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Analysis of $^{\text{nat}}\text{Ce}(n,f)$

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Nicolás Sánchez Vázquez for the n_{TOF} collaboration.

Nuclear fission is a complex process characterized by the splitting of a nucleus into two fragments of comparable mass. The mass and charge distributions of the resulting fission fragments are governed by the interplay between macroscopic nuclear properties and microscopic shell effects under extreme deformation. This competition manifests in the asymmetric mass distributions observed in actinide fission and, more recently, in the sub-lead region [1]. Previous studies of high-energy fission in systems around $Z=60$ have suggested possible asymmetric distributions [2], though limited statistics have prevented definitive conclusions. Current understanding indicates that favored deformed shells—specifically $Z=52, 56$ for heavy fragments in actinides [3] and $Z=34$ for light fragments in sub-lead systems [4,5]—serve as primary drivers of these asymmetries. These findings motivate further investigation into the role of nuclear structure in lighter fissioning systems.

In 2024, an experiment was conducted at the n_{TOF}/EAR1 facility to determine the symmetric or asymmetric character of fission yields in $^{\text{nat}}\text{Ce}(n,f)$ reactions. The experimental setup employed ten tilted Parallel Plate Avalanche Counters (PPACs) to maximize angular coverage [6]. The configuration included seven $^{\text{nat}}\text{Ce}$ targets, along with ^{197}Au and ^{238}U targets as references, each positioned between two PPACs. This arrangement enables comprehensive measurements of the reaction cross-section, along with angular and mass distributions of the fission fragments.

This presentation will provide an overview of the current analysis status and present preliminary results from the experiment.

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[6] D. Tarrío et al., Nucl. Instr. Methods A 743, 79 (2014).

Abstract

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