

# Study of v26e and v26c geometry

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30.09.2026

# Data and method

CBMROOT is used , the master version is used for the analysis.

URQMD event generator with 8AGeV Au+Au 1000 events each is used for geometry v26c and v26e .

Hit rates are simulated hits/event.



# V26c AND V26e geometry comparison

| • <b>Parameter</b>    | • <b>v26c</b>                     | • <b>v26e</b>                     |
|-----------------------|-----------------------------------|-----------------------------------|
| • Stations / layers   | • 2 stations / 6 layers each      | • 2 stations / 6 layers each      |
| • C-frames            | • 12                              | • 12                              |
| • Module types        | • S1, S2, S3, F                   | • S1, S2, S3, F                   |
| • Active modules      | • 396 (264 × 2.5 m + 132 × 5.0 m) | • 396 (264 × 2.5 m + 132 × 5.0 m) |
| • Active straws       | • 32,256                          | • 32,256                          |
| • Active 32-ch groups | • 1,008                           | • 1,008                           |
| • Stereo angles — S0  | • 0°, -5°, +5°, 0°, 0°, -5°       | • 0°, -5°, +5°, 0°, 0°, -5°       |
| • Stereo angles — S1  | • +5°, 0°, 0°, -5°, +5°, 0°       | • +5°, 0°, 0°, -5°, +5°, 0°       |
| • Station 0 layer z   | • 287, 293, 297, 303, 307, 313 cm | • 290, 296, 302, 308, 314, 320 cm |
| • Station 1 layer z   | • 347, 353, 357, 363, 367, 373 cm | • 360, 366, 372, 378, 384, 390 cm |
| • Global z-offset     | • -40 cm                          | • -40 cm                          |
| • Module dimensions   | • S1/S2/S3/F: identical           | • S1/S2/S3/F: identical           |
|                       |                                   |                                   |

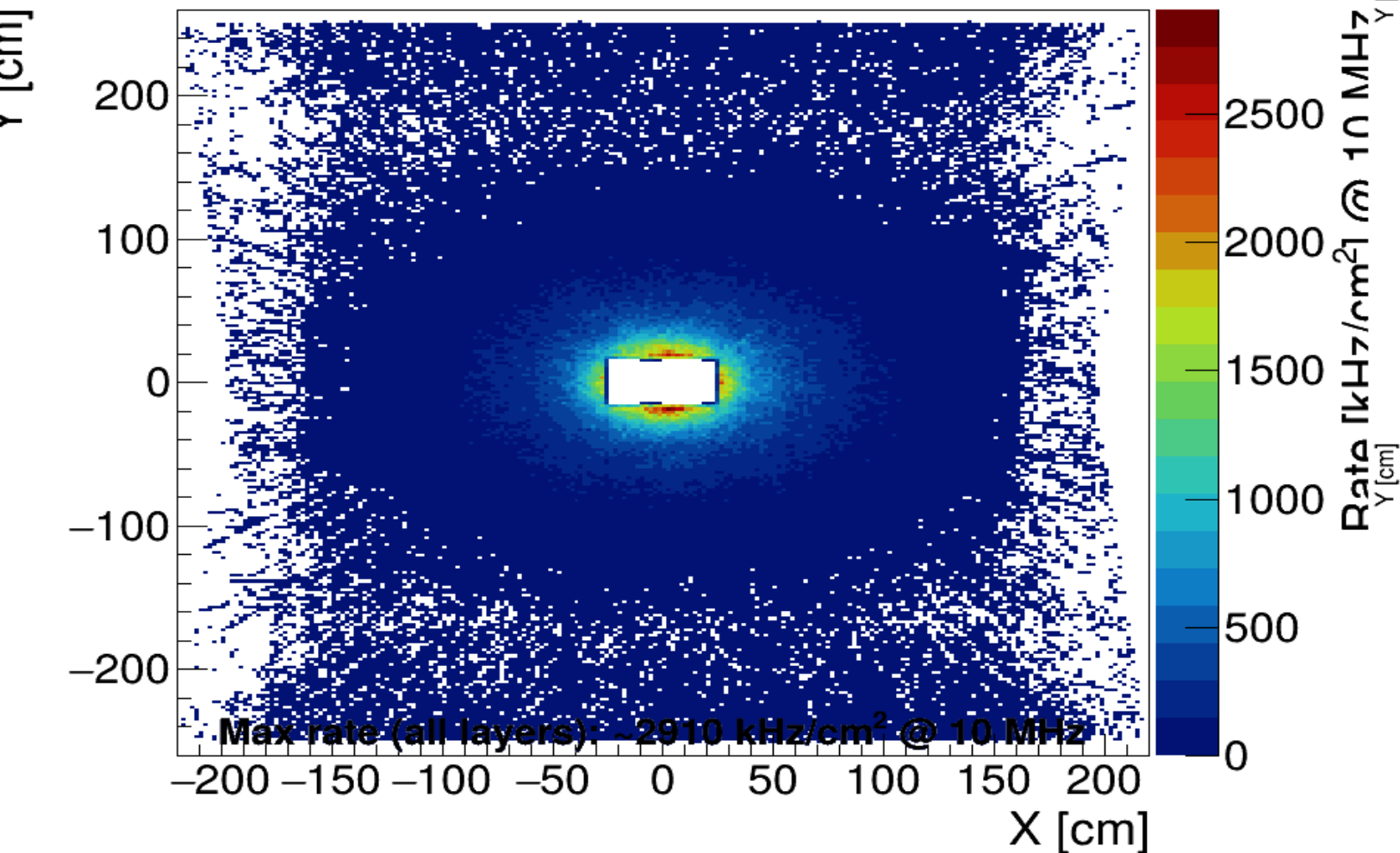
## Main geometry difference:

- The detector layout, module types, active straw count and stereo-angle pattern are the same; v26e shifts the MUST layers downstream, especially in Station 1.
- The position of F and C frames will be confirmed when the geometry will be plotted for v26c.

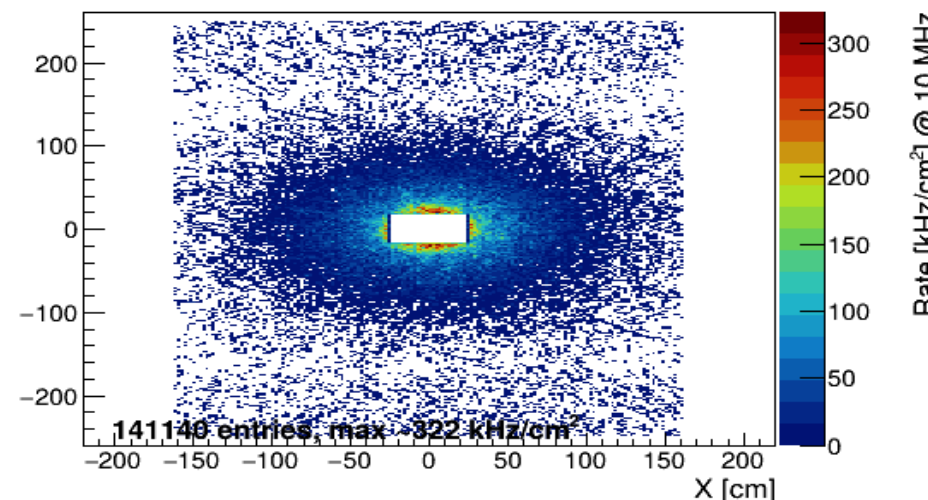
# MUST hit rate for v26c

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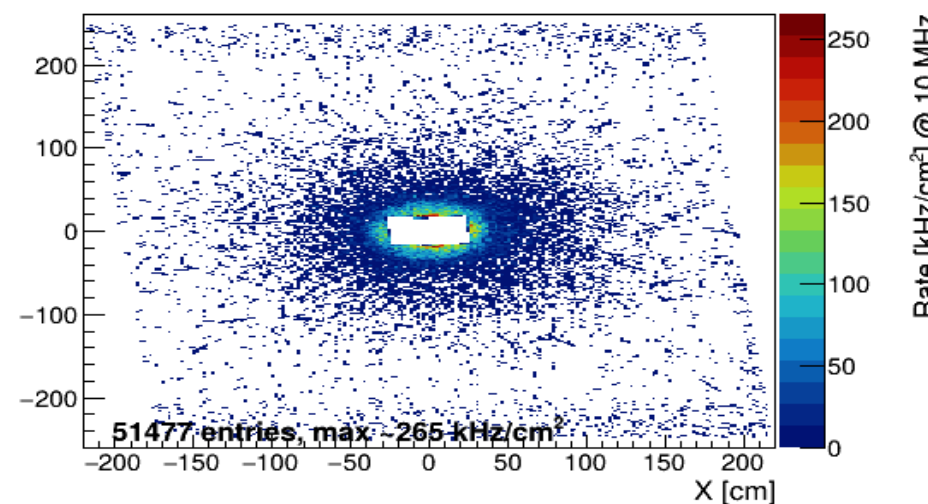
[v26c] Global X-Y map



[v26c] XY Map, Station 0, Layer 0



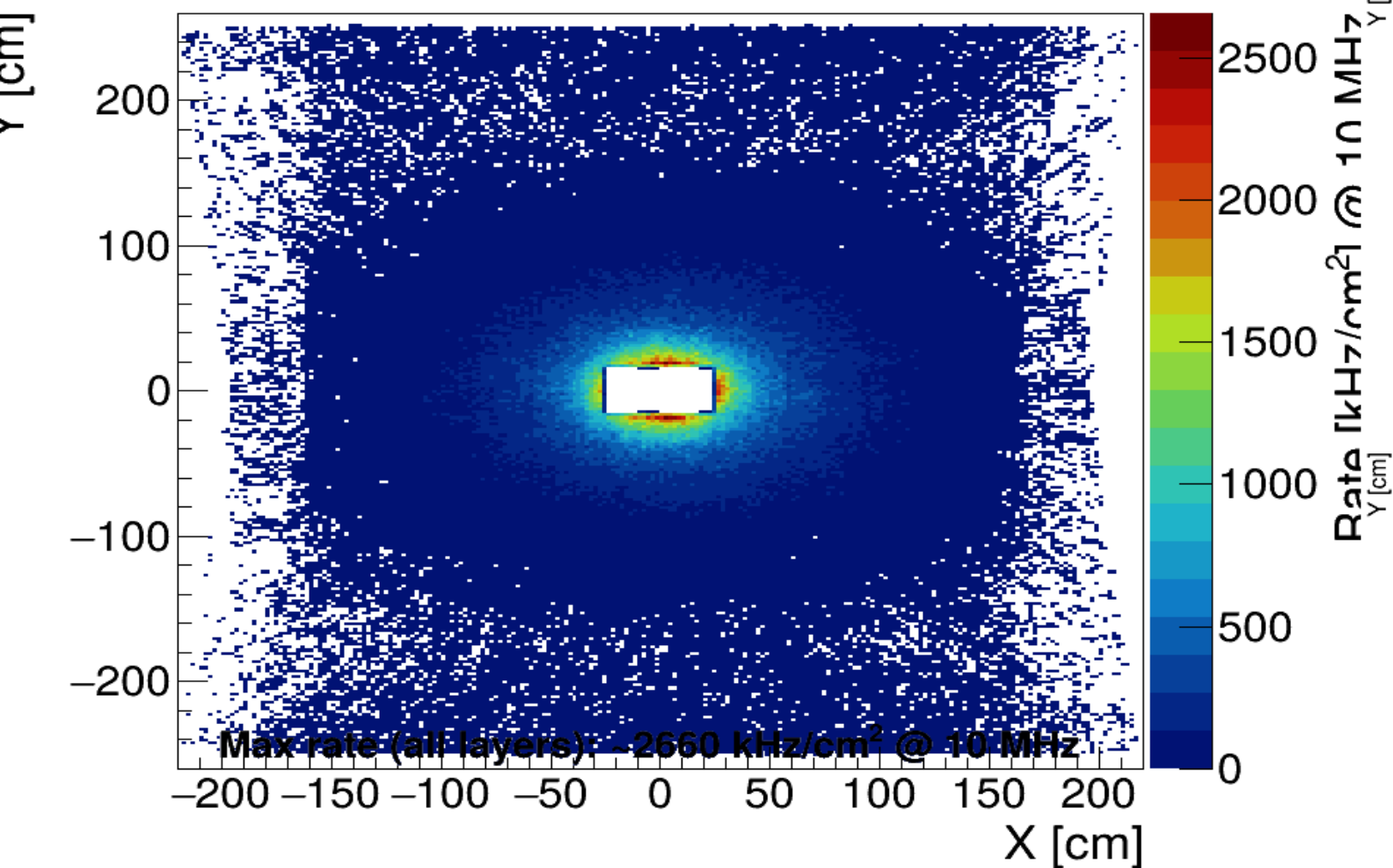
[v26c] XY Map, Station 1, Layer 0



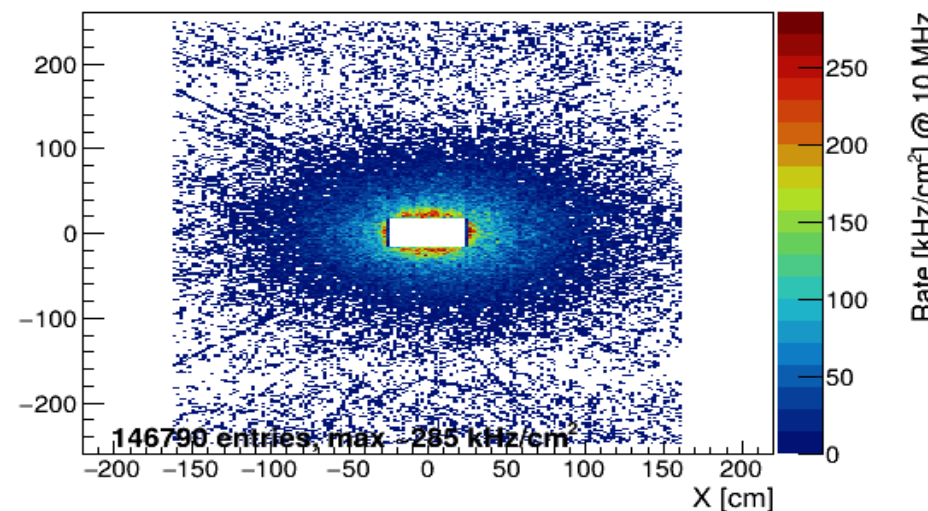
# MUST hit rate for v26e

4

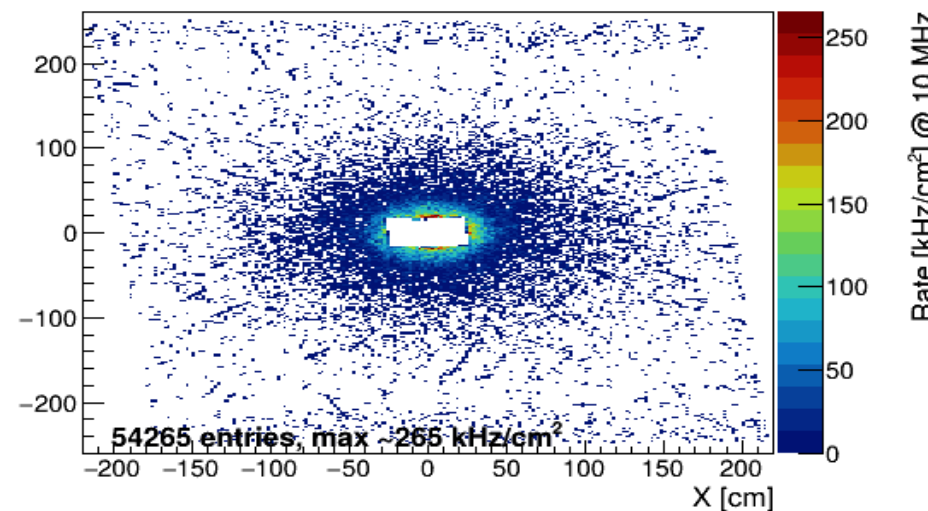
[v26e] Global X-Y map



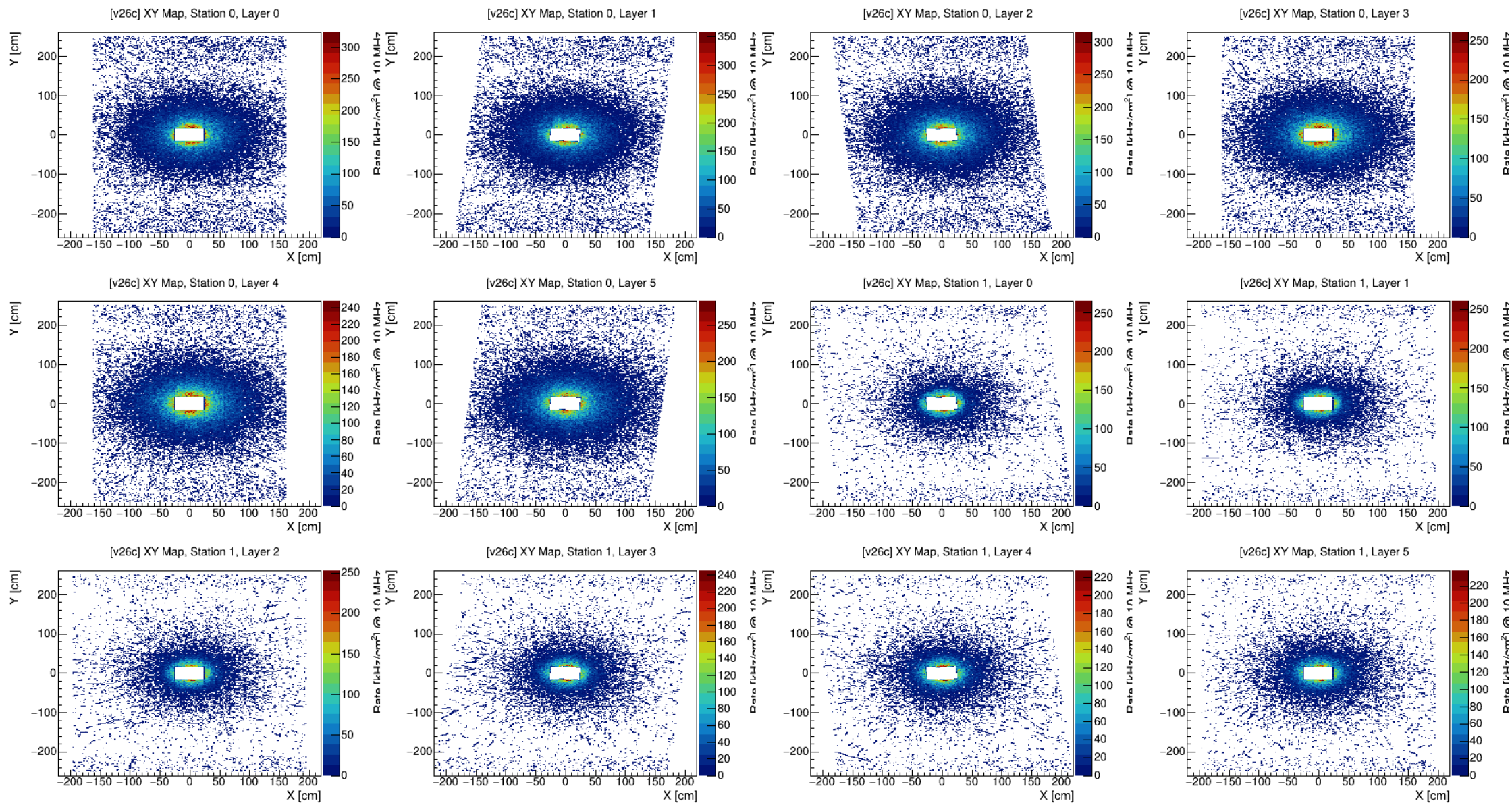
[v26e] XY Map, Station 0, Layer 0



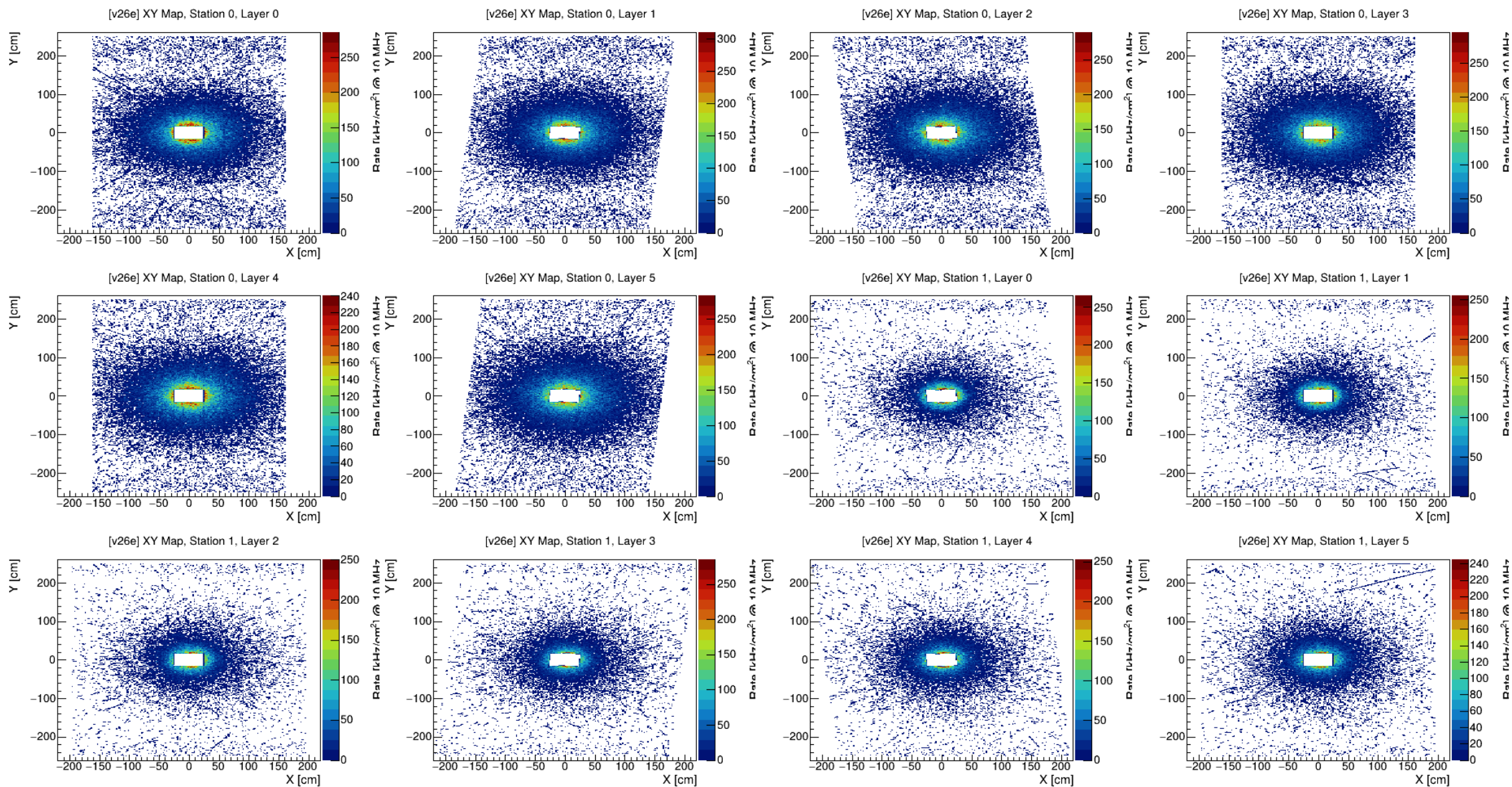
[v26e] XY Map, Station 1, Layer 0



# MUST hit rate for all 12 layers in v26c



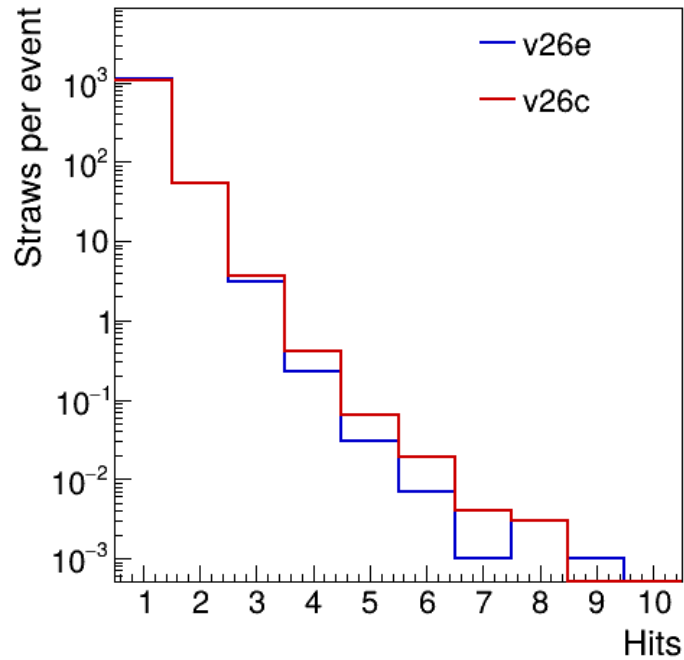
# MUST hit rate for all 12 layers in v26e



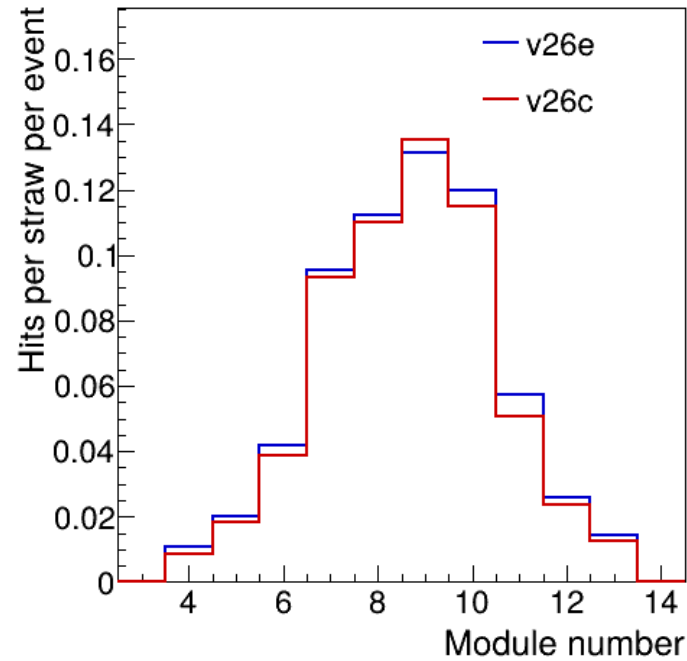
# Occupancy: multiple hits and modules

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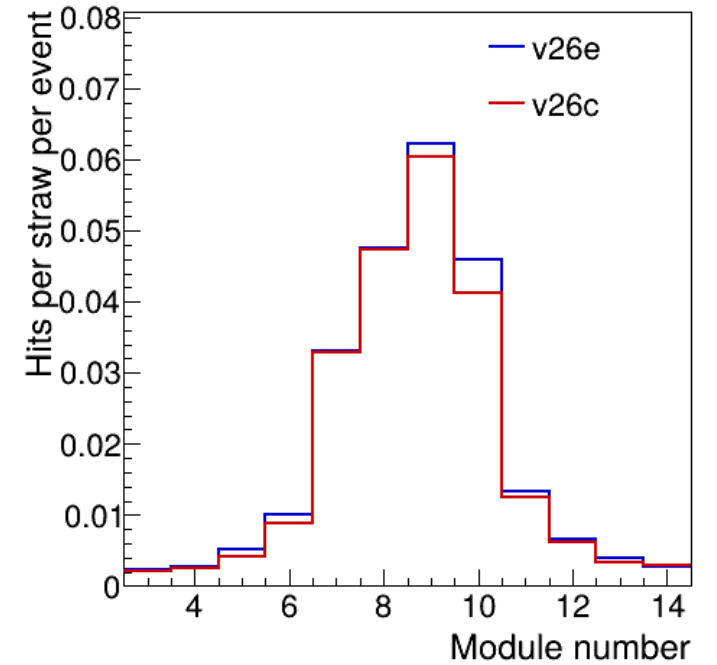
Multiple hit occupancy



Module occupancy (Station 0, Layer 0)



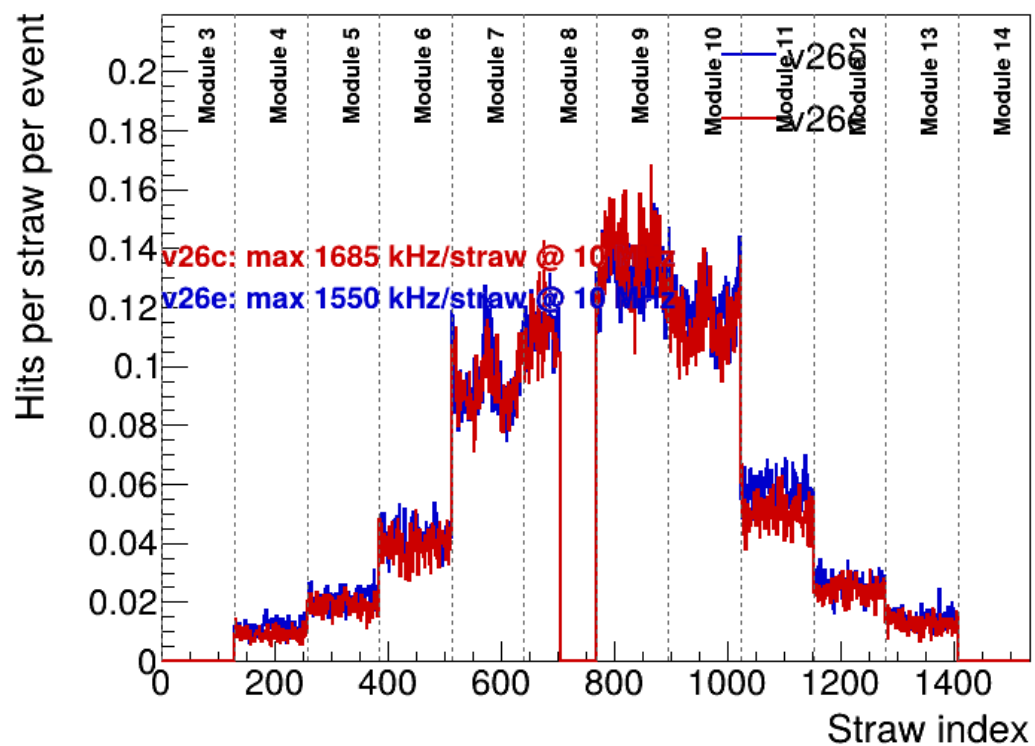
Module occupancy (Station 1, Layer 0)



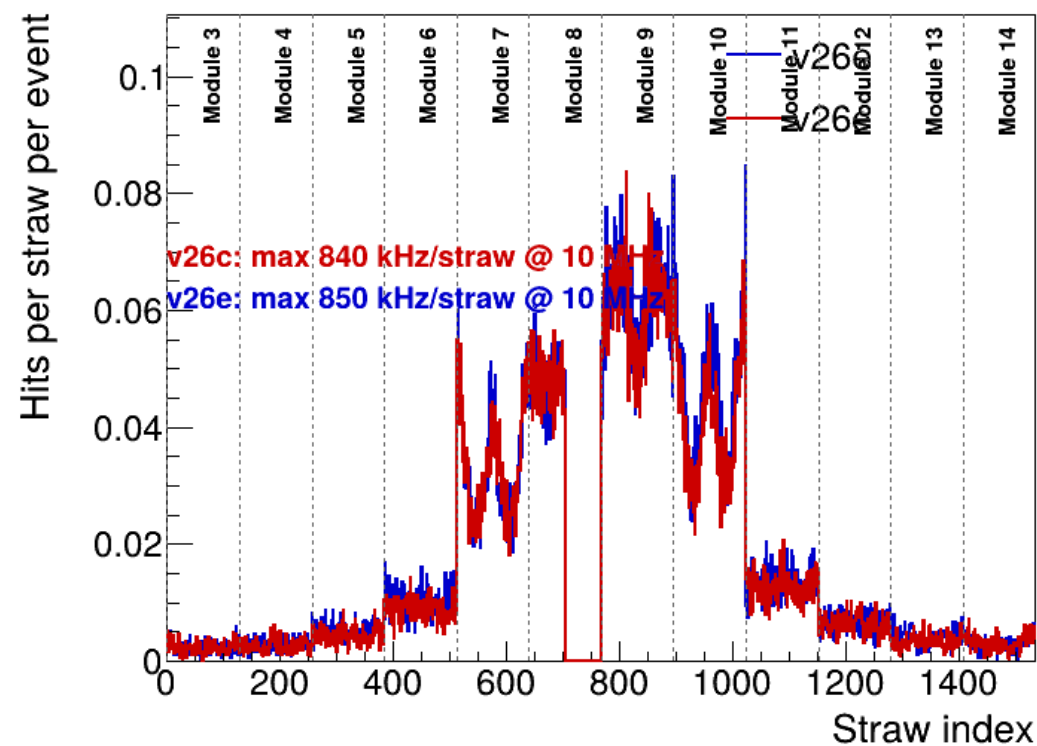
# Straw occupancy by module

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Straw occupancy (Station 0, Layer 0)

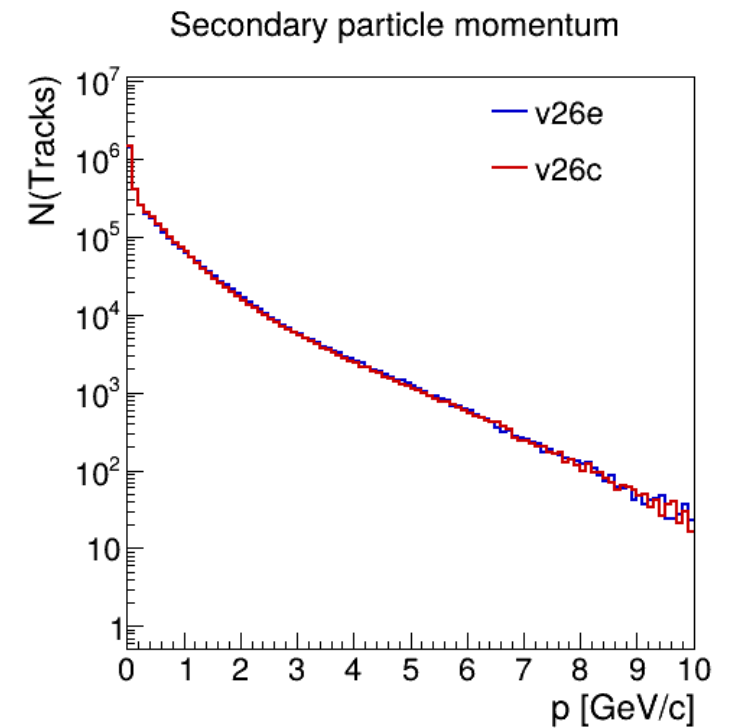
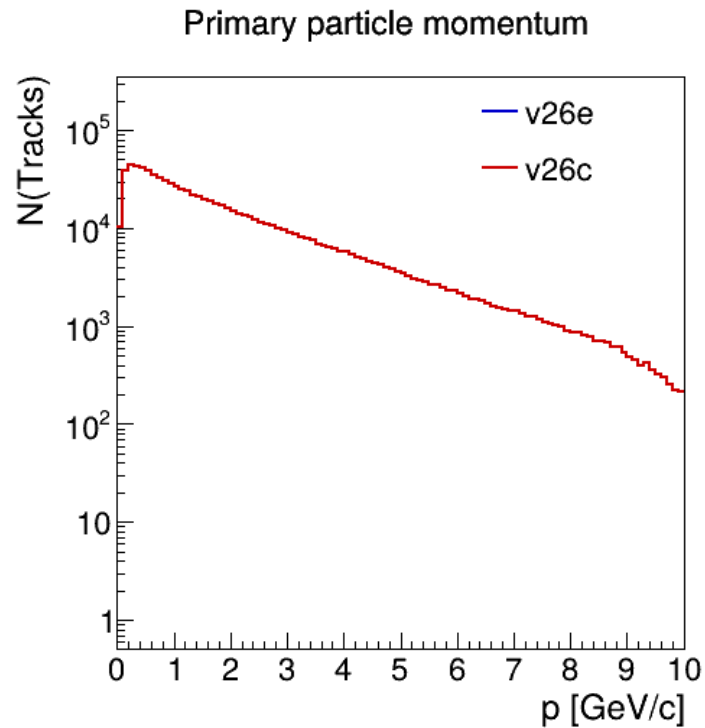
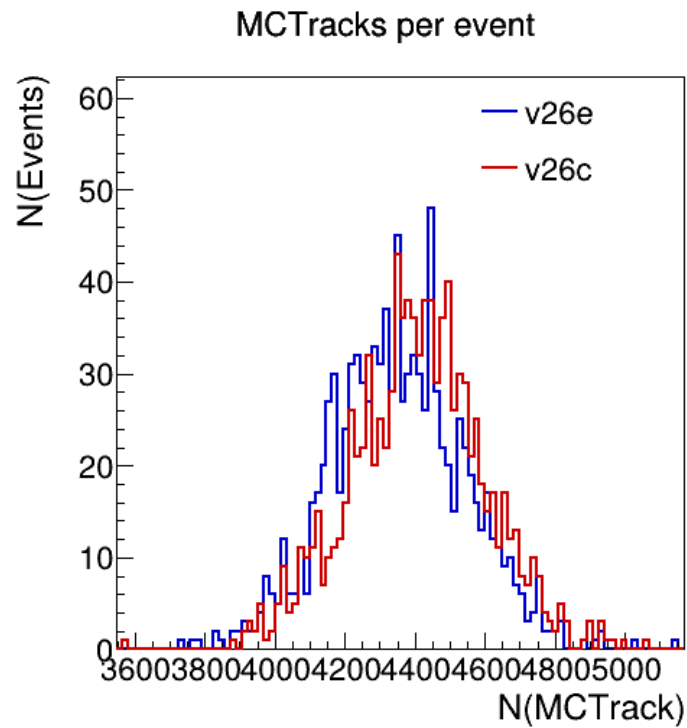


Straw occupancy (Station 1, Layer 0)



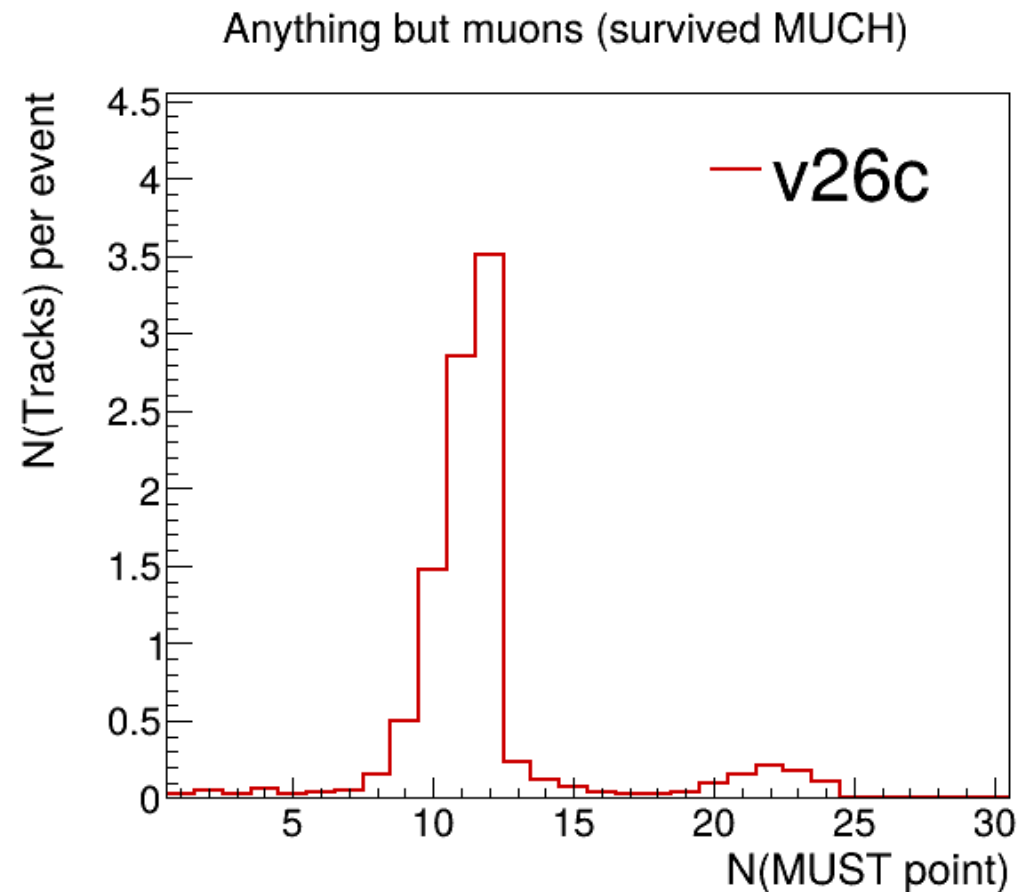
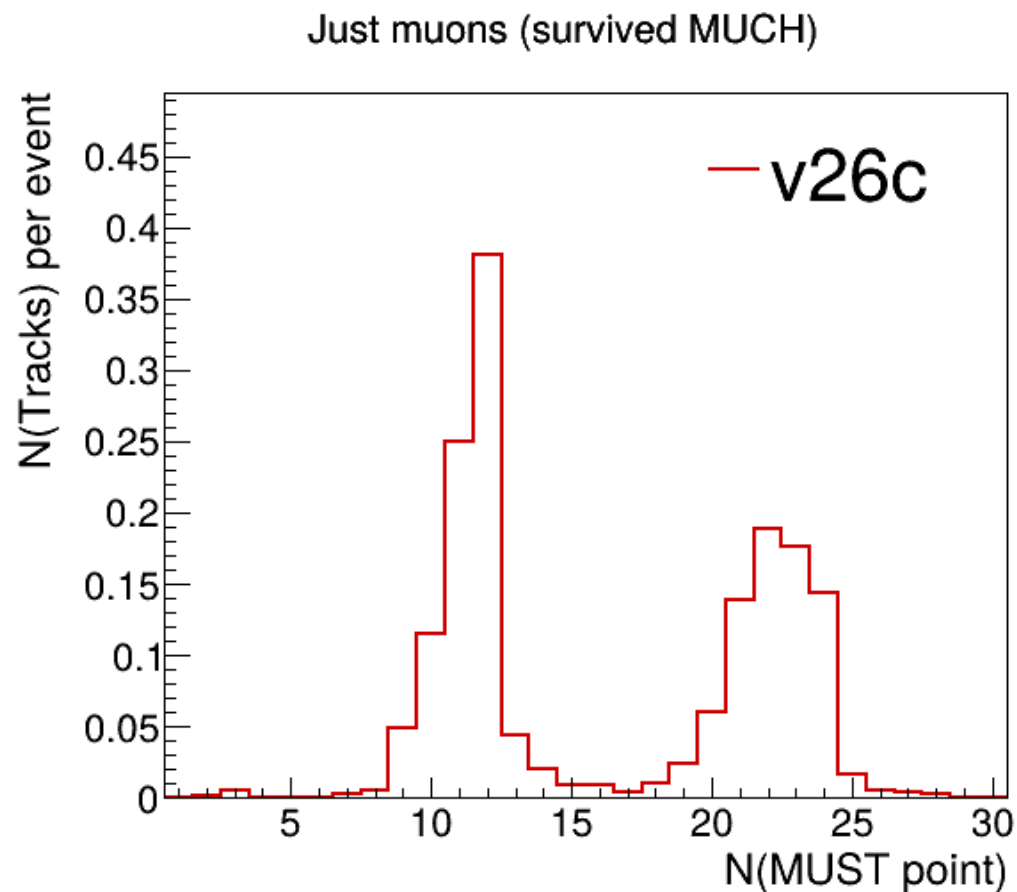
# MCTracks per event and momentum

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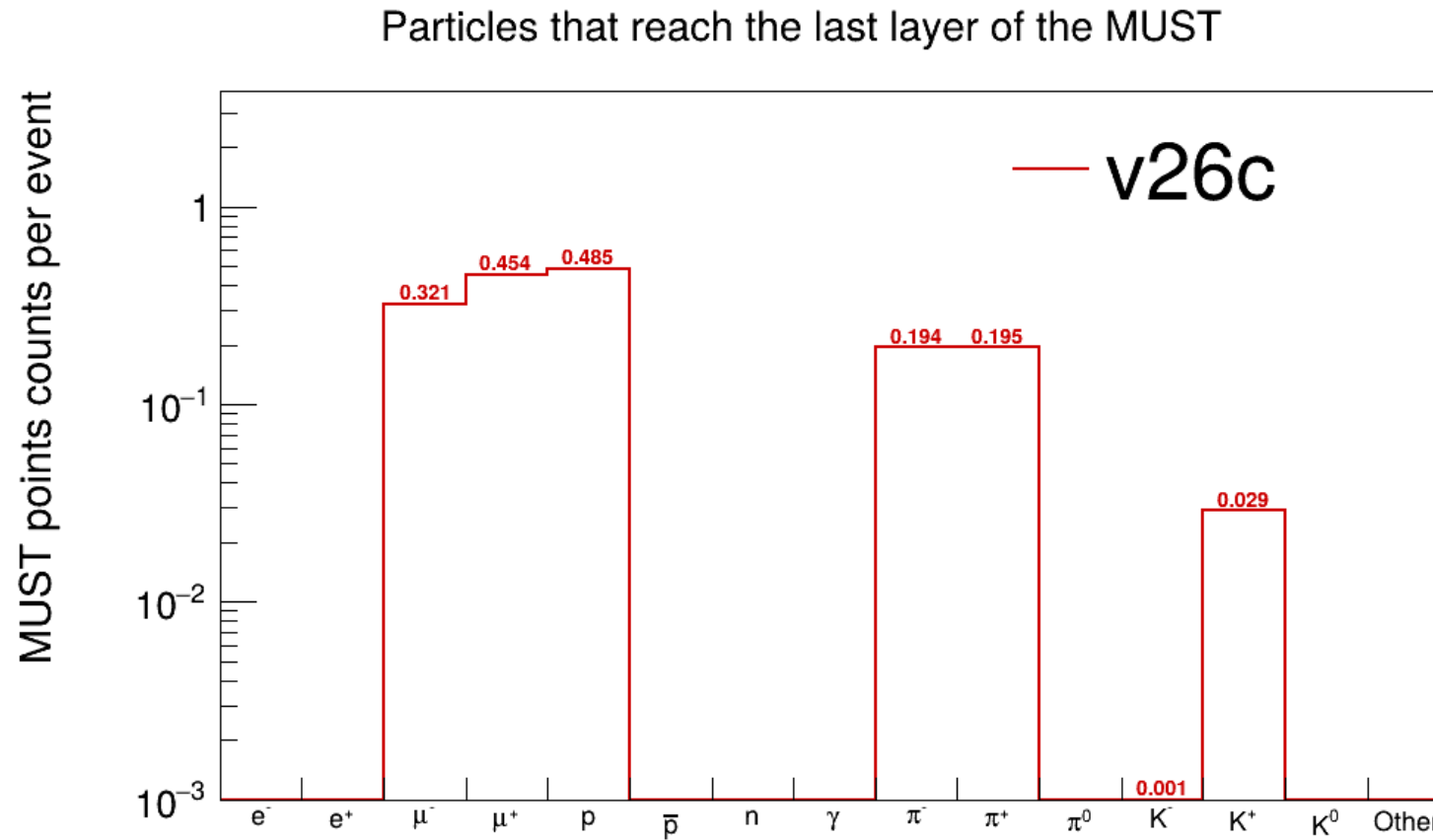
# MUST points per track — v26c

10



# Particles reaching the last MUST layer - v26c

11

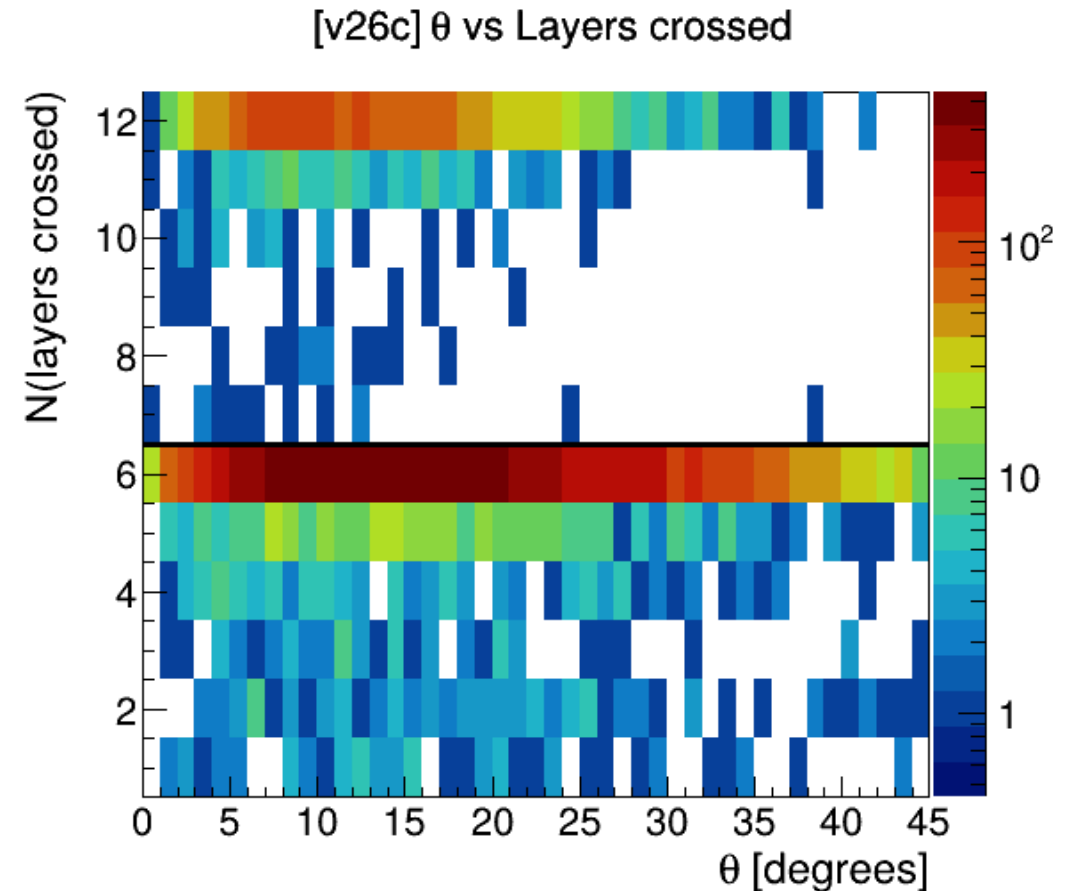
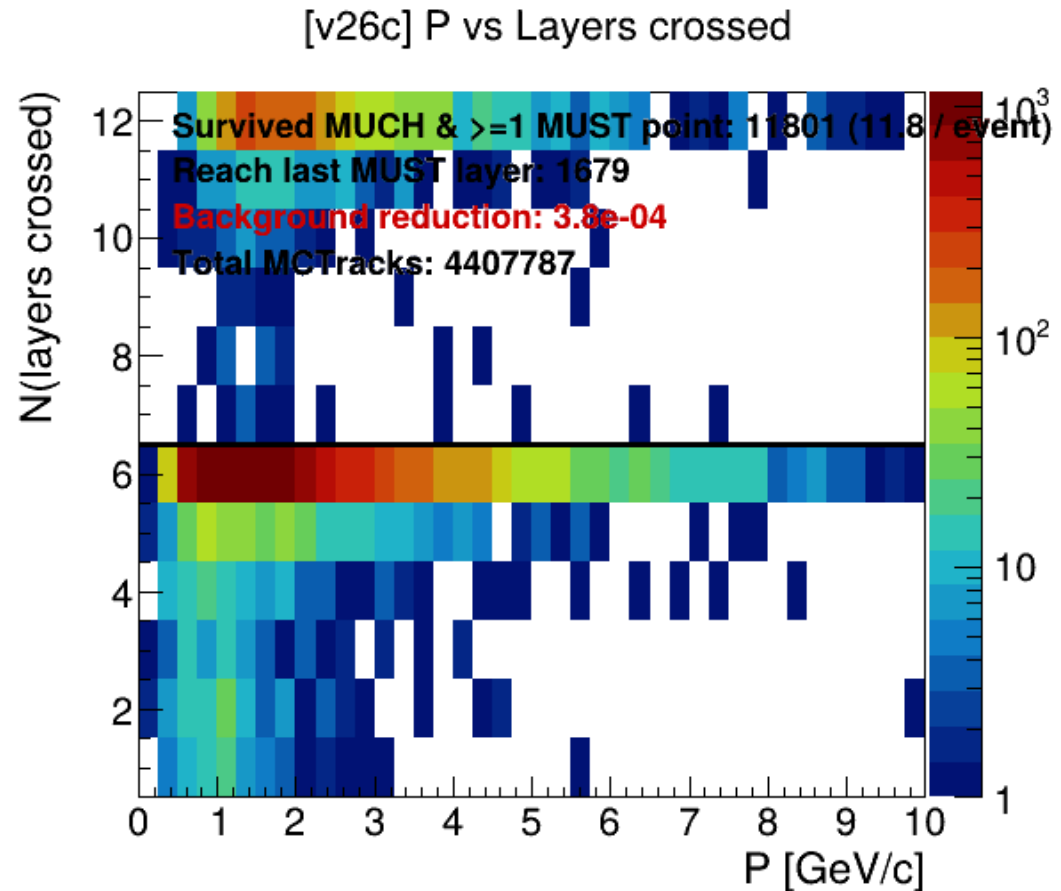


Dominated by protons (0.485/event),  $\mu^-/\mu^+$  (0.32 / 0.45), and  $\pi^-/\pi^+$  (~0.19 each)

# Layers crossed vs momentum and $\theta$

## — v26c

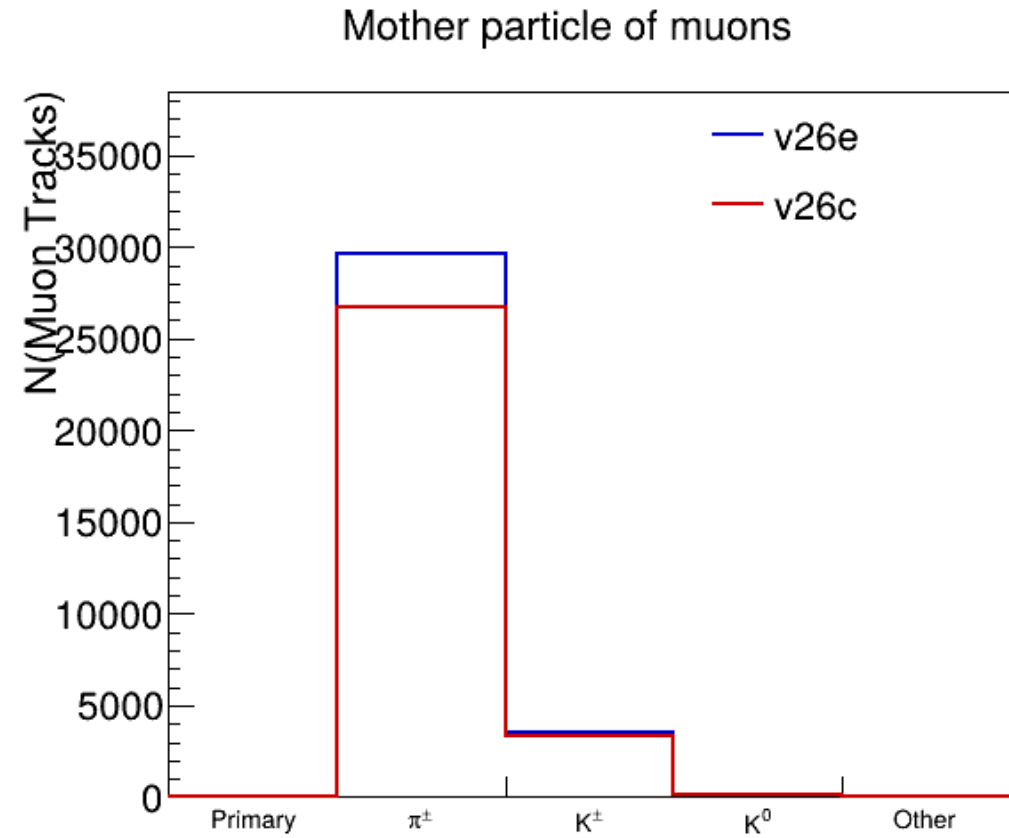
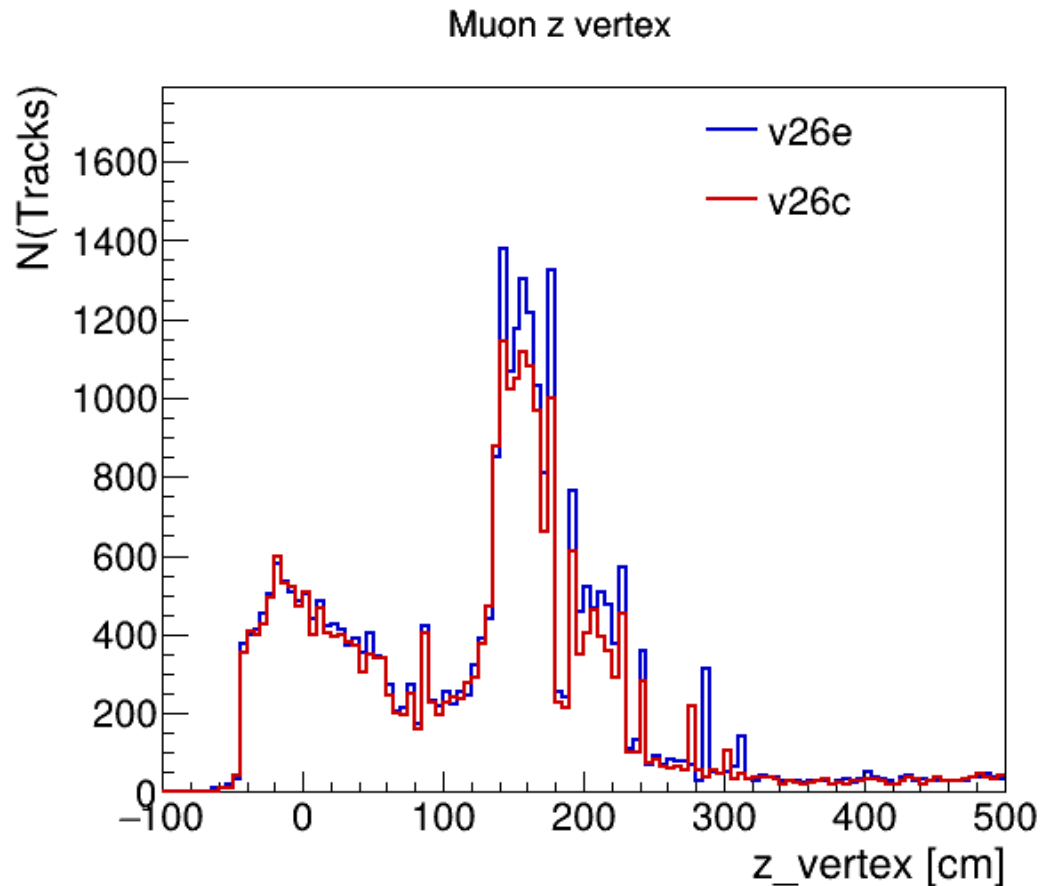
12



11.8 tracks/event reach the MUST with  $\geq 1$  point; 1.68/event reach the last layer — background reduction  $3.8 \times 10^{-4}$

# Muon z-vertex and mother particle

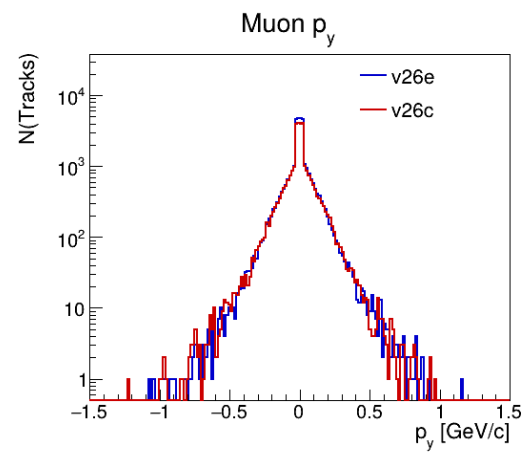
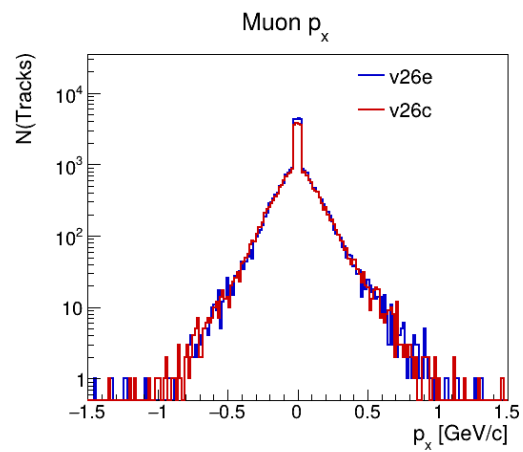
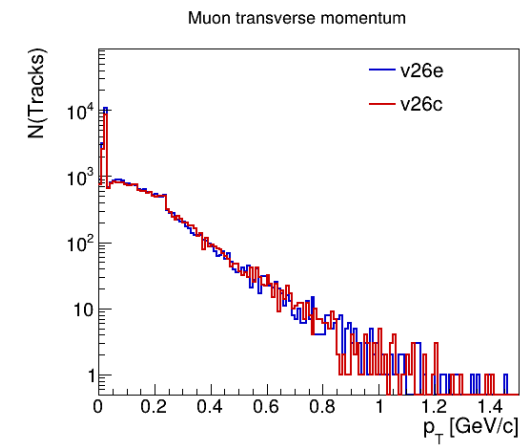
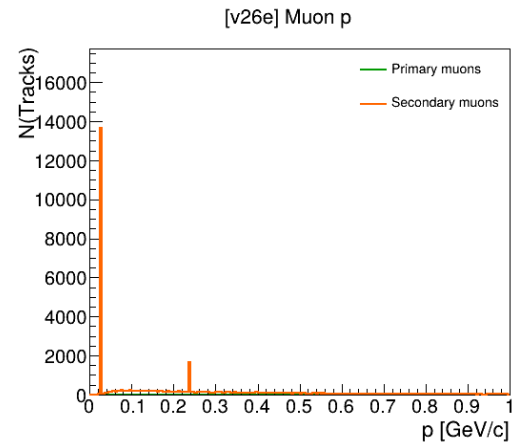
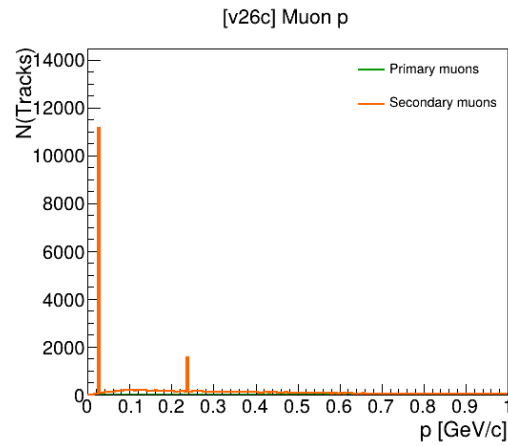
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~90% of muons come from  $\pi^\pm$  decay, ~10% from  $K^\pm$  decay; negligible primary or  $K^0$  contribution

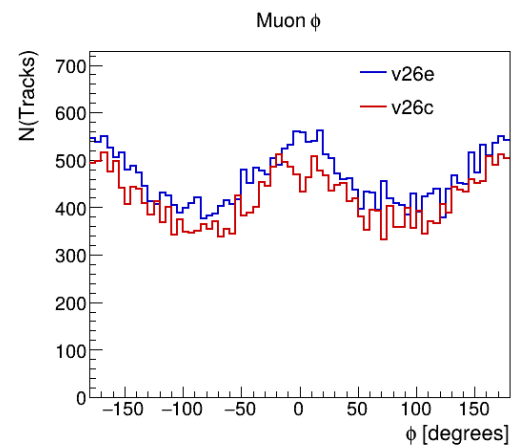
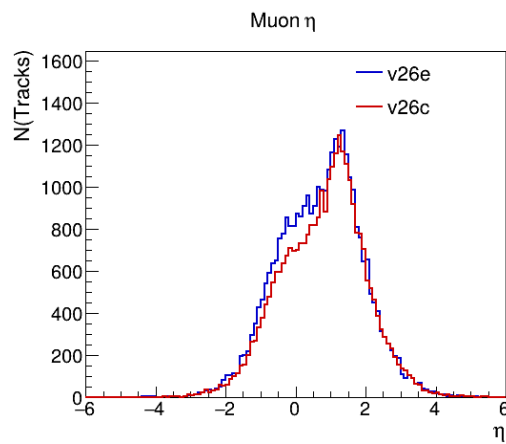
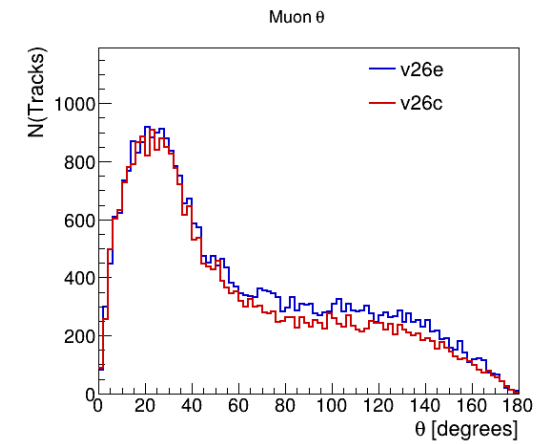
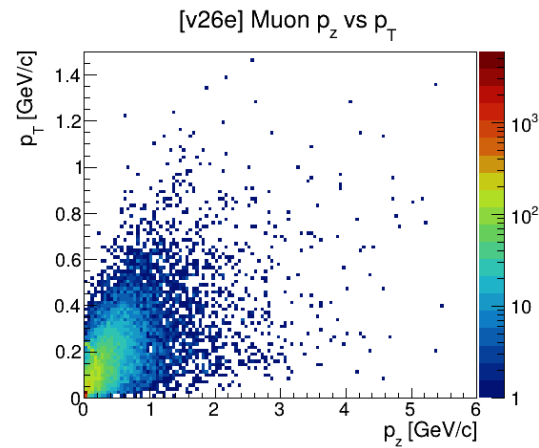
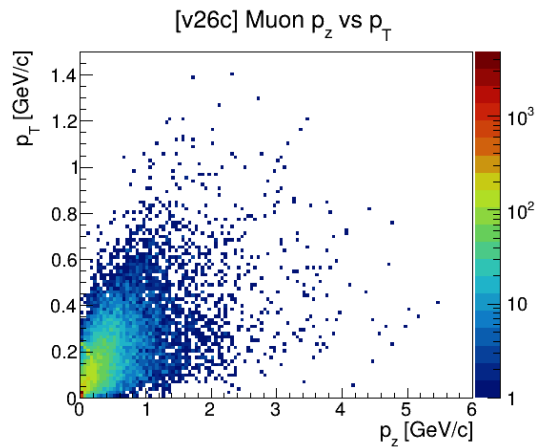
# Muon momentum

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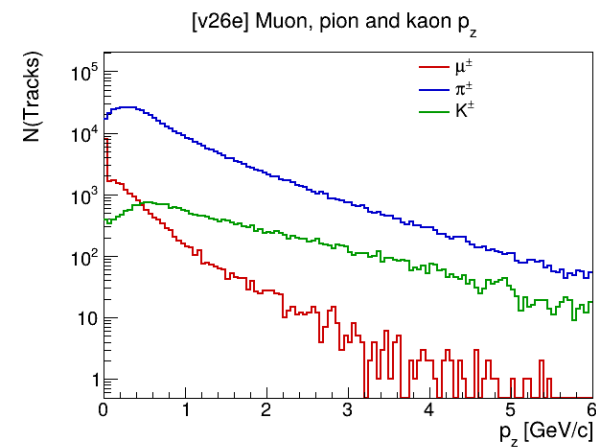
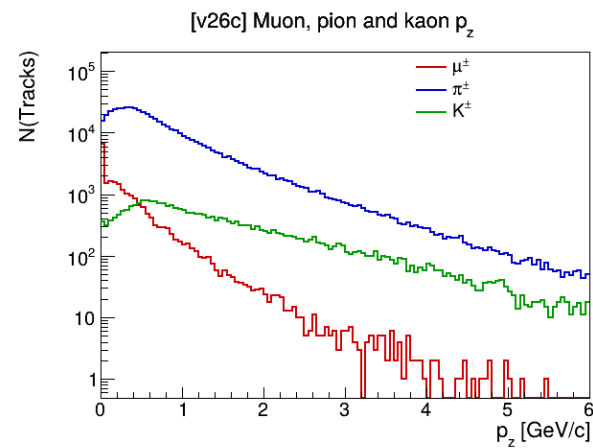
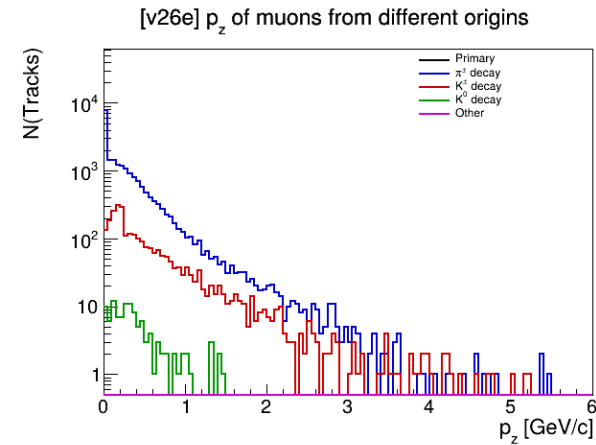
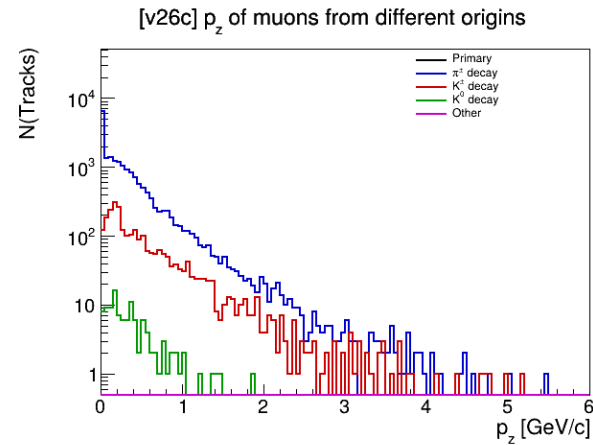
# Muon $p_z$ vs $p_T$ , $\theta$ , $\eta$ , $\phi$

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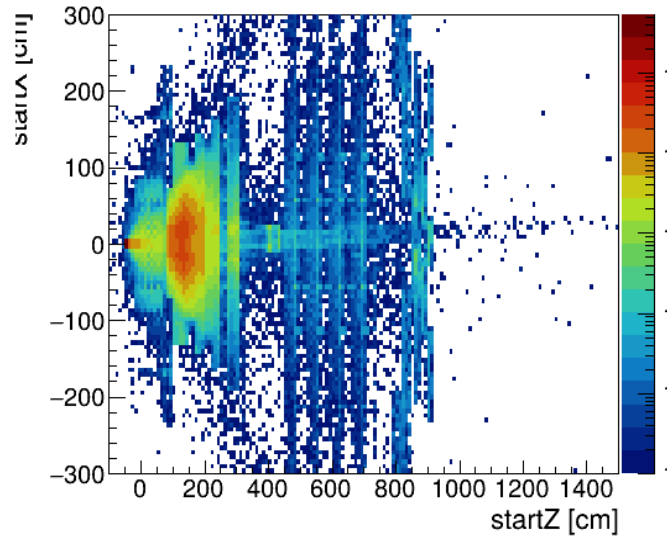
# Muon $p_z$ by mother particle and species

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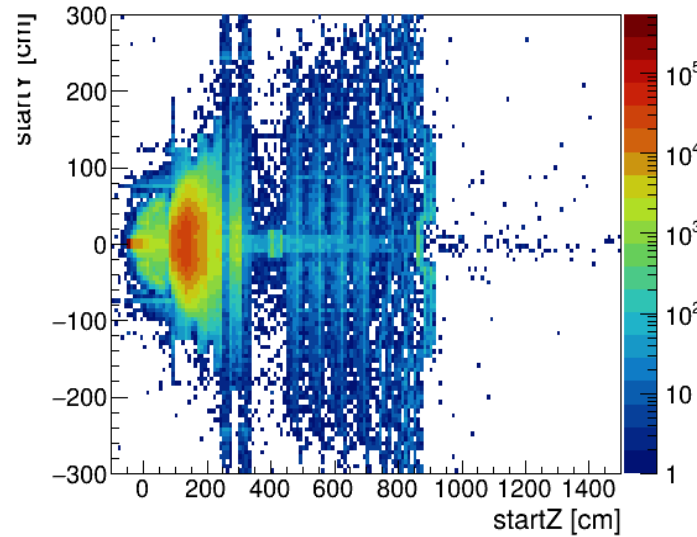


# MCTrack start positions

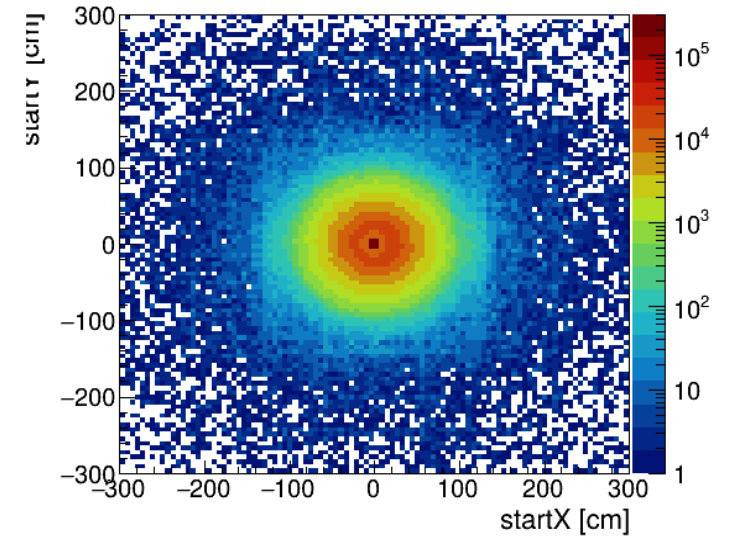
[v26c] MCTrack startX vs startZ



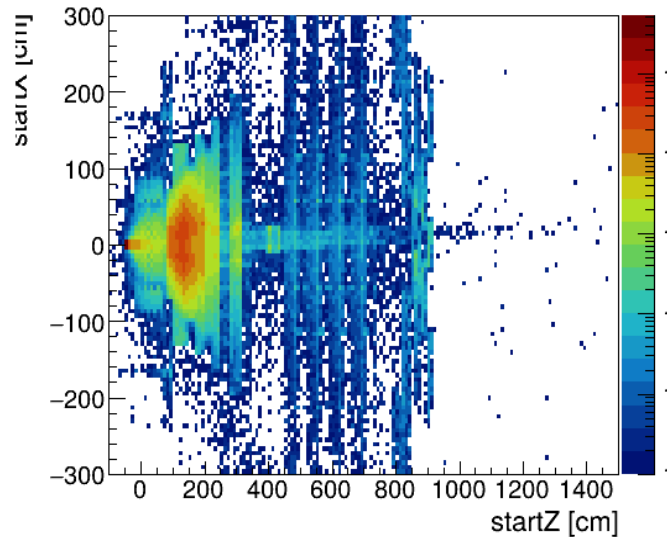
[v26c] MCTrack startY vs startZ



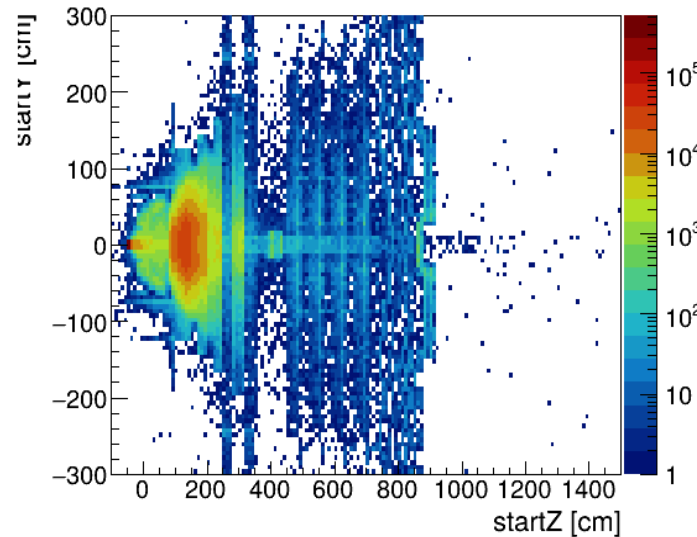
[v26c] MCTrack startX vs startY



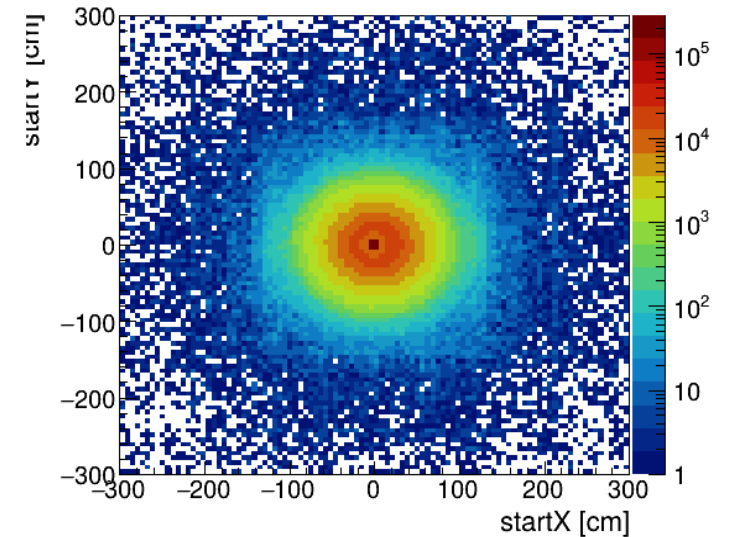
[v26e] MCTrack startX vs startZ



[v26e] MCTrack startY vs startZ

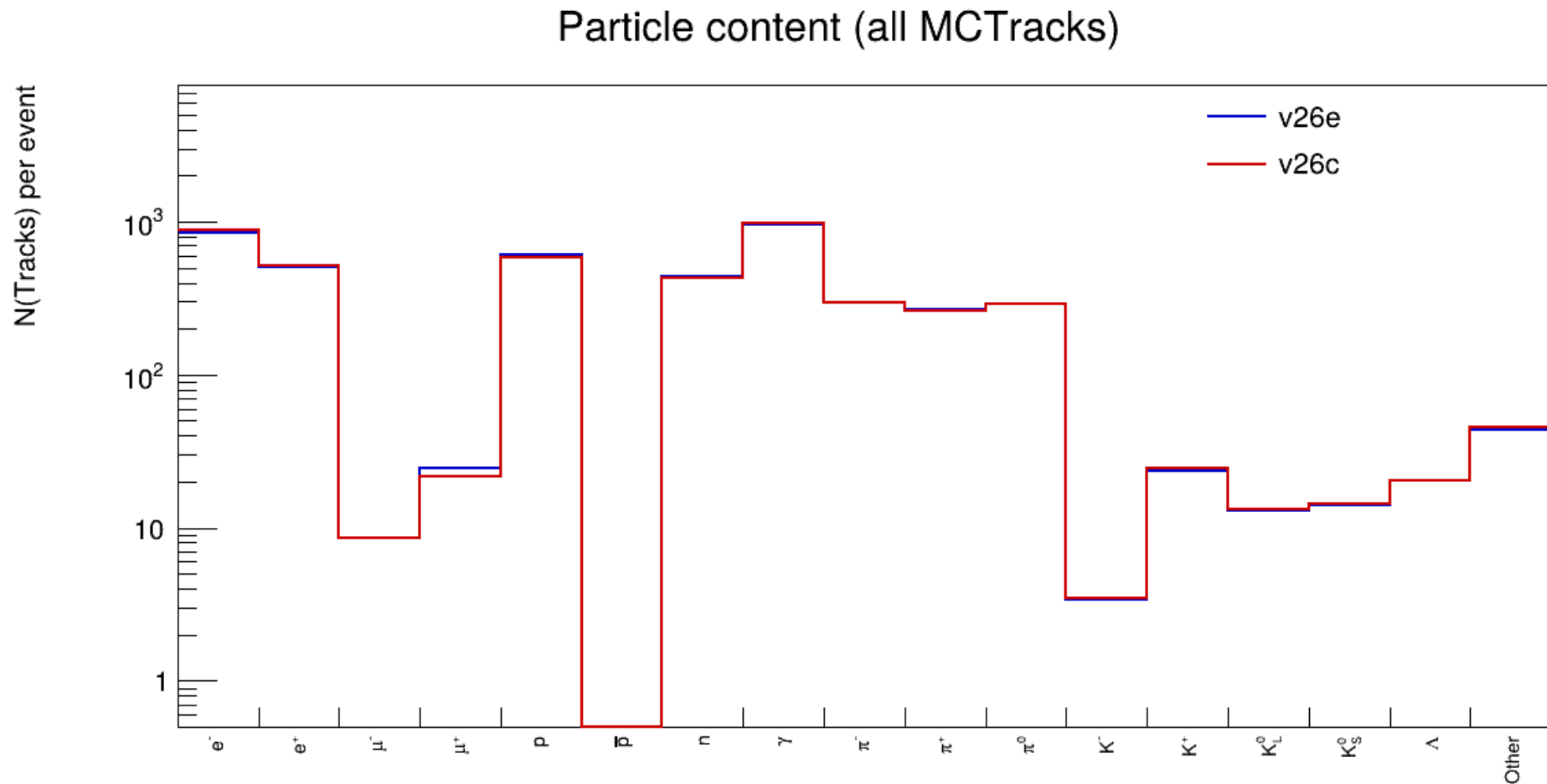


[v26e] MCTrack startX vs startY



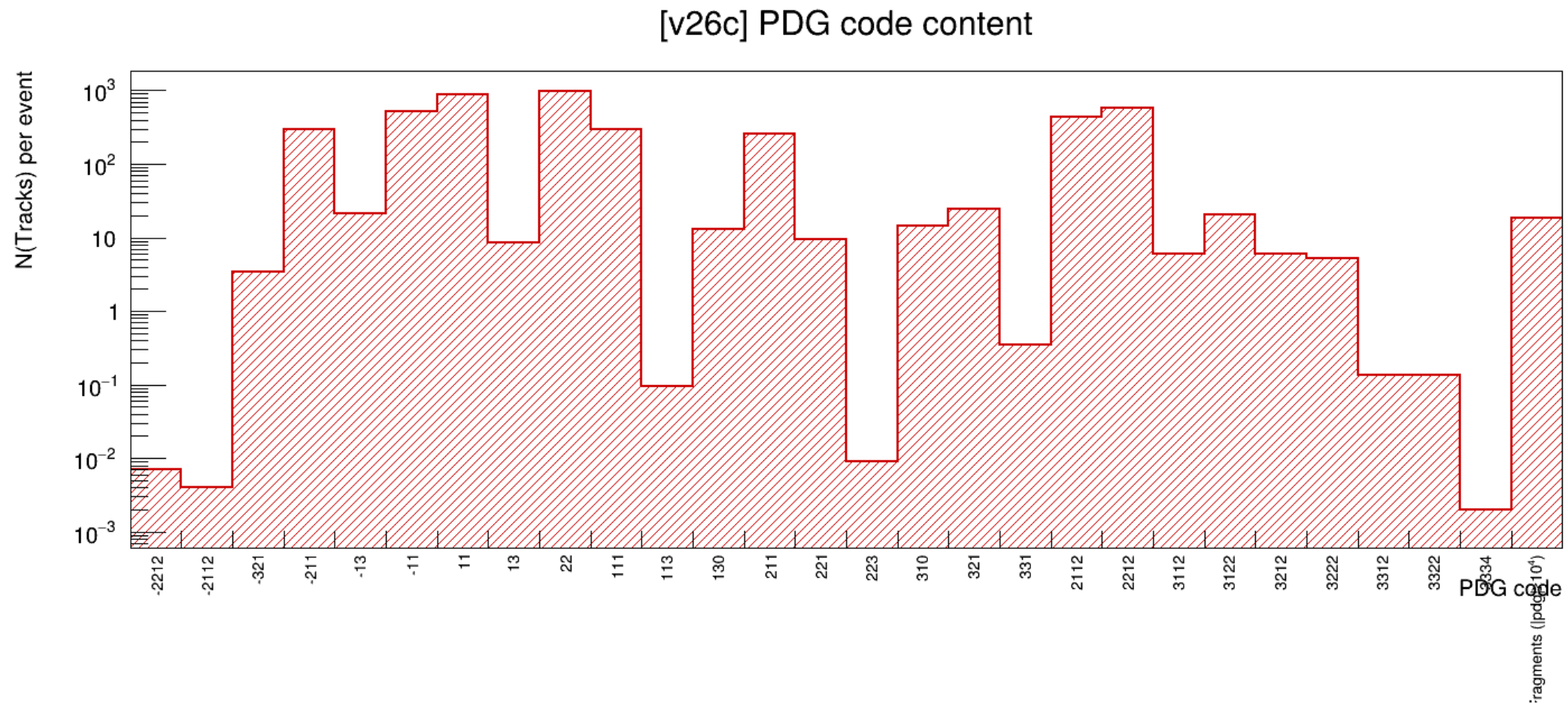
# Particle content — all MCTracks

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# PDG code content — v26c

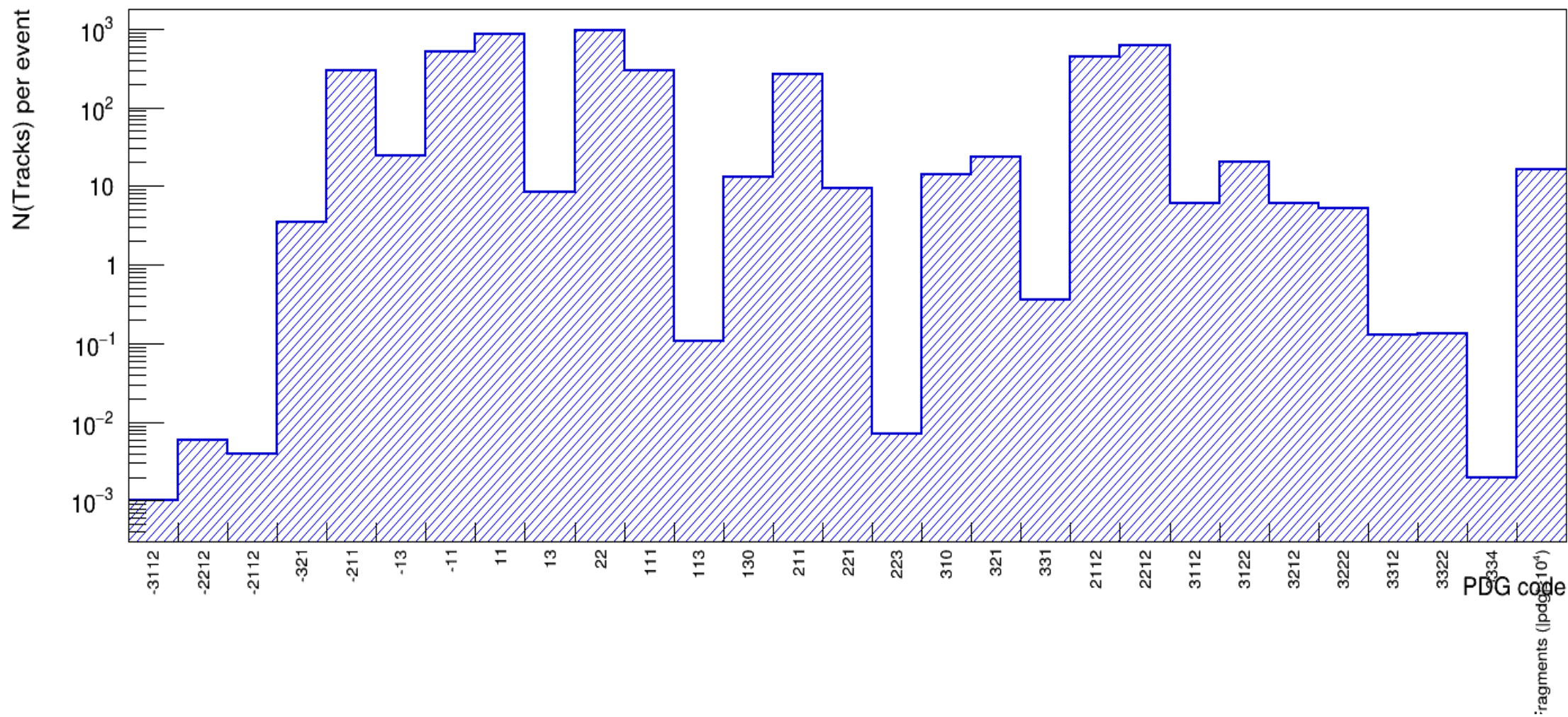
19



# PDG code content — v26e

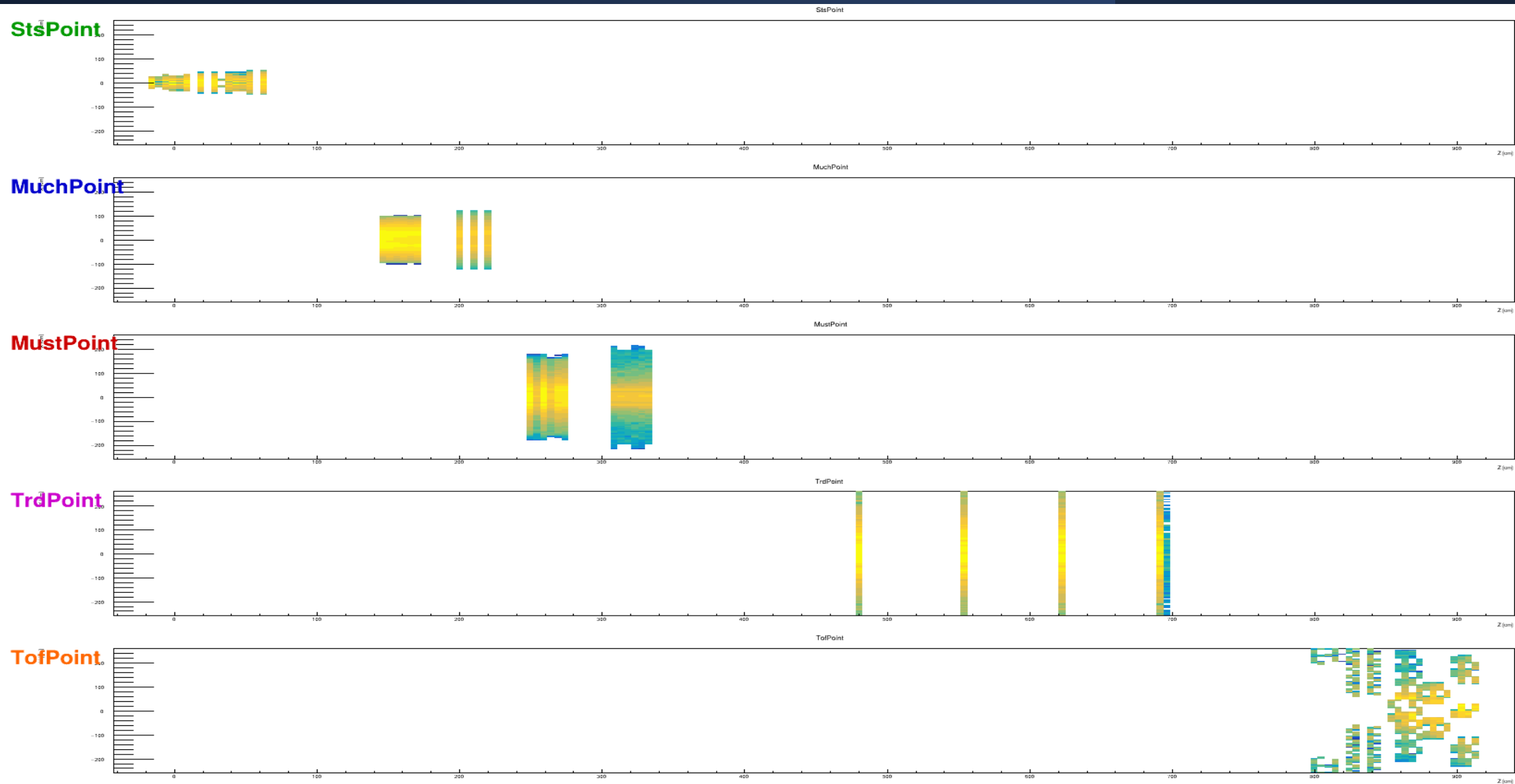
20

[v26e] PDG code content



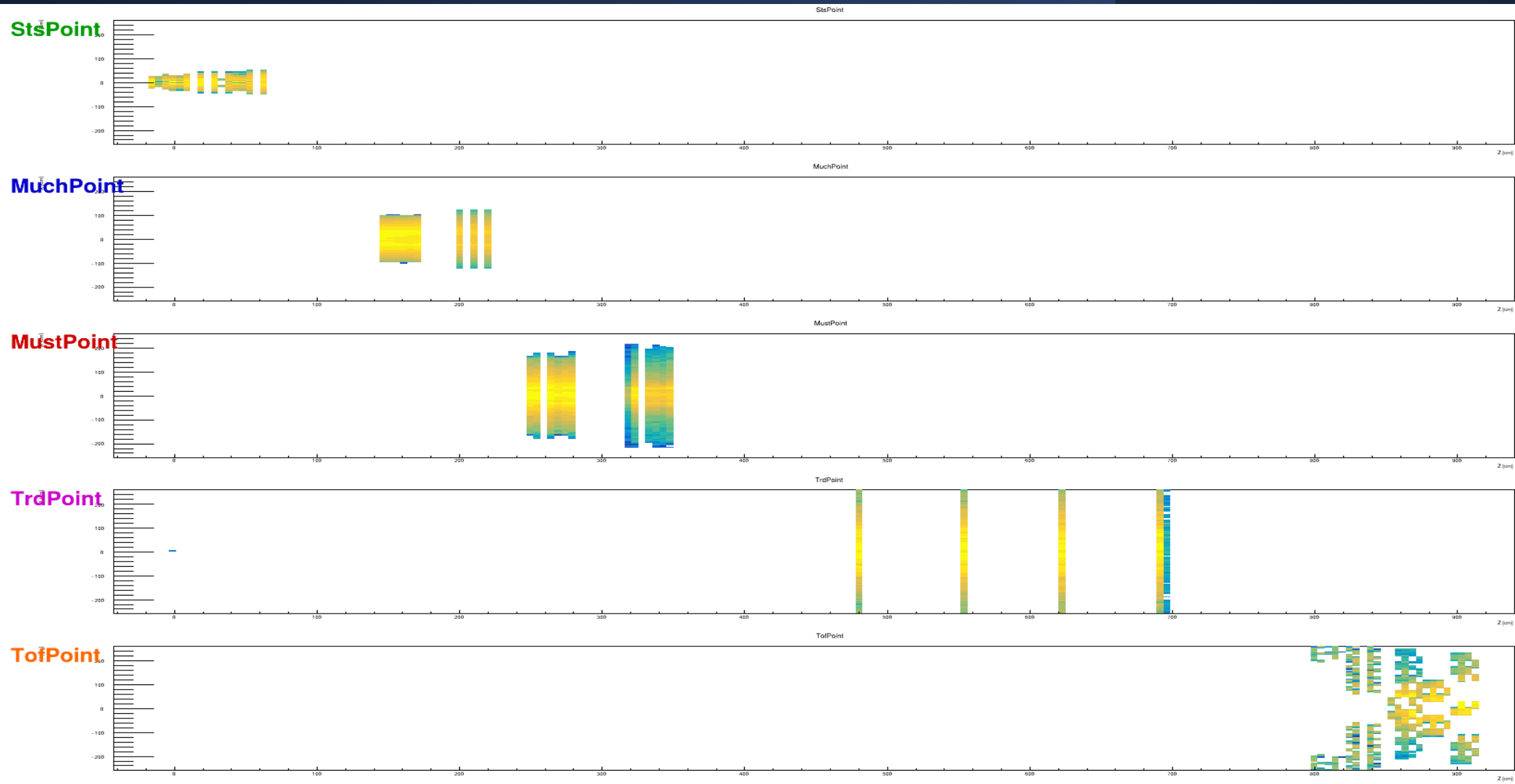
# Detector hit map (Z-X), stacked by detector — v26c

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# Detector hit map (Z-X), stacked by detector — v26e

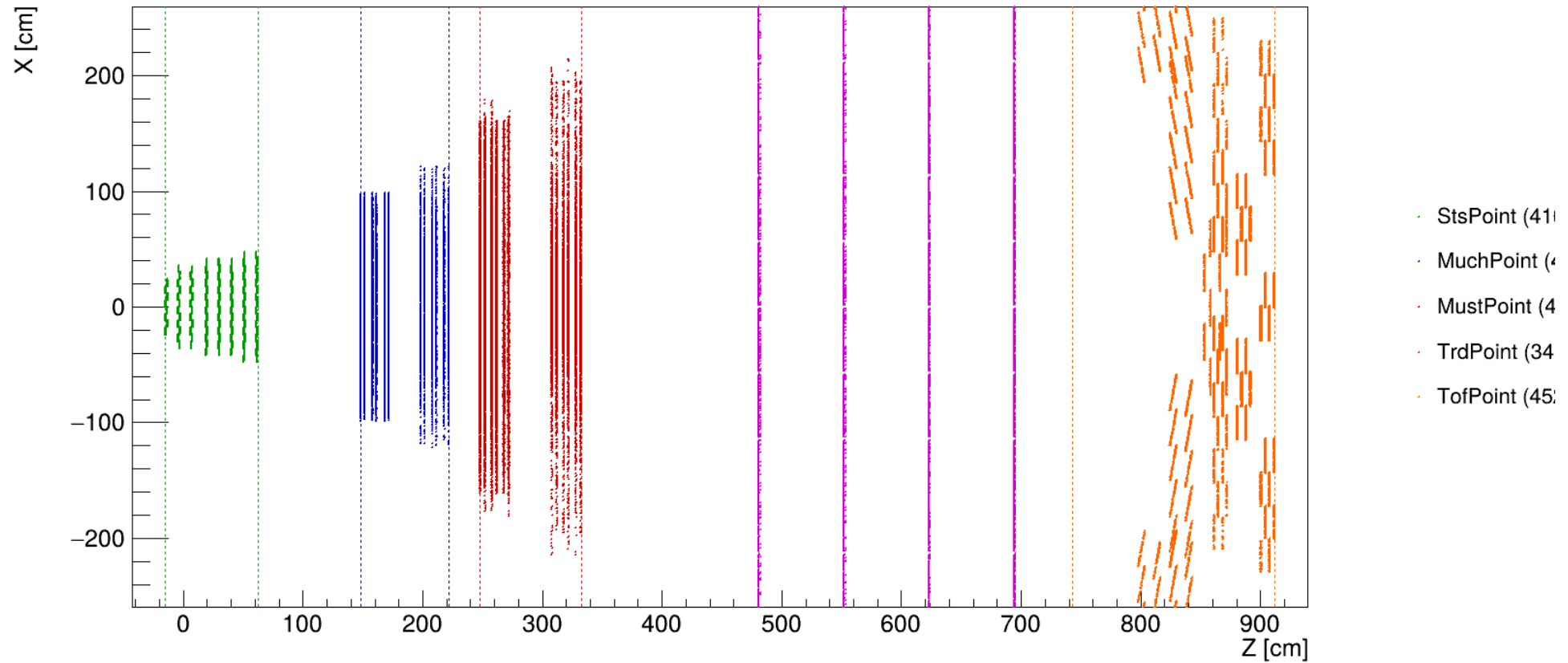
22



# Particles crossing the detector layers — v26c

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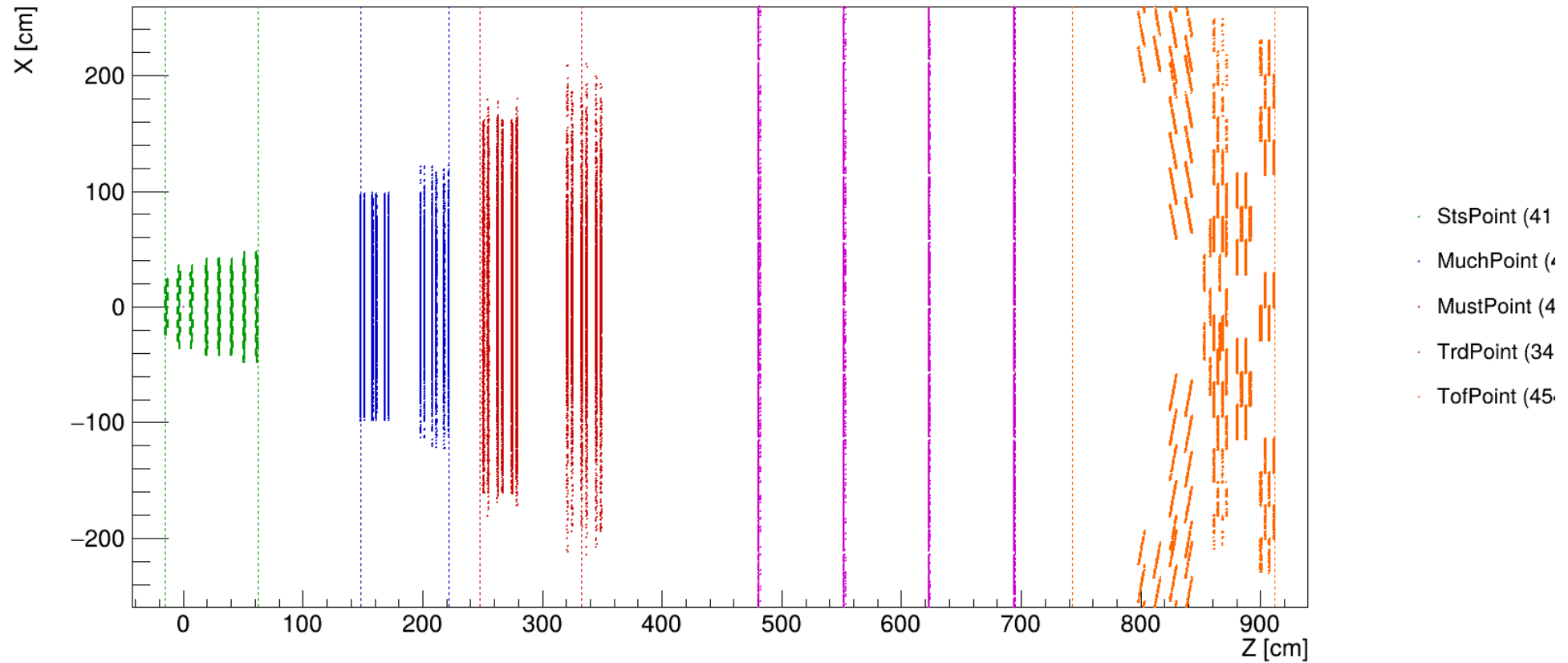
[v26c] Particles crossing the detector layers



# Particles crossing the detector layers — v26e

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[v26e] Particles crossing the detector layers



# Summary and Future work



v26c and v26e give very similar particles, momentum spectra, and MUST occupancy patterns.



Peak MUST rates: The rate at Station 0 Layer 0 drops roughly by 20% at Station 1



v26c background rejection: 1.68 tracks/event reach the last MUST layer out of ~4408 MCTracks/event



Future work: The v26e file is not correctly connecting the detector hits to the particles that made them, so we need to rerun the simulation before we can make the same track-based plots as v26c.