



LUND
UNIVERSITY



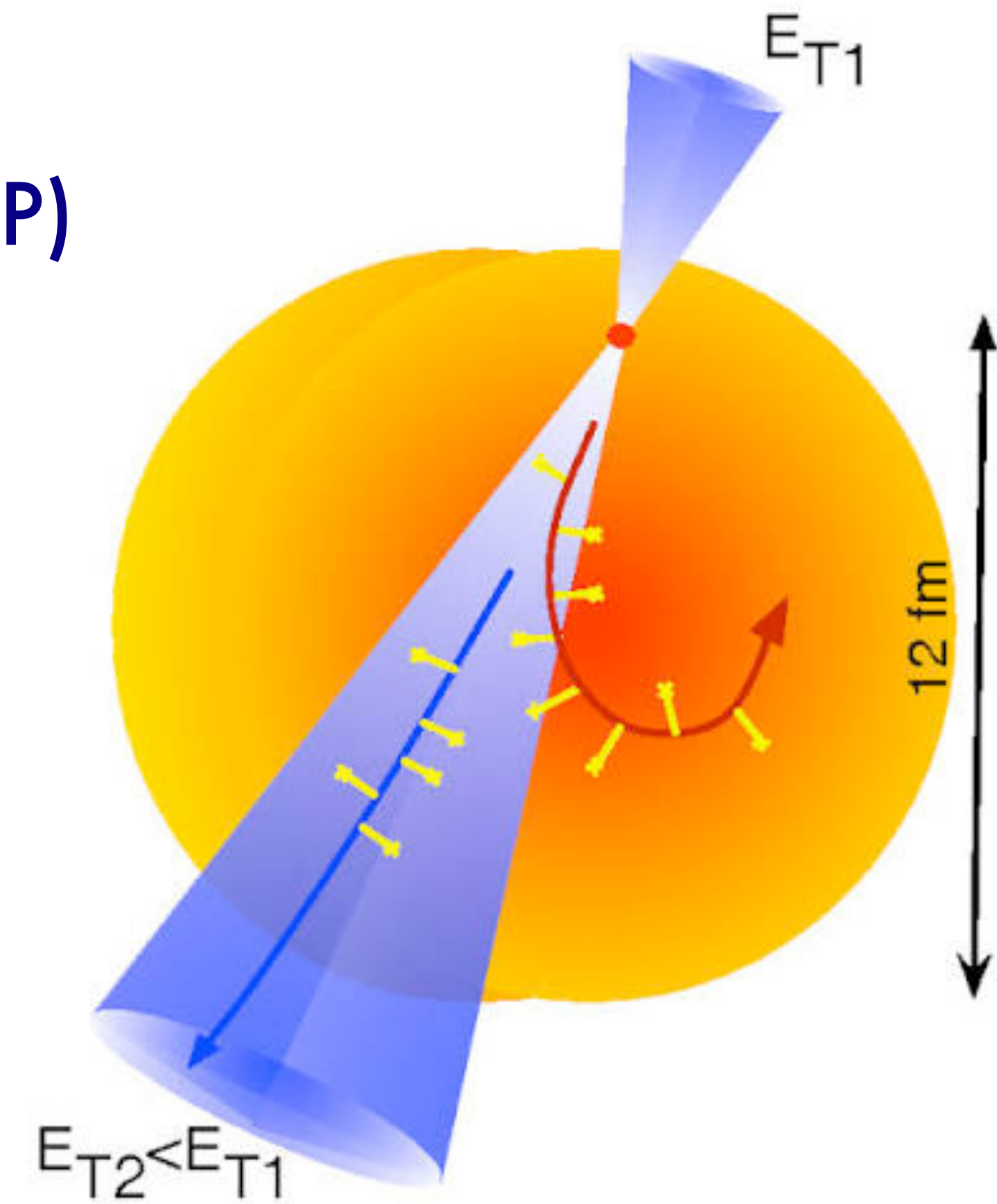
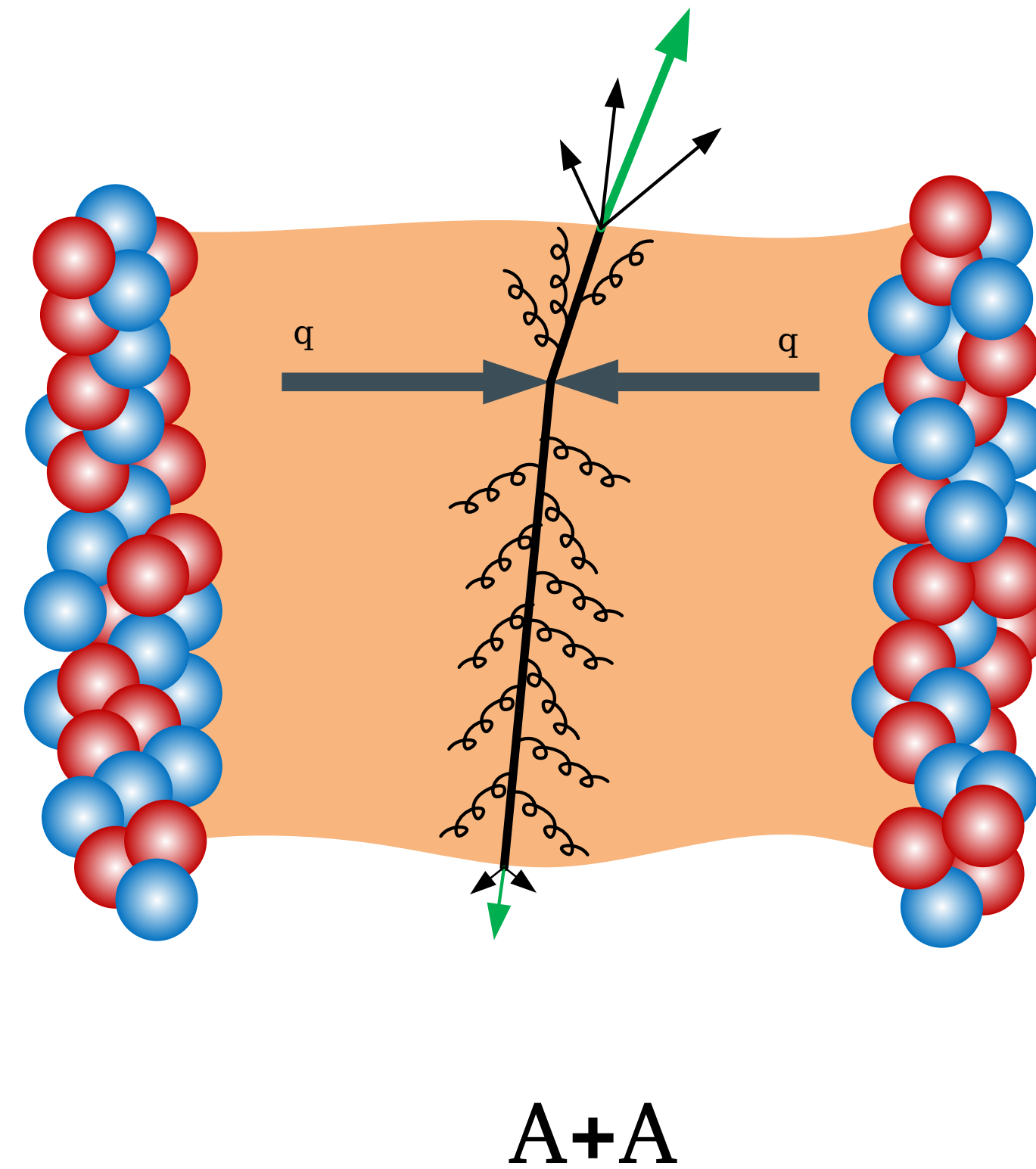
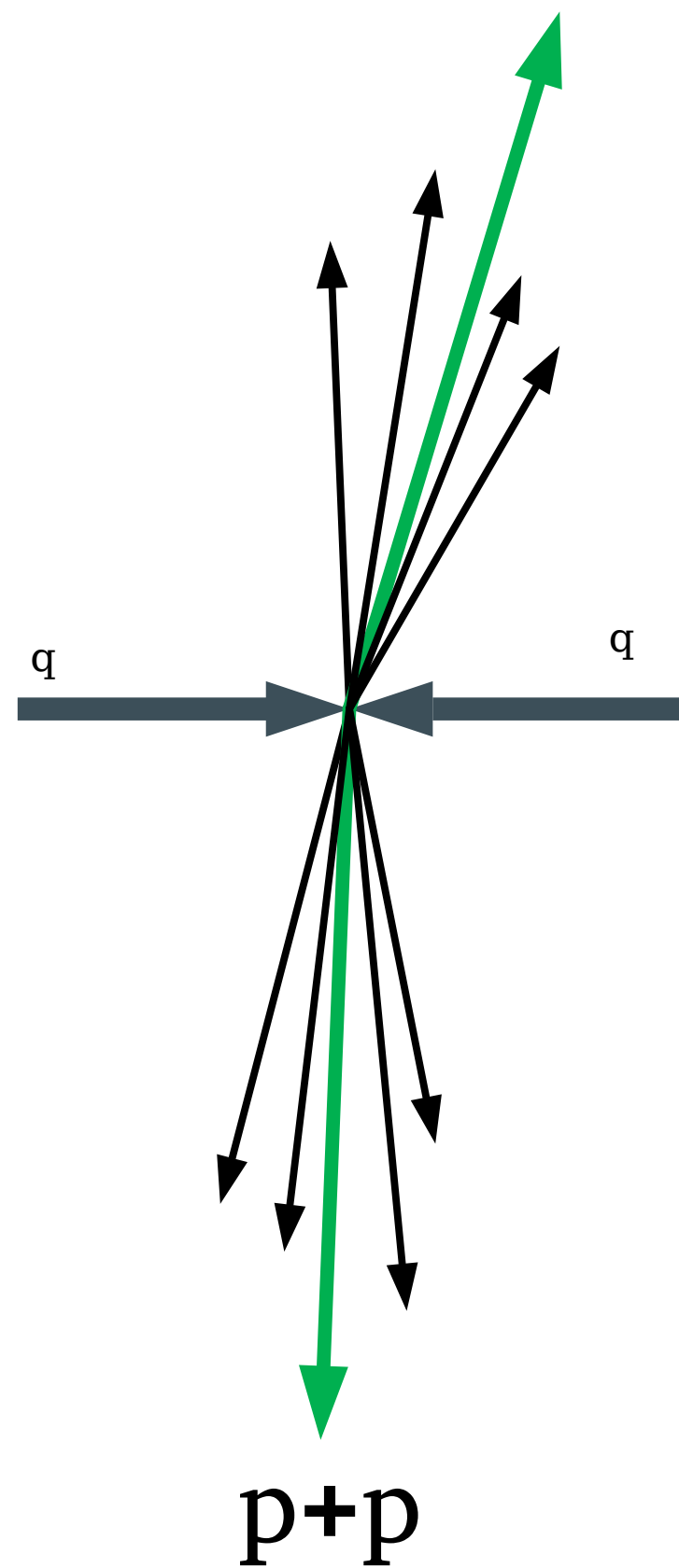
ALICE

Probing path-length dependent jet energy loss in Pb–Pb collisions with the ALICE detector in Run 3

Joachim C.K.B. Hansen
Lund University

Partikeldagarna 2026
17/09-2026

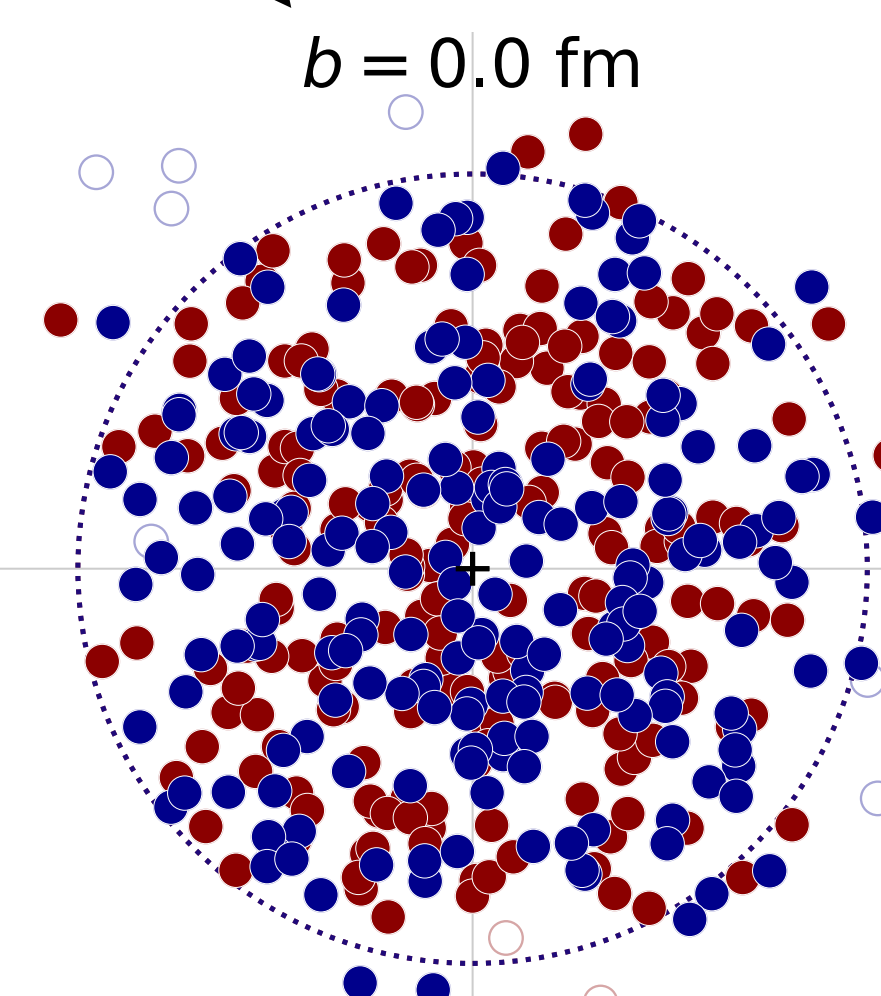
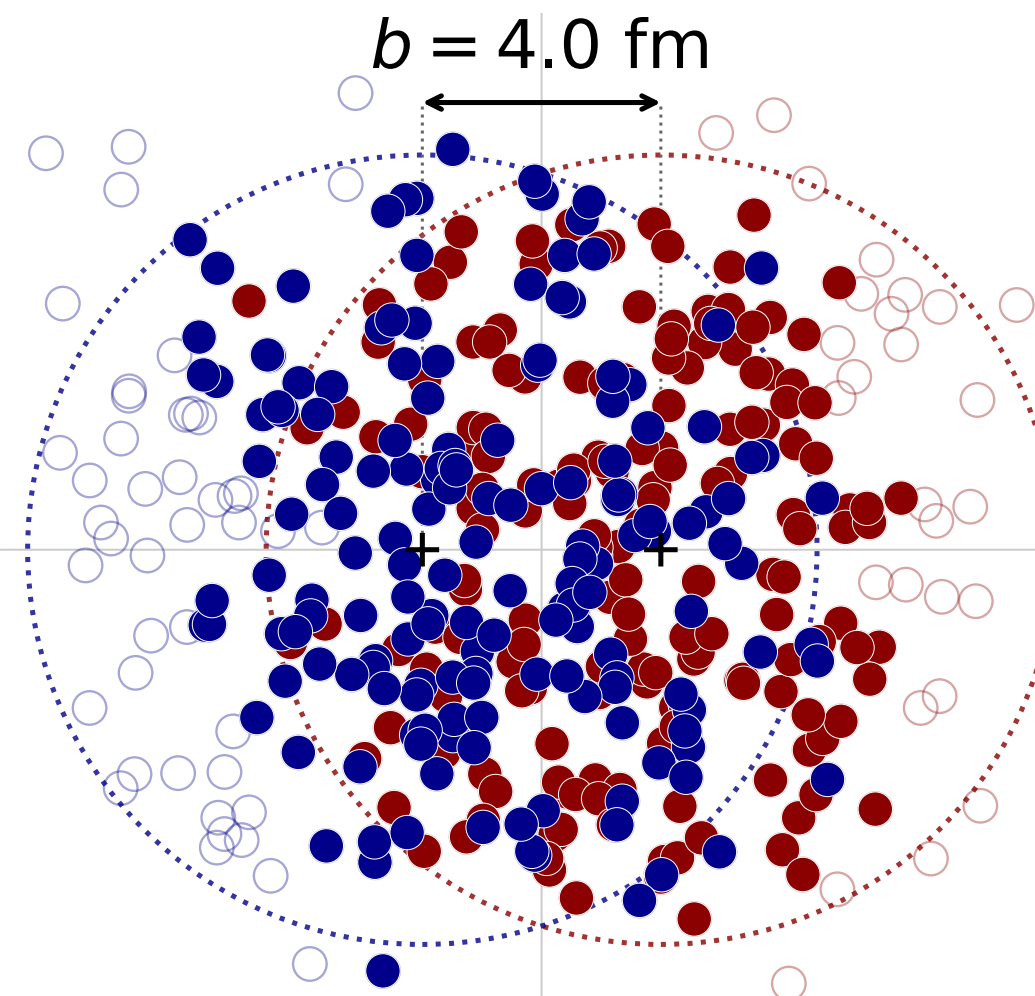
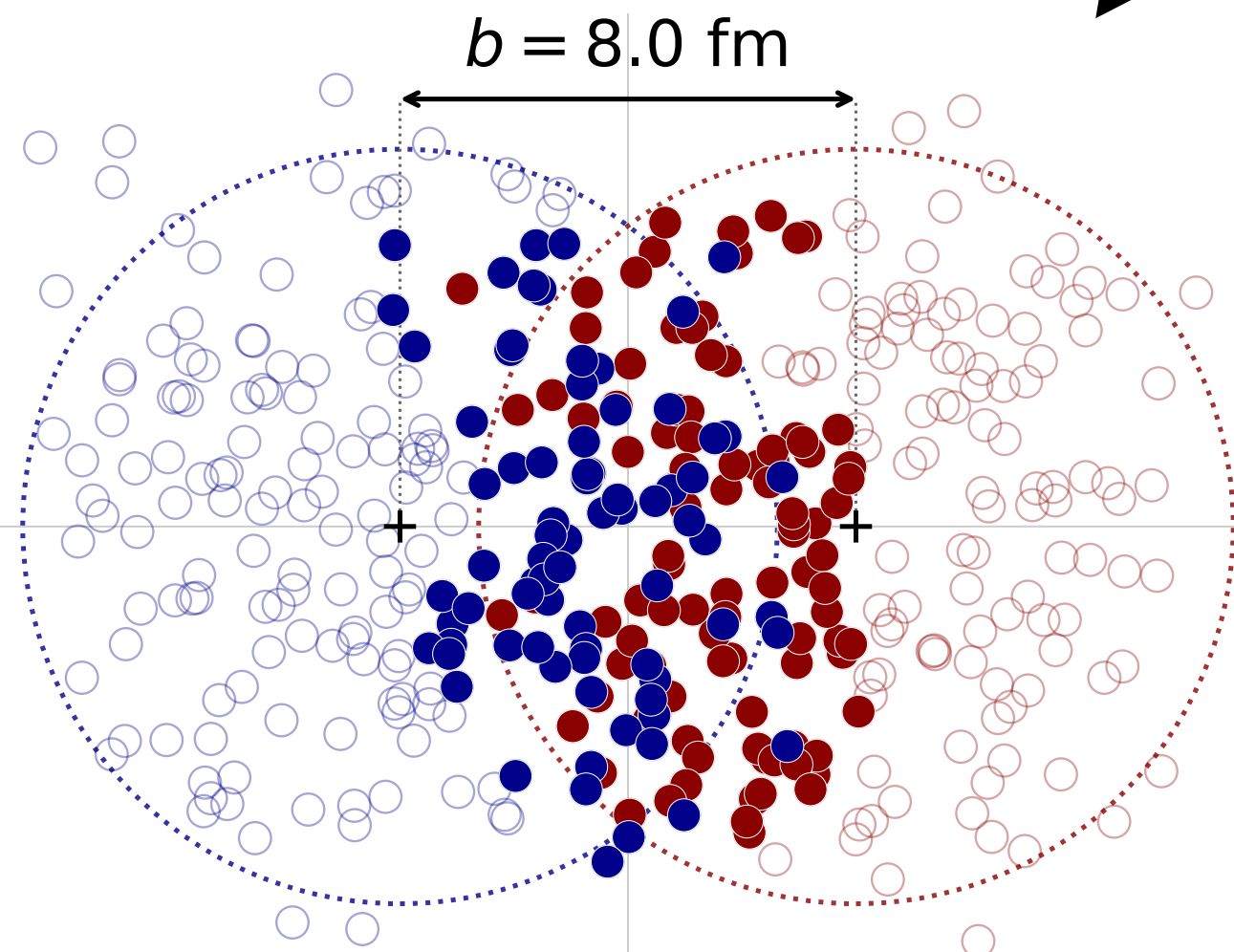
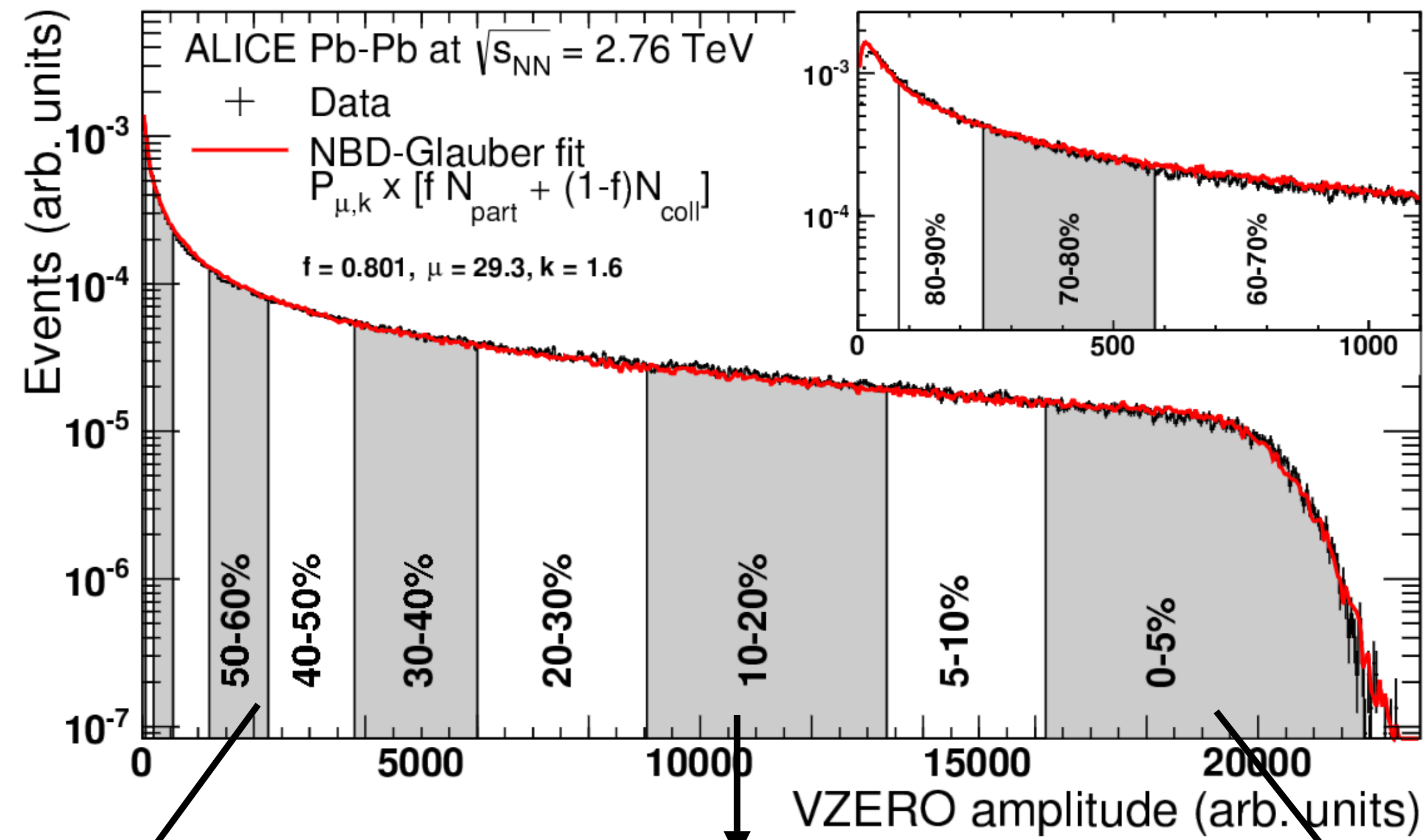
Jets as probes of the Quark Gluon Plasma (QGP)



- Hard partons are produced early and lose energy while traversing the medium

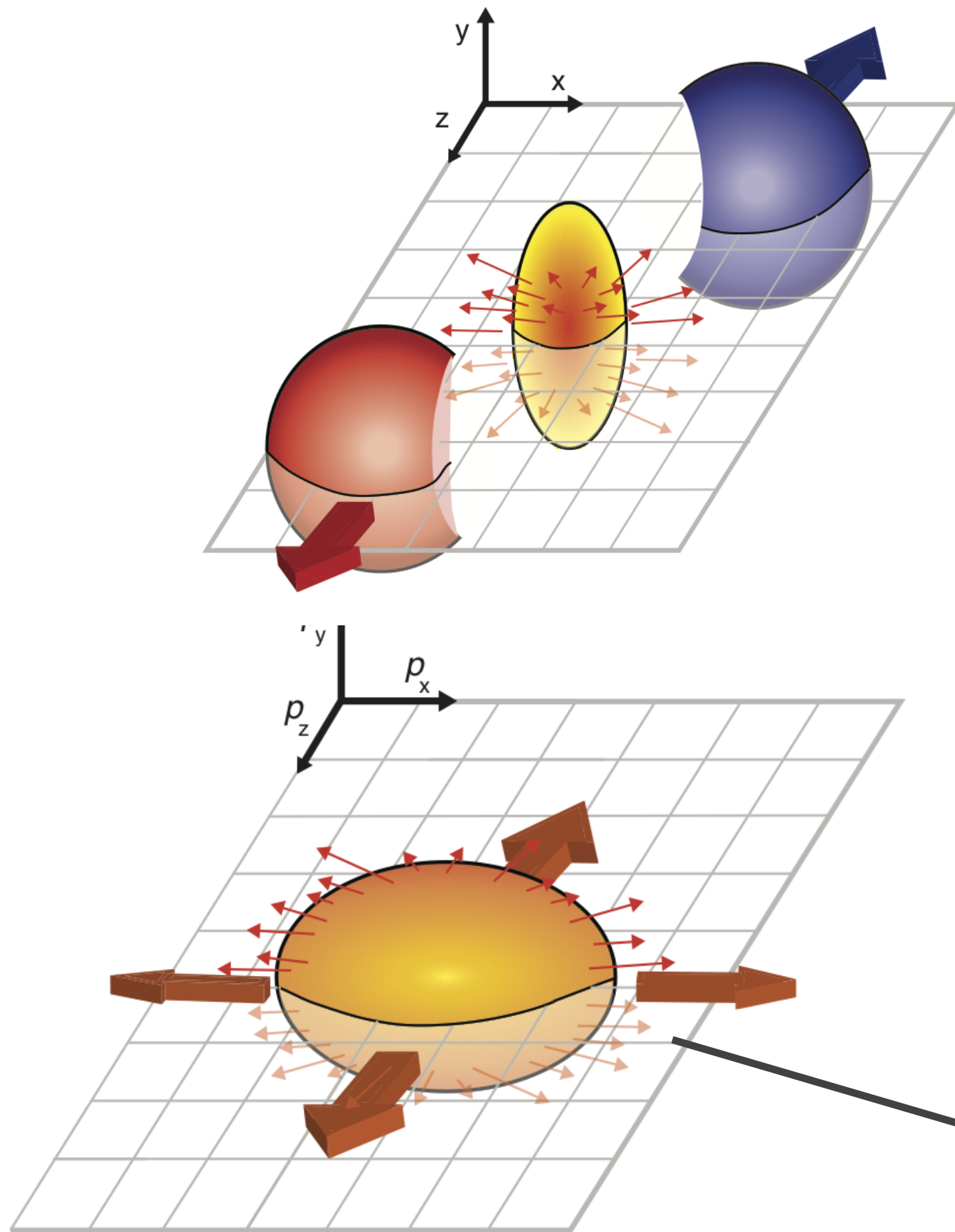
Centrality

- Centrality determine geometry of collision

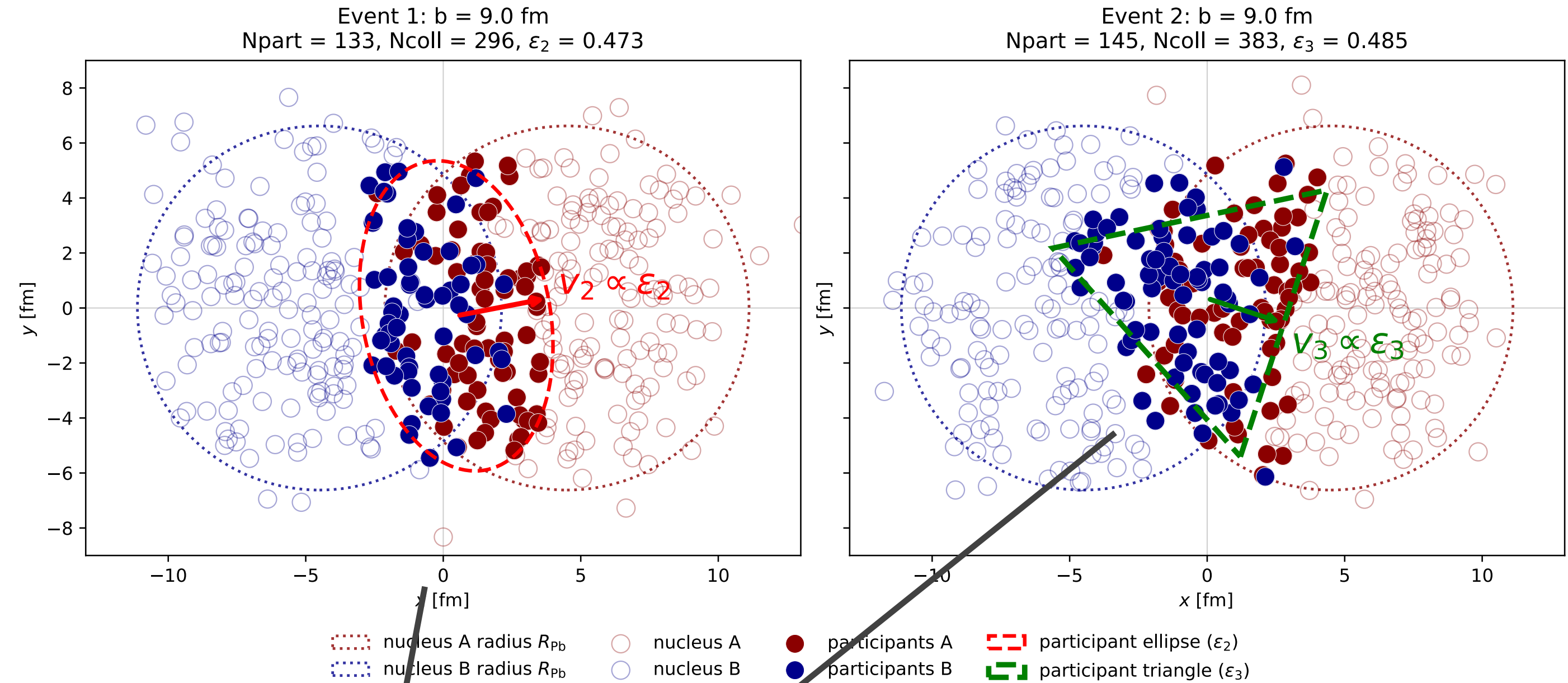


- Impact parameter $b \longrightarrow$ centrality of collision $\longrightarrow$ size of the medium

Geometry of collisions



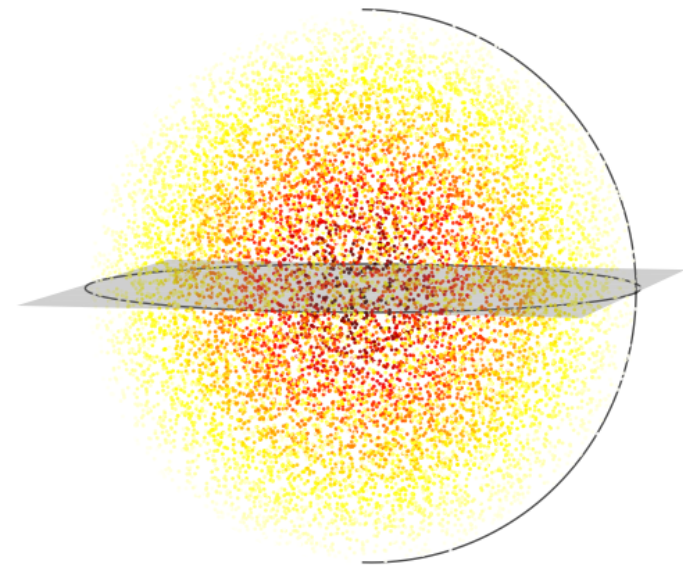
In "reality"



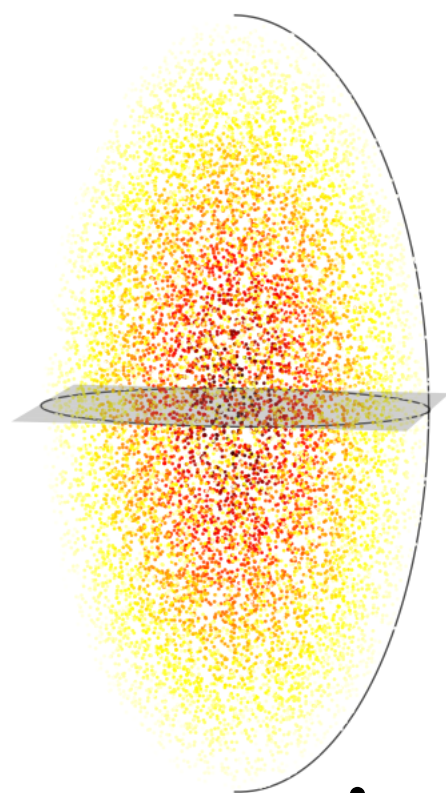
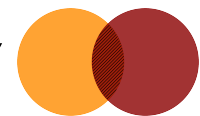
$$\frac{dN}{d\phi} \sim 1 + 2 \sum_{n=1} v_n \cos(n(\phi - \Psi_n))$$

Shapes measured through "flow"

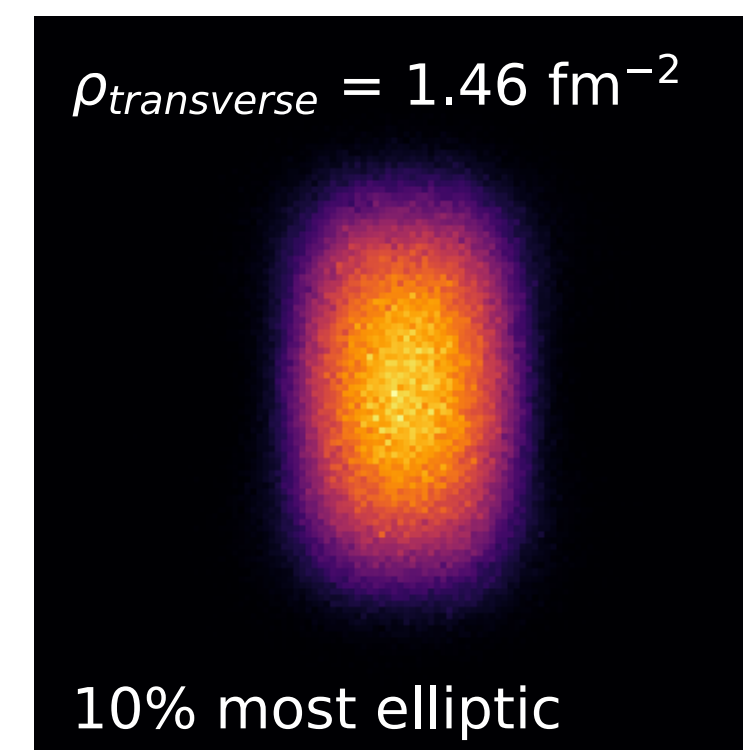
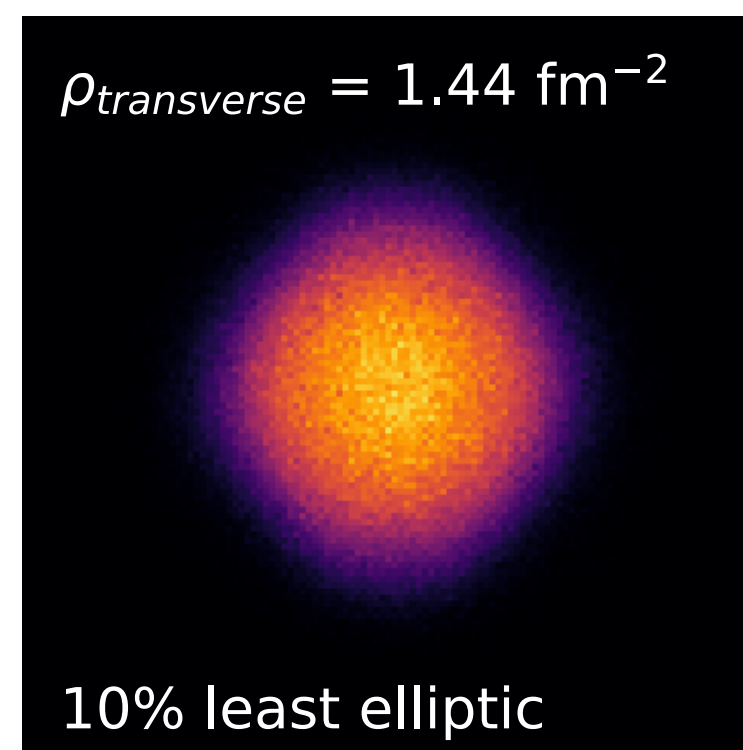
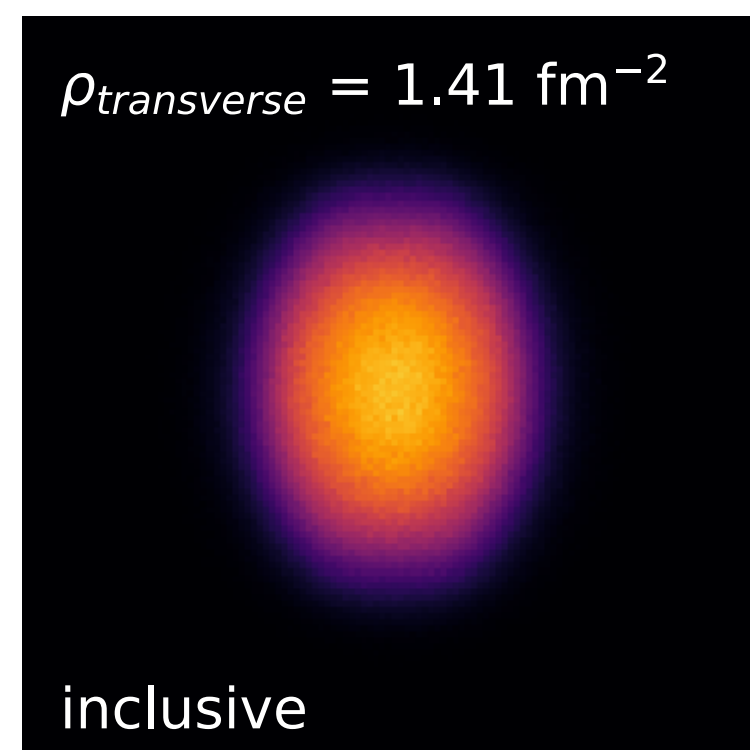
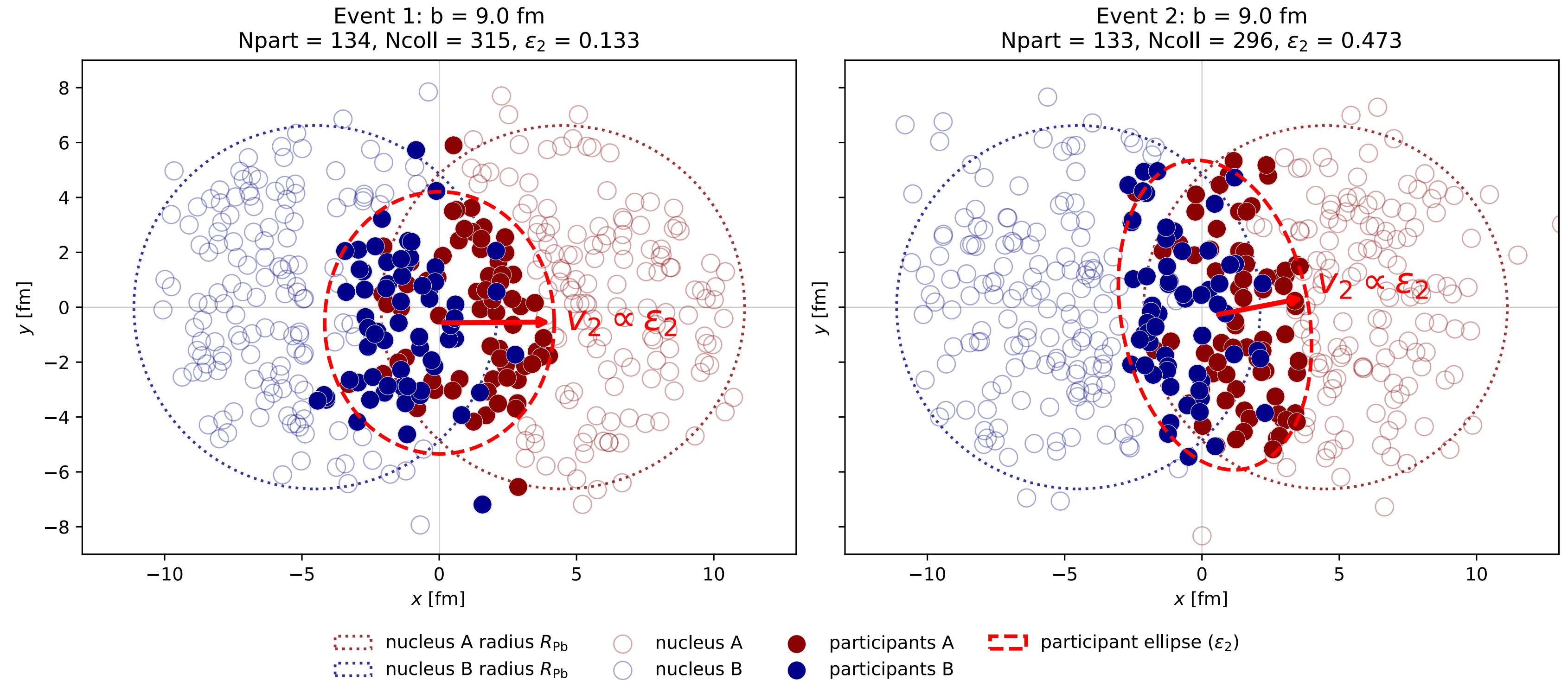
Event shape engineering (ESE)



Both events will have the **same centrality**



Events categorized using reduced flow vector q_2



Nucleon density roughly stays the same

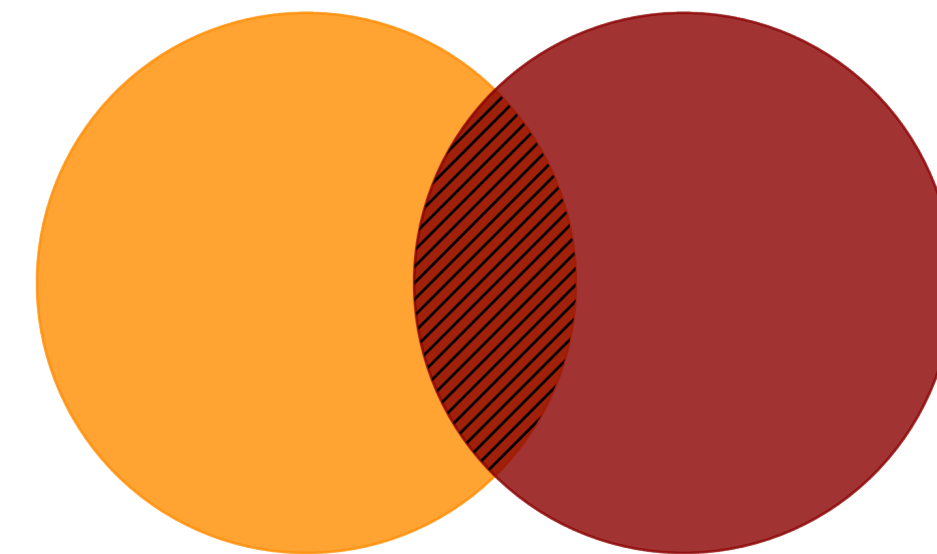
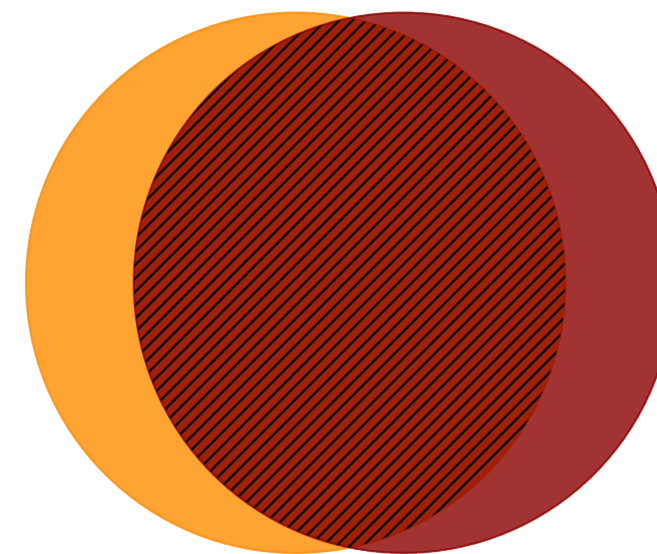
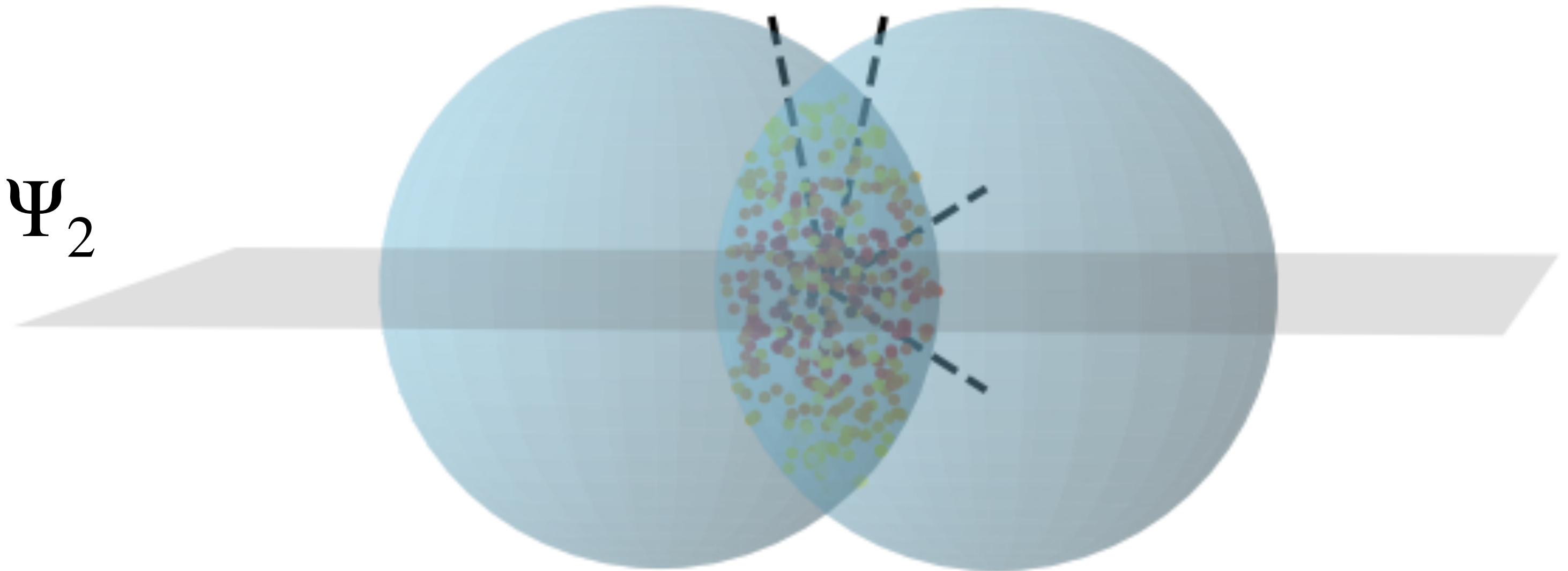
Geometry gives us a path-length dependent experiment

Non-central Pb–Pb collisions naturally provide different path lengths

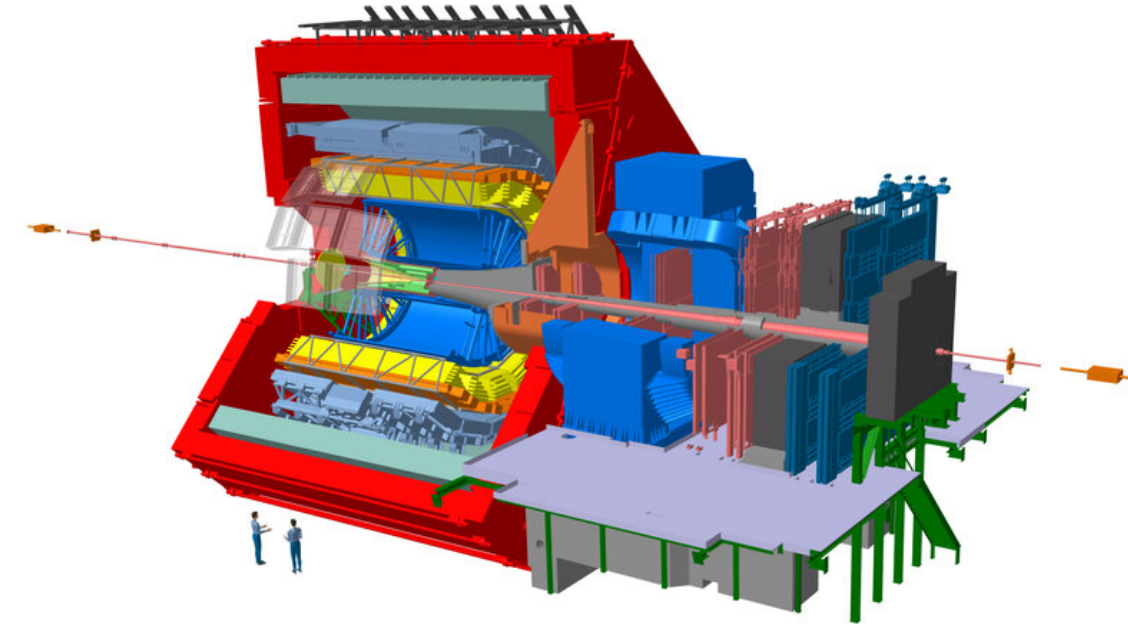
- Event plane determination Ψ_2

$$L_{\text{in}} < L_{\text{out}} \stackrel{?}{\Rightarrow} \Delta E_{\text{in}} < \Delta E_{\text{out}}$$

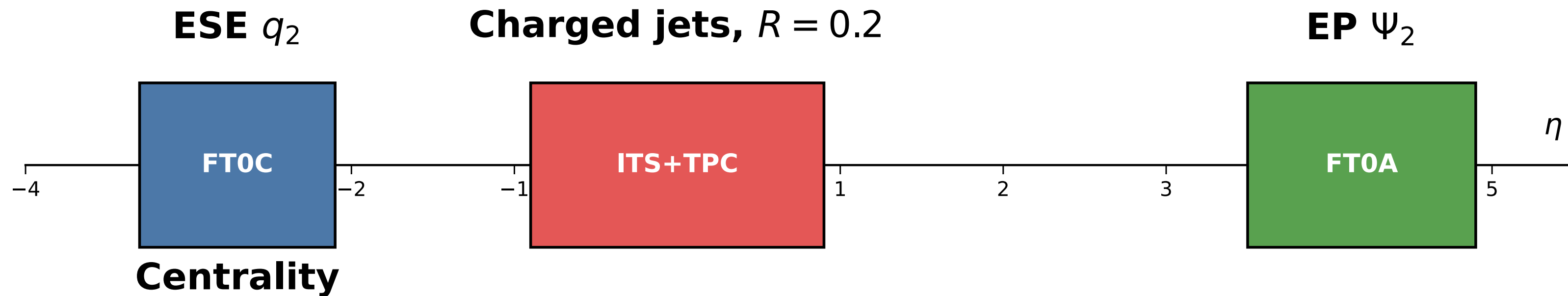
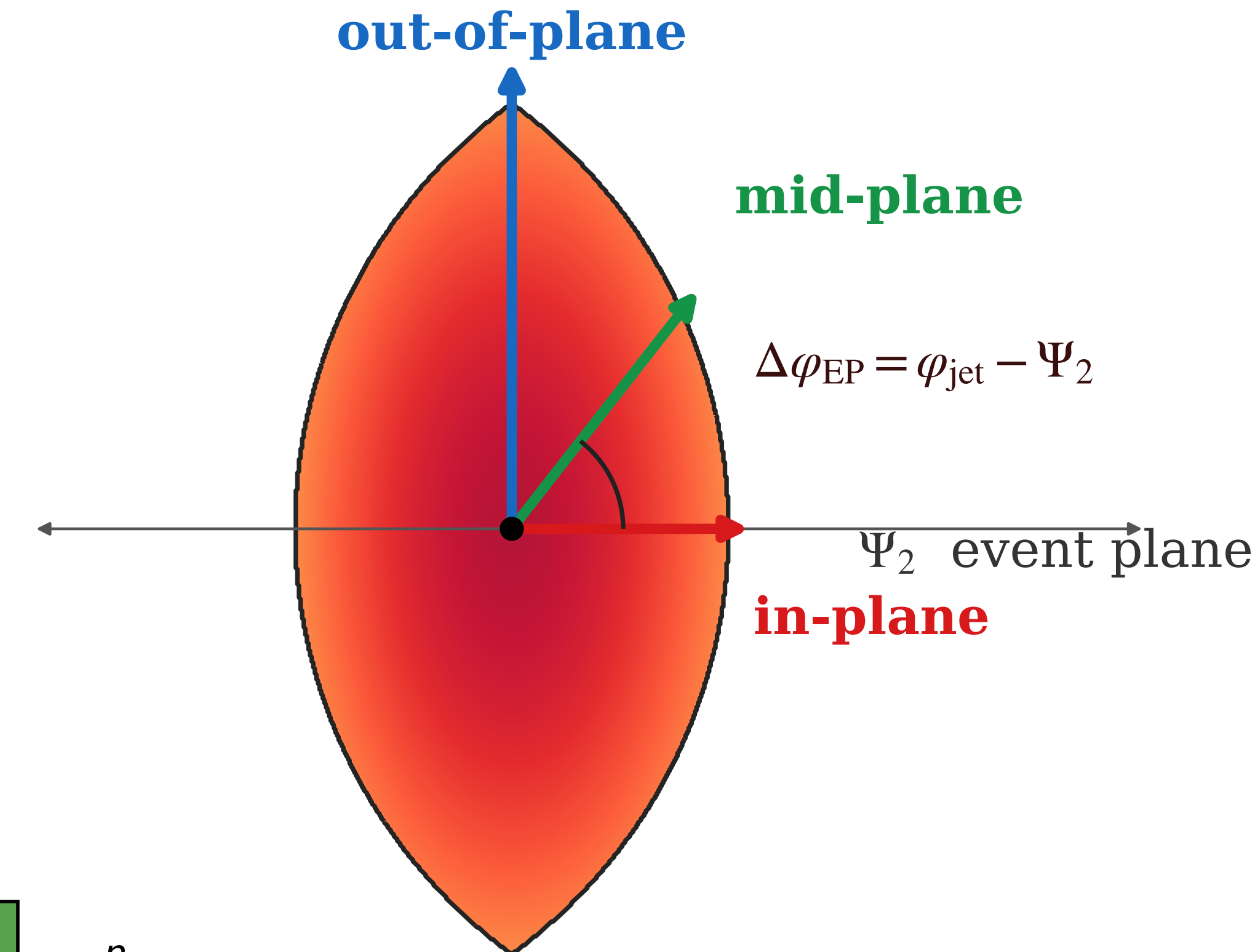
- **Naturally** expect stronger modification out-of-plane



How we measure this in ALICE

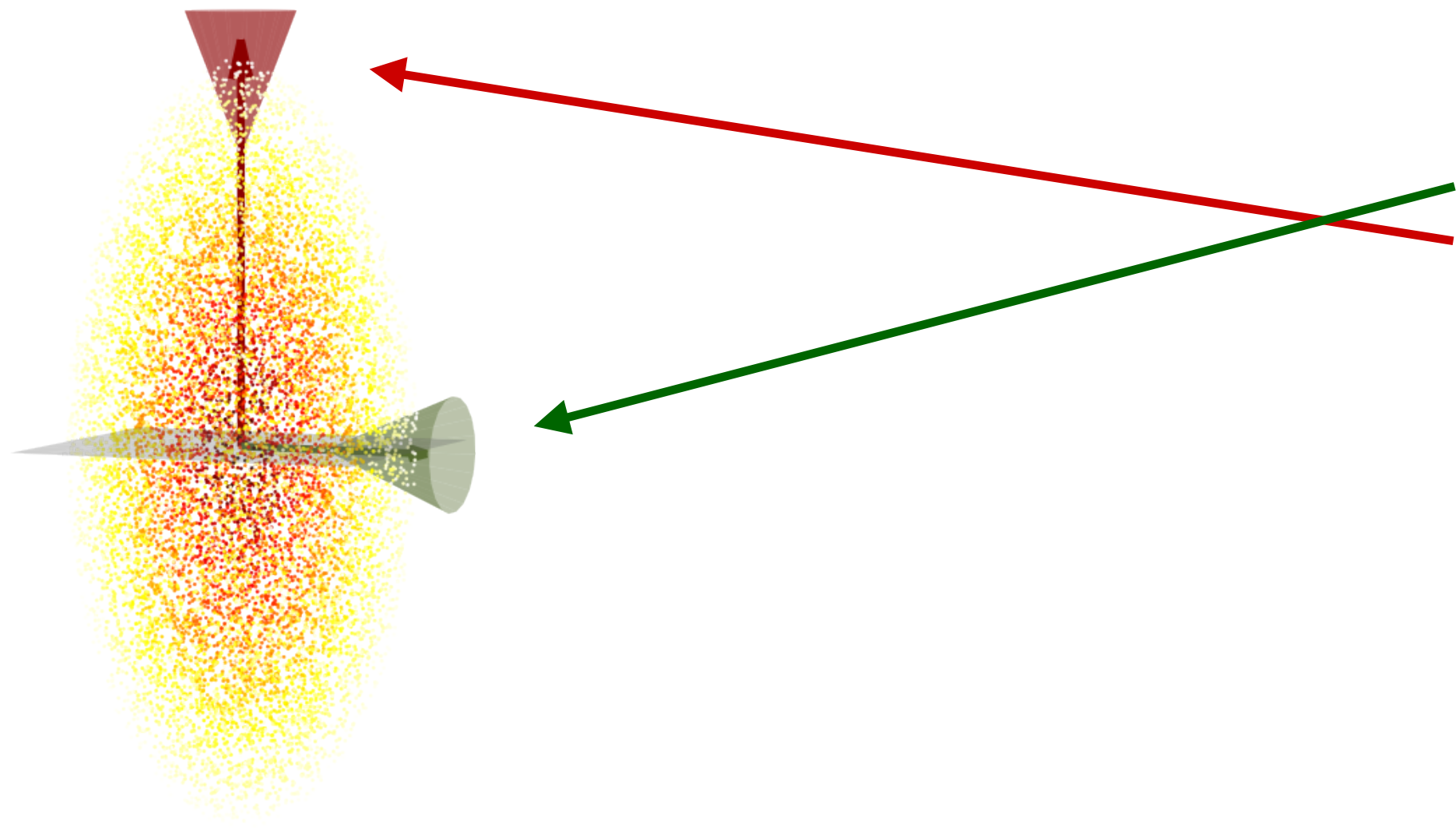


- Pb–Pb $\sqrt{s_{\text{NN}}} = 5.36$ TeV
- 30–50% collision centrality
- Jets from anti- k_T
- Jet cone $R = 0.2$

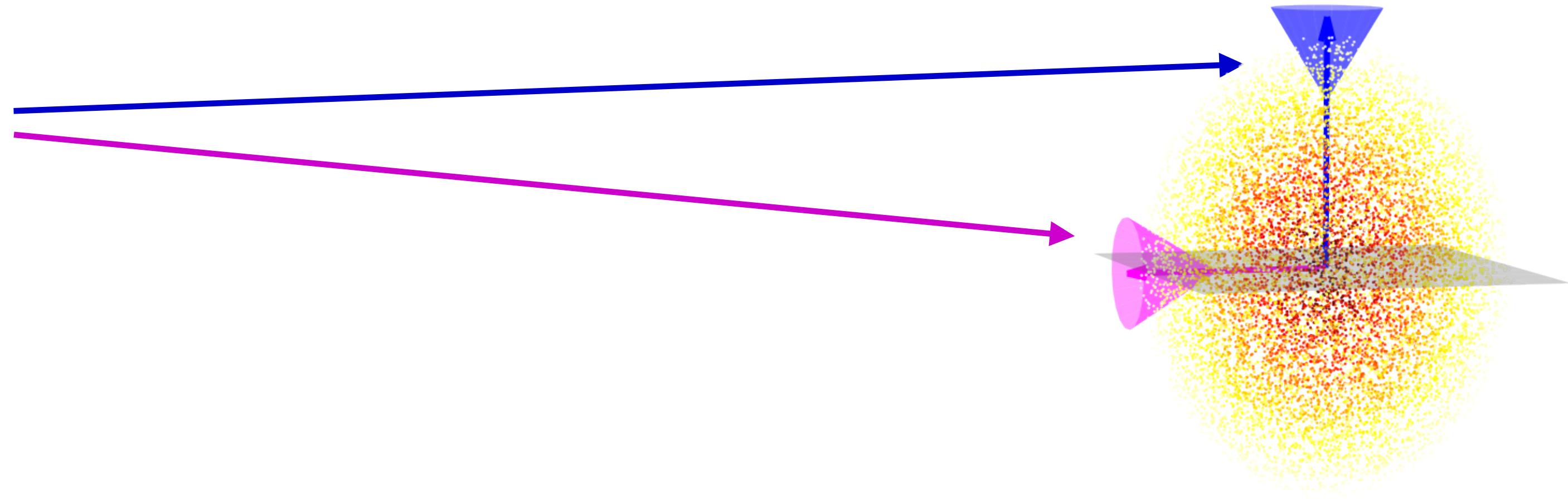


Jet spectra vs event geometry

Round events show
little difference

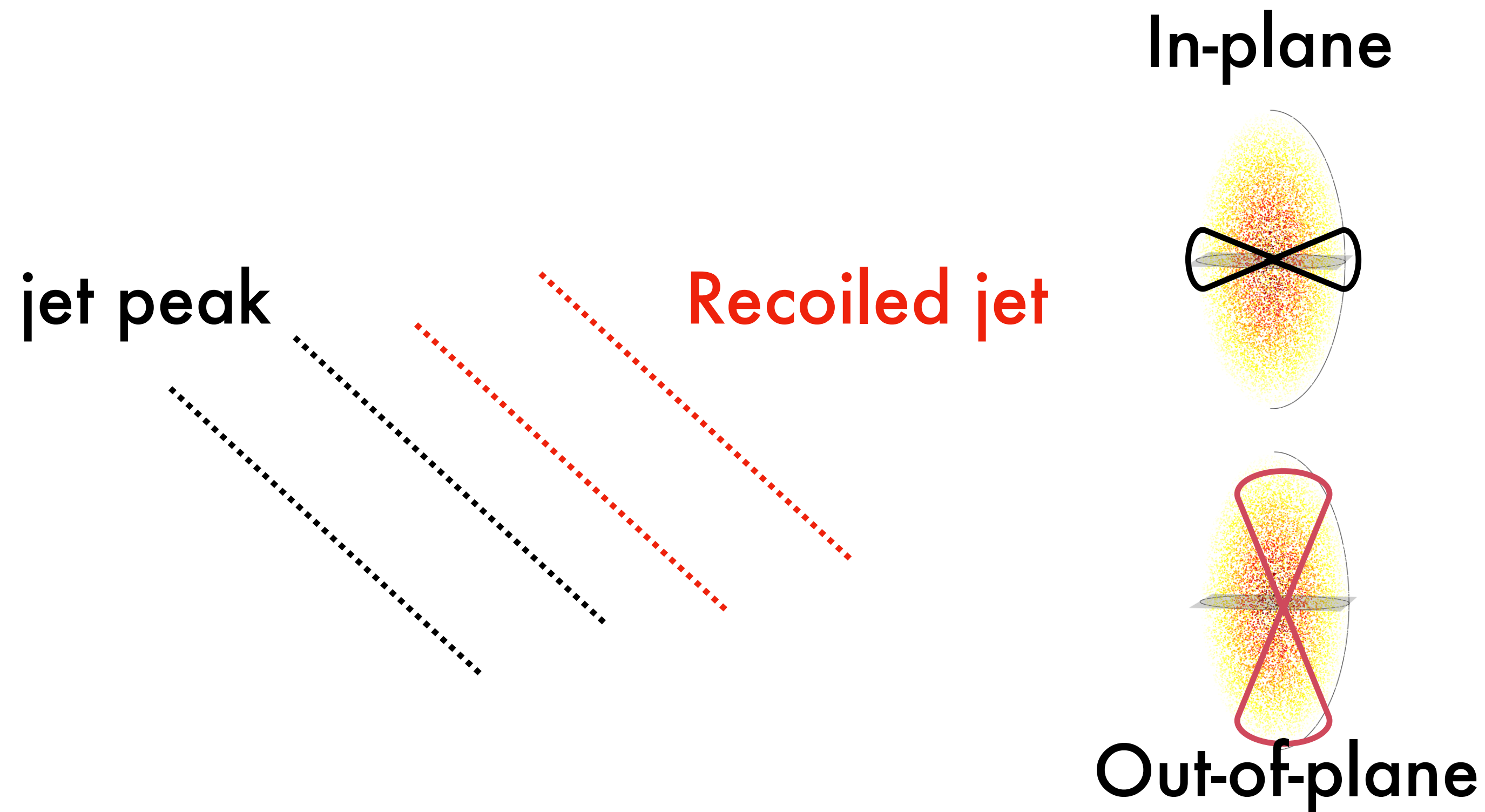


Elliptic events show
large differences in jet
yields



Looking inside the modification: jet-hadron correlations

Correlation function $C(\Delta\eta, \Delta\phi)$



We see modification of associated hadrons depending on path length

Jet–hadron correlations with ESE

- Extending jet–hadron correlations with Event Shape Engineering
- Ongoing: disentangling geometry-dependent modifications

Take-home message

- Using the collision geometry, we use the QGP itself as a controlled variable
 - Event plane + ESE provide complementary handles on the collision geometry and expected jet path length.
 - Jet spectra show a geometry-dependent modification consistent with path-length-dependent energy loss.
 - Jet-had probe how the jet-correlated particle distribution is modified

Geometry $\longrightarrow$ Different path lengths $\longrightarrow$ Jet yield modification $\longrightarrow$ Correlated particles