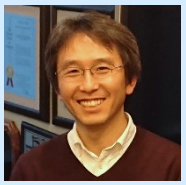
Current availability of ^{211}At in Japan



Kohshin Washiyama, Ph.D

Advanced Clinical Research Center,
Fukushima Medical University

FUKUSHIMA MEDICAL UNIVERSITY

^{211}At is available in Japan

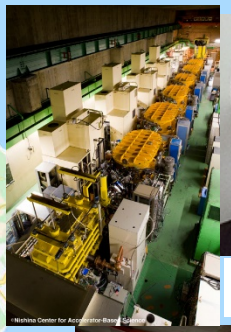
Manufacturing facilities	Production route and Separation metod	Production	The main contributor of ^{211}At manufacturing
Research Center for Nuclear Physics(RCNP), Osaka University	^{209}Bi(α,2n)^{211}At Dry distillation	More than Two decades	Dr. Atsushi Toyoshima Prof. Atsushi Shinohara
Takasaki Ion Accelerators for Advanced Radiation Application(TIARA), Takasaki Advanced Radiation Research Institute, National Institutes for Quantum and Radiological Science and Technology(QST)	^{209}Bi(α,2n)^{211}At Dry distillation	Since 2012	Dr. Shigeki Watanabe Dr. Noriko S. Ishioka
Quantum Medical Science Directorate, National Institute of Radiological Sciences(NIRS), National Institutes for Quantum and Radiological Science and Technology(QST)	^{209}Bi(α,2n)^{211}At Dry distillation	Sine 2013	Dr. Katsuyuki Minegishi Dr. Kotaro Nagatsu
Nishina Center for Accelerator-Based Science, Institute of Physical and Chemical Research(Riken)	^{209}Bi(α,2n)^{211}At Dry distillation	Since 2015	Dr. Hiromitsu Haba
Advanced Clinical Research Center(ACRC), Fukushima Medical University(FMU)	^{209}Bi(α,2n)^{211}At Dry distillation	Since 2016	Dr. Kohshin Washiyama Prof. Kazuhiro Takahashi
The tandem accelerator facility, Nuclear Science Research Institute, Japan Atomic Energy Agency(JAEA)	^{209}Bi(^{7}Li,5n)^{211}Rn/^{211}At Dry & Wet chemistry	Since 2011	Dr. Ichiro Nishinaka Dr. Kazuyuki Hashimoto

Production facilities of α-emitters in Japan

- ^{211}At production facilities (5 places)
- ^{211}Rn production facility (1 place)
- User facilities including production (more than 13 places)

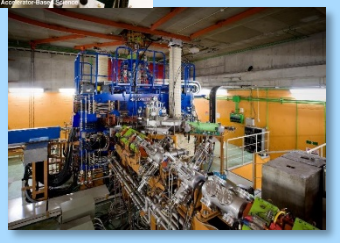
Dr. Watanabe

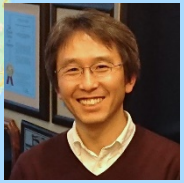
QST@Takasaki



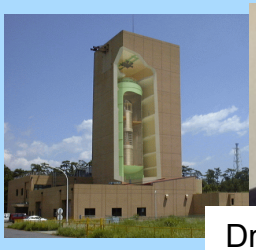
Riken

Dr. Haba





Fukushima Med. Univ.



JAEA@ Tokai

Dr. Nishinaka

Dr. Toyoshima

Osaka Univ.

Riken

NIRS, QST

Dr. Nagatsu

Production facilities of α-emitters in Japan

- ^{211}At production facilities (5 places)
- ^{211}Rn production facility (1 place)
- User facilities including production (more than 13 places)

Short-lived RI supply platform program (since 2016)

https://www.rcnp.osaka-u.ac.jp/~ripf/index.html

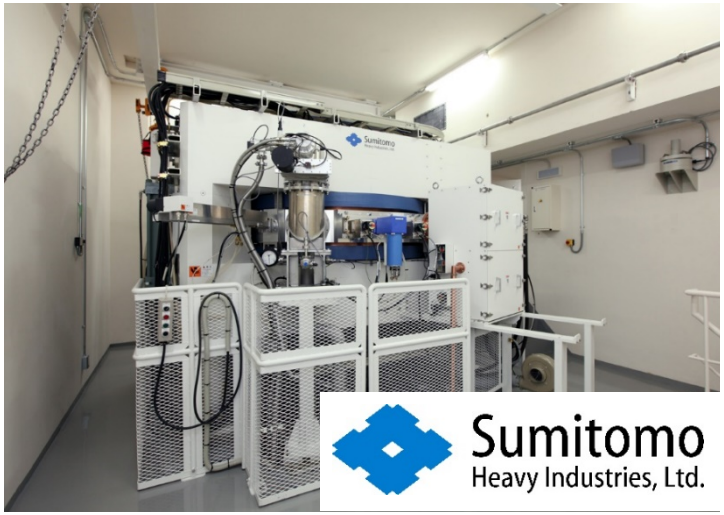
This program will provide stable supply of research radioisotopes throughout the year and technical support for safe handling.

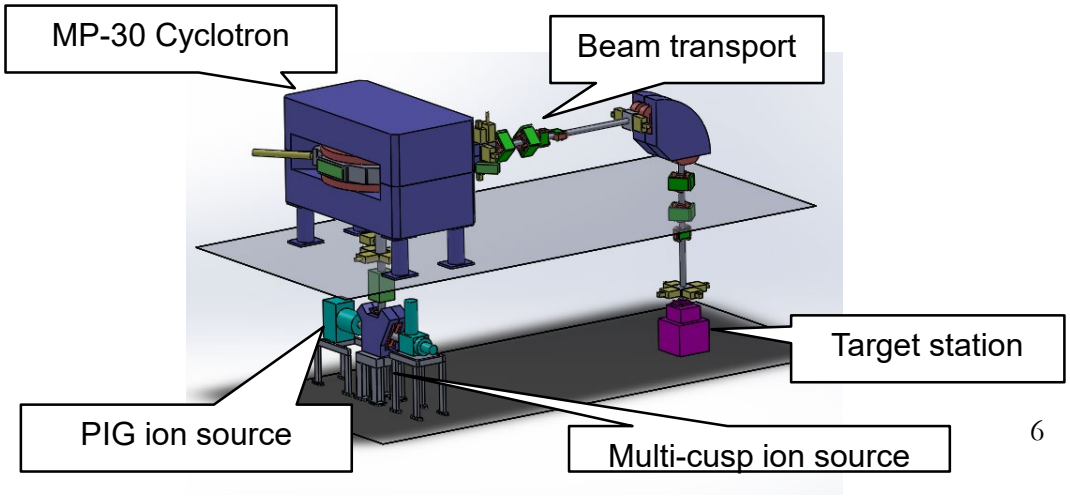
1. Supply of short life isotopes that cannot be purchased from the commercial base.
2. A prompt and stable supply by the world's highest level of accelerator facility association.
3. Support for the promotion of basic research in a wide range of fields: ex. Development of probes for next generation PET, development of next generation therapeutic drugs, metabolic research of biological trace elements, etc.

- Research Center for Nuclear Physics[RCNP], Osaka University (Osaka)
- Nishina Center for Accelerator-Based Science, Riken (Tokyo)
- Cyclotron and Radioisotope Center [CYRIC], Tohoku University (Sendai)
- Research Center for ELectron PHoton Science (ELPH), Tohoku University (Sendai)
- TIARA, Takasaki QST (Takasaki)
- Quantum Medical Science Directorate,NIRS, QST (Chiba)

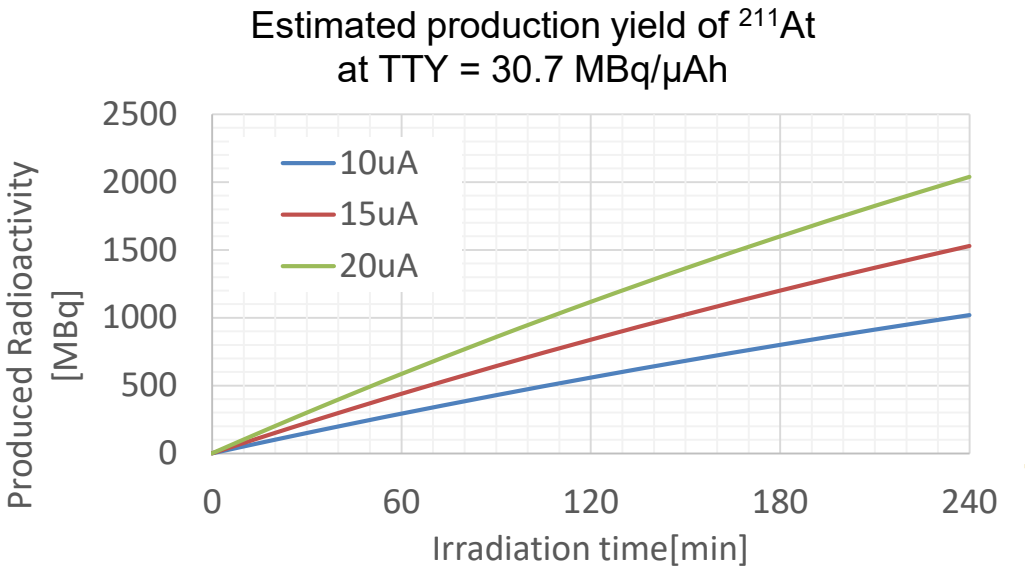
^{7}Be, ^{11}C, ^{18}F, ^{15}O, ^{24}Na, ^{28}Mg, ^{38,39}Cl, ^{38,42,43}K, ^{43,46,47}Sc, ^{44}Ti, ^{48}V, ^{55}Fe, ^{56,57,58}Co, ^{57}Ni, ^{61,64,67}Cu, ^{74}As, ^{83,84,86}Rb, ^{86,87,90}Y, ^{88,89,89m,95}Zr,….^{207}Bi, ^{207,210,211}At, ^{213}Fr, ^{238}Np, ^{255}Md

Middle sized cyclotron; MP-30 at Fukushima Medical University

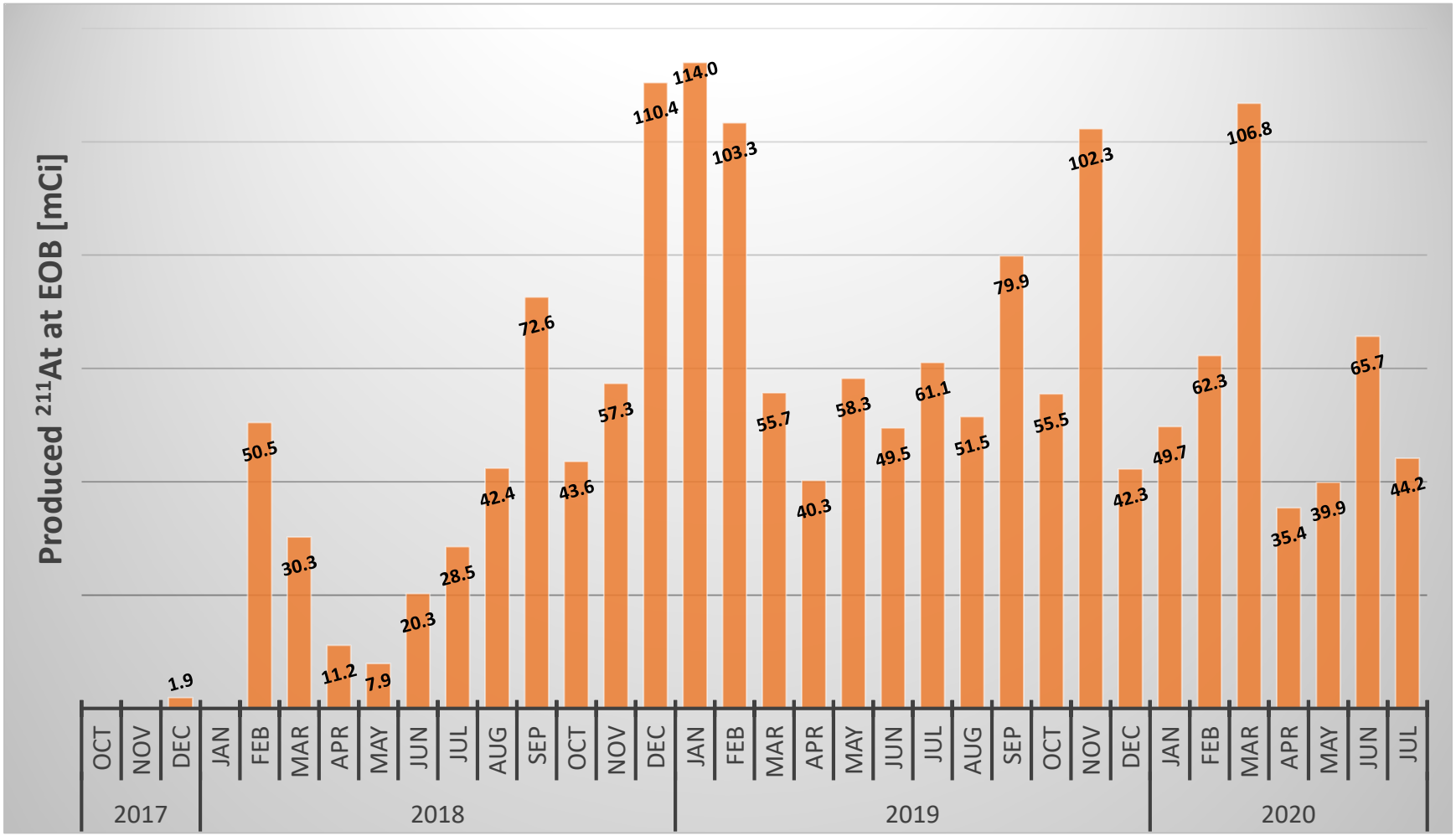




		MP-30
Proton	Energy	15-30 MeV (Valuable)
	Current	100 μA
Deuteron	Energy	8-15 MeV (Valuable)
	Current	50 μA
Alpha	Energy	32 MeV
	Current	30 μA
Ion Source		External(PIG:α+Multi-cups:P,D)
Extraction Port		1
Max. Targets		Depend on Requirement
Power		150 kW
Non Shield	Room	W6.0xD5.5xH3.6
	Weight	60 ton



Monthly production of ^{211}At at FMU



Summary

- Before 2010, Japan has only 1 facility that produced ^{211}At.
- Owing to the advent of ^{223}Ra with its efficacy to prolong the overall survival of metastatic HRPC patients, Japanese physician change their opinion and they are interested in using α emitters.
- Due to the availability of target materials and the usability of cyclotron that can produce α emitters, ^{211}At would be the most appropriate candidate to manufacture.
- There exist 5 facilities to produce ^{211}At by direct reaction
- There also exist one facility to produce ^{211}Rn that will be a generator to produce ^{211}At.
- Due to the short half-life of ^{211}At, At-related chemistry and preclinical studies have been restricted to the ^{211}At production site or its vicinity. However, since the platform has been launched, the availability and sustainable supply of ^{211}At have improved than ever, and as a result, many researchers have had more opportunities to come into contact with ^{211}At.


At
At
At
At
Thank you for your kind attention!