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"Event shape and multiplicity dependence of $K^*(892)^{\pm}$ mesons at midrapidity in pp collisions at $\sqrt{s}$ = 13 TeV with ALICE at the LHC"

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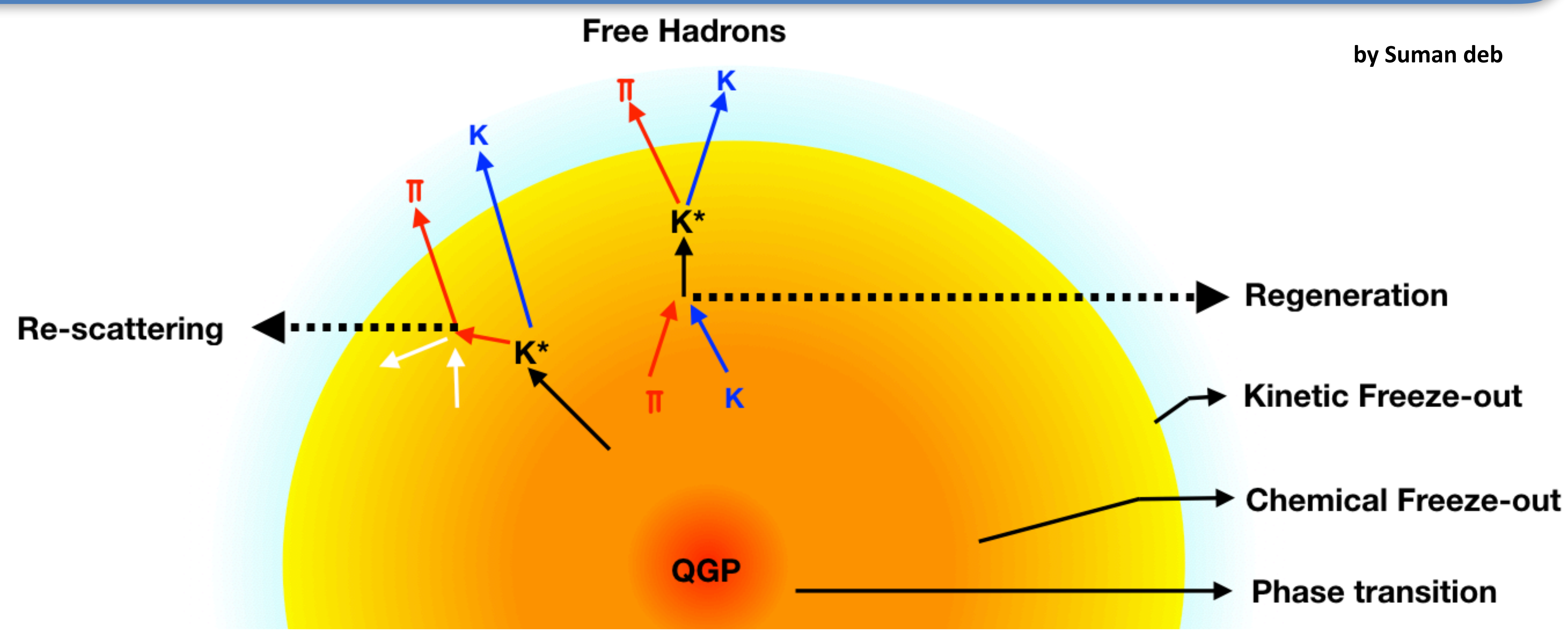
Introduction and Motivation

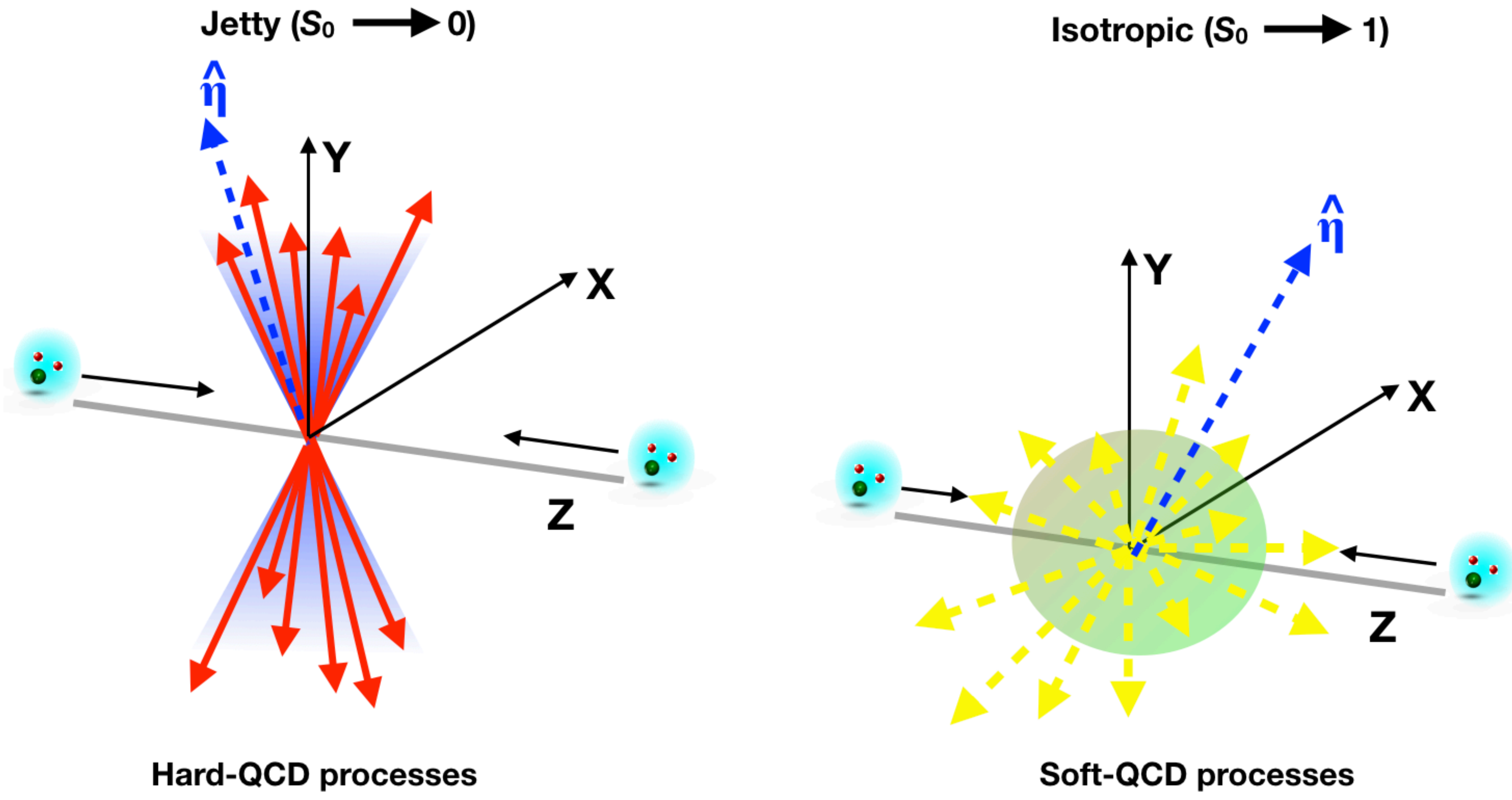
- **Resonances are the ideal tool** to study the medium produced in heavy-ion collisions at ultrarelativistic energies

- K*± meson is particularly interesting because of its very **short lifetime (~ 4 fm/*c*), comparable to the one of the hadronic phase**. Its yields and transverse momentum (p_T) spectra shapes can be affected by regeneration and rescattering processes during the hadronic phase. **Rescattering will reduce yield**, while **regeneration will lead to yield enhancement**. The adjacent figure depicts the overall mechanism

- An event shape observable like **transverse spherocity (S_0) is sensitive to hard ($S_0 \rightarrow 0$) and soft processes ($S_0 \rightarrow 1$)**. Such an observable can be used to distinguish isotropic (dominated by soft QCD) and jetty (dominated by hard QCD) pp collisions as shown in adjacent figure

- Although pp collisions are used as a baseline for heavy-ion collisions, recent preliminary results for K*± production as a function of multiplicity and spherocity in pp collisions at √s = 13 **shows a hint of spherocity dependence** of the yield and ratio to the long-lived hadrons





$$S_0^{p_T=1.0} = \frac{\pi^2}{4} \min_{\vec{n}=(n_x,n_y,0)} \left(\frac{\sum_i |\vec{P_{T_i}} \times \hat{n}|}{N_{tracks}} \right)^2$$

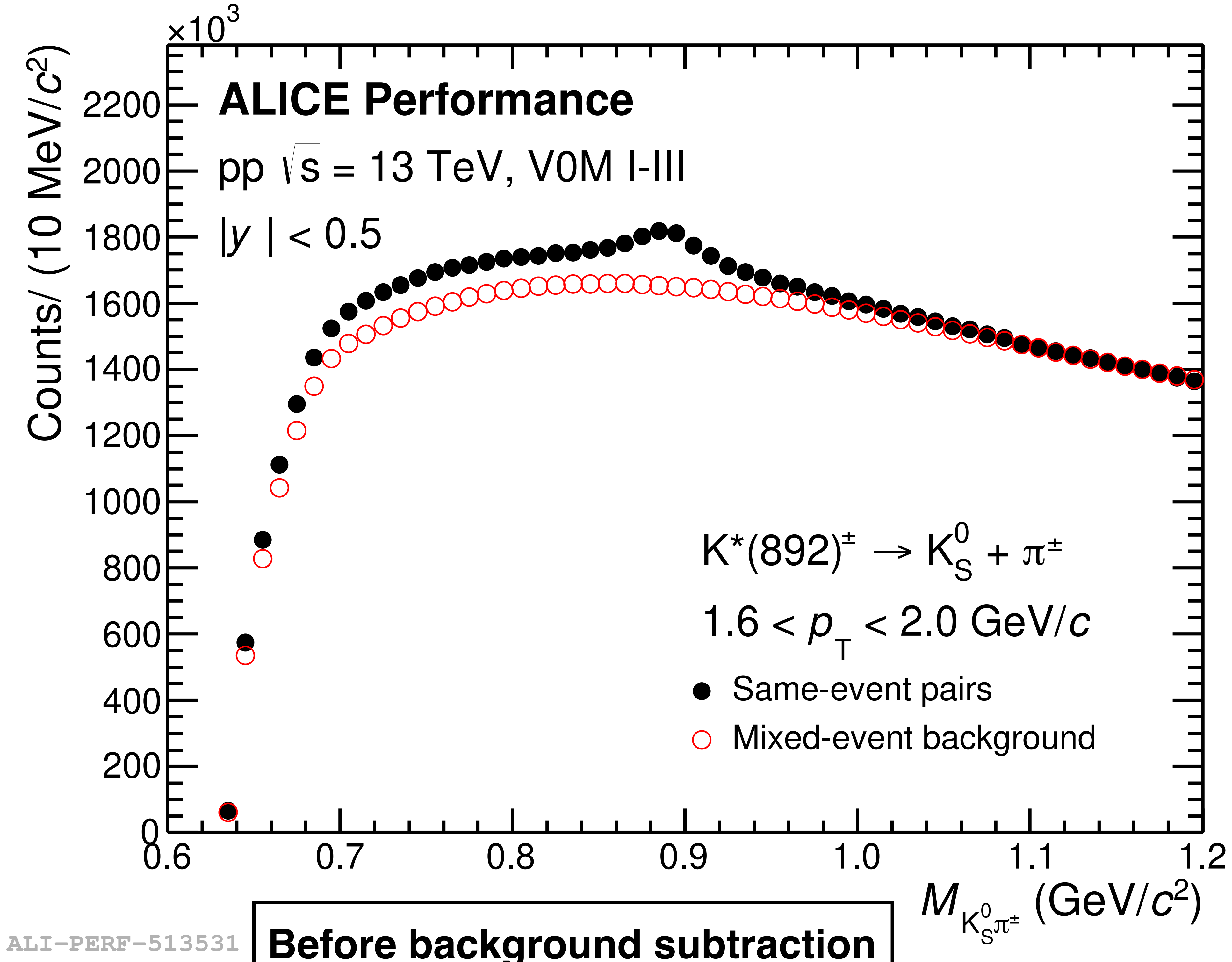
Facts related to K*±: Quark content -> $u\bar{s}$; Mass -> 0.891 GeV/c^2; Spin -> 1; BR -> 33.3% ($K_s^0\pi^{\pm}$)

K*(892)$^{\pm}$ Reconstruction

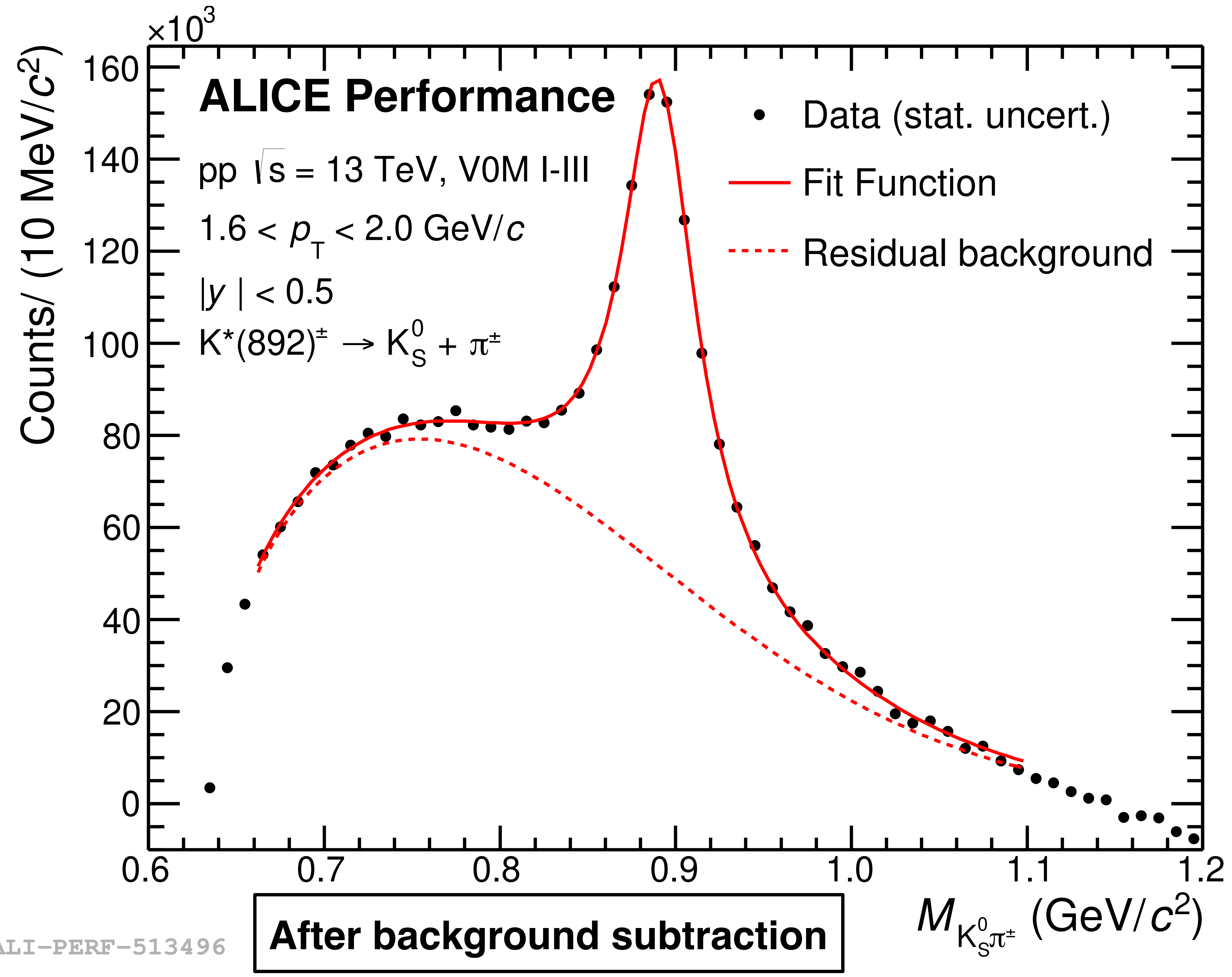
- K*$^{\pm}$ is reconstructed through its hadronic decay channel $K^{*\pm} \rightarrow \pi^{\pm} + K^{0}_{s}$ with BR 33.3%
- Uncorrelated background is estimated via event mixing technique
- The distribution remaining after mixed event subtraction is fitted with a **Breit-Wigner function** to describe the K*$^{\pm}$ and an exponential polynomial function to describe the **background**

$$\frac{A}{2\pi}\frac{\Gamma_0}{(M_{K\pi}-M_0)^2+\frac{\Gamma_0^2}{4}}+F_{BG}$$

$$F_{BG}(M_{K\pi}) = [M_{K\pi} - (m_{\pi} + m_{K})]^{n} \exp(A + BM_{K\pi} + CM^{2}_{K\pi})$$

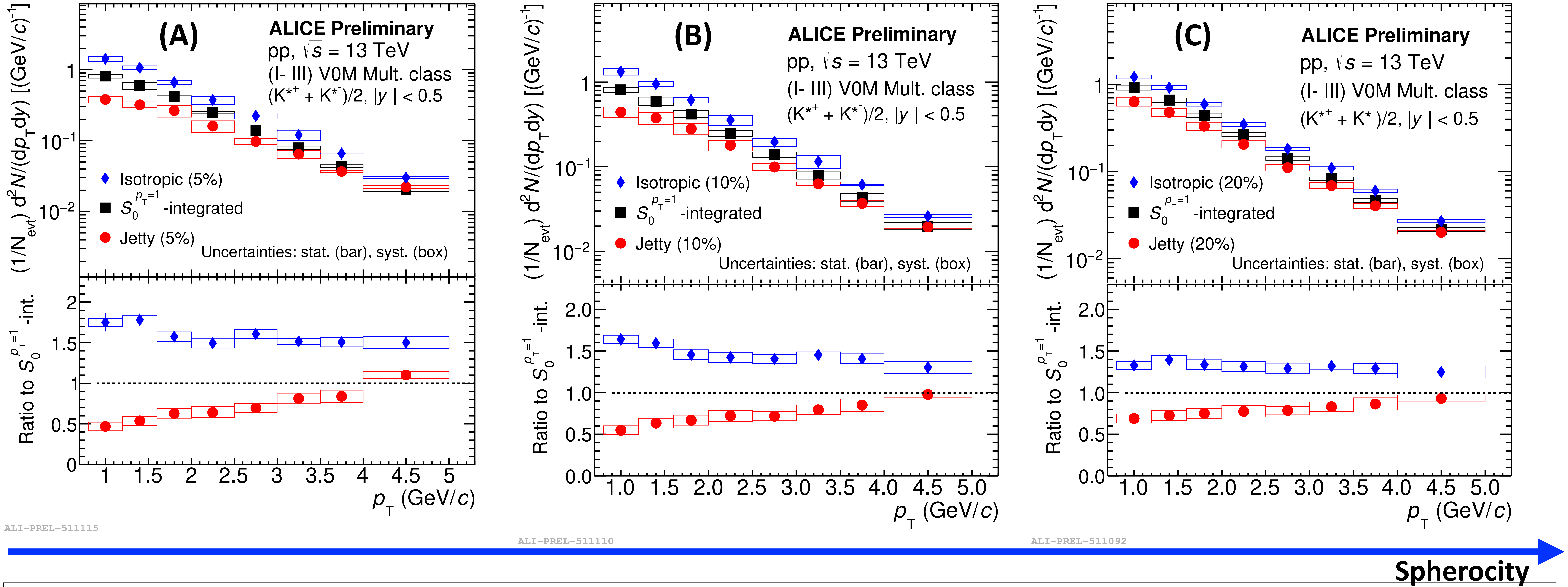


Before background subtraction



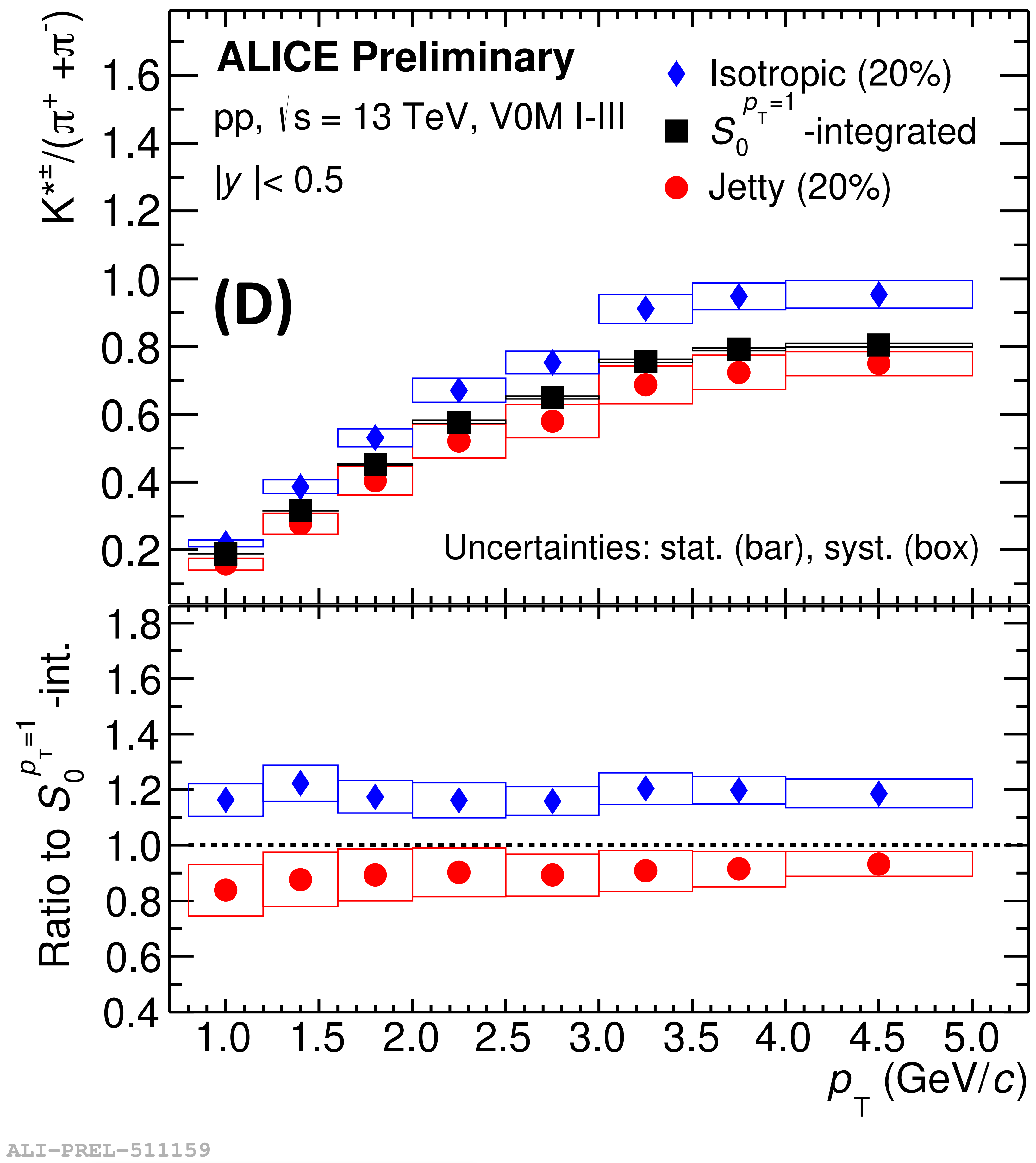
After background subtraction

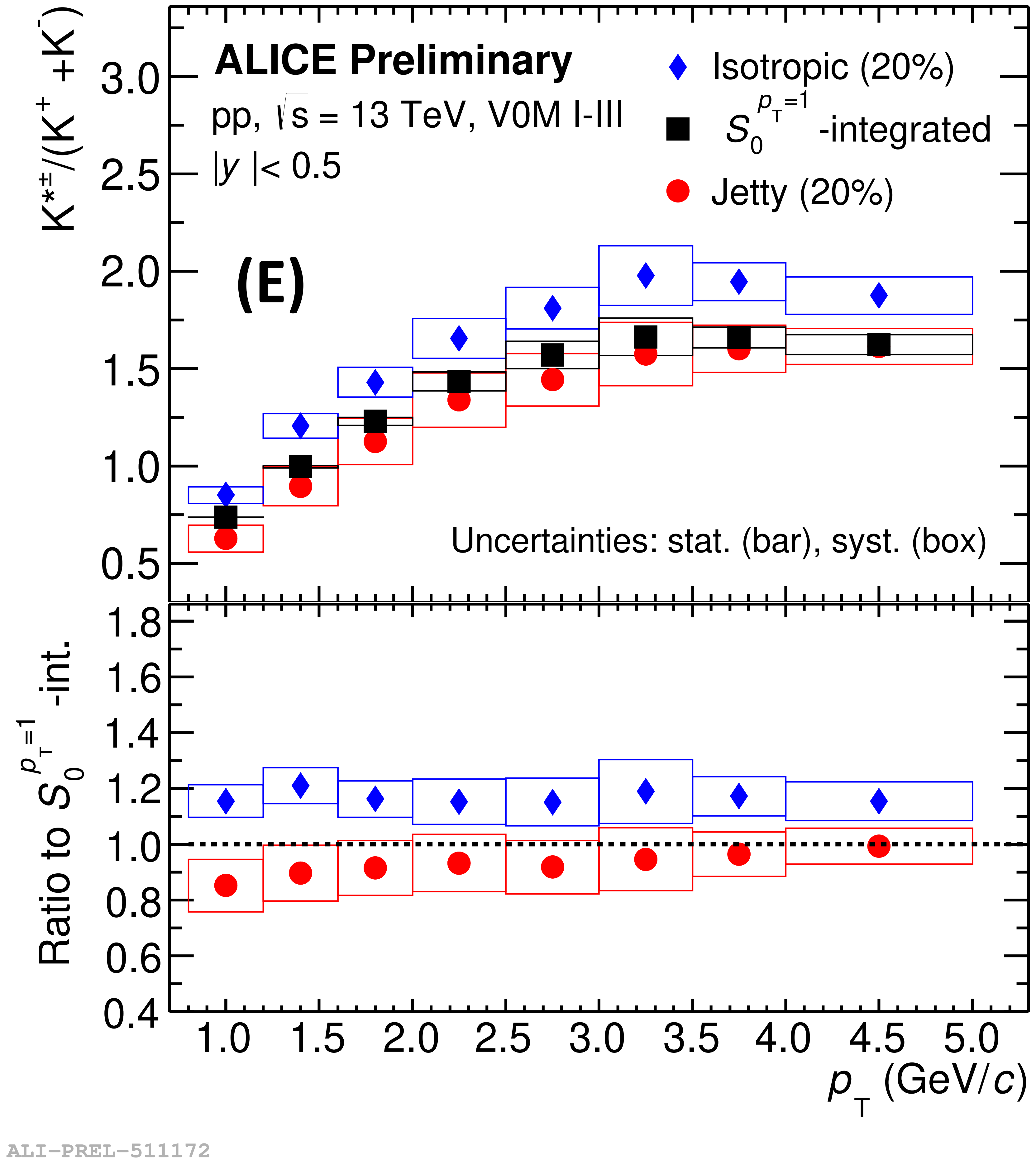
K*(892)± p_T spectra



- **Upper panel**: K*± p_T spectra for three $S_0^{p_T=1}$ intervals for 5% **(A)**, 10% **(B)** and 20% **(C)** $S_0^{p_T=1}$ quantiles; **Lower Panel**: Ratio with $S_0^{p_T=1}$-integrated events.
- **Observation**: Larger K*± production in isotropic events in the measured p_T interval, but for p_T >3.5 GeV/*c* in-jet production increases

Particle Ratio: K*(892)± to Pion and kaon





- **Upper panel**: K*± yield ratio to pion **(D)** and kaon **(E)** in three spherocity intervals; **Lower panel**: Ratio of isotropic and jetty events with $S_0^{p_T=1}$ -integrated events
- **Observation**: The isotropic/integrated ratio is higher and stays flat, while the jetty/integrated rises with p_T, implying an increasing relative contribution of hard processes with increasing p_T

Summary

- First measurements of K*± production at midrapidity in pp collisions at √s = 13 TeV for different $S_0^{p_T=1}$ and V0M multiplicity classes have been reported
- Preliminary results show a hint of spherocity dependence of K*± spectrum and yield ratio to the pion and kaon indicating a larger K*± production in isotropic events