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The parton-flavour dependence of splittings in parton showers can be explored using heavy-flavour jets. We report charm-tagged jet substructure measurements, using jets tagged with a reconstructed D^0 meson. Using the newly collected Run 3 data, these measurements span a large range of jet transverse momenta, allowing us to systematically probe the contribution of mass effects at low jet transverse momenta, where the dead-cone effect of the charm quark is significant, as well as the contribution of Casimir colour factor effects at high transverse momenta as the charm-tagged jet sample is quark-enriched.

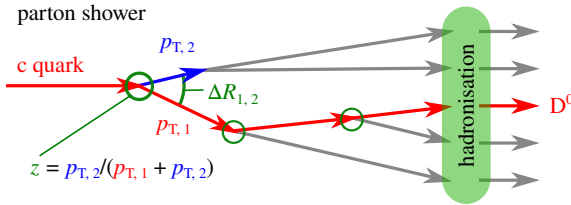
Heavy-flavour jet groomed substructure

Heavy-flavour jets are tagged with a reconstructed D^0 meson.

The jet constituents, including the D^0 , are reclustered using the Cambridge–Aachen algorithm.

The resulting tree of angular-ordered splittings is groomed using the Soft-drop (SD) condition to identify perturbative splittings.

$$z = \frac{p_{T,2}}{p_{T,1} + p_{T,2}} > z_{\text{cut}} \left(\frac{\Delta R_{1,2}}{R} \right)^\beta$$

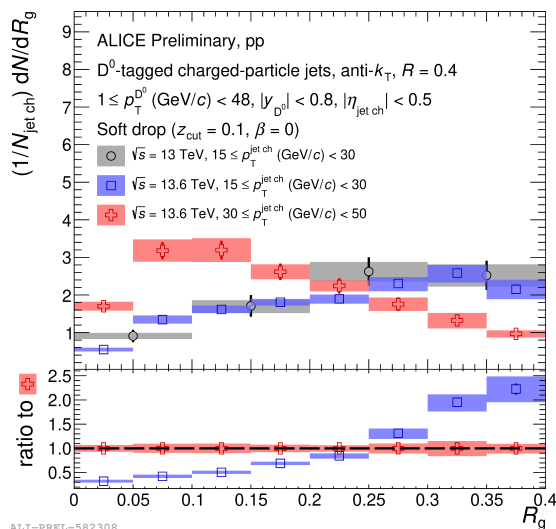


Splittings passing the grooming condition are used to construct observables characterising the parton shower. These observables are closely linked to fundamental ingredients of the QCD splitting functions describing $1 \rightarrow 2$ parton emissions.

Groomed opening angle R_g

Opening angle $\Delta R_{1,2}$ of the first splitting passing SD

- Probes the angular dependence of the splitting function.

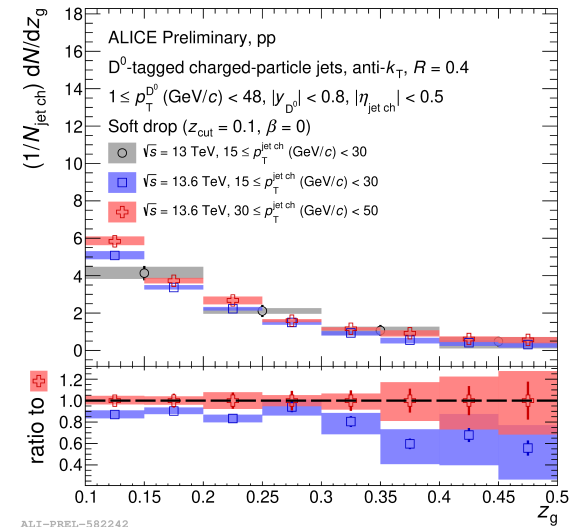


More collimated perturbative emissions for larger jet p_T

Groomed momentum fraction z_g

Momentum fraction z of the first splitting passing SD

- Converges to the splitting function.



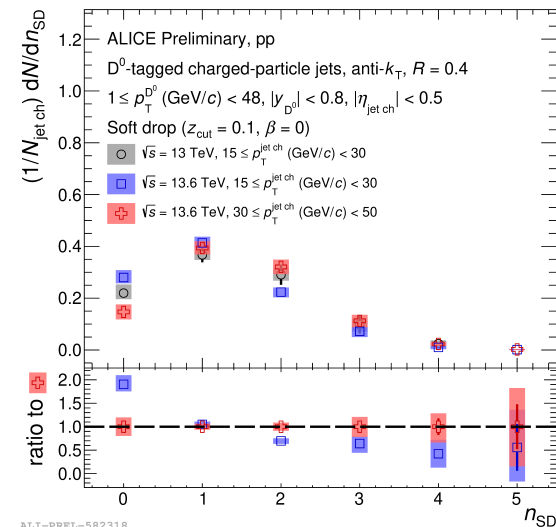
More probable perturbative emissions for larger jet p_T

Number of groomed splittings n_{SD}

Number of splittings passing SD along the charm branch

- Targets number of perturbative emissions.

- Links to the perturbative part of the fragmentation function.



More abundant perturbative emissions for larger jet p_T

Conclusions

The data sample of pp collisions recorded by ALICE in Run 3 allowed us to improve the precision of the measurements of the heavy-flavour jet substructure and extend their kinematic reach. We observe that with increasing jet p_T , perturbative emissions of gluons by charm quarks become more probable, more collimated and more abundant. These results are consistent with the expected mass effects.