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## Studies of the top quark production in nuclear collisions and impact on nuclear PDFs in CMS

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In proton-nucleus collisions, the top quark is a novel and theoretically precise probe of the nuclear gluon density at high virtualities  $Q^2 \approx m_{\text{top}}$  and in the less explored high Bjorken- $x$  region. The first observation of the inclusive  $t\bar{t}$  production has been performed using  $174 \pm 6 \text{ nb}^{-1}$  of data in pPb collisions at  $\sqrt{s_{\text{NN}}} = 8.16 \text{ TeV}$ . However, the total uncertainty of about 17% is not sufficient for imposing constraints on current nPDF parameterizations, the dominant source of uncertainty in the theoretical prediction of  $\sigma(\text{pPb} \rightarrow t\bar{t} + X)$ . The prospects of measuring  $\sigma$  differentially have recently been examined and a feasibility study of the measurement with the CMS detector at the High-Luminosity LHC (HL-LHC) era is therefore carried out as a function of the reconstructed lepton  $p_{\text{T}}$  and rapidity. The relative statistical uncertainty in both variables is found to be at the level of 4–5% in each bin, and it is expected to be the dominant uncertainty at  $\sqrt{s_{\text{NN}}} = 8.16 \text{ TeV}$  for an integrated luminosity scenario of  $2 \text{ pb}^{-1}$ . The motivations for measurements of top quarks in nucleus-nucleus collisions are multifold and are discussed: the top quark decay products are sensitive to the energy loss of heavy quarks, and a probe of the space-time structure of the QGP at HL-LHC.

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