Plasma edge current fluctuation measurements with the atomic beam probe diagnostic at COMPASS

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The evolution of the edge plasma current in magnetically confined plasmas is identified as a critical parameter of Edge Localized Mode (ELM) destabilization. While the plasma pressure gradient, the other critical parameter, is routinely measured with high spatial and temporal resolution on fusion experiments, the plasma edge current measurement capabilities are limited.

The Atomic Beam Probe [1] (ABP) is an extension of the widely used Alkali atomic beam emission spectroscopy diagnostic [2] offering a novel solution for plasma edge current measurement. The atomic beam, which is injected into the plasma, is ionized due to the collisions with the plasma particles. The ions originating from the beam follow a curved path in the magnetic field and might hit the wall of the machine. The impact location and the number of ions carry information about the toroidal plasma current distribution, the density profile and the electric potential in the plasma. The ion beam distribution can be sampled with a custom designed, 5x10 micro Faraday cup matrix detector [3] on the microsecond time scale.

The capabilities of the diagnostic technique have been demonstrated at COMPASS [4] previously [5] however, only with limited, 20 channel measurement capacity. A 64 channel amplifier was developed, tested, installed and commissioned to be able to utilize the 50 channel ABP detector matrix.

Experimental results will be presented showing the response of the ion beam distribution for plasma current ramps and gas puff induced plasma edge cooling in order to validate the diagnostic method. Results from NBI heated Type I ELMy H-mode scenarios will also be presented.

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