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Beta delayed neutron measurements by means of Modular Total Absorption Spectrometer

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Beta decay is one of the fundamental transformations of atomic nuclei. If energetically permitted, neutrons emitted after beta decay are called beta delayed neutrons (β-n). Beta decay and delayed neutrons are essential in two main fields of study. First is r-process and its abundance, the second one is nuclear reactor physics, including decay heat calculations [1]. A good knowledge of decay schemes and β-n ratios are needed. Total absorption spectrometry is a technique that allows for a very efficient measurements of beta delayed gamma transitions.
Many uranium fission products have been measured in HRIBF, ORNL by means of Modular Total Absorption Spectrometer (MTAS) [2]. MTAS consists of 18 NaI(Tl) hexagonal modules. Each of the 18 modules is 21" long and 6.93" wide (side-to-side). There is also one central module of the same length and cross section, but with a 2.5" hole drilled through. The crystals are arranged in a honeycomb like structure. Radioactive sample, to be measured, is placed between two 1 mm thick silicon detectors in the geometrical center of the detector. The total active NaI(Tl) mass is approximately one ton, making MTAS the largest and most efficient detector of this type currently in use. Due to its large volume β-n neutron are efficiently slowed down and captured in the active volume of the detector, thus allowing for the estimation of the β-n component in the full decay scheme.
In my presentation the evaluation of 87Br (2,6% β-delayed neutron emitter) decay will be presented.

[1] Ryuzo Nakasima Tadashi Yoshida. Decay heat calculations based on theoretical estimation of average beta- and gamma-energies released from short-lived fission products. Journal of Nuclear Science and Technology, 18:393-407, 1981
[2] M.Karny et al. Modular Total Absorption Spectrometer. Nuclear Instruments and Methodology A 836 (2016) 83-90.

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