# Matching with Truth Vertex and Update on Tracking Performances (Realistic Seeding)

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# MC Vertex (Single Particle)

epic_craterlake_tracking_only.xml

Single pi+ generated in each event

Generated status 1 for primary particles

Particle gun

| EventNo | TrackId | Vx | Vy | Vz | generatorStatus | PDG |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 1 | 211 |
| 1 | 0 | 0 | 0 | 0 | 1 | 211 |
| 2 | 0 | 0 | 0 | 0 | 1 | 211 |
| 3 | 0 | 0 | 0 | 0 | 1 | 211 |
| 4 | 0 | 0 | 0 | 0 | 1 | 211 |
| 4 | 1 | 30.309367 | 8.3227010 | -10.04410 | 0 | 11 |
| 4 | 2 | 21.218572 | -22.60151 | -557.7210 | 0 | 22 |
| 5 | 0 | 0 | 0 | 0 | 1 | 211 |
| 6 | 0 | 0 | 0 | 0 | 1 | 211 |
| 7 | 0 | 0 | 0 | 0 | 1 | 211 |
| 8 | 0 | 0 | 0 | 0 | 1 | 211 |
| 9 | 0 | 0 | 0 | 0 | 1 | 211 |
| 10 | 0 | 0 | 0 | 0 | 1 | 211 |
| 10 | 1 | 33.243014 | -7.367120 | -235.2024 | 0 | 11 |

# Pythia Simulation File (December Campaign)

pythia8NCDIS_18x275_minQ2=1000_beamEffects_xAngle=-0.025_hiDiv_1.0000.eicrecon.tree.edm4eic.root

| Event No | TracksId | Vx | Vy | Vz | generatorStatus | PDG |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 4 | 2212 |
| 0 | 1 | -0.004803 | -0.021076 | -37.79402 | 61 | 2 |
| 0 | 2 | -0.004803 | -0.021076 | -37.79402 | 63 | 2101 |
| 0 | 3 | 0 | 0 | 0 | 4 | 11 |
| 0 | 4 | -0.004803 | -0.021076 | -37.79402 | 21 | 11 |
| 0 | 5 | -0.004803 | -0.021076 | -37.79402 | 21 | 2 |
| 0 | 6 | -0.004803 | -0.021076 | -37.79402 | 23 | 2 |
| 0 | 7 | -0.004803 | -0.021076 | -37.79402 | 62 | 2 |
| 0 | 8 | -0.004803 | -0.021076 | -37.79402 | 1 | 211 |
| 0 | 9 | -0.004803 | -0.021076 | -37.79402 | 1 | -211 |
| 0 | 10 | -0.004803 | -0.021076 | -37.79402 | 2 | 213 |
| 0 | 11 | -0.004803 | -0.021076 | -37.79402 | 2 | 111 |
| 0 | 12 | -0.004803 | -0.021076 | -37.79402 | 1 | -211 |
| 0 | 13 | -0.004803 | -0.021076 | -37.79402 | 2 | 3222 |
| 0 | 14 | -0.004803 | -0.021076 | -37.79402 | 2 | -3222 |
| 0 | 15 | -0.004803 | -0.021076 | -37.79402 | 2 | 221 |
| 0 | 16 | -0.004803 | -0.021076 | -37.79402 | 1 | 2212 |
| 0 | 17 | -0.004803 | -0.021076 | -37.79402 | 1 | 11 |
| 0 | 18 | -0.004803 | -0.021076 | -37.79402 | 1 | 211 |
| 0 | 19 | -0.004803 | -0.021076 | -37.79402 | 2 | 111 |
| 0 | 20 | -0.004908 | -0.021123 | -37.79359 | 1 | 22 |
| 0 | 21 | -0.004908 | -0.021123 | -37.79359 | 1 | 22 |
| 0 | 22 | -10.55645 | 4.3327749 | 112.02846 | 1 | 2112 |
| 0 | 23 | -10.55645 | 4.3327749 | 112.02846 | 1 | 211 |
| 0 | 24 | -11.30032 | -7.610446 | 192.86719 | 1 | -2212 |
| 0 | 25 | -11.30032 | -7.610446 | 192.86719 | 2 | 111 |
| 0 | 26 | -0.004803 | -0.021076 | -37.79401 | 1 | 211 |
| 0 | 27 | -0.004803 | -0.021076 | -37.79401 | 1 | -211 |
| 0 | 28 | -0.004803 | -0.021076 | -37.79401 | 2 | 111 |
| 0 | 29 | -0.004996 | -0.021092 | -37.79354 | 1 | 22 |
| 0 | 30 | -0.004996 | -0.021092 | -37.79354 | 1 | 22 |
| 0 | 31 | -11.30054 | -7.610637 | 192.87125 | 1 | 22 |
| 0 | 32 | -11.30054 | -7.610637 | 192.87125 | 1 | 22 |
| 0 | 33 | -0.004857 | -0.021074 | -37.79165 | 1 | 22 |
| 0 | 34 | -0.004857 | -0.021074 | -37.79165 | 1 | 22 |
| 1 | 0 | 0 | 0 | 0 | 4 | 2212 |

PYTHIA sim+Particle gun

## Event No 0

**We can loop over all particles and find the $V_x$, $V_y$, $V_z$ common to few particles: It will increase extra computing power (better way to fill in the status code from Pythia)**

# Pythia Simulation File (December Campaign)

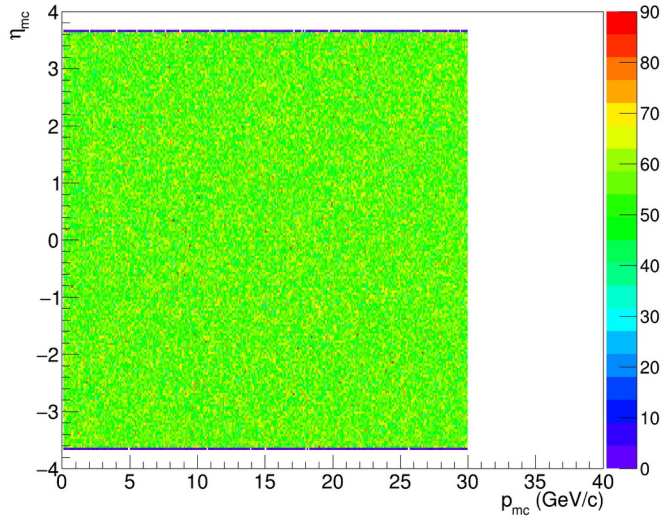
```
 2 *       0 *         0 *         0 *         0 *         4 *      2212 *
 2 *       1 * 0.0597330 * -0.014292 * 10.548336 *        61 *         2 *
 2 *       2 * 0.0597330 * -0.014292 * 10.548336 *        63 *      2101 *
 2 *       3 *         0 *         0 *         0 *         4 *        11 *
 2 *       4 * 0.0597330 * -0.014292 * 10.548336 *        42 *        11 *
 2 *       5 * 0.0597330 * -0.014292 * 10.548336 *        41 *         2 *
 2 *       6 * 0.0597330 * -0.014292 * 10.548336 *        71 *      2101 *
 2 *       7 * 0.0597330 * -0.014292 * 10.548336 *        42 *        11 *
 2 *       8 * 0.0597330 * -0.014292 * 10.548336 *        41 *         2 *
 2 *       9 * 0.0597330 * -0.014292 * 10.548336 *        43 *        21 *
 2 *      10 * 0.0597330 * -0.014292 * 10.548336 *        51 *        21 *
 2 *      11 * 0.0597330 * -0.014292 * 10.548336 *        52 *        21 *
 2 *      12 * 0.0597330 * -0.014292 * 10.548336 *        62 *        21 *
 2 *      13 * 0.0597330 * -0.014292 * 10.548336 *        71 *        21 *
 2 *      14 * 0.0597330 * -0.014292 * 10.548336 *        51 *        21 *
 2 *      15 * 0.0597330 * -0.014292 * 10.548336 *        51 *        21 *
 2 *      16 * 0.0597330 * -0.014292 * 10.548336 *        51 *        21 *
 2 *      17 * 0.0597330 * -0.014292 * 10.548336 *        62 *        21 *
 2 *      18 * 0.0597330 * -0.014292 * 10.548336 *        71 *        21 *
 2 *      19 * 0.0597330 * -0.014292 * 10.548336 *        51 *        21 *
 2 *      20 * 0.0597330 * -0.014292 * 10.548336 *        62 *        21 *
 2 *      21 * 0.0597330 * -0.014292 * 10.548336 *        71 *        21 *
 2 *      22 * 0.0597330 * -0.014292 * 10.548336 *        51 *        21 *
 2 *      23 * 0.0597330 * -0.014292 * 10.548336 *        62 *        21 *
 2 *      24 * 0.0597330 * -0.014292 * 10.548336 *        71 *        21 *
 2 *      25 * 0.0597330 * -0.014292 * 10.548336 *        43 *        21 *
 2 *      26 * 0.0597330 * -0.014292 * 10.548336 *        44 *        21 *
 2 *      27 * 0.0597330 * -0.014292 * 10.548336 *        52 *        21 *
 2 *      28 * 0.0597330 * -0.014292 * 10.548336 *        52 *        21 *
 2 *      29 * 0.0597330 * -0.014292 * 10.548336 *        62 *        21 *
 2 *      30 * 0.0597330 * -0.014292 * 10.548336 *        71 *        21 *
 2 *      31 * 0.0597330 * -0.014292 * 10.548336 *        21 *         2 *
 2 *      32 * 0.0597330 * -0.014292 * 10.548336 *        21 *        11 *
 2 *      33 * 0.0597330 * -0.014292 * 10.548336 *        23 *         2 *
 2 *      34 * 0.0597330 * -0.014292 * 10.548336 *        23 *        11 *--
 2 *      35 * 0.0597330 * -0.014292 * 10.548336 *        44 *         2 *
 2 *      36 * 0.0597330 * -0.014292 * 10.548336 *        44 *         2 *
 2 *      37 * 0.0597330 * -0.014292 * 10.548336 *        62 *         2 *
 2 *      38 * 0.0597330 * -0.014292 * 10.548336 *        71 *         2 *
 2 *      39 * 0.0597330 * -0.014292 * 10.548336 *         1 *       211 *
 2 *      40 * 0.0597330 * -0.014292 * 10.548336 *         2 *       221 *
 2 *      41 * 0.0597330 * -0.014292 * 10.548336 *         1 *      -211 *
 2 *      42 * 0.0597330 * -0.014292 * 10.548336 *         2 *       111 *
```

**Event 2**

```
 2 *      43 * 0.0597330 * -0.014292 * 10.548336 *         2 *       213 *
 2 *      44 * 0.0597330 * -0.014292 * 10.548336 *         1 *      -211 *
 2 *      45 * 0.0597330 * -0.014292 * 10.548336 *         2 *       111 *
 2 *      46 * 0.0597330 * -0.014292 * 10.548336 *         1 *       211 *
 2 *      47 * 0.0597330 * -0.014292 * 10.548336 *         1 *      -211 *
 2 *      48 * 0.0597330 * -0.014292 * 10.548336 *         2 *       113 *
 2 *      49 * 0.0597330 * -0.014292 * 10.548336 *         2 *       223 *
 2 *      50 * 0.0597330 * -0.014292 * 10.548336 *         2 *       113 *
 2 *      51 * 0.0597330 * -0.014292 * 10.548336 *         2 *       223 *
 2 *      52 * 0.0597330 * -0.014292 * 10.548336 *         1 *       211 *
 2 *      53 * 0.0597330 * -0.014292 * 10.548336 *         1 *      2112 *
 2 *      54 * 0.0597330 * -0.014292 * 10.548336 *         2 *       223 *
 2 *      55 * 0.0597330 * -0.014292 * 10.548336 *        44 *        11 *
 2 *      56 * 0.0597341 * -0.014291 * 10.548337 *         2 *       111 *
 2 *      57 * 0.0597341 * -0.014291 * 10.548337 *         2 *       111 *
 2 *      58 * 0.0597341 * -0.014291 * 10.548337 *         2 *       111 *
 2 *      59 * 0.0601034 * -0.014057 * 10.548618 *         1 *        22 *
 2 *      60 * 0.0601034 * -0.014057 * 10.548618 *         1 *        22 *
 2 *      61 * 0.0597330 * -0.014292 * 10.548336 *         1 *       211 *
 2 *      62 * 0.0597330 * -0.014292 * 10.548336 *         2 *       111 *
 2 *      63 * 0.0599230 * -0.014132 * 10.548549 *         1 *        22 *
 2 *      64 * 0.0599230 * -0.014132 * 10.548549 *         1 *        22 *
 2 *      65 * 0.0597330 * -0.014292 * 10.548336 *         1 *       211 *
 2 *      66 * 0.0597330 * -0.014292 * 10.548336 *         1 *      -211 *
 2 *      67 * 0.0597330 * -0.014292 * 10.548336 *         1 *       211 *
 2 *      68 * 0.0597330 * -0.014292 * 10.548336 *         1 *      -211 *
 2 *      69 * 0.0597330 * -0.014292 * 10.548336 *         2 *       111 *
 2 *      70 * 0.0597330 * -0.014292 * 10.548336 *         1 *       211 *
 2 *      71 * 0.0597330 * -0.014292 * 10.548336 *         1 *      -211 *
 2 *      72 * 0.0597330 * -0.014292 * 10.548336 *         1 *       211 *
 2 *      73 * 0.0597330 * -0.014292 * 10.548336 *         1 *      -211 *
 2 *      74 * 0.0597330 * -0.014292 * 10.548336 *         2 *       111 *
 2 *      75 * 0.0597330 * -0.014292 * 10.548336 *         2 *       111 *
 2 *      76 * 0.0597330 * -0.014292 * 10.548336 *         1 *        22 *
 2 *      77 * 0.0597330 * -0.014292 * 10.548336 *         1 *        11 *
 2 *      78 * 0.0599422 * -0.013997 * 10.548572 *         1 *        22 *
 2 *      79 * 0.0599422 * -0.013997 * 10.548572 *         1 *        22 *
 2 *      80 * 0.0597915 * -0.014220 * 10.548390 *         1 *        22 *
 2 *      81 * 0.0597915 * -0.014220 * 10.548390 *         1 *        22 *
 2 *      82 * 0.0597949 * -0.014212 * 10.548403 *         1 *        22 *
 2 *      83 * 0.0597949 * -0.014212 * 10.548403 *         1 *        22 *
 2 *      84 * 0.0616474 * -0.011814 * 10.550267 *         1 *        22 *
 2 *      85 * 0.0616474 * -0.011814 * 10.550267 *         1 *        22 *
 2 *      86 * 0.0597496 * -0.014287 * 10.548355 *         1 *        22 *
 2 *      87 * 0.0597496 * -0.014287 * 10.548355 *         1 *        22 *
 2 *      88 * 0.0597209 * -0.014275 * 10.548851 *         1 *        22 *
 2 *      89 * 0.0597209 * -0.014275 * 10.548851 *         1 *        22 *
 2 *      90 * 0.0592819 * -0.014040 * 10.563678 *         1 *        22 *
 2 *      91 * 0.0592819 * -0.014040 * 10.563678 *         1 *        22 *
```

# Update on Tracking Performances (Realistic Seeding)

- Simulation of $\pi^+$ completed for momentum [0.1,30.] GeV/c and η [-3.5,3.5]

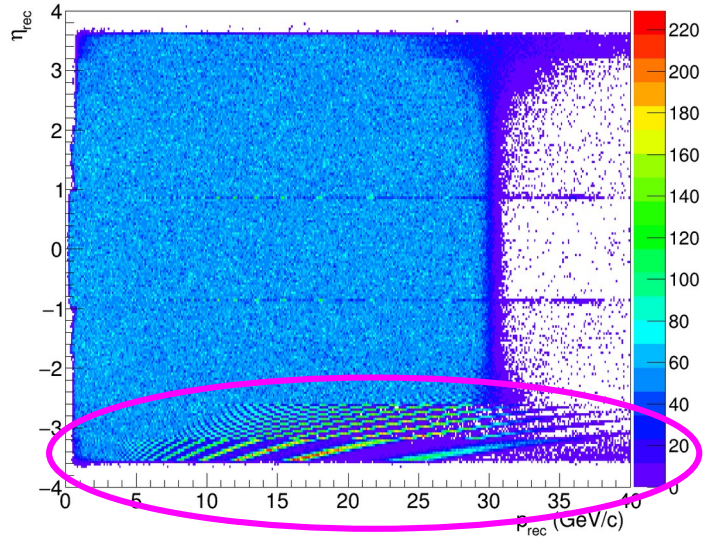


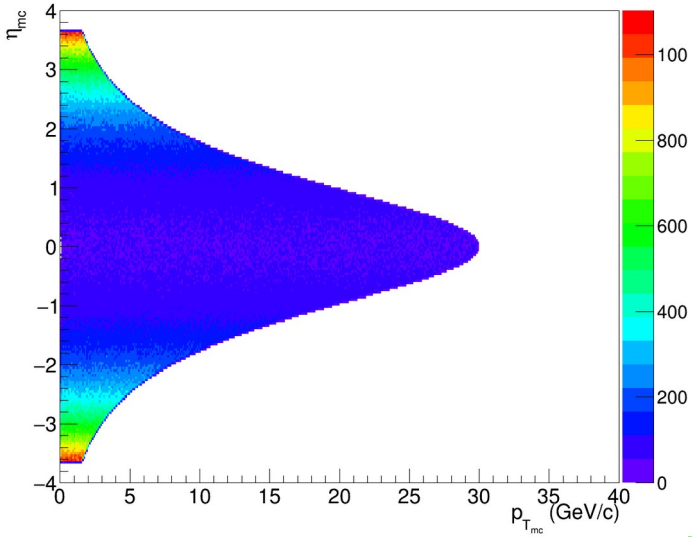

**Structures reported previously**

$$\eta = -\ln[\tan(\theta/2)]$$

$$pz = p\cos(\theta)$$

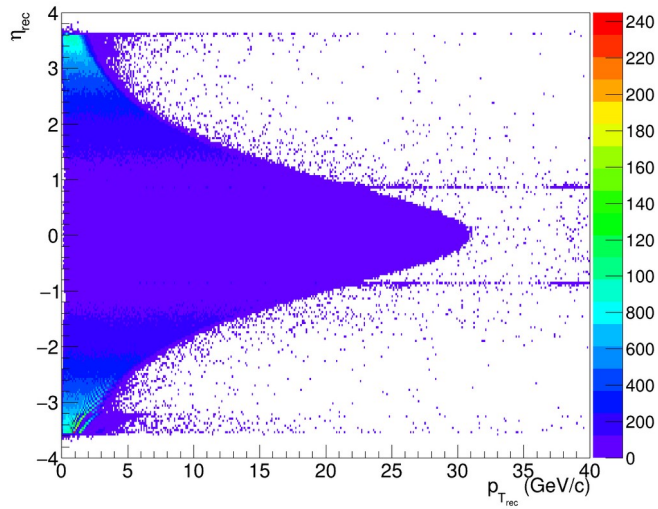
**etamc** = -1.0*TMath::Log(TMath::Tan((TMath::ACos(pz_mc[iParticle]/pmc))/2));




**etarec** = -1.0*TMath::Log(TMath::Tan((TMath::ACos(pz_rec[iParticle]/prec))/2));

I am debugging it



# Matching Flag for Realistic Seeding

Matching Flag for realistic seeding: ReconstructedSeededChargedParticles.type

**Momentum Resolution**

```
root [1] events->Scan("ReconstructedSeededChargedParticles.type")
**********************************
*    Event No   * Track * Type *
**********************************
*        0 *         0 *         0 *
*        0 *         1 *        -1 *
*        0 *         2 *        -1 *
*        0 *         3 *        -1 *
*        1 *         0 *         0 *
*        1 *         1 *        -1 *
*        2 *         0 *         0 *
*        2 *         1 *        -1 *
*        2 *         2 *        -1 *
*        2 *         3 *        -1 *
*        2 *         4 *        -1 *
*        3 *         0 *         0 *
*        3 *         1 *        -1 *
*        4 *         0 *         0 *
*        4 *         1 *        -1 *
*        4 *         2 *        -1 *
*        5 *         0 *         0 *
*        5 *         1 *        -1 *
*        5 *         2 *        -1 *
*        5 *         3 *        -1 *
*        6 *         0 *         0 *
*        6 *         1 *        -1 *
*        6 *         2 *        -1 *
*        6 *         3 *        -1 *
*        6 *         4 *        -1 *
*        7 *         0 *         0 *
*        7 *         1 *        -1 *
*        7 *         2 *        -1 *
*        8 *         0 *         0 *
*        8 *         1 *        -1 *
*        9 *         0 *         0 *
*        9 *         1 *        -1 *
*        9 *         2 *        -1 *
*       10 *         0 *         0 *
*       10 *         1 *        -1 *
*       10 *         2 *        -1 *
*       11 *         0 *         0 *
*       11 *         1 *        -1 *
*       11 *         2 *        -1 *
*       12 *         0 *         0 *
*       12 *         1 *        -1 *
*       12 *         2 *        -1 *
*       13 *         0 *         0 *
*       13 *         1 *        -1 *
*       13 *         2 *        -1 *
*       13 *         3 *        -1 *
*       14 *         0 *         0 *
*       14 *         1 *        -1 *
*       14 *         2 *        -1 *
```

Matched track flaged with 0

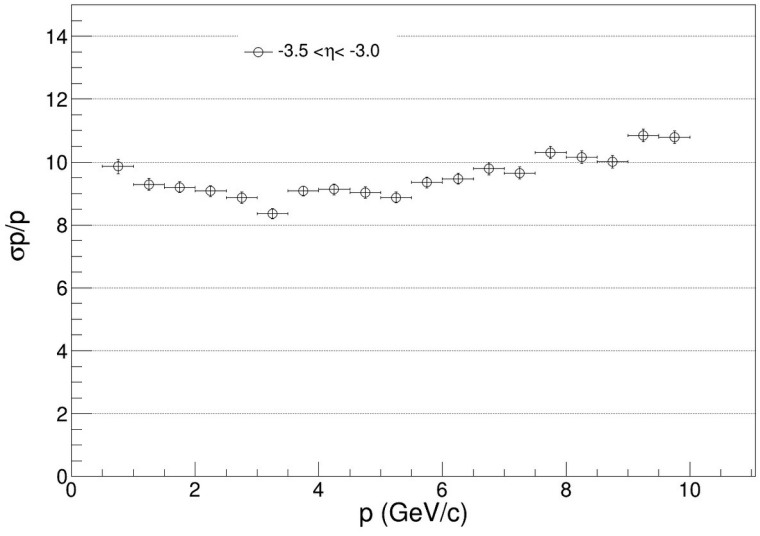
Are we storing only matched track here ? Will confirm it

**Transverse and Longitudinal pointing resolution**

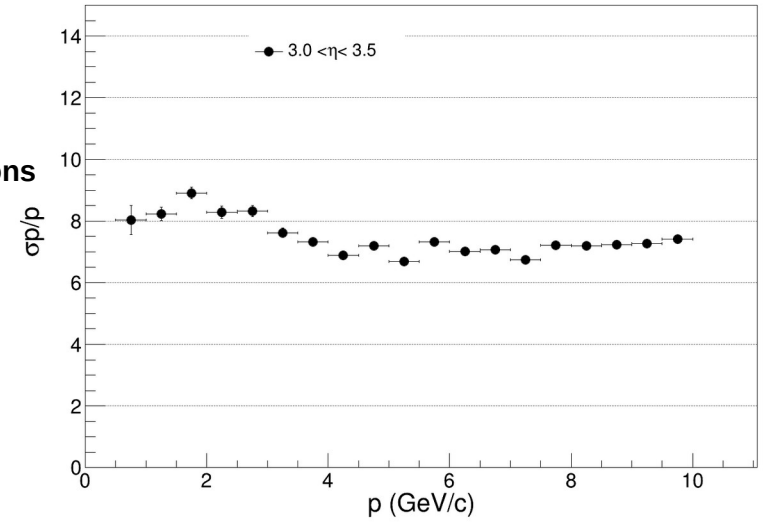
```
root [3] events->Scan("CentralCKFTrackParameters.type")
**********************************
*   Event No   * Track  * Type *
**********************************
*      0 *      0 *      0 *
*      1 *      0 *      0 *
*      2 *      0 *      0 *
*      3 *      0 *      0 *
*      4 *      0 *      0 *
*      5 *      0 *      0 *
*      6 *      0 *      0 *
*      7 *      0 *      0 *
*      8 *      0 *      0 *
*      9 *      0 *      0 *
*     10 *      0 *      0 *
*     11 *      0 *      0 *
*     12 *      0 *      0 *
*     13 *      0 *      0 *
*     14 *      0 *      0 *
*     15 *      0 *      0 *
*     16 *      0 *      0 *
*     17 *      0 *      0 *
*     18 *      0 *      0 *
*     19 *      0 *      0 *
*     20 *      0 *      0 *
*     21 *      0 *      0 *
*     22 *      0 *      0 *
*     23 *      0 *      0 *
*     24 *      0 *      0 *
```

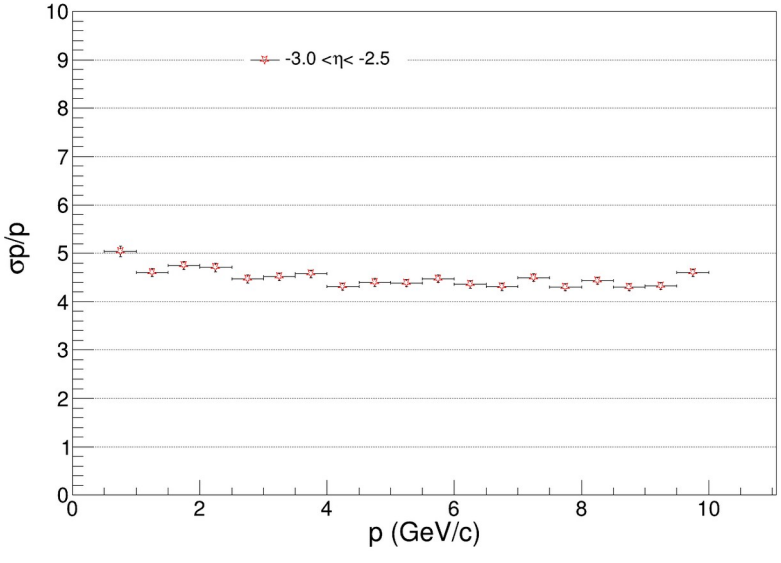
I will also extract it

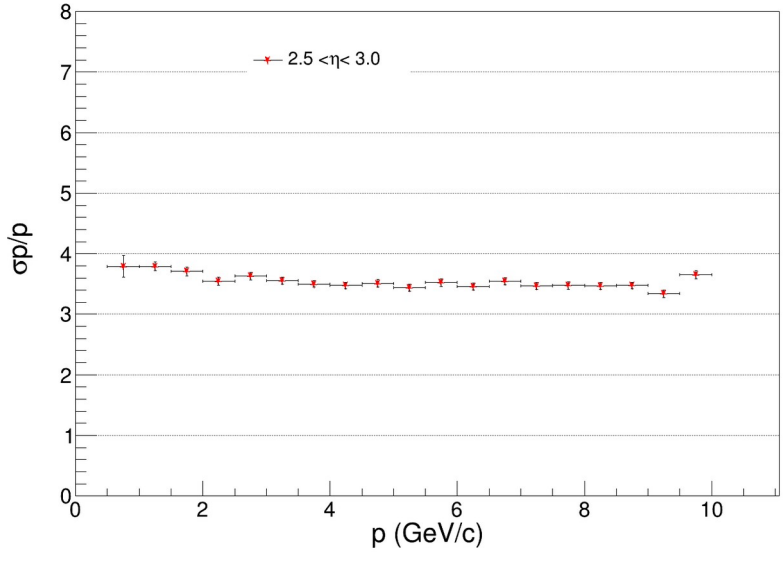
# Momentum Resolutions



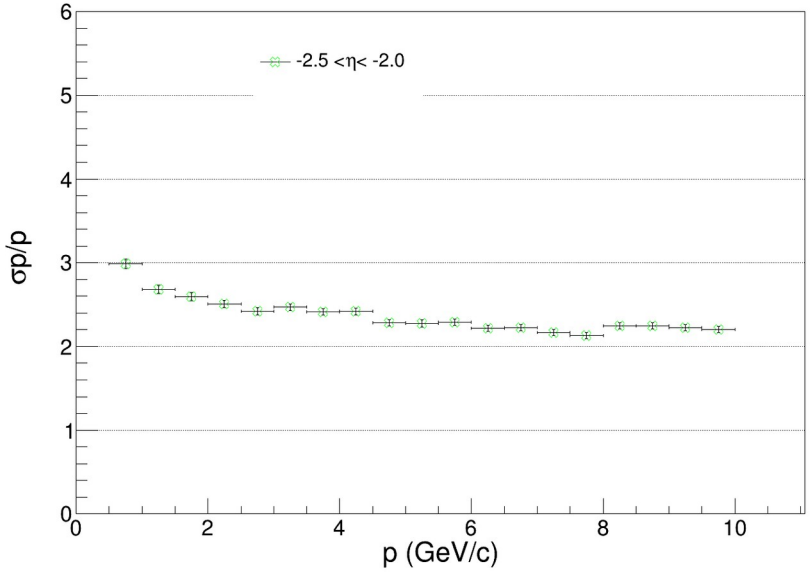

**Looking individual distributions**

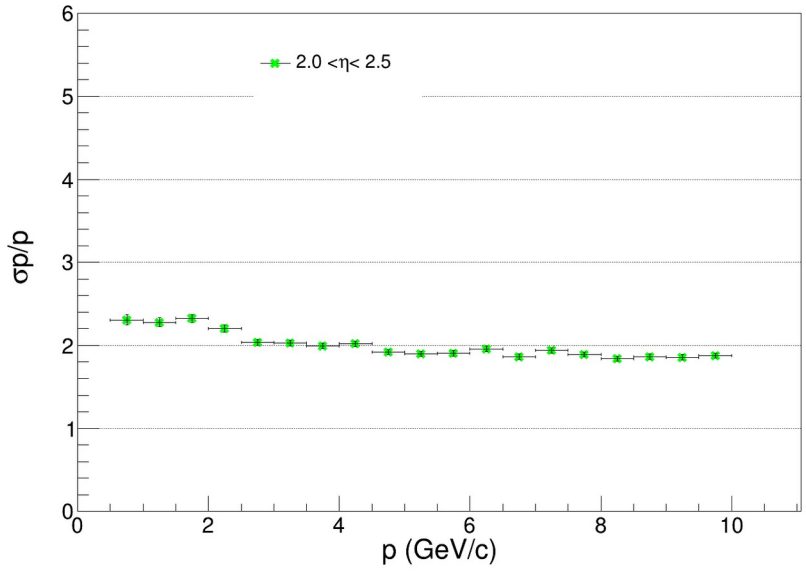


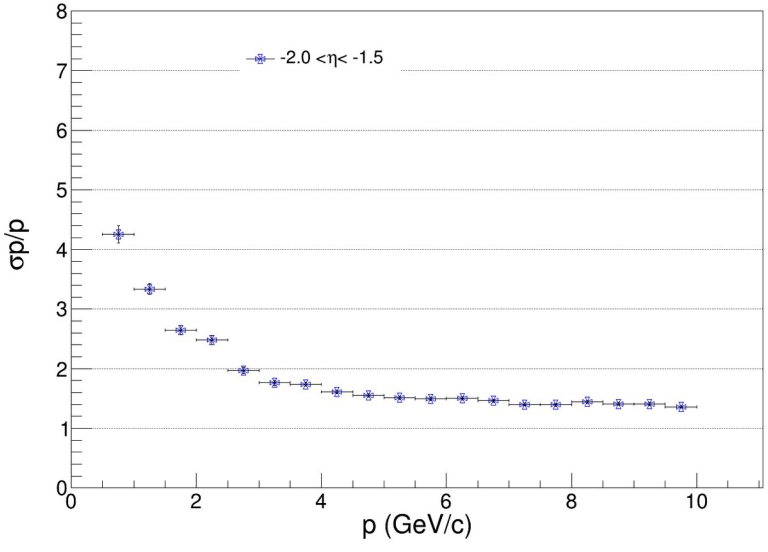



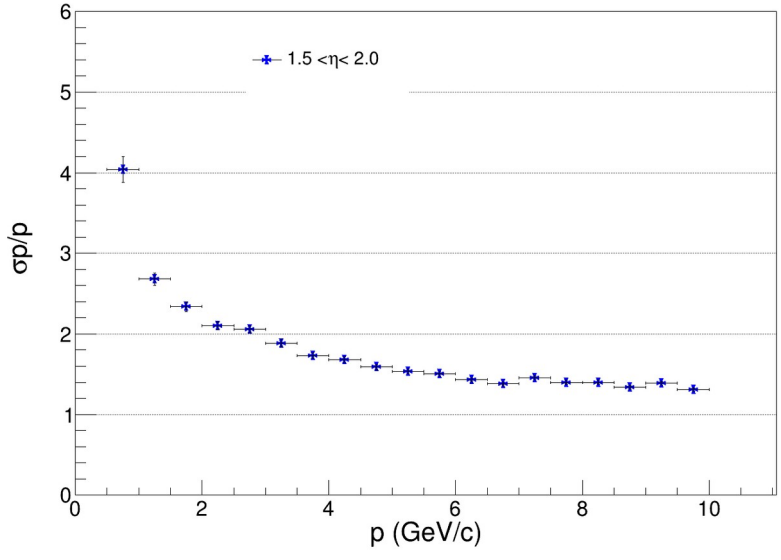



# Momentum Resolutions

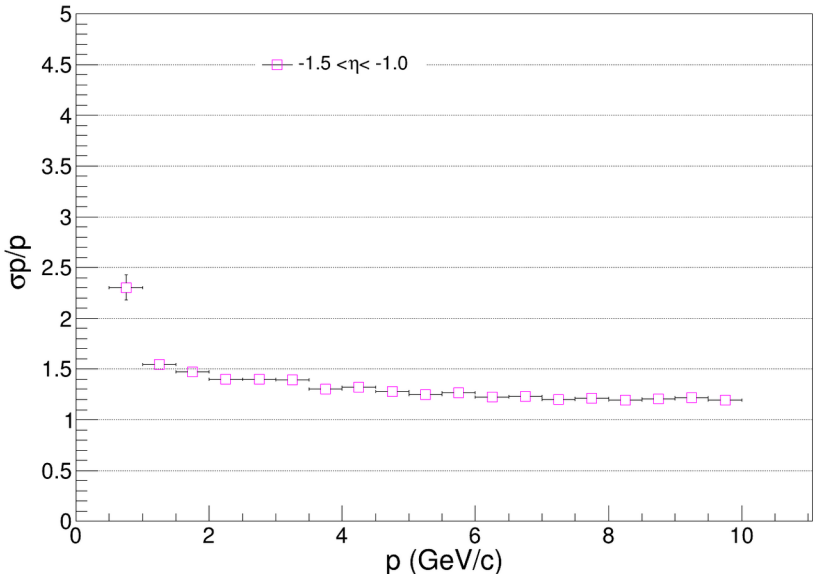


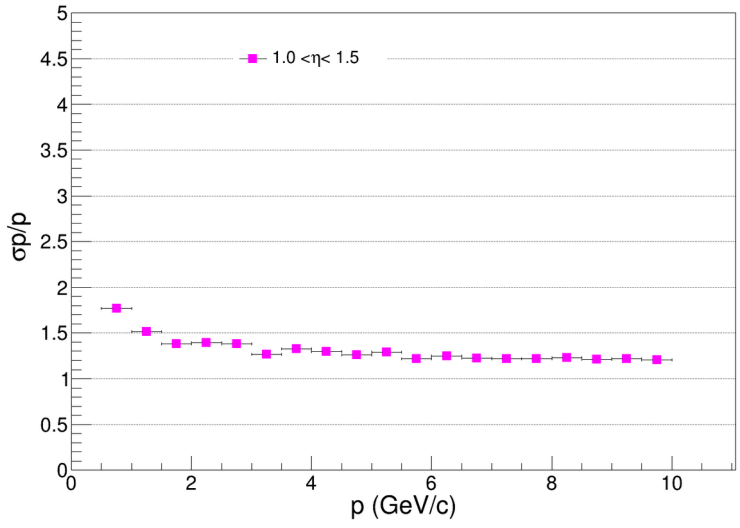



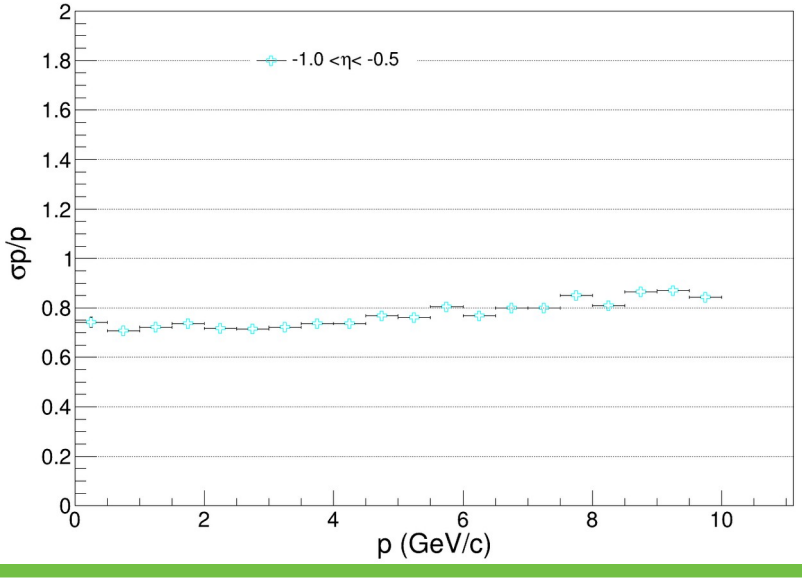



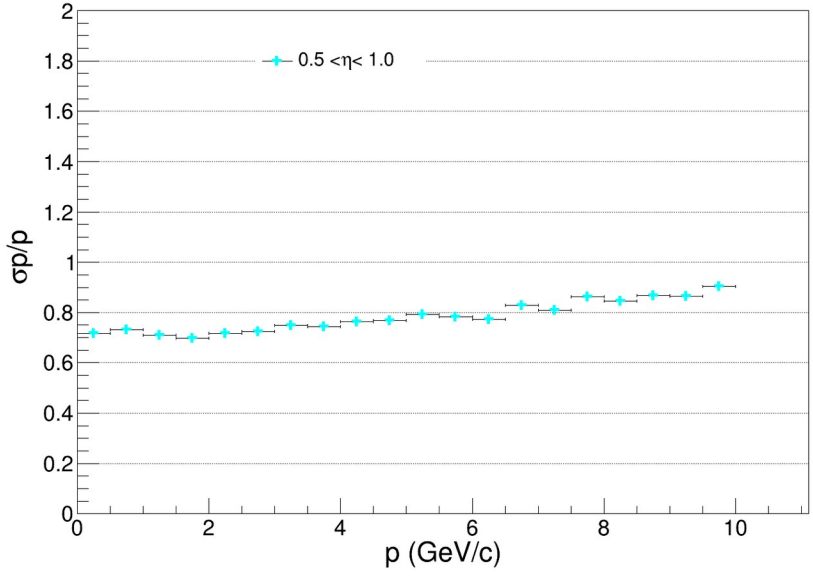



# Momentum Resolutions

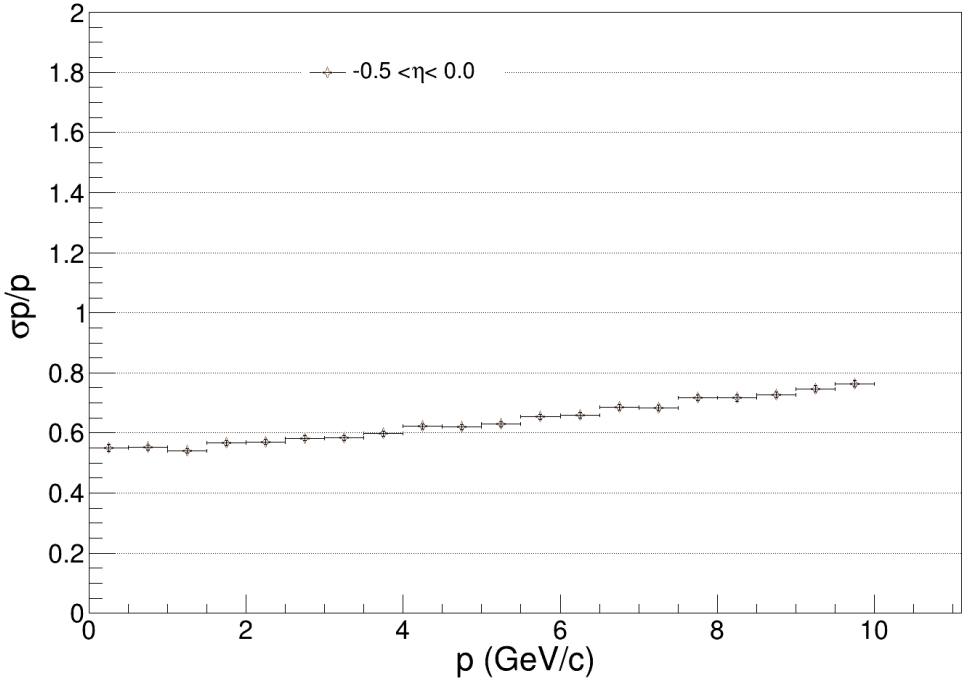


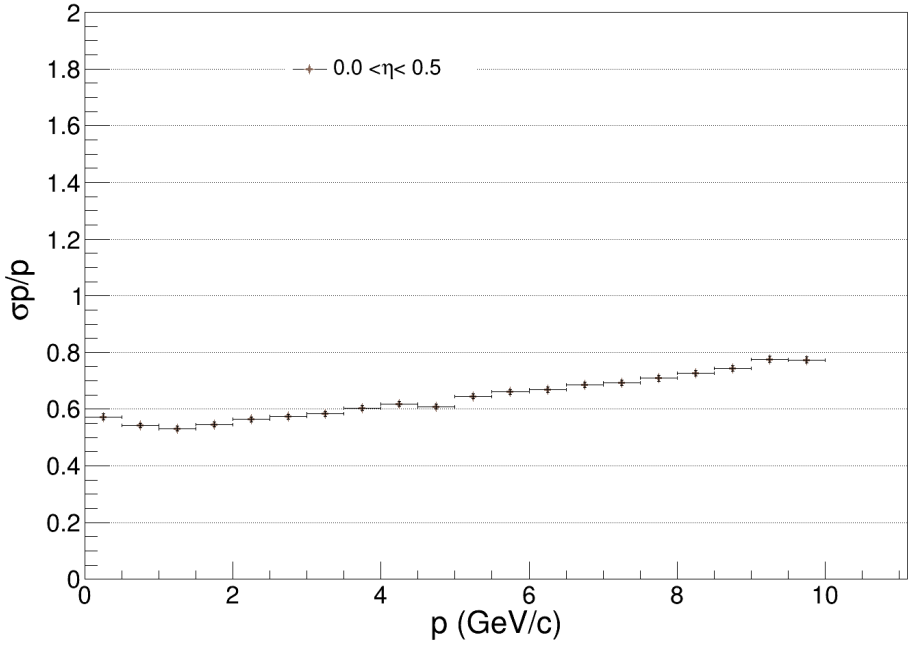



# Momentum Resolutions



# Summary

- Implement the true vertex information and develop matching algorithm
- Next I will understand the structure in reconstructed eta vs momentum (Further increase stats at low momentum)
- I will also extract Transverse and Longitudinal pointing resolution (Also make sure that Inward fitting is used)