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NSTX-U Contributions to Disruption Mitigation Studies in Support of ITER

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Predicting and controlling disruptions is an important and urgent issue for ITER. In support of this activity, NSTX-U will employ three Massive Gas Injection (MGI) valves that are similar to the double flyer plate design being developed for ITER [1]. NSTX-U will be the first device to operate this valve configuration in plasma discharges. NSTX-U experiments will offer new insight to the MGI database by studying gas assimilation efficiencies for MGI gas injection from different poloidal locations, with emphasis on injection into the private flux region [2]. These results are expected during Spring 2016. The valve has also been successfully operated in external magnetic fields of 1 T.

A limitation with the use of gases for pellet propulsion, whether they be solid refractory, shell, or cryogenic shatterable, is that the propellant gas limits the pellet velocity to about 300-400 m/s [1]. The Electromagnetic Particle Injector (EPI) described here overcomes this limit by relying on an electromagnetic propulsion system for pellet acceleration [3]. In this system, J x B forces acting on the projectile, which is located between two linear electrodes, propel the projectile. The primary advantage of the EPI concept over gas-propelled injectors is its potential to meet short warning time scale events. The system could also be located very close to the reactor vessel. The high levels of external magnetic fields that are present near the reactor vessel actually help to improve the efficiency of the system. The system has the potential to respond very rapidly by injecting impurities, into the plasma, within 3 ms after a command to inject is issued to the system. An off-line, non-tokamak test, is underway with results expected during Spring 2016.
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[1] L. Baylor, et al., Fusion Science and Technology 68, 211 (2015)

[2] R. Raman, T.R. Jarboe, B.A. Nelson, et al., Review of Sci. Instrum. 85, 11E801 (2014)

[3] R. Raman, T.R. Jarboe, J.E. Menard, S.P. Gerhardt, M. Ono, L. Baylor, W-S. Lay, Fusion Science and Technology 68, 797 (2015)

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