The $^{241}\text{Am}(n,f)$ reaction study at the n_TOF/CERN facility

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Introduction/Motivation:

- $^{241}\text{Am} \left( T_{1/2} = 433 \text{ y} \right)$ is present in high-level nuclear waste
- Represents 1.8% of the actinide mass in spent PWR UOx fuel
- Additional production from the beta-decay of $^{241}\text{Pu} \left( T_{1/2} = 14.3 \text{ y} \right)$
- Important for different waste transmutation and recycling scenarios
- $^{241}\text{Am}(n,f)$ reaction is included in the Nuclear Energy Agency (NEA) Nuclear Data High Priority Request List (HPRL)

Challenge of the measurement:

Specific activity of $^{241}\text{Am}$: 127 MBq/mg → This strong alpha particle background limits the mass of the samples that can be used
Experimental Details:

- **Samples** provided by JRC-Geel: 
  6 samples of $^{241}\text{Am}$ (99.98% purity) with total mass of 0.78 mg (~4.6 μg/cm² per sample) and activity of ~0.1 GBq

  Reference samples: 2 x $^{235}\text{U}$ (total mass 0.56 mg) and 2 x $^{238}\text{U}$ (total mass 4.28 mg)

- Measurement performed at the **vertical experimental area (EAR2)** of the neutron time-of-flight facility (n_TOF) at CERN so as to take advantage of the high instantaneous neutron flux and also be able to cover an **energy range of almost 10 orders of magnitude** starting from ~$10^{-3}$ eV

- **Detectors**: Array of Micromegas Detectors (Micro-Mesh Gaseous Structure)
Analysis Progress: Correction factors

- Gamma-Flash Subtraction and Signal Reconstruction:

- Dead Time Correction:

- Resolution Function Correction:

- 241Americium sample purity check:

Unreported Contaminant 239Pu~ 0.5 %
Analysis Progress: Profile of 241Am samples and Detector’s Response

- Geant4 Simulations/GEF Calculations:

- Investigation of Am targets surface homogeneity:

![Geant4 Simulations/GEF Calculations](image)

![Profile of Deposits with gamma spectroscopy](image)

- Amplitude Cut correction factor:

![1 MHz Counting Rate](image)

![3 MHz Counting Rate](image)
Results/Conclusions:

- Measurement of the $^{241}\text{Am}(n,f)$ reaction at the n_TOF Experimental Area 2 using micromegas detectors
- Preliminary data in a wide energy range from thermal up to the MeV with emphasis at the near threshold energies

![Graph showing cross section vs. neutron energy]
Publications in Conference Proceedings for this work:

- Z. Eleme, N. Patronis et al., HNPS Advances in Nuclear Physics, 27, 189-194 (2019)
  http://dx.doi.org/10.12681/hnps.3008

- Z. Eleme, N. Patronis et al., ND2019, EPJ Web of Conferences 239, 05014 (2020)
  https://doi.org/10.1051/epjconf/202023905014

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