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A high repetition rate laser-heavy water based neutron source JUNGMOO HAH, ZHAOHAN HE, JOHN NEES, KARL KRUSHELNICK, ALEXANDER THOMAS, University of Michigan, Ann Arbor, CENTER FOR ULTRAFAST OPTICAL SCIENCE TEAM — Neutrons have numerous applications in diverse areas, such as medicine, security, and material science. For example, sources of MeV neutrons may be used for active interrogation for nuclear security applications. Recently, alternative ways to generate neutron flux have been studied. Among them, ultrashort laser pulse interactions with dense plasma have attracted significant attention as compact, pulse sources of neutrons. To generate neutrons using a laser through fusion reactions, thin solid density targets have been used in a pitcher-catcher arrangement, using deuterated plastic for example. However, the use of solid targets is limited for high-repetition rate operation due to the need to refresh the target for every laser shot. Here, we use a free flowing heavy water target with a high repetition rate (500 Hz) laser without a catcher. From the interaction between a 10 micron scale diameter heavy water stream with the Lambda-cubed laser system at the Univ. of Michigan (12mJ, 800nm, 35fs), deuterons collide with each other resulting in D-D fusion reactions generating 2.45 MeV neutrons. Under best conditions a time average of $\sim 10^5$ n/s of neutrons are generated.

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