The First CEBAF Experiment
E91-013 - The Nuclear Dependence of the (e,e'p) Reaction and the Propagation of Protons in Nuclear Material.

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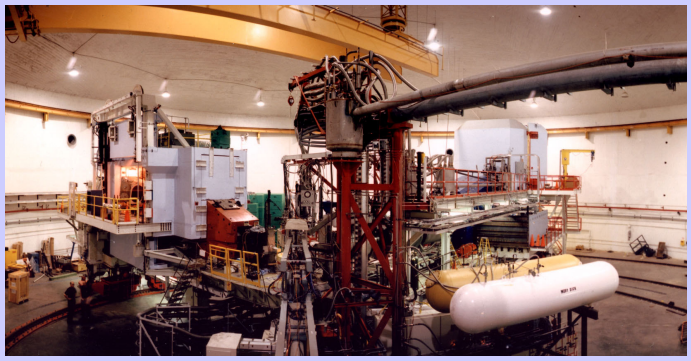
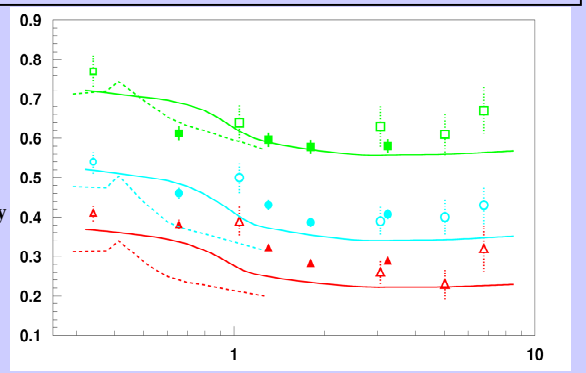
On November 15, 1995 the first experiment to use the CEBAF beam began in Hall C. Experiment E91-013 studied the (e,e'p) reaction over a broad range of energy and momentum transfer on targets of carbon, iron and gold. The goals of this experiment touched many of the far-reaching science goals that led to CEBAF's construction.

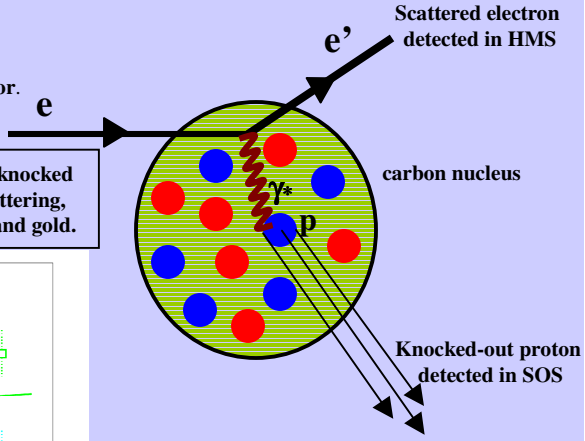
- How do hadrons propagate in nuclear matter?
- What are the reaction mechanisms involved in (e,e'p) reactions?
- What is the single particle structure of nuclei?
- Does the structure of the proton change inside the nucleus?

As one of the two commissioning experiments for Hall C, the collaboration had to validate and calibrate all the new experimental equipment, including the High Momentum Spectrometer and the Short Orbit Spectrometer. The first results were presented at the PANIC96 meeting in Williamsburg a few days after the commissioning experiments were completed.



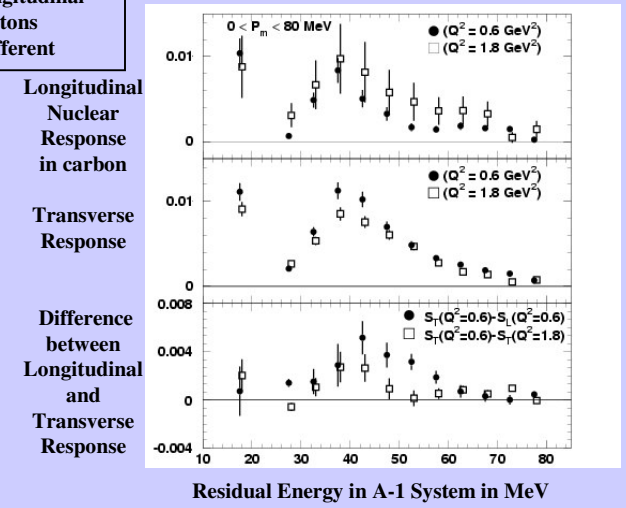
The nuclear transparencies, the probabilities that a knocked out proton emerges from the nucleus without rescattering, were precisely measured on targets of carbon, iron and gold.





The collaboration and the first publication of nuclear research results from the CEBAF accelerator

The coupling of longitudinal and transverse photons to the nucleus is different



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Quasifree $(e,e'p)$ Reactions and Proton Propagation in Nuclei

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The $(e,e'p)$ reaction was studied on targets of C, Fe, and Au at momentum transfers squared Q^2 of 0.8, 1.3, 1.8, and 3.3 GeV² in a region of kinematics dominated by quasifree electron-proton scattering. Missing energy and missing momentum distributions are reasonably well described by plane wave impulse approximation calculations with Q^2 and A dependent corrections that measure the attenuation of the final state protons. [S0031-9007(98)06279-8]

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The $(e,e'p)$ reaction with nearly free electron-proton kinematics (quasifree) has proven to be a valuable tool to study the propagation of nucleons in the nuclear medium [1–3]. The relatively weak interaction of the electron with the nucleus allows the electrons to penetrate the nuclear interior and knock out protons. These studies complement nucleon-induced measurements of proton propagation in nuclei which give more emphasis to the nuclear surface. This paper reports the first results of a systematic study of the quasifree knockout of protons of 300–1800 MeV kinetic energy from carbon, iron, and gold targets. This energy range includes the minimum of the nucleon-nucleon (N-N) total cross section, the rapid rise in this cross section with energy above the pion production threshold, and extends to the long plateau in the energy dependence of the N-N total cross section. These features of the N-N interaction would be expected to be reflected in the energy dependence of attenuation of protons as they pass