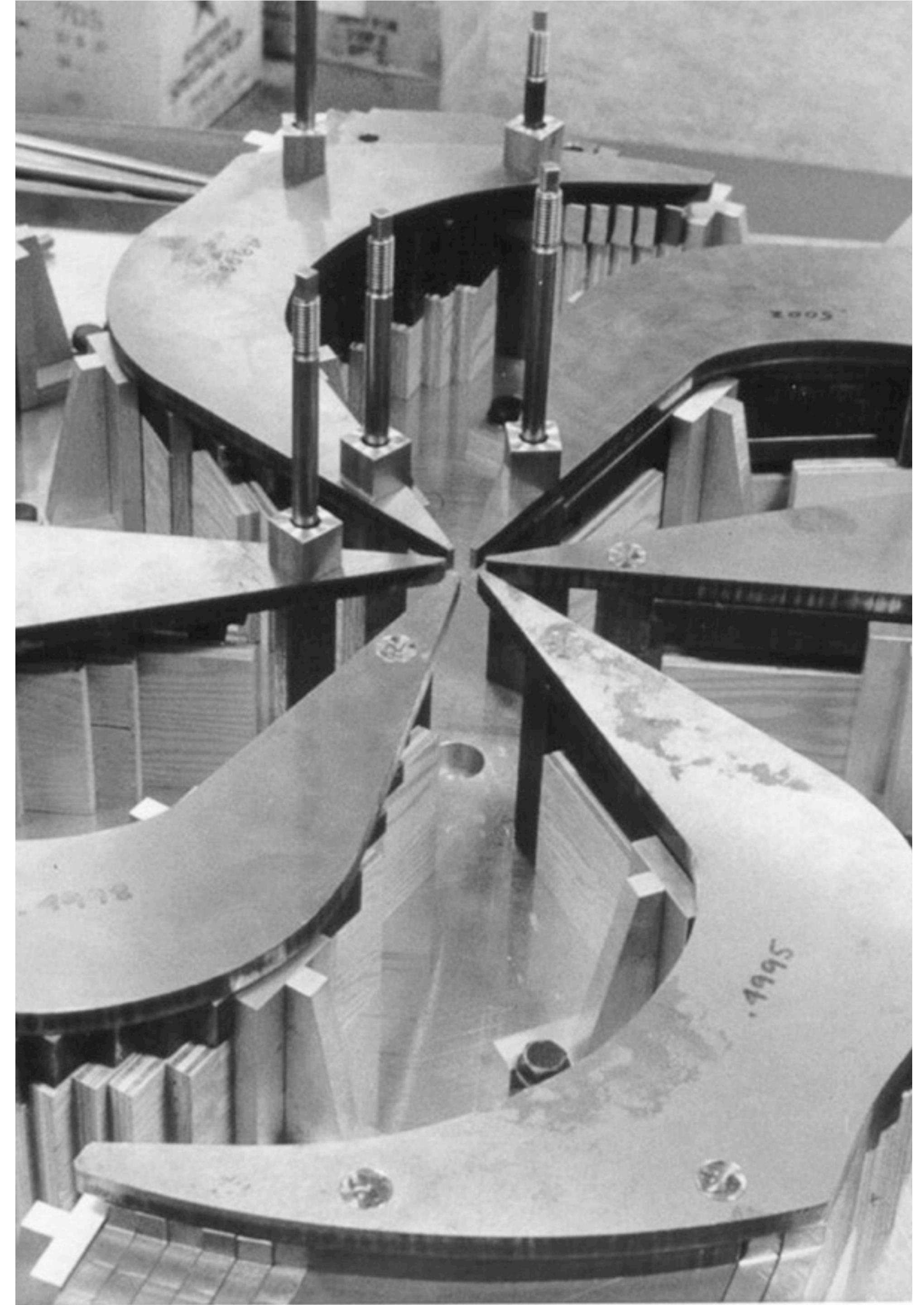




Software and Simulation Status Overview

Laura Miller

DarkLight Collaboration Meeting
July 10th, 2024



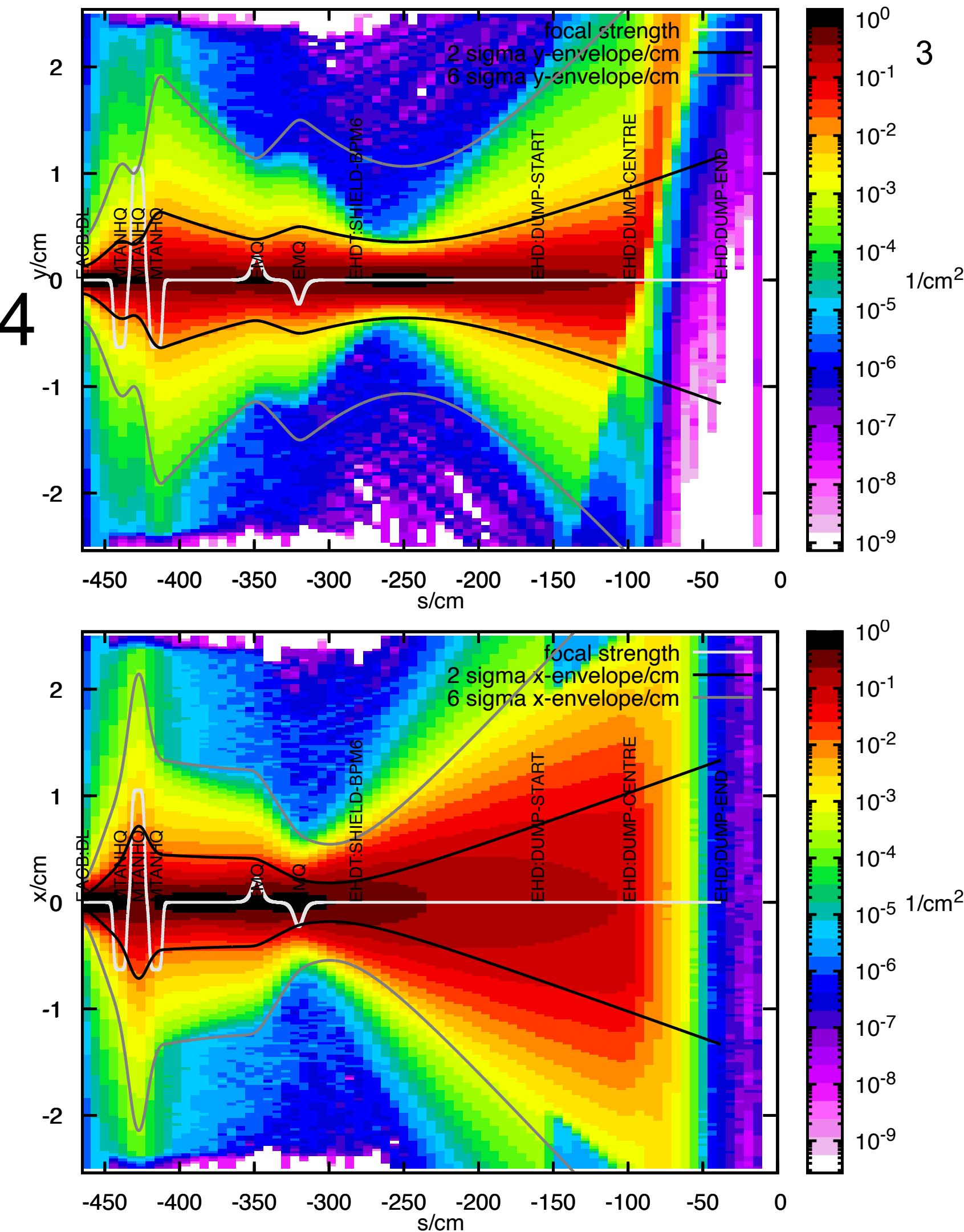
**Discovery,
accelerated**

Introduction

- Broad summary of simulation work since the last collaboration meeting, plus some future plans
- Will liberally reference other talks that will go into more specifics on certain topics

Beam Optics and Shielding

- See Ethan and Aveen's talks this morning
- Have converged on FLUKA vs. Transoptr vs. Geant4 agreement
- In the process of getting final approval for magnet order and finalizing shielding and safety report
- Angela is working on possible configurations for additional energies and target materials



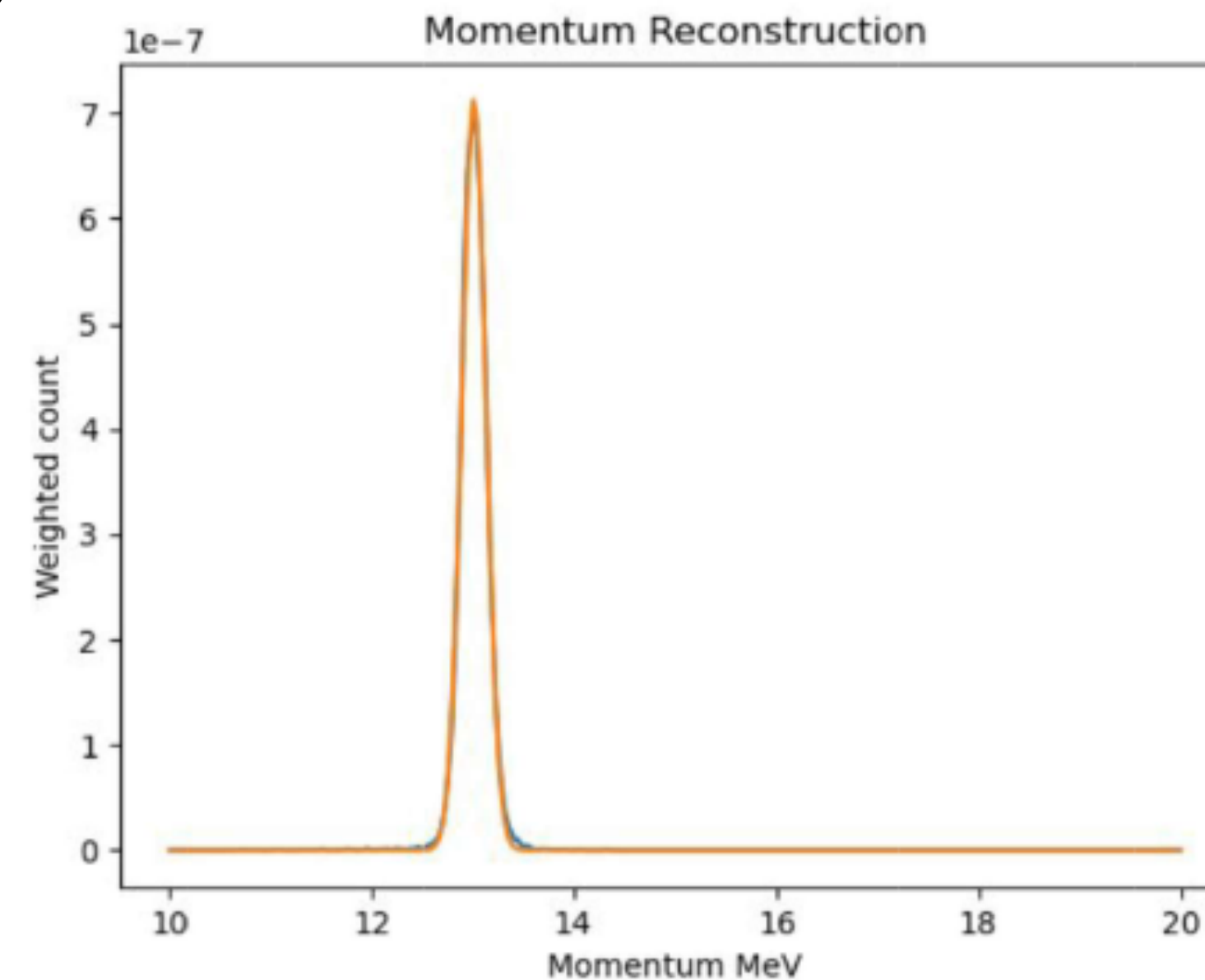
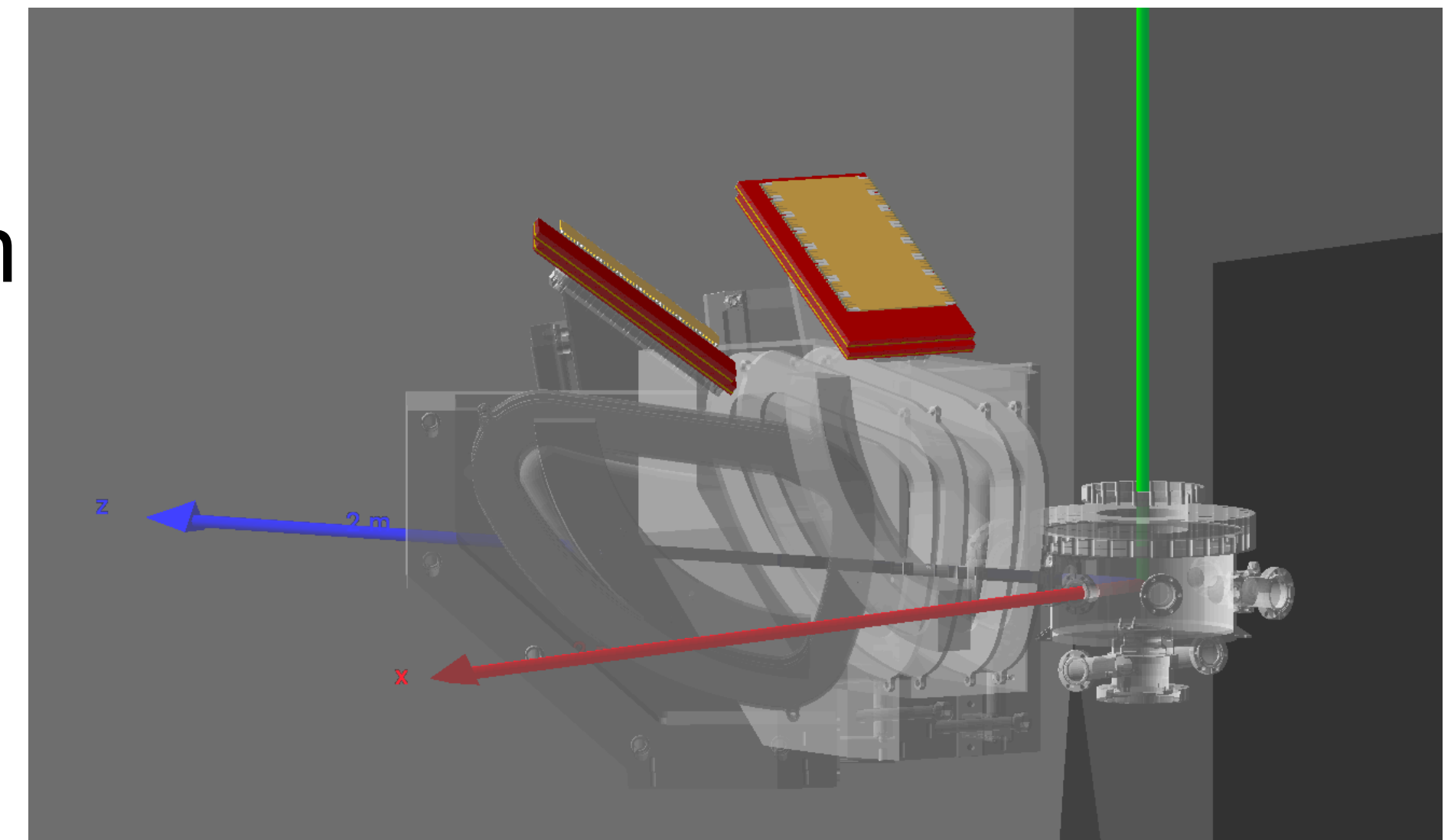
Monte Carlo Simulation

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- MainzGen: David is in the process of confirming the configuration
 - Will probably involve a cross check with MadGraph
- RadGen: fixed a bug where momenta would become NaNs after running a large number of events
- Generators for Moller and Bethe-Heitler are on git

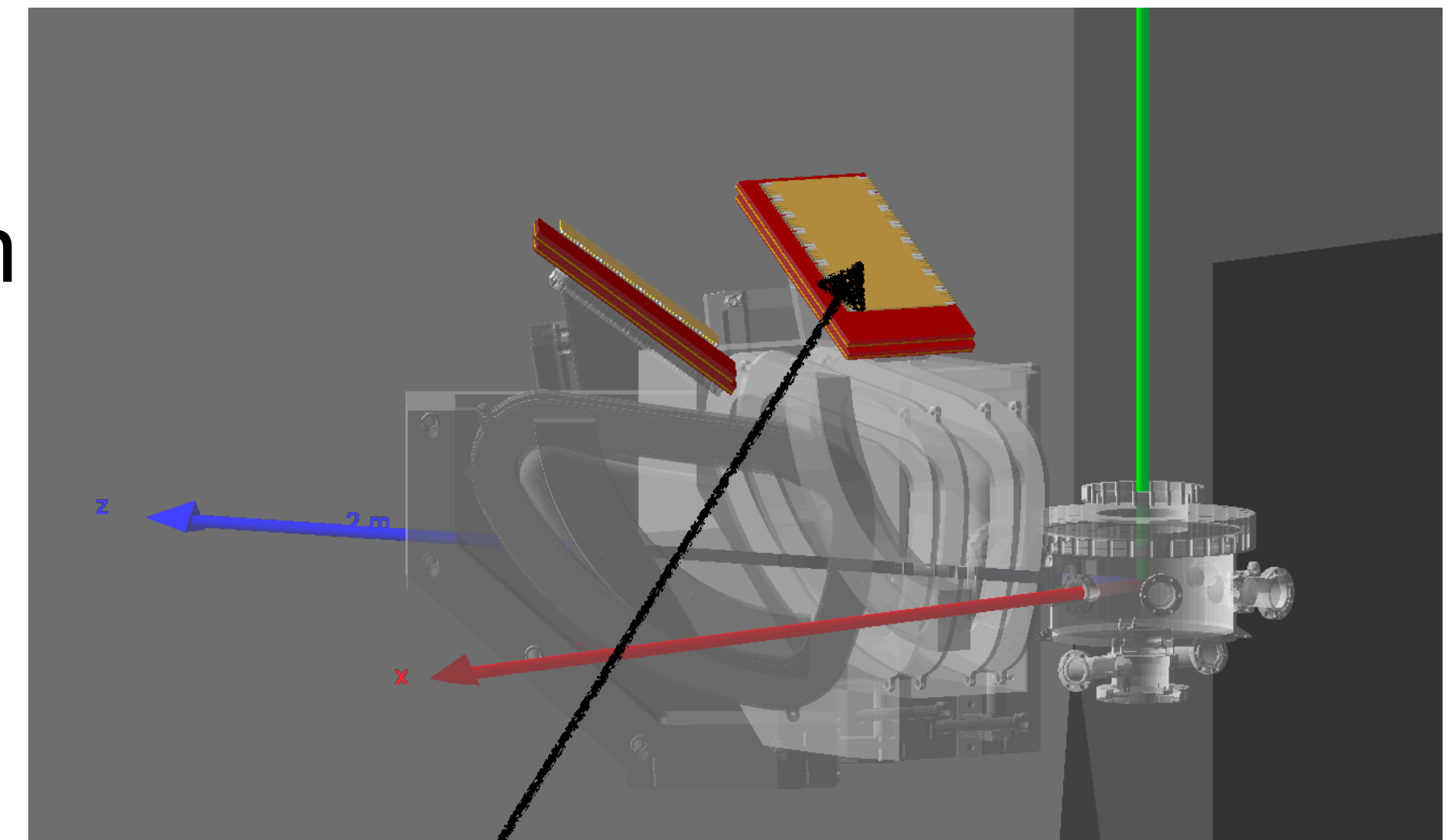
Geant4 Simulation

- Finalized design for the scattering and vacuum chambers implemented
- Cameron verified that mass resolution is not affected by aluminum window (still ≈ 120 keV)



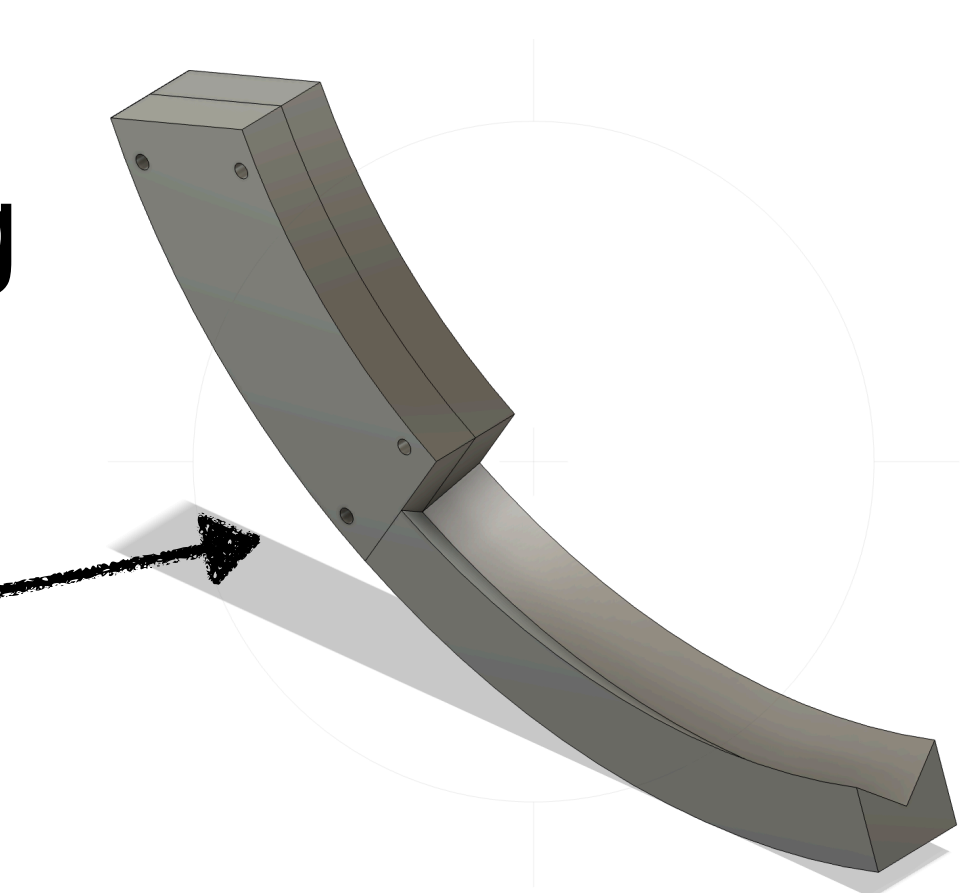
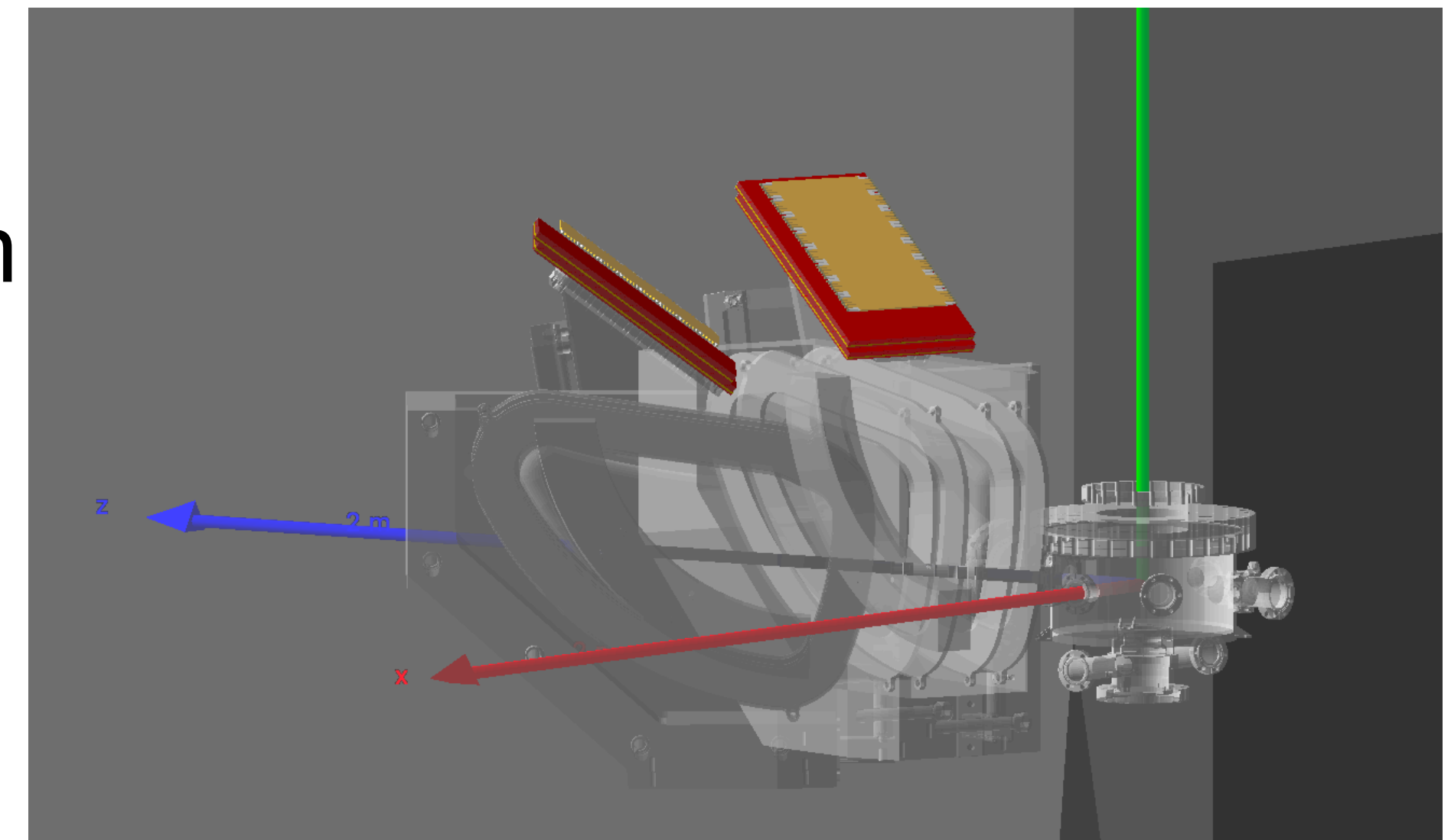
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- Win has implemented the trigger detectors and output



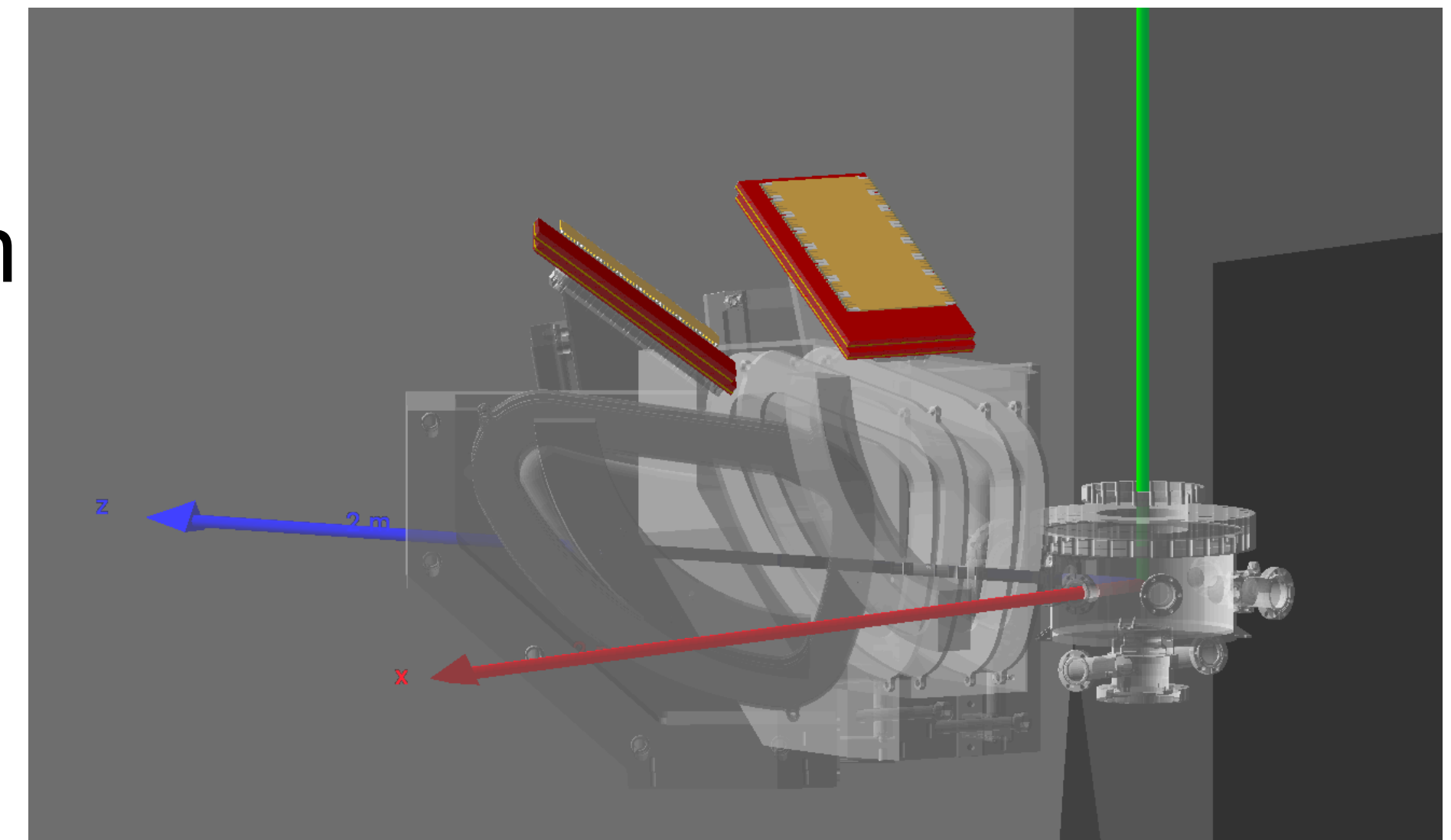
Geant4 Simulation

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- Cameron verified that mass resolution is not affected by aluminum window (still ≈ 120 keV)
- Win has implemented the trigger detectors and output
- Studies to finalize the PEEK shape are ongoing but converging
- Positron arm works with solid PEEK
- Current iteration for the electron arm



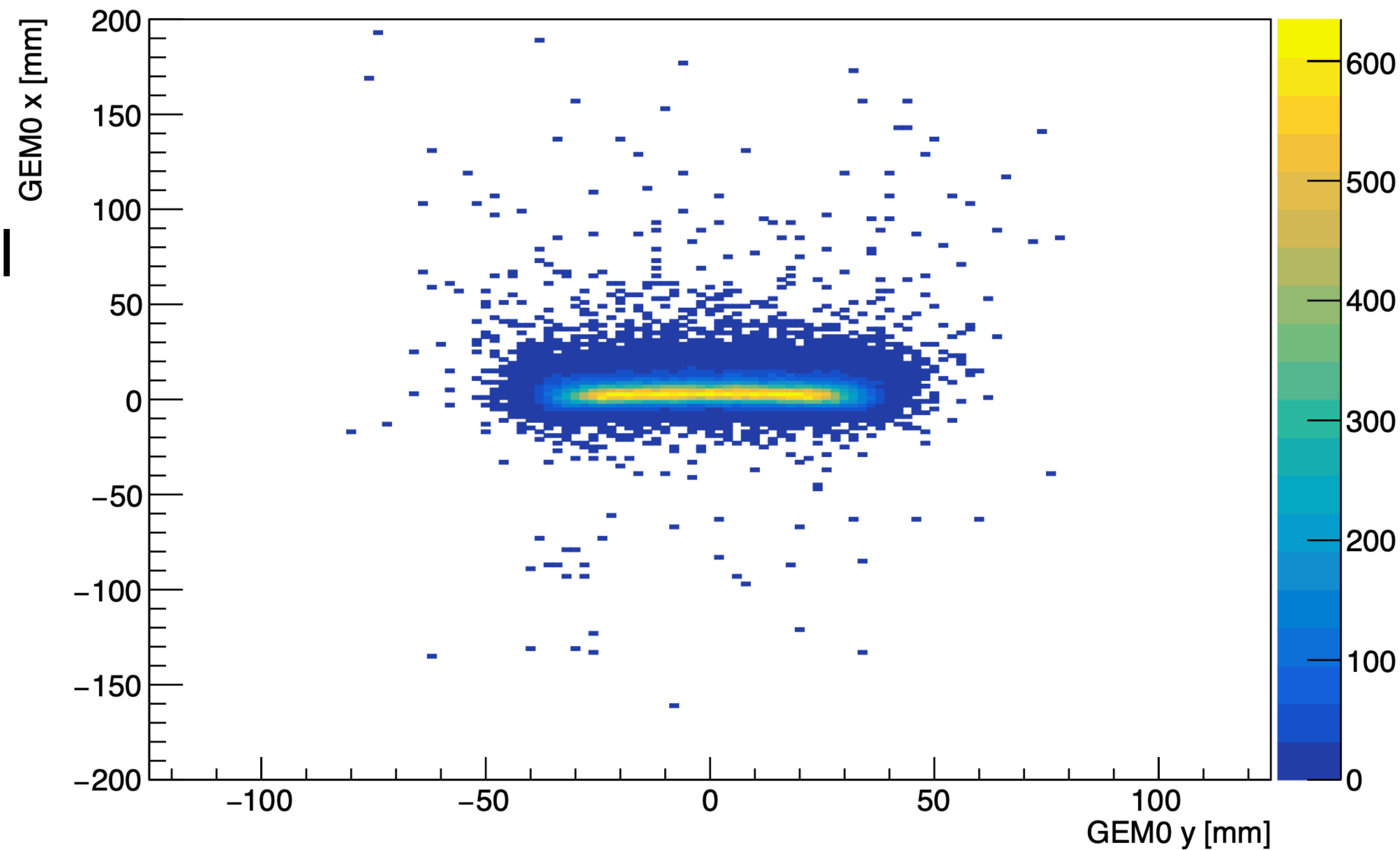
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- Win has implemented the trigger detectors and output
- Studies to finalize the PEEK shape are ongoing but converging
- Story is working on adding the APVs to get a measure of dose



Digitization and Reconstruction

- GEM digitization and reconstruction now implemented with the proper geometry
- Cooker recipes:
recipes/GEMini/gemini_digi.xml
recipes/GEMini/gemini.xml



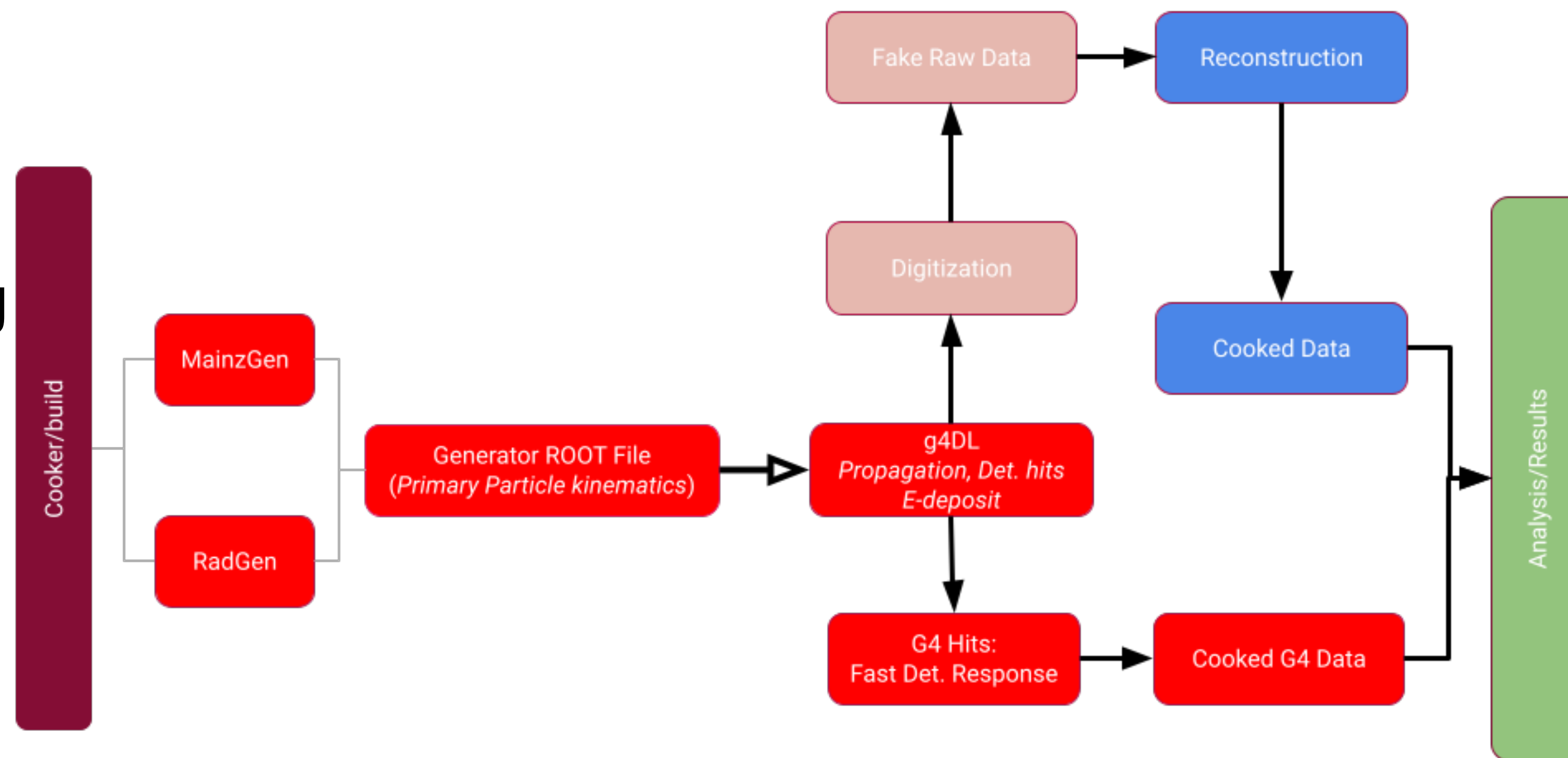
Digitization and Reconstruction

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- GEM digitization and reconstruction now implemented with the proper geometry
 - Cooker recipes:
recipes/GEMini/gemini_digi.xml
recipes/GEMini/gemini.xml
- Trigger digitization and reconstruction also implemented
 - Cooker recipes:
recipes/TrigScint/trs_digit.xml
recipes/TrigScint/trs.xml
- See Win's talk for more discussion

Framework Updates

- See Bishoy's talk
- Making a concerted push towards having everything contained in the Cooker



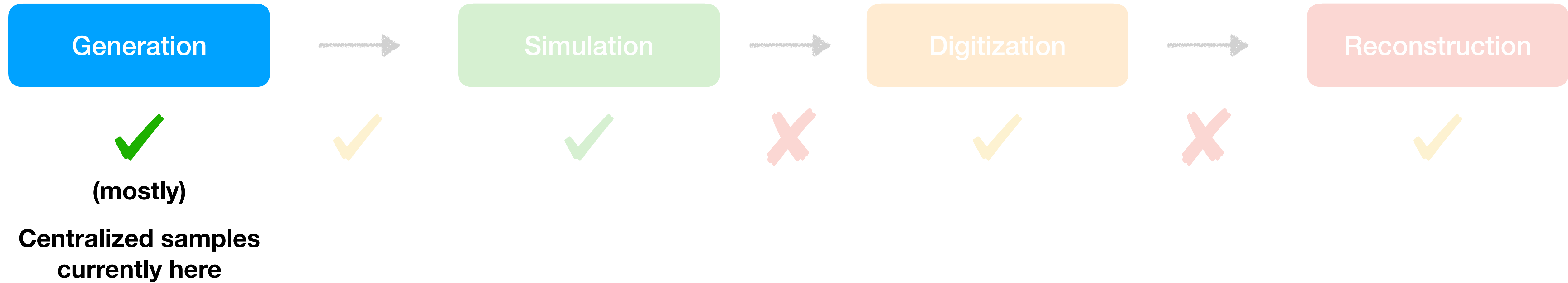
- MainzGen, RadGen, and Geant4 moved over and old git repositories are now defunct
- Please use the cooker version!

Central MC Samples

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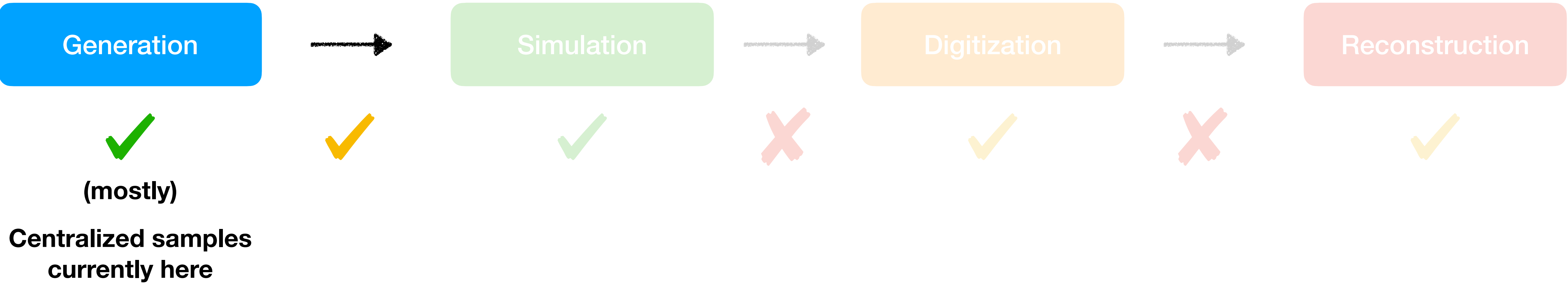
- Have started to develop central Monte Carlo samples for collaboration use
 - Link: https://triumfoffice365-my.sharepoint.com/:f:/g/personal/lmiller_triumf_ca/EqOd2uB_WCNJgQog1QY3YpMB6mvfVPWFI4Qv8VHsywZrGg
 - Password protected, happy to provide upon request (also in the simulation slack channel)
- Currently contain generator level events only, instructions for appropriate scaling can be found [here](#) (for the moment)

Towards a Unified Framework



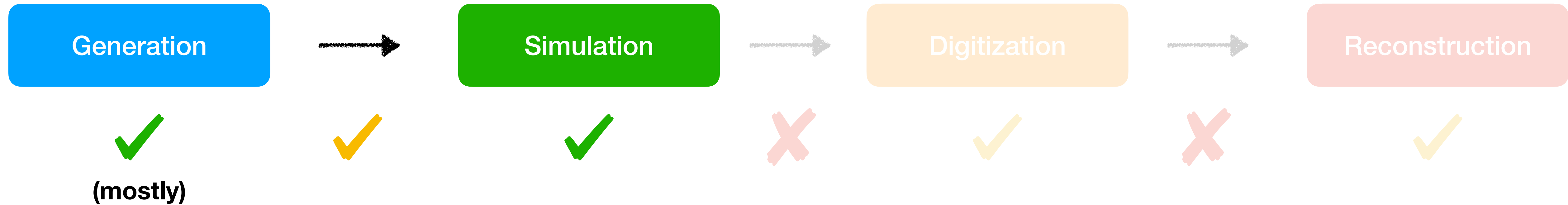
- Work ongoing to check MainzGen configuration

Towards a Unified Framework



- This pipeline is established for the centralized sample root files
 - They have the correct format, units, etc.
- Perhaps some playing to be done with the output files

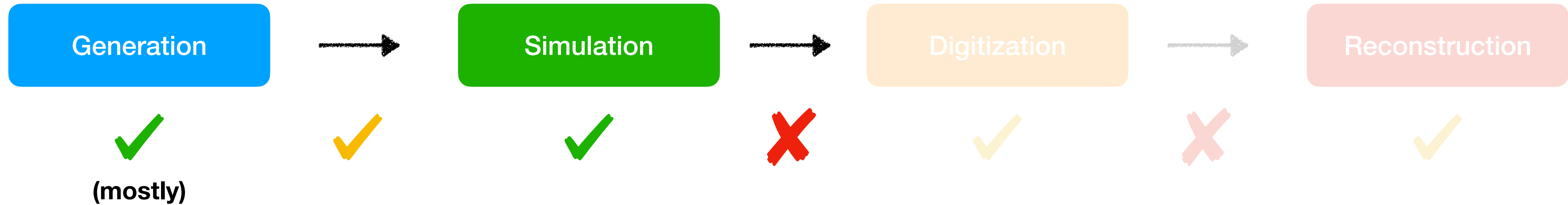
Towards a Unified Framework



Centralized samples currently here

- Geant4 simulation is in largely good shape
- A few minor outstanding tasks:
 - Random positioning for vertex in foil
 - Final trigger position
 - Shielding

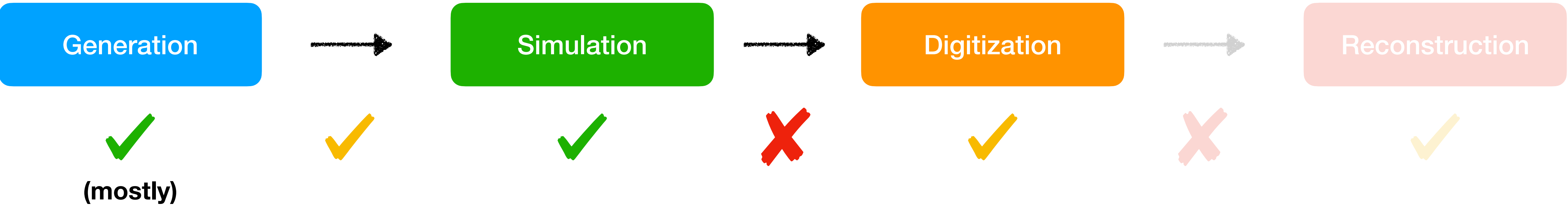
Towards a Unified Framework



Centralized samples
currently here

- Works when run manually of course, but no nice automated process yet

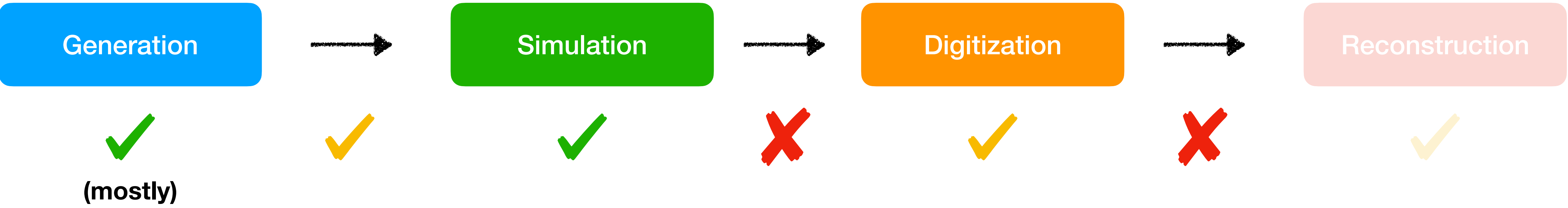
Towards a Unified Framework



Centralized samples currently here

- Code developed and running for both the trigger and the GEMs
- Needs some fine tuning of parameters

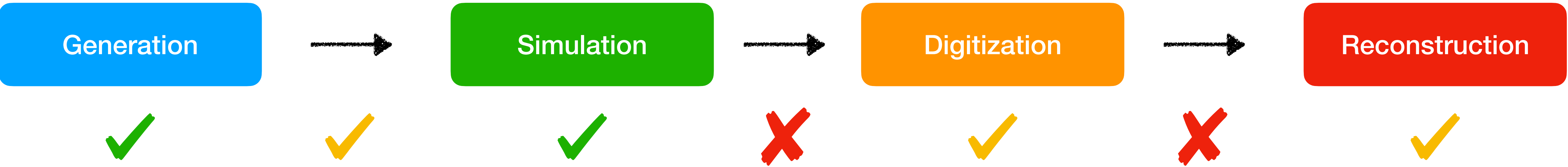
Towards a Unified Framework



Centralized samples
currently here

- Again, working nicely manually, but should automate for the simulation

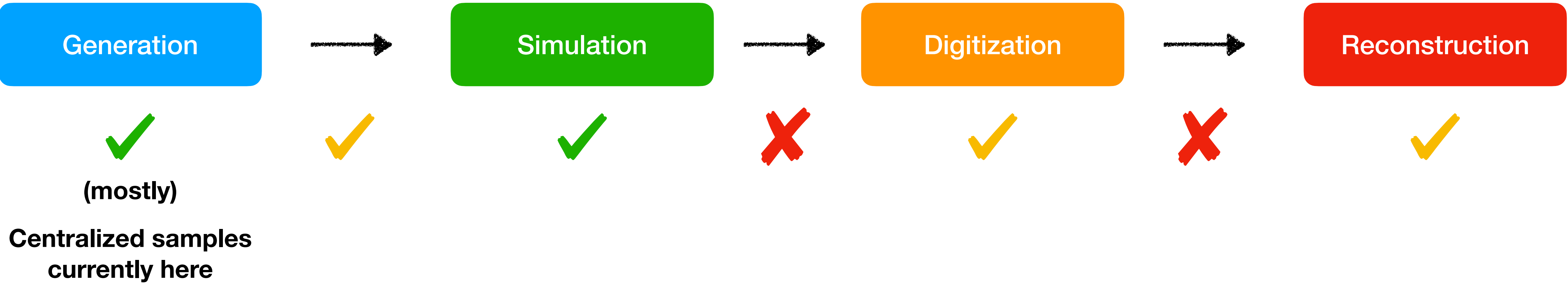
Towards a Unified Framework



(mostly)
Centralized samples
currently here

- Trigger and GEM hits working, although some fine tuning still required
- Still need to implement tracking algorithm
- Coordinate with the current DAQ setups
- Will also need to integrate run conditions

Towards a Unified Framework



- Hoping to fill in a few of these gaps this week!

Summary

- Beam optics have converged, finalizing shielding and safety report
- Geant4 simulation:
 - Final scattering chamber/spectrometer design
 - Trigger detectors added
 - PEEK shape studies progressing
- Trigger and GEM digitization and reconstruction implemented
 - Tracking still to be finalized
- Code largely moved into the cooker framework
- Centralized MC samples available
- Work ongoing towards developing a full simulation chain

Thanks! Comments? Questions?