Status update

Beam-background for tracking

Chenguang Zhang / 28Apr2025
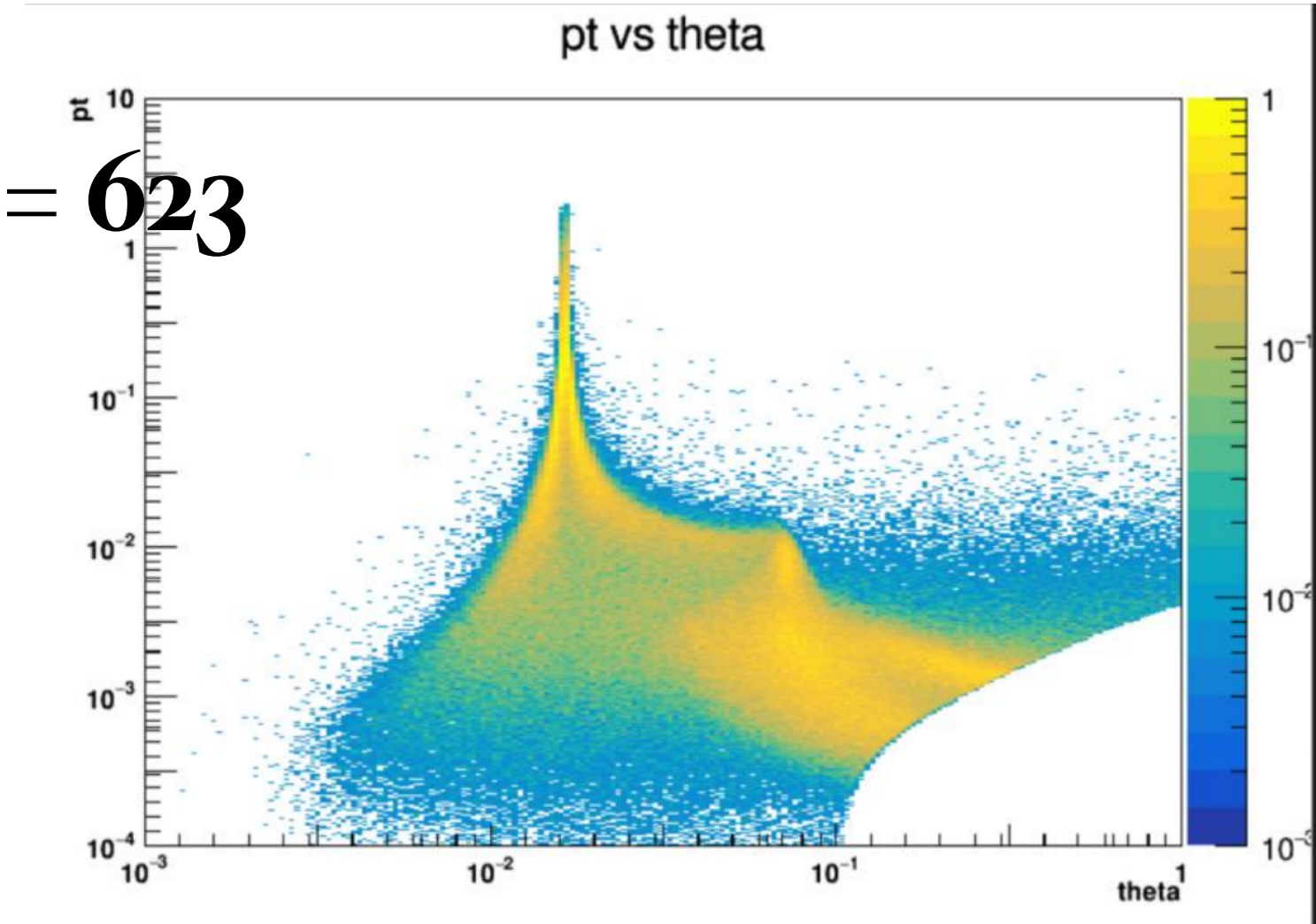
Background-only

Entries: 13676

10 BX

Starting-points of stable particles
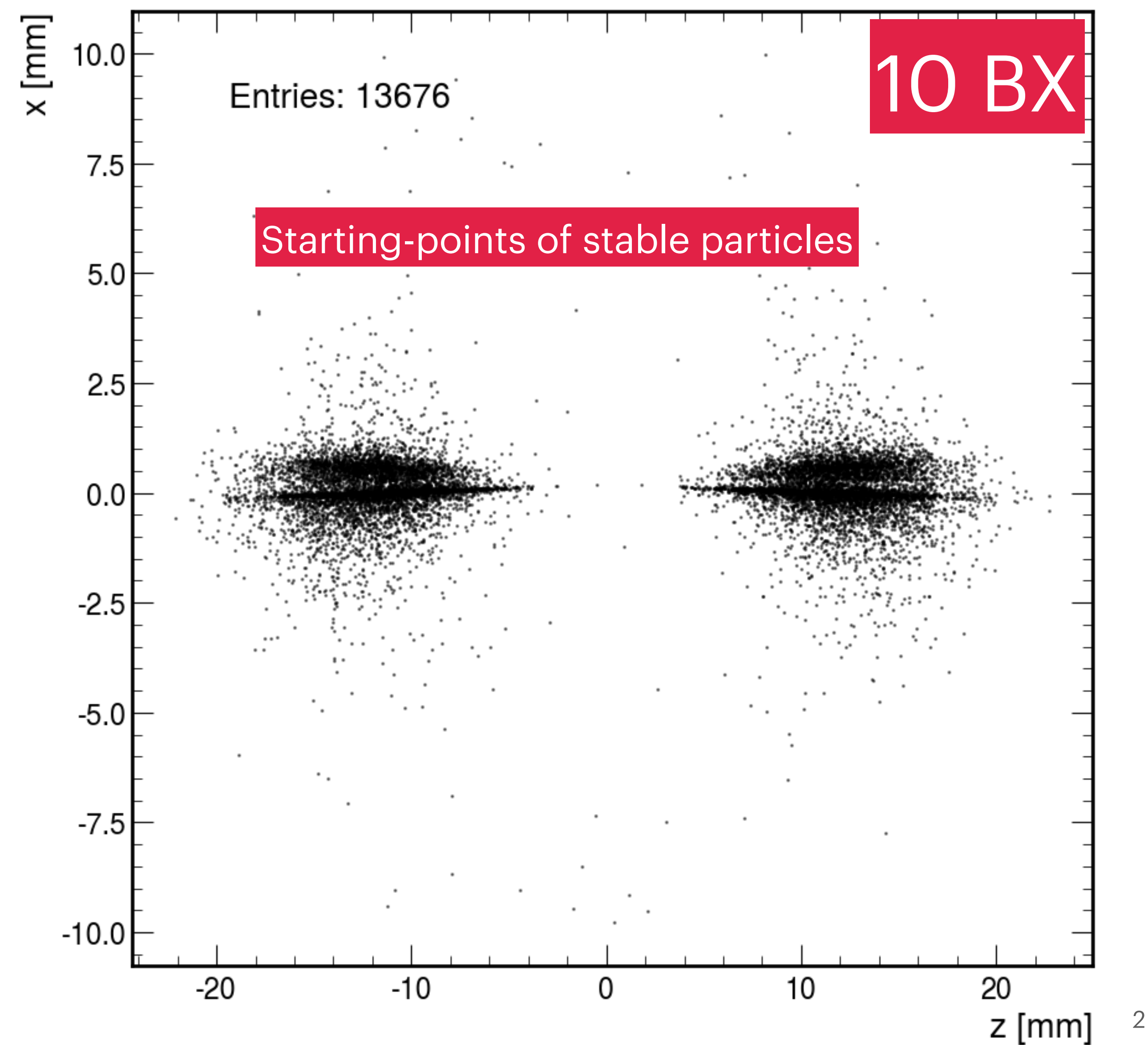
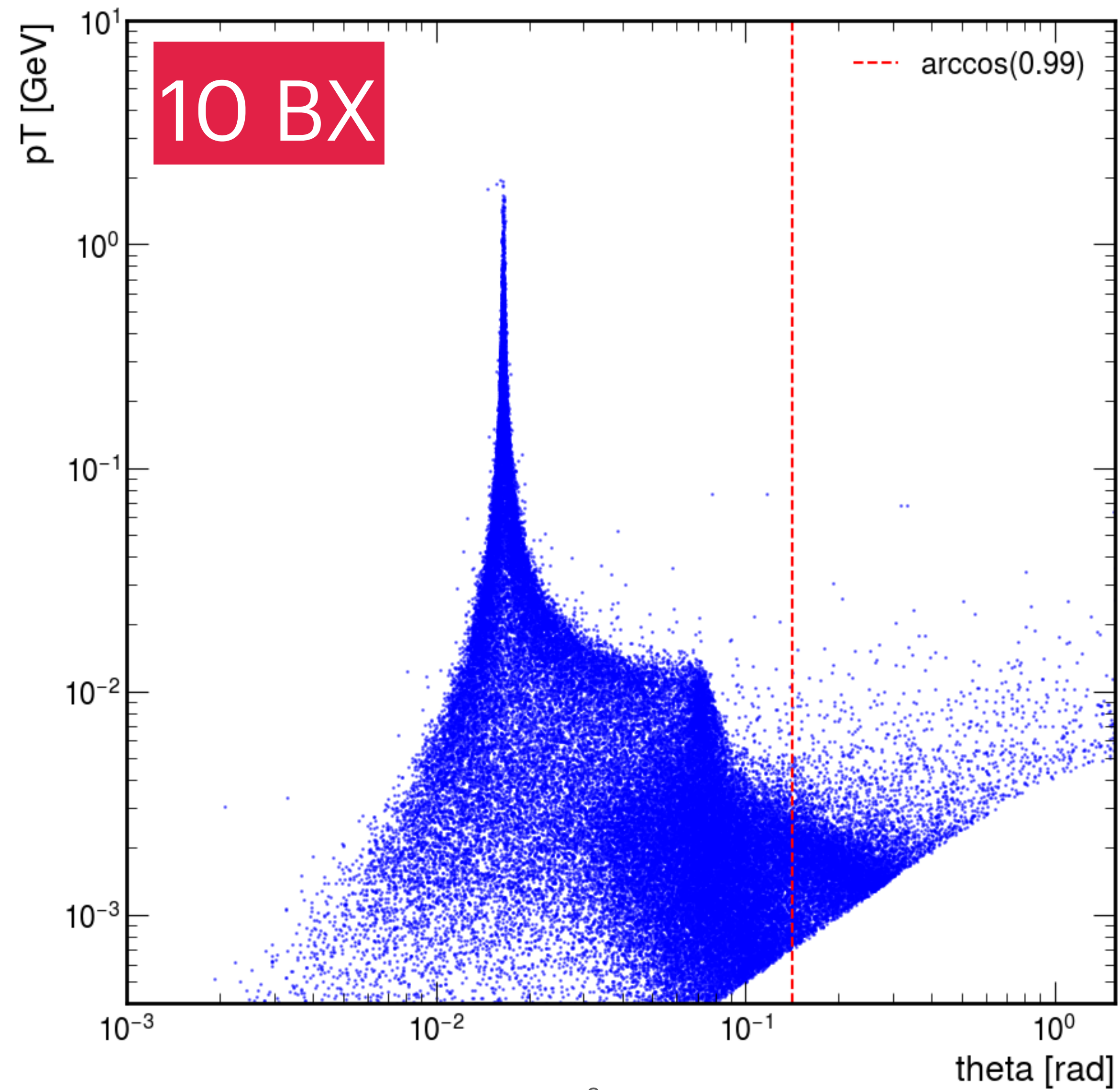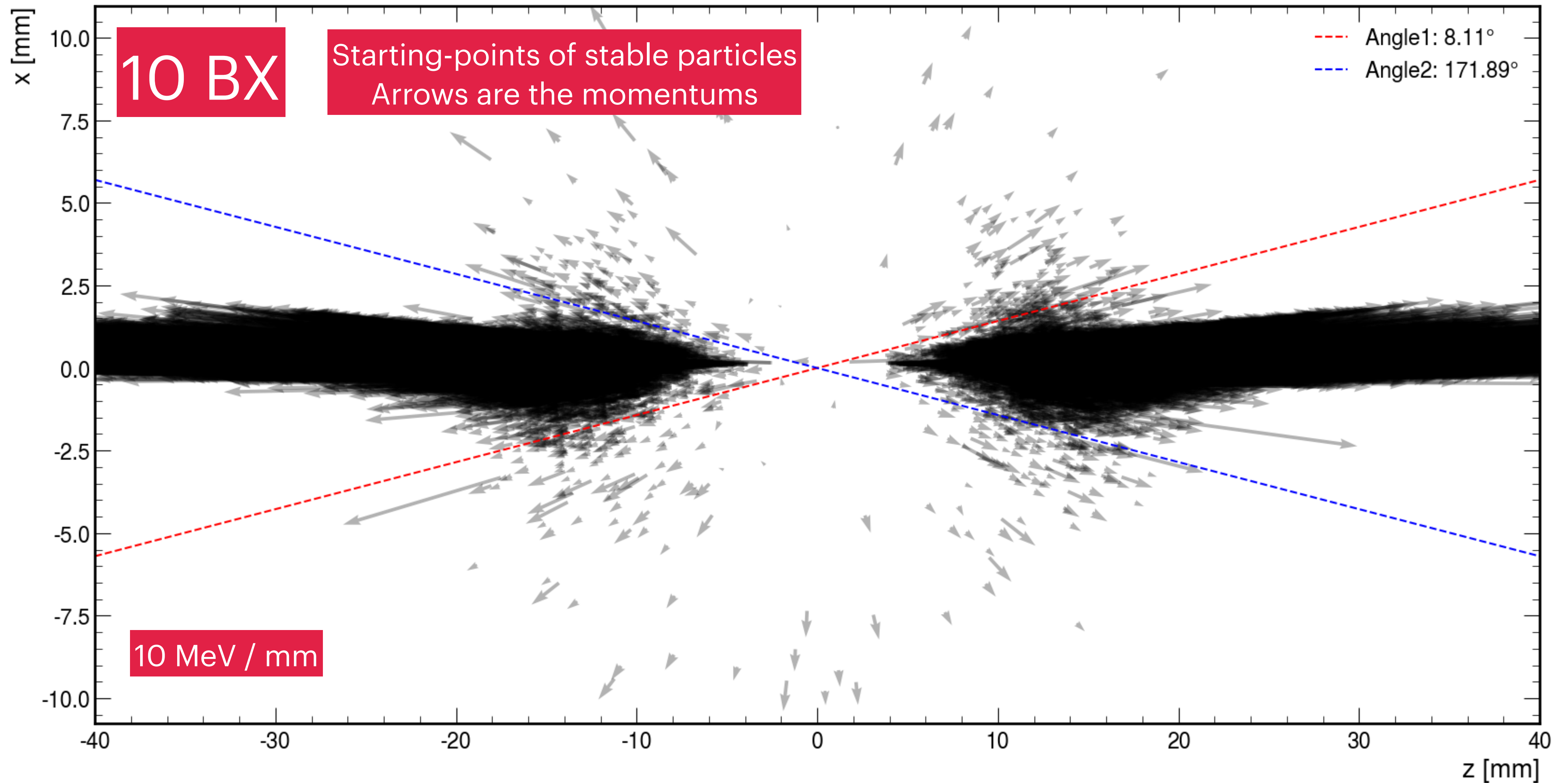|	50MW Higgs, 346ns/BX
Pair Production	~1.82GHz in IR
Beam Thermal Photon	~0.30MHz/beam in IR
Beam Gas Bremsstrahlung	~0.04MHz/beam in IR
Beam Gas Coulomb	~0.23MHz/beam in IR
Touschek Scattering	~0.06MHz/beam in IR
SR	~630 PHz/beam generated at last bending magnet

From Haoyu Shi

1.8 x 346 = 623

pt vs theta

Mode	Higgs	Z(10MW)
Pairs/BX	~2200	~850

Background-only

Background-only

Plot axes: x [mm] vs z [mm]

10 BX

Starting-points of stable particles
Arrows are the momentums

Angle1: 8.11°
Angle2: 171.89°

10 MeV / mm

Background-only

Starting-points of stable particles
Arrows are the momentums

Angle1: 8.11°
Angle2: 171.89°

100 BX	N stable particles	pT>10MeV; costheta < 0.99; > -0.99	N reco'ed tacks
	120 k	167	45

nnHgg+Background

mixed_sim_TPCHits, N=212546

mixed_reco_TPCHits, N=56791
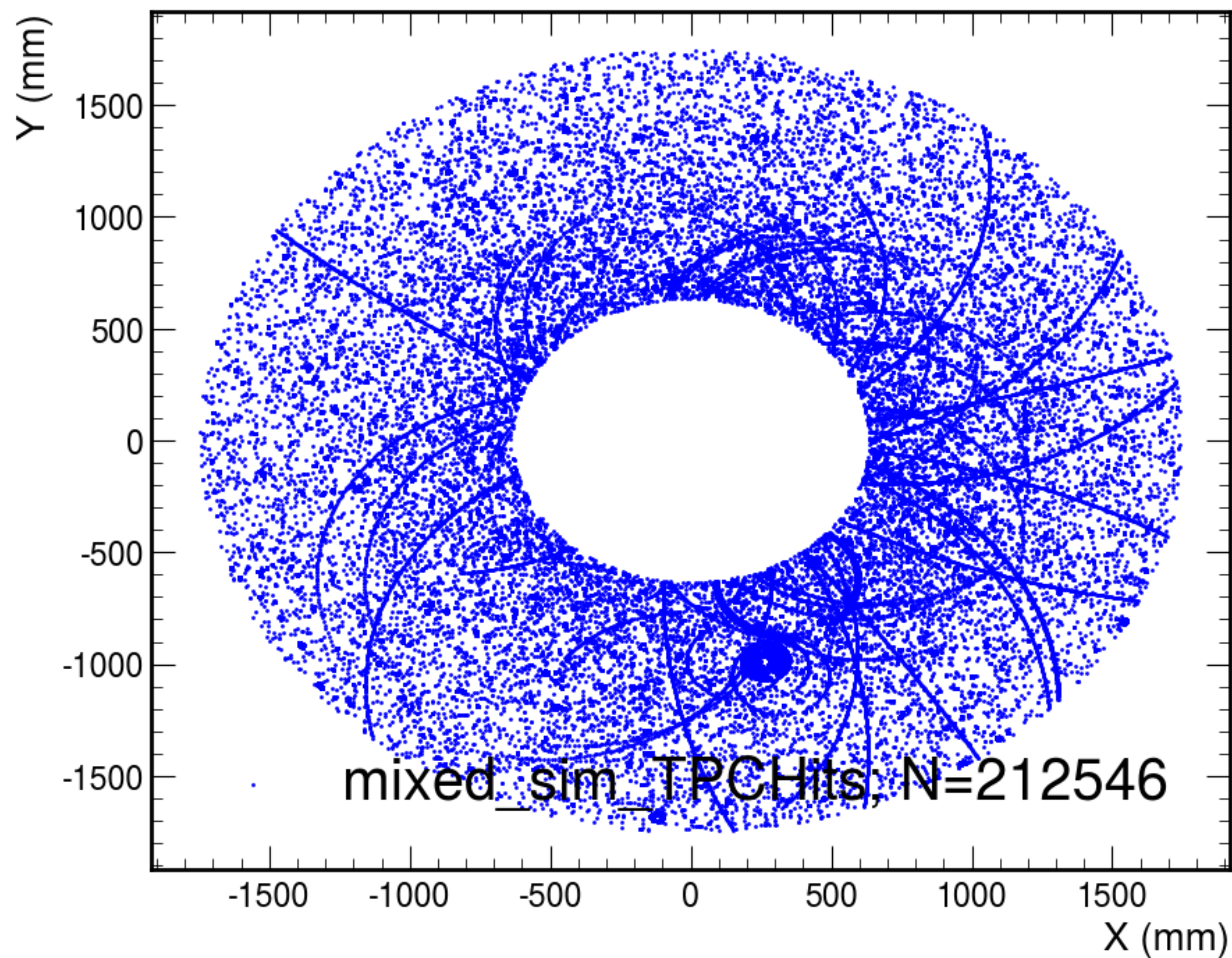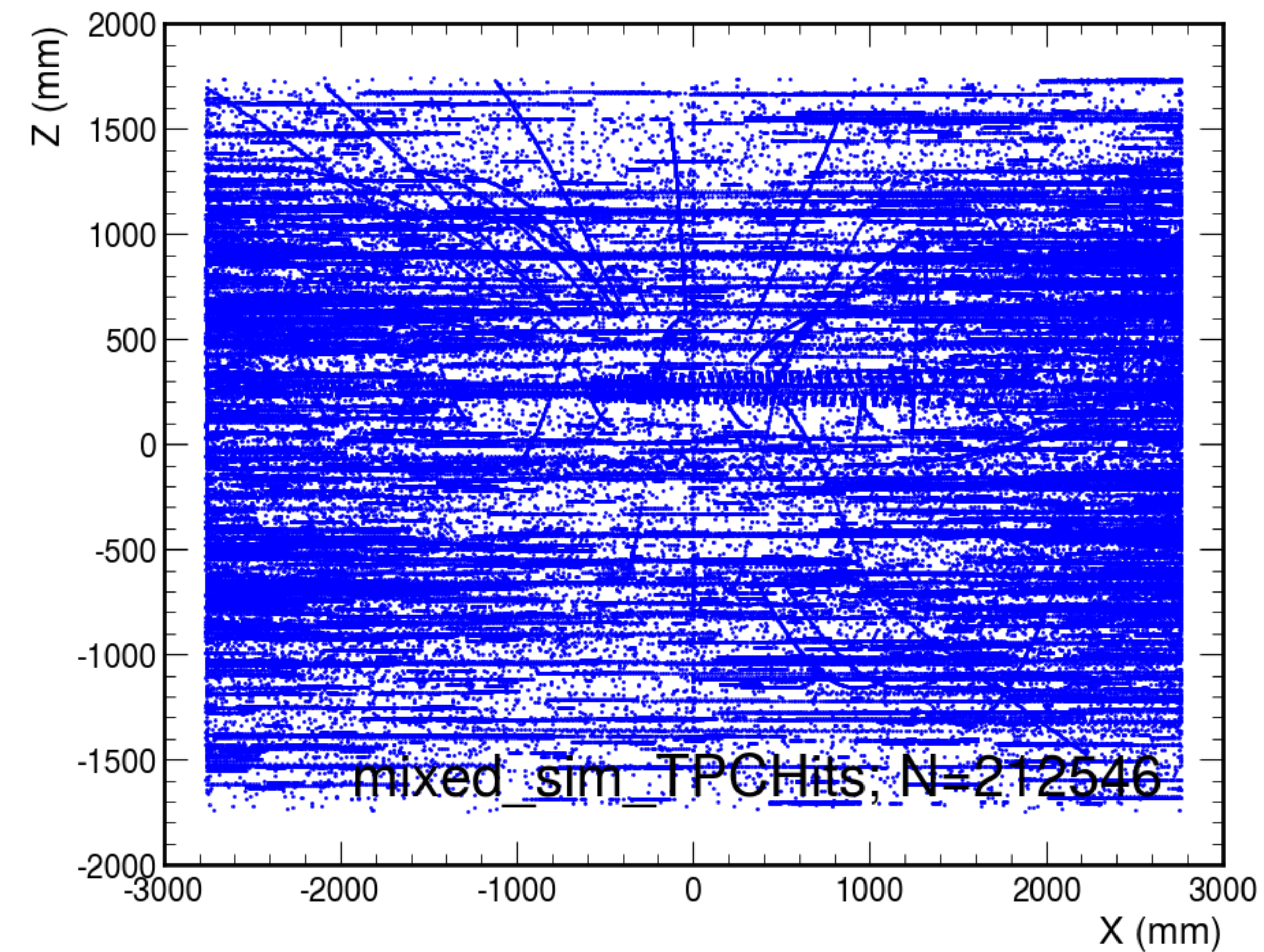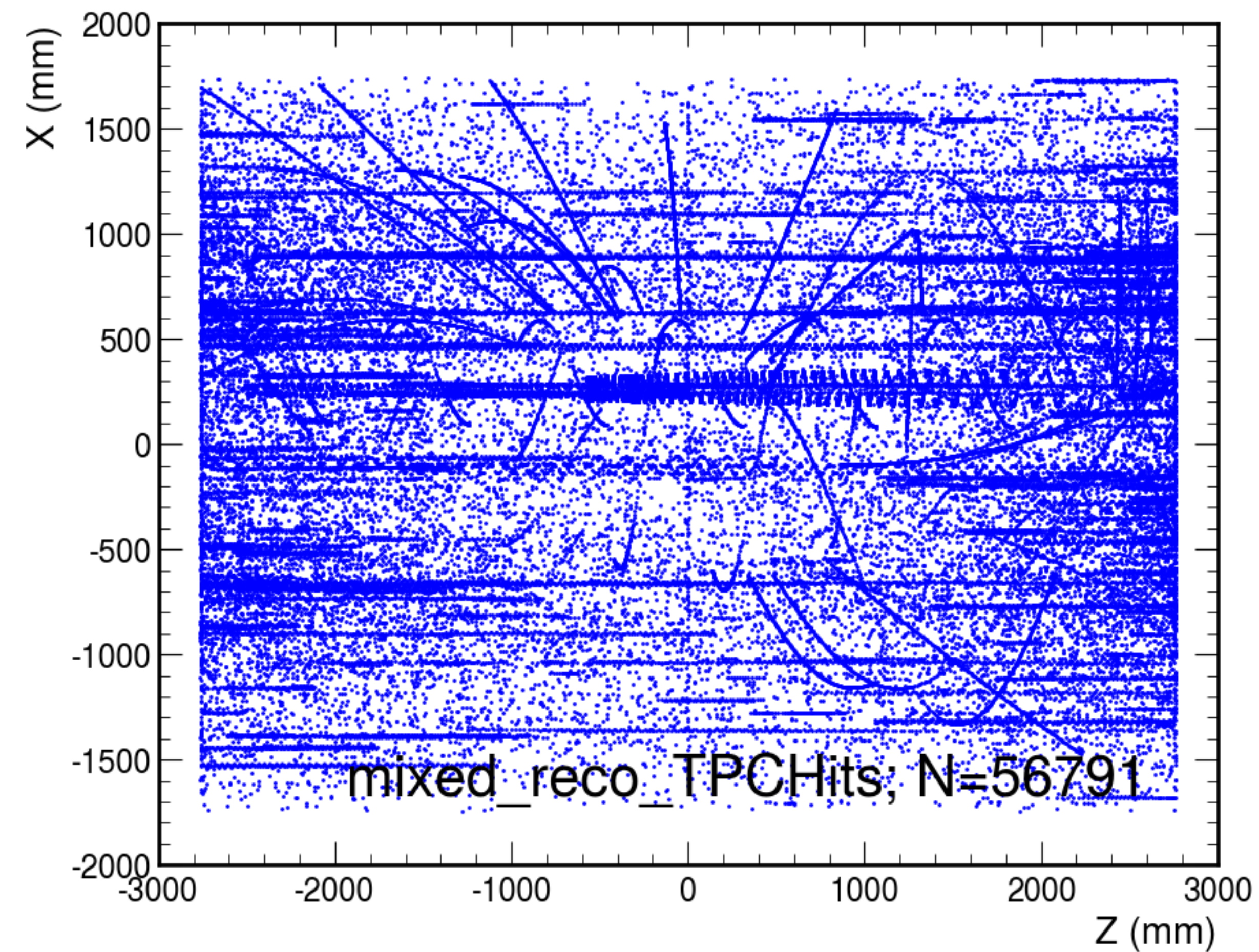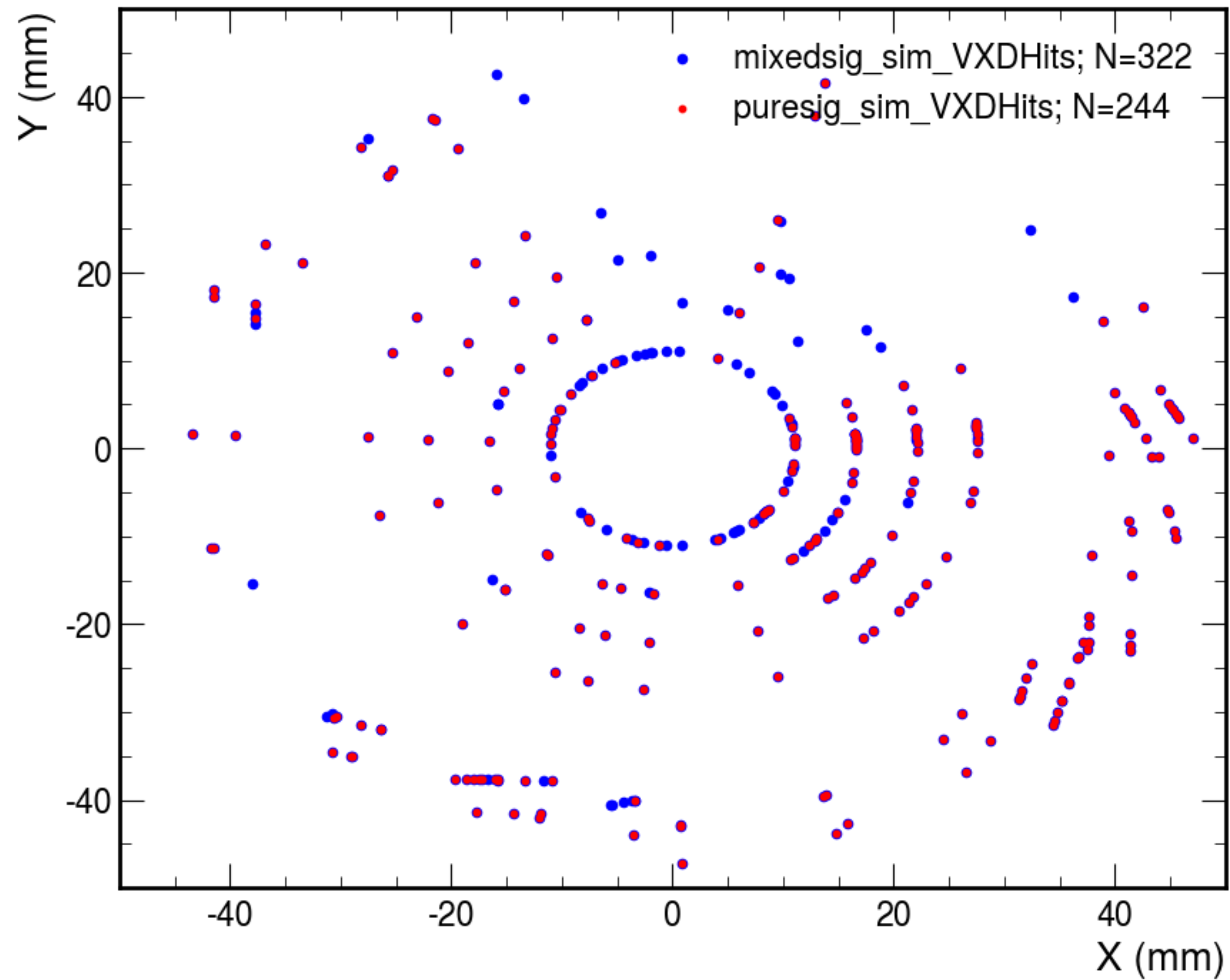
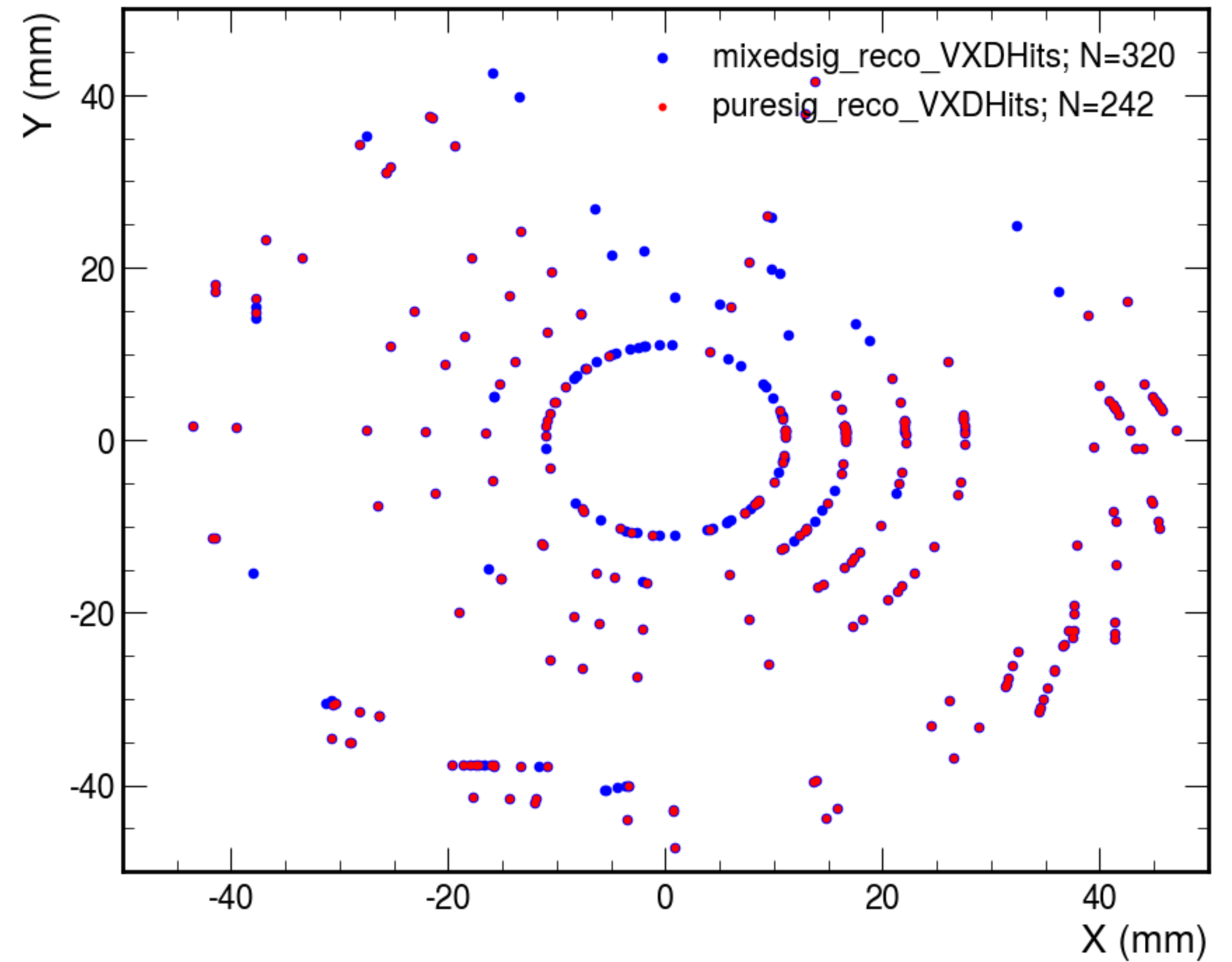TPC sim hit

TPC rec hit

nnHgg+Background
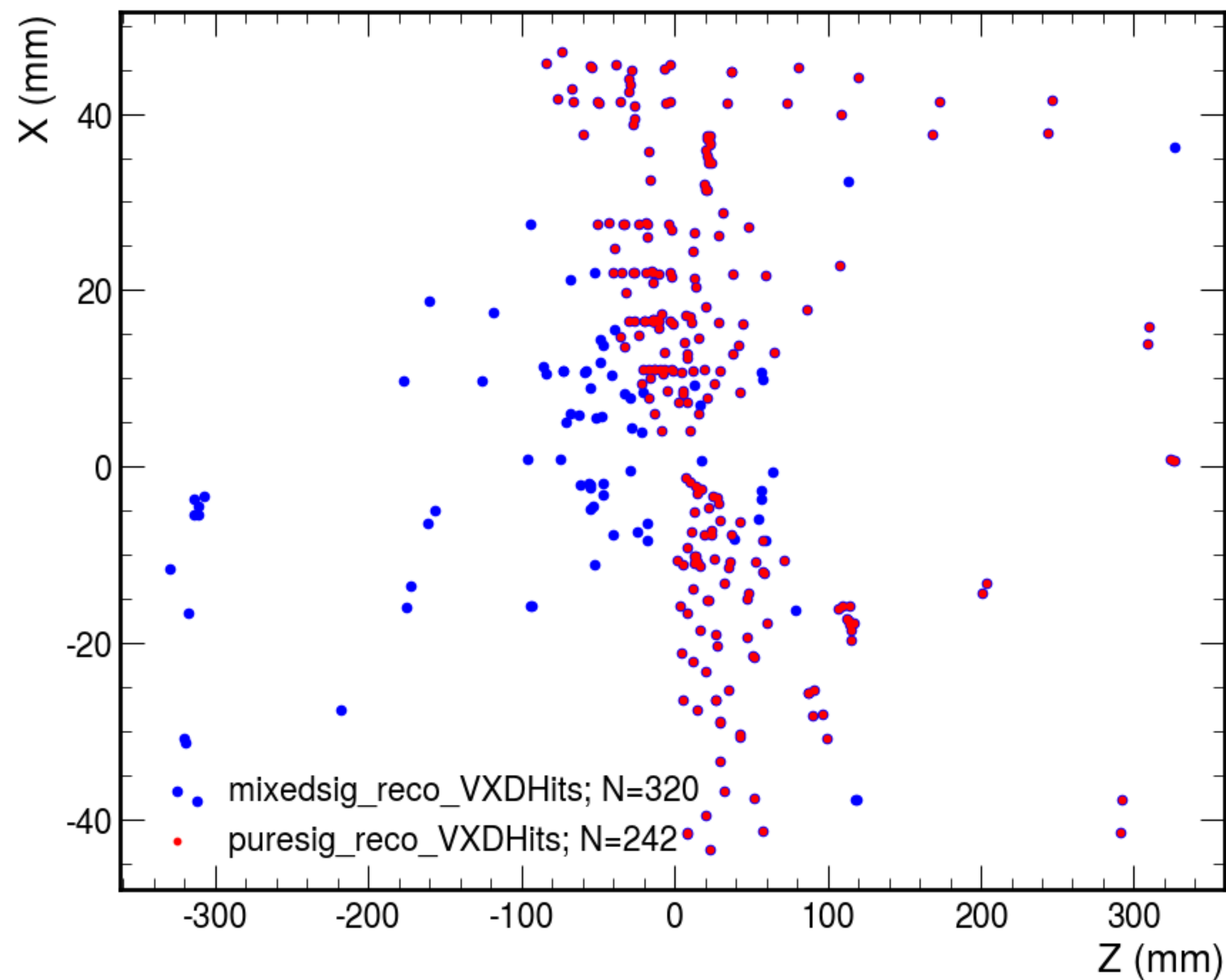

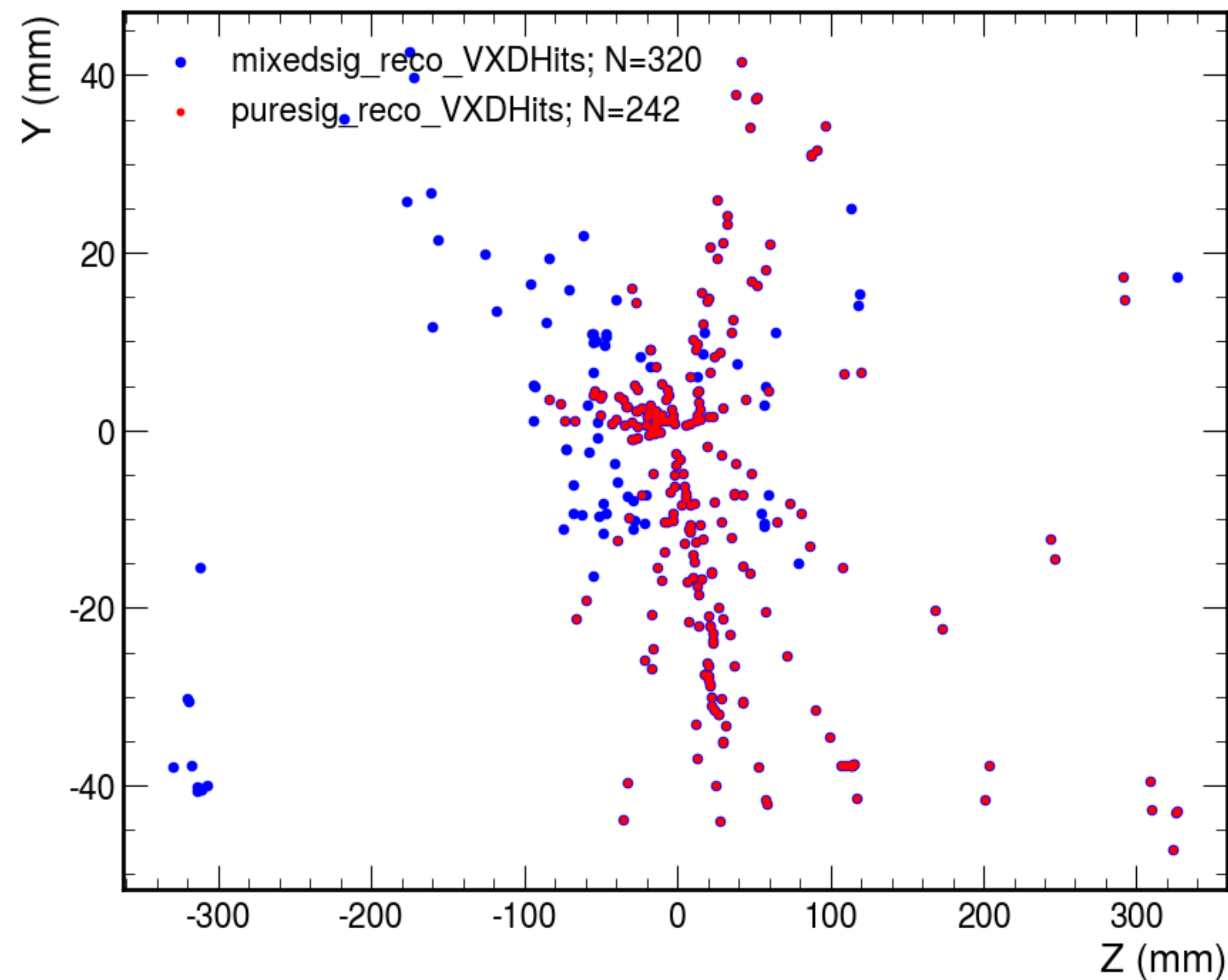TPC sim hit

TPC rec hit

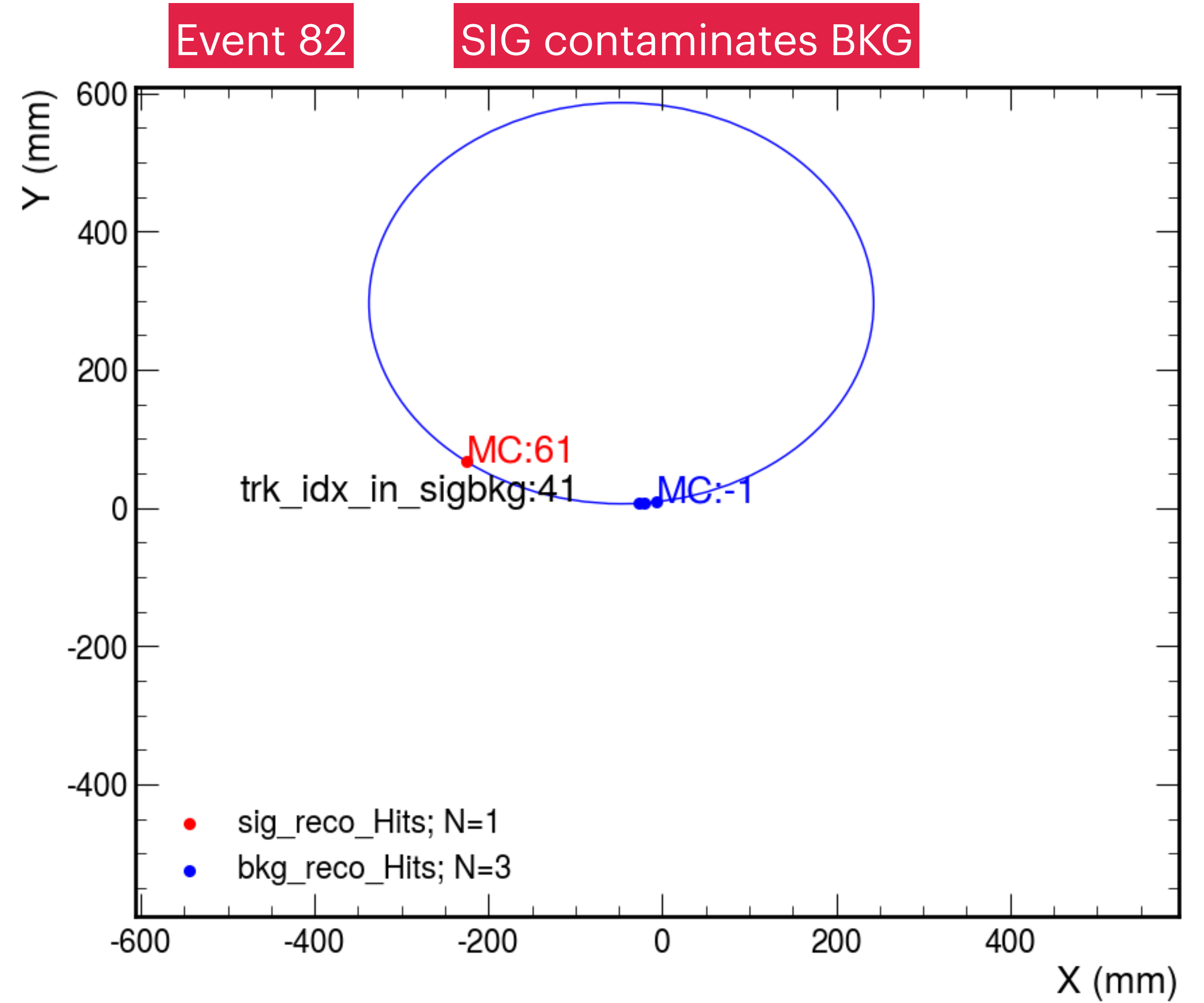# nnHgg+Background

VXD sim hit

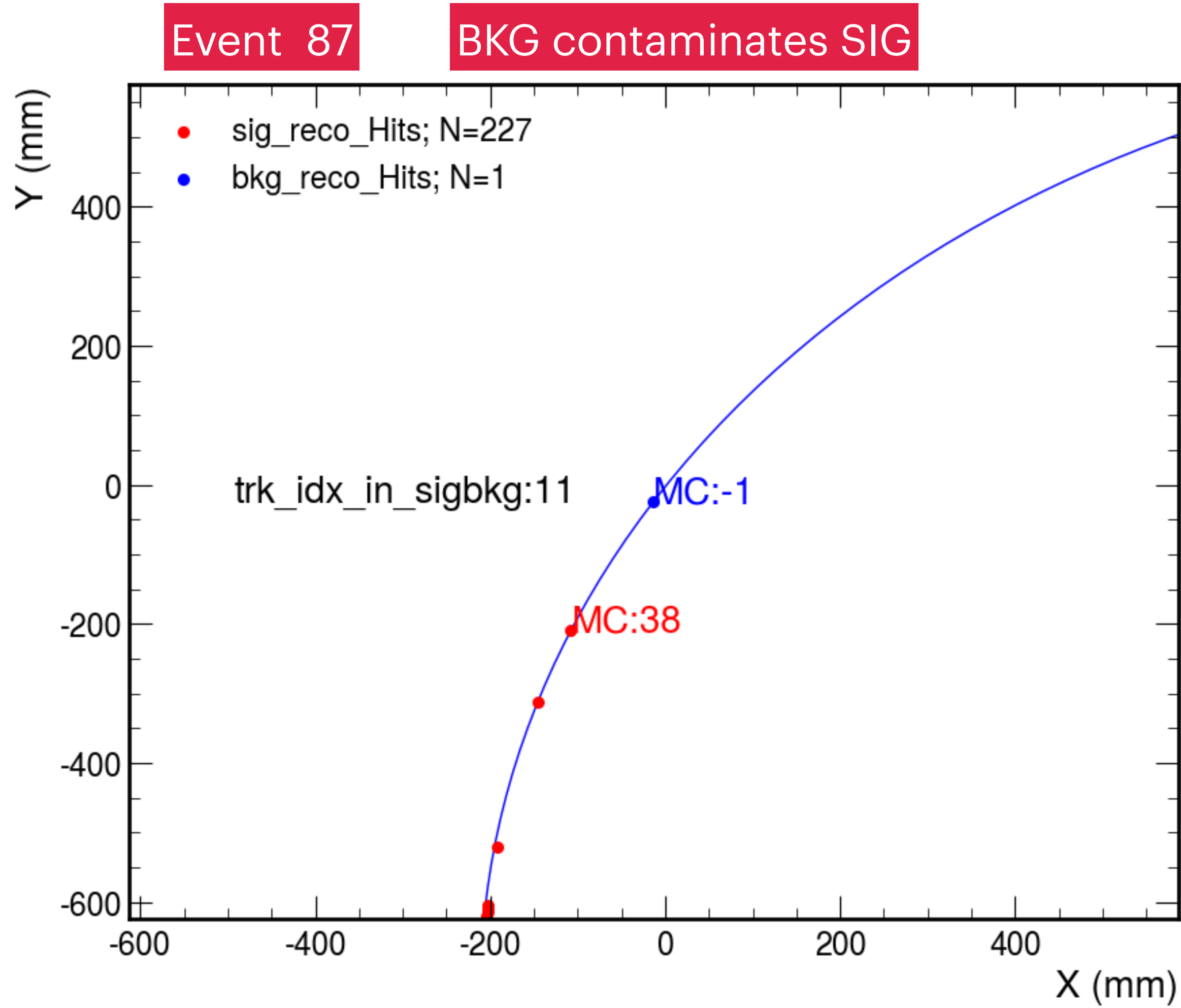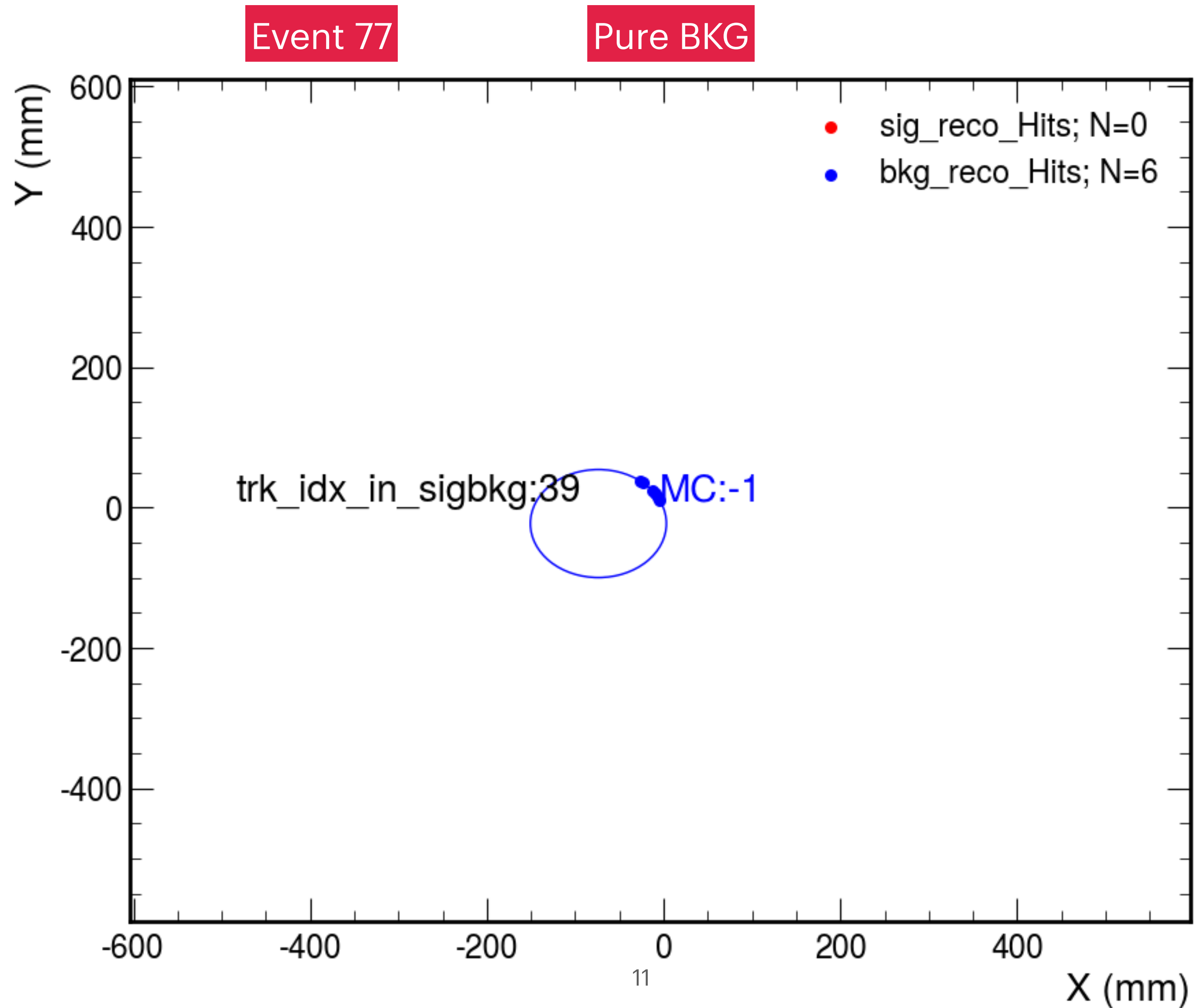VXD rec hit

nnHgg+Background

VXD sim hit

VXD rec hit

# nnHgg+Background

nnHgg+Background

Todo

- **Need a better understanding of the TPC hit distribution**

- **Mixed-MCParticle is missing**

  - **Current MIX algo. doesn't cooperate with TPR algo.**

  - **No hit-level mcp-trk matching, no efficiency and fake rate**

- **Need to remove the impacts from digitization**

- **Some ERRORs occur in trakcing (only with sig+bkg)**

```
657 TDecompLU::Inve...   ERROR matrix is singular, 0 diag elements < tolerance of 2.2251e-308
658 TDecompLU::Deco...   ERROR matrix is singular
659 TDecompLU::Inve...   ERROR matrix is singular, 0 diag elements < tolerance of 2.2251e-308
660 TDecompLU::Deco...   ERROR matrix is singular
661 TDecompLU::Inve...   ERROR matrix is singular, 0 diag elements < tolerance of 2.2251e-308
662 TDecompLU::Deco...   ERROR matrix is singular
663 TDecompLU::Inve...   ERROR matrix is singular, 0 diag elements < tolerance of 2.2251e-308
664 TDecompLU::Deco...   ERROR matrix is singular
665 TDecompLU::Inve...   ERROR matrix is singular, 0 diag elements < tolerance of 2.2251e-308
666 TDecompLU::Deco...   ERROR matrix is singular
667 TDecompLU::Inve...   ERROR matrix is singular, 0 diag elements < tolerance of 2.2251e-308
668 EventLoopMgr         SUCCESS Terminating event processing loop due to scheduled stop
```

Overview

- **MR247 supports bkg-mixing with fixed time-window mode**
  - **Bunch-spacing: 340 ns**
  - **VXD, ITK: 200 ns**
  - **OTK: 1000 ns**
  - **TPC: 34 us**

- **Bkg-simulations from Haoyu Shi, one file includes 10 BX**

- **For one signal, the event-time-window is [-34 us, 34 us], with the signal centered at zero**
  - **100 BX before and after a signal corresponds to +/- 10 bkg-simulations**
  - **Silicon hits are not included in the event-time-window if their timestamps exceed the detector-time-window**
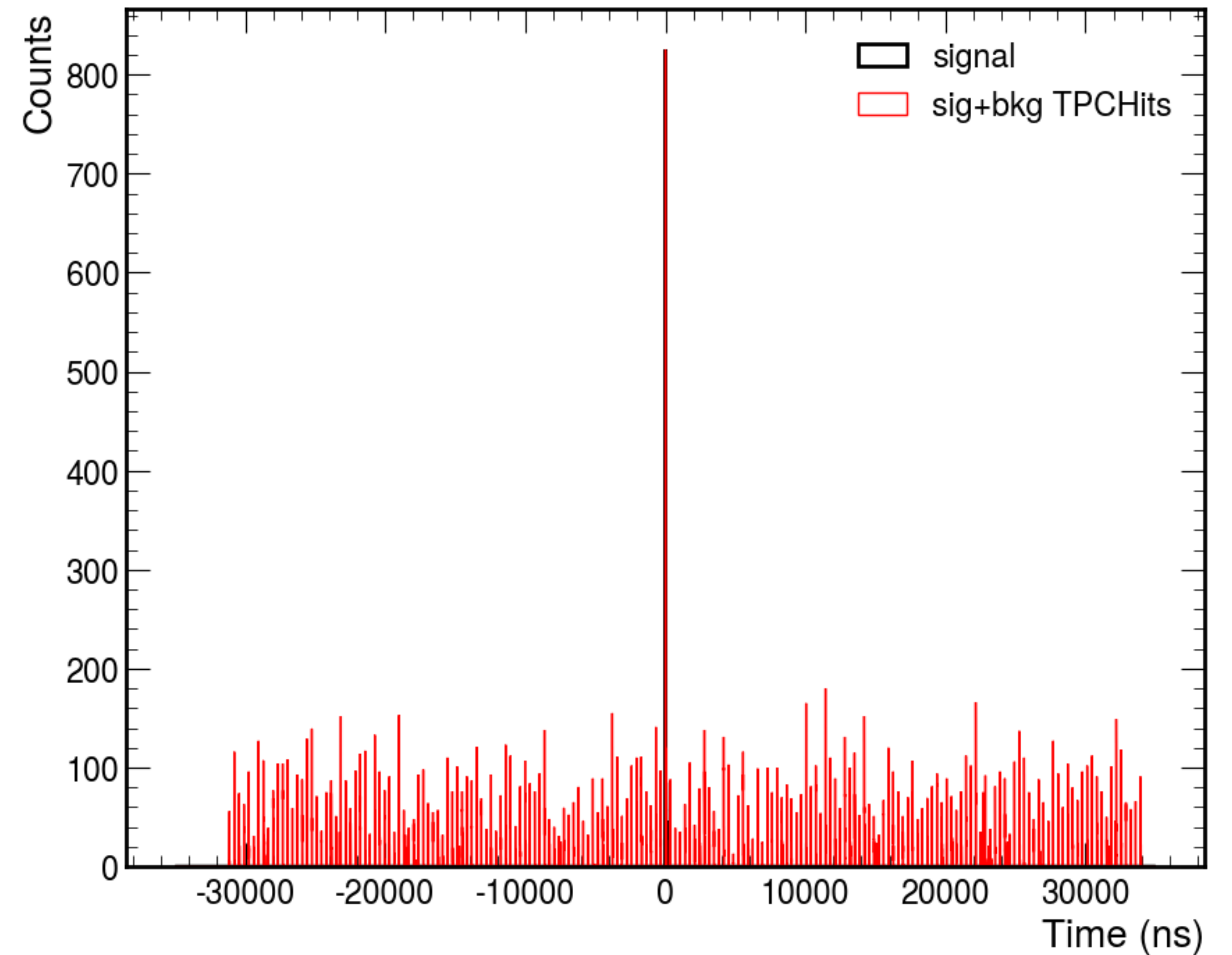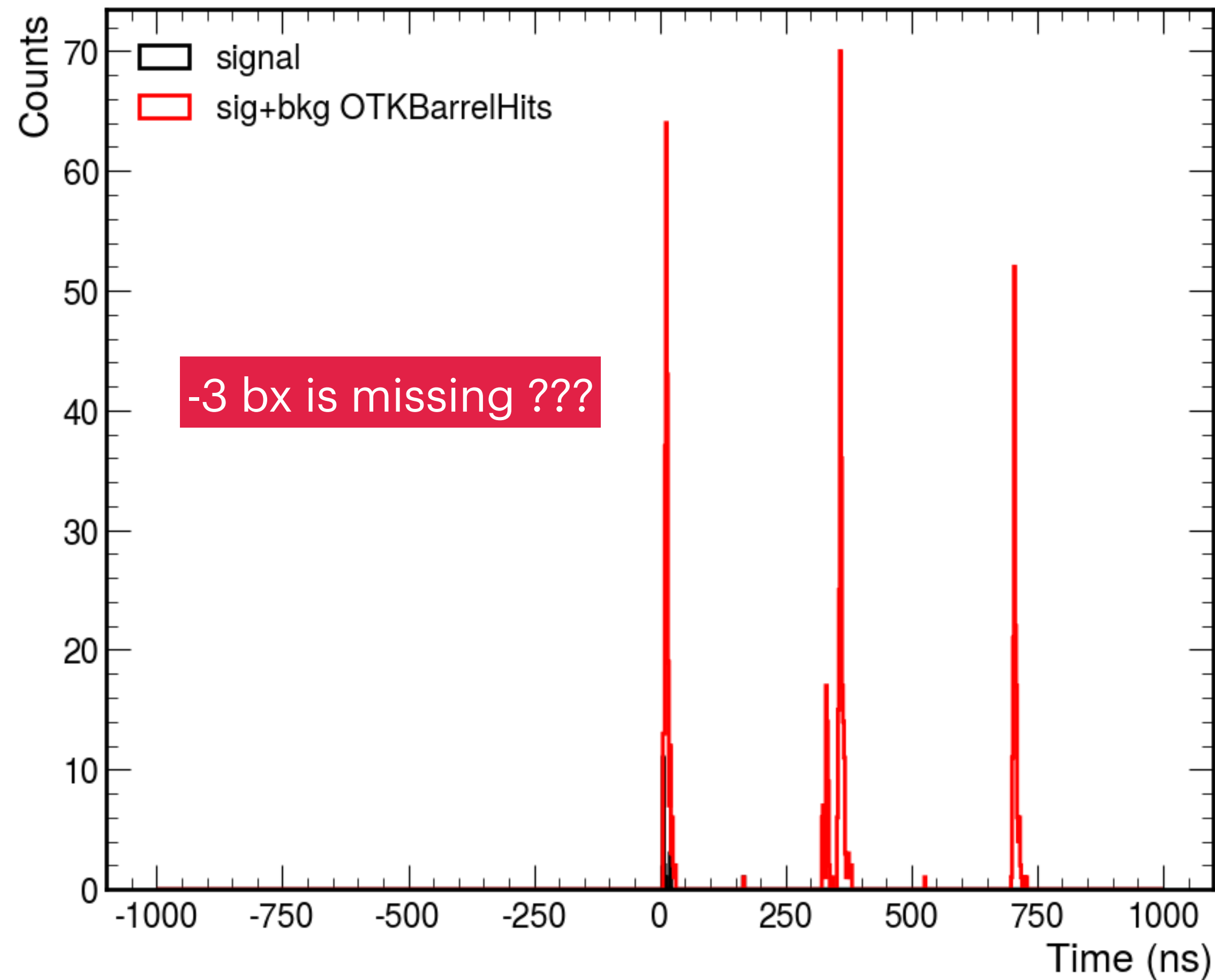
Sanity plots
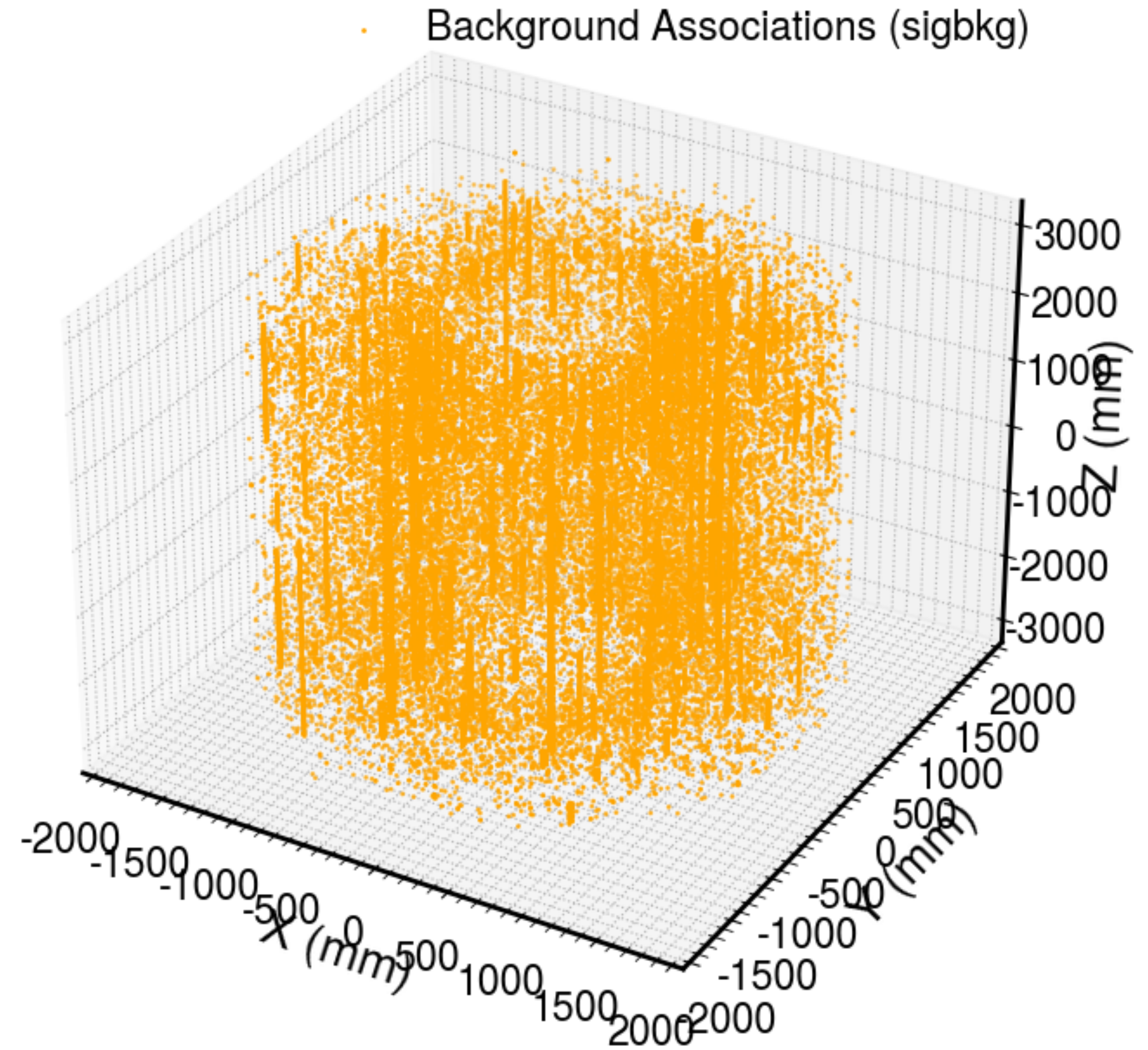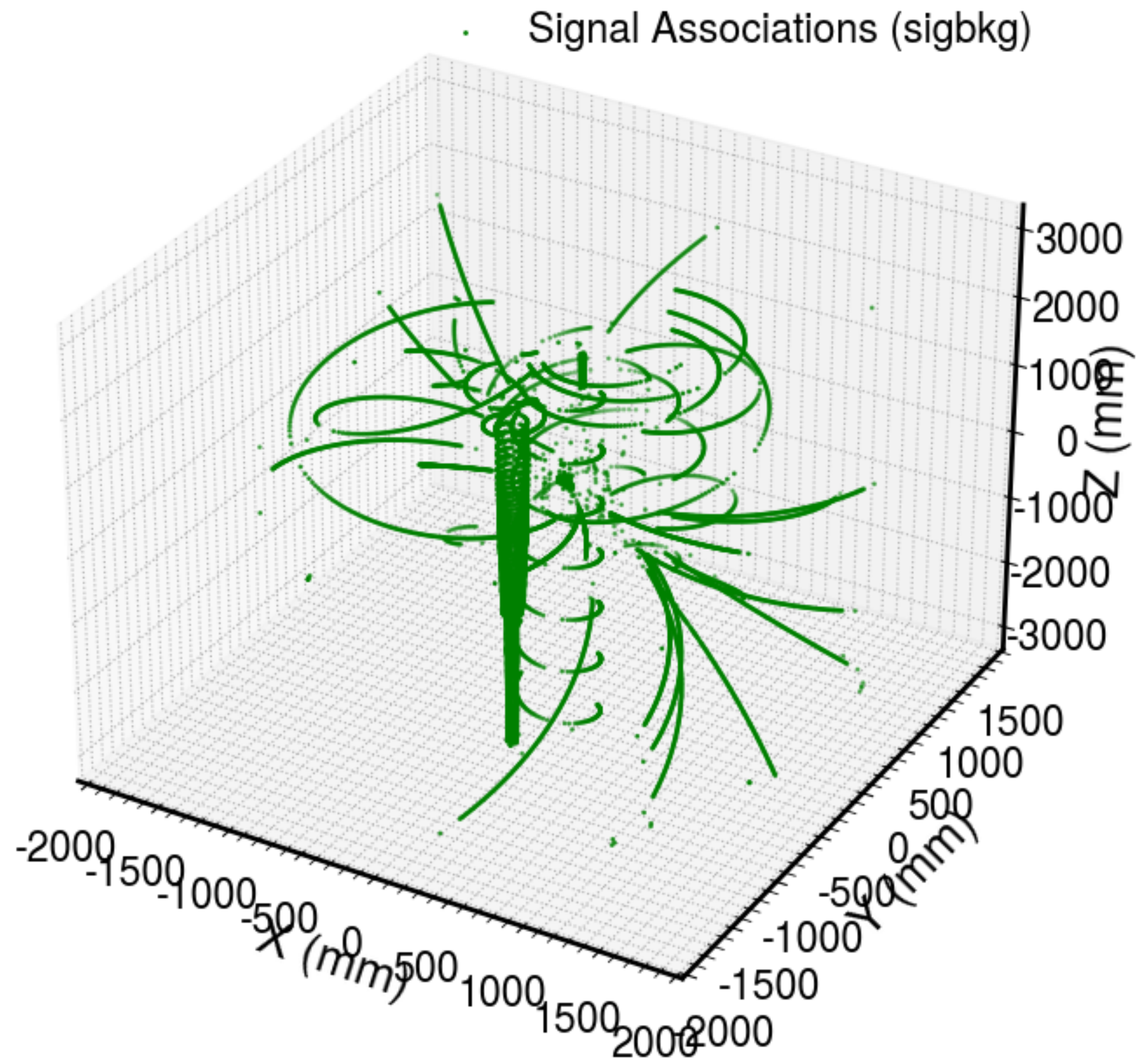
Sanity plots
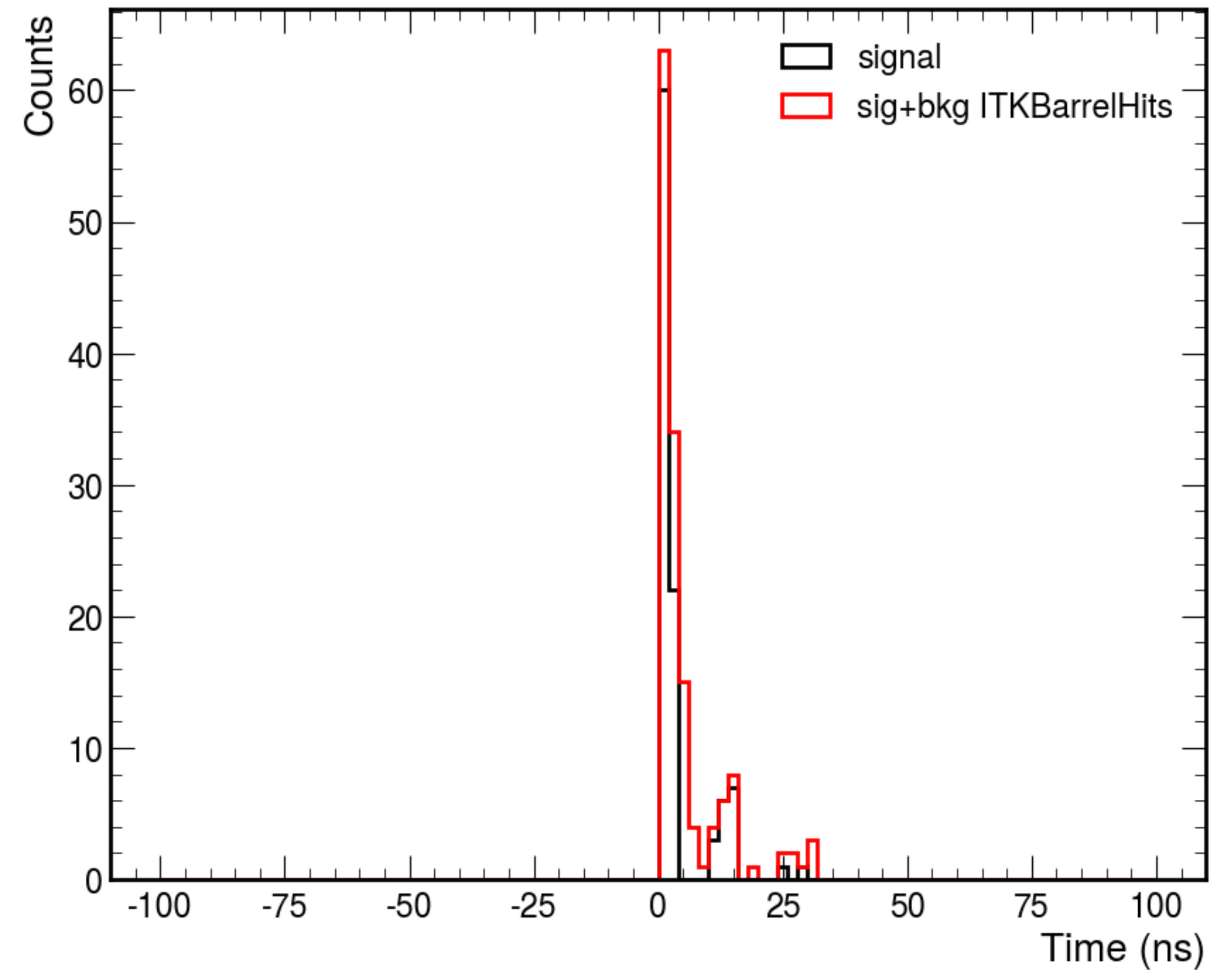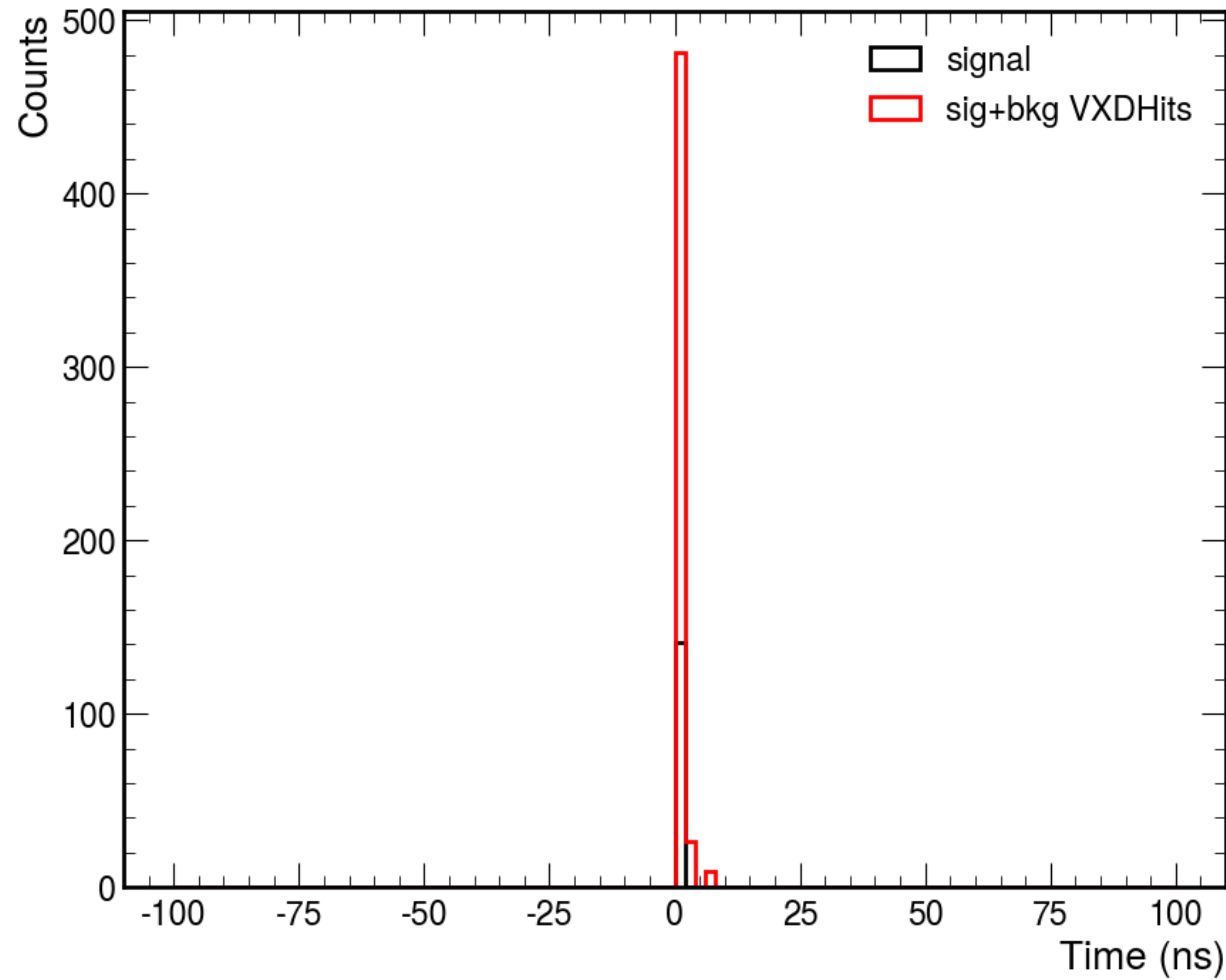
- **VXD and ITK time distributions; time-window 200 ns**

- **Only the bkg in the same BX as the signal is included**

Sanity plots

- **OTK (1k ns), +/- 3 bx in the time-window**
- **TPC (34k ns), also as event-time-window, +/- 100 bx in the time-window**