“Nine, eight, seven, six, five, four, three, two, one” *\*discharge\**

*\*intro\**

Hello and welcome to the TOKAMAK Golem education facility at the Czech Technical University in Prague, Faculty of Nuclear Sciences and Physical Engineering. I am Vojtěch Svoboda. I am a member of the Department of Physics and I would like to tell you something about this device.

First of all, I will start with the mission of such a device. So, in principle, we are going to create a microstar on the Earth, where light nuclei, which fuse into heavier ones and release huge amounts of energy. With that energy, we want to heat up the water, generate steam and we want to lead the steam to the electrical turbine and thus produce the electricity. So, our dream is a fusion power plant. And I hope you understand that this is a real scientific and technological challenge. And we are proud that we can contribute with this old and small device to the fulfillment of such a dream via education. So, the mission of the device is to educate new generation of high-quality scientists and engineers.

\*experimental setup\*

So, in principle, we have to create a magnetic bottle in the toroidally shaped vessel. In our case, the major radius of the vessel is 40 cm, and the minor radius is 10 cm. And we have to create the plasma in this vessel and to reach the high temperature state of this plasma. For that purpose, we have here this transformer core equipped with the primary coils, and when we introduce the current into these coils, we generate the magnetic flux, which is directed to the central column of this transformer and that way we generate electric field. This electric field helps us to break down the working gas into a plasma state and when there is a plasma, it acts as a secondary loop and we drive the current in the plasma. In our case up to 10 kA. And we are ohmic heating, we are rising the temperature of this plasma up to approximately one million centigrade. But of course, it is necessary to avoid any contact of such a hot metal with the cold vessel. For that purpose, the vessel is equipped with 28 toroidal magnetic field coils, and when we introduce the current to these coils by discharging the capacitor, we create a toroidal magnetic field in the vessel that experiences the magnetic pressure against the kinetic pressure of the plasma, and it forces the plasma to levitate in the center of the vessel. Finally, we create the plasma with the density of ten to the nineteenth power of particles per cubic meter and discharge **lens** is approaching 25 ms.

\*education\*

We are operating this TOKAMAK in two educational modes. On site and remote. So, on site, our students are doing their bachelor project, research projects, master thesis like a hands-on tokamak experiment. We are also organizing a practical laboratory for our students. And a science week even for high school students. And GOLEM training course for students from other universities around the world. The second mode is remote operation. We can operate this tokamak via any device connected to the internet including mobile phones. So, it is possible for foreign students to configure it, to request the technological parameters of the discharge and to submit this request to the queue. And we can perform the discharges almost every two minutes. So, this is an excellent tool for systematic studies, and we can give the students basic introduction to the tokamak physics, technology, operation, and diagnostics. In the ten years of history of this tokamak, we have organized almost sixty training courses where students configured 3500 discharges remotely.

\*science\*

Beside the education, we also have a scientific program with two tasks: studying H plasma physics with help of various electrostatic and magnetic probes and studying the behavior and dynamics of so-called run-away electrons with the help of various high x ray probes.

\*history\*

The history of this TOKAMAK is rather unique. It was built 60 years ago at the Kurchatov institute near Moscow under the name TM 1 (tokamak maly) and in 1974 my colleagues from The Institute of Plasma Physics transported this tokamak from the Soviet Union to the Czechoslovak Republic. And it became its second era as a scientific device under the name CASTOR (Czech Academy of Sciences TORus). In 2007 we transported this tokamak once more, from the Institute of plasma physics to the Faculty of Nuclear Sciences and Physical Engineering and we baptized this tokamak with the name GOLEM and it started its educational mission. So, I hope, that I have shown you ???? Although, it is the smallest tokamak in the world and the oldest tokamak, it has the biggest control room, because it is possible to control this tokamak remotely so it can contribute to the fulfillment of this dream of building a fusion power plant. Finally, I would like to acknowledge the financial support from the Faculty of Nuclear Sciences and Physical Engineering Czech Technical University in Prague, our Ministry of Education and Youth, the IAEA and Eurovision funds, And in the end, I want to offer to those of you, who are interested in the education in the field of TOKAMAK physics and technology, do not hesitate to contact us, we can organize a training course for your students.

Thank you for your attention to TOKAMAK Golem