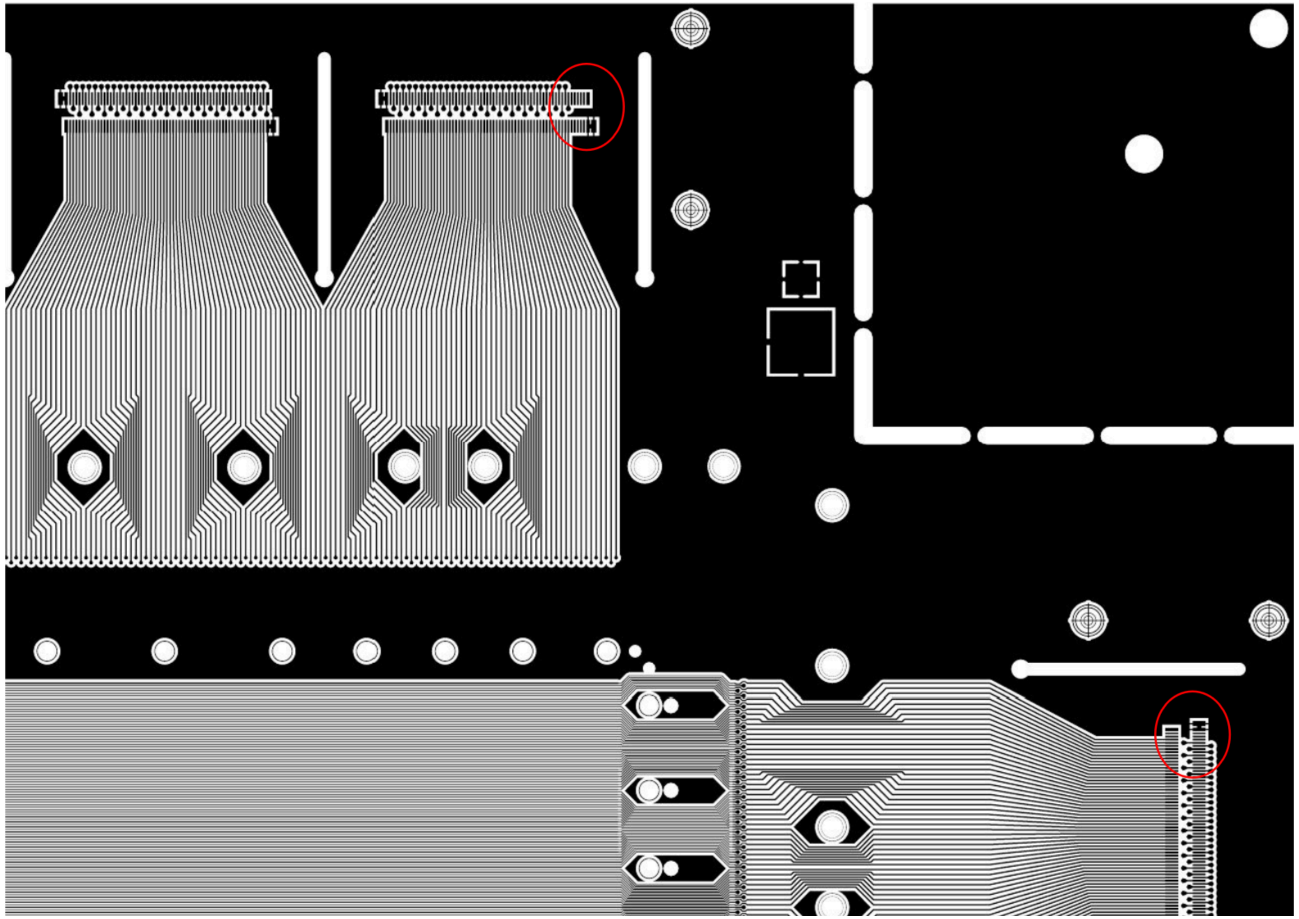
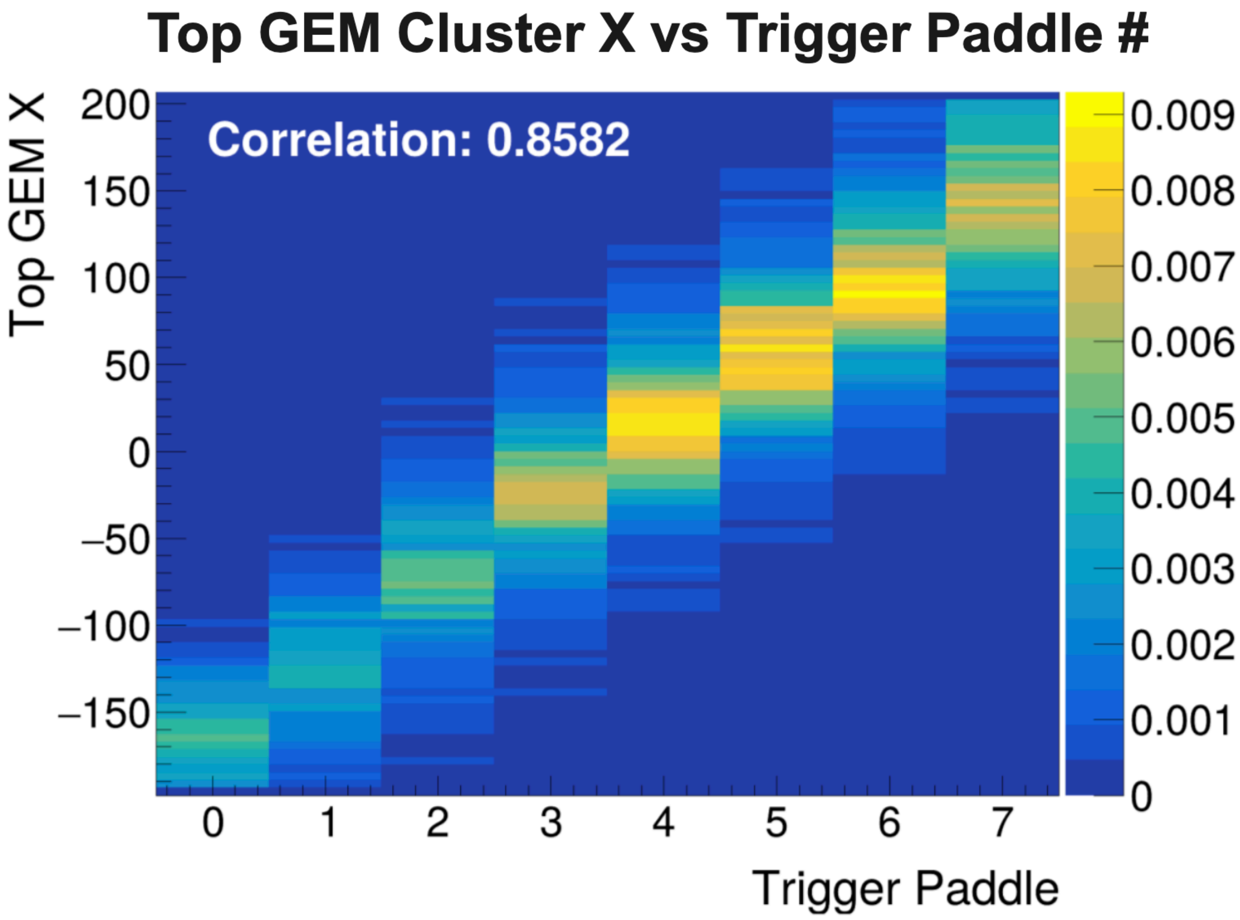


We Need to Understand Our Detectors

- **Trigger timing not well understood**
- **Trigger efficiency low, detector also noisy, need to confirm method of in-situ determination, or decide to remeasure in the lab**
- **Critical to determine in-time hits to correlate with GEM tracks to identify "good" events**



Outlook

- There is significant work to do
- There is light at the end of the tunnel
- We have plans for all detector components and analyses
- Nothing stopping us in principle, in practice it will take time
- Timeline for publishable results on data unclear

The light at the end of the tunnel is New Jersey, but that’s ok