the role of jet collimation in jet quenching

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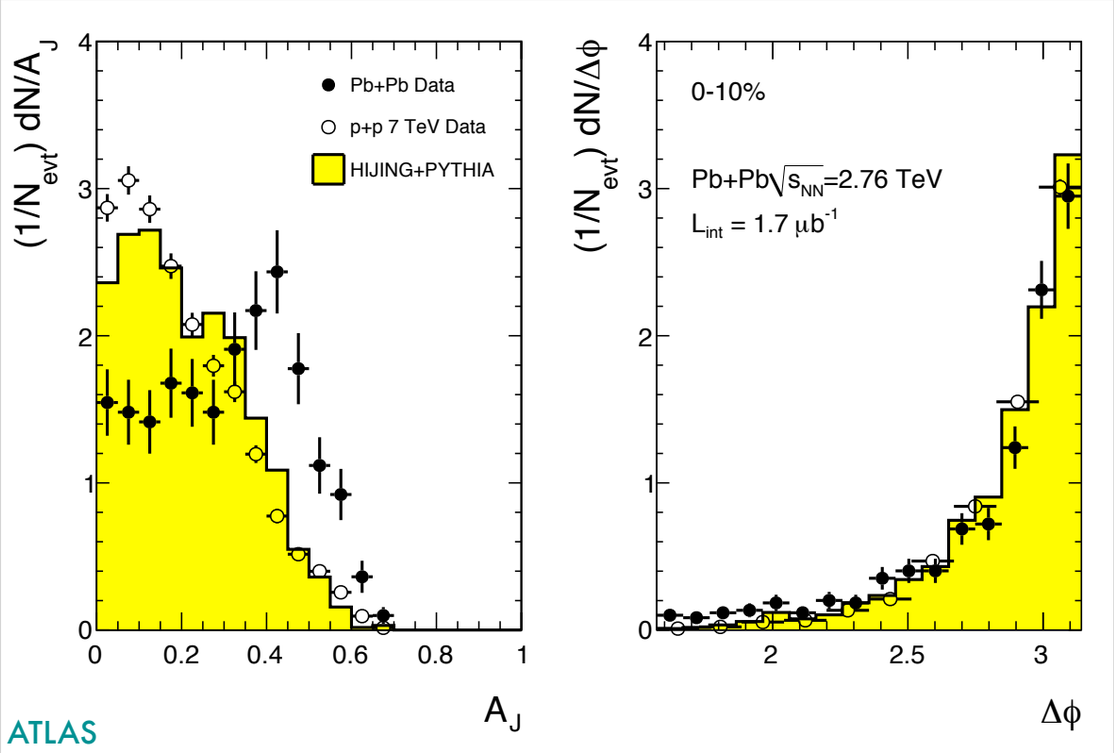
CENTRA-IST (Lisbon) & CERN PH-TH

[with J. Casalderrey and U. Wiedemann]

Hard Probes 2012, Cagliari, 29th May 2012

jet collimation [circa 2010]



- sizeable displacement of asymmetry distribution
- no change in azimuthal distribution

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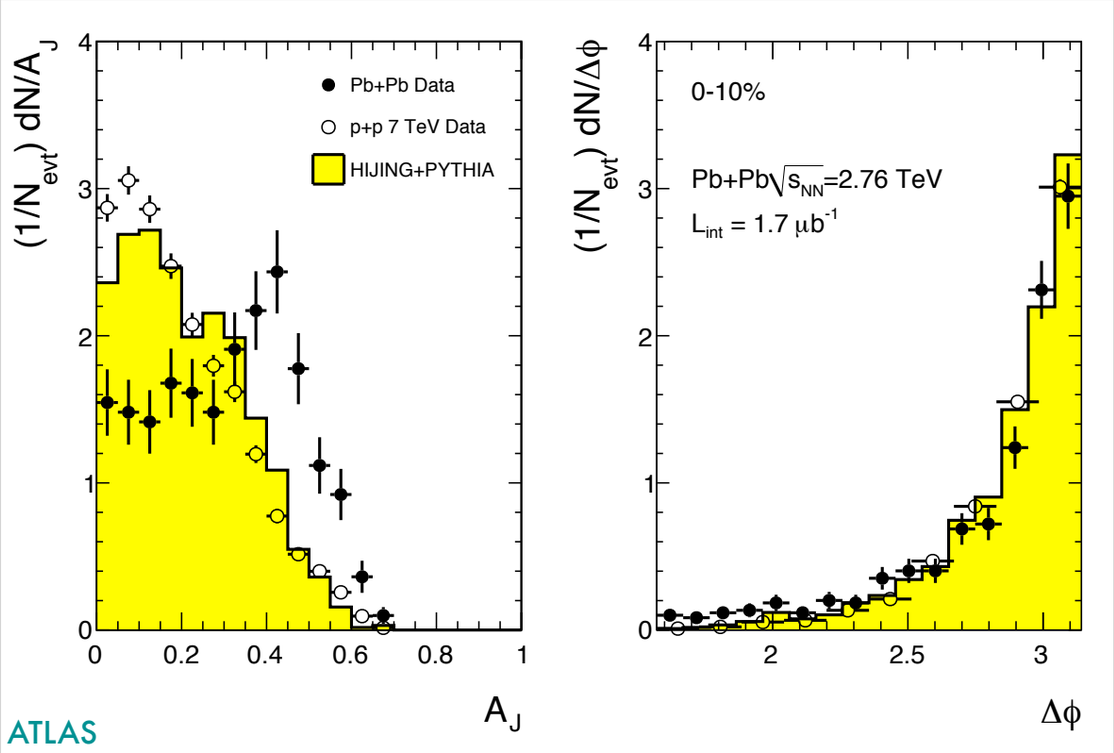

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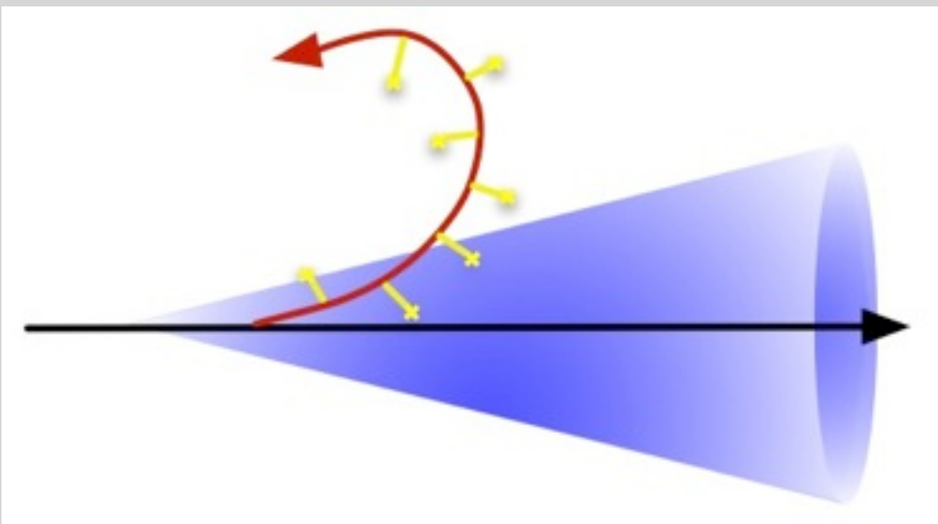

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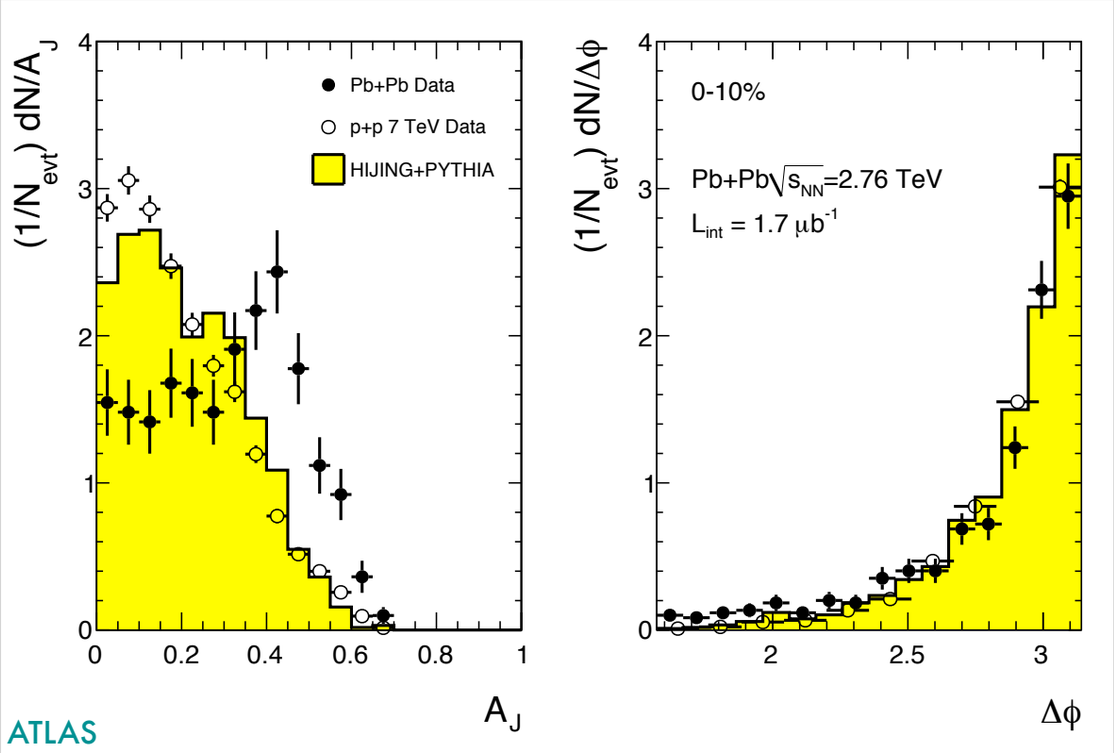

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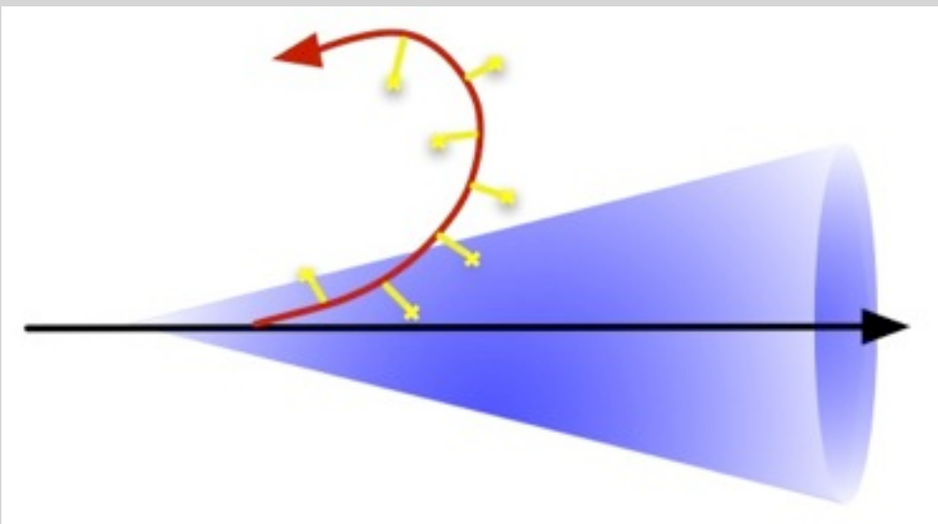

all jet components accumulate transverse momentum

$$\langle k_\perp \rangle \sim \sqrt{\hat{q}L}$$

early availability of soft modes

$$\tau \sim \frac{\omega}{k_\perp^2} \xrightarrow[\langle k_\perp^2 \rangle \sim \hat{q}\tau]{} \langle \tau \rangle \sim \sqrt{\frac{\omega}{\hat{q}}}$$

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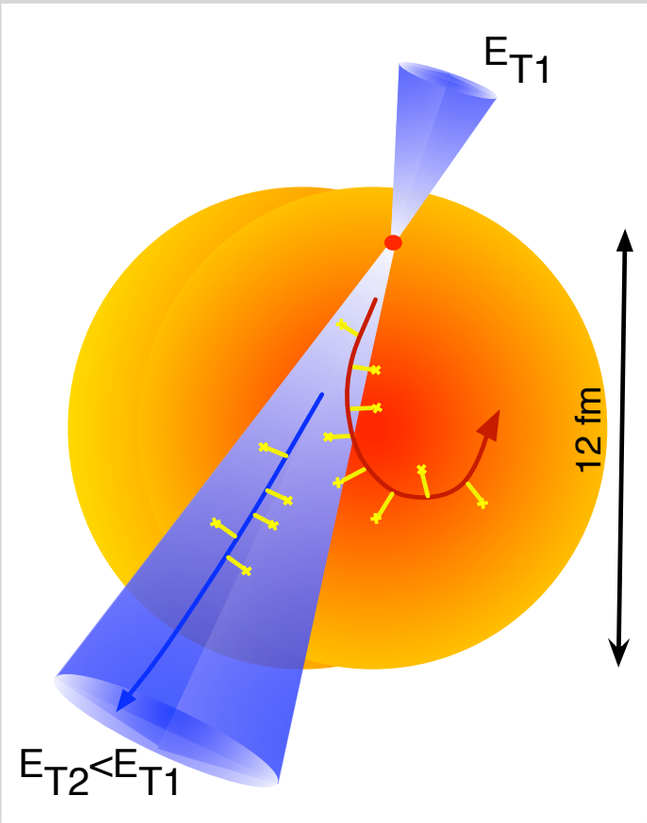
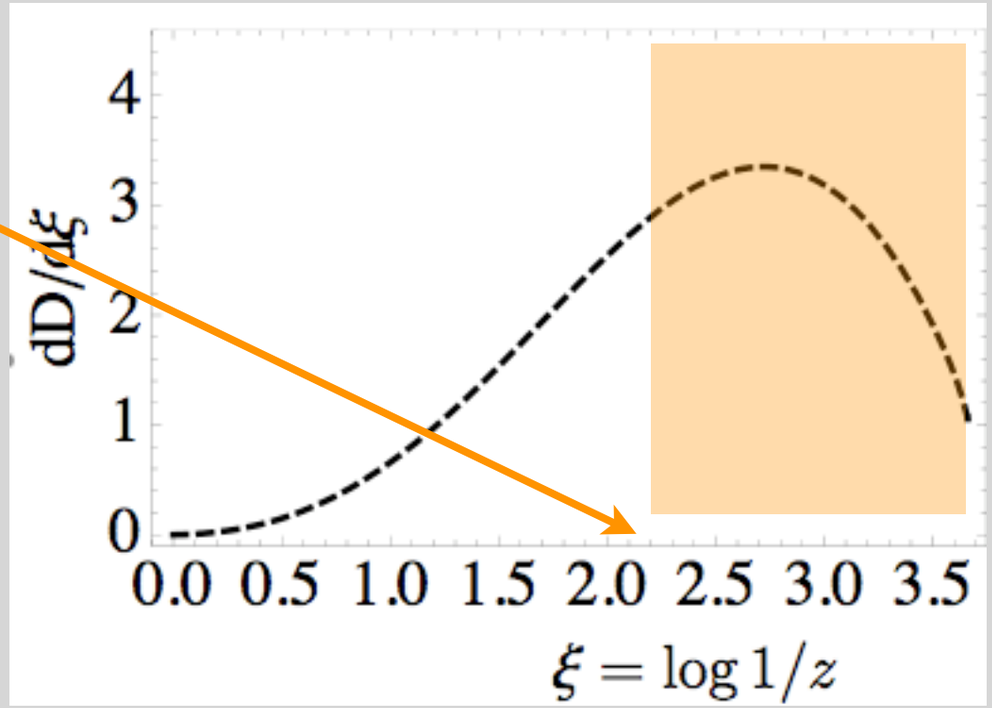


- sufficiently soft modes decorrelated [lost] from jet

$$\omega \leq \sqrt{\hat{q}L}$$



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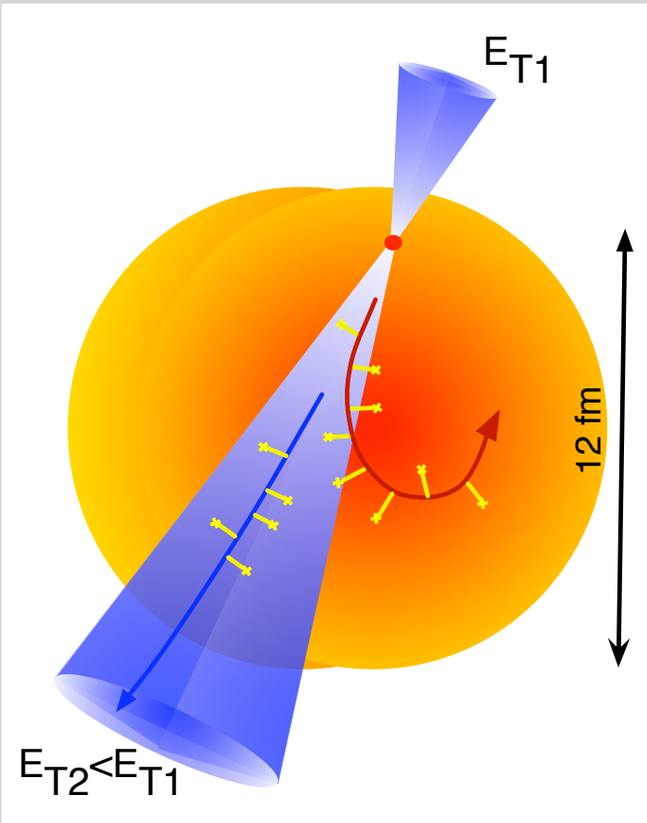

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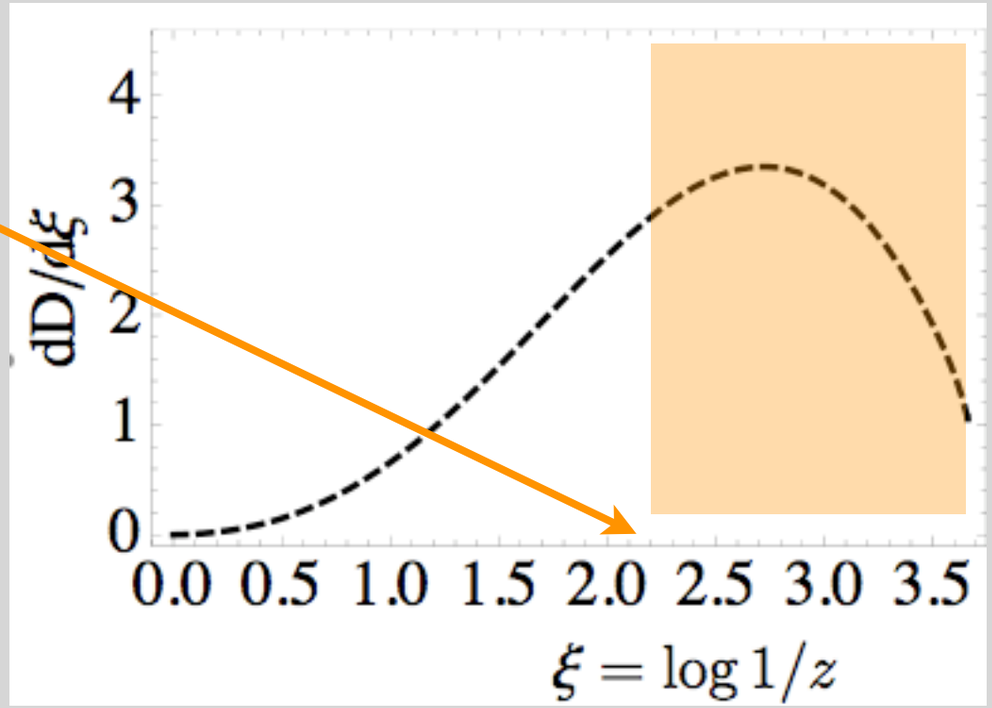

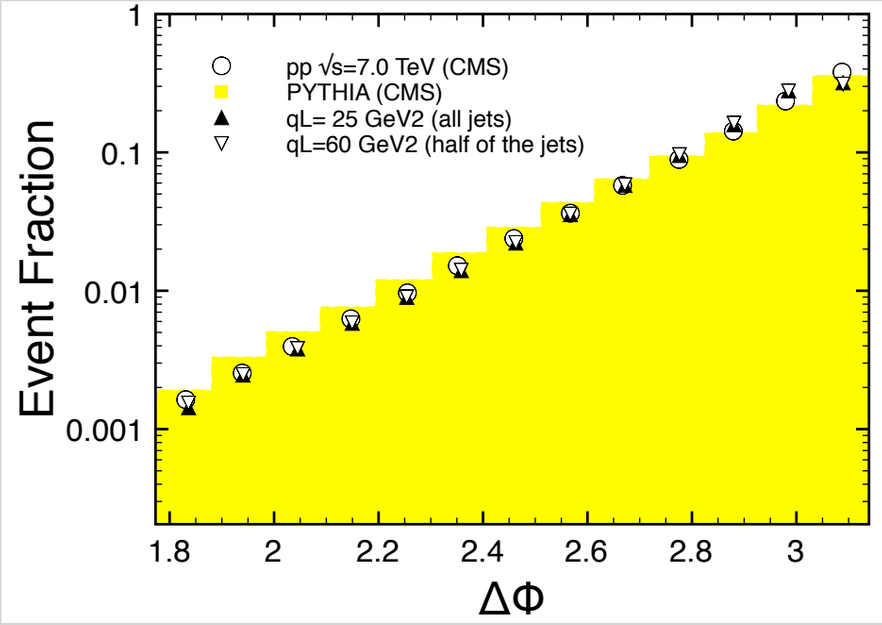

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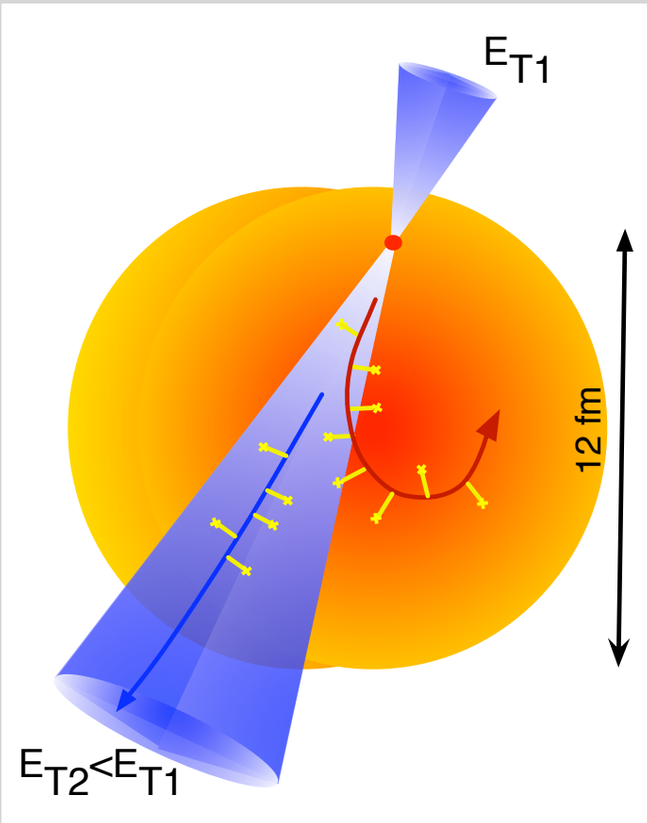

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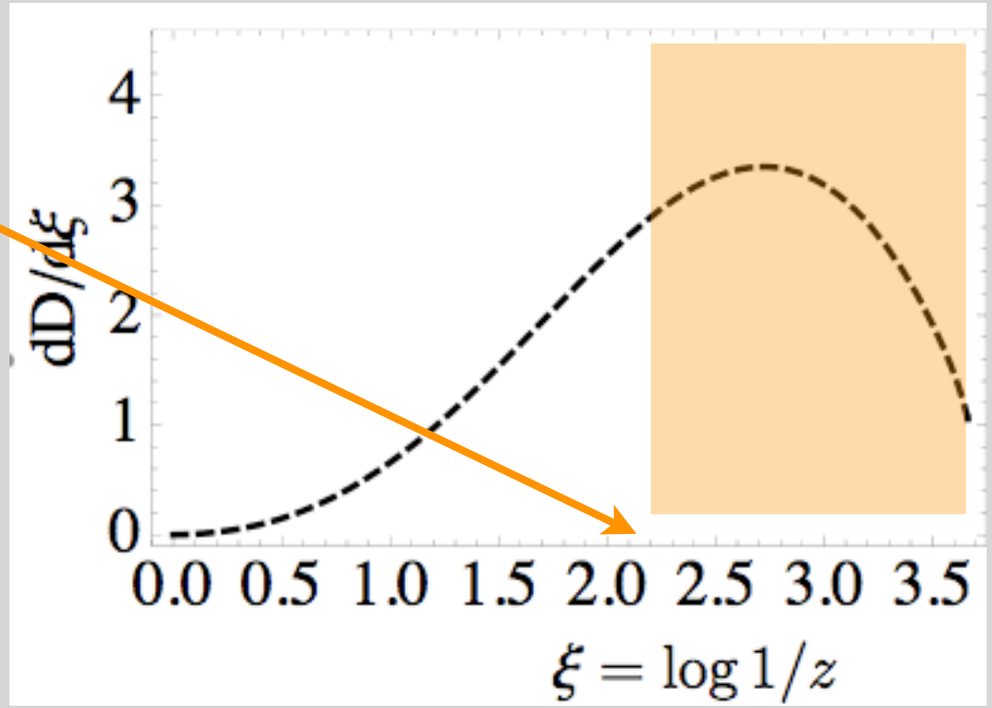

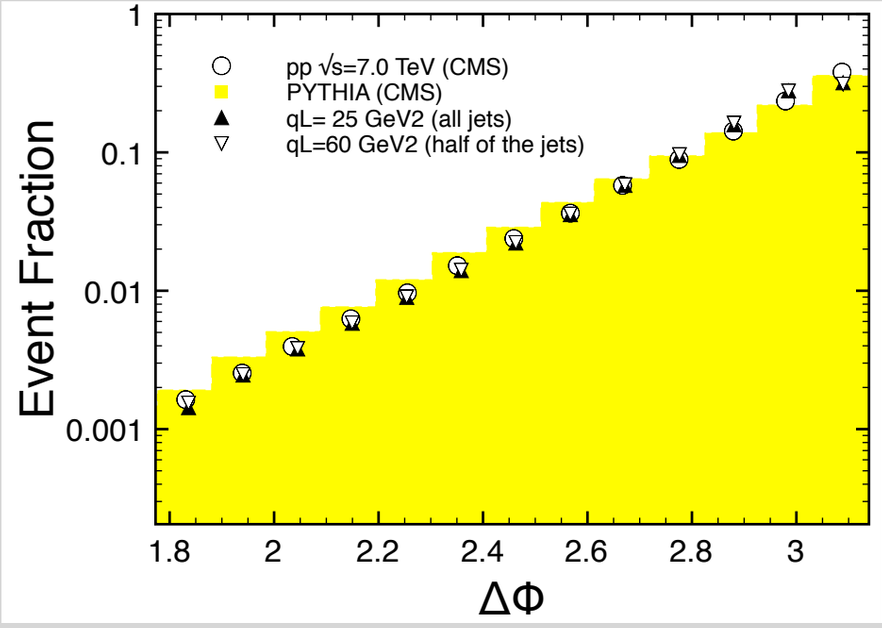

good qualitative description of average medium induced asymmetry

- does not disturb azimuthal correlation

very simple picture restricted to average statements

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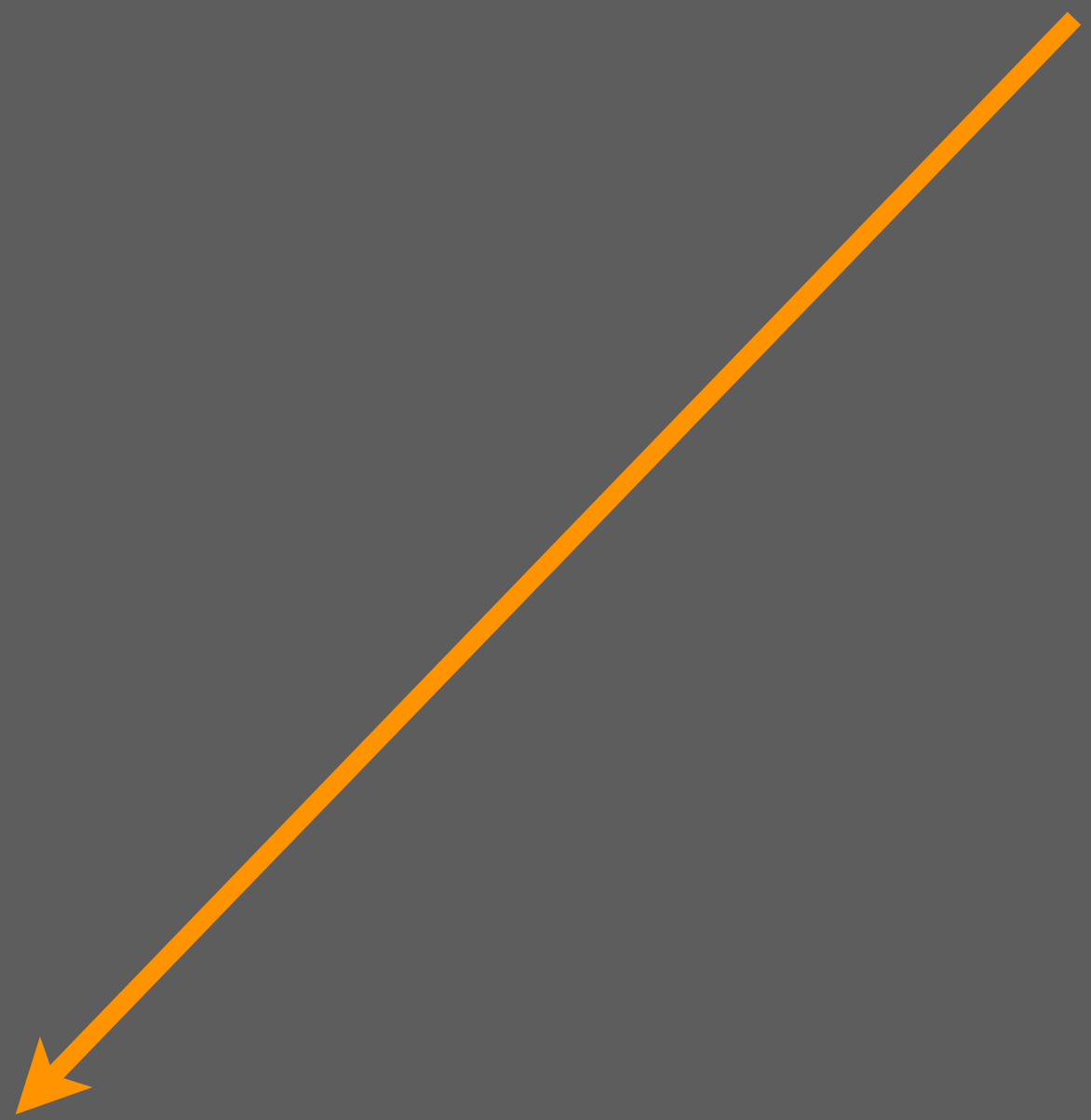

improvements ?

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  - ↪ path length fluctuations with realistic nuclear profile [see J Casalderrey's talk]
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  - ↪ additional medium induced gluons from Gaussian distributed 'BDMPS' formula
    - path length dependent
    - event-by-event with [independent] Poissonian assumption

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[= 0.3]

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  - ↪ vacuum baseline from data [CMS]

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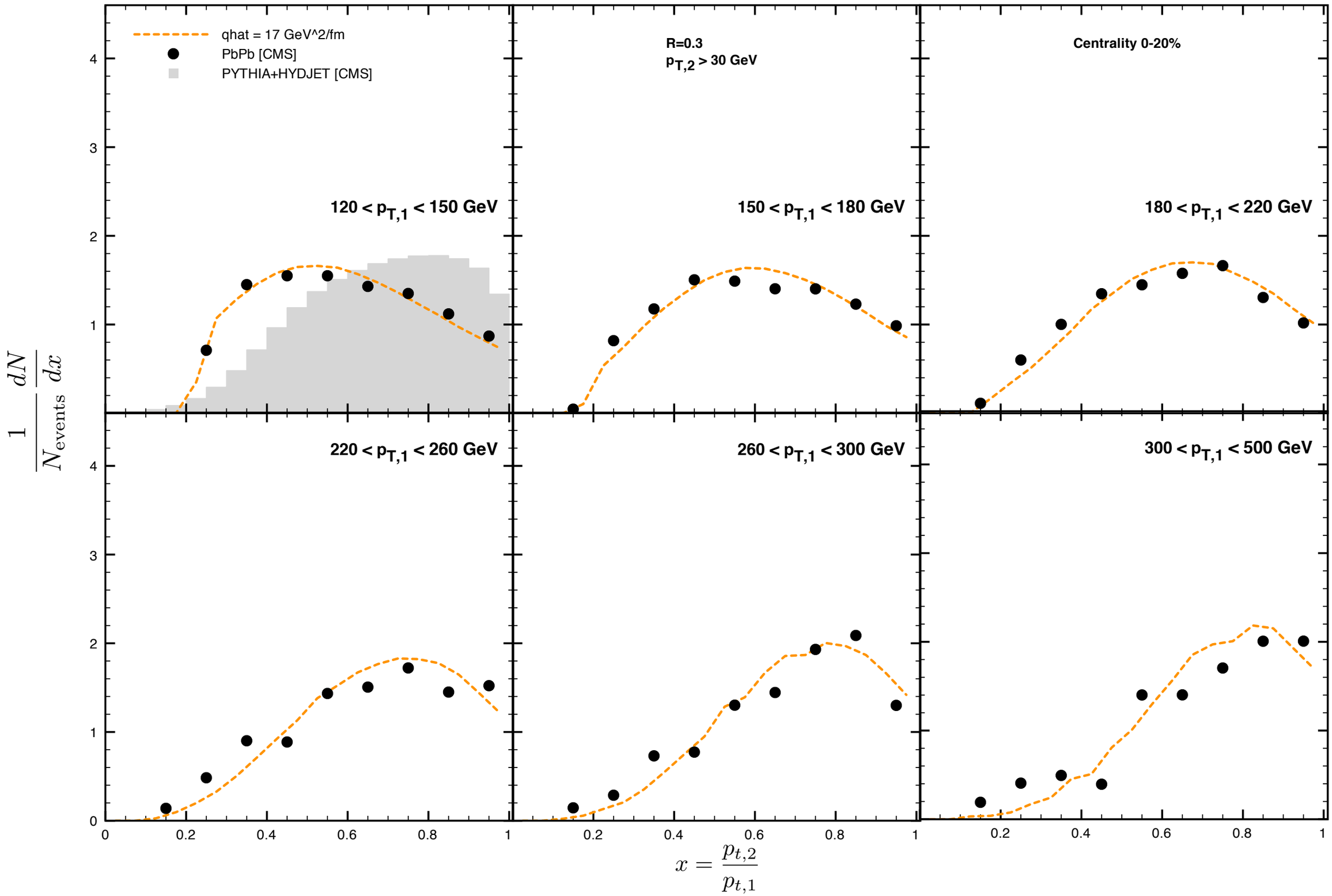
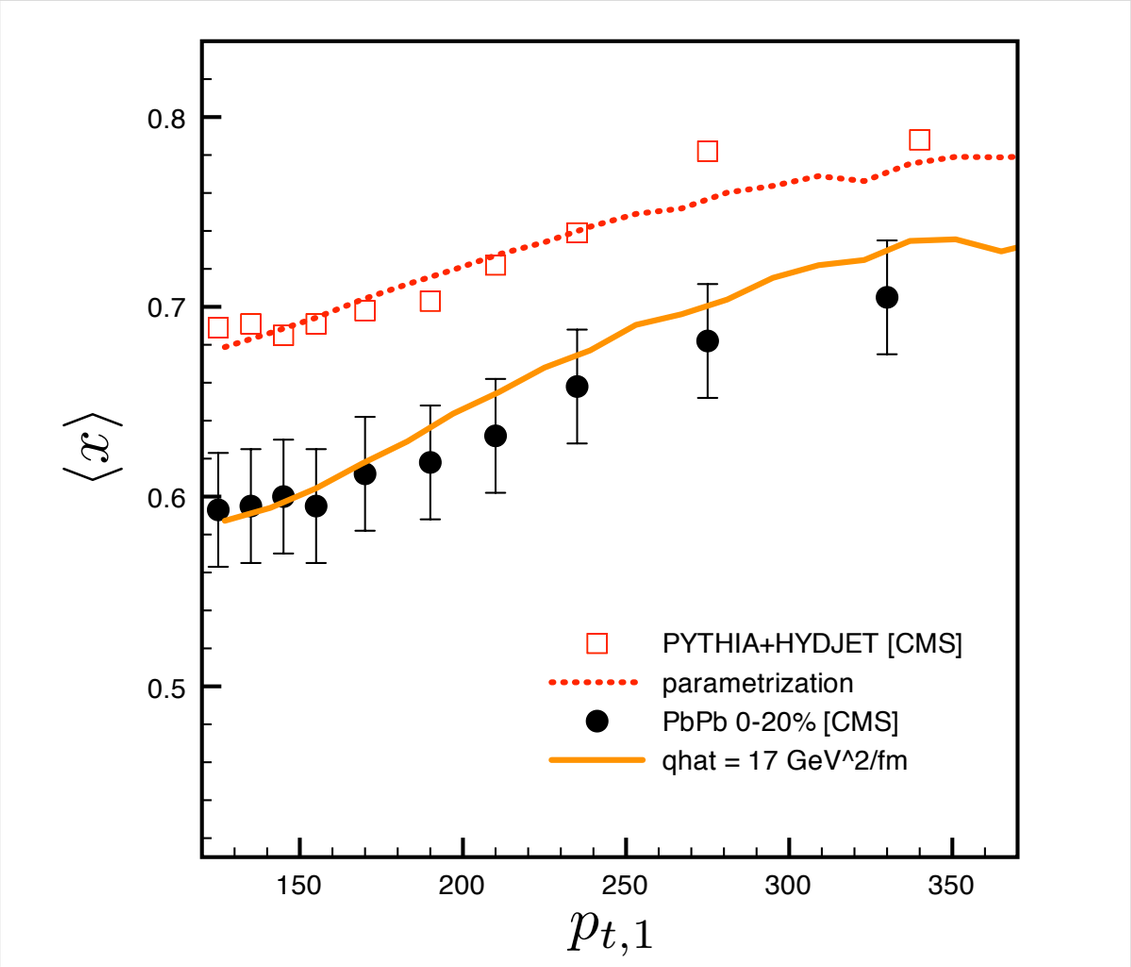
[= 0.3]

energy dependence of dijet imbalance



average imbalance



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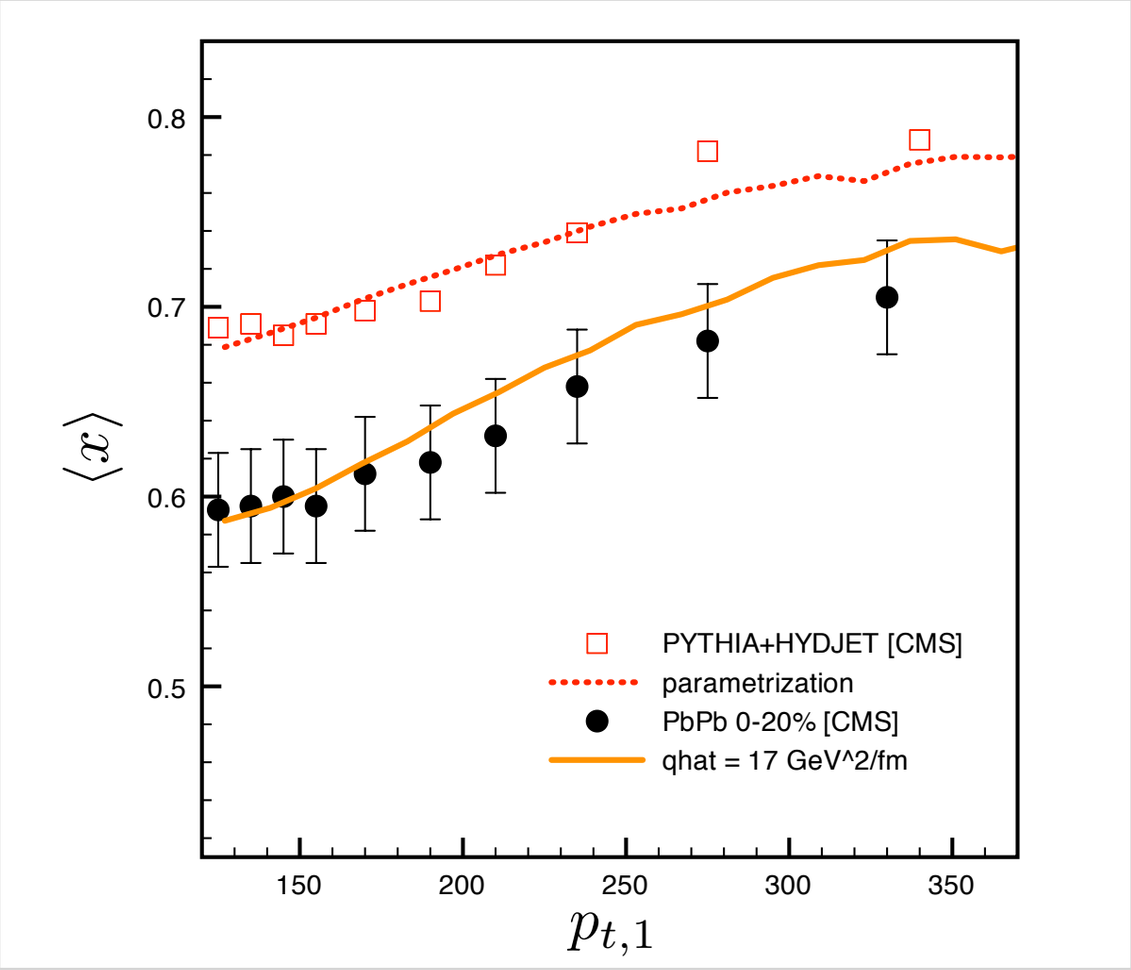
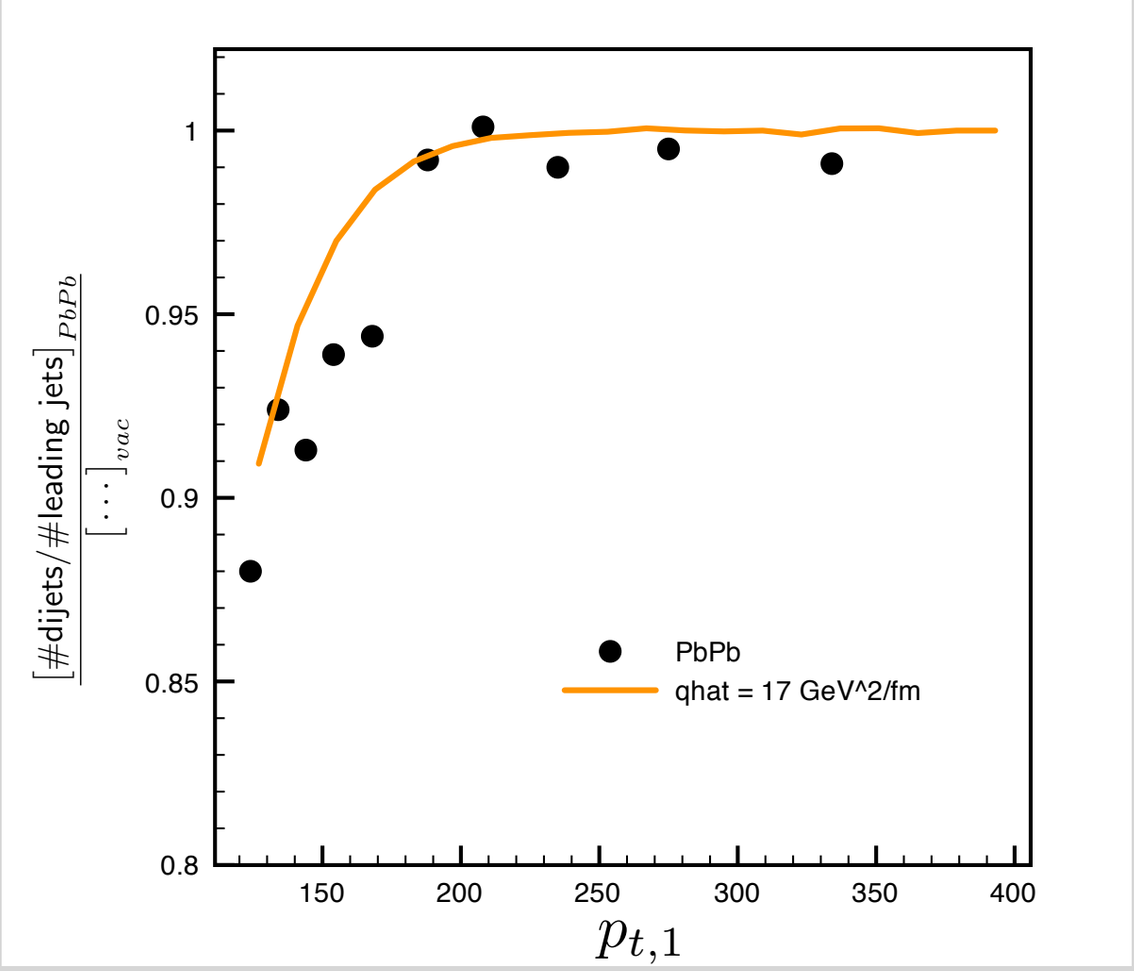
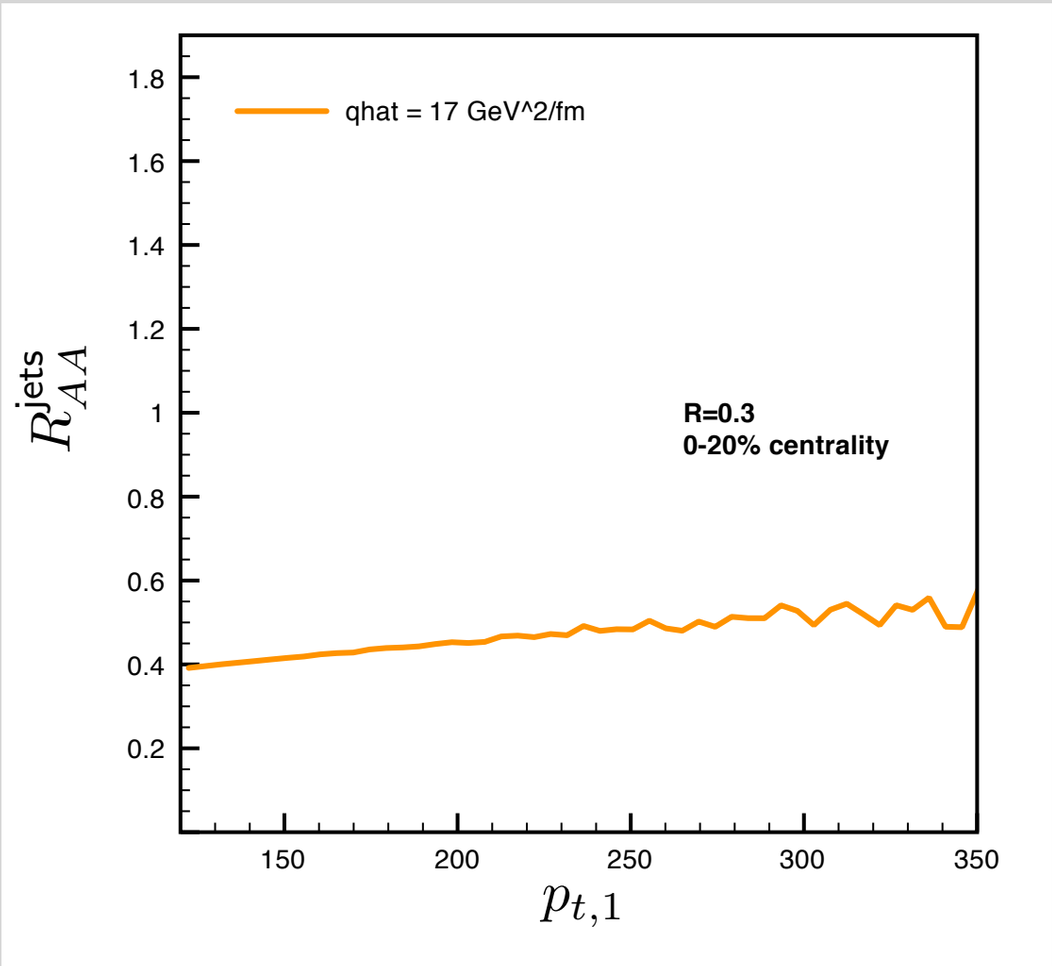
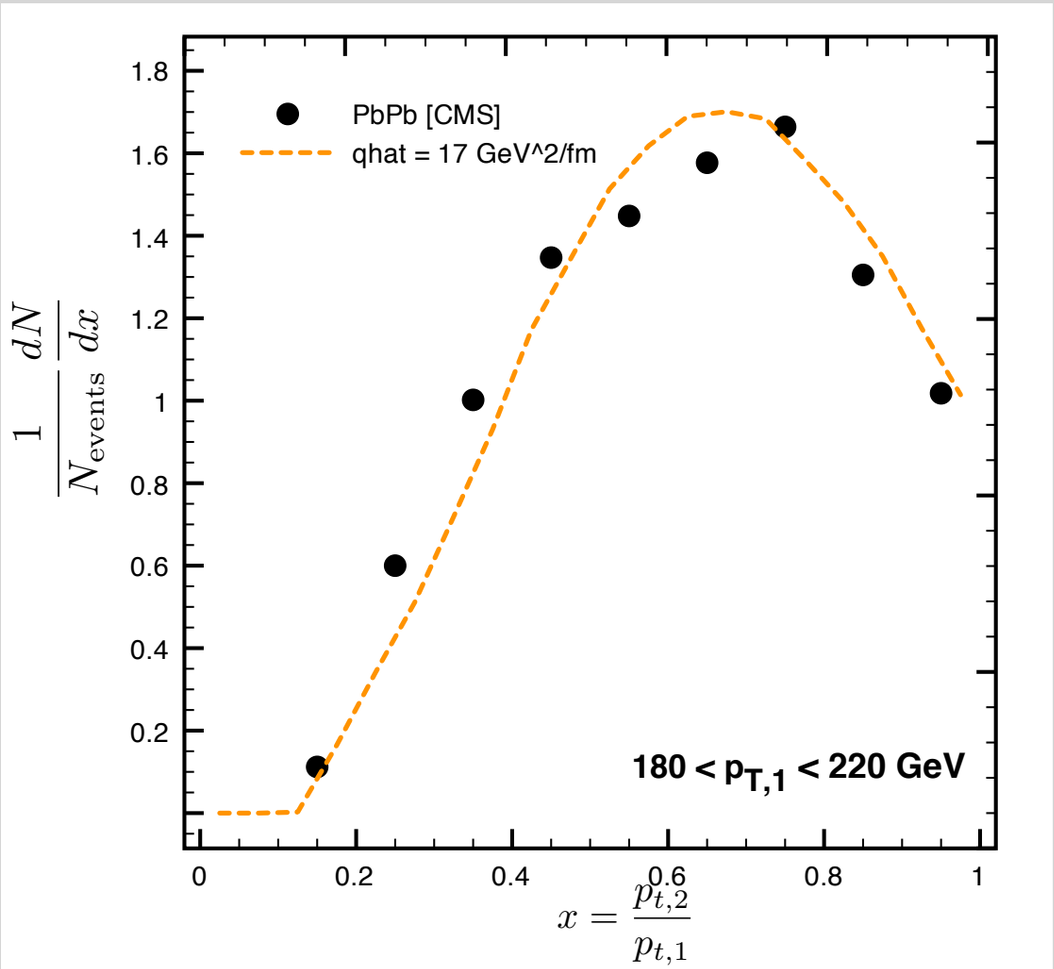


must also account for fraction of jets quenched beyond reconstruction cut



R_{AA}





- dijet imbalance sensitive to transverse dynamics
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- constrains energy loss relation to broadening
- leading and recoiling jet probe different path-length ranges

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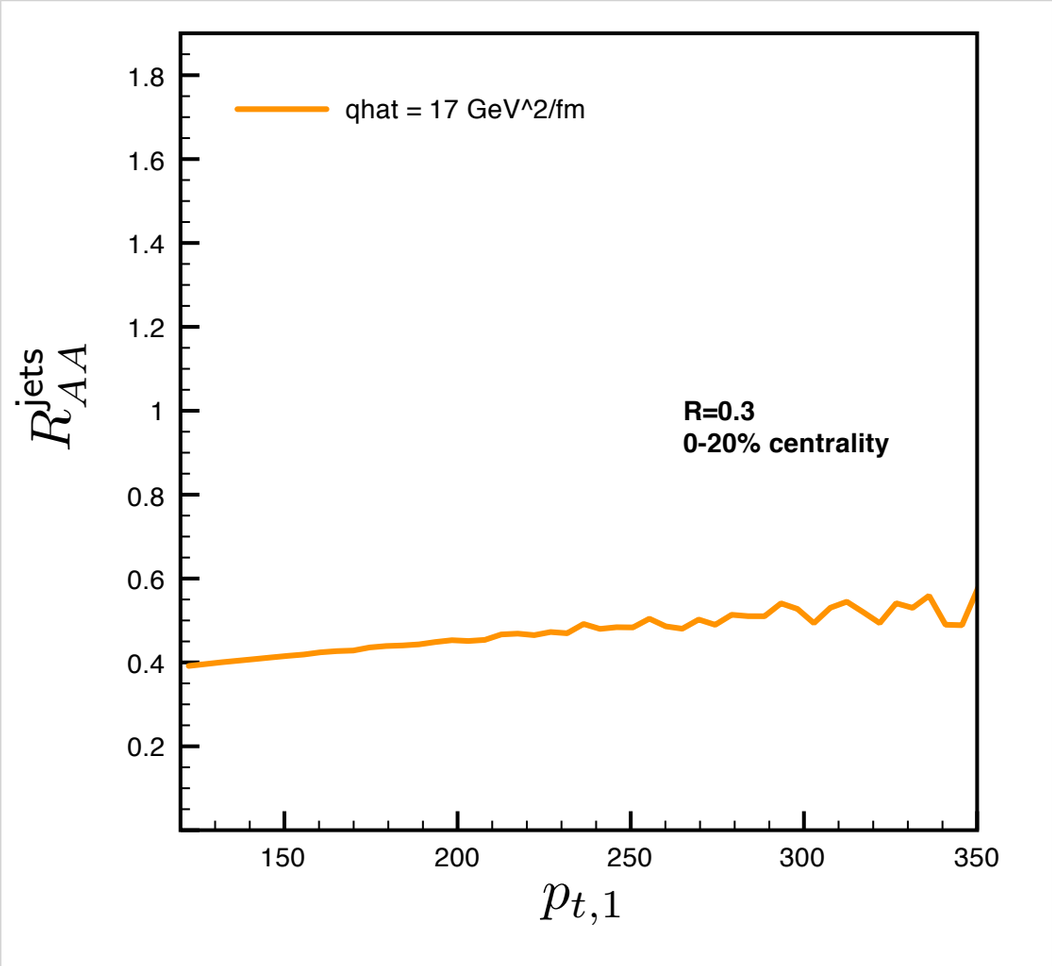

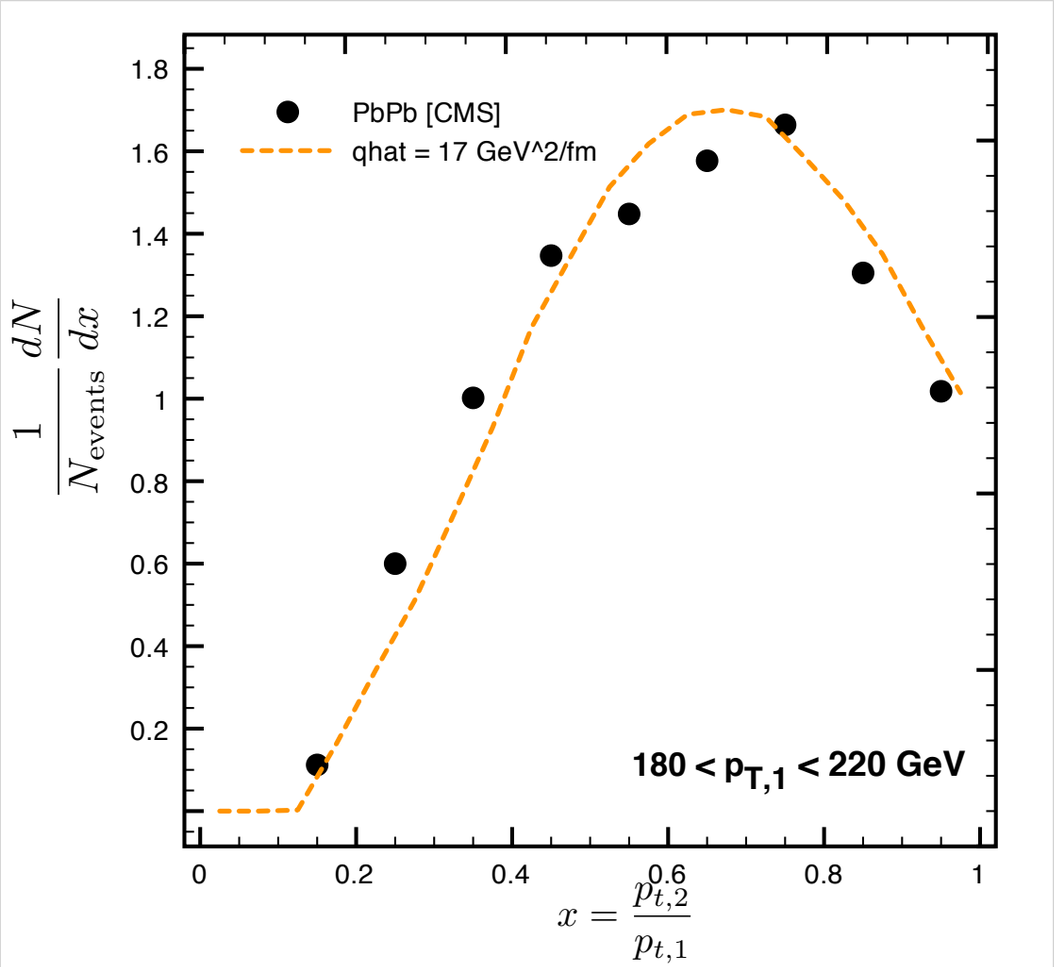

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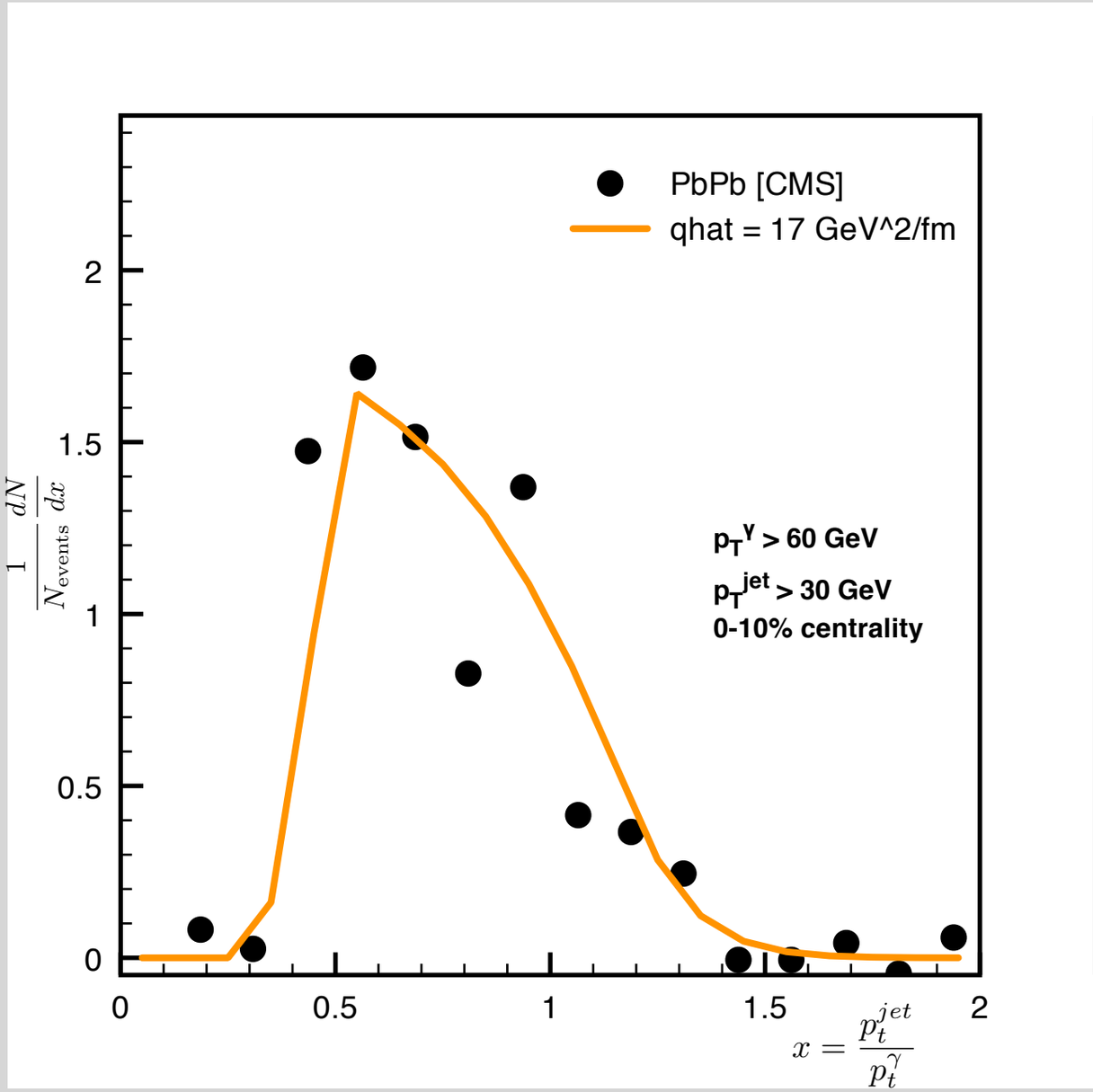
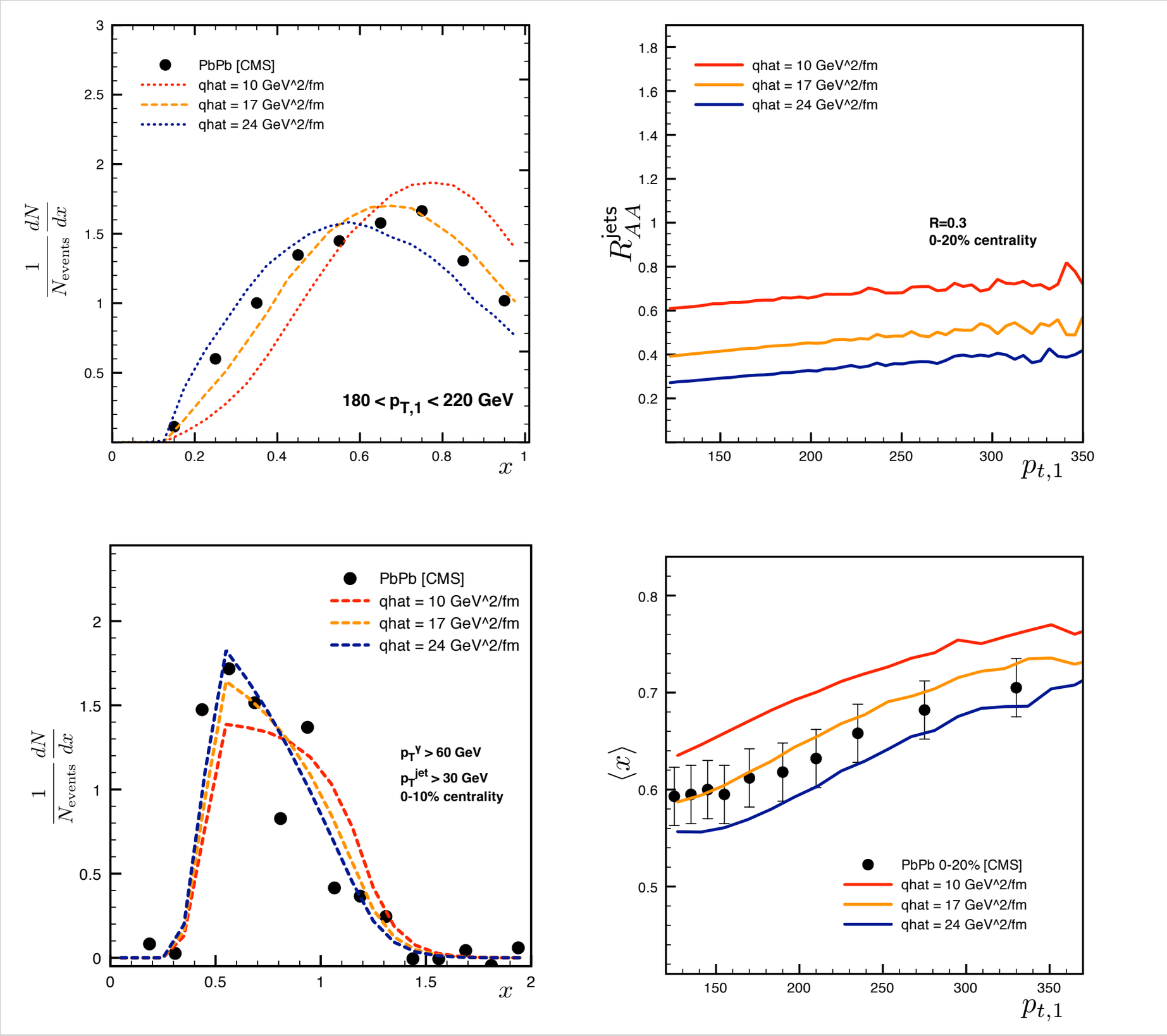
together provide tight constraint on underlying dynamics

γ-jet



quark jets, otherwise same set-up

qhat dependence



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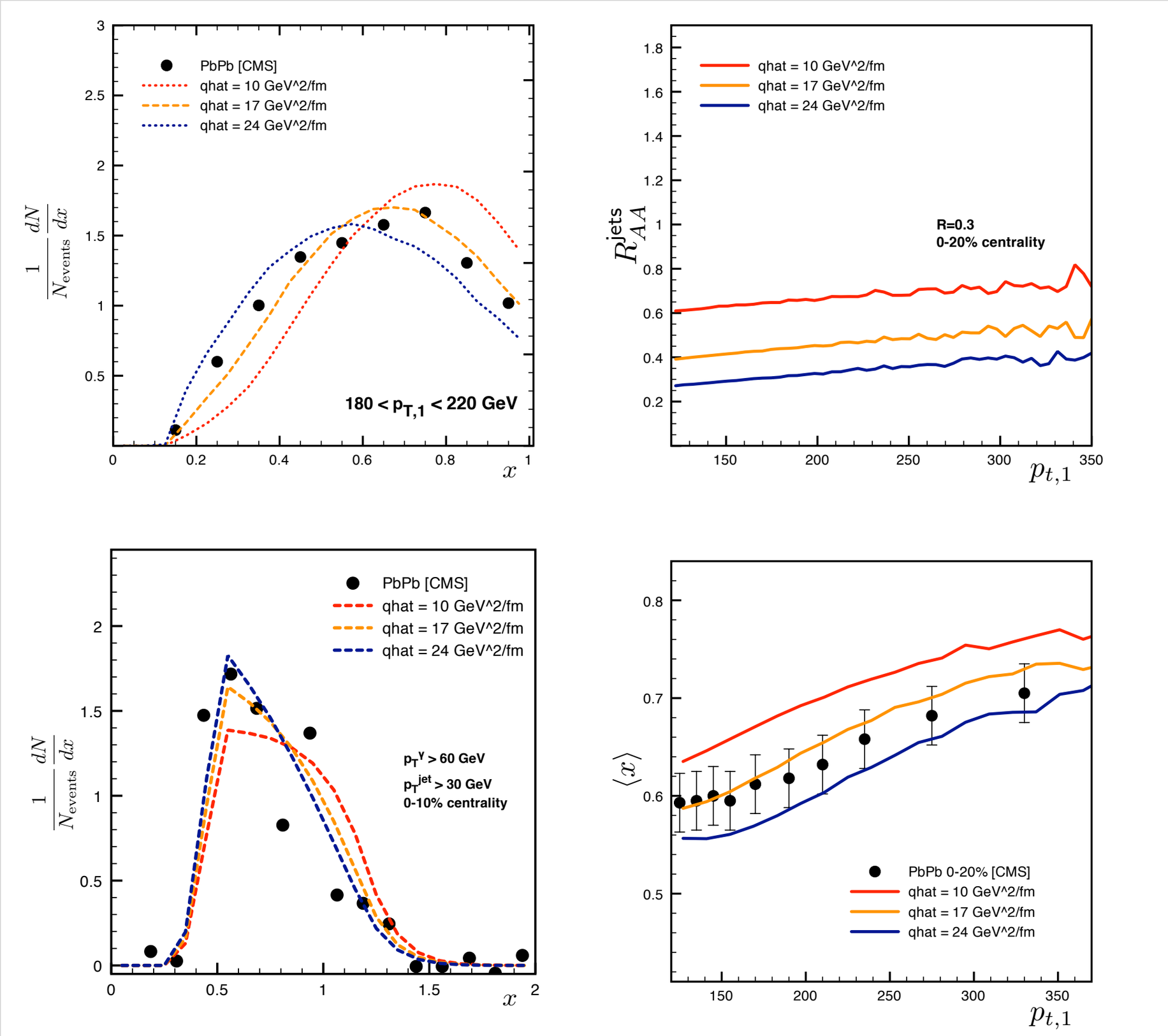

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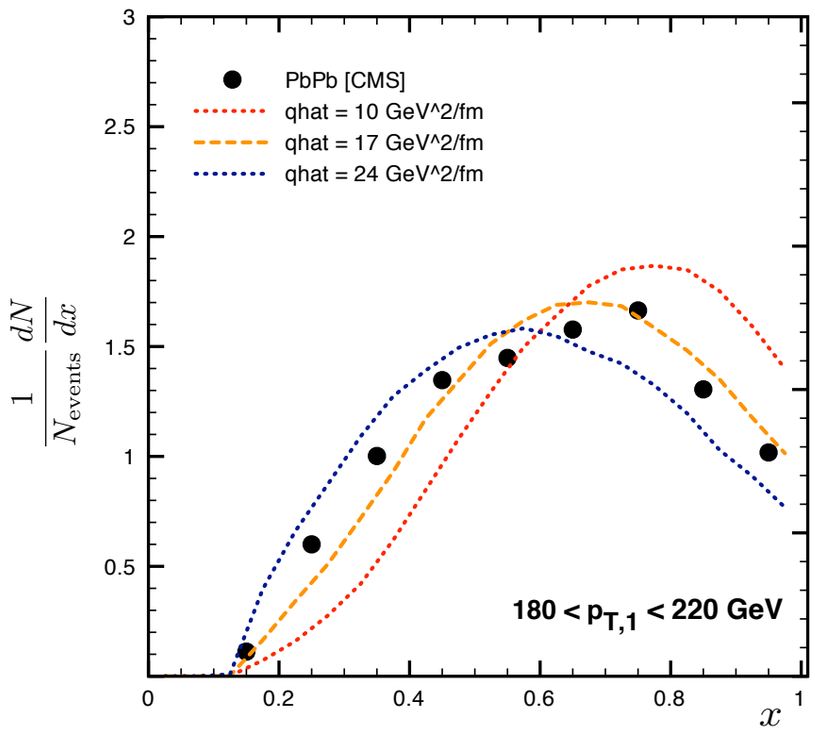

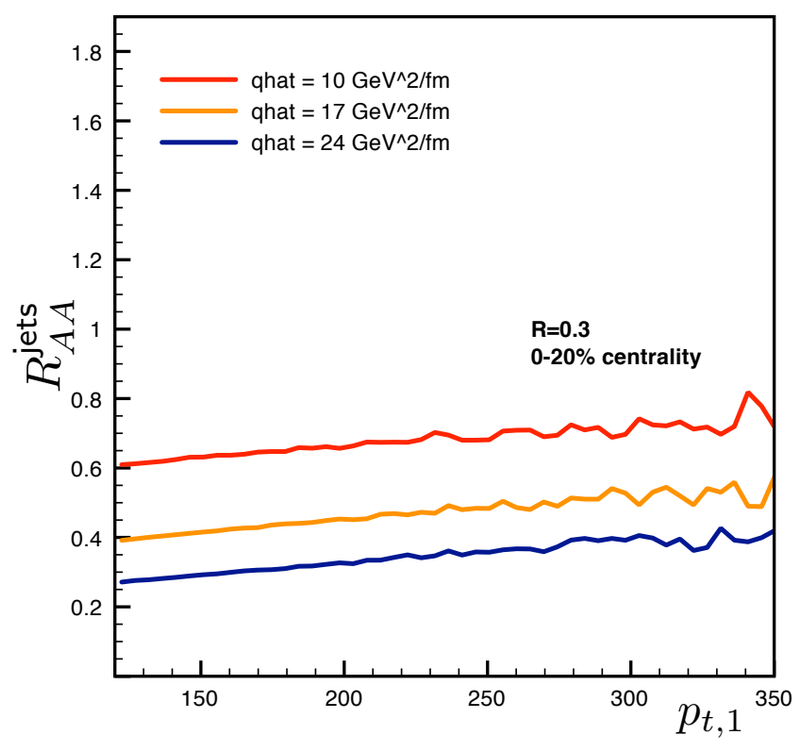

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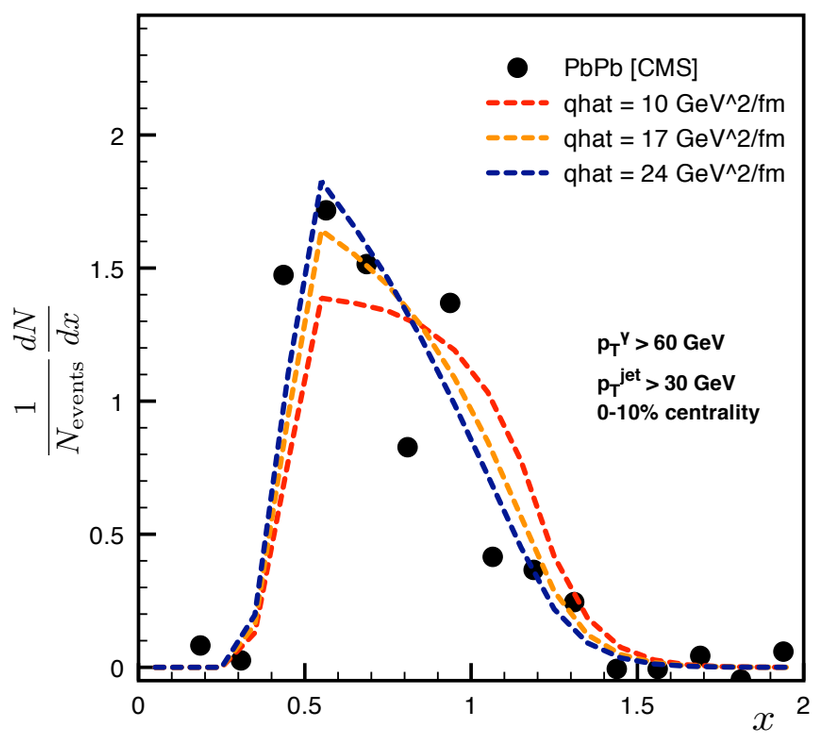

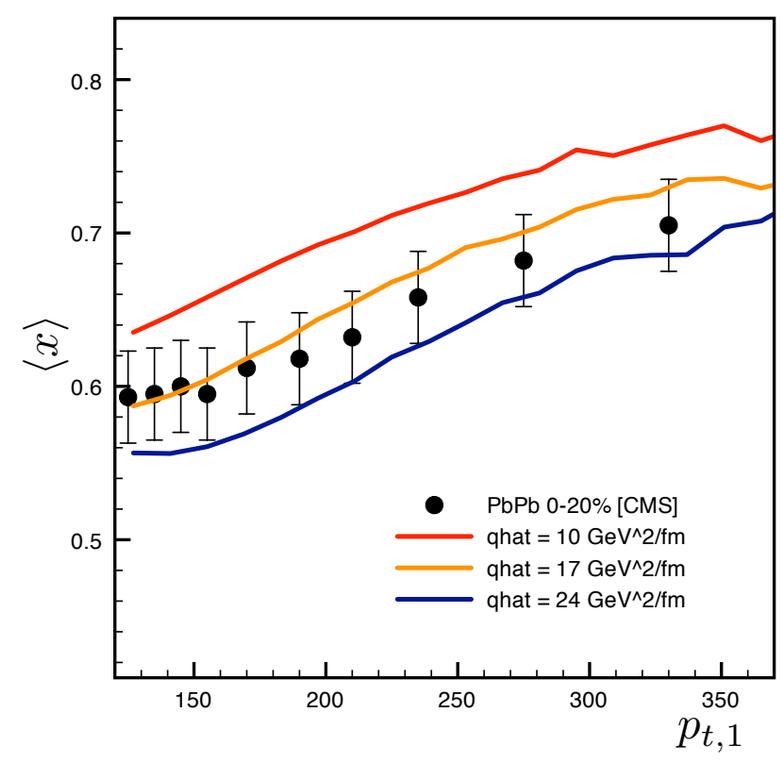

weak sensitivity to qhat variation in γ-jet

consistent multi-observable description
very simple but well motivated physical input

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may be sufficiently simple to allow for extraction of medium properties

summary

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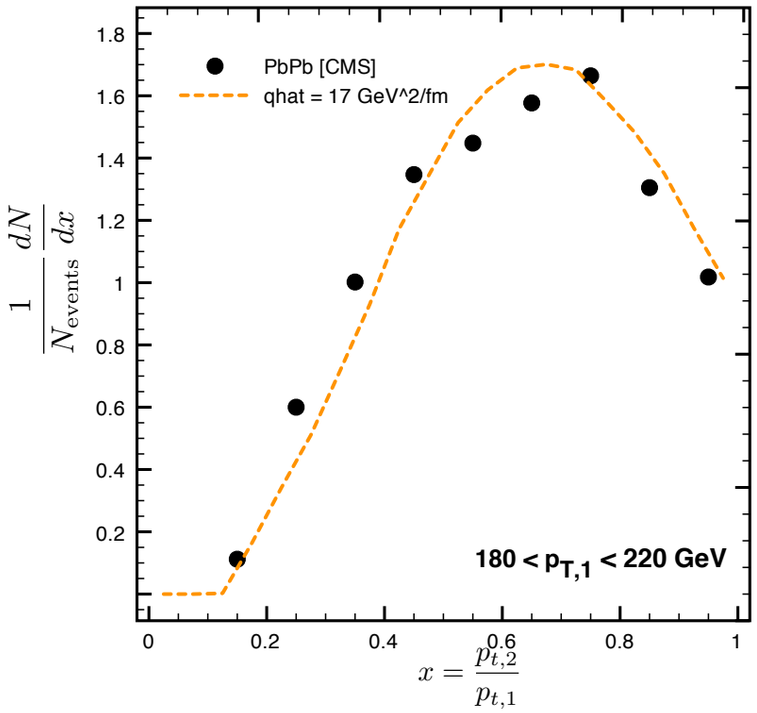
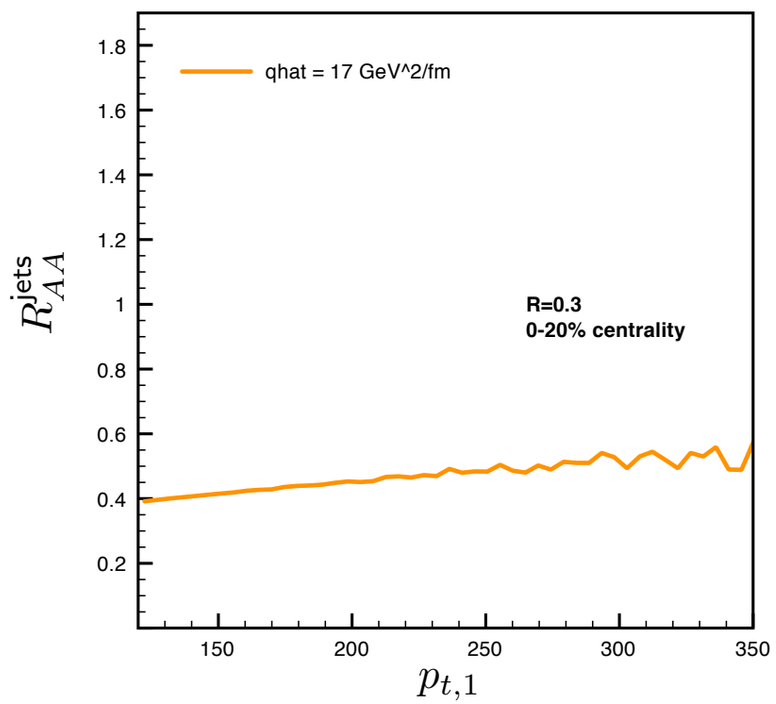
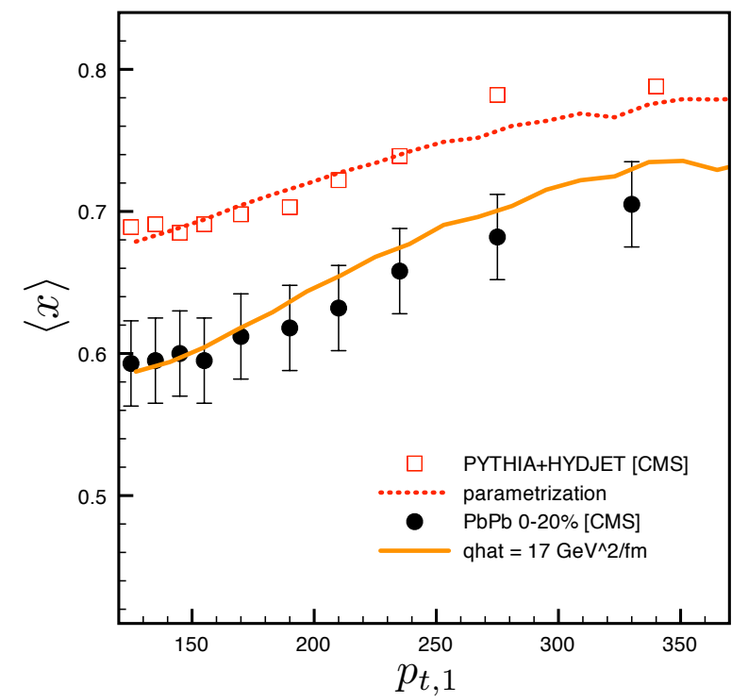

PbPb [CMS]
qhat = 17 GeV^2/fm
180 < $p_{T,1}$ < 220 GeV
$\frac{1}{N_{\text{events}}}\frac{dN}{dx}$
$x = \frac{p_{t,2}}{p_{t,1}}$


qhat = 17 GeV^2/fm
R=0.3
0-20% centrality
R_{AA}^{jets}
$p_{t,1}$


PYTHIA+HYDJET [CMS]
parametrization
PbPb 0-20% [CMS]
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$\langle x \rangle$
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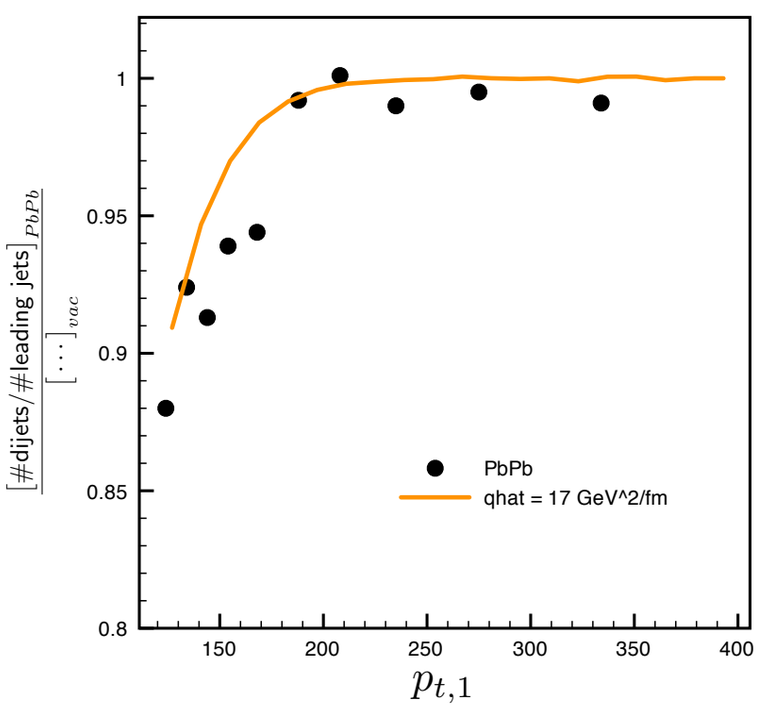
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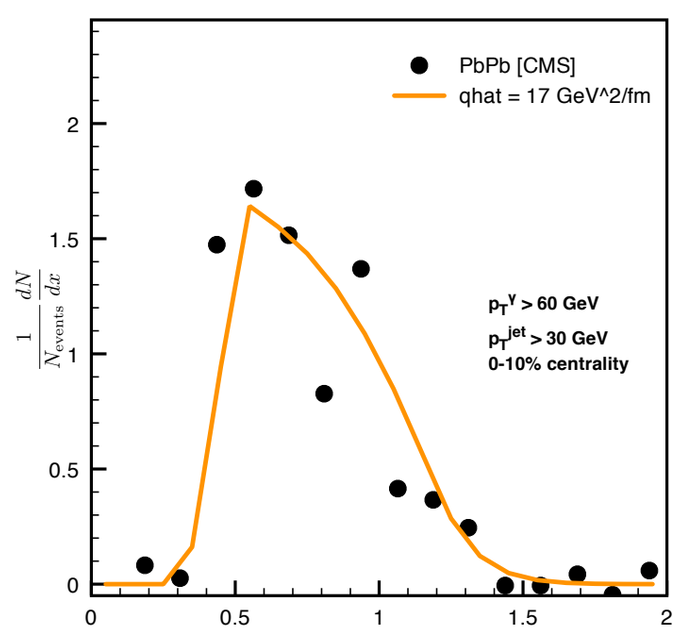
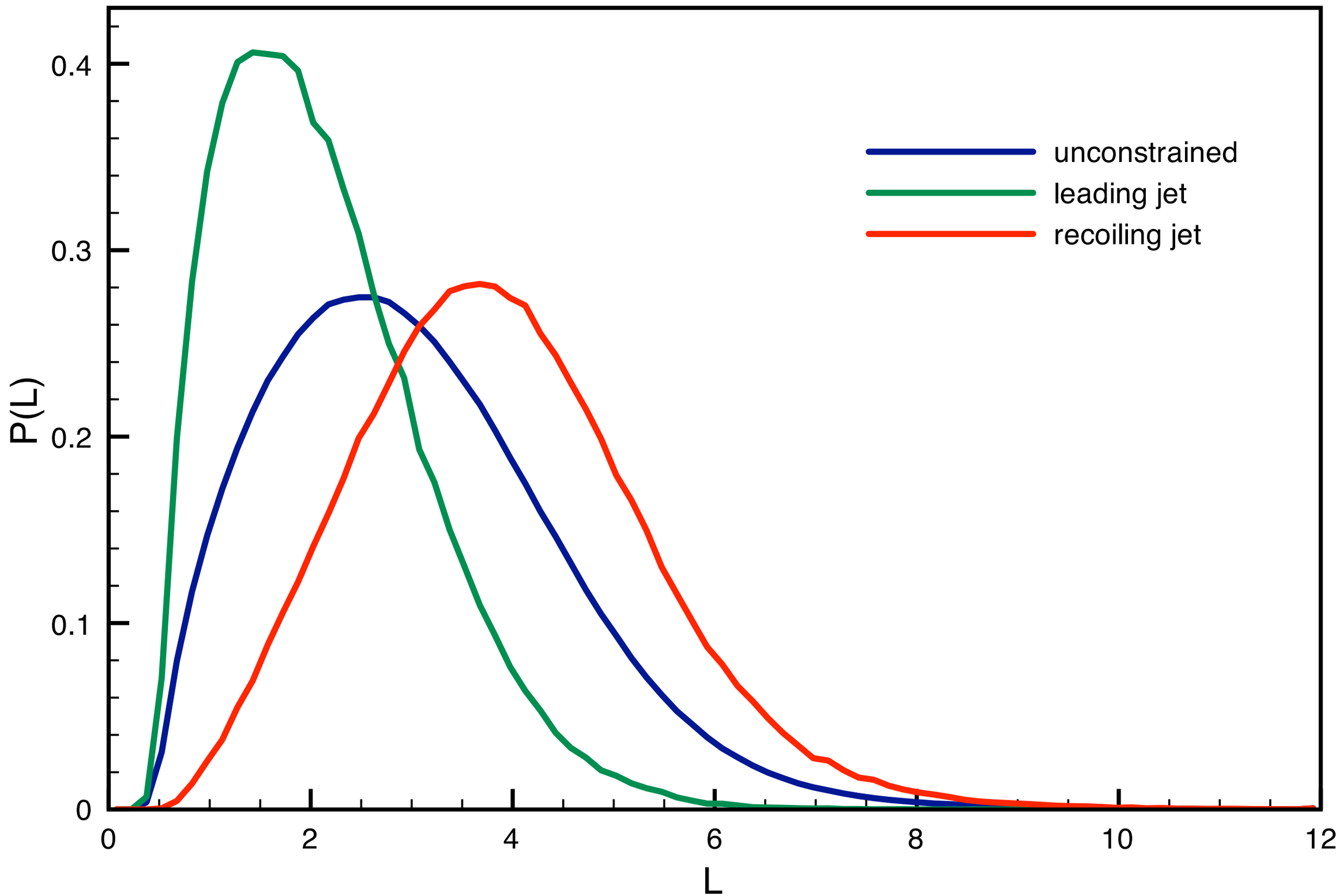
$\frac{[\#\text{dijets}/\#\text{leading jets}]_{PbPb}}{[\cdots]_{vac}}$
$p_{t,1}$


PbPb [CMS]
qhat = 17 GeV^2/fm
p_T^{γ} > 60 GeV
p_T^{jet} > 30 GeV
0-10% centrality
$\frac{1}{N_{\text{events}}}\frac{dN}{dx}$

backups

surface bias



vac+med average gluon number