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

Minutes of the 24th meeting held
24(Mon)-26(Wed) July 2017

OPEN SESSION:

1. Welcome and Mandate to the Committee: K. Tokushuku (KEK)
2. J-PARC Center Report: N. Saito (J-PARC/KEK)
3. J-PARC Accelerator Status & Plan: F. Naito (J-PARC/KEK)
4. T2K/T2K-II status and Plan 1
— Overview, Beam, Near Detector, Cross Section —
M. Wascko (Imperial College London)
5. T2K/T2K-II status and Plan 2
— Super-K and Oscillation Analysis — R. Wendell (Kyoto)
6. E61: M. Hartz (IPMU)
7. E07(Double Strangeness System with a Hybrid Method) :
K. Nakazawa (Gifu)
8. E56 (Sterile ν Search): T. Maruyama (J-PARC/KEK)
9. E34(g-2/EDM) : T. Mibe (J-PARC/KEK)
10. Hadron Hall & SX beam status, schedule and Target R&D plan
H. Takahashi (J-PARC/KEK)
11. E14 (KOTO): T. Yamanaka (Osaka)
12. FIFC Report: S. Uno (KEK)
13. E21(COMET): Y. Kuno (Osaka)
14. E03 (Measurement of X-rays from Ξ-Atoms): K. Tanida (JAEA)
15. E31 (Hyperon Resonances below KN Threshold): H. Noumi (Osaka)
16. E62 (Precision Spectroscopy of Kaonic Atom X-rays with TES)/

E57 (Strong Interaction Induced Shift and Width of Kaonic Deuterium):

J. Zmeskal (SMI-OeAW)

17. E42 (H Dibaryon): J.K. Ahn (Korea U.)
18. E16 (Measurements of Spectral Change of Vector Mesons in Nuclei):
    K. Aoki (J-PARC/KEK)
19. E40 (Measurement of the Cross Sections of Σp Scattering):
    K. Miwa (Tohoku)
20. E36 (Lepton Universality): S. Shimizu (Osaka)
21. Strangeness Nuclear Physics Results and Future Plan I - E15/E05
    T. Nagae (Kyoto)
22. Strangeness Nuclear Physics Results and Future Plan II - E13/E63
    H. Tamura (Tohoku)
23. E21 (COMET): Y. Kuno (Osaka)
24. COMET Facility: S. Mihara (J-PARC/KEK)
25. MR ESS Plan M. Tomisawa (J-PARC/KEK)
26. Beam time schedule for 2017-2018 T. Kobayashi (J-PARC/KEK)

CLOSED SESSION:

Present: N. Aoi (Osaka/RCNP), T. E. Browder (Hawaii), S. I. Eidelman (BINP), J. Haba (Chair, KEK), K. Hanagaki (KEK/Osaka), D. Harris (FNAL), A. Ohnishi (Kyoto/YITP), G. Isidori (UZH), S. Kettell (BNL), R. Kitano (KEK), M. Kuze (Tokyo Inst. of Tech.), J. Pochodzalla (Mainz), W. Weise (TU Munich), H. Tamura (Tohoku), W.A. Zajc (Columbia), K. Tokushuku (KEK-IPNS Director), T. Kobayashi (KEK-IPNS Deputy Director), and N. Saito (J-PARC Director)

1. PROCEDURAL REPORT

The minutes of the 23rd J-PARC-PAC meeting (KEK/J-PARC-PAC 2017-7) were approved.

2. LABORATORY REPORT

2-1 Welcome and Mandate to the Committee (Katsuo TOKUSHUKU, KEK IPNS Director)

The director of the Institute of Particle and Nuclear Studies (IPNS), Katsuo Tokushuku, welcomed the PAC members. Tokushuku reported that Prof. Tetsuo Hatsuda stepped down from a PAC member, and he introduced a new committee member, Prof. Akira Ohnishi. Tokushuku reminded the committee of the general mandates and approval process of proposals. Tokushuku expressed his appreciation to Prof. Gino Isidori for his outstanding contributions over a period of several years. Prof. Isidori will step down from a PAC member after the 24th meeting.

Tokushuku summarized the progress since the previous J-PARC PAC meeting. Beam delivery to E11(T2K) was almost as expected. The MR SX beam delivery from 2017 April to June was only 45% of scheduled due to ESS (Electro-Static Septum) troubles. In this period, data taking for E07 was completed, while the planned beam for E31 and E21(COMET) was not delivered. Stage-2 approval of E42 has been granted after assessment of a revised TDR by the FIFC in July 2017. Despite the fact that there is no indication of recovery of the J-PARC project budget by the government, KEK management decided to operate the J-PARC MR for at least 6 cycles of user beam time in JFY2017. The middle term schedule of the J-PARC facility upgrade needs to be updated. However, it is still certain that the JFY2017 budget barely maintains compatibility with the plans for the MR-Power upgrade and replacement of the SX target in summer 2019 along with completion of the high-p/COMET beam lines in JFY2019.

Tokushuku reported that one new proposal on the study of radiation damaged materials in the MR was submitted. As this is a special case of using the MR beam, the review procedure for this proposal is under discussion among the IPNS and J-PARC managements. TDRs for E16 and E56 were submitted, and assessed by FIFC.

Tokushuku asked the committee to provide a recommendation on the priority of beam time allocation until summer 2018 taking the following constraints into account; a total of 6 cycles of MR operation in JFY2017, at least 6 cycles in JFY2018 assuming no surprise in the JFY2018 budget, and a long Super-Kamiokande shutdown scheduled in summer and autumn of 2018. He also asked the PAC to review the status of strangeness nuclear physics experiments after the two years of operation since April 2015, and other on-going experiments based on presentations at this J-PARC meeting.

2-2 J-PARC Center Report (Naohito SAITO, J-PARC Center Director)

The J-PARC Director, Naohito Saito, welcomed the PAC members, and led a silent prayer for Professor Emeritus Satoshi Ozaki, who passed away on July 22, 2017.

After presenting an overview of the J-PARC facilities, Saito explained the operation status of two accelerators, RCS and MR, aiming at about 1 MW beam power. For the MR, a trial operation above 500 kW was performed and prospects for about 1.3 MW beam power were shown. The neutron target in MLF will be replaced in the autumn of 2017.

Saito explained a scenario with beam power upgrade reaching 1 MW in 2020 in addition to giving a status report on accelerators and experimental facilities in JFY2016. He emphasized the variety of scientific topics explored at J-PARC, which led to thirteen press releases in JFY2016 including the results from E11 (T2K).

Saito explained the J-PARC budget situation for JFY2017. Operation for 6 cycles will be managed under the current very tight budgetary conditions. The J-PARC action plan in JFY2017 intends to maintain safe and stable operation of the facility with availability of more than 90% while maintaining the activity toward higher machine power, and increasing scientific outputs. The International Advisory Committee (IAC) of J-PARC that met in Feb. 2017 also expressed its concern on the tight budget situation. Collaboration with domestic universities, oversea institutions, and industrial sectors is developing more and more at J-PARC. J-PARC is carefully strengthening high-power target R&D and has joined the international activity studying radiation damage of materials (RADIATE).

The Japan Science Council has recently established the 2017 Master Plan for large-scale research projects. Two proposals related to J-PARC were selected as 28 important projects; these are (1) Elucidation of the origin of matter with an upgrade of the J-PARC experimental facility and (2) Nucleon Decay and Neutrino Oscillation Experiment with a Large Advanced Detector (Hyper-Kamiokande). Hyper-Kamiokande was also selected as one of the seven projects in the 2017 MEXT roadmap.

2-3 J-PARC Accelerator Status (Fujio Naito, J-PARC/KEK)

Fujio Naito summarized the J-PARC accelerator status and plan. He presented the status and beam power history of the accelerators as well as details of the beam time allocation after the last PAC meeting. Stable operation of the MR in the FX mode was established at a beam power of 470 kW.

At the beginning of the beam time in the SX mode, the Electro-Static Septum (ESS) for SX beam extraction developed a problem. Naito explained its details. The beam time for users was thus reduced by half while the beam power was reduced from 44 kW to 37 kW. Repair work of the ESS is in progress at the moment; it will be installed by the beginning of October 2017.

Naito then presented the mid-term plan for the MR beam power upgrade. The new power supplies are in development; construction of the new buildings where they are stationed will be completed soon. The first power supply for a bending magnet is being constructed and will be tested in this winter.

Naito finally showed the operation schedule for JFY2017. He pointed out that it is more convenient for the next autumn operation to start with the FX mode in view of vacuum scrubbing of the repaired ESS for SX mode. In addition, he mentioned a longer power outage scheduled in JFY2018.

2-4 Hadron Hall Beam Status, and Target R&D Plan (Hitoshi Takahashi, J-PARC/KEK)

Hitoshi Takahashi reported the status of the Hadron Hall including the status of recent beam delivery and construction of the high-p/COMET beam lines. He also explained the R&D status of the new primary target (T1 target).

Takahashi showed the integrated beam power history. The original goal was 2229 kW·days for E07, E31, the E03/E40 beam study, and the COMET 8 GeV test. Because of the ESS problem, both the beam power and beam time had to be reduced. The total integrated power was 1014kW·days in the end. As the result, only the E07 experiment was completed during this beam period.

Construction work for the high-p/COMET beam lines is in progress. Within this year, construction of the high-p beam dump, the shielding wall of the COMET beam line, and stages for magnet power supplies will be completed. Takahashi showed the construction schedule of the high-p/COMET beam line. The beam line is expected to become available at the end of JFY2019.

Takahashi finally reported the upgrade plan for the T1 target. The next primary target will be operated with indirect water cooling capable of accepting primary beam power of no less than 80 kW. They plan to install this target in 2019 and make it operational immediately. Furthermore, a "euro-coin" type target composed of a nickel disk with a gold or platinum edge is in development for the future, capable to receive higher power beam. The primary proton beam strikes the edge of the disk, which is continuously rotating and cooled directly by water or He gas. The PAC had a concern about developing two types of targets simultaneously with a limited budget and manpower. The PAC urges a review of all the relevant issues of the technology as well as a strategy for building the next primary target in time.

2-5 FIFC Report (Shoji UNO, IPNS/KEK)

Shoji Uno presented a report from the Facilities Impact and Finance Committee (FIFC). He reported on changes in the membership of the committee; new members are Kazuhiro Tanaka (IPNS/KEK), Tomohisa Uchida (IPNS/KEK), Kyo Shibata (Acc./KEK), and Toshihiro Mimashi (Acc./KEK), are in charge from April 2017 for a term of two years. Uno introduced also a new secretary, Taku Ishida (IPNS/KEK). He then reported on the FIFC committee meeting held on July 4th, 2017. At this meeting, the feasibility of E56, which is requesting stage-2 approval, and two status reports (E42 and E21) were discussed.

E56: The FIFC heard reports on the safety issues both from the E56 group and the safety working group for E56. It has now become clear that there is no legal issue concerning the fire and radiation protection laws. However, the largest concerns are possible risks while moving the detector with liquid scintillator (LS) filled and handling the LS itself. These possible risks depend on the location of the detector, the upper floor of the neutron target, and thus the FIFC asks the PAC to clarify whether the proposed baseline of 24m is really crucial for E56. The FIFC also heard the status of detector design.

It is found that there is no major concern in spite of some minor comments that should be addressed in their updated TDR.

E42: The E42 group presented the status of the experimental preparation, especially the result of structural analysis of the magnet, which was thoroughly checked following the request from the previous FIFC meeting. E42 showed the result of a new calculation with an updated FEM model, clarifying that the maximum stress is reduced well below the acceptable value to follow the FIFC recommendation.

E21(COMET): The E21 group reported on the status of facility construction with a focus on the tungsten alloy radiation shield to be installed in the capture solenoid, the pion production target and sinkage of the experimental area. Design work of the radiation shield is in progress with more than one conceptual design being considered. The FIFC strongly recommends consulting engineering experts to finalize the design. Prototype R&D of the pion production target is in progress, which is in good shape. The FIFC also heard about the possible use of a different material from the baseline design (Graphite), which would potentially increase the muon yield. However, taking into account the time scale until the start of the experiment, the FIFC suggests that the experimental group should converge on the design as early as possible. As for measurement of the floor sinkage in the experimental area, it was found that the level is not significant (less than 0.2mm). The FIFC recommends that the experimental group should continue to monitor the level carefully while and after installing heavy equipment into the area.

Discussions at the FIFC meeting are summarized in detail in a separate report.

3. EVALUATIONS OF THE PROPOSALS AND STATUS OF THE ONGOING EXPERIMENTS

E11 (T2K) & E65 (T2K-II)

The T2K and T2K-II Experiment(s) (E11 and E 65) gave two presentations at this PAC meeting, where each presentation covered aspects of both E11 and E65. T2K made two different requests: one is the now "standard" request for 9×10^{20} protons on target (POT) in JFY18, and the other is a decision at this meeting on the accelerator schedule up to the summer 2018 shutdown.

The first presentation covered the detector and beamline operations since the last PAC meeting, a progress report on the ND280 upgrade, a comparison of the statistics of T2K and NOvA as a function of time, and a brief description of T2K's recent neutrino cross section results. They made a request for at least 9×10^{20} POT before the summer of 2018.

Thanks to the excellent performance of the accelerator and the high detector livetime, T2K was able to accumulate almost twice as much Forward Horn Current (neutrino mode) data in the past year as it has accumulated since the start of the experiment in 2010. As a result T2K is leading the field in the search for leptonic CP-violation. At the same time, T2K is initiating a joint working group with NOvA whose goal is consistent joint-experiment averages on oscillation parameters.

In order for T2K-II to reach the POT goal of 20×10^{21}, they will need to upgrade the neutrino beamline itself, in addition to the proton source upgrade. To reduce the systematic uncertainties on the oscillation measurement, there is an upgrade to the ND280 detector complex. They plan to submit various funding requests to support the ND280 detector complex upgrade to several international groups and also a request for technical supports from the CERN Neutrino Facility. A TDR will be submitted at a future PAC meeting for Stage-2 approval. Another TDR being prepared will cover the beamline upgrade necessary for T2K-II. The ND280 upgrade will improve the near detector acceptance to measure cross sections at a broader range of lepton angles and to better match the uniform acceptance of the Super-K detector.

The PAC congratulates T2K on the past 6 months of successful data taking and its recent suite of publications on both oscillations and neutrino interactions. The PAC would like to understand better what the schedule is for the ND280 detector upgrade, and by what point in the T2K-II run would the ND280 detector needs to be ready. The PAC was also interested in seeing the T2K results expressed as a function of $\sin\delta_{cp}$ including the unphysical region, rather than simply seeing the results as a function of δ. This would help to test the oscillation framework and not simply determine δ_{cp} within that framework. The PAC encourages T2K to continue to engage NOvA so that parameter fits using both experiments' results can be done properly, by taking into account the correlated systematic uncertainties between the two experiments.

The second presentation covered recent analysis improvements of T2K far detector data. These improvements include a new reconstruction algorithm that uses more information about the charge and timing of the incoming light signals, and a much less restrictive fiducial volume cut. The improvements both increase the signal statistics and decrease the relative fraction of background events, without degrading the systematic uncertainties. By adding charged current pion production as a signal channel, T2K has added an additional 10% in statistics. This selection also removes some of the backgrounds originating from misidentified charged current interactions. T2K showed that the far detector systematic uncertainties did not increase with these selection improvements, and in some cases decreased. T2K reported that the near to far extrapolation uncertainties are improved by the analysis improvements listed above.

Plans for updating the Super-K detector were also presented. The update will take place in two stages, refurbishment of the detector and Gadolinium doping of the water. For refurbishment the tank will be emptied and all welding lines will be sealed with sealants. Dead channel PMTs and calibration fibers will be replaced in parallel. The tank will then be refilled with pure water. This stage is expected to take 6.5 months, shortened from the previous estimate of 8.5 months. In the second stage of the update Gadolinium will be added to improve neutron tagging efficiency; this will be carried out after detector recommissioning.

The T2K group explained the request of the Super-K collaboration and ICRR/Kamioka to determine the accelerator schedule through July 2018. This enables them to schedule the upgrade work of the Super-K detector or determine the "earliest start date" of the tank draining while minimizing the impact on T2K data-taking.

The PAC recommends that T2K should start data acquisition early in the fall and receive a total of at least 8×10^{20} POT by June 2018. Running T2K in the antineutrino mode in this period would double the antineutrino statistics, or in the neutrino mode would add 50% more statistics. This, together with the analysis improvements presented so far, will provide a huge advantage in the experimental search for the CP violation in the neutrino sector.

The PAC recommends, once the two TDR's described above are completed, two focused reviews, one for the beamline upgrade and the other for the ND280 detector upgrade before discussing Stage-2 approval.

E61 (NuPRISM)

E61 is proposed to measure neutrino cross sections, and to measure neutrino energy spectra at a wide variety of off-axis angles with a water Cerenkov detector to reduce interaction model systematics in the Hyper-K experiment. NuPRISM has joined with TITUS and is currently using the name E61 for the collaboration. This unification has increased the number of collaborators to 100 and adds expertise in many areas (data acquisition, photo-sensor development, calibration, and neutron simulation). The experiment is carried out in two phases; the first, the Phase-0 experiment, will be located on the J-PARC site at an off-axis angle to test the calibration techniques and to measure electron neutrino cross sections, and the second, the Phase-1 experiment, will be located at a longer baseline distance and cover a broad range of angles. E61 plans to use the same detector for Phase-0 and Phase-1.

The E61 presentation at this PAC meeting covered activities in the past 6 months: neutron background measurements, photo-sensor and electronics developments, calibration plans, simulation improvement, detector design and Phase-0 site optimization. In particular, they have changed the baseline design of the Phase-0 inner detector height to be 6 m instead of 10 m, and shown that the detector capability is not significantly compromised.

E61 has studied the signal and background rates by simulations for two different Phase-0 locations: 6 and 8 degrees off-axis. They have also studied various Phase-1 locations, ranging from 749 m to 1850 m away from the primary beamline target. The farther locations require larger amounts of excavation to locate the detector on-axis; the farthest location requires a detector as tall as 10 m. It should also be noted that realizing the Phase-I experiment at the nearest location at 749m from the target requires further studies to improve the inefficiency due to the coincidence of beam events in the detector. Without improvements, vetoing on outer detector coincidences introduces a 79% reduction to the efficiency and vetoing on the inner detector coincidences introduces a 24% efficiency reduction for the case of MR operation at 1.3MW. They plan to design the detector to be modular so that the Phase-0 detector of 6 m height can be used for a part of the Phase-I detector even if the site selection dictates a 10 m tall detector.

E61 collaborators are all in the T2K collaboration and thus they are aware of the analysis improvements described in the T2K presentation. They have designed the E61 experiment in such a way to provide necessary inputs for T2K-II given the projected statistical precision of T2K-II.

For more realistic evaluation of the background E61 requests that J-PARC provides the accelerator timing signal at the Phase-0 site in order to clarify the beam-induced background. The PAC recommends that E61 confirms the backgrounds using the accelerator timing signal.

E61 plans to submit a TDR by the end of 2017 and requests support from KEK to develop the Phase-0 facility; this includes site preparation as well as construction and installation planning of the detector. E61 also requests support to develop the options of the detector location, and to investigate the possibility to acquire the site for the Phase-I detector. The PAC recognizes that these are mandatory to finalize the TDR.

The optimization of the Phase-1 location in view of the impact on the future neutrino programs (both T2K-II and T2-HyperK) should also be further investigated. The PAC also encourages E61 to minimize the differences between the Phase-0 and the Phase-1 detector design. If the detector optimization is strongly dependent on the detector location for Phase-1, the Phase-1 location should be chosen as soon as possible to minimize the differences between Phase-0 and Phase-1. The PAC notes that, if Phase-0 is to be considered without Phase-1, then the detector R&D aspects described in the proposal and the benefit to Hyper-K need to be more clearly demonstrated.

E56 (Sterile Neutrino Search)

E56 (JSNS2 experiment) presented their current status and discussion of the TDR describing a one-detector version of the experiment. E56 represents an exciting opportunity to explore key parts of the phase space for possible sterile neutrinos. They can directly confront the LSND result with an improved experimental configuration. They are in competition with many experiments. E56 presented a plan to start running in JFY2018 with one detector. The PAC notes that the collaboration has presented substantial progress on many fronts, including: liquid scintillator, tanks, cosmic-ray veto, PMT, and electronics development. They presented work towards meeting the fire code standards at the MLF and some considerations of the safety for the case of earthquakes and detector transportation. They measured the acceleration induced on the detector when it is transported by the crane (with no load) and found that it is safe enough to transport the detector filled with liquid scintillator. However the detector robustness under full load should be considered in future study. They also showed initial work on pulse-shape discrimination based on neutron test data generated by Tohoku University Cyclotron. They updated expected sensitivity of the experiment by fixing a software bug, which caused subsequent increase of the external gamma-ray background by a factor of four. The PAC recognizes these impressive work that went into the TDR.

The PAC notes that the experimental energy resolution is evaluated by a simple simulation with a constant term extrapolating from lower energy reactor experiments and that very little detail is provided to assess the detector calibration; the PAC requests that

E56 shows how many events are needed per detector voxel (i.e. unit of volume for calibration) to achieve the planned energy resolution and/or the uniformity of response across the fiducial volume. Regarding the calibration method using the monochromatic neutrino energy source at 236 MeV from kaon decay at rest as described in TDR, the PAC points out that it is necessary to evaluate the energy resolution at the peak and to optimize the dynamic range of the electronics. Figure 5 of the TDR (examples of oscillation signals) should also be updated with a realistic detector energy resolution and background. Furthermore, the 90% CL exclusion plot (Figure 73) should be updated based on a realistic detector energy resolution model with a constant term.

The PAC recommends that the single detector version of JSNS2 should be located at a distance of ~30 m or less where the experiment has a sensitivity to higher sterile mass splittings and that E56 should reconsider locating the second detector to improve the robustness of the experiment and along with improving the sensitivity. This is because there are concerns about the systematics and reliability in the single detector version of the experiment. More complete evaluation of the systematic uncertainties associated with the experiment is indispensable; they should assign an uncertainty to the accidental background.

E56 discussed safety issues with the J-PARC Working Group and FIFC. In addition to this discussion the PAC requests that E56 examines the detector performance when the scintillator is drained and refilled each time the detector needs to be moved. The PAC requests that E56 also shows the engineering analysis with detailed detector supporting structures and liquid interconnects, which would help to convince the committee that moving the detector will not result in a change to the internal detector.

The PAC concludes that the TDR should be updated by addressing the issues raised by the FIFC and PAC before granting the stage-2 approval.

E14 (KOTO)

KOTO showed the publication of their 2013 result in PTEP 021C01 (2017), and presented the status of the 2015 data analysis (Run 62 & 65) with tight cuts, normal cuts and looser cuts. Regarding this analysis, studies continue on the known backgrounds and, especially, on searches for unknown sources of backgrounds. Some inconsistencies in the background estimates near the signal region, in particular in the vertex sideband and at low barrel energy persist under loose cut conditions among other things.

KOTO presented data from the 2016 run with the Inner Barrel installed. Preliminary studies from the short 2017 data run with several special background studies and trigger/DAQ improvements were also presented. Finally, the plan for calorimeter readout upgrades in 2018 was discussed. The latter involves the installation of SiPM's, which provide very good timing, on the front faces of the crystals. Comparison of the signals from the SiPM on the front and the PMT on the back of the CsI crystal should provide a powerful discrimination between the neutron background and photons from the $K_L \to \pi^0 \nu \bar{\nu}$ signal.

KOTO requests 2 months of running before the summer 2018 shutdown in order to set an upper bound on $BR(K_L \rightarrow \pi^0 \nu\bar{\nu})$ in the 10^{-9} range close to, or possibly below, the (indirect) Grossman-Nir bound. They further request 2 months of running after the calorimeter upgrade and before the summer 2019 shutdown. The goal of the KOTO experiment is both interesting and challenging. The timely achievement of a Single Event Sensitivity (SES) in the 10^{-9} range would be important in view of the progress on rare K decay searches expected by the NA62 experiment at CERN.

The PAC endorses their 2018 running request. However, it stresses the importance of completing the 2015 data analysis before proceeding with further hardware upgrades. The PAC requests a detailed plan and realistic schedule for completing this data analysis as soon as possible. The PAC strongly encourages the collaboration to present such an analysis at the next PAC meeting.

KOTO is encouraged to recruit more people and, at the same time, to focus available human resources on the analysis team in order to accomplish the background studies in a systematic and timely manner. The PAC emphasizes the importance of optimizing the background studies not only for the 2015 runs, but also in view of the recent data taking. The PAC needs the analysis results to assess the priority of the KOTO upgrades within the context of future beam-time requests.

E34 (g-2/EDM)

The E34 experiment is designed to measure the anomalous magnetic moment of the muon (g-2) using innovative muon cooling techniques. The experiment will use a surface muon beam to produce muonium, which is ionized and accelerated to 300 MeV/c in a LINAC and then injected into a solenoid magnet instrumented with silicon strip detectors to measure electrons from muon decays. The experiment reported on further development of the collaboration organization, responses to the 15-16 November 2016 focused review and R&D progress.

Initial E34 studies in response to the focused review indicate that it would be difficult to substantially accelerate an initial rapid deployment of the experiment. Nevertheless these studies have led to improved understanding of cost estimates. Various R&D efforts have made good progress, although the laser amplification crystal remains unproven.

The PAC is pleased to see that the new collaboration organization explicitly includes personnel responsible for managing interfaces between and within subsystems. The PAC was happy to see new data on muonium production (TRIUMF-S1249) that shows no degradation of yield over times for a couple of days and observation of muonium spin precession in vacuum. Both of these are encouraging and a more detailed presentation in the TDR is anticipated. Initial studies have been completed on a possible drift tube LINAC option, relaxed Kilpatrick factor, interdigital H-mode acceleration, beam profile monitors and injection studies using SITE. An RFQ demonstration is scheduled in November.

Valuable engineering on the magnet is in progress along with plans for B-field monitoring. Work on the detector system design and systematic error budget has started. The PAC strongly encourages development of the specific E34 systematic error table recognizing that this will continue to require substantial work over the next many months. This is a very important step for updating the TDR.

Plans for a complete end-to-end simulation of the entire experiment are encouraged. The PAC agrees that the TDR should fully explain the experimental sequence along with the interfaces between slow muon production and the RFQ, and between the accelerator output and magnet injection. The simulations of the whole system should be described in more detail, and some description of the optimization of the initial electrostatic acceleration system and of the injection system should be included.

A more detailed cost estimate should be developed that describes how each estimate was made. A more detailed schedule should be developed along with supporting documentation about how task duration lengths were estimated. It would be good to consider linkages between the various activities.

The experiment plans to present a complete response to major items from the focused review and request for stage-2 approval at the next PAC meeting. All of the previous focused review recommendations should be addressed and the TDR updated before the experiment requests stage-2 approval; this should be submitted well in advance of the PAC meeting. The updated TDR should include (1) end-to-end simulation results, (2) a complete description of the interfaces between all accelerator components and the analysis system, (3) results of the muonium polarization and production measurements, (4) a detailed plan for achieving the required muonium yield and transport efficiency for phase I of the experiment, (5) a new E34 systematic error table, and (6) a detailed plan for the initial engineering run.

<u>E21 (COMET)</u>

The COMET team has now addressed a number of items that were highlighted at the January 2017 PAC meeting.

The central drift chamber (CDC) was completed in June 2016. A cosmic-ray test started in August 2016. Resolutions in the best region of the chamber below 150 microns have been achieved; this is acceptable. A CDC hit efficiency of 95% was obtained. Irradiation tests of the CDC electronics frontend (RECBE) have been carried out recently. There may be neutron damage issues for the FPGAs and gamma-ray damage issues for other components; additional shielding for the CDC readout electronics may be needed. An aging test of the CDC was carried out as previously recommended. With a He-C_2H_6 mixed gas there is a degradation of 6% at an accumulated charge of 20mC/cm/wire, which is somewhat worse than expected. Other helium-based gas mixtures will be investigated.

The CDC and the detector solenoid will be completed in the second quarter of 2019 rather than summer of 2018 due to budgetary conditions. A cosmic-ray test of the complete detector system with magnetic field could take place after installation of the system to the detector solenoid.

Straw-tube mass production for Phase-I tracker construction has been completed. The straw-tube tracker design is being finalized with help of the KEK engineering group. An improved cooling system will be implemented in the design. Straw-tube tracker construction can begin soon. Another major component of the beam measurement detector (StrEcal), the calorimeter, will use LYSO crystals. 273 crystals out of 500 necessary for Phase-I have been purchased by JINR and KEK. The readout will use APDs mounted on PCBs for which the mass production will start in 2017. A successful beam test of the StrEcal system and the full readout chain was carried out at Tohoku University in March 2017. The energy resolution for the crystals was found to be 4.7%. A position resolution of 230 microns and reasonable x-t correlation were obtained with the straw-tube tracker prototype. High rate tests were also carried out in this beam test. There is also significant progress on the muonic x-ray measurements of the muon stopping target at Technical University of Dresden in Germany.

Work is underway on the construction of the COMET beam line and the associated components as was discussed earlier in this report.

The design of the tungsten-alloy shield for the pion capture solenoid is the next item on the critical path. Overall, the schedule for the COMET beam line and magnet system construction is determined by funding rather than technical issues. The COMET beam line construction should be completed by the end of JFY2019.

As noted in the reports from the last PAC and the FIFC, COMET requires significant engineering support from KEK throughout its construction and installation phase. The PAC reaffirms its importance and encourages the group to work with the relevant activities of KEK.

Tests of main ring operation at 8 GeV and extraction in bunched SX mode (including the extinction factor measurement) should be carried out. These tests were originally planned in spring 2017 but were cancelled because of the ESS problem. The request is two periods of 8 GeV running for a total of 8 days. This test has high priority and should be incorporated into the plan for the next running period. A detailed plan of the engineering run prior to COMET physics data acquisition should be provided, requiring additional simulation work. The engineering run should be included in the beam time schedule once the construction schedule is determined.

The COMET group has set up an editorial board to finalize the COMET TDR and post it to the ArXiv by the end of the year. The COMET team is to be commended for systematically addressing the comments from the previous PAC meeting.

E07 (Double Strangeness System with a Hybrid Method)

The hybrid-emulsion experiment E07 is an unique experiment aiming at production of bound double lambda nuclear systems. Measuring the ground state masses of several light double-hypernuclei with high precision will provide important constraints on the Λ–Λ interaction in nuclear systems.

The goal of E07 was to reach about ten times the statistics of the previous KEK experiment (E373). A first 5-day physics run was performed in June 2016 permitting the exposure of 18 emulsion stacks. In 2017, the remaining 100 emulsion stacks were successfully exposed to the K^- beam. Several improvements (optimization of the target position, improving the DAQ efficiency etc.) helped to increase the expected number of stopped Ξ^-'s significantly. Estimates guided by the results of the 2016 run and based on a very preliminary scan of a small section of one stack indicates the number of stopped Ξ^- consistent with the goal of E07 of about 10000 events.

The PAC congratulates the E07 collaboration for the successful completion of data taking. The committee also thanks the machine group for the extremely professional actions taken for the ESS recovery in a short time during the beam time period before summer 2017.

The PAC looks very much forward to the first physics results of E07. The committee hopes that the manpower presently working on the experiment can be maintained not only during the scanning process of the emulsions in 2017/2018, but also during the subsequent physics analysis stage of this larger data set as compared to previous emulsion experiments. In order to guarantee the transfer of knowledge, detailed documentation of the data and analysis procedures seems mandatory as well as securing continuous support for human resources to work on the analysis during the next years.

E31 (Hyperon Resonances below $\bar{K}N$ Threshold)

This experiment systematically explores $\bar{K}N \rightarrow \pi\Sigma$ reaction mechanisms in the threshold and sub-threshold regions with the aim of clarifying the complex nature of the $\Lambda(1405)$, which cannot be described as a simple three-quark baryon. Recent effective field theory approaches suggest instead a double-pole structure of this baryonic state as a $\bar{K}N$ quasi-bound system embedded in the $\pi\Sigma$ continuum.

E31 had previously reported on the analysis of $\pi\Sigma$ missing mass spectra in all charge configurations ($\pi^+\Sigma^-$, $\pi^-\Sigma^+$ and $\pi^0\Sigma^0$), measured in a first run in 2016. Furthermore a $\pi^0\Sigma^-$ (pure I = 1) spectrum was deduced from $d(K^-,p)$ reaction data. The detailed analysis of these channels makes it possible to perform a complete isospin decomposition of the $\bar{K}N \rightarrow \pi\Sigma$ amplitudes and to focus on the I = 0 channel in which the $\Lambda(1405)$ appears prominently. It was pointed out that the $\pi^0\Sigma^0$ mode requires further efforts with higher statistics and a detailed assessment of background subtraction in order to further establish the line shape and the behavior around 1420 MeV in the I=0 channel below the $\bar{K}N$ threshold. The PAC recommends that an analysis of the existing $\pi^0\Sigma^0$ data be performed even at this early stage.

At the January 2017 PAC meeting E31 requested 20+2 days for the second run with 45 kW beam power. The PAC approved this request and proposed to allocate beam time before the summer shutdown in 2017 in order to complete this experiment. This second run started in April 2017 but was forced to stop after half a day of data taking, as a consequence of the ESS incident.

The PAC reconfirms its previous assessment of the experiment and recommends scheduling 20+1.5 days of beam time in early 2018. The committee is thereafter looking forward to a detailed analysis of the complete set of final data. In particular, the observed pronounced maximum in the $\pi\Sigma$ spectra above $\overline{K}N$ threshold around 1460 MeV needs to be understood consistently with the sub-threshold structure around 1420 MeV, in close communication with theorists.

E57 (Strong Interaction Induced Shift and Width of Kaonic Deuterium)

E57 proposes to make a pioneering measurement of X-rays from K-d atoms. Precision measurement of the shift and width of the 1s state by the strong interaction will provide crucial information on the kaon-nucleon interaction at threshold.

Working with the FIFC, E57 successfully demonstrated that safe operation of the hydrogen target is possible. Tests of the cryogenic target assembly underway at KEK will be completed by the end of August 2017. E57 also reported on progress towards assembling the Silicon Drift Detectors (SDD) that will be used to detect X-rays. 28 units of 4×2 cells have successfully been tested, 12 units are undergoing long-term tests at SMI or LNF. 26 pieces still need to be mounted and bonded at Milano Politecnico. Ultimately, 48 SDD's units will be needed for the full experimental implementation at J-PARC.

Based on the present status, E57 presented an updated time line indicating a slight delay from the previous estimate. Final tests of the DAQ systems operating at least 8 SDD units, which are mounted on the cryogenic target are planned at J-PARC during January/February 2018. Following a switchover from E62, it is anticipated that E57 could be ready for data-taking in K1.8BR by summer 2018.

The collaboration has requested 3.0 days for beam tuning and detector commissioning, to be followed by 3.5 days of measurements at 45 kW beam power with a gaseous hydrogen target (5% of liquid hydrogen density) to validate their Monte Carlo estimates of backgrounds. For this commissioning run at least 24 SDD units will be available.

The PAC encourages the collaboration to pursue preparations based on this schedule, and requests that the collaboration provide an update on their readiness and time request for a 2018 beam test at the next PAC meeting in January 2018.

E62 (Precision Spectroscopy of Kaonic Atom X-ray with TES)

The E62 experiment aims to observe X-rays from kaonic ^{4}He and ^{3}He atoms emitted in the transition from the 3d to the 2p orbitals. The energy shift and the width of these transitions are essential to resolve the long-standing problem concerning the depth of the K^- nucleus potential. Since the width of the transition is predicted to be as small as 2eV, a high energy-resolution measurement technique based on superconducting transition-edge-sensors (TES) was introduced.

The progress since the last PAC meeting was reported, and includes the development of the ^{4}He/^{3}He target system and the X-ray tube. The ^{4}He and ^{3}He target system is based on the one used previously for the E15 experiment. The target cell of a cylindrical shape with a dimension of 6 cm in diameter and 6 cm in length has been fabricated for this experiment. The vacuum chamber to mount the target cell has been modified so as to accommodate the TES detector. It has been confirmed that the cryogenic target has been cooled down successfully as expected and that the TES detector worked well without having significant thermal fluctuation induced by the target system.

An X-ray tube has been introduced to irradiate the TES detector with intense X-rays, which will be used to monitor the energy calibration during the measurements to compensate the change of the detector response due to fluctuation in the experimental environment such as the beam intensity. This is essential to ensure the accuracy and the reliability of the high energy-resolution measurement.

The PAC appreciates the progress of development of the cryogenic target and the X-ray tube. The previous PAC supported the joint request of E62 and E57 to perform a commissioning run to optimize their beam line and target configuration. These measurements were performed in K1.8BR line and showed good control and understanding of K^- stopping in a Li target. A test of the TES has also been performed and energy resolutions of 5.0 eV (6.7 eV) have been achieved under beam-off (beam-on) conditions.

A beam time allocation after March 2017 has been requested, which includes four days for full commissioning and 16 days for the production run. Note that the experimental group now thinks it is better to perform the measurement with the ^{3}He and ^{4}He targets separately instead of measuring simultaneously using a mixed target as originally planned. It is not necessary to extend the beam time to realize the separate measurements.

The PAC recommends the requested beam time be allocated when the K1.8BR beam line becomes available after completion of the ongoing experiment.

E16 (Measurement of Spectral Change of Vector Mesons in Nuclei)

E16 is an experiment to measure the spectral change of vector mesons in nuclei. They presented a revised proposal for Run0 and requested Stage-2 approval to have Run0 with the limited acceptance detector they can afford with the current budget in early 2019. This run of 40 × 8-hour shifts will allow a test of the beam line, detector performance and yields estimation, and preparation for extending the acceptance if they obtain a JSPS grant (KAKENHI).

They addressed various PAC suggestions presented before. Manpower has increased with the addition of two students from Kyoto University. Dependence on the target was tested by varying the target material and shape in the simulation. They plan to use various target configurations with two Cu components and one C component and to minimize the amount of material. The spectral function should be measured as a function of multiplicity. This will be possible in the high-statistics Run2. One should extend the measurement mass range below the rho peak. However, the current trigger does not allow this study. In addition, backgrounds should also be studied in detail in the mass range.

The Run0 program includes beam line commissioning with a plan to measure and minimize beam halo (10 shifts) and detector commissioning (30 shifts). Run0 will measure two main types of background (BG): combinatorial BG and random hit BG. Combinatorial BG (uncorrelated electron-positron pairs) comes from electrons from Dalitz decays of the π^0, gamma conversion in the material, and misidentification of pions as electrons. Random hit BG degrading the resolution comes from beam halo, neutrons from the beam dump, and secondary particles from the target. The beam halo effect was studied using E325 experience while neutron yield from beam dump was estimated based on MARS simulation, and minimized by optimizing the dump structure. However, this type of BG is difficult to estimate and beam measurements are needed.

E16 detector commissioning (30 shifts) includes:

- Detector setup (4 shifts)
- Combined HBD and LG performance test (6 shifts)
- Zero-magnetic field run for detector alignment (4 shifts)
- Tracking performance evaluation with various intensities (10^8, 10^9, 10^{10}/spill) (7 shifts)
- Data taking to measure the meson yield (10^{10}/spill) (9 shifts)

Tests of the integrated detector include:

- Separate studies of pion rejection from the HBD and LG,
-Magnetic field mapping and detector alignment,
-Optimization of trigger conditions,
-Evaluation of effects of random hits in the trackers,
-Validation of analysis algorithm such as track finding,
-Validation of the yield estimate of vector mesons.

The PAC recommends Stage-2 approval for Run0 and encourages the group to thoroughly review the strategy of beam commissioning in close cooperation with the beamline team.

E40 (Measurement of the Cross Section of Σp Scatterings)

The E40 experiment is designed to provide high statistics measurements of the Σp cross section at the K1.8 beam line using the KURAMA spectrometer and a new detector system (CATCH) for scattered protons. These data will provide isospin-separated information on the Σ-N potential for comparison to Effective Field Theory and lattice QCD calculations, which may be of vital importance to our understanding of nuclear matter at high density.

The E40 collaboration has made excellent progress since the last PAC meeting. The CATCH system was commissioned and tested with 80 MeV protons using the CYRIC cyclotron facility at Tohoku, clearly showing the ability to separate p+p from p+C scattering events. The BGO calorimeter system demonstrated an energy resolution of 1.4% at 80 MeV, consistent with expectations. This detector system has been moved to J-PARC, where it is currently undergoing additional testing with cosmic rays. At the end of June 2017, the collaboration made effective use of 11 hours of beam time to optimize focusing on the K1.8 beam line at the E40 target position and to check the stability of the beam line counters at high intensity.

E40 is ready to begin installation of the CATCH detector in the K1.8 beam line in December 2017, which will allow for test runs in February 2018. The collaboration has requested 5×12-hour commissioning runs (following E31) for calibrations, establishing triggers and setting beam interlock thresholds for high intensity running. These studies will position E40 for production running any time after March 2018. Their physics running request consists of 26.5 days for studying Σ^-p scattering, to be followed (after a two-week change-over) by 22 days of Σ^+p running, which will require first 2 days commissioning and 2 days of calibration.

The PAC recommends allocating commissioning runs of 0.5 days × 5 in February 2018, and a physics run after May 2018. Given the tight constraint on the available beam time, it is strongly suggested to re-examine whether the data-taking period can be reduced.

E42 (H dibaryon)

E42 presented an updated TDR on the search for S=-2 H-dibaryon between the ΛΛ and ΞN thresholds via the (K^-, K^+) reaction at K1.8. Measurements of the ΛΛ, $\Lambda p\pi^-$ and Ξ^-p final states with good mass resolution and high statistics will provide key information on the possible H-dibaryon, which has been searched for by the previous E224 and E522 experiments at the KEK-PS and hinted at by recent lattice QCD simulations. This experiment has an advantage compared with other experiments such as e^+e^- or heavy-ion collisions; S=-2 quantum numbers are produced in the primary processes and the background is low.

The E42 hyperon spectrometer consists of a time projection chamber (HypTPC) and a superconducting Helmholtz magnet. After the FIFC in December 2016, they have performed magnet quench tests at KEK, improved the magnet thermal condition, and submitted an updated TDR with extended description on the magnet as requested by the FIFC. With the examination of the revised TDR in the most recent FIFC, conditional Stage-2 approval suggested by the PAC in January 2017 was finally granted by the IPNS director.

The group is encouraged to submit a commissioning and physics run plan including a detailed experimental setup to a future PAC meeting.

E03 (Measurement of X-rays from Ξ-atoms)

The E03 experiment is designed to make the world's first observation of X-rays from Ξ-atoms. The ultimate goal is to obtain direct information on the Ξ-A optical potential, which may have important implications for the structure of both doubly-strange hypernuclei and neutron stars. E03 aims at establishing a new experimental method in order to provide a basis for future more systematic measurements. Specifically, Ξ's produced via a (K^-, K^+) reaction will stop in an iron target to form Ξ−Fe atoms. E03 proposes to measure 1) the n=7→6 172 keV X-ray, which is expected to show little or no modifications the energy and width and 2) the n=6→5 ~286 keV transitions, which is expected to exhibit ~4 keV modifications to its mass and width.

E03 has previously proposed a two-phase strategy, with the first phase using ~10% of requested running time using X-rays from the n=7 level to optimize the experimental setup, to be followed in the second phase with the measurement of the energy shift and level of the transition from the n=6 level. At its January 2017 meeting the PAC approved a one-day commissioning run to optimize the location of the Ge detectors, which was to be completed before the Summer 2017 shutdown.

At this PAC meeting, E03 reported that accelerator issues delayed their 2017 commissioning run, originally scheduled from June 1 to June 29. As a result, they were not able to change the Ge crystals location used for E07. Also, they were limited to 2.5 hours of background measurements using the E07 configuration (not optimized for E03 measurement). In this mode, they were able to demonstrate an energy resolution of 3 keV or less in all crystals. Analysis is ongoing to determine the event rate in the signal region between 200 and 300 keV. In light of this, E03 requests 1.5-days setup time for the beamline and the KURAMA spectrometer, followed by a 1-day commissioning run. While not a strong requirement, they prefer to carry out this prior to the E40 setup. The 1.5-days of setup time can be shared with other tests at K1.8. Following their commissioning and E40 running, E03 requests to take their Phase-1 data (15 days with 45 kW beam), with the possibility of moving directly to Phase-2 should 80 kW beam intensity be available.

E36 (Lepton Universality)

E36 has completed data taking and is now in the final stage of preparation for a lepton universality test. Due to the relatively short data taking period, the expected sensitivity on the lepton universality ratio is 0.5% rather than 0.3% as originally planned. There is a high level of interest in lepton universality tests, especially given the recent results from B semi-leptonic decays.

Since the last PAC meeting in January 2017, there has been significant progress on calibration and analysis of the data. The tracking has been upgraded from 4-point tracking to 5-point tracking using the spiral scintillating-fiber tracker (SFT). The momentum resolution improved from 1.4% to 0.9% as reported at the last PAC. Furthermore, the SFT efficiency has been improved from ~75% to ~95% since the last PAC.

Although the time resolution remains at the 200 ps level in the TOF system, there has been an important improvement in the particle identification, which combines three detector systems; an overall muon rejection of 10^{-6} has now been achieved.

The separation of various channels has improved after refinement of the tracking and particle identification. A clear Ke2 signal from a small data subsample is now visible, along with a reduced Kμ2 feed-down and a Ke3 tail. In addition, the contribution of the radiative modes has can now been included. The radiative SD (structure-dependent) component of Ke2 from data can be constrained by measuring the associated photon in the CsI(Tl) calorimeter.

E36 expects to complete their systematic studies by winter 2018. The PAC hopes for regular updates on the final version of the analysis at the upcoming J-PARC PAC meetings.

There is also world-wide interest in dark photon searches including on-going dedicated experiments at JLAB and Mainz as well as searches by collider experiments (e.g. at KLOE, BaBar and Belle). Initial work on the dark photon was presented at this PAC meeting. There is some background from Kl3 with π^0 Dalitz decay that can be suppressed easily. Since this analysis is not systematics limited, it should be straightforward to finish in the near future. The PAC recommends timely completion of this analysis given the pressing competition from the NA62 experiment at CERN.

4. Review of Recent progress of Strangeness nuclear physics

One of the goals of hadron and nuclear physics is to explore the structure of hadrons and their interactions based on quarks and gluons, and then to understand properties and structure of atomic nuclei as well as nuclear matter including high density matter in compact stellar objects, in a way that establishes connections to the underlying dynamics and symmetry patterns of QCD. In this endeavor, strangeness plays an essential role. Studies of hyperon-nucleon and hyperon-hyperon interactions elucidate the origins of nuclear forces. The exploration of properties and the behavior of hyperons and strange hadrons in the nuclear medium deepens our understanding of hadronic many-body systems. This is the key motivation for the strangeness nuclear physics program at J-PARC.

The accomplishments of the JPARC experiments on strangeness nuclear physics were summarized at this PAC meeting. The PAC recognized the success of the many excellent experiments, hitherto impossible at other facilities. The results and broad spectrum of physics insights gained by these experiments have already had a great impact in the nuclear and hadron physics communities worldwide.

Anti-kaon nuclear physics data obtained in the E15, E27, and E31 experiments have clarified the response of nuclei to anti-kaon induced reactions. The quest for the existence of deeply bound anti-kaonic nuclei has attracted much attention during the last 15 years. There have been active debates on the existence of narrow deeply bound states of anti-kaonic nuclei. DAFNE, DISTO, and J-PARC-E27 data were analyzed under the hypothesis of a K-pp bound state. By comparison, the combined response function of E15 and E27 data display enhancements at energies corresponding to $B(K^-)$ ~ 20-50 MeV. In addition, new E05 data on the $C(K^-,p)$ reaction together with E27 data suggest a long tail at deeper binding energy regions. These experiments have provided us with unified and coherent perspective in the S=-1 systems around and below the anti-kaon-nucleus threshold. Starting from the ground state of S=-1 systems (Λ hypernucleus), J-PARC has opened a window to nuclear systems containing hyperon resonances such as the $\Lambda(1405)$ and anti-kaons as strongly interacting constituents. J-PARC has thus extended the area of research in nuclear and hadron physics far beyond previously accessible areas.

Hypernuclear spectroscopy initiated at KEK-PS and further developed at J-PARC has significantly contributed the determination of the Hamiltonian of systems containing nucleons and hyperons. High precision gamma-ray data on many excited levels of various Λ hypernuclei lead to theoretical developments constraining the basic interactions between hyperons and nucleons. The J-PARC E13 experiment extended the p-shell hypernuclear level-scheme data to lighter (s-shell) and heavier (d-shell) nuclear systems. The experiment also observed clear evidence for an extraordinarily large charge symmetry breaking effect in hypernuclei. As a consequence, the interaction matrix elements of light Λ hypernuclei have been well determined, and the experimentally constrained Λ-nucleon interactions can be compared with theoretical approaches such as chiral EFT and lattice QCD.

Furthermore, new types of hypernuclei containing an S=-2 Ξ hyperon have been confirmed to exist by the E05 pilot run via the (K^-,K^+) reaction, following the KISO event discovered by E07 members with the KEK-PS E373 emulsion data. These results extend our knowledge on strangeness nuclear systems beyond S=-1. Further studies of strange nuclear systems including the H dibaryon and ΛΛ hypernuclei will strongly improve our understanding of baryon mixing and baryon-baryon interactions in nuclear matter.

Altogether these data serve as the first version of "tables of hyper-isotopes" and provide a valuable database for investigations of low-energy QCD including strangeness quantum numbers. J-PARC results have greatly improved our understanding of the origin and evolution of visible matter in the universe.

The PAC strongly supports the strangeness nuclear physics program at J-PARC. This requires sufficient beam time as well as upgrades of the primary target and beam lines. The PAC also encourages activities aiming at extension of the Hadron Hall in the future.

5. BEAM TIME ALLOCATION FOR JFY2017

The PAC is pleased to observe the fruitful operation since the last meeting in January. T2K has accumulated almost the same amount of FHC (neutrino) data in the last year as was integrated in previous years and successfully established an improved analysis algorithm, which provides a further increase of statistics. In the Hadron Hall, the E07 experiment has been completed; they were able to expose the emulsion stacks stored for a long period in the Kamioka site. An unprecedented number of Ξ^- hypernuclei are expected to be discovered from their hundred sets of emulsion stacks. Meanwhile because of the unfortunate trouble of the ESS in the MR SX, the beam scheduled to E31 for 22-days and to COMET for 8 days was not delivered.

To schedule the coming operations by the summer 2019, the following important work should be completed.

- SK repair work for 6.5 months in the summer of 2018.
- The MR power supply upgrade in the summer of 2019.
- The KOTO upgrade for 7 months, which is assumed to take place after summer 2018.

The following experiments are ready to accept beam in the coming operation period.

- T2K with a beam request to accumulate 9×10^{20} POT by the summer 2018.
- E31 with a beam request for 22 days.
- E40 with a beam request for about 50 days including commissioning and physics data taking.
- E62 with a beam request for about 20 days including commissioning and physics data taking.
- E03 requests 1 day for a pilot run.
- E57 requests about 7 days for a pilot run as suggested by the previous PAC.

Considering the intense ongoing worldwide competition in neutrino physics with T2K and a range of unique physics in the hadron hall ready to harvest, PAC suggests the following beam operation plan for the period from fall 2017 to summer 2018.

The operation after the summer 2017 starts with FX until the end of December 2017. SX operation will resume in January 2018 and continue until mid-February for 32 days. 8 GeV MR tests for COMET, E31 data taking, E03 pilot run and E40 commissioning would be arranged to execute in this period, with priority in this order. FX operation will resume in March with the remaining operation budget for JFY2017, which is expected to be longer than a few days depending on the electricity cost and will be connected with the FX operation in the entire period of April and May. SX operation will resume in June with E40 ready at K1.8 and E62 at K1.8BR. The priority and practical beam delivery plan for the above two experiments will be discussed at the next meeting after assessing their readiness. E57's pilot run may be arranged in this period.

The PAC assumes continued operation of SX in fall 2018 with minimal beam time to perform significant fractions of the E40, E62 and E57 (a pilot run) experiments. The allocated beam time should be reexamined at the coming PAC meeting, after reviewing the detailed plans from the experiments. Since SK repair work may start in June 2018 for 6.5 months, FX operation for T2K is expected to resume in January 2019. The length of the SX and FX operation periods after the summer shutdown will be discussed further after reviewing the JFY2018 operation budget, SK repair work, and the status of KOTO.

6. DATES FOR THE NEXT J-PARC PAC MEETING

The next J-PARC PAC meeting will be held January 15-17, 2018.

7. FOR THIS MEETING, THE J-PARC PAC RECEIVED THE FOLLOWING DOCUMENTS:

- Minutes of the 23rd J-PARC PAC meeting held on 11-23 January, 2017 (KEK/J-PARC-PAC 2017-7)
- Proposal
  - J-PARC E16 Run0 proposal (KEK/J-PARC-PAC 2017-10)
  - Measurement of displacement cross section of proton in energy region between 3 and 30 GeV for high-intensity proton accelerator (KEK/J-PARC-PAC 2017-12)
- Technical Design Reports
  - Technical Design Report: Searching for a Sterile Neutrino at J-PARC MLF (E56, JSNS2) (KEK/J-PARC-PAC 2017-8)
  - TDR on the Proposal E42 (Updated, KEK/J-PARC-PAC 2017-11)
- Status Reports
  - Report from the E61 Experiment, July 2017 (KEK/J-PARC-PAC 2017-12)
- Letter of Intent
  - Letter of Intent for J-PARC: Study of anti-deuteron physics at K1.8BR beam line (KEK/J-PRAC-PAC 2017-9)