

LA-UR-

11-04234

Approved for public release;  
distribution is unlimited.

*Title:* LANL Nuclear Data Measurement Program and Detector Development

*Author(s):* Morgan White, Fredrik Tovesson, Robert Haight, and Aaron Couture

*Intended for:* Fuel Cycle Research and Development  
Nuclear Physics Working Group  
Montauk, NY  
June 20, 2010



Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By acceptance of this article, the publisher recognizes that the U.S. Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Presentation at the Fuel Cycle Research and Development  
Nuclear Physics Working Group  
Montauk, NY  
June 20, 2010

## LANL Nuclear Data Measurement Program and Detector Development

Morgan White, Fredrik Tovesson, Robert Haight and Aaron Couture  
Los Alamos National Laboratory

### Abstract

The Los Alamos Nuclear Data Measurement Program and Detector Development in support of the DOE-Nuclear Energy Fuel Cycle Research and Development Program are summarized. The experiments are performed at the Los Alamos Neutron Science Center (LANSCE) and include measurements of fission cross sections, fission neutron spectra and neutron capture cross sections. New detectors for each are being developed.

# LANL Nuclear Data Measurement Program and Detector development

**Morgan White, Fredrik Tovesson,  
Robert Haight, Aaron Couture**

*Los Alamos National Laboratory*

LA-UR-11-xxxxx



UNCLASSIFIED

Slide 1

Operated by Los Alamos National Security, LLC for the U.S. Department of Energy's NNSA



# Outline

---

- **The Los Alamos Neutron Science Center (LANSCE)**
- **Nuclear science capabilities at LANSCE**
- **Current nuclear data program:**
  - Fission
  - Neutron output
  - Capture
- **Conclusions**

# The Los Alamos Neutron Science Center (LANSCE)

Lujan Center

Weapons Neutron Research (WNR)

Isotope Production



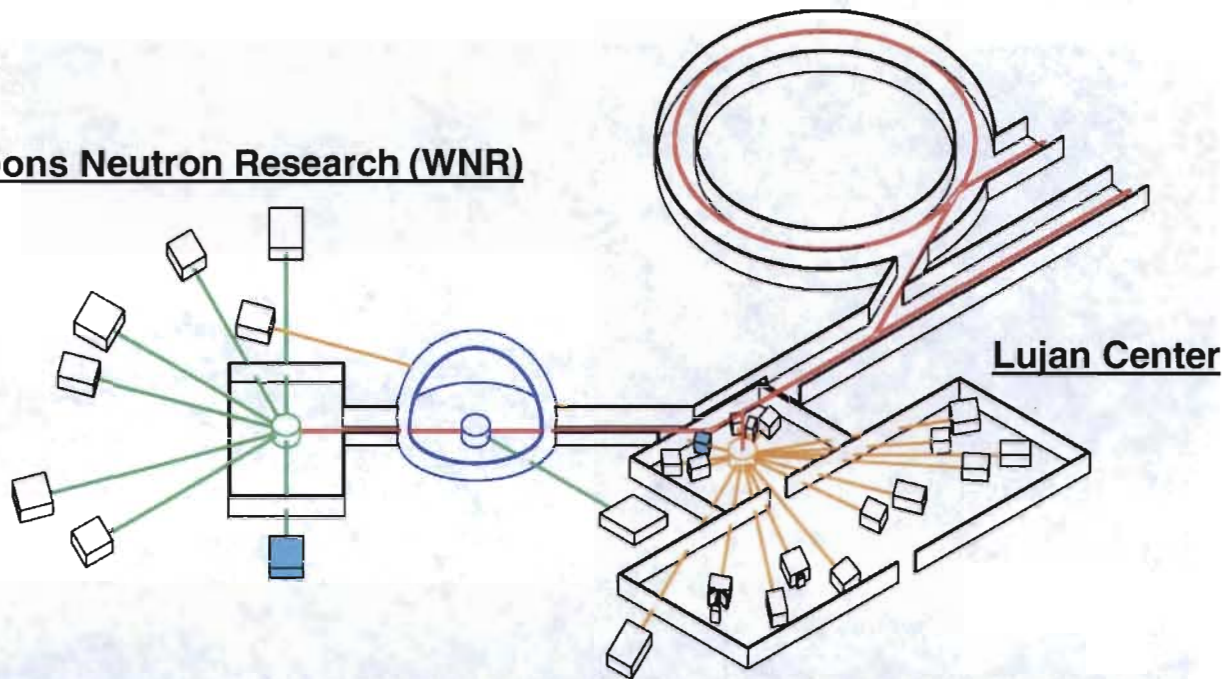
Proton Radiography

UCN Experiment



# Weapons Neutron Research (WNR) and Lujan Center

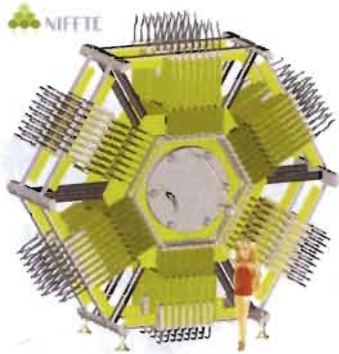
## Weapons Neutron Research (WNR)



- The 800-MeV proton accelerator at LANSCE produces neutrons through spallation on tungsten
- Moderated and un-moderated spallation neutron spectra available
- White source – neutron energies measured using time-of-flight
- Lujan Center and WNR cover neutron energies from sub-thermal to hundreds of MeV

# Nuclear science instruments at LANSCE

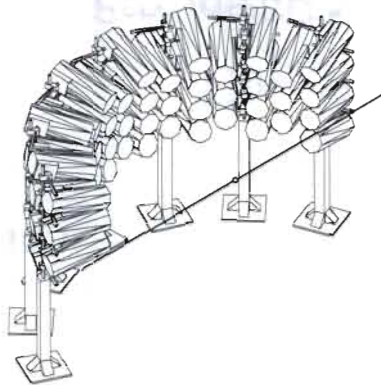
TPC, ionization chambers



N,Z (n, charged particle)



FIGARO (n,xn+ $\gamma$ )



DANCE (capture)

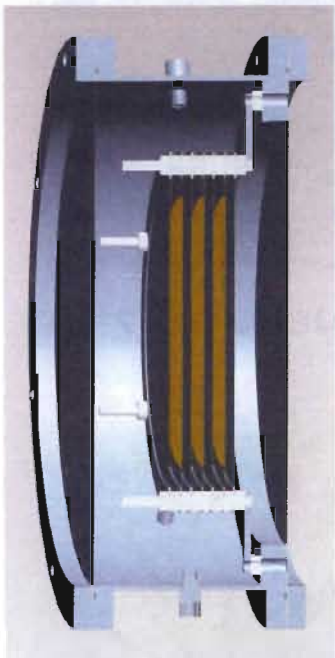


GEANIE (n,x $\gamma$ )



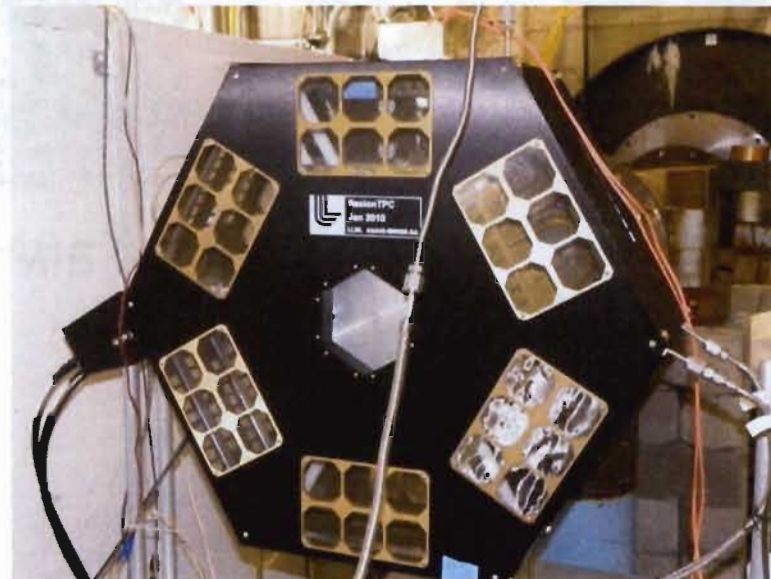


## Instrumentation: Fission detectors



### Ionization chambers

- Used since the '40s
- Reliable, fast, insensitive to radiation damage
- Limited event information



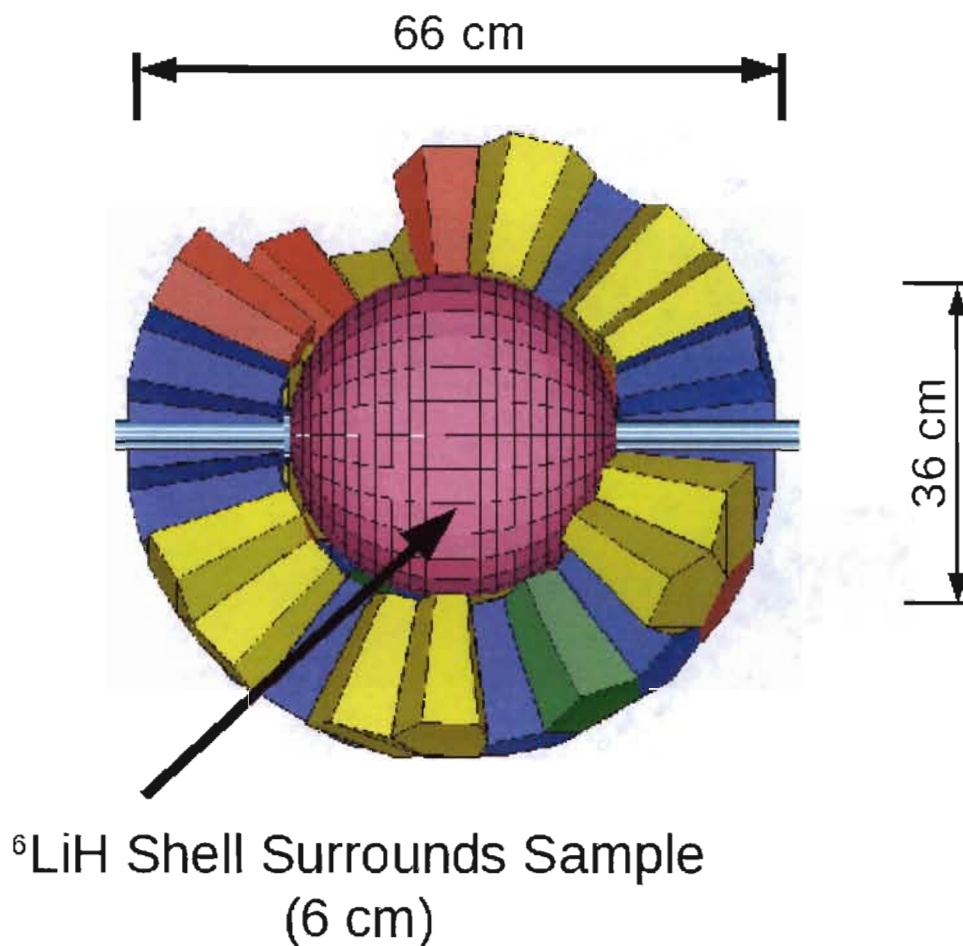
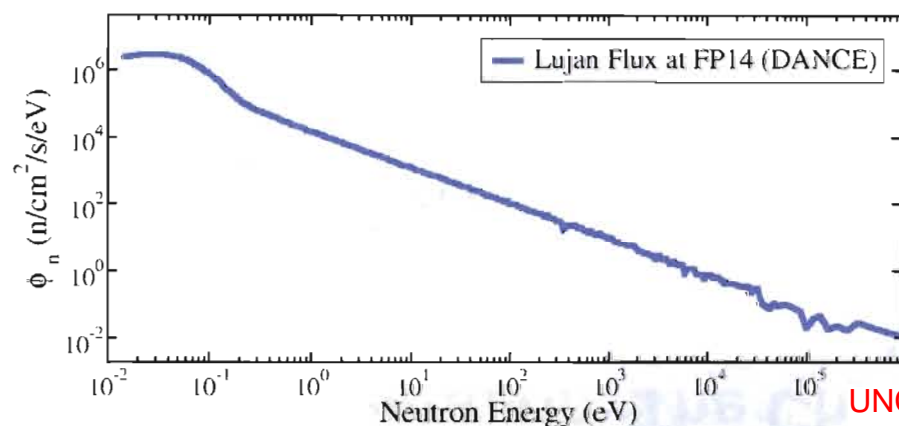
### Time Projection Chambers (TPC)

- Provide 3D representation of particle tracks
- Invented in the late 1970's for particle physics
- The NIFFTE TPC is being commissioned for fission studies



# Instrumentation: Detector for Advanced Neutron Capture Experiments (DANCE)

- 160 BaF<sub>2</sub> Scintillators
- 4 Detector Shapes each covering the same solid angle
- $\epsilon_v \approx 90 \%$
- $\epsilon_{casc} \approx 98 \%$
- Neutron energy coverage from  $10 \text{ meV} < E_n < \sim 300 \text{ keV}$

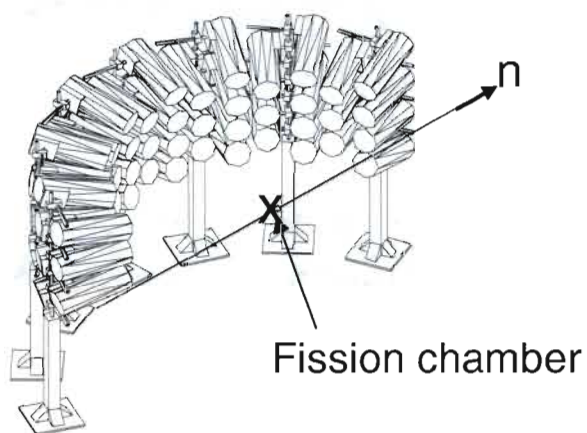


UNCLASSIFIED

Slide 7

# Instrumentation: The Chi-Nu array fast neutron detection

Chi-Nu ( $n, xn+\gamma$ )



22.7 m from  
WNR source

**20 liquid scintillator  
neutron detectors**

**2 gamma-ray detectors**



**Double time-of-flight experiment**