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Internal transport barrier (ITB) formation in KSTAR

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One of important goals of tokamak experiments is the exploration of enhanced confinement regimes, and the access of the internal transport barrier (ITB) formation is dealt with an important physics issue in the most of tokamaks [1-3]. Investigation of the ITB formation condition in the KSTAR is also valuable in that point of view although its heating and current drive systems are not fully equipped to see the ITB with H-mode. We have therefore assumed that an early injection of the full NBI power (~ 4.5 MW) during the current ramp-up would give a chance to form an internal barrier if the plasma could stay in the L-mode. To avoid the H-mode transition, we have produced inboard limited plasmas with detaching from the both upper and lower divertors. An ITB formation during L-mode has been observed which shows improved core confinement as shown in the Figure 1 [4-5]. Time trace parameters indicating the plasma performance such as temperatures, the stored energy and the β_N are comparable to the H-mode in the discharge. Ion and electron temperature profiles show the barrier clearly in the temperature, and it was sustained for about 7 s in the dedicated experiment. In this work, we present the formation of the ITB with reconstruction of the current profile using a measured time-resolved pitch angle and the study of possible MHD activity that could terminate the ITB.

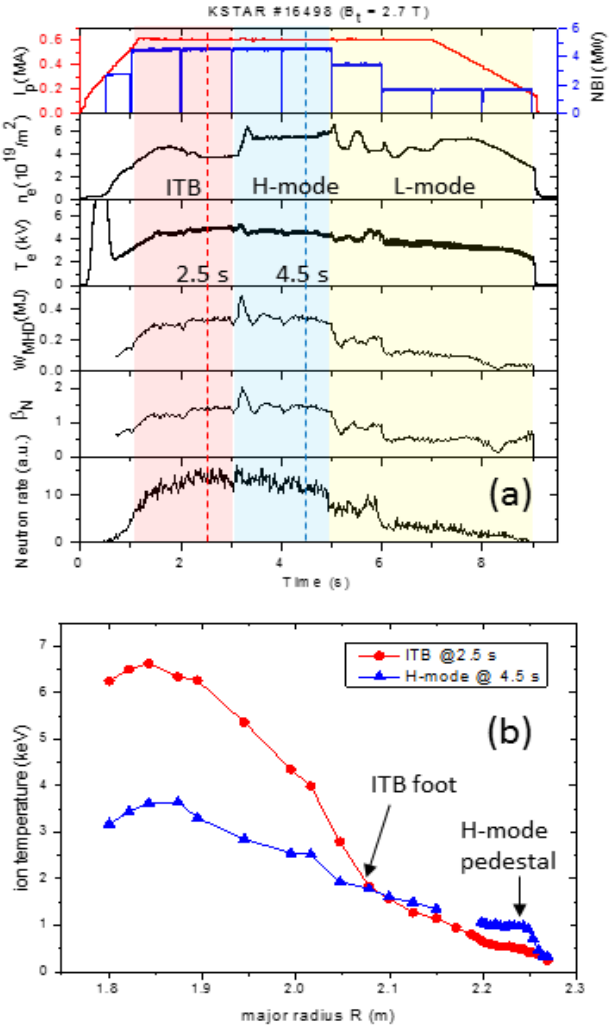

Figure 1. The first ITB discharge in KSTAR (Bt = 2.7 T). A total of 4.5 MW neutral beam injected in the middle of the current ramp-up (dIp/dt = 0.5 MA/s). Time trace parameters of the discharge (a) and ion temperature profiles at 2.5 s and 4.5 s (b) show the plasma performance during the ITB.

References
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