Anisotropic flow of ϕ meson in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with the ALICE detector

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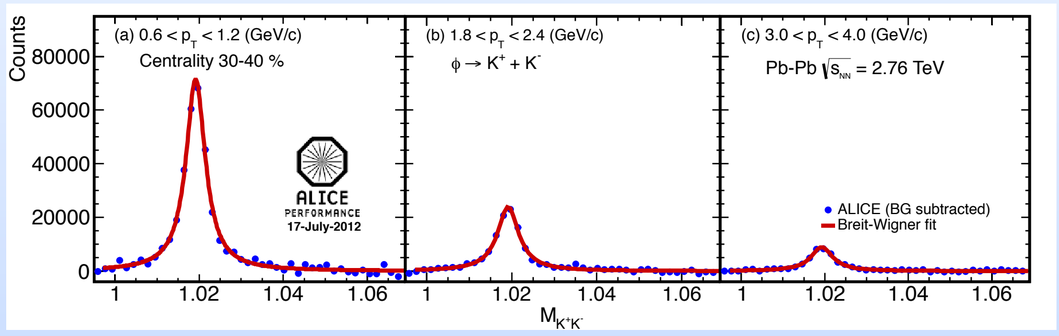
Motivation

- The main goal of the heavy-ion program at the LHC is the creation of the Quark Gluon Plasma (QGP) and the study of its properties.
- Anisotropic flow, especially elliptic flow (v_2), is an observable which is sensitive to the properties of this matter.
- ϕ meson flow is an important experimental probe:
  - assuming a smaller hadronic cross section,
    -> reflects the partonic collectivity
  - has a large mass,
    -> test the mass splitting picture of differential flow
    -> study the hydrodynamic behavior
  - carries two strange quarks,
    -> check/confirm the NQ scaling picture built at RHIC energies

ϕ reconstruction



- The combinatorial background is subtracted using the distribution of like-sign kaon pairs.
- a polynomial fit used to remove the residual background,
  - the 2nd and 3rd polynomial functions has been tested.
- Both Breit-Wigner and Voigtian functions are applied to fit the spectrum. The differences between extracted v_2 is used to estimate the systematic errors.

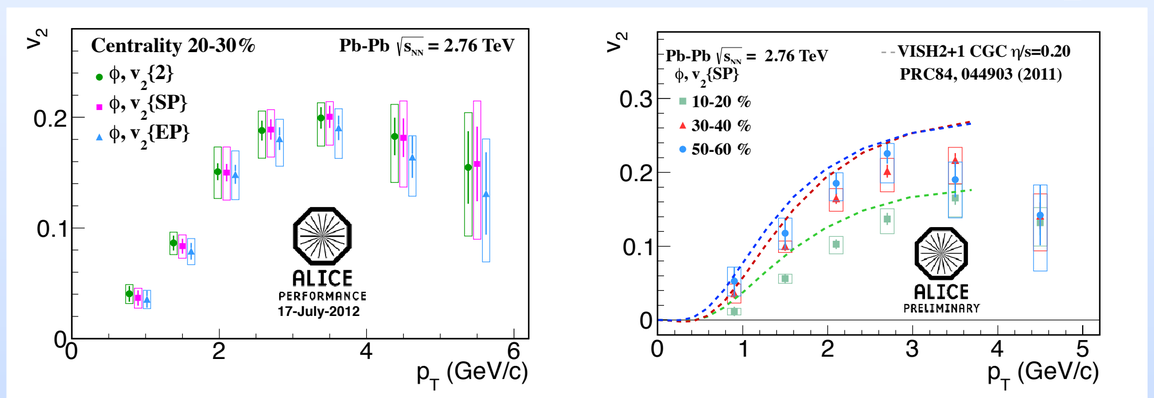
v_2 versus invariant mass method

- We extract the ϕ meson v_2, fitting the v_2 of kaon pairs $v_2^T(m_{inv})$ with invariant mass method[2]:

$$v_2^T(m_{inv}) = v_2^S \frac{N^S}{N^T}(m_{inv}) + v_2^B(m_{inv}) \frac{N^B}{N^T}(m_{inv}) \qquad (1)$$

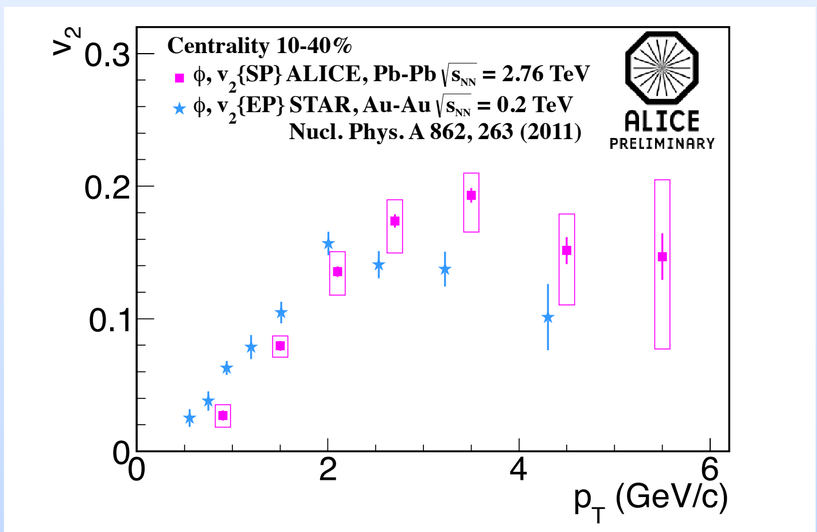
  - the yields N^S, N^B are obtained from the fits to the ϕ meson invariant mass distribution.
  - the $v_2^T(m_{inv})$ are measured by Q-Cumulant[3] ($v_2\{2\}$), Scalar Product[4] ($v_2\{SP\}$) and Event Plane[5] ($v_2\{EP\}$) methods.
  - v_2 of background is parameterized with the polynomial function.

Centrality dependence of ϕ meson v_2



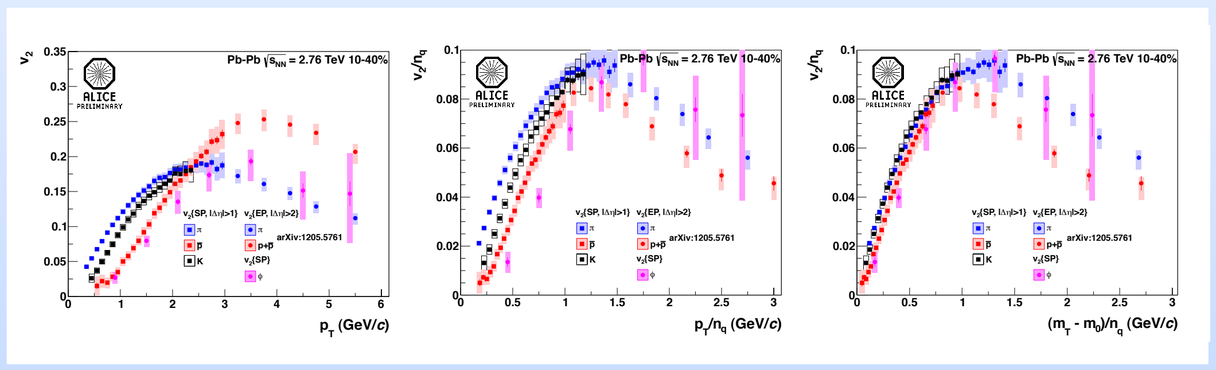
- A good agreement is observed among $v_2\{2\}$, $v_2\{SP\}$ and $v_2\{EP\}$ measurements.
- There is a clear centrality dependence of ϕ meson v_2.
- ϕ meson v_2 is compared with viscous hydrodynamic model calculations. The theoretical predictions slightly overestimate the ϕ meson v_2 measurements.
- Adding the phase of hadronic rescattering into the hydrodynamic model calculations may improve the agreement with measured ϕ meson v_2.

Comparisons with ϕ meson v_2 at RHIC



- ϕ meson v_2 at the LHC is pushed toward higher p_T.
- This might indicate a stronger radial flow produced at the LHC energy.

Mass splitting and number of quark scaling



- ϕ meson reveals a behavior similar to antiprotons at low p_T (mass splitting) but similar to pion at high p_T (number of quark).
- We don't observe a clear number of quark scaling picture.

Conclusions

- Elliptic flow of ϕ meson is measured in $\sqrt{s_{NN}}$ = 2.76 TeV Pb-Pb collisions with the ALICE detector.
  - hydrodynamic calculations slightly overestimate the ϕ meson v_2
  - comparison with STAR measurements indicate a stronger radial flow produced at LHC energy.
  - ϕ meson flow follows the mass splitting at low p_T and follows meson's flow at intermediate p_T, but there is no clear scaling with the number of quarks observed at intermediate p_T region.

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