(Discussion)
Future Science & Beamline

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On behalf of the 4GSR Project

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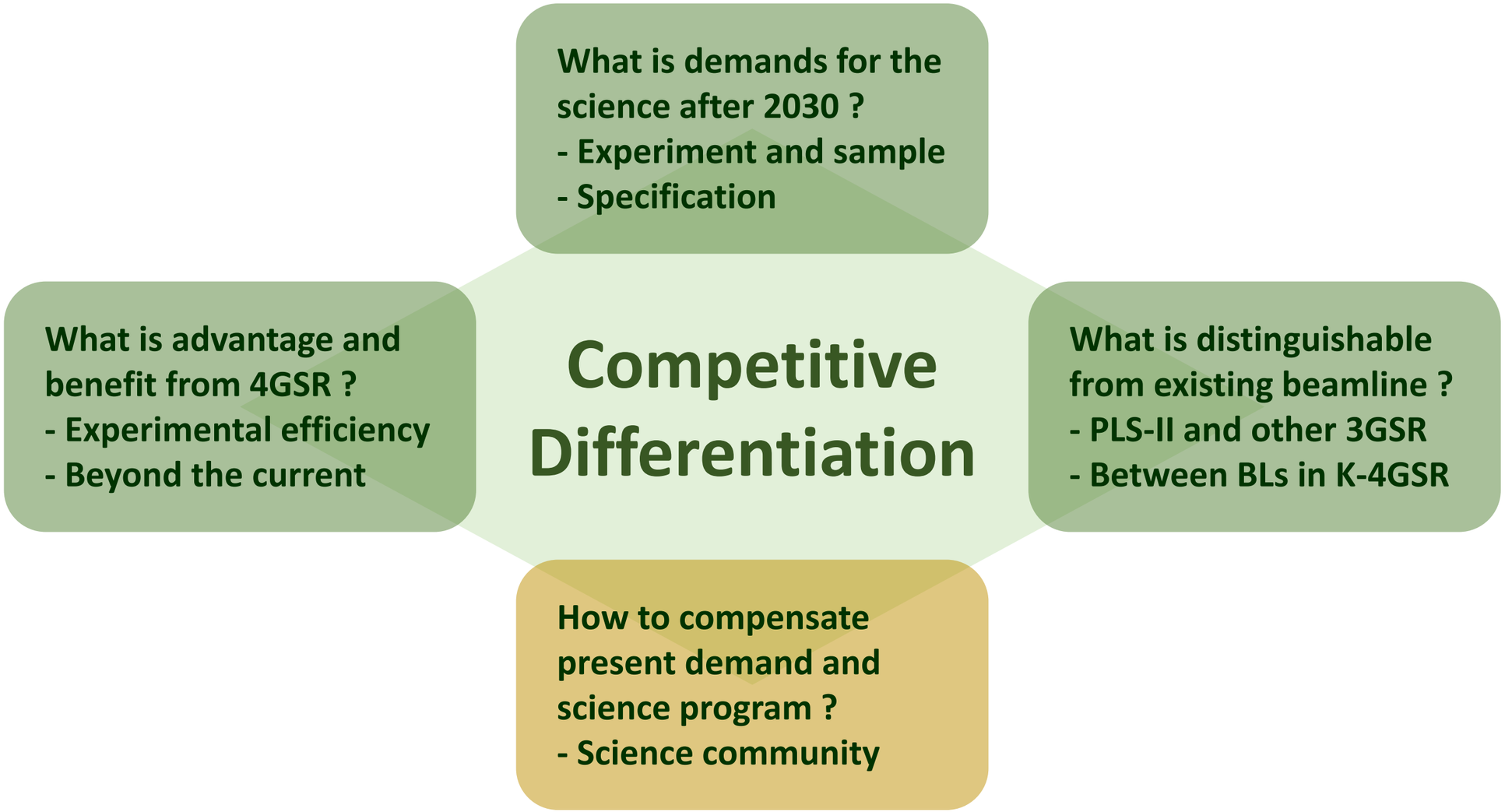
Discussion and Advisory Agenda

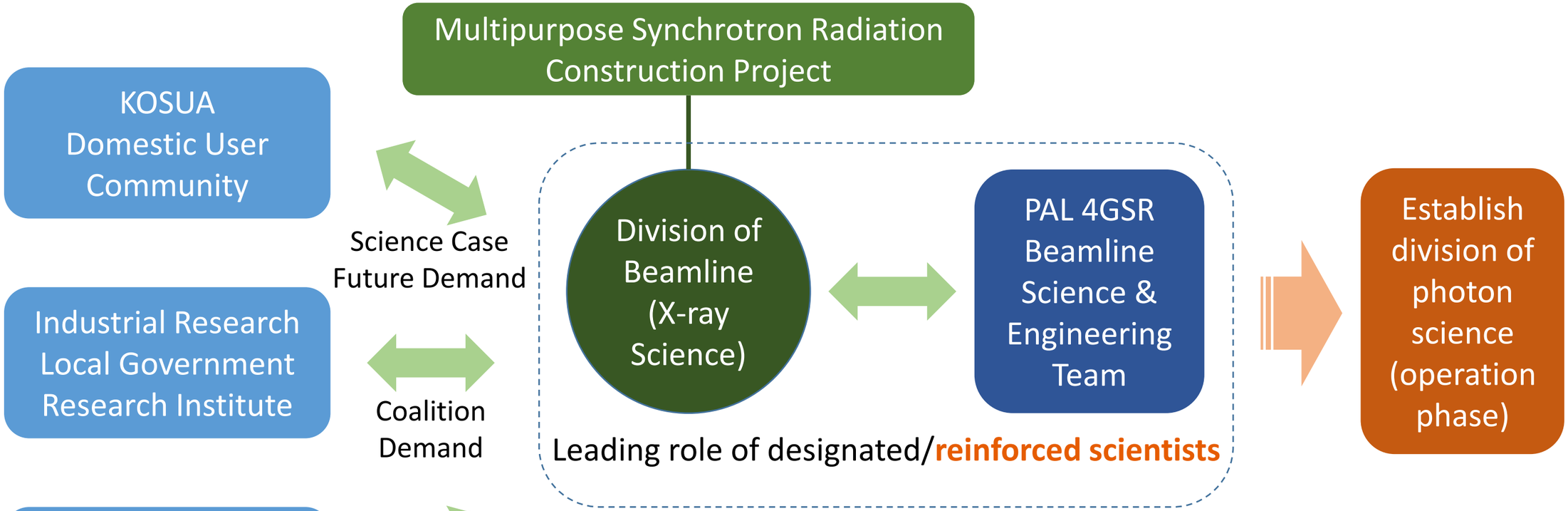
1. Expanding the beamline staffs
2. Project schedule and budget
3. Engage on the data science and AI
4. Expand Science Portfolio

1. Key Concept for debating beamline program



1. The project overall structure of beamline

◆ In 2025, we started a debating of long term beamline plan.



Unified and concentrated beamline group

- **Review and improve the beamline** and instrumentation plan
- Refine competitive differentiation of 1st and 2nd phase beamlines
- Debate and shape the 2nd phase beamline portfolio

1. Refine the specification and program of beamlines

Group	Beamline	Key Change
Bio Science	#1 Bio-SAXS (Bio-Pharma)	- Focused beam for various fluidics measurements - Shutter and DMM for time resolved MX
	#8 Bio nano crystallography	
Imaging	#9 High energy microscope	- Focus on the white beam imaging / more path filter
Coherent X-ray Science	#5 Coherent XRD	- BCDI, CDI oriented program - Fix the main goal of cSAXS for time resolving and XPCS - Modified main optics and focusing methods
	#6 Coherent SAXS	
	#10 Nano-probe (long)	
Material Science	#2 Material Structure Analysis	- Focus on the high energy diffraction - Simplify the monochromator / rapid tr-XAFS
	#7 Realtime XAFS	
Soft X-ray Science	#3 Soft X-ray Nanoprobe	- Update detailed layout of x-ray optics
	#4 Nano-ARPES	

◆ It is preparing to order the beamline optics

1. Two policies made finite successes

◆ **Beamline scientists** was reinforced* in this year (end of 2025)

- **Long-term** management and operation of **beamline program** (regular position)
- Review and discussion of beamline and instrumentation
- International exchange to sharpen the science program (i.e., workshop, …)

SAG / SAC

- Science Program (2030~2035)
- Competitive Differentiation
- Priority and Role
- International Science Advisory

Group	Beamline
Hard X-ray Science	#5 Coherent XRD
	#6 Coherent SAXS*
	#10 Nano-probe (long)*
Material Science	#2 Material Structure Analysis
	#7 Realtime XAFS*
Soft X-ray Science	#3 Soft X-ray Nanoprobe*
	#4 Nano-ARPES*
Bio Science	#1 Bio-SAXS (Bio-Pharma)*
	#8 Bio nano crystallography
Imaging	#9 High energy microscope (long)

* Reinforced in 2024

Beamline Scientists

- Review and technical proof
- Domestic user Community
- International Communication

1. Communication to extend our scope

- The 1st workshop for future science in next generation synchrotron (25~27 June)
  - Recent development of beamlines and experiments in next generation synchrotron

- The Science Advisory Committee – the 1st meeting (20 October)
  - Detailed aim for the domestic SAC
  - The working group activity for the early science case was planned

The 1st International Workshop (25~27 June 2025)

The 1st SAC Meeting (20 October 2025)

2. Researchers and Technicians (Agenda 1)

- Beamline staff will continue to expand in the next year
  - 11 scientist and technician positions will be secured from the government
  - Regular job positions are essential to find highly experienced staff
  - The unification of recruitment(human) and project(device) is essential **to develop long-term project tasks targeting the operation stage**

- **Lack of supply and flexibility of staff positions** is an obstacle to smooth improvement
  - Many technician position requires flexible hiring depending on the situation
  - 11 positions for the beamlines can only fulfill the minimum requirements
  - Even the limited opening on the accelerator part may be another long-term risk

- How can we manage these issues for the green-field 4GSR project?
  - Strong support from the **international collaboration**
  - **Collaborative expansion** with PAL and domestic accelerator and x-ray groups

2. Technical Assessment and Budget (Agenda 2)

◆ The target date of beamline projects changed to **the late 2030**.
- The delivery and installation have to be postponed
- The project schedule should be optimized in the next year
- The budget is the most doubtful risk under the total budget management system (**It was secured in mid-2024, and the target year was 2027**)

◆ We expect the detailed design can be improved in reasonable terms
- **SAC** will start discussing **the early science cases** and the required experimental station
- We have time for some minor corrections on the beamline until next year.

◆ The risks of beamline projects
- Cost increase may cause a severe problem at the final stage of the project
- What is the possible way for the reevaluation of the device budget ?

2. Data Science and AI application (Agenda 3)

◆ The AI has become **the most important agenda of Korean science policy**

- At the initial planning of the project in 2020~2021, the data science plan was barely discussed, and explicit budget and planning were relatively weak
- The project team is requested to establish a plan for the new synchrotron

◆ What is the current status of ML/AI frameworks for the X-ray measurement and analysis ?

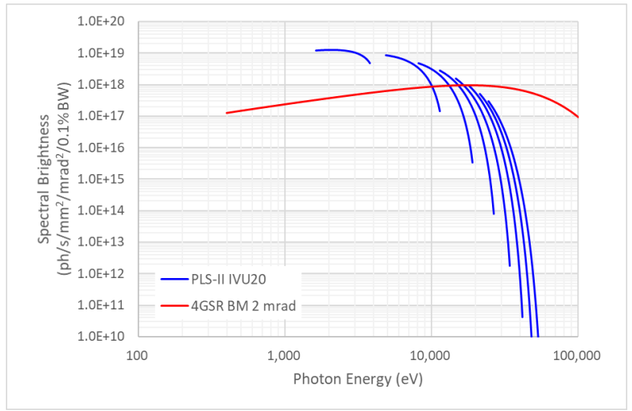
- How can we expand **the infrastructure, manpower, and utilization**?
- A satellite meeting for international collaboration (12/Nov/2025)
- **An important task of the project team in the next year**

Time	Speaker	Title
09:30 ~ 10:00	**Takaki Hatsui** Director of Control System and Data Infrastructure Group, RIKEN	SPring-8 Data-Center Initiative: Integrating Synchrotron and HPC Ecosystems for the Next Era of Photon Science
10:00 ~ 10:30	**Fazhi Qi** Director of Computing Center, Institute of High Energy Physics	The Scientific Data Infrastructure and Software for HEPS
10:30 ~ 11:00	**Jaehoon Cha** Leader of AI Data Analysis Group, Science and Technology Facilities Council	Advancing Automated Scientific Discovery at Rutherford Appleton Laboratory
11:00 ~ 12:00	Panel: **Takaki Hatsui, Fazhi Qi, Jaehoon Cha** **Seongyeol Kim (PAL-XFEL)** **Seong Hee Park (Korea Univ.)** **Seung-Hwan Shin (Korea-4GSR, KBSI)**	Panel Discussion on Data Science, AI/ML for 4th Generation Photon Sources

2. Beamline portfolio and Next phase (Agenda 4)

- The target date of beamline projects changed to **the late 2030**.
  - Can we provide the whole program of X-ray science, which is requested by various science communities?
  - If we are waiting and starting the next-phase project in 2031, the next beamlines will be delayed more
  - What kinds of **beamlines and science programs** are required, considering the current beamline portfolios?
  - **SAC may start debating** in the near future

- Ordinary x-ray techniques may be supplied using BM beamlines
  - ESRF(CRG), Nanoterasu(Coalition) model can be considered



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3. Discussion and Advice on the Agenda

- Increase staff for the operation stage
  - Accumulating required manpower within the limited policy environment
  - Establishment and transition to the unified organization for the operation stage

- Technical advice and target science program
  - Advice for the early science program development in the SAC activity in the next year

- Data science and AI strategy for the new synchrotron
  - The infrastructure, manpower, and utilization

- Beamline portfolio and Next phase
  - Advice for the detailed direction of current and future beamlines
  - Strategic advice for the 2nd phase beamlines


Thank You