

THERMALIZATION TIME CONSTRAINED BY HIGH- p_{\perp} QGP TOMOGRAPHY

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IN COLLABORATION WITH: MAGDALENA DJORDJEVIC,
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INTRODUCTION

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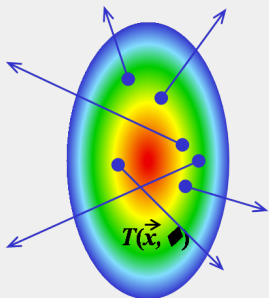
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- Theoretical predictions can be compared with a wide range of experimental data.
- Our state-of-the-art dynamical energy loss formalism is embedded in **DREENA-A framework**

- **Next goal:** use high- p_{\perp} data to infer bulk properties of QGP.

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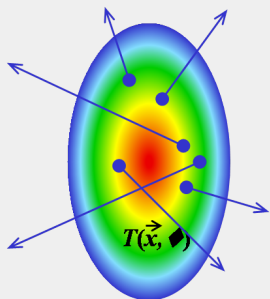
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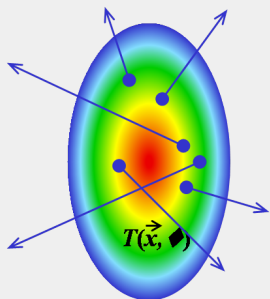
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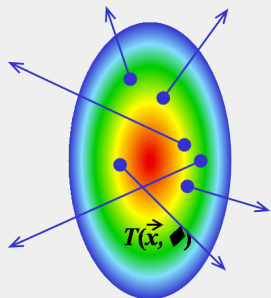
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- **High- p_{\perp} probes are excellent tomography tools.**
- We can use them to infer some of the bulk QGP properties.

**HOW TO CONSTRAIN QGP
THERMALIZATION TIME USING HIGH-
 p_{\perp} DATA?**

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- Conventional hydrodynamics approach: vary τ_0 and compare obtained distributions with data
- An analysis employing Bayesian statistics has shown that low p_{\perp} data provides only weak limits to the thermalization time: $\tau_0 = 0.59 \pm 0.41 \text{fm}/c$, with 90% credibility
- Further constraints would be useful.

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- High p_{\perp} particles start to lose energy through the interactions with the medium.

MODEL DESCRIPTION

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- We ignore pre-equilibrium evolution and set a constant $\eta/s = 0.12$
- Model parameters are tuned for each τ_0 to match observed charged particle multiplicities and low $p_{\perp} v_2$ in $Pb + Pb$ collisions at $\sqrt{s_{NN}} = 5.01$ TeV.

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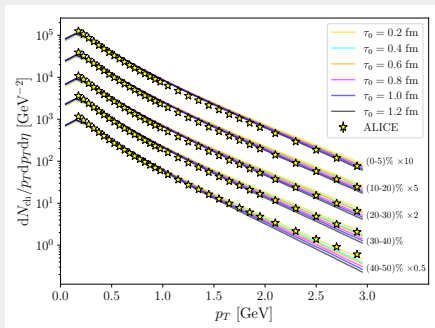
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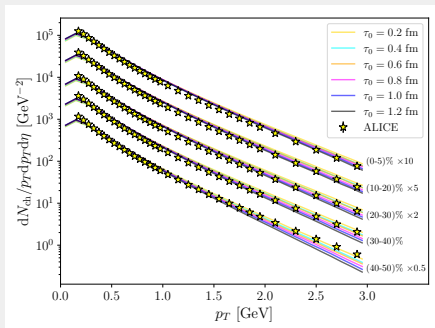


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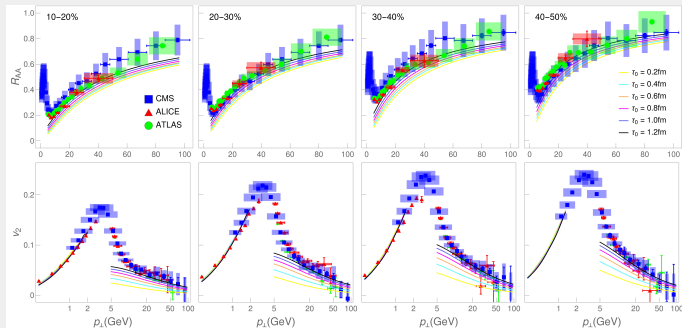


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- **Can this indeterminacy be further constrained through high p_{\perp} theory and data?**

HIGH p_{\perp} RESULTS FOR VARIOUS τ_0

- **Next step:** use DREENA-A to generate high p_{\perp} data for all τ_0 (charged hadrons, $Pb + Pb$ @ $\sqrt{s_{NN}} = 5.01$ TeV)

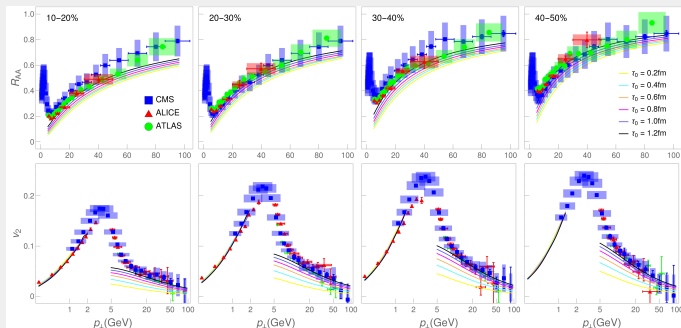
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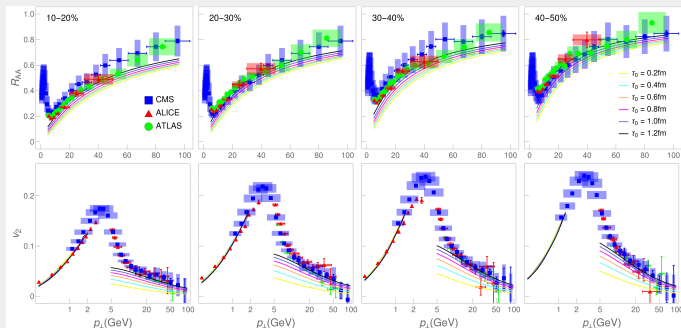


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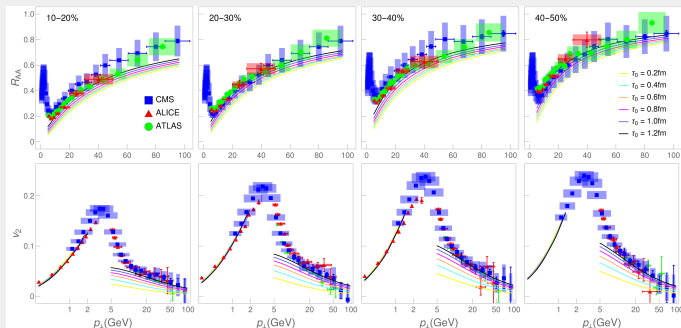


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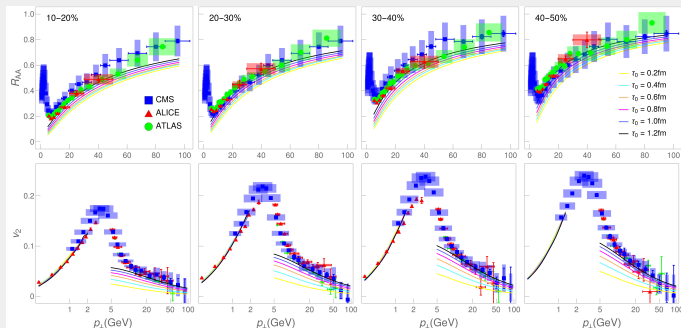


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- Resolution increases for higher centrality.

HEAVY FLAVOR HIGH p_{\perp} RESULTS FOR VARIOUS τ_0

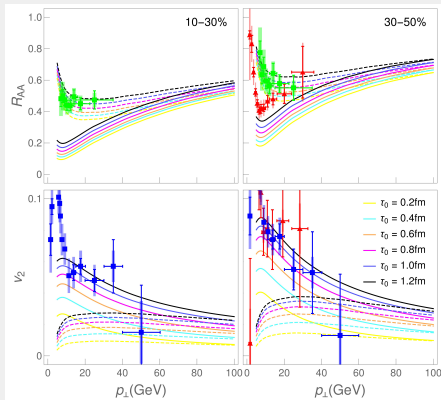
- DREENA-A predictions for D mesons (full curves) and B mesons (dashed curves), $Pb + Pb$ @ $\sqrt{s_{NN}} = 5.01$ TeV

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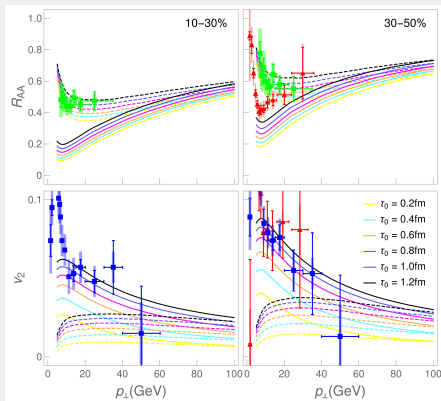


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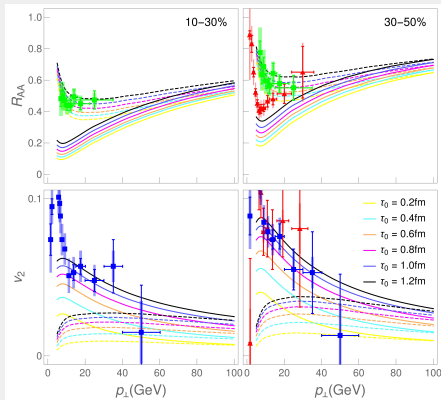


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- Available data suggests that later thermalization time is preferred.

LATER QUENCHING TIME?

- What if jet quenching starts later than QGP thermalization time (and subsequent medium evolution) τ_0 ?

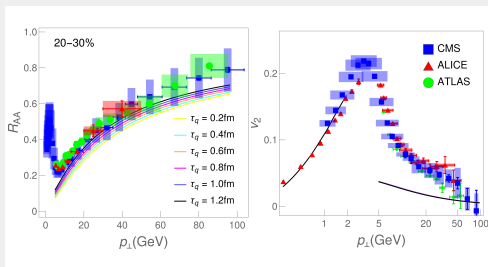
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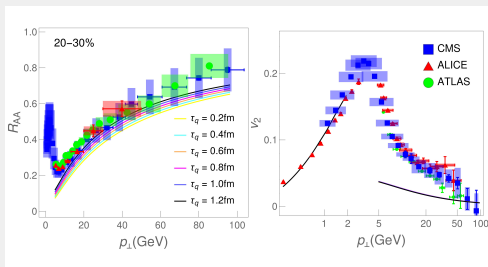
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- v_2 surprisingly insensitive to τ_q !

EXPLAINING THE OBSERVED SENSITIVITY

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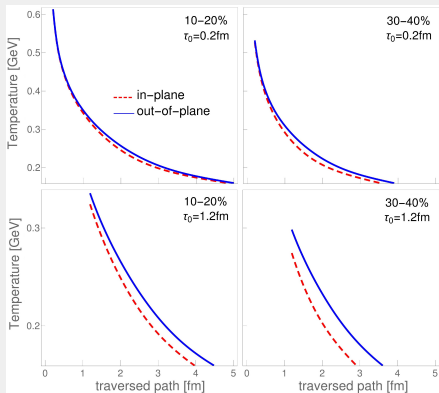
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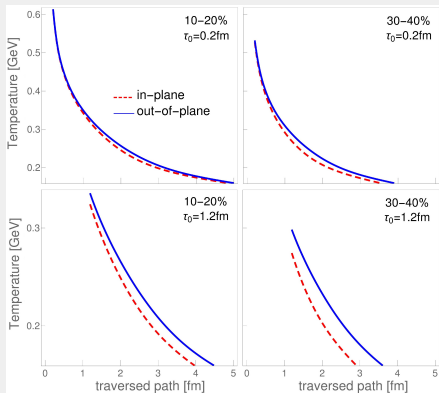
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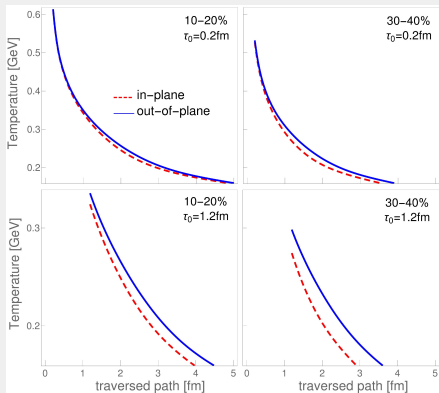
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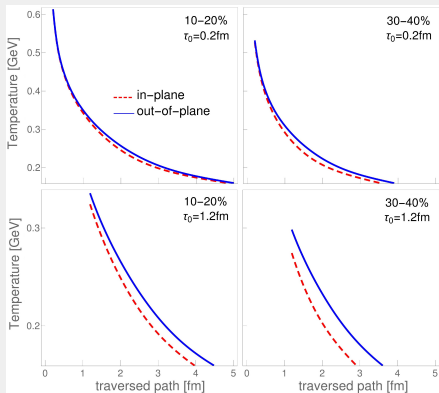


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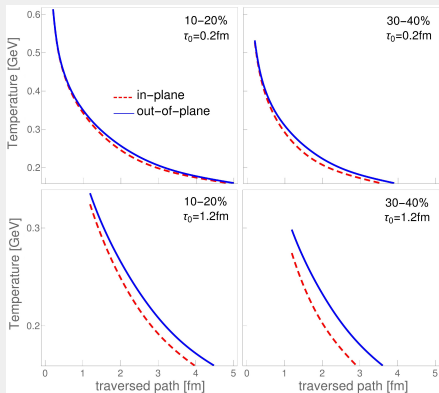
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- Explains the observed dependence of v_2 on τ_0 .

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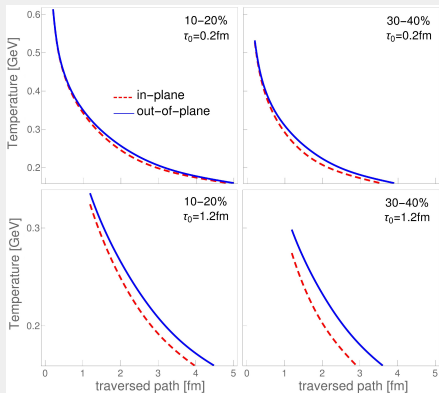
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- Larger τ_0 have lower overall avg $T \implies$ explains behaviour of R_{AA} .

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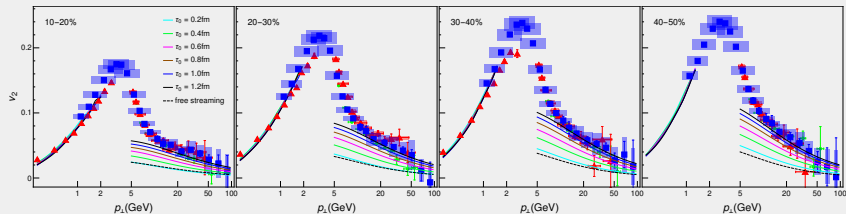
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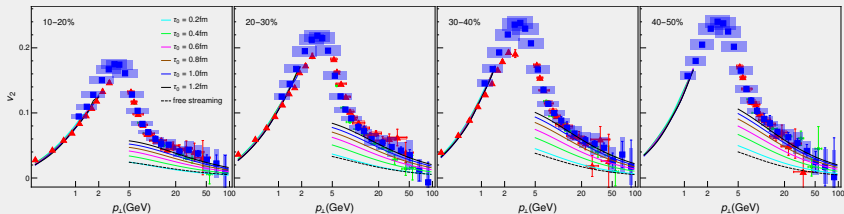
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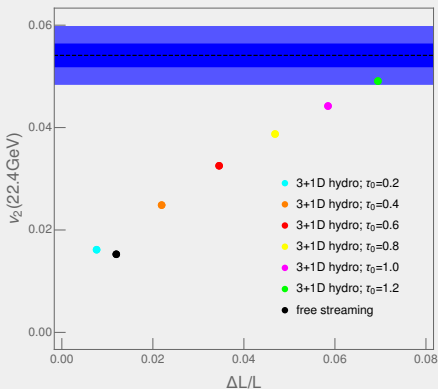
- We observe that the free-streaming scenario cannot explain v_2 experimental data!

FREE-STREAMING RESULTS

- Can we explain the observed result?

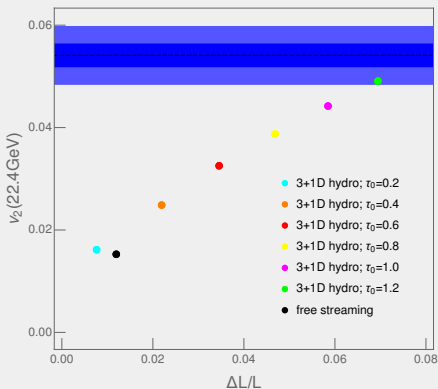
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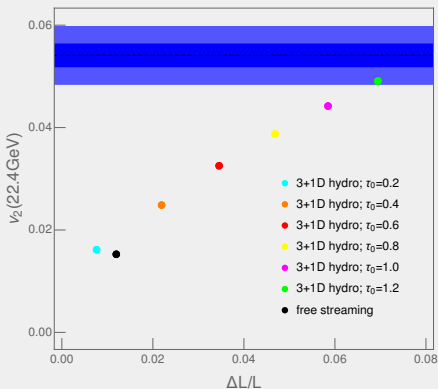
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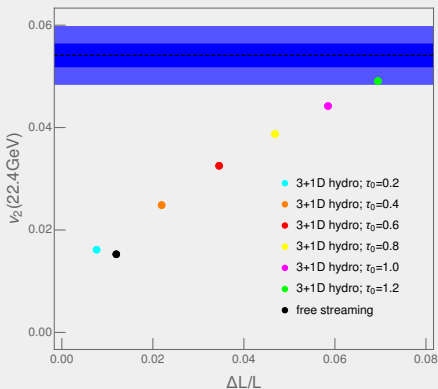
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- Inclusion of free-streaming before thermalization leads to small $\Delta L/L$ and thus cannot explain the experimental data.

CONCLUSION

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- All this demonstrates synergy of low- and high- p_{\perp} QGP physics, supporting our QGP tomography approach.

ACKNOWLEDGEMENTS



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НАУКЕ И ТЕХНОЛОШКОГ РАЗВОЈА**

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