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A Prototype for Passive Gamma Emission Tomography

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Combined efforts of multiple stakeholders of the IAEA Support Programme task JNT 1510: “Prototype of passive gamma emission tomograph (PGET)”, resulted in the design, manufacturing and extensive testing of an advanced verification tool for partial defect testing on light water reactor spent fuel. The PGET has now reached a proven capability of detecting a single missing or substituted pin inside a BWR and VVER-440 fuel assemblies.

The task started in 2004 and it is planned to be finished this year. The PGET head consists of 2 banks of 104 CdTe detectors each with integrated data acquisition electronics. The CdTe detectors are embedded in tungsten collimators which can be rotated around the fuel element using an integrated stepping motor mounted on a rotating table. All components are packed inside a toroid watertight enclosure. Control, data acquisition and image reconstruction analysis is fully computerized and automated. The design of the system is transportable and suitable for safeguards verifications in spent fuel ponds anywhere.

Four test campaigns have been conducted. In 2009, the first test in Ringhals NPP failed collecting data but demonstrated suitability of the PGET for field deployments. Subsequent tests on fuel with increasing complexity were all successful (Ispra, Italy (2012), Olkiluoto, Finland (2013) and Loviisa, Finland (2014)).

The paper will present the PGET design, results obtained from the test campaigns and mention also drawbacks that were experienced in the project. The paper also describes further tests which would allow evaluating the capabilities and limitations of the method and the algorithm used. Currently, the main technical shortcoming is long acquisition time, due to serial control and readout of detectors. With redesigned electronics it can be expected that the system would be able to verify a VVER-440 assembly in 5 minutes, which meets the IAEA user requirements.

Country or International Organization

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