Report from the 7th Meeting of the KEK Science Advisory Committee

24-26 February, 2026

1 Executive Summary

The 7th meeting of the KEK Science Advisory Committee took place over video-link from February 24 to 26, 2026. The agenda of the meeting and the membership of the SAC are provided in the Appendices. The mandate to the SAC for this meeting is shown in Fig. 1.

Dr Toshi Azuma has been appointed the director of QUP, and expected significant reform of the quantum centre. The aim is to develop a range of fundamental symmetry measurements with a strong overlap with KEK's technology expertise.

The D-G reported that "Sudden Beam Losses" (SBL) at SuperKEKB had been largely identified and fixed, and that the target of 1 ab^{-1} was aimed for by summer 2026.

He also reported that J-PARC had achieved stable operation of MR and MLF, with beam power of 900 kW for fast extraction and 92 kW for slow extraction. With good progress towards 1.3 MW MR-FX and 100 kW MR-SX, Hyper-K is on schedule for data taking in 2028.

The D-G also reported that the Photon Factory beam lines BL-11a and BL-11b are operational, representing the beginning of multi-beam operation at the KEK PF. He asked that the SAC review the new proposal for the next synchrotron light facility - the MB-LINQ. The latest concept for this proposal was presented to the SAC.

The D-G reported on the continuing struggle to obtain enough operational funding to satisfy the needs of KEK's large array of activities. In particular, the J-PARC proton beam facility will need to serve the highest priority program, the Hyper-K neutrino beam, from 2028. It was stated that even with the hoped-for funding to operate the J-PARC proton beam for 6 cycles (approximately 6 months running) per year, of which the neutrino beam would receive 5 cycles, even optimistically that leaves only 1 cycle for the remaining program.

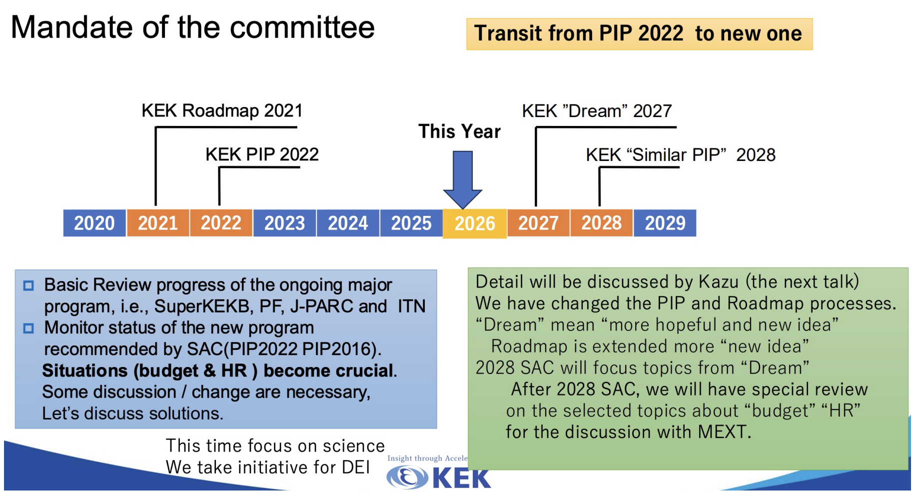

Figure 1: D-G Mandate to the KEK-SAC, 2026

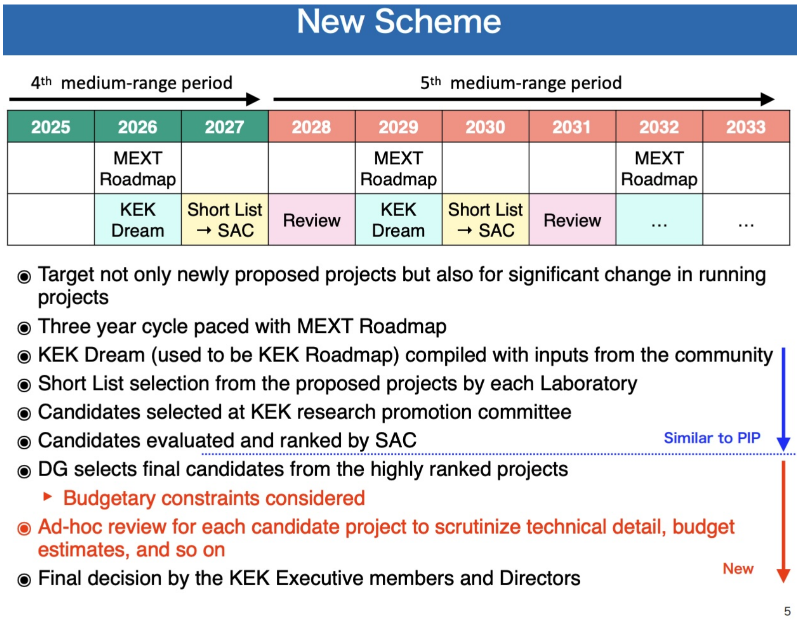

Figure 2: New Scheme for Project Selection - from K. Hanagaki

Kazunori Hanagaki (Executive Director) highlighted priorities of MEXT for the large-scale frontier science facilities which includes the KEK Super B factory, the "Origin and Evolution of the Universe and Matter Investigated by High-Intensity Proton Beams (J-PARC)", "Elementary Particle Experiments Using the High Brightness Large Hadron Collider (HL-LHC)", and "Nucleon Decay and Neutrino Oscillation Experiments Using a Large Advanced Detector (Promotion of the Hyper-Kamiokande Project)". The SAC takes note of these priorities in its deliberations.

The discussions on the photon factory replacement prompted discussion of the future of the Tsukuba campus beyond SuperKEKB. The SAC encourages a broad, structured discussion of the future of the KEK Tsukuba Campus.

Dr. Hanagaki presented a figure of the previous cycles of KEK Roadmaps (2016, 2021) and Project Implementation Plans (KEK PIP 2017, 2022) (see Figure 2). He described the foreseen change to a three-year cycle, synchronised with the MEXT Roadmap. It will consist of the "KEK Dream" (name to be reviewed), compiled from inputs from the community, followed by short-listing of projects by each Laboratory, and selection by the KEK Research Promotion Committee.

This selected list will be evaluated and ranked by the SAC, before going back to the D-G, who selects final candidates from the highly-ranked projects, with consideration of budget and technical constraints. The final decision on project selection is then taken by the KEK Executive Members and Directors.

In view of the extreme resource constraints, the SAC applauds this update to the planning process.

The new process will have the SAC review the 2026 shortlisted "KEK Dream" projects at their 2027 KEK-SAC meeting.

As will be seen below, there are concerns of continuing loss of beam time due to breakdown of aging equipment across the KEK program.

Following the directions of the D-G to concentrate on specific subjects, this year's report breaks to some extent from the previous layout to reflect the specific areas upon which we focused. However, comments and recommendations are made in additional areas that the SAC deems important.

1.1 *Observations*

- The laboratory continues to suffer serious problems due to insufficient operations funding. The D-G must continuously negotiate with MEXT for Supplemental funding in order to keep the laboratory program operational.
- At KEK the various Directors have considerable autonomy, not only for the experimental programs they oversee, but also for making independent proposals for the funding of (often large) facilities. However, providing for operational requirements remains the responsibility of the Director-General.
- It is unclear to the SAC who makes the final decisions about the overall program. Such decisions are particularly difficult to make, given the diversity of the KEK program, the limited overall funding, and the need to balance operations with investment in new facilities.
- In the opinion of the SAC, the Director-General would ideally have final control over the laboratory program, especially in consideration of limited resources and with an overview of both the current and long-term plans for the laboratory.
- In the "New Scheme" described in the presentation of the Executive Director (see Figure 2), there appears to be potential for the D-G to take stronger overall responsibility for the KEK program. The role of the D-G would be strengthened if the qualification "subject to the approval of the Director General" were added to the last step described in the document: "Final Decision by the KEK Executive members and Directors *subject to the approval of the Director General*".

1.2 *Recommendation*

1. The SAC asks KEK to provide a report on the planned schedule for upgrading aging components that risk future reliability issues across the KEK programs.

2 Accelerators

2.1 *Observations*

SuperKEKB is in Phase3 Run2 operation since January 2024, following a long shutdown, during which major maintenance and upgrades were carried out in the main ring, linac, damping ring, and beam transport lines to mitigate sudden beam loss (SBL) events, improve HER injection efficiency, and reduce radiation backgrounds.

In the 2025c run, the machine reached a peak luminosity of $3.4 \times 10^{34}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$ with $\beta_y^* = 1.0\,\mathrm{mm}$ and accumulated a total delivered/recorded luminosity of $681/599\,\mathrm{fb}^{-1}$.

During operation in 2025, SBL events were significantly reduced through the VAC-SEAL removal, and the injection efficiency increased. However, SBL events with pressure bursts in the LER wiggler section remain. Several major issues were encountered, including an abort kicker malfunction, QCS quenches, liquid helium level fluctuations in QCS-L, and a global dipole (B2P) power supply trip. These issues were addressed. The QCS-L helium level is being managed with a possible repair after the 2026b run.

The 2026ab run has resumed with the highest priority remaining the achievement of more than $1\,\mathrm{ab}^{-1}$ total recorded integrated luminosity, alongside plans to increase beam current and luminosity further toward the $10^{35}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$ region. The strategy to achieve the operation target in 2026 includes establishing stable operation at $5 \times 10^{34} cm^{-2}s^{-1}$, gradually increasing the beam currents to reach $6 \times 10^{34} cm^{-2}s^{-1}$, with the primary target of integrated luminosity $> 400 fb^{-1}$, and 1 ab^{-1} in total. This was supported by the SuperKEKB-Belle II Joint Review, in which integrated luminosity and operational efficiency are treated as primary objectives. The long-term SuperKEKB upgrade route toward higher luminosity is dependent on higher beam currents, further β_y^* reduction, and major IR/RF upgrades planned around LS2, with the LS2 timescale itself appearing later than earlier expectations. There will also be an increasing reliance on present hardware to perform reliably for a longer period.

J-PARC demonstrated strong performance across the RCS and Main Ring (MR), with the RCS operating at the design beam power of 1 MW and stably delivering beam to both MR and MLF, while the MR achieved 900 kW in fast extraction (MR-FX) for neutrino operation and 92 kW in slow extraction (MR-SX) for the hadron hall, including a successful SX demonstration at 101 kW and improved extraction efficiency through adoption of second-harmonic RF and optics optimization. The FX cycle was shortened from 1.36 s to 1.28 s, enabling 830–900 kW user operation, and beam loss was significantly reduced via new arc optics and operating-point tuning. Mid-term plans targeting 1.3 MW FX and 100 kW SX are steadily progressing, alongside upgrades toward 1.5 MW RCS operation for a second target station and preparation for linac 50 Hz operation, positioning J-PARC for further beam power increases and support of next-generation experiments.

The upgrade from 25 to 50 Hz repetition rate (successfully demonstrated in an integrated systems test without beam) will allow for an additional irradiation facility. A possible future upgrade for J-PARC could be the development of multi-MW beams and the addition of heavy ions, with the goal of exceeding the FAIR event rates by an order of magnitude.

Linear collider development at KEK continues within the broader international framework of the ILC Technology Network (ITN), which coordinates accelerator R&D activities across multiple laboratories and institutions. The program benefits from technical experience accumulated in existing facilities such as SuperKEKB and ATF, which serve as practical platforms for developing and validating beam physics concepts relevant to a future linear collider. Infrastructure for SRF development, cryomodule assembly, and accelerator component testing is being strengthened, including facilities associated with the Innovation Center for Applied Superconducting Accelerators (iCASA). In parallel, advisory board reviews and international workshops provide regular evaluation of progress and facilitate coordination between national programs and global R&D efforts.

R&D is progressing within the ITN as part of Japan's MEXT-ATD framework (JFY2023-2027), focusing on three critical technologies: SRF, positron source, and nanobeams. In JFY2025, six single-cell SRF cavities achieved $E_{\mathrm{acc}} \geq 35\,\mathrm{MV/m}$, $Q_0 \sim 1 \times 10^{10}$. Five 9-cell cavities were produced, including the world's first medium-grain 9-cell cavity, and progress was made toward cryomodule design. The positron source program advanced rotating-target heat-load tests and capture-linac component fabrication, while nanobeam R&D at ATF continued equipment upgrades and international collaboration to realize beam sizes below 37 nm and long-term stabilization. Supported by approximately 6.6 oku-yen per year and strengthened by global participation from Europe and Korea, the program remains on schedule, with JFY2026 and beyond focused on integrating components, demonstrating nanobeam stability, and preparing for next-stage cryomodule and source system validation.

KEK is maintaining a portfolio of future accelerator initiatives beyond current operating facilities. These include participation in international collaborations on HL-LHC, future collider studies, and continued development of accelerator technologies that could support next-generation facilities. Activities include R&D on beam sources, advanced accelerator components, and beam control techniques. These programs aim to provide the technological basis for potential future projects in high-energy physics as well as other accelerator-based scientific fields.

The SRF technology program focuses on improving cavity performance, reliability, and manufacturability for future accelerators. Progress has been made in cavity fabrication techniques, surface treatment procedures, and performance testing, with several cavities reaching gradients around the levels required for linear collider applications. Development work also includes cryomodule design, ancillary components such as tuners and couplers, and the infrastructure needed for cryomodule assembly and testing.

Nanobeam research at ATF continues to play a central role in KEK's accelerator technology program. Upgrades to the ATF beamline, including improved magnets, beam size monitors, and control systems, are intended to support the generation and stabilization of extremely small beam sizes relevant for linear collider applications. These studies also provide valuable data on beam dynamics, wakefield effects, and beam stability in high-brightness accelerator systems.

The impact of the three technological areas on future colliders, both circular and linear, as well as for industrial applications justify the continuation of the R&D.

In view of the success of the program to date, the SAC encourages the KEK management to seek a continuation of the program beyond 2027.

2.2 *Comments*

The SuperKEKB team has demonstrated sustained and commendable effort in improving accelerator performance and stabilizing operations in support of the high-energy physics program, and has also clearly taken the recommendations of the previous SAC seriously, as reflected in the implemented hardware upgrades, operational adjustments, and structured planning for the current running period.

The nano-beam scheme and $\beta_y^* = 1.0\,\mathrm{mm}$ optics are now operationally established, with continued luminosity growth and a significant reduction in sudden beam loss (SBL) events, demonstrating that the fundamental machine performance at the present level is sound. Integrated luminosity is presently limited by subsystem reliability and fault propagation more than by beam-beam or optics constraints, as evidenced by the abort kicker malfunction, QCS quenches, cryogenic liquid helium level instability, external power-supply disturbances, and residual pressure bursts in wiggler sections. These events show that machine protection logic, cryogenic control robustness, infrastructure coordination, and collimation hierarchy require further hardening to reduce downtime and protect critical components. Improved operational stability, protection systems, and cross-system coordination may yield larger gains in annual recorded luminosity than aggressive parameter pushes, implying that reliability enhancement must take priority over further luminosity increases toward the $10^{35}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$ regime.

The injection of the SuperKEKB HER remains the dominant performance bottleneck. While hardware upgrades have expanded operational flexibility, the demonstrated robustness under relaxed optics does not yet translate into full confidence at $\beta_y^* \approx 1$ mm and a higher beam current. Given that luminosity scaling critically depends on both injection quality and beam–beam performance, progress in these areas must be demonstrated under realistic operating conditions before more aggressive parameters are adopted.

J-PARC has reached a mature high-power operating regime, achieving 1 MW operation in the RCS, 900 kW fast extraction (MR-FX), and 92–100 kW slow extraction (MR-SX), with successful cycle shortening to 1.28 s and significant beam-loss reduction through optics optimization and second-harmonic RF adoption. These results demonstrate strong control of beam dynamics and validate the upgrade strategy toward 1.3 MW FX and 1.5 MW RCS.

Annual beam time has, however, been limited, and a number of system failures have occurred. A more systematic program to address aging and obsolete components has now been implemented. Progress in spares readiness and prioritized procurement have been implemented in response to previous review recommendations. However, budget constraints prevent comprehensive coverage of all critical systems.

The most critical current and future issue is reliability at higher beam power, including component lifetime, robustness of the neutrino target and horns, and aging infrastructure, which will increasingly limit annual integrated beam delivery and optics performance.

A reliability-focused approach, emphasizing planned equipment replacement and risk-managed power scaling, will be essential to sustain stable multi-hundred-kilowatt operation and realize future multi-megawatt ambitions.

The development of multi-MW beams and heavy-ion capabilities will need many years and significant resources. A strategic decision will be needed on the most promising path forward.

The ILC accelerator program has made steady technical progress, with encouraging results in high-gradient single-cell SRF cavity performance, positron source component test (20 kW test of rotating target), and nanobeam infrastructure upgrades at ATF. The addition of 6 young researchers to the team strengthens the ILC effort significantly.

The ILC program has taken note of the European Strategy Group's recommendation for the Future Circular Collider (FCC-ee) as CERN's future large facility in which opportunities for KEK expertise abound. It is also noted that the advanced development of the ILC forms an important basis for the Linear Collider Facility (LCF) at CERN to maintain a credible alternative to the FCC-ee should one be required. The SAC encourages KEK to maintain its central expertise in core e^+e^- collider technologies. Furthermore, the SAC encourages developments in the iCASA to apply this expertise in industrial and medical applications.

The current activities remain primarily focused on advancing technology readiness rather than addressing the broader questions of project realization. As the technical foundations continue to mature, increased attention will need to be given to system integration, industrialization feasibility, and alignment with the international high-energy physics roadmap. Sustained international engagement will remain essential for ensuring that progress in accelerator technology can effectively support future collider initiatives.

Maintaining a strong program in future accelerator concepts is important for ensuring that KEK remains a key contributor to global accelerator developments. The current activities provide opportunities to test new technologies and to develop expertise that will be required for future facilities. At the same time, these programs must balance long-term R&D objectives with the operational demands of existing facilities such as SuperKEKB and J-PARC.

Progress in SRF technology is an important component of KEK's accelerator R&D program. High-gradient SRF cavities are a key enabling technology for many future accelerators, including other advanced facilities as well as linear colliders. Continued collaboration with international partners will be essential for maintaining competitiveness and for sharing the significant technical challenges associated with large-scale SRF systems.

The ATF program remains an important experimental platform for exploring advanced beam dynamics concepts. Achieving and maintaining nanometer-scale beam sizes is a fundamental challenge for future accelerators, and the work at ATF contributes significantly to understanding these issues. Continued international participation in the ATF program also strengthens collaboration in the global accelerator community.

2.2.1 *Recommendations*

1. For SuperKEKB near-term operation, the primary focus should be on improving machine reliability and protection-system robustness, since reducing fault-induced downtime will increase annual integrated luminosity more effectively than increases in peak luminosity.

2. Within the ITN program, it is necessary to define clear milestones for system-level demonstrations of key accelerator components, including cryomodules, positron source subsystems, and beam-delivery elements, for the development of integrated technical solutions beyond individual component performance.

3. For J-PARC, it is necessary to develop a more explicit long-term reliability strategy for sustained high-power operation, including renewal priorities for aging accelerator components, infrastructure interfaces, and maintenance-critical systems, so that increasing beam power does not outpace the robustness of the facility.

4. Continued international engagement, being a hallmark of KEK's status, should continue in accelerator technology for future colliders, including SRF technology and the further development of the ATF facility. International engagement should include continuing KEK's central expertise in linear collider development in the LCF initiative and also pursuing opportunities at FCC-ee.

3 Particle and Nuclear Physics

3.1 SuperKEKB and Belle II

See the Accelerator section above.

3.2 HL-LHC and ATLAS

KEK is to deliver 6 D1 separation dipoles to CERN for the HL-LHC upgrade. Successful development of 3 short dipoles has been completed at KEK. Cold tests of 5 magnets at KEK were successfully completed. Remaining magnets will be tested in 2026. 3 cold masses have been delivered to CERN. KEK is also participating in the IT-String test at CERN.

In parallel, KEK physicists are active in ATLAS upgrades for operation at the HL-LHC.

3.3 ILC

See the Accelerator section above.

3.4 T2K and Hyper-Kamiokande

Observations The Japanese long-baseline neutrino program is world-leading and represents a flagship of the Japanese HEP program. The main responsibilities of KEK/J-PARC for T2K and HK are the beam and the near detector complex.

T2K is running well and is benefiting from the continued efforts at J-PARC to increase the beam power, which is now approaching 1 MW stable operation. The upgraded ND280 detector is now taking data as part of the T2K program. This will allow for improved and detailed understanding of neutrino interactions, which is important science in its own right, as well as being a central component of the control of systematic errors in the long-baseline oscillation measurements.

T2K plans to double its data set before the start of HK operation, but expects to receive only about 85% of the originally planned protons on target. T2K's current results exclude CP conservation at 90% CL, but NOvA results do not show a strong preference for CP violation.

The J-PARC beam power increases are closely following the decade-long plan, and the prospects to achieve the goal of 1.3 MW by the start of Hyper-K operation appear good. Long-term reliability for high accelerator uptime remains a concern, due to limited resources. See Section 2, for further discussion of these issues.

Planning for the transition from T2K to HK is proceeding, with an MOU nearing completion for the transfer of ND280 to HK in 2028.

The HK IWCD is a crucial element of the HK program, needed to achieve the required systematic error budget. Ground has now been broken for the IWCD facility, which is on track to be delivered in early 2028. Assembly and commissioning of the detector will follow and the start of data taking is planned to be at about the same time as the start of HK operations. Funding for some elements of the IWCD, which is the responsibility of the HK Collaboration, is not yet secured, which represents a potentially significant risk that could delay the start of IWCD operations. Limited personnel resources, especially for engineering, also presents a risk for the timely completion of the IWCD.

Construction of HK is proceeding well, with only modest delays relative to the original schedule. Tank construction is under way, PMT production and electronics preparation are in progress.

HK plans for 10^7 seconds of physics running (6 cycles) per year. This will be challenging to achieve due to budgetary constraints (power bill) and reliability issues. To the extent that delivering this much beam for HK is the top priority, the hadron program using the slow-extracted beam will suffer.

HK has strong CP violation discovery potential and KEK puts priority on making this discovery. Once CPV has been definitively established, priorities for beam time at J-PARC may be modified.

3.4.1 *Comments*

The KEK SAC congratulates KEK/J-PARC and the T2K and HK collaborations on both their world-leading work and the excellent progress toward maintaining leadership in neutrino physics. Japan has led the world in neutrino research and clearly aims to continue this. With HK planning to start data taking in 2028, well ahead of the rival DUNE experiment, the prospects for continued Japanese leadership are strong.

It is very important to continue to support the last years of T2K running and to achieve a timely start of HK, together with the necessary investment in the J-PARC complex to provide a reliable 1.3 MW beam to maintain Japanese leadership. However, the limited budget set aside for maintenance and reliability improvements is a concern. It is important to recall that the most relevant metric is total protons on target (POT), not maximum beam power, and maximizing POT requires highly reliable and efficient beam delivery.

T2K should work with NOvA to understand the apparent differences in results. Joint analyses can shed light on the source and nature of systematic errors, which will be critical to guide the HK research program. The complementary nature of T2K and NOvA (different baselines, beam energies, detector technology) can be powerful in identifying systematic effects that might be "invisible" in analyzing one experiment alone.

The design of the IWCD is proceeding well. Nonetheless there are significant risks that could delay the successful completion of this critical detector and KEK, as host lab, should ensure that adequate resources are provided to enable timely completion.

3.4.2 *Recommendation*

1. Provide the necessary support to ensure that IWCD operations can start together with HK operations.

3.5 Hadron Hall Physics Program

The Hadron Experimental Facility (HEF) at J-PARC utilizes a slowly extracted 30-GeV proton beam and provides a variety of secondary particle beams such as pions, kaons, and antiprotons for particle and nuclear physics experiments aiming to understand strongly-interacting particle systems from quarks to neutron stars. In addition, a small part of the primary proton beam is split to the B-Line and delivered directly to hadron physics experiments.

The HEF facility comprises a community of 788 users of which 411 are foreigners, comparable to the larger international collaboration memberships of the BELLE-II, T2K and Hyper-Kamikande callaborations.

The facility has provided many important scientific results, including:

- As part of dedicated searches for new physics beyond the standard model, the KOTO experiment observed rare CP Violating decays within dedicated searches for new physics beyond the standard model,

- Discovery of charge symmetry breaking in ΛN interaction observed by comparing the masses of the hypernuclei ${}^{4}_{\Lambda}$H and ${}^{4}_{\Lambda}$He, which are very different from the charge symmetry preserved in mirror nuclei.

- The measurement of strong interaction effects in Kaonic ^{3}He/^{4}He systems using superconducting transition-edge sensor micro-calorimeters has achieved 10 times higher precision. As result of this breakthrough in 2024 the Koshiba prize was given to the researchers.

- The high-precision measurement of hyperon-nucleon scattering (Σp) made with improved angular coverage and high statistics confirms the large repulsive force between quarks due to the Pauli effect, and stimulates theoretical efforts to go beyond NLO in the chiral EFT approach.

All these achievements have been accomplished together with a large training effort, including 260 Master's and 68 PhD projects.

In view of this list of successes, an extension of the Hadron Hall was considered as the highest priority of PIP2022. This extension project included several upgrades:

- A second target station and new secondary beamlines, including the High Intensity High Resolution (HIHR) beamline;

- Systematic Λ hypernuclear spectroscopy using targets up to Pb with missing-mass resolution of 0.4 MeV/c^2 (P84);

- K10 beamline to provide mass-separated secondary beams of up to 10 GeV/c;

- Polarised Λp scattering;

- KOTO-II proposed to follow KOTO in measuring the CP-violating decay $\mathrm{K}_L^0 \to \pi^0\nu\bar{\nu}$ with sensitivity to test the SM prediction in a new K_L beamline;

- An upgrade to the B-Line to provide a high-momentum (up to 20 GeV/c) unseparated charged secondary beam line for charmed baryon spectroscopy.

However, it is noted that in view of budget constraints, the extension to the hadron hall, long considered an important requirement for the future program, falls outside the foreseen KEK budget and is no longer supported.

Furthermore, with limited operations funding and with the high cost of electricity, the HEF program will be reduced to approximately 1 cycle per year, a very serious limitation for the hadron hall program.

3.5.1 *Comments*

The MR beam running outlook is somewhat uncertain due to the necessity of requesting a supplemental budget for high electricity costs. For JFY2026 funding is currently secured for about 4 cycles; efforts are on-going to increase beam time. For JFY2027 a plan is under discussion to run in FX mode (serving the neutrino beam) for 4 cycles and in SX mode (serving the hadron hall) for 1 cycle. HK is planned to start physics data taking in June 2028 and MEXT would like to see 5 running cycles allocated to the HK program. For JFY2028 and beyond, 5 cycles for FX and 1 cycle for SX are planned.

It is proposed that after the start of HK physics data taking in June 2028, J-PARC MR will run for 5 cycles per year until CP violation can be established with at least 5σ. In case of maximal, or near-maximal CP violation, and optimal operations and efficiency, this is estimated to take 2 to 3 years. Under less optimal circumstances, 5-6 years of data taking may be required.

This scenario implies, if funding will be available for 6 cycles, approximately 1-cycle/year for SX running serving the hadron hall experiments in the five-year period JFY2026 to

JFY2031. There may be supplemental funds that can extend SX running, but this is far from guaranteed.

Such a severe curtailment of beam-time, for a prolonged period of time, will likely have a profound effect on physics programs that depend on the MR SX beam. In this SAC meeting, there was no discussion of plans of re-evaluation of the hadron hall program in view of this prospect.

COMET is scheduled to be ready for data taking in January 2028. While COMET is also housed in the hadron hall, the C-beamline for COMET cannot run concurrently with the A and B-lines that are needed for the hyperon and kaon programs.

In view of the considerable time since the 2024 review, the SAC suggests that an update of the project status be presented at its 2027 meeting.

KEK and J-PARC should engage in in-depth discussion with the Hadron Hall programs (Hyperon Program, KOTO and other kaon experiments, and COMET) in view of the likely severe curtailment of available beam-time in the next 5 years. These discussions should cover not only the next 5-year period and possible running scenarios during that time, but also the outlook for these programs beyond 2032.

3.5.2 *Recommendations*

1. That an open and formal discussion among the different approved experiments be held, under the auspices of the JPARC PAC, to understand and agree on a common and acceptable set of priorities based on the impact of the physics program and readiness for data taking and analysis.

2. KEK and J-PARC should engage in in-depth discussion with the Hadron Hall programs in view of the likely severely curtailed available beam-time in the next 5 years. These discussions should cover not only the next 5-year period, and possible running scenarios during that time, but outlook for these programs beyond 2032.

3. That KEK provides support for the Hadron Hall users to carry out renewed optimization studies for the future of their program. The community could consider using the coming years to prepare the hall extension if some funds are identified.

3.6 QUP

A new director of QUP, the center for Quantum of the Universe and Particles, has been appointed with the vision to build up QUP as a new research hub in Japan for fundamental basic science using quantum technologies. Leveraging KEK's core technological expertise and international network, QUP aims to become a global quantum physics experimental hub. Three research directions are the initial primary focus: fundamental forces and hidden sector studies, the search for dark matter including axion searches, and studies of gravity. Technologies to be deployed will be based on superconducting and semiconductor detectors. A significant portfolio of experiments has already been established. A new building has been dedicated for quantum-based sensing experiments, enabling supersensitive measurements with low noise and low background. This effort is a very promising refresh of QUP and strongly supported.

The new vision and research program is well suited to KEK, aiming to explore physics at the highest energy scale with precision physics using quantum technologies. New projects centered around superconducting and semiconductor detectors to explore fundamental forces, hidden sectors, light dark matter including axions, and gravity with tests of CPT and the weak equivalence principle within one organization gives QUP a unique edge and ample opportunity to explore new exciting physics and technology. The use of a slow-muon beam to study muonic atoms is quite interesting and has already produced exciting new results. Trainees will have access to first-rate researchers and acquire handson experience with cutting-edge technology. Robust industry partnerships are already established and likely to continue.

3.7 Theory Center

The appointment of three new staff members is a welcome realization of the renewal that SAC recommended in 2025. The SAC applauds this staff renewal for theory.

A requirement for the Theory Center and across the KEK program is advanced scientific computing. A major upgrade was launched in 2024, but demand already exceeds capacity. A four-year upgrade cycle is the goal. However, it appears challenging to meet the resource needs within a constant budget.

3.8 WAKO Nuclear Science Center

Low-energy nuclear properties of exotic species are studied at the Radioactive Beam Facility (RIBF) at RIKEN where KEK runs the WAKO Nuclear Science Center. This Center aims to explore the nuclear chart with the KEK Isotope Separation System (KISS) dedicated to high-precision mass measurements using the MRTOF mass spectrometer. This meter-long device effectively measures, by using multiple reflections, path lengths of more than 100 m, allowing for accurate mass measurements with precision well below 1 part-per-million. KISS is the first ISOL (isotope Separation On Line) facility using multi-nucleon transfer (MNT) reactions to reach even more neutron-rich species. The main focus is to measure the half-lives, masses and beta-decay schemes of the so-called waiting-point nuclei with the neutron magic numbers N=50, 82 and 126 that are produced in the r-process. With KISS one is interested in characterizing the neutron-rich nuclei around N=126 by using the various nuclear spectroscopic techniques available in the facility in a combination of MNT reactions. As part of this program, a new isotope of uranium (^{241}U) was discovered in 2023. The amount of results obtained is large and the list of publications is remarkable.

Due to the successful results of KISS, an upgrade was planned. The so-called KISS 1.5 project was launched in 2024 and is progressing well with the installation of a He gas-cell chamber, a variable mass range separator, and a Multi-Reflection Time-of-flight (MRTOF) spectrometer. On-line experiments with a prototype of the He gas-cell demonstrated an increase of extraction efficiency by a factor of 10, and remain constant up to beam intensities of 100 pnA. The decay spectrometer can be moved downstream of the MRTOF-MS, and preparations are underway to identify multiple mass nuclides in the MRTOF-MS and perform decay spectroscopy simultaneously. This will increase the measurement opportunities in one measurement period. As a result, the measurement efficiency of KISS-1.5 will be improved by a total factor of about 100 compared to KISS. In addition, the energy resolution of the alpha-TOF detector placed in the MRTOF for the spectrometry of super-heavies has been greatly improved.

3.8.1 *Recommendations*

The SAC commends the group for their progress and would like to hear more about the new results obtained at the WAKO Nuclear Center in the 2027 KEK SAC meeting.

4 Material and Life Science

4.1 Institute of Materials Structure Science (IMSS)

4.1.1 *Observations*

- The number of students enrolled in the Sokendai program in this discipline is relatively small compared to other disciplines. Competition with prominent universities is cited as one of the reasons.

4.1.2 *Comments*

- While it can be argued that studying at beamlines is more demanding than working in university labs, the decline in student numbers after COVID-19 is alarming. KEK's materials science might have lost its appeal due to the aging facility or the shift in scientific focus. Before reaching a quick conclusion and implementing plans, it is important to understand what is driving the trend.

4.1.3 *Recommendations*

1. SAC recommends that KEK gather hard data to explain the loss of students after COVID-19. This might include comparing the number of students with those at other facilities, old and new.

4.2 PF and Multi-Beam Proposal

4.2.1 *Observations*

1. Two presentations covered aspects of the future direction for photon sciences at KEK. The first of these was a report on the Institute of Materials Structure Science (IMSS), while the second was on the planned Multi Quantum Beam Facility.

2. Summary responses were provided to the 22 recommendations given in the 2025 SAC report.

3. The Tsukuba campus includes the Photon Factory (PF), operating 48 beamlines on two rings, and the Slow Positron Facility (SPF), operating a single beam with four end stations. A 100 keV cryo-electron microscope was recently installed.

4. The new multi-functional R&D beamline is now operational, having delivered first beam in October 2025 and simultaneous irradiation with two beams (hard and soft X-rays) in late November. Examples of two first experiments were shown.

5. Evidence was shown of increasing demand for multi-probe experiments, based on the number performed in FY2023 (95) and FY2024 (116). These include sequential application of synchrotron radiation, positrons, neutrons, and muons. Most experiments use two probes, while a few use three. Application areas are highly diverse.

6. The MB-LINQ (Multi Quantum-Beam facility with superconducting linac for material-quantum life sciences) concept is a reworking of the PF-HLS plan taking into account recommendations of the previous SAC report.

7. MB-LINQ targets integrated use of multiple probes using a multi-GeV superconducting linac, a small electron storage ring, an intense positron source, and high-harmonic laser sources.

8. The initial steps for MB-LINQ will be a 2.5 GeV superconducting linac supporting a soft X-ray free electron laser, a ring-based soft X-ray source, and positron facility. It aims to enhance simultaneous hard/soft X-ray capabilities at the PF.

9. A set of brightness curves where presented for Japanese X-ray facilities, showing the dominance of SPring-8 and NanoTerasu over the other operating light sources in Japan. An updated presentation showed that the proposed MB-LINQ facility would be significantly brighter in the low energy range.

10. A preliminary facility concept was shown, including long-pulse and CW options for a multi-GeV linac and a storage ring that operates alternately at 0.75 or 1.5 GeV. The facility is envisioned to include positron and laser sources.
11. PF and PF-AR availability is very high, just shy of 99%, with operating hours of 3600 and 2400 hours in FY2025, respectively.

4.2.2 *Comments*

1. The SAC recognises the additional effort put into this proposal following discussion and recommendations last year.
2. Tsukuba has over 50 national laboratories providing a ready-made user community just a short drive away. This is well demonstrated by the fact that the aging Photon Factory still serves over 3000 users.
3. The brightness curves for Japanese X-ray sources show a need for higher-brightness sources of soft X-rays. This suggests that the emphasis on soft X-rays is appropriate for MB-LINQ. However, we note that the curves do not include Japanese FEL facilities.
4. The MB-LINQ proposal builds on the IMSS's long experience with positron surface science, and the combination of FEL, SR, positrons and high harmonic lasers would provide a unique capability. It is pleasing to see a consortium of Japanese research institutions have joined the project.
5. The availability of a dedicated full-energy linac injector for the proposed storage ring should allow operation in swap-out mode, which supports pushing the ring design to achieve very low emittance. Technologies developed for the ILC damping ring injection system may have applications here.
6. Many working examples exist of FEL-driver linacs using concepts similar to those shown for MB-LINQ.
7. Even at this stage, MB-LINQ plans should include consideration of reliability and availability in the design. This might include a dual-gun arrangement and the ability to run without one cryomodule while maintaining beam energy.
8. Development of a superconducting CW electron gun is an active and challenging area of research. SLAC and DESY are developing such guns and SLAC, for example, has recently shown promising results. This might be a fruitful area for collaboration.
9. Development of superconducting undulators could be very beneficial in extending the photon energy range of a low-energy, low-emittance storage ring. This is a natural outgrowth of on-going work on a superconducting wiggler and other superconducting magnets.

4.2.3 *Recommendations*

1. Continue to develop accelerator concepts for MB-LINQ and provide more detail at the next SAC review.
2. In designing the MB-LINQ systems, search out synergies with technological developments for advanced accelerators, e.g., ILC.
3. The SAC considers the current proposal insufficiently ambitious in terms of brightness. Therefore, the SAC recommends that, before finalizing the concept, KEK conduct a review of the concept under the D-G's auspices to ensure it aligns with

KEK's mission of advancing accelerator technology and serving universities with unique tools not available elsewhere.

4. Run a program of user community workshops to establish evidence of the demand for the MB-LINQ facility, to contribute to the Science Case for the facility, and hopefully to attract additional Member Institutions.

5. The SAC is concerned about the PF's operating budget, which will be under increased pressure once the MB-LINQ is realized. Therefore, we strongly recommend developing an operating budget plan and initiating discussions among partners regarding funding and the facility's future operating model.

4.3 Neutron Beam Science

4.3.1 *Observations*

1. KEK operates 8 neutron beamlines at the J-PARC MLF in Tokai. The most recent addition was the polarized-neutron instrument POLANO. These beamlines are sufficiently specialized and, combined with the world-leading neutron flux, deliver world-class performance. They complement each other and other beamlines at MLF and JRR-3 in their capabilities.

2. Scientific output from the neutron beamlines is good. Including papers published in prominent journals such as Science and the Journal of the American Chemical Society, there have been about 50 peer-reviewed research articles in 2025 alone.

3. Yet as a world-leading spallation neutron scattering facility, there is room for improvement. MLF is engaged in the MLF Double program to increase research output by 2030. As part of the program, they are updating instruments with state-of-the-art devices, such as neutron guides, detectors, and polarization devices, while making the entire facility more robust.

4. To overcome staff shortages, as mentioned in previous years' SAC recommendations, KEK has actively engaged with other institutions, such as the University of Tokyo, to jointly appoint staff. SAC is pleased with this development and encourages further expansion of the collaboration network.

5. In the meantime, J-PARC is planning MLF Target Station 2, which will feature the world's first combined neutron-muon source. TS2 is still in an early design stage, and KEK, along with many stakeholders, is actively participating in the effort.

4.3.2 *Comments*

1. KEK is well-known for its strong neutron instrumentation and scientific prowess. The competitive nature of the world's high-end user facilities, however, also calls for a large staff to cover ever-expanding, diverse scientific endeavors and techniques. By combining efforts with its JAEA counterparts, KEK has at least partially overcome this limitation.

2. However, the number of staff per beamline, who should provide continuous service to users, remains quite small compared to other major spallation neutron facilities. The number of beam days required per experiment is known to be longer at MLF than that of comparable neutron facilities, perhaps because of the low staffing level.

3. As per SAC's previous recommendation, KEK has sought ways to increase staffing as described in the Observations section. Although limited in numbers, SAC is pleased that KEK is making efforts in this regard. There are serious constraints, however.

The government rarely adds numbers once a facility is operational. Therefore, scientific communities should raise staffing issues in a concerted manner.

4. The exchange of ideas on MLF TS2 and the upcoming discussion of the neutron roadmap by the country's neutron community thus provides a much-needed opportunity to reflect on the status and build consensus on the future role of the facilities. KEK and its members must take a leading role in this effort.

5. Meanwhile, it still seems possible to increase activity at MLF by collaborating with other organizations. Given the high number of foreign users, entering a formal partnership with foreign governments or institutions could be very beneficial in this regard.

4.3.3 *Recommendations*

1. SAC recommends that KEK actively participate in discussions with the neutron community and other stakeholders regarding TS2 and the country's neutron roadmap, including the role of the current facility in the future, and identify the required resources to maximize its productivity.

2. SAC recommends that KEK explore avenues to collaborate with domestic and international institutions to boost scientific and technical activities at MLF.

4.4 Muon Beam Science

4.4.1 *Observations*

1. There are currently four muon beamlines within MLF: D-line, S-line, U-line and H-line. Two experimental stations are available at present on each beamline: D1, D2, S1, S2, U1A, U1B, H1 and H2. A third S3 station is also being prepared on the S-line.

2. Within the MLF muon facility, the development of slow muon generation and acceleration techniques is a major program that has continued as part of a staged plan towards generating low emittance muon beams that can be used for a unique muon microscope facility for materials and life science, as well as providing a beam suitable for applications in particle physics experiments aimed at areas such as muon g-2/EDM.

3. Following the recommendation in our previous report to discuss with other laboratories how to realise next-generation muon experiments in the most efficient way, discussions with PSI are ongoing.

4. As we wrote previously, the efficiency of the laser system and the intensity of the source remain critical points for the $g_\mu - 2$ experiment. A dedicated laser system has been built and produced first light, and its quality is being evaluated.

5. Collaboration with Liverpool is underway, focusing in particular on attaining better precision than Fermilab.

6. Development progress was demonstrated by a report published in June 2025 of the acceleration of slow muons generated at the S2 beamline up to 100 keV by an RFQ.

7. A 5 MeV cyclotron was installed at the U1B beamline as the first stage in a transmission muon microscope that could be used for relatively thin samples.

8. A 50 MeV muon microscope suitable for thicker samples is dependent on completion of the H2 beamline. It is encouraging that first beam to the H2 beamline was achieved in May 2025 and the the first ultra-slow muon generation in the H2 beamline was achieved in Dec 2025.

4.4.2 *Recommendations*

1. Continue to focus on optimizing the USM production, which plays a key role in a wide range of programs from nanoscale material science to particle physics.

2. The current USM source intensity is already sufficiently strong for experiments in nanoscience to be performed. It is understood that MLF facility target problems in 2025 will have held back such experiments, but it is noted that producing such scientific results will strengthen the case of all USM-based activities.

3. Improving the efficiency and throughput of muon experiments on all beamlines as part of the MLF Double program is encouraged. Experience from other muon facilities could suggest ways that might benefit the overall throughput of user μSR experiments, e.g. providing multiple sample positions on a dilution refrigerator, as employed at the FLAME instrument at PSI, or investing in multiple interchangeable cryostats and inserts, as employed at the ISIS muon facility.

4. The status of the $g_\mu - 2$ experiment should be reviewed in the light of the latest FNAL results published in late 2025 and the progress and prospects of the KEK $g_\mu - 2$ experiment.

5 Industrial-Academic Collaboration

KEK is seeking joint research and collaboration with industry and academia

KEK has identified four "strategic Pillars" of the seventeen critical technology areas of interest listed in the JST K-Program,:

- Quantum Technology: quantum sensing and quantum measurement technologies, quantum materials and device development

- Semiconductors: EUV-FEL light source RD for next-generation EUV lithography, strategic RD hub for semiconductor-related industries

- Fusion Energy: 10 MW-class proton accelerator, key accelerator-driven technologies for fusion energy systems

- Space: proton irradiation facility at J-PARC for space industry applications, radiation tolerance testing for spacecraft and satellite component

Joint research with a variety of companies is also underway. External funding has been trending upwards from FY2021.

Two areas with great potential are in the quantum technology and semiconductor sectors.

5.1 Quantum Technology

- Cryo-CMOS circuitry
- Theory capacity in quantum communication and error correction
- High-frequency technology
- Cryogenic technology
- Superconducting acceleration cavities
- High-Q technology
- Laser cooling and other optical technologies

5.2 Next-generation EUV lithography

An important application of KEK core capacities and expertise is in the development of fundamental technology for a next-generation EUV lithography high-power 800MeV FEL light source as a further development of the KEK compact ERL. Funding for this development is also expected through the K Program of JST.

Contracted research to date includes technology development of a compact muon source, development of next-generation EUV lithography light sources using free electron lasers that are receiving support from the K Program, and structural analysis of proteins.

5.3 Comments

The SAC applauds these developments. The motivations of broader societal benefit of KEK activites, and potential additional resources for the lab are convincing. Building upon activities in IPNS, IMSS, ACCL, ARL and QUP, joint research and collaboration with industry and other academic institutions is expected to have positive benefits for KEK. The SAC looks forward to hearing of further developments in the coming years.

6 Social Issues

6.1 Research Ethics, Diversity and Gender Equality

KEK is serious about making itself a better place to work for its staff, users, and students from diverse backgrounds. To this end, KEK operates the DE&I office. The office conducts surveys on the work environment, work-life balance, and harassment, and makes efforts to educate members on unacceptable behavior and to provide support when necessary. SAC commends the DE&I office's steadfast efforts, and calls for its continued support by the KEK management.

6.2 Engagement, Public Relations and Outreach Activities

Significant effort has been made to reach the public. In particular, the outreach efforts presented include those that are especially targeted to female students. The efforts presented include female student camps, the Athena program, open campus programs, and appearance on Abema Prime by Dr. Nojiri which garnered over 54k views. They are great activities and should be continued.

6.3 Higher Education at KEK

The KEK management is aware that a strategic approach is needed to foster students especially in accelerator science. They rely on three systems to train and attract students. The SOKENDAI, Graduate School for Advanced Studies, has 20 programs at the national level of which three are based at KEK: Accelerator Science; Materials Structure Science; Particle and Nuclear Physics. Furthermore, KEK research staff also supervise graduate students on universities request. In addition, KEK research staff become members of graduate school programs of universities and accept students under these programs. Most students belong to the University of Tokyo, although the plan is to extend this framework to other Universities.

It is worth noting that about 50% of KEK–Sokendai students are international, mainly from Asia, particularly in the materials science and accelerator science programs. This demonstrates the attractiveness of the KEK Institute. KEK provides scholarship for international students as well as some support that can come from the Sokendai special research program.

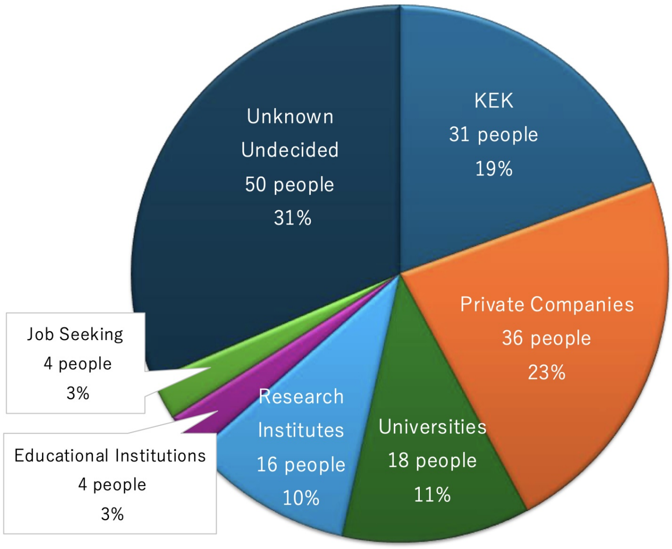

Figure 3: Career Outcomes of Graduates from the Past 10 Years at The Graduate University for Advanced Studies (KEK-SOKENDAI)

The ratio of graduate students among the users have been rather stable over the years, being close to 55% in the last decade. If we concentrate on the foreign users, the students are around 40-45% except during the COVID period (mainly in 2021).

In the answer to one of the SAC questions, the SAC is happy to hear that KEK has initiated a program where engineers can work in a different section for one year. This will help building up a more dynamic organization and broadening the training of the personnel.

In summary, KEK has the right tools to attract young people and facilitate generational renewal. We were shown the statistics, see Fig. 3, of the professional careers taken by the KEK-SOKENDAI students of the last ten years. The committee learned that 19% of the former students have been attracted by KEK and are now working at the lab. Another 21% (34 people) are at other research Institutes or universities. This is a very good rate. To enlarge the reach of this graduate University for Advanced Studies, one should consider attracting students from other continents. The SAC commends KEK's actions.

6.3.1 Recommendations

1. The activities in higher education are the right ones. To increase the number of people retained at the Center, one could make the advanced schools more attractive for students from other continents, e.g., by enlarging the distribution of information.

2. Due to the large number of young users, efforts should be made to increase the interaction with them as they can also be a source of future personnel for the Facility.

A Progress on KEK-SAC Recommendations, 2025

A.1 2025 KEK-SAC Recommendations - Executive Summary

- *To fully resource the operation of flagship experiments and facilities – SuperKEKB, Belle II, T2K, HyperKamiokande, and MLF*
- *To maintain and develop a large user community for its multi-user facilities*
- *To consider a reduction in the number of experiments and operating facilities and smaller projects, so that better resource allocation (personnel and funds) can be made to the highest priority activities.*

Response: KEK Management is continually looking to both cost reduction and income increase.

A.2 2025 KEK-SAC Recommendations - Accelerators

1. *Integrate planning for replacement of obsolete equipment and infrastructure into the annual planning and budget cycles.*

   Response:

   For each accelerator, a list of ageing components and prioritized replacement scenarios have been prepared, with the plan integrated into the annual budget request including the supplementary budget. The main measures implemented in 2025 to address ageing issues are as follows:

   - J-PARC : Replacement of the power supply of bending magnet B15U in 3-50 BT, replacements of a part of the interlock system (PPS, MPS), transformer rectifier radiators of the RF system, BPM signal processing system, etc.
   - SuperKEKB : Replacements of parts of the control devices, magnet power supplies, inverter control unit for cooling water pump, and manufacturing of a spare klystron, etc.
   - Electron positron linac : Production of the new type high-gradient accelerating structure as a multi-year upgrade plan, semiconductor implementation of the Klystron RF drive section, replacements of electron gun, small-scale magnet power supplies, etc.
   - PF : Manufacturing of a spare klystron, quadrupole/sextupole magnet power supplies, etc.

2. *Develop a long-term strategy and implementation plan for the future of the Tsukuba campus after SuperKEKB.*

   Response:

   Various plans are under consideration regarding the future of the Tsukuba Campus. Within the IPNS, an "Internal Committee on the Future Development of the Tsukuba Campus" has been established, and discussions have begun, primarily led by young researchers.

A.3 2025 KEK-SAC Recommendations - Particle Physics

1. *In view of the uncertainties concerning the realisation of the ILC, it is important to identify synergies between the ongoing ILC R&D efforts and other projects at KEK and elsewhere.*

   Response:

Accelerator technologies developed for the ILC are highly useful in accelerator applications. At iCASA, we have started the development of SRF technology aiming at application in next-generation semiconductor micro-fabrication processes. We are also advancing the development of a compact electron beam irradiation facility utilizing the SRF technology. The nano-beam technology and the positron source development for the ILC are also useful for current and future electron-positron circular colliders such as SuperKEKB and FCC-ee. The new project, MB-LINQ, is also based upon the SRF technology which is developed at KEK for the ILC

2. *We recommend that KEK engage with other laboratories working on muon physics, such as Fermilab, PSI and TRIUMF, with a view to optimizing muon research programmes worldwide.*

   Response:

   Vital discussion sessions were held not only on physics, but also on high-intensity beams, targets and muon technologies. A BRIDGE workshop with PSI was held at the University of Tokyo. (https://conference-indico.kek.jp/event/321/overview).

3. *The completion of the NA62 represents CERN's last approved kaon physics experiments. It is recommended that KEK continues to support its kaon physics program as a unique opportunity worldwide.*

   Response:

   - The XIII International on Kaon Physics was held in Mainz, 8-12, September.
   - A KOTO II workshop were held right after, where the J-PARC hadron group actively participated.
     ($https://conference-indico.kek.jp/event/321/overview$,
     see also KAON2025 - XIII International Conference on Kaon Physics.)

4. *It is important to establish clear leadership of SuperKEKB. This is particularly important for the participants from the foreign laboratories, who require a clear focal point to establish formal partnerships. The committee urges the KEK management to appoint a project leader with authority to manage resources.*

   Response:

   A new generation of leadership has been identified and more coherent actions of the entire SuperKEKB and Belle II teams have been encouraged. In addition, organizational structure change is under discussion with a strong leadership of the D-G to encourage coherent efforts to achieve the goal.

   Shoji UNO has been appointed assistant to the D-G for luminosity improvement.

5. *There has been a few months' delay in excavating the Hyper-K cavern, but it is still expected that the detector will be ready to take data by the end of 2027. Hyper-K will then become a flagship project for KEK, and it is essential that providing it with maximum beam be given top priority.*

   Response:

   Rapid improvements on the J-PARC facility are ongoing, and finally the IWCD construction started. Various improvements were reported:

   - Reinforcement of cooling and water systems.
   - Expansion of remote handling capability.
   - Upgrade of primary beamline components.

6. *The efficiency of the laser system and the intensity of the source remain critical points for the $g_\mu-2$ experiment. These issues should remain the focus of development effort, and we recommend that a timeline be established with milestones to achieve the design parameters. Since a measurement with an accuracy similar to that of the Fermilab experiment will require additional R&D, this should also be prioritised.*

   Response:

   Building construction is now in two phases, for an early realization.

   A dedicated laser system has been built; the first light has proved its potential.

   The RFQ is waiting for a beam in the H-line.

7. *Beyond the $g_\mu-2$ experiment the high power laser is critical for the muon microscope and other applications. Its development should be supported.*

   Response:

   Following the first light of Lyman-α in the H-line, collaboration with QUP on an anti-hydrogen experiment is being explored.

   The team is working on a high-power Lyman-α source to be used for both muonium and anti-hydrogen application in the H-Line.

8. *We encourage the KEK management to initiate a discussion among worldwide particle physics accelerator laboratories such as CERN, FNAL, KEK, PSI and TRIUMF with the aim of constructing a global strategy how and where to realise next-generation muon experiments in the most efficient way.*

   Response:

   Discussions with PSI are ongoing.

9. *It is important that the losses of experienced staff in the Theory Center be compensated through recruitment of young staff.*

   Response:

   New members in the Theory Center:

   - Kaori FUYUTO, Associate Professor
   - Yuki YOKOKURA Assistant Professor
   - Motoi ENDO Newly promoted to Professor

10. *The COMET collaboration should make a resource-loaded project plan to demonstrate the timely completion of Phase 1. Anything beyond Phase 1 should be discussed in a global context with other laboratories interested in muon physics, including Fermilab, PSI and TRIUMF.*

    Response:

    A review was held in July, 2024, chaired by Augusto Ceccuci.

    - The review report is available at "The collaboration and the Lab should work closely to realize the phase-1 LI"
    - It identified four conditions to move forward:
      (a) Minimize the remaining cost to complete the Low Intensity mode of phase-1 (currently 2.83 Oku-yen);
      (b) Organization of the collaboration management should be improved within and outside the collaboration;
      (c) Good understanding of the community should be gained;

(d) The collaboration should egotiate with J-PARC to utilize the operation budget to cover the remaining cost.

- All steps are in progress.

  In view of the time since the 2024 review, the SAC requests an update for the 2027 meeting.

11. *The KEK management should consider ways to coordinate its plans for the KOTO experiment with other interested laboratories and the international community of physicists interested in kaon physics.*

    Response:

    - The XIII International Conference on Kaon Physics was held in Mainz on 8-12 September.
    - A KOTO II workshop were held just afterwards, where the J-PARC hadron group participated actively.

      ($https://conference-indico.kek.jp/event/321/overview$

      see also KAON2025 - XIII International Conference on Kaon Physics.)

12. *The KEK management should prepare a proposal on how the QUP research programme could be continued when WPI funding is no longer available.*

    Response:

    Following the appointment of the new QUP director, the QUP program is being re-developed.

A.4 2025 KEK-SAC Recommendations - Nuclear Physics

1. *The committee recommends that the Hadron Hall Extension project be revisited taking into account the potential of experiments and activities to produce important scientific outcomes whilst giving consideration to the resource requirements and constraints.*

2. *KEK should strengthen the collaboration with top domestic universities in order to realize the HEF project, mitigating the current financial shortage and enhancing human resources for the project. This might be included in the provision of upgrades or staffing either via direct university support or via funding schemes available to research universities of high standing.*

   Responses to above (see Figures 4 and 5): University collaboration being enhanced within current Hadron Hall program in view of the delay in the Hadron Hall Extension. This includes collaboration with RIKEN, Osaka U, the COMET collaboration and universities Tokyo, Tohoku, Hiroshima. amd Tsukuba.

A.5 2025 KEK-SAC Recommendations - Materials and Life Science

1. *There is a proposal to streamline the CIQuS further through establishing one center focused on future simultaneous measurement using an integrated quantum beam facility. The SAC considers this initiative is not supported, as yet, by the current metrics for sequential multi-beam access and should be reconsidered in coming years.*

   Response:

   Without changing CIQuS functions, we are strengthening the S.I. Center to advance MB-LINQ.

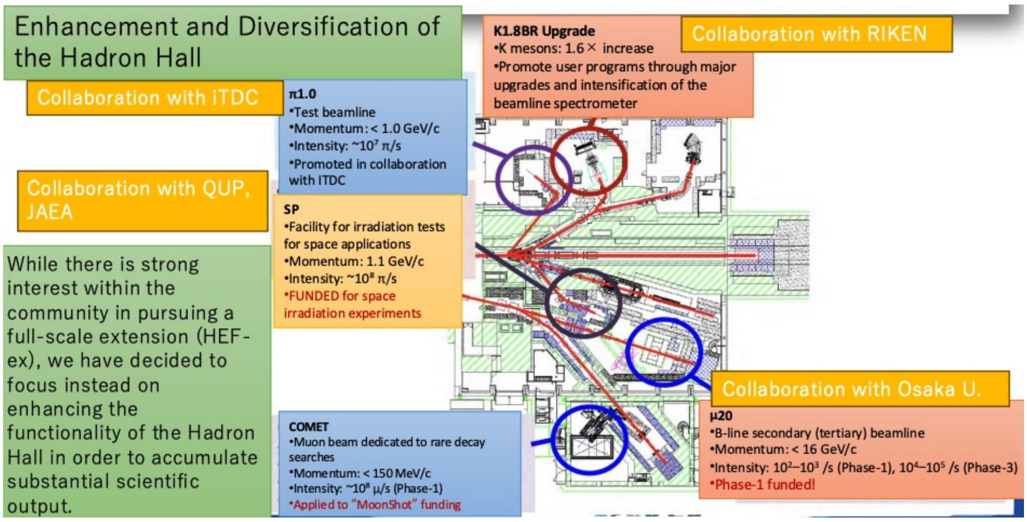

Figure 4: Collaboration with Universities 1

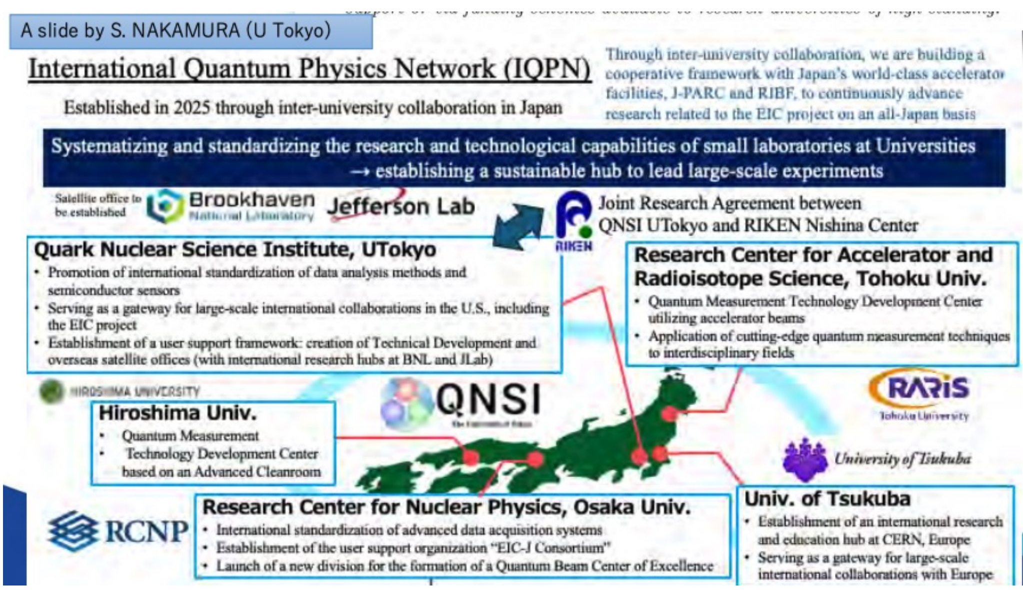

Figure 5: Collaboration with Universities 2

Multi-probe Experiments Conducted with CIQuS

SR	Positron	Neutron	Muon	Materials	
Diffraction, Scattering, Absorption		Diffraction, Scattering		Strongly-correlated Electron System	11
				Devices (Electronics, Battery, Energy, etc.)	11
				Catalysts	13
				Magnetic Materials	3
Diffraction, Scattering, Absorption		Diffraction, Scattering	μSR	Devices	1
				Magnetic Materials	10
				Hydrogen-related Materials	2
				Soft Matter	1
Small Angle Scattering, Absorption		Small Angle Scattering, Reflectivity		Foods, Health & Beauty	11
				Soft Matter	8
Absorption, Photoemission		Reflectivity		Devices	8
				Magnetic Films	8
				Soft Matter	11
Absorption			μSR	Catalysts	2
Photoemission, Absorption	Diffraction			Low dimension system	8
				Catalysts	3
Diffraction, Scattering	Diffraction			Low dimension system	1
Imaging		Imaging	Imaging	Devices	9
Diffraction, Absorption, Fluorescence			Element Analysis	Asteroid, Heritage, Environment, etc.	15
136	12	107	40		136

cf. 95 in FY2023, 116 in FY2024

Figure 6: Multi-Probe Experiments Conducted with CiQuS

2. *Further refine statistics on unique users at the KEK facilities to quantify the combined use of different quantum beam facilities and their evolution.*

   Response:

   Annual changes were examined with AI (see Figure 6).

3. *Beamline staff exchange between quantum beam facilities would assist in better integration of the multi-beam access offerings to users.*

   Response:

   Cross-facility exchanges are under discussion. One early-career professor or engineer will be sent abroad for one year in FY2026 to an XFEL facility to advance MB-LINQ.

4. *If a project to build a compact accelerator-driven neutron source is further pursued, a business case should be developed and presented.*

   Response:

   A pilot test of sequential use of a compact neutron source imaging and synchrotron XAFS was conducted; evaluation continues.

A.6 2025 KEK-SAC Recommendations - Photon Factory

A.6.1 *Recommendations*

1. *Reduce the number of operating PF beam lines to enable better support for users and to reduce costs.*

   Response to items 1, 8:

   Activities considered for reduction are user-driven and require minimal cost and effort. Discontinuation would require additional effort. User support will be streamlined.

2. *Clarify and pursue a staged approach to PF-HLS, starting with the 2.5-GeV superconducting linac as the first step.*

3. *Development of an alternative design concept to the level that it could be presented for the 2026 MEXT roadmap will be challenging in the available time, but should be given high priority. Existing, proven approaches (ESRF-EBS, APS-U, SLS 2, IHEP) can be used as reference designs.*

4. *Consider alternative, cost-effective methods to provide the desired photon energy span for the facility.*

5. *Significant development of the science case should be addressed immediately. In particular, highlighting the relevance of the outcomes of experiments undertaken at the newly constructed beamlines together with an aggressive program of National user workshops prior to any 2026 MEXT roadmap proposal.*

6. *To demonstrate the importance of the PF-HLS project there should be a clear strategy outlining the level of the related National academic facility support (UVSOR, HiSOR, and ISSP-SOR) and the appeal to the broader Japanese user community interest.*

   Response to items 2,3,4,5,6:

   Taking these recommendations into account, PF-HLS has been recast as the MB-LINQ project with a superconducting linac at its core (see p. 25, p. 26, and the materials by Prof. Igararashi).

7. *Previous year recommendations have highlighted the need for a contingency plan. SAC reiterates that this still needs to be addressed and now with some urgency. With the reduction in University power user beamline support this becomes even more critical for beamline staff management. In addition, rationalisation of beamline operations must become a priority.*

   Response (see response to item 1 above):

8. *For such a large development as the PF-HLS (or similar), it is suggested that collaboration be carried out with other major laboratories (Spring-8, Nanoteras) to develop a unique, internationally competitive proposal, whilst potentially expanding the development resources.*

9. *Seek international collaborators in the development of such a proposal as well as international users to help define its science case.*

10. *In view of the significance the PF-HLS proposal and the many questions raised, the SAC strongly recommends that PF-HLS proponents hold a workshop for all interested parties with the aim of agreeing on plans for the PF-HLS. An agreed program documenting a formal proposal should be prepared for the SAC in advance of the KEK-SAC 2026 meeting for review and comment.*

    Response to items 8,9,10:

    Workshops with partner institutions are held regularly, including outreach to Asian and Oceanian countries. Preparation for the 2026 MEXT roadmap is underway, with an English CDR to follow soon.

A.7 2025 KEK-SAC Recommendations - Neutron Beam Science

1. *Prepare a strategy to increase the staffing level at the KEK instruments to a level on a par with other world-class neutron facilities.*

2. *Consider the viability of a structural re-organisation to simplify and reinforce the lines of responsibility. Such an organisational change should be designed to support the recommended increase in staffing levels.*

3. *Consider increased staffing for operational support be prioritized when balancing limited resources for MLF and PF. Scientific impact of these user facilities limited by staffing levels which are very low compared to international benchmarks.*

4. *The SAC suggests consideration be given to establishing alliances with universities or pursuing international collaborations to strengthen the permanent presence of scientists and technicians.*

   Response provided for the above:

   Beamline staffing is being strengthened through improved user support efficiency and external collaboration.

5. *Continue development of MLF Double and TS2 with a view to including them in the next update of the KEK Roadmap*

   Response:

   MLF roadmap workshops are held twice a year to advance discussions.

A.8 2025 KEK-SAC Recommendations - Muon Beam Science

1. *Continue to focus on optimizing the USM production, which plays a key role in a wide range of programs from nanoscale material science to particle physics.*

2. *With the current USM source intensity, first experiments in nanoscience are possible and should be performed. Scientific results will strengthen the case of all USM-based activities.*

3. *Given the successful acquisition of funding for new projects, we recommend a careful planning of the use of the limited manpower in the different muon activities.*

   Responses provided for the above:

   Staff allocation continues to be optimized while projects on USM production and applications progress.

A.9 2025 KEK-SAC Recommendations - Social Issues

1. *There is a concern that women will burn out shouldering the burden of this work while carrying on their own research programs, and the current level of activities is not sustainable. We recommend that KEK spreads the workload more evenly across men and women wherever appropriate, and considers bringing in external advisors to oversee the DE&I program.*

   Response: The DE&I office has ben set up to coordinate DE&I related actions. (M. Nojiri) A DE&I Survey was completed in May 2025. Results presented by M. Nojiri.

2. *The SAC recommends that KEK formulates a long-term strategic plan to counter the difficulties of hiring scientists due to the declining Japanese population. The plan could include changing KEK's work culture to hire and retain foreign-born scientists.*

   Response: Discussions are ongoing.

3. *The committee recommends that KEK commit more resources toward outreach programs including funding, administrative support, materials, and outside partnerships. KEK should seek external sources of funds including private foundations and government grants.*

   Response: M. Nojiri appeared on Abema Prime "Female researcher in Japan" (Jan, 2026):

   $https://www.youtube.com/watch?v=-88s-twqJ_8\&t=21s$

   54k views, with a US biology researcher and company researchers.

4. *Develop a peer mentoring program, where people can support one another. In addition to mentoring those who are more junior, create opportunities for people at similar career stages to connect, share experiences, and support one another.*

   Response:

   There is no direct answer or corresponding program. However, a new program where engineers can work in different section for one year has been started up so that they can have a wider range of experience. This will help building more dynamic organization. KEK looking for new mechanisms to recruit foreign students, such as

   - A new framework, to establish strong partnerships with foreign Universities;
   - Advertising specifically for Asia, e.g., information sessions abroad.

5. *Create professional development opportunities for all staff at all career stages by bringing in experts from within and outside KEK. Women and those who are under-represented will especially benefit from such programs as they often have fewer role models and fewer opportunities for informal mentoring.*

   Response: Several initiatives to encourage women at KEK have been undertaken. These include a female student camp (April, 2025), a program of young female visiting researchers (part of the Athena program) and an open campus program (Sept., 2025) for longer term sustainability.

   Mihoko Nojiri appeared on Abema Prime "Female researcher in Japan" (Jan, 2026)

6. *Due to the amplifying effect that an enthusiastic teacher has on the student year after year, the program of visits to high schools should be extended to organise a course for high school teachers at KEK. We recommend looking to programs such as those at CERN to bring teachers to KEK who could bring the science and excitement for science back to their schools.*

   Response: There was no report on this suggestion.

7. *As both the Summer Challenge and the Rikei-jyoshi Camp has been running for more than a decade, we recommend to learn which has been the impact of that efford both in attracting them to study physics and/or to join KEK.*

   Response: Investigation of career directions began some time ago but still with limited statistics.

   Data on career outcomes for Sokendai students were presented by Dr Hanagaki. (See Fig. 3)

8. *The SAC learned that two out of the three female professors are retiring next year, we recommend KEK to open a female position at the level of professor.*

   Response: There have been 15 "female only" job openings in 7 years period, foreseeing "tension" of increasing retirements.

9. *KEK should establish a sustainable framework for its outreach activities, which could include partnerships with external foundations and/or the establishment of its own "KEK and Society" foundation to support activities that lie beyond its scientific mandate.*

   Response: Various activities were reported on, aimed at a sustainable outreach program

Members of the KEK Science Advisory Committee

Field	Name	Affiliation	
HEP	Reina Maruyama	Yale University	*
	James Strait	Fermilab Scientist Emeritus and LBNL Retired	**
	Geoffrey Taylor	The University of Melbourne	*
	Marcel Demarteau	Oak Ridge National Laboratory(ORNL)	**
Theory	John Ellis	King's College, London	*
Nuclear	Rikutaro Yoshida	Argonne National Laboratory(ANL)	**
	Maria Jose-Borge	Consejo Superior de Investigaciones Científicas, Spain	*
Accelerator	Qing Qin	European Synchrotron Radiation Facility(ESRF)	**
	Wolfram Fischer	Brookhaven National Laboratory(BNL)	*
PF (Synchrotron Radiation)	Michael David Borland	Argonne National Laboratory(ANL)	*
	Richard Garrett	Australian Nuclear Science and Technology Organisation(ANSTO)	**
Neutron	Ken Andersen	The Institut Laue-Langevin (ILL)	*
	Sungil Park	Korea Atomic Energy Research Institute (KAERI)	*
Muon	Francis Pratt	ISIS Neutron and Muon Source, Rutherford Appleton Laboratory(RAL) / STFC / UKRI	**

*   Term ; April 1, 2023 - March 31, 2027

** Term ; April 1, 2025 - March 31, 2029

The 7th KEK Science Advisory Committee

Feb 24, 2026, 6:00 AM → Feb 26, 2026, 9:00 AM Asia/Tokyo

Description *** Meeting Time (same for 3 days) ***

Japan/Korea; 6:00-9:00, Feb.24-26
Australia; 8:00-11:00, Feb.24-26
U.S. (PST); 13:00-16:00, Feb.23-25
U.S. (CST) 15:00-18:00, Feb.23-25
U.S. (EST); 16:00-19:00, Feb.23-25
UK; 21:00-24:00, Feb.23-25
France/Spain; 22:00-25:00, Feb.23-25

*** Zoom Connecting Information***

https://us06web.zoom.us/j/83293052033?pwd=qigo2dta3RHzAxXIPIbPnznVHVifUJ.1

Meeting ID: 832 9305 2033
Passcode: 595065

Agenda (in English, with Timezones) | Agenda (in Japanese) | Materials on the rescent measures of KEK | References

Tuesday, February 24

6:00 AM → 6:15 AM **Executive Session(closed)** 15m

- introducing new members of the committee

6:15 AM → 6:25 AM **Mandate of the committee** 10m

Speaker: Prof. Shoji ASAI (KEK)

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6:25 AM → 6:40 AM **Status of the KEK Roadmap 2021 and KEK PIP2022 / Changes in the method of formulating KEK's major research projects after 2026** 15m

Speaker: Prof. Kazunori HANAGAKI (KEK)

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6:40 AM → 7:00 AM **Future planning for Institute of Particle and Nuclear Studies** 20m

Speaker: Prof. Naohito SAITO (KEK IPNS)

IPNS-SAC-2026-022...

7:10 AM → 7:50 AM **Status reports of the selected topics**

7:10 AM **SuperKEKB and BelleII** 10m

Speakers: Kyo SHIBATA (KEK ACCL), Kodai MATSUOKA (KEK IPNS)

1_KEK-SAC_SuperK... | 2_Belle2_KEKSAC_2...

7:30 AM **T2K-HyperKamiokande** 10m

Speaker: Ken SAKASHITA (KEK IPNS)

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7:50 AM → 8:05 AM **Break** 15m

8:05 AM → 8:25 AM **Future planning for Institute of Materials Structure Science** 20m

Speaker: Prof. Nobumasa FUNAMORI (KEK IMSS)

KEK-SAC_IMSS_202...

8:35 AM → 8:55 AM **Status reports of the selected topics**

8:35 AM **Multi Quantum Beam Facility Project** 10m

Speaker: Noriyuki IGARASHI (KEK IMSS)

KEK-SAC_MB-LINQ_...

8:55 AM → 9:00 AM **Executive Session(closed)** 5m

Wednesday, February 25

6:00 AM → 6:05 AM **Executive session(closed)** 5m

6:05 AM → 6:25 AM **Future Planning for the Accelerator Laboratory** 20m

Speaker: Tadashi KOSEKI (KEK ACCL)

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6:35 AM → 6:55 AM **Status reports of the selected topics**

6:35 AM **ILC** 10m

Speaker: Hiroshi SAKAI (KEK ACCL)

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6:55 AM → 7:15 AM **Future Planning for the Applied Research Laboratory** 20m

Speaker: Prof. Yoshihito Namito (KEK ARL)

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7:25 AM → 7:35 AM **Future Planning for the J-PARC Center** 10m

Speaker: Takashi KOBAYASHI (J-PARC)

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7:45 AM → 8:00 AM **Break** 15m

8:00 AM → 8:10 AM **Future Planning for QUP** 10m

Speaker: Prof. Toshiyuki Azuma (QUP)

KEK-SAC2026_QUP....

8:20 AM → 8:55 AM **Issues outside scientific program**

8:20 AM **Education at KEK** 5m

Speaker: Kazunori HANAGAKI (KEK)

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8:25 AM **Industry-academia collaboration and joint research** 5m

Speaker: Shin-ichi ADACHI (KEK)

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8:30 AM **Diversity Equity & Inclusion** 5m

Speakers: Shinichiro MICHIZONO (KEK), Mihoko NOJIRI (DE I Promoter / KEK IPNS)

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8:35 AM **(QA and discussion)** 15m

8:55 AM → 9:00 AM **Executive session(closed)** 5m

Thursday, February 26

6:00 AM → 8:30 AM **Executive Session and drafting (closed)** 2h 30m

- discussion for drafting
- Individual questions for KEK members (if any)

8:30 AM → 9:00 AM **Executive session with KEK members (closed)** 30m

- discussion with KEK members
- tentative review of the 3-day meeting