Oct 23, 2015
ANPhA Symp., 慶州

Present Status and Future Plans of J-PARC Hadron Experimental Facility

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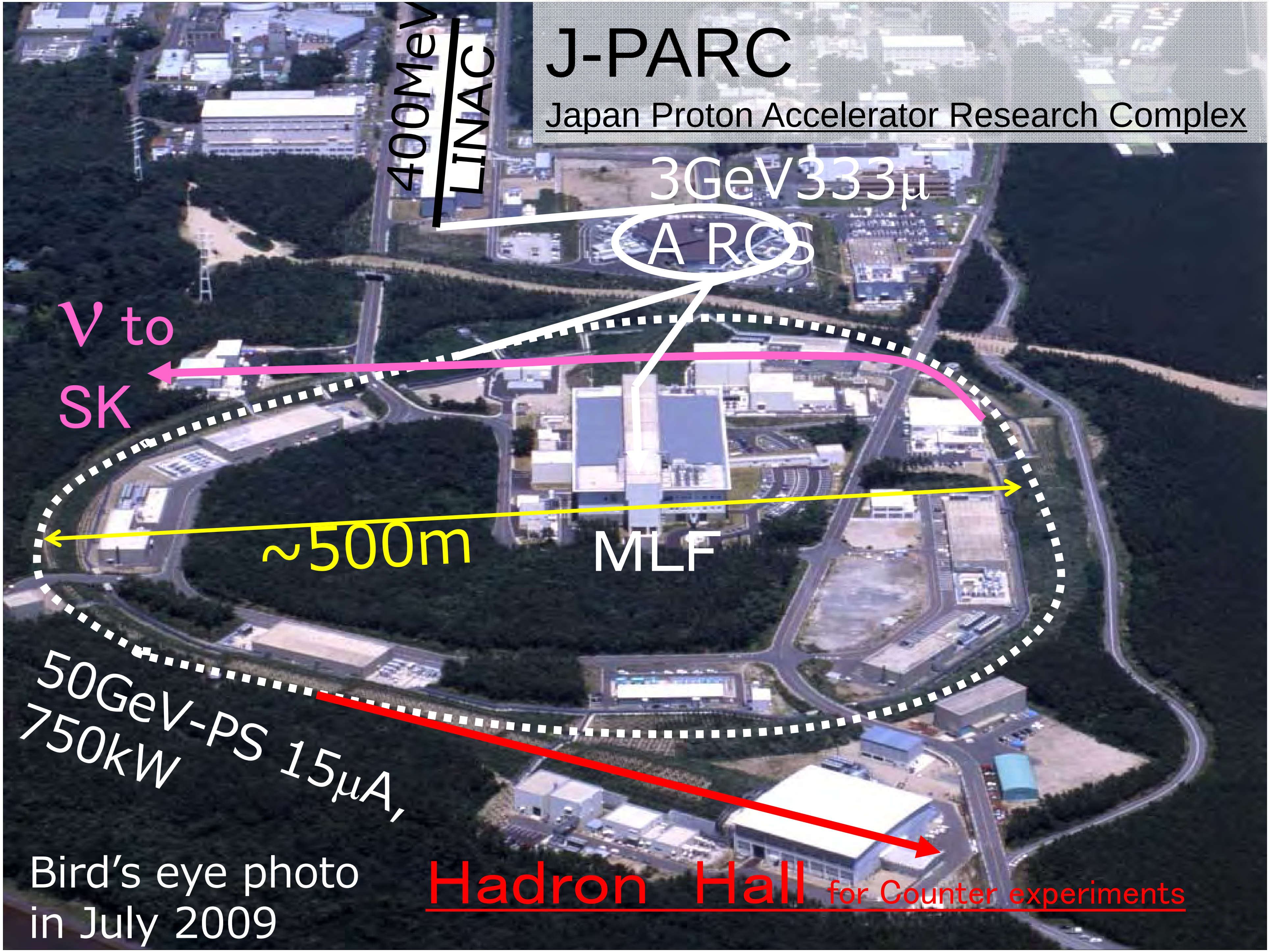
J-PARC

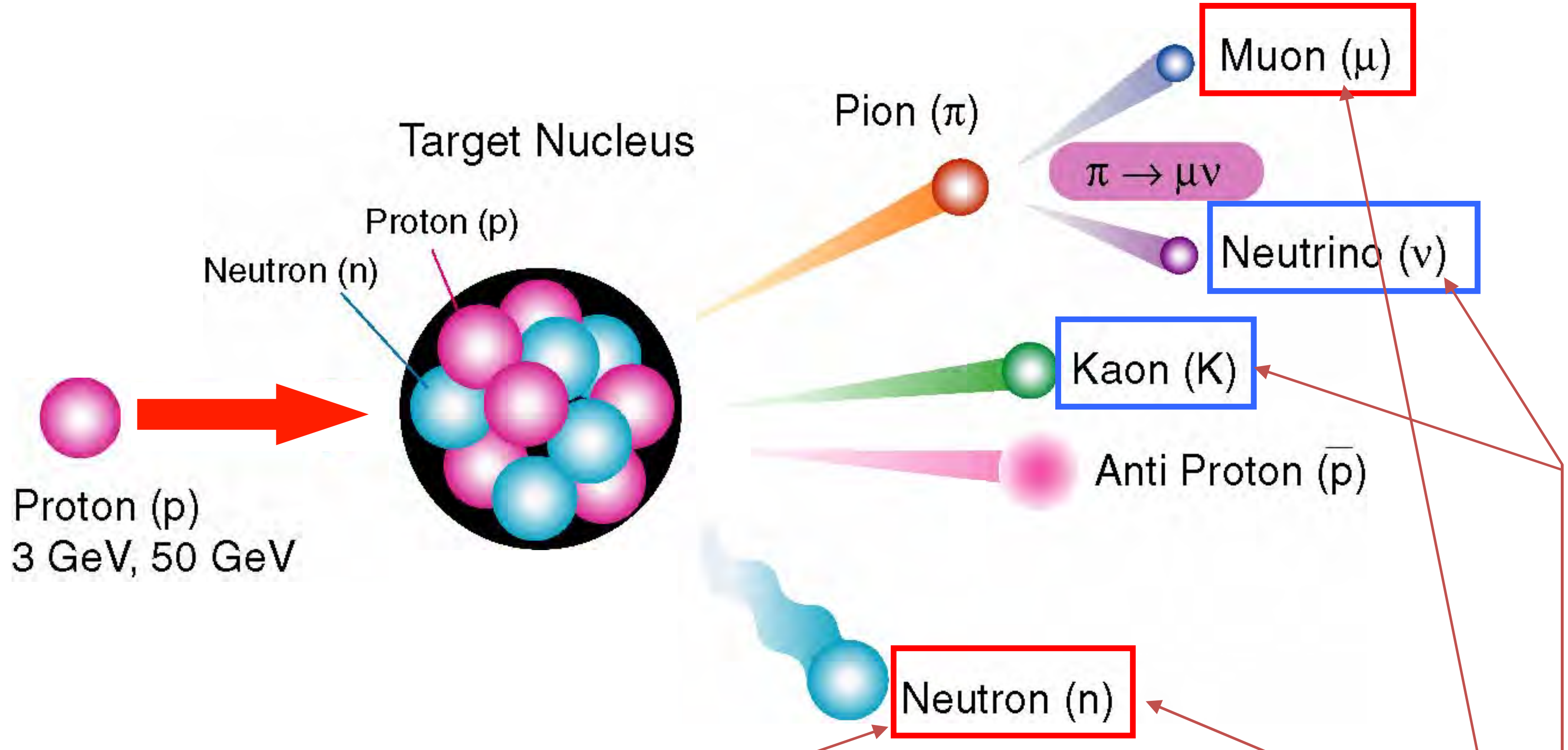
Japan Proton Accelerator Research Complex

J-PARC at Tokai-mura, Ibaraki-ken



J-PARC
Japan Proton Accelerator Research Complex
400MeV
LINAC
3GeV333μ
A RCS
ν to
SK
~500m
MLF
50GeV-PS 15μA,
750kW
Bird's eye photo
in July 2009
Hadron Hall for Counter experiments

Goals at J-PARC



Need to have high-power proton beams

Materials & Life Sciences at 3 GeV
Nuclear & Particle Physics at 50 GeV
R&D toward Transmutation at 0.6 GeV

→ MW-class proton accelerator
(current frontier is about 0.1 MW)

2011.3.17.

Around the Linac

Photos were taken on

March 17, 2011

Electric wires and water pipes were all damaged.

About 1.5 m drop as seen left pic., over a wide area.

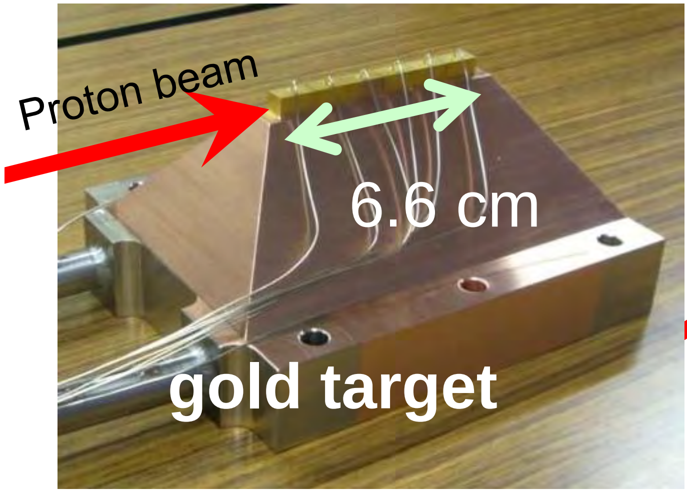
Recovered by the end of 2011! Beam recoved in early 2012.

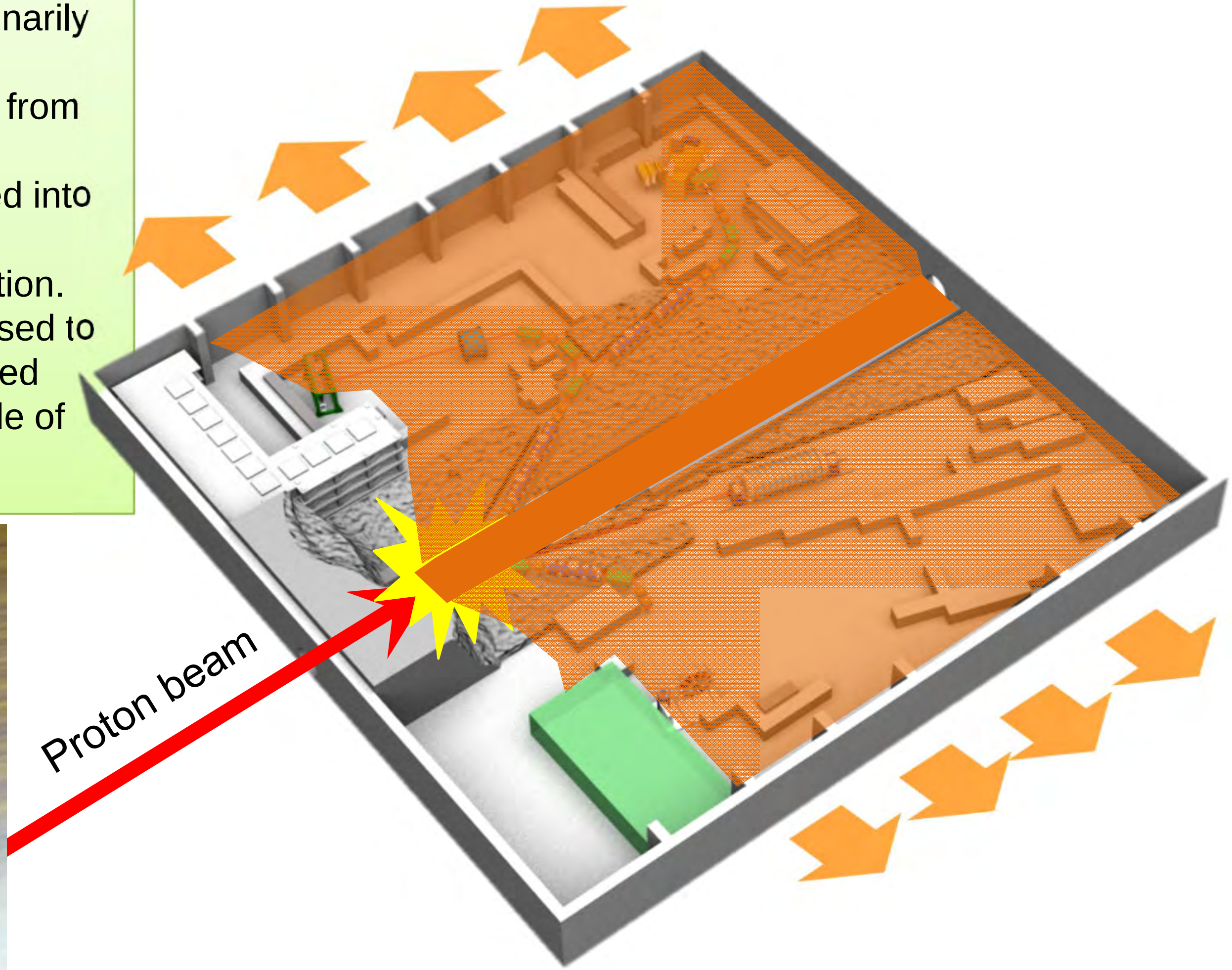
Radioactive Materials Leak Incident

11:55 on May 23, 2013

- An abnormal proton beam was injected to the gold target.
- The target heated up to a extraordinarily high temperature.
- Radioactive material was released from the target.
- The radioactive material was leaked into the HD hall.

  → Workers were exposed to radiation.
- The radioactive material was released to the outside of the radiation controlled area and to the environment outside of the HD hall.

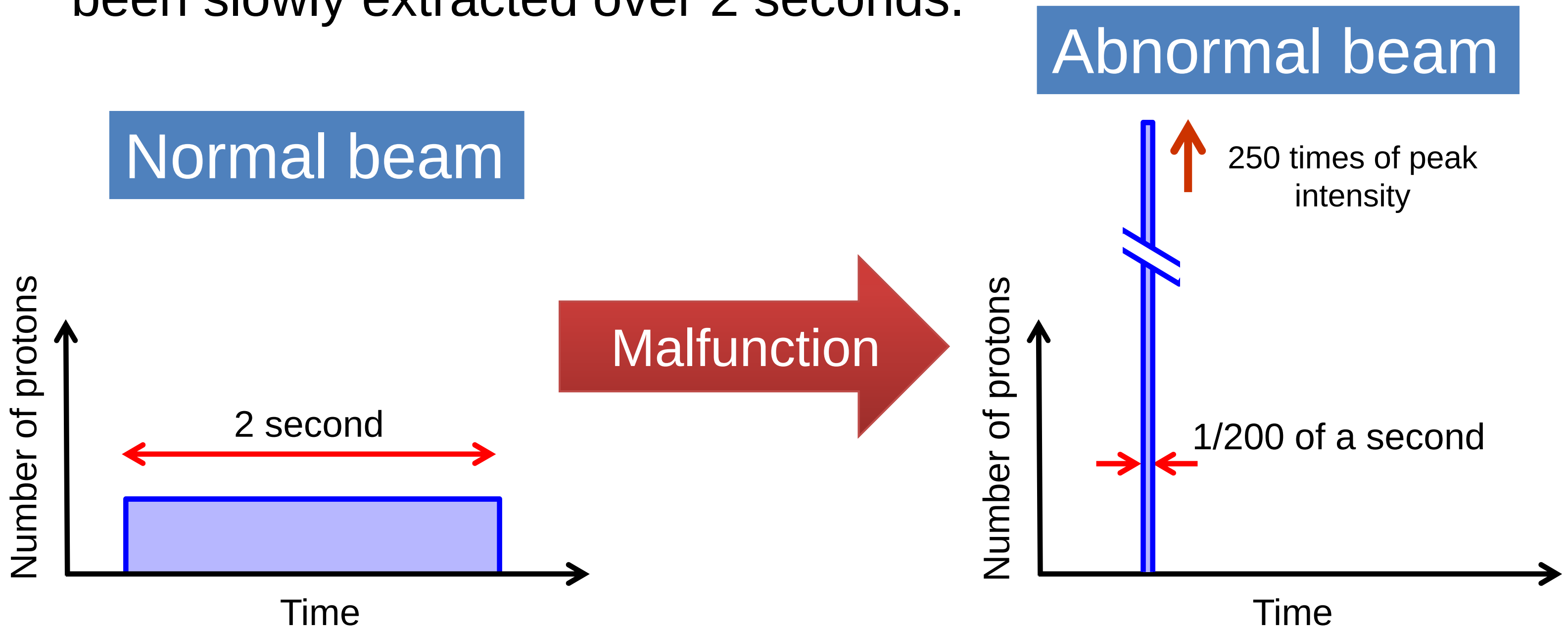




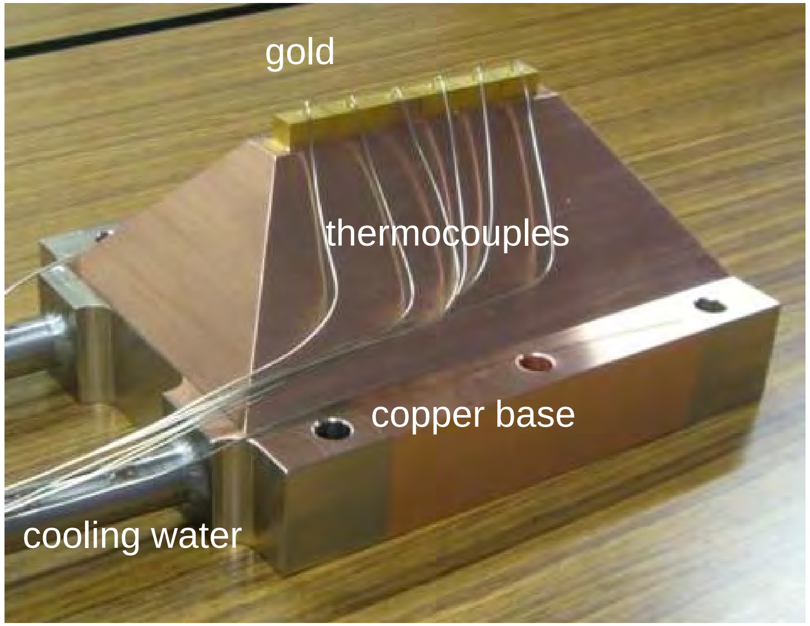
Abnormal Beam

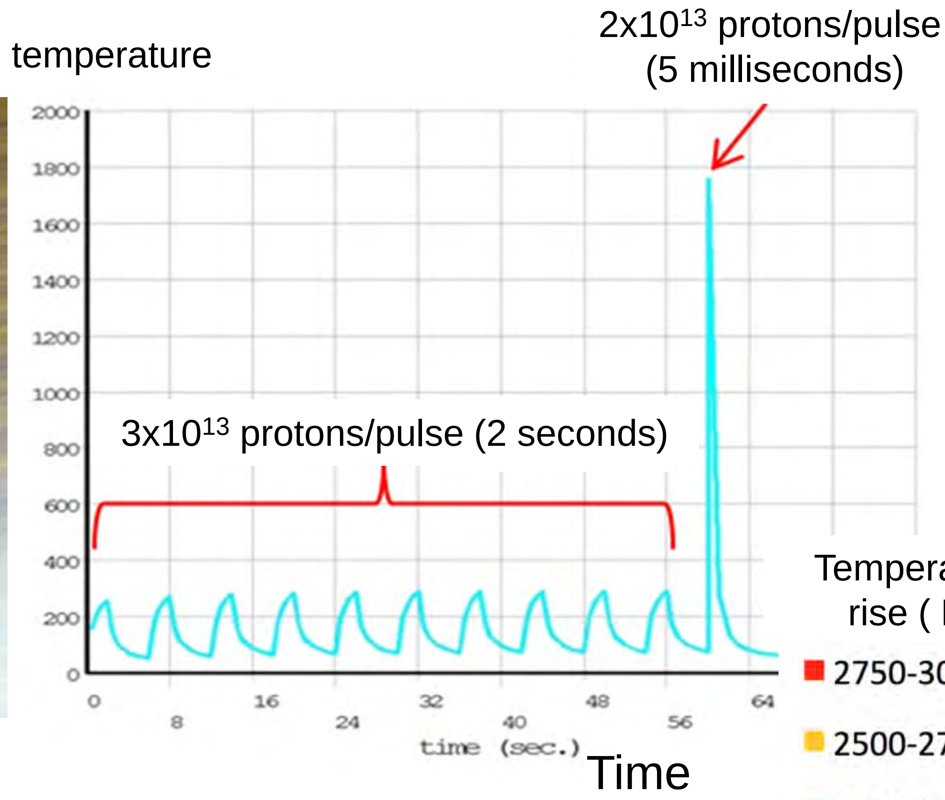
- At around 11:55 on May 23, the power supply system of a special magnet in the 50 GeV Synchrotron malfunctioned.

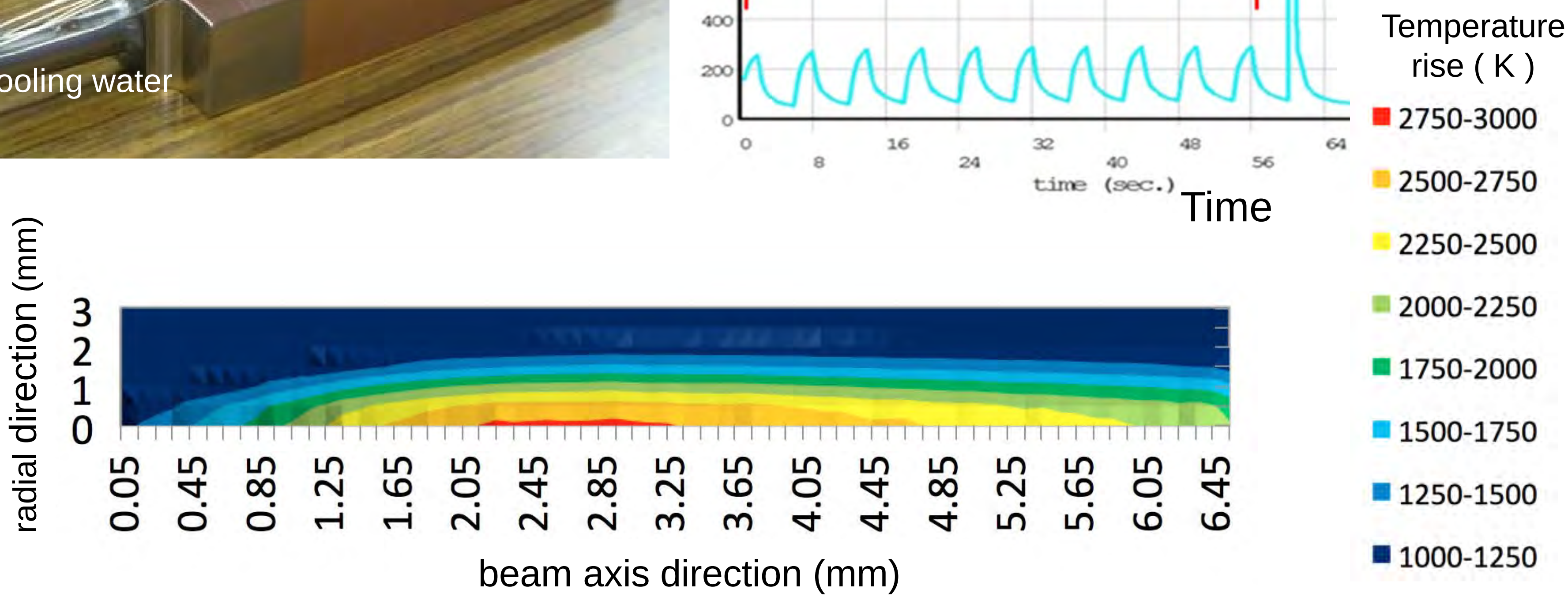
  → $2x10^{13}$ protons were extracted in a very short period of 5 milliseconds, while in normal operation $3x10^{13}$ protons should have been slowly extracted over 2 seconds.



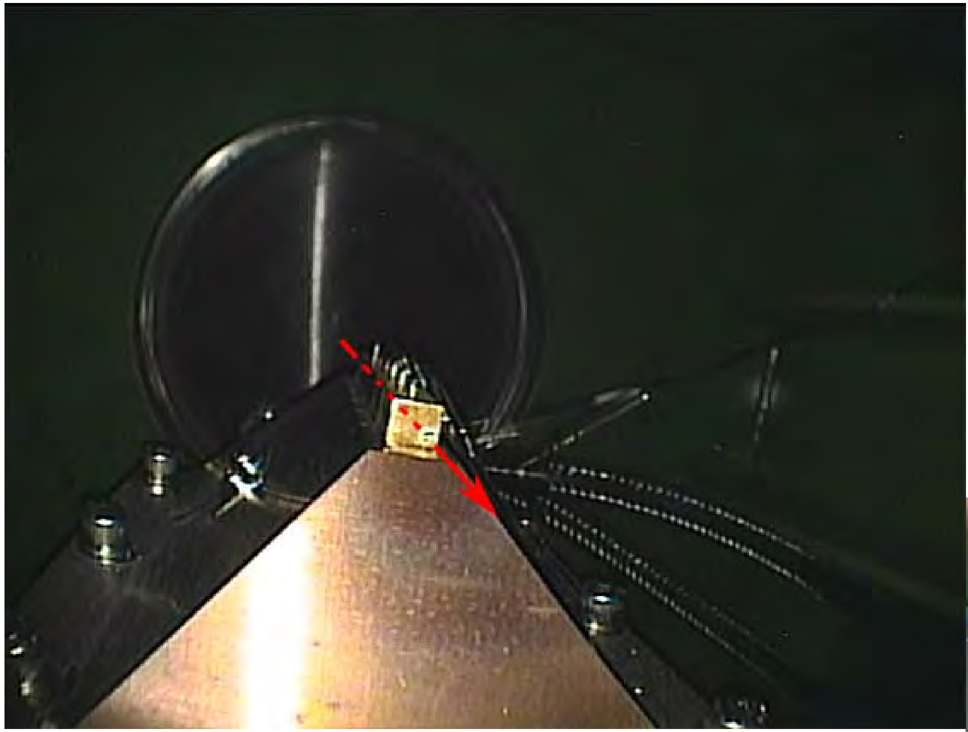
Target Temperature（Simulation Results）





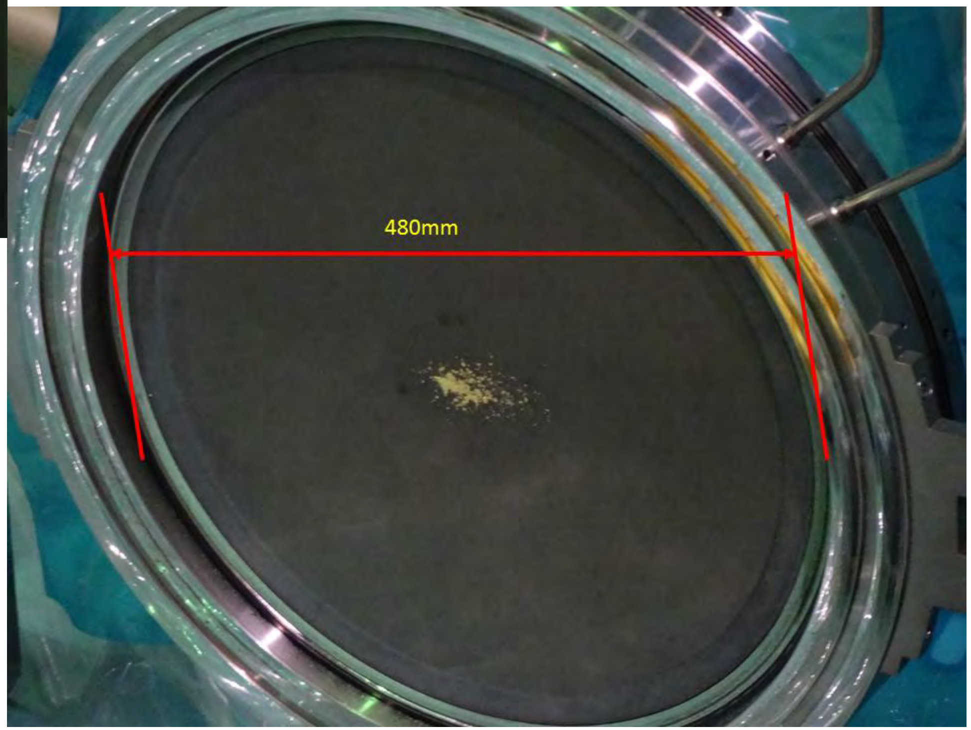


Observed Au Target



Au target observed from the downstream: a 1mm in diameter hole was seen at the downstream end.

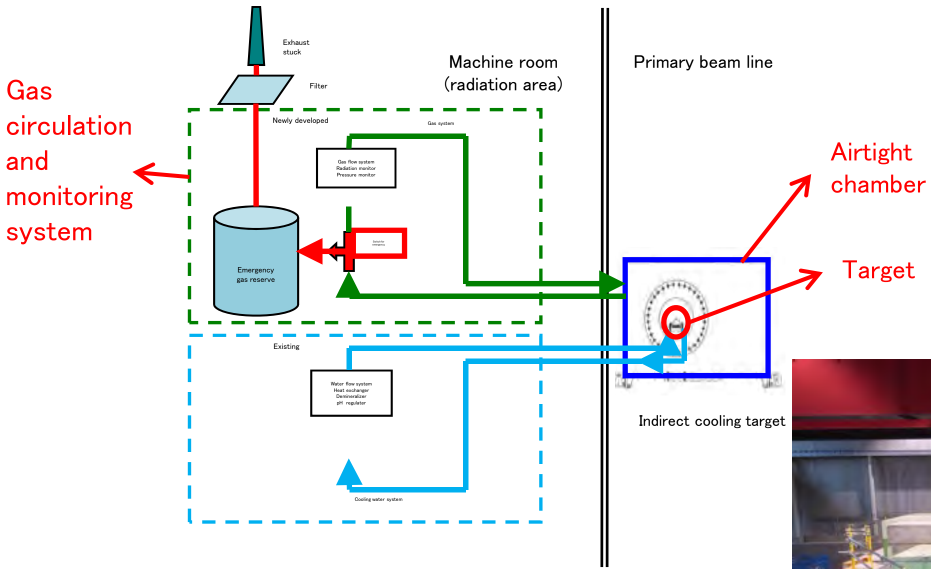
Traces of sprayed-out melting gold at the Be window at the downstream

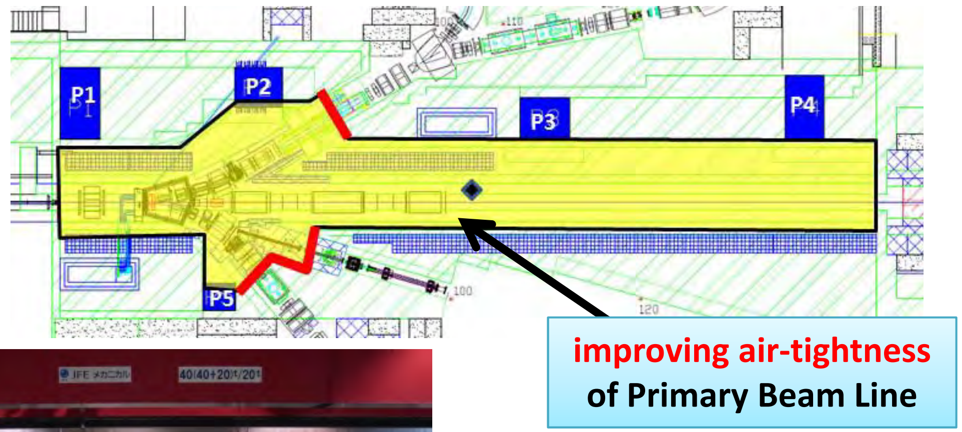


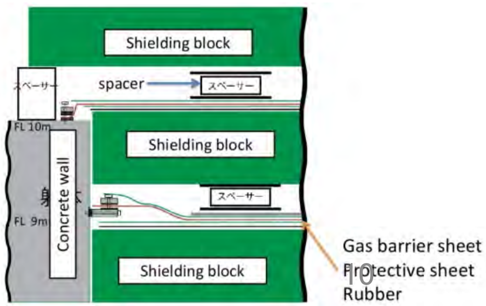
These observations well match with our simulation results.

Countermeasures

- Hardware:
  - Strengthen interlocks including the accelerator side
  - Airtight target chamber and gas circulation system
  - Reinforced airtightness of the primary beam line
  - Air exhaust system and monitors at the Hadron Hall
- Software: organization, manuals, etc.

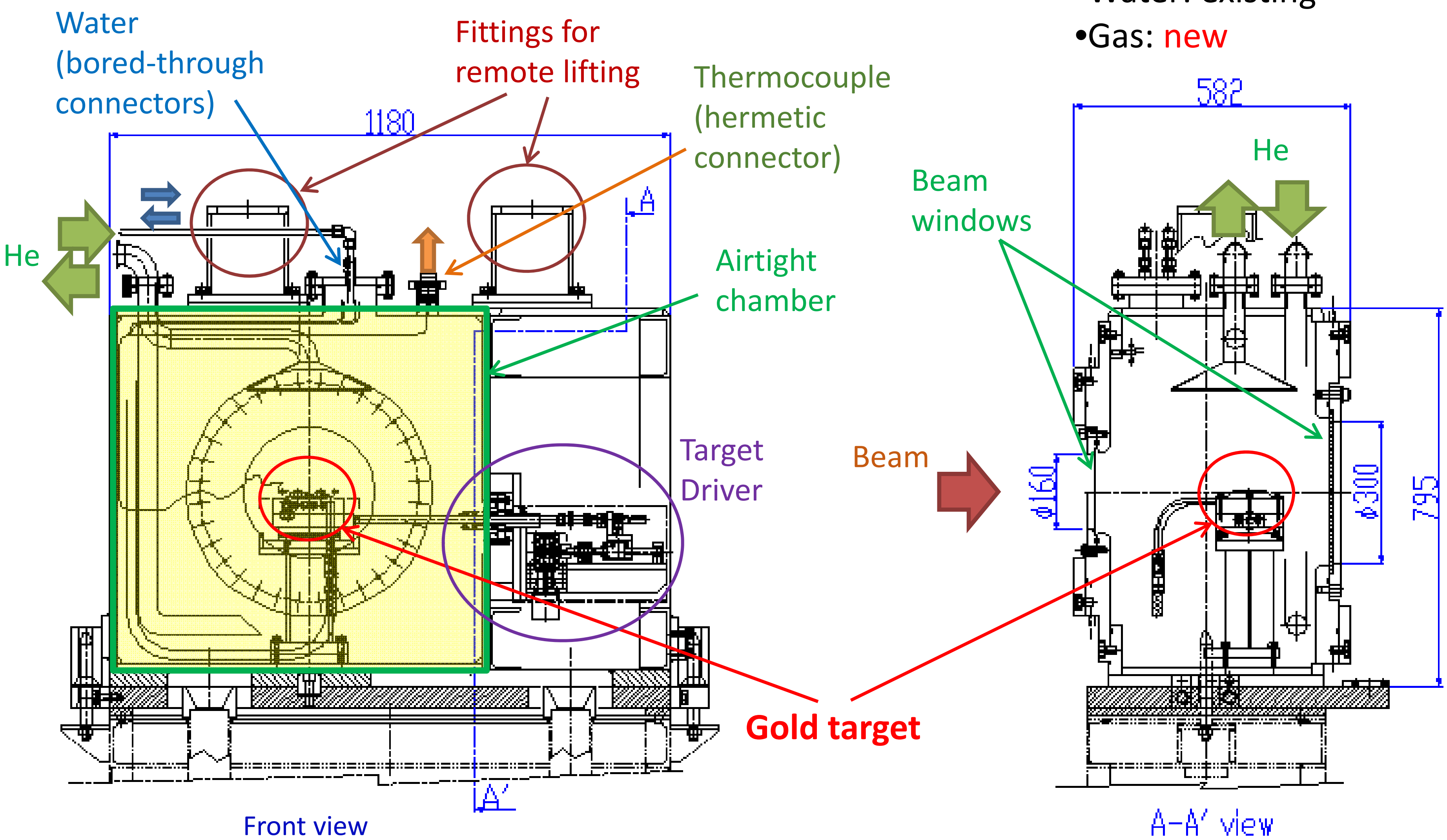






Structure of New Target chamber

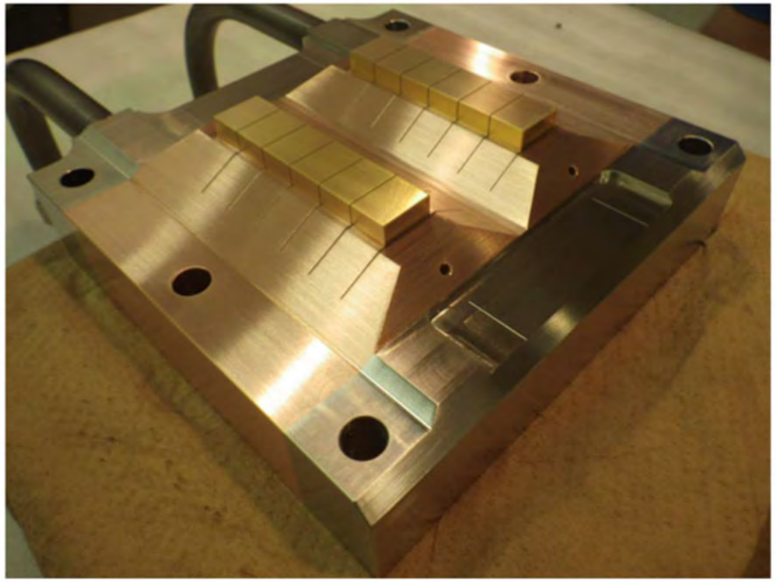
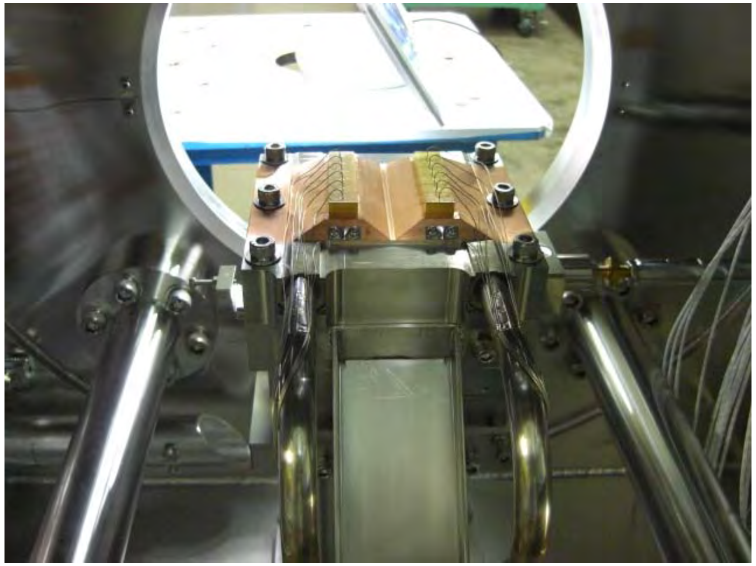
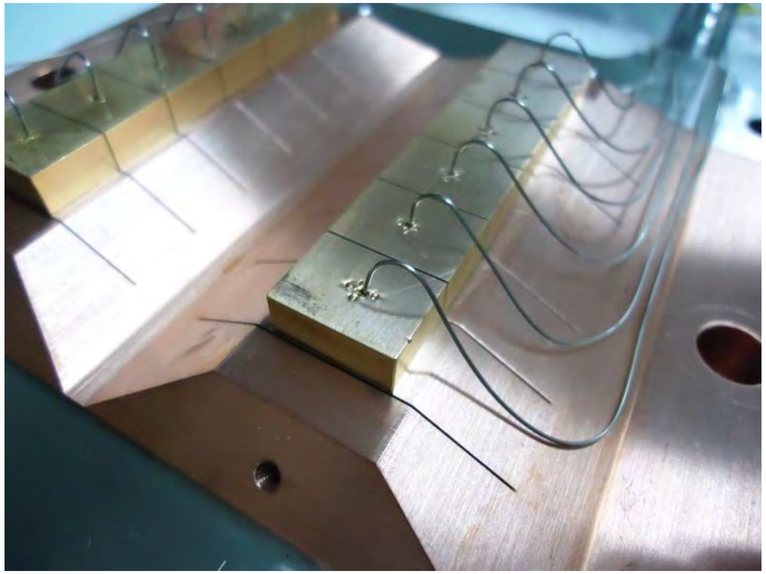
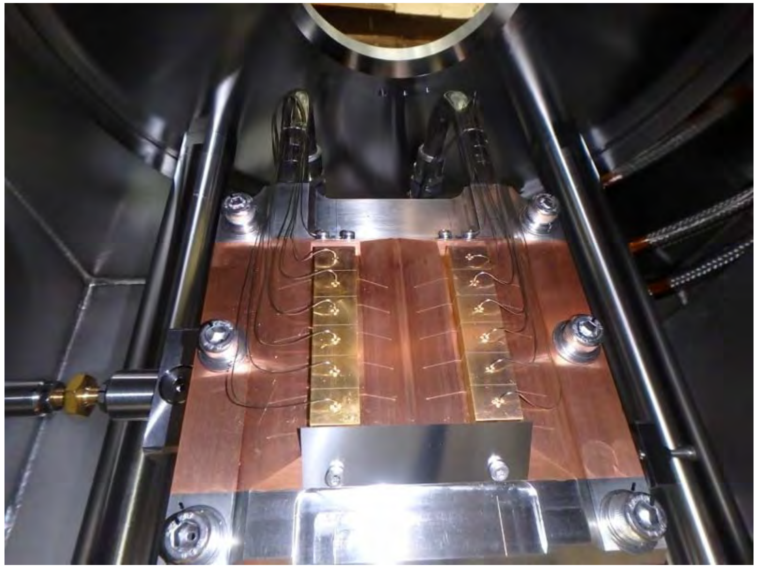
Circulation System
•Water: existing
•Gas: new



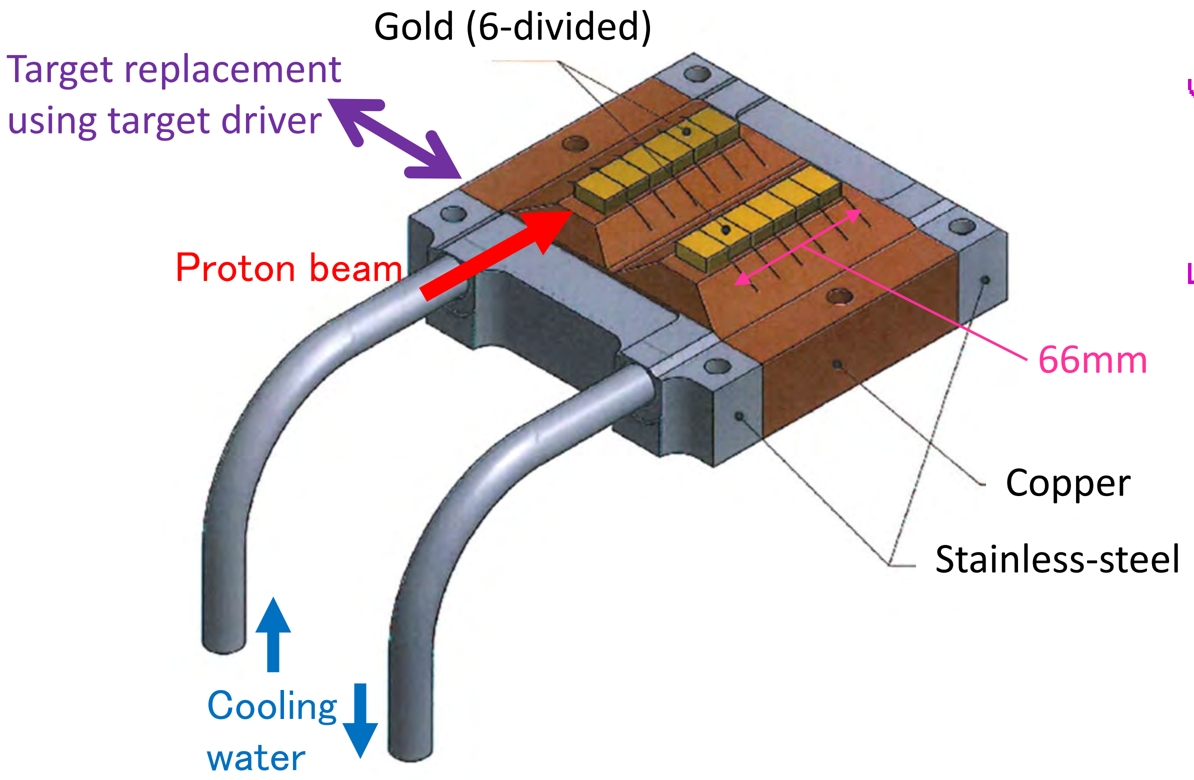
Since the beam windows are always exposed to a primary beam directly,
we designed the windows to keep their soundness even in the case of 5-μs pulse beams.

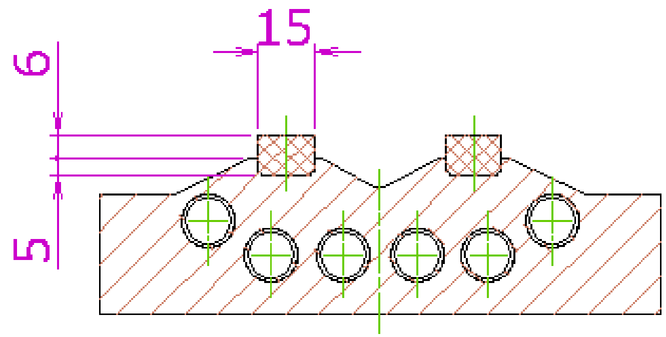
* 5-μs = revolution of Main Ring


2519　標的組込作業写真

Structure of New Target





Cross-sectional view

*Gold, copper, and stainless-steel are bonded by **HIP (Hot Isostatic Pressing)**

Improvements

- Gold is partially sunk in copper block to avoid instantaneous separation of gold from copper.
- Cooling pipes are located closer to gold for efficient cooling.
- Width of gold is incleased (6 => 15) for wider beam.
- 2-headed structure for quick and remote replacement of target.

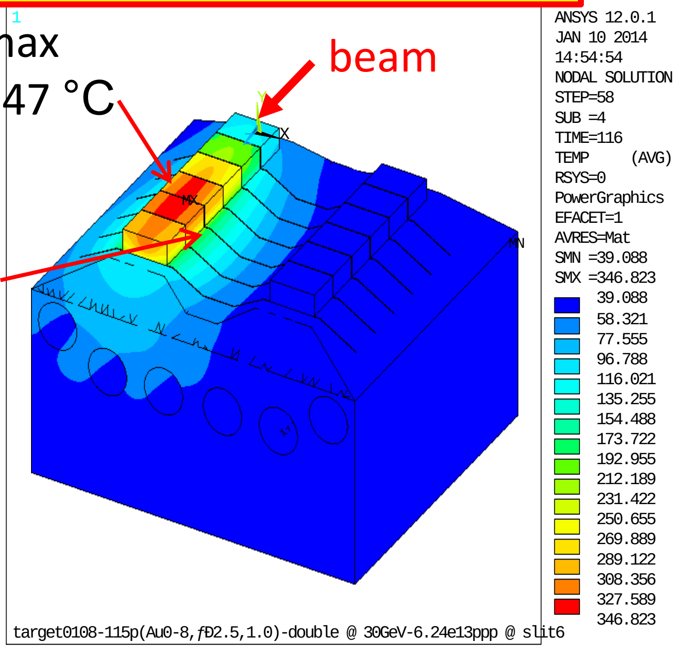
Result of Thermal Analysis of Target (50kW)

In normal operation (2-sec extraction)

max 347 °C

beam

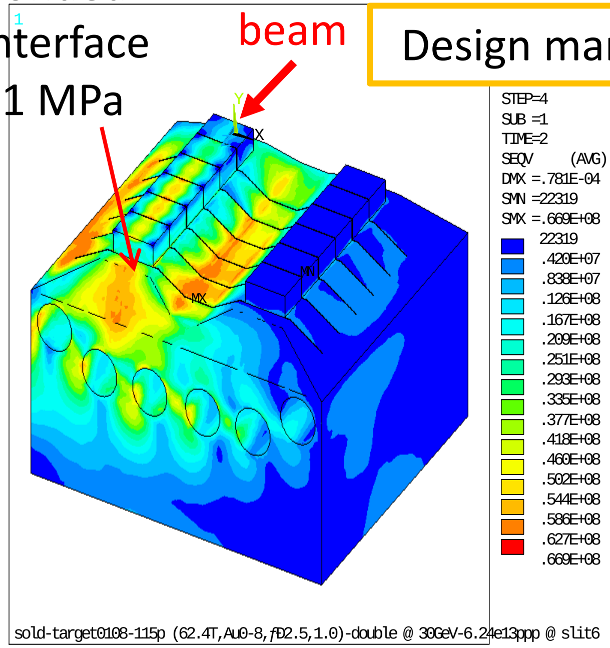
Bonded interface 225 °C



Bonded interface 61 MPa

beam

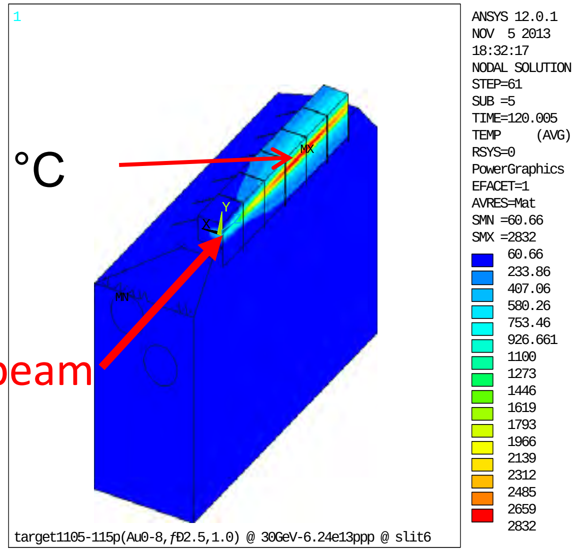
Design margin: 2.1



In accident (5-msec extraction)

max. 2832 °C

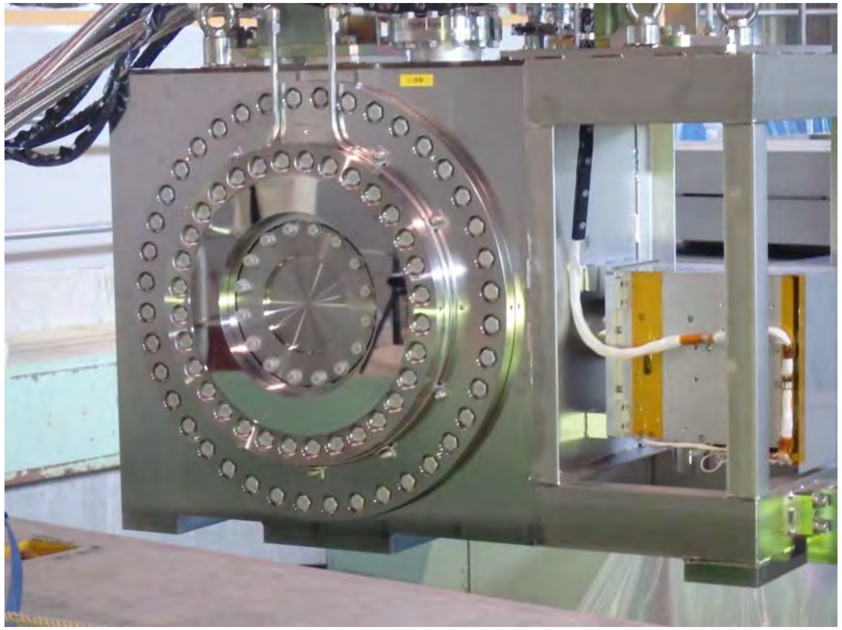
beam

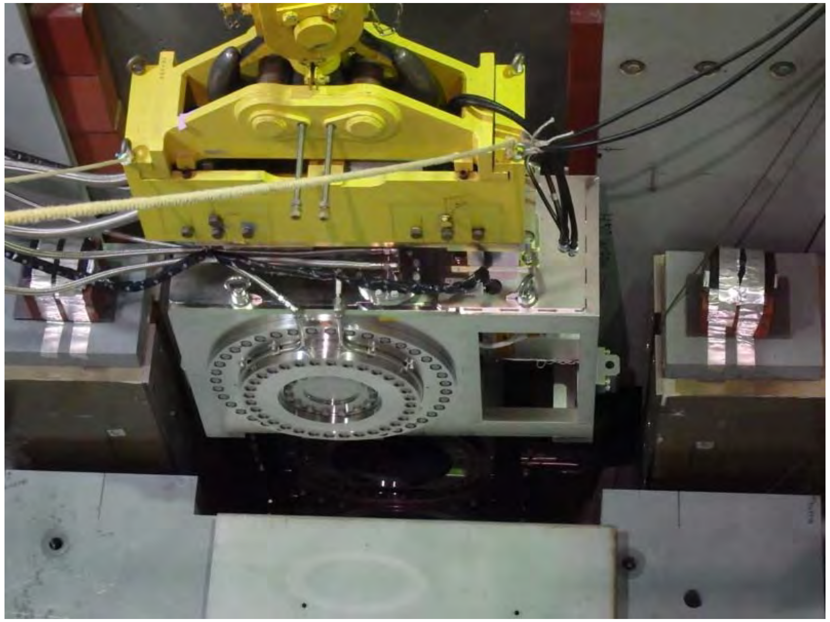


*Latent heat and radiation cooling are not included.

Bonding strength:
171MPa(@25°C)
137MPa(@200°C)
76MPa(@400°C)
linear interpolation:
129MPa(@225°C)

New Chamber Installation





Sept 30, 2014

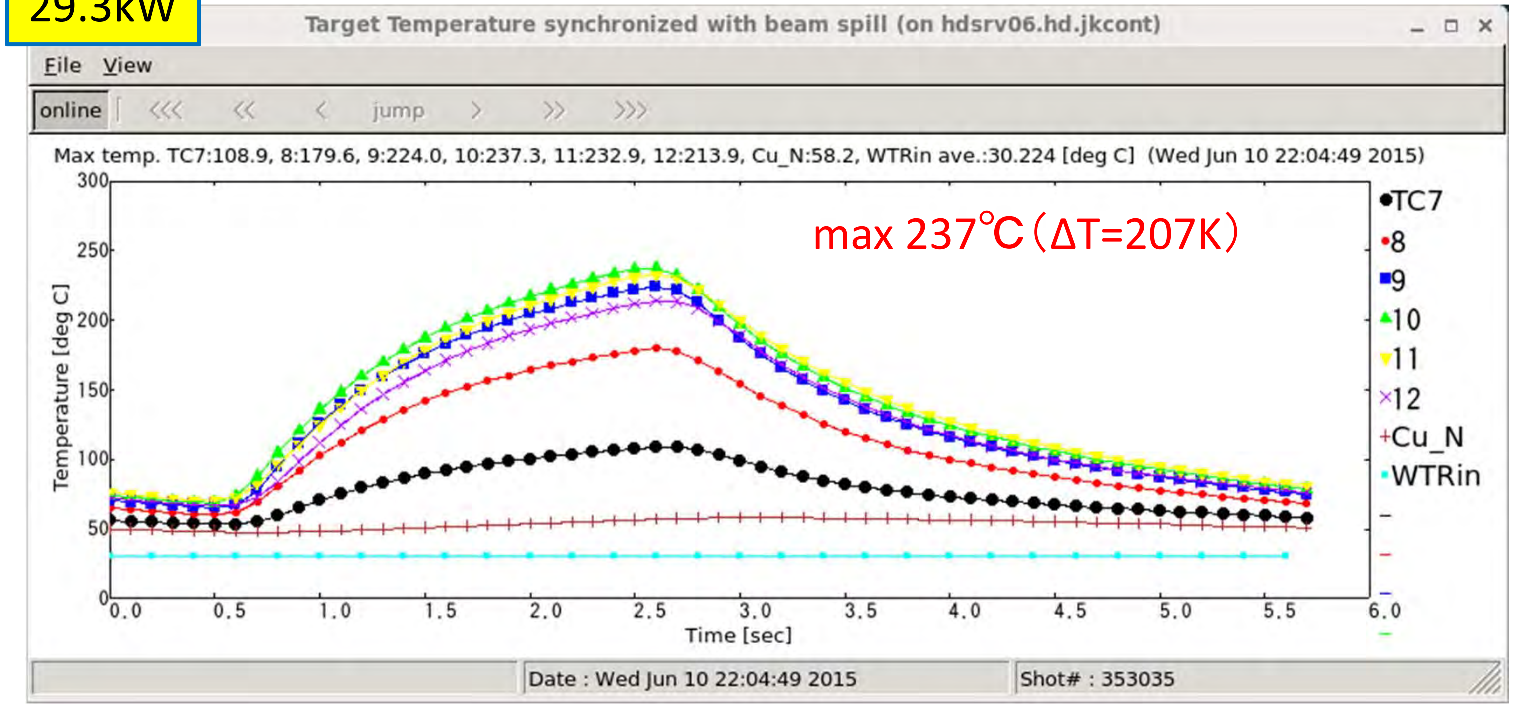

JFE メカニカル
40(40+20)t/20t

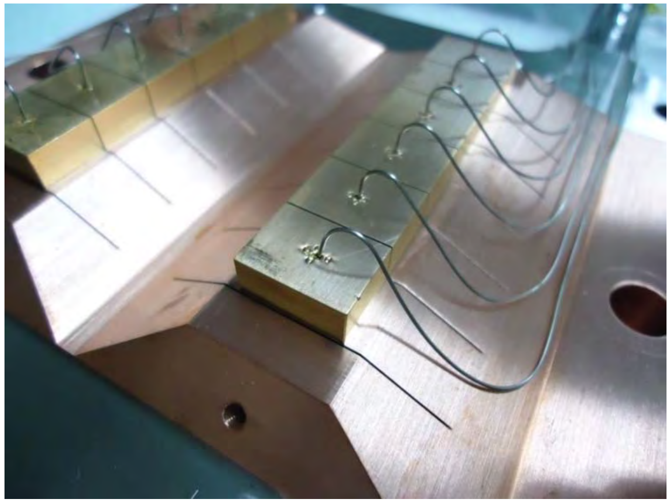
Events at early 2015

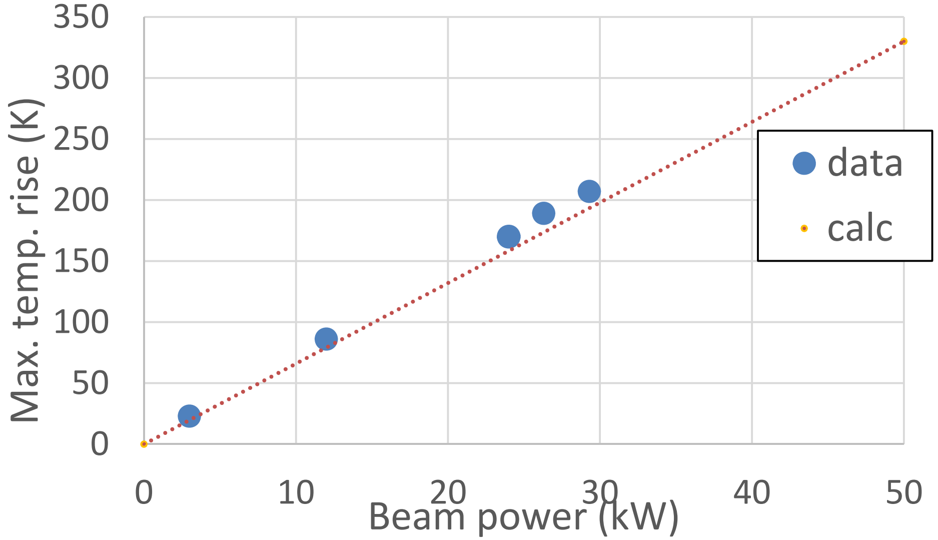
- Renovation of hadron Experimental Facility (HEF) was completed by January 2015.
- In Jan~March period, inspections by Japanese and local governments were made, and explanations to Local people were also made.
- **Then HEF could restart its user operation in April 24, 2015.**
- Now HEF is running with 32kW beam, which is about 8kW higher than previous beam (24kW).
- Neutrino Facility and MLF (neutrons and muons for applications) recovered in early 2014. Now they are running 300~400kW.

T1 Target Temperature

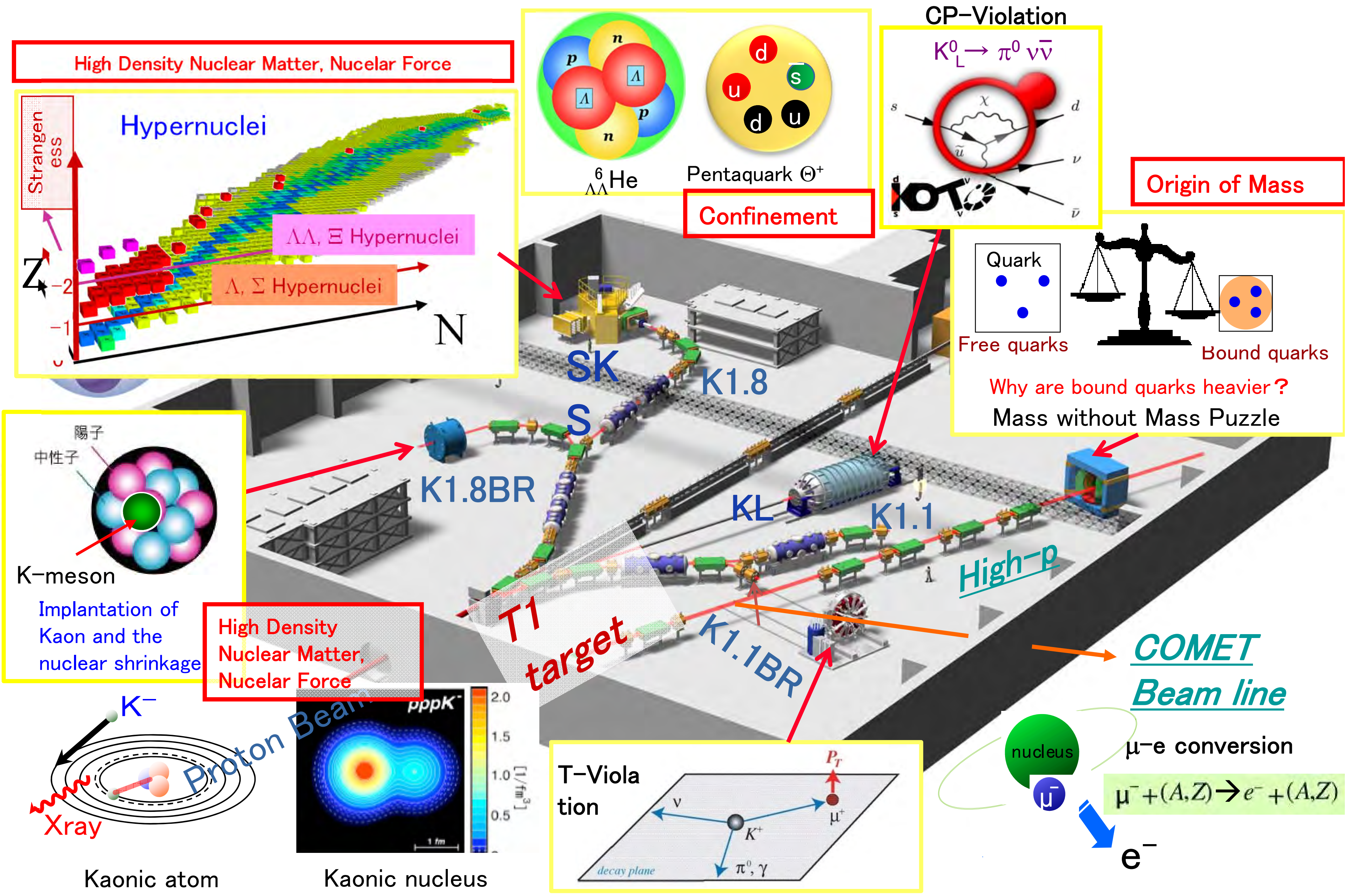
29.3kW

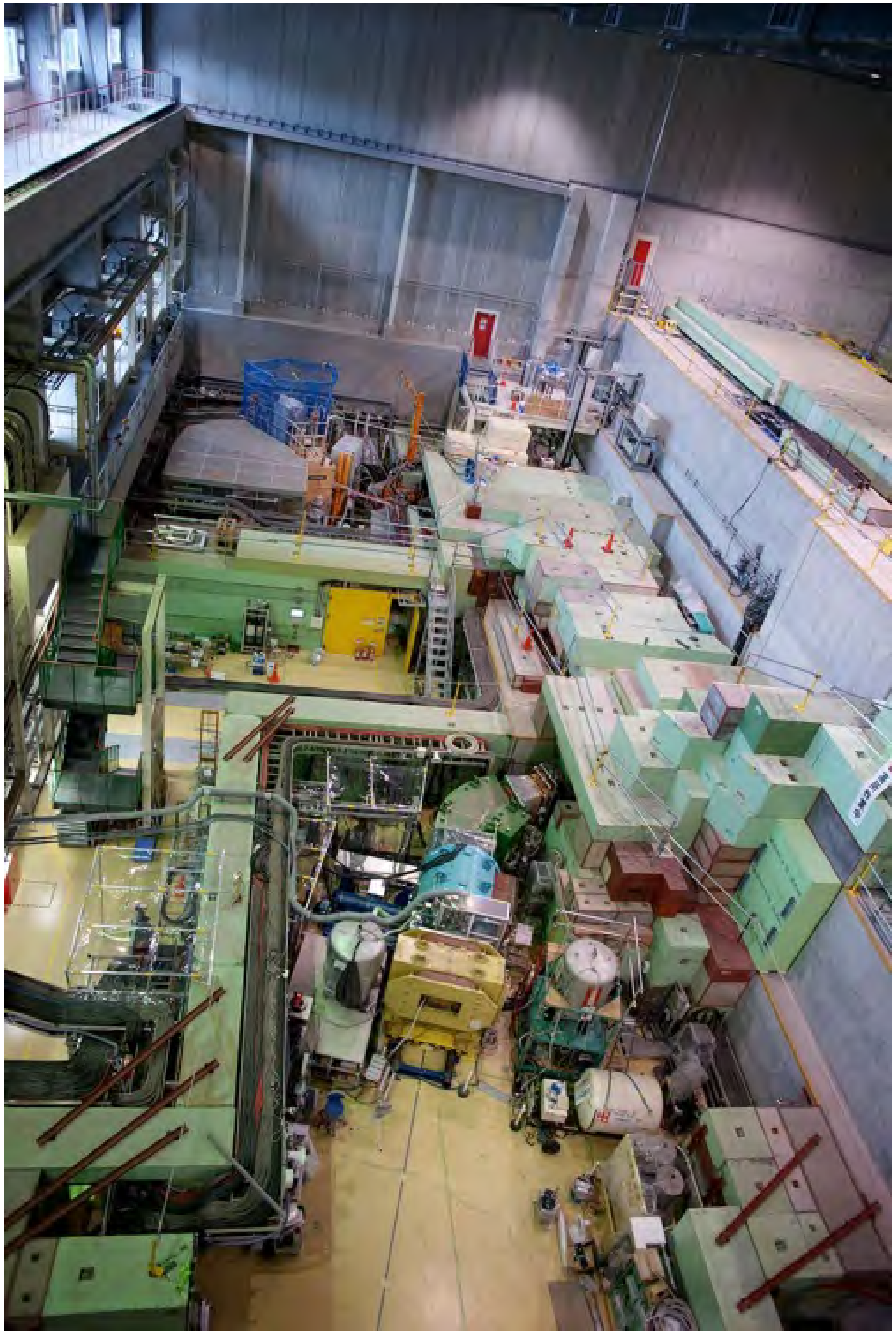




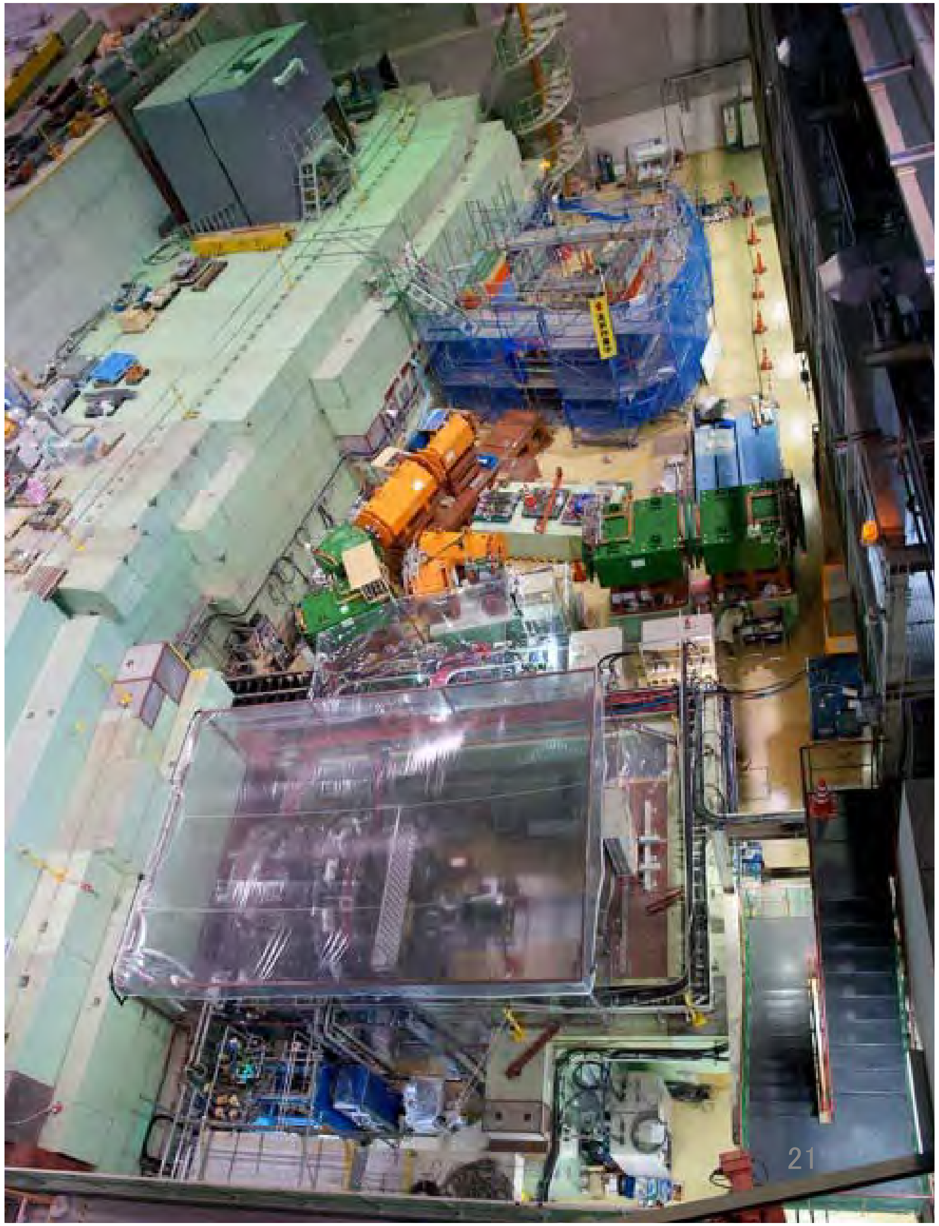


Nuclear, Hadron, & Particle Physics at Hadron Hall





Hadron Hall 2015 June



Search for CP violating $K_L \to \pi^0 \nu\nu$

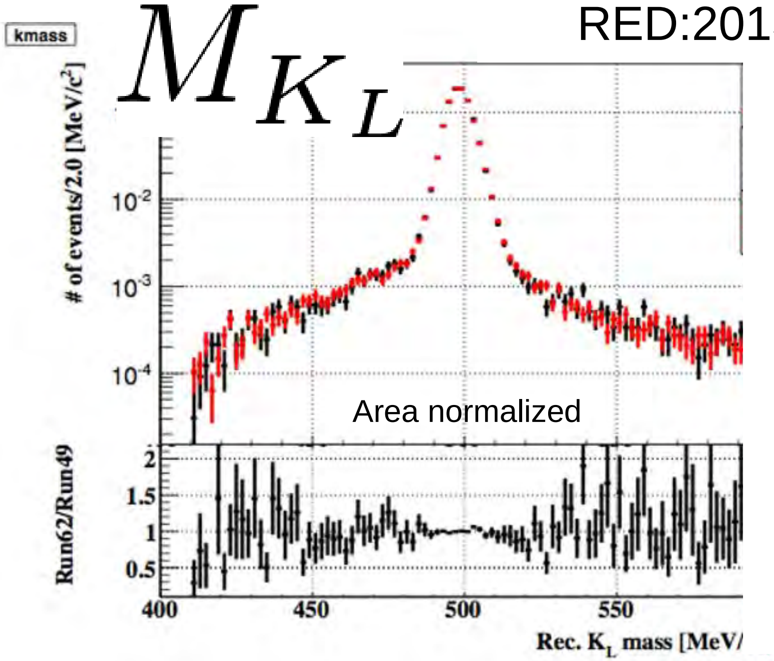
KOTO Experiment status

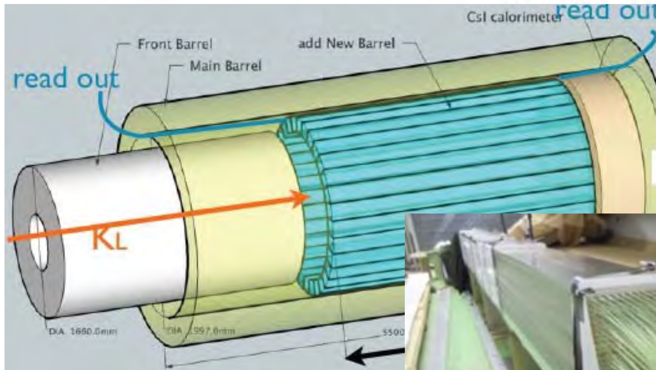
- Analysis of 2015 spring run
  - 5.3 statistics than 2013 run
- 10/15 midnight, autumn run started with 32kW
- 10/17 Physics data taking started!

➔Sensitivity below $O(10^{-9})$ will reach soon!

- Detector upgrade is in progress

$K_L \to 3\pi^0$ mass
BLK:2015Spring,
RED:2013





TROIDAL at K1.1BR

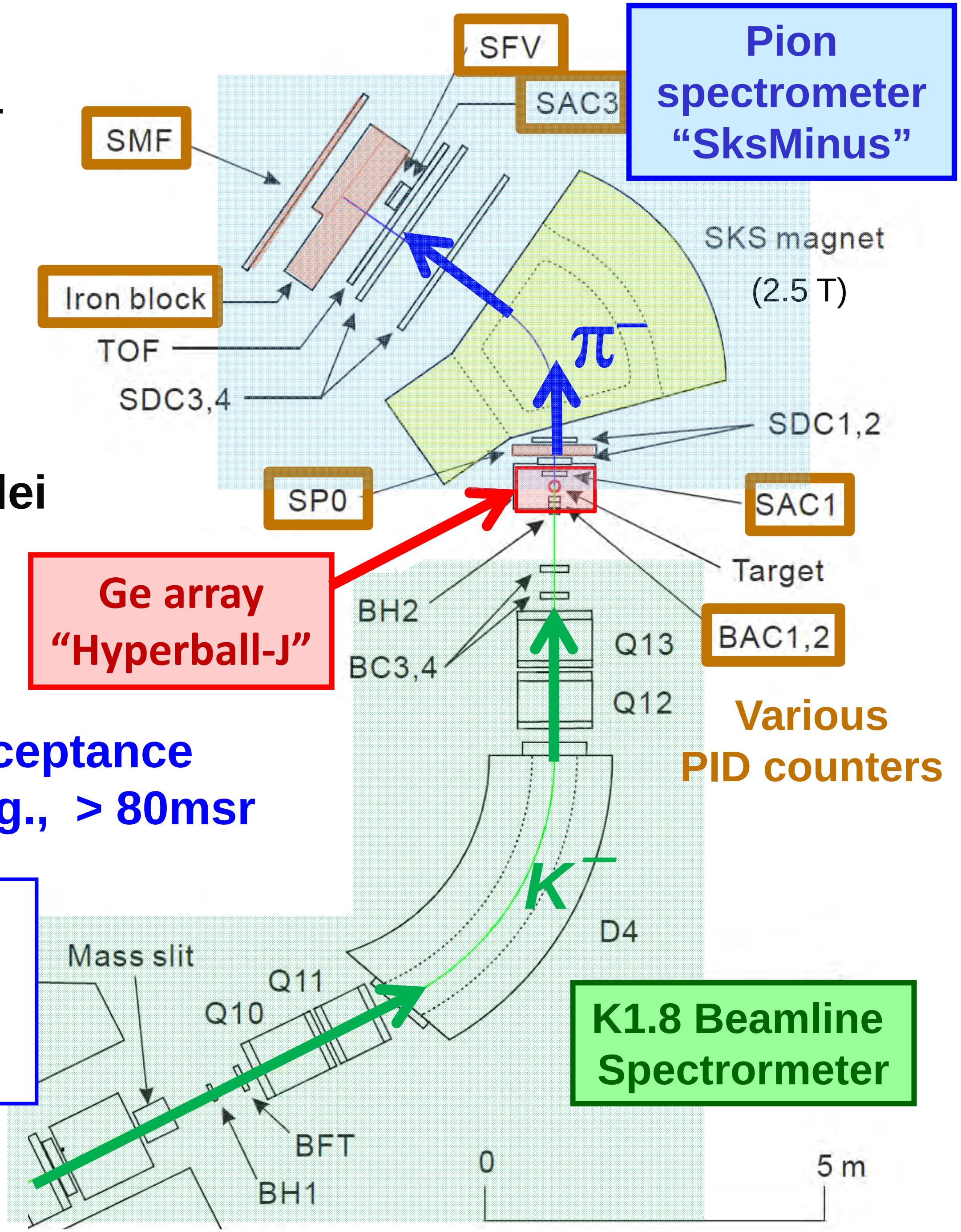
Setup at K1.8 for E13-1

$$ {}^{A}Z\,(K^-,\pi^-)\,{}^{A}_{\Lambda}Z^* \rightarrow {}^{A}_{\Lambda}Z + \gamma $$

- Tag production of hypernuclei
- Detect gamma-rays from hypernuclei

SksMinus: wide and large acceptance 1.2 ~ 2.0 GeV/c, 0 ~ 20 deg., > 80msr

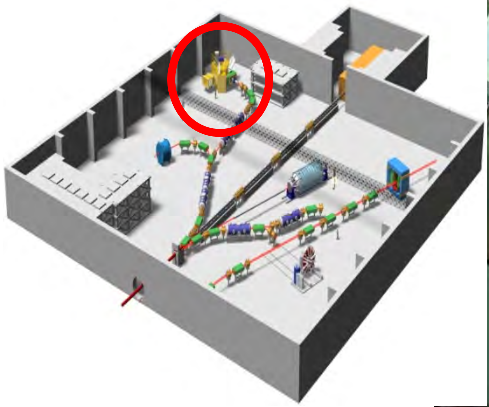
$^{4}_{\Lambda}$He : Charge symmetry breaking in ΛN interaction
$^{19}_{\Lambda}$F : ΛN interaction in sd shell region

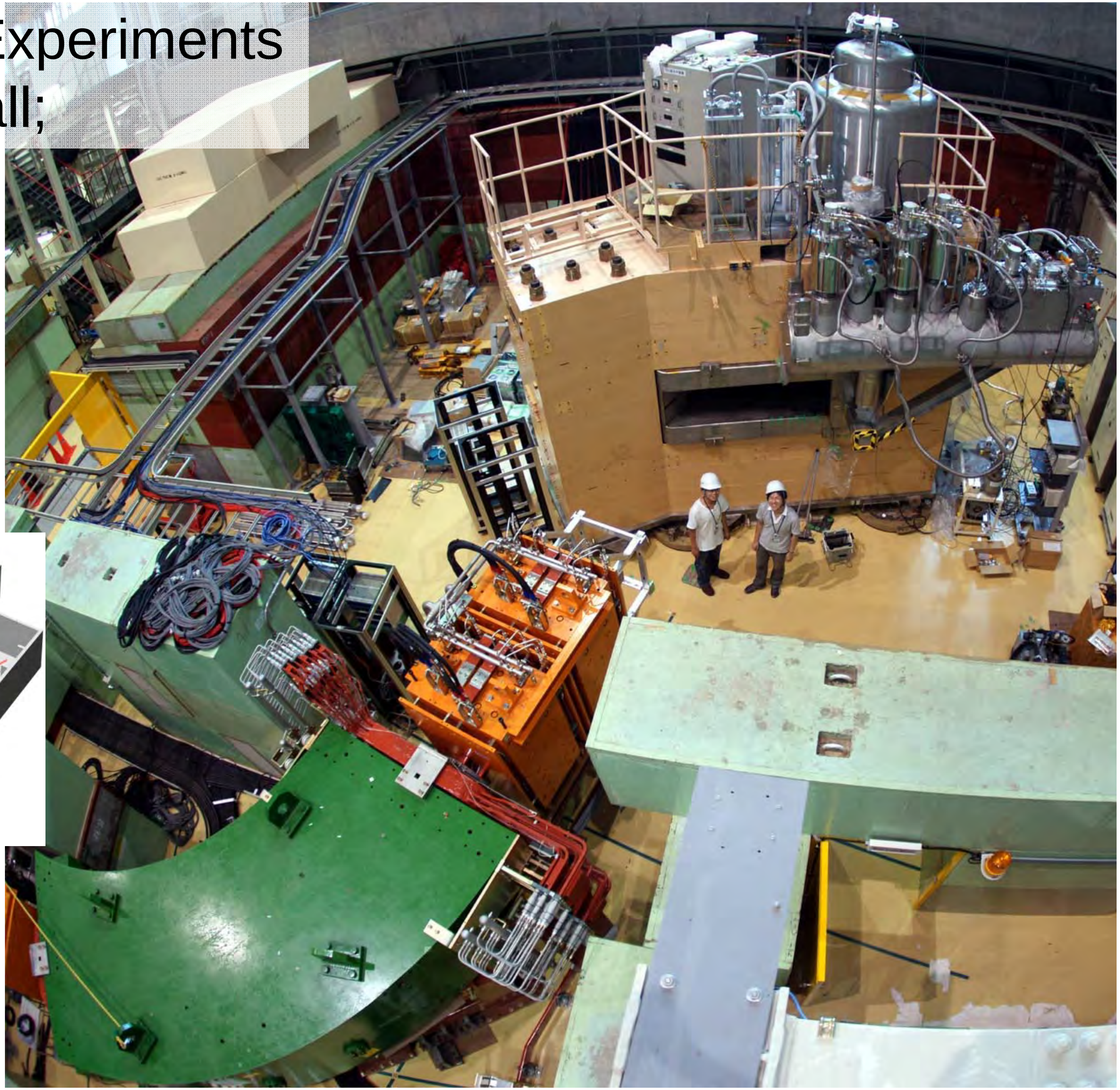


Typical Big Experiments
at Hadron hall;

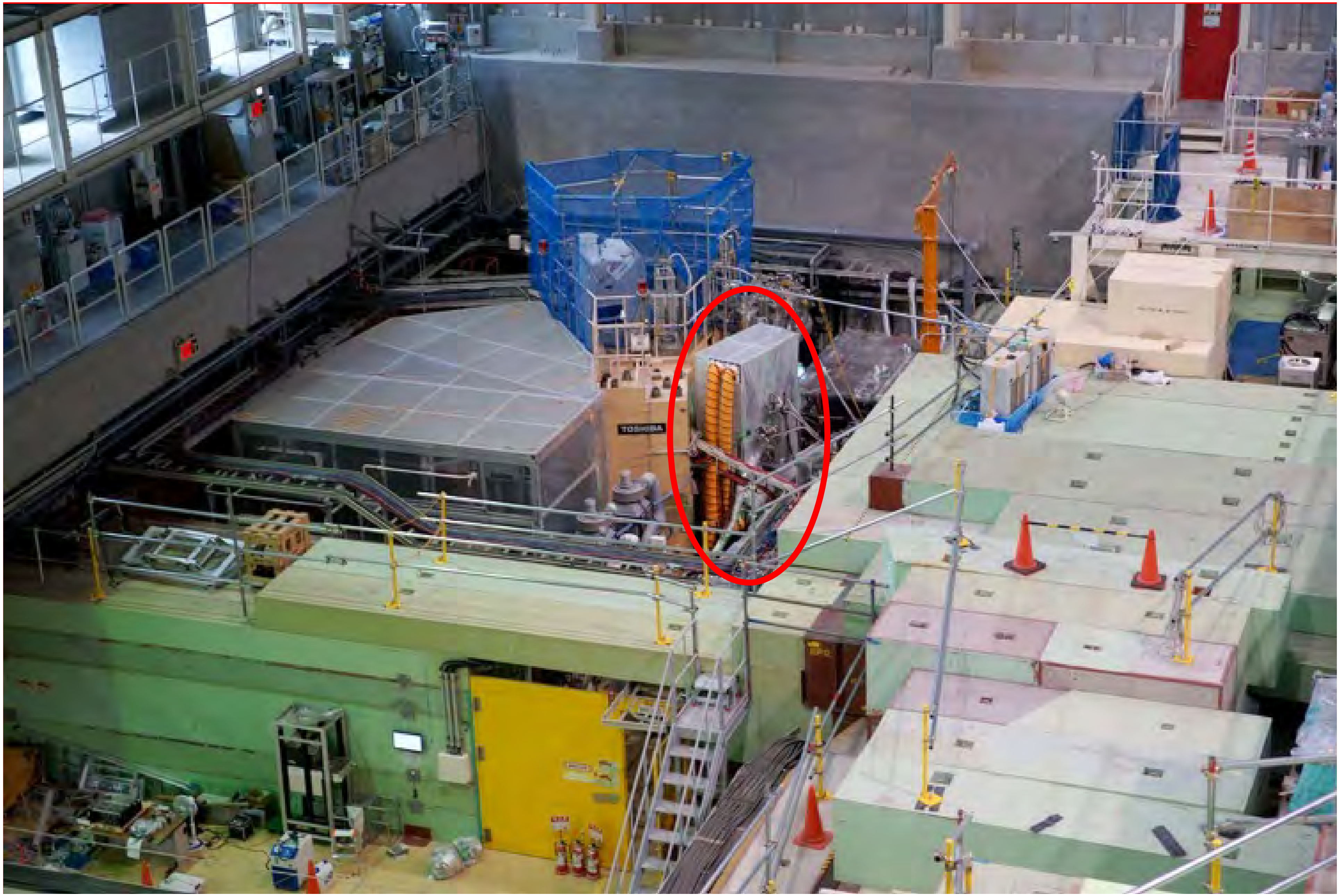
SKS

Hypernuclear Spectroscopy with Kaons

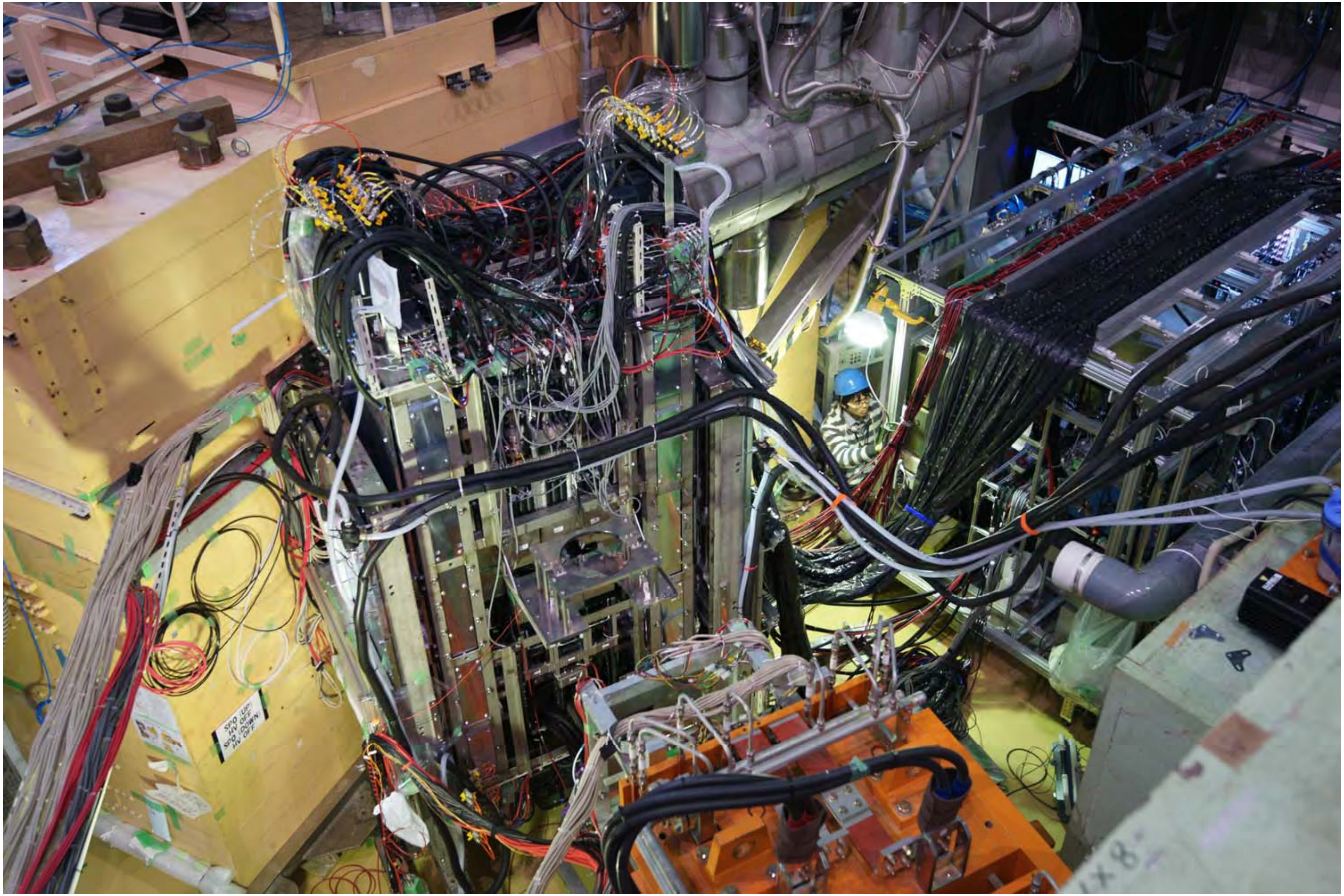




SKS with HB-J: 2015 June for E13-1



Hyperball-J

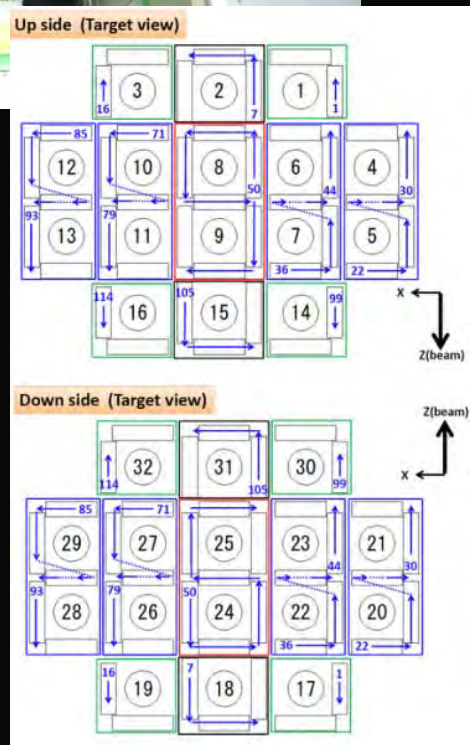


Hyperball-J

Ge cooled down to ~70K
by pulse-tube refrigerator
(c.f. 92K w/LN2)

Fast background
suppressor made of PWO

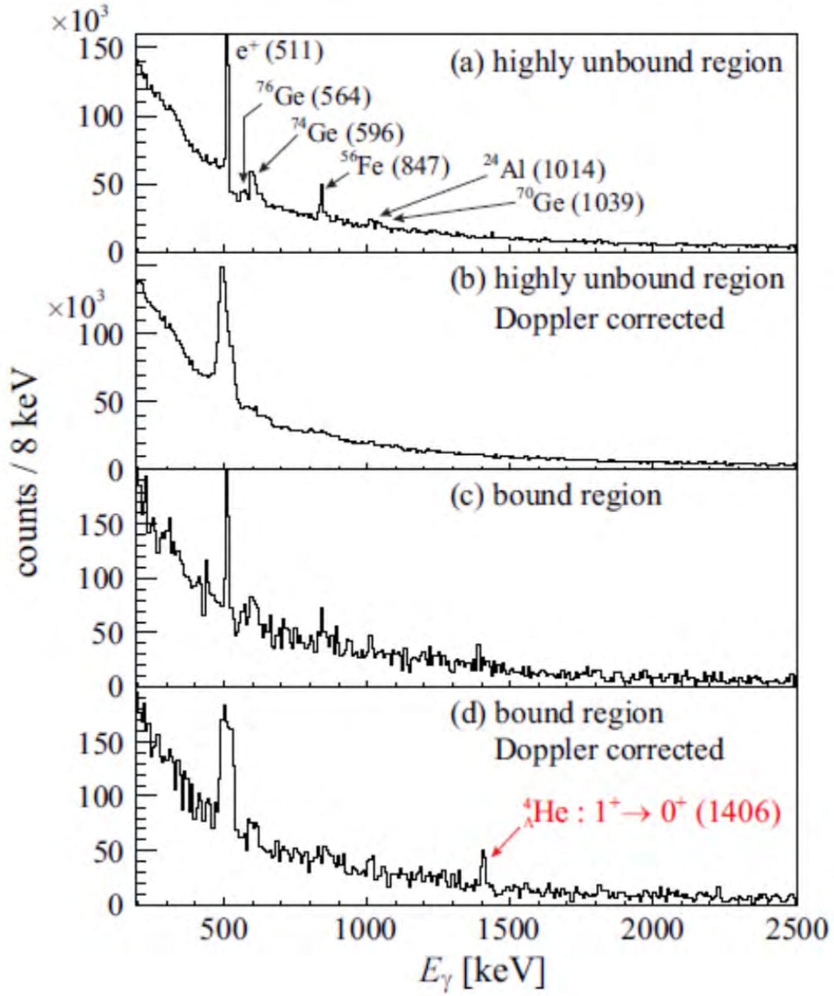
ΔE= 3.1(1) keV at 1.33 MeV
Eff. = 5.4% @1 MeV
with 28 Ge(re=60%)



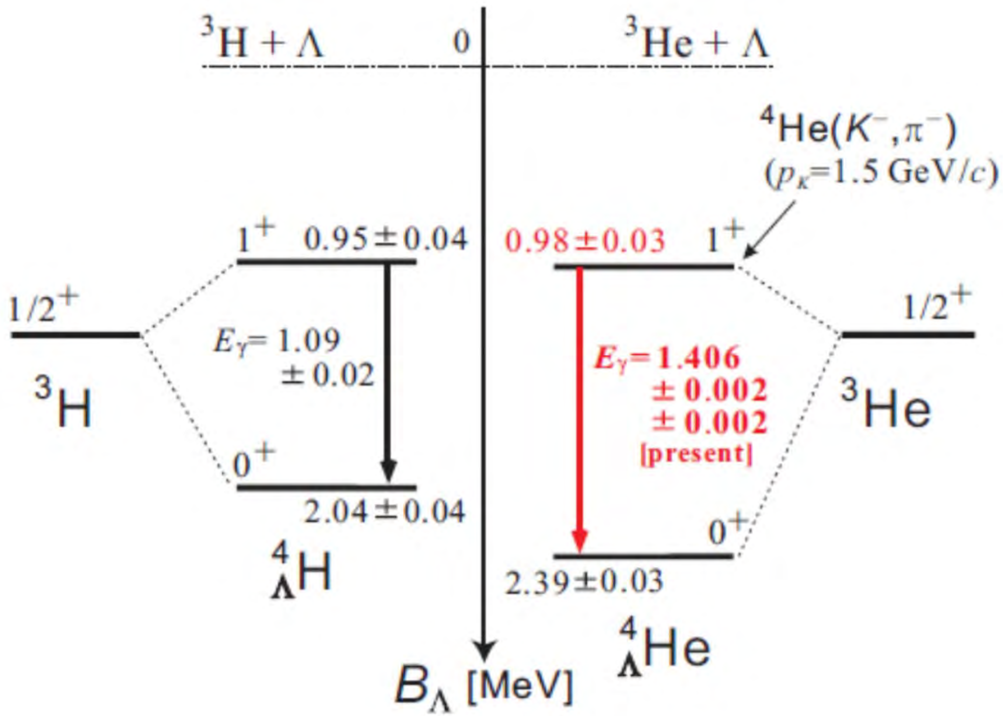
E13 RUN#62の結果
Large Charge Symmetry Breaking in A=4 Hypernuclei

$K^- + {}^4He \rightarrow {}^4_\Lambda He^* + \pi^-$

${}^4_\Lambda He^* \rightarrow {}^4_\Lambda He + \gamma$



SKS + Hyperball-J at K1.8 beamline

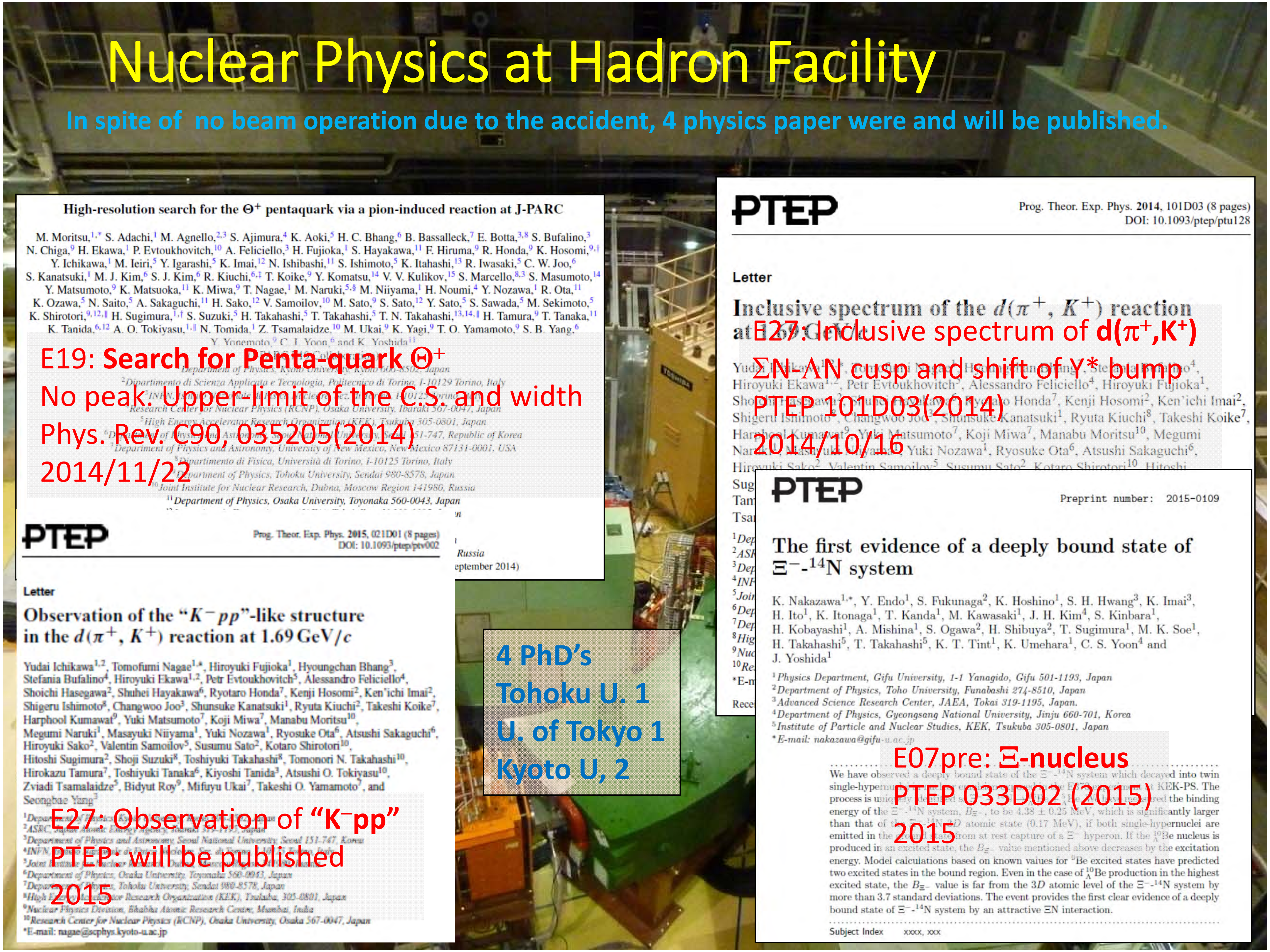


arXiv:1508.00376 [nucl-ex]

PRL in press

Nuclear Physics at Hadron Facility

In spite of no beam operation due to the accident, 4 physics paper were and will be published.



High-resolution search for the Θ^+ pentaquark via a pion-induced reaction at J-PARC

M. Moritsu, S. Adachi, M. Agnello, S. Ajimura, K. Aoki, H. C. Bhang, B. Bassalleck, E. Botta, S. Bufalino, N. Chiga, H. Ekawa, P. Evtoukhovitch, A. Feliciello, H. Fujioka, S. Hayakawa, F. Hiruma, R. Honda, K. Hosomi, Y. Ichikawa, M. Ieiri, Y. Igarashi, K. Imai, N. Ishibashi, S. Ishimoto, K. Itahashi, R. Iwasaki, C. W. Joo, S. Kanatsuki, M. J. Kim, S. J. Kim, R. Kiuchi, T. Koike, Y. Komatsu, V. V. Kulikov, S. Marcello, S. Masumoto, Y. Matsumoto, K. Matsuoka, K. Miwa, T. Nagae, M. Naruki, M. Niiyama, H. Noumi, Y. Nozawa, R. Ota, K. Ozawa, N. Saito, A. Sakaguchi, H. Sako, V. Samoilov, M. Sato, S. Sato, Y. Sato, S. Sawada, M. Sekimoto, K. Shirotori, H. Sugimura, S. Suzuki, H. Takahashi, T. Takahashi, T. N. Takahashi, H. Tamura, T. Tanaka, K. Tanida, A. O. Tokiyasu, N. Tomida, Z. Tsamalaidze, M. Ukai, K. Yagi, T. O. Yamamoto, S. B. Yang, Y. Yonemoto, C. J. Yoon, and K. Yoshida

E19: **Search for Penta-quark Θ^+**
No peak: Upper-limit of the C.S. and width
Phys. Rev. C90, 035205(2014)
2014/11/22

PTEP

Prog. Theor. Exp. Phys. 2015, 021D01 (8 pages)
DOI: 10.1093/ptep/ptv002

Letter

Observation of the "K^-pp"-like structure in the $d(\pi^+, K^+)$ reaction at 1.69 GeV/c

Yudai Ichikawa, Tomofumi Nagae, Hiroyuki Fujioka, Hyoungchan Bhang, Stefania Bufalino, Hiroyuki Ekawa, Petr Evtoukhovitch, Alessandro Feliciello, Shoichi Hasegawa, Shuhei Hayakawa, Ryotaro Honda, Kenji Hosomi, Ken'ichi Imai, Shigeru Ishimoto, Changwoo Joo, Shunsuke Kanatsuki, Ryuta Kiuchi, Takeshi Koike, Harphool Kumawat, Yuki Matsumoto, Koji Miwa, Manabu Moritsu, Megumi Naruki, Masayuki Niiyama, Yuki Nozawa, Ryosuke Ota, Atsushi Sakaguchi, Hiroyuki Sako, Valentin Samoilov, Susumu Sato, Kotaro Shirotori, Hitoshi Sugimura, Shoji Suzuki, Toshiyuki Takahashi, Tomonori N. Takahashi, Hirokazu Tamura, Toshiyuki Tanaka, Kiyoshi Tanida, Atsushi O. Tokiyasu, Zviadi Tsamalaidze, Bidyut Roy, Mifuyu Ukai, Takeshi O. Yamamoto, and Seongbae Yang

*E-mail: nagae@scphys.kyoto-u.ac.jp

E27: Observation of "K^-pp"
PTEP: will be published
2015

4 PhD's
Tohoku U. 1
U. of Tokyo 1
Kyoto U, 2

PTEP

Prog. Theor. Exp. Phys. 2014, 101D03 (8 pages)
DOI: 10.1093/ptep/ptu128

Letter

Inclusive spectrum of the $d(\pi^+, K^+)$ reaction at 1.69 GeV/c

E27: Inclusive spectrum of **$d(\pi^+,K^+)$**
ΣN-ΛN cusp and shift of Y* bump
PTEP 101D03(2014)
2014/10/16

PTEP

Preprint number: 2015-0109

The first evidence of a deeply bound state of Ξ^--^{14}N system

K. Nakazawa[1,*], Y. Endo[1], S. Fukunaga[2], K. Hoshino[1], S. H. Hwang[3], K. Imai[3], H. Ito[1], K. Itonaga[1], T. Kanda[1], M. Kawasaki[1], J. H. Kim[4], S. Kinbara[1], H. Kobayashi[1], A. Mishina[1], S. Ogawa[2], H. Shibuya[2], T. Sugimura[1], M. K. Soe[1], H. Takahashi[5], T. Takahashi[5], K. T. Tint[1], K. Umehara[1], C. S. Yoon[4] and J. Yoshida[1]

[1] Physics Department, Gifu University, 1-1 Yanagido, Gifu 501-1193, Japan
[2] Department of Physics, Toho University, Funabashi 274-8510, Japan
[3] Advanced Science Research Center, JAEA, Tokai 319-1195, Japan.
[4] Department of Physics, Gyeongsang National University, Jinju 660-701, Korea
[5] Institute of Particle and Nuclear Studies, KEK, Tsukuba 305-0801, Japan
*E-mail: nakazawa@gifu-u.ac.jp

E07pre: **Ξ-nucleus**
PTEP 033D02 (2015)
2015

We have observed a deeply bound state of the Ξ^--^{14}N system which decayed into twin single-hypernuclei ... KEK-PS. The process is uniq... the binding energy of the Ξ^--^{14}N system, B_{Ξ^-}, to be 4.38 ± 0.25 MeV, which is significantly larger than that of the ... 3D atomic state (0.17 MeV), if both single-hypernuclei are emitted in the ... from at rest capture of a Ξ^- hyperon. If the $^{10}_{\Lambda}$Be nucleus is produced in an excited state, the B_{Ξ^-} value mentioned above decreases by the excitation energy. Model calculations based on known values for ^{9}Be excited states have predicted two excited states in the bound region. Even in the case of $^{10}_{\Lambda}$Be production in the highest excited state, the B_{Ξ^-} value is far from the 3D atomic level of the Ξ^--^{14}N system by more than 3.7 standard deviations. The event provides the first clear evidence of a deeply bound state of Ξ^--^{14}N system by an attractive ΞN interaction.

Subject Index xxxx, xxx

$d(\pi^+, K^+)$ reaction (E27)

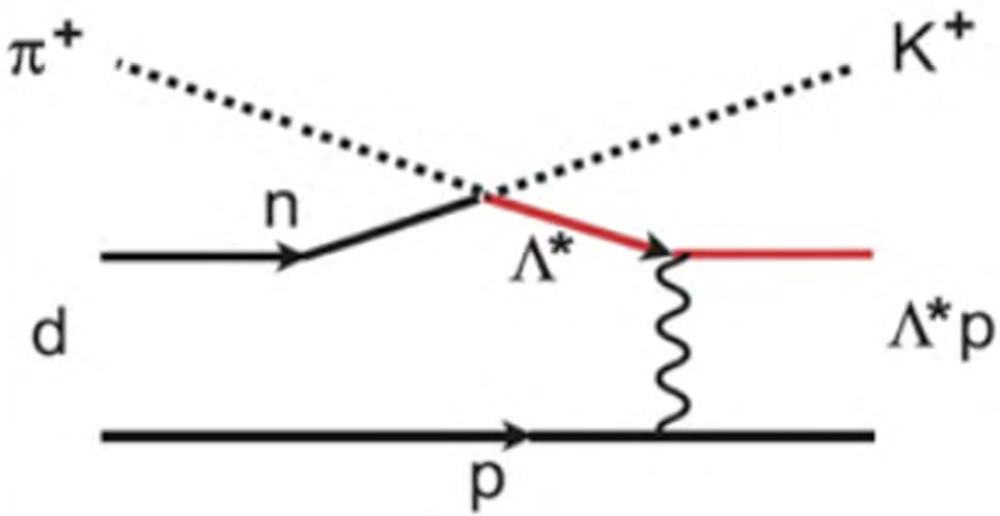
Yamazaki & Akaishi, Phys. Rev. C76 (2007) 045201.

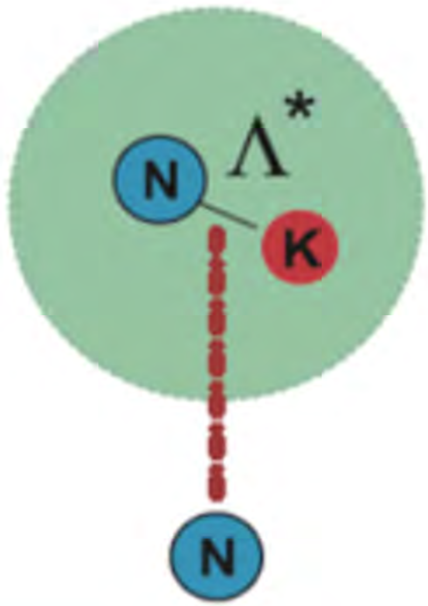
"Inclusive spectrum of the d(π +, K+) reaction at 1.69 GeV/c", PTEP, 101D03 (2014)

π^+ + "n" --> "Λ^*" + K^+

"Λ^*" + "p" --> bound K^-pp *minor*

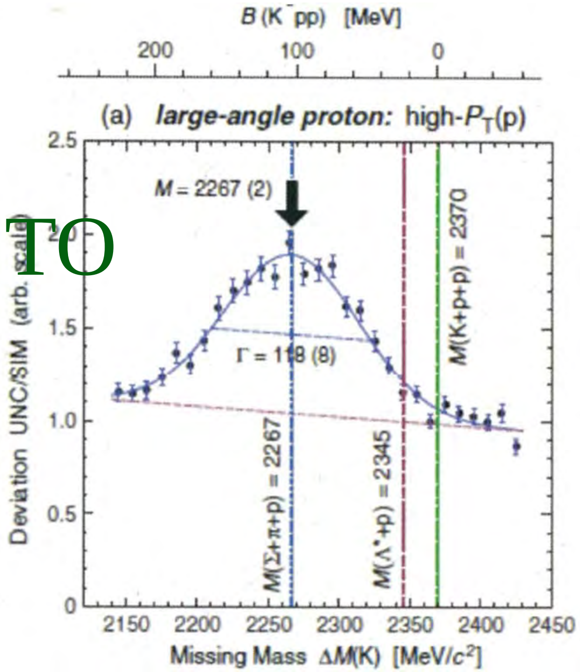
--> quasi-free Λ^* *dominant*

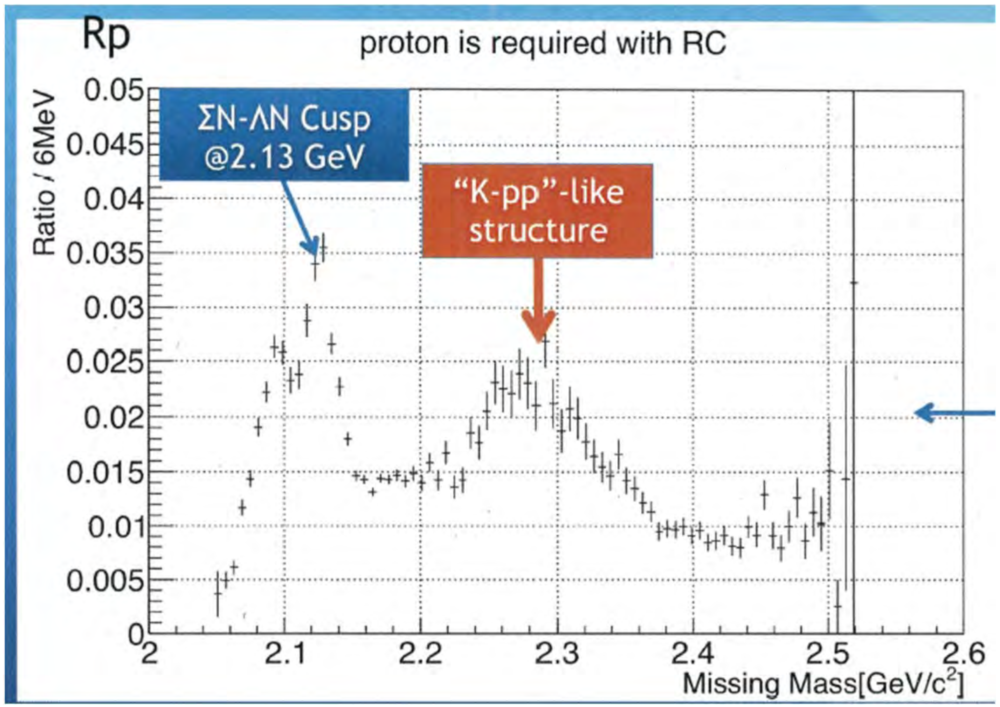


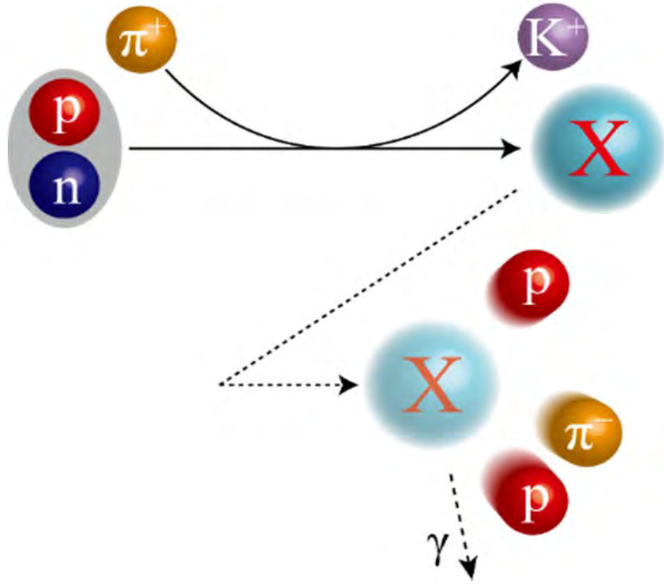


Experimental Method

DISTO







J-PARC E27:

$\pi^+ + d \;\text{->}\; K^+ + X$

Preliminary

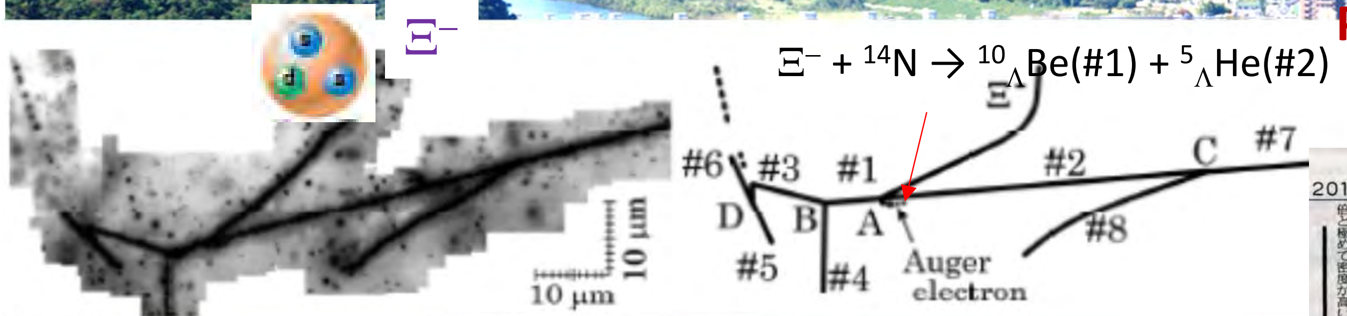
A deviation spectrum

Results (4)

In the R&D of E07

Discovery of Ξ-Nucleus for the first time – KISO Event –

In the test application of **Overall Scanning Method**, which is under R&D for incoming **E07 Experiment**, to the emulsion sample irradiated before, we found the event in which Ξ^- is deeply bound in ^{14}N. This is the first evidence of Ξ-nucleus



PTEP 033D02 (2015)

Newspaper (2015/1/19)

2015年（平成27年）1月19日（月曜日）

岐大、宇宙創生の謎に一歩

中性子星に「グザイ」存在

岐阜大の仲沢和馬教授（実験物理学）と日本原子力研究開発機構（茨城県）などのグループは、恒星の最終形態である中性子星に含まれていると推定されている素粒子「グザイ」の性質を解明した。中性子星にグザイが存在することをほぼ確定する成果で、宇宙創生の秘密に迫る一歩として注目される。（松野穂波）

仲沢和馬教授

結果は、日本物理学会などがインターネットで発表する学術論文誌に近く掲載される。

中性子星は、寿命が尽きた恒星が爆発した後に残る星。大きさは太陽の百万分の一程度だが、質量は約二倍と極めて密度が高い。このため、素粒子のうち陽子や中性子より重い「ラムダ」「シグマ」「グザイ」のいずれかが存在すると考えられた。

仲沢教授は二〇〇一年、通常は陽子と中性子でできている原子核に、ラムダを結合した超原子核を作製。陽子、中性子とラムダが結び付くことが分かり、中性子星に存在する可能性が高まった。シグマは原子核と反発する関係と判明し、残るグザイの性質を解き明かすことが、中性子星を知る最後の鍵と位置付けられていた。

グザイは、中性子星より低密度の地球では百億分の一秒で崩壊してしまうため、地球上に存在しないとみられる。このため、仲沢教授らは高エネルギー加速器研究機構（茨城県）で、K中間子という粒子の放射線をダイヤモンドに照射することで、人工的にグザイ粒子を生成。特殊な写真乾板に当てて顕微鏡で撮影した。約八百万枚の画像を分析した結果、窒素の原子核にグザイが吸収された超原子核を発見した。

超原子核内の引力を測定すると、原子核とグザイが互いの電磁力の三十倍の強さで引き合っていた。グザ

中性子星

大きさは太陽の100万分の1だが重さは2個分

重い素粒子が存在?

太陽 太陽

○=陽子 △=中性子 ●=グザイ、ラムダなどの重い素粒子

Binding energy of Ξ^-

> 1.11±0.25 MeV c.f. 0.17 MeV（atomic orbit）

4.38±0.25MeV if $^{10}{}_{\Lambda}$Be is in ground state.

Attractive ΞN interaction has been established.

In E07, ~100 double-strangeness events will be observed.

⇒ detailed information on S=-2 interaction

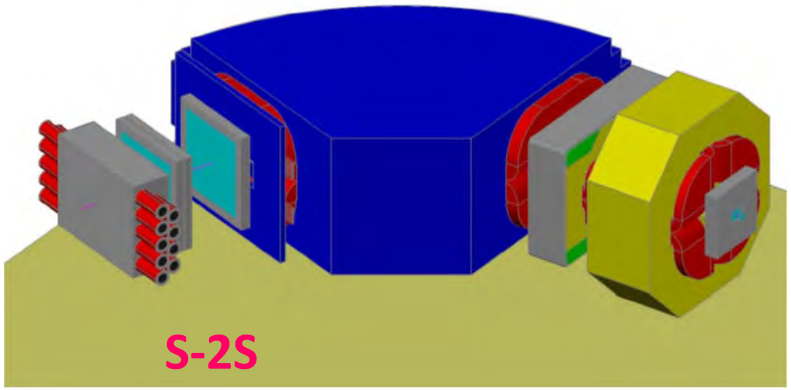
Coming Experiments in Autumn 2015

NOW: SKS＋Hyperball-J gamma ray spectroscopy of HN (E13)

S=−2 Hypernuclei

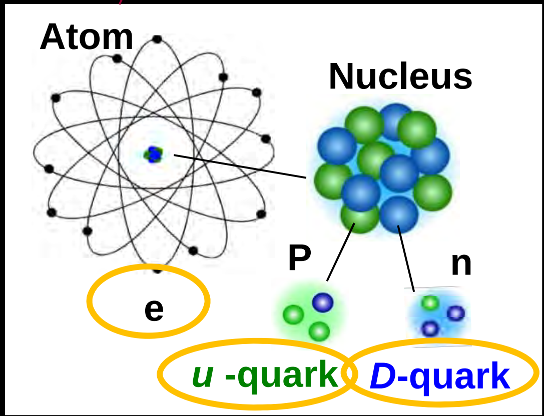
SKS ⇒ KURAMA @ K1.8

- **S=-2 Hyper nuclei by Hybrid Emulsion method（E07)**
  S=-2 HN Spectroscopy will be the main stream at J-PARC
  - X ray spectroscopy of Ξ atm（E03)
  - **Ξ hypernuce Spectroscopy by S-2S（E05)**
  - H particle hunting by Hyperon Spectrometer（E42)
- SKS will be moved to K1.1 for S=-1 HN



Strangeness Nuclear Physics in J-PARC

Structure of NS ➡ New Era of Material Understanding



Present COSMOS

Matter consists of u,d-quarks and electron

NS: Neutron Star

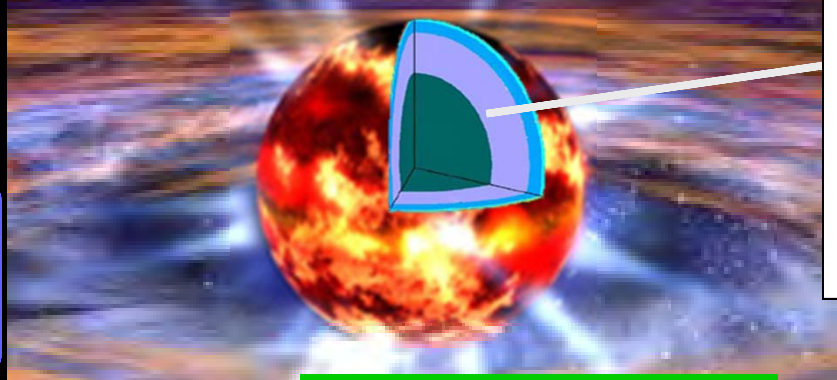
Biggest Nucleus in COSMOS

Remnant of Supernova

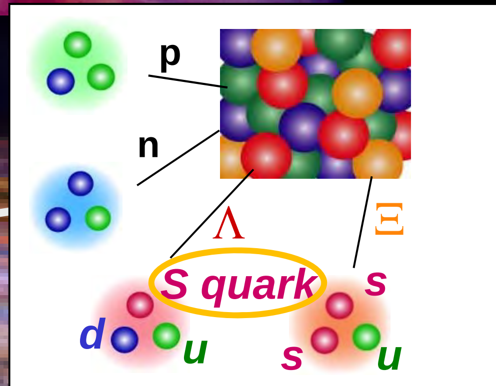
Mass：1~2 SM, Radius：~10 km,

→ Highest density matter in space

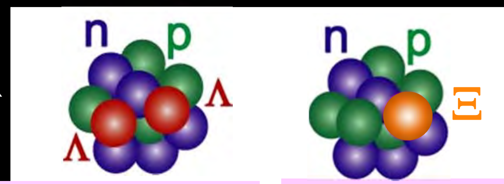
Internal Structure is still unknown



Strange matter?



Nuclei with 2 s-quarks



ΛΛhypernuclei

Ξhypernuclei

Nuclear force between two strange particle will be measured.

→ Internal structure of NS

Micro Neutron Star in Laboratory

Can stable Strange matter exist?

New COSMOS

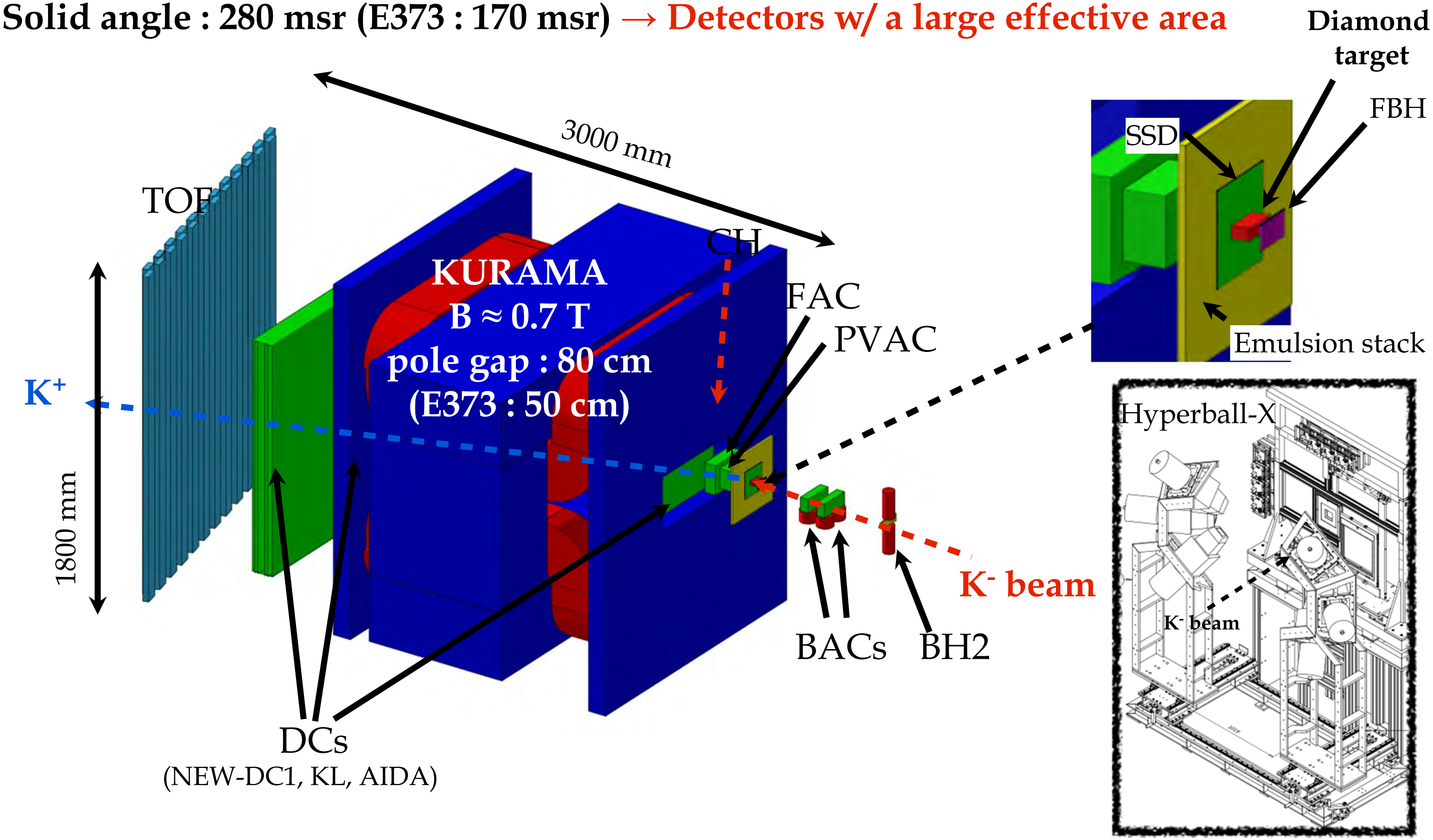
New matter consists of u,d,s-quaks and electron

We studied Λ hypernucei （No. of *s-quark=1*）
at KEK-PS and J-PARC and lead the world!
For Strange matter study, two strange
particles must be implanted in a nucleus
->100 times higher intense beam is necessary!

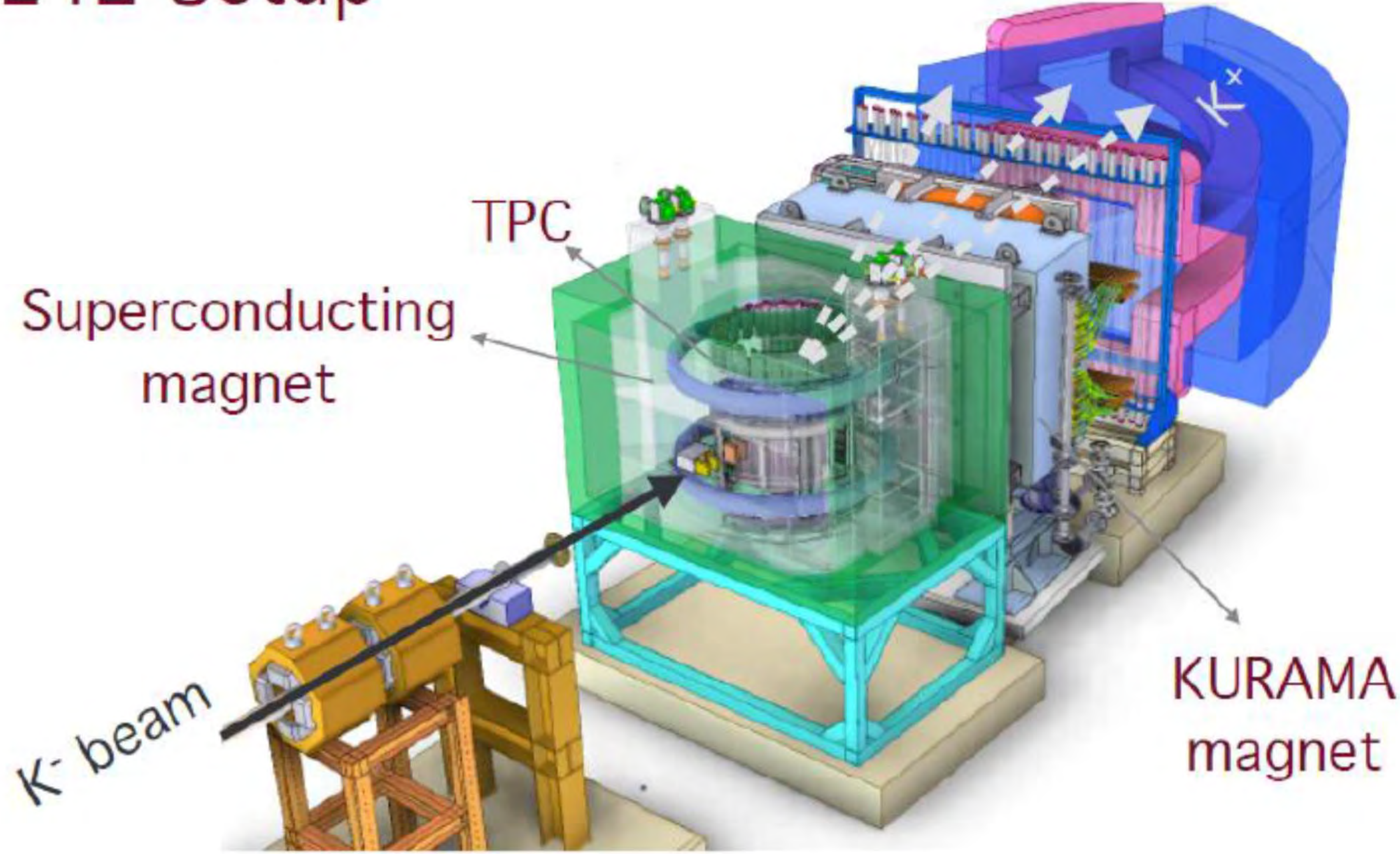
Only possible at J-PARC!

New KURAMA spectrometer

Beam : 1.67 GeV/c, 10^5 - 10^6 K^-/spill → Operation with a high counting rate
Solid angle : 280 msr (E373 : 170 msr) → Detectors w/ a large effective area

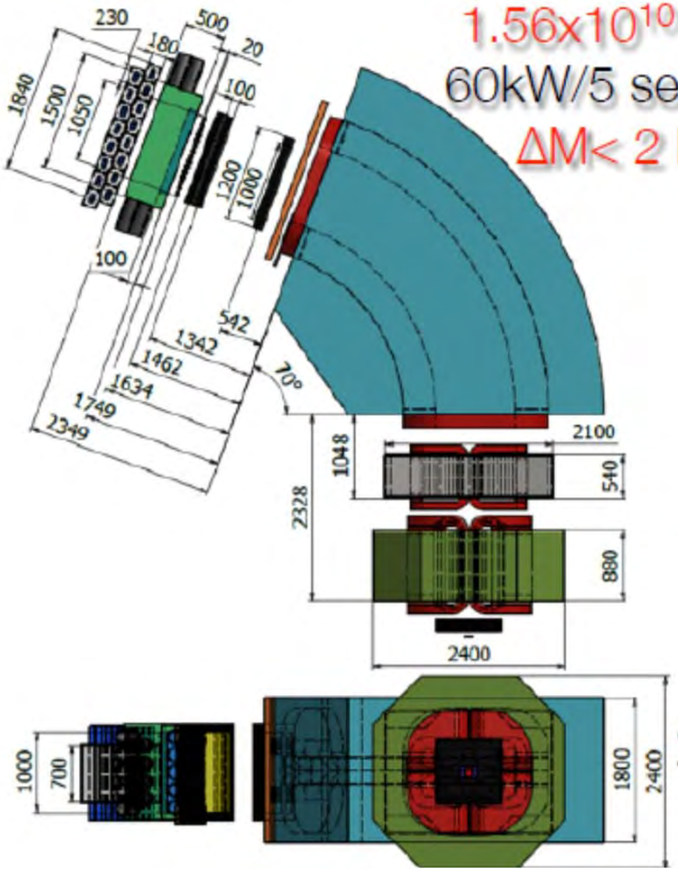


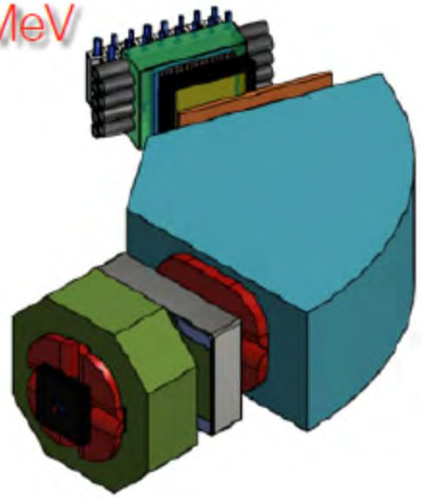
E42 Setup



S-2S

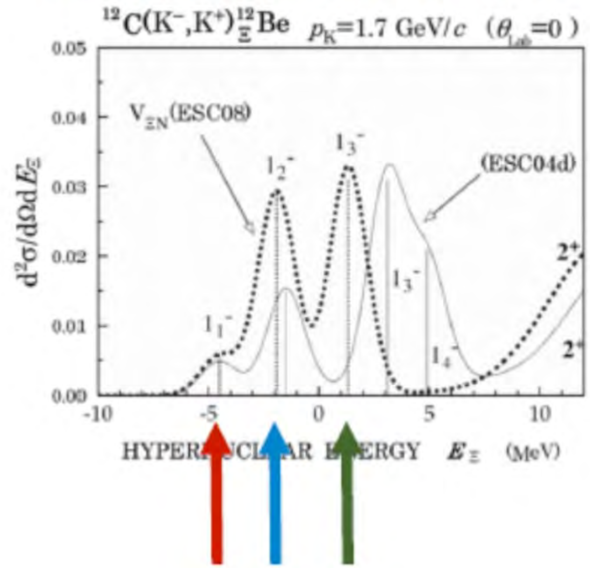
1.56x10^{10} K$^-$/day
60kW/5 sec. cycle
ΔM< 2 MeV

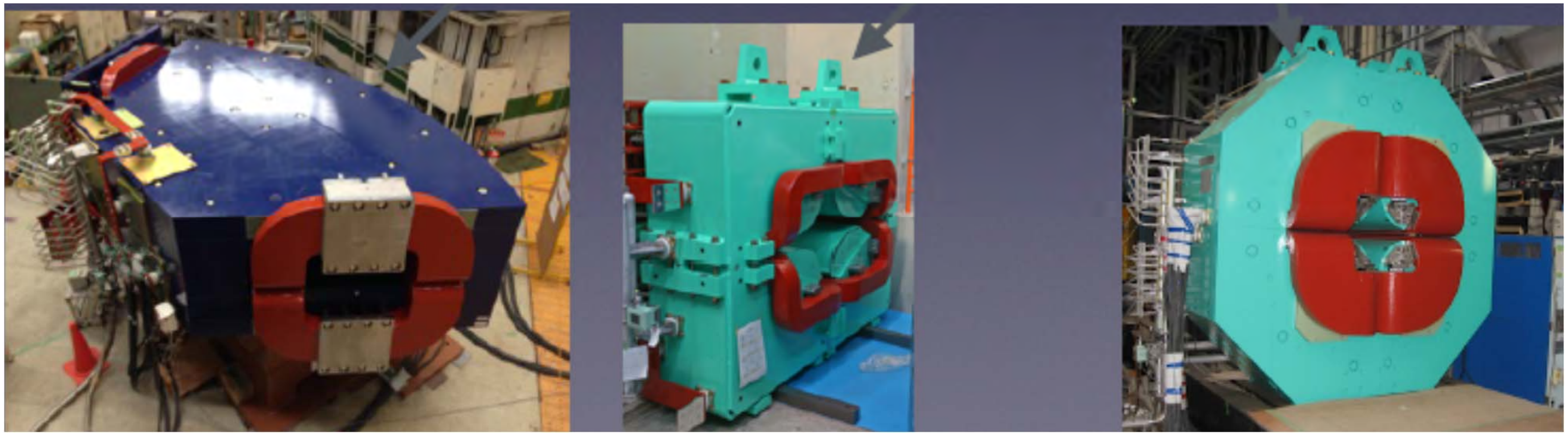




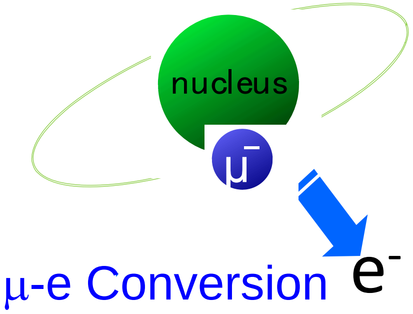
S-2S spectrometer
ver. 29Aug2014

T.Motoba and S.Sugimoto, *NPA* **835** (2010) 223-230





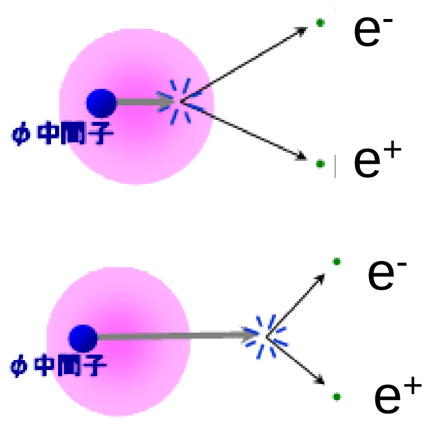
Experiments at High-p/COMET

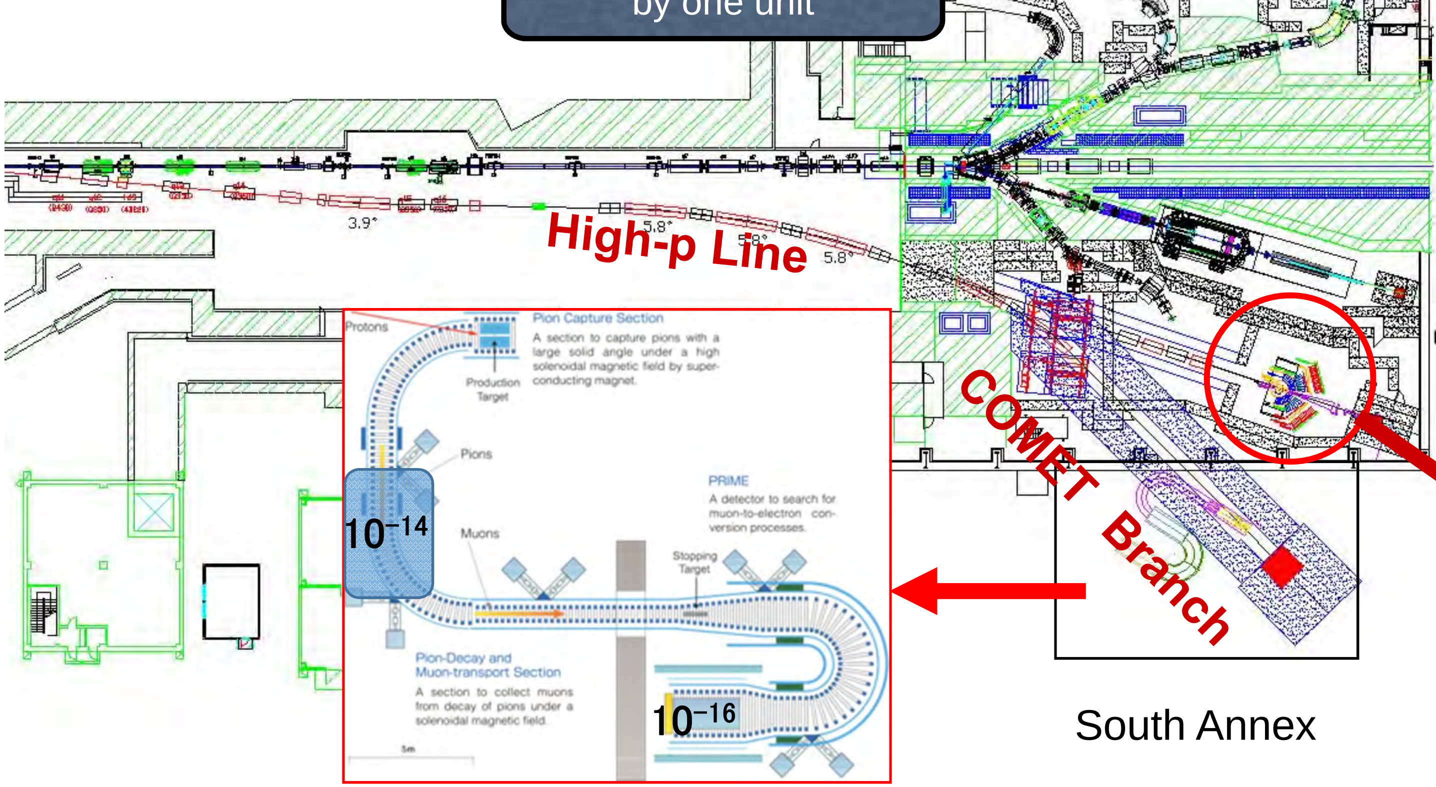


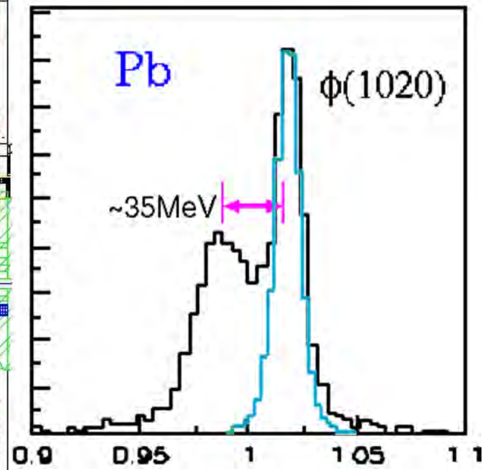
Neutrino-less muon nuclear capture (=μ-e conversion)

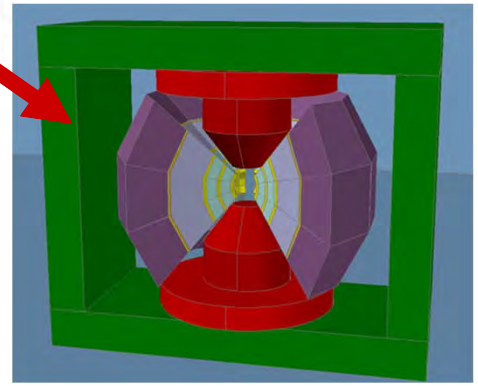
$$\mu^- + (A,Z) \rightarrow e^- + (A,Z)$$

lepton flavours changes by one unit

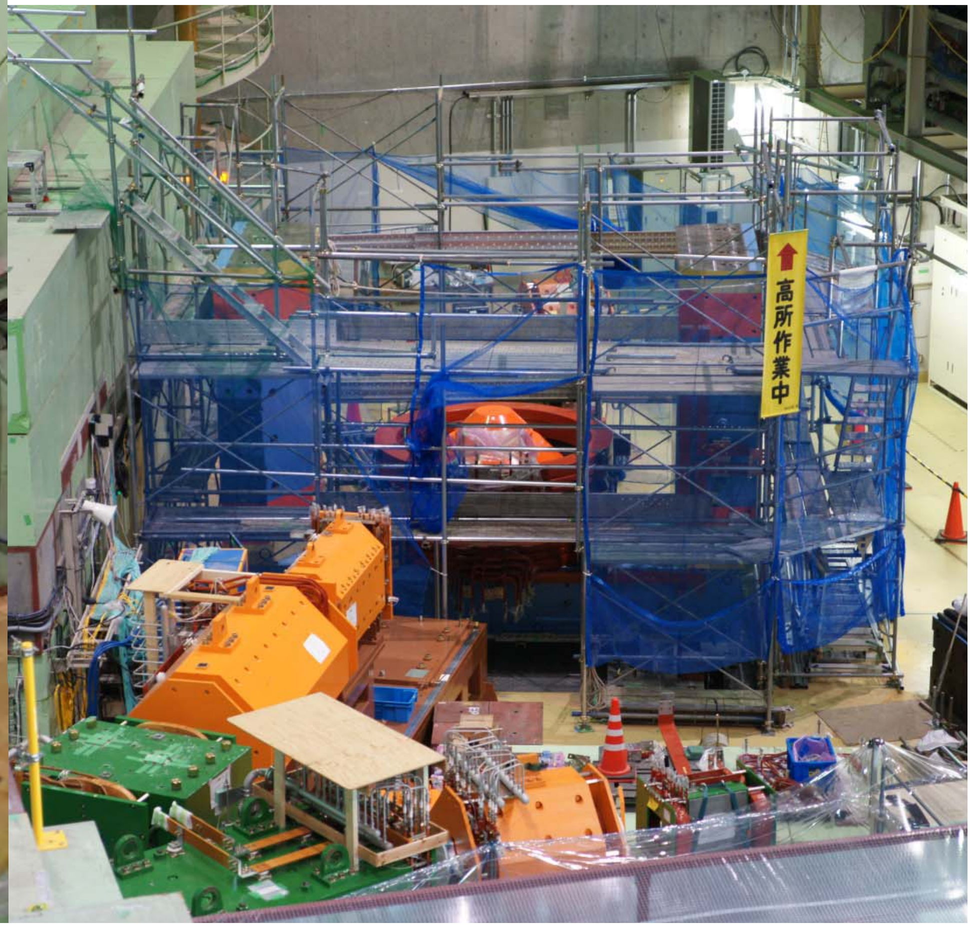






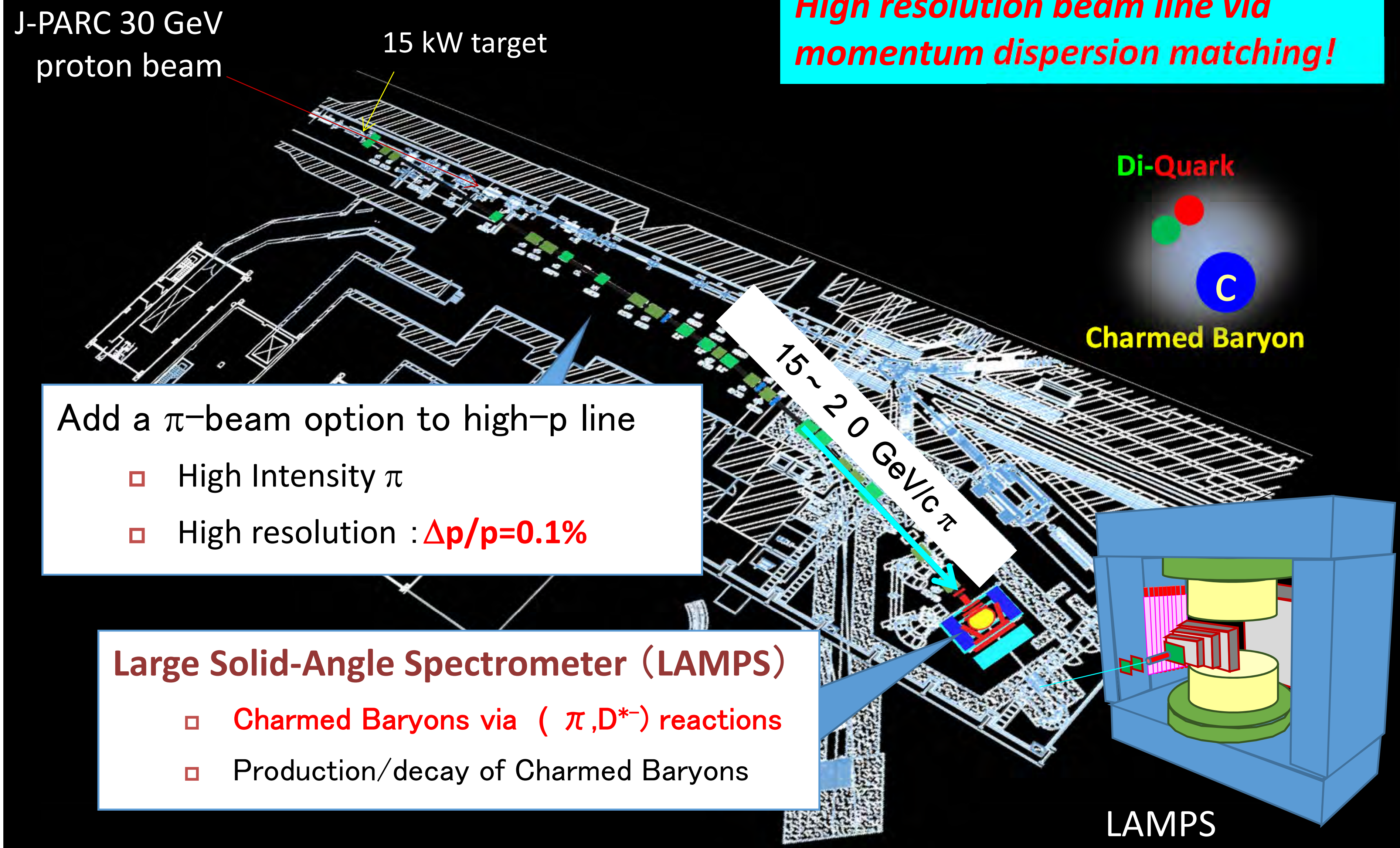


FM magnet renovation for E16 experiment



High Mom. π-beam

Traditional ***RCNP*** technology:
High resolution beam line via momentum dispersion matching!



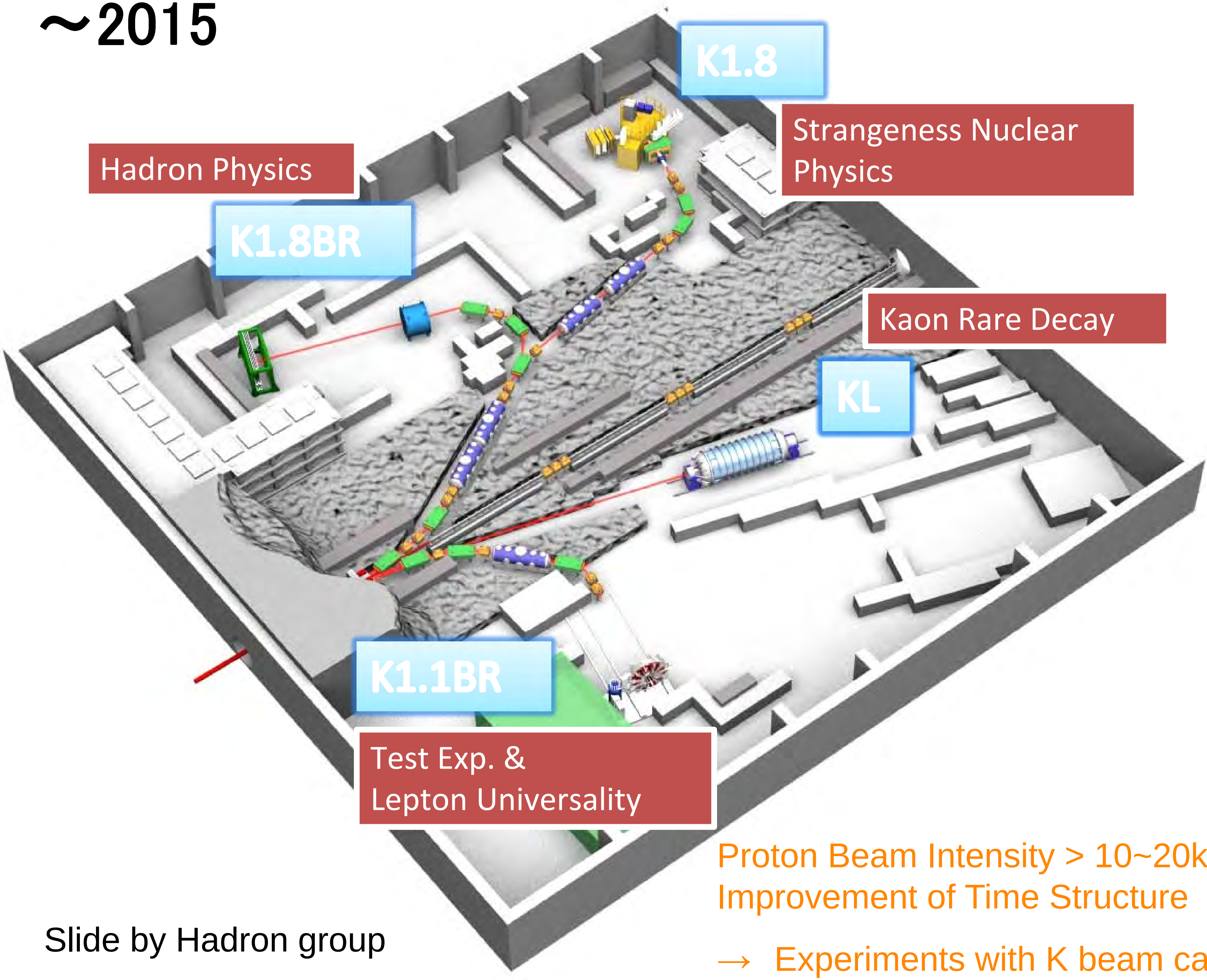
Add a π−beam option to high−p line

- High Intensity π
- High resolution : **Δp/p=0.1%**

Large Solid-Angle Spectrometer（LAMPS）

- Charmed Baryons via （π,D*⁻）reactions
- Production/decay of Charmed Baryons

～2015



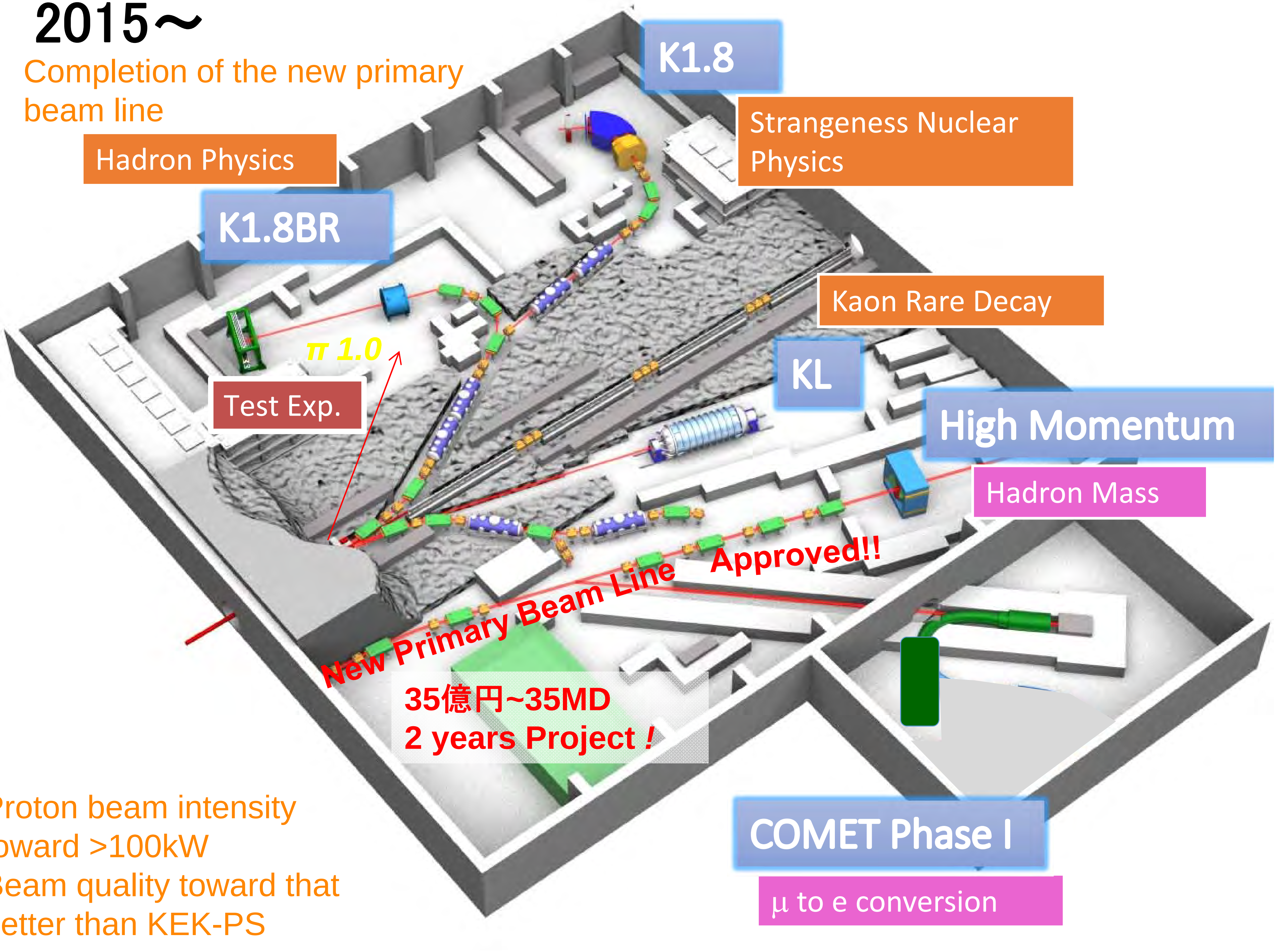
Proton Beam Intensity > 10~20kW
Improvement of Time Structure

→ Experiments with K beam can start

Slide by Hadron group

2015～

Completion of the new primary beam line



Proton beam intensity toward >100kW
Beam quality toward that better than KEK-PS

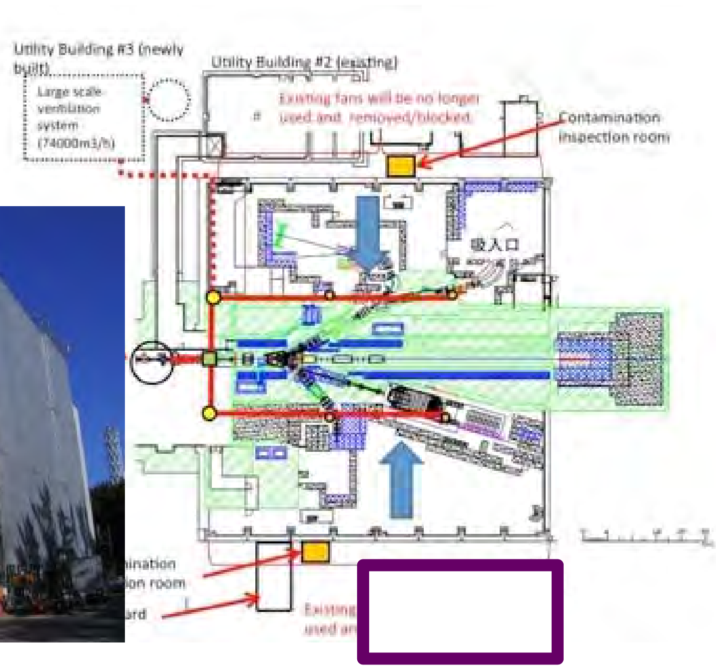
Restart of Hadron Facility User Run, 2015 April 24.

COMET Construction Status

SC magnets production

Hall construction


40t
KAMEI



New Controle room is completed at 3F.

Summary 1

- Physics experiments re-started at the Hadron Experimental Facility (HEF) of J-PARC after the recovery works from the radiation leak incident.

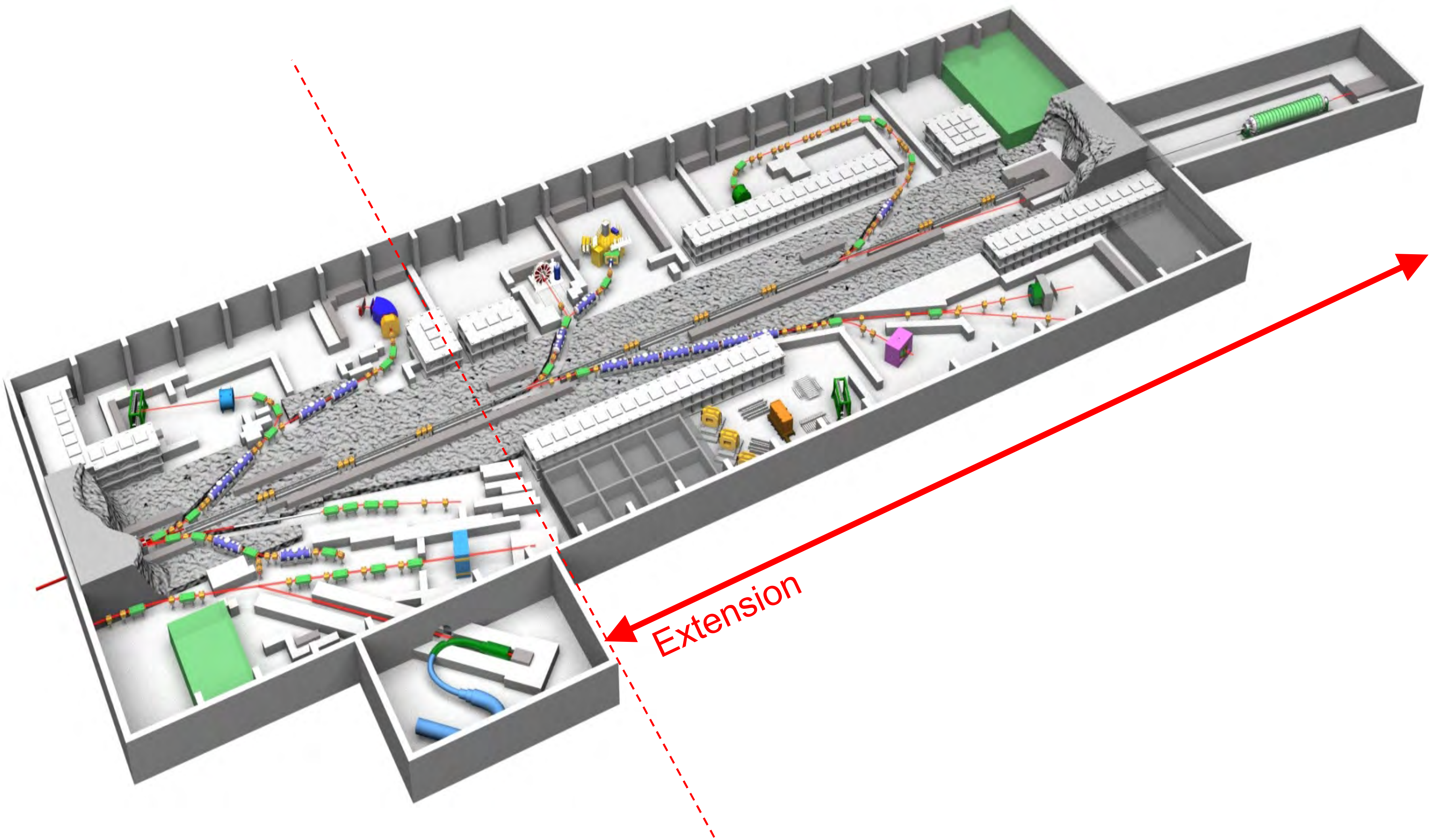
- The first physics papers have been published from the several experiments using new data as well as previously accumulated data.

- Main nuclear physics experiments at HEF are now going to S=-2 hypernuclei! Spectrometer KURAMA will be installed at K1.8 in the next spring for hybrid emulsion experiment.

Summary 2

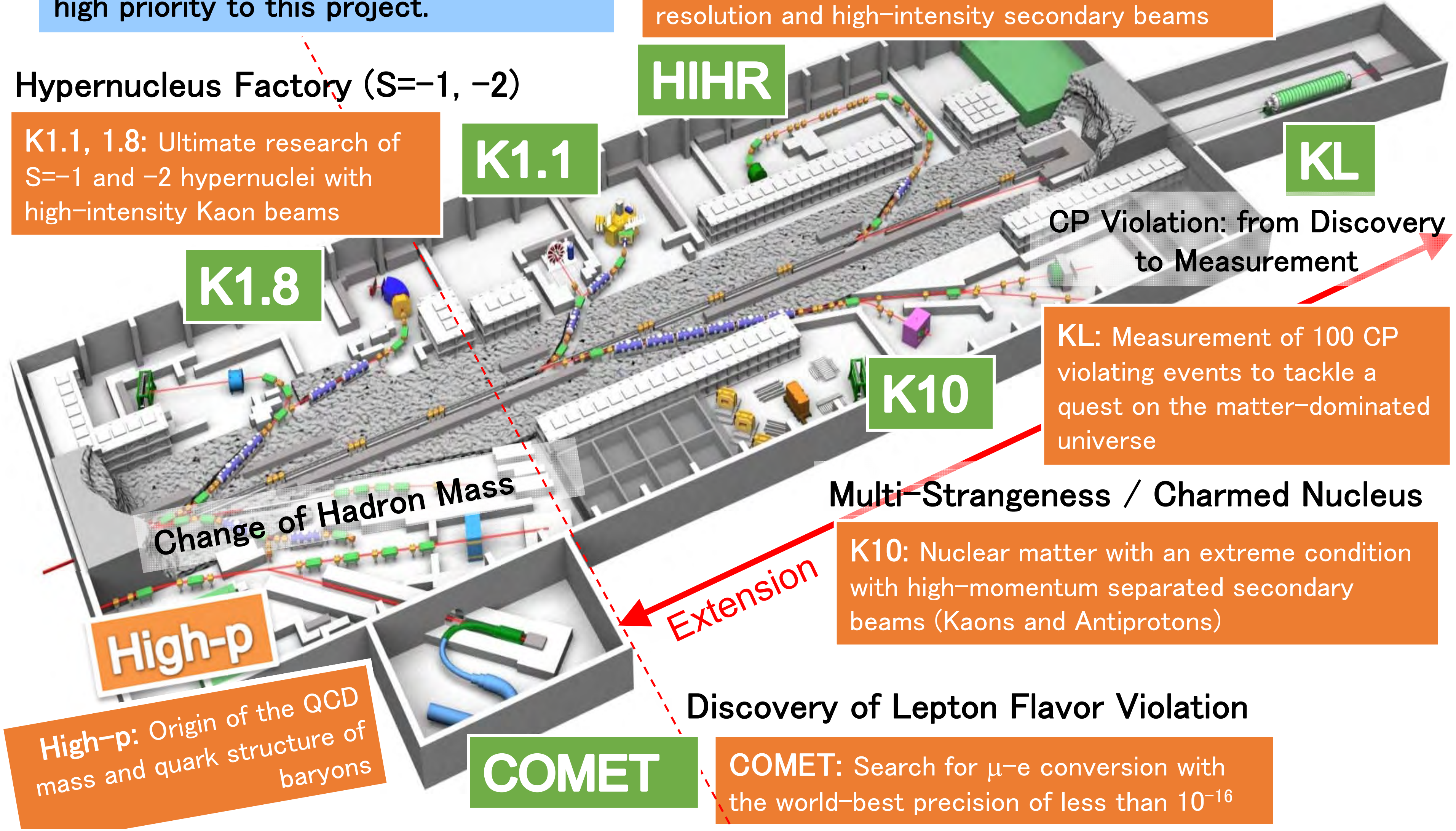
- New spectrometer S-2S is almost ready and waiting for its place to study S=-2 hypernuclei via (K-,K+) reactions.
- The funding for the high-momentum beam line with COMET branch was approved by the government and paid. The construction will be completed soon. Mass shift of phi meson would be the first experiment, and other experiments are being discussed.
- Hadron Hall Extension was selected one of 27 major big projects in Science Council of Japan. Now discussion on the extension is becoming active.
- **An International workshop on HH Extension would be held sometime around spring of the next year by HUA and IPNS**

Next Step: Hadron Hall Extension



Next Step: Hadron Hall Extension

Both Nuclear Physics community and High Energy Physics community gave high priority to this project.



Hypernucleus Microscope

HIHR: Very Precise spectroscopy with high-resolution and high-intensity secondary beams

Hypernucleus Factory (S=−1, −2)

K1.1, 1.8: Ultimate research of S=−1 and −2 hypernuclei with high-intensity Kaon beams

CP Violation: from Discovery to Measurement

KL: Measurement of 100 CP violating events to tackle a quest on the matter-dominated universe

Multi-Strangeness / Charmed Nucleus

K10: Nuclear matter with an extreme condition with high-momentum separated secondary beams (Kaons and Antiprotons)

High-p: Origin of the QCD mass and quark structure of baryons

Discovery of Lepton Flavor Violation

COMET: Search for μ−e conversion with the world-best precision of less than 10^{-16}

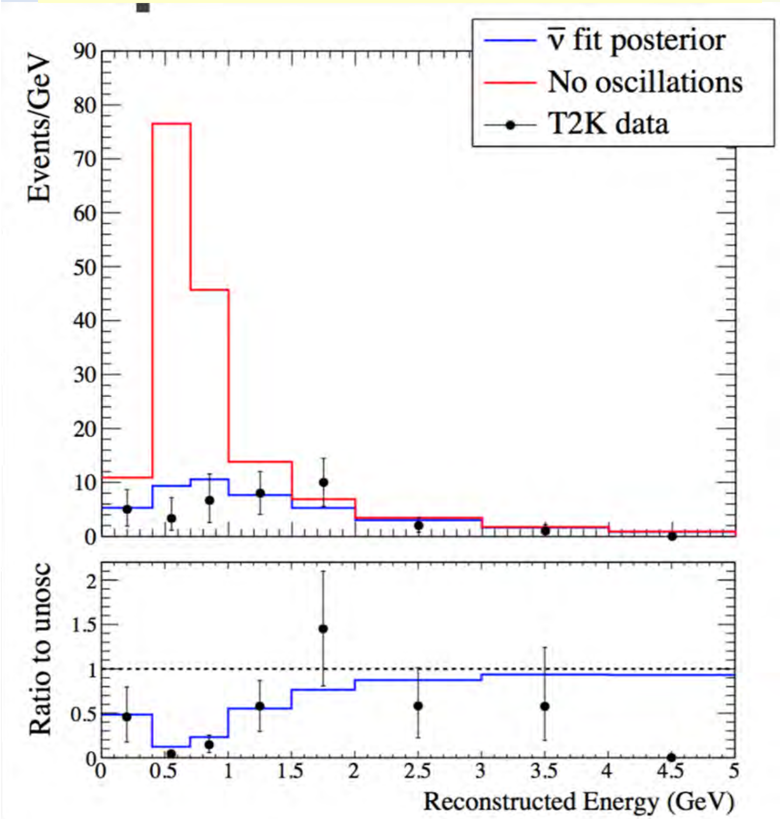
Neutrino   Experimental Facility

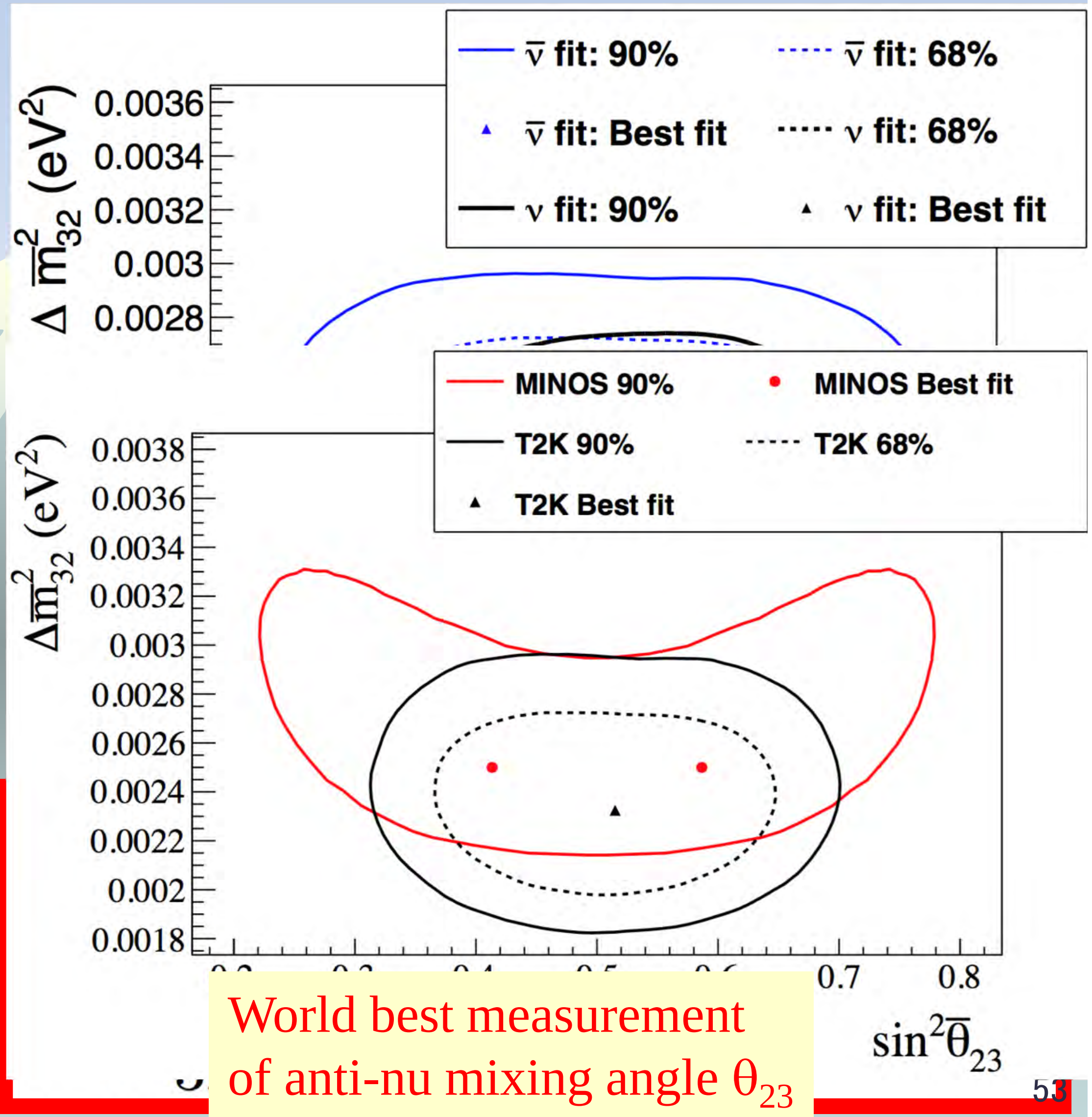
Latest ν_μ–bar disappearance results

- First physics result from anti-nu data
- $2.315\text{x}10^{20}$POT by Mar. 13, 2015

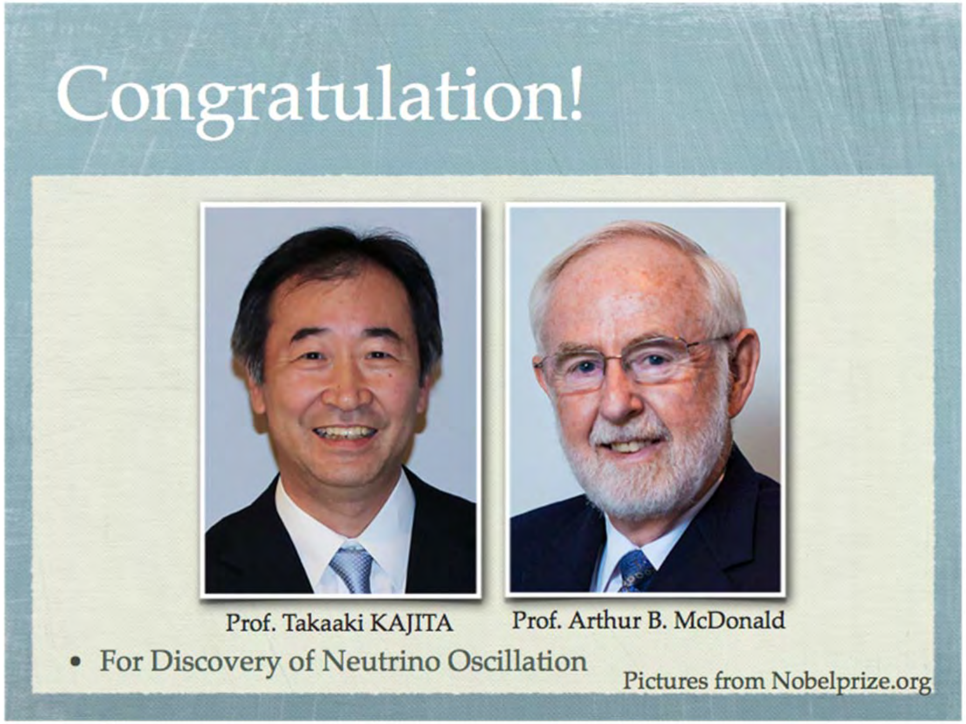
Released on May 18, 2015

17 single μ-like events

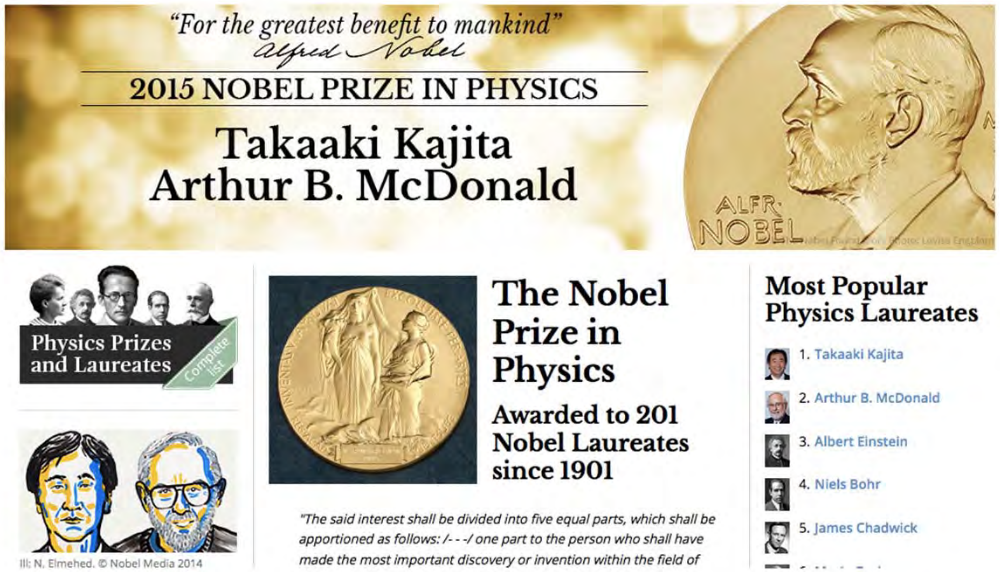




World best measurement of anti-nu mixing angle θ_{23}



Congratulations!!



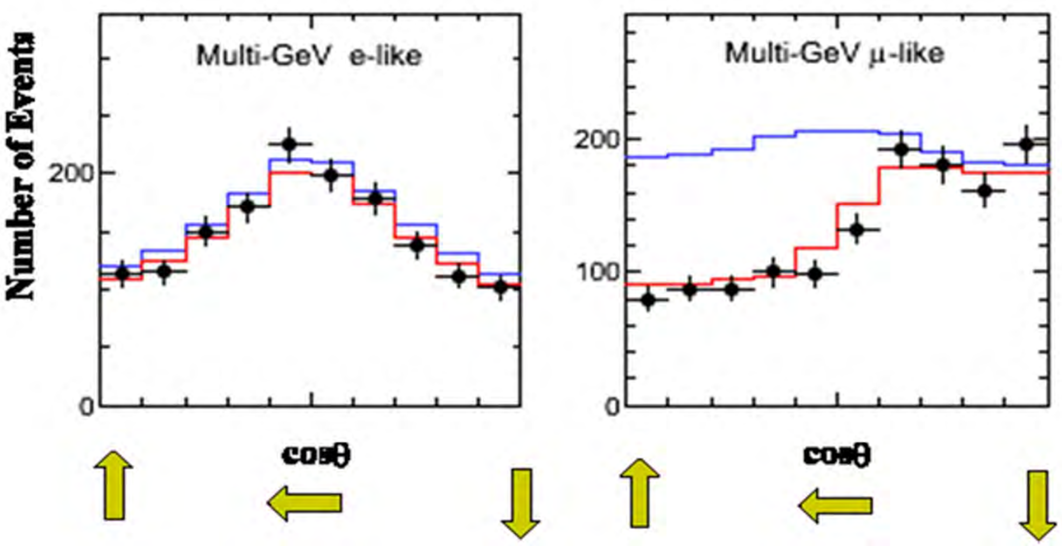
Neutrino

Atmospheric ν Experiment

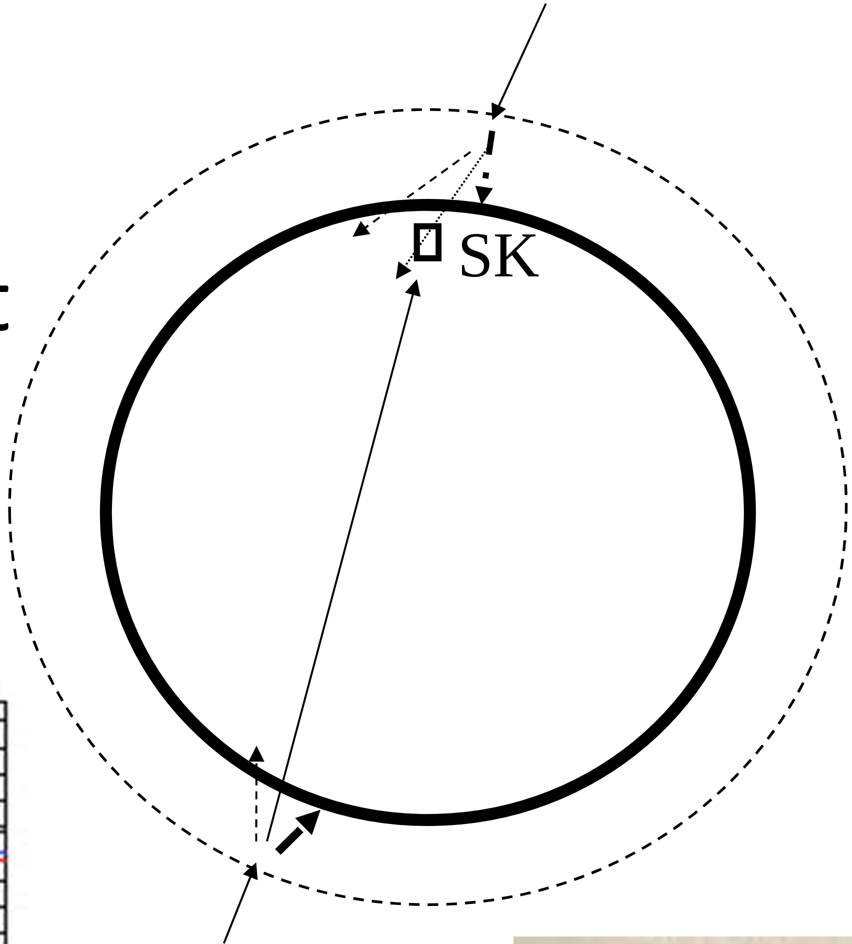
No ν Oscillation；Blue line

$\nu_\mu \rightarrow \nu_\tau$ **Oscillation assumed**；Red Line

e neutrino　　　μ neutrino



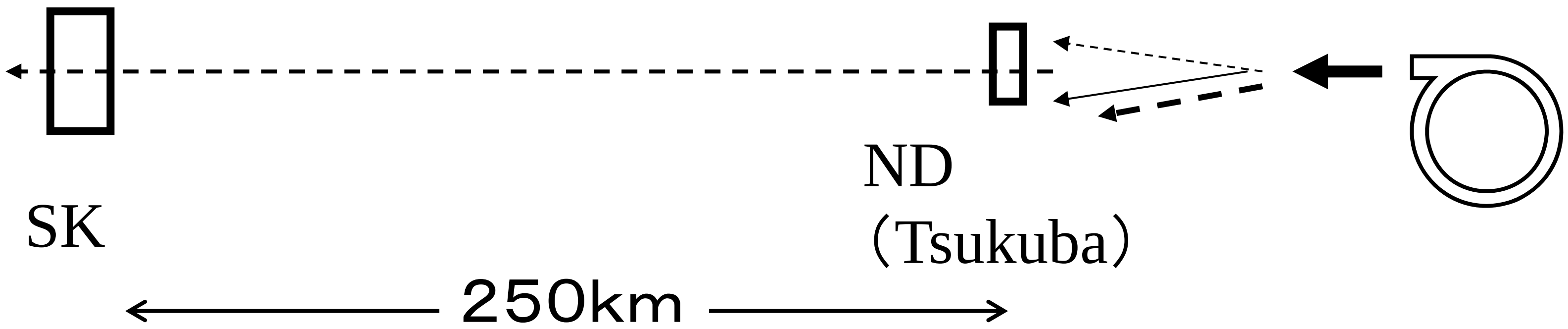
Directions of ν coming

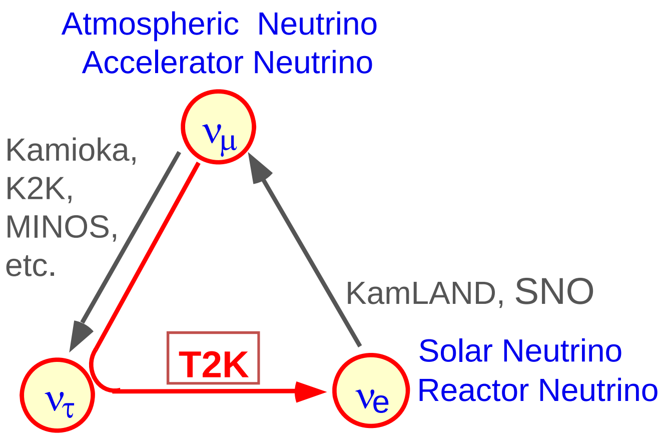


Number of μ-neutrino coming from the other side of earth is almost half of expectation! This was the start point of neutrino oscillation discovery.

Prof. Totsuka

The First Long Baseline
ν Oscillation Experiment (K2K)



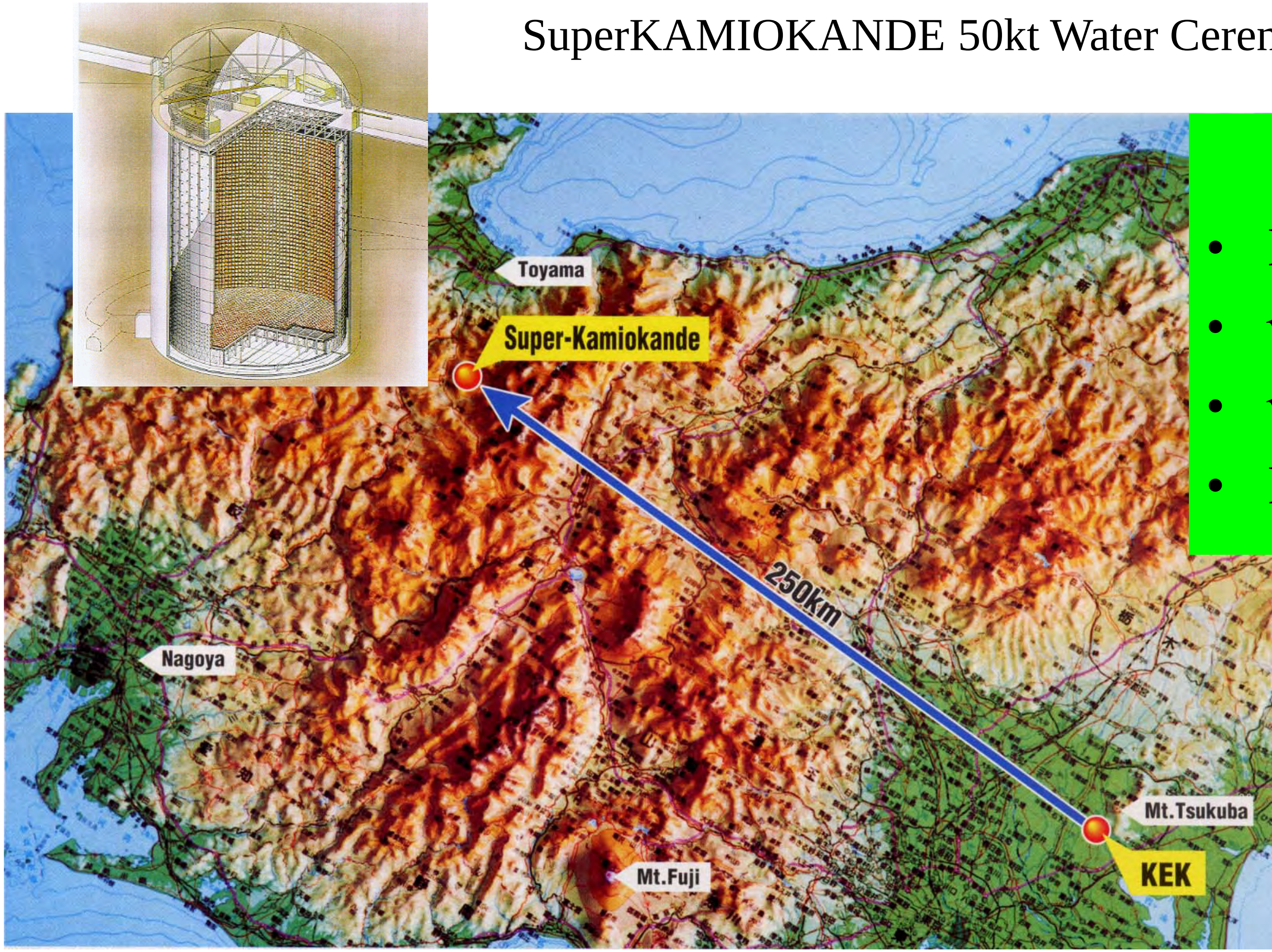


K2K Experiment

Long Baseline Neutrino oscillation Experiment

Far Detector:

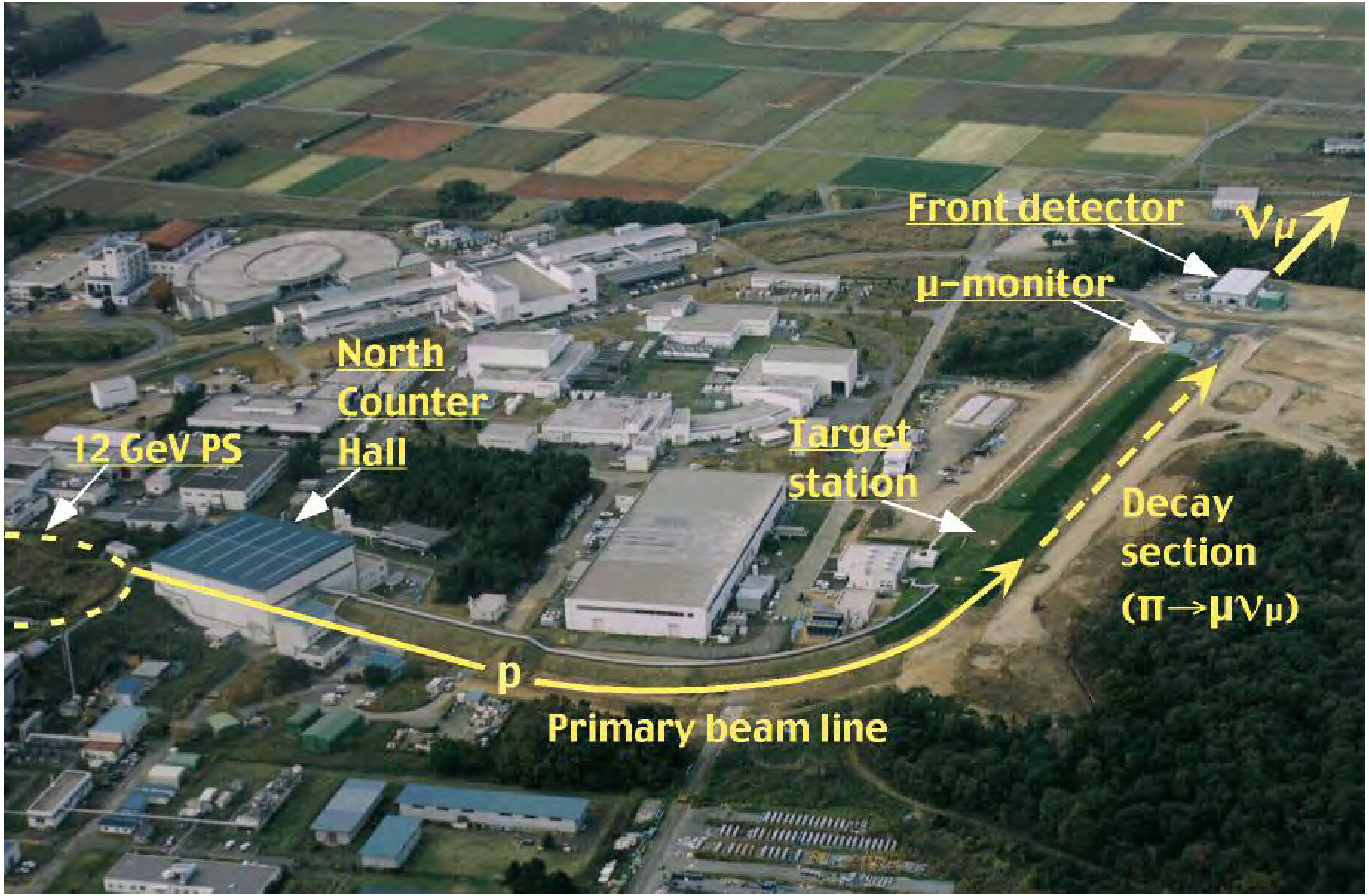
SuperKAMIOKANDE 50kt Water Cerenkov Detector



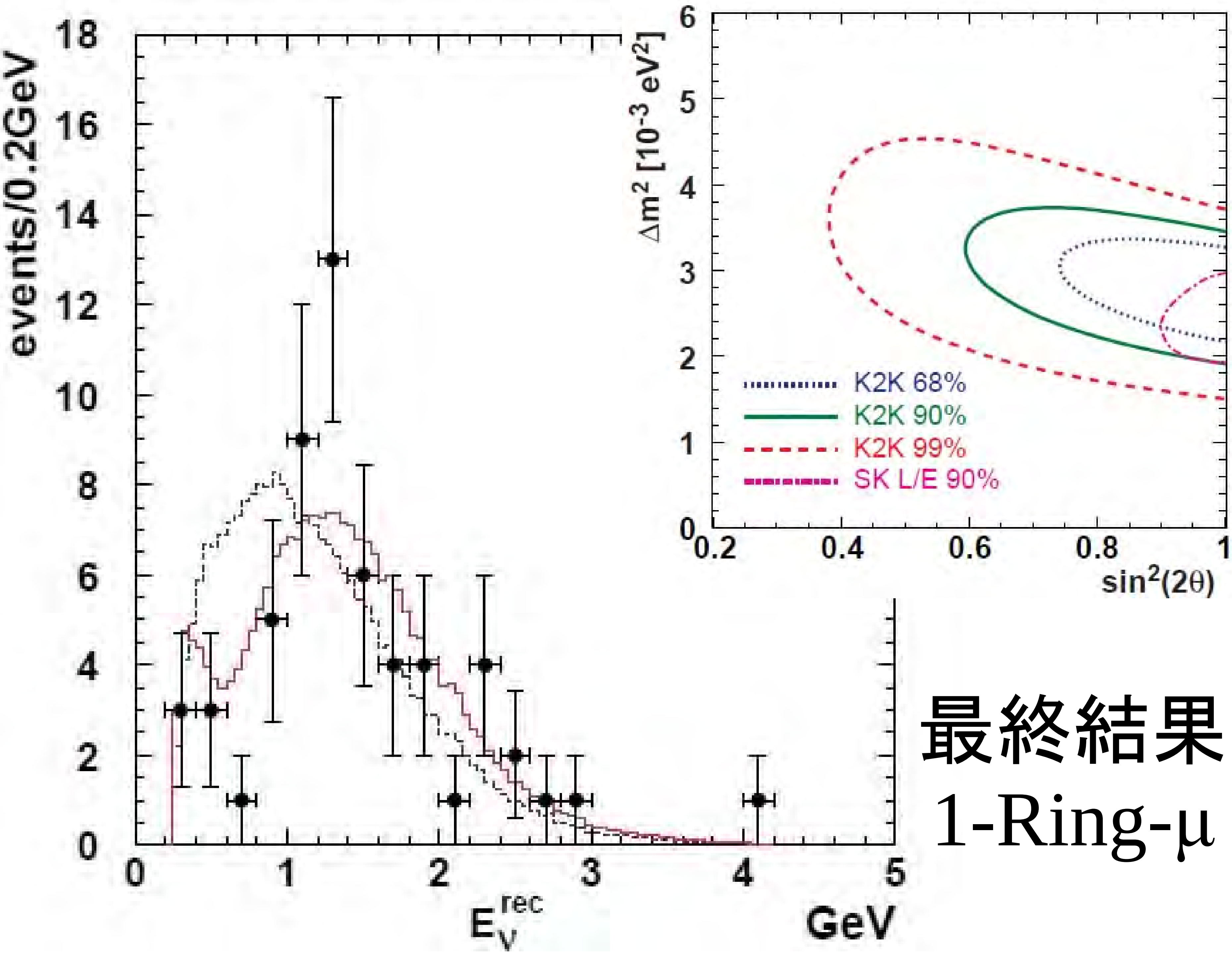
Shooting Side

- KEK 12GeV PS
- νBeam Line
- νBeam Facility
- Front Detectors

K2K Neutrino Beam Facility (1998)



Birdseye View



events/0.2GeV
18
16
14
12
10
8
6
4
2
0
0
1
2
3
4
5
E_ν^{rec}
GeV
Δm^2 [10^{-3} eV^2]
6
5
4
3
2
1
0
0.2
0.4
0.6
0.8
1
$\sin^2(2\theta)$
K2K 68%
K2K 90%
K2K 99%
SK L/E 90%

最終結果
1-Ring-μ

Conclusions or Present Status (2000)

- Accelerator, Beam channel, Horns, and Beam Monitors are all stable.
- Life time of our Magnetic Horns is ~6 M excitation and ~2x10^{19} POT was Achieved.

- Nice pointing to Super-K is established and we have stable event rate at SK.
- Strategy to 10^{20} POT has been established.
- Future High Intensity Project has started.

To Project Drivers

- 15 years from K2K project to NP
- 20 years from superKAMIOKANDE to NP
- 10 years for J-PARC construction

- Enjoy your situation!
- There were so many people who wished to be here. However you are only one person who can be here as a selected person.