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# The MINER$\nu$A experiment at FNAL

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**Abstract.** I present detector and physics capabilities of the MINER$\nu$A experiment.

**PACS.** 13.15.+g Neutrino interactions – 25.30.Pt Neutrino scattering from nuclei

MINER$\nu$A is a dedicated neutrino cross-section experiment planned for the NuMI beamline at Fermilab [1]. The detector (Fig. 1) consists of a low-mass active scintillator target surrounded by calorimetric detectors and upstream heavy nuclear targets. The low-mass target allows for separation of final state particles and therefore the identification of exclusive final states. The surrounding calorimeters ensure complete energy collection in the events, except for final state muons, which may be measured in the MINOS experiment's near detector located immediately downstream of MINER$\nu$A.

The physics goals of the experiment include measurements of the $A$-dependence of quasi-elastic ($\nu n \to \mu^- p$) scattering, measurement of the axial form factor of the nucleon at high $Q^2$ (shown in Fig. 2), tests of quark-hadron duality in the axial current and measurements of coherent single-pion prodution in the Coulomb field of a target nucleus (Fig. 3).

The physics of neutrino cross-sections is an exciting subject in its own right and explores physics in the axial current similar to that being probed at high precision in the vector current at high intensity electron scattering machines. These measurements are also important for future neutrino oscillation experiments planned with beams of energies 1–a few GeV, where neutrino cross-sections are difficult to predict theoretically and are poorly measured [2]. Results from the MINER$\nu$A experiment will significantly reduce errors from unknown neutrino cross-sections in the MINOS, T2K and NO$\nu$A experiments.

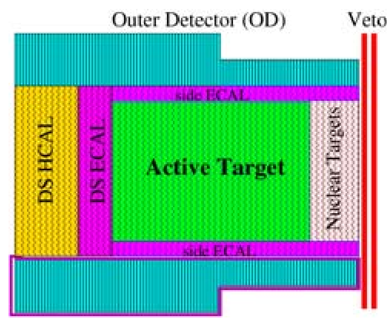


**Fig. 1.** A schematic side view of the MINER$\nu$A detector. Neutrinos enter from the *right*

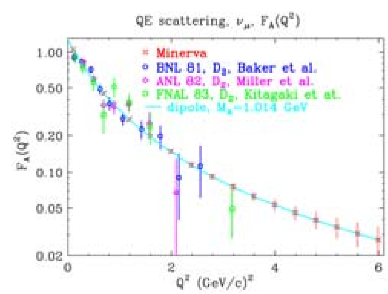


**Fig. 2.** Estimation of $F_A$ from a sample of Monte Carlo neutrino quasi-elastic events recorded in the MINER$\nu$A active carbon target, assuming a dipole form with $M_A = 1.014$ GeV/$c^2$. Also shown is $F_A$ from bubble chamber experiments

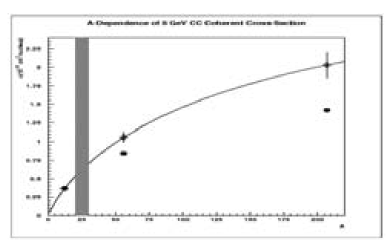

**Fig. 3.** Coherent cross-sections for 5 GeV neutrinos vs. atomic number. The *solid curve* and *circles* are two different models; crosses show expected MINER$\nu$A measurements. The *shaded band* indicates the $A$ region of previous experiments

## References

1. D. Drakoulakos et al. [Minerva Collaboration]: "Proposal to perform a high-statistics neutrino scattering experiment using a fine-grained detector in the NuMI beam," arXiv:hep-ex/0405002
2. D.A. Harris et al. [MINERvA Collaboration]: "Neutrino scattering uncertainties and their role in long baseline oscillation experiments," arXiv:hep-ex/0410005

[a] presenting on behalf of the MINER$\nu$A Collaboration