On the radial propagation of Edge Localized Modes and edge fluctuations in JET

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The radial propagation of ELMs and the structure of fluctuations are under investigation in the JET SOL region. The experimental set up consist of arrays of Langmuir probes radially separated 0.5 cm, allowing a unique investigation of the propagation of ELMs events and fluctuations with good spatial (0.3 cm) and temporal (2 μs) resolution.

The response of ion saturation current and potential signals show a sudden increase followed by a slow decay. We denote the initial sharp change in the time evolution of the ion saturation current traces by the time of arrival of the ELM event propagation. Typical time delays for the time of ELMs arrival are in the range of 10 μs for sensors radially separated 0.5 cm. This implies a radial velocity in the range of 500 m / s. Interestingly this value is rather close to the speed of 200 m/s reported during the evolution of transport through the L-H transition in JET [1]. On the other hand, the ELMs radial speed in the SOL is larger than the radial effective velocity of broadband fluctuations and much larger than the effective radial velocity of pure diffusive models for the SOL region.

The dynamical link between ExB driven transport and gradients has also been investigated in ELMy and L-mode discharges. The effective radial velocity of fluctuations computed is close to 20 m/s for small transport events (i.e. small deviations from the most probable gradient). This effective radial velocity is consistent with a diffusive modeling of the plasma boundary in JET. On the contrary, the effective radial velocity increases up to 500 - 1000 m/s for large transport events (i.e.ELMs and large turbulent events in L-mode plasmas). The effective radial velocity of ELMs increases with the amplitude and appears to be independent on the distance to the Last Closed Flux Surface (LCFS) location.

These results suggest the existence of different transport mechanisms for small (diffusive) and large transport events (ballistic) in the JET plasma boundary region.

[1] J.G. Cordey et al., Nuclear Fusion 35 (1995) 101.