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Duality and Nuclear Medium Effects in Weak Structure Functions at Low Q^2

In the neutrino/antineutrino energy region of 1-3 GeV, inelastic processes contribute significantly to neutrino interaction event rates at the DUNE experiment.

These processes are mainly dominated by single-pion production, with some contribution from eta production, kaon production, associated particle production, multi-pion production, etc. Generally, single-pion production is understood as due to the $\Delta(1232)$ resonance mechanism. However, in the neutrino energy region (1.5-3.0 GeV), it has been realized that other nucleon resonances like P11(1440), D13(1520), S11(1535), S11(1650), P13(1720), etc. are also important. In this region of energy the principle of quark-hadron duality can be very effectively used to connect the deep-inelastic scattering (DIS) cross section to the cross section in the resonance region. We present the deep inelastic structure functions in the weak interactions at $Q^2 < 1 \text{ GeV}^2$ where parton distribution functions become unreliable. We use the Capella et al. (CKMT) parameterizations for the low- Q^2 region.

We present results for nuclear medium effects in weak structure functions at $Q^2 < 1 \text{ GeV}^2$. To take into account the dynamics of the nucleons bound inside the nucleus we use a phenomenological approach at the nucleon level and a field theoretical approach to include Fermi motion, binding energy effects, and nucleon correlations (AMUVal DIS model). This work was supported in part by US DOE grant DE-FG02-94ER40847.

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