



Track Cut Study: Update

sPHENIX Tracking Meeting

February 22nd, 2023

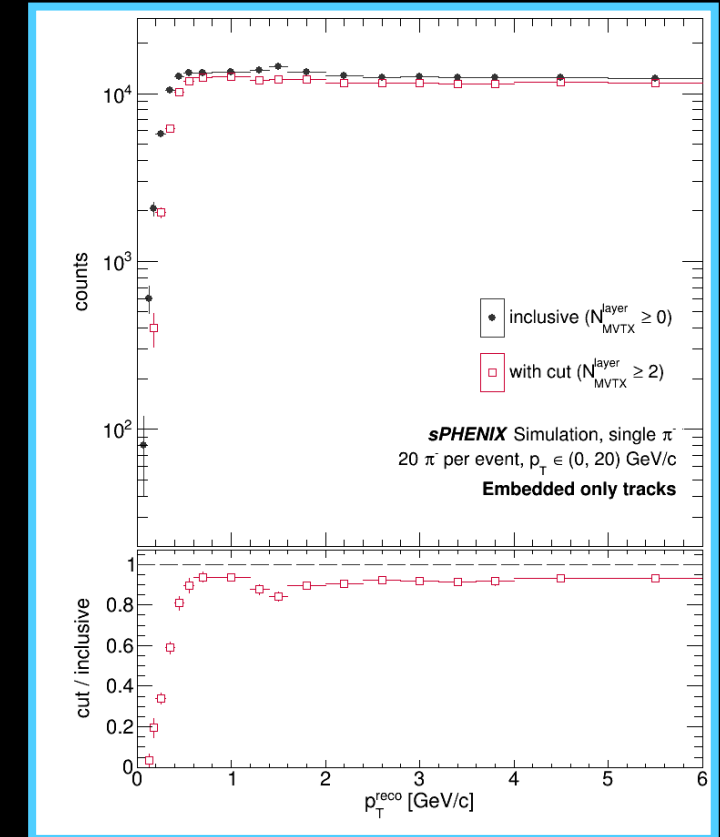
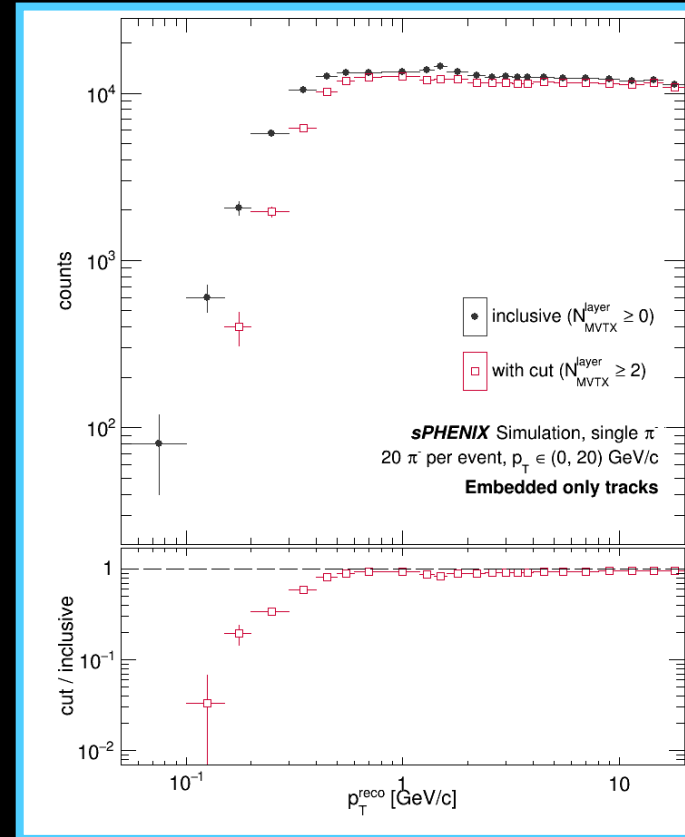
Derek Anderson



MVTX Hits ≥ 2 vs. Inclusive

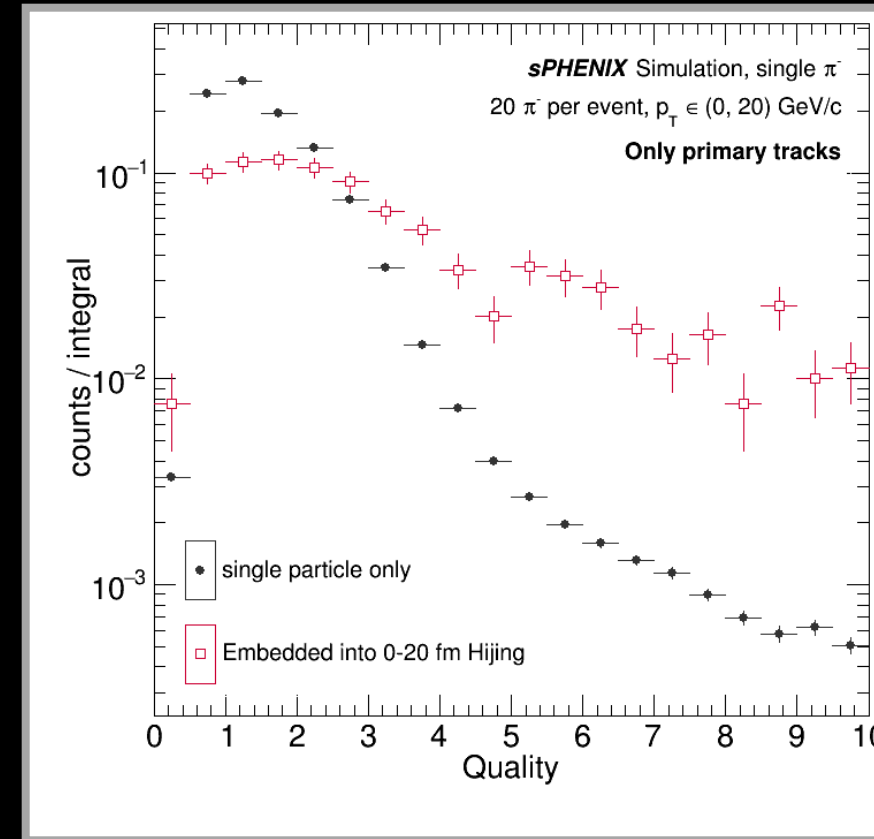
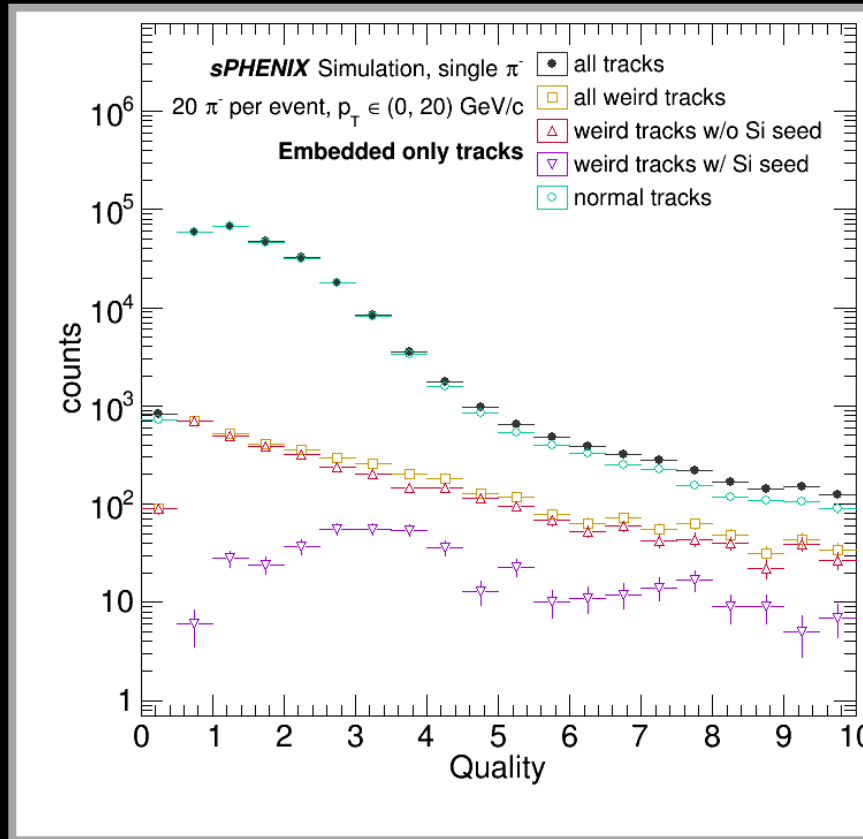


- Reconstructed track p_T of primary tracks w/
 - $N_{MVTX}^{layer} \geq 2$ (red) vs.
 - Inclusive (black)
- Rebinned left figure on slide 5 to accentuate low- p_T region
 - **Left:** log x-axis
 - **Right:** linear x-axis



Previous Slides





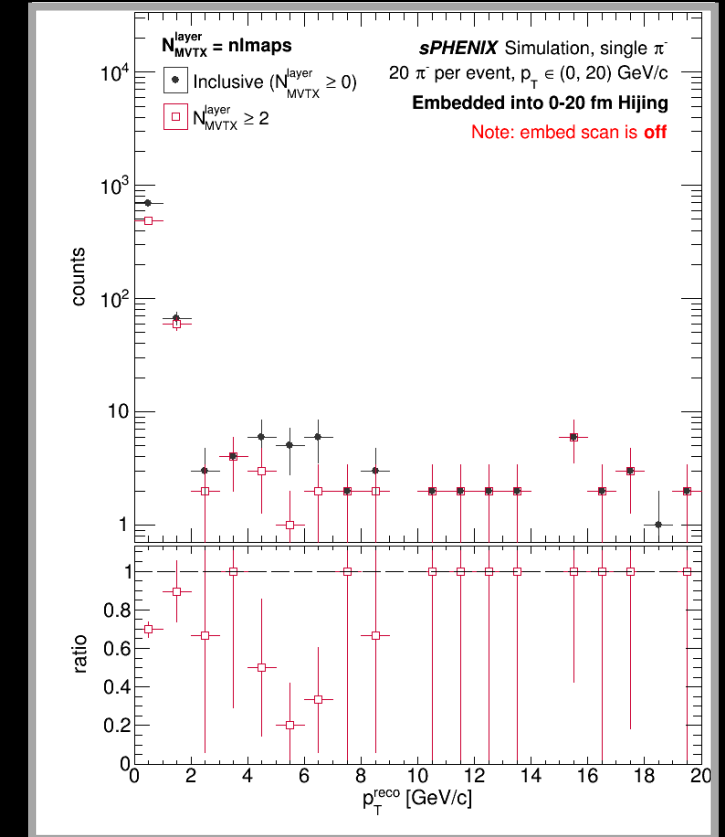
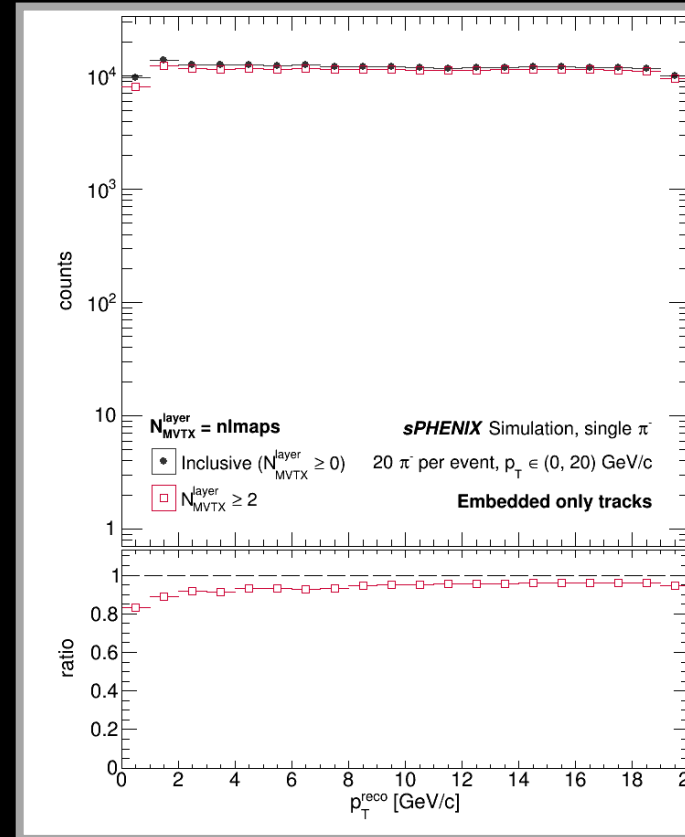
- Ratio of weird/normal (primary) tracks to all (primary) tracks as a function of quality
 - Left: single particle only
 - Right: single particle vs. embedded into Hijing

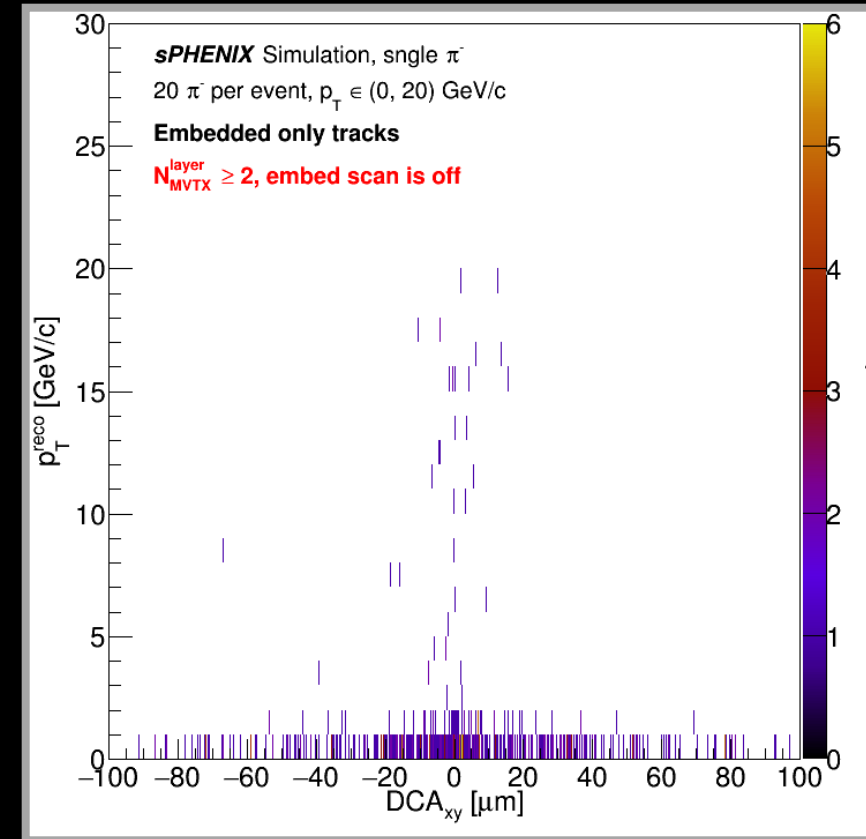
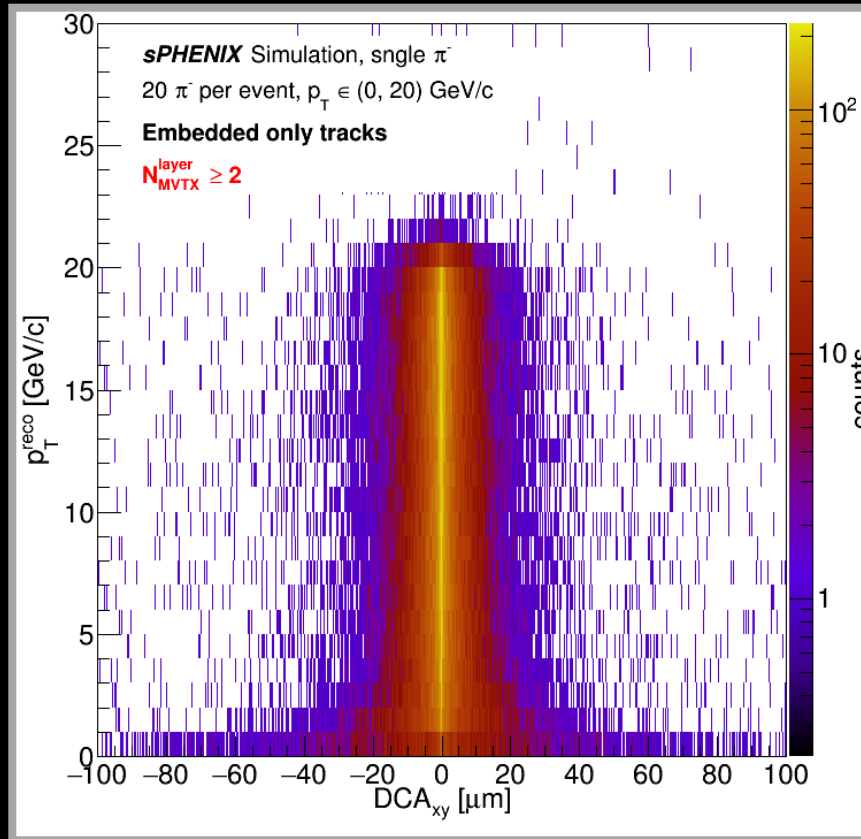
- **Reminder:**
 - Weird $\Rightarrow p_T^{reco} / p_T^{true} \notin (0.2, 1.20)$
 - Normal $\Rightarrow p_T^{reco} / p_T^{true} \in (0.2, 1.20)$

MVTX Hits ≥ 2 vs. Inclusive | track p_T



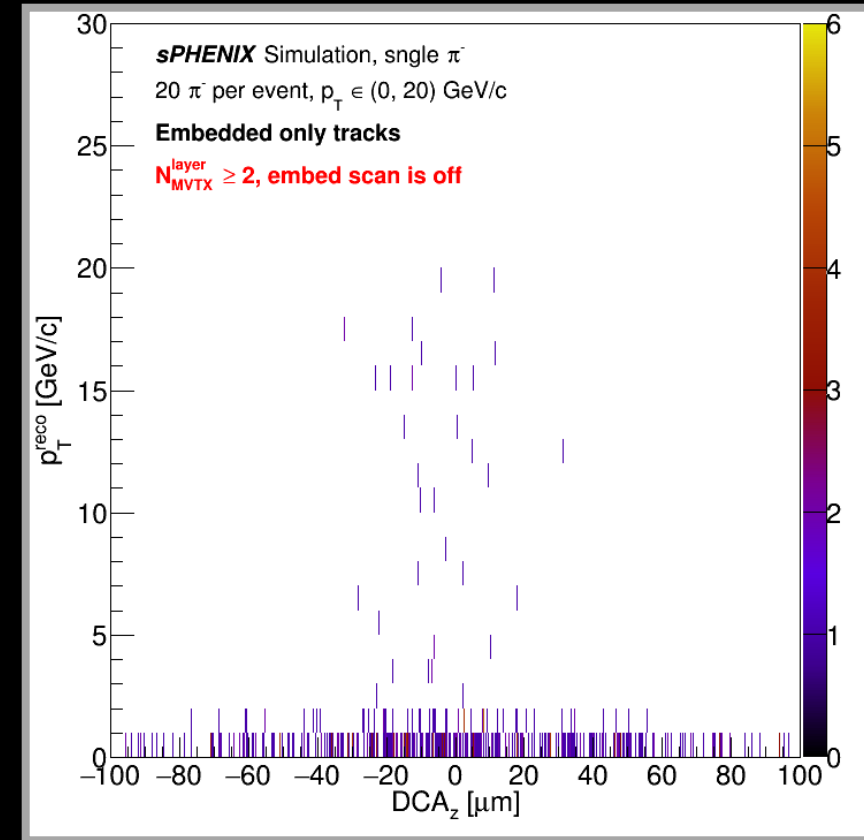
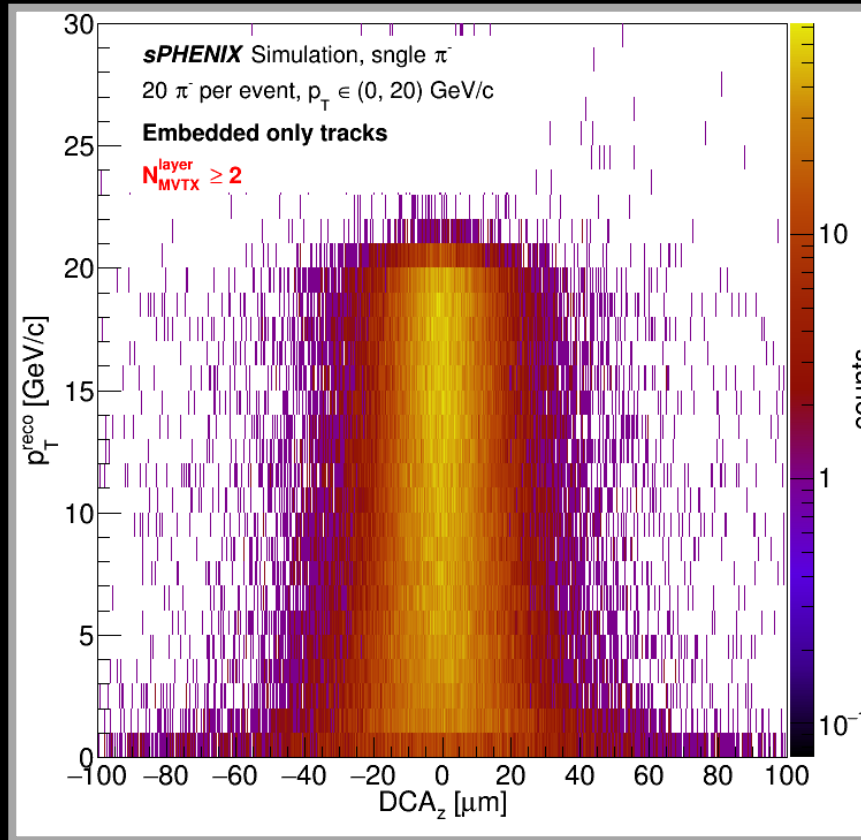
- Reconstructed track p_T of primary tracks w/
 - $N_{MVTX}^{layer} \geq 2$ (red) vs.
 - Inclusive (black)
- **Left:** single particle only
Right: single particles embedded into Hijing
⇒ Not enough stats for embedded tracks!





- Primary track DCA_{xy} for primary tracks w/ $N_{MVTX}^{layer} \geq 2$

- **Left:** single particle only
Right: single particles embedded into Hijing
 \Rightarrow Not enough stats for embedded tracks!



- Primary track DCAz for primary tracks w/ $N_{MVTX}^{layer} \geq 2$

- **Left:** single particle only
Right: single particles embedded into Hijing
 \Rightarrow Not enough stats for embedded tracks!

Plots to Make:

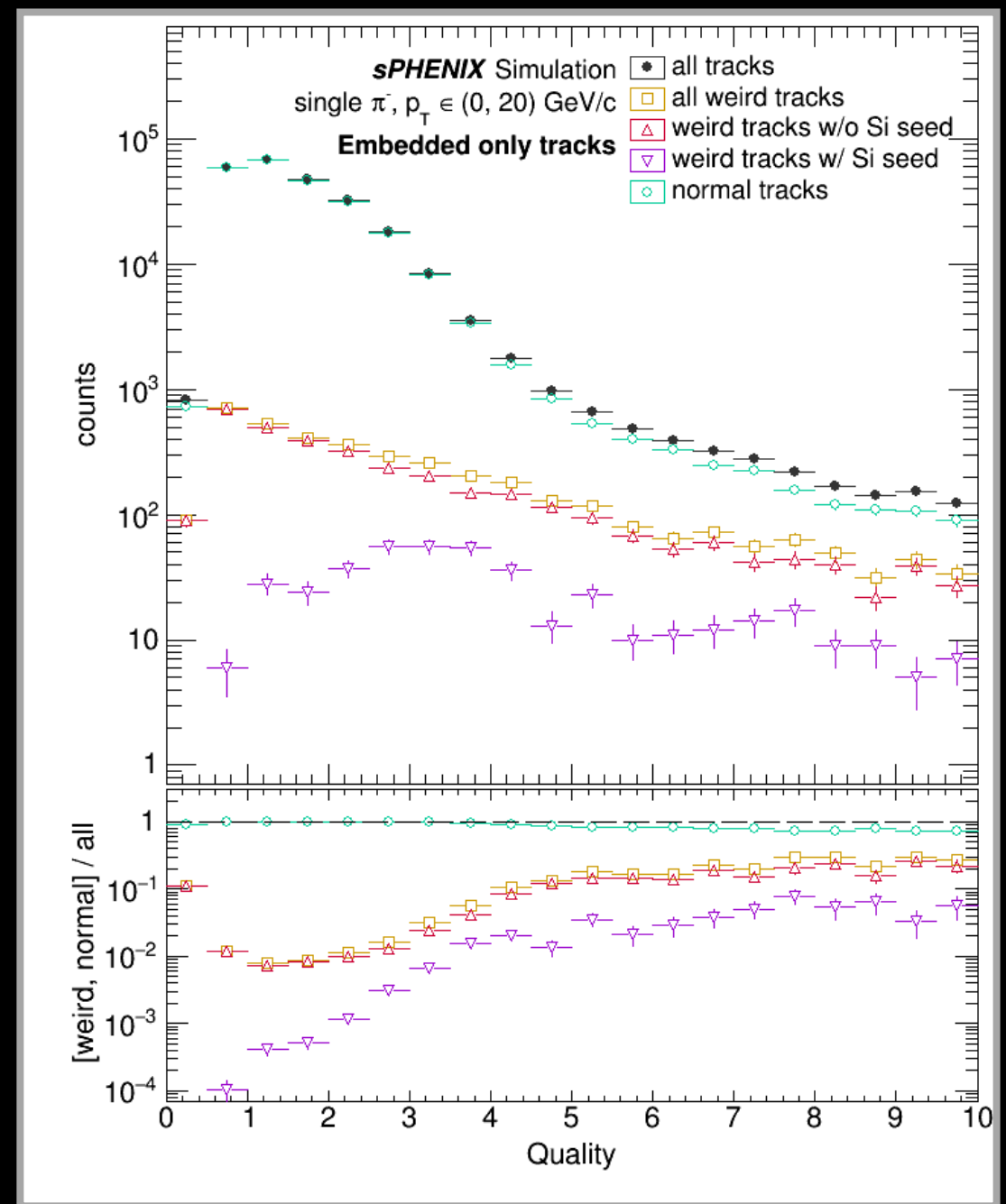
- Quality (and other track quantities) vs. N_{TPC}^{hit}
- Average cluster size for weird tracks vs. normal tracks
 - ☞ Do we have access to that in the evaluator?

To Take Care Of:

- Finish refactoring code
 - › Did not set it up intelligently 😊
 - › Became unmanageable as the no. of different populations to look at grew
- Generate more embedded stats

Ratio of Weird/Normal Tracks to All

- Ratio of weird/normal (primary) tracks to all (primary) tracks as a function of quality
- Reminder:
 - Weird $\Rightarrow p_T^{reco} / p_T^{true} \notin (0.2, 1.20)$
 - Normal $\Rightarrow p_T^{reco} / p_T^{true} \in (0.2, 1.20)$



Details

- **Weird Tracks:** tracks with $p_T^{trk} / p_T^{true} \notin (0.2, 1.2)$
 - Split weird track population into 2 samples:
 - › W/o Silicon Seeds: **nmaps == 0**
 - › W/ Silicon Seeds: **nmaps == 3**
- **Normal Tracks:** tracks with $p_T^{trk} / p_T^{true} \in (0.2, 1.2)$
- Color scheme:
 - **Black triangles** = primary tracks
 - **Magenta triangles** = truth
 - **Red X's** = weird primary tracks
 - **Blue circles** = normal primary tracks
- In 2D plots:
 - **Color maps** = all primary tracks
 - **Red X scatter plots** = weird primary tracks
 - **Blue circle scatter plots** = normal primary tracks

- Simulated sample of single π^-
 - 20 π^- per event
 - $p_T^{true} \in (0, 20)$ GeV/c
 - Ran w/ scan_for_embed on
- Using larger sample than in previous updates:
 - No. of primary tracks: **244015**
 - No. of weird tracks: **4175**
 - › No. w/o silicon seeds: **3582**
 - › No. w/ silicon seeds: **578**
 - › **15** weird tracks had nmaps == 4
 - No. of normal tracks: **239840**
- Cuts Applied:
 - **gprimary == 1** (select only primary tracks)
 - Cuts to select weird & normal tracks

Some Observations

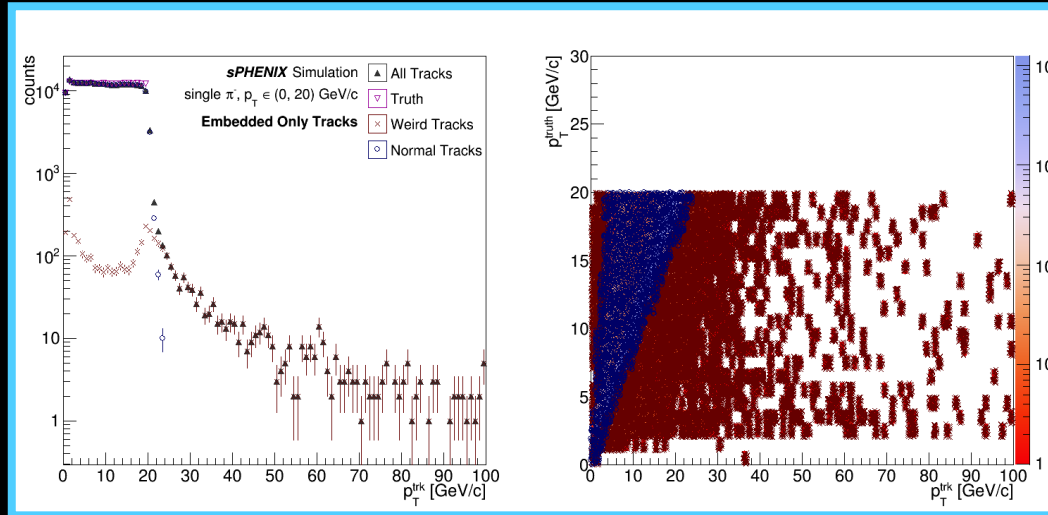
Weird Tracks w/o Silicon Seeds

- p_T^{trk} distribution is bimodal (slide 4)
- Majority seem to lie at sector boundaries in phi (slide 5)
- Majority have large DCAxy values (slides 6 and 7)
 - › Show no correlation in DCAz (slides 8 and 9)
- χ^2/ndf distribution is falling (slide 10)

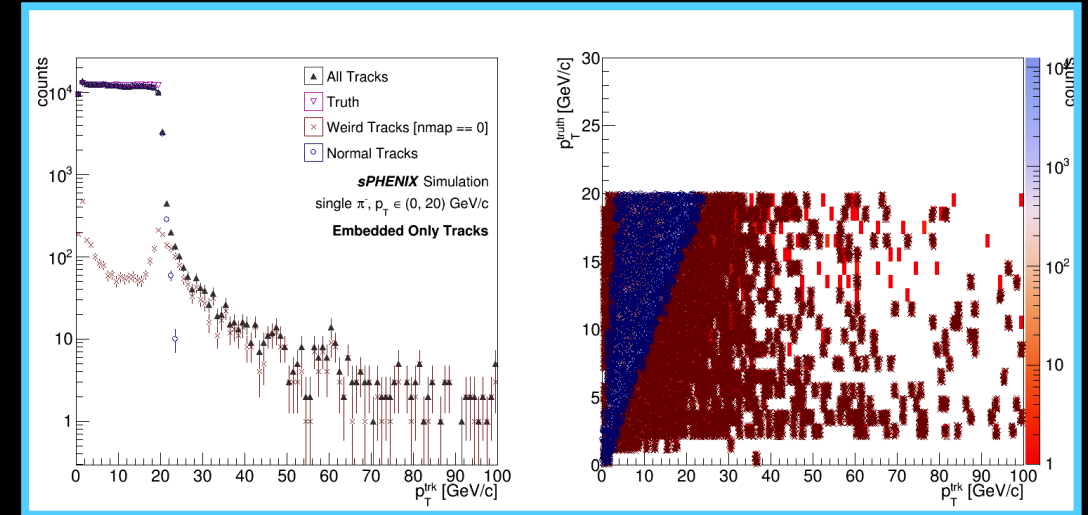
Weird Tracks w/ Silicon Seeds

- p_T^{trk} distribution is unimodal (slide 4)
- No correlation in phi (slide 5)
- χ^2/ndf distribution is roughly flat (slide 10)

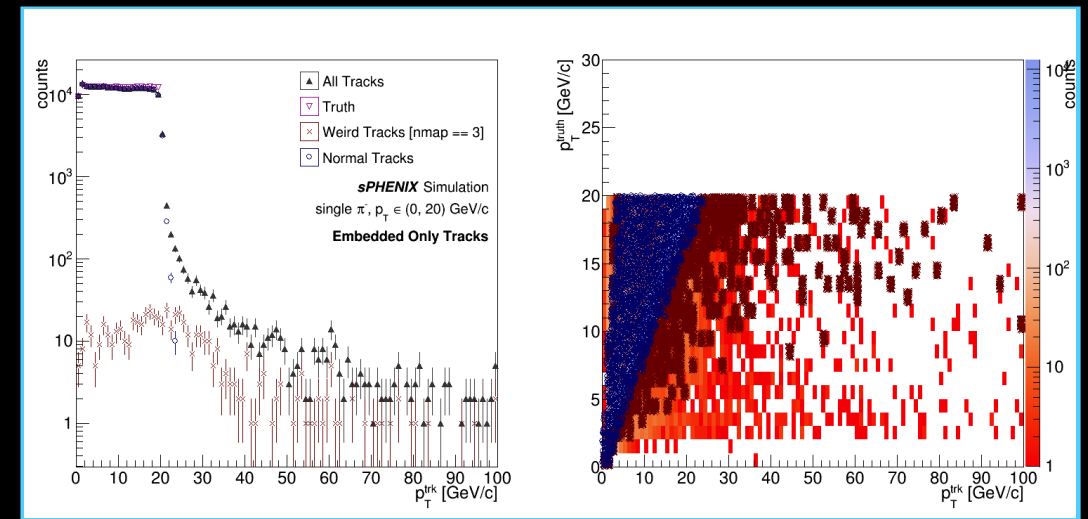
All Weird Tracks



Weird Tracks w/o Silicon Seeds

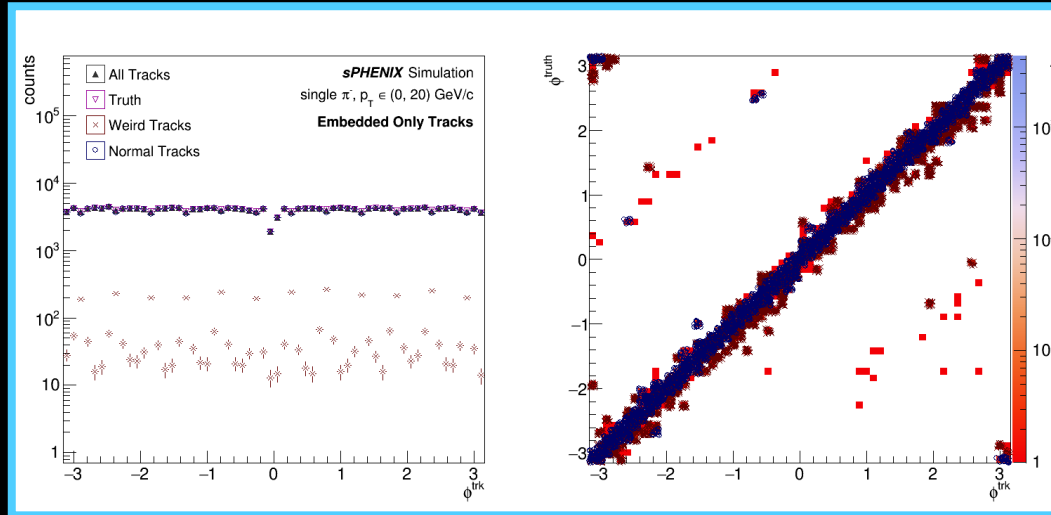


Weird Tracks w/ Silicon Seeds

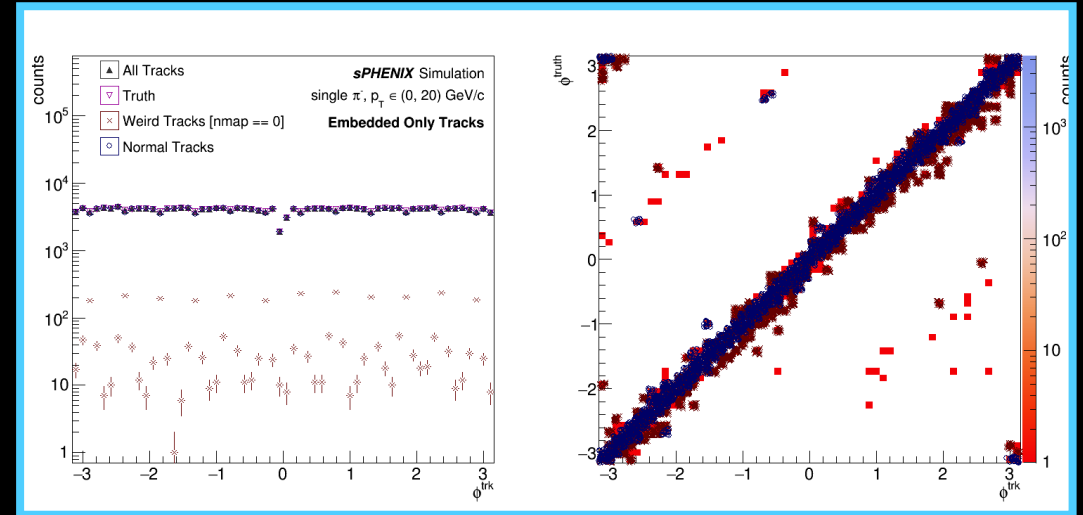


- Reconstructed and truth p_T
 - reco. p_T (left panels)
 - reco. vs. truth p_T (right panels)
 - **pt vs. gpt** leaves of ntp_track tuple
- **Note:** y-axes are **not** scaled
 - y-axis range changes between plots (apologies!)

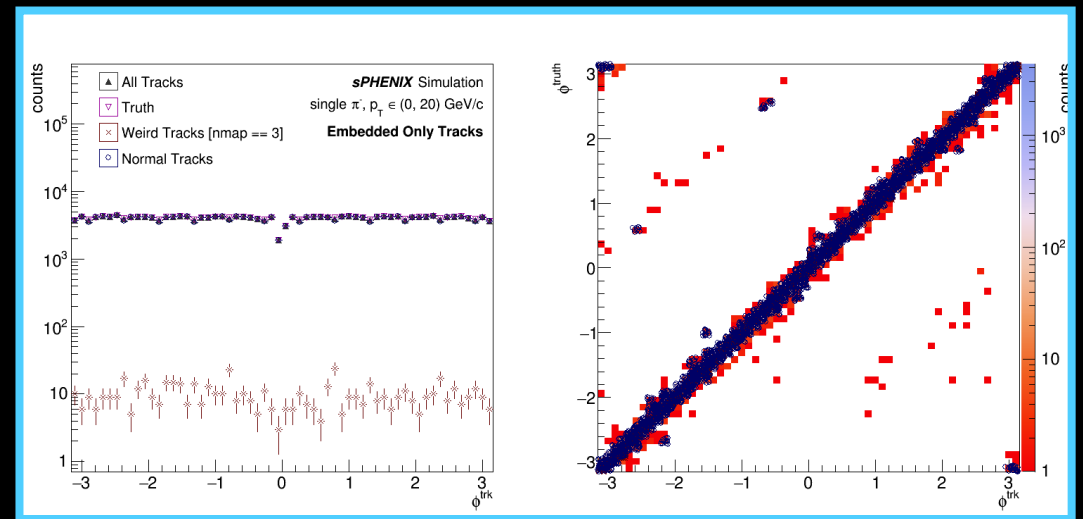
All Weird Tracks



Weird Tracks w/o Silicon Seeds

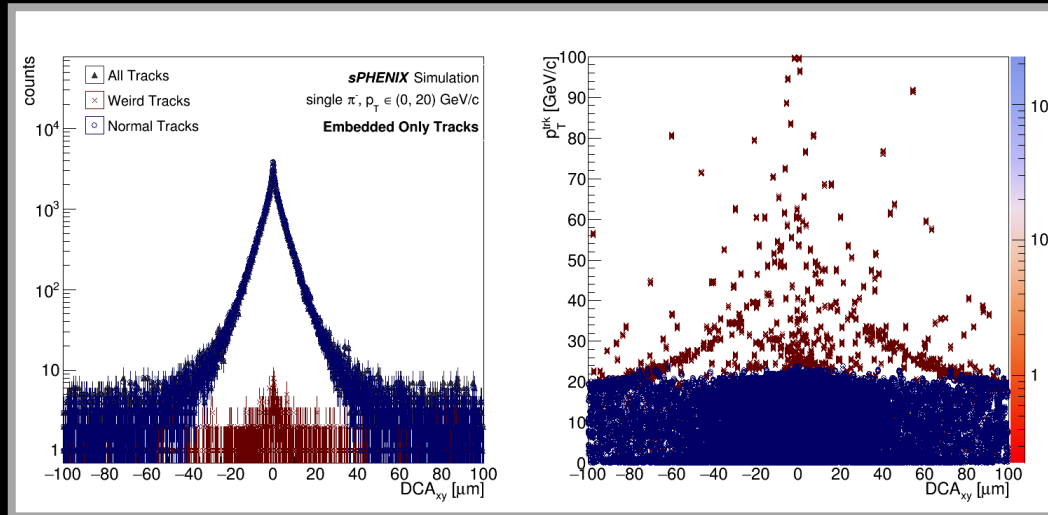


Weird Tracks w/ Silicon Seeds

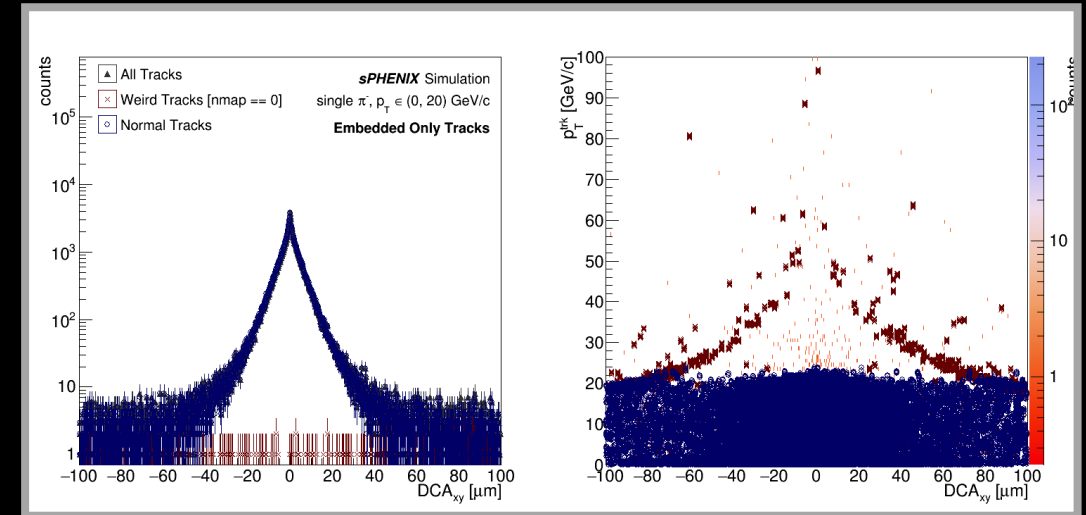


- Reconstructed and truth phi
 - reco. phi (left panels)
 - reco. vs. truth phi (right panels)
 - **phi vs. gphi** leaves of ntp_track tuple
- **Note:** y-axes are **not** scaled
 - y-axis range changes between plots (apologies!)

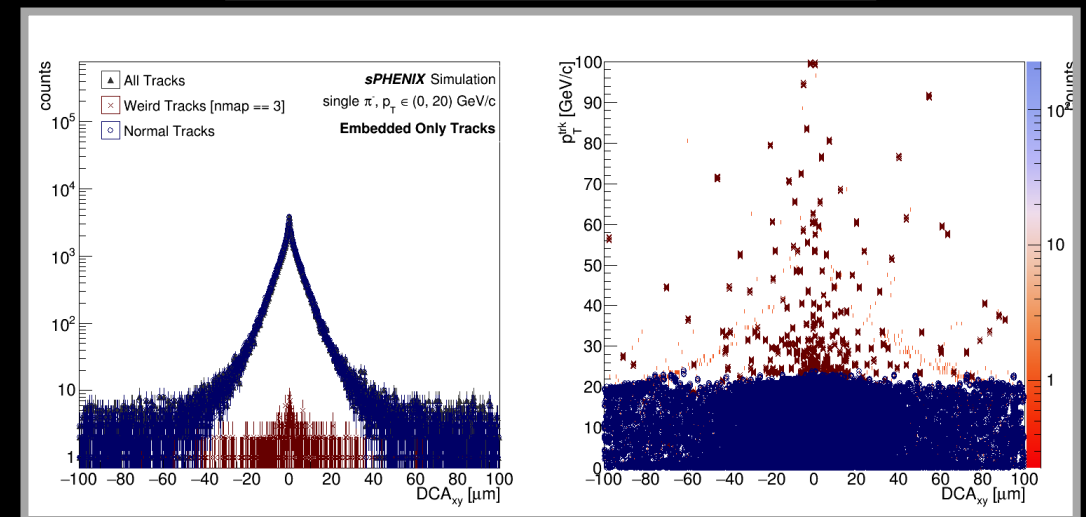
All Weird Tracks



Weird Tracks w/o Silicon Seeds

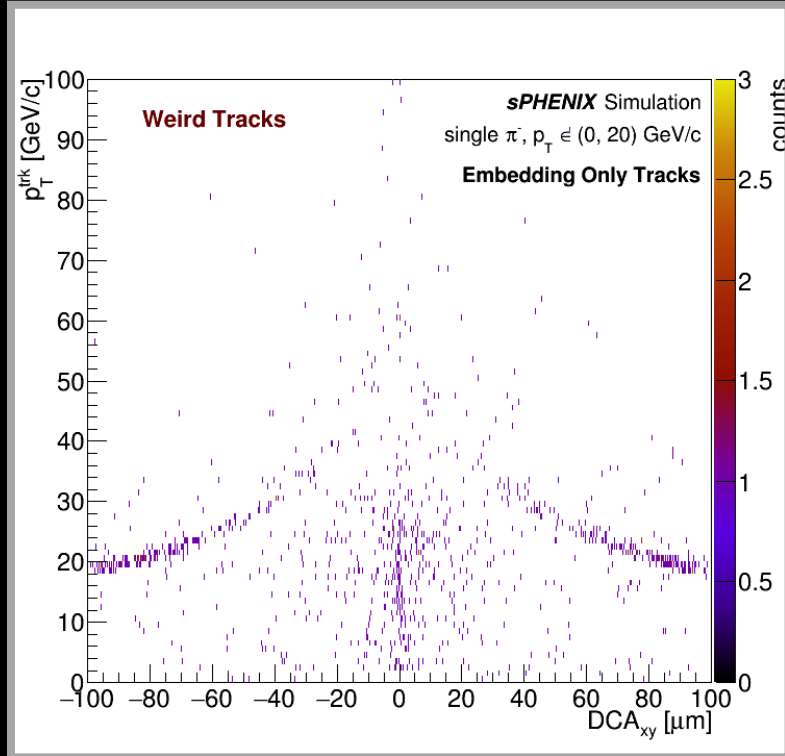


Weird Tracks w/ Silicon Seeds

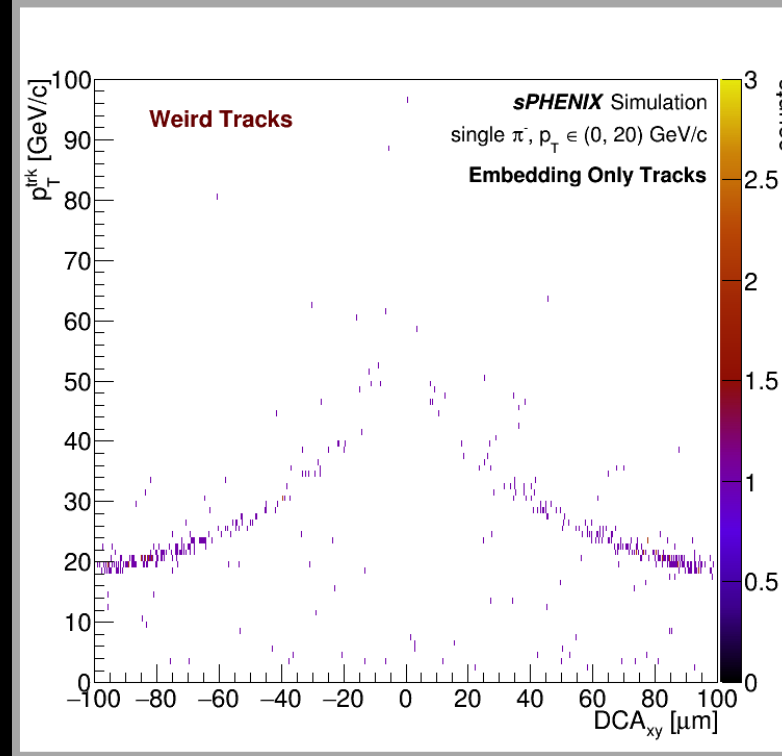


- Track DCAxy
 - Track DCAxy (left panels)
 - DCAxy vs. p_T^{rk} (right panels)
 - `dca3dxy` vs. `pt` leaves of `ntp_track` tuple
- Note: y-axes are not scaled
 - y-axis range changes between plots (apologies!)

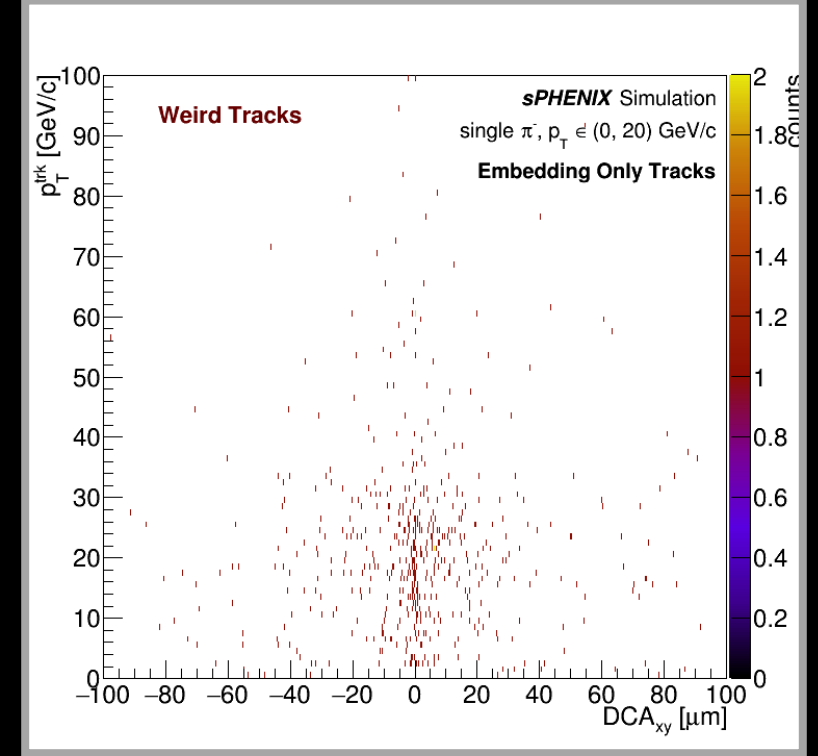
Weird Track DCAxy



All Weird Tracks



Weird Tracks w/o Silicon Seeds

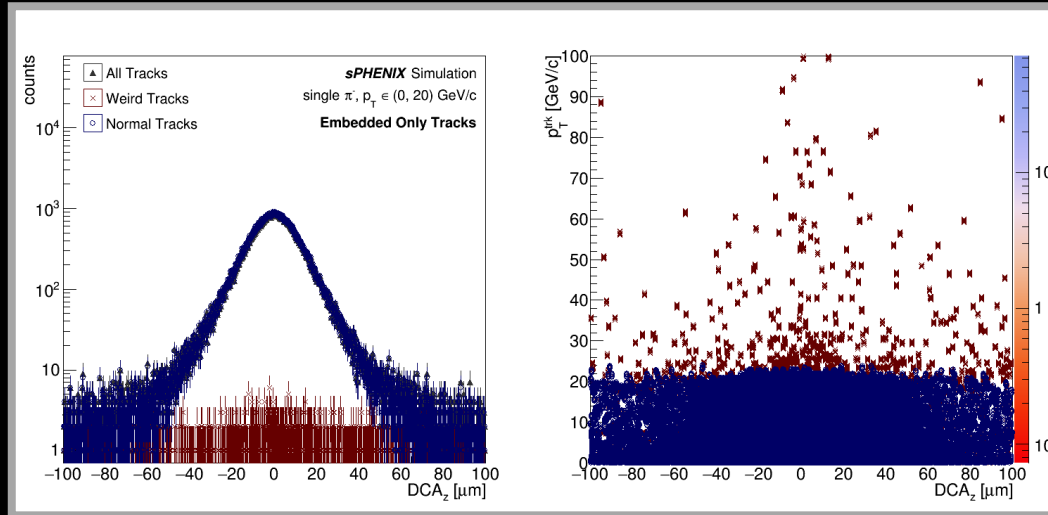


Weird Tracks w/ Silicon Seeds

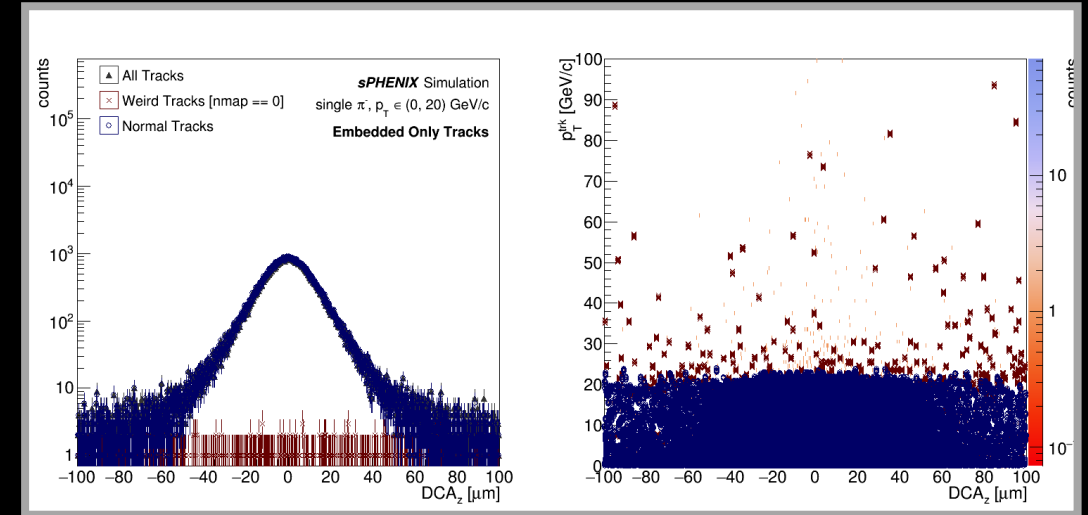
- Weird track DCAxy
 - `dca3dxy` leaf of `ntp_track` tuple for only weird tracks

- **Note:** z-axes are not scaled
 - z-axis range changes between plots (apologies!)

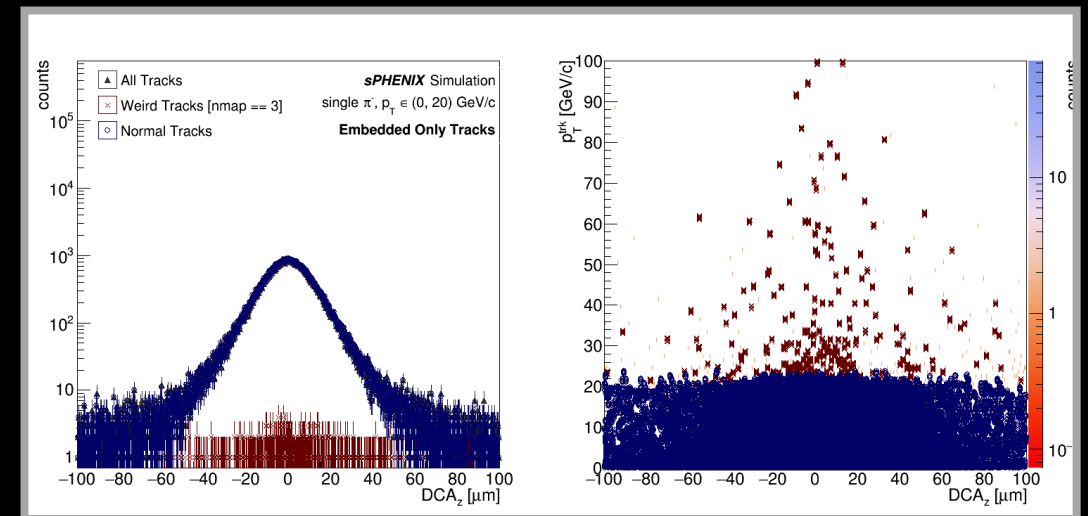
All Weird Tracks



Weird Tracks w/o Silicon Seeds

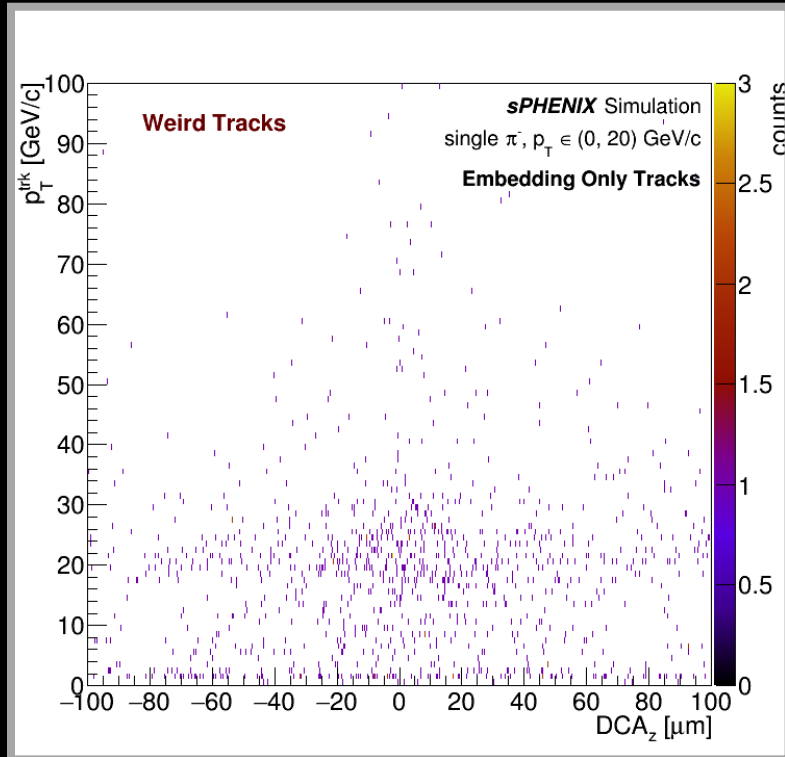


Weird Tracks w/ Silicon Seeds

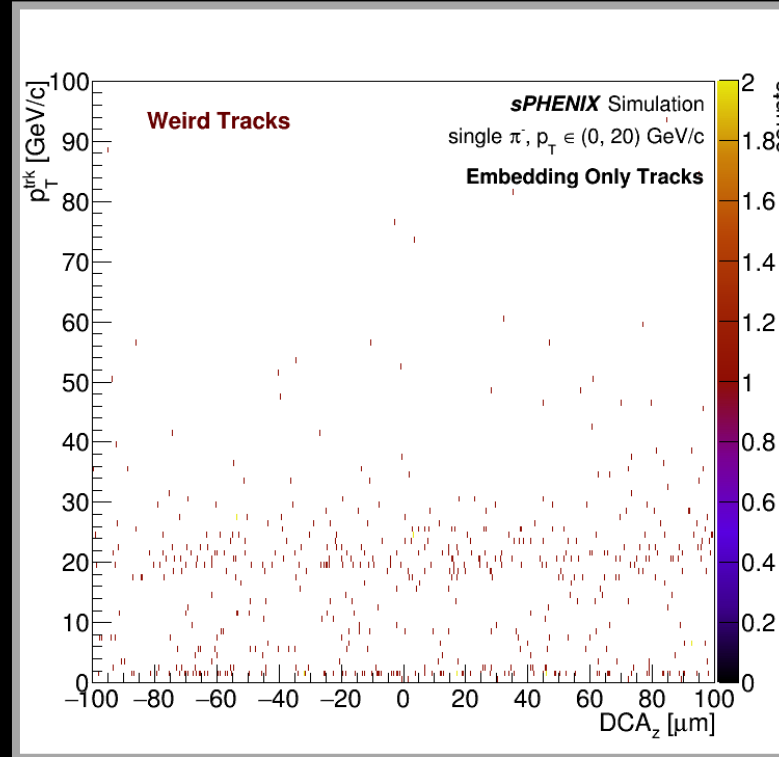


- Track DCAz
 - Track DCAz (left panels)
 - DCAz vs. p_T^{trk} (right panels)
 - `dca3dz` vs. `pt` leaves of `ntp_track` tuple
- Note: y-axes are not scaled
 - y-axis range changes between plots (apologies!)

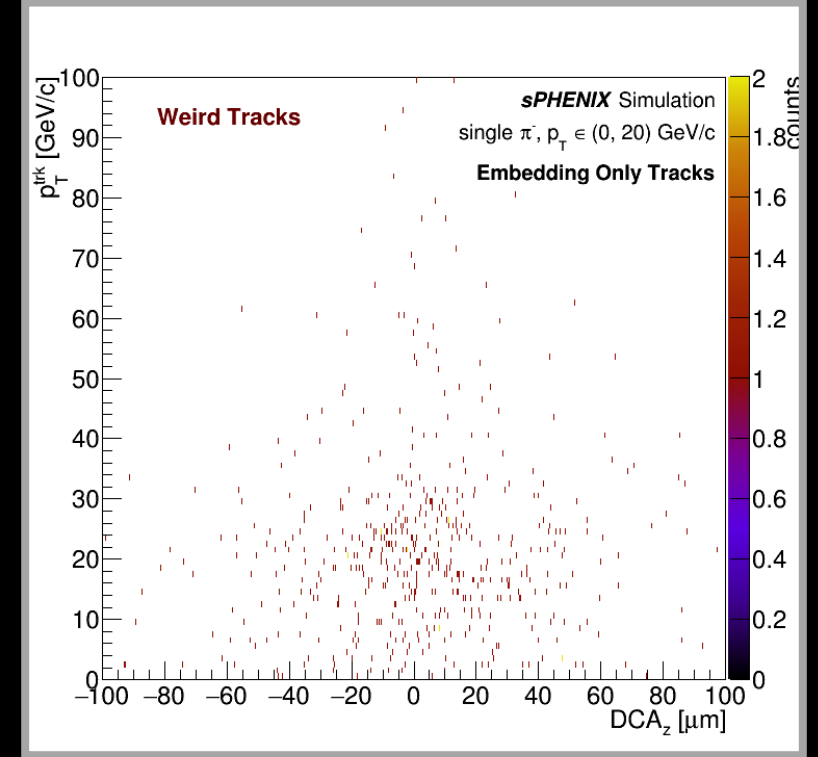
Weird Track DCAz



All Weird Tracks



Weird Tracks w/o Silicon Seeds



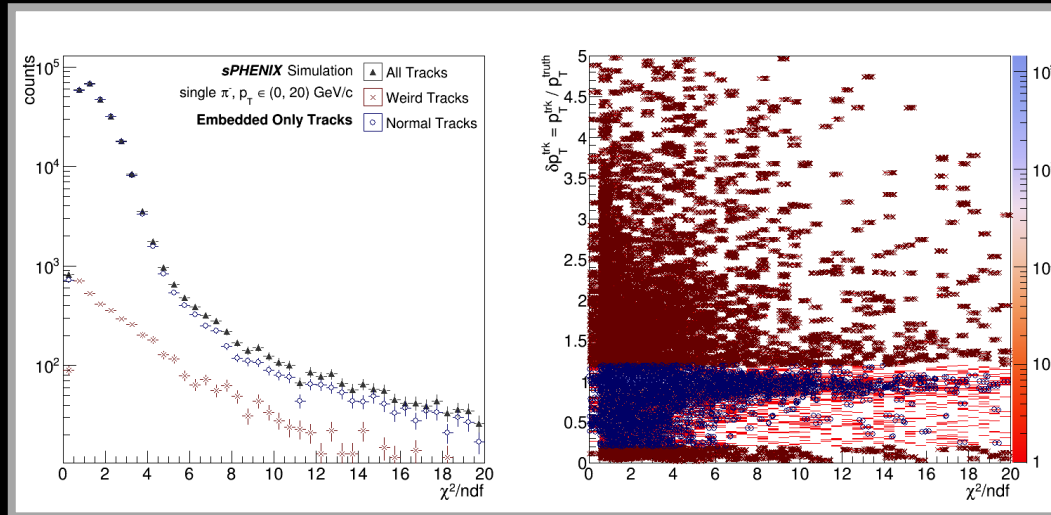
Weird Tracks w/ Silicon Seeds

- Weird track DCAz
 - `dca3dz` leaf of `ntp_track` tuple for only weird tracks

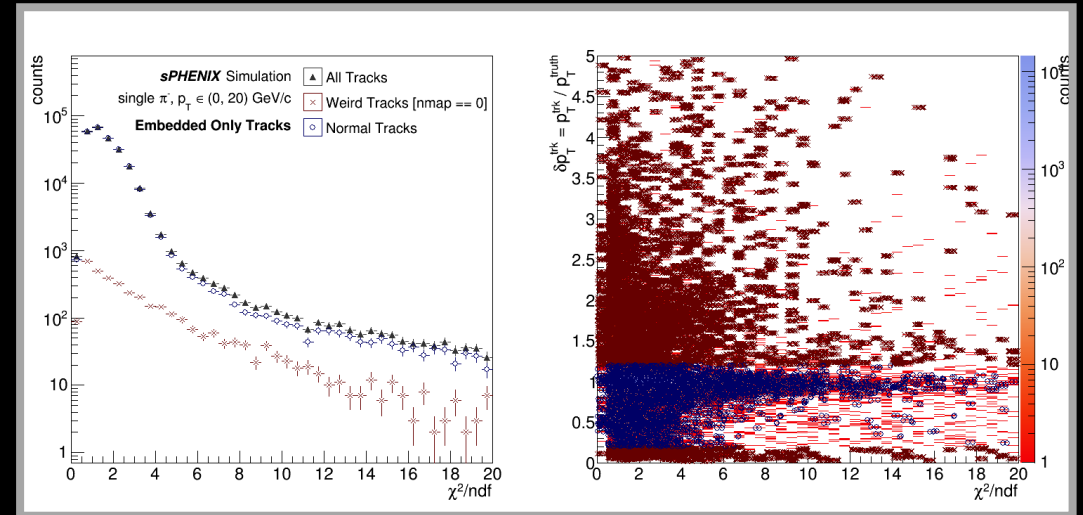
- Note: z-axes are not scaled
 - z-axis range changes between plots (apologies!)

Track Quality

All Weird Tracks



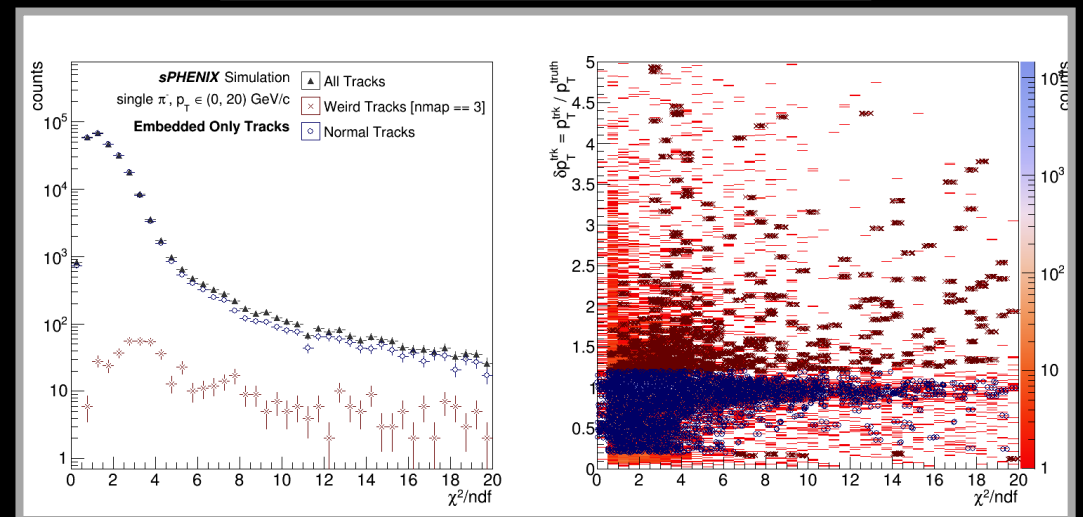
Weird Tracks w/o Silicon Seeds



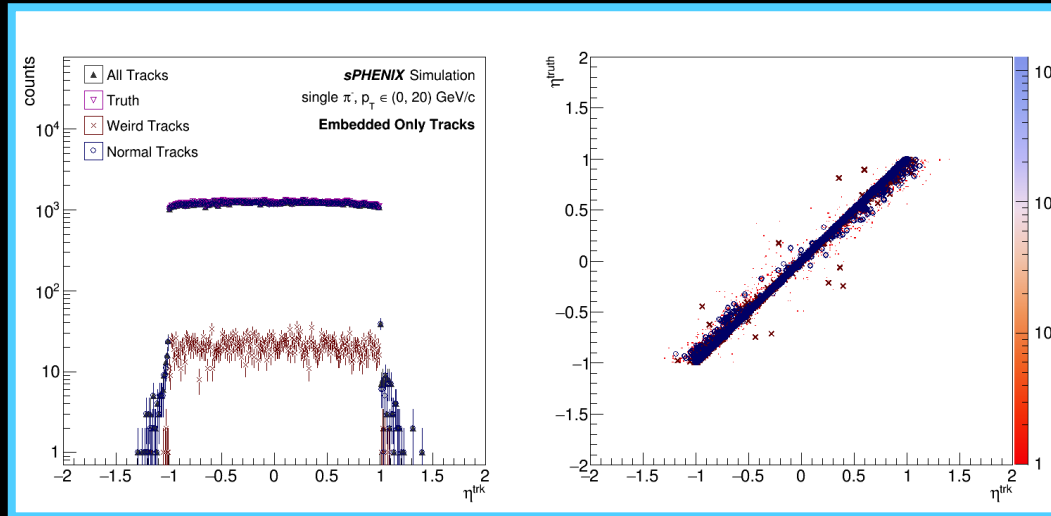
- Track χ^2/ndf
 - Track χ^2/ndf (left panels)
 - χ^2/ndf vs. $p_T^{\text{trk}}/p_T^{\text{true}}$ (right panels)
 - quality vs. pt/gpt leaves of ntp_track tuple

- Note: y-axes are not scaled
 - y-axis range changes between plots (apologies!)

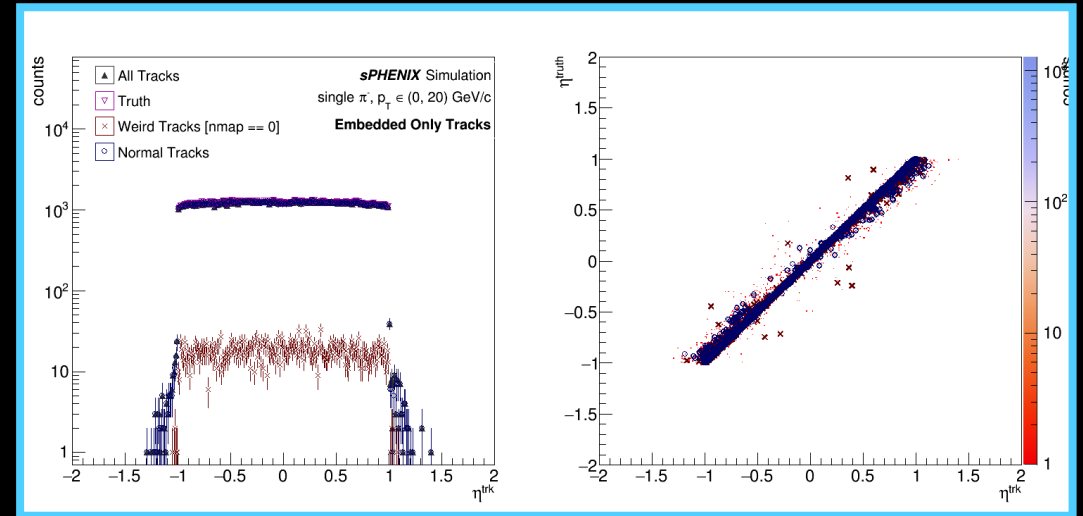
Weird Tracks w/ Silicon Seeds



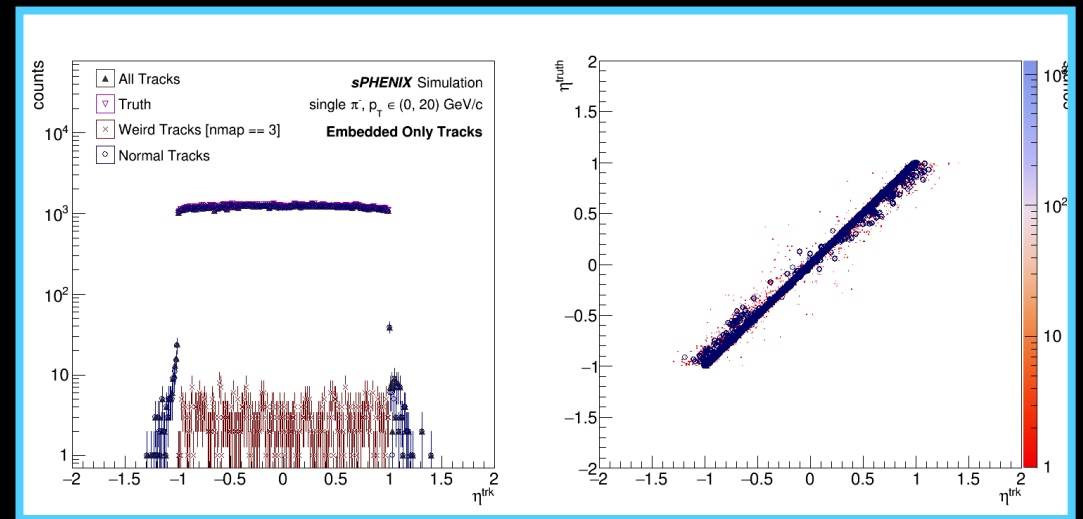
All Weird Tracks



Weird Tracks w/o Silicon Seeds

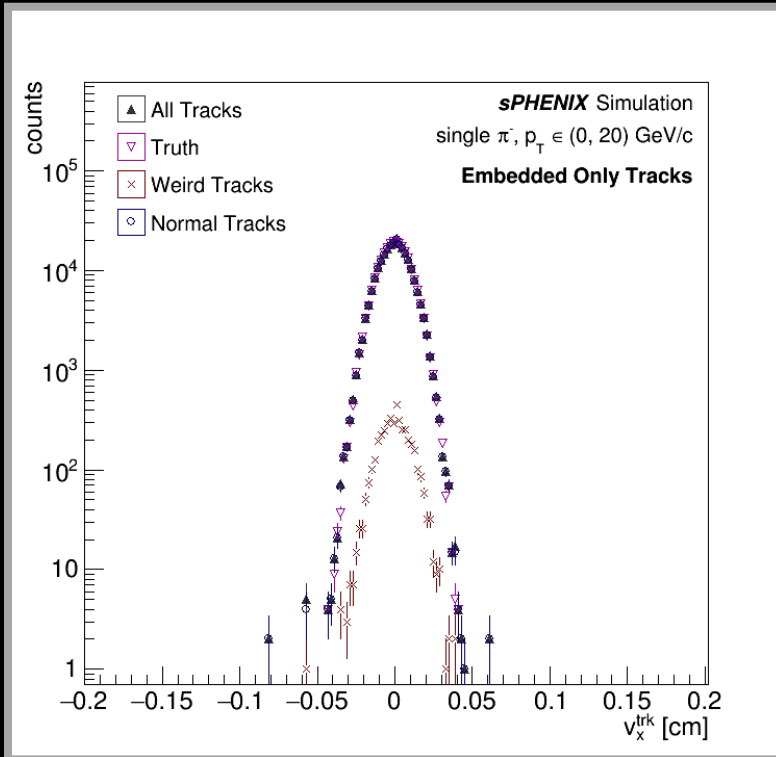


Weird Tracks w/ Silicon Seeds

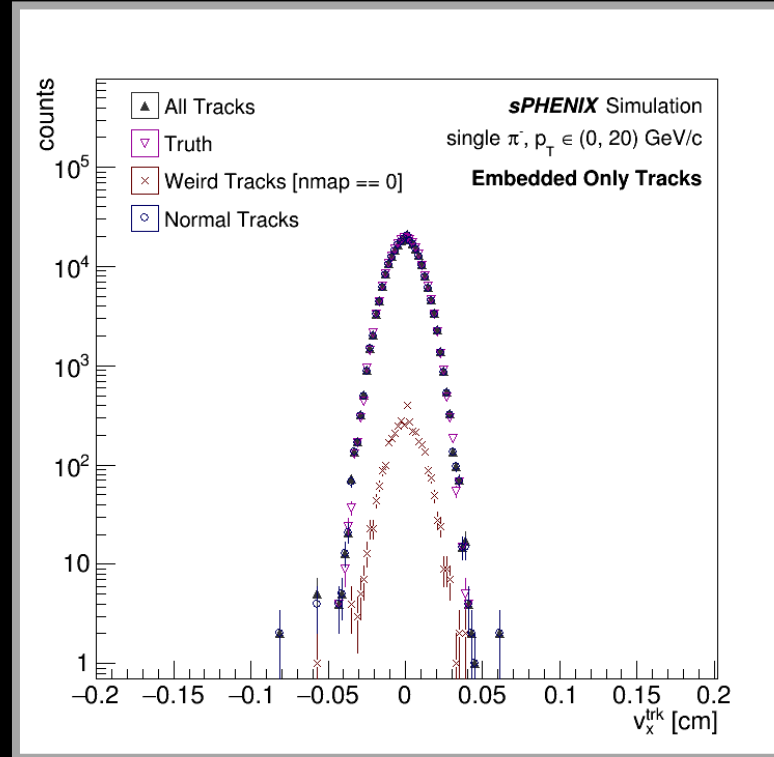


- Reconstructed and truth eta
 - reco. eta (left panels)
 - reco. vs. truth eta (right panels)
 - eta vs. geta leaves of ntp_track tuple
- Note: y-axes are not scaled
 - y-axis range changes between plots (apologies!)

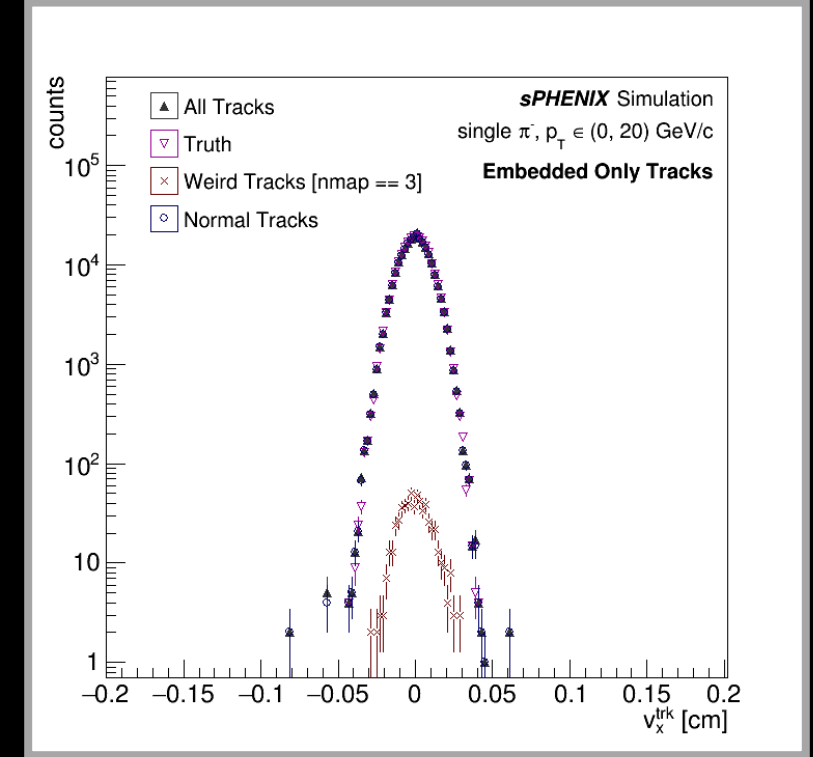
Track X-Vertex



All Weird Tracks



Weird Tracks w/o Silicon Seeds



Weird Tracks w/ Silicon Seeds

- X-component of reconstructed vertex
 - v_x leaf of `ntp_track` tuple

- **Note:** y-axes are **not** scaled
 - y-axis range changes between plots (apologies!)