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P3.028 Design of KSTAR ECH launcher for long pulse high performance Tokamak operation

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Since KSTAR first plasma operation, ECH played a key role in obtaining various experimental results such as ECH preionization, ECH-assisted startup, plasma rotation study, impurity transport study, high poloidal beta operation, and long pulse operation. The main heating systems in KSTAR are NBI and ECH which are planed to provide 12 MW NBI by 2019 and 6 MW ECH by 2020 to prepare long pulse, high beta discharges. The ECH launcher should also be able to operate in steady state and to serve as central/off-axis heating and current drive, q-profile control, NTM, and sawtooth controls. The launcher has features such as continuous operation by water cooling and realtime precise-high speed beam control by connection with Plasma Control System (PCS) for supporting above experiments, in particular for NTM suppression. The whole control system with PCS has control loop rate of 1 kHz and a latency of about 10 msec at the mirror speed of 40 degree/sec. In addition, highly localized power deposition is very beneficial to the experiments, so the curvature and size of the mirrors in the launcher have been optimized to minimize the beam diameter in the resonance range. In this paper, the design of ECH launcher and its control system are presented with the test results.

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