

How many interactions does it take to modify a jet?

And is that the whole story?

Chiara Le Roux

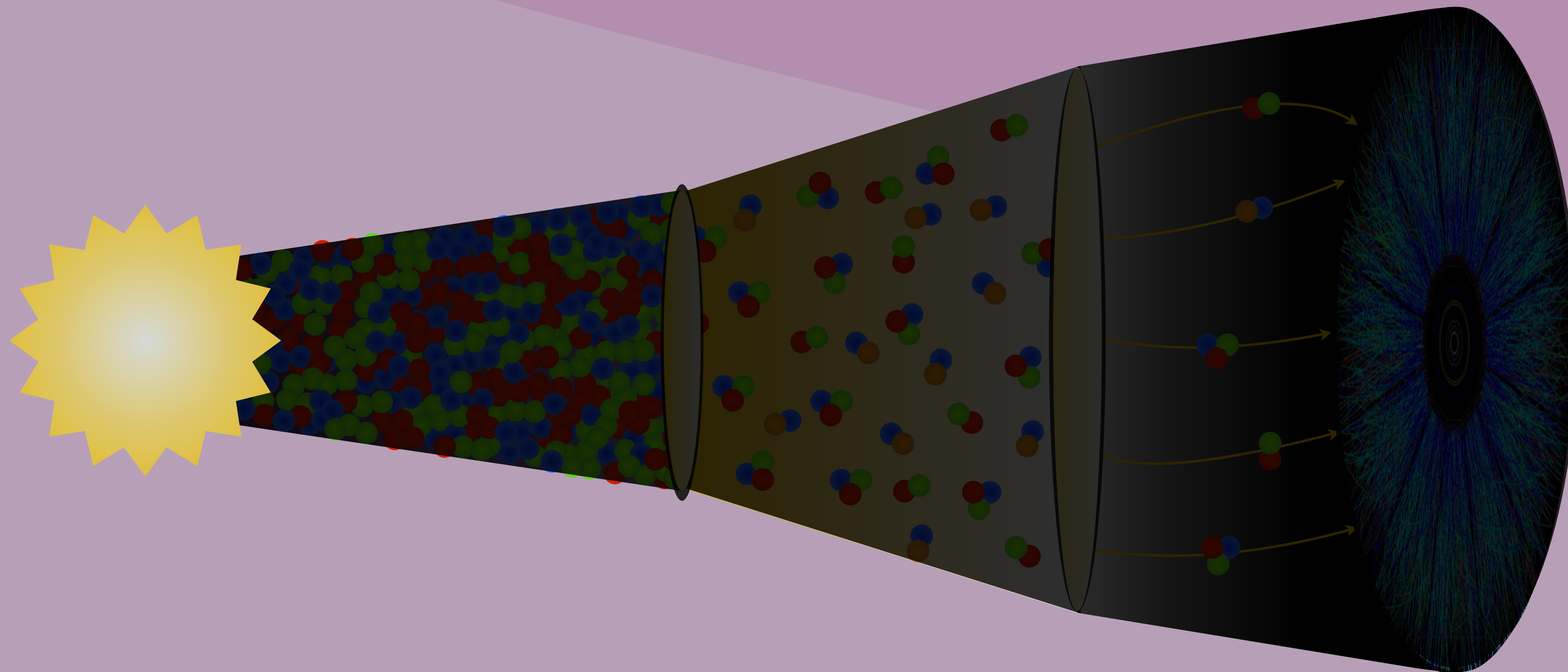
José Guilherme Milhano (LIP) and Korinna Zapp



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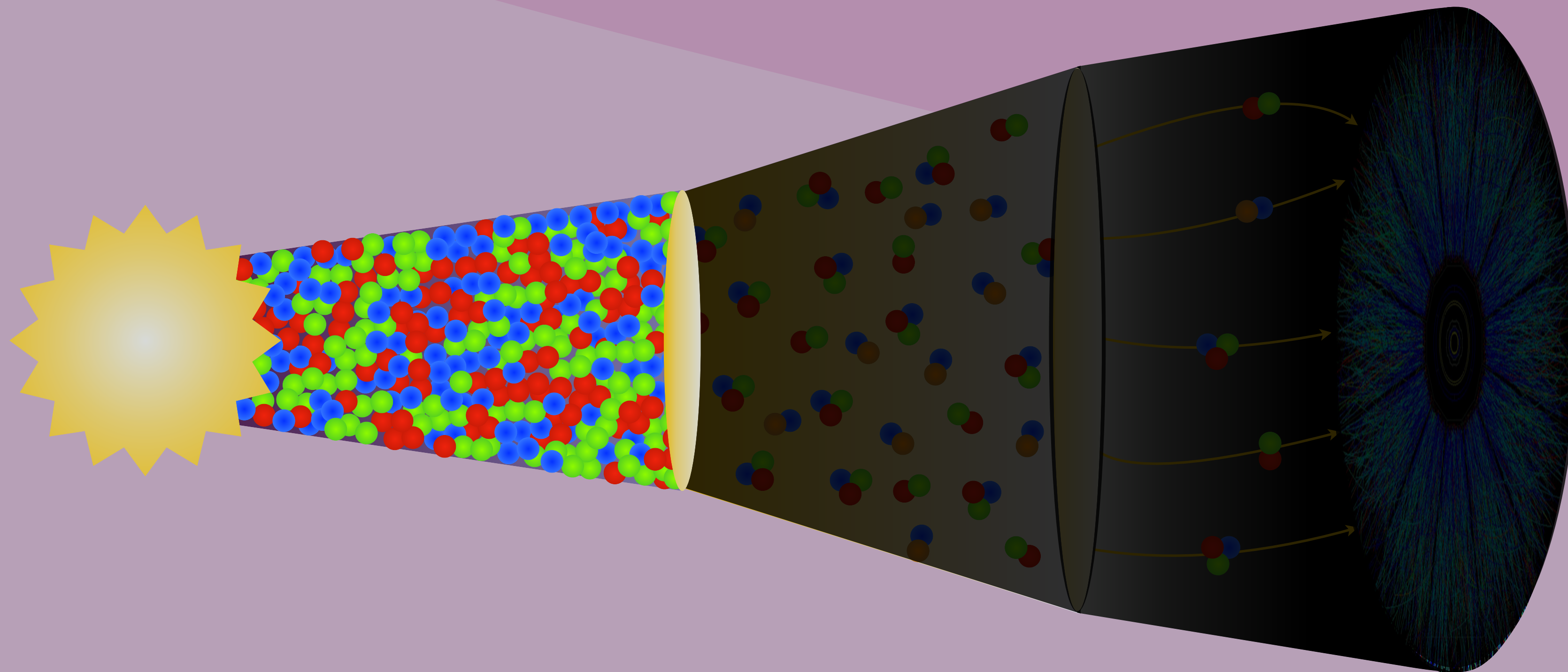
Relativistic Heavy Ion Collisions

➤ Heavy ions collide at high energies



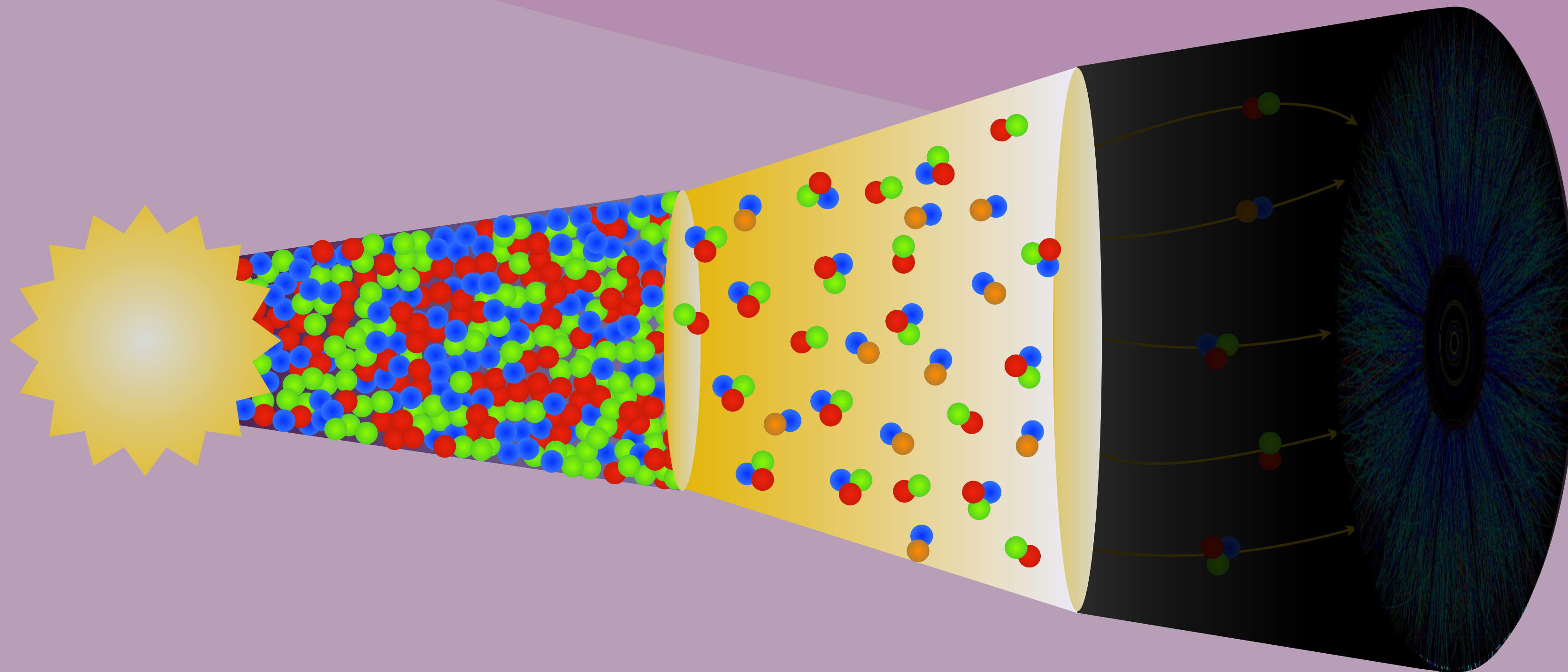
Relativistic Heavy Ion Collisions

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- A system of free quarks and gluons (QGP) is created and expands



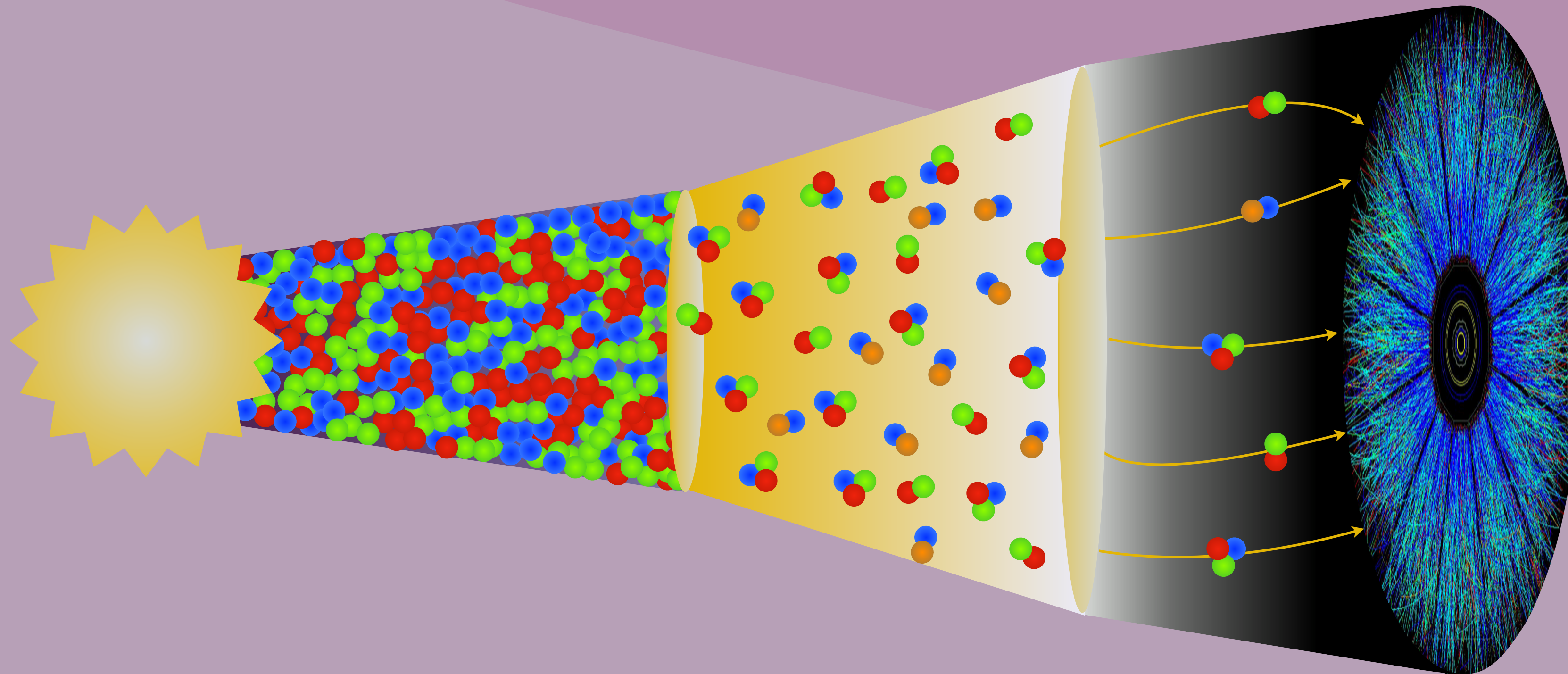
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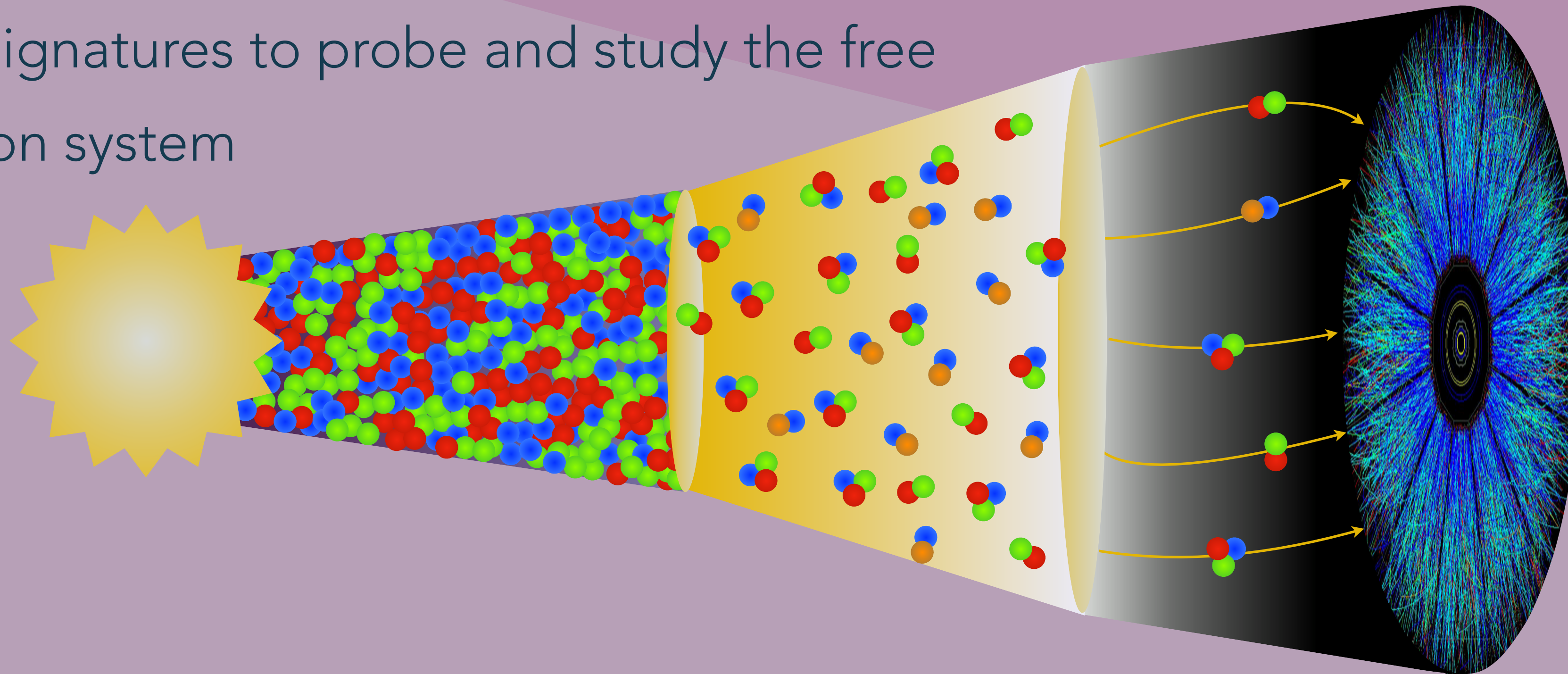
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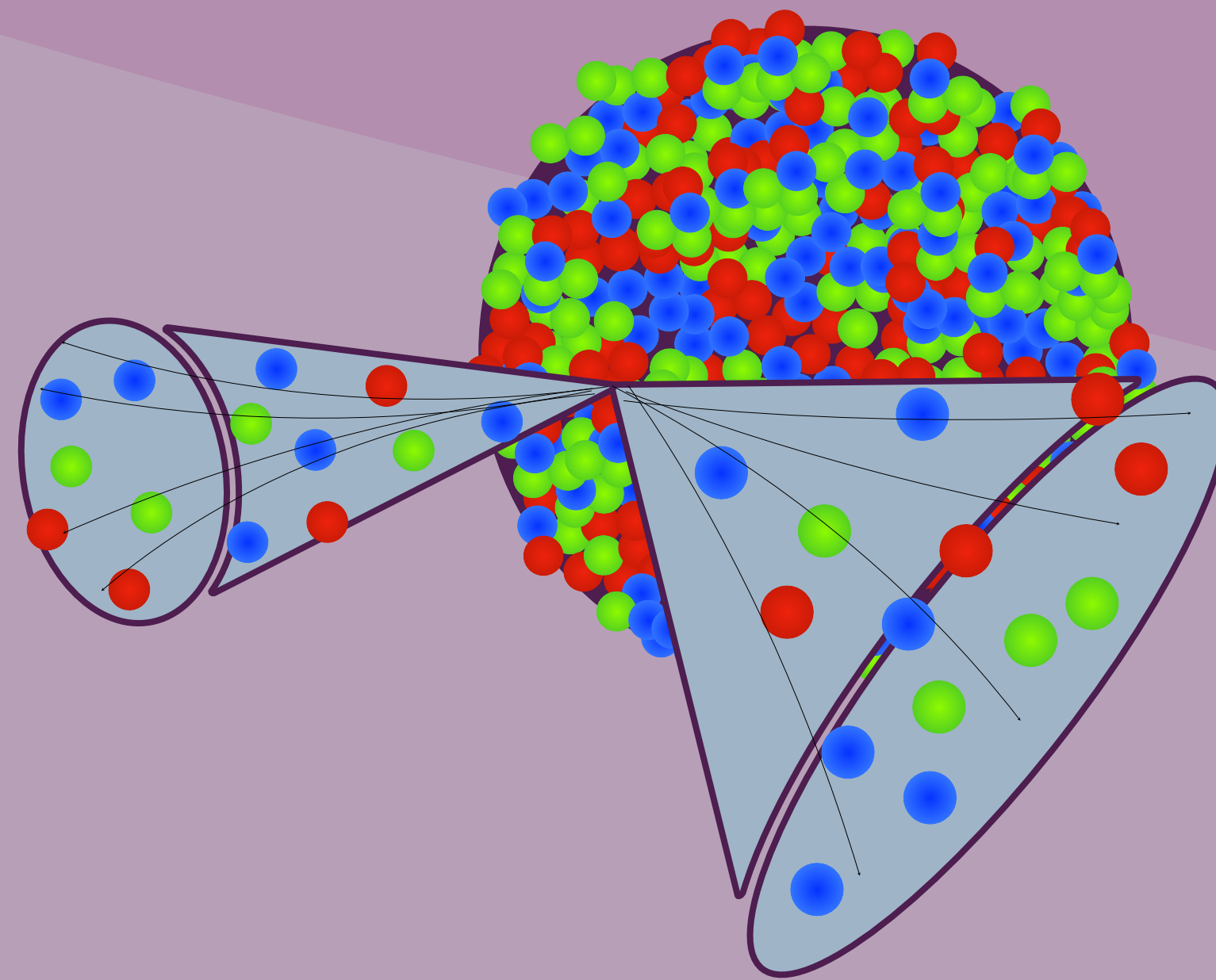
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- A system of free quarks and gluons (QGP) is created and expands
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- Different signatures to probe and study the free quark-gluon system



Jet quenching

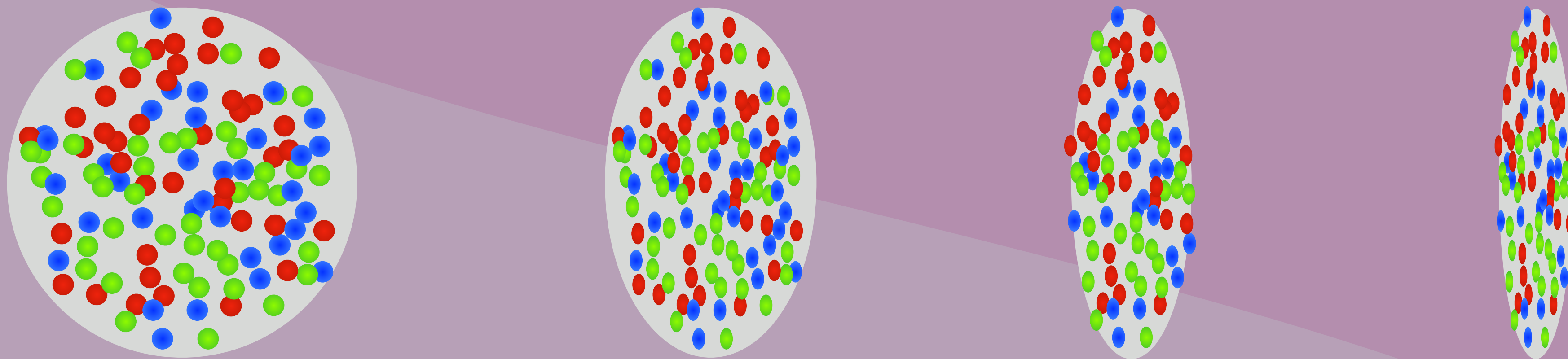
- High energy jets are created early in the collision
- They traverse the medium and lose energy and momentum
- Depending on how much medium they traverse they can lose more or less energy



- Jet quenching is measured with the R_{AA} (ratio between AA and pp collision)

Collective behavior

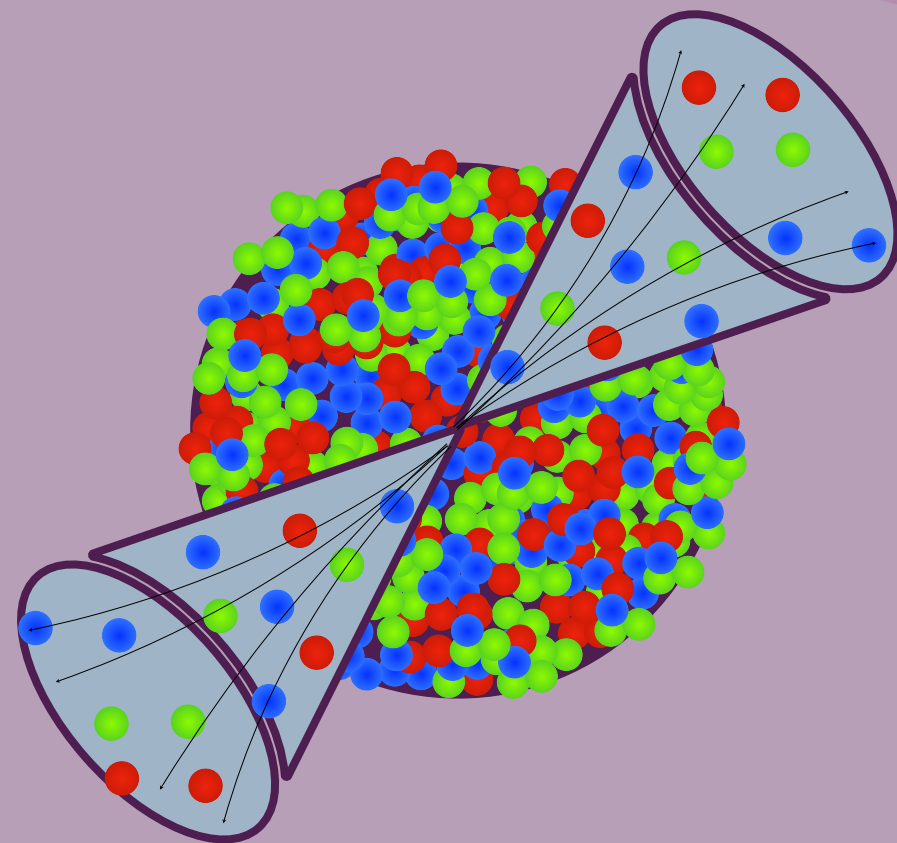
- Different collision centralities create medium with different eccentricities
- This anisotropy can be observed in the final distribution of particles



- One way to quantify collectivity is to measure v_2 (related to the anisotropy in the final state partial distribution)

What is going on in small systems?

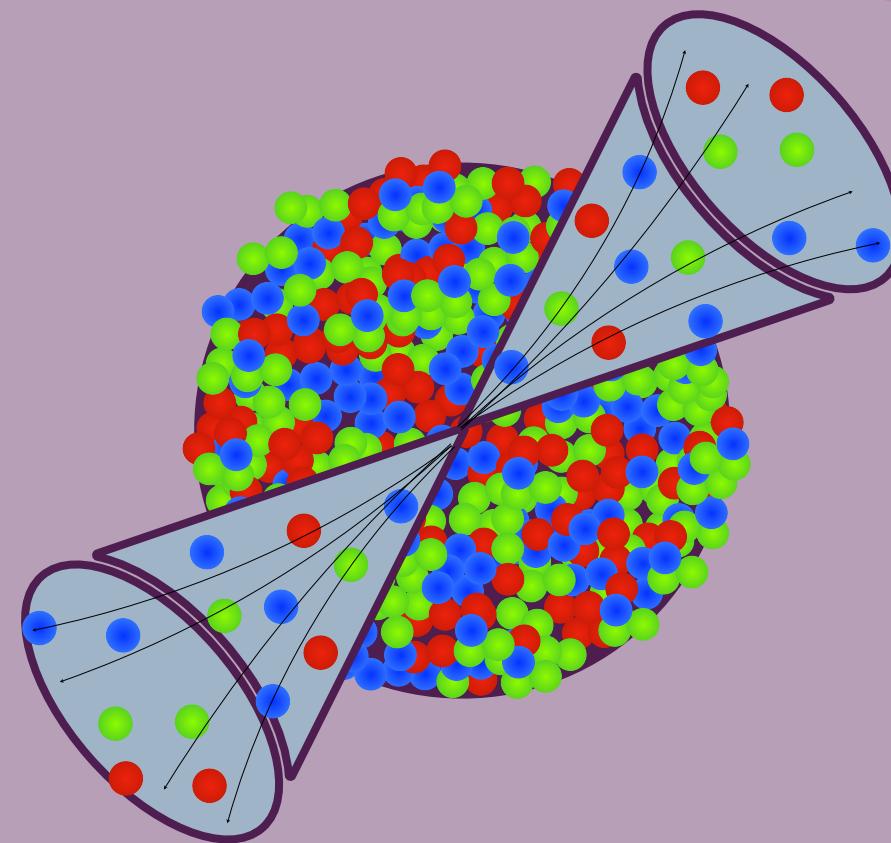
- Both signatures have been observed in heavy ion collisions
- Small systems collisions (pp, pA, etc.) are not dense enough to produce a medium
- Jet quenching has not been observed in small systems
- Collectivity has been observed in pA and even pp
- Other QGP signatures have also been observed in small systems



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If there is medium formation in small systems, it must be very small

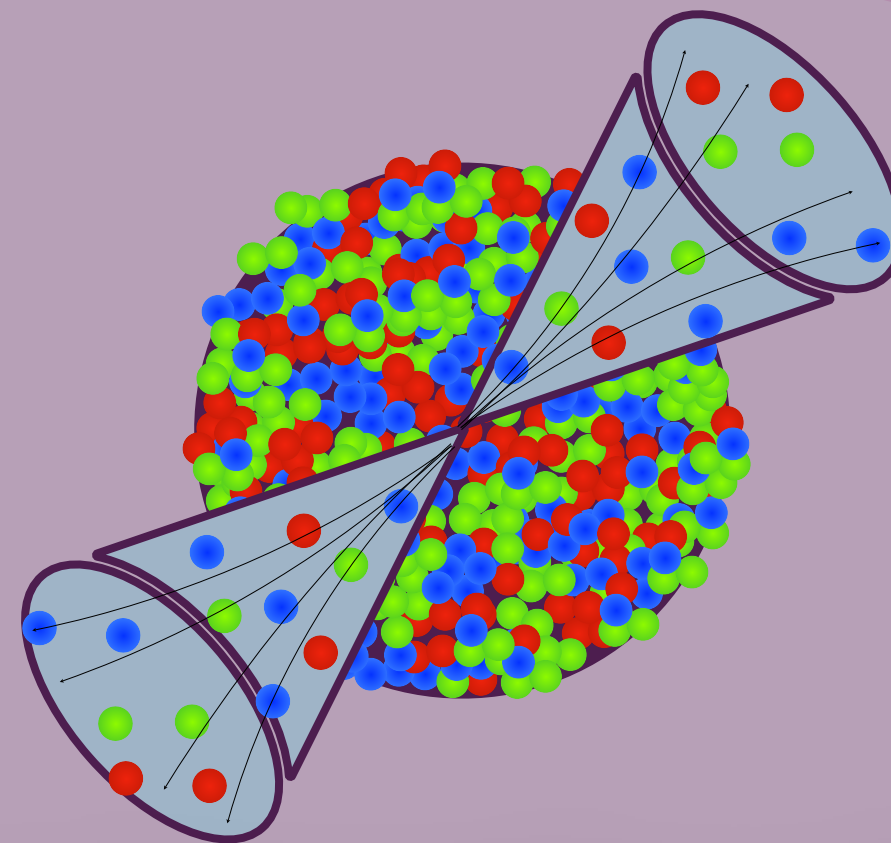


Too small to have enough interactions to produce a jet quenching signal?

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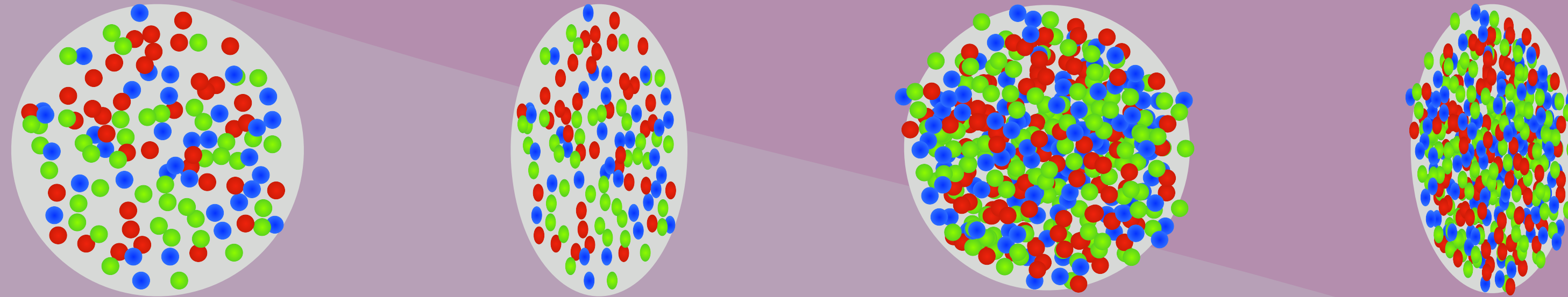
How many jet-medium interactions does it take to quench a jet?
And to observe collectivity?

JEWEL jets in a brick-like medium

- JEWEL is a parton shower that can be evolved inside a medium
- Between each splitting, partons can interact with medium particles

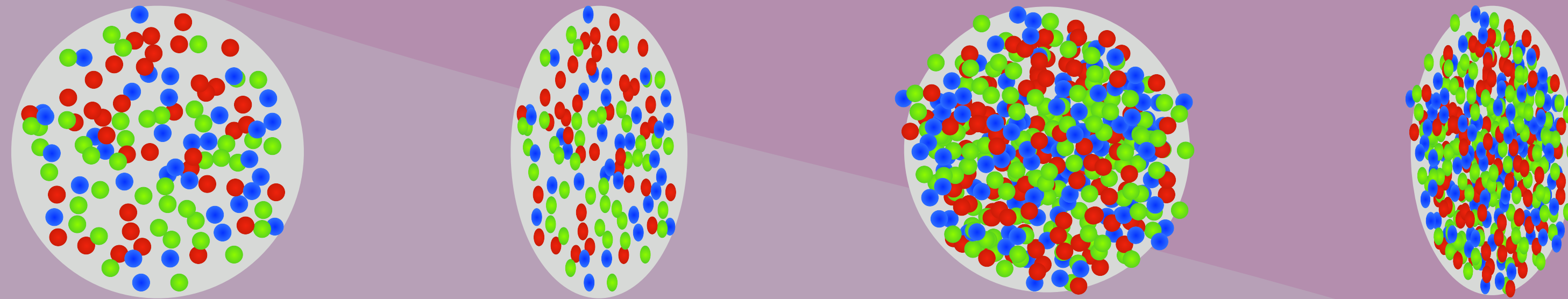
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- Define a brick-like medium in JEWEL with a given density, temperature and geometry

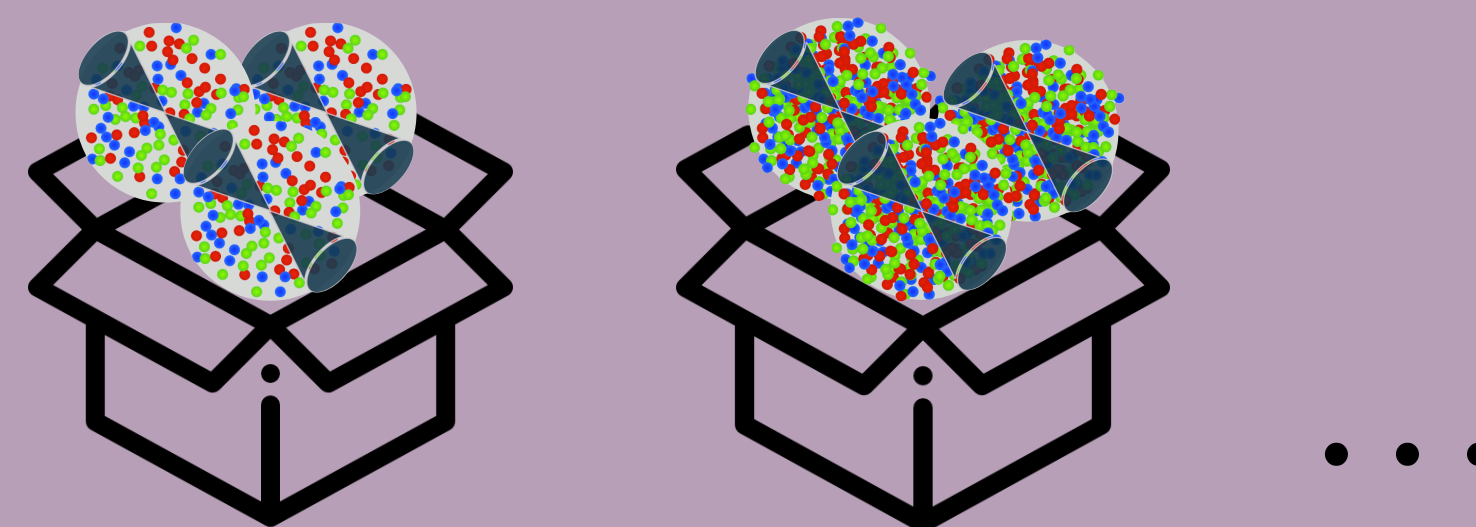


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- Let jets evolve inside the brick while counting the number of jet-medium interactions

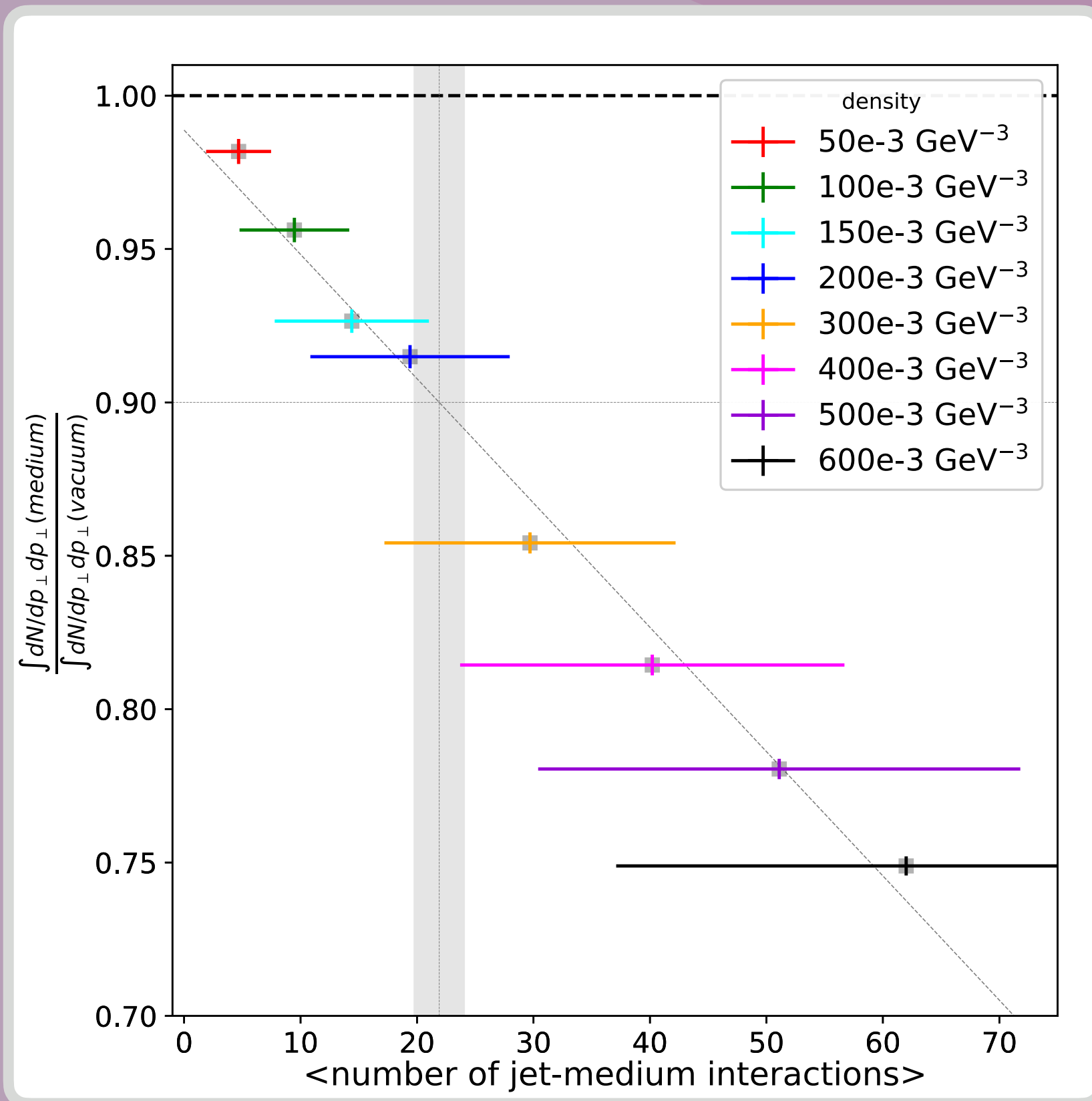


0-5
interactions

6-10
interactions

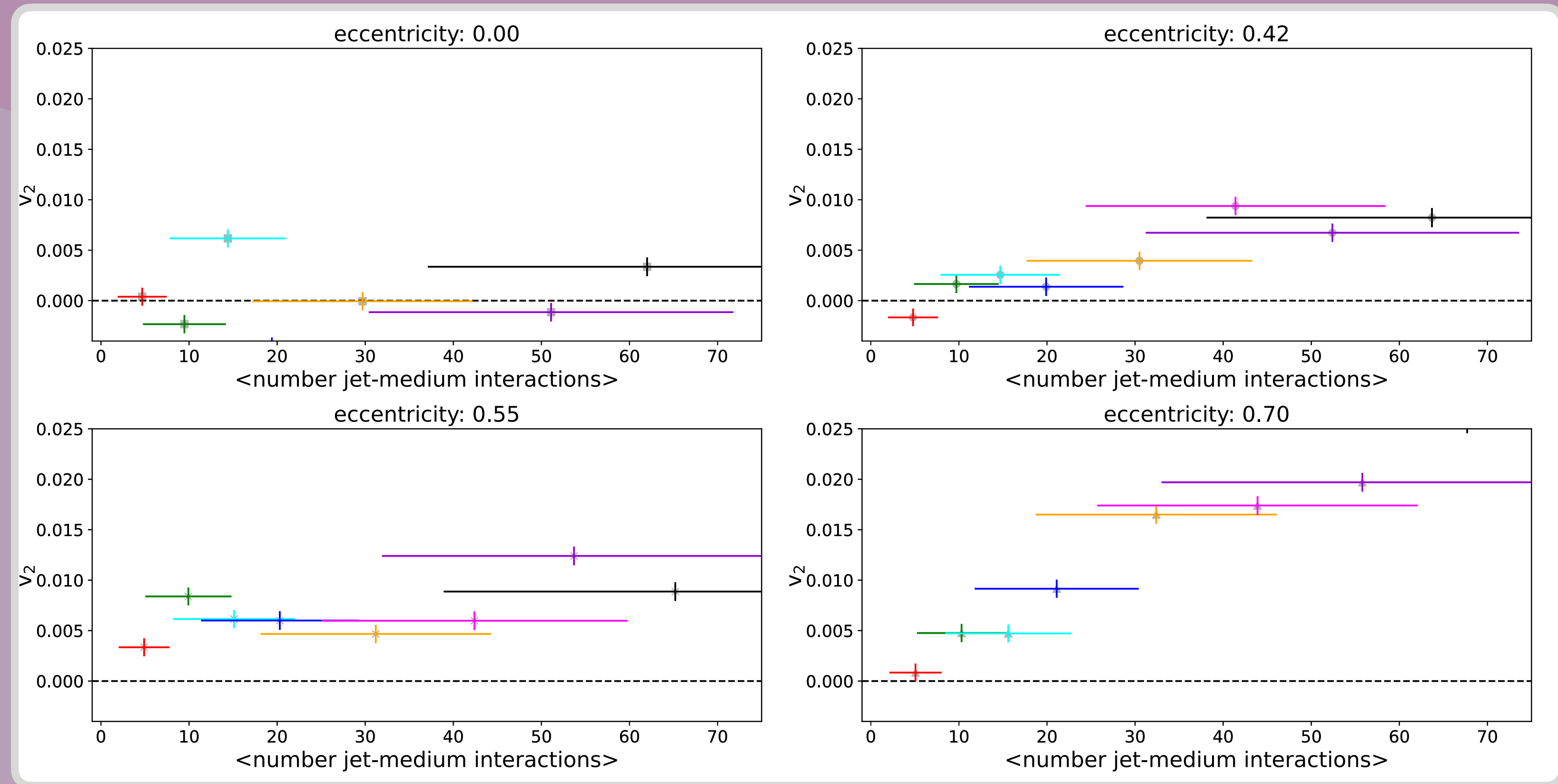
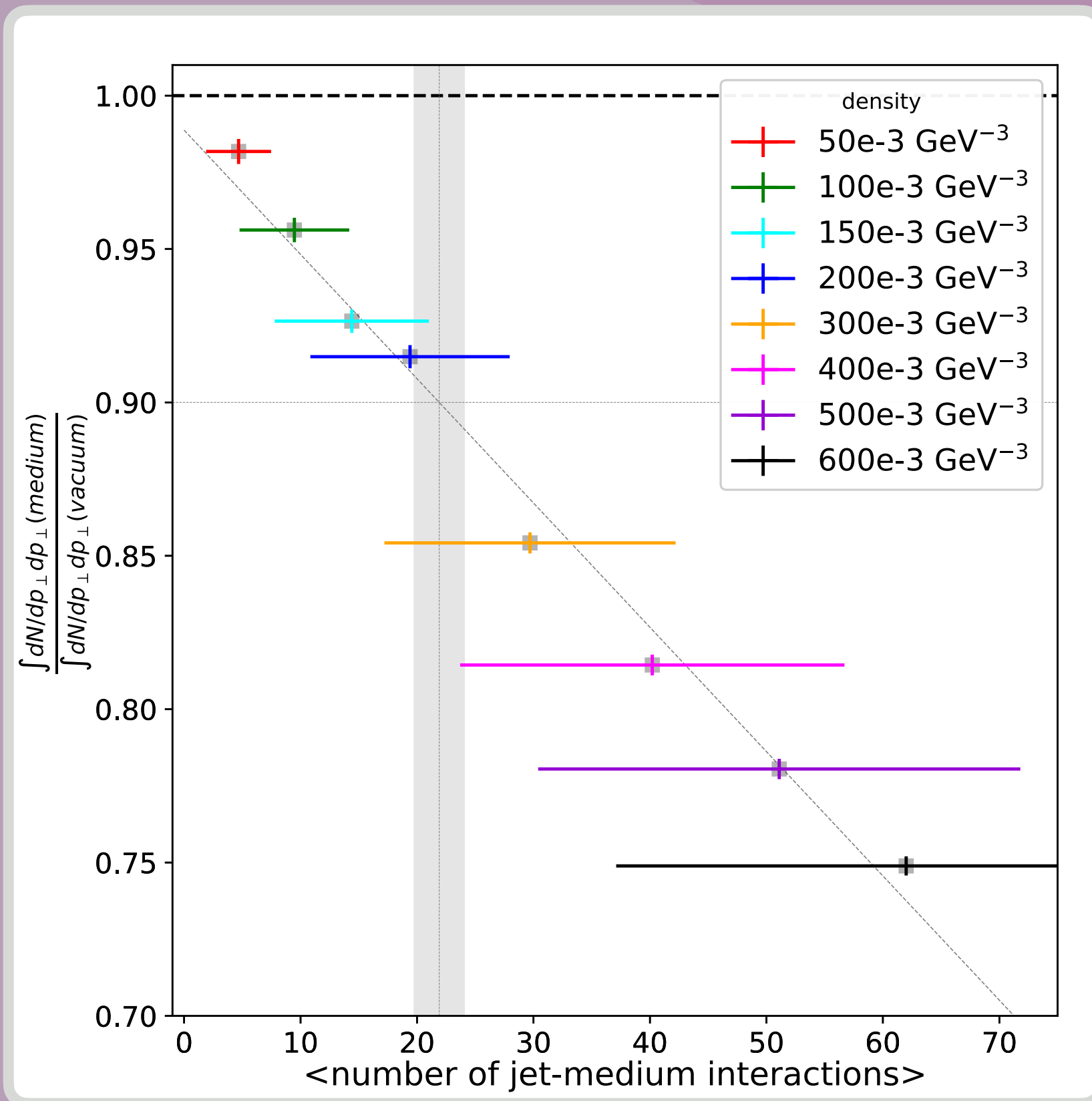
Results

🔍 At about 20 interactions, a 10% effect in R_{AA} (jet quenching) is observed



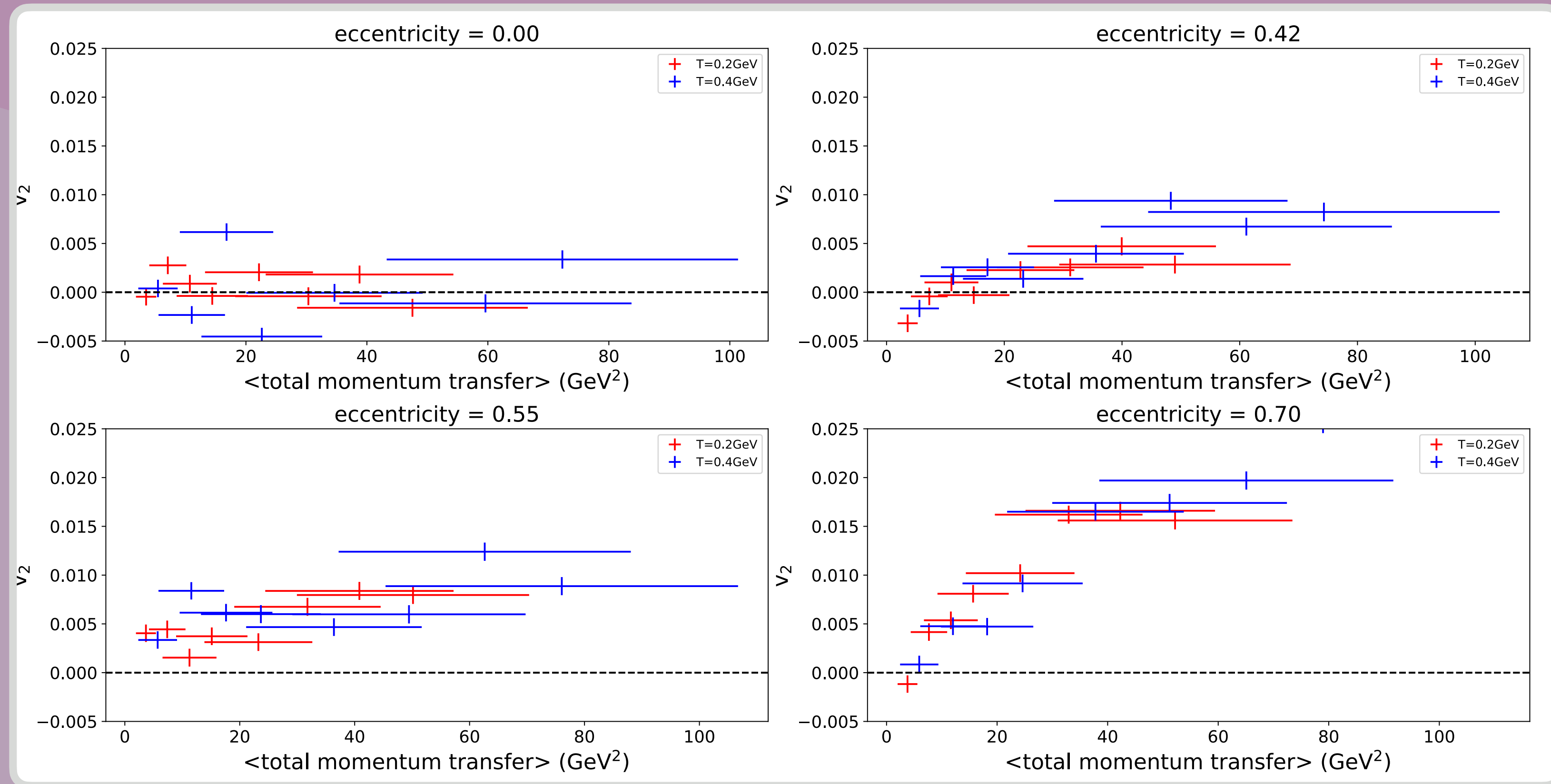
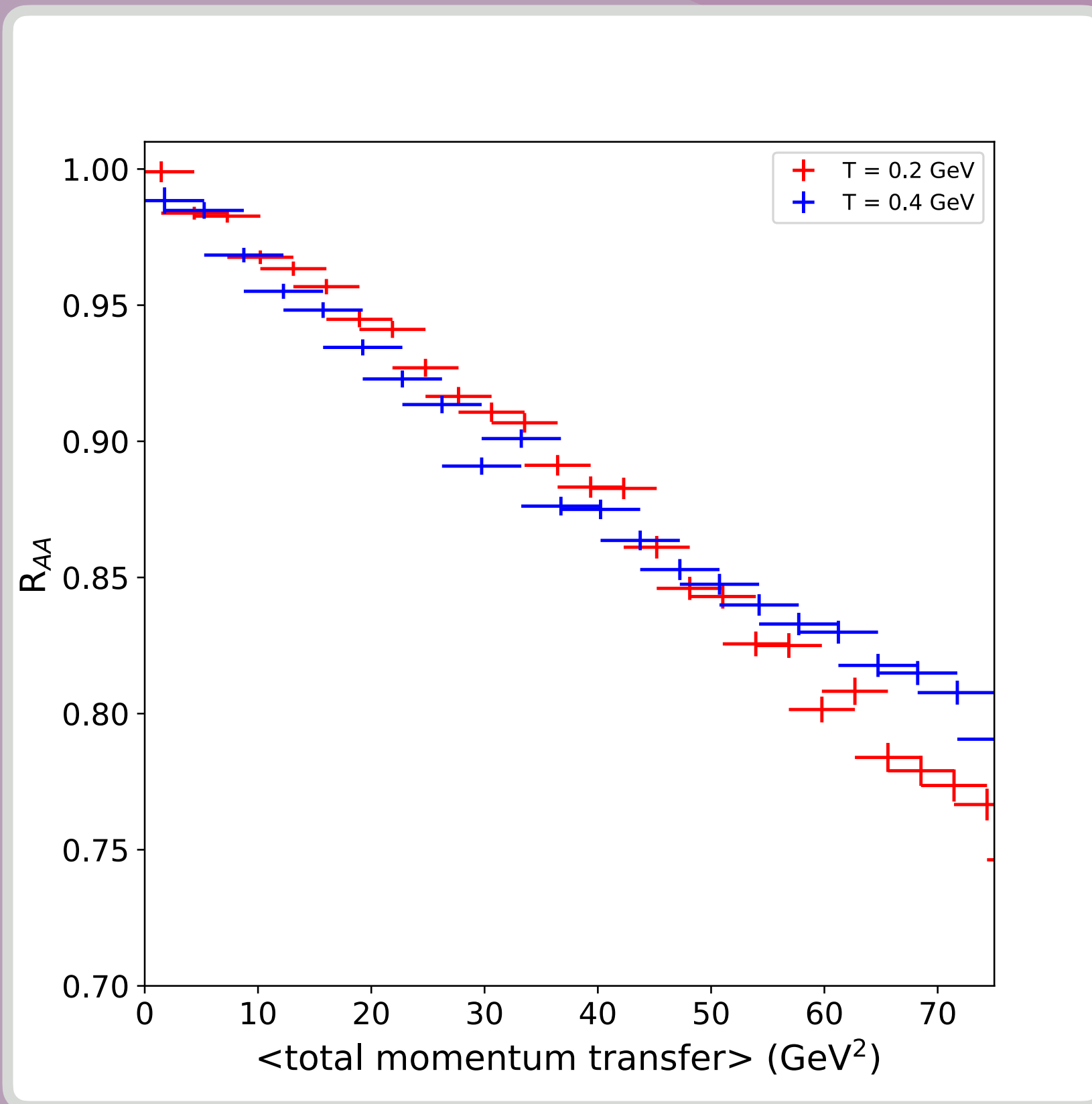
Results

- At about 20 interactions, a 10% effect in R_{AA} (jet quenching) is observed
- v_2 (collectivity) can be seen well before that in certain eccentricities



But that is not all...

- At different screening masses, the number of interactions changes
- R_{AA} and v_2 scale with total momentum transfer



Conclusions and outlook

- ✦ Results indicate that there are more interactions required to observe R_{AA} than v_2
- ✦ Implement an improved method to select on number of jet-medium interactions avoiding selection biases
- ✦ Understand how deflection angle and momentum transfer separately affect the v_2 signal
- ✦ Compare our results with a more realistic medium model

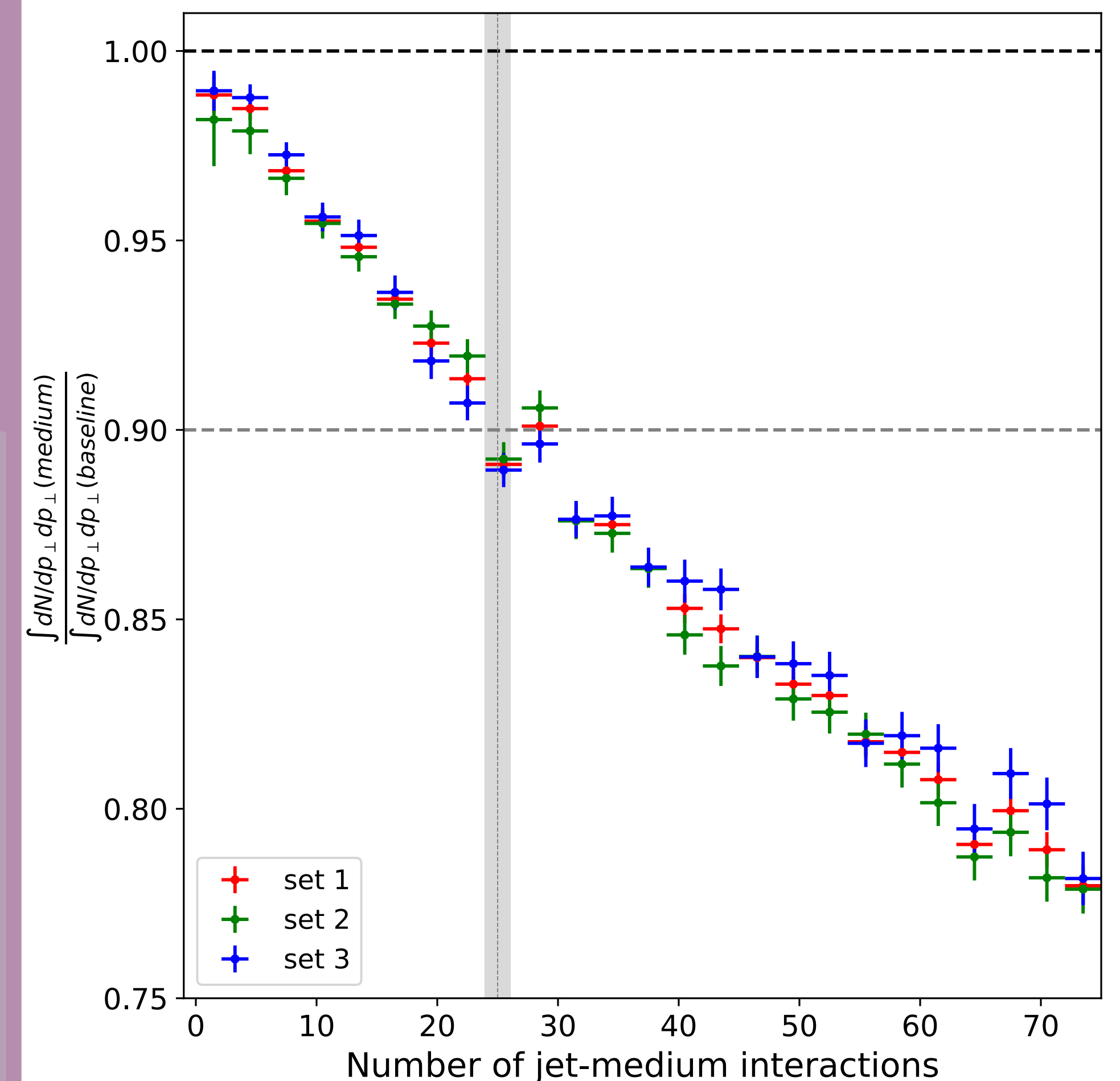
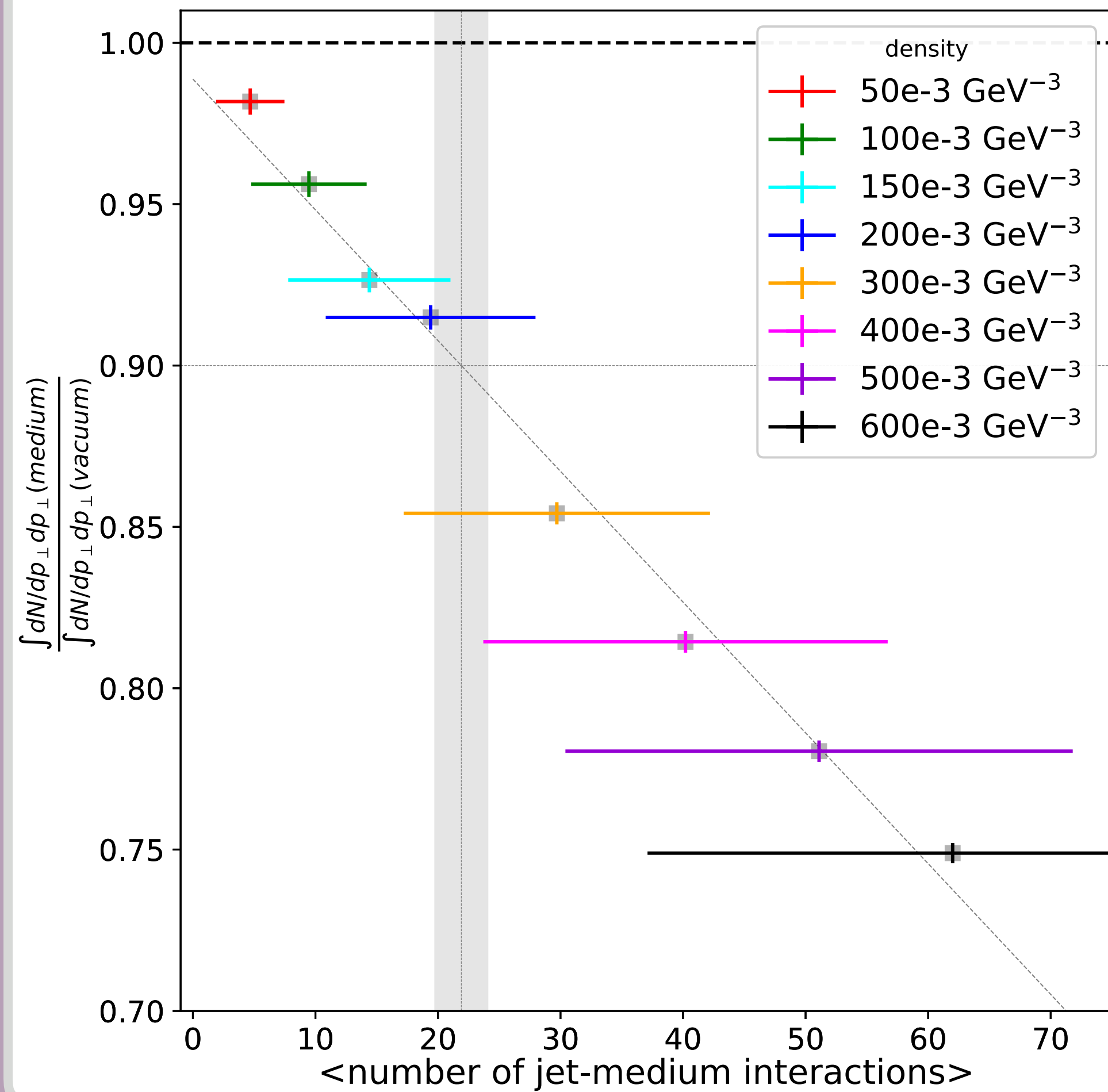
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Thank you!



Back up



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