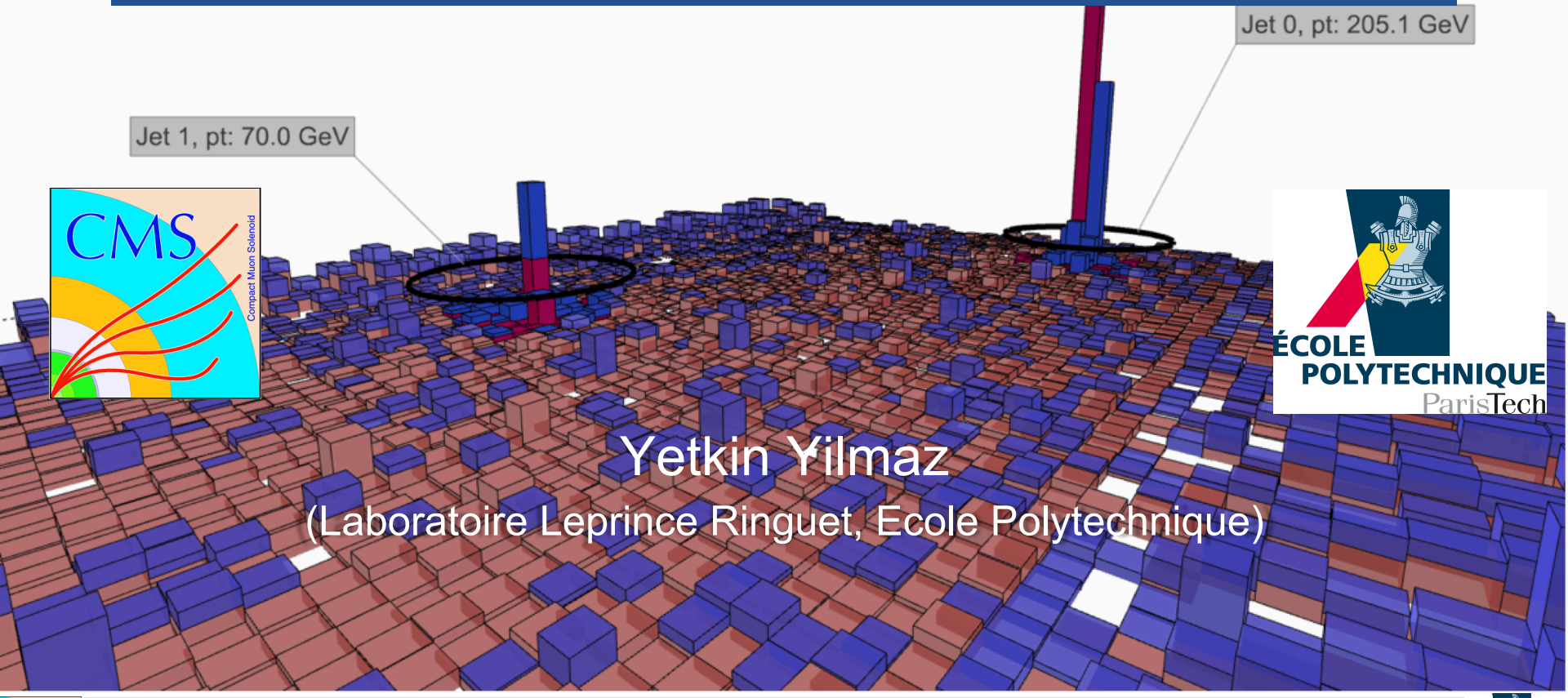
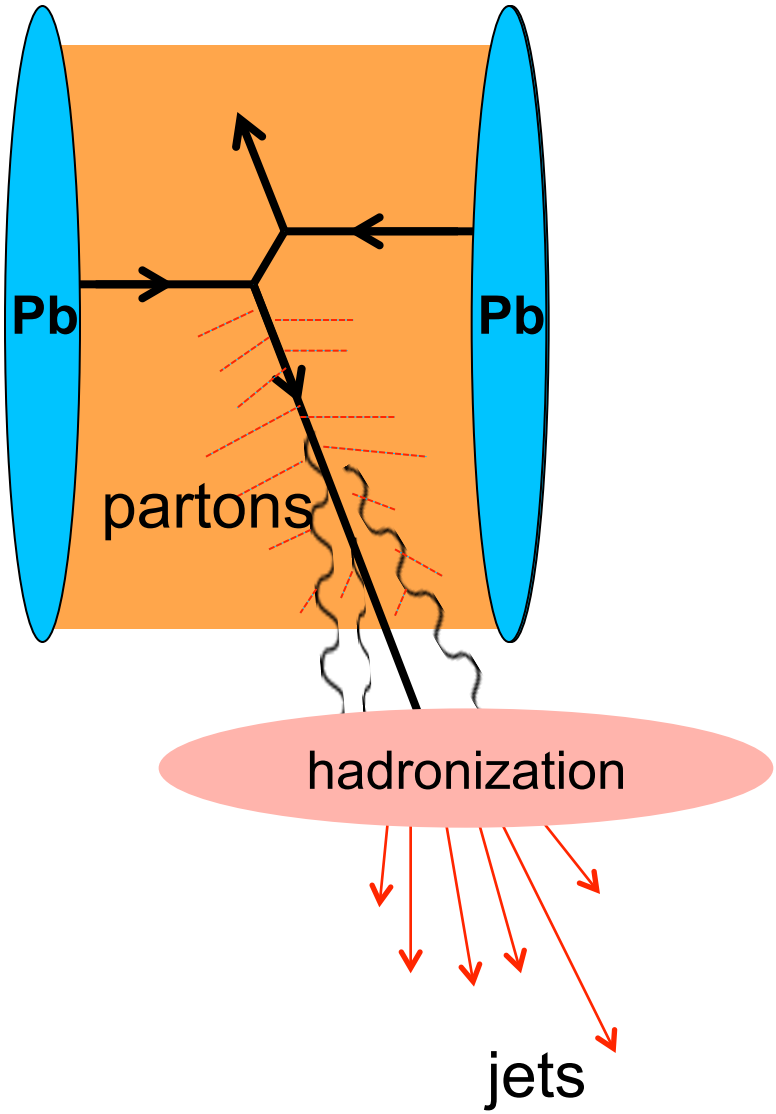
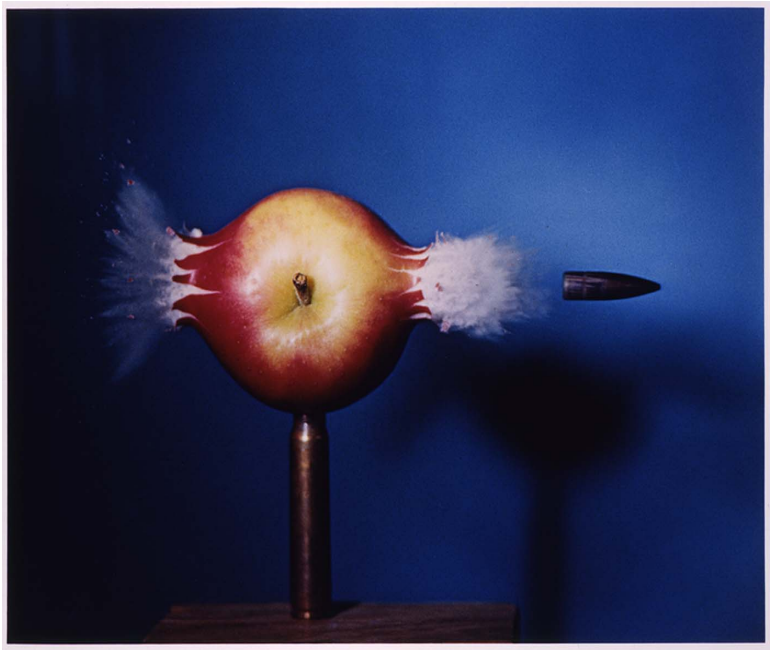
Jets in CMS



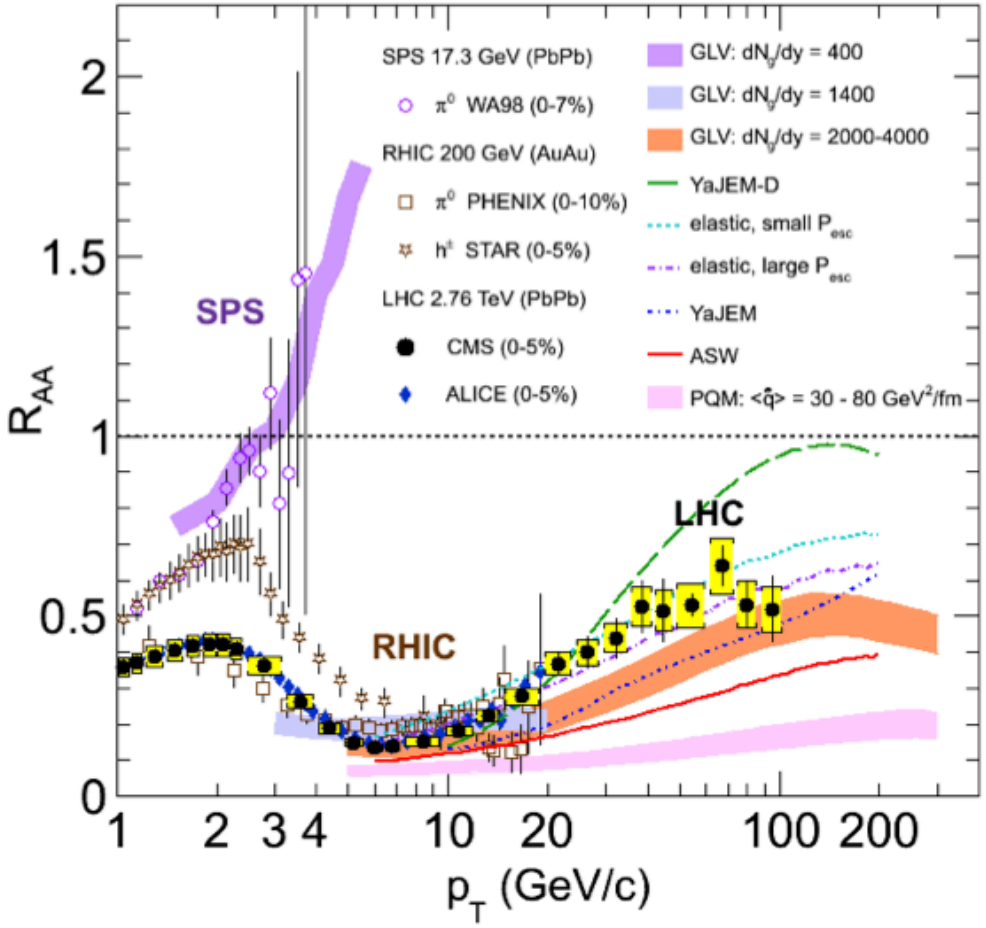
Yetkin Yilmaz
(Laboratoire Leprince Ringuet, Ecole Polytechnique)

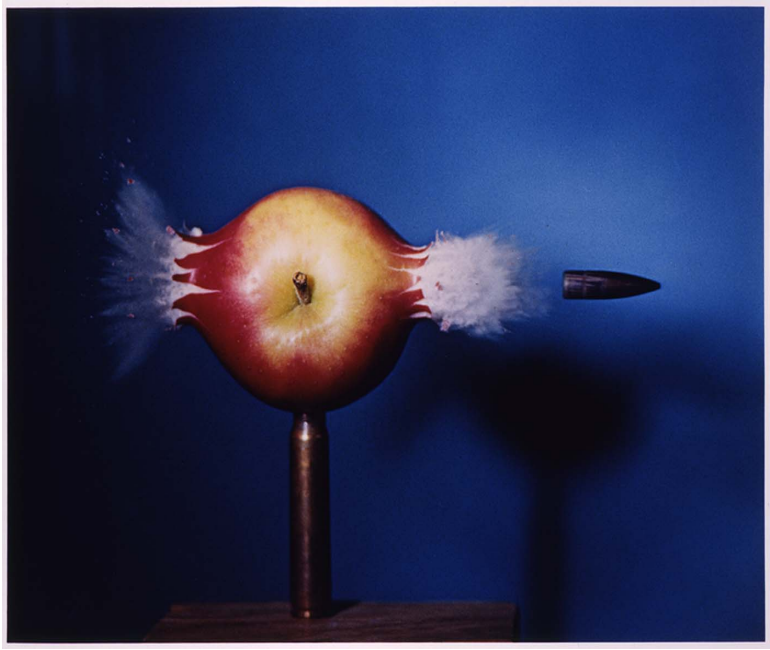
Jets in QCD medium





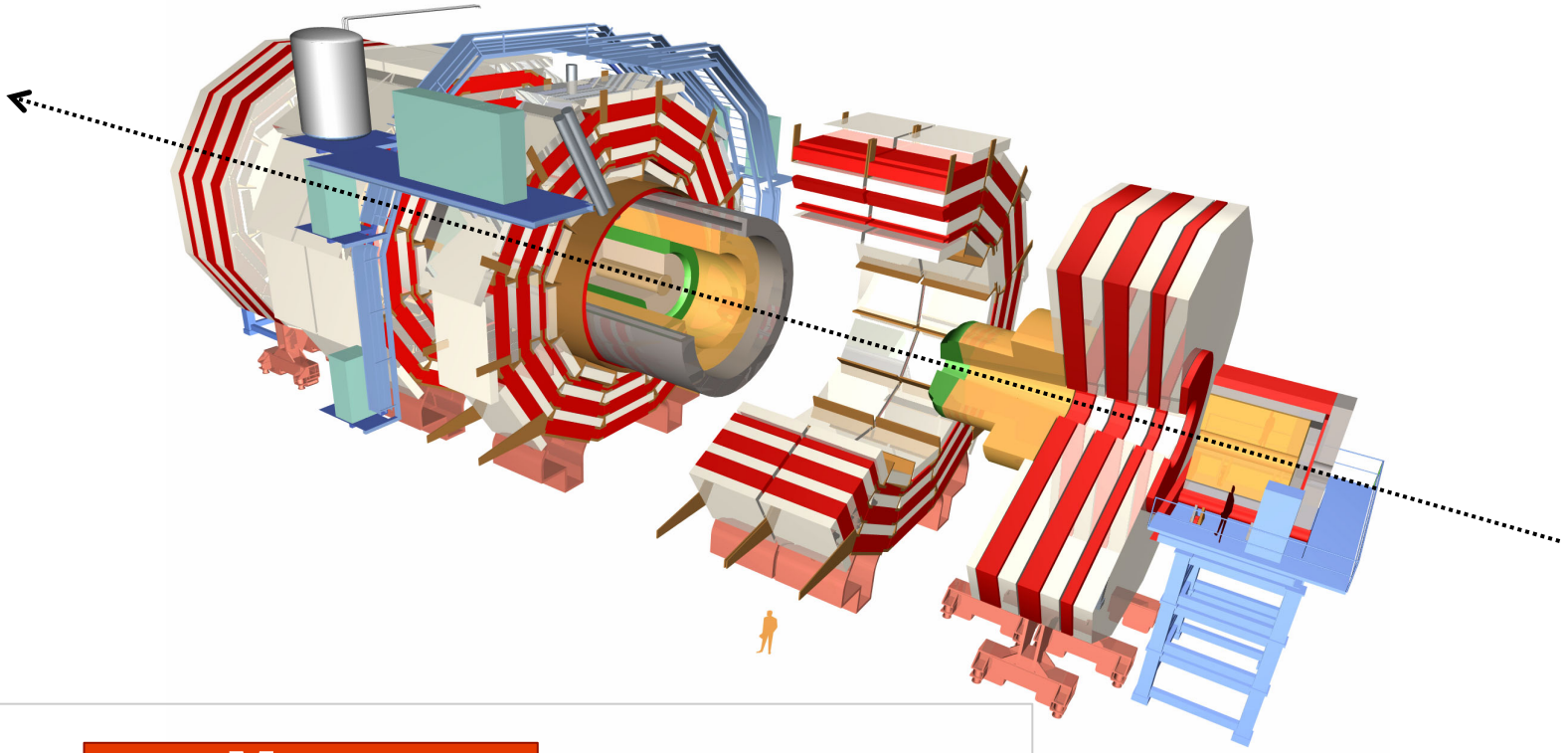
Jet quenching





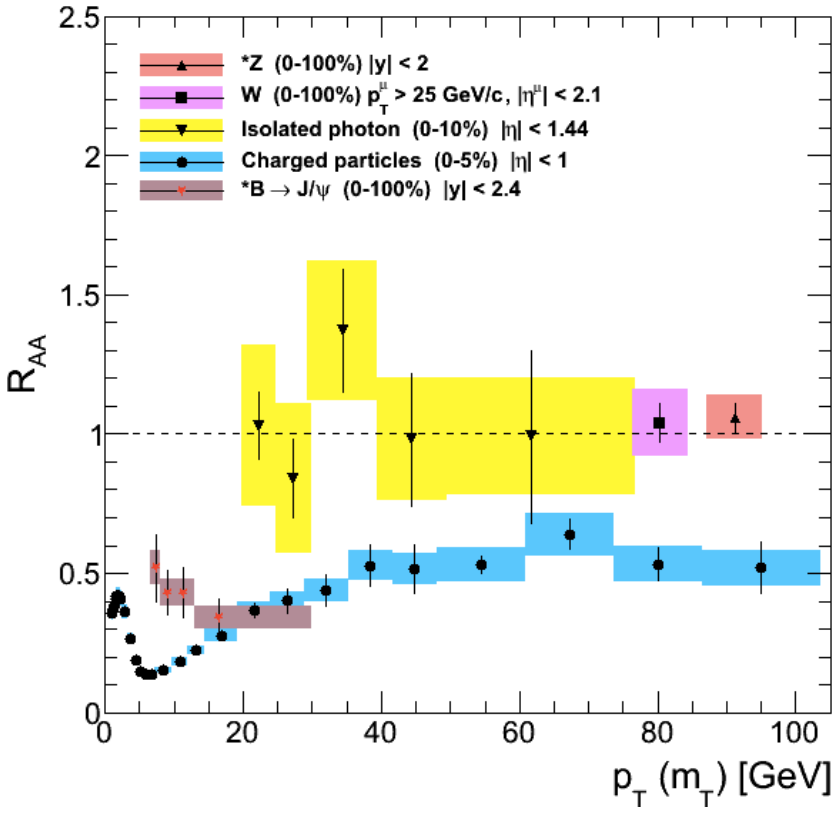
$$R_{AA}(p_{\mathrm{T}}) = \frac{d\sigma^{AA}/dp_{\mathrm{T}}}{< \mathrm{N}_{\mathrm{coll}} > d\sigma^{pp}/dp_{\mathrm{T}}}$$

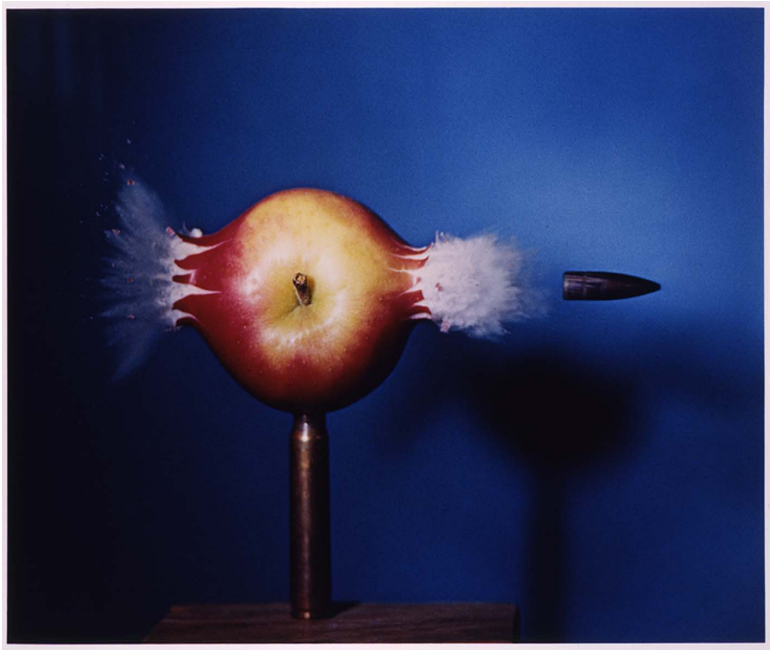
CMS detector & coordinate system



Muon	|η|< 2.4	
HCAL	|η|< 5.2	Calojet
ECAL	|η|< 3.0	
Tracker	|η|< 2.5	Particle Flow Jet (track p_T> 0.9GeV/c)

R_{AA} Results from PbPb Collisions

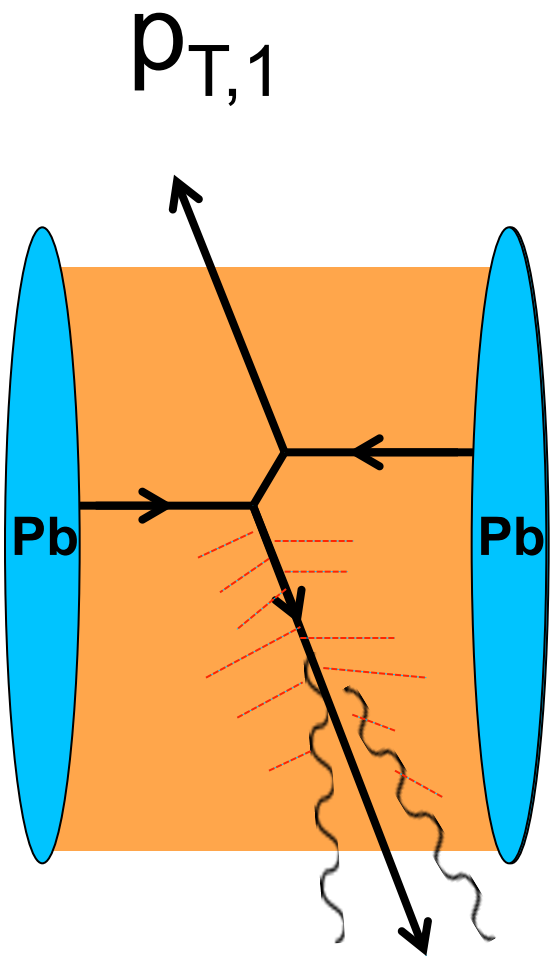


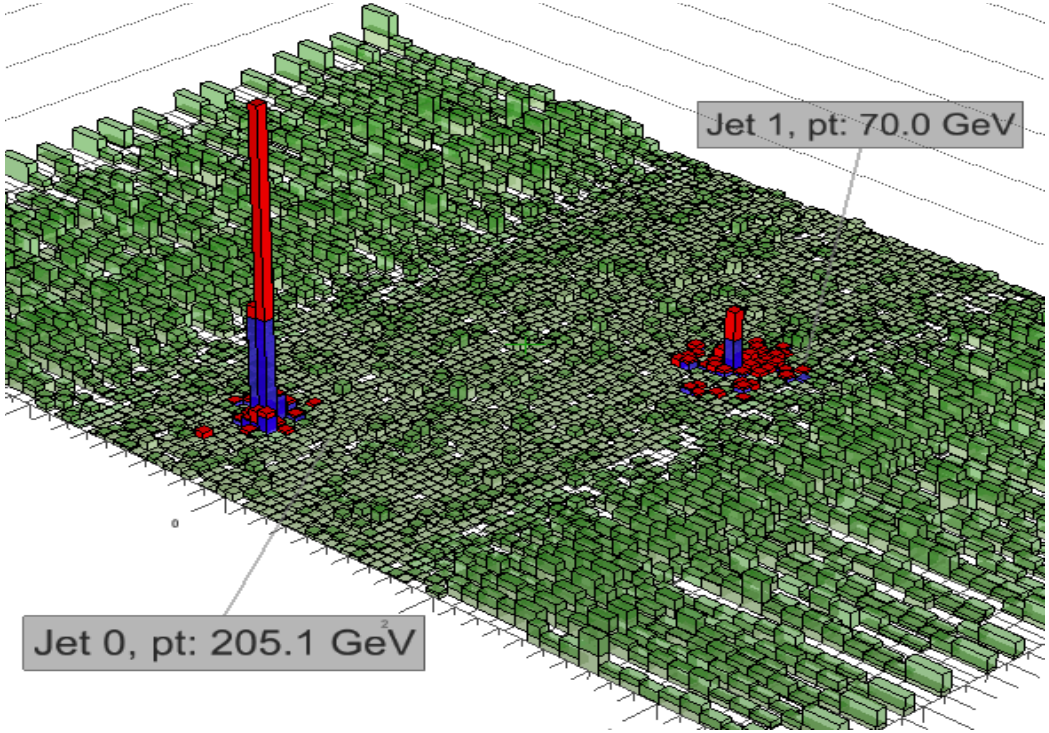


- Initial-state and final-state effects combined
- Need R_{pPb} for the interpretation of the suppression

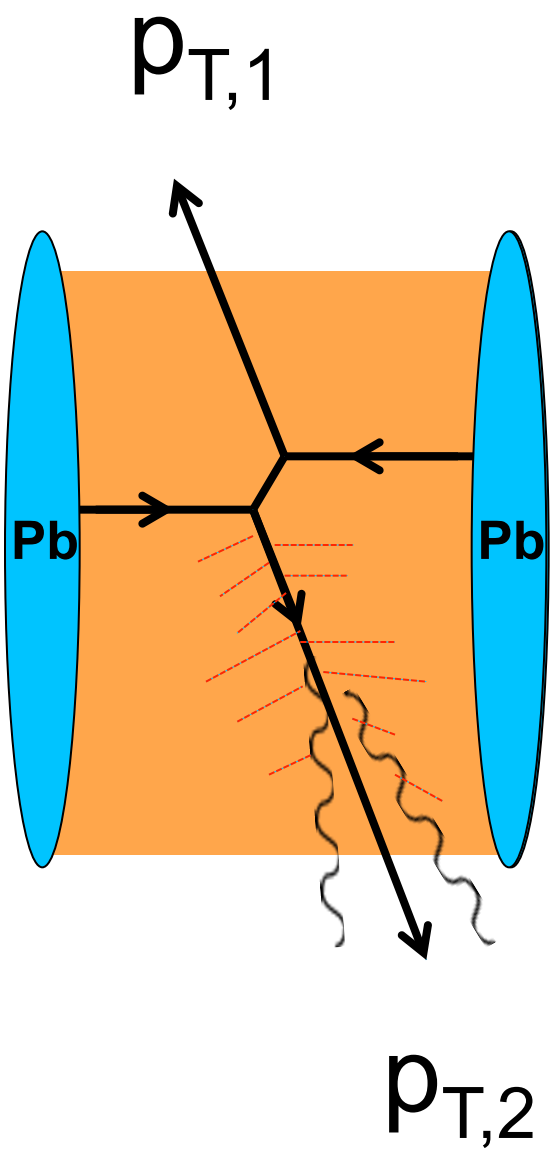
CMS: EPJC 72 (2012) 1945 , PLB 715 (2012) 66, PLB 710 (2012) 256, HIN-12-014, HIN-13-004, HIN-12-004, HIN-12-003

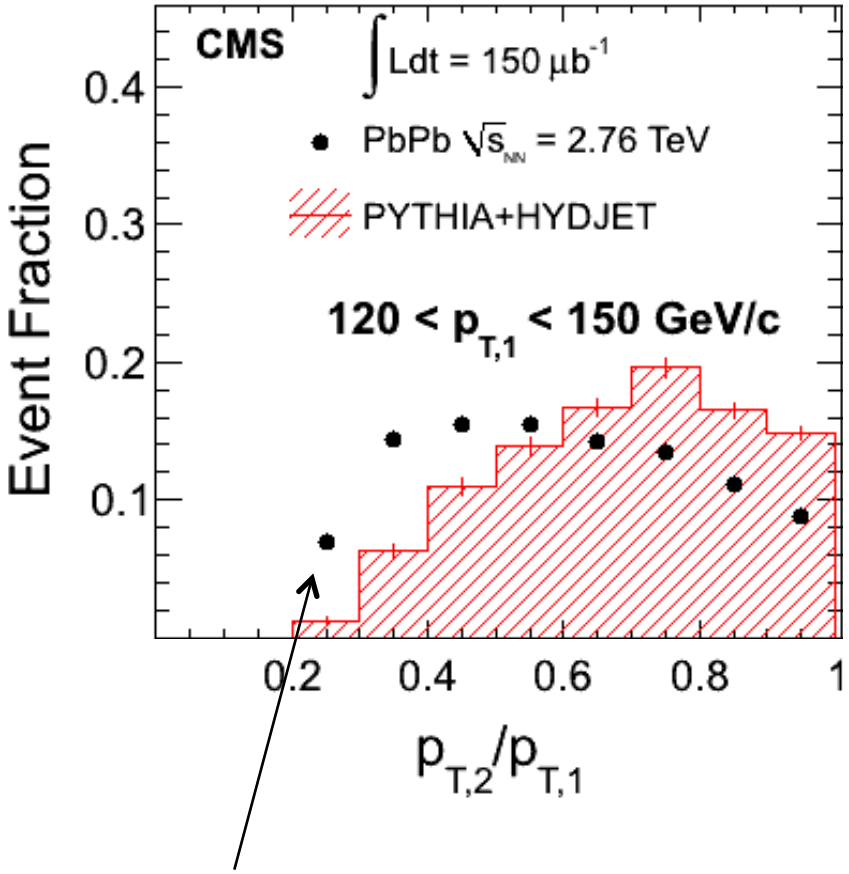
Jets in CMS





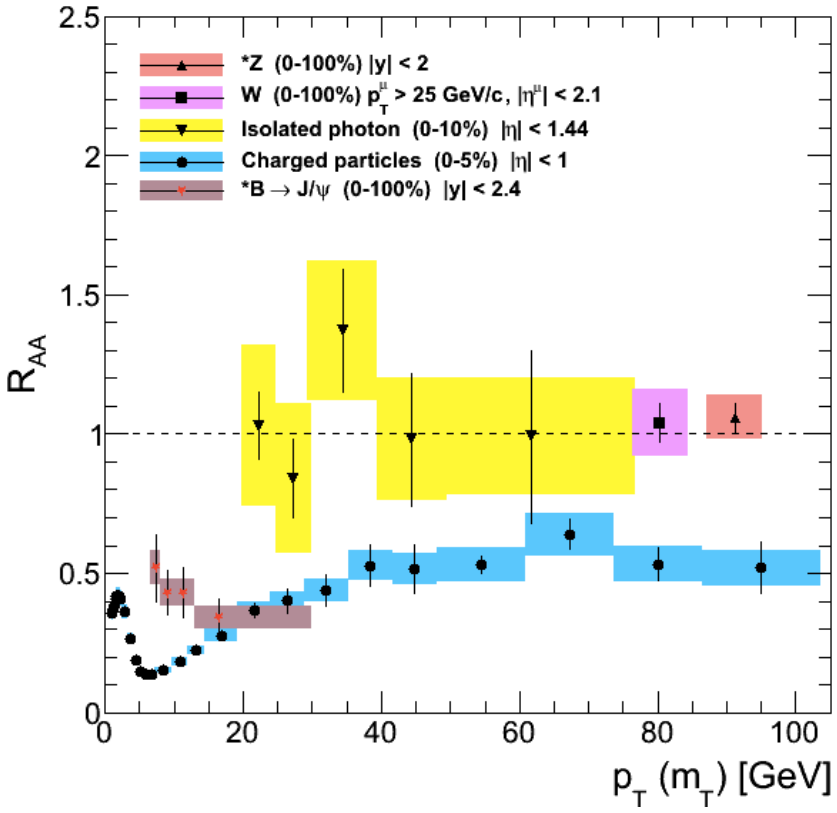
Jets in CMS

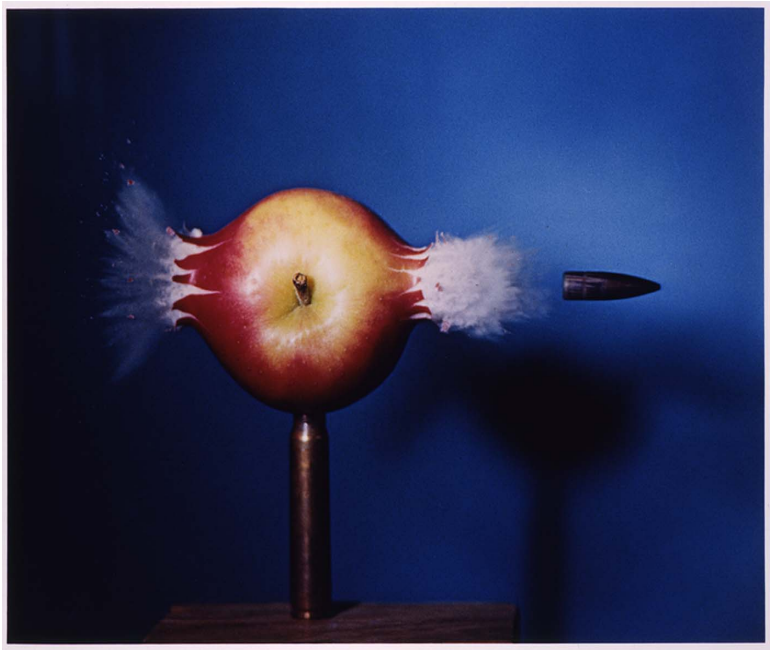




Dijets are more imbalanced in PbPb collisions

R_{AA} Results from PbPb Collisions

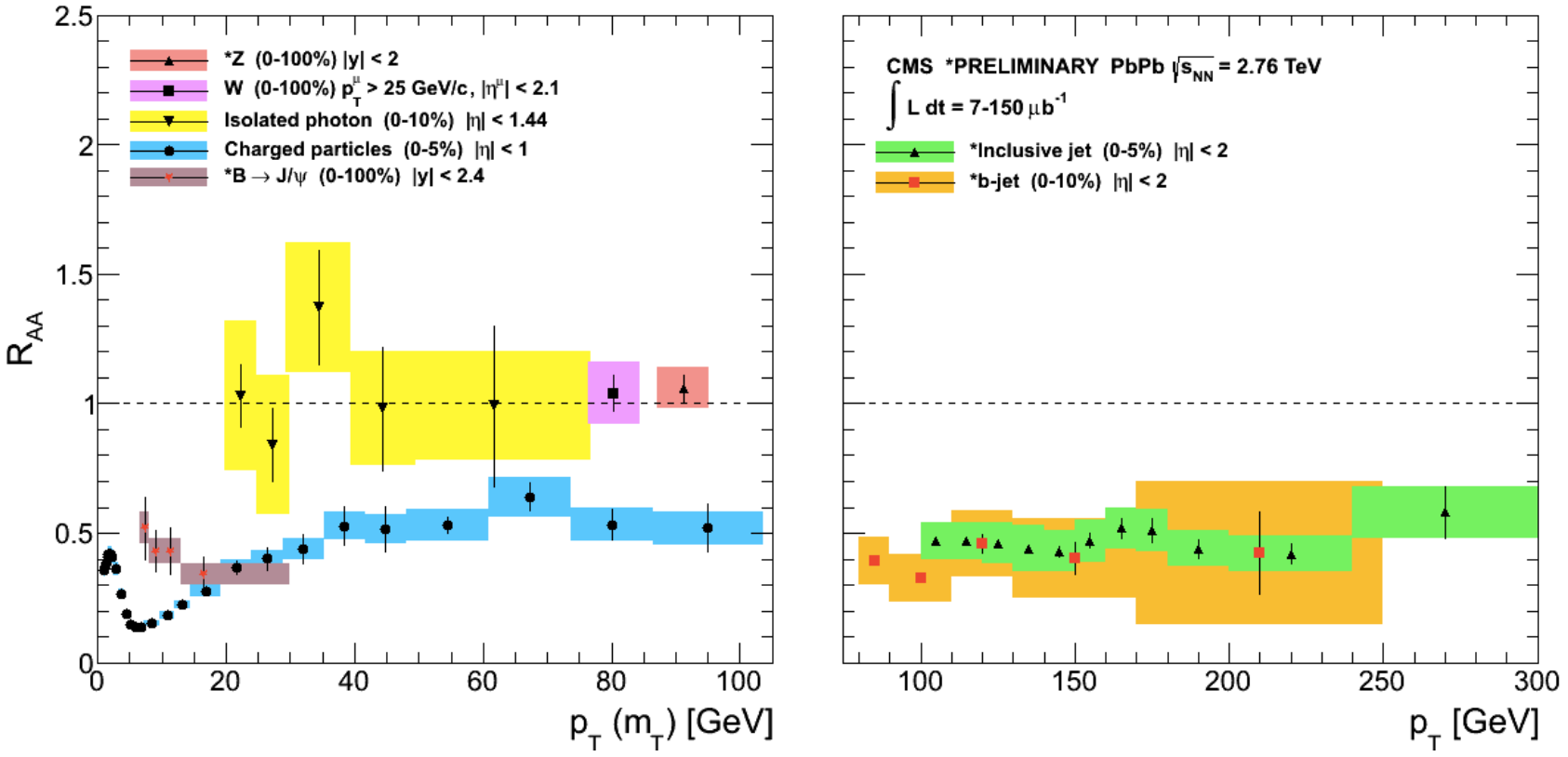




- Initial-state and final-state effects combined
- Need R_{pPb} for the interpretation of the suppression

CMS: EPJC 72 (2012) 1945 , PLB 715 (2012) 66, PLB 710 (2012) 256, HIN-12-014, HIN-13-004, HIN-12-004, HIN-12-003

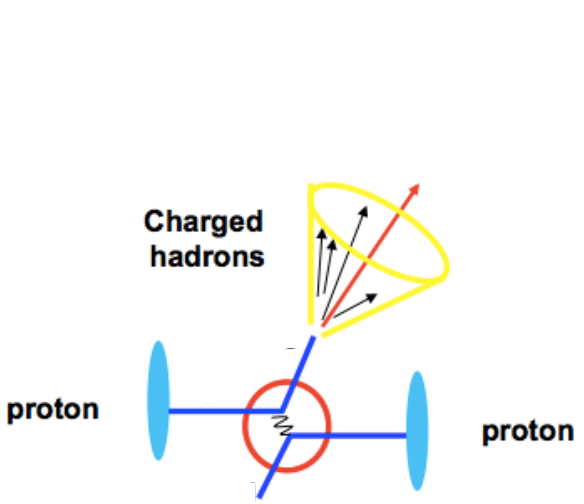
R_{AA} Results from PbPb Collisions



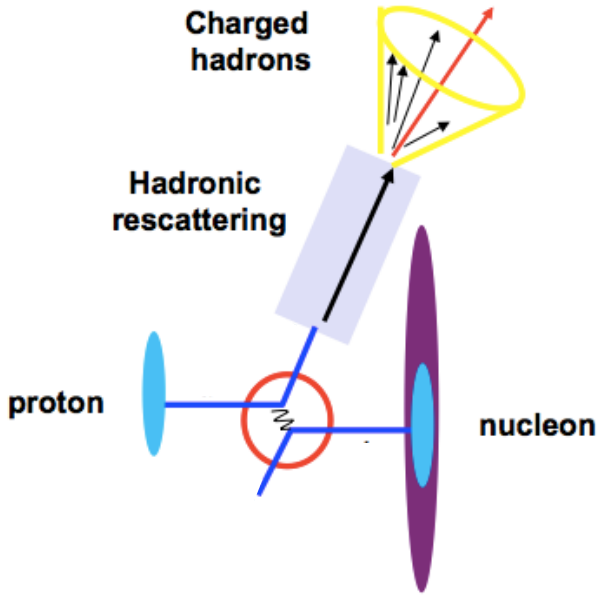
- Initial-state and final-state effects combined
- Need R_{pPb} for the interpretation of the suppression

CMS: EPJC 72 (2012) 1945 , PLB 715 (2012) 66, PLB 710 (2012) 256, HIN-12-014, HIN-13-004, HIN-12-004, HIN-12-003

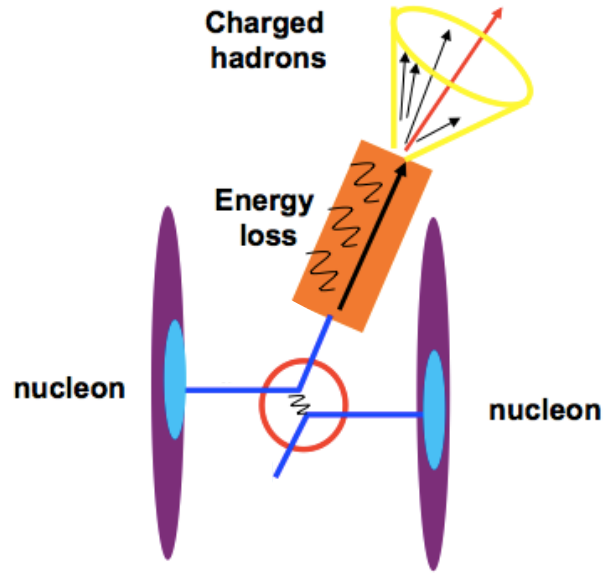
Nuclear Effects in pPb and PbPb Spectra



Parton Distribution Function
Hard-scattering cross-section
Fragmentation function



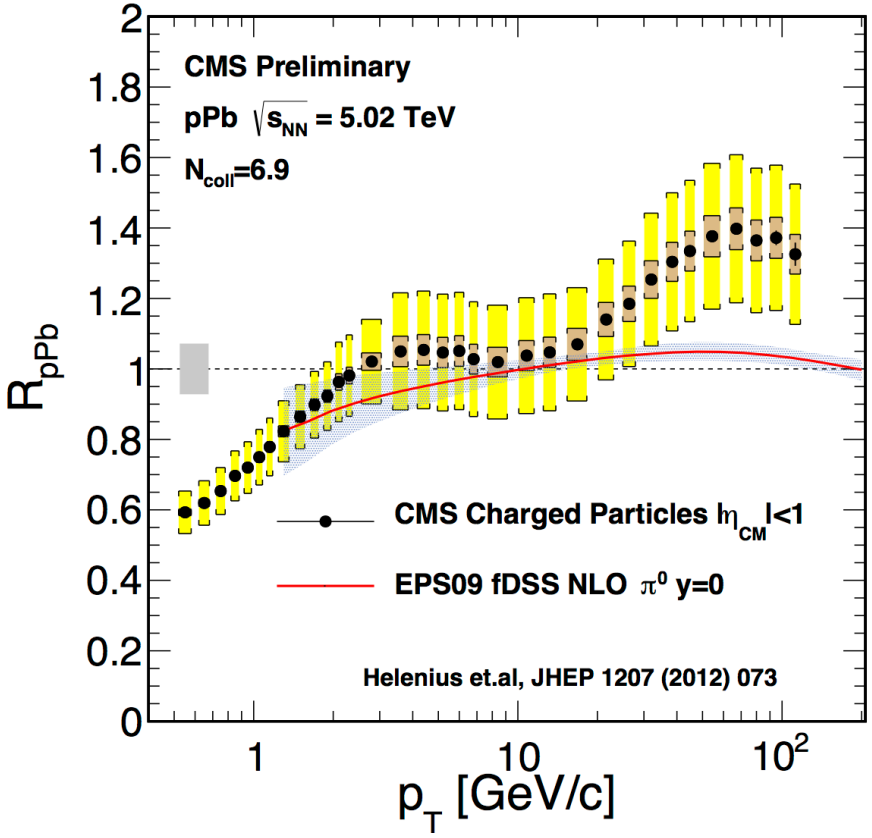
Nuclear PDF
Hard-scattering cross-section
Hadronic rescattering
Fragmentation function

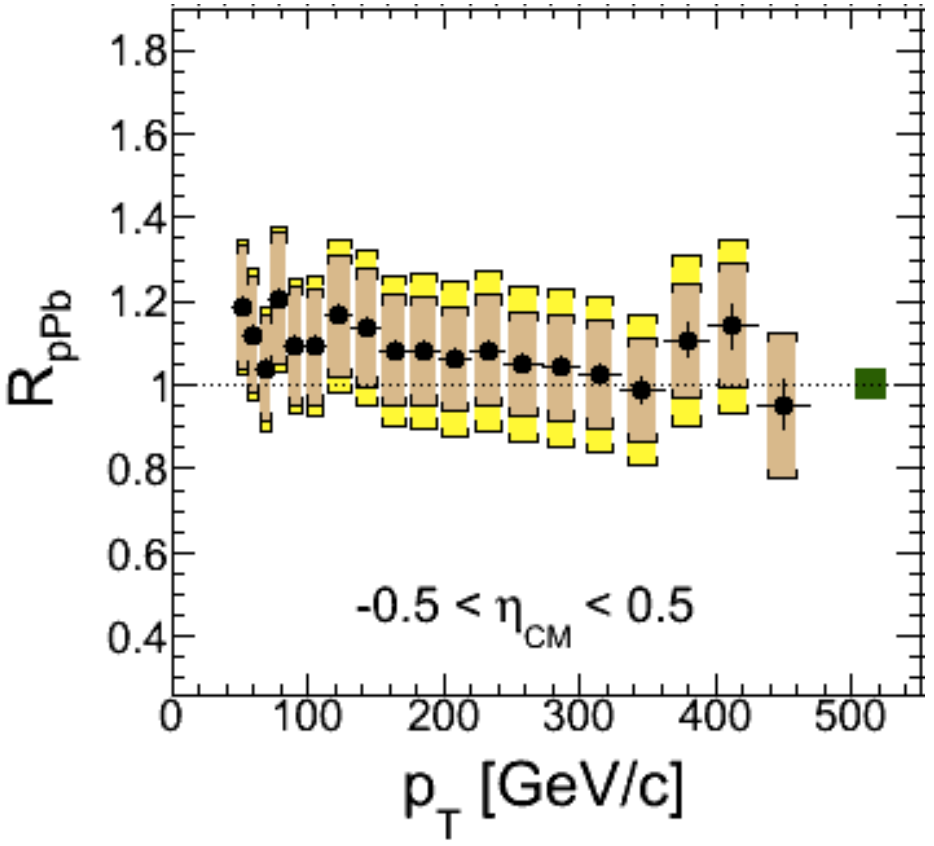


Nuclear PDF
Hard-scattering cross-section
Energy Loss in Medium
Fragmentation function

Challenge: pPb at a different energy than pp and pPb

Hadron and jet R_{pPb}

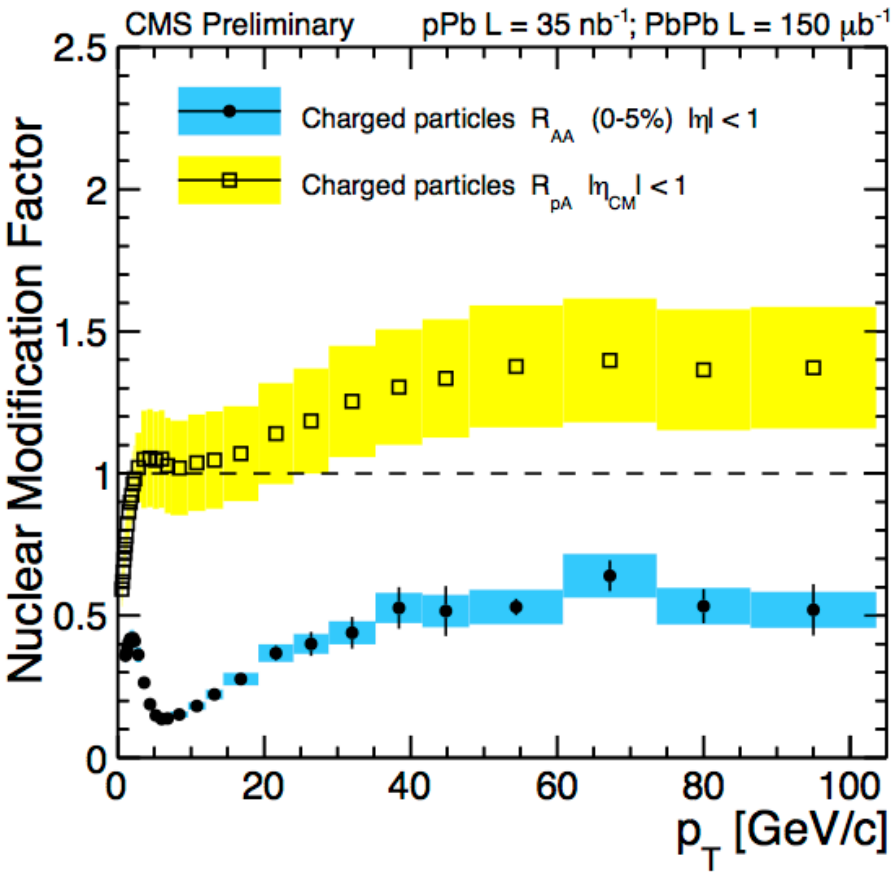




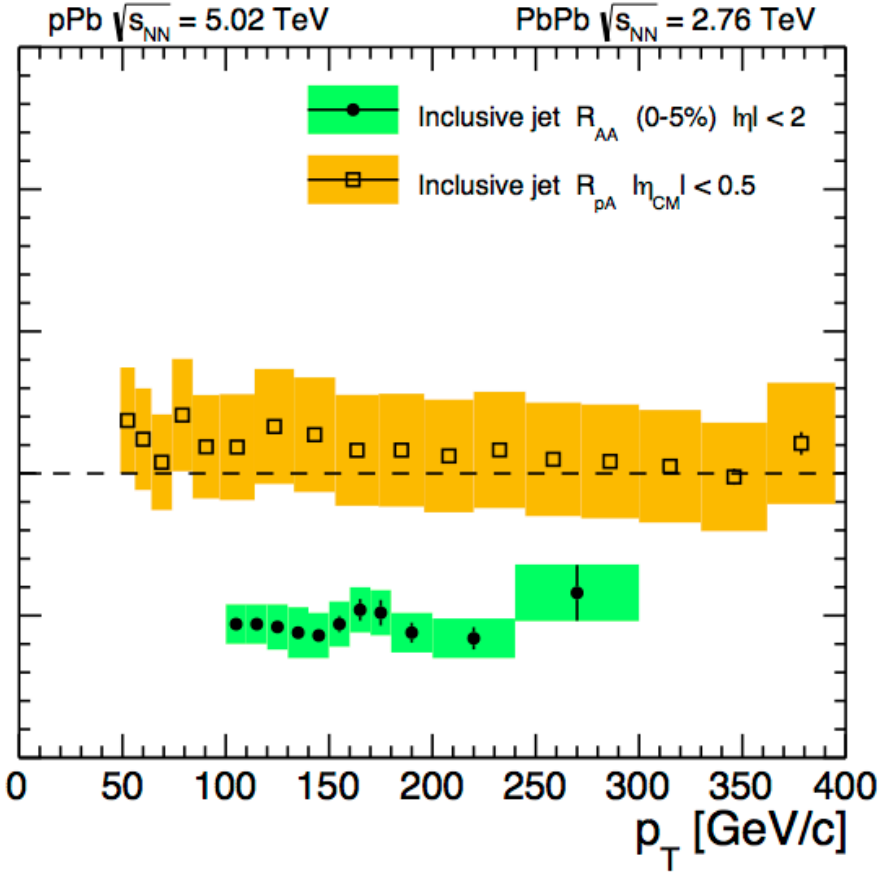
CMS: HIN-14-001

R_{pPb} and R_{PbPb}

Charged Particles



Anti-k_T R=0.3 Jets



CMS: EPJC 72 (2012) 1945 , HIN-12-004, HIN-12-017, HIN-14-001

Relation to x

CMS Preliminary

pPb 31 nb^{-1}

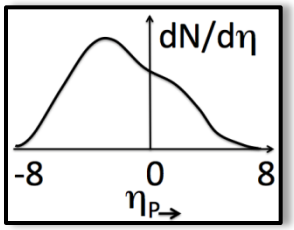
$\sqrt{s_{NN}}$ = 5.02 TeV

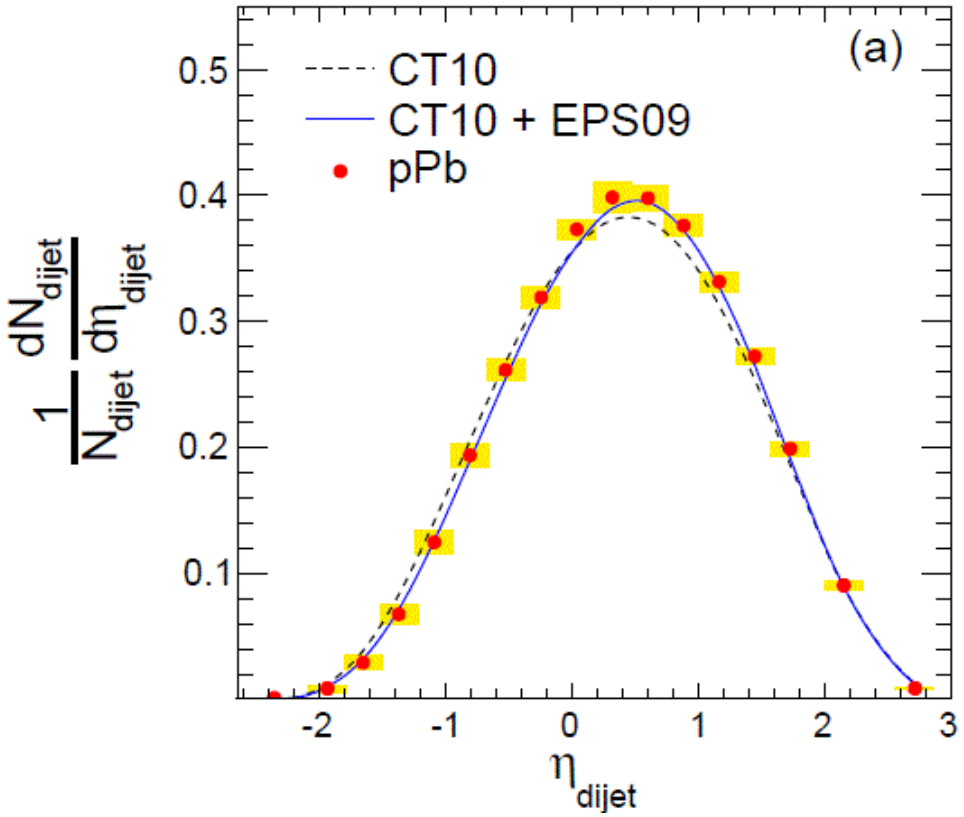
$p_{T,1}$ > 120 GeV/c

$p_{T,2}$ > 30 GeV/c

$\Delta\phi_{1,2} > 2\pi/3$

All $E_T^{HF[|\eta|>4]}$

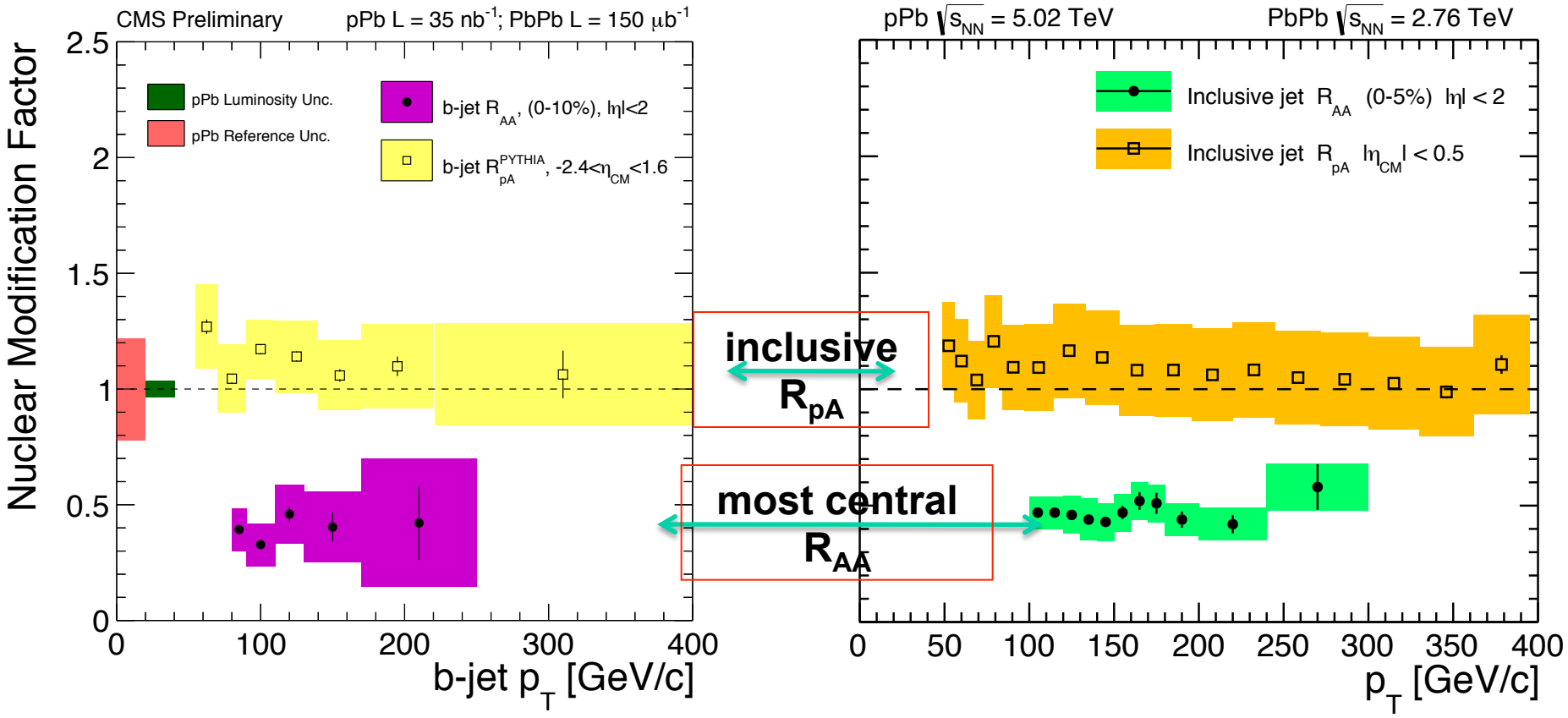




Modification to rapidity of jets previously observed, except,

- absolute normalization not known
- limited p_T range → Crucial for understanding the various effects

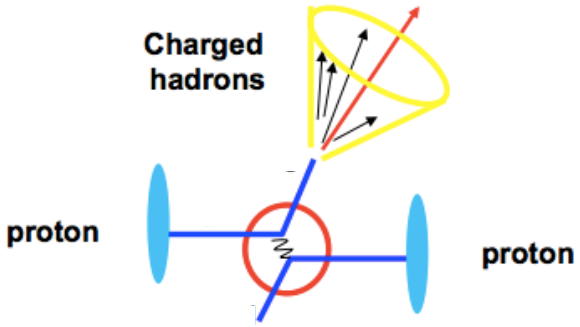
More: b-jets



- Dramatic energy loss for jets in PbPb collisions
- Virtually no modification seen in pPb collisions
- ***We observe virtually no modification as a function of jet flavor***

CMS PAS HIN-12-003 | **CMS PAS HIN-14-007** | **CMS PAS HIN-12-004** | **CMS PAS HIN-14-001**

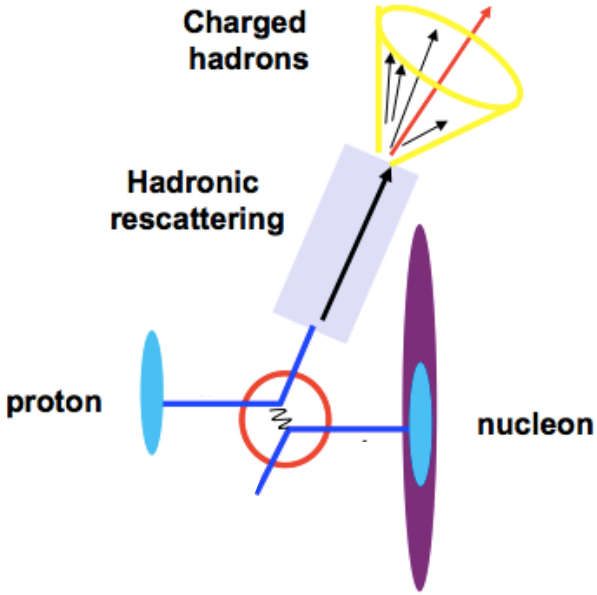
Summary



Parton Distribution Function

Hard-scattering cross-section

Fragmentation function

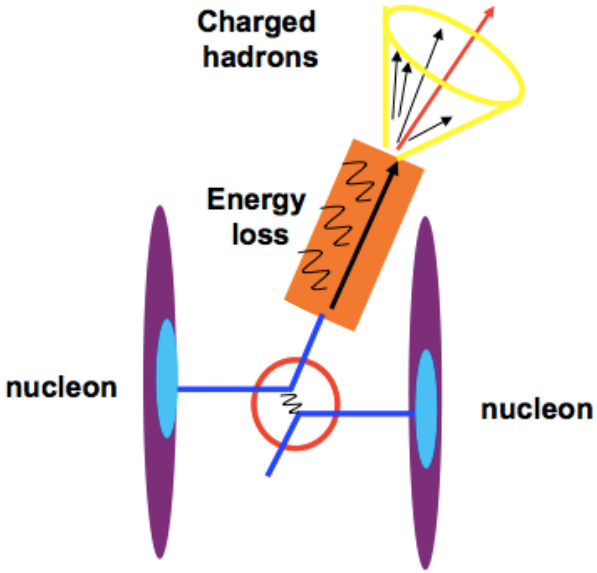


Nuclear PDF

Hard-scattering cross-section

Hadronic rescattering

Fragmentation function



Nuclear PDF

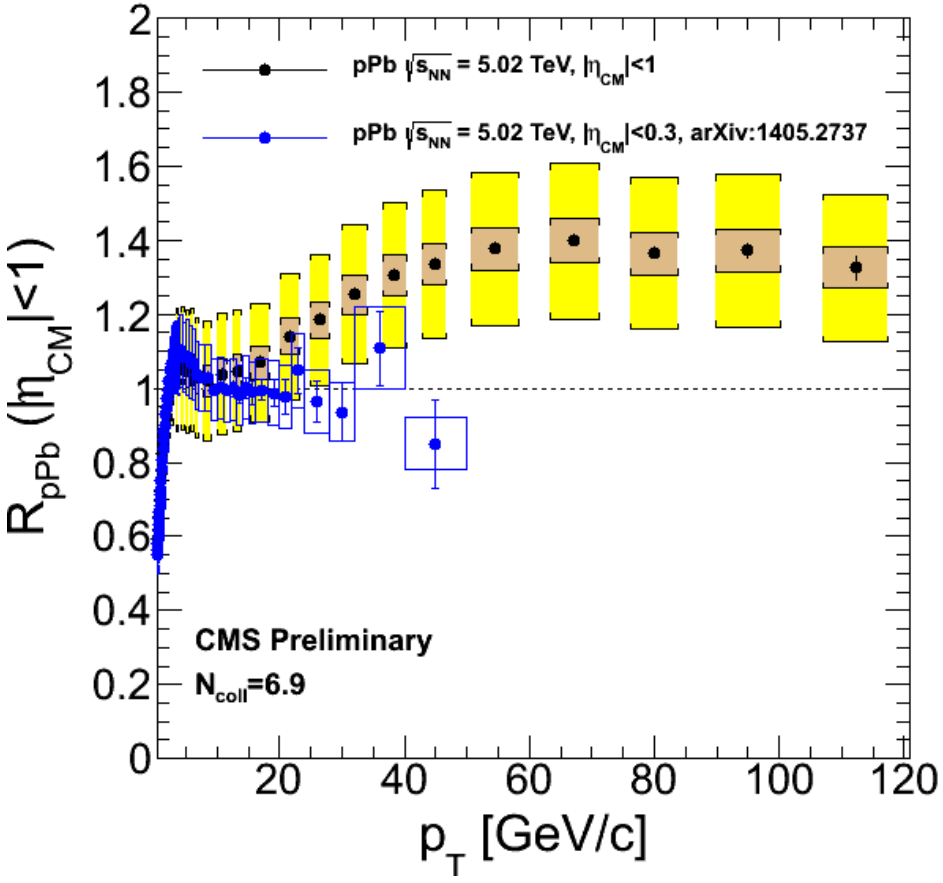
Hard-scattering cross-section

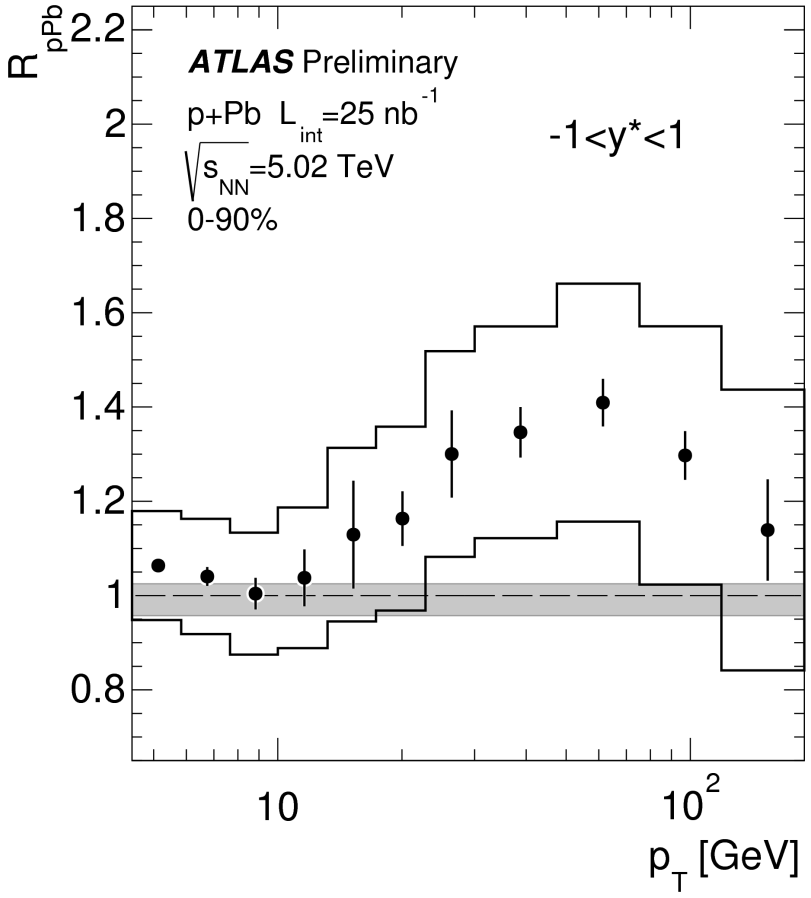
Energy Loss in Medium

Fragmentation function

Thanks

Comparison to other experiments

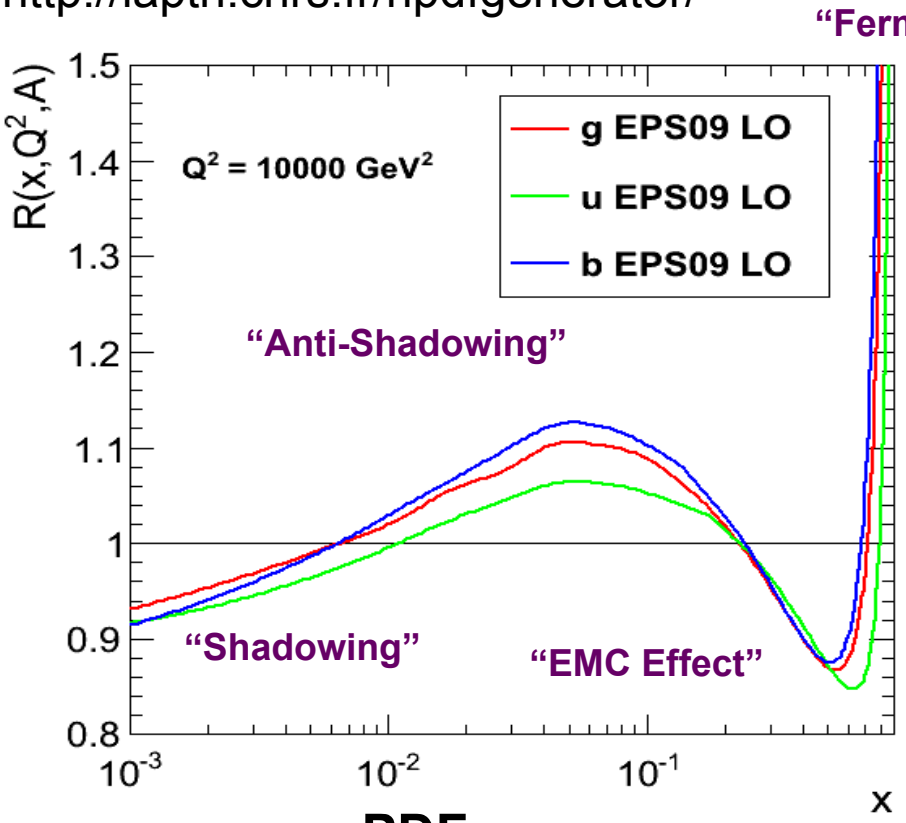




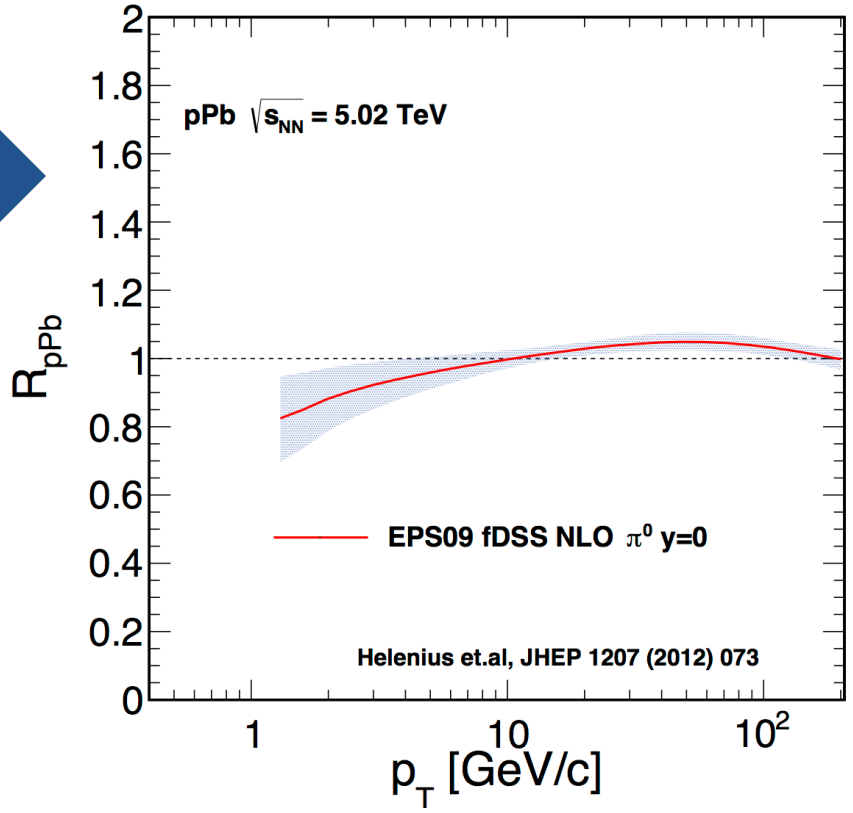
ALICE: arXiv:1405.2737
CMS: HIN-12-017
ATLAS: ATLAS-CONF-2014-029

Nuclear PDFs

François Arleo and Jean-Philippe Guillet
http://lapth.cnrs.fr/npdfgenerator/



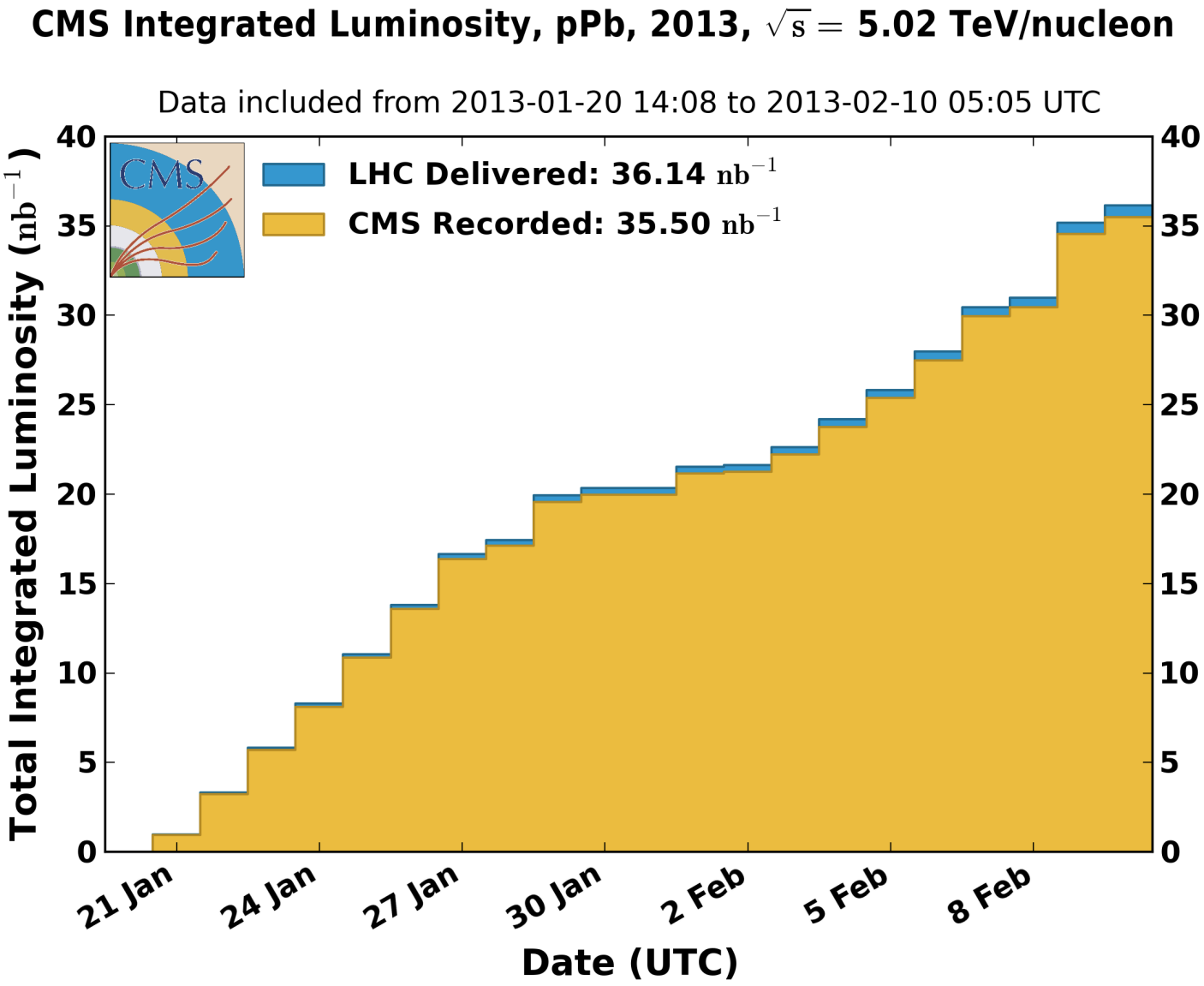
$$R = \frac{\text{nPDF}}{\text{PDF}}$$



EPS09 - K. Eskola, H. Paukkunen, C. Salgado: JHEP 04 (2009) 065

I. Helenius, et al. JHEP 07 (2012) 073

2013 pPb Luminosity



Particle Flow

Particle flow reconstructs all stable particle in the event: $h^{+/-}$, γ, h^0, e, μ

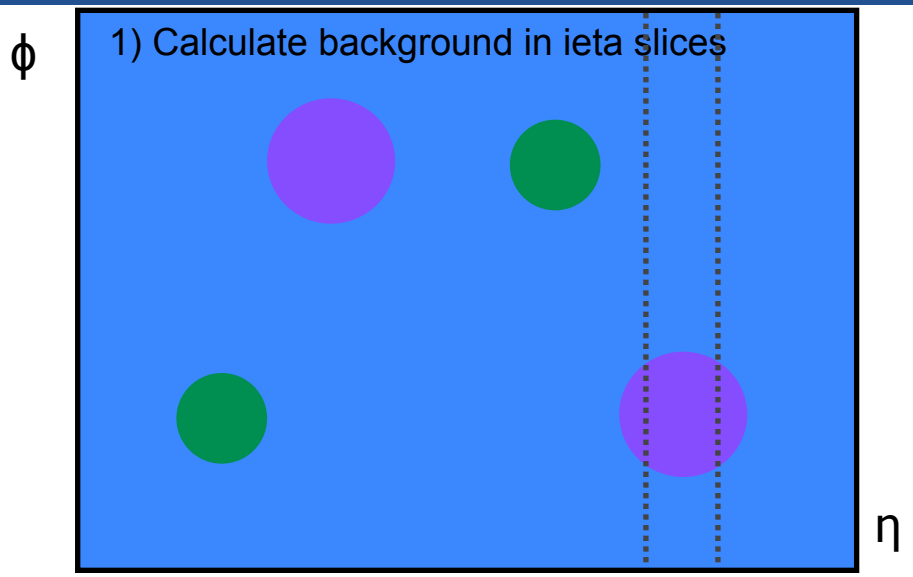
- **On average jets are:**

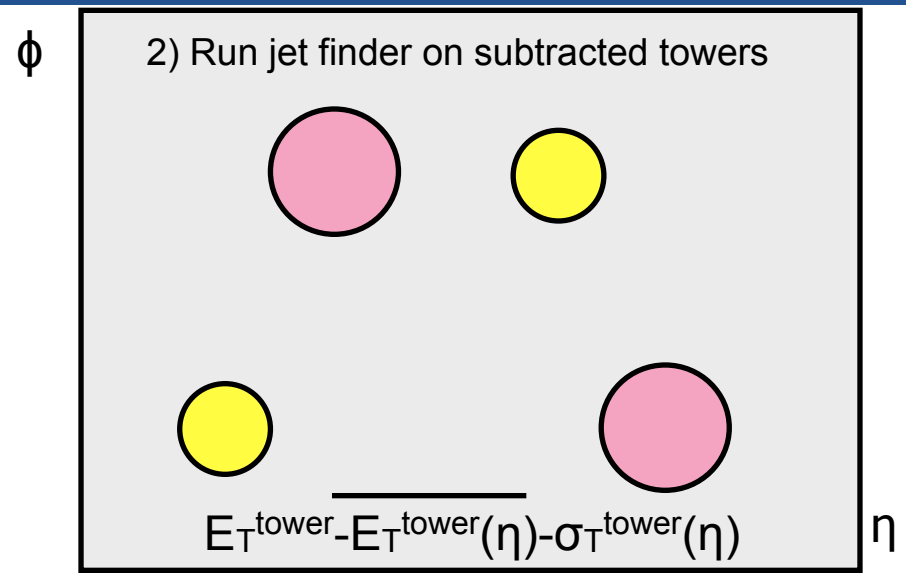
  ~ 65% charged hadrons, ~ 25% photons, ~ 10 % neutral hadrons

- **Using the silicon tracker (vs. HCAL) to measure charged hadrons**
  - **Improves resolution, avoids non-linearity**
  - **Decreases sensitivity to the fragmentation pattern of jets**
- **Used extensively in ALEPH, CMS and proposed for the ILC**

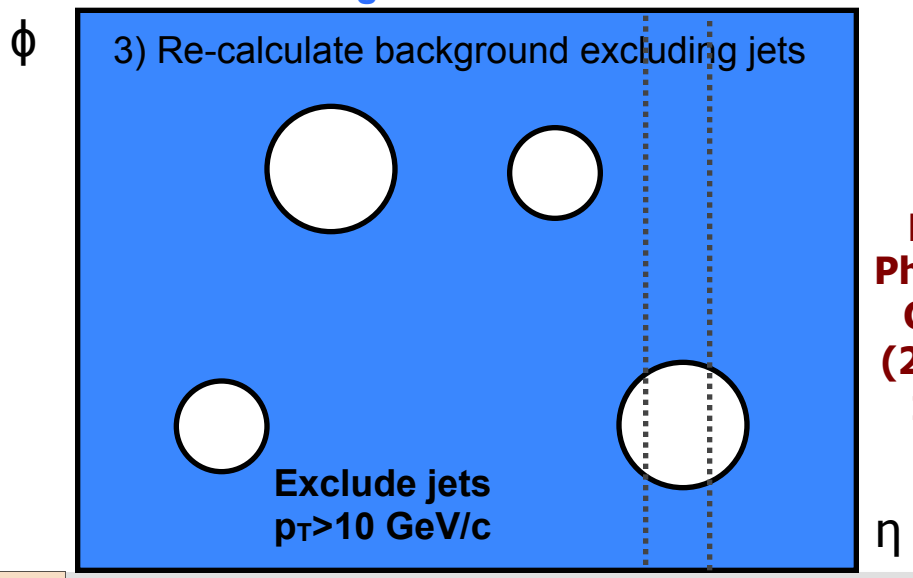
M. Nguyen for CMS, QM2011 talk

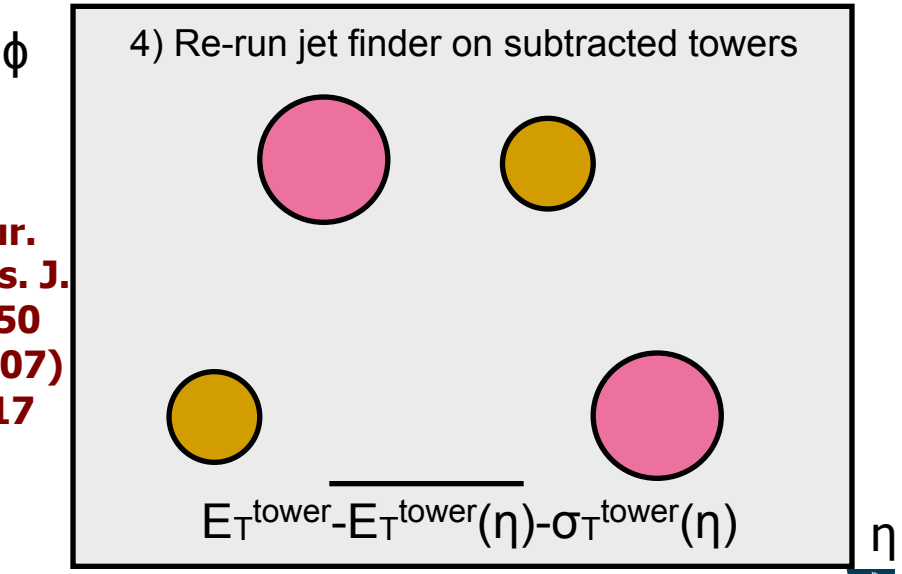
Iterative Pileup Subtraction





Original towers





Eur. Phys. J. C 50 (2007) 117