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湖北·武汉·华中师范大学(科学会堂)

System and event activity dependent inclusive jet production with ALICE

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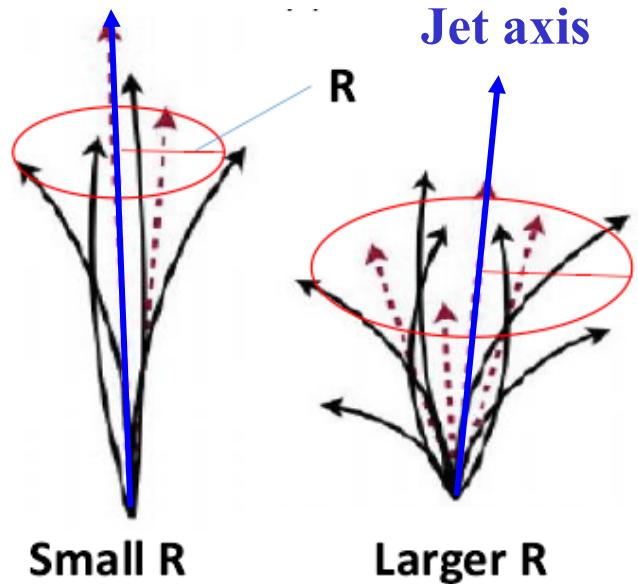
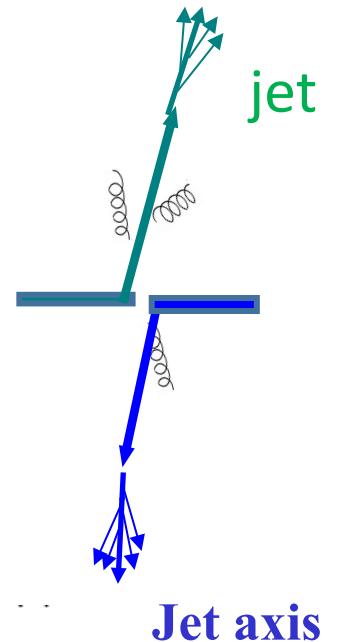


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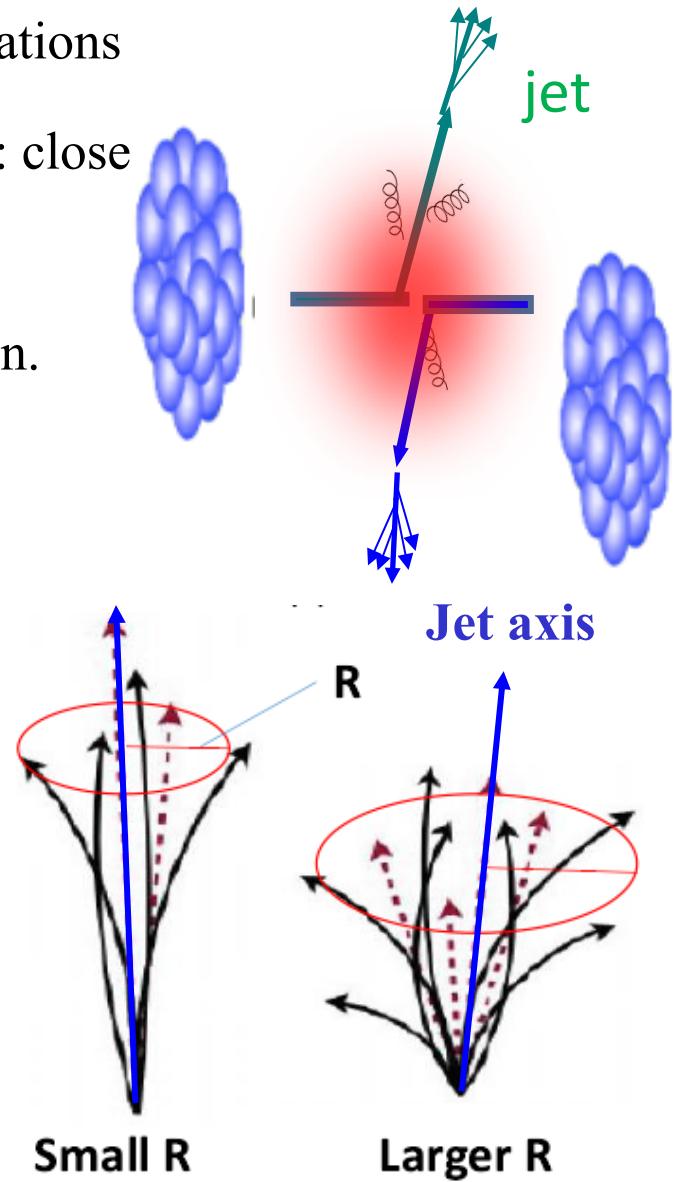
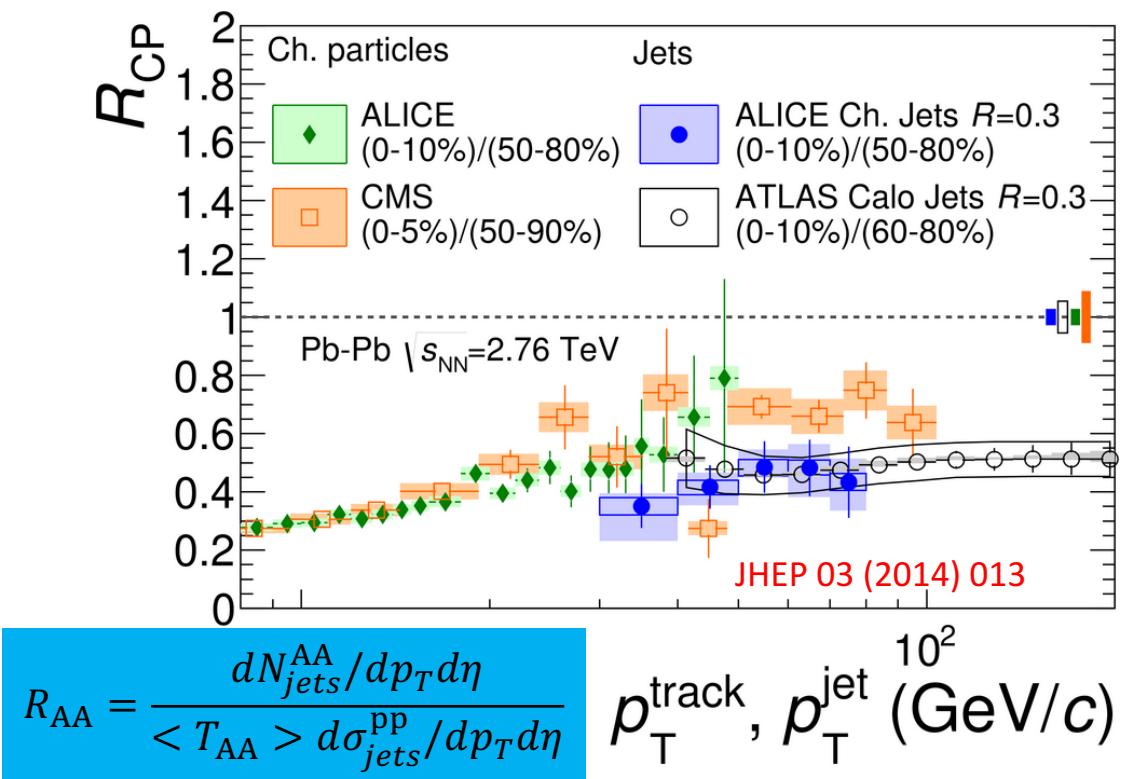
Why the study of jets

- Jet cross section provides constraints to pQCD calculations
- Investigate the splitting function of parton in vacuum: close to original collimation information.



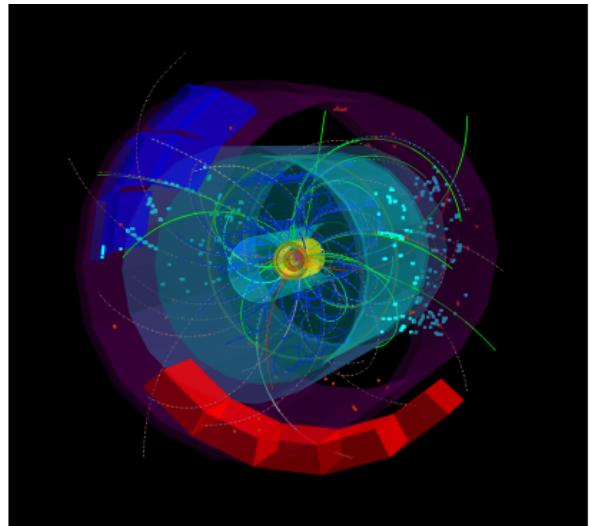
Why the study of jets

- Jet cross section provides constraints to pQCD calculations
- Investigate the splitting function of parton in vacuum: close to original collimation information.
- Study jet quenching effect in nucleus-nucleus collision.

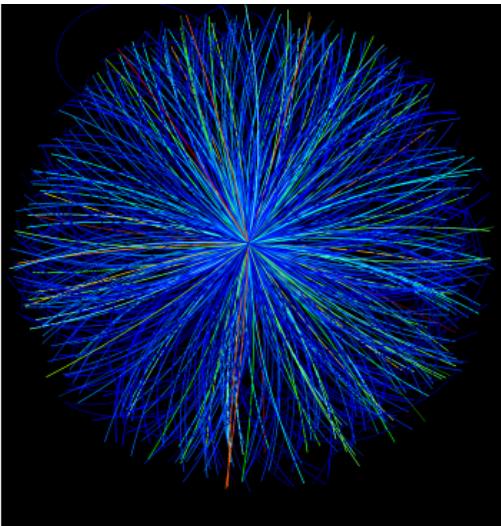


Why the study of high multiplicity jets

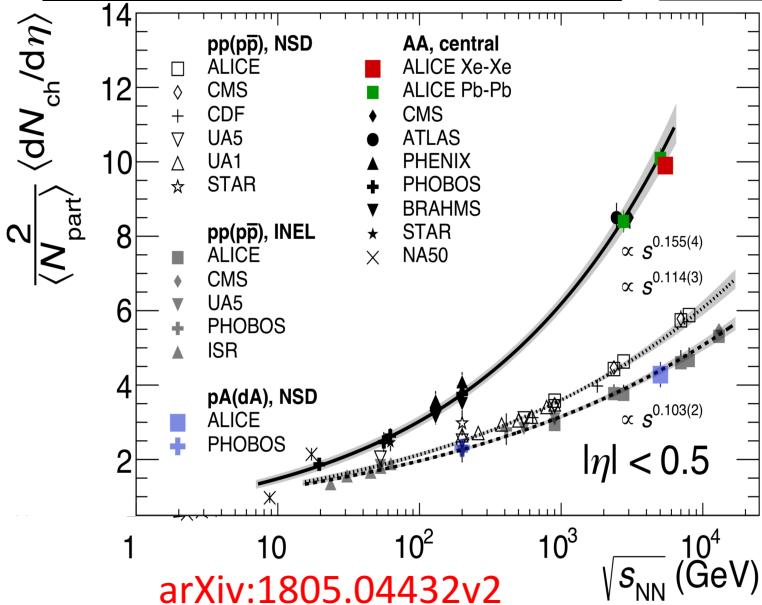
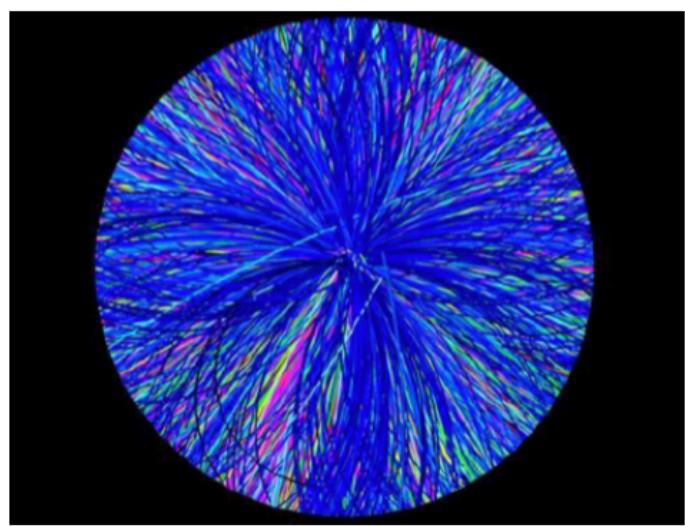
pp: Minimum bias



pp: high multiplicity



Pb-Pb



- Charged particle density increases with \sqrt{s} for different collision systems
- High particle multiplicity pp events can have similar particle multiplicity as in pA/AA collisions
 - What happens for jet production in high particle multiplicity environment: quenching? enhancement?

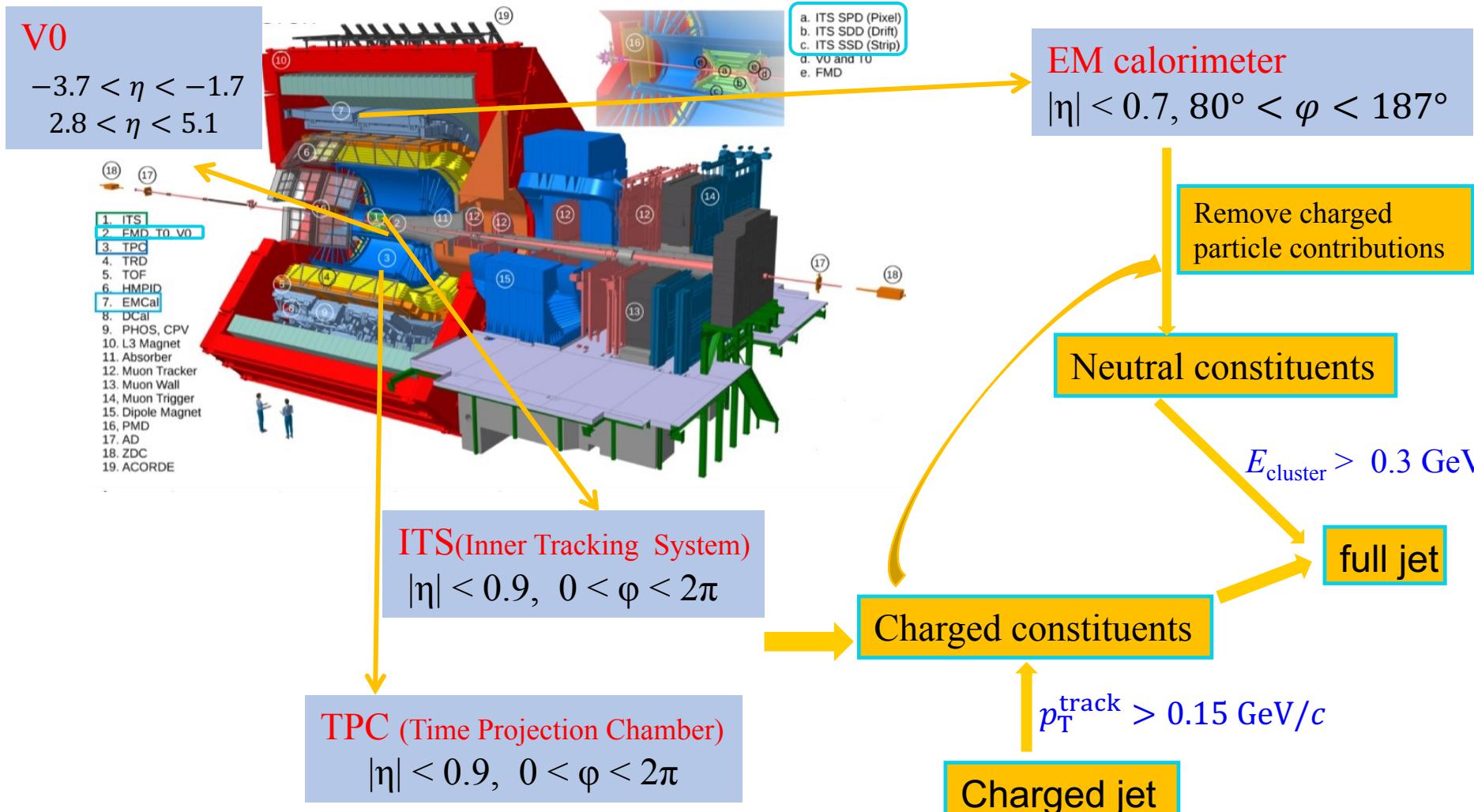


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Jet measurements in ALICE

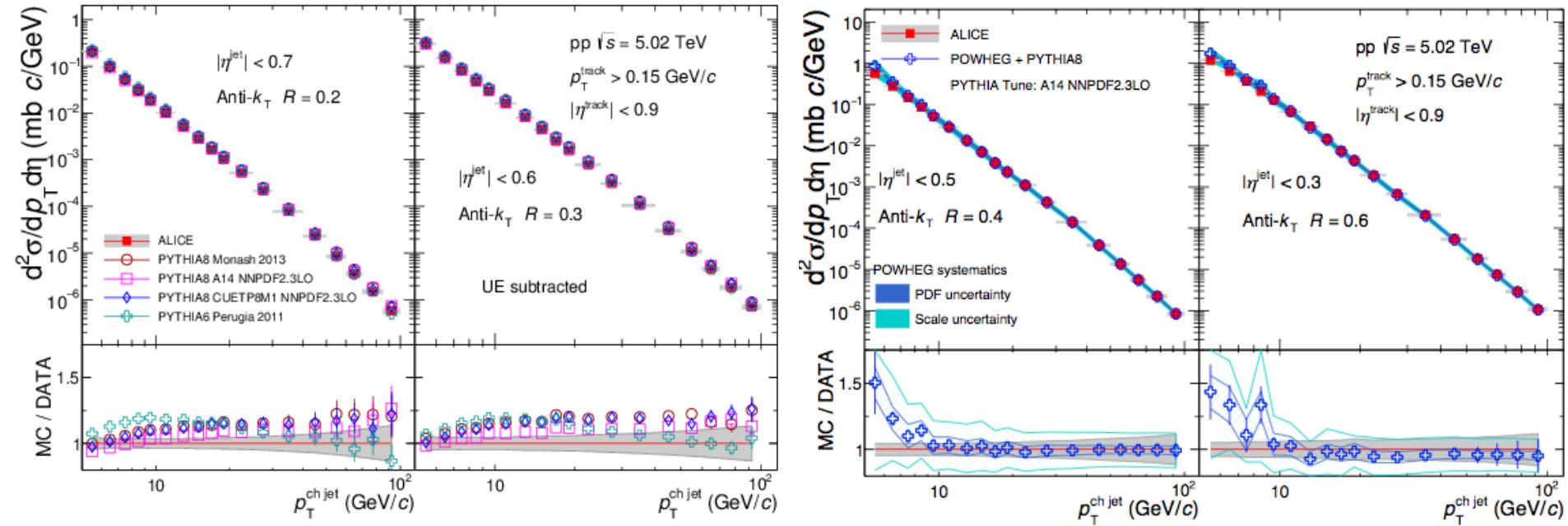
- Event selection and multiplicity categorization: SPD, V0
- Track and jet reconstruction: ITS, TPC, EMCal



Measurement of charged jets in pp and Pb-Pb collisions at $\sqrt{s}_{\text{NN}} = 5.02 \text{ TeV}$

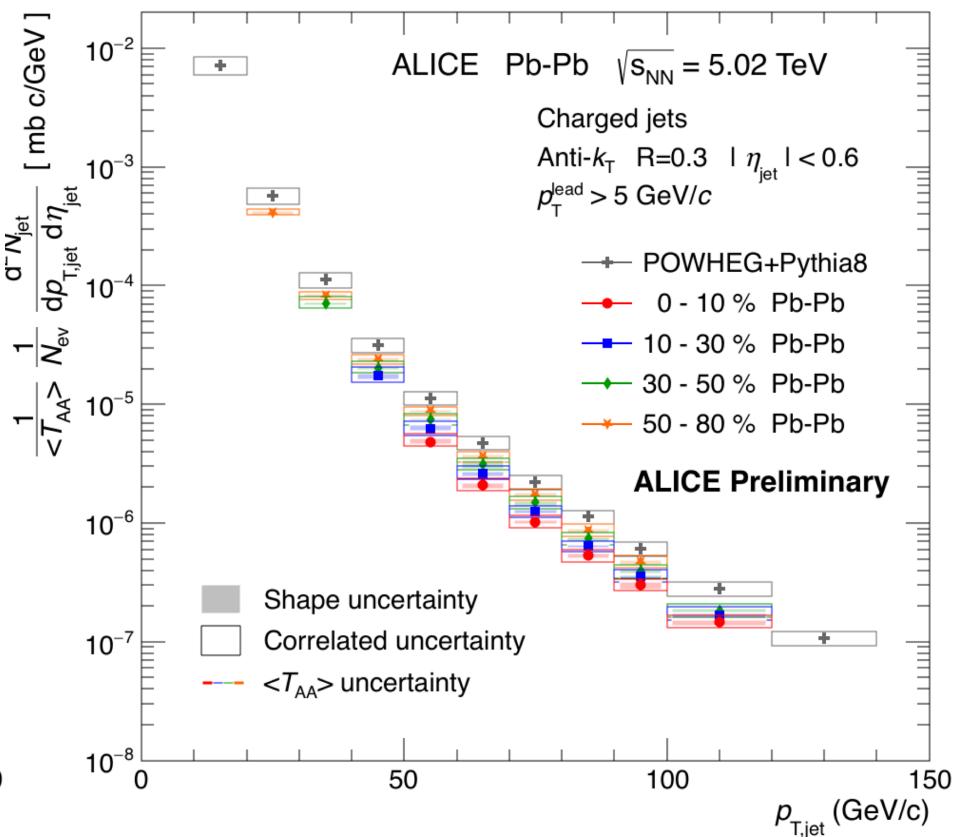
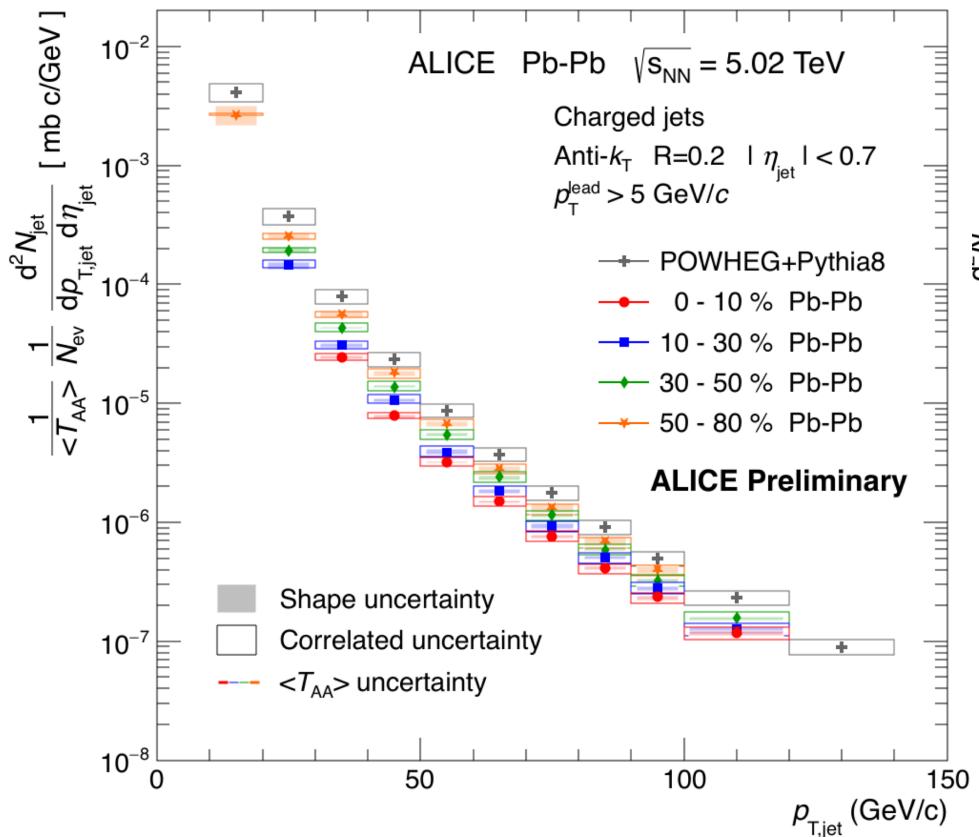
Cross section in pp collisions

ALICE, arXiv:1905.02536



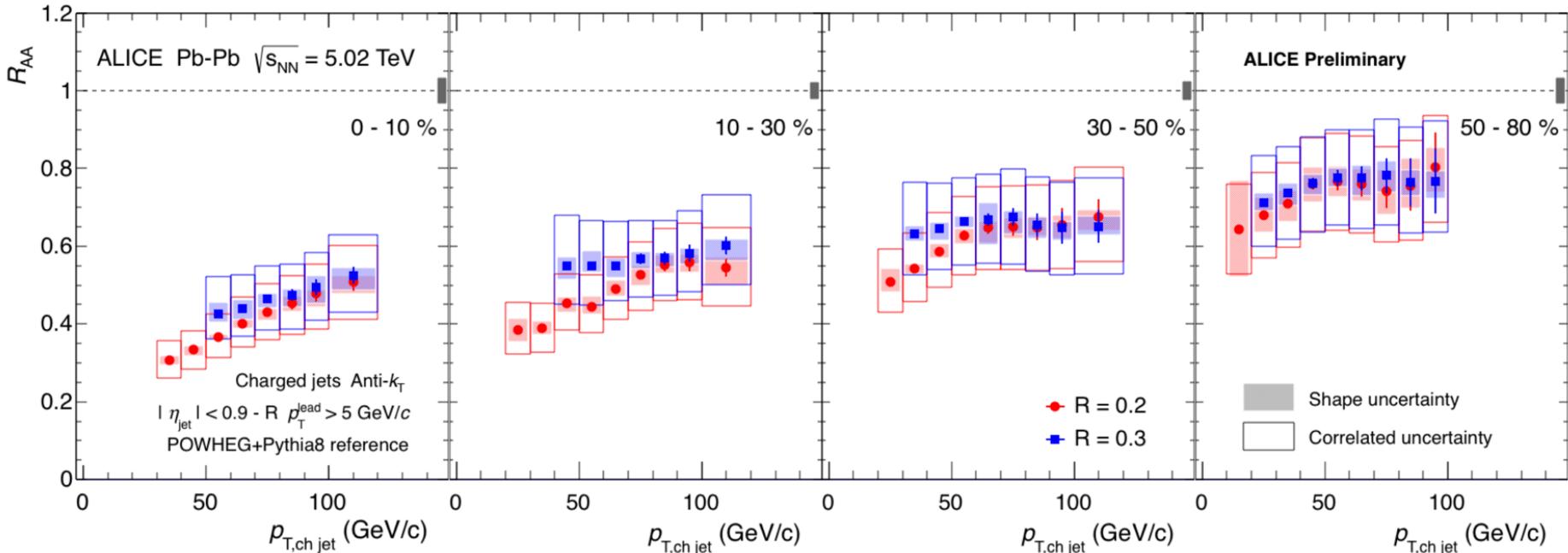
- Charged jets are reconstructed using different resolution parameters and down to very low p_T ($p_{T,\text{jet}} > 5 \text{ GeV}/c$)
- Jet cross section is well described by POWHEG+PYTHIA8 predictions (NLO pQCD+parton shower+hadronization) within systematic uncertainties

Spectrum in Pb-Pb collisions



- Charged jet spectra in different centrality intervals are measured in Pb-Pb collisions with different cone radii
- Centrality ordered jet production found in Pb-Pb collisions after T_{AA} scaling

Jet nuclear modification factor R_{AA}

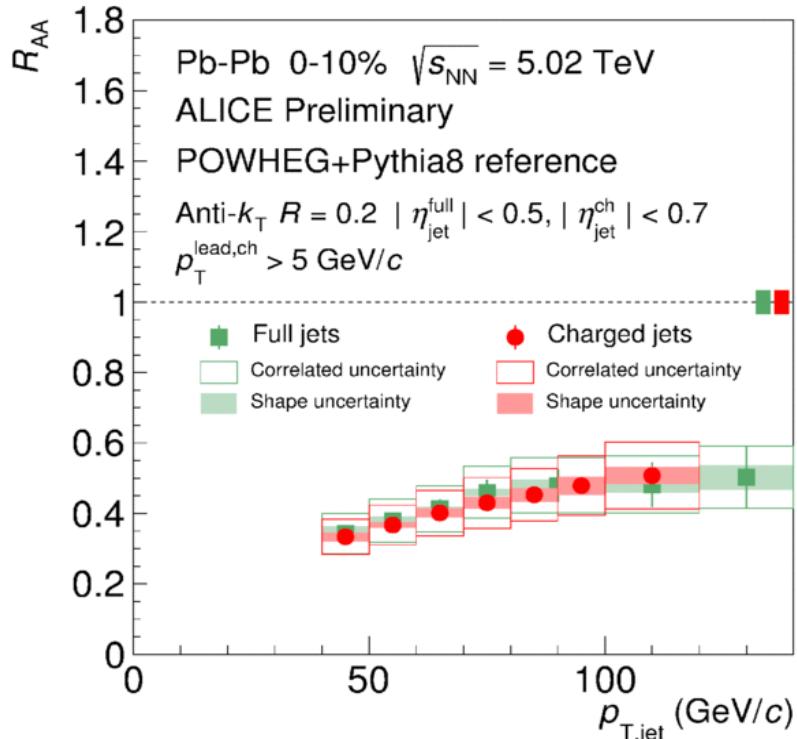


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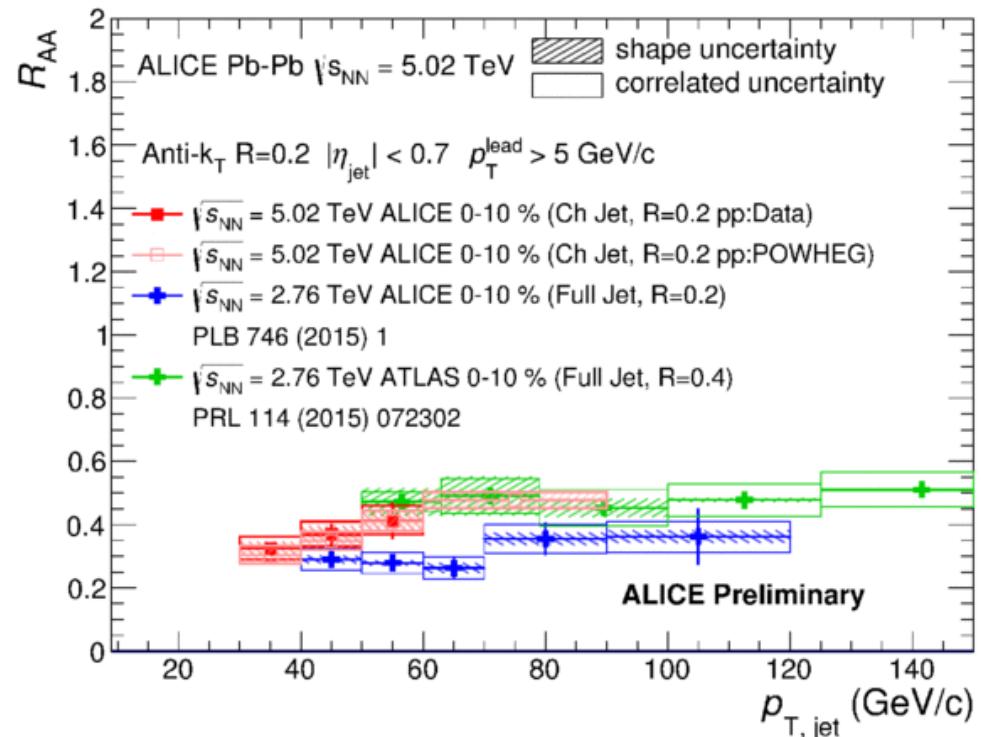
$$R_{AA} = \frac{dN_{\text{jets}}^{\text{AA}}/dp_T d\eta}{\langle T_{AA} \rangle d\sigma_{\text{jets}}^{\text{pp}}/dp_T d\eta}$$

- Strong suppression is observed in central Pb-Pb collisions
- Less suppression for peripheral events
- R_{AA} of different radius jets agree with each other within uncertainties

Jet R_{AA} comparison



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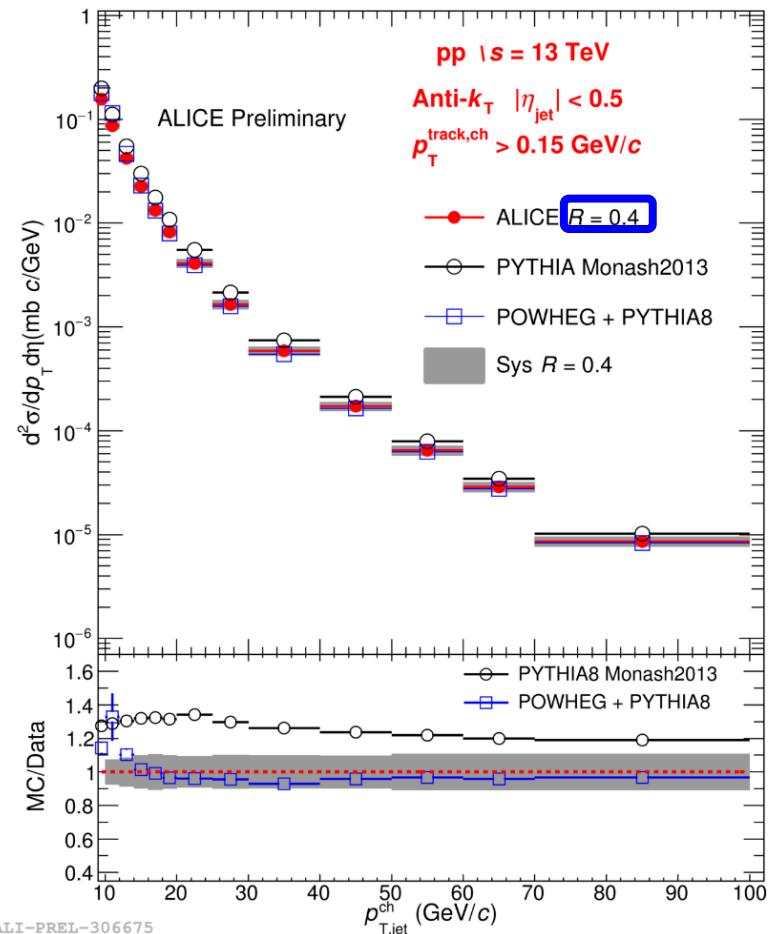
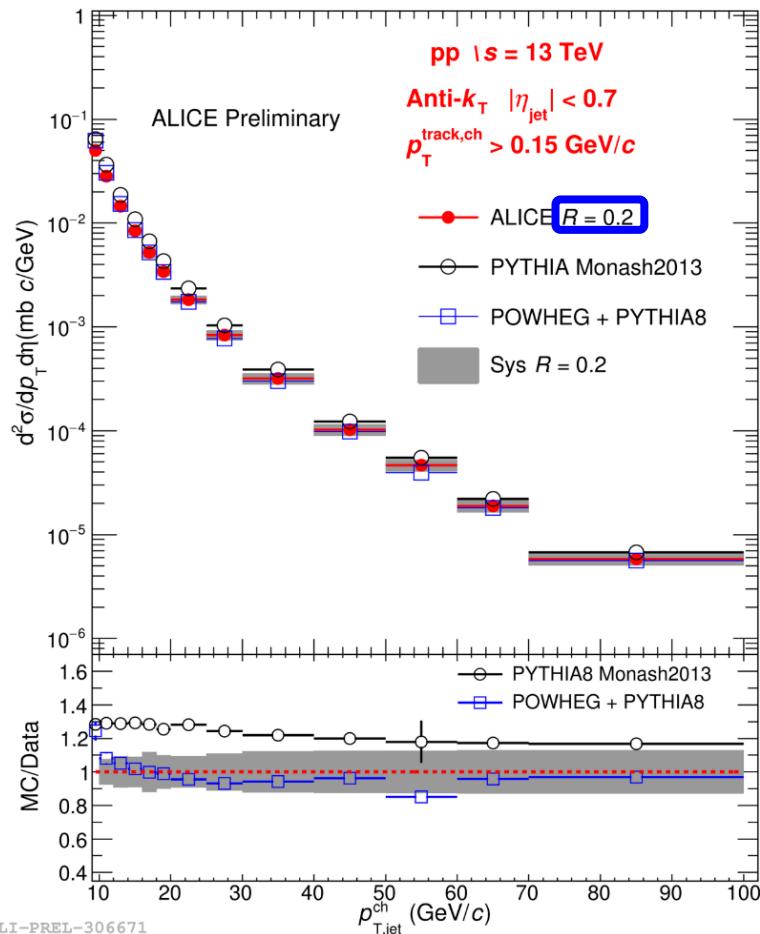
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- Full jets and charged jets R_{AA} are consistent
- R_{AA} in different collision energies are similar
 - Compensating effect of flattening of the spectrum and stronger jet suppression in higher collision energy

$$R_{AA} = \frac{dN_{jets}^{AA}/dp_T d\eta}{\langle T_{AA} \rangle d\sigma_{jets}^{\text{pp}}/dp_T d\eta}$$

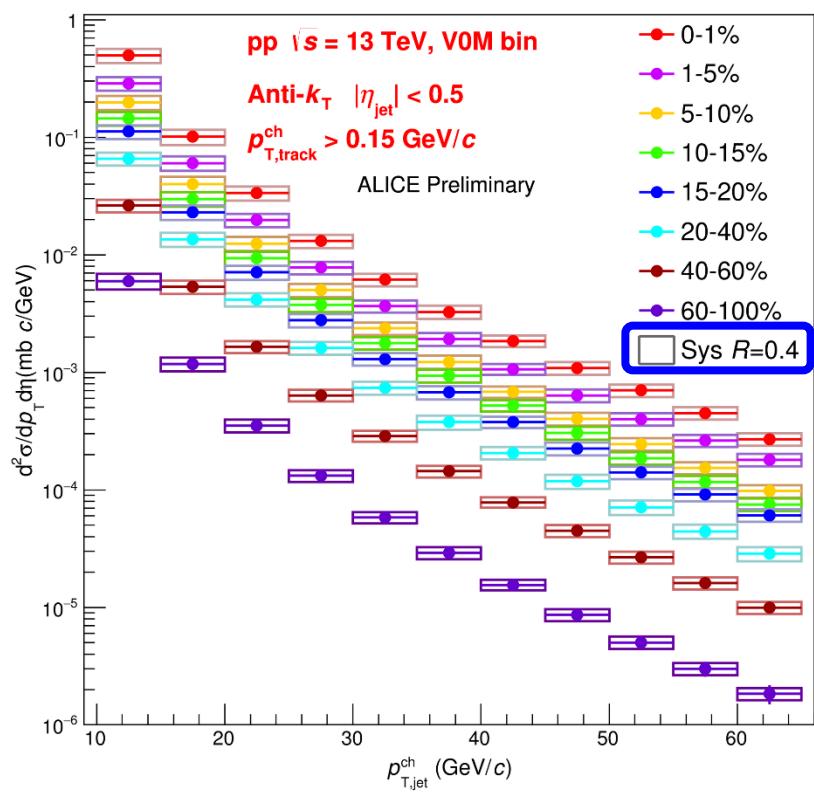
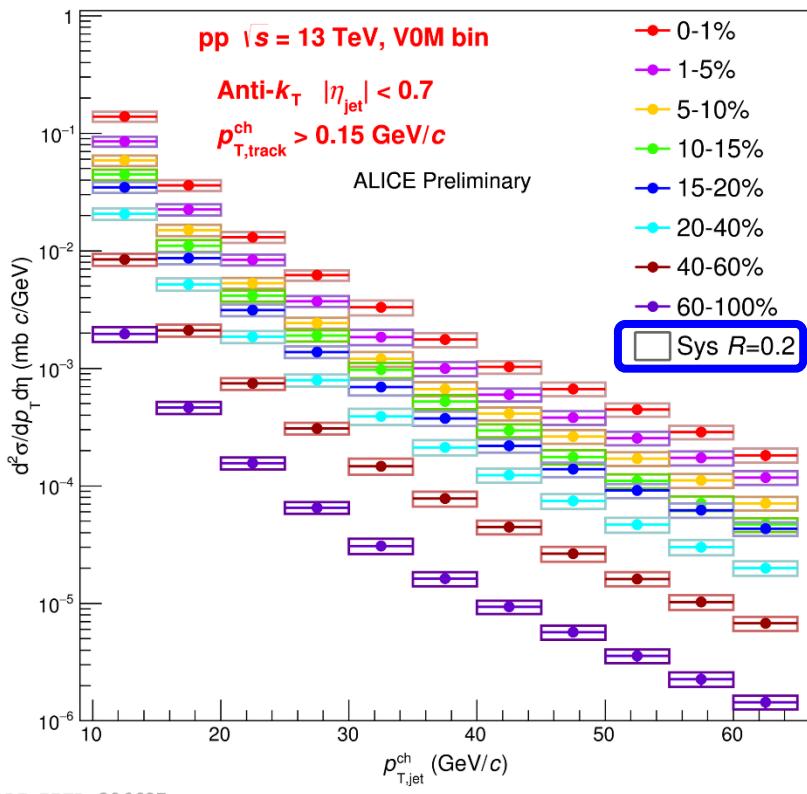
Charged jets measurements in pp collisions at $\sqrt{s} = 13 \text{ TeV}$

Charged jet cross section in pp collisions



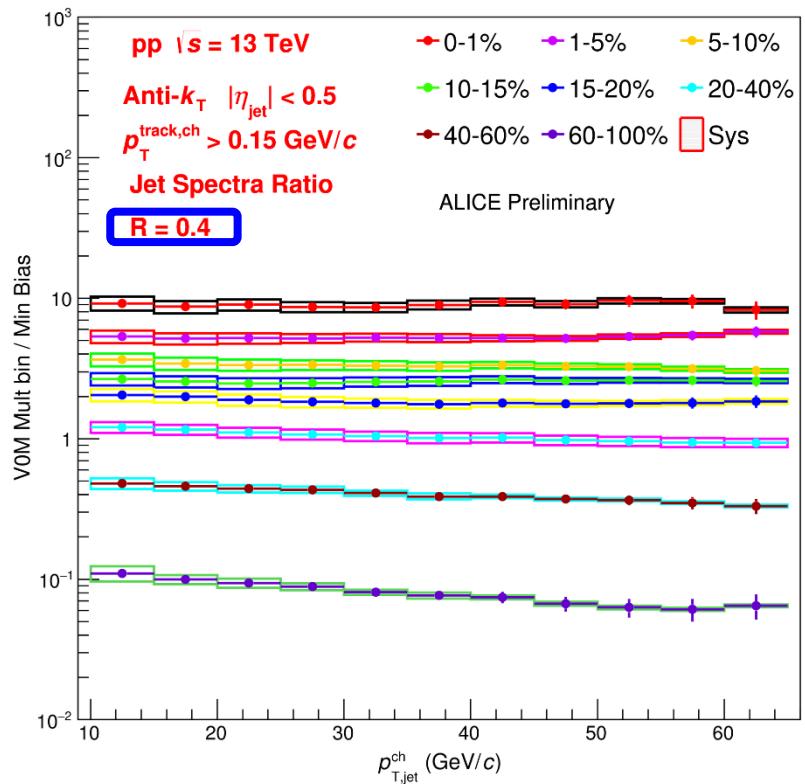
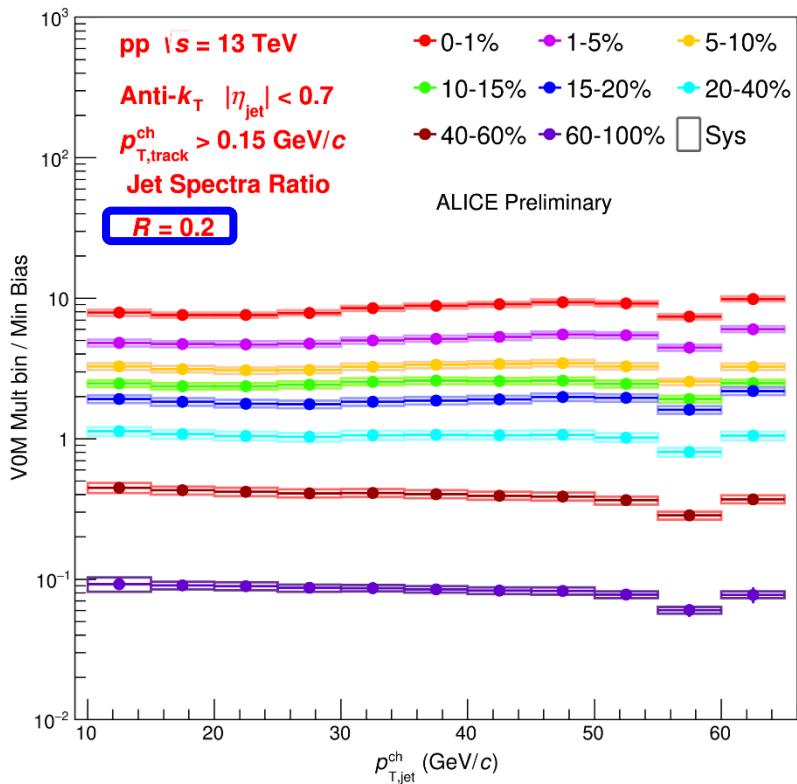
- Charged jet cross sections measured for $R=0.2$ and $R=0.4$
- Cross sections are compared with different MC calculations, POWHEG + PYTHIA8 (NLO pQCD+parton shower+hadronization) agrees with data

Multiplicity dependent jet production



- Charged jet cross sections in different multiplicity bins for $R = 0.2$ and $R = 0.4$ in pp collisions
- More jets are produced in high multiplicity events compared to low multiplicity bins

Multiplicity dependence of jet production ratio



ALI-PREL-306695

ALI-PREL-306699

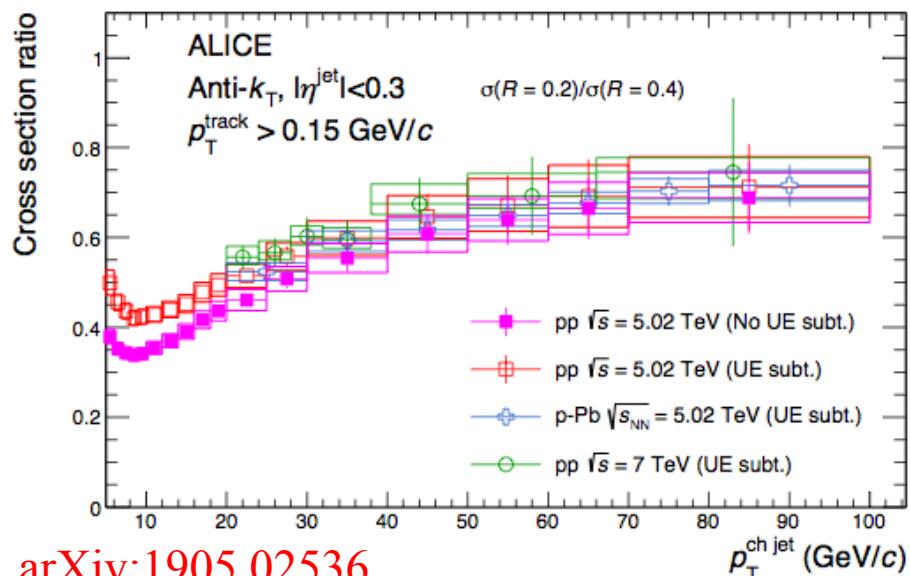
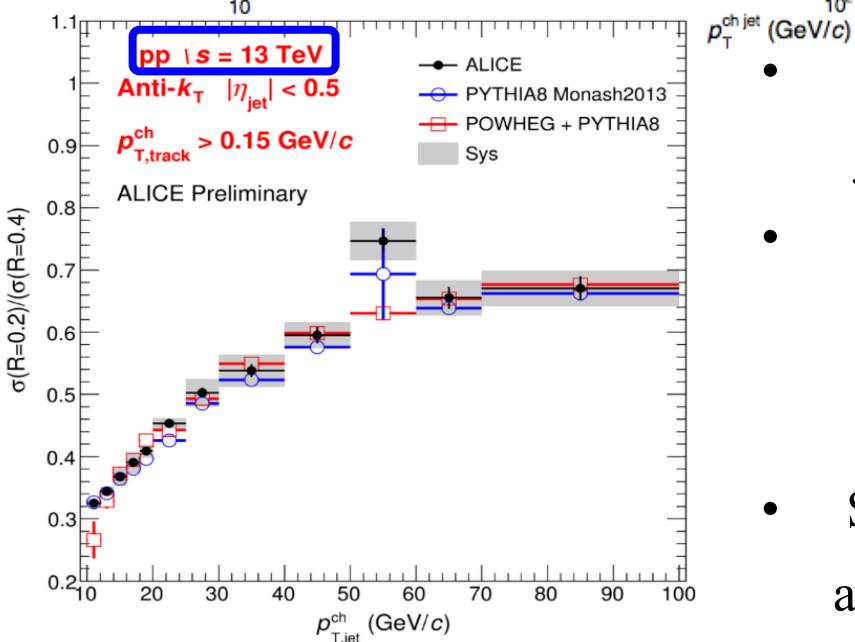
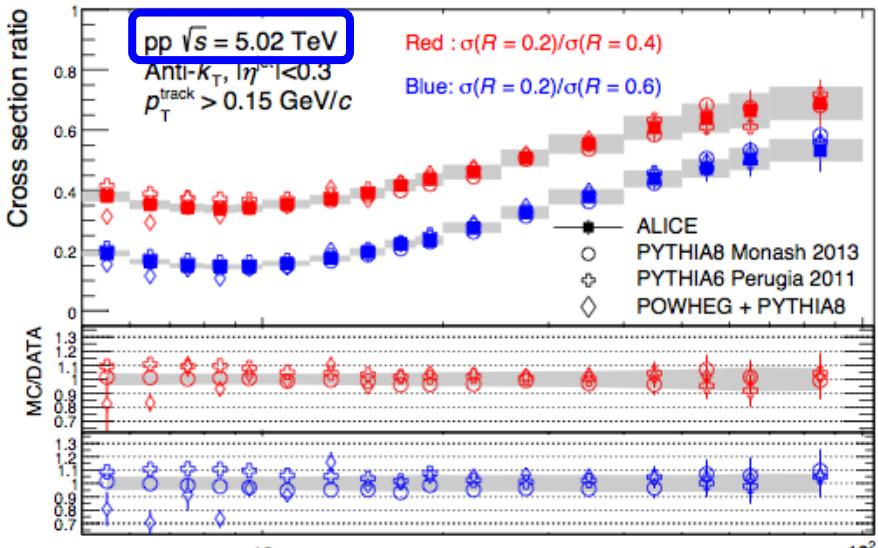
- Ratio of charged jet cross sections in different multiplicity intervals with respect to Min. bias one in pp collision
- Cross section ratio has weak p_T and resolution parameter R dependence in different multiplicity bins



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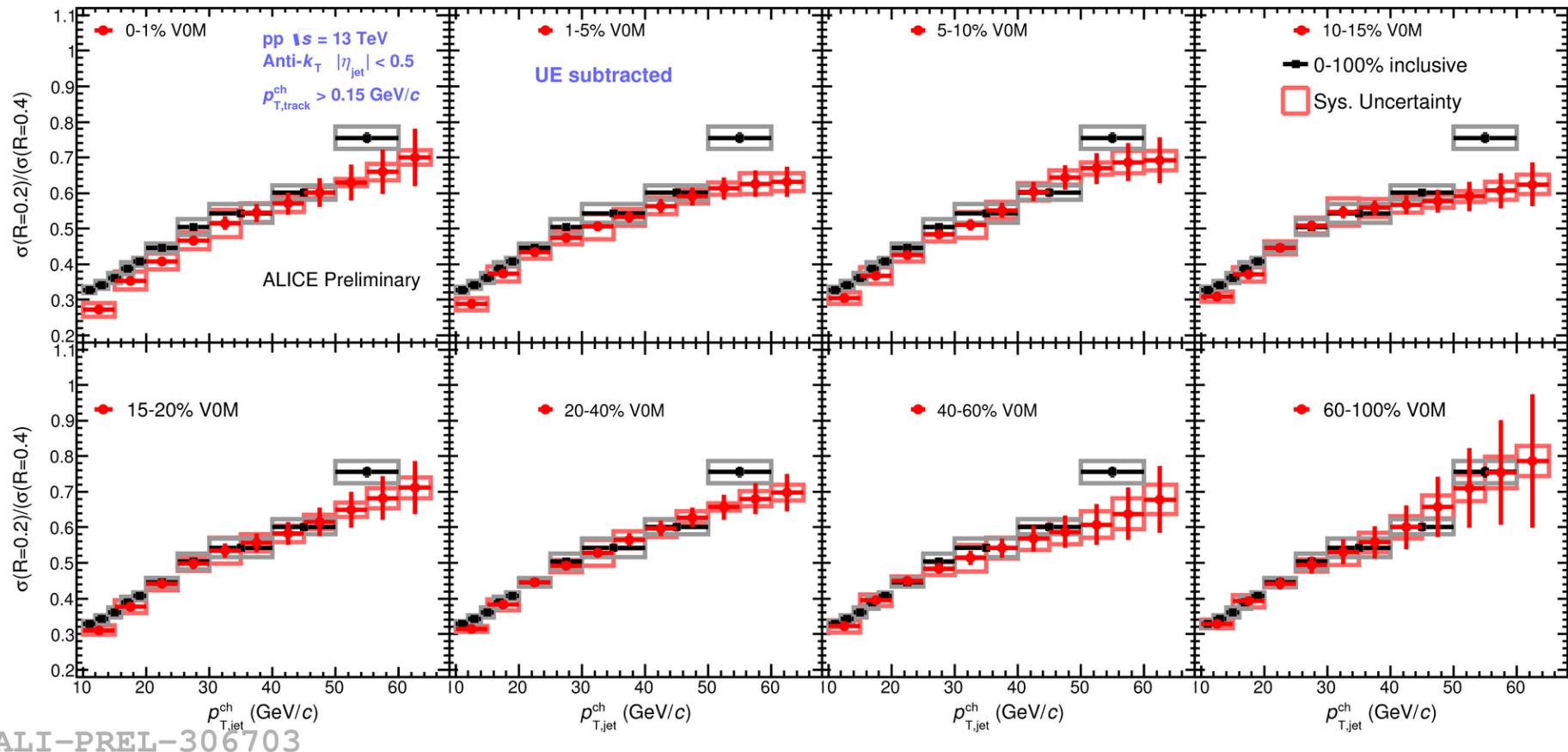
Jet cross section ratio: $R = 0.2/R = (0.4 \text{ or } 0.6)$



- Jet cross section ratio measurements reflect jet collimation information
- Different jet cross section ratio is slightly increasing with jet p_T , and consistent with Monte Carlo simulation
- Similar jet cross section ratios for different \sqrt{s} and collision mode

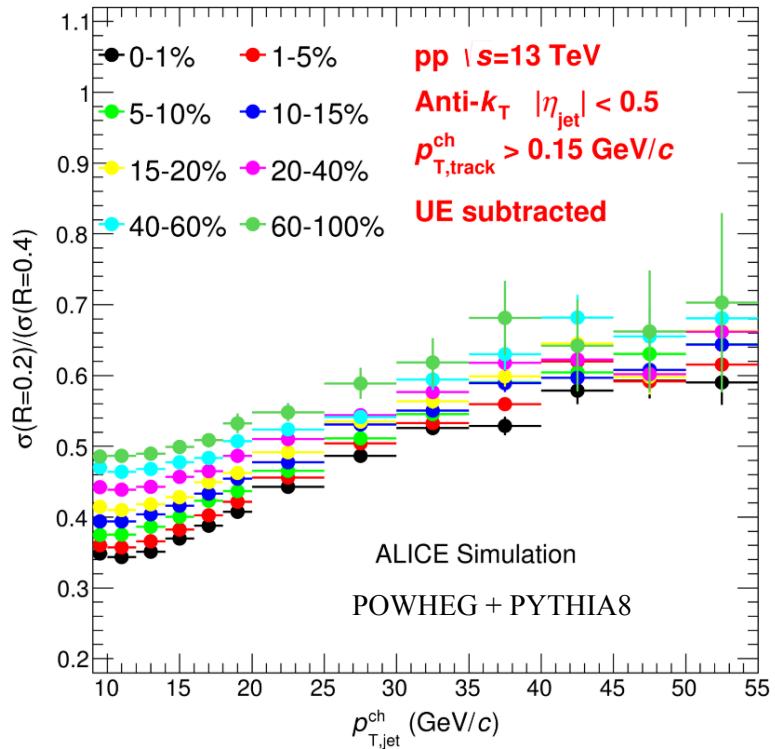
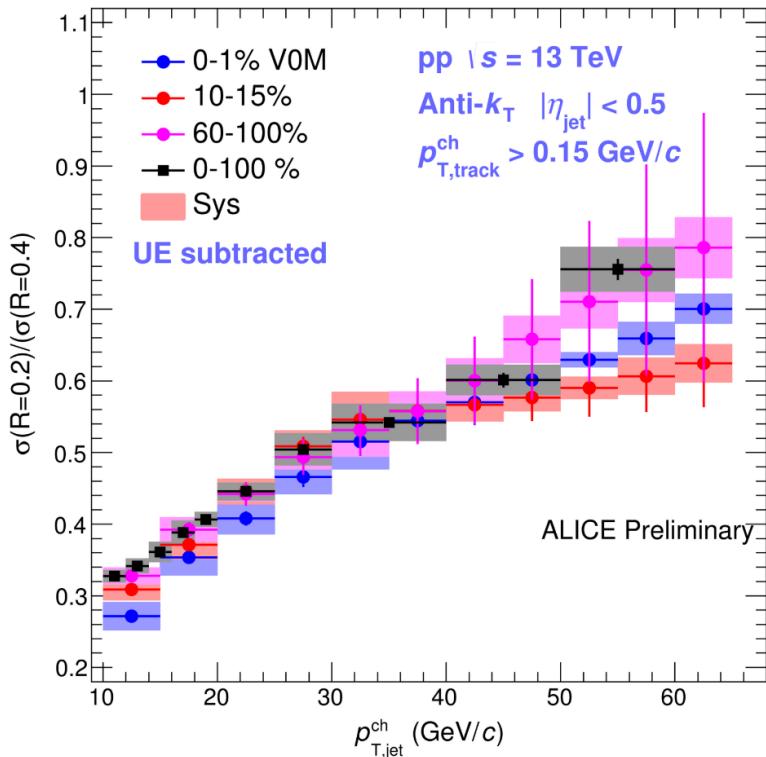
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Multiplicity dependent jet cross section ratio



- Jet cross section ratio between $R=0.2$ and $R=0.4$ in different multiplicity intervals
- No strong multiplicity dependence in ratio of the jet spectra

Cross section ratio from data and simulation



- Jet cross section ratio from data shows no centrality dependence while simulation indicates centrality ordering
 - Inclusive jet cross section can be reproduced by POWHEG calculation but not the centrality dependent cross section ratio in pp collisions
 - Multiplicity differences or UE subtraction effect?



Summary and outlook

- **Charged jet production** studied in pp and Pb-Pb collisions
- **Inclusive jet cross sections** in pp collisions can be reproduced by **POWHEG+PYTHIA8**
- **Nuclear modification factor (R_{AA})** has been measured
 - Centrality dependent jet suppression is observed in Pb-Pb collisions
 - Full jets and charged jets R_{AA} are consistent
- **Multiplicity dependent jet cross section** is studied
 - Higher(lower) jet yield in high(low) multiplicity events compared to inclusive one
 - Jet production ratios have no significant jet p_T and resolution parameter dependence
- **Jet cross section ratio between $R = 0.2/R = 0.4$ (or 0.6)** have been measured
 - No strong dependence for different collision systems or collision energies
 - Weak dependence on multiplicities from data, while multiplicity ordering in simulation

Thanks for your attention!



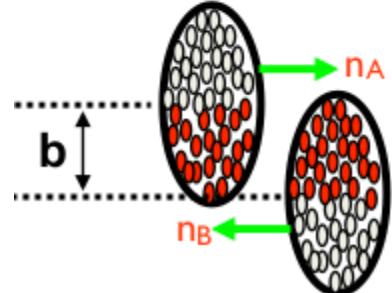
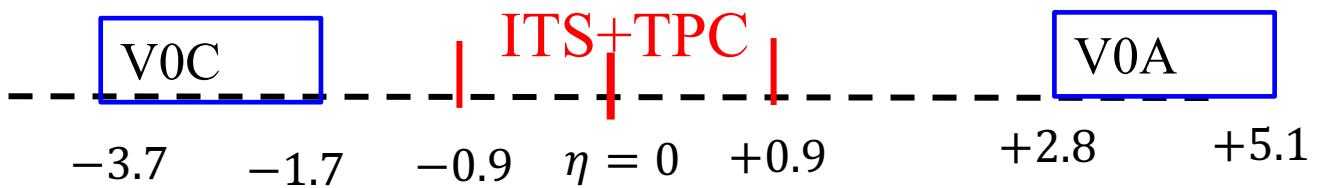
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Backup

Multiplicity estimator in pp collisions

- Selecting different multiplicity events using forward detector (V0) to avoid auto correlations between event activities and jet measurements



Event activity categorization (V0M): $V0A + V0C$

Jet measurements: ITS+TPC

- Multiplicity percentile is determined using V0M amplitude distribution

