Prague, Czech Republic June 21-25, 2021

Contribution ID: **47** Type: **Oral presentation**

#06-47 Analysis of the Signal over Noise Ratio of the hodoscope determined by Monte Carlo calculation

Wednesday, June 23, 2021 3:20 PM (20 minutes)

The CABRI experimental pulse reactor, located at the Cadarache nuclear research center, southern France, is devoted to the study of Reactivity Initiated Accidents (RIA) for the purpose of the CABRI International Program (CIP), managed by IRSN in the framework of an OECD/NEA agreement. The hodoscope equipment installed in the CABRI reactor is a unique online fuel motion monitoring system, thanks to the measurement of the fast neutrons emitted during a power pulse by a tested rod positioned inside a dedicated test loop reproducing PWR conditions. This system is dedicated to the analysis of fuel displacement and degradation of the tested rod during the power excursion. Hence, one of the most important parameter measured by the hodoscope detectors is the Signal over Noise Ratio (SNR), characterizing the fraction of neutrons directly coming from the test rod ("signal") over neutrons coming from the core ("noise"). Nowadays, this value is measured during a power plateau of the CABRI reactor, a few days before the experiment.
It is interesting to calculate the SNR in order to define some quantitative criterions to improve hodoscope measurements and to understand if any modification linked to the test loop may significantly change this essential parameter.
In this article, the method used to calculate the SNR using MCNP6.2 Monte Carlo code will be detailed. Because the hodoscope detectors are located far away from the test rod (up to 4 meters), a 2D model of CABRI core and instrumentation has been implemented. No variance reduction techniques have been used to solve this problem in order to record the place of birth of neutron which contributes to the different scores with the goal to perform a detailed analysis of the SNR.
Another parameter of interest which will be evaluated by means of this new model is the so-called "scattering coefficient", which corresponds to the fraction of neutrons coming from the test rod and being scattered between their birth and their detection. This parameter is used to enhance the analysis of the fuel displacement which may happen during the power transient.
Finally, the comparison between calculated and measured SNR for a case study will be carried out. A quite good agreement between the 2D simulations and experiments recently performed in the CABRI reactor has been obtained.

Primary authors: DI SALVO, Jacques (IRSN); MIROTTA, Salvatore (IRSN); Mr CHEVALIER, Vincent (IRSN)

Presenters: DI SALVO, Jacques (IRSN); MIROTTA, Salvatore (IRSN)

Session Classification: 06 Severe Accident Monitoring

Track Classification: 06 Severe Accident Monitoring