Atomic Beam Probe diagnostic for plasma edge current measurements at COMPASS

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The measurement of the plasma edge current density distribution and temporal evolution during the edge localized mode (ELM) cycle is of particular interest on the field of magnetically confinement plasmas, since the theoretical models recognize it as a key element for the trigger mechanism of the ELMs. The atomic beam probe (ABP [1]) is an extension of the beam emission spectroscopy (BES) diagnostic [2]. The beam atoms are ionized due to the collision with the plasma particles, deflected through a curved path due to the magnetic field and may be detected close to the wall of the machine. The arrival location and intensity of the ions carry information about the toroidal plasma current distribution, the density profile and the electric potential in the plasma.

Detecting the few microampere ion current close to the plasma edge requires a special detector. The measurements with a preliminary test detector head has been carried out, and a final detector head design was proposed based on the results [3]. A new detector head for the ABP was designed and tested in the lab. The new setup utilizes a shallow Faraday cup matrix, produced with printed-circuit board technology, and double mask for secondary electron suppression. Noise characterization, switching time, cross talk and fluctuation sensitivity test results in the lab setup will be presented, along with the first measurement results with the new setup at COMPASS tokamak [4].

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