STUDY OF INFLUENCE OF MASSIVE GAS INJECTION IN T-10 TOKAMAK ON PROCESSES During DISruption OF PLASMA DISCHARGE [[1]](#footnote-1)\*)

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One of the main areas of research in modern plasma systems is the study of plasma disruptions and the prevention of the formation of runaway electron beams [1]. In experiments on the T-10 tokamak, along with standard plasma and gas puffing control systems, a number of plasma perturbing systems were used: a fuel pellet-injector with a chord pellet-injection system [2, 3], movable and stationary impulse gas valves for massive gas injection [4].

The PMGI movable gas valve and chord pellet-injection system are unique and not available on other tokamaks. The first system provides the ability to scan over a distance within 1.2 m from the edge of the plasma, including the location of the valve nozzle close to the last closed magnetic surface, and the second system allows you to evaluate the dependence of the processes in the plasma on the impact parameter of pellet injection and compare options for co- and counter-pellet-injection.

It was experimentally shown that, as the movable valve approaches the plasma boundary, thermal and current quenches are faster and more intensively, and for the current quench there is also a dependence of the change in current decay rate on the valve position, which also increases as the valve approaches the plasma. Moreover, it was found that the current quench can be switched from slow to fast using massive gas injection during the quench. On the other hand, it is fixed that the integral amount of energy radiated in a thermal quench in similar discharges is the same, regardless of the position of the valve. Massive gas injection prior to disruption leads to its initiation and allows one to study scenarios of optimal plasma quenching, and injection during plasma disruption provides an opportunity to prevent the formation or suppress the generated runaway electron beams.

Using the ASTRA code [5], the influence of various channels of thermal energy loss as a disruption develops is considered. The initial slow phase of the development of thermal quench is described by selecting impurity sources and transport coefficients, and for the final fast phase of thermal quench, it is necessary to take into account the increasing of instabilities and plasma mixing. In the simulation, a comparison was made of 4 options for the forced discharge disruption: disruption on critical density, using pellet-injection and two options for massive gas injection. The simulation demostrated the possibility of changing the confinement regimes due to the injection of gas or pellets and estimated the radiation of thermal energy due to repeated injection of the gas jet during thermal quench taking into account the geometry of the location of the gas jet source.

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