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#4-114 Understanding the origins of the Signal-to-Noise Ratio of CABRI hodoscope

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The CABRI experimental pulse reactor is devoted to the study of Reactivity Initiated Accidents (RIA), for the purpose of the CABRI International Program (CIP), managed by the French Radioprotection and Nuclear Safety Institute (IRSN). CABRI's hodoscope equipment detects the fast neutrons emitted during a power pulse by a tested rod, positioned inside a dedicated test loop reproducing either sodium reactor or Pressurized Water Reactor (PWR) conditions. Among other experimental acquisitions, its first role is to monitor the fuel displacements inside the test rod during the pulse. Complementary, Hodoscope measurements are used to estimate the axial power profile on the test rod, and the so-called coupling factor, involved in the determination of the deposited energy on the test rod during the pulse. To reach these results, one of the most important parameters measured by the hodoscope detectors is the Signal-to-Noise Ratio (SNR), characterizing the fraction of neutrons directly coming from the test rod ("signal") over neutrons coming from the core ("noise").
In this article, the method used to calculate the SNR using a 2D model of CABRI, with the MCNP6.2 Monte Carlo code, will be detailed. The model consists of a full description of the CABRI core, as well as the hodoscope equipment. It is interesting to note that the SNR indicator is quite independent of the Z-axis, so as a 2D description is well suited to estimate this parameter.
This model has been applied to a calibration experiment of the hodoscope equipment, with a fresh UO2 rod used as a test rod. This calibration step involves acquisition performed during a steady-state 10 MW power plateau; no power pulse being required for this goal. The measured signals have been reproduced by the calculation, in order to estimate the SNR. The calculation allows to explain the shape of the experimental curves, thanks to a precise localization of the origin of the noise in the CABRI core.
Finally, calculated and measured signals show a quite good agreement. However, a discrepancy can be observed for the noise measured by a set of detectors, which is not described by the simulation, and which will require further investigations.

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