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Establishment of best practices in reducing the uncertainty of neutron cross-sections with Bayesian methods

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The multiplication factor (keff) and its uncertainty are critical design parameters in nuclear reactors. Reducing this uncertainty would help in achieving more optimal design and safer operation of nuclear reactors. This uncertainty mostly comes from neutron cross-section uncertainties. It is difficult to measure the neutron cross-sections more accurately with direct measurements using currently available technologies. In this seminar three Bayesian algorithms allowing for more accurate indirect measurements are presented. The potential to ultimately reduce the keff uncertainty by applying such algorithms is presented on an example.
A list of best practices for conducting uncertainty reduction with Bayesian methods is established. The compilation of such list was motivated by absence of these practices in many papers which apply Bayesian methods for uncertainty reduction or quantification in the field of nuclear engineering. These best practices include a rigorous procedure for validation of posterior results based on so-called "synthetic experiments" and improved prior uncertainty quantification of experimental data assimilated with Bayesian algorithms.

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