ICHEP 2022 BOLOGNA

ALICE

INFN Istituto Nazionale di Fisica Nucleare

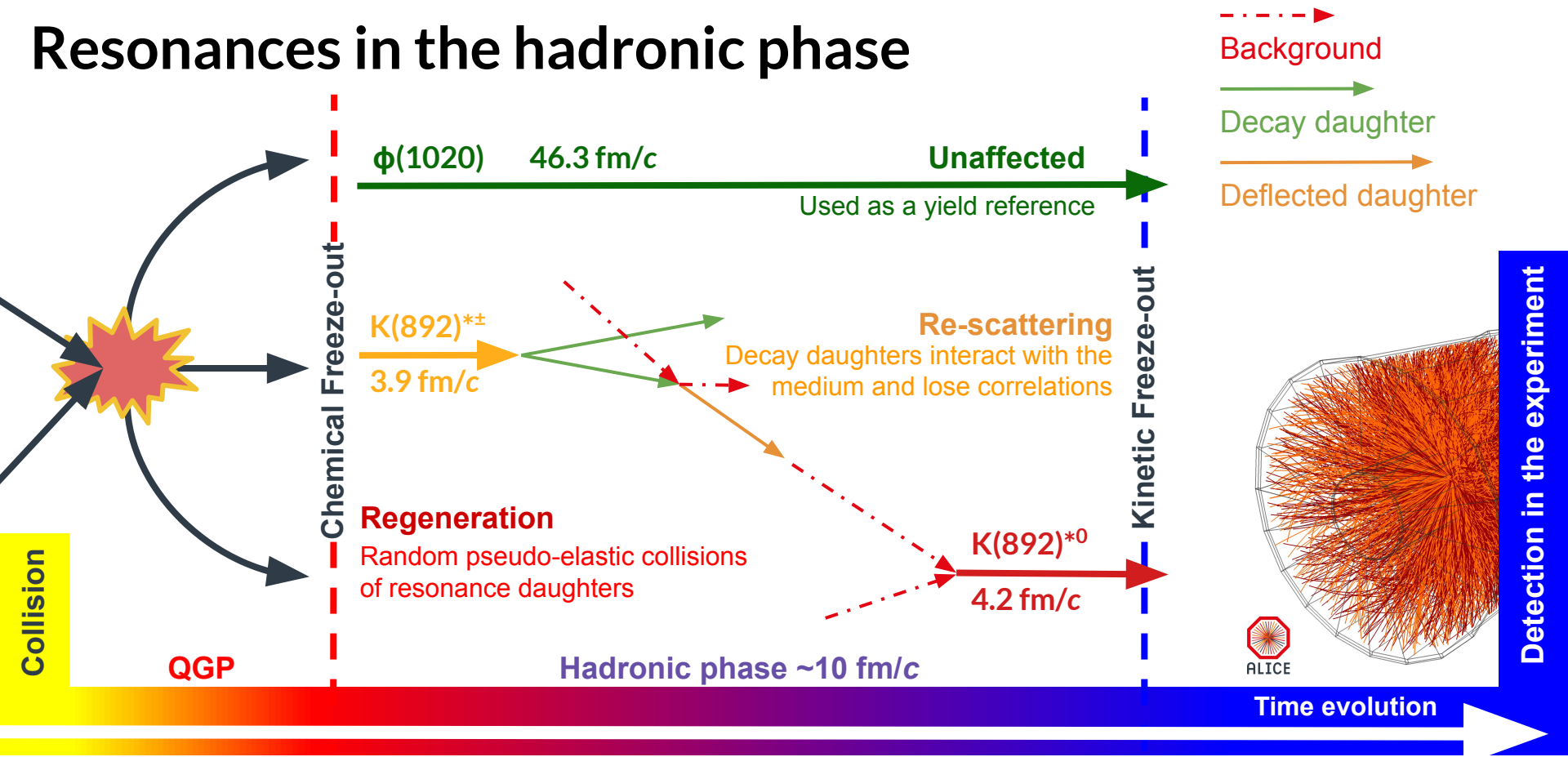
Rescattering effects on resonances production in small systems with ALICE at LHC

Nicola Rubini on behalf of the ALICE Collaboration

INFN Bologna, University of Bologna

9 July 2022

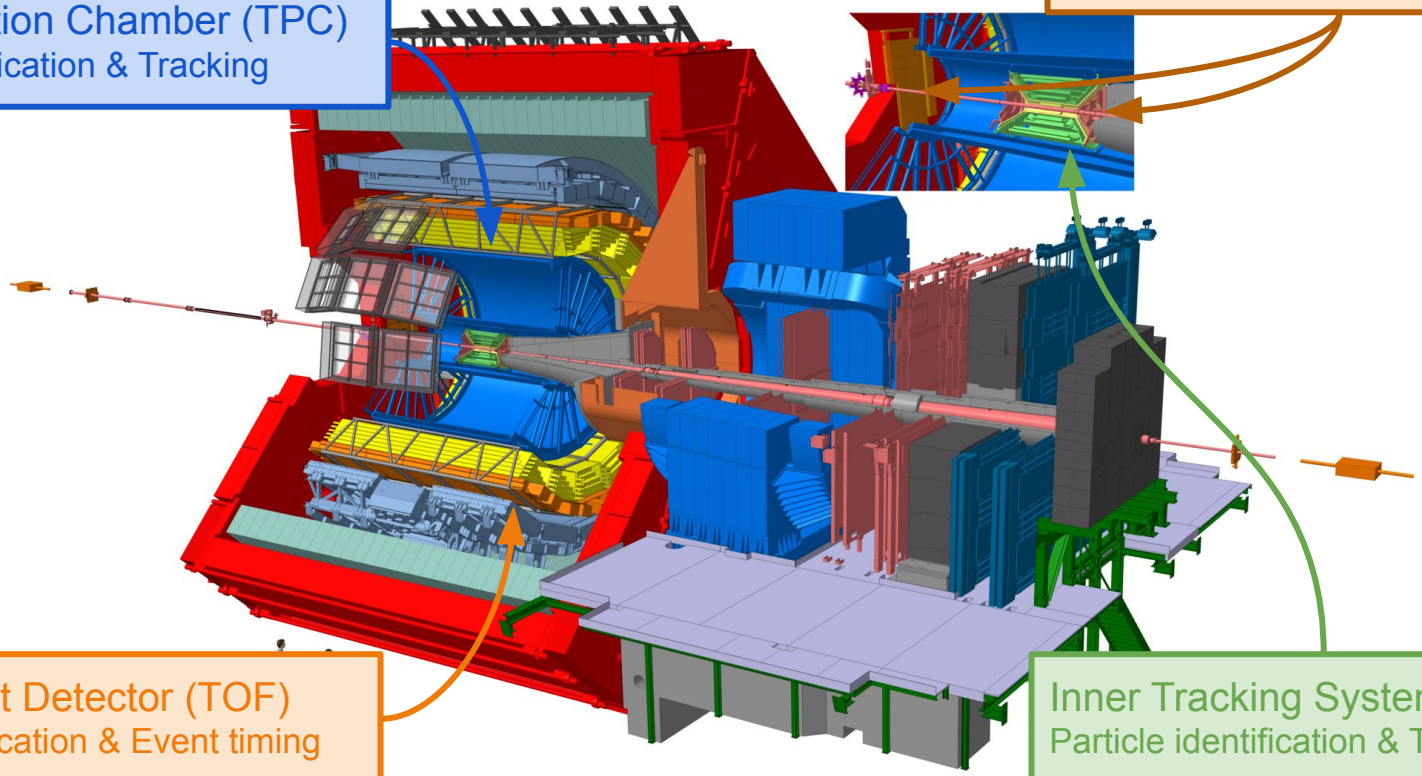
Resonances in the hadronic phase



The ALICE detector

Time Projection Chamber (TPC)
Particle identification & Tracking

V0A & V0C
Trigger and multiplicity estimation



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

Inner Tracking System (ITS)
Particle identification & Tracking

The ALICE detector

Time Projection Chamber (TPC)
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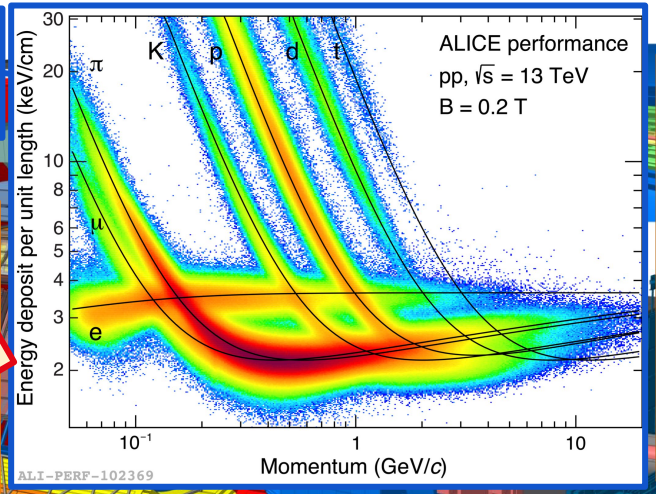
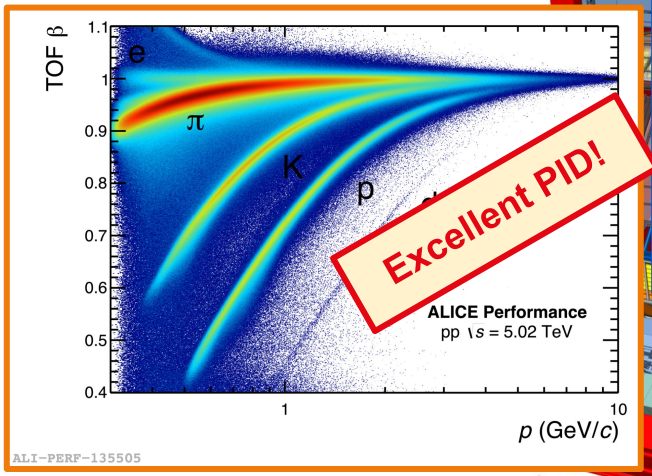
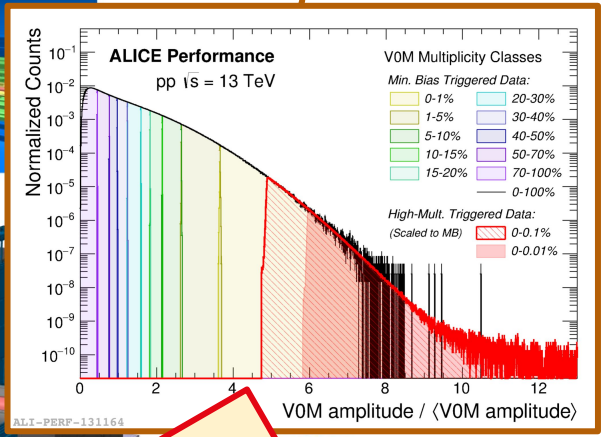




Excellent PID!



Centrality and multiplicity estimation

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

Inner Tracking System (ITS)
Particle identification & Tracking

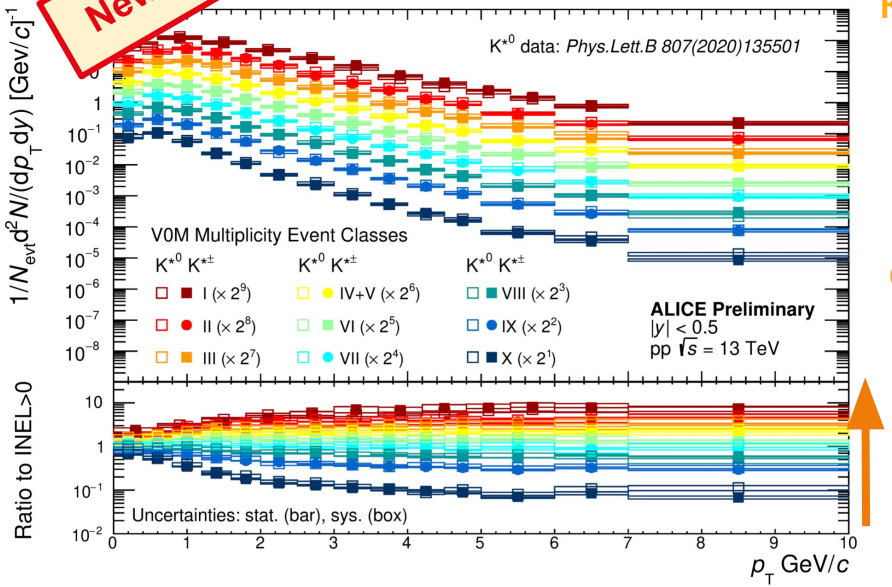
Posters by Antonina Rosano, Prottay Das, Sonali Pradhan

K(892)*± and Λ(1520) p_T spectra

K(892)*0 4.2 fm/c
K(892)*± 3.9 fm/c
Λ(1520) 12.6 fm/c

Consistent results from K(892)*± and K(892)*0

New!

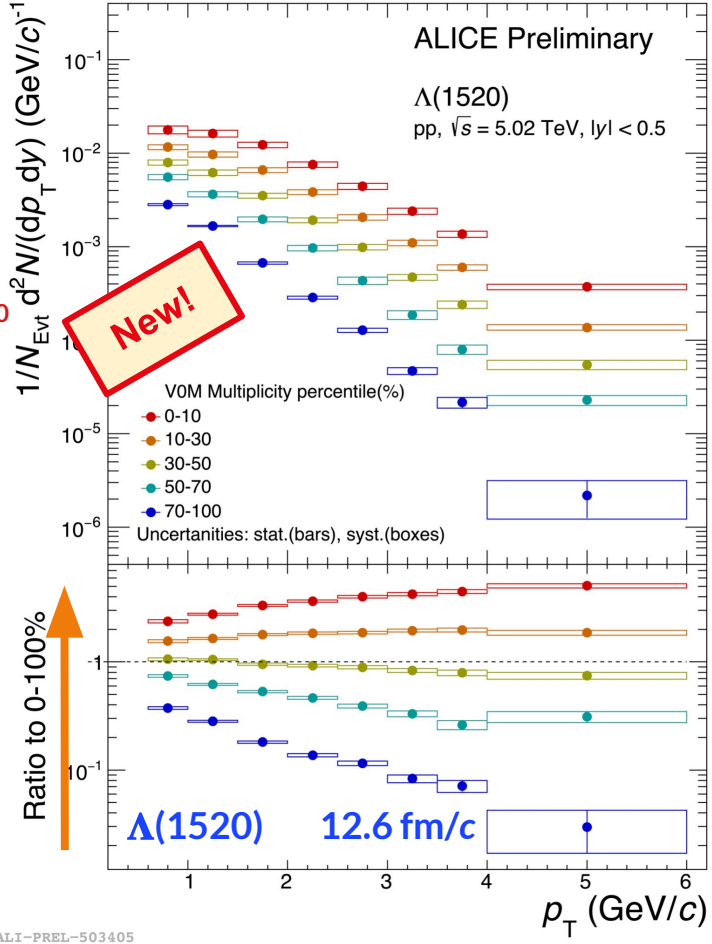


ALI-PREL-503116

Hardening of K(892)*±, K(892)*0 and Λ(1520) spectra.

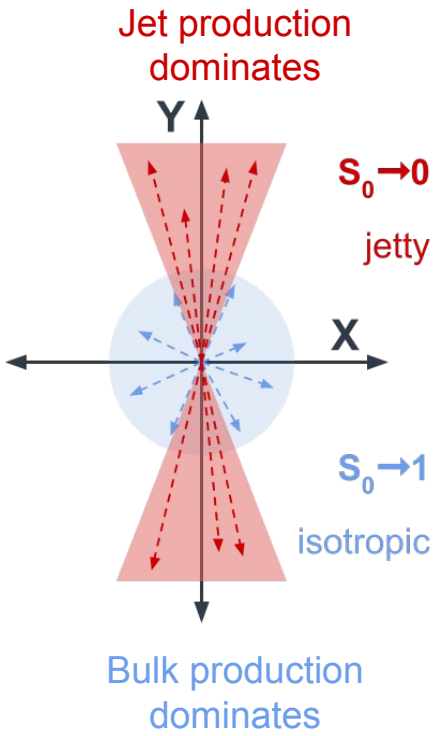
Behaviour associated to a collective system expansion

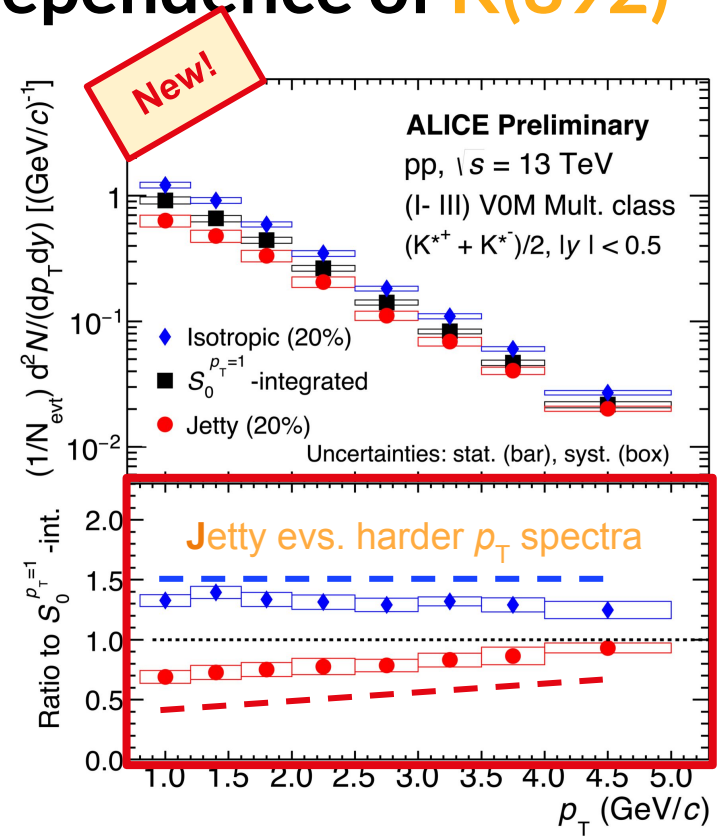
New!

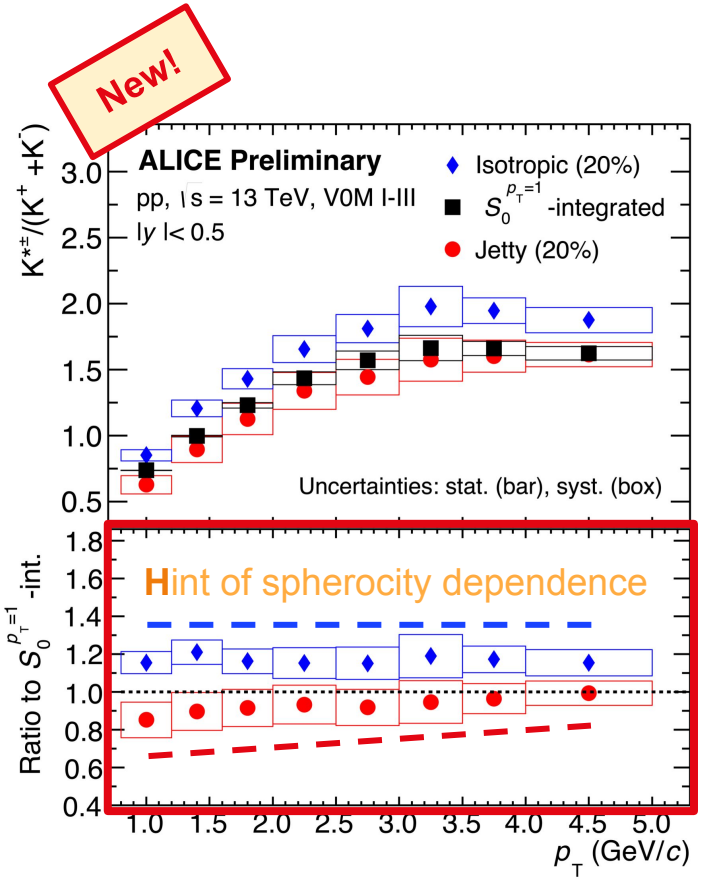


ALI-PREL-503405

Spherocity dependence of K(892)*±



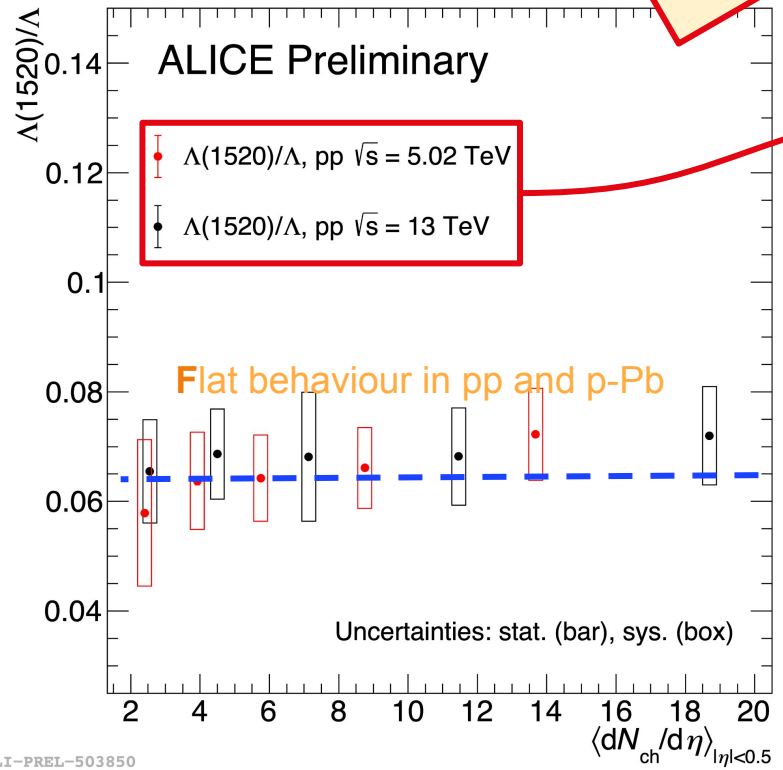




Posters by Antonina Rosano, Neelima Agrawal, Sonali Pradhan

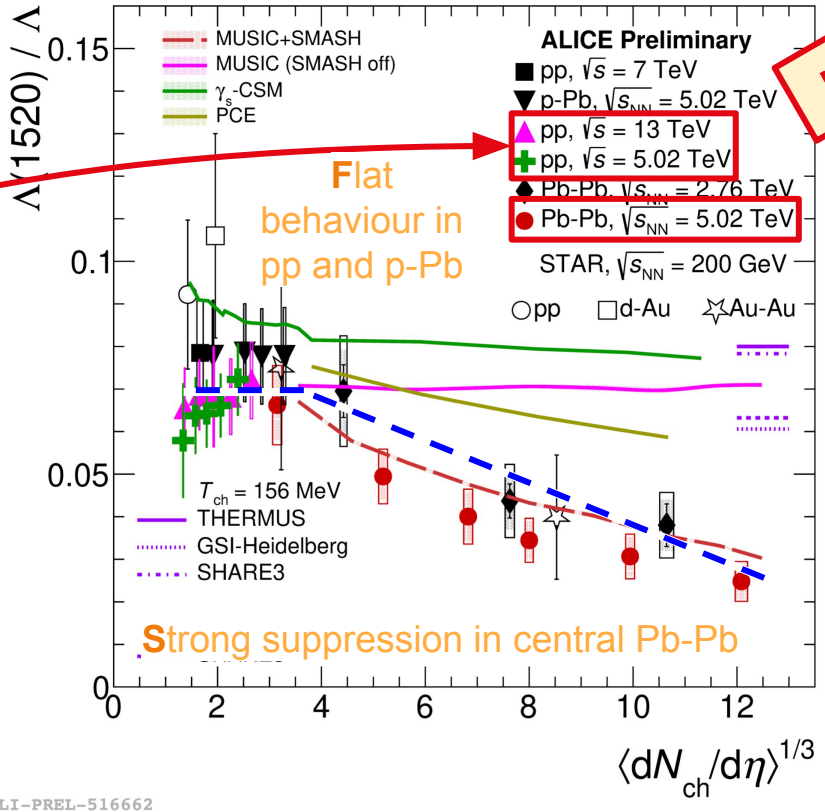
Λ(1520) ratio to Λ

New!



ALI-PREL-503850

Λ(1520) 12.6 fm/c



New!

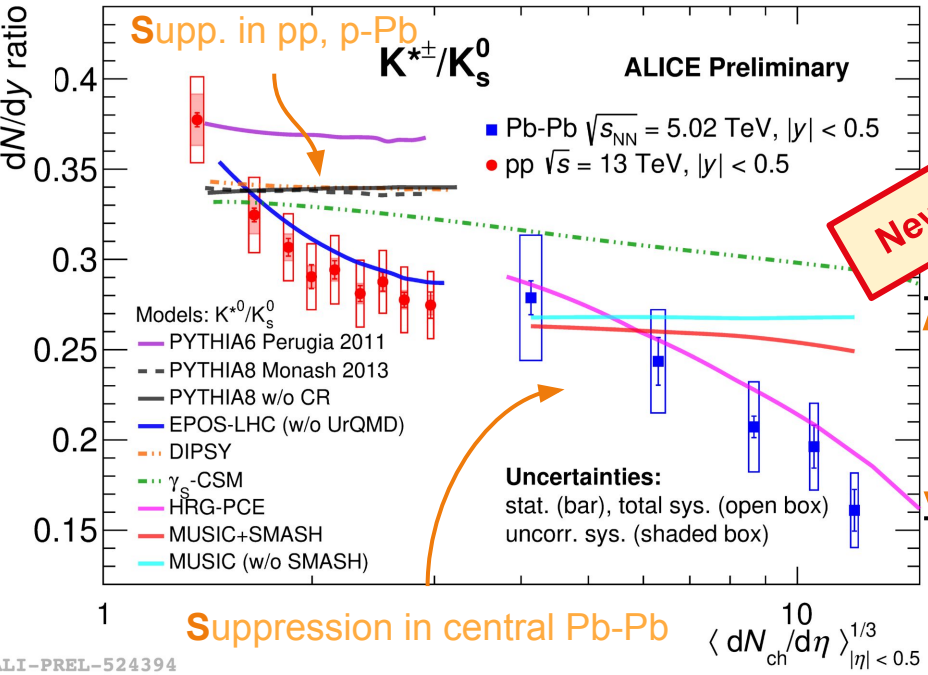
Significant decrease

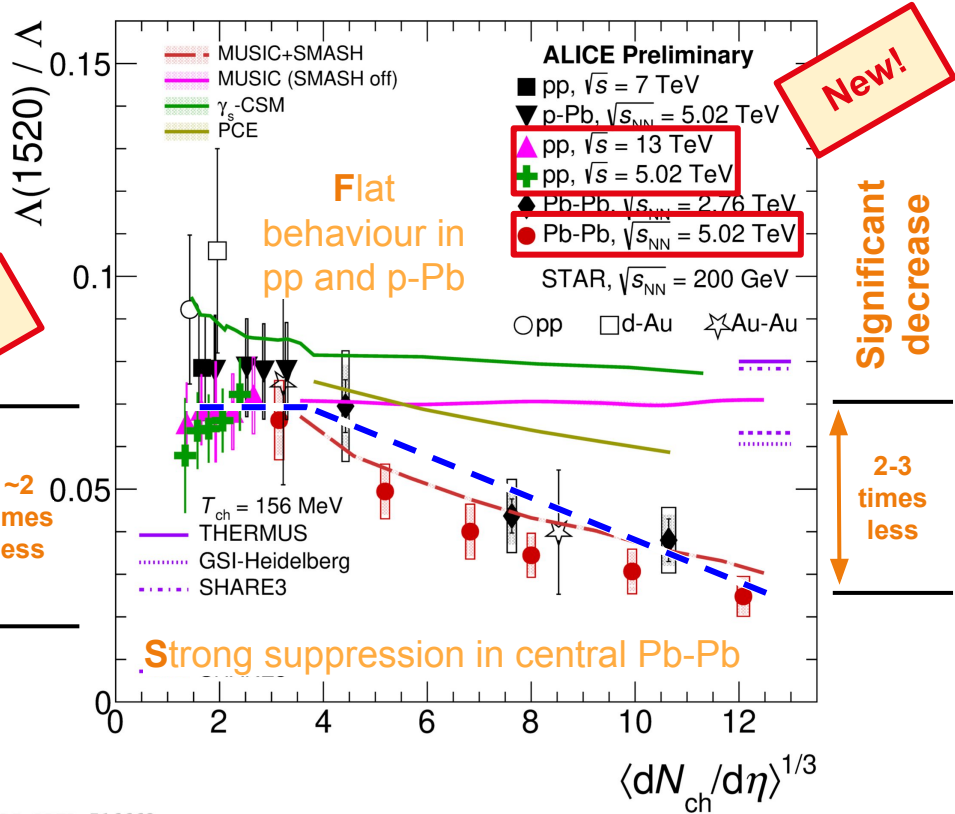
2-3 times less

ALI-PREL-516662

PCE:Phys.Rev.C 102 (2020) 2, 024909
MUSIC:arXiv:2105.07539
ALICE: Phys. Rev. C 99, (2019) 024905
ALICE: Eur. Phys. J. C 80 (2020) 160

Λ(1520) and K(892)*± ratios

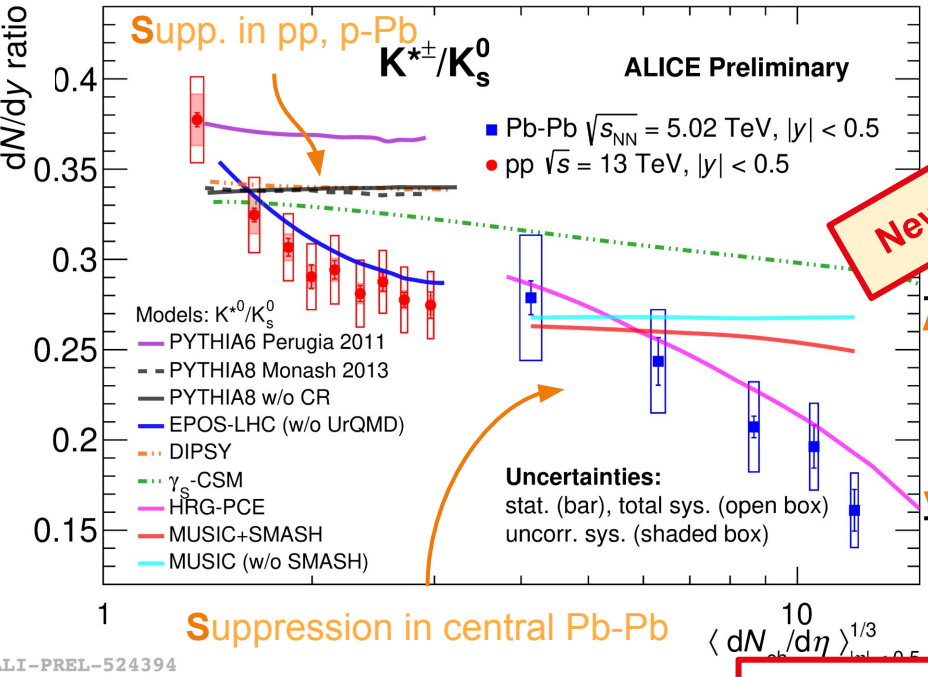


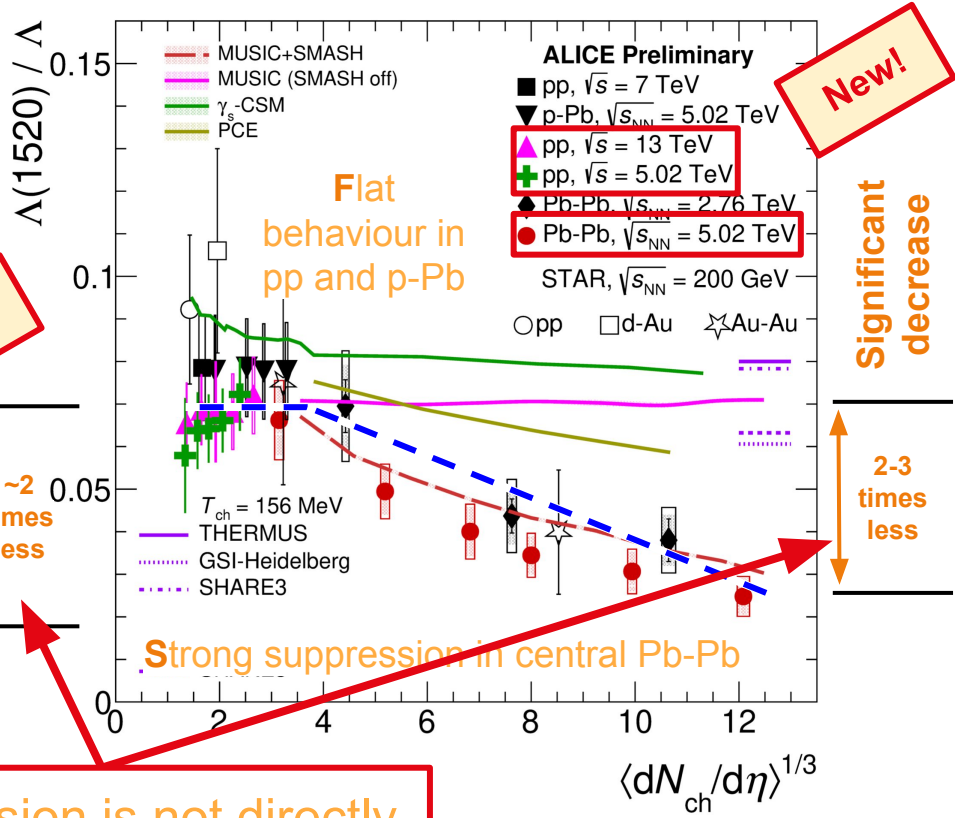


K(892)*± 3.9 fm/c
Λ(1520) 12.6 fm/c

STAR, PRL 97, 132301 (2006)
STAR, Phys. Rev. C 78, 044906
γ-CSM:Phys.Rev.C 100 (2019) 5, 054906
EPOS3:10.1103/PhysRevC.93.014911

Λ(1520) and K(892)*± ratios

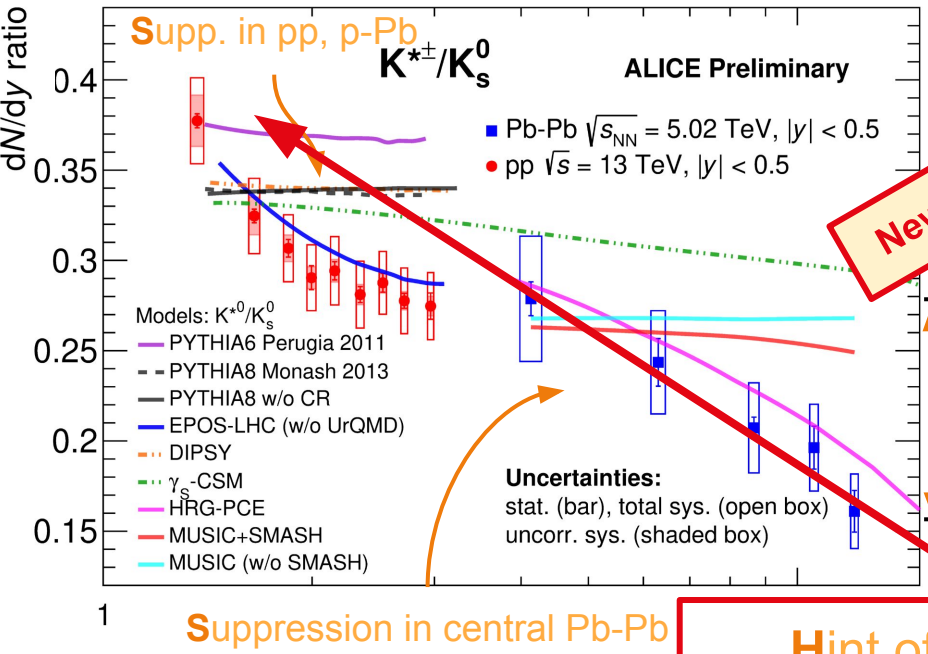




Suppression is not directly correlated with lifetime

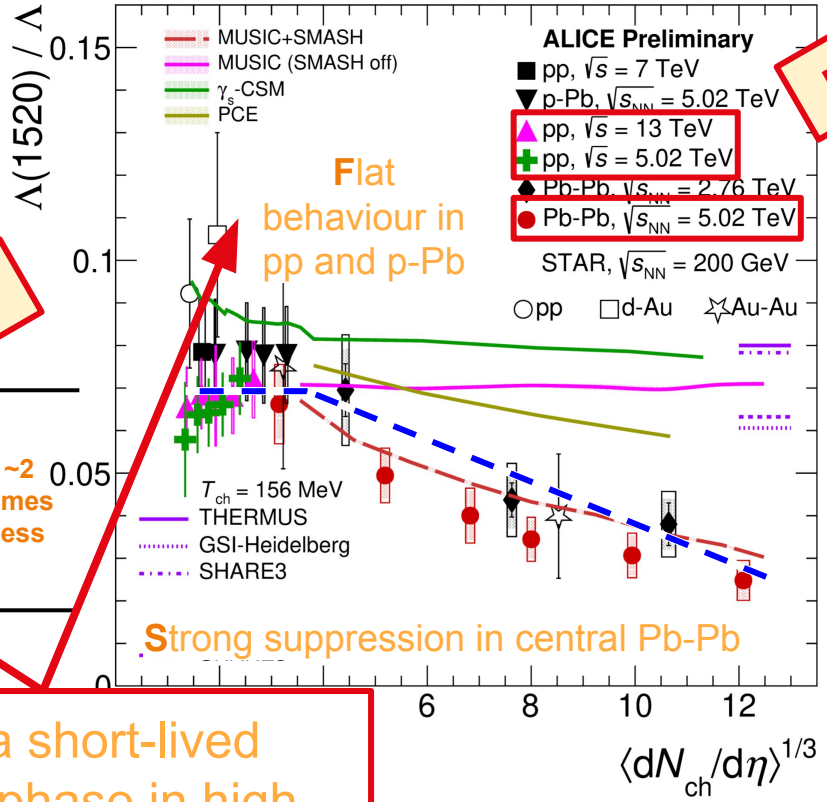
K(892)*± 3.9 fm/c
Λ(1520) 12.6 fm/c

Λ(1520) and K(892)*± ratios



New!

~2 times less



New!

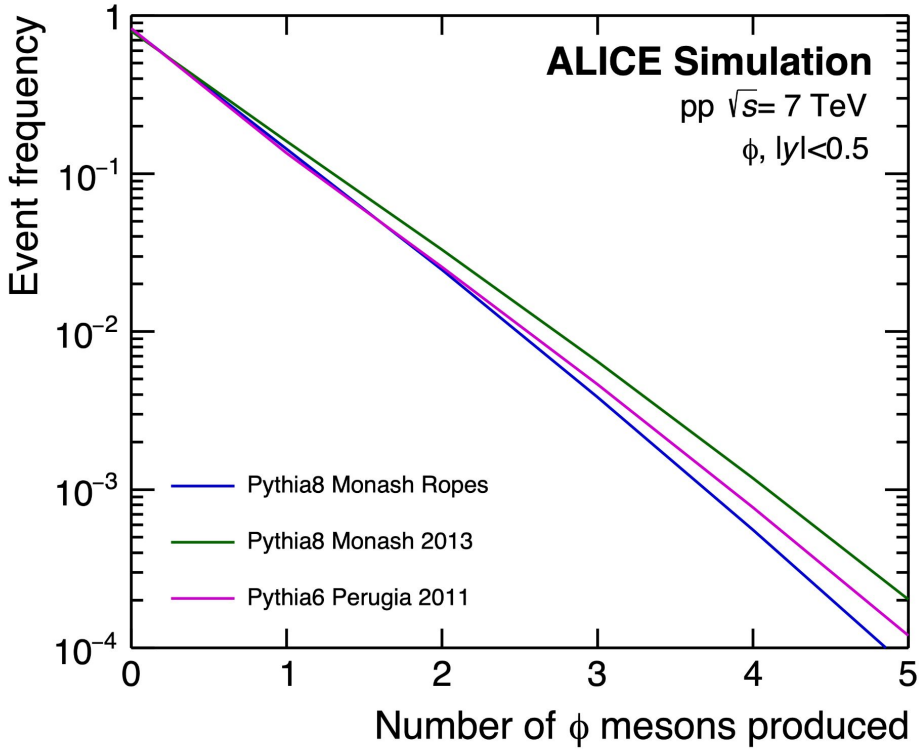
Significant decrease

2-3 times less

Hint of a short-lived hadronic phase in high multiplicity pp collisions

K(892)*± 3.9 fm/c
Λ(1520) 12.6 fm/c

Understanding the ϕ(1020) baseline



ALI-SIMUL-510293

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

$\langle Y_{\phi\phi} \rangle$ Inclusive ϕ-meson pair production

New!

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

Average yield of produced ϕ meson

New!

$$\sigma_\phi^2 = 2\langle Y_{\phi\phi} \rangle + \langle Y_\phi \rangle - \langle Y_\phi \rangle^2$$

Variance of produced ϕ mesons

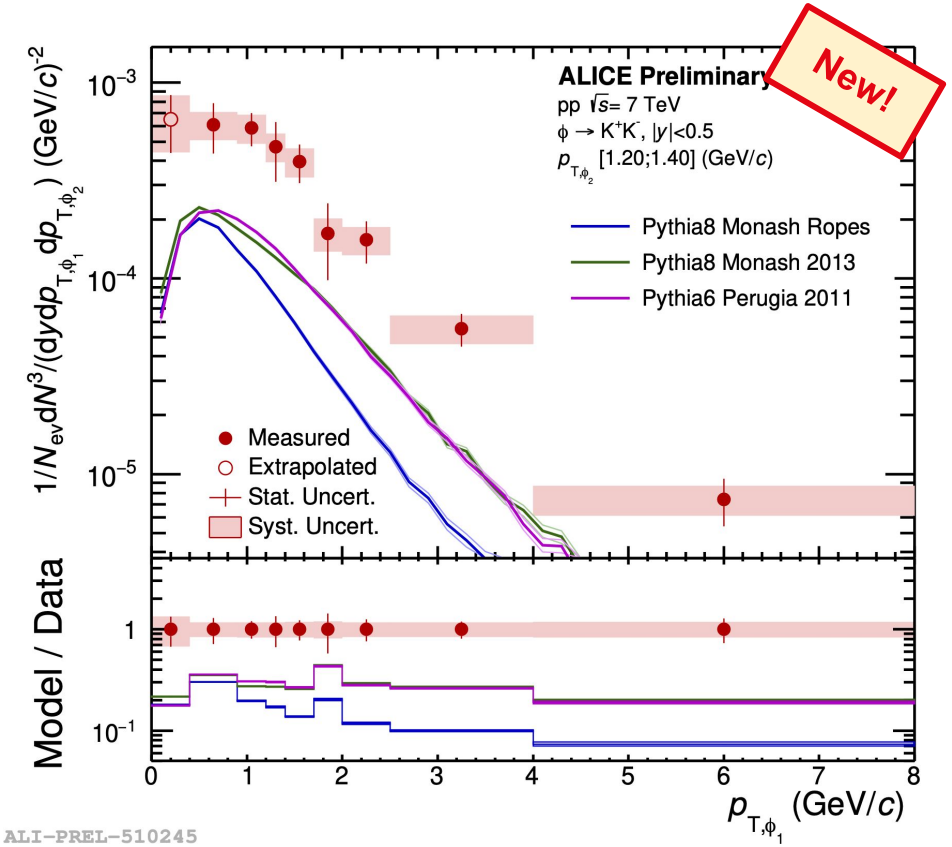
New!

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

New method to characterise production

ϕ(1020) production statistics

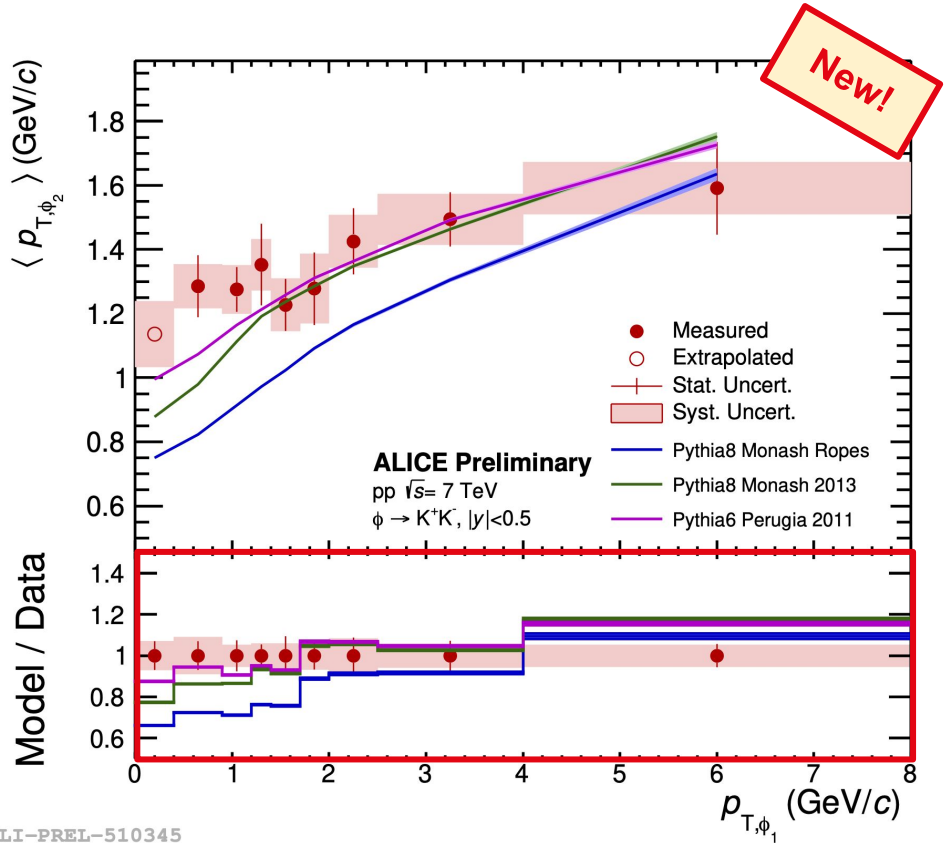
Conditional spectra can now be accessed, exploring the paired production of the meson



ϕ(1020) production statistics

Conditional spectra can now be accessed, exploring the paired production of the meson

Mean p_T of conditional spectra can point to the generator's ability to reproduce their shape, although their yields are not reproduced



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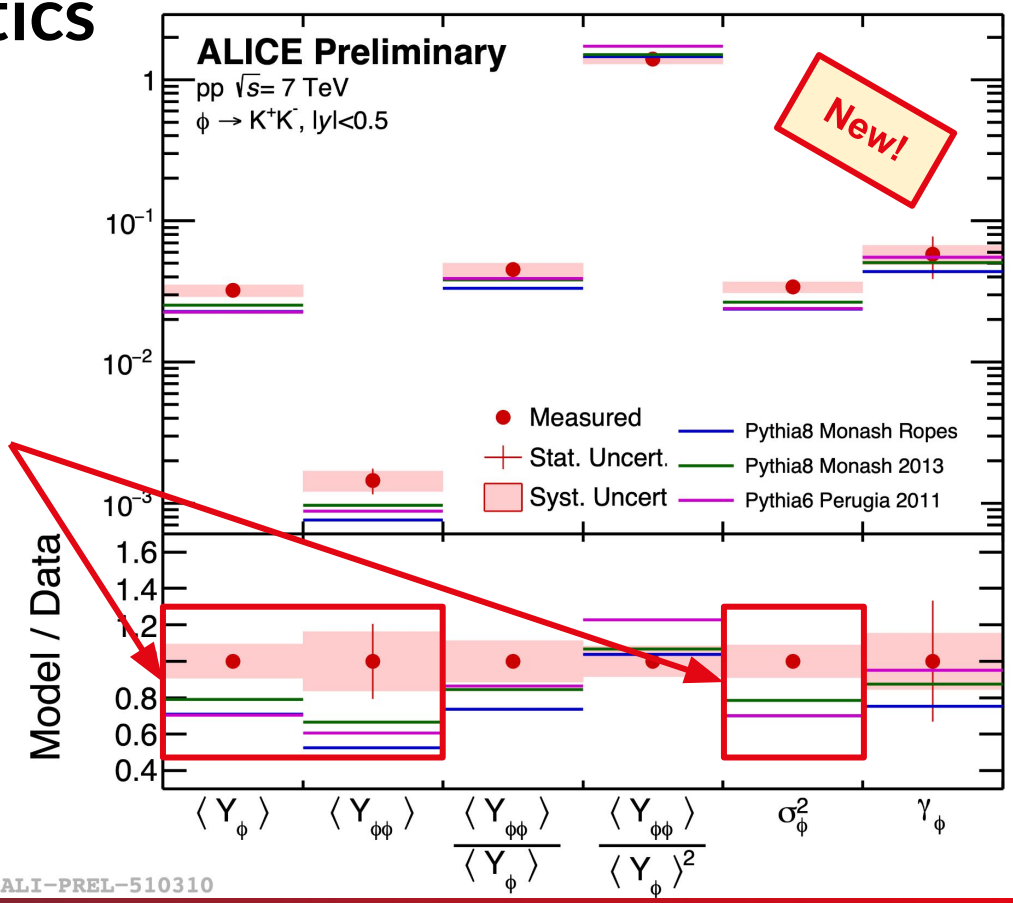
Average yield of produced ϕ mesons and ϕ-meson pairs, together with variance are underestimated



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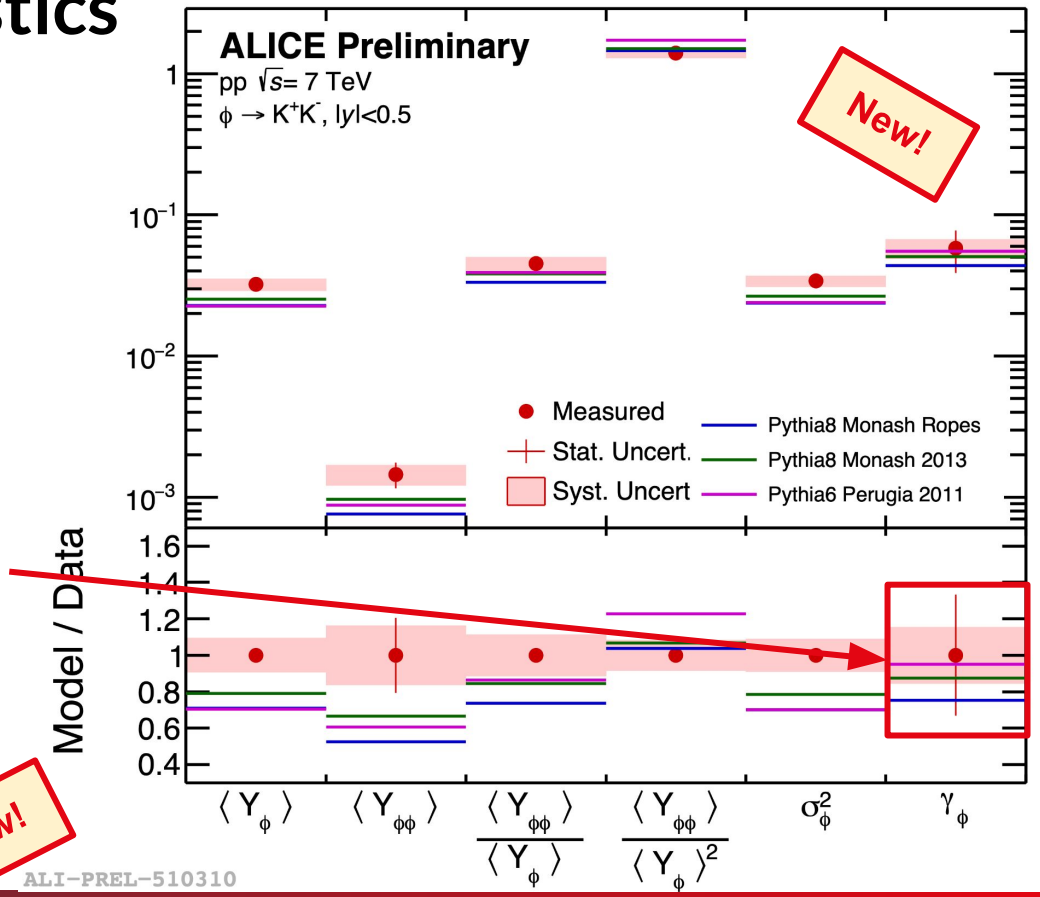
Mean p_T of conditional spectra can point to the generator's ability to reproduce their shape, although their yields are not reproduced

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

Excess w.r.t poissonian hypothesis: hint of accordance between data and string model

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

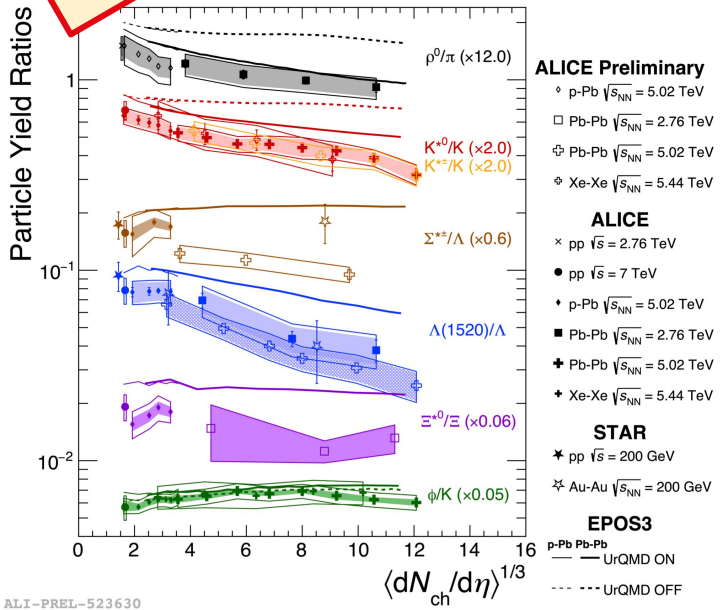
New!



Summary

ALICE continues to add new results on resonances that shed a brighter light on the hadronic phase

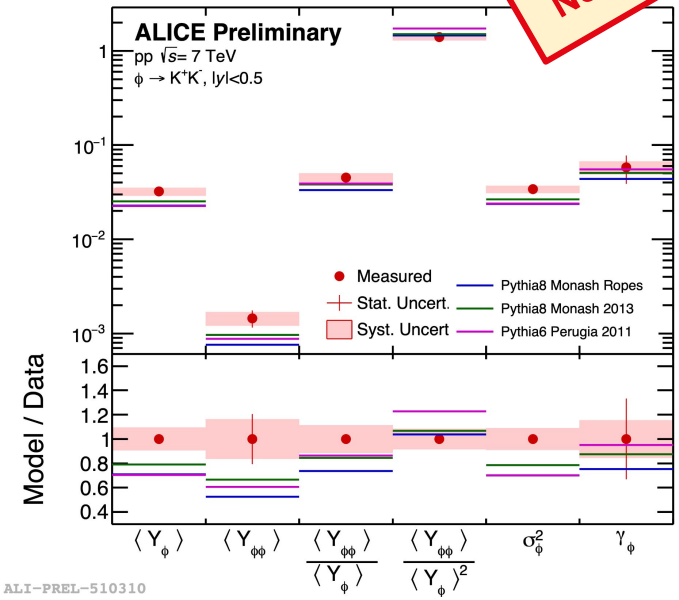
New!



Results from $K(892)^{*\pm}$ and $\Lambda(1520)$ hint at the presence of an hadronic phase in small systems

Results from $\phi(1020)$ are a new way to challenge phenomenological models

New!



π K Λ Ξ	>> 100 fm/*c*	$\Xi(1530)^0$	21.7 fm/*c*	$\Sigma(1385)^{*\pm}$	5-5.5 fm/*c*	$K(892)^{*\pm}$	3.9 fm/*c*
$\phi(1020)$	46.3 fm/*c*	$\Lambda(1520)$	12.6 fm/*c*	$K(892)^{*0}$	4.2 fm/*c*	$\rho_0(770)$	1.3 fm/*c*

ALICE: Phys.Rev.C 99 (2019) 064901
ALICE: Phys.Rev.C 91(2015) 024609
ALICE: PLB 802 (2020) 135225

Thank you!
Enjoy Bologna!

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