Anisotropic flow of multi-strange particles in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with ALICE

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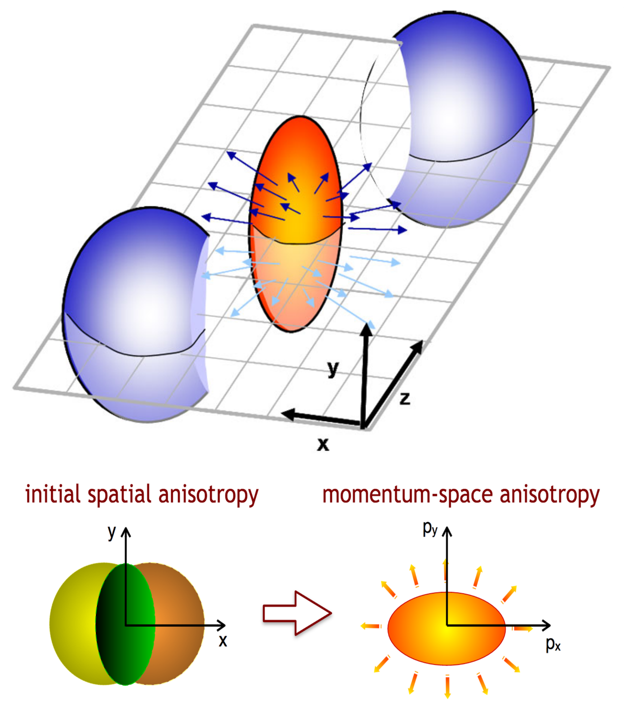
Abstract

Anisotropic flow plays a critical role in understanding the properties of the quark-gluon plasma. In this poster we present the elliptic and triangular flow of multi-strange particles in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV recorded by the ALICE detector. The measurements are presented at mid-rapidity for a wide range of particle transverse momenta. The results are compared to those for elliptic and triangular flow for other identified hadrons.

Collective flow

Multiple interactions between medium constituents convert initial geometric anisotropy into a final state momentum anisotropy.



The anisotropy is quantified by a Fourier expansion of momentum distribution:

$$E\frac{d^3N}{dp^3} = \frac{d^2N}{2\pi p_T dp_T dy}\left\{1+\sum_{n=1}^{\infty} 2v_n \cos\left[n\left(\phi-\Psi_n\right)\right]\right\}$$

where ϕ is the azimuthal angle of each particle and Ψ_n is the symmetry plane angle.

$$v_n = \langle\cos\left[n\left(\phi-\Psi_n\right)\right]\rangle$$

v_n of identified hadrons is measured using the scalar product method:

$$v_n = \frac{\langle\langle \mathbf{u}\cdot\mathbf{Q}_{V0C}\rangle\rangle}{\sqrt{\frac{\langle \mathbf{Q}_{V0C}\cdot\mathbf{Q}_{V0A}\rangle\langle \mathbf{Q}_{V0C}\cdot\mathbf{Q}_{TPC}\rangle}{\langle \mathbf{Q}_{V0A}\cdot\mathbf{Q}_{TPC}\rangle}}}$$

$$\mathbf{u} = e^{in\phi}$$

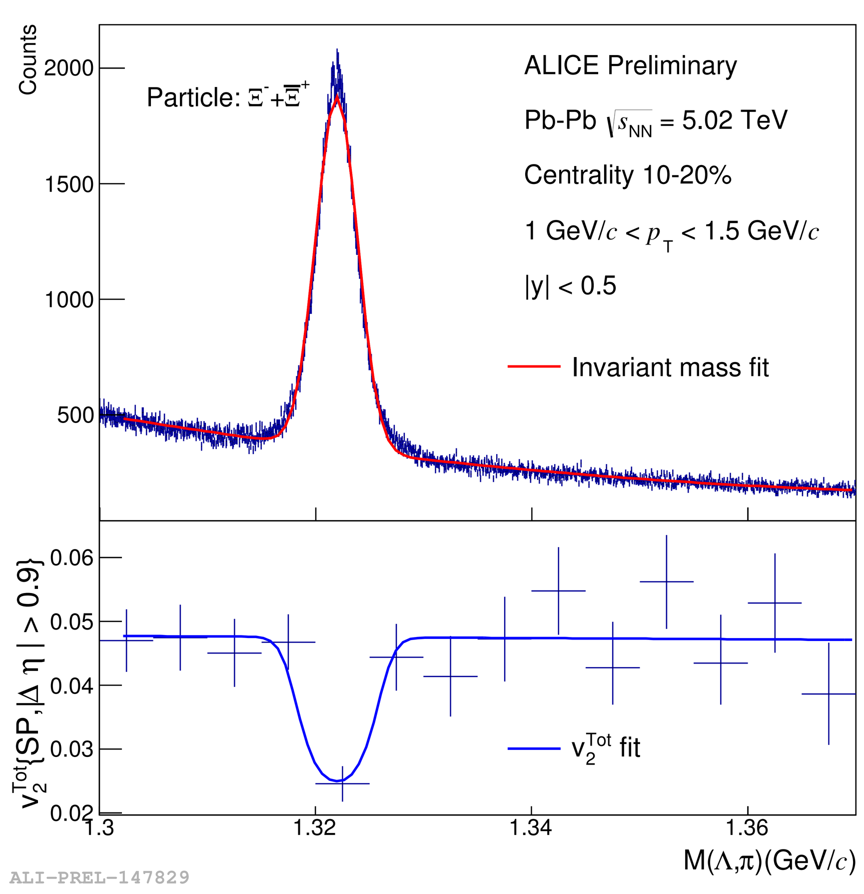
$$\mathbf{Q} = \sum w_i e^{in\phi}$$

where w_i is a weight.The scalar product method allows for a $\triangle\eta$ separation between correlated particles, supressesing correlations coming from nonflow.

v_n vs. invariant mass method

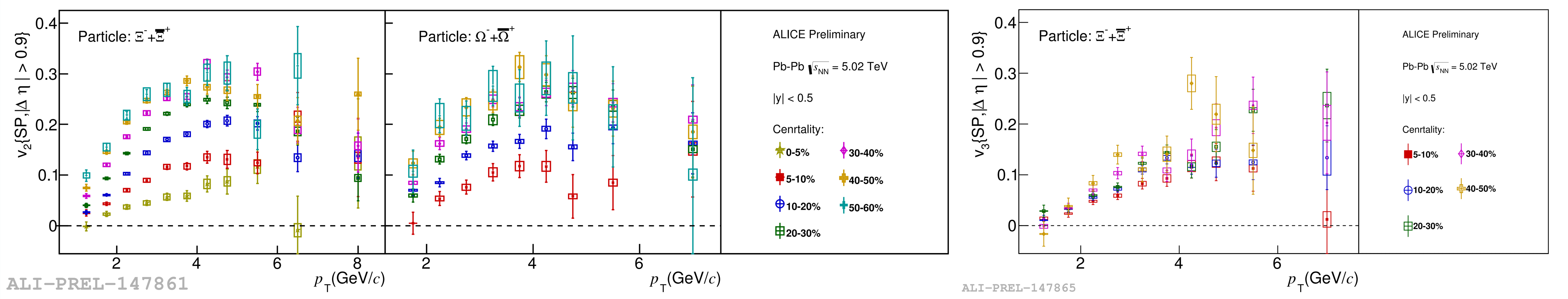
For the v_n measurement of multi-strange particles, the v_n versus invariant method was used.

$$v_n^{Tot}\left(m_{inv}\right) = v_n^{Sig}\frac{N_{Sig}\left(m_{inv}\right)}{N_{Tot}\left(m_{inv}\right)} + v_n^{Bg}\left(m_{inv}\right)\frac{N_{Bg}\left(m_{inv}\right)}{N_{Tot}\left(m_{inv}\right)}$$



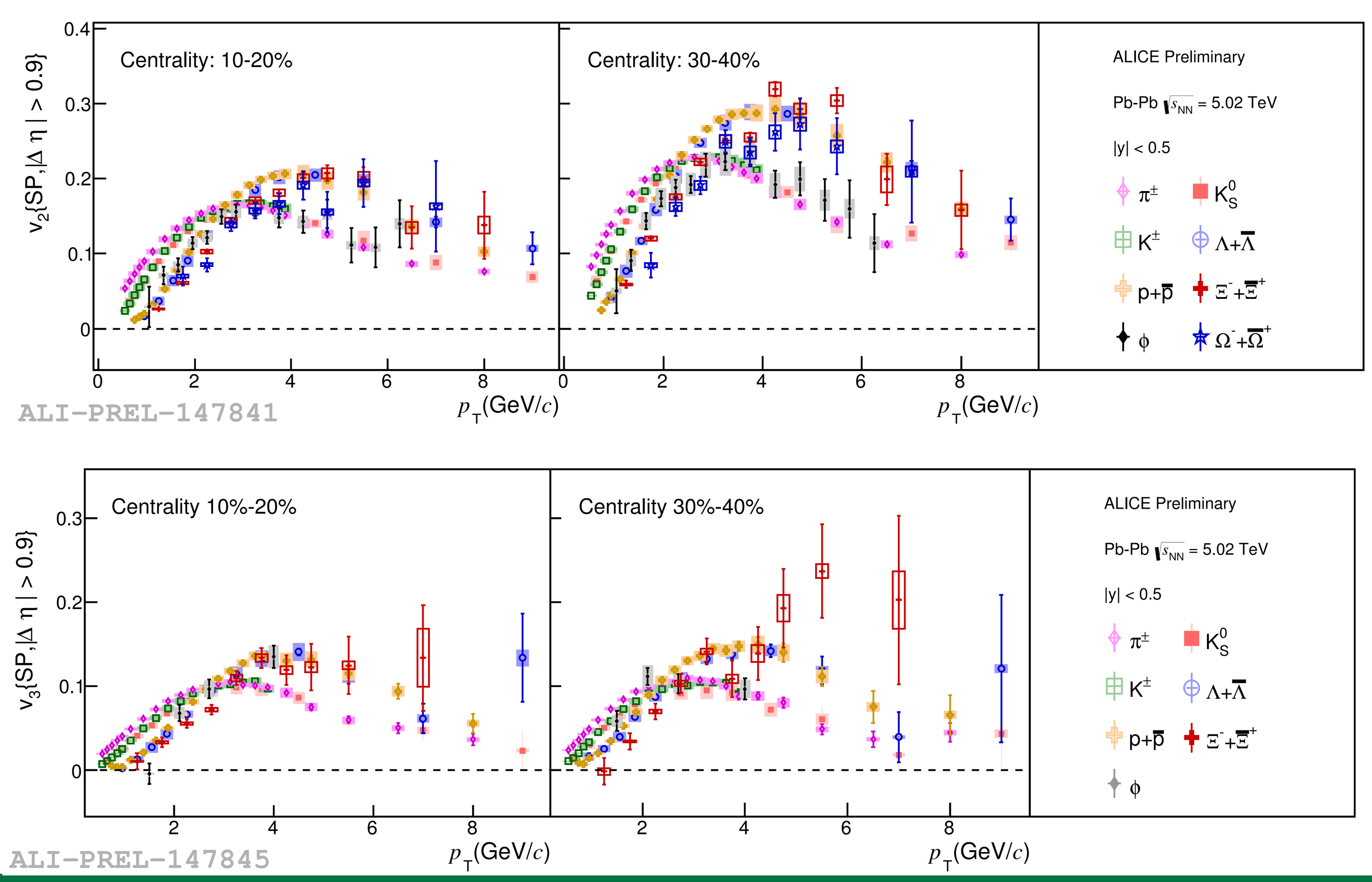
Yields N_{Sig} and N_{Bg} are extracted from fitting the invariant mass distributions. v_n^{Sig} is extracted from fitting the v_n distribution. The candidates are reconstructed in bins of p_T and invariant mass. Azimuthal correlations are calculated for candidates in each bin.

v_n of multi-strange particles



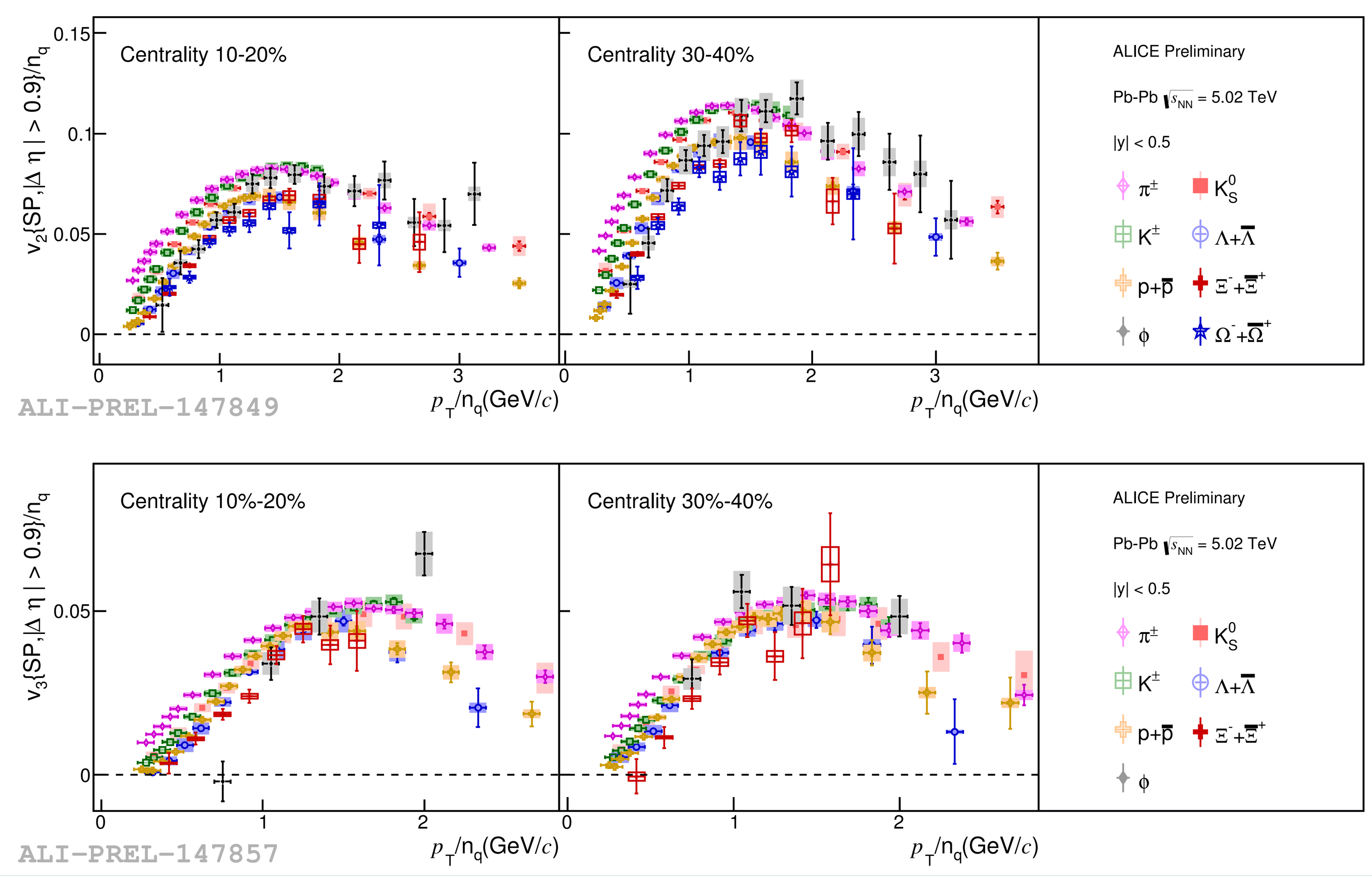
◇ The value of v_2 progressively increases from central to peripheral collisions up to the 40–50% centrality.
◇ The transverse momentum dependence of v_2 exhibits an almost linear increase up to about 3 GeV/c.
◇ There is no significant centrality dependence of v_3 .

v_n of identified hadrons



◇ v_n of $\pi^{\pm}$, $K^{\pm}$, p and K_s^0, Λ is measured with $|\triangle\eta|$>0.9 gap using Pb-Pb collisions at 5.02 TeV
◇ Mass ordering is observed for p_T<2 GeV/c.
◇ v_2 of identified particles is non-zero up to high p_T.

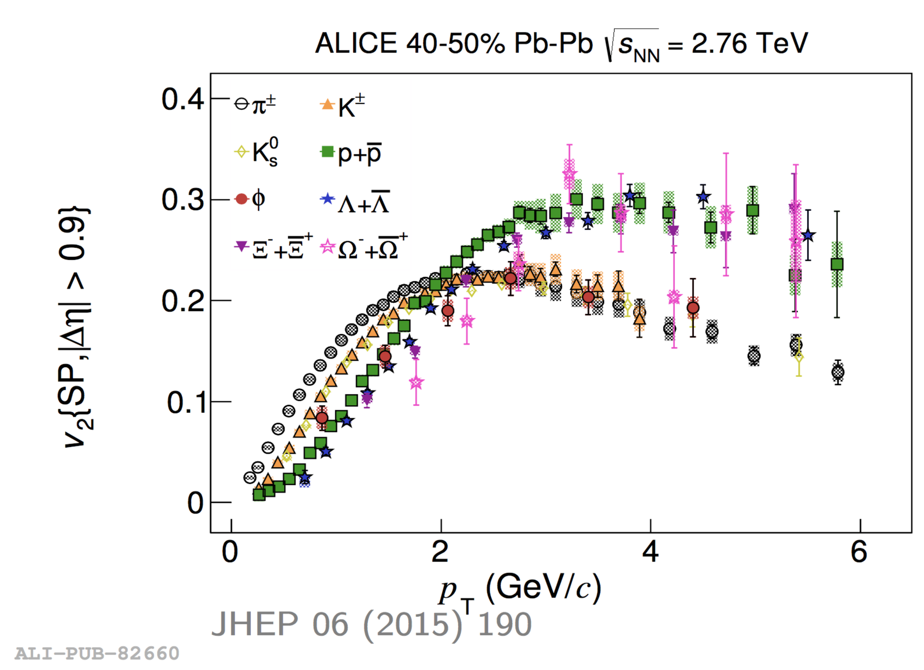
p_T/n_q dependence of v_n/n_q



◇ Both v_n and p_T are scaled by the number of constituent quarks (n_q). The various hadron species approximately follow a common trend at intermediate p_T .

Improvements over Run I

◇ Larger data sample gathered in Run II compared to Run I.
◇ Kinematic range of measurements is extended.
◇ Run II provides more stringent constraints for models.



Conclusions

◇ Clear centrality dependence is observed for v_2 of multi-strange particles.

◇Mass ordering of v_n is observed for p_T < 2 GeV/c.

◇If both v_n and p_T are scaled by the number of constituent quarks, the various hadron species approximately follow a common trend at intermediate p_T .