# Study of resonance's properties in heavy-ion collisions using angular hadron-resonance correlations in ALICE experiment

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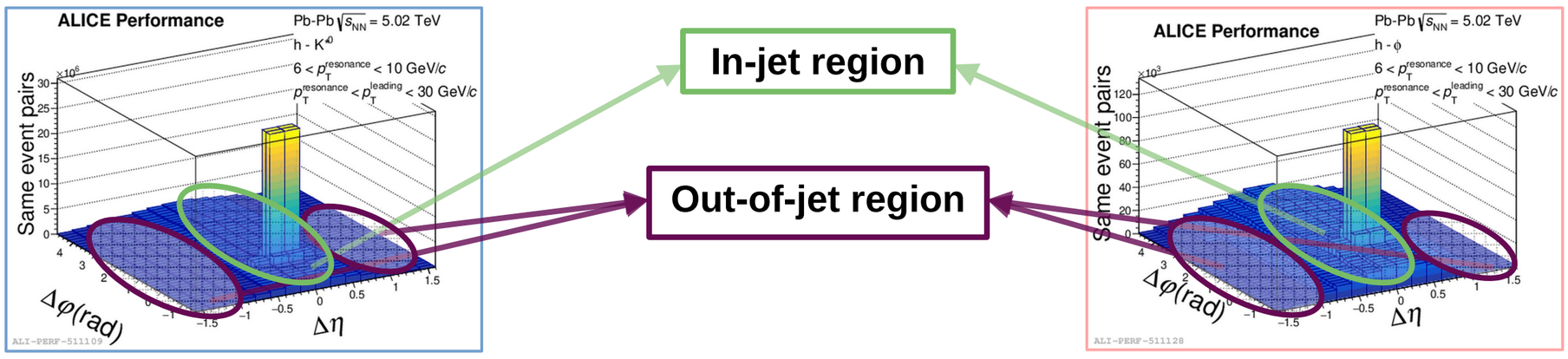
## Motivation

- Hadronic resonances can act as useful probes to examine the hadronic phase in ultrarelativistic heavy-ion collisions.
- Besides, the study of their production yield, resonance properties can be used to study the partonic phase created after the collisions [1].
- High $p_T$ resonances could probe not only the hadronic phase but also the partonic phase, if they are created very early by jet fragmentation.
- Hadron-resonance angular correlations could help to select resonances coming from the jet or out-of-jet region.

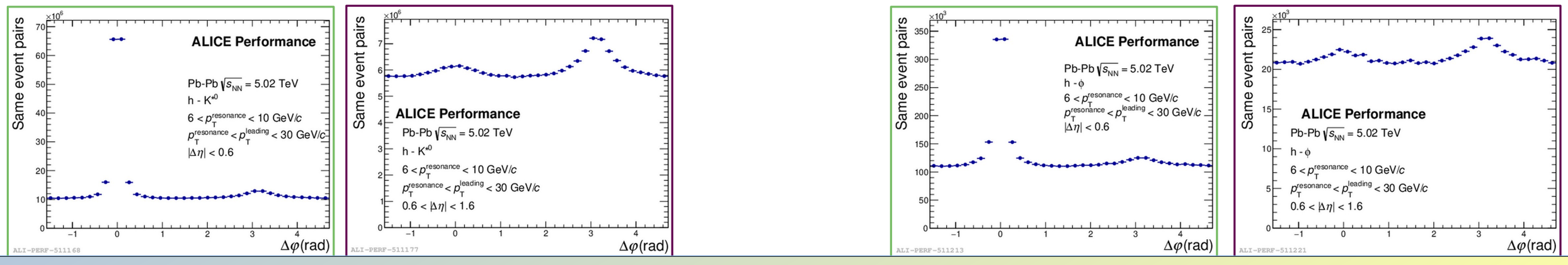
## Method

- Jet axis can be approximated by the highest momentum charged particle reconstructed in an event (**leading particle**).
- The resonance candidates are sampled according to $\Delta\varphi$ ($\varphi_{leading} - \varphi_{resonance}$) and $\Delta\eta$ ($\eta_{leading} - \eta_{resonance}$):
  - the resonances from jet region: $|\Delta\eta| < 0.6$
  - the resonances out of jet region: $|\Delta\eta| > 0.6$
- Resonances are reconstructed through their decay channels: $K^{*0} \rightarrow K^+ + \pi^-$ ($\bar{K}^{*0} \rightarrow K^- + \pi^+$), $\phi \rightarrow K^+ + K^-$

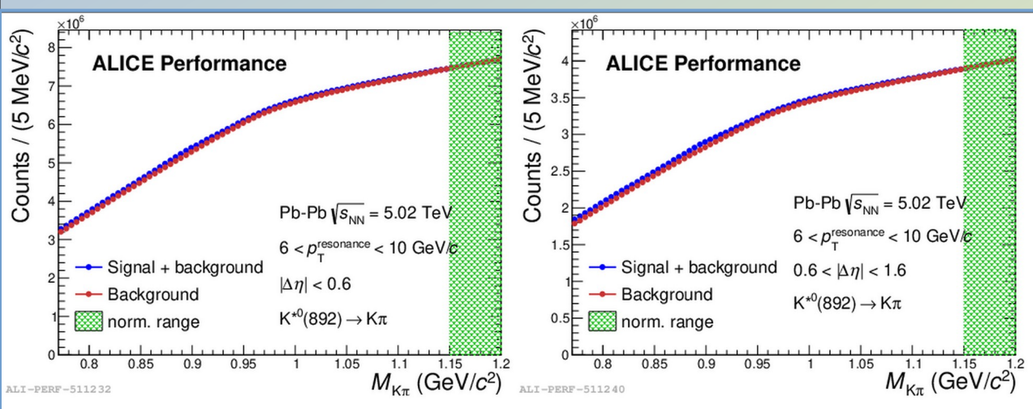
## ($\Delta\varphi$,$\Delta\eta$) distributions



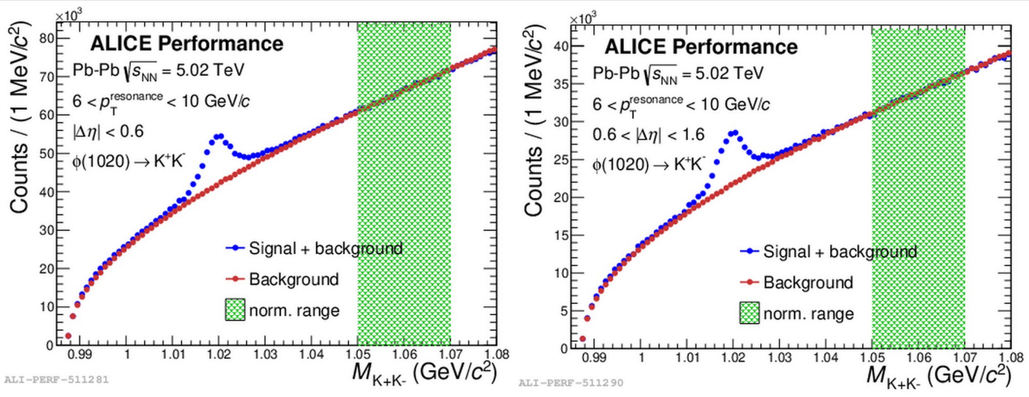

Select different $\Delta\eta$ ranges and project along $\Delta\varphi$ to select resonances coming from different regions




## Invariant mass distributions




Combinatorial background (estimated using the event mixing technique) was normalized and subtracted to obtain the resonance invariant mass peak.

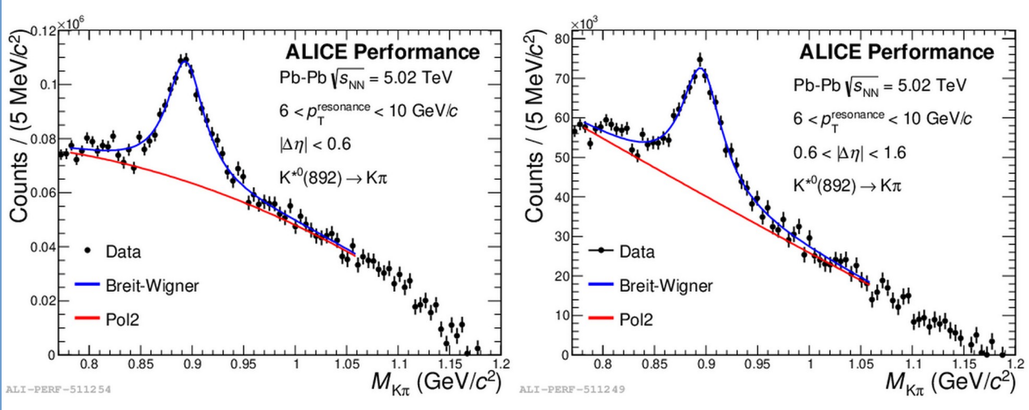



$$F_{BW}(m-M,\Gamma) = \frac{2\sqrt{2}M\Gamma\gamma}{\pi\sqrt{M^2+\gamma}} \cdot \frac{A}{(m^2-M^2)^2+M^2\Gamma^2}$$

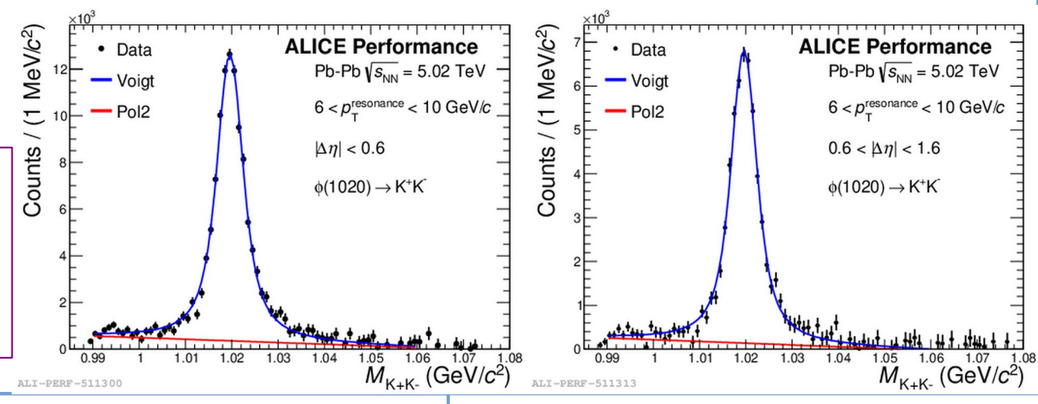
$$\gamma = \sqrt{M^2(M^2+\Gamma^2)}$$

The invariant mass distribution is fitted with the sum of a Breit-Wigner function for the K*0 and a Voigtian function for the ϕ meson (signal) and a polynomial function (background).

$$F_V(m-M,\Gamma,\sigma) = A \cdot \frac{\Gamma/2\pi}{(m-M)^2+\Gamma^2/4} \cdot \frac{e^{-(m-M)^2/2\sigma^2}}{\sqrt{2\pi}\sigma}$$




The mass (M) and width (Γ) of mesons are free parameters of the fit function.




**Outlook:**

- After selecting sufficiently high-$p_T$ resonances in specific $\Delta\varphi$ and $\Delta\eta$ intervals, we select a non-negligible fraction of particles coming from the partonic phase.
- Next steps: study of the in-jet and out-of-jet yield and resonance mass and width as a function of multiplicity, $\Delta\varphi$, $\Delta\eta$, $p_T^{resonance}$ and $p_T^{leading}$.


[1] C. Markert, R. Bellwied, I. Vitev, Physics Letters B 669 (2008) 92 - 97

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