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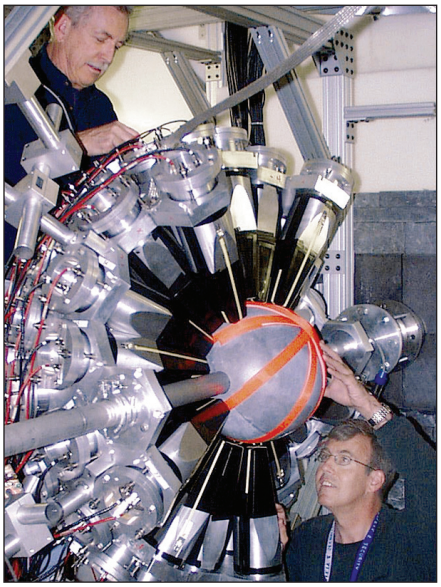
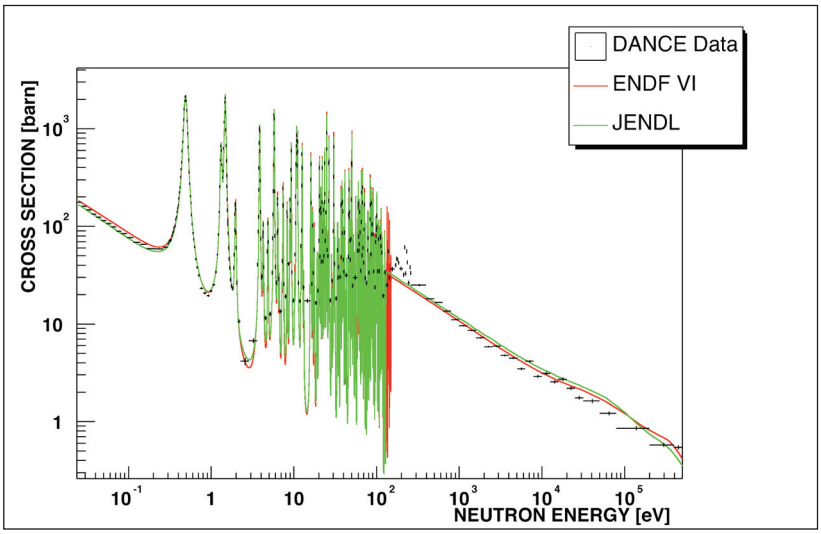
Detector for Advanced Neutron Capture Experiments (DANCE)

DANCE is designed to study neutron capture reactions on small quantities, of order 1 mg, of radioactive or rare stable nuclei. These reactions are important in weapons physics, radiochemistry, and element formation in stars. DANCE's unique 4π geometry allows measurement of the total gamma-ray energy emitted following neutron capture. When compared to existing neutron capture measurements, this enables a significant advance in detector sensitivity and allows a much more accurate understanding of the detection efficiency. Experiments can be done at neutron energies from thermal to about 100 keV.

The detector consists of 160 equal-area barium fluoride crystals of four different shapes arranged in a soccer ball-like array to completely cover the surface of a sphere (except for ports for the beam pipe). The inner radius of the crystal ball is 17 cm, and the crystals are 15 cm deep. A ^{6}LiH sphere is mounted inside the ball to minimize the background from neutrons scattered in the target. Radioactive targets are fabricated at C Division's radioisotope handling facilities and mounted in fully enclosed target holders to minimize the handling of radioactive material at the Lujan Center.



A view of the DANCE detector, opened to allow access to the crystals and beam pipe.



Cross-sections measured with DANCE for neutron capture on ^{237}Np. The target mass was 400 micrograms. Also shown are evaluated cross-sections from the ENDL and JENDL libraries.

Specifications	
Moderator	Water (2nd Tier)
Flight Path	20 m to sample
Beam Size at Sample Location	1 cm diameter
Sample Size	> 100 micrograms
Gamma Detection	160 BaF_2 scintillators
Flux Monitoring	^{6}Li, BF_3, ^{235}U fission
Typical Experiment Duration	10 days