Upgrades for Cold Neutron Beam Facilities

A reconstruction of neutron guide NG7 in the NIST Center for Neutron Research will result in a much more spacious sample area for prompt gamma-ray activation analysis (PGAA). It will greatly reduce background levels of radiation and allow the analysis of bulky samples. The neutron depth profiling (NDP) instrument will also be moved to the same guide.

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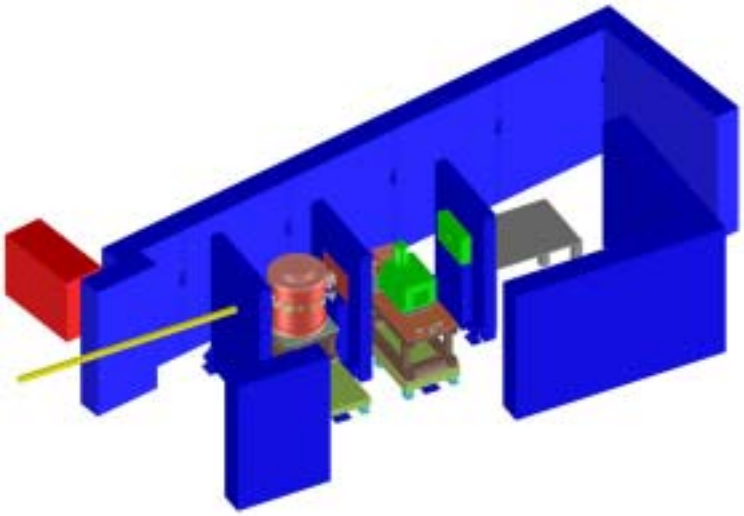
Both the PGAA and the NDP instruments at the NIST Center for Neutron Research are being reconfigured to operate together on a new beam from a dedicated curved guide, NG7'. The bottom half of the existing NG7 guide will be compressed from 5 cm x 5 cm to 3 cm x 3 cm, bent 10° with ten 50-cm supermirror guide sections, and then made more uniform by passing through an additional 7.5 m of straight guide. According to Monte Carlo modeling, at the exit of the guide, the thermal neutron equivalent fluence rate will be 5 x 10^8 cm^{-2} s^{-1}. As the figure shows, kinematically mounted tripod instrument bases and shielding walls are designed for ready but precise reconfiguration as experimental requirements dictate. The PGAA sample position was previously 3 cm directly underneath the adjacent guide, so the sample size and shape were severely restricted and the background was undesirably high. The new position will give greatly improved access to the sample area, and consequent flexibility with regard to sample size and shape, detector geometry, and sample environment control. A large evacuable sample chamber will have space for positioning equipment, a beam chopper, and a variety of sample holders and containers. A cryostat will replace the normal chamber when sample temperature is important. The sample-detector distance will be adjustable, and space is available for a second Ge detector for gamma-gamma coincidence measurements. The NDP instrument is relocated from guide NG0. In the new position, the beam will contain less gamma radiation, and thus the background will be improved. A multidetector array of charged particle detectors is being constructed for the NDP instrument and will improve the determination of He, N, and Cl profiles.

The new configurations will provide greater sensitivities, better detection limits, and much lower background radiation. Analyses of SRMs and other materials will greatly benefit from these improvements.

Future Plans: The new configuration is scheduled to be installed in mid-2007, and will be followed by a complete facility characterization.



In this illustration, the neutron beam enters from the left, passes through the NDP chamber, and then the PGAA system. On the right side is an optical bench, for installation of ad-hoc experiments requiring a freely accessible neutron beam.