KEK/J-PARC-PAC 2011-21
January 15, 2012

J-PARC Program Advisory Committee

for the

Nuclear and Particle Physics Experiments at the J-PARC 50 GeV Proton Synchrotron

Minutes of the 13th meeting held on
Friday, Saturday and Sunday, 13-15 January 2012

OPEN SESSION (13,14-January-2012):

1. Welcome, Mandate of this meeting: K. Nishikawa (KEK)
2. J-PARC status and recovery plan: S. Nagamiya (J-PARC)
3. J-PARC accelerator status: T. Koseki (KEK)
4. E11 status report (T2K): T. Kobayashi (KEK), C.K. Jung (SUNY Stony Brook)
5. P42 proposal presentation (Search for H-Dibaryon with a Large-Acceptance Hyperon Spectrometer): J. K. Ahn (Pusan)
6. E14 status report (KOTO): T. Yamanaka (Osaka)
7. P34 presentation (A New Measurement of the Muon Anomalous Magnetic Moment g-2 and Electric Dipole Moment at J-PARC): N. Saito (KEK)
8. Middle term plan of the hadron hall: K.H. Tanaka (KEK)
9. E05 revised run plan (Spectroscopic Study of Ξ-Hypernucleus, $^{12}_{X}$Be, via the ^{12}C(K^-, K^+) Reaction): T. Nagae (Kyoto)
10. E13 revised run plan (Gamma-ray spectroscopy of light hypernuclei): H. Tamura (Tohoku)
11. E18 status report (Coincidence measurement of the weak decay of $^{12}_{\Lambda}$C):

H. Outa (RIKEN)

12. Status of the SKS spectrometer and experiments at K1.8:

T. Takahashi (KEK)

13. E17 status report (Precision spectroscopy of Kaonic ^{3}He *3d→2p* X-rays):

R.S. Hayano (Tokyo)

14. E15 status report (A Search for deeply-bound kaonic nuclear states by in-flight ^{3}He(K^-, n) reaction): M. Iwasaki (RIKEN)

15. P36 presentation (Measurement of Γ(K→eν)/ Γ(K→μν) and Search for heavy sterile neutrinos using the TREK detector system): J. Imazato (KEK)

16. Muon Task Force (MTF) Report: S. Mihara (KEK)

17. E21status report (COMET): Y. Kuno (Osaka)

18. E16 status report (Electron pair spectrometer to explore the chiral symmetry in QCD): S. Yokkaichi (RIKEN)

CLOSED SESSION(13,14,15-January-2012):

Present: I. Bigi, A. Gal, M. Grosse-Perdekamp*, M. Ieiri(Secretary),
S. Nagamiya*, K. Kleinknecht, T. Kishimoto*, T. Kobayashi (Secretary),
T. Komatsubara (Secretary), S. Kumano, T. Mori, T. Nagae,
Y. Nagai, S. N. Nakamura, K.Nishikawa (IPNS Director),
N.Saito (Secretary), M. Shaevitz, S. Shimoura,
K.Tokushuku (Chairperson), H.Yamamoto

*) Part of the time

1. PROCEDURE

The minutes of the twelfth J-PARC-PAC meeting (KEK/J-PARC-PAC 2011-5) were approved.

2. REPORT FROM THE IPNS DIRECTOR

The INPS director K. Nishikawa welcomed the PAC members.
He reported the budget situation at KEK. A supplemental budget for recovery from the earthquake and for the replacement of old components in the J-PARC facilities has recently been approved by the Diet. The amount was ~70 Oku-yen (7 billion yen) for J-PARC. The budget for JFY2012 has been fixed. The total J-PARC budget from KEK is 66 Oku-yen. In order to keep 9 months of beam time under these budget constraints, it will be necessary to delay some upgrades.
The government has started a review process for J-PARC to look at the current achievements and the plans for the next five years. The review will be concluded in June, 2012. The PAC's assessment of the mid-term plan will be a valuable input to the review and for this purpose an extra PAC meeting is planned on March 16-17, 2012.
Some initial previews of the plan were shown at this PAC meeting. The main issues on the mid-term plan in the hadron hall are the conflicting demands for the beam lines. In the south side of the hadron hall, the K1.1BR line is currently in place and is to be used for test experiments and, in the future, for the P36 and TREK experiments. There are several requests to use the K1.1 line for nuclear physics experiments including E29. The budget for the high-p beam line, where E16 is to run, has been requested several times but has yet not been funded. The COMET experiment is to be set in this area as discussed in the following section.
Considering this conflict, a plan is to be presented describing the construction of the high-p line along with the beam line for the COMET experiment. This implies that the K1.1BR beam line will be terminated in the future and the space in the K1.1 line will be limited (or only available for time-sharing with the high-p line). A detailed proposal of the plan will be shown at the next meeting.
The other requests to the PAC for this meeting are an assessment of the accelerator status and test plans for future beam power upgrades, the status of the ongoing experiments, and the running scenarios and priorities of the experiments in K1.8/K1.8BR lines. Also to be discussed is the new proposal for an H dibaryon search and P34 (g-2) who has submitted a conceptual design report (CDR) and asked for Stage-1 approval.
The PAC took note of these requests for future deliberations and made them part of the discussions during the meeting.

3. REPORT FROM THE J-PARC PROJECT DIRECTOR

The J-PARC Center Director S. Nagamiya presented the general status of J-PARC. Recovery from the earthquake has gone very well. A milestone was set to resume beam operation in December 2011 and this was achieved. The Linac was re-aligned successfully with a bend at the ~40 m point. On December 9th, the first beam was injected to the Linac and went through it without difficulty. The acceleration in the RCS was also successful and the beam was extracted to the newly produced neutron target. At this stage, owing to a problem in the bubbler, which cools the target, the maximum beam power that can be put on the target was limited to 100kW, whereas the beam power from 3 GeV was able to be achieved to 300kW. The energy spectrum of the neutrons was measured and shown to be similar to that before the earthquake.

On December 22nd, the beam was accelerated in the MR and on December 24th extracted to the neutrino target. The horn magnet was not operational due to a problem of the horn power supply described below, but neutrino events were observed in the near detector of the T2K experiment.

The machine study was resumed on January 7th after a short New Year's break. There is to be 2 months of beam time for the RCS and MR users in this fiscal year followed by additional running through June.

The total J-PARC budget for JFY2012 is 188.52 Oku-yen. In addition, supplemental funding for the recovery was received as reported by the previous speaker.

The PAC was very glad to hear that the J-PARC recovery was progressing on schedule and that the re-commissioning with the beams started in December as planned. The Committee was impressed with the hard work by the Lab and J-PARC users on the recovery and the efficiency in restoring J-PARC operations. The PAC congratulates everyone involved for their efforts in restarting the J-PARC physics program.

4. REPORT ON THE J-PARC ACCELERATORS

T. Koseki reported on the status of the accelerators. After the earthquake, the RCS magnets were displaced by up to ±5mm. The realignment of the RCS to correct these displacements will be postponed to the summer shutdown in either 2012 or 2013. According to simulation, the emittance growth, and hence extra beam loss, due these misalignments could be minimized by modifying the tune manipulation. The beam loss at injection to the MR was estimated to be 135W for MR 150 kW operation, which did not so increase from the value before the earthquake (93W).

In addition to recovery work from the earthquake, all planned upgrades shown in the previous PAC meeting were completed. Additional shielding was partially installed around the MR ring collimator. The injection kicker magnets were replaced with new ones of a lamped constant type, which has more simple structure. Two additional RF cavities (the 7^{th} and 8^{th}) were installed to achieve higher accelerating voltage. The cooling water system for the RF cavities was isolated from that of the magnets, in order to avoid the contamination by copper ions, which deteriorated the insulation of the magnet alloys in the cavities. Solenoid coils were installed on the RF excitor in order to reduce multipactoring effects. With these solenoids, the transverse RF can be switched on for the slow extraction so that a better spill structure can be expected for the 2012 running. Collimators were also added in the slow extraction section in order to reduce the activation of the beam components.

The beam commissioning started on December 9^{th}. Beams with a peak current of 15 mA and 100~500 microseconds in width were accelerated in the Linac and successfully injected into the RCS. The beam profile was similar to the previous running period. Increases of beam loss in the downstream section of the Linac were observed and are under investigation. On the other hand, the beam loss in the RCS was consistent with simulation. Beams were finally injected into the MR on December 22^{nd} , whose magnets had been re-aligned in the summer to their nominal position. Measured beam parameters such as the beta function and the dispersion are well reproduced by the simulations. 60kW operation with 3.8×10^{13} protons in 8 bunches was demonstrated. Thanks to the re-alignment, the COD values were better than those before the earthquake.

In January, the RCS will start with 100kW user operation. By April, the RCS will be tuned to be ready for 300kW operation, depending on the availability of the bubbler system for the neutron target.

For the MR, studies of high power operation will be performed in January, which will include the tuning of the bunch-by-bunch feedback system and the optimization of the tune manipulation of the RCS beam to reduce the beam emittance and beam loss. The target beam power after January is 100~150kW in the MR. From March to June, further tests are planned to increase the repetition rate and to increase the protons per bunch to a value greater than the current 10^{14}.

Operation for the slow extraction will also be started in January. The spill feedback system with the transverse RF will be activated for the better spill structure. At the beginning, a fixed bump orbit will be used and the target intensity is 1~3kW operation.

In February, tuning with a dynamic bump orbit will be started. The target beam power in this period is >3kW.

For the future, an Annular Coupled Structure (ACS) linac is to be installed in the long summer shutdown in 2013. The beam energy delivered from the Linac will then be increased from 181MeV to 400MeV. The target MR power for 2014 is 300kW. The beam power for the slow extraction is expected to be ~10kW after the summer 2012 shutdown and ~50kW from 2014.

To achieve higher beam power, several R&D projects have been started. New magnet power supplies with the repetition rate more than 1Hz are being prototyped and new types of magnetic alloys will be tested to allow higher accelerating voltage.

The PAC congratulates the J-PARC accelerator group for their rapid recovery of the accelerator complex and reestablishment of beam to the various facilities. The PAC is pleased to hear that the performance of the accelerators is similar to the stage before the earthquake, which indicates that a vibrant J-PARC physics program can resume very soon. The Committee appreciates the crucial need for the improvements being planned for higher power accelerator operation and improved slow-spill beam. The accelerator group is encouraged to complete the necessary beam tests before the summer 2012 shutdown so that upgrades can be accomplished this summer before the important fast and slow-spill data runs next year.

5. REPORT ON THE MIDTERM PLAN OF THE HADRON HALL

K.H. Tanaka reported on the midterm plan of the hadron hall. The beam lines in the north area will remain as they are now. In the K1.8 line, there is a proposal to replace the SKS spectrometer by 2015 with a recently funded S-2S spectrometer with 2 quadrupoles and 1 dipole magnet. The new spectrometer would have better momentum resolution and reasonable solid angle coverage (60msr) and be optimized for S=–2 (K^-,K^+) spectroscopy. The current SKS spectrometer would then be available to be used in another beam line such as K1.1.

For the south area, the budget request for the high-p beam line was submitted without success. A design of the beam line, including the upstream beam separator at SM1, was shown. The beam line can provide primary beam of 30GeV up to 10^{10} protons or un-separated secondary beam with momentum between 2 and 15 GeV/c.

An idea to use the upstream components of this line for the COMET experiment has been presented. The COMET experiment requires a 50-60 kW bunched primary beam of 8GeV protons. It has been found to be feasible to have common beam transport

elements for this 8 GeV and the high-p beams. A combined budget request for the two beam lines is planned if there is strong support from the community and an endorsement from the PAC. After the beam line for COMET is set up, however, thick shielding walls will need to be installed and the current K1.1BR line will need to be removed.
The PAC took note on this plan and would like to hear more details on the plan and the physics programs planed in the high-p, K1.1(BR) and COMET beam lines at the March meeting.

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

1. **P36:** (Measurement of $\Gamma(K\rightarrow e\nu)/\ \Gamma(K\rightarrow \mu\nu)$ and Search for heavy sterile neutrinos using the TREK detector system)

   The collaboration proposes to measure this ratio, which is based on the helicity rule of the V-A current and which is an excellent test of the standard model. Including the radiative corrections, the theoretical prediction is known within a relative uncertainty of 4×10^{-4} and gives a value of $R= 2.477 \pm 0.001 \times 10^{-5}$. The most precise measurement to date is by the CERN experiment NA62, which achieved a relative uncertainty of 4×10^{-3}, equally shared between statistical and systematic error sources, with a measured value of $R_{exp}= 2.488 \pm 0.010 \times 10^{-5}$. A deviation of the experimental value from the standard model (SM) prediction would indicate the existence of new physics, e.g., a minimal supersymmetric extension of the SM could cause lepton flavor violation and change R at the percent level.

   The P36 collaboration proposes to improve on the NA62 measurement by almost a factor of two by collecting 250,000 K_{e2} decays at rest with an optimized KEK-PS E246 detector. The improved statistical accuracy is complemented by systematic uncertainties, which are completely different for this experiment since it is studying kaon decays at rest.

   From a request by the IPNS director for the PAC to re-evaluate the systematic uncertainties for P36, the collaboration submitted an Addendum II to the proposal, which contained a thorough evaluation of the sources of systematic errors for this measurement. These include uncertainties from detector performance (detector efficiencies and particle identification), background subtraction of structure-dependent radiative decays, and Monte Carlo simulation of the ratio of

acceptances for K_{e2} and $K_{\mu 2}$ decays. The largest single uncertainty is due to the ratio of acceptances and is at the 7.8×10^{-4} level The authors propose to measure this ratio by means of two-body decay data to be taken with different magnetic fields. The collaboration has also used the existing $K_{\mu 3}$ three-body decay data from the former E246 experiment together with the detector simulation to evaluate the relative systematic uncertainty of this acceptance ratio and obtained a value of 7.8×10^{-4}. The total systematic uncertainty including other sources is then estimated to be 1.5×10^{-3}, and the statistical error to be 2×10^{-3}.

The PAC congratulates the proponents on the detailed work performed in order to substantiate the systematic uncertainties. The PAC reiterates the recommendation for Stage-1 approval for this proposal with the conditions shown in the minutes of the PAC-11 meeting. In addition, it should be noted that there is a potential conflict for beam time with the COMET experiment, which the PAC views as having higher priority.

2. **P42:** (Search for H-Dibaryon with a Large-Acceptance Hyperon Spectrometer)

The P42 proposal aims to study the H dibaryon with a large-acceptance hyperon spectrometer HypTPC. The existence of the H dibaryon is a very important issue in hadron physics. There is increasing evidence by recent Lattice QCD calculations suggesting that the H dibaryon might exist as a resonance above the ΛΛ binding threshold. It therefore would be timely to carry out such a measurement with the high-intensity K^- beam available at J-PARC. While all of the previous experimental efforts showed no evidence for the existence of an H dibaryon as a bound state, the constraint for the resonant state is not so stringent. In fact, KEK-PS E224 and E522 showed some enhancements in the invariant mass of the ΛΛ pairs just above the binding threshold. Unfortunately, the statistics were not enough to prove the existence of a resonance. Now the proponents propose to construct a new large-acceptance detector to detect two Λ's as the signal in high statistics experiment. As for the bound H, there still remains a small mass window of about 7 MeV that is not excluded by the observation of weak decays of double-Λ hypernuclei. Thus, it is also worthwhile to pursue the search for the bound H in this mass region. The proponents are proposing to have such detection sensitivity by measuring $\Sigma^- p$ and $\Lambda p \pi^-$ decay modes.

After reviewing the proposal, the Committee requests that the following questions be answered by the proponents as part of the consideration for Stage-1 approval.

1. The production cross section of the H dibaryon is estimated with the scaling of the number of correlated two-proton pairs in a nucleus. However, the distortion effects of both the K^- and K^+ should be carefully taken into account, which would reduce the cross section significantly. The estimates must reproduce the $A^{2/3}$ dependence of the inclusive (K^-, K^+) process as measured in KEK-PS E176. Also, absorption of the H inside the nucleus as well as conversion and re-scattering effects of the final state two Λ's must be considered to evaluate the H dibaryon signals. All of these effects will reduce the mass number dependence of the H production cross section. For these reasons, the Committee asks that the choice of nuclei for the target be examined carefully.
2. The background processes, which produce two Λ's in two-step processes such as $K^-p \to \Lambda\pi^0$, $\pi^0 p \to K^+\Lambda$ and $K^-p \to K^+\Xi^-$, $\Xi^- p \to \Lambda\Lambda$ should have a large mass number dependence. This is also a concern for the choice of the target. In order to estimate the background shapes in the invariant mass of the two Λ's, a detailed understanding of the production mechanism and the effects of the nuclear cascade process is necessary. The reliability of this estimate based on an intra-nuclear cascade code should be demonstrated quantitatively.
3. On the design of the new large-acceptance hyperon spectrometer HypTPC, the proponents should present a more complete design of each component such as the TPC, the Helmholtz magnet, the target holder, etc. Based on the design, the Committee also requests to be shown the expected performance of the spectrometer such as momentum resolution, vertex resolution, and mass resolution, all based on full detector simulations.
4. The proponents have already started some R&D work using a TPC prototype with GEM readout to be operated at high rate and this has shown good progress. The proponents should now identify the next R&D items needed to construct the real detector. For example, increasing the size of the GEM detector will be necessary and may not be a simple extrapolation of current setup.
5. The final sensitivity in the production cross section of the H dibaryon both in the bound region and in the resonance region must be quantitatively presented. For these sensitivity estimates, the systematic ambiguities of the background shapes and of the background levels should be taken into account.
6. Estimates of the costs and the expected construction schedule should be presented.

3. **P34:** (A New Measurement of the Muon Anomalous Magnetic Moment *g*-2 and Electric Dipole Moment at J-PARC)

The PAC heard a progress report and stage 1 approval request from the g-2 collaboration. The collaboration aims to measure the anomalous magnetic moment, a_μ, of the muon with a precision of 0.1 ppm and the electric dipole moment (EDM) of the muon possibly reaching $d_\mu=1.0\text{x}10^{-22}$ e·cm. The proposed measurement will improve the precision of the previous E821experiment at BNL by a factor 5 for a_μ from 0.54 ppm to 0.1 ppm and by more than a factor 100 for d_μ as compared to the E821 limit of $d_\mu<1.9\text{x}10^{-19}$ e·cm.

Measurements of g-2 and the EDM of the muon at high precision could provide important insights into the nature of the dynamics of physics beyond the standard model that hopefully will emerge in high p_T collisions at the LHC.

The collaboration submitted a detailed Conceptual Design Report (CDR) to the laboratory prior to the PAC-13 meeting. The CDR summarizes the overall design of the experiment and documents impressive progress on all subprojects. These include the cold muonium production using the surface muon beam in the H-line, the ionization of muonium atoms with a high power laser system, the reacceleration of positive muons, the injection of the muon beam into the high-precision superconducting muon-storage magnet, the storage magnet systems including the precision field measurement instrumentation and the decay positron detection systems.

The PAC commends the excellent progress that the g-2 collaboration has made in all areas and recommends that Stage-1 approval should be granted.

The realization of the experiment still requires significant advances for the chosen experimental technology. Most importantly, the intensity of the cold muon source needs to be improved by almost a factor 10. In addition to the design and R&D the collaboration has provided a set of milestones that can be used to monitor the progress of the g-2 project. These milestones appear well suited to guide the development of the project towards Stage-2 approval (CDR, section 1.7):

M1) Demonstration of the ultra-cold muon production with the required conversion efficiency leading to an intensity of $1\times10^6\mu^+/\text{s}$.

M2) Muon acceleration tests with the baseline configuration of low-β muon LINAC, i.e. RFQ, and IH-LINAC.

M3) Tests of the spiral injection scheme.

M4) Production of a prototype magnet and development of the field monitor with the required precision.

M5) Demonstration of rate capability of the detector system for decay positron detection.

The PAC emphasizes the importance of rapid progress on the first milestone, to increase the intensity of the ultra-cold muon production. This goal should be pursued by the collaboration with the highest priority.

Good progress was reported in enlarging the g-2 collaboration to 92 members from 25 institutions in 7 countries. With the CDR in place, it appears timely to connect institutions and manpower in the collaboration to R&D tasks and sub-projects laid out in the CDR. The PAC observes that some sub-tasks are well suited to be carried out by collaborating institutions with external manpower and funding and suggests amending the CDR with a table that spells out the contributing institutions for each sub-task.

The PAC observes the complicated structure of the proposed experiment. The experiment is proposed for the H-line of the Muon Facility in the MLF, where the IMSS has primary ownership. The core of the collaboration is largely a mixture of members from two labs under IPNS and IMSS. Considering the scale of the project, a coherent strategy of the two labs is essential. The PAC encourages the labs to work closely with each other on this experiment and to develop a Memorandum of Understanding (MOU), if necessary, to clarify the responsibility and priority for the components of the project.

4. **E11:** Tokai-to-Kamioka Long Baseline Neutrino Oscillation Experiment (The T2K experiment)

Over the past six months, the T2K collaboration has published first results on electron neutrino appearance and muon neutrino disappearance. The appearance result was of great interest to the field and established that the θ_{13} mixing angle is non-zero with a value greater than 5° at 90% CL. The result was listed as a "Top 10 Breakthrough of 2011" by the Physics World magazine and the Double Chooz

experiment also presented indications for a large θ_{13} value recently. Such a large mixing angle makes the prospects for the future neutrino oscillation program high and puts the possibility for CP violation measurements within reach for future upgraded experiments.

It is now important for T2K to collect a larger data sample to substantiate and more accurately measure the size of θ_{13}. There is short-term competition from the Double Chooz and Reno reactor neutrino experiments and it is important for T2K to increase the data sample before the summer conferences including the Neutrino 2012 conference this June in Kyoto. Three to four months of running this spring would increase the data by a factor of two to three and give a 3σ discovery potential at the 0.06 to 0.08 level for $\sin^2 2\theta_{13}$.

Longer-term milestones include reaching 1×10^{21} protons-on-target (pot) by summer 2013 and 2 to 3×10^{21} pot before the NOVA experiment turns on in 2014/2015. The run period between October 2012 to June 2013, before the long summer 2013 shutdown, is very important for meeting these goals and any accelerator improvements that can be done before that period to increase the fast spill intensity will have a big payoff. The 3×10^{21} pot data sample will allow T2K to reach a sensitivity level close to the final goal for the experiment. The PAC concurs with these milestones, which will allow T2K to fully exploit the oscillation sensitivity of the experiment and keep the experiment at the forefront in neutrino oscillation measurements.

The PAC was very impressed with the T2K and Lab work to reestablish the neutrino program at J-PARC after the earthquake. This was a heroic effort that has gone very well. By December 2011, the functionality of all beam line elements and monitoring was confirmed and the experiment took data for ~3 hours at 28 kW without any trouble. The beam losses as well as muon and neutrino rates in the near detector were shown to be similar to previous running. All ND280 detector systems have been checked out and are ready for commissioning and data taking. Unfortunately, during the final operation tests on December 22, the horn power supply broke. The problem was traced to the failure of several insulated gate bipolar transistors (IGBTs) in the switching circuits. This problem is to be solved by either repairing the existing supply or by bringing in a refurbished old supply that uses a different design. The power supply failure brings up the issue that T2K and J-PARC need spares for all the critical components for the neutrino beam, since the loss of beam time is very costly. Spare horns and spare parts for critical components should be

secured as soon as possible.

For fast spill running this year, the plan is to have a working power supply by the end of February and restart the full experiment at the beginning of March. The PAC supports this plan to reestablish neutrino data taking as soon as possible and agrees that the work should be done with the highest priority.

5. **E14:** Proposal for $K_L \rightarrow \pi^0 \nu\bar{\nu}$ Experiment at J-PARC (The KOTO Experiment)

The proponents have set the first physics benchmark for KOTO is to reach the so-called Grossman-Nir limit $BR(K_L \rightarrow \pi^0 \nu \bar{\nu}) < \sim 1.4 \times 10^{-9}$ by the summer shutdown in 2013 for the linac upgrade. Effects of new physics could appear below this limit, and the PAC supports this benchmark to maintain the momentum of the experiment. The eventual goal of the experiment is to probe new physics well beyond the Grossman-Nir limit reaching the single event sensitivity corresponding to the standard model. The allocation of beam time for this final goal depends on future improvements of the slow extraction intensity.

After the March 11 earthquake, the experiment has been steadily recovering from the damage including the lost contact between the CsI crystals and PMTs and the misaligned beam line. The vacuum test of the CsI calorimeter during August to September 2011, however, revealed a few problems. First, the UV transmission of silicone cookies between the CsI and PMTs dropped approximately by a factor of two due to outgassing from the potting material of the PMT base. Second, the temperature of CsI rose by about 20 °C resulting in a 20% light yield reduction. Third, 0.8% of PMT preamps were damaged due to discharge in vacuum. These problems were acted on quickly and solutions have been found; namely, to bake the PMT bases, to improve the cooling of the CsI, and to redesign the preamps with protection circuits. In addition, the data acquisition system will be upgraded so that the event rate per spill can be increased by over a factor of four.

The collaboration is requesting a few weeks of K_{e3} running with the spectrometer in February 2012 and about 1 month for an engineering run using π^0s in March or June 2012. A physics run is requested in May through June 2013 preceded by an engineering run. The K_{e3} run would be executed with the problems of reduced transmission of the PMT cookies and the broken preamps, and repairs will not be completed for the π^0 run planned before the 2012 summer shutdown. The PAC believes, however, that enough valuable information and calibrations can be

obtained by these runs to keep the experiment on schedule, and supports the overall plan leading to a push to sensitivity at the Grossman-Nir limit before the 2013 summer shutdown.

6. **E16:** (Electron Pair Spectrometer to Explore the Chiral Symmetry in QCD)

The E16 collaboration proposes to measure vector meson decays in nuclei with the goal to study chiral symmetry restoration in dense nuclear matter. The experiment will use the high momentum beam line. The collaboration has made good progress in developing a spectrometer for the observation of vector meson decay into e^+e^-. The detector has a modular structure where each module consists of 3 layers of GEM trackers, a hadron blind Cherenkov detector with a CsI GEM readout, and a lead glass calorimeter.

The collaboration derives a bench mark for the performance of E16 from the results of the KEK-PS E325 experiment. E325 has measured ϕ meson production on nuclear targets and, for Cu targets, has observed a shoulder in the ϕ meson invariant mass distribution at masses below the nominal ϕ meson mass. Monte Carlo simulations show that the observed shoulder would be consistent with a ϕ meson mass shift of 35 MeV/c^2 and the invariant mass resolution of E325.

The goal of E16 is to improve the invariant mass resolution from 11 MeV/c^2 in E325 to 5 MeV/c^2 and to increase the statistics by a factor 100. These improvements would make it possible for E16 to resolve the possible mass shifted ϕ meson peak in the shoulder observed in the ϕ invariant mass spectrum at E325.

A prototype detector module was built successfully to demonstrate that the proposed GEM detectors reach a position resolution of 100 μm. This is the resolution required to reach the proposed invariant mass resolution of 5 MeV/c^2. Detailed mechanical design drawings of the detectors and electronics tests are still a work in progress. In order to meet the schedule to start stepwise production and installation of detector modules from 2013, the collaboration has requested from the lab to install the spectrometer magnet in JFY2012. The collaboration also has requested test beam time to evaluate the performance of the prototype detector module. The schedule of the E16 measurement also depends on the construction schedule for the high momentum beam line.

The PAC commends the E16 collaboration on the good progress made on detector development and supports its request for beam tests.

The PAC is concerned with regards to the long term stability of the CsI-GEM detectors to be used in the HBD detector. The E16 schedule calls for high intensity running for a long period. In an application of HBD detectors in the PHENIX experiment, the detector was used only for one heavy ion run and the stable use of HBD technology at high rates over several years was not demonstrated in PHENIX. The long term stability of the CsI GEMs should be explored experimentally.

In the next PAC meeting in March, the Committee requests an update of the experimental status and theoretical developments on vector-meson mass modifications in nuclei. The update should include a discussion of the international competition from future experimental programs around the world. The collaboration presented simulation studies that assumed a nuclear mass shift for ϕ mesons of 35 MeV/c^2 as suggested by E325. It would be helpful to compare simulations based on other scenarios, in evaluating the sensitivity of E16 for the mass shifts.

7. **Muon Task Force Report and E21:** An Experimental Search for Lepton Flavour Violating mu-e Conversion (The COMET experiment)

The COMET experiment aims to improve the experimental sensitivity to detecting muon-to-electron conversion by four orders of magnitude below the current measured limit. Measurements at this sensitivity level would probe the region expected by many well-studied new physics models such as SUSY-GUT in a perspective different from LHC. As such COMET could become a flagship experiment for J-PARC and Japanese physics later in the decade.

The PAC was pleased to receive a progress report and a detailed presentation from COMET and the Muon Task Force (MTF). Significant progress has been made for many aspects of the experiment.

R&D on superconducting solenoid magnets, such as an excitation test at FNAL, is going well as a Mu2e-COMET collaboration under the US-Japan program. The technical design of the whole magnet system has been completed after various studies including a finite element analysis of the magnetic field distribution and electromagnetic forces on the coils and the cryostats, studies of radiation heat loads at the pion capture solenoid and quench protection. A neutron irradiation test at Kyoto University Research Reactor showed that neutron damage to aluminum stabilizer would not be a problem and frequent thermal cycles of the pion capture

solenoid should not be required for the total exposure of 6×10^{20} n/m^2 during the whole COMET running time.

The technical design work of pion production and the muon stopping target system are in progress together with GEANT4 simulation, which incorporates full 3D field mapping and realistic detector geometry. R&D on the detector subsystems have been recently accelerated and some of the highlights such as development of front-end electronics, studies of a prototype straw tube tracker, an electron calorimeter, and of cosmic ray shielding were presented. R&D on X-ray measurements to monitor the number of formed muonic atoms is also underway.

One of the most important issues, a beam extinction study, has not been carried out due to the earthquake. The MTF intends to make a further extinction measurement (T25) in 2012 when the test beam line is available for SX and, in particular, do a mandatory test of double injection kickers. The PAC strongly supports that this beam test be done.

The PAC is pleased to know that Technical Design Report (TDR) is being finalized and will be submitted after completing the ongoing detector R&D.

The PAC also heard that the collaboration will be reorganized according to the newly written COMET constitution. It is hoped that the efforts for pursuing the experimental goals will be strengthened by the reorganization. The PAC would like to point out that closer contact with the Lab is essential to make the experiment run timely under the various constraints.

The MTF showed a design of the 8 GeV-50 kW beam line for COMET as a branch of high-p beam line with the experimental area and the beam dump extended to the south of the hadron hall. MTF proposed to construct it as part of the mid-term future plan. A rough estimate of the cost and the construction schedule was shown. The plan includes the muon source (the pion production target and the capture solenoid) and possibly the upstream part of the transport solenoid. The COMET collaboration intends to revise their schedule of R&D, construction, and engineering/physics runs to match the MTF's proposal.

The PAC considers the proposed mid-term plan as an important and indispensable step forward toward realization of the experiment and urges the collaboration to develop a realistic schedule for the experiment. The experiment may have two stages with a first stage for beam studies and a physics run with a somewhat lower experimental sensitivity followed a second stage with physics sensitivity. The PAC

is looking forward to hearing about this strategy at the next meeting in order to evaluate the mid-term plan for the hadron hall.

8. **Experiments at K1.8BR**

The PAC heard the status of the experiments at K1.8BR: E15 (Search for deeply-bound kaonic nuclear states by the in-flight ^{3}He(K^{-}, n) reaction) and E17 (Precision spectroscopy of Kaonic ^{3}He 3d→2p X-rays).

Recovery work from the earthquake has been done according to the plan shown in the previous PAC meeting. The E17 proponents requested a measurement of the width of the Kaonic ^{3}He X-rays using L-edge absorption on a Nd foil in addition to the measurements of the energy of the X-rays and the isotope shift between ^{3}He and ^{4}He. Working plans for the both experiments were essentially the same as the previous reports, where the beam tuning and commissioning runs with low beam intensity of 1-3 kW in the first half of 2012, and physics runs with 10 kW beam intensity after the summer 2012 shutdown.

In spite of a sophisticated method for the additional width measurement for E17, the impact of this measurement to the kaon-nuclear physics is not enough to change the priority of the two experiments, which was reported in the previous PAC minutes. Thus, the PAC advises again that the actual plan be that the running time for the first stage of E15 be maximized as soon as it is ready for tests and physics runs.

9. **SKS experiments**

The SKS collaboration updated the recovery status of the K1.8 beamline and the SKS. The configuration of the SKS was changed from SKSZero to SKSMinus' and the aerogel Cerenkov counters were renewed. Pre-cooling and excitation tests up to 2.5T were successfully performed.

Preliminary results of E19 (penta-quark search), which took data before the earthquake, were reported. The physics motivation for experiments, E27 (K^{-}pp bound state search) and E10 (study of neutron rich hypernuclei), were briefly summarized and the current preparation status was updated.

The E05 (Ξ– hypernucleus search) collaboration presented a run plan with a 30 kW beam and 1 month of beam time in K1.8 as a phase 1 experiment. The collaboration showed the phase 2 plan with a newly developing spectrometer S-2S which has

already secured funding for construction. With the S-2S spectrometer, the momentum resolution of K^+ can be significantly improved from the existing SKS and, thus, a 1.5 MeV mass resolution can be expected.

E13 (Hypernuclear gamma ray spectroscopy) also showed a two phases run plan. The phase 1 experiment requests 1 month of beam time with 10 kW beam and the SKS in the K1.8 line in order to study $^{4}_{\Lambda}$He and $^{19}_{\Lambda}$F hypernuclei. The collaboration also proposed to move the SKS to the K1.1 line to study $^{10}_{\Lambda}$B, $^{11}_{\Lambda}$B and $^{7}_{\Lambda}$Li (measurement of B(M1)) as a phase 2 experiment. In the K1.1 line, even with a 50 kW (Pt-target) beam, a similar measurement be obtained as the original run plan with a 270 kW (Ni target) beam in K1.8 line since the lower momentum of the beam contributes to lower background but adequately populates the spin states for the gamma ray measurements.

E18 (weak decay of $^{12}_{\Lambda}$C) explained their strategy to control the final state interaction (FSI) effect. The collaboration proposed to start the first stage experiment with a duty factor of more than 30% and 2-sec spill duration after the upgrade of the beamline chambers.

The SKS collaboration requested 12 days of commissioning for the K1.8 and SKS after the earthquake, 8 days of physics data taking for E19 with 2.0 GeV/c beam, and 15 days of E27 running for feasibility checks and beam tuning before the summer shutdown in 2012.

The PAC encourages the SKS users to perform the commissioning of the beamline with the SKS and recommends priority for E19 physics data taking in the K1.8 line before the summer 2012 shutdown.

7. EVALUATION OF TEST BEAM EXPERIMENT

The PAC chairperson reported on the evaluation of a new test beam experiment, P43 (Test of Hadron Blind Detector and GEM Tracker for the J-PARC E16 Experiment), which was received during the time since the previous meeting. To address this proposal, a meeting of the Test Experiment Committee was held on December 26th in 2011. The members were Katsuo Tokushuku (the PAC chairperson), Junji Haba (the FIFC chairperson), Takashi Kobayashi (the leader of the particle and nuclear physics division of J-PARC), and Masaharu Ieiri who is a member of the JPNC and a consultant for the capabilities and schedules of the hadron hall beam lines.

The proponents are requesting beam time after April 2012. The committee concluded that the test was able to be performed in the K1.1BR beamline without serious conflict with other experiments and recommended approving the proposal.

The PAC discussed on this recommendation in closed session and endorsed the committee's decision.

8. RECOMMENDATIONS FOR BEAM TIME ASSIGNMENT AND PLANNING SINCE JANUARY TILL JUNE 2012

The PAC reiterates that the two goals with the highest priority are: 1) a timely delivery of neutrino beam at the highest intensity (integrated pot) to the T2K experiment and 2) the delivery of improved slow extraction beam to the hadron hall experiments. In order to address these goals, it is important to perform accelerator studies for higher beam intensity and better slow-extraction spill structure during this running period so that any accelerator improvements can be realized during the summer 2012 shutdown.

Assuming that the horn magnet system is ready by the beginning of March, the PAC endorses the Lab's plan to have neutrino fast-extraction beam from March through May and to have slow extraction in June. The schedule will be re-evaluated at the March PAC meeting when the status of the accelerator and experiments is clearer.

For the experiments in the K1.8/K1.8BR beamlines, the PAC considers that completing the second physics run of the E19 experiment has first priority. Pilot runs for the E27 experiment in the K1.8 line and for the E15 experiment in the K1.8BR line are the second priority.

In the K0 beam line, the PAC strongly supports the calibration of the CsI calorimeter by the KOTO experiment.

The beam extinction test led by the MTF group is also very important and should be arranged to go ahead.

The beam allocation for the autumn 2012 and winter 2013 runs will be discussed at the PAC meeting in July.

9. DATES FOR THE NEXT J-PARC PAC MEETINGS

The next meeting will be held on 16-17 March 2012. This is a special meeting to assess the mid-term plan for J-PARC and, in particular, the accelerator upgrade for the fast and slow extraction and the plans for the hadron hall and the muon facility in the MLF. The PAC would like to hear the outcome of the ATAC meeting on future MR accelerator plans. For the hadron hall, two major issues should be addressed; 1) usage of the south area where a conflict between the K1.1, the high-p and COMET beamlines are foreseen and 2) usage of the SKS and other magnets in the K1.8 and other beamlines. For this assessment, the PAC encourages the lab to survey the interest in the high-energy and nuclear communities for the physics to be performed in the high-p and K1.1(BR) beamlines as well as in the new line optimized for the COMET experiment. A realistic proposal for the beam time allocations for the experiments in the next five years should also to be presented at the March and/or July PAC meetings.

The date of the 15th meeting is tentatively set to 13-15 July in 2012. The meeting will be the joint meeting of both the new and outgoing PAC committee members.

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

- Minutes of the J-PARC PAC meeting held on 8-10, July 2011 (KEK/J-PARC-PAC 2011-5)
- Document for 50GeV Proton Synchrotron: Search for H-Dibaryon with a Large-Acceptance Hyperon Spectrometer (KEK/J-PARC-PAC 2011-6)
- Test of Hadron Blind Detector and GEM Tracker for the J-PARC E16 Experiment (KEK/J-PARC-PAC 2011-7)
- Conceptual Design Report for The Measurement of the Muon Anomalous Magnetic Moment g − 2 and Electric Dipole Moment at J-PARC (KEK/J-PARC-PAC 2011-8)
- A Run Plan of J-PARC E05 (KEK/J-PARC-PAC 2011-9)
- (KEK/J-PARC-PAC 2011-10 was withdrawn.)

- A Revised Run Plan of J-PARC E13 “Gamma-ray spectroscopy of light hypernuclei” (KEK/J-PARC-PAC 2011-11)
- Report on the Circumstances of E18 with regards to the Beamline and SPS spectrometer: Coincidence Measurement of the Weak Decay of ${}^{12}_{\Lambda}\mathrm{C}$ and The Three-Body Weak Initeraction Process (KEK/J-PARC-PAC 2011-12)
- Addendum II to Proposal P36: Systematic Error Analysis of the Measurement of $\Gamma (K^+ \rightarrow e^+\nu) / \Gamma (K^+ \rightarrow \mu^+\nu)$ (KEK/J-PARC-PAC 2011-13)
- Internal Document (KEK/J-PARC-PAC 2011-14)
- Short-term RUN plan at K1.8 Beam Line (KEK/J-PARC-PAC 2011-15)
- E15 first-stage plan and the current status (KEK/J-PARC-PAC 2011-16)
- Status and plan of the J-PARC E16 experiment as of the end of 2011 (KEK/J-PARC-PAC 2011-17)
- Status Report on P41 (KEK/J-PARC-PAC 2011-18)
- Precision spectroscopy of Kaonic Helium 3 3d→2p X-rays (E17) Status and run plans (KEK/J-PARC-PAC 2011-19)
- Progress Report of Experimental Search for Lepton Flavor Violating $\mu^- \rightarrow e^-$ Conversion at Sensitivity of 10^{-16} with a Slow-Extracted Bunched Proton Beam (COMET) (KEK/J-PARC-PAC 2011-20)