# $Q^2$ Dependence of Nuclear Transparency for Incoherent $\rho^o$ Electroproduction

According to QCD, pointlike colorless systems, such as those produced in exclusive processes at high $Q^2$ have a vanishingly small transverse size. Therefore, they are expected to travel through nuclear matter experiencing very little attenuation. This effect, referred to as color transparency (CT), can not be explained in the hadronic picture of nuclear matter (Glauber theory) and calls upon the quark's degrees of freedom. Earlier measurements were mainly focused on quasi-elastic hadronic (p, 2p) and leptonic (e, e'p) scattering off nuclear targets. Although high energy experiments observed a clear signal of CT, none of the intermediate energy experiments produced an evidence for CT up to a $Q^2 \sim 8\,GeV^2$.

In this experiment, we would like to look for the onset of CT in the incoherent diffractive $\rho^0$ electroproduction on deuterium, nitogen, and iron. In this process, the virtual photon fluctuating into a $q\overline{q}$ pair could produce a vector meson by interacting with a nucleon inside the target. This fluctuation can propagate over a distance $l_c$ called "coherence length".

The observable carrying the signature of CT is the transparency ratio :

$$T_A = \frac{\sigma_A}{A\sigma_N}$$

where $\sigma_A$ is the $\rho^0$ production cross section on the nuclear target (A) and $\sigma_N$ is the one measured on nucleon. The possible manifestation of CT is a significant increase of $T_A$ as a function of $Q^2$. Recent theoretical calculations by Kopeliovich et al predicted an increase of more than 40 % at $Q^2 \sim 4\,GeV^2$.

Recent measurements by HERMES collaboration have shown that $T_A$ increases when $l_c$ varies from long to short compared to the size of the nucleus. This so called coherence length effect can mock the signal of CT and should be under control. Therefore, we propose to measure the $Q^2$ dependence of the transparency $T_A$ at fixed coherence length $l_c$.

The proposed measurements will be done using the standard setup of the CLAS detector at Hall B. A photon beam of 2 GeV and electron beam of 4 and 6 GeV will be used in order to cover the whole $Q^2$ region up to 4 $GeV^2$.