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MEASUREMENT OF RUNAWAY ELECTRON BEAMS HARD X-RAY RADIATION ON T-15MD TOKAMAK *)

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The formation of powerful runaway electron beams during the initial discharge stage, as well as during disruptions, and their subsequent interaction with in-vessel elements, can potentially damage the first wall and the divertor of the tokamak device. Evolution of RE beams is accompanied by the generation of bremsstrahlung radiation in the energy range up to tens of MeV. X-ray detection in combination with model calculations provide important information about the development of runaway electron beams inside the plasma discharge [1].

The Hard X-Ray diagnostic system, that consists of *NaI(Tl)* monitor and two $LaBr_3(Ce)$ spectrometric detectors, implemented on the T-15MD tokamak. The Hard X-Ray monitor is an assembly of d25x25 мм *NaI(Tl)* scintillation crystal, PMT and signal repeater. The monitor is located at a distance of 3 m outside vacuum vessel and has 40 mm lead shielding from sides. Calibration in absolute units was performed using an Eclipse IV X-Ray tube.

Two $LaBr_3(Ce)$ scintillation detectors with dimensions of d38.1x38.1mm arranged in sealed case with PMT and pre-amplifier 2007P are used for obtaining Hard X-Ray radiation spectra. Detectors are located in movable collimation system, providing field-of-view of 2° and allowing the field-of-view to be moved across plasma discharge [2]. To obtain Hard X-Ray spectra, the HARDSPEC algorithm for numerical processing of pulse signals was developed, including data filtering, determining pulse amplitudes and sorting pulses by amplitude.

In first experiments on the T-15MD tokamak with ECR plasma discharge initiation, Hard X-Ray spectra of runaway electrons were obtained. The maximum energy of runaway electrons E_{RE} is determined from Hard X-Ray spectra with an exponential fitting ~$\exp(E/E_{RE})$. The total current of runaway electron is also estimated. The differential cross-section of X-Ray radiation $d\sigma_k/dk$ is determined from the maximum energy of runaway electrons during their interaction with graphite first wall. Then absorbed radiation in Hard X-Ray monitor $W=d\Omega \cdot dt \cdot \int d\sigma_k/dk \cdot N_{RE} \cdot n_s \cdot k \cdot dk$ is calculated, which allows us to obtain the value of the runaway electron current $I_{RE}=N_{RE} \cdot e \cdot 2\pi R/v$.

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