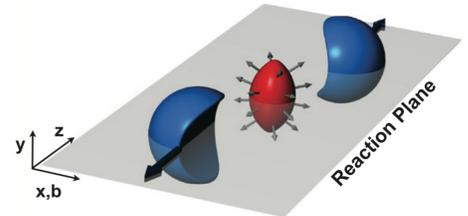


Abstract

The measurement of azimuthal anisotropy in bulk particle production plays a key role in understanding the properties of Quark-Gluon Plasma. The second order Fourier component of the particle azimuthal distribution is referred as elliptic flow (v_2), whose transverse momentum dependence is suggested to be a sensitive probe for different physics processes, like hadron production mechanism and path-length dependence of energy loss in intermediate and high- p_T range, respectively. Neutral pions are considered to carry more direct information from the early stage of collisions.

Flow definition

$$E \frac{d^3N}{d^3p} = \frac{1}{2\pi} \frac{d^2N}{p_t dp_t dy} \left(1 + 2 \sum_{n=1}^{\infty} v_n \cos[n(\varphi - \Psi_{RP})] \right) \quad v_n(p_t, y) = \langle \cos[n(\varphi - \Psi_{RP})] \rangle$$

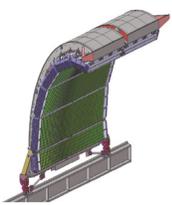


ALICE experiment

ALICE (A Large Ion Collider Experiment) is a major experiment at the LHC (Large Hadron Collider). ALICE detector is a multipurpose, large-acceptance detector, designed for the comprehensive study of QCD matter created in the high-multiplicity environment of the high energy Pb-Pb collisions.

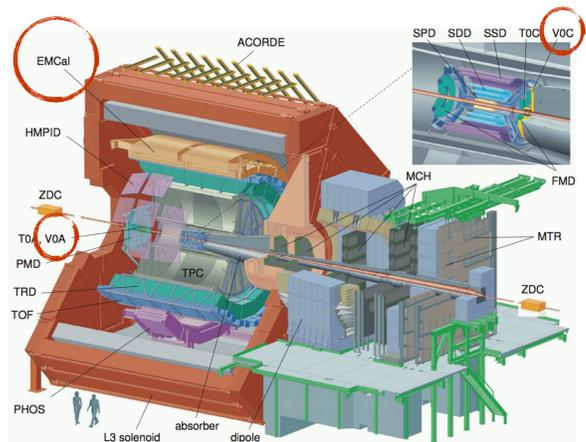
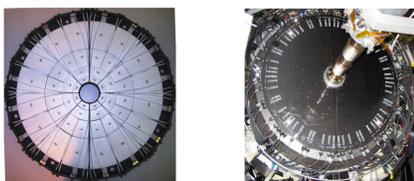
EMCal

The EMCal (Electromagnetic Calorimeter) is a lead-scintillator sampling calorimeter containing 10 supermodules of 48 x 24 cells and 2 supermodules of 48 x 8 cells ($|\eta| < 0.7$ and $\Delta\varphi \approx 100^\circ$). It provides efficient triggering on high energy jets as well as high- p_T **neutral pions** and photons. The energy deposited by photons in the calorimeter is reconstructed by grouping nearby cells into a cluster.



VZERO

The ALICE VZERO system, consists of two scintillator arrays at forward asymmetric positions, VZERO-A ($2.8 < \eta < 5.1$) and VZERO-C ($-3.7 < \eta < -1.7$). The VZERO system is used as a trigger source, and also plays an important role in monitoring beam conditions and measuring luminosity, multiplicity, centrality and **event plane** direction.

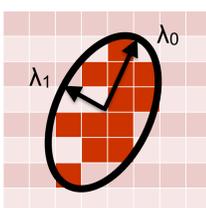


Analysis strategy

Neutral pions are identified by the study of the shape of the overlapping electromagnetic showers developed in the calorimeter by the two decaying photons at high- p_T (>6 GeV/c) or via invariant mass analysis at low- p_T . v_2 is measured with event plane method.

π^0 reconstruction

For low- p_T π^0 , whose decay photons form more circular shower shape clusters (normally one photon per cluster), one can reconstruct invariant mass from γ pairs.

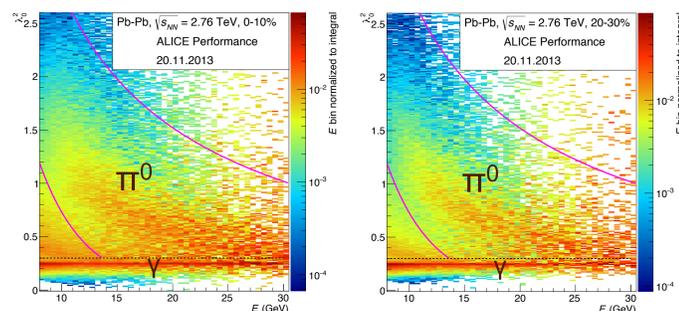


For high- p_T π^0 , whose decay photons tend to merge into the same cluster (more elongated), a dynamic cut on λ_0 (shower surface ellipse long axis, as shown in the left figure) along with cluster energy are employed.

$$\lambda_0^2 = 0.5(\delta_{\phi\phi} + \delta_{\eta\eta}) + \sqrt{0.25(\delta_{\phi\phi} - \delta_{\eta\eta})^2 + \delta_{\eta\phi}^2}$$

where different δ are weighted coefficients by the cell energy,

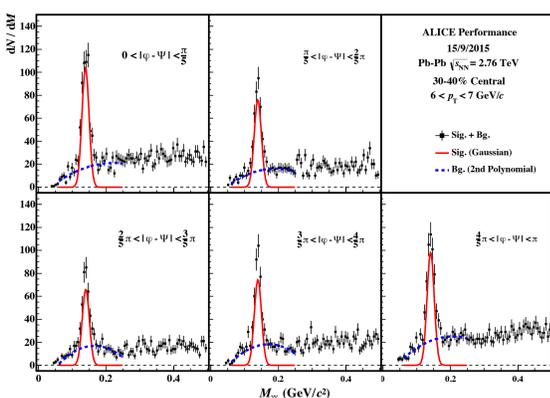
$$\delta_{\alpha\beta} = \frac{w_i \alpha_i \beta_i}{w_{tot}} - \frac{w_i \alpha_i}{w_{tot}} \frac{w_i \beta_i}{w_{tot}} \quad w_i = TMath::Max(0, w_0 + \ln(\frac{E_i}{E_{cluster}})) \quad w_{tot} = \sum_i w_i$$



More π^0 PID details please refer to poster
Measurement of high p_T neutral pions at $\sqrt{s_{NN}}=2.76$ and 7 TeV with ALICE-EMCal at the LHC

Azimuthal dependence of π^0 yield

The productions of neutral pion are investigated in different centrality, p_T and azimuthal bins. The azimuthal dependence of yield is symmetric around event plane, which can be seen in figure below.

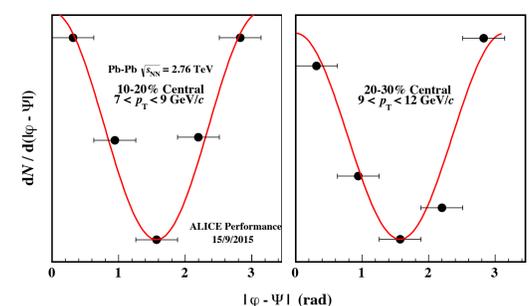
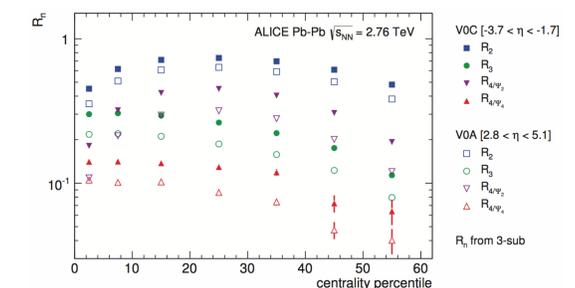


Extraction of elliptic flow of π^0

Neutral pion yields per azimuthal angle are fitted by **Yield($\Delta\varphi$) = a(1+2v₂cos $\Delta\varphi$)** as shown in the right figures.

Event plane reconstruction

One can construct the two-dimensional event plane vector from the measured azimuthal distribution of produced particles. The correction for the finite event plane angle resolution is calculated using three sub-detector correlation method. The large η gap between EMCal and VZERO can ensure the quality of flow measurement by reducing the non-flow contribution, which mainly locates at small $\Delta\eta$ region. (Figure below: different event plane resolutions as functions of centrality.)



Summary

In this poster, we present the strategy for the measurement of the elliptic flow of neutral pions in mid and high- p_T range in Pb - Pb collisions at ALICE with EMCal. This measurement will serve as an important check for the current knowledge of neutral pion flow as well as corresponding physics interpretation.

Reference

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Acknowledgement

This work is supported partly by the National Basic Research Program of China (2013CB837803) and the NSFC Grant (11375071, 11475068 and IRG11221504).