Institute of Material Structure Science /KEK

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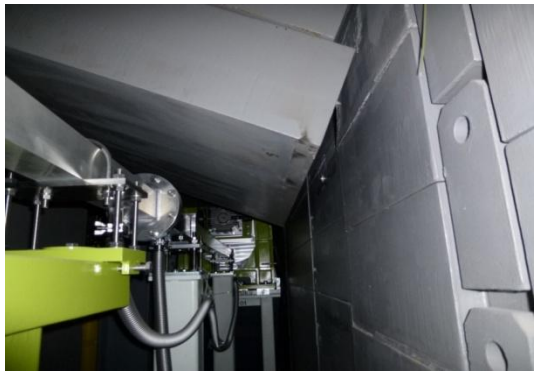
Damage and recovery at PF

May 10, 2011 Linac test operation started
May 16, 2011 Injection to PF ring
May 23, 2011 Beamline commissioning and user test run
June 1, 2011 Injection to PF-AR ring
June 6, 2011 Beamline commissioning and user test run
Sept. 30, 2011 Full User run resumed

Damage and recovery at J-PARC



March11, 2011

Jan. 24, 2012

Dec. 22 , 2011 : proton beam was injected to the Hg target to verify neutron generation

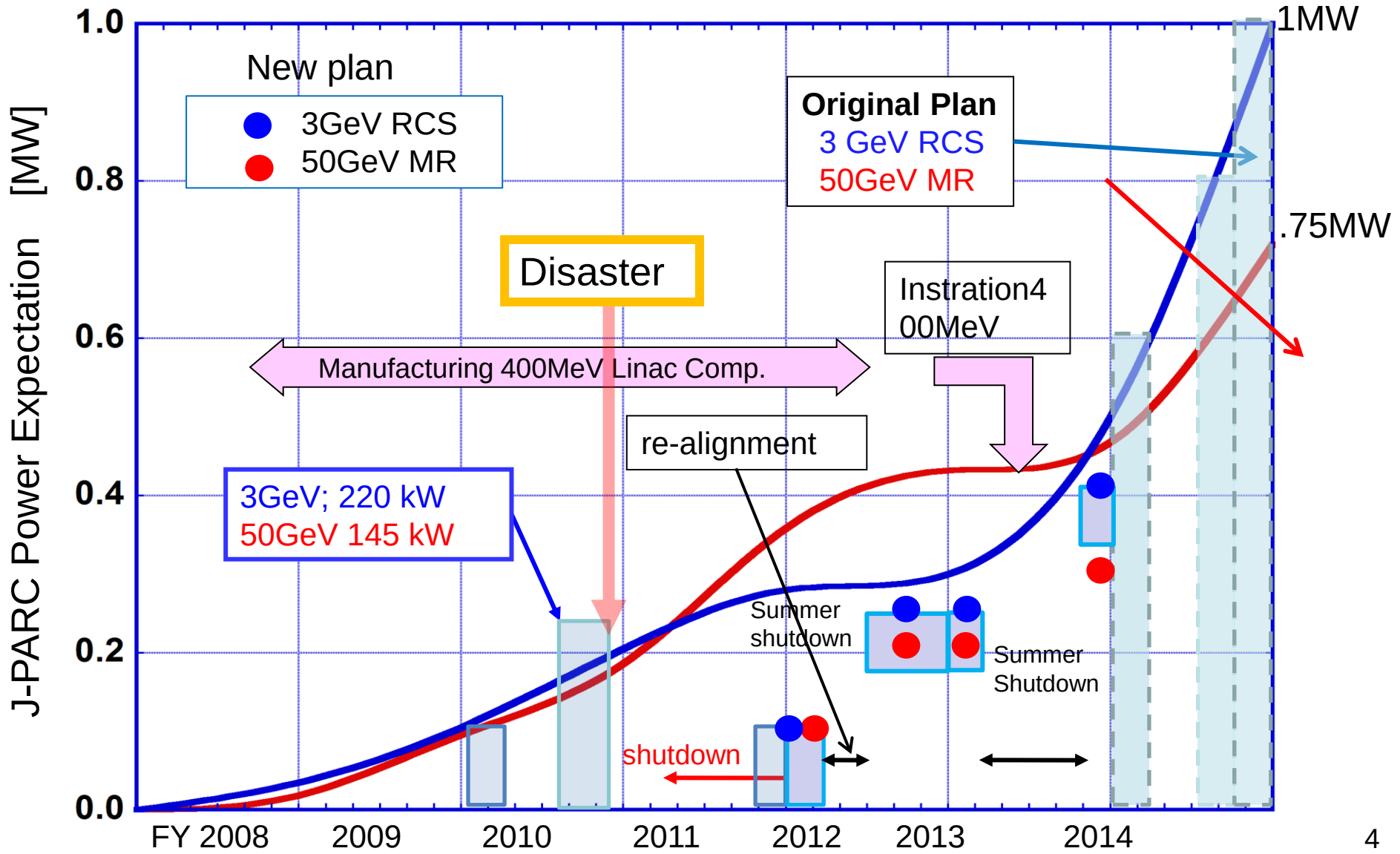
Jan. 24 , 2012 : muon beam was verified with 120kW operation

Jan. 24 2012 : commissioning at D1/D2 area

Feb. 1 , 2012 : user operation resumed

Recovery Plan

(Restoration in Dec., User operation In Feb.)



Cancelled proposals have been performed at the facilities.

KEK staff helped users at each facilities

SR (Domestic)

SPring-8	100
IPR,Osaka U.	9
SAGA-LS	10
HiSOR	6
JAEA	3
UVSOR	3
NIMS	1
New SUBARU	1

SR (International)

・SSRL(USA)	3
・TLS(Taiwan)	4
・SSRF(China)	3
・ESRF(France)	2
・ALS(USA)	4
・APS(USA)	1
・AS(Australia)	5
・MAX-lab(Sweden)	1

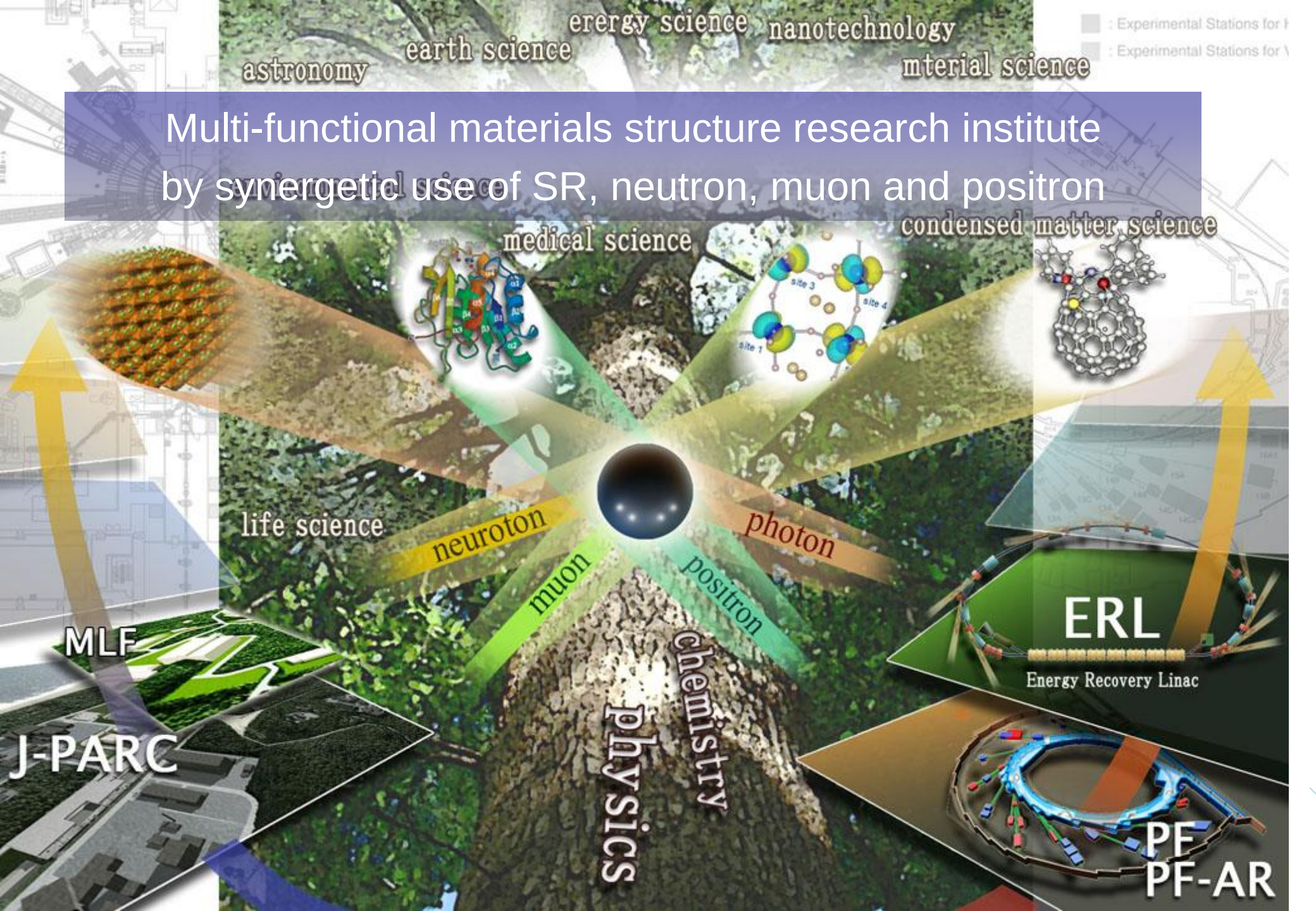
Neutron

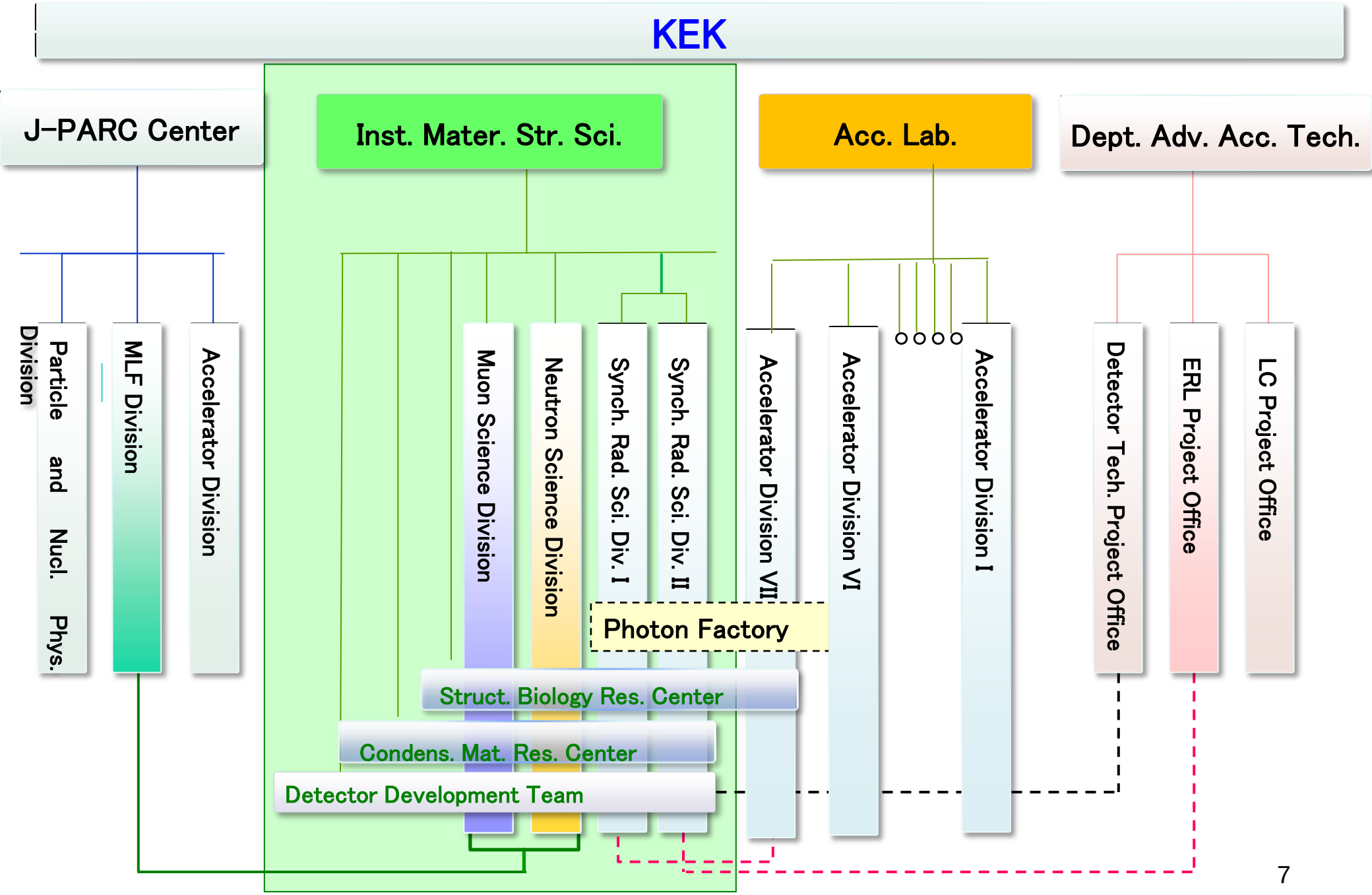
SNS (USA)	24
LANSCE (USA)	5
SPring-8	1

Muon

RIKEN-RAL	12

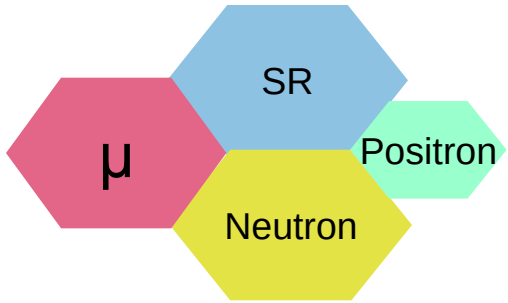
We deeply thank all the researchers and facilities who expressed their sincere sympathy and cooperation to the restoration.


erergy science
nanotechnology
earth science
astronomy
mterial science
Multi-functional materials structure research institute
by synergetic use of SR, neutron, muon and positron
medical science
condensed matter science
life science
neuroton
photon
muon
positron
chemistry
physics
MLF
J-PARC
ERL
Energy Recovery Linac
PF
PF-AR


KEK
J-PARC Center
Inst. Mater. Str. Sci.
Acc. Lab.
Dept. Adv. Acc. Tech.
Particle and Nucl. Phys. Division
MLF Division
Accelerator Division
Muon Science Division
Neutron Science Division
Synch. Rad. Sci. Div. I
Synch. Rad. Sci. Div. II
Accelerator Division VII
Accelerator Division VI
Accelerator Division I
Detector Tech. Project Office
ERL Project Office
LC Project Office
Photon Factory
Struct. Biology Res. Center
Condens. Mat. Res. Center
Detector Development Team

Condensed Matter Research Center

New frontier sciences through complimentary use of SR (X & VUV-SX), neutron and muon



Collaboration network with universities: Univ of Tokyo, Tohoku Univ, Univ, Tsukuba Univ, TITEC etc.

Coorperation with other SR, neutron, & muon facilities

NIMS, Tsukuba

AIST, Tsukuba

Inst of Solid State Physics, U. of Tokyo, Kashiwa

JAEA J-PARC (Quantum Beam)

Center Director

- Soft condensed matter & biomolecules
- Surface, interface, catalysis
- **Strongly correlated electron systems**
- Materials under extreme conditions

Electronic properties of biomolecules: Corporation with Structural Biol. Research Center, IMSS

Static and dynamic electronic structures of surface and interface

Magnetic structure and excitation of surface and interface

Static and dynamic ordered structure of electron systems

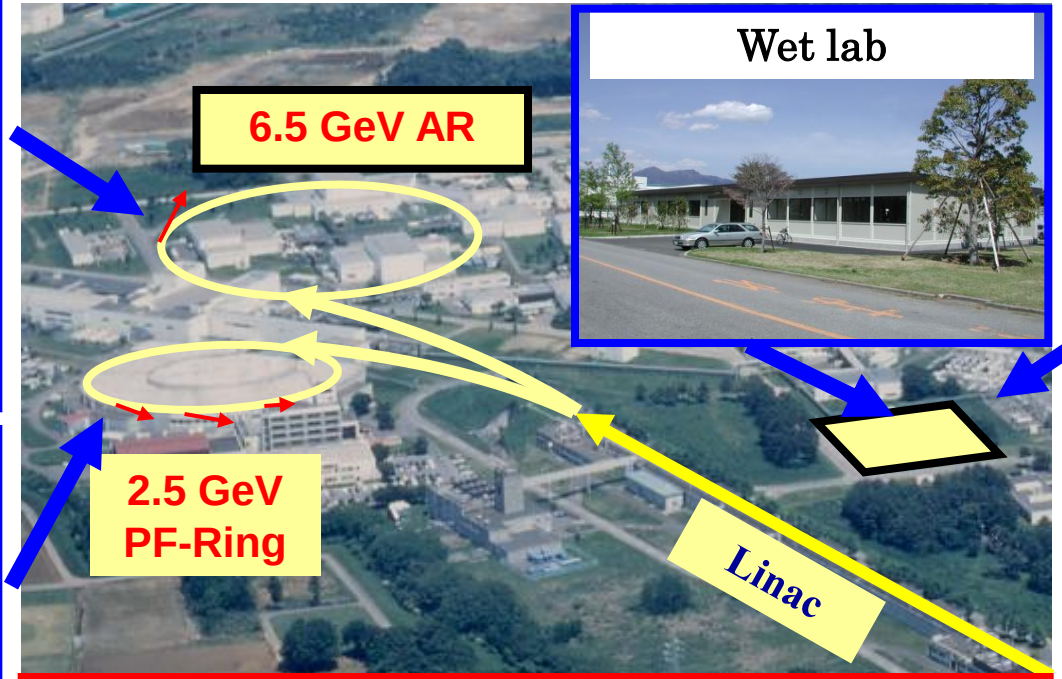
Frontiers in experimental and theoretical sciences using next LS (ERL)

KEK-Photon Factory (Tsukuba)
Structural Biology Research Center（since 2003）

AR NW12

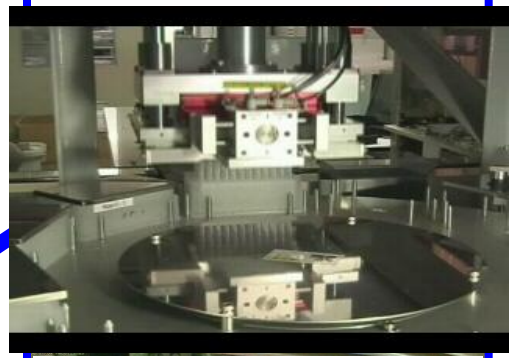
PF BL5

PF BL17

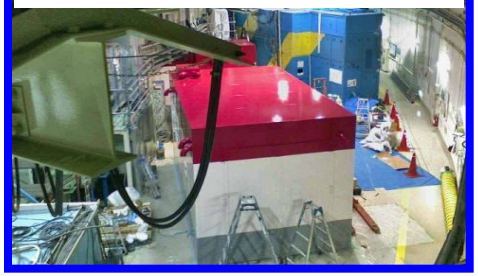


Wet lab

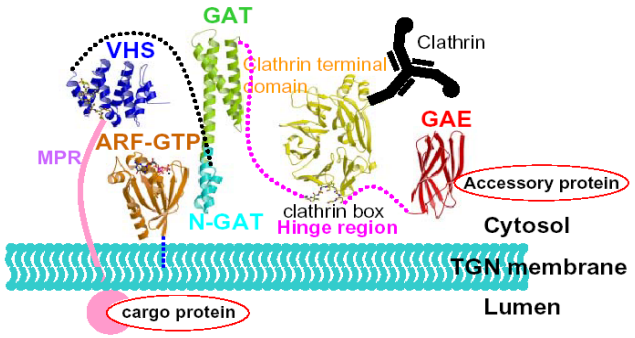
Crystallization robot
200,000 cond./day

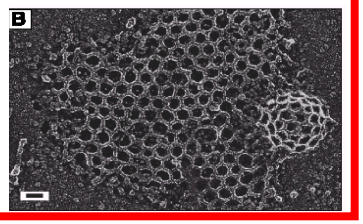


AR NE3 Astellas

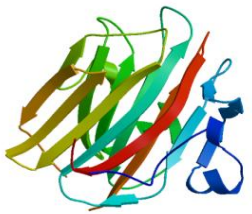


Vesicle transport and posttranslational modification





PF BL1



Low energy SAD, microfocus

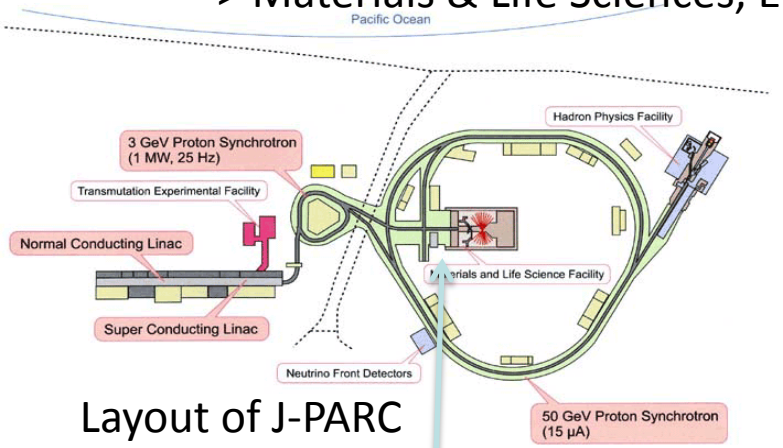
5 large grants（01～09：Total US$ 69 M、US$40M for KEK）

Collaboration with domestic and overseas groups from 8 countries

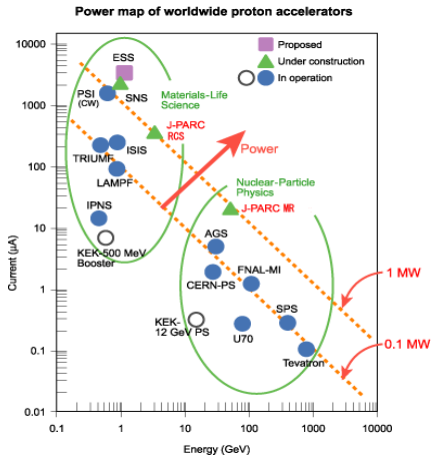
Current status of J-PARC

Joint project of KEK & JAEA

=> Materials & Life Sciences, Elementary Particle and Nuclear Sciences



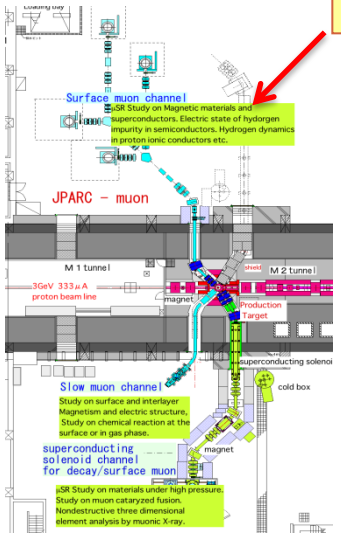
Layout of J-PARC



J-PARC :

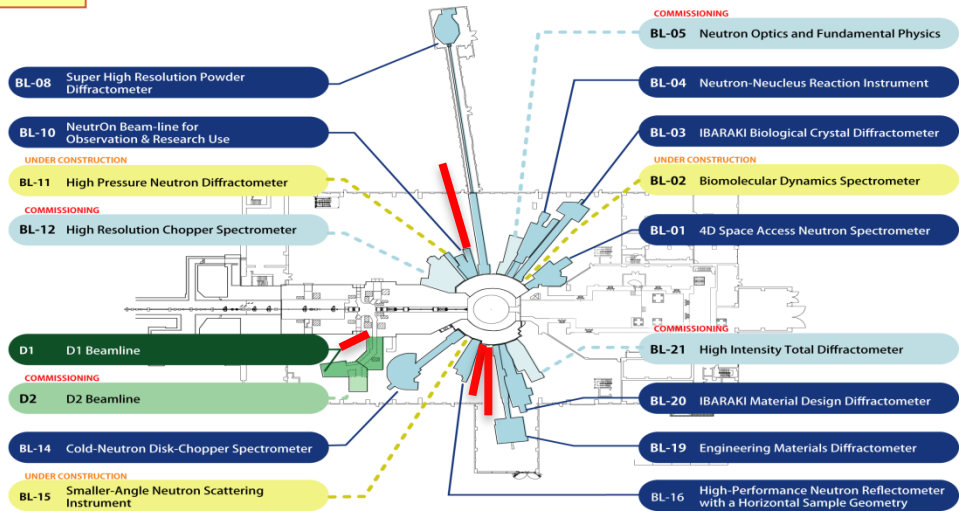
1 MWclass machine

MLF (Material&Life Facility)



Muon facility

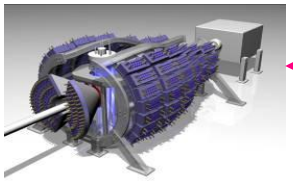
1 BL among 4 BLS is in operation



Neutron facility: 19 BLs among 23 potential BLs are in operation or under construction

Neutron Instruments

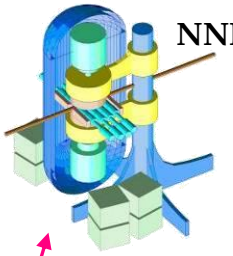
NOBORU (JAEA)



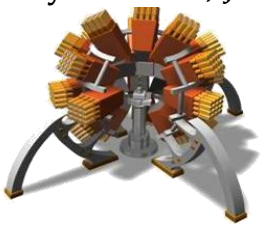
SHRPD (KEK)

No Image

NOP (KEK)



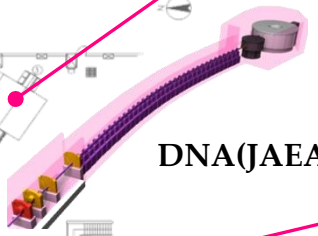
NNRI（Tokyo Tech. U., JAEA, Hokkaido U.)



iBIX (Ibaraki Pref.)

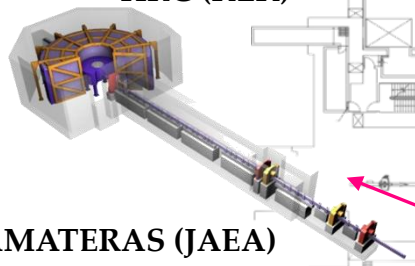
HRC (KEK)

1st Experimental Hall



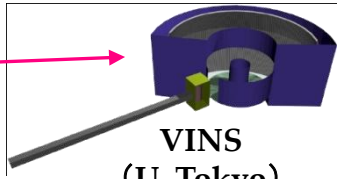
DNA(JAEA)

4SEASONS
（JAEA, KEK, Tohoku U.）

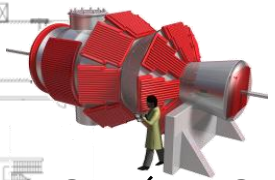


AMATERAS (JAEA)

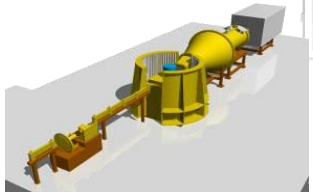
2nd Experimental Hall



VINS
（U. Tokyo）

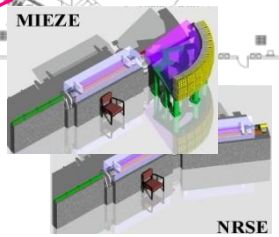


NOVA（NEDO, KEK）

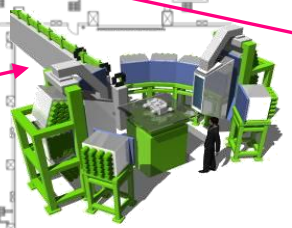


HI-SANS (JAEA)

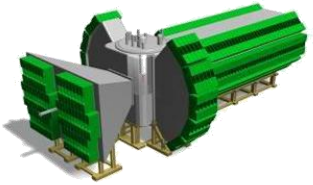
H-REF (KEK)



VIN_ROSE (Kyoto U.)



TAKUMI (JAEA)

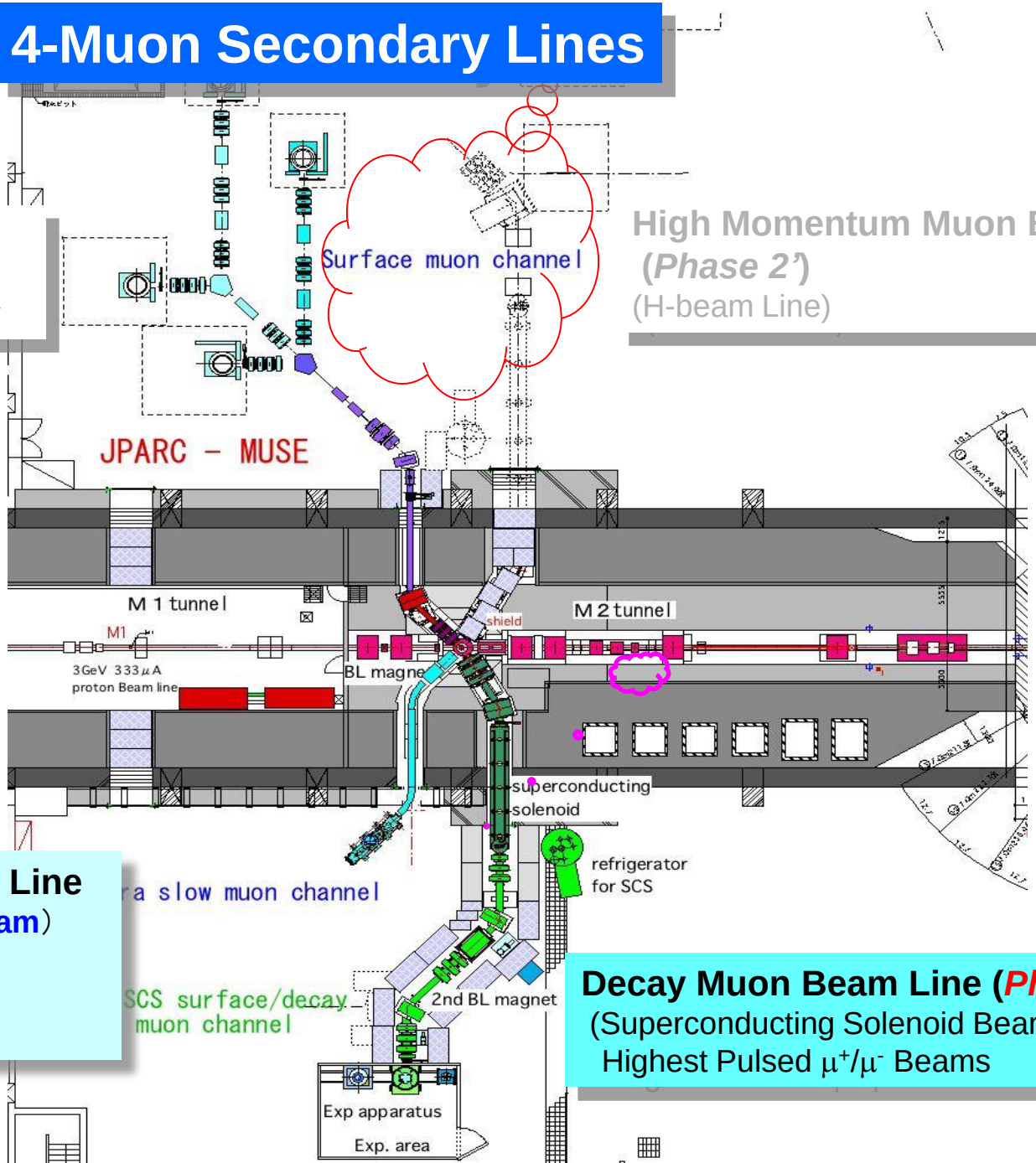


iMATERIA (Ibaraki Pref.)

4-Muon Secondary Lines

Surface Muon Beam Line
(***Phase 2***)（S1-S4 Port）
Highest Intensity pulsed 4MeV μ^+

High Momentum Muon Beam
(***Phase 2'***)
(H-beam Line)



Super Omega Muon Beam Line
(***Phase 2***; **Ultra Slow Muon Beam**）
Low energy,
Highest Energy resolution,
Shortest pulse width muon

Decay Muon Beam Line (*Phase 1*)
(Superconducting Solenoid Beam Line)
Highest Pulsed μ^+/μ^- Beams

Current status of muon facility

<User operation>
• D-line is in the state of stable user operation, delivering the most powerful pulsed muon beam in the world for D1/D2 instruments.

<Construrction>
• Ultra slow muon beamline
Surface muon beamline (U-line) <= KEK
Moderator system & μSR apparatus <= Grants-in-Aid for Scientific Research, Scientific Research on Innovative Areas (by E.Torikai *et al.*)

<In-house Research Activities>
• Commitment to the national project
"New Strategic Initiative for Chemical Elements"
"Basic Research for Light-Quantum Science"
Complementary use of muon, SR and nuetron

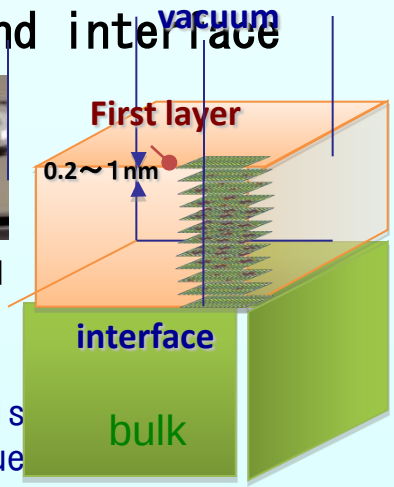
<Future plan>
Argument of the utilization of H-line involving high energy people has started.

Ultra-Slow muon for Material science

NEW BEAM
Ultra-slow muon
1-200nm

Surfae and interface

Interface related devices



Surface catalysis
Electrodes of fue
spintronics
Surface magenetism
Electronic state at the interface
micro μSR

New probe for materials science
which can cover conventional method

Ultraslow muon μSR

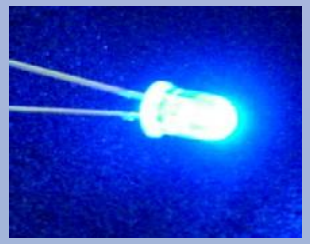
Microscope

Conventional BEAM

Slow muon
0.2mm

Bulk property
Chemical reaction

superconductivity



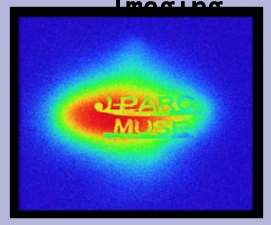
Hydrogen inside semiconductor

Magnetic material,
semiconductor、、
Superconductor,
Hydrogen stored materials
Hydrogen difusing system
Chemical reaction

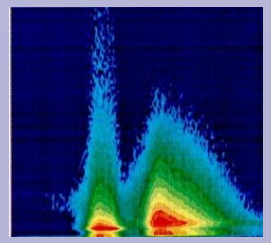
High sensitive magnetic probe
Hydrogen in matter

High speed muon
0.02-2cm

Bulk interior,
Imaging



Muon imaging



Muon catalyzed fusion

Elemet analysis

<+/- muon are usable>
High pressure,
Muon catalyzed fusion,
Element analysis,
Radiography,
Muon physics,
Muon atom.

Current status of the Photon Factory

PF (since1982)

(2.5GeV, 450 mA)

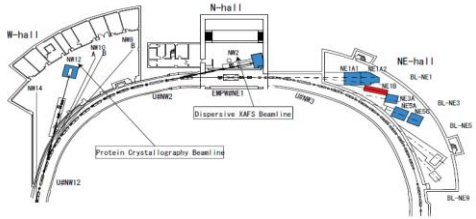
almost 3rd generation machine

The longest MTBF in the world

PF-AR(since1985)

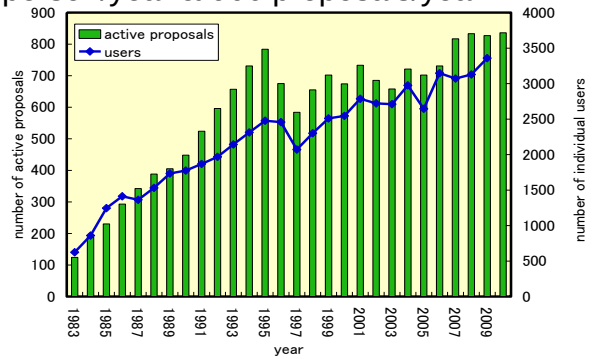
(6.5 GeV, 60mA)

Single bunch with high current



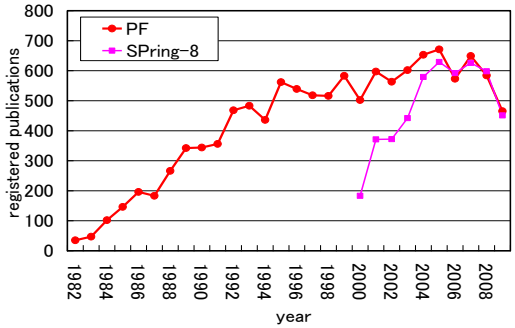
Numbers of Users and Proposals

3500person/year & 900 proposals/year



Publication

over 600/year



SR facilities in Japan（number of users /year in 2009 qnd 2010）

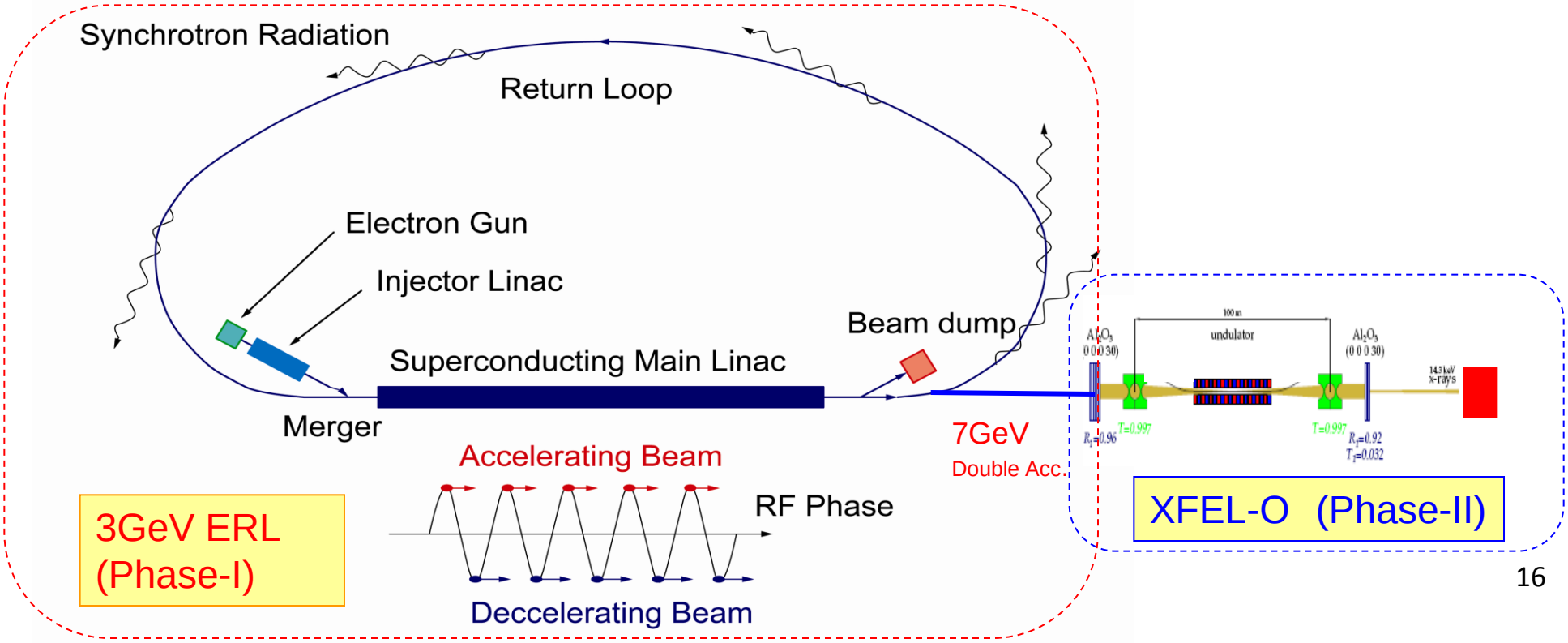
PF	Inter-University Organization	（3400person/year）
UVSOR	Inter-University Organization	（ 300person/year ）
HiSOR	Joint Usage / Research Center	（ 400person/year ）
SPring-8	The law for Common use promotion	（3400 person/year ）

PF：World top level facility by the continuous upgrade, even though 30 years old
Inevitable facility for materials & life sciences in basic and industrial applications

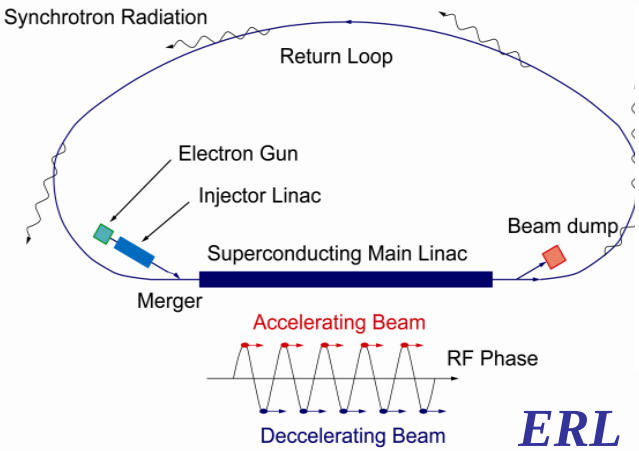
Next Generation SR machine

1） Linac Based SR
   ① emittance ～ 15 pm-mrad （Diffraction limit）
   ② Puls width ～ 0.1-1 pico-second
2) large number of ID section
3) Option of full Coherence
   XFEL-O option（Diffraction & Fourier limits)

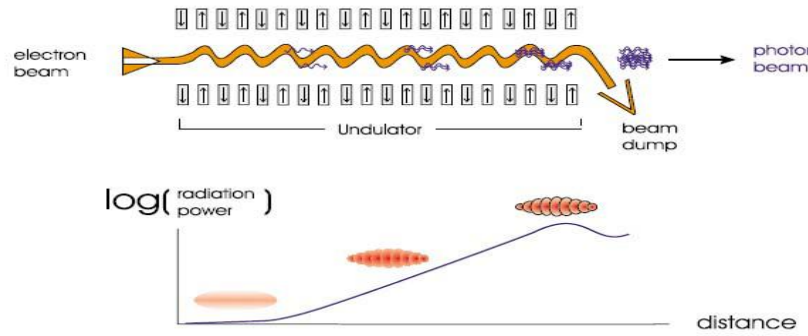
→ 3GeV ERL



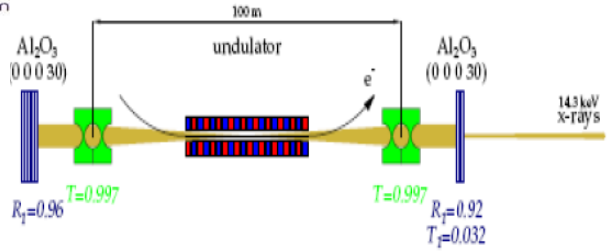
Functions of ERL, SASE-FEL & XFEL-O



ERL



SASE-FEL



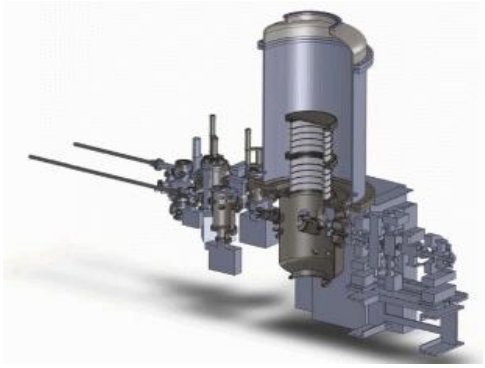
XFEL-O

	average brilliance	peak brilliance	repetition rate (Hz)	coherent fraction	bunch width(ps)	# of BLs	Remark
ERL	**~10^{23}**	**~10^{26}**	**1.3G**	**~20%**	**0.1~1**	**~30**	**Non-perturbed measurement**
XFEL-O (Option)	**~10^{27}**	**~10^{33}**	**~1M**	**100%**	**1**	**few**	**Single mode FEL**
SASE-FEL	**~$10^{22\sim24}$**	**~10^{33}**	**100~10K**	**100%**	**0.1**	**few**	**One-shot measurement**
3rd-SR	**~$10^{20\sim21}$**	**~10^{22}**	**~500M**	**0.1%**	**10~100**	**~30**	**Non-perturbed measurement**

(brilliance : photons/mm^2/mrad^2/0.1%/s @ 10 keV)

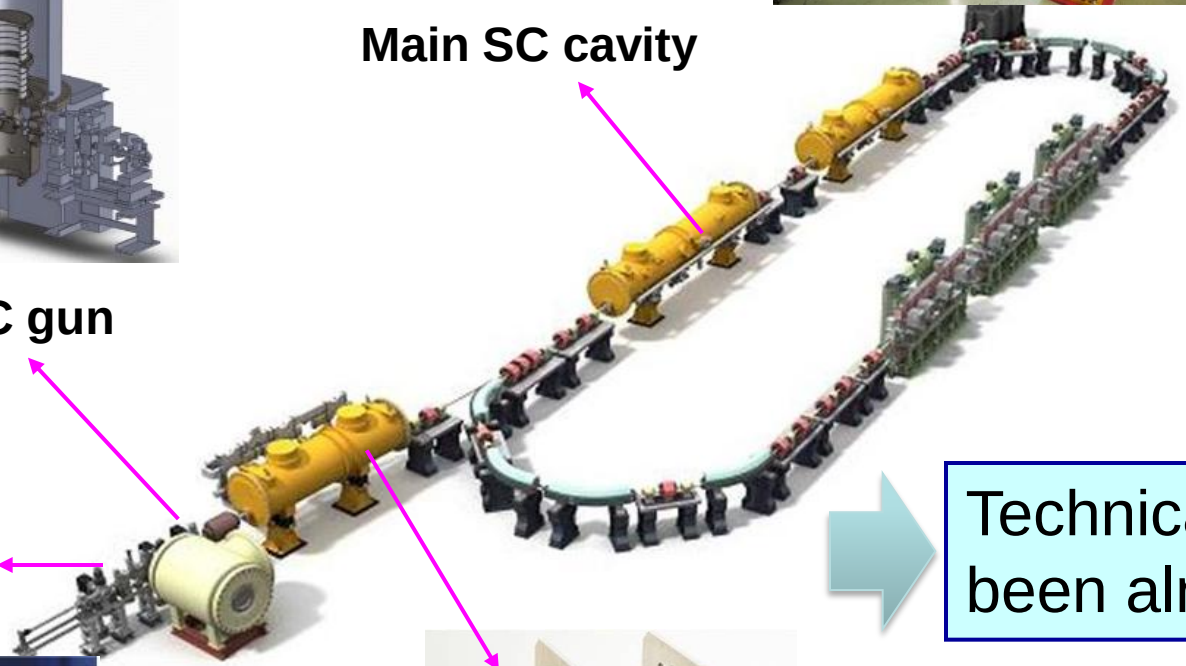
Technical Developments => c-ERL(35MeV→250MeV)

RF source

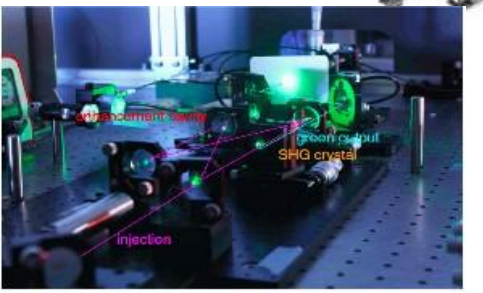


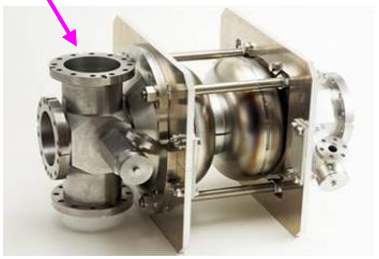
DC gun

Main SC cavity



Drive laser





Injector SC cavity

Technical issues have been almost cleared.

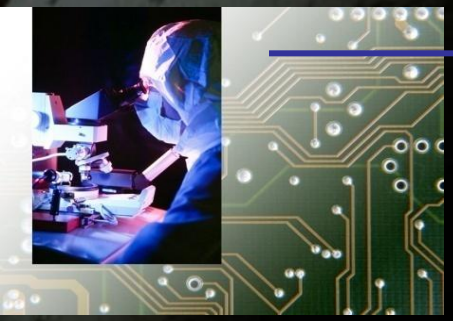
the first beam is expected in 2012

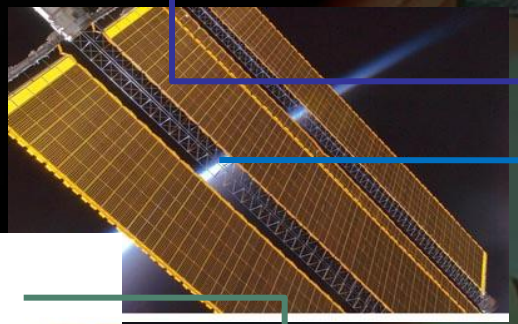
Nano beams from ERL and XFEL-O

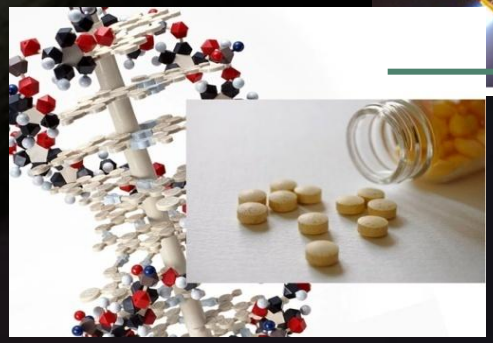
■Probing nano structures/domains with
Extremely Intense X-ray beams

ERL

■Strong Collaboration with materials and biological science groups and industries







Next generation semiconductor and electronics (CMOS, Spintronics, molecular electronics, DNA computers, photonics etc.)

Novel technologies for environment and energy (solar cell, artificial photosynthesis, fuel cell, catalysts, etc.)

Nano-bio technologies (drug design, diagnosis, tailor-made medication and regenerative medicine, biochips, clinical micro robots, etc.)