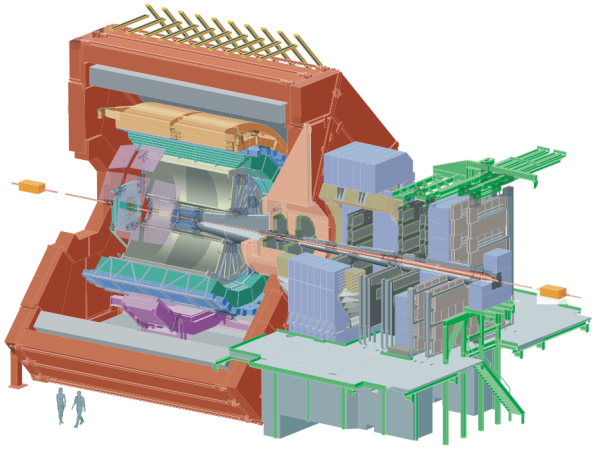
Yale University

Inclusive jet measurements in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with ALICE



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for the
ALICE Collaboration

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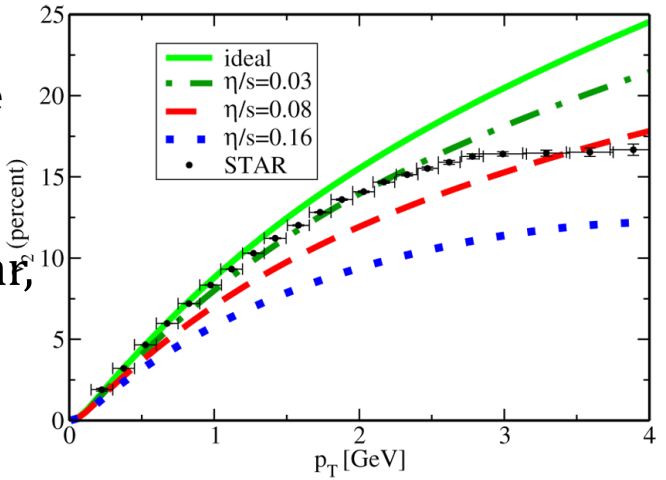
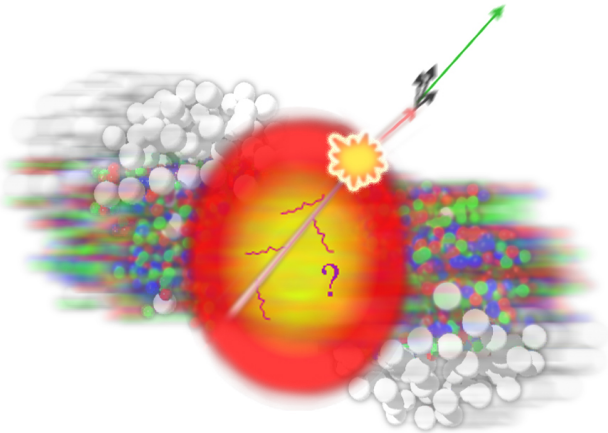
Introduction

- Since the discovery of the QGP, there have been two particularly exciting discoveries:
  - Strong coupling: η/s and the AdS/CFT correspondence
  - Small systems: The nearside ridge, strangeness enhancement
- The implications of these discoveries are not yet clear, but they point to fundamental insights about QCD
- Can jet physics offer a similar insight?
  - The past: Jet suppression as proof of the QGP
  - The present: Learn about the structure of the hot QCD medium by understanding how jets interact with it
- Two indirect approaches discussed in this talk:
  - Inclusive spectra: Measure inclusive jet spectra at different collision energies and kinematical ranges, to constrain jet energy loss models
  - Jet substructure: Investigate how quenching modifies the structure of jets



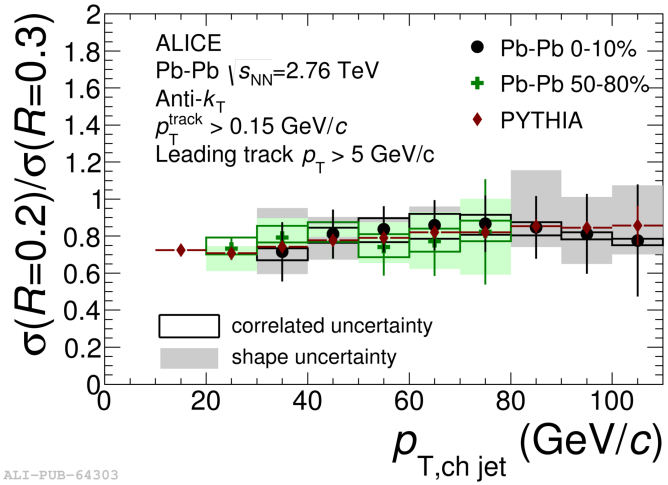
P. Romatschke and U. Romatschke, Phys. Rev. Lett. 99, 172301 (2007)

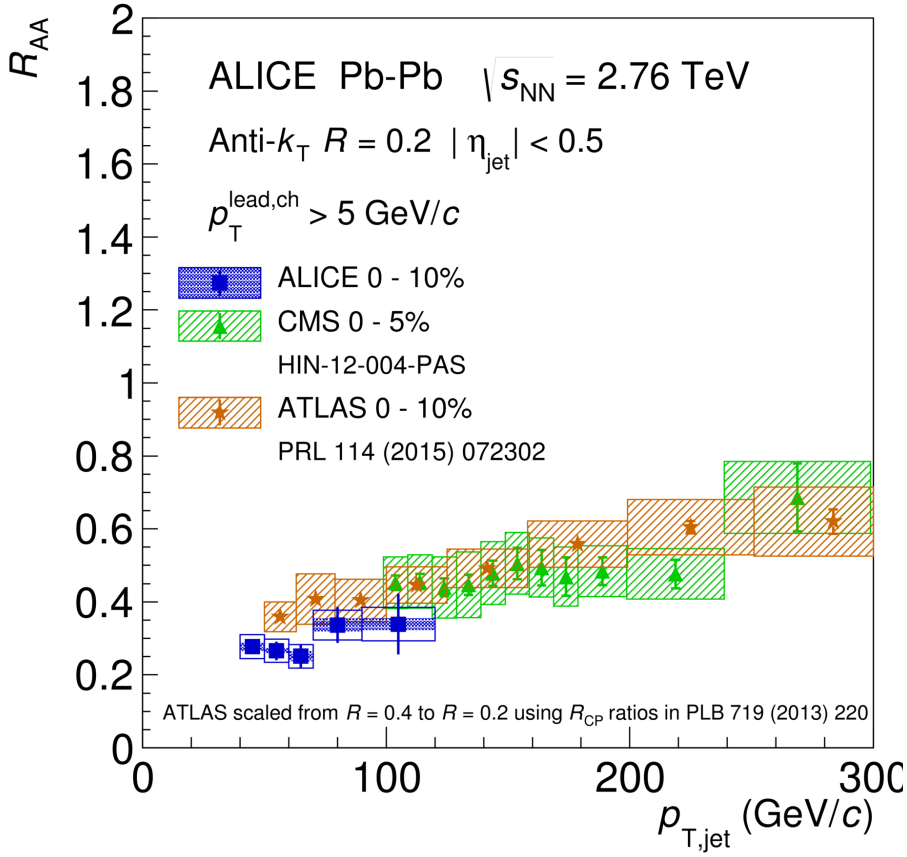


http://newscenter.lbl.gov/2010/01/14/jet/

Inclusive jet measurements

- ALICE has published full jet R_{AA} down to $p_T = 40$ GeV at $\sqrt{s_{NN}} = 2.76$ TeV
  - Strong quenching observed
- Jet cross-section ratio R=0.2 / R=0.3 published for charged jets at 2.76 TeV
  - Consistent with Pythia



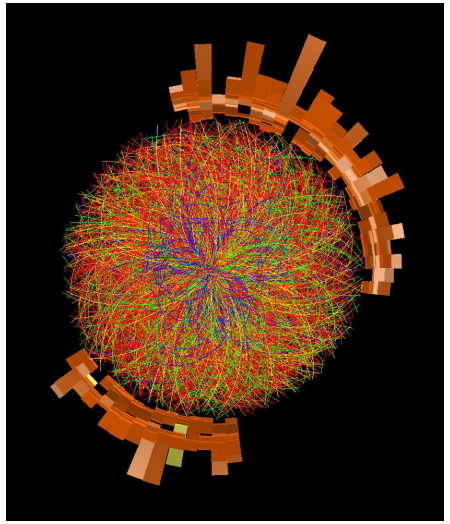


- This talk: Full jet measurement at 5.02 TeV in 0-10% centrality

Jet reconstruction in ALICE

- ALICE reconstructs "full" jets by combining charged tracks with neutral EMCal clusters using the anti-k_T algorithm:

$$p_{\mathrm{T}}^{\mathrm{jet}} = \sum_i p_{\mathrm{T,i}}^{\mathrm{track}} + \sum_i p_{\mathrm{T,j}}^{\mathrm{cluster}}$$

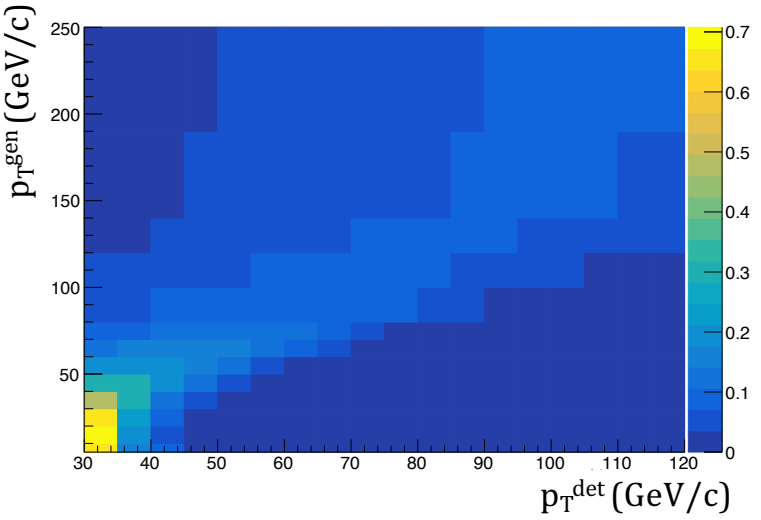


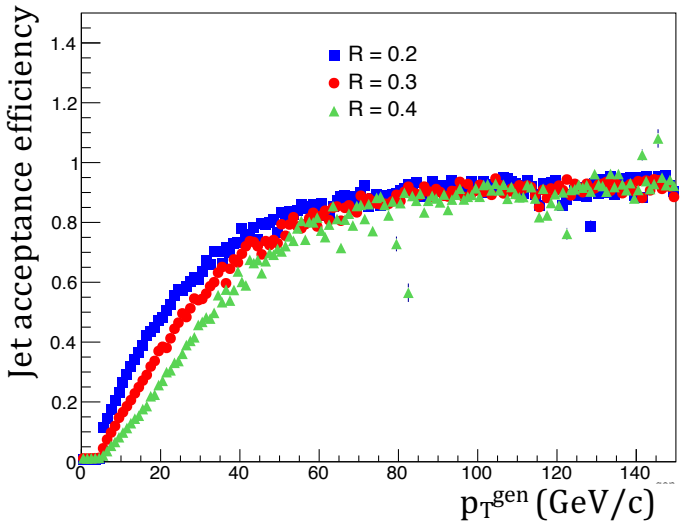
- The average combinatorial background is subtracted event-by-event using k_T charged jet p_T-density, scaled by a calorimeter density factor

- Full jets are more accurate than charged jets, and more directly comparable to theory
  - Experimentally, they are more challenging
- ALICE precision tracking allows jet reconstruction down to low p_T

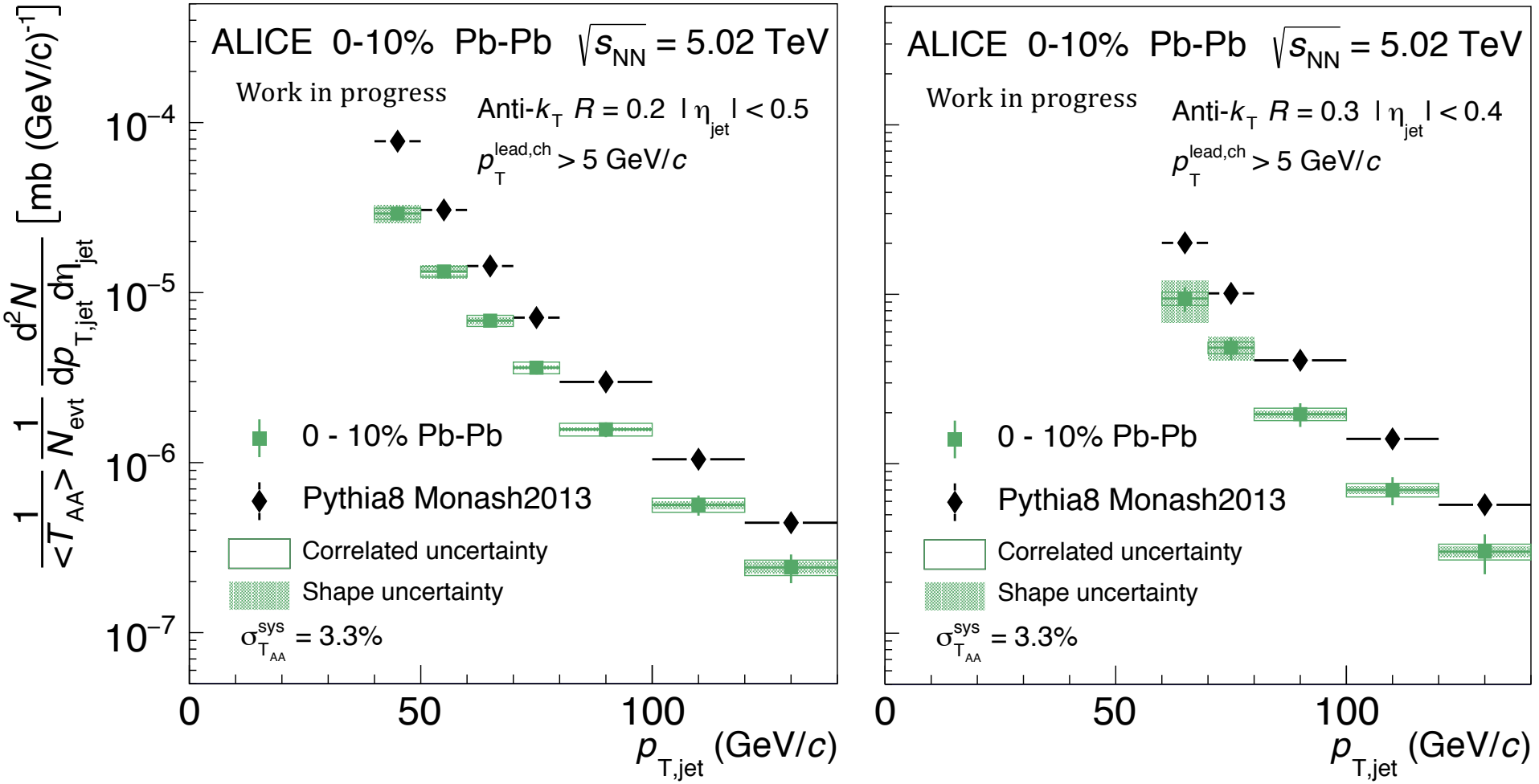
Analysis method

- Reconstruct R = 0.2, 0.3 jets
  - 0-10% centrality
- Suppress combinatorial jets by:
  - Requiring jets to contain a 5 GeV charged track
  - Selecting a measured range ≈5σ above the background fluctuations
- Unfold detector response and background fluctuations
  - Build a response matrix by **embedding** Pythia8 events into Pb-Pb data
- Correct the unfolded result for kinematic efficiency and jet reconstruction efficiency
- Dominant systematics:
  - Tracking efficiency
  - Unfolding regularization

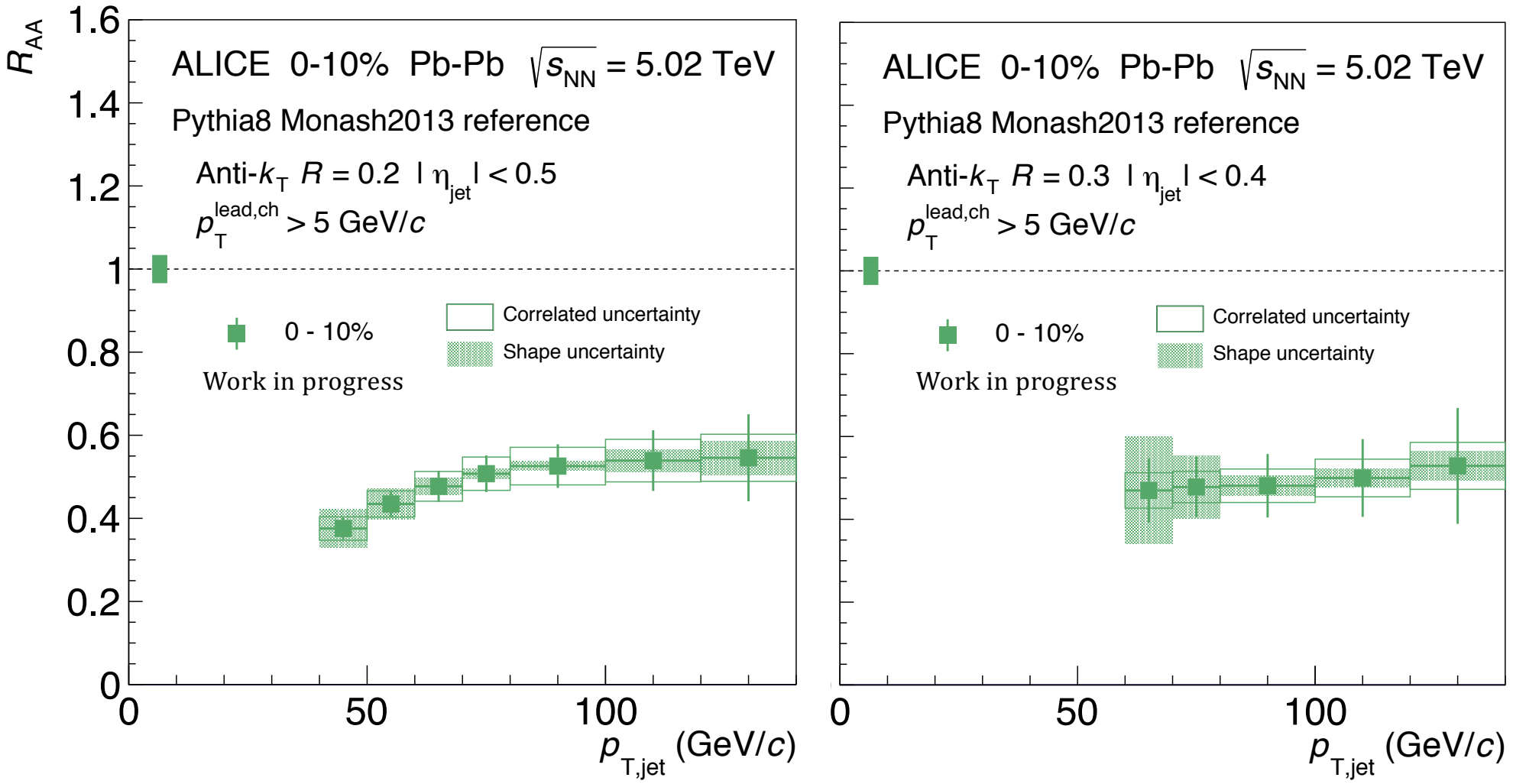




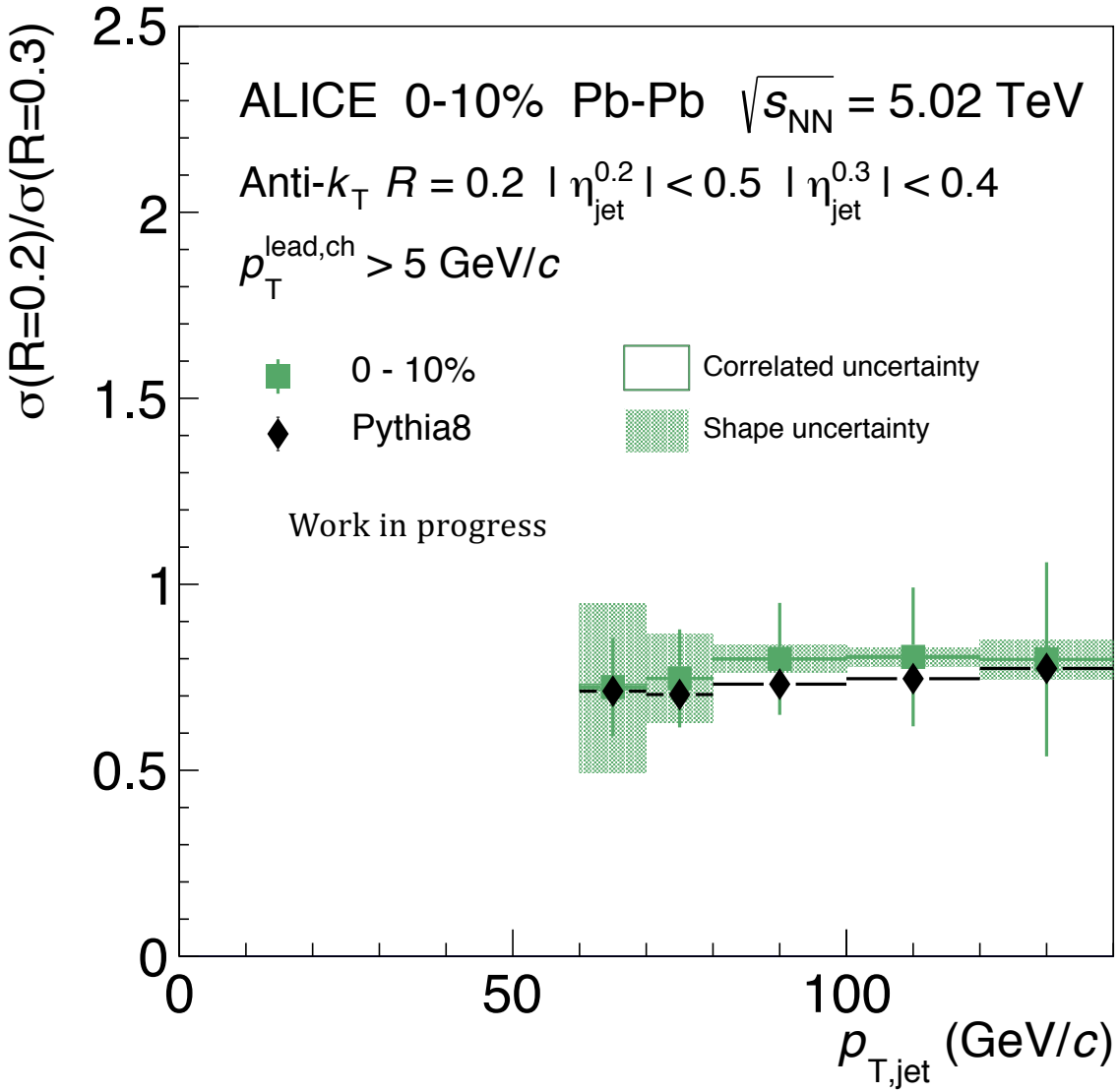
Results – Jet spectra



Results – Jet R_{AA}

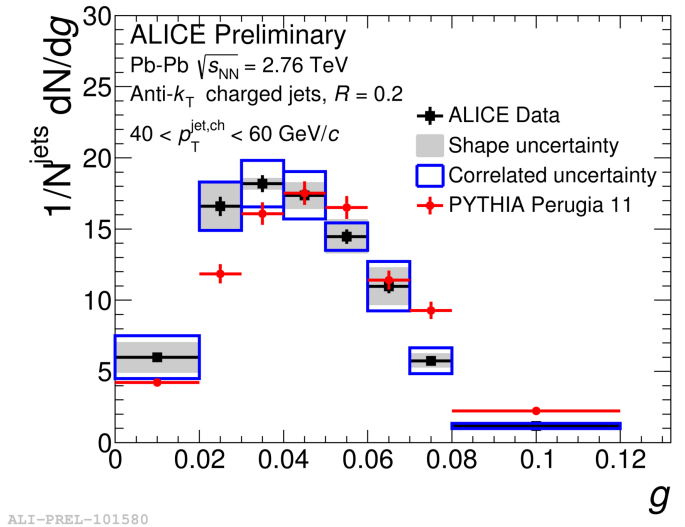


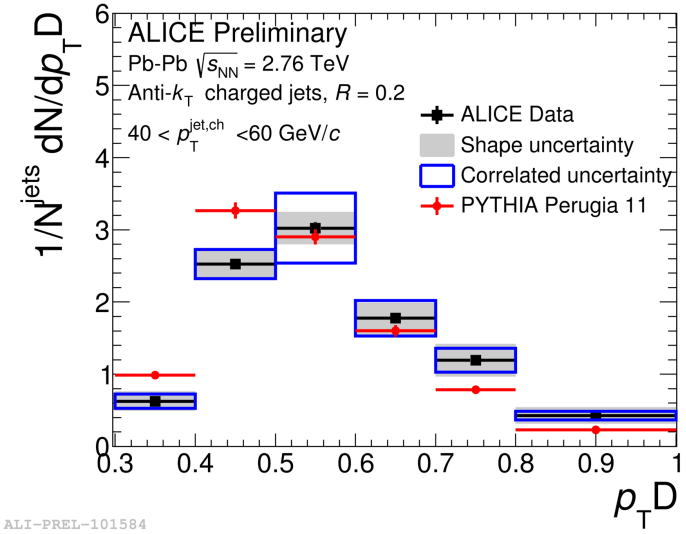
Results – Jet cross-section ratio



Jet core modification

- How is the jet core modified?
  - We know that jets are quenched, and we know there is soft energy at large angles
- Several observables show that the softer parts of the jet core are removed from the jet core
  - ALICE R=0.2 charged jet g, $p_{T,D}$ at show modification towards harder core
  - ATLAS/CMS jet fragmentation shows large z enhancement
- What exactly does this mean?
  - Quark/gluon modification results in these distributions, since more quark jets means more high-z jets?
  - Specific quenching mechanism strips out softer parts of core?





Conclusion

- New measurement of full jet R_{AA} from ALICE at 5.02 TeV, which can further constrain jet quenching models
- Jet cross-section ratio adds to the continuing discussion of how exactly the medium modifies the jet structure

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Jet fragmentation