

# QGP TOMOGRAPHY: INFERRING BULK MEDIUM PROPERTIES FROM HIGH $p_{\perp}$ DATA

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**IN COLLABORATION WITH:** MAGDALENA DJORDJEVIC,  
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СРБИЈА  
РЕПУБЛИКА СРБИЈА  
НАУКЕ И ТЕХНОЛОГИЈА



# INTRODUCTION

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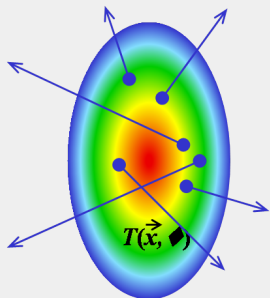
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- Theoretical predictions can be compared with a wide range of experimental data.
- Our state-of-the-art dynamical energy loss formalism is embedded in **DREENA-A framework**

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

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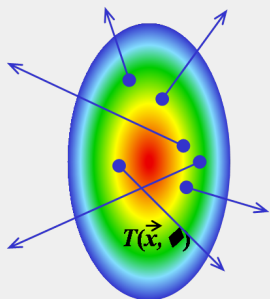
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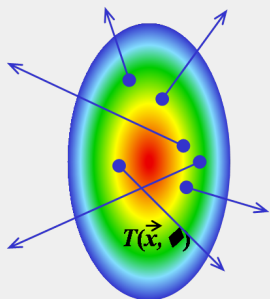
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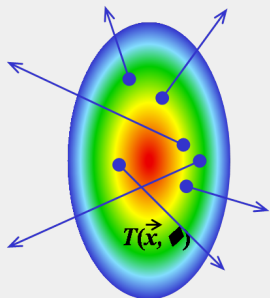
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- **High- $p_{\perp}$  probes are excellent tomography tools.**
- We can use them to infer some of the bulk QGP properties.

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

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- Conventional hydrodynamics approach: vary  $\tau_0$  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:  $\tau_0 = 0.59 \pm 0.41 fm/c$ , 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.

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- Model parameters are tuned for each  $\tau_0$  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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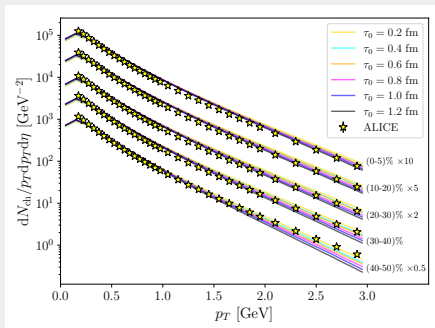
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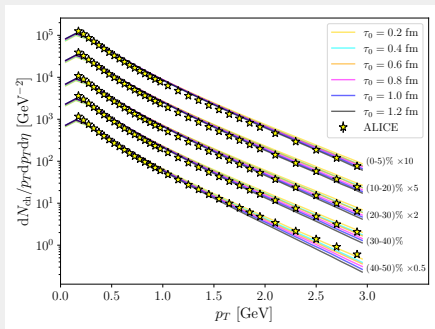


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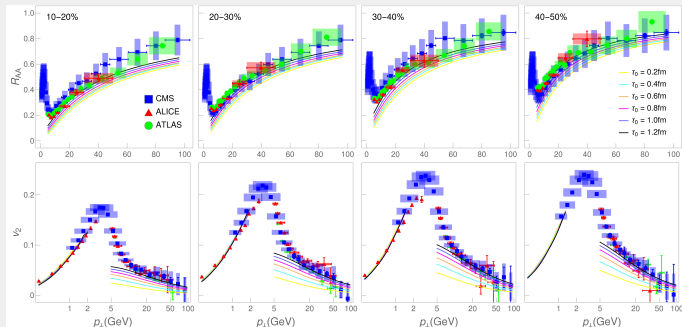


- Good agreement with low  $p_{\perp}$  data confirms low sensitivity to  $\tau_0$ .
- **Can this indeterminacy be further constrained through high  $p_{\perp}$  theory and data?**

# HIGH $p_{\perp}$ RESULTS FOR VARIOUS $\tau_0$

- **Next step:** use DREENA-A to generate high  $p_{\perp}$  data for all  $\tau_0$  (charged hadrons,  $Pb + Pb @ \sqrt{s_{NN}} = 5.01$  TeV)

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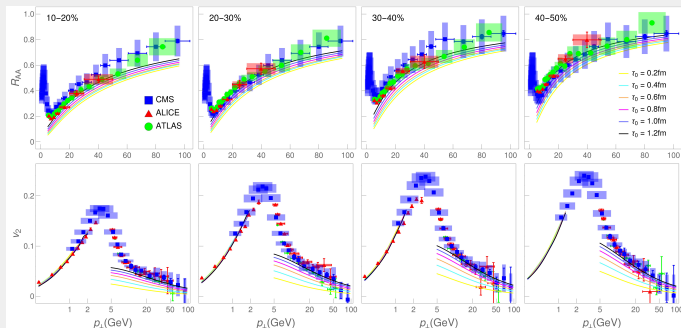




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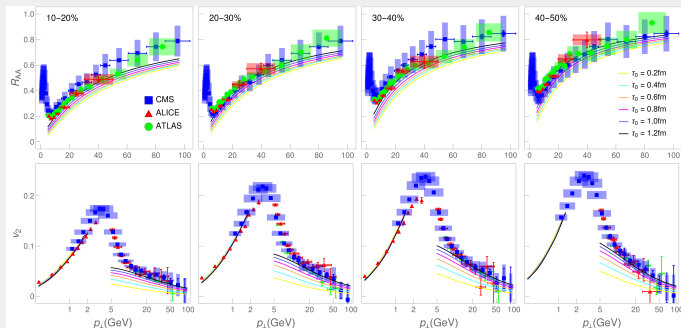


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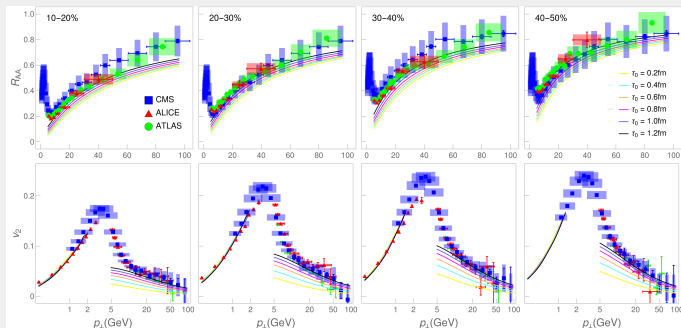


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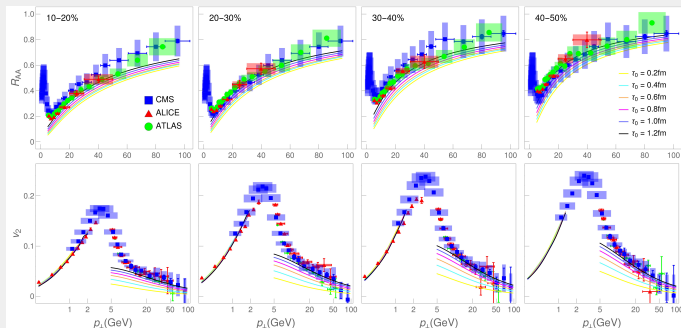


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- Resolution increases for higher centrality.

# HEAVY FLAVOR HIGH $p_{\perp}$ RESULTS FOR VARIOUS $\tau_0$

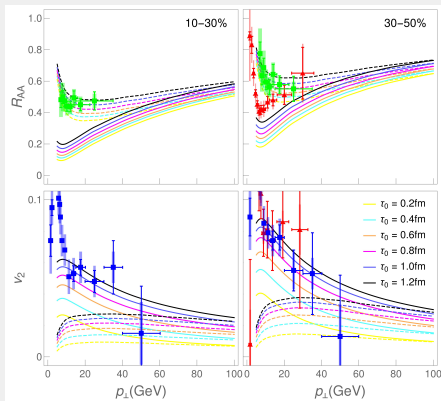
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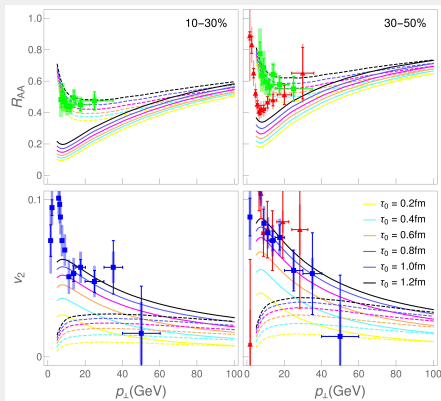


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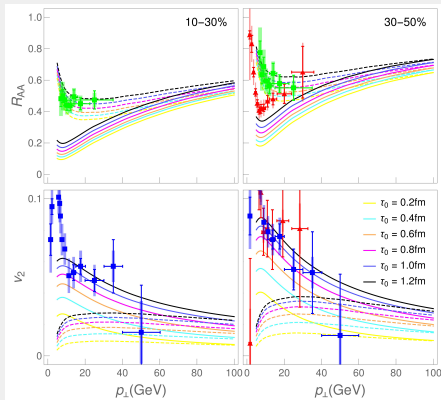


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- Available data suggests that later thermalization time is preferred.



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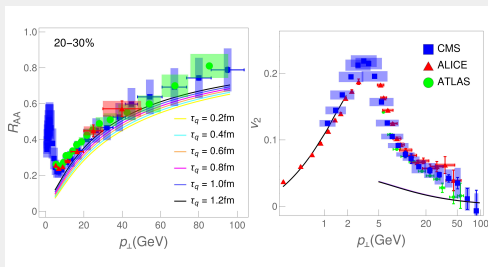
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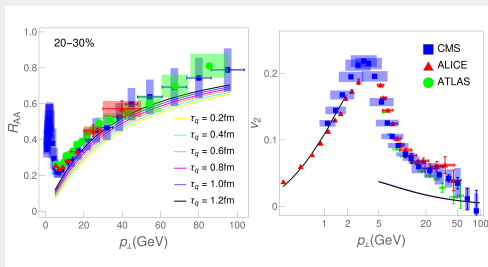
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- $v_2$  surprisingly insensitive to  $\tau_q$ !

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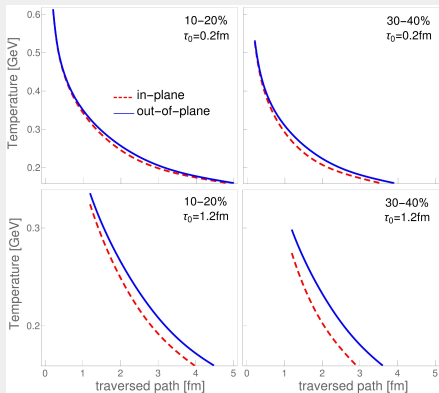
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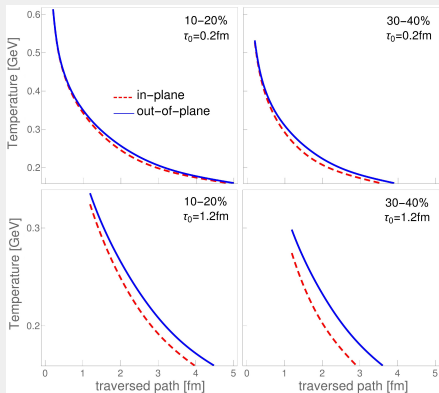
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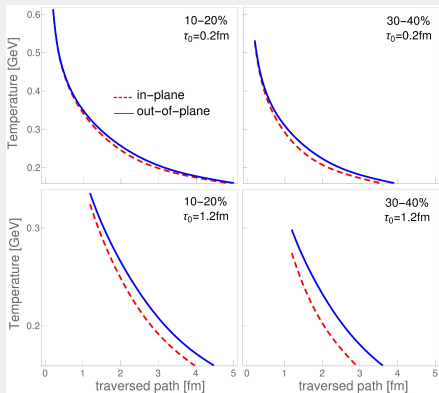


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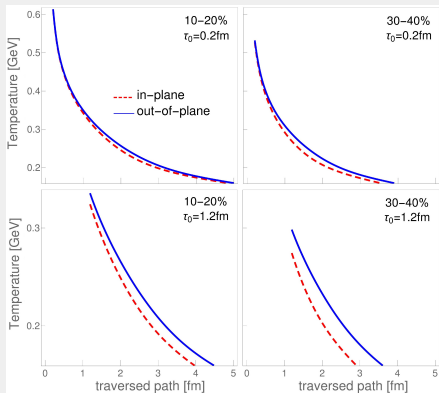


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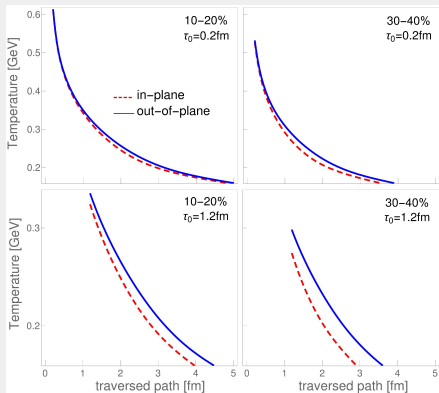
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- Explains the observed dependence of  $v_2$  on  $\tau_0$ .

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- S. Stojku, J. Auvinen, M. Djordjevic, P. Huovinen and M. Djordjevic, arXiv:2008.08987 [nucl-th]

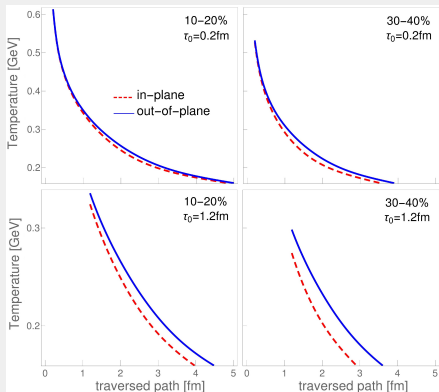


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- All this demonstrates synergy of low- and high- $p_{\perp}$  QGP physics, supporting our QGP tomography approach.

# ACKNOWLEDGEMENTS



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НАУКЕ И ТЕХНОЛОШКОГ РАЗВОЈА**

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