Current status of the accelerator neutron source in Budker Institute

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A source of epithermal neutrons [1] based on a tandem accelerator with vacuum insulation and lithium target is created in Budker Institute to facilitate development of Boron Neutron Capture Therapy (BNCT) for malignant tumors [2]. A stationary proton beam with 2 MeV energy, 5 mA current, 0.1 % energy monochromaticity and 0.5 % current stability is obtained for neutron generation [3]. Currently, neutrons are generated for multiple *in vitro* and *in vivo* studies, proton beam is used for radiation blistering study and the facility is improved for patient treatment at 2.3 MeV 10 mA proton beam. The effect of neutron radiation on different cell cultures incubated in boron medium is studied in cooperation with the Tsukuba University and the Institute of Molecular and Cell Biology. It was shown that the viability of U251human glioma cells and T98G human glioblastoma cells was significantly inhibited [4]. The viability of tumor-grafted mice is studied in cooperation with the Institute of Cytology and Genetics and SPF-Vivarium. It was shown that irradiation led to a complete cure in mice grafted with human glioblastomas. The formation of blisters on the surfaces of selected metal targets is examined using 2 MeV protons in concert with a team of Okinawa Institute of Science and Technology. A new, long-life, thin neutron-producing target and Beam Shaping Assembly [5] were manufactured and prepared for installation in the facility to obtain a therapeutic neutron beam that meets the requirements of BNCT to the greatest extent. The report describes the facility, presents and discusses the results of the research and declares the possibility of using accelerator neutron source for BNCT and for calibration of a dark matter detector [6].

References

[1] S. Taskaev, Physics of Particles and Nuclei **46** (2015) 956-990.

[2] Neutron Capture Therapy: Principles and Applications. Eds.: W. Sauerwein et al. Springer, 2012.

[3] A. Ivanov *et al.*, Technical Physics Letters **42** (2016) 608-611.

[4] O. Volkova *et al.*, Russian J. Radiology **97** (2016) 283-288.

[5] L. Zaidi *et al.*, Physics of Atomic Nuclei **80** (2017) 60-66.

[6] A. Makarov and S. Taskaev, JETP Letters **97** (2013) 667-669.