

# Zr Nuclear Data Campaign: Measurement of ( $n, \gamma$ ) cross section of $^{90}\text{Zr}$

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The isotopes of Zr with  $A = [90, 91, 92, 94]$  make up more than 97% of naturally occurring Zr [1] and are important to many nuclear applications such as nuclear reactors. One of the attractive qualities of naturally occurring Zr isotopes is that they have a low  $\sigma_\gamma/\sigma_t$  ratio at most neutron energies, such that they improve the neutron economy in reactors by preferentially scattering neutrons rather than absorbing them. This same quality also presents a challenge to measuring the capture cross section,  $\sigma_\gamma$ , of Zr isotopes. The ENDF/B-VIII.0 library has a relative uncertainty of approximately 10-20% for incident neutron energies  $< 0.1$  MeV, and uncertainty greater than 20% for energies  $> 0.1$  MeV for the majority of natural Zr isotopes. This motivated the Nuclear Criticality Safety Program (NCSP) to embark on a campaign to accurately measure and evaluate these isotopes of Zr. Here we will show energy-dependent neutron capture cross section measurements for the first enriched sample to be measured:  $^{90}\text{Zr}$ .

The measurements of isotopically enriched samples are being carried out at the Geel Electron Linear Accelerator (GELINA) facility of the Joint Research Center - Geel (JRC-Geel) of the European Union. As isotopic enrichment is a costly process we are careful not to activate any of the samples, as this may hinder future radiation-sensitive measurements. The activation analysis is presented in a report by Brown et al. [2]. Once we were satisfied that the Zr samples would not be activated by the measurements, the  $^{90}\text{Zr}$  sample was fabricated at Oak Ridge National Laboratory (ORNL) and shipped to GELINA. The dimensions of the cylindrical sample are approximately 0.12 cm thick and a radius of 2.5 cm. Since  $^{90}\text{Zr}$  is not chemically reactive to air, bare metallic samples were employed. The sample was measured at a flight path (FP) length of 60 m, using four  $\text{C}_6\text{D}_6$  detectors on FP14.

The final paper will include experimental details and measured cross section data for  $^{90}\text{Zr}$  compared to current evaluated nuclear data libraries. <sup>1</sup>

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## References

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