STUDY OF BETA DECAY OF FISSION PRODUCTS USING TOTAL ABSORPTION TECHNIQUE FOR DECAY HEAT CALCULATIONS

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Decay heat, i.e., the energy emitted during the beta decay of fission products, accounts for nearly 10% of the total energy released during reactor operation, while also being the main source of heat after the reactor has been shut down.
Understanding the amount and form of energy released in the radioactive decay of fission products is crucial for ensuring the safety of nuclear power plant operations, reactor cooling after shutdown, and the transport, reprocessing, and storage of spent nuclear fuel.
However, decay heat estimates based on experimental data often differ from direct observations due to the underestimation of the electromagnetic component and overestimation of electron-carried energy. These discrepancies arise from incomplete or incorrect β-decay schemes of fission products, largely due to a systematic error caused by the inability of high-resolution, low-efficiency detectors to capture weak β transitions feeding highly excited states of the daughter nucleus. This results in underestimated γ-energy and overestimated β-energy emissions.
A solution to this problem is total absorption spectroscopy, a high-efficiency technique for detecting γ radiation across a wide energy range. Instruments like the Modular Total Absorption Spectrometer (MTAS) enable the precise determination of β-feeding distributions and de-excitation pathways of daughter nuclei, allowing accurate assessment of the energy released in radioactive decay. This presentation will showcase results from a decade-long β-decay of fission products measurement campaign conducted at Oak Ridge National Laboratory.

154_abstract