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Measurements of prompt-fission neutrons in ^{235}U(n$_{th}$,f) and ^{252}Cf(sf)

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Prompt fission neutrons carry valuable information on how excitation energy is shared between fragments in nuclear fission. Precise measurements on the neutron multiplicity are needed both as a function of fragment mass and excitation energy, as data are rather scarce. In this work we present two complementary experimental setups to measure prompt fission-neutrons, at different excitation energies; namely the 2E and the 2E-2v techniques.

The 2E-2v method is a state-of-the-art technique to determine the masses of pre- and post neutron emission yields. Several competing setups world-wide aim at using the 2E-2v method to suppress uncertainties in fission yields. The VERDI (VElocity foR Direct particle Identification) spectrometer is one such setup, developed at JRC-GEEL. VERDI has two Time-Of-Flight (TOF) sections and 16 silicon detectors in the end of each section. The fission fragment energies are measured in the silicons whereas the fragment velocity is obtained by means of its TOF. Electrons ejected from the target itself are deflected and detected in a MCP (Micro-Channel Plate) to provide a start trigger. The fragments entering the silicon detector provide the stop signal.

From VERDI we present results on the spontaneous fission of ^{252}Cf(sf). A superior mass resolution was observed as compared to conventional techniques. Some main challenges associated with the instrument as well as the method itself will be subject of a detailed discussion.

In the second part, we present our experiments using the 2E technique by utilizing a Frisch-Grid Ionization Chamber (FGIC) together with two liquid-scintillator detectors. By means of a coincidence measurement we derive the average prompt fission neutron multiplicity, $\overline{\nu}(A)$, in ^{252}Cf(sf) and ^{235}U(n$_{th}$,f). Results on $\overline{\nu}(A)$ and $\overline{\nu}(TKE)$ agree well with recent measurements from JRC-GEEL; however, both data-sets disagree with older reference data.

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