IGORR 22nd & IAEA TM
15-19 June 2025
Mito, JAPAN

Activities of Nuclear Science Research Institute, JAEA

Nuclear Science Research Institute
Japan Atomic Energy Agency
MAEDA, Toshikatsu

R&D centres of JAEA

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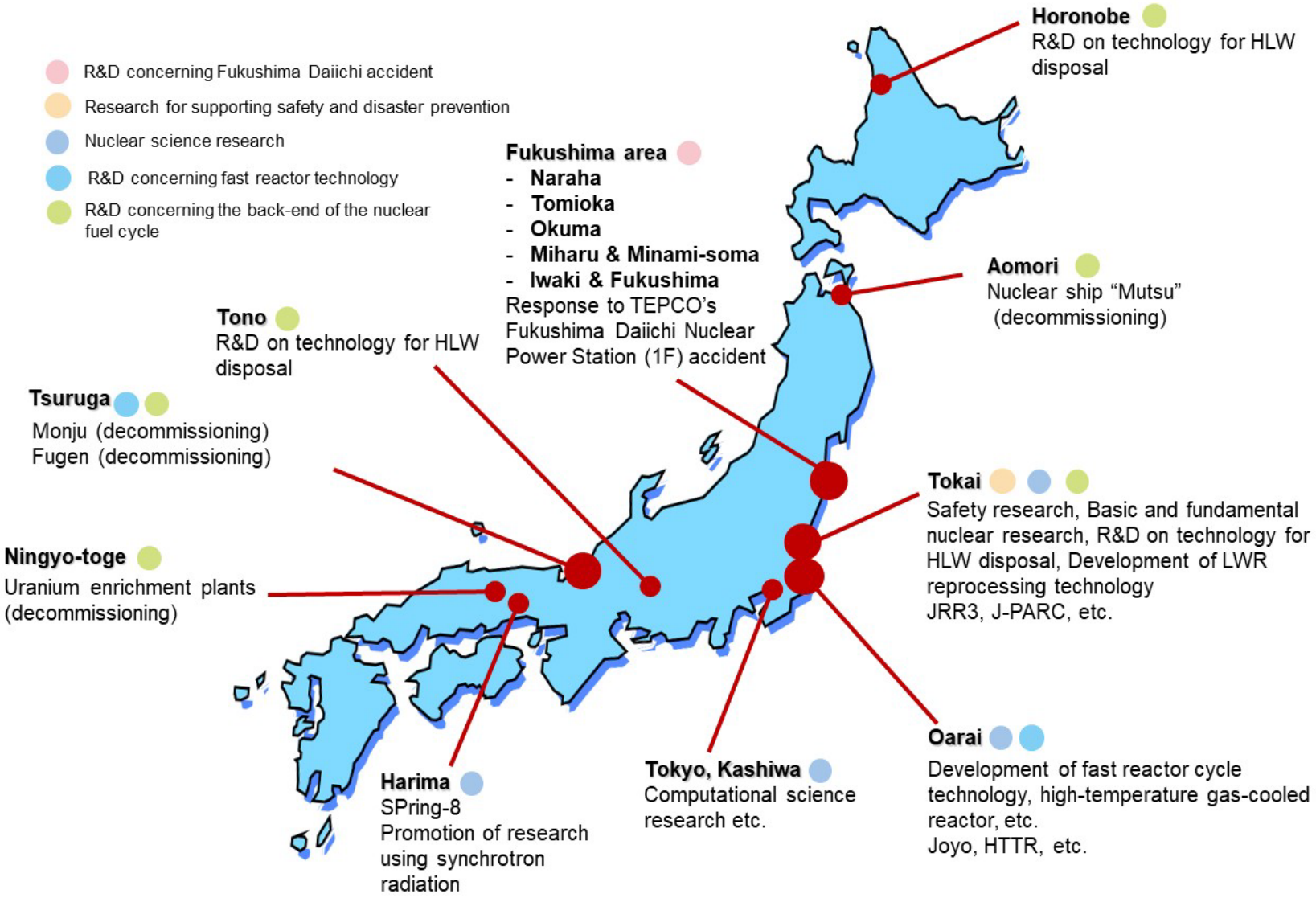
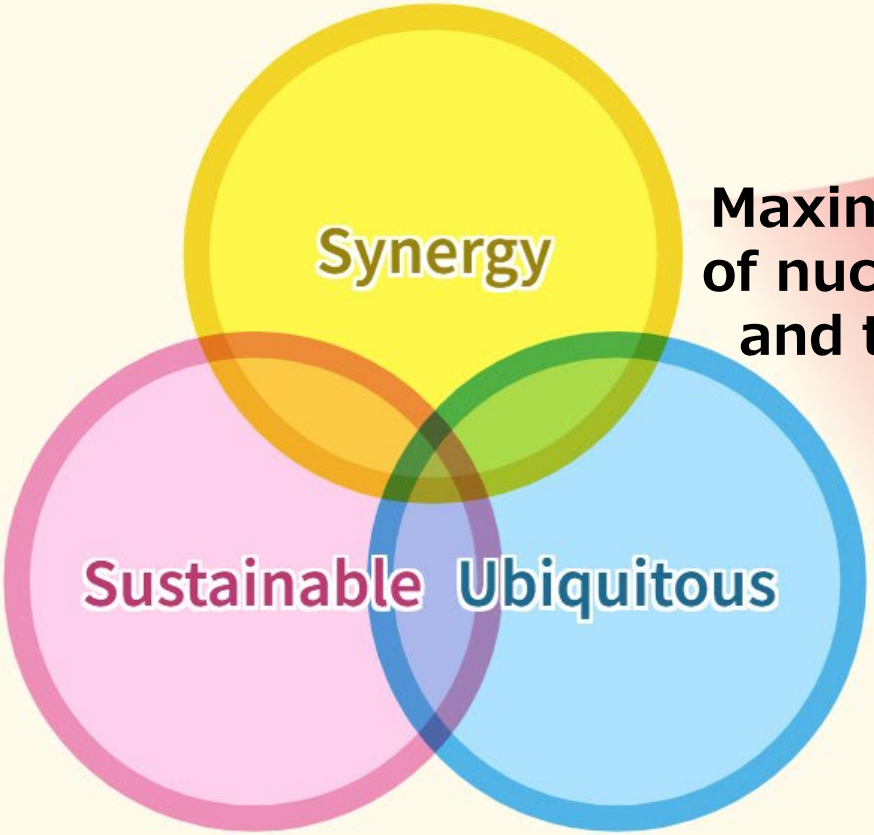
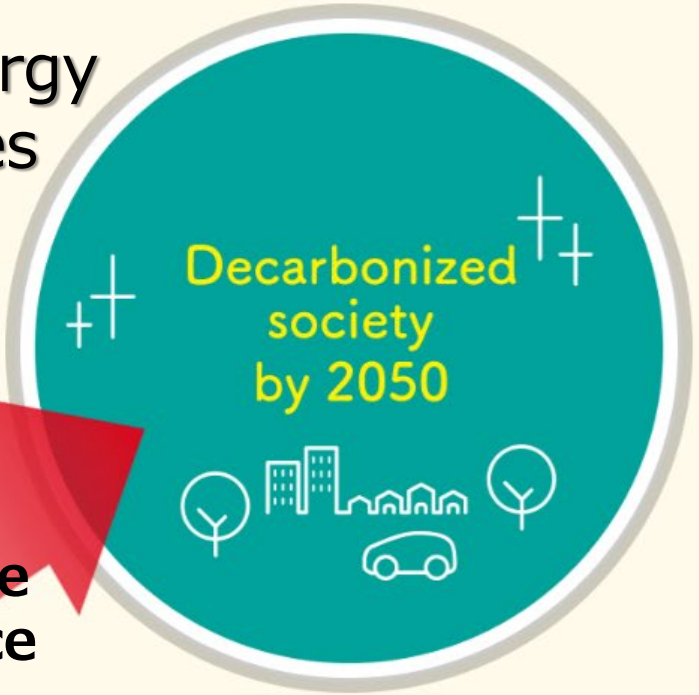


JAEA's Vision

Exploring the Future though the Synergy of **Nuclear** and **Renewable** Energies



Maximize the use of nuclear science and technology



Pursuing Synergy of Nuclear and Renewable Energies

Making Nuclear Energy Sustainable

Making Nuclear Technology Ubiquitous

R&D Using General-purpose Research Reactor JRR-3

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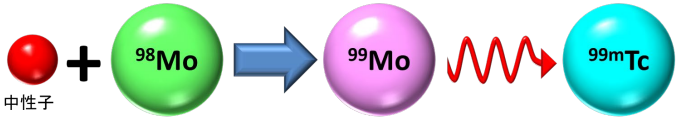
RI production for medical use

- Diagnostic use : Mo-99/Tc-99m
- Cancer treatment : Au-198,Ir-192,Lu-177



Making nuclear technology **Ubiquitous**

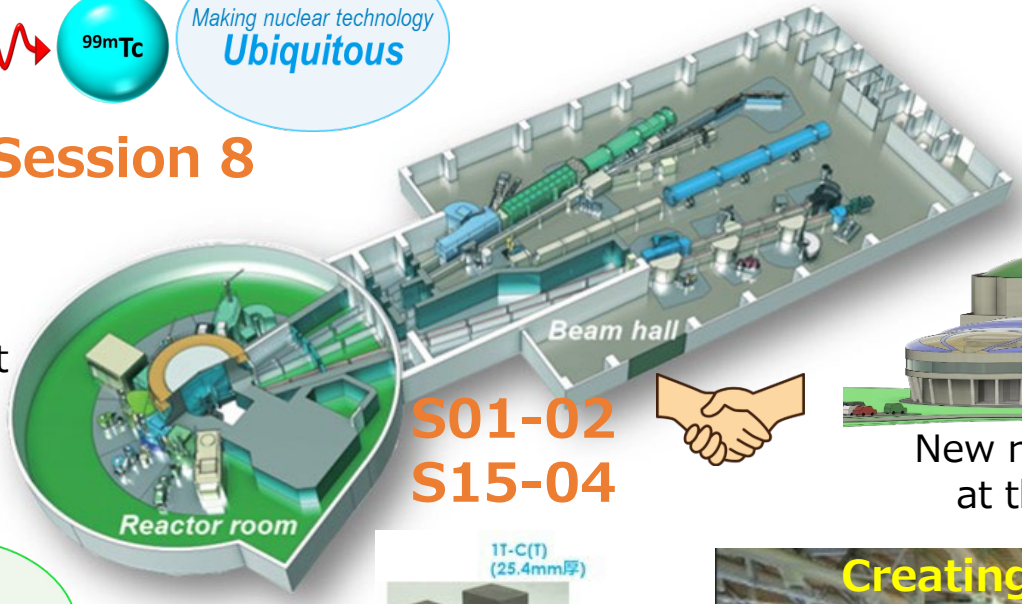
(Left)Tongue cancer treatment using Au-198
(Right)Oral cancer treatment using Ir-192

Contributing to technological development in diverse industries

Technical Tour on Thursday

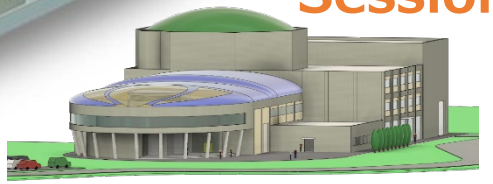
Making nuclear technology **Ubiquitous**

Session 8



S01-02
S15-04

Session 2



New research reactor at the Monju site

Making nuclear energy **Sustainable**

For LTO of NPPs

- Irradiate reactor materials with neutrons equivalent to over 60 years to determine the degree of embrittlement

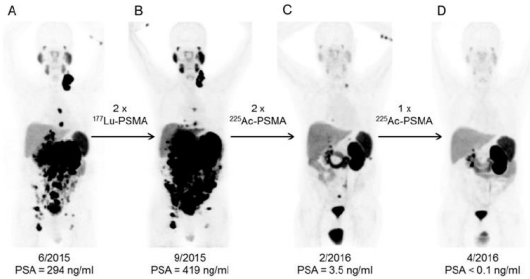
Assessing embrittlement by neutrons using miniature specimen neutron radiated

RI Production for Medical Use (Ac-225) by Joyo

Oarai R&D Institute

S03-02

S08-04



Efficacy of Ac-225*1

Experimental Fast Reactor: Joyo

- Joyo's high fast neutron flux and large irradiation capacity **enable large production capacity of Ac-225**
  - ✓ Demonstrates Ac-225 production by FY2026

*1 Kratochwil,Giesei, JNM (2016)

Enhancing LWR safety

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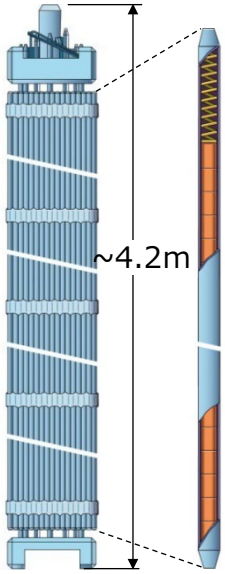
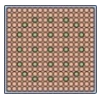
Making nuclear energy Sustainable



Fuel cladding



For PWR

[SiC/SiC Composite: for BWR, PWR]
- Toshiba ESS
- Hitachi GE/GNF-J

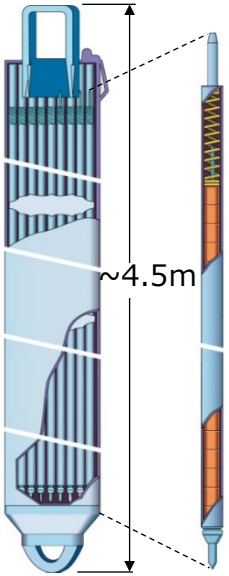
[Modified stainless steel: for BWR]
- Hitachi GE/GNF-J

[Coated-Zry: for PWR]
- MHI/MNF

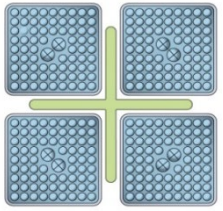
[ATF Common Fundamental Technology Development]

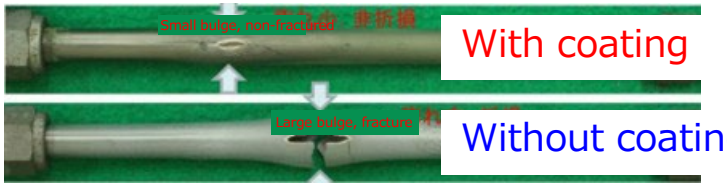
Alternative irradiation technology development

Overseas furnace irradiation tests
- **JAEA**



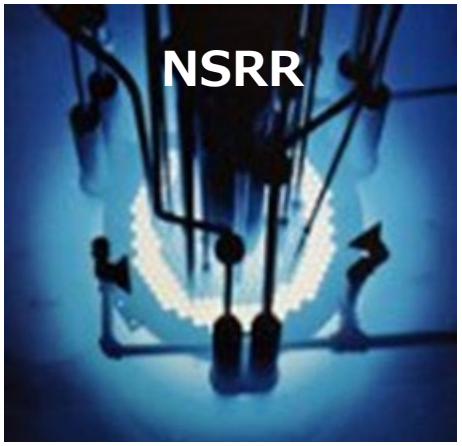
For BWR



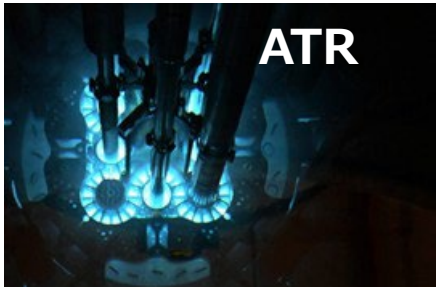


Fuel cladding after LOCA tests
(MHI Technical Journal Vol.57 No.4 (2020))

S06-03



Collaboration with INL



R&D for assessing conditions inside 1F reactors

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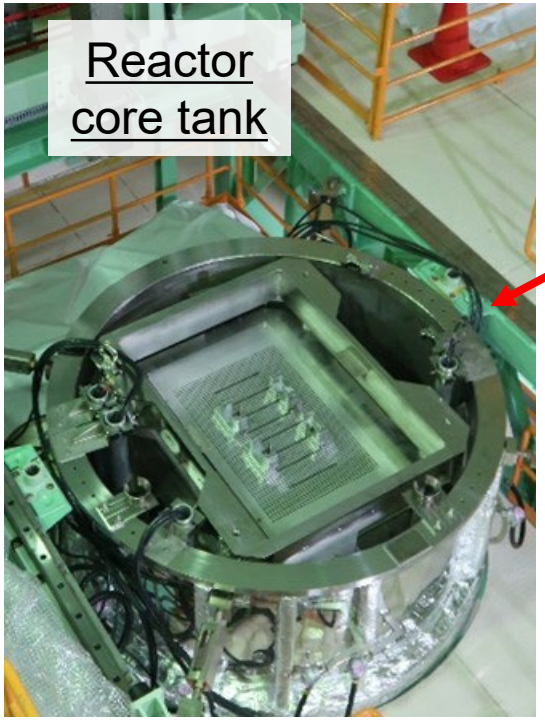
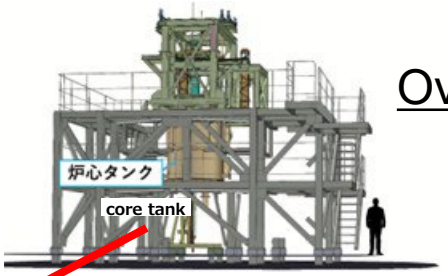
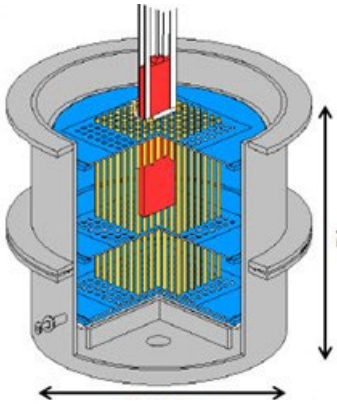
Making nuclear energy Sustainable

S10-02





Overall



Structure of tank interior

Height 1.9 m

Diameter 1.8 m

Static Experiment Critical Facility STACY

The world's most advanced beamline for synchrotron X-ray spectroscopy experiments on trans-uranium elements

Technical Tour on Thursday

Utilization of valuable resources lying in Japan
- Our new Project -

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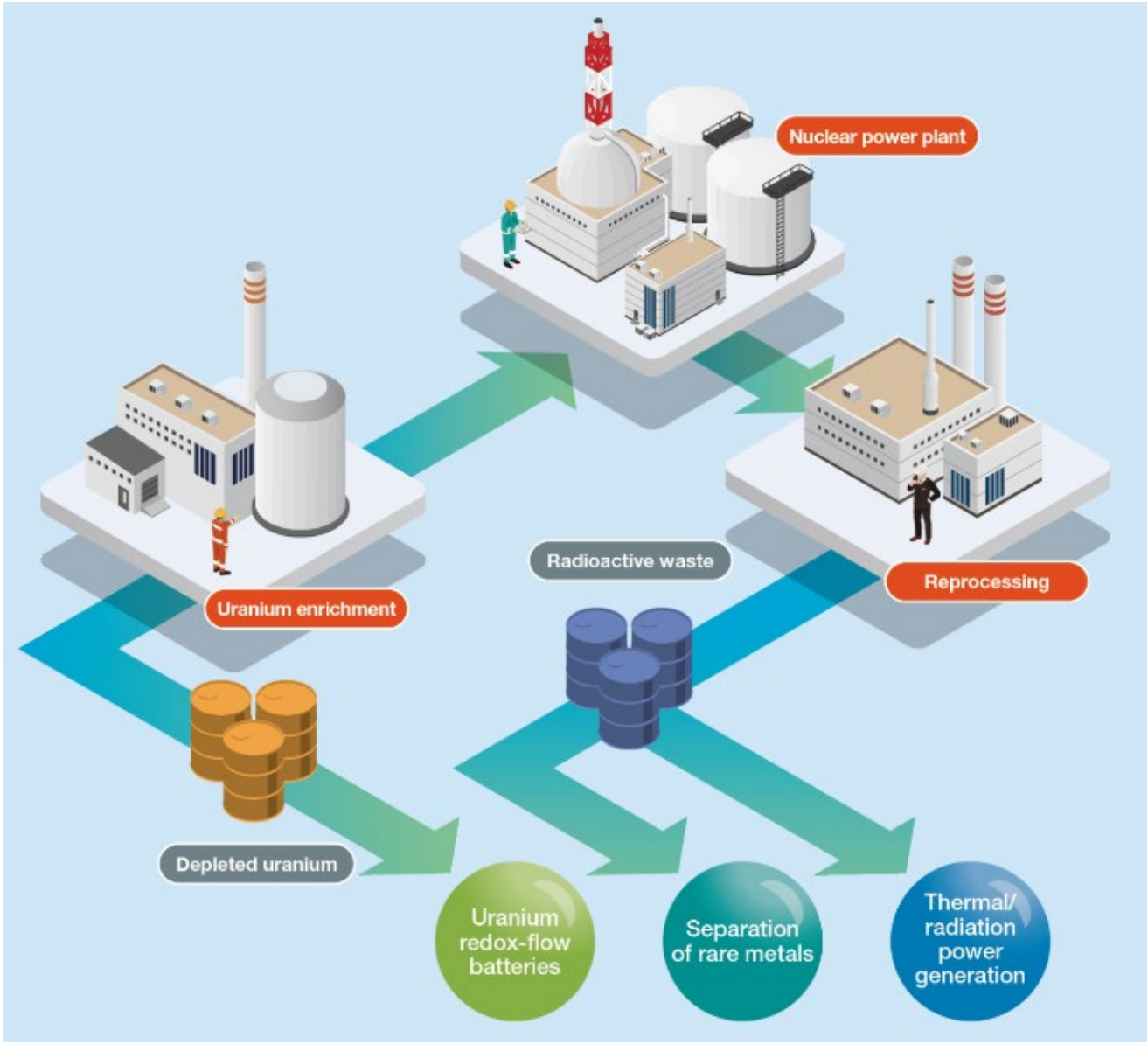

Pursuing nuclear-renewable
Synergies

Making nuclear energy
Sustainable

Making nuclear technology
Ubiquitous

R&D for Uranium redox-flow batteries

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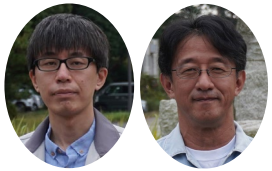
Developing **uranium storage battery** that can store and generate electricity by the ionic reaction of uranium

Pursuing nuclear-renewable **Synergies**

Utilizing **depleted uranium**

Uranium redox-flow (URF) battery

- Large-capacity energy storage; 30 MWh with 650 tones of uranium
- No deterioration even after repeated charging and discharging



Dr.Ohuchi & Dr.Watanabe

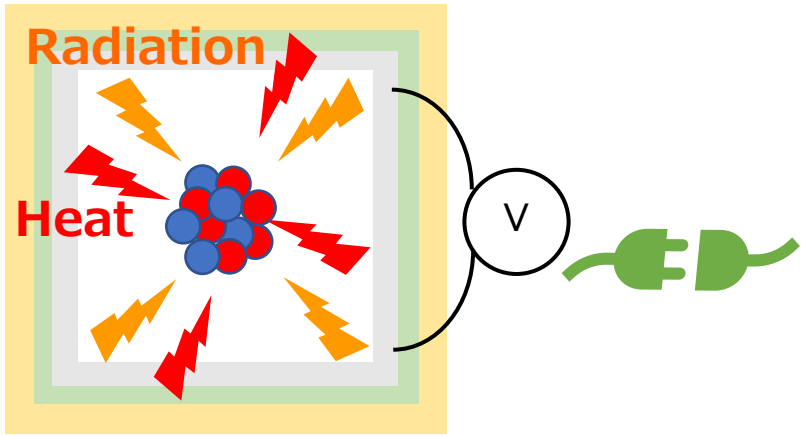
Successful charge & discharge using uranium solution (2024)

R&D for thermal/radiation power generation

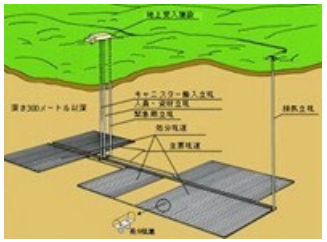
Create **semi-permanent power sources** that can be used in harsh environments that are not easily accessible by humans

Making nuclear technology Ubiquitous

Exothermic RI separated from radioactive waste



Dr.Ban & Dr.Takano



Power Supply for Extreme Environments

- For heat insulation/signaling of instruments in extremely cold regions and deep sea
- For in-situ monitoring equipment at geological disposal sites
- Heat insulation/power source for equipment of deep space probes under weak sunlight

Power source for critical infrastructure in emergency

Developing Human Resources for Nuclear Utilization

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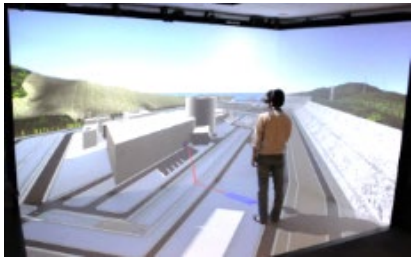
Making nuclear energy
Sustainable

Driving practice with NSRR

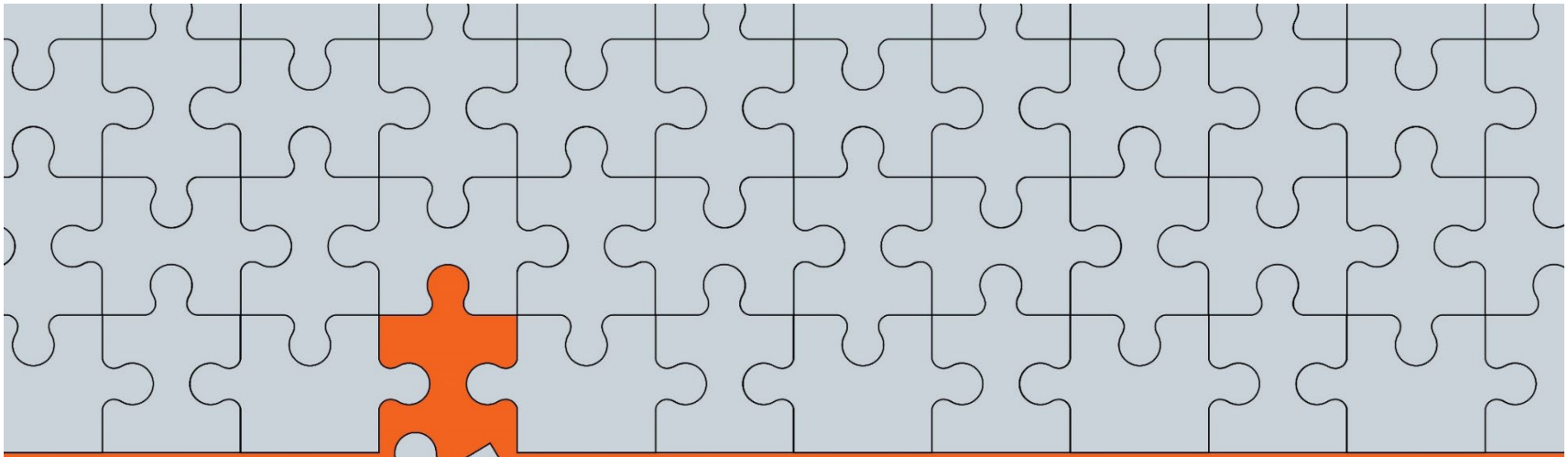
Neutron beam experiments at JRR-3



VR-based nuclear material protection and safeguards exercises

Outdoor radiation measurement practice

With Philippine nuclear research institute

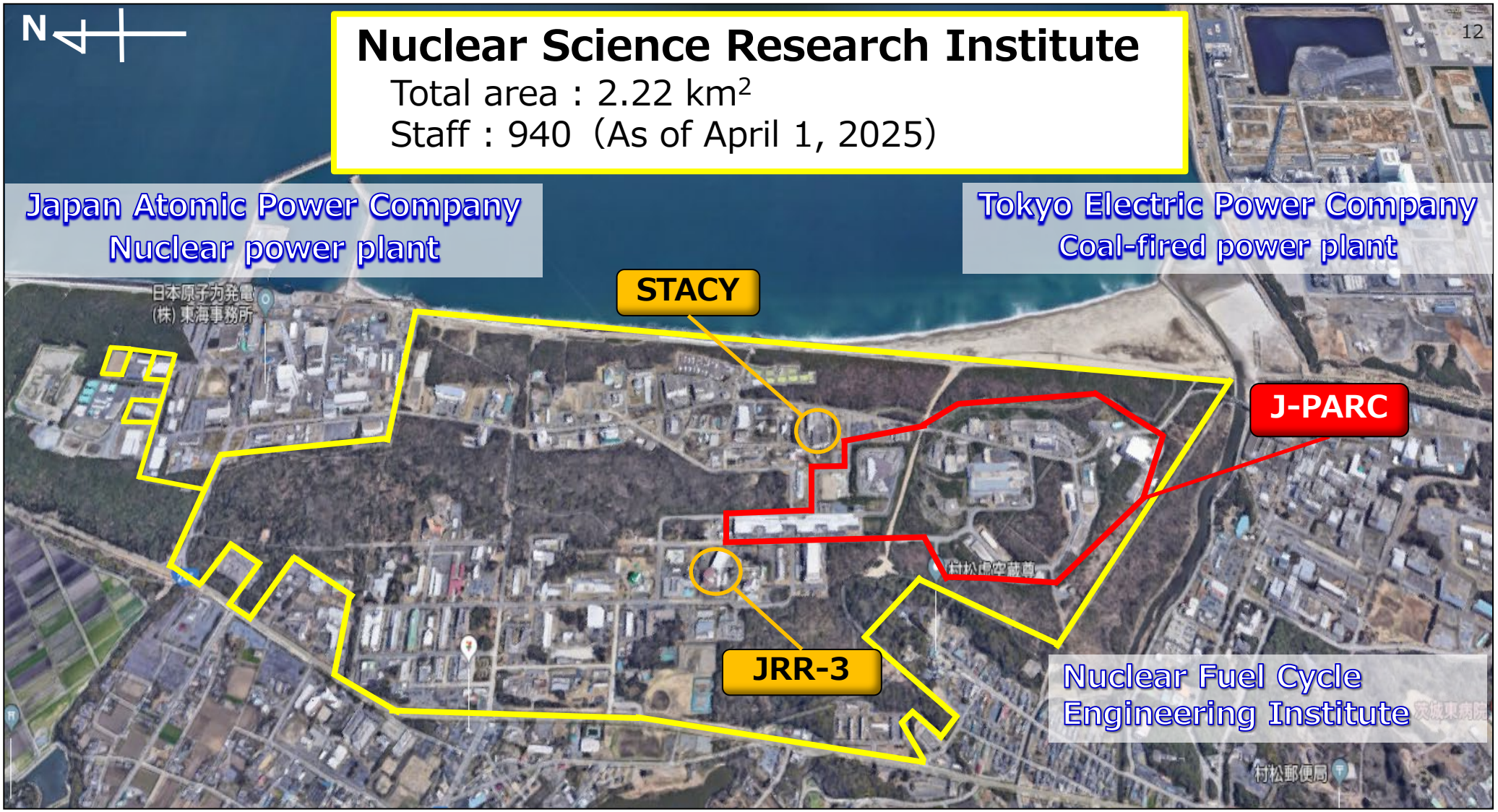


Das war die Hauptsache!

これが眼目だったのか！

JAEA GVision
原科研ビジョン

Enjoy NSRI Technical Tour on Thursday ! -JRR-3 and STACY-



Appendix

R&D centres in the Ibaraki region

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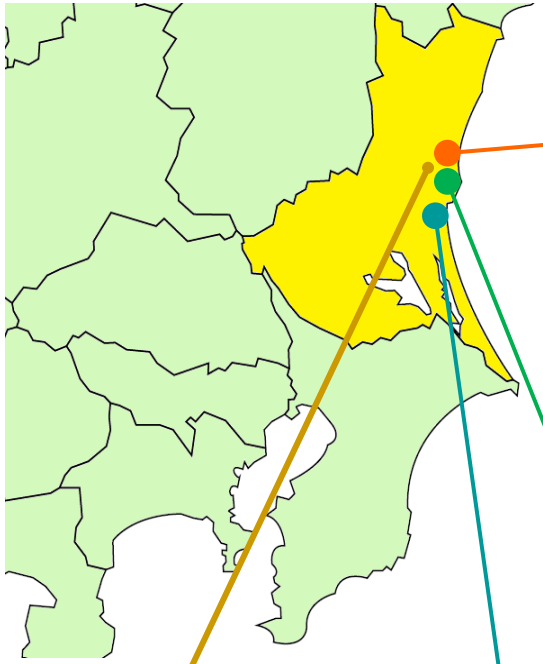
(Staff numbers as of R6.4.1)



Nuclear Science Research Institute (950 staff)

Basic nuclear energy research, advanced nuclear science research, material science research, operation of large research facilities and related technical developments, treatment and disposal of radioactive waste and related technical developments, research towards decommissioning of the F1, etc.

J-PARC (124 staff)

Nuclear Fuel Cycle Engineering Institute (622 staff)

Development of reprocessing technology, development of MOX fuel fabrication technology, development of technology for waste treatment and disposal and decommissioning, research for decommissioning of the Fukushima Daiichi Nuclear Power Plant, etc.

HQ (301 staff)

Core functions related to the operational management and business promotion of the corporation .

Oarai R&D Institute (508 staff)

Research and development of **high-temperature gas-cooled reactors** and heat utilisation technology, research and development on **fast reactor** cycle technology, decommissioning and technology development of material testing reactors, technology development related to decommissioning and radioactive waste treatment and disposal, research towards decommissioning of the Fukushima Daiichi Nuclear Power Plant, etc.

R&D using the world's top output beam※ at J-PARC

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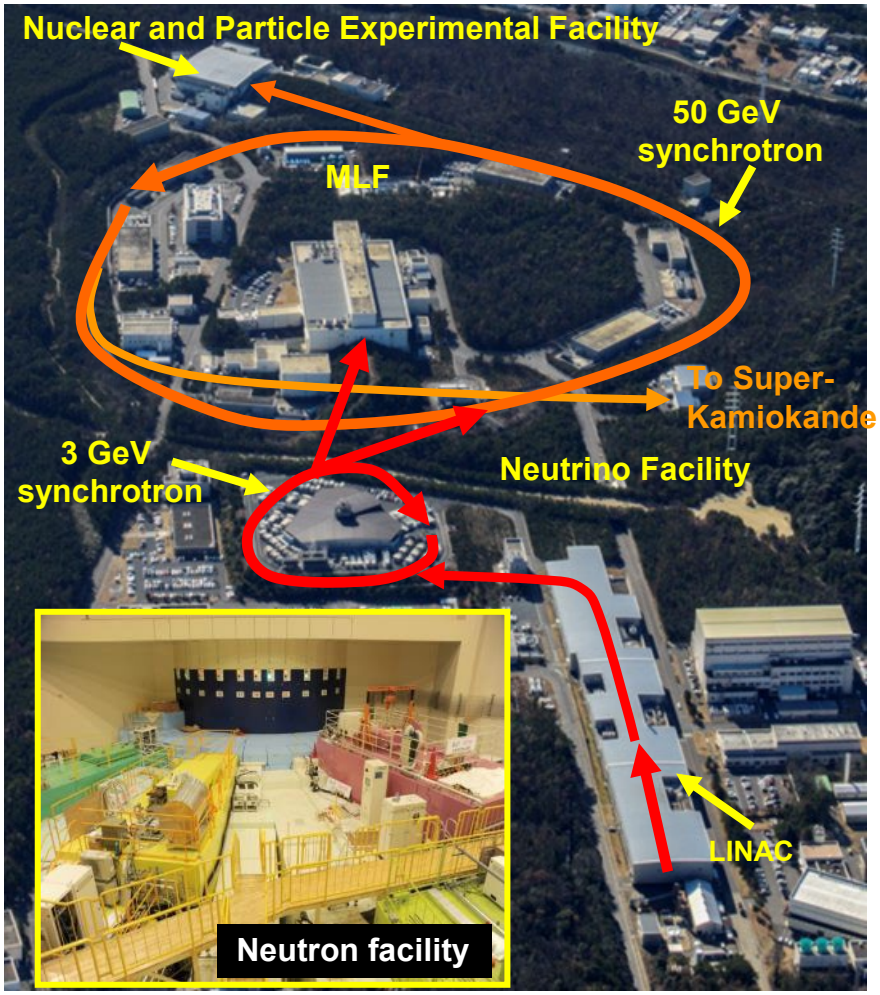
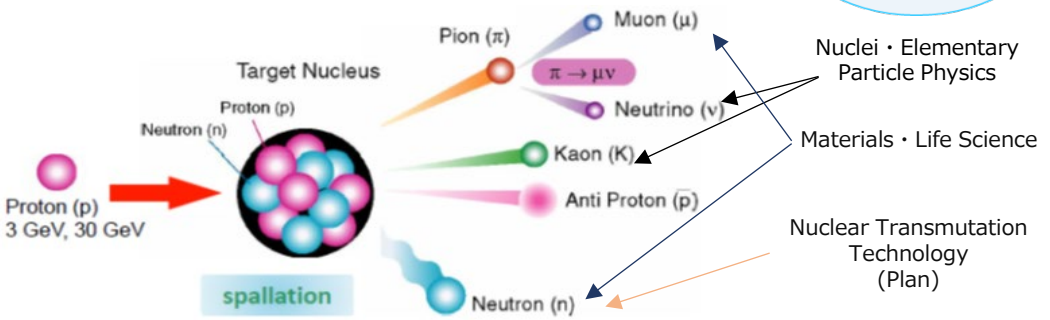


Japan Proton Accelerator Research Complex

Making nuclear technology Ubiquitous



Variety of secondary particles generated with high-energy and high-intensity protons

- Searching for the origin of matter and life
  - Search for new neutrino
  - Elucidation of the origin of mass
  - Verification of particle-antiparticle symmetry breaking
- Supporting various R&D from Scientific basis to industrial applications

*A wide variety of secondary particle beams, including neutrons, muons, K mesons and neutrinos, produced by the world's highest class proton (1MW) beam.

DX technology for nuclear energy system development

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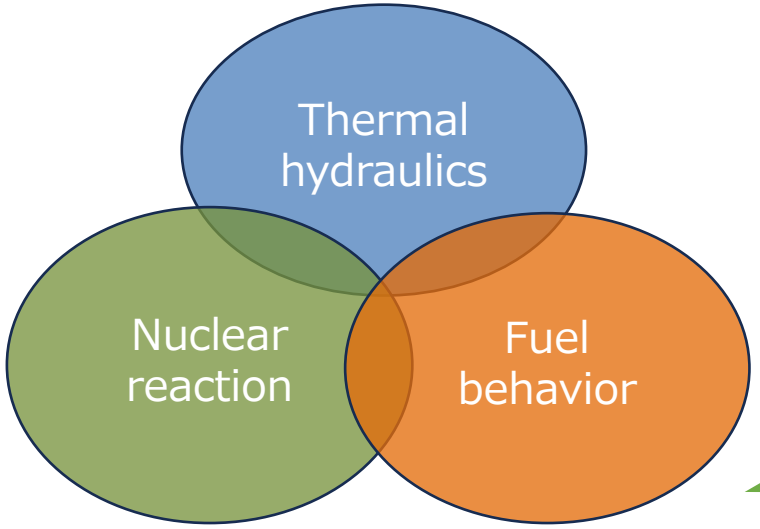
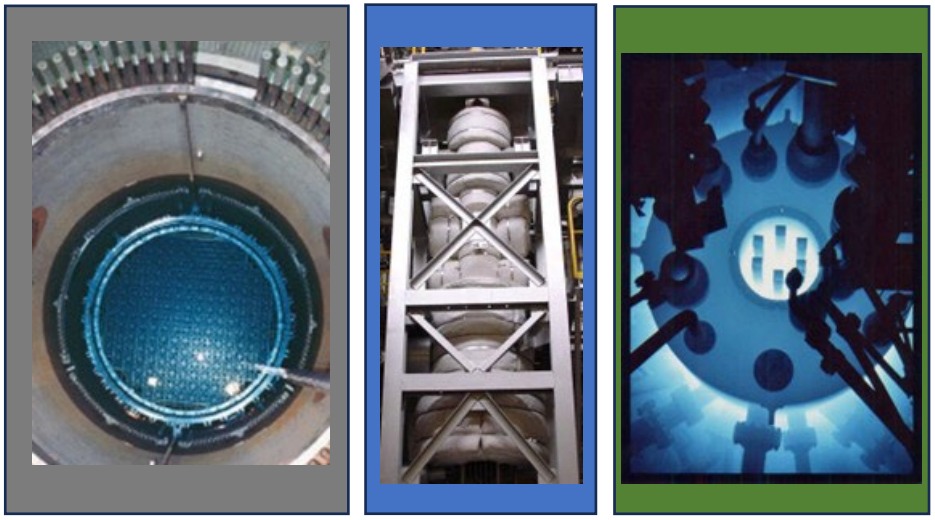
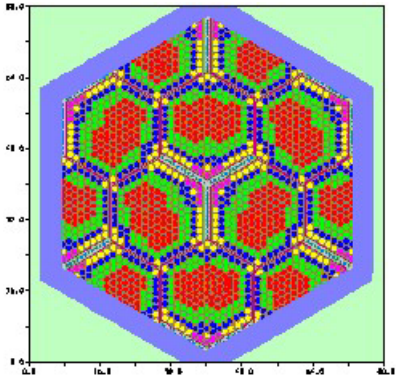
Making nuclear energy Sustainable



Reactor physics | Thermal hydraulics | Irradiation





Virtual space simulation with coupled multiple physical phenomena

Real-space data acquisition using large-scale test facilities

Minimising the use of large scale testing facilities

Simulation of various radiation behaviors in any material

Fundamental Technologies

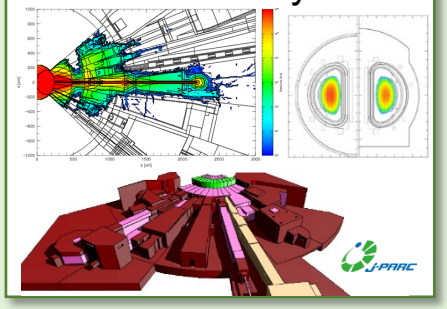
- **Computer Science**: OpenMP, MPI
- **Nuclear & Atomic Data**: JENDL, EGS5
- **Nuclear Reaction Model**: JQMD, JAM, INCL, SMM
- **Human modeling**: Mesh phantom
- **Induced Activity**: DCHAIN-PHITS

PHITS

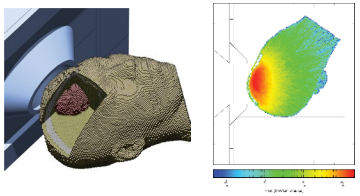
Monte Carlo code for analyzing the motion of nearly all radiations in 3D matters

Application Fields

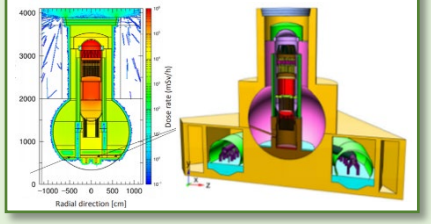
Facility Design
- Accelerator (J-PARC etc)
- Fusion (JT-60 etc.)
- Medical facility



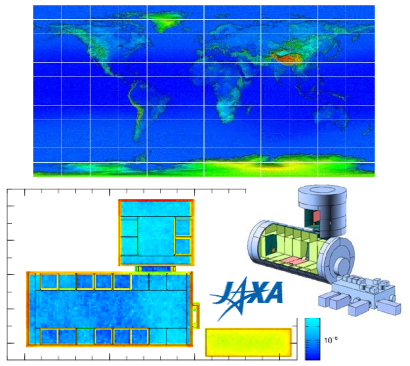
Medical Physics
- Particle Therapy
- BNCT
- Nuclear medicine
- Diagnostic dose



Radiation Protection
- Conversion Coefficient (ICRP116,123,144)
- Nuclear accident

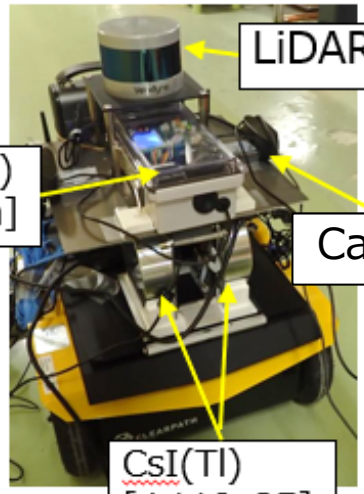


Geosciences
- Air shower simulation
- Cosmic-ray dose

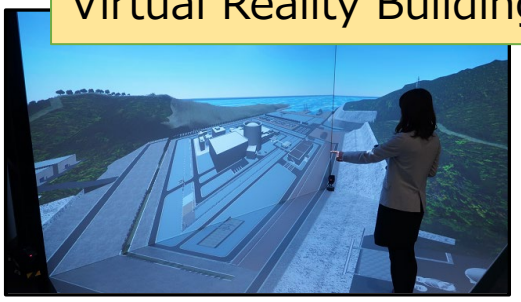


PHITS has been used in more than 60 countries for various applications

Strengthening nuclear nonproliferation and security



3D mapping technology with a radiation detector

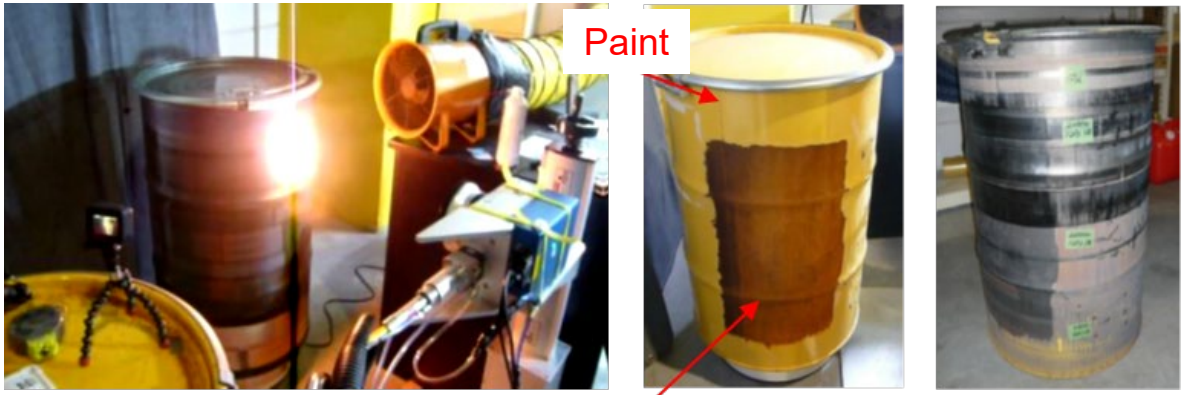


Practical, hands-on training facilities: the ISCN training field

Detecting nuclear tests by observing radioactive xenon in the atmosphere (SAUNA III)

Accelerate decommissioning

Example of equipment demolition (glove box)



Laser irradiation test Before ▸ After

Reuse of drums
by laser-assisted rust removal