Jet analysis on a hybrid transport model in Heavy Ion Collisons

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A linearized-Boltzmann-Langevin Transport Model (*Lido*)

- Interactions are divided into large-q scattering and small-q diffusion.

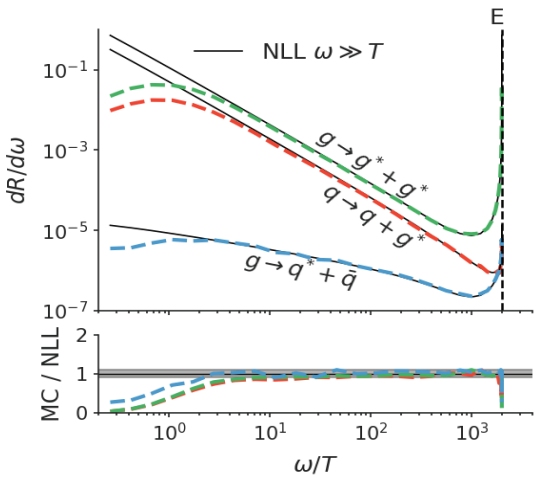
$$\frac{df}{dt} = \mathcal{D}[f] + \mathcal{C}^{1\leftrightarrow 2}[f] + \mathcal{C}^{2\leftrightarrow 2}[f] + \mathcal{C}^{2\leftrightarrow 3}[f]$$

$$\mathcal{D}: \frac{\Delta\vec{p}}{\Delta t} = -\eta_D\vec{p} + \vec{\xi}(t), \left\langle \vec{\xi}(t)\vec{\xi}(t')\right\rangle = \delta(t-t')\left(\hat{P}_L\hat{q}_L + \hat{P}_T\frac{\hat{q}}{2}\right)$$

$$\mathcal{C}: \text{sample } \vec{p}_1, \vec{p}_2 \text{ from } \frac{\Delta t dR}{d^3p_1 d^3p_2 \ldots}$$

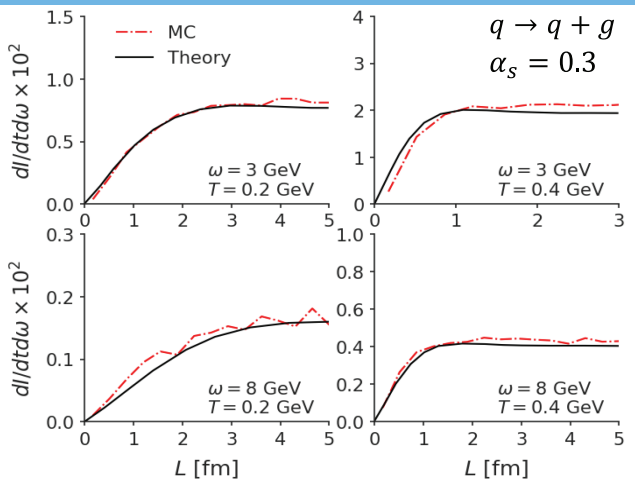
- Monte-Carlo implementation of the Landau-Pomeranchuk-Migdal (LPM) effect [1].

Comparison of splitting rate with Theory in a Static Medium



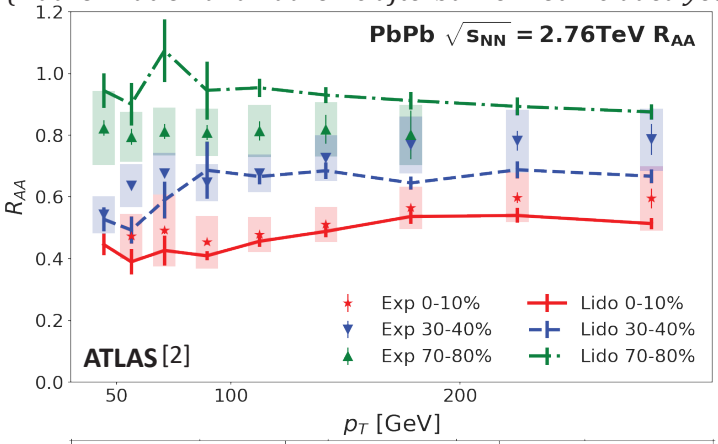
Left: Splitting rate as functions of daughter parton's energy in a infinite static medium. Mother parton has a energy of 1 ($T = 0.5GeV, \alpha_s = 0.1$)

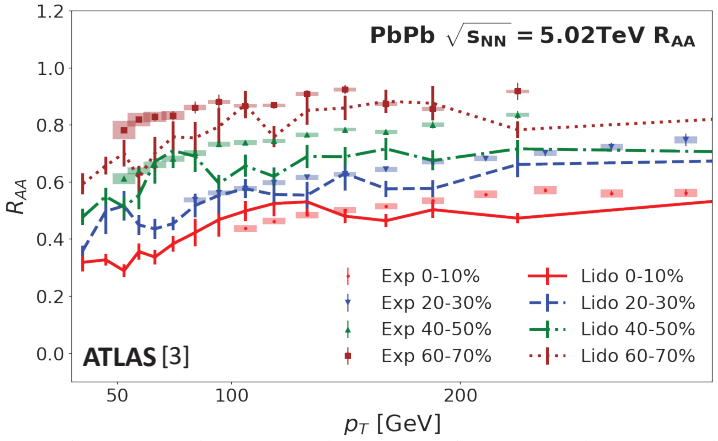
Right: Path-length dependence of the emission rate compared with theory. Mother quark has an energy of 16GeV.

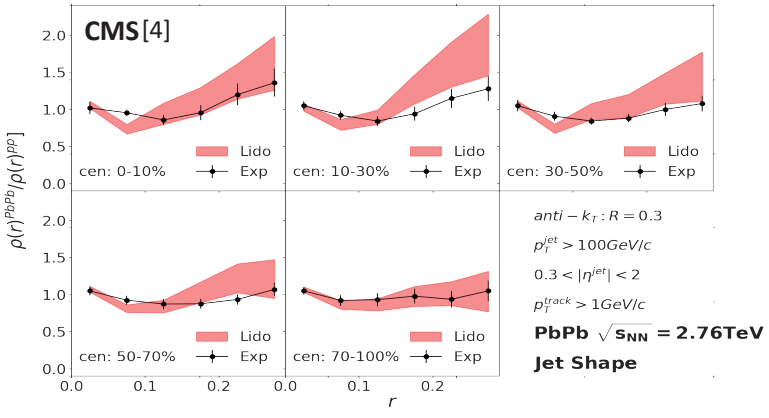


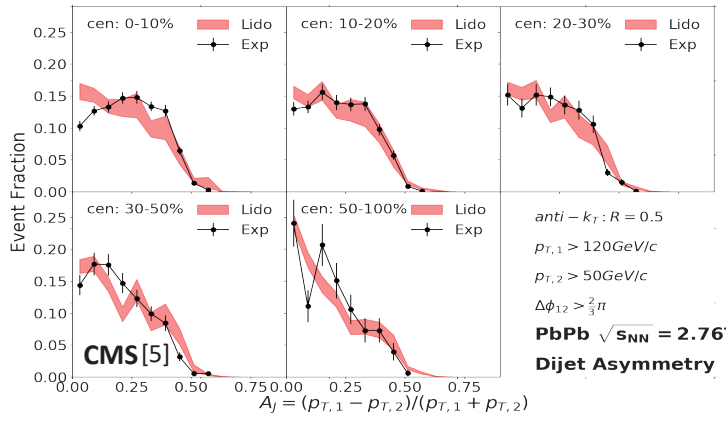
Inclusive Jet Observables for PbPb 2.76TeV and PbPb 5.02TeV

Initial condition: *Pythia, Trento.* ***Bulk evolution:*** *Freestream, 2+1D viscous event-averaged hydro.* ***Parton showering:*** *Lido. (Hadronization and hadronic afterburner not included yet).*









Conclusion and Outlook

- Our model is capable of describing many inclusive jet observables with a single set of parameters (and was previously calibrated on open heavy flavor observables).
- Next steps: using event-by-event hydro and add hadronization; perform Bayesian analysis to get a better inference on the transport coefficients; understand the correlation between medium space-time evolution and jet substructure.

Github: https://github.com/keweiyao/Duke-Lido

Reference:

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