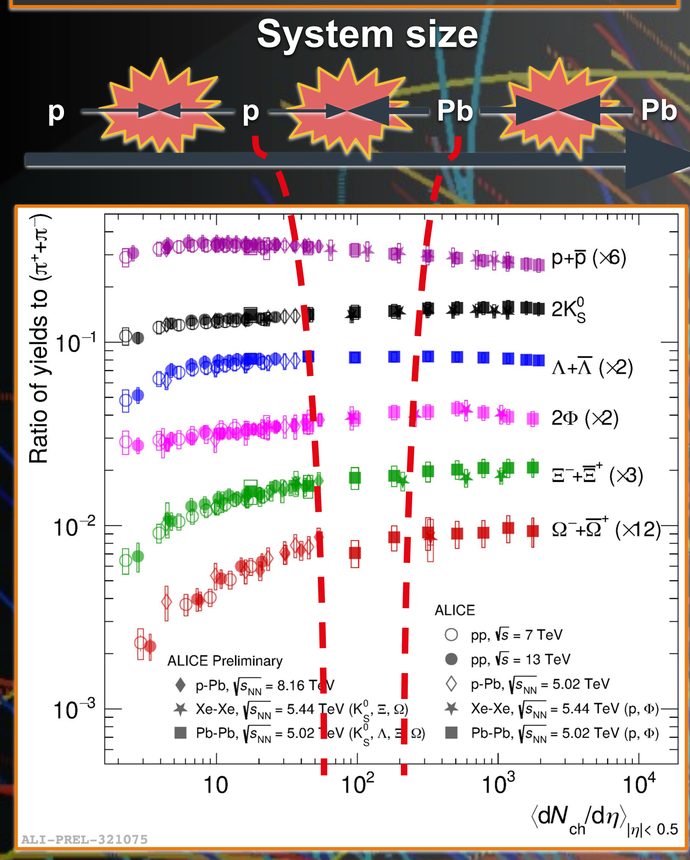
# Production of $\phi$-meson pairs with ALICE at the LHC: a novel probe for strangeness production

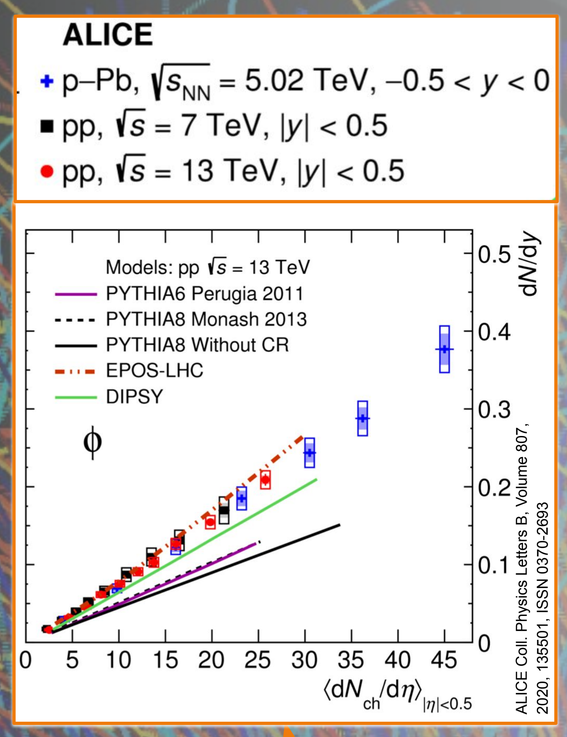
Nicola Rubini on behalf of the ALICE Collaboration

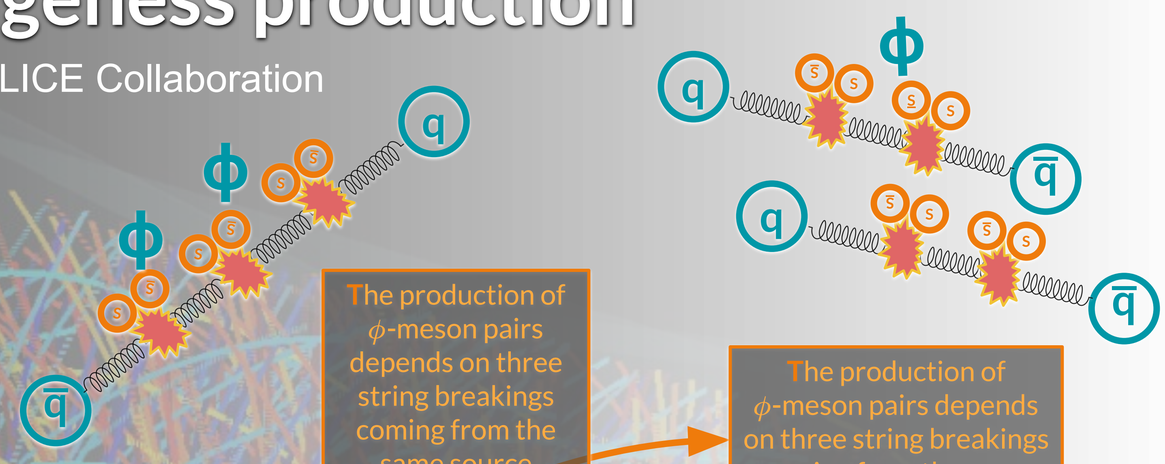
Istituto Nazionale di Fisica Nucleare

Strangeness enhancement is an increase observed in the yield ratio of strange hadrons to pions




The ratio smoothly increases from high multiplicity pp collisions to heavy ion collisions




The production of $\phi$-meson pairs depends on three string breakings coming from the same source

The production of $\phi$-meson pairs depends on three string breakings coming from the same source

The Lund string model prescribes in a naïve approach an enhancement of the $\phi$ meson production

$\langle Y_\phi \rangle$ Inclusive $\phi$ meson

$\langle Y_{\phi\phi} \rangle$ Inclusive $\phi$-meson pairs NEW!

$\mu_\phi = \langle Y_\phi \rangle$ Average

$\sigma^2_\phi = 2\langle Y_{\phi\phi} \rangle + \langle Y_\phi \rangle - \langle Y_\phi \rangle^2$ Variance NEW!

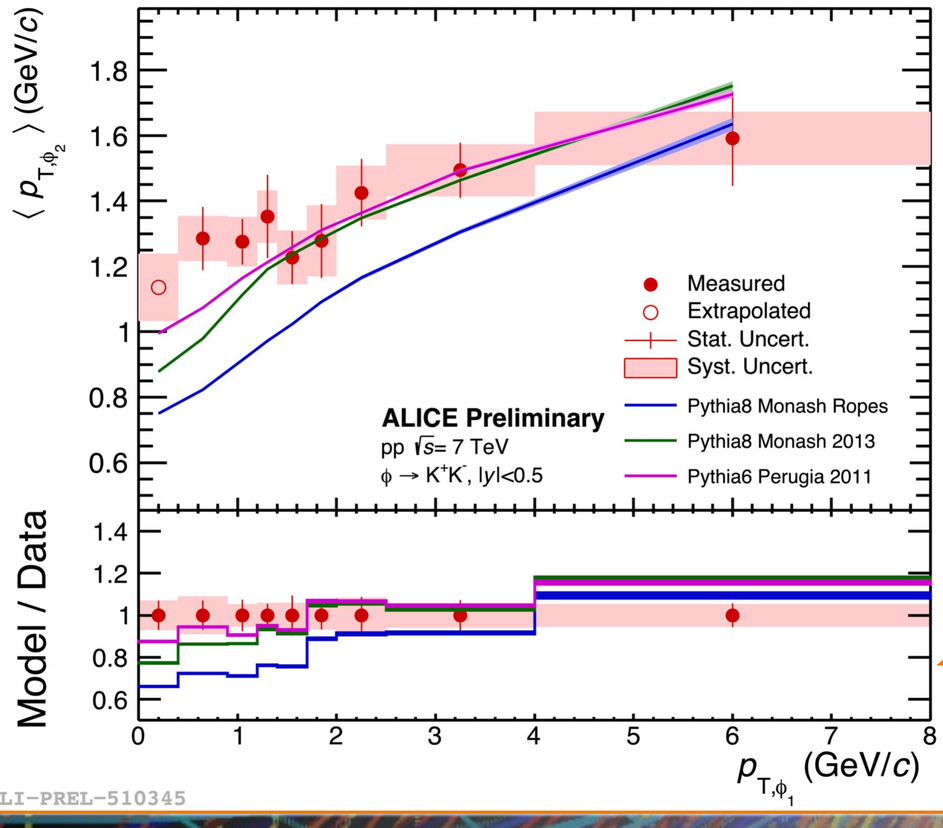
Combining we can compare to poissonian hypothesis NEW!

$\gamma_\phi = \frac{\sigma^2_\phi}{\mu_\phi} - 1 = 2\frac{\langle Y_{\phi\phi} \rangle}{\langle Y_\phi \rangle} - \langle Y_\phi \rangle$

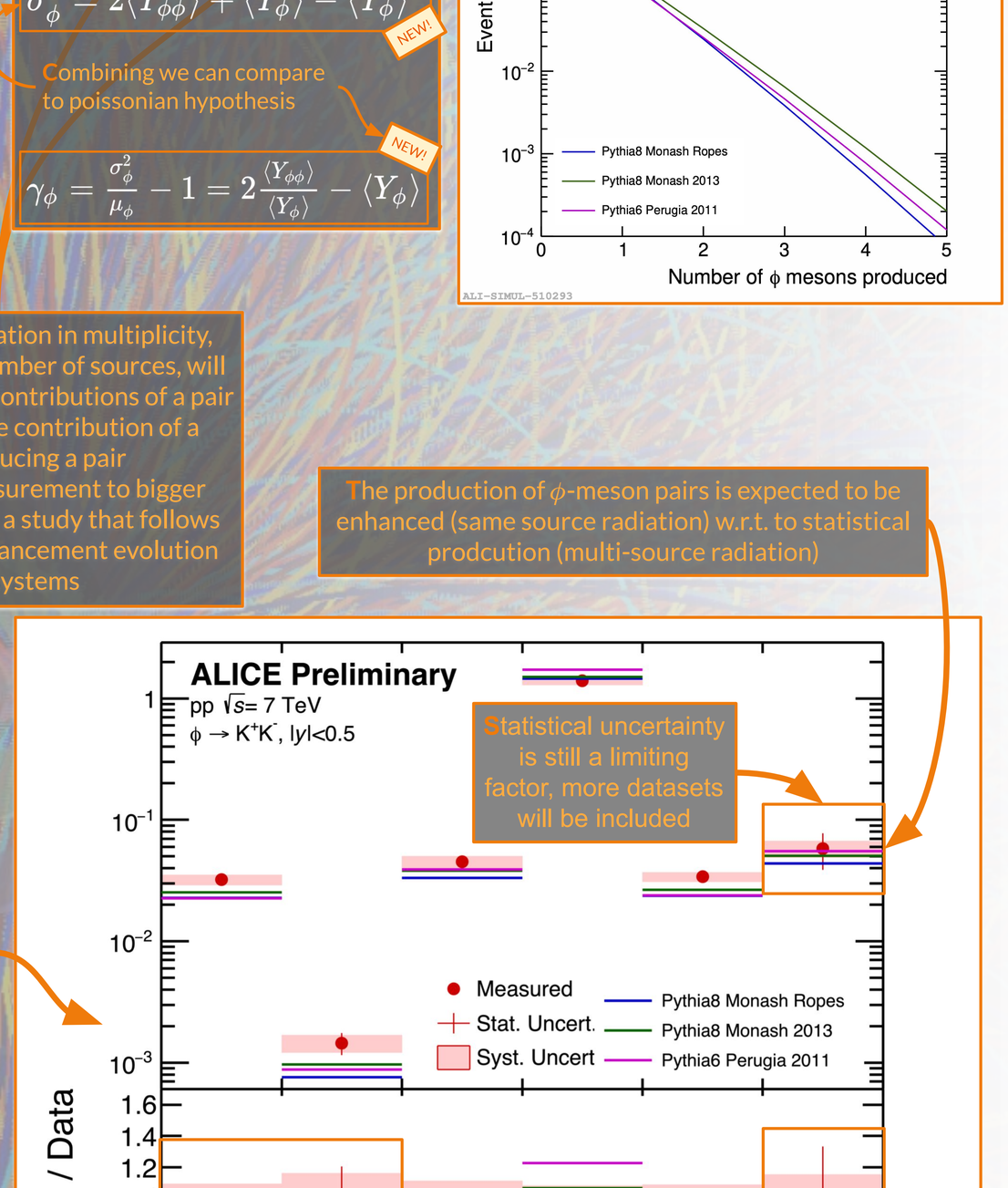



A further differentiation in multiplicity, used as a proxy to number of sources, will help disentangle the contributions of a pair of sources from the contribution of a source producing a pair
Extending the measurement to bigger systems will provide a study that follows the strangeness enhancement evolution across systems

The production of $\phi$-meson pairs is expected to be enhanced (same source radiation) w.r.t. to statistical prodcution (multi-source radiation)




This analysis represents a new way to challenge phenomenological models with a thorough characterisation of resonance and strangeness production
New characterisation technique hints an accordance of string model to data w.r.t. to the excess over a poissonian production, even though the yields are not reproduced




Mean $p_T$ for conditional spectra indicates Pythia models reproduce the shape of the spectra at first order
**Rope** tune of Pythia has a softer spectrum

Average yield of produced ϕ mesons and ϕ-meson pairs, together with variance are underestimated

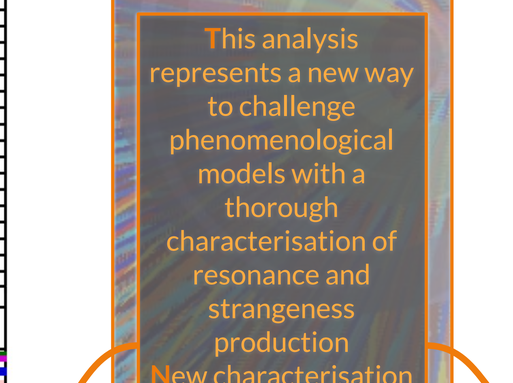
A combined approach to Particle Identification takes advantage of the strong separation for Kaons both in TOF and TPC in different $p_T$ ranges.
The ϕ meson is reconstructed via its decay in $K^+K^-$. The ϕ-meson pair is then measured extracting the signal from a 2-dimensional invariant mass plot

## ALICE Performance

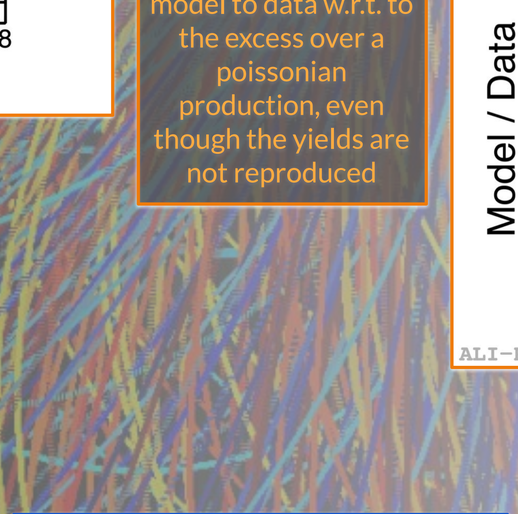
pp $\sqrt{s}$= 7 TeV
ϕ → $K^+K^-$, |y|<0.5

$1.20 < p_{T,\phi_1} < 1.40$ GeV/c
$1.40 < p_{T,\phi_2} < 1.70$ GeV/c




**Time Projection Chamber (TPC)**
Particle identification & Tracking




**Time of Flight Detector (TOF)**
Particle identification & Event timing