

# $R_{pA}$ and $R_{AA}$

---

Yeonju Go  
28 Jan. 2014

- The process of measuring ‘nuclear modification factor’ of ‘inclusive isolated photon’.

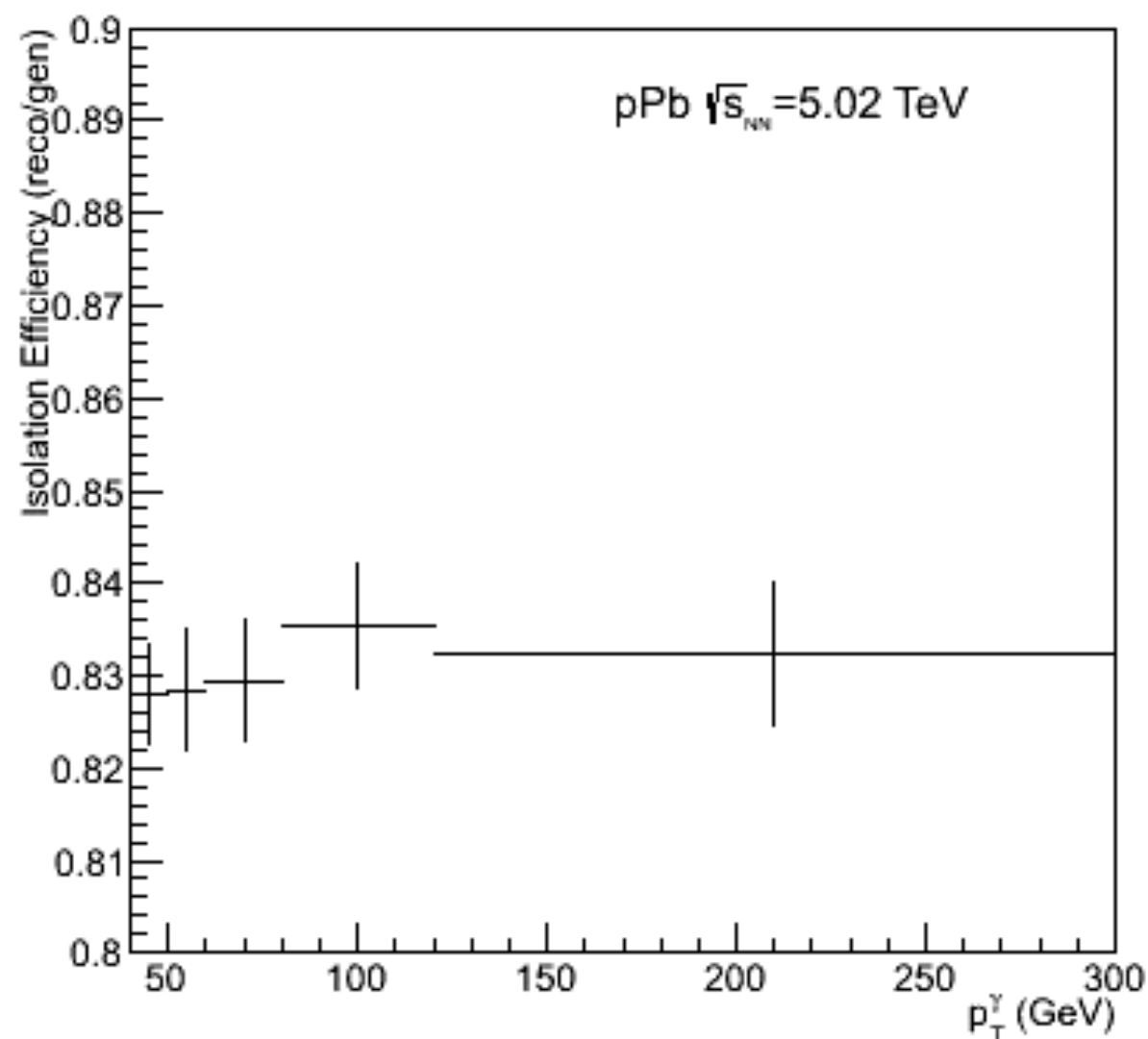
$$R_{AA}(p_T) = \frac{d^2 N_{ch}^{AA} / dp_T}{\langle T_{AA} \rangle d^2 \sigma_{ch}^{NN} / dp_T}$$

$$\langle T_{AA} \rangle = \langle N_{coll} \rangle / \sigma_{inelastic}$$

- It needs efficiency and purity correction

Isolation efficiency =  $\frac{reco}{gen}$  , 5  $p_T$  bin (GeV) : 40-50, 50-60, 60-80, 80-120, 120-300

pA



<Efficiency cut>

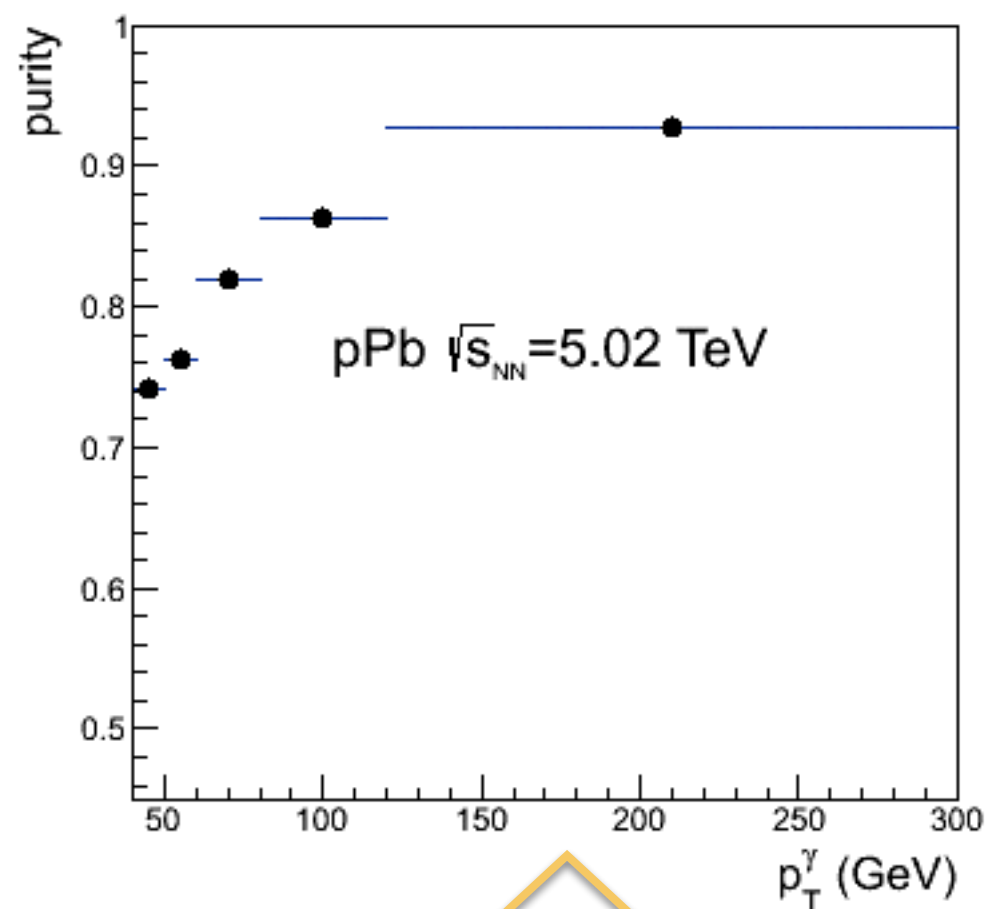
Gen condition :  $abs(momId) \leq 22 \ \&\& \ abs(\eta) < 1.44 \ \&\& \ H/E \text{ ratio} < 0.1 \ \&\& \ genIso < 5$

Reco condition : Gen condition + (Ecal Iso < 4.2 && Hcal Iso < 2.2 && Track Iso < 2)

reco isolation

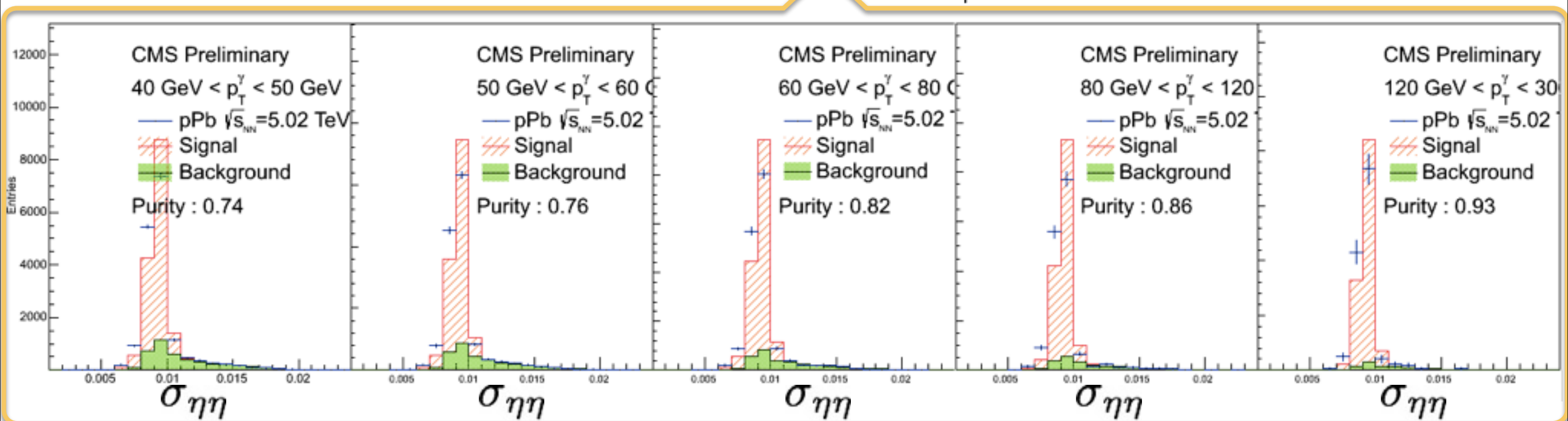
# Purity

pA



Purity is measured by using 'Shower Shape'

$$\text{Purity} = \text{signal} / (\text{bkg} + \text{signal})$$



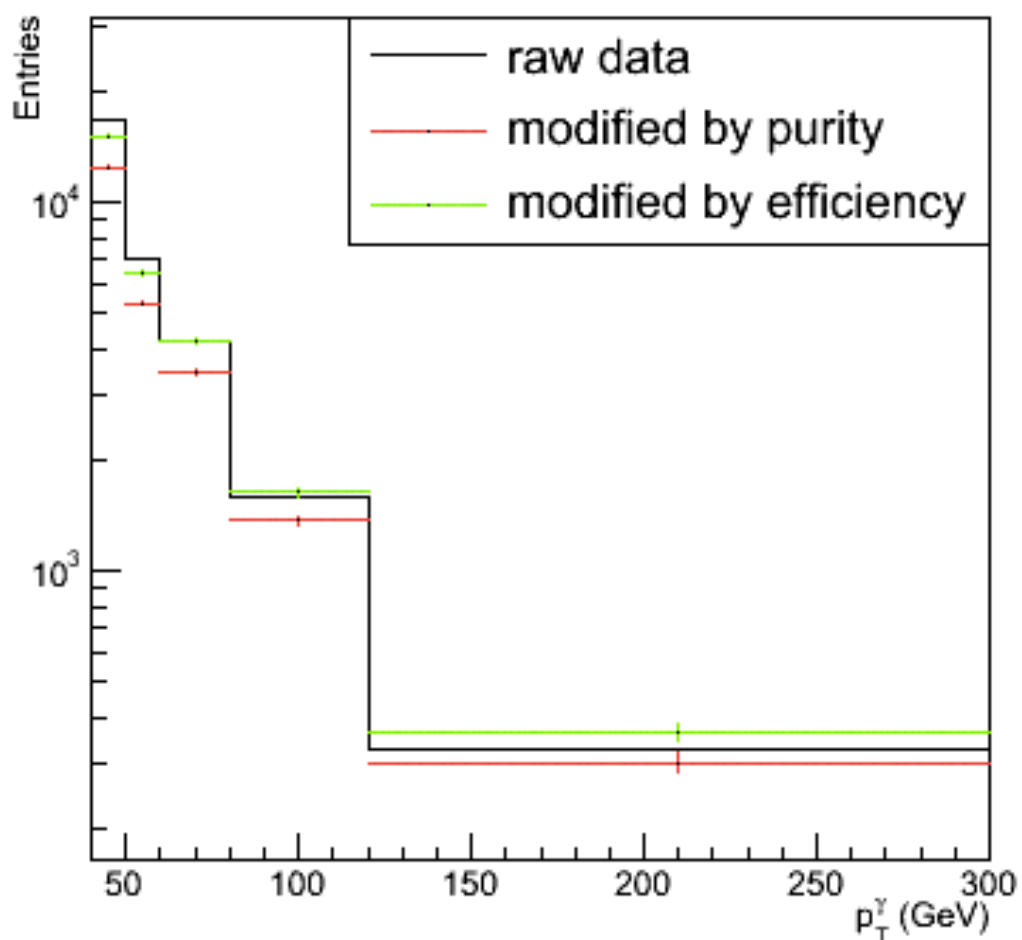
# of isolated photon = # of photon from data \* purity / isolation efficiency

pA

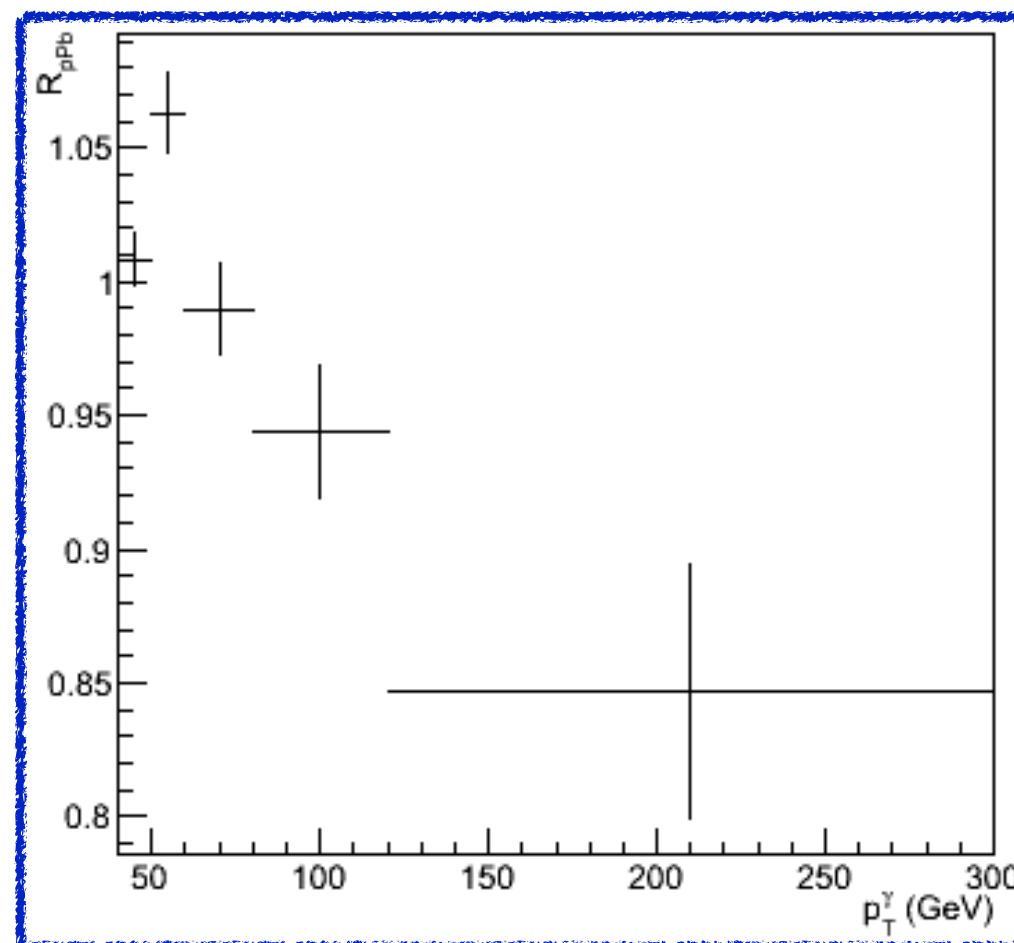
$$R_{pA} = \frac{N_{pA} \cdot \frac{1}{N_{inelastic}} \cdot \frac{1}{dp_T}}{\sigma_{pp} \cdot \frac{N_{coll}}{\sigma_{inelastic,pp}} \cdot \frac{1}{dp_T}}$$

For 5.02 TeV pp reference, I used the JETPHOX values  $d^2\sigma/dE_T/d\eta$  in nb/GeV

- |                       |                                     |
|-----------------------|-------------------------------------|
| 40-50 : 0.0715079     | • $N_{inelastic} = 2.11 * 35 * 1e9$ |
| 50-60 : 0.0289211     | • $N_{coll} = 6.9$                  |
| 60-80 : 0.0100936     | • $\sigma_{inelastic,pp} = 7e7$     |
| 80-120 : 0.00207405   |                                     |
| 120-300 : 0.000113533 |                                     |

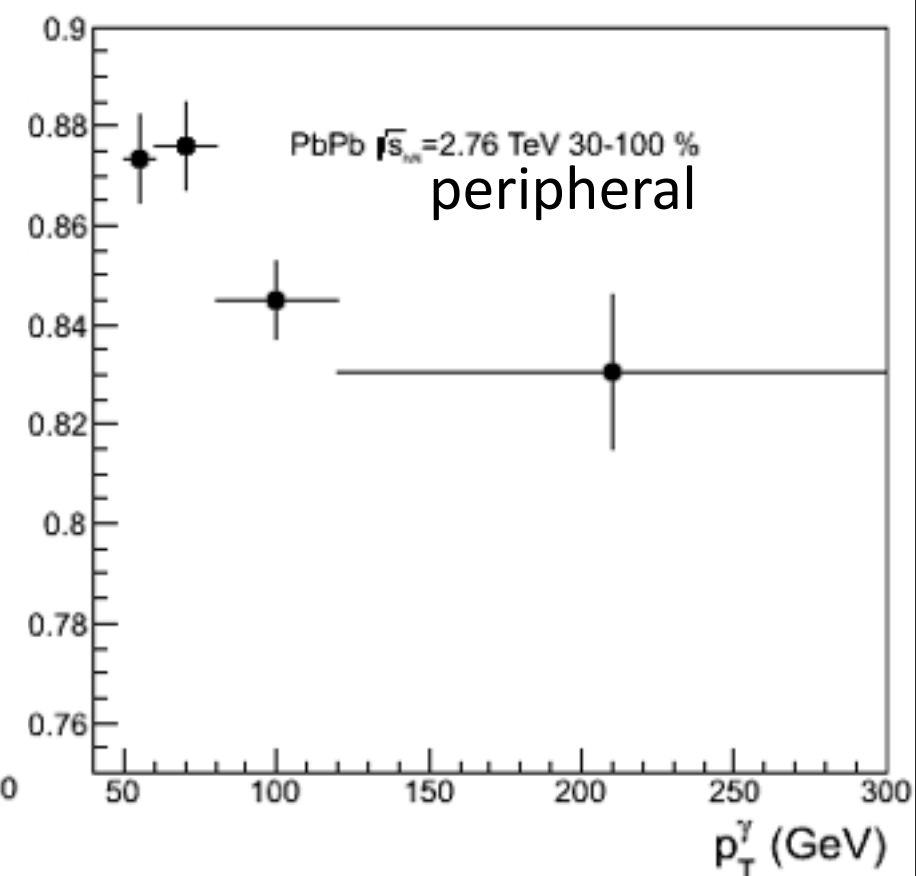
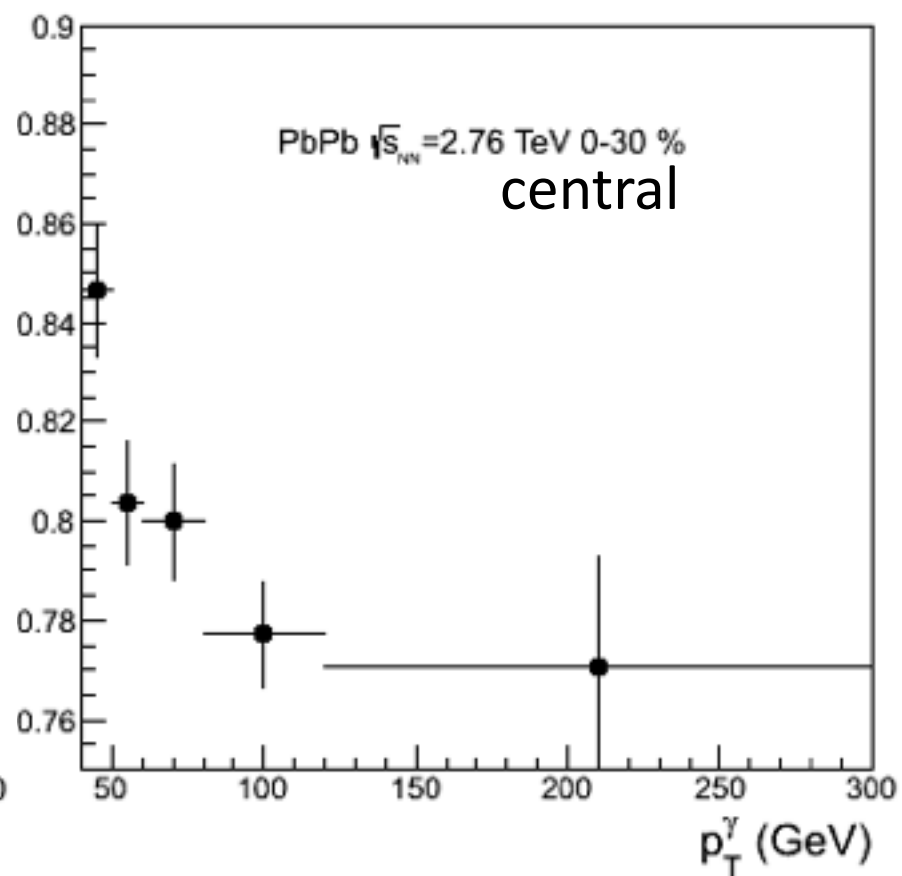
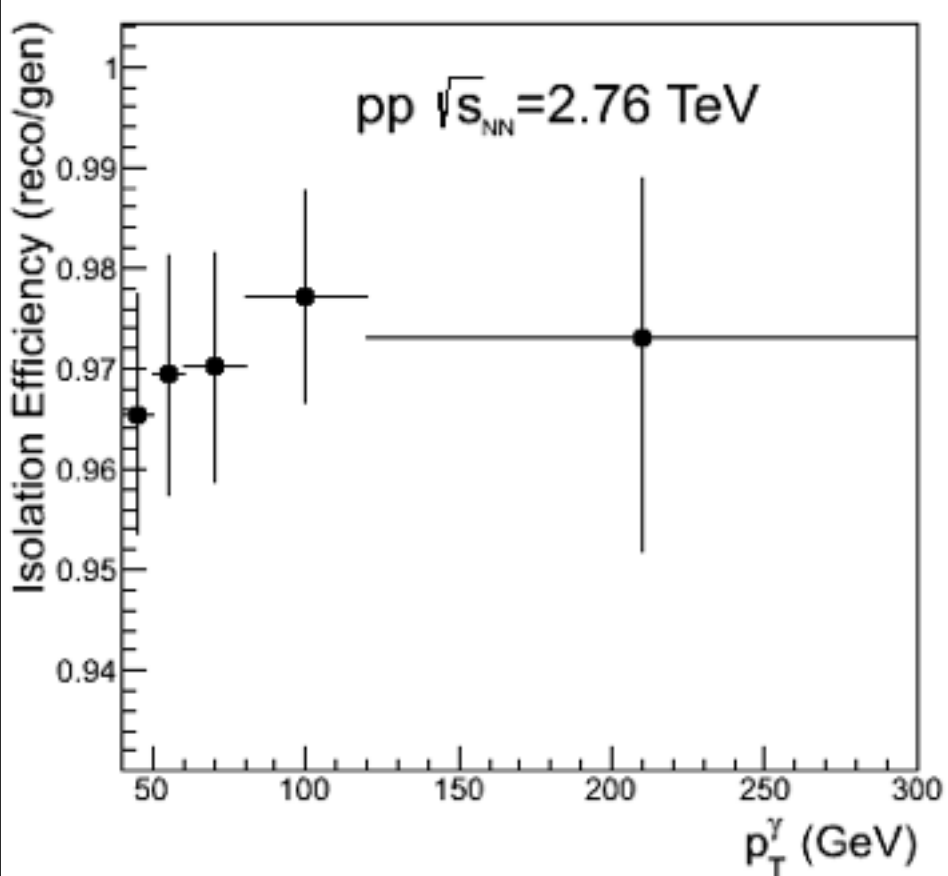


after correction



5  $p_T$  bin (GeV) : 40-50, 50-60, 60-80, 80-120, 120-300

PbPb



<Efficiency cut>

Gen condition :  $\text{abs}(\text{momId}) \leq 22 \ \&\& \ \text{abs}(\text{eta}) < 1.44 \ \&\& \ \text{H/E ratio} < 0.1 \ \&\& \ \text{genIso} < 5$

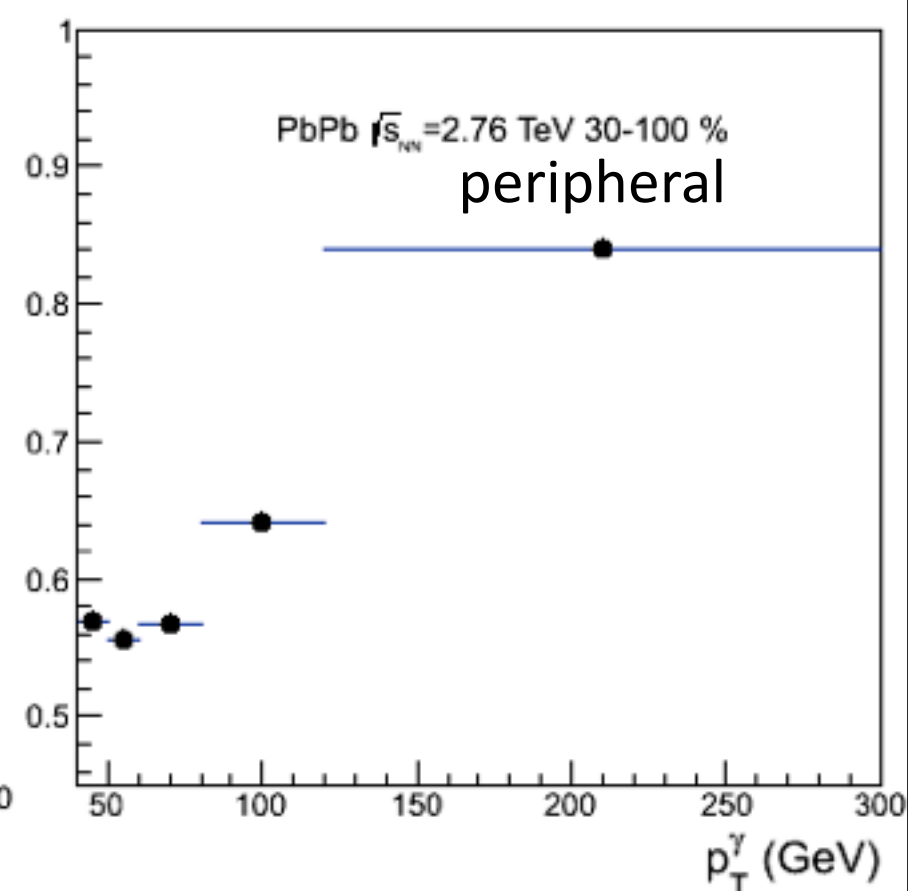
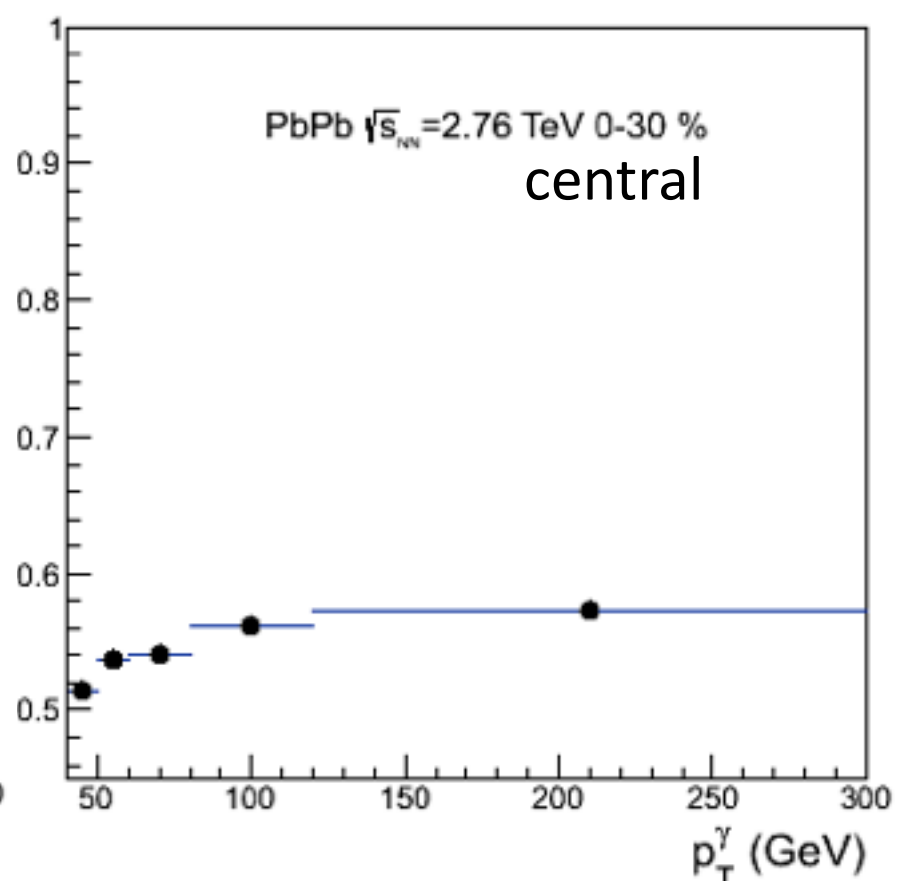
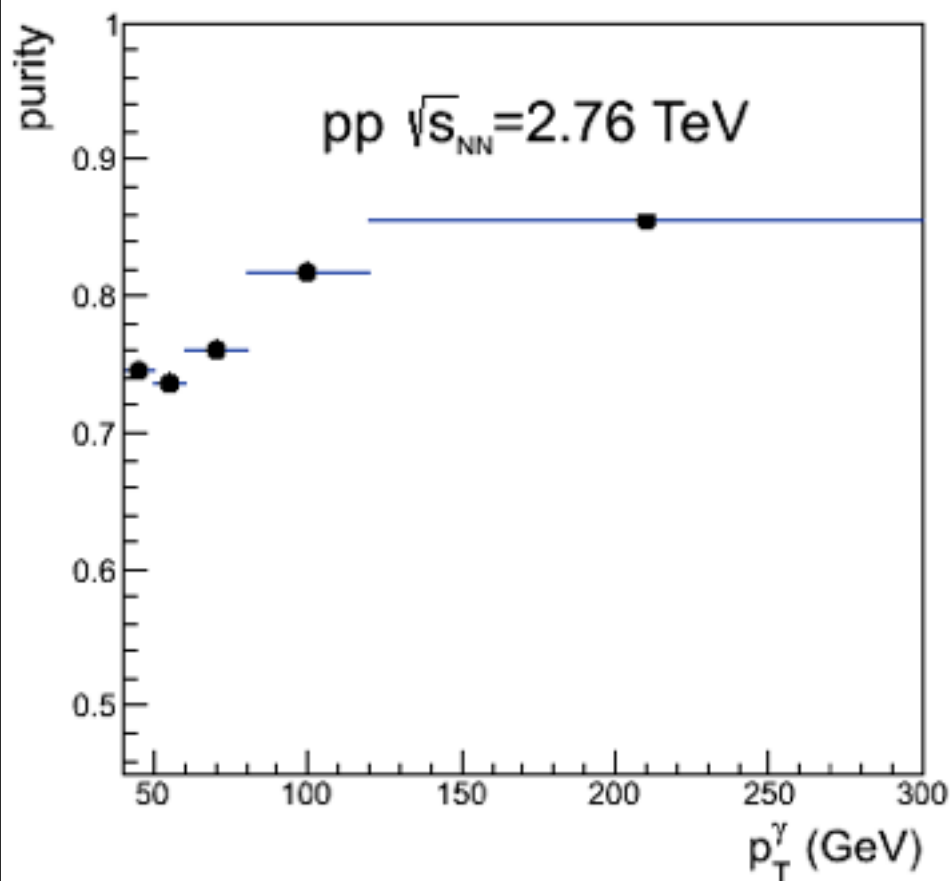
Reco condition(**pp**) : Gen condition + (Ecal Iso < 4.2 && Hcal Iso < 2.2 && Track Iso < 2)

Reco condition(**PbPb**) : Gen condition + (Sum Iso < 1) [reco isolation](#)

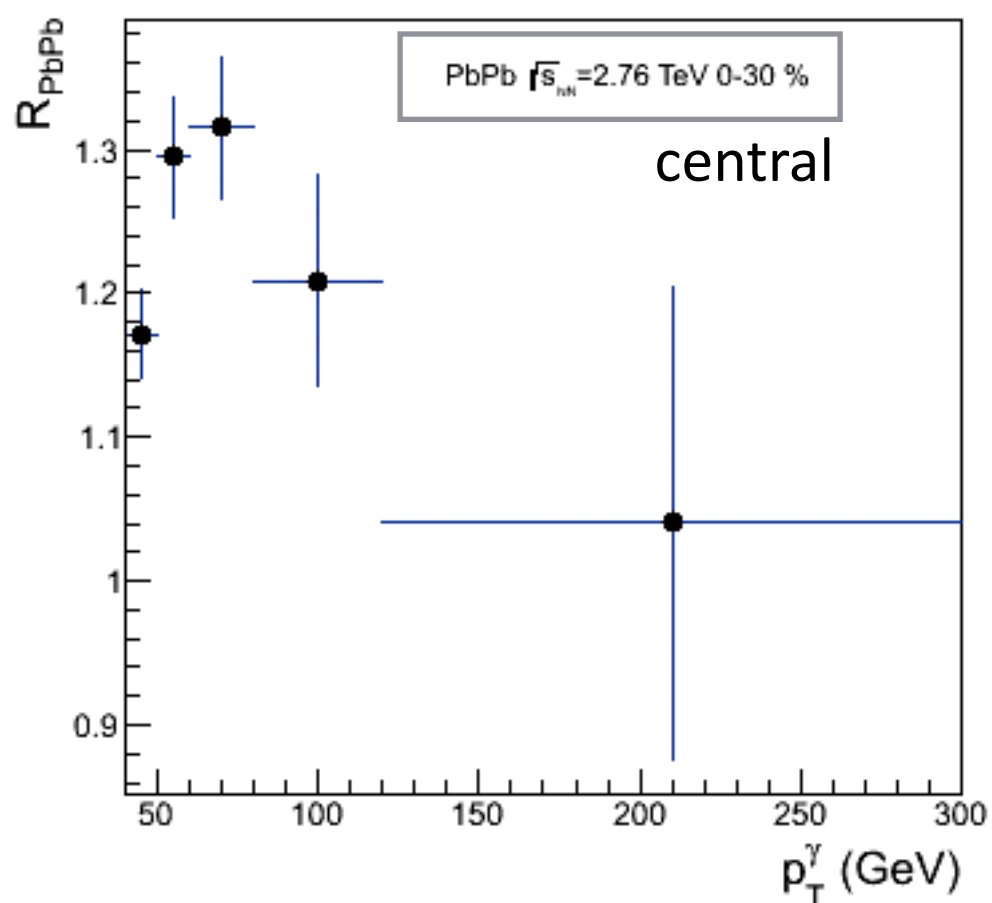
# Purity

5  $p_T$  bin (GeV) : 40-50, 50-60, 60-80, 80-120, 120-300

PbPb

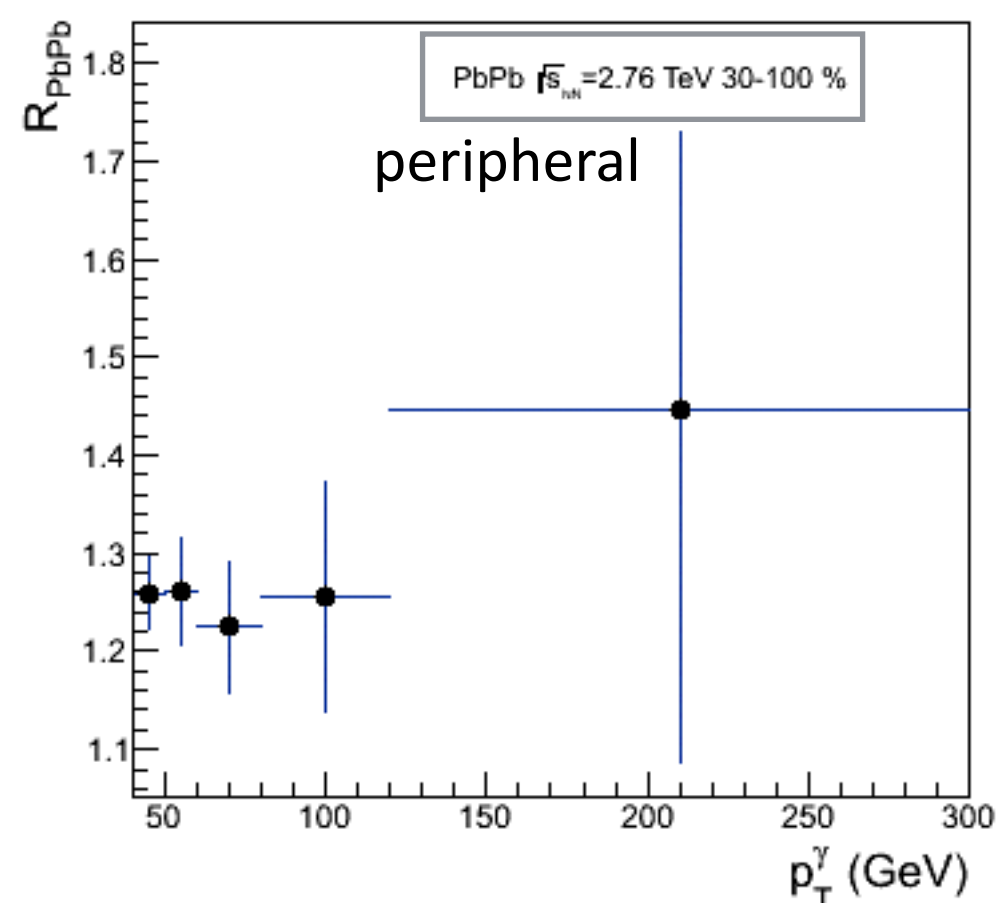


$$R_{AA}(p_T) = \frac{d^2 N_{ch}^{AA} / dp_T d\eta}{\langle T_{AA} \rangle d^2 \sigma_{ch}^{NN} / dp_T d\eta}$$



<PbPb 0-30%>

- $N_{MB} = 7.66 * (150 * 1e6) * 0.3$
- $\langle T_{AA} \rangle = 15.5 \text{ mb}^{-1}$



<PbPb 30-100%>

- $N_{MB} = 7.66 * (150 * 1e6) * 0.7$
- $\langle T_{AA} \rangle = 1.44 \text{ mb}^{-1}$



- It also need centrality re-weighting correction.