

# Kaon Isospin Fluctuation in Pb-Pb collisions at

$\sqrt{s_{NN}} = 2.76$  TeV with ALICE at the LHC

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## Introduction

► **DCC: Transient region** where chiral order parameter ( $\sigma$ ) differs from its value in the vacuum [5].

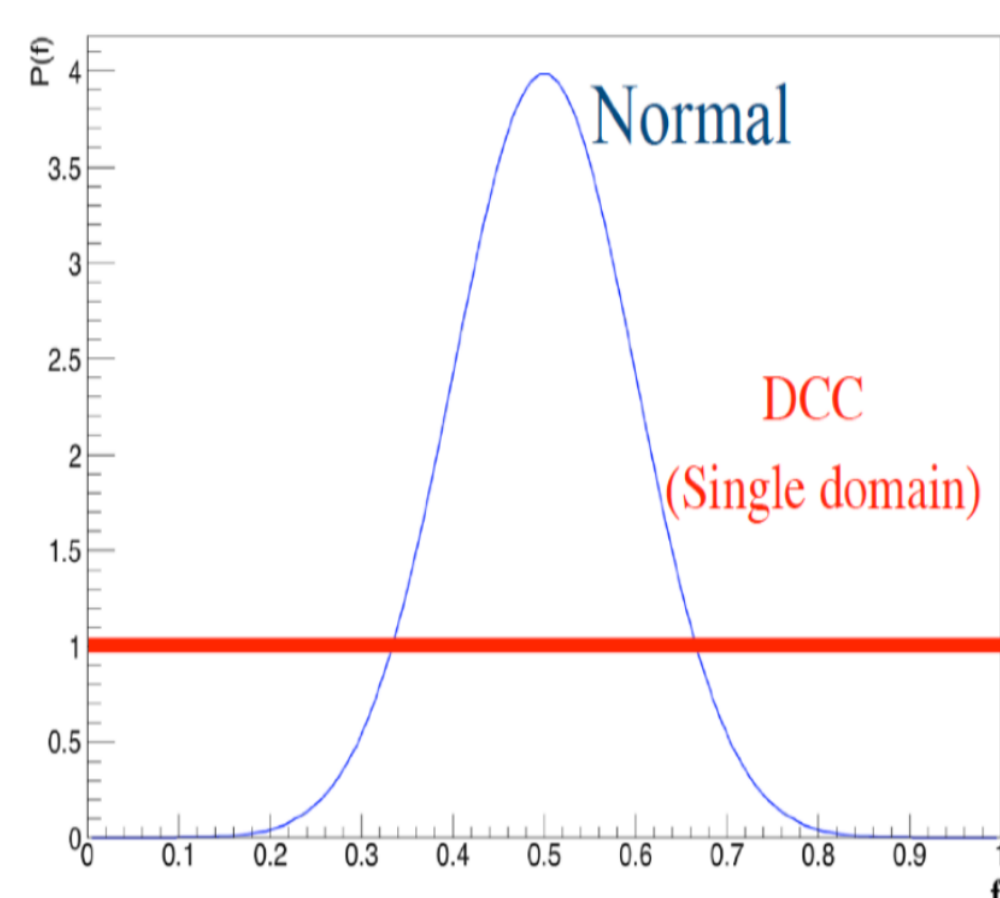
► **Generic production** : Kaons are produced normally.

► **For SU(3):**  $\sigma \sim \cos\theta \langle \bar{u}u + d\bar{d} \rangle + \sin\theta \langle \bar{s}s \rangle$

► **Kaon fraction** = 
$$f_K = \frac{K^0 + \bar{K}^0}{K^0 + \bar{K}^0 + K^+ + K^-}$$

► **Generic production** :  $f_K = 1/2$ .

► **DCC production** : Low  $p_T$  kaons with probability  $P(f_K) = 1$  [3,4].



► **DCC in kaon** : Can be studied with  $v_{dyn}$  [1].

► **Seek evidence for anomalous kaon isospin fluctuation** in central Pb-Pb collisions.

► **Determine magnitude of the isospin fluctuation.**

## Fluctuation Observable

$$R_{cc} = \frac{\langle N_c(N_c - 1) \rangle}{\langle N_c \rangle^2} - 1 \quad R_{c0} = \frac{\langle N_0(N_0 - 1) \rangle}{\langle N_0 \rangle^2} - 1 \quad R_{c0} = \frac{\langle N_c N_0 \rangle}{\langle N_0 \rangle \langle N_c \rangle} - 1$$

$N_c$  - Number of charged kaons ( $K^\pm$ ).

$N_0$  - Number of neutral kaons ( $K_s^0$ ).

$$v_{dyn} = R_{cc} + R_{00} - 2R_{c0} \quad [2]$$

► **In specific acceptance**  $K^\pm$  and  $K_s^0$  are calculated for each centrality.

► **Average number of singles and pairs** are obtained.

► **Values of  $v_{dyn}$**  are then calculated for each centrality bin.

## Data and Particle Selection

**Pb-Pb data:** ALICE, **MC data:** HIJING and AMPT

► **Event selection:**

Vertex cut of  $\pm 10$  cm.  
Centrality selection with V0A and V0C.  
MB trigger.

►  **$K^\pm$  track selection:**

$|\eta| < 0.5$   
 $0.2 < p_T < 1.5$  GeV/c

► **Neutral kaon selection ( $K_s^0$ ):**

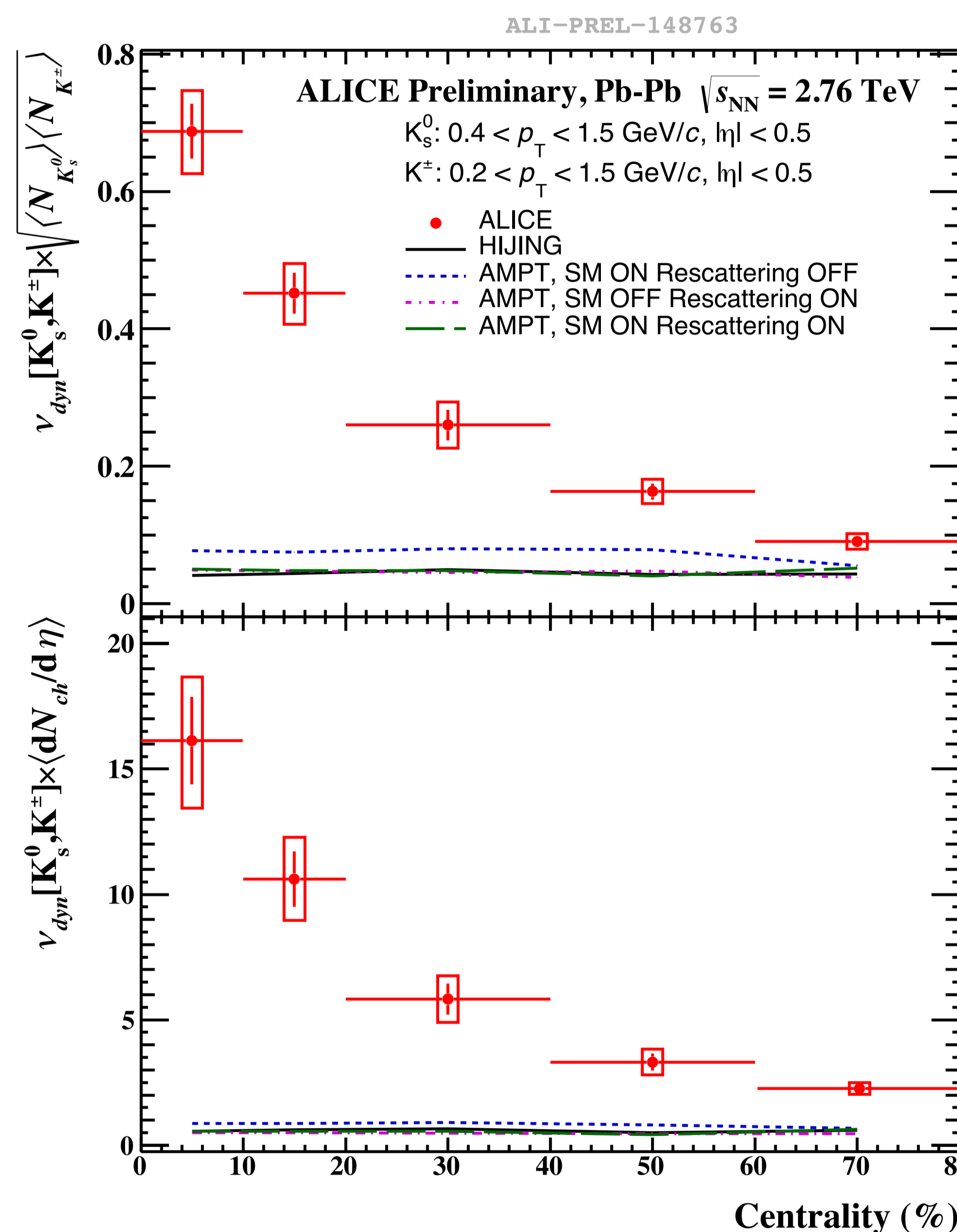
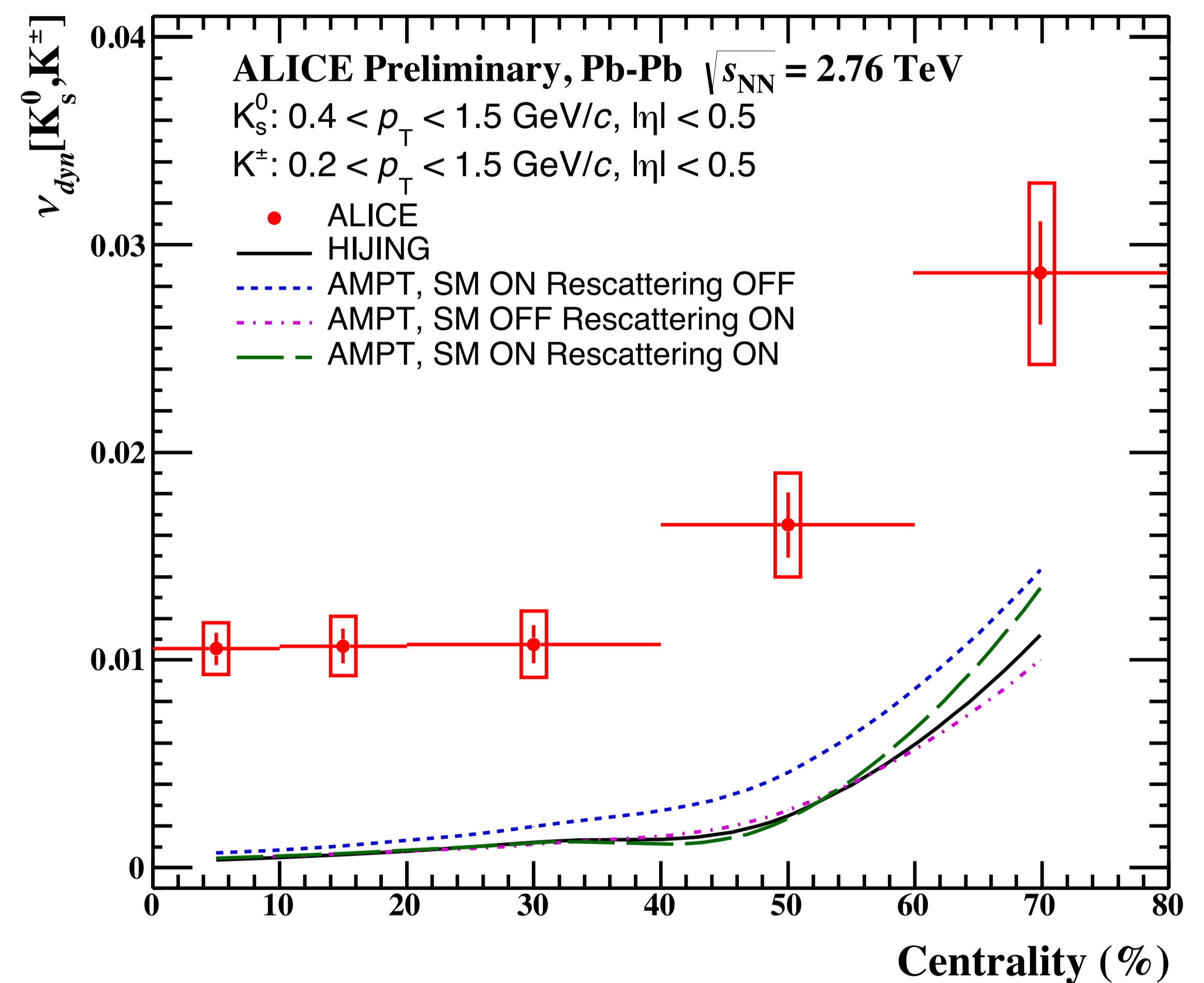
$|\eta| < 0.5$ ,  
 $0.4 < p_T < 1.5$  GeV/c

$K_s^0 \rightarrow \pi^+ + \pi^-$   
 $0.49 < M_{inv} < 0.505$  GeV

$0.2 < p < 0.39$	$ \eta\sigma  < 2$	TPC
$0.39 < p < 0.47$	$-0.5 < n\sigma < 2$	TPC
$0.47 < p < 0.5$	$ \eta\sigma  < 2$	TPC
$0.5 < p < 0.7$	$ \eta\sigma  < 2$	TPC+TOF
$0.7 < p < 1.5$	$ \eta\sigma  < 2$	TOF

## Results

- **Values of  $v_{dyn}$  increase as a function of centrality.**
- **Models underestimate the data.**



- **HIJING and AMPT:  $v_{dyn}$  is flat.**
- **Data: 1/n scaling violation.**
- **Intriguing signal in data.**

## Summary

- **Measured  $v_{dyn}$  values for  $K_s^0$  and  $K^\pm$ , signals that 1/n scaling is violated in data.**
- **May be sensitive to possible isospin fluctuation in kaon.**
- **HIJING and AMPT models fail to describe the data.**

## References

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