J-PARC Program Advisory Committee for the Nuclear and Particle Physics Experiments at the J-PARC Main Ring v1.3

[To be approved at the 41th PAC meeting
KEK/J-PARC-PAC 202X-XX
January XXX, 2026]

Minutes of the 40th meeting held on
July 16 (Wed.) – 18th (Fri.), 2025

Contents

1 Open Session

1. Welcome and J-PARC Center Report,
   T. Kobayashi (J-PARC/KEK)

2. Welcome and Mandate to the Committee,
   N. Saito (KEK)

3. J-PARC Accelerator Status & Plan,
   Y. Sato (J-PARC/KEK)

4. Hadron Facility Status & Plan,
   A. Toyoda (J-PARC/KEK)

5. FIFC Report,
   M. Nakao (KEK)

6. E16: Measurements of Spectral Change of Vector Mesons in Nuclei (high-p),
   Satoshi Yokkaichi (RIKEN)

7. E72: Search for a Narrow Λ^* Resonance Using the $p(K^-, \Lambda)\eta$ Reaction with the HypTPC (K1.8BR),
   Shuhei Hayakawa (Tohoku Univ.)

8. E104: Double ϕ Production in $\bar{p}p$ Reactions Near Threshold (K1.8BR),
   Jung Keun Ahn (Korea Univ.)

9. E45: 3-Body Hadronic Reactions for New Aspects of Baryon Spectroscopy (K1.8BR),
   Hiroyuki Sako (JAEA)

10. E80: Systematic Investigation of the Light Kaonic Nuclei (K1.8BR),
    Fuminori Sakuma (RIKEN)

11. E94: New Generation Λ Hypernuclear Spectroscopy with the (π^+, K^+) Reaction by S-2S (K1.8),
    Toshiyuki Gogami (Kyoto Univ.)

12. E90: High Resolution Spectroscopy of the "ΣN Cusp" by Using the $d(K^-, \pi^-)$ Reaction (K1.8),
    Yudai Ichikawa (Tohoku Univ.)

13. P111: J/ψ Production in $\pi^- p$ Reaction near Threshold (high-p),
    Sun Young Ryu (RCNP, Osaka Univ.)

14. E100: Neutron Lifetime Measurement with Pulsed Cold Neutrons (MLF),
    Kenji Mishima (RCNP, Osaka Univ.)

15. E73: Lifetime Measurement of ${}^3_\Lambda$H (K1.8BR),
    Yue Ma (RIKEN)

16. E88: Study of In-medium Modification of ϕ Mesons inside the Nucleus with $\phi \to K^+K^-$ Measurement with the E16 Spectrometer (high-p),
Hiroyuki Sako (JAEA)
17. E21: (COMET) ,
Yuki Fujii (Imperial College London)
18. E14: (KOTO) ,
Tadashi Nomura (J-PARC/KEK)
19. E56/E82: (JSNS^2/JSNS^2-II) ,
Takasumi Maruyama (J-PARC/KEK)
20. E71: (NINJA) ,
Tsutomu Fukuda (Nagoya Univ.)
21. E11/E65 (T2K): Talk 1 ,
Tsunayuki Matsubara (J-PARC/KEK)
22. E11/E65 (T2K): Talk 2 ,
Yasuhiro Nakajima (Univ. of Tokyo)
23. P112: Proposal for the Second Stage of the P93 Experiment (Evaluation of the Properties of the Secondary Particles Delivered at the High-momentum Beam Line) (high-p),
Kotaro Shirotori (RCNP, Osaka Univ.)
24. P113: Proposal for an Experiment to Demonstrate the Radiography with a Multi-GeV Muon Beam (high-p),
Hiroyuki Noumi (RCNP, Osaka Univ.)
25. E34: ($g-2$/EDM) ,
Tamaki Yoshioka (Kyushu Univ.)
26. Hadron Hall K1.8/K1.8BR Plan and Request Summary,
M. Ukai (J-PARC/KEK)
27. Beam Time Schedule,
T. Nakadaira (J-PARC/KEK)

2 Closed Session

Present:

M. Aoki (Kanazawa Univ.), V. Cirigliano (Univ. of Washington), L. Fabbietti (Tech. Univ. of Munich), H. Ishino (Okayama Univ.), K. Joo (Univ. of Connecticut), G. Karagiori (Columbia Univ.), C. Lazzeroni (Univ. of Birmingham), K. Miyabayashi (Nara Women's Univ.), M. Oka (RIKEN), X. Qian (BNL), K. Sekiguchi

(Kyoto Univ.) J. Stroth (Goethe Univ.), Y. Yamazaki (Kobe Univ.), T. Yamanaka (Chair, KEK),
N. Saito (KEK-IPNS, Director), T. Komatsubara (KEK-IPNS, Deputy Director) and T. Kobayashi (J-PARC Center, Director)

3 Procedural Report

The minutes of the 39th J-PARC-PAC meeting (KEK/J-PARC-PAC 2025-13) were approved.

4 Laboratory Report

4.1 Welcome and J-PARC Center Report (Takashi KOBAYASHI, J-PARC Center Director)

The J-PARC Director, Takashi Kobayashi, gave a welcome address and presented the current status and future plan of the J-PARC Center.

Kobayashi firstly reported the achievements regarding beam power. MLF has already achieved stable operation at its design power of 1 MW. Fast Extraction (FX) has achieved stable operation at 830 kW, and successful single-shot extraction at 954 kW. The FX beam power is following the planned power upgrade, targeting 1.3 MW by 2028. Slow Extraction (SX) has achieved stable operation at 92 kW, corresponding to 8×10^{13} ppp, which is a world record for SX beam operation. Single-shot extraction at 100 kW was also successfully demonstrated.

Kobayashi then reported a brief summary of 2025 operation. SX operation from January 20 to February 25 was completed as scheduled, at more than 80 kW. NU operation began on February 27, but had to stop on March 4 due to a failure in the neutrino target: a helium leak developed in the target cooling system. The cause has been identified, and repair work is expected to be completed by November, with the target ready for operation in December. MLF had no user operation during the latter half of JFY2024 due to a gas leak in the liquid target circulation loop. Although the operation resumed in April 2025, it was stopped again in May 2025 due to a water leak in the target cooling system.

Kobayashi also provided a budget status for JFY2025. JAEA received 101.8 Oku-yen[1] (same as 2024), enabling 6.4 cycles of operation (LINAC, RCS, and MLF). KEK received 50.48 Oku-yen, which is 2.6 Oku-yen less than last year. Currently, KEK cannot guarantee the operation period of FX and SX at the Main Ring.

Kobayashi then presented a draft operation schedule for the latter half of JFY2025. Due to the MLF/NU target issues, the summer maintenance period started a month earlier than usual. MLF user operation is planned for Oct. 30 – Mar. 24, with the final decision made after this PAC meeting. Additional budget or internal budget arrangements are necessary to realize the draft schedule.

[1] Oku-yen = 10^8 Japanese Yen

Kobayashi mentioned that the SOKENDAI Joint Research Center/J-PARC Experimental Equipment Development Building was completed by the end of March 2025 and is now available for users. Requests and assignments are handled by the J-PARC Center. Kobayashi also mentioned the status of the access road to the J-PARC. The construction budget for the access road was not granted in JFY2025. JAEA is requesting a budget for it in JFY2026.

4.2 Welcome and Mandate to the Committee (Naohito SAITO, KEK IPNS director)

The director of the Institute of Particle and Nuclear Studies (IPNS), Naohito Saito, welcomed the PAC members.

Saito firstly emphasized the completion of the SOKENDAI Joint Research Center / J-PARC Experimental Equipment Development Building. Some experimental groups have already started to use the building. He then introduced the physics programs driven by IPNS covering a wide range of scientific research topics, the organization structure of the IPNS, and the current status of IPNS projects. The timeline of various ongoing and future large scale projects was updated based on the recent developments worldwide, but the long-term plan after 2033 is still under discussion.

There are various task forces assigned to review and follow the progresses of major projects. The director requested the PAC to evaluate the several new proposals along with requests for the Stage-1 Status and the Stage-2 Approval, providing recommendations to the IPNS and J-PARC directors. He also requested the PAC to assess the progress of ongoing experiments as well to give advice on the beam time allocation plan for the period until summer 2026.

Saito introduced the PAC members participating in this meeting, as well as Facilities Impact and Financial Committee (FIFC) members. He also introduced the new FIFC chair, Prof. Mikihiko Nakao, who has taken the role since the beginning of JFY2025.

Saito reported the recent progress of the Hyper-Kamiokande project. The excavation of the cavern is close to completion, and the water tank construction will follow soon. The civil construction of the Intermediate Water Cherenkov Detector facility has been started, and its detector pit excavation will start soon. Full-scale data taking is scheduled to begin in JFY2028.

Saito reported that proposals for three test experiments (P106, P108, and P110) were evaluated by the PAC chair, the FIFC chair, and the head of J-PARC Particle and Nuclear Physics Division, and approved as test experiments (T106, T108, and T110). T106, to measure yields of secondary beams at B-Line with the exisiting beam line components, was conducted in January 2025. T108, to measure and optimize $\bar{d}$ beam intensity at K1.8 beam line, was conducted in May 2025. T110, to evaluate the performance of an improved E72 trigger counter and Kaon Veto Counter in the K1.8BR beam line, was conducted in May 2025.

Finally, Saito listed new documents submitted to this PAC meeting: three new proposals, regarding one experiment (P111 at B-Line) and two test experiments (P112 and P113 at B-Line) at the Hadron Experimental Facility; six reports (E16, E21, E99, E03, E36, E42); one addendum from E45. To request the Stage-2 Approval, four Technical Design Reports were submitted by E90, E94, E100, E104, and thus an FIFC meeting was held for this PAC meeting. The two test experiments, P112 and P113, are examined at this PAC meeting, because both experiments request a dedicated beam time exceeding 24 hours and prioritization of experiments is necessary.

4.3 J-PARC Accelerator Status (Yoichi SATO, J-PARC/KEK)

Yoichi Sato reported on the current status of accelerator operations, future plans, and the present conditions of the FX and SX beams at the Main Ring (MR).

In JFY2024, the total operating time of the accelerator reached 5,200 hours. The FX beam achieved 830 kW and the SX beam reached 92 kW. The SX beam power was particularly notable as the highest ever recorded, largely due to a shortened repetition cycle. Challenges related to achieving high availability of the system were also highlighted, including reducing malfunctions and addressing aging issues. A five-year budget plan from 2026 to 2030 was also presented.

Looking ahead, a plan to reach a 1.3 MW beam operation by 2028, with a 1.16 s repetition cycle and 3.3×10^{14}ppp, was presented. This will require hardware upgrades, including capacitor bank replacements. However, budget constraints are a significant concern for its realization.

For the FX operation, the beam power was increased to 800 kW in June 2024 and to 830 kW by March 2025, as already mentioned. To further enhance beam power, a new arc beam optics system was introduced to reduce beam loss, and initial results as of May 2025 are promising. A 900-kW user operation with a 1.28-s cycle is scheduled for the fall 2025, and future operation at 1.3 MW is being explored through simulation studies.

For the SX beam operation, the repetition cycle was shortened from 5.2 s to 4.24 s, and beam diffusers were installed upstream of the septum magnet. These improvements enabled operation at 83 kW in February 2025 and 90 kW in April 2025. A 100-kW demonstration run was also successfully conducted in May 2025, and preparation is underway to ensure beam stability and to optimize spill characteristics for the user operation starting this fall.

In conclusion, Sato emphasized the importance of ongoing efforts towards future high-power beam operations.

4.4 Hadron Facility Status and Plan (Akihisa TOYODA, J-PARC/KEK)

Akihisa Toyoda from the J-PARC Hadron Section presented the status and plans of the Hadron Experimental Facility (HEF).

Toyoda firstly reported on the beam operation in 2025. HEF has accepted the beam in two periods so far in 2025: January–February and April–May.

January–February 2025: Although MR experienced a short beam stop due to an issue with the SX Bump power supply (PS), the beam remained stable overall, delivering 2200 kW×days, which is 94% of what was planned. E73 at K1.8BR completed data taking and test experiments (T98: Test of liquid argon TPC, T105: Secondary particle measurement for a future test beam line, and T106: Secondary particle measurement at high-p beam line) were conducted. Overall, 82% of user operation was achieved, excluding the beam stop period due to the SX Bump PS. The maximum beam power was 84 kW during this period.

April–May 2025: Although MR had a short non-operating period due to an issue with the MR BM4 PS, beam operation was stable, and 1710 kW×days were achieved, which was 115% of what was planned, owing to the increased beam power. User operation reached 92.9%. E70 and E96 data taking at K1.8 were completed. Test experiments (T108: Optimizing d-bar beam intensity at K1.8 beam line, T110: Beam test of improved trigger counter for the E72 experiment) were conducted. The official regular radiation inspection (every five years) was successfully conducted. The maximum beam power was 92 kW during this period.

Toyoda then explained the preparation status of each beam line for the coming beam time:

- $\pi 20/\mu 20$ for P112, P113: Polarity-changers should be installed for P112, which requires a negatively charged beam transfer. The polarity changers will be installed during the summer maintenance period in 2026, and the beam line is expected to be ready by the fall of 2026.

- K1.8BR for E104 and E45: E104 and E45 require a momentum of 1.17 GeV/c at maximum. The power cables for the magnet PSs must be upgraded to provide such a beam, and the work is expected to take approximately one month.

- K1.8BR for E80: The K1.8BR area rearrangement will be performed during the summer maintenance period in 2026, requiring K1.8BR programs that use the current K1.8BR configurations to be completed by then.

- E16: The operation of the B-line and the E16 experiment may have to stop due to the limitation of the total electric power demand at the J-PARC site during the daytime. During the 2025-2026 winter, the 24-hour E16 operation may be possible, assuming careful arrangement (with other experiments at HEF) and scheduling. After spring 2026, daytime E16 operations will become less likely.

Toyoda then presented the R&D status and plans for the rotating target. The current production target can accommodate a beam power of 95 kW for a 5.2 s beam cycle and 115 kW for a 4.24 s beam cycle. The SX beam achieved a maximum beam power of 92 kW for 4.24 seconds, approaching the limit of the production target, hence necessitating a new target. Therefore, a directly cooled rotating target is being developed. The target is He-gas cooled and is expected to accept more than 150 kW. The key device is gas-bearing. It has no lifetime limit even in a high-radiation environment and enables high rotational speeds. A long-term stability test was performed from March to June 2025. A total of 1245 hours of testing were conducted (10 days twice with dry-air, and 31 days with He). A closed gas loop was made to provide gas to drive rotation and to lift the rotating axis. He-gas compressors used for the test did not have a gas-tight structure, resulting in a leakage of 15 liters/day, which was compensated for during the test. The rotational speed of 800–900 rpm was maintained for 31 days without any trouble. Pressure variations were caused by the balance between driving gas and the bearing gas pressures, and had to be manually adjusted using the bypass line of the gas loop. An automated feedback system will be necessary for real operation. After the 31-day test, a visual inspection revealed no issues with the rotating system. Remaining R&D items include a flow-control system, gas-tight compressors, final disk design, finalization of the disk fabrication method, and a monitoring system. These remaining items are estimated to take two years. Fabrication of the real target is expected to take two years. A long-term test outside the beam line is needed for a year. If there are no budget or technical issues, target replacement may occur in JFY2030.

Toyoda also provided a rough estimate for the life of the current gold target. The fatigue of the gold, caused by the thermal stress associated to the beam cycles (spills), determines the life of the target. Thermal analysis suggests that the target will be free from fatigue up to 10^7 cycles at a full beam power. The target has experienced 2.5×10^6 cycles until May 2025, but considering the actual integrated beam power, 6.8 years remain before the end of lifetime is reached. Replacement should therefore be scheduled by JFY2031 or 2032.

5 Evaluations of the Proposals and Status of the Ongoing Experiment

5.1 E16 (Vector meson in nucleus)

Recommend Stage-2 Approval for the first stage (300 hours)

At the 40th PAC meeting, the E16 collaboration reported the results obtained with a refined event reconstruction procedure. Central improvements are a two-dimensional clustering procedure applied to the signals of the GTR (GEM trackers), and the usage of timing information, allowing for a separation of pile-up in individual strips of the GTR readout. In addition, the calibration of the GTR's alignment and correction for Lorentz angle were substantially improved. These improvements resulted in a reconstruction of vector mesons invariant mass with a resolution of about 14 MeV and 12 MeV for the ω and ϕ, respectively. These values, which still fall short of the values targeted in the TDR, were obtained after the first iteration of the calibration procedure and the PAC recons that these values can still be gradually improved with a refined calibration. The collaboration has also verified the mass resolutions with a MC simulation assuming a precision in the track position measurement of around 170 μm. The PAC congratulates the collaboration and the task force of the FIFC for the progress since the last PAC meeting.

At the 39th PAC meeting, new event reconstruction method with an improved efficiency for single tracks was demonstrated, resulting in a pair reconstruction efficiency of 74 % instead of 53 %. The current detection efficiency for dilepton decays of the vector mesons (acceptance $\times$ trigger efficiency $\times$ reconstruction efficiency) $\times$ electron-ID efficiencies is estimated to be $0.0149 \times (0.84 \times 0.46) \times (0.74 \times 0.41) \times (0.56^2 \times 0.95^2) = 4.9 \times 10^{-4}$. Among the contributing efficiencies, the dilepton hardware trigger has room for significant improvement. During the run, the noise level of the trigger signals from one GEM foil of the GTR-3 chambers was unexpectedly high so that the threshold had to be set higher than others. The mitigation strategy foresees the replacement of the respective chambers by newly developed quadruple GEMs. The extra layer will increase the gain of the chamber sufficiently so that the signal to noise ratio should be high enough for triggering. Respective chambers have been tested with electron beam already.

Given the demonstrated performance of the detection system, the PAC recommends the Stage-2 Approval for the first stage (300 hours of physics operation) of the E16 experiment. The collection of high statistics data will enable a refined calibration of the full system. If the anticipated improvements can be realized, the collaboration would be ready to take the full statistics. Before recommending the Stage-2 Approval for the second stage of the data taking, the PAC requests a report demonstrating the performance of the experiment.

5.2 E72 (Λ^* resonance)

The experiment E72 aims to search for the Spin = 3/2 Λ^* resonance in the reaction $Kp \rightarrow \Lambda\eta$ with p_K= 735 MeV/c. This resonance state is not explained by the standard quark model and it is normally considered to be a molecular state composed of different meson-baryon coupled channels. If the resonance is observed, the experiment also aims to determine its parity.

The HypTPC will be used to identify the produced Λ hyperon and to measure the angular distribution of decayed particles. The liquid hydrogen target has been recently transferred from Tsukuba to the experimental area of K1.8BR, and different detector parts are currently being commissioned.

The PAC congratulates the collaboration for the improved π/K separation power and the detection efficiency of the spectrometer. The PAC also acknowledges the successful tests with the superconducting magnet.

At the next PAC meeting, the PAC would like to hear the analysis status of the data taken in the fall 2025.

5.3 E104 (Double ϕ production)

Recommend Stage-2 Approval for a cross section measurement

The E104 collaboration proposes to utilize the HypTPC for studying the double ϕ production in proton-antiproton annihilation near the production threshold. The original motivation of the proposal was to provide a high precision excitation function of the exclusive cross section starting from just above the threshold up to $\sqrt{s} = 2.14$ GeV. The JETSET collaboration published measurements above $\sqrt{s} = 2.14$ GeV about three decades ago. The E104 measurement should foster the observation of a strong enhancement of the cross section above expectations based on calculations strictly obeying the OZI rule. During the 39th PAC meeting it was recommended to extend the measurement to at least two-fold differential measurements to assess polarization observables.

The E104 experiment will rely on the excellent PID capabilities and momentum resolution of the TPC combined with HTOF detectors. PID performance, involving momentum and energy loss measurements and invariant mass resolution, has been demonstrated in MC simulations and in measurements using the setup for other studies (e.g. E42). It was also shown that strong background channels due to multi-pion production can be significantly suppressed at the trigger level by vetoing reactions with activities in the HTOF detectors in the backward hemisphere and requiring at least three hits in the detectors in the forward hemisphere.

Recognizing the importance of the proposed measurement and considering that the anticipated performance for measuring the double ϕ exclusive production cross section can be achieved, the PAC recommends Stage-2 Approval for 6 days of data taking.

Details about the systematic uncertainties of the final data, specifically the statistical relevance of multi-differential cross section analyses, were not demonstrated. The PAC reiterates the importance of providing additional insight in the underlying reaction mechanisms leading to double ϕ production. Therefore, the PAC asks for a detailed simulation study before recommending the Stage-2 Approval for the remaining data taking campaign.

5.4 E45 (3-body hadronic reactions)

Recommend to approve running at K1.8 BR

The E45 experiment aims to measure the reactions $\pi N \to \pi\pi N$ and $\pi N \to KY$ in the low beam momentum region, to clarify the existence and properties of nucleon resonances up to 2 GeV via partial wave analysis (PWA). The original plan was to collect data at the K1.8 beam line using $\pi^{\pm}$ beams in the momentum range of 0.74 to 1.98 GeV/c. The experiment obtained the Stage-2 Approval based on the PAC recommendation by the 26th PAC meeting.

In the 40th PAC meeting, E45 presented a proposal to prioritize measurements at the K1.8BR beam line, using $\pi^{\pm}$ beams in the momentum range of 0.73 to 1.15 GeV/c, which covers the second and third nucleon resonance regions. This proposal came in the context of competition with the HADES experiment, which has already measured the $\pi^- p \to \pi\pi N$ reactions in the second resonance region and plans to extend its coverage to the third resonance region in 2026.

The data collected by E45 will not only be competitive with HADES results through their distinct experimental setup, but will also contribute uniquely by measuring the reaction $\pi^+ p \to \pi\pi N$, which is not in the HADES measurement plan. These π^+ beam data are critical for isospin decomposition and the extraction of $I = 3/2(\Delta)$ resonances.

Although E45 and HADES may be seen as competing efforts, the PAC recognizes the strong collaborative ties between the two teams, particularly in the pursuit of combined PWA to jointly determine the resonance properties.

The E45 collaboration requests the beam time for 2.5 days for the measurements in the 3rd resonance region as the first priority.

The PAC recommends to give E45 beam time for 4 days, including 1.5 days of the commissioning, for that measurement, just after the E72 experiment in K1.8 BR. The PAC also recommends the remaining physics run for 4.5-day + commissioning beam time requested by E45 for the measurement of the second resonance region and the wider mass range with less priority, but understands that those runs are important for performing a complete PWA.

The PAC requests the E45 Collaboration to address the following points by the next PAC meeting:

- Estimate the systematic uncertainties on the absolute cross section measurement.
- Estimate the statistical uncertainties on the physics parameters obtained by the PWA.
- Estimate the required statistics to measure at least a three-dimensional cross section, such as $d\sigma/dW dM_{ij} d\cos\theta_k$, minimally required to understand two-pion productions from $\pi\Delta$, $N\sigma$ and $N\rho$.
- Seek an analysis method to make the PWA less dependent on theoretical models.

The PAC encourages E45 to seek collaborative work with the Osaka-Argonne group to evaluate the dependence of the model on the PWA.

5.5 E80 (Light kaonic nuclei)

E80 aims to study the $K^- ppn$ nuclei produced by a K^- beam hitting a ^{4}He target at the K1.8BR beam line. The decay particles from the kaonic nuclei will be measured using a new cylindrical detector system (CDS). This proposal was granted the Stage-2 Approval in the 38th PAC meeting, in 2024. At the 40th PAC meeting, the E80 proponents reported on their preparation. The PAC recognizes the achievements of E80, including the CDS, the electronics and DAQ systems, as well as the new K1.8BR beam line. As in their 38th meeting, the PAC recommends that E80 and the facility continue to hold detailed discussions on the plan to modify the K1.8BR beam line, including the timeline and budget.

5.6 E94 (Λ hypernuclear spectroscopy by S-2S)

Recommend Stage-2 Approval

E94 aims to measure the Λ-hypernuclei $^{7}_{\Lambda}$Li, $^{10}_{\Lambda}$B, and $^{12}_{\Lambda}$C spectra from the missing mass of the (π^+, K^+) reaction using the high-resolution spectrometer S-2S at the K1.8 beam line. The purpose of the measurement is to investigate charge symmetry breaking in the ΛN interaction in the p-shell region and compare it with the mirror hypernuclei. The latter is planned to be measured at JLab with the $(e, e'K^+)$ reaction. The proponents estimate the total uncertainties of the Λ binding energies to be between 91 and 127 keV, assuming the designed and current momentum resolutions obtained from the preliminary results by J-PARC E70 for $^{12}_{\Lambda}$C. Although the missing mass energy resolution is twice worse than the original designed value, the proponents estimate that this resolution is adequate for investigating charge symmetry breaking in the ΛN interaction.

At the 40th PAC meeting, the FIFC presented their review of the E94 TDR, which covered the missing mass resolution, the new Cherenkov counters, and handling of the lithium target. The FIFC concluded that the E94 experiment is feasible. The FIFC also noted the importance of conducting systematic measurements on multiple mirror-hypernuclear pairs at J-PARC and JLab in order to study the charge symmetry breaking in detail.

The PAC appreciates FIFC's careful review of the E94 TDR. Based on the FIFC's report and the status report by E94, the PAC recommends E94 to be given the Stage-2 Approval. The PAC notes that the total uncertainty foreseen may make a definitive comparison with theory values difficult, and the expected measurement may represent an improvement with respect to some of the existing experimental values but not to all of them. Therefore, the PAC suggests that, at the next PAC meeting, E94 present the progress of the analysis for the missing mass resolution estimated from the E70 experiment, and explain in a quantitative manner how the understanding of charge symmetry breaking in the p-shell Λ-hypernucleus is expected to improve through this measurement.

5.7 E90 (ΣN cusp)

Recommend Stage-2 Approval

The E90 experiment proposes missing-mass spectroscopy in the $d(K^-, \pi^-)$ reaction using the S-2S spectrometer at the K1.8 beam line with a liquid deuterium target. The experiment will utilize the high momentum resolution of the spectrometers and the high background suppression capability of the HypTPC to measure the ΣN mass spectrum. The primary goal of the E90 experiment is to resolve the long-standing puzzle of the "ΣN cusp", an enhancement of events observed near the Σ-hyperon-nucleon (ΣN) production threshold. The experiment aims to determine whether this enhancement is a true unstable bound state of the ΣN

system or a threshold effect (i.e. an inelastic virtual state). To achieve this, E90 will perform high-resolution spectroscopy of the missing-mass spectrum from the $d(K^-, \pi^-)$ reaction. By precisely measuring the shape of the resulting spectrum, the proponent can deduce the complex ΣN scattering length ($A_0 = a + ib$) in the spin-triplet ($S = 1$), isospin-1/2 ($T = 1/2$) channel, which directly reveals the nature of the interaction. The collaboration requested a beam time of 15 days (physics run) + 5 days (empty target run) + 1 day (H_2 target run) + 3 days (detector commissioning).

The scientific merit and technical design of the proposal are strong. The choice of the $d(K^-, \pi^-)$ reaction at forward angles is exceptionally well-suited for this measurement, as it provides a unique and clean probe of the spin-triplet ΣN interaction; a crucial advantage over competing experimental approaches that suffer from admixtures of spin-singlet states. Using the HypTPC detector to detect the charged decay products of the final state (Λp) will enable powerful background suppression through multiplicity cuts. This combination of a clean reaction channel and excellent signal-to-background rejection promises a high-statistics dataset, estimated at 1.4×10^4 events, representing a qualitative and quantitative leap beyond all previous experimental efforts in this area. The PAC at the 33rd meeting held in January 2022 recommended the Stage-1 Status, and considered good mass accuracy, along with high resolution, to be crucial for understanding the nature of the enhancement in the ΣN spectrum. The PAC at the 33rd meeting also encouraged the proponents to develop calibration procedures and to project the accuracy of the mass determination.

At this PAC meeting, the proponents presented their calibration strategy, which involves using calibration data from the $p(K^-, \pi^-)\Sigma^+$ reaction, which has kinematics similar to those of the $d(K^-, \pi^-)\Sigma N$ cusp. The $p(K^-, \pi^-)\Sigma^+$ calibration encompasses all relevant effects, including detector alignment and energy loss corrections. A rough estimate based on E70 preliminary data suggests ΔE is $\sim$ 0.1 MeV or less.

The PAC congratulates the E90 collaboration for their achievement. Based on the updated report and the evidence provided during this PAC meeting, the PAC recommends the Stage-2 Approval for E90.

5.8 P111 (J/ψ production near threshold)

Deferred

P111 proposes to measure the $\pi^- p \to nJ/\psi$ reaction to access the hidden-charm pentaquark states. This direct production channel is highly valuable, as it complements the production through the decays of bottom baryons explored by LHCb. The P111 proposal addresses a key puzzle in hadron spectroscopy, highlighted by LHCb, and tests fundamental aspects of QCD dynamics by examining OZI suppression. It aims to resolve a major theoretical controversy spanning five orders of magnitude. The scientific merit of this proposal is high. The measurement is very timely, providing an essential follow-up to the intriguing but inconclusive results from both LHCb at LHC and GlueX at JLAB.

However, the proposed experiment is technically challenging. The main source of background is non-resonant multi-pion production, especially the reaction $\pi^- p \to n\pi^+\pi^-$. The cross section for this process is about 1 mb. Assuming a signal cross section in the nanobarn range (e.g., 1 nb), the initial background-to-signal ratio is 10^6:1. If the actual cross section is at the low end of the prediction (e.g., 10 pb), this ratio increases to 10^8:1. Effectively managing this background is the most critical factor for the experiment's success.

The PAC congratulates the proponents on their progress with this challenging experiment proposal and recognizes its high scientific impact. The PAC encourages them to develop a detailed, quantitative breakdown of the background rejection for the $\pi^- p \to n\pi^+\pi^-$ channel: starting with a 1 mb cross-section, the proponents should illustrate the explicit reduction factor from each analysis cut (e.g., two-track topology, PID, missing mass, invariant mass, etc.) and so justify the final signal-to-background ratio within the J/ψ mass window. This work should include a scenario with a conservative J/ψ signal cross-section (e.g., 50 pb). The PAC also urges the proponents to further work with theorists. The physics case crucially depends on the idea that $\pi^- p$ reactions are more sensitive to Pentaquarks states than γp reactions, and the foundation and robustness of this idea should be clarified.

5.9 E100 (Neutron lifetime)

Deferred Stage-2 Approval

The E100 experiment at MLF BL05 aims to measure the neutron lifetime using the beam method, and has a target precision of 1 second. This effort is highly motivated by the long-standing 4.6σ discrepancy (approximately 9.5 seconds) between the beam and bottle methods. A recent result by E100 based on data from 2014–2023, now submitted to arXiv (arXiv:2412.19519), reports a neutron lifetime of $\tau_n = (877.2 \pm 1.7\ (stat.)^{+4.0}_{-3.7}\ (sys.))$ s, which is consistent with the world average from bottle experiments and exhibits a 2.3σ tension relative to the beam method average. This is a significant achievement and marks an important milestone in resolving the so-called "neutron lifetime puzzle."

At the same time, there remain unexplained discrepancies among four subsets of E100 data taken using different TPC gas pressures (50 and 100 kPa) and two versions of the Spin Flip Chopper. While these inconsistencies do not undermine the validity of the result, they do limit the current understanding and control of systematic uncertainties. To address this, the collaboration has already collected new data under varied pressure conditions. The PAC is looking forward to the forthcoming analysis, that is expected to clarify the origin of these discrepancies and provide a solid foundation for future precision improvements.

In 2024, the team commissioned a new setup involving a superconducting solenoidal magnet and a three-section TPC (the LiNA configuration) to address dominant systematic uncertainties, particularly those arising from gas-induced backgrounds in measuring the neutron β decays. Data were collected with and without magnetic fields. While the system operated successfully, the commissioning run revealed several outstanding issues. Notably, the projected $\times 50$ background suppression with the magnetic field has not yet been achieved; a factor of approximately 2 increase in the shutter-open background, likely due to beta emitters such as ^{20}F from the beam catcher, remains a concern. Additionally, the veto system suffers from high deadtime (approximately 75% with magnetic field), limiting effective data collection.

At this PAC meeting, the team presented a phased approach: Phase I, aiming for a 5-second precision measurement during JFY2025–2026, followed by Phase II targeting 1-second precision in JFY2027–2029. While a standalone measurement with uncertainty $\delta\tau_n \sim 1$ s may not significantly impact the determination of the quark mixing angle V_{ud} extracted from neutron decay, such a result using the beam method would provide a crucial and independent cross-check of the results from bottle experiments, which currently report $\delta\tau_n \sim 0.3$ s. A consistent result from E100 would establish neutron decay as the most precise and reliable source of information on V_{ud}. To enable this, the team also proposed a series of technical improvements aimed at addressing the current limitations and enhancing the experimental sensitivity, including revised veto logic and enhanced shielding configurations, which hold strong potential to reduce background and improve data quality.

The PAC strongly endorses the proposed pilot run (20 days each for JFY2025 and JFY2026). This run will be essential for demonstrating stable operation of the upgraded apparatus and for resolving technical challenges identified during commissioning, particularly those related to background suppression and systematic control.

The PAC commends the collaboration for its significant progress to date and looks forward to the pilot run outcomes, which are expected to play a pivotal role in advancing our global understanding of the neutron lifetime. At this time, the PAC believes it is premature to grant Stage-2 Approval for the 1-second precision measurement. While the collaboration has submitted a Technical Design Report (TDR), further clarification is necessary, particularly in response to recommendations from the FIFC report regarding the detailed strategy for systematic uncertainty reduction. The results of the pilot run will be crucial for validating these approaches and informing any necessary modification to the experimental design. A well-defined roadmap for uncertainty reduction in the form of an updated TDR will be essential before the Stage-2 Approval.

5.10 E73 (Hypertriton lifetime)

E73 aims to measure the lifetime of the hypertriton ${}^{3}_{\Lambda}$H produced by the $^{3}\,\mathrm{He}(K^-, \pi^0)$ reaction to solve the so-called hyper-triton lifetime puzzle, i.e., the discrepancy among different experiments. The forward emitted π^0 and the π^- emitted from the ${}^{3}_{\Lambda}$H weak decay are detected. The production method of the ${}^{3}_{\Lambda}$H hypernuclei was proven effective in the measurement of ${}^{4}_{\Lambda}$H. The proof of concept of the direct measurement of the hypertriton lifetime by means of the exclusive reaction was made in the previous data taking by the measurement of ${}^{4}_{\Lambda}$H.

In JFY2024-2025, the production run with a ^{3}He target was performed with 12.5 days beam time at $\sim$ 83 kW and achieved 41×10^9 K^- on target.

The PAC congratulates the collaboration for the successful data taking and for having achieved the resolution goals. The PAC is looking forward to seeing the final results on the first direct measurement of the hyper-triton lifetimes.

5.11 E88 (ϕ meson in nucleus)

The E88 experiment aims to observe partial restoration of chiral symmetry using $\phi \to K^+K^-$ decays in finite density. This approach is complementary to that of E16 which uses the $\phi \to e^+e^-$ mode.

E88 plans to collect data for carbon, copper and lead targets. With 30 days of beam time, they expect two orders of magnitude higher statistics than the $\phi \to e^+e^-$ sample accumulated by the E325 experiment at KEK-PS. Because of this scientific interest, the 33rd PAC recommended the Stage-1 Status for E88.

In this PAC meeting, E88 proponents reported the status of detector R&D progress as well as the funding situation. The detector system features the MRPC (Multi-gap Resistive Plate Counter) and the SC (Start Counter) for the time-of-flight measurement, the AC (Aerogel Cerenkov counter) for pion rejection, and the STS (Silicon Tracking System) as well as GTR (GEM Trackers) for track reconstruction. The PAC is pleased to see that small prototypes of the detectors were constructed and tested with beam. The PAC encourages the proponents to analyze the test-beam data in more details, and perform other tests if necessary.

To obtain the Stage-2 Approval, a TDR is required. In the TDR, PAC strongly suggests to include a more precise estimation of the polarization fractions and interpretation of the resultant mass shift. Contamination from other physics processes such as non-resonant K^+K^- production and $f_0(980) \to K^+K^-$, should be suppressed to a manageable level, or properly subtracted. Potential final state interactions effect should also be estimated.

5.12 E21 (COMET)

The COMET experiment is designed to search for a muon converting into an electron without emitting any neutrino inside an aluminium target at a new C-line beam line in the Hadron Experimental Facility. The original strategy involved two phases, Phase-I with beam power of 3.2 kW, and Phase-II with 56 kW. Phase-I would achieve a sensitivity 100 times better than the current limit.

While Phase-I has received the Stage-2 Approval, to ensure collection of some data as soon as possible, a revised schedule (Phase-1 LI) was devised, reducing the beam power to 10% of the Phase-I original, and using less iron shielding to reduce cost. Phase-1 LI would reach a SES comparable to the current limit. The COMET data taking is mutually exclusive to both NU and HEF operations.

A Review Committee for COMET, commissioned by PAC, was held in 2024. The final Review Report was produced in September 2024 and preliminary findings were presented to the PAC in July 2024. Also, the COMET Promotion Task

Force is closely following the progress of COMET. Among other points, the review recommends taking data as soon as possible at low intensity (Phase-1 LI), and that the collaboration and the laboratory should continue to work together to ensure that the necessary funding is secured for the realization of Phase-1 LI as soon as possible. At the July 2024 meeting, the PAC agreed that taking data at a reduced intensity in Phase-1 LI as early as possible is the correct strategy at this point. Subsequent COMET Phases will be eventually discussed in future.

The Collaboration has produced a detailed response to the Review Report and has presented it to the PAC in July 2025. Progresses on many aspects were reported at this PAC meeting.

Intensive simulation studies are being finalized to optimize the muon beam, while keeping under control the hit rate in detectors and radiation levels. In this context, the design of the new proton target and new muon beam collimator have been optimised, reaching 60% reduction of neutron/photon fluxes at the front CRV and 50% reduction of number of hits inside the CTH. The baseline PCS field has been lowered from 4.9 T to 4.4 T to increase the safety margin, and the TS-dipole field was re-optimised. The connection between the PCS and the refrigerator has been postponed due to lack of funding. There is an ongoing effort to source the funding and parts of the CS, with JINR and IHEP having agreed to contribute. The optimization of the downstream radiation shield and related area arrangements is still in progress. The CTH is moving towards a construction phase; 20% light yield degradation was observed in some counters but this does not represent a problem for Phase-I intensities. The technology choices for the CRV are being finalised, and contributions from different countries have significantly improved its funding status.

The COMET collaboration has recently agreed on implementing a Common Fund scheme to share the maintenance and operation (M&O) cost including the necessary service tasks and in-kind contributions to ensure the smooth operation of the experiment. A part of the funding needed for the realization of the facility is still missing, despite the in-kind contributions secured from JINR and IHEP. The Collaboration is planning a campaign of grant applications in autumn 2025. At this stage, the earliest beam is foreseen from the second half of 2027.

The Collaboration is also putting an effort on finalizing the analysis of data taken in Phase-α: a dedicated analysis review committee was formed and the review process is ongoing. A detector paper based on this phase has been recently published.

The PAC congratulates the collaboration on the progress made, acknowledging their efforts in overcoming several challenges. The PAC encourages COMET to continue their efforts towards the timely realization of Phase-1 LI, which has an increasingly crucial timescale, and to continue working on the implementation of the Review Report recommendations. The PAC encourages the collaboration and the laboratory to continue working together to ensure that the necessary funding for Phase-1 LI is secured with the minimum impact on the J-PARC operation costs.

5.13 E14 (KOTO)

The KOTO experiment (E14) searches for the rare CP-violating decays $K_L \to \pi^0 \nu \bar{\nu}$ in the J-PARC neutral beam line. The decay rate is precisely predicted theoretically and thus provides an excellent probe for physics beyond the Standard Model. The PAC congratulates KOTO for the result based on 2021 data and its final publication in February 2025.

KOTO received beam in mid-January to mid-February at 83 kW and mid-April to mid-May 2025 at 92 kW (4.24 sec spill) with good efficiency. Basic checks have been performed on the 2025 data set, that appears to be of satisfactory quality, and offline calibrations are in progress. Data accumulated in 2024-25 are a factor of 2 more than those taken in 2021. In the first 2025 period a leak current happened in the Beam Hole Charged Veto, making one of the three layers of the wire chamber unusable. A "FilmBHCV" was prepared and installed; its performance looks good and a detailed examination is in progress. Features based on GPU that were introduced in the DAQ in 2022-23 allow for an accidental rate monitor, providing quick feedback about the spill shape to the accelerator group, as well as performing the High-Level Trigger for online event selection and pedestal suppression. KOTO acknowledges the improvement in the spill shape in 2025 and has evaluated that this gives a 10% gain in signal acceptance.

For the next data taking, an improvement of the mechanical structure of the FilmBHCV, and further improvement of the DAQ efficiency are planned. KOTO stresses again the importance of a good spill quality (with a potential further improvement of 15%), and requests 1 month of data in autumn 2025, and > 60 days at > 80 kW beam power every year for 3-4 years with a smooth beam spill shape. KOTO could take a higher beam power and therefore reduce the beam time request.

The PAC congratulates KOTO for the 2025 data taking campaign and for the progress made on the preliminary analysis of recent data sets. The PAC commends the introduction of the spill-structure monitor and encourages KOTO to continue its close collaboration with the accelerator division to further improve the spill quality. Finally, the PAC acknowledges KOTO beam request and recommends that beam time for KOTO remains a high priority.

5.14 E56/E82 (JSNS2, JSNS2-II)

The JSNS^2/JSNS^2-II experiment searches for sterile neutrino oscillations using the J-PARC MLF as the source of neutrinos. Data-taking campaigns have been carried out in 2021, 2022 and 2024. Analysis is ongoing with the 2022 data set as a reference and differences relative to 2021 (slightly different liquid scintillator composition) and 2024 (minor change of trigger condition) data are being studied.

In the past six months, the JSNS^2/JSNS^2-II experiments have not received beam due to MLF mercury target instabilities, and the collaboration has been focusing on analysis and other improvements.

The PAC congratulates JSNS^2/JSNS^2-II on the recent publications, and the partial unblinding of the sideband regions in the 2022 data analysis. The successful implementation of the staged unblinding process has provided a comprehensive understanding of the data and analysis framework. Results from the unblinding of the signal region using pulse shape discrimination are expected to be available in Autumn 2025, with a publication to follow.

The PAC looks forward to the full unblinding of the 2022 dataset and encourages the collaboration to refine their sensitivity estimates for the full dataset. In particular, the PAC recommends exploring alternative statistical approaches, such as the CLs method, which could potentially enhance the exclusion sensitivity.

The PAC was also pleased to hear about the successful debugging of the Michigan electronics, which solved the trigger inefficiency issue discussed at the 39th J-PARC PAC meeting.

The PAC endorses the collaboration's request for MLF beam and further urges for the cooperation of the MLF such that the $JSNS^2$/$JSNS^2$-II experiments can carry out important neutron background measurements upon return of the beam.

5.15 E71 (NINJA)

The NINJA experiment continues to demonstrate steady progress toward its goal of precise neutrino–nucleus interaction measurements using nuclear emulsion technology. Its unique ability to detect low-energy final-state particles with good momentum resolution plays an important role in reducing systematic uncertainties relevant for neutrino oscillation experiments. The PAC commends the collaboration for its continued innovation, including detector upgrades and automation of track reconstruction, which have further enhanced the experiment's capabilities.

Recent developments from Physics Run E71a include significant improvements in muon identification, which have effectively reduced contamination from misidentified events, although some discrepancies remain in the low muon momentum region between data and Monte Carlo. The PAC acknowledges these improvements and encourages further work to fully resolve these differences. The PAC strongly supports NINJA's structured publication plan, which targets the first physics results from E71a for release in early 2026. This will represent a major milestone for the experiment.

In parallel, analysis of the E71b dataset is well underway. The collaboration has begun scanning emulsion films using the newly-developed HTS2 system, which achieves high tracking efficiency (>99%) and operates at the maximum speed currently possible. The PAC is pleased to see the integration of machine learning techniques, such as graph neural networks, for automating muon track identification and improving signal-to-noise separation in offline reconstruction. These developments not only enhance analysis throughput but also increase the reliability of event classification. Preparations for the next physics run, E71c, are progressing steadily, including detector upgrades, film production, and DAQ developments.

The PAC looks forward to continued progress and encourages the collaboration to maintain its momentum in both detector construction and physics output. In particular, the collaboration is encouraged to explore electron-neutrino charged-current cross-section measurements using the E71 dataset, leveraging the fine granularity and good particle identification capabilities of the detector.

5.16 E11/E65 (T2K)

The T2K experiment is a long-baseline neutrino experiment which utilizes a high-power neutrino beam and a combination of a near detector suite at J-PARC and the Super-Kamiokande (SK) detector in Kamioka in order to precisely measure three-neutrino oscillations and search for CP violation in the neutrino sector.

The PAC congratulates the T2K collaboration on its most recent publications, and excellent progress on simulation and data analysis. Beam operations during February 28 to March 4, 2025, were stable at 805 kW, as also demonstrated by INGRID, and achieved a new record of 830 kW beam power. ND280 detectors are performing well, and calibration and performance improvement efforts are underway, with detector papers under preparation.

First-time operation at new record-breaking beam power has also presented some challenges. The PAC was informed about the unfortunate target cooling incident that has prevented T2K from collecting data beyond March 4, 2025. The collaboration, together with KEK and Rutherford Appleton Lab, were able to identify the probable cause and resolve the issue. The collaboration has also identified countermeasures to help prevent this issue from occurring in the future.

Beam readiness is foreseen after the end of November 2025. Given the March cooling target setback, the new POT projections for before Hyper-K operations begin correspond to $8.5{\times}10^{21}$ POT, slightly short of the target 1×10^{22} POT. This assumes that T2K receives 85.5 days of beam in JFY2025 at 800 and 900 kW, and 88 days of beam in JFY2026 at $\geq$ 900 kW. This beam delivery is needed in order to advance T2K's physics program. The PAC endorses this request, and recommends that T2K be given high beam priority in JFY2025 and JFY2026. The PAC also urges T2K to continue their efforts on analysis improvements and explore further mitigation strategies to temper the impact of the anticipated reduction in statistics on the sensitivity.

5.17 P112 (Second stage of P93)

Recommend approval as a test experiment

The P112 experiment is the second phase of the P93 experiment, and its primary objective is to evaluate the properties of negatively charged secondary particle beams (pions, kaons, and antiprotons) and muon beams produced by the high-momentum beam line. This is a critical step for future experiments at J-PARC, including the Charmed Baryon Spectroscopy experiment (E50). The experiment will measure beam intensity, profile, and particle composition across a range of momenta from 2 to 20 GeV/c. It will also test a beam line configuration to make a muon beam, which is referred to as "μ20 mode".

The experiment requires transporting negatively charged particles, which the B-line was not initially designed for. This necessitates the installation of polaritychanging devices on some of the magnet power supplies. Funding for these devices has been secured through the K-Program[2], and their installation is expected to be completed by Autumn 2026. The total requested beam time is 60 hours, broken down into 6 hours for beam line commissioning, 4 hours for detector commissioning, and 50 hours for physics measurements (42 hours for the hadron beam and 8 hours for the muon beam).

The J-PARC Hadron Section has reviewed the feasibility of the P112 experiment, and their assessment indicates that the experiment is viable. The Section has confirmed that both the standard and the μ20 mode (with different upstream and downstream magnet settings) are technically achievable. The proposed modifications to beam line monitors are considered manageable but will require close coordination with the beam line staff. Switching between P112 and other experiments, such as P113 and E16, will require approximately a week for each transition, necessitating careful scheduling. The experiment is expected to be ready to run in the Autumn 2026 or later, following the installation of the polarity changers.

The PAC congratulates the proponents on their progresses and recognizes the significance of the proposed experiment for future experiments at J-PARC. The PAC recommends approving P112 as a test experiment. The PAC encourages the proponents and the laboratory to continue collaborating closely to ensure the experiment is ready for scheduled beam time with minimal impact on other experiments.

5.18 P113 (Radiography with muon beam)

Recommend approval as a test experiment

The P113 collaboration proposes a test experiment to demonstrate the practical use of multi-GeV muons by performing a radiographic imaging experiment in the B-line. Muon radiography utilizes the fact that high-energy muons undergo multiple Coulomb scattering as they pass through dense materials. The standard deviation of the projected angular distribution caused by this scattering depends on the muon momentum and the ratio of the radiation length to the path length of the material traversed by the muon. By applying a tomographic back-projection method using measured muon spatial profiles and momenta, the internal structure of dense objects can, in principle, be inferred. This proposed application of high-energy muons can potentially establish a novel platform for interdisciplinary research.

The P113 uses backward decaying muons, which carry approximately 57% of the momentum of their parent pions and can be efficiently separated from the background of the pion using a conventional optical setup. The successful detection of such muons with near-unity purity was previously demonstrated by the T106 experiment.

At the PAC meeting, P113 presented a proposal for a demonstration exper-

[2] Key and Advanced Technology R&D through Cross Community Collaboration Program, https://www8.cao.go.jp/cstp/anzen_anshin/kprogram.html (in Japanese)

iment, involving a $30 \times 30 \times 30$ cm^3 concrete block with embedded iron bars. High-energy muons will be directed perpendicularly through the block and the one-dimensional muon profile will be measured at momenta of 3, 4.8, and 6 GeV/c. The PAC acknowledges that P113 has shown simulation results demonstrating the feasibility of reconstructing the iron bars. The PAC recommends approval of P113 as a test experiment. Still, the PAC is unsure of how the beam time request is exactly derived. The PAC encourages P113 to provide a quantitative estimate of the statistics required to achieve the spatial resolution necessary to reconstruct and determine the position and size of iron bars accurately, and looks forward to seeing a revised report at the next PAC meeting.

5.19 E34 (g-2/EDM)

E34 aims to measure the anomalous magnetic moment and electric dipole moment of the muon at the J-PARC MLF H-line using a novel technique that employs a cold surface-muon beam, muon acceleration, and injection into a compact storage magnet. This method offers an opportunity to measure the muon g-2 with systematic effects distinct from those using the magic-gamma approach, and a muon EDM sensitivity by about two orders of magnitude better than the current best limit.

Rapid progress has been made by the E34 collaboration from the last meeting. The acceleration of a low-emittance muon beam using their H2 line, demonstrated last spring, is now published. Further increase in the muon intensity is planned by using higher power laser equipment prepared in the H2 area. The unavailability of the funding for H-line extension building in FY2025, as recognized by previous PAC meetings, led to re-designing of the building and the LINAC to achieve cost reduction. Initial ideas of a revised plan for the building and a new LINAC acceleration scheme were presented at this PAC meeting. The third series of the Progress Review by IPNS took place in April 2025. Two important issues were identified there: the design to ensure high efficiency for the muon-beam injection to the storage ring magnet, and the mitigation of the noise in tracking sensors induced by the kicker magnet. The status of studies on these issues was presented. The review also pointed out that the IPNS should help the project by recruiting human resources and asking for cooperation from the accelerator experts from the Tsukuba campus. The PAC noted that the planned completion of the project is shifted by about one year, now targeting 2030, due to the re-planning of the H-line building and the accelerator.

The PAC congratulates the steady progress of the project and acknowledges the effort for realizing the experiment, which involves the cost reduction and consolidation of the muon source, the accelerator and the detector. The PAC emphasises that a timely realization of the E34 project is crucial, as it is awaited by multiple communities. The low-emittance muon beam can be used not only for the proposed muon g-2 and EDM measurements, but also for the muon microscope, a project being conducted by KEK IMSS, and also for demonstrating positive muon acceleration for future applications.

5.20 E03 (X-rays from Ξ^- atom)

The PAC received the report summarizing the results obtained from the initial Ξ^--atom X-ray experiment at K1.8, conducted with 10% of the planned beam time due to MR power limits. In 2020-2021, about 9.5×10^{10} kaon beams were used, and the initial analysis showed no significant X-ray peaks near the expected energies, with an upper emission probability limit of 0.19 at 90% confidence level.

The PAC acknowledges the attempt by the collaboration to interpret the observed low yield as due to the $\Xi^0 p - \Xi^0 n$ mixing, which might suppress X-ray transitions, especially in Fe targets. The PAC supports the proposal to carry out further tests with a ^{12}C target in J-PARC E96. The PAC also strongly encourages the finalization of the analysis of existing data to obtain solid upper limits before any further measurement is planned. The PAC expects a detailed report and a proposal for future plans at the next PAC meeting in the beginning of 2026.

5.21 E36 (R_K)

E36 is an experiment designed to test lepton universality through the ratio $R_K = \mathrm{Br}(K^+ \to e^+\nu)/\mathrm{Br}(K^+ \to \mu^+\nu)$, using a stopped K^+ beam. The original goal was to surpass the sensitivity of the NA62 result, which confirmed the Standard Model prediction at the 0.4% level. Although data collection was completed in December 2015, limited statistics and several experimental challenges — such as suboptimal beam conditions, detector performance limitations, and DAQ inefficiencies — have significantly impacted the achievable precision. The final uncertainty on R_K is now expected to be at the few-percent level, falling short of the original 0.3% target and worse than NA62. Nevertheless, the use of an entirely different detector system and independent systematics will make E36 a valuable cross-check in the global effort to test lepton universality.

The collaboration published two papers on structure-dependent radiative kaon decays ($K_{e2\gamma}$ (SD)) in 2022 and 2023, which provided critical input to the main R_K analysis that began in 2023. Despite constrained manpower, the team has made significant progress. The final momentum spectrum analysis after particle identification is underway, guided by a weekly international collaboration meeting. The report outlines key contributions to the experimental uncertainty, including a $\sim$4000-event $K_{e2(\gamma)}$ sample, 2% relative uncertainty from PID calibration, and DAQ-related systematics at the 1% level. The PAC acknowledges the collaboration's sustained effort and encourages timely completion and publication of the R_K result.

E36 also holds potential for a competitive search for dark photons decaying to e^+e^- in kaon decays. The PAC supports this complementary analysis and looks forward to its submission for publication.

5.22 E42 (H-dibaryon)

The PAC acknowledges the receipt of the progress report of E42 conducted at K1.8 in 2021. The experiment searched for the H-dibaryon, a long-standing challenge in hypernuclear physics. The experiment is strategically designed to access a broad mass spectrum, targeting three specific hypothesized states: weakly-bound, virtual state, and resonance.

The experimental setup at J-PARC, utilizing a 1.8 GeV/c K^- beam incident on a diamond target within the Hyperon Spectrometer, showcases advanced detection capabilities. The integration of the Hyperon Spectrometer, HypTPC, and forward KURAMA spectrometer provides high precision in tracking and particle identification, crucial for reconstructing $\Lambda\Lambda$ and $\Xi^- p$ events.

The preliminary results, including cross sections for double-strangeness production, the analysis of the $\Lambda\Lambda$ system, and the estimation of the $\Xi^- p$ inelastic scattering, are promising. The observed bump structure near $E_\Xi = 120$ MeV and the comparison with previous measurements validate the experimental methodology. Moreover, the focused analysis on the $\Lambda\Lambda$ mass spectrum — highlighting the enhancement at small opening angles — indicates sensitivity to possible di-baryon signals.

The PAC congratulates the collaboration for the ongoing effort to simulate potential H(2050) signals; coupled with the estimation of the statistical significance, this demonstrates a rigorous approach toward establishing or constraining the existence of the H-dibaryon. The PAC is looking forward to the presentation of the first results in the near future.

6 General Remarks and Recommendations

The PAC congratulates IPNS and J-PARC on their steady effort to improve the facility and to increase the beam power. Stable beam operations at 830 kW for the fast extraction and 92 kW for the slow extraction are remarkable achievements. In addition, the improvement on the spill structure is highly commendable, as the poor spill quality has been an issue for Hadron Hall experiments for many years. Every opportunity should be explored to further improve the beam structure, taking advantage of close collaborations with the users. It is encouraging to hear that there is a solid plan to increase the beam power, and that the rotating target for higher beam intensity is being studied and prepared in a systematic way.

The PAC much appreciates the work of the FIFC and many Task Forces for monitoring and guiding experiments closely.

The main current concern of the PAC is the budget for running the accelerator. The principal purpose of J-PARC is to produce physics results, as this is the drive behind the operation, maintenance and also the programme of improvements of the accelerator complex; to fulfill its principal purpose, availability of beam time is necessary. The KEK, JAEA, IPNS, and J-PARC should continue to work together to secure funding to give long-enough beam time to users.

The PAC was asked to advise on the data taking plan, in particular until summer 2026. Because of the difficulty to give solid beam time allocations without a concrete budget, the PAC will only provide a guideline. Neutrino experiments should be given enough beam time considering the loss caused by the target problem experienced earlier on. In the K1.8 beam line, E63 should be given beam time and finish data taking, before switching to E75. In the K1.8BR beam line, E72 should have the highest priority, followed by the high-momentum data taking of E45, then E104, and then the mid/low-momentum phases of E45. In the neutral beam line, beam time for KOTO should remain a high priority. IPNS and J-PARC may make the necessary adjustments to the plan to maximize the physics output considering the limited and complicated beam schedule. Finally, the PAC points out that the efficient turn-over of experiments is even more crucial at times when there are so many constraints and limitations on the beam time.

7 Dates for the Next J-PARC PAC Meeting

The next J-PARC PAC meeting will be held in January 2026.

8 Documents Received

For this meeting, the J-PARC PAC received the following documents.

- Minutes of the 39th J-PARC PAC meeting held on January 8 - 10, 2025 (KEK/J-PARC-PAC 2025-13)

- Proposals:
  - P110: Proposal for Beam Test of Improved Trigger Counter for the J-PARC E72 Experiment (KEK/J-PARC-PAC 2025-14)
  - P111: J/ψ Production in $\pi^- p$ Reaction near Threshold (KEK/J-PARC-PAC 2025-15)
  - P112: Proposal for the Second Stage of the P93 Experiment (Evaluation of the Properties of the Secondary Particles Delivered at the High-momentum Beam Line) (KEK/J-PARC-PAC 2025-16)
  - P113: Proposal for an Experiment to Demonstrate the Radiography with a Multi-GeV Muon (KEK/J-PARC-PAC 2025-17)
- Technical Design Reports:
  - E90: High Resolution Spectroscopy of the "ΣN Cusp" by Using the $d(K^-, \pi^-)$ Reaction (KEK/J-PARC-PAC 2025-18)
  - E94: New Generation Λ Hypernuclear Spectroscopy with the (π^+, K^+) Reaction by S-2S (KEK/J-PARC-PAC 2025-19)
  - E100: Neutron Lifetime Measurement with Pulsed Cold Neutrons (KEK/J-PARC-PAC 2025-20)
  - E104: Double ϕ Production in $\bar{p}p$ Reactions Near Threshold (KEK/J-PARC-PAC 2025-21)
- Reports:
  - E16: E16 Analysis Report (KEK/J-PARC-PAC 2025-22)
  - E21: Response to COMET Phase-I Review (KEK/J-PARC-PAC 2025-23)
  - E99: Status Report for J-PARC E99 (NOPTREX) (KEK/J-PARC-PAC 2025-24)
  - E03:Present Status and Plan of J-PARC E03 (KEK/J-PARC-PAC 2025-25)
  - E36: Status of E36 (KEK/J-PARC-PAC 2025-26)
  - E42: Progress Report of J-PARC E42 (KEK/J-PARC-PAC 2025-27)
- Addendum
  - E45: Addendum to the E45 Proposal "3-Body Hadronic Reactions for New Aspects of Baryon Spectroscopy" to Run at the K1.8BR Beam Line (KEK/J-PARC-PAC 2025-28)