Heavy flavor production in heavy ion collisions with JETSCAPE

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On behalf of the JETSCAPE Collaboration

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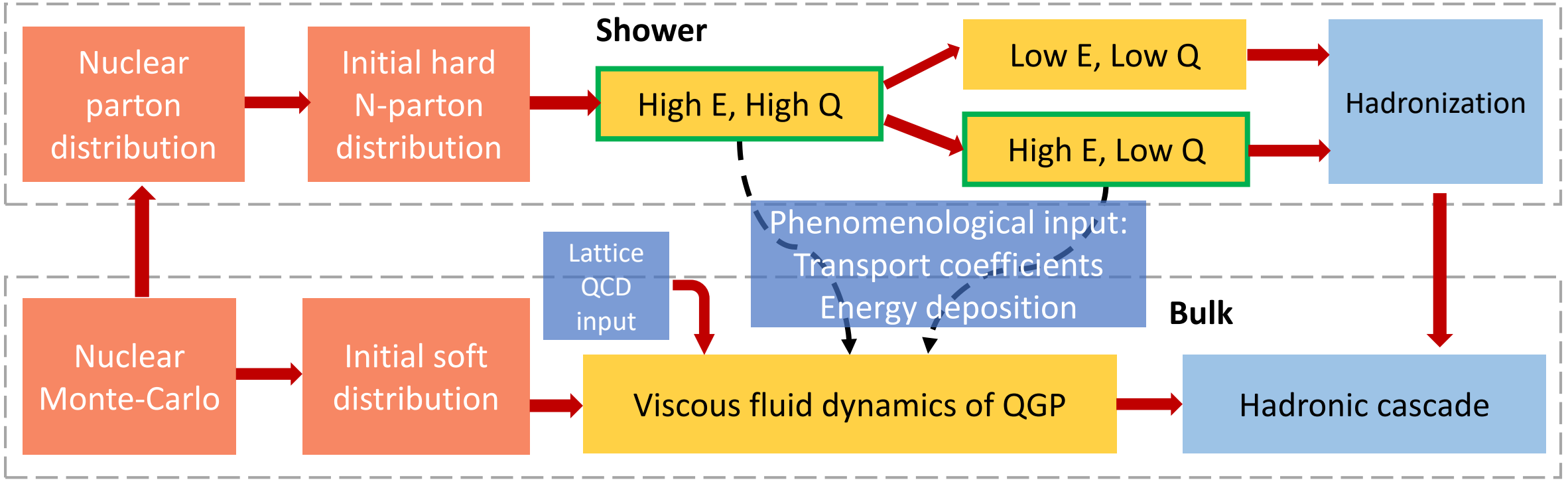
PART 1 **The JETSCAPE framework**

Jet Energy Loss Tomography with a Statistically and Computationally Advanced Program Envelope



- **Modular** framework; allows for study of different physics concepts in a consistent environment.
- Applicable to full range of heavy ion phenomenology.
- **Bayesian analysis** enables systematic model-to-data comparison

PART 2 **Hard parton evolution**

- High virtuality **in medium** parton showering is solved by the **MATTER** model which employs the Higher Twist formalism. Generates virtuality-ordered shower with splittings above $Q \gg Q_0$. *[Adv.Ser.Direct.HEP, 573 (1989); NPA 696, 788 (2001)]*

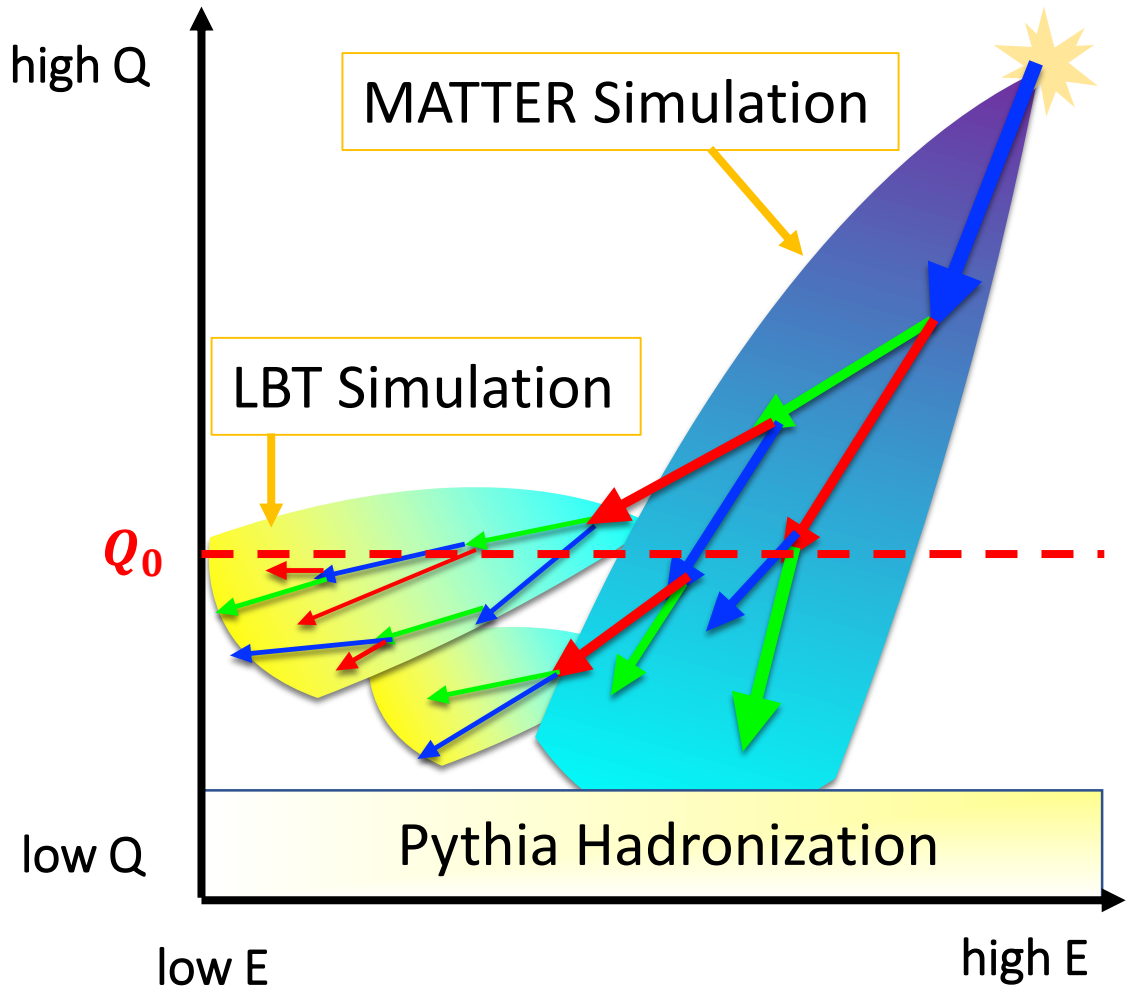
- The virtuality dependent $\hat{q}$ *[Phys. Rev. C101, 034908 (2020)]* with a simple parametrization:

$$\hat{q}(Q) = \hat{q}^{HTL} \frac{c_0}{1 + c_1 \ln^2 Q^2 + c_2 \ln^4 Q^2}$$

where $c_0 = 1 + c_1 \ln^2 Q_0^2 + c_2 \ln^4 Q_0^2$.

- Low virtuality parton showering is solved by Linear Boltzmann transport (LBT) equation.

$$p_1^{\mu}\, \partial_{\mu} f_1(x_1, p_1) = \mathcal{C}_{el}[f_1] + \mathcal{C}_{inel}[f_1]$$

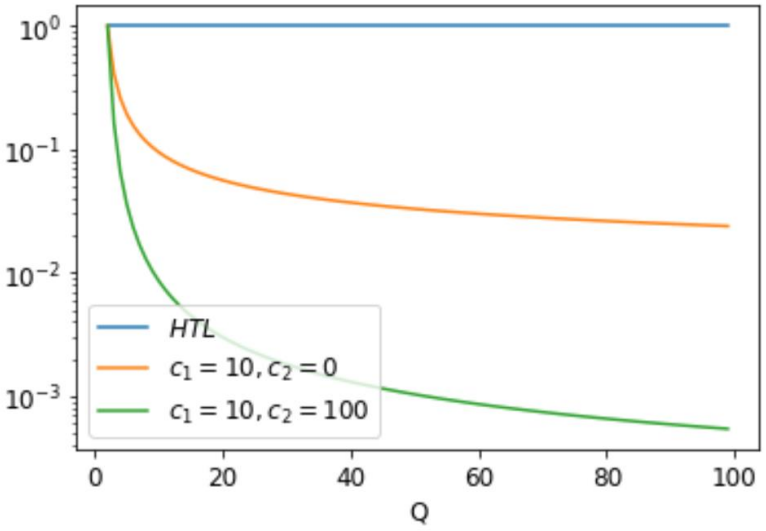


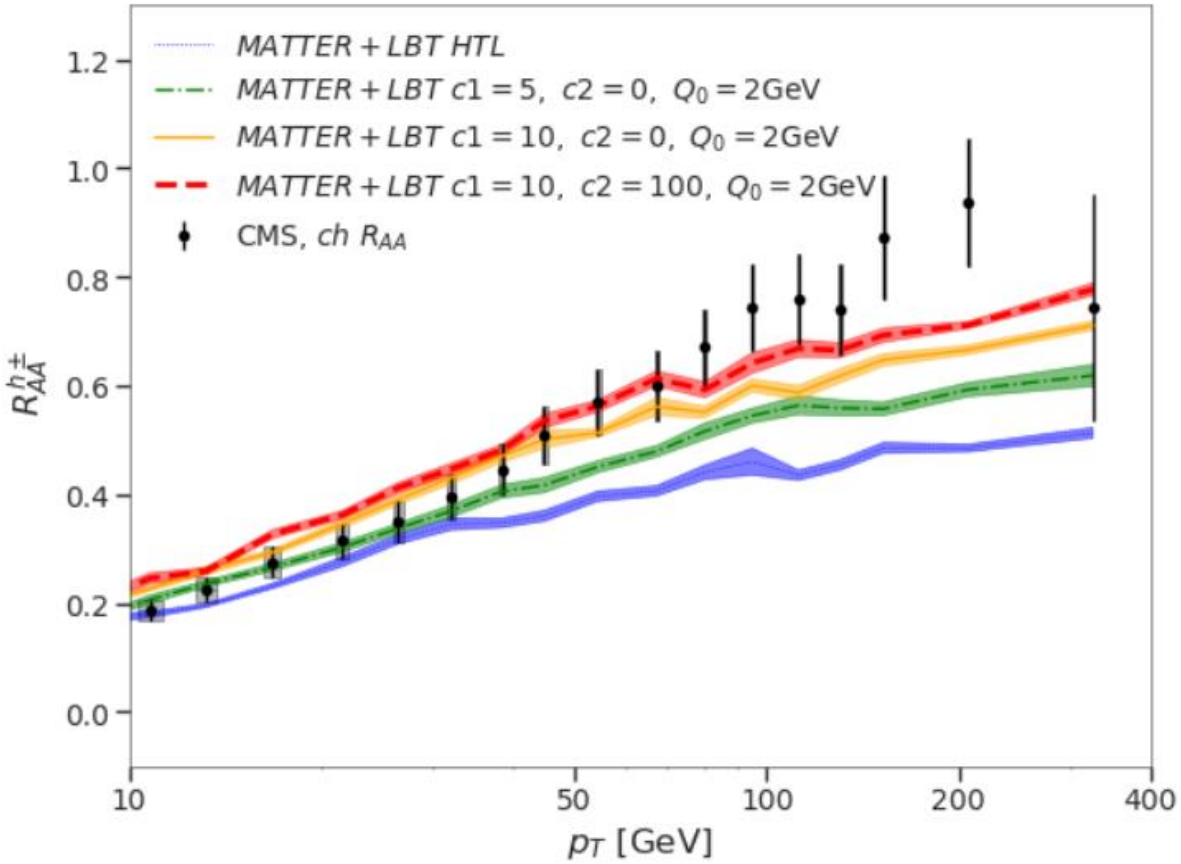
Phase space evolution, figure credit: Gojko Vujanovic

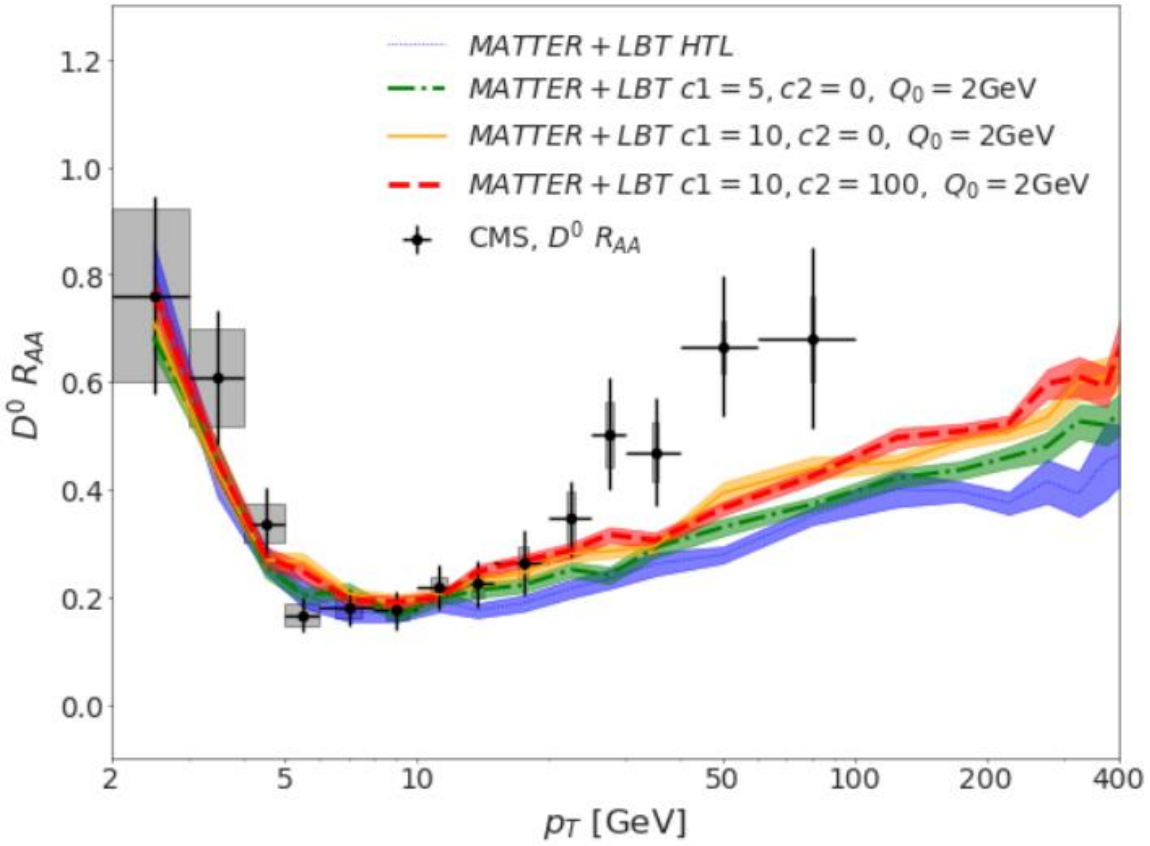
PART 3

The JETSCAPE framework – PbPb 5.02TeV 0-10%, MATTER+LBT

- **Left:** charged hadron R_{AA}. **Right:** D meson R_{AA}.
- Smaller $\hat{q}$ at large virtuality -> higher R_{AA} at large p_T.







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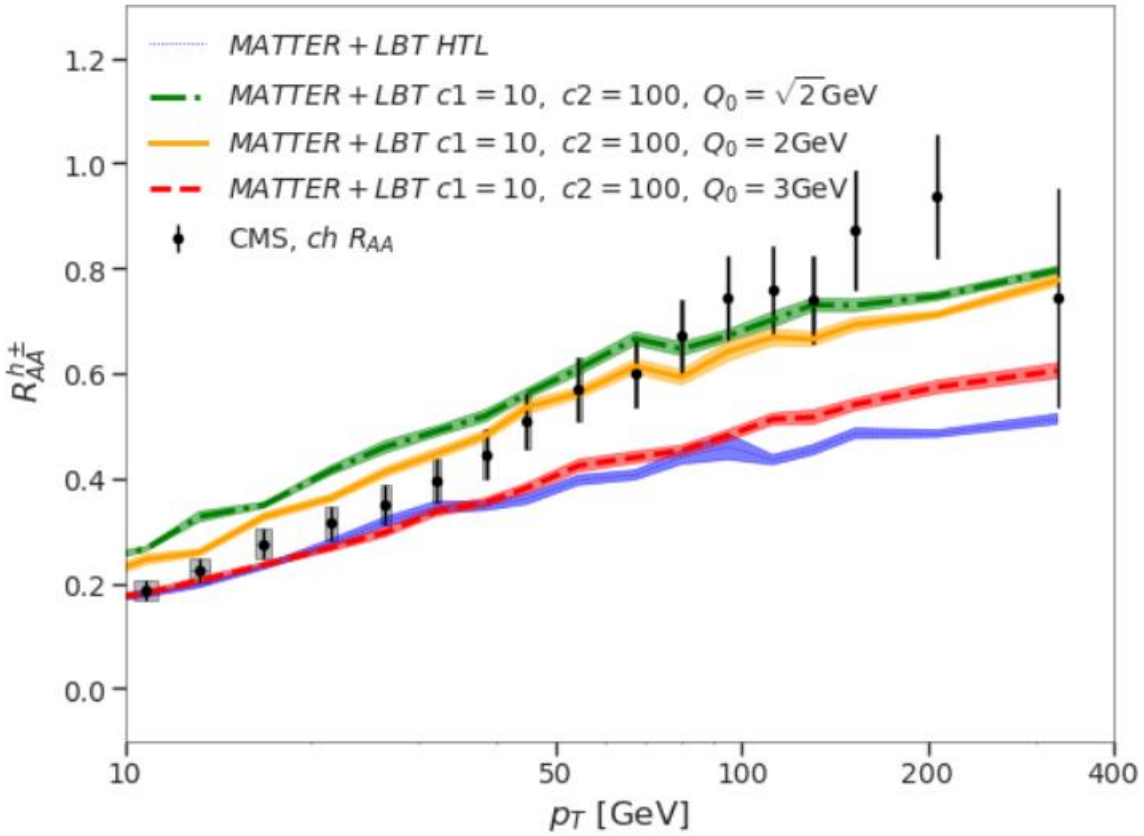
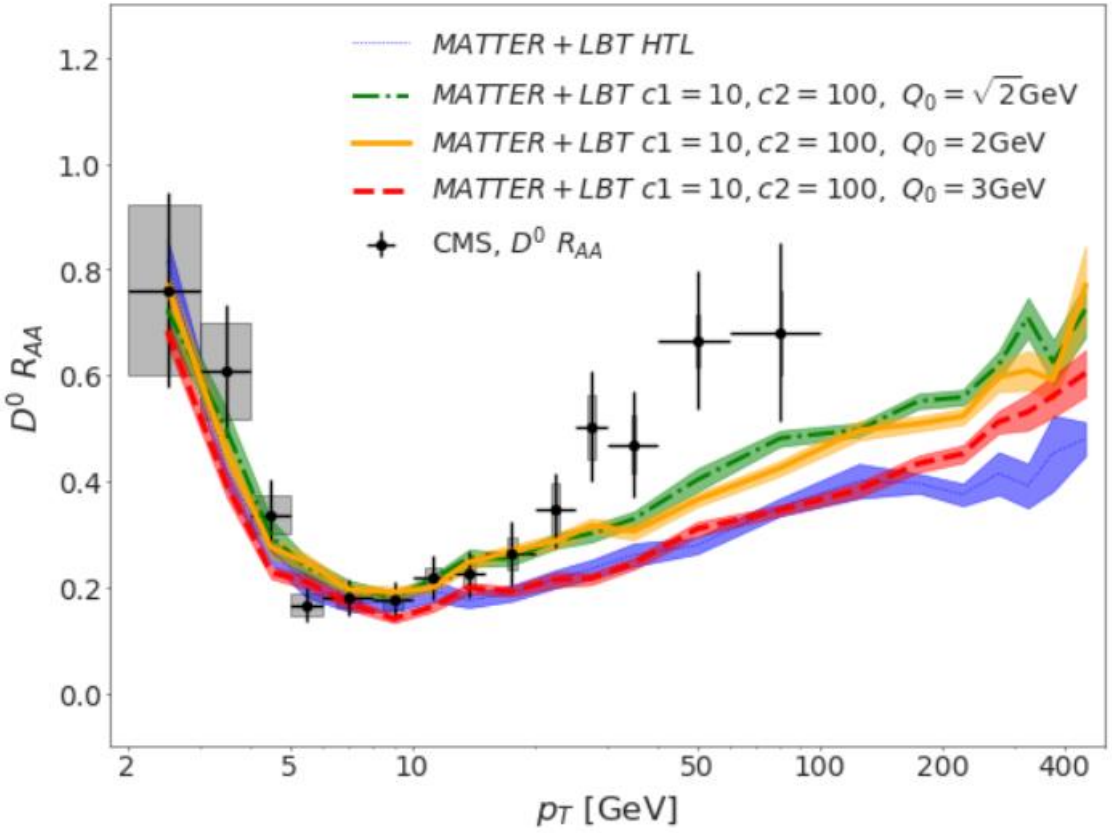
The JETSCAPE framework – PbPb 5.02TeV 0-10%, MATTER+LBT

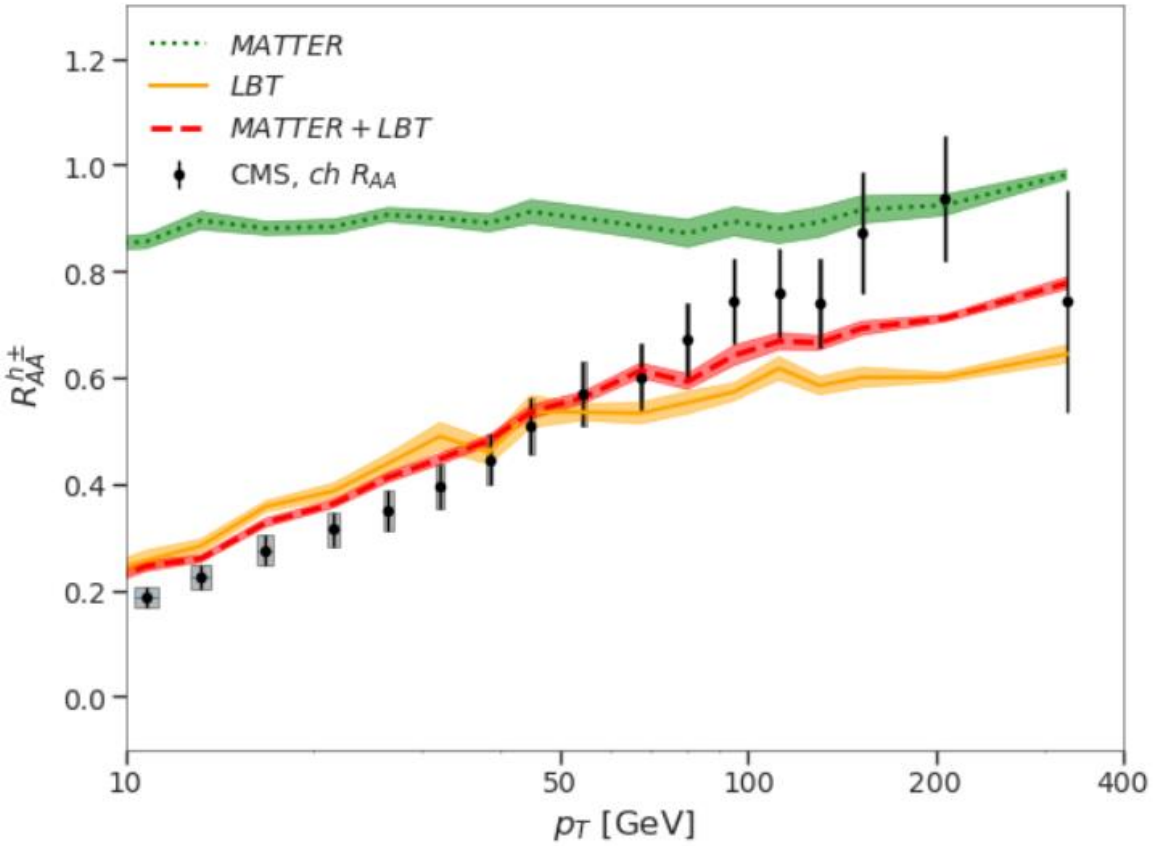


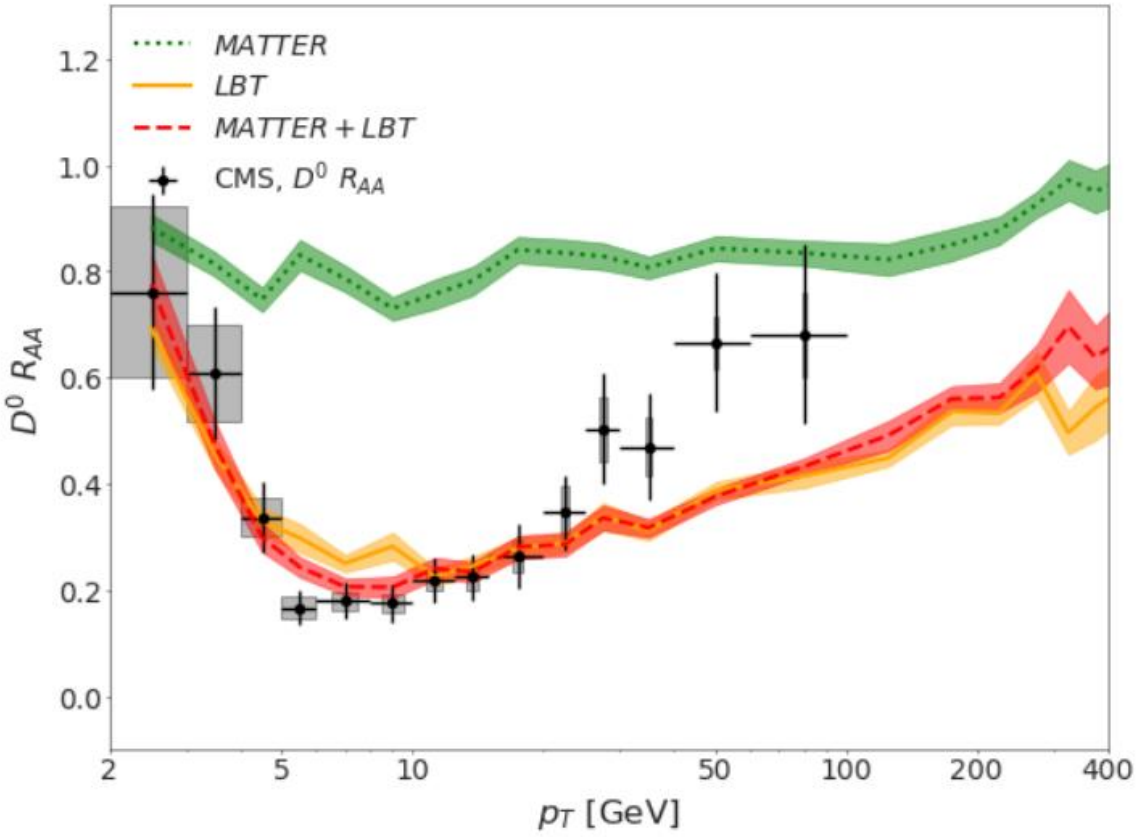


- **Left:** charged hadron R_{AA}. **Right:** D meson R_{AA}.
- Different switching virtuality shifts the entire R_{AA}. Combined with different $\hat{q}$ parametrization -> possible Bayesian extraction with simutaneous description of charged and heavy flavor data.

PART 3

The JETSCAPE framework – PbPb 0-10%, 5.02TeV





- **Left:** charged hadron R_{AA}. **Right:** D meson R_{AA}.
- Effects of only consider MATTER or LBT compared with the full MATTER+LBT calculation.
- Jet results can be found in poster Using Jet Substructure to probe Heavy-Flavor Energy-Loss.