

Based on arXiv: 2407.13818 (submitted to JHEP)

Motivation

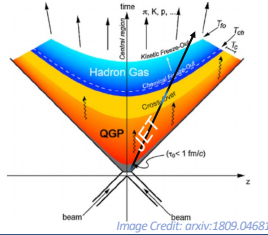
Quark Gluon Plasma (QGP) → strongly coupled liquid of deconfined partons.
Jets & jet substructure → useful probe of vacuum QCD and of the QGP.
Jets and jet substructure modified in medium → interaction with medium.

EEEC probes **shape** of energy flow in vacuum. In the presence of medium, it probes the **shape of the medium response via energy flow.**

Jets and the QGP

Jets produced during the initial hard scattering traverse the QGP. Evolution of medium is imprinted on jets!

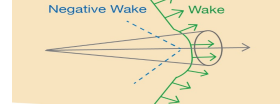
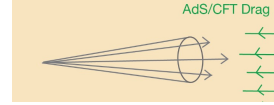
Jets & their substructure are modified in medium [1]



Medium Response (Strong Coupling Limit): Wake

Impact of medium on jet

Impact of jet on medium



For details, see [2]

"Jet Energy Loss"
Drag Force

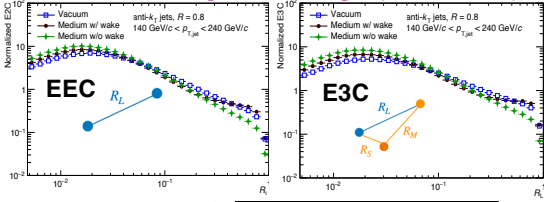
"Medium Response"
Hydrodynamic Wake

*Schematic in position space

Projected N-point Energy Correlators (ENC)

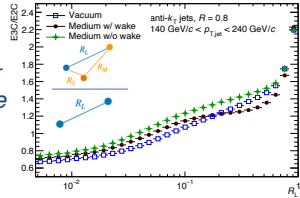
$$ENC(R_L) = \left(\prod_{k=1}^N d\Omega_{\vec{n}_k} \right) \delta(R_L - \Delta \hat{R}_L) \cdot \frac{1}{(E_{\text{jet}})^{n(N)}} \langle \mathcal{E}^n(\vec{n}_1) \mathcal{E}^n(\vec{n}_2) \dots \mathcal{E}^n(\vec{n}_N) \rangle$$

In vacuum, QCD angular ordering imprinted on slopes [3]!



In medium, large angle enhancement
effect of the wake

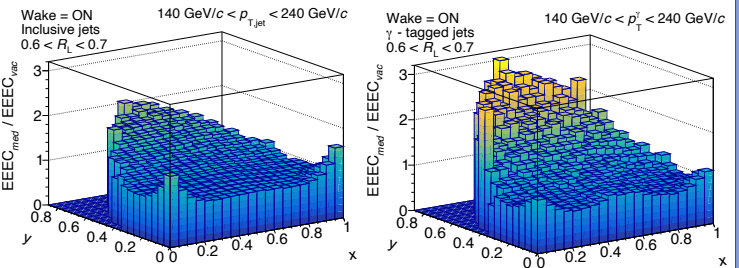
Ratios-robust to detector effects + minimize uncorrelated background



Wake effects show up as deviations from vacuum scaling!

EEEC sensitivity to the Wake

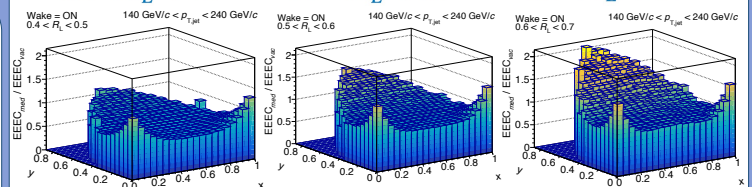
Ratio with vacuum shows **significant** enhancement in the equilateral region - effect of the wake!



Stronger enhancement for γ -tagged jets - mitigation of jet selection bias!

Evolution of medium effect with R_L

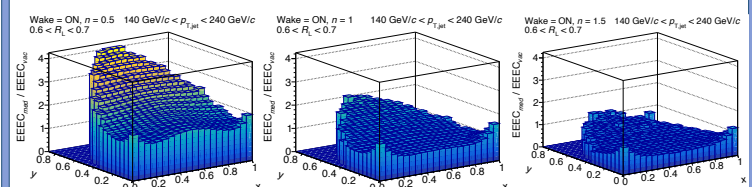
0.4 < R_L < 0.5 0.5 < R_L < 0.6 0.6 < R_L < 0.7



Effect of the wake is prominent at larger values of R_L

Tuning the medium response

$n = 0.5$ $n = 1$ $n = 1.5$



Effect of the wake can be tuned by changing the energy weight!

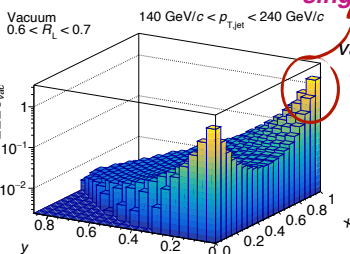
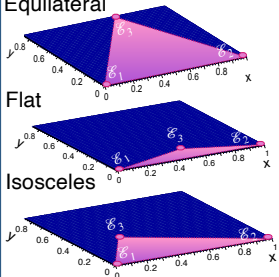
EEEC: new coordinates for Heavy Ions

x-y coordinate system has a **flat Jacobian** - important since medium response effects are not solely collinear!

Equilateral

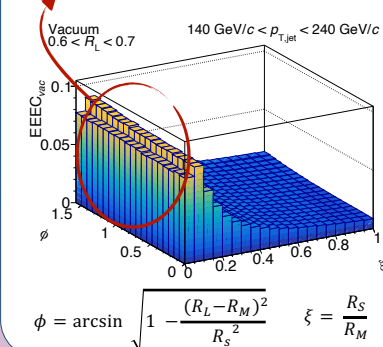
Flat

Isosceles

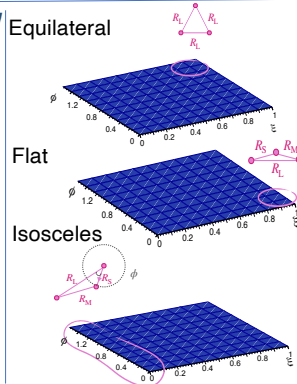


Collinear singularity of vacuum QCD!

Collinear singularity of vacuum QCD!



$$\phi = \arcsin \sqrt{1 - \frac{(R_L - R_M)^2}{R_S^2}} \quad \xi = \frac{R_S}{R_M}$$



[1] arXiv:2110.14490
[2] arXiv:1405.3864
[3] PhysRevLett.130.051901

See talks by: Arjun Kudinoor (Sept 25, 9:40 am)
Daniel Pablos (Sept 26, 9:00 am)
Ananya Rai (Sept 24, 12:10 pm)