Hard X-RAY DIAGNOSTICS IN THE t-15md TOKAMAK [[1]](#footnote-1)\*)

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Diagnostics of hard (E ~ 0.1-10 MeV) and nonthermal (E ~ 10-150 keV) x-ray radiation represent one of the main techniques for studying spatial and temporal evolution of accelerated electron beams in a tokamak. Measurement of the spectral characteristics of suprathermal electron beams also makes it possible to estimate efficiency of the non-inductive current drive in quasi-stationary plasma discharges. Of particular interest is the study of rapidly varying radiation disturbances at the initial stage of the discharge and at the moment of plasma disruption.

Present report provides an overview of diagnostics used on the T-15MD tokamak for measuring fast-changing perturbations of nonthermal and hard X-ray radiation (time resolution up to 0.1-10 ms). The diagnostic complex consists of a multi-angle system for recording nonthermal x-rays in current mode based on Eurorad CdTe detectors with tube collimators, a multi-channel system of Eurorad CdTe spectrometric detectors with integrated amplifiers, and two-channel spectrometers based on Canberra LaBr3 lanthanum bromide scintillation detectors. Local distributions of the x-ray radiation intensity (with a spatial resolution of up to 3-5 cm) are determined using tomographic reconstruction technique based on the modified Cormack method [1]. To reconstruct spectral characteristics of radiation, a system for numerical spectrometric analysis of experimental data is used.

The CDTe detectors are located in detection blocks combined with the amplifiers and filtration system. Detection units are placed in protective cylindrical boxes with Teflon insulation. In front of the detector is an entrance window of beryllium foil 25 microns thick, limiting the registration of soft X-ray streams. The signal from the detector is processed using a remote-controlled signal amplification system consisting of amplifiers and a power supply. Operational testing of detectors is provided by the pulse generation module located in the amplifier block. The power source with a control unit is used to disconnect from the external network during the tokamak pulse

Design of the diagnostics location on the T-15MD tokamak, results of calculating the system of movable tube collimators, as well as the results of testing and calibration of detectors and data processing programs on a laboratory bench using an x-ray tube and a calibrated set of radiation sources are presented.

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References

1. P.V. Savrukhin, E.A. Shestakov, and A.V. Khramenkov; Plasma Physics Reports, 2018, Vol. 44, No. 12, pp. 1085.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Mu/ru/BB-Savrukhin.docx) [↑](#footnote-ref-1)