SiCalo Tracking meeting

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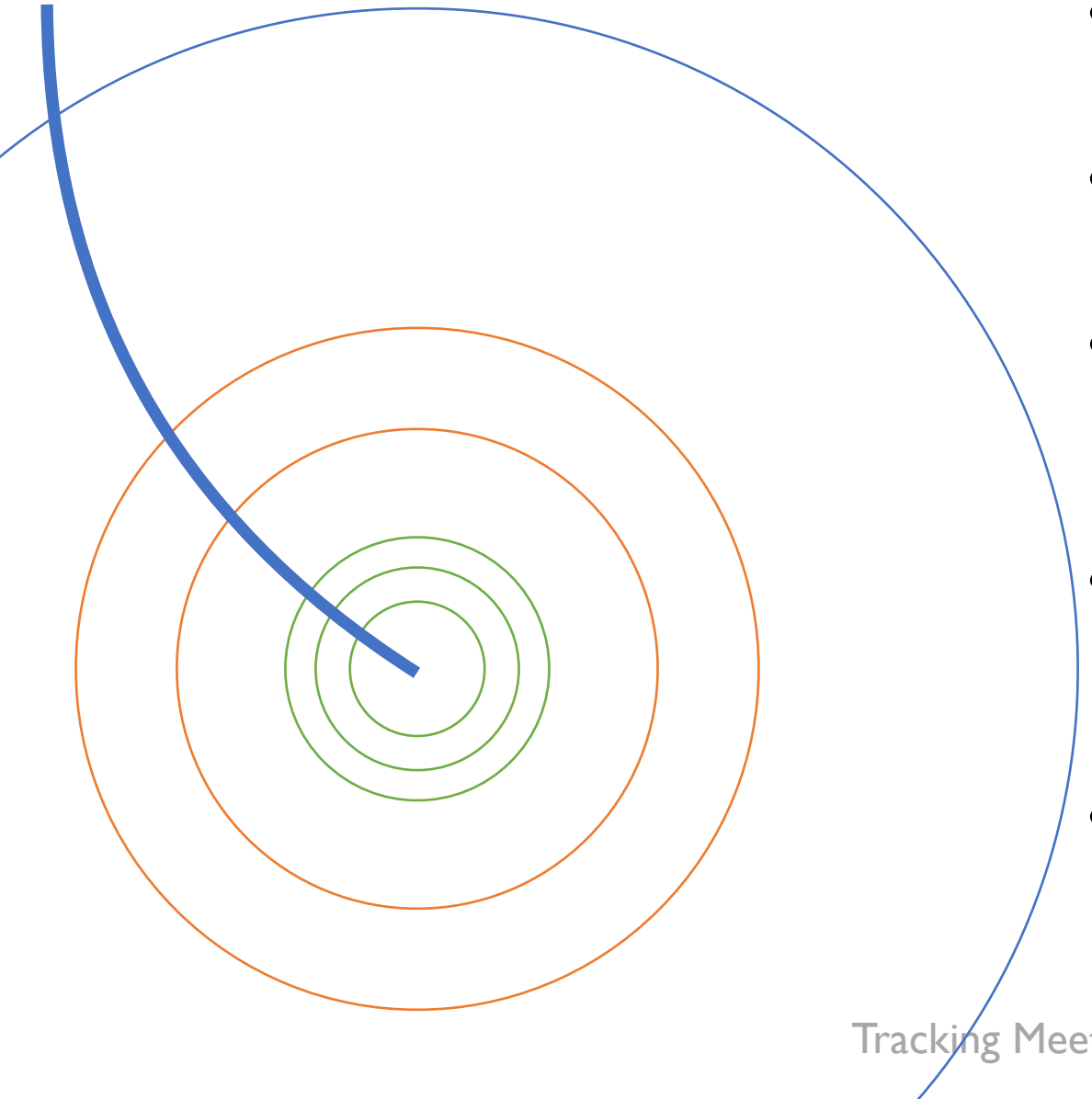
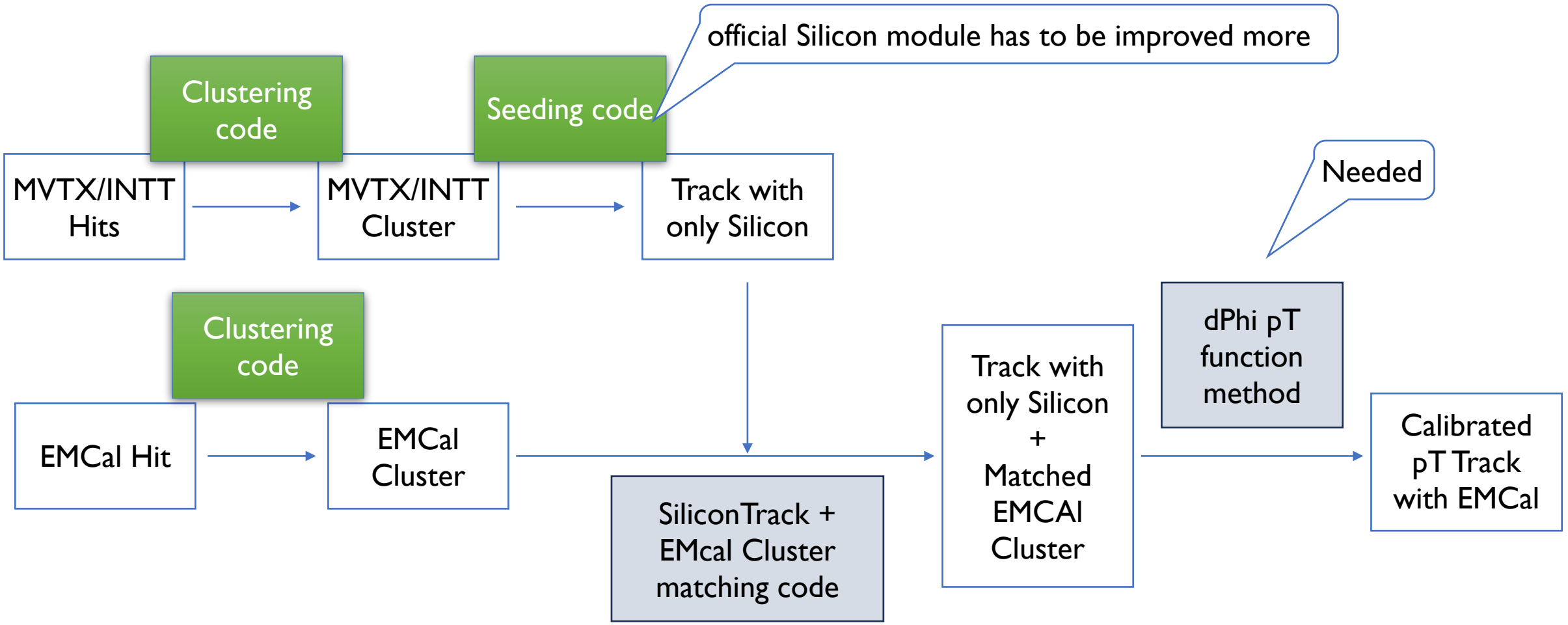
May 28 2025

Recap



- SvtxTrack class includes various kinematic variables
- Track->get_x() get_phi(), get_z()….
  Default returns the track info at the R=0
- Need projection to EMCal surface and extract correct information for Si-Calo Matching
- Software is available (not easy to use unless you know how to use it..)
- Preparing macro so people can use it..

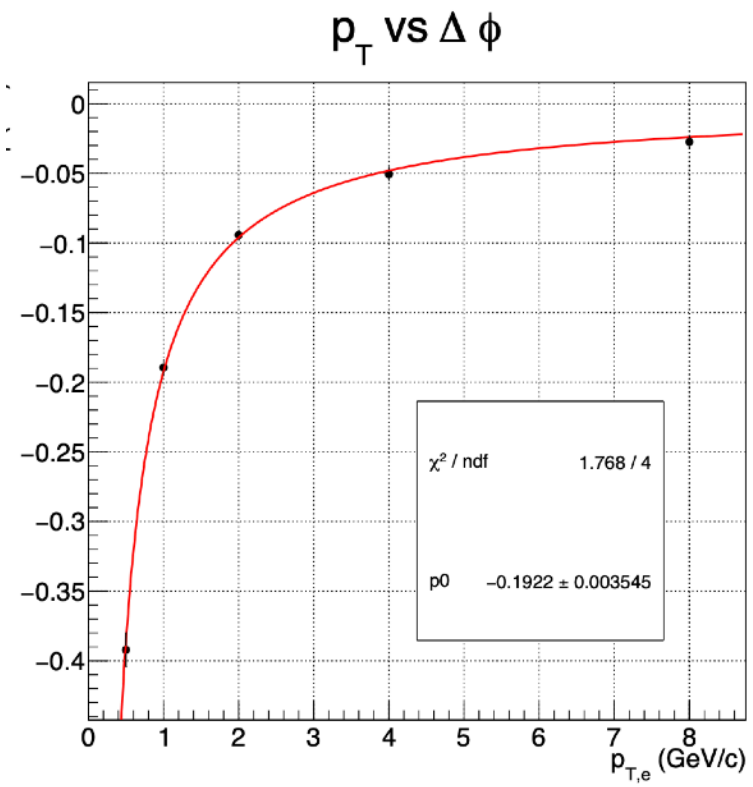
Macro / code framework overview

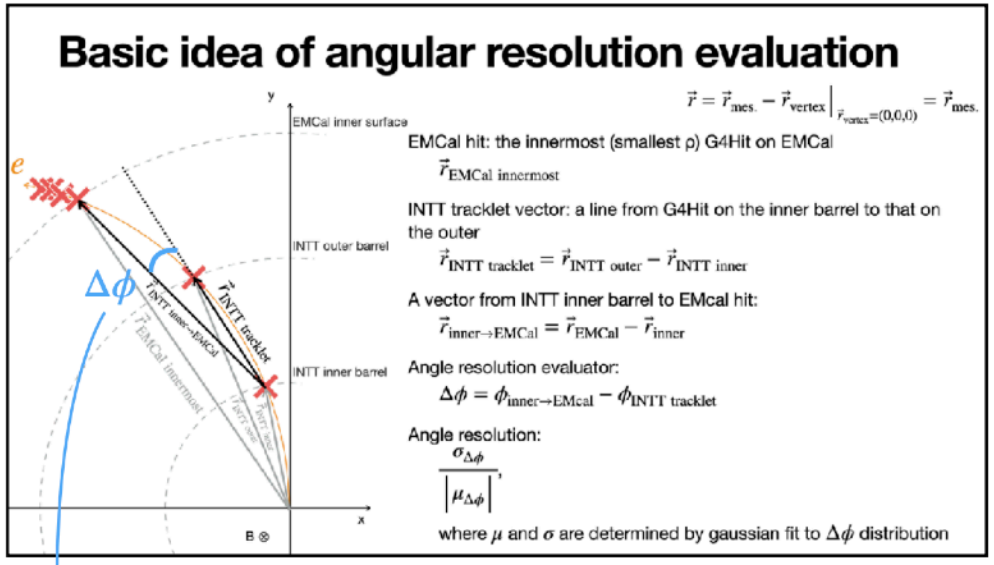


Check eta dependence of pT-dphi relation

- Slide from Genki's last Si-Calo meeting -> need to check eta dependence

p_T vs $\Delta\phi$





$$\Delta\phi = \Delta\phi(p_T, \phi, \eta, z, \mathrm{PID})$$

$$\rightarrow \Delta\phi(p_T) = \frac{p_0}{p_T}$$

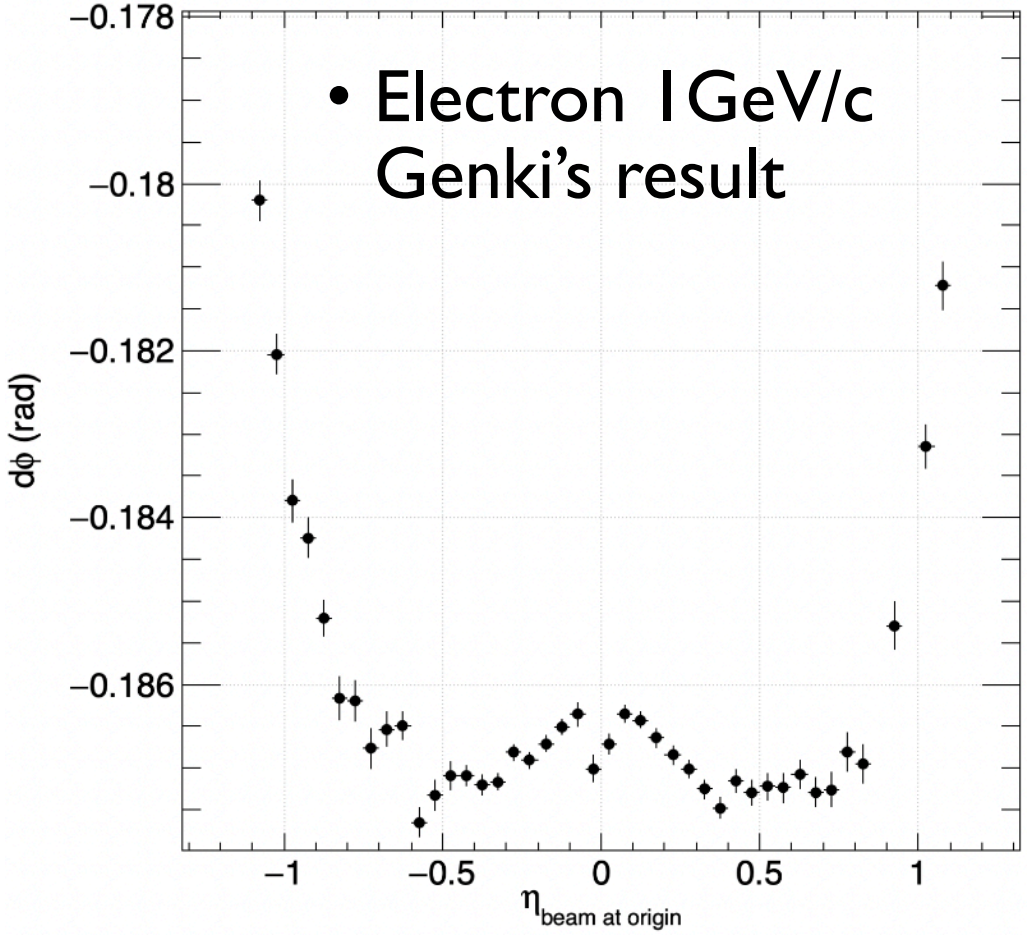
Is this function correct to use?

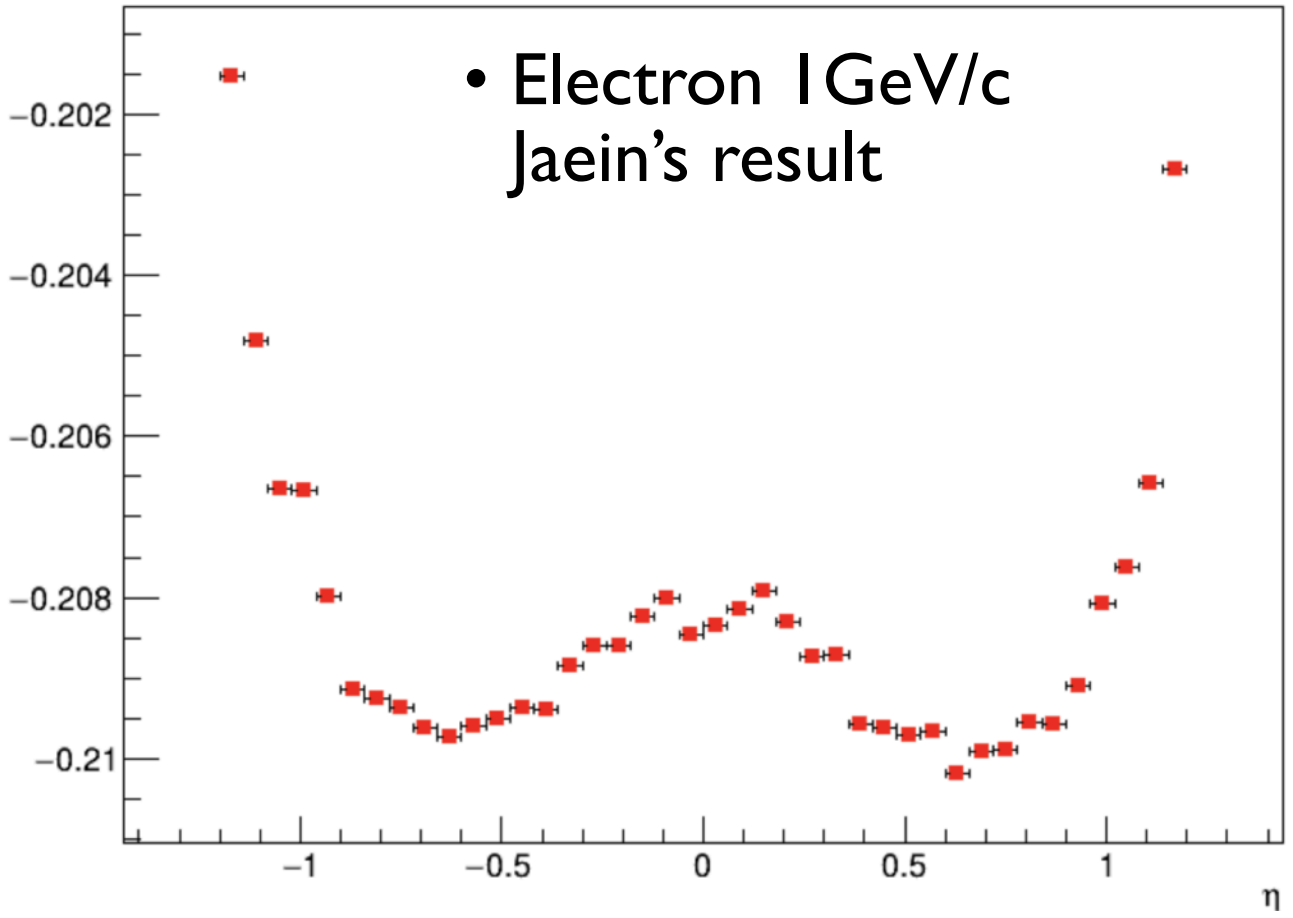
$$p_0 = -0.1922 \pm 0.003545$$

$$p_T(\Delta\phi) = \frac{p_0}{\Delta\phi}$$

Check eta dependence of pT-dphi relation

- dphi-eta shows waving shape from both of us.





Check eta dependence of pT-dphi relation

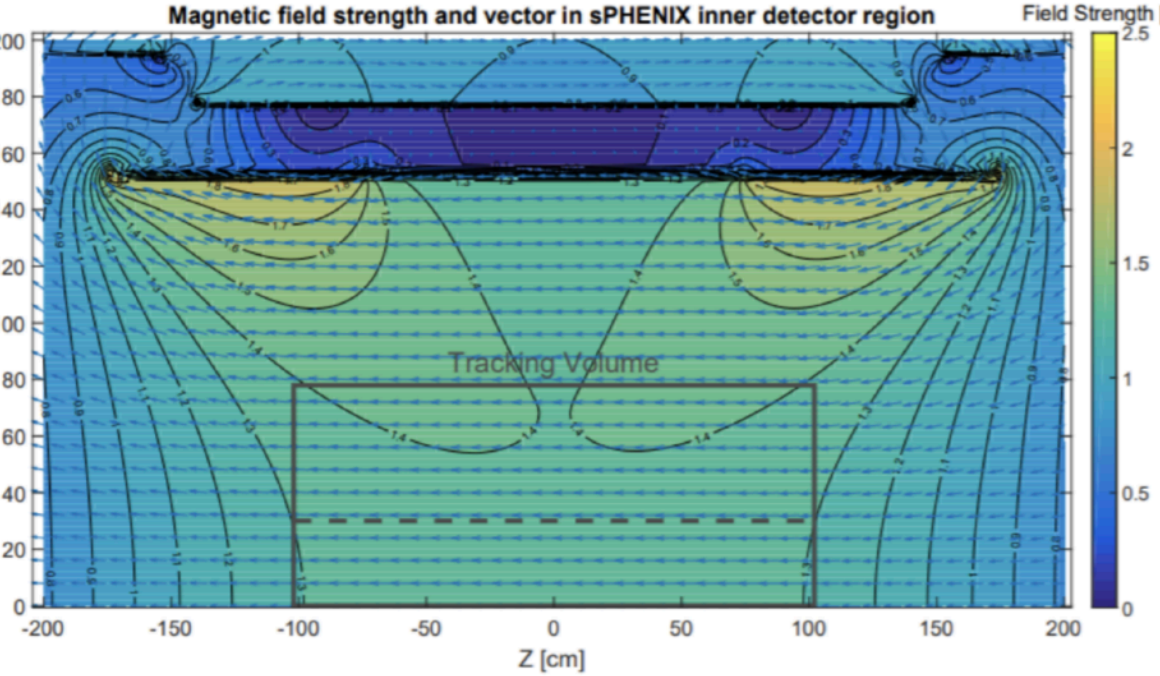
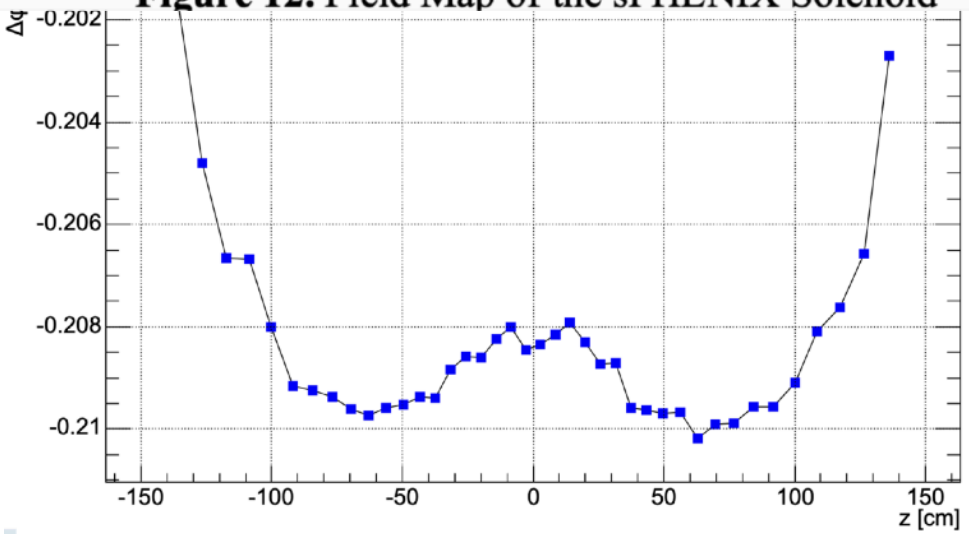
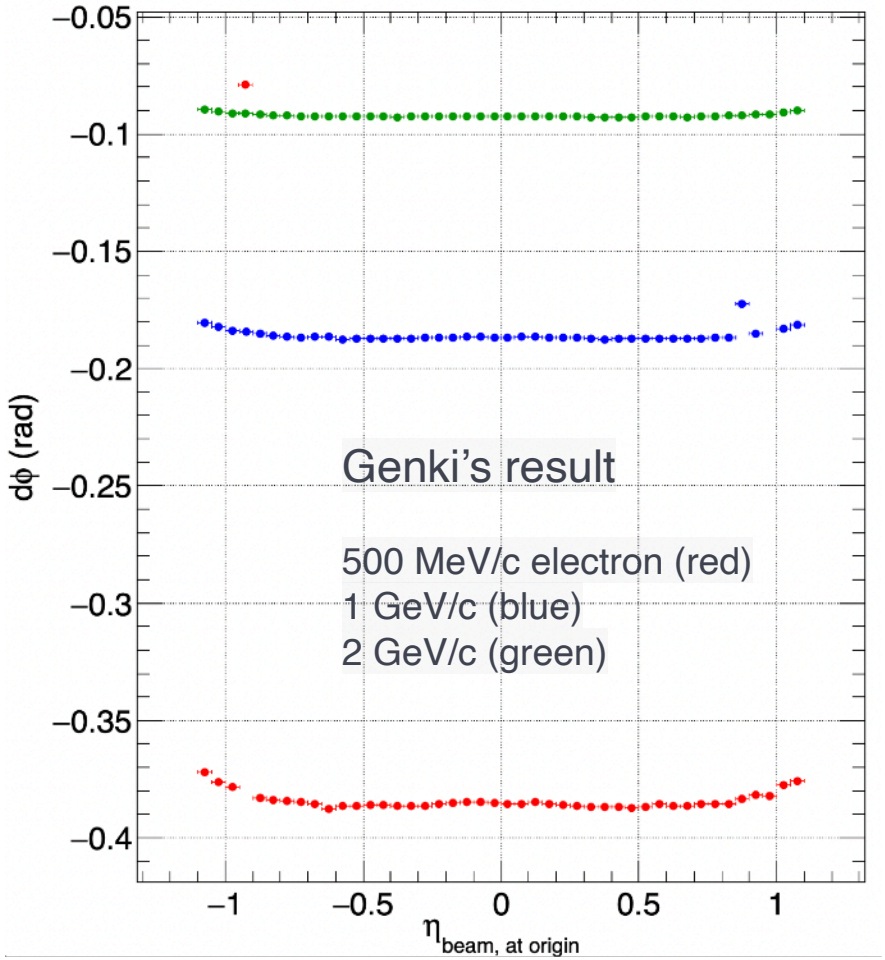


Figure 12. Field Map of the sPHENIX Solenoid



- Magnetic field map effect



Status

https://github.com/gwd213/INTT/tree/main/general_codes/Jaein/SiliconSeeding/SiliconSeedAna

SiliconSeedAna Framework

Recent update: March 30, 2025

This project is designed to simulate and analyze charged particle tracking and calorimeter matching in the sPHENIX environment. The core component, `SiliconSeedAna`, collects information from silicon trackers, EMCal, and HCal, and stores it in a structured ROOT file for further physics analysis.

Directory Overview

1. `PHYTIAmacro/`

- **Purpose**: Contains macros for full simulations based on PYTHIA event generation.
- **Main Macro**: `Fun4All_PHYTIA_Silicon.C`
- **Usage**:
  i. First, compile `SiliconSeedAna` and build the shared library.
  ii. Then run this macro to simulate PYTHIA events.
- **Output**: ROOT file containing tracker and calorimeter hit information.

2. `gunmacro/`

- **Purpose**: Contains macros for single-particle simulations.
- **Main Macro**: `Fun4All_singleParticle_Silicon.C`
- **Usage**:
  i. Compile `SiliconSeedAna` first.
  ii. Run the macro to simulate single-particle events with fixed momentum and direction.
- **Use case**: Useful for analyzing magnetic deflection and detector matching at specific kinematics.

3. `SiliconSeedAna/`

README.md files at GitHub

More documentation is ongoing(Mahiro is working on it by running/learning the code)

Checking pT with phi correction

Will be good to check with Jingyu's machine learning

BACKUP

- BACK UP

Recap

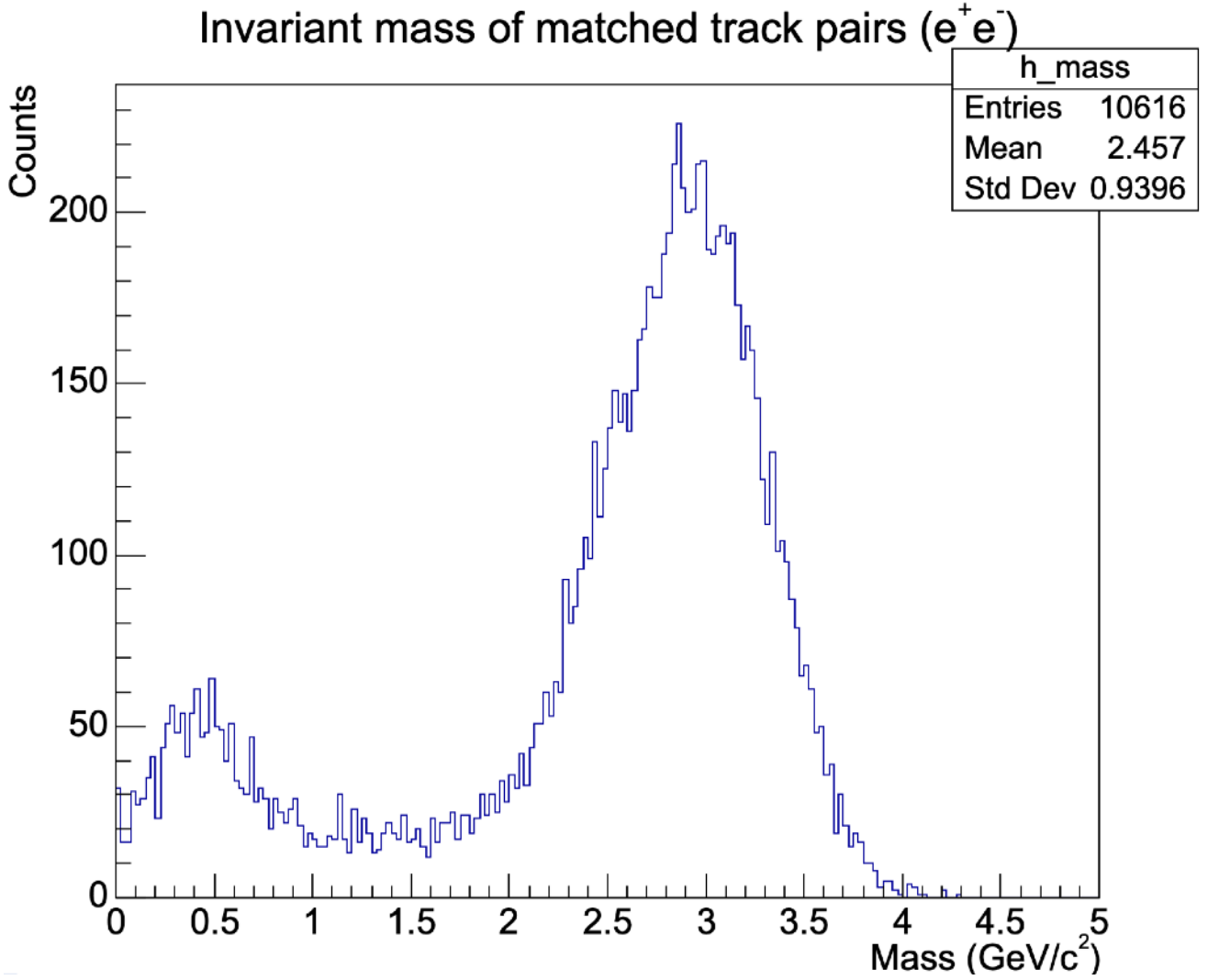
Basic Matching criteria

Minimum $\Delta R = \sqrt{(\Delta z)^2 + (\Delta \phi)^2}$

(Planning to change to $\Delta R = \sqrt{(\Delta \eta)^2 + (\Delta \phi)^2}$

Additional cut

0.8 < E/p <1.2
dz < 4 cm
pt > 0.5 GeV
nINTT > 1 && nMVTX > 2
Chi2/ndf < 4
opposite sign



THIS IS NOT Physics yet! Just for fun and testing the algorithm

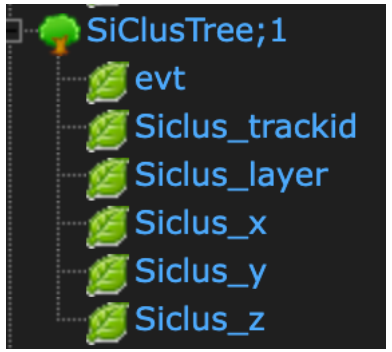
SiliconSeedAna Output information

https://github.com/gwd213/INTT/tree/main/general_codes/Jaein/SiliconSeeding

Evt : event number
track id
(x,y,z) Eta,phi,pt at R=0
Track Chi2ndf
Charge(+ or -)

# of associated clusters
crossing info(for data)

(x_emc,y_emc,z_emc)
position at R=93.5 cm
eta_emc phi_emc,
pt_emc at R=93.5 cm



Track-associated Clusters information from Silicon
Note)We can use it for dphi - pT conversion

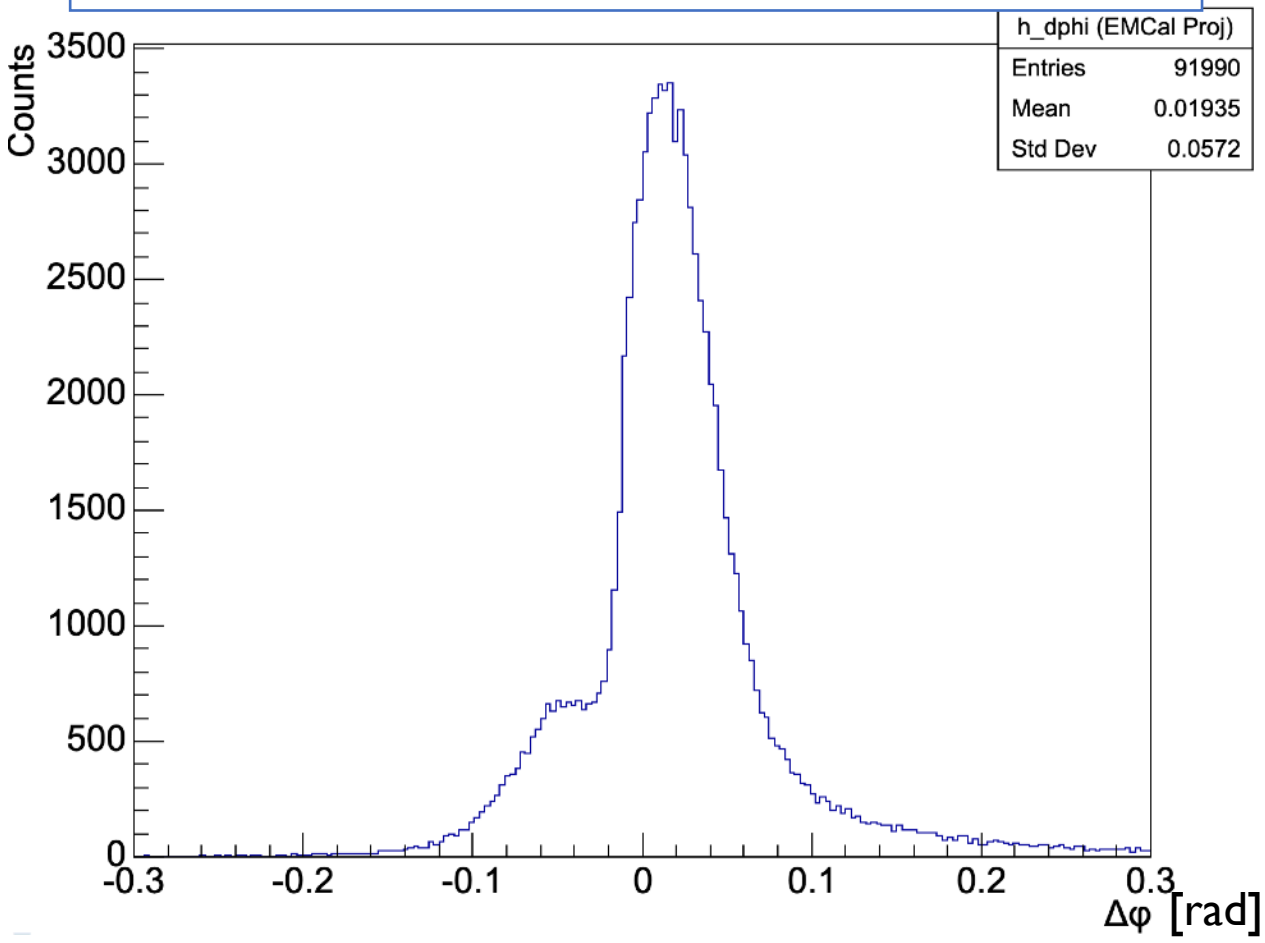
Calo cluster information (EMCal only)

NOTE
(x0,y0,z0)
(px0,py0,pz0)
(xproj_emc,yproj_emc,zproj_emc)
Truth information TTree
Put some truth vs reco comparison

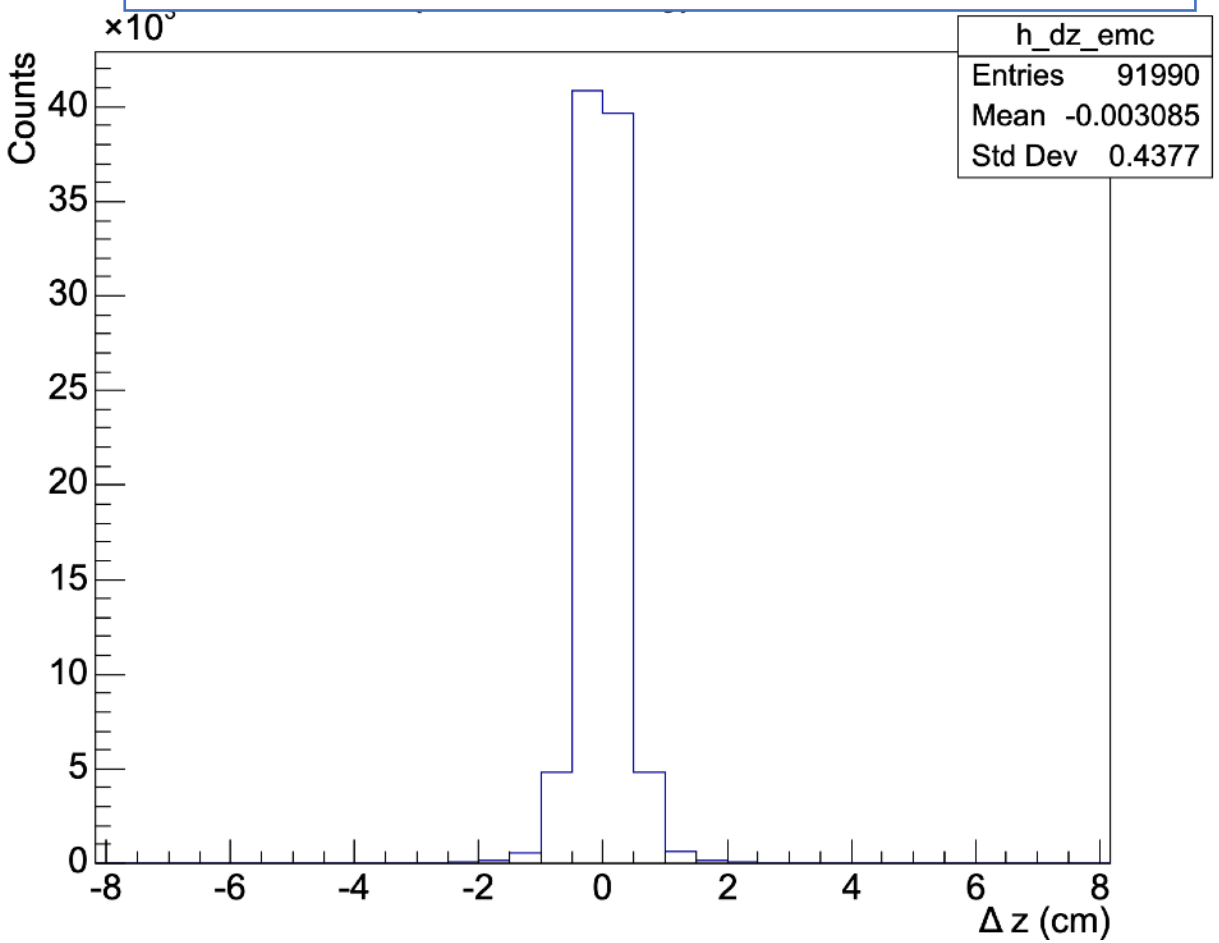
Projection test with electron gun

https://github.com/gwd213/INTT/tree/main/general_codes/Jaein/SiliconSeeding

[Track phi at EMCal surface] - [Calo phi]



[Track z at EMCal surface] - [Calo z]



Trial for Si-Calo matching

Try to Si-Calo matching .. electron gun might not good enough..
Try J/ψ reconstruction with J/ψ gun! -> more than 1 track!
also Good test tool for E/p cut ; rejection for di-muon / hadronic decay