Individual Letter of Intent Report

Letter of Intent: LOI-06-004

Title: First Measurement of Polarized EMC Effect for the Neutron

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Motivation: This LOI describes an experiment aiming at measuring the EMC effect in polarized structure function for the neutron by combining results measured in DIS scattering on polarized ^{3}He and ^{129}Xe targets (alternatively ^{21}Ne). The results of this measurement would provide the first data on polarized EMC effect.

Measurement and Feasibility: The experiment is proposed to be performed in Hall A using the standard HRS spectrometers to detect the scattered electrons and discriminate them from the pions. Due to the smallness of the expected asymmetries in the case of nucleus target, a parity beam quality is required but with specifications that are now standard in Hall A.
The main technical issue is to build/operate the polarized nuclear target. It appears that only two of the noble gas can be used for the polarized target:^{129}Xe is preferred over ^{21}Ne. Although the latter one would be more difficult to polarize, it might be the only choice if difficulties in calculating the nuclear corrections for the ^{129}Xe nucleus from theory are too challenging.

Issues : The authors have made clear the serious challenges in both theoretical and experimental aspects. For the latter, the experiment requires a polarized heavy nucleus. Although required technique already exists, and solutions are foreseen to handle problems with the ^{129}Xe, such development are likely to last for several years. Theoretically, how to do nuclear corrections remains a challenge for nuclear theorists.
The "spin dependent EMC effect" is experimentally difficult to define. Since we cannot polarize all the nucleons in a given nucleus, the concept of mean field spin effect is ill defined compared to the unpolarized case. The spin structure function of a nucleus g1 is the product of the asymmetry A_1 by the unpolarized structure function F_1. The unpolarized structure function F_1 has obviously a well defined "EMC" effect and A_1 is an already small quantity which decreases with the atomic number A of the nucleus. Given the uncertainty of the nuclear spin structure effects and the small size of the asymmetry A_1, it will be difficult to disentangle what the proponents call the "spin EMC effect".

Recommendation: The PAC remains skeptical that data, if successfully recorded, could be interpreted in a meaningful way.