# SiCalo Tracking meeting

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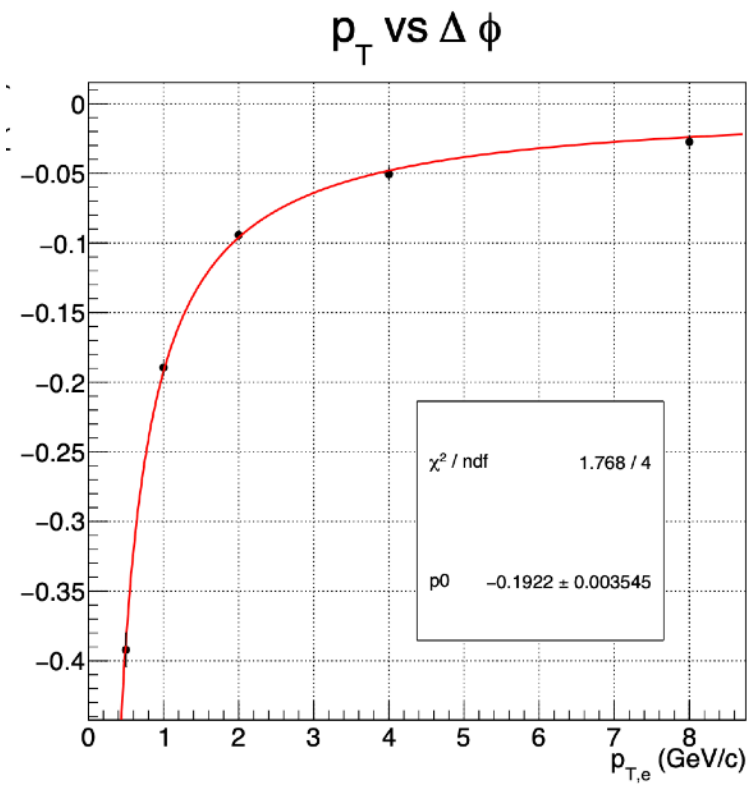
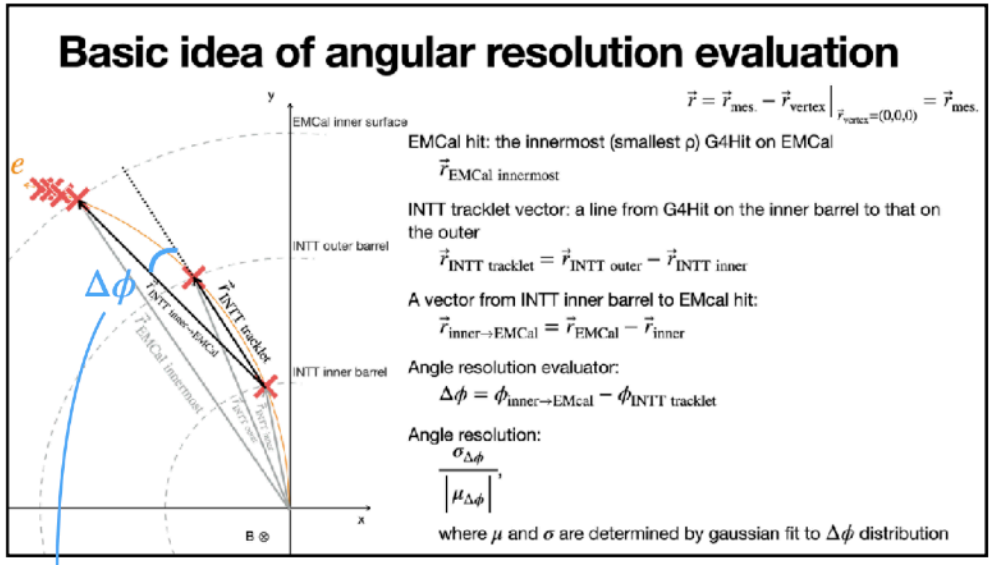
# Check dPhi-pT function

- Slide from Genki's last Si-Calo meeting, Following Genki's definition

**$p_T$ vs $\Delta\phi$**




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

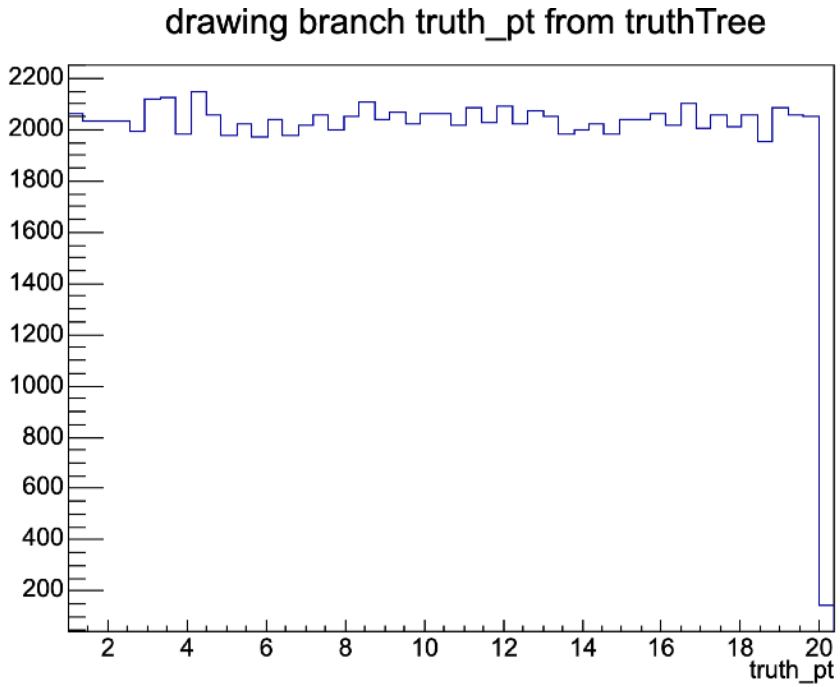
$$\rightarrow \Delta\phi(p_T) = \frac{p_0}{p_T}$$

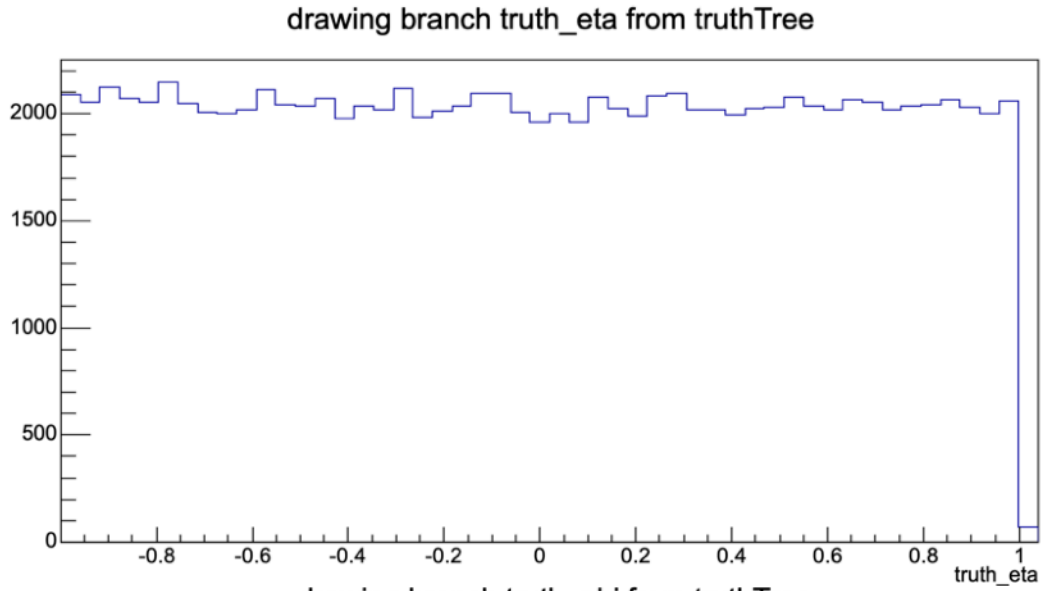
Is this function correct to use?

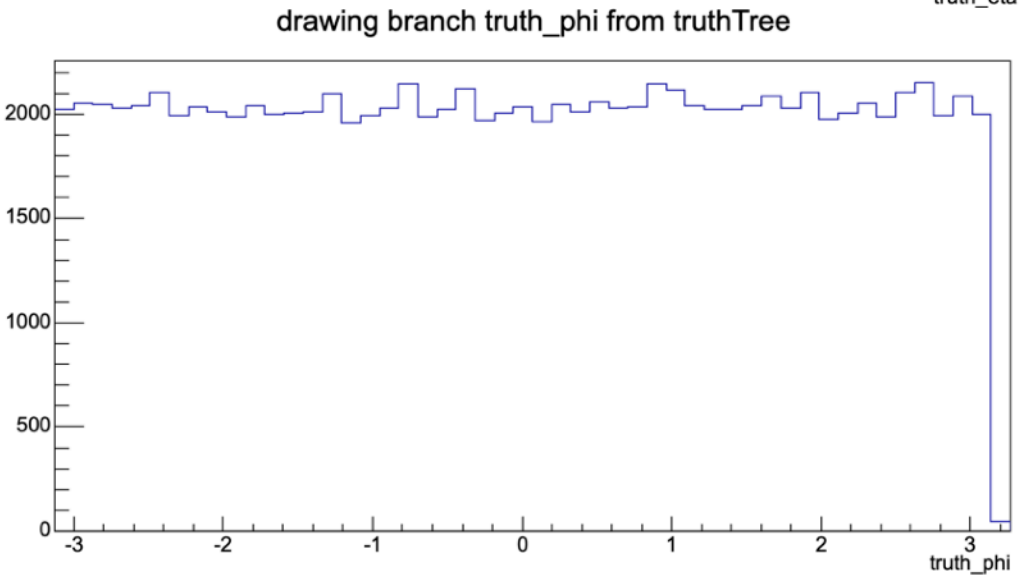
$$p_0 = -0.1922 \pm 0.003545$$

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

# Electron Simulation SetUp

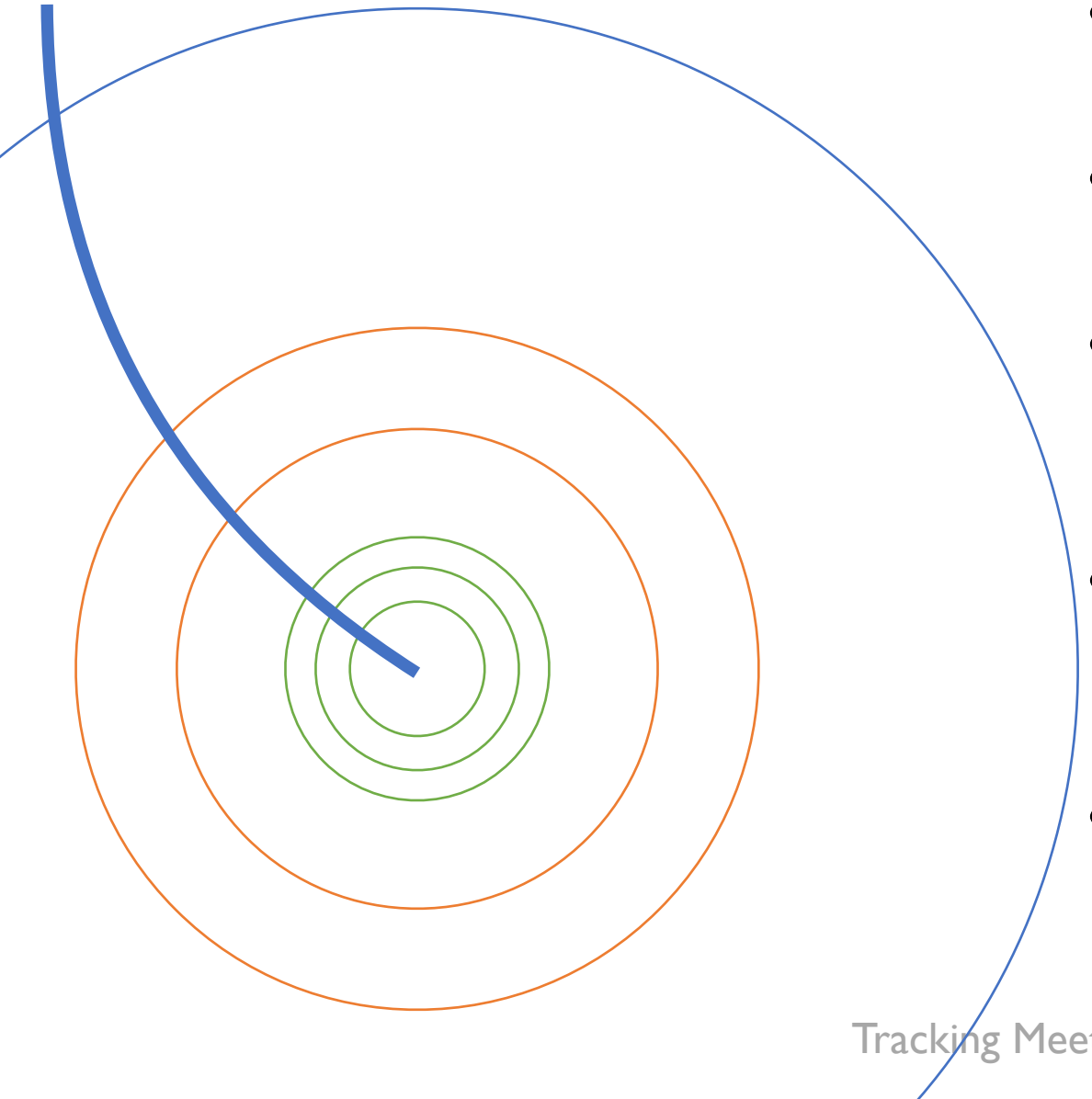


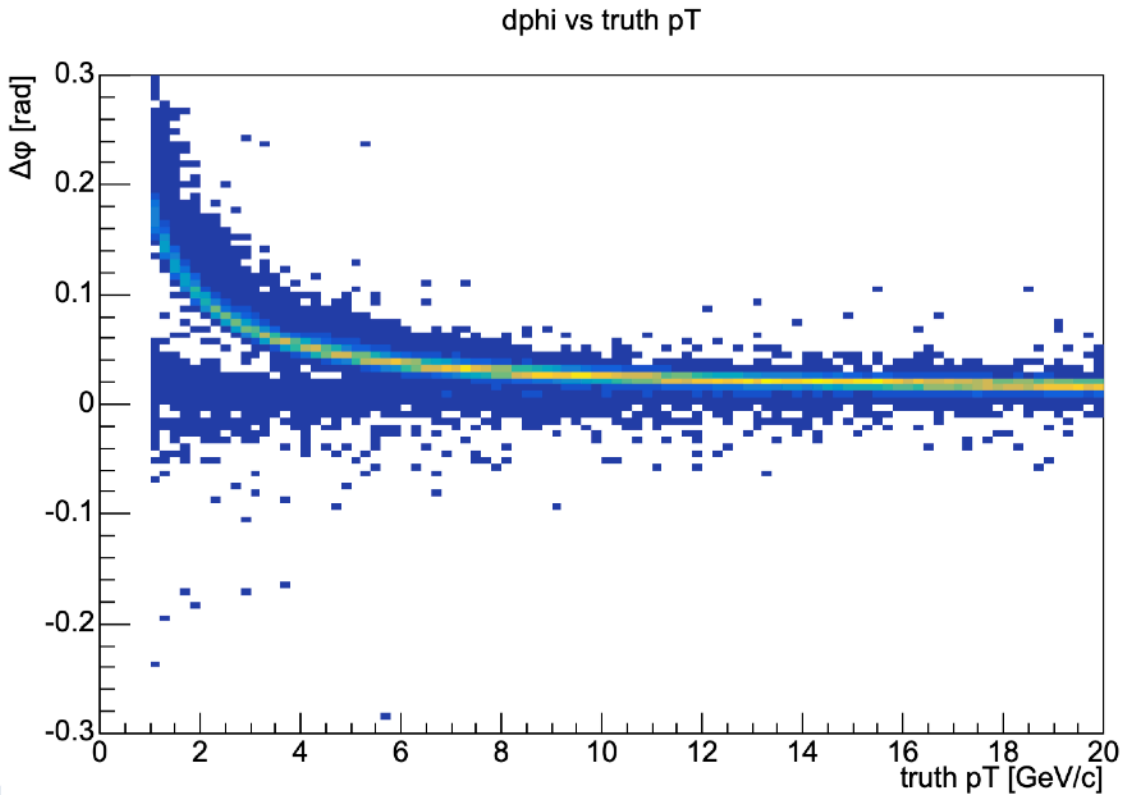

Truth pT : [1, 20] GeV/c
Truth eta : [-pi, pi] rad
Truth phi : [-1, 1] rapidity

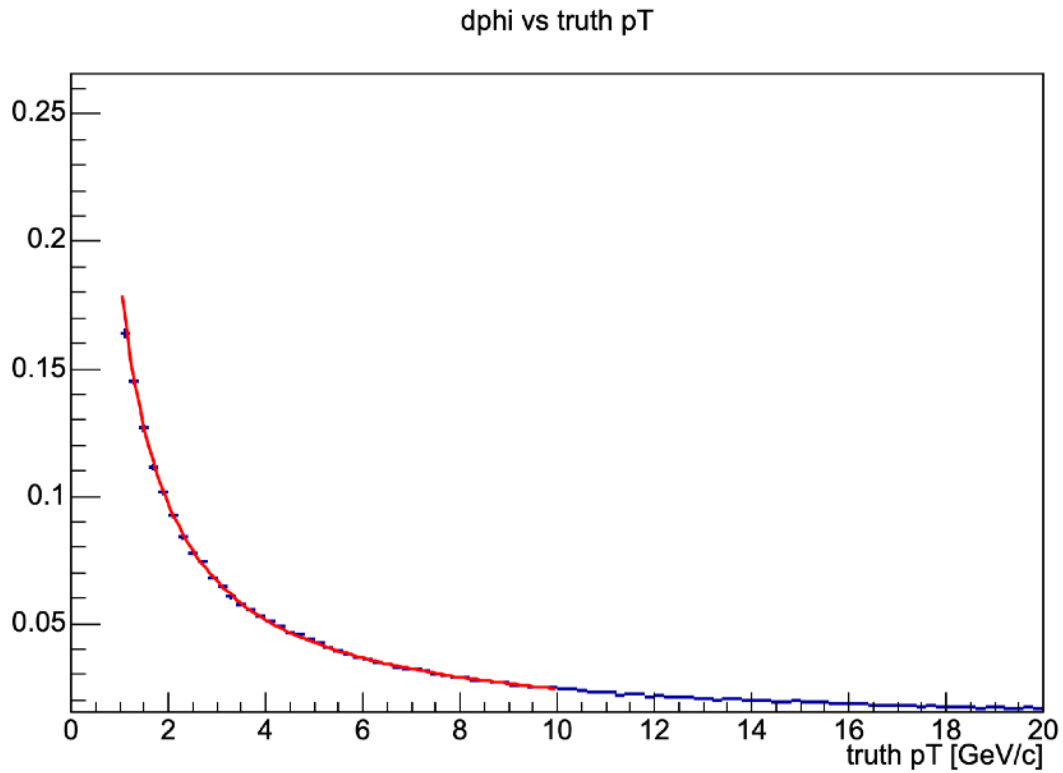
# Recap



- 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..

# dPhi-pT function electron simulation



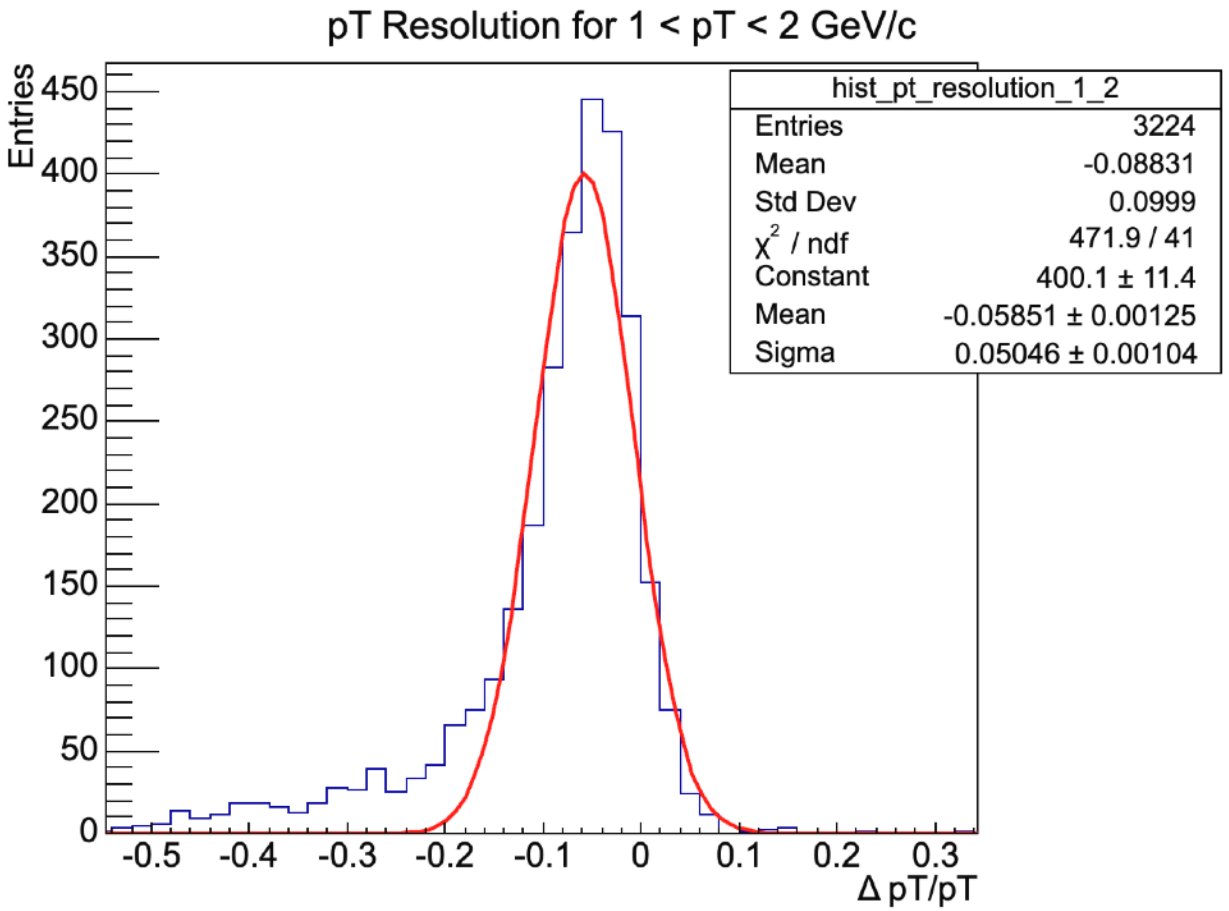




Making dphi-pT(truth) distribution -> Projection on X plane and fitting

```
**********************************************
Minimizer is Minuit2 / Migrad
Chi2                      =      38.9562
NDf                       =           43
Edm                       =  5.39605e-21
NCalls                    =           38
p0                        =   0.00644345   +/-   0.000141213
p1                        =      0.18019   +/-   0.000841162
Fitted p0 = 0.00644345 ± 0.000141213
```

Fitting Function : y(pT) = [0]+[1]/x(dphi)

# pT resolution Estimation




Fitting range fix around the peak region only

5% of pT resolution achieved.(Almost reach to goal)
pT = [1 GeV/c,2 GeV/c]
Genki's dphi resolution
at 1 GeV/c ~ 3%, at 2GeV/c ~ 3.76%
But here, dphi resolution is estimated with fixed eta

## 2nd report: Summary

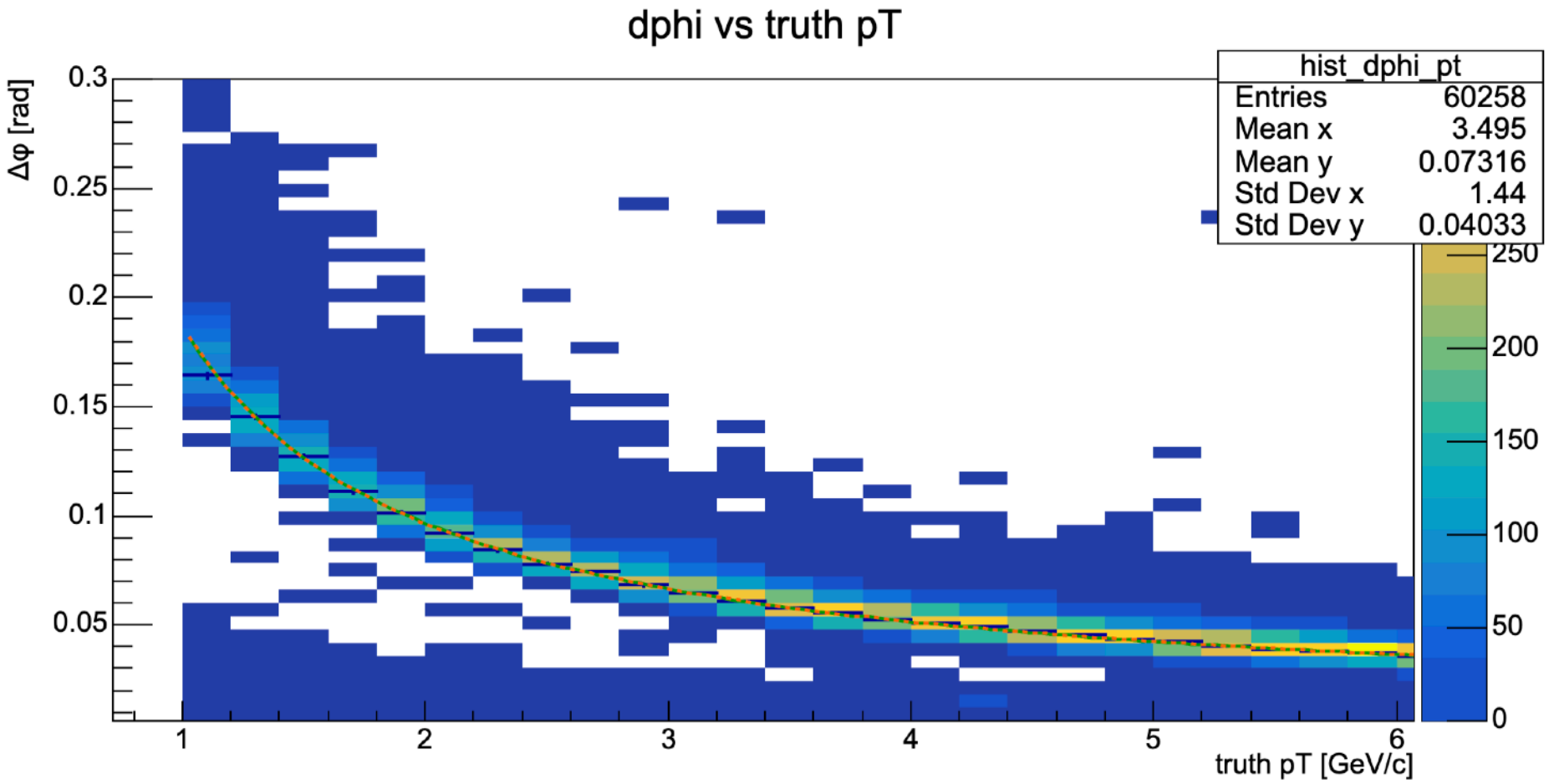
| Run | #event | Beam | Momentum (GeV/c) | φ dist (rad) | η dist | vertex (cm) | with EMCal hits asso. with beam Δφ mean (mrad) | Δφ std. dev. (mrad) | Δφ resolution (%) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 5.4E+04 | μ⁻ | 0.5 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -385.3 | 8.7 | 2.25% |
| 1 | 5.0E+04 | μ⁻ | 1 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -186.0 | 3.9 | 2.07% |
| 2 | 4.9E+04 | μ⁻ | 2 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -91.9 | 1.9 | 2.10% |
| 3 | 5.0E+04 | μ⁻ | 4 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -45.7 | 2.1 | 4.54% |
| 9 | 5.6E+04 | e⁻ | 0.5 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -392.1 | 12.3 | 3.14% |
| 5 | 5.1E+04 | e⁻ | 1 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -189.4 | 5.8 | 3.07% |
| 6 | 2.9E+04 | e⁻ | 2 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -94.3 | 3.5 | 3.76% |
| 7 | 4.1E+04 | e⁻ | 4 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -50.6 | 4.7 | 9.27% |
| 8 | 4.5E+04 | e⁻ | 8 | [-π, π] | fixed at 0 | fixed at (0, 0, 0) | -27.4 | 4.4 | 16.01% |

# pT resolution Estimation

We have to try to reduce the effect of the width from eta effect / radius effect

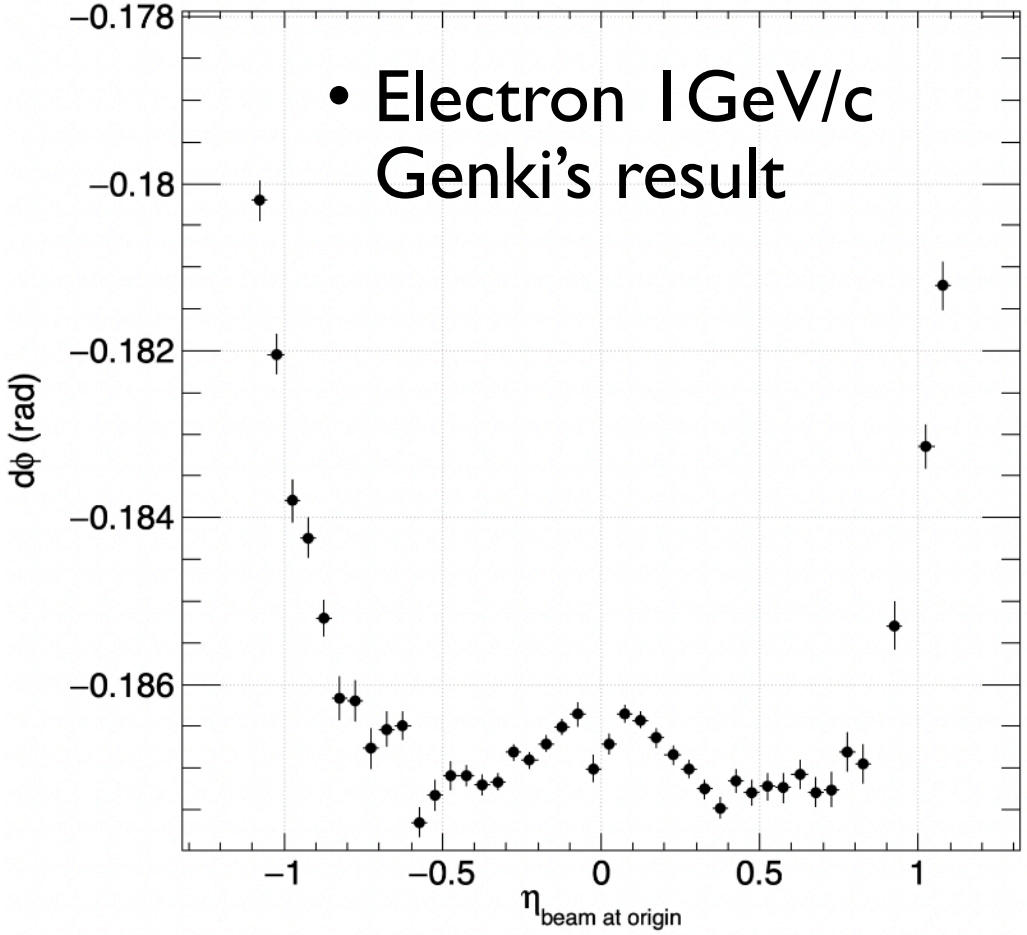
$$\Delta\phi = a + \frac{b*f(\eta)}{pT}$$

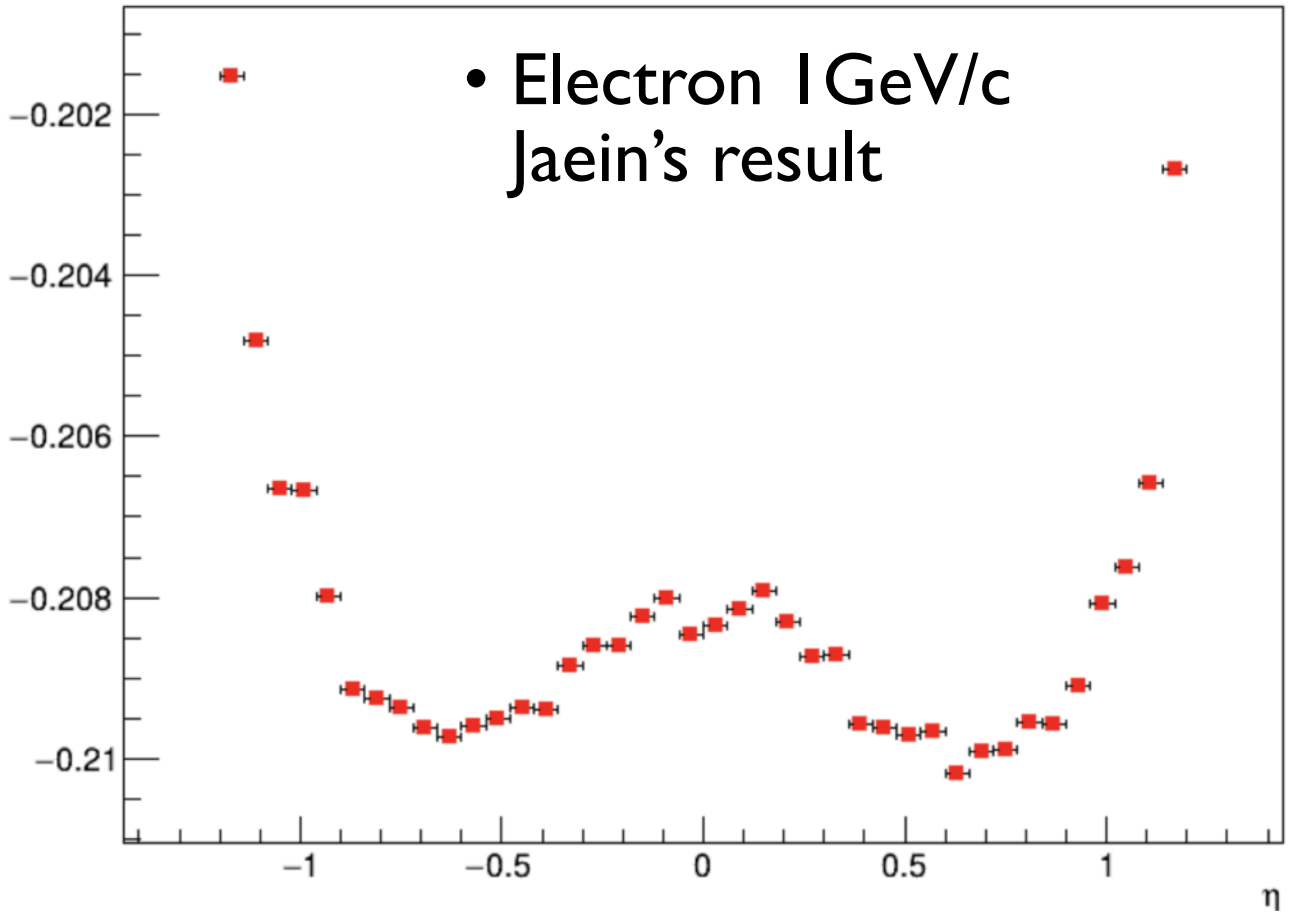
$$p_T = b * \frac{f(\eta)}{\Delta\phi - a}$$



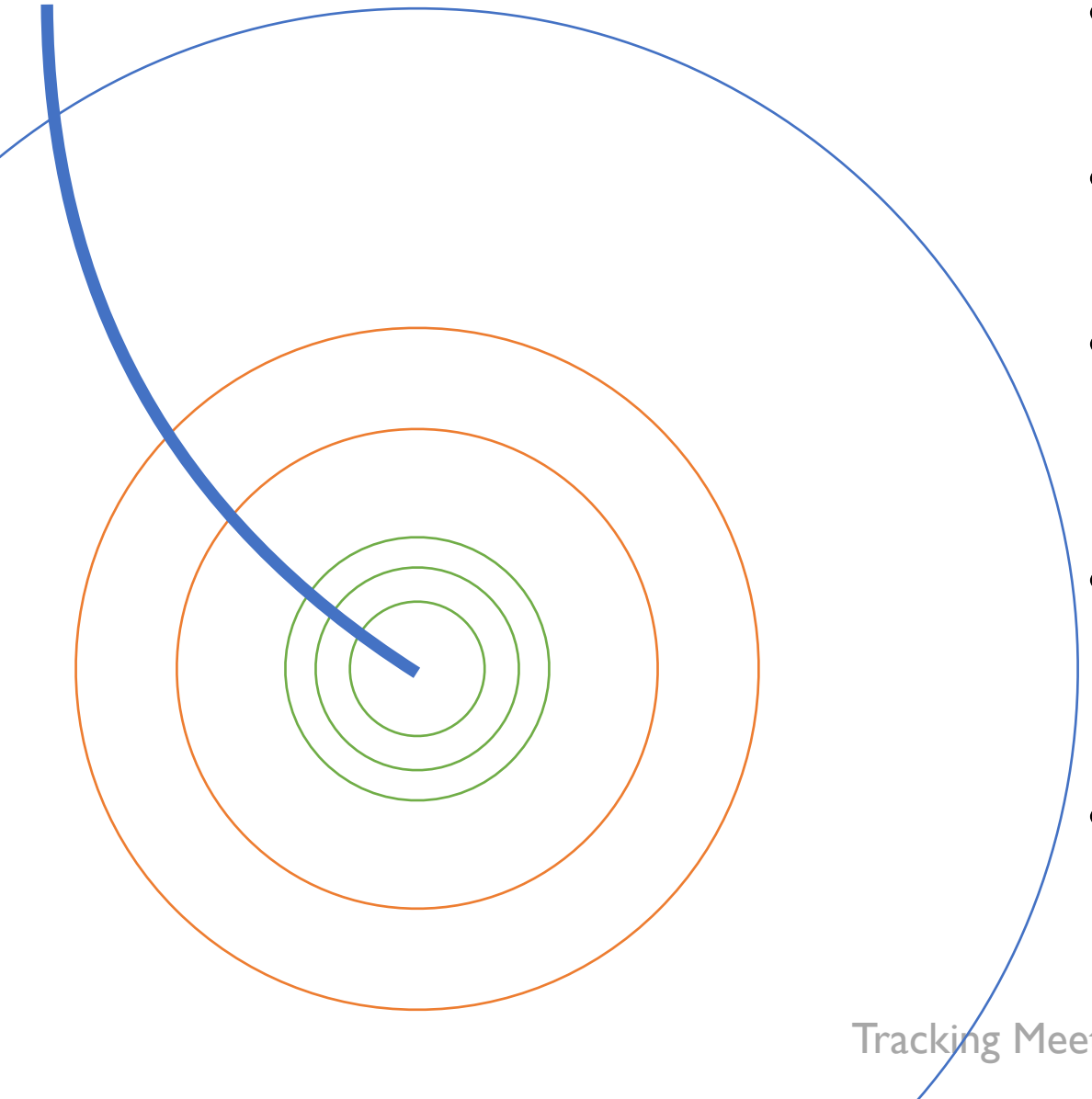
# Estimate pT resolution based on dp

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



# Recap



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# Check eta dependence of pT-dphi relation

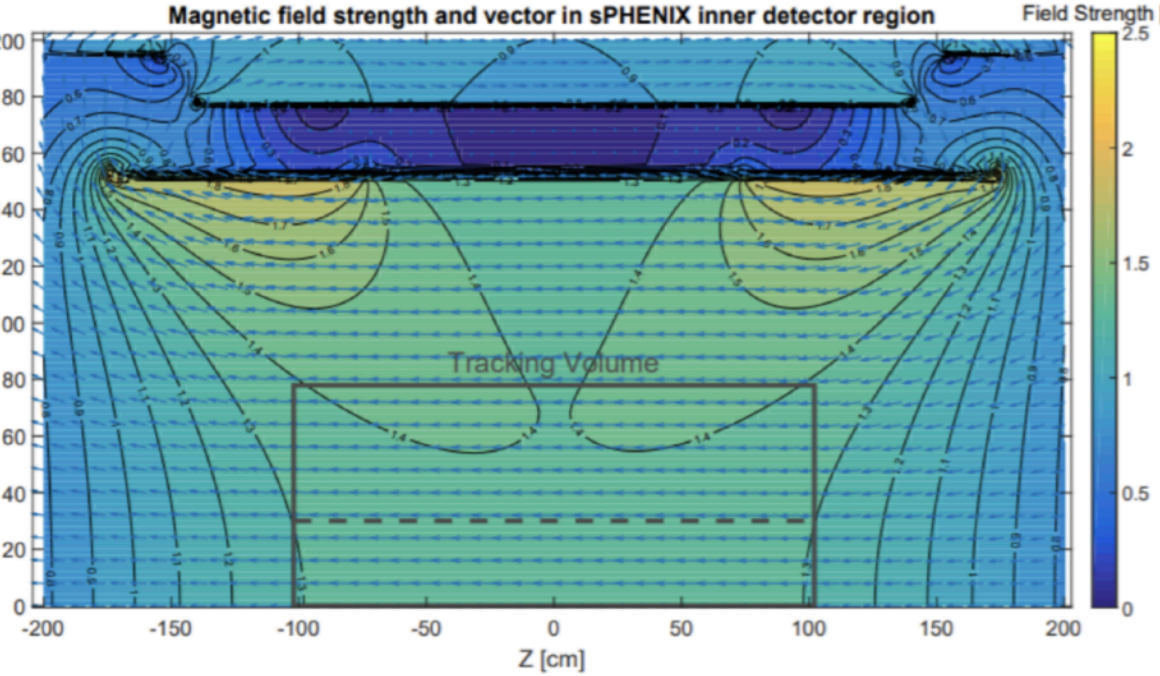
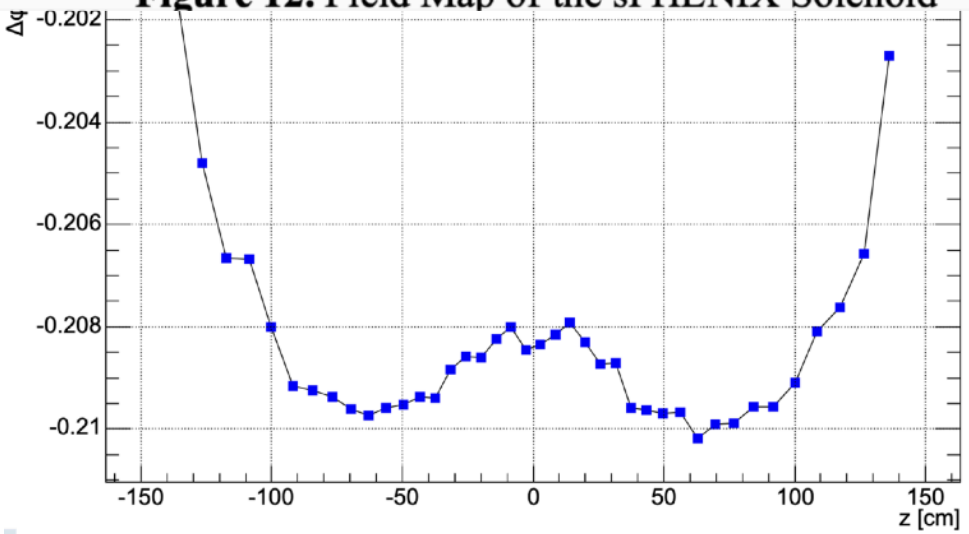
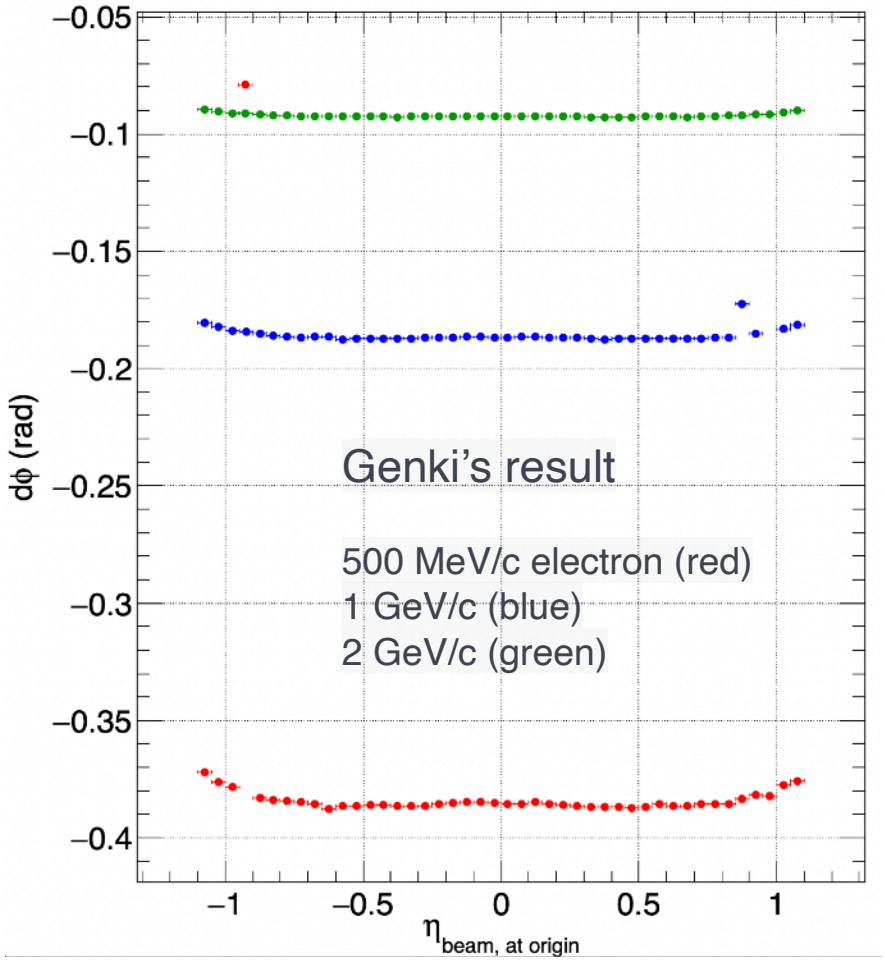


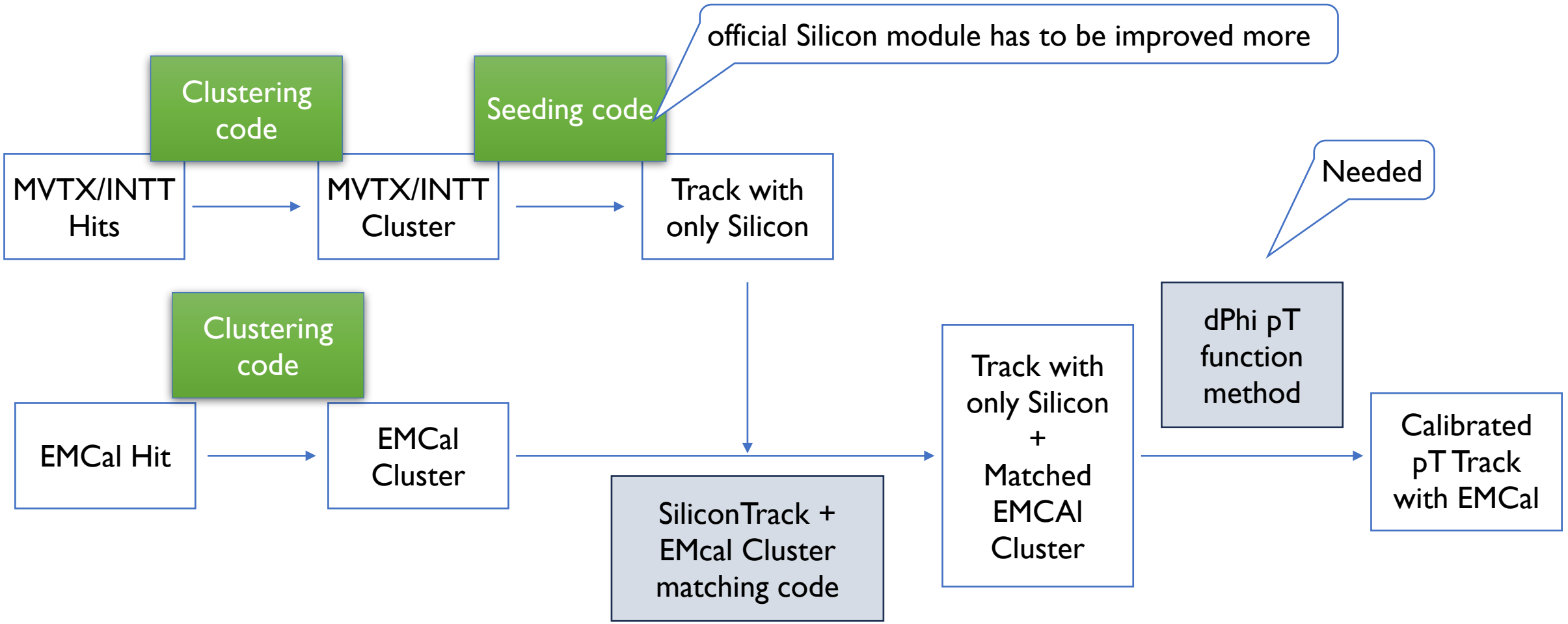

**Figure 12.** Field Map of the sPHENIX Solenoid




- Magnetic field map effect



# Macro / code framework overview



# Recap

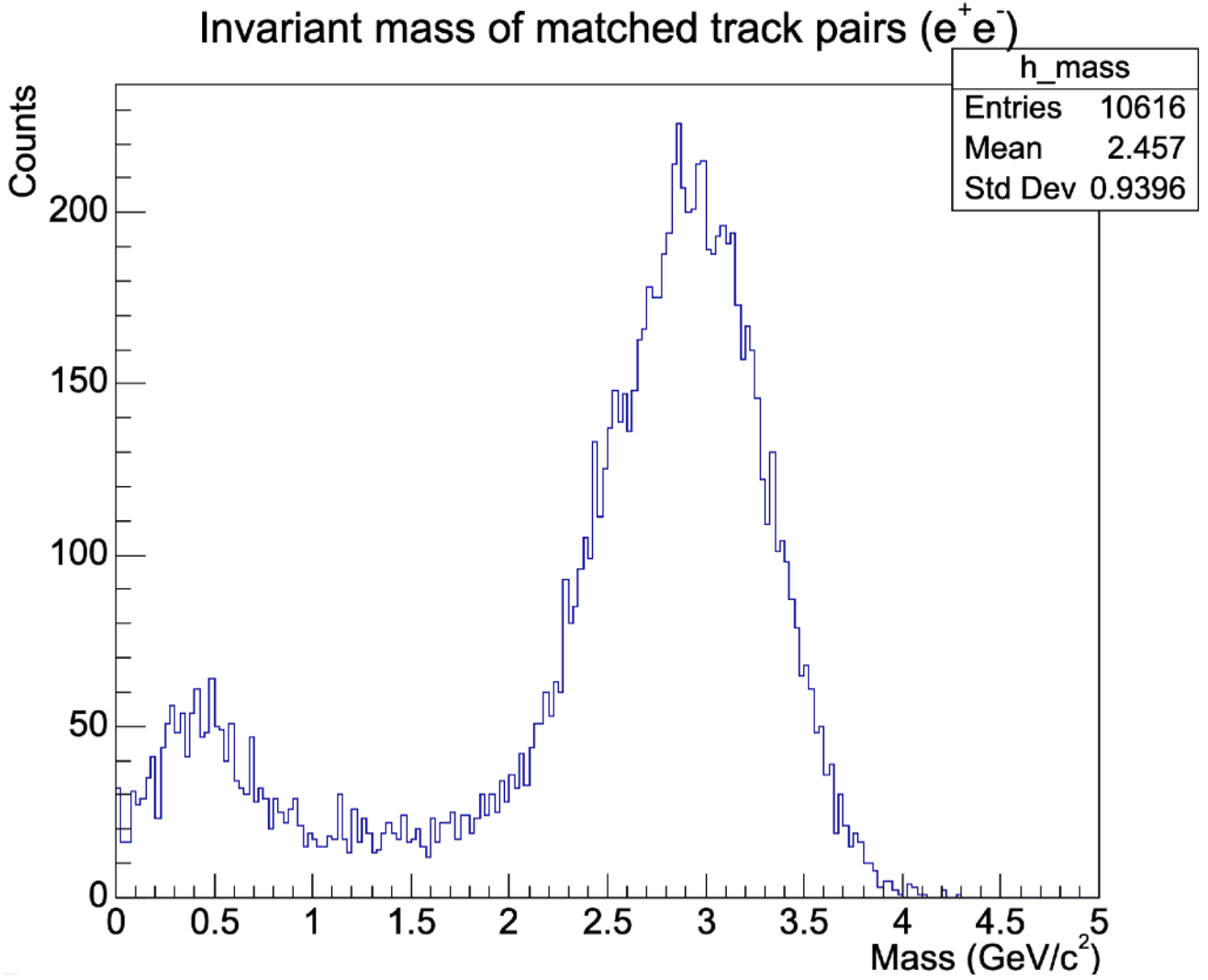
## Basic Matching criteria

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

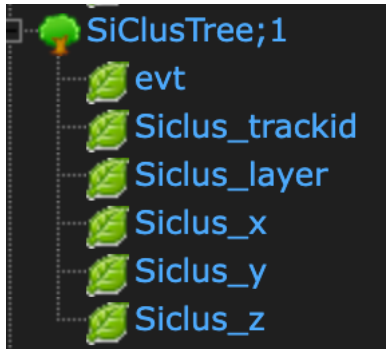
# SiliconSeedAna Output information

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

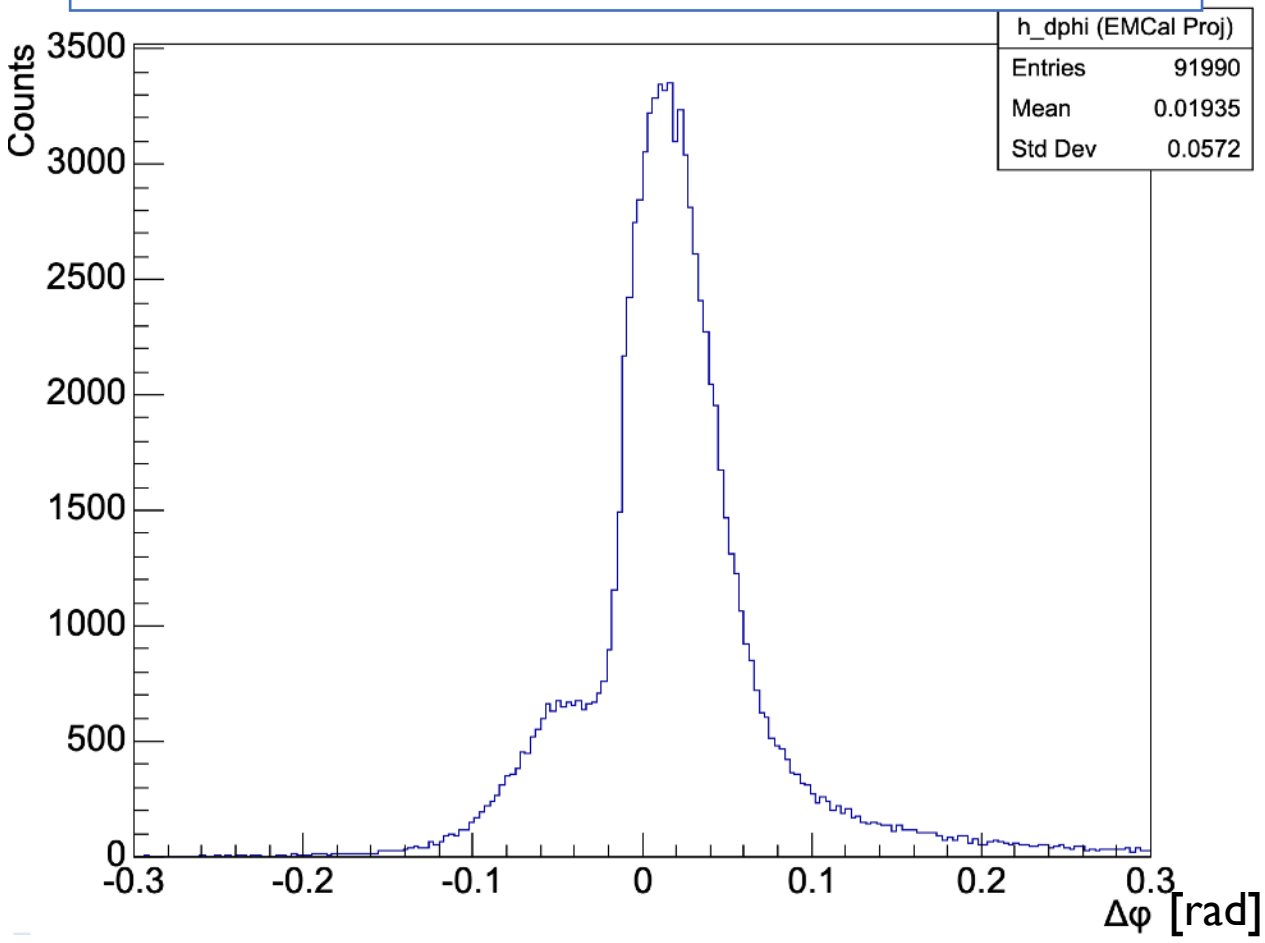

Calo cluster information (EMCal only)

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

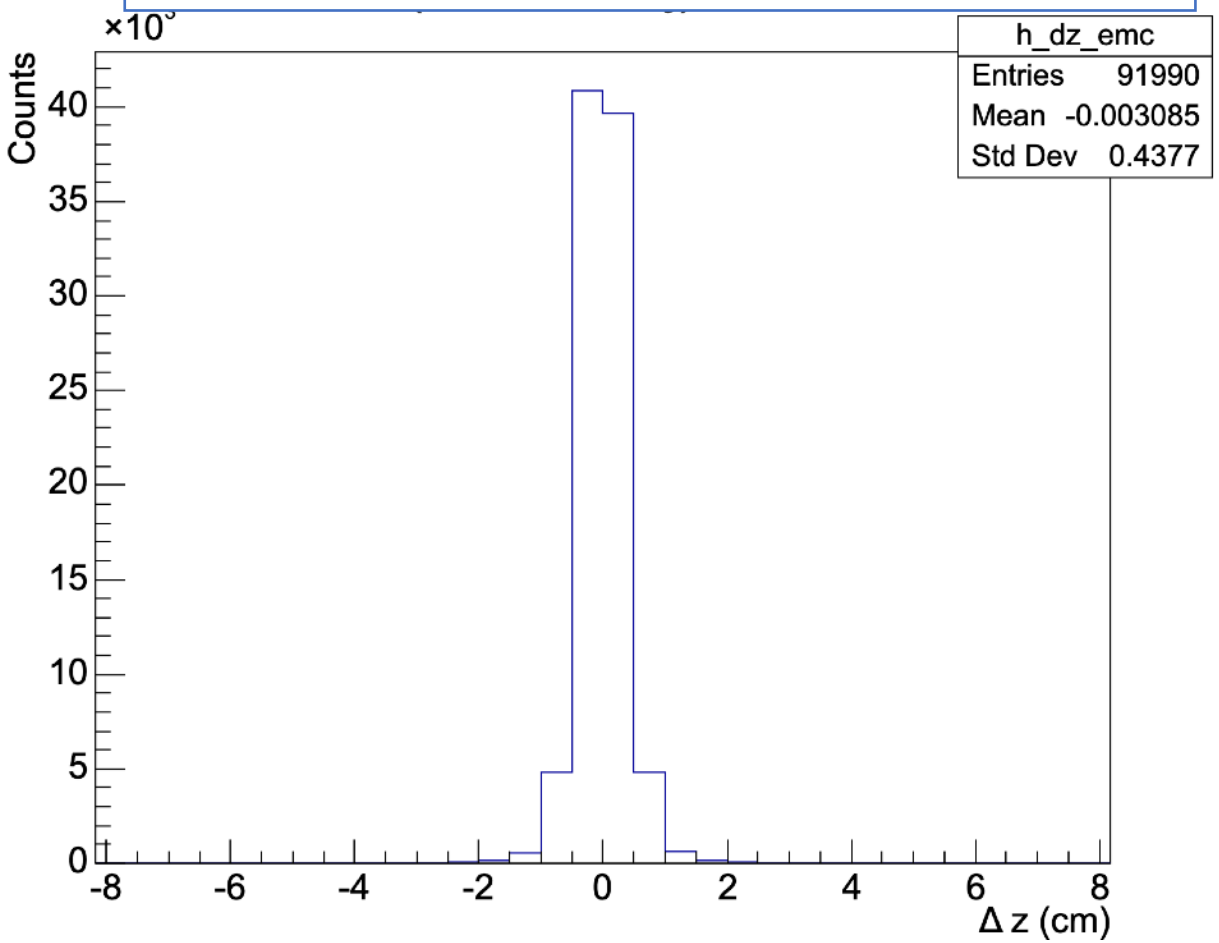
# Projection test with electron gun

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