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The first GRIFFIN Experiment: An investigation of the s-process yields for ^{116}Cd

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In adopted models for the s-process, it is assumed that helium shell flashes give rise to two neutron bursts at two different thermal energies ($kT \sim 10$ keV and $kT \sim 25$ keV). The contribution to the isotopic abundance of ^{116}Cd from the higher temperature neutron bursts are calculated assuming thermal equilibrium between the ground state and the long-lived isomeric state of ^{115}Cd. However, it is unknown if the thermal equilibrium between these states is present at the low temperature of the first burst. The presence of thermal equilibrium at low temperatures would significantly decrease the calculated s-process yields of ^{116}Cd.
To answer this question, we are searching for gateway levels at slightly higher excitation energy than the isomer in ^{115}Cd that could be populated from the isomeric state via (γ, γ') reactions within stars.

Currently, the lowest potential gateway level at an excitation energy of 394 keV has only been observed to decay directly to the isomeric state in ^{115}Cd. Nonetheless, the observation of this state decaying to the previously known 361 keV level via a weak 33 keV transition would provide a γ-ray cascade which would bypass the isomeric state. Thus, the observation of this decay would be a direct signature for the presence of thermal equilibrium during the lower temperature neutron burst. However, the direct measurement of a 33 keV transition is difficult due to the large low-energy γ-ray backgrounds observed in β-decay experiments. We therefore require high-efficiency γ-ray detection to indirectly observe this transition via γ-γ coincidences of γ-rays cascading through this transition.

In November 2014, the high-efficiency GRIFFIN HPGe spectrometer was commissioned at TRIUMF's Isotope Separator and Accelerator (ISAC). GRIFFIN is a state-of-the-art array consisting of 16 HPGe clovers, and boasts a large γ-ray efficiency of roughly 17% at 1 MeV. GRIFFIN also hosts a large suite of auxiliary detectors such as SCEPTAR, which is an array of 20 plastic scintillators designed for β-particle detection.
In this first experiment, beams of ^{115}Ag and ^{115}Ag^{m} were delivered to the GRIFFIN spectrometer equipped with SCEPTAR in order to search for these very-low-intensity γ-γ coincidences following the β decay of ^{115}Ag into ^{115}Cd. In this talk, results from this first GRIFFIN experiment will be presented.

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