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Super-thermal and runaway electrons at reconnection events during JET disruptions.

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Abstract

A series of experiments on major disruptions intentionally provoked by gas puff as well as detailed analysis of the spontaneously occurring disruptions in JET has been carried out to further understanding of the trends of disruption induced runaway process. Runaway electron parameters have been measured using the hard X-ray and neutron diagnostics. The runaway beam also produces an observable soft X-ray image by exciting plasma impurity ions. Soft X-ray inverse reconstruction and ECE measurements of the electron temperature profile have been used in order to investigate the effect of the magnetic field re-arrangement at disruptions on the runaway process. Evolution of the soft X-ray image is compared to the evolution of the electron temperature profile at the beginning of negative voltage spikes. Short and intense bursts of ECE emission with non-thermal properties have been observed at the time when soft X-ray diagnostic indicates that a reconnection event occurs in the magnetic configuration. The bursts of the hard X-ray signal have been observed at the beginning of minor and major disruptions in JET, especially, in early JET pulses when the detector sensitivity was much higher than now.

Soft X-ray inverse reconstruction of the magnetic field evolution at a reconnection event has shown that an axis-symmetric confining configuration has been created again in a very short time-scale (~200 microseconds) after reconnection providing confinement of the super-thermal or low energy runaway electrons generated at this event.

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