KEK/J-PARC-PAC 2014-27
December 5, 2014

J-PARC Program Advisory Committee

for the Nuclear and Particle Physics Experiments

at the J-PARC Main Ring

Minutes of the 19th meeting held on
3(Wed.)-5(Fri.) December 2014

OPEN SESSION:

1. Welcome and Mandate to the committee:	M. Yamauchi (KEK)
2. Address from the J-PARC center	Y. Ikeda (J-PARC)
3. J-PARC Center report:	N. Saito (J-PARC/KEK)
4. J-PARC accelerator status & plan:	F. Naito (J-PARC/KEK)
5. P56 (sterile ν search):	T. Maruyama (KEK)
6. E14 (KOTO)	T. Nomura (KEK)
7. E34 (μ g-2/EDM)	T. Mibe (KEK)
8. E36 (Lepton universality)	S. Shimizu (Osaka)
9. High-p/COMET beam line construction status	K. Ozawa (KEK)
10. E16 (electron pair spectrometer)	S. Yokkaichi (RIKEN)
11. COMET facility construction status	Y. Fukao (KEK)
12. E21 (COMET)	Y. Kuno (Osaka)
13. E11 (T2K) Beam status and plan	K. Sakashita (KEK)
14. E11 (T2K) Detector/analysis status and plan	H. Tanaka (UBC/IPP)
15. Hadron Hall floor plan update in 2014-2015	T. Takahashi (KEK)
16. E05 (SKS pilot run proposal)	T. Nagae (Kyoto)

17. E07 (Beam time request for emulsion test) S. Hwang (JAEA)

18. FIFC report S. Uno (KEK)

19. E13 (Gamma-ray spectroscopy of light hypernuclei)
H. Tamura (Tohoku)

20. E15 (Deeply-bound kaonic nuclear states) M. Iwasaki (RIKEN)

21. E17 (Precision spectroscopy of kaonic ^{3}He) S. Okada (RIKEN)

22. P58 (Hyper-K) M. Yokoyama (Tokyo)

23. Status and prospects for Hadron Experimental Facility (HEF) renovation T. Komatsubara (KEK)

24. Beam time planning S. Sawada (KEK)

CLOSED SESSION :

Present: E. Blucher (Chicago), A. Dote (KEK), S.I. Eidelman (BINP), J. Haba (Chair/KEK), K. Hanagaki (Osaka), T. Hatsuta (RIKEN), K. Imai (JAEA), K. Inoue (Tohoku), G. Isidori (UZH), W. Louis III (LANL), H. Sakurai (RIKEN), H. Shimizu (Tohoku), W. Weise (ECT), W.A. Zajc (Columbia), M. Yamauchi (IPNS Director), K. H. Tanaka and K. Tokushuku (IPNS Deputy Director)

Apologies: T. Browder (Hawaii)

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1. PROCEDURE

The minutes of the eighteenth J-PARC-PAC meeting (KEK/J-PARC-PAC 2014-17) were approved.

2. Report from the laboratory

2-1 Welcome and mandate to the committee

The IPNS director Masanori Yamauchi welcomed the PAC members.

He reported on the financial situation of KEK; the financial difficulty in JFY 2014 reported at the last PAC has not been solved yet. The KEK directorate is making great efforts to increase the J-PARC operation budget, and to obtain funding for the Main Ring (MR) power supply replacement.

Director Yamauchi then summarized improvements related to the facility and organization since the last PAC meeting such as progress on renovation work for the Hadron Experimental Facility (HEF), forming a new group of experts for the primary beam-line in HEF, and smooth resumption of beam operation of the neutrino facility for E11(T2K). The Facility Impact and Funding Committee (FIFC) has been reactivated recently. The FIFC reviews technical details and safety issues for all the stage-1 experiments in order to give feedback before the PAC discusses stage-2 approval. The FIFC has started reviewing E40, E16, E21, and the target for E13.

Director Yamauchi explained the commissioning plan for the Slow Extraction (SX) beam, and presented two possible beam schedules consistent with the construction work plan of the HEF. He asked the PAC to discuss the run plan up to July 2015 at this meeting.

He gave the following mandate to the PAC:

1) Discussion of the run schedule until summer 2015

2) Examination of beam time allocation to E11 (Now ~ Mid. Feb. + one month) and to the SX experiments (Mid. Feb. ~Mid. Mar. + two months)

3) Evaluation of the readiness of E36 and its schedule for engineering and physics runs

4) Evaluation of the optimized run plans of E13 and E15, which are ongoing at K1.8 and

K1.8BR respectively, and requests for pilot runs from E05 and E07

5) Review of experimental status and construction plan

- Ongoing experiments: E11 and E14
- Experiments being planned (stage-1): E34, E21, and E16
- High-p/COMET beam line construction
- Major modification of the experimental apparatus proposed in E17
- Beam time allocation for E13
  - The IPNS director and J-PARC director decided not to approve using liquid hydrogen fluoride as a target, with a minor modification of the current set-up, although an ad-hoc safety committee formed within the FIFC gave a positive assessment for the proposed set-up. This is because there is no way to avoid an immediate shutdown of the HEF in case of a failure around the target container. An alternative target will be proposed along with a longer beam-time request by E13.
- Review of the progress in Hadron Hall renovation

6) Review of new proposals

- P56: review of background study results, scientific merit and feasibility
- P58: IPNS/KEK and ICRR/the University of Tokyo will exchange an MOU to jointly carry out the design of this experiment. A dedicated committee will be formed to review the design regularly. The PAC will hear reports from the experiment group, but is not requested to discuss approval of the experiment at the moment.

Finally, Director Yamauchi reported the status of two test experiments, T59 and T60, which were approved by the sub-committee.

2-2. Address from J-PARC Center

The J-PARC Center Director Yujiro Ikeda presented the overall status of the facility. He showed the development of beam power and reported stable operation of the MR with 220-240 kW beam

power for Fast Extraction (FX). Progress on recovery work and safety reinforcement of the HEF was presented. The results of accelerator studies aimed towards 1 MW operation of the RCS were shown. An international workshop on science at J-PARC was successfully held in June 2014 at Tsukuba. Director Ikeda congratulated Prof. Kobayashi and Prof. Nakaya on receiving the Nishina Memorial Prize for their outstanding work on the T2K experiment at J-PARC. Finally, he explained the recent difficult financial situation, which was reported in detail by J-PARC Deputy Director Saito in the following talk.

2-3. Report from the J-PARC Center

The J-PARC Deputy Director, Naohito Saito, reported on the progress in the J-PARC organization since the last PAC meeting including the budgetary situation for operations in JFY 2014 and beyond. The J-PARC center requested a budget to provide beam for 9 months in JFY 2105. However only 60% of this request was submitted from the MEXT (Ministry of Education, Culture, Sports, Science and Technology) to the MOF (Ministry of Finance). The J-PARC Center continues negotiations to recover and even increase the operations budget for the future. He suggested that a new framework would be required to obtain a sufficient funding level for the years from JFY 2016 onward. He also clarified the necessity of a supplemental budget to replace power supplies of MR magnets that are indispensable to carry out the planned power upgrade scenario.

Deputy Director Saito also reported on the facility status and the J-PARC operation plan up to March 2015. Renovation of the HEF is underway. The target date for restarting the facility is in the middle of February. The J-PARC Main Research Building is under construction in the area between the MLF and the HEF, providing a gathering place for users and office space for supporting staff.

The issue of forest preservation was also raised; there is an agreement with the local community to retain 75% of the forest on the site, which needs an update to cope with construction of buildings housing new MR power supplies. A task force has been set up to discuss this issue with the local community.

Deputy Director Saito concluded his presentation by showing the near future plan of J-PARC. The plan includes an extension of the HEF, phase II of the muon-to-electron conversion experiment (COMET), and precision muon measurements (g_μ-2/μEDM). This upgrade plan was selected as one of 27 important projects along with the Hyper-Kamiokande project among 209 proposals in the master plan of Japan Science Council for “Large Scale Research Projects.”

2-4 J-PARC accelerator status

Fujio Naito of the accelerator division reported on J-PARC accelerator status, operation schedule, and the mid-term plan of accelerator upgrade.

The J-PARC LINAC has been successfully upgraded to 400 MeV in summer 2014. A peak beam current of 30 mA was achieved in October 2014 thanks to a newly installed front-end system composed of a new ion source and a new RFQ accelerator. The anticipated goal of the front-end system is stable operation at 50 mA beam current, which is necessary for 1 MW operation of the RCS. A series of trials to achieve this goal has been conducted; operation at 773 kW was successfully tested although the power supply for the RF system needs to be upgraded to go beyond this level. Careful study of the beam loss was also conducted in 773 kW operation. Losses were found to be localized near the injection foil; these losses are well below the limit of the collimator capacity even for 1 MW operation. In the Main Ring (MR) collimators installed in 2013 were replaced during the summer shutdown because of a vacuum leak found near them. New RF cavities, FT3L, made of the magnetic alloy Fine-Met, are being installed to replace old ones. The new ones have a 40% larger gap-impedance, which enables them to achieve higher acceleration voltage. An optical monitor system was recently installed in the transport line between the RCS and the MR; this monitor was used to confirm the importance of LINAC beam tuning for stable MR operation.

Naito presented a summary of accelerator operations in 2014; in general they successfully provided a 300 kW beam to the MLF and a 240 kW beam to the T2K experiment in 2014.

After the HEF accident in 2013, the accelerator group investigated possible measures to prevent and/or monitor the short-pulse extraction to the Hadron Hall as well as carefully inspecting the relevant hardware. This work was reported at the previous PAC meeting. In addition to these measures the accelerator group recently further modified the energizing timing of the abort-line kicker magnet, and installed a new scheme to switch off the focusing magnets (QFX) in case of a malfunction of an extraction device(s).

Naito then summarized the operation plans for the period from January to March, and from April to July in 2015. The accelerator group plans to provide 68.5 days of user operation for the MLF and 68.5 days for the hadron or neutrino programs. He also showed possible MR operation patterns to maintain the level of peak electricity consumption for the SX operation mode in the period from January to March 2015 within the restricted electricity contract compatible with FX. He proposed that extending the flat-bottom period is the most realistic approach to reducing electricity consumption below the 24 MW level for SX operation.

Finally, a mid-term plan for accelerator operations including necessary R&D toward the goals of 750 kW and 100 kW operations for FX and SX, respectively, in 2017 was presented.

2-5 High-p/COMET beam line construction status

Kyoichiro Ozawa reported the status of construction of the High-p/COMET beam line with a focus on activities initiated after the last PAC meeting.

The status of the new beam-line construction was reviewed. The new beam line is designed to provide two kinds of a beam, namely a primary beam of 30 GeV directed away from the main primary line with a Lambertson magnet to be installed at the branch, and an 8 GeV COMET beam extracted from the MR without destroying its bunch structure. Preparation of an application for approval of a new radiation facility to the nuclear regulatory agency of Japan is underway. A J-PARC radiation safety committee, dedicated to the High-p/COMET beam line, was formed to investigate the design in detail and prepare a strong application. The committee, composed of experts from KEK, JAEA, J-PARC, and RIKEN, had a meeting in August to discuss basic designs of radiation protection in the beam line and in the experimental areas. Further discussion will continue in this committee, which is working toward obtaining government approval of beam operation.

Several workshops were held at Tokai concerning the physics program to be carried out at the High-p beam line. Discussions of new experiments and physics using the planned E16/E50 spectrometers have been initiated. In addition, discussions with the heavy-ion physics community also continued.

The status and schedule of the beam-line construction were reported. Installation of beam-line elements is in progress in the Switch Yard as scheduled. Installing magnets between the Switch Yard and the Hadron Hall should be conducted in a manner consistent with the beam time schedule.

2-6 COMET facility construction status

Yoshinori Fukao reported on the status of COMET facility construction after reviewing the facility design. Building construction is in progress and will be completed by the end of March 2015. He also explained the design principles of the radiation protection system. He summarized the discussions and remaining issues at the J-PARC radiation safety committee for the High-p/COMET beam line.

2-7 Hadron Hall Floor Plan in 2015 and near future

Toshiyuki Takahashi explained the Hadron Hall floor plan. As of the end of 2014 the configurations of three beam-lines (K1.8, K1.8BR, and KL) are the same as those before the HEF accident in 2013; the CDS and neutron TOF counter for E15 and E31 are located in K1.8BR, the SKS spectrometer and Hyperball-J detector for E13 remain in K1.8, and the KOTO detector for E14 is in the KLarea. K1.1BR is being renovated for E36 where a toroid magnet and the E36 detector are being installed.

The SKS spectrometer will be moved to the south area by the end of JFY2015. The KURAMA spectrometer will then come into the K1.8 area for E07 and E03. Fabrication of all the magnets of S-2S for E05 will be completed by the end of March 2015 and they will be installed in the K1.8 area after E07 and E03 complete data taking runs using the KURAMA spectrometer.

The construction work on the High-p/COMET beam line between the Switch Yard and Hadron Hall limits the available running time of the K1.1BR beam line and restricts beam extraction to the Hadron Hall. K1.1BR can operate until the end of October 2015 due to this constraint while beam operation at KL, K1.8BR and K1.8 beam lines can be extended to November 2015. The construction of the High-p beam line will be completed in JFY 2016 for E16 to start beam-line commissioning.

In 2017 S-2S will replace the KURAMA spectrometer in K1.8 where E05 and other spectroscopy experiments such as 2nd stage of E10 will be carried out. In the south area, the SKS spectrometer is installed in K1.1 to conduct hypernuclear experiments such as 2nd stage of E13, and E18.

2-8 FIFC report

Shoji Uno reported on the discussions at the recent FIFC (Facilities Impact and Finance Committee) meeting on 29th November. Their main topics were the status of E40, E16, and E21. The FIFC also discussed the technical feasibility of the liquid-hydrogen-fluoride (HF) target for E13.

E40: The FIFC raised the following three points to be considered before the experiment starts; a realistic design of the liquid-hydrogen target for E40 including safety control in the Hadron Hall, verification of the final detector configuration with full simulation, and a detailed implementation of a trigger and DAQ system capable of handling beam power up to the 50kW level.

E16: E16 needs to address the following issues; precision measurement of the magnetic field is mandatory to achieve their goal of 1% momentum resolution, demonstration of physics sensitivity

for both partial and full detector configurations by simulation taking various experimental effects into account, and increasing the size of the collaboration to enhance the manpower. Technical aspects of the experiment should be summarized in their revised Technical Design Report (TDR) to be submitted by the next PAC meeting.

E21: The FIFC understands that the technical and safety aspects of E21 have already been reviewed. The FIFC raised a concern on the comprehensive performance of the pion capture and muon transport sections. In any case, this has to be demonstrated before E21 starts data taking. The FIFC also points out that the pion production target needs to be carefully designed and examined because it will be located in a high-radiation environment.

Finally, Uno addressed the issue of the liquid-HF target. The FIFC together with another committee organized in J-PARC for this inspection recognized that the target system would be feasible with the proper measures proposed by the experiment. However as discussed by the IPNS director, the risk of significant damage in an accident with the liquid-HF target in the Hadron Hall should not be underestimated at the moment. Therefore, they have reached the conclusion that the experimental group should use a material other than liquid HF to conduct the experiment.

2-9 Hadron Experimental Facility renovation

Takeshi Komatsubara reported on the status of and prospects for the renovation of the HEF. The renovation work is proceeding as scheduled: it will be ready toward the end of 2014. The target was replaced in September, the radiation monitors became ready in November, and an improved air-confinement system for the Primary Beam Line (PBL) is to be completed in December.

In the new target system, two gold targets mounted on a copper base are set in an air-tight chamber. The target on the PBL can be selected by moving the mount using a driver from outside. When target monitors indicate that the target cooling has deteriorated, the target will be replaced with a new one before it degrades. The new target chamber is air-tight and filled with circulating He-gas; the beam windows are made of titanium alloy. The He circulation system is to monitor the radioactivity contained in the gas to confirm the soundness of the target. The He gas in the chamber and circulation line will be transferred to a storage tank in case of emergency. The radiation levels of the air both in the PBL and in the experimental hall are monitored by newly installed air monitors. A warning system composed of displays, speakers and flash lamps is prepared in the hall to inform users about the radiation levels (and emergency).

A J-PARC wide emergency drill at HEF was executed on November 25. It was pointed out that

the HEF can resume operation when the permission of the local government is given according to the safety agreements between the local government and the nuclear facilities in Tokai including J-PARC.

2-10 Beam time planning

Shin'ya Sawada reported possible scenarios for the beam time schedule. The MR will start its operation in January 2015 with the FX mode for the T2K experiment. Once the HEF is ready for operation and approved to restart, MR operation will be switched to the SX mode for HEF and continues to run as far as the operation funding allows until the end of March 2015. It should be noted that the first days after the SX restart should be spent to check newly installed equipment. The governmental inspection of HEF as a radiation facility is scheduled in the week of March 2nd.

For the beam schedule from April to summer 2015, Sawada showed two options depending on the period of installation work in the area between the Switch Yard and Hadron Hall. The Hadron Hall cannot accept beam during this work. Option 1) schedules the installation from June to October 2015 for the earliest construction of the High-p/COMET beam line. In this case, the E36 experiment at K1.1BR and the fluorine target run of the E13 experiment at the SKS spectrometer need to be finished by the end of May 2015. In option 2) the installation work would be carried out in the summer of 2016. In this case beam is available in the Hadron Hall until October 2015.

3 . Special remark from the PAC on J-PARC operations in the coming period

The committee recognizes that J-PARC provides unique and rich scientific opportunities to the world physics community. The progress in particle and nuclear physics will be greatly harmed if its operation is seriously limited by a budget shortfall. It should be noted that it is extremely important to operate the facility stably in a manner that is scientifically useful. It should also be emphasized that substantial investments have been made by various foreign funding agencies around the world in the experiments at J-PARC with the assumption that these experiments will be carried out according to their scientific priorities. The PAC committee urges the management of KEK and the J-PARC Center to take strong action to find solutions to the recent problem and ensure MR operation of at least 9 months per year, which will allow J-PARC to provide outstanding and internationally recognized contributions to particle and nuclear physics.

4 EVALUATIONS OF THE PROPOSALS AND STATUS OF THE ONGOING EXPERIMENTS

E14: Proposal for experiment at J-PARC (KOTO Experiment)

The committee is very pleased to see the first result shown by the KOTO collaboration, which is based on 5 days of data taking in May 2013. For this sample, they estimated the single event sensitivity (SES) to be 1.3×10^{-8} and the background level to be 0.4 events. They observed a single event in the signal region.

The remaining background is believed to be due to beam neutron interactions. It is consistent with the expected background level, but the overall level is alarming because the SES needs to be improved by a factor of order 1000 to see the Standard Model (SM) signal. The committee recommends further studies to understand the source of the neutron background to obtain quantitative estimates and/or to reduce it.

The KOTO Collaboration is making several minor detector modifications for the upcoming run to reduce backgrounds, to allow further background studies, and to reduce the 20% level-2 dead time observed in the May 2013 run. Work is progressing on the new inner barrel veto, which will be installed during the summer of 2015.

The current event selection scheme is clear and seems to be reliable, but the committee looks forward to seeing the justification of the selection criteria or further optimization. The committee is concerned about the $K_L \rightarrow 2\pi^0$ reduction when applying the photon veto, although the simulation predicts the same level of the signal reduction. It is desirable to either understand the reason for such a large signal loss or else the photon veto requirements should be better optimized.

The committee recommends further running time for the E14 experiment to reach the Grossman-Nir limit, which is a well-motivated near-future target. The further running is also important as a kind of engineering run to understand and study the neutron background.

E11: Tokai-to-Kamioka Long Baseline Neutrino Oscillation Experiment (T2K experiment)

With only 6.58×10^{20} Protons On Target (POT) collected in the neutrino mode, T2K has observed ν_e appearance for the first time at the atmospheric mass scale and has made world-leading measurements of $\nu_\mu$disappearance. Furthermore, a joint T2K analysis together with

reactor-neutrino results provide a hint for CP violation in the lepton sector with a non-zero value for δ_{CP} and a slight preference for $\theta_{23} > \pi/2$. The systematic uncertainties for the estimated ν_e and ν_μ event rates are down to 6.8% and 7.7%, respectively, and further improvement is possible. During the summer, the magnetic focusing horns and the power supply for a normal conducting magnet were replaced. The experiment is ready for a 400 kW beam and is preparing for a 750 kW beam in 2016. T2K is now running in the antineutrino mode and has so far collected 1.1×10^{20} POT. The INGRID detector observes approximately 0.56 events per 1×10^{14} POT in the antineutrino mode and 1.71 events per 1×10^{14} POT in the neutrino mode, which are in good agreement with the Monte Carlo simulation. T2K has already published several papers on neutrino oscillations and neutrino cross sections, and many more papers are in the pipeline.

For the future, major T2K goals include measurements of δ_{CP} and possible evidence for CP violation, high precision ν_μ disappearance measurements, neutrino and antineutrino cross section measurements, tests of the 3-neutrino paradigm, and studies of nuclear effects (e.g. multi-nucleon processes) in neutrino and antineutrino interactions. The studies of nuclear effects are especially important because these effects can cause the distortion of neutrino energy spectrum, and therefore the neutrino oscillation mass scale and mixing angle are biased. To achieve these goals, T2K plans to collect approximately half the data in the neutrino mode and half in the antineutrino mode. As a start in achieving these goals (and to remain competitive with the NOvA experiment at Fermilab), T2K requests an additional 3.9×10^{20} POT in the antineutrino mode by summer 2015 (5×10^{20} POT total); this includes about 75 days of running time for the first 5 months of 2015. T2K should achieve a 3-sigma sensitivity for $\bar{\nu}_e$ appearance, assuming $\delta_{CP}=0$, once it has collected 1.5×10^{21} POT.

In summary, T2K has already achieved world-leading results with only a small fraction of the requested POT. The upcoming antineutrino results are eagerly anticipated and the T2K physics potential with the full data set remains very high. T2K has a non-negligible probability of obtaining evidence for CP violation with the full approved running time. The proposed T2K running time is strongly endorsed and every effort should be made to provide T2K with its requested beam in a timely manner before the 2015 summer shutdown. In addition, T2K will definitely need some running time in 2015 after the summer shutdown.

P58: A long Baseline Neutrino Oscillation Experiment Using J-PARC Neutrino Beam and Hyper-Kamiokande

Hyper-K is a very ambitious proposal to build a 0.99-Mton (0.56-Mton fiducial volume) water Cherenkov detector near the present Super-K detector and to expose it to the J-PARC

neutrino beam for 10 years, corresponding to 1.56×10^{22} POT. The HyperK detector will contain 99K 20" PMTs in the active region (20% coverage) and 25K 8" PMTs in the veto region. Hyper-K is complementary to the LBNE long-baseline neutrino experiment in the US; however, it has several advantages, including: (1) better δ_{CP} sensitivity; (2) a smaller matter effect for beam neutrinos; (3) higher statistics with approximately 2000-3000 ν_e appearance events; (4) well understood systematic errors; (5) excellent Supernova neutrino sensitivity; and (6) excellent nucleon decay sensitivity for both the $p \rightarrow e^+ + \pi^0$ and $p \rightarrow K^+ + \nu$ decay modes. Extensive photosensor development work is being carried out in the US, UK, Canada, and Japan with the goal of producing photosensors with better performance and lower cost than present photosensors. The collaboration is preparing a Conceptual Design Report (CDR) within the next year, and the PAC looks forward to hearing a future progress report.

E16: Measurements of spectral change of vector mesons in nuclei

The E16 progress report responded, in particular, to previous requests by the PAC to clarify the motivation of the experiment. The presentation of the physics case is now convincingly focused on high-precision measurements of vector meson spectral functions in the nuclear medium. The title of the project has been changed accordingly.

The experiment will be performed with 30 GeV incident protons in the High-p beam line, using a newly designed electron pair spectrometer to detect time-like virtual photons from hadronic sources. The assembly of the spectrometer magnet is foreseen in April – June 2015, followed by the installation of detectors in the period July – December 2015 so that detector commissioning can proceed in January – March 2016. While the full E16 proposal aims at working with 26 detector modules, a first physics run in JFY 2016 with only 8 modules will measure ϕ meson spectral functions in C and Cu in order to confirm results of a previous KEK experiment (E325), but now with far superior mass resolution of 5 MeV and improved statistics (4000 ϕ's).

The more complete E16 program includes measurements of ρ and ω meson spectral functions. For added value, the experiment is prepared to determine for the first time the momentum dependence of spectral functions so that extrapolations to vector mesons "at rest" in the nuclear medium may become possible.

Beyond using only C and Cu as targets, the PAC strongly recommends measuring vector meson production in p-p and p-Pb collisions in order to establish important systematics. It is

furthermore suggested to investigate, at a later stage, the lower mass range involving eta meson spectral functions as this opens additional potential for interesting physics.

The previous (18^{th}) PAC requested an updated TDR. In accordance with the recent assessment of the E16 project by the FIFC, this TDR should demonstrate the feasibility of achieving the expected very high-momentum resolution. It should also respond to the manpower issue addressed by the FIFC. The PAC encourages the E16 group to consider opening up its membership to form an international collaboration. The updated TDR will serve as the basis for discussing stage-2 approval at the next PAC meeting.

E21:An Experimental Search for μ−e Conversion at a Sensitivity of 10^{-16} with a Slow-Extracted Bunched Beam (COMET)

The COMET collaboration has updated the TDR as a single document of 170 pages in October 2014 based on the comments and suggestions made by the COMET Phase-I Technical Review panel in September 2014. The TDR has been submitted to the PAC for stage-2 approval so that the beam time allocation for COMET can be discussed. As explained in the updated COMET response to the Technical Review Panel based on the updated TDR in November 2014, all the requirements and recommendations are properly incorporated.

The PAC observed the construction of the COMET hall is making rapid progress. The PAC reviewed the progress in proton target design, superconducting solenoids production, muon transport design and detector developments (StrEcal and CyDet). Based on a test of GSO and LYSO crystals in March, LYSO provided better energy resolution, $\Delta E/E=4.6\%$, and was chosen as the Ecal crystal. The PAC acknowledges steady progress in the detailed detector design, prototype production, development of analysis software and background studies. Based on the detailed design, the required beam time for a single event sensitivity of 3×10^{-15} was updated to 110 days with 3.2 kW beam power.

In order to optimize the beam time allocation in 2015, major construction will be delayed to 2016. Although this will impact and unfortunately delay the start of the COMET beam time by at least half a year with respect to the request, the PAC expects that COMET Phase-I is still competitive and the relaxed schedule will increase the possibility that the ongoing developments will reach completion. Stage-2 approval should be discussed in the next PAC meeting. The PAC endorses the requests for continuing and strengthened support from KEK and J-PARC for engineering, construction and integration of the detector.

E34: An Experimental Proposal on a New Measurement of the Muon Anomalous Magnetic Moment g-2 and Electric Dipole Moment at J-PARC (μ g-2/EDM)

Tsutomu Mibe reported on the R&D status of the muon source and so on. PAC members appreciate the effort to obtain a higher yield of muon production by investigating various patterns of laser drilled aerogel targets. Including the muon source development, the progress in the R&D activity seems to be in good shape.

The PAC looks forward to seeing the TDR that is expected to be released in March 2015, and which should include a clear timeline for the completion of the R&D. In addition, the PAC recommends an early and smooth transition from the R&D phase to the production and running phase, because there is competition.

P56: A Search for Sterile Neutrino at J-PARC Materials and Life Science Experimental Facility (Sterile Neutrino)

The status of P56 was presented to the PAC. The experiment, which will be performed at the J-PARC Materials and Life Science Experimental Facility (MLF), will use muon decay at rest to search for oscillations. The experiment will use two 25-ton fiducial mass, Gd-loaded liquid scintillator detectors, very similar to those used for recent reactor neutrino experiments. The experiment assumes 1 MW operation at the MLF.

Following the recommendations in the PAC 17 report, the collaboration has performed a series of background measurements on the 3rd floor of the MLF using a 500 kg array of 24 plastic scintillators surrounded by cosmic veto scintillators. They made measurements at points with 3 different baselines: 17 m, 20 m, and 40 m. Only the results from 20 m were reported. For comparison with the rates quoted in their proposal, Monte Carlo was used to extrapolate the 20 m results for the 500 kg detector to a 25-ton liquid scintillator detector at 24 m. They investigated two sources of beam-related background: beam fast neutrons and accidentals. They saw no evidence for beam-related fast neutrons and set a limit of < 8 events/ 4 years/ 50 ton / MW. A 30 times larger accidental rate of photons than expected was observed, originating from the large flux of neutrons striking the concrete below the experiment area. To reduce this background they propose to use a 12.5 cm layer of lead under the detector: the effect of this shielding has already been tested and will reduce the gamma flux to 1/10 of the proposal rate.

Based on the background measurements presented, the PAC is convinced that the background rates described in the proposal are achievable. The PAC recommends stage-1 status for P56.

While waiting for the stage-2 approval, the PAC recommends a further optimization of the exact location of the detector in order to maximize sensitivity in the Δm^2-$\sin^2(2\theta)$ plane.

E36: Measurement of $\Gamma(K\rightarrow e\nu)/\Gamma(K\rightarrow \mu\nu)$ and search for heavy sterile neutrinos using the TREK detector system (Lepton universality)

The E36 experiment plans to measure the ratio $\Gamma(K\rightarrow e\nu)/\Gamma(K\rightarrow \mu\nu)$ to a precision of 0.25% (0.2% (statistical) and 0.15% (systematic)). This is a sensitive test of lepton universality and could reveal new physics if the above ratio deviates from SM expectations. To achieve a useful sensitivity to lepton universality violation beyond the result of NA62, an earlier experiment at CERN, E36 must run for 50 days at 30 kW beam power. In addition, 10 days of calibration running are needed. Thus, a total of 60 days of running at 30 kW are required.

In the same running period and with the same set-up, E36 will be able to perform a competitive search for e^+e^- decays of exotic light bosons possibly produced in K decays.

An update on the installation of the E36 detector in the Hadron Hall was presented. The superconducting (SC) toroid was installed in the K1.1BR area on November 27, 2014. The detector installation should be completed in mid-January, when the group will begin commissioning with cosmic rays. Final government inspection of the SC toroid system will occur at the beginning of March.

The E36 collaboration initially requested a 2-month engineering run (beginning in mid-March once the toroid system is fully commissioned), a 1-month period for detector optimization using engineering run data, and a 3-month physics run in JFY 2015. This full request seems impossible to fulfill given schedule and budget constraints. After further discussion in the closed PAC session, the request by the E36 collaboration has been reformulated as follows: 1 engineering run of two weeks toward the end of February, without magnetic field + 1 engineering run of two weeks at the beginning of April + 6 weeks of physics run before the summer shutdown + 4 weeks of physics run in October.

The PAC endorses this updated schedule up to the summer shutdown. The allocation of an additional physics run in October is possible, but this decision —and the possible duration of the October run— is postponed to the next PAC meeting. The PAC wishes E36 a successful data run and recommends the optimization of the limited machine time available until the summer shutdown. The PAC invites the collaboration to perform a timely analysis of their first results in order to provide convincing arguments for the need of the October run at the next PAC meeting.

E13: Gamma-ray spectroscopy of light hyper-nuclei

One of the main purposes of the E13 experiment (part 1) is to measure the energy of the M1 transition due to the Λ-N spin-spin interaction. This will be the first study of sd-shell hypernuclei. For this purpose, the E13 group proposed at the previous PAC meeting to utilize a liquid-HF target for the study of ${}^{19}_{\Lambda}F$. A sub-committee of the FIFC and a special committee were organized to find a way to handle the HF target safely. As a result, the Directors of IPNS and the J-PARC Center made a decision not to allow E13 to use the liquid HF with the present setup in the Hadron Hall at J-PARC.

Given these circumstances, the E13 collaboration changed the run plan of their experiment to use target materials such as CF_2 or CF_4. A two-step approach was proposed by the E13 group to the present PAC. At first, a series of short runs will be made to determine the background levels when either the CF_2 or CF_4 target is employed. Measurements for the first step are requested to take place by the end of March 2015 as well as an additional measurement with a ^{4}He target. Taking into account the results from this first set of short runs, the experiment group will request a second longer beam run to complete the study of ${}^{19}_{\Lambda}F$ by the end of October 2015 before moving on to the 2nd part of the E13 experiment, which will be conducted at the K1.1 beam line in future.

The PAC understands the current situation of the E13 experiment and encourages the collaboration to carry out their updated plan with first priority on the K1.8 beam line.

E15: A Search for deeply-bound kaonic nuclear states by in-flight ^{3}He(K^-, n) reaction (Deeply-bound kaonic nuclear states)

The E15 program aims to search for the deeply bound kaonic state of K-pp via the ^{3}He(K^-,n) reaction at 1 GeV/c. At this PAC detailed results from 5.1×10^9 kaons on target in the 1st stage running in March and May 2013 were presented. These results, available as arXiv:1408.5637, have been prepared for publication and were submitted to Physics Letters B in August 2014. The data shows a small excess below the quasi-elastic KN peak in the kinematic region expected for a loosely-bound K-pp bound state. Due to the small yield in this region of missing mass, no definitive physics conclusion is possible at this time. The PAC encourages the collaboration to study in detail the sensitivity of the observed structure to the tails of both the experimental resolution and of the nuclear Fermi momentum distribution that broaden the quasi-elastic peak.

E15 has also demonstrated the ability to improve their sensitivity by moving to more exclusive channels such as ^{3}He(K^-,Λp)n. However, the resulting loss of statistical precision makes the current analyses proof-of-principle only, and drives their request for 50×10^9 kaons on target in their 2nd stage run 1) to confirm the spectral shape of the Λp invariant-mass from an exclusive measurement of the ^{3}He(K^-, Λp)n channel, 2) to explore the neutron spectrum at zero degrees with the full kinematics measurement of ^{3}He(K^-, Λp)n, and 3) to extend their study to other channels such as ^{3}He(K^-, Σπp)n. The proposed beam time plan consists of three run sets; beam line commissioning, a calibration run with the H_2 target and a 2nd stage production run with a ^{3}He target. The commissioning is needed since the beam orbit and target configuration have been changed. The calibration run is a carryover from the 1st stage run and is necessary to obtain the neutron detection efficiency. The 2nd-stage run with the 50kW beam will provide 10 times higher statistics than the 1st stage. The high-power beam reduces the required beam time significantly from 40 days to 25 days.

The PAC endorses this request subject to the global scheduling constraints discussed in Section 5.

E17: Precision spectroscopy of K-^{3}He 3d-2p X-ray

E17 will perform precision spectroscopy of K-^{3}He 3d-2p X-rays for the study of the K-nucleus interaction. E17 was approved a long time ago. After the approval, a precise measurement of the K-^{3}He 3d-2p X-ray was reported by SIDDHARTA, which certainly affected the priority of E17. An experiment for K-D X-ray spectroscopy (P57) was proposed by a group that largely overlaps with E17 at the last PAC. The PAC, then, asked the proponents to make an integrated plan with E17 to optimize the physics output. Shinji Okada presented an E17 status report in response to this PAC request.

The SDD (Silicon Drift Detector) was the key X-ray detector in the original E17 proposal. However, the proponents have decided to replace SDD's with TES's (Transition Edge Sensors), which have 30 times better resolution than SDD's (150 eV vs 5 eV). They carried out a test measurement of pionic atom X-rays at PSI and demonstrated the precision of TES devices. The PAC appreciates the new efforts to develop TES detectors for E17, since this improvement of the energy resolution will greatly contribute to the physics output of E17 as well as the physics of other exotic atoms. The PAC encourages the group to continue TES R&D efforts especially to understand the detector performances under realistic K beam environment and requests an update of the proposal.

The TES methodology, however, is not applicable to P57, where the expected X-rays from K-D atom have large natural widths. The PAC asks P57 to update the proposal including a more detailed study of the S/N ratio considering the possible duty factor of the beam.

E07: Beam time request for an emulsion test

The PAC recognizes the importance of the alignment between counters and nuclear emulsions in the E07 experiment. The proposed test for the new rapid alignment method can be performed with 2nd priority on the same beam line of the E13 experiment.

E05: Beam time request for a pilot run

The E05 collaboration proposed to have a pilot run to search for clues to the existence of a Ξ-hypernuclus, using the large acceptance SKS spectrometer placed on the K1.8 beam line. Unlike the original E05 experiment, the momentum resolution on the outgoing K^+ is not sufficient to separate expected bound states since a thick target will be used to obtain additional statistics with the current 24 kW beam. A pilot run can be performed on the K1.8 beam line with the priority given in section 5.

E31: Beam time request for a pilot run

E31 aims to study the $\Lambda(1405)$ through the $\pi\Sigma$ spectra produced in the $d(K^-, n)$ reaction at K1.8BR using the E15 apparatus. Stage-2 approval was given to E31 at the last PAC. Masa Iwasaki presented a beam time request for a pilot run of E31 as part of the E15 status report. E31 requested a total K-beam exposure of 14×10^9 K^- on the deuterium target, which is equivalent to 13 days of beam time with a 24 kW proton beam of 6 sec duration. The expected numbers of $\Lambda(1405) \rightarrow \Sigma^+\pi^-$, $\Sigma^-\pi^+$, $\Sigma^0\pi^0$ events are 750, 120, 33, respectively.

The PAC recognizes the importance of the pilot run for the success of E31. The data with the D_2 target will be useful for the data analysis of E15, which uses a ^{3}He target. However, the first priority at K1.8 and K1.8BR is the completion of the 1st phase of E13 before the SKS transport. PAC recommends that E31 should perform a pilot run with the priority summarized in the next section.

5 BEAM TIME AND PROGRAM ARRANGEMENT FOR FY2014-15

Considering the constraints from HEF and MR, the PAC suggests that IPNS should adopt a beam time plan in which

1) FX operation continues until February 10 or the time when the SX mode becomes operational.

2) SX operation continues until the electricity budget of JFY 2014 is exhausted in March. The PAC expects a possible extension of MR operations in March from a supplemental budget allocation.

3) In the period from April to June 2015, FX and SX will be allocated one month and two months beam time, respectively, where the detailed time slots should be optimized by the facility group allowing for the possibility for SX operation in October.

4) Among the experiments in the HEF, the PAC assigns a higher priority to E36, E13 and E14 before the summer of 2015. The execution of the experiments in K1.8BR might be arranged for the period of E13 down time. The pilot runs proposed in K1.8 could be arranged after E13 completion where E07 has a higher priority than E05. The E31 pilot run can be executed after them.

The PAC suggests that IPNS reexamine the stage-2 experiments assuming the likely scenario of operation at a low beam power level, 50 kW, in the coming few years. IPNS may request the stage-2 experiments to submit a revision of their proposals, which should include an update of the physics goals, significance, and any improvement/modification in the experimental set-up and the run plan assuming the feasible beam power level of 50 kW.

6. DATES FOR THE NEXT J-PARC PAC MEETINGS

The next PAC meeting will be held from July 15-17, 2015.

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

- Minutes of the 18th J-PARC PAC meeting held on 14-16 May, 2014 (KEK/J-PARC-PAC 2014-17)

- Proposals
    - Proposal of an emulsion-based test experiment at J-PARC (KEK/J-PARC-PAC 2014-18)
    - Beam time request for a pilot run of E05 (KEK/J-PARC-PAC 2014-20)
    - E07 beam time request after the E13 run (KEK/J-PARC-PAC 2014-23)
- Letter of Intent
    - Letter of Intent to Construct a nuPRISM Detector in the J-PARC Neutrino Beamline (KEK/J-PARC-PAC 2014-19)
- Technical Design Report from E21 COMET
    - Phase-I Technical Design Report (KEK/J-PARC-PAC 2014-21)
    - Response to the Technical Review Panel (KEK/J-PARC-PAC 2014-22)
- Status Reports
    - P56 Status Report (KEK/J-PARC-PAC 2014-24)
    - E17 Status Report (KEK/J-PARC-PAC 2014-25)
- FIFC report (KEK/J-PARC-PAC 2014-26)