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Summer Student Programme 2023 Report

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1. Introduction

The Summer Programme is about gathering students from all over the world who are studying mainly Physics and Engineering and currently in their bachelor's or master's phase. During my time here, I participated in several activities such as attending the lectures which were very intensive and as an engineering student, I had the impression that the lectures were more dedicated to physics students.

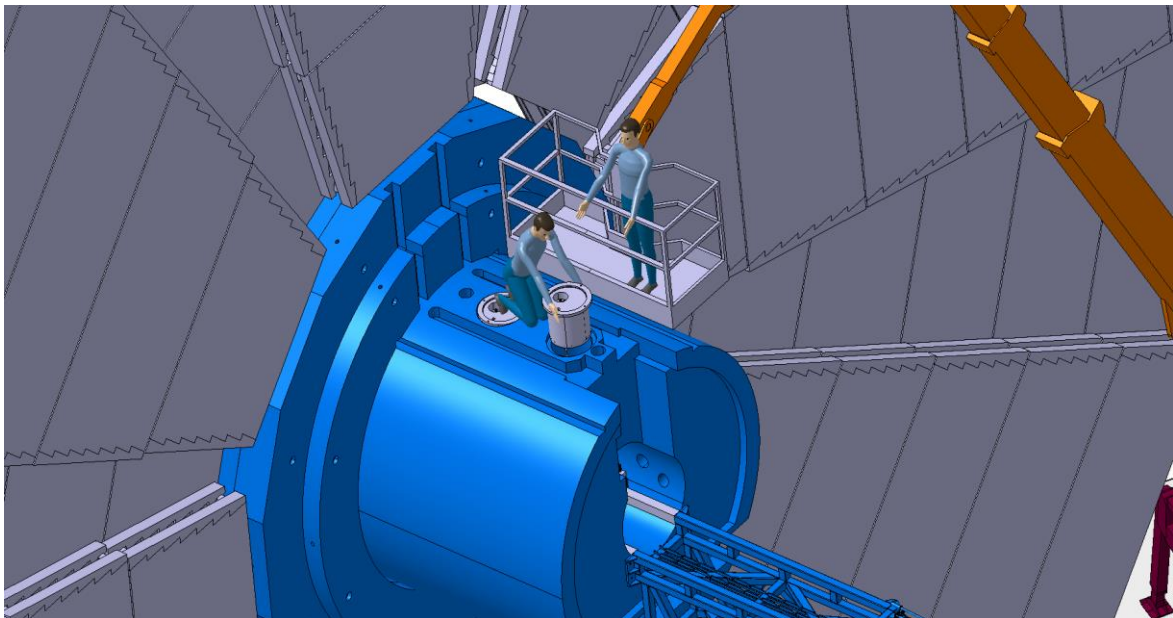
There were also social activities by the programme such as the welcome party and the alumni party, which gave the chance for students to meet, and this is how I met my friends here where we spent much time together, hanging out, eating, partying and travelling together. We had the chance to travel on the weekends to see other cities mostly in France, Switzerland and Italy.



2. Main Project

The project which I was assigned to was to support the project engineer for the Hi-Lumi project with 3D models to make the procedures of dismantling and installing equipment in the ATLAS and CMS cavern.

I had good experience with 3D modelling which I gained from previous internships and projects I worked on in college. I mainly worked with SOLIDWORKS in my previous work. However, here I was required to work with CATIA which I had to prepare for before I came here for about 2 weeks, and here it took me another 2 weeks of work with a colleague to be able to understand my task and reach the required level to do my project.



At first, I didn't fully understand the task and it was somehow complicated to do the task as the CATIA GUI is different than SOLIDWORKS and there is more icons and features. However, there's somewhat similarity between all CAD softwares. So, it didn't take me long to figure out where are the icons and start producing the images.

The worst part in my opinion is SmarTeam. As it gives codes to parts, and it becomes sometimes impossible to find what you're looking for.

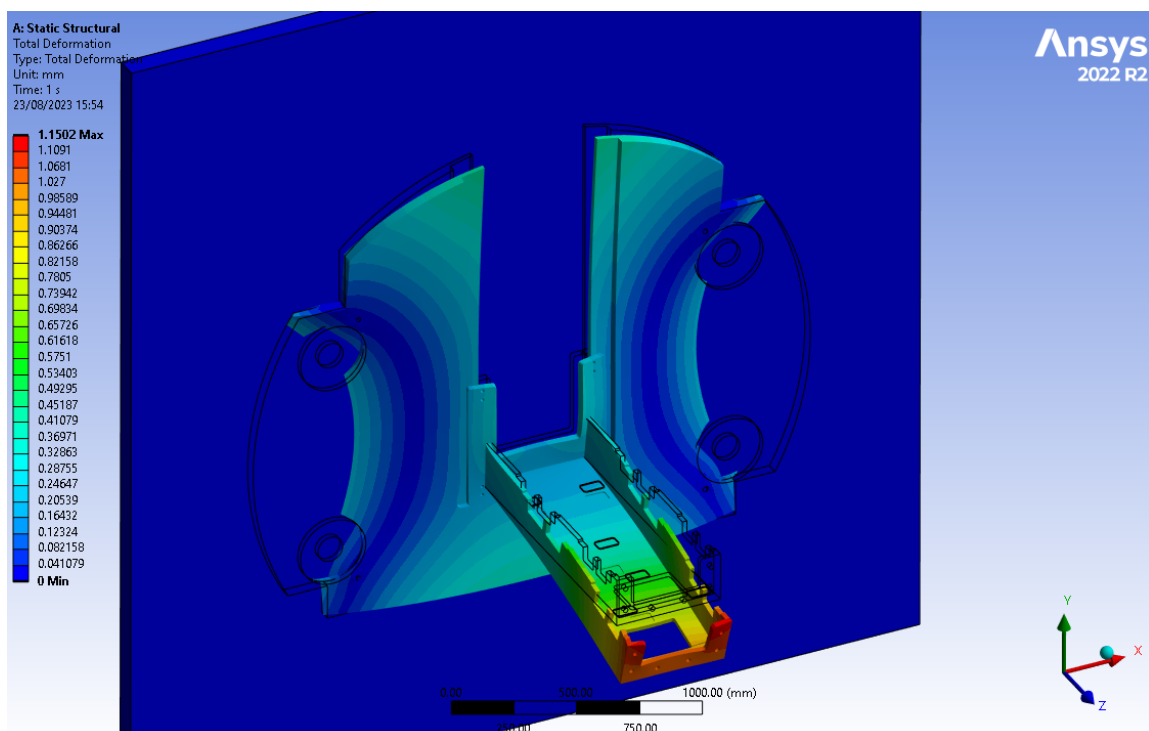
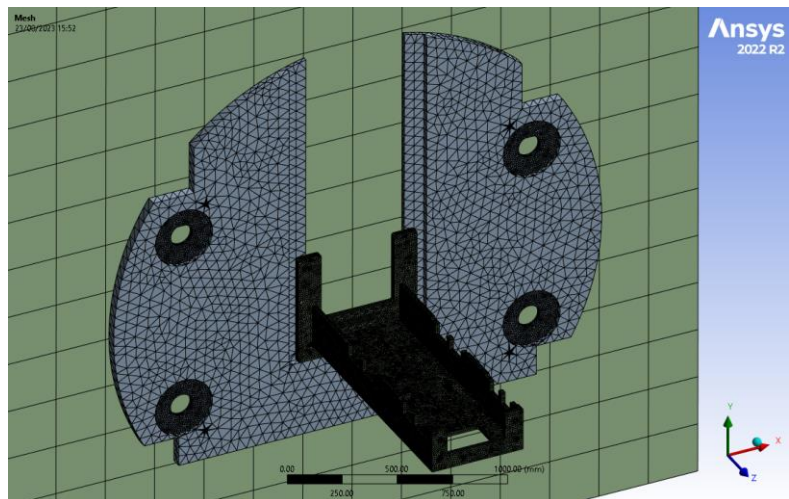
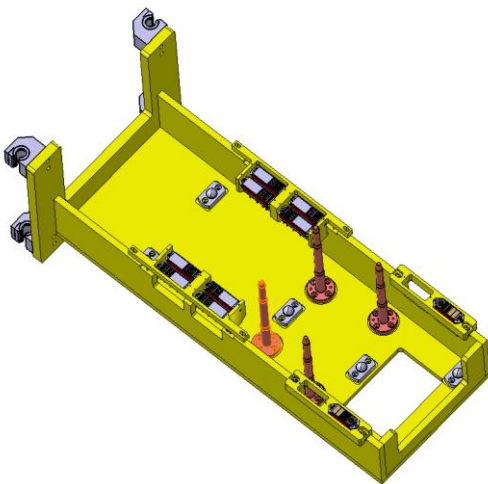
In the end I managed to produce about 80 images for different environments and scenarios for work in the cavern that would help illustrate the procedures to people.

3. Extra Project

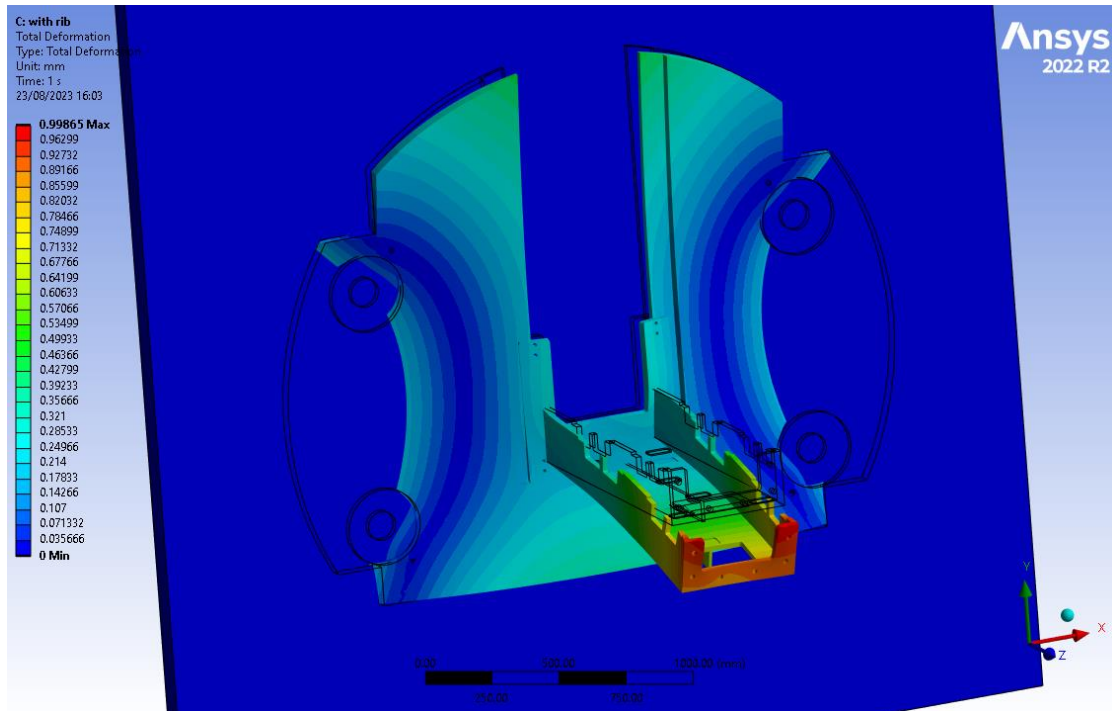
Aside from the main project, I asked for a task involving simulations. I was given a task to study the deflection of the VAX box in ATLAS experiment due to high preload of 100 kN on the bolts after changing from steel to aluminium to reduce weight.

In this task I practiced 3D modelling using Spaceclaim to simplify the geometry extracted from CATIA.

The goal was to see how much deflection we would get and the simulation shows it is about 1.15 mm.

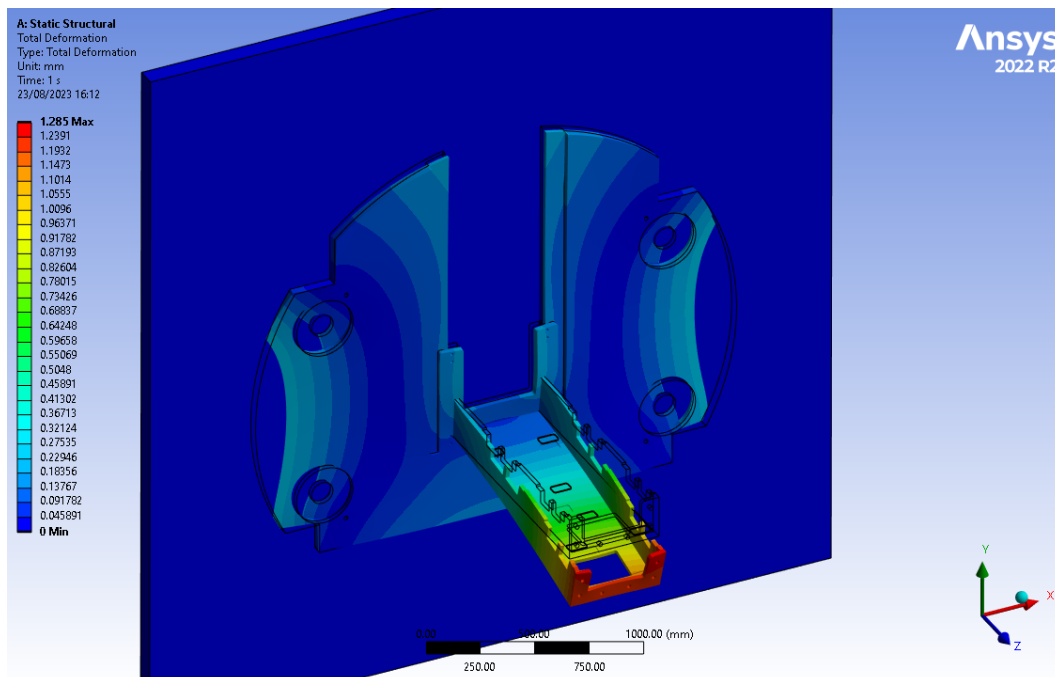


The simulation shows that if a 12mm rib is added to the VAX box, the deflection is 0.99 mm so it is reduced by 13%



and if the rib is 16 mm, then the deflection would be 0.97 mm so 16% reduction.

And if you use half the pretension without a rib the deflection would be almost 1.3 mm so it actually increased.





In the same very task, I helped another intern, he was a first-year engineering student. He was responsible for doing the same simulation but in CMS. I managed to explain to him the process of completing a successful and accurate simulation.

The task I would say is relatively easy if you know the whole process of how to simulate. For me, that was the case except the structural simulations I did before was on SOLIDWORKS but it didn't take much time to do it on Ansys as I already had experience in CFD simulation on Ansys.

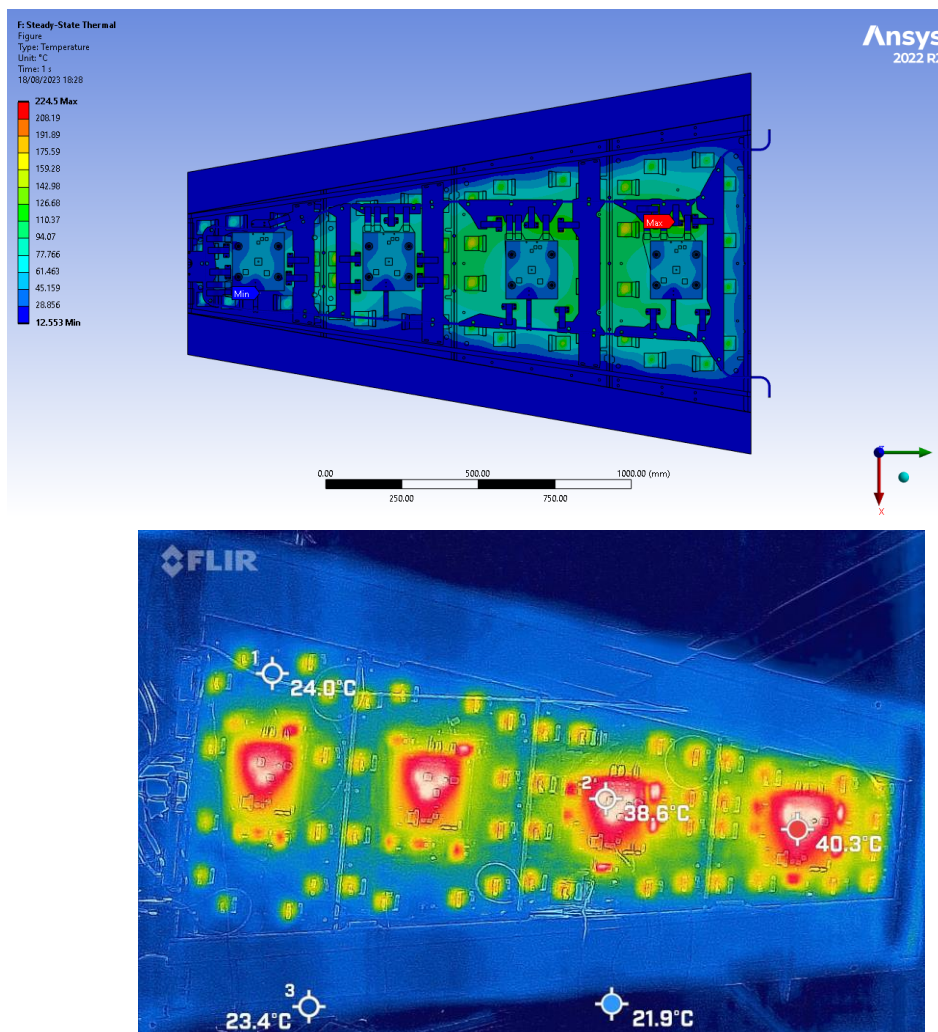
This task took me about 10 days to complete.

4. Graduation Thesis

In my first weeks at CERN, a delegation from Egypt came to visit and discuss the possibility of Egypt becoming an associate member state. I had the chance to spend the day with the delegation and tell them about my project along with other Egyptian students and staff working here at CERN.

This meeting helped me make new connections; I learnt about what other people from Egypt at CERN work on. This is how I found a project for my thesis.

Since my studies are more focused on thermofluids engineering, I wanted to do my thesis on a project involving thermal and fluid simulations. An Egyptian colleague working on the GEM detector in the CMS experiment showed me ideas that could benefit my thesis, so my thesis is about investigating cooling of the detector by means of simulation using Ansys fluent and steady-state thermal and validating the simulation by measurements using a thermal camera, thermal sensors and infrared gun.





For the measurements we took it on different modes, with and without coolant and without the cooling plate at no voltage, voltage on, voltage on and configured and voltage on and data taken.

The simulation is showing a maximum temperature of about 224 degrees which I know is wrong and I know specifically what's wrong with my model and how to correct it.

Due to my short time here, I couldn't get to the accurate results as it needs a lot of iterations. However, this will be my thesis for the next academic year, and we came to agreement that I continue to work on the simulation remotely and follow up with the people here and send them my results once it's ready.



5. Conclusion

The summer programme was extremely a unique experience and I'm grateful to be selected to participate in such a life changing environment and to meet all those lovely people. I made many friends here; I even feel that we are more of a family than friends. In this summer all of us were deprived of sleep but I would definitely do it again.

The programme was so flexible that we had plans before coming here and it ended up differently. For example, we were supposed to work with VR but due to technical difficulties we had to drop that, and I ended up working on three different projects which was a bit stressing but totally worth the experience I got from that.

In the last two weeks, we had to make sure that my work can be continued in the future, so we spent some time training my supervisor to work with SpaceClaim and it was successful.

The technical experience I got here just in two months is something you don't get anywhere else. I learnt many things starting from organizing my time to very complicated technicalities in my field.

What I loved most about CERN is that everyone is supportive and is happy to help you. It is such a big place with very experienced engineers that are always happy to talk about their projects and guide you towards your goals.

This was such a great opportunity for me to grow mentally and technically, I'd always love to come back at CERN in the future.