

Overview of DD fusion product diagnostics at the Gas Dynamic Trap facility

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Gas dynamic trap (GDT) is an open magnetic mirror trap for plasma confinement. Diagnostics of fusion reaction products for GDT should solve the following scientific problems. Measurement of the absolute values of the intensity of the deuterium fusion reaction in the system in each experiment. Observation of the fast particle accumulation with NBI plasma heating and the loss of fast particles as a result of MHD instabilities. Study of fusion reaction spatial distributions and rebuilding of profiles as a result of micro instabilities. The entire system operates under conditions of gamma ray and hard X-ray radiation, which occurs when superheated electrons are lost from the plasma.

The diagnostic system consists of the following main elements.

Fusion reaction intensity monitor based on a scintillator and PMT. The detector is located outside the vacuum chamber and operates in current mode. It provides 25 μ s time resolution. The main task is a survey measurements, observation of the accumulation of fast particles and global events associated with MHD plasma activity.

A set of 3.02 MeV proton detectors local inside the vacuum vessel. They work in the count mode. The detectors make it possible to measure the absolute values of fusion reaction intensity the system, to observe the spatial profiles of the reaction intensity and the temporal evolution of the reaction intensity profiles as a result of micro instabilities.

A neutron and gamma spectrometer based on a stilbene scintillator and a PMT is designed for fast neutron spectrometry under the conditions of gamma and X-ray background. It can be used to analyze superheated electrons that appear in the GDT because of additional microwave (ECRH) heating.