

## Academia and industry cooperation for promoting advanced accelerator

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Advanced Accelerator Association Promoting Science and Technology (AAA) was established in June 2008 in Japan. International Linear Collider (ILC) is one of the main themes of our study. We held 30 times symposiums to gain broad public understanding of the ILC and other accelerators. And our members of industry side have been studying the accelerator technologies and their applications in collaboration with the academia members. The detail of these activities is described.

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## 1. Introduction

Advanced accelerator association promoting science and technology (AAA) was established in 2008 with 76 members from the academia and the industry [1]. Our vision is to realize the affluent future with the advanced accelerator science and technology. As known well, the accelerator technology has been created new products helping our society and our life such as medical diagnostics, cancer therapy machine and inspection equipment for industry. We are promoting science and technology related to advanced accelerators including the International Linear Collider or the ILC project in collaboration with Government, Academia and Industry.

## 2. AAA activities

### 2.1 4 Groups of AAA

AAA has four groups of the technology study group, the outreach group, the CIVIL group and the large project study group. At the technology study group seek directionality of advanced accelerator technology toward the realization of the ILC. And they investigate “manufacturing technologies” from a variety of industrial field to create innovative scientific technologies. The outreach group inform the general public about possibilities and significance of advanced accelerator and the ILC, through a variety events such as symposium and media exposure. The CIVIL group contribute to hosting the ILC smoothly in Japan with studying civil issue. Finally, the large project study is to research how to reach a consensus to realize the ILC in Japan, and to study proper organization for promoting the ILC in collaboration with law makers and government officials.

### 2.2 Example of our activities

We have some seminars in order to educate members. We share the information of ILC status, application of accelerators and so on. And working group activity is very practical for promoting ILC. Green ILC group has studied the energy-saving technology for the ILC. They publish the summery of their study timely. And AAA members visit some laboratories to understand the important things in order to realize large facility.

We have conducted symposiums all over Japan and could obtain over 7000 participants as indicated in **figure 1**. We have over 800 people at once in Tohoku. This shows that people expect to host the ILC in Tohoku. Themes of our symposium are the universe, the medical accelerators and the international cooperation on science. We have good relationship with lecturers as key persons from the other area than the accelerator through the symposium.

**Figure 2** shows the event for our first trial of producing campaign goods in collaboration with SANRIO Co, Ltd. Hello Kitty is very famous character all over the world. This event was the unveiling party of “Science x Hello Kitty”. We tried to gather some influencers who have no relationship with the ILC. The guests understood the significance of ILC and were interested in this project. They spread this event through SNS.

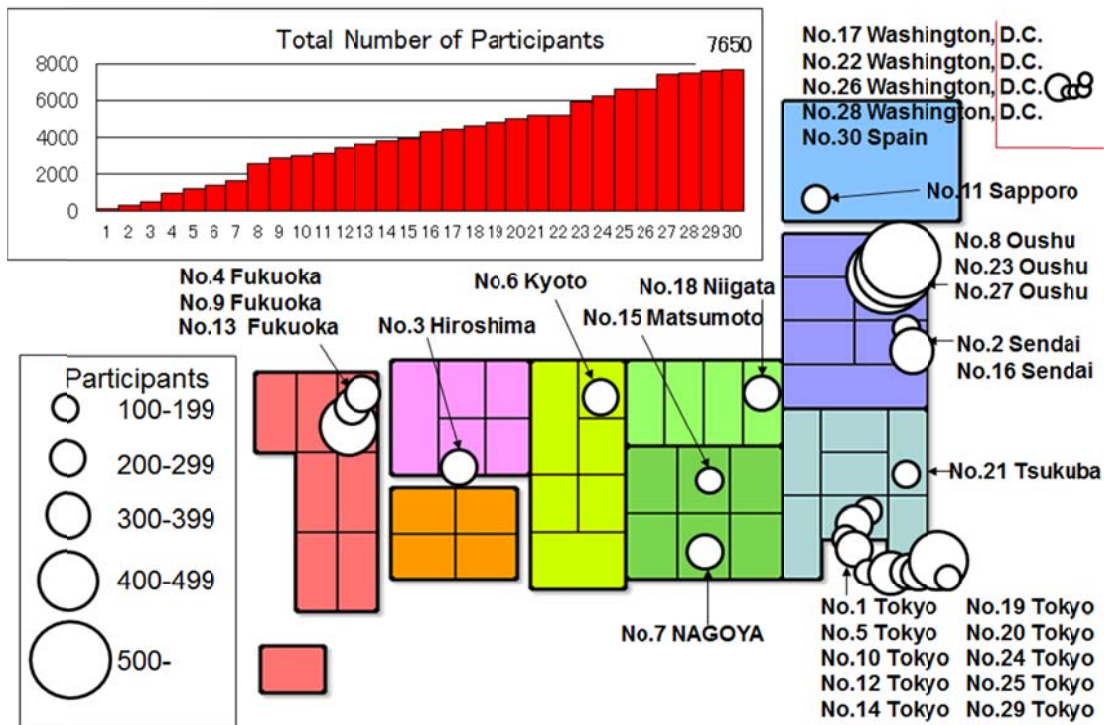


Figure 1 AAA symposiums at all over Japan and other countries



Figure 2 ILC event and character in collaboration with SANRIO

### 3. Accelerator science and industry in Japan

#### 3.1 Accelerator industry in Japan

We call **figure 3** the accelerator pyramid. The high-end accelerator like LHC creates some new technology and spread it to our society. At the same time, a variety of technologies support the LHC. A Japanese company entered the accelerator business about fifty years ago. At that time the technology developed aircraft was applied in the manufacturing of the accelerator. And XFEL project in both Japan and Europe have applied the technology developed for the linear collider. The important point is that the accelerator projects can be drive force for the circulation of high technology. Many companies in Japan are playing important roles in various fields from the latest accelerator for the particle physics to the application products. High end accelerators push up the top of this pyramid and contribute to widen the science and the technology related with the advanced accelerators.

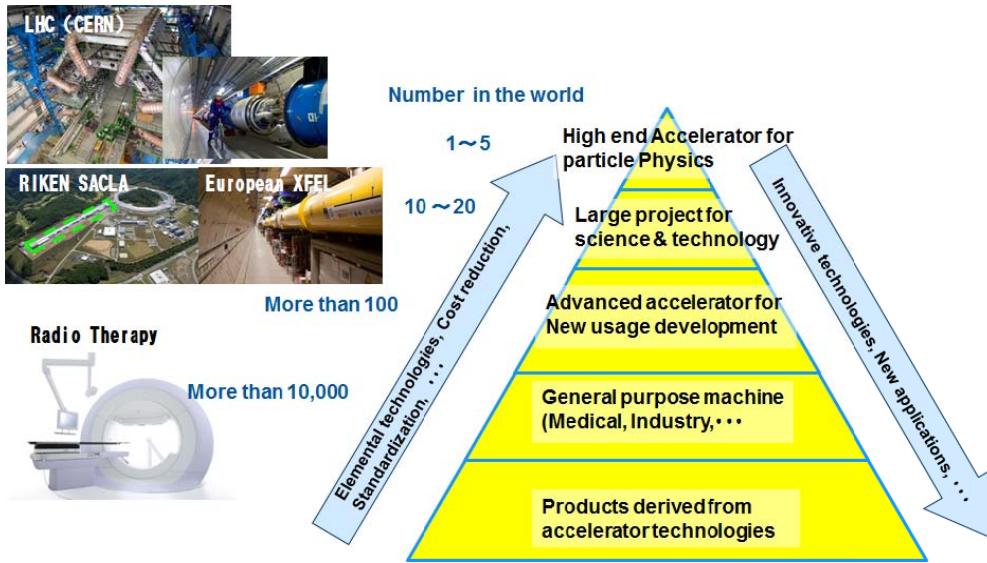


Figure 3 Accelerator Pyramid

### 3.2 Japanese companies contribute to the advanced accelerator projects in the world

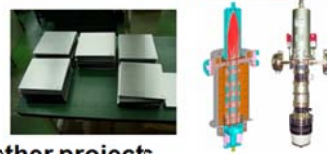
Japanese companies are playing important roles in the world. **Figure 4** is a company list of Japan which contributed to Large Hadron Collider (LHC) construction. We Japanese companies can provide their products with high reliability. You can see some of these companies in the exhibition in this building. **Figure 5** shows Japanese companies contributing to European XFEL and other projects. The Japanese companies have delivered high purity niobium, klystrons, feed through of high-frequency power and so on. which contribute to get the high performance of a superconducting accelerator. In addition, the Japanese companies are playing important roles in overseas various accelerator projects.

| Company                         | Products                               |
|---------------------------------|--|
| Toshiba corporation             | Superconducting magnet, TDC chip       |
| Furukawa, Ltd.                  | Superconducting cable                  |
| IHI corporation                 | 1.8K refrigeration units               |
| Nippon steel, Ltd.              | Non-magnetic steel plate               |
| JFE steel corporation           | Non-magnetic steel plate               |
| Kaneka corporation              | Insulation film for SC wire            |
| Hitachi Cable, Ltd.             | Superconducting cable                  |
| Kawasaki Heavy Industries, Ltd. | Cryosta: for Liquid-Ar, CMS end york   |
| Sumitomo Chemical               | Aluminum for SC Cable                  |
| Kyocera corporation             | Ceramics duct                          |
| Fujikura, Ltd.                  | Rad-hard optical fibers                |
| Hamamatsu photonics K. K.       | Photo-tube, Silicon sensor, SCT module |
| Rinei Seiki, Co., Ltd.          | TGC(Thin Gap Chamber) trigger chamber  |
| Nippon Mektron, Ltd.            | Cu/Polyimide flexible circuits         |
| Arisawa Manufacturing Co., Ltd. | Polyimide film                         |

Figure 4 Japanese companies contributing to LHC

**Companies which have contributed to Euro-XFEL**

| Company  | Products            |
|--|---------------------|
| Tokyo Denkai Co., Ltd.                         | Pure Niobium Sheet  |
| Toshiba Electrical Tubes and Devices Co., Ltd. | L-band Klystron     |
| Kyocera corporation                            | Feed through flange |



**Companies which have contributed to other projects**

| Company                     | Products  |
|-----------------------------|---|
| Mitsubishi Heavy Industries | S-band accelerator<br>Superconducting accelerator     |
| Mitsubishi Electric         | Superconducting accelerator<br>Superconducting magnet |
| Toshiba corporation         | Normal conducting cavity                              |
| Toyama                      | Beam line instruments                                 |

Figure5 Japanese companies contributing to Euro-XEL and other projects

4. Toward the realization of the ILC

The construction cost of the ILC is estimated about 1 trillion yen. This investment will spend for the basic science fundamentally, but this idea may not be able to accept by the ordinary tax payer. We are considering that the ILC is not only for the basic science but also for the innovation which will be useful for all the people. This point of view is very important to obtain more understanding from general people. We studied technology spillover effect of the ILC shown as **figure 6** to inform general people about the impact of our life as correctly as possible. The key technology from the ILC shows here in the red boxes. And yellow boxes are produced by technical derivation, and blue is products using them. For example, when superconducting accelerator technology ripens, the neutron source of large intensity and synchrotron orbital radiation equipment are miniaturized and used widely, and it can be expected that the exotic material development which is the use place, and development of a new medicine will be promoted. Moreover, when the reliability of a superconducting accelerator develops, I think that the way to nuclear transmutation technology is also opened.

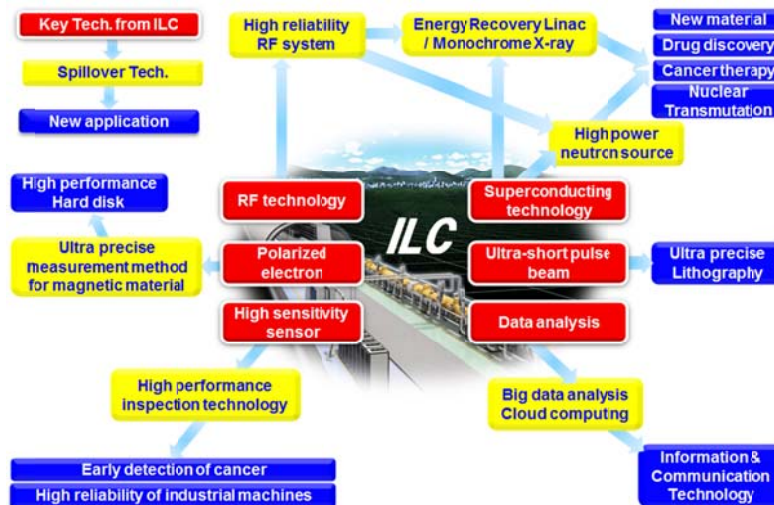


Figure 6 Study of technology spillover effect of ILC

## 5. Conclusion

Takashi Nishioka, chair of the AAA insisted as follows at the symposium in 2012. “Two view points are significant regarding ILC. One is the cutting-edge manufacturing and the other is to make the model case to improve Japanese industry. In this several decades, the mass production has been our strong advantage, but in the future we need to create new fields. New Intellect should become a core competence of Japan.” I believe that development of regional economy, accumulation of the excellent talented people from overseas, improvement in technology, development of a new market, and creation of an innovation are expectable by hosting the ILC in Japan. We want to realize the ILC in Japan in order to continue to contribute to the world by science and technology.

## References

- [1] Home page of AAA, [http://aaa-sentan.org/ne/about\\_us.html](http://aaa-sentan.org/ne/about_us.html)