



Contribution ID: 77

Type: Poster

A Principal Component Analysis of event-by-event fluctuations in hydrodynamic simulations at the LHC

Hydro simulations are compared with recent experimental data by CMS, on a Principle Component Analysis. The trends for the scaled leading and sub-leading components for $n=2,3$ agree with data. In contrast, for $n=0$ there is a qualitative disagreement: the leading component increases with p_T while it is constant in data. Using a toy model where the principal components can be computed analytically, it is shown that the $n=0$ leading and sub-leading components are extremely dependent on fluctuations in N and p_T as well as their covariance and provide a new and clean way to study fluctuations and rule out initial condition models.

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Session Classification: Posters

Track Classification: Initial conditions for hydrodynamics & transport coefficients