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Progress on high β_N steady-state scenario development and its energetic particle modeling in KSTAR

J. Kang[1], T. Rhee[1], J. Kim[1], M. Podestà[2], S. H. Hahn[1], H. Han[1], J. Chung[1], R. Nazikian[2], and J. M. Kown[1]

[1] National Fusion Research Institute, South Korea, [2] Princeton Plasma Physics Laboratory, USA

e-mail (speaker): jskang@nfri.re.kr

This study reports recent high β_N experiments in KSTAR plasma and the role of energetic particle transport for this achievement. $\beta_N > 3$ and long-pulse operation is one of the key milestones in KSTAR.

Over the past years, the fast-particle-driven Alfvénic activities used to be observed in high-NBI-power injected KSTAR H-mode experiments. [1] In addition, there have been several reports that the existence of Alfvénic modes (AEs) is strongly related to the possibility of achieving high β operation of KSTAR. [2,3] The control of AEs has not only done by fine tuning of electron cyclotron wave heating (ECH) resonance, but has been reproduced in a wide range of q_{95} regimes. [4] Recently, the recipe for achieving the high β steady-state scenario of KSTAR has been expanded to the early diverting scenario.[5] The aim of this method is to achieve a high-q_{min} value by minimizing Ohmic current penetration and avoiding MHD instabilities during the plasma current ramp-up phase.

Numerical investigation with TRANSP [6] / NOVA [7-9] / Kick-model [10-11] performed in addition to the experiment observation as in figure 1, so that the impact of the mode tailoring q profile was intensively analyzed. The confinement of thermal plasma and fast ion was dominantly changed according to the q_{min} in recent KSTAR high $\beta_N$discharges. In this moment, we reports potential high β_N candidates briefly. KSTAR experiment campaign of this summer is planned soon and will be added.

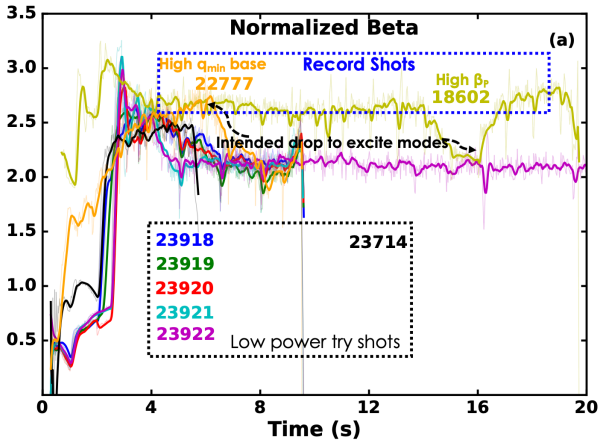

Figure 1. Potential candidates of high normalized beta operation shots. Pulse length and normalized beta values are over-plotted. More optimization is required to achieve $\beta_N > 3$ operation. Efforts for $\beta_N > 3$ would be mainly conducted in this summer.

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