Contribution ID: **643** Type: **Poster**

EX/P5-37: Scrape-off Layer Properties of ITER-like Limiter Start-up Plasmas at JET

Thursday 11 October 2012 08:30 (4 hours)

The scrape-off layer (SOL) power decay length, lambda_q, in the limiter phase of ITER as well as the overall power balance are critical parameters for optimization of the wall geometry and thereby determining the power handling limits of the beryllium clad wall modules in ITER. Historically, an L-mode divertor SOL scaling has been used to estimate the ITER width, but recent measurement in limiter configuration on a variety of tokamaks, including those described here from JET, are showing that this is not a valid approach and that a new scaling is required. One issue associated with this new database is that it is almost exclusively constructed from power decay length measurements made using reciprocating Langmuir probes in the main SOL, usually far from the limiters. The power loads on the limiters are usually predicted by projecting the upstream power density along the field line (cross-field transport or poloidal asymmetry are neglected). It has been long known that the sink action of the limiter can locally enhance the radial plasma flux, especially when the last closed flux surface is close enough to the limiter and when the field lines come at a grazing angle. In dedicated limiter experiments with the new ITER like wall at JET (beryllium first wall and tungsten divertor) IR thermography data show that the peak power load at the limiter can be underestimated by a factor 2 if local action of the limiter is not taken into account. In this contribution, we characterise the conditions at which the limiter plays a significant role. When it does not play a role, the lambda_q measured at the limiter matches probe measurements. For ohmic plasmas, lambda_q scales inversely to the heating power, in line with the scaling found on Tore Supra. Beam heated plasmas do not follow this trend.

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Session Classification: Poster: P5

Track Classification: EXD - Magnetic Confinement Experiments: Plasma–material interactions; divertors; limiters; scrape-off layer (SOL)