Modelling the Potential of Neutron Defectoscopy for PCHE Using MCNP Code

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Abstract. This paper is dedicated to the research and development activities related to non-destructive testing capabilities of detecting defects and failures of printed circuit heat exchangers. The usage of these components is currently considered for future utilization in high energetic systems and future Gen IV reactors due to the high heat transfer efficiency, compactness and resistance to the high operating pressures. Current prototypes of the printed circuit heat exchangers are under examination to demonstrate their applicability in nuclear power engineering field. One of the questions arising before the commercial deployment of this type of heat exchanger in prospective reactor designs is how to reliably detect potential failures, ruptures or other defects. The paper presents potential capabilities of fast neutron imaging of industrial components and applicability of this method to the on-site inspection processes. Updated neutronic models are presented in the paper and neutron transport simulations are performed to investigate various failure modes of the printed circuit heat exchanger.