# High-resolution 2D electron temperature measurements via ECE-imaging

G.W. Spakman[1], I.G.J. Classen[1], C.W. Domier[2], A.J.H. Donné[1], N.C. Luhmann Jr[2], E. Mazzucato[3], T. Munsat[4], H.K. Park[3], M.J. van de Pol[1], and TEXTOR team

*1. FOM-Institute for Plasma Physics Rijnhuizen, Association EURATOM-FOM, Trilateral Euregio Cluster, P.O. Box 1207, 3430 BE Nieuwegein, The Netherlands*
*2. Dept. of Applied Physics, UC Davis,USA*
*3. PPPL, Princeton, USA*
*4. Univ. of Colorado at Boulder, USA*

The ECE-Imaging system at TEXTOR (R/a = 1.75/0.46 m) can directly retrieve 2D information without the need for any assumptions. The system has 128 measuring channels, arranged in an 8 (horizontal) ×16 (vertical) channel matrix of measuring volumes of approximately 1 $cm^2$ in the poloidal plane, thus covering an area of about 8 ×16 $cm^2$.

A procedure for temperature calibration of the system has been developed. A vertical row of channels of the imaging system can be absolutely calibrated by direct overlapping of them with those of the Thomson Scattering system. The Thomson scattering system measures the absolute electron temperature with an accuracy of 2% on a vertical chord through the plasma. Together with a relative calibration of horizontal adjacent channels, by means of a small magnetic field ramp, all channels of the imaging system are calibrated. The stability of the calibration factors has been tested for changes in the operational system settings.

One of the first applications of the system was to study the details of the sawtooth crash. The formation of an X-point, leading to a puncture in the magnetic flux surface around q=1, and the subsequent heat flow from the plasma core to the area between inversion and mixing radius has been clearly observed.

The system has been further used to study the effect of ECRH and ECCD on Neoclassical Tearing Modes (NTMs). In particular the evolution of the temperature profile inside the magnetic islands has been followed.

Since the ECE-Imaging channels can be moved through the plasma by changing the local oscillator frequency, it is possible to locate the measuring channels also at the very plasma edge. Even though the intensity of the signal cannot be straightforwardly interpreted as a temperature, it has been demonstrated that the system is able to observe structures in the ergodic and laminar zones of DED (Dynamic Ergodic Divertor) plasmas. In a similar configuration also the structures of ELMs in limiter H-mode plasmas can be diagnosed.