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The modeling of reaction cross sections in the production of theranostic radionuclides

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Recently, a new high-energy (up to 70 MeV) and high-intensity cyclotron has been installed at the INFN-LNL National Laboratories of Legnaro (Padova, Italy). This facility will be soon put in operation and one of its research goals will focus on the production of radioisotopes for medicine and, in particular, theranostics, in the context of the INFN LARAMED initiative.
As research group, we are presently involved in the measurements and modeling of proton-induced nuclear reactions for the production of theranostic isotopes such as 67Cu and 47Sc. A series of measurements have been already performed thanks to a collaboration with the Arronax facility (Nantes, France) and are reported in this very same Symposium by G. Pupillo, L. Mou, et al.
Here we review the theoretical reaction models in a study performed with various codes with the aim to guide, interpret, and support the experiments in the proton-induced reaction measurements. The understanding of reaction cross sections at low-intermediate energies is crucial in this context and requires the knowledge of nuclear models available in different codes, analytical or MonteCarlo, such as EMPIRE, TALYS, FLUKA and others.
The use of nuclear reaction codes is very important to interpret the measurement of production cross-sections and to complete the measurements with estimates of production of contaminants and/or stable isotopes that are difficult to measure, particularly if the measurements have to rely heavily on radiochemical techniques. We will present a general study of different model calculations to simulate isotope production useful in measurements of proton-induced production reactions of the two theranostic radio-isotopes 67Cu and 47Sc.

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