The Atomic Beam Probe Synthetic Diagnostic

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The Edge Localised Modes (ELMs) are repetitive instabilities of fusion plasmas. A significant particle and heat flux leave the confined region by ELM events. The ELMs are caused by the large pressure gradient and the edge current in the pedestal region. It is important to understand the edge current dynamics, however, the high temporal resolution edge current measurements are limited.

The Atomic Beam Probe (ABP) was a novel diagnostic tool installed on COMPASS tokamak [1]. A 40–100 keV light neutral alkali beam was injected into the plasma and ionised close to the last closed flux surface [2]. The primary ions were collected by a Faraday cup detector matrix, and their current was measured with high temporal resolution [1, 3]. The ion beam position and distribution at the detector are related with the magnetic field along the ions' trajectories [2, 3]. This work presents a synthetic diagnostic to support the understanding of the measurements.

The synthetic diagnostic is a machine independent tool which combines the relevant physical processes of beam diagnostics in tokamaks: magnetic and electric field, primary [4] and secondary ionisation, GPGPU ion trajectory simulation [5]. The fast changes of the magnetic field are parametrised by simplified models and added to the numerical solver. The output of the synthetic diagnostic is the current distribution of the Faraday cup matrix.

We will present synthetic cases with the variation of plasma parameters and compare with the COMPASS ABP measurements [6].

References:

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