neutron source

Evolution of Accelerator based Neutron Source VITA

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Budker Institute of Nuclear Physics has proposed, developed and is operating accelerator based neutron source VITA, which includes an electrostatic tandem accelerator of charged particles of an original design (a tandem accelerator with vacuum insulation), a lithium neutron-generating target and a number of neutron beam shaping assemblies. The facility ensures the production of the continuous beam of protons or deuterons with the energy of up to 2.3 MeV, with the current of up to 10 mA, the generation of a powerful neutron flux and the formation of a beam of neutrons of various energy ranges, from cold to fast. The facility is actively used for the development of boron neutron capture therapy of malignant tumors (BNCT), radiation testing of promising materials, measuring the cross-section of nuclear reactions and a number of other applications.

The second version of the accelerator based neutron source VITA-II is distinguished by the presence of pre-acceleration to increase the proton energy, the use of a volumetric source of negative hydrogen ions instead of a surface plasma source to increase the proton beam current, and a decrease in the height of the installation due to the modernization of the high-voltage power supply and its connection to the accelerator. The accelerator based neutron source VITA-IIα was delivered to the BNCT clinic in Xiamen (China) for the treatment of patients with the BNCT method. The second accelerator neutron source VITA-IIβ was manufactured to equip Blokhin National Medical Research Center of Oncology in Moscow with the purpose of conducting clinical trials of the BNCT technique in the Russian Federation starting in 2025.

Based on the experience gained, the third version of the accelerator based neutron source VITA-III is being developed. Burnazyan Federal Medical Biophysical Center in Moscow will be equipped with the accelerator based neutron source VITA-IIIα.

The research team is also developing the accelerator based neutron source VITAmin, which is compact due to the placement of the Cockcroft-Walton generator in the upper part of the feedthrough insulator.

The lecture presents and discusses the design of neutron sources, their features, parameters and applicability.

Acknowledgments:
This research was supported by the Russian Science Foundation (grant number 19–72-30005).