Study of charm in jet using D^{*+} mesons in pp collisions at the LHC with ALICE

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Motivation for charm jet studies

- Fragmentation function: distribution of the original parton momentum fraction carried by the hadron
  - Charm quark fragmentation into hadrons is known from e^+-e^- experiments and peaked at large momentum fraction z

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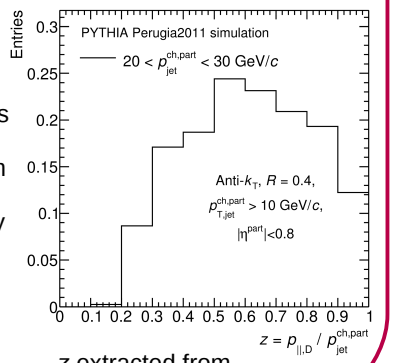
- Measure charm fragmentation in pp to study
  - Production mechanisms
  - Fragmentation into hadrons
- Measurement in Pb-Pb collisions to address in-medium modifications
- Jet momentum used as a proxy for the quark/gluon initial momentum

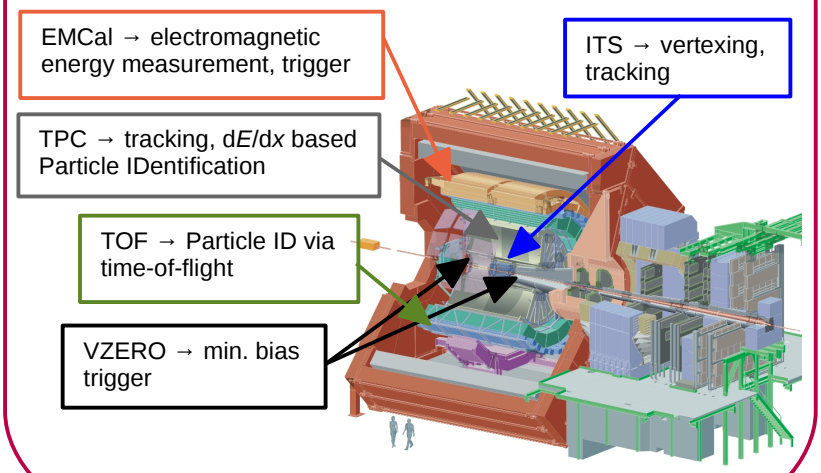
$$z = p_{||,D} / p_{jet}^{ch,part}$$

with $p_{||,D} = \bar{p}_D \cdot \bar{p}_{jet}^{ch,part} / |p_{jet}^{ch,part}|$



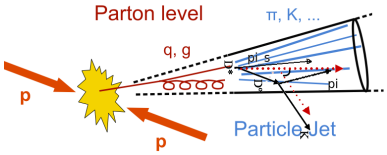
z extracted from PYTHIA Perugia2011

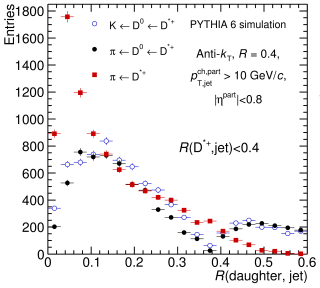
The ALICE detector

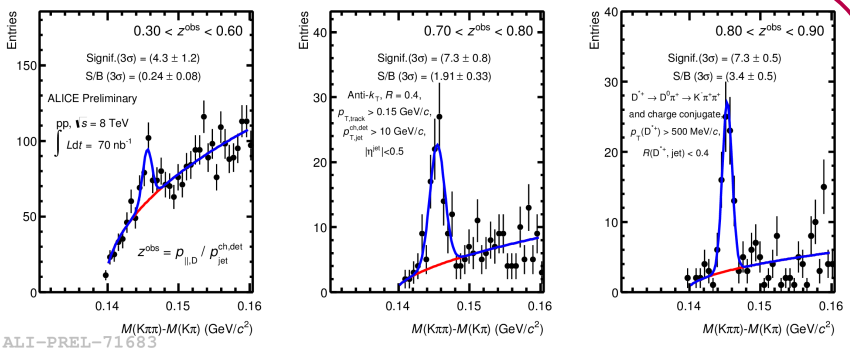


Analysis strategy

- *D meson* yield is measured via an invariant mass analysis of fully reconstructed displaced vertices
  - Focus on: $D^{*+} \rightarrow D^0 \pi^+ \rightarrow K^- \pi^+ \pi^+$ and charge conjugate (largest S/B)
  - Exploit topological selections on the D^0 decay vertex and PID to reduce the combinatorial background
- *Jets* are reconstructed from charged tracks
  - Anti-k_T, R = 0.4, $p_{T,jet}^{ch,det} > 10$ GeV/c, p_T-scheme







- D^{*+} in jet ≡ $R(D^{*+}, jet) < 0.4$
  - A D meson within the jet can have its decay products (daughters) falling outside the jet cone, due to kinematics

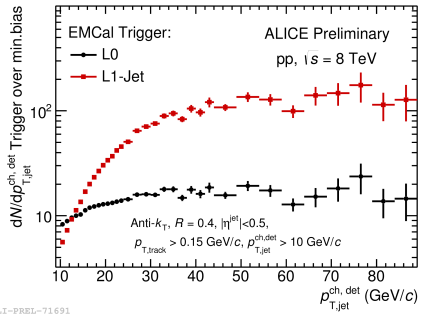
Figure above: pp collisions, EMCal L1-jet trigger, examples of signal extraction in bins of $z^{obs} = p_{||,D} / p_{jet}^{ch,det}$

- In data, the jet momentum is corrected for the "missing daughter" effect

Data sample: pp at √s = 8 TeV, EMCal triggered events

Large statistics is needed for D meson and jet studies

The EMCal triggered samples provide larger jet (see figure) and D meson samples with respect to min. bias interactions



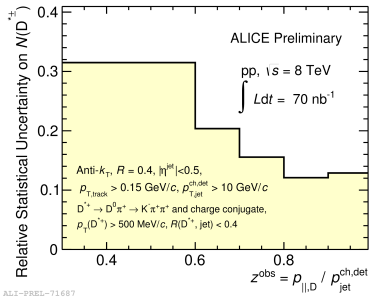
EMCal cell size (ηxφ): 0.014 rad

L0 trigger: 4x4 cells, 8 GeV threshold,

L1-Jet trigger: 32x32 cells, 16 GeV threshold

Plateau in the charged jet yield to min. bias at around 25 GeV/c for L0 and 40 GeV/c for L1-Jet triggers

D^{*+} in Run 1 and perspective for Run 2



- 10-30% relative statistical uncertainty on signal yield for L1-jet trigger (integrated luminosity = 70 nb^{-1})
- Expected integrated luminosity from triggered data in Run 2, pp at √s = 13 TeV: 40 pb^{-1}
  - factor ~500 larger statistics → few percent relative statistical uncertainty on signal

Summary and outlook

- D^{*+} in jet signal extracted in pp EMCal triggered events at √s = 8 TeV collected with the ALICE detector
- Current z^{obs} region covered: $0.3 < z^{obs} < 1$
- Next steps: apply corrections (D^{*+} efficiency, jet unfolding), perform this analysis on 2011 Pb-Pb data sample

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