Diagnostics of the proton beam position using the luminescence of the lithium neutron producing target

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In the Budker Institute of Nuclear Physics an accelerator based epithermal neutron source was proposed and designed [1] to the development of the perspective cancer treatment, which is the Boron Neutron Capture Therapy. The principal unit of the facility is the neutron producing target. The target was irradiated by the proton beam with various energy values from dozens of keV to 2 MeV. Moreover, the current of the proton beam was gradually changed from dozens of μm to 2.5 mA. With the proton beam hitting the target surface the luminescence was detected. The luminescence was visually seen with the use of Smart IP-camera (Hikvision, China), mounted on the BaF2 window. The observed wavelengths were measured using spectrometers (HR2000+ (Ocean Optics, UK), CCS100 Compact Spectrometer (Thorlabs, USA)). The spectrum measurement was carried out through the window with the fused quartz glass. The distinctly distinguished spectral lines of lithium (670.67 nm and 610.4 nm) were detected. Furthermore, hydrogen lines were detected, which correspond to the proton beam presence, and lines suspected to be caused by an argon presence.
It is very important to be sure that the proton beam is on the target during the experiments. The luminescence allows online watching for the proton beam footprint on the target in the process of neutron generation. In this way, it helps to control the location of the proton beam.

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References

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