

December 6-7, 2005
The Third European Conference on Research Infrastructures

Towards Optimal Use of Research Infrastructures

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Ministry of Education, Culture, Sports, Science and Technology

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Academic use **Industrial use**

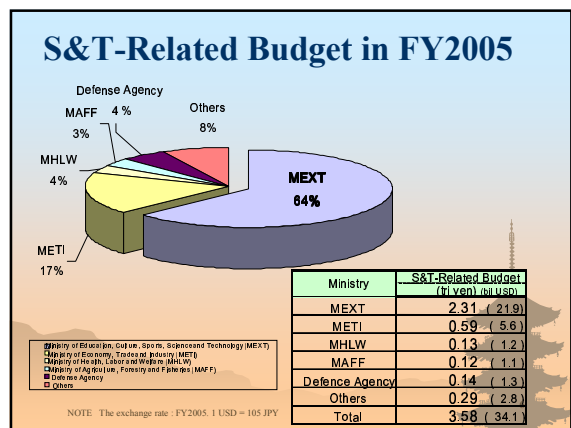
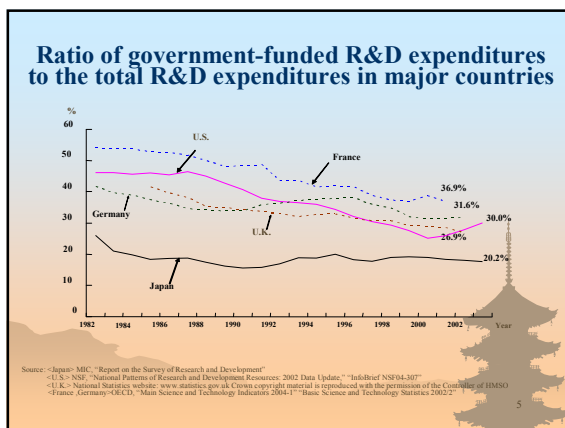
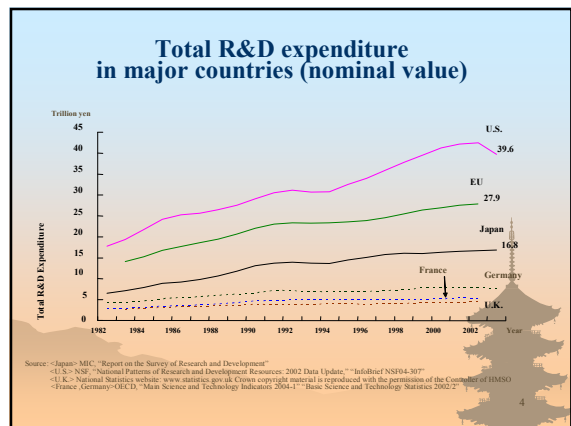
Earth Simulator

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Academic use **Industrial use**

Spring-8

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Large Research Facilities - Physics

SPRING-8

- The largest third-generation synchrotron radiation facility
- Electron energy 8GeV

RI Beam Factory

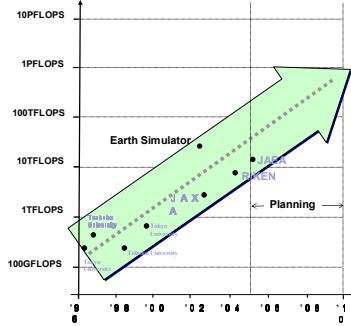
- World's most intense Radioisotope (RI) beam
- Accelerate the whole elements up to uranium ions at higher than 350 MeV/nucleon

Ultra-High Voltage Electron Microscopy

- 3 MV ultrahigh voltage electron microscopy
- World's highest acceleration voltage

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Large Research Facilities- IT



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Large Research Facilities - Environment

E-Defense

- 3 Dimensional Full-Scale Earthquake Testing Facility
- Payload : 12MN (1,200tonf)
- Table Size: 20m x 15m

CHIKYU

- Deep Sea Drilling Vessel
- Operation Capability for Water Depth
 - Riser Drilling : 2,500m
 - Length of drill string : 10,000m

SHINKAI 6500

- Manned research submersible
- 6,500m, World's deepest operation depth

MIRAI

- World class oceanographic research vessel

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Large Research Facilities under construction

J-PARC Project

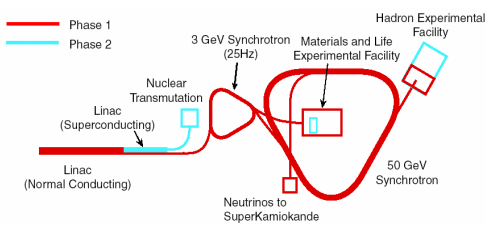
Japan Proton Accelerator Research Complex

Collaborative Project
Japan Atomic Energy Agency (JAEA)
High Energy Accelerator Research Organization (KEK)

Production and Utilization of Various Secondary Beams

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J-PARC



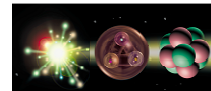
Facility Construction Schedule (Fiscal Year)
2001 Construction Started
2008 User Operation Start
(2009: Neutrino Facility)

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J-PARC Nuclear & Particle Physics

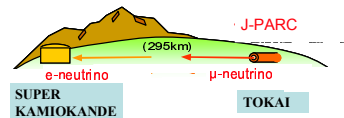
Research on Fundamental Law

- Origin of the Hadron Mass
- Origin of the Universe
- Beyond the Standard Model



Neutrino Oscillation

- Neutrino mass and mixing



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J-PARC Material & Life Science

Research on Materials Science
 → Structure & function of materials
 → Synthesis of a new material

Research on Life Science
 → Development of new drugs
 → Conquest of intractable disease

Battery material X-ray Neutron

Protein Structure

Neutron is powerful to determine the structure for atoms with small atomic numbers
 → Advanced battery, Hydrogen storage, etc.

Neutron is sensitive to probe hydrogen atoms around the protein
 → Study of the function of protein.

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Large Research Facilities under consideration

Peta-Scale Super computer

X-ray Free Electron Laser

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Development of Peta-Scale Super computer

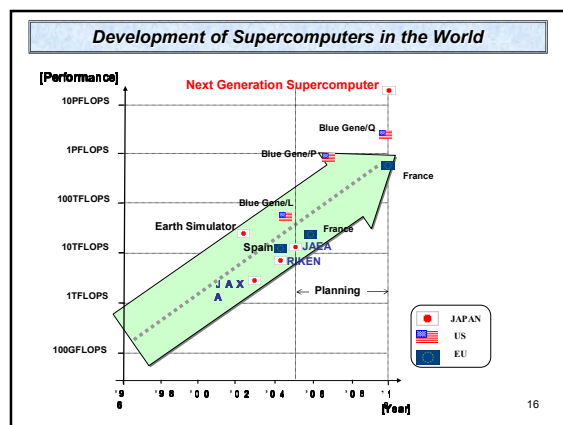
Reach Beyond the Limit by Developing Fundamental Technology

Micro Manufacturing Technology

Achieve Ultra-fast Transmission By Optical Interconnect Technology

Enhance CPU Processing Performance

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Next Generation Light Source : X-ray Free Electron Laser

Development of Light Source

Coherent

Incoherent

1970s
1st Generation Synchrotron Radiation (in Physics Research Facilities)

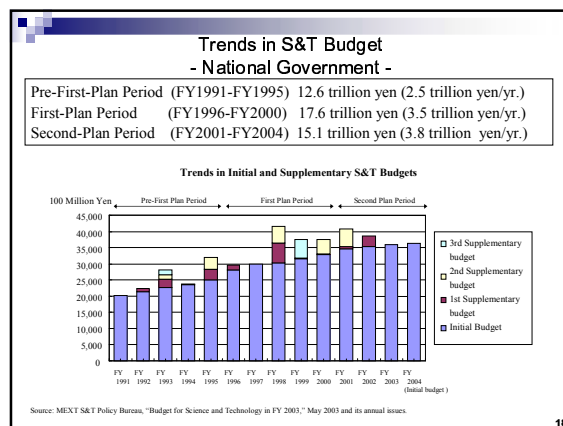
1980s
2nd Generation Synchrotron Radiation (Facilities only for SR)
UVSOR (IMS), PF (KEK) etc.

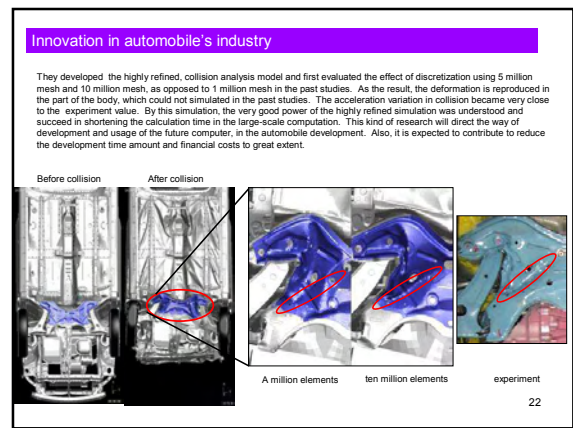
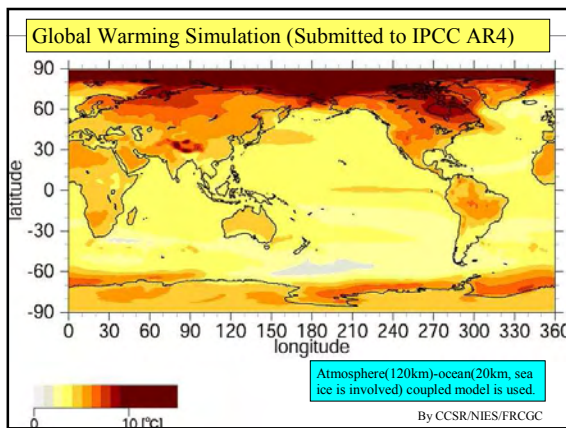
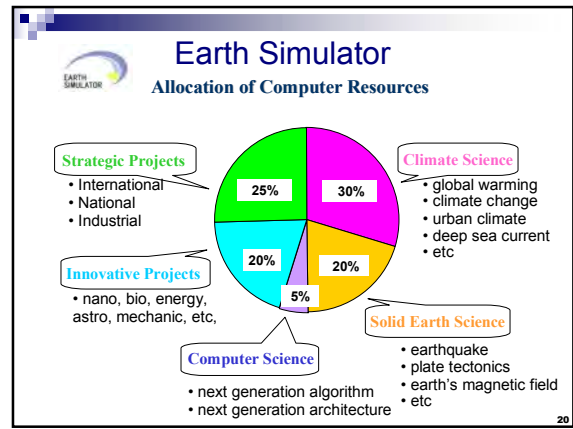
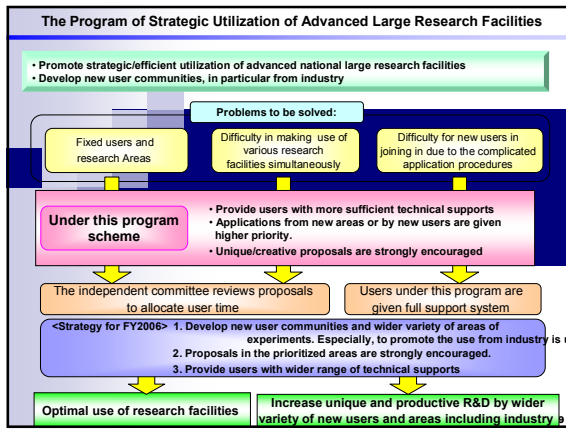
1990s
3rd Generation Synchrotron Radiation (Insertion Device)
JAPAN : SPring-8 [Nishi Harima, Hyogo]
US : AFS [Argonne, IL]
EU : ESRF [Grenoble, France]

Around 2010
Next Generation Synchrotron Radiation (Hi-Coherence X-ray)
Development of XFEL
US : SLAC [Stanford, CA]
EU : DESY [Hamburg, Germany]

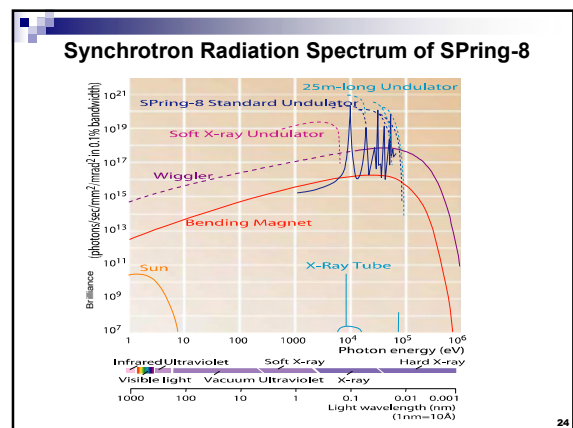
Long (Low Energy) ← [Wavelength] → Short (High Energy)


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- ### Earth Simulator
- #### Examples of New Areas
- Simulation for structural design of anti-disaster
 - Design and development of new functional materials
 - Analysis and development of new methods for application of gene functions
- #### Prioritized Areas
- Screening of new chemical materials for development of medicine
 - New methods for quality improvement of industrial products



Recent Attainments in Life Science 

C. Toyoshima and H. Nomura, "Structural changes in the calcium pump accompanying the dissociation of calcium," *Nature* **418** (2002) 605.

A key step on intercellular signal transduction
 The ATP molecule binding (ATP binding site: approx. 5Å apart from the calcium ion binding site) affects the change in comprehensive structure of the protein, and controls the dissociation of calcium

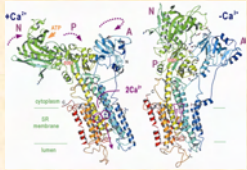
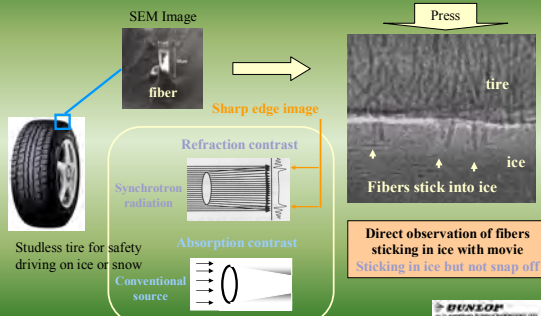


Fig. Structure of muscular calcium ion pump

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SPring-8 Direct Observation of Contact Behavior between Studless Tires and Ice by Refraction Contrast Imaging



SEM Image
fiber

Sharp edge image

Press


tire
ice
Fibers stick into ice

Refraction contrast
Synchrotron radiation


Absorption contrast
Conventional source

Studless tire for safety driving on ice or snow

Direct observation of fibers sticking in ice with movie
 Sticking in ice but not snap off



Kishimoto et al. ; The 6th SPring-8 Symposium Abstract 11 (2002).

 **SPring-8**

Examples of New Areas

- Construction materials
- Health-care products
- Active pharmaceutical ingredients
- Device development by hard X-ray photoelectron emission spectroscopy, etc.

Prioritized Areas

- Fuel cell
- Next-generation semiconductor device
- Flat panel display

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