The n3He Experiment: Target Ion Chamber

for the n3He Collaboration
Mark McCrea
University of Manitoba

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n3He: Target Ion Chamber

1. Introduction

2. Experiment Setup

3. Ion Chamber Assembly

4. Current Status
n3He Introduction

n3He probes the weak nucleon-nucleon interaction by measuring the parity violating directional asymmetry between the polarization direction of the incoming cold neutrons and the direction of the outgoing protons in the reaction

\[ \vec{n} + ^3\text{He} \rightarrow ^4\text{He} \rightarrow p + T + 765\text{keV} \]
n3He Schematic Diagram in FnPB

H2.05: Resonant Frequency Spin Rotator for the n3He Experiment, Christopher B. Hayes
Beamline CAD Model
n3He Target/Detector Chamber

• HV 17 HV Frames with 8 wires each
• Signal 16 signal Frames with 9 wires each
1 atm. He-3
Proton Asymmetry in Chamber

$n + ^3He \rightarrow p + T + 765\text{keV}$
Target CAD Drawing

Frame Stack with signal and HV PCB on mount plate

Chamber exterior with all flanges in place.
Aluminum Chamber Vessel

- 10” conflat end flanges
- windows are 1mm thick Al
- 4 signal feed thrus
- 2 gas feed thrus
- 2 HV feed thrus
- Al body, SS knife edges
Target Frames

1/4” thick macor ceramic

Signal Frame
- 9 wires

HV Frame
- 8 wires
Completed Frame - HV

- 0.02” dia. wire
- 0.8kg Tension
Frame Stack Assembly
Assembled Frame Stack
Circuit Boards Attached
Frame Stack Shielding

- Teflon Shielding on signal board to stop stray charge collection
- Teflon on HV to stop unwanted discharge
- Kapton around ends to stop unwanted discharge
- Ceramic beads on bare wires when possible
Survey and Alignment

- The position and angle of the frame stack inside the housing needs to be known to align it to the neutron beam.

- Faro Arms are 3D measurement devices.

- Position and angle of frame stack measured to base flange

- Compression plate was approx. 1.5 milliradian from parallel to the base
Mounting Housing on Frame Stack
Housing In Place
Survey and Alignment Checking for Frame Stack
Vacuum Testing

- Fully Assembled Chamber currently pumped down to less than $10^{-6}$ Torr
- Leak checked at $10 \times 10^{-10} \text{mbar}\cdot\text{l/s}$ level to be helium tight
Current Status:

- n3He Chamber Assembled.
- Initial HV testing passed
  - $1.5 \times 10^{-8}$ amps at 1400V from HV to ground
- Initial leak check passed
- Currently pumping chamber to remove degassing residuals

Upcoming Tasks:

- fill with pure 4He for final HV testing and electronics testing
- fill with pure 3He for short testing on beam before SNS summer maintenance break
n3He Collaboration

Duke University, Triangle Universities Nuclear Laboratory
  • Pil-Neo Seo

Istituto Nazionale di Fisica Nucleare, Sezione di Pisa
  • Michele Viviani

Oak Ridge National Laboratory
  • Seppo Penttil
  • David Bowman
  • Vince Cianciolo
  • Jack Thomison

University of Kentucky
  • Chris Crawford
  • Latiful Kabir

Western Kentucky University
  • Aaron Sprow

University of Manitoba
  • Ivan Novikov
  • Michael Gericke
  • Mark McCrea
  • Carlous Olguin

Universidad Nacional Autnoma de Mexico
  • Libertad Baron
  • Jose Favela

University of New Hampshire
  • John Calarco

University of South Carolina
  • Vladimir Gudkov
  • Young-Ho Song

University of Tennessee
  • Nadia Fomin
  • Geoff Greene
  • S. Kucuker
  • C. Hayes
  • Irakli Garishvili

University of Tennessee at Chattanooga
  • Josh Hamblen
  • Caleb Wickersham

University of Virginia
  • S. Baessler