Study of the influence of space charge on proton beam transport from an accelerator to a neutron target

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An accelerating source of epithermal neutrons based on Vacuum Insulated Tandem Accelerator (VITA) and lithium target was proposed and created in the Budker Institute of Nuclear Physics. It intended for carrying out an investigations on BNCT of malignant tumors. A proton beam with 2 MeV energy and up to 8.6 mA current was obtained in the VITA, and this is enough for carrying out BNCT. An influence of space charge on proton beam transport was studied in high-energy tract from the accelerator to the lithium target. Earlier it was discovered, that space charge in the low-energy tract of the VITA has an essential role [1] and it is possible to increase current density of the beam by almost a third, varying vacuum conditions. In this study the proton beam current was varied. 8 thermocouples inserted into the target and an infrared camera FLIR were used to monitor the position and size of the proton beam on the lithium target. Proton beam current was measured by contactless current sensor Bergoz and by resistor divider which is connected to target and electrically isolated from the facility. Obtained results allows to make a statement that size of the proton beam on the lithium target without beam scanning system is 31 ± 3 mm and there is no dependence versus proton current in a range from 0.48 to 3.17 mA. Thus it is established that the space charge of protons, transported from the VITA to the lithium target is compensated.

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References

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