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4P69 - Characterization of Neutron Production in Deuterium Z-pinch Experiments at Current of 3 MA

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In order to study the mechanisms of deuteron acceleration and neutron production, deuterium gas-puff z-pinch experiments are performed at the terawatt-class GIT-12 generator. In these experiments, during the stagnation of z-pinch implosion at a time of about 700 ns, the generator current achieves approximately 3 MA. After a relatively stable implosion, the disruption of the z-pinch by instabilities occurs during a moment shorter than 1 ns. The fast plasma column disruption causes a high time derivative of the z-pinch current. It leads to generation of a high electric field which accelerates hydrogen ions up to the energies of 40 MeV. By collisions of the accelerated deuterons, a 20 ns pulse of more than 10^{12} neutrons is generated. In the radial direction, the neutron energies exceed 20 MeV. Due to the high deuteron energies, in dependence on the experimental set-up, approximately 15% of the total neutron yield could be produced by non-DD reactions of deuterons with materials inside the vacuum chamber, especially stainless steel and aluminum alloy. The high deuteron energies and non-DD reactions cause a relatively anisotropic neutron emission which is measured using indium activation samples.

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