

UT Future Polarized Target Development

PSTP²⁰²⁴

20TH INTERNATIONAL WORKSHOP
ON POLARIZED SOURCES,
TARGETS, AND POLARIMETRY

SEPTEMBER 22-27

JEFFERSON LAB
NEWPORT NEWS, VA

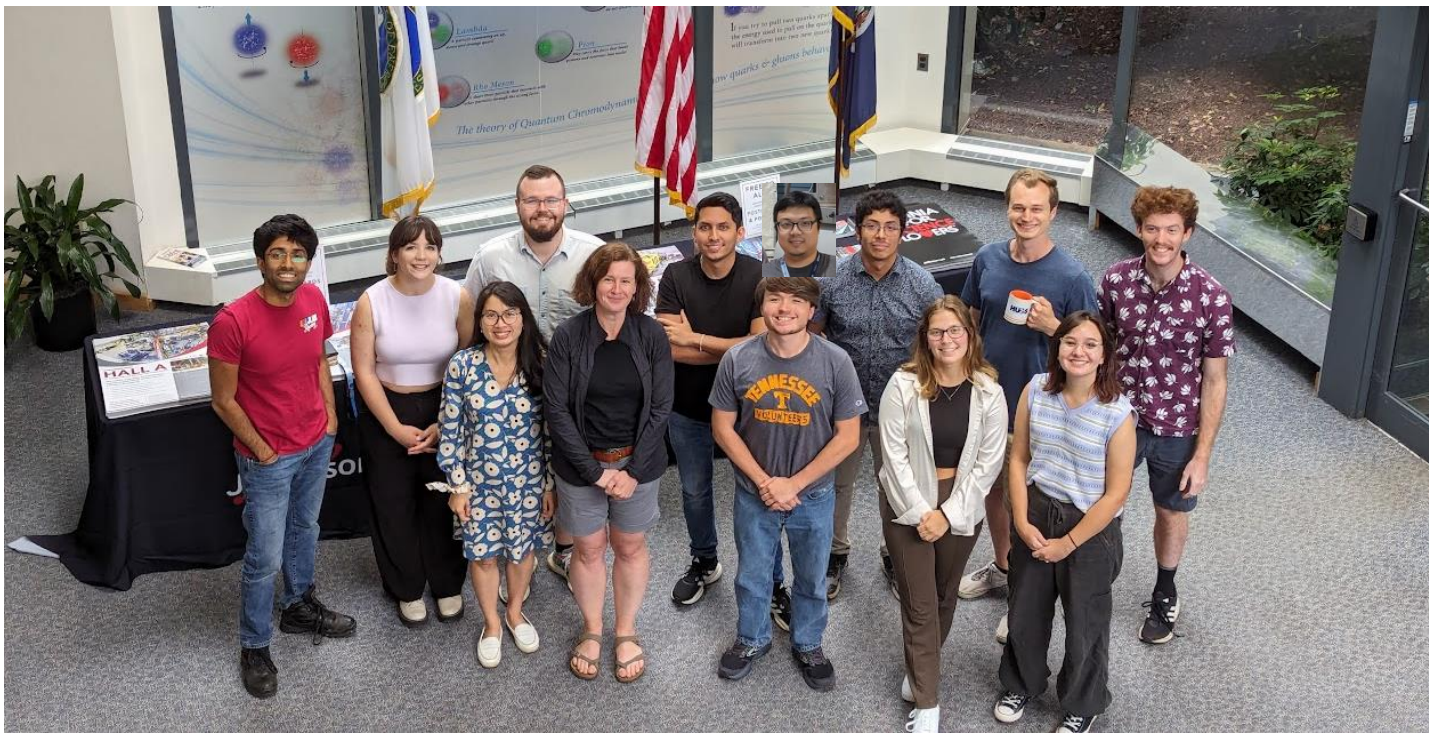


Nadia Fomin and Dien Nguyen

September 27, 2024

1

UT Medium Energy Group



Spin Studies in Hall B with CLAS12

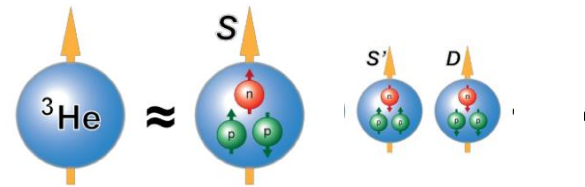
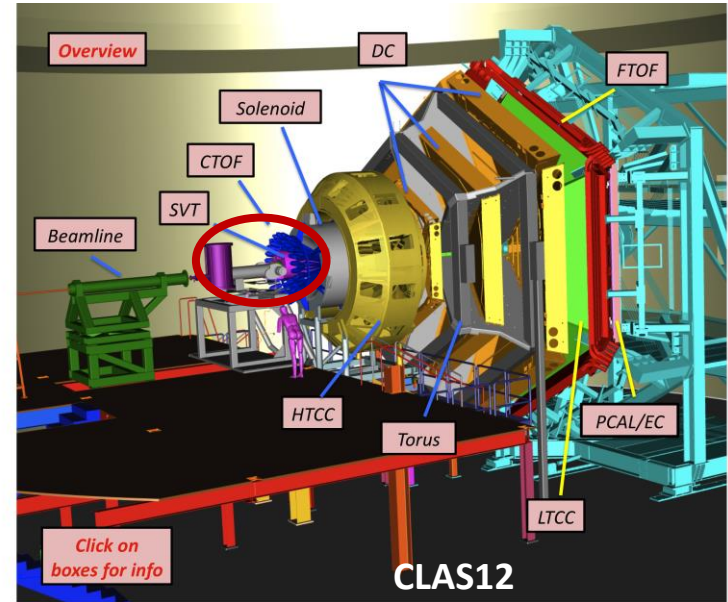
CLAS12

- ❖ Large acceptance
- ❖ Multi-particle final-states
- ❖ Luminosity appropriate for Pol ^3He

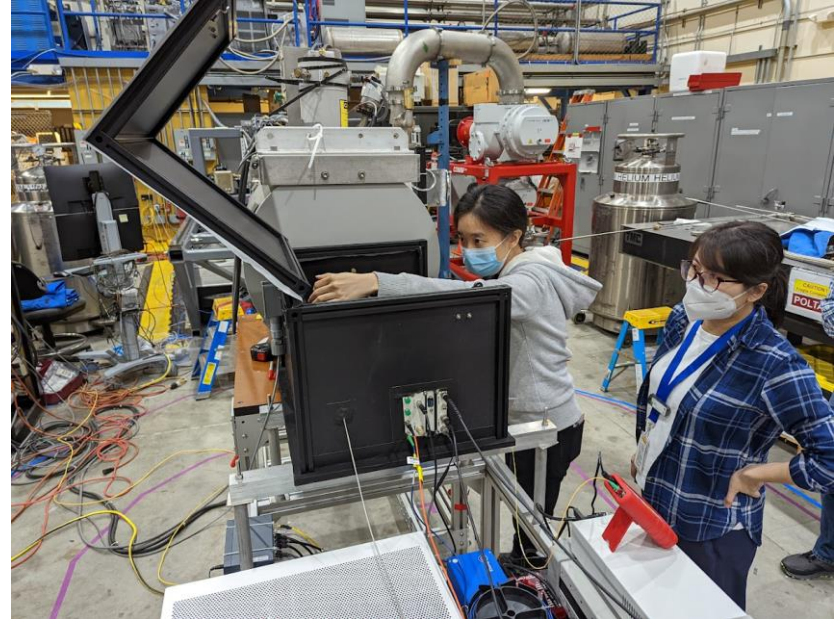
Polarized ^3He target

- ❖ Neutron carries 87% of spin in pol ^3He
 - ❖ Effective polarized neutron target
- ❖ **Challenge: Polarization in 5T solenoid field**
 - ❖ **Combine: MEOP + Double cell**

CEBAF Large Acceptance Spectrometer



MEOP at JLab



See Hao Lu's and Pushpa Pandey's slides

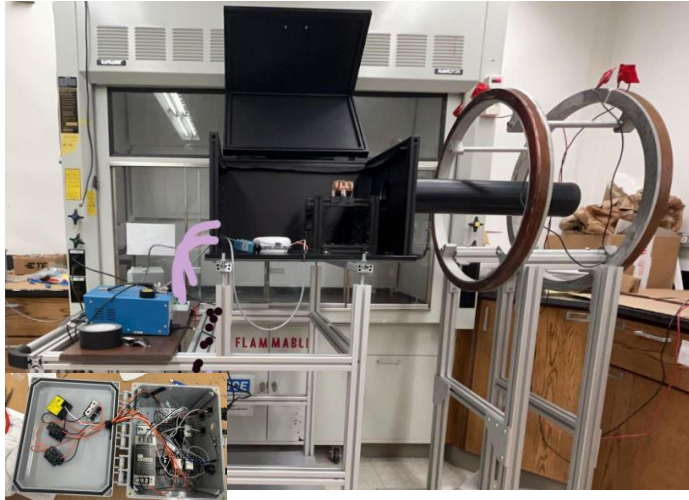
Attempting MEOP at UT



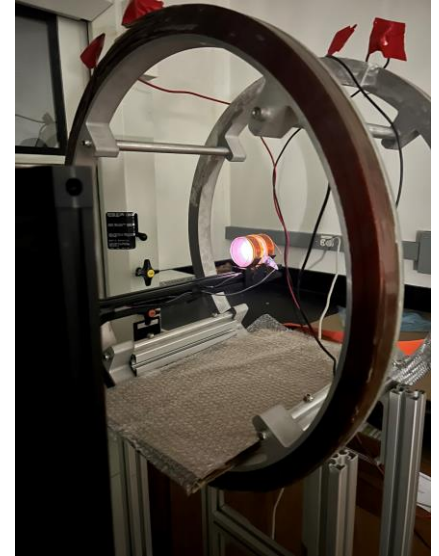
Grad Students: Ryan Elder, Dessie Durham, Ramon Ogaz, Julio Gil Gutierrez, Jordan O’Kronley

Undergrads: Keegan Dolan, Lindsey Hessler, Amelia Sandoval, Logan Gaters

^3He Polarization Lab at UT (D. Nguyen)



- Support apparatus designed and constructed
- Magnetic field Mapped
- A lot of Labview written
- Safety approvals for laser acquired
- Aim to polarize by end of 2024



Let's also Polarize Solids



[About](#) [Research](#) [People](#) [Undergraduate](#) [Graduate](#) [News & Events](#) [Outreach](#) [Alumni](#)

News

UT Future Polarized Target Development

(UT/Jlab/ORNL Invited Meeting) | August 12-13, 2024 | Knoxville, Tennessee

Invited Speakers and Topics:

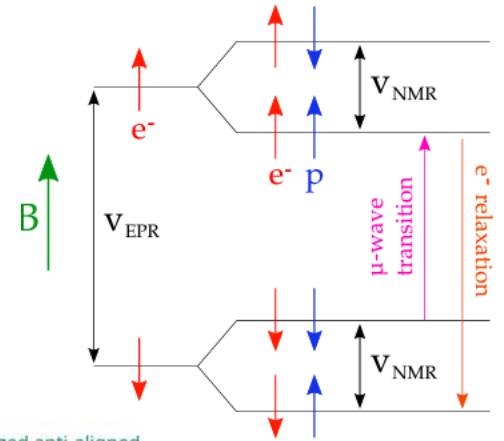
- Josh Pierce (ORNL): Overview of Decommissioned ORNL System Capabilities
- Mark Dalton (JLab): (E12-20-011) Measurement of the High-Energy Contribution to the GDH Sum
- James Maxwell (JLab): Measuring Polarization using NMR
- Chris Keith (JLab): DNP Spin Relaxation Studies at Low Temperature
- Nadia Fomin (UT): UT DNP Future Development Efforts

Organized by N. Fomin

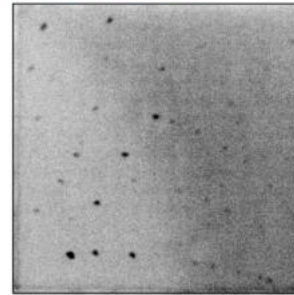
ORNL's DNP system



- Dilution Refrigerator
- Sample space
- Warm bore 5T magnet



Polarized anti-aligned

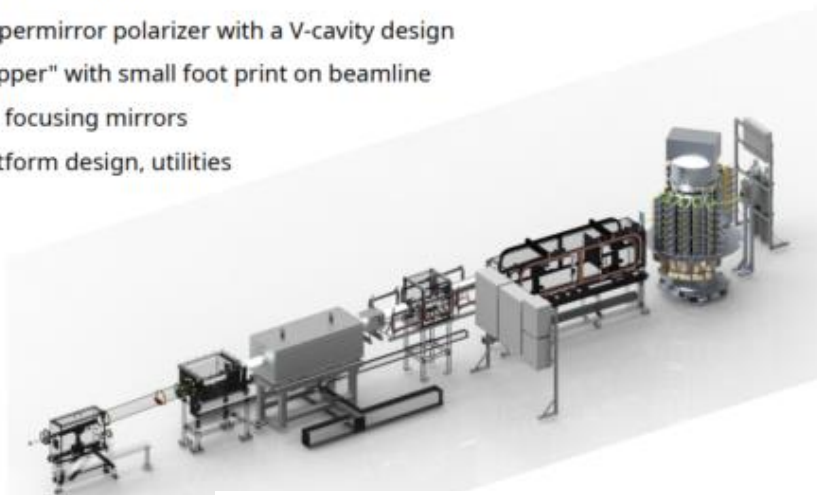


See. M. Yurov's Wednesday Slides

New Facility: IMAGINE-X for DNP-NMC

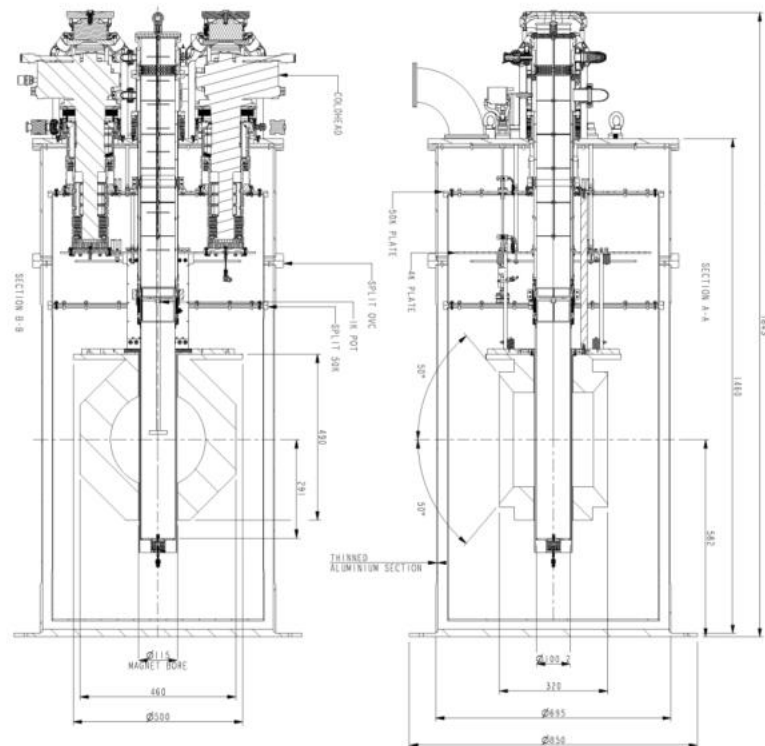
■ New beamline includes

- multi-supermirror polarizer with a V-cavity design
- "Cryo-flipper" with small foot print on beamline
- elliptical focusing mirrors
- cryo-platform design, utilities



■ DNP magnet + cryostat (ICEoxford)

- Cryogen-free, superconducting 5T Helmholtz Coil
- Cryogen-free 1K recirculating 4He refrigerator
- continuously pumped DNP to maximize and maintain high, steady state levels of polarization

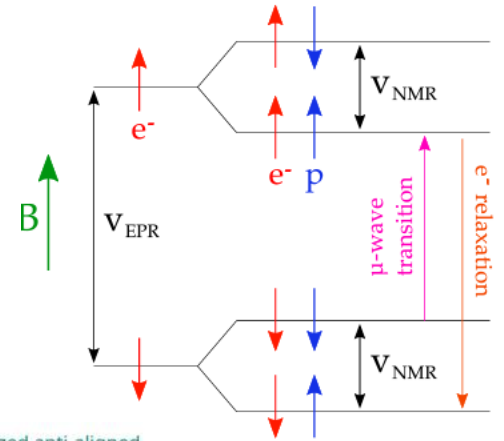


See. M. Yurov's Wednesday Slides

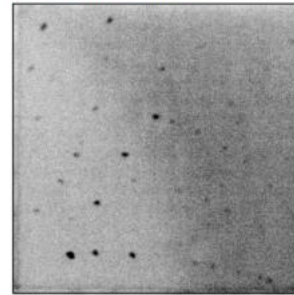
ORNL's DNP system



- Dilution Refrigerator
- Sample space
- Warm bore 5T magnet

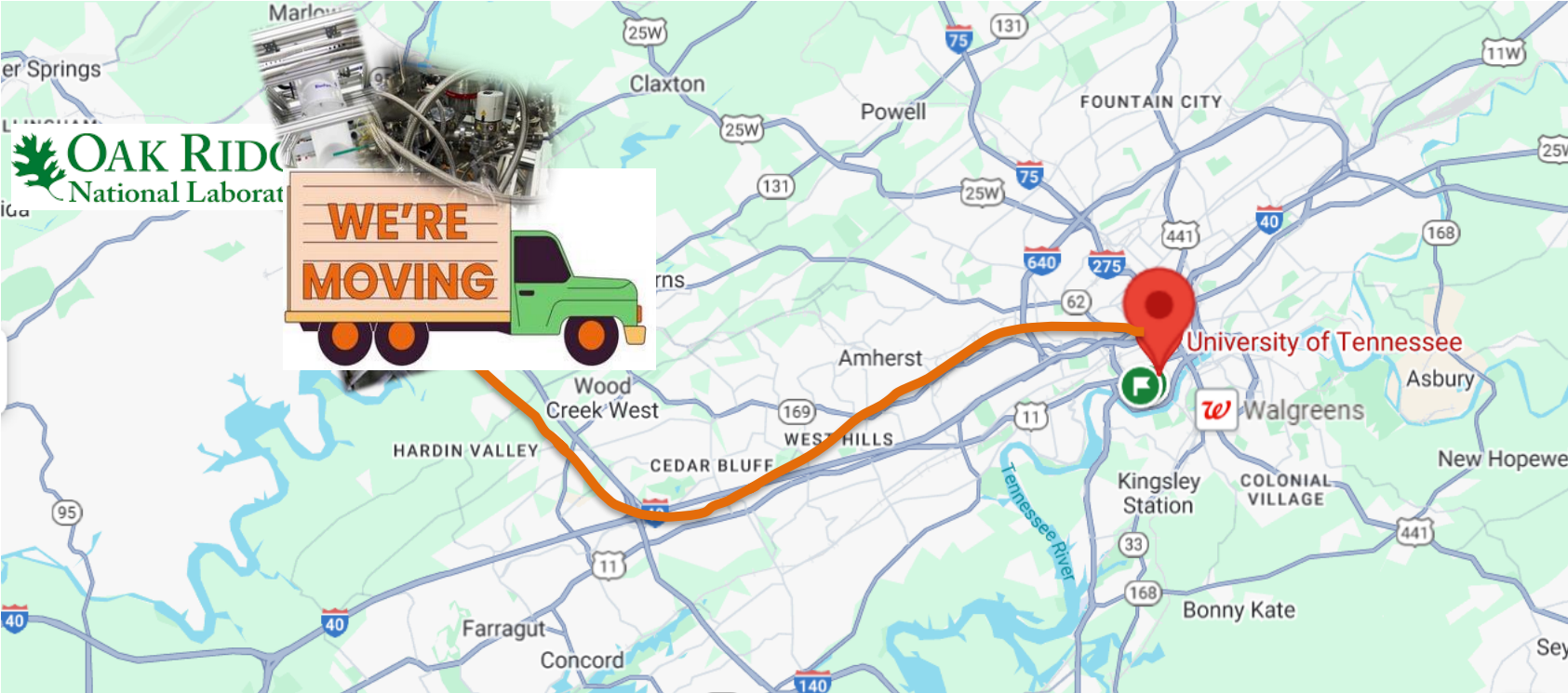


Polarized anti-aligned



See. M. Yurov's Wednesday Slides

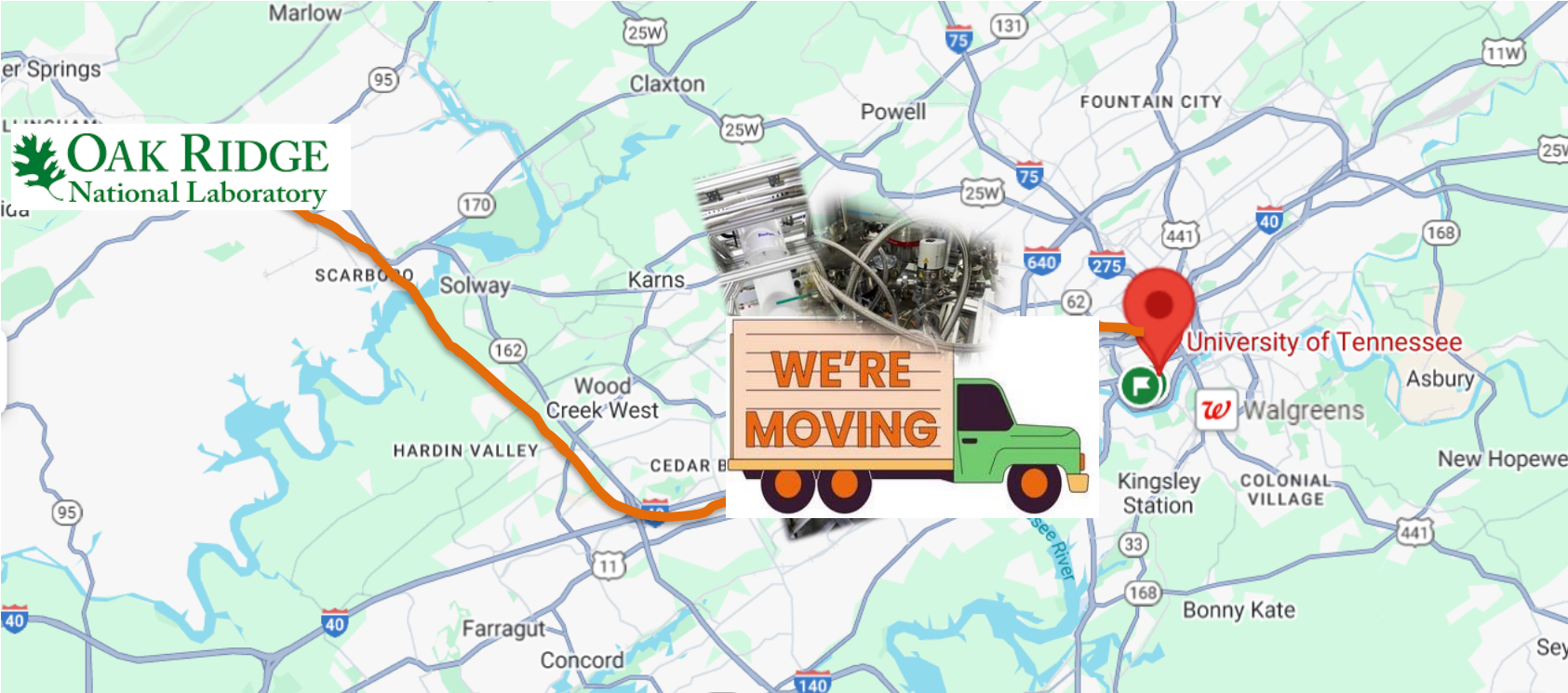
ORNL's DNP system at UT



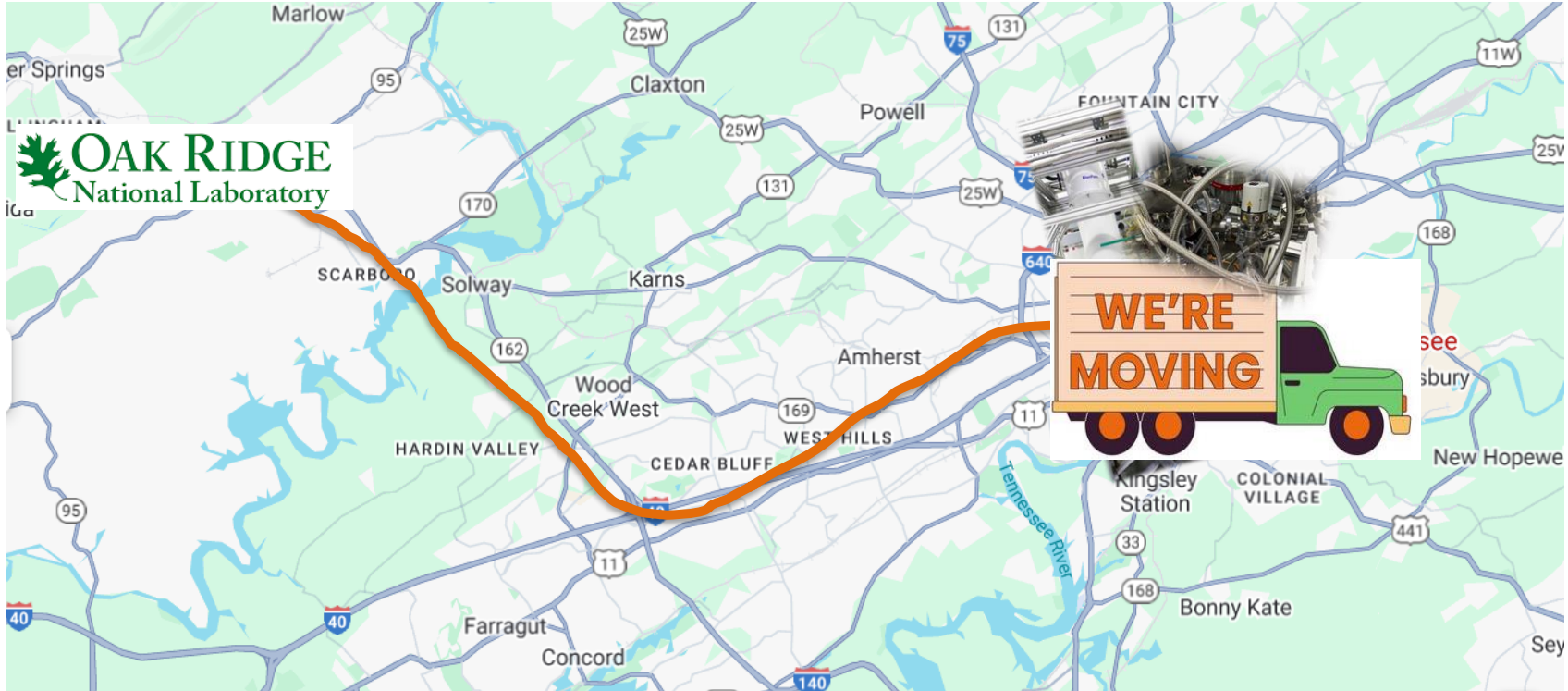
ORNL's DNP system at UT



ORNL's DNP system at UT



ORNL's DNP system at UT



Support Crystallography and Nuclear Physics

- Demonstrate and maximize polarization in a variety of nuclei and proteins
- Detailed Measurements of nuclear spin-relaxation times at ultra-low temperatures
- Design and construction of superconducting shim coils
- Demonstration and characterization of negative tensor polarization using AFP
- Maybe More...

C. Keith's ideas



See M. Iunuma's Monday slides

Outlook/Timeline

- Polarize sealed ^3He cell by end of 2024
 - Optimize the maximize polarization using low field
- Modify ORNL DNP apparatus for UT lab operation
 - New insert design
 - New endcap design (no neutron beam)
 - Try to reach lower operating temperature
- Training platform for both undergraduate and graduate students to support experiments at multiple facilities



Will have polarization studies to show at PSTP2026 in Crete!

PSTP 2026

