

A FRUITFUL COLLABORATION BETWEEN NEIGHBOURS



Difficult connection: specialists from Cracow (IFJ PAN) install the complex superconducting coils of Wendelstein 7-X. (Picture: IPP, Anja Richter Ullmann)

The Polish fusion Association is heavily engaged in the advanced stellarator Wendelstein 7-X. The experiment is under construction in Greifswald, Germany – less than 100 kilometres away from the border to Poland. With a total investment of EUR 6.5 million, Poland is the second largest contributor to Wendelstein 7-X after the US. In return Poland becomes scientific partner of the project.

“I can get faster to Warsaw than to Munich, because Szczecin airport is so near,” says Thomas Klinger, project leader of Wendelstein 7-X (W7-X), when asked how the close ties between IPP Greifswald and the Polish Associates came about. “Right after Poland joined the European Union, I got on the train and presented the W7-X project at all research institutes in Poland. In 2007 we had a first meeting with Polish and German government representatives.” Also Roman Zagórski from the Institute of Plasma Physics and Laser Microfusion (IPPLM) in Warsaw remembers those first days of collaboration: “My

contact to IPP started in the late nineties with modelling work. During that time other Polish researchers also established ties to IPP. Eventually Poland decided to contribute to the assembly of W7-X. I was not directly involved back then. As far as I know, Poland had considered a national fusion experiment and opted for a partnership with W7-X instead.” Roman Zagórski is Head of Research Unit of the Polish fusion Association, which comprises eleven institutions across the country. Two of them are located in Szczecin, only 80 km from Greifswald, he says: “I hope that they will strongly participate in the Wendelstein 7-X experiment and I am trying to stimulate that at the moment.”

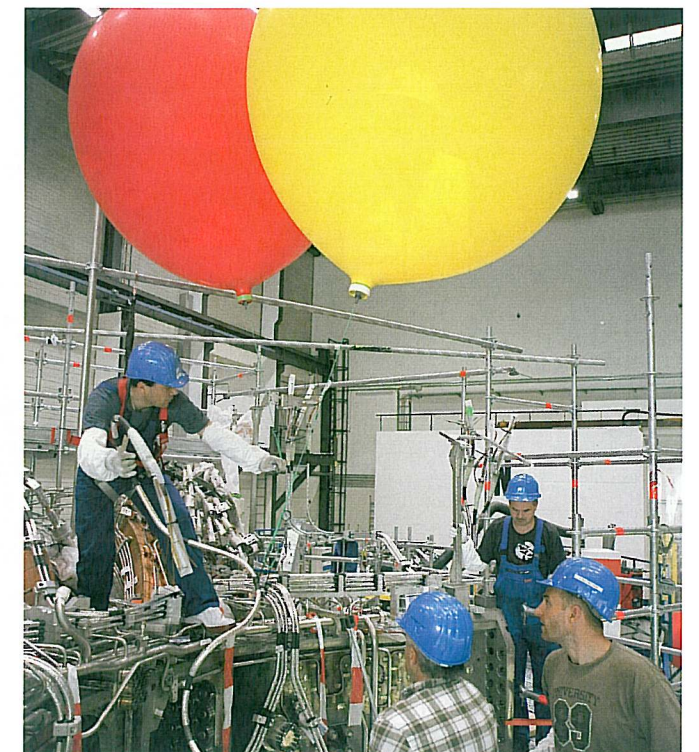
Superconducting joints. Poland brings lots of expertise for the complex assembly of W7-X. The Henryk Niewodniczanski Institute of Nuclear Physics (IFJ PAN) in Cracow is extraordinarily accomplished when it comes to assembling superconducting cables. Financed by the Polish Government, between ten and twenty technicians from Cracow were working at any time in Greifswald to make the 184 joints for the superconducting magnets. About 50 engineers and technicians were involved in

the preparation and training for the assembly of these superconducting connectors known as busbars. In total, the effort lasted for more than six years and amounted to more than 160 Full Time Equivalent Years of working time. “Long before the project was finished in late 2012, the Polish teams had become part of our W7-X family,” Thomas Klinger recalls. “The complex geometry and very limited space inside the cryostat was quite a challenge for these experts. I am really impressed by their work.” Because of their expertise, the group is well booked: Before coming to W7-X, they had worked at CERN and now they are involved in the construction of the European X-ray laser XFEL.

Neutral beam heating system. A second large project, the neutral beam heating system, is well under way. Experts for particle accelerators from the National Centre for Nuclear Research (NCBJ) in Swierk are responsible for the construction of the concrete support structures. The institute also contributes to the cooling system that dissipates the heat generated during the process of producing the powerful neutral particle beams. Together with the gate valves, which separate the injector boxes from the plasma, and two magnets, which reflect the particle beams, the total value of the NCBJ project amounts to five million euro. Most components are already in Greifswald and the final delivery is scheduled for September 2013.

Mechanical analysis, diagnostic and modelling. In 2004, the Warsaw University of Technology (WUT) started with structural and mechanical analyses of the W7-X magnetic system. Among other tasks, the group collaborated with IPP to develop finite element parametric models of critical system elements. Those models enabled a numerical analyses of the mechanical connections, helped understand the behaviour of the joints and allowed simulation of complex manufacture and assembly processes.

The Institute for Plasma Physics and Laser Microfusion is building two sophisticated soft X-ray diagnostic systems, which will be used to study impurities and very fast electrons in the plasma. For their design, a numerical code to simulate and evaluate the X-ray emission of a stellarator plasma was developed. IPPLM and IPP have been collaborating for the development of a code (FINDF) for simulating the parameters in the plasma edge region of the stellarator W7-X. This collaboration is expected to continue for further plasma edge modelling and for using the FINDF code to interpret the experimental results of W7-X. Further diagnostic systems for W7-X are developed by other Polish institutions,



Helium-filled balloons were enlisted to levitate the perfectly shaped and sensitive superconducting connectors carefully into the hall. (Picture: IPP, Anja Richter Ullmann)

e.g. IFJ PAN Instruments for neutron measurements and the Opole University impurity monitors.

Research plans. The investment in Wendelstein 7-X earns Poland a seat in the experiment's international programme committee. In June, IPP and the Polish partners held their first workshop to discuss their research plans. The options are plentiful. Wendelstein 7-X will benefit from Polish know-how in fields like neutron and x-ray diagnostic and in simulations, believes Thomas Klinger. Also Roman Zagórski envisages diagnostic work: “IPPLM has contributed to the diagnostic systems, so we are interested in such projects.” Other options would lie in the areas of plasma wall interaction and plasma modelling. Roman Zagórski is looking forward to the start of experiments: “There are not so many fusion devices in Europe at which our scientists can conduct their research. Having access to the newest and most advanced experiment in Europe is certainly a good opportunity for us.” ■

Contact & information:

Prof Dr Thomas Klinger, IPP, thomas.klinger@ipp.mpg.de
Prof Dr Roman Zagórski, IPPLM, roman.zagorski@ipplm.pl
Association EURATOM-IPPLM:

<http://tinyurl.com/euratom-ipplm>

Wendelstein 7-X: <http://tinyurl.com/IPP-Wendelstein-7X>

The Polish contributions to W7-X:

<http://tinyurl.com/Polish-participation-W7-X>