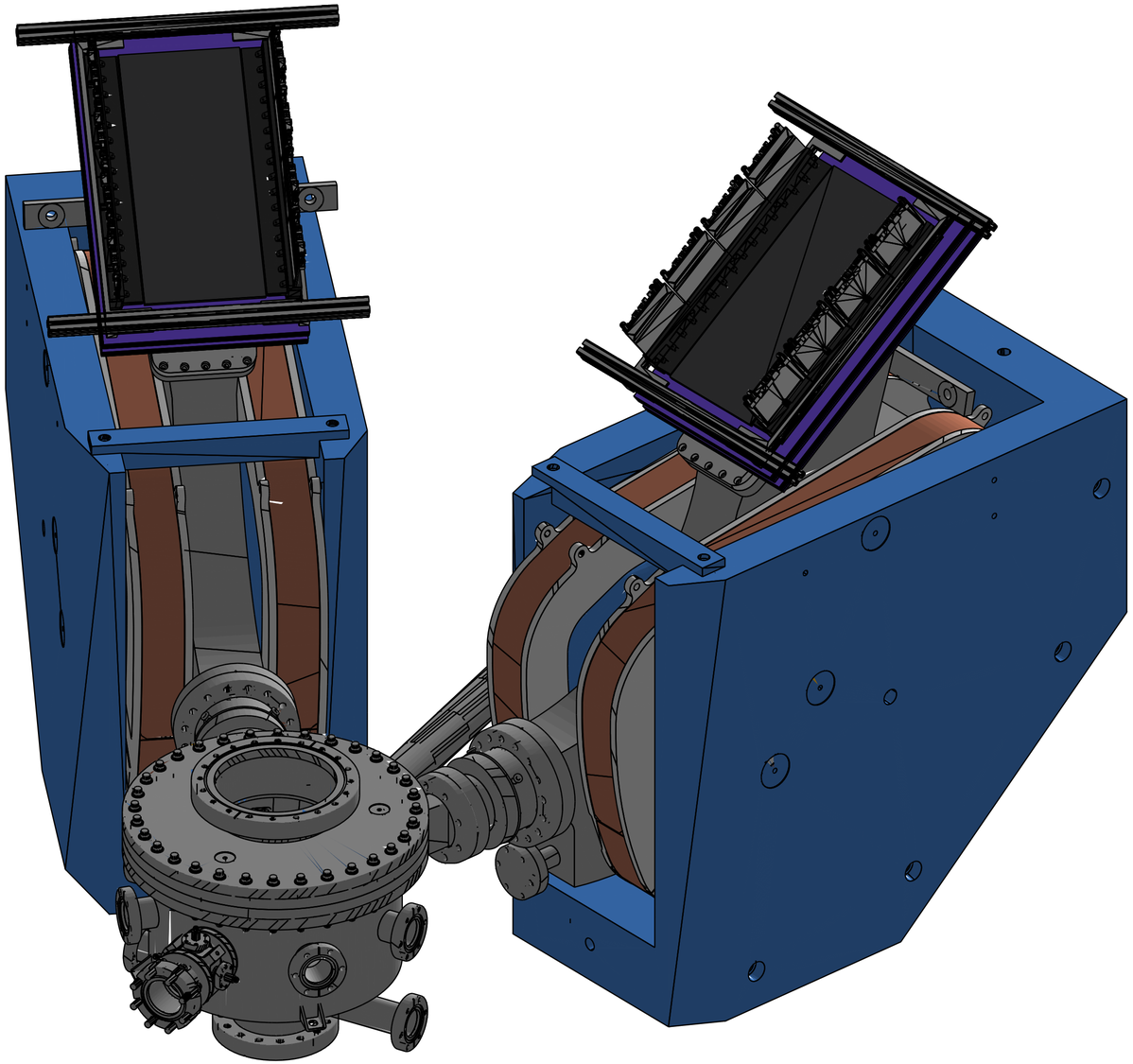
Simulation & Analysis Status

Win Lin
Stony Brook University

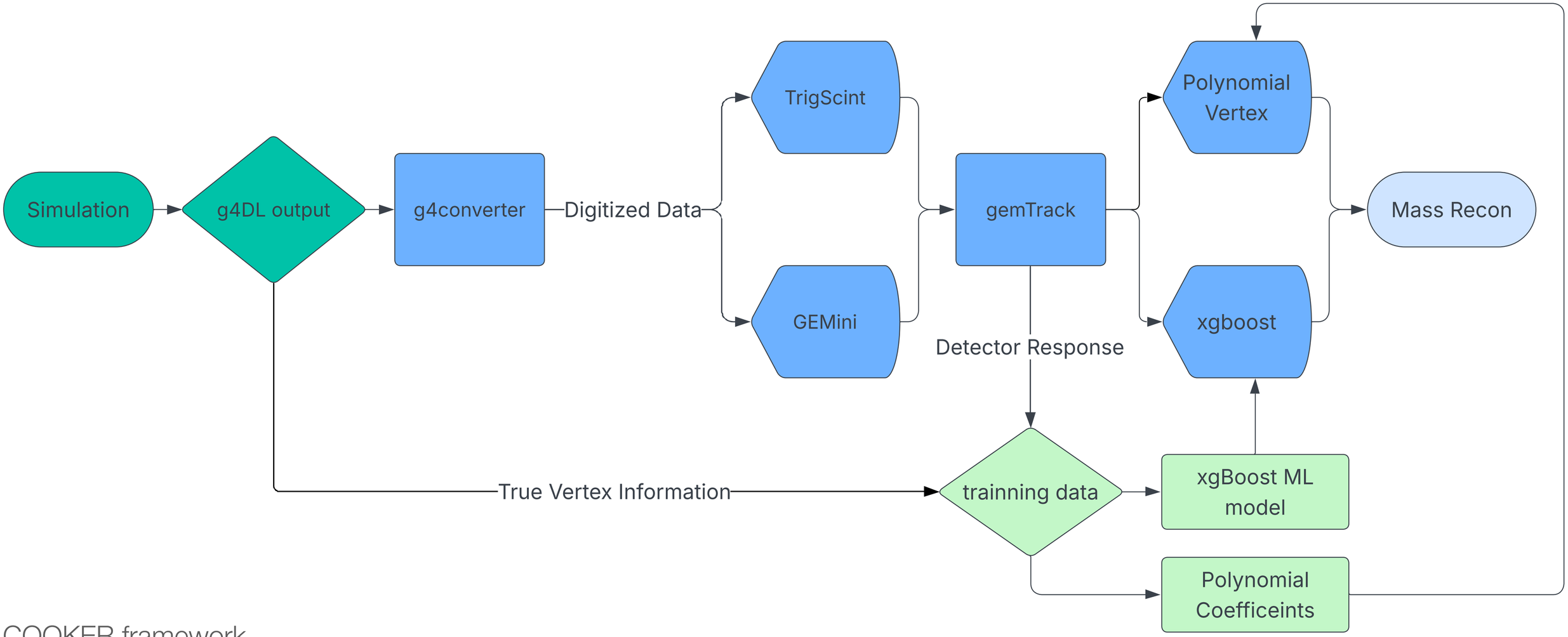
DarkLight Collaboration Meeting
02/07/2025

Center for Frontiers in Nuclear Science

Stony Brook University



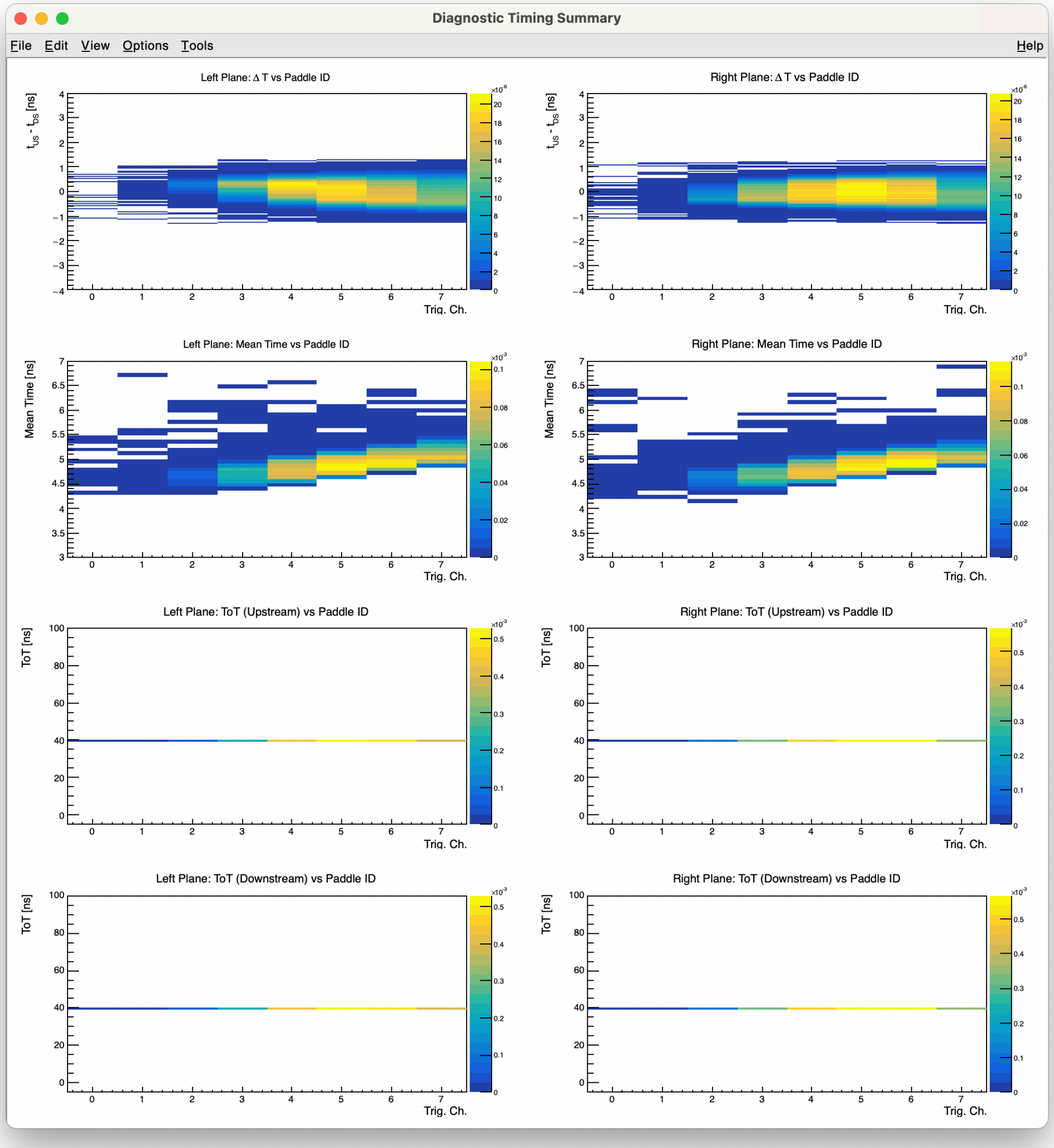
Simulation and Analysis chain

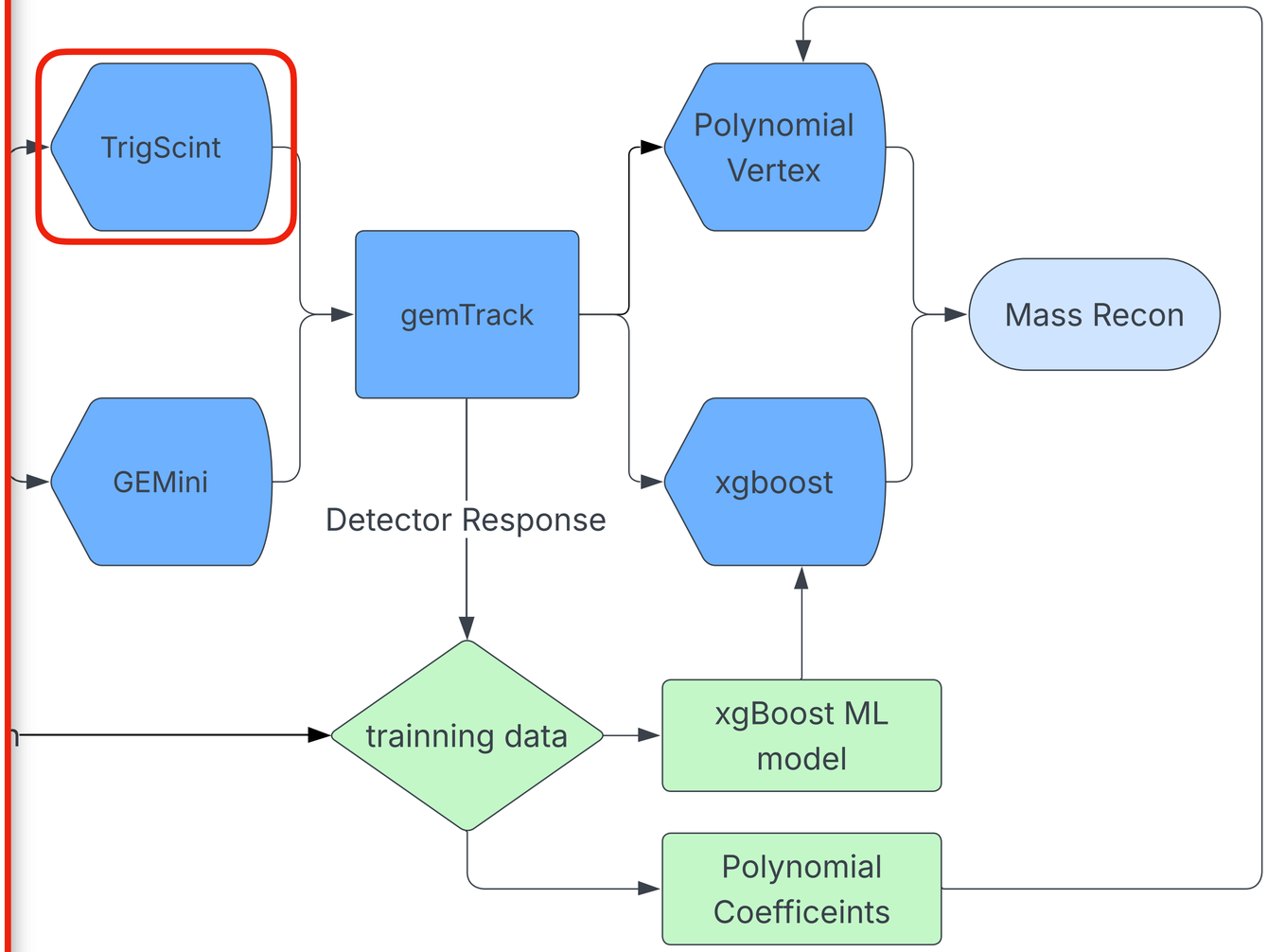


COOKER framework

Trigger timing

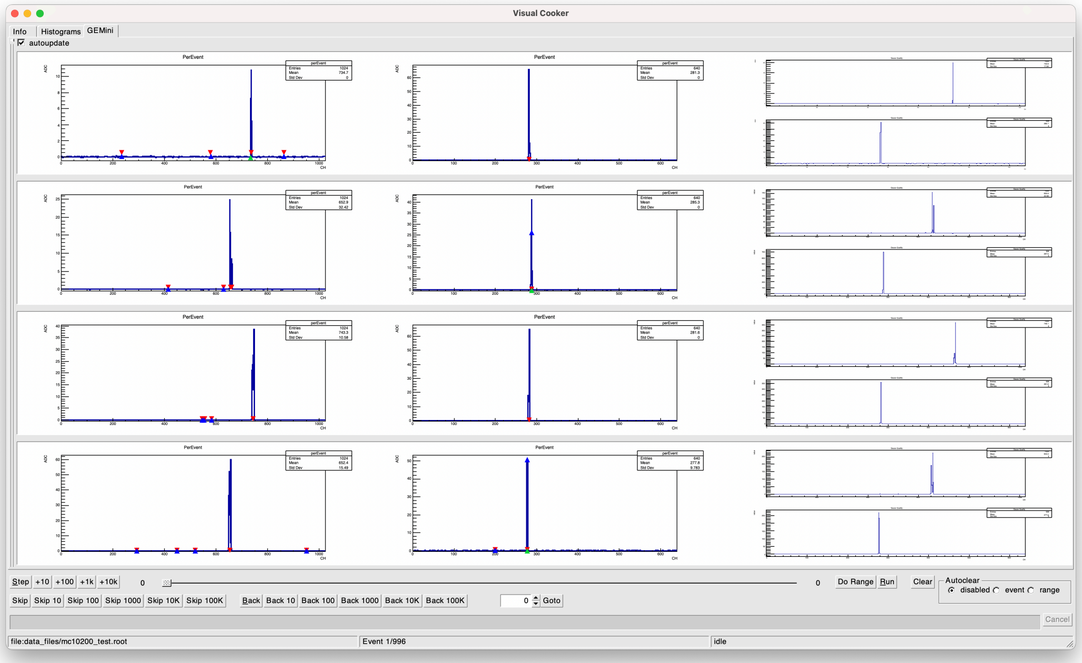
- Figure by Xavier B. (SBU)



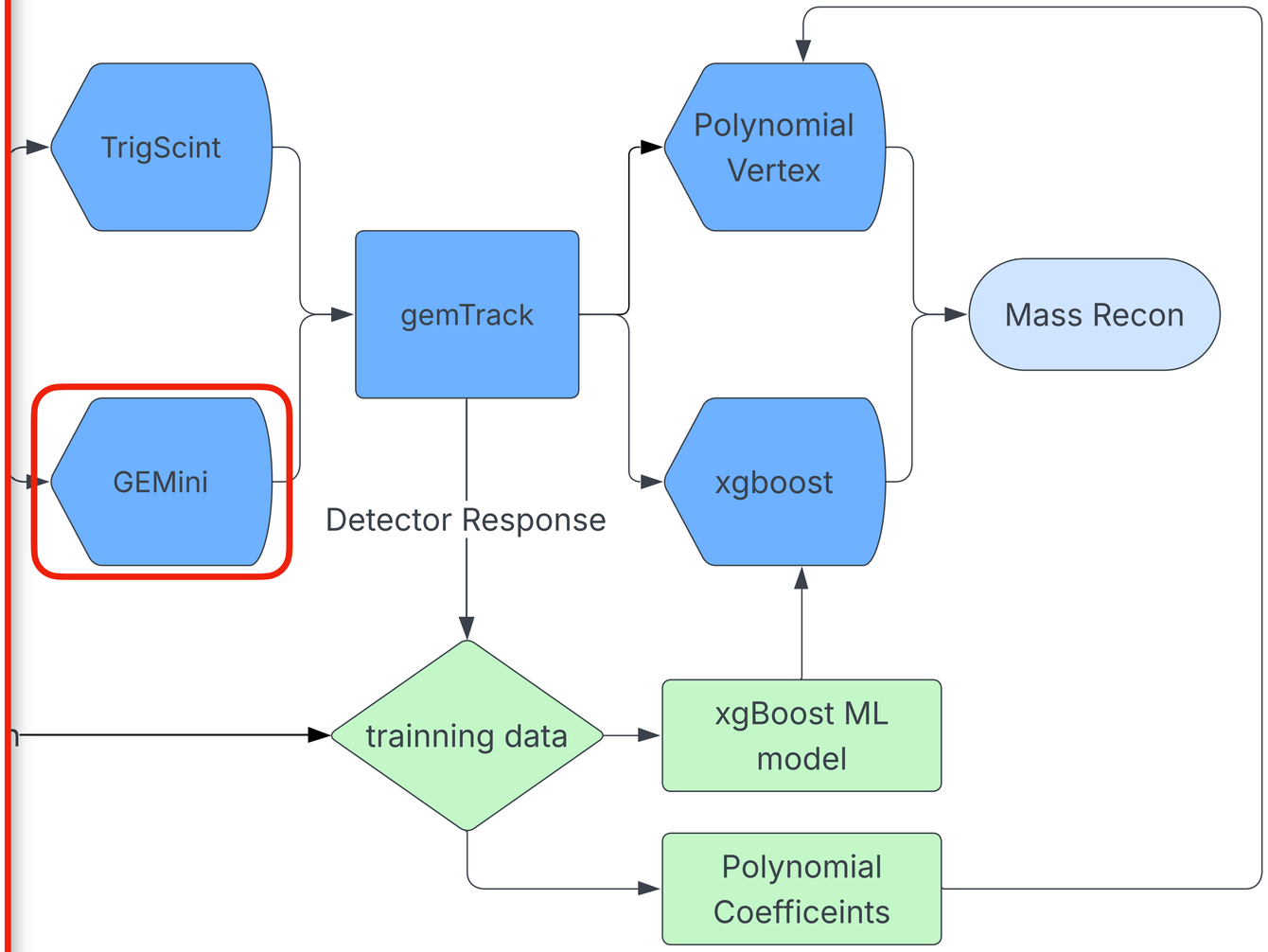


GEM analysis

- Plugin by Jan B. (SBU)



Need more diagnostic histograms



GEM analysis - digitization

- Simulation by Andy Y. (TRIUMF)

COMSOL → HEED → Garfield++ → Digitization

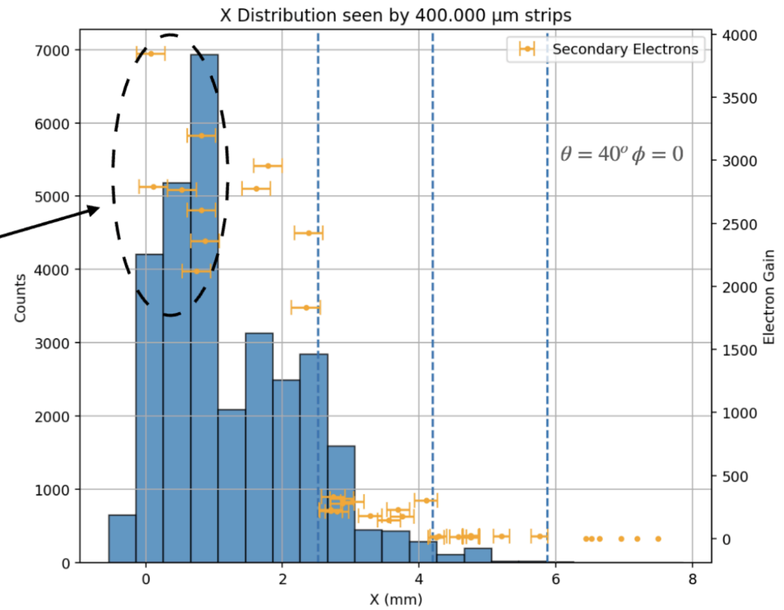
Correlating Gain and X Distribution

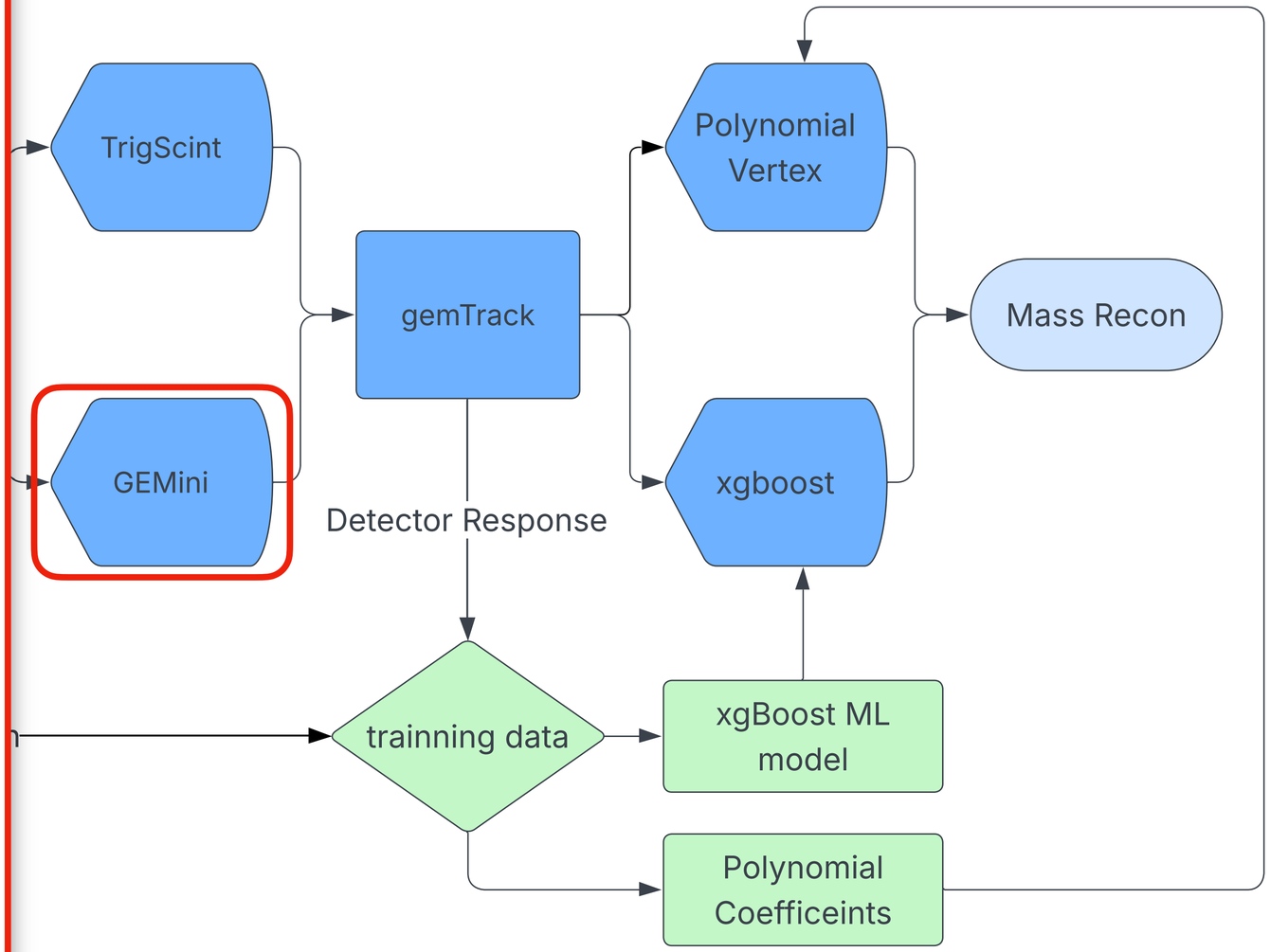
Continued

At a lower resolution of 400um, showers from multiple secondary electrons merge into a single gaussian

Showers caused by these electrons are indistinguishable from eachother

Most of the signal comes from electrons ionized between drift electrode and 1st Gem





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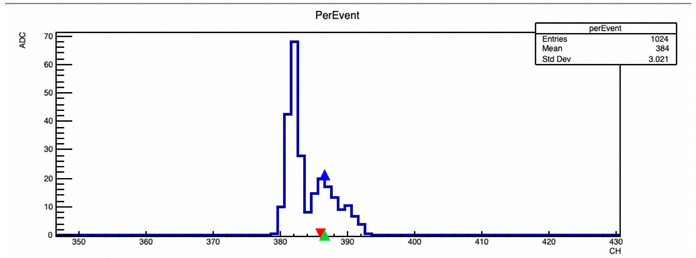
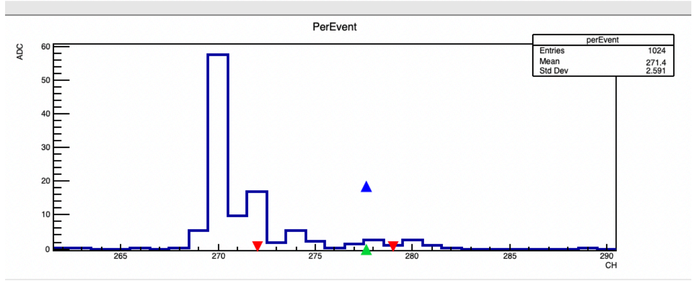
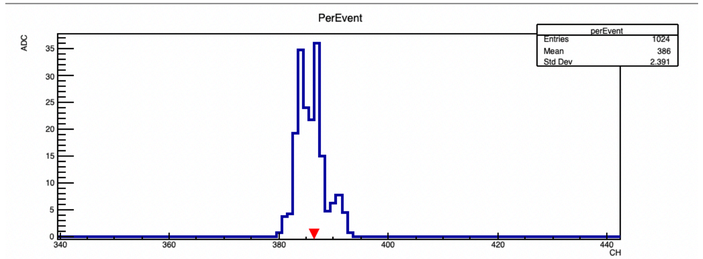
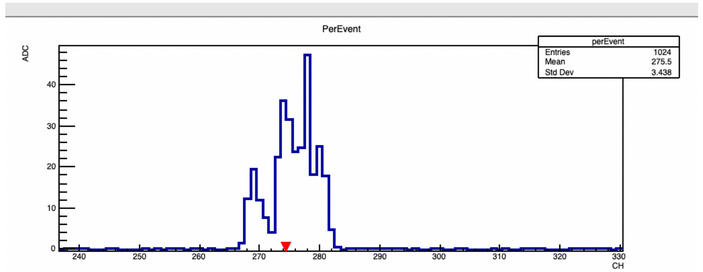
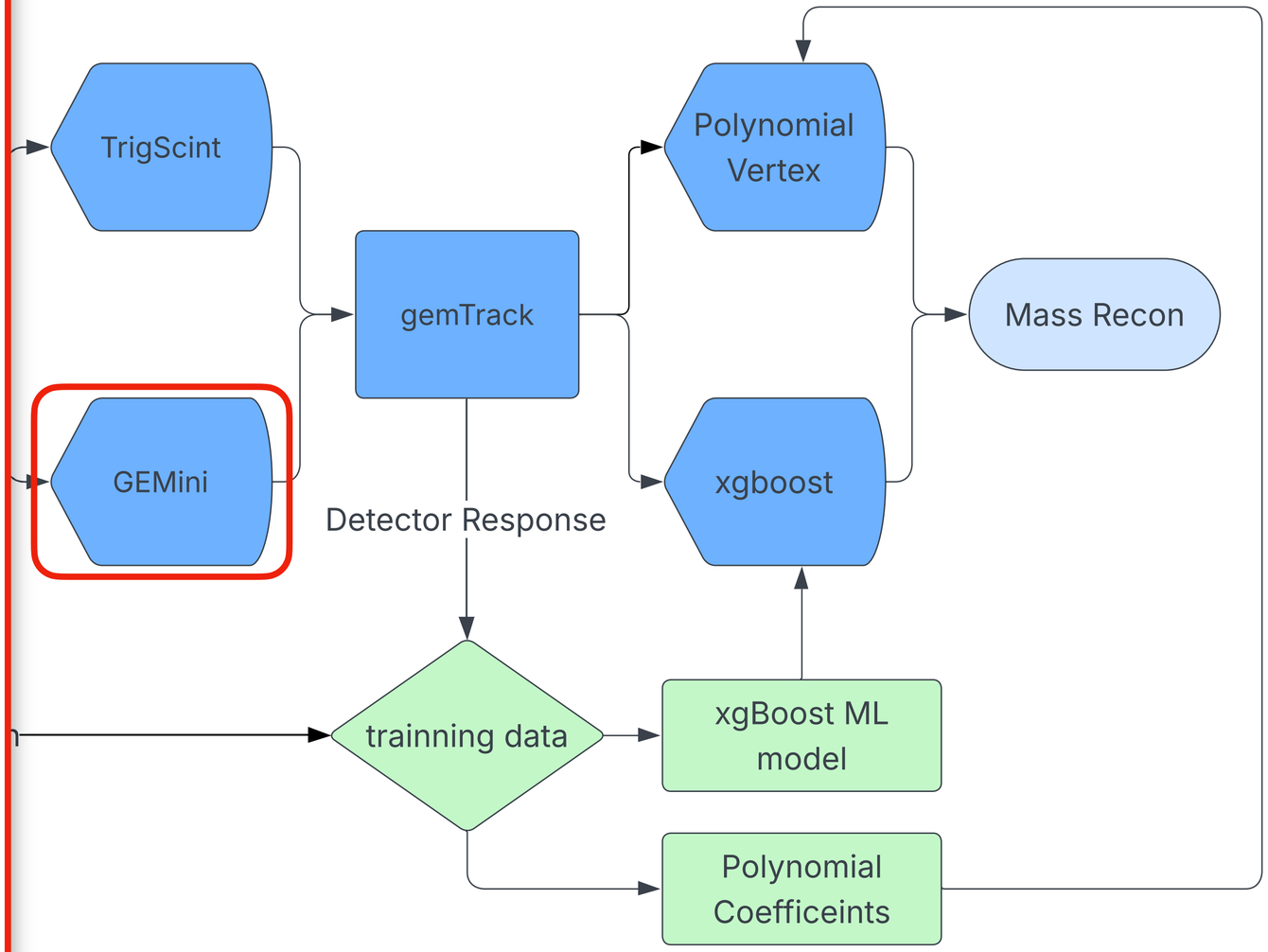




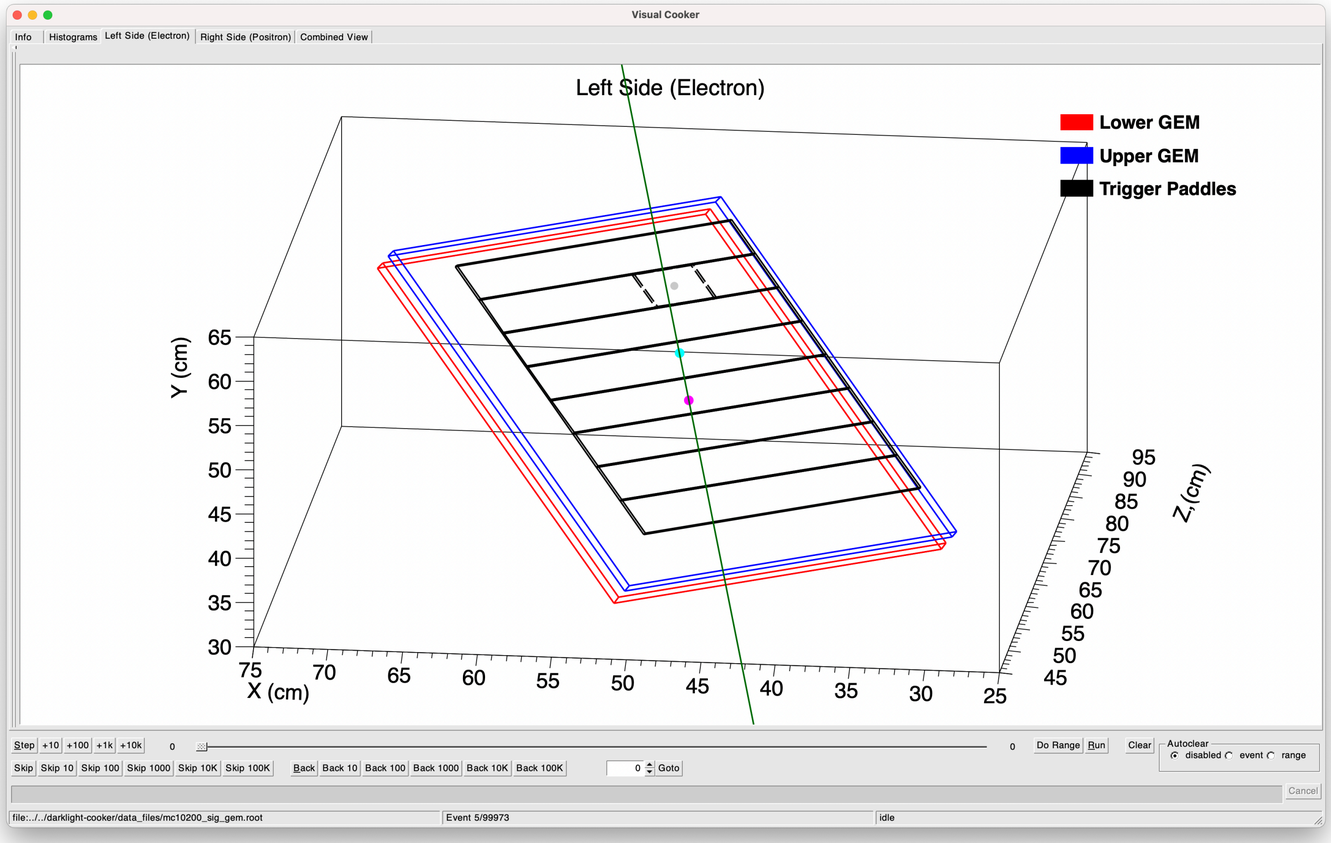


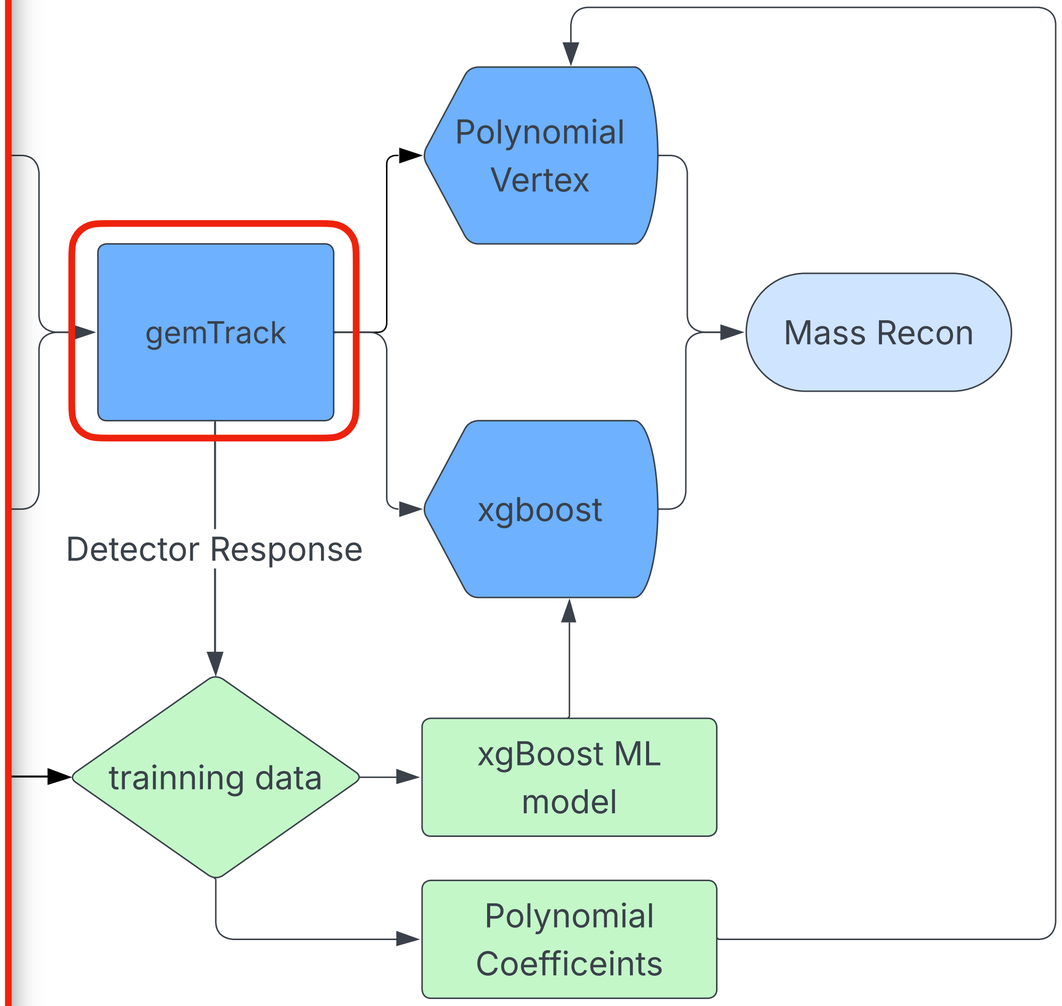




Tracking Analysis

- Analysis by Sid G. (SBU)





Find all combinations of GEM x and y hits, draw straight lines for tracks

Can be compared to trigger hits to select good tracks

Tracking Analysis

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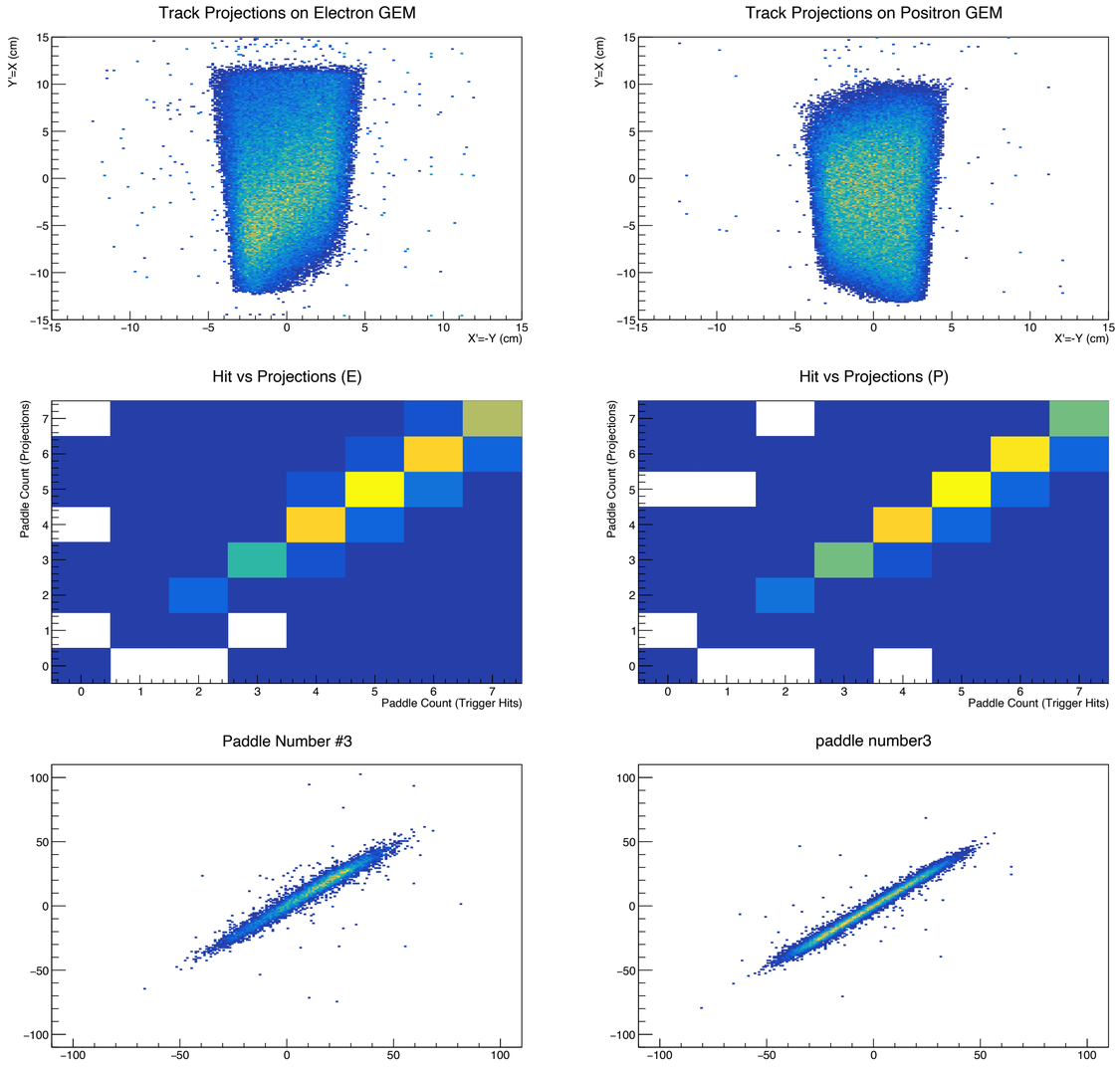
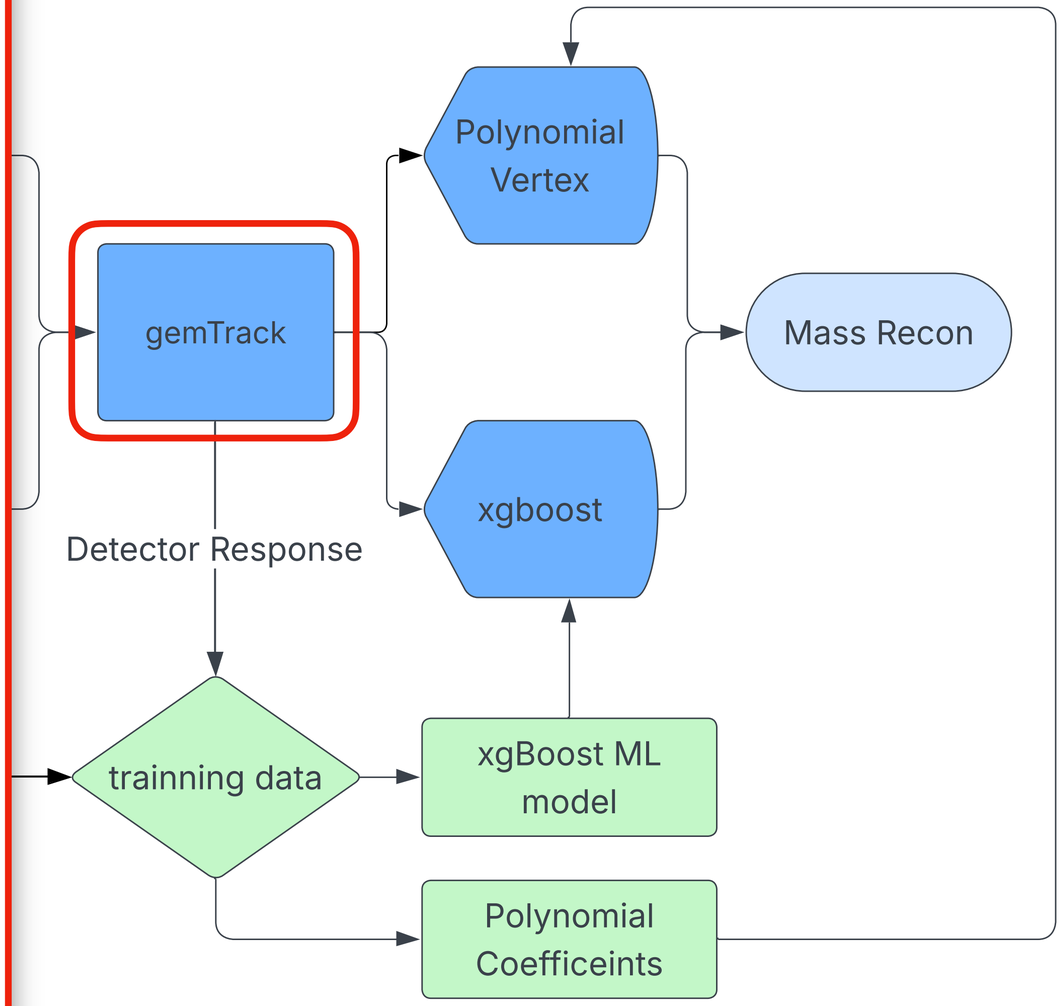
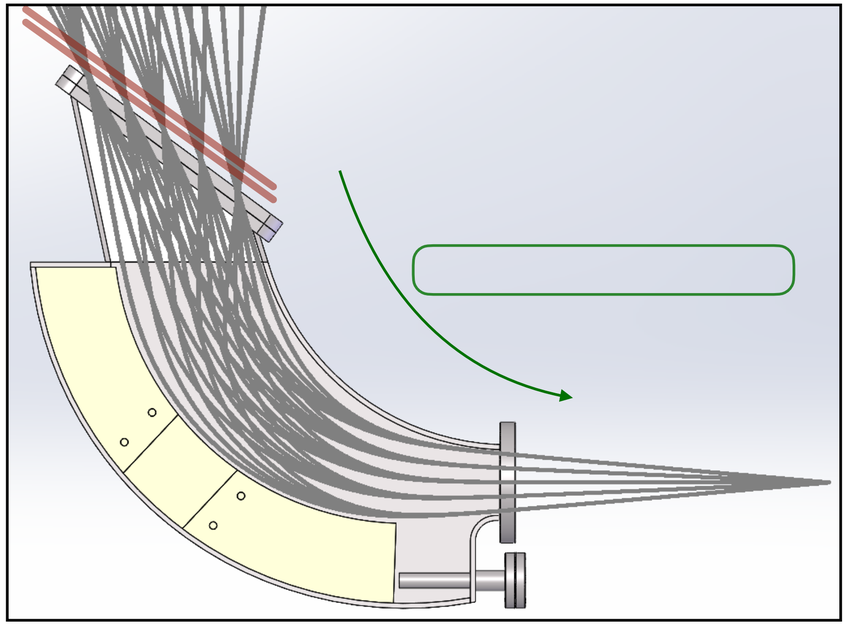
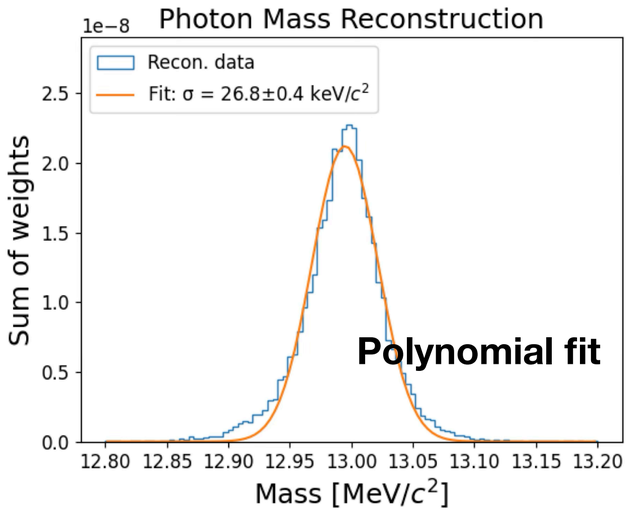


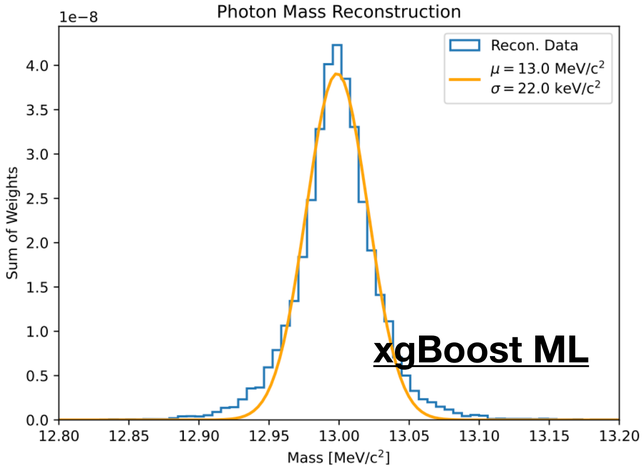


Vertex Reconstruction - Kinematic Variables

- ML analysis by Sid G. (SBU)

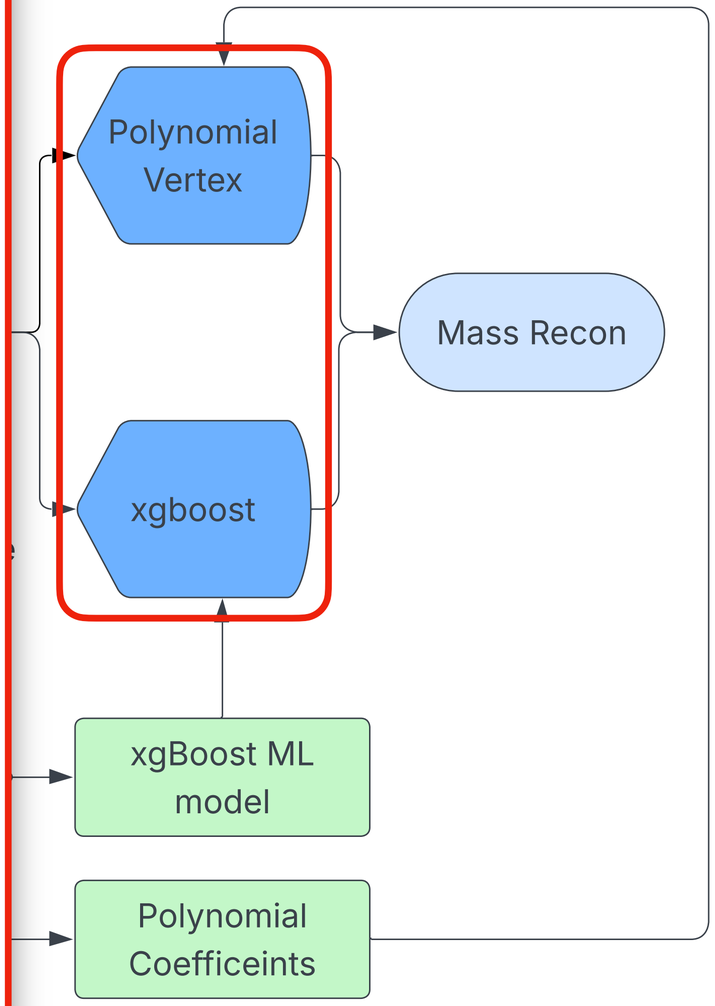




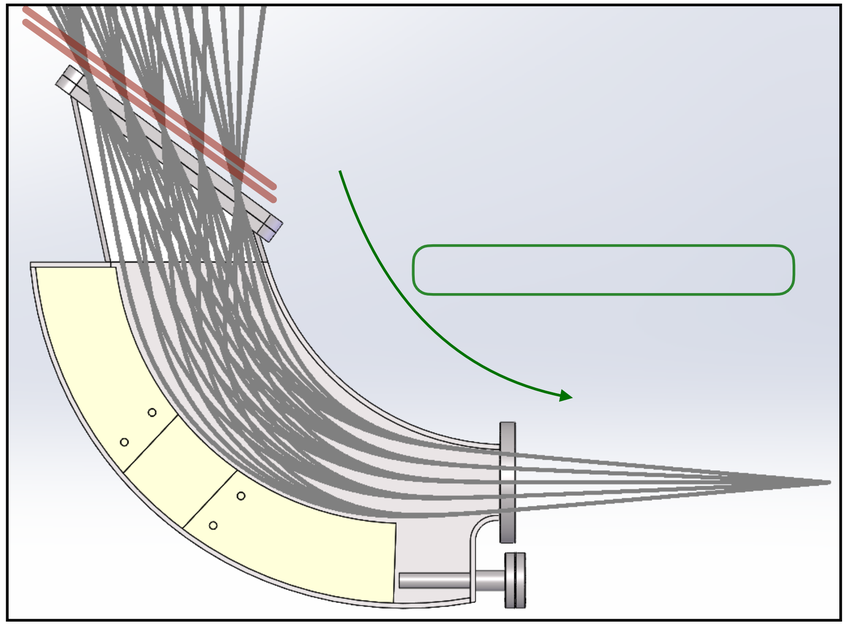


Two reconstruction algorithms available

Click link on plots for details

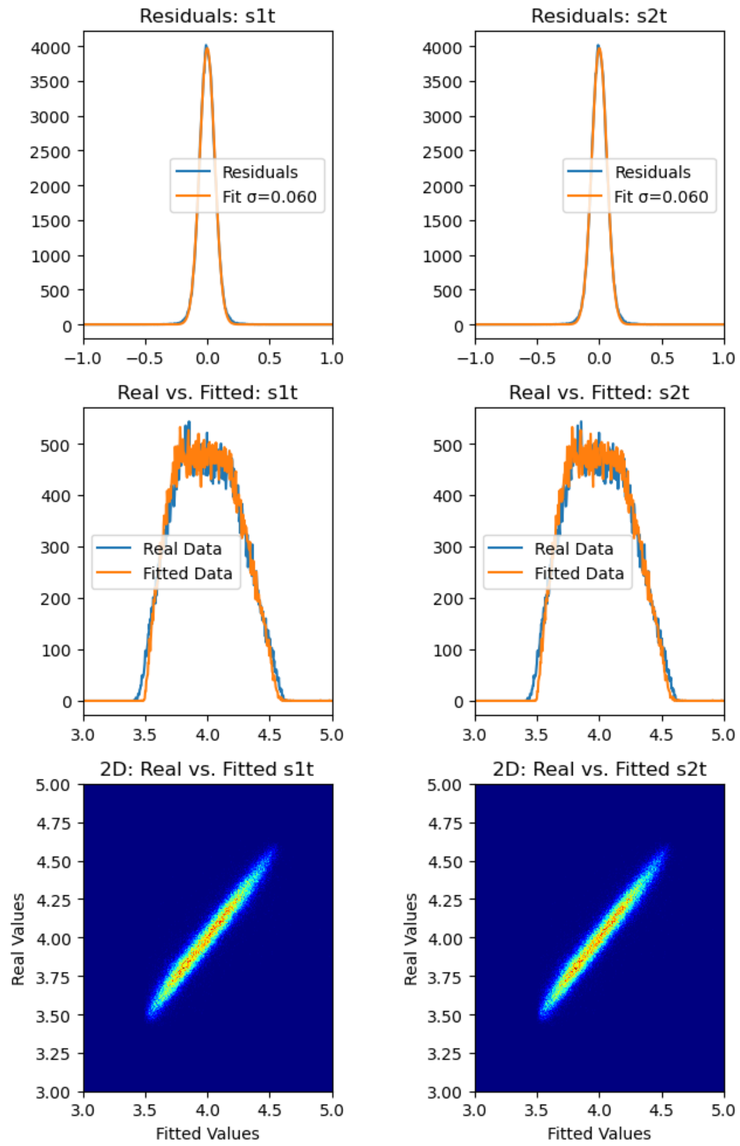


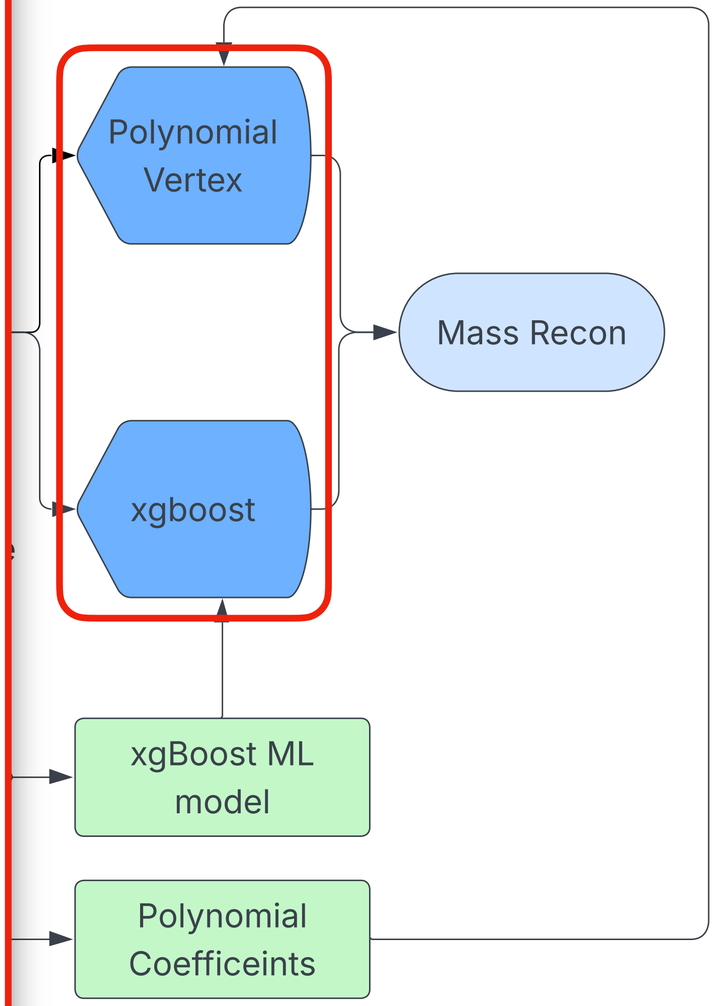
Vertex Reconstruction - Time of Flight



$$f_t = \sum_{a,b,c,d=0}^{a,b,c,d=3} \alpha_{a,b,c,d} \cdot x^a \cdot y^b \cdot dx^c \cdot dy^d$$

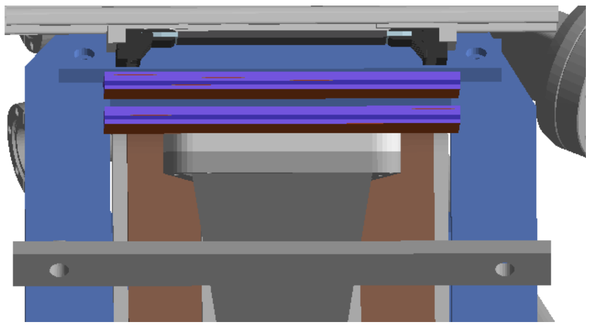
TOF analysis to be added



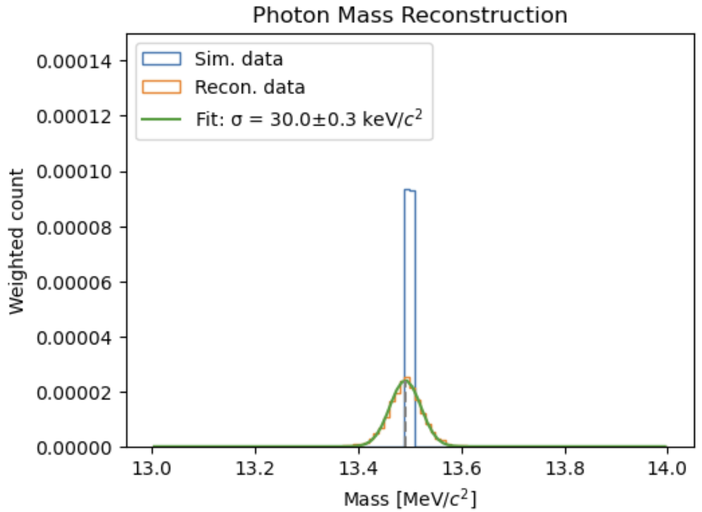


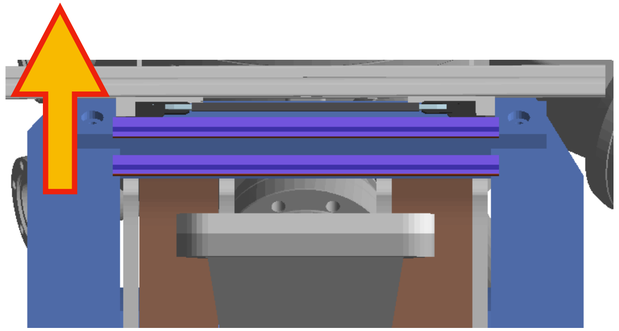
Mass Reconstruction

- Analysis by Xavier B. (SBU)

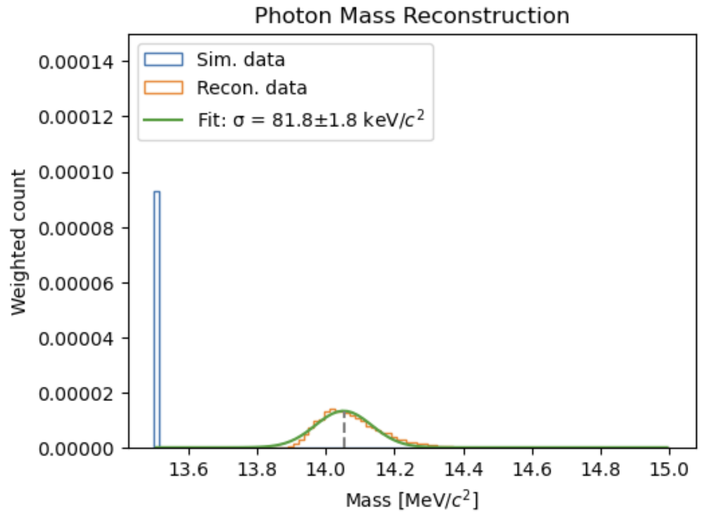


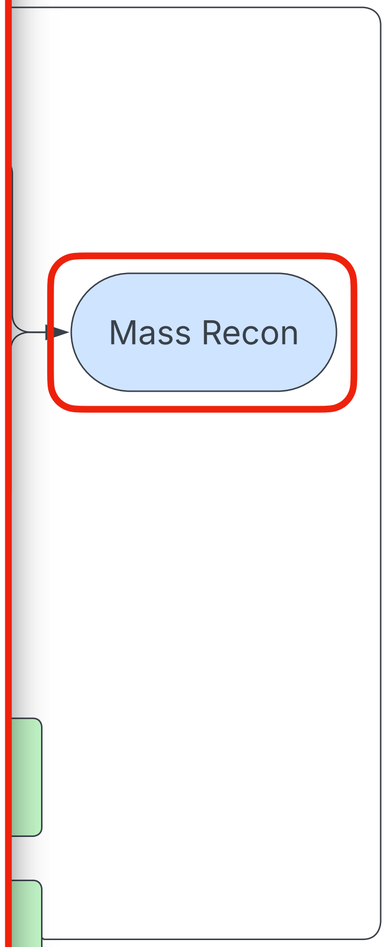
Nominal position





+20 mm





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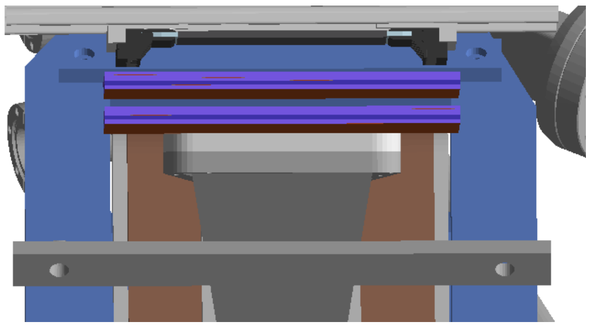
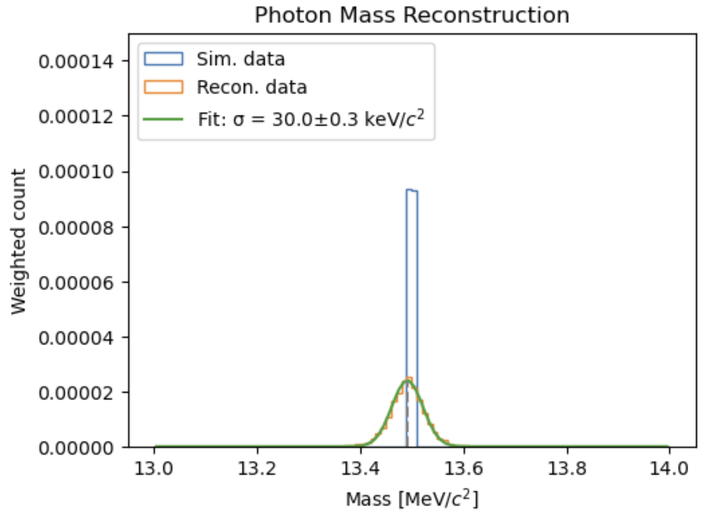
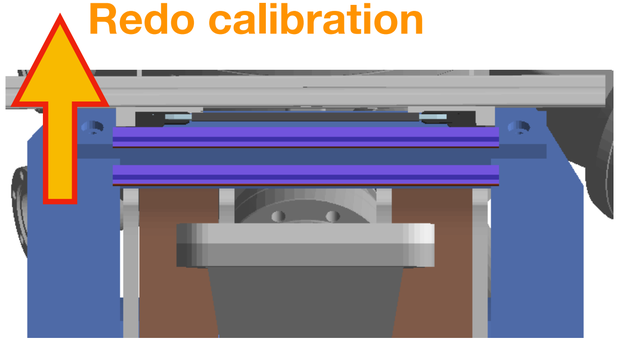


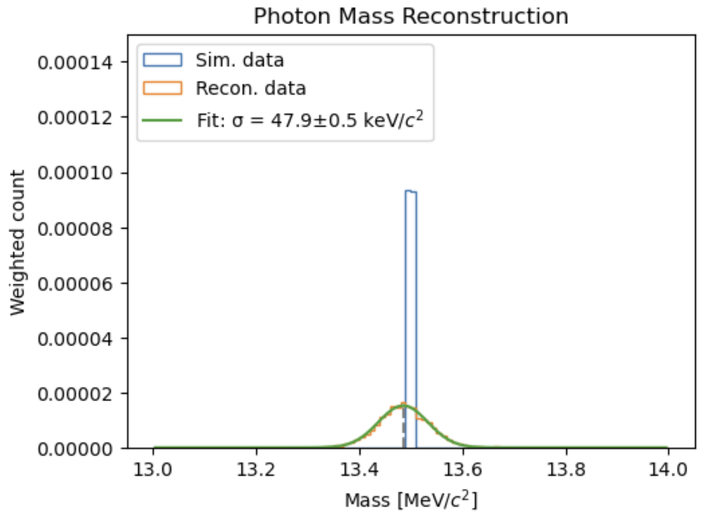
Nominal position

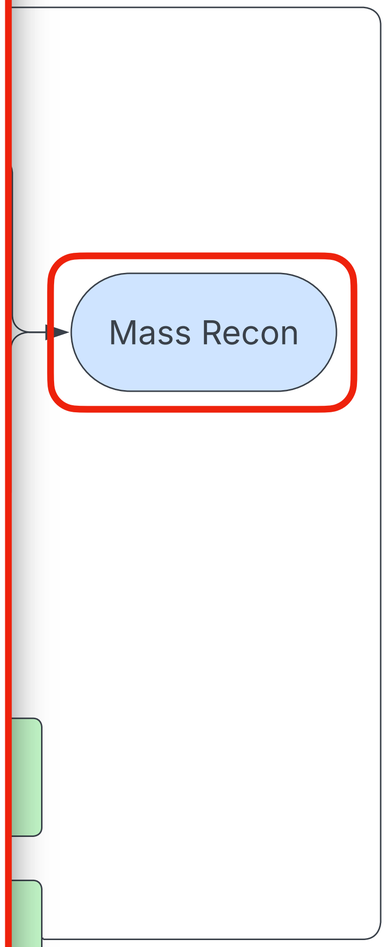


Redo calibration



+20 mm

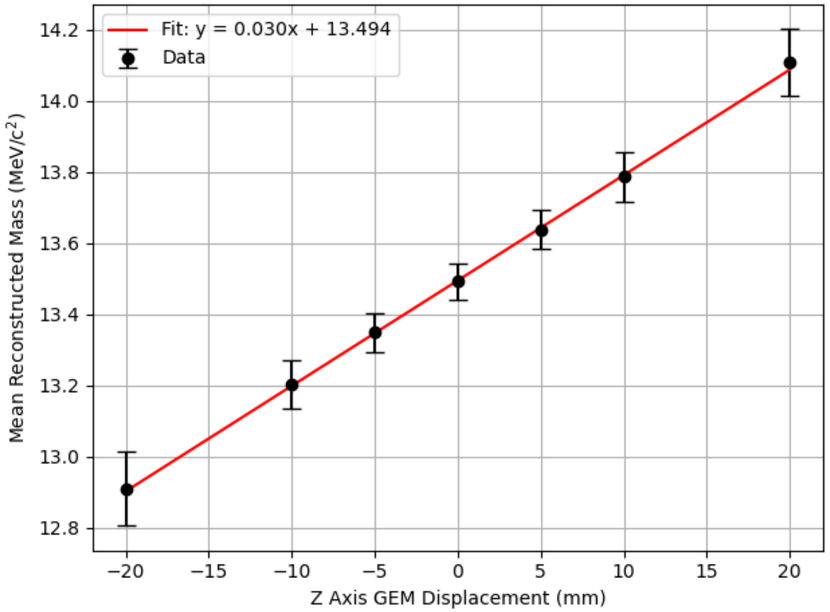


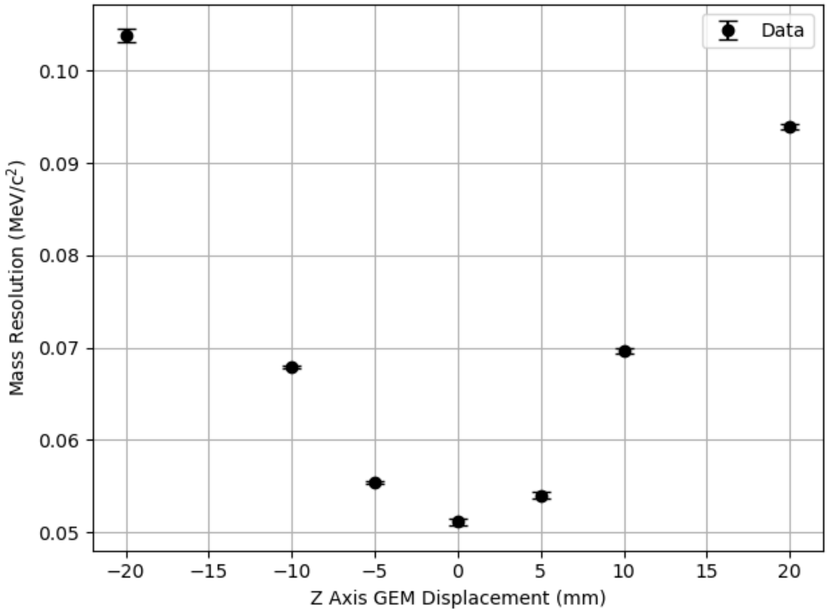


Mass Reconstruction

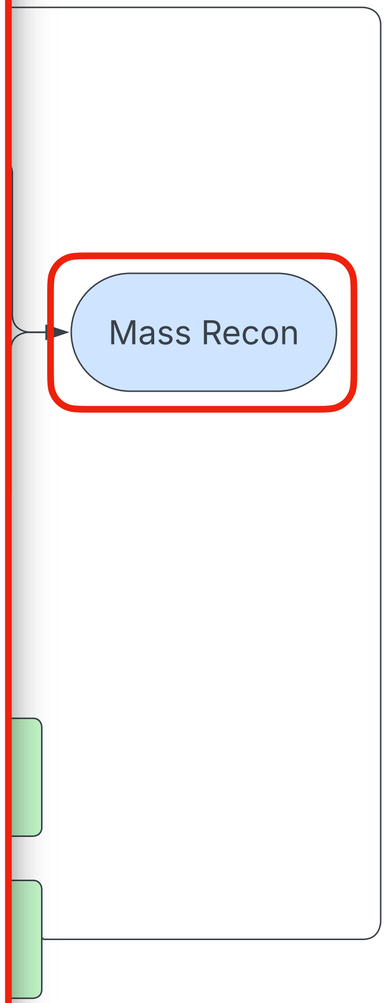
- Analysis by Xavier B. (SBU)

No recalibration at new location:



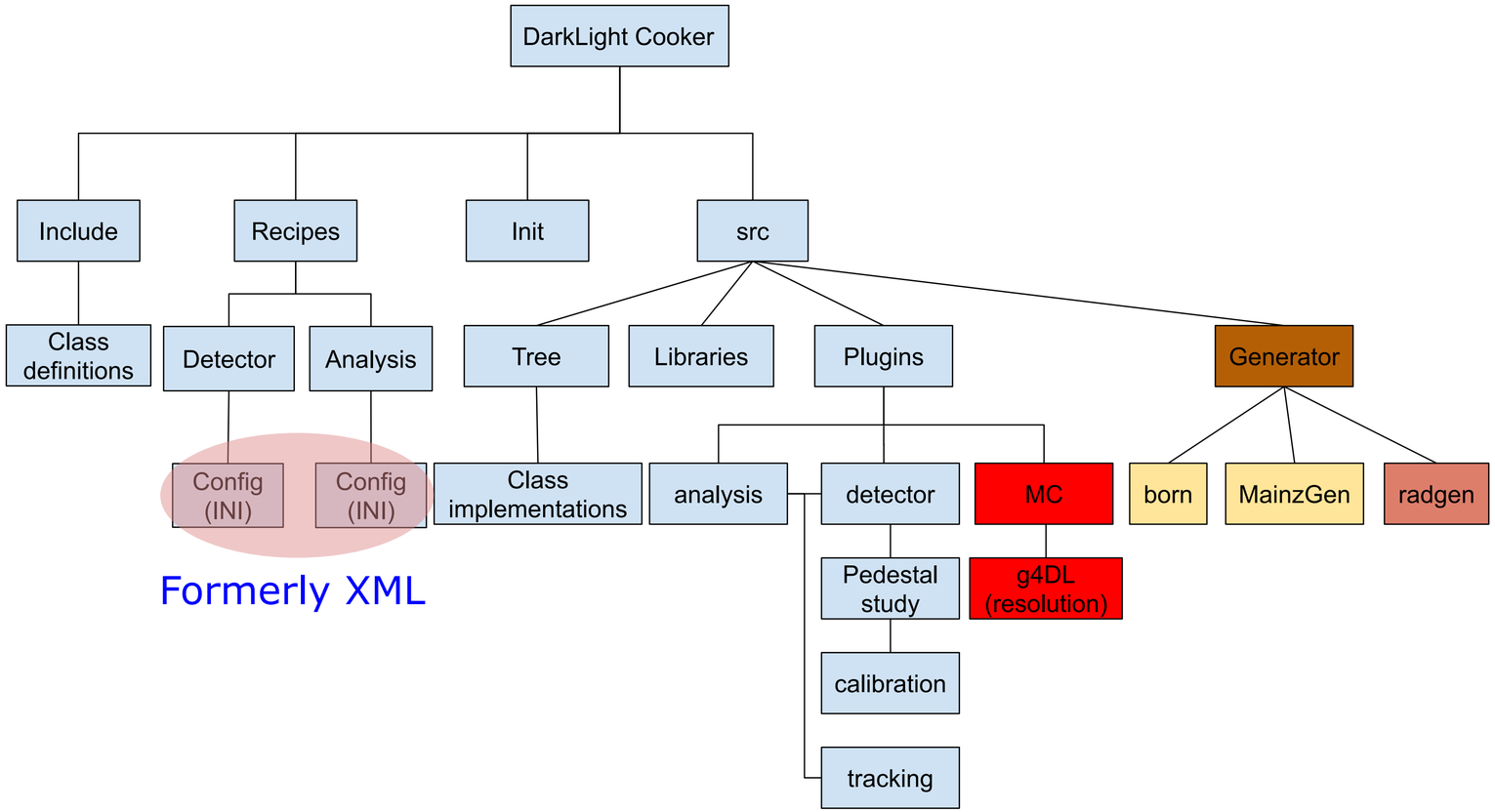


Will work on using the elastic scattering peak for calibration



Config parser: eet-sum-mor

- Update from Bishoy D. (SBU)



customConfig Recipe

- `Xqilla` is deprecated/discontinued since 2018 and removed from package managers (self-build)
- Need new hierarchical configuration architecture
- Structurally `Cooker` remains the same
- Human-friendly data serialization
- Get rid of `XML parsers`
- `customConfig:` handle loading of plugins and configuration files (`init files`)
- `plugin(s)` are `keyed` by `name`
- `TOML:` ✗
- `YAML:` ✗

Old config option with XML will be deprecated after August 1st!

Summary

- Simulation and analysis are in good progress
  - More lower level analysis will be added as we go
  - GEM clustering?
  - Survey?

- Simulation meeting -> Software meeting.

Join us on Tuesdays at 10AM PST (1PM EST) :)

Thank you!