

ANISOTROPIC FLOW MEASUREMENTS IN ALICE

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Anisotropic flow, particularly elliptic flow, has proved to be a powerful probe to understand the dynamics of heavy ion collisions. Its observation and systematic study have provided enough evidence to indicate the presence of a thermally equilibrated strongly interacting matter in relativistic heavy ion collisions. The large values of elliptic flow observed at Relativistic Heavy Ion Collider propound the ideal hydrodynamic description for the evolution of a heavy ion collision system, where the equation of state can be constrained empirically. However, more detailed investigations on measurements of differential flow of identified particles, and the rapidity dependence of flow, have questioned the validity of the ideal hydrodynamic picture, maintaining the need for further studies of collective flow in heavy ion collisions. It is imperative that further flow measurements of identified particles are made in a variety of interacting systems, at larger energies and in different phase space regions. The ALICE experiment at the Large Hadron Collider is ideally suited for this and we will present some examples of expected flow measurements using the various detectors.

To measure anisotropic flow, a variety of analysis methods exist, with their relative merits. A common feature of all of them is that each method works the best with increasing multiplicity and increasing flow, both expected to be large at the LHC, and therefore allowing for a more accurate determination of the flow coefficients. Use of different methods in ALICE will provide a good estimate of the systematic uncertainties.

Theoretical calculations predict values of integrated flow of about 5-10% at the LHC energies. Simulations have demonstrated the capability of reconstructing the assumed transverse momentum dependence of flow for charged particles and also for identified particles measured in the Time Projection Chamber (TPC). The measurements in Silicon Pixel Detectors (SPD), the Photon Multiplicity Detector (PMD) and the Forward Multiplicity Detector (FMD), in addition to those in TPC, will determine the rapidity dependence of elliptic flow up to forward rapidities. Further, correlations with event planes from different sub-detectors will allow a consistency check on the values of v_2 and provide the systematic uncertainty in the measurement. The segmented zero degree calorimeter will also provide an estimate of the reaction plane for any sizable amount of directed flow at the LHC. These estimates of the reaction plane make it amenable to obtain any possible anisotropy in the J/ψ absorption, (or any other particle/resonance), helping in discerning between the Glauber and comover absorption of the charmonium in matter.

In summary, the ALICE experiment at the LHC, with the expected higher multiplicity and increased flow compared to lower energies, will provide an environment for improved estimates of non-statistical fluctuations in flow. In addition, measurement of higher harmonics will provide another probe to test the ideal fluid behaviour.