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FAST PERTURBATIONS OF THE SOFT X-RAY RADIATION IN PLASMA OF THE T-10 AND T-15MD TOKAMAKS ^{*)}^{1,2,3}Savrukhin P.V., ^{1,3}Shestakov E.A., ¹Lisovoy P.D., ^{1,2}Tepikin V.I., ^{1,2}Aristov A.I.,
¹Khramenkov A.V.¹NRC «Kurchatov Institute», 123182, Moscow, Russia // Savrukhin_PV@nrcki.ru²NRU «Moscow Power Engineering Institute», 111250, Moscow, Russia³RFDA Project Center ITER », 123060, Moscow, Russia

Fast varying (up to ~2 MHz) plasma perturbations are observed in various plasma processes in tokamaks, including nonlinear processes of energy and particle transport, magnetic reconnection, arc discharges, as well as processes of generation of runaway electrons and plasma disruptions.

In the experiments conducted on the T-10 tokamak, Si and CdTe detectors with toroidal plasma viewing, located inside the tokamak vacuum vessel, were used. Along with the increased sensitivity to suprathreshold x-ray radiation, the registration of radiation in the direction tangential to the magnetic field lines in the T-10 tokamak provided the possibility of studying small-scale MHD disturbances that are not identifiable when the detector's field of view is located normal to the plasma column. In experiments with ohmic and ECRH heating of plasma, the development of rapidly alternating x-ray oscillations of 20°-80° kHz is observed simultaneously with the destabilization of large-scale MHD modes with poloidal (m) and toroidal (n) wave numbers $m^{\circ}=2, n^{\circ}=1$ before the disruption at high density. Analysis showed a possible connection between fast perturbations and instability of the accelerated electron beams with suprathreshold energies (100°-200°keV), localized near X-points of magnetic islands $m^{\circ}=2, n^{\circ}=1$.

To study fast oscillations of the soft x-ray radiation (energy up to 15 keV) in the frequency range up to 1°-2° MHz on the T-10 tokamak, Si surface-barrier detectors of n-type conductivity with normal (orthogonal) direction to the plasma column were also used. Measurements showed the development of oscillations of the x-ray radiation intensity in the frequency range of 200°-300° kHz during minor disruption at the stage of plasma current growth and during the development of internal disruptions.

Preliminary design of the diagnostic of the soft x-ray radiation (1.5°-15°keV) with an increased time resolution ($dt^{\circ}\sim 0.2^{\circ}-0.5^{\circ}mks$) is considered for observation of the fast x-ray oscillations in the tokamak T-15MD. Diagnostics is based on Si and CdTe detectors characterized by increased time resolution (up to 10-8°-10-9°sec), a signal pre-amplification system with gain control, a remote foil replacement unit and data collection and processing programs (Fig.1). The results of preliminary experiments on the T-15MD tokamak are presented.

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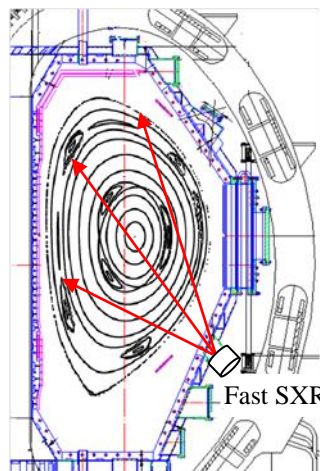


Fig. 1. Si and CdTe detectors for measurements of the fast-scale x-ray perturbations in preliminary experiments in T-15MD tokamak

^{*)} [abstracts of this report in Russian](#)