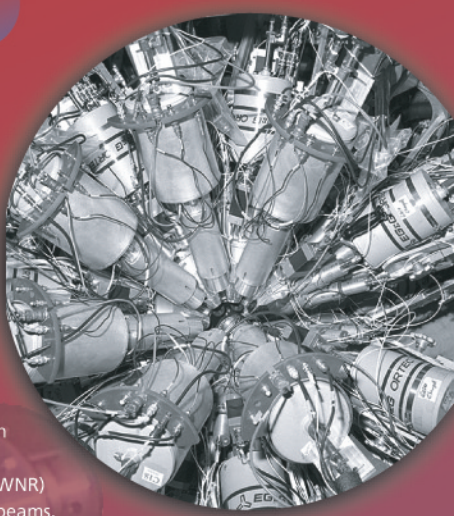
LANSCE

Los Alamos Neutron Science Center

Neutron Science for Defense

Playing a key role in nuclear weapons research

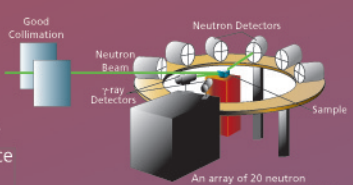
The Weapons Neutron Research (WNR) facility provides high-energy neutron beams simultaneously to six different experiments. Neutrons are produced by spallation reactions on a tungsten target with the 800-million-electron-volt (MeV) pulsed proton beam of LANSCE.



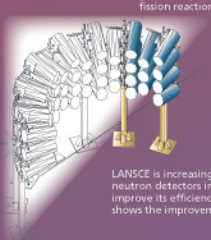
The GEANIE array (above), consisting of 21 high-resolution gamma-ray detectors, allows identifying a particular reaction by its characteristic gamma-ray energy. GEANIE is used to measure gamma-ray production for radiochemical diagnostics and fission energy output.

Nuclear reactions provide the major source of energy in nuclear weapons. To allow understanding of those reactions, LANSCE provides the defense complex with neutron beams covering the entire energy range of interest in nuclear weapons. There are two neutron sources at LANSCE: The Lujan Center, which provides low-energy neutron beams, and the Weapons Neutron Research (WNR) facility, which provides high-energy neutron beams.

Although underground testing of nuclear weapons ended in 1992, archived results from 50 years of testing are available to Laboratory scientists. By analyzing the isotopic composition of debris from past nuclear tests, weapons scientists can learn about the underlying physics of the weapon that was tested. This radiochemical analysis, however, has been hindered by lack of knowledge of the fundamental cross sections. By acquiring more complete and accurate knowledge of the cross sections, scientists can develop a deeper understanding of how well our codes predict the performance of nuclear weapons and thus enhance their ability to predict nuclear weapons performance as those weapons are aging. In addition, more stringent requirements on the Laboratory's ability to predict nuclear weapon performance have demanded additional, more-detailed measurements of the basic energy-producing fission reaction.



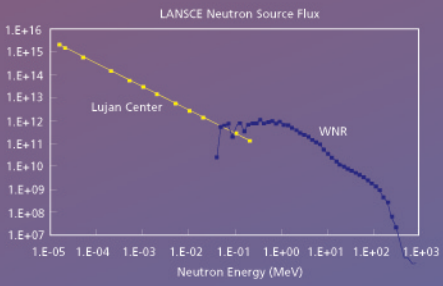
An array of 20 neutron detectors and several gamma-ray detectors, FIGARO is used to measure neutron and gamma-ray spectra following fission reactions.



LANSCE is increasing the number of neutron detectors in FIGARO to improve its efficiency. This diagram shows the improvement plan.

Several instruments were developed at LANSCE to address important weapons physics issues. The DANCE detector array at the Lujan Center measures low-energy neutron capture on radioactive samples for radiochemical analysis. The GEANIE detector array at the WNR facility measures gamma-ray production for radiochemical diagnostics and fission energy outputs. The FIGARO spectrometer measures fission neutron and gamma-ray spectra. The Lead Slowing-Down Spectrometer uses a block of lead that slows down incoming neutrons. This spectrometer measures fission cross sections on ultrasmall samples.

LANSCE has two neutron sources, which cover the entire neutron energy range of interest to the nuclear weapons program. The Lujan Center covers the range from subthermal to approximately 100 kilo-electron-volts (keV) and the WNR, from below 100 keV to several hundred million electron volts.



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