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Jet quenching and holography: experimental aspects

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(focus on light flavour energy loss)

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(not a comprehensive experimental summary)

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Hadron nuclear modification factor

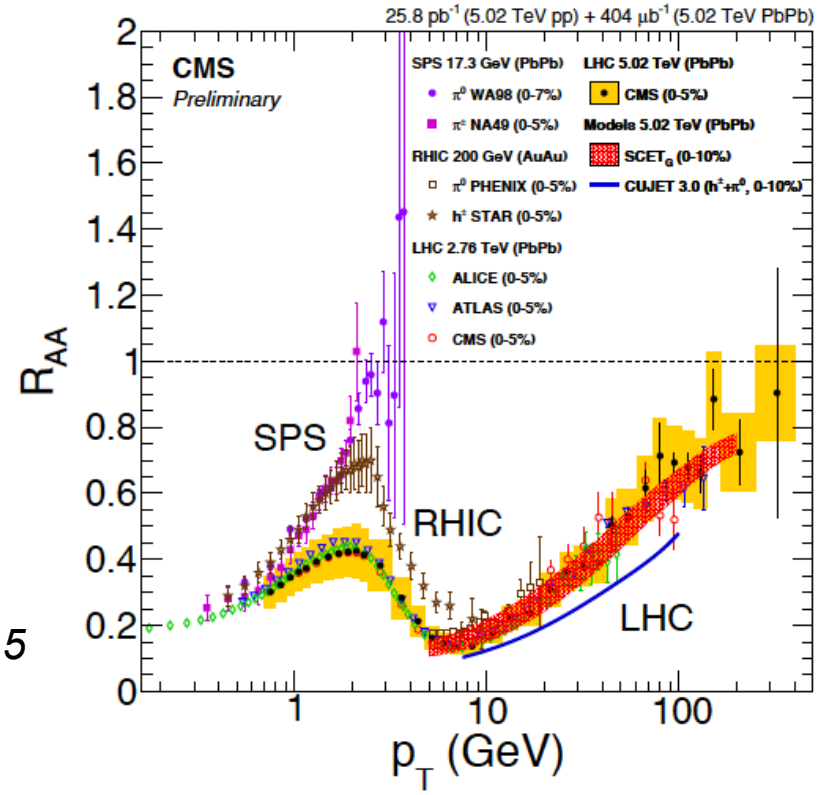
- high-p_T hadron as a proxy for jet:
  small experimental uncertainties, but often
  difficult to calculate for theory (fragmentation needed)

- experimental biases: high-*z* fragment, 'hard' fragmentation pattern

- connection to parton kinematics
  not straight forward

$$R_{AA}(p_{\mathrm{T}}) = \frac{1}{T_{AA}} \frac{\mathrm{d}^2 N_{\mathrm{ch}}/\mathrm{d}\eta\,\mathrm{d}p_{\mathrm{T}}}{d^2\sigma^{\mathrm{pp}}_{\mathrm{ch}}/d\eta\,\mathrm{d}p_{\mathrm{T}}}$$

CMS PAS HIN 15-015



Jets in heavy-ion collisions

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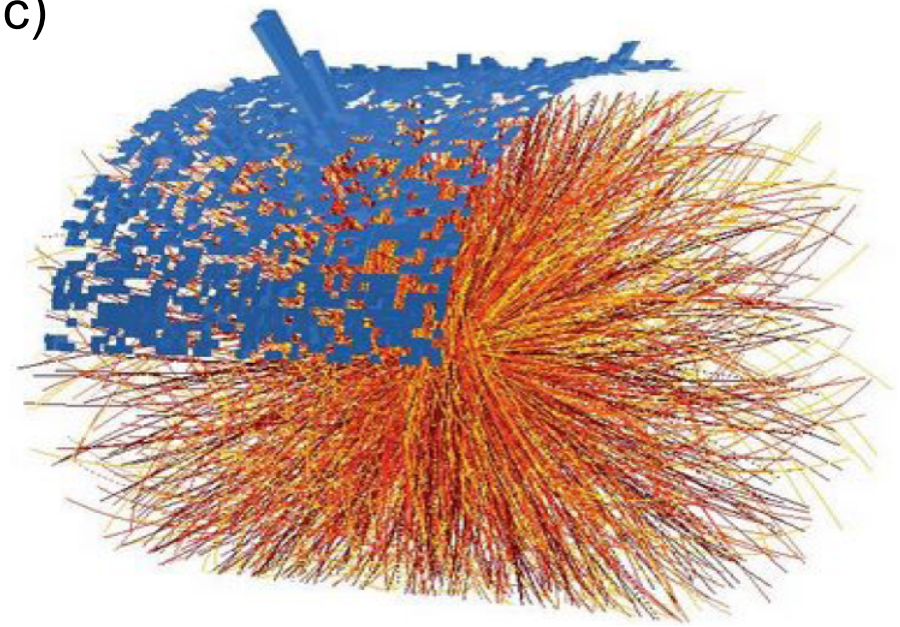
- jet reconstruction in heavy-ion collisions :
  high underlying event background from soft particles not related to hard scattering

- relevant scale for quenching effects likely T^{med} : several 100 MeV

- compromise between experimental uncertainties and physics significance

- parameters:
  - constituent p_T (150 MeV/c - 2 GeV/c)
  - jet radius (0.2 - 0.5)
  - fragmentation biases
    (minumum leading constituent p_T,
    match to tracking jet, …)
  - jet p_T (40 - several 100 GeV/c)
  - (semi-)/inclusive
    (*ALICE JHEP 09 (2015) 170)*



Jet nuclear modification factor

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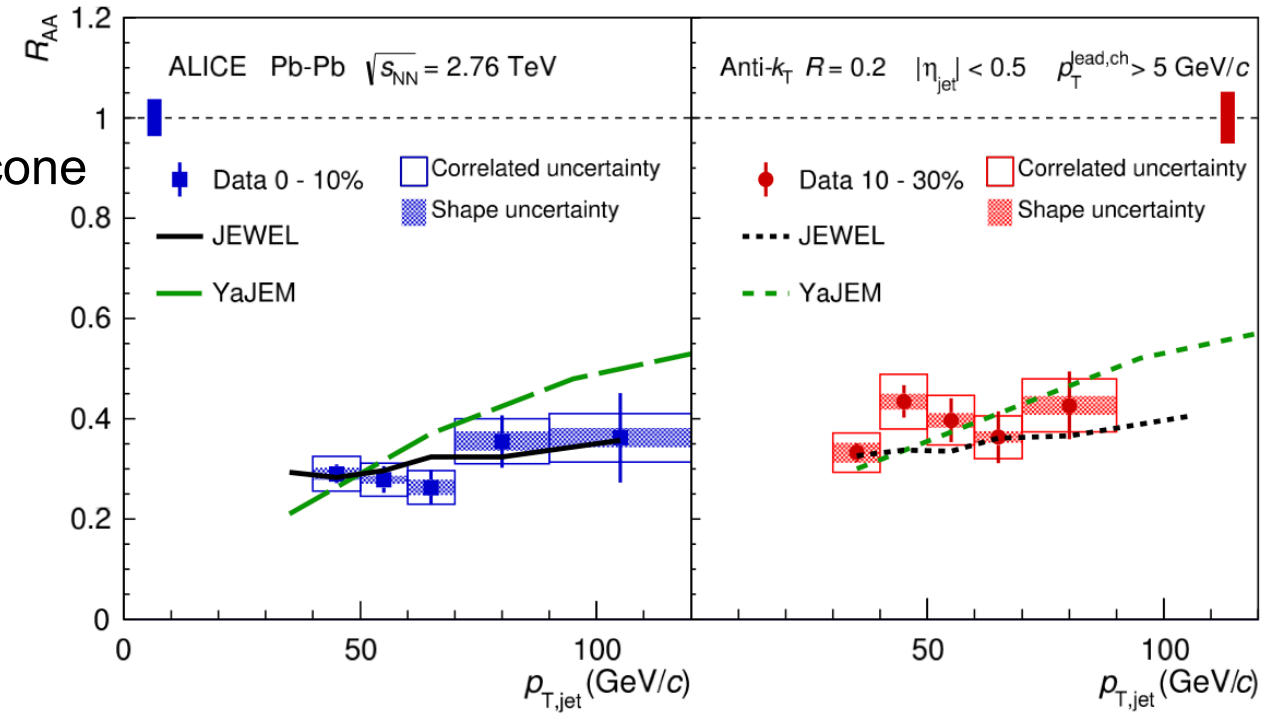
- strong suppression, similar to hadron RAA
  → parton energy not recovered inside jet cone

- increase of suppression with centrality, weak p_T dependence

- JEWEL:
  - microscopic pQCD parton shower + gluon induced emissions



- YaJEM:
  - detailed fireball model
  - parameterisation of radiative and collisional energy loss

Phys.Lett. B746 (2015) 1
JEWEL: PLB 735 (2014)
YaJEM:PRC 88 (2013) 014905

- different models reproduce observed jet suppression
  → further constraints needed, more differential measurements !

Democratic branching ?

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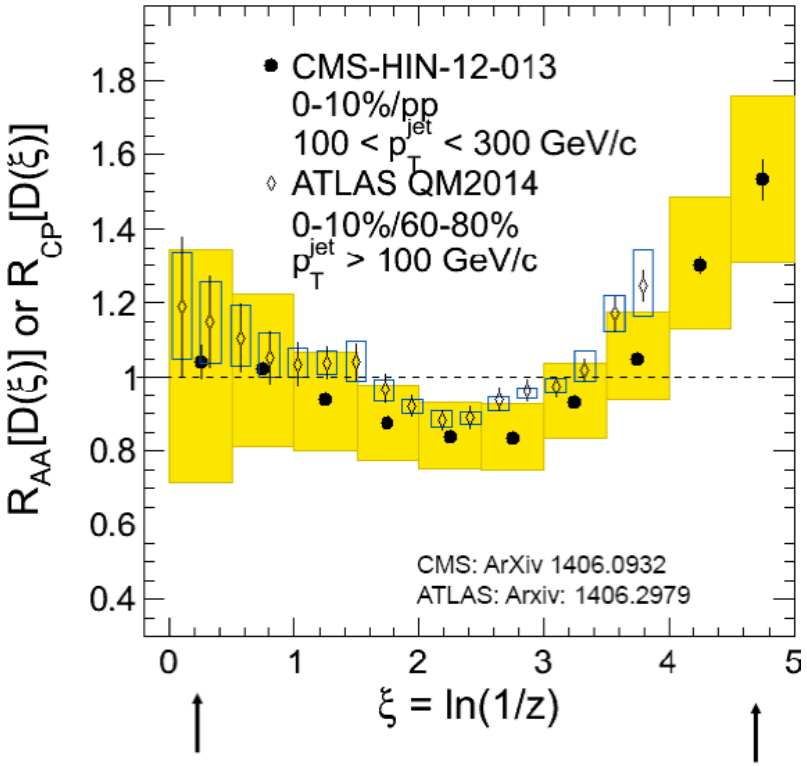
- democratic branching expected in strongly coupled energy loss (?)
- jet fragmentation measured by ATLAS, CMS:
  modest modification of jet fragmentation compared to pp
- high-z region seems unmodified / only weakly modified
- enhancement at low p_T
- also note CMS results for splitting functions
  (CMS-HIN-16-006)



Jet and high-p_T hadron v_2

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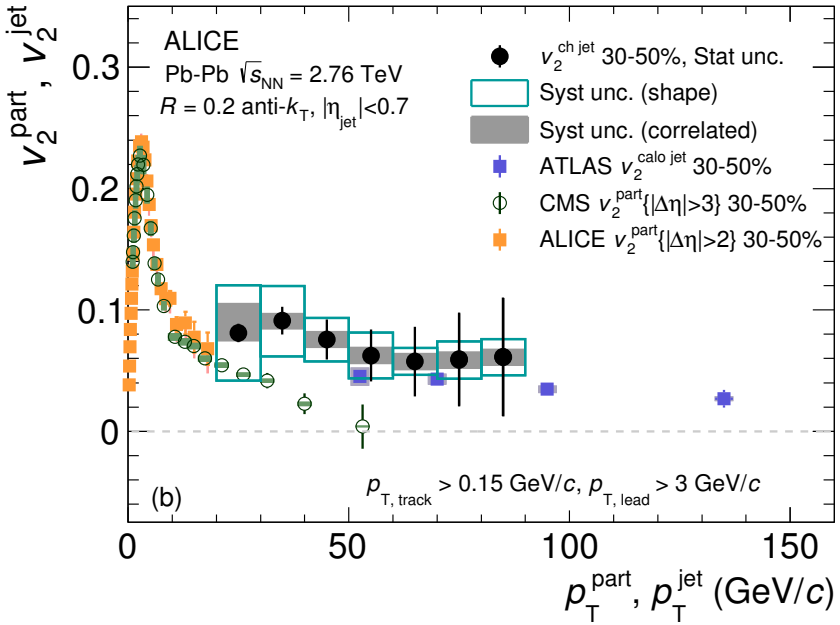
- path-length dependence of energy loss:
  - elastic ~L
  - pQCD ~L^2
  - strong coupling ~L^3

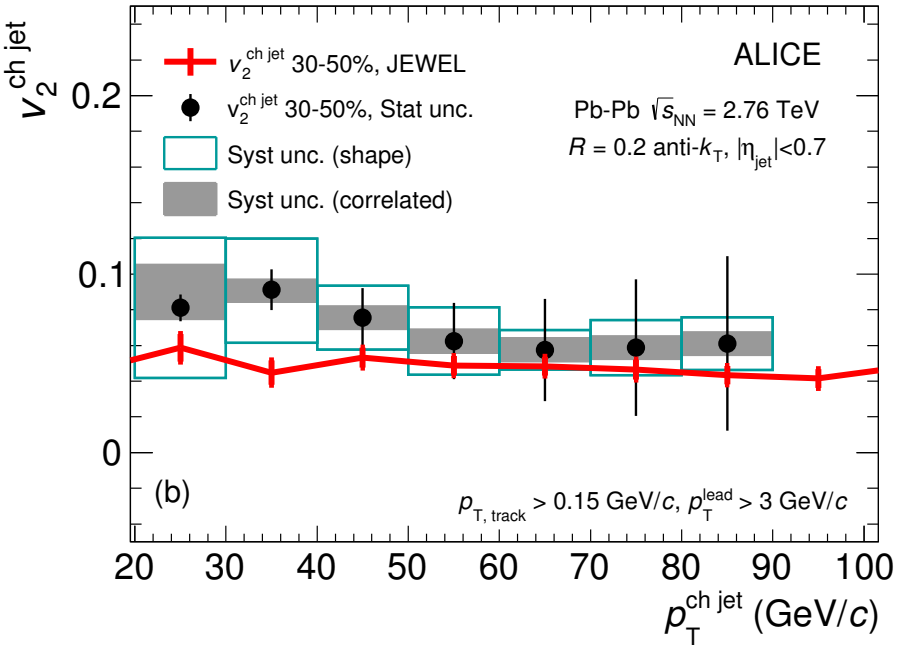
CMS, PRL 109 (2012) 022
ATLAS, PRL 111 (2013) 152

ALICE, Phys. Lett. B753 (2016) 511
ALICE, Phys. Lett. B719 (2013) 18

JEWEL: K.C. Zapp, F. Kraus, U.A. Wiedemann, JHEP 1303 (2013) 080

- v_2 described by JEWEL (pQCD based)

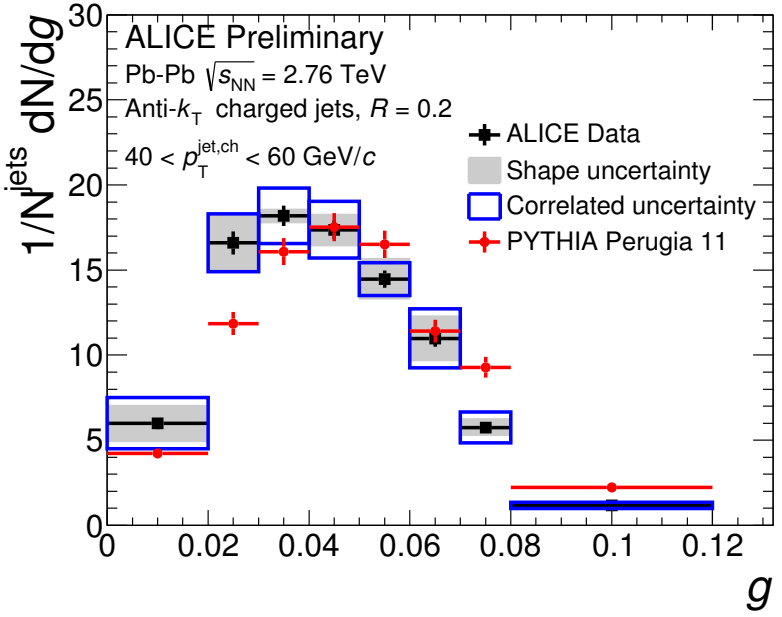


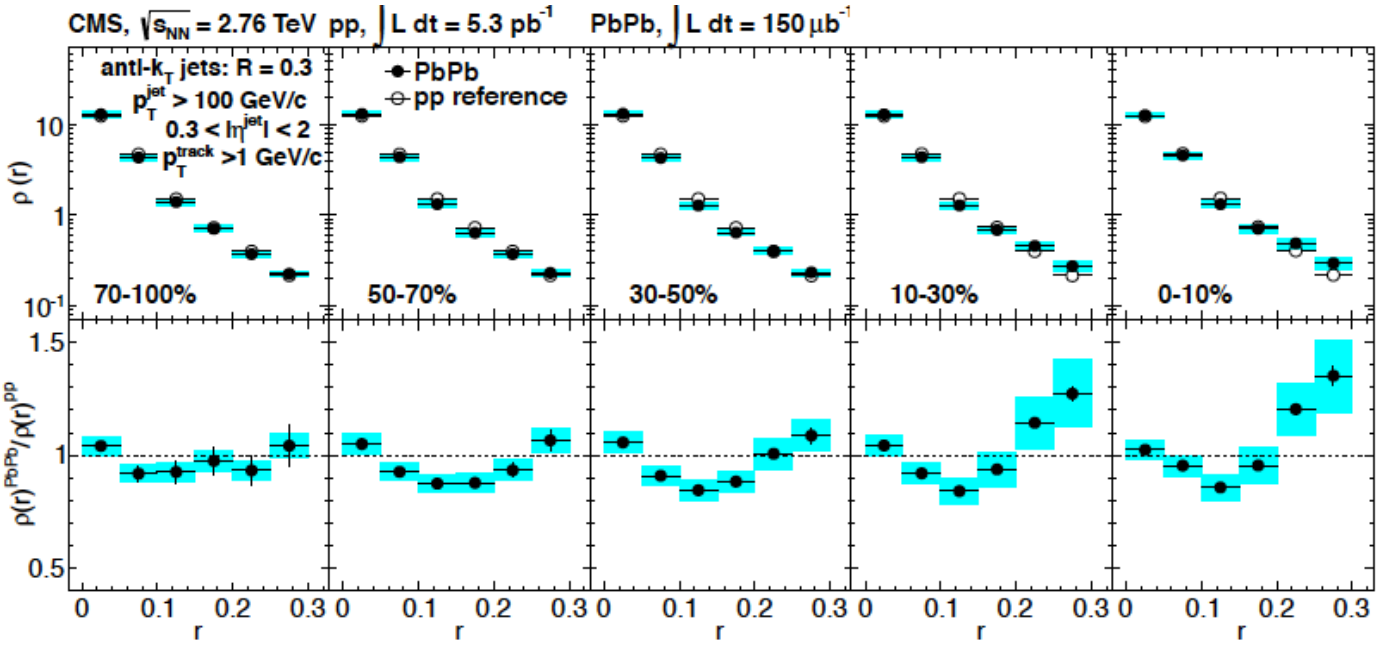


Transverse jet profile

- transverse structure by CMS (p_T^{jet} ~100 GeV/c)
- girth (average transverse width) by ALICE (p_T^{jet} > 40 GeV/c)

- many other measurements …





CMS,
Phys. Lett. B 730 (2014) 243