

Tokamak GOLEM for fusion education - chapter 8

J. Cerovsky¹, M. Farnik¹, M. Sos^{1,2}, J. Svoboda¹, O. Ficker^{1,2}, M. Hetflejš¹, P. Svihra¹, M. Shkut¹,
O. Grover¹, J. Veverka¹, V. Svoboda¹, J. Stockel^{1,2}, J. Adamek², M. Dimitrova²

¹ *Faculty of Nuclear Sciences and Physical Engineering CTU in Prague, Prague, Czech Rep.*

² *Institute of Plasma Physics AS CR, Prague, Czech rep.*

Tokamak GOLEM is the oldest tokamak still in operation. For eight years it has been the main pillar for education of the future thermonuclear fusion specialists throughout the world. This has been achieved thanks to the unique full remote control ability of the GOLEM [1] tokamak.

Students of the Czech Technical University in Prague contribute to the development of the daily operation of the tokamak and on its diagnostics. Their projects help to upgrade the present technological solutions while also carrying out the research in following fields of physics: i) For the purpose of the reproducibility and stability of a discharge, the component for sustaining a constant plasma current flat-top regime was designed. ii) The investigation of runaway electrons (RE) has continued, focusing on the study of RE generation and characterization of resulting HXR radiation. iii) Semiconductor detectors are widely used in high energy physics. New diagnostic tool using these semiconductor detectors was installed and tested. iv) The plasma temperature was investigated using a spectrometer and a system of photodiodes by analysing energy transitions of atoms visible in the plasma spectrum. Pyrometric line method line was used. v) Analog circuit for measurements of the density by the interferometer was examined in relation to the plasma position. First steps in a design and realisation of the second chord was suggested. vi) A no-installation-needed data analysis platform based on the JupyterHub web application is being developed for students participating in the remote training courses and other activities.

Furthermore, an advanced probe head, combining the classical Langmuir probe (LP) and the Ball Pen Probe (BPP) was installed on the GOLEM tokamak to study basic properties of the plasma edge region. Analysis of IV characteristics of LP and the temporal evolution of the floating potential of BPP allow determination of important quantities such as the ratio of electron and ion saturation currents and its dependence on the value of the toroidal magnetic field. This provides better understanding of properties of combined LP and BPP, which is used to measure the plasma potential and the electron temperature with a high temporal resolution [2].

References

- [1] V. Svoboda, et al., *Fus. Eng. and Des.* **68**, 1310-1314 (2011)
- [2] J. Adamek, et al., *Rev. Sci. Instr.* **87**, 043510 (2016)