High transverse momentum resonance production in Pb-Pb, pp and p-Pb collisions at LHC

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Outline

- Motivation
- Resonance reconstruction in ALICE
- Results
- Nuclear modification factor
- Summary

ALICE

A JOURNEY OF DISCOVERY

Resonances in heavy-ion collision

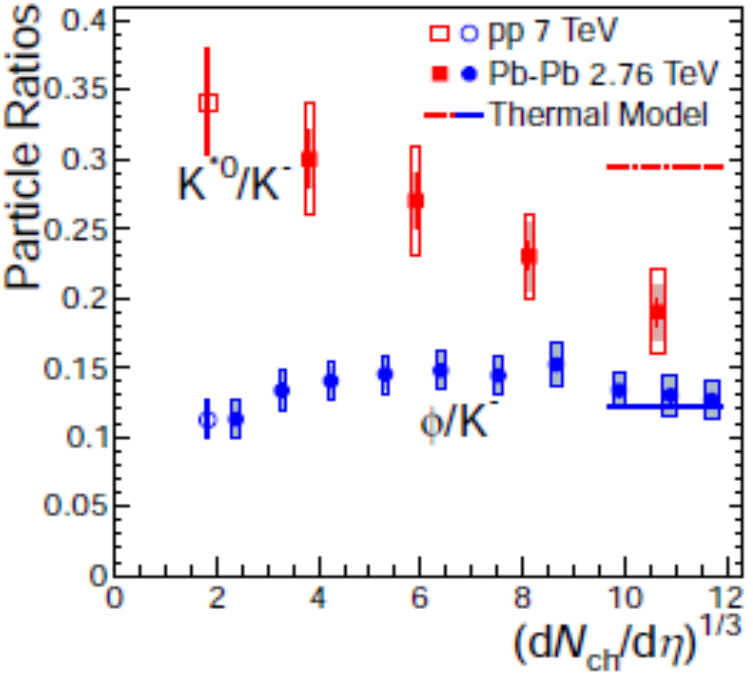
Resonances have very short lifetimes about few fm/c:

τ resonance ~ τ fireball

- **Yield :**
  - Information about regeneration and re-scattering

- **Nuclear modification factor :**
  - parton energy loss in the medium

- **Comparison with particles that have similar mass, baryon number and strangeness content :**
  - particle production mechanisms



arXiv:1404.0495v1

K^{*0}	Lifetime ~4 fm/c
Φ	Lifetime ~45 fm/c

pp and p-Pb provide reference to heavy-ion collisions

- **p-Pb measurement at $\sqrt{s_{NN}}$ = 5.02 TeV :**

  -- the study of the system size dependence of re-scattering effect
  -- disentangle nuclear matter effects from medium effect

- **pp measurement at $\sqrt{s_{NN}}$ = 2.76 TeV and 7 TeV :**

  -- are used to build reference spectra for R_{AA} and R_{pPb}
  -- help tuning QCD-inspired event generators

Pb-Pb

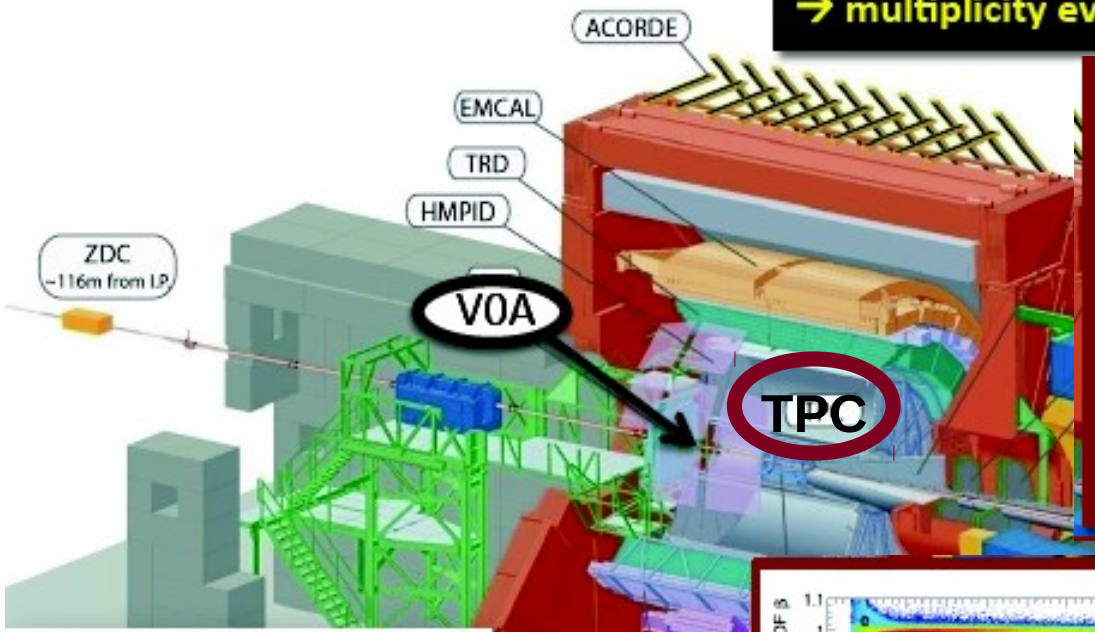
$$R_{PbPb} = \frac{1}{\langle T_{PbPb} \rangle} \times \frac{d^2 N^{ch}_{PbPb}/dp_T dy}{d^2 \sigma_{pp}/dp_T dy}$$

p-Pb

$$R_{pPb} = \frac{1}{\langle T_{pPb} \rangle} \times \frac{d^2 N^{ch}_{pPb}/dp_T dy}{d^2 \sigma_{pp}/dp_T dy}$$

The ALICE Detector

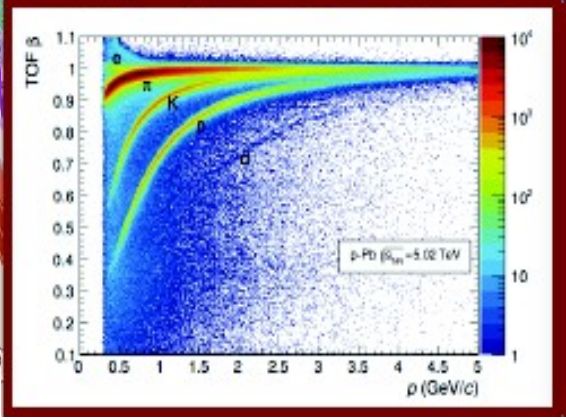
VZERO scintillator detectors:
→ **centrality** definition in Pb-Pb (V0A and V0C)
→ **multiplicity event classes** in p-Pb (V0A)

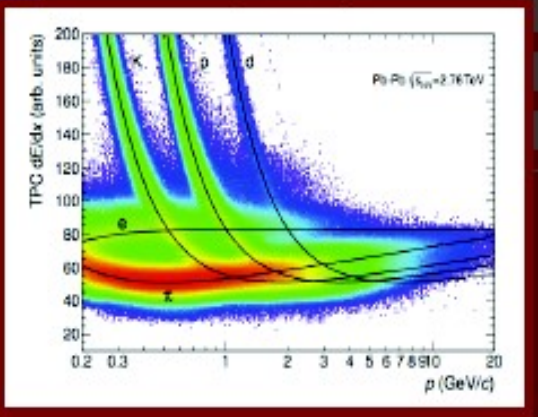


Time Projection Chamber (TPC)
- primary vertex
- global tracking
- Particle IDentification via d*E*/d*x* in gas

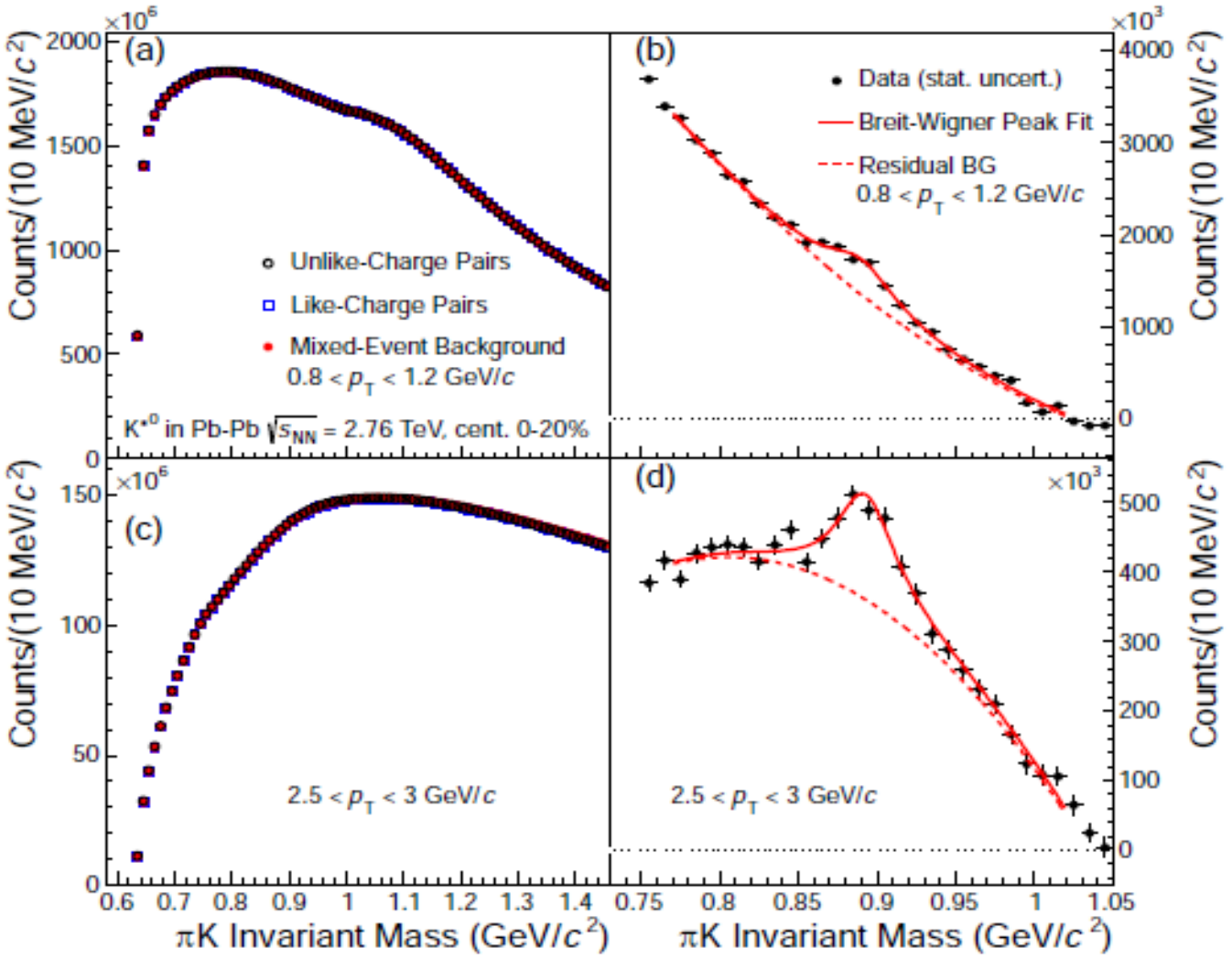
Time-Of-Flight (TOF)
- PID via time-of-flight measurement

→ **Identification of K,π** from resonance decay





Resonance reconstruction in ALICE

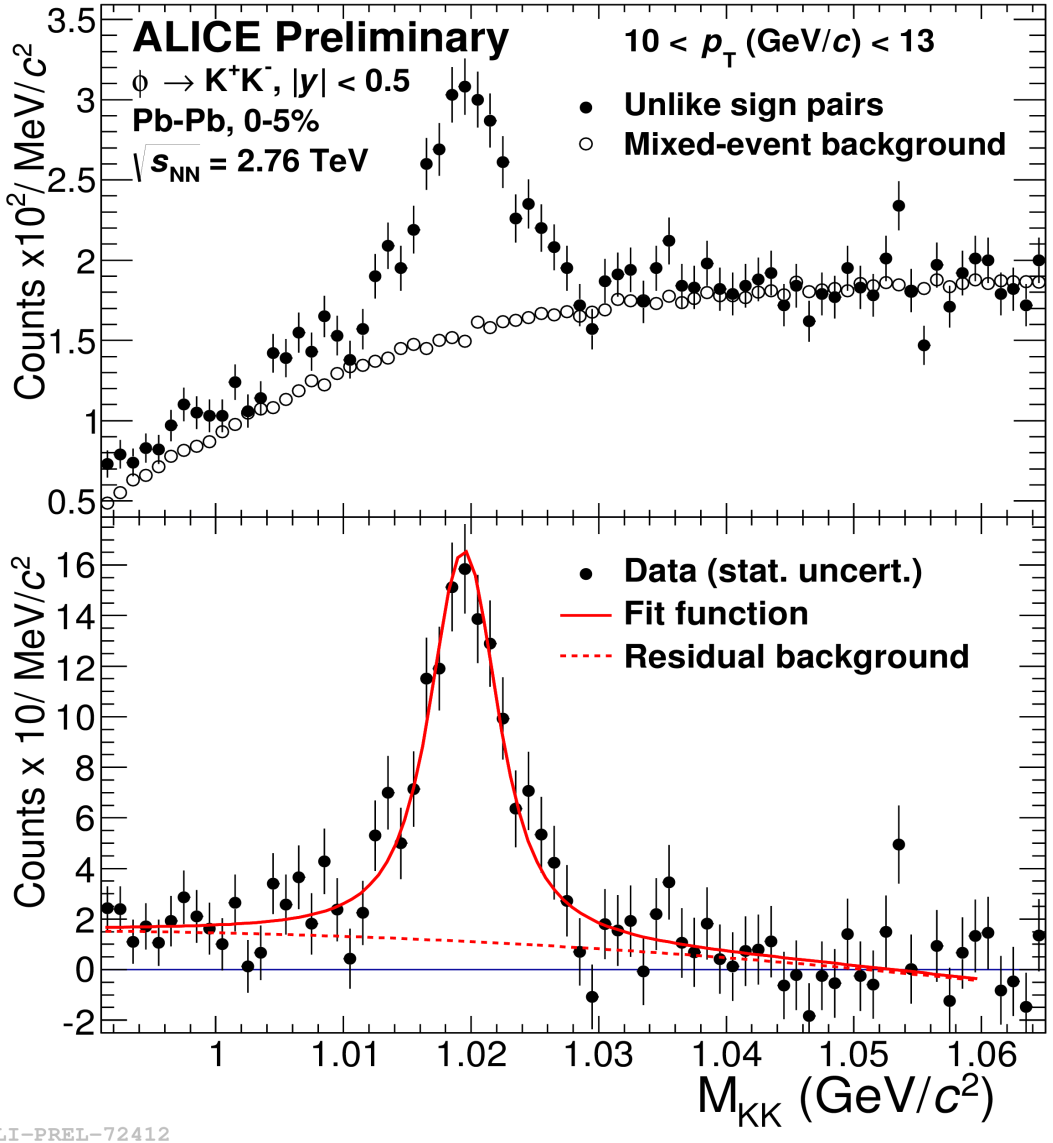


Low p_T Signal:

$K^{*0} \rightarrow K\ \pi$

Default Normalization Region: 1.1-1.3 (GeV/c^2)

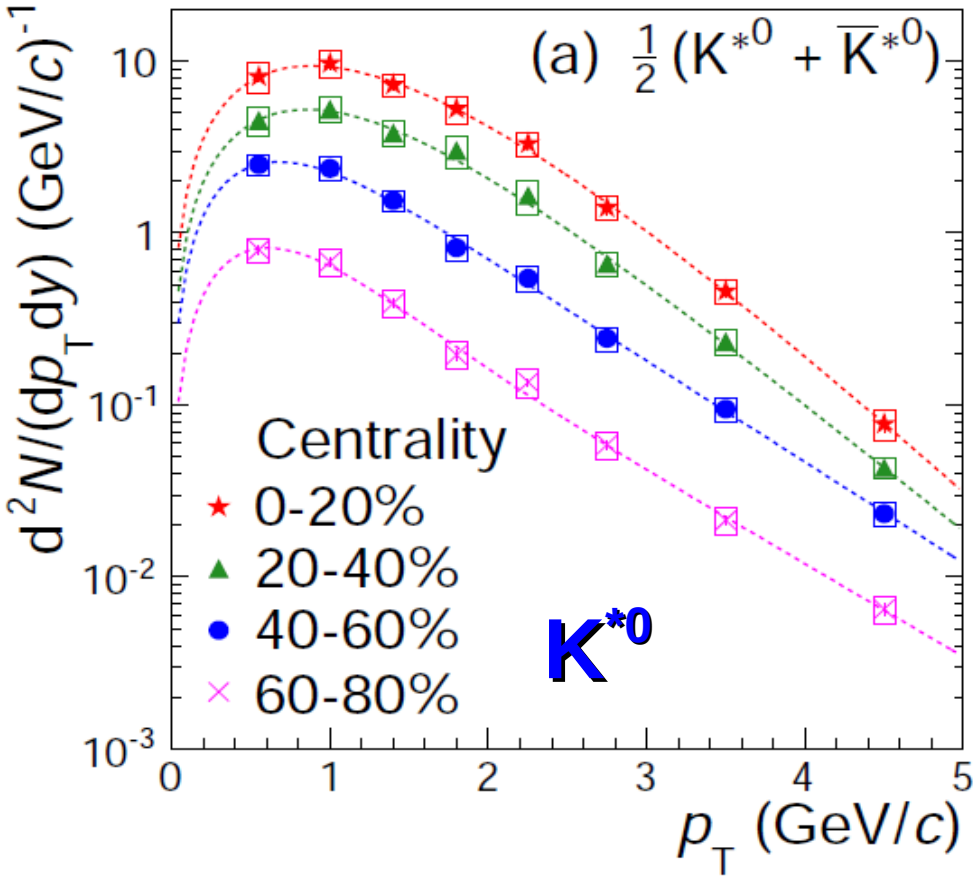
Resonance reconstruction in ALICE

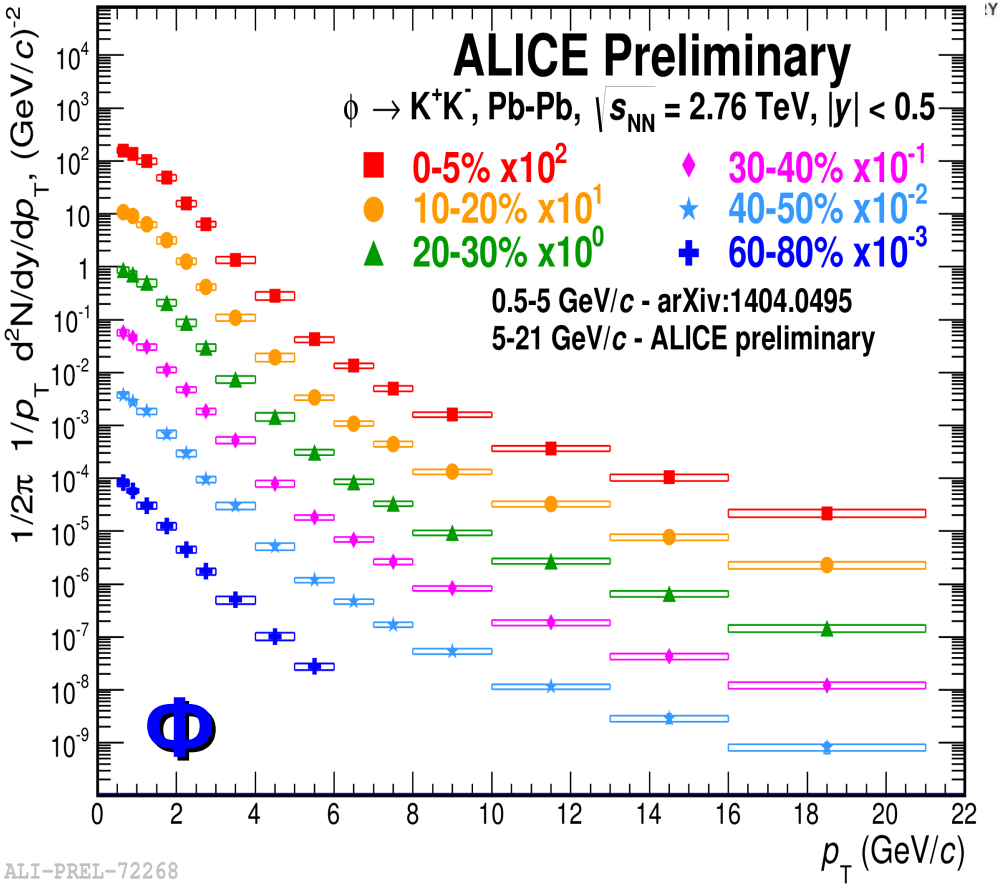


High p_T Signal:

$\varphi \rightarrow K^+K^-$

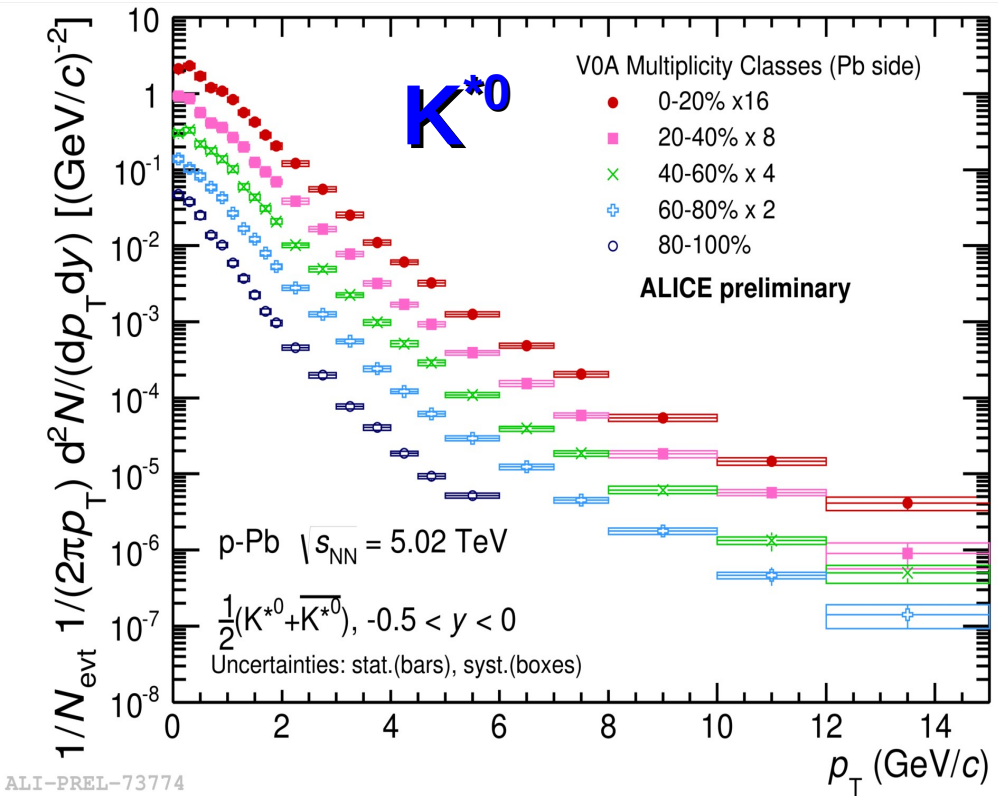
K^{*0}, Φ p_T spectra in Pb-Pb collisions

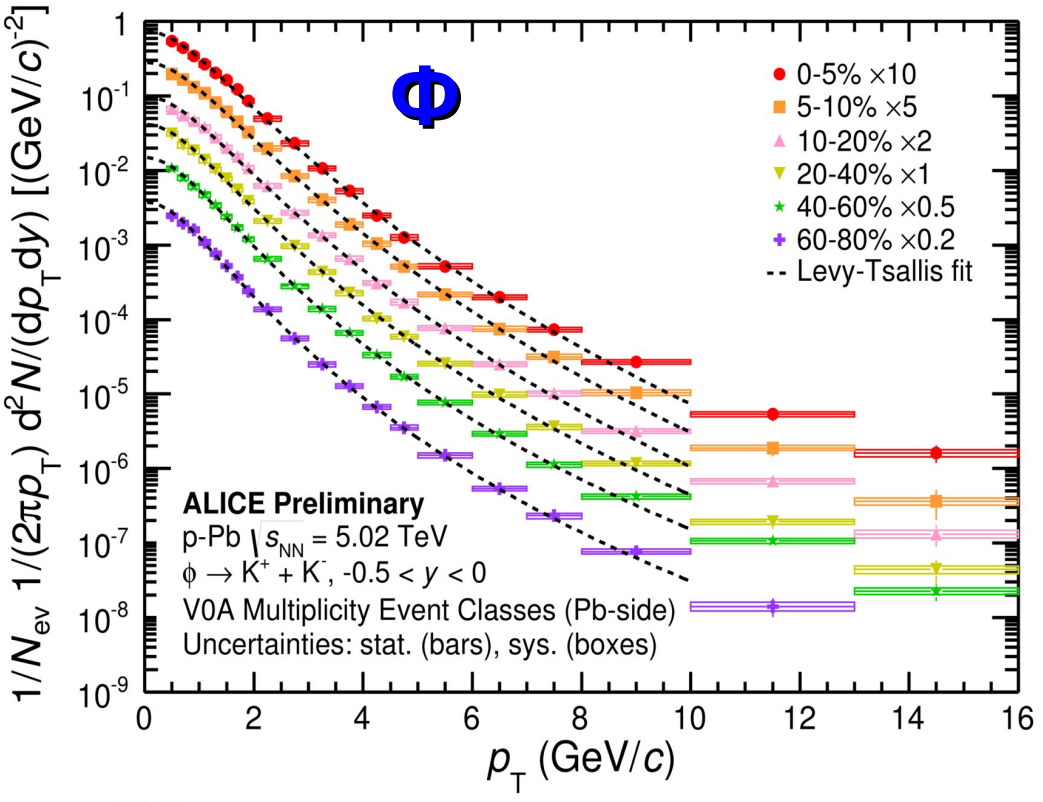




- 2010 data of Pb-Pb at $\sqrt{s_{NN}}$ = 2.76 TeV (arXiv: 1404.0495)
- 2011 data of Pb-Pb at $\sqrt{s_{NN}}$ = 2.76 TeV: p_T reach up to 21 GeV/c for Φ with finer centrality binning.

K^{*0}, Φ p_T spectra in p-Pb collisions



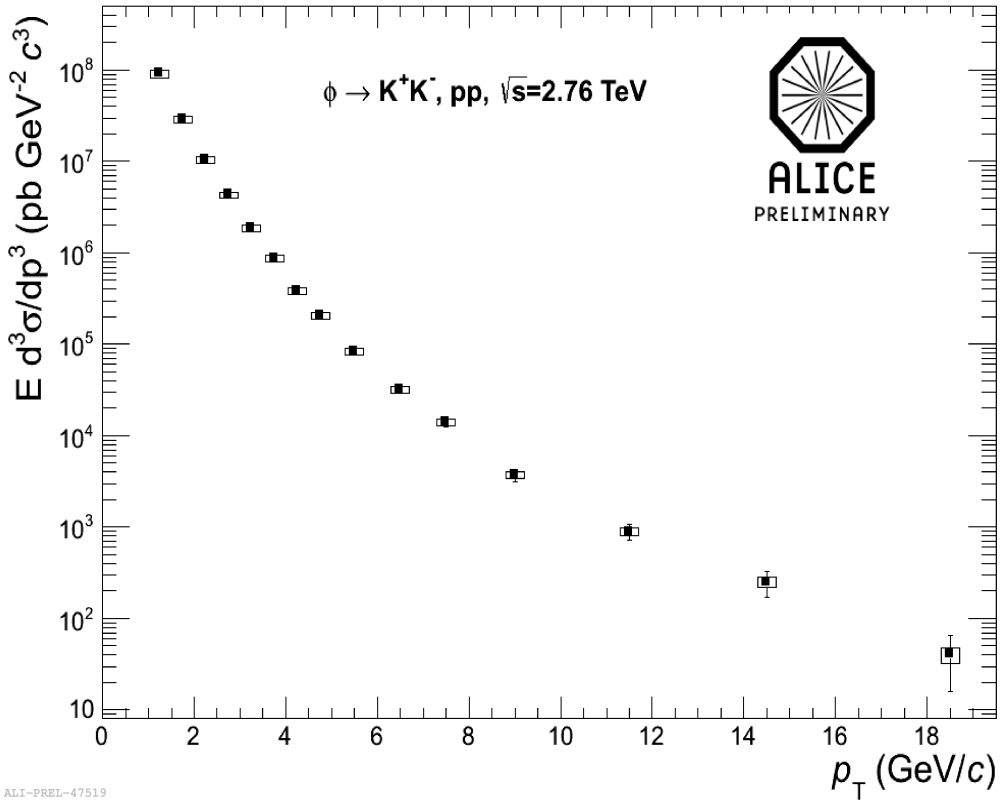


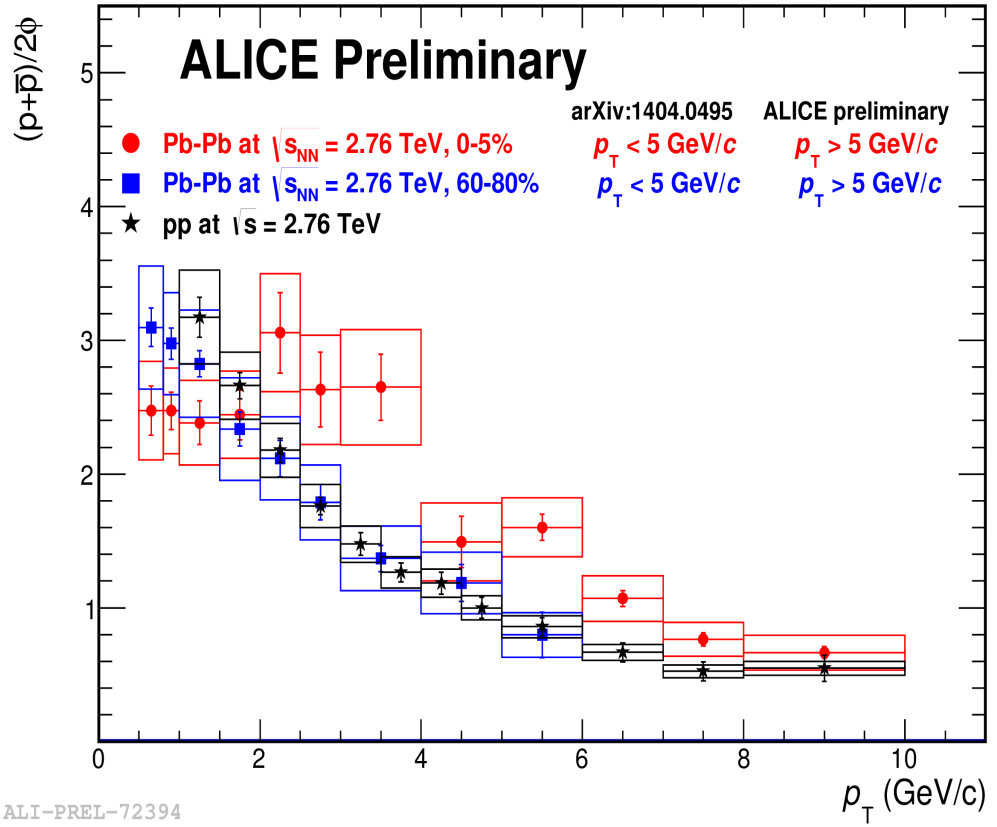
- 2013 data set for p-Pb $\sqrt{s_{NN}}$ = 5.02 TeV
- K^{*0} spectra: 0 < p_T < 15 GeV/c
- Φ spectra: 0.3 < p_T < 16 GeV/c

Levy-Tsallis:

$$\frac{1}{N_{evt}}\frac{d^2N}{dydp_T} = p_T\frac{dN}{dy}\frac{(n-1)(n-2)}{nT[nT+m(n-2)]}\left[1+\frac{\sqrt{p_T^2+m^2}-m}{nT}\right]^{-n}$$

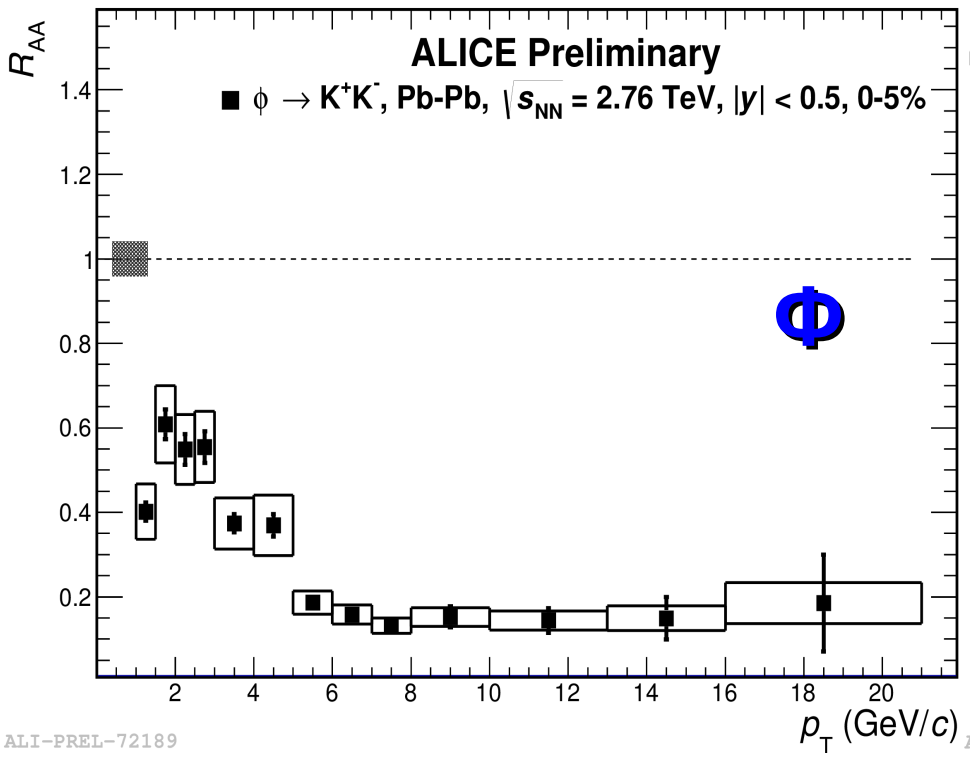
p/Φ ratio at high-p_T in Pb-Pb

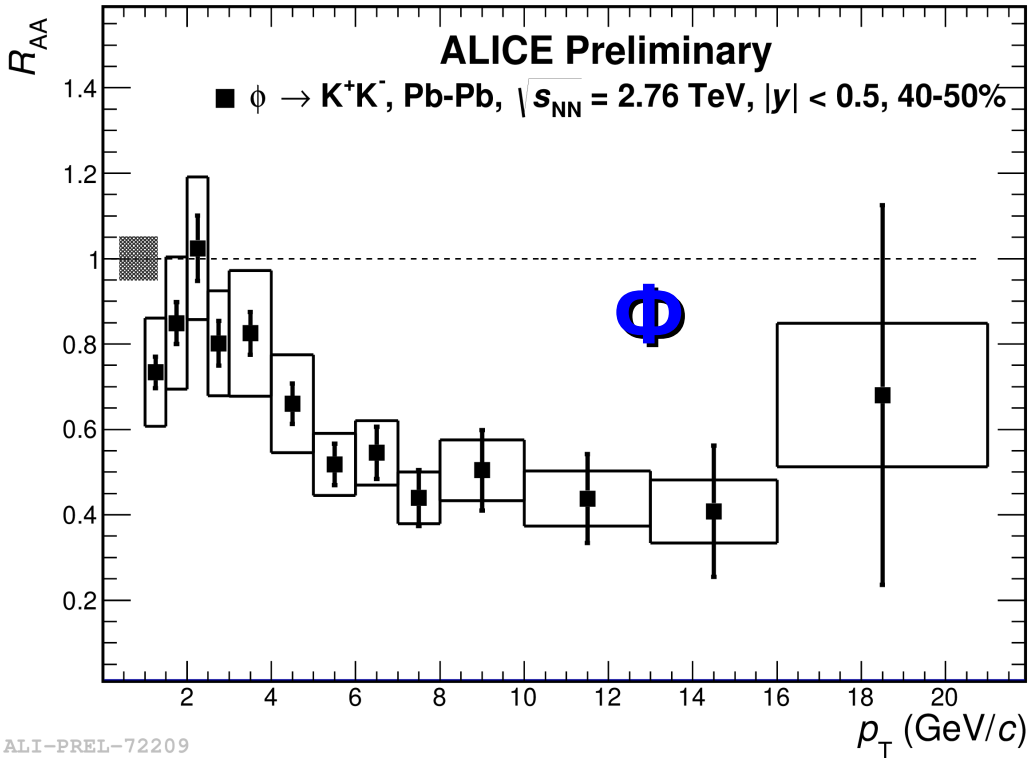




- At low-p_T in central collision ratio is flat
- At high-p_T almost no centrality dependent

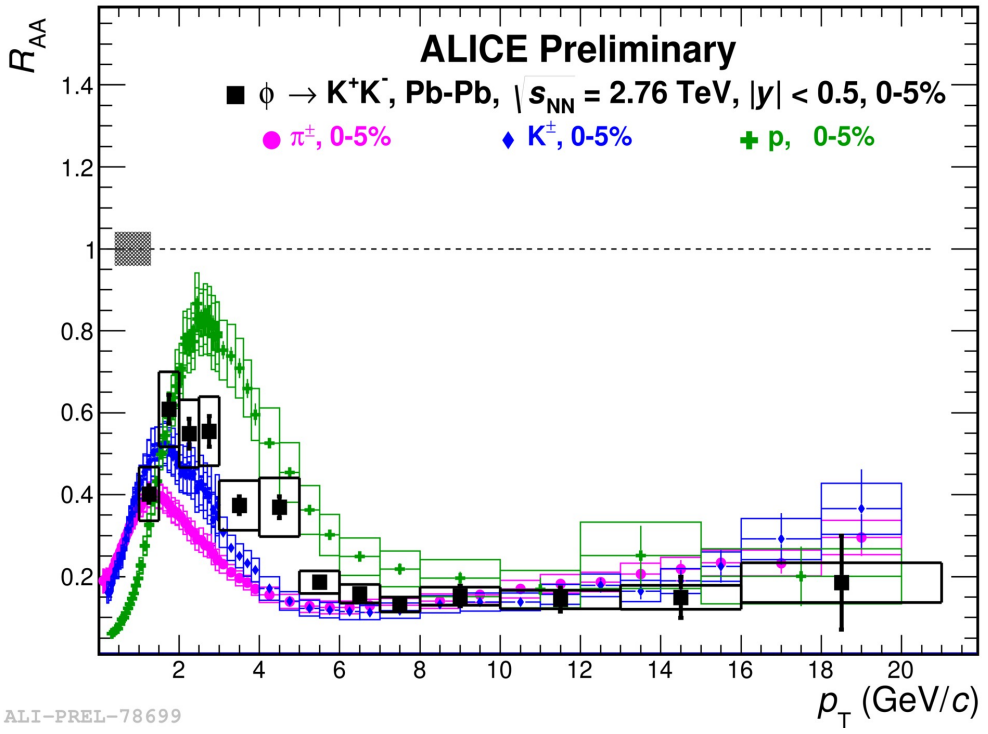
Nuclear modification factor: R_{AA}

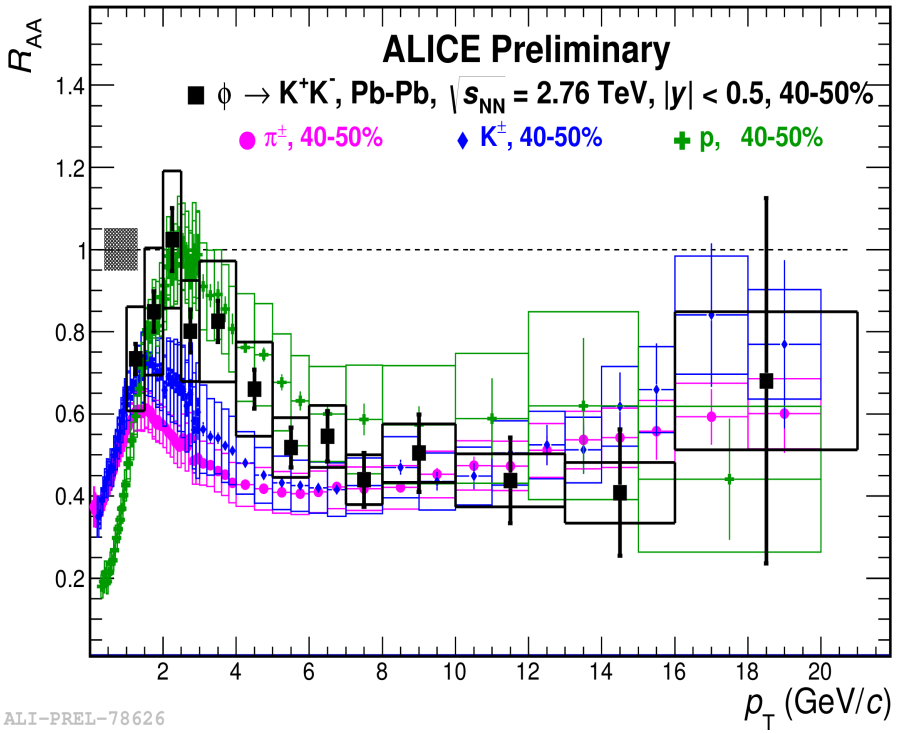




- R_{AA} < 1 for for all centrality
- Strong suppression for most central collisions

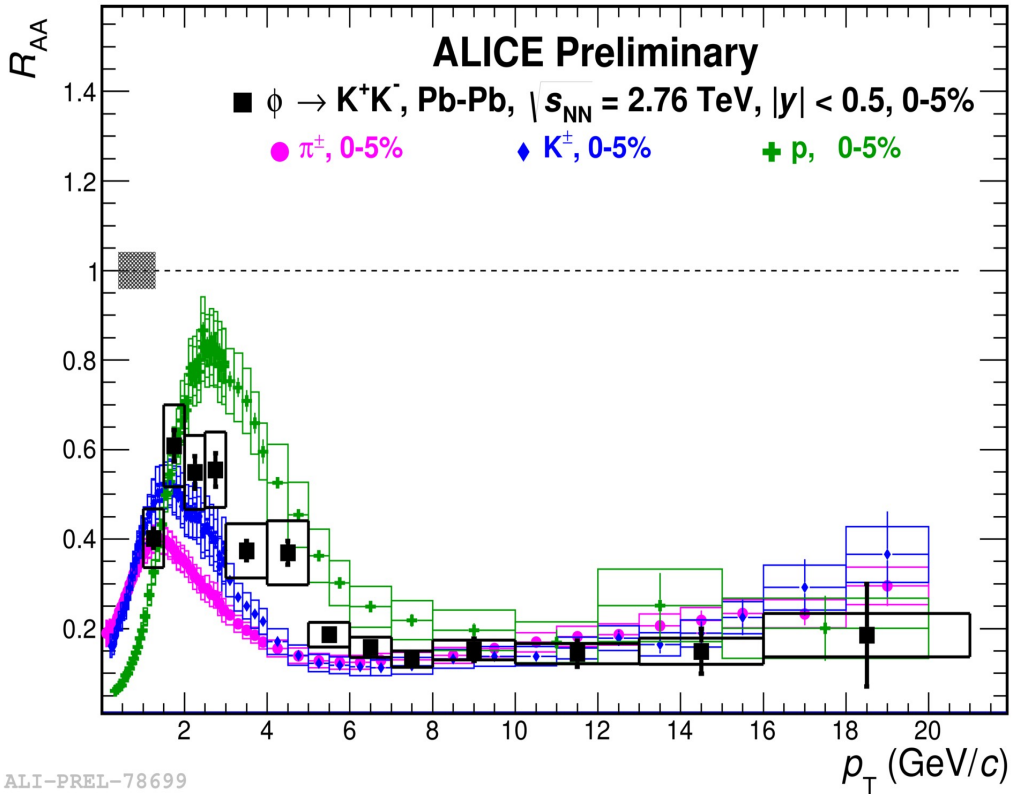
Nuclear modification factor: R_{AA}

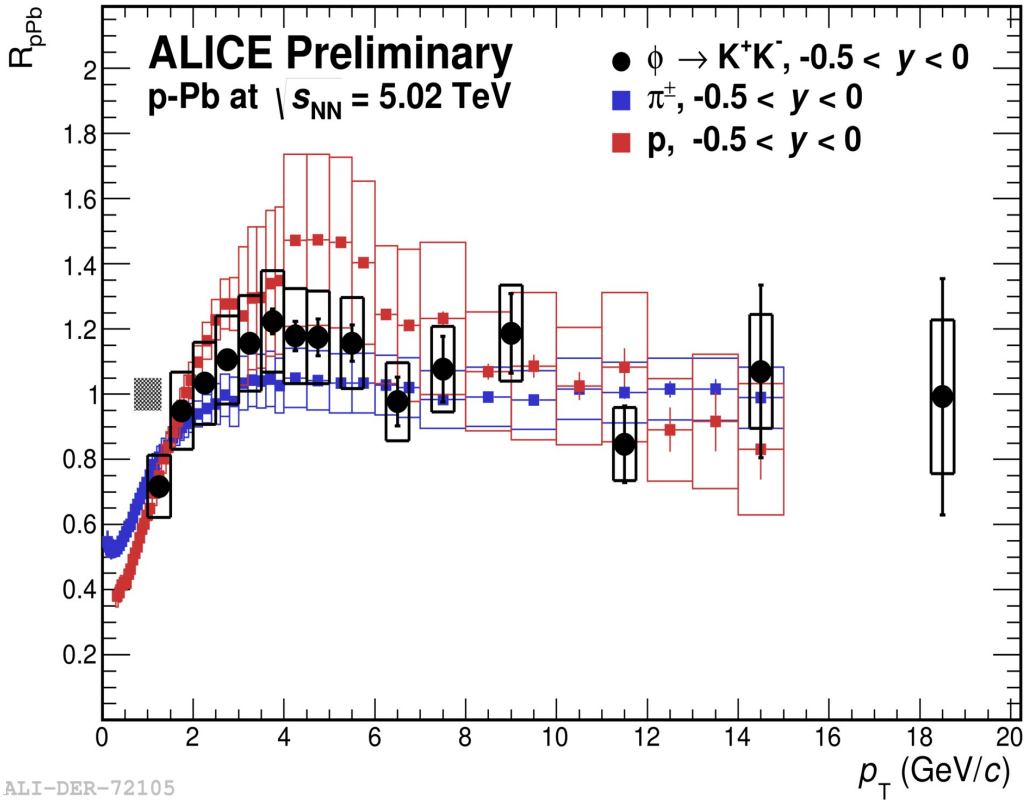




- **Intermediate-p_T :** Differences between p and φ R_{AA} due to the pp reference
- **High-p_T (p_T > 5 GeV/c)**: All hadrons have similar supression. No flavour dependence.

Φ nuclear modification factor in p-Pb, Pb-Pb





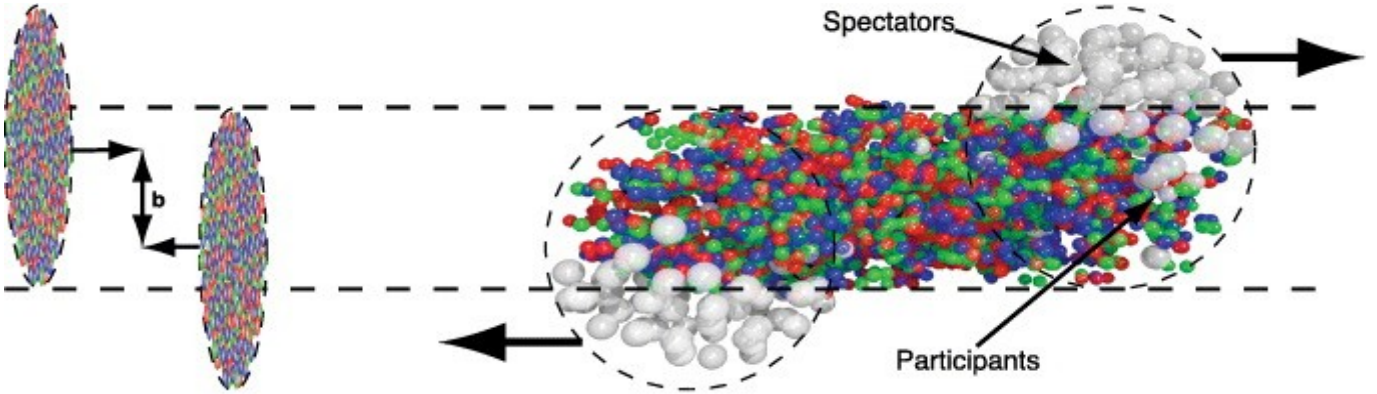
- In p-Pb no suppression with respect to pp at high p_T
- Moderate Cronin peak is visible at intermediate p_T
- Possible baryon/meson difference or mass dependence of R_{pPb}

Summary

- K^{*0}, φ resonance production has been measured in a wide momentum range in Pb-Pb,p-Pb and pp collisions in different centrality intervals with the ALICE experiment at LHC.
- Resonances are strongly suppressed (as all other hadrons) at high-p_T in central Pb-Pb collisions.
- No suppression in p-Pb collisions.
- No flavour dependence of suppression is observed in Pb-Pb and p-Pb
- p/Φ ratio is flat at low-p_T and it has no centrality dependence at high-p_T.

Thank You

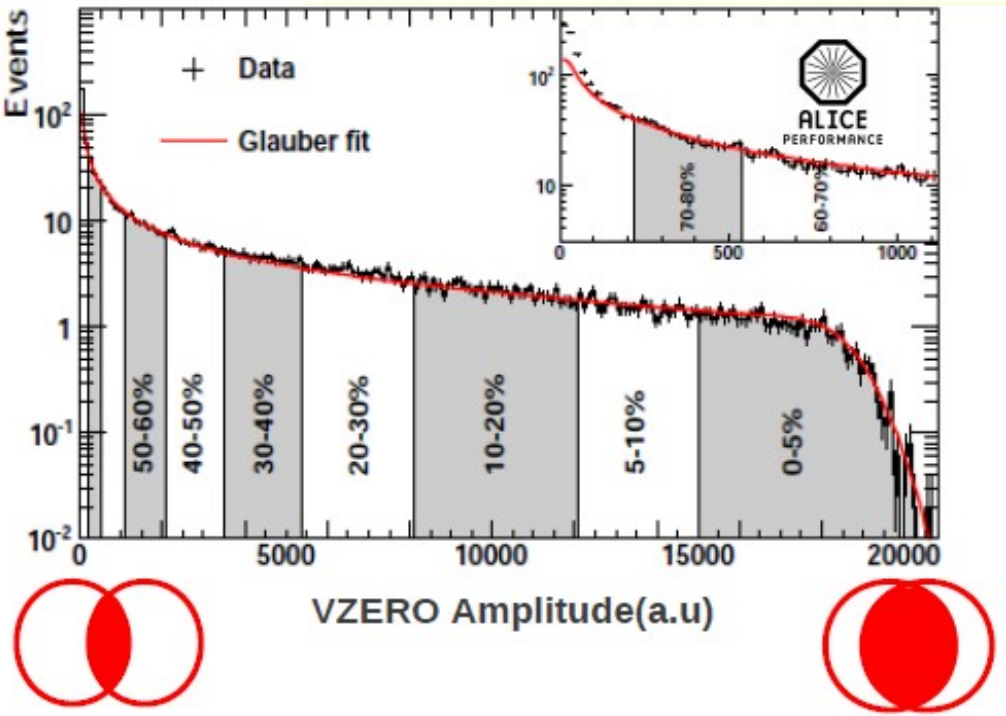
Event charactrization



before collision

after collision

- ✔ Impact parameter can't be determined experimentally.
- ✔ By fitting the data with Glauber model number of participant nucleons is extracted which is related to impact parameter.



B. Abeleb et al., Phys. Rev. C 88 044909 (2013)
R. J. Glauber Nucl. Phys. A 774, 3 (2006)