



# Research Institute of Electrical Communication, Tohoku University (Sendai, Japan)



July 2014



# Overview of Tohoku University



## Campuses

**Katahira** (Headquarters, Research Institutes (4), Graduate School of Life Sciences, Professional Graduate Schools)

**Aobayama** (Graduate Schools of Engineering/Science/Pharmaceutical Sciences/Information Sciences/Biomedical Engineering, etc.)

**Kawauchi** (Graduate Schools of Art and Letters/Education/Law/Economics and Management/International Cultural Studies, etc.)

**Amamiya** (Graduate School of Agricultural Science)

**Seiryō** (Tohoku University Hospital, Graduate Schools of Medicine/Dentistry, Institute of Development, Aging and Cancer)

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**Students** 17,852 (16,667 Japanese students, 1,185 international students)

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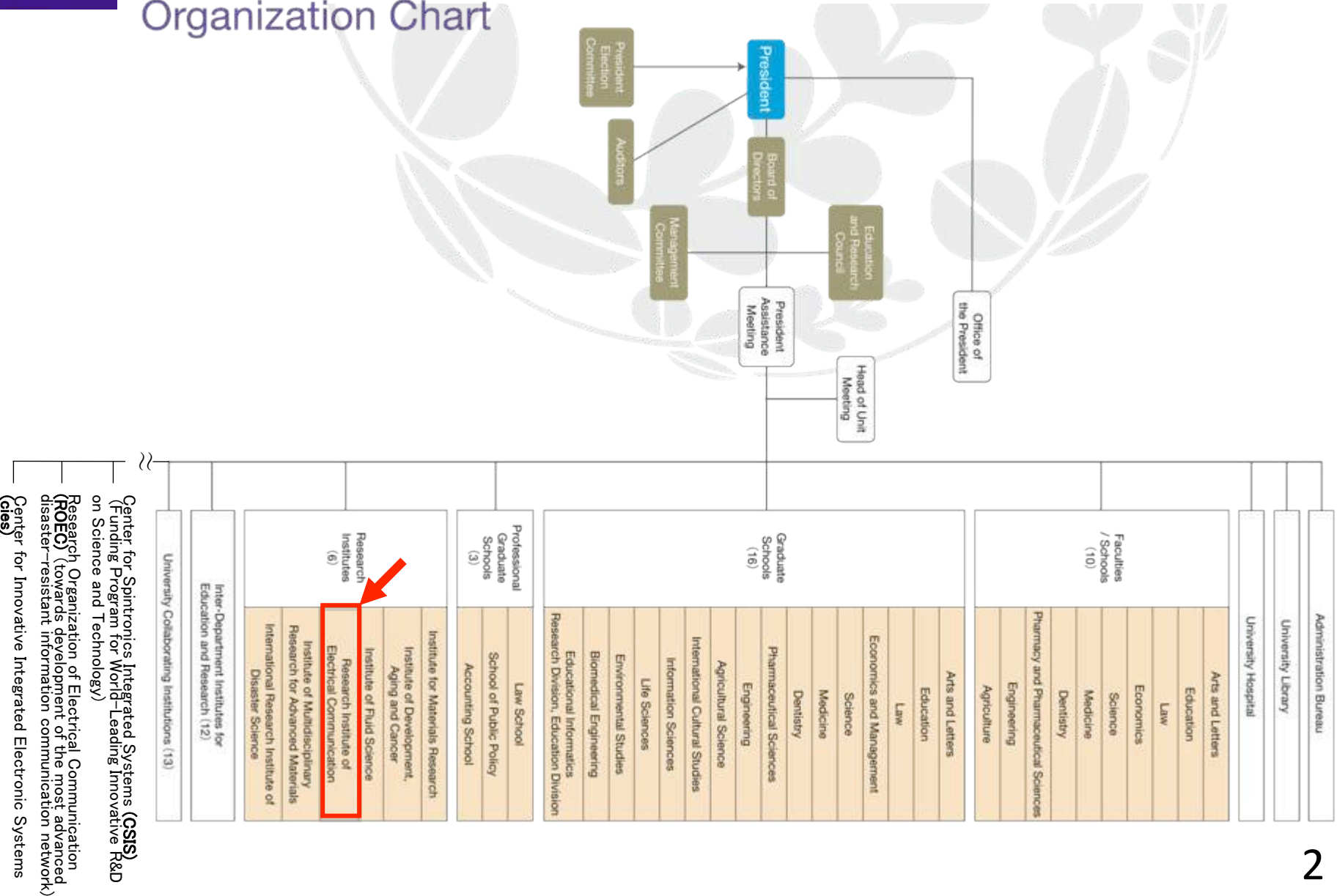
**Faculty and Staff** 6,379



# TOHOKU UNIVERSITY

Sendai, Japan

## Organization Chart





# Research Institute of Electrical Communication, Tohoku University (Sendai, Japan)



Tohoku Univ. (1907- )

Res. Inst. Electr. Comm. (RIEC, 1935- )



Tohoku Univ.	Number (2014 Spring)	RIEC
886	Professors	24
737	Associate Profs.	18
1202	Assistant Profs.	25
11,060	Undergrad. Students	56
4,106	MC Students	125
2,651	DC Students	38

Total 67

Total 219



**The Fact of RIEC**

**Brief History of RIEC**

**1935 Establishment of RIEC as a  
research institute affiliated  
with Tohoku Imperial  
University**

**1994 Reorganized as National  
Centre for Cooperative  
Research**

**2010 Reorganized as Joint Usage /  
Research Center**

**1950 Three elements of optical  
communication technology**

**1950 Static induction transistor**

**1958 Parametric computer  
SENAC-1**

**1958 Metal particle magnetic tape**

**1975 SAW filter**

**1977 Perpendicular magnetic  
recording**



Prototype  
in 2005



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## The Fact of RIEC



IEEE Electrical Engineering Milestone for Yagi-Uda Antenna



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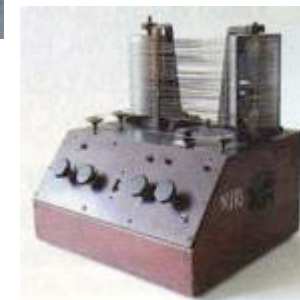
## The Archives Room



**Yagi-Uda  
Antenna (1929)**



**Split Anode  
Magnetron (1927)**



**AC-Bias Magnetic  
Recorder (1937)**

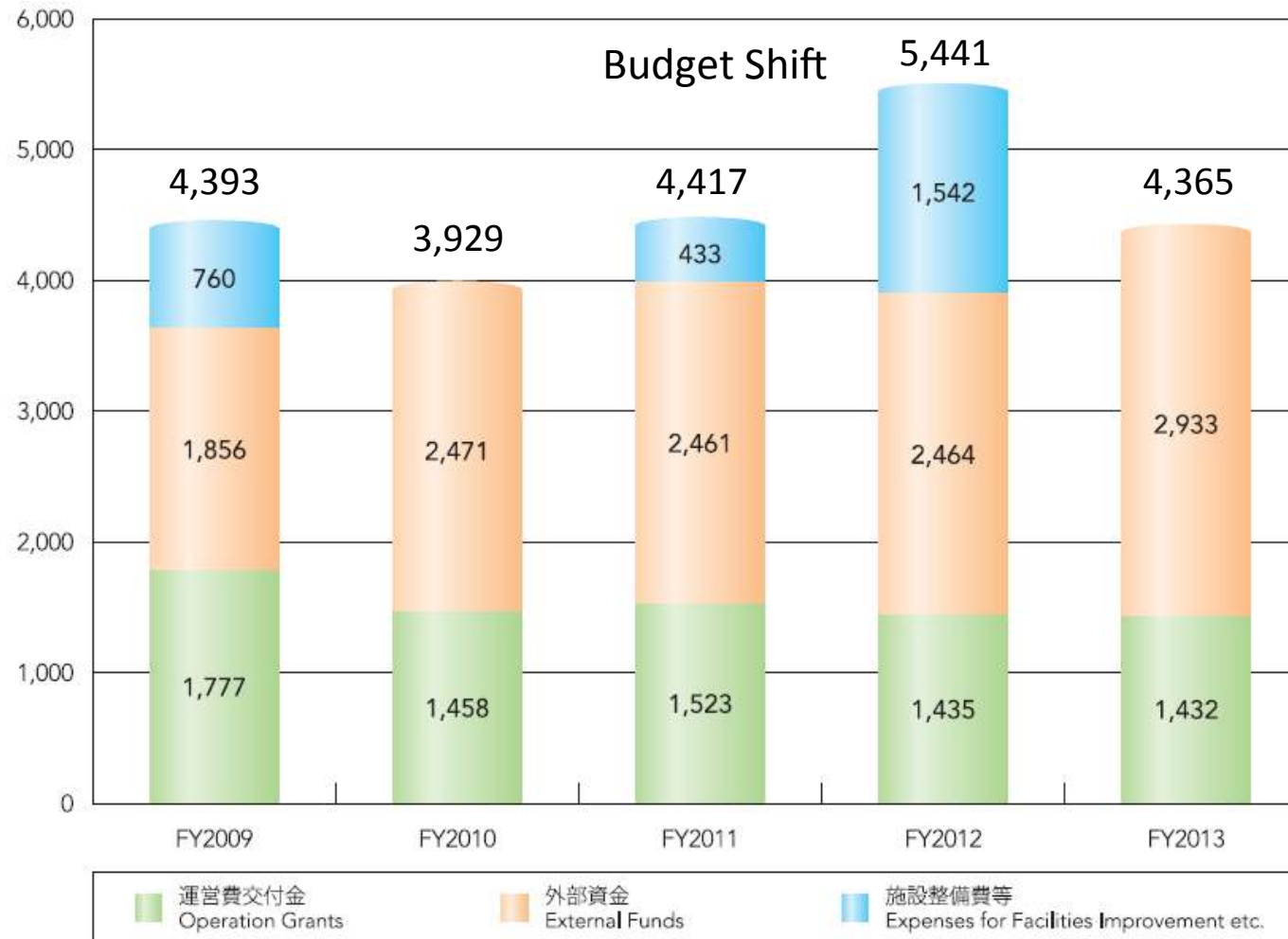


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## The Fact of RIEC

単位：百万円 / million yen





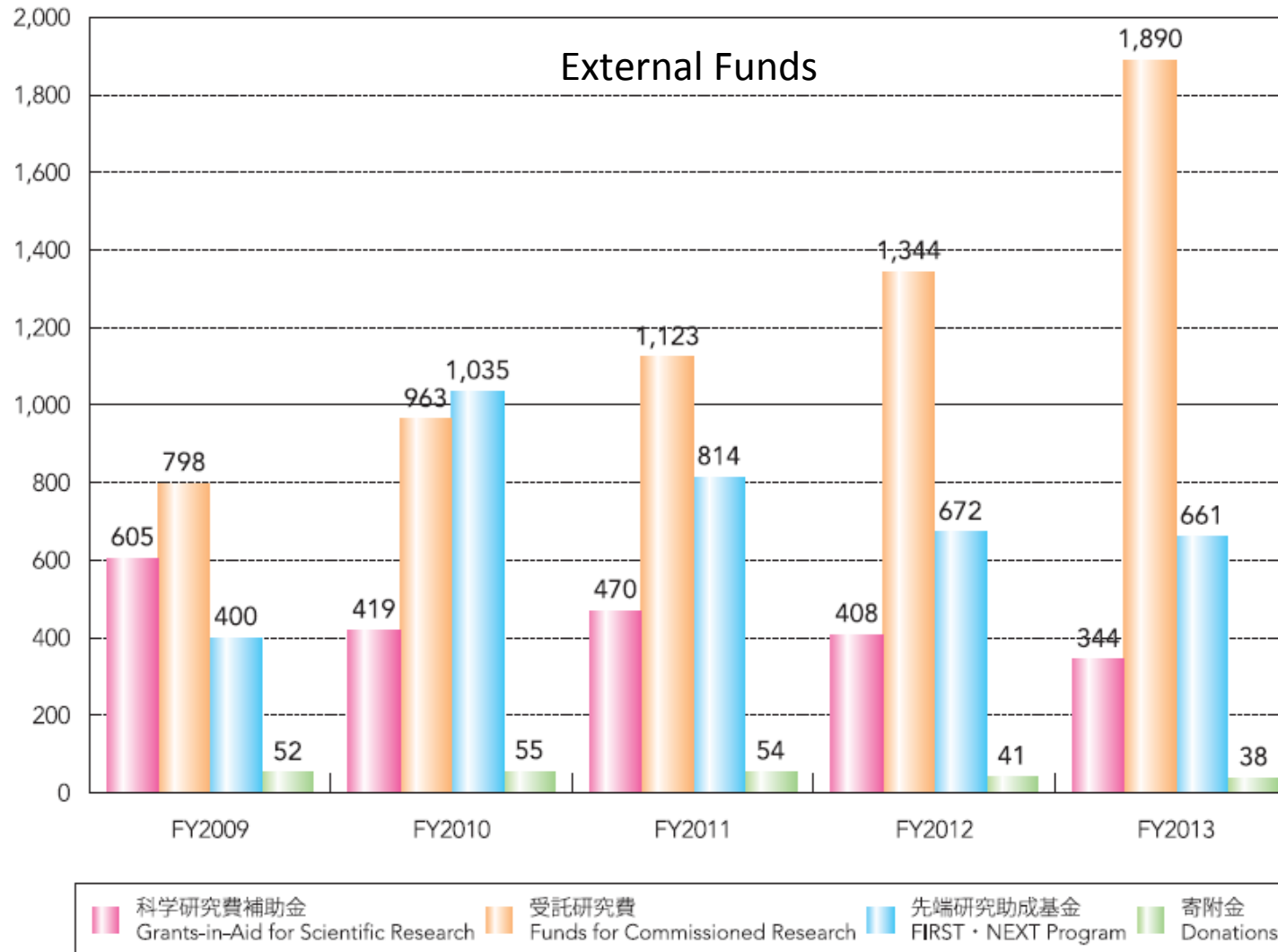


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## The Fact of RIEC

単位：百万円 / million yen





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## Current Research Organizations in RIEC

4 Research Divisions, 2 Research Laboratories & 1 Research Centre

**Research Divisions**  
Kernels for long-range basic research

### Information Devices Division

Creation of nanoelectronics information devices based on physical phenomena

### Broadband Engineering Division

Creation of next generation system for Ultra-Broadband communication

### Human Information Systems Division

Creation of information system harmonizing human with environment

### Systems & Software Division

Creation of system and software supporting information society

### Research Center for 21st Century Information Science

- Creation of new ICT industry by industry-university cooperation
- Prototype development with short-term (5 yrs.) horizon

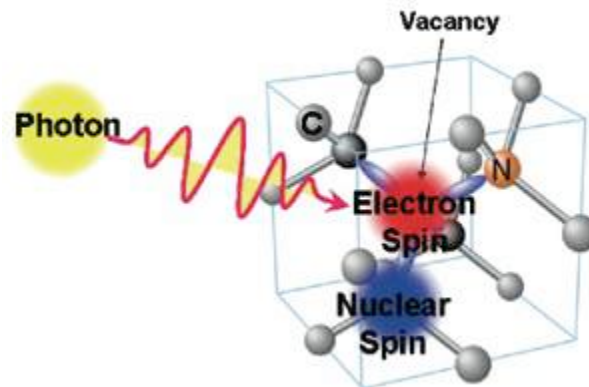
### Laboratories

Next generation technology research with middle-term horizon

- **Laboratory for Nanoelectronics and Spintronics**
  - Creation of base nano-spin technology for future ICT
- **Laboratory for Brainware Systems**
  - Technology mixing real and virtual world seamlessly

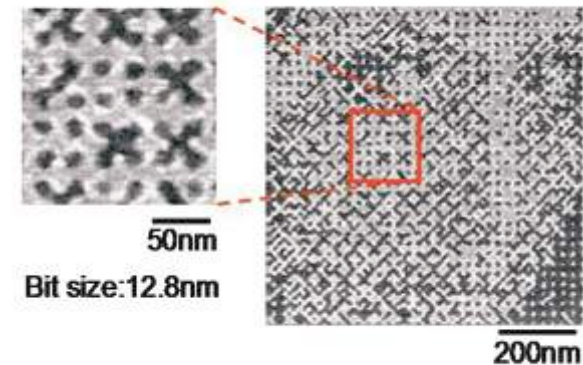


## Information Devices Division



Quantum media conversion from a photon to  
an electron/nuclear spin

( Edamatsu Gr. )



An achievement of the recording density of  
4 Tbit/inch<sup>2</sup> in actual information storage

( Cho Gr. )



## The Fact of RIEC

### Broadband Engineering Division

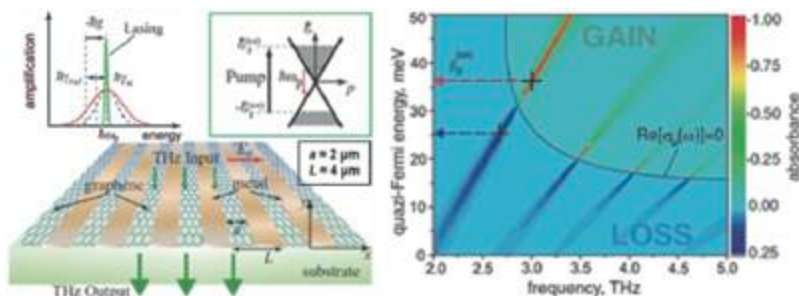


Experiment on ultrahigh-speed optical transmission



A large-scale storage system with parallel HDD operation

( Muraoka Gr. )

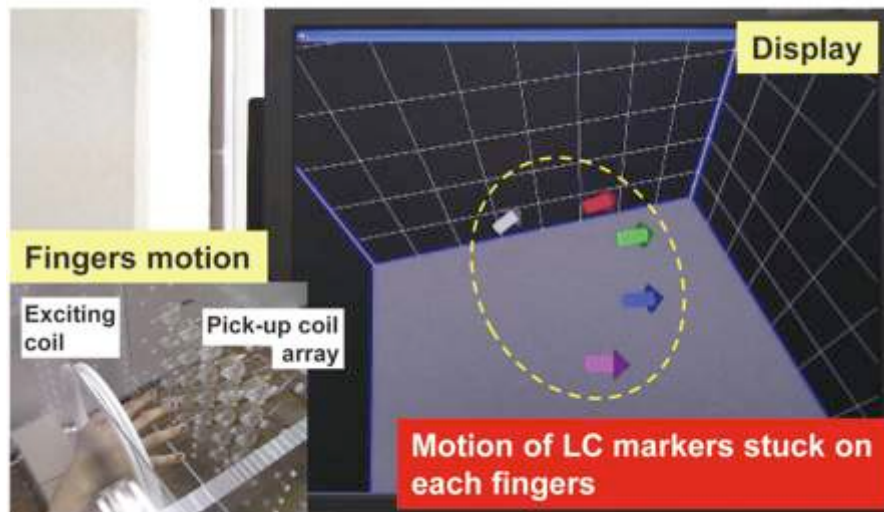


Superradiant THz lasing with giant gain in population-inverted graphene-metal ribbon arrays

( Nakazawa-Hirooka-Yoshida Gr. )



## Human Information Systems Division



Wireless magnetic motion capture system

( Ishiyama-Hashi Gr. )



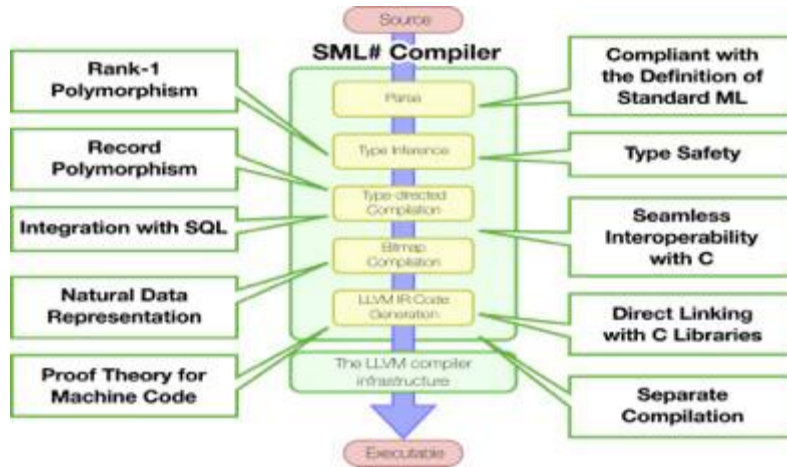
Accurate sound space communications system  
based on higher order Ambisonics by using  
157ch loudspeaker array

( Suzuki-Sakamoto Gr. )



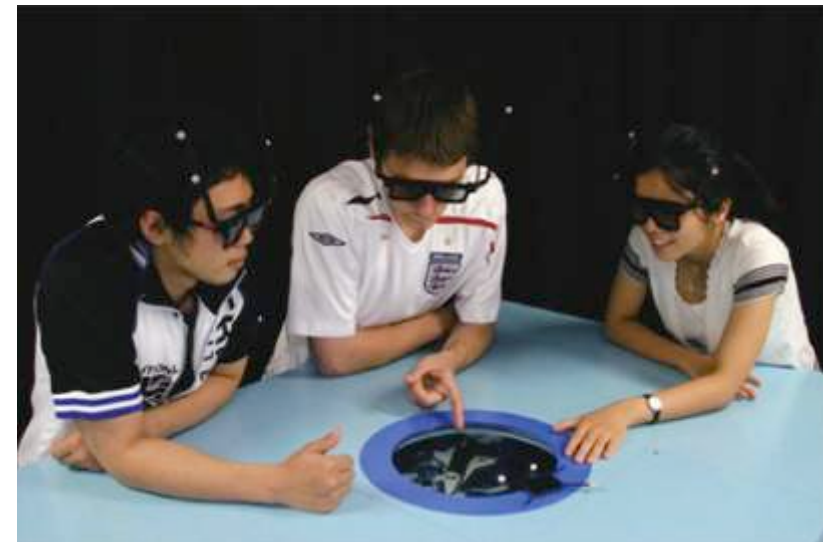
## The Fact of RIEC

### Systems & Software Division



SML#, a state of the art compiler

( Ohori Gr. )



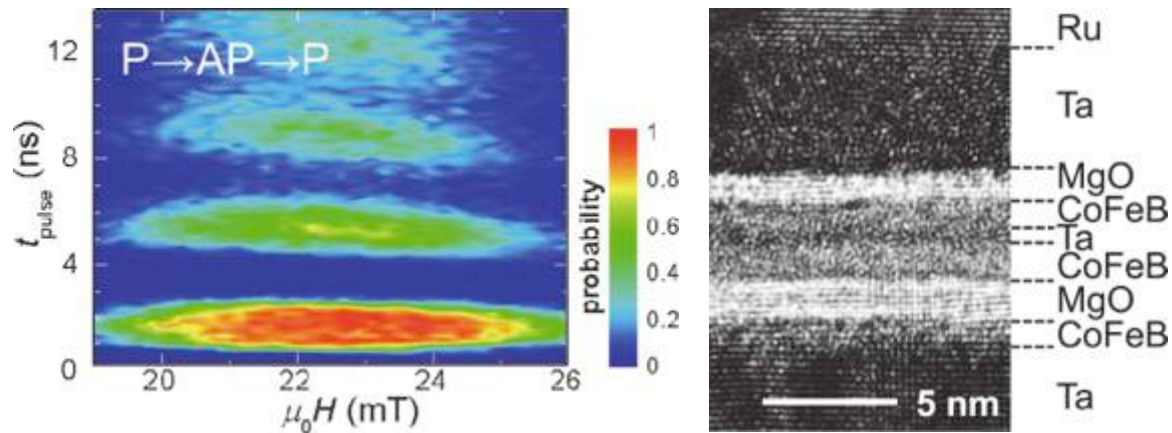
Conducting comprehensive research on a variety of interactive content which creates new value

( Kitamura Gr. )



The Fact of RIEC

Laboratory for Nanoelectronics and Spintronics

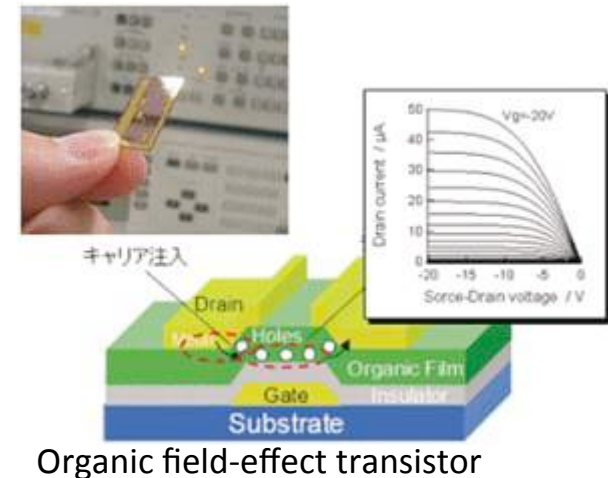


( Niwano Gr. )

(LEFT) Probability of successive back-and forth switching by the application of voltage pulses of 0.9V as functions of pulse duration and magnitude of an external magnetic field along 21° from film normal. (Applied Physics Letters 2012)

(RIGHT) Cross sectional transmission electron microscope image of perpendicular anisotropy magnetic tunnel junction with double interface MgO/CoFeB/Ta/CoFeB/MgO recording layer. (Applied Physics Letters 2012)

( Ohno Gr. )



Organic field-effect transistor

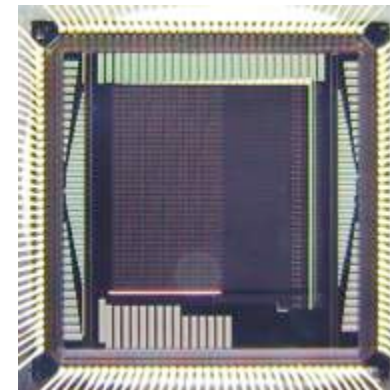


The Fact of RIEC

Laboratory for Brainware Systems



Ophiuroid robot that enables  
omnidirectional locomotion  
( Ishiguro Gr. )



Microchip of a neural network  
( Nakajima Gr. )



High performance LSI for mobile applications  
(Nonvoltage TCAM chip)

( Hanyu-Natsui Gr. )





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## The Fact of RIEC

Research Center for 21st Century Information Technology



Highly-Available Storage System

( Muraoka Gr. )