Efficiency corrections on photon and neutral pion flow

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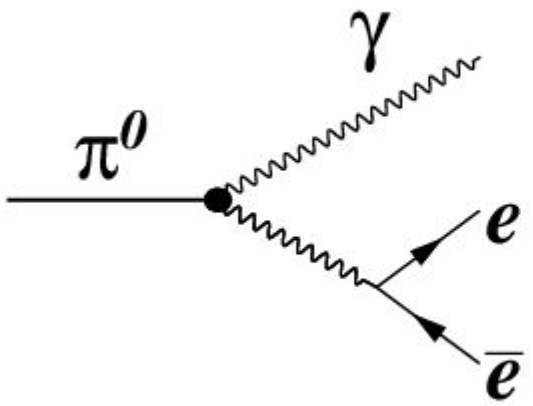
Reminder

- Two possibilities for photon reconstruction:
  - Signal in EMC
  - e^+e^- pairs from TPC for converted photons

- Three methods for π^0 reconstruction:
  - Calorimeter (both photons reconstructed with EMC)
  - Hybrid (EMC + converted photon)
  - Conversion (two converted photons)

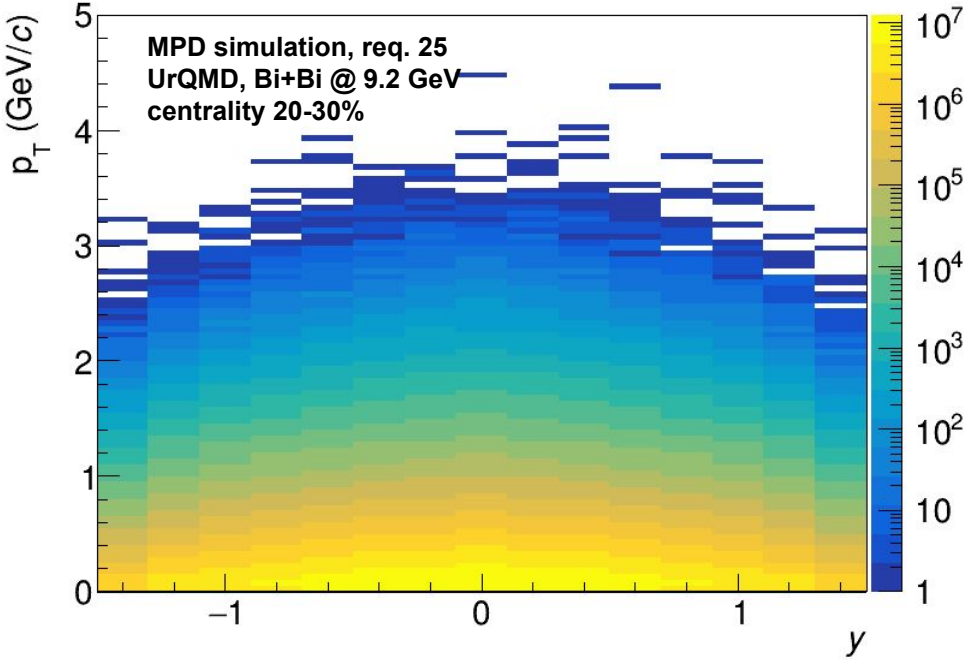


Conversion method gives significantly higher momentum resolution but much lower reconstruction efficiency.

Analysis details

- UrQMD, Bi+Bi @ 9.2 GeV (request 25)
- Analysis procedure implemented in MpdConvPi0 class
- Output from EP, PID and V0Maker wagons is used
- Results are shown for the analysis train request #5

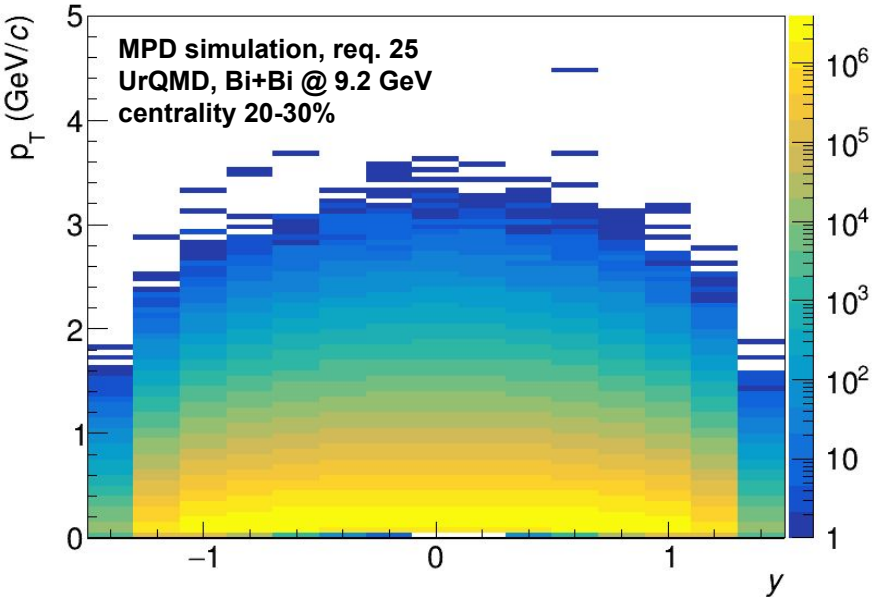
Primary* photon MC spectra**



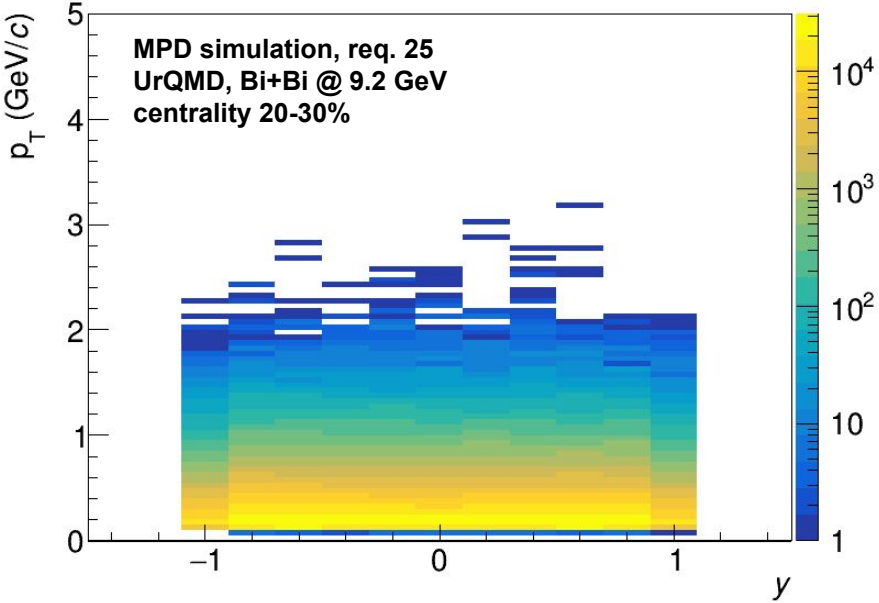
* produced within 1 cm from primary vertex of the collision
**in UrQMD most photons come from π^0 decays

Reconstructed primary photon spectra

Calorimeter



Conversion



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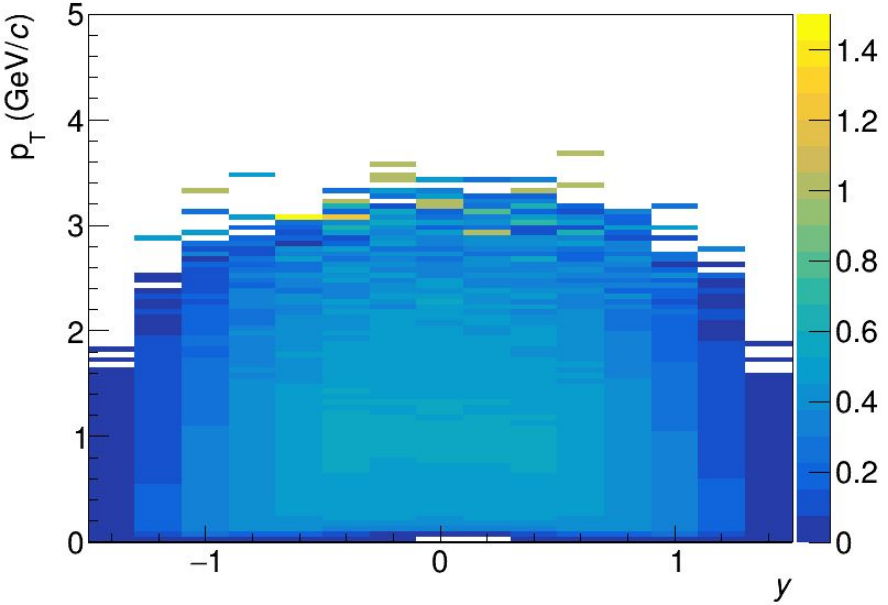
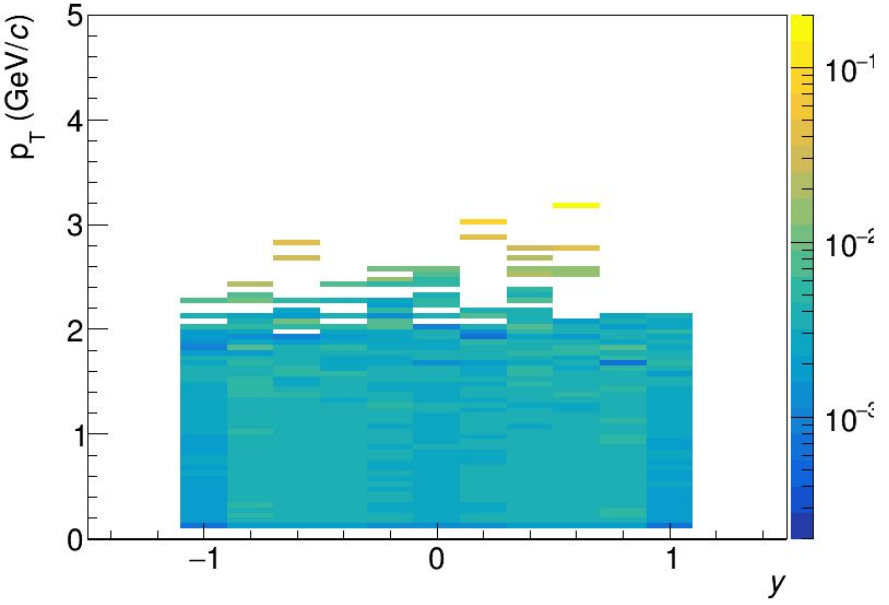
Primary photon reconstruction efficiency

Calorimeter



Conversion



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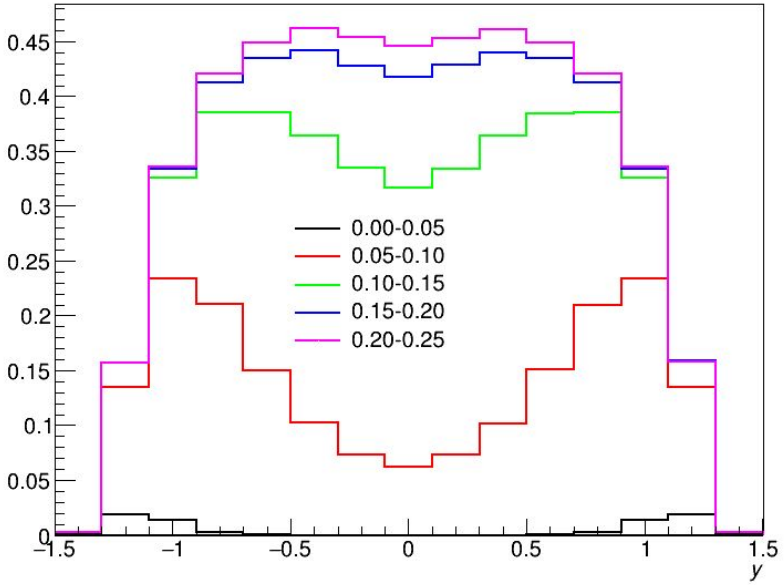
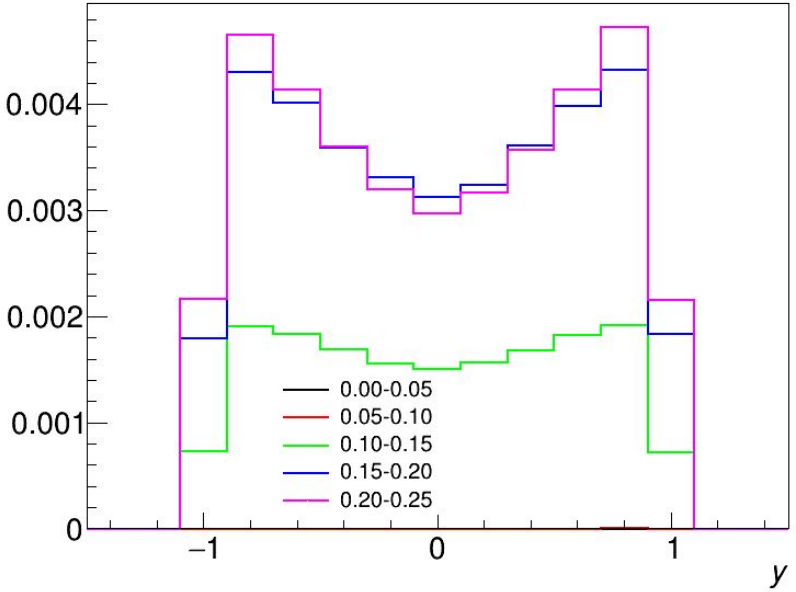
Primary photon reconstruction efficiency

Calorimeter



Conversion



- Calorimeter efficiency drops at midrapidity and low p_T. Tuning cluster energy cuts might help?
- Very low efficiency for conversion method.

Efficiency correction

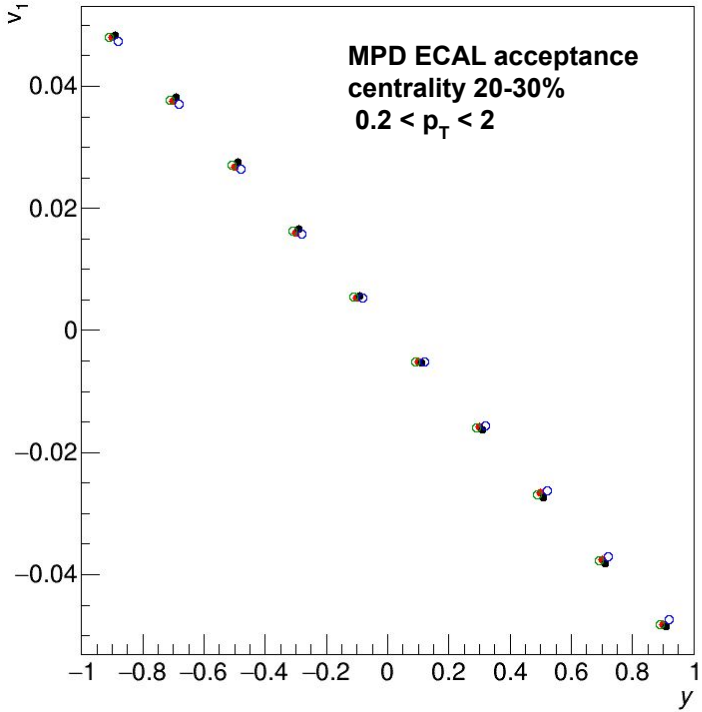
p_T-y differential efficiency correction may be applied using weights w=1/eff during:

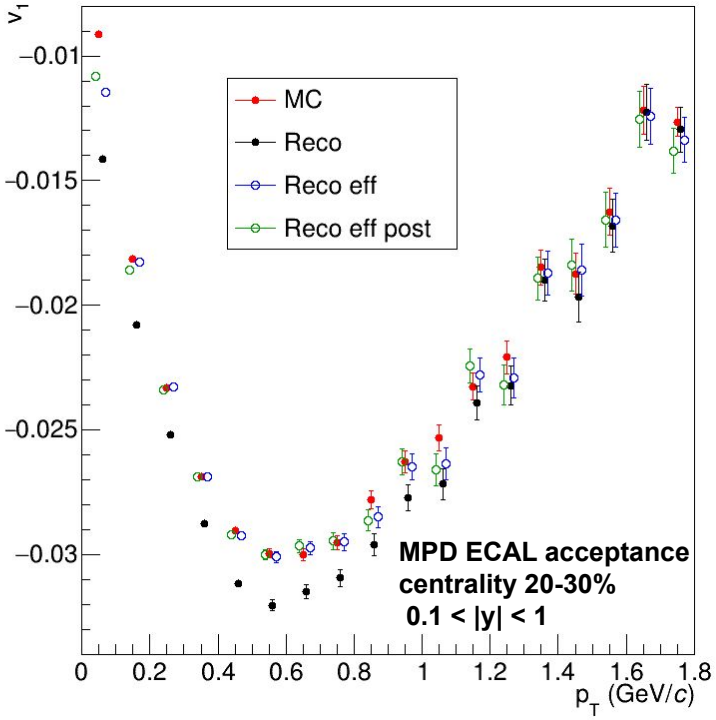
- filling of TProfiles (smoothed efficiency can be used),
- postprocessing of TProfiles.

Both methods were checked in the closure test:

- Sample y, pT, and $v_{1,2}$ according to distributions from the analysis
- Apply calorimeter efficiency map from the analysis
- Apply weights during filling of TProfile or postprocessing.

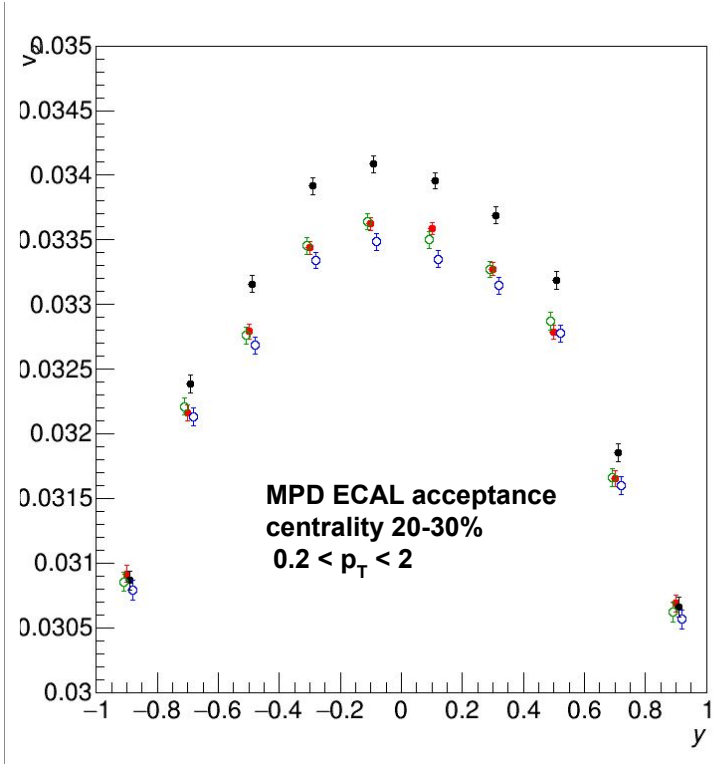
Efficiency correction closure test

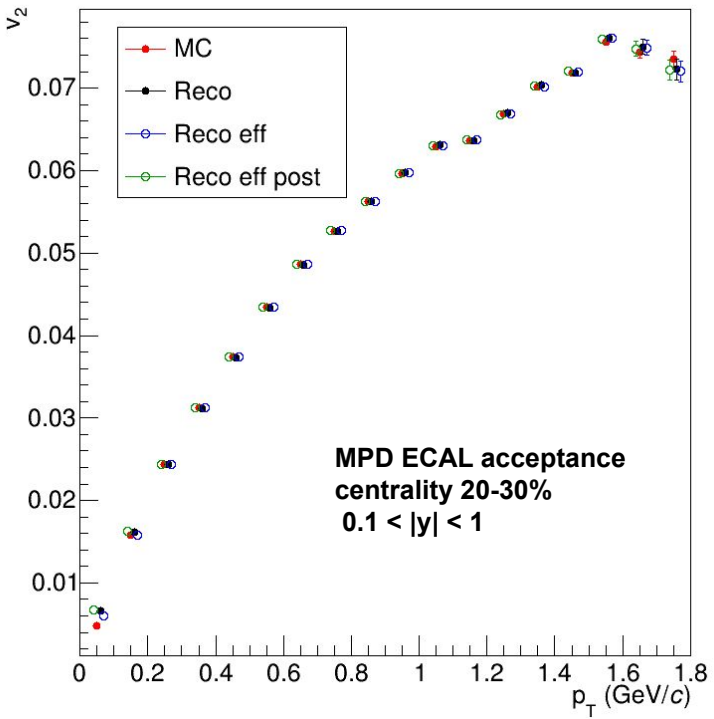




- Little effect on v_1 rapidity dependence.
- Both methods succeed in correcting p_T dependence.

Efficiency correction closure test





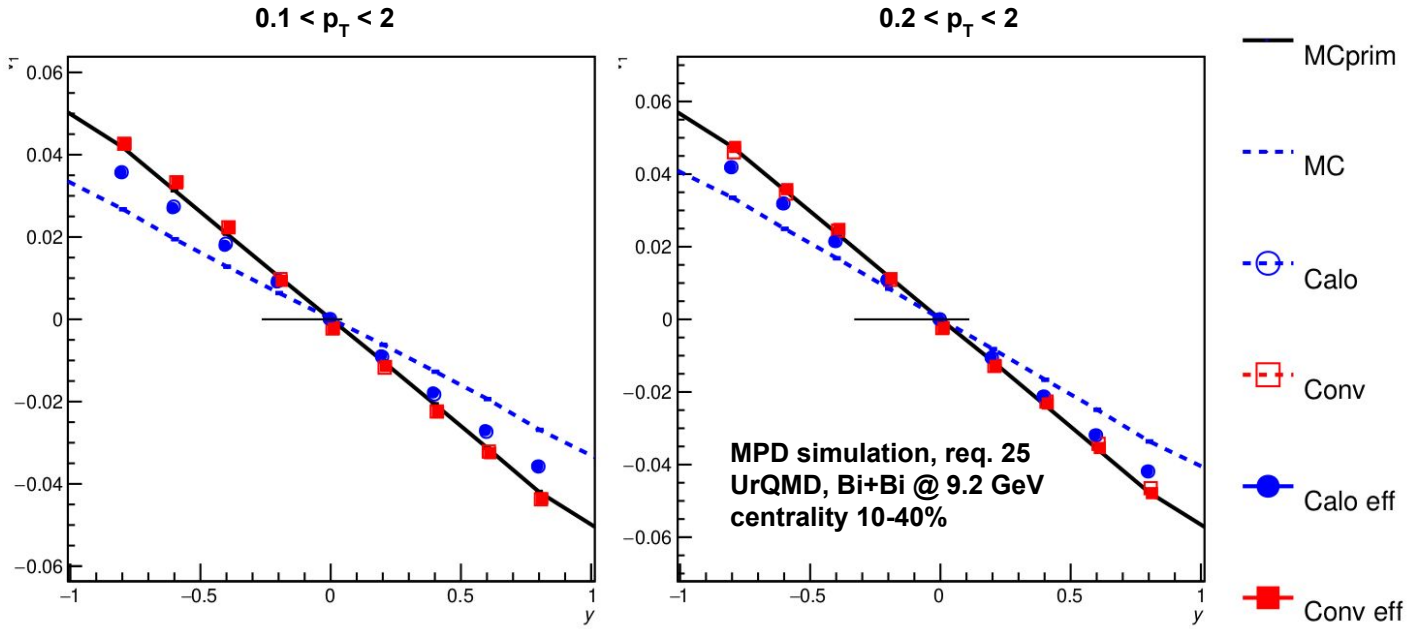
- Stronger effect on v_2 rapidity dependence.
- Both methods effective.

Effect of efficiency correction on photon and π^0 flow measurement

Notations at flow plots

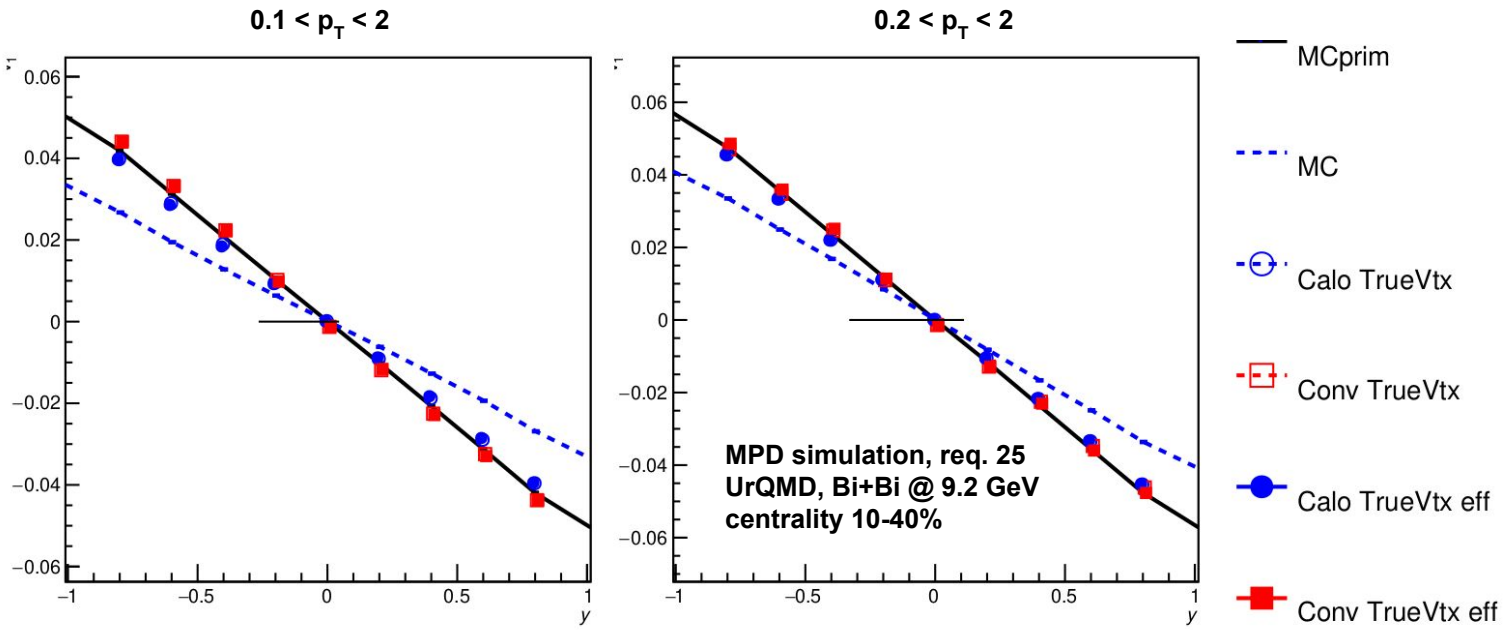
- Primary photon - photon produced in the vicinity of the primary vertex (DCA_{vtx}<1cm)
- **MCprim** - primary photons
- **MC** - all photons
- **Calo TrueVtx** - clusters with the main contribution from a primary photon
- **Conv TrueVtx** - track pairs descending from a primary photon

Photon $v_1(y)$



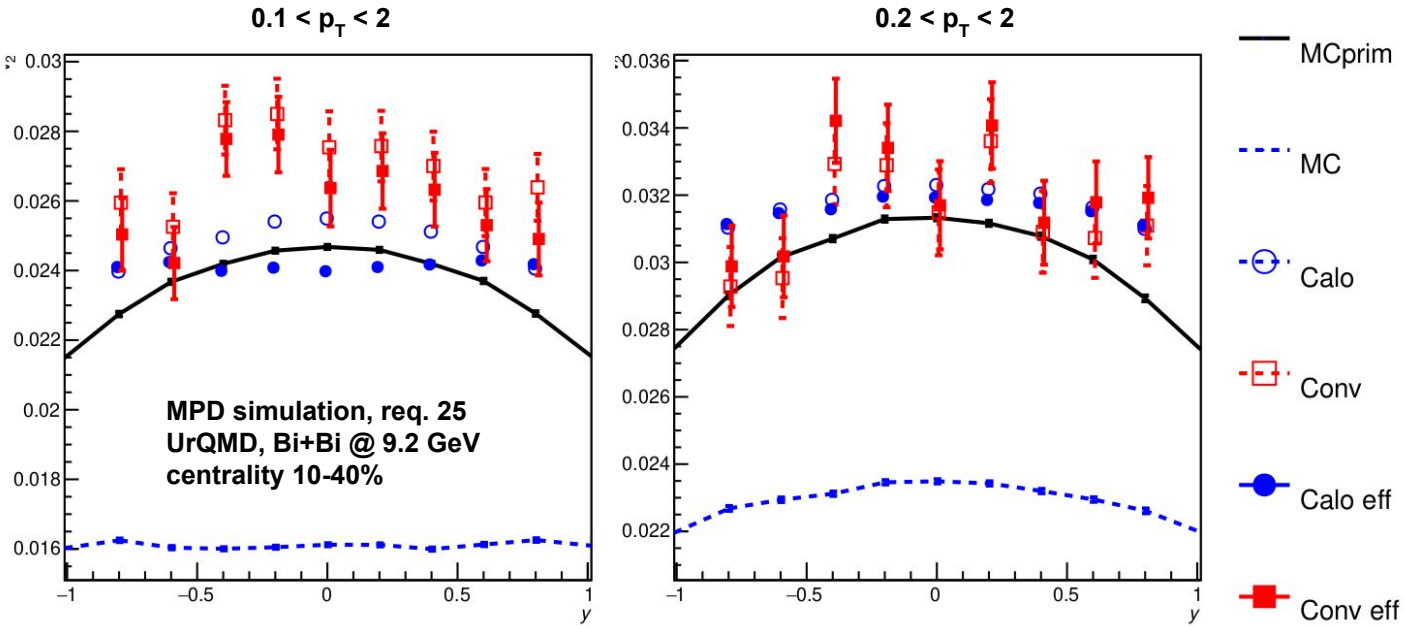
- Subtle effect of efficiency correction on $v_1(y)$
- Better agreement for conversion method.
  Less contamination by secondary photons?

True vertex photon $v_1(y)$



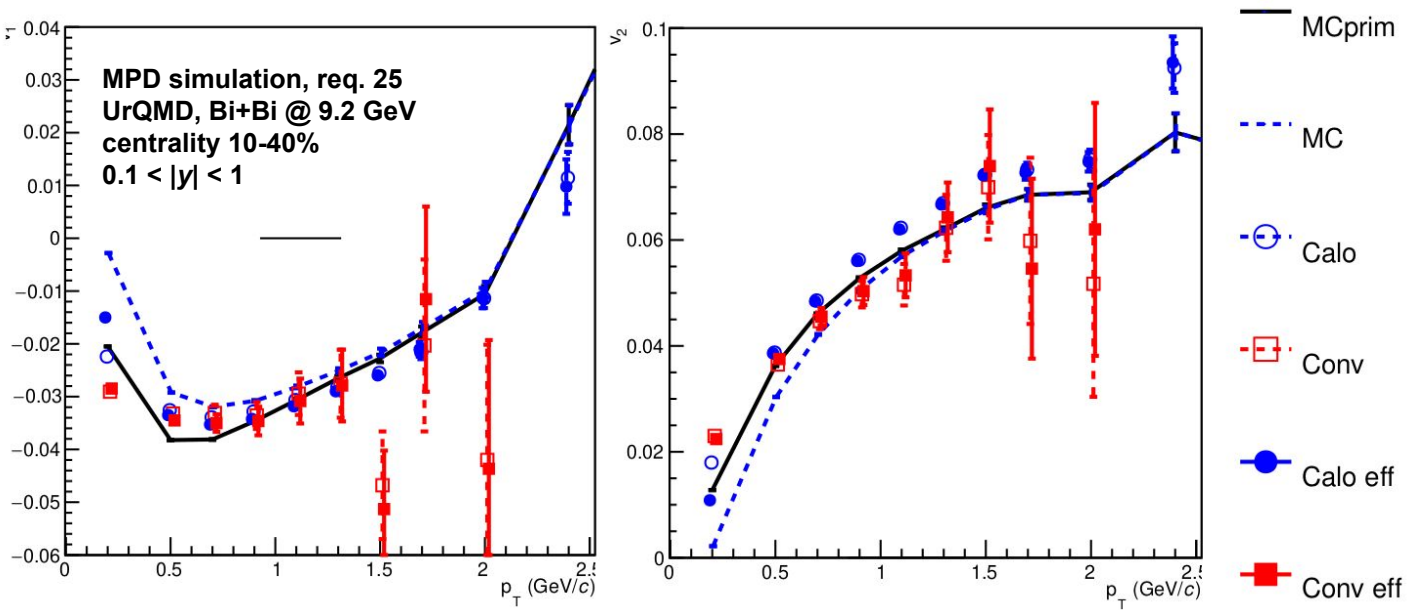
- Subtle effect of efficiency correction on $v_1(y)$
- Better agreement for conversion method.
  Less contamination by secondary photons?

Photon $v_2(y)$



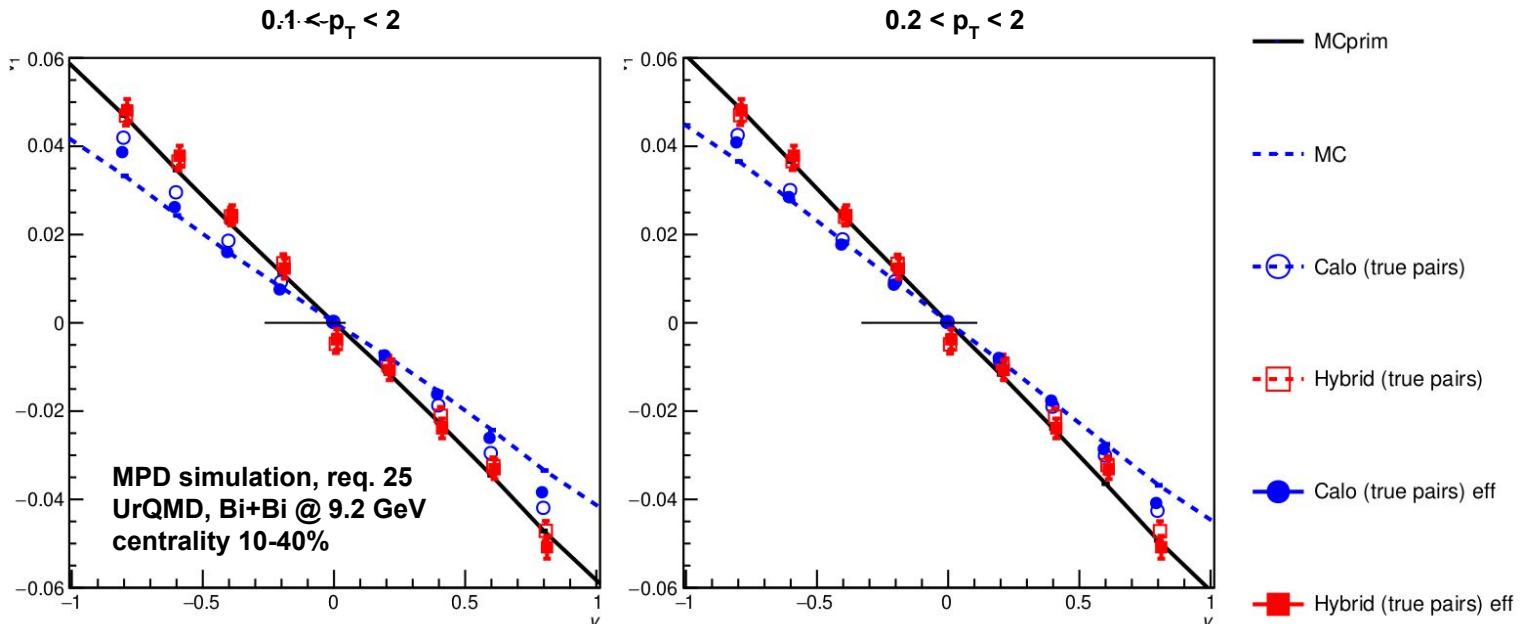
- Small effect of efficiency correction on $v_2(y)$ esp. including low p_T
- Conversion method requires more statistics.

Photon $v_{1,2}(p_T)$



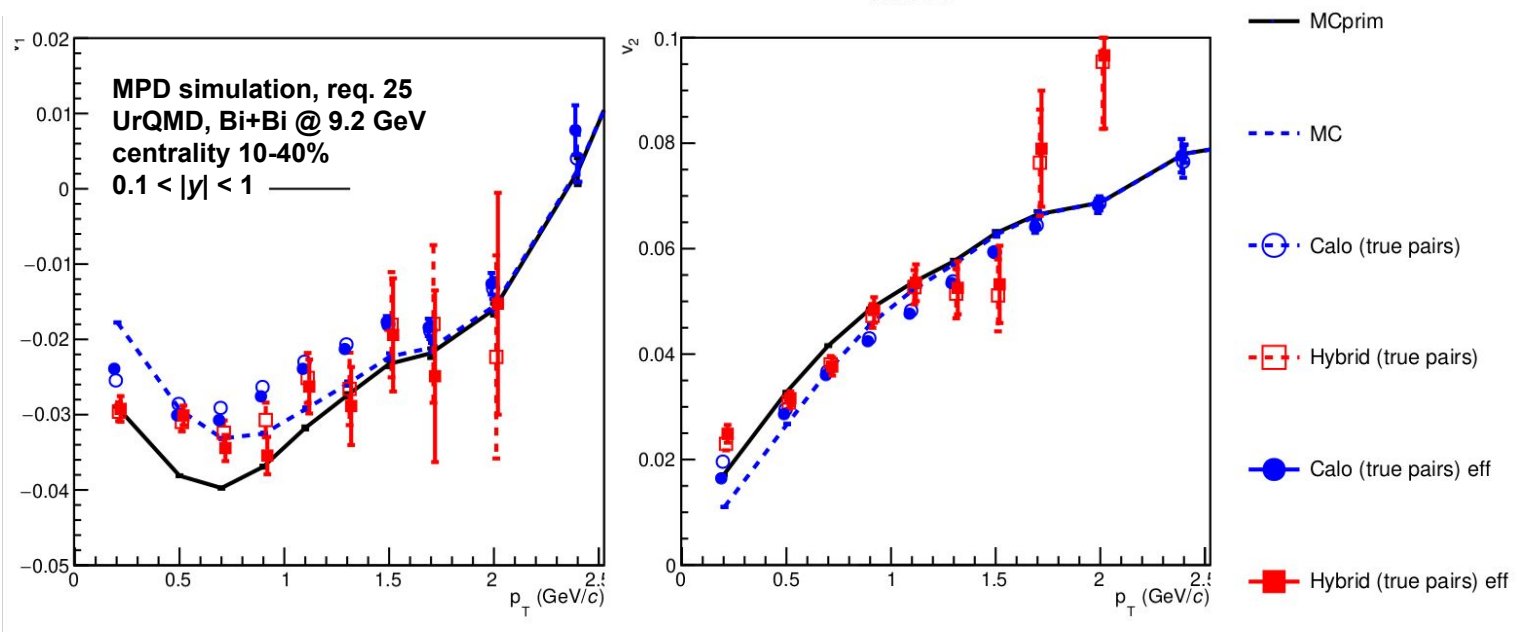
- Small effect of efficiency correction on measured $v_{1,2}(p_T)$
- Conversion method requires more statistics.

True π^0 $v_1(y)$



- Efficiency correction seems to be small but significant, esp. with low p_T.
- Hybrid method is closer to primary π^0 while calorimeter measurements reproduce the curve with all simulated π^0

True π^0 $v_{1,2}(p_T)$



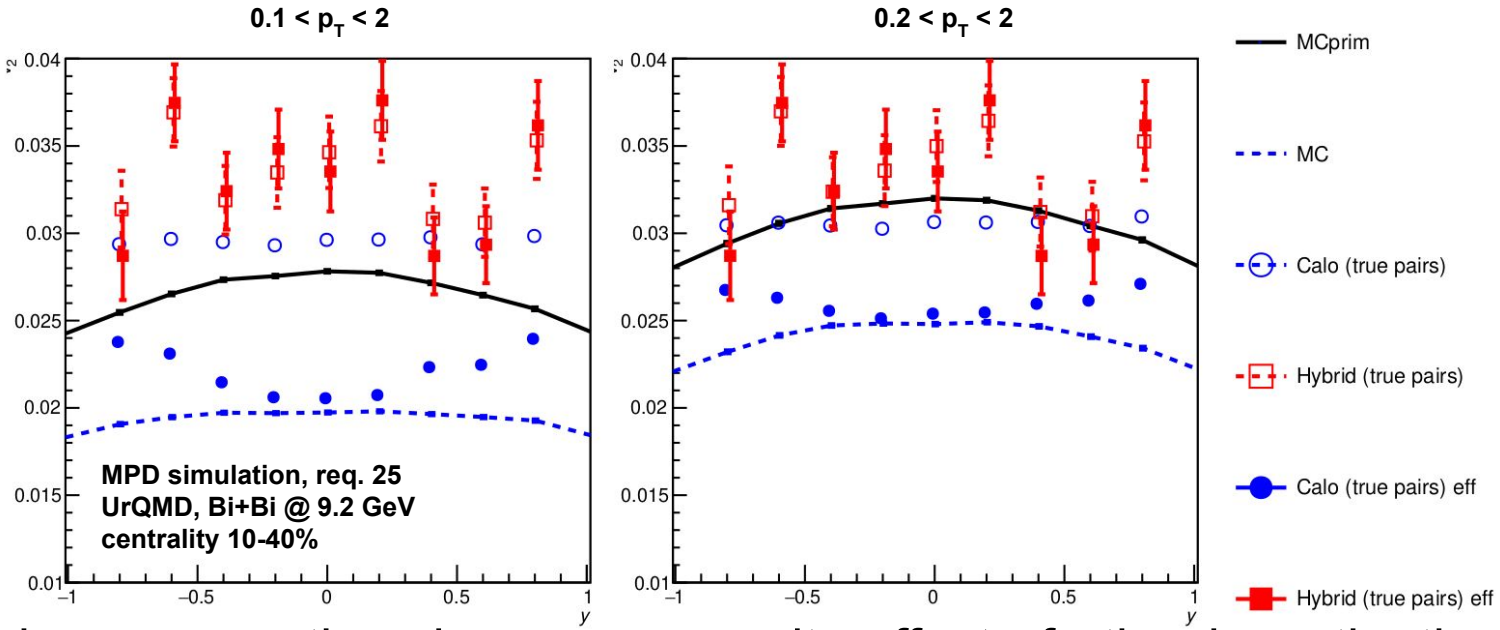
- Small effect of efficiency correction on measured $v_{1,2}(p_T)$
- Limited agreement of calorimeter measurement
- Conversion method requires more statistics.

Summary

- Effect of efficiency corrections on photon and π^0 flow measurements is small but still helps to improve agreement with the model input
- Steep drop of photon reconstruction efficiency with calorimeter at low p_T - try tuning cluster selection?
- In certain cases efficiency corrections do not allow to reproduce model input - the cause for the discrepancies needs to be investigated

Backup

True π^0 $v_2(y)$



- Efficiency correction shows an opposite effect - further investigation needed