Optimization From Core to Experiment -

Using Monte Carlo Computer Codes for the Conversion of High Flux Neutron Sources

The performance of a neutron source is not only dependent on the maximum flux, but is a function of available beam time per year, number and efficiency of neutron guides and instruments and available flux at the experiment. The conversion of research reactors, especially for high flux systems, which are used in neutron research often involves the re-optimization of the whole system to increase the performance and minimize losses. The first and inevitable step of the optimization procedure are simulation calculations of the reactor core. But striving to optimize the performance of the complete system it would be well-advised to expand the calculation beyond the moderator tank to address the experimental devices as well . Today, this is possible with a variety of Monte Carlo codes which track the propagation of neutrons through the neutron guides to the instrument and thus virtually simulate a complete experiment . So far, we have used MATHEMATICA as a tool for our simulation routines addressing the reactor core optimization. Now, we implemented MATHEMATICA also as a linkage routine between MCNPX and the neutron ray-tracing code MCSTAS. This code system is capable of assessing and quantifying changes in performance of a high flux research reactor from core to experiment. It could be useful in overall conversion strategies by making the various trade-offs between neutron flux, neutron quality costs of conversion measures and neutron usage at experiments more transparent.