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Loss of Pre-disruptive Runaway Electrons by Magnetic Perturbation and Its Effect on Plasma Disruption

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Recently it is suggested that the loss of runaway electrons localized in the plasma triggers the plasma disruption by transferring their energy to the first wall generating massive impurities, based on the observation in KSTAR. In order to check the feasibility of the suggestion, localized magnetic perturbation was applied on the plasma edge to remove runaway electron beam from the plasma, utilizing the in-vessel field error correction coil installed at KSTAR. It is observed that sudden burst of photoneutrons was generated at certain level of the FEC coil current during a shot where a gradual increase of the perturbed field penetration was occurring by increasing the FEC coil current, indicating that the runaway electron beam localized on certain drift orbit were transported to the first wall by the magnetic perturbation reached the location. At the time of the neutron burst, typical disruptive behaviors such as the sudden decrease of the electron temperature, negative spike in the loop voltage, burst of D-alpha signal, fluctuation in Mirnov coil signal, and current decay with characteristic positive current excursion were observed, confirming the validity of the runaway-triggered plasma disruption model.

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