EIC USER GROUP MEETING AT WASHINGTON D.C.

OUTLOOK ON THE JAPANESE NUCLEAR PHYSICS PROGRAMS

Tomofumi Nagae
Kyoto University

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CONTENTS

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JAPANESE NUCLEAR PHYSICS COMMUNITY 原子核談話会

- Composed of Nuclear Physics Experimentalists
    - More than 625 people
    - # of Institutes : about 160
    - established in 1953
- the Nuclear Physics Executive Committee
    - T. Nagae (Kyoto: President), N. Aoi (RCNP: vice-president), T. Uesaka (RIKEN), H. En'yo (RIKEN), K. Ozawa (KEK), T. Kawabata (Osaka), N. Saito (J-PARC), H. Sakurai (RIKEN/Tokyo), T. Shimoura (CNS,Tokyo), T. Suda (ELPH), K. Sekiguchi (Tohoku), K.H. Tanaka (KEK), H. Tamura (Tohoku), K. Tokushuku (IPNS, KEK), T. Nakano (RCNP), T. Nakamura (TIT), H. Noumi (RCNP), H. Hama (ELPH), T. Wakasa (Kyushu), M. Wada (KEK)

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SENDING REPRESENTATIVES TO

- Advisory committee of the Institute of Particle and Nuclear Studies of KEK.
- Steering committee of RCNP of Osaka University.
- J-PARC Center Users Committee.
- Advisory committee of ELPH, Tohoku University.
- Managements of Nuclear Physics Division of JPS.

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OUR FACILITIES

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NUCLEAR PHYSICS COMMUNITY IN JAPAN

- Experimentalists ~600
- Theorists ~400

~1,000

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OUR FUTURE PROJECTS

- From Nuclear Physics Community, we proposed in 2017,
    - Two Large Facility Projects and
    - Two Large Research Projects.
- Two Large Research Projects:
    - Quark-Nuclear Physics with Photons from ELPH and LEPS2/RCNP.
      32 M$
    - Research for Quark-Gluon Plasma with HE-HI from Tsukuba, CNS, Hiroshima, RIKEN, Nara Women.
      37 M$

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LARGE FACILITY PROJECTS

- Understanding the Origin of Matter with upgrade of J-PARC facilities from KEK (+RIKEN, RCNP)
    - 304 M$ for Hadron Hall Extension, COMET, g-2.
    - → selected as Large Facility Projects with High Priority by SCJ. (28 in total)
- Promotion of Heavy-Element Science with upgrade of RIBF from RIKEN (+RCNP, IPNS/KEK, CNS)
    - 146 M$
    - not in the High Priority projects

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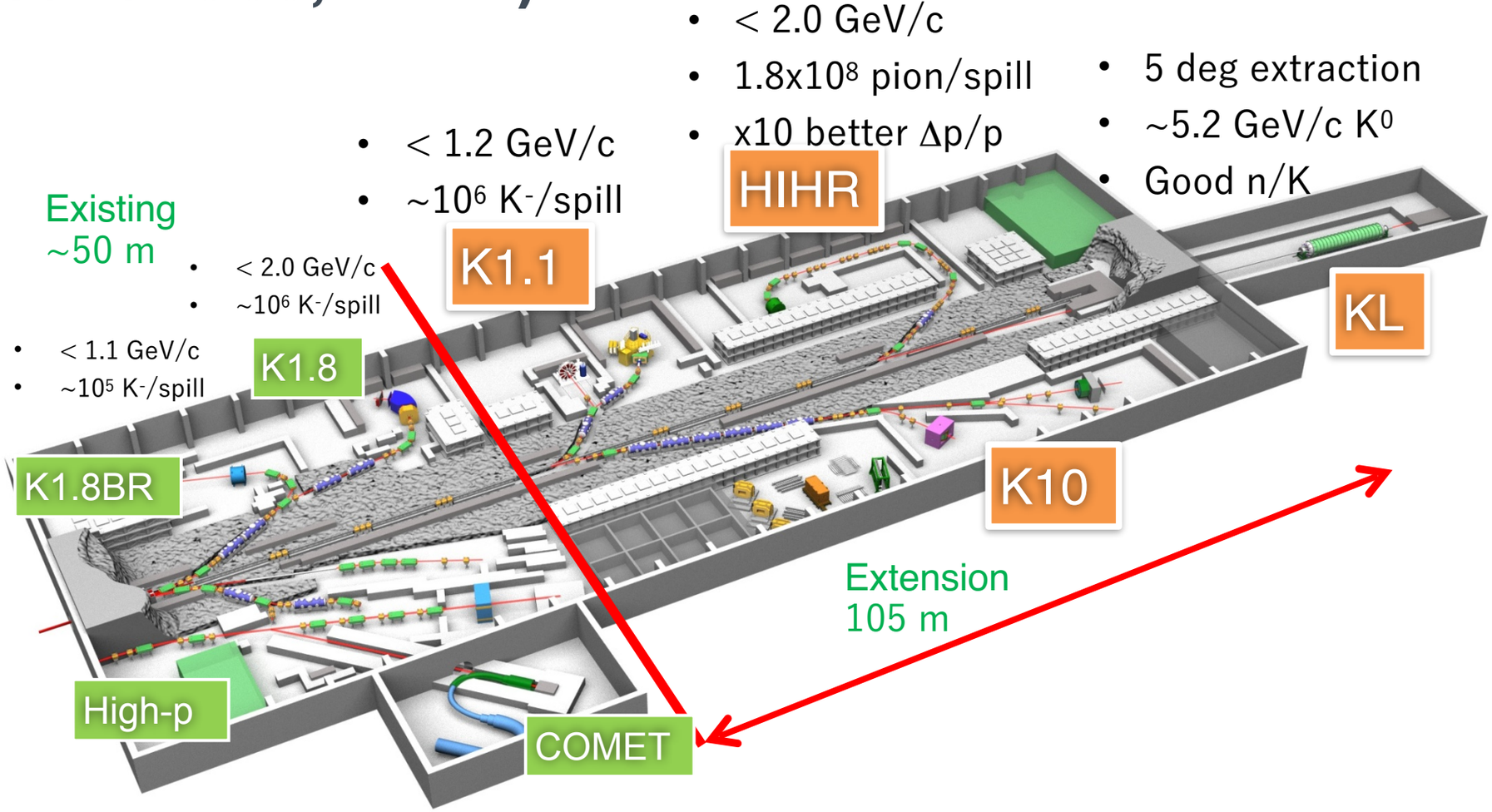
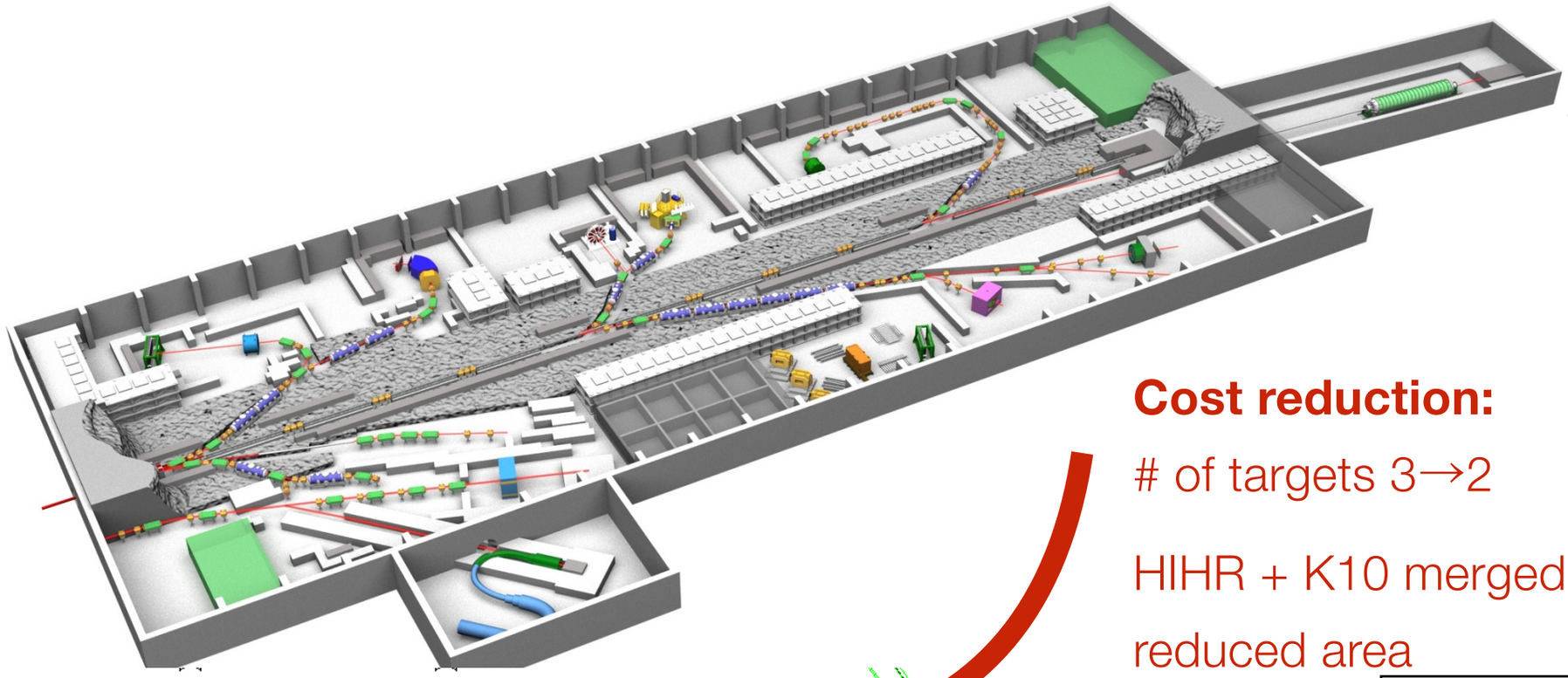
J-PARC UPGRADE

Hadron Hall Extension Plan (proposed for SCJ, MEXT)



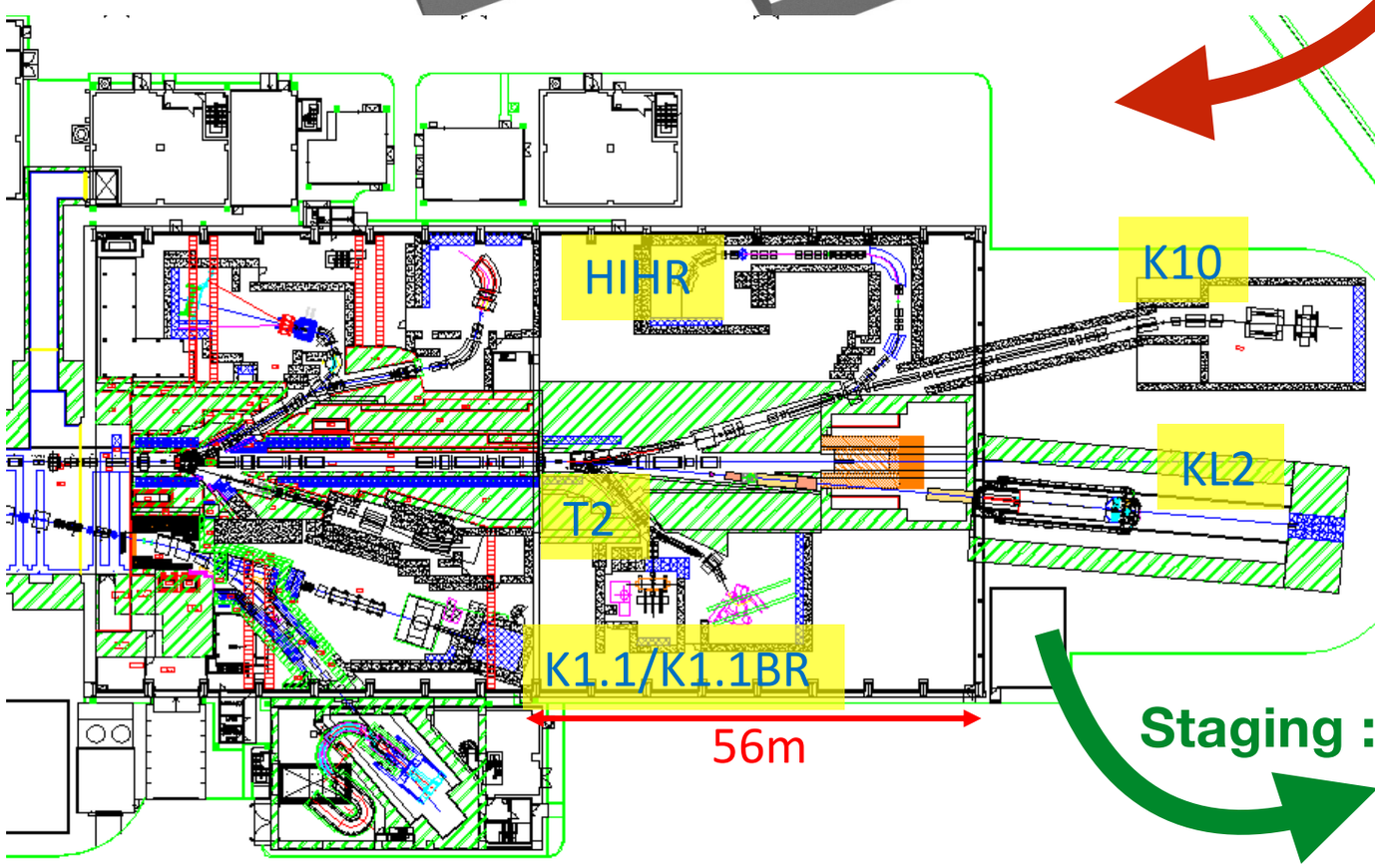


Cost reduction:

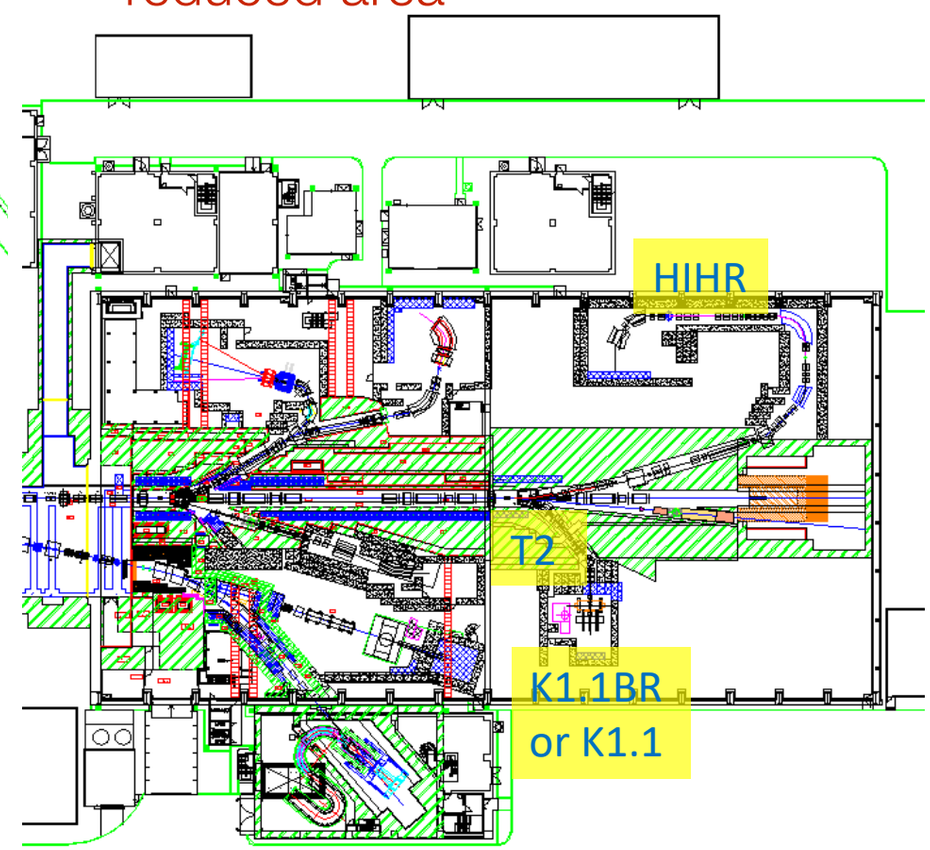
# of targets 3→2

HIHR + K10 merged

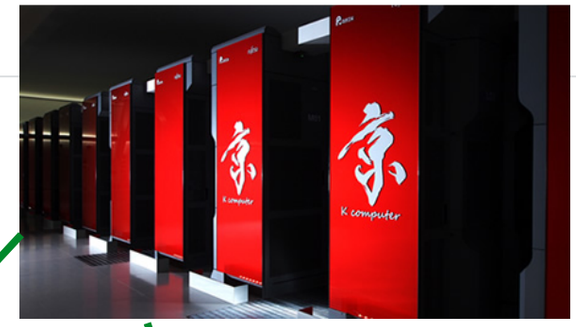
reduced area



Staging :



Science Goal

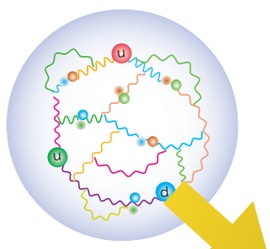


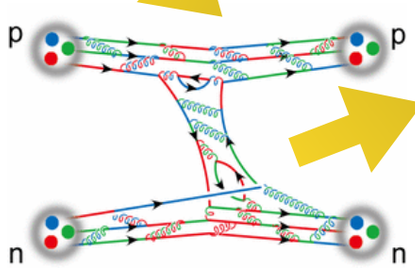
LatticeQCD

HAL QCD

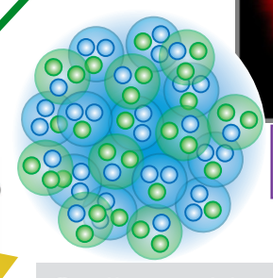
Numerical Relativity simulation

A=1
Quark Confinement

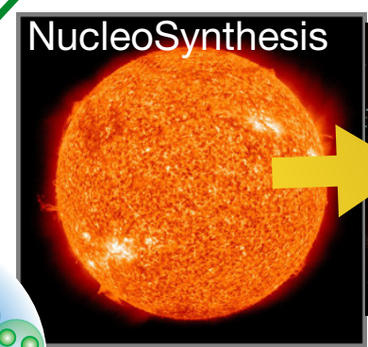




A=2
Baryon Interactions (Nuclear Force)

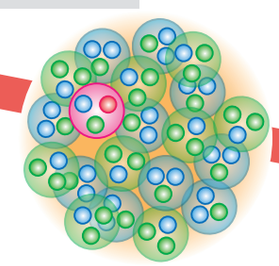


Ordinary Nuclei



u, d-quark World

Heavy Nuclei ?

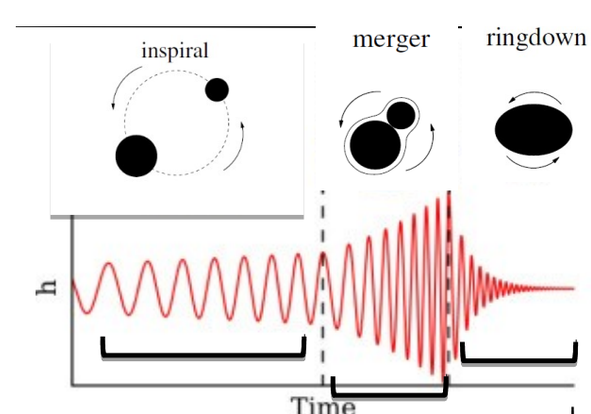


Dense Matter Physics
r-Process Site

A=∞

Λ, Σ Hypernuclei

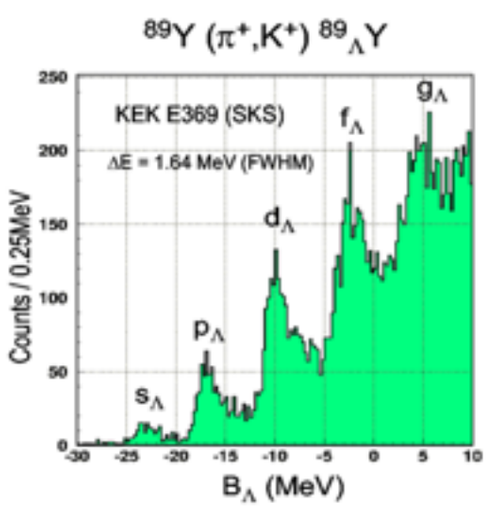
u, d, s-quark world



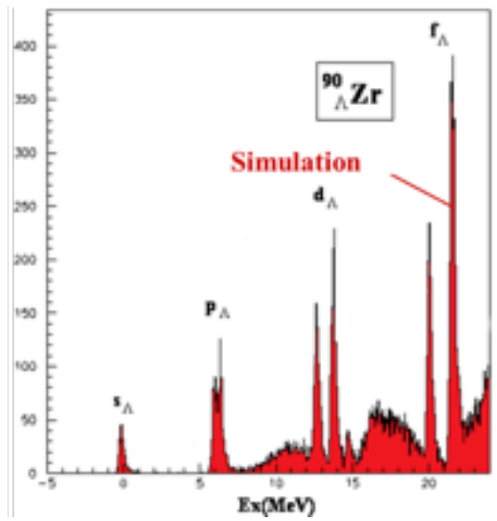
SπK spectroscopy

- Supra-precision (π,K) spectroscopy to probe 3-body YNN force with ΔE~0.1 MeV

KEK-PS E369 with SKS → Expected at HIHR beam line

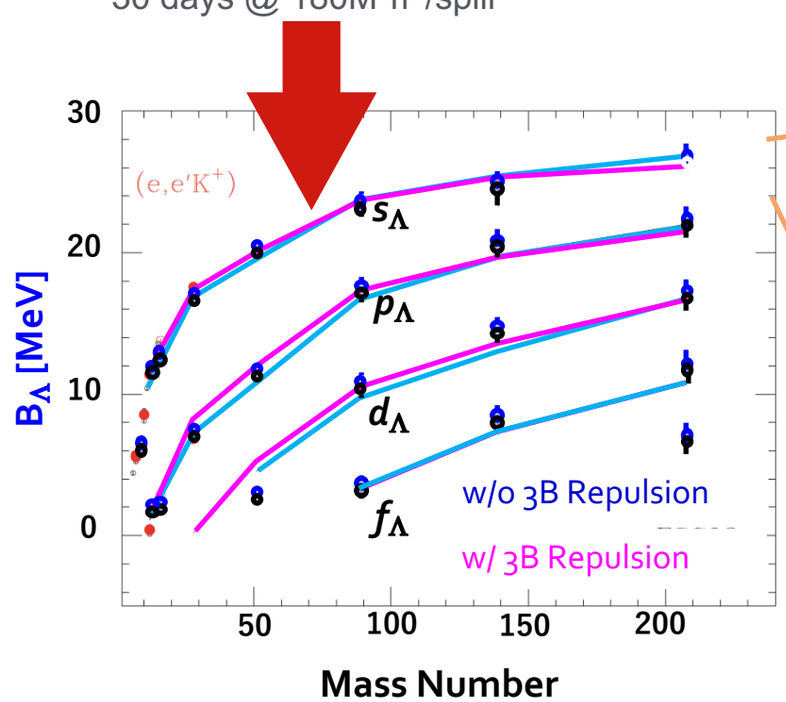


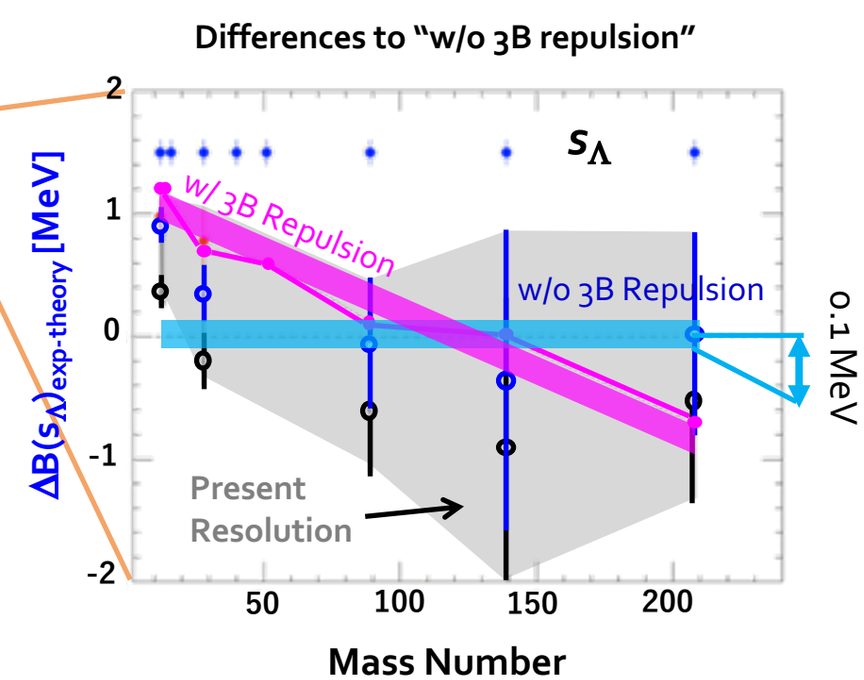
~60 days @ 3M π⁺/spill



~30 days @ 180M π⁺/spill

Verification of 3-body repulsion can be a solution to the Hyperon Puzzle.

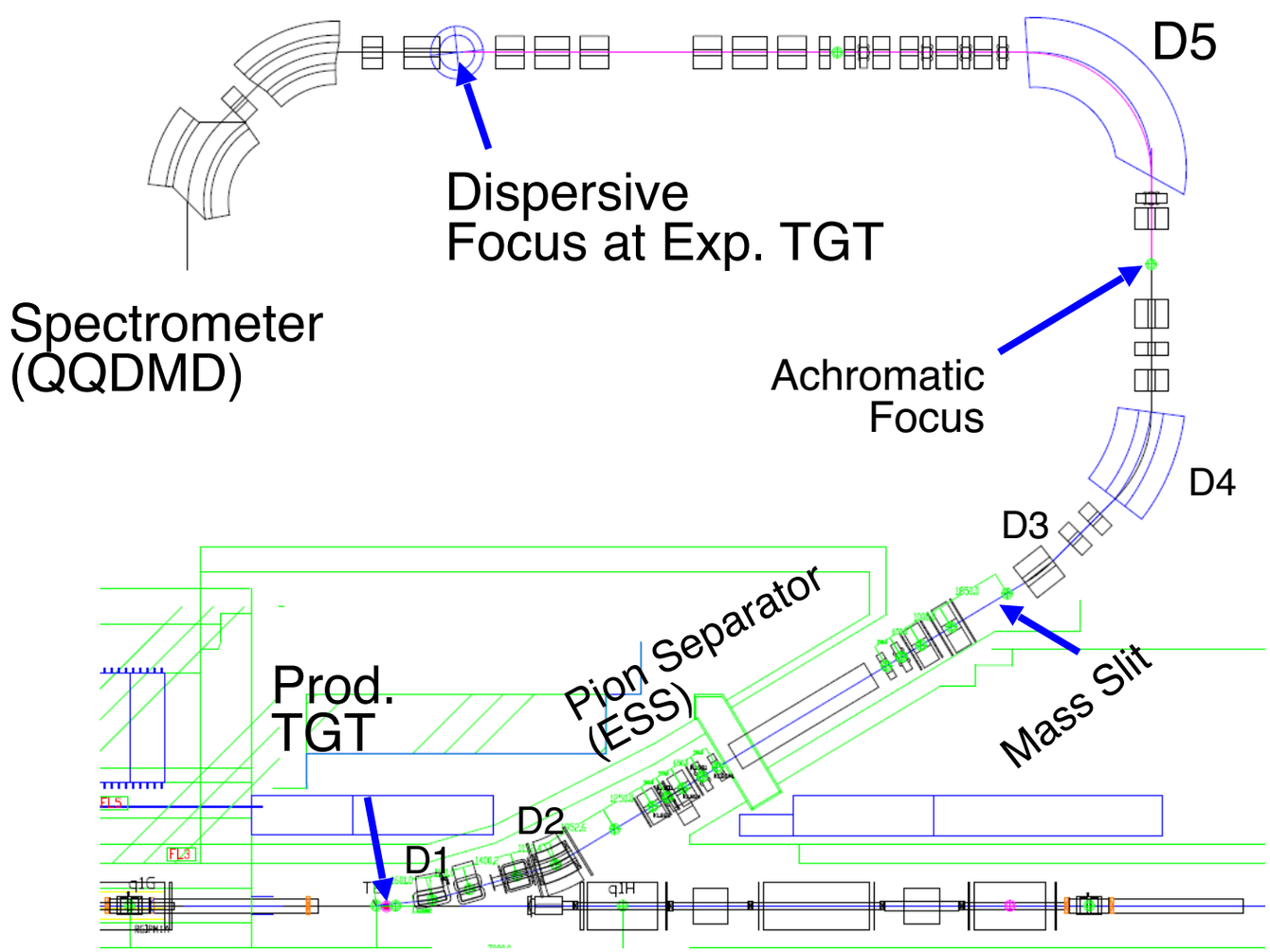




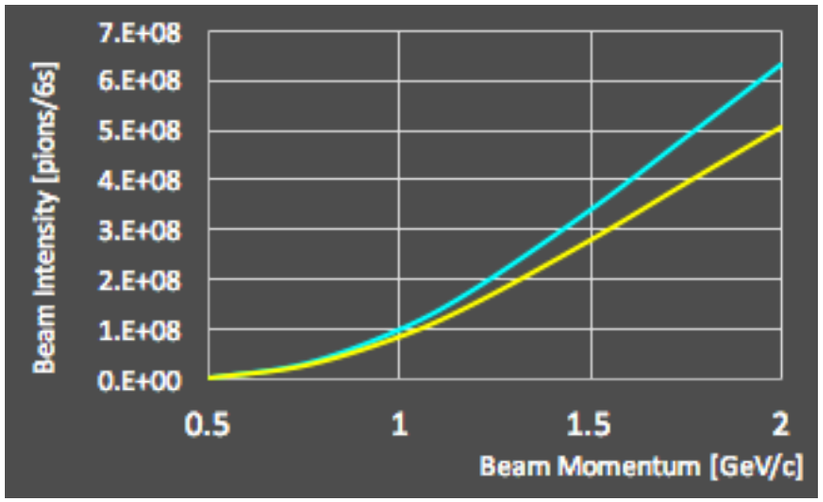
Facility: HIHR

Present beam lines:
~10^6 pions/pulse, $\Delta p/p$ ~ 1/1000

- High-Intensity High-Resolution Beam line for High Precision (π, K^+) Spectroscopy in ΔE=0.1 MeV
  - Dispersion matching ; no beam tracking (well established tech.)

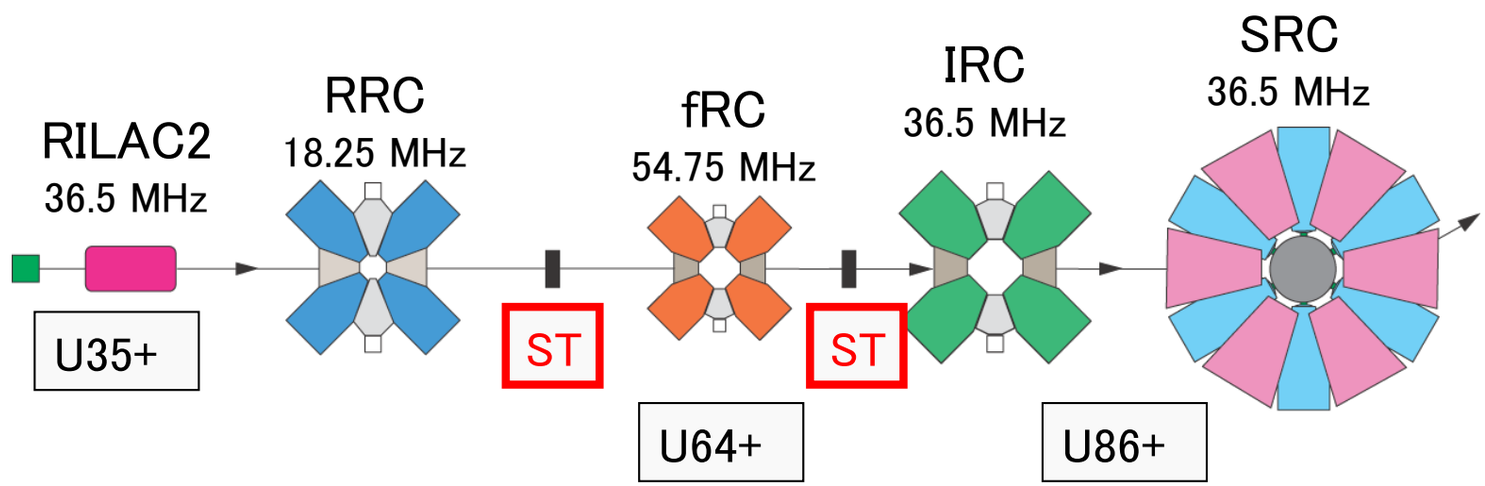


Intensity: ~ 1.8×10^8 pion/pulse
(1.2 GeV/c, 58 m, 1.4msr*%,
100kW, 6s spill, Pt 60mm)
$\Delta p/p$ ~ 1/10000



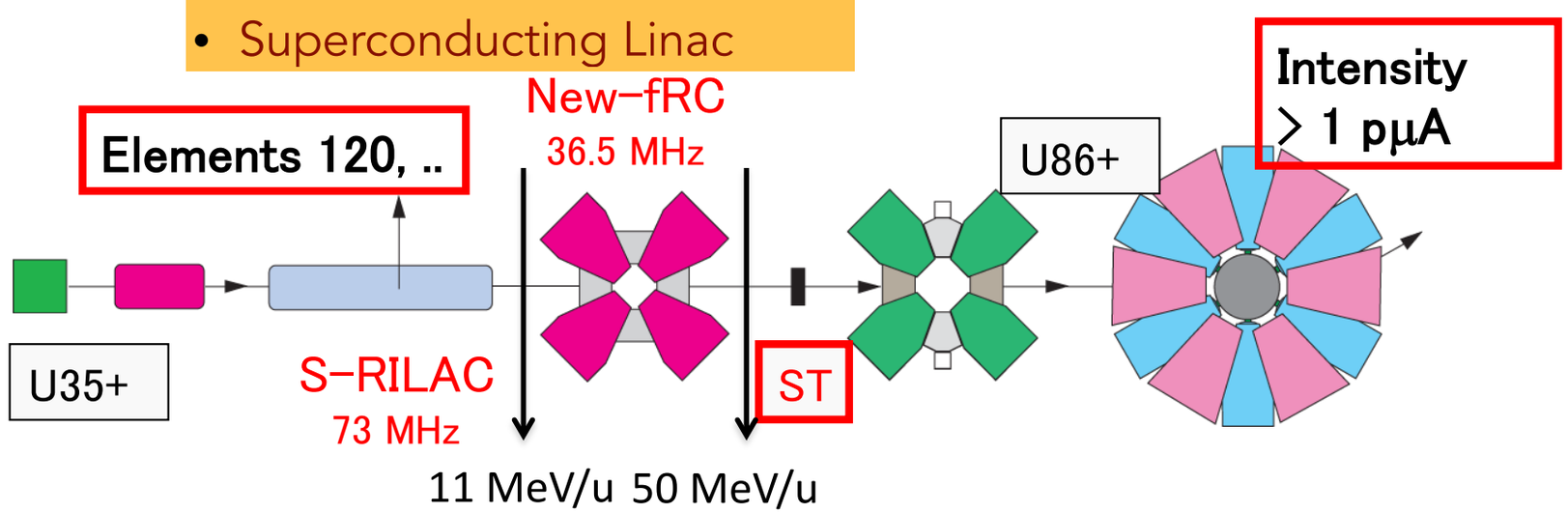
RIKEN RIBF UPGRADE

PRESENT



FUTURE

- 1-stage Stripper→New fRC
- Superconducting Linac



30 TIMES MORE BEAM INTENSITY

RIKEN RIBF UPGRADE

KEK

Multi-nucleon transfer reactions
Ultra-slow (E<30 keV) RI beam

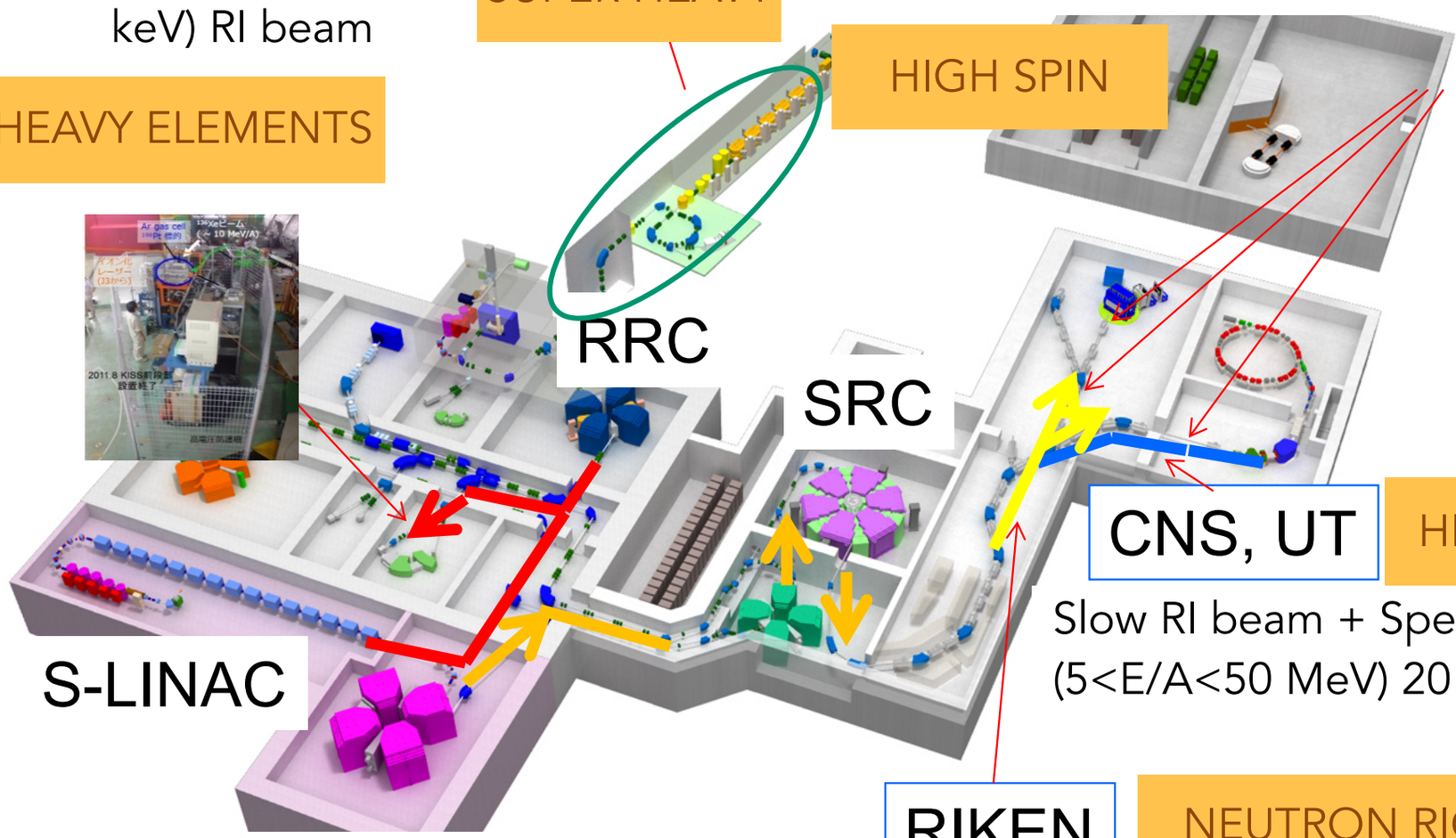
HEAVY ELEMENTS

SUPER HEAVY

RCNP, Osaka

Next generation Ge Detectors 2016 ~

HIGH SPIN



CNS, UT

HIGH EXCITATION

Slow RI beam + Spectrometer
(5<E/A<50 MeV) 2017 ~

RIKEN

NEUTRON RICH

Fast RI beam (50<E/A<300 MeV)
Delivered for existing equipment

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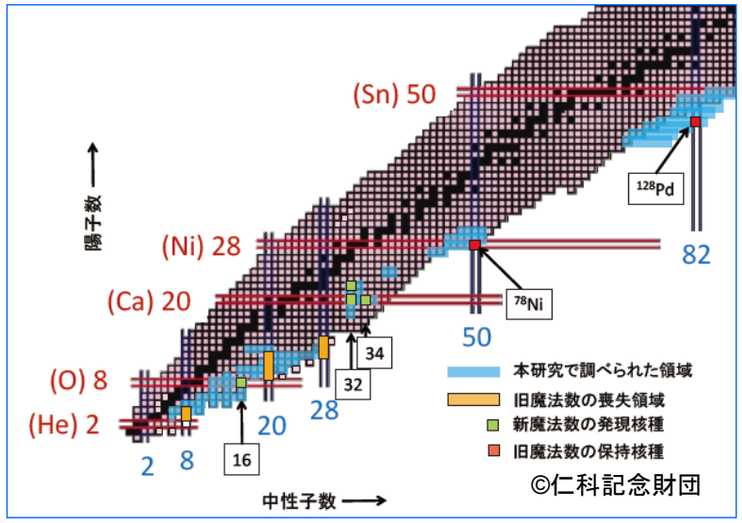
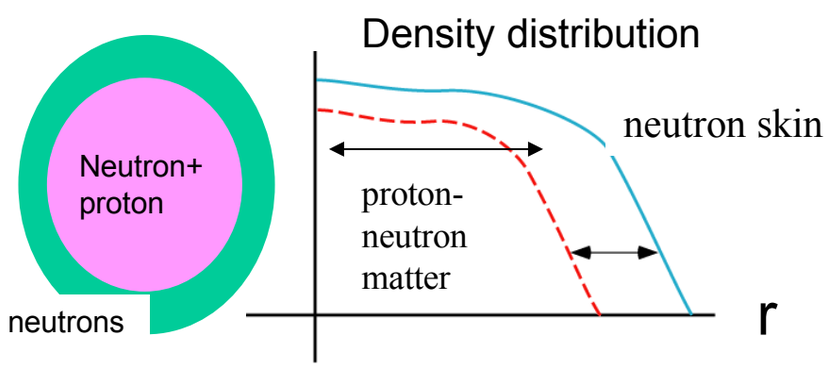
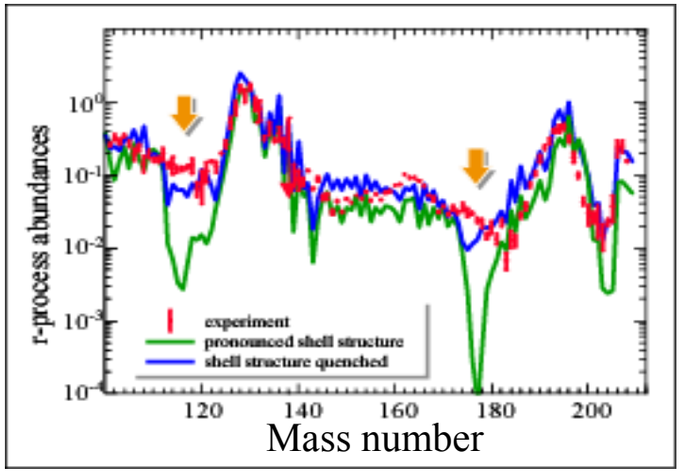
RIBF UPGRADES

- Explore the nuclear chart toward drip-lines
- New Magic Numbers





- r-process



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QCD PHASE DIAGRAM

- Explore the Phase Boundary with LHC, RHIC, and J-PARC HI
    - LHC ALICE Upgrades : 2021~
    - RHIC sPHENIX 2022 ~

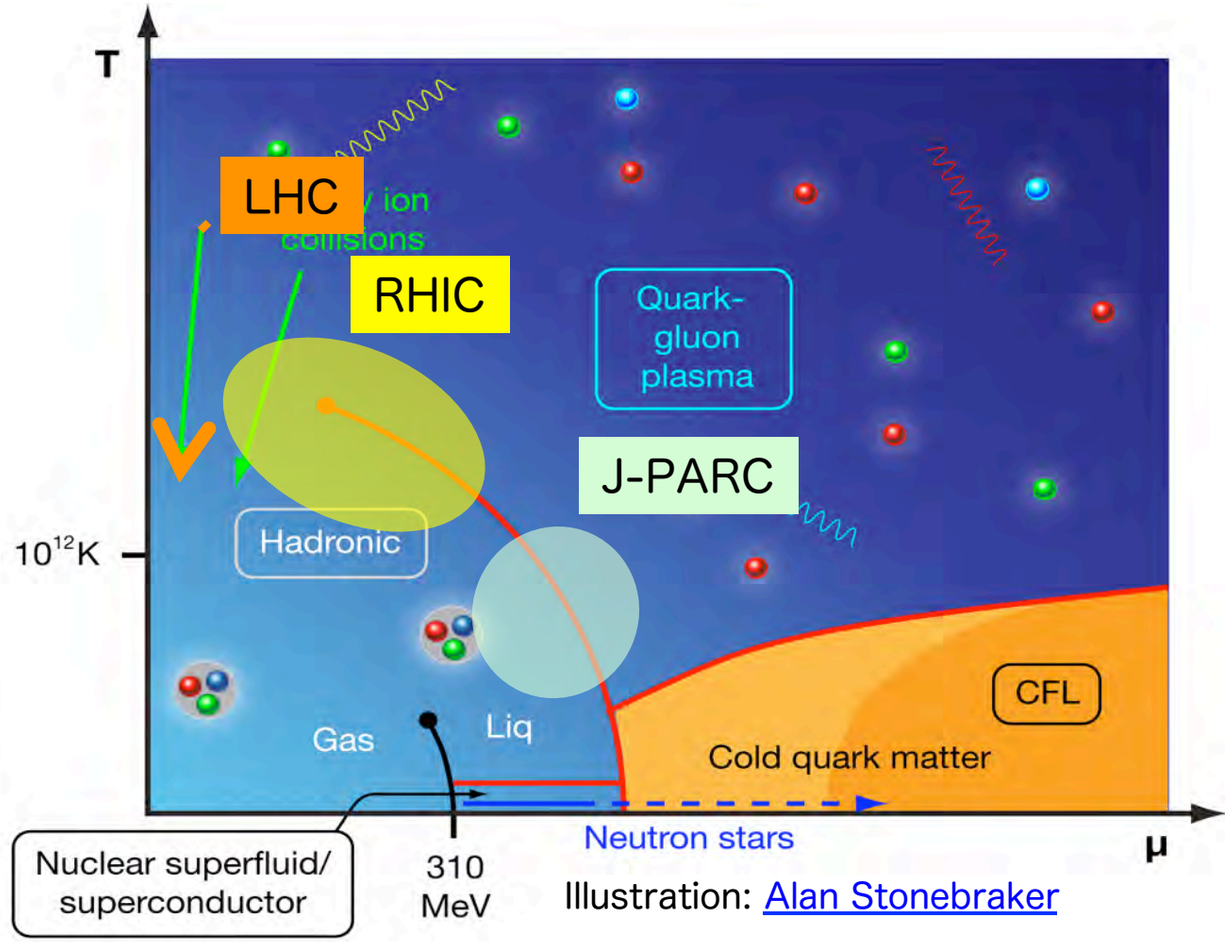
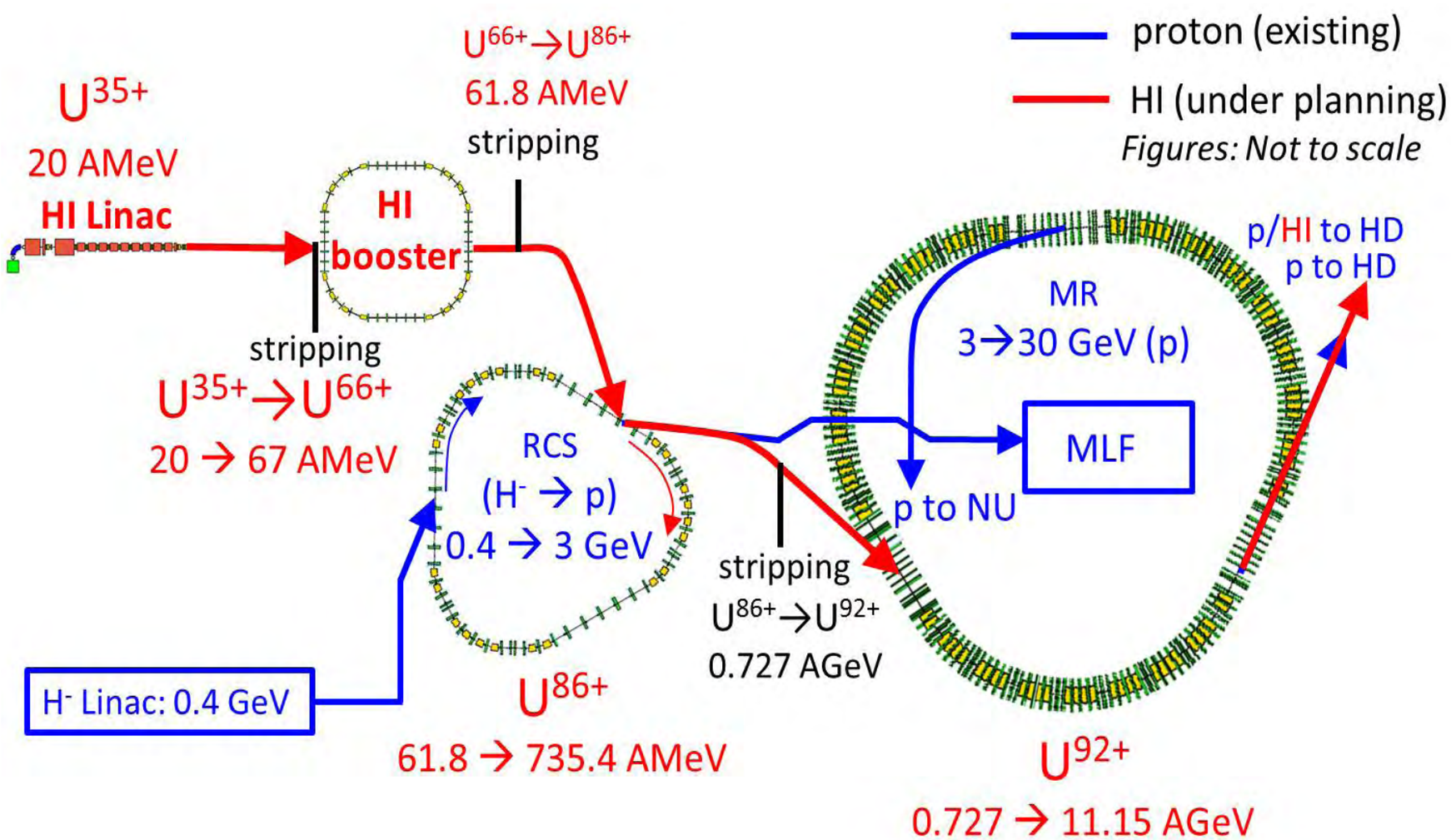


Illustration: Alan Stonebraker

HEAVY IONS AT J-PARC



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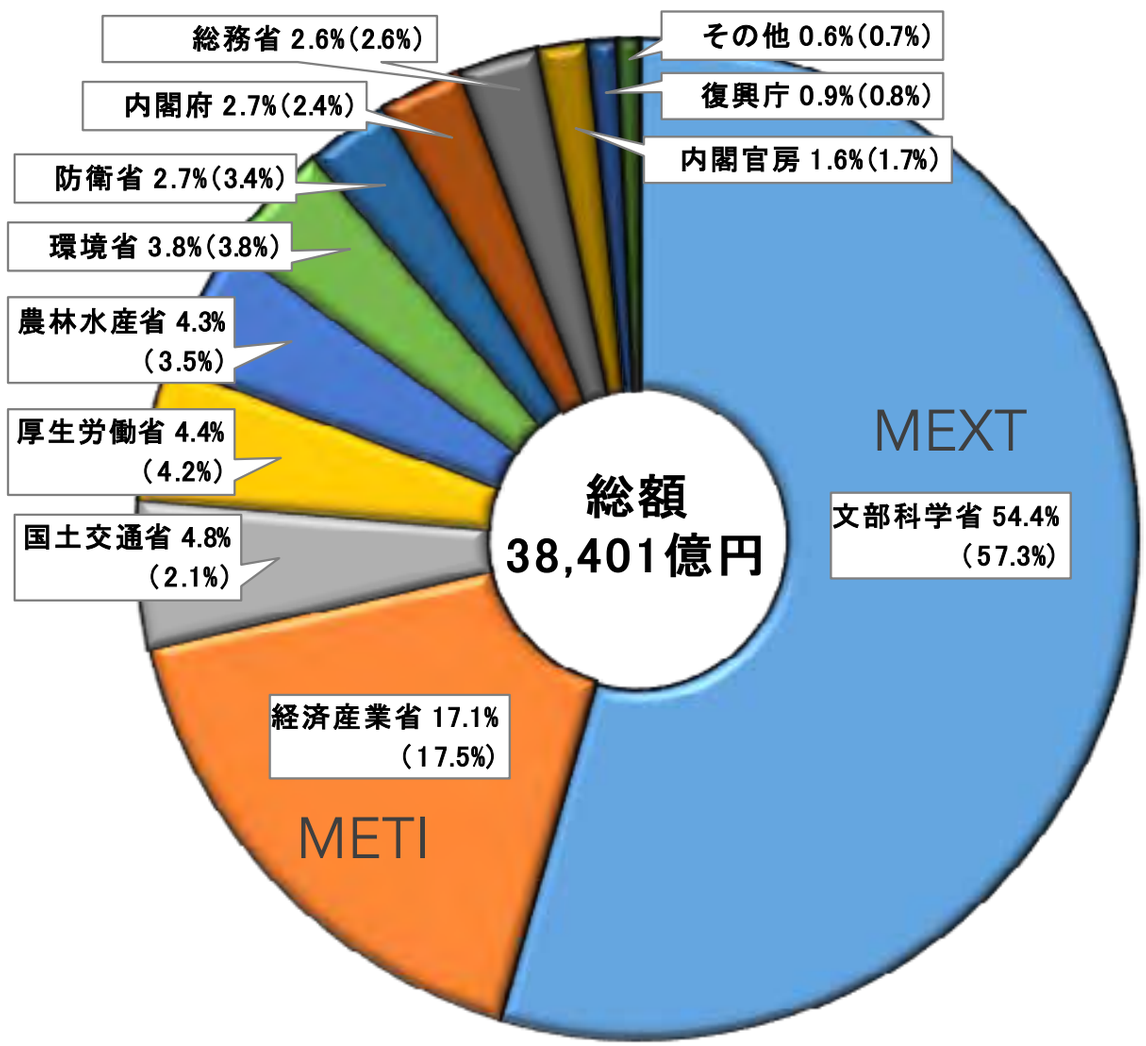
OUR FUNDING AGENCY

- Ministry of Education, Culture, Sports, Science and Technology

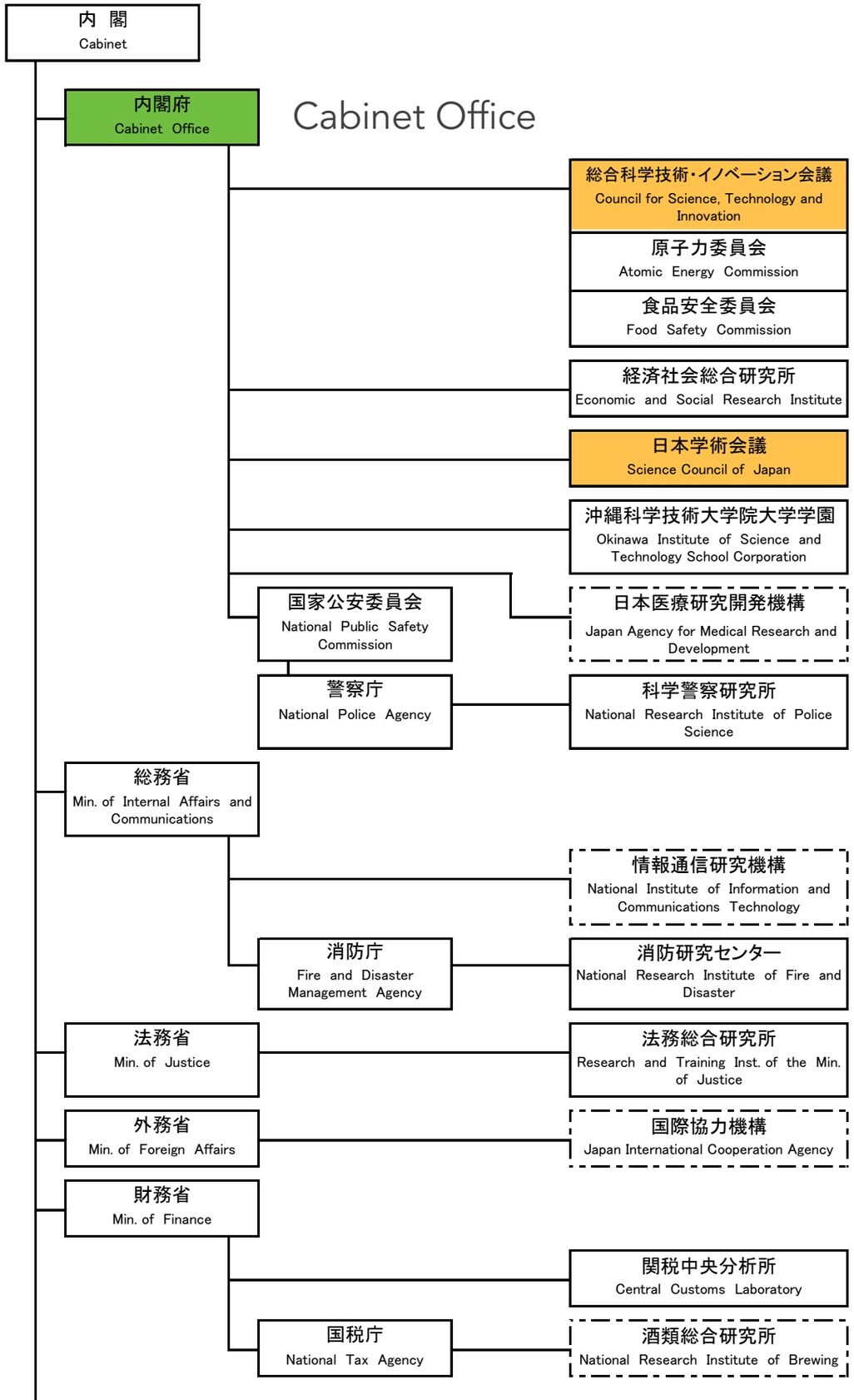
- M$ ~ 億円



Budget for
Science and Technology
~38,401 M$

MEXT 54.4%

25. 科学技術行政機構図　S&T administrative organization charts



Cabinet Office

CSTI (Council for Science, Technology and Innovation)

Science Council of Japan

①

MEXT

Ministry of Education, Sports & Culture + Science & Technology Agency
⇒ MEXT (2001)

文部科学省
Min. of Education, Culture, Sports, Science and Technology

- 科学技術・学術審議会 Council for Science and Technology — Council for Science and Technology
- 日本学士院 Japan Academy
- 地震調査研究推進本部 Headquarters of Earthquake Research Promotion
- 国立教育政策研究所 National Institute for Educational Policy Research
- 科学技術・学術政策研究所 National Institute of Science and Technology Policy

UNIV

- 国立大学法人 National Universities Corporation
  - 附置研究所 Laboratories Attached to Universities — Univ Labs : RCNP, ELPH, etc.
- 大学共同利用機関法人 Inter University Research Institutes Corporations — Inter-Univ. Institutes: KEK, NAOJ

JST

- 国立科学博物館 National Science Museum
- 量子科学技術研究開発機構 National Institutes for Quantum and Radiological Science and Technology — QST
- 国立特別支援教育総合研究所 National Institute of Special Needs Education
- 防災科学技術研究所 National Research Institute for Earth Science and Disaster Prevention
- 科学技術振興機構 Japan Science and Technology Agency
- 海洋研究開発機構 Japan Agency for Marine-Earth Science and Technology
- 日本学術振興会 Japan Society for the Promotion of Science — JSPS
- 宇宙航空研究開発機構 Japan Aerospace Exploration Agency — JAXA
- 理化学研究所 Institute of Physical and Chemical Research — RIKEN
- 国立青少年教育振興機構 National Institute for Youth Education
- 物質・材料研究機構 National Institute for Materials Science
- 日本スポーツ振興センター National Agency for the Advancement of Sports and Health
- 日本原子力研究開発機構 Japan Atomic Energy Agency — JAEA
- 国立高等専門学校機構 National Institute of Technology

文化庁 Agency for Cultural Affairs

- 日本芸術文化振興会 Japan Arts Council
- 国立文化財機構 National Institutes for Cultural Heritage

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SCIENCE AND TECHNOLOGY ADMINISTRATION IN JAPAN

Prime Minister of Japan

↓

Council for Science, Technology and Innovation (in the Cabinet office)

✓ *The 5th Science and Technology Basic Plan(2016-2020)*

- Ministry of Education, Culture, Sports, Science and Technology
- Ministry of Economy, Trade and Industry
- Ministry of International Affairs and Communications
- Ministry of Land, Infrastructure, Transport and Tourism
- Ministry of Health, Labor and Welfare
- Ministry of the Environment
- Ministry of Agriculture, Forestry and Fisheries

+ Other ministries, agencies,…

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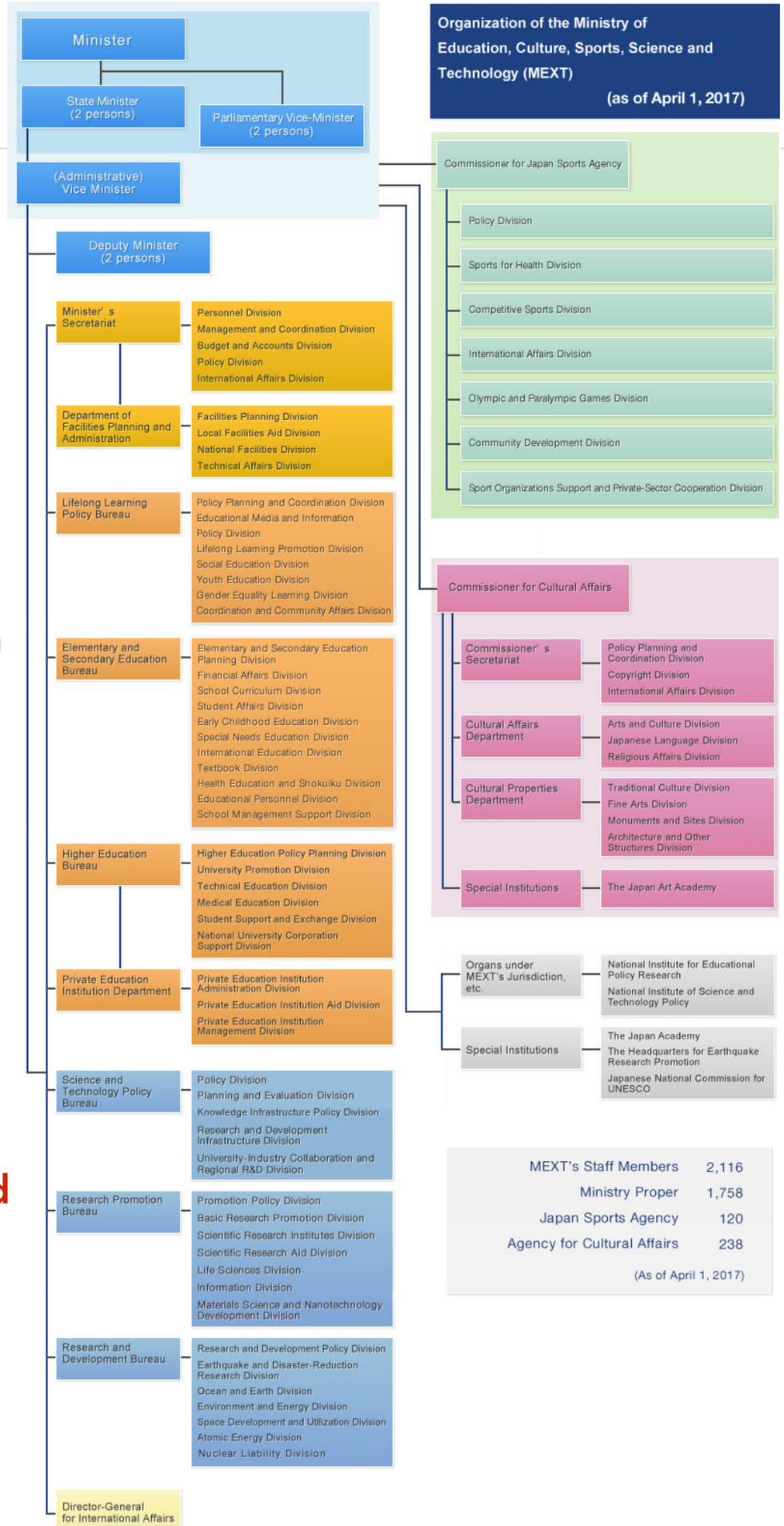
MEXT ORGANIZATION

- Ministry of Education, Culture, Sports, Science and Technology



- Higher Education Bureau
  - Higher Education Policy Planning Division
  - University Promotion Division
  - Technical Education Division
  - Medical Education Division
  - Student Support and Exchange Division
  - National University Corporation Support Division
- Private Education Institution Department
  - Private Education Institution Administration Division
  - Private Education Institution Aid Division
  - Private Education Institution Management Division
- Science and Technology Policy Bureau
  - Policy Division
  - Planning and Evaluation Division
  - Knowledge Infrastructure Policy Division
  - Research and Development Infrastructure Division
  - University-Industry Collaboration and Regional R&D Division

科学技術・学術政策局

- Research Promotion Bureau
  - Promotion Policy Division
  - Basic Research Promotion Division
  - Scientific Research Institutes Division
  - Scientific Research Aid Division
  - Life Sciences Division
  - Information Division
  - Materials Science and Nanotechnology Development Division

研究振興局

- Research and Development Bureau
  - Research and Development Policy Division
  - Earthquake and Disaster-Reduction Research Division
  - Ocean and Earth Division
  - Environment and Energy Division
  - Space Development and Utilization Division
  - Atomic Energy Division
  - Nuclear Liability Division

研究開発局

- Special Institutions
  - The Japan Art Academy
- Organs under MEXT's Jurisdiction, etc.
  - National Institute for Educationa Policy Research
  - National Institute of Science and Technology Policy
- Special Institutions
  - The Japan Academy
  - The Headquarters for Earthquak Research Promotion
  - Japanese National Commission UNESCO

RIKEN
J-PARC

KEK

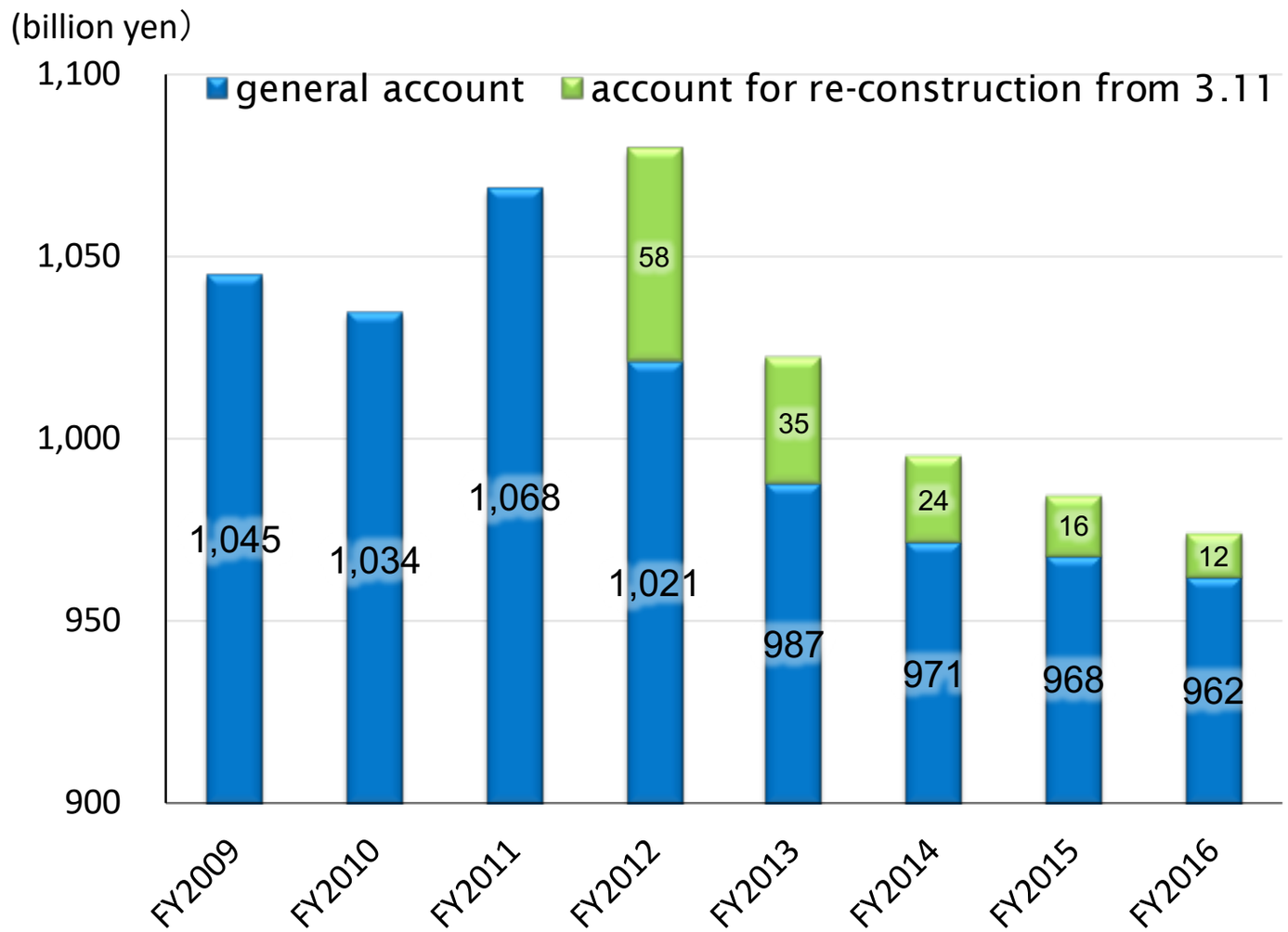
JAEA

MEXT's Staff Members	2,116
Ministry Proper	1,758
Japan Sports Agency	120
Agency for Cultural Affairs	238

(As of April 1, 2017)

CAPLINE HEADER ELEMENT

SCIENCE AND TECHNOLOGY BUDGET IN MEXT



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GRANT-IN-AID FROM JSPS & MEXT

Our daily research budget

Category	Period (Year)	Budget (M$)
Innovative Areas	5	(0.1 ~ 3) x5 < 15
Specially Promoted	3 ~ 5	5
S	5	0.5 ~ 2
A	3 ~ 5	0.2 ~ 0.5
B	3 ~ 5	0.05 ~ 0.2
C	3 ~ 5	< 0.05
Challenging	1 ~ 3	< 0.05

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LARGE SCIENTIFIC PROJECTS

- Period : 5 ~ 10 years or more
- Budget in total : > 20 M$
- Need Community Support → Promoting Body (Institutes, Universities, etc.)
- Prioritized by Science Council of Japan. 日本学術会議 SCIENCE COUNCIL OF JAPAN

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CLASSIFICATION OF LARGE SCIENTIFIC PROJECTS

Measures to promote large scientific research projects

Political request

Top-down R&D

Nationally strategic research projects
Projects for industry-academia-government research

- Space transportation system (rocket development)
- K computer, etc.

Bottom-up R&D

Research to seek the truth, develop, or apply scientific knowledge on the basis of the internal motivation of individual researchers

- Super Kamiokande
- Super KEKB, etc.

Proposition from the scientific community

Formulation and use of the roadmap

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MEASURES FOR THE PROMOTION OF LARGE PROJECTS BY MEXT

Master Plan (SCJ: Science Council of Japan)

Priority large-scale research projects (projects that should be performed promptly)

Evaluate each project from a scientific viewpoint

Roadmap (formulated by the Council for Science and Technology, MEXT)

Using the master plan, evaluations clarify the priority while considering the urgency and strategic features.

For budget requests, projects assessed highly in the roadmap undergo a preliminary evaluation.

Large-scale Scientific Frontier Promotion Project, etc. (MEXT)

Budget request for Ministry of Finance (MOF), based on the preliminary evaluation

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SCHEDULE OF MASTER PLAN AND ROADMAP

Master Plan (SCJ)		Roadmap (Council for Science and Technology, MEXT)
● Formulation of the Master Plan (March 2010)	→	● Formulation of the Roadmap (October 2010)
● Minor revision of the Master Plan (September 2011)	→	● Minor revision of the Roadmap (May 2012)
● Formulation of the Master Plan (February 2014)	→	● Formulation of the Roadmap (August 2014)
● Formulation of the Master Plan (February 2017)	→	● Formulation of the Roadmap (July 2017)

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PROCESS OF APPROVING ROADMAP 2017

182 projects proposed

Master Plan 2017
(SCJ)

163 large scientific research projects (new)

28 priority large-scale research projects

Roadmap 2017
(Council for Science and Technology, MEXT)

7 high-priority projects

High-Luminosity LHC, Hyper Kamiokande

None of them are funded yet.

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SUMMARY

- If you want to participate in EIC from Japan with > 20 M$,

- You need to pass through the "Master Plan" by SCJ and "Road Map" by MEXT, with the high priority support from the Nuclear Physics Community of Japan.

+

- You need to identify the Institute to conduct the EIC research program in Japan.

- We can join the EIC personally, if 2 M$ /five years is enough.