BiBi 9.2 GeV UrQMD Request 25

Flow QA

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NRNU MEPhI

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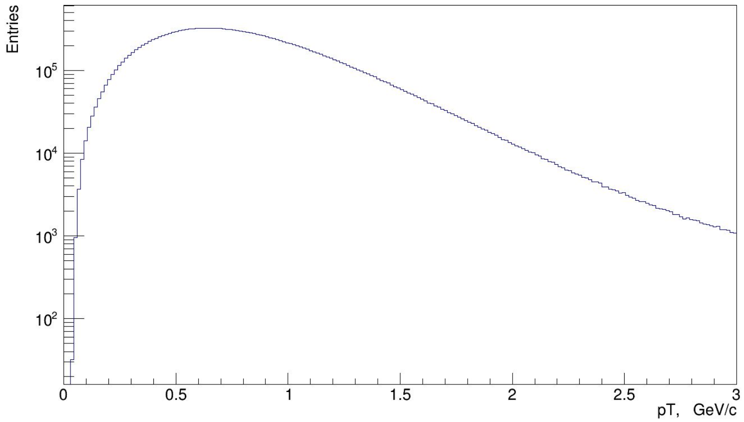
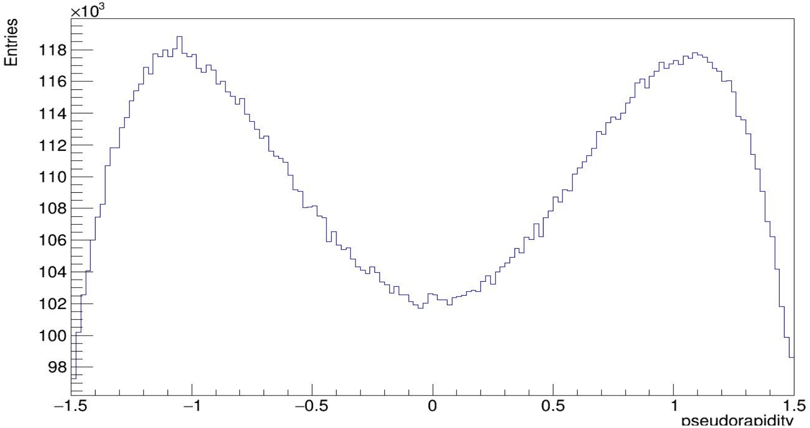
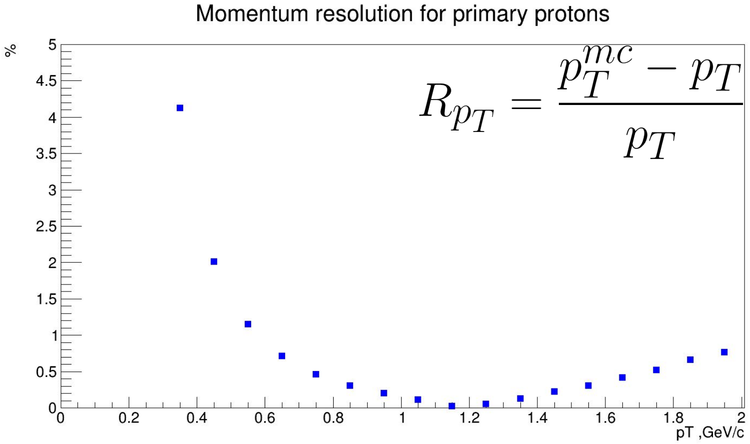
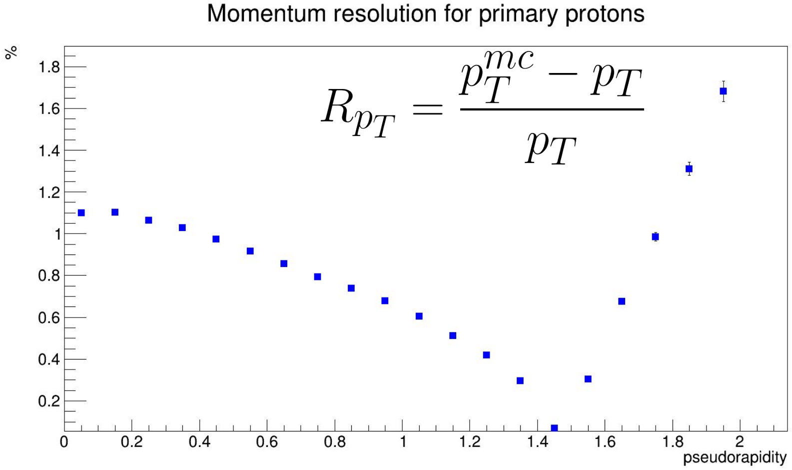
Tpc Track Quality; Primary protons

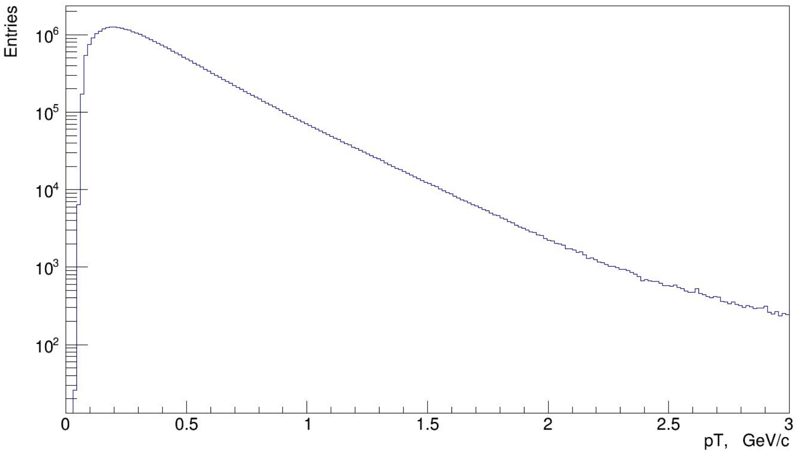


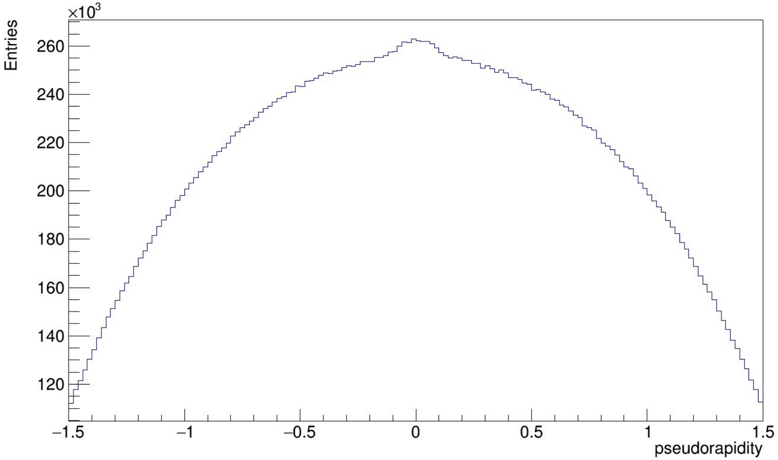




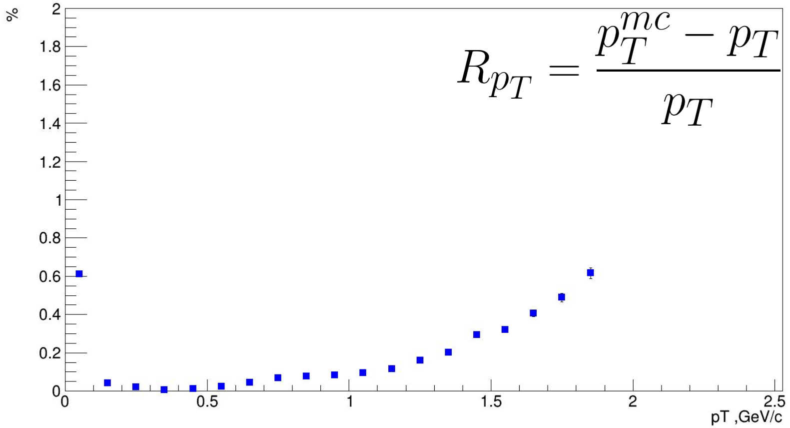


Tpc Track Quality; Primary pions

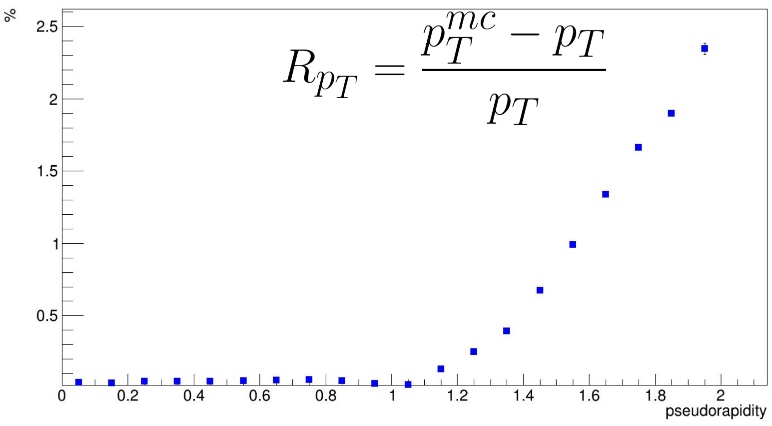




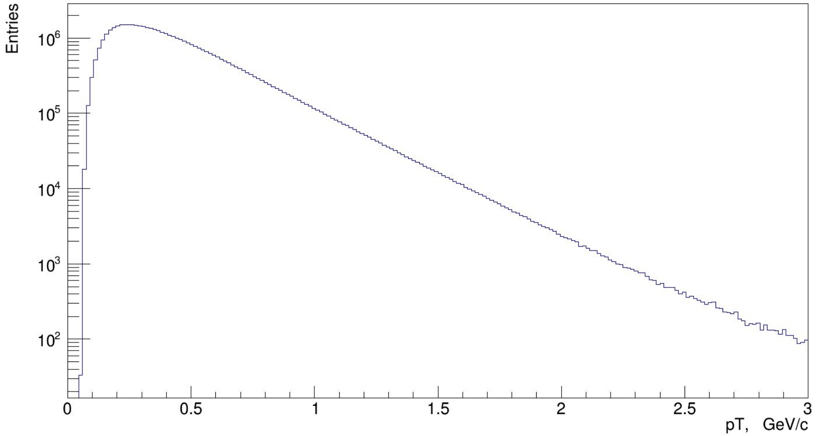
Momentum resolution for primary pions

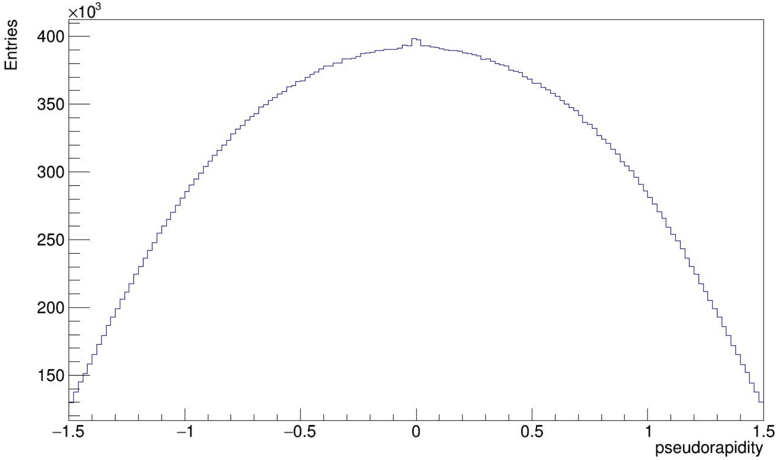


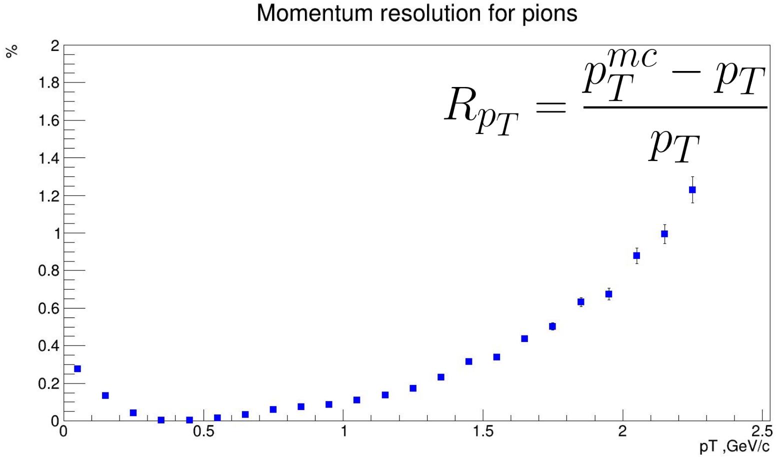
Momentum resolution for primary pions

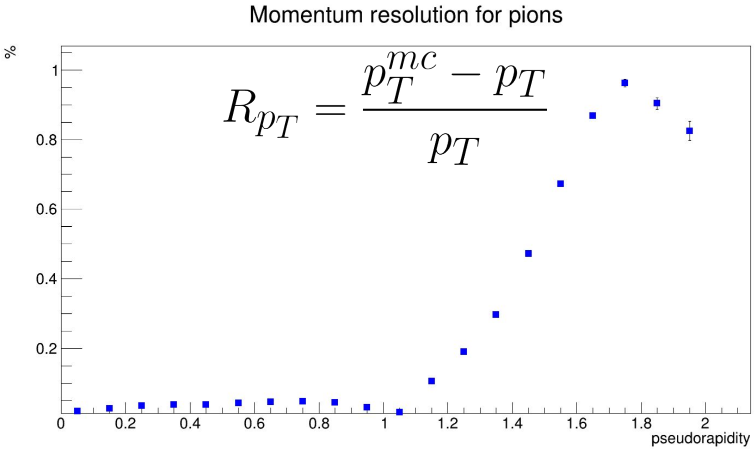


Tpc Track Quality; pions |DCA|<1cm









Anisotropic transverse flow

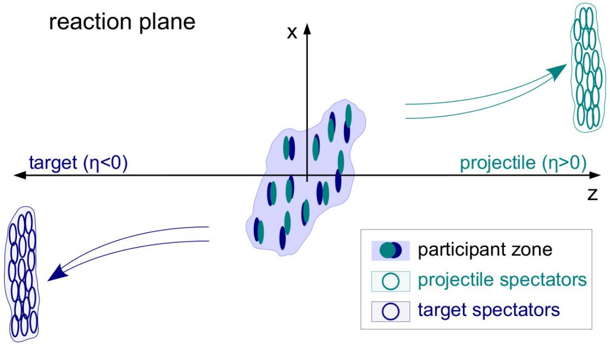
Spatial asymmetry of energy distribution at the initial state is transformed, through the strong interaction, into momentum anisotropy of the produced particles.

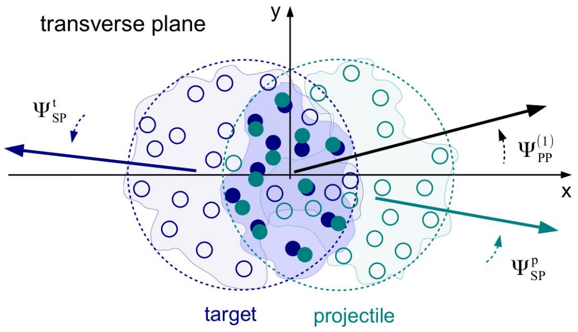
$$E\frac{d^3N}{d^3p} = \frac{1}{2\pi}\frac{d^2N}{p_T dp_T dy}\left(1+\sum_{n=1}^{\infty} 2v_n \cos(n(\phi-\Psi_{RP}))\right)$$

$$\Downarrow$$

$$v_n = \langle \cos(n(\phi - \Psi_{RP}))\rangle$$

In the experiment reaction plane angle Ψ_{RP} can be approximated by participant Ψ_{PP} or spectator Ψ_{SP} symmetry planes.





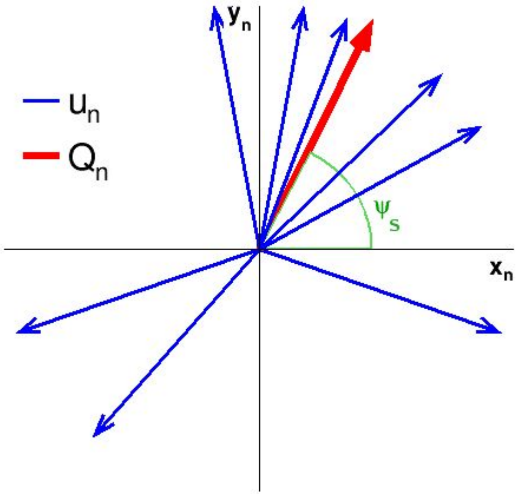
Scalar product method for v_n measurement

u and **Q**-vectors:

$$\mathbf{u_n} = \{u_{n,x}, u_{n,y}\} = \{\cos n\phi, \sin n\phi\}$$

$$\mathbf{Q_n} = \{Q_{n,x}, Q_{n,y}\} = \left\{\sum_k w^k u^k_{n,x}, \sum_k w^k u^k_{n,y}\right\}$$

Here w^k is energy in k-th module of FHCal.



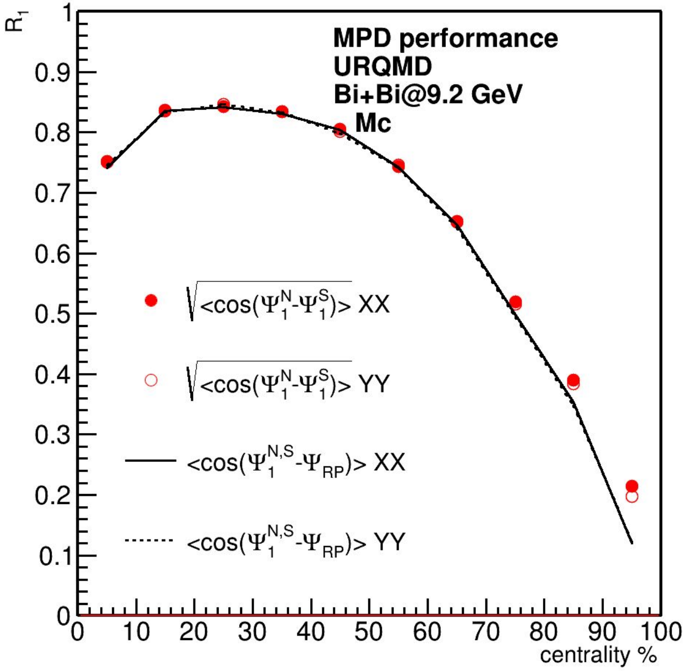
Scalar product method gives independent estimates for flow valu
Q-vector components and symmetry plane sources.

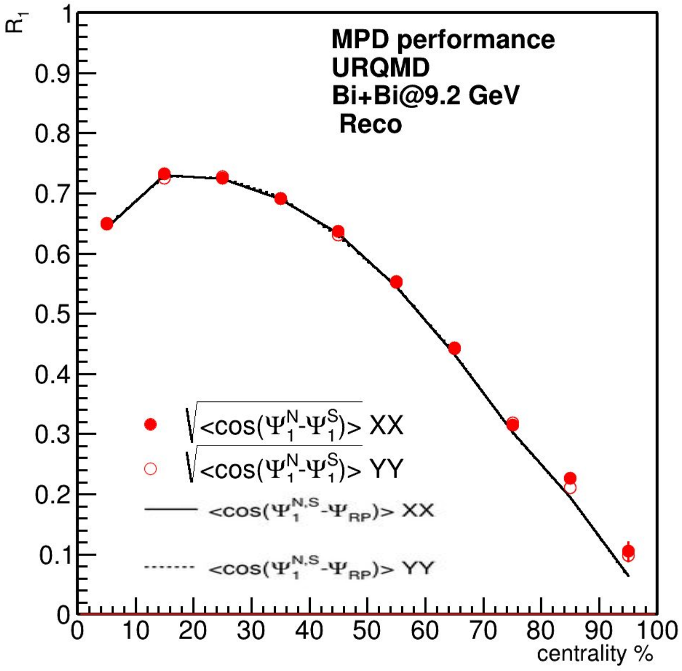
v_1 with respect to symmetry plane Ψ_S is calculated using group of particles (modules) "*a*":

$$v^a_{1,i}(p_T, y) = \frac{2\langle u_{1,i}(p_T, y) Q^a_{1,i}\rangle}{R^a_{1,i}}, i = x, y \quad v^a_{2,i}(p_T, y) = \frac{2\langle u_{2,i}(p_T, y) Q^a_{2,i}\rangle}{R^a_{2,i}} \quad v^a_{2,i}(p_T, y) = \frac{4\langle u_{2,i}(p_T, y) Q^a_{1,i} Q^b_{1,i}\rangle}{R^a_{1,i} R^b_{1,i}}$$

$R^a_{1,i}$ is a 1st order event plane resolution correction (details in the following slides)

R_1 2 sub-event method: FHCal





$$R_{1,i} = \sqrt{\langle \Psi_{1,i}^{N} \Psi_{1,i}^{S} \rangle}, i = x, y$$

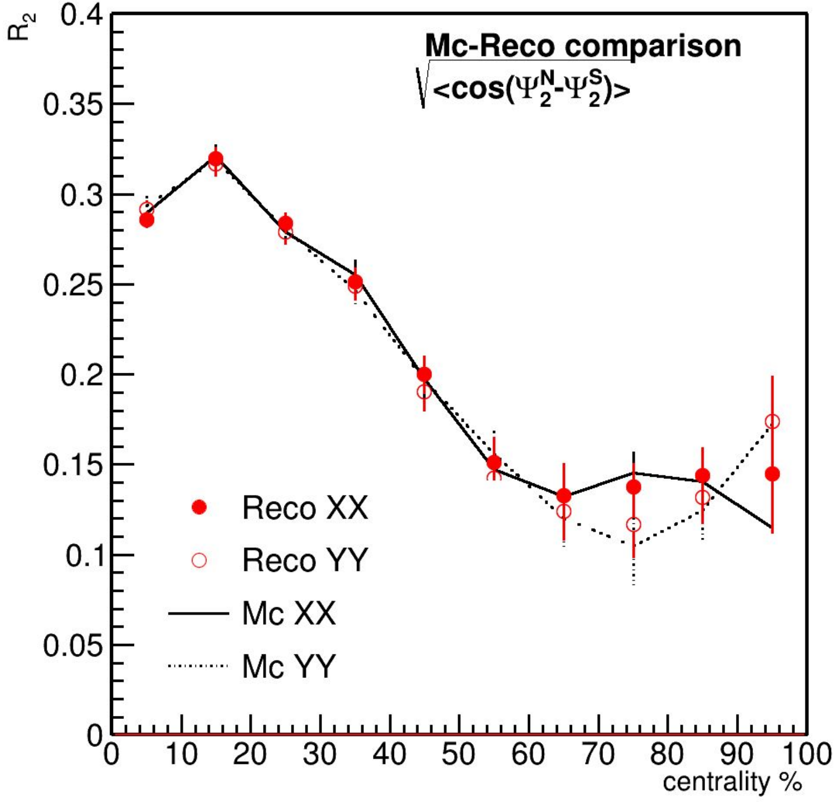
N - northern FHCal: η∈ [2,5]
S - southern FHCal: η∈ [-5,-2]

$$R_{1,x}^{True} = \langle \Psi_{1,x} \cos \Psi_{RP} \rangle$$

$$R_{1,y}^{True} = \langle \Psi_{1,y} \sin \Psi_{RP} \rangle$$

Centrality determination with multiplicity of reconstructed tracks.

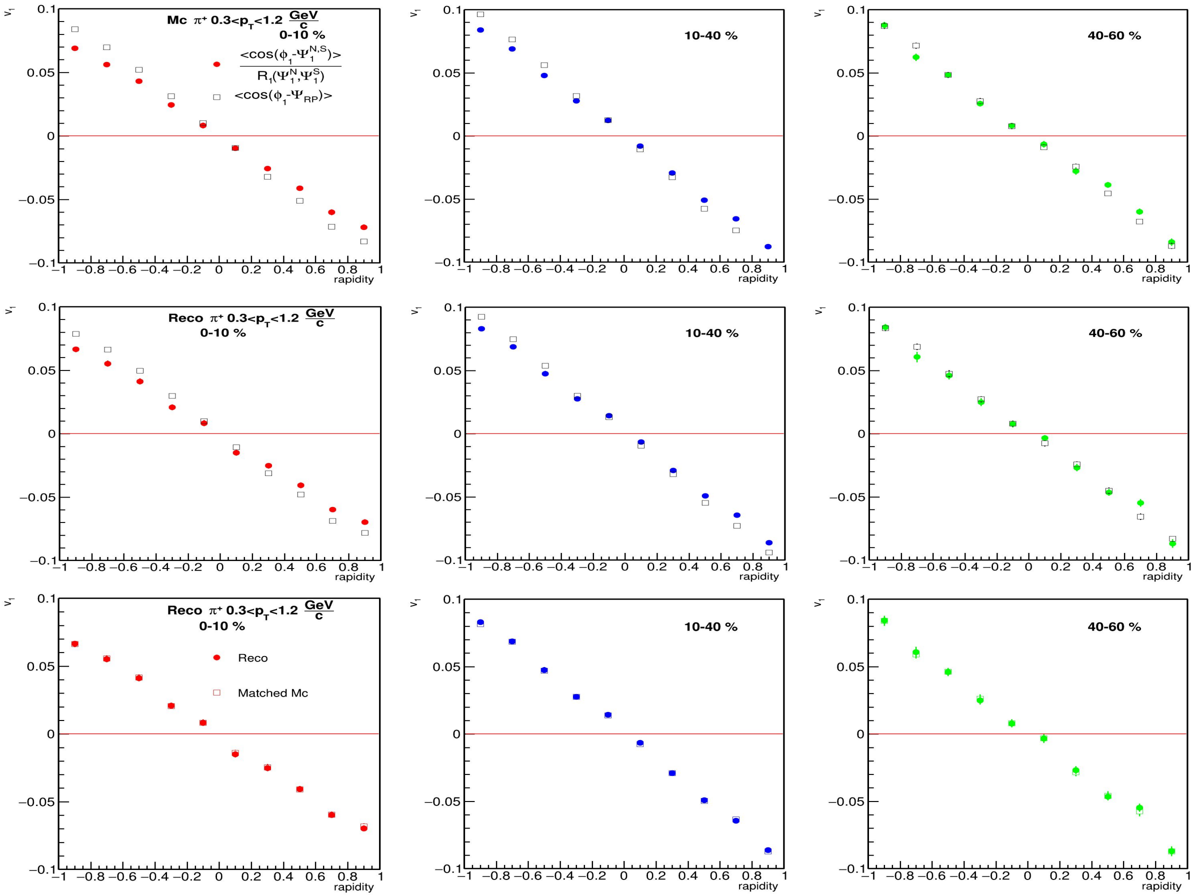
R_2 2 sub-event method: TPC



$$R_{2,i} = \sqrt{\langle \Psi^N_{2,i} \Psi^S_{2,i} \rangle}, i = x, y$$

ψ -vectors formed by charged hadrons in TPC acceptance:
N - $\eta \in [\, 0.05, 1.5 \,]$
S - $\eta \in [\, -1.5, -0.05 \,]$

$v_1(y)$ π^+: u_1Q_1



MC particles:

- |DCA|<1 cm
- PDG code

Primary tracks in FHCal acceptance

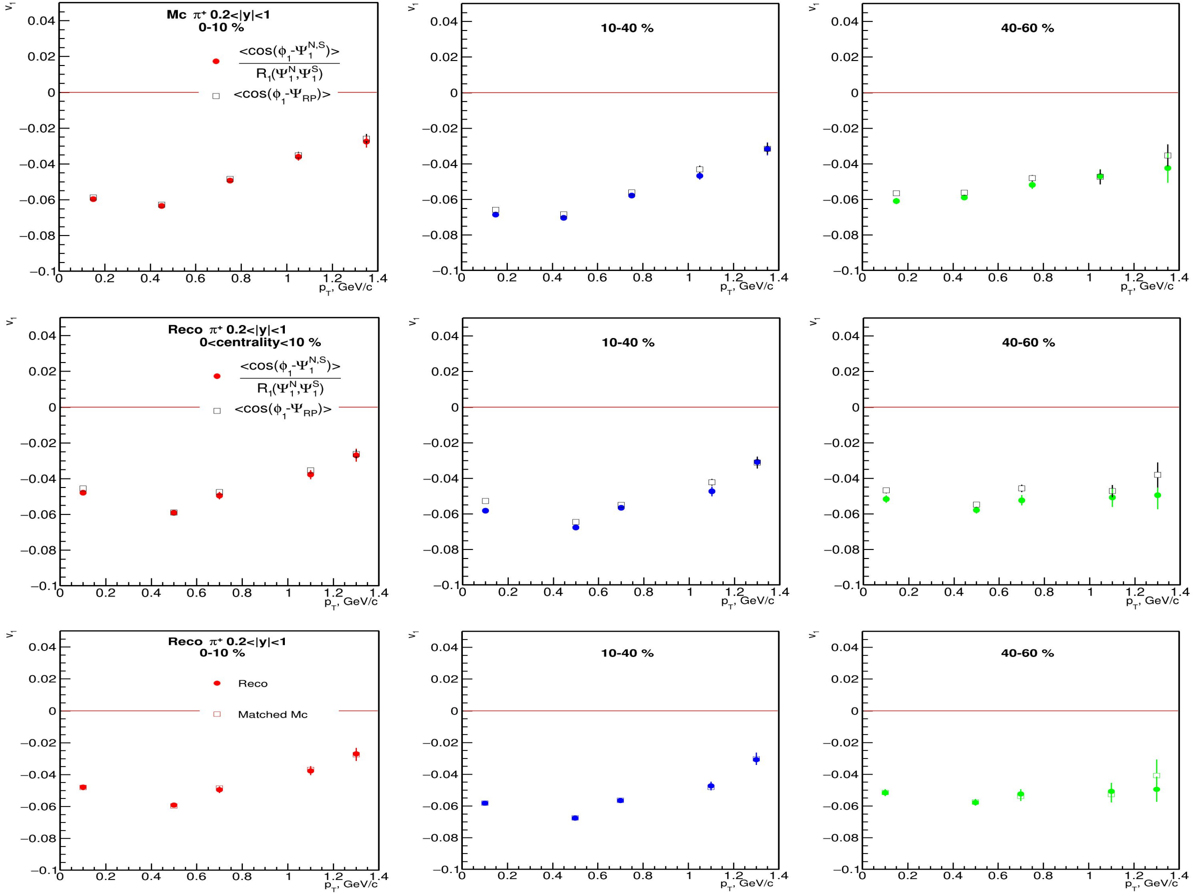
TPC tracks:

- |DCA|<1 cm
- Number of hits in TPC> 16
- PDG code

FHCal

TPC tracks + MC particles matched with those TPC tracks

$v_1(p_T)$ π^+: u_1Q_1



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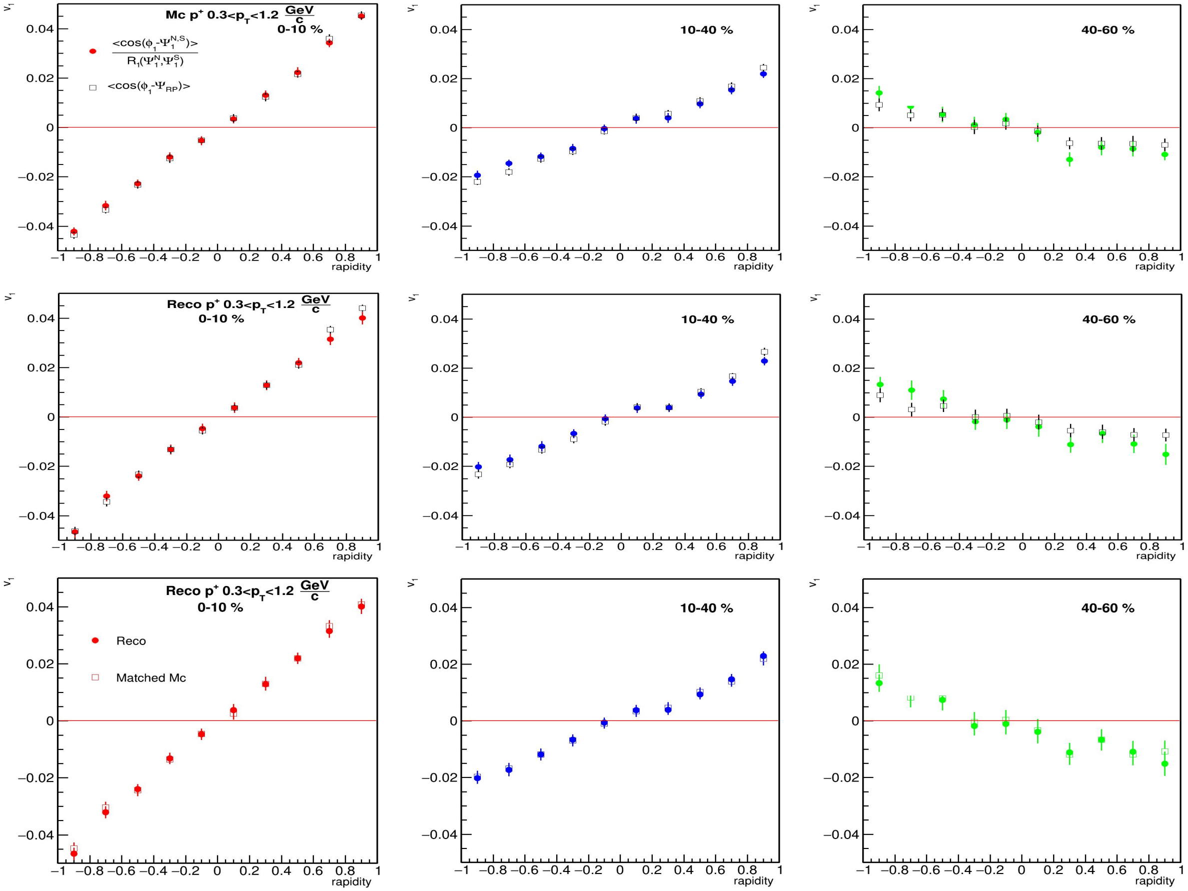
FHCal

TPC tracks + MC particles matched with those TPC tracks

$v_1(y)$ p: u_1Q_1



MC particles:

- mother id =-1
- PDG code

Primary tracks in FHCal acceptance

TPC tracks:

- mother id =-1
- Number of hits in TPC> 16
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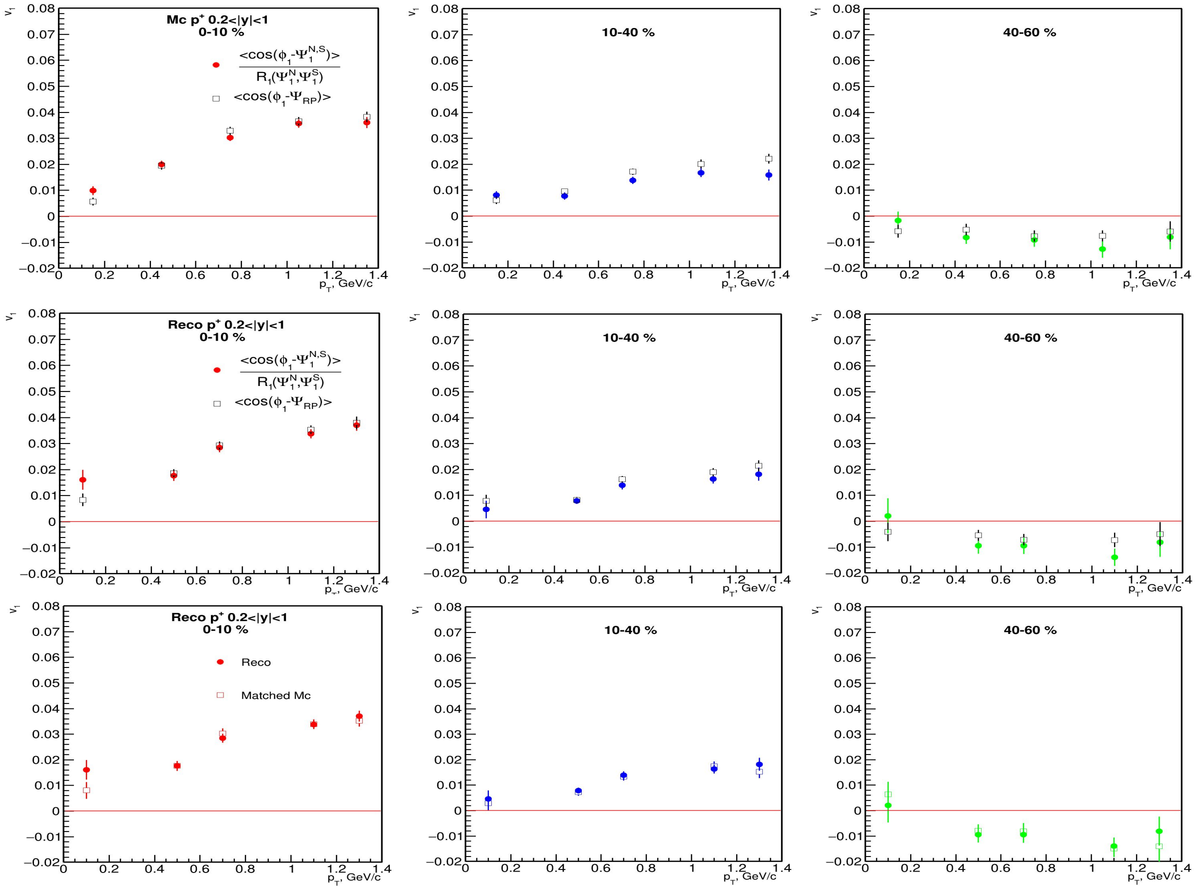
FHCal

TPC tracks + MC particles matched with those TPC tracks

$v_1(p_T)$ p: u_1Q_1



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Primary tracks in FHCal acceptance

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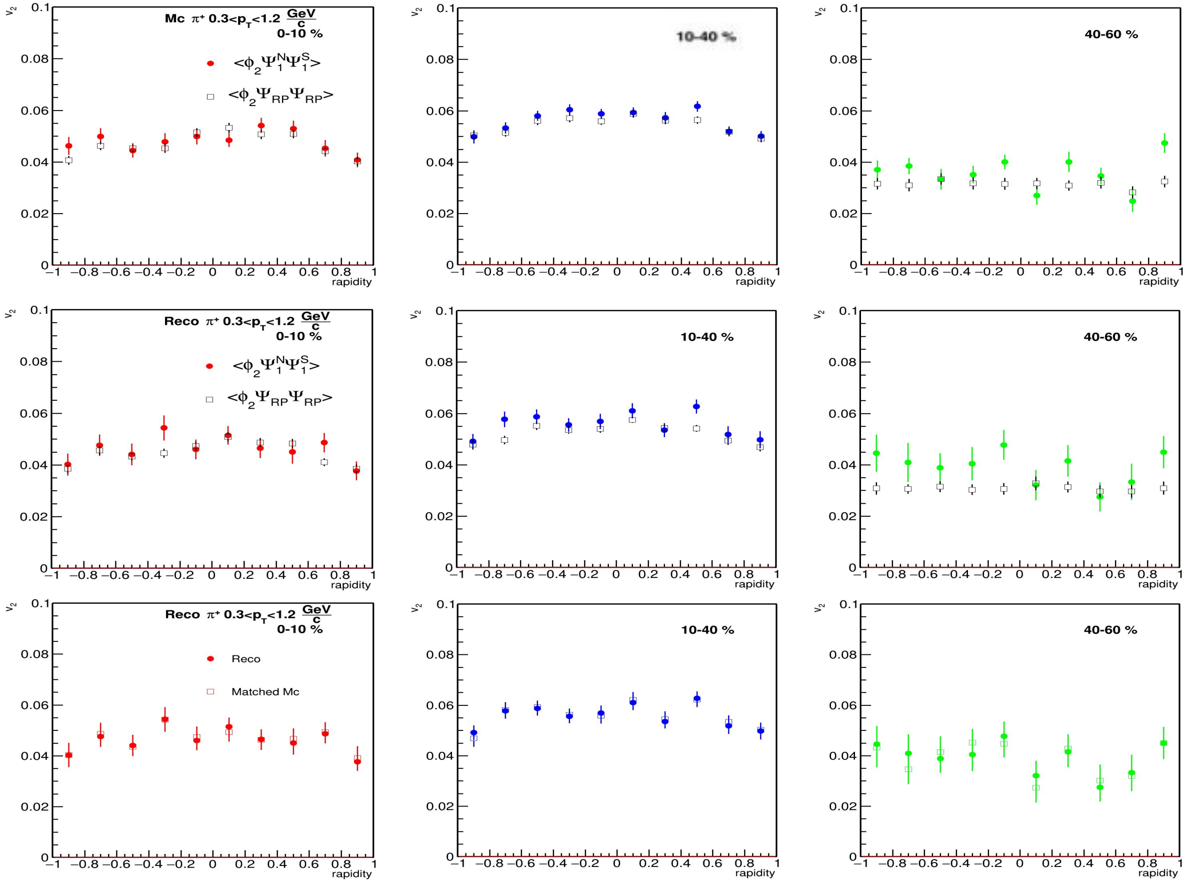
FHCal

TPC tracks + MC particles matched with those TPC tracks

$v_2(y)$ π^+: $u_2Q_1Q_1$



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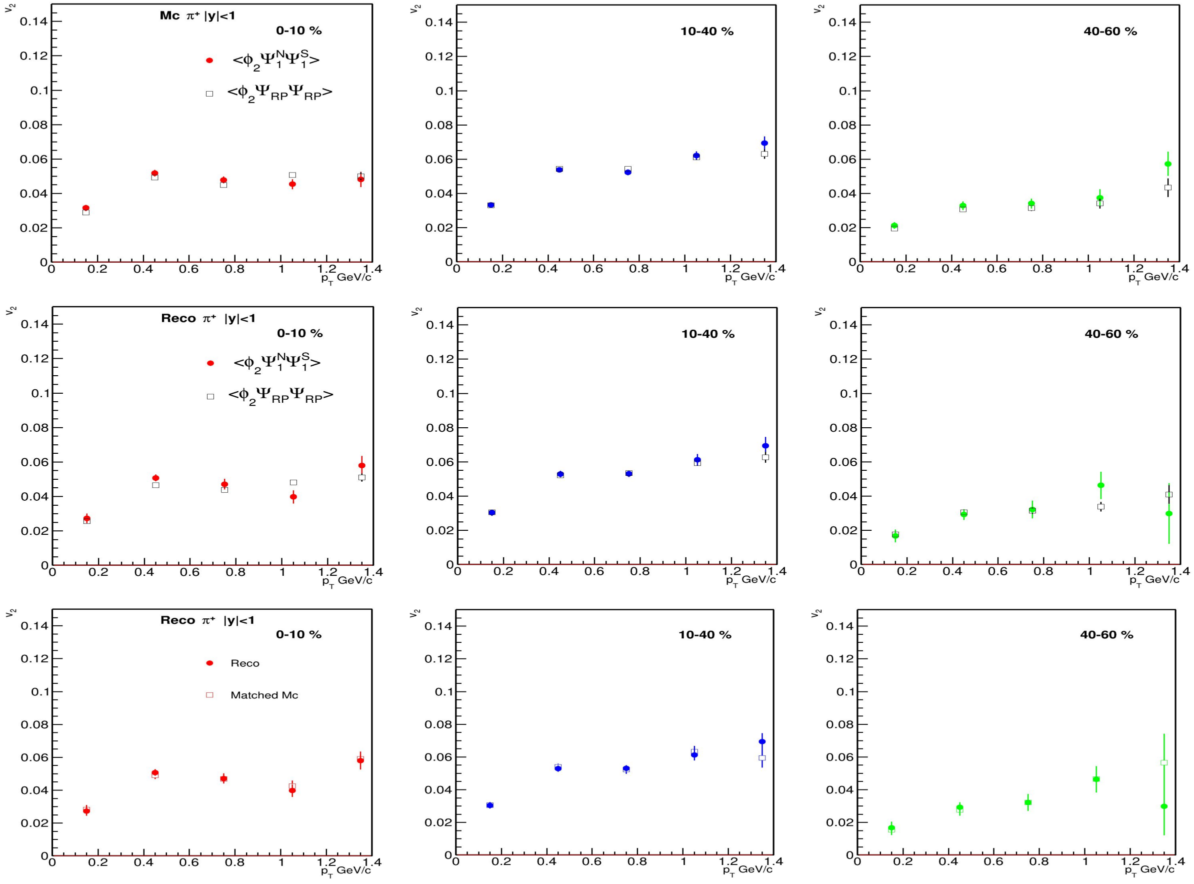

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Primary tracks in FHCal acceptance

TPC tracks:

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TPC tracks + MC particles matched with those TPC tracks

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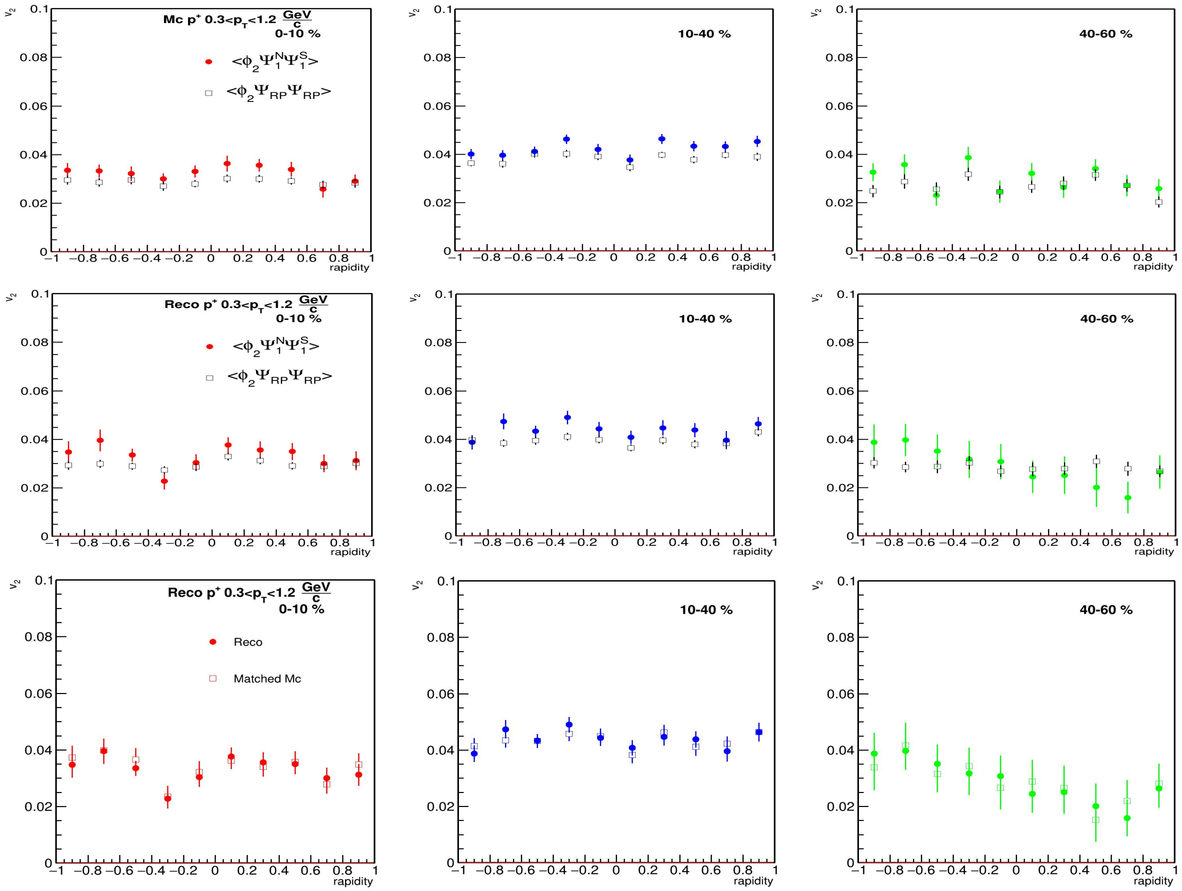


MC particles:
- mother id =-1
- PDG code

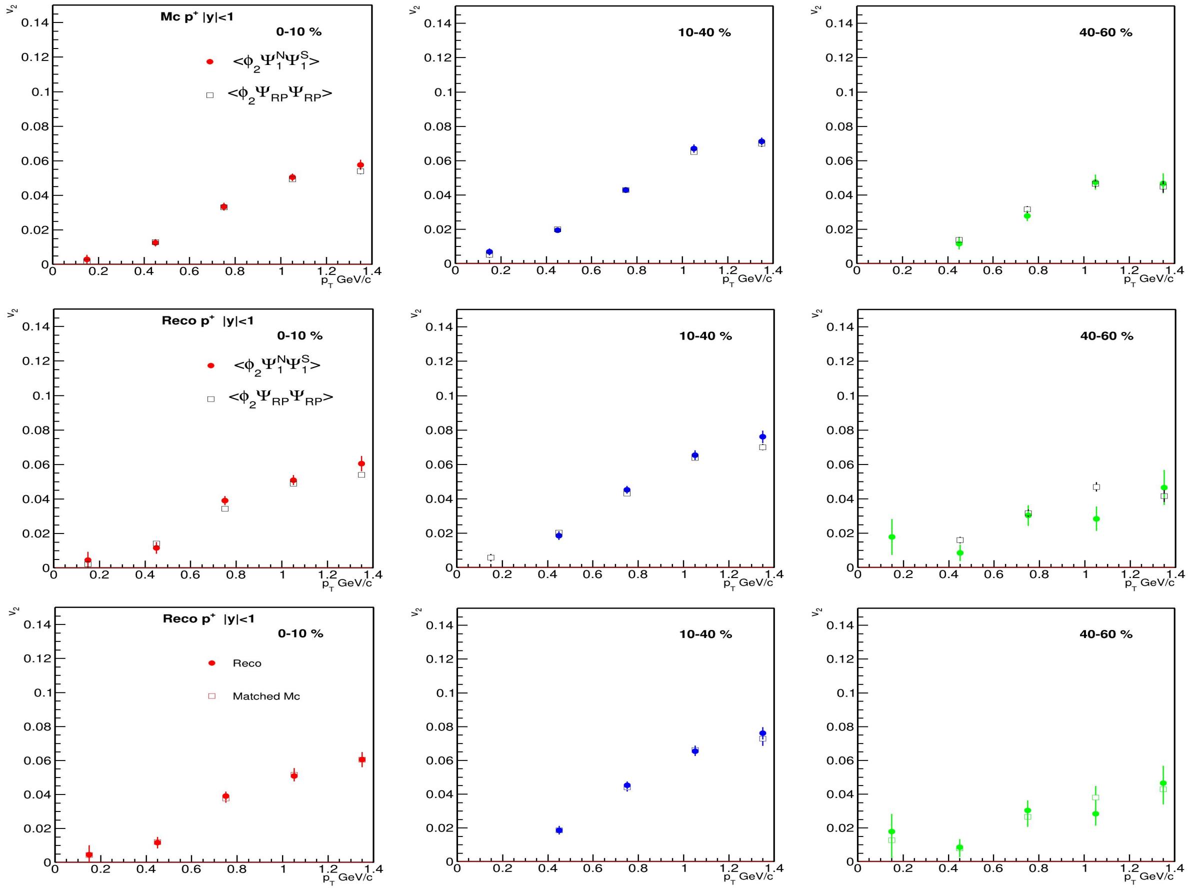
Primary tracks in FHCal acceptance

TPC tracks:
- mother id =-1
- Number of hits in TPC> 16
- PDG code

FHCal

TPC tracks + MC particles matched with those TPC tracks

$v_2(p_T)$ p: $u_2Q_1Q_1$



MC particles:

- mother id =-1
- PDG code

Primary tracks in FHCal acceptance

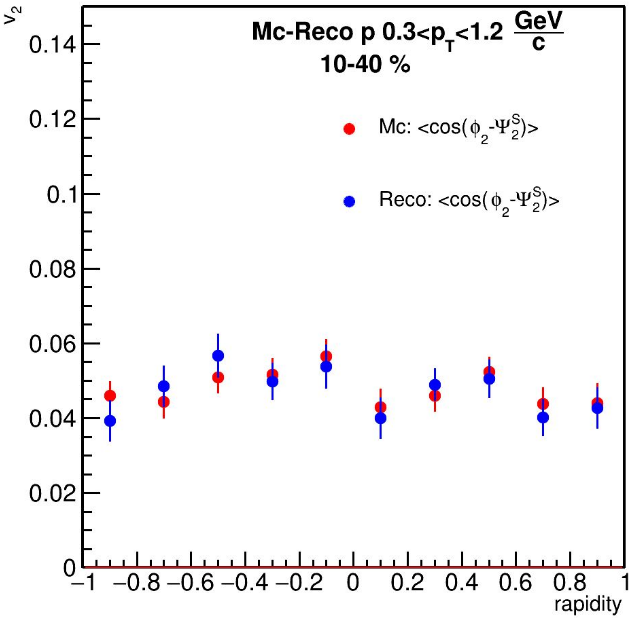
TPC tracks:

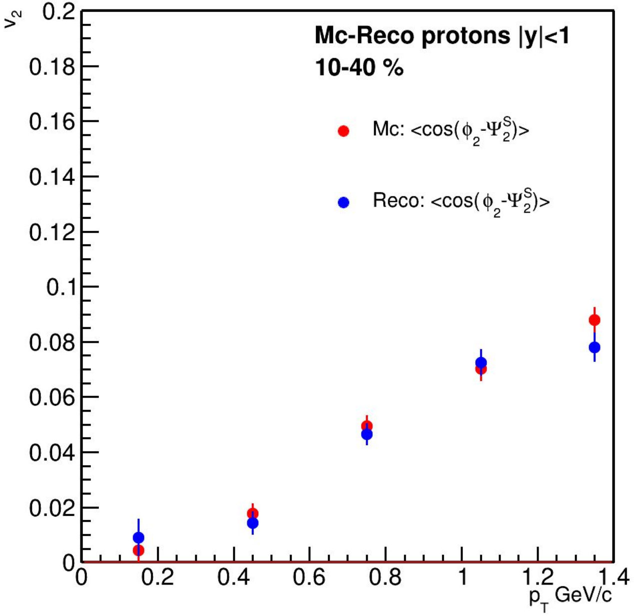
- mother id =-1
- Number of hits in TPC> 16
- PDG code

FHCal

TPC tracks + MC particles matched with those TPC tracks

$v_2(y,p_T)$ p: u_2Q_2





MC particles:

- mother id =-1
- PDG code

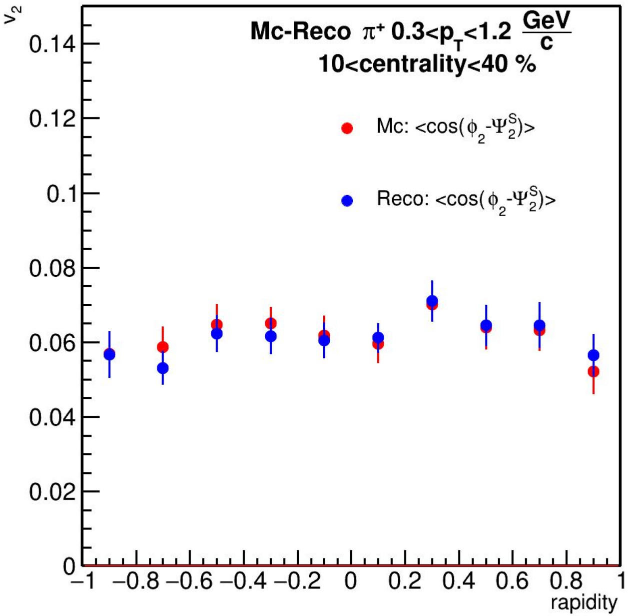
Primary tracks in FHCal acceptance

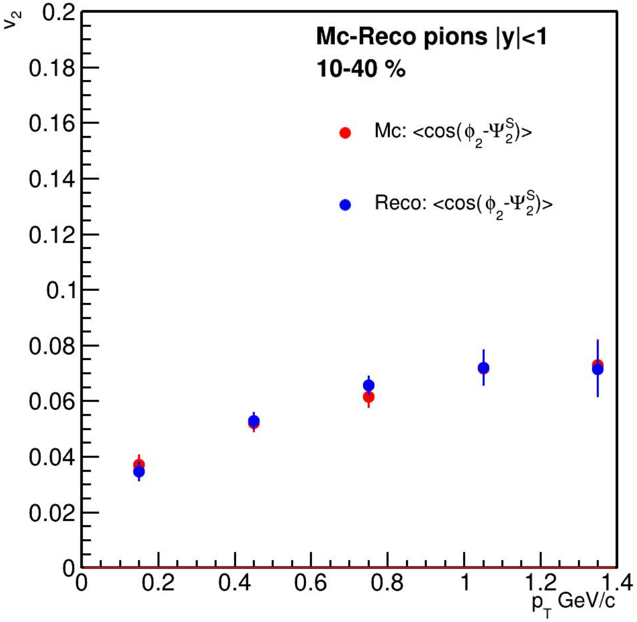
TPC tracks:

- mother id =-1
- Number of hits in TPC> 16
- PDG code

FHCal

$v_2(y,p_T)$ π^+: u_2Q_2





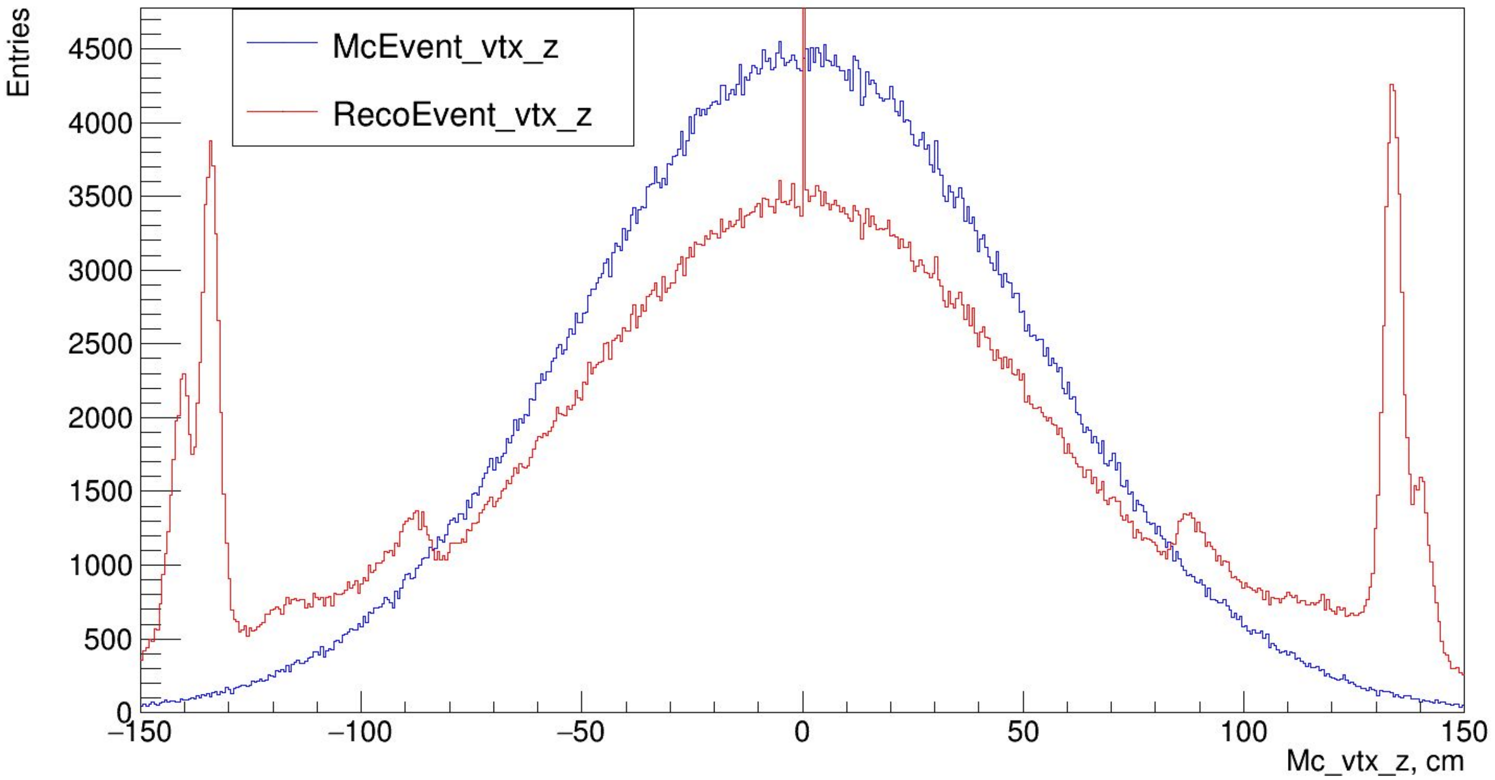
TPC tracks:

- |DCA|<1 cm
- Number of hits in TPC> 16
- PDG code

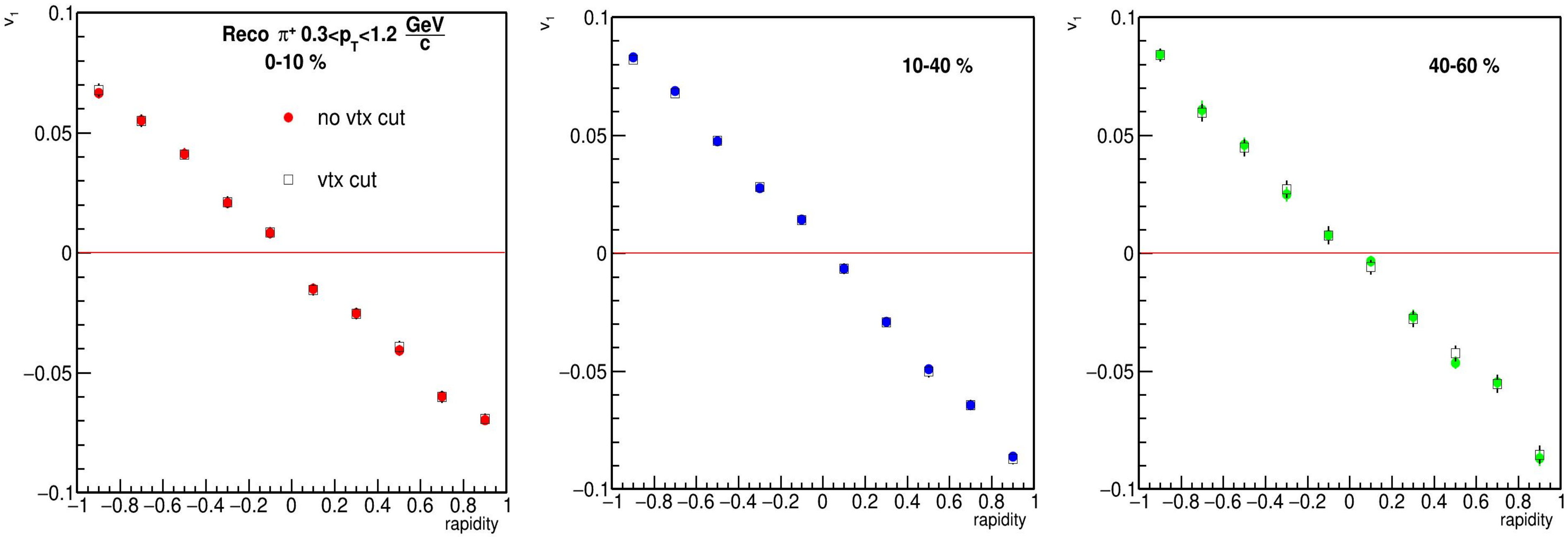
FHCal

MC particles matched with those TPC tracks

|vtx_z|<70 cm effect

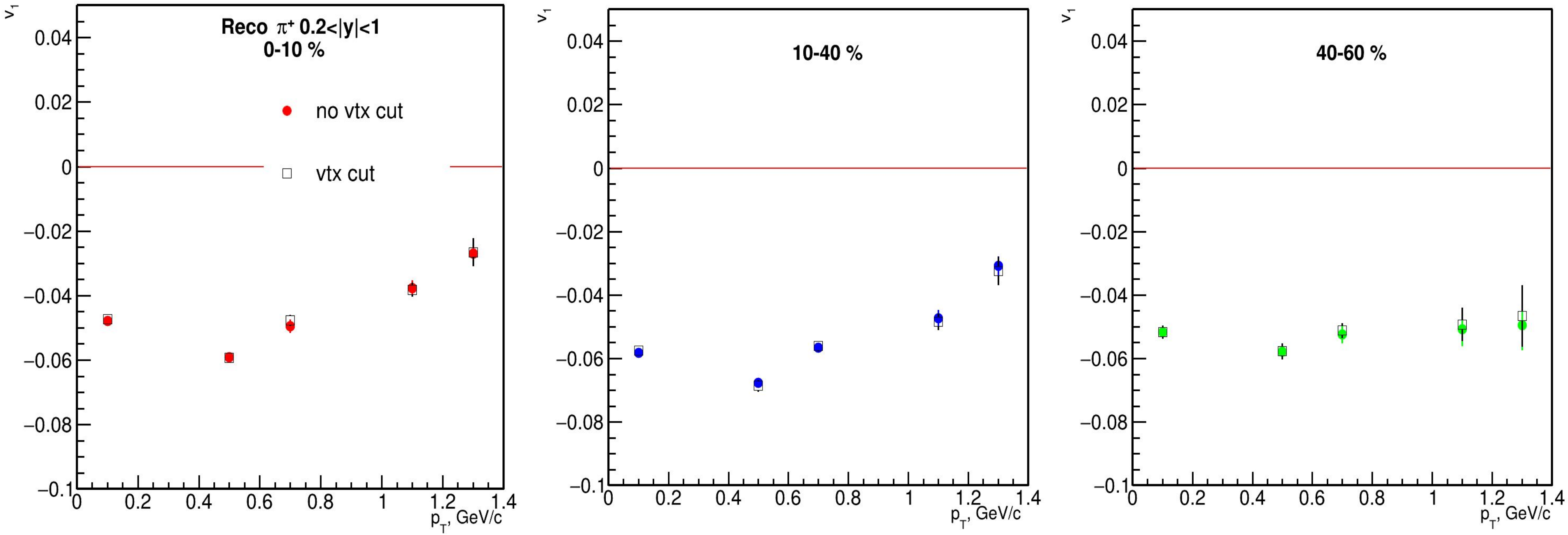


$v_1(y)\ \pi^+$: u_1Q_1

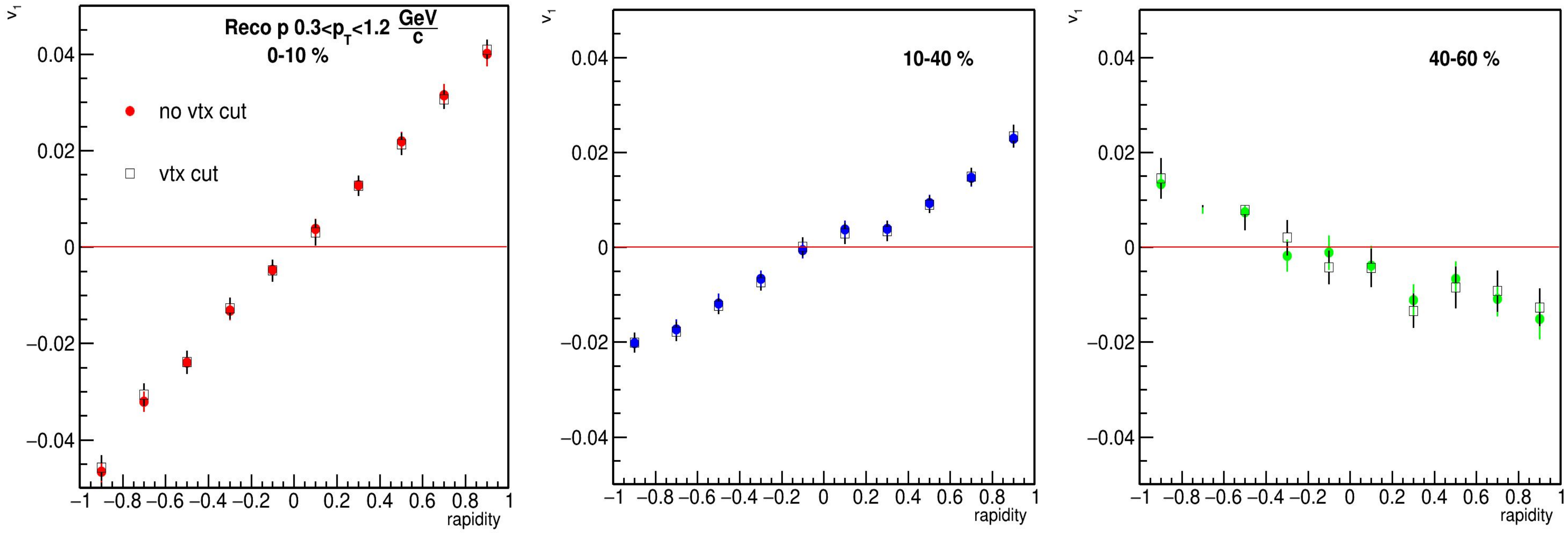


v1
Reco π+ 0.3<pT<1.2 GeV/c
0-10 %
no vtx cut
vtx cut
rapidity
10-40 %
40-60 %

$v_1(p_T)$ π^+: u_1Q_1

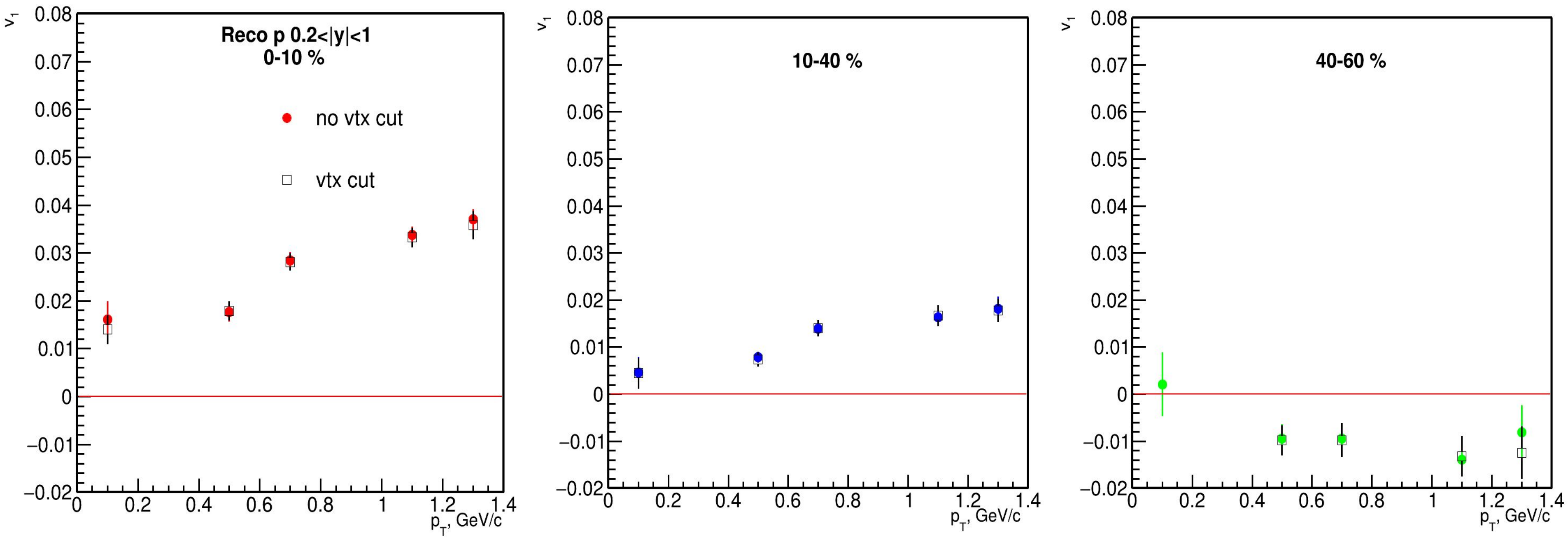

Reco π^+ 0.2<|y|<1
0-10 %
no vtx cut
vtx cut
10-40 %
40-60 %
v_1
p_T, GeV/c
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
−0.1
0
0.2
0.4
0.6
0.8
1
1.2
1.4

$v_1(y)$ p: u_1Q_1

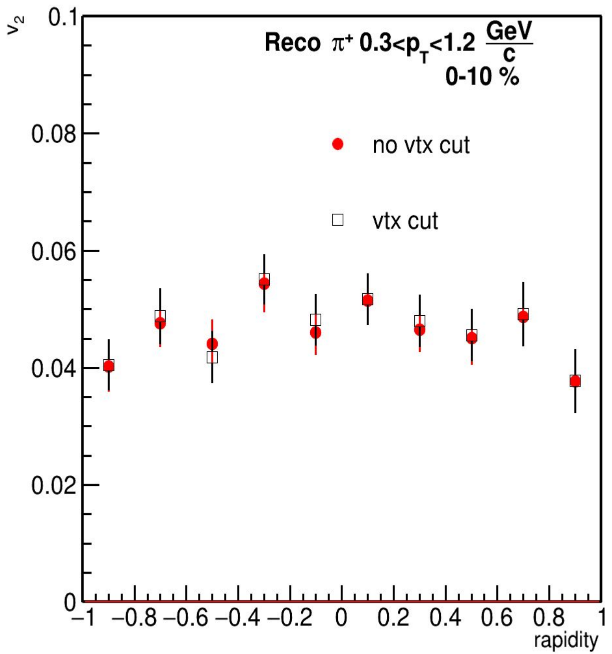


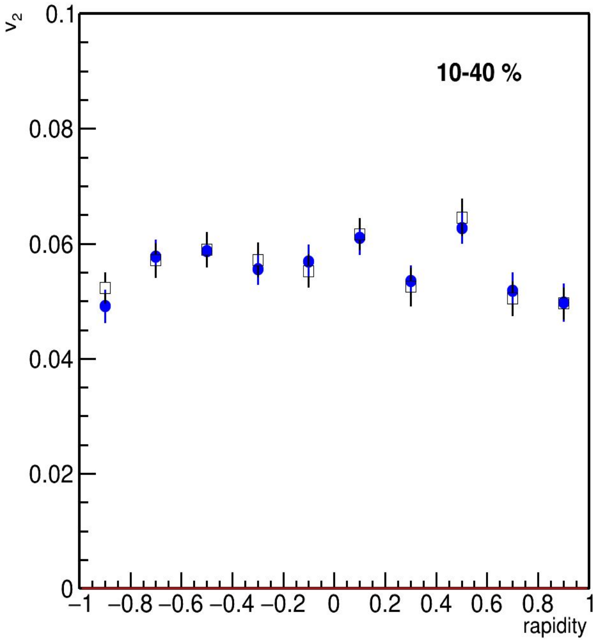
Reco p 0.3<p_T<1.2 GeV/c
0-10 %
no vtx cut
vtx cut
10-40 %
40-60 %
v_1
rapidity

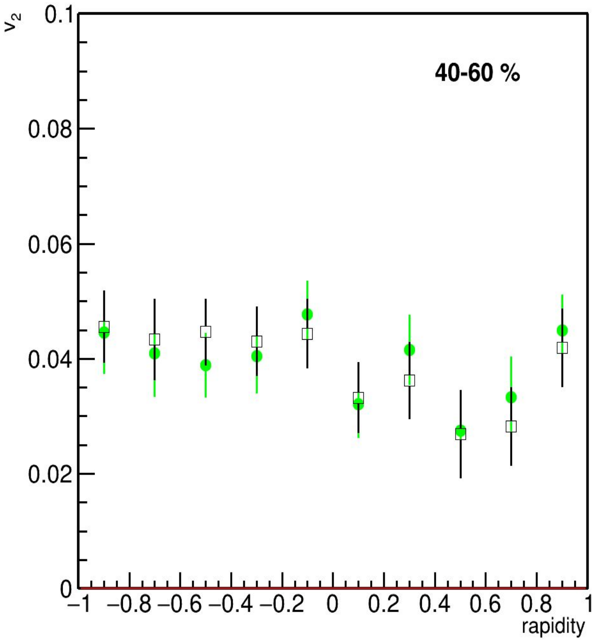
$v_1(p_T)$ p: u_1Q_1



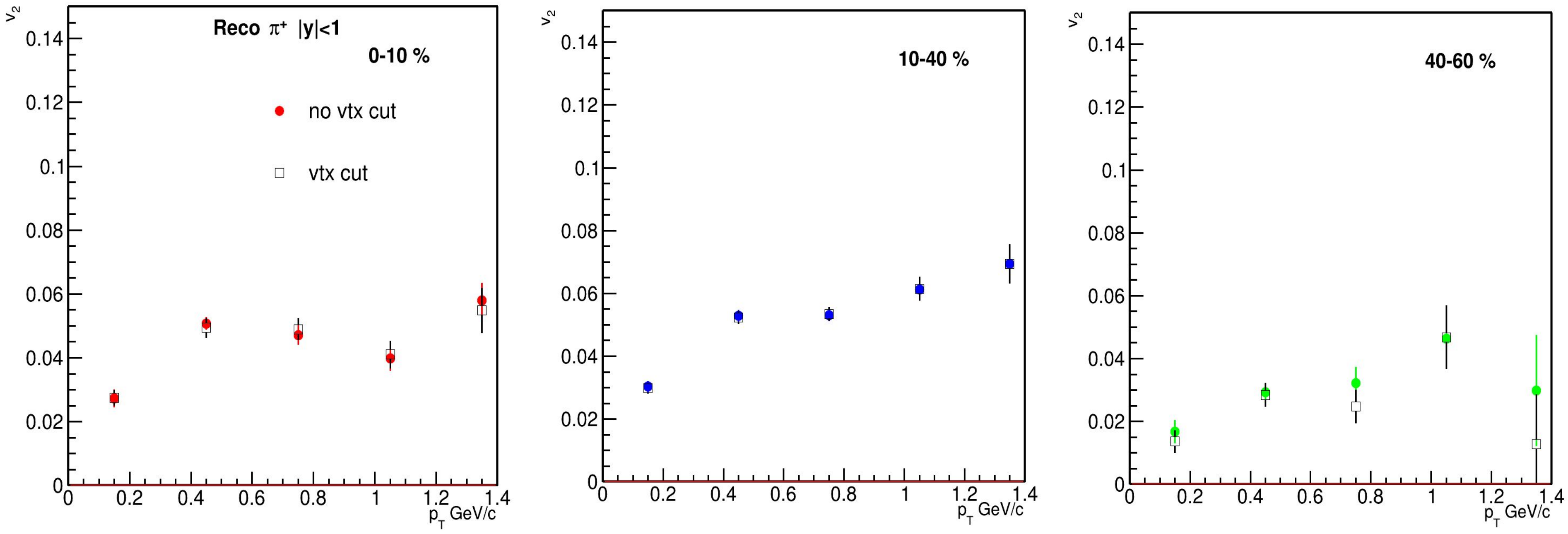
$v_2(y)\ \pi^+$: $u_2Q_1Q_1$



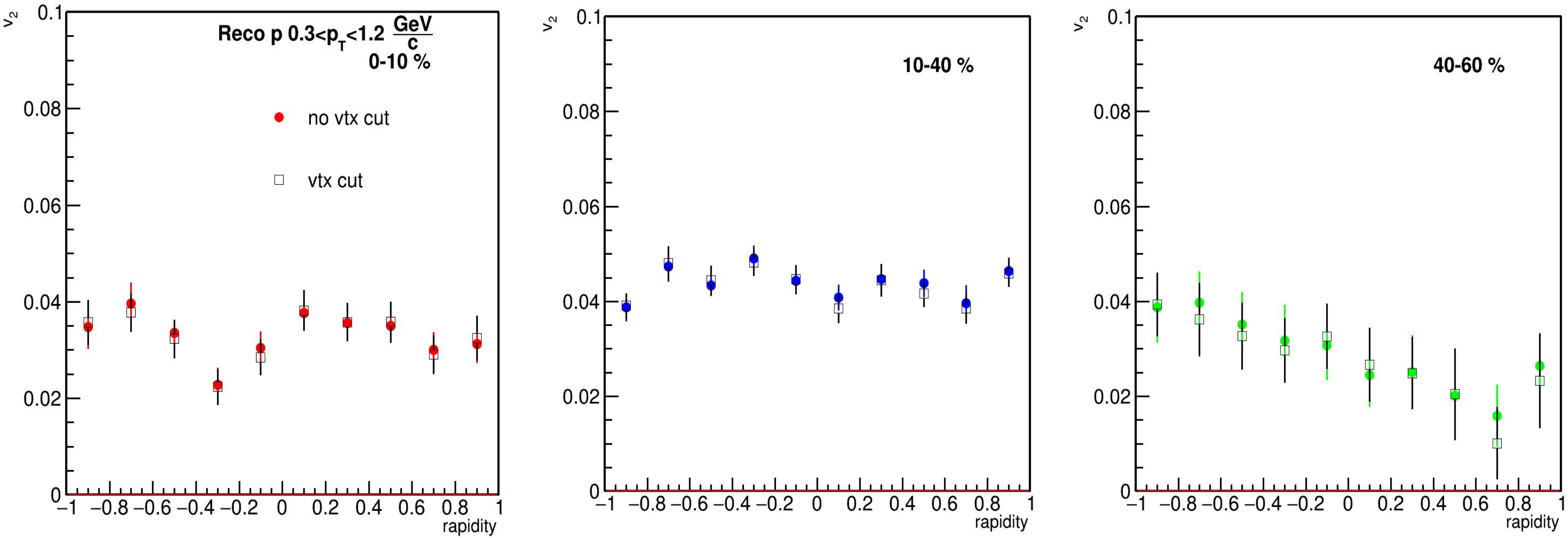




$v_2(p_T)$ π^+: $u_2Q_1Q_1$

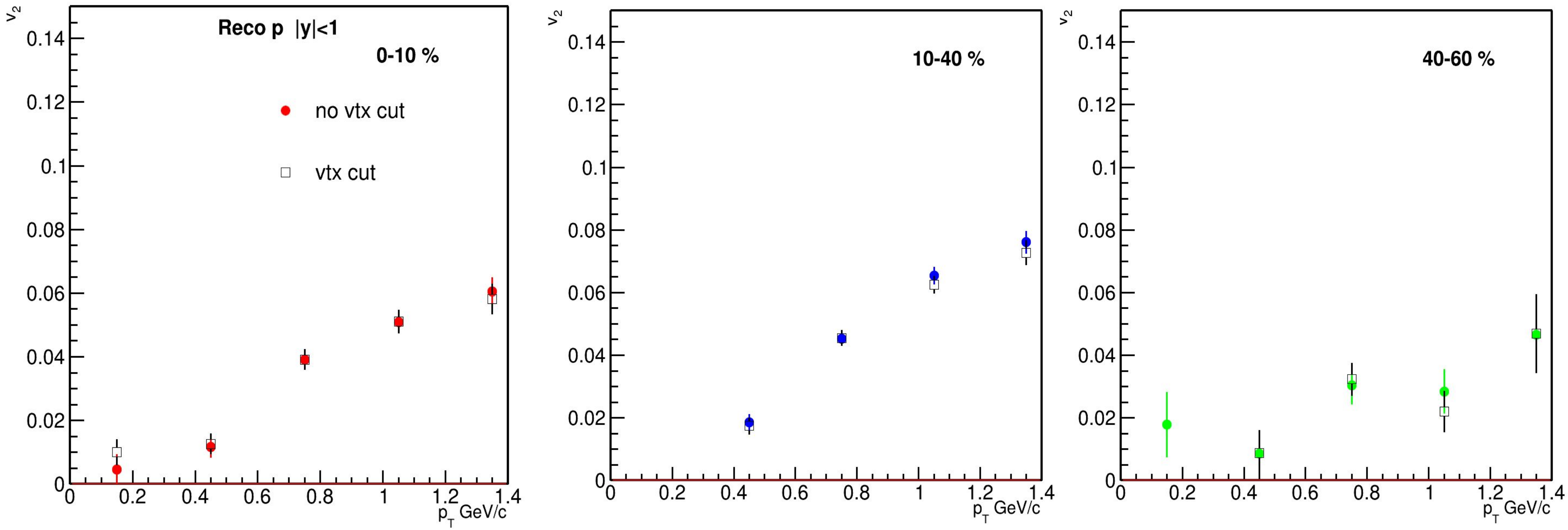


$v_2(y)$ p: $u_2Q_1Q_1$



Reco p 0.3<p_T<1.2 GeV/c
0-10 %
no vtx cut
vtx cut
10-40 %
40-60 %
v_2
rapidity

$v_2(p_T)$ p: $u_2Q_1Q_1$



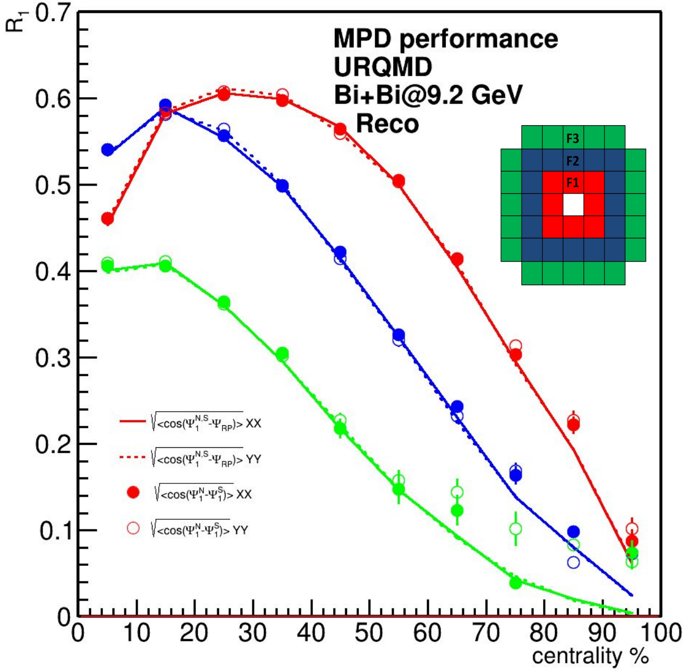
Summary

- Good agreement of reconstructed and true resolution for FHCal except for most peripheral collisions.
- Consistent resolution values obtained with X and Y components of Q-vectors.
- p_T and rapidity dependences of directed flow of protons are in good agreement with values from the event generator.
- The flow of reconstructed tracks is consistent with the flow of corresponding tracks from the model
- The wide distribution of vertex_z and the influence of the reconstruction on it does not significantly affect the flows
- Rapidity dependences of directed flow of pions is inconsistent with true flow for model and reconstruction. It may be affected by non flow correlations. It can be checked by differential analysis with bigger statistics.

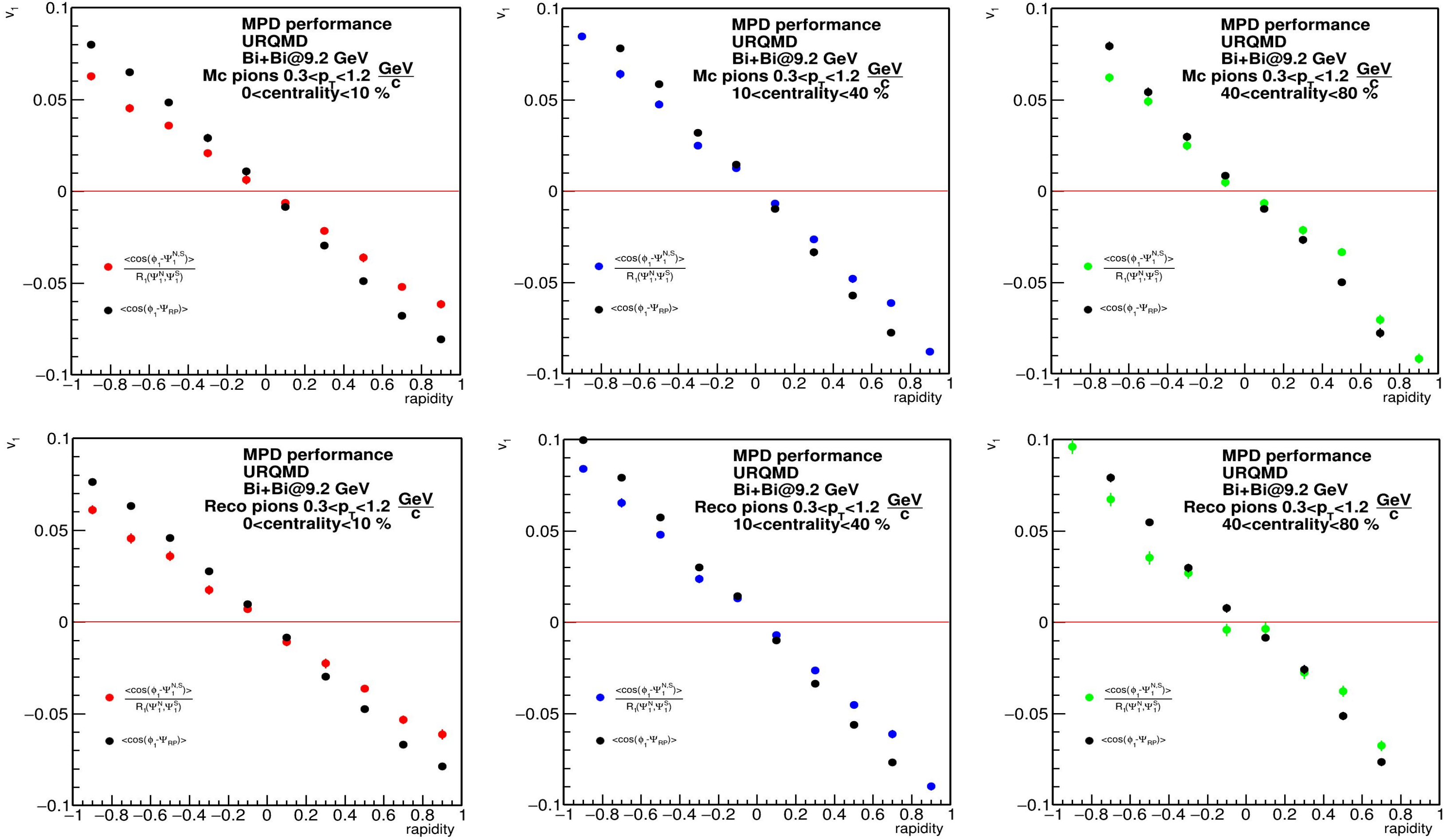
Do not see any problems with the productions

Backup

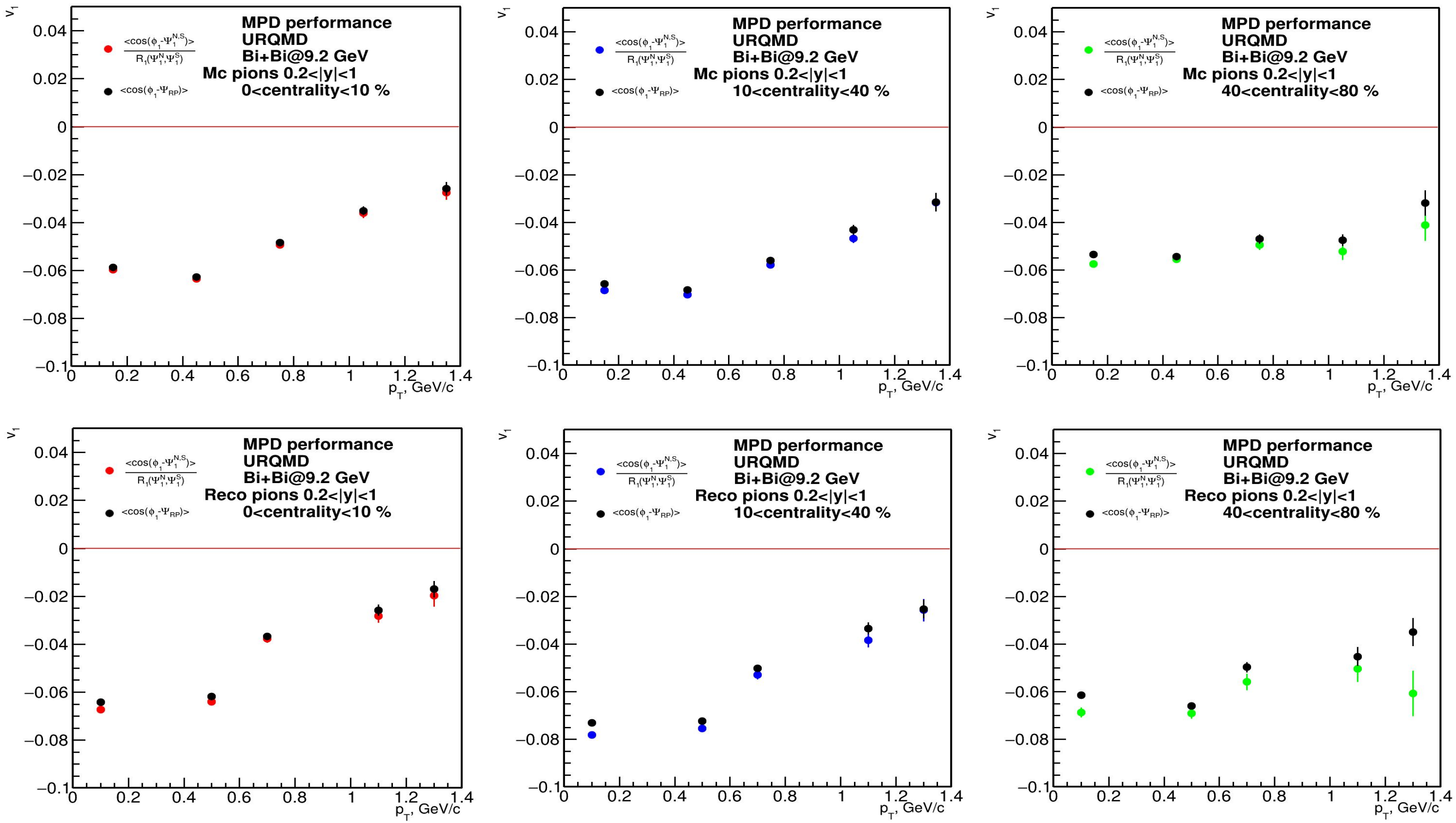
R_1 2 sub-event method: FHCal rings



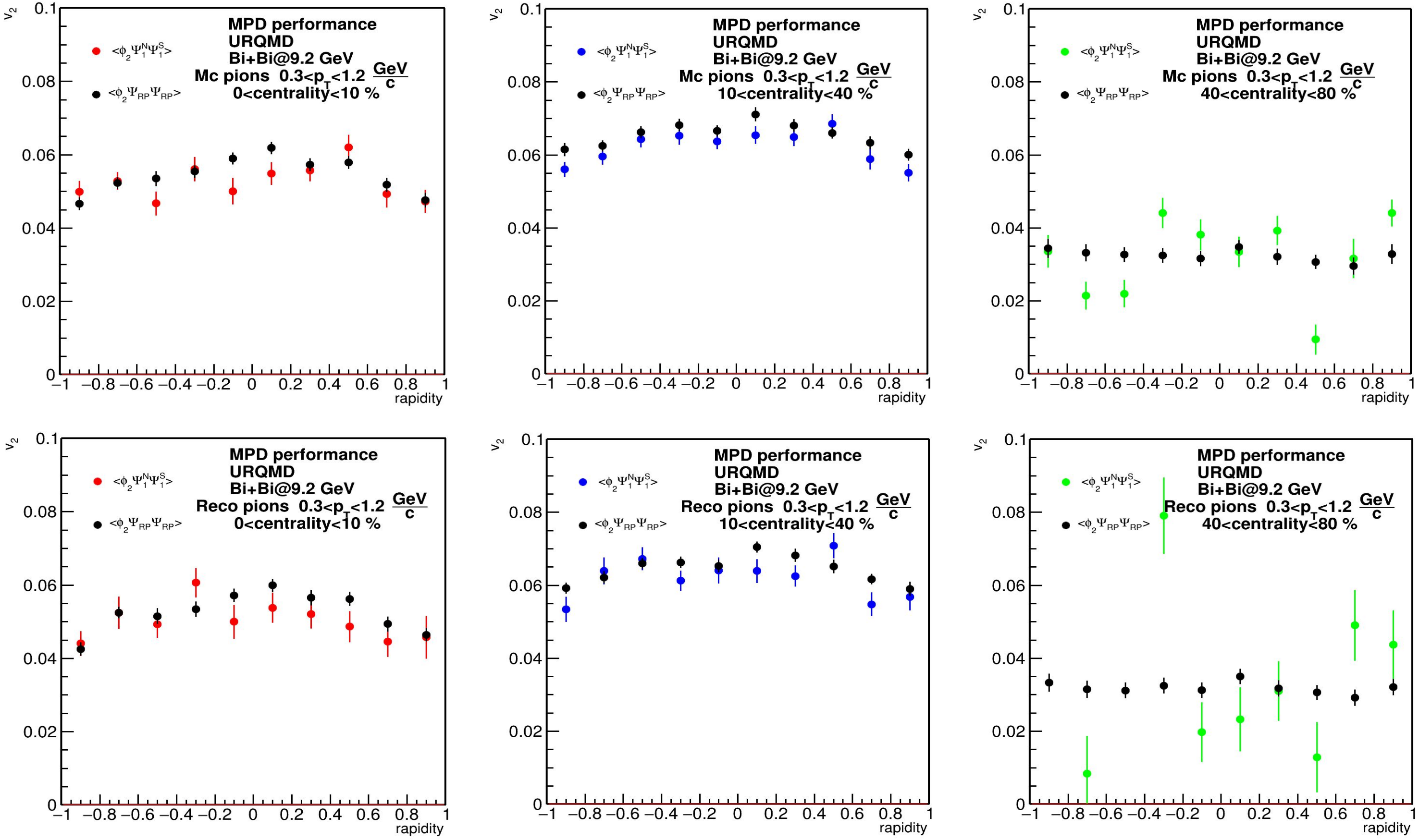
$v_1(y)$ π^+: u_1Q_1; mother_id=-1



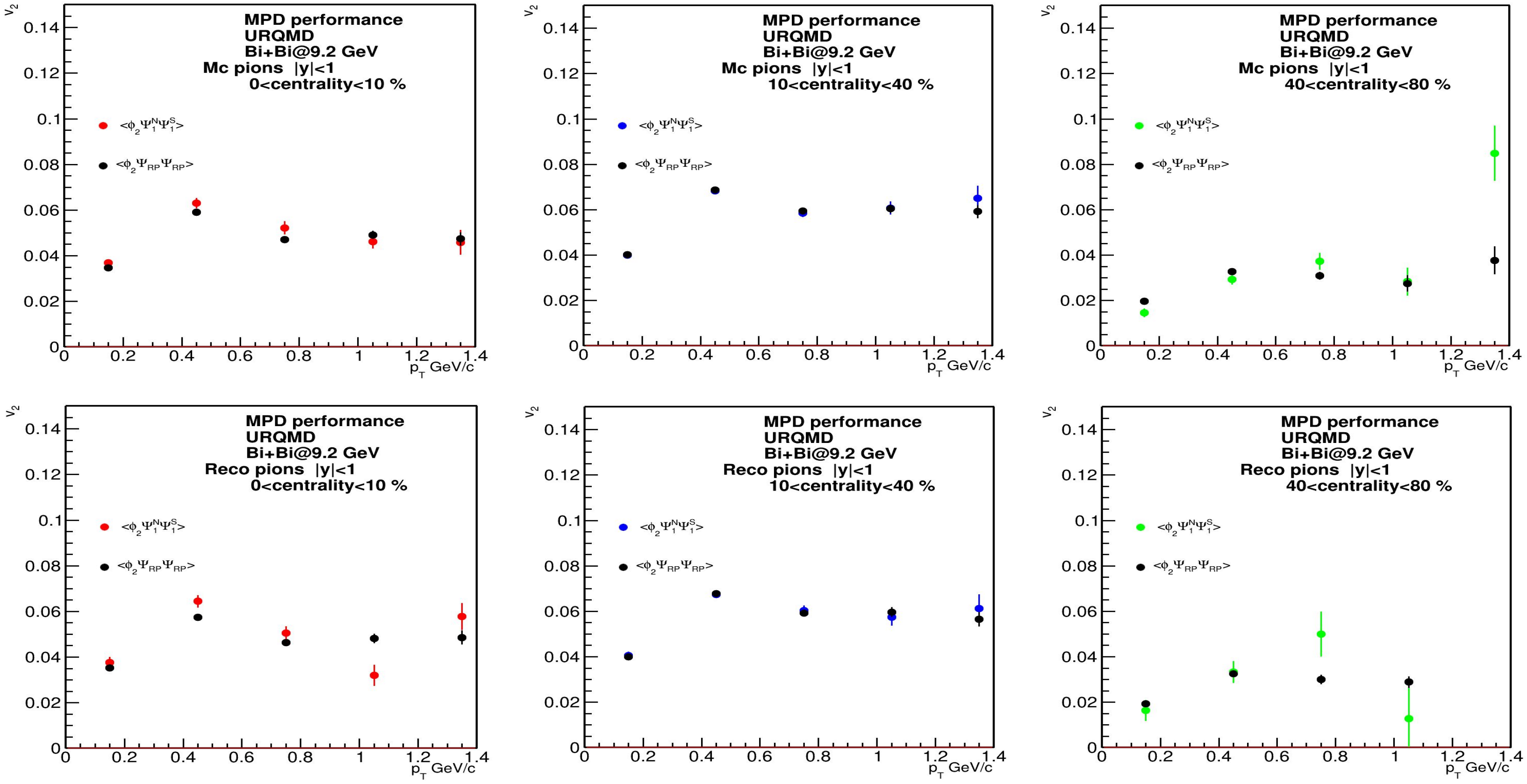
$v_1(p_T)$ π^+: u_1Q_1; mother_id=-1



$v_2(y)$ π^+: $u_2Q_1Q_1$; mother_id=-1



$v_2(p_T)$ π^+: $u_2Q_1Q_1$;mother_id=-1



$v_2(y,p_T)$ π^+: u_2Q_2; mother_id=-1