Measurements of charged particle jet properties in pp collisions at $\sqrt{s}$ = 7 TeV using ALICE at the LHC

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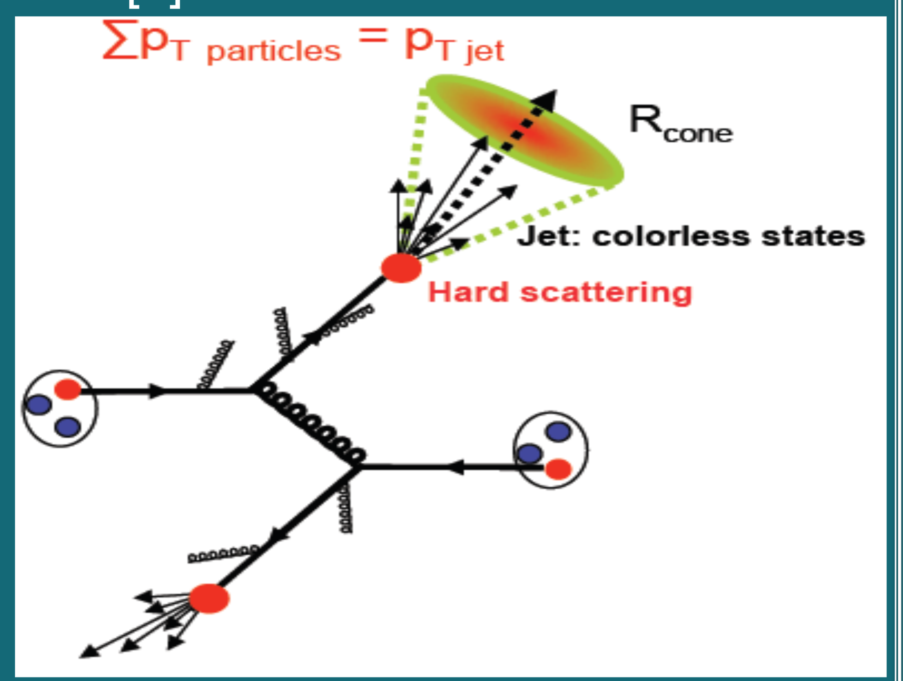
Introduction

❖**Jet:** a collimated spray of particles originating from the fragmentation of hard scattered partons in pp (or in A-A) collisions [1]



❖**Jets provide**
- a proxy for high p_T partons produced in elementary collisions
- an experimental tool for measuring the parton kinematics
- an unique tool to test perturbative quantum chromodynamics (pQCD)

❖**Jet shapes are sensitive to**
- the details of the fragmentation process [1]
- the type of parton (quark or gluon) that fragments into hadrons, can be used to distinguish between a quark and a gluon jet

❖**Measurements in pp collisions:**
- a baseline for similar measurements in more complex A-A collisions where one expects parton energy loss and change in the jet structure

Analysis details

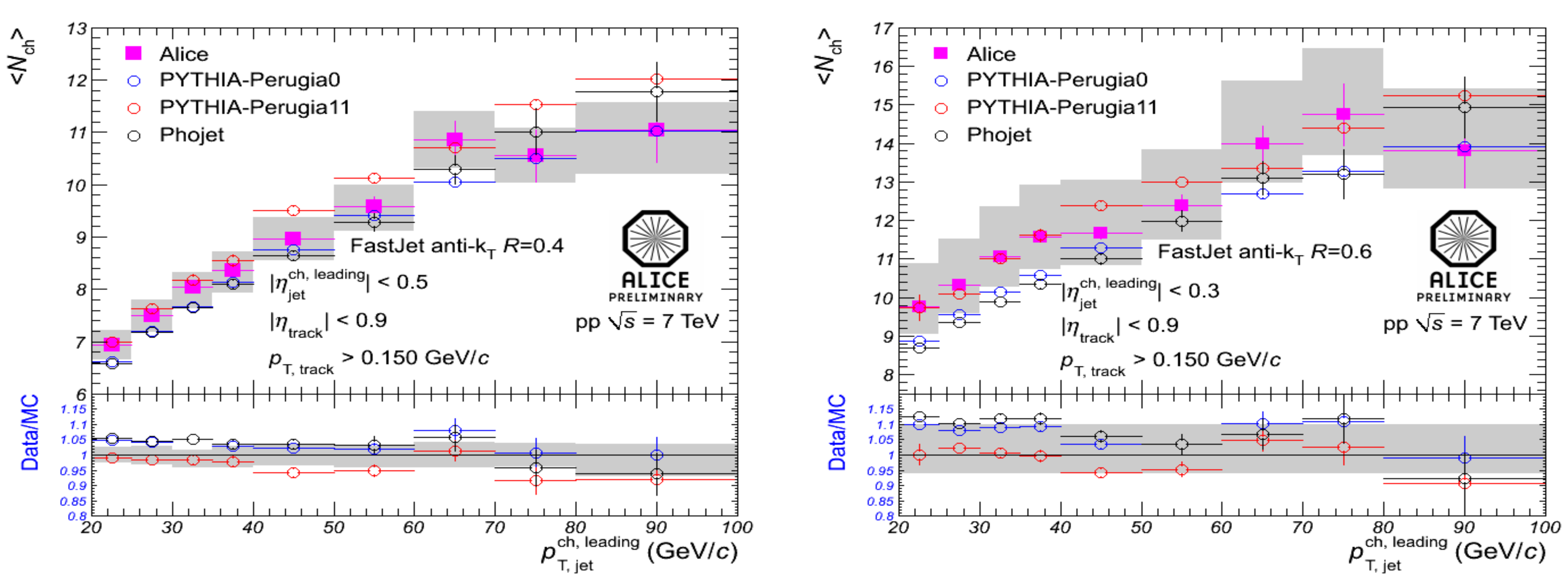
❖pp collisions at $\sqrt{s}$ = 7 TeV
❖Event selection : Minimum bias collisions
❖Vertex (V_z) selection: $|V_z|$ < 10 cm
❖Total number of events analyzed: 161 M
❖Detector subsystems used: The Time Projection Chamber (TPC) and Inner Tracking System (ITS) for tracking and the V-ZERO and ITS for online trigger
❖Track selection:
- Charged track reconstruction with the TPC and ITS
- $|\eta_{track}|$ < 0.9
- $p_{T,\ track}$ > 0.150 GeV/c

Jet reconstruction

❖Algorithm: Fastjet anti-k_T [2], a sequential recombination clusterizer
❖Resolution parameter R = 0.4, 0.6
❖$|\eta_{track}|$ < 0.9
❖$|\eta_{jet}|$ < 0.9 – R
❖20 < $p_{T,\ jet}$ < 100 GeV/c

Charged particle multiplicity in leading jet (N_{ch})

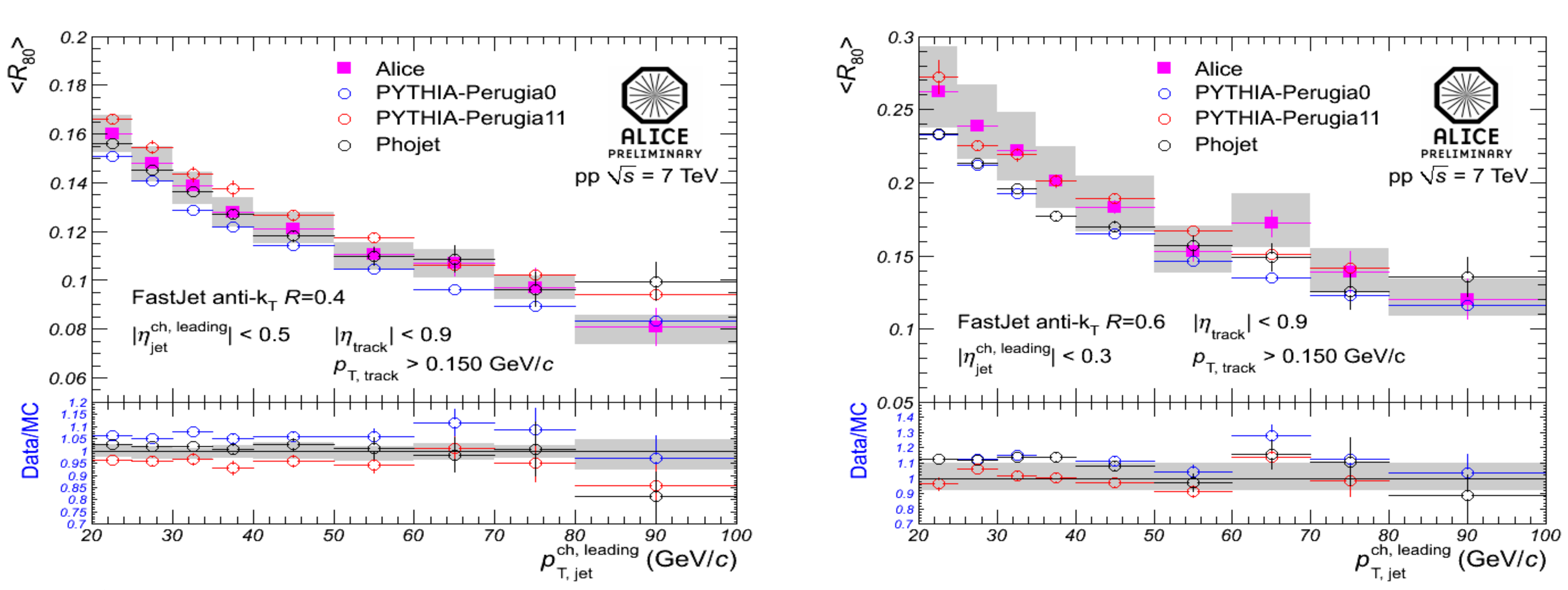
$\langle N_{ch}\rangle$: Mean number of charged particles within the leading jet



- $\langle N_{ch}\rangle$ in the leading jet as a function of jet p_T
- $\langle N_{ch}\rangle$ increases with increasing jet p_T
- Reasonable agreement between data and MC models
- Error bars: statistical errors; Error bands: systematic errors

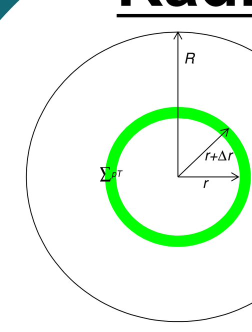
Leading charged jet size (R_{80})

$\langle R_{80}\rangle$: Mean value of the radius containing 80% of the total jet p_T found in the jet cone (R = 0.4, 0.6)



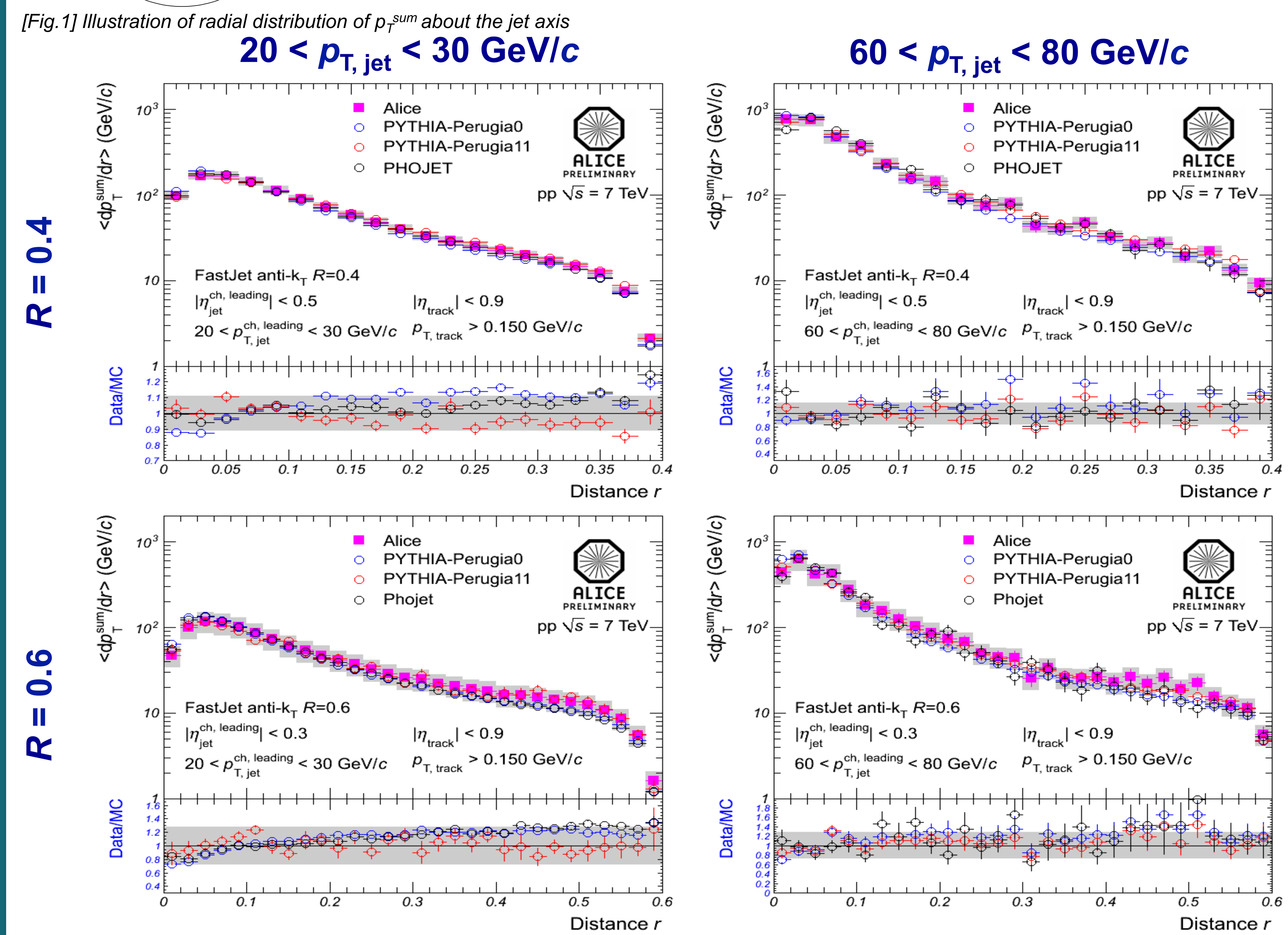
- $\langle R_{80}\rangle$ as a function of jet p_T
- Decreasing trends of R_{80} with increasing jet p_T indicate that high p_T jets are more collimated than low p_T jets
- Agreement between data and MC models seems reasonable within uncertainties

Radial distribution of p_T within the leading jet (p_T^{sum})



$\langle p_T^{sum}\rangle$: The average value of the scalar p_T sum of all charged particles produced in the annulus reconstructed at given r about the jet axis [Fig.1]

[Fig.1] Illustration of radial distribution of p_T^{sum} about the jet axis



- p_T^{sum} as a function of distance r from the jet axis
- Transverse momentum density is largest near the jet axis; decreases with r
- Higher slope in case of high p_T jets: jets become more collimated with increasing p_T
- Reasonable agreement between the data and MC models

Summary

❖Preliminary measurements of charged particle jet properties in pp collisions at $\sqrt{s}$ = 7 TeV obtained with ALICE detector using anti-k_T jet finding algorithm presented.
❖$\langle N_{ch}\rangle$ increases with increasing jet p_T as expected [4].
❖Measured p_T^{sum} and R_{80} show that jets become more collimated with increasing p_T.
❖Reasonable agreement found between the data and MC models within the statistical and systematic uncertainties.

References

[1] S. D. Ellis, Z. Kunszt and D. E. Soaper Phys. Rev. Lett. 69 3615 (1992)
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[3] T. Sjostrand, S Mrenna and P. Z. Skands JHEP 0605 026 (2006)
[4] CDF Collaboration Phys. Rev. D 65 092002 (2005)

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