Vertical Electron Cyclotron Emission Diagnostic for TCV Plasmas

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TCV is equipped with nine gyrotrons for flexible electron cyclotron resonance heating (ECRH) and current drive (ECCD). ECRH and ECCD are used routinely not only for auxiliary heating but also to control MHD instabilities, to tailor the plasma profile and achieve advanced scenarios with electron internal transport barriers (eITBs). However, the understanding of plasmas with ECRH/ECCD is not complete without information on the dynamics of non-thermal electrons. On TCV, the observation of anomaly high synergetic absorption of second and third harmonic X-mode beams is attributed to the presence of non-thermal tail electrons. To quantify this observation and broaden the understanding of the dynamics of non-thermal electrons, a new vertical electron cyclotron emission diagnostic has been designed and will be installed on TCV in the coming few months. This diagnostic will be based on the existing radiometer suites, which are used for the horizontal electron cyclotron emission (ECE) measurements. The bandwidth of the radiometers is ~750 MHz, and the signal is acquired at a maximum frequency of 200 kHz, which will allow the non-thermal electrons to be diagnosed at relatively high time and energy resolutions. The density and pitch angle distribution versus energy of electrons and time will be inferred. The diagnostic layout, the calibration, the modeling for data interpretation, the physics potentials and limitations will be discussed.