

Measurement Requirements for the Advanced Tokamak Operation of a Burning Plasma Experiment (BPX)*

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The optimization of the tokamak performance has been the focus of Advanced Tokamak (AT) research for the past decade. A central theme of the AT research is control: of the plasma shape; control of the profiles of current, pressure, and transport; and active MHD control. To optimize the performance, measurements of crucial parameters such as the current density and the plasma pressure, are required with appropriate spatial coverage and resolution. In addition, measurements of other critical parameters will be necessary to develop fundamental understanding of the complex nonlinear interactions amongst the current density profile, the pressure profile and transport in high beta AT plasmas. Present day experiments are providing insight into what a Burning Plasma Experiment (BPX) may require for achieving the best performance. Recent research has been focussing on MHD stability aspects such as the NTM and RWM stabilization. However, in burning plasmas additional important new factors such as turbulence and alpha particles, and their relationship to transport barriers, in the edge and the core may play key roles. Thus we need to explore the needs for measurements and diagnostics, and seek the best techniques to achieve these requirements, while identifying the areas for which the development of new measurement techniques are critical. We will also discuss the close relationship between measurements and active control, and how they impact the requirements.

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