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# Measurement of initial stages via color neutral probes in pPb and PbPb with the CMS detector

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The electroweak process is often used to probe the parton distribution functions (PDFs) in a proton and the nuclear parton distribution functions (nPDFs) in heavy ions. In this presentation, the measurements of the Drell-Yan process in pPb collisions at 8.16 TeV and of Z bosons decaying to pairs of leptons in PbPb collisions using data collected at 5.02 TeV from the CMS experiment at the LHC will be summarized.

In pPb collisions, the dimuon rapidity, mass,  $p_T$ , and  $\phi^*$  (which is an angular variable correlated with  $p_T$  measured for the first time in pPb collisions) dependences are shown. In addition, comparisons to theoretical proton PDF and nPDF models show that the data are sensitive to the presence of nuclear modifications to the parton distributions in the lead nucleus, and can help improve and constrain theoretical calculations.

In PbPb collisions, the differential cross-sections of Z bosons decaying to pairs of leptons are measured as a function of transverse momentum  $p_T$  and rapidity  $y$ . The measurements are performed with an integrated luminosity of  $1.7 \text{ nb}^{-1}$ , using the dimuon and dielectron decay channels. High precision measurement of the Z boson elliptic azimuthal anisotropy is found to be compatible with zero, showing that Z bosons do not experience a significant final-state modification in heavy-ion collisions. Yields of Z bosons in various centrality bins are compared to Glauber model predictions for the production rates of hard probes not modified by the presence of initial collision geometry and centrality selection effects.

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