

Industrial Application of Neutron at JRR-3 & J-PARC

- Current Status of JRR-3
- Trial Use of Neutron
- J-PARC Project

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Neutron Science Facility at JRR-3

JRR-3M: 20MW, 3×10^{14} n/cm²s, CNS, 175 days/year

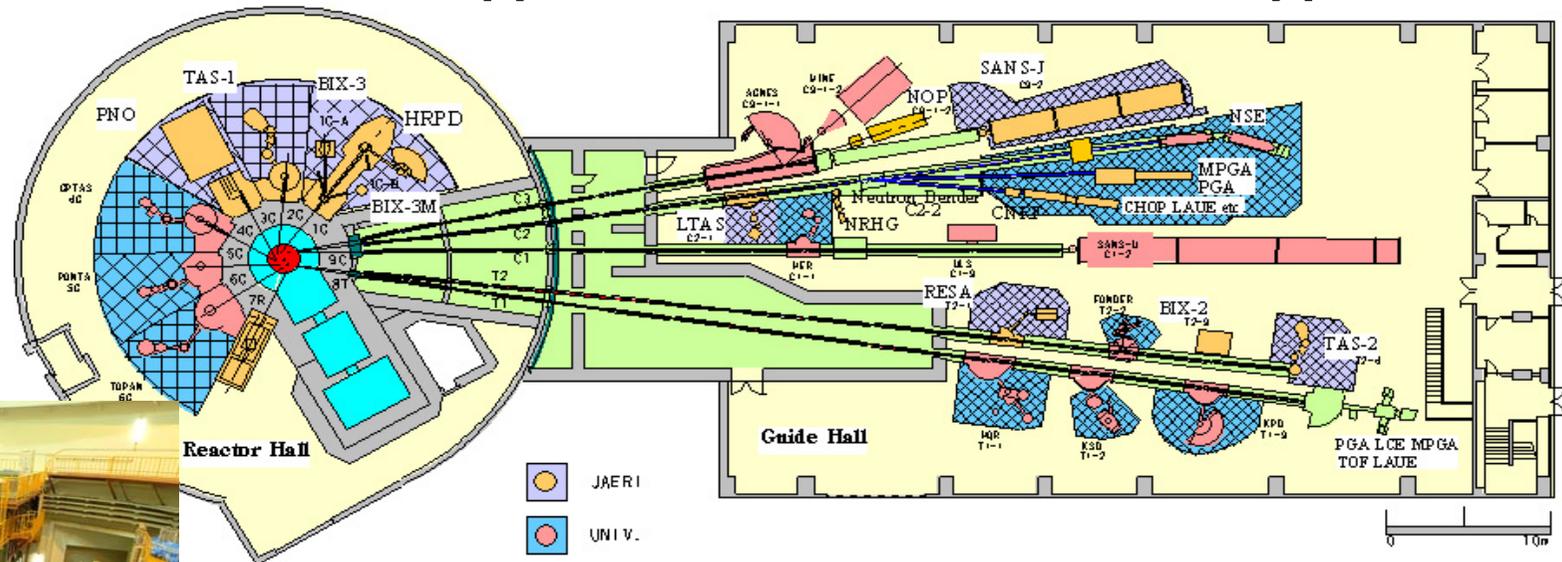
NS: 25 instruments (14 University's + 11 JAEA's)

PGA: 2 instruments (JAEA's) NRG: 2 instruments (JAEA's)

IRRADIATION FACILITY: 1 vertical hole (JAEA's)

RESEARCH FIELD:

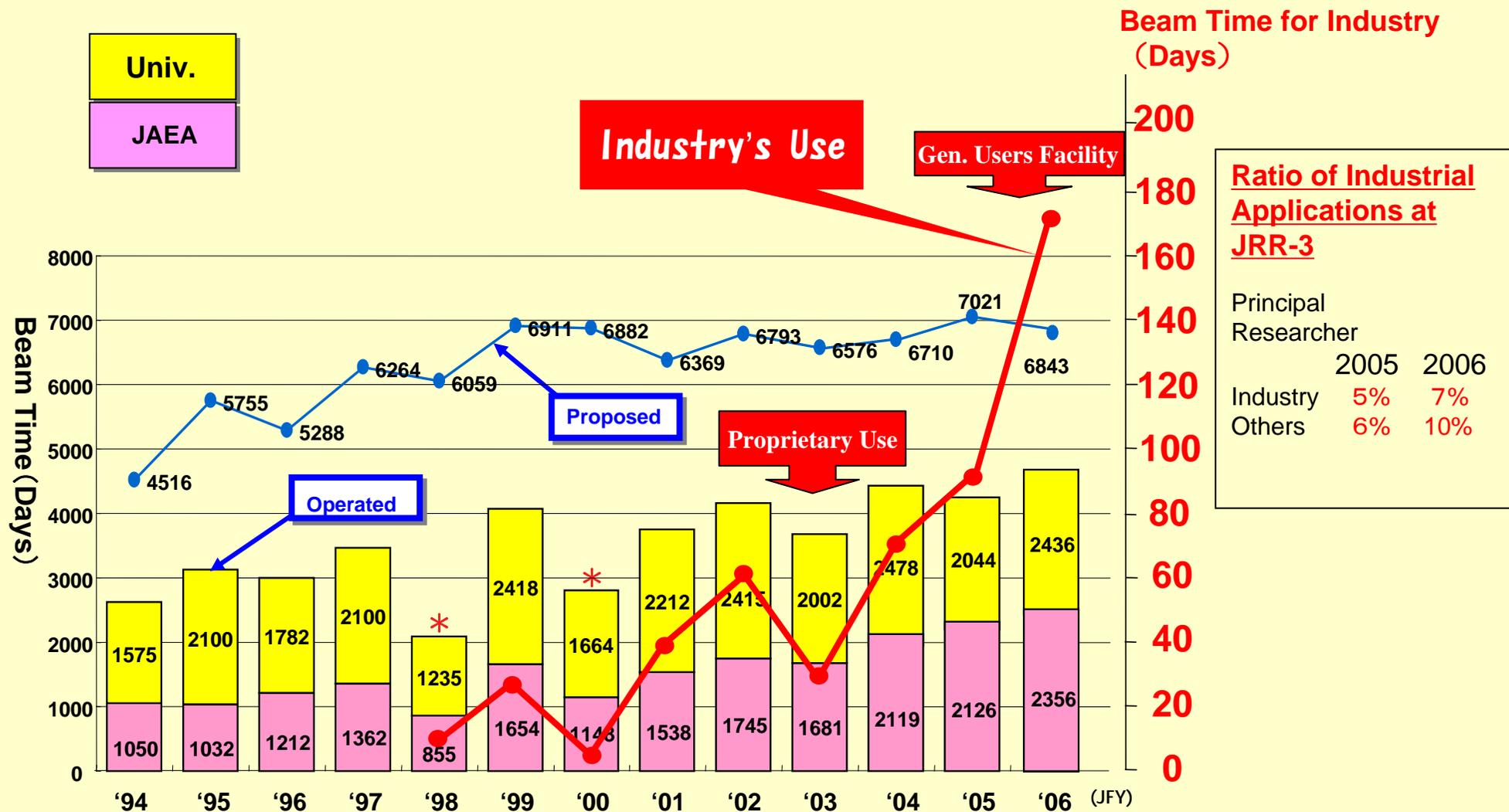
- Physics, Chemistry, Biology, Medicine, Materials Science, Engineering
- Basic, Applied Science and Industrial Application



JRR-3 Beam Experimental Facilities

Demand for Neutron Beam Time at JRR-3

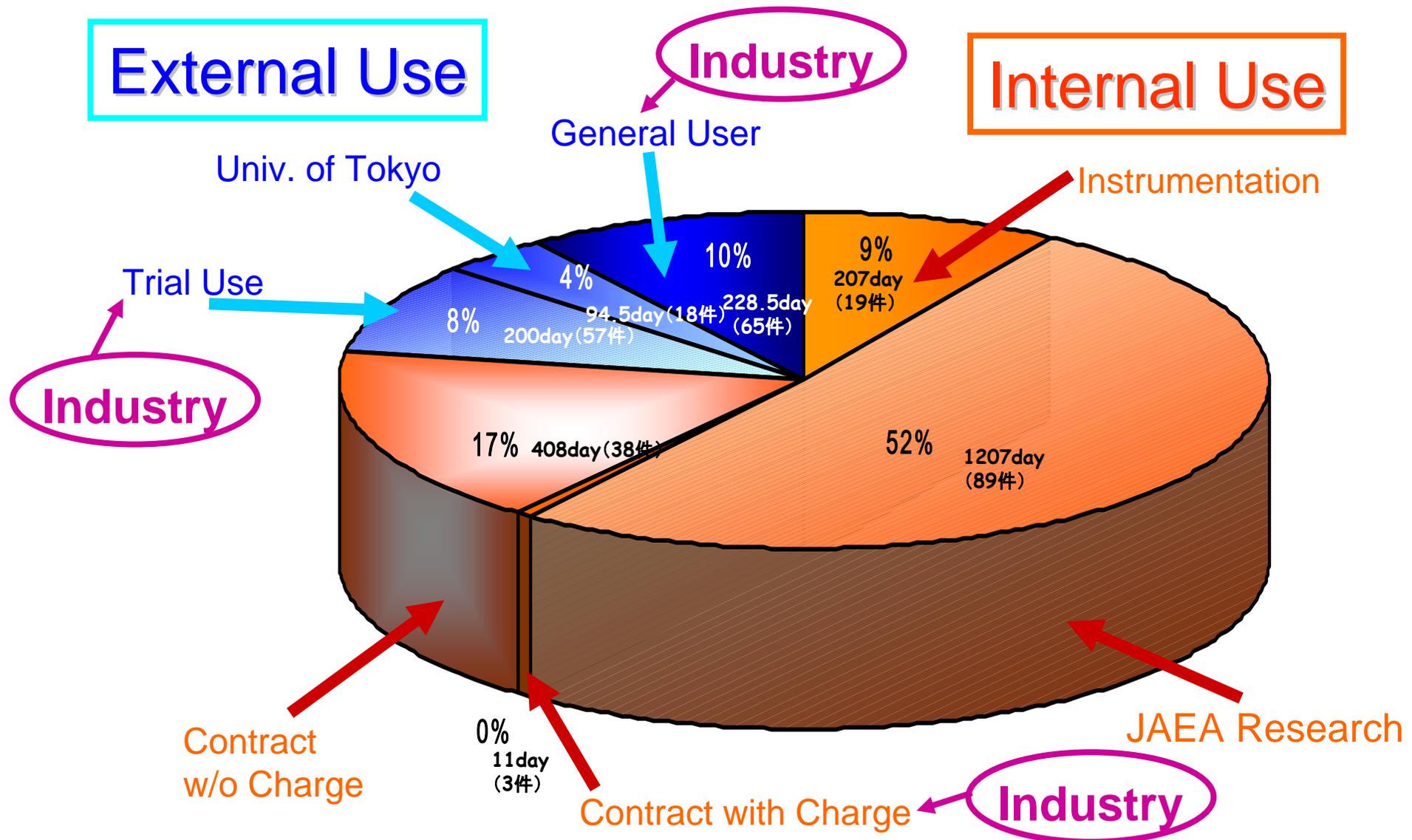
(NS: since 1994, PGA: since 2004, TNRF: since 2005)



*長期間の原子炉停止により稼働日数が低減

Access to JAEA Instruments at JRR-3

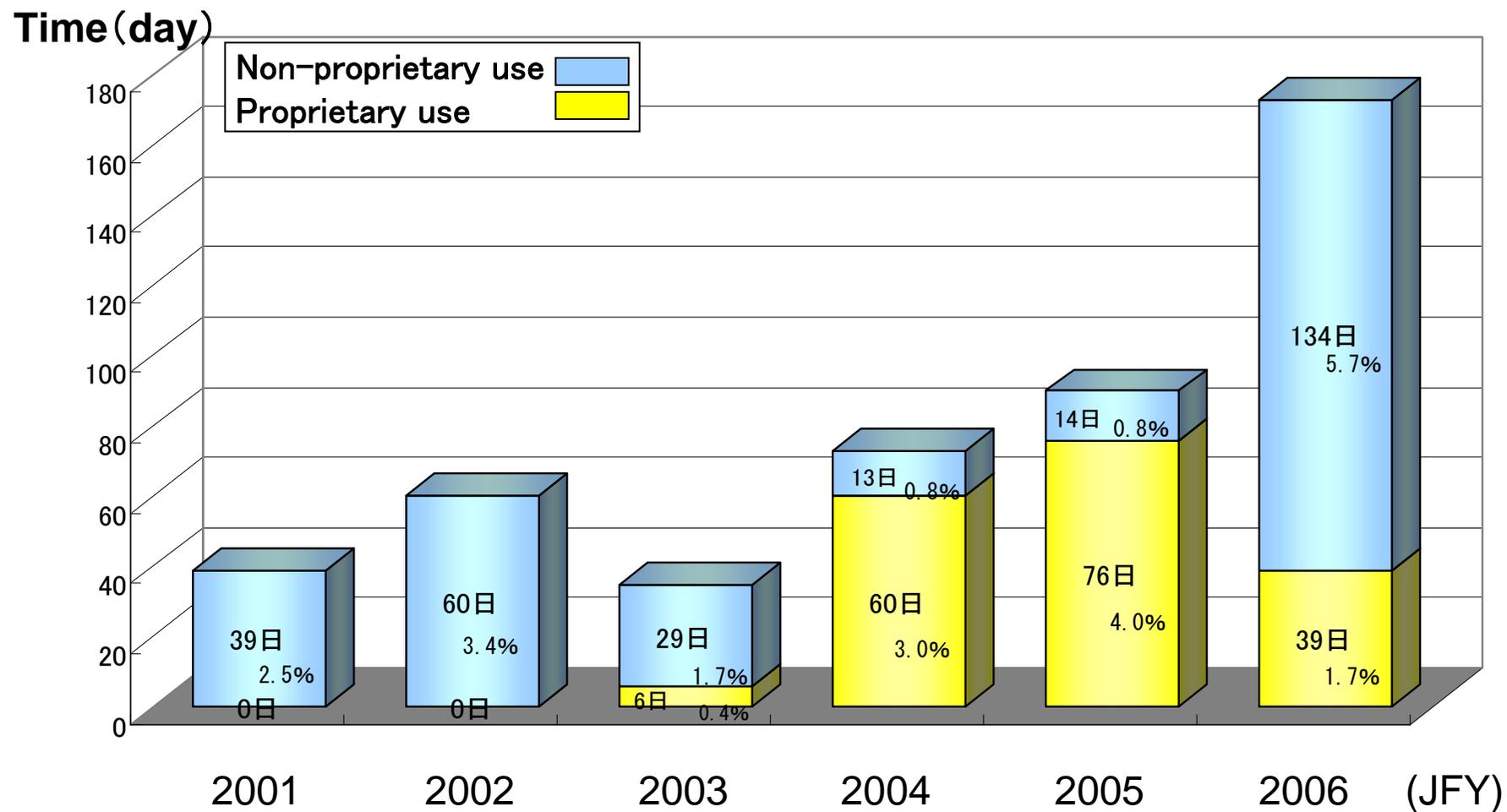
(Total Machine time: 2,356 days, 15 instruments, JFY 2006)



Industrial Application of Neutron at JRR-3

(Assigned Machine Time at JAEA Instruments)

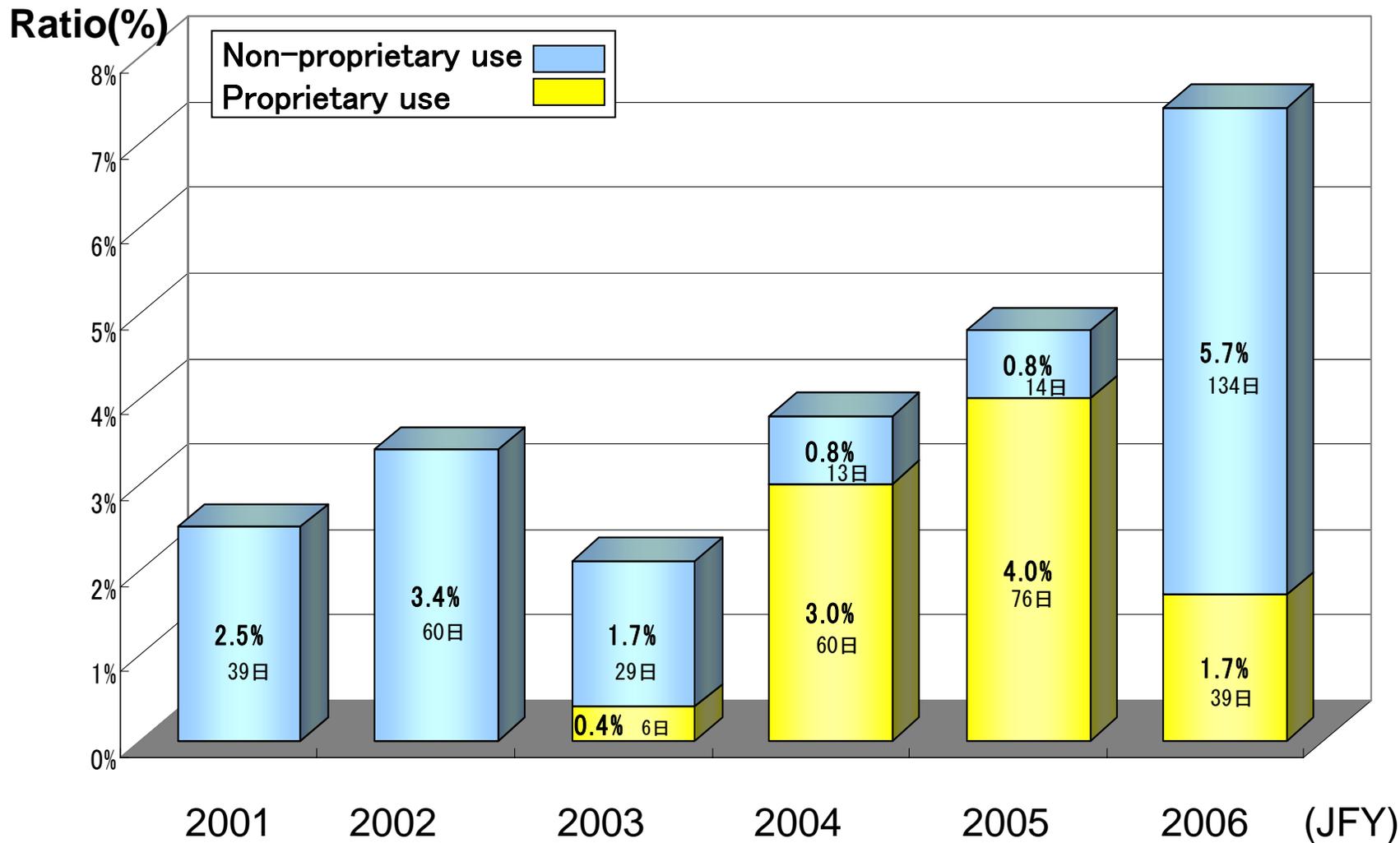
(Principal researcher is industry person.)



Industrial Application of Neutron at JRR-3

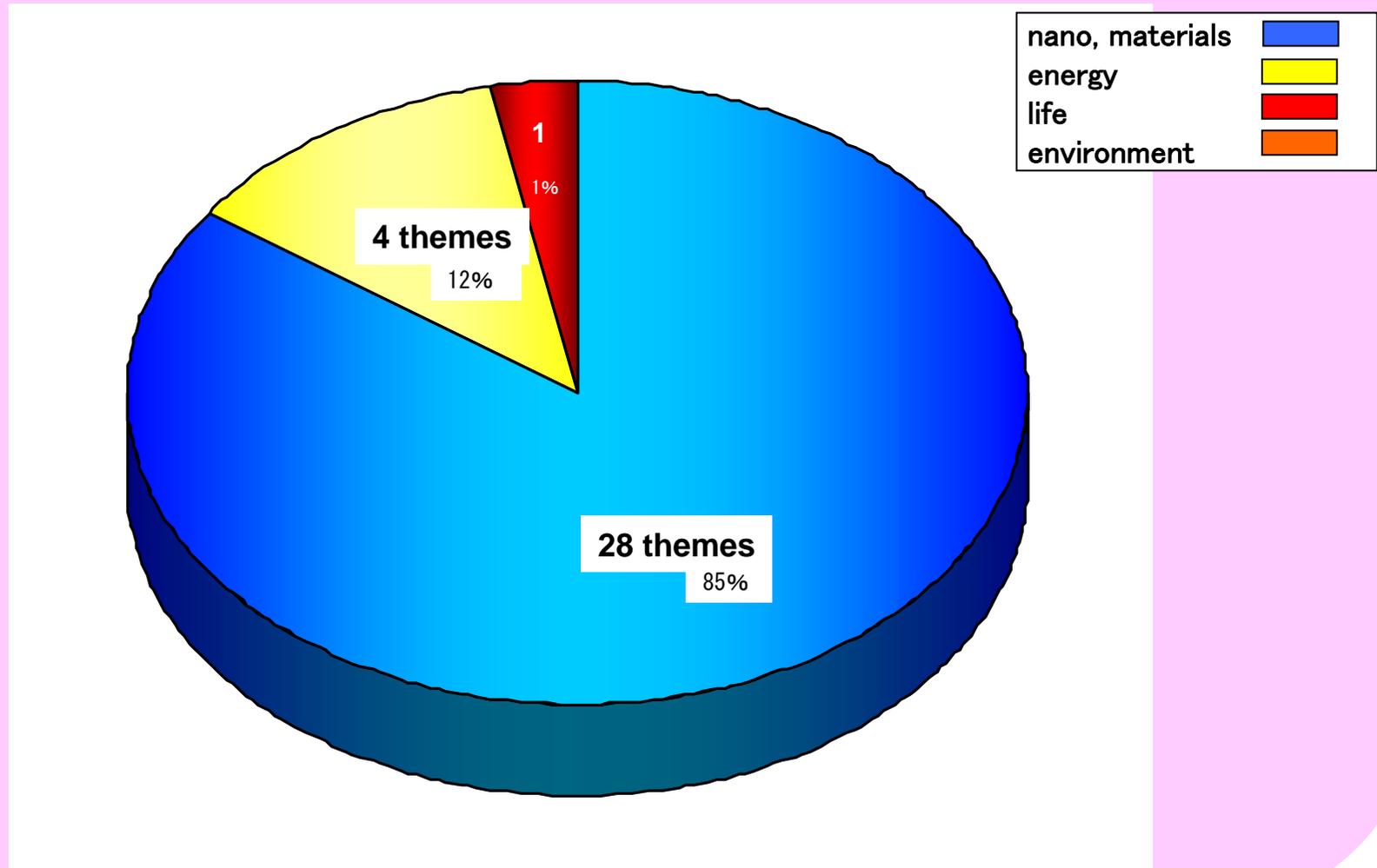
(Ratio of the Assigned Machine Time at JAEA Instruments)

(Principal researcher is industry person)



If the proposals which have industrial persons as members are included, the ratio was increased to 10% in 2006.

Fields of Industry in Neutron Application at JRR-3 (JFY 2005, JAEA Instruments)

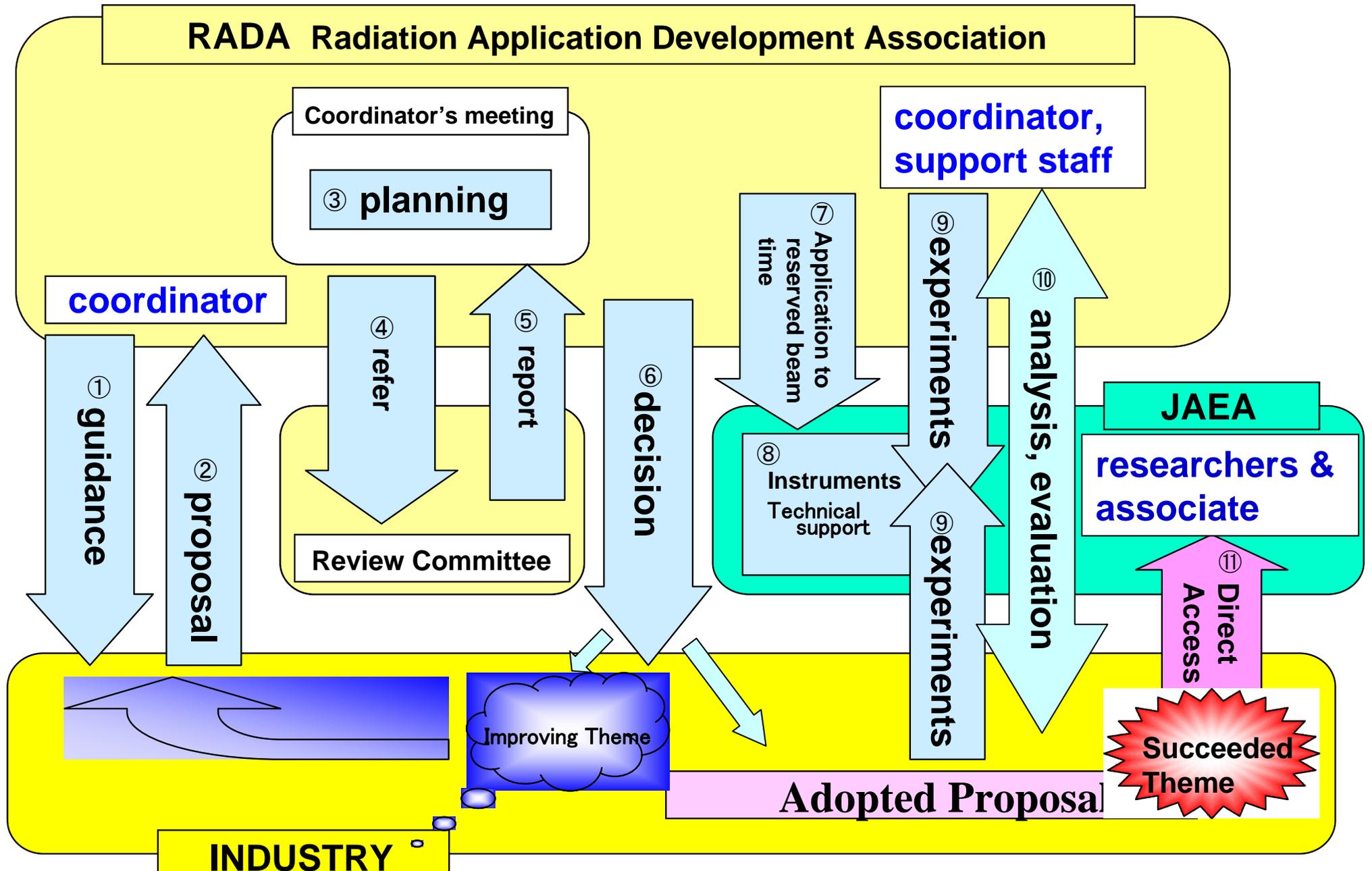


Neutron Trial Use at JRR-3 (2006-)

purpose: promotion of industrial neutron application

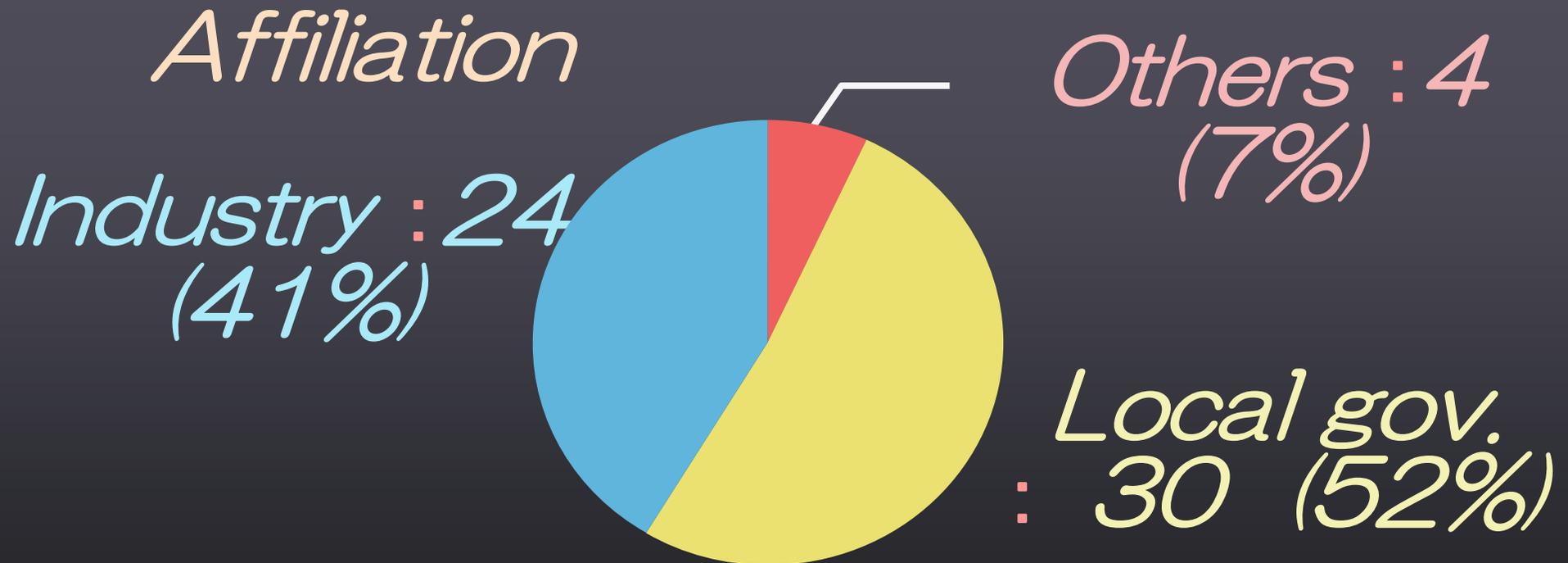
- applicant: industry & local government in the area of nuclear plant**
- call for proposal: twice a year & any time**
- technical support: from seeds to fruits by contracted coordinators and two supporting staffs in RADA, and researchers & two research associates in JAEA**
- financial support: given to everything except travel and sample (User's cost is almost nothing. RADA pays to JAEA for the beam time and the technical supports. MEXT funded.)**
- number of adopted proposal: 58 in JFY2006**
- beam time used: 207 days with 15 JAEA instruments in JFY2006**
- topics of result: residual stress analysis of weld in boiler tube and carbonated iron surface, structural analysis of fluorescent nitride, structure analysis of skin cell, NRG image analysis of turbo molecular pump, heavy metal analysis of agricultural products**
- result: open to public for next promotion**

Procedure of the Neutron Trial Use



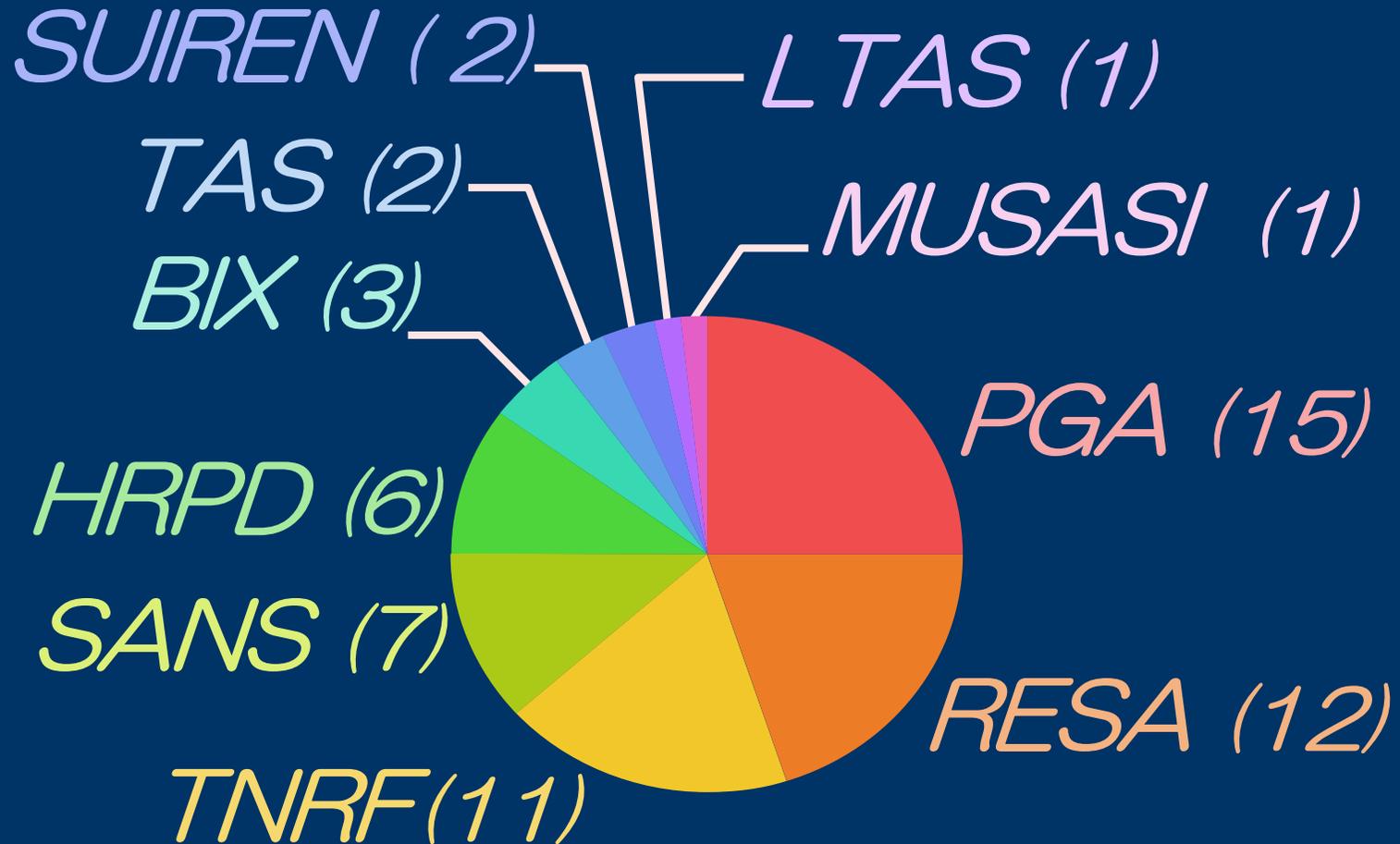
Applicants of Trial Use in 2006

▲ Total # of proposal : 58



• industry' commitment : 40 (68%)

Instruments used in 2006



*Total # of proposal : 58
(some used more than 1 instrument)*

Machine Time used in 2006

<i>instrument</i>	<i>planned</i>	<i>1st half</i>	<i>2nd half</i>	<i>Total days</i>
TAS-1	4	5	3	8
LTAS	—	5	0	5
HRPD	26	16	3	19
RESA	40	28	12	40
SANS-J	20	8	8	16
BIX-3	20	0	2	2
BIX-4	20	0	31	31
TNRF	40	11	19	30
PGA	40	13	21	34
SUIREN	—	—	15	15
MUSASI	—	—	7	7
合計	210	86	121	207



NRG Image of Water in Concrete Buildings

T U (1) 2006 Ibaraki pref. and Building Research Institute

Purpose

- **Study on water effects to reinforced concrete (iron corrosion)**
- **Technical development of crack repairing of concrete buildings**

NRG experiment

- a concrete block (100X100mm², 20mm in thickness) with a crack

result

one image / minute
space resolution : 100μm

⇒

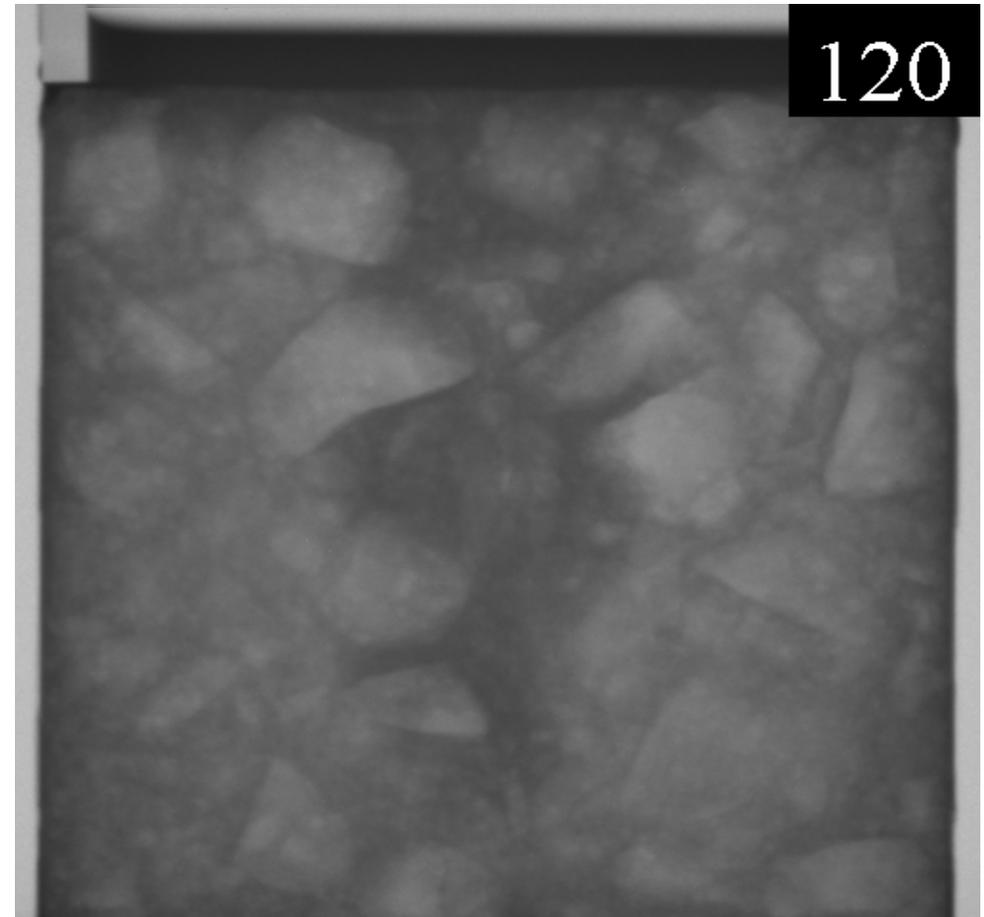
Gravity should be taken into account !

Further experiment

- Analysis of water behavior in the concrete block
- Quantitative analysis of water

Application

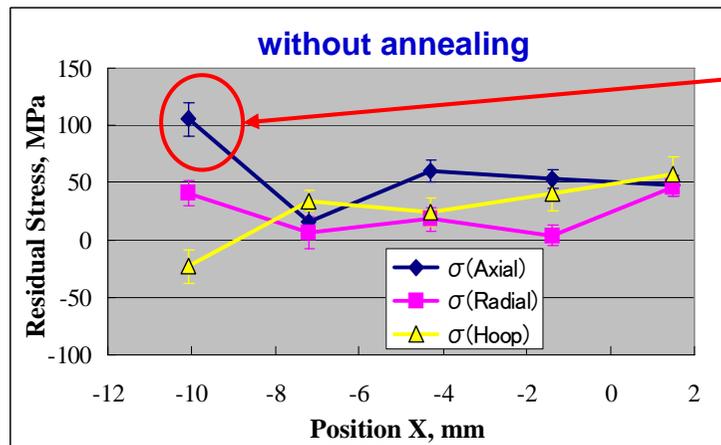
- **Evaluation of crack repairing method for reinforced concrete buildings**



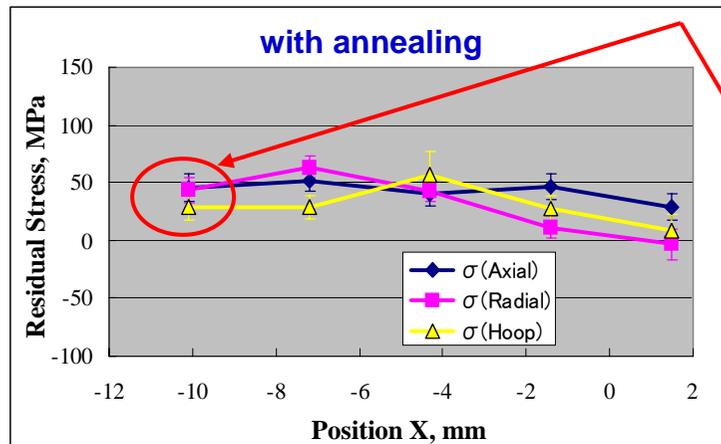
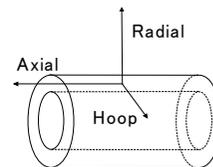
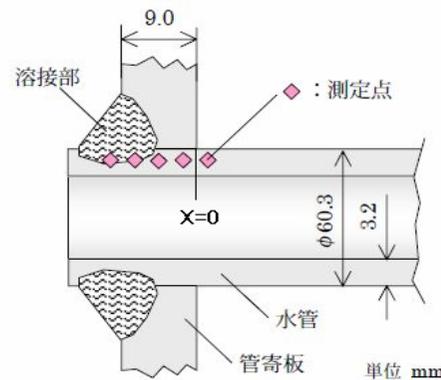
Residual Stress Analysis in Welded Area of Boiler

TU(2) 2006 MIURA Co., Ltd.

- Cracks were founded in the welded Area of boilers after several years use.
- Neutron residual stress analysis is required to evaluate the heat treatment after



100 MPa tensile stress is observed in the axial direction.



The tensile stress is released by the annealing.

What caused the crack?



Fig.2: Crack

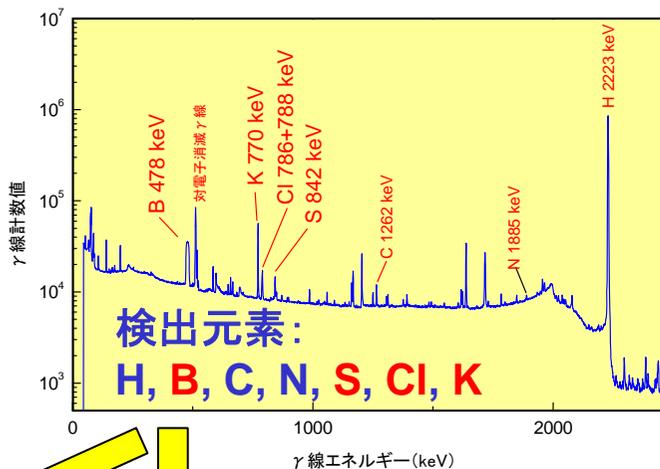
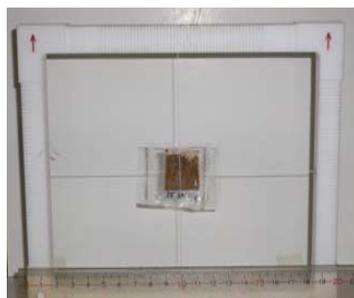
Fig.3: Measured residual stress

Can PGA identify the field of agricultural product?

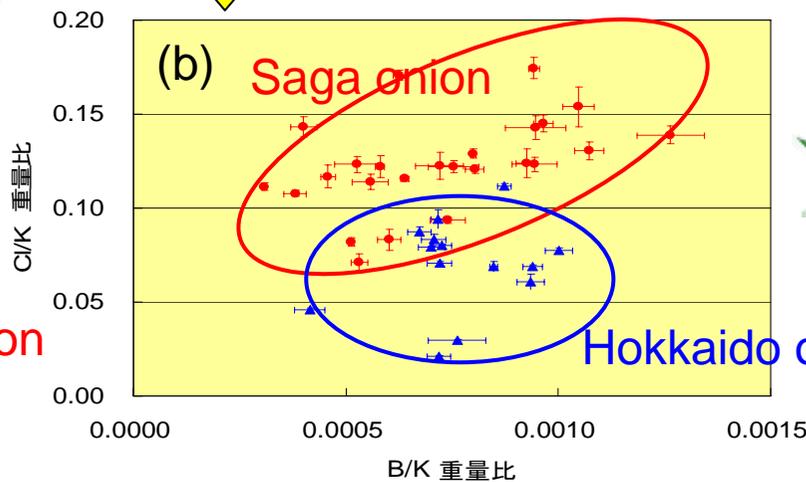
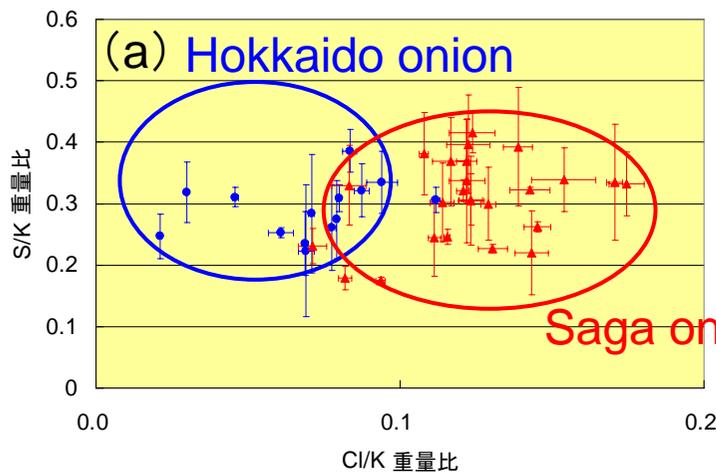
TU(3) 2006 Ibaraki pref., National Food Research Institute



PGA



Homogenized,
dried sample



Ratio of elements (a) S/K - Cl/K, (b) Cl/K - B/K

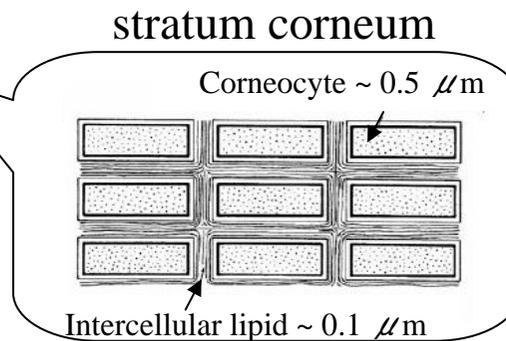
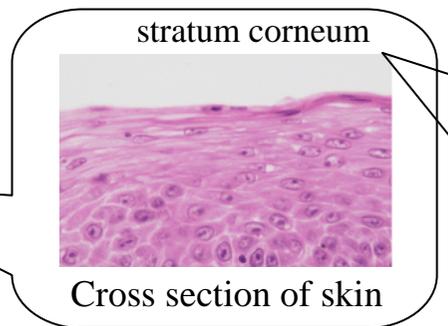
Selection of
Healthful Food,
protection of
Intellectual
property of
agricultural
products



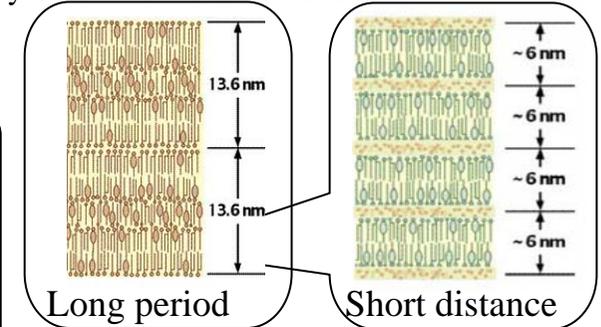
Structure of skin corneum and its functions

TU(4) 2006 Shiseido Co., Ltd.

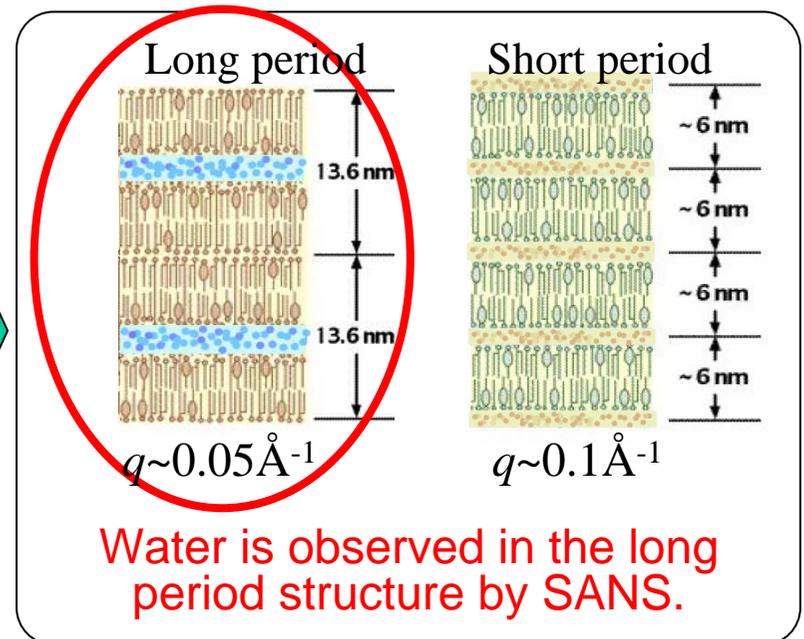
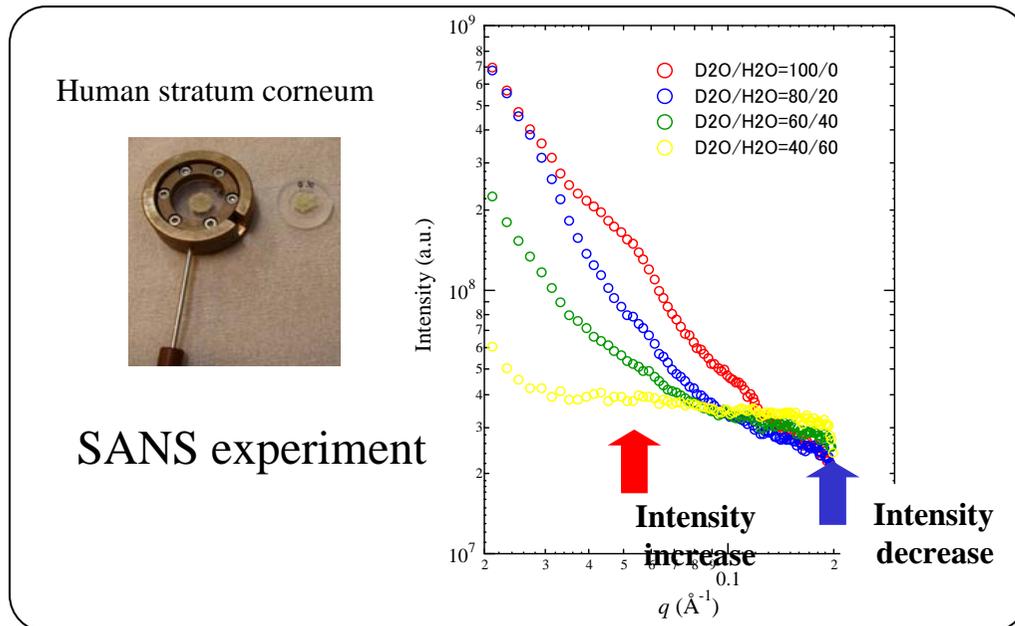
How to keep one's skin young, healthy and beautiful.
 Interests in the permeable pathway of medicine and poison through skin
 >>> Thickness of the water layer? Swelling of the stratum corneum?



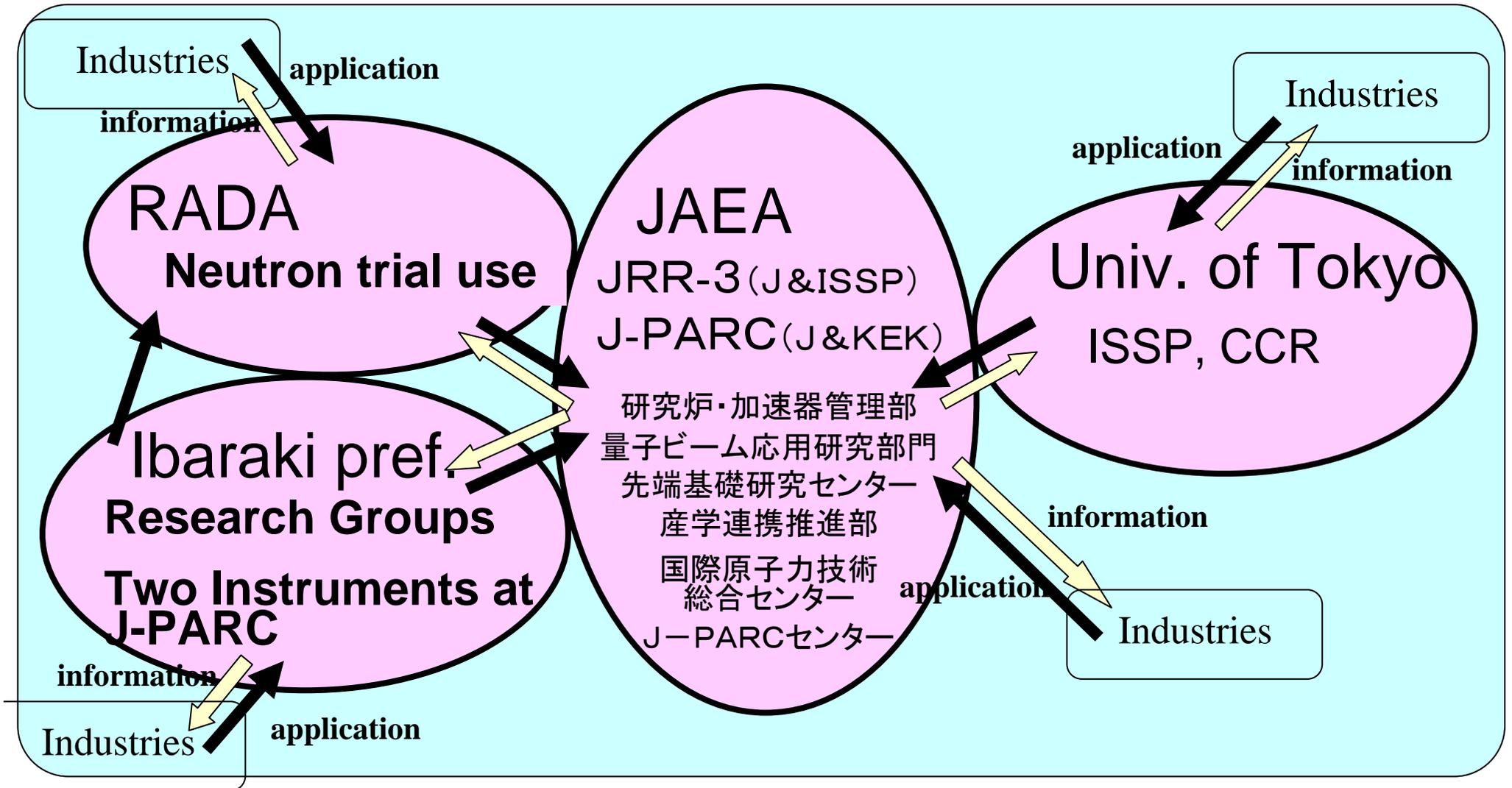
The layer structure of intercellular stratum corneus.



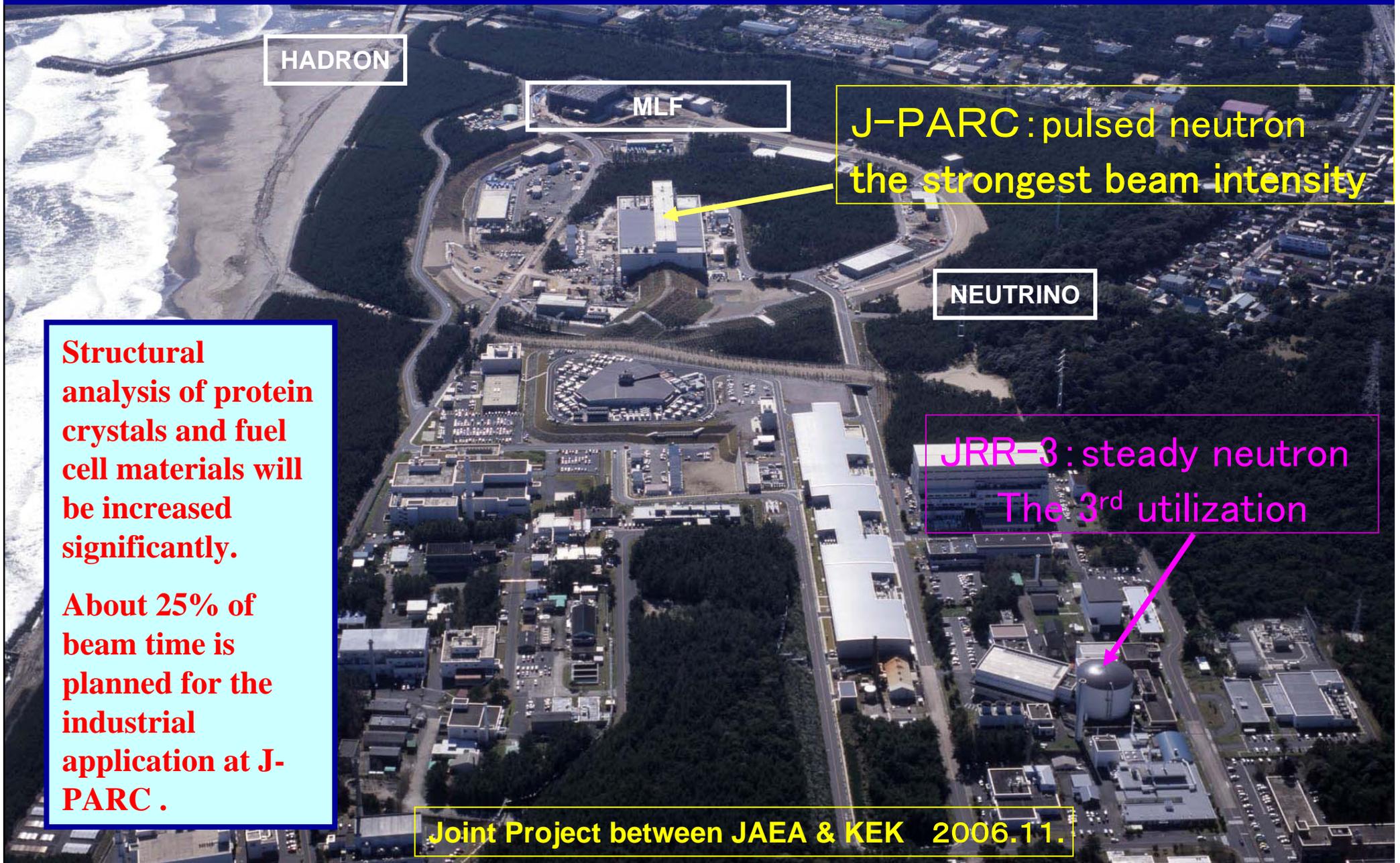
Results of SAXS



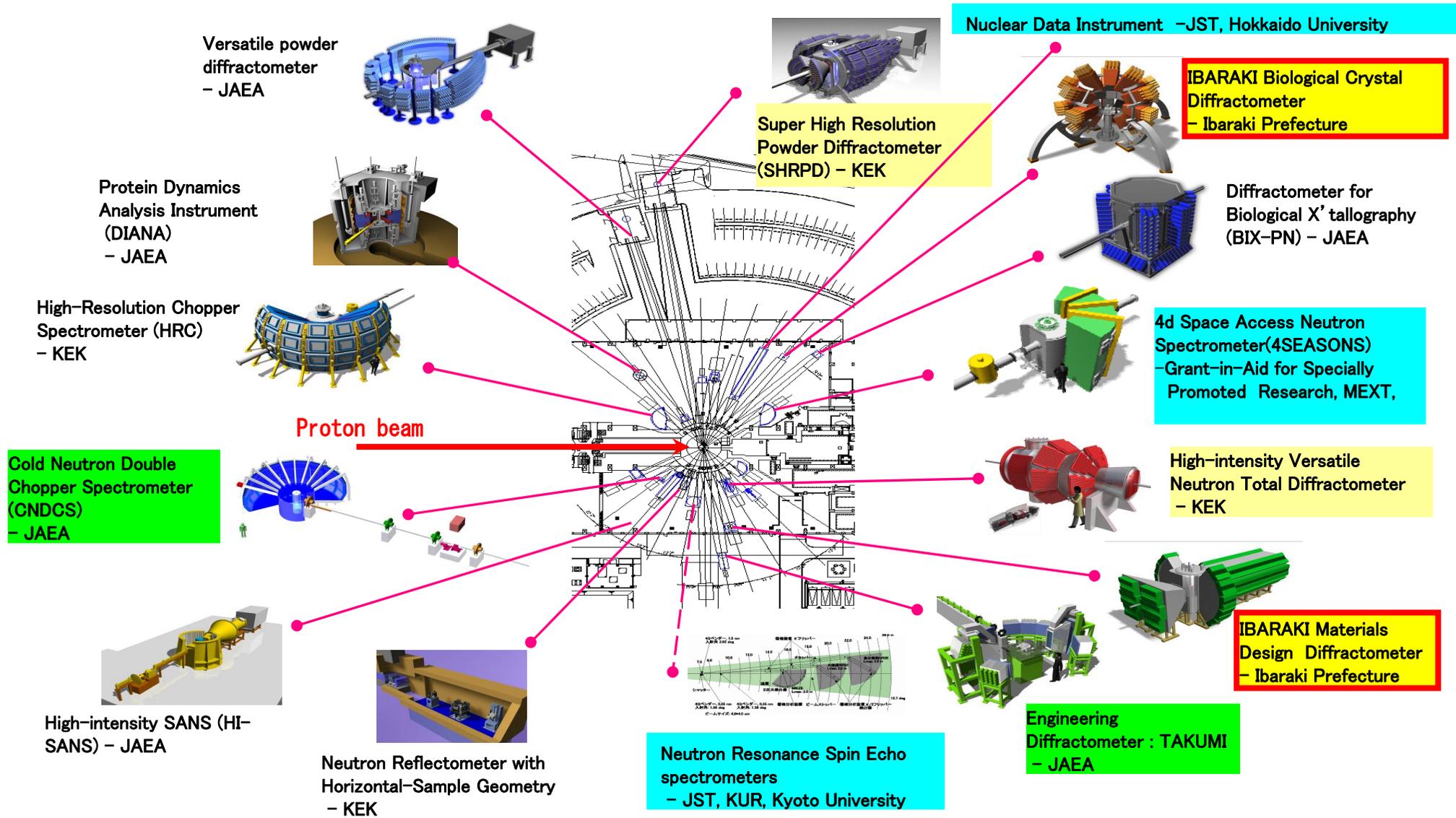
Network for Neutron Beam Application



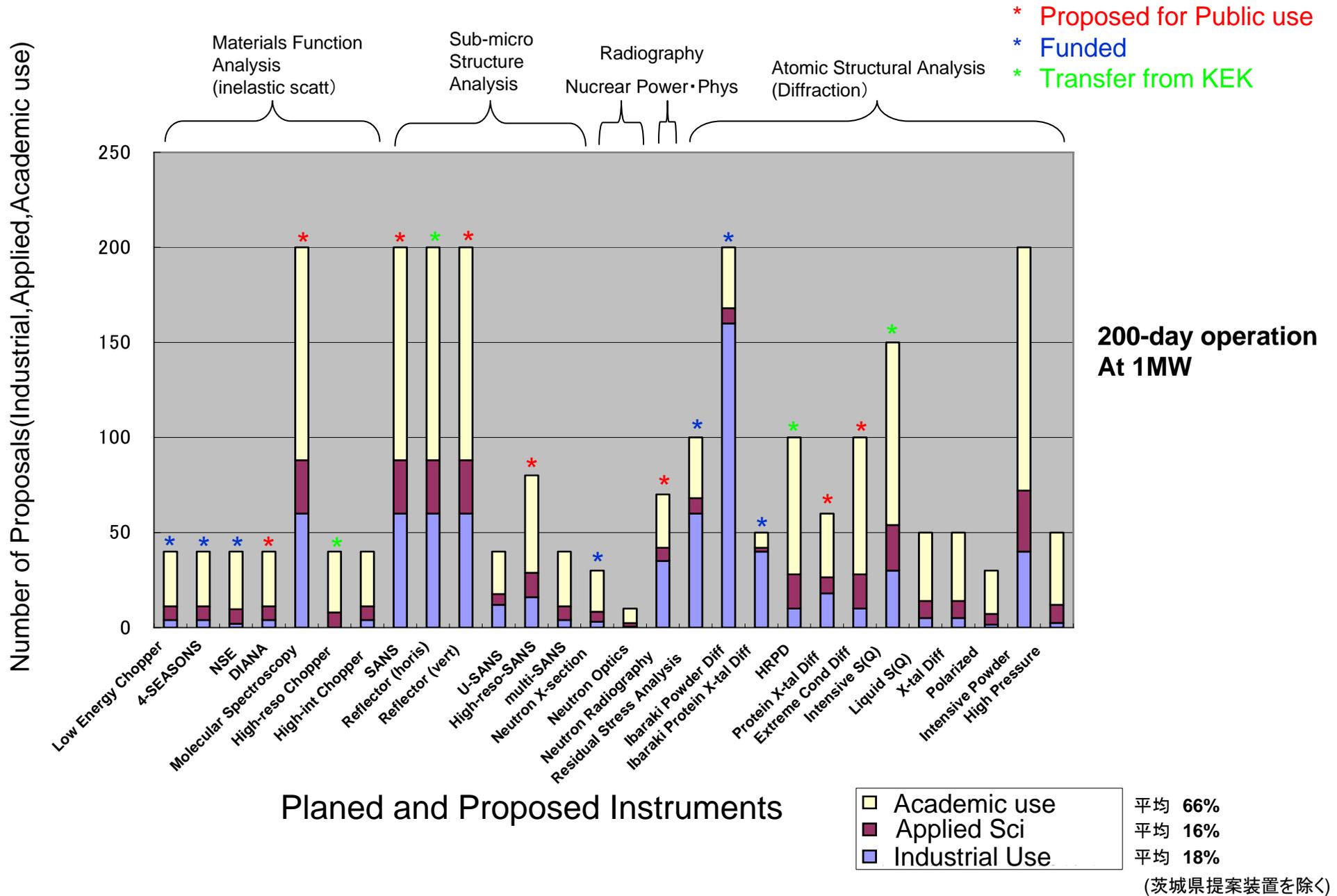
Future Application of Neutron at JRR-3とJ-PARC



Tentatively Approved Instruments

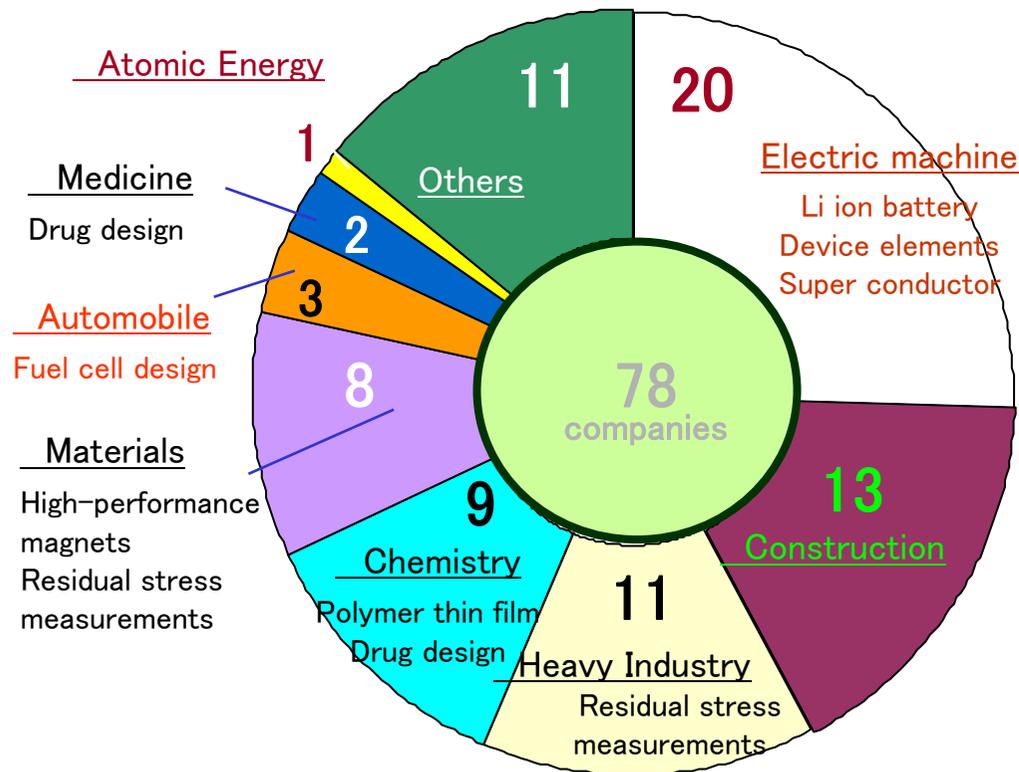


J-PARC instruments and their use profile



Industrial Applications in JSNS

Companies that demand use of neutrons



Industrial applications of nationwide scale

- **Neutron Industrial application forum** (Establishment in Oct. 2001)
117 members
- **Trial use at JRR3**
30 experiments by industries in 2006

Industrial applications in local area

- **Science Frontier 21 Plan**
Plans for activation of industries around J-PARC area (Northern part of Ibaraki)

Industries are ignorant of neutron. Enlightenment is very important.

Science Frontier 21 project in Ibaraki Prefecture (150km from Tokyo to the north)

Forming Science Frontier
Regional Cluster

Hitachi

Hitachi Industrial
Complex and
Research Center

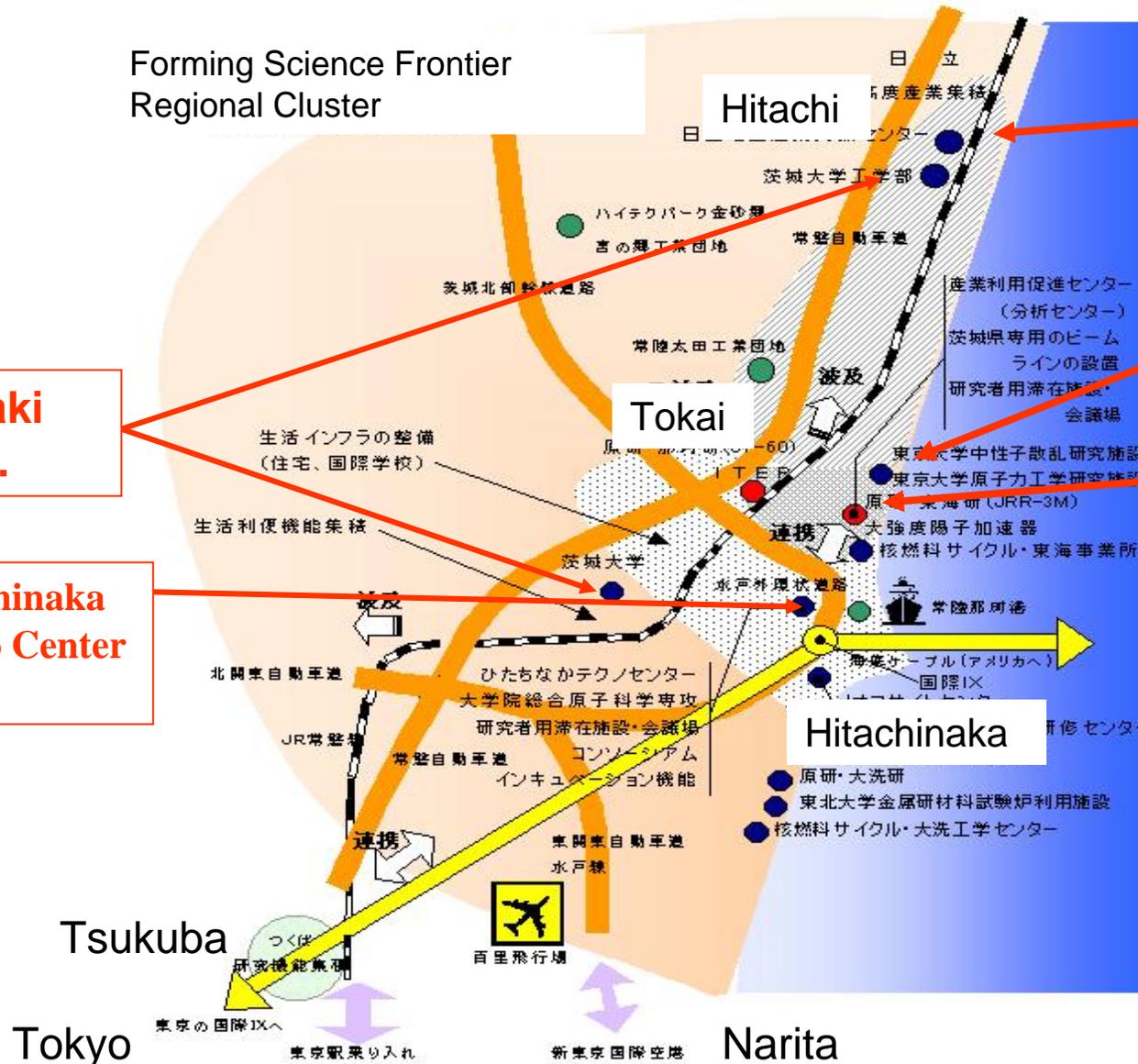
Univ. of Tokyo

Ibaraki
Univ.

JSNS
J-PARC

Hitachinaka
Techno Center

North region of
IBARAKI



SF21 project aim at
formation of science and
technology base in north
region of IBARAKI
prefecture, like Tsukuba
area.

Thank you for your attention.