NEUTRON FLUX DETERMINATION BY HIGH ACCURACY TEMPERATURE MEASUREMENT

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The idea of neutron flux determination by high accuracy measurement of temperature differences at the massive spallation uranium target QUINTA was begun in the Joint Institute for Nuclear Research in November 2015. The main goal of this ongoing research is to determine neutron gain in all sections of QUINTA Target Assembly (TA). The uranium mass of QUINTA is about 512kg whereas this mass is situated into uranium cylinders located in 5 hexagonal sections. Thermocouples type T are used with high accuracy analogue/digital converters from National Instrument, type NI9212, and NI9214. Until now, 3 experiments were performed in November 2015, December 2015 and March 2016, respectively. Thermocouples were measuring temperature of samples of ^{232}Th, ^{nat}U and enriched ^{235}U. Samples with thermocouples were inputted into narrow space about 17 mm located between two neighbouring sections of QUINTA TA. Results from these experiments are comparing with MCNPX simulation as well as with activation foil techniques. Measured heat consists of heat released by neutron fission and spallation reactions, proton spallation and absorption reactions and possibly by gamma heating. Reached heat, or rather temperature, needs to be sophisticated recalculate to determine neutron flux, respectively neutron gain. This research is continuing with further planned experiments in 2016, first planned to be in the middle of May. QUINTA TA is irradiated by proton beam with energy about 660 MeV and generally, the temperature during 6 hours experiment may rise up to 34 °C, so the temperature difference is about 12 °C.