



CZECH  
TECHNICAL  
UNIVERSITY  
IN PRAGUE



## **GOLEM experiment for the Hungarian Nuclear Societies summer camp for students**

Authors: O. Asztalos<sup>1,2</sup>, D.I. Réfy<sup>2</sup>, G.I. Pokol<sup>1,2</sup> and V. Svoboda<sup>3</sup>

<sup>1</sup> Budapest University of Technology and Economics, NTI, Műgyetem rakpart 3, 1111 Budapest

<sup>2</sup> Centre for Energy Research, FPL, Konkoly-Thege Miklós 19-21, 1121 Budapest

<sup>3</sup> Czech Technical University, Faculty of Nuclear Sciences and Physical Engineering, Prague

**Time:** 2022.06.29 @ 14:00 – 15:00

**Location:** Budapest University of Technology and Economics, Building R-214

### **Description:**

The Hungarian Nuclear Society organized a summer camp between 2022.06.27 – 2022.06.02 for gifted high school students interested in nuclear physics. The aim of the camp was to introduce the students to fundamental concepts related to nuclear physics and its various application in the fields of energy production, safety and medical sciences. Thermonuclear fusion was a main focus for this year's summer camp, with particular focus on thermonuclear fusion reactions and magnetic confinement.

### **Program:**

The GOLEM exercise of the Nuclear Summer camp was attended by 18 high school students. The aim of the lab exercise was to demonstrate tokamak operations to the students and allow them to experiment with live tokamak. The students were divided into three groups: “Atom Antik”, “2. Padsor” and “tokagroup”. Each student group had access to a virtual control room and was supervised by a plasma physicist tutor, namely O. Asztalos, D.I. Refy and G.I. Pokol. The students were allowed to plan and queue plasma discharges in the allotted time. The students had the following tasks to perform:

- Achieve plasma breakdown.
- Generate a plasma with the highest Ohmic heating.

The exercise to reach the highest Ohmic heating was considered a contest between the groups. Figure 1 shows the list of discharges performed by each group. The table content is labeled as follows: Discharge number, was there a plasma (red for NO, green for YES), group name, Max. plasma current [A], Loop voltage [V] and Max. heating power [W]. The successful plasmas are marked with green and no plasma with red. Blue marks the plasma discharge with the highest Ohmic heating, indicating that the group led by D.I. Réfy, “Atom Antik” achieved the highest plasma heating power at discharge #39612. In total the groups performed 24 plasma discharges during the exercise. The group “Atom Antik” was the most successful, achieving 68.6 kW plasma heating and a 90% success rate for generating plasmas, followed by “2. Padsor” with a 55.6 kW plasma heating and 50% success rate for plasma generation and finally the “tokagroup” with 33.6 kW and 16% success rate.

Kisülés szám	Plazma	Csapat	Max plazma áram (A)	Hurok feszültség (V)	Max. Fűtési teljesítmény (W)
39594	NEM	Teszt	0	0	0
39595	IGEN	Teszt	4370	8.365	36555
39596	NEM	Teszt	0	0	0
39597	IGEN	Atom Antik	3529	8.283	29231
39598	IGEN	Atom Antik	4585	9.634	44172
39599	IGEN	2. Padsor	3929	8.292	32579
39600	NEM	2. Padsor	0	0	0
39601	IGEN	tokagroup	3504	9.615	33691
39602	IGEN	Atom Antik	4641	9.306	43189
39603	IGEN	2. Padsor	4652	11.959	55633
39604	NEM	2. Padsor	0	0	0
39605	NEM	2. Padsor	0	0	0
39606	NEM	2. Padsor	0	0	0
39607	IGEN	Atom Antik	5506	12.116	66711
39608	IGEN	Atom Antik	5715	11.412	65220
39609	IGEN	2. Padsor	4875	10.53	51334
39610	NEM	tokagroup	0	0	0
39611	IGEN	Atom Antik	6100	10.584	64562
39612	IGEN	Atom Antik	6570	10.442	68604
39613	NEM	Atom Antik	0	0	0
39614	NEM	tokagroup	0	0	0
39615	NEM	tokagroup	0	0	0
39616	NEM	tokagroup	0	0	0
39617	IGEN	Atom Antik	5937	10.239	60789
39618	IGEN	Atom Antik	5673		0
39619	NEM	tokagroup	0	0	0
39620	NEM	tokagroup	0	0	0
39621	IGEN	2. Padsor	3037	10.352	31439

Figure 1: Table of the plasma discharges for each group, the peak plasma current, corresponding loop voltage and peak Ohmic heating

### **Conclusion:**

During the laboratory exercise the students had the opportunity to test and experience their knowledge on fusion plasmas. All teams managed to perform the tasks set out of achieving plasma breakdown and competing for the highest plasma heating. The competition was won by the “Atom Antik” group. The laboratory exercise was successful in generating interest in fusion plasma

physics and allowed the students to test and improve their knowledge and understanding of tokamak operation.

**Appendix:**



