Large Acceptance Multi-Purpose Spectrometer (LAMPS) Budget, Schedule & Collaboration

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Rare Isotope Science Project

Institute for Basic Science

LAMPS Review

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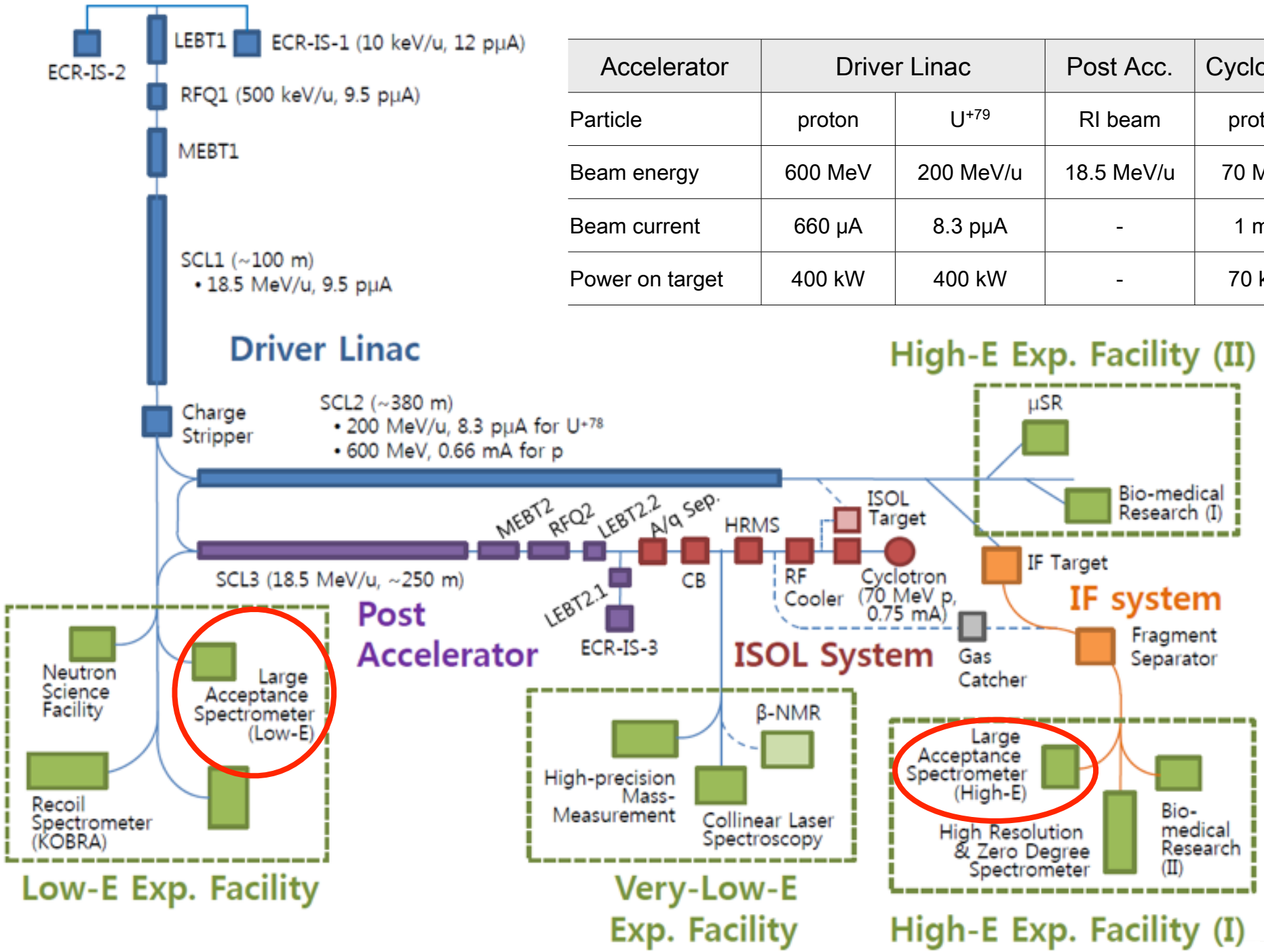
RAON Accelerator & Experimental Facilities

Accelerator	Driver Linac		Post Acc.	Cyclotron
Particle	proton	U^{+79}	RI beam	proton
Beam energy	600 MeV	200 MeV/u	18.5 MeV/u	70 MeV
Beam current	660 μA	8.3 pμA	-	1 mA
Power on target	400 kW	400 kW	-	70 kW

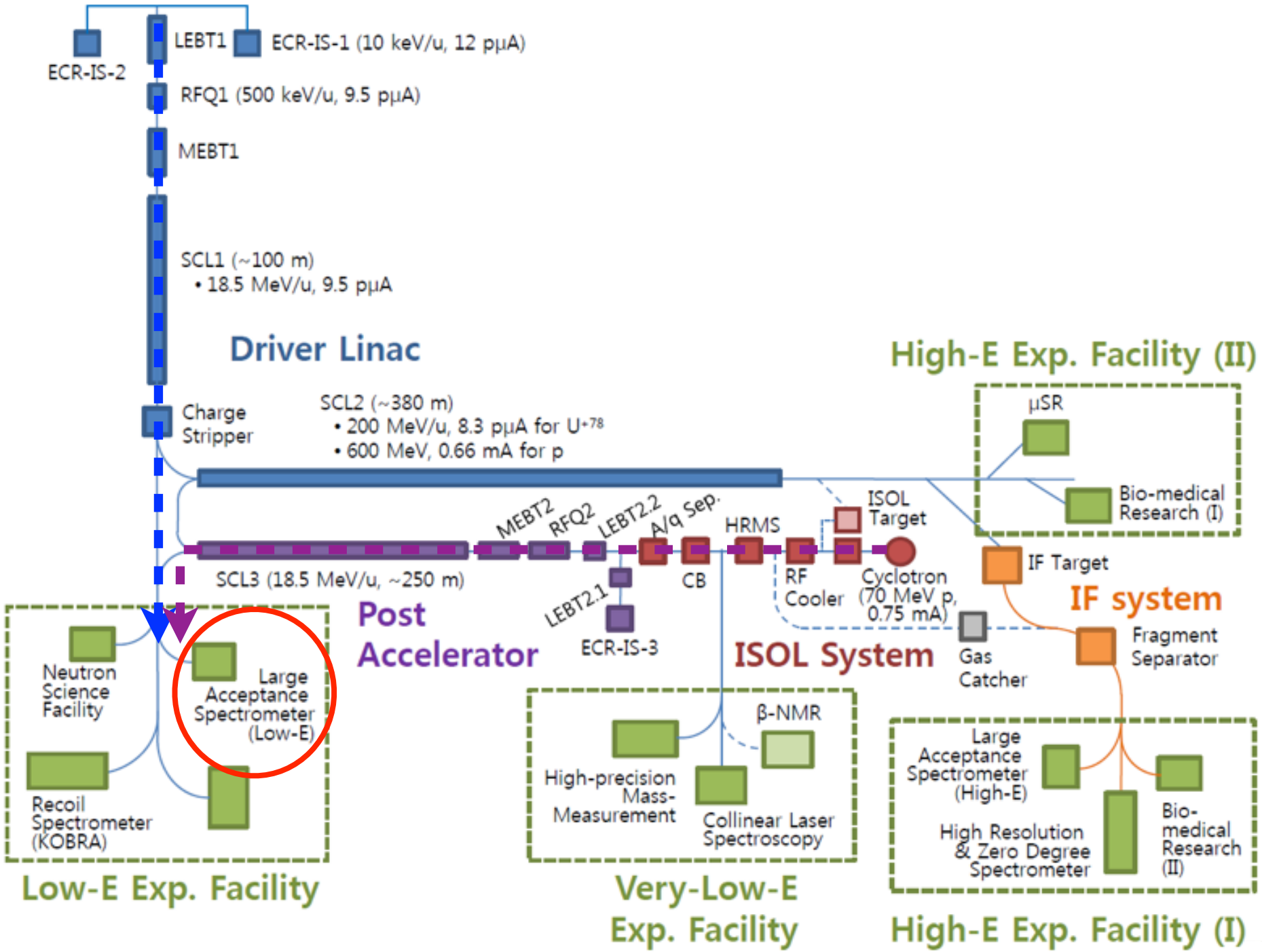


▶ Some example of RI Beam

* ISOL (10 kW power at the 1st stage, proton 70 MeV, cyclotron, UCx target)
IF (400 kW heavy ion superconducting linear accelerator, C target)

RI Bean	Bean Intensity [pps]	Beam Energy [AMeV]	Expected Beam Intensity at Experiment [pps]	Production Method (Primary Beam)
^{6}He	10^{9}	200-250	~10^{9}	IF(^{16}O)
^{8}He	>10^{7}	200-250	~10^{8}	IF(^{18}O)
^{11}Be	10^{8}	< 30 keV	~10^{10}	IF(^{18}O)
^{8}B	>10^{7}	300	~10^{10}	IF(^{16}O)
^{12}B	>10^{7}	200-250	~10^{9}	IF(^{18}O)
^{9}C	>10^{7}	300	~10^{10}	IF(^{16}O)
^{11}C	>10^{7}	300	~10^{12}	IF(^{16}O)
^{14}C	>10^{7}	200-250	~10^{12}	IF(^{18}O)
^{15}O	>10^{10}	< 10	~10^{12}	IF(^{16}O)
^{45}V	>10^{7}	< 5	10^{10}	IF(^{50}Cr)
^{68}Ni	10^{8}	10-250	~10^{7} (ISOL) ~10^{9} (IF)	• Low E: ISOL(p) • High E: - IF (^{238}U)
^{106}Sn	10^{9}	10-250	~10^{9}	IF(^{124}Xe)
^{132}Sn	>10^{7}	5-250	~10^{7} (ISOL, IF)	• High Purity – ISOL(p) • High Energy: IF (^{238}U)
$^{133\text{-}136}$Sn	>10^{2}	< 60 keV	10^{3}-10^{7}	ISOL(p)
^{140}Xe	10^{8}	10-250	10^{8}	ISOL(p)
^{142}Xe	10^{7}	10-250	10^{7}	ISOL(p)
^{144}Xe	10^{5}	5-20	10^{5}	ISOL(p)
^{64}Ni	>1 pμA	< 5	~ 10 pμA	Primary Beam (stable)
^{238}U	>1 pμA	200	~ 8 pμA	Primary Beam (stable)

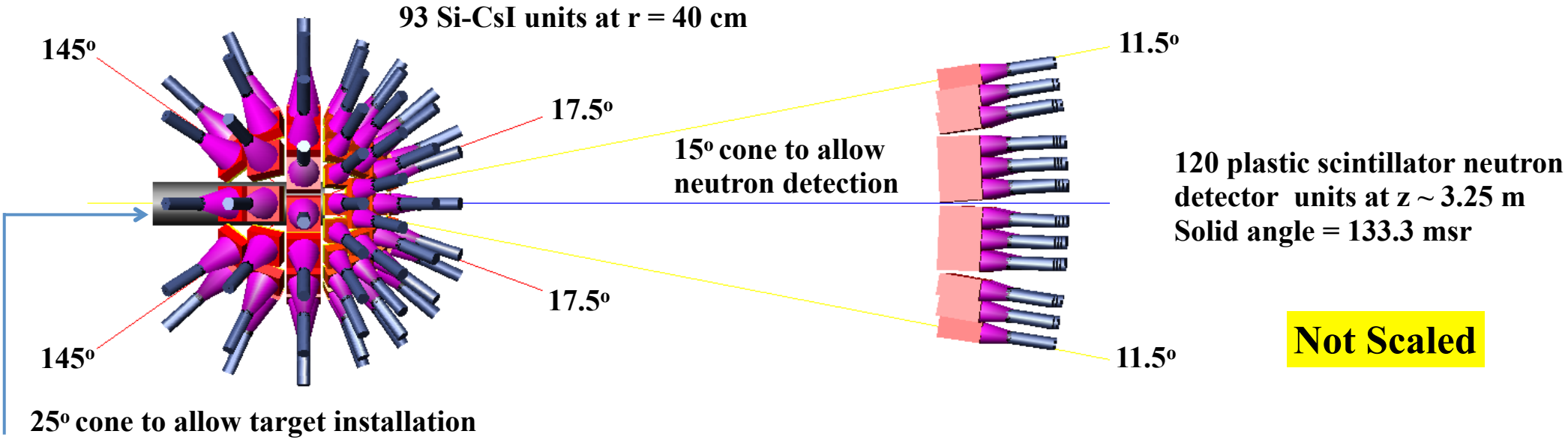
LAMPS Experimental Facilities

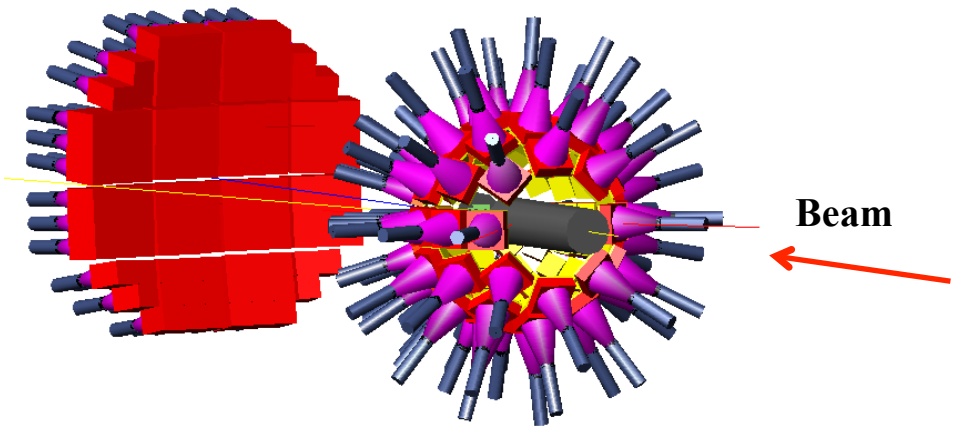


Low Energy LAMPS (LAMPS-L) Experimental Setup

$E_{beam} < 18.5A$ MeV

For GDR Experiments (to test PDR measurements as well)





Example of Experiments

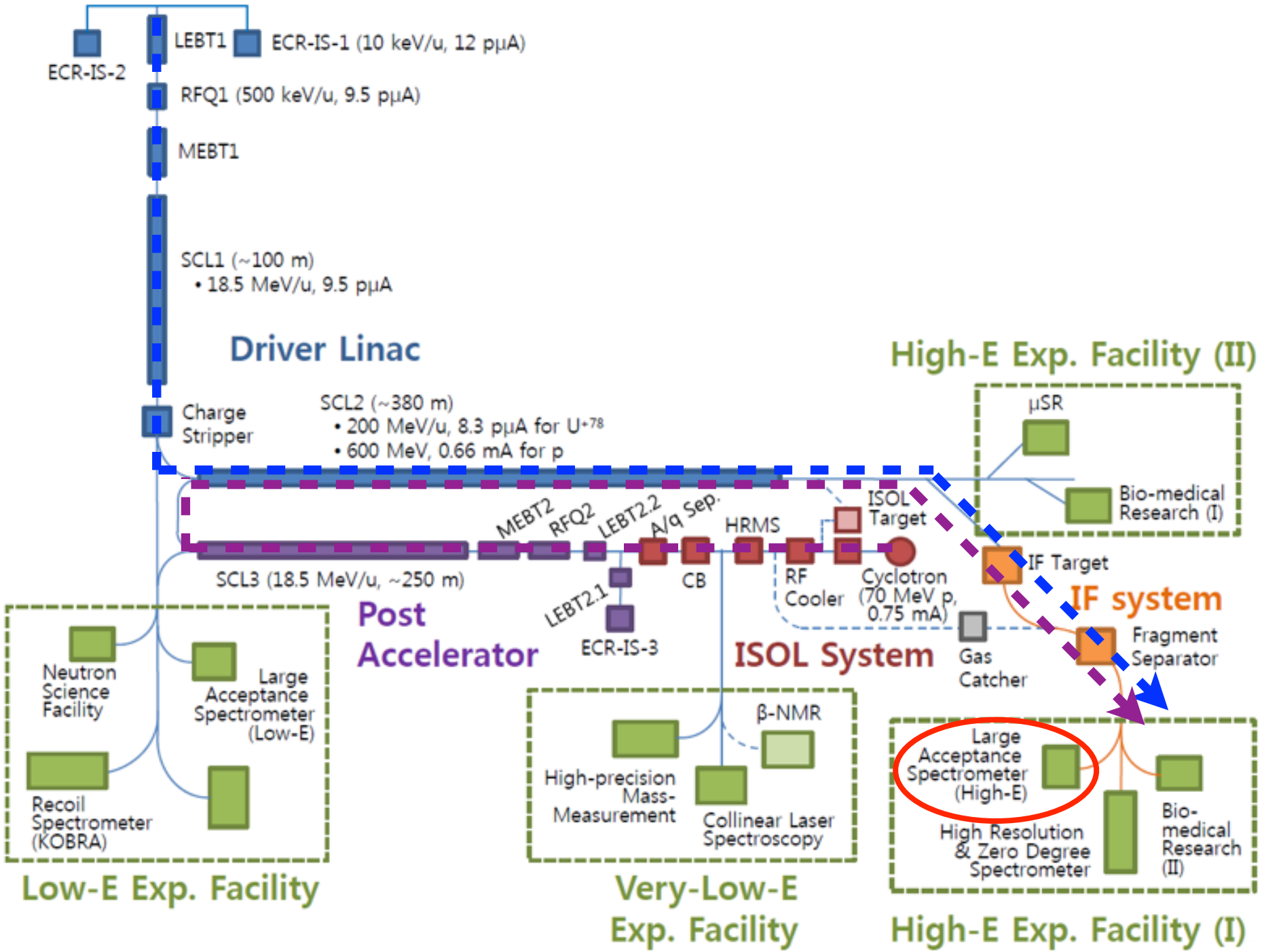
^{50,54}Ca, ^{68,70,72}Ni, ^{106,112,124,130,132}Sn RI beam

+ ^{197}Au/^{208}Pb (stable target)

+ ^{12}C/no target (background control)

❖could be possible from ISOL

LAMPS Experimental Facilities



High Energy LAMPS (LAMPS-H) Experimental Setup

18.5*A* MeV< E_{beam} < 250*A* MeV

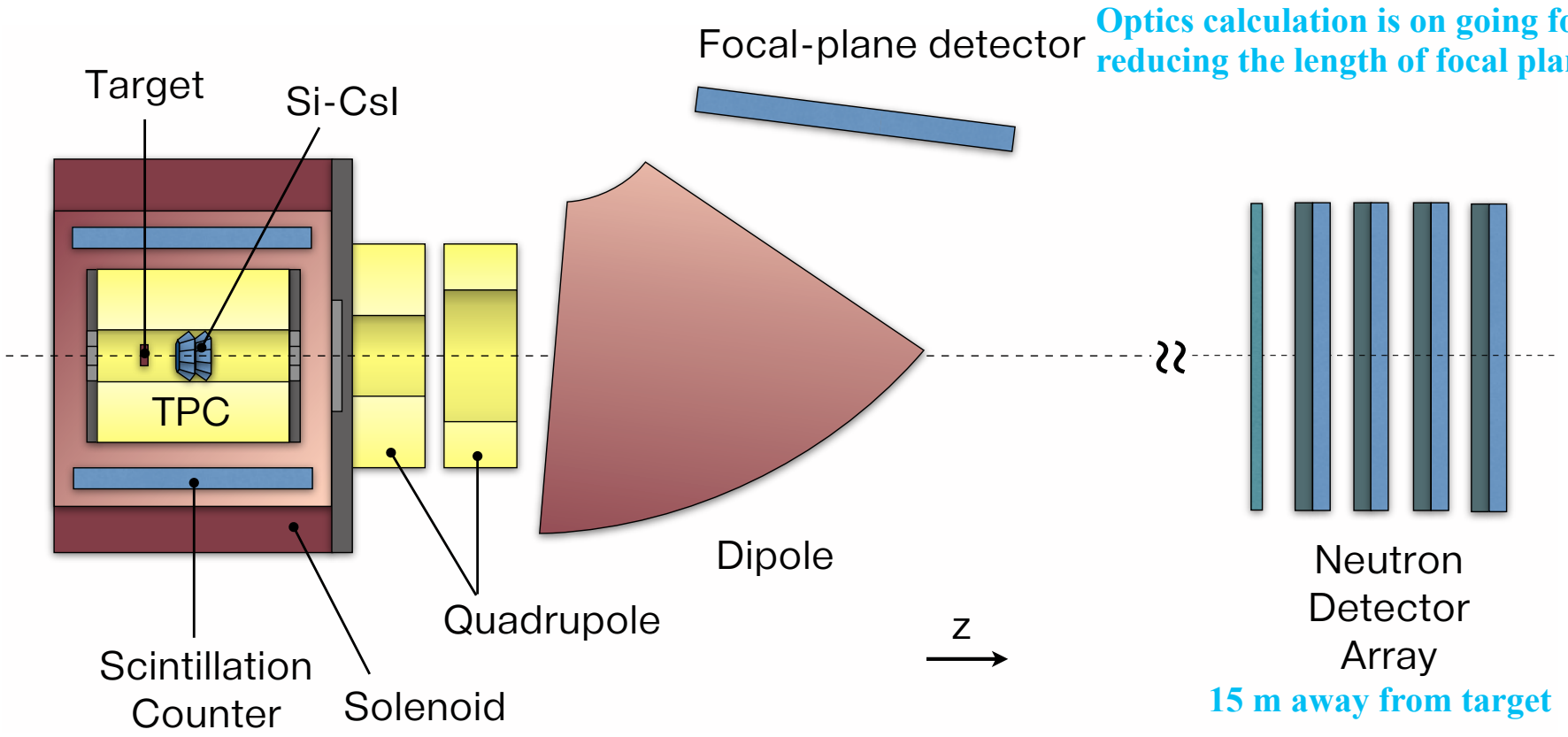
For Heavy-Ion Collision Experiments

-Example of Reactions:

Central and peripheral collisions

$^{50,54}Ca + ^{40}Ca$, $^{68,70,72}Ni + ^{58}Ni$, $^{106,112,124,130,132}Sn + ^{112,118,124}Sn$,

$^{96,100,104}Ru(^{88,92,96}Zr) + ^{96}Ru(^{96}Zr)$ ➔ **when it is available**



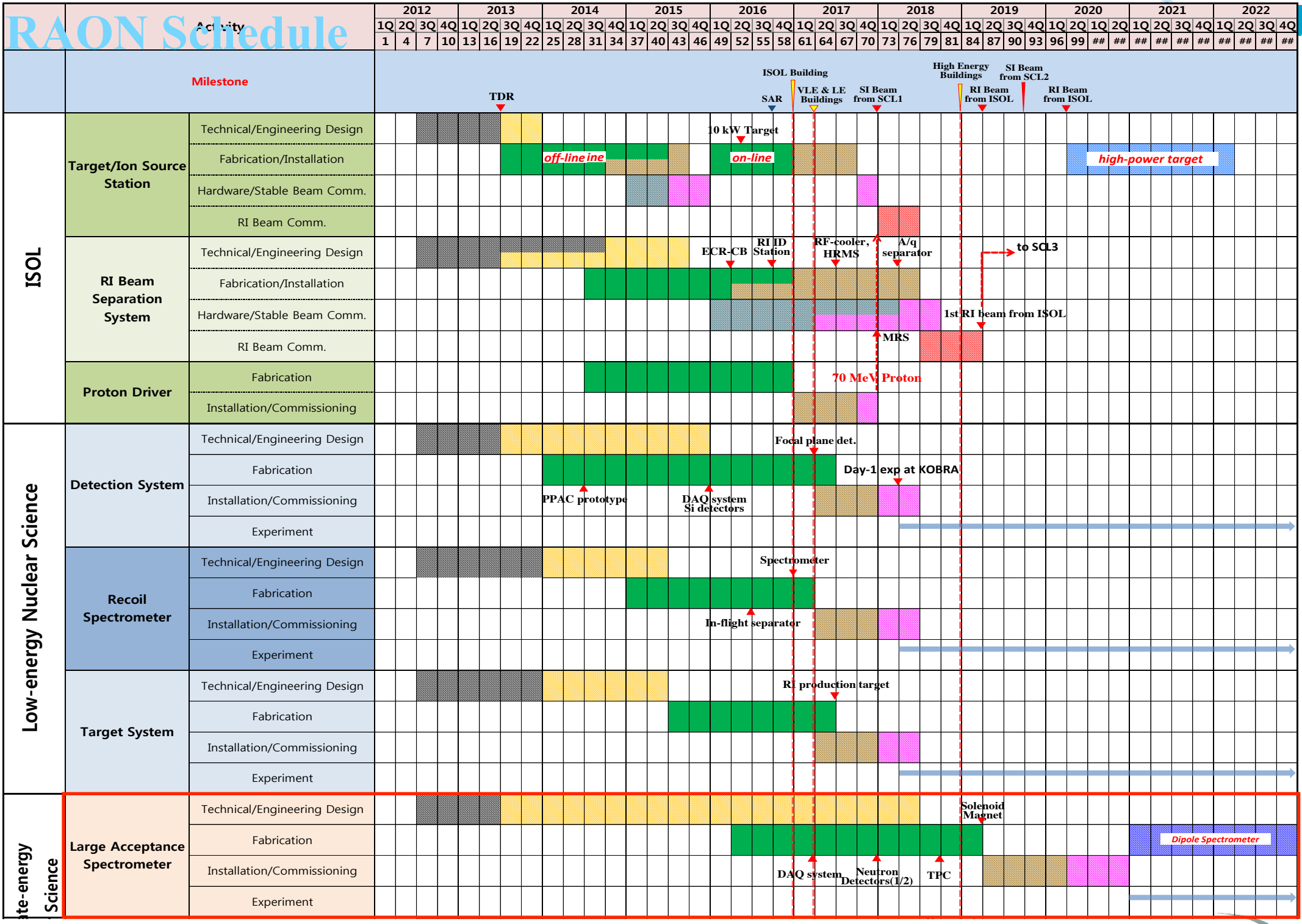
LAMPS Budget

Item	Budget (M USD)
LAMPS-L Detector & Electronics	3.3
LAMPS-H Detector, Electronics & Magnet	26.7
Start Counter & Solid Target	0.6
DAQ & DAQ Electronics	2.2
Total	32.8 (-11.2)
Currently available budget	23.4 (21.6)
Item	**Budget (M USD)**
LAMPS-H Dipole Spectrometer	8.9
LAMPS-H Si-CsI	2.3
Total	11.2

In order to fit to currently available budget, dipole spectrometer and Si-CsI detecter at high energy experimental setup will be for the upgrade

- Forward fragmentation measurement
- PDR/GDR resonance measurement
- Nuclear structure study (e.g. Coulomb breakup)

RAON Schedule



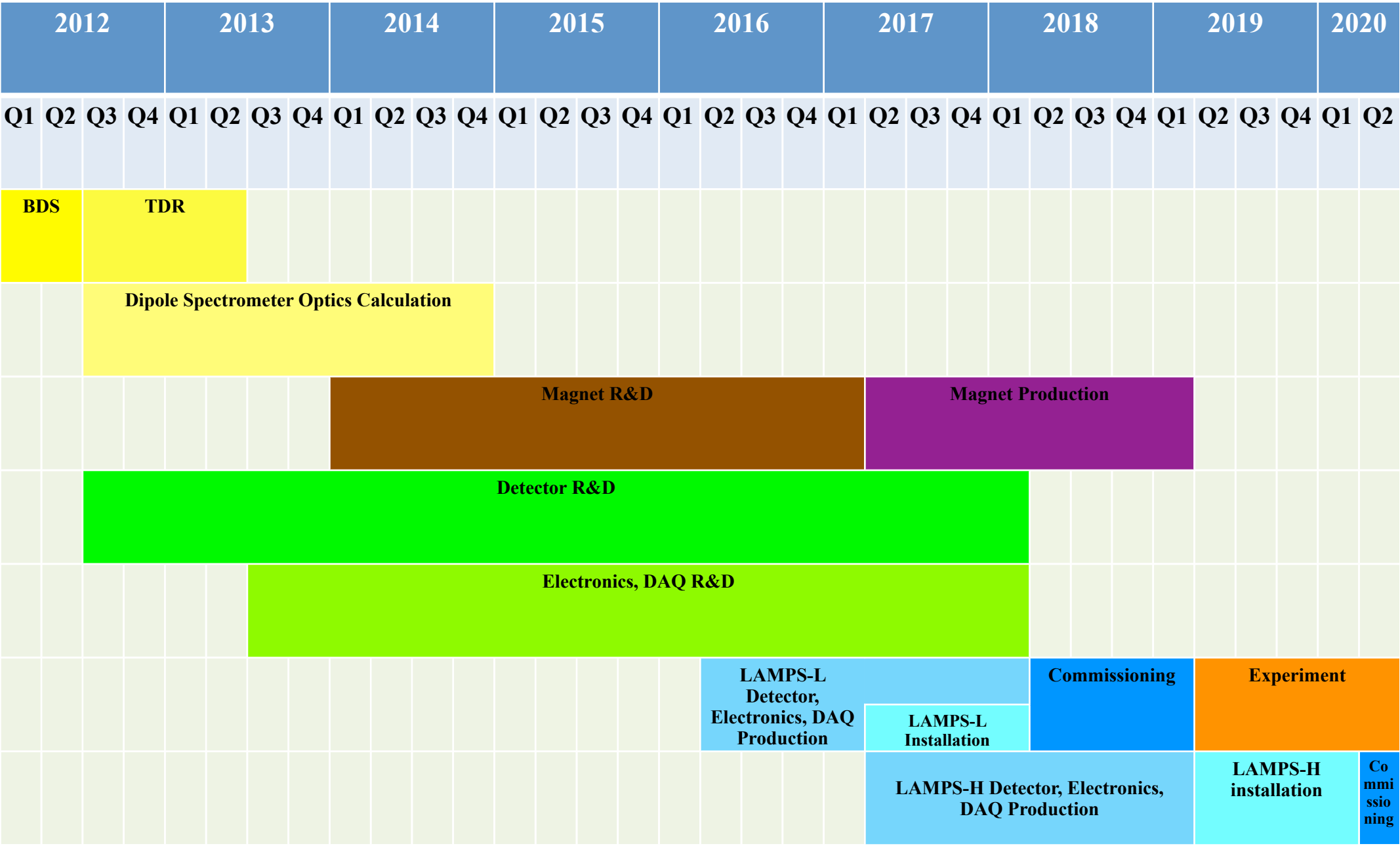
Technical Design | Engineering Design | Fabrication | Installation

Hardware test | Commissioning | Future upgrade

기초과학연구원 Institute for Basic Science

RISP Rare Isotope Science Project

LAMPS Schedule



LAMPS Participants

Institute	Members
RISP/IBS	D. G. Kim, Y. H. Kim, Young Jin Kim, Y. -J. Kim, Y. K. Kim, H. S. Lee, Taeksu Shin, C. C. Yun
Korea University	J. K. Ahn, Y. Go, Byungsik Hong, G. Jhang, E. Joo, B. Kim, M. Kim, S. H. Kim, J. W. Lee, K. Lee, K. S. Lee, S. H. Lee, S. K. Lee, I. Lugendo, B. Mulilo, J. Park, H. Shim, J. Yoo
Chonbuk National University	Eunjoo Kim, H. H. Kim
Inha University	Minjung Kweon, J. H. Park
Kyungpook National University	J. B. Bae, H. J. Hyun, H. B. Jeon, K. H. Kang, Hwanbae Park

35 people from 5 institutes

Looking for more collaborators from both domestic and international

➢ **To form international collaboration**

Responsibility & International Collaboration

Element		Participating Institutes	Status & Comments
Magnet		IBS	Negotiation of contract
TPC	Hardware	IBS, Korea University	Prototyping
	Software	Korea University, Inha Univesity	Under the development
Neutron Detector & Barrel Detector		Korea University, Chonbuk National University	Prototyping
Si-CsI		IBS, Kyungpook National University	Prototyping
Dipole Spectrometer		IBS, Korea University	Designing

International Collaboration

- GSI
  - -Triggerless DAQ
  - -Diamond detector
- GANIL, Saclay, RIKEN, J-PARC
  - -TPC electronics (GET system)
  - -NAVAL DAQ

R&D Plan, Production Plan

- Solenoid magnet design is completed
  - Need to figure out production feasibility
  - Communicate with domestic and foreign magnet companies
- Si-CsI detector & neutron detector are commonly used at both experimental setups
  - Electronics also can be common
- TPC detector and electronics are quite complicated
  - Need longer R&D time than other detectors

❖R&D and production of most of detectors will be done with domestic people

❖Adapt advanced electronics & DAQ system from foreign research institute and modify

◉For future upgrade

➡Longer optics calculation for better dipole spectrometer performance

- After optics calculation completed, magnet design will be started & focal plane detector design will be fixed

➡Build Si-CsI detector at high energy experimental setup

Thank for your attention!