

Analysis on the recent test productions

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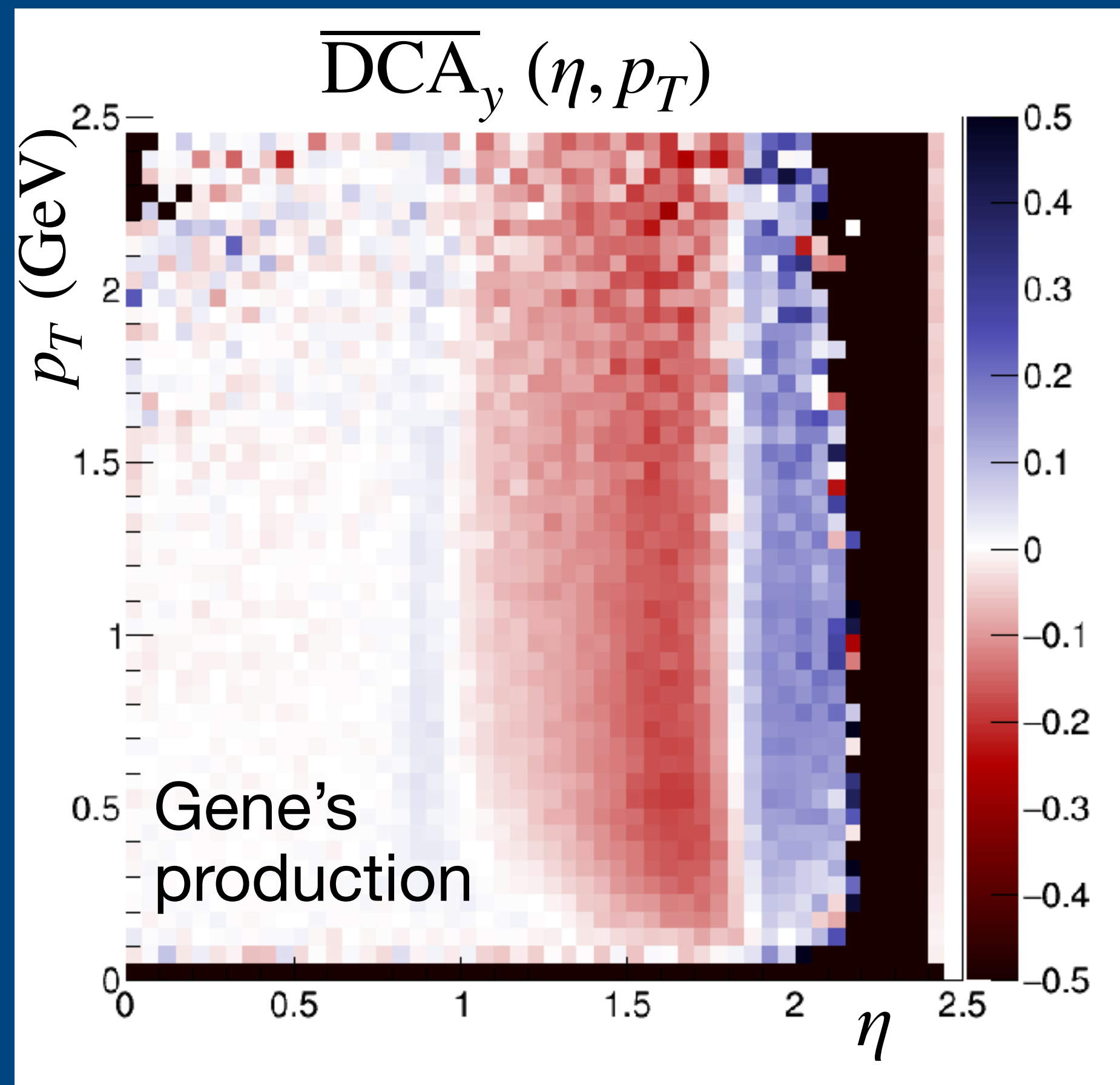


Outstanding issues

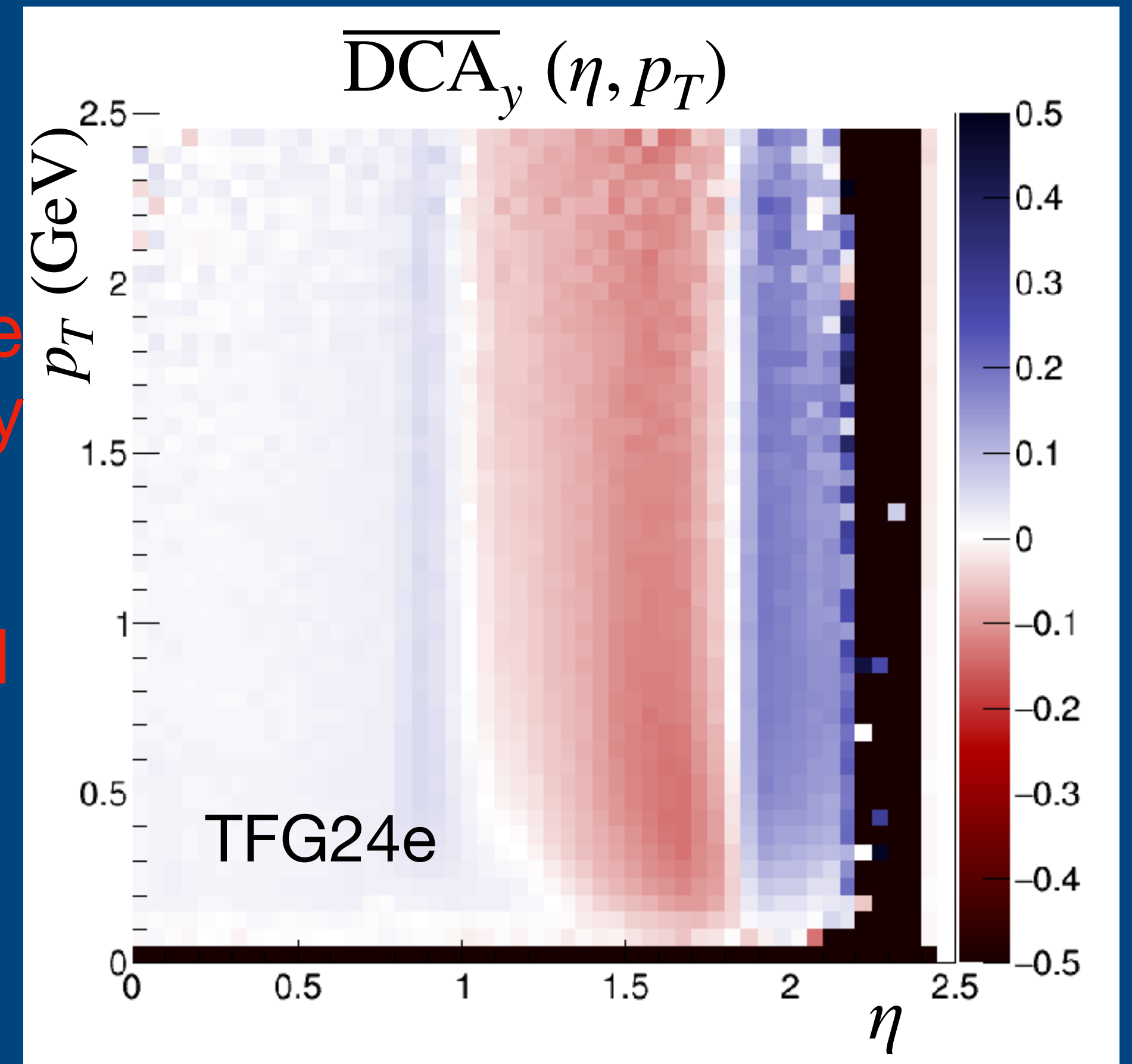
- Discrepancy in the DCA y
- Asymmetric particle production measurements forward and backward of mid-rapidity
- **New “test productions” made with new cuts in the vertexer**
 1. From Gene: Includes new alignment, and vertexer cuts centered around the target (3 cm radial cut around $x = 0, y = -2$). 40k events
 2. TGF24e (Yuri): Includes a 6 cm radial cut around $x, y = 0$ in the vertexing algorithm. 33M events
- Both at at 4.59 AGeV

Comparisons in DCA y

- Below: Mean DCA y distributions as a function of phase space for the new productions (**NOTE:** the same DST file in each test production did not exist at time of creation)



Still see a dependence in the DCA y distribution even with the updated vertex cuts



A potential interpretation of this finding

The updated vertex cut does *not* resolve our DCA y distributions. In TFG24e, it is more blue for $\eta < 1$, and the red is less intense. When Yuri did this analysis integrated over the phase space, he may have been seeing some cancellations from this effect, leading to the conclusion that the vertex cut resolved the issue. See here: <https://drupal.star.bnl.gov/STAR/system/files/PrimaryVertexCuts.pdf>

In other words, when we study DCA differential in η and p_T , we see the integrated DCA y in TFG is zero, because of cancellations as a function of η . Looking at the integrated means of each production supports this conclusion:

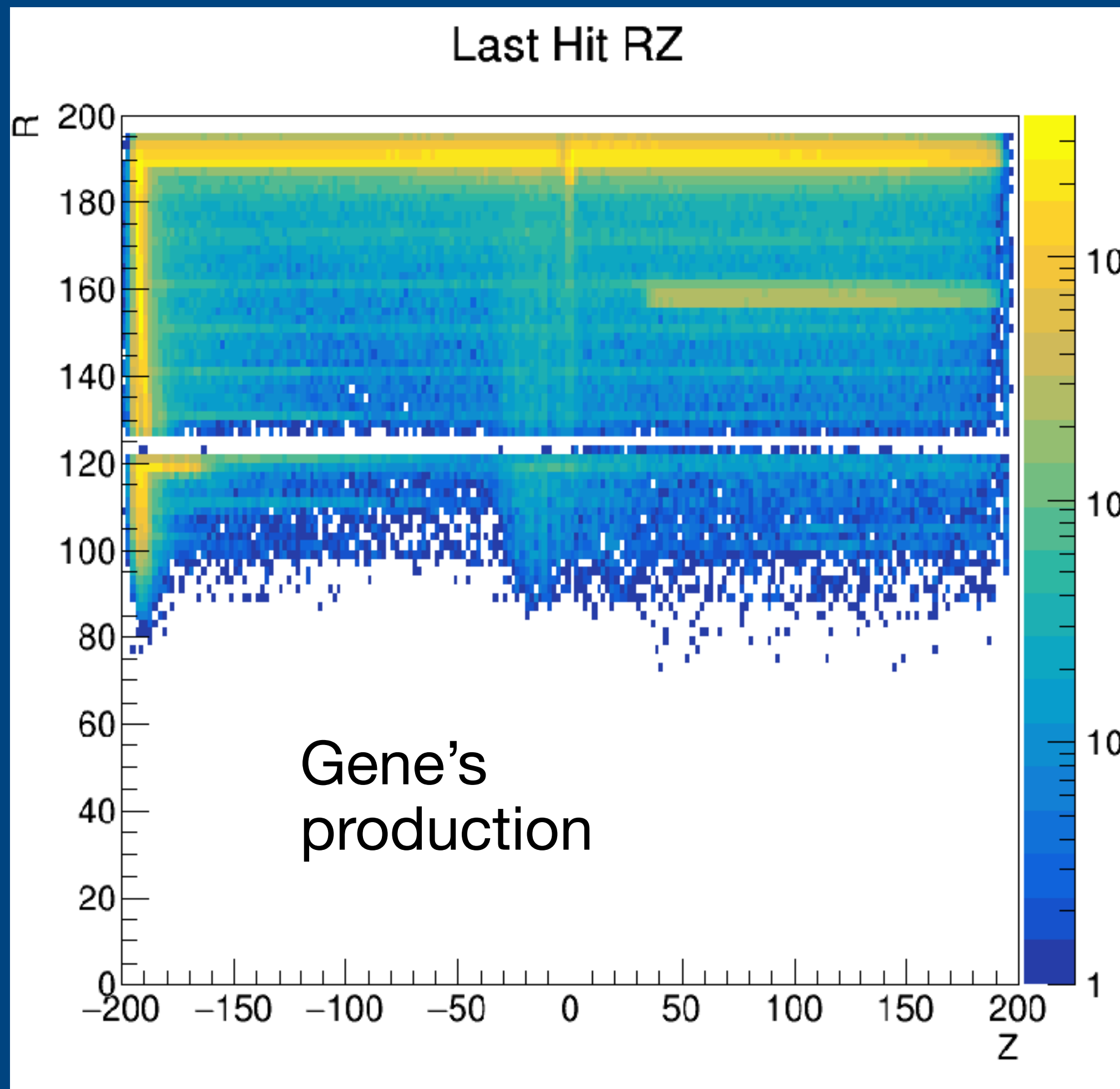
$$\overline{\text{DCA}}_{y, \text{gene}} = -0.0149 \pm 0.002 \text{ cm}$$

$$\overline{\text{DCA}}_{y, \text{TFG24e}} = 0.005 \pm 0.002 \text{ cm}$$

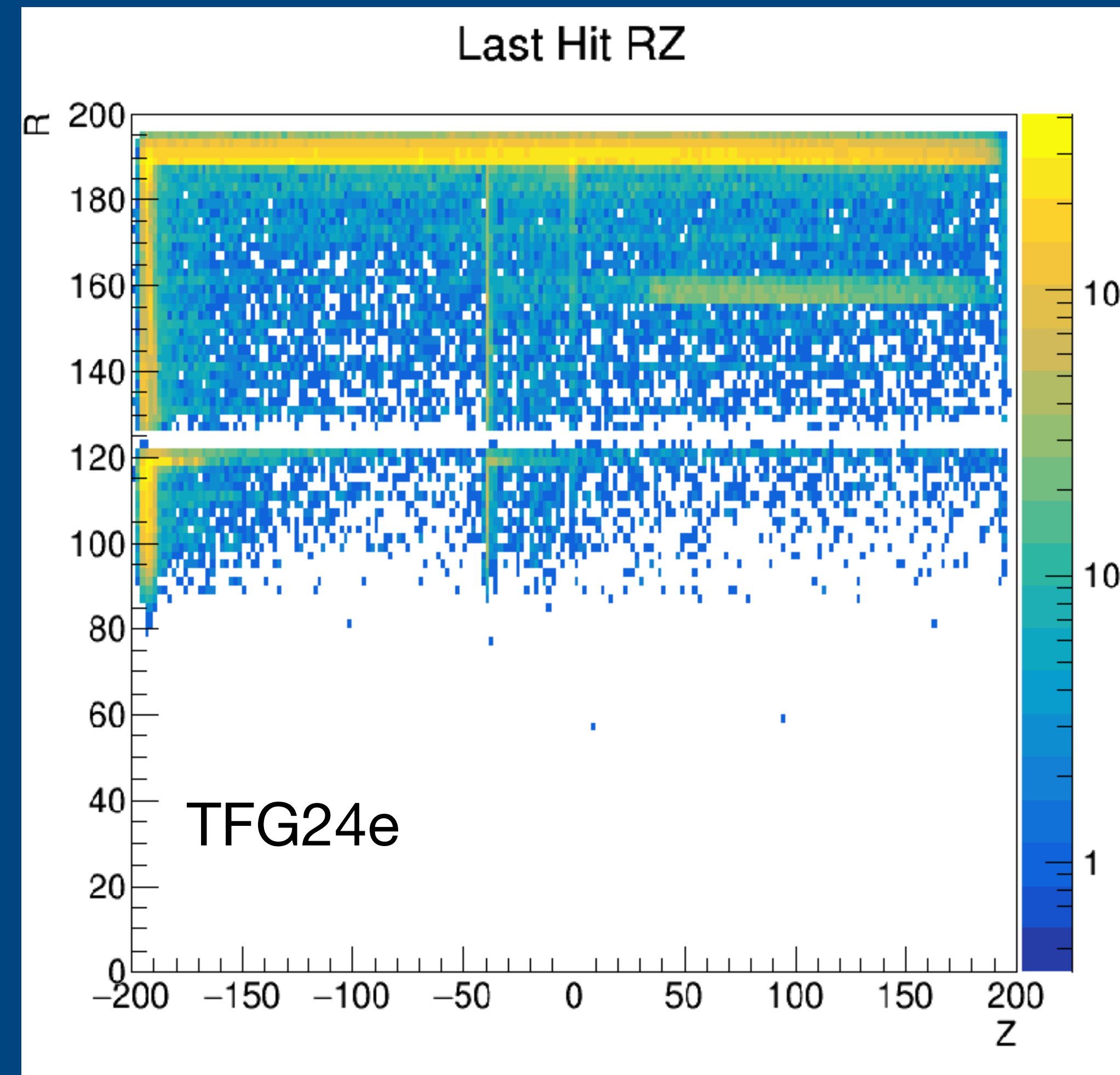
TFG not *quite* consistent with zero, but more than an order of magnitude closer

Last Hit Distributions

- Below: Last hit of primary tracks with a DCA < 1 cm. No other cuts applied. I have no code other than my embedding code that looks at MuDst. This means I just copied a MuDst to my machine, and wrote a quick simple code that cuts on primaries with DCA < 1 to save time. nEvents gene's production: ~4k. nEvents TFG: ~ 3k

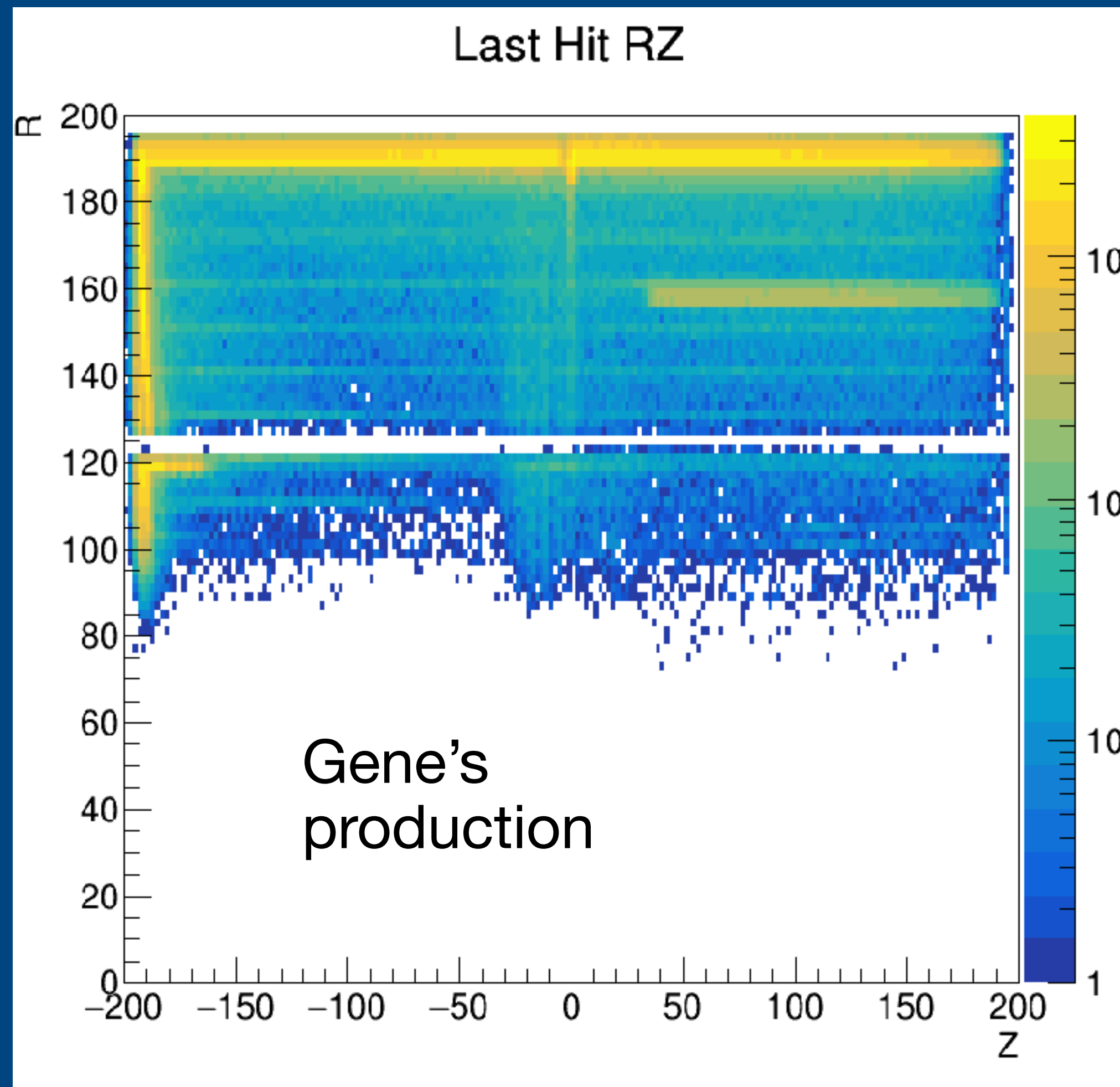


The central membrane is no longer visible in the last hit distribution. However, TFG24e shows a line at $Z = -40$ that I can not explain

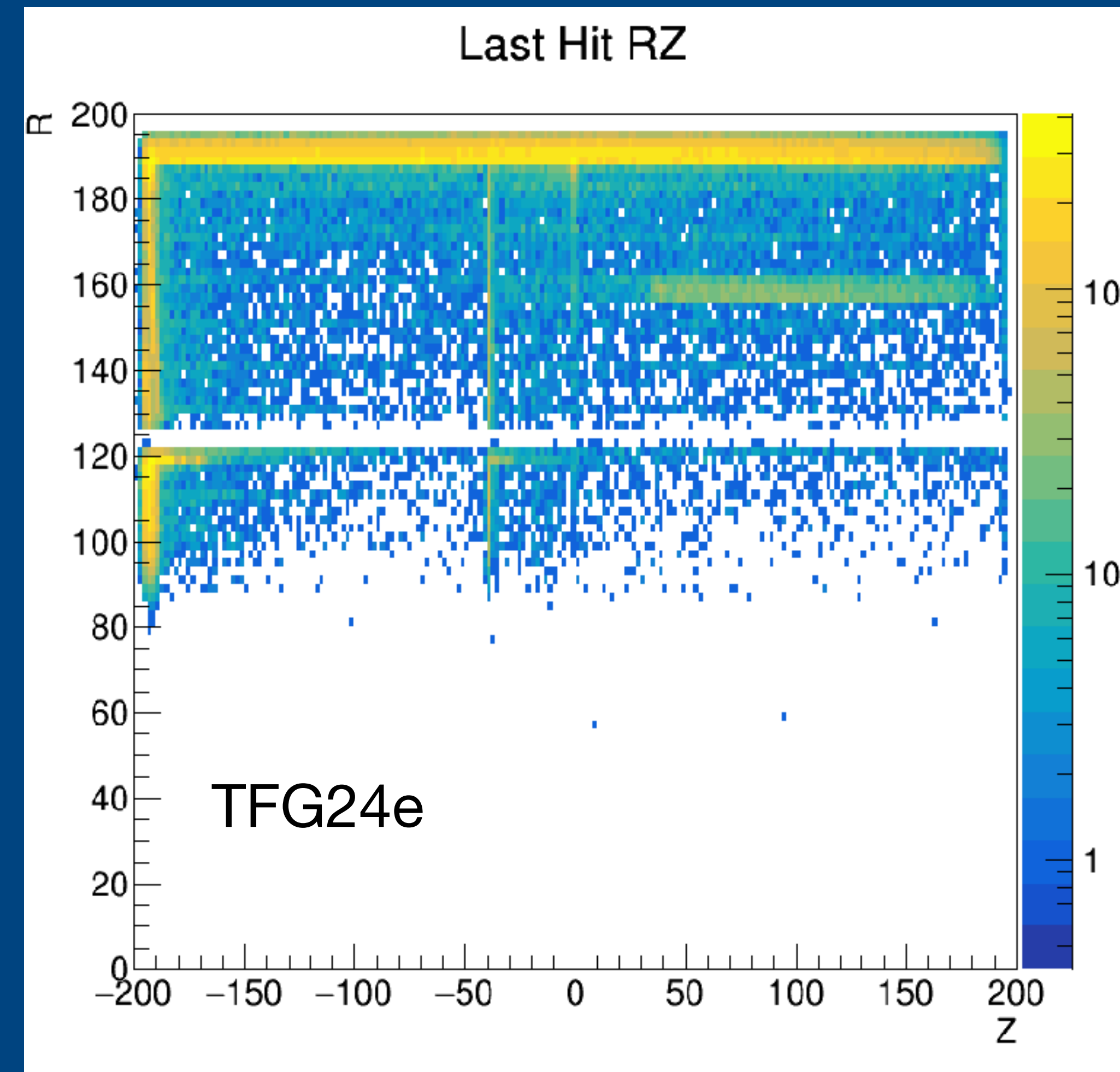


Last Hit Distributions

- Below: Last hit of primary tracks with a DCA < 1 cm. No other cuts applied.

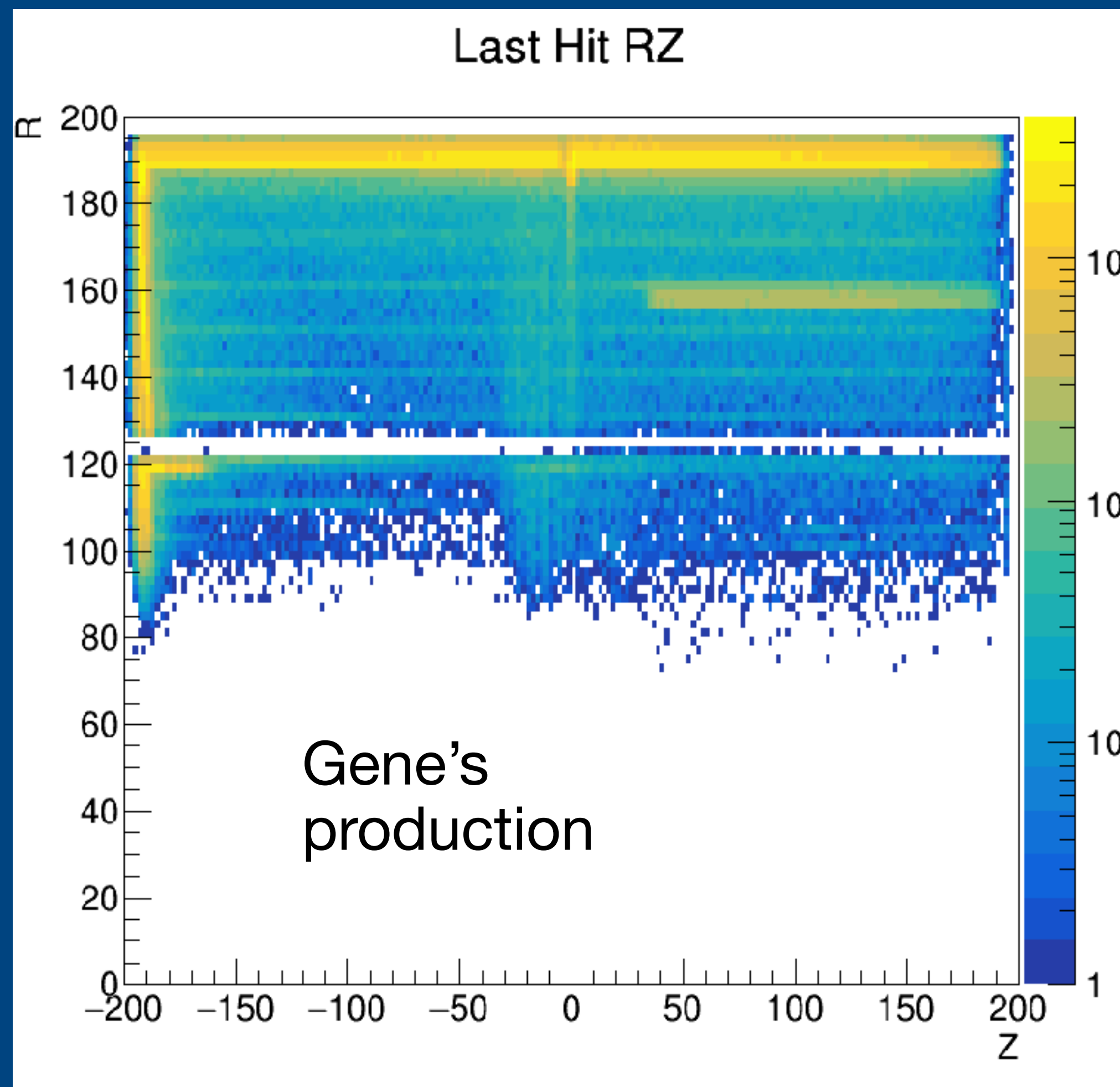


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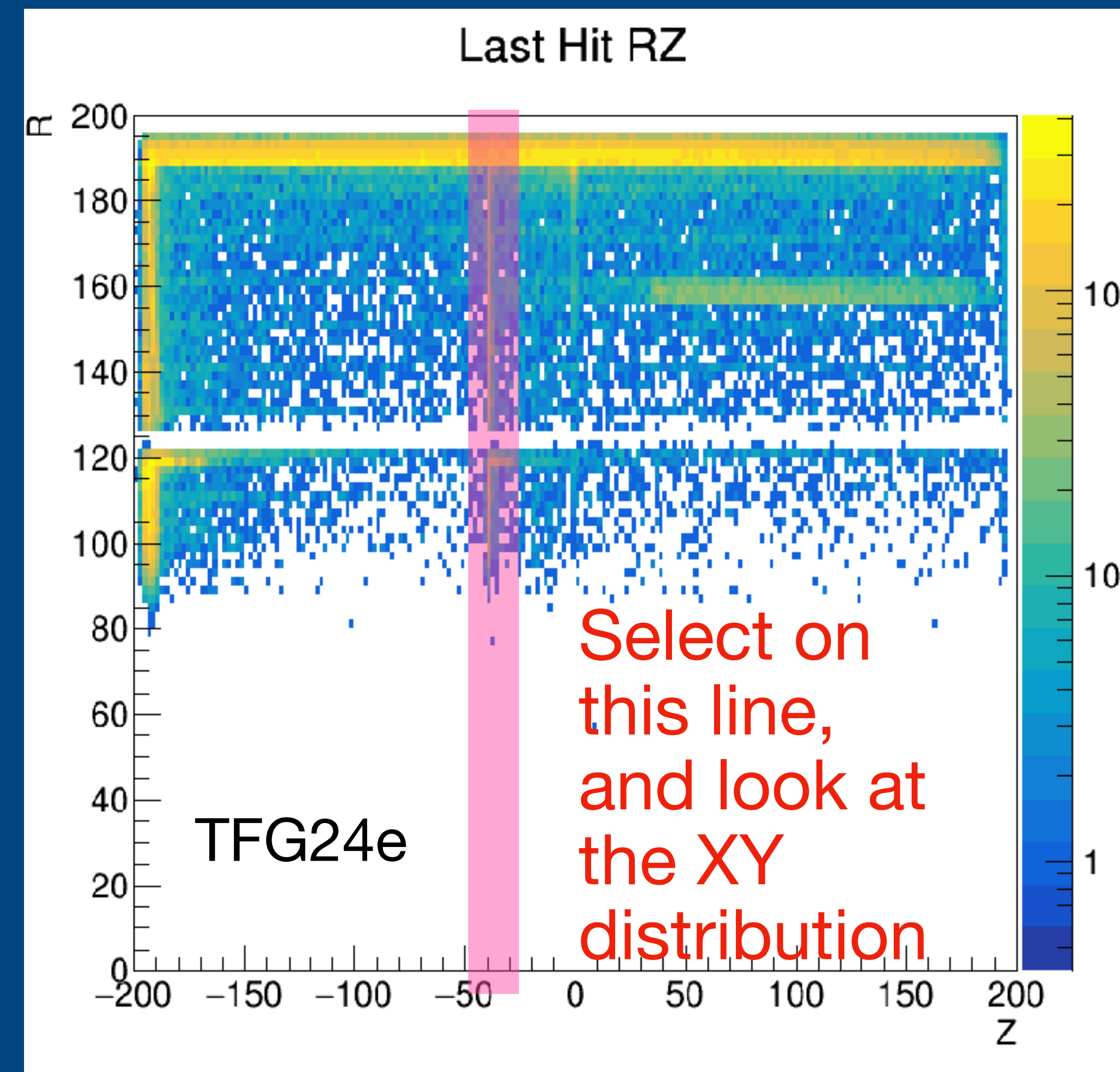


Last Hit Distributions

- Below: Last hit of primary tracks with a DCA < 1 cm. No other cuts applied.

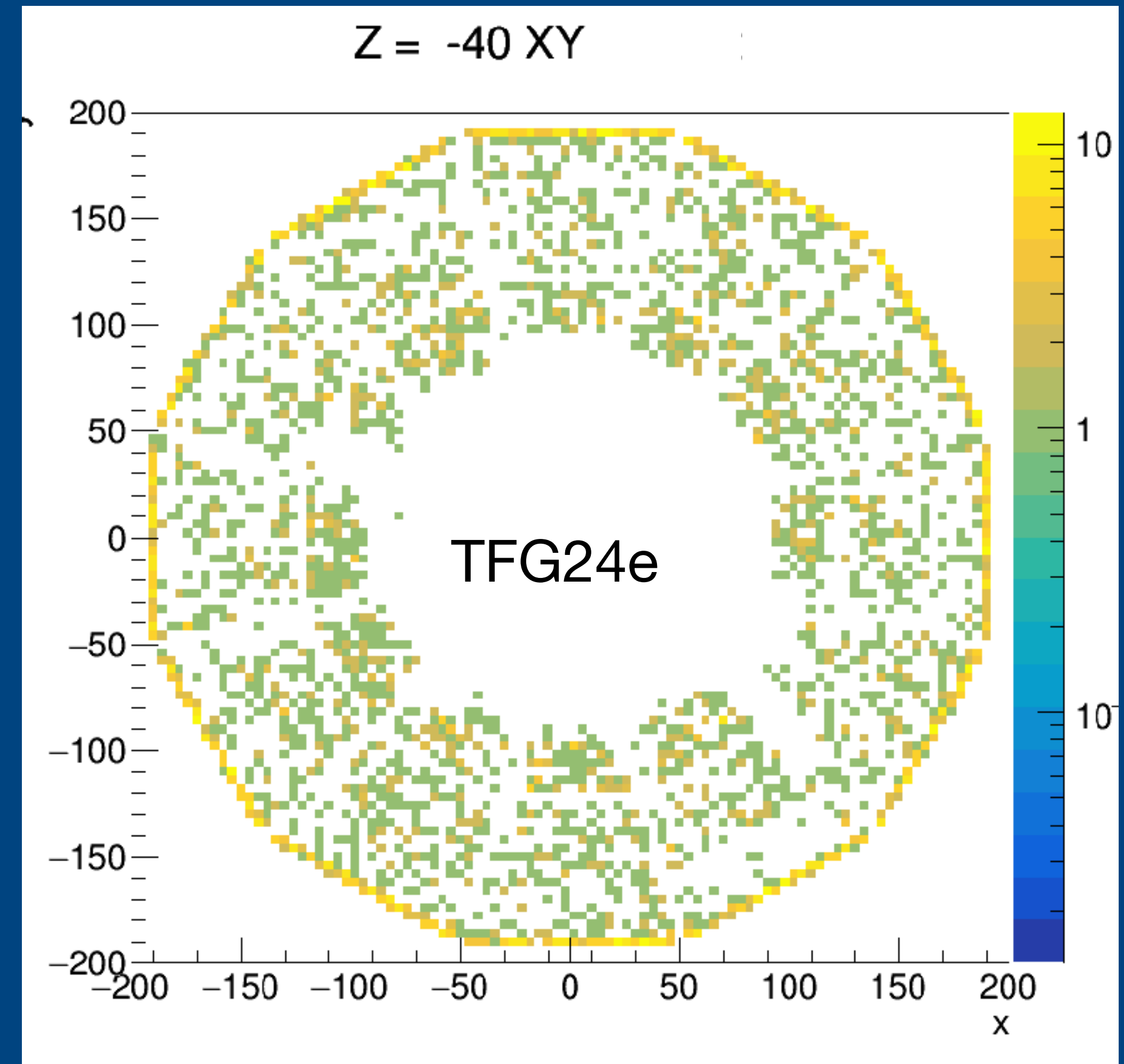


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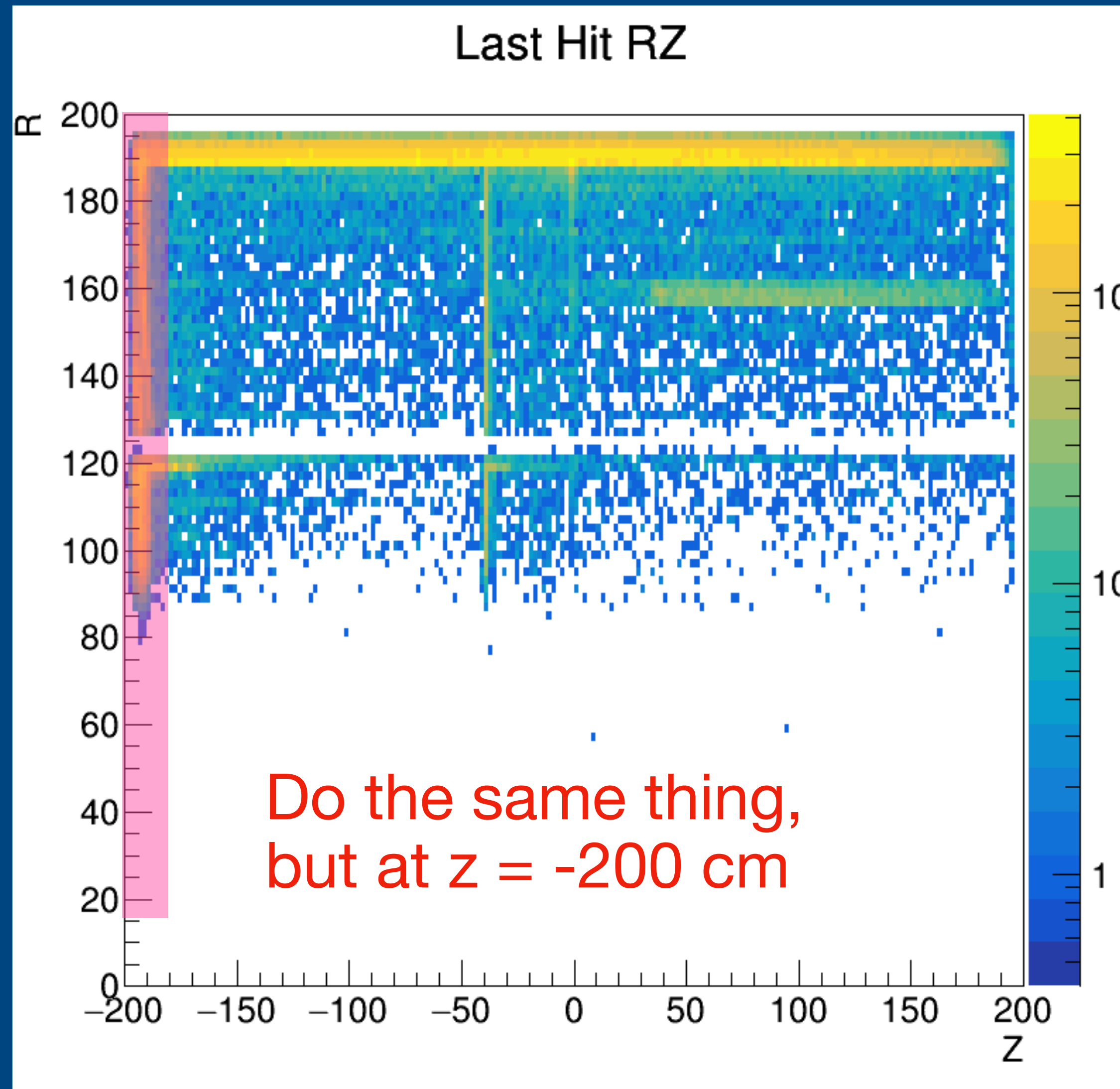


Last Hit Distributions

- Below: Last hit of primary tracks with a DCA < 1 cm. No other cuts applied.
 $-40 < z < -45$ cm
- Concentrated in the iTPC.
- For TFG At $z = -40$, tracks are terminating in the iTPC. Does not happen in the other production.
- Maybe some holes; will come back to this in the following slides

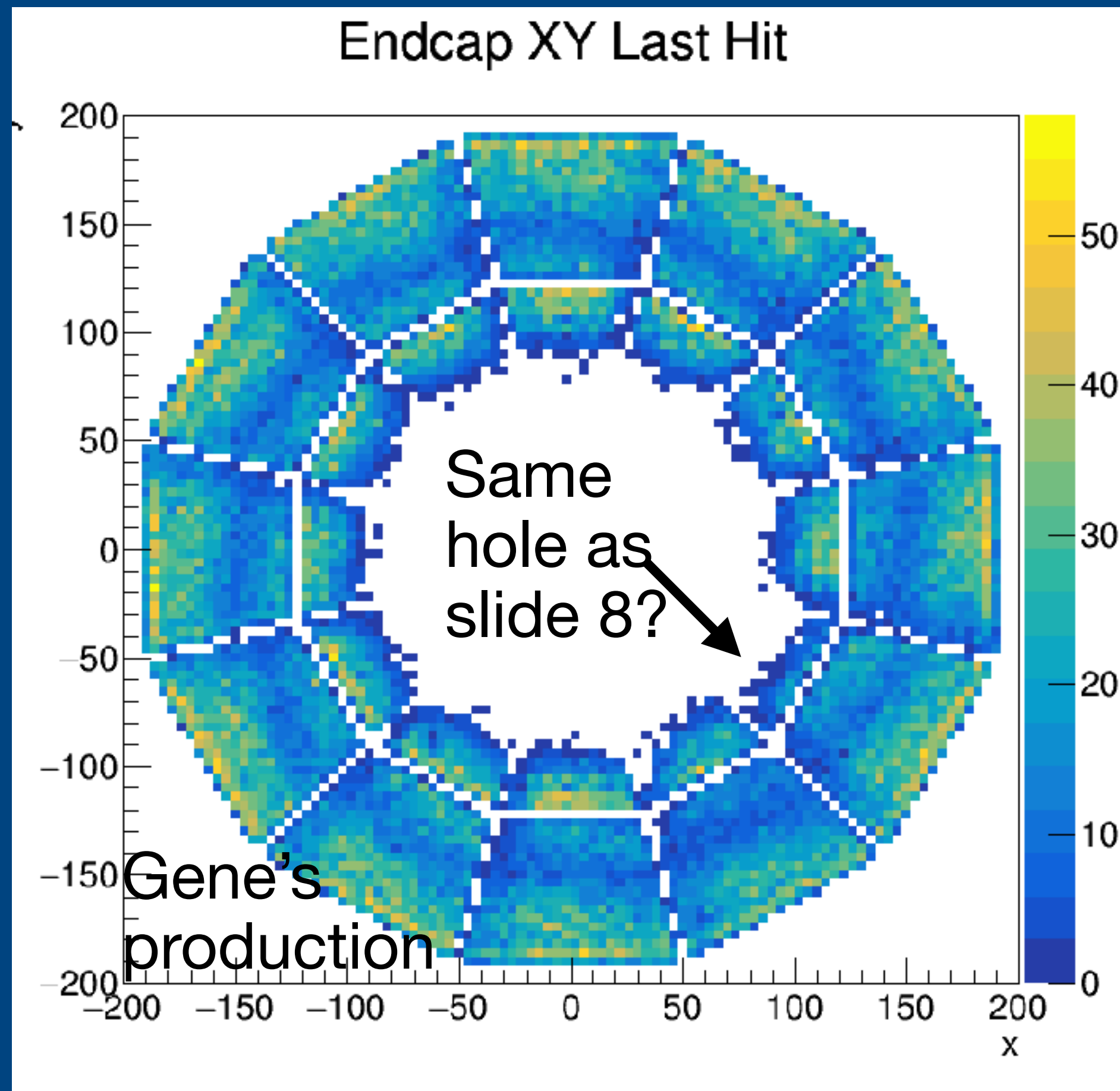


Last Hit Distributions

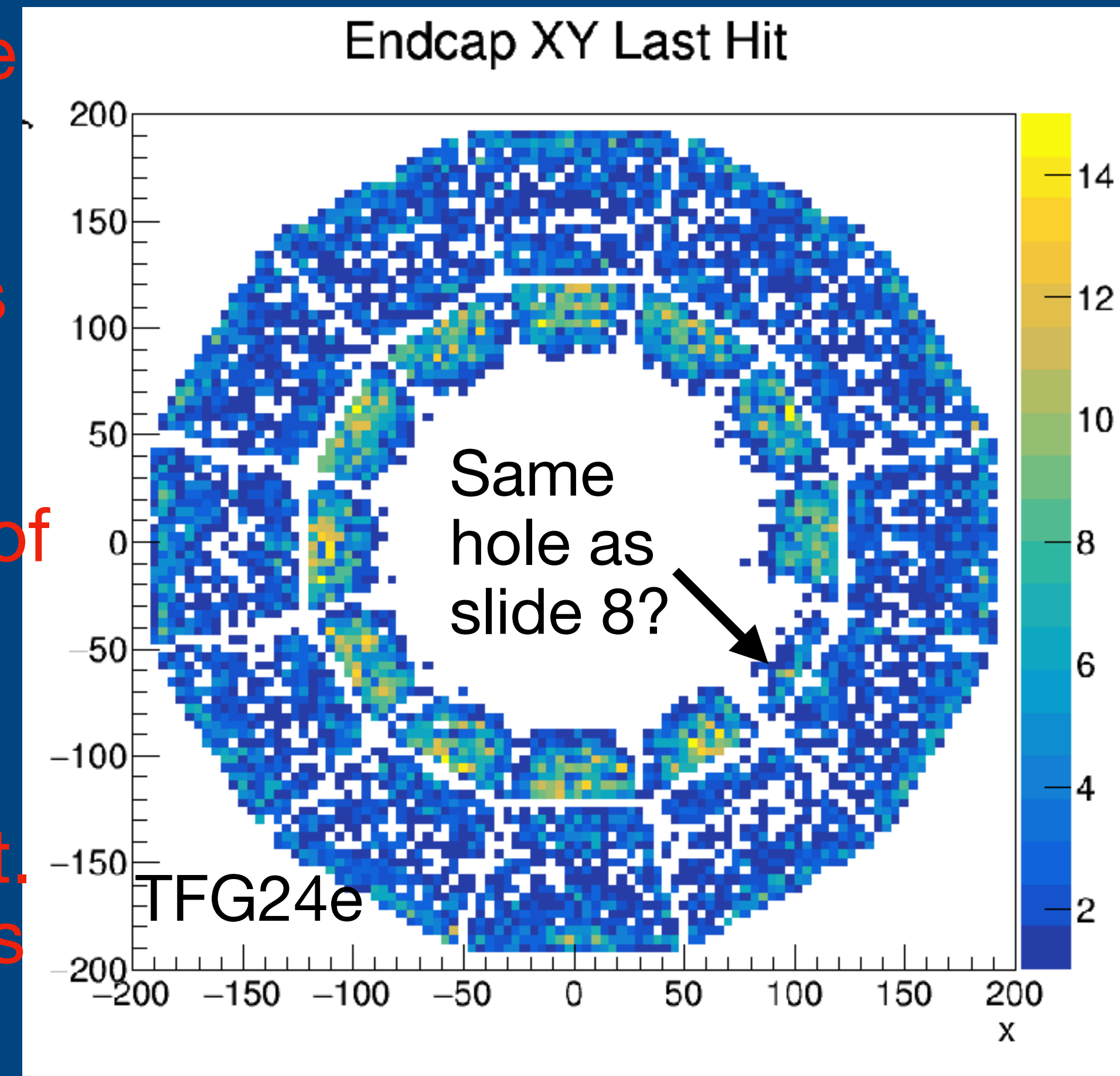


Last Hit Distributions

- Below: Last hit of primary tracks with a DCA < 1 cm. No other cuts applied.
 $-205 < z < -195$ cm



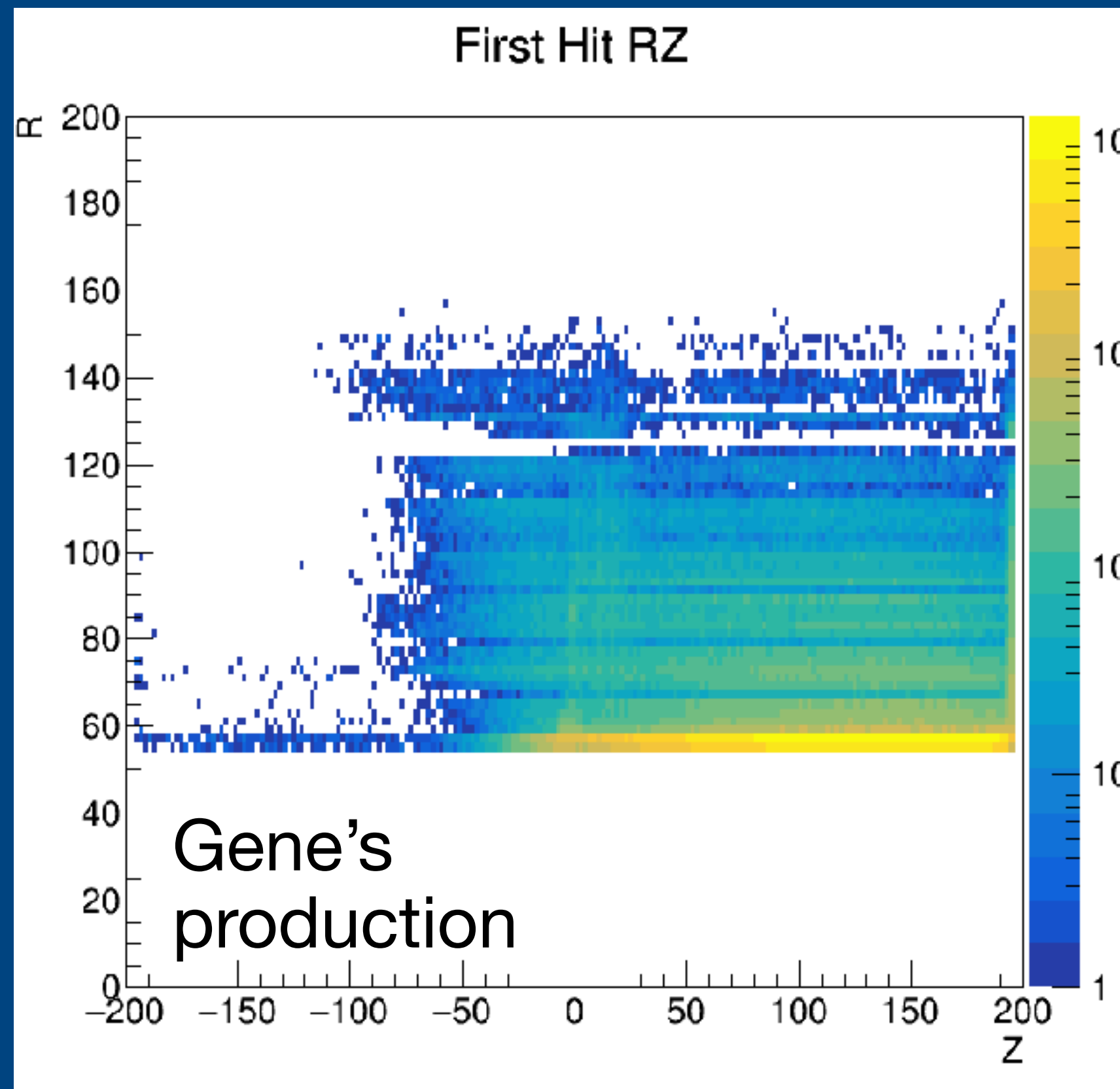
I would expect more tracks with a last hit in the outer TPC, since more particles are produced at smaller eta. TFG shows the majority of the last hits produced in inner TPC. The other production does not. I can not explain this



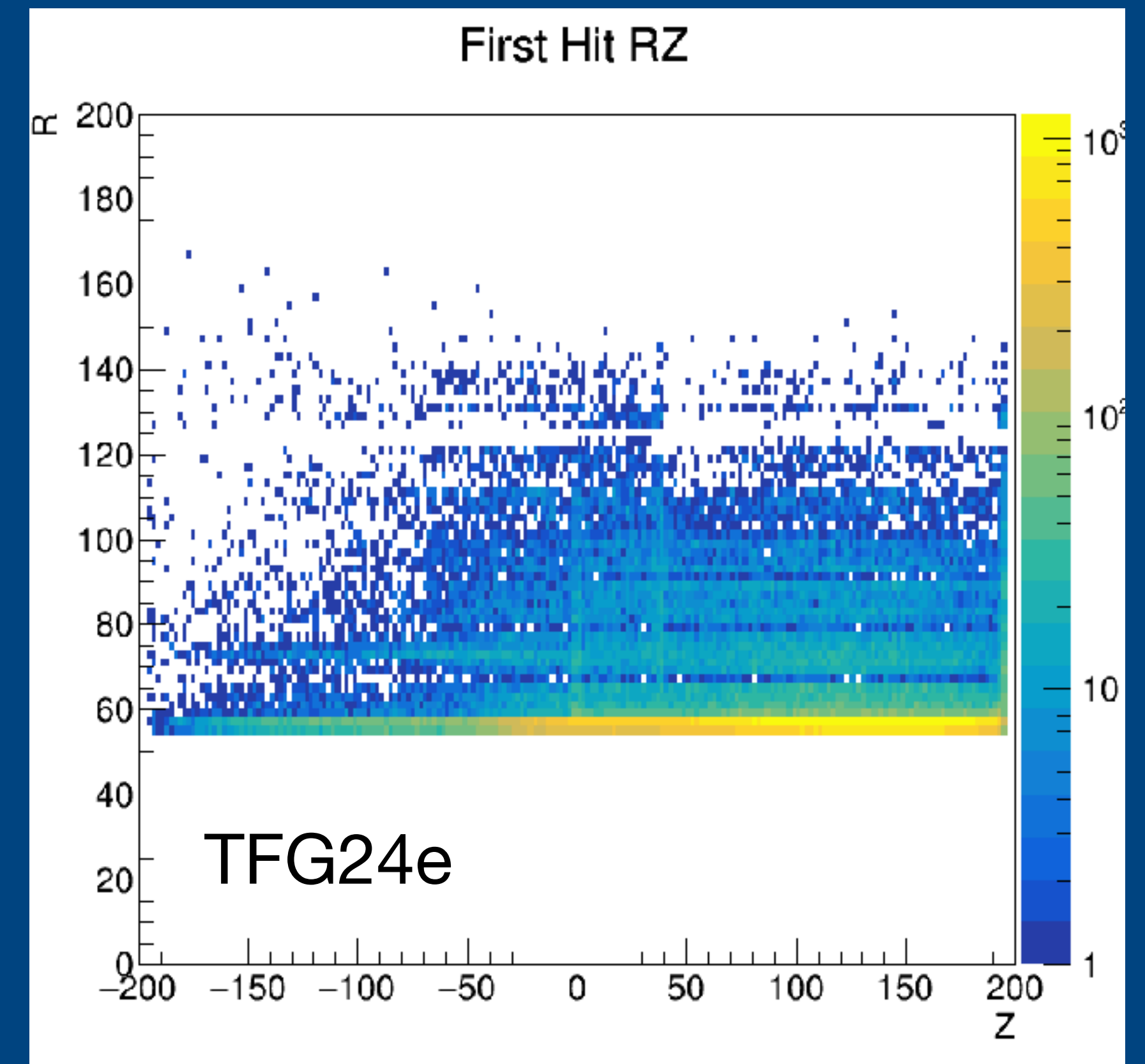
Inner edge of iTPC: $\eta \approx 2.3$, outermost edge of iTPC: $\eta \approx 1.8$, outermost edge of TPX $\eta \approx 1.5$

First Hit distributions

- Below: First hit of global tracks with a DCA < 1 cm. No other cuts applied. Primary tracks first hit is the target, so we can't use primaries.



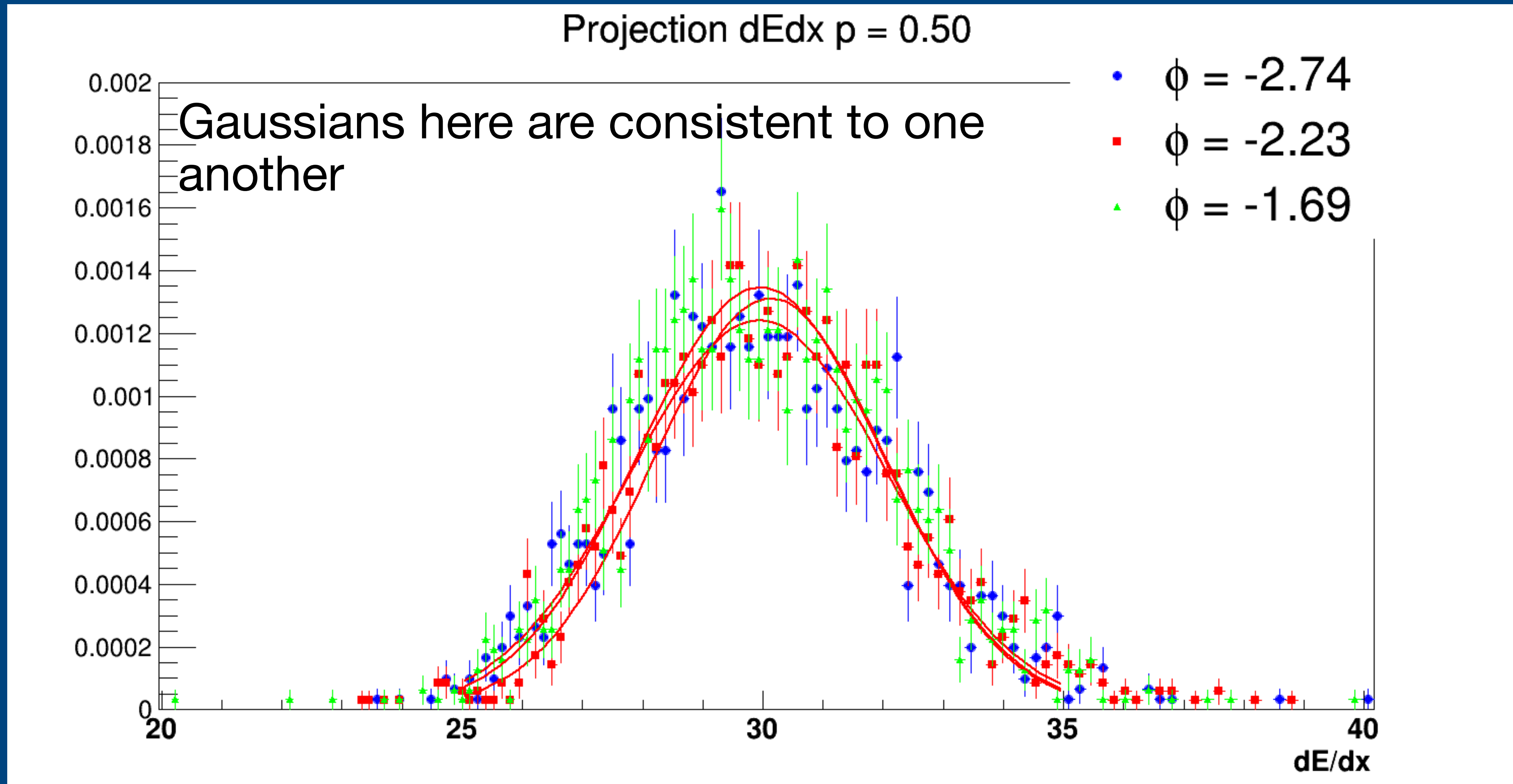
TFG shows far more first hits in the forward region. Again, please remember the same events in each production have not been produced. This also means TFG has ~ 1000 events less than the other production



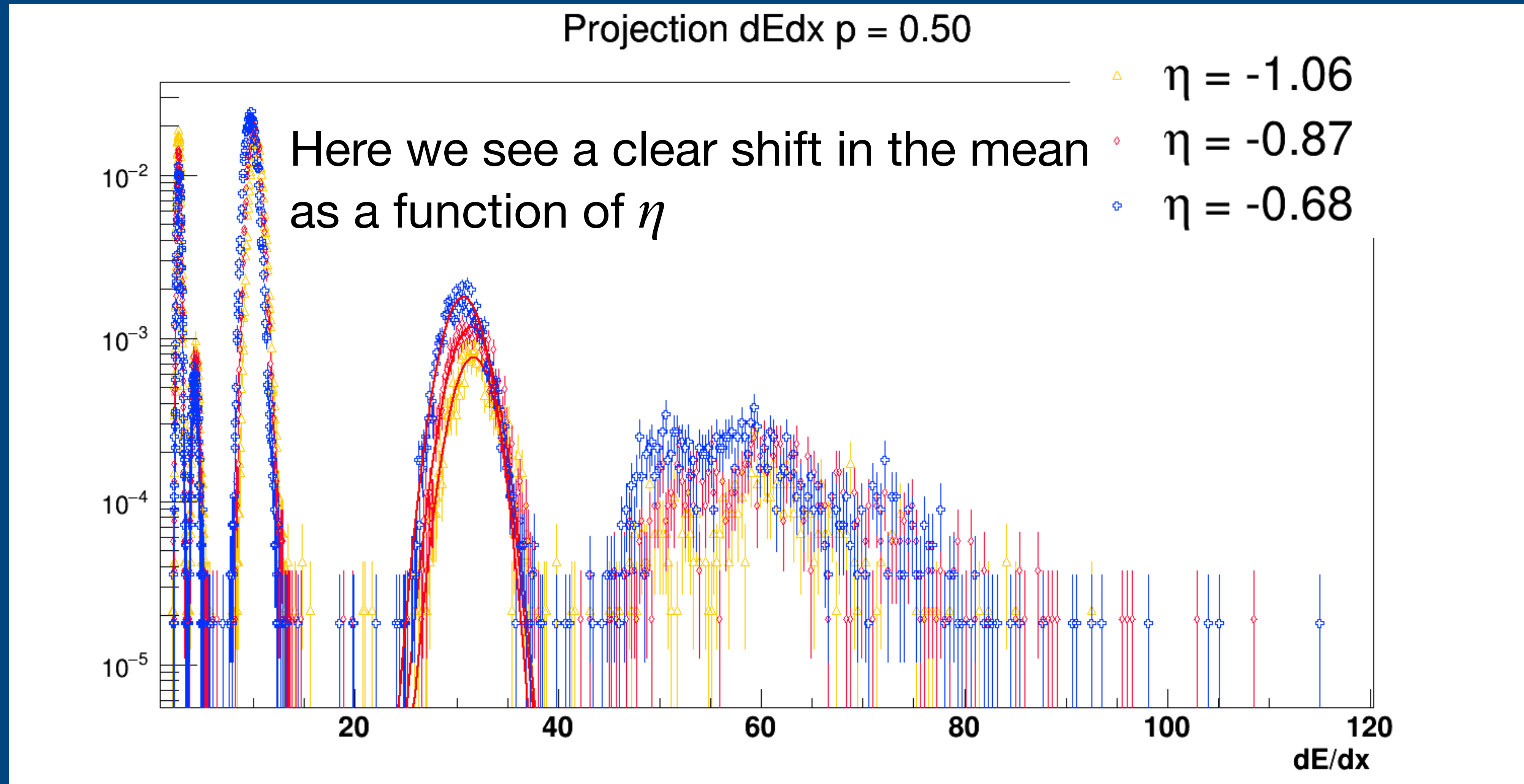
A quick look at calibration

- I had previously looked at dE/dx as a function of η and ϕ . See here: <https://drupal.star.bnl.gov/STAR/blog/mlabonte/Test-Production-QA-ML>
- Procedure: Make dE/dx vs. momentum plots in bins of η and ϕ , then project in the dE/dx axis at $p = 0.5$ GeV
- The conclusion was there was an η and ϕ dependence in dE/dx
- I have checked this again in TFG24e, since there is new calibration
- ϕ dependence is now consistent within errors
- We still see dependence with η
- The fitted peak shown on the following slides is deuterons

ϕ dependence of dE/dx



η dependence of dE/dx



Conclusion from dE/dx studies

- ϕ dependence looks to be more stable
- η dependence looks the same
 - If analyzers are careful, this shouldn't be too much of a problem

Conclusion

- The DCA y distribution still has a dependence on η , even with the vertexer changes;
 - My explanation: We thought it was resolved because we were looking at the observable integrated over the entire phase space, and not differentially.
- There are different features between the two test productions and they should be discussed.
 - Last hits on the endcap
 - Last hits at $z = -40$ cm
 - First hit distributions
- η dependence in dE/dx
- Next I will look at the Forward/Backward ratios in the new productions
- Other suggestions to look into are welcomed and encouraged!