

2018 HMDY MC Momentum Reconstruction Study

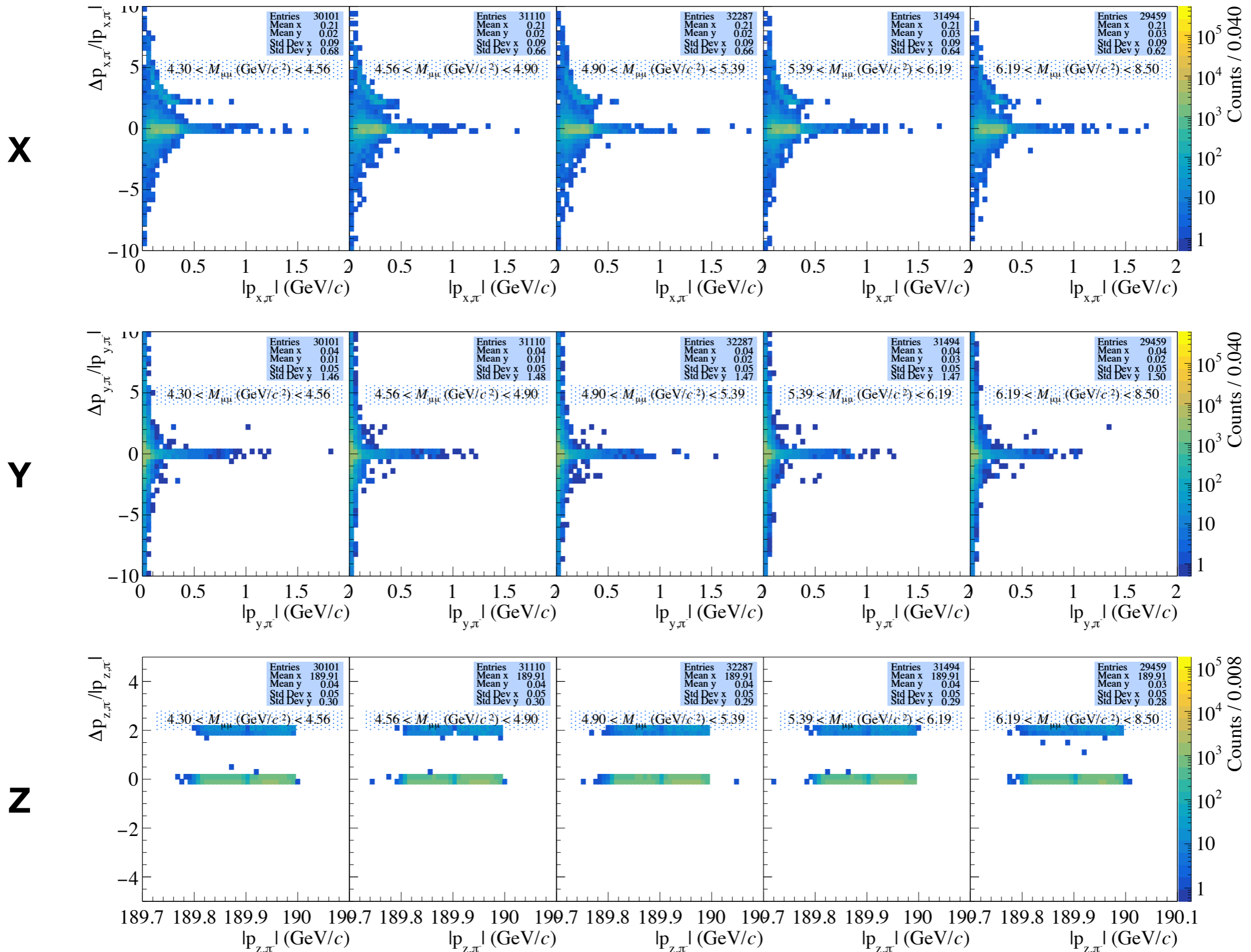
CORAL Weekly Meeting

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Chia-Yu Hsieh
Yu-Shiang Lian

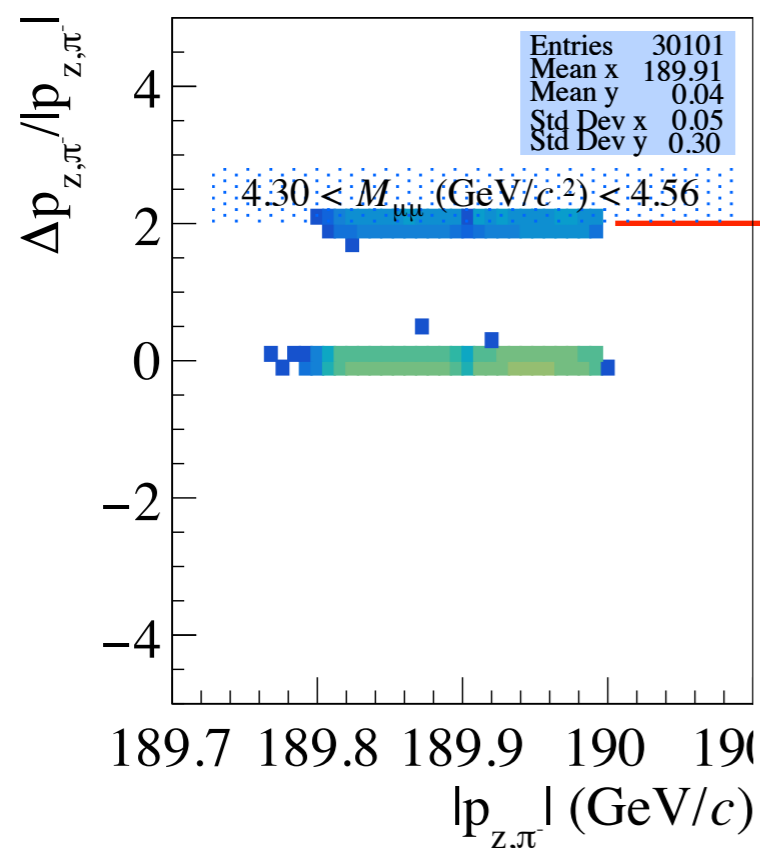
MC Momentum Reconstruction Study

- **MC sample:** [2018 HMDY MC](#) for current HMDY cross-section analysis.
 - ▶ Geant4 version: **geant4.10.02.p02**
 - ▶ TGEANT revision: **master** - commit c07ed0ad014662c59d3141287bd00e10ceb9968a (**Dec 20 2019**)
- **Selection criteria:** same as 2018 UAs analysis but w/o BDMs cut. (**NH₃ only**)
- **Checking quantities:** $\Delta p = p_{rec} - p_{gen}$, $\frac{\Delta p}{|p|} = \frac{p_{rec} - p_{gen}}{|p_{rec}|}$, also $\Delta p_x, \Delta p_y, \Delta p_z$
- **Method to get p_{rec} :** PaTrack -> PaParticle -> PaTPar.
- **Method to get p_{gen} :** PaTrack -> iMCtrack() -> PaMCtrack.
 - ▶ For true beam track: $p_x = -P(0)$, $p_y = -P(1)$, $p_z = -P(2)$ \Rightarrow “one has to invert signs of beam's momentum components, as in simulation beam goes upward”
 - ▶ For true muon track: $p_x = P(0)$, $p_y = P(1)$, $p_z = P(2)$

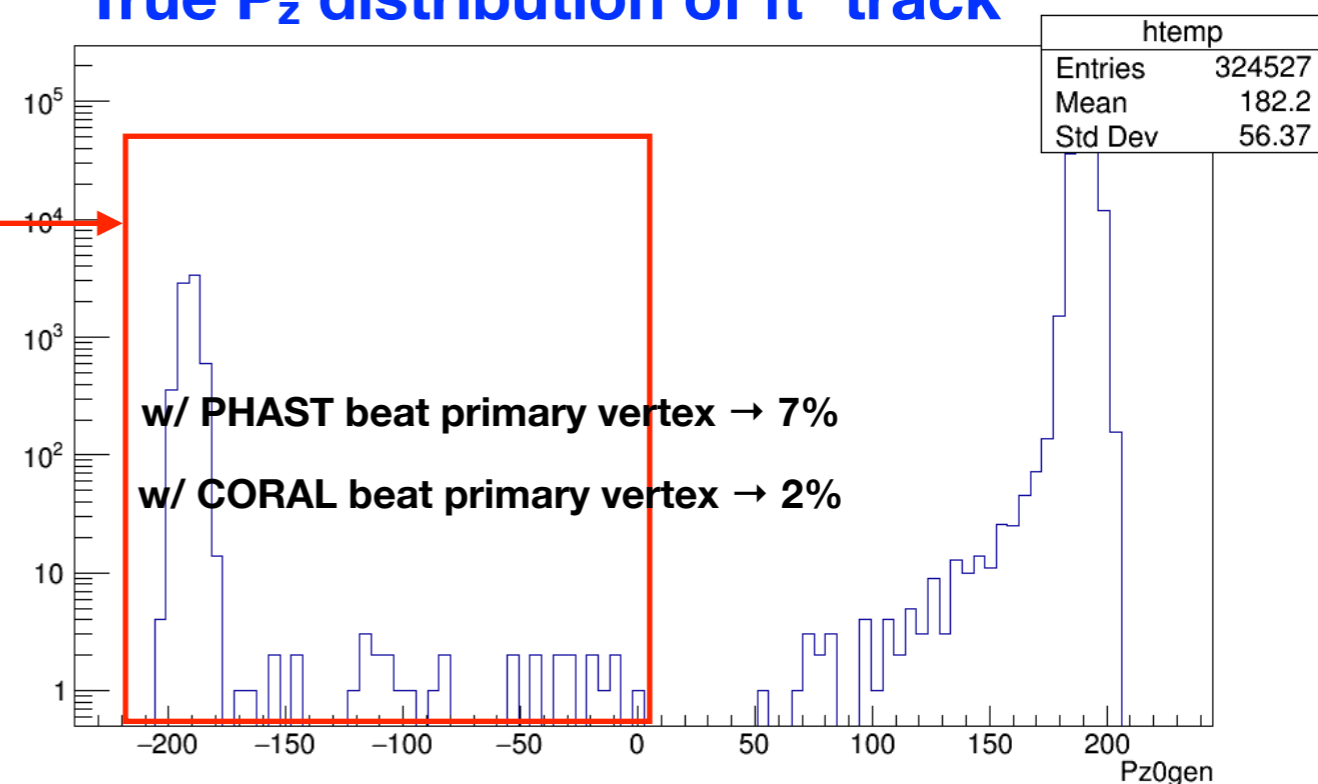
$\Delta p/|p|$ v.s. $|p|$ for π^- track (LL only)



Beam Track Association

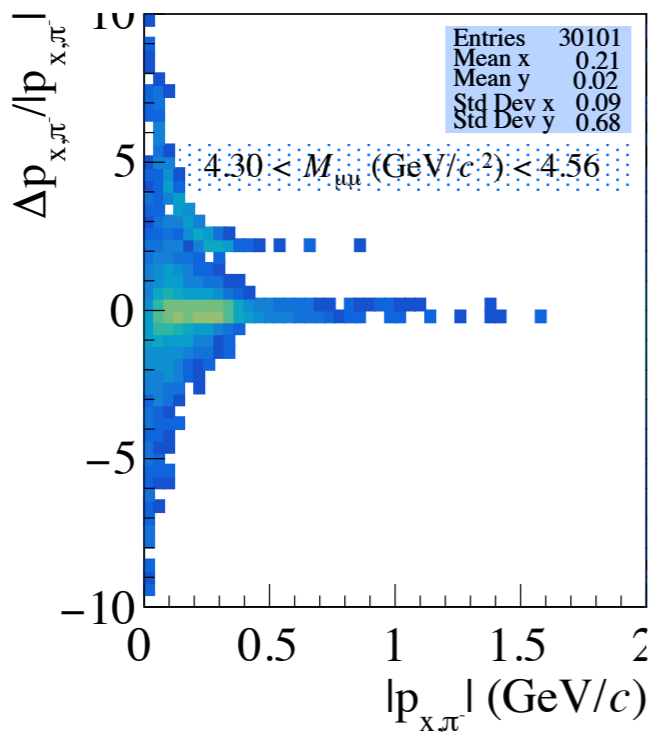


True P_z distribution of π^- track

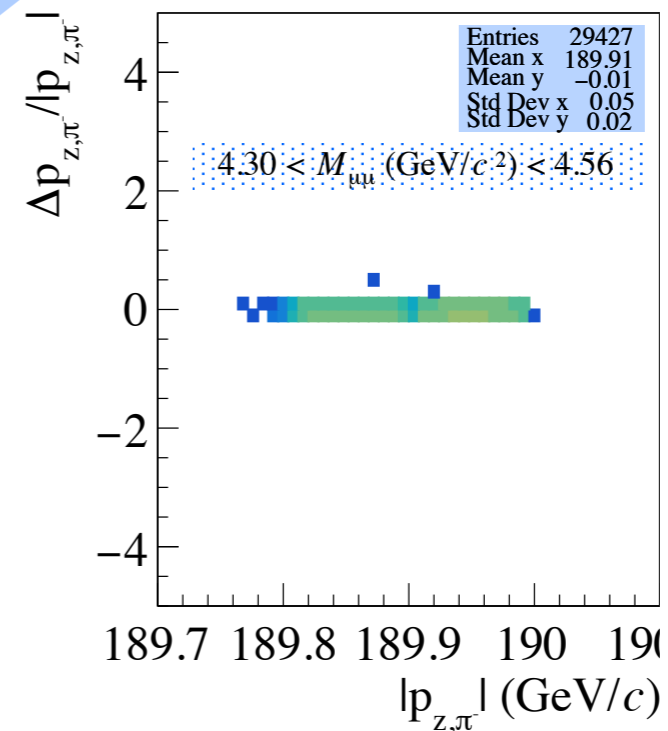
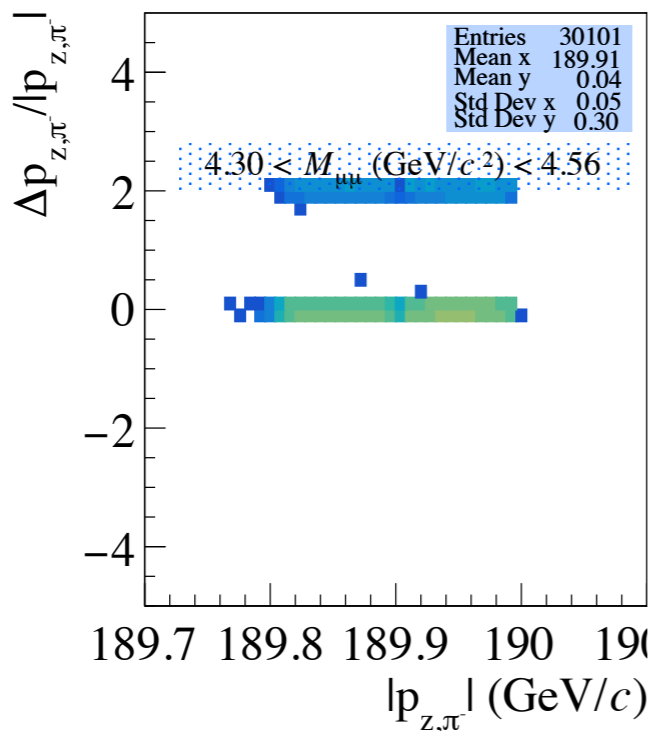
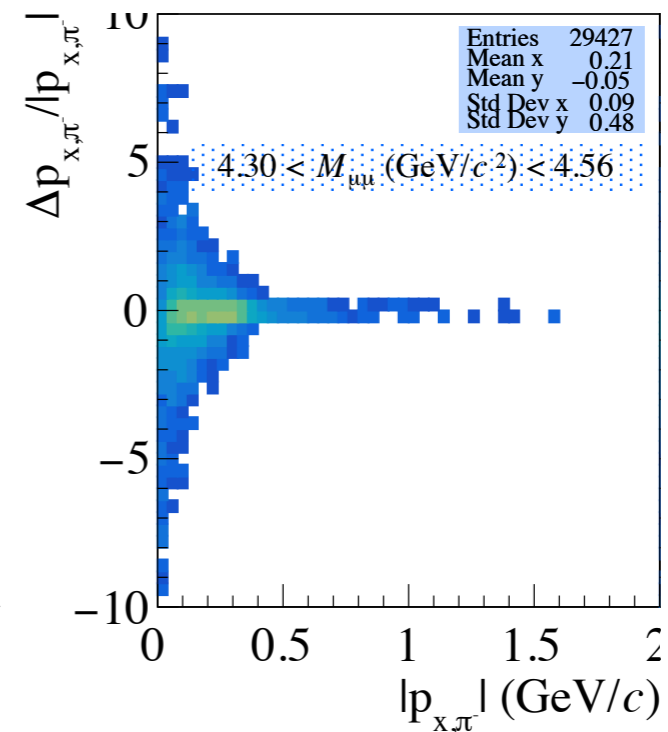


- The discrete distribution in p_z is coming from **existence of negative $p_{z,gen}$ momentum**.
- In the fact that one has to invert the sign of beam momentum in PHAST level, the one possibility to get this negative $p_{z,gen}$ might be **the wrong MC track association**. (associate w/ not-beam track)
- We have confirmed that the discrete distribution in p_x is cause by this issue.

Beam Track Association

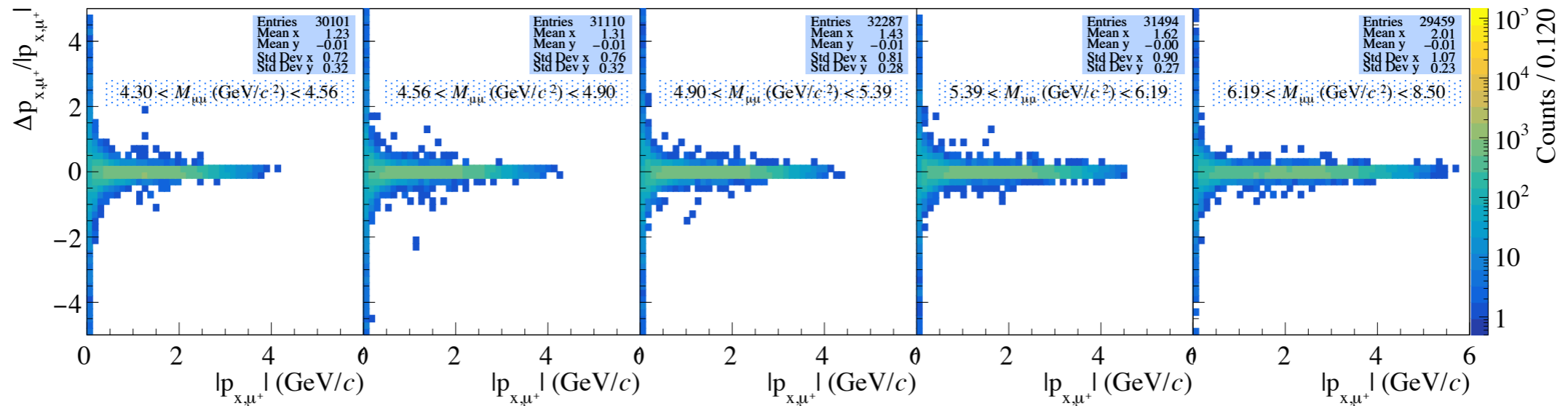


remove negative $p_{z,gen}$

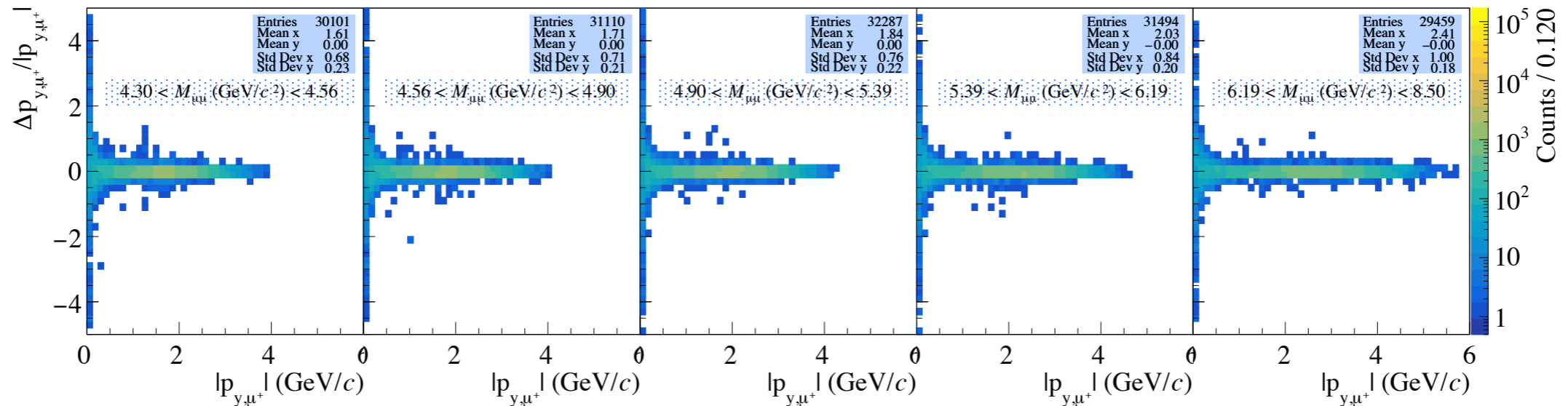


$\Delta p/|p|$ v.s. $|p|$ for μ^+ track (LL only)

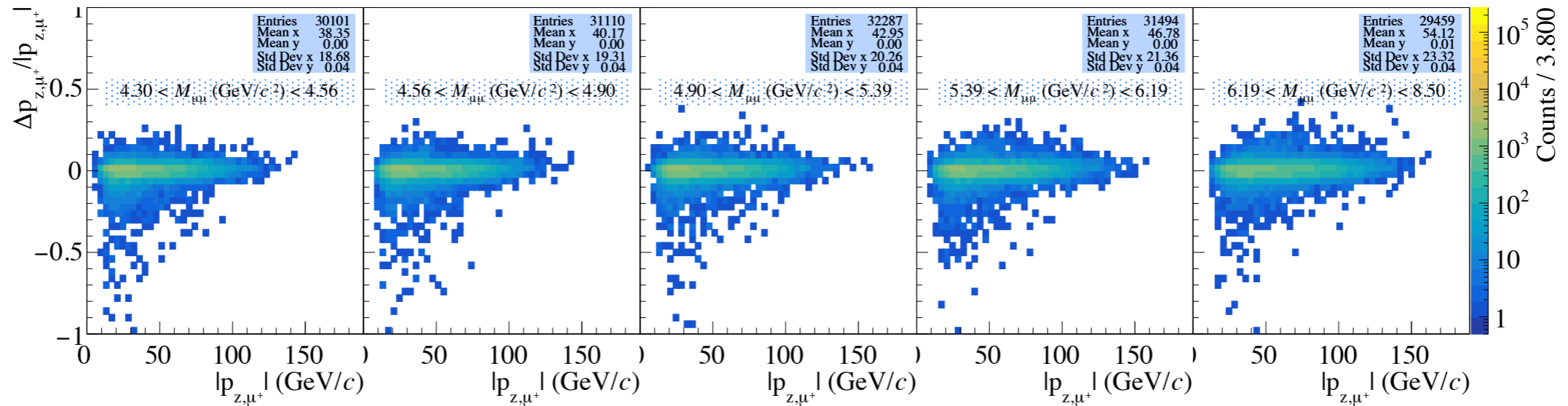
X



Y

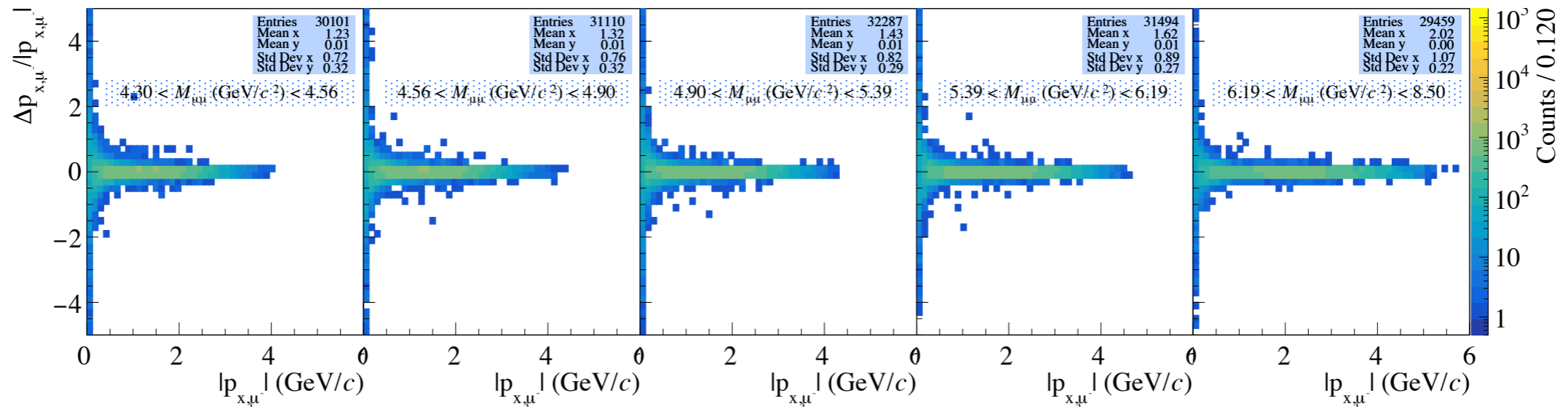


Z

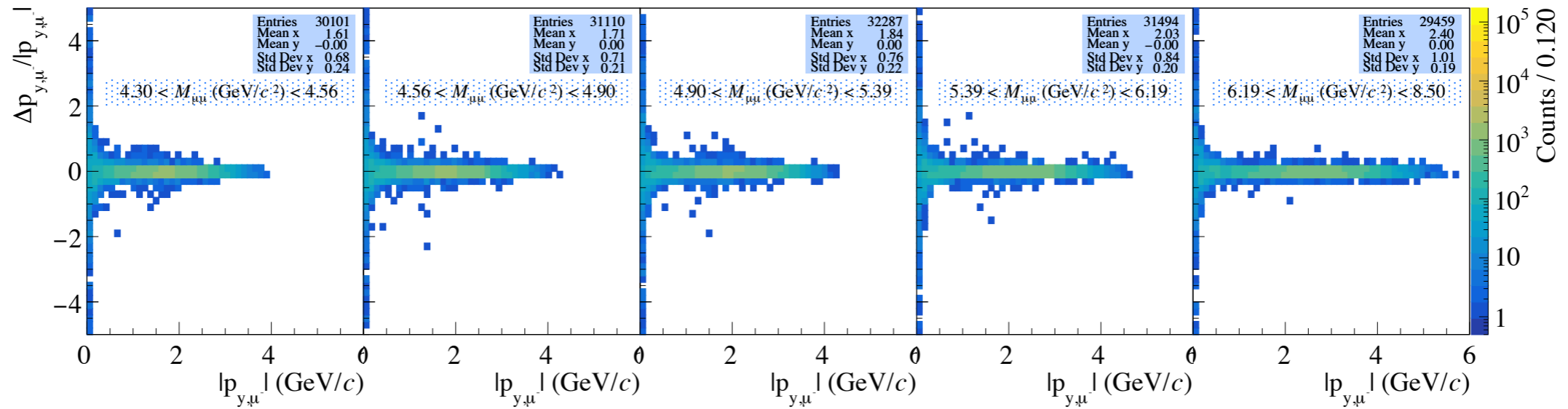


$\Delta p/|p|$ v.s. $|p|$ for μ -track (LL only)

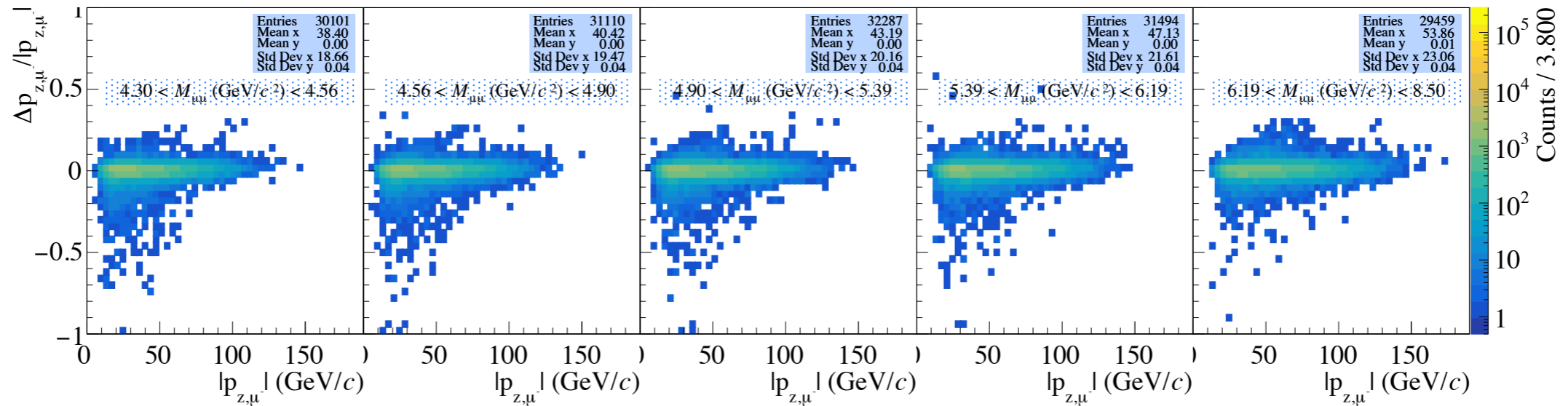
X



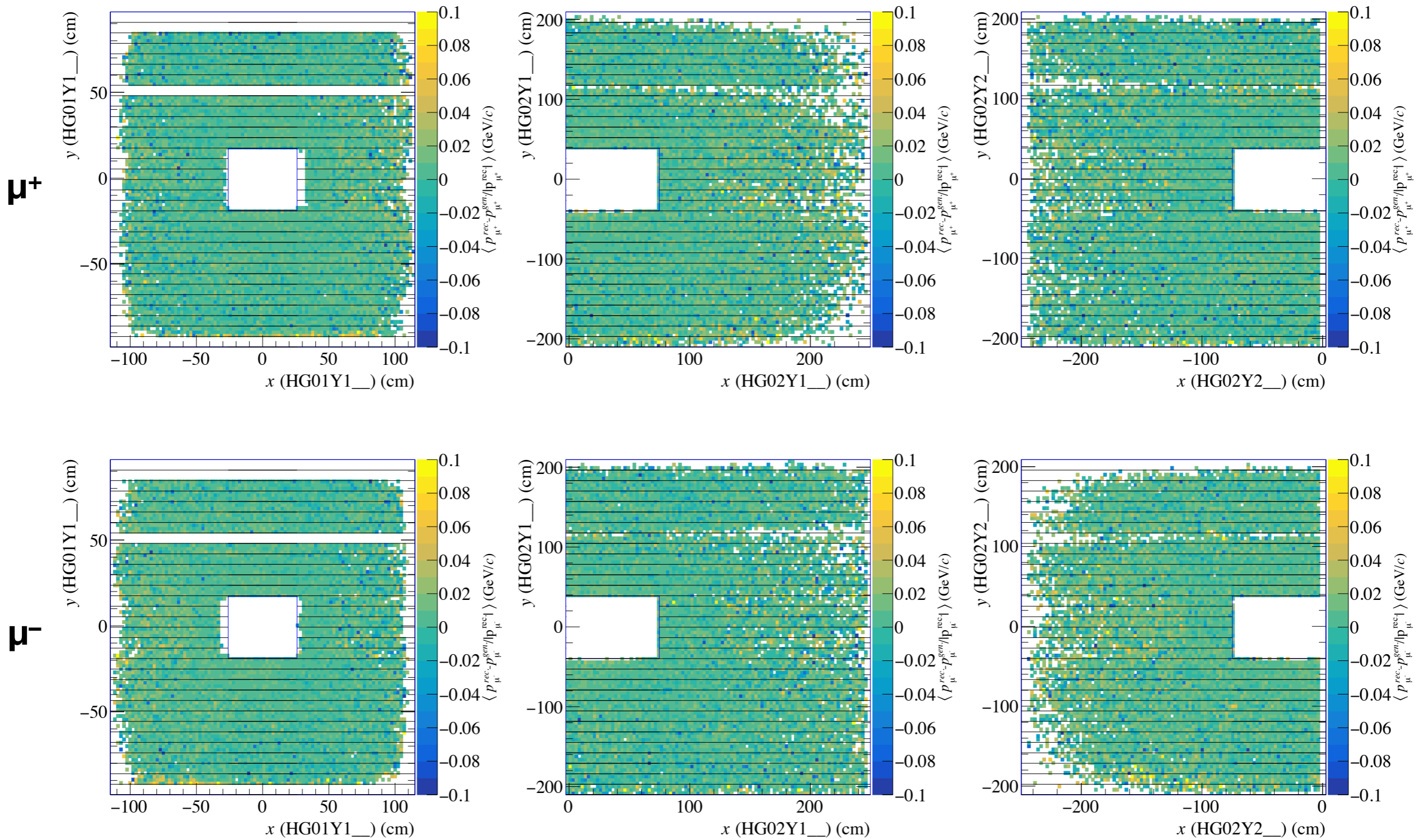
Y



Z

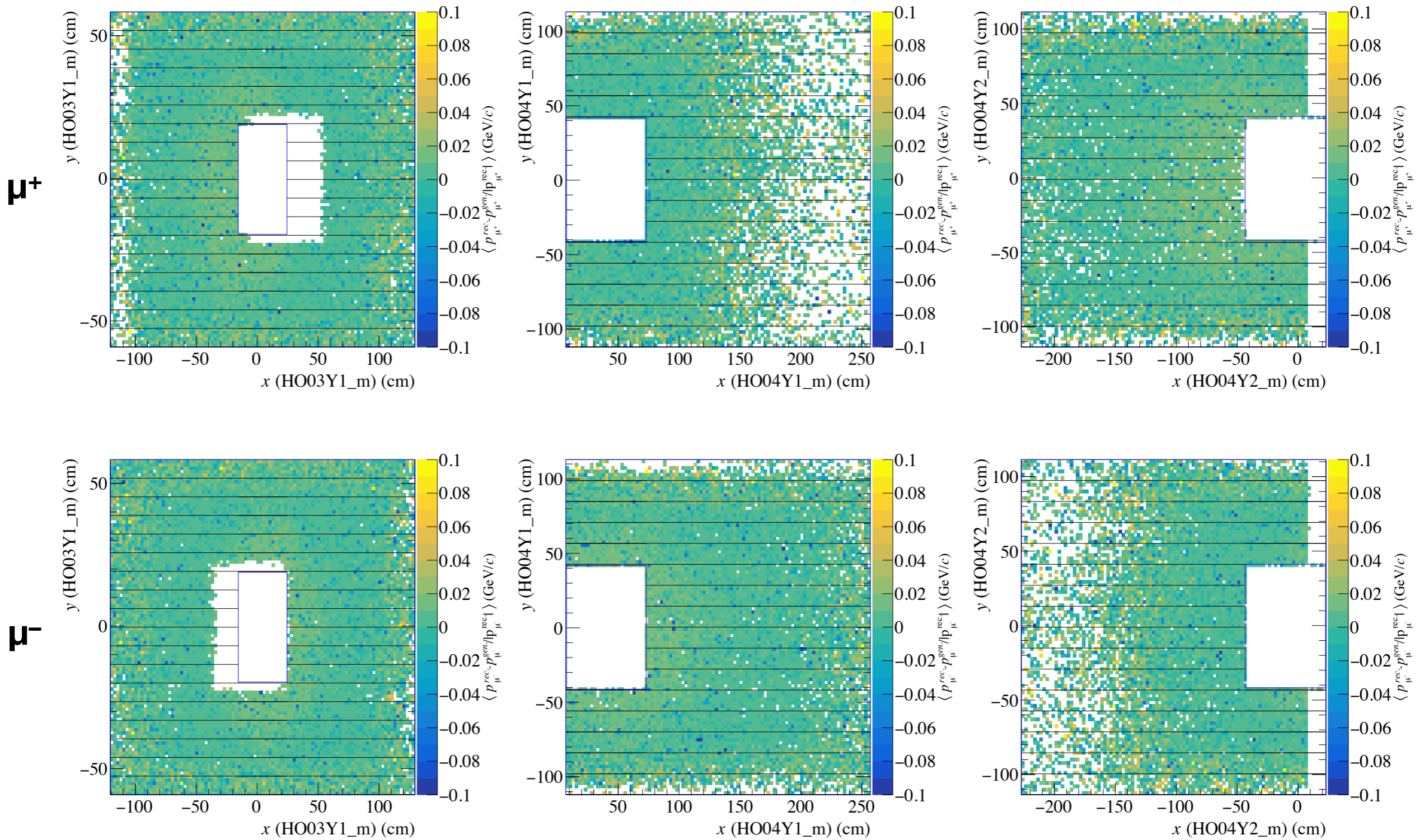


$\langle \Delta p/|p| \rangle$ on XY plane



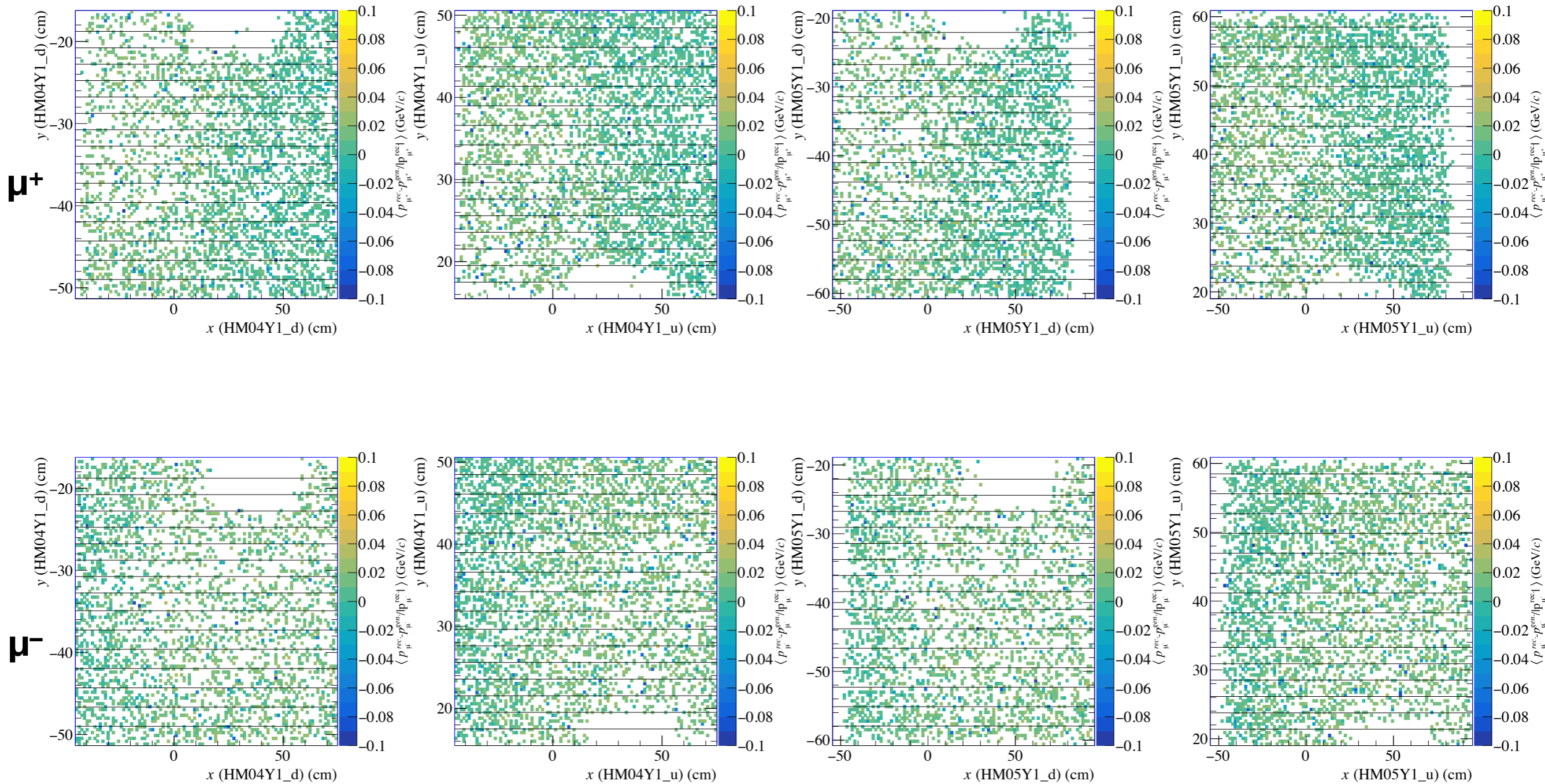
w/ inclusive LAST-LAST fired

$\langle \Delta p/|p| \rangle$ on XY plane



w/ inclusive OT-LAST fired

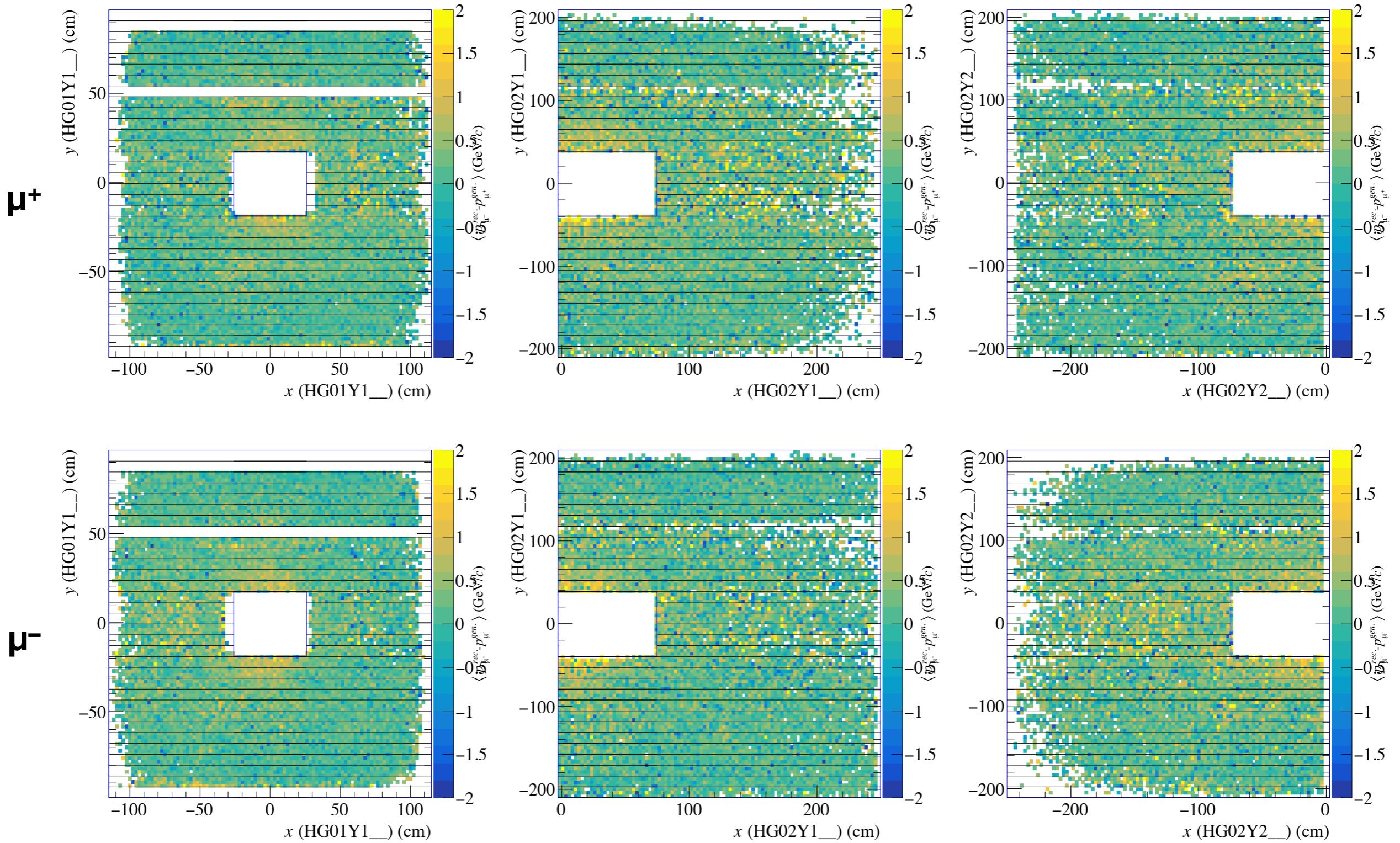
$\langle \Delta p/|p| \rangle$ on XY plane



w/ inclusive MT-LAST fired

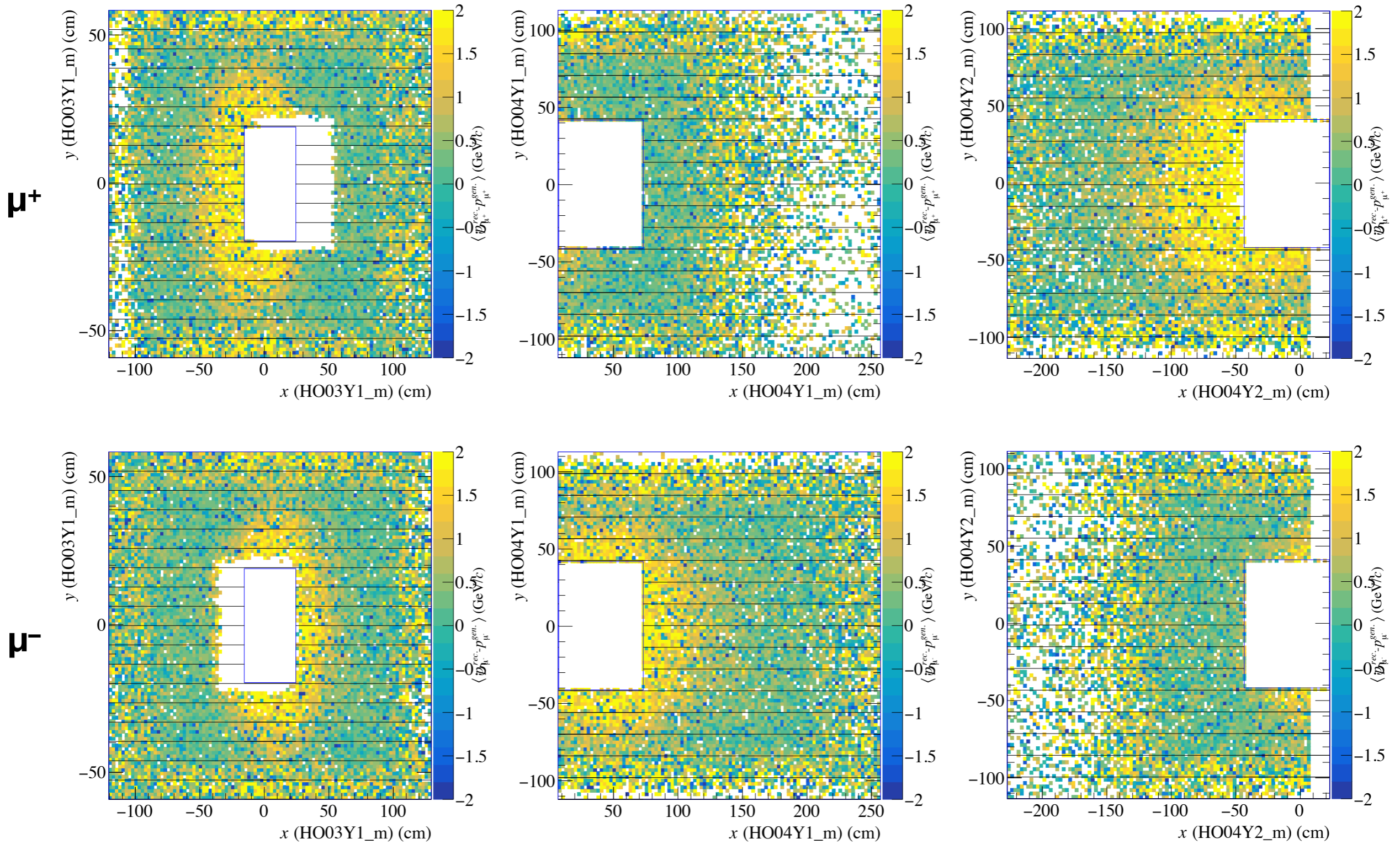
Back Up

$\langle \Delta p \rangle$ on XY plane



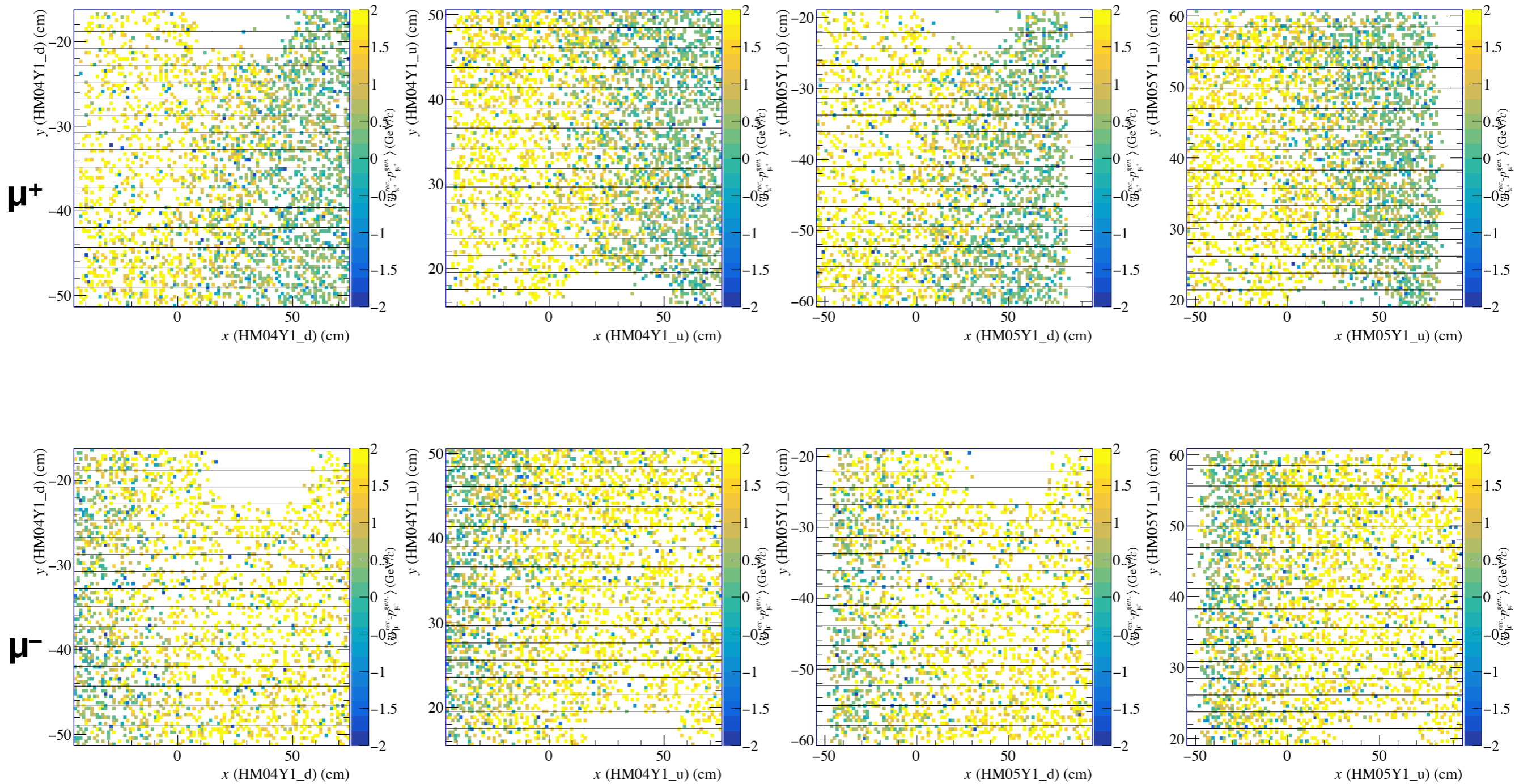
w/ inclusive LAST-LAST fired

$\langle \Delta p \rangle$ on XY plane



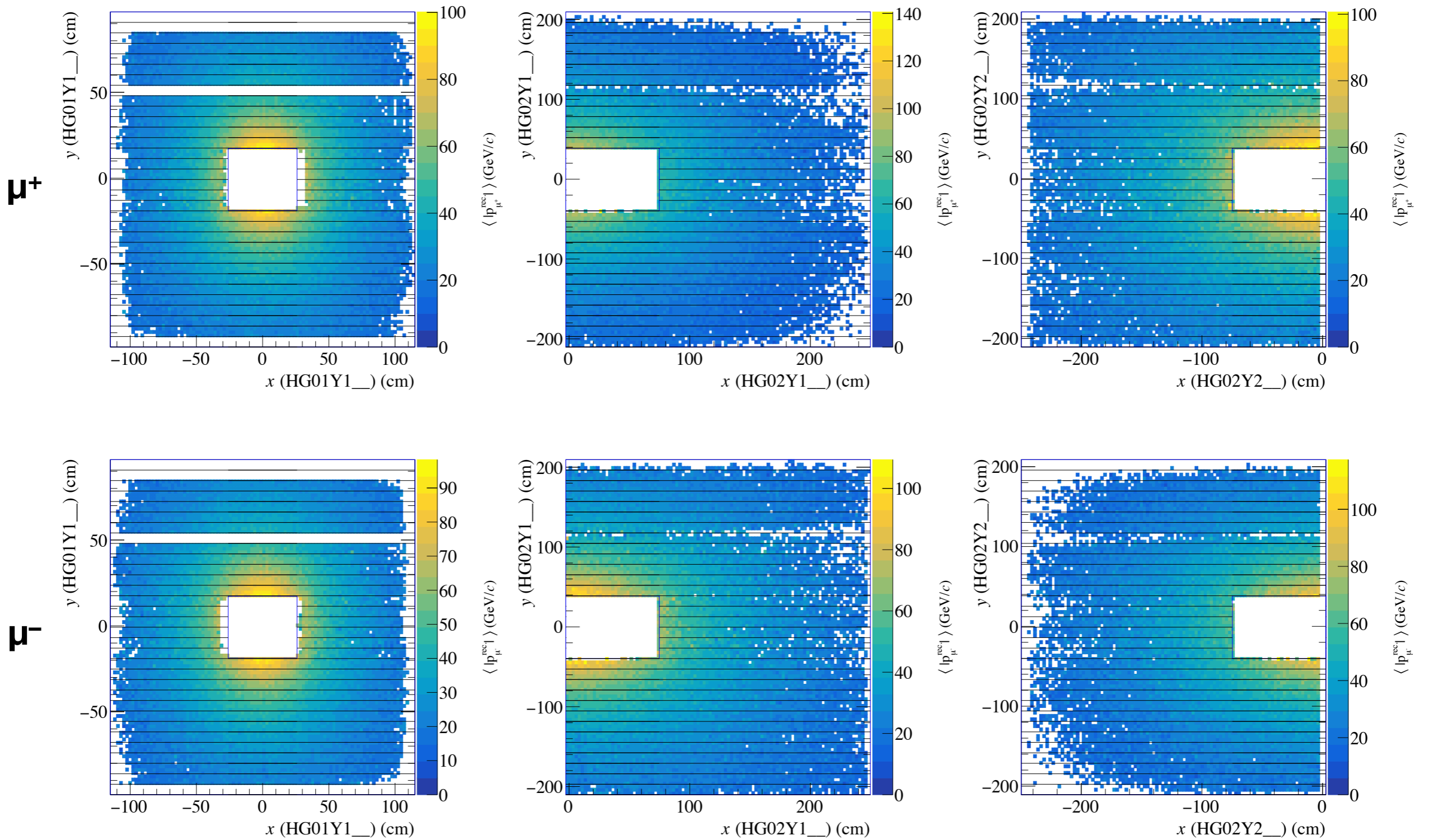
w/ inclusive OT-LAST fired

$\langle \Delta p \rangle$ on XY plane

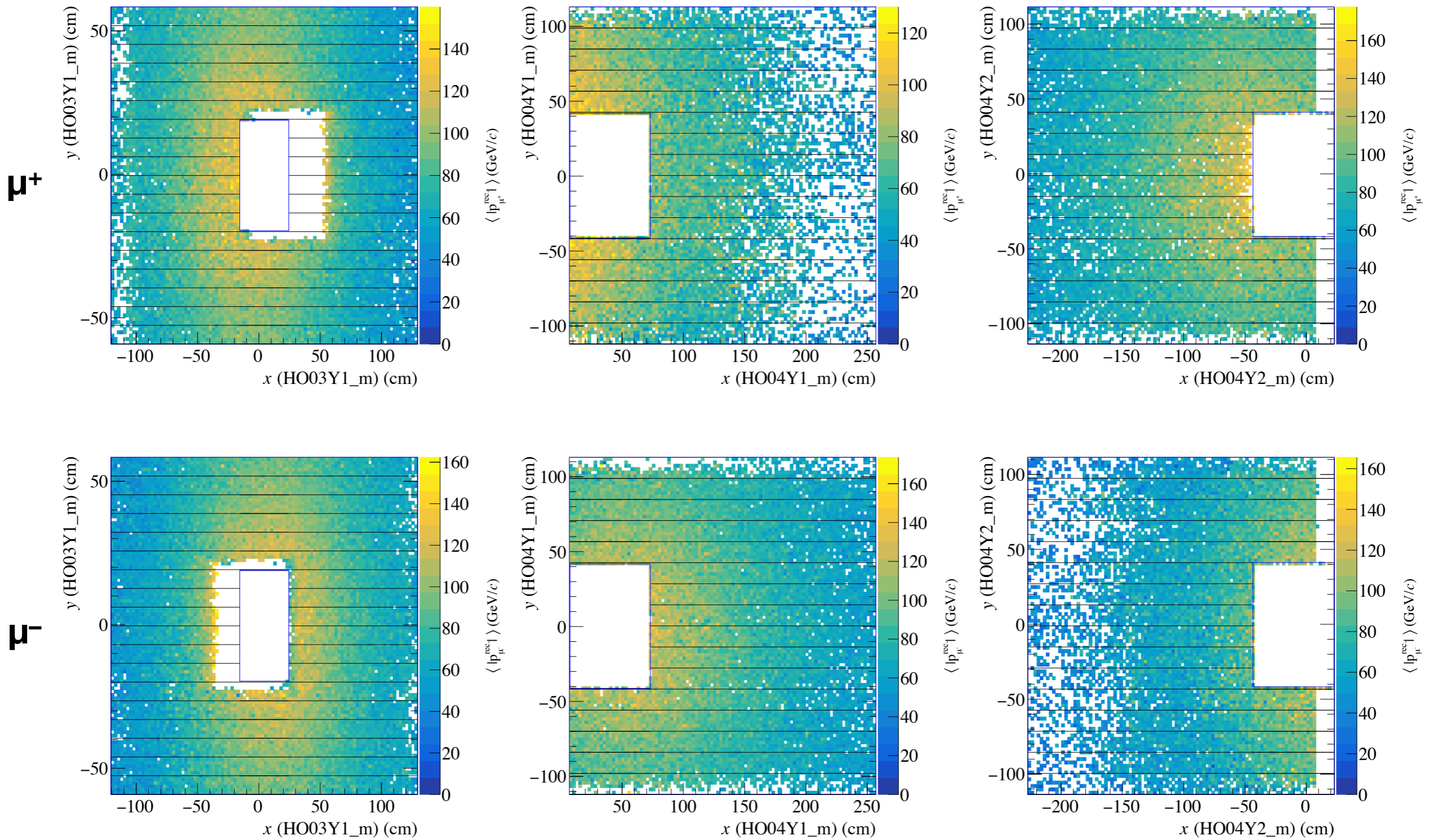


w/ inclusive MT-LAST fired

$\langle p \rangle$ on XY plane

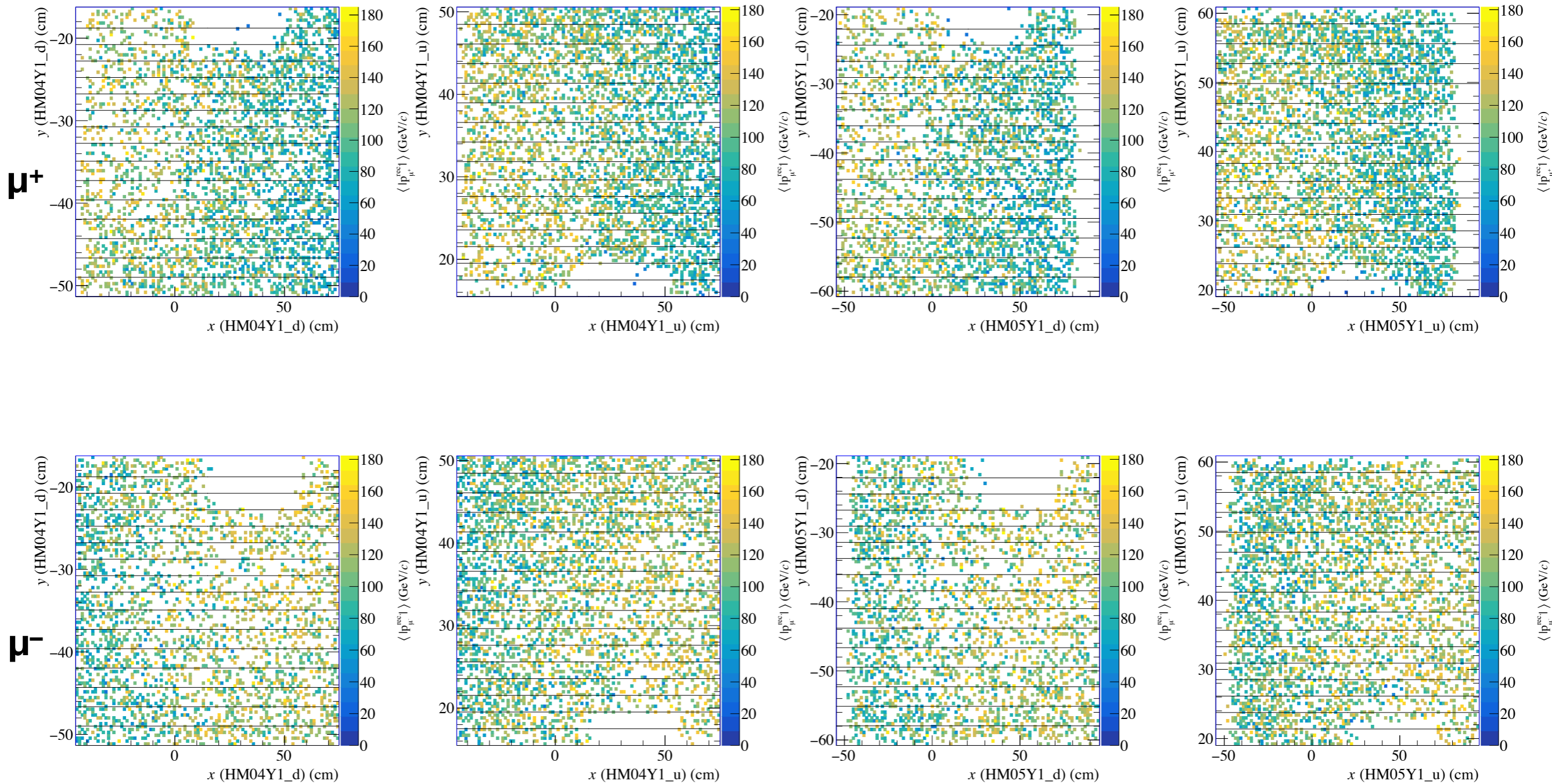


$\langle p \rangle$ on XY plane



w/ inclusive OT-LAST fired

$\langle p \rangle$ on XY plane



w/ inclusive MT-LAST fired