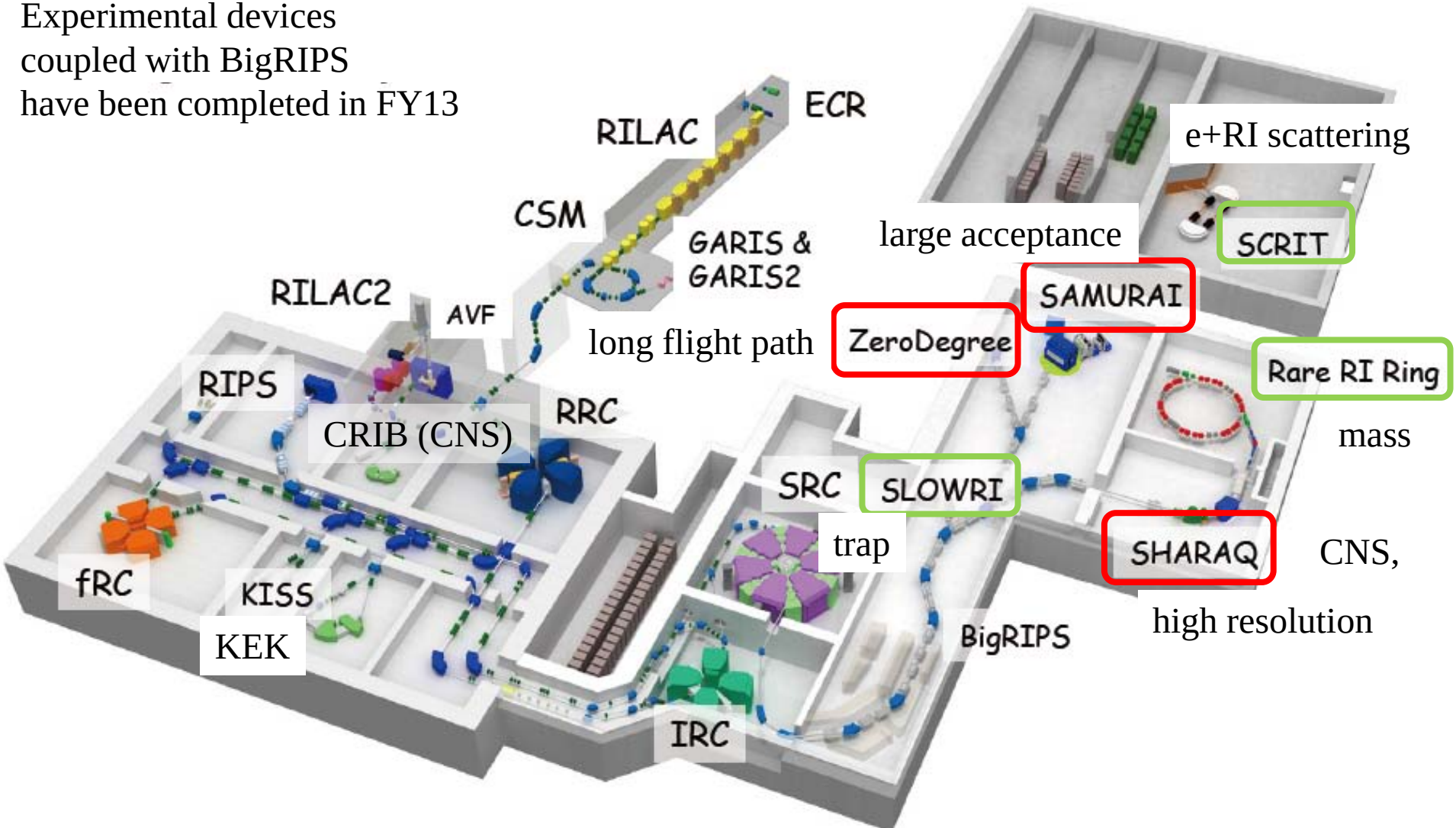
RIBF Upgrade Plan

H. Sakurai
On behalf of RIBF chief scientists
Kamigaito, Ueno, Uesaka, Sakurai

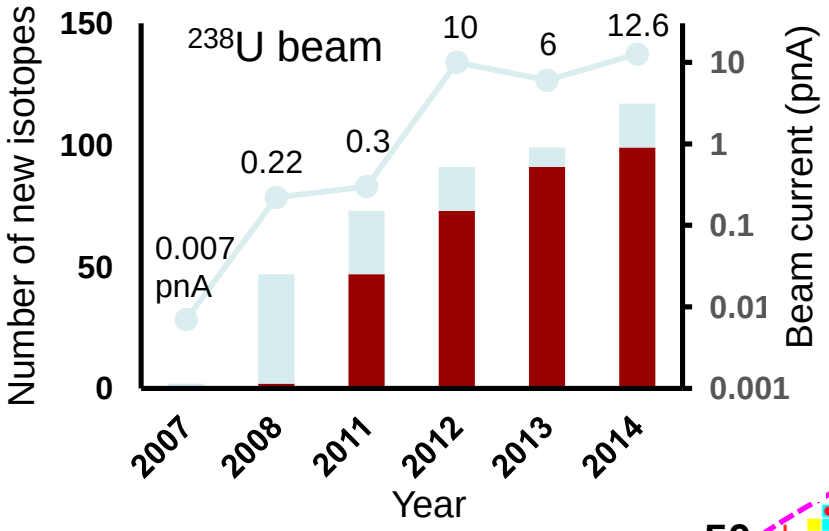
RI Beam Factory

5 cyclotrons + 2 linacs
3 inflight separators
Experimental devices
coupled with BigRIPS
have been completed in FY13



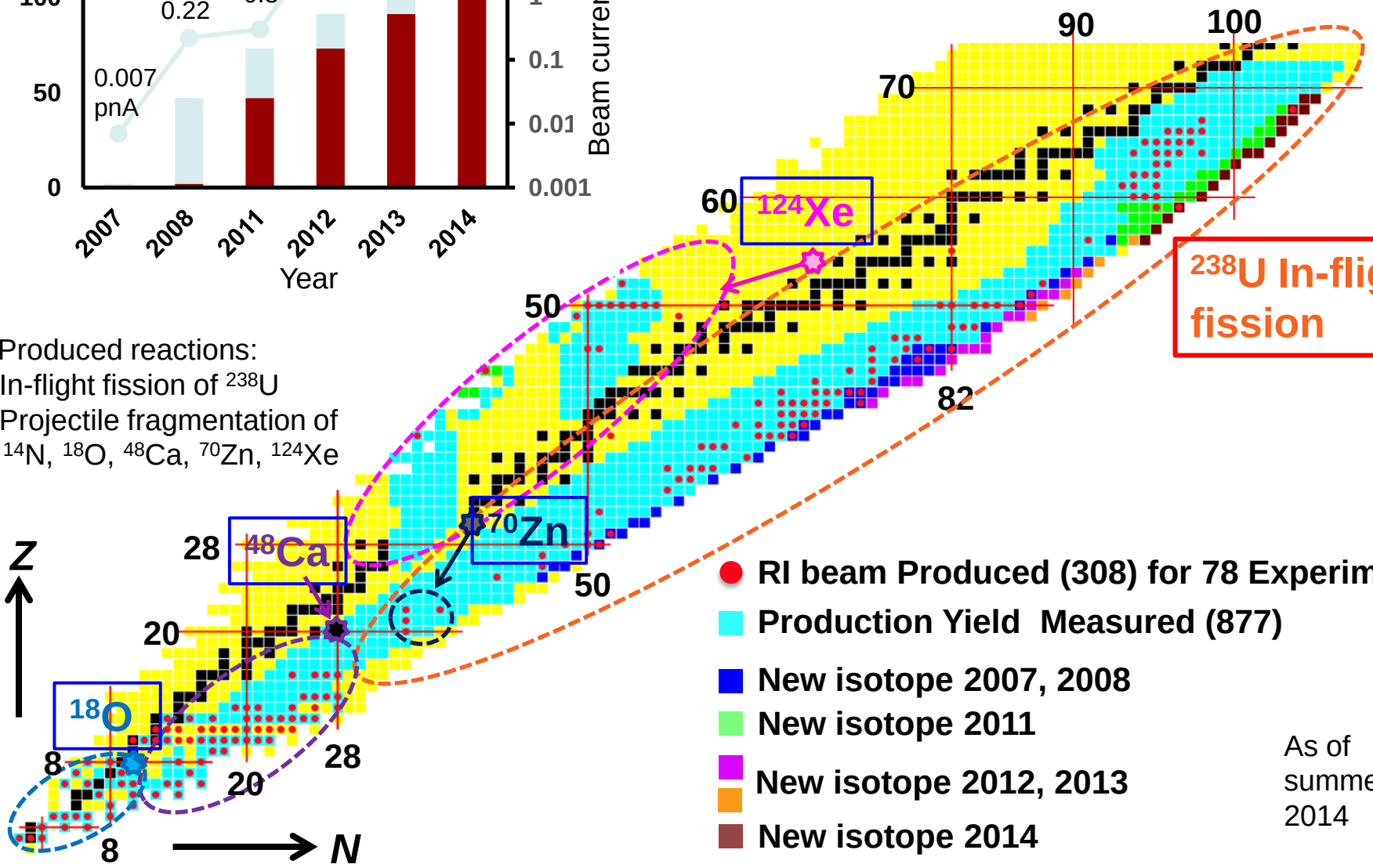
RI Beam Production at BigRIPS Since 2007

Kubo et al.



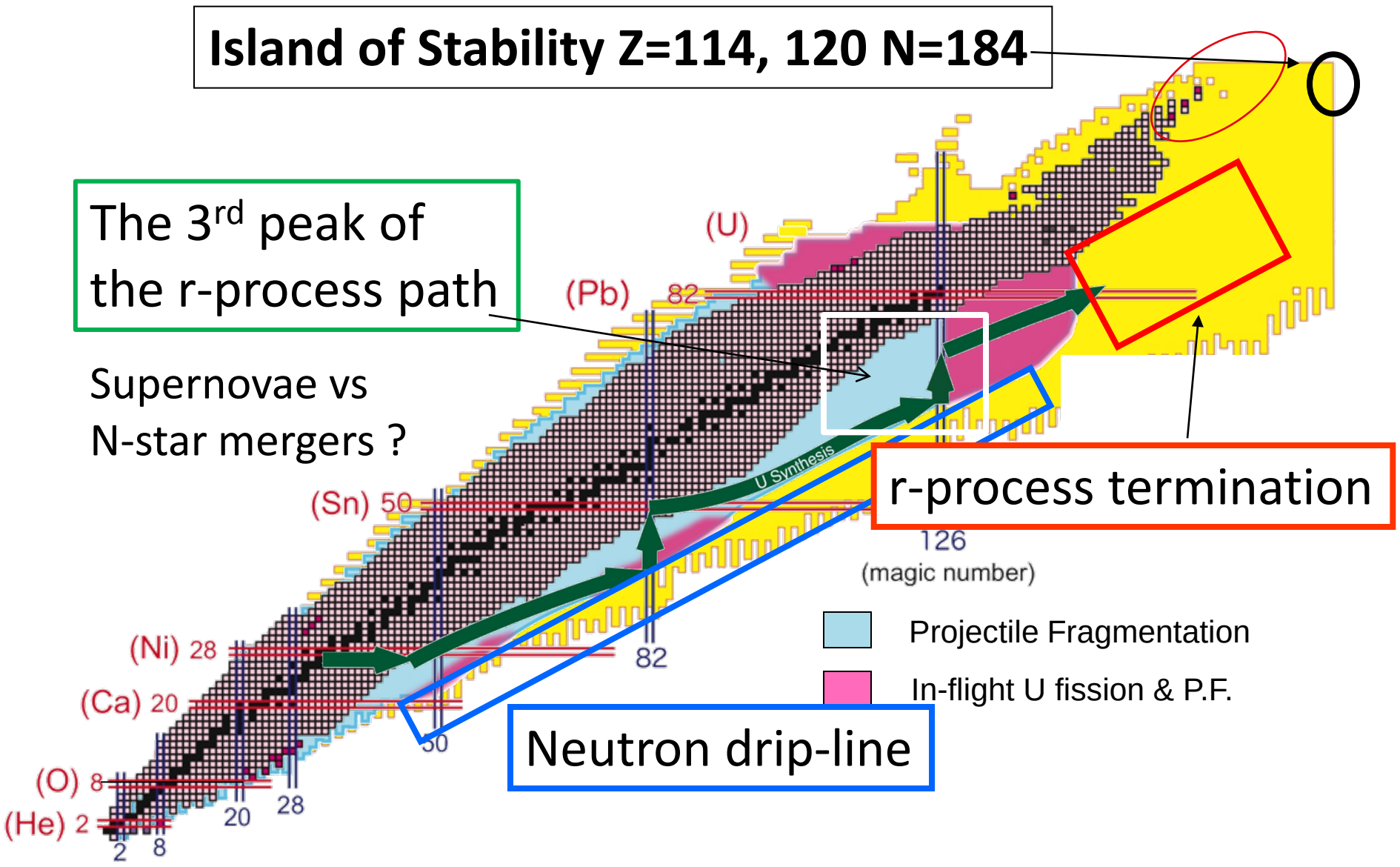
New isotopes: 120
New isomers: 43

Produced reactions:
- In-flight fission of ^{238}U
- Projectile fragmentation of ^{14}N, ^{18}O, ^{48}Ca, ^{70}Zn, ^{124}Xe



As of summer 2014

Challenge for the limit of existence



SuperRIBF project

Phase 0 : Starting new projects at the present facility

Phase 1 : Intensity upgrade by constructing

Super RILAC + new fRC

intensity up to 1 pμA

New In-flight Separator System

upgrade of target system and beam dump

thick radiation shield

new ion optics 2 stages -> 3-4 stages

rf technology for beam purification

efficient E reduction

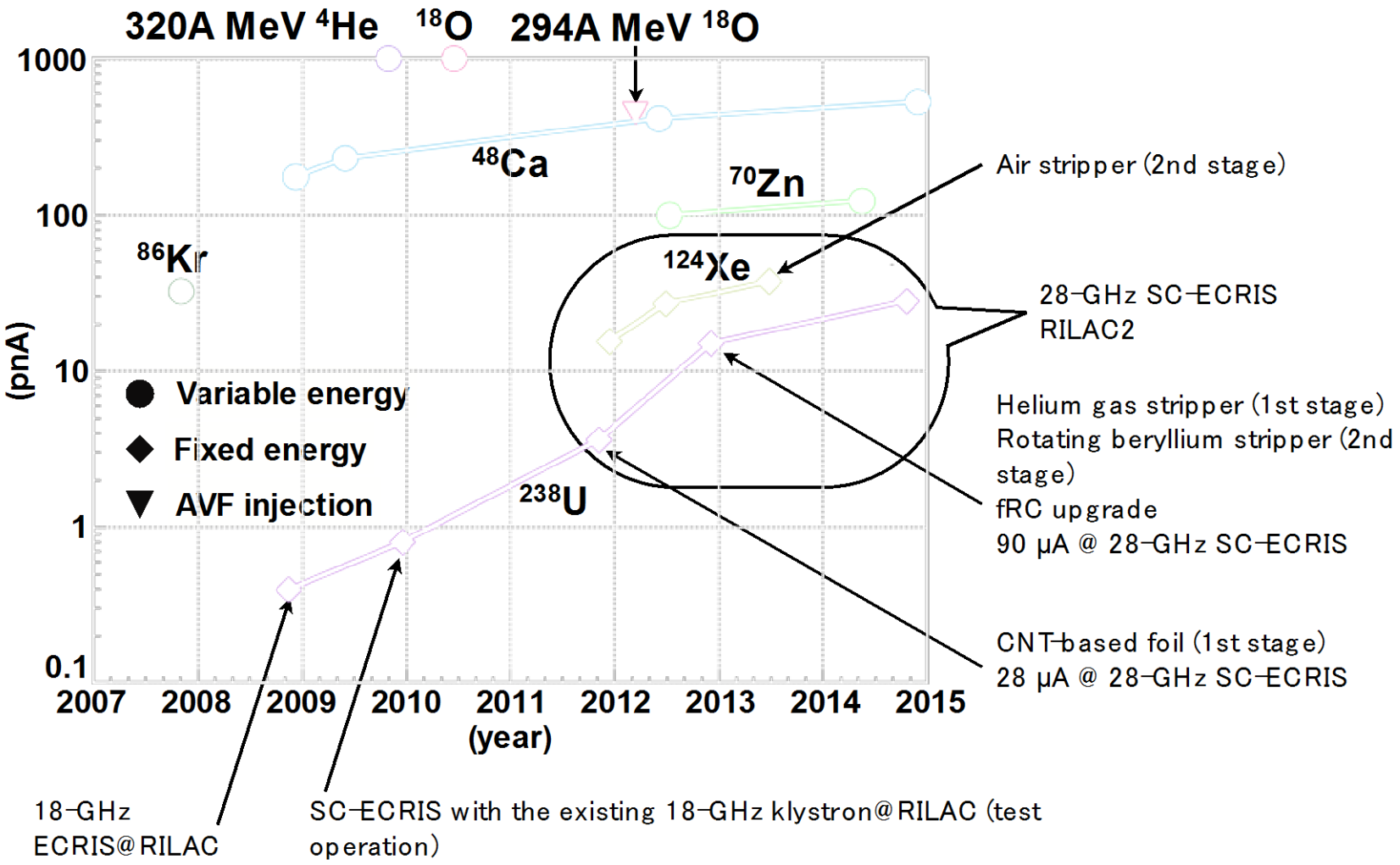
New experimental devices fit for low-E

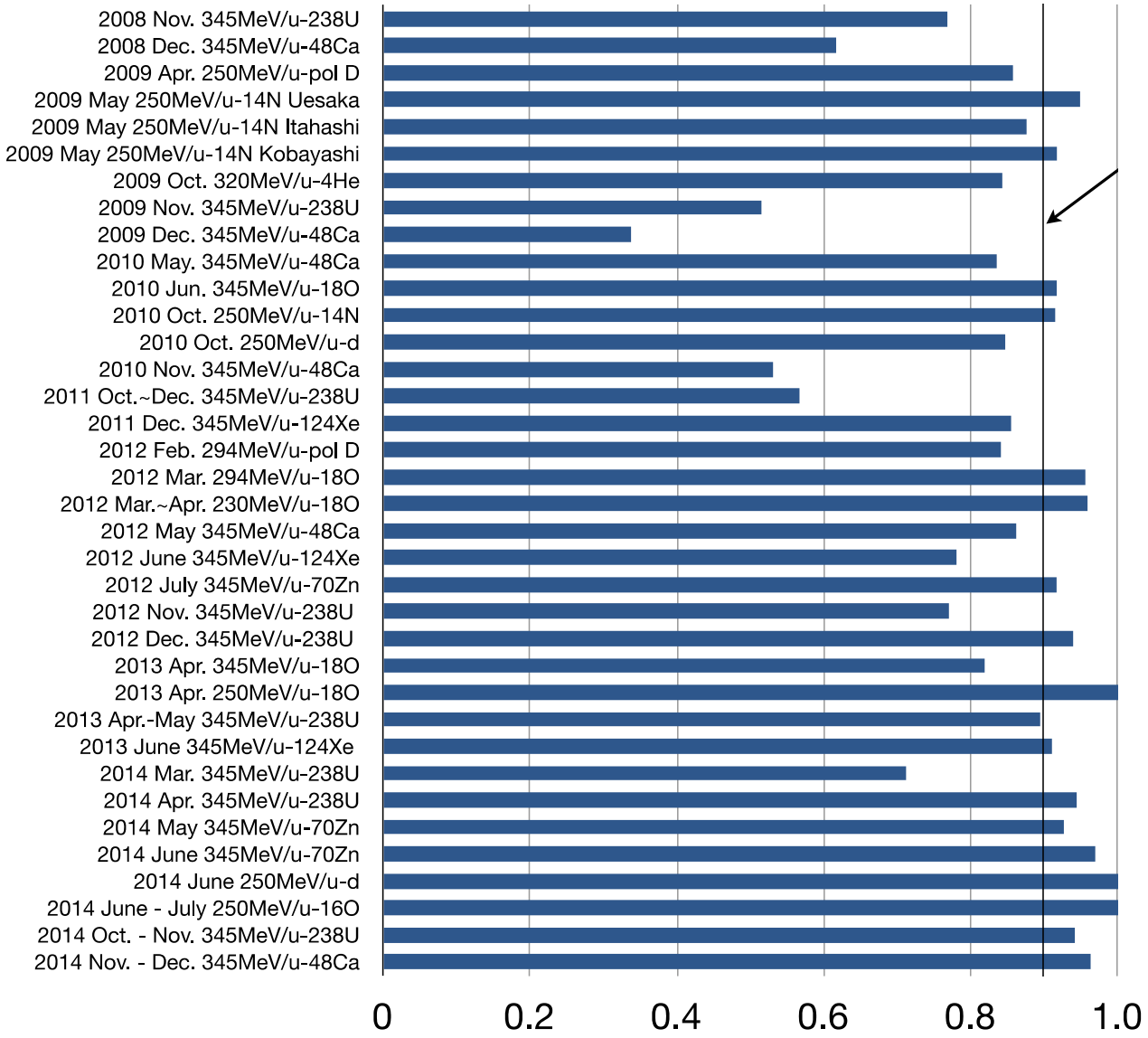
+ TRU-ISOL?

Phase 2 : Energy upgrade up to 1 GeV/nucleon (~2040)

+ EOS + hadron-physics +muon+….

History of Beam Intensity Upgrade

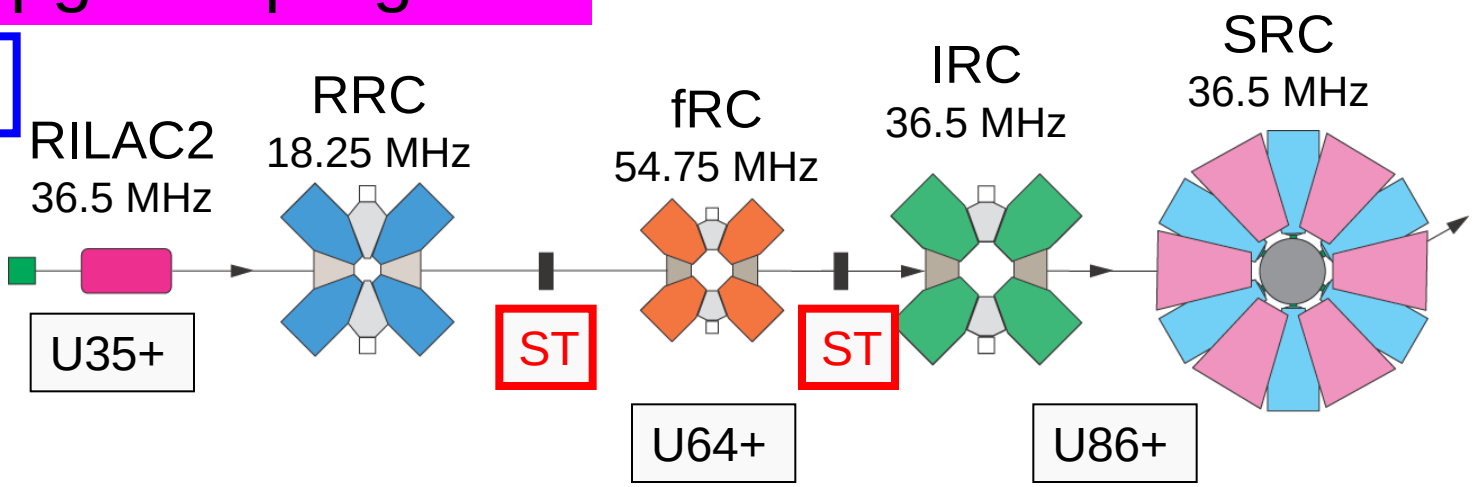



2008 Nov. 345MeV/u-238U
2008 Dec. 345MeV/u-48Ca
2009 Apr. 250MeV/u-pol D
2009 May 250MeV/u-14N Uesaka
2009 May 250MeV/u-14N Itahashi
2009 May 250MeV/u-14N Kobayashi
2009 Oct. 320MeV/u-4He
2009 Nov. 345MeV/u-238U
2009 Dec. 345MeV/u-48Ca
2010 May. 345MeV/u-48Ca
2010 Jun. 345MeV/u-18O
2010 Oct. 250MeV/u-14N
2010 Oct. 250MeV/u-d
2010 Nov. 345MeV/u-48Ca
2011 Oct.~Dec. 345MeV/u-238U
2011 Dec. 345MeV/u-124Xe
2012 Feb. 294MeV/u-pol D
2012 Mar. 294MeV/u-18O
2012 Mar.~Apr. 230MeV/u-18O
2012 May 345MeV/u-48Ca
2012 June 345MeV/u-124Xe
2012 July 345MeV/u-70Zn
2012 Nov. 345MeV/u-238U
2012 Dec. 345MeV/u-238U
2013 Apr. 345MeV/u-18O
2013 Apr. 250MeV/u-18O
2013 Apr.-May 345MeV/u-238U
2013 June 345MeV/u-124Xe
2014 Mar. 345MeV/u-238U
2014 Apr. 345MeV/u-238U
2014 May 345MeV/u-70Zn
2014 June 345MeV/u-70Zn
2014 June 250MeV/u-d
2014 June - July 250MeV/u-16O
2014 Oct. - Nov. 345MeV/u-238U
2014 Nov. - Dec. 345MeV/u-48Ca
0
0.2
0.4
0.6
0.8
1.0

2014: 92 %

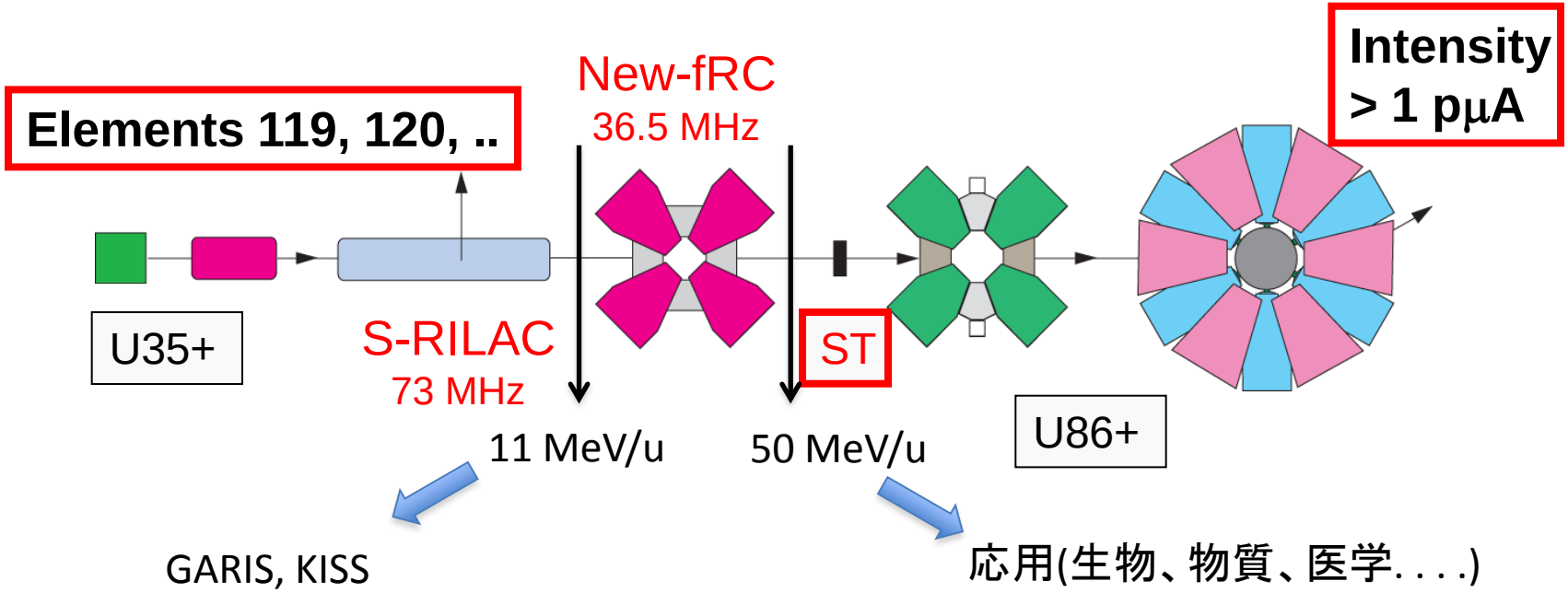
RIBF upgrade program

Present

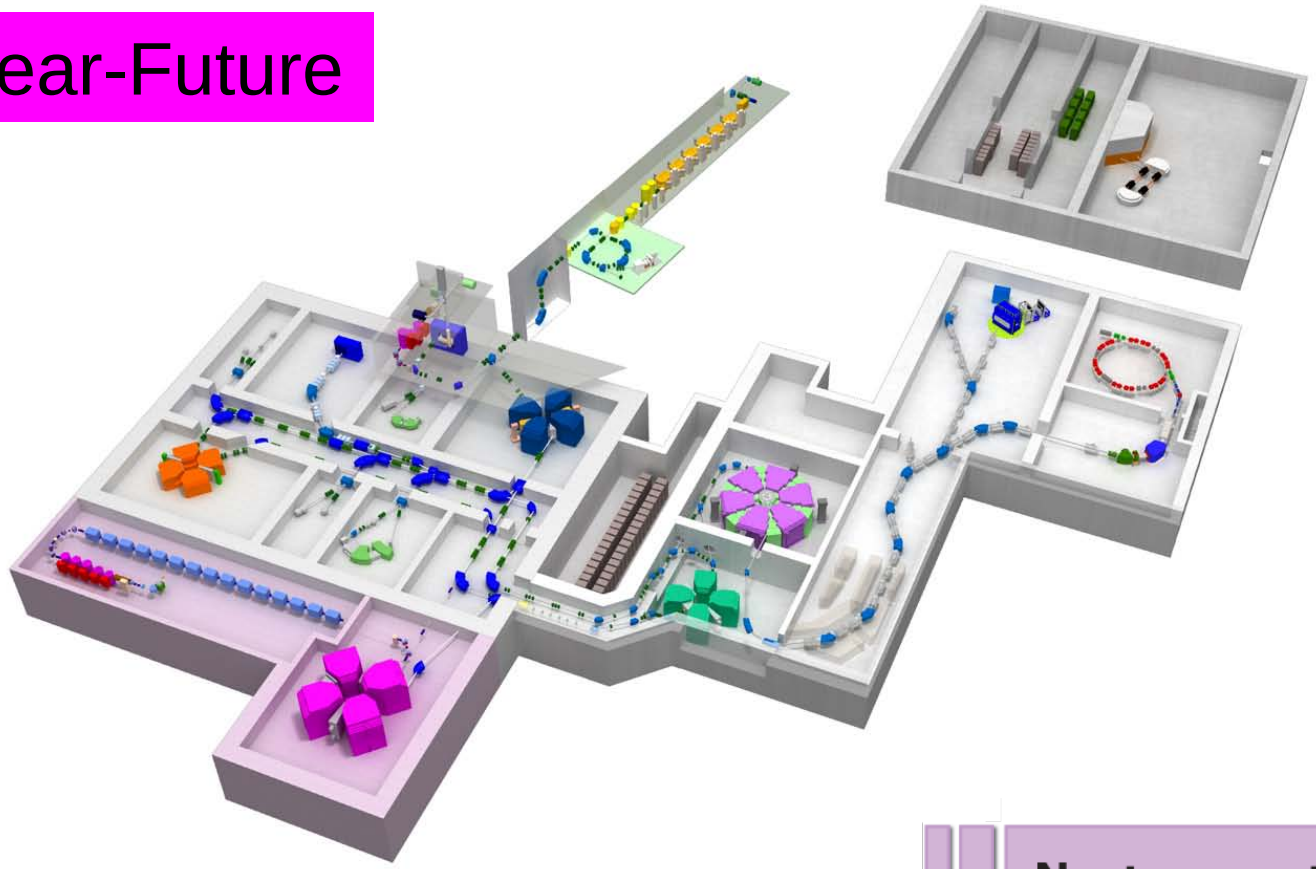


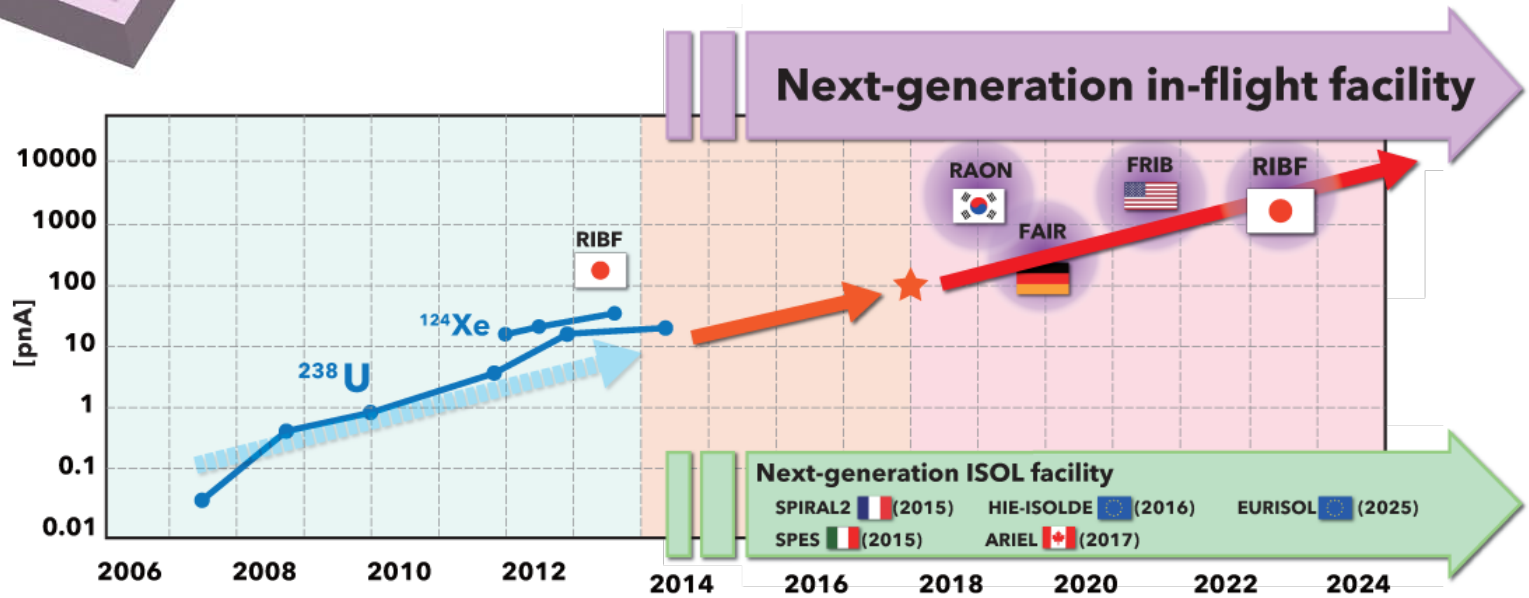
Upgrade plan

- Single stripping stage => New fRC
- Supercondcuting linac injector



Near-Future




Next-generation in-flight facility
10000
1000
100
10
1
0.1
0.01
[pnA]
RIBF
^{124}Xe
^{238}U
RAON
FAIR
FRIB
RIBF
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
Next-generation ISOL facility
SPIRAL2 (2015)
HIE-ISOLDE (2016)
EURISOL (2025)
SPES (2015)
ARIEL (2017)

RIBF Initiatives :Pilot Programs at the present facility

R&D for Production and Separation of heavy and n-rich nuclei
Particle Identification Techniques

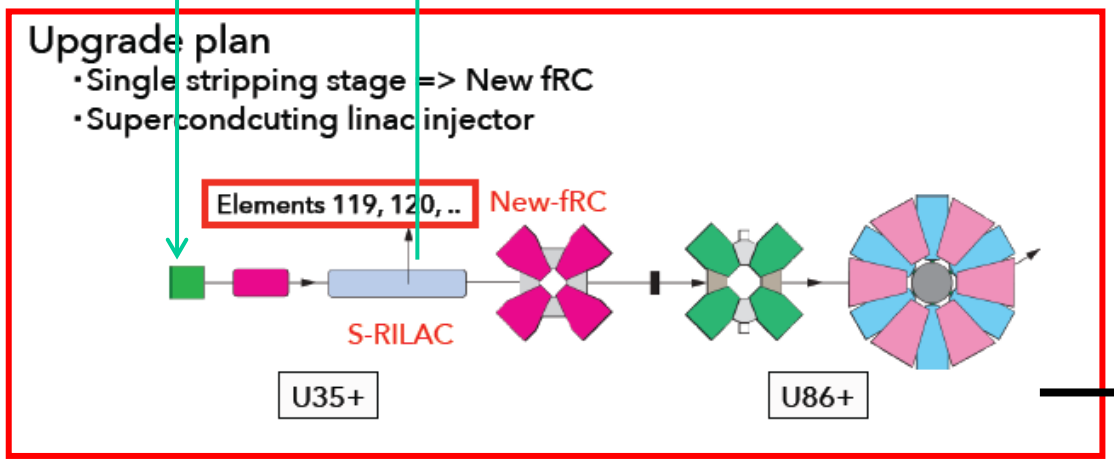
RI+stable reactions

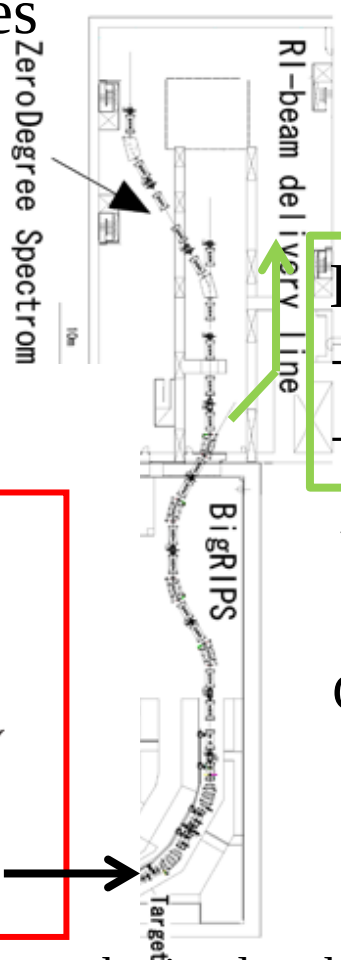
Storage Ring?

MA Acceleration

TRU-ISOL?

Post-accelerated RI ions





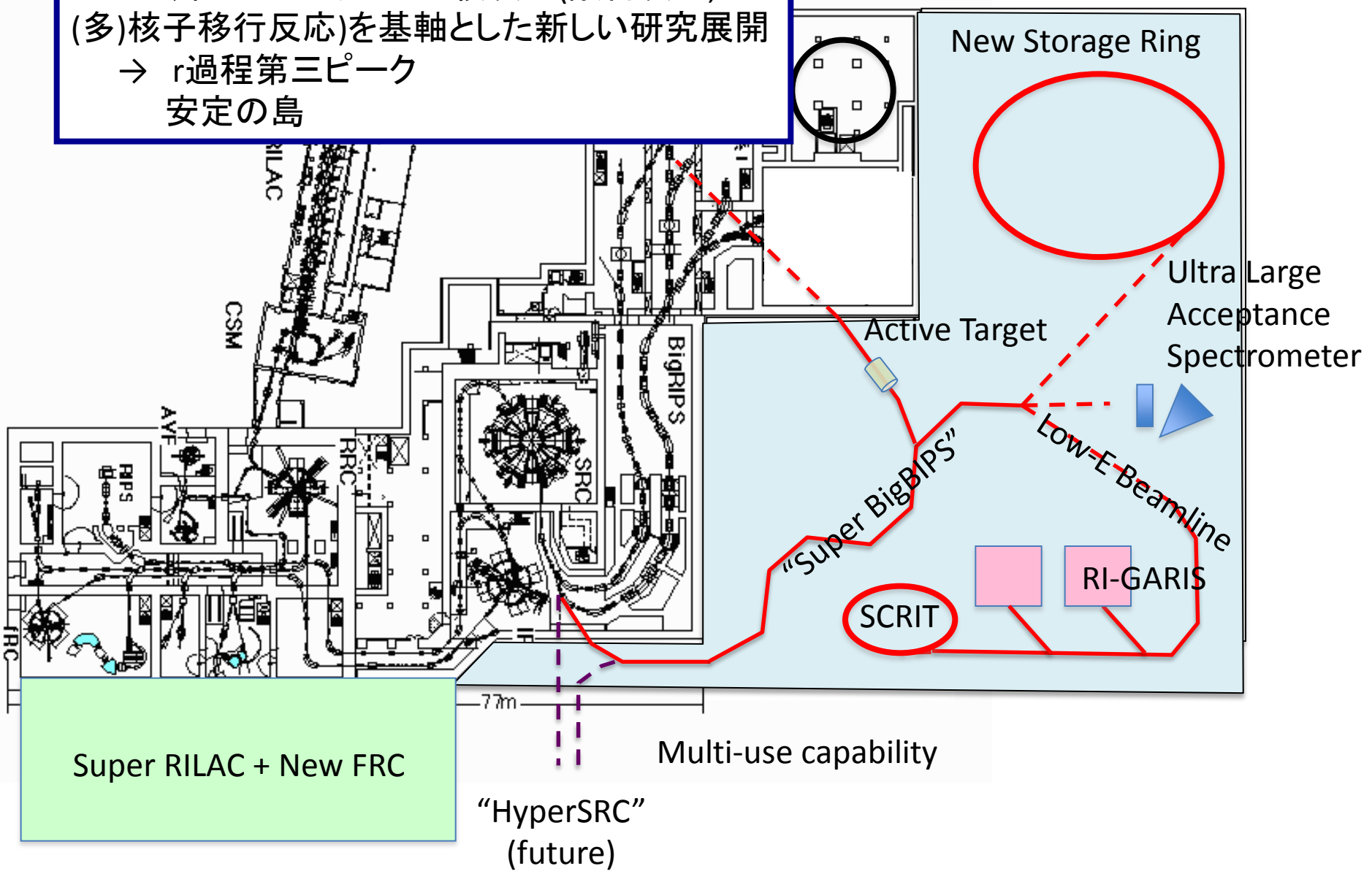
Low-E Branch
+ Spectrometer
+ Ge detectors

Reaction Study+
Collectivity

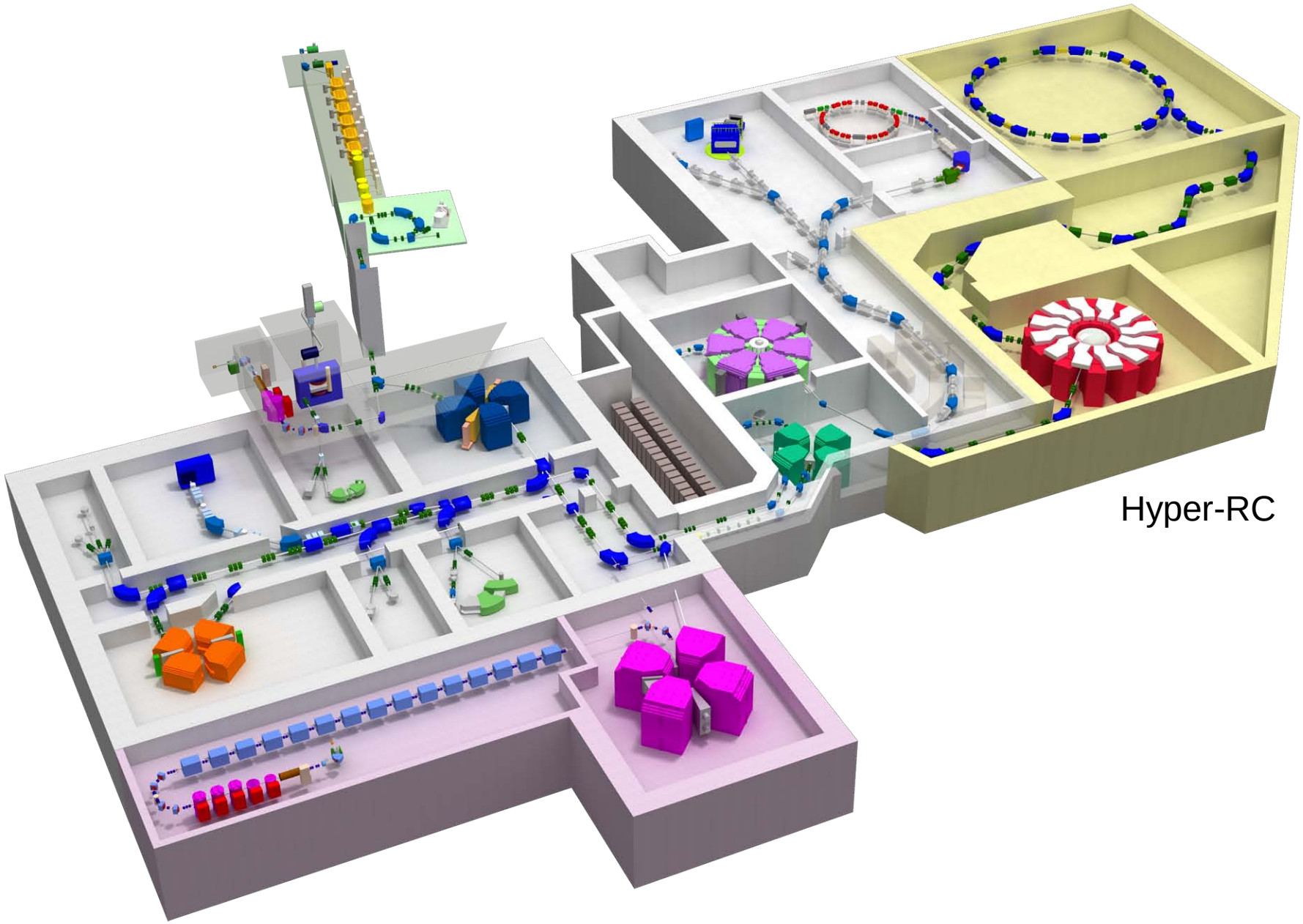
Ca-52, 54 + Cm-248

The upgrade plan aiming at the completion in 2020 has been submitted to the Science Council of Japan in 2013. Although it was not listed in the top 27 proposals, we will improve the accelerator design and physics case.

中間エネルギーのアクティビティを維持
しつつ、低エネルギーRIの核反応(融合反応,
(多)核子移行反応)を基軸とした新しい研究展開
→ r過程第三ピーク
安定の島



Future



Workshop!