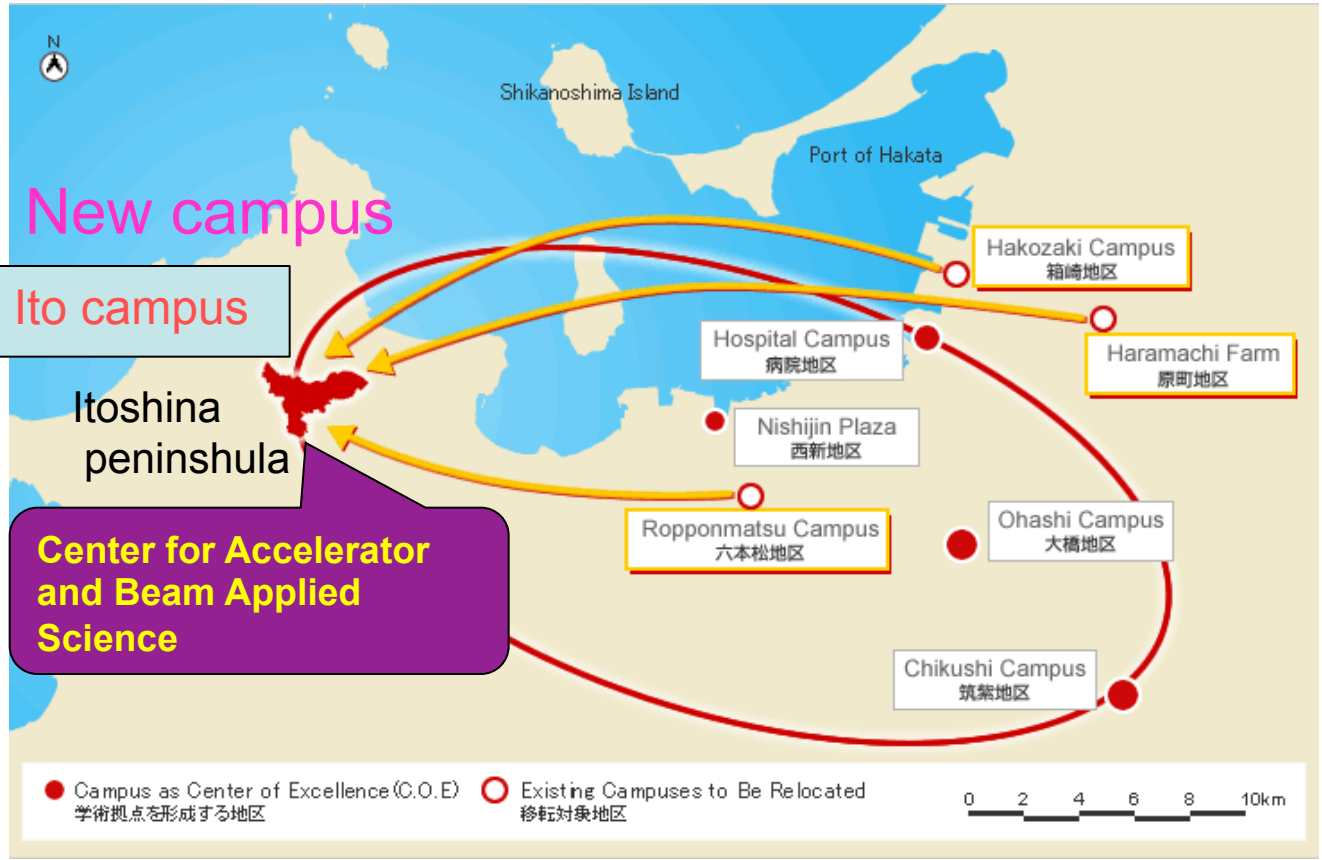
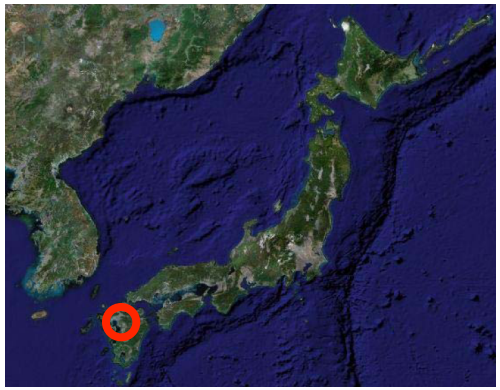
Kyushu University new campus plan





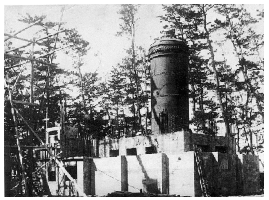
Fukuoka City

http://www.kyushu-u.ac.jp

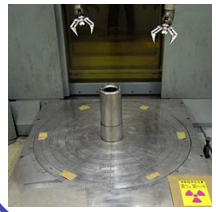
Center for Accelerator and Beam Applied Science of Kyushu University

relocation of engineering related faculties (2005, 2006)

1st stage (2007~)



Cockcroft-Walton accelerator laboratory (Faculty of Engineering)



^{60}Co gamma-source (Institute for irradiation and analysis of quantum radiation)

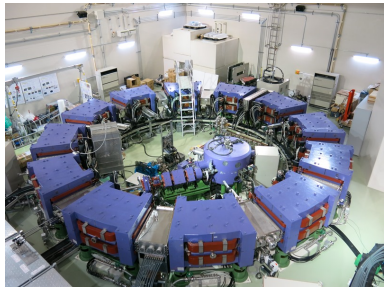
relocation of science related faculties (2015)

2nd stage (2013~)

10 MV tandem accelerator laboratory (Faculty of Sciences)

Hakozaki campus

New Accelerator Facility on Ito Campus

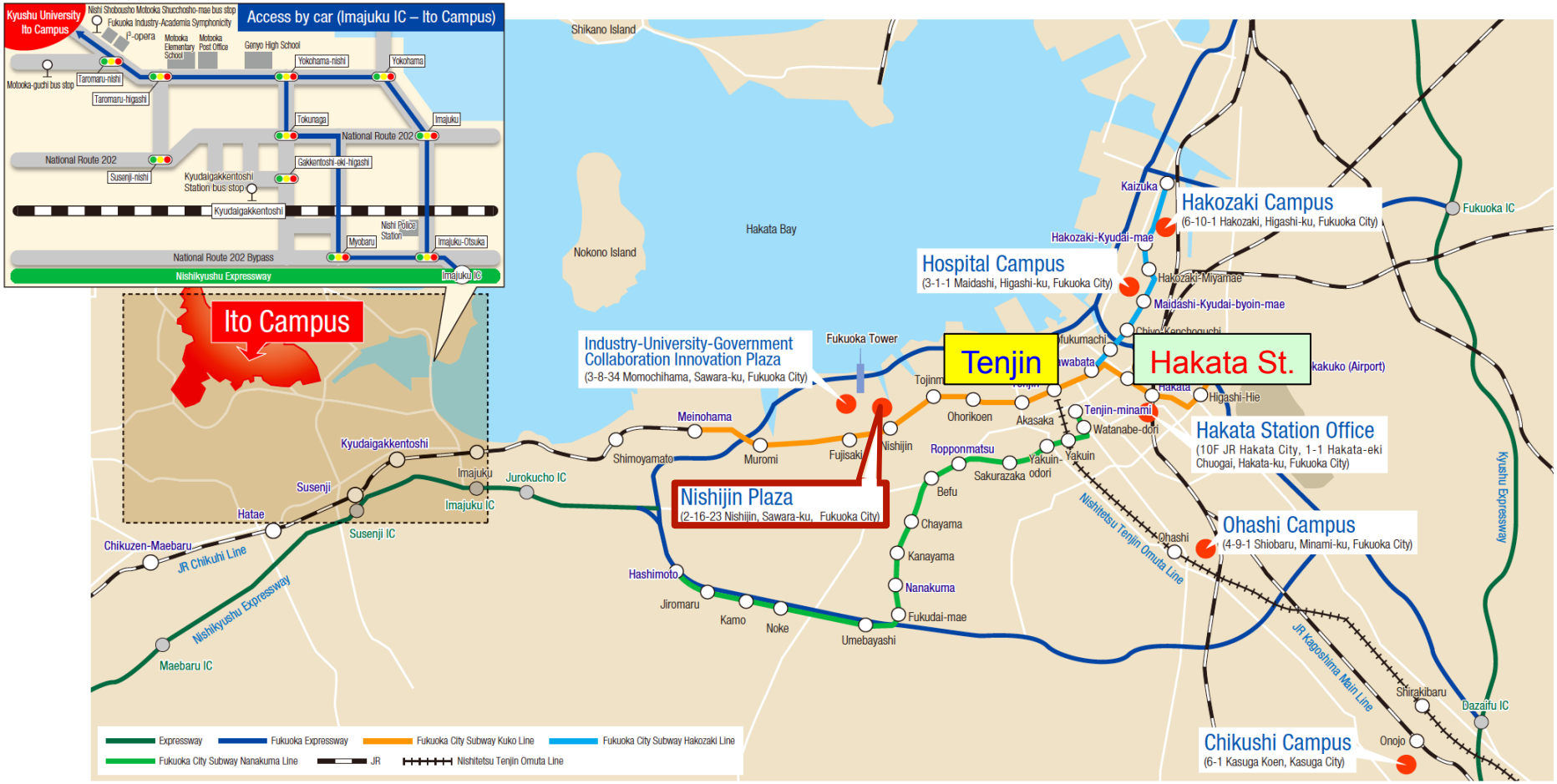


Main accelerator: 150 MeV FFAG Accelerator

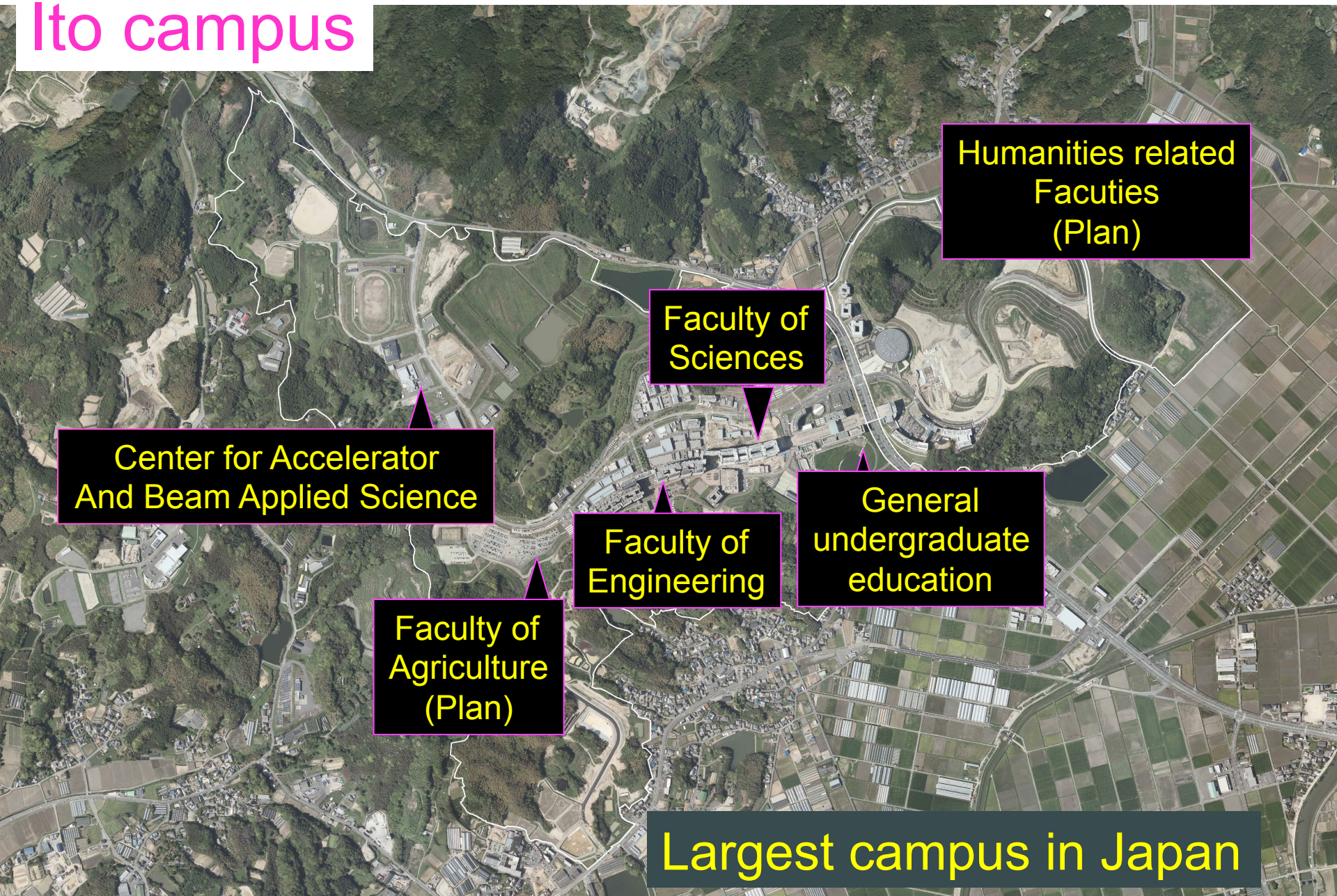
New ^{60}Co gamma-source (185 TBq)

8 MV tandem accelerator (NEC Pelletron 8UDH)

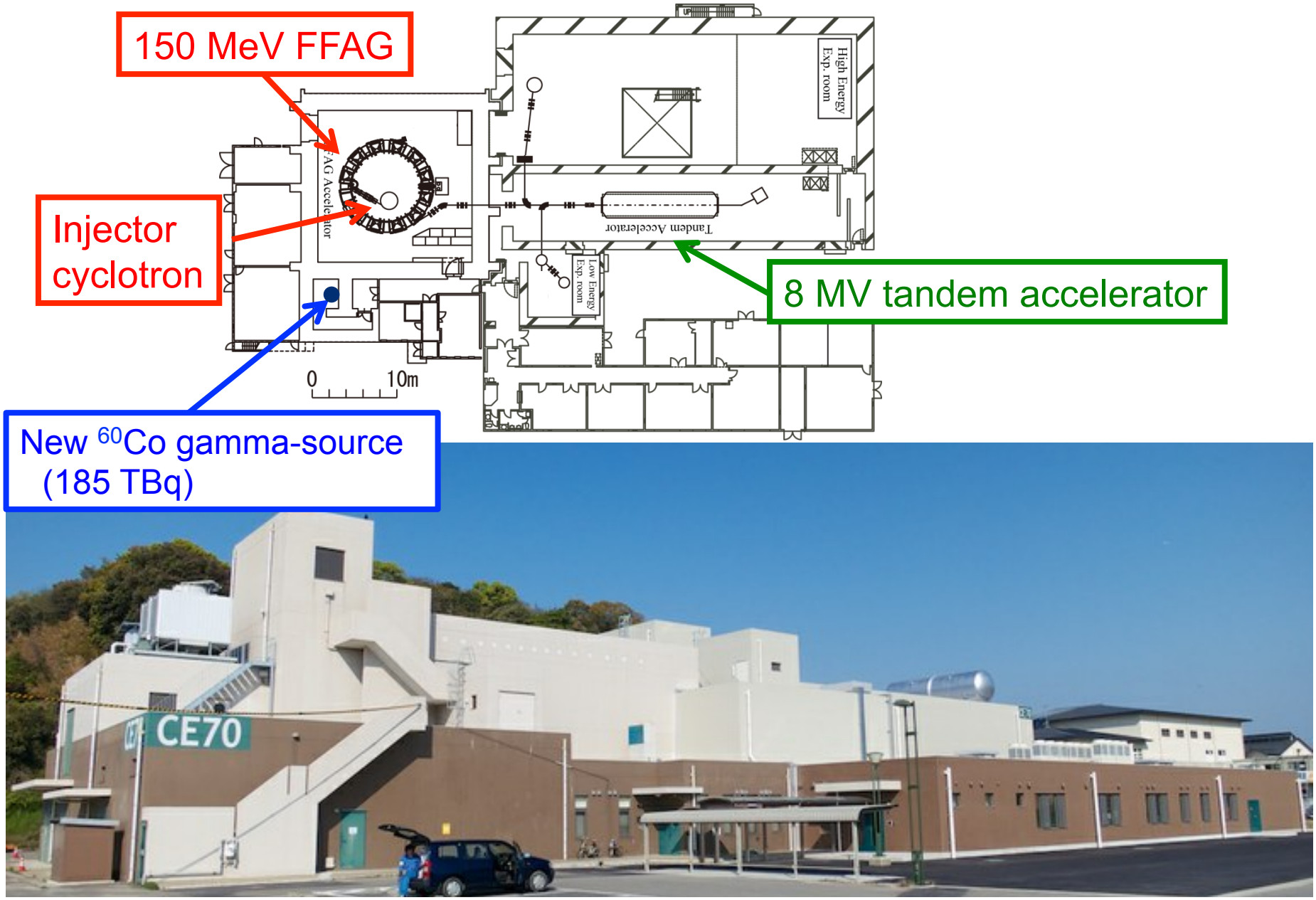
Access to the Ito Campus



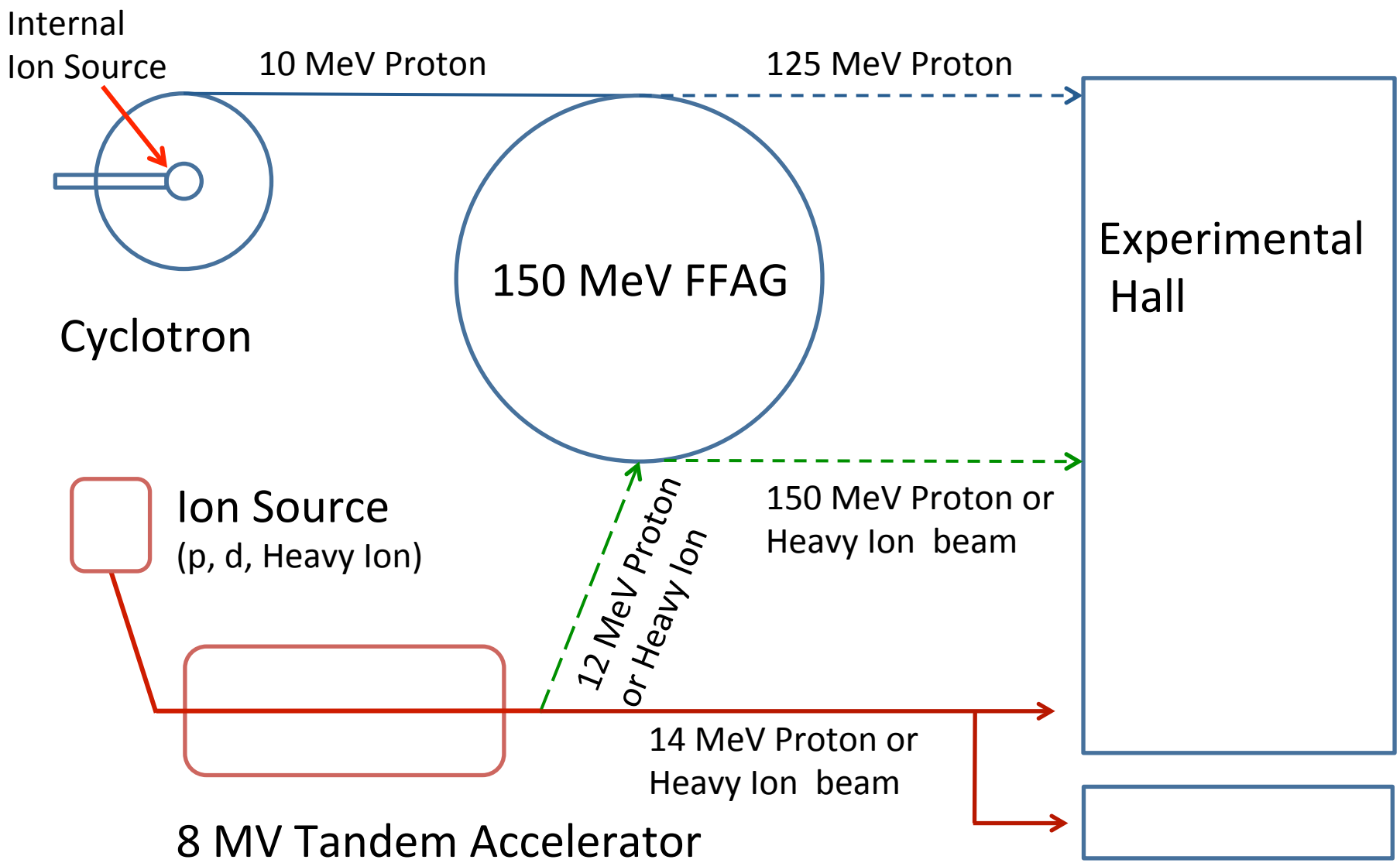
Ito campus


Humanities related Facuties (Plan)
Faculty of Sciences
Center for Accelerator And Beam Applied Science
Faculty of Engineering
General undergraduate education
Faculty of Agriculture (Plan)
Largest campus in Japan

Center for Accelerator and Beam Applied Science of Kyushu University



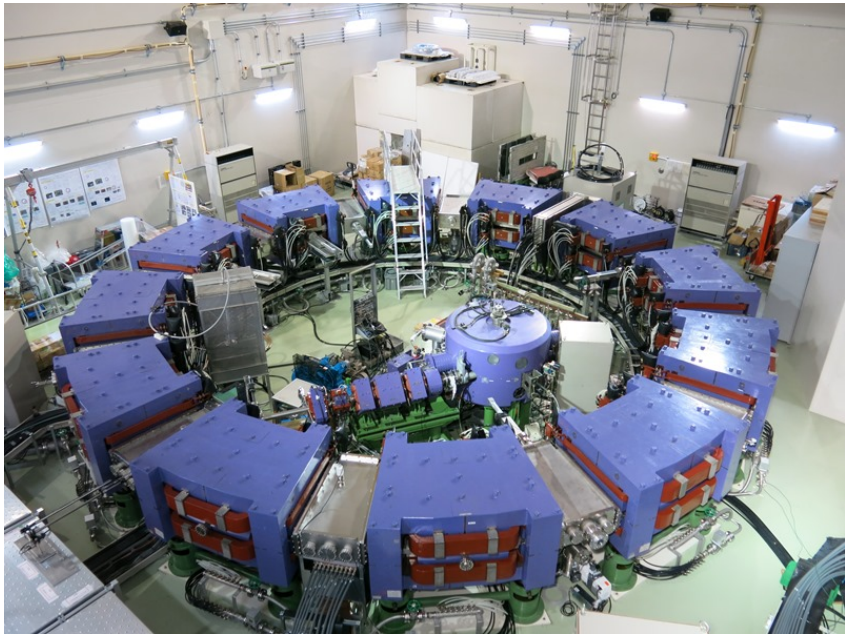
Accelerator Facility of Kyushu University



150 MeV FFAG Accelerator

(developed by Prof. Mori and others at KEK)

The prototype machine for various applications such as ADS, cancer therapy, etc.



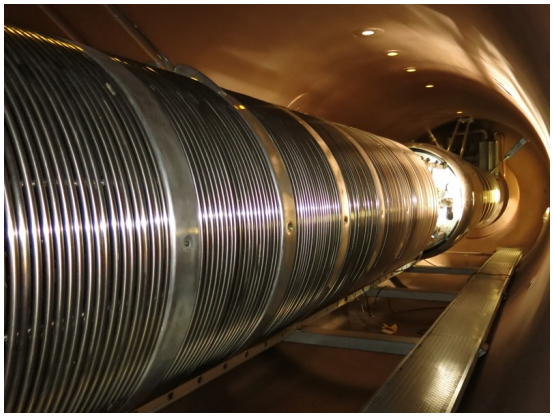
Moved to Kyushu University

Researchers working for the development of the FFAG:

Y. Yonemura, H. Arima, students (H. Okita, N. Motohashi…), N. Ikeda

Y. Mori

Tandem Accelerator



Parameters of Tandem Accelerator

Accelerator Type	Horizontal Tandem Van de Graaff
Model	National Electrostatics Corp. (NEC) , Pelletron 8UDH
Terminal Voltage	max. 8 MV (stable operation up to 7 MV)
Accelerator Tank	Diameter: 3.0 m / Length: 13.6 m
Insulation Gas	SF_6 (Pressure: 0.6 MPa)
Ion Source	Sputter Ion Source or RF Ion Source
Beam Current	Proton 1 nA (in the 1st stage) (1 μA in near future)
Terminal Stripper	C Foil and N_2 Gas
Charging Device	Double Pellet Chains (Current: 150 mA × 2)

Tandem Accelerator

The tandem accelerator will be employed as a heavy ion injector to the 150 MeV FFAG

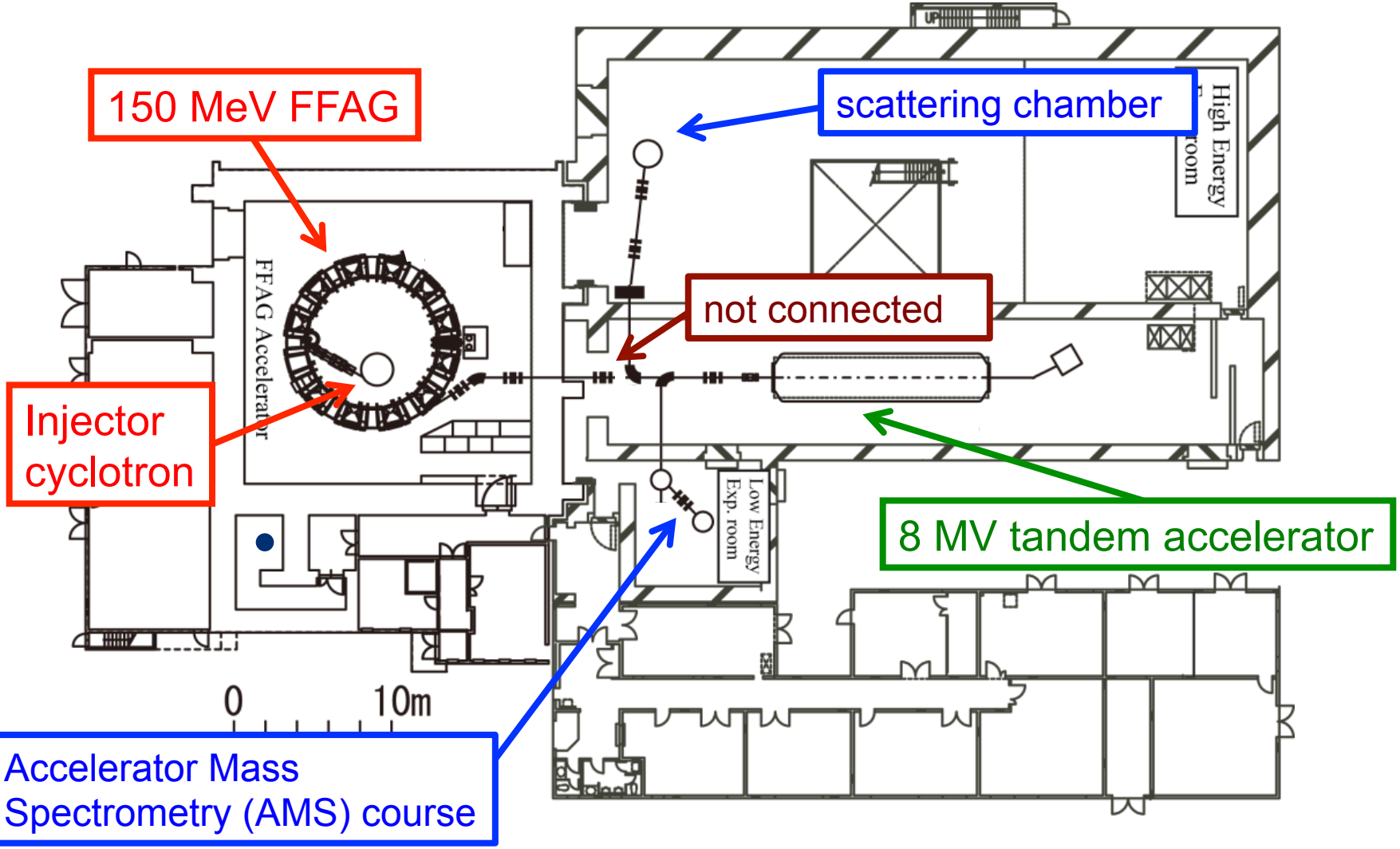
Accelerator disassembled at Kyoto University

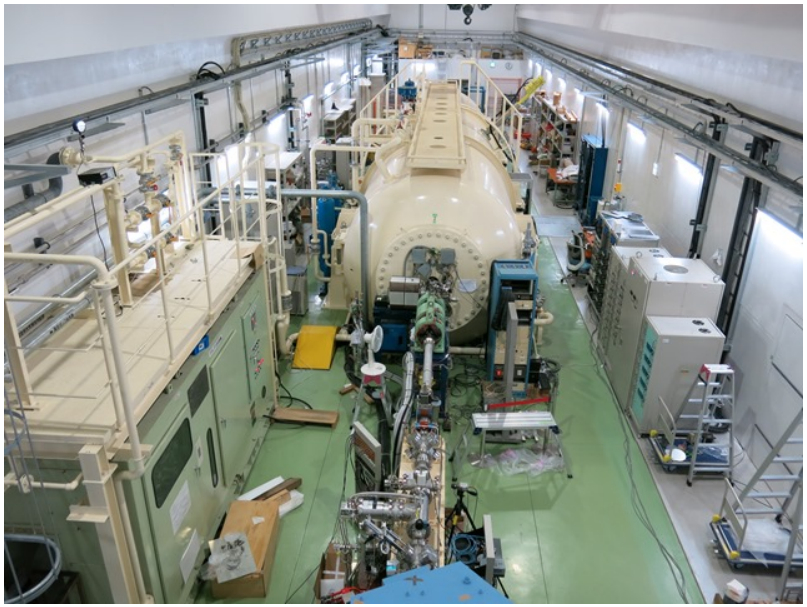
Moved to Kyushu University

Beams from the tandem accelerator will also be used for AMS, nuclear physics experiment, and so on.

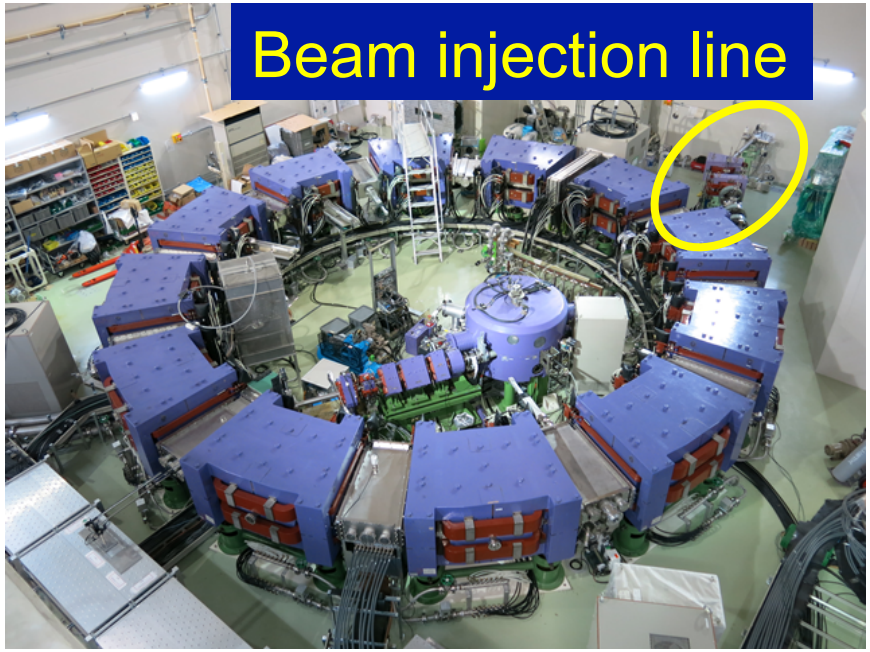
Researchers working at tandem accelerator facility:
staffs of faculty of sciences;
T. Noro, T. Teranishi, T. Wakasa, …

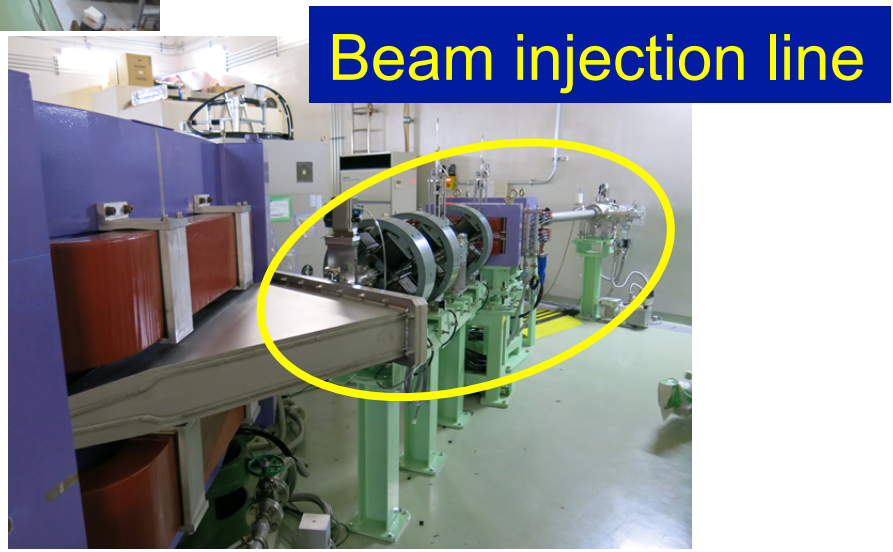
Present beam line configuration of Center for Accelerator and Beam Applied Science of Kyushu University



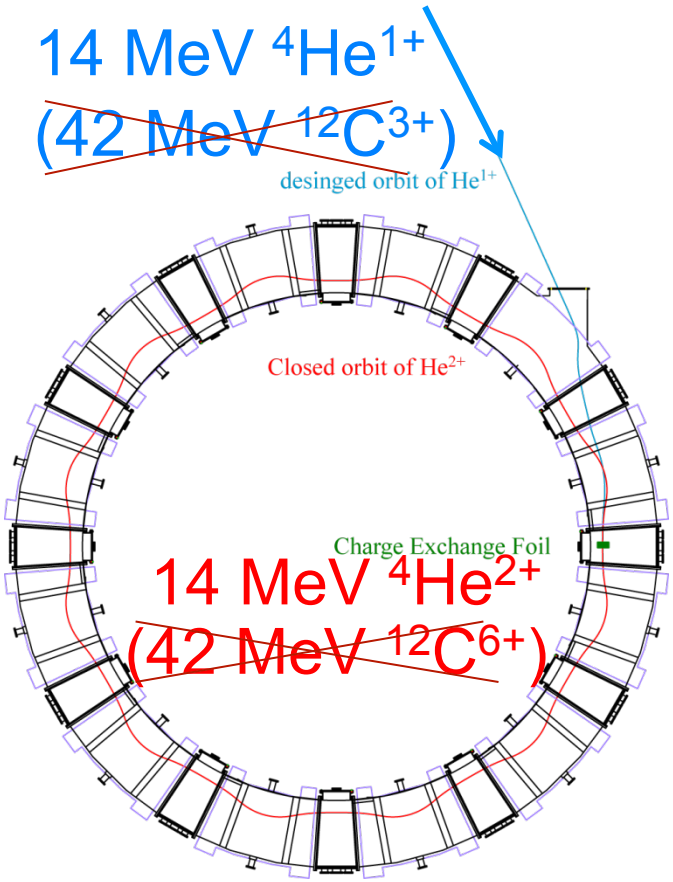


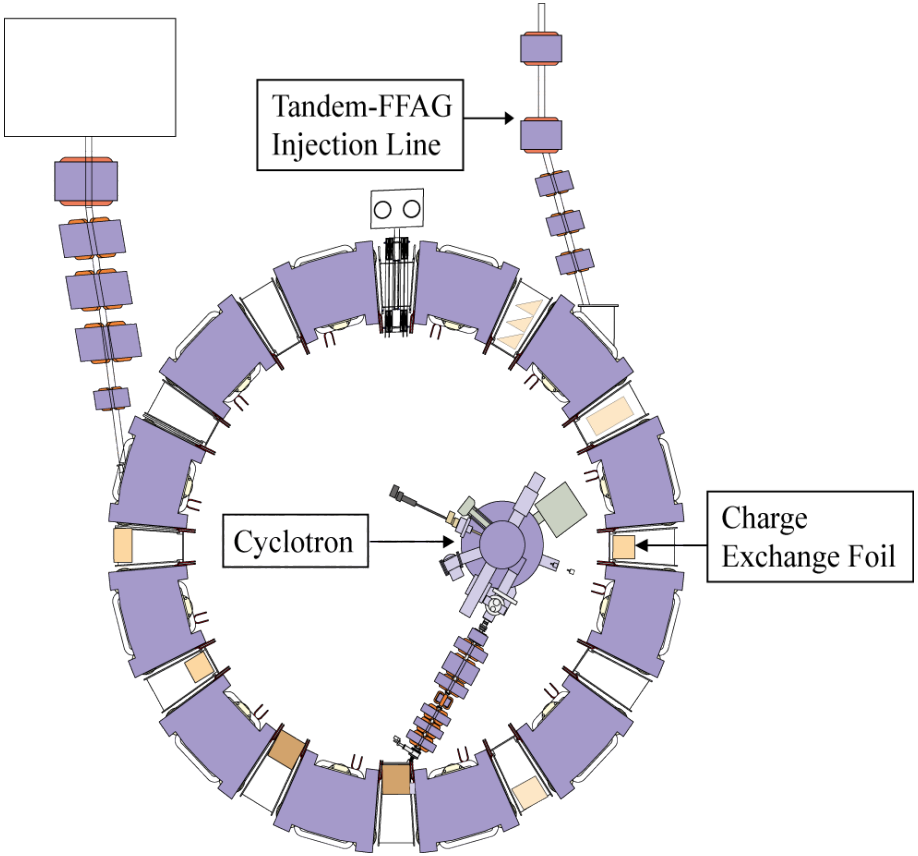
charge exchange
injection system
for positive ion beams

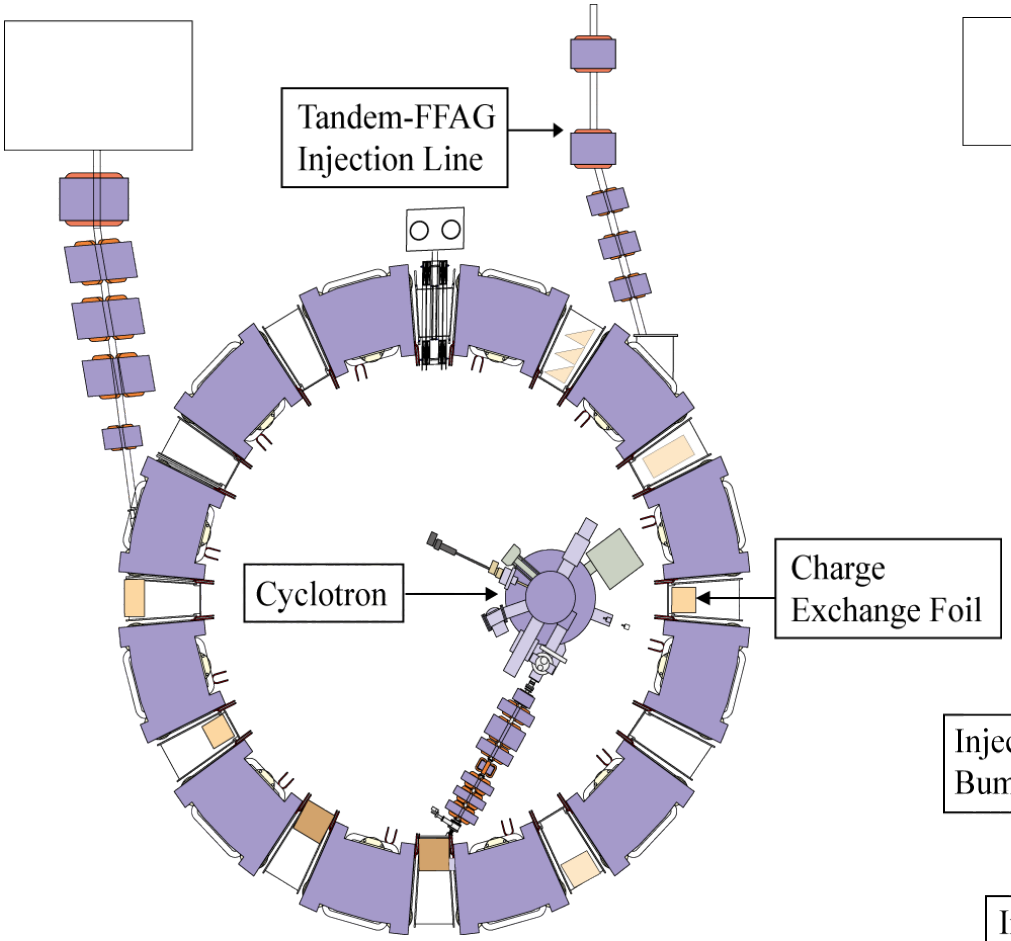




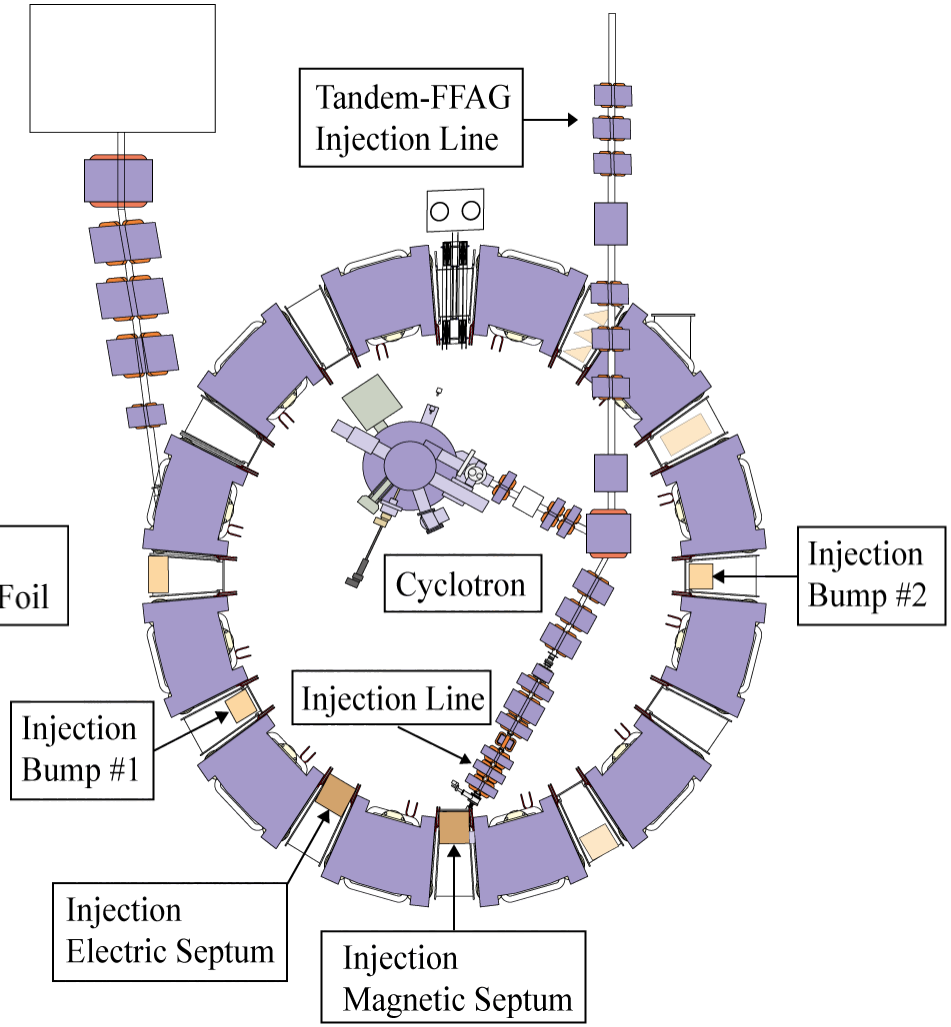
charge exchange injection system from tandem accelerator







Present beam line

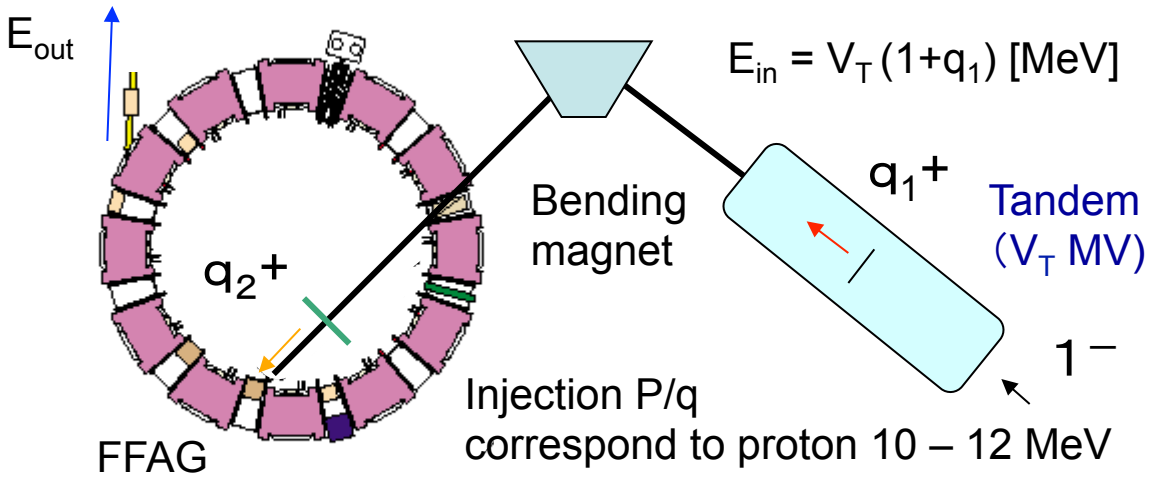


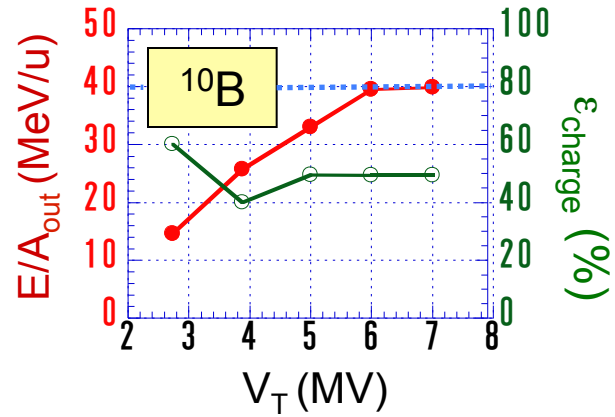
Future plan

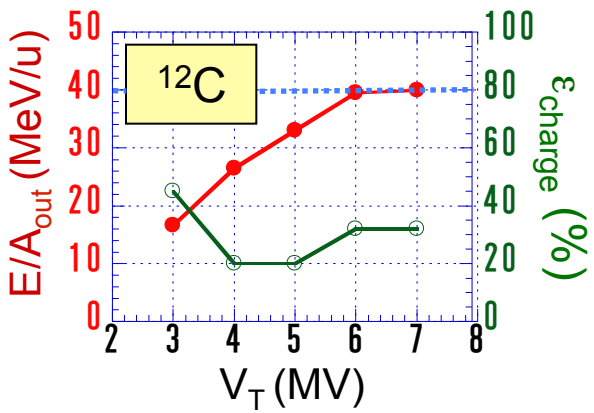
Tandem – FFAG complex

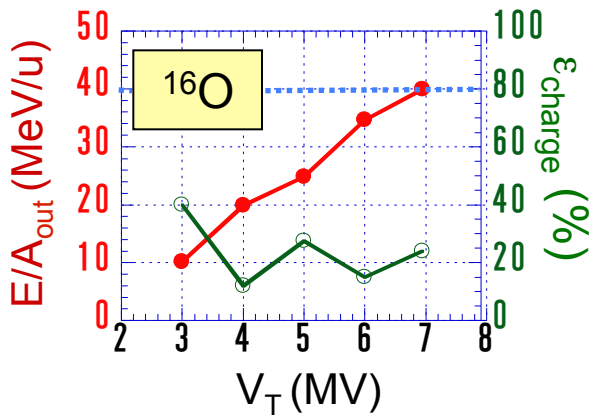
Injector	Baby Cyclotron	Tandem Accelerator
Particle	Proton	Heavy Ion ($^{A}_{Z}X^{q+}$)
E/A	12 ➔ 150 MeV (10 ➔ 125 MeV)	$12\left(\frac{q}{A}\right)^2$ ➔ $160\left(\frac{q}{A}\right)^2$ MeV/u 3 MeV/u ➔ 40 MeV/u for fully stripped light-heavy ions
Revolution Frequency	1.6 ➔ 4.6 MHz	$1.6\frac{q}{A}\sim5.7\frac{q}{A}$ MHz
Repetition Rate	100 Hz	100 Hz

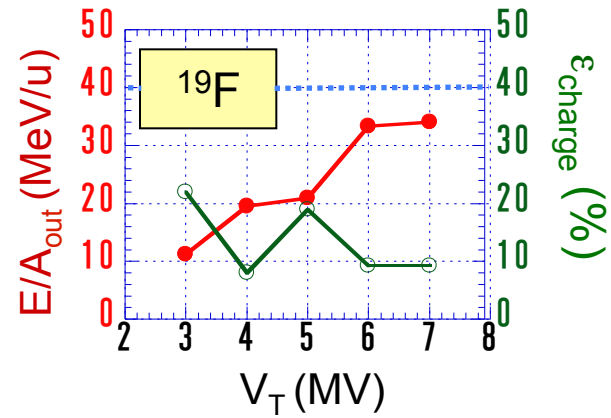
Energy of Heavy Ion versus Terminal Voltage

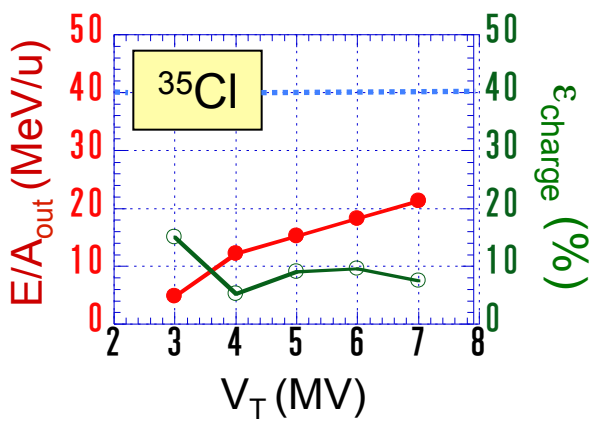


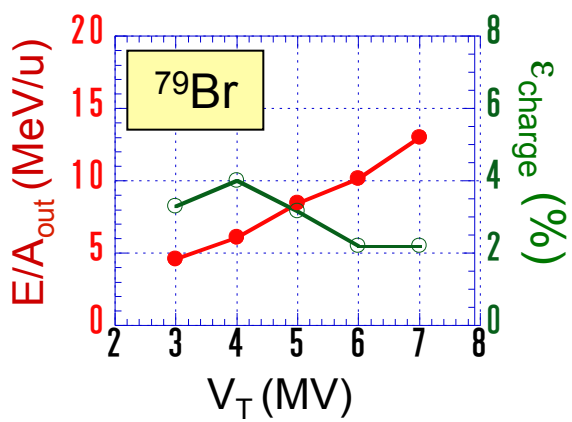


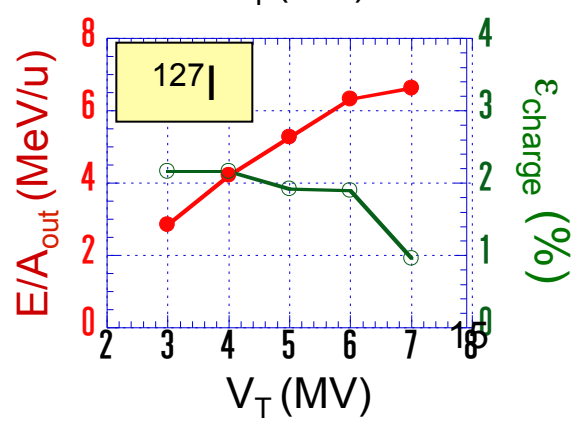




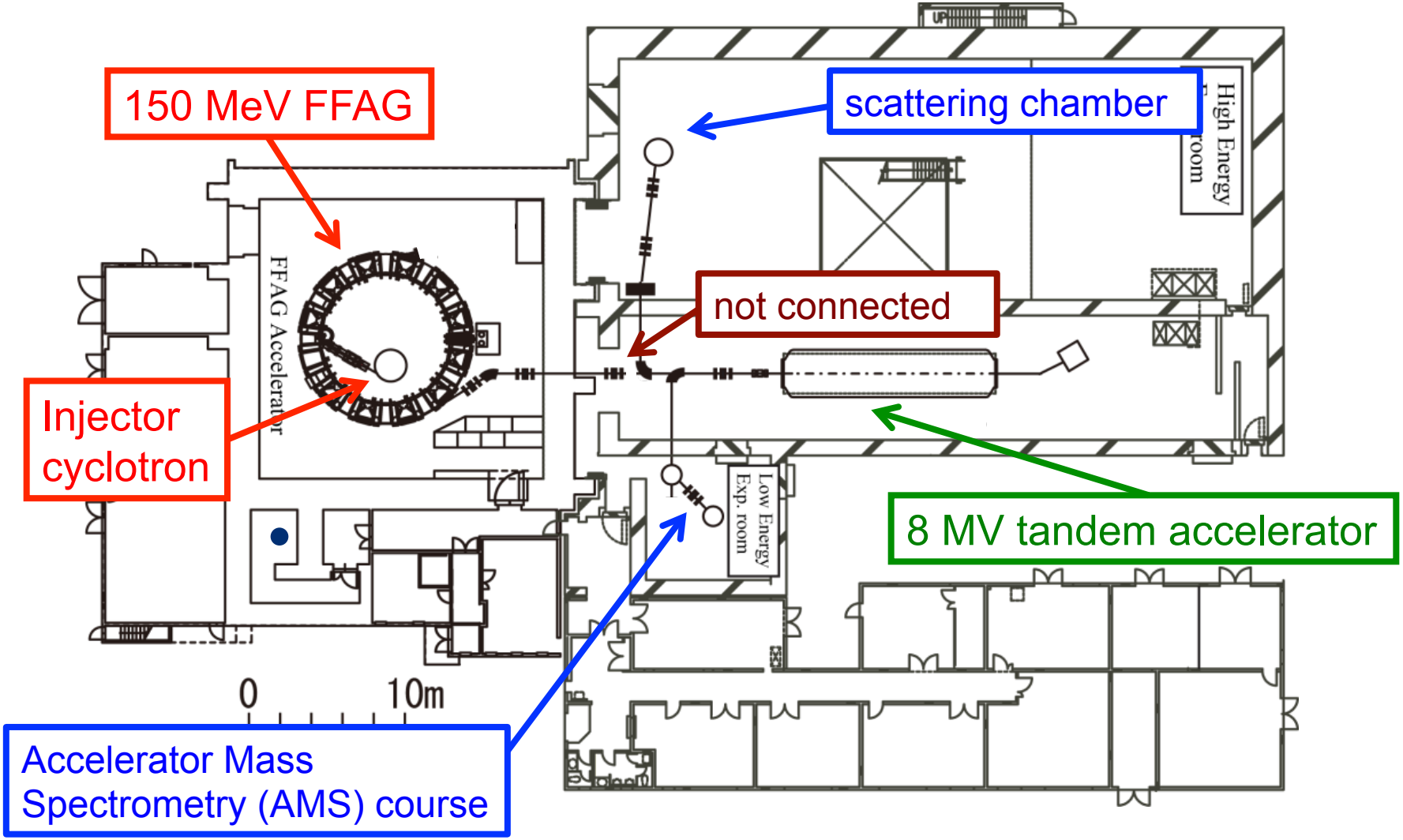




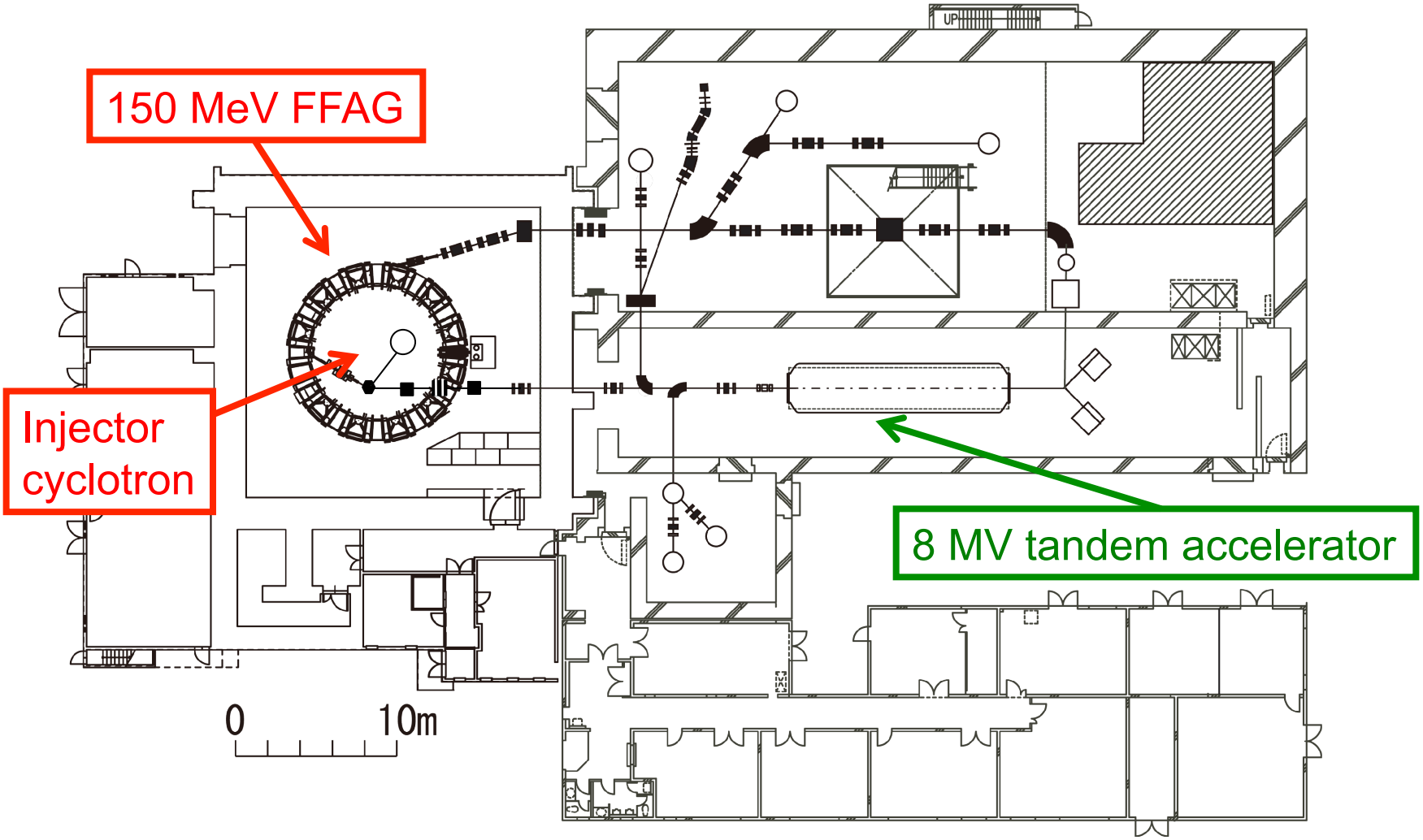




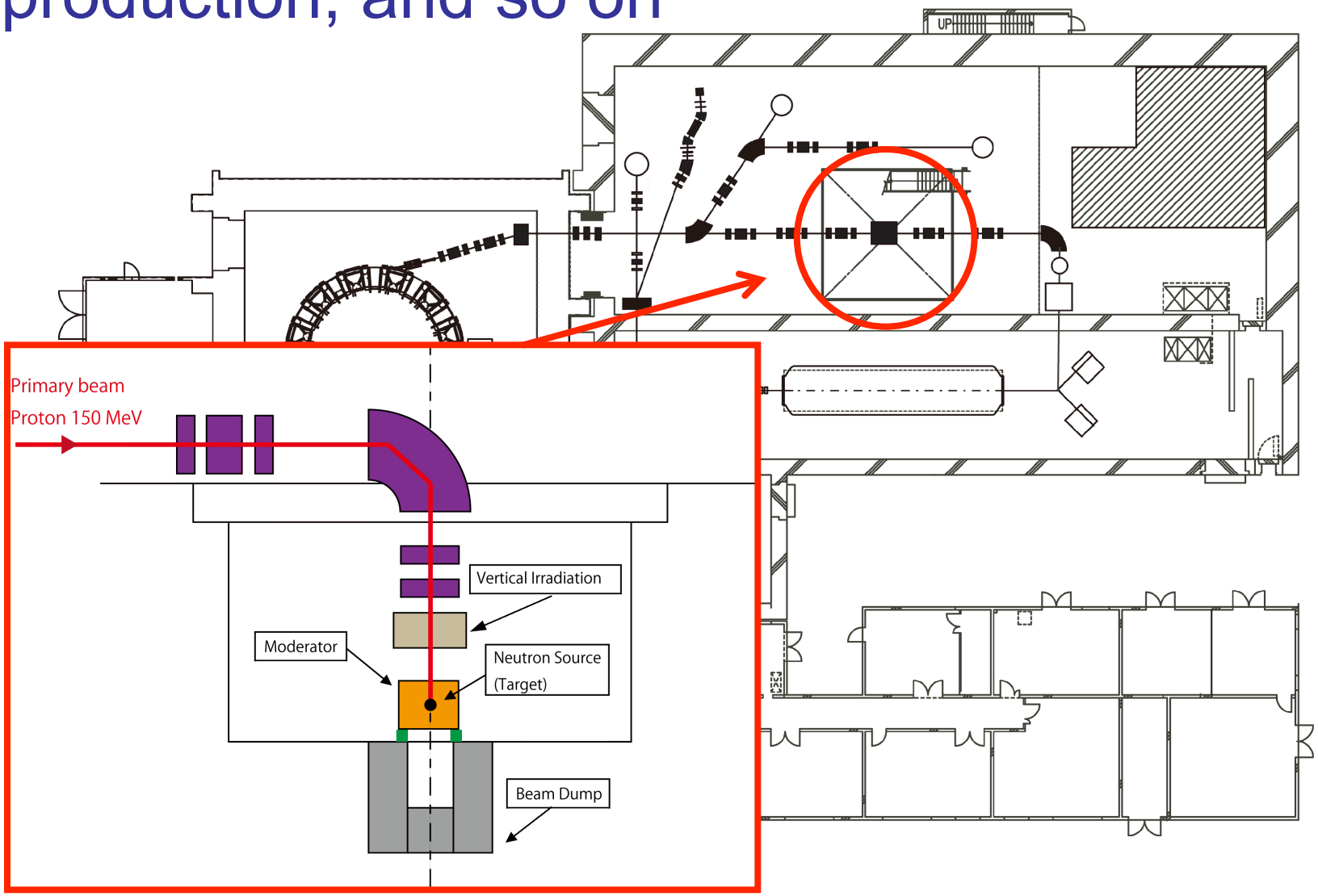
Present beam lines



Construction Plan (2017 ~ ?)



vertical beam line for irradiation, neutron production, and so on



Collaborators

FFAG R&D

Faculty of Eng., Kyushu Univ. : Y. Yonemura, H. Arima,
Students (H. Okita, N. Motohashi…)

Res. Reactor Inst., Kyoto Univ.: Y. Mori

KEK: A. Takagi, H. Nakayama

Tandem Accelerator facility

Faculty of Sci., Kyushu Univ.: T. Noro, T. Teranishi, T. Wakasa,
S. Sakaguchi, K. Fujita

Radiation safety, future plan, etc.

Faculty of Eng., Kyushu Univ. : K. Ishibashi, Y. Uozumi, N. Shigyo
(Faculty of Sci., Kyushu Univ.: T. Noro, T. Teranishi)

Construction and Beam Commissioning log

2008 2009 2010 2011 2012 2013 2014 2015 2016

1st stage
2008 ~ 2011

1.5 stage
2011 ~ 2013

2nd stage
2014 ~

Cyclotron

Maintenance & Reassembling (2008.9 - 2009.3)

Beam commissioning

Radiation Inspection (2014. 6)

In Operation

FFAG

Construction FFAG (2009.5 – 2012. 2)

Test of Power sources & Beam injection (2011.12 – 2012. 12)

Beam Acceleration (2013.7 – 2015. 12)

Construction of beam line

In Operation

Tandem

Construction of Tandem (2011.3 – 2013. 6)

Radiation Inspection (2014. 9 and 2015 6)

Beam commissioning (2014.4 – 2015.6)

In Operation