

Development activities at PAL-XFEL:

- R&D for 0-D Silicon Detector
- PERCIVAL Detector Development (Collaboration)

January 12, 2026

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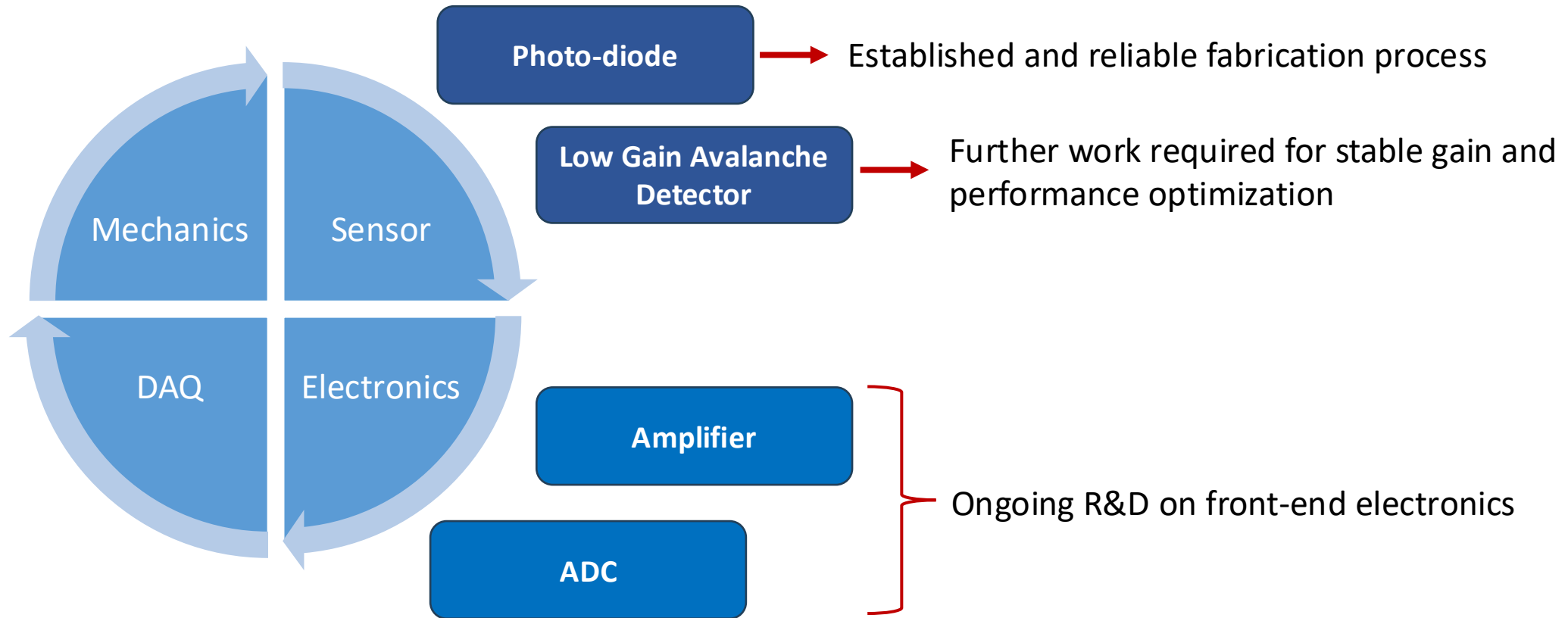
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XFEL Beamline Division

Pohang Accelerator Laboratory



R&D for 0-D Silicon Detector



→ Final Goal : Development of a Multi-channel silicon detector – Considering Collaboration

R&D for 0-D Silicon Detector

- The silicon sensors have been fabricated at Electronics and Telecommunications Research Institute (ETRI, Daejeon in South Korea)

PIN Photo-Diode

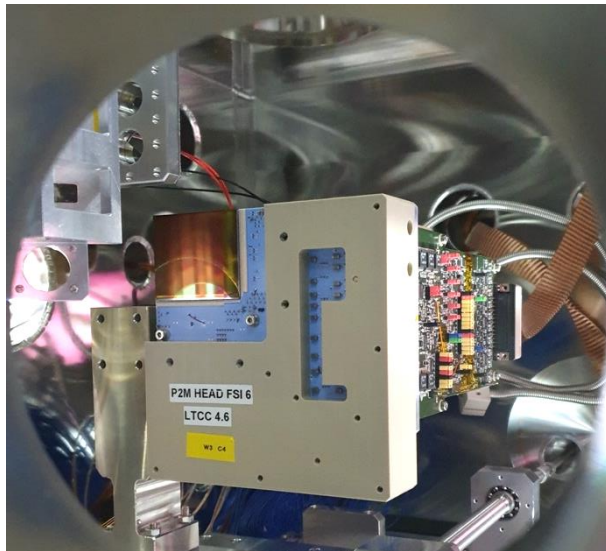
- **N-type high resistivity silicon wafer** with a 6-in. diameter, 500 μm -thick, and $\langle 100 \rangle$ -orientation have been utilized
- A total of three fabrication processes have been completed and, so far, there have been no significant issues with the fabrication parameters
- Packaging R&D using photodiodes is currently ongoing
- IEEE TRANSACTIONS ON NUCLEAR SCIENCE, VOL. 69, NO. 8, AUGUST 2022, "Performance Measurements of Photodiodes for X-Ray Detection"
- Nuclear Inst. and Methods in Physics Research, A 1045 (2023) 167598, "Development of photo-diodes for Pohang-Accelerator-Laboratory X-ray free-electron laser"
- Frontier in Physics, 11 (2024) 1328639, "X-ray beam test of fabricated photodiodes for Pohang-Accelerator-Laboratory X-ray free-electron laser"

Low Gain Avalanche Detector

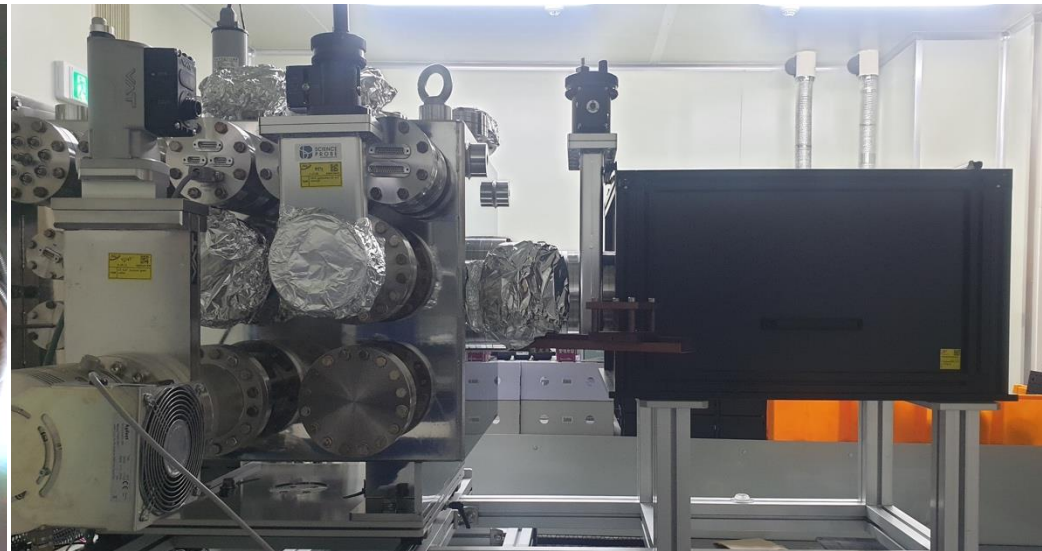
- **P-type high resistivity silicon wafer** with a 6-in. diameter, 400 μm -thick, and $\langle 100 \rangle$ -orientation have been utilized
- A total of two fabrication processes have been completed
- Chips from the second fabrication had been under characterization, and TCAD simulation had been in progress; however, both activities are currently on hold
- Nuclear Inst. and Methods in Physics Research, A 1080 (2025) 170790, "Fabrication and characteristics of low gain avalanche detector for X-ray"

Collaboration for PERCIVAL Detector Development

- At the PAL-XFEL soft X-ray beamline, APDs and MCPs are the primary detectors. 2D detectors are used selectively: AXIS-SXR for scattering and PI-MTE for FTH experiments.
- For a fast, high-dynamic-range 2D detector at the soft X-ray beamline, we are participating in the PERCIVAL development collaboration



V1-FSI detector head



Set up for detector characterization and calibration

- Calibration work is being performed, and analysis of test data (v1-FSI at tender X-ray region) is in progress
- Contribution to re-spin sensor testing is planned
- A beam test using a BSI detector at the soft X-ray beamline is planned in the second half of this year