

Tohoku Accelerator Production Cluster (May 29, Industry Session)

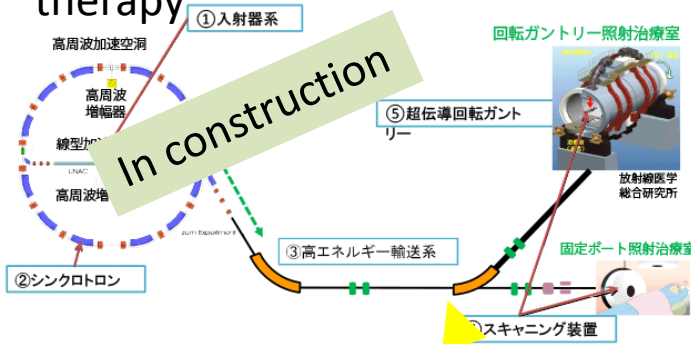


Masakazu Yoshioka
Iwate/Iwate Prefectural/Tohoku University
Tohoku ILC Promotion Council
Tohoku ILC Preparation Office

Current accelerator projects in TOHOKU, where it was a blank area of accelerator

Yamagata University Hospital

Heavy ion synchrotron for cancer therapy



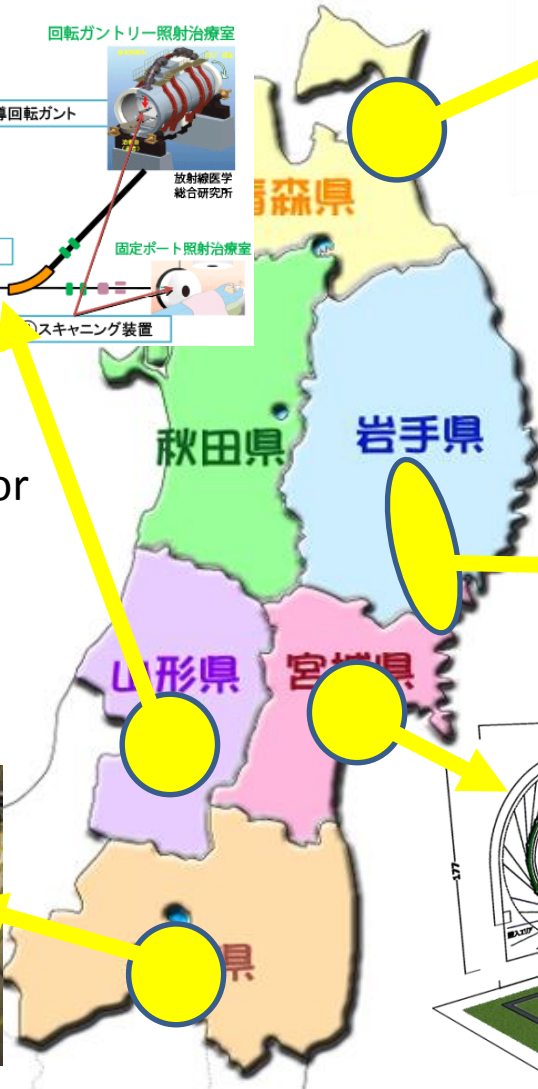
In construction

Southern TOHOKU General Hospital

Proton synchrotron for cancer therapy and Boron Neutron Capture Therapy facility (BNCT)

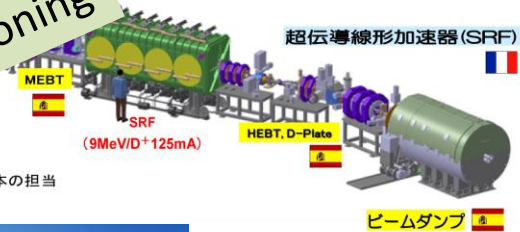


In operation



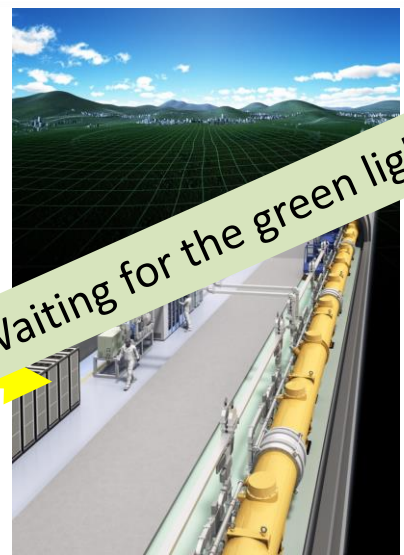
Commissioning

QST, Rokkasho Fusion Institute: IFMIF/EVEDA

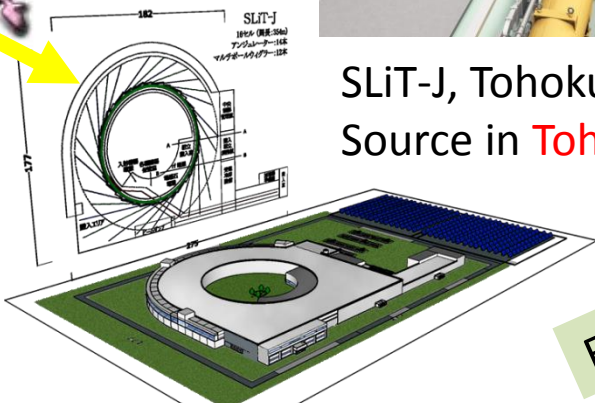


Waiting for the green light

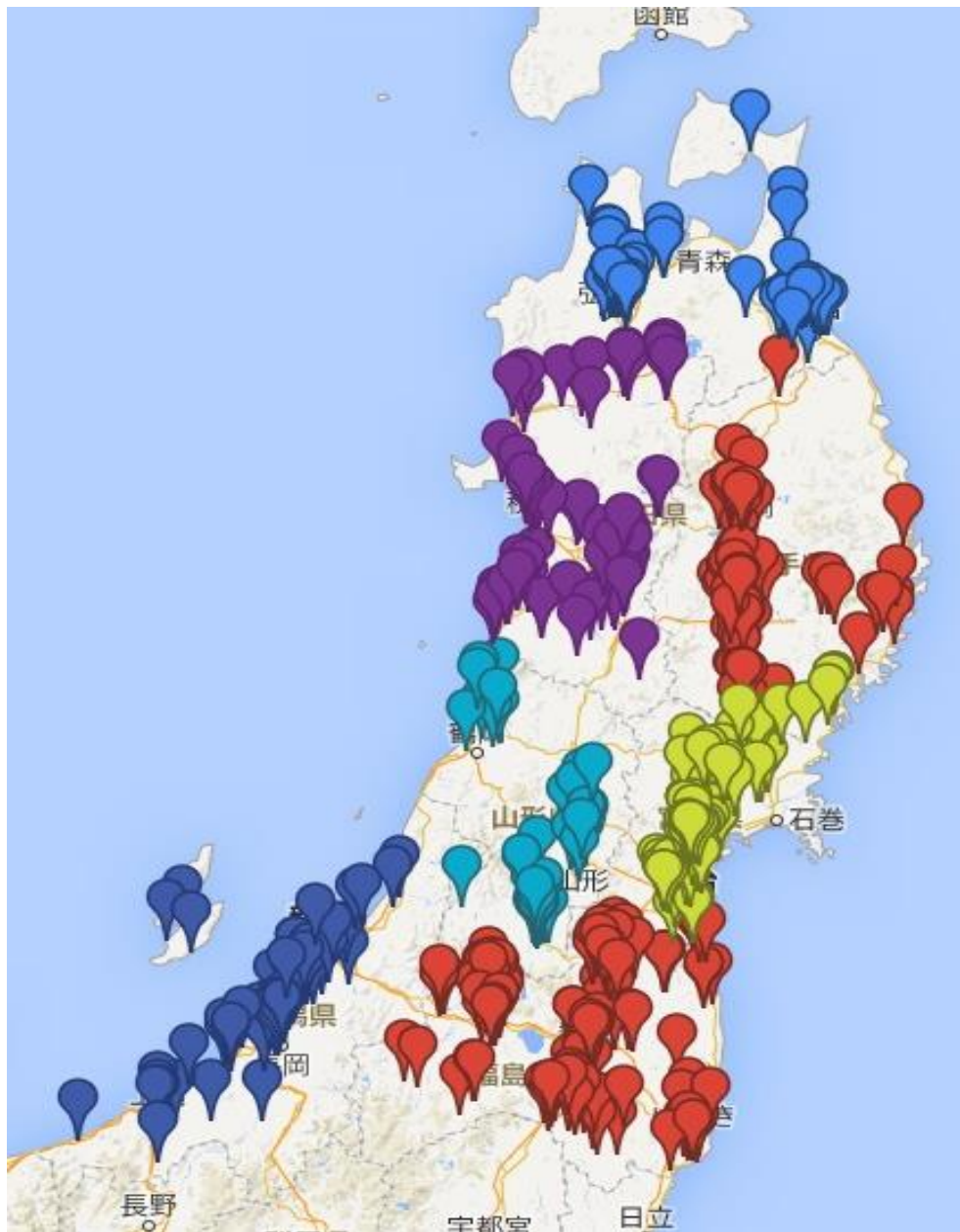
ILC



SLiT-J, Tohoku Synchrotron Light Source in Tohoku University



Feasibility study



In TOHOKU, many large and small manufacturing industries (in total, more than 700) are located such as

- Automotive
- Aerospace
- Semiconductor
- Medical equipment
- Precision machinery
- Others

1st step of our effort

Among them, more than 110 companies want to enter the accelerator-related businesses and create a **loose alliance** in **General Incorporated Association, TOHOKU ECONOMIC FEDERATION.**

2nd step is to

organize the cluster in a few companies in order to expand their technical capacity.

Giants

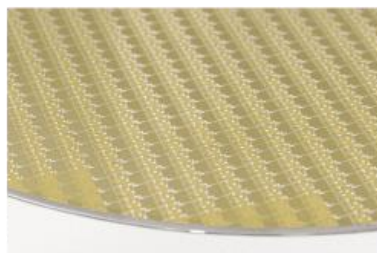
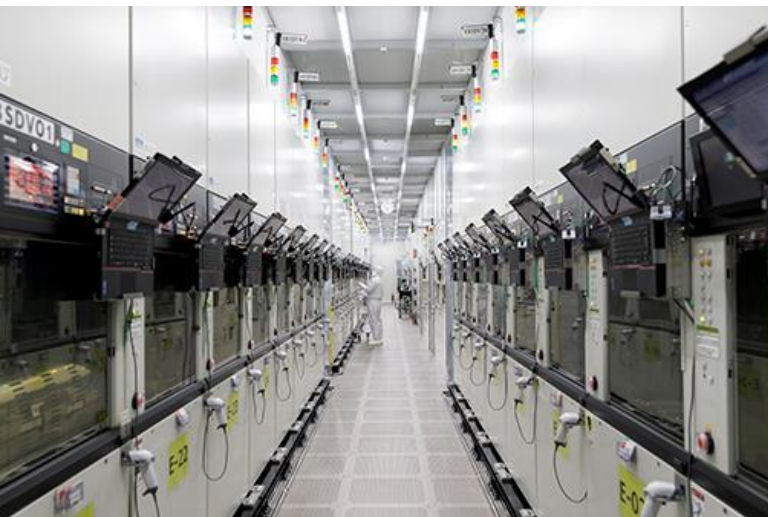
TOYOTA Motor TOHOKU



TOYOTA AQUA



DENSO IWATE



Class-1 clean room
4000 m² !! for the production
of semi-conductor circuit

Recruitment

Explorers Wanted



Positions in R&D, engineering, sales and more are open to people willing to join us on a journey to change the world.

We are Toshiba Memory,
explorer of the world of nanotechnology,
expander of human possibilities.

The evolution of technology has given rise to autonomous cars, robotics,

**New factory
will be soon
established
in Kitakami**

Small but
unique
corporates

TOSEI EB(FUKUSHIMA)



電子ビー

①large size EBW machine
4.5m × 3.1m × 1.4m



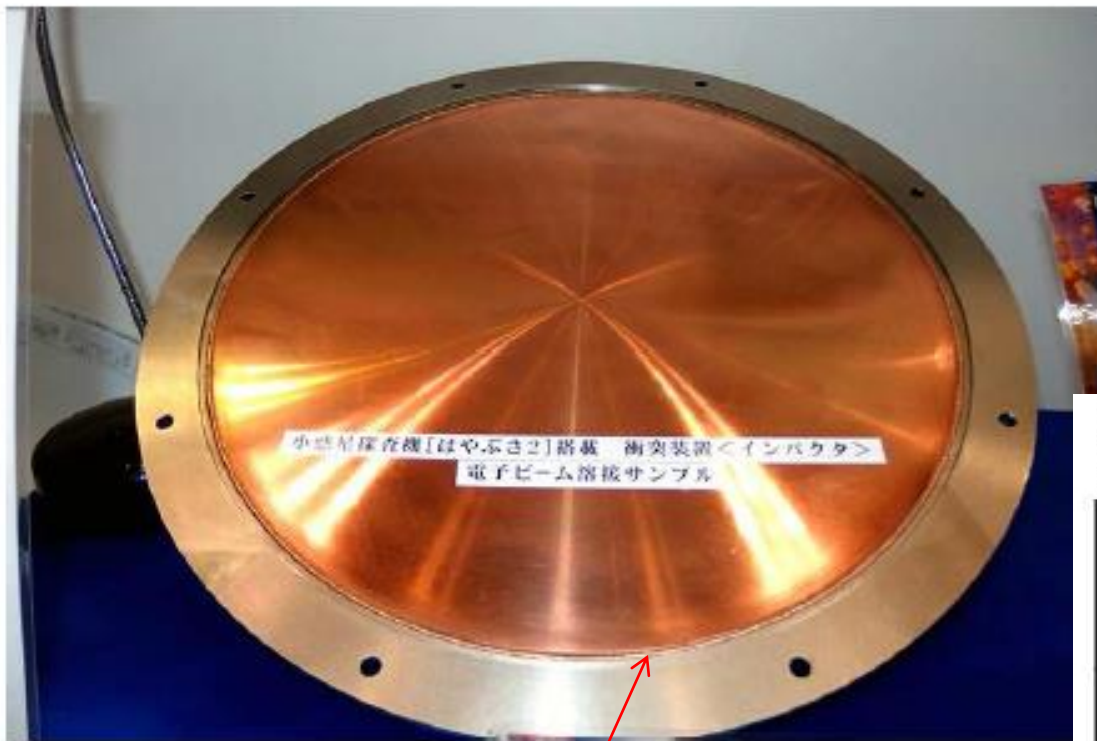
- EB welding machine
- Laser cutting machine

ていく決意です。より良い

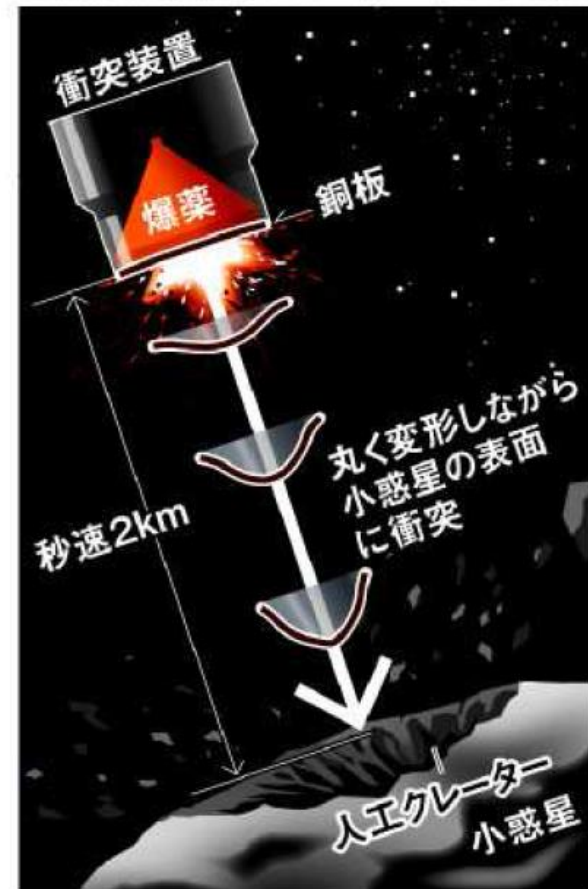
④small size EB welding machine
0.55m × 0.45m × 0.45m



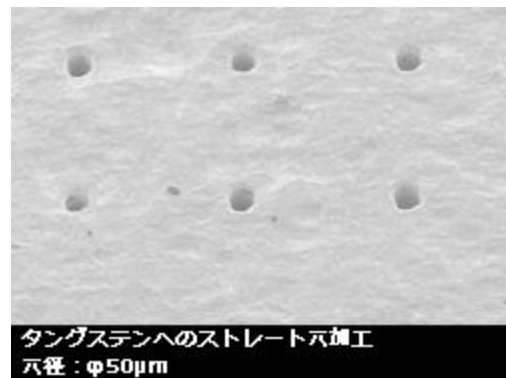
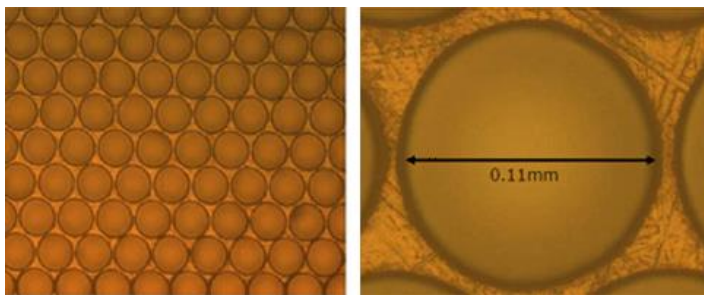
会社
邦香



はやぶさ2の衝突装置が小惑星に
衝突して人工クレーターをつくる



EB welding for Hayabusa-II artificial
satellite to bring back samples
from asteroid



Laser cutting technology
with ultra short pulse
laser (pico second)
A kind of thermal
insulation work, which is
burr-free processing

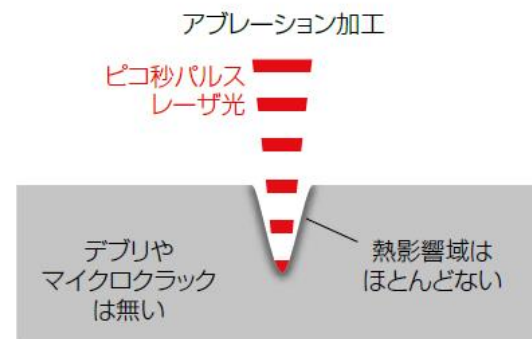
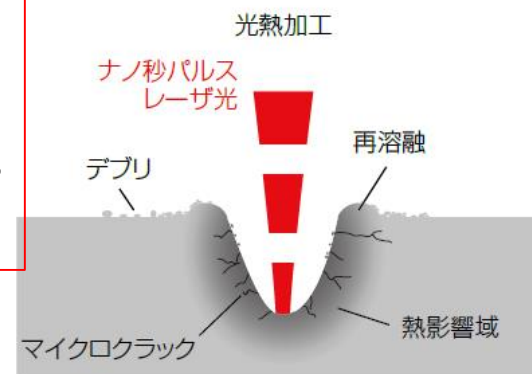
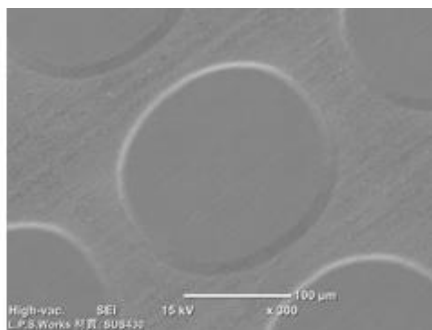
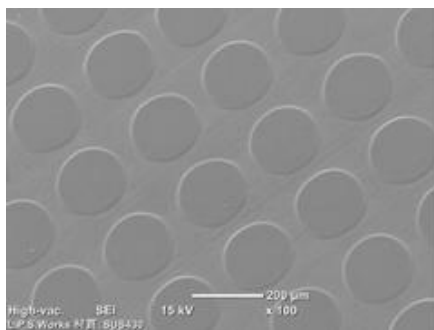
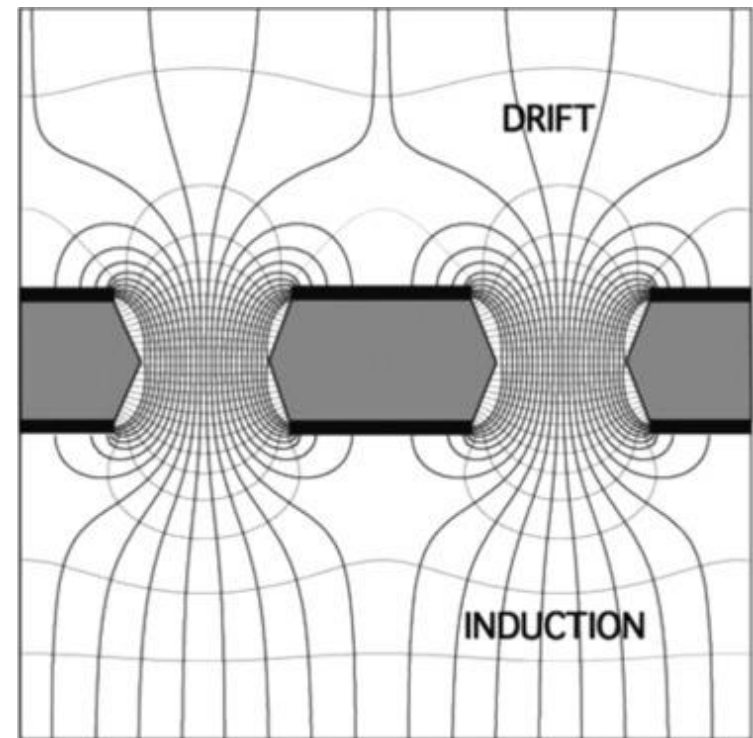
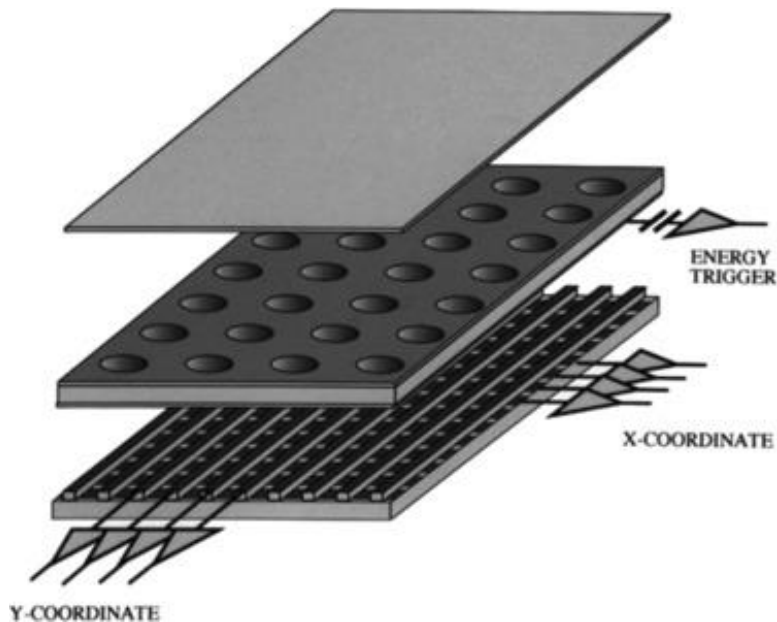
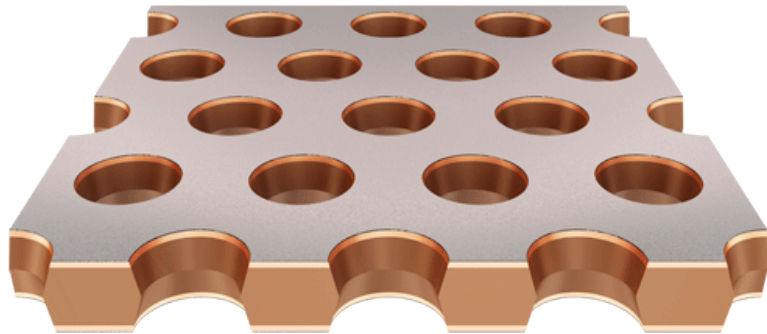


図1 光熱作用対アブレーション概念図



Example of application

- ◆ Micro Pattern Gaseous Detector (MPGD)
- ◆ Gas Electron Multiplier (GEM)



Fine Polish TDC

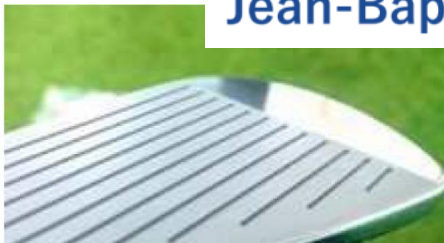
MIYAGI



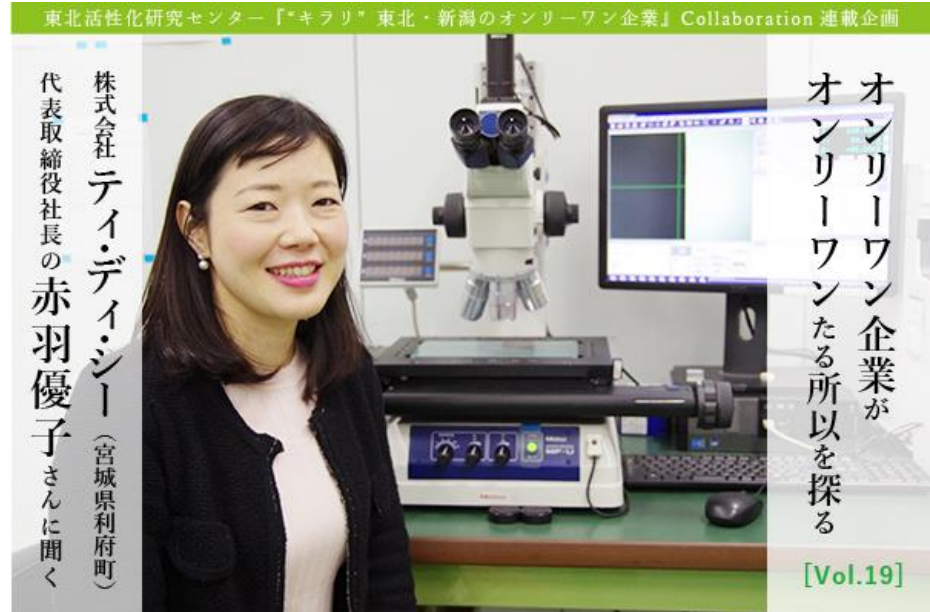
Maintenance of Precision stage, positioning stage, vacuum chuck and granite plate.



Precise polished foil for production of Monolayer Graphene



Jean-Baptiste's NANO flat face model ~ultra flat face of golf club~



Unique technology of TDC can achieve the accuracy of nanometer level for any material and any shape

Metal

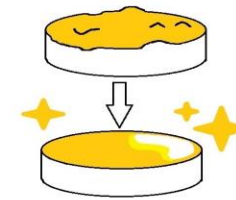
Ceramics

Crystal

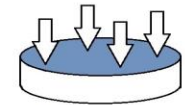
Plastic

Semiconductor

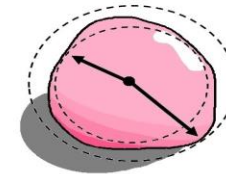
New material



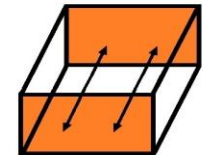
面粗さ : $Ra1nm$



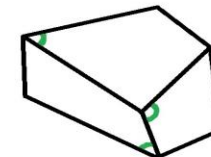
平面度 : $30nm$



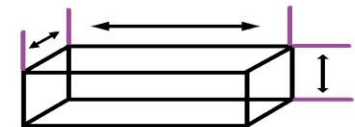
真球度 : $50nm$



平行度 : $100nm$



角度 : $\pm 3秒$



寸法公差 : $\pm 100nm$



JAXA

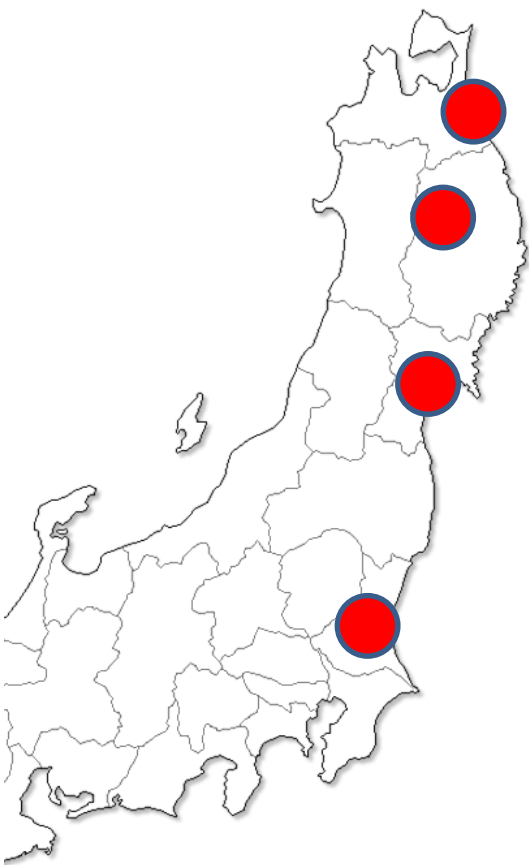
Hayabusa-II artificial satellite to bring back samples from asteroid

Harvard University

BICEP3 telescope @ South-pole



Companies cluster



Cluster #1: Vertical Electro-polishing Equipment for Fabrication of Superconducting Cavities



- **MARUI GALVANIZING CO.,LTD.** (HQ in Hyogo Pref. & Aomori Branch): Plating business
- **Higashi Nihon Kiden-kaihatsu CO.,LTD.** (Iwate, Morioka): Various Control Panel for social infrastructures.
- **WING CO.,LTD.** (Iwate, Morioka): Plastic Processing business.
- **Iwate Prefecture**
- **Tohoku Economic Federation**
- **KEK**

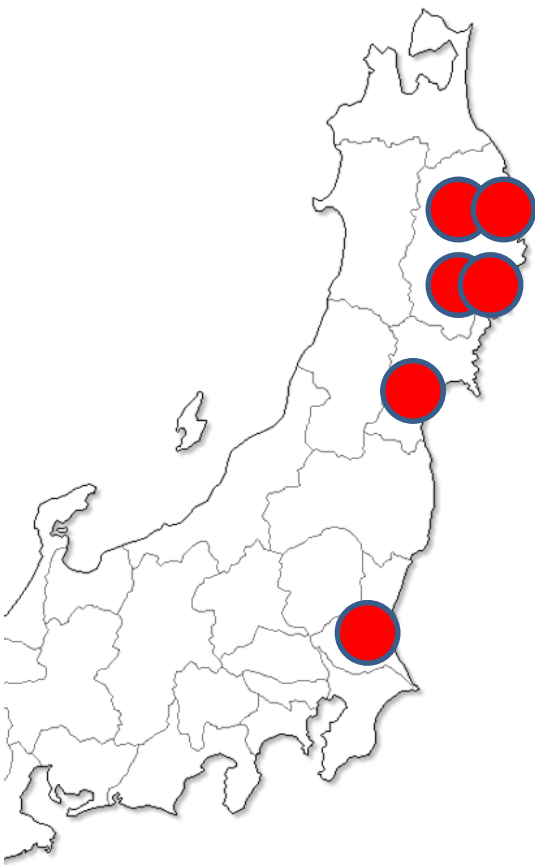


Main target:

Cost reduction by

- making compact EP facility
- minimizing necessary time to make EP





Cluster #2: Support stand of the ILC cryomodule with active alignment system



- **National Institute of Technology, Ichino-seki Kosen** (college, Iwate, Ichino-seki city),

This college is to grow engineers and have many collaboration program with companies.



- **Iwate Iron Corporation** (Iwate, Kitakami City),
mechanical structure
utilizing casting
technology

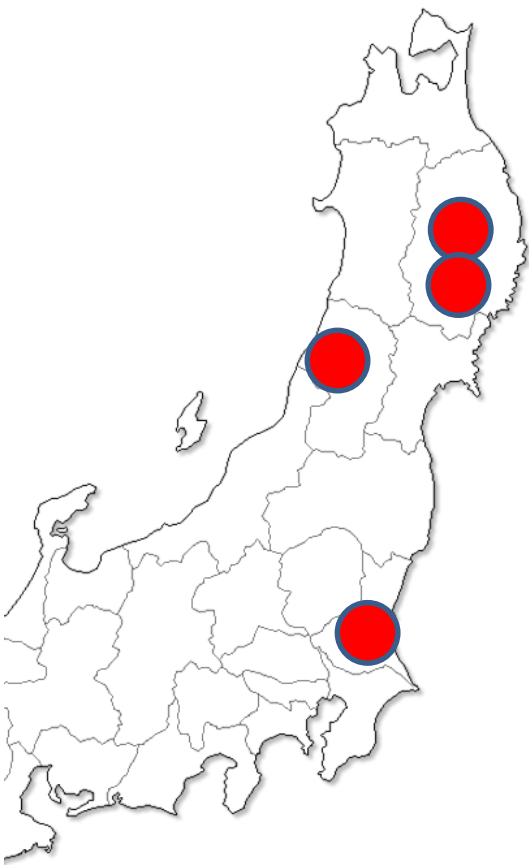


- **NEC Ichinoseki branch**, control system

One of the leading companies in Japan for communication, control system, etc.



- **Iwate prefecture**, technical and financial support
- **Tohoku Economic Federation**, financial support
- **KEK**



Cluster #3: Tunable magnets for accelerators based on the permanent magnet technology

- **Suzuki Kikai Co., Ltd.,**

In Takizawa-city of Iwate prefecture
Precision machining, assembling,
quality assurance



鈴木機械株式会社
Suzuki Kikai Co., Ltd.



- **San-ai Seiki limited company**

In Oshu-city of Iwate prefecture

- Various type of magnetic chuck
- Good handling technology of permanent magnets

- **OHTSUKA INC.** in Tsukuba

Many experiences of precision machining
of accelerator components for KEK

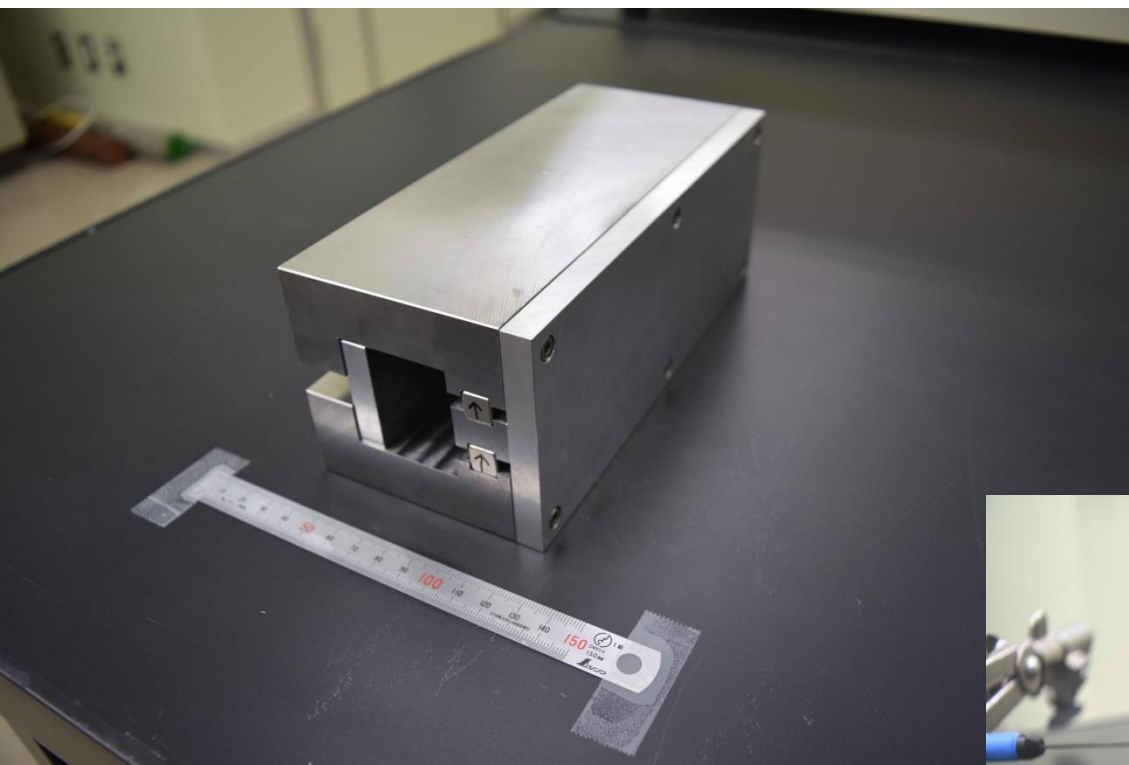
- **PREFACT (Precision Factory)**

Yamagata
prefecture

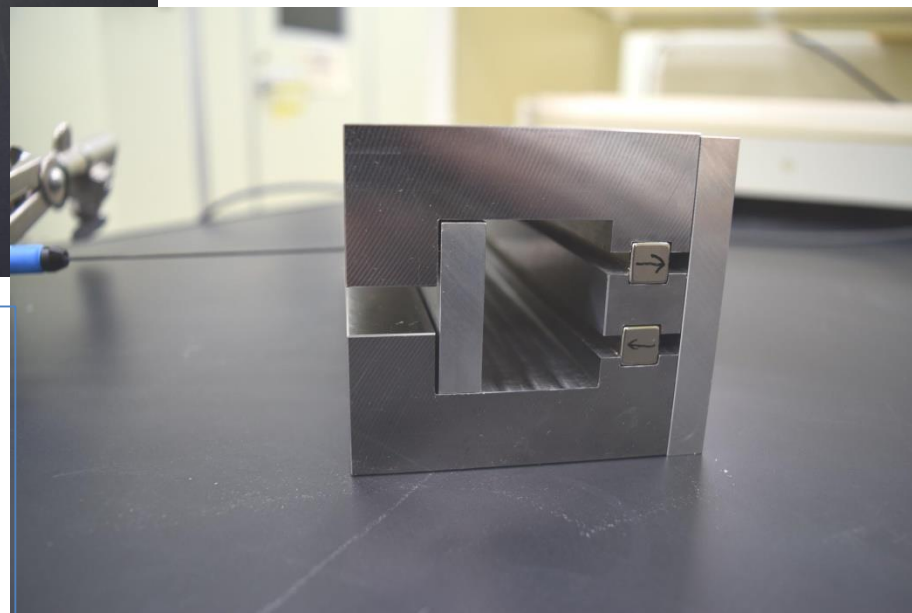


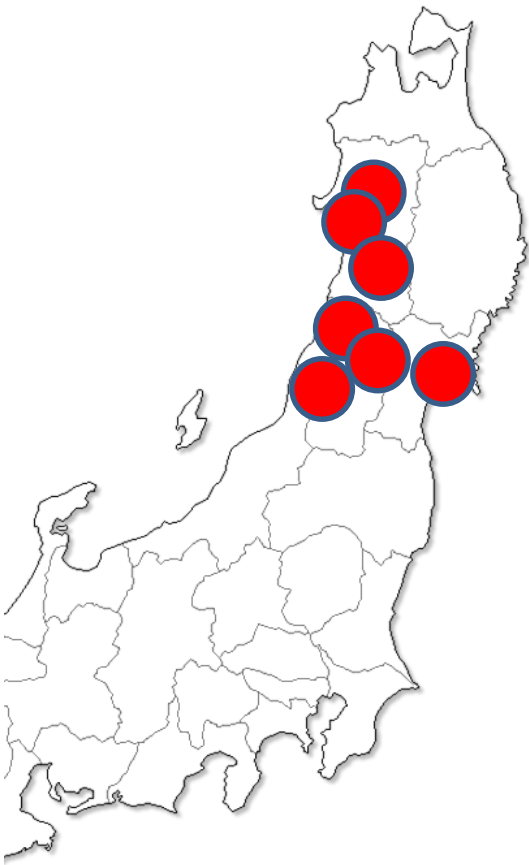
- **Iwate prefecture**

Effort in Iwate prefecture to develop tunable permanent magnets



- This is the first prototype of a dipole magnet.
- This year, we will make advance the R&D by collaboration with KEK



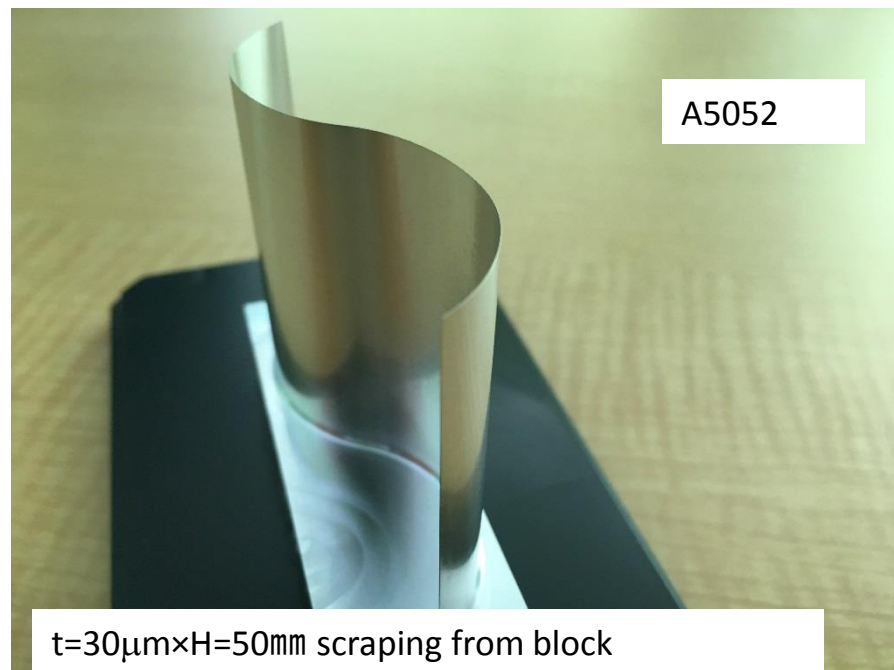
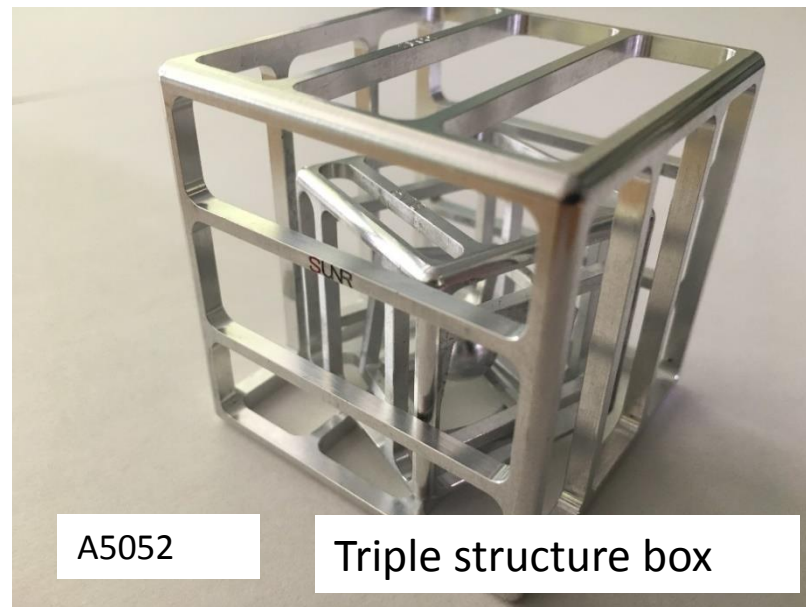
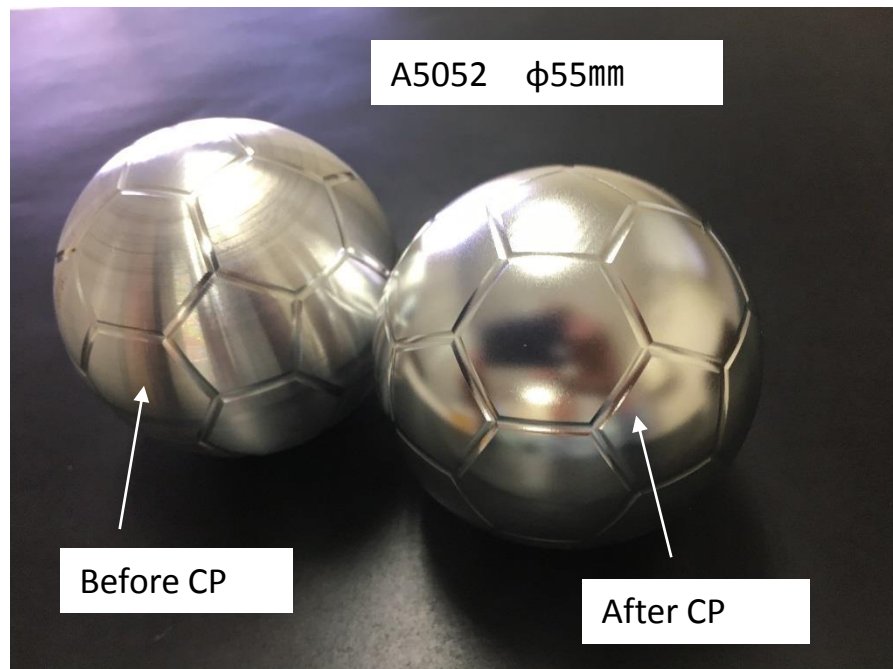


Cluster #4: Ultra high vacuum component, precision machining, welding, electro-polishing and plating

- Taiyo Group
 - Tokyo and Yamagata
 - Vacuum components, printing machines, welding
- Saito Machine Engineering Co., Ltd. (Saito Kikai Kogyo)
 - Yamagata
- Towa Engineering Co., Ltd. (Towa Kogyo)
 - Miyagi
 - Vacuum components, precision machining
- VIC International
 - Yamagata
 - UHV components, SR beam lines
- **Akita Kagaku (Chemistry)**
 - **Akita**
 - **Electro-polishing, copper plating**
- Nihon Seiki (precision machining)
 - Akita
- San-ei Kikai (precision machining)
 - Akita



株式会社 三栄精機製作所



precision machining
Challenges by SAN-EI SEIKI



株式会社 三栄精機製作所

Cooperation between industry and academia

ILC-related facility (laboratory buildings, guest houses, and etc.) should be “Wood first” by taking advantage of the characteristics of the Tohoku region

Collaboration
between
Iwate University
and
Shelter Co., Ltd. (Yamagata)



Shelter®
株式会社シェルター



Cultural hall of Nanyo-city,
Yamagata Prefecture
Wooden hall for 1400-seat
by Shelter Co., Ltd.



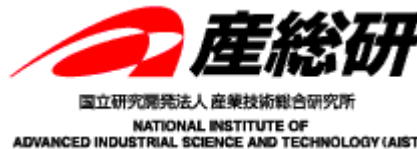
Swiss Light Source (PSI)

We are making a design of
detector assembly hall of
ILC based on the hybrid
structure of wood, RC and
steel frame by this
collaboration.

Collaboration between Iwate University,



National Institute of Industrial Science and Technology,



Takasago Thermal Engineering Co., Ltd. (Tokyo)

and



Higashinihon Kiden Kaihatsu Ltd. (Iwate)



Waste heat utilization by using the heat storage absorbent

Waste heat energy recovery and its off-line transportation

Transportation of heat energy using “HAS-Clay” by container truck

Principle of “HAS-Clay”

- ➔ Sintered nano-scale compound of
Hydroxy Aluminum Silicate + Amorphous Aluminum Silicate
- ➔ Phase transition of H_2O (Vapor \rightleftharpoons Water) + Chemisorption
- ➔ HAS-Clay: “Adsorbent” developed by the National Institute of Advanced Industrial Science and Technology (AIST)
- Specific gravity 1.2
- Adsorbed moisture content 0.37kg/kg
- Volume filling rate 50%
- Heat storage density **580 MJ/m³**
- ➔ **12 times of energy of natural gas (45 MJ/ m³)**



Energy recovery from waste heat of factory, incineration plant, co-generation, solar and etc.



Heat utilization business:
Greenhouse agriculture, wood and biomass drying, heat supply business for community and etc.

The accelerator science-based vision in Tohoku

Taking advantage of the Tohoku characteristics, the primary, secondary, and tertiary industry should be well-balanced harmoniously and rich cultural nation should be created

1. Base of the synchrotron radiation and neutron science, fundamental physics, and radiation therapy
2. International brain base, Japan's first large-scale international project
3. Training of the next generation scientists and engineers
4. Realization of the creation of new industries and innovation base
- 5. These things contribute to the stability of Asia**