Reseberättelse Europe

Omvärld, Young Generation 2024

Applied Nuclear Technology in Switzerland

During an enlightening trip to Switzerland, we visited the Leibstadt Nuclear Power Plant (KKL) and the European Organization for Nuclear Research (CERN) to deepen our understanding of nuclear technology and particle physics. The journey took place in the late summer and provided us with a unique insight into both the operational excellence of nuclear power production and the groundbreaking research in particle physics.

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Participants

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Purpose of the trip

Our expedition to Switzerland's esteemed nuclear facilities and research institutions is a deliberate choice aligned with the 'Omvärld' theme, which emphasizes a comprehensive understanding of the global nuclear landscape. As members of the Young Generation in Nuclear Sweden network, we are driven by a profound interest in nuclear technology, its role in sustainable energy, and the importance of international cooperation in advancing the field.

Leibstadt Nuclear Power Plant (KKL): The visit to KKL is particularly significant as it not only showcases Switzerland's commitment to operational excellence in nuclear energy production but also serves as a testament to the collaborative efforts within the industry. This excursion will provide us with a firsthand look at the stringent safety measures and innovative practices that are essential to the plant's success, thereby enhancing our understanding of the practical aspects of nuclear power generation.

CERN (European Organization for Nuclear Research): The culmination of our journey at CERN represents the pinnacle of scientific inquiry and unity in nuclear research. Our established connections within this international hub of particle physics will facilitate in-depth conversations and hands-on experiences that are invaluable for young professionals in the nuclear sector. The diversity of thought and expertise at CERN is a beacon for those of us seeking to contribute to the future of nuclear science.

In essence, our Swiss sojourn is more than a series of site visits; it is an immersive educational experience designed to foster professional development and inspire a new generation of nuclear advocates. By engaging directly with industry pioneers and witnessing the synergy between technology and sustainability, we are poised to expand our perspectives and catalyze innovation in nuclear science, both in Sweden and on the global stage.

Kernkraftwerk Leibstadt (KKL)

Arrival and Accommodation

The team took a flight from Arlanda, Sweden, at 13:15 and arrived in Zurich at 15:45. After traveling to the hotels, the team settled in for the night.

Guided Tour and Information Session

Early the next morning, the team visited KKL in Leibstadt. The visit began with a guided tour through KKL's information center located in the reception area, which attracts significant traffic from locals, school groups, and study tours. The plant's dedication to public education was evident, and the tour was surprisingly detailed, catering to both the general public and more knowledgeable visitors. A myriad of showcases was available here: A big replica of the reactor vessel, a very detailed replica of the power plant, a VR-room showing the fuel change procedure and much more. Swedish nuclear sites can learn a thing or two.

Figure 1: Group picture at the information center before the reactor replica

Tour of the Nuclear Facilities

The team was guided through the nuclear power plant (NPP), starting with the refrigeration water towers. The scale and the wind generated by natural convection were impressive. Entry

into the NPP required passport presentation, volume control, metal detectors, and radiation sensors. The team changed into overalls and was equipped with dosimeters.

After a safety briefing, the tour commenced. The facility's map indicated areas with different radiation levels. The plant, being a Boiling Water Reactor (BWR), has certain areas that are inaccessible due to high radiation. The tour included the pump and valve room beneath the turbine hall, the generator room, and a view of the turbines through lead glass windows. The heat emanating from the turbines was palpable.

The team also visited the containment hall above the pressure vessel, restricted to a small area marked by yellow tape, and the spent fuel pool, with similar access limitations. Radiation scanning was meticulous throughout the visit.

Robotics Team Presentation

An invitation from KKL's robotics team led to a lunch and a PowerPoint presentation showcasing their equipment, including two Boston Dynamics Spot robots and a drone encased in a spherical shell. The robots were equipped with various sensors, such as sonar, video, thermal, radioactive, and 3D mapping. The presentation included a demonstration of leakage detection on a low-pressure turbine using motion amplification techniques, similar to those seen in the provided YouTube video.

The visit to KKL provided valuable insights into the nuclear facility's operations, public education efforts, and technological advancements in robotics and maintenance. The unexpected opportunity to engage with KKL's robotics team enriched the experience, compensating for the canceled visit to Mont Terri.

CERN

Arrival and Accommodation

Upon arrival in Geneva, the team settled into the hotel and met with Mattia, our CERN contact and a connoisseur of cheese and wine. The logistics of accessing CERN were discussed over dinner.

The CLOUD Experiment

The following day, we were introduced to the CLOUD experiment by Mattia. The experiment, originally designed to study the effects of cosmic radiation on cloud formation, has evolved to incorporate a chemical perspective. We learned about the various circuits within CERN that house particles at different energy levels. The CLOUD experiment utilizes protons from the Proton Synchrotron (PS) circuit, one of the lower energy sources at CERN. We also learned

that CLOUD experiment is the only experiment at CERN directly affiliated with environmental research. Particle physics research does not only provide a deeper understanding of the universe but can, as shown by CLOUD, give a benefit for the environment.

The setup for the CLOUD experiment was intricate, with numerous gas tanks and precision valves controlling the flow and temperature of gasses injected into a large cylindrical tank. The environment was a hive of activity, with scientists working on various experiments in clearly demarcated zones. The contrast with KKL was striking; here, the equipment was arranged in a seemingly disorganized manner, held together with tape, and the wiring resembled spaghetti. This underscored the transient nature of research setups, which are often assembled for specific measurements and later dismantled for new experiments.

The Compact Muon Solenoid (CMS) Experiment

After our insightful visit to the CLOUD experiment at CERN, we proceeded to explore the Compact Muon Solenoid (CMS) experiment, one of the largest and most complex scientific instruments ever constructed. The sheer scale of the CMS experiment was indeed mind-bending. Our tour began at the hangar-like assembly area, at the french side of CERN, where we observed the intricate process of piecing together the massive components of the CMS detector. The retractable floor revealed the cavernous space below, where the heart of the experiment lay. Descending 100 meters underground, we were escorted by our guide, who emphasized the importance of safety within such a high-tech environment. She advised us to leave behind any credit cards to prevent potential damage from the intense magnetic fields generated by the CMS detector's superconducting magnet.

The server room was our next stop, a hub of activity where the raw data from particle collisions was initially processed. The sophisticated systems here were responsible for compressing and forwarding the valuable information to CERN's public database, contributing to the global pool of particle physics research.

Regrettably, our proximity to the CMS detector was limited. An ongoing experiment necessitated a strict no-access policy for visitors, leaving us a tantalizing few meters from the actual equipment. Despite this, the magnitude of the engineering and scientific endeavor was palpable, leaving us with a profound appreciation for the quest to understand the fundamental constituents of the universe.

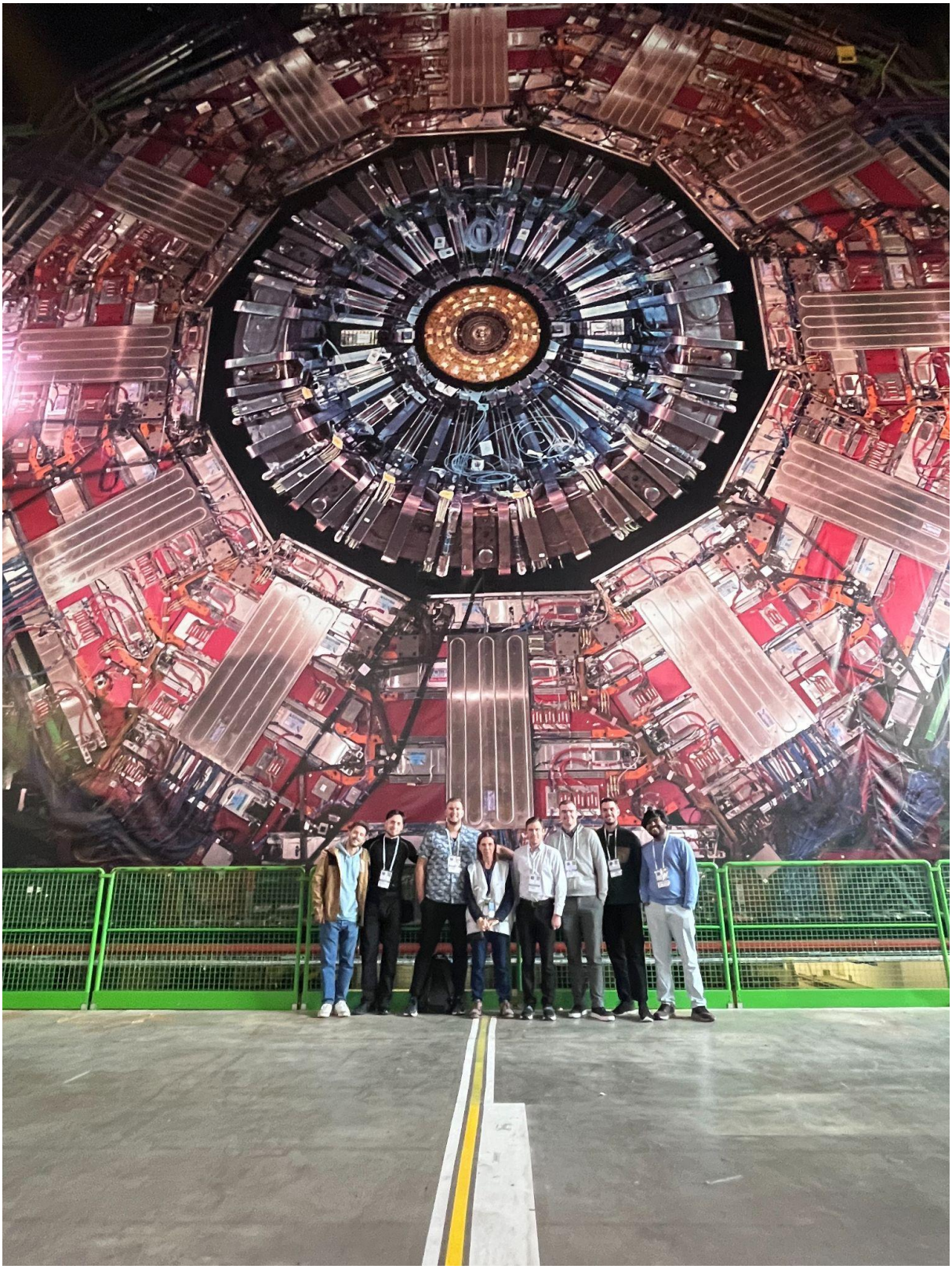

Figure 1: Group picture of the 1:1 canvas of the CMS

In conclusion, our visit to CERN was a stark contrast to the meticulous and rehearsed procedures of KKL. The dynamic and somewhat chaotic environment of CERN's experimental

areas reflected the cutting-edge and transient nature of research, where equipment is assembled for specific measurements and later dismantled for new experiments. This visit not only expanded our understanding of particle physics but also provided a glimpse into the collaborative and innovative spirit that drives scientific discovery at one of the world's most prestigious research centers. Maybe nuclear power plants can learn a thing or two from CERN in this regard?

Lessons Learned and Insights

- Anticipate and prepare for strict security checks at nuclear power plants.
- Approach different research environments with an open mindset to fully benefit from the experience.
- Seize opportunities to network with industry experts and professionals, enhancing professional growth and knowledge exchange.
- Make sure that nothing is forgotten when travelling on a tight schedule. We learned this the hard way.