

Table of Contents

| | |
|--|----|
| Preface | 1 |
| The beginning | 2 |
| Visits | |
| <i>CMS Cavern Visit</i> | 4 |
| <i>ATLAS Visit</i> | 6 |
| <i>ALICE Summer Party</i> | 9 |
| <i>ALICE Visit</i> | 11 |
| <i>LHCb Visit</i> | 14 |
| <i>Antiproton Decelerator and CERN Data Center</i> | 17 |
| <i>SM18</i> | 20 |
| Workshop | |
| <i>Cloud Chamber</i> | 24 |
| Experiences | |
| <i>Living Abroad</i> | 27 |
| <i>Traveling</i> | 32 |
| <i>Working</i> | 36 |
| <i>Socializing</i> | 39 |
| Until We Meet Again | 42 |
| CERN Work Report | |
| <i>ITS Cluster Finding Benchmark on GPU</i> | 46 |

Preface

Time does fly. I still cannot believe that it has been a month already since I left CERN. The feeling of accomplishment still lingers inside me and keeps telling me that those experiences were real. I would like to share these feelings with everyone who read this report and hope that your goal could be accomplished if you do not give up easily. This report does not have detailed information about CERN research and experiment because I believe that it can be found easily on the internet. In fact, this report contains my opinions and thoughts toward CERN, my experience working at CERN and living abroad. Since it based solely on me, you can be sure that you cannot find it anywhere outside this report. In other word, it is 100% authentic and unique.

I structured this report in chronological order. This book starts from how I became to know about the summer internship program to the very end of the stay. Due to the LHC shutdown, I could say that I was very lucky to visit CERN this year. I had a chance to visit all main accelerators (ATLAS, CMS, ALICE and LHCb) and I had pictures included! From these visits alone, I would said that my dream was fulfilled. To top it off, I also visited other places and joined a number of workshop like cloud workshop which I placed it to be the coolest workshop at CERN (Dry ice was used in this workshop, while it was not used in others). Worry not that this book is going to be bore you with just academic aspect. My belief is one should balance life and work well to really be successful. Therefore, not only activities inside CERN (academically visit, lectures, workshops, etc.) were mentioned here, but also my travelling experience and people I met there. I did enjoy international culture at the workplace and the hostel I stayed. It was not easy to meet people from all around the world and laugh with them. I can only hope that you will enjoy it through my word like I really did back in Switzerland.

Even though, writing is not an easy task, I did enjoy my time writing this report. It brought me back to that two month period. Moreover, it made me reflect on myself. I cannot say that I only had good times while I was there. That would be too good of a life. I can only appreciate good times and learn from bad times. Thinking back and writing it out, actually made me wonder what I will do if I were to be put in that situation again. I became more mature as I was writing out each word in this report. At the same time, I still laughed hard at some playful things I had done back there.

Lastly, I wrote this report from my own experience and expressed it to you with good will. Even though, there is a saying that reading is like travelling, but let me ask you this, “Do you want to walk on the same track as others?” Your experience will definitely be different from mine and even greater. All you need is a courage to take the first step and you might be surprised your own change when you look back. Life is a continuous learning process.

The beginning

I first heard about CERN when I was in grade 11. The news said that they are studying about black hole and such. I just smirked and went back to do my homework. It was far from my wildest dream to have a chance to visit and actually work under CERN umbrella. Then the chance had come to me from my advisor, Assoc. Prof. Tiranee. She sent me an email regarding the Summer Student Internship at CERN from Thai-CERN collaboration. I was very curious since I majored in Computer Engineering, not Physics. It appeared that year 2014 was the first year for the collaboration to recruit computer engineer student. I did not hesitate to apply at all. I did not know the number of applicants, but on the interview day, there were four computer engineering students. There were two students from KMUTT; me and Kwang. From four of us, the number went down to two; me and Kwang. I did not make it, though. Actually I could see this coming because Kwang's profile is very good and her research topic is more relevant. However, I did not give up. I applied to CERN directly and eventually, I got accepted. On that day, I told myself that it is going to be great!

I learned from my mistake and would like to share it with you, my dear reader. There are three tips here if you want to be selected. First of all, you need to have a strong background in the research topic. If you have published a paper already, that will give you an edge over others. Start from now, you should try to go and get involved in conferences. This is not only for applying for CERN, but it will help you with your study as well. Even though, Thai-CERN collaboration stated that the applicants should be well-verse in High Performance Computing (HPC), there are several topics for you to apply at CERN website including web application, network security and programming. Therefore, do not be discourage if you did not get selected from Thai-CERN collaboration, you still have a chance to give it another shot. Secondly, English is important. CERN is a multi-cultural organization. The communication language here is English. Even if you are really good with your research topic with a ton of experience, there is no use if you cannot convey it to others. You should start practicing it now before you apply to go to CERN. Lastly, you have to be prepared mentally. Good work will help you finish the task, but good attitude will win you a ticket to success. In order to apply in both protocol, you will be asked to write essay about yourself. Surprisingly, your attitude can be known from your writing. Not to mention that on the interview day of Thai-CERN collaboration, there will be a lot of committees against one of you. All you need to do is calm down and show what you are capable of. These are my tips that I believe to be very important.

Even though you are selected by Thai-CERN collaboration, you still need to submit your document to CERN website under Summer Student Internship category. Therefore, it is advisable for you to actually visit the CERN website while you are waiting for the result. So you will have more time to refine your essay and study for anything that appear on the website that you do not know now. You never know what department in CERN that you will be working with, so be prepared. Moreover, I would like to warn you about visa application. It takes at least a week to get your visa done. In CERN case, you need to apply the visa directly at the embassy. Please go to the embassy as early as you can since they are opened for visa application from 9.00 to 11.30. There is also a limited number of application per day. I got my visa three days before the departure date, so I know how it feels and do not want you to go through the experience like mine. CERN will also ask you to choose your

accommodation. There are two choices. The first one is a hostel in CERN and another one is a hostel in France. I chose the one in France due to the cheaper cost of living. However, the hostel in CERN is more comfortable. Once you receive the email, you need to react fast, otherwise, you might not get the room type that you want. It seemed like CERN loves the first come first serve policy. Having to go through each procedure for CERN and my university, I was so tired. At that time though, all I thought was “Can I go now?”. And then the departure day arrived, due to the curfew, my family could only drop me off at the airport and headed home. There was no hugging or waving in front of the gate. And so began my journey to CERN.

Visits

CMS Cavern Visit

This visit was marked as my first visit at CERN and it was the visit to see the accelerator, so I was very excited. This one was somehow special because it was called a CMS Party! Everybody from CMS were invited to join. There were food and drinks offered at the cost of 20 CHF. Unfortunately, there was no discount for the summer student. You might be thinking how I got in. Well, another two Thai students (Milk and Pias) worked at CMS, so I and Kwang tagged along and I did not regret paying that 20 CHF at all.

The CMS detector is not located at CERN-Meyrin site. In fact, it is located in Prévessin, France and is quite far from CERN. The organizer were very nice to provide us the commute (they probably included it in 20 CHF, anyway). We were required to book a time of visit beforehand, so we booked for the earliest time because we wanted to have more time enjoying the food. We paid 20 CHF, you know. Despite the fact that they asked us to book the visit time, they did not arrange people to the bus that well. We were supposed to take the bus that left first, but it was already full. I thought that they could make it better if they arranged people to buses according to their visit time. We were worried about our visit and yes, we did not make it in time.

The first thing we did after the bus parked was running. We were desperately looking for the entrance of the cavern, but well, we did get distracted a little from the sight of food and drinks. This was to make sure that we know where to get our stomach filled. Anyway, following signs around each corner, we finally reached the entrance and we found that actually, we did not really need to book since at the cavern as well, they did not check anything. They did not even ask for my signature. We had worried for naught. I should have seen this coming since I saw their bus management. However, we could consider ourselves lucky. I also learned that CERN is so prepared. They asked me to change from flip-flops to clutch shoes that they offered. I was so impressed.



“Just In Time” with Kwang and Milk @ CMS Detector, France

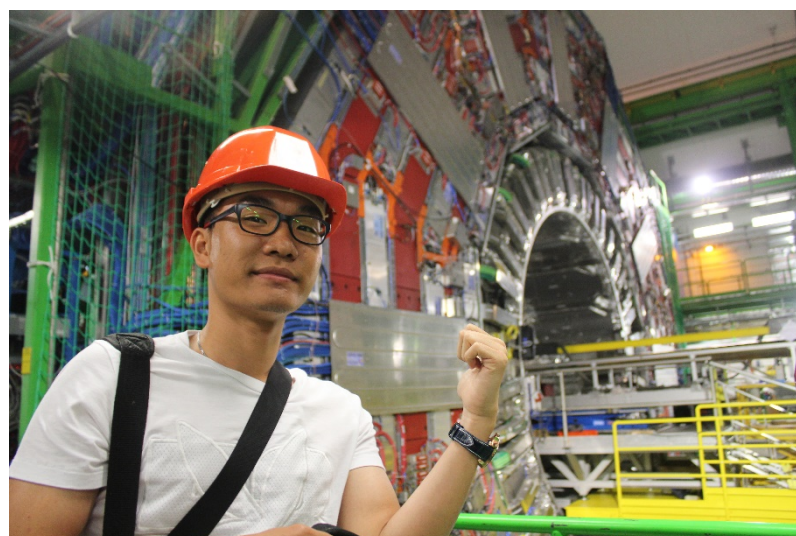
Getting inside was not a piece of cake. You need to have a key and your iris! Yes, I meant a real iris scanner like in many sci-fi movies! Unfortunately, I did not have a chance to

use it, the guide just went inside and then open another big door to let us in. Then, we were brought to the elevator to go down 100 meters from the ground. On the way to see the detector, we saw the data center where they kept all computing resource and data storage. They seemed to invest a lot of money in this data center speculating from all the hardware I saw and the explanation from the guide.



“Off Limit” @ CMS Cavern

Finally, we reached the detector. It was enormous, more like gigantic. I was very excited to be able to see it up close. This was not an opportunity that everyone can possibly have. Even though, all I wanted to do at that time was taking photo, but we had to show the courtesy toward the guide. Listening to him for a bit would not hurt, actually it made me appreciate this technology even more. They sure put a lot of effort building this thing! To tell you the truth, I did not get the theory behind this, but at the very least I just learned a couple of new things about my work here. After that, it was “Photo Time”! Sadly, there were a lot of people and more groups were coming down, so we had to leave and that conclude my “cavern” visit.



“Me and Transformer (?)” @ The CMS Detector!



“My 20 CHF” @ CMS, France

Of course, we know that 20 CHF is not a small amount of money. Therefore, we enjoyed the food there to our hearts. I was kind of upset when they said that we can only take one dish, so I went with the pasta. Halfway through my pasta, though, they just announce that since there were food left, we can take the second. Yes, I did take the second, but the second one was not quite good. I guess Thai food is still the best for me anyway. Enough with the food, there was a concert there as well. CMS personnel just showed their talents apart from physics or computer to sing. I really admired these people, they sure do know how to make themselves happy. I just learned another new thing from this concert, the joke of intellect people requires a certain level of knowledge. Most of them were laughing, but I was there sitting trying to figure it out and eventually, gave up. The drinks and desert kept us company until we left with the last bus to CERN. And that was the real conclusion to this CMS visit.

ATLAS Visit

After the CMS visit, I set my goal that I will visit all other three detectors before I go back. The HR said that summer students should wait for them and they will arrange visits and workshops for us, but they also added that there might not be enough slots for all people. Therefore, I tried to find a way to guarantee my visits by going straight to the secretariat office of ATLAS and submit a request to be in a group visit. Not before long that they sent me a contact of the guide and I proceed from there on my own. Being so desperate and afraid that I might not be able to get another chance, the visit was at 8.45 and the meeting time was at 8.30.

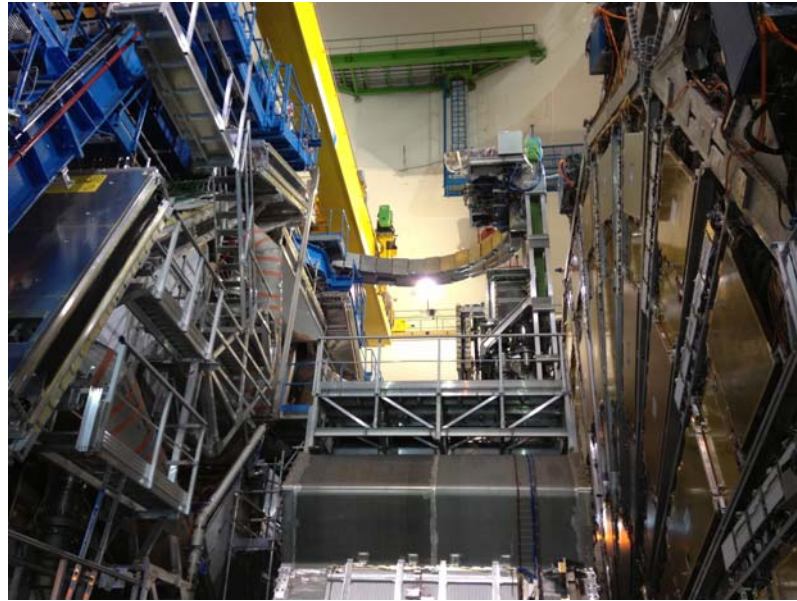
At the meeting point, I just learnt that anyone can visit any detectors at CERN. Some of them were just tourists. Next time, I will bring my parents with me and let them see these humongous tubes. There were about 15 people in a group and once everyone came, we started walking to see the detector. It was not a long walk since ATLAS is located just opposite of the CERN main site. There was something special about ATLAS, though. Last time, I forgot to mention that there is a painting of detector on a wall at CMS. The guide explained that it was started here at ATLAS. A scientist from ATLAS came up with this idea and other team followed him.

The first stop was the control center. There were a lot of screen and people were there to work already. The guide said that those people monitor the process of detector and solve the problem whenever it occurs. Then he went inside to get the radioactive meter and keys. Since the LHC accelerate the particle to the speed of light, it is classified to be radioactive by nature and the meter is used as a precaution. The procedure is to show everyone that firstly, the meter stay at zero and after the visit, it still stay at zero. Otherwise, we might be in trouble. The most interesting thing in the control center is the toy emergency button. Once you press, the alarm light will go off and your photo will be taken. It was so fun that I could not resist to press it. Then, it was time to go to see the detector.



“Classy Control Room” @ ATLAS, CERN

We went through the security gate like CMS and went down to see the detector. The ATLAS detector, as far as I know, is the biggest one at CERN. According to the guide though, he said that it is just bigger in size, but not the quality. He admires the CMS detector better, because it is more compact and still be able to do things like this big one. I have to admit that I like CMS better, it is more beautiful. This time we had a lot of time to take a photo since there were no people there and the guide did not explain much about Physics because he is a tech guy. I did enjoy his talk about structure of the detector though. After that we went to the data center. Again, I think that CMS still has a better facilities than ATLAS. They are both the biggest groups here at CERN, I wonder why they do not have the same level of equipment.



“My Second Detector!” @ The ATLAS Detector

It was not a long visit after all, so we went up and the guide provided us a question and answer session. I was there listening, but did not know what to ask. I think that I might have to read more about this particle physic stuff in order to appreciate the novelty of these detectors. Oh, I almost forgot the Lego version of the detector. I just love it and I believe that it is exclusive to ATLAS since CMS does not have this shown at their site.



“Caught At The Scene!” @ ATLAS, CERN

All in all, it was a fascinating tour and I met a nice guy from Germany. We did exchange opinions and culture a bit, but I was running late, so I just excused myself and went straight back to the office. These visits always give me new ideas to apply it to my work

since at the very first I did not know much about these detectors. It is definitely true that you learn something new every day, eh?

ALICE Summer Party

Since CMS visit, I was hoping for another party-like visit because it is a good opportunity to meet other people and still let me fulfill my goal of seeing all detectors at CERN. Again, party is not free since they offered you food and drinks. However, I was content with the price. It was 10 EUR for summer students. Therefore, I ask Milk and Pias to join me and Kwang to this party. The problem is there was no commute between the site at Point-2 (in France) and CERN. This somehow posed a problem for us since we did know so well around the area we lived and most people do (not) speak English very well. Google map was our only friend. After consulting with people in the corridor, we managed to find the ride there but, there were not enough slots. We decide to go there together, so that we left no one behind.

There were no buses passing the site at all, so our best bets were either to walk or bike. Fortunately, at that time, we all had bikes and google told us that it was not a long ride at all, around 15 minutes. However, we reckoned that we were not used to road around here, we better left earlier than that. It was really nice biking along the quiet road surrounded by trees. I thought that it is safer to bike in France than in Thailand (obviously!), but it might be because we lived in the suburb, not the urban area. During the ride, I just realized that I was out of shaped. Pias had no problem biking up the steep hills. I definitely need to do some exercises after this. Finally, we reached a junction with a sign leading to the ALICE Point-2 site. It was almost time for food too!



“Dinner in a Factory” @ Point-2, France

People were still coming when we arrived. Comparing ALICE to ATLAS and CMS, ALICE is smaller by far, but it did not disappoint me though. Unfortunately, there was no cavern visit on that day, they just let us see the control room. The control room looked brand new to the extent that I was proud we have a better facilities than ATLAS, but learned about

it afterward that it was officially opened on that day. Since it was an opening, there was a ceremony! It was so funny, they are joking with each other and handed out to the team a big surprise. It was a banner saying “ALICE Control Center”. I can feel the warmth in ALICE through here. I felt like they are a big family. And then, it was party time!



“Hooray!” @ Point-2, France

In a queue, I was wondering, is this restaurant (I cannot remember its name) the only restaurant in town. I mean, I saw this restaurant at CMS party and now, at ALICE party again. The menu was the same too which was a chicken curry and it had the same taste! At the very least, they can maintain the same standard in every dish they cook, I suppose. Choosing table was also difficult. We have 4 people in our group, but most of the people there, already know each other. For us to just join in would be a little bit awkward. Luckily, we met new friends. Four of them are from USA and one is from France. We were caught by surprise. The French guy has a perfect English accent due to living overseas. We exchanged conversation and I am not going to lie, I think we are the loudest ones there. It was so funny when you heard people made fun of their own country and these guys know so well how to make it fun. From this talk, I realized my desire to go out and meet more people from all around the world. Some people might love to indulge themselves in nature, but for me, meeting and chatting with people is more interesting. I can learn about their country without having to travel there.



“Multi-Cultural Dinner” @ Point-2, France

All good time always comes to an end. Before, we left we decide to take a little group photo. We posed in a funny way and one lady also took a picture of us. We do not know that lady though, so it was quite funny. By the time we left, it was almost dark, but we did just fine getting back to the hostel. Actually, it took us less time to go back, maybe because we already know the way. From this party though, it made me realize that sometimes people (including me) focus too much on materials instead of relationship which is the thing that yields the true happiness to us. I learned this when I saw ALICE staff in a family-like party. It was such a good time.

ALICE Visit

I had always felt awkward when someone asked me if I have seen ALICE detector since I was working for ALICE. I always said I have not and they would reply that is strange. Well, I know real well, but ALICE is the only detector that has no news about the visit whatsoever. Even before I left, I had not seen any mail from the HR regarding ALICE visit. A local I met on the bus also confirmed me on this matter. He said that normally, you can just go to the CERN lobby and ask for a visit. However, ALICE is rarely shown up on the list. It was halfway through my internship that I finally had a chance to go down there. This visit though is quite special since there were only 6 people including our guide who is actually the leader of my team.



“More Than Ready” with AJ, Tiranee, Milk and Kwang @ Point-2, France

If it was not for my teacher, we would not have this chance. My teacher, Assoc. Prof. Tiranee Achalakul, came to propose the collaboration between KMUTT and ALICE, so Mr. Pierre Vande Vyvre, offered her an exclusive tour. And one we told him that we have not yet visited ALICE detector, he gladly took us there and he said that how come you work at ALICE and have not seen the detector! Good question, I really wanted to know as well.

Again, there were not enough seats in his car for six people, so we rode a bike to Point-2 where the ALICE party was held. It did not take long to get there. However, this time, one of us forgot to bring the CERN ID card along and the guard did not let her in. With the help from Pierre, everyone could enter just fine. The detector is actually under the building we had a party last time. This time though, we had the control room all for us and it was up and was operating as well. Then, our guide took us to the gate and this time we had a chance to actually go through the gate that the faculties use which posed some problems. Anyway, everybody got in and we went down hundred meters below the ground to see the ALICE detectors.



“Down, We Go” @ Cavern Elevator, Point-2, France

I actually like ALICE detector the best, because of the design. It is more colorful than ATLAS and CMS, but also a lot smaller. By the way, ALICE detector is the oldest detector that is still being used at CERN. It was actually the first detector used at the beginning of CERN and went through several modification to support the experiment. There is also a gate to close the detector. It did give out the sophisticate feeling. The photo spot was perfect. There was no one there and the balcony was in front the detector. So we had a very good time taking photos and listen to the explanation from our guide. Pierre took us on a walk around the detector so we could see the whole station. He told us that the process of building a detector was not easy. Each part was from different places. It required a lot of hard work to assemble and make it work altogether. I really admire those engineers and scientists. How could they wire all those cables? These were not the only thing that made this trip exclusive. Since there were not many people, we could get up close to the border of keep out area. Seeing it from this distance was so different from seeing it from the balcony. Then we got up to the -1 floor which contained the data center of ALICE.

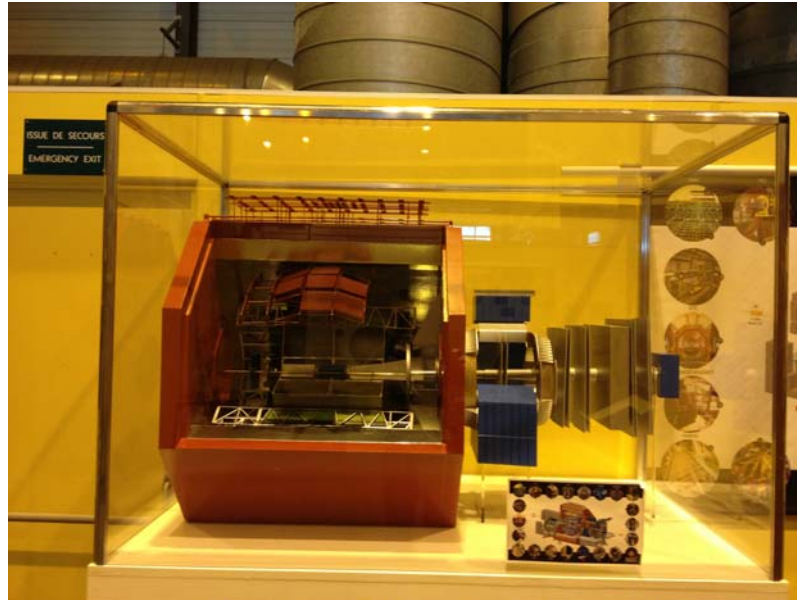


“ALICE and I” @ The ALICE Detector



“Here we are, CPE@KMUTT” @ The ALICE Detector

ALICE's data center is not big compare to ATLAS and CMS. However, judging from the collision rate, I would said it is big enough to handle the job. The detector itself was planned to be upgraded in 2018 and this data center will also be upgraded to handle more collision and data. I am a part of this working group. My work actually contribute to find the suitable platform for data reduction. It is good to hear your work getting mentioned, you know.



“I Want It On My Desk!” @ Point-2, France

When we went back up, we were in the exhibition zone. This zone explained what ALICE trying to achieve which is to find the Quark-Gluon Plasma. It is the phenomena that exists for very short period after the big bang. They try to prove it to find the beginning of the universe. There were also some comic strips, unfortunately, it was in French. So we did not understand it. That pretty much concluded the visit. It was the longest visit so far, but we were so happy about it because we could see the detector clearly and took photo without worrying about others. Today was a long day, indeed. We just needed to get good rest.

LHCb Visit

At first, I thought LHCb was the most difficult one to get a visit. However, it turned to be the easiest one so far. I just needed to ask at the lobby and they told me all the available schedule in my preferred language! Nothing can be simpler. Well, I did not go to book it myself, but I asked the others to book it for me and yes, again, it is 9.00 in the morning. She also said the guy at the counter was also hilarious and know one of Thai people here.

On the visiting day, we went to the lobby and listened to the speaker about CERN. It was really fascinating. It seemed like at first CERN was feared by locals because of their experiment, but as time went by, people do not care about it anymore. Some people in Geneva do not even know what CERN is. The highlight of this session was the video. One of the lecturers just biked inside the CERN tunnel. It is even below the detector where they actually place the LHC tube. I really want to go down there, but they said it is off-limit due to radiation. Although, the lecturer was in her casual clothes biking with a helmet on her head.

After the presentation, we got on a bus. There were not so many people. I guessed that they limit the size to be around 15 people only and with this amount of people, two guides were arranged for the tour. LHCb detector is located in France. There was a very nice scenery along the way there. From the first day I came here, I fell in love with the nature here. Living in Bangkok is not as refreshing. All you can see is the square building here and there, but here there are mountains, blue skies and stars at night. Oh, I almost forgot the sound of cow bell as well. Back to LHCb, LHCb study about antimatter. They already found it, but cannot trap it yet, so if you have seen “Angel and Demon”, that antimatter trap was a fake one.



“The So Called (Fake) Antimatter Trap!” @ Main Auditorium, CERN

As usual, we must follow the procedure, going through the small gate, staying still, and walking out. This time though, we could all get in, but the guide. It was really funny, he did it at least four times scanning his iris. Then, we went down to see the detector. At LHCb, it was a bit special because they have two detectors! One is called LHCb and is currently in used. Another one is obsolete and is called Dolphin. Our group went to see LHCb first. My first impression was ruined. I did not know at first this is the detector until the guide said so. It was like several square combined together. To be frank, I think it is okay to go with modern design, but this just failed miserably! In term of size, this is the smallest one in all four, but is equipped with the newest technology. Enough with the design, the guide said that there is a special part that only exist in LHCb which called vertex. I cannot remember the purpose of it, but it seems to be very important in this experiment. So, we took photo with the detector (seem like a ritual now). And move on to see another one.

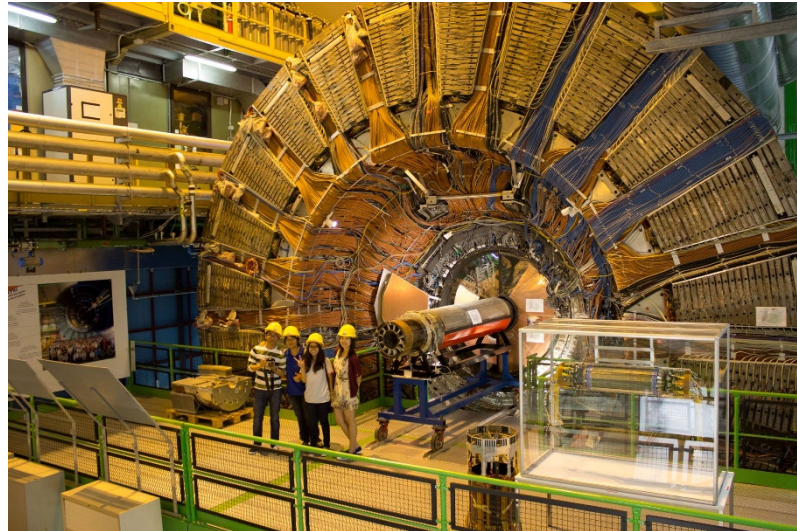


“On The Way” @ Somewhere in France

I was impressed Dolphin more than LHCb. Maybe, it was because the design was more traditional. And I could touch it! I could feel every inch of this obsolete detector. It was great to be able to see it up close like this. It helped me understanding the process of extracting data even more because they still have it wired and preserve it at its best condition. I just love the way they do things here.



“The Last Checkpoint!” @ The LHCb Detector, France



“So Close, Yet So Far” @ Dolphin, the obsolete detector

After a while, we went back up to the surface and see the exhibition zone. I think that because this experiment is brand new, there were so many toys for us to play with. The most impressive one is the 360 degree panorama that captured almost every corner of the underground. Since the LHC is scheduled to run soon, this might become a great tool for visitor, if there are going to any. Now that concluded my goal of visiting all detectors at CERN. From these experiences, I realized how small a human being can be, but when we combine our strengths together, we can achieve something really big. These four detectors and CERN are the proof.

Antiproton Decelerator and CERN Data Center

When I first heard about the antimatter, I was very excited to go to see the decelerator at CERN. As soon as I saw the booking for this visit, I booked for it right away and I got a place. The meeting point was again at the lobby. We met the HR and then got on to the bus. I did not get the idea why we needed a bus because Antiproton Decelerator (AD) is in CERN. It would take about 15 minutes to walk from the cafeteria. Anyway, the bus dropped us off at one building and then he left. HR staffs did not come with us, so we assume this building was the place. We went inside and saw no one. There was no sign at all. There were about 20 people in our group and no one had an idea where the data center or AD were. We wandered around and complimented HR for their super good job. Finally, someone called the HR and they told us to wait until they can contact the guide. However, someone just walked around and met the guide at the entrance of another building. And that was when our visit start. We were about 15 minutes late for the visit already.



“Très Japonais” @ CERN

Since we were late, the group that came before us were visiting the data center, so we were guided to the Antiproton Decelerator (AD). Our guide was very active. He explained the theory in excitement and showed us around the building. Basically, at AD, they try to decelerate the antiproton which was moving at the speed of light to only 10% of the original speed which is still fast to aid the antimatter study. There are several experiment here. There is one called “ASACUSA”. It has the same pronunciation as the famous temple in Japan. The machine was running at that time, so we were not allowed to see the actual one. However, there is an obsolete one for us to look at. Comparing the size of antiproton to the size of the decelerator, The machine was way too big. The new one is actually even bigger. The reason is because the magnet are being used in the experiment and occupy about 80% of the whole machine. For your information, whenever an accelerator or decelerator is running, there is a radiation from particles inside. People who are working there need to wear special suit and had time limit in contacting with the machine. CERN treats this matter seriously. Every staff always carry a radiation meter with them and need to submit the radiation level every month. If the level is beyond the safety level, he or she will not be allowed to work near the radiation sites and need to be treated at the hospital. It was then time for another group to come in and we went to the data center.



“Live On WLCG Channel” @ Data Center, CERN

I would say that the data center here, apart from supervising and maintaining the computing resource, acts like a museum. They have very old computer stuff, from the big floppy disk to the old router and server. Well, I have seen some of them before, but most of them were too old for me. The interesting point about CERN computing resource is “Worldwide LHC Computing Grid” or WLCG in short. It is near to impossible to let invest in data center to the extent that can serve all computation task from scientists around the world. This is not to mention the amount of data flow from each detector. WLCG is used to solve this problem. By pooling the resource from many institutes, scientist can submit the job to their local server and avoid the communication overhead. There are three tiers. The zero tier is CERN data center. The first tier is the local server. The tier 1 server in ASIA is in Taipei. Thailand is in tier 2. With cloud being so popular nowadays, I believe that the reason for CERN to not change the platform to cloud is probably the security issue. They want to be able to regulate and create the policy on their own.



“The Museum For Computer Geek” @ The Data Center, CERN

After walking around, we were taken to a dark room, where routers and other disk storage are kept. I saw the biggest CD I have ever seen in my life. Judging from the size of the CD, I really want to see the computer reading it. That computer must be a size of a room! Then what I thought to be a screen suddenly turn clear and the data center was shown to us. It is big. There are so many racks. The guide explained about the storage system at CERN. They use typical hard disk and tape for back up. Given that CERN has a lot of budget each year, someone asked why they do not use solid state disk (SSD) instead since it is way faster and will aid in computation. The answer was plain, but straight. He said that SSD is too expensive comparing to the size of storage. We would need tons of it to replace only a portion where resources are used for computation. Even CERN cannot afford it. I agreed with him on this matter completely. People of this department must be working really hard to keep this big system up and running at all time. Another point that I want to point out is CERN support green computing. In the past, was only one index for the super computer; the computation power. There is another new index for super computer now; the green index. This index calculates the efficiency per watt of the super computer. Even though, CERN is not in the top 500 list, I am glad to actually hear that they were being active on this matter. Living here in the midst of nature made me realize how important the nature is. Then it was time to head back to work.



“FYI, WLCG” @ Data Center, CERN

AT the very first, we thought that there would be a bus to bring us back to the lobby. That was not the case, though. We had to walk back ourselves in the rain! However, when you have a lot of people tagged along, it was quite a pleasant walk. Chatting and laughing were great. I almost forgot about walking in the rain part, if only my clothes were not wet.

SM18

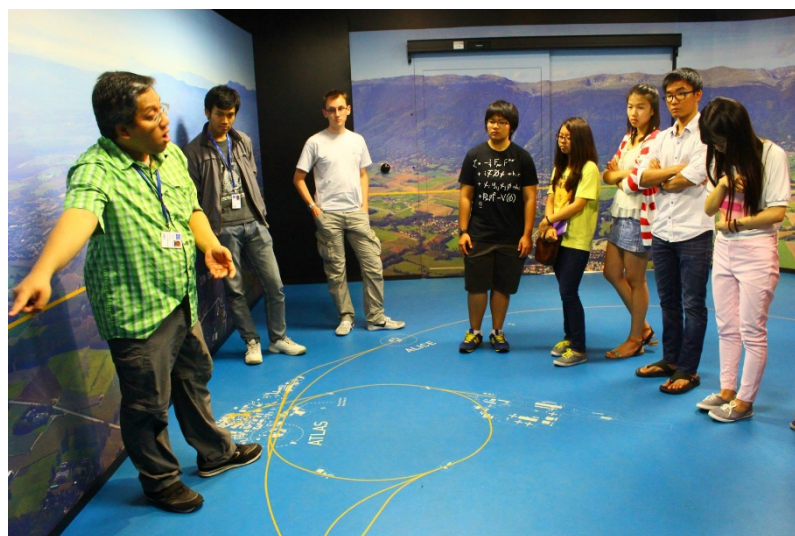
After several visits, I realized that at CERN, magnet actually worth more than money. It is in every major component ranging from accelerators to detectors. These magnets are designed by CERN since they will be used in an extreme condition and do the job that most of the time, not intended to be done by a factory magnet. I figured that it was sensible to go to look at where these magnets, after manufactured, are tested. That place is called “SM18”; the Magnet Testing Facility.

I could not recall what exactly the name “SM18” stands for, but I am sure the number “18” is the location of the building. There were a lot of people in a group, so we were asked to separate into four groups. Each groups will go to different point and circle around. We started by looking at the CERN map that shows how big the LHC is. The guide seemed to be very well verse in what he was talking about. He showed us here and there. From this map, CERN head quarter is so small, when you really see what it does.



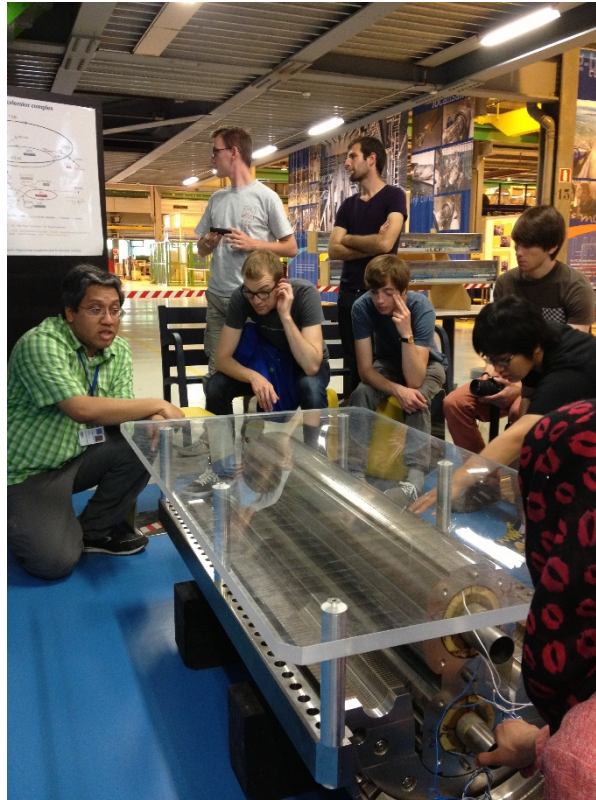
“Come On In!” @ SM18, CERN

Moving on to the next checkpoint, we saw obsolete parts of magnets. They used the old magnet to make a table which is quite fascinating. I bet that this table costs a lot of money, and not to mention about the weight which must be very heavy. Here, he explained to us the superconductivity property of these magnet and how it can help in every experiment. First of all, the LHC is in a circle (not exactly, there is a straight line at each detector). Therefore, the beam of particle need to be bend to follow the tube and there is a part to accelerate the particle. These two parts use the same type of magnet, but are constructed differently. Then he explained the procedure of bringing the tube down to the underground. It looked very easy from the model, but the real deal must be another story.



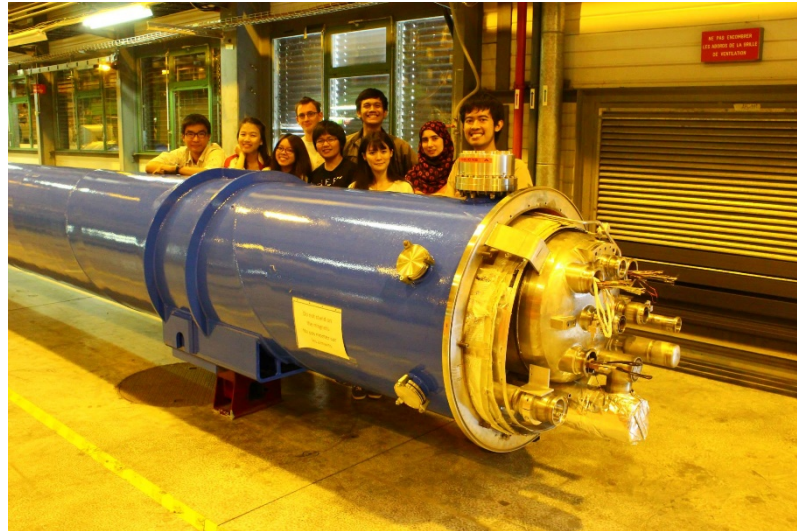
“CERN 360°” @ SM18, CERN

Then we move on to the next checkpoint which is about testing magnet. The process of testing magnet use the software and test if the magnet can operate fine within given conditions. One condition is to be able to work at 1900 Kelvin and also in cool down temperature! That is why they said CERN is the hottest and coldest place in the world. The test facility was like a garage. In each slot, there was a monitor showing the temperature and the status of the test.



“SM18 Style Glass Top Table” @ SM18, CERN

The next checkpoint is actually the complete LHC tube. I thought we were quite lucky because we went around in order. First, we listened to the preface of the visit, what SM18 is about. Then we looked at each part and magnet. After that we saw the testing facility and finally, we saw a complete product. I asked if CERN produce the magnet by themselves. The answer is no. CERN is the one who design the specification and the third party manufacture it. However, this part is a little bit tricky because the third party might have a collaboration with CERN and have their lab established in CERN. This might be the strategy to cut the manufacturing cost, who knows. My next question was is this a patent-free product. The guide explained that there are some research opened freely to the society, but some are not. However, any research that is done in CERN or with CERN is considered to be CERN's property. CERN will be the one who regulate the content. It is understandable since CERN funds those research. Then it was a photo time.



“Say Cheese!” @ SM18, CERN



“For Once, We Were There” @ SM18, CERN

Again our group was quite lucky because we had got two cameras and people who were willing to take photos, so it was very fun. The guide was also very understanding and helpful. He told us where to take pictures so it will look best. I really like this guy. We went back to the first checkpoint where there is a map. The question and answer session took place here, but it was mostly out of scope for everyone. It requires more of a deep electrical engineering knowledge and most of us were physicists. It ended up with the guide explaining everything over again. This visit was around the half of the second month, so most of us know each other. We decided to take a group photo in front of the building and it turned out to be quite a good one, I really love it. That concluded my last visit at CERN. I was glad to be able to visit many places. I appreciated how we can destroy the nationality barrier and working together in this multi-cultural environment. CERN is indeed full of inspiring people.