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Electromagnetic Particle Injector (EPI) as a Fast Time Response Disruption Mitigation Concept

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The Electromagnetic Particle Injector (EPI) has the potential for delivering the radiative payload to the plasma center on a 3-4 ms time scale, much faster, and deeper, than what can be achieved using present methods. Predicting and controlling disruptions is an important and urgent issue for ITER. While a primary focus is the early prediction and avoidance of conditions favorable to a disruption, it is understood that some disruptions may be inescapable. For these cases, a fast time response method is essential to protect the ITER facility. Experimental tests on a proto-type system have been able to verify the predicted rapid response capability of the EPI system by accelerating a 3.2 g sabot to 150 m/s in 1.5 ms.

The primary advantage of the EPI concept over present systems is its ability to meet short warning time scales while accurately delivering a radiative payload composed of acceptable low-Z materials such as Be, B or BN. This is done at velocities of ≥ 1 km/s required to achieve core penetration in high power ITER discharges, thus providing thermal and runaway current mitigation. This capability will provide the means for initiating a controlled plasma termination that originates at the plasma center, rather than from the outer periphery. This added capability, in addition to the fast time-response capability, should provide greater flexibility in controlling tokamak disruptions.

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