# Megapie: Residue yields and radioactivity predictions with different models in MCNPX

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During the last years, in the field of spallation reactions, numerous experiments have been performed and codes have been developed and tested against experimental data. These studies were motivated by interest for Accelerator Driven System (ADS) and new projects of Radioactive Ion Beams (RIB) facilities and neutron sources in the world.
Among these studies, a lot of efforts have been devoted to the validation of the intra-nuclear cascade (INC) model, INCL4, developed in Saclay in collaboration with Liège University, combined with the evaporation-fission model, Abla from GSI, since the spallation process is generally modelled in these two steps. These models have been implemented into the transport code MCNPX2.5.0, so we can on one hand easily compare them with the other models already in (Bertini and Isabel for INC part, Dresner (with two different fission models - RAL and ORNL) for the deexcitation step, and also the CEM2k stand alone combination), and on the other hand use them for calculations in thick targets where secondary reactions take place.
INCL4/Abla has been largely compared to elementary thin target data as neutron double-differential cross sections, light charged particle spectra and residue production. In particular, we used the data from GSI in inverse kinematics for the mass, charge and isotopic distributions with U, Pb, Au, Fe beam on hydrogen target, and excitation functions measured by gamma- spectrometry to test the validity on a large energy range. This allowed to determine the domains where the models are reliable and the regions in which improvements are still needed. Recently, residue production yields in thick targets have been obtained by two groups and compared to predictions of different models: volatile gas from a Pb-Bi target at ISOLDE and production rates along a cylindrical lead target at Dubna. In both cases, INCL4/Abla was found to very well reproduce the experimental data, confirming what was expected from the elementary data comparisons.
In this paper, we will study the residue production in a *real* spallation target, the Megapie target that will be irradiated next July at PSI, with emphasis on volatile gas production for which the predictions of the different models differ substantially. The differences between the models predictions for isotope yields and activity rates will be shown and discussed. The results will be compared later with the experimental data obtained from gas samples taken during the irradiation phase or from analysis of Pb-Bi samples within the Post Irradiation Experiment (PIE) planned after the six months operation (from July to December 2006). Megapie aims at demonstrating the feasibility of a liquid lead bismuth target for spallation facilities.