

EXPERIMENTAL STUDIES OF CURRENT RAMP RATES IN ASDEX

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Because of the importance for JET experimental studies on current ramp rates and skin-current penetration were undertaken on ASDEX. Anomalous skin-current penetration at high ramp rates has been associated with disruptive behaviour and with release of impurities due to enhanced plasma-wall interaction. According to the scaling law given by the Alcator team (1) this can only be avoided with such low current ramp rates that the full current flat-tops can be reached in ASDEX after 320ms and in JET after 3 (circular) to 5 (D-shaped) seconds. This has important consequences for the operation of JET. Therefore the Granetz scaling law should be checked at a tokamak of intermediate dimensions.

Experimental results will be presented for limiter and diverted discharges ( $R=1.64$ ;  $a=0.4$ ;  $B_t=2.2T$ ). These were found by varying the current ramp-rates between 0.4 and 1.6 MA/s corresponding to a flat top current of 325 kA reached between 0.6 and 0.2s at various gas influx rates leading to a density rise between 0.4 and  $1.7 \cdot 10^{20} \text{ m}^{-3} \text{ s}^{-1}$  corresponding to a flat-top  $\langle n_e \rangle$  of  $410^{19} \text{ m}^{-3}$  reached between 1.0 and 0.25 sec. The data are now under analysis but some clear observations can already be mentioned:

1. Limiter discharges are operationally more vulnerable than diverted discharges but the current penetration is only slightly different.
  2. At  $\dot{I} > 1.5 \text{ MA/s}$  ( $t_{\text{rt}} < 0.25\text{s}$ ) major disruptions during or shortly after the current-rise could not be avoided.
  3. At  $0.8 < \dot{I} < 1.5 \text{ MA/s}$  burst of internal MHD were observed as predicted by the Granetz-scaling, however their intensity could be reduced by intense gas influx.
  4. At  $\dot{I} < 0.8 \text{ MA/s}$  no MHD-bursts were observed.
  5. The first moment of appearance of sawteeth on soft X-ray and ECE measurements showed a strong dependence on the gas influx rate at equal current ramp-rate. At high gas influx the plasma could be forced into sawtooth oscillation already 50ms before the current maximum was reached with a low MHD-activity. However, only a bit more gas influx would lead to a hard disruption preceded by m-2 activity of the normal high density limit type.
- 1) R S Granetz et al, Nucl. Fus. 19, 1587 (1979).

**Preliminary Abstract (4-page paper not received in time).**