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# #4-183 Acoustic Microscopy Sensor to Estimate the Water-Channel Thickness in a Research Reactor Spent Fuel Element

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High Performance Research Reactors (HPRR) produce neutrons for material testing and scientific experiments in a wide range of fields. These neutrons are produced by fissions in the reactor's fuel elements. During an irradiation cycle, various micro-structural and physical-chemical transformations take place in the HPRR fuel element depending on its specific irradiation history.

The High-Flux Reactor (RHF) of the Institut Laue Langevin produces the most intensive thermal neutron flux in the world with a thermal power of 58.3 MW. In the framework of the global nonproliferation initiative, the ILL is deeply engaged in the conversion of the RHF from highly enriched uranium to low enriched uranium. This conversion is a challenging process, requiring strict adherence to safety standards and the preservation of similar performance levels in the new fuel elements.

In this context, the Institut Laue Langevin and the Institute of Electronics and Systems of the University of Montpellier have launched a collaboration known as the PERSEUS project. Its goal is to ensure that the RHF fuel under irradiation behaves consistently with its qualification. In order to achieve this, and as the swelling process is the most interesting phenomenon for the RHF, we estimate fuel plate behavior by measuring the water channel thickness after irradiation.

Several ultrasonic devices were therefore specifically engineered and manufactured to perform these measurements. In a previous work, we demonstrated that this type of devices is suitable for in-situ measurements. In the present presentation, we
propose a new design for the device, which now comprises of a 100-MHz-double-element-ultrasonic transducer whose performances were quantified using laboratory equipment to prepare for the in-situ measurements. A mechanical system was also developed to control the ultrasonic device underwater and record the device's position inside the water channel while testing the RHF fuel element. This experimental set-up will be presented along with the signal processing. We will then discuss the results of an in-situ measurement performed along 50 cm of a fuel element water channel.

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