Transmutation of ^{232}Th into ^{233}U at SwissFel

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Abstract

In the thorium cycle, the fissile isotope ^{233}U necessary for the fuel production is formed by neutron capture on ^{232}Th. A strategy to produce ^{233}U from ^{232}Th is therefore to irradiate ^{232}Th in a high neutron flux environment. This can be achieved using the electron beam from the SwissFel accelerator, coupled to a neutron flux amplifier such as a Lead Slowing-Down Spectrometer (LSDS).

Part of the high gamma flux intensity from SwissFel can be directed to a spallation source (made of Ta or W) to produce neutrons. This spallation source, placed at the center of the LSDS, will produce a very intense neutron flux. By placing Th foils in this very high neutron flux environment, a quantity of ^{232}Th will be transmuted into ^{233}U.

This project will first consist in modelling the spallation neutron source with MCNP, taking into account the characteristics of SwissFel. In a second step, the LSDS needs to be modelled (also with MCNP). The neutron flux (intensity and spectrum) needs to be characterized at different positions in the LSDS, as well as reaction rates on ^{232}Th. Adjustments of different quantities (such as irradiation time, position, amount, reflectors, spallation material,*etc.*) need to be done to optimize the ^{233}U production.

Subject review (ämnesgranskning) is performed att Applied Nuclear Physics/UU. Contact Henrik Sjöstrand henrik.sjostrand@physics.uu.se for details around the project, finacing, etc.