Measurement of edge plasma parameters at KSTAR using a combination of Lithium and Deuterium Beam Emission Spectroscopy

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A 60 keV neutral Lithium beam system was designed and built up for beam emission spectroscopy measurement of edge plasma on KSTAR. The measurement will be the complementary of the heating beam based emission spectroscopy system which was built up in 2012, using the same observation system with different interference filter.

The upgraded lithium beam system consists of three parts: a recently developed thermionic ion source (j≥2.5mA/cm²), a high focusing efficiency ion optic (~50% of the extracted current can be found in the plasma) and a newly developed recirculating neutralizer; it gives the possibility to measure continuously even at long (<20s) discharges.

The observation system consists of two parts: a 4 by 8 channel APD camera unit and a CMOS camera which run in parallel: 95 % of the collected light goes to the APD unit which is digitized with 2MHz sampling rate while the CCD camera is operated in the 100 Hz range.

The finite decay time of the measured Li 2p-2s transition (670.8 nm) and the diagnostic arrangement gives the limit for the radial resolution of around 1 cm.

The diagnostic beam can be cut from the plasma using deflection plates together with a fast high voltage switch. This beam chopper can be operated up to 250 kHz giving a possibility to monitor the background on the time scale of the turbulence. This technique enables the study of changes in the plasma during the L-H transition, ELMs and other fast transient events.

In this paper the main improvement of the lithium beam system and the first measurement are described, analysed and compared to Deuterium BES measurements.