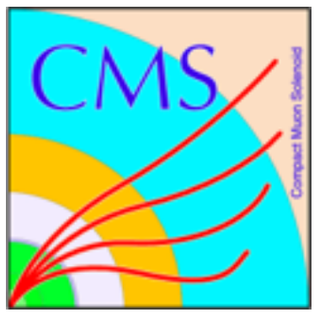
Plan for the photon performance poster in ISMD & Gamma-jet 5 TeV Results

14 Jul. 2016

Yeonju Go



Status

- **Gamma-jet analysis conditionally pre-approved**
  - TODOs
    - Alterations to mixed-event background subtraction
    - Photon isolation systematic
    - Jet residual correction
    - Theory comparisons
  - Target approval date is Sep 2, 2016

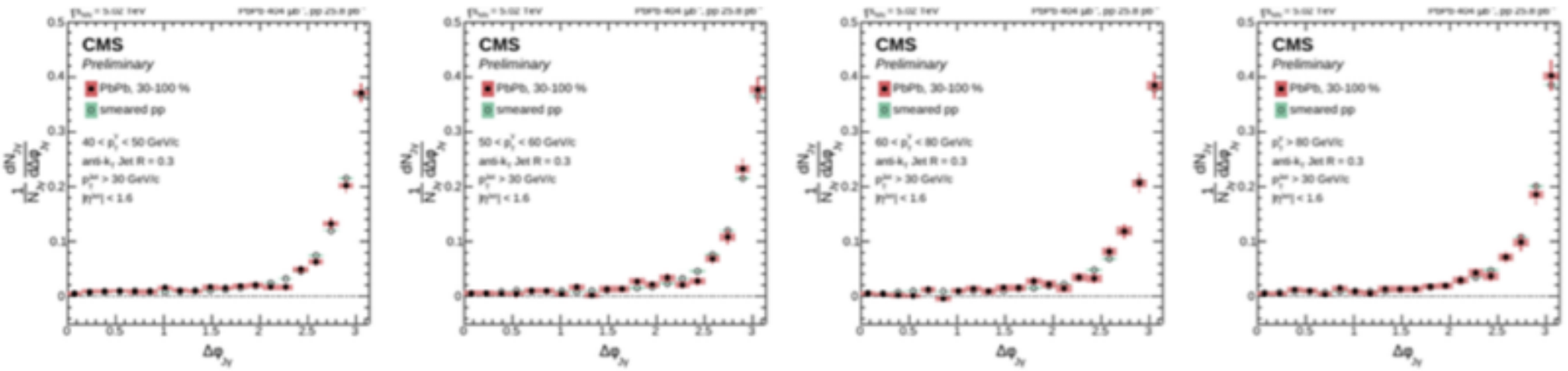
- **Submitted poster presentation for isolated photon performance at ISMD conference**
  - Photon Trigger Efficiency
  - Photon Isolation Efficiency
    - ROC curves for different isolation variables
  - Photon Purity
    - MVA method
    - signal template shift correction using Z->ee Data/MC difference
    - different background template using sideband cut variation

  - Possibility of using 5 TeV data will be discussed at tomorrow HI EGamma meeting

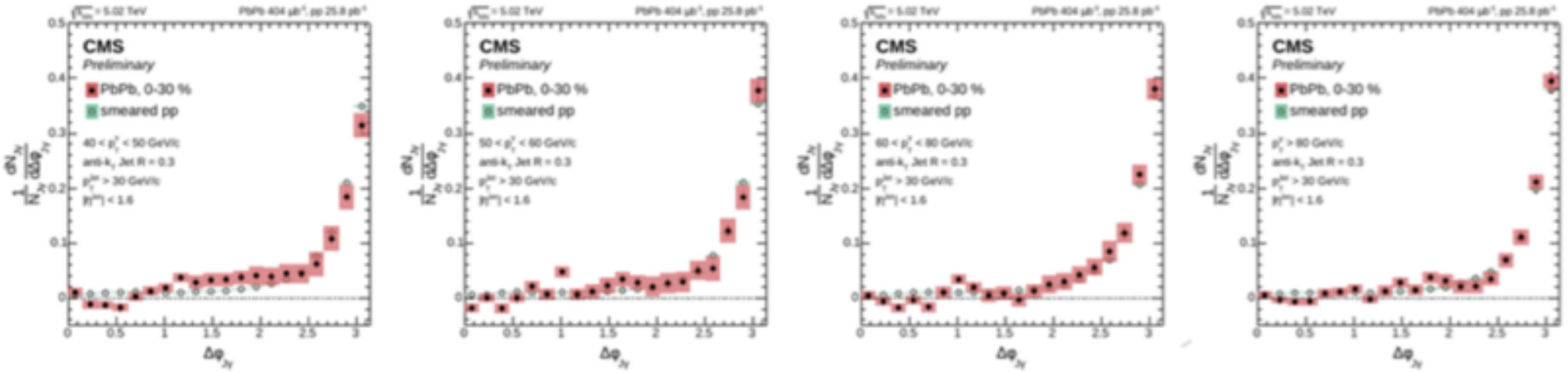
Δφ

40 < p_T^γ < 50 GeV | 50 < p_T^γ < 60 GeV | 60 < p_T^γ < 80 GeV | p_T^γ > 80 GeV

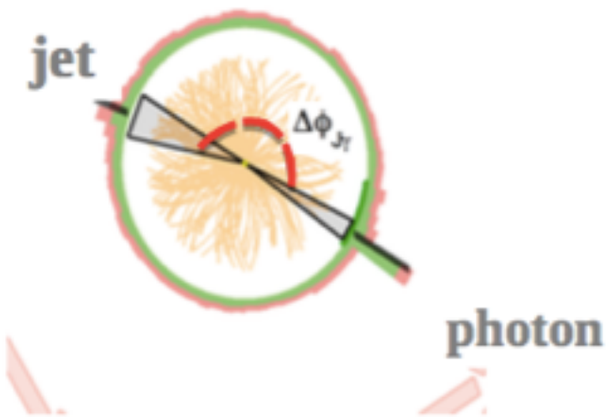
30-100%



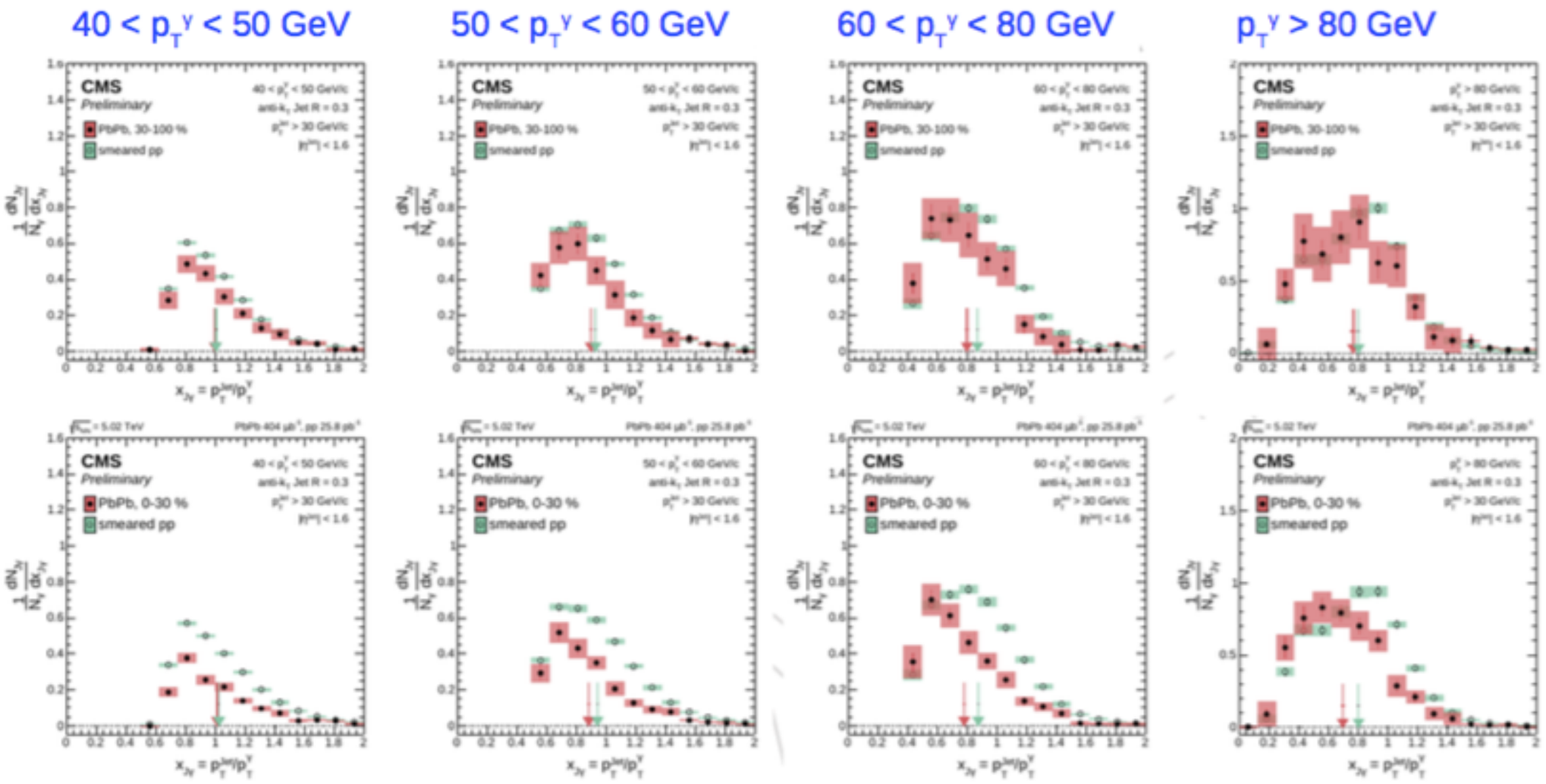
0-30%



- Δφ between the photon and each jet in the event
- Differences from pp would imply angular deflection of jets in the medium
- Central, low photon p_T bins show structure (discussed later)
- High photon p_T bins show agreement with pp within errors



XJγ (= pTJet /pTphoton)



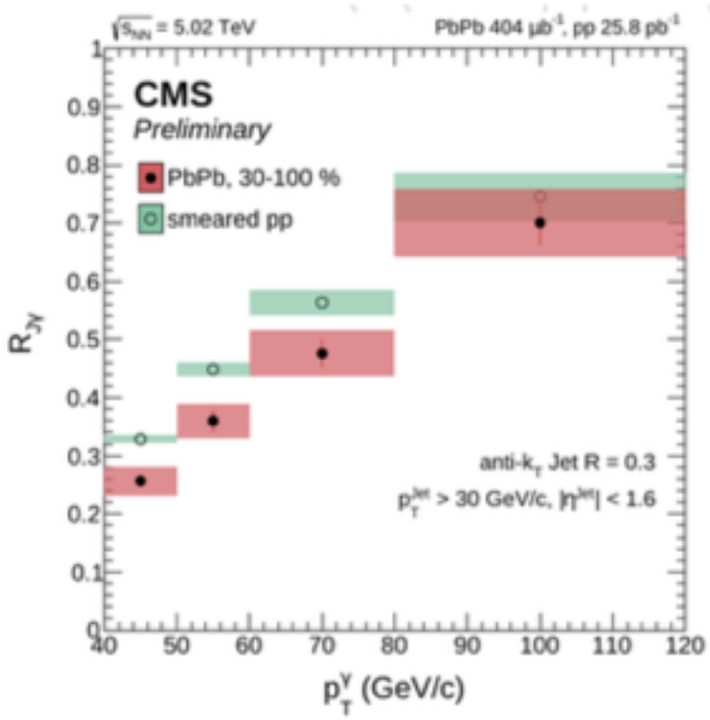
- Ratio of jet energy over photon energy
- Normalization is by number of photons
- Low photon p_T, dominant effect is suppression of PbPb
  - integral of PbPb is lower than pp
  - jets are quenched below the kinematic cuts and “lost”
  - more suppression in central events

- High photon p_T, dominant effect is shift of mean to lower $X_{Jγ}$
  - integral of PbPb rises
  - jets are quenched, shifts distribution left
  - more energy loss in central events

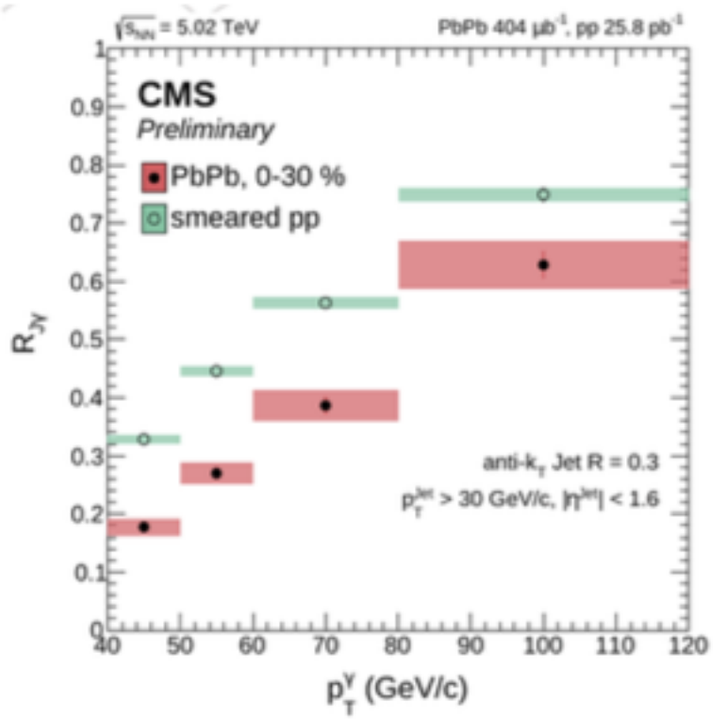
RJγ (= Integral of XJγ)

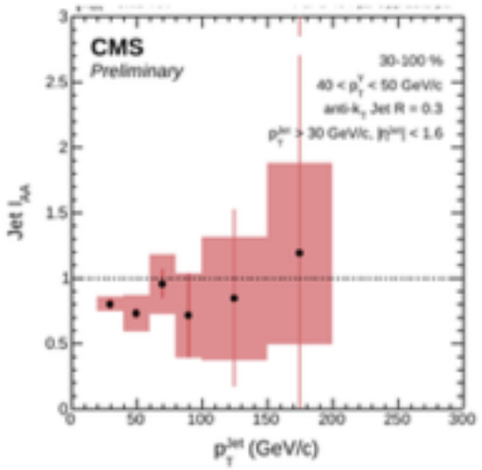
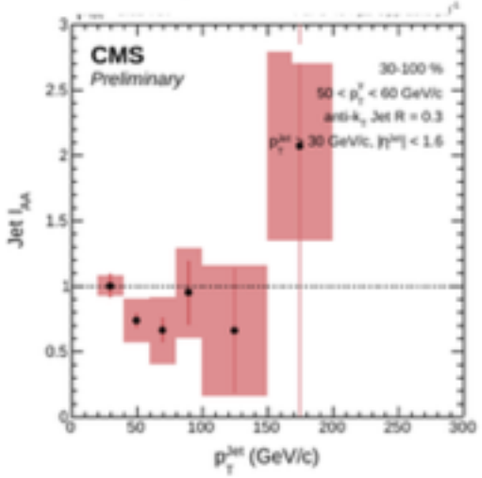
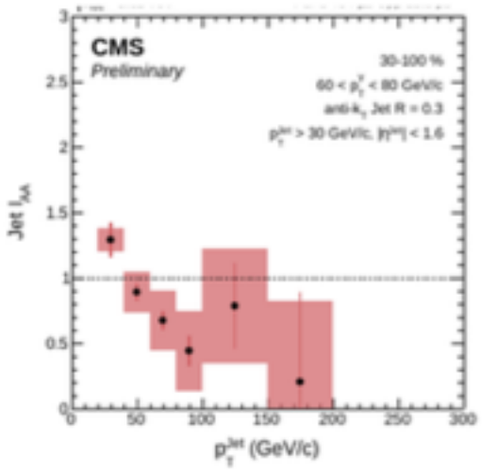
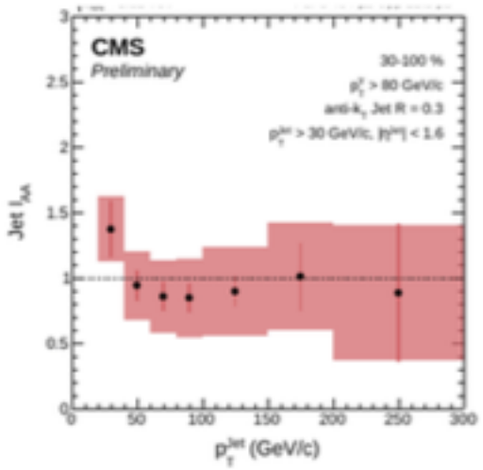
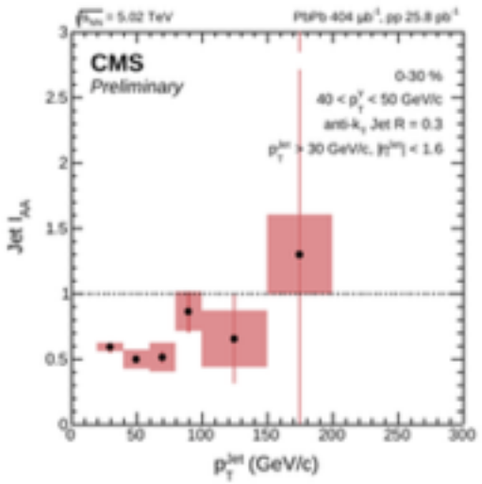
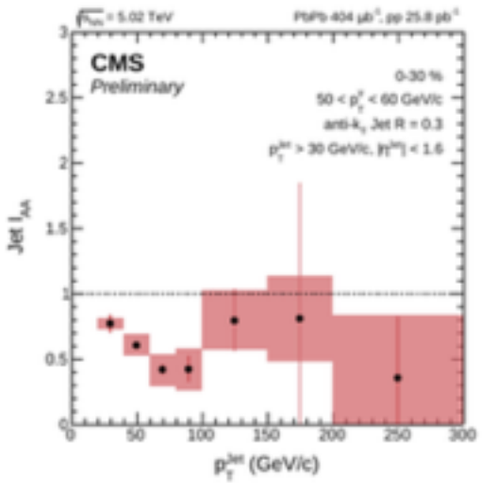
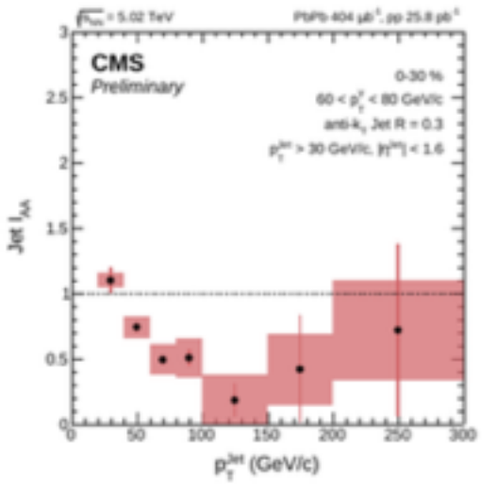
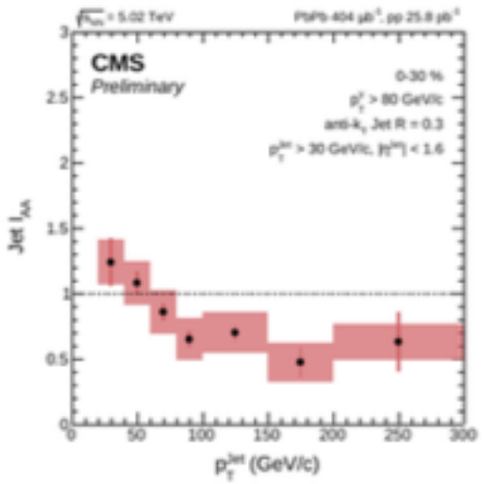
- Integral of distributions from slides 24, 25
- Roughly, $R_{Jγ}$ is the fraction of photons with a jet partner inside the kinematic cuts
- More jets “lost” in central events
- PbPb – pp difference roughly constant over photon p_T range, perhaps decreasing slightly

30-100%



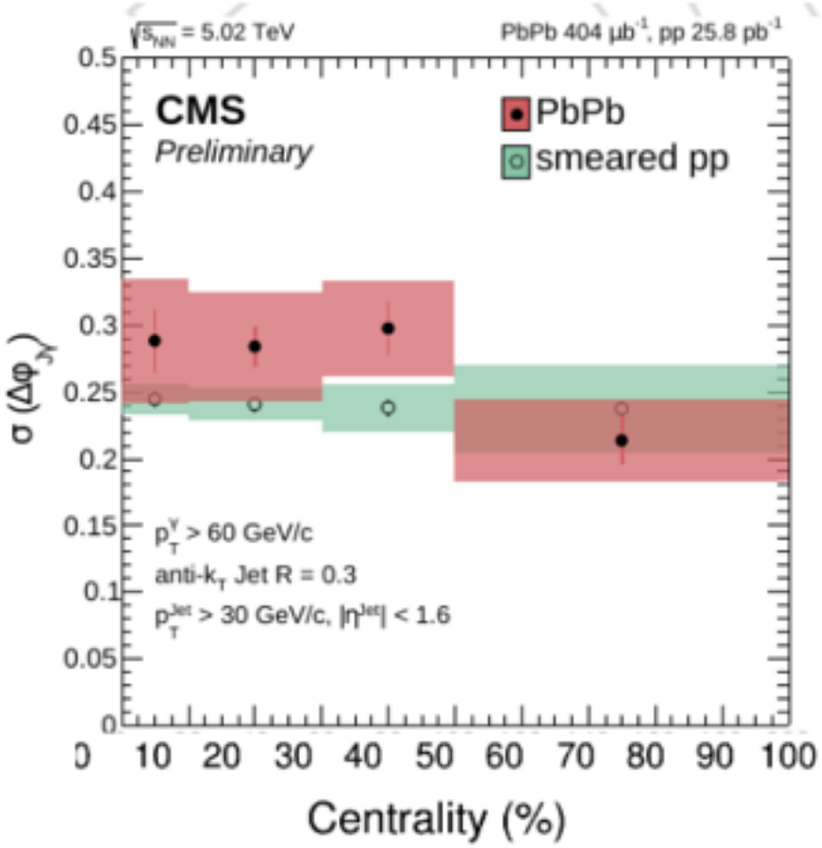
0-30%

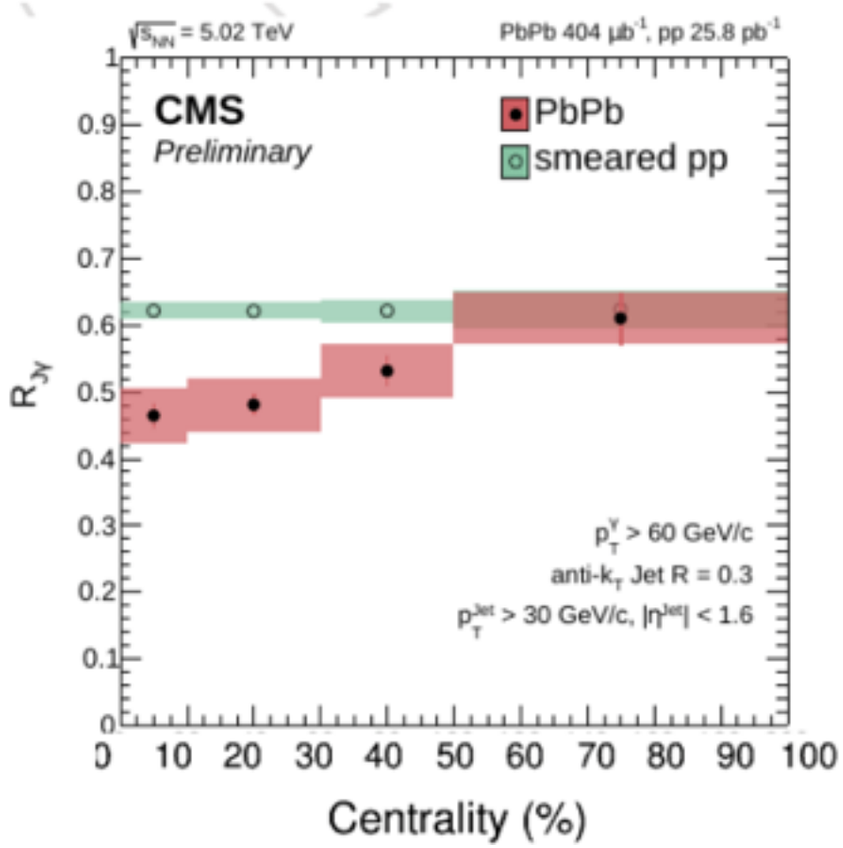


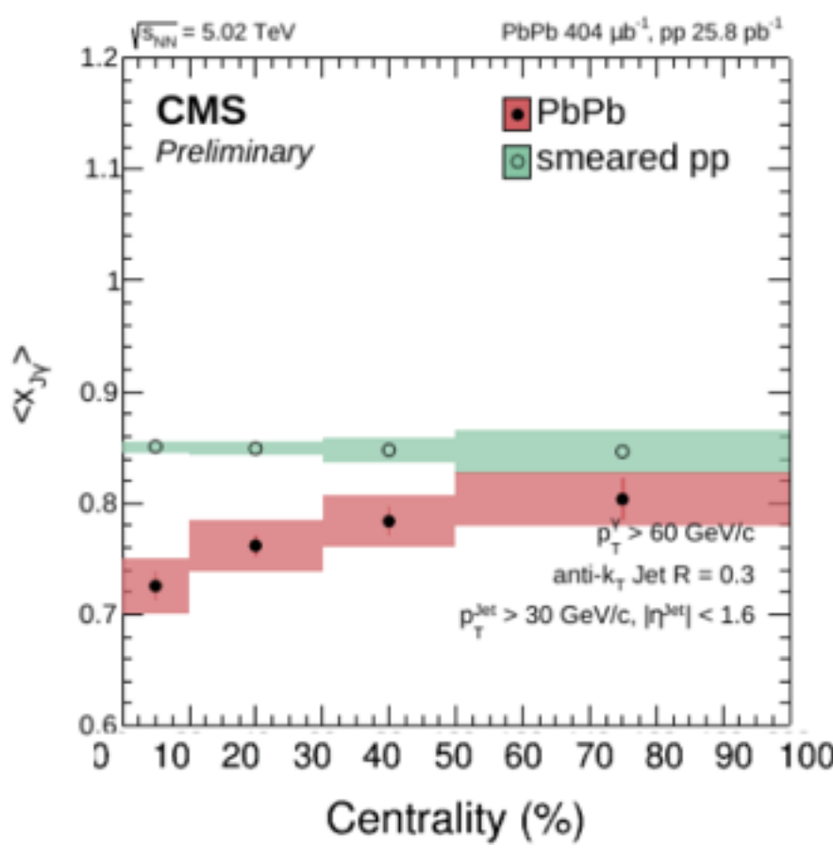
	$40 < p_T^\gamma < 50$ GeV	$50 < p_T^\gamma < 60$ GeV	$60 < p_T^\gamma < 80$ GeV	$p_T^\gamma > 80$ GeV
30-100%				
0-30%				

- Ratio of matched jet spectra in PbPb over pp
- Below 1 means fewer jets at the same energy in PbPb than pp
- low photon p_T bins show suppression of jets in PbPb compared to pp
- high photon p_T bins show transfer of jets from high p_T to low p_T

Centrality dependence





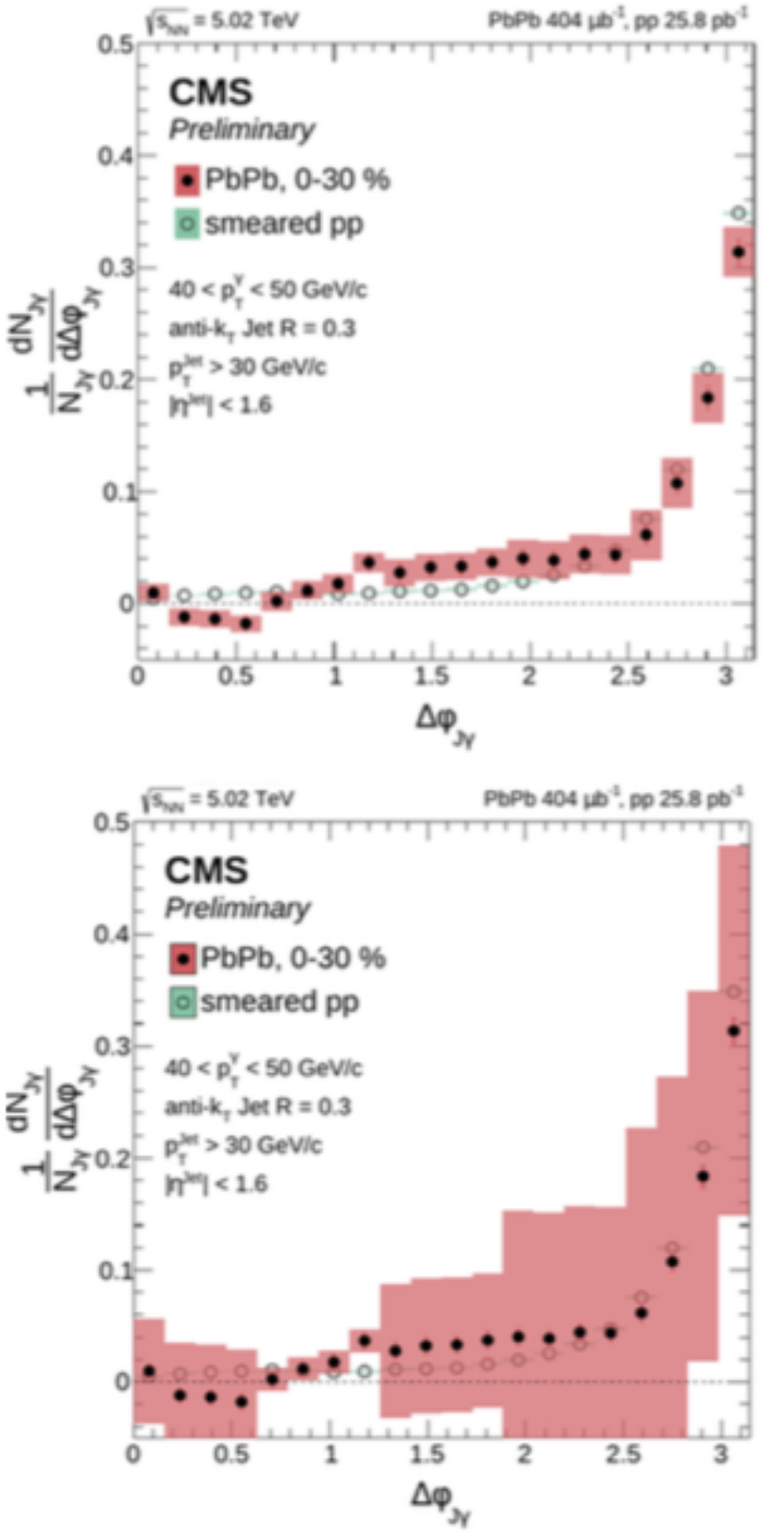


- **no significant difference in delta phi between PbPb and pp**
- **Rjg decreases as a function of centrality. More jets “lost” in central events.**
- **shift of <Xjg> to lower energy significant as a function of centrality**

BACK UP

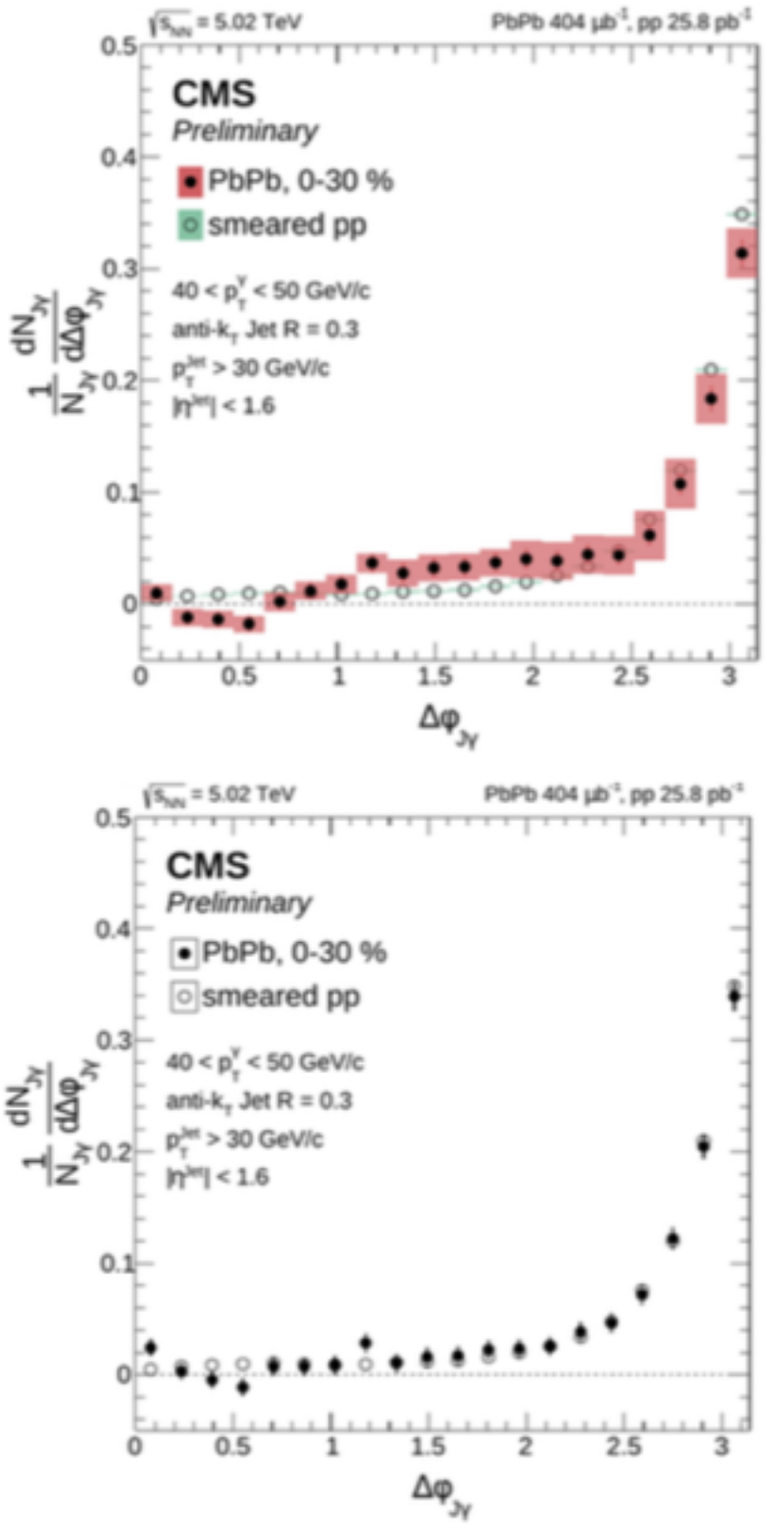
Mixed Event Jet Subtract

- Significant structure is observed in the Δφ correlations after mixed-event subtraction
- First cross-check is to use a sideband in Δφ to do the subtraction rather than the mixed events
- The difference between the nominal and Δφ sideband method is shown as an uncertainty to the right ->



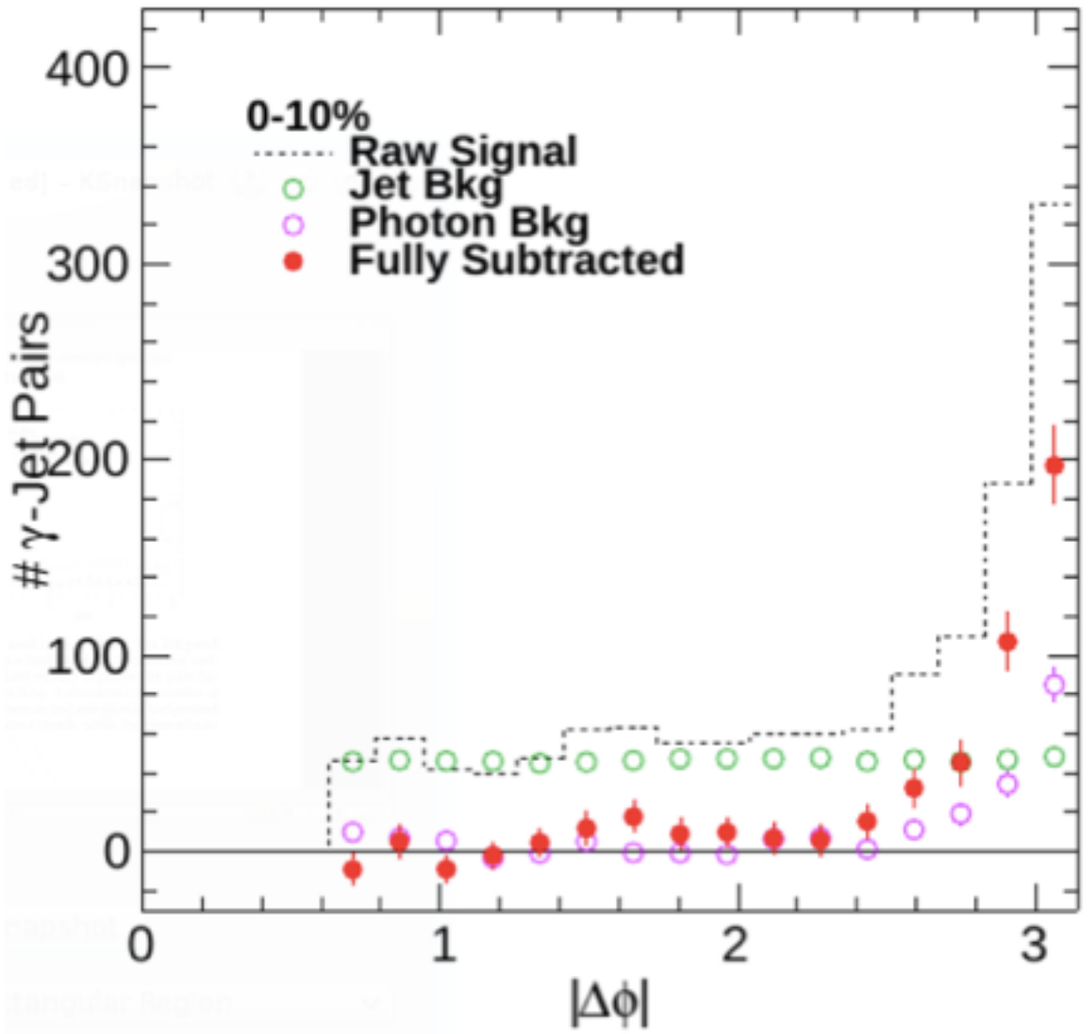
Mixed Event Jet Subtract

- Structure could be due to correlations caused by photon isolation requirement – no isolation is imposed on the mixed event.
- Isolation cut causes photons to preferentially sit on low background (like v2 trough, or fluctuation)
- One approach is to bin mixed events into v2 event plane angles, causes much better agreement with pp →
- Method needs higher statistics MC to validate – DIGI-RECO finished this week, did not make freeze



Mixed Event Jet Subtract

- A significant background from uncorrelated UE "fake" jets
- Mix photons into minbias events, subtract the uncorrelated background
- Must account for photon background from neutral mesons already subtracted



$$\frac{dN^{Corr}}{dx} = \frac{N^{Raw}}{dx} - \frac{dN^{Bkg\ Jet}}{dx} - \left(\frac{dN^{Bkg\ \gamma}}{dx} - \frac{dN^{Bkg\ \gamma,Bkg\ Jet}}{dx}\right)\alpha,$$

Systematic : electron rejection

- Electrons can be reconstructed as isolated photons
  - Rejected by matching to electron candidates within a 0.3 square in η and φ of the photon candidate
- Before rejection, the fraction of isolated photons matched to gen-level electrons was 5.79%
- After rejection, the fraction of isolated photons matched to gen-level electrons was 2.10%
- The total variation between turning rejection on/off, scaled by the remaining fraction of electrons (57%) was quoted as the uncertainty
- Fraction of electrons rejected in data was 3.76% (consistent with MC fraction
- Fraction of good photons rejected in MC was 0.68%