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D-D fusion neutron generation and detection in laser-plasma interaction with free-flowing D_2O stream .[1] JUNGMOO HAH, JOHN NEES, MARK HAMMIG, Univ of Michigan - Ann Arbor, GEORGE PETROV, Naval Research Laboratory, KARL KRUSHELNICK, ALEC THOMAS, Univ of Michigan - Ann Arbor — Due to increasing demand for fast neutrons, there have been many efforts to generate neutrons using Laser Plasma Interactions (LPI). LPI can generate keV to MeV ions, which can undergo fusion reactions. Here, we use a 5-15mJ, 35fs laser operating at kHz, to accelerate deuterons from a 20 μm D_2O stream. These deuterons collide with cold deuterons in the heavy water stream and the low density D_2O vapor yielding 2.45MeV fusion neutrons. From the hydrogen capture peak (2.22MeV) recorded by a HPGe detector, we calculate a flux of $2x10^5$ n/s. In addition, the ^{73}Ge(n, γ) peak on the HPGe detector and nToF analysis confirm the generation of neutrons. Plasma expansion generated by intentional laser pre-pulses boosts the laser absorption efficiency, giving 10 times higher neutron flux compared to 'clean' interactions. 2D particle-in-cell simulations show that deuterons are accelerated forward, in the laser propagation direction, and backward in comparable numbers. But, the backward moving deuterons interacting with the low-density gas/plasma are the main contributors to fusion neutrons. Further experiments with background helium should isolate the region of fusion reactions by stopping backward traveling ions.

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