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Beyond the leading dipole approximation: modelling junctions in the event generator PYTHIA

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The recent discovery at the LHC of order-of-magnitude enhancements of the Λ_c/D ratio (relative to its LEP value) at low pT, and several related measurements, has prompted renewed interest in baryon production in hadron collisions, especially in the heavy-flavour sector. One scenario that successfully accounts for (and in fact predicted) these effects is based on QCD colour reconnections with so-called string junctions, already implemented in the event generator PYTHIA. String junctions are an explicitly beyond the leading colour string configuration that makes use of the SU(3) colour structure of QCD, and are particularly important as they provide a baryon production mechanism additional to standard string fragmentation. These junction baryons form around the junction itself, and thus the modelling of the junction motion is important for accurately predicting the effects of junctions on baryon production. Though junction topologies are already included in the event generator PYTHIA, the current modelling of junctions encounters convergence errors for around 10% of cases whilst using an unphysical averaging procedure, and neglects special treatment of so-called soft-quark cases. In order for a junction baryon to be a heavy-flavour baryon, the heavy quark is often considered soft, and thus these soft-quark cases become particularly important and the heavy-quark baryon becomes even more sensitive to the modelling of the junction motion. Though the predictions with the current modelling show a surprising agreement to data (particularly in the heavy-flavour sector), in order to draw conclusions about the impact of junction topologies, more physically robust modelling is required. Thus here we propose a new iterative procedure for modelling the junction motion, including a novel pearl-on-a-string treatment which takes care of junctions with a soft quark, aiming to more accurately describe and model heavy-flavour baryon production.

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