FUSENET ARTICLE

1. Self-assessment

1.1. Implemented skills

During the time the internship lasted, what I used most were my analytical skills. When you write a Python or Matlab script you will never obtain the results you are looking for at the first try. Because of that, you will need to use your analytical capability to find where the error is, taking into account that I worked with large scripts in which you could find a lot of concatenated loops.

Apart from that, I had to be very self-taught, since I had never worked with Abaqus and Python, nor Matlab at that level. Of course, I had a supervisor that was pleased to answer my questions whenever I asked him something, but I am not the kind of person that gives up trying to solve my problems and wastes someone's time if it is not necessary.

1.2. Identified difficulties

The most difficult moment was at the beginning of the internship, when I was told the objectives I was supposed to achieve. I had worked as an intern before, but I had never been so independent. In that sense, I got a little bit scared when my supervisor told me what my final aim was. I could not even think how I was going to deal with the different tasks, because I hardly understand them and, as I said before, I didn't know how to work with the programs I was supposed to use. Nevertheless, these weeks my supervisor helped me a lot. We had a meeting almost once a day, so that I could understand the problem we were facing and learn to use the programs I had to use. Once I saw that the hole problem could be separated into little problems, I was able to start working by myself.

1.3. Personal integration

My personal integration at IPP was very productive. Apart from the excellent relation I had with my supervisor, with whom I could speak about everything, I found that everyone there was willing to know new people. But the best of my

experience have been the two friends I made at IPP. It is much easier going to work if you know that whenever you need to have a little talk you will be able to have it, or just because of the fact of having lunch everyday with someone you can talk everything and not only about how work is going on.

1.4. Compliance of the expectations

In words of my supervisor, I achieved 99% of the goals I was told at the beginning. Besides, I left everything ready for the one that is chosen to continue my work. I tried to explain my work as best as possible to that future person and to make for him/her easy to continue my work without the need of understanding what I have done.

1.5. Final balance

In conclusion, I would say that this experience has been really nice. There hasn't been anything that I have missed in Greifswald. Every morning when I woke up I felt happy to be there and I wanted to go to the Institute and try to solve the problems I couldn't solve the day before. Besides, I was going to see my friends there, and if the three of us finished our work for the day early, we would make some plans. I have been working during the summer but I have also had a great time.

2. Observations

I highly recommend IPP for doing an internship for people that would like to work on something related to engineering. Currently, nuclear fusion is the most advanced technology in the world.

Researchers are trying to reproduce the conditions of the solar external surface in the Earth. In fact, when the tokamak (one of the two types of machines in which fusion takes place) in Princeton Plasma Physics Laboratory was run in 1995, the temperature of the plasma inside was about 510 millions degrees Celsius, thirty times higher than Sun's core temperature.

On the other hand, the coils used for confining the plasma are made of superconductor materials, so they have to be at temperatures close to the absolute zero. These coils are used to produce a magnetic field in the toroidal direction in the tokamaks. But the confinement of the plasma needs to be done by addition of two different magnetic fields: the toroidal one and also a poloidal one. An illustration of the magnetic surface of the Wendelstein 7-X is shown in figure 1.

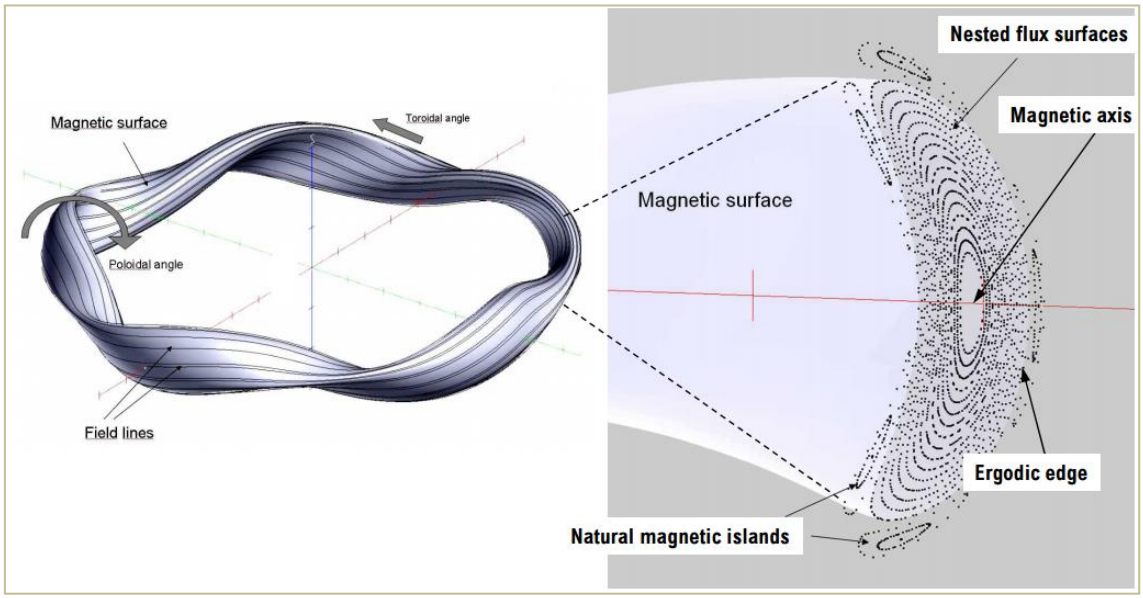

Figure 1. Magnetic surface of the Wendelstein 7-X.

Here it is the main difference between tokamaks and stellarators. In the tokamaks, the coils produce the toroidal field and another structure produces the poloidal one. However, in the stellarators, the coils produce the addition of both toroidal and poloidal fields, so that is why they have a very strange shape. They look like bent beans. An image of the Wendelstein 7-X coils is shown in figure 2.

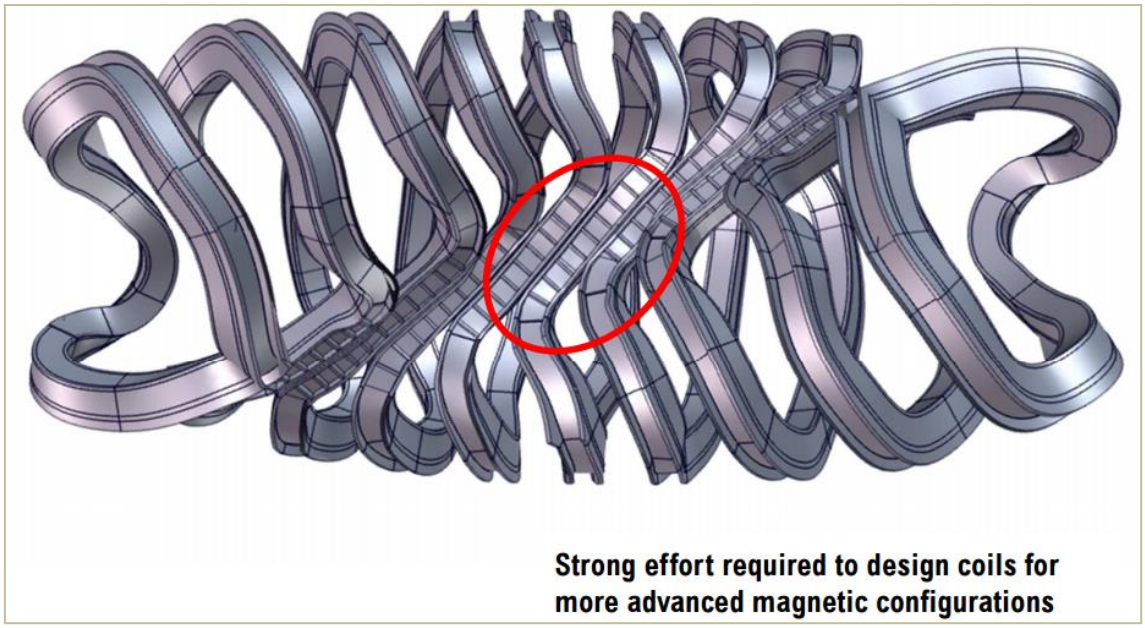

Figure 2. Image of the Wendelstein 7-X coils.

The need of having coils with these strange shapes, which have to be manufactured in a very accurate way to produce the magnetic fields exactly as they have been predicted to be produced, is causing the development of new manufacturing techniques.

The things described below demonstrate that fusion technology is high technology, and that is why I highly recommend to work in this field to anyone that has the opportunity. When working at IPP I felt like I was contributing a little to the big changes that nuclear fusion is going to suppose in a short and midterm.