



Testing the QA Method for Calculating Jet v_2

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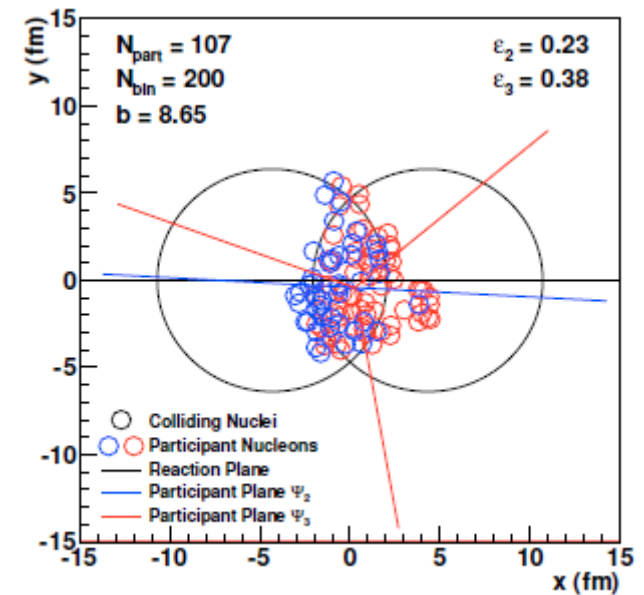
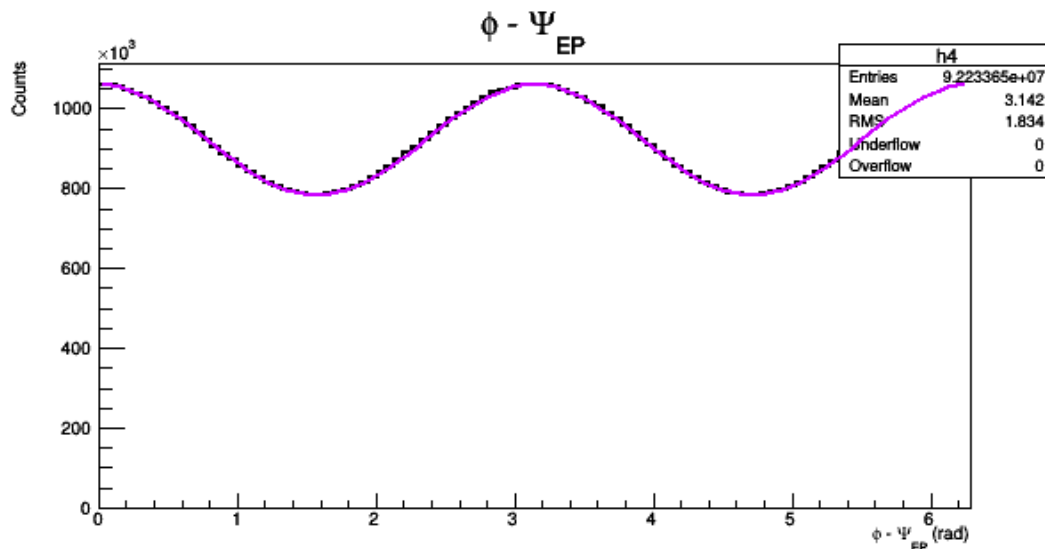
Overview

- What is v_2
 - Bulk v_2
 - Jet v_2
- Methods for calculating jet v_2
 - Standard method
 - QA method
- Simulations
- Results
- Conclusions

Bulk v_2

- Soft component of Pb-Pb collisions
- Hydrodynamic flow
- Elliptical overlap region

$$\frac{dN}{d(\phi - \psi_{EP})} \propto 1 + \sum_{n=1}^{\infty} 2v_n \cos[n(\phi - \psi_{EP})]$$



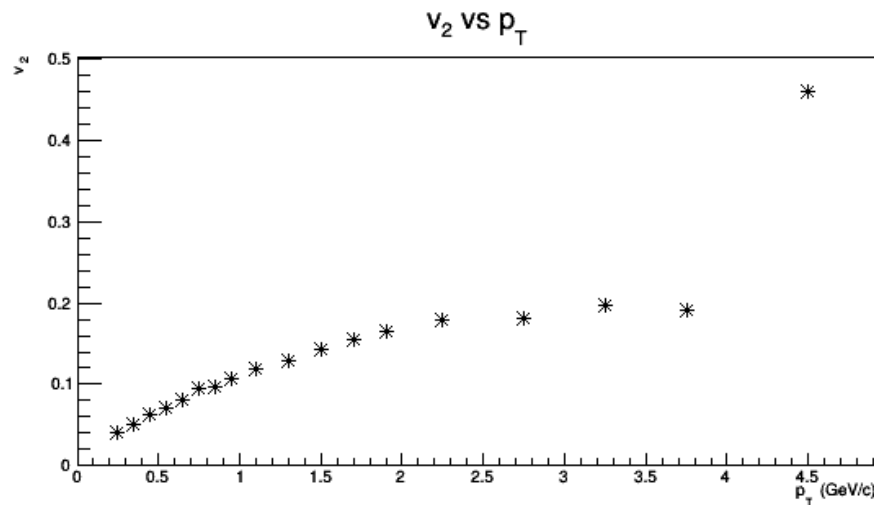
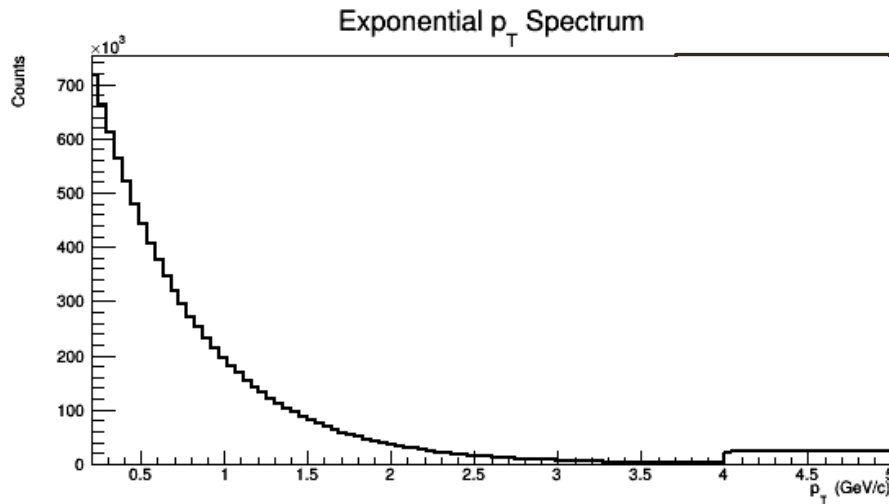
Jet v_2

$$\frac{dN}{d(\psi_{jet} - \psi_{PP})} \propto 1 + \sum_{n=1}^{\infty} 2v_n^{jet} \cos[n(\psi_{jet} - \psi_{PP})]$$

- Jets emitted isotropically
- Lose energy to QGP as function of pathlength
- Jet v_2 is the correlation of the jet axis with the event plane.
- Information about jet-QGP interaction

Standard method

- EP bias
- v_2 overestimation

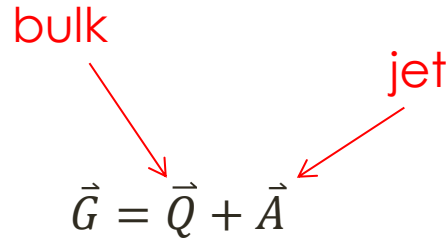


Standard method

- Solutions to EP-bias problem
 - Remove all particles from jet cone
 - Remove certain η ranges

QA method

- Account for jets, don't remove them
- Assumes we can reconstruct jets well

$$\vec{G} = \vec{Q} + \vec{A}$$


The diagram shows the equation $\vec{G} = \vec{Q} + \vec{A}$ with two red arrows. One arrow points from the word "bulk" to the vector \vec{Q} , and another arrow points from the word "jet" to the vector \vec{A} .

QA method

*Calculate a few higher order moments,
assume Q_x and Q_y are Gaussian,
and solve a system of equations...*

$$v_2^{jet} = \frac{4\langle G_x \rangle \langle G_y^2 \rangle - 4\langle G_x G_y^2 \rangle}{\mu^3}$$

We may also calculate ψ_{EP} now

$$\psi_{EP} = \frac{1}{2} \arctan \left(\frac{\sum_i w_i \sin[2(\phi_i - \psi_{jet})]}{\sum_i w_i \cos[2(\phi_i - \psi_{jet})] - \langle A \rangle} \right) + \psi_{jet}$$

where

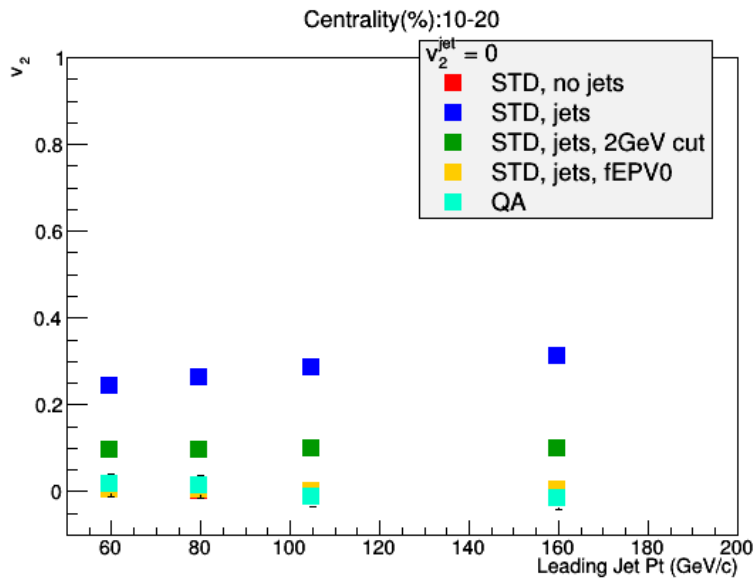
$$\langle A \rangle = \langle G_x \rangle - \mu v_2^{jet}$$
$$\mu^2 = \sqrt{8\langle G_y^2 \rangle^2 - \frac{8}{3}\langle G_y^4 \rangle}$$

Simulations

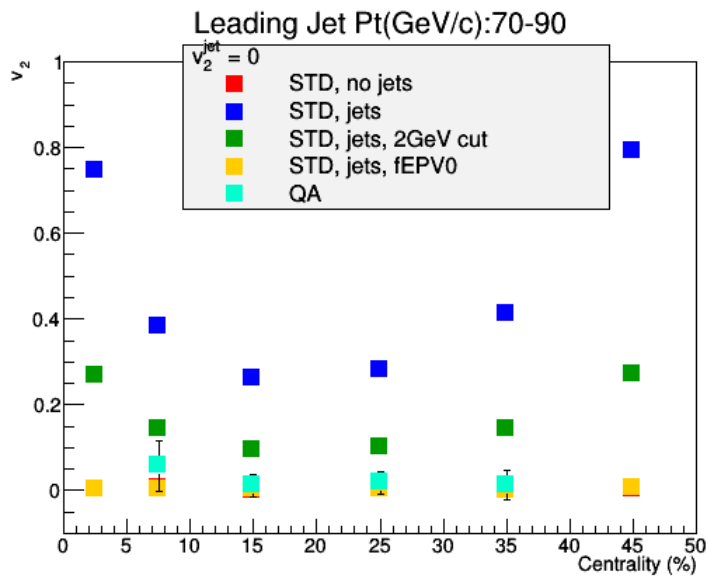
- Real Pb-Pb events from 2011
- PYTHIA jets
- Charged jets reconstructed before embedding
- Event plane and v_2^{jet} calculated with
 - No jets
 - Background + Jets
 - Background + Jets & 2 GeV track cutoff
 - QA method

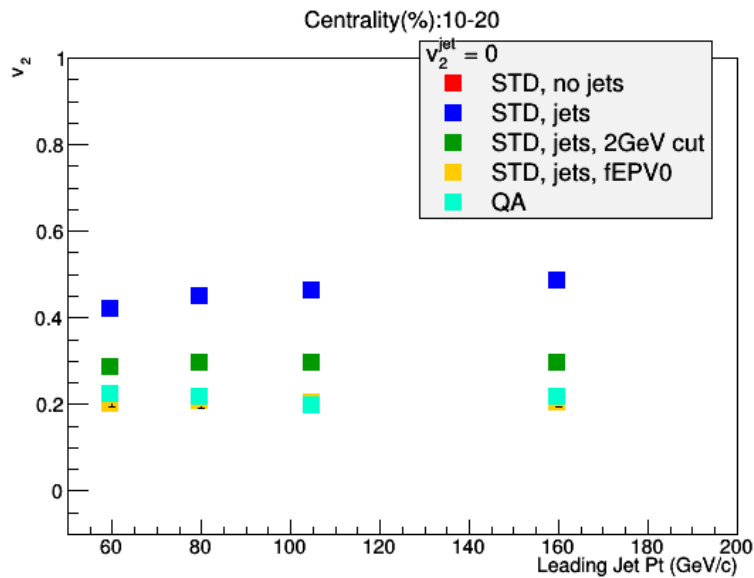
Results



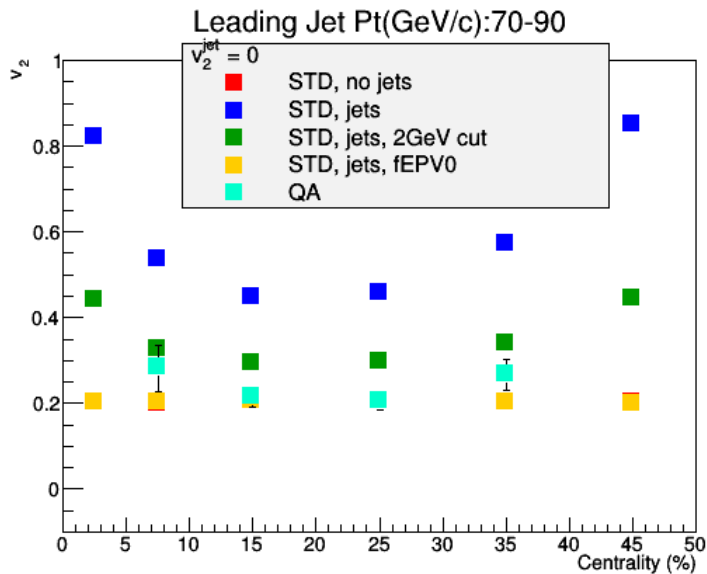


- Jets embedded randomly
 - Simulated $v_2^{jet} = 0$
- Standard method overestimates
- QA requires a lot of statistics





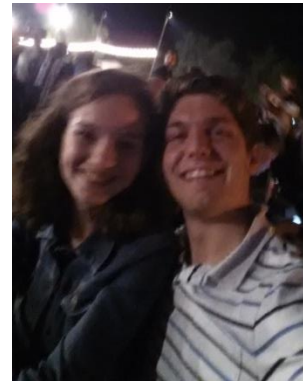
- Events weighted with $v_2^{jet} = 0.2$
- Similar trends as before

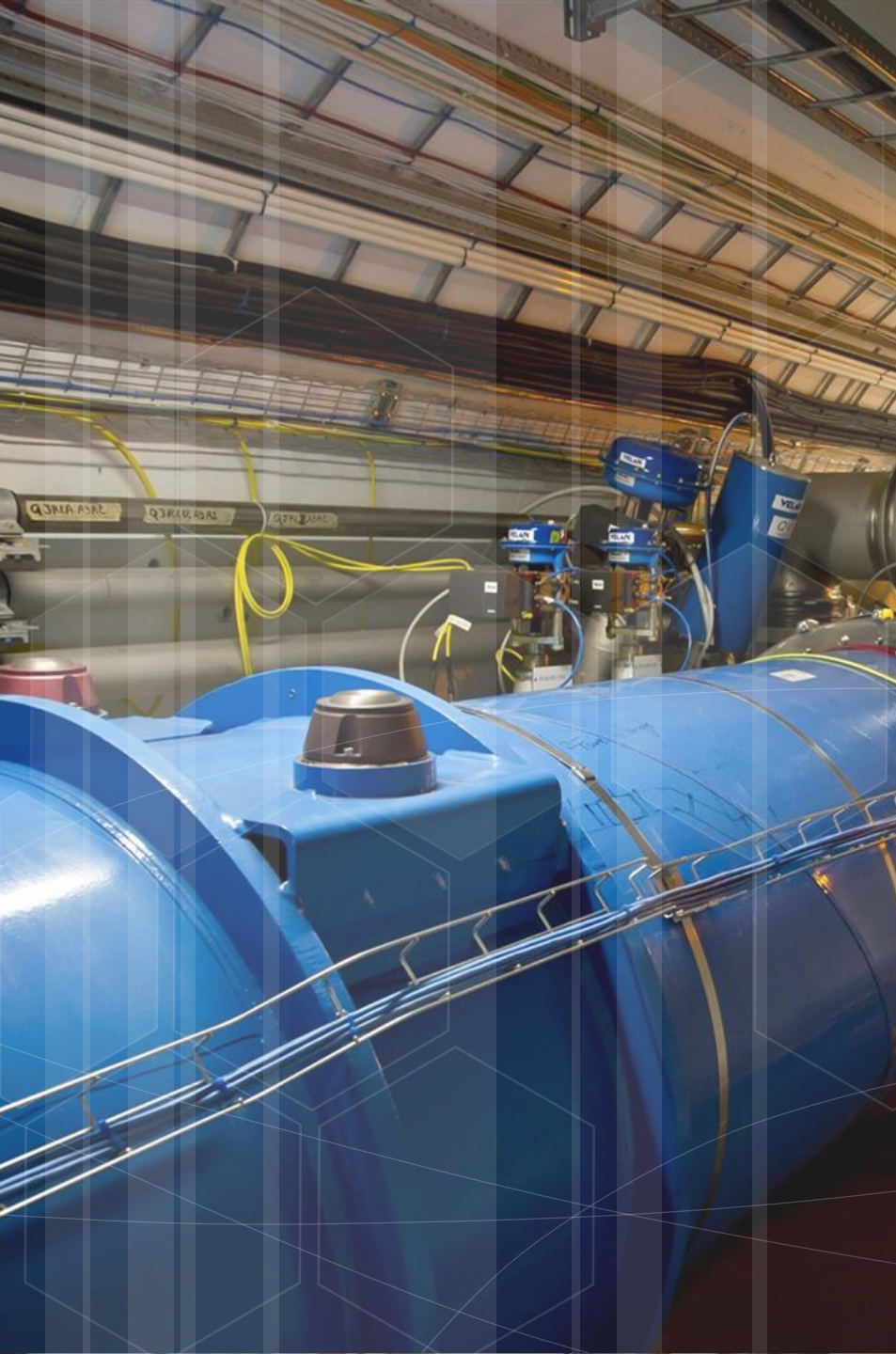


Conclusions

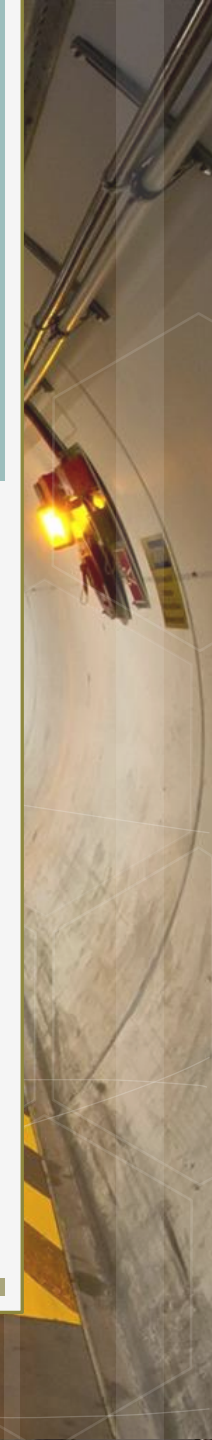
- Jet v_2 can give us useful information about how jets interact with QGP.
- Jets bias event plane
- QA method functions well in simple simulations if jets can be reconstructed accurately.
 - Requires a lot of statistics

Best part of the trip





Questions?



References

A. Ohlson, Phys. Rev. C **89**, 034909 (2013).