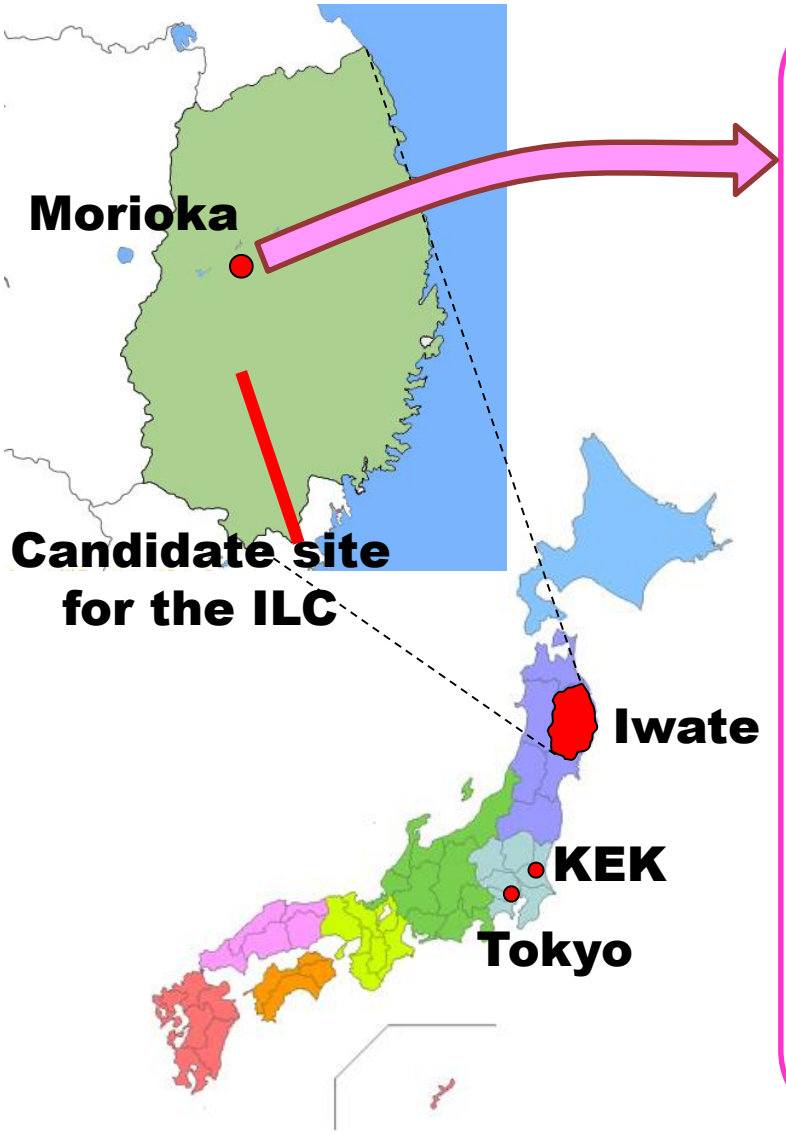
R&D for Beam Transport System using Permanent Magnet for the ILC

Iwate Industrial Research Institute

Kazuyuki Meguro

Mt. Iwate seen from Takizawa

Overview of the Iwate Industrial Research Institute



Iwate Industrial Research Institute

(= Public Research Organization)

President	T. Kimura
Establishment	1873
Employees	63
	(in research positions: 55)
Lot area	67,744 m^2
Building area	10,177 m^2

Our mission

Iwate Industrial Research Institute

"The joy of creating, and contributing to the region"

Mission

Universities	Academic research
National Institutes	Solutions for national-level issues Support for major enterprises
Public Research Organizations	Solutions for regional-level issues Support for small-to-medium companies Technical consultations Experiments on contract Equipment lending

Companies in Iwate involved in the accelerator industry

Vertical electropolishing

WING. CO. LTD

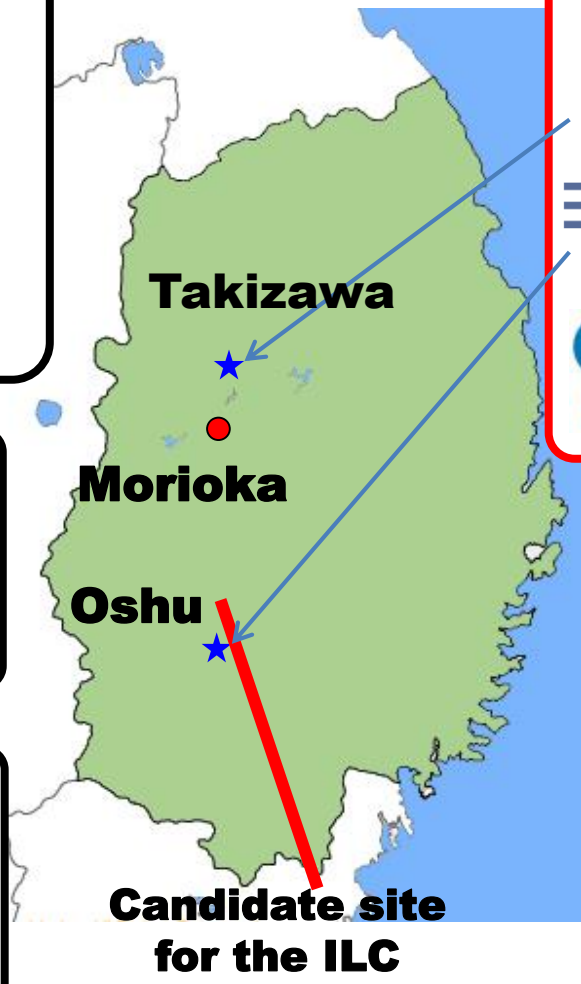
Higashi-nihon kidenkaihatsu, Ltd.

Cavities

PROFIT Co., Ltd.

Pulse power supplies

P&A Technologies Inc.



Magnets

Suzuki Kikai Co., Ltd.

Sun Ai Inc.

KAMAISHI electrical machinery factory Co.,Ltd

Active Movers

NEC Platforms, Ltd.

IWATE IRON CO, LTD

Tohotechnos Co., Ltd.

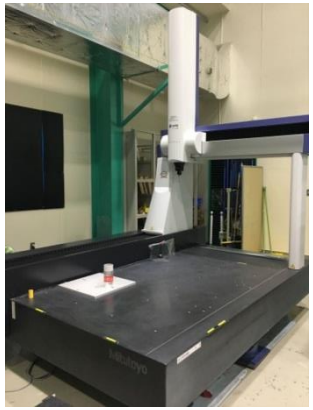
Suzuki Kikai Co., Ltd.

Suzuki Kikai Co.,Ltd.

Employees	: 80
Annual sales	: 1,600 million yen

Precision machining, Design, Assembly, Vacuum parts
for semiconductor manufacturing facility

Five-Axis Machining Center



Coordinate Measuring Machine

Beam Position Monitor

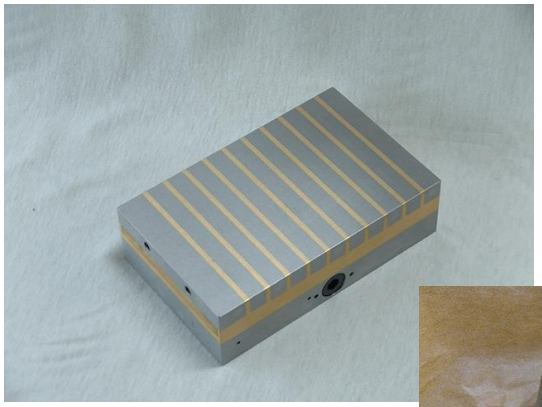
Clean Room

Sun Ai Inc.

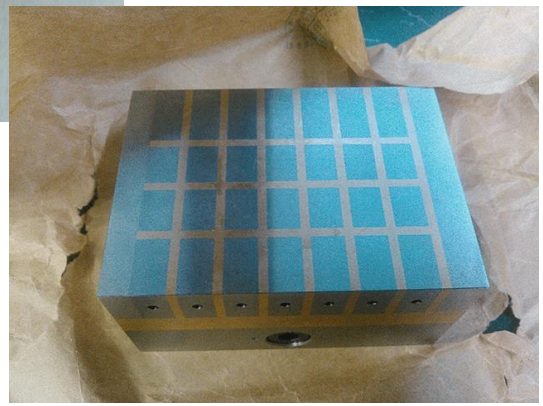
Sun Ai Inc.

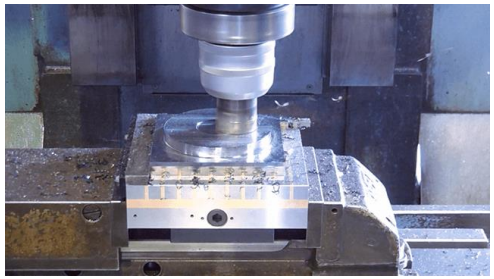
Employees	: 12
Annual sales	: 60 million yen

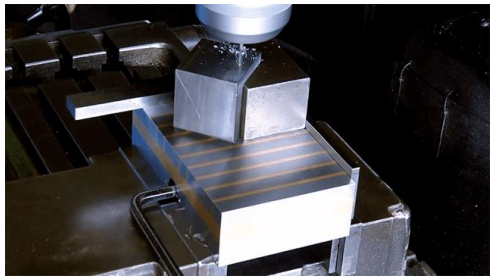
Jigs, molds, permanent magnetic chucks



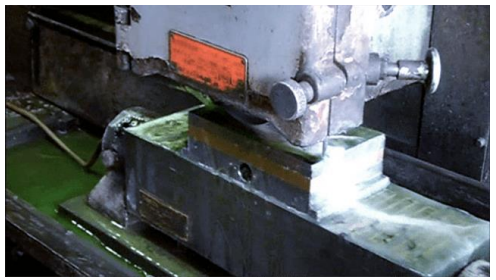
Permanent Magnetic Chucks







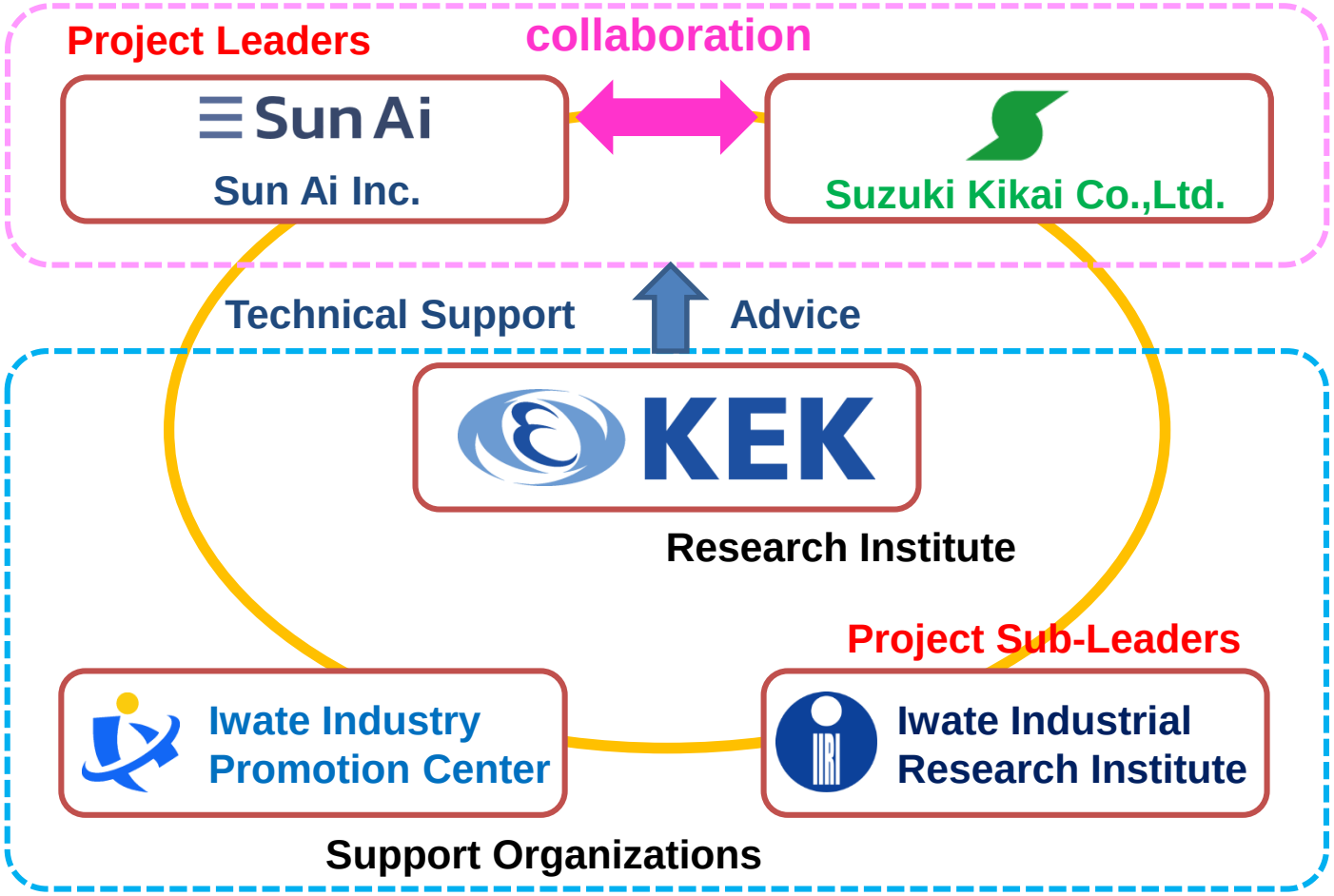
for Cutting



for Grinding

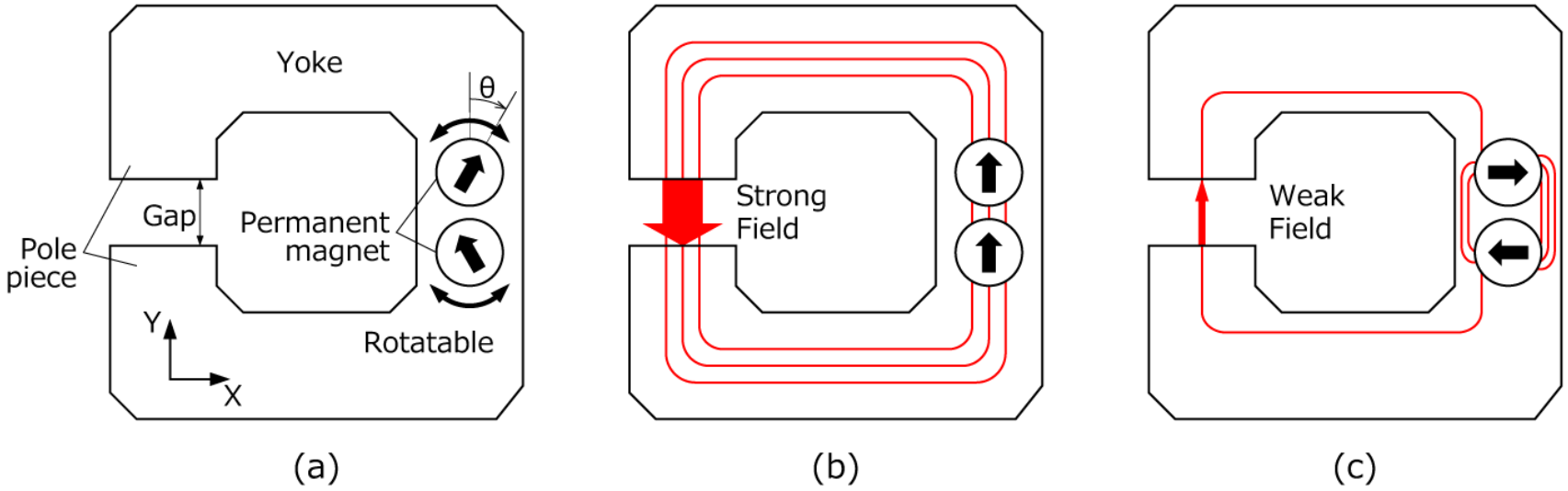
Permanent Magnetic Circuit Project

Our aim ⟶ To replace the electromagnet with a permanent magnet to reduce the initial cost and the running cost of the ILC



Iwate Strategic Research and Development Promotion Project

Magnetic field adjustment mechanism



(a) The two cylindrical permanent magnets are arranged so that they can freely rotate.

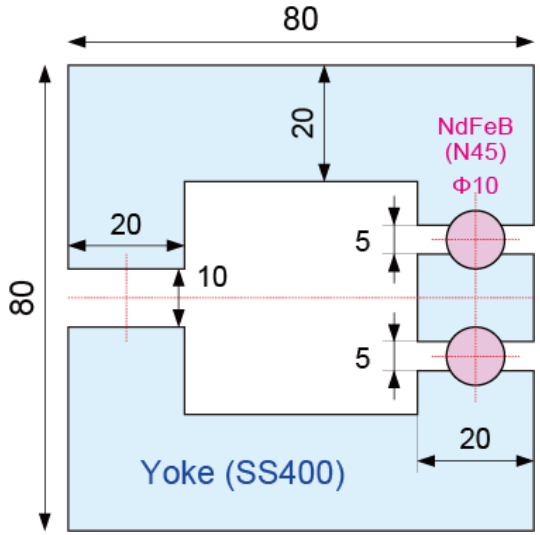
(b) When the two magnets are aligned in the same direction,

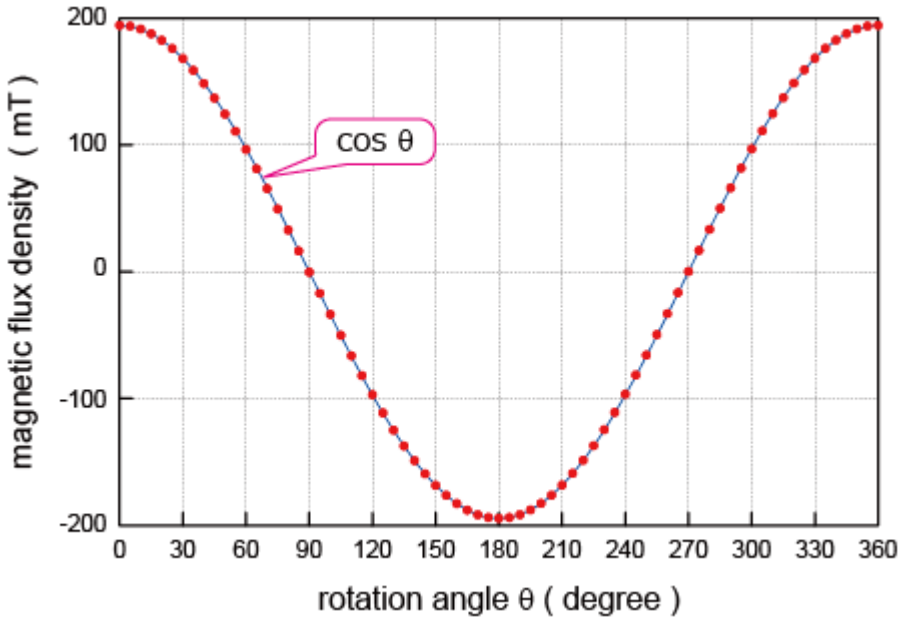
➡ a strong magnetic field is generated in the gap.

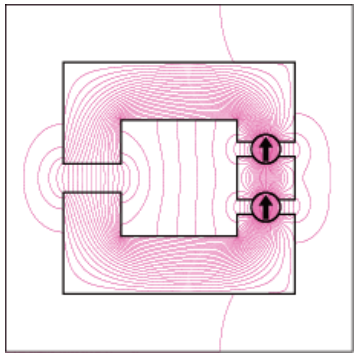
(c) When the two magnets are antiparallel,

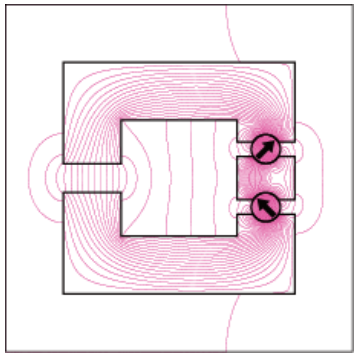
➡ almost no magnetic field is generated in the gap.

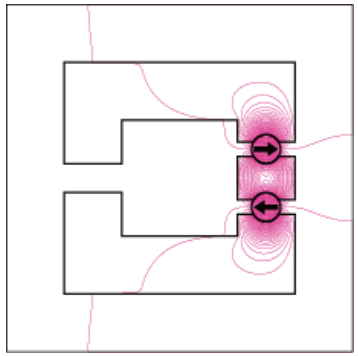
Result of magnetic field simulations

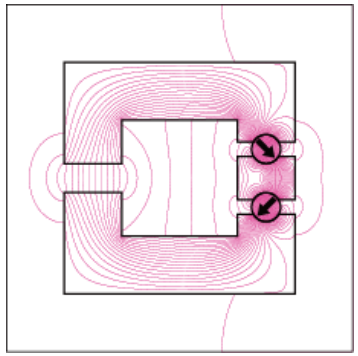


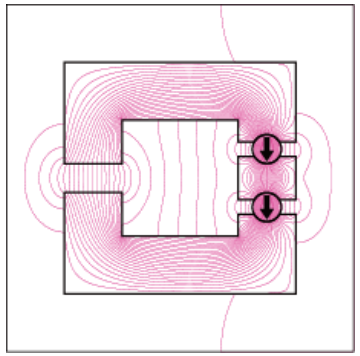



θ = 0°

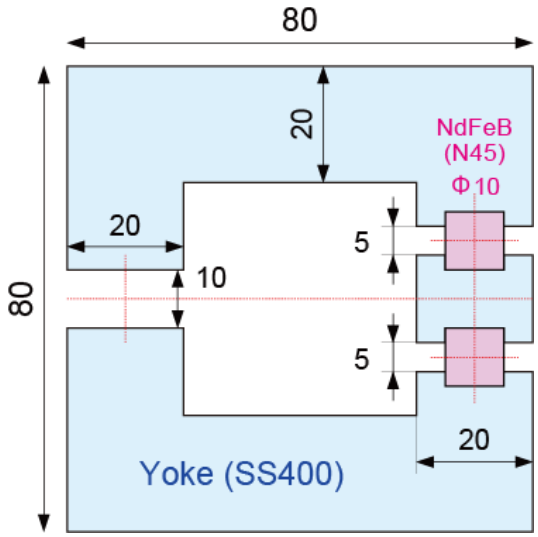

θ = 45°


θ = 90°

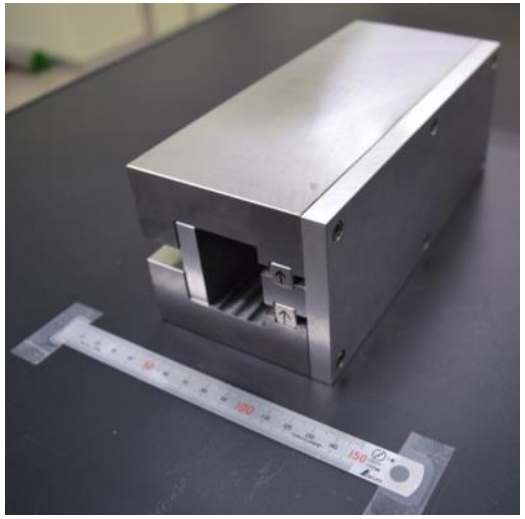

θ = 135°

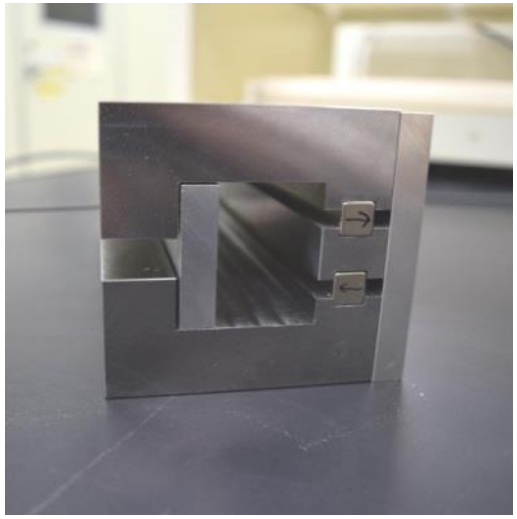

θ = 180°

Prototype of the principle model



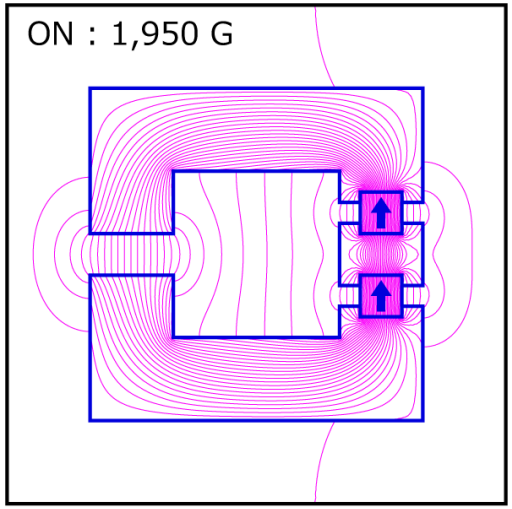
L = 200 mm

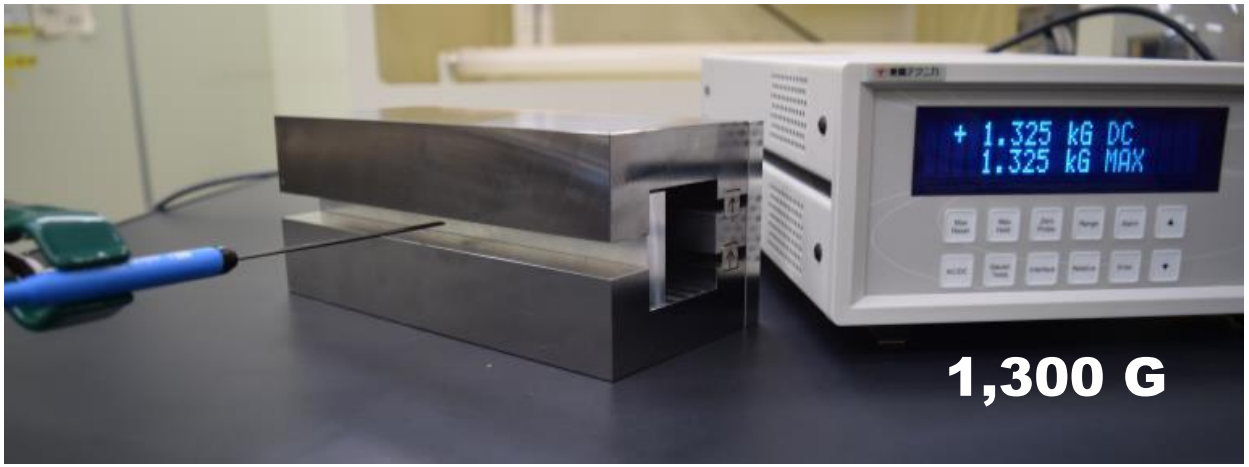


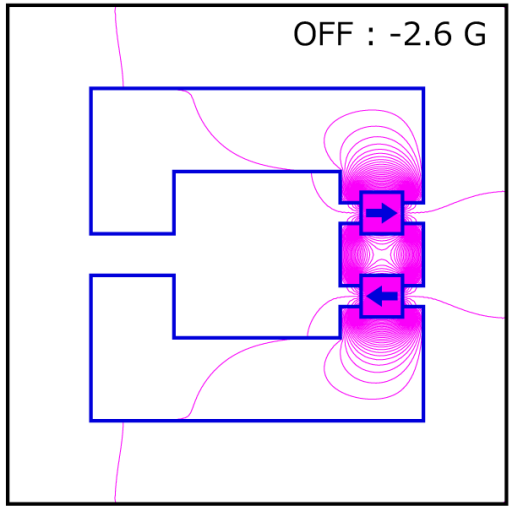


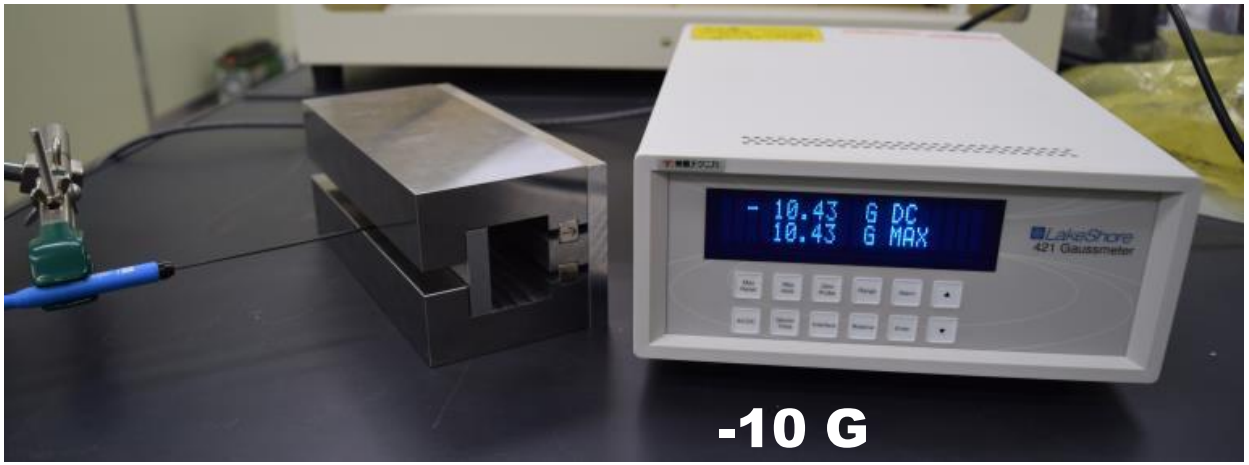
Note
The permanent magnets cannot be rotated in this prototype.

Result of measuring the magnetic field in the prototype









Summary

- We formed a development group centered on Sun-Ai and Suzuki Kikai in order to manufacture a magnet circuit based on permanent magnet for accelerators.

- We devised a mechanism for magnetic field adjustment based on mechanically moving permanent magnets.

- We have confirmed that it is possible to adjust the magnetic field using rectangular permanent magnets.

- Future plans

(1) Carry out simulation and prototyping with dimensions suitable for the ILC's beam transport system.

(2) Verify the rotation mechanism of the permanent magnets as well as the accuracy of adjustments to the magnetic field.

We expect that at least 1,000 of the 7,000 electromagnets used for ILC can be replaced with permanent magnets.

Thank you for your attention