

# Charged-particle production in pp collisions at 13.6 TeV and Pb-Pb collisions at 5.36 TeV with ALICE

Abhi Modak\* (University of Brescia)  
On behalf of the ALICE Collaboration

\*[abhi.modak@cern.ch](mailto:abhi.modak@cern.ch)



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- ❑ Described by pQCD

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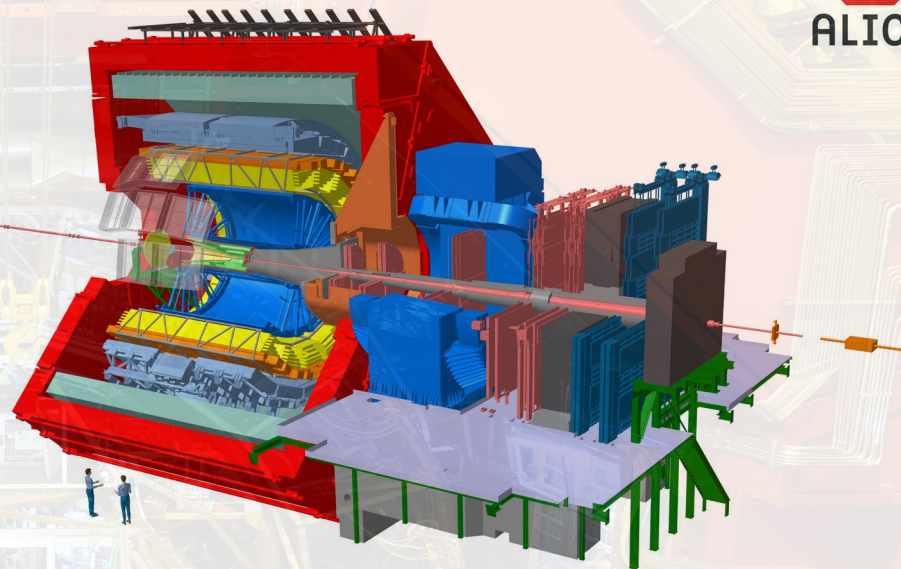
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### ALICE Run 3 results presented here

- ✓ pp collisions @  $\sqrt{s} = 13.6$  TeV
- ✓ Pb-Pb collisions @  $\sqrt{s_{\text{NN}}} = 5.36$  TeV

# ALICE detector system (Run 3)



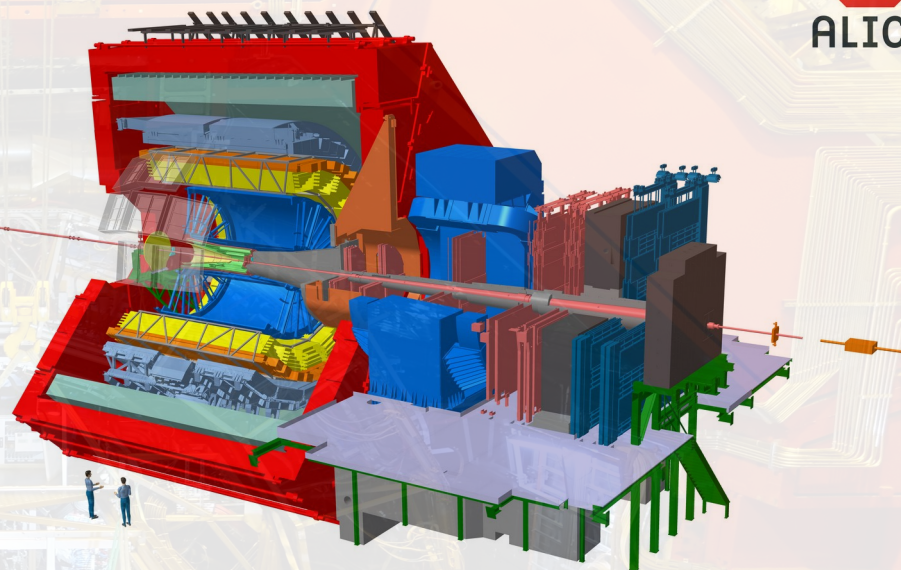
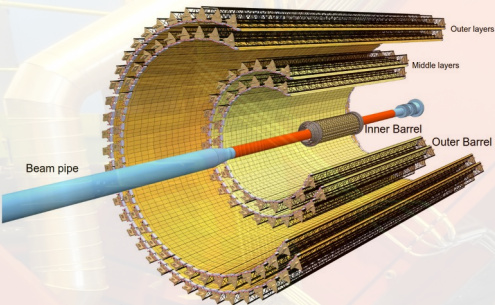
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ALICE

## New Inner Tracking System [See Jian Liu's talk](#)

- ❖ New Si inner tracker
- ❖ 3 inner layers 0.36% X0 each
- ❖ Closer to beam
- ❖ 50 kHz continuous readout
- ❖  $|\eta| < 1.3$

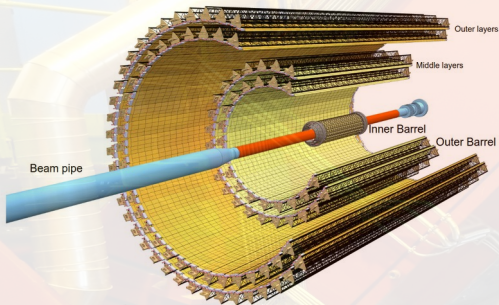


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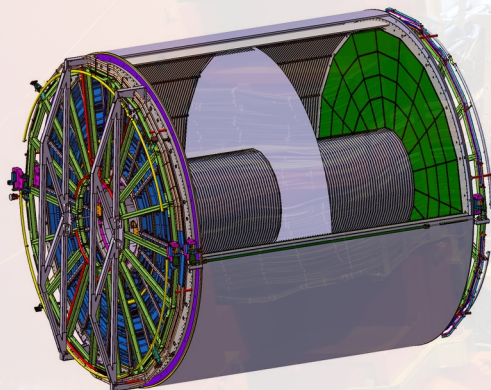
ALICE

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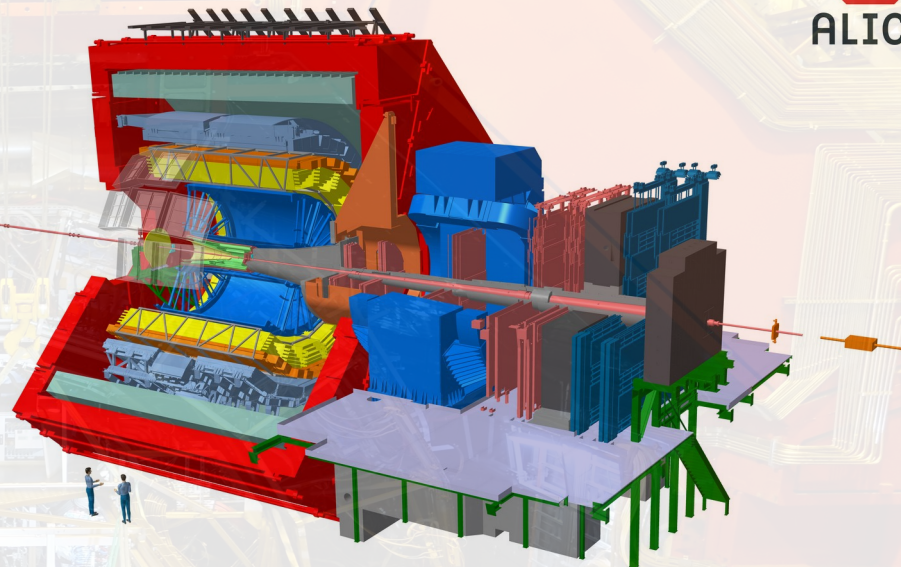


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## Time Projection Chamber



- ❖ 4 layers of GEM
- ❖ 50 kHz continuous readout
- ❖  $|\eta| < 0.9$



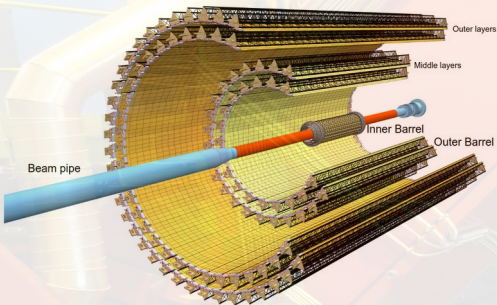


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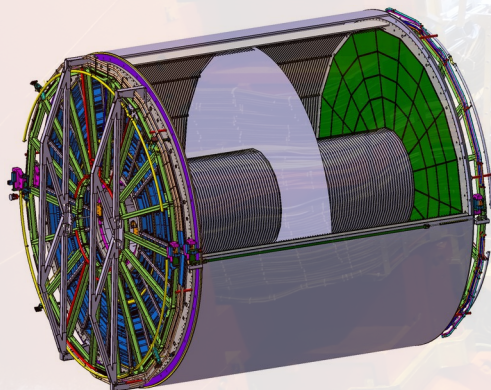
ALICE

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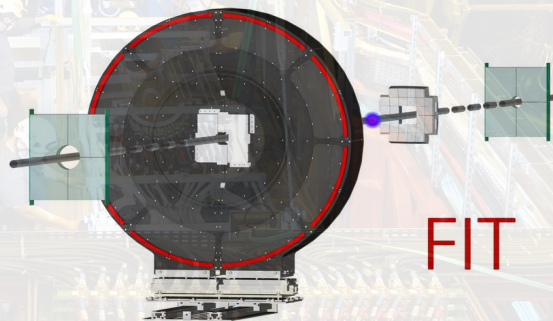
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## Fast Interaction Trigger

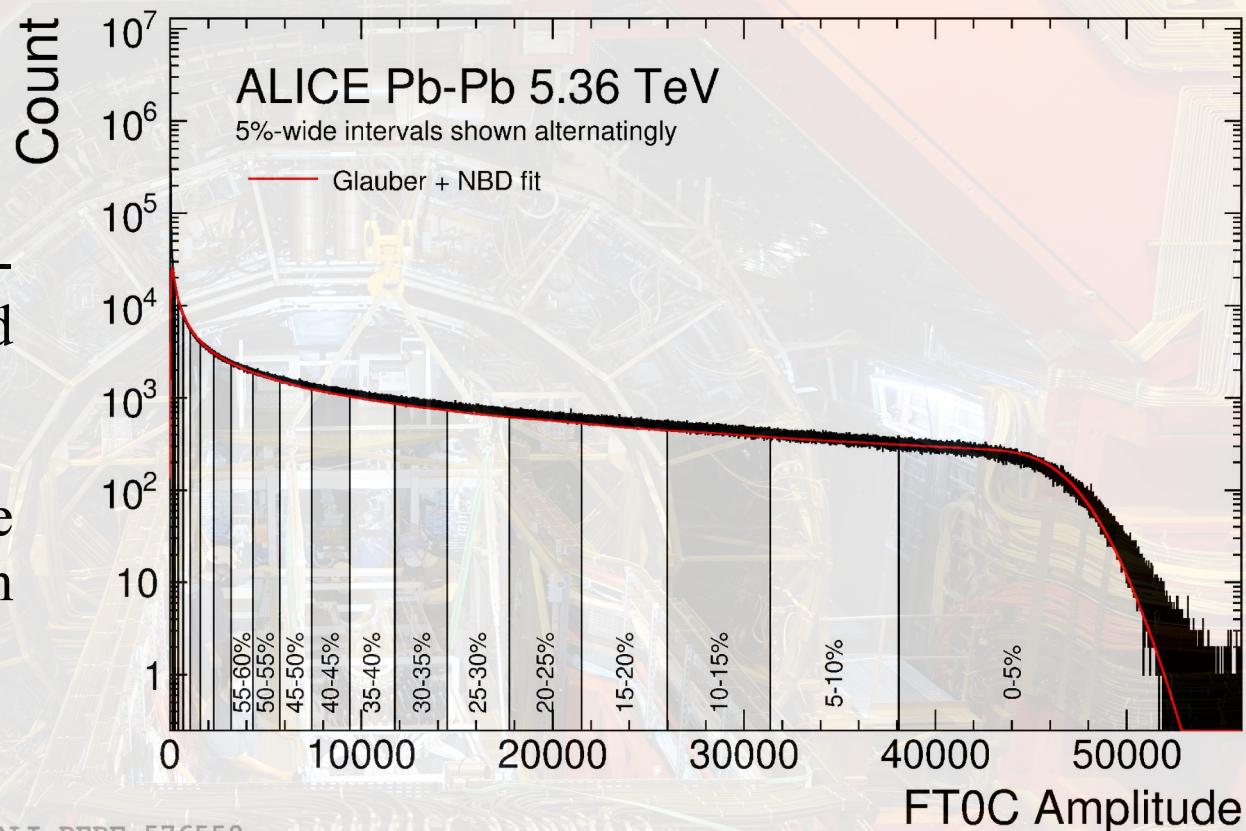


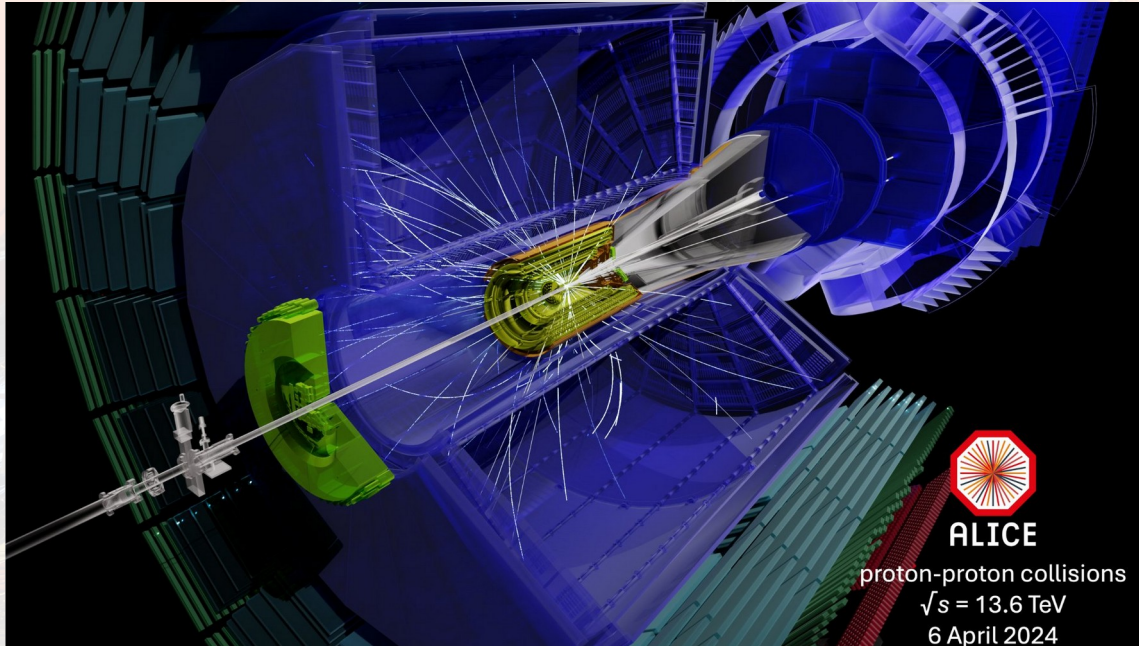
[See Yury Melikyan's talk](#)

- ❖ Centrality, event plane
- ❖ Luminosity
- ❖ Interaction time
- ❖ FT0A ( $3.5 < \eta < 4.9$ )
- ❖ FT0C ( $-3.3 < \eta < -2.1$ )

## Centrality classification

- **Pb-Pb:** Performing NBD-Glauber fit to measured FT0C amplitude
- **pp:** Multiplicity classes are determined by the signal sum of FT0A and FT0C





# Proton-proton collisions

# Minimum-bias $dN_{\text{ch}}/d\eta$ in pp

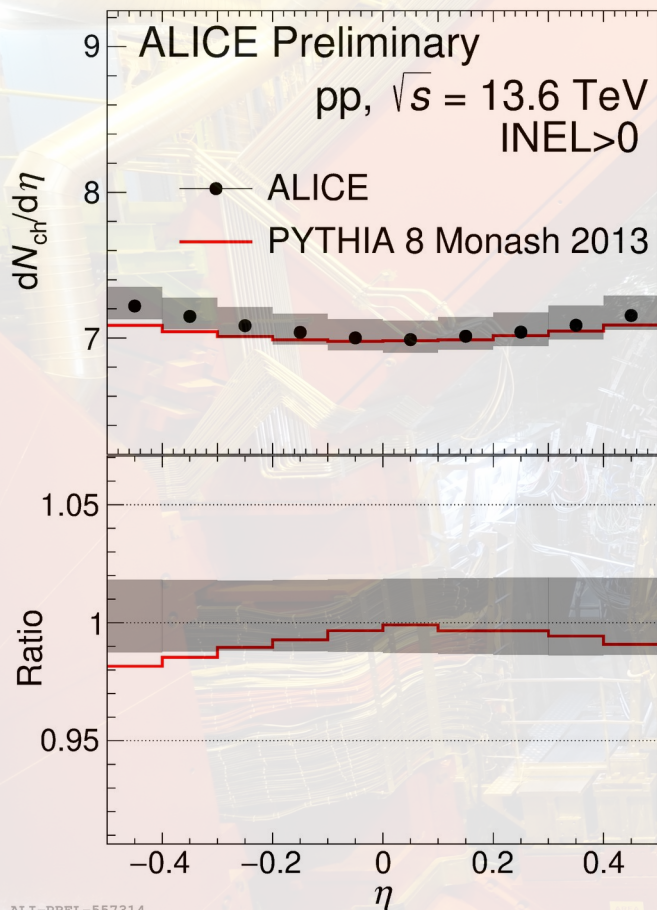


ALICE

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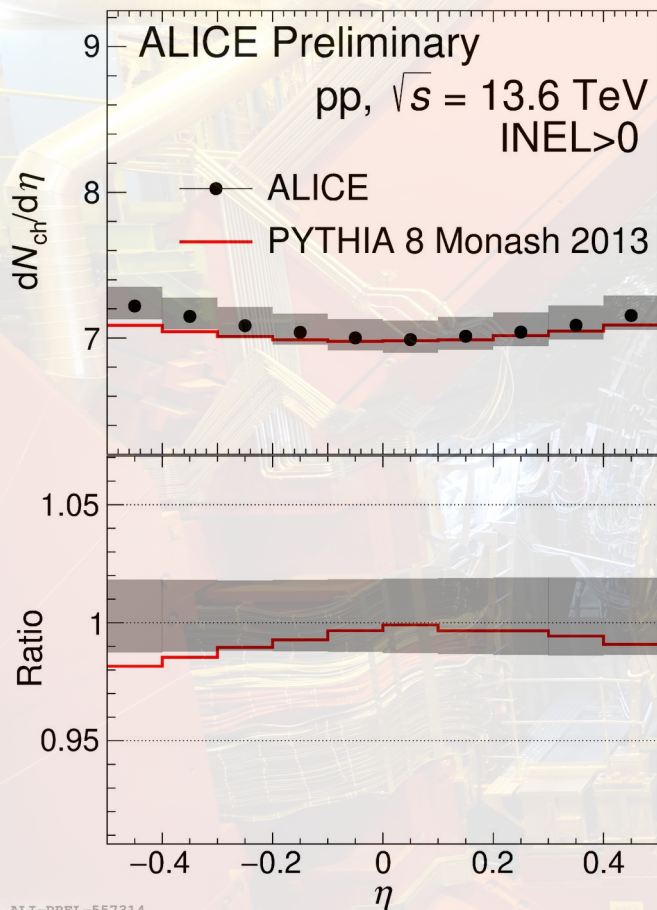


ALICE

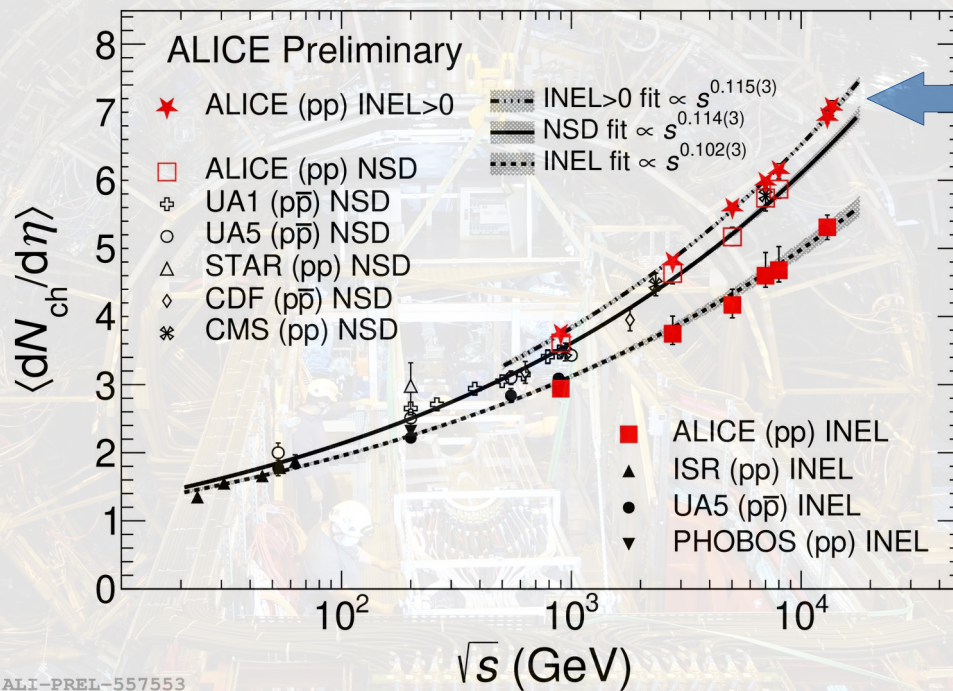


- ❖ INEL>0: Inelastic events having at least one  $N_{ch}$  in  $|\eta| < 1$
- ❖ PYTHIA 8 describes the MB results well

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13.6 TeV

New result follows the trend established from previous pp measurements

ALI-PREL-557314

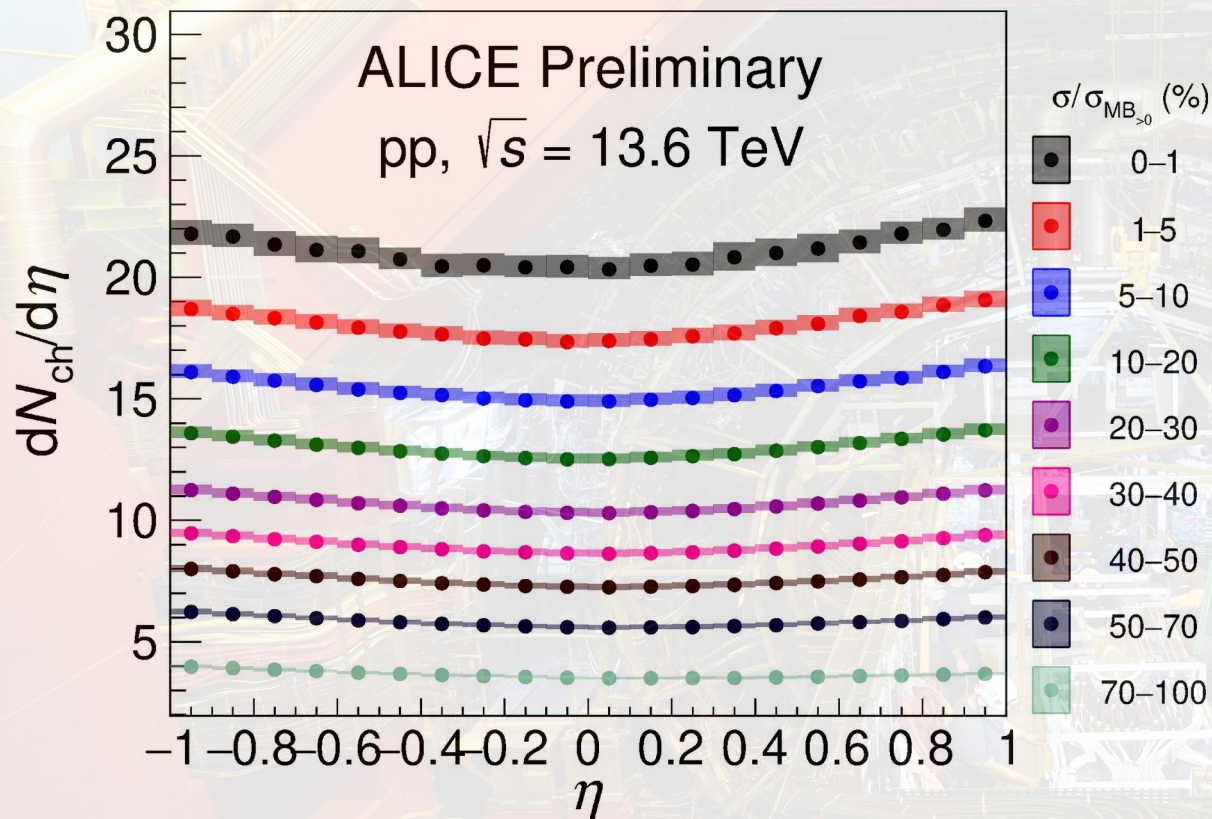
ALI-PREL-557553

# Multiplicity dependent $dN_{ch}/d\eta$ in pp



ALICE

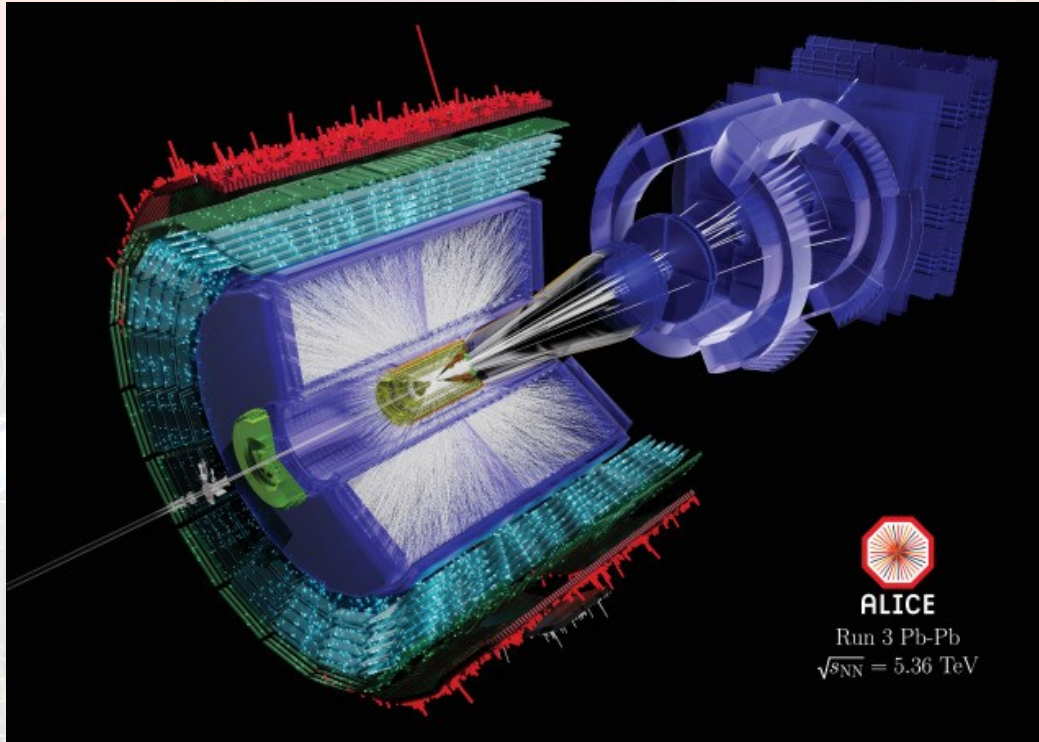
**NEW**



❖ Factor  $\sim 7$  increase in  $dN_{ch}/d\eta$  at 0-1% relative to 70-100%

❖ Good input for various particle production models

ALI-PREL-574016



## Lead-lead collisions

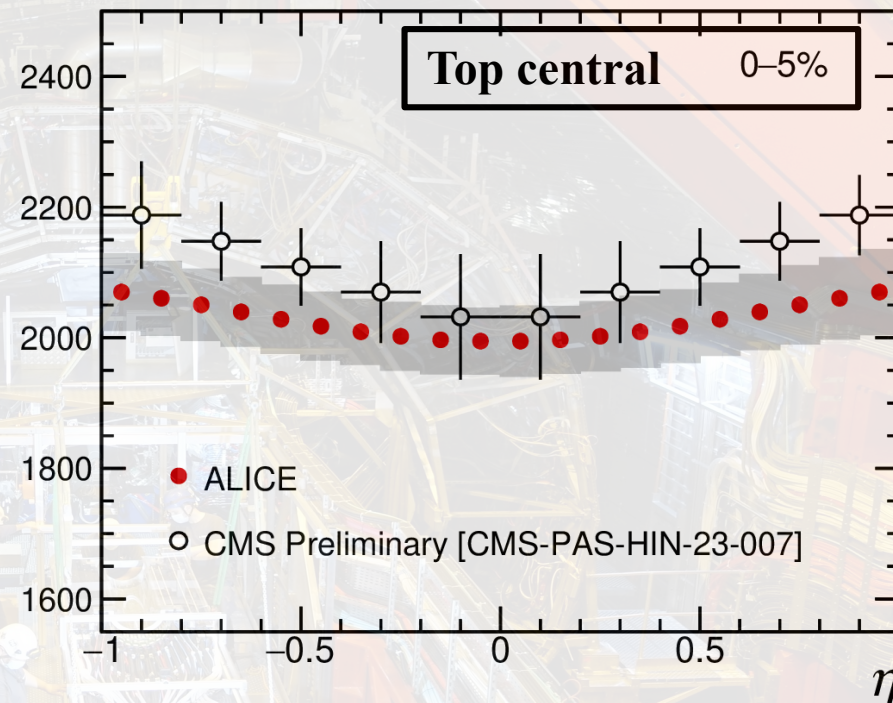
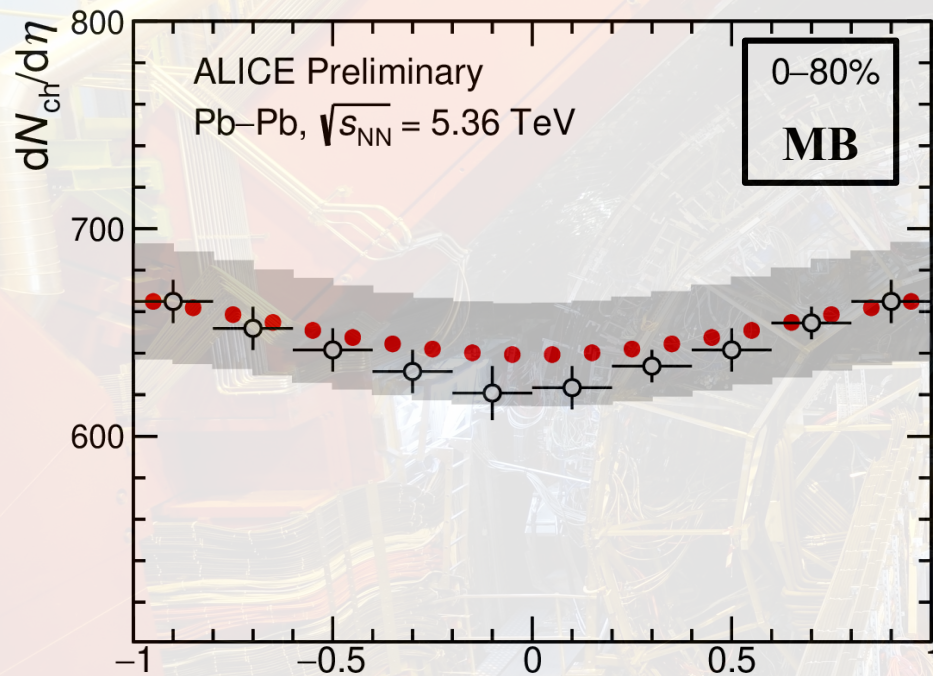


# $dN_{ch}/d\eta$ distributions in Pb-Pb



ALICE

NEW



ALI-PREL-571640

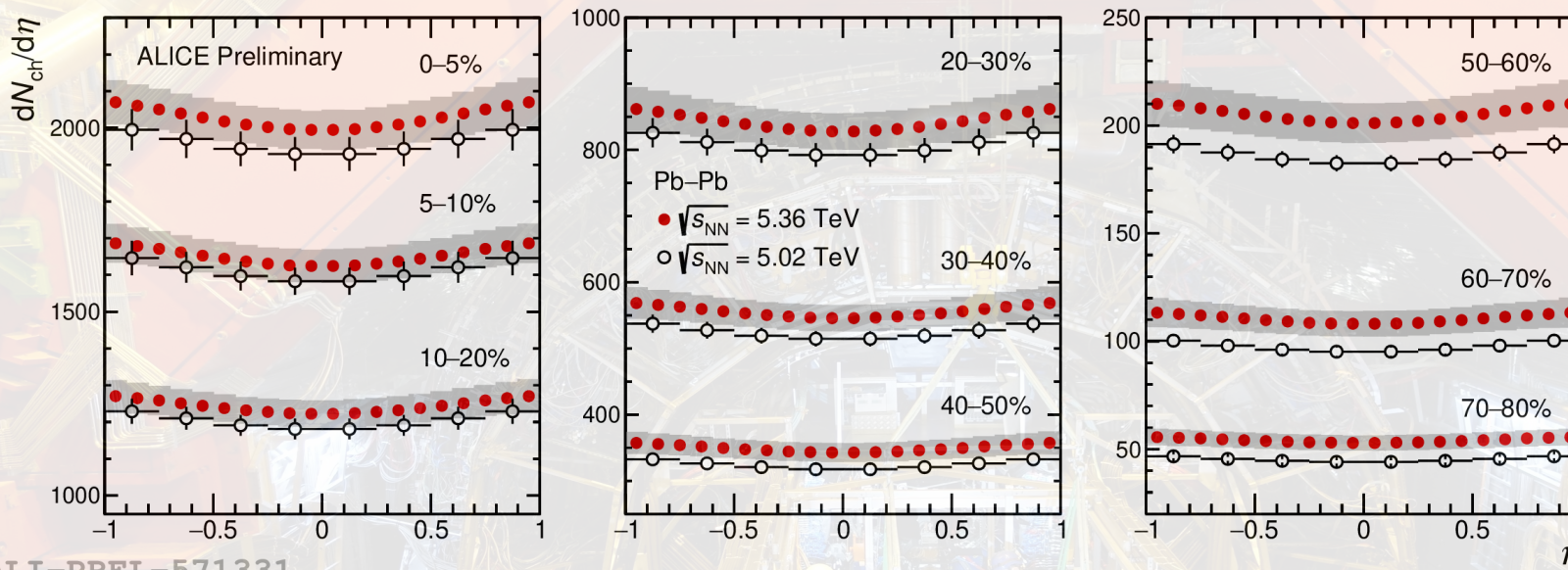
❖ Good agreement with ALICE and CMS measurements

# $dN_{ch}/d\eta$ distributions: comparison with 5.02 TeV



ALICE

**NEW**



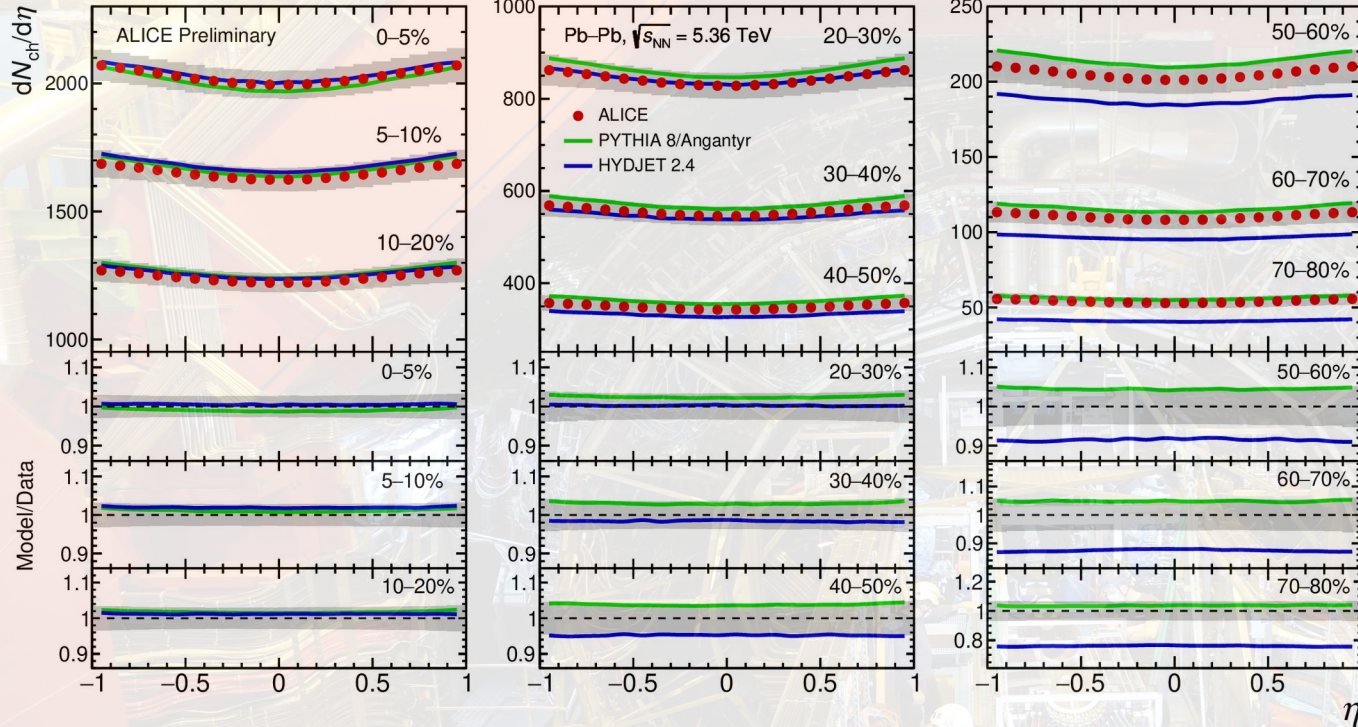
❖ We observe larger values of  $dN_{ch}/d\eta$  for 5.36 TeV compared to 5.02 TeV

$\frac{5.36 \text{ TeV}}{5.02 \text{ TeV}}$	Most Central	Most peripheral
	$1.03 \pm 0.04$	$1.18 \pm 0.12$

# $dN_{ch}/d\eta$ distributions: comparison with model



ALICE



**NEW**

## PYTHIA/Angantyr

Consider extrapolation of pp dynamics to describe nuclear collisions

[J. High Energ. Phys. \(2018\) 2018: 134](#)

## HYDJET++

Full evolution of heavy-ion collisions (jet interaction, QGP, hadronic phase)

[J. Phys.: Conf. Ser. 736 012024](#)

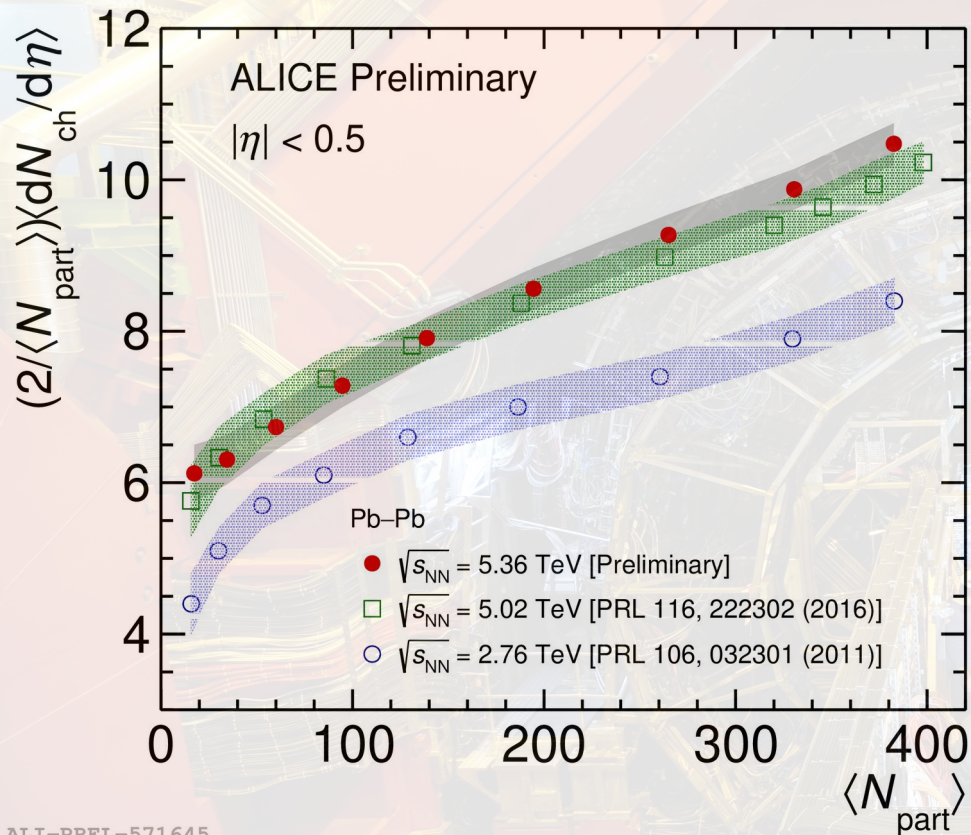
ALI-PREL-571341

❖ Non-QGP-based model (Angantyr) describes the data better than QGP-based model (HYDJET)

# Centrality dependence of $\langle dN_{ch}/d\eta \rangle$



ALICE



**NEW**

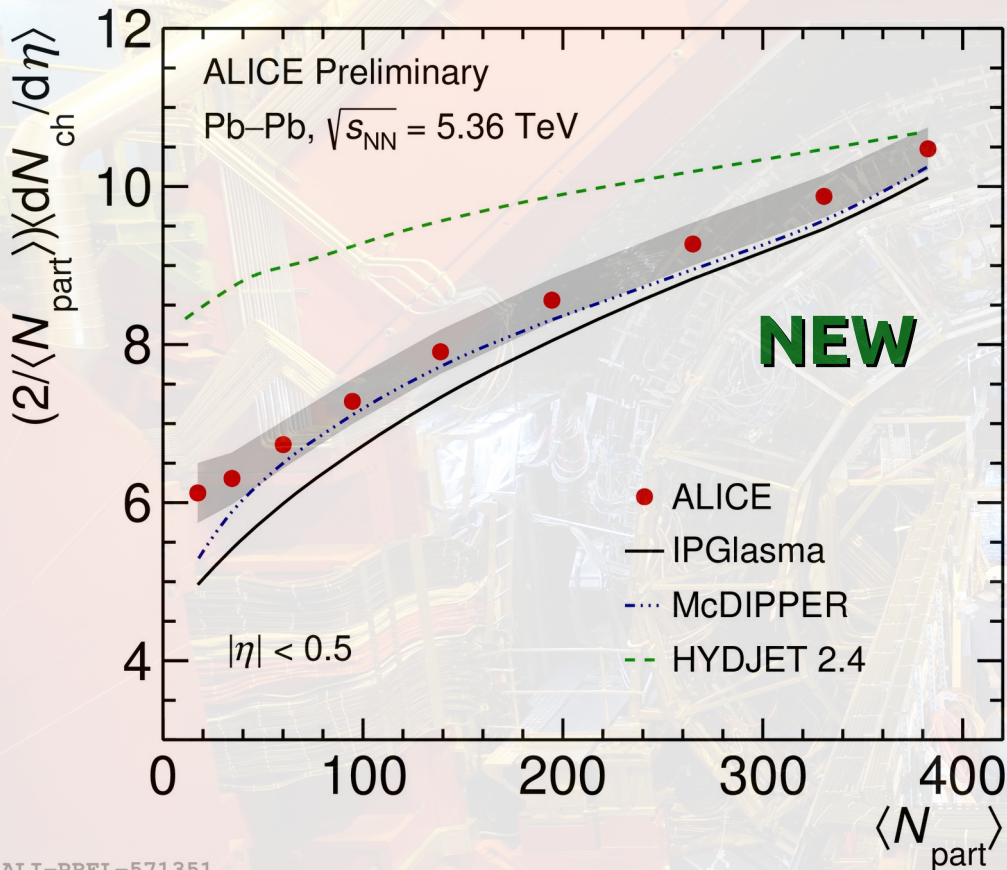
- ❖ Factor  $\sim 1.7$  increase in  $dN_{ch}/d\eta$  from peripheral to central events
- ❖ Centrality evolution at 5.36 TeV is similar to earlier measurements

ALI-PREL-571645

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ALICE



## Initial-state models

**IP-Glasma[1]:** primarily designed to describe the initial state around mid-rapidity in 2+1D hydro simulations.

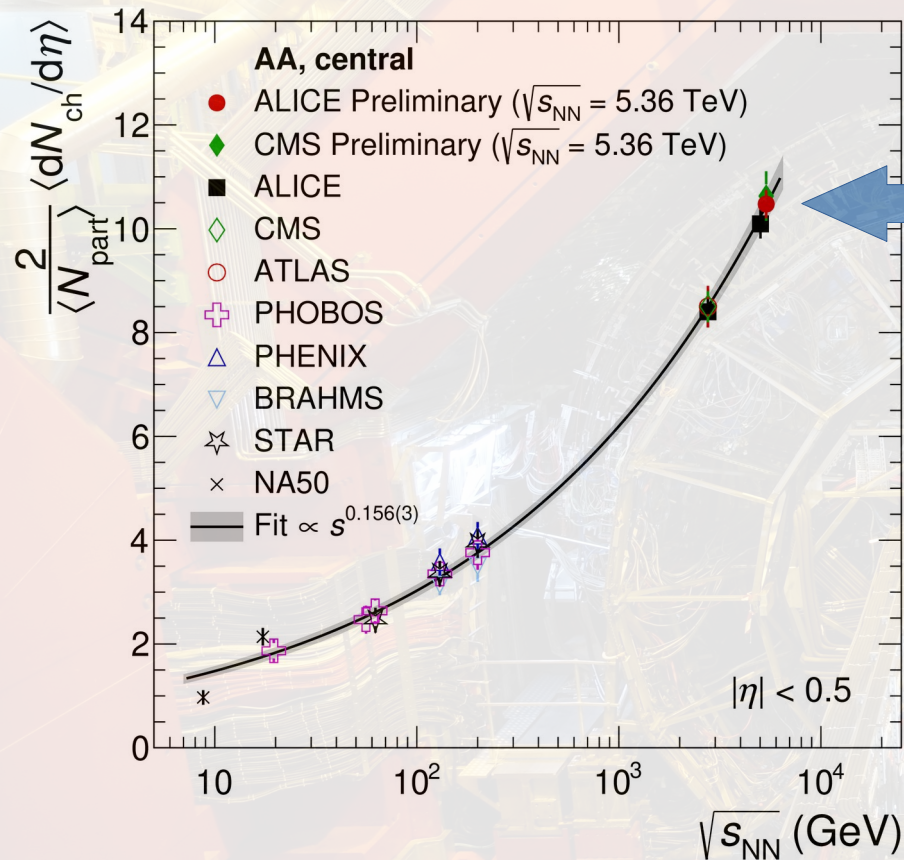
**McDIPPER[2]:** low x, 3+1D hydro simulations

❖ Initial-state models describe the data better than the event generator HYDJET++

[1] [PRL108, 252301 \(2012\)](#)

[2] [Phys.Rev.C 109 \(2024\) 4, 044916](#)

# Energy dependence of $\langle dN_{ch}/d\eta \rangle$



Pb-Pb,  $\sqrt{s_{NN}} = 5.36$  TeV

- ❖ New result consistent with the trend established from previous heavy-ion measurements
- ❖  $dN_{ch}/d\eta$  increases faster in Pb-Pb ( $\propto s^{0.156(3)}$ ) than pp ( $\propto s^{0.115(3)}$ )

# Summary



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**Thanks for your kind attention**