



ANPhA
Asian Nuclear Physics Association

Future Perspective of ANPhA (Asian Nuclear Physics Association)



Dong-Pil MIN, ANPhA Chair
UNSG Scientific Advisory Board
Professor Emeritus, Seoul National University

20150629, Almaty, 9th APCTP-BLTP JINR Joint Workshop

International Union of Pure and Applied Physics (IUPAP)
C12 (commission of Nuclear Physics) &
WG.9 (International Cooperation in Nuclear Physics (ICNP))
(May 2008 held at CERN)

Strongly suggested to form
some cooperative organization
in Asia



Shoji Nagamiya (KEK/J-PARC, Japan),
Dong-Pil Min (SNU, Korea),
Hideyuki Sakai (U. Tokyo, Japan), and
Wenqing Shen (NSFC, China)
agreed to launch an initiative to form some
organization in Asia similar to NuPECC.

ANPhA Members from 8 countries/region

- | | |
|--------------|---------------|
| 1. Australia | ~50 |
| 2. China | ~1,000 |
| 3. India | ~300 |
| 4. Japan | ~1,000 |
| 5. Korea | ~200 |
| 6. Mongolia | ~30 |
| 7. Taiwan | ~50 |
| 8. Vietnam | ~50 |
| total | ~2,700 |





ANPhA Board

As of today

Member countries and regions
alphabetical order



Australia China India Japan



Korea Mongolia Taiwan Vietnam

**Science
Network !**

Chairs and Secretary:

- Chair:** Dong-Pil Min (Korea)
Vice Chair: Weiping Liu (China)
 Anthony Thomas (Australia)
Secretary: Tohru Motobayashi (Japan)

Members:

- Australia:** Anthony Thomas (The University of Adelaide)
China: Furong Xu (Peking University)
 Weiping Liu (China Institute of Atomic Energy)
 Guoqing Xiao (Institute of Modern Physics)
 Yugang Ma (Shanghai Institute of Applied Physics)
India: Vivek Datar (Bhabha Atomic Research Centre)
 Dinesh Kumar Srivastava (Variable Energy Cyclotron Centre)
Japan: Kazuhiro Tanaka (KEK)
 Tohru Motobayashi (RIKEN)
 Takaharu Otsuka (The University of Tokyo)
 Hirokazu Tamura (Tohoku University)
Korea: Dong-Pil Min (Seoul National University)
[Insik Hahn \(Ewha Women's University\)](#)
[Woo-Young Kim \(Kyungpook National University\)](#)
[Byung Sik Hong \(Korea University\)](#)
 Byung-Geel Yu (Korea Aerospace University)
Taiwan: Wen-Chen Chang (Institute of Physics, Academia Sinica)
Vietnam: Dao Tien Khoa (INST Hanoi)
Monglia: To be announced
Observer: Angela Bracco (NuPECC Chair, University of Milan, Italy)
 Hideyuki Sakai (Past Chair, RIKEN, Japan)
 Shoji Nagamiya (RIKEN and KEK, Japan)
 Yanlin Ye (Past Chair, Peking University, China)

last update: April 25, 2014



History of ANPhA Meeting

- 10th, Oct. 24, 2015, **Gyeongju**, Korea, 8th ANPhA Symposium
- 9th, Nov. 7, 2014, **Ho Chi Minh**, Vietnam, 7th ANPhA Symposium
- 8th, Feb. 19, 2014, **Kolkata**, India, 6th ANPhA Symposium
- 7th, Apr. 27, 2013, **Taipei**, Taiwan, 5th ANPhA Symposium
- 6th, Aug. 4, 2012, **Adelaide**, Australia, 4th ANPhA Symposium
- 5th, Nov. 27, 2011, **Hanoi**, Vietnam
- 4th, Apr. 30, 2011, **Lanzhou**, China, 3rd ANPhA Symposium
- 3rd, Oct. 2, 2010, **Seoul**, Korea, 2nd ANPhA Symposium
- 2nd, Jan. 17, 2010, **Tokai**, Japan, 1st ANPhA Symposium
- 1st, Jul. 18, 2009, **Beijing**, China



Objectives:

1. The objective of ANPhA is to strengthen **"Collaboration"** among Asian nuclear research scientists through the promotion of nuclear physics and its transdisciplinary use and applications.
2. The objective of ANPhA is also to promote **"Education"** in Asian nuclear science through mutual exchange and coordination.
3. It also aims at **"Coordination"** among Asian nuclear scientists by actively utilizing existing research facilities.
4. Furthermore, at a later stage, it will help to discuss **future planning** of nuclear science facilities and instrumentation in Asia.



ANPhA Symposium



**1st Tokai
Japan**



**2nd Seoul
Korea**



**3rd Lanzhou
China**



**4th Adelaide
Australia**



**5th Taipei
Taiwan**



**6th Kolkata
India**

Issues of ANPhA activity (an observer's observation)

- Activity remains minimum.
- It still remains as an information exchange club.
- Almost no collective/harmonic motion.
- Join Association of Asia Pacific Physical Societies (AAPPS) as a division ?

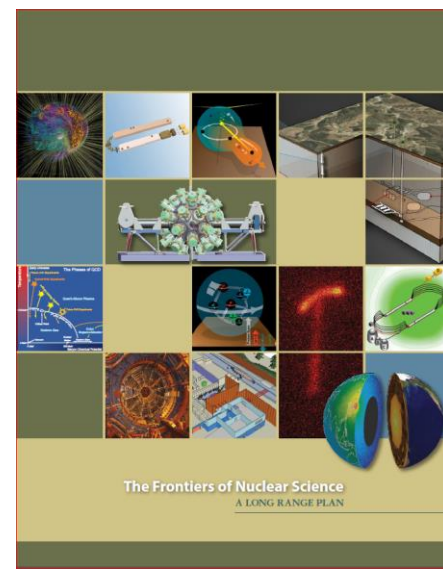
Our Colleague: NuPECC



- NuPECC(Nuclear Physics European Collaboration Committee)
 - Mission as Expert Committee in the ESF to strengthen collaboration /Humanities/ Life, Earth and Environmental Sciences:/ Medical/ Physical and Engineering/ Social/ Marine/ Materials S&E/ **Nuclear Physics**/ Polar/ Radio Astronomy/ Space Science/
 - For collaboration in **research, funding, and science policy**, to promote nuclear physics, and its trans-disciplinary use and application.
 - NuPECC encourages **network** of complementary facilities, provides a **forum** for discussing the provision of future facilities and instrumentation, and supports **new projects**.
 - Activities: “Perspectives of Nuclear Physics in Europe”
NuPECC Long Range Plan 2010



Our Colleague: NSAC



- NSAC (Nuclear Science Advisory Committee)
 - Mission as Expert Committee in the DOE/OS and NSF to give advices on the national program for basic nuclear science research.
 - For collaboration in **research, funding, and science policy**, to promote nuclear physics, and its trans-disciplinary use and application.
 - NSAC has published 7 “NSAC Long Range Plans” since 1979.
 - * made strong recommendations such as CEBAF, FRIB, education, etc.
 - * plays the central opinion hub in the US nuclear physics society.

Robert Tabb (Chair)	Texas A&M University
Douglas Bryman	TRIUMF, University of British Columbia
David Dean	Oak Ridge National Laboratory
Charlotte Elser	Ohio University
Ralf Eise	Thomas Jefferson National Accelerator Facility
Thomas Chmacek	Michigan State University/National Superconducting Cyclotron Laboratory
Ulrich Heinz	The Ohio State University
Xiangsheng Ji	University of Maryland
Ray Lacey	State University of New York - Stony Brook
Ji-Yang Lee	Lawrence Berkeley National Laboratory
Nasser Maham	University of Illinois
Richard Miller	Massachusetts Institute of Technology
Michael Ramsey-Musolf	University of Wisconsin
Hans Nussle	University of California, Berkeley
Guy Savard	University of Chicago/Argonne National Laboratory
Susan Swanson	Los Alamos National Laboratory
Thomas Ullrich	Brookhaven National Laboratory
Ulrich von Klotz	University of Arizona
John Wilkerson	University of Washington
William Zipp	Columbia University



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Characteristics of ANPhA:

We are

- Expert group to represent the nuclear physics society of member countries, independent from national physical societies.
- Friends to pursue the common objectives of members on
 - collaboration, education, capacity building, planning, etc.
 - finding common goals,
 - *preparing the common future in our activities such as*
 - * *acquiring new nuclear data for use in fission and fusion reactors*
 - * *developing new accelerators for use in nuclear physics and neighbor fields and for other application such as cancer therapy*
 - * *designing collectively nuclear physics tools (as accelerators, detector systems, simulation codes etc.) and systems for application such as for security.*



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- * Indeed, nuclear physics tools as
 - accelerators creating new particles, synthesizing complex nuclei, breaking nuclei apart, and probing the interior of nucleons and nuclei,
 - detectors registering the fragments of hadronic and nuclear reactions and radiation that is emitted from nucleons and nuclei
 - facilities and infrastructures helping scientific and theoretical understanding, such as innovative and high-performance computer and computational techniques, networking and governance

- * Also, we are giving efforts in application of nuclear physics methods to the humanities (archaeology, art analysis, restoration and dating).

ANPhA, the real and the ideal

NuPECC: The Nuclear Physics European Collaboration Committee is an Expert Committee of the European Science Foundation

	ANPhA	NuPECC
Body	Representatives from nuclear physics community → indirect feed back	Funding agency and NP community → direct feed back, future plan
Budget	No member fee → volunteer base good will !	Member fee → various activities
Phase (Stage)	“Communication stage “ foster collaboration	Role(function) under EU(ESF)
Activities	Board meeting: 1 time/y ANPhA workshop, Coordination of NP of APPC	3 times/year Nucl. Phys. News Int. Many.....
Office Web	RIKEN voluntary base) http://ribf.riken.jp/ANPhA/	Yes, Dr. Gabriele-Elisabeth Körner http://www.nupecc.org/



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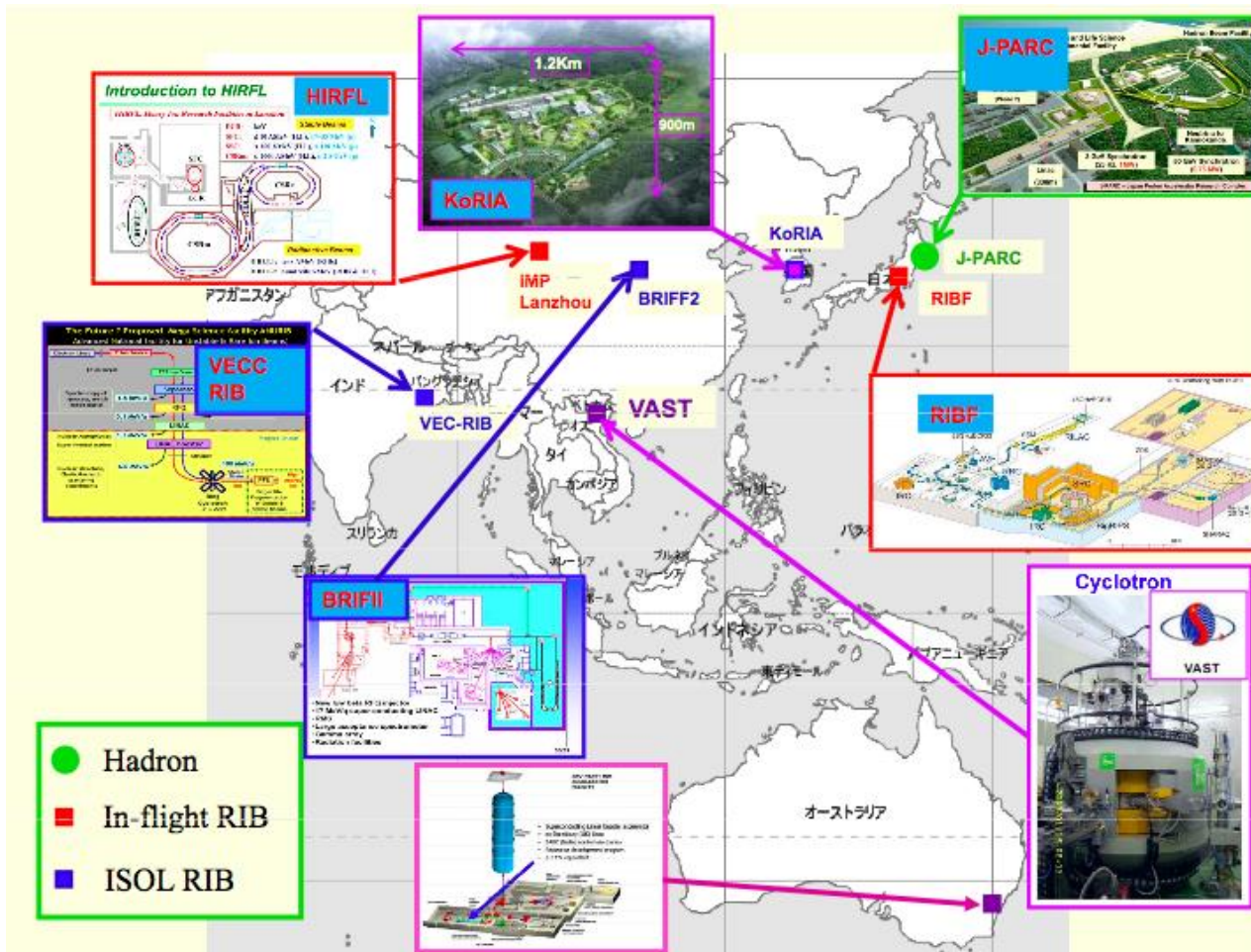
ANPhA

ANPhA's objective: to publish a LR Plan which should be (*personal view*):

- to review recent achievements and the current state of the art in NP
- to identify open problems and hot topics
- to develop medium and long-term strategies to tackle them
- to develop a common perspective and put it into a worldwide context
- to formulate recommendations and propose a concrete plan of action for each member countries and regions,
- to prepare a roadmap to upgrade the present facilities and to build new and powerful NP facilities in Asia



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Future Perspectives of **ANPhA**



1. **New NP Facilities in Asia**

2. **- RI Facilities:**

3. **RAON in Korea, BRIF and HIAF in China**

4. **- Hadron Facilities:**

5. **JPARC/HEF in Japan, JUNA in CJPL**

6. **- Dark Matter Research:** Stawell Lab. in Australia,
7. **CDEX & PANDA in China, KIMS & AMoRE in Korea, TEXONO in Taiwan**

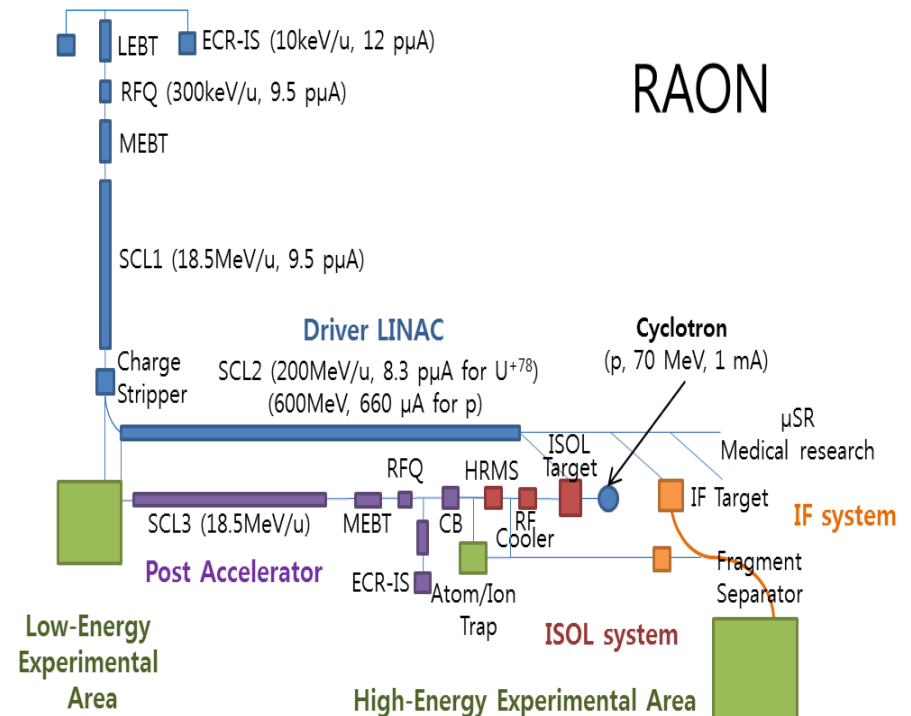
8. **- ADS**

9. **CICAS proj. in China, P-T in Japan, SKK in Korea**



RAON in Korea

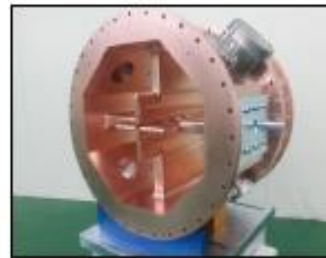
- Total budget of US\$ 1.44 B for 2011-2021
- Important milestones in 2014-2015
 - Dr. Sunchan Jeong appointed as a new director in Jan. 2015
 - Civil engineering and construction launched in Dec. 2014
 - 1st radiation safety review in Nov. 2014
- Design and R&D of radioactive ion beam (RIB) accelerator and experimental systems are progressing rapidly.



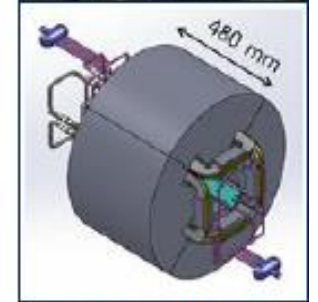
Progress of RAON Accelerator Components



28 GHz ECR Ion Source



RFQ



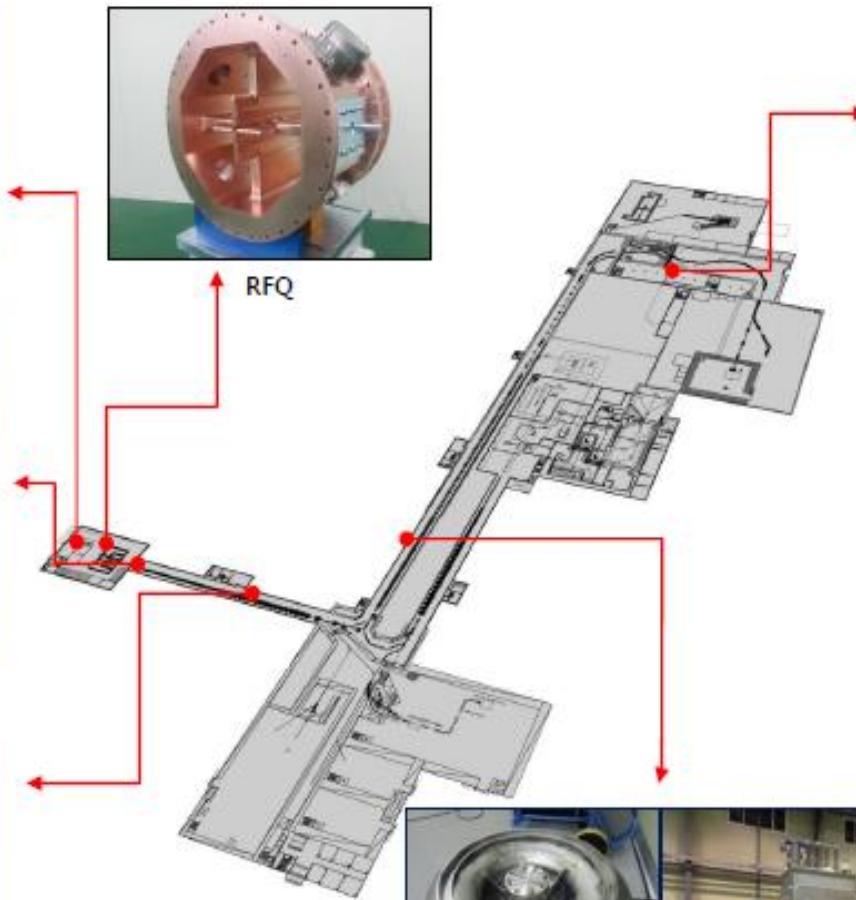
HTS Q-magnet



QWR SC Cavity & its Cryomodule



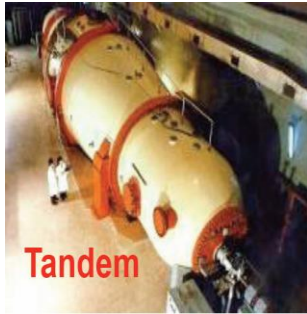
HWR SC Cavity & its Cryomodule



SSR SC Cavity and its Cryomodule

Nuclear Physics Roadmap of China

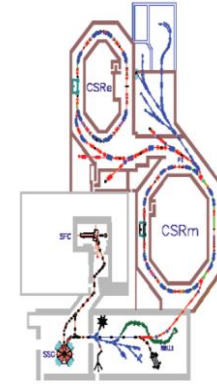
1986
Beijing Tandem
HI-13



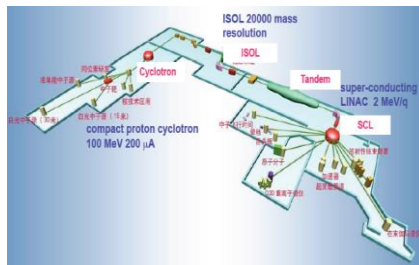
1988
Lanzhou Cyclotron
SSC



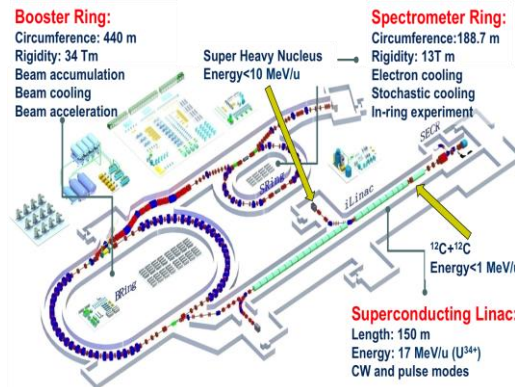
2008
Lanzhou Storage Ring
CSR



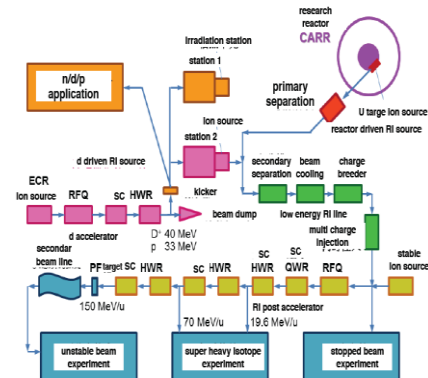
2015
Beijing Rare Ion Beam High Intensity Heavy Ion Accelerator
BRIF



2022
High Intensity Heavy Ion Accelerator
HIAF



2027
Beijing ISOL

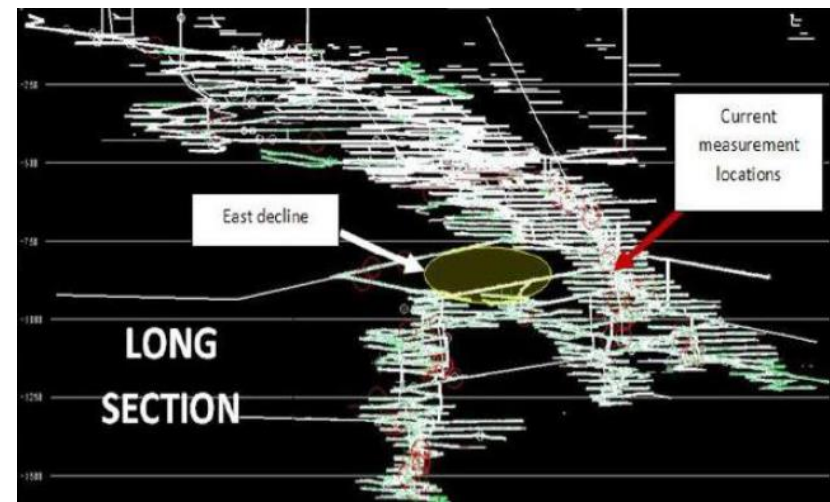


J-PARC in Japan

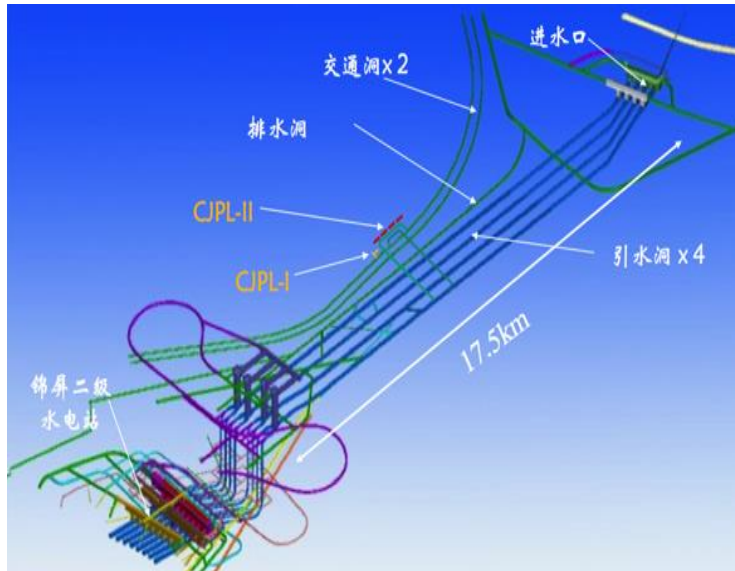
- Hadron Experimental Facility (HEF) of J-PARC restarted its user operation at 11:03AM on [24th April, 2015](#).
- Now all the experimental areas of J-PARC, i.e. neutron, muon, neutrino and hadron, are in the normal operation!
- After the radiation leak incident on 23rd May, 2013, J-PARC spent the most of efforts for the renovation of HEF in order to make the facility tighter against the same kind of troubles.
- Now HEF of J-PARC is running with the beam power of 27kW, which is a bit stronger than the previous best achievement before the incident, i.e. 24kW.

Dark Matter Search in Australia

- **Stawell** Underground Laboratory in Stawell gold mine
 - Located at 1 km underground (~3 km w.e.): Similar to Gran Sasso)
 - Highly pure NaI crystals with veto
 - Background levels have been estimated.
 - Joint initiative of Adelaide, Melbourne, Australian National and Swinburne Universities as well as CoEPP (the ARC Centre of Excellence in Particle Physics)
- Funding Situation
 - \$1.75M from the Victorian Govt. + \$1.75M from the Federal Govt. + more
- Timeline of the delivery of Lab: 2016



CJPL and JUNA in China



CJPL

2400 m rock

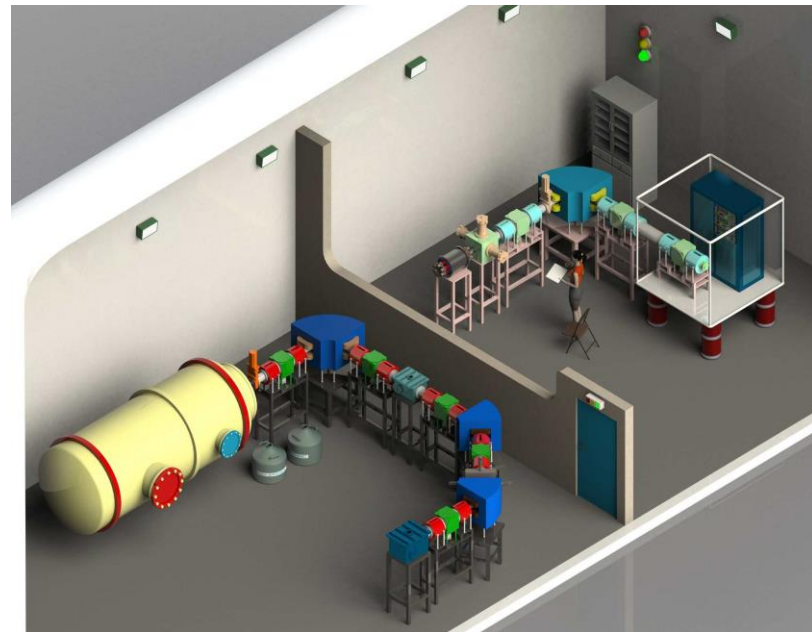
Phase I: 4000 m², 2009

Phase II: 200000 m², 2015

JUNA

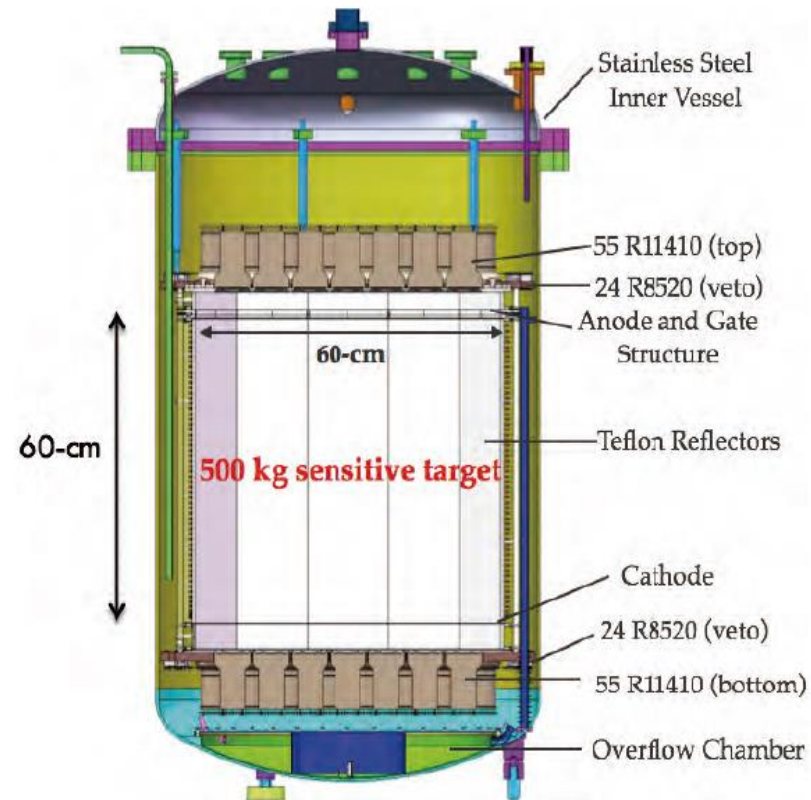
Phase I: 400 kV, p, α ,
10 mA, 2019, ~\$5 M NSFC etc

Phase II: 4 MV, α , ^{12}C , ^{16}O ,
1 mA, 2022



Dark Matter Search in China

- **CDEX-1** experiment at China Jiping
 - Underground Laboratory (CJPL)
 - Ge detector
 - It will evolve to CDEX-1T with ton-scale Ge detector array in the future.
- **PandaX** experiments at CJPL
 - Liquid Xe as a target medium
 - PandaX-I with 120-kg sensitive target collected 17+63 days of dark-matter search data by Nov. 2014.
 - PandaX-II with 500-kg sensitive target is being commissioned and will start data taking later this year.

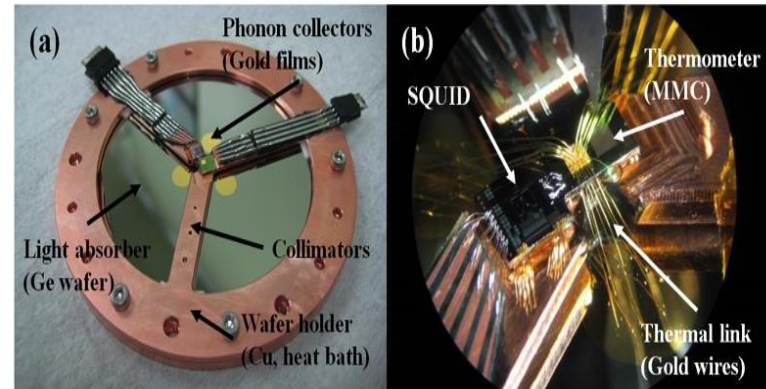
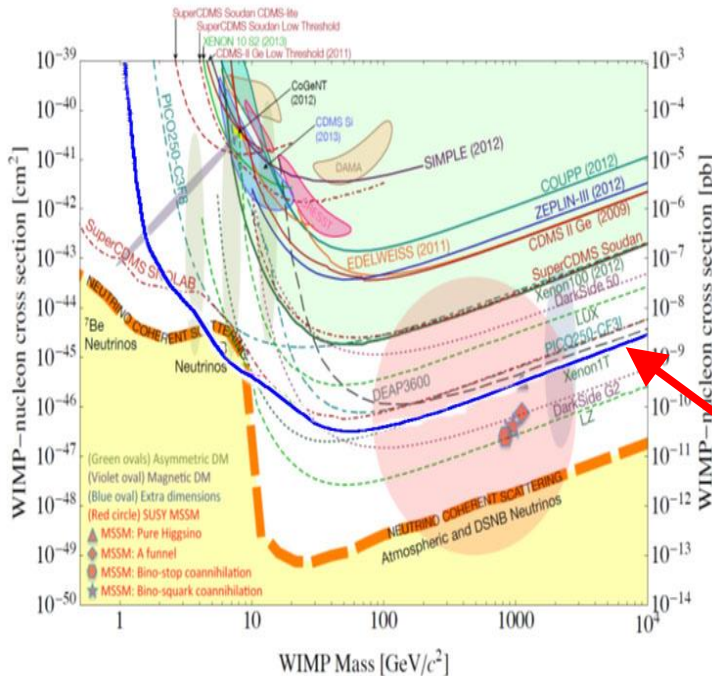


PandaX-II TPC design

Dark Matter Search in Korea

- Center for Underground Physics (CUP) at Institute of Basic Science (IBS)
- Main projects: **Dark matter search (KIMS+)**/**Double beta decay (AMoRE)**/New underground Lab. by 2018

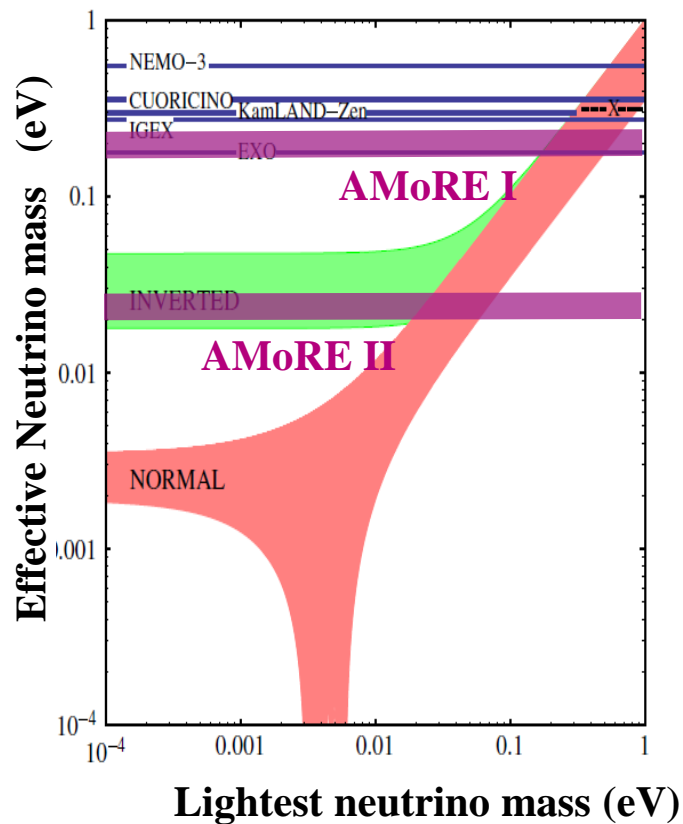
- **KIMS**-NaI & LT dark matter experiment
 - CUP will develop low-temperature scintillating crystal detectors.
 - Optimization of phonon+light detector is under study.
 - Expect to have similar sensitivity to SuperCDMS for $M_{\text{WIMP}} < 10 \text{ GeV}$



Sensitivity of 200 kg year with background level of 0.01/keV/kg/d
Plans to run 200 kg in 2019-2022

AMoRE Double β Decay Experiment

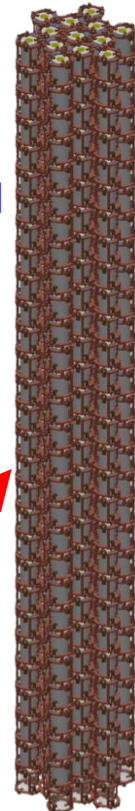
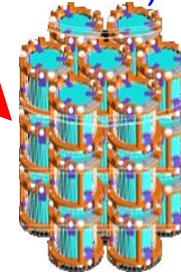
- Advanced Mo based Rare process Experiment
 - Search for $0\nu\beta\beta$ of ^{100}Mo using low-temperature scintillation detectors
 - 200 kg of $^{40}\text{Ca}^{100}\text{MoO}_4$, doubly enriched crystals
 - Expected to reach 20-50 meV mass region (Inverted Mass Hierarchy)



AMoRE-Pilot
setup at Y2L
(2015)

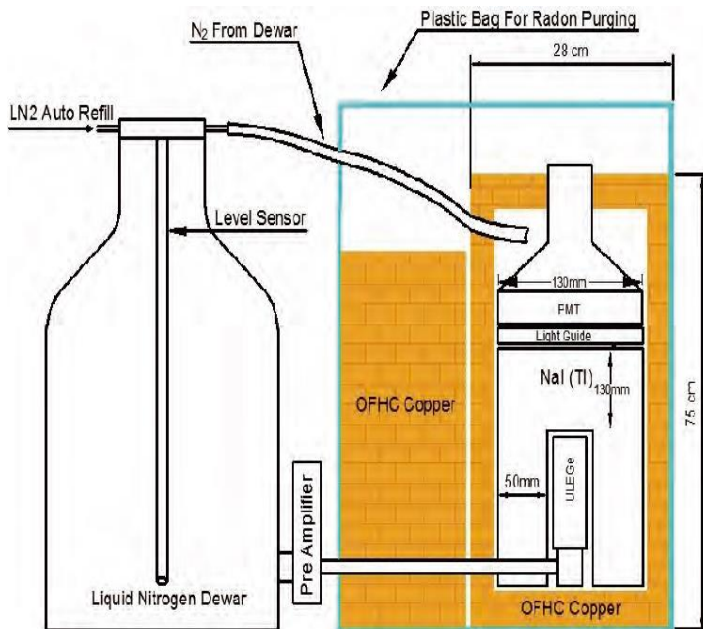
AMoRE II
(2020-
2022)

AMoRE I
(2017-
2018)



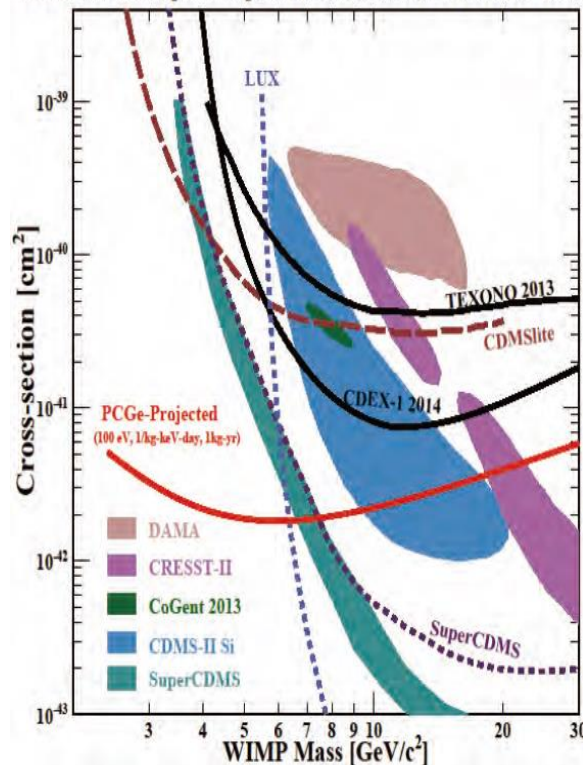
Dark Matter Search in Taiwan

- **TEXONO** (Taiwan EXperiments On Neutrino) experiment at Kuo-Sheng Reactor Neutrino Laboratory (KSNL)
 - 28 m from a 3 GW power reactor core
 - Ge detectors with NaI and 50 tons of passive shielding
 - Various Ge configurations are investigated.



Baseline design

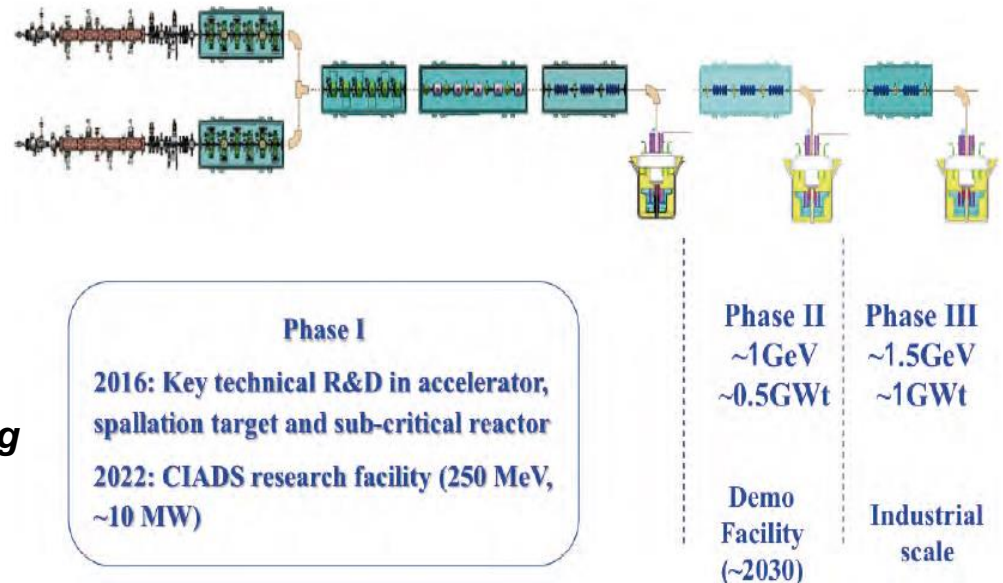
WIMP-Nucleon Spin-Independent Cross-section Vs WIMP Mass



Red line:
Projected
sensitivity at 100
eV_{ee} threshold, 1
kg-year data size
and background at
1 cpkcd

ADS in China

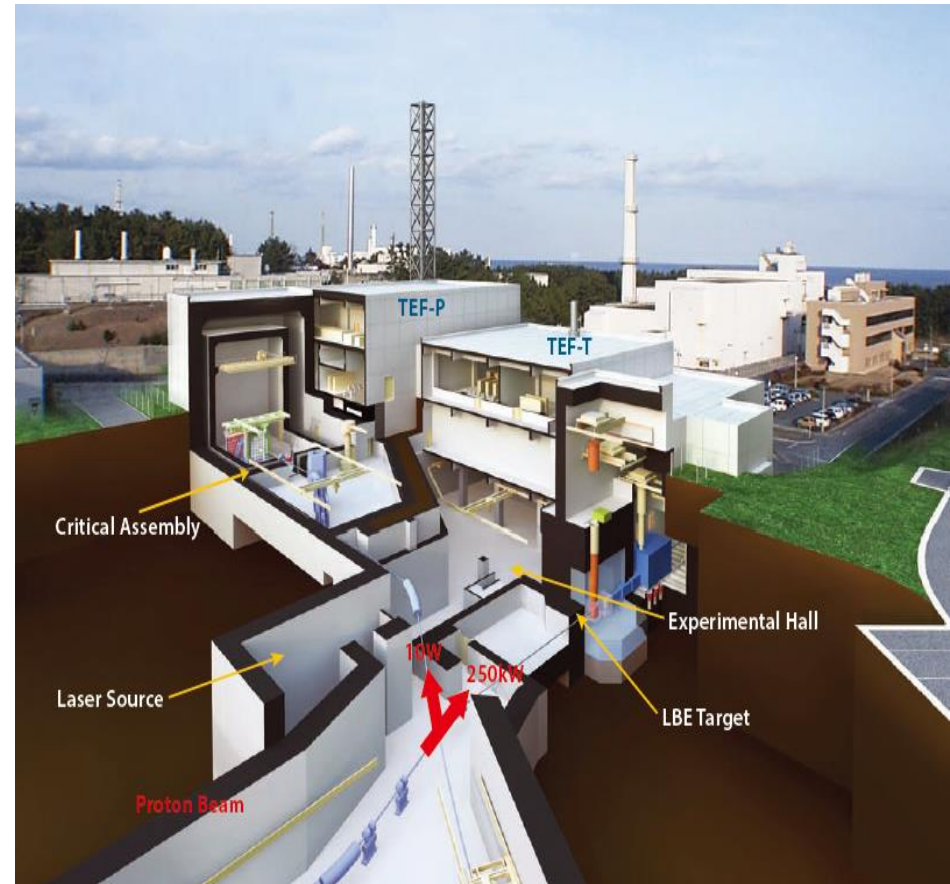
- **CIADS** (Accelerator Driven Sub-Critical System) program by CAS
- R&D of key technologies
 - CW proton beams at 2.55 MeV with ~11 mA current obtain in Feb. 2015
 - Prototype spallation GFT (Granular Flow Target) tested
 - Design of sub-critical reactor core, etc.



*A roadmap for developing
ADS facilities in China*

ADS in Japan

- JAEA promoted the design of the Transmutation Experimental Facility (TEF) within the framework of the J_PARC project.
- Lead-bismuth spallation target bombarded by 400 MeV-250 kW proton beams
- Construction will start within a few years after the national review



Transmutation Experimental Facility

ADS in Korea

- ADS has **deterministic safety** with passive elements to eliminate **Criticality, Meltdown, Decay heat, and Seismic protection**.
- SNU and SKKU are doing fundamental but original researches.
- Close international collaboration with China, Japan and Europe is needed.



Summary: ANPhA

- To strengthen the infrastructure:
 - Europeans': NuPECC, ENSAR, SPIRIT, NuPNET, ESFRI(European Strategy Forum on Research Infrastructures), ESF(European Science Foundation), EC, etc.
 - Americans': NSAC(under FAC Act), Office of Science for NP (DOE), MPSD (NSF), ..
 - Asians': Japan putting more than 1.5 b\$ on JPARC, China on new nuclear science research facilities, India on new projects, Korea on new RIB, etc., but not yet any apparent structure to make their investment more efficient.
- To form a group of beyond-critical-mass:
- NuPECC of ~6000, NSAC of ~2400, ANPhA of ~2700
- To answer the questions of our curiosity for deepening our knowledge on our universe, our existence, and for the sustainable development of world.



ANPhA
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ANPhA and Its Mission

- **To develop communication and coordination**
- **To convert consensus to governmental policy**
- **To collaborate across the region and globe, being a Platform.**





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Thank You.

