

# **Prompt Gamma-Ray Activation Analysis at NIST-- Status of Thermal and Cold Neutron Instruments And A New Cold Neutron PGAA Facility**

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## Abstract

The National Institute of Standards and Technology's Center for Neutron Research (NCNR) maintains two prompt gamma-ray activation analysis (PGAA) instruments, one using a vertical beam of thermal neutrons and the other a guided beam of cold neutrons. These two facilities have been operated continually since each was built, the thermal neutron PGAA (TNPAA) instrument since 1978, and the cold neutron PGAA instrument since late 1990. Both have been upgraded. The TNPAA instrument was almost entirely rebuilt during a major upgrade 2003. The CNPAA instrument was upgraded once in 1995 and again in 2001, each time following the installation of a new cold source. Each of these two instruments is optimized for analyses of different types of materials, based primarily on the hydrogen content of the sample matrices. The CNPAA instrument was designed for analysis of trace hydrogen typically a few mg/kg up to a few tenths of a percent by mass. Because cold neutron scattering by hydrogenous materials can result in a change in the average energy of the neutrons, materials containing more than a few tenths of percent hydrogen are typically analyzed using the TNPAA instrument where neutron scattering does not result in a net change in neutron energies. A third PGAA instrument, designed for use at a new higher intensity cold neutron beam is under construction and is expected to be operational in 2010. This instrument will incorporate new sample environment controls, be able to accommodate a wider variety of sample geometries and, due to higher neutron intensity, provide greater analytical sensitivities. An overview of recent work performed at the two existing PGAA instruments and a description of the new CNPAA instrument will be presented.

*Keywords – cold neutrons, prompt gamma-ray activation analysis, thermal neutrons, hydrogen analysis, multi-element analysis, Standard Reference Materials*

I. THERMAL NEUTRON PGAA, VT-5

II. COLD NEUTRON PGAA, NG-7

III. NEW COLD NEUTRON PGAA FACILITY, NG-D