
GOMTRAIC 2023

PROPOSAL FOR THE FUSENET MINI – WORKSHOP

Vojtěch Svoboda, Jaroslav Čerovský

Igor Girka

UA version (glory to the heroes)

Faculty of Nuclear Sciences and Physical Engineering CTU Prague, CZ

together with

V. N. Karazin Kharkiv National University, UA

27.11-1.12.2023

ABSTRACT

Based on the successful organization of the first year of the event in 2019¹, Faculty of Nuclear Sciences and Physical Engineering at the Czech Technical University in Prague offers five-days **GOleM TRAI**ning Course on high temperature plasma experiments at the GOLEM tokamak. Aim of the workshop is

- to have hands-on experience of tokamak operation and learn its basic principles.
- to learn basic instrumentation related to tokamak operation and diagnostics.
- to provide working experience with an integrated tokamak facility, including planning of experiments, plasma control, data acquisition and processing commonly used in today's fusion plasma experiments, finalization and presentation of experimental results.

1 Tokamak GOLEM offers the following physical, diagnostic and technological tasks for the workshop:

- Task 1: (All students) **Hands-on measurements of the plasma basic parameters** like loop voltage U_l , plasma current I_p , toroidal magnetic field B_t , basic estimation of the electron temperature T_e and rough approximation of the tokamak GOLEM electron energy confinement time τ_{E_e}
- Task 2: (3 students) **Study of runaway electrons behaviour in the GOLEM tokamak**- This task aims to explore complex RE diagnostics system at the GOLEM tokamak and making basic studies of the RE phenomena.
- Task 3: (3 students) **Plasma position control stabilization**- The goal of the task is to measure plasma position by magnetic diagnostics, understand the measurement method and control plasma position by stabilization coils.
- Task 4: (3 students) **Turbulence characterization** with ion saturation current measured with various advanced Langmuir probes. The goal of the task is to analyze the distribution function of density fluctuations, i.e. describe the skew, kurtosis and exponential or power law tails and to relate the findings to theory.
- Task 5: (3 students) **Runaway electron diagnostics** with ECE Radiometer, Timepix detector, Strip detector, scintillation probes.

¹See the final report at the <http://golem.fjfi.cvut.cz/wiki/TrainingCourses/PlasmaSchools/GOMTRAIC.cz/19/FinalReport.pdf>

- Task 6: (3 students) **Visible tomography** using minimum Fisher regularization from two fast cameras observing one poloidal cross-section of the tokamak.

2 Programme

For the preparation of data processing, 3-4 weeks before the workshop, all the participants will communicate with their respective supervisors about the data analysis, softwares and the routines to be used during the workshop

- **Day 1:**
 - * Talks:
 1. Vojtech Svoboda: Introduction to the tGOLEM, its Diagnostics, Operation.
 2. Petr Macha: Data analysis @ tGOLEM.
 3. Jan Mlynar, Jaroslav Cerovsky and RE team@tGOLEM: Runaway electrons in tokamaks (physics, diagnostics and recent results from the tGOLEM)
 4. Petr Macha: Physics of advanced electrostatic probes.
 5. Daniela Kropackova: Plasma position measurements and its stabilization.
 - * Hands-On experience with tokamak operation and plasma control Data processing in the tGOLEM using MATLAB and python
 - * Welcome Dinner
- **Day 2:**
 - * Hands-On experience with tokamak operation and plasma control Data processing in the tGOLEM using MATLAB and python
 - * Tasks based experiments and data analysis: Each group will be engaged with their respective tasks
- **Day 3:**
 - * Tasks based experiments and data analysis: Each group will be engaged with their respective tasks
 - * Social Dinner
- **Day 4:**
 - * Morning: tokamak COMPASS upgrade (in construction) visit.
 - * Afternoon: Preparation of presentation by participants.
- **Day 5:**
 - * Morning: Preparation of presentation by participants.
 - * Afternoon: Presentations by participants (20+5 minutes).
 - * Closing the workshop

3 Production issues

- The workshop can accommodate a maximum of 15 students. Of these, 6 places are reserved for Ukrainian **master level** students.
- This workshop offers an interactive course on fundamental and advanced toroidal plasma physics, which is suitable for undergraduate and post-graduate students. The course covers important aspects of experimental work on tokamaks, i.e., tokamak operation, plasma control, diagnostics and processing of experimental data.

4 Top-level budget breakdown

Expense	Amount
Accommodation (15 participants, 5 nights @ IBIS*** hotel in Prague)	≈ €3900
All lunches including welcome dinner and social dinner	≈ €1200
Contribution to the tGOLEM operation DAS cDAQ-9185 NI CompactDAQ Chassis	≈ €2000 ^a
Rewards to 5 organizers	≈ €500 ^b
Overheads	≈ €1400 ^c
Subtotal	€9000 €5100
100 % EUROFUSION contribution for UA participants travel costs (3900+2100)*6/15	€-2040
Total	€6960 €3060 ^d

^aAccording to the FuseNet Executive office, these expenses are ineligible. This makes me quite sad, I don't know how else I could appreciate the whole week's dedication to the operation of the demanding GOLEM tokamak device.

^bAccording to the FuseNet Executive office, these expenses are ineligible. I'm quite sorry for that, it doesn't make sense to pay it only as real personal costs (€/hour). Increasing or changing working hours or setting up a part-time job for a mere weekly event does not make sense as well. Our doctoral students will participate in this event, and I have no idea how to at least symbolically reward them and thank them for quite a lot of work.

^cAccording to the FuseNet Executive office, these expenses are ineligible. I have no idea how I will explain this rule to our finance department and faculty management.

^dThanks to the above-mentioned facts and the obviously increased production demands, I lost a little bit of motivation to organize such things...

Date: August 11, 2023

Vojtěch Svoboda
Tokamak GOLEM
CTU Prague