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Gluon saturation with forward photons at LHC: prospects for a high-granularity calorimeter upgrade for ALICE

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Direct photon production at forward rapidity is a promising probe for the gluon content of protons and nuclei at small x . In particular, the measurement of the nuclear modification factor for direct photons in p -A collisions at the LHC should provide a crucial test for gluon saturation. We discuss the unique role of such a photon measurement in the context of other measurements at the LHC and also of possible future measurements at EIC. To allow us to perform this measurement, a new forward calorimeter (FoCal) is proposed as an upgrade to the ALICE experiment. The proposed detector covers the range $3.5 < \eta < 5$ which probes the gluon distributions at $x \sim 10^{-5}$ and $Q^2 \sim p_T^2 > 4$ GeV. We will discuss performance studies of such a detector, which demonstrate that extremely high-granularity calorimetry is required for a successful measurement, and show a few recent results from R&D for this project.

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