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The (Sea)Quest to map anti-up and anti-down quarks[1]

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The SeaQuest experiment at Fermilab continues a series of Drell-Yan measurements to explore the antiquark content of the nucleon and to study the modifications to nucleon structure when the nucleon is embedded into a nuclei. To extend existing measurements to larger values of Bjorken-x, a 120 GeV proton beam extracted from Fermilab's Main Injector is used, resulting in 50 times more luminosity than previous experiments and enabling access to values of x up to 0.9. One of the key physics goals of the SeaQuest collaboration is the exploration of the origin of the intrinsic nucleon sea. The scale dependence observed in high-energy scattering experiments reflects the quantum fluctuations predicted by QCD. A sea of virtual gluons arises in the nucleon; these gluons radiate other gluons or pairs of quarks and antiquarks. Gluon splitting, e.g. into an u anti-u quark pair or a d anti-d quark pair, is a perturbative QCD process and flavor symmetric. However, there is clear experimental evidence that the nucleon sea is not flavor symmetric. The distributions for anti-d quarks and anti-u quarks differ by up to 50% and suggest a substantial role of non-perturbative QCD processes in the creation of the nucleon sea. Measuring the ratio of the anti-d quark and anti-u quark distributions with high accuracy and within a large x-range is the key measurement of the SeaQuest experiment. The SeaQuest results will help to identify effective theories that can describe the intrinsic nucleon sea and help to explore its origin.

[1]On behalf of the SeaQuest Collaboration.