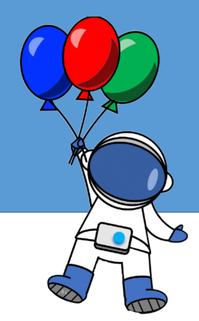
Differences in the population of jets at different *R* contribute to the *R*-dependence of the R_{AA} in a manner consistent with recent ALICE results.



Investigating the *R*-dependence of Jet Suppression

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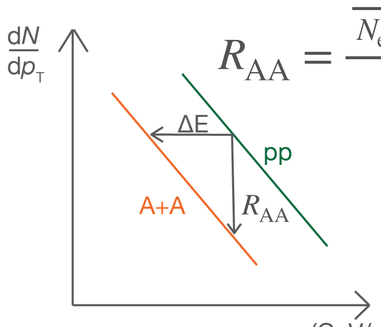
INTRODUCTION

- Jet quenching measurements in heavy-ion collisions, such as the suppression of the jet yield compared to binary scaled pp collisions, aim to elucidate the various mechanisms of parton energy loss [1] and mechanisms for the addition of energy to the jet cone (see Fig 1).
- Differential measurements of the dependence of the inclusive jet nuclear modification factor (R_{AA}- defined in Eq.1) can be used to disentangle different energy loss mechanisms.



$$R_{\mathrm{AA}} = \frac{\frac{1}{N_{\mathrm{event}}}\frac{d^2N_{\mathrm{jet}}^{\mathrm{PbPb}}}{dp_{\mathrm{T}}dy}\Big|_{\mathrm{cent}}}{\langle T_{\mathrm{AA}}\rangle \frac{d^2\sigma_{\mathrm{jet}}^{pp}}{dp_{\mathrm{T}}dy}} \quad (1)$$

- *R*-dependence of R_{AA}: This project examines the dependence of the R_{AA} on the resolution parameter *R*. Jets with different *R* are unique in terms of their fragmentation function, q/g fractions, etc. We will investigate the influence of these effects!

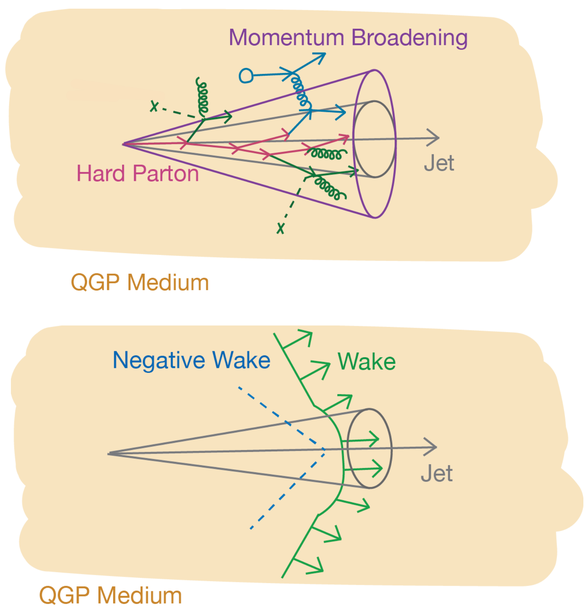


Figure 1. Illustrations of example jet energy loss effects such as momentum broadening (top) and medium response effects such as the wake (bottom).

PYTHIA AND METHODS

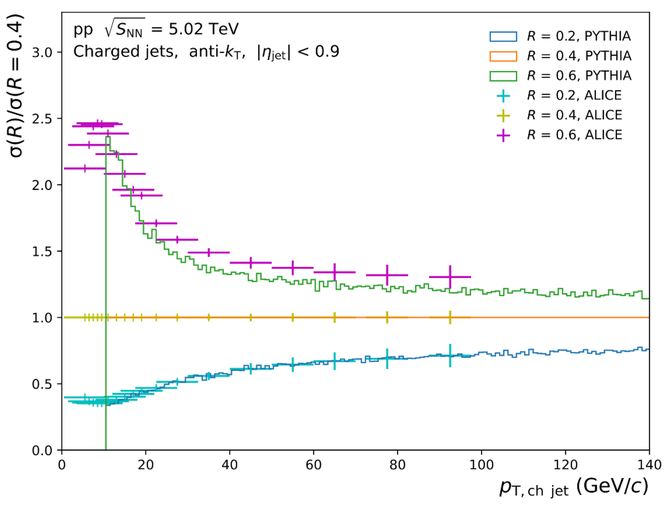
- Used PYTHIA [2] to simulate charged-particle jets with various *R* at $\sqrt{s} = 5.02$ TeV.
- Used ALICE kinematic settings ($|\eta_{\mathrm{jet}}| < 0.9 - R$, $p_{\mathrm{T,const}} > 150$ MeV).
- Model energy loss (S) with $\alpha = 0.55$ as : (1) fractional quenching, (2) p_{T}-dependent quenching, and (3) flavor-dependent quenching similar to Ref. [3].

$$p_{\mathrm{T,quenched}} = p_{\mathrm{T,unquenched}} - S$$

$$S = s'\left(\frac{p_{\mathrm{T,unquenched}}}{p_{T,0}}\right)^{\alpha} \qquad S_{\mathrm{quark}} = s'\left(\frac{p_{\mathrm{T,unquenched}}}{p_{T,0}}\right)^{\alpha} \qquad S_{\mathrm{gluon}} = \left(\frac{9}{4}\right) \times s'\left(\frac{p_{\mathrm{T,unquenched}}}{p_{T,0}}\right)^{\alpha}$$

RESULTS

PYTHIA vacuum simulations match experimental data; consistent shift between simulation and experiment at larger *R* observed may propagate into R_{AA} and *R*-dependence calculations with QGP



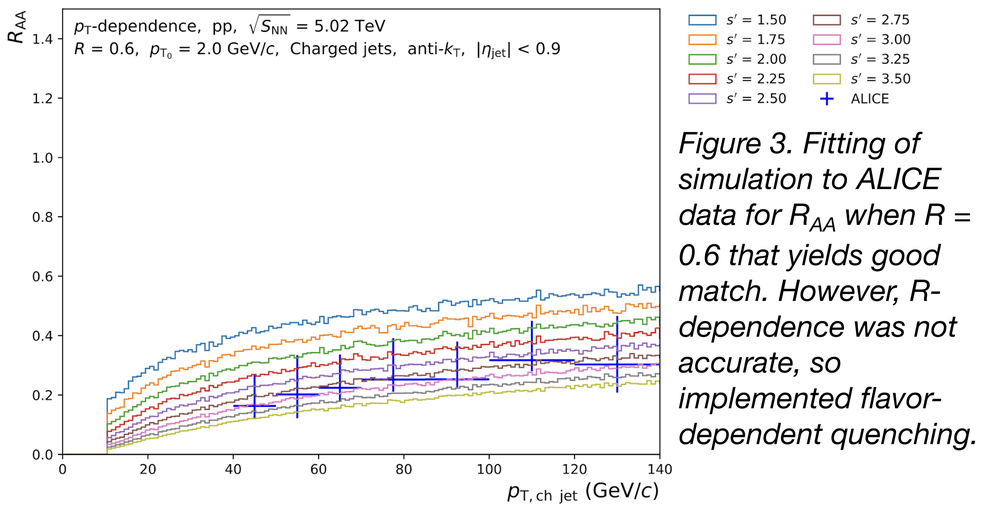


Figure 3. Fitting of simulation to ALICE data for R_{AA} when R = 0.6 that yields good match. However, R-dependence was not accurate, so implemented flavor-dependent quenching.

Figure 2. Simulated cross section ratios of jets at a given R over that when R = 0.2 overlayed with ALICE data.

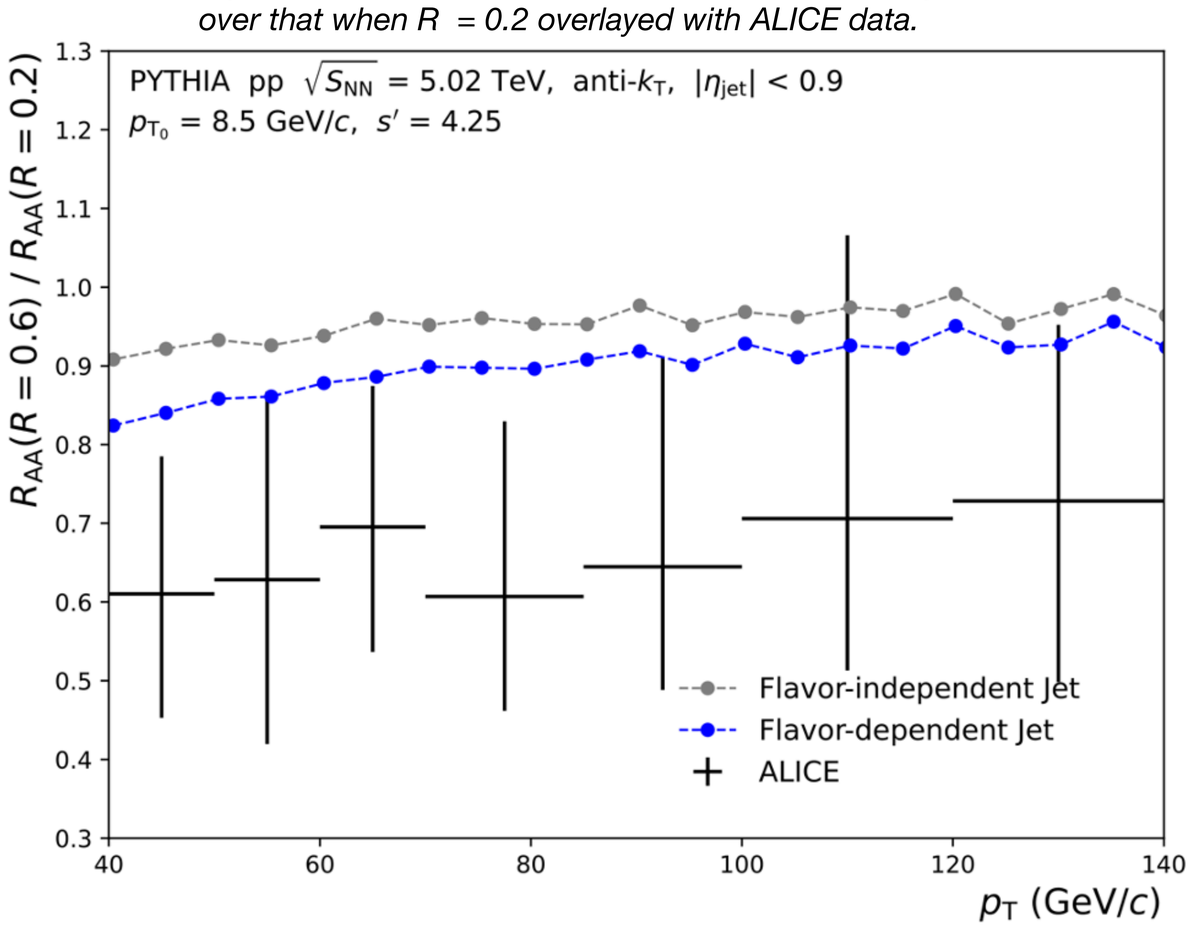
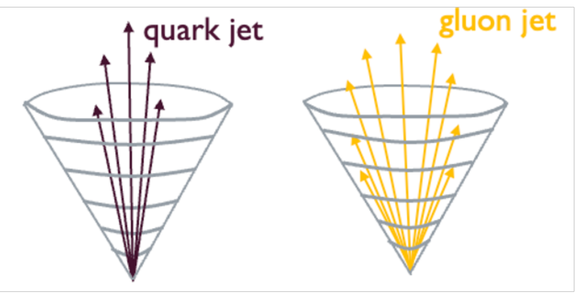


Figure 4. Ratio of R_{AA} at R = 0.6 over that of R = 0.2 for jets with and without jet population flavor taken into account in the implemented energy loss. Compared to ALICE data from Ref. [4].



Quark jets are more collimated than gluon jets, which could contribute to the *R*-dependence.

Figure 3 suggests that adding in flavor dependence increases the *R*-dependence and improves the fit with experimental data.

CONCLUSIONS

- The differences in jet population at different *R* could describe the observed *R*-dependence of jet quenching in experiment.
- Developed a framework that has the capacity to build-in and study each energy loss mechanism independently.
- Continued work could include implementing momentum broadening, substructure influence, fragmentation function, and groomed jet observables.

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