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LANL Nuclear Data Measurement Program and Detector Development

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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.

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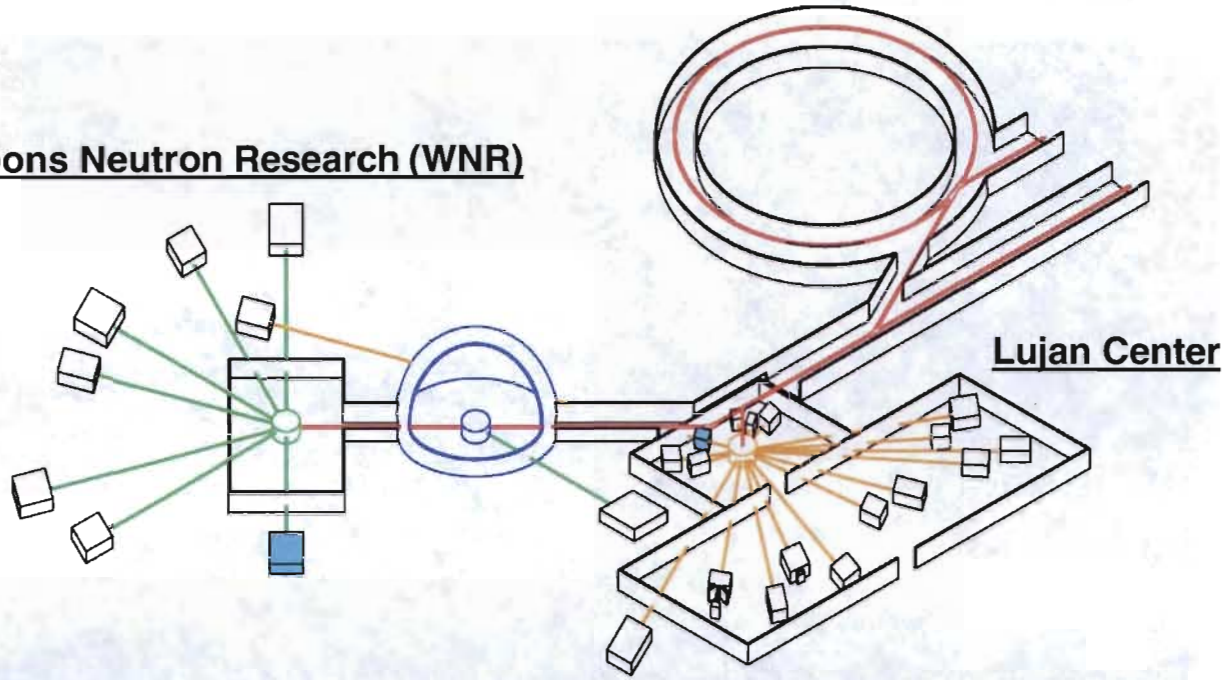
Outline

- **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)

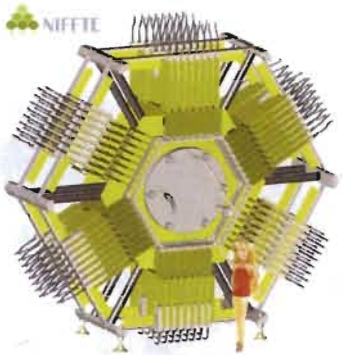
Weapons Neutron Research (WNR) and Lujan Center



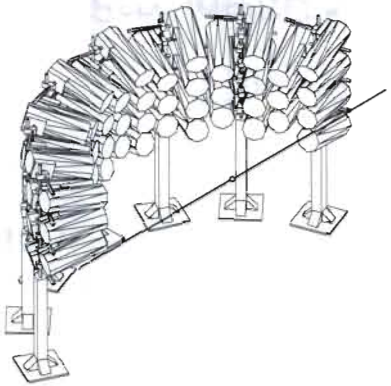
- The 800-MeV proton accelerator at LANSCE produces neutrons through spallation on tungsten
- Moderated and un-moderated spallation neutron spectra available
- White source – neutron energies measured using time-of-flight
- Lujan Center and WNR cover neutron energies from sub-thermal to hundreds of MeV

Nuclear science instruments at LANSCE

TPC, ionization chambers



FIGARO (n,xn+γ)

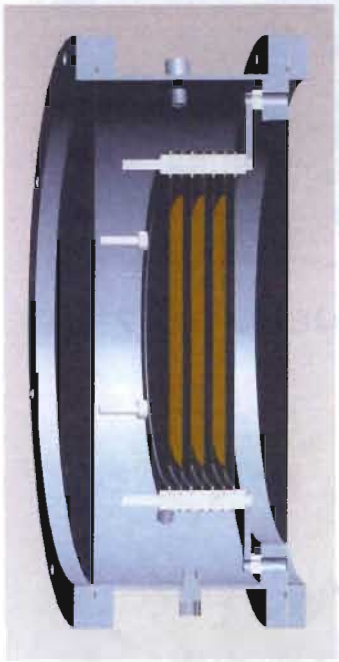


DANCE (capture)

N,Z (n, charged particle)

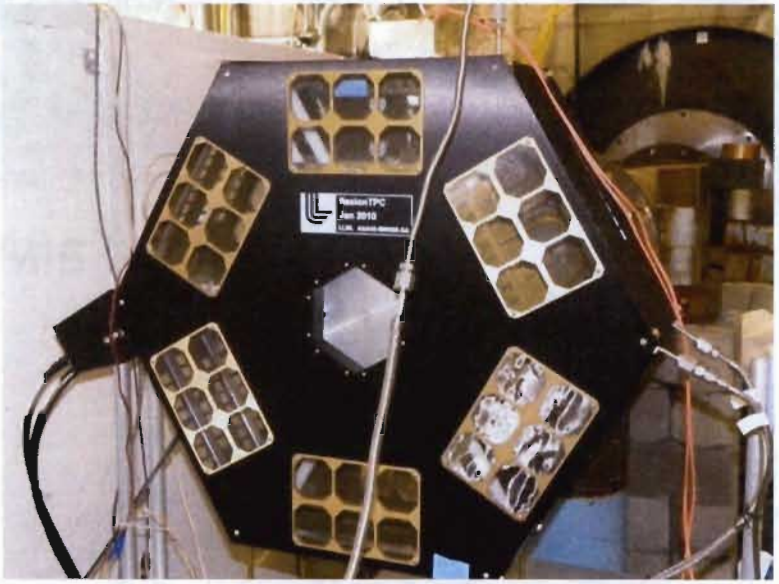
GEANIE (nxγ)

Instrumentation: Fission detectors



Ionization chambers

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

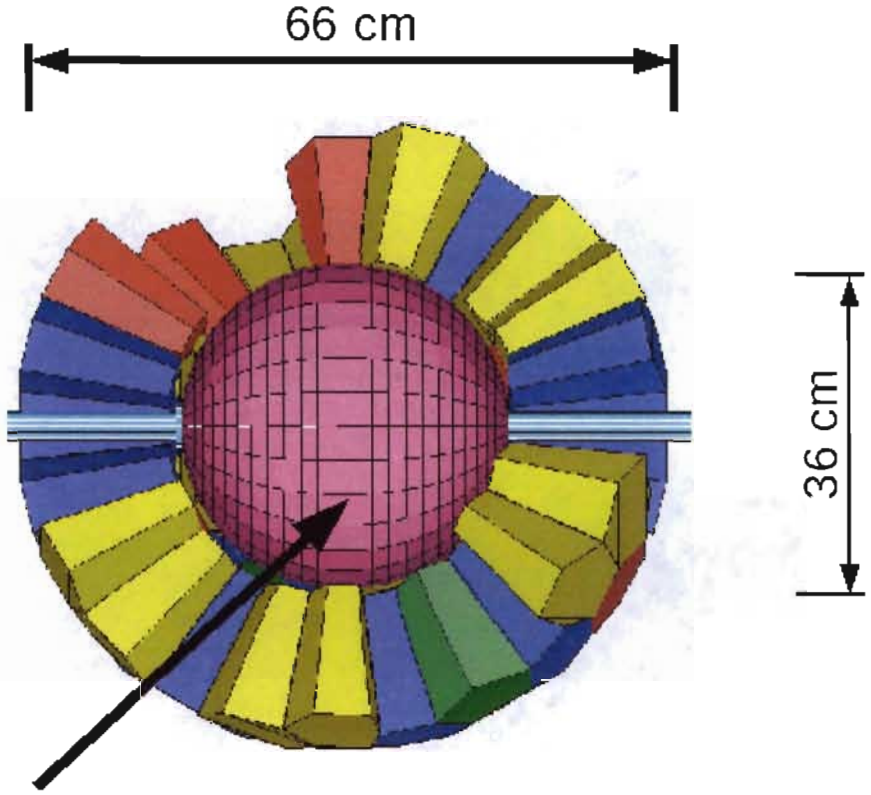


Time Projection Chambers (TPC)

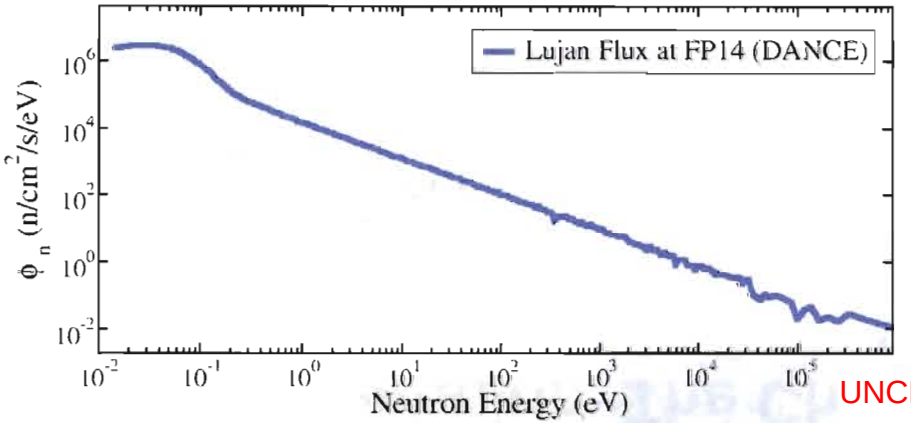
- Provide 3D representation of particle tracks
- Invented in the late 1970's for particle physics
- The NIFFTE TPC is being commissioned for fission studies

Instrumentation: Detector for Advanced Neutron Capture Experiments (DANCE)

- 160 BaF_2 Scintillators
- 4 Detector Shapes each covering the same solid angle
- $\varepsilon_\gamma \approx 90$ %
- $\varepsilon_{casc} \approx 98$ %
- Neutron energy coverage from 10 meV < E_n < ~300 keV

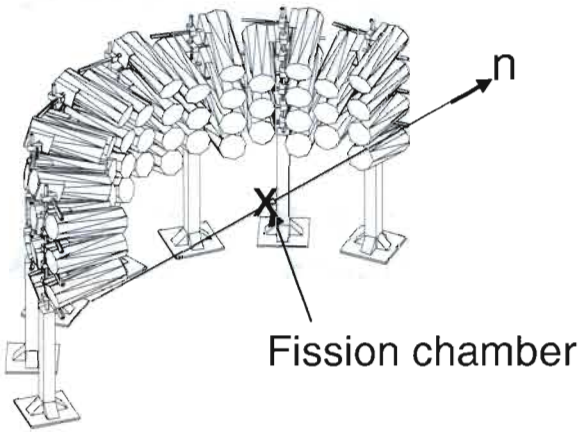


^{6}LiH Shell Surrounds Sample (6 cm)



Instrumentation: The Chi-Nu array fast neutron detection

Chi-Nu (n,xn+γ)



22.7 m from
WNR source

20 liquid scintillator neutron detectors

2 gamma-ray detectors

Double time-of-flight experiment