# PEP-26 Critical edge parameters for achieving L-H transition

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| **TG priority:** High | **Start date:**   | **Status:**  On-going | **Personnel exchange:**   |
| **IO priority:**   | **End date:**   | **Motivation:** Plasma Operations |

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| **Device / Association** | **Contact****Person** | **2016 TGRequest** | **Activity (from JEX/JA spreadsheet)** |
| **2012** | **2013** | **2014** | **2015** | **2016** |
| C-Mod  | J. Hughes | Desirable | Committed | Analysis | Analysis | Committed |   |
| AUG | E. Wolfrum | Desirable | Committed | Committed | Committed | Committed |   |
| DIII-D | P. Gohil | Desirable | Analysis | Committed | Not doing | Considering |   |
| EAST | T. Lan | Desirable | Committed |   |   |   |   |
| JET | C. Maggi | Desirable | Committed | Committed | Committed | Committed |   |
| MAST-U | H. Meyer | Desirable | Committed | Committed | Analysis |   |   |
| KSTAR | W.-H. Ko | Desirable |   |   |   |   |   |

**This template is based on the 2013 report.**

**Purpose**: The goal of these experiments is to use improved diagnostics with high radial resolution on multiple devices to measure (1) edge quantities before L-H transition, including densities, temperatures and flow velocities and (2) fluctuations in edge parameters. Thresholds over a wide range of densities are obtained in order to access both the low and high-density branches of the power threshold, and scans of plasma current and toroidal field are also used. Local edge threshold conditions for the L-H transition are sought, and used to test models for the transition which might help guide predictions for threshold power on ITER.

**Results**: Analysis of experiments on AUG with ECH heating at moderate to low densities (1—6x1019 m-3) was completed and published [1]. Dependence of Pth with current was observed at the lowest densities, with transport analysis demonstrating that the ion heat flux, normalized to density, must reach a critical to trigger the transition. This implies a critical Ti gradient, as suggested by prior work [2]. New experiments on JET, with its ITER-like wall, have been run with a focus on understanding the non-monotonic dependence of Pth on density, and the effects of impurities on Pth when going from C to metal PFCs [3]. Much emphasis has been placed on collecting edge ion and electron data around L-H transitions, and characterizing edge turbulence with reflectometry. On MAST H-mode access and pedestal evolution have been studied in a current scan, to examine the effect of ion orbit loss (and therefore Er) on Pth. An experiment has also been run to examine the substantial effect of midplane HFS vs. X-point fueling on Pth. Analysis is ongoing.

**Executive summary**: (closed as a Joint Experiment, moving to Joint Activity)The power required to access H-mode Pth is of great importance to the success of ITER, in terms of achieving H-mode and perhaps of the subsequent plasma performance. Though projections of Pth to ITER are based on scaling laws fit to global experimental parameters, one expects the L-H transition should be linked to some critical set of edge conditions which result in the formation of an edge transport barrier. Data from multiple machines with diverse operating parameters provide an opportunity to determine underlying common trends and to test models for the transition. Thus this will be transferred to a Joint Activity and closed as a PEP.

[1] F. Ryter *et al.* Nucl. Fusion **53** (2013) 113003

[2] P. Sauter *et al.*,Nucl. Fusion **52** (2012) 012001

[3] C.F. Maggi *et al.*, submitted to Nucl. Fusion