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Role of fast-ion confinement for high β_N steady-state milestone in 2021 KSTAR campaign

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This study reports 2021 KSTAR high β_N experiments and the impact of fast-ion transport on achieved scenario. Since typical operation density regime is less than 50% of Greenwald density limit, the amount of fast particle pressure has been crucial for achieving one of the key missions in KSAR. It is used to be observed that the thermal and fast particle transport is enhanced by Alfvénic or tearing mode mitigation [1]. Mode control experiments have also been carried out several times to recover the plasma stored energy as the modes disappears utilizing electron cyclotron heating [2]. Numerical investigation with TRANSP [3] / NOVA [4-6] / Kick-model [7-8] are planned in addition to the experiment observation, so that the role of fast-ion confinement was intensively analyzed and performance degradation per each MHD mode is evaluated. Finally, high β_N experiments by avoiding and controlling MHD modes, especially critical for fast-ion confinement, were conducted and initial analysis results are presented.

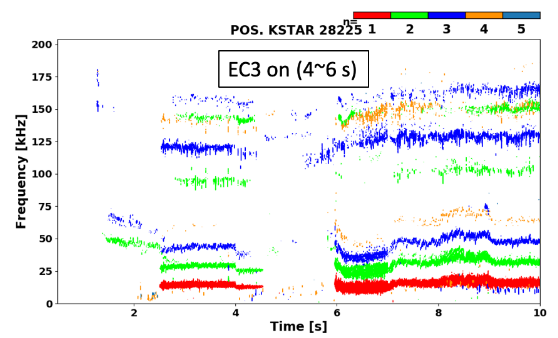

Figure 1. Mirnov spectrogram of MHD mode control experiments with ECH. During 4 to 6 s with ECH, almost the all MHD modes are disappeared. This shot is the baseline discharge to evaluate fast-ion transport behavior with multiple MHD modes.

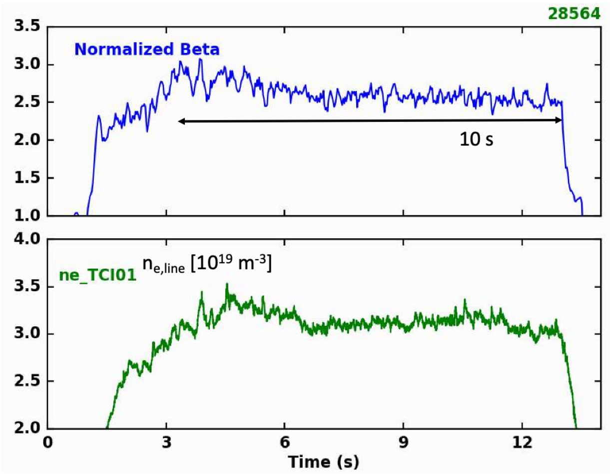

Figure 2. One of the record shot of high β_N steady-state discharges by avoiding MHD mode excitation. Upper figures shows normalized beta and below figure is line averaged density.

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