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Precision determination of the small- x gluon from charm production at LHCb

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The small- x gluon in global fits of parton distributions is affected by large uncertainties from the lack of direct experimental constraints. In this work we provide a precision determination of the small- x gluon from the exploitation of forward charm production data provided by LHCb for three different centre-of-mass (CoM) energies: 5 TeV, 7 TeV and 13 TeV. The LHCb measurements are included in the PDF fit by means of normalized distributions and cross-section ratios between data taken at different CoM values, $R_{13/7}$ and $R_{13/5}$. We demonstrate that forward charm production leads to a reduction of the PDF uncertainties of the gluon down to $x \approx 10^{-6}$ by up to an order of magnitude, with implications for high-energy colliders, cosmic ray physics and neutrino astronomy.

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