

sTGC Simulation & Performance

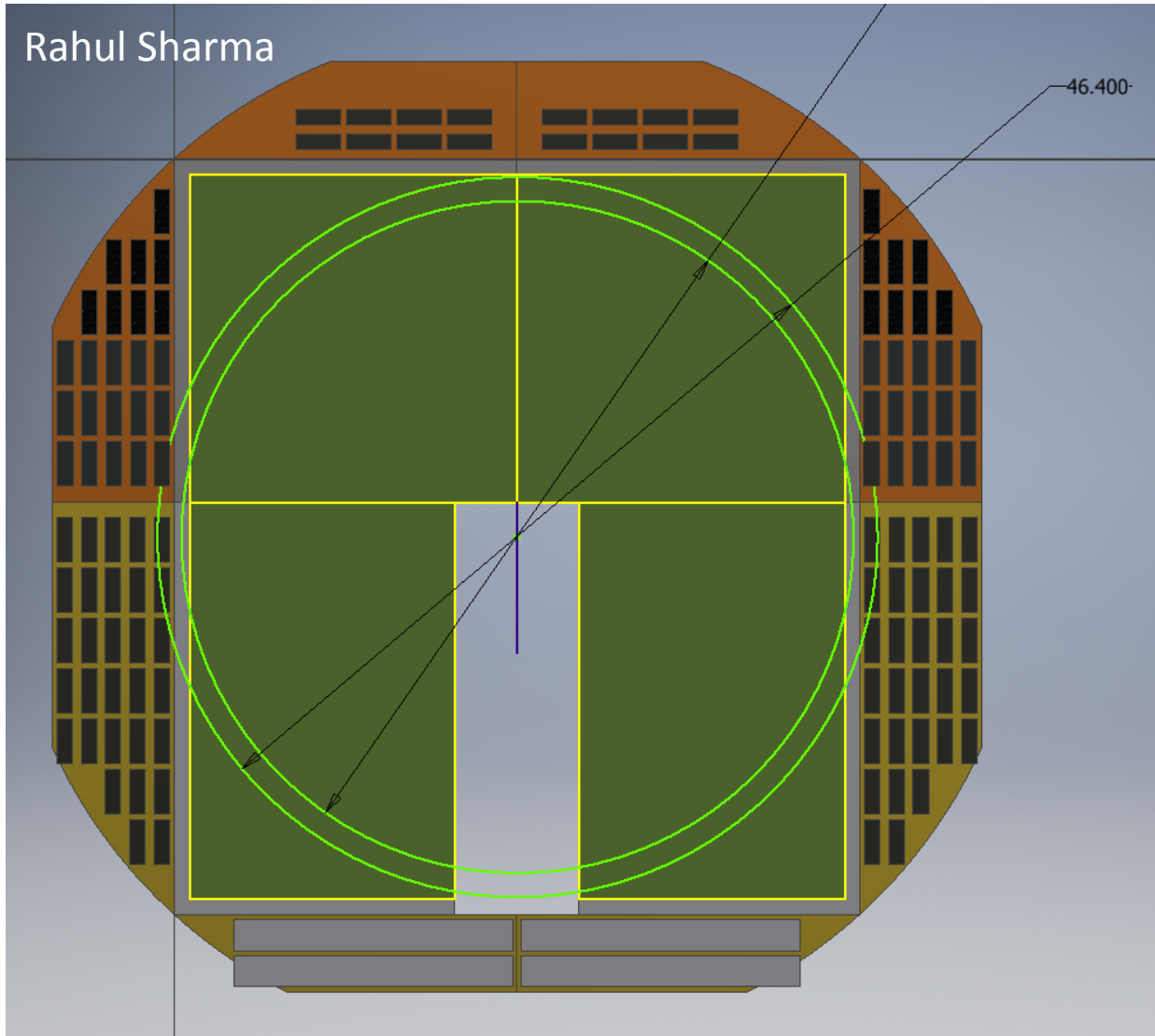
Zhenyu Chen
陈震宇

(Stony Brook University & BNL)

STAR Forward Upgrade Workshop
May 2019



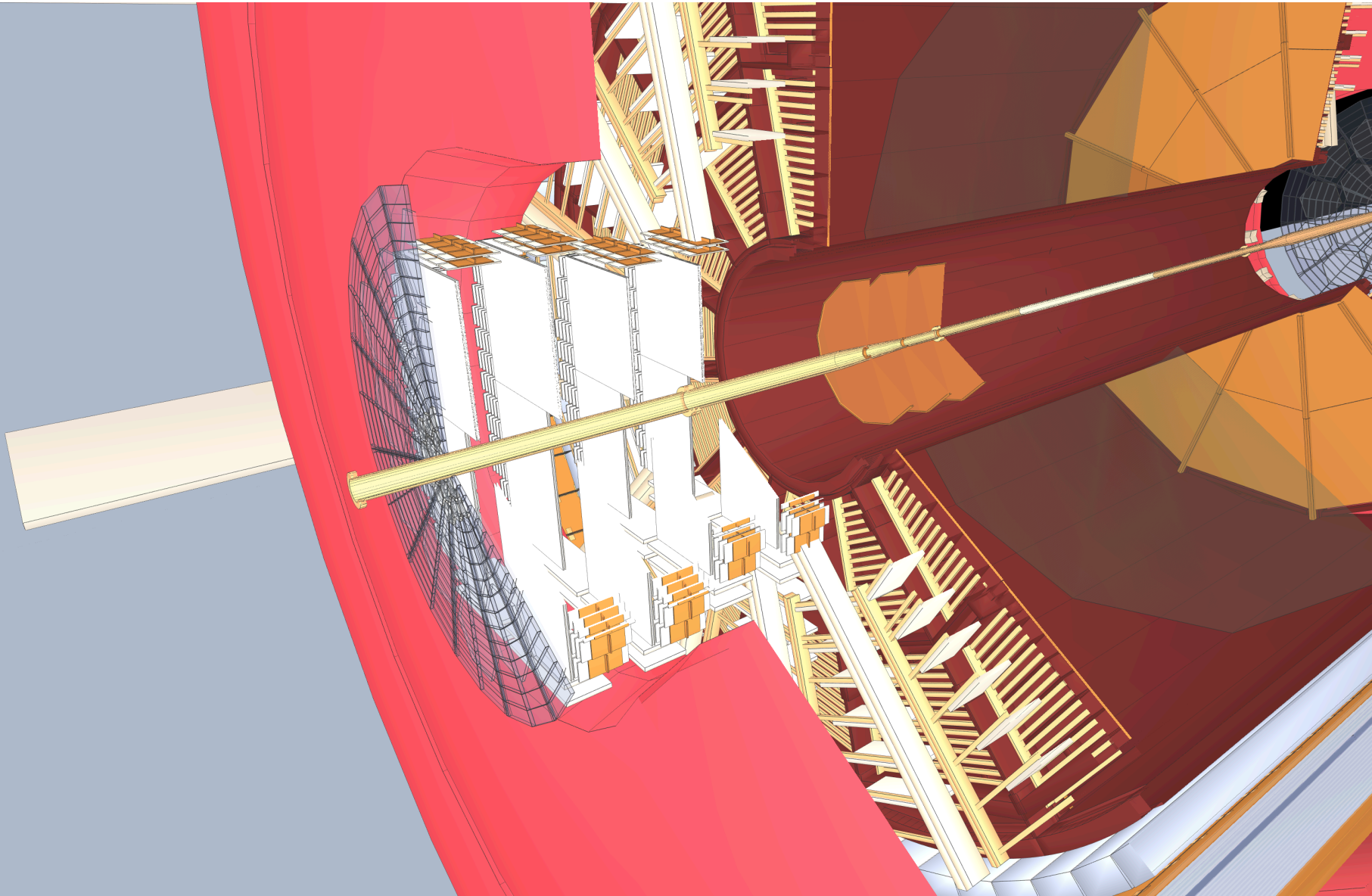
The “new” spatial constrain



sTGC disks sizes
have to shrink in
order to:

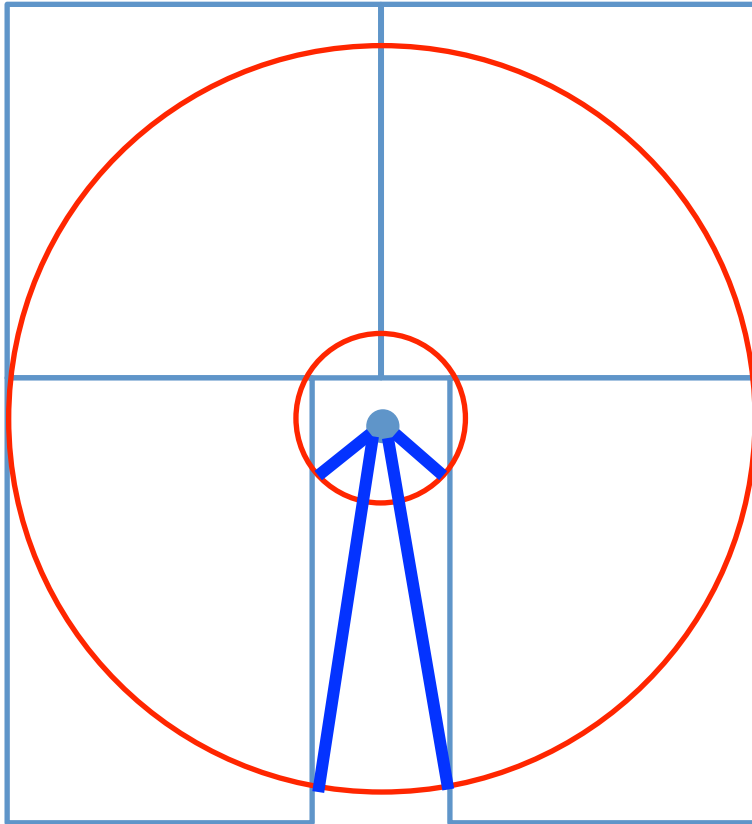
- Fit in FEE and RDO
- Leave space to lift and move pole-tip

The new geometry

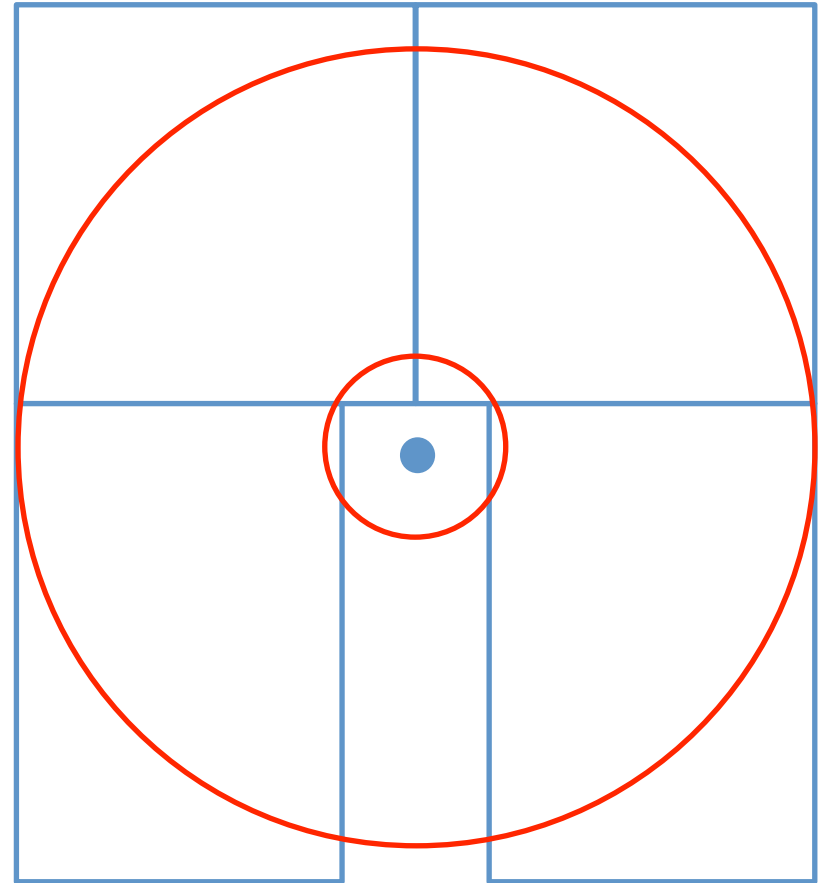


The new acceptance

Disk 1,2 ($z = 280,304\text{cm}$)



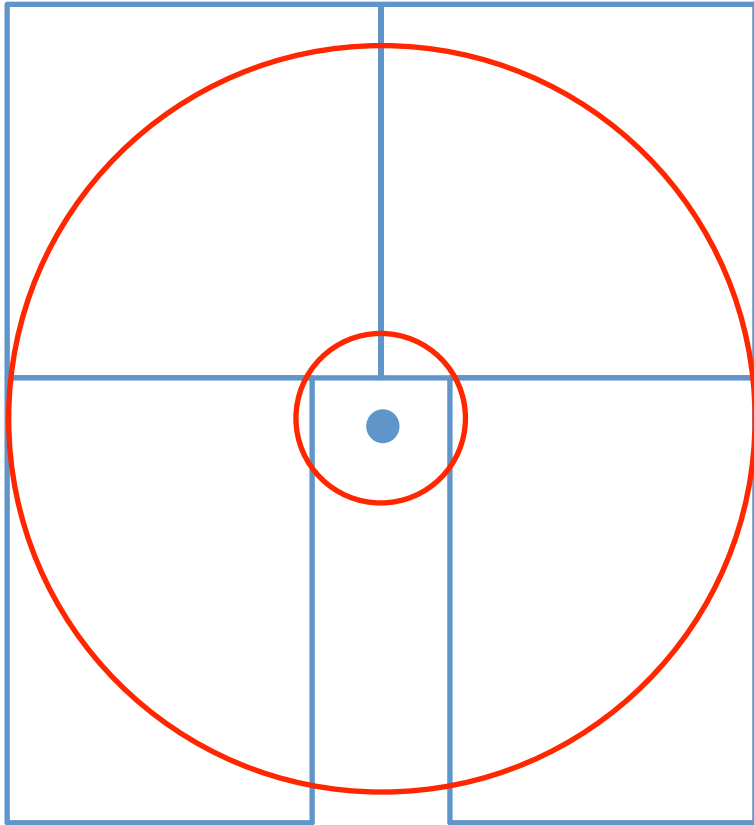
Disk 3,4 ($z = 327,349\text{cm}$)



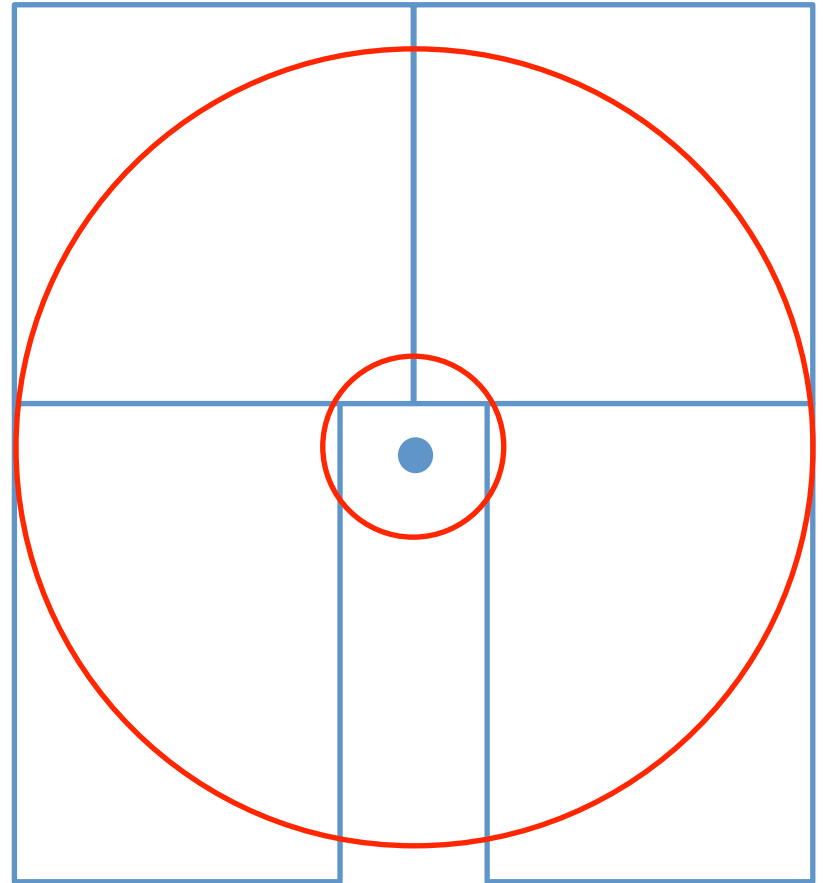
The hole results in larger acceptance loss in ϕ at larger eta

The new acceptance

Disk 1,2 ($z = 280,304\text{cm}$)



Disk 3,4 ($z = 327,349\text{cm}$)



Full azimuthal coverage (besides the hole)

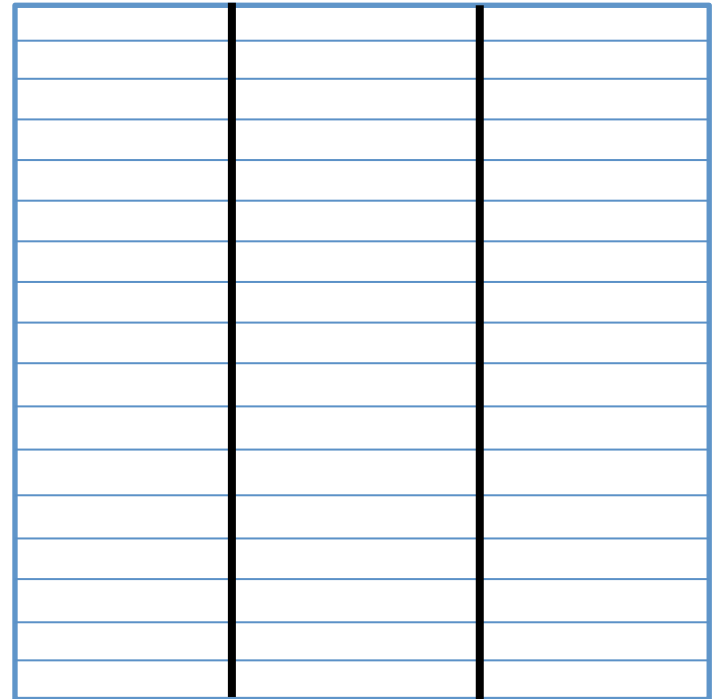
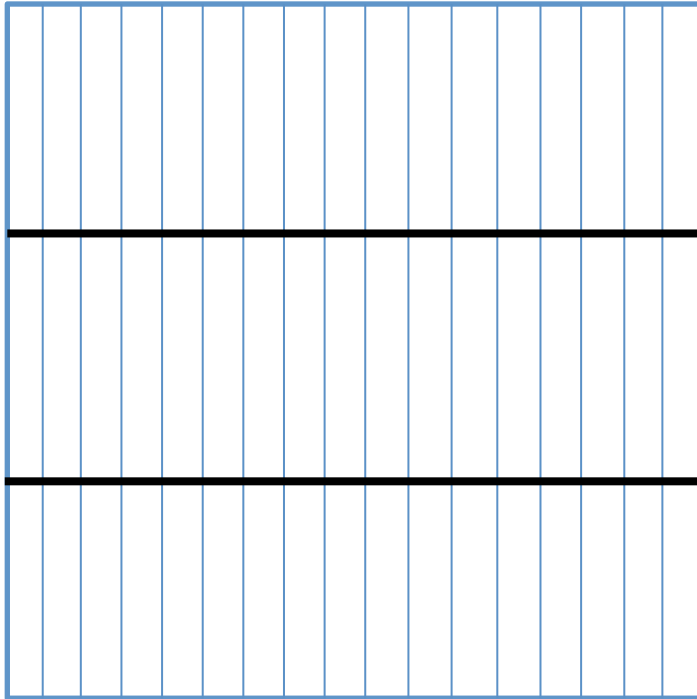
Disk 1: $2.5 < \eta < 3.9$

Disk 2: $2.6 < \eta < 4.0$

Disk 3: $2.5 < \eta < 4.0$

Disk 4: $2.6 < \eta < 4.1$

sTGC hit reconstruction

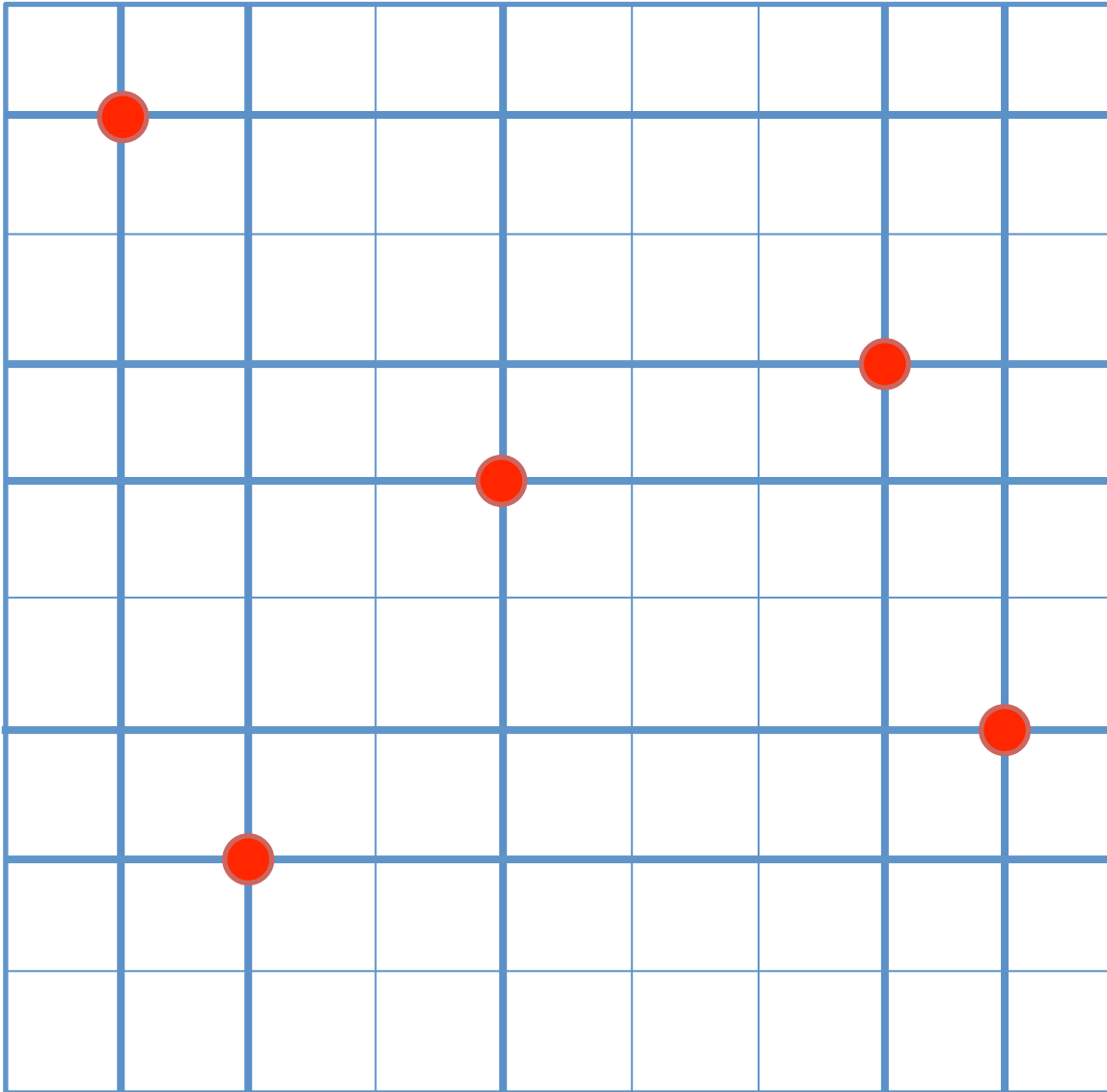


Two layers of one sTGC station provide 2D position information
The strips length is set to be 1/3 of width/height of the chamber

Strip width = 0.32 cm

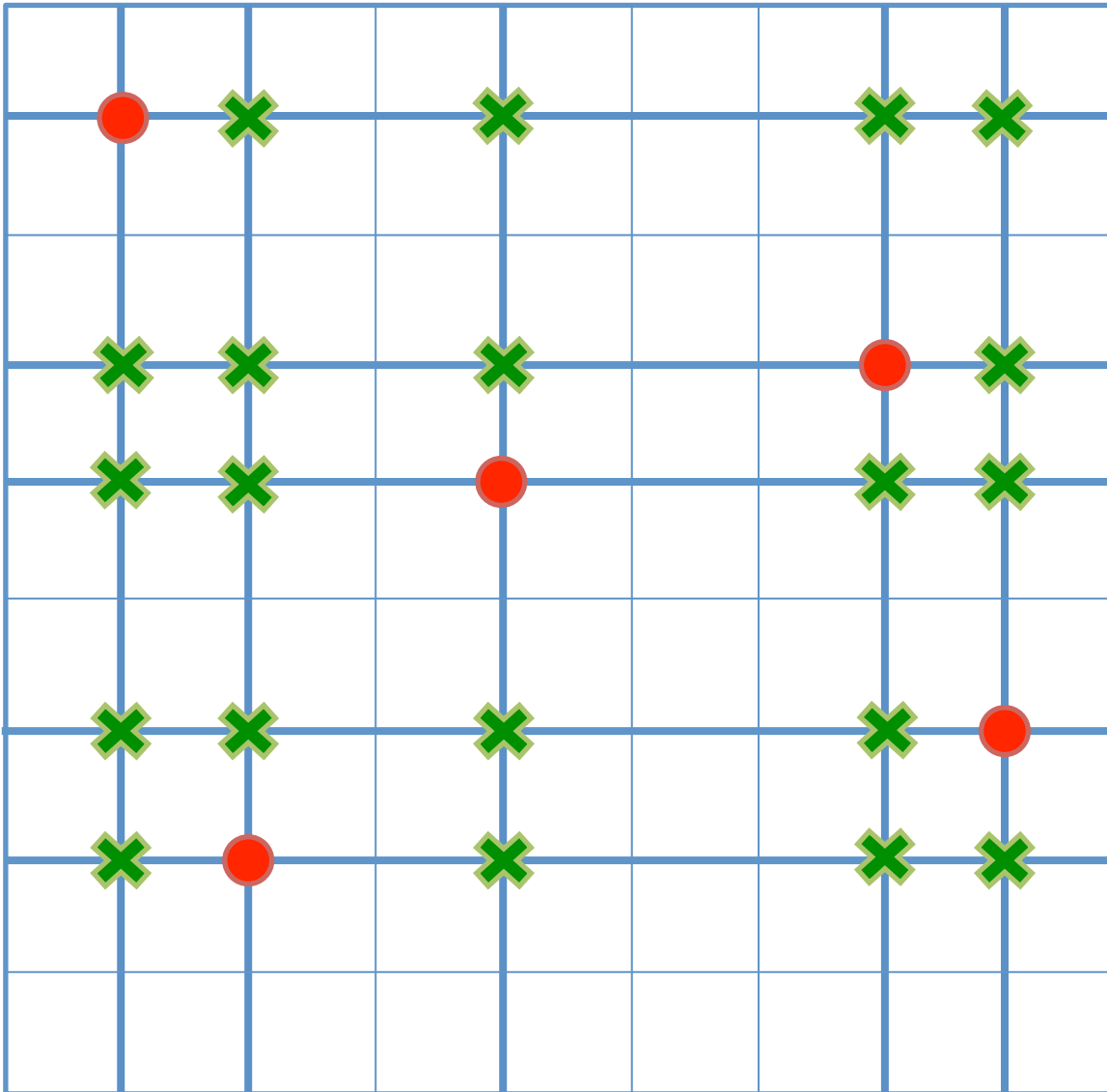
Total channel # for entire sTGC = 14,780

sTGC ghost hits



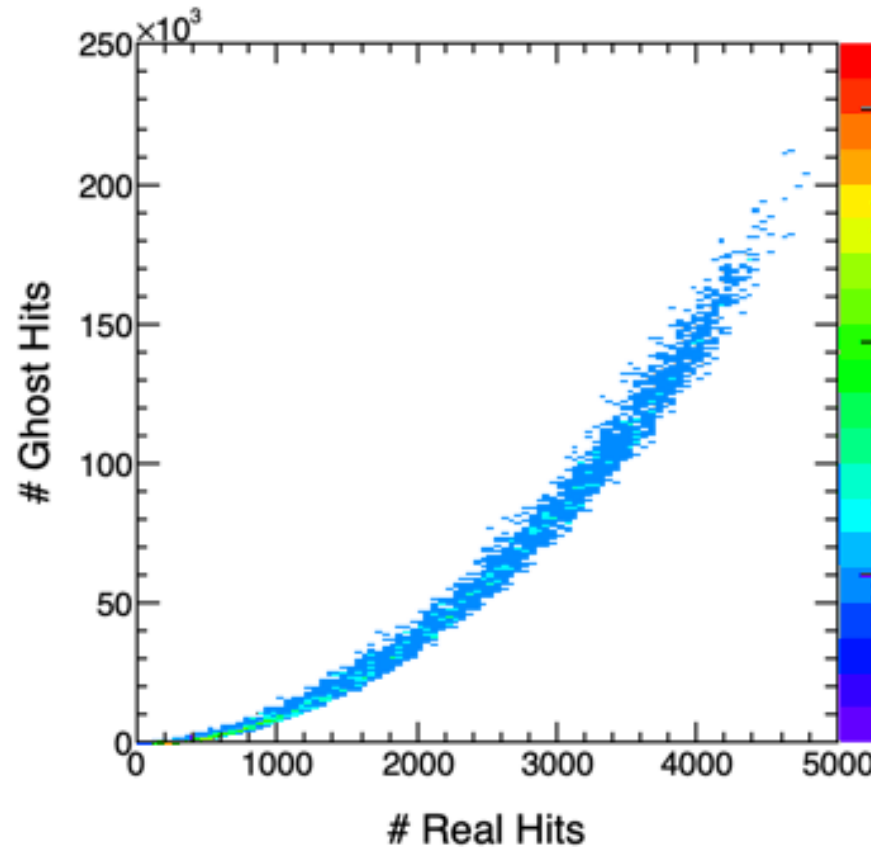
 **Real Hit**

sTGC ghost hits



-  Real Hit
-  Ghost Hit

sTGC ghost hits

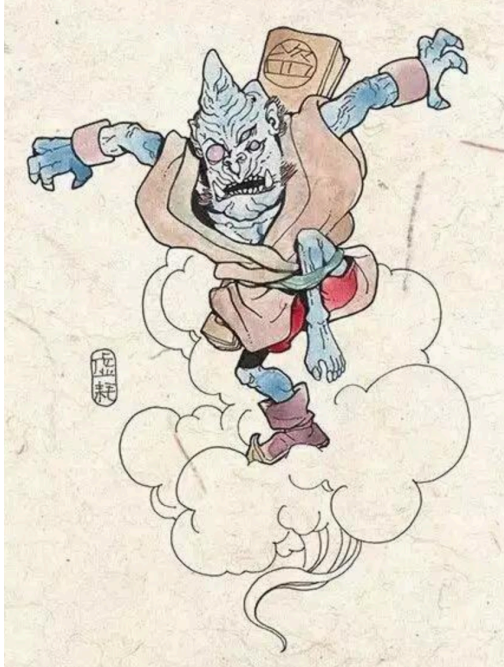


Ghost hits increase as N^2 !

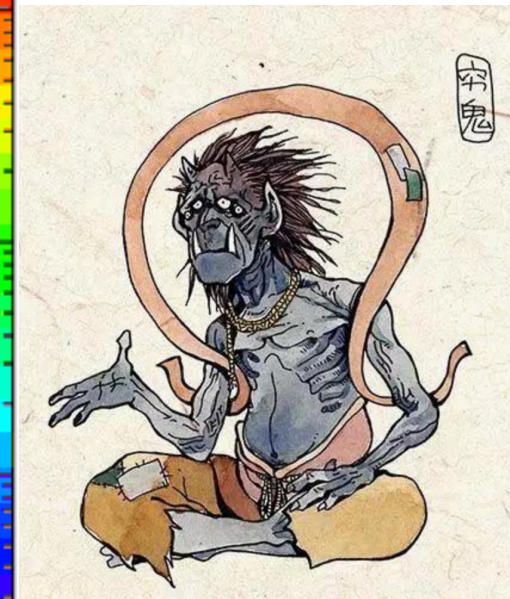
Large impact on track reconstruction at high occupancy

sTGC ghost hits

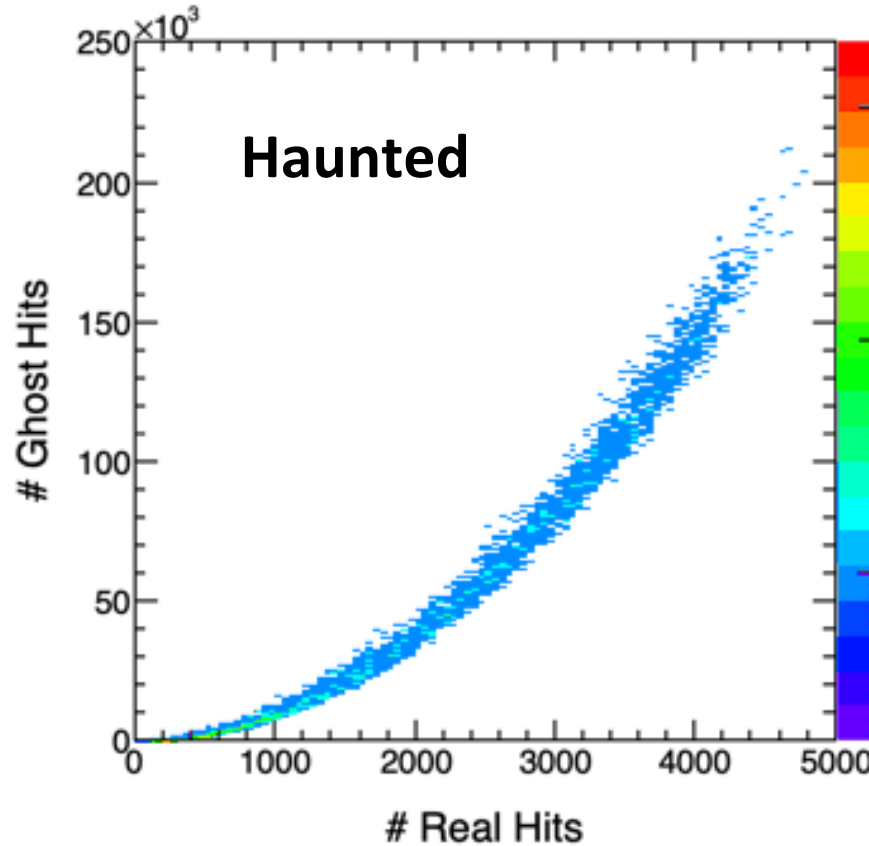
Ghost of losing



Ghost of poverty



By Xin He

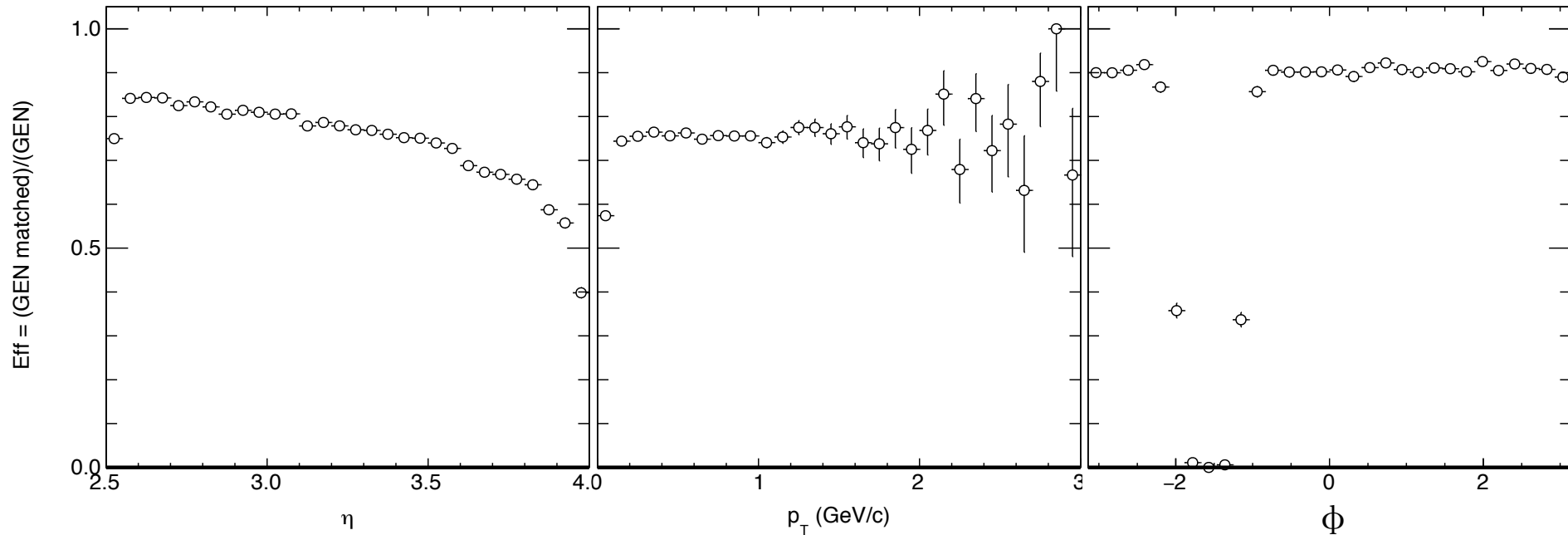


Ghost hits increase as N^2 !

Large impact on track reconstruction at high occupancy

Tracking performance – PP

$$\langle \text{mult}_{\text{GEN}}^{\text{forward}} \rangle \approx 5$$

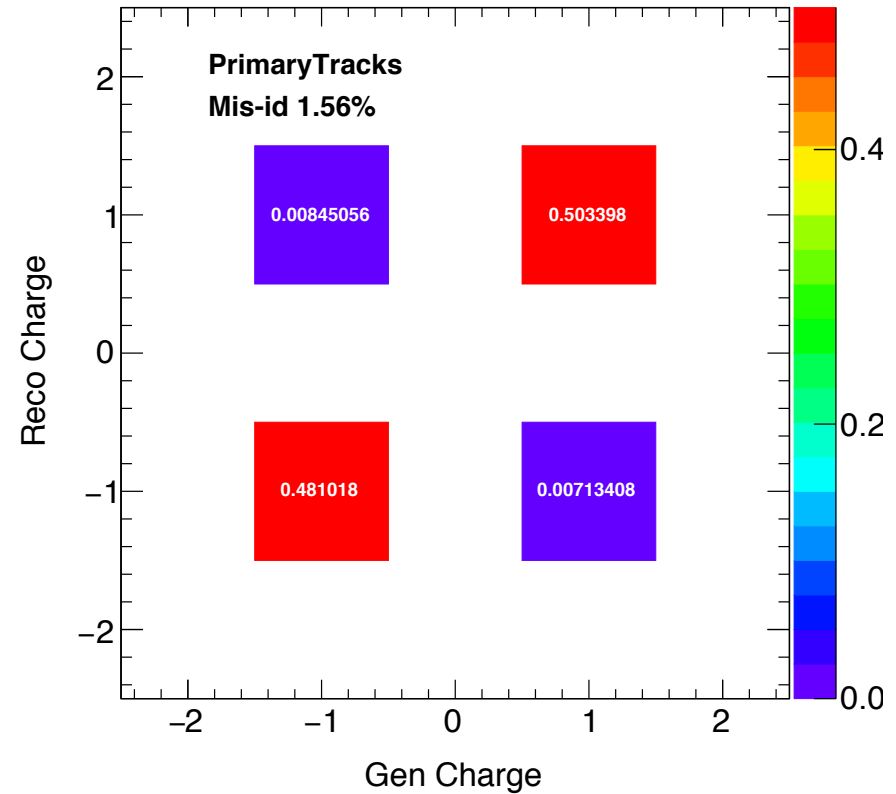
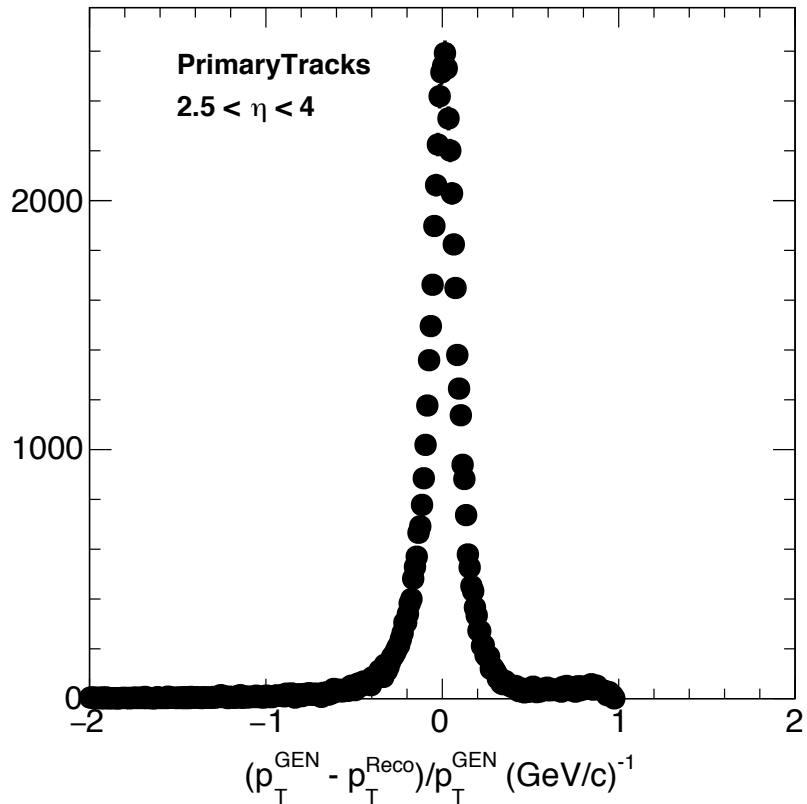


80% efficiency flat over p_T & drops at high eta
The hole introduce a sharp efficiency valley in phi

Note: A modified TPC tracker is used here. A new tracker is under development, please see Daniel's talk

Tracking performance – PP

$$\langle \text{mult}_{\text{GEN}}^{\text{forward}} \rangle \approx 5$$

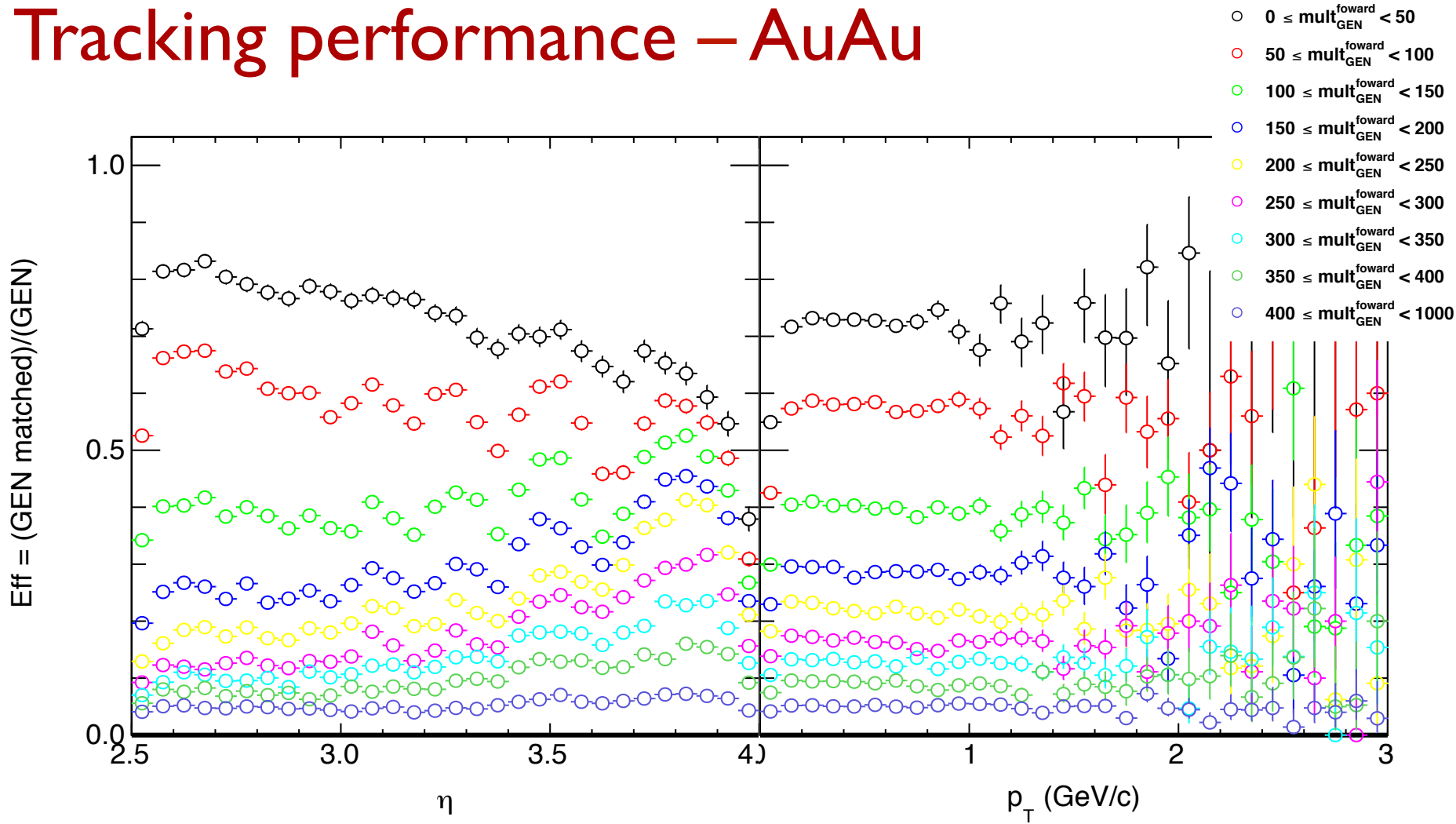


Good pT resolution and charge identification

Meet the requirement for Cold QCD program

Still large room to improve tracker, see Daniel's talk

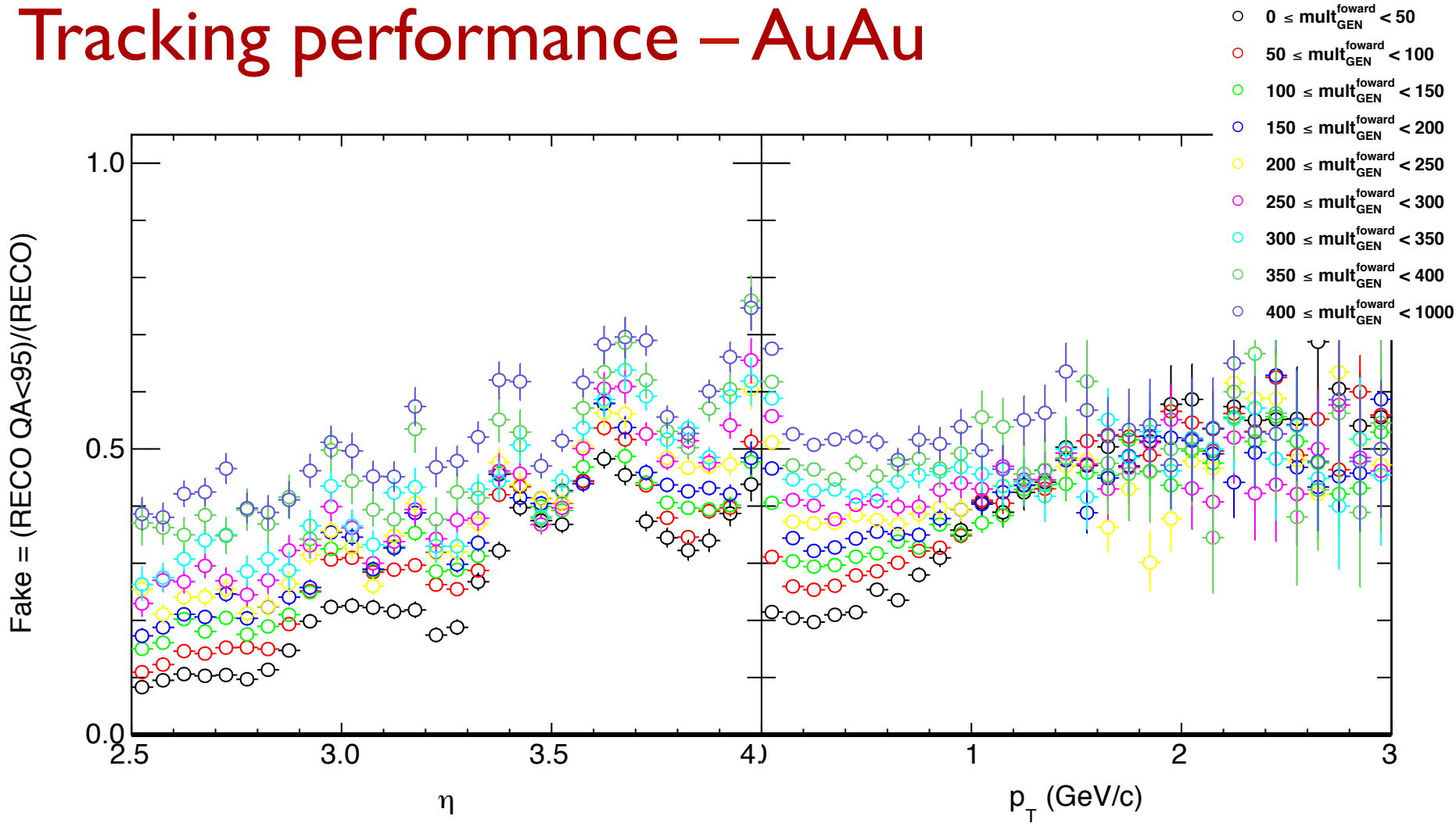
Tracking performance – AuAu



Efficiency drops at high multiplicity & high eta

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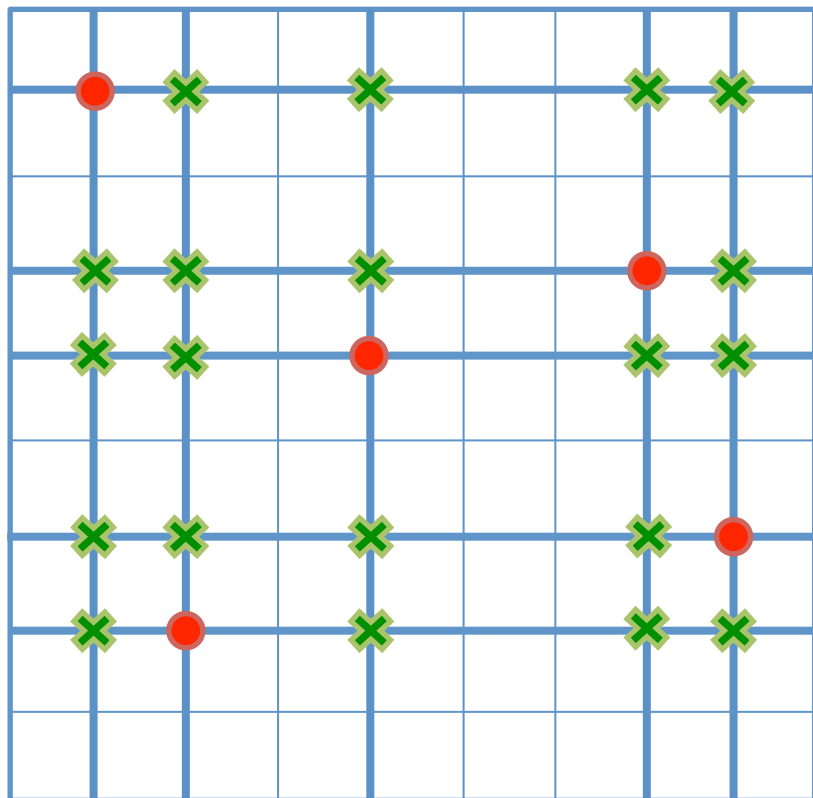
Tracking performance – AuAu



Fake rate increase at high multiplicity & high eta/pt

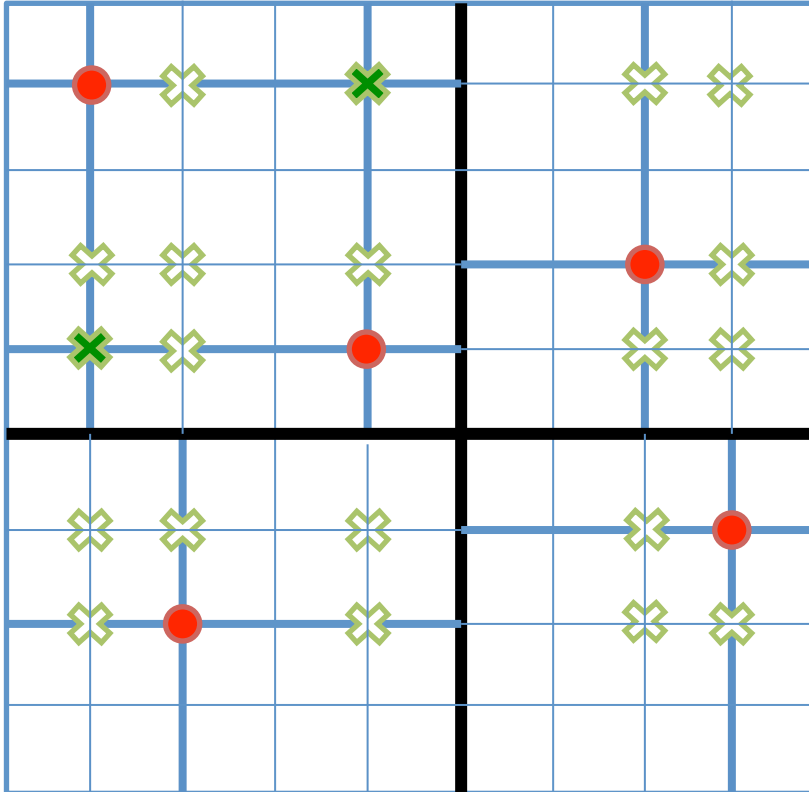
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sTGC ghost hits rejection



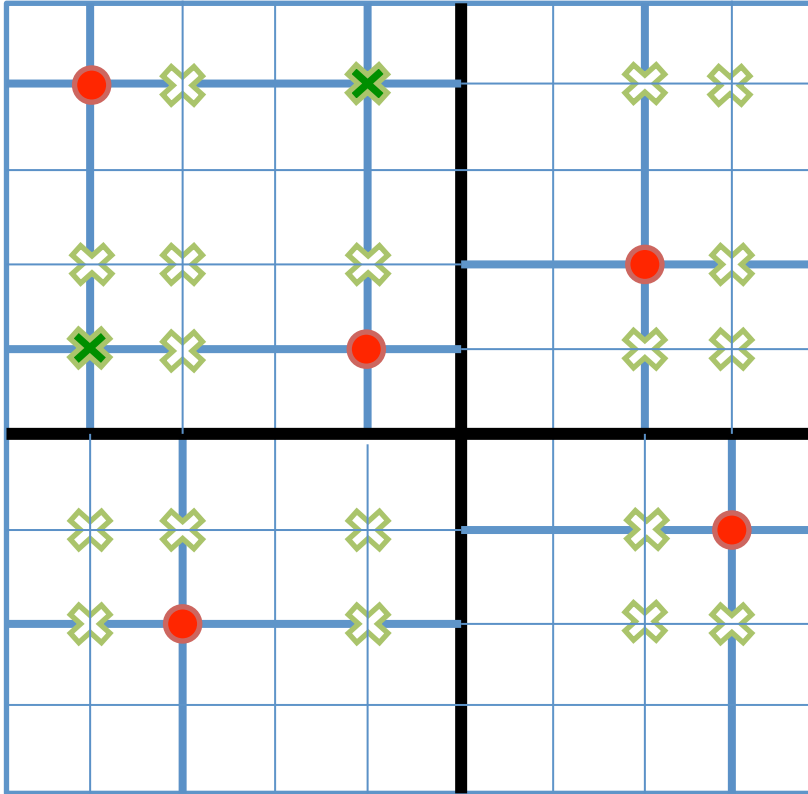
sTGC ghost hits rejection

Split strip

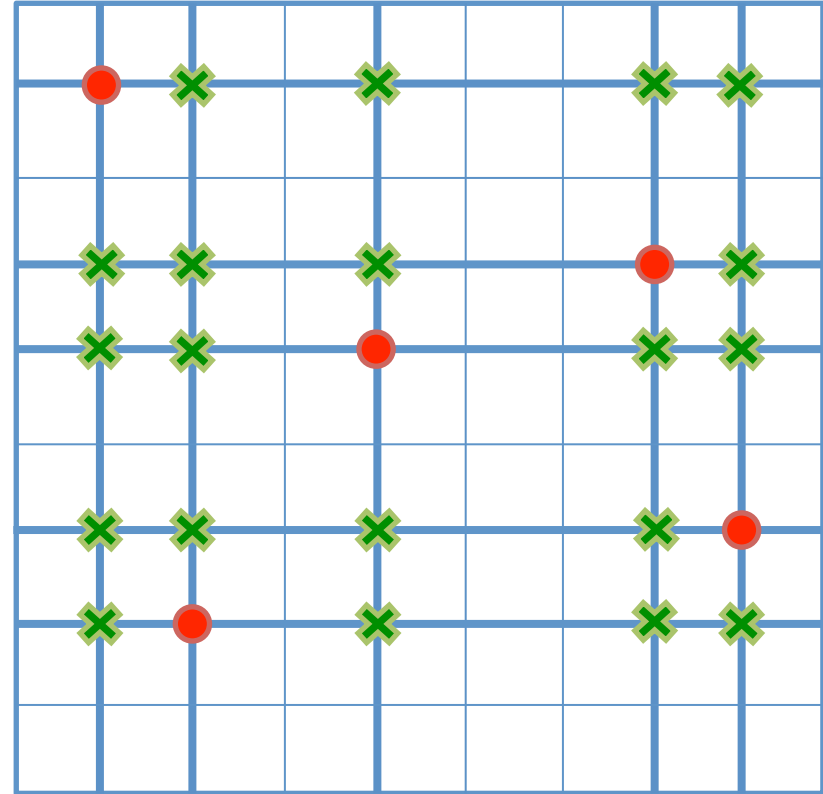


sTGC ghost hits rejection

Split strip

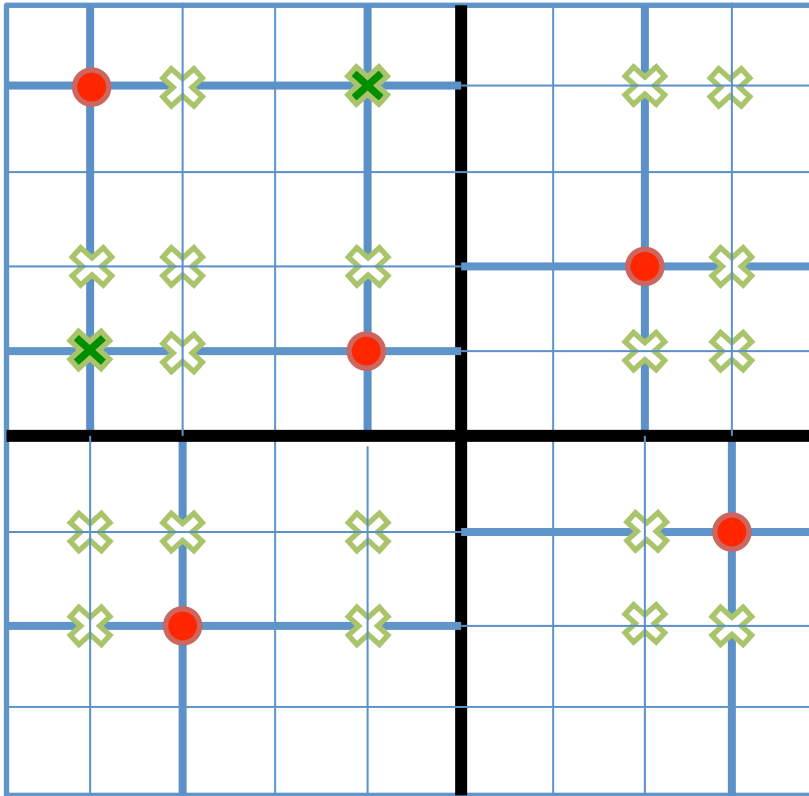


Diagonal strip

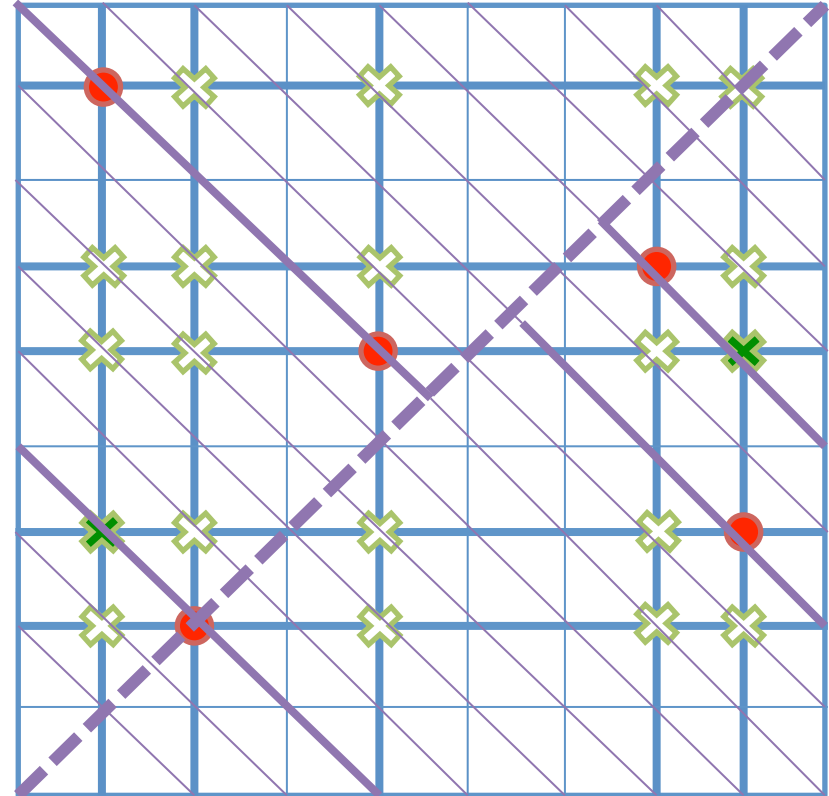


sTGC ghost hits rejection

Split strip

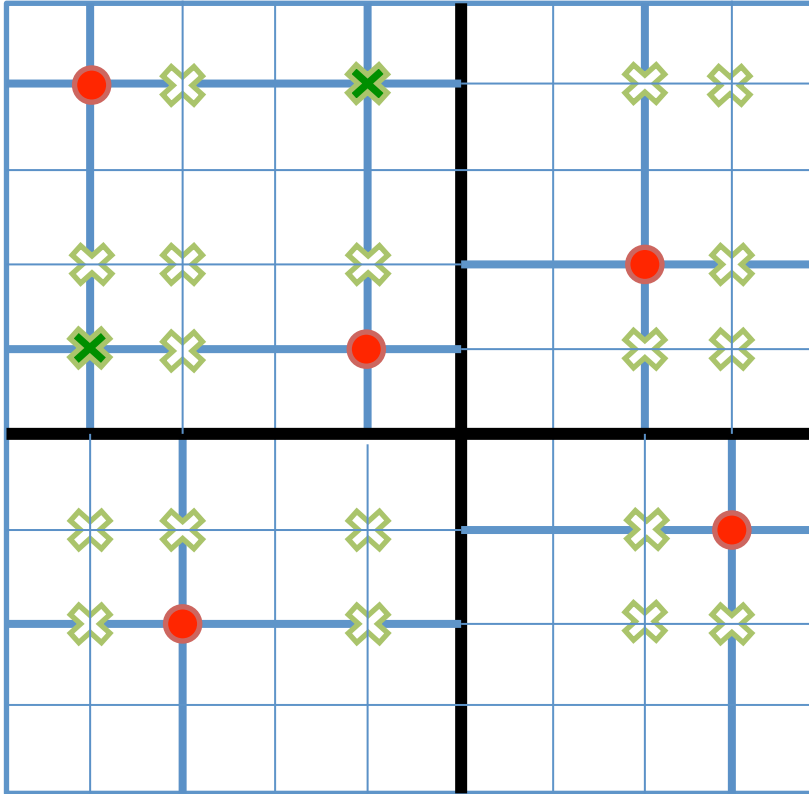


Diagonal strip



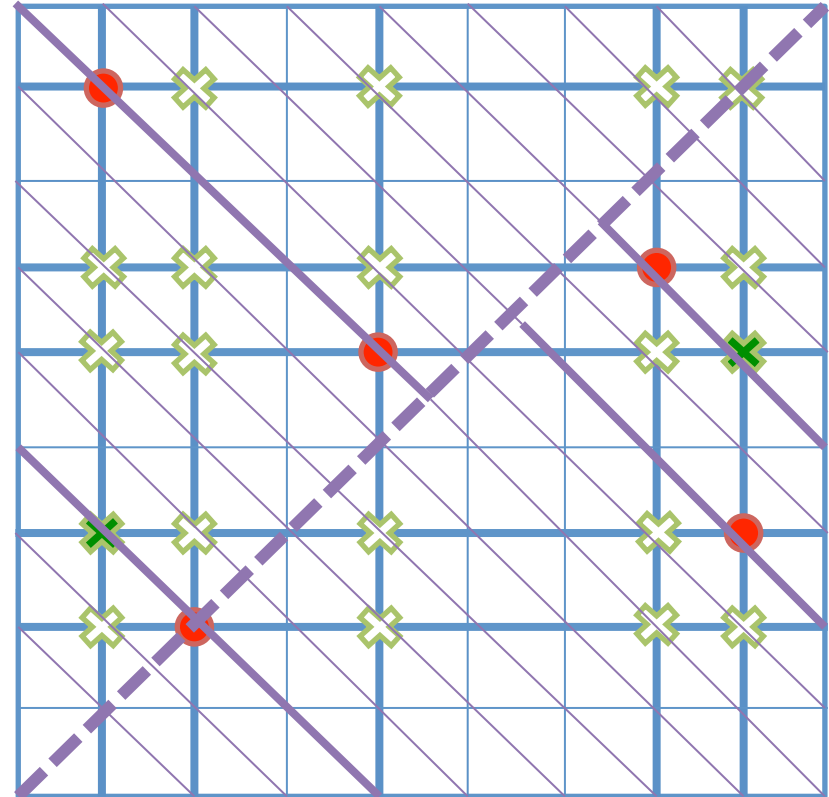
sTGC ghost hits rejection

Split strip



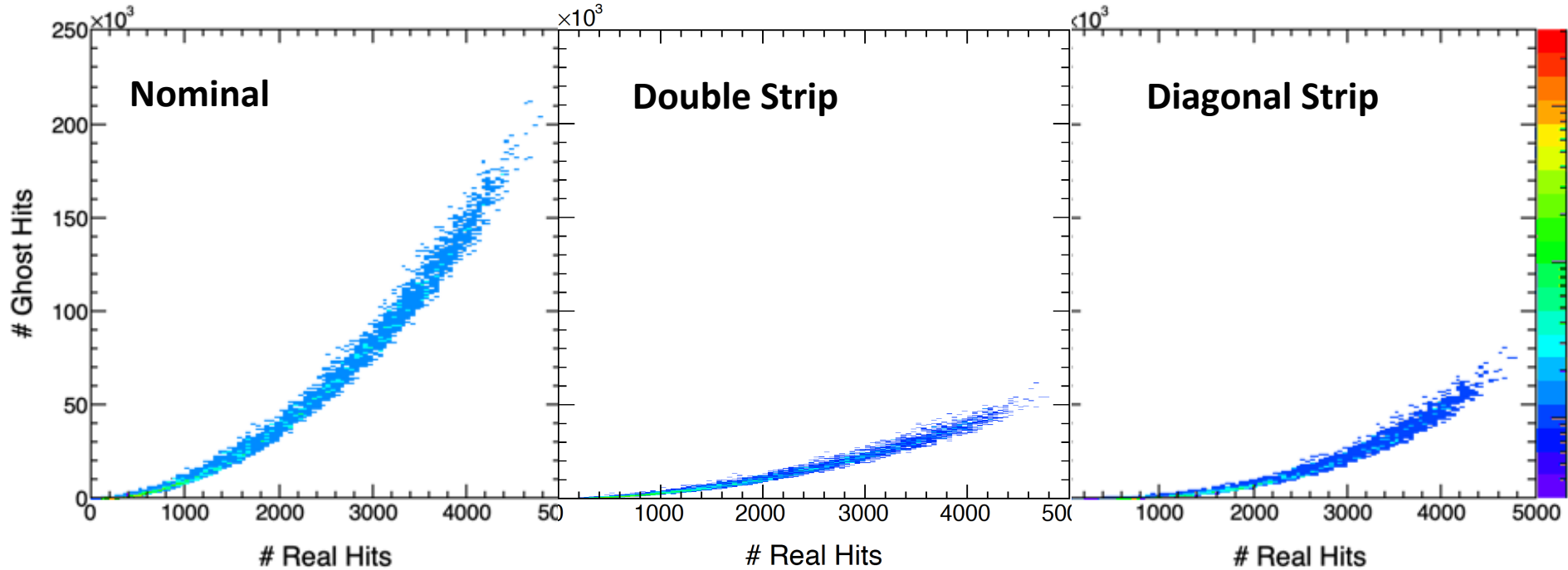
Divide strips into 2
Add **14,780** channels

Diagonal strip



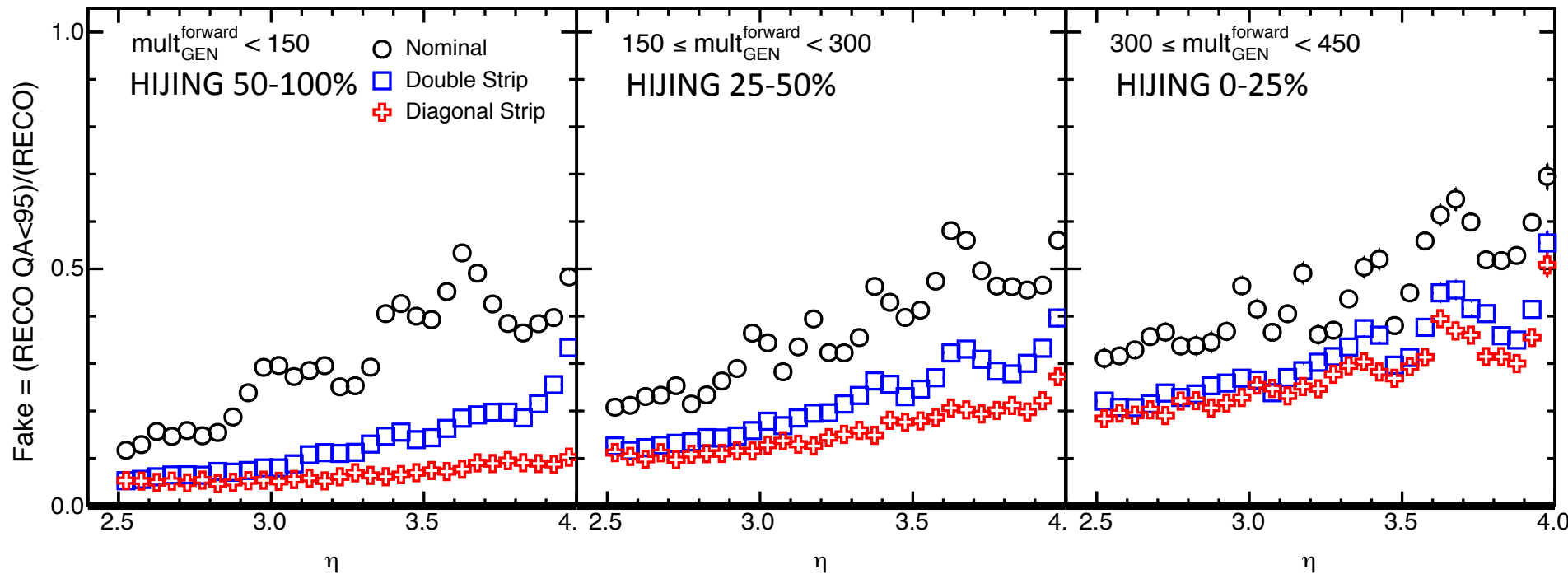
Add diagonal strips with 3.2mm width
Add **13,984** channels

sTGC ghost hits rejection



Significant reduction of ghost hits

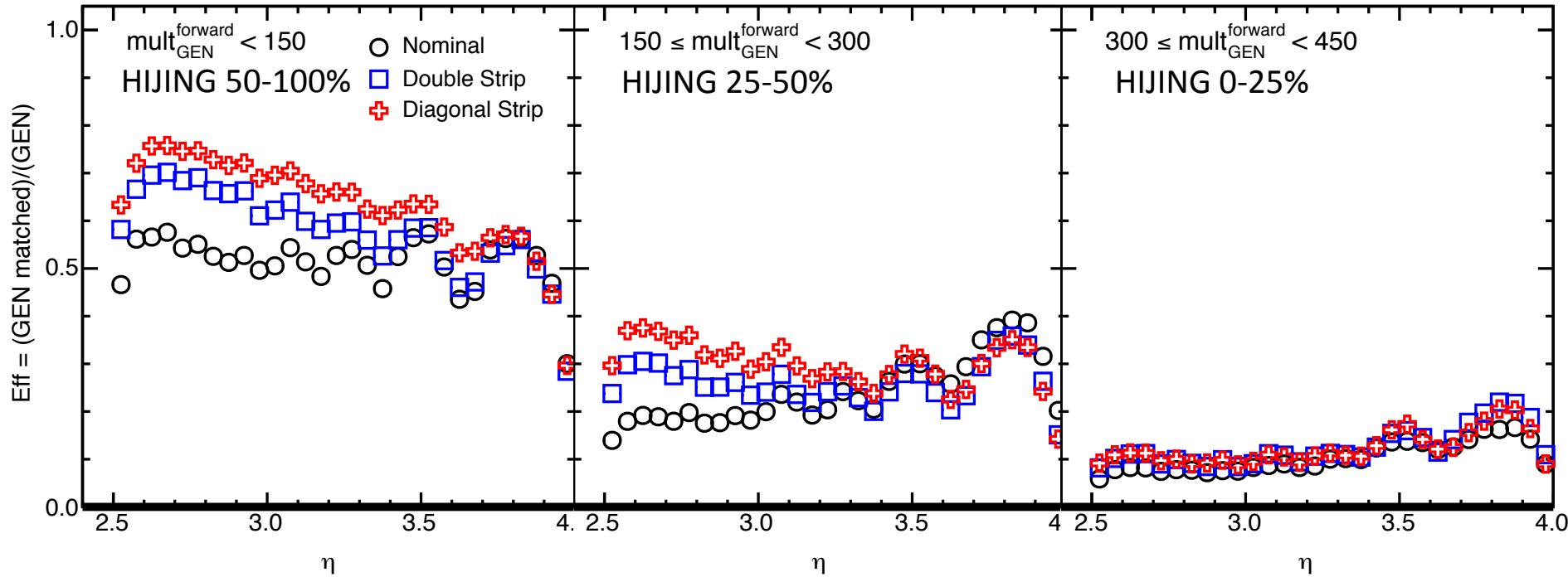
sTGC ghost hits rejection



Significant improvement of fake rate
Diagonal strips are more efficient

Note: A modified TPC tracker is used here. A new tracker is under development, please see Daniel's talk

sTGC ghost hits rejection



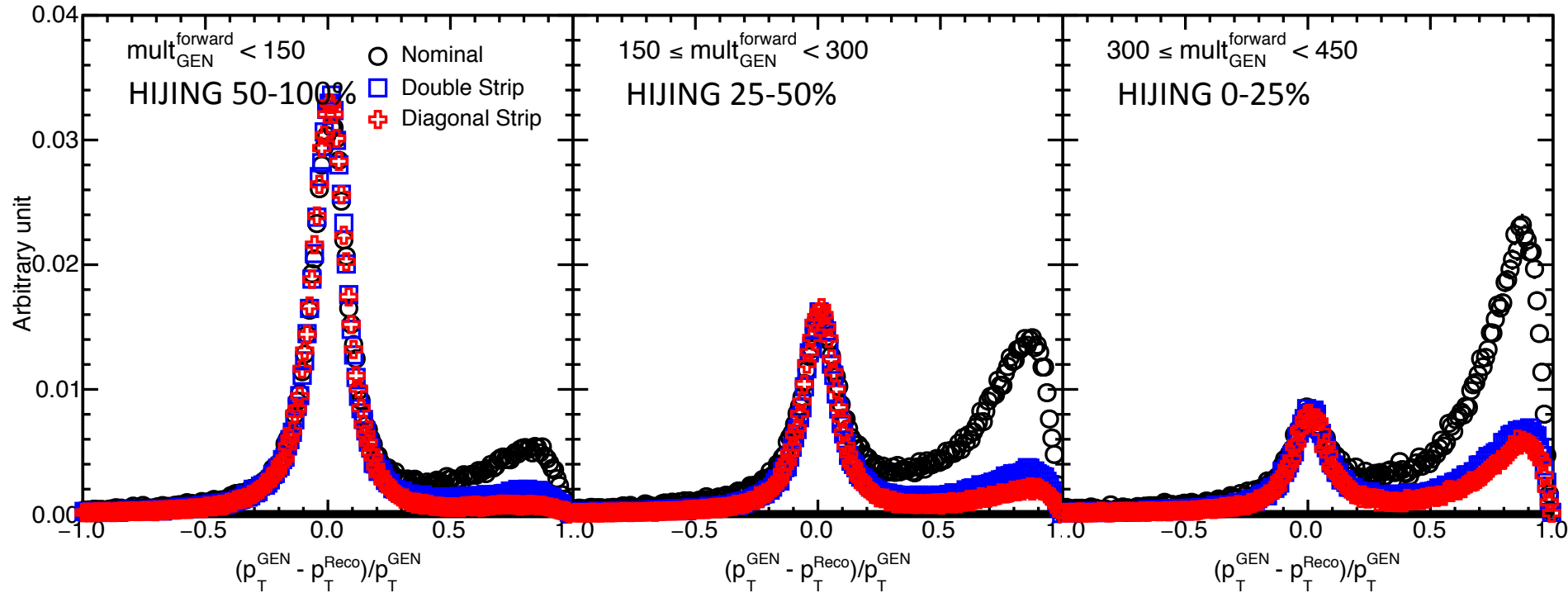
Significant improvement of efficiency for low-mid multiplicity

Diagonal strips are more efficient

No improvement for high multiplicity indicating issue in tracker?

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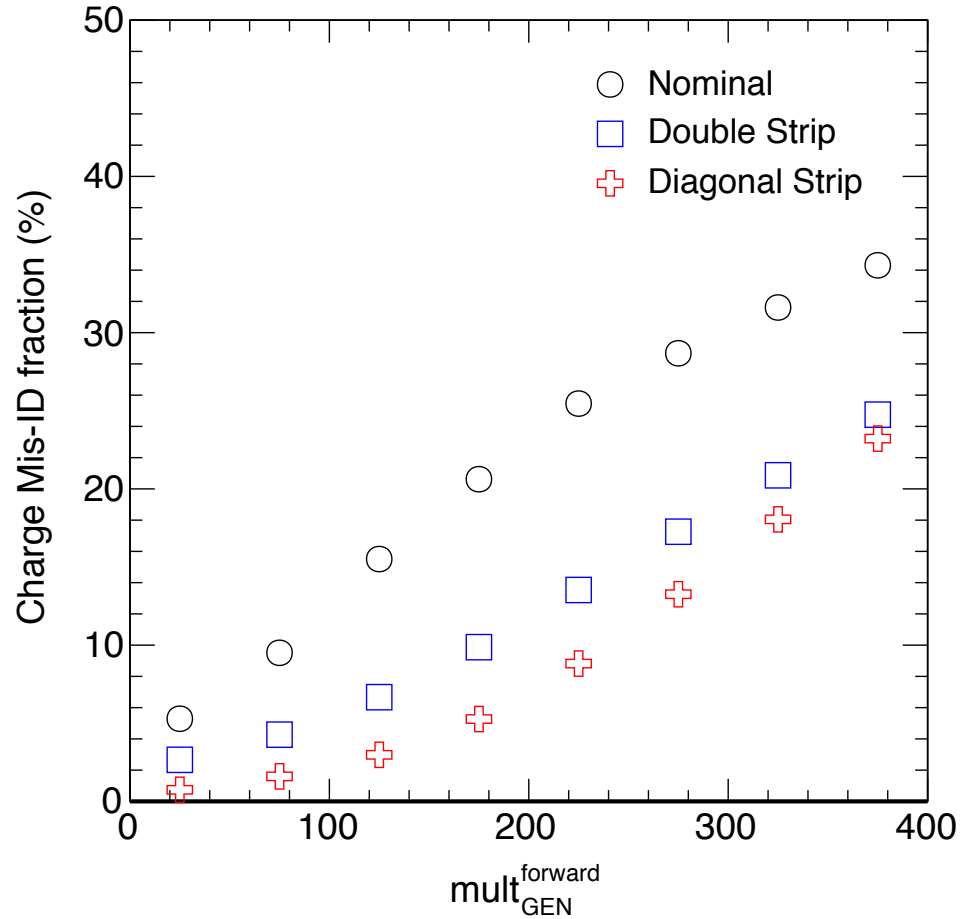
sTGC ghost hits rejection



No big improvement for pT resolution
Significant improvement for wrong-pT tracks

Note: A modified TPC tracker is used here. A new tracker is under development, please see Daniel's talk

sTGC ghost hits rejection



Significant improvement for charge mis-ID

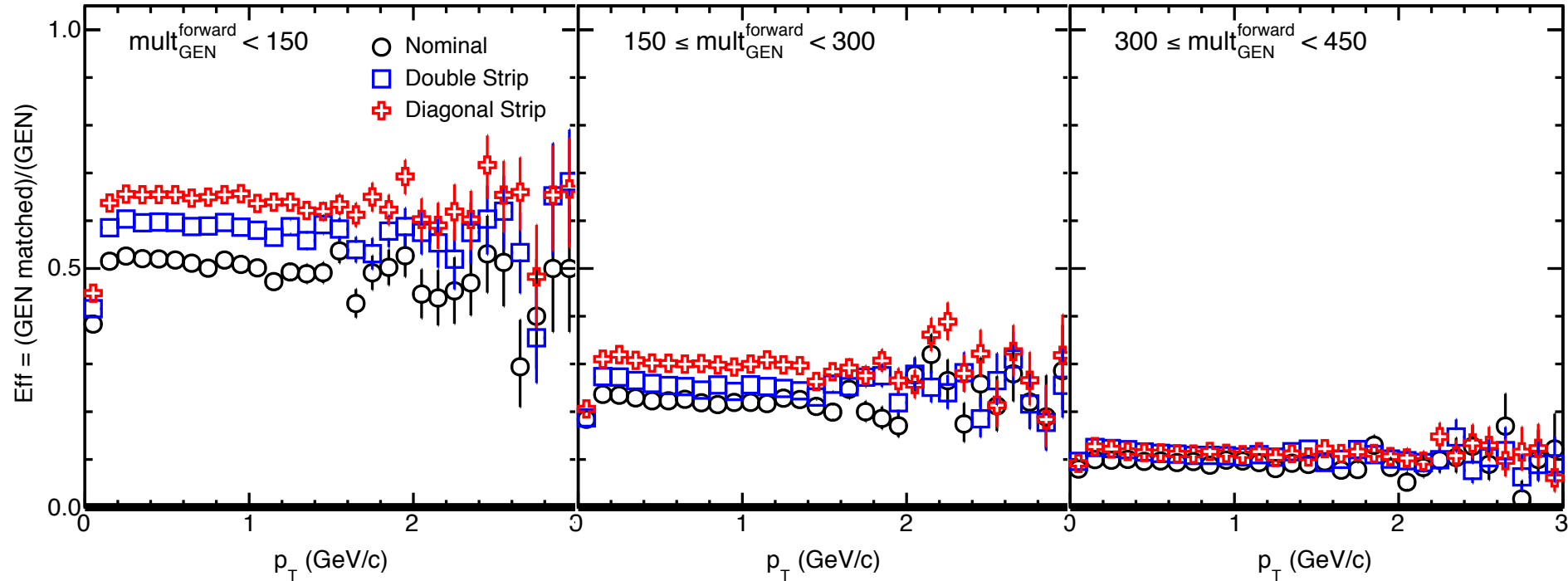
Note: A modified TPC tracker is used here. A new tracker is under development, please see Daniel's talk

Summary

- New geometry has been implemented for sTGC simulation
- Performance in PP meet Cold QCD program requirement
- Performance in AuAu plagued by ghost hits
 - Ghost rejection design can significantly improve the situation
 - Adding diagonal strips are more efficiency
- Indication of room for improvement in tracker
 - Please see Daniel's talk

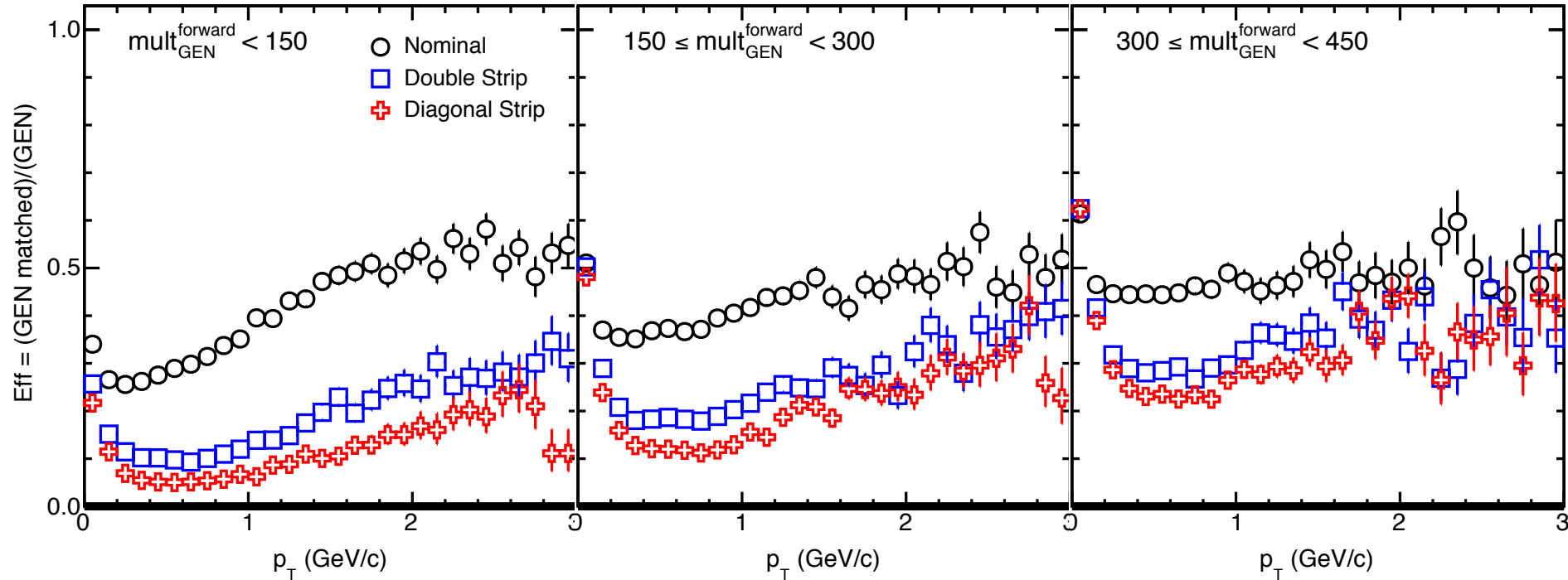
Back up

sTGC ghost hits rejection



Note: A modified TPC tracker is used here. A new tracker is under development, please see Daniel's talk

sTGC ghost hits rejection



Note: A modified TPC tracker is used here. A new tracker is under development, please see Daniel's talk