# Database Overview

1. SimHit will tell use what set of strips were hit and this information (position, trajectory) can be used to produce centroid offsets and uncertainties.

2. SimHit Info is used with parameterized beam test data to generate centroids and offsets for each strip (e.g. X/Y). Test beam data can also be used to give the number of strips the charge spreads over (e.g. strip multiplicity)

   - Returns: $x^{rec}, y^{rec}, \sigma_x^{rec}, \sigma_y^{rec}, N_x^{strip}, N_y^{strip}$

3. Common Database contains the needed parameterized data

Workflow chart (5/14/2025):

Simulation
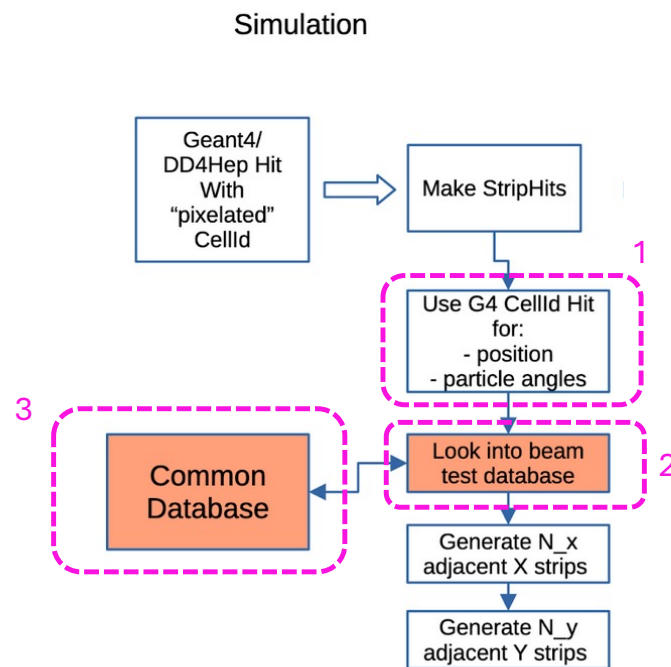
Generating Centroids Example
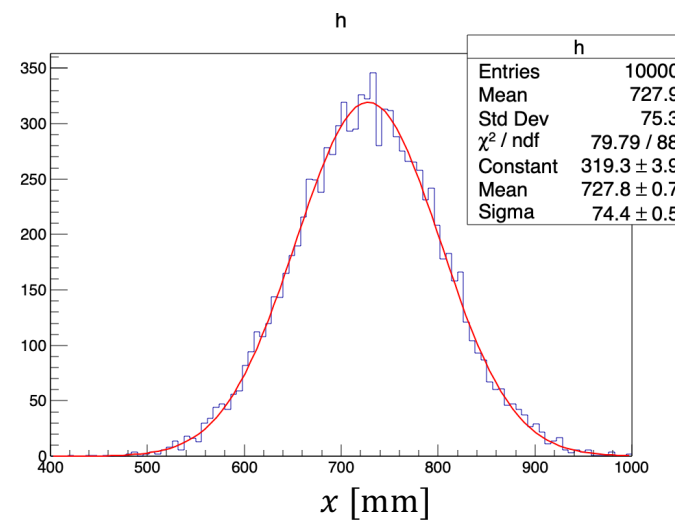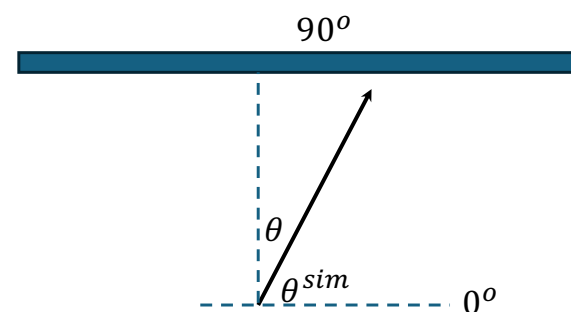
```
OuterMPGDBarrelHits = (vector<edm4hep::SimTrackerHitData>*)0x60000307de20
OuterMPGDBarrelHits.cellID = 18132059263126741056
OuterMPGDBarrelHits.eDep = 0.000001
OuterMPGDBarrelHits.time = 2.439589
OuterMPGDBarrelHits.pathLength = 3.009055
OuterMPGDBarrelHits.quality = 0
OuterMPGDBarrelHits.position.x = 727.465
OuterMPGDBarrelHits.position.y = 50.1989
OuterMPGDBarrelHits.position.z = -26.2668
OuterMPGDBarrelHits.momentum.x = 5.977343
OuterMPGDBarrelHits.momentum.y = 0.412169
OuterMPGDBarrelHits.momentum.z = -0.214823
_OuterMPGDBarrelHits_particle = (vector<podio::ObjectID>*)0x60000307e8c0
_OuterMPGDBarrelHits_particle.index = 0
_OuterMPGDBarrelHits_particle.collectionID = 2714477136
```

OuterMPGDBarrelHits
(SimHit)

$$\theta^{sim} = \tan\left(\frac{p_T}{p_Z}\right) = -87.9^o, \quad \phi^{sim} = \tan\left(\frac{p_y}{p_x}\right)$$

$$p_T = 5.99 \; GeV, \qquad x^{sim} = 727.5 \; \text{mm}$$

- Generate random Gaus(x^{sim}, σ_x) and pick and return value:

  ➢ $x^{rec} = 709.50$ mm

  ➢ $\sigma_x = 75.67$ μm

- Similar for y/ϕ

x [mm]

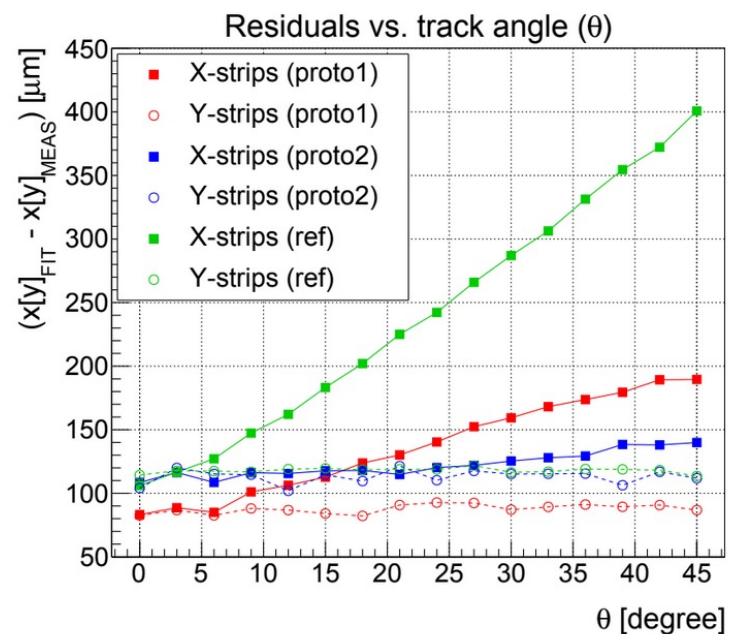| h	
Entries	10000
Mean	727.9
Std Dev	75.3
χ^2 / ndf	79.79 / 88
Constant	319.3 ± 3.9
Mean	727.8 ± 0.7
Sigma	74.4 ± 0.5

Test Beam Parameterization: Centroids

❑ SimHit will tell use what set of strips were hit and this information (position, trajectory) can be used to produce

 centroid offsets and uncertainties.

 ➢ Eyeball linear fit (proto 1):

$$\sigma[\mu m] = 70\mu m + 2.7\frac{\mu m}{deg.} \cdot |\theta[deg.]|$$

Residuals vs. track angle (θ)

Legend:
- X-strips (proto1)
- Y-strips (proto1)
- X-strips (proto2)
- Y-strips (proto2)
- X-strips (ref)
- Y-strips (ref)

y-axis: $(x[y]_{FIT} - x[y]_{MEAS})$ [μm]
x-axis: θ [degree]

Incorporating into EICrecon Framework

❑ How best to implement into simulation framework?

1. Modify MPGDTrackerDigi

2. Via algorithm (ala PID LUT)

3. A more appropriate approach?

❑ Potential S&C help with technical implementation

Workflow chart (5/14/2025):

Simulation

MPGD Detector Response

Workflow chart (5/14/2025):

Areas where S&C could help are marked in orange
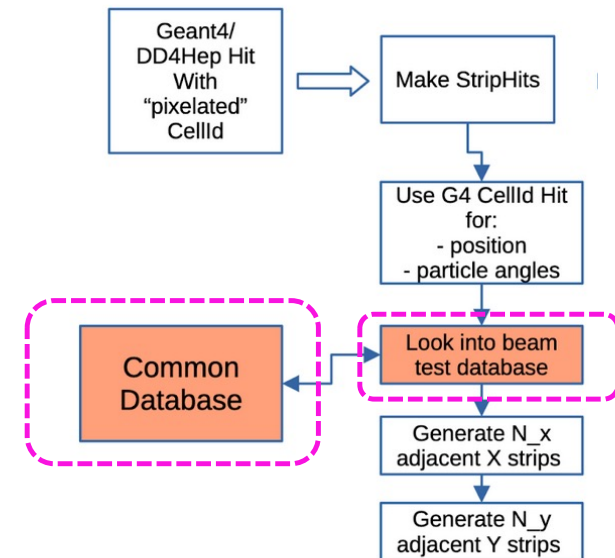
Test Beam Parameterization: Strip Multiplicity

❑ Strip multiplicity can also be parameterized and used.

  ➢ Data presents the normalized strip multiplicity, we

    would need the unnormalized version, what is the strip

    multiplicity at 0 degrees.

Normalised strip multiplicity vs. track angle (θ)

- X-strips (proto1)
- X-strips (proto2)
- X-strips (ref)
- Y-strips (proto1)
- Y-strips (proto2)
- Y-strips (ref)