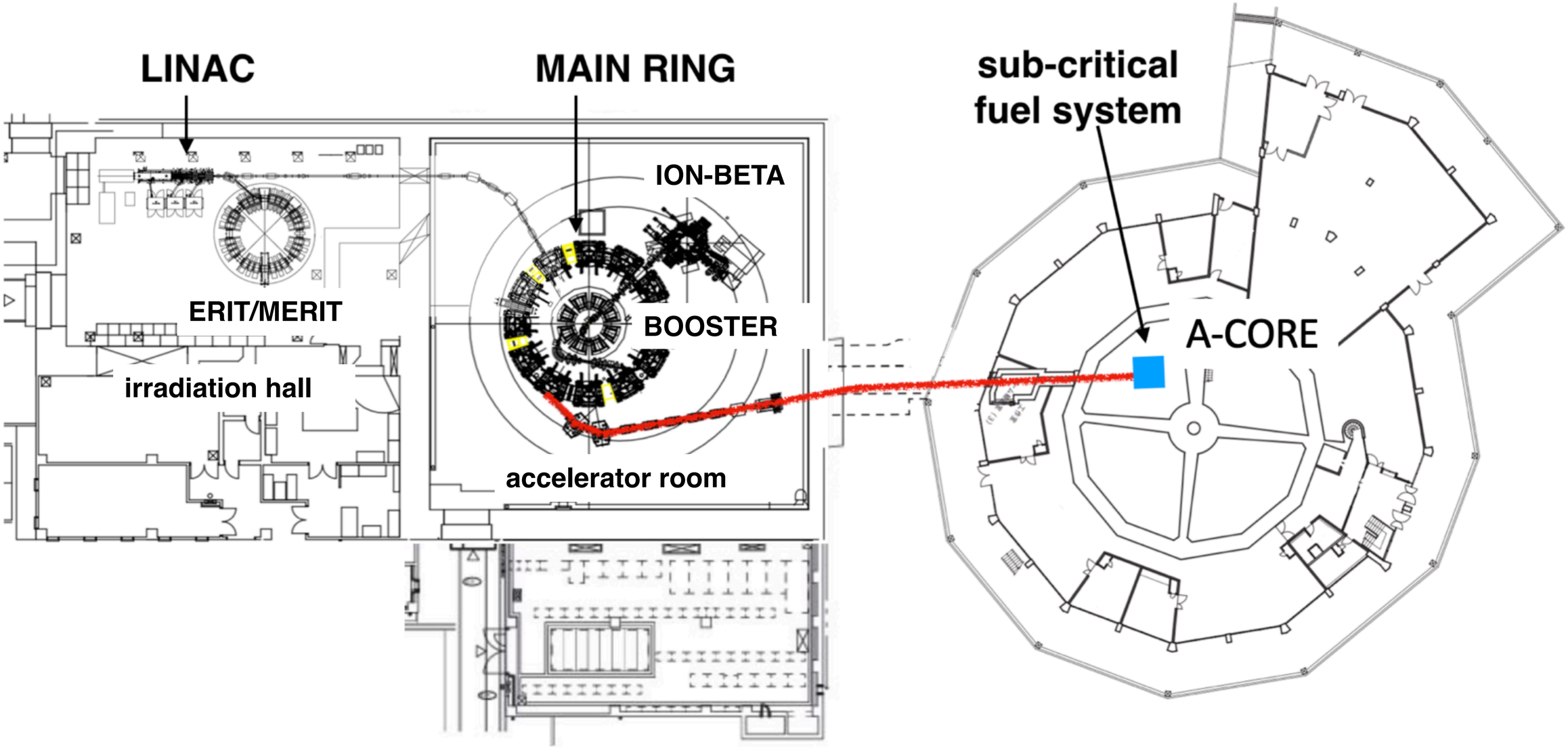
Status and Plans for the FFA Complex at KURNS

2020.12.01 y.ishi

Outline

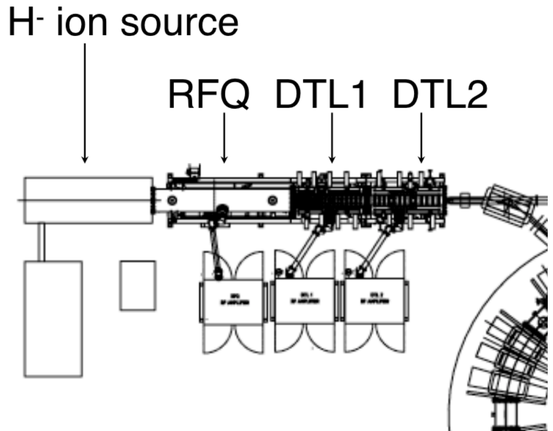
1. overview of the complex
2. current status
3. plans
4. summary

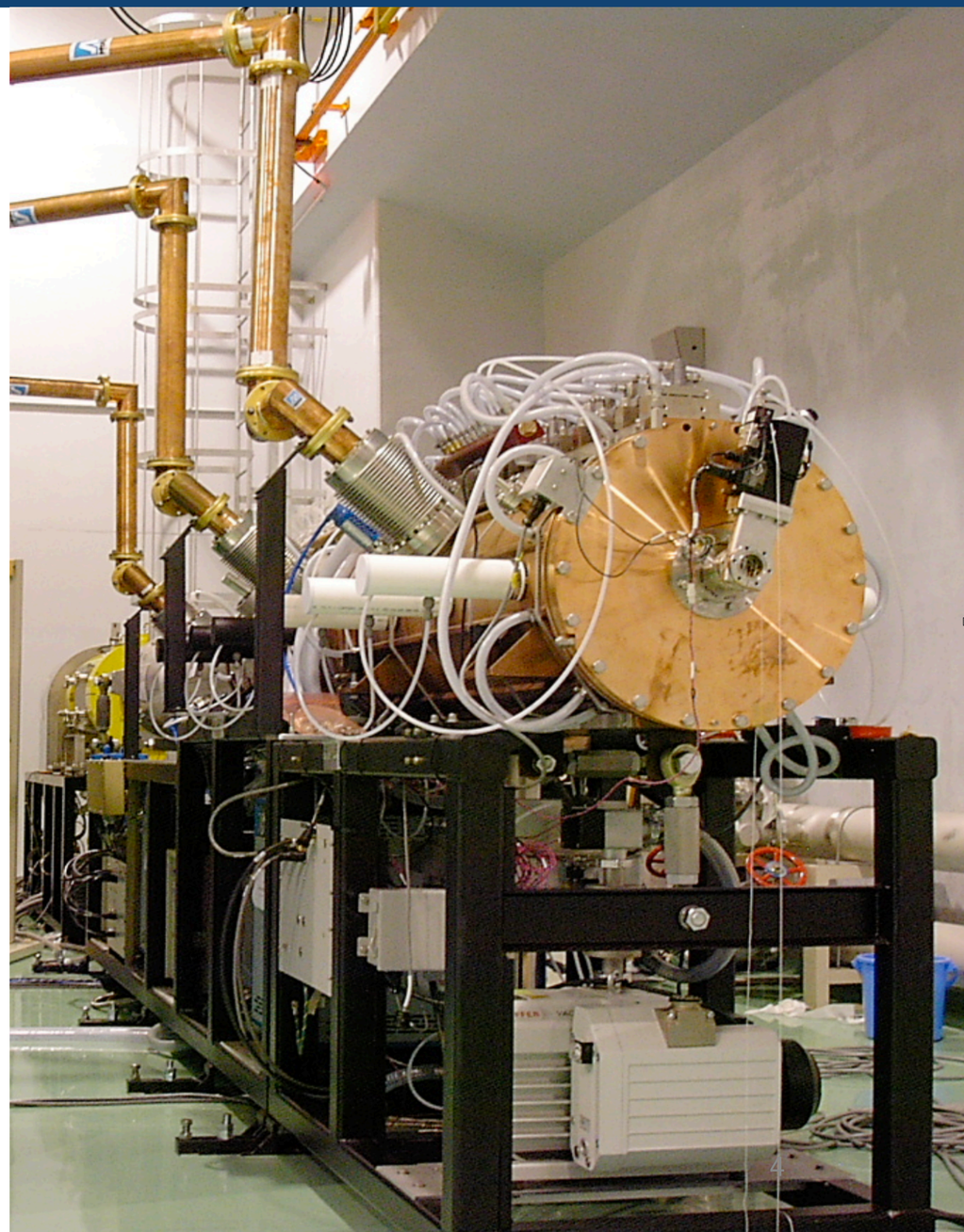
Layout of the accelerator complex



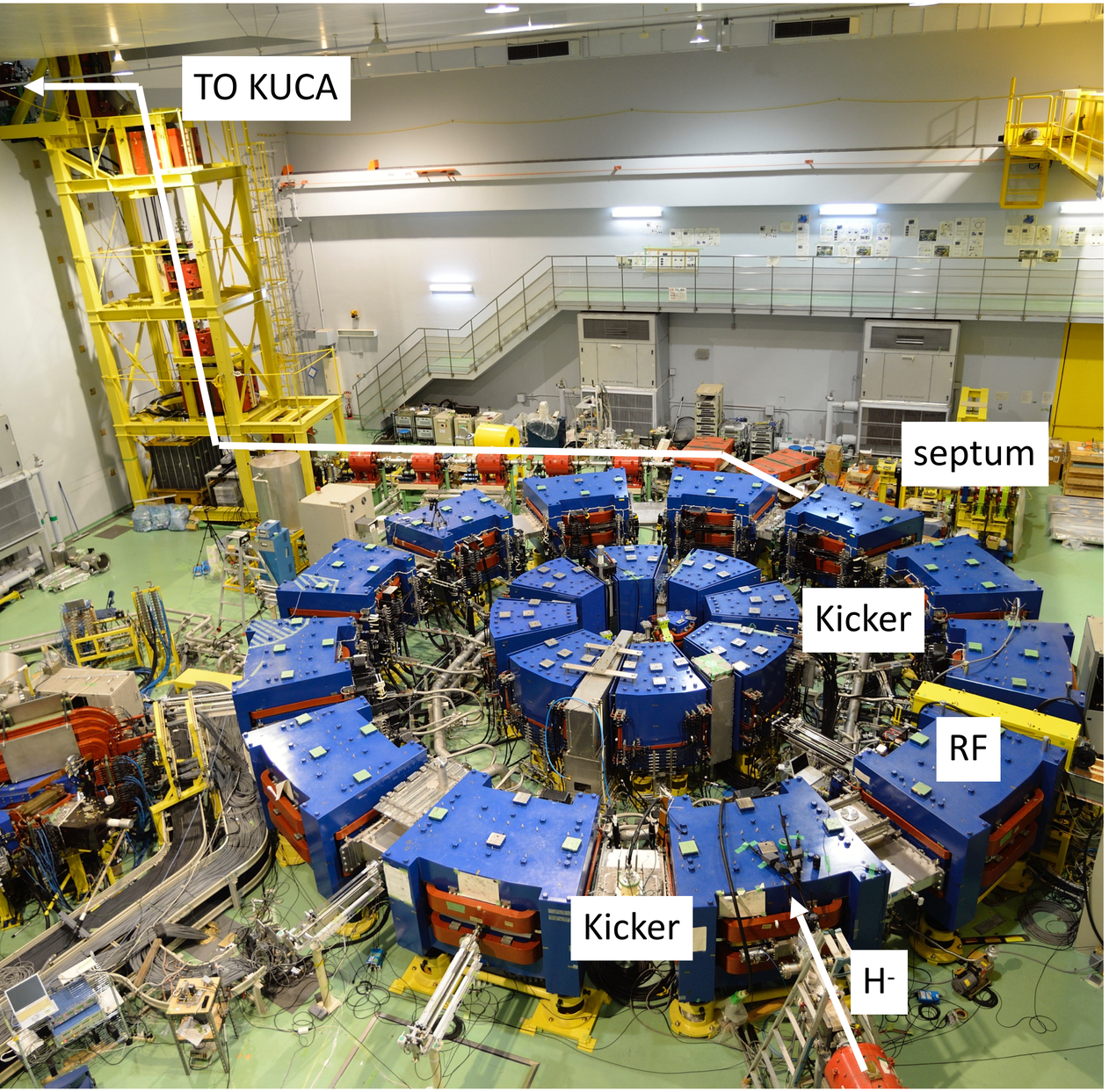
Injector LINAC

Beam species	: H-
Injection energy	: 30 keV
Extraction energy	: 11 MeV
Beam Pulse width(MAX)	: 100 μsec
Peak Curr.(MAX)	: ~5 mA
	: ~3.12*1012[ppp]
rep. rate	: 1Hz~200Hz
Rf frequency	: 425 MHz
Power supply	: tube (triode YU176A)



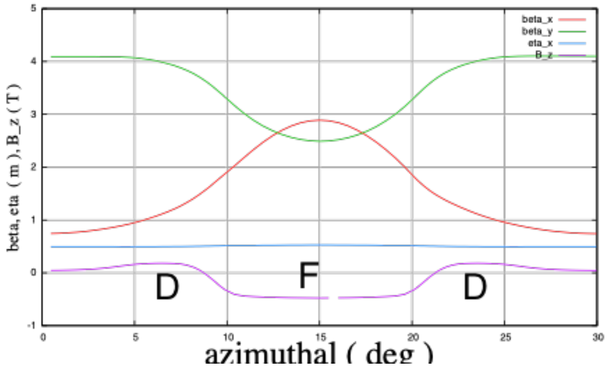


MAIN RING

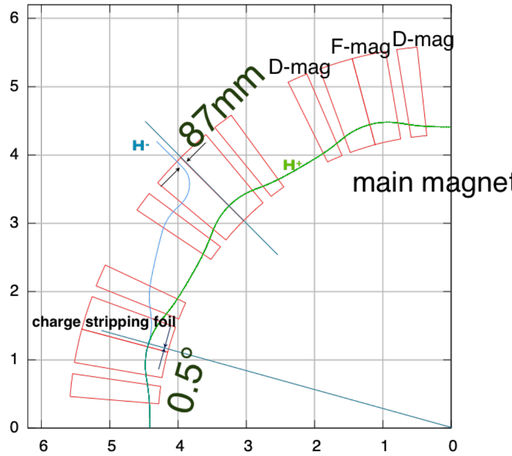


Beam species	: proton
Injection energy	: 11 MeV
Extraction energy	: 150 (100) MeV
Beam current	: 1 nA (safety reg.)
Lattice structure	: 12-cell DFD
Field index k	: 7.5
Average orbit radii	: 4.52 – 5.12 m

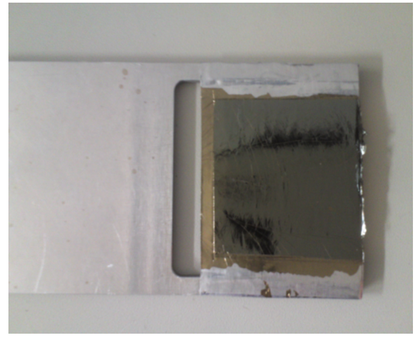
Betatron functions



Beam injection



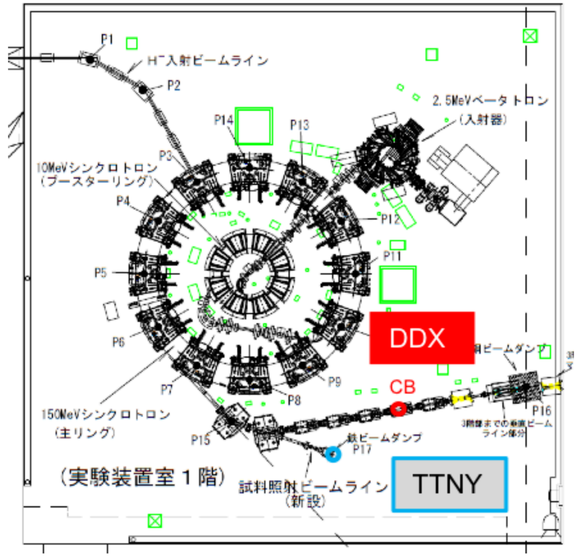
Charge stripping foil

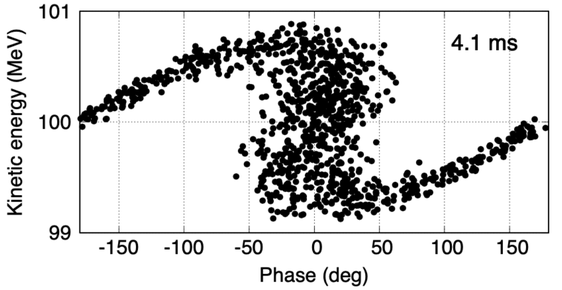


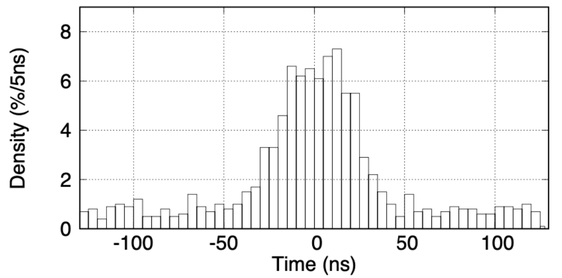
Machine operation

	2020	2021	2022	2023
RF cavity and corrector maintenance				
Nuclear data-taking (JAEA)				
UK Collaboration				
other beam usage for medical studies, HEP detector				

Nuclear data-taking with JAEA





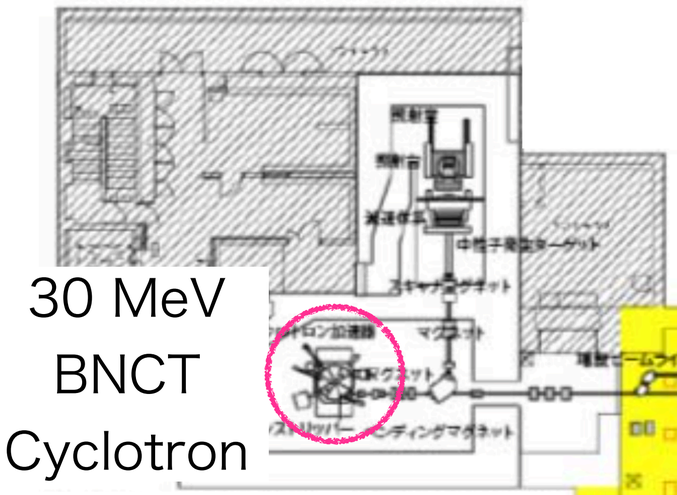


Production of spallation neutrons using 100 MeV proton beams for DDX (double differential cross section) and TTNY (thick target neutron yields) measurements to check the nuclear reaction model which is essential for ADS study.

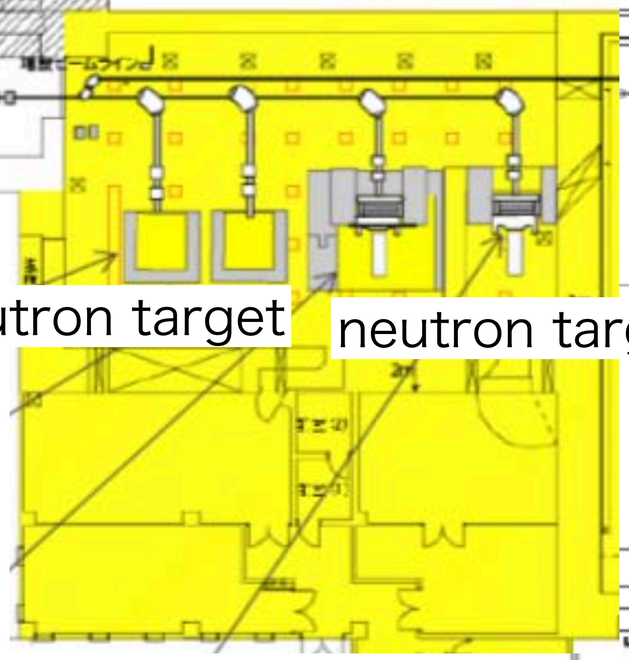
These experiments needs 10 ns order short bunch. To realize this, a bunch rotation in the longitudinal phase space and beam chopping methods using kicker magnet will be used.

Future plans for the Irradiation Hall

The utilization plan of the entire facility and the future reuse of the accelerators installed in it are under consideration.



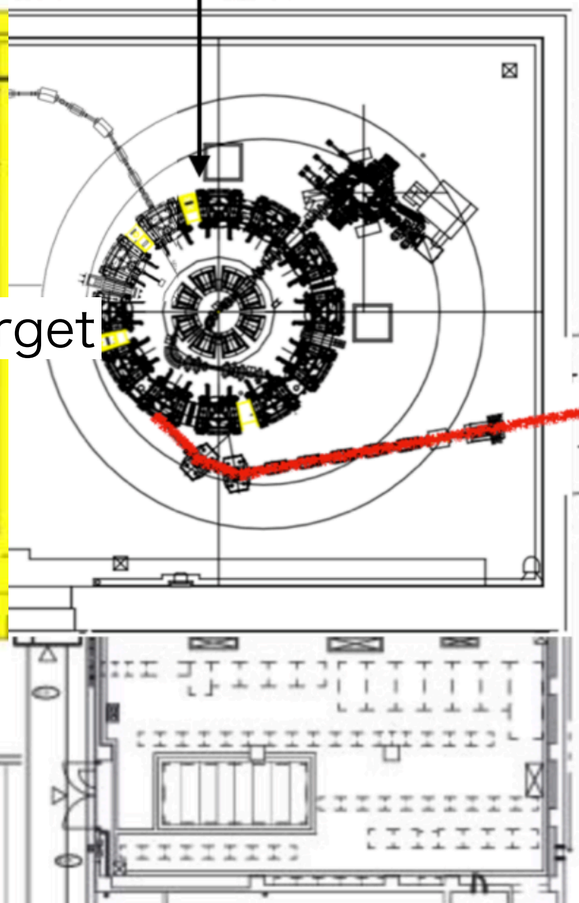
30 MeV
BNCT
Cyclotron



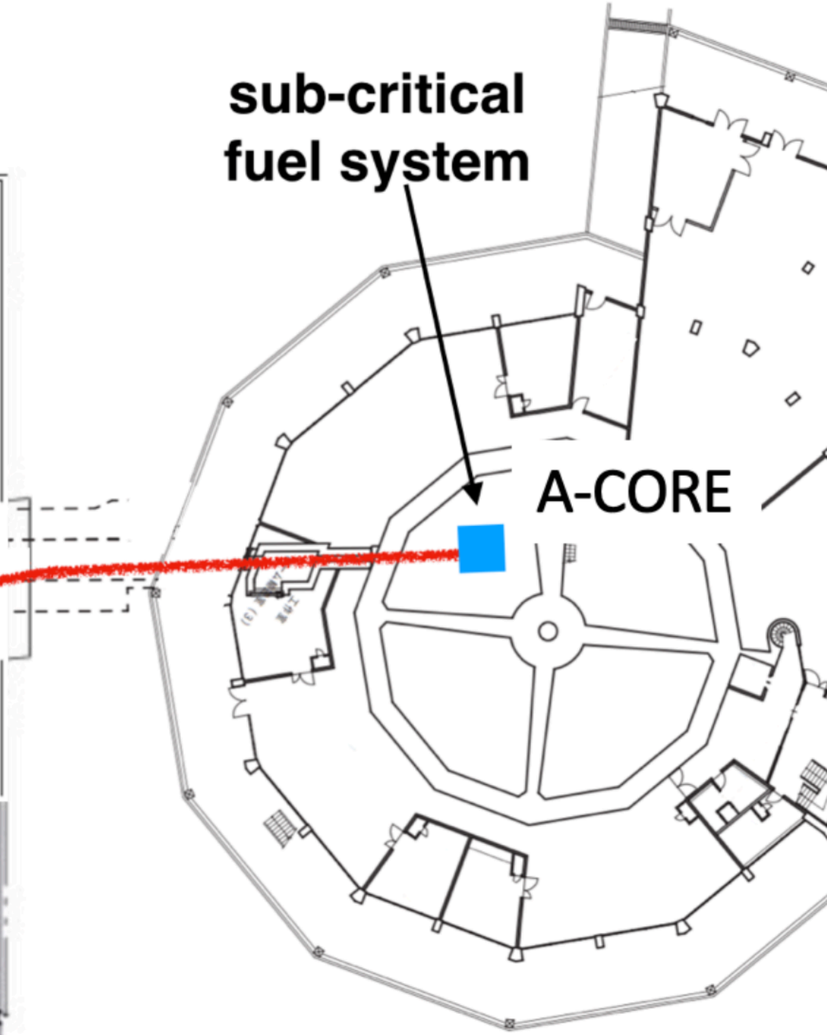
Irradiation Hall

neutron target

neutron target



Accelerator Room



sub-critical
fuel system

A-CORE

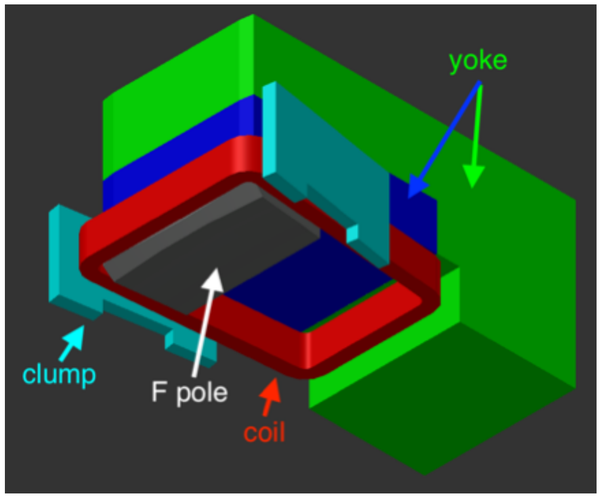
MERIT → Kyushu University

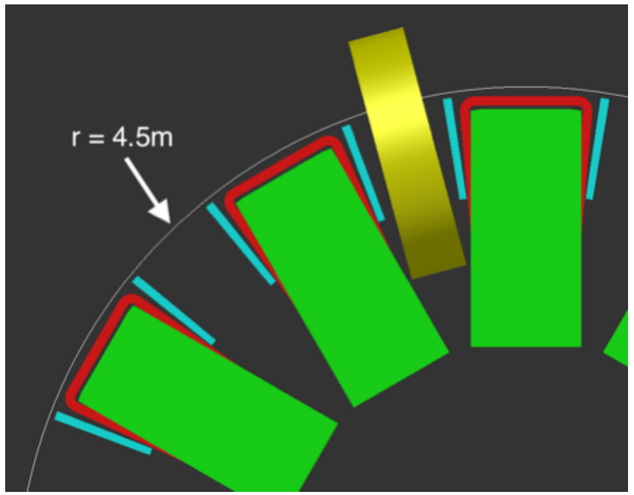
MAIN RING → PiPER（Pion Production ERIT Ring）

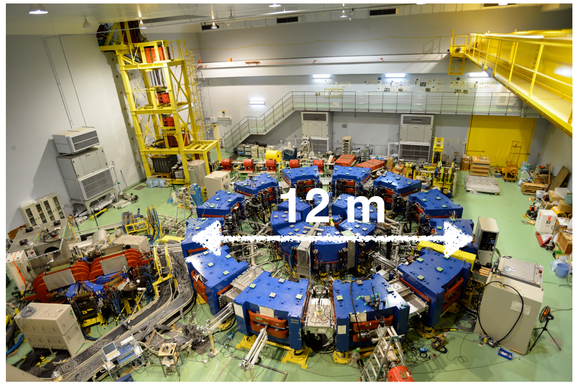
PiPER (Pion Production Erit Ring)

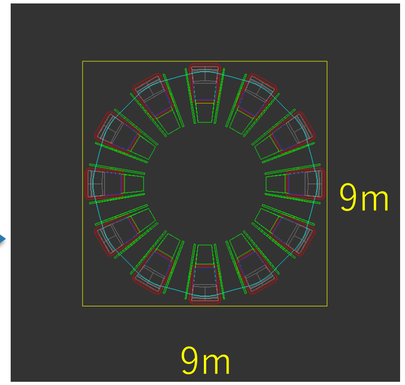
Concept and constraints

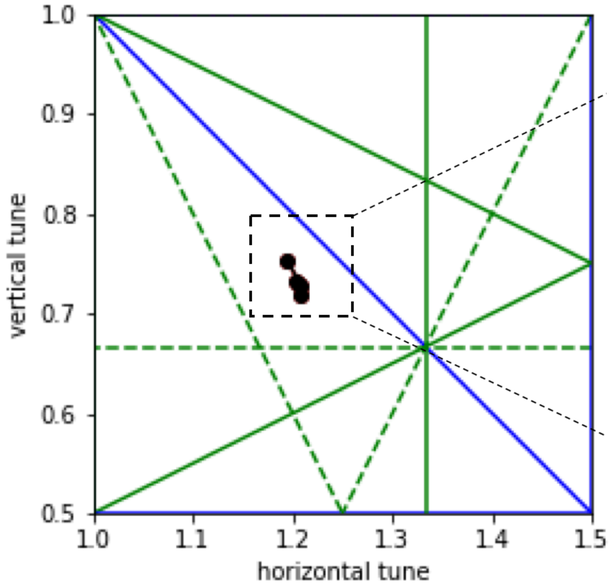
1. Dedicated to pion production
2. Use ERIT scheme i.e. no acceleration
3. Inject 330 MeV proton from AFV cyclotron at RIKEN
4. Fit to the existing building at RIKEN $R_{\mathrm{footprint}} < 5$ m
5. No reverse bending
    1. Use only F magnets
    2. Low k for the horizontal focusing
    3. Edge angle for the vertical focusing
6. Aiming design at small tune variations and small COD

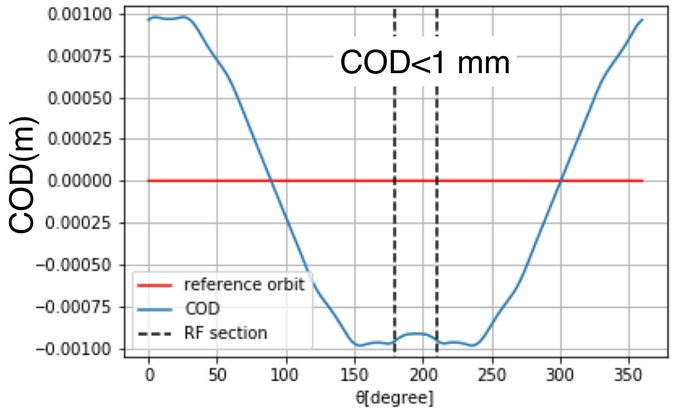








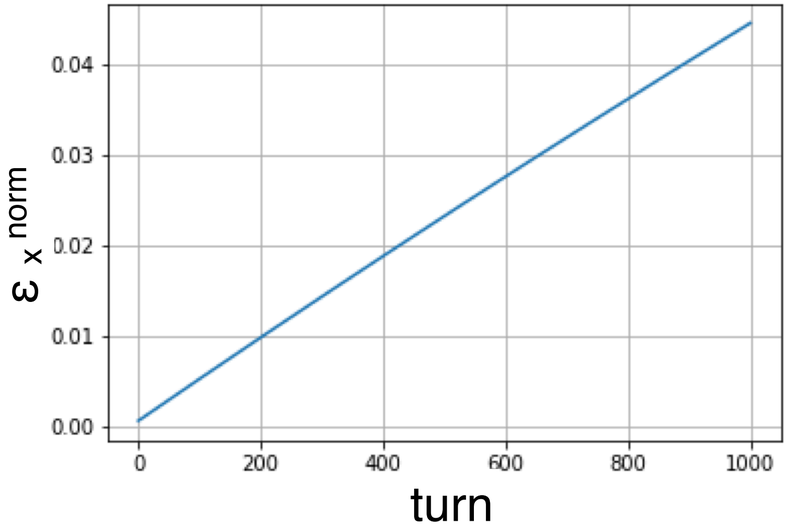


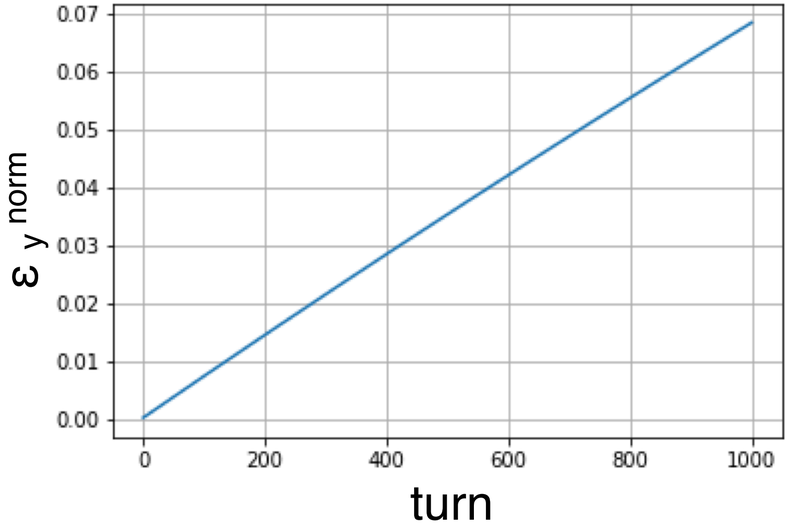


horizontal tune

Parameters of the PiPER

beam species	proton
energy	330 MeV
radius of central orbit	4.07 m
tune	(1.21, 0.73)
β@ center of F	(3.5 m, 5.5 m)
minimum gap	142 mm
B field @ central orbit	1.48 T
I_{beam} from injector	1 pA
target thickness	100 μm
survival	100 turn
injected beam size	5 mm
production rate	200/s π^- (1000/s π^+)





Summary

1. It has been 10 years since the main ring started operation.
2. Proton beams from the main ring will be available until March 2022.
3. The utilization plan of the entire facility and the future reuse of the FFAs are under consideration.
4. The basic design of PiPER ring has been completed.