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Experiment-based determination of the excitation function for the production of ^{44}Ti in proton-irradiated vanadium samples

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The artificial production of radionuclides has a considerable significance for many different applications. Recently, we observe increasing interest in the field of nuclear medicine, with ^{44g}Sc being one of the promising nuclides for positron emission tomography. Besides its direct production routes by irradiating suitable targets like Sc or Ti with charged particles, ^{44}Ti is in in the spotlight of radiopharmaceutical research because of the possibility to realize a ^{44}Ti/^{44g}Sc radionuclide generator. Therefore, exploring the possible production routes for the mother nuclide is of great interest, and spallation reactions on V induced by high-energetic protons seem to be one of the most promising ones.

We determined the excitation function for the production of ^{44}Ti in the nuclear reaction ^{nat}V(p,X) ^{44}Ti. Seven metallic vanadium disks were proton irradiated within an energy range of 111 to 954 MeV between 1995 to 1996. The experiments' cross sections were determined using two independent measurements by combining γ spectrometry with both a low-energy germanium detector and a high-purity germanium detector. The maximum cross section was observed for energies of 145 $\pm$ 1.2 and 150.2 $\pm$ 1.2 MeV with values of 803 $\pm$ 28 and 805 $\pm$ 27 μb, respectively, and are in good agreement with former unpublished results (**Fig. 1a**). In combination with these earlier measurements, a consistent data set for the ^{nat}V(p,X) ^{44}Ti excitation function from 111 to 1350 MeV was obtained. Model calculations using Liège Intranuclear Cascade (INCL)/ABLA reproduce the shape of the excitation function correctly but over-predict the absolute values by factors of 2 to 3 (**Fig. 1b**). Some considerations regarding this already earlier observed systematic overestimation of neutron-poor residues are discussed and the experimental results will trigger new approaches in code development in order to improve the predictions. The work has been published in [1].

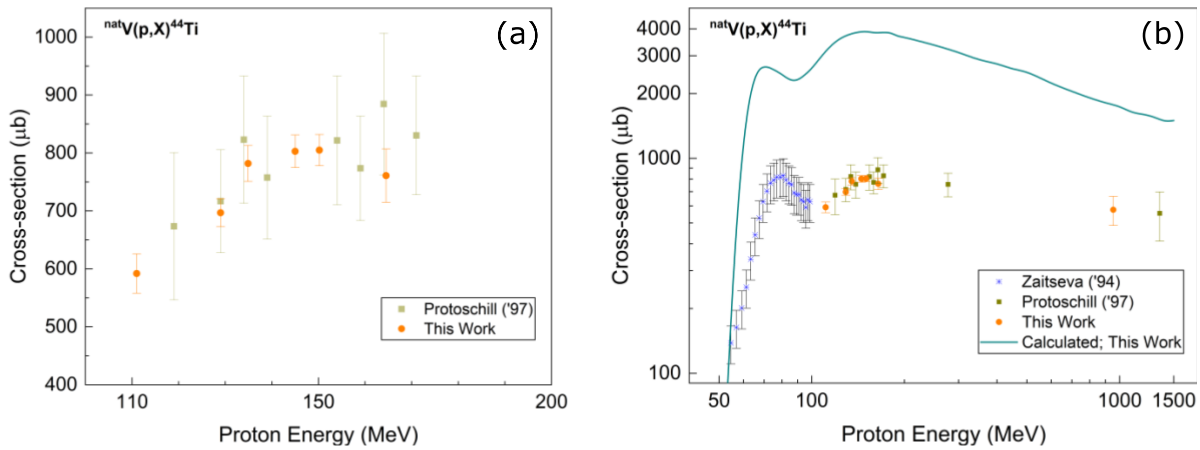

Fig. 1: (a) Experimental results for the ^{44}Ti production from p-induced reactions, shown in comparison with previous data, and **(b)** comparison of the excitation function for the ^{44}Ti production.

Reference:

[1] Veicht, M., Kajan, I., David, J. C., Chen, S., Strub, E., Mihalcea, I., & Schumann, D. (2021). Experiment-based determination of the excitation function for the production of Ti44 in proton-irradiated vanadium samples. *Physical Review C*, *104*(1), 014615.

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