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Neutron and photon yields for the 51V(p,n)51Cr reaction near threshold

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The characterization of the neutron and photon yields of reaction 51V(p,n)51Cr at energies close to the threshold have been performed at JRC-MONNET on October 2023.
To ensure a thorough measurement, we employed the time-of-flight technique to measure angle-energy neutron yields at various angles. The primary outcomes of our experiment include Time-of-Flight (TOF) spectra at different angles, followed by deconvolution into energy spectra at those angles. This presentation will encompass dN/dE for each angle, along with the corresponding neutron yields. Our experiment has also encompassed the determination of the 51V(p,n)51Cr reaction threshold through activation by measuring the decay of 51Cr. In addition, we performed a photon yield measurement of our reaction to comprehensively understand the whole production process.
Complementary measurements were undertaken to glean more insights into the reaction and the experiment. First, we measured the energy neutron yield of the 7Li(p,n)7Be reaction at 1912 keV, a well-established neutron field with available angle-energy spectra and yields at each angle, serving as a valuable reference. Second, we conducted an energy threshold sweep of the Vanadium reaction to ensure accuracy in our values.
During the experiment, we observed significant resonance effects of vanadium in the considered thick target. This realization prompted an unplanned transmission measurement using vanadium. Employing lithium as a neutron source, we examined how the known neutrons at 1912 keV proton energy transmitted through our vanadium thick target. This additional step yielded valuable insights into transmission characteristics within the scope of our experiment.
The primary goal of this characterization is to utilize the vanadium neutron source due to a scarcity of data on angle-energy yields. Potential applications include monoenergetic neutron beams, validation of nuclear data, and neutron capture therapy. The complete experiment, with time-of-flight and activation measurements, is intended to be part of the training of Antònia Verdera. Since, the study of the 51V(p,n)51Cr reaction is the major part of her PhD Thesis. Ariel has granted funding for the experiment and for a 12-week stay in the JRC-Geel to Antònia Verdera as PhD student. Ariel has also supported the attendance of the Spokesperson of the experiment (Javier Praena) and thesis supervisor of Antònia.

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