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# Advanced cold neutron source for HEC-3 at the reactor PIK (status & performances)

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Several cold neutron sources (CNS) are planned to be built at the reactor PIK. Two of them are planned to be mainly used for condensed matter physics. They will produce cold neutrons in the horizontal experimental channels HEC-3 and HEC-2 with highest brightness. Neutron source for the channel
HEC-3 will be mounted in the vertical vacuum tube placed in the heavy water reactor reflector [1]. The chamber of spherical form filled with liquid deuterium will be placed into the tube. The operation temperature of the deuterium is in the range of 21 –25 K, and the volume of it is about 24.6 liters. The chamber has a displacer of special form to increase the neutron brightness of the source. The CNS will be operated in two modes: the normal mode with the chamber filled with liquid deuterium and the standby mode without deuterium. In both cases the released heat in the chamber will be removed with the special helium loop. Heat load in the chamber and in the other elements of the source placed in the vertical tube was calculated using MCNP code and the full computer model of the reactor. It includes prompt neutron and gamma heat releases as well as heat release from the decay gamma radiation from the reactor core as well as from the activation products of the reactor and CNS constructional materials. Also, the impact of the β-decay radiation was included. Tritium production in the deuterium was evaluated as well as the activity of the deuterium along the reactor operation. There is also a special neutron reflector in the tube between the chamber and a heat exchanger. The purpose of the reflector is to increase the brightness of the source as well as to reduce the activation of constructional materials in the upper part of the CNS.
The neutron guide system of CNS HEC-3 is also described as well as setups in the experimental hall and in the hall of horizontal channels which are planning to use these cold neutrons.

1. V.A. Mityukhlyaev et al. Neutron-physical calculations for the CNS HEC-3 of reactor PIK. Preprint PNPI # 2959 (2014)

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