

ENDF/B-VIII.0 NUCLEAR DATA SENSITIVITY AND UNCERTAINTY (S/U) ANALYSIS OF KEY SAFETY-RELEVANT REACTIVITY COEFFICIENTS FOR THE ALFRED CORE

Friday 22 April 2022 10:30 (2 hours)

ENEA has a long-lasting expertise in the design of Gen IV nuclear reactors, in particular the ones cooled by liquid Lead (LFRs). In the EU context, through the participation to the FALCON Consortium, ENEA is pursuing all the activities required to support the construction of ALFRED –the European demonstrator of the LFRs –in Romania.

S/U analyses are a paramount step for the licensing of such an innovative reactor. In fact, no previous LFR experience can be used for validating neutronic calculations justifying the design of the core, so that a thorough assessment of the calculation uncertainties has to be used in front of the safety authorities asked to license ALFRED construction.

In fact, S/U analyses are used for establishing the adequateness of the assumed safety margins, as one of the key goals in designing the demonstrator, by verifying that such safety margins cope –with the aimed confidence –with the relative uncertainties.

The objective of this paper is to present the S/U analysis of the ALFRED reactor in order to assess the impact of the nuclear data uncertainties on the core reactivity and on the most important safety- relevant reactivity effects: e.g. coolant density effect, temperature-related geometric effects, control rod worth, delayed neutron fraction, etc.

Both the sensitivity and uncertainty analyses are here presented so to give the full picture of the parameters investigated, outlining what are the most important isotope-reaction couples both from the purely physical and nuclear data quality standpoints.

S/U analyses are performed using one of the most up-to-date nuclear data evaluations, ENDF/B-VIII.0, prepared in a special format readable by the selected neutronic code, ERANOS, which does not accept libraries in the standard ENDF-6 format.

Moreover, regarding the needed covariances, in order to avoid inconsistencies and with the aim of enhancing the confidence on the obtained results, a new homemade one also based on the state-of-the-art evaluation ENDF/B-VIII.0, was generated and used.

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Session Classification: Poster Session

Track Classification: Track 6. Modelling, Simulations, and Digitilization