Oral content (Y. Kimura)

I'm Yuto Kimura. My research theme is Kaonic nuclei. These are the bound states of Kbar and nucleons. Here, one big fundamental question existed. "Can meson be a constituent particle forming nuclei?" Matter in the world is made up of fermions. Then, in, nuclei, mesons are virtual particles. So basically, meson isn't a constituent of nuclei.

However, the existence of $\Lambda(1405)$ and kaonic hydrogen X-ray data provided by SIDDHARTA experiment concluded that $\bar{K}N$ interaction is strongly attractive. Thus we can embed $\bar{K}$ into nucleus and explore a whole new state of nuclei.

Recently, in the J-PARC E15, the bound state of K^-pp was successfully observed.

Now, an upgraded experiment is proposed for $\bar{K}NNN$ research. This is the J-PARC E80, an international collaboration, and I belong to the group. We'll use K^- beam and 4He reaction. "K^-ppn" is formed and a neutron is knocked out. The bound state decays into Λ and a deuteron or a proton and a neutron. By detecting all decay particles, we can reconstruct the invariant mass spectra and then obtain the signal of the bound state of K^-ppn. To realize the experiment, we need a larger acceptance and a higher efficiency in neutron detection. The new spectrometer is under construction. I'm responsible for two detectors in the spectrometer, the Cylindrical Neutron Counter and the Cylindrical Drift Chamber.

For this year, I evaluated the performance of the CNC. The prototype design is like this. It has a very long horizontal length. The roles are to identify the particles, detect neutrons and determine their momentum. Here, the time resolution is crucial. We set 150 ps as a required performance. Then, a test experiment was conducted at ELPH this October. I did design and make the frame and jig. I made a plan of all. The purposes of this experiment were to determine the intrinsic time resolution and to check the position dependence. The result is shown in this figure. The sigmas are equal to about 120 ps, and clear position dependence was not seen. From the experiment, I got a lot of data that would be the ingredients of the final decision about the design. Now I'm working for a publication.

Then, my next work is about CDC. This will be used for tracking charged particles and analyzing their momentum. Because of such a large size, there are a lot of things to study. I'll establish the operating condition, develop the analysis routine, and select the proper gas mixture ratio. It requires great patience. I have the power of perseverance. So I'm perfectly suited for the work.

From now on, I talk about my research plan. I'll launch the CDC in March, make it available, prepare E80, and take data from it. Besides, to get a Ph.D., I have to be a specialist in Kbar N interaction. So, in parallel to my research in J-PARC, I'll join SIDDHARTA-2 and EXKALIBAR experiments to investigate $\bar{K}N$ interaction in more detail.

In conclusion, in the future, I'd like to lead large-scale international experiments to enlarge human knowledge. So through the GPPU, I'll obtain cutting-edge techniques and improve my international communication skills.