Single diffraction and elastic scattering in proton-proton collisions with the STAR detector at RHIC

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Abstract

We present results obtained with the STAR detector on single diffraction (SD) and elastic scattering in proton-proton collisions at RHIC energies. The forward scattered protons are tagged in the STAR Roman Pot system and the hadronic final state system produced in the SD process is reconstructed using the STAR Time Projection Chamber.
The diffractive cross section constitutes a large fraction of the total hadronic cross section and its precise modelling is important for measurements of other processes. On the other hand, due to its nonperturbative nature, it can not be calculated in QCD but must be modelled phenomenologically, which needs input from an experiment.
In this talk, I will report the inclusive and identified charged-particle spectra measurements in SD at $\sqrt{s} = 200$ GeV. The results are compared to Monte Carlo models. The production ratio of antibaryons to baryons is related to the baryon number transfer from the colliding protons to the midrapidity region and is used to constrain models' parameters ("diquark", "string-junction"). The K/π ratio is sensitive to the strangeness production in the fragmentation process. The measured $\bar{p}/p$ ratios indicate a nonnegligible baryon number transfer in SD at $\xi < 0.05$. The measured K/π ratio suggests a larger strangeness production at $p_{\mathrm{T}} > 0.5$ GeV/c in the SD process compared to inclusive proton-proton collisions.
In addition, the first measurement of the proton-proton elastic cross section at $\sqrt{s} = 510$ GeV will be presented. The measured total elastic cross-section is in agreement with the expected energy dependence. The measured differential cross section $d\sigma_{\mathrm{el}}/dt$ can be fitted only with the nuclear slope parameter parametrised as a second-degree polynomial. The results are also compared with models.