



My Adventures at DESY Hamburg(online)

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Abstract

The report is a detailed overview of the work I did as a summer student, the skills I have learned and my overall experience with the program.

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Acknowledgement

I would start by thanking Dr. Hannes Jung and Dr. Qun Wang for their help in providing necessary guidance and information to complete the project. I would like to thank the DESY-CMS group for providing such a welcoming and healthy environment for us to work and participate in the meetings.

Also I would like to thank Olaf Beneke and the whole team, for their efforts to organise such a wonderful program for us despite the limitations arising due to the pandemic.

Finally, I would have to thank my friends and fellow summies with whom I had such a nice working experience and express my gratitude to everyone involved.

1.Introduction

This report is an overview of my two month work and experience at DESY remotely . Apart from being an accelerator facility , other wide range of experiments related to High-Energy, photon science and astroparticle physics are being carried out here. Although the participation could not be onsite, the organisers did a really nice work in making it interesting and immersive experience.

2.Common Programs

2.1 Welcome Session and virtual visit

A welcome session was organised for all the summer students via zoom. We all were randomly put into different rooms and talked for a few minutes. It helped breaking the barrier and got to meet everyone like that. After this, there was a presentation where the DESY team introduced us to their two working sites along with the type of research work carried out there. A day after the welcome session, a virtual visit of Hamburg site was organized . We got to see the infrastructure and laboratories there. Queries of students were taken in between the visit.

2.2 Lecture Program

The program was open to everyone irrespective of being selected for the summer program. The common lectures aimed to provide an introduction to topics of High energy physics, photon science, detector physics, astroparticle , neutrino physics and so on. We were advised to attend the common lectures along with the ones that were related to our domain of projects. Most of the lectures I had attended were from HEP domain. The lectures were really good, although lengthy but quite informative with questions of participants being answered in between or at the end of talks. Material presented was also provided and some of the lectures were recorded. The lecturers did a great job at providing the necessary basics which somewhat helped me in my project work as well.

3. Project work

There were a total of 20 projects in the domain of Elementary Particle Physics , Accelerator Physics and Computing. A few of them were created in a hybrid format that would require remote as well as onsite participation. We all were expected to complete the project by the end of August and would have to present our work in front of our respective working groups.

3.1. Assigned group

I was assigned remote project B8^[1], that was provided by the CMS group at DESY. 24 students in total were selected for this project although, each one was assigned individual sub-projects . The work required analysing the data from experiments at HERA & ZEUS and compare it to theoretical models to predict better results and finally validate our analysis. My work was looking for azimuthal asymmetries in deep inelastic scattering.

3.2. Methodology

The work was based on writing Rivet^[2] codes (analysis) for such implementation in a C++ framework. The experiment data was obtained from Hepdata^[3] and linked to the analysis. The data from theoretical models was obtained using Rapgap^[4], a monte carlo event generator, in the form of 'hepmc' file. It required generating various types hepmc files to compare and obtain better results.

For validation, the corresponding plots obtained in Rivet were compared to the ones obtained from HzTool^[5] to study which of them provides better result closer to the experiment data.

3.3. Results and Presentation

After the results were obtained, we all were segregated into different groups according to our projects. I was assigned to the group 'Multiplicities' which had a total of 5 members. We were tasked with presenting our work at the CMS group meeting on September 6.

Apart from presentation, our work is going to get published as an article on arxiv^[6] as proposed by our supervisor, Dr. H. Jung.

3.4. Other activities

Apart from project work, there were also meets from CMS group in which we were allowed to attend. They provided an insight to the group's workings and activities. During first two weeks, there were coffee break, an informal meet on fridays, where I got to meet and interact with a few PhD students and other members from CMS groups.

During the last few weeks, we were all exempted from work on fridays and would have informal social hour organised by Dr. Jung for us B8 summies. We all got to know each other as well as our supervisors well and had discussions on different topics unrelated to project.

4. Skills Acquired

Working on project helped me getting familiar with tools such as rivet and Rapgap. My coding in C++ also got better because of it. I also learned how to work on the desy machine, something which was really new for me.

Conclusion

My overall experience with the Desy Summer Student program was very productive. I learned new things and made good friends. The supervisors were very supportive and patient . I would definitely want to continue to work in the field and want to pursue my career as a researcher for the same.

I found the experience very positive and I'm sure I will be able to use the skills I learned in my career later.

References

- [1] <https://www.desy.de/f/students/2021/projects/B8.txt>
- [2] <https://rivet.hepforge.org/>
- [3] <https://www.hepdata.net/>
- [4] <https://rapgap.hepforge.org/>
- [5] <https://hztool.hepforge.org/>