

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

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On behalf of the ALICE Collaboration

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PIANO NAZIONALE
DI RIPRESA E RESILIENZA



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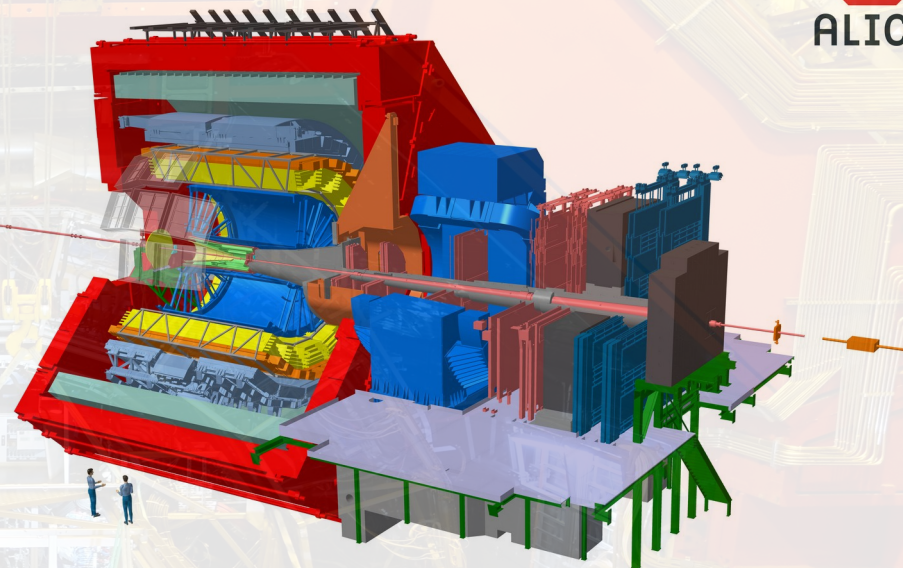
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ALICE Run 3 results presented here

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

ALICE detector system (Run 3)



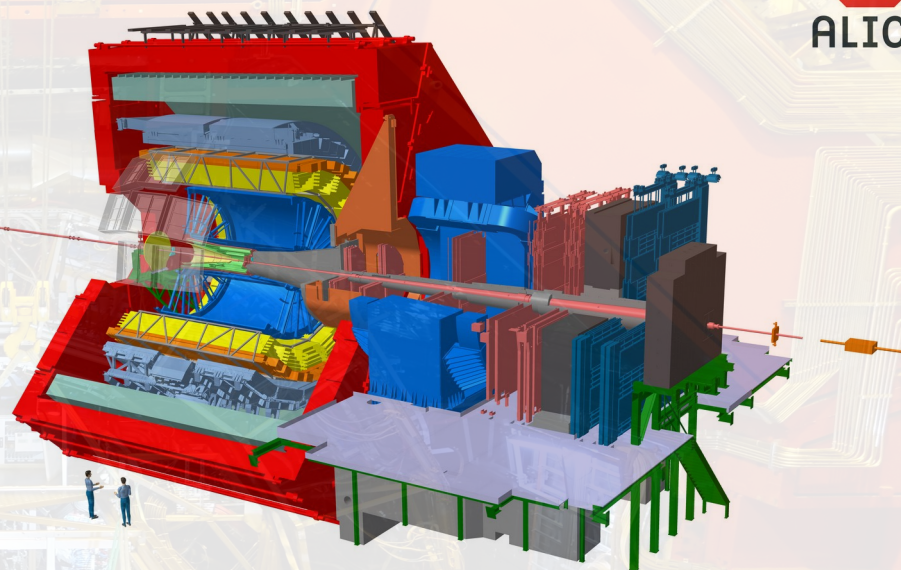
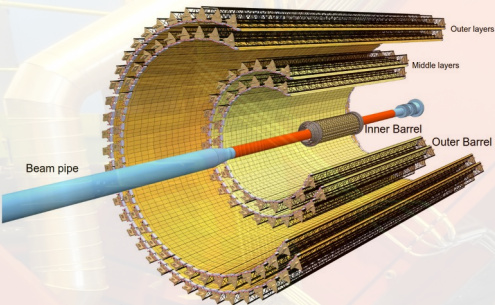
ALICE detector system (Run 3)



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
- ❖ $|\eta| < 1.3$

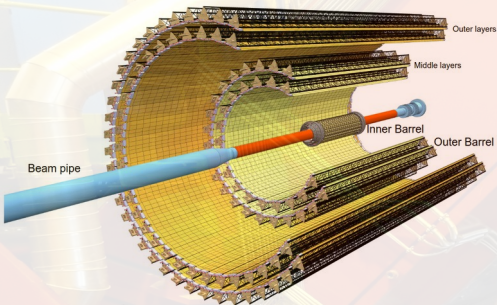


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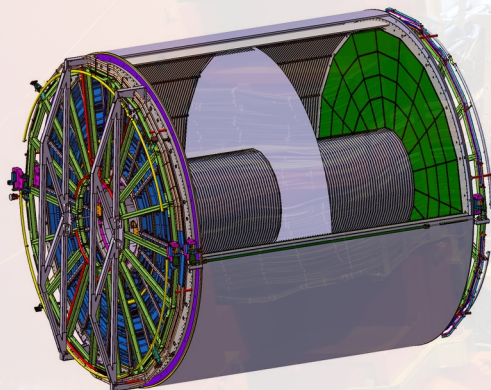
ALICE

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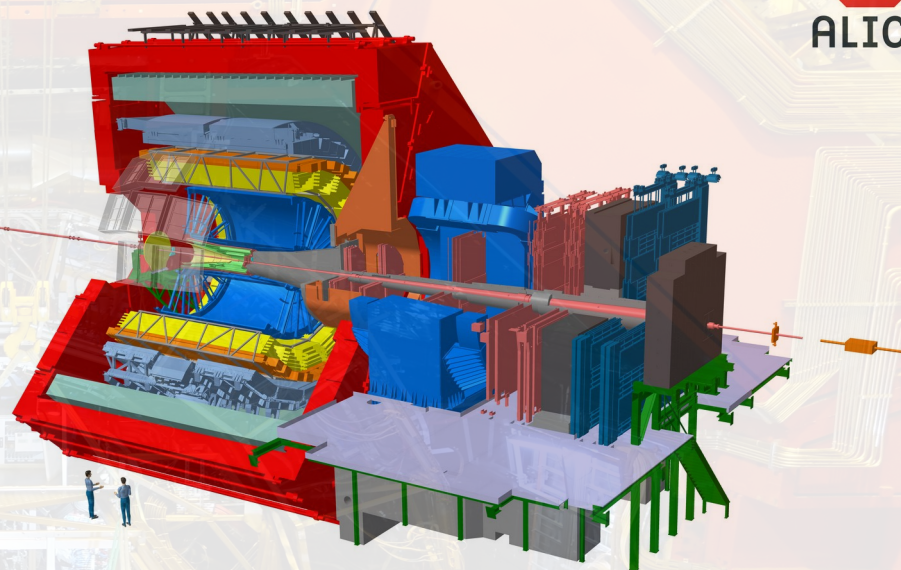


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Time Projection Chamber



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

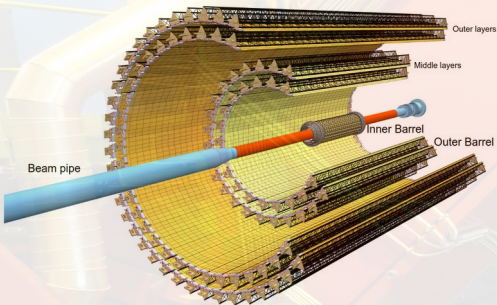


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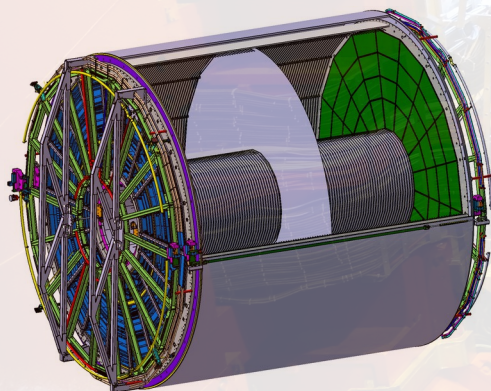
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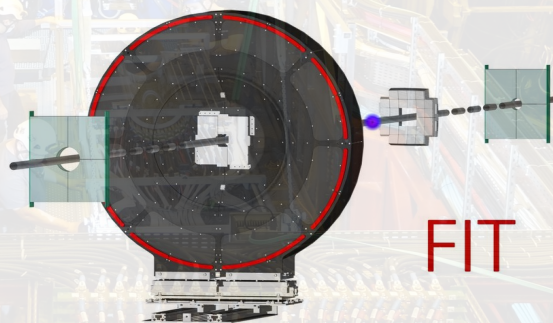
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Fast Interaction Trigger

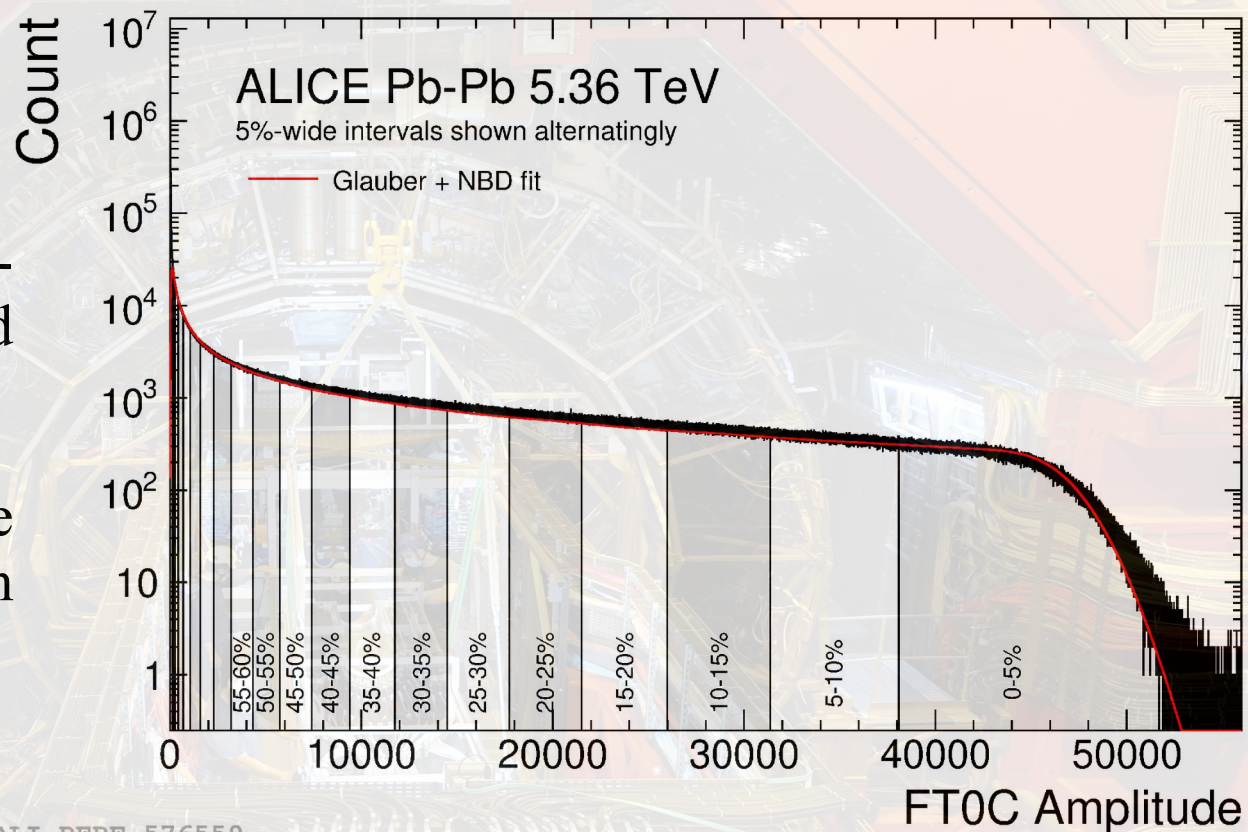


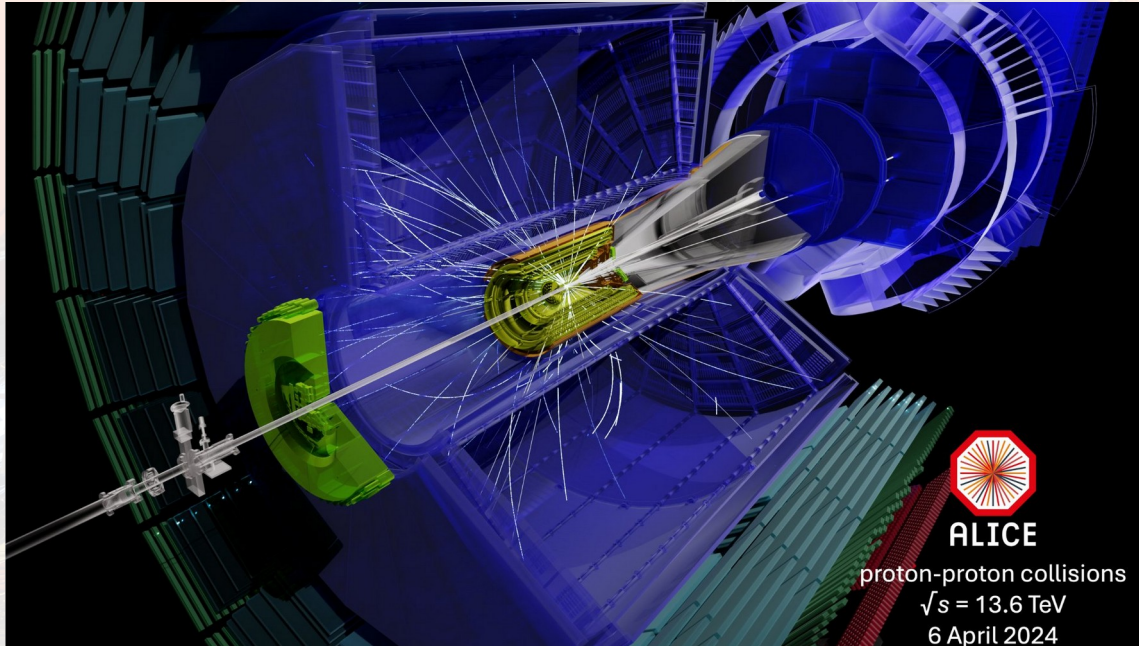
[See Yury Melikyan's talk](#)

- ❖ 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

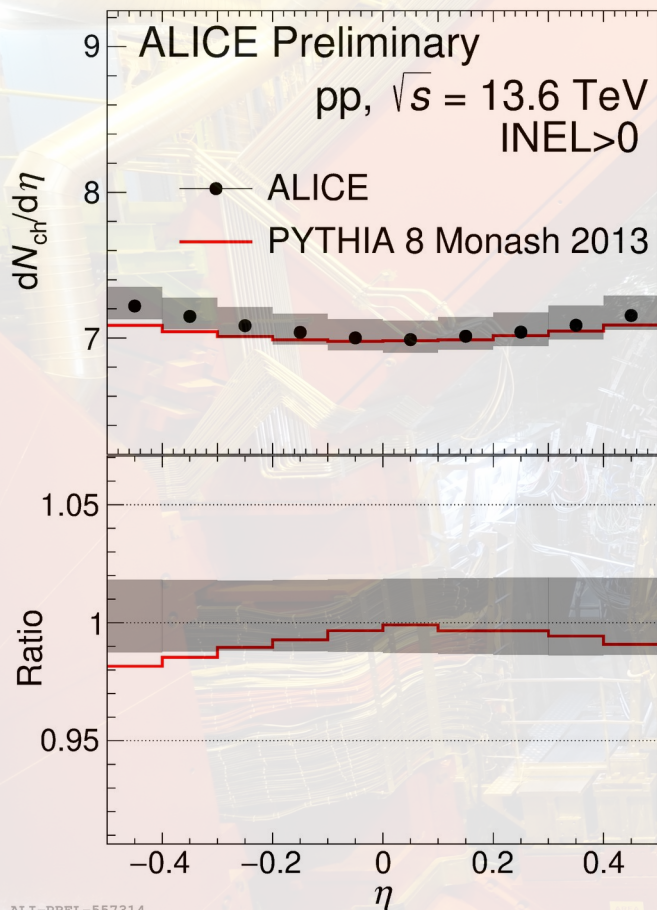


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ALICE



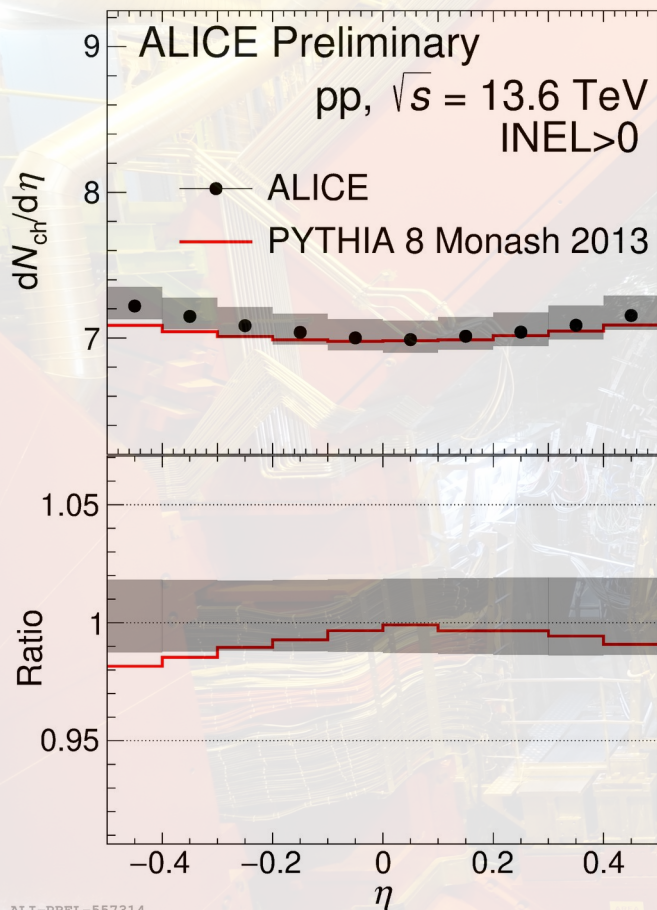
- ❖ INEL>0: Inelastic events having at least one N_{ch} in $|\eta| < 1$
- ❖ PYTHIA 8 describes the MB results well

ALICE-PREL-557314

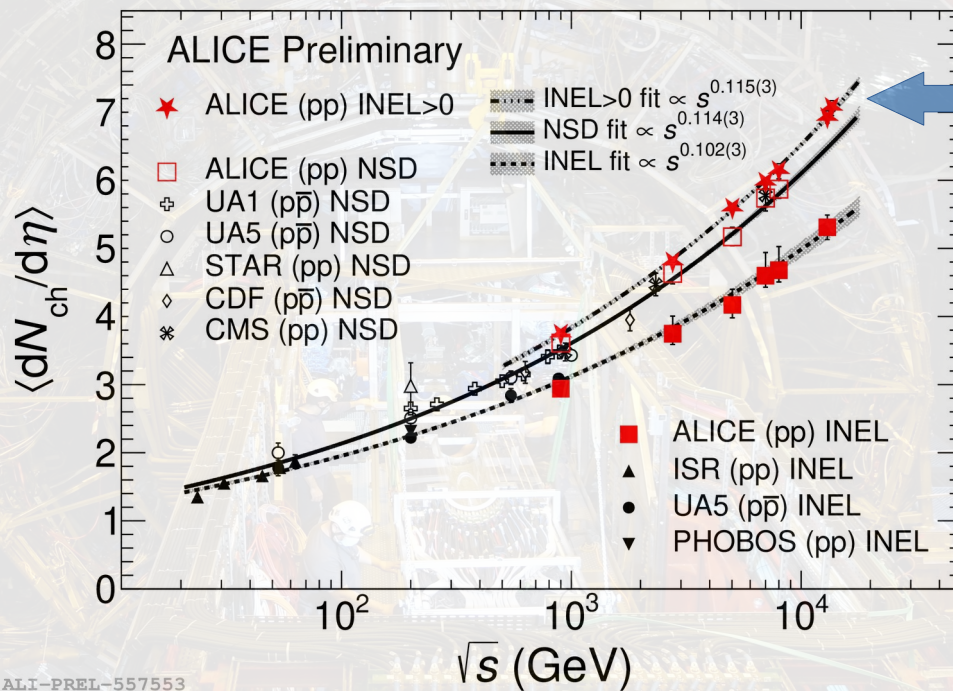
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ALICE



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13.6 TeV

New result follows the trend established from previous pp measurements

ALI-PREL-557314

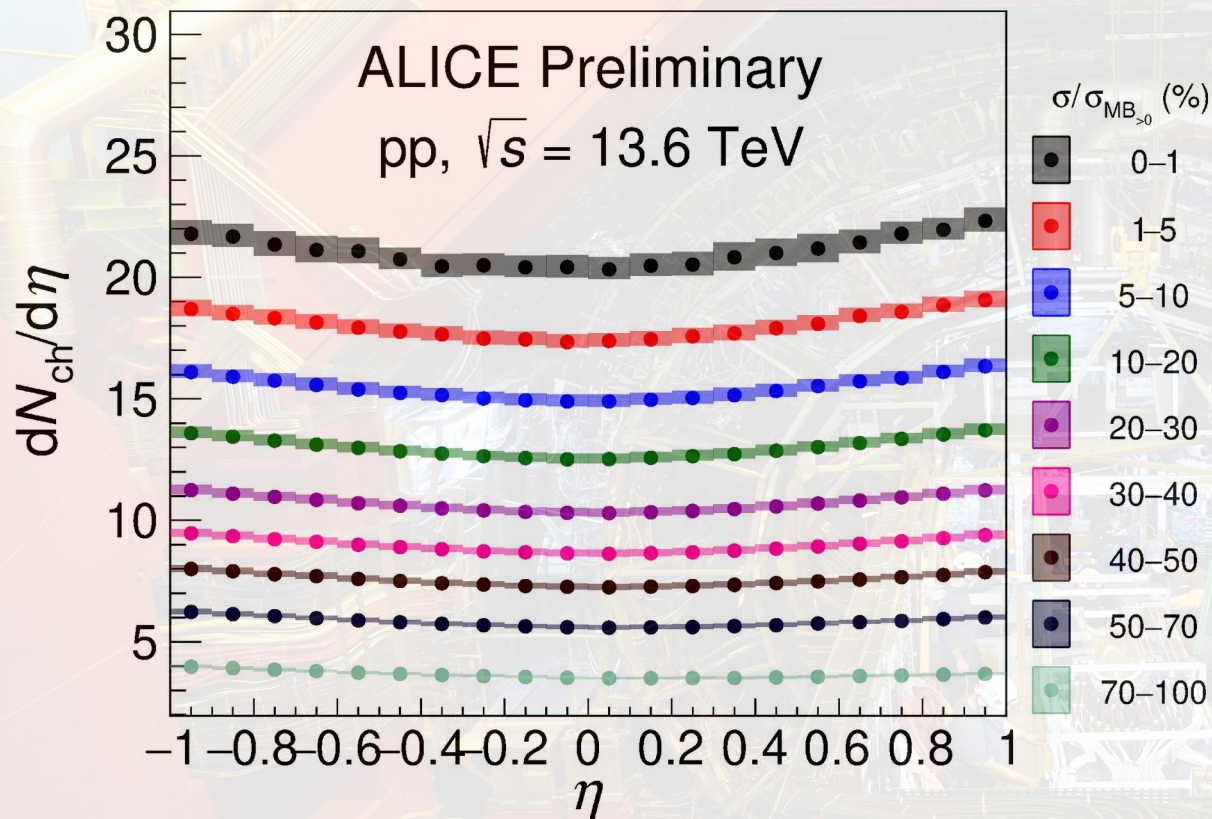
ALI-PREL-557553

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



ALICE

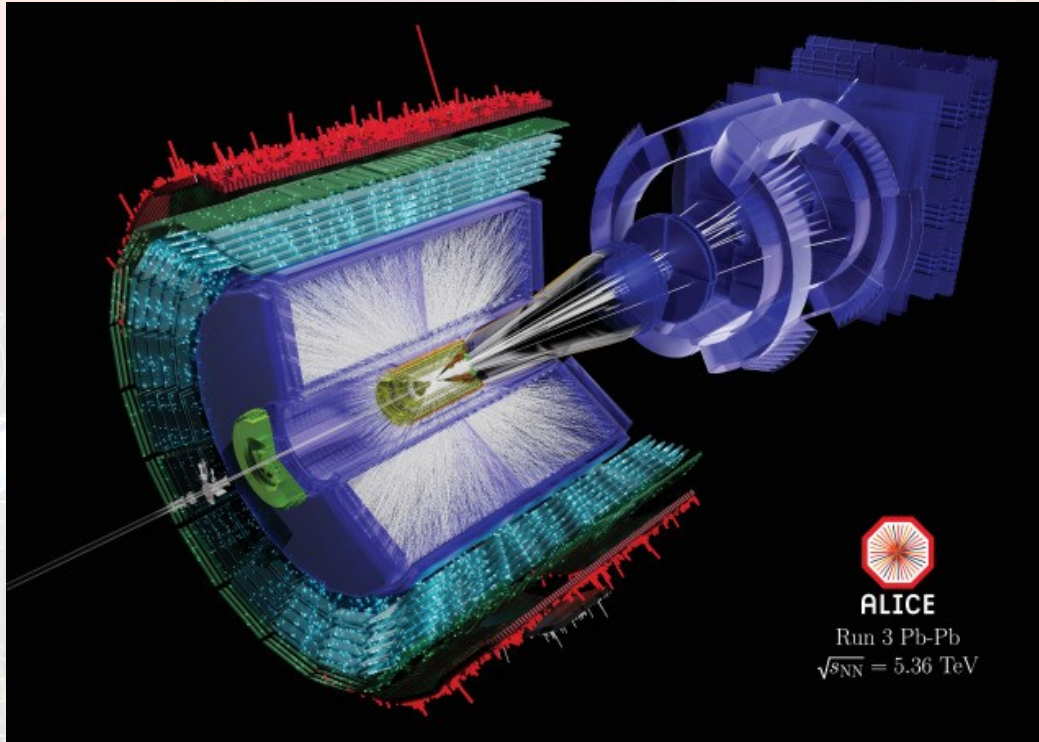
NEW



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

❖ Good input for various particle production models

ALI-PREL-574016



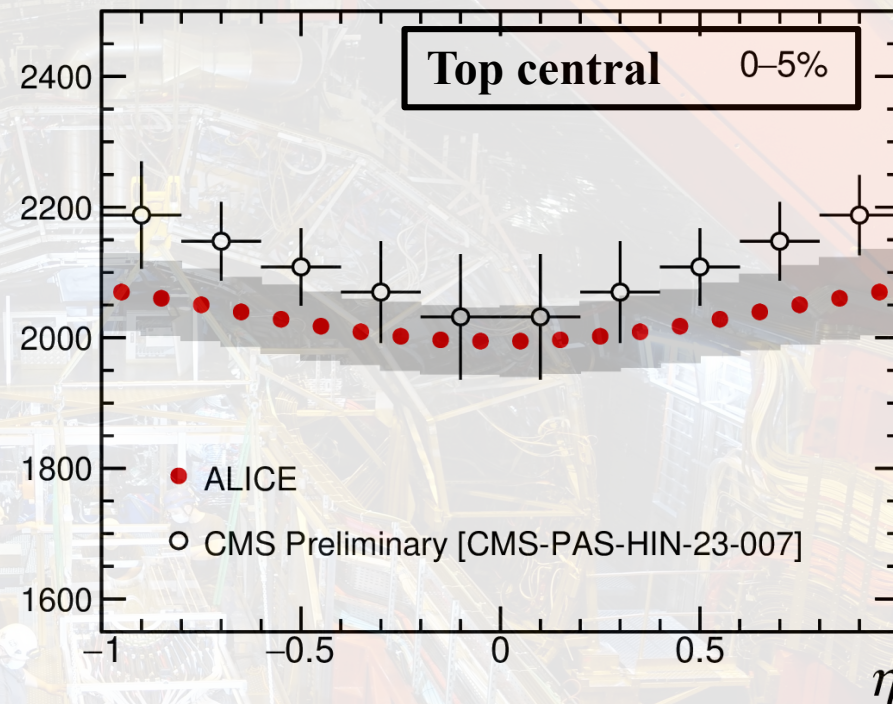
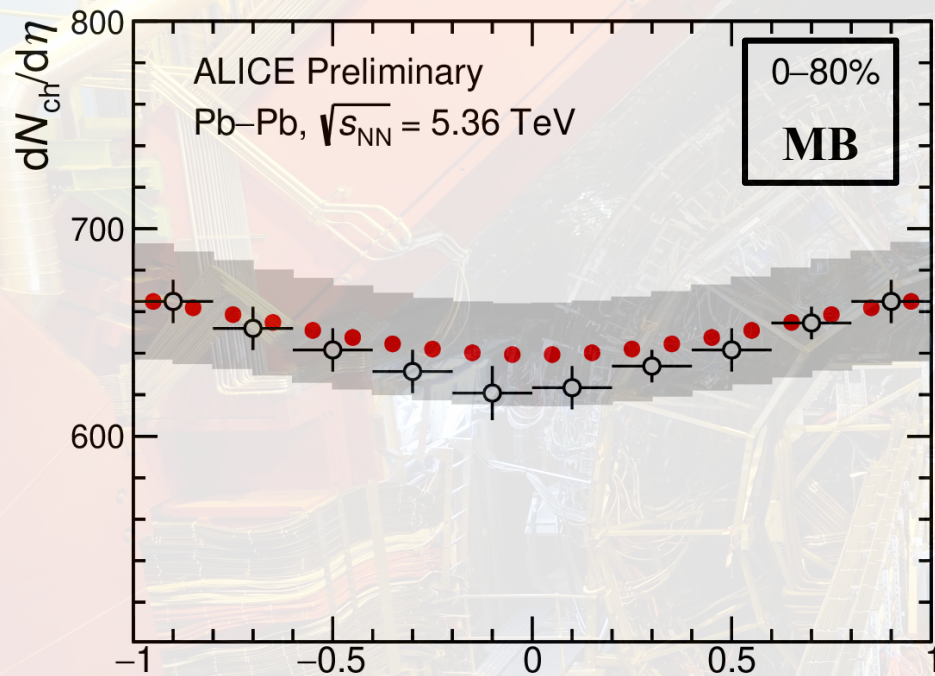
Lead-lead collisions

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



ALICE

NEW



ALI-PREL-571640

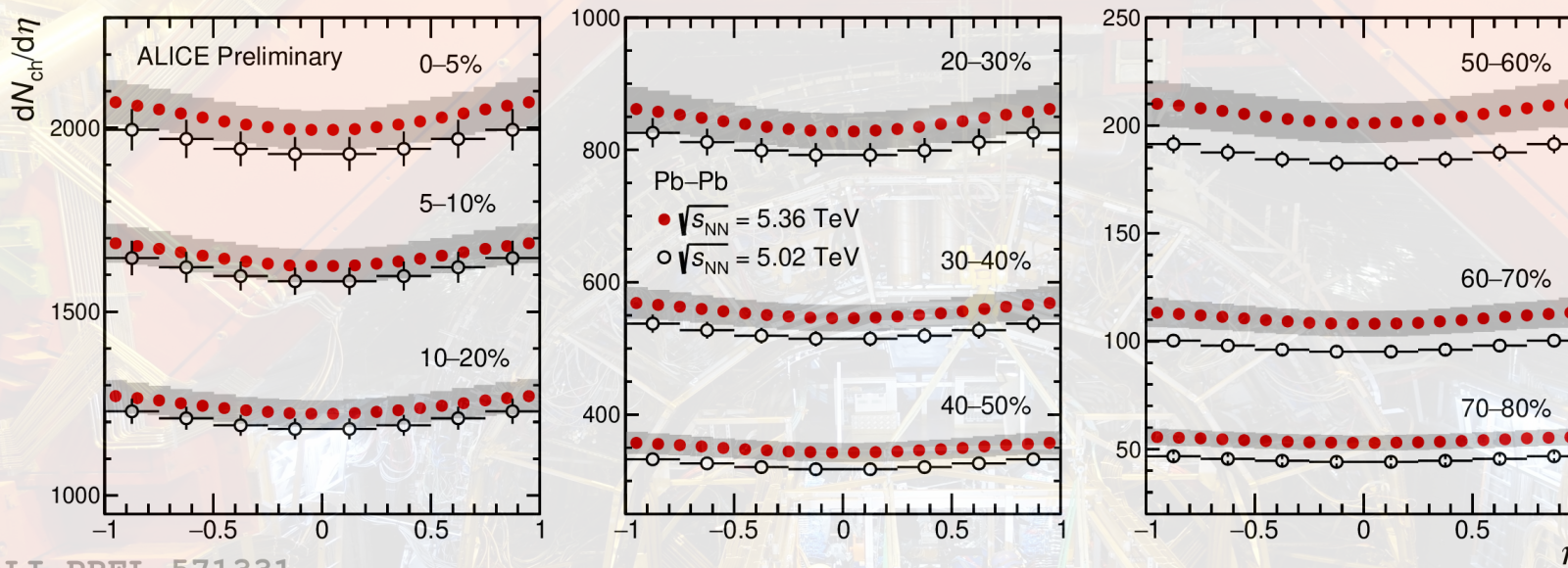
❖ Good agreement with ALICE and CMS measurements

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



ALICE

NEW



ALI-PREL-571331

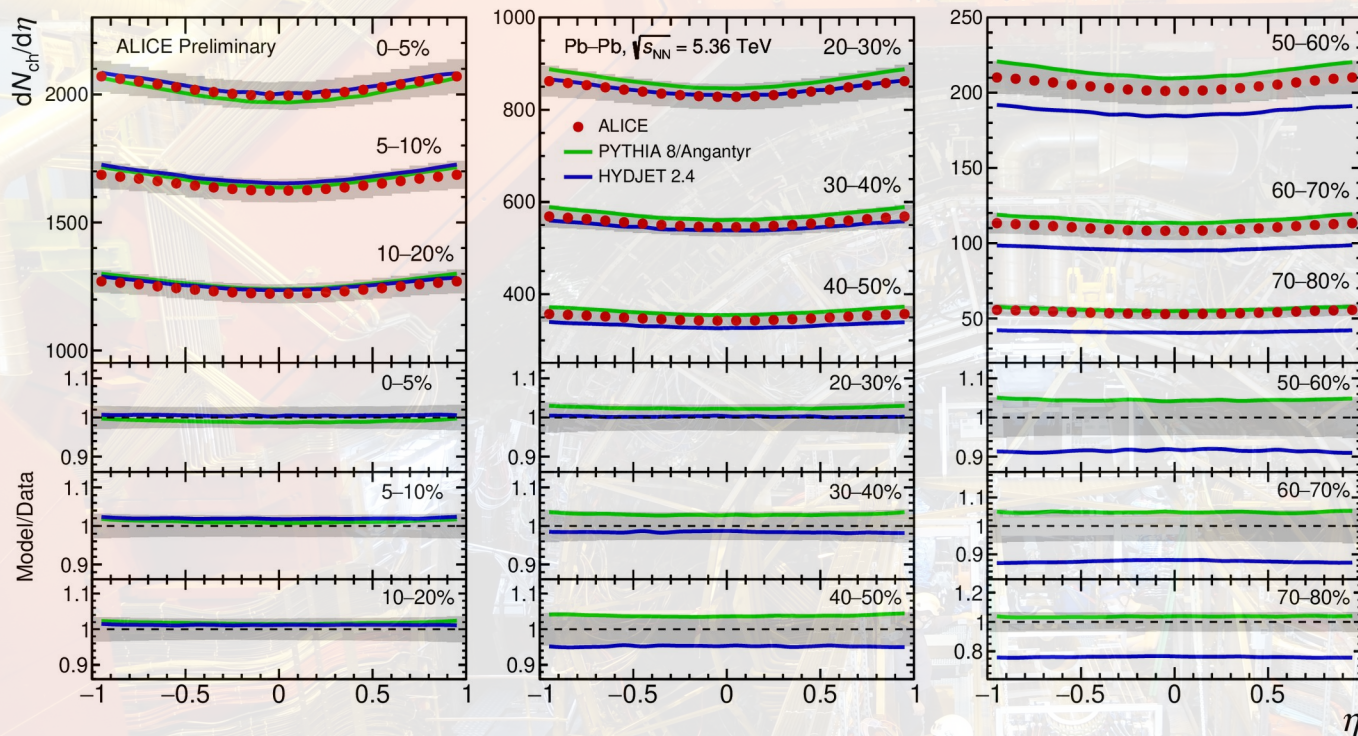
❖ We observe larger values of $dN_{ch}/d\eta$ for 5.36 TeV compared to 5.02 TeV

<u>5.36 TeV</u>	Most Central	Most peripheral
5.02 TeV	1.03 ± 0.04	1.18 ± 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++

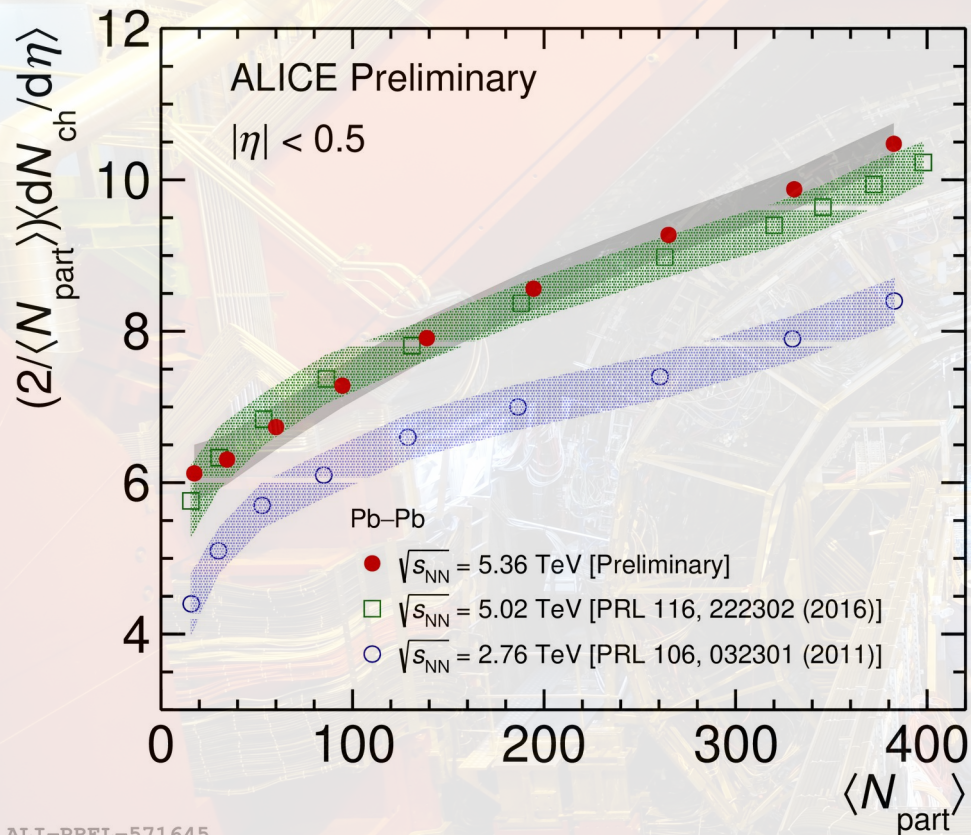
Full evolution of heavy-ion collisions (jet interaction, QGP, hadronic phase)

[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 $\langle dN_{ch}/d\eta \rangle$



NEW

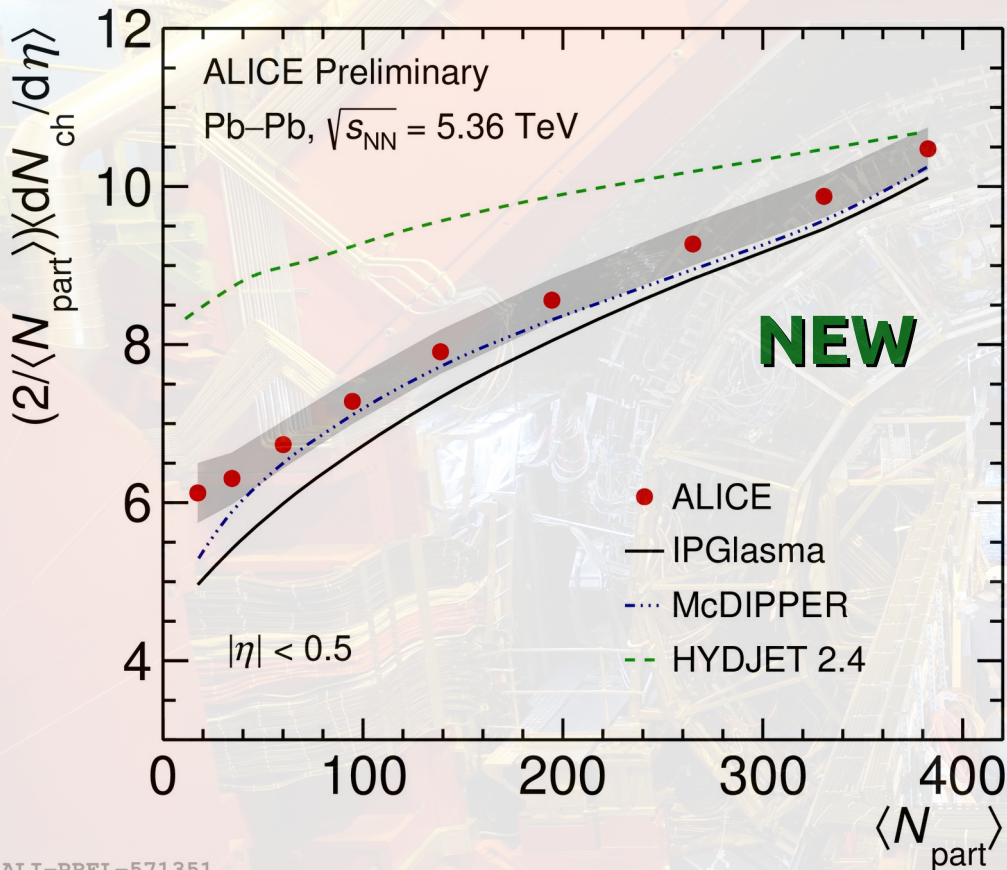
- ❖ Factor ~ 1.7 increase in $dN_{ch}/d\eta$ from peripheral to central events
- ❖ Centrality evolution at 5.36 TeV is similar to earlier measurements

ALI-PREL-571645

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



ALICE



Initial-state models

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

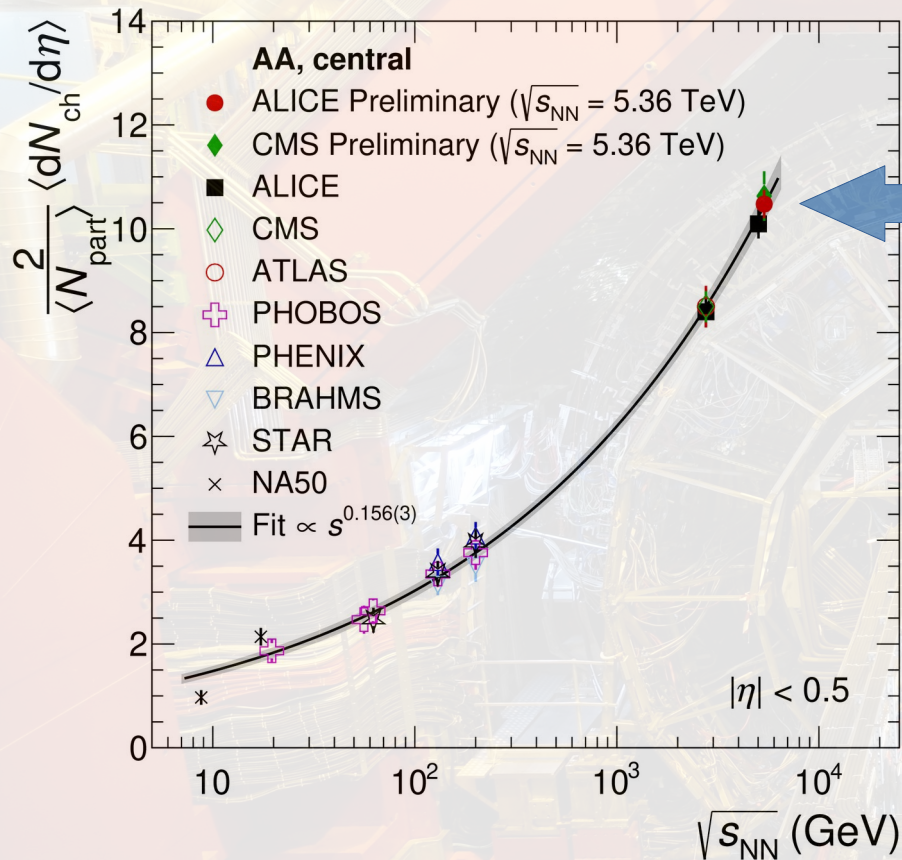
McDIPPER[2]: low x, 3+1D hydro simulations

❖ 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



ALICE

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Thanks for your kind attention