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Study of the ^{3}He **Nucleus through Electrodisintegration at High Momentum Transfer**

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Coincidence experiments have proven to be very useful tools to study specific aspects of the nucleus. In particular the (e,e'p) reaction has been used not only to study the single nucleon structure of nuclei but also to study the behaviour of nucleons embedded in the nuclear medium. The high energy, high duty cycle beam at Jefferson Lab. will allow us to fully develop such studies: (i) to extend the domain of momentum transfers towards higher values where short range effects and possibly the internal structure of the nucleons are manifested, (ii) to explore nuclear structure in its extreme conditions, by focusing on the high momentum part of the wave functions, and (iii) to increase the specificity of the probe by separating the response functions associated with different polarization states of the virtual photon.

We will exploit these new possibilities by undertaking a series of (e,e'p) measurements on the ^{3}He nucleus. Next to the deuteron, the A=3 nuclei are the simplest systems in which all the basic ingredients of a complex nucleus exist. Sophisticated methods to solve the Schrodinger equation almost exactly have been applied to the A=3 nuclei. Microscopic calculations of FSI and MEC contributions have been developed and applied to reactions on few nucleon systems.

We will investigate three specific aspects of the electromagnetic response of ^{3}He through (e,e'p) coincidence measurements at $\vec{q}$ from 1.0 to 3.0 GeV/c. In Part 1. we will study the single nucleon structure of ^{3}He with special emphasis on high momenta (up to $p_{miss} = 0.8$ GeV/c) by the separation of the R_L R_T and R_{LT} response functions in constant $(\vec{q},\omega)$ kinematics for p_{miss} up to 0.550 GeV/c and by measuring cross sections at $p_{miss} = 0.700$ and 0.800 GeV/c. The $\vec{q}$ dependence of the reaction will be examined in Part 2 by performing longitudinal/transverse (L/T) separations for protons emitted along $\vec{q}$, up to $\vec{q} = 3.0$ GeV/c at quasifree kinematics ($p_{miss} = 0$) and for $\vec{q} = 1.0$ and 2.0 GeV/c at $p_{miss} = 0.3$ GeV/c. In Parts 3 and 4 we focus on the continuum region to study correlated nucleon pairs.

1 PART 1: $|\vec{q}| = 1.5\,\mathrm{GeV/c}$ Separations in Perpendicular Kinematics

Complete separations up to $p_{miss} = 0.550\,\mathrm{GeV/c}$ and two cross section measurements for $p_{miss} = 0.700$ and $0.800\,\mathrm{GeV/c}$ Allocate 50 hours for the last two cross section points. The total time required for part 1 is 410 hours.

2 PART 2: Separations in Parallel Kinematics.

1) $|\vec{q}| = 1.0\,\mathrm{GeV/c}$, $p_{miss} = 0.\,\mathrm{GeV/c}$

2) $|\vec{q}| = 2.0\,\mathrm{GeV/c}$, $p_{miss} = 0.\,\mathrm{GeV/c}$

3) $|\vec{q}| = 3.0\,\mathrm{GeV/c}$, $p_{miss} = 0.\,\mathrm{GeV/c}$

4) $|\vec{q}| = 1.0\,\mathrm{GeV/c}$, $p_{miss} = -0.300\,\mathrm{GeV/c}$

5) $|\vec{q}| = 2.0\,\mathrm{GeV/c}$, $p_{miss} = -0.300\,\mathrm{GeV/c}$

6) $|\vec{q}| = 1.2\,\mathrm{GeV/c}$, $p_{miss} = +0.300\,\mathrm{GeV/c}$

(Note: The perpendicular kinematics already include a point with $|\vec{q}| = 1.5\,\mathrm{GeV/c}$, $p_{miss} = 0.\,\mathrm{GeV/c}$)

Part 2 will take 130 hours.

3 PART 3: Separations at Large E_{miss} in Perpendicular Kinematics

Two back angle points to match the large E_{miss} data that are included in acceptance bite of the perpendicular kinematics for the $p_{miss} = 0.300\,\mathrm{GeV/c}$ and $0.425\,\mathrm{GeV/c}$ forward angle data points.

Part 3 will require 85 hours.

4 PART 4: Separation at Large E_{miss} in Parallel Kinematics

One back angle data point at $p_{miss} = -0.300\,\mathrm{GeV/c}$, $|\vec{q}| = 2.0\,\mathrm{GeV/c}$ at parallel kinematics to match the large E_{miss} data that are included in the acceptance bite of the forward angle data of Part 2. Part 4 will require 50 hours.

The total time for data taking is estimated to be 675 hours. The remaining 45 hours would be devoted to calibrations. The approximate break down by beam energy is attached below.

Data taking

E_{inc}(GeV)	Time (hrs)
4.795	241
4.045	30
3.045	10
2.045	85
1.345	276
1.045	33

Calibrations

E_{inc}(GeV)	Time (hrs)
4.795	15
2.045	15
1.345	15