

# Electric probes in magnetized plasmas

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Electrical probes are routinely used in magnetized plasmas in tokamaks and stellarators, because they provide unique information on edge plasma parameters with a sufficiently high temporal and spatial resolution [1].

A variety of electric probes designed and tested in tokamaks for measurements of important plasma parameters as well as selected examples of achieved experimental results will be described in the talk.

- Slow measurements of the electron temperature and density from current – voltage characteristics of a classical cylindrical Langmuir probe
- Direct measurements of the plasma potential by the Ball Pen [2] and the emissive probes [3].
- Direct measurements of the electron temperature and density by the tunnel probe [4]
- Measurements of plasma flows (Mach numbers) by the Gundestrup probe [5]
- Measurements of plasma fluctuations by means of arrays of Langmuir probes [1]

Examples of probe design in the CASTOR, COMPASS, and Tore Supra tokamaks will be presented.

Some specific technological aspects related to exploitation of probes in high performance plasmas in tokamaks, such as high heat loads of probe heads and design of reciprocating manipulators, will be described.

The tutorial part of the lecture is devoted to on-line operation of probes on the GOLEM tokamak, which is located in the Faculty of Nuclear Physics and Physical Engineering, CTU in Prague. A specific and unique feature of this facility that it can be operated remotely via internet [6]. Participants will be able to execute several discharges on the GOLEM tokamak and examine the acquired probe measurements. Current-voltage characteristics will be processed to determine the electron temperature and density. Participants are requested to bring PCs with software for data processing (e.g. Origin, MatLab, ...).

[1] Stockel J et al 2007 Journal of Physics, Conference Series, 63 012001

[2] Adamek J et al 2004 Czech. J. Phys. 54 , Supl. C, C95

[3] Schrittwieser R et al 2002 Plasma Phys. Contr. Fusion 44, No 5, 567-578

[4] Gunn JP et al 2004 Review of Scientific Instruments 75 (10): 4328-4330

[5] Gunn JP et al 2001 Physics of Plasmas 8: (5) 1995-2001

[6] Svoboda V et al 2011 Fusion Engineering and design 86 6-8, 1310-1314