AxeLatoon - Let's Build an Accelerator at School !

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KEK launched an education project for the fabrication of an accelerator named "AxeLatoon" in 2020 together with the National Institute of Technology (KOSEN). This project aims to improve engineering skills of students and foster the next generation of accelerator researchers by providing hands-on training in the field of accelerator science.

In this poster, we would like to share the status of AxeLatoon's activities based on the actual production of students at KOSEN and deepen the discussion on accelerator outreach programs.

What is AxeLatoon ?

KEK has started an education project for the next generation named "AxeLatoon" in 2020 together with a National Institute of Technology (KOSEN). Through this project, we aim to reduce the number of people who do not know about accelerators to zero. This project is led by accelerator researchers who conduct world-leading research at Japan's accelerator facilities.

Why AxeLatoon ?

In the field of accelerator science, most of the education activities are based on information processing exercises such as data analysis of large accelerator experiments, and almost no activities in which students actually touch and build accelerators. We thought that the establishment of such a workshop will bring innovation to our community. By collaborating with KOSEN and providing practical training, we aim to improve the engineering skills of students and foster accelerator researchers who will lead the next generation.

Our Timelines

Step1

We will create a model case for KOSEN students to build accelerators by themselves with nearby schools. We have already started working with Ibaraki College and Oyama College to design an accelerator by simulating electromagnetic field distribution using Geant4 and other methods. We use communication tools such as Zoom and Slack to keep our activities going during novel coronavirus pandemic.

Step2

We will develop workshops based on model cases and aim to spread accelerator fabrication to KOSEN in Japan. We will create a system in which researchers from large accelerator facilities in Japan work together as mentors for each KOSEN, providing a complementary educational opportunity to school education that is rooted in the local community.

Discussions are also underway with the University Accelerator Collaboration Council, which brings together Japan's accelerator facilities.

Step3

We will hold an accelerator contest. Organized by KEK's Accelerator Science Innovation Office, this contest aims to foster and discover young researchers who will lead the next generation of accelerators.

Accelerators are a comprehensive science that encompasses a variety of technologies, including mechanical processing and materials science for building accelerator cavities, radio frequency control and circuit technology, and the cooling water and air conditioning technology that is essential for stable operation, and will open up career paths in a variety of fields.

National Institute of Technology (KOSEN)

KOSEN is a unique institution of higher education in Japan that nurtures highly skilled technical and engineering specialists through a five-year integrated education.

There are 51 KOSEN schools in Japan, and produces engineers and entrepreneurs with creativity and practicality through lectures, experiments, practical training, and other classes unique to KOSEN, such as robot contests (ROBOCON) and programming contests (PROCON).

Some graduates go on to universities and graduate schools to work as researchers.The expertise developed at KOSEN is an indispensable skill for accelerator manufacturing, which is a comprehensive science combining various fields.

Impact of the COVID19

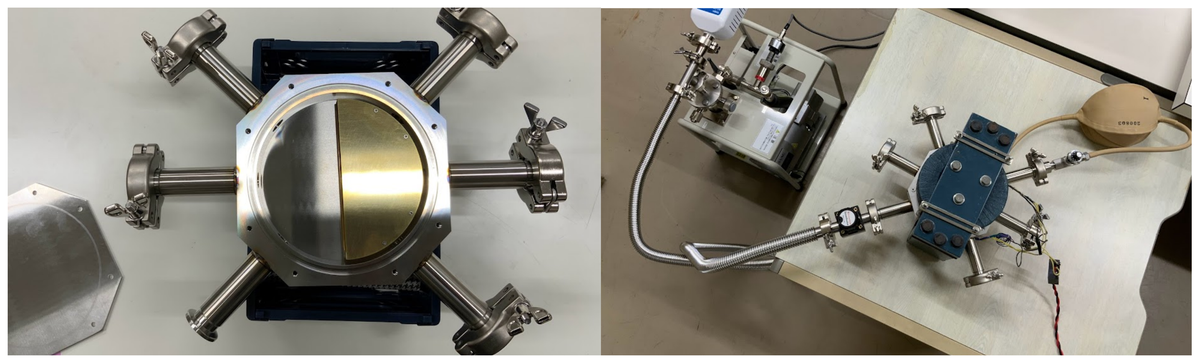
Due to the novel coronavirus pandemic, there was a period of time when we were unable to gather on campus, making it difficult to proceed with our activities. However, we have been able to proceed with the design of a small cyclotron through discussions while also making use of online resources.

Activities at KOSEN, Ibaraki College

Starting in October 2020, we held several remote information sessions at Ibaraki College to introduce the history and principles of accelerators to students. In parallel, we proceeded to procure and set up the equipment (vacuum equipment and personal computers) necessary for accelerator fabrication.

In April 2021, an "A-Lab" team was formed with students from Ibaraki National College of Technology. Aiming to fabricate a classical cyclotron, the team began learning to use simulation codes for electromagnetic field distribution under the guidance of researchers (Mr. Otani) and others.

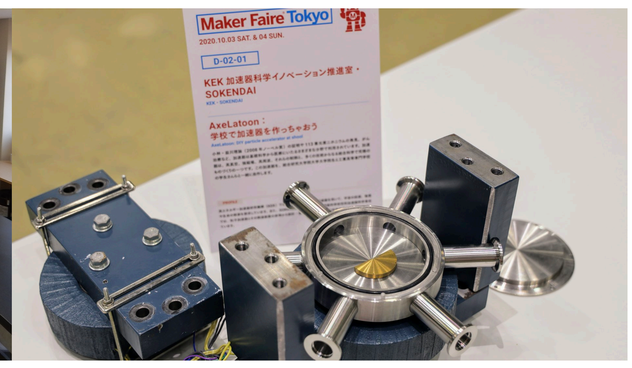
Around the middle of June, the team was divided into Teams A and B with 5 ~6 members each and started designing a small cyclotron. They completed the design of the vacuum chamber and Dee electrodes, and worked with a local company on the machining process.



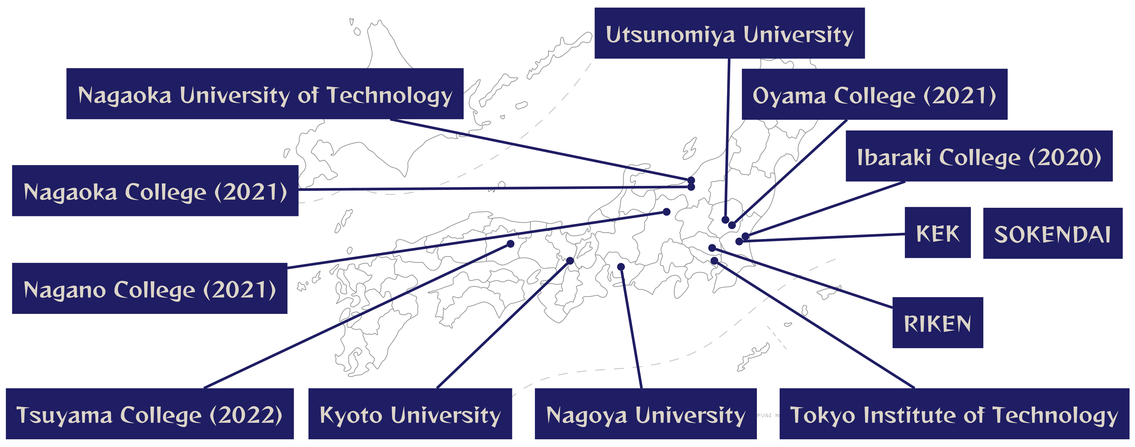
A Dee electrode placed inside the vacuum chamber. Dee electrode is made of a brass and the chamber from stainless steel. Students confirmed that their vacuum reached nearly 9×10^{-4} Pa, and it also fits s well in between electromagnets.

Activities at KOSEN, Oyama College

At Oyama College, students had long been working remotely on software-based simulations due to the pandemic; in August 2021, face-to-face workshops were finally restored. Students formed a team "ATHENA" and have been working on a development. They presented their progress at the Jr. session of the Physical Society of Japan (JPS) in March 2022.



Expanding AxeLatoon !



Conclusion and Discussion

We have started accelerator fabrication activities at the KOSEN. In cooperation with nearby KOSEN, we are working toward the completion of a small cyclotron accelerator.

Also students themselves are reporting their results and conducting research activities.

Discussions are underway to expand the project to other technical colleges throughout Japan.

Acknowledgments

This project has been supported by the Comprehensive Growth Program for Accelerator Sciences, Chuden Foundation for Education, General Donation for the Research, Educational and Social Activities by KEK, SOKENDAI Outreach Activities, and the grant program for young inventors of the Futaba foundation.