KEK/J-PARC-PAC 2012-23
January 11, 2013

J-PARC Program Advisory Committee

for the Nuclear and Particle Physics Experiments

at the J-PARC 50 GeV Proton Synchrotron

Minutes of the 16th meeting held on
9-11 January 2013

OPEN SESSION (9, 10-January-2013):

1. Welcome and Mandate to the committee: M. Yamauchi (KEK)
2. J-PARC status: Y. Ikeda (J-PARC)
3. J-PARC accelerator status: T. Koseki (KEK)
4. E11 status report (T2K): T. Nakadaira (KEK)
   A. Ichikawa (Kyoto)
5. E14 status report (KOTO): T. Yamanaka (Osaka)
6. E10 status report (Study of neutron rich hypernuclei by double charge-exchange reactions): A. Sakaguchi (Osaka)
7. E27 status report (Search for a nuclear Kbar bound state K^-pp in the $d(\pi^+,K^+)$ reaction): T. Nagae (Kyoto)
8. E36 presentation (Measurement of $\Gamma(K\rightarrow e\nu)/\Gamma(K\rightarrow \mu\nu)$ and Search for heavy sterile neutrinos using the TREK detector system): S. Shimizu (Osaka U)
9. E21status report (COMET): Y. Kuno (Osaka)
10. Report from high-p beamline workshops: K. Ozawa (KEK)
11. P50 (Charmed Baryon Spectroscopy via the (π^- D^{*-}) reaction in the high-p beam line
    H. Noumi (Osaka)

12. P45 status report (3-Body Hadronic Reactions for New Aspects of Baryon Spectroscopy): K. Hicks (Ohio)
H. Sako (JAEA)

13. E31 presentation (Spectroscopic study of hyperon resonances below $\bar{K}N$ threshold via the (K^-, n) reaction on Deuteron): H. Noumi (Osaka)

14. E34 status report (A New Measurement of the Muon Anomalous Magnetic Moment g-2 and Electric Dipole Moment at J-PARC): N. Saito (KEK)

15. Test beam lines: Y. Sato (KEK)

CLOSED SESSION(9,10,11-January-2013):

Present: E. Blucher, T. Browder, A. Dote, M. Grosse-Perdekamp, J. Haba (Chairperson), T. Haruyama (IPNS Deputy Director), M. Ieiri (Secretary), K. Imai, K. Inoue, G. Isidori, K. Kleinknecht, T. Kishimoto, W. Louis III, T. Nagae, K. H. Tanaka (IPNS Deputy Director), K.Tokushuku (IPNS Deputy Director), M. Yamauchi (IPNS Director), W. Weise

1. PROCEDURE

The minutes of the fifteenth J-PARC-PAC meeting (KEK/J-PARC-PAC 2012-15) were approved.

2. REPORT FROM THE IPNS DIRECTOR

The IPNS director Yamauchi Masanori welcomed the PAC members.
He first summarized the status of J-PARC after the last PAC meeting.

1) Beam operation started from Oct. 17. The beam power has increased to 210kW(FX) and 12kW(SX).
2) A governmental review was held to decide on a mid-term plan for JFY2013-17 and beyond following the previous review last spring. The plan includes a) upgrade of the MR to 750kW at higher repetition rate with new power supplies and b) a new high momentum beam line and COMET. MEXT submitted the corresponding budget request to the MOF.

3) Four test beam experiments were approved by a subcommittee whose members are J. Haba, K. Tanaka and M. Ieiri. The following two experiments have already been completed:

- T47, Lead glass EMC and GEM tracker for E16;
- T48, Aerogel Cherenkov counter for E36.

Two additional experiments will be performed before next summer:

- T46, a training course using a hadron beam for the EDIT instrumentation school;
- T49, a 250L liquid Ar TPC.

Taking the following points into consideration, the run plan and schedule for the period between January and July of 2013 was decided,

- T2K has high priority to establish 5σ significance of ν_e appearance by summer.
- Beam operation will be continued for an additional month until the end of July.
- We assign 52 and 16 days to the SX experiments and machine studies, respectively.
- A long shutdown is scheduled starting from August 2013 to upgrade the LINAC to 400MeV. MR operation will resume in early 2014.

Director Yamauchi gave the following mandate for the committee in this meeting:

1) Examine stage-2 approval for E31;
2) Examine stage-1 status for P45;
3) Evaluate the new proposal, P50, to study charmed baryon spectroscopy in the high momentum beam line;
4) Review the status of the running experiments (E10, T2K, KOTO, E27) and the readiness of the future experiments (COMET, g-2/EDM, E36).

The PAC took note of these requests and made them part of its discussions and deliberations during the meeting.

3. REPORT FROM THE J-PARC PROJECT DIRECTOR

The J-PARC Project Director Yujiro Ikeda presented a review of major progress at J-PARC during the last 6 months. Along with those in MR covered in detail by Koseki, he presented several achievements of the RCS and MLF,

- Good user availability as high as 93.4 % and stable beam power close to 300kW,
- Successful mitigation of damaging pressure waves in the mercury neutron target,
- Completion of several new neutron beam lines and instruments,
- Installation of front end equipment in the MUON S- and H-lines,
- Commissioning and world record intensity muon flux (25M muons/pulse) achieved in the MUON U-line

He concluded the report with the operation plan for FY2013 beginning from April. As suggested by the PAC a one month extension of operation up to the end of July is scheduled. Beam power is expected to be 300 kW for the MFL, 220 kW for the MR-FX and higher than 20kW for the SX line. After the LINAC upgrade to 400MeV during the long shutdown after July, further improvements are expected at the start of operation in early 2014.

4. REPORT ON THE J-PARC ACCELERATORS

T. Koseki reported on the status of the accelerators.

He first showed some highlights of accelerator operation since the restart of J-PARC operation after the 2012 summer shutdown. A high power test of RCS has been successful up to 539 kW, in which, the incoherent tune shift is equivalent to 1.8 MW for a 400 MeV injection. As for MR, thanks to the modifications during the 2012 summer shutdown such as enhancement of the capacity of the ring collimator from 0.45 to 2 kW, a new transverse rf system to improve a spill duty factor of SX and so on, stable beam has been delivered to FX with power as high as 220 kW and to the SX up to 15 kW with the duty factor better than 40%. The SX power will be further improved while controlling the residual radiation level in the extraction section.

Based on the following considerations, the beam plan for coming year was established.

- A few days of maintenance for the ion source, which will be replaced every 1.5 months
- A half day maintenance or beam tuning for every week
- Several half-day studies in the MR for every run period
- A high power 600kW study for a week in the RCS
- Sufficient user operation before the long shutdown
- The SX/FX ratio should be 1/2 as recommended by the previous PAC

The operation period will be extended to the end of July according to the PAC's recommendation. The long shutdown for the LINAC upgrade after summer will be completed by November when LINAC cavity conditioning will be started. The beam for the MR will resume at the end of January 2014.

The upgrade of the LINAC and the installation of an additional ring collimation system with an enhanced capacity would enable beam delivery to the FX with power up to 400 kW by 2014. For further intensity upgrade, a scheme of high repetition rate of 1 Hz is adopted by replacing magnet power supplies and rf cavities. The design intensity of 750 kW for the T2K experiment is expected to achieve by 2017 after the replacements. Several improvements in the SX beam extraction system and replacement of some SUS

beam ducts with Ti would reduce the residual radiation significantly and allow beam power up to 50 kW by 2014 and higher than 100 kW by 2017.

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

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

   The T2K experiment has made excellent progress since the previous PAC meeting. The experiment has now collected a total of 4.19E20 POT (from 3E20 POT in July) and expects to reach ~7.5E20 POT by the start of the MR shutdown on August 1, 2013. Both the near detector (ND) and far detector (FD) report good running efficiencies of 96.6% and 99.2%, respectively. There have been a few problems (e.g. a beamline vacuum leak in December); however, these problems have been addressed and countermeasures have been implemented. The new horn power supply has been fixed and is being tested. It is expected that the 2013 run will make use of two horn power supplies and that the beamline will be ready for operations on January 17.

   No new results were presented for the ν_e appearance analysis; however, it is expected that the appearance signal sensitivity will reach 5σ significance by the time of the August shutdown. Preliminary ν_μ disappearance results were presented, and it appears that T2K may have already achieved (with only 3E20 POT) the world's best measurement of the atmospheric neutrino oscillation parameters. This is a very significant milestone and measurement. At present, the ν_e appearance and ν_μ disappearance systematic uncertainties are at the 10% and 13% levels, respectively. The committee strongly supports further improvement on these uncertainties with the full inclusion of ND data.

   Progress was also reported on sensitivity studies in the determination of θ_{13} , θ_{23}, Δm^2, and δ_{CP} with increased running and from a combined analysis with the NovA and reactor experiments. Depending on the oscillation parameters, it may be possible to make some determination of δ_{CP} and the mass hierarchy once the running goal of 7.8E21 POT is achieved.

The PAC looks forward to seeing the results of this very important exercise at the next PAC meeting.

The committee is further of the opinion that running in antineutrino mode will be beneficial for obtaining the best δ_{CP} sensitivity. Therefore, the T2K collaboration should consider some amount of antineutrino running in the near future. As it takes only one day to change horn polarity, the collaboration could, for example, start the 2014 run in antineutrino mode. It would be beneficial to obtain some antineutrino data as soon as possible in order to test the horn focusing hardware and to test the analysis simulation packages with actual data. This is especially important for measuring CP violation, as nuclear effects, which can affect neutrinos and antineutrinos differently, will need to be accounted for properly. An important initial test for nuclear effects is to measure the ν_μ disappearance parameters in anti-neutrino mode and compare with neutrino mode parameters. CPT conservation requires that ν_μ and $\overline{\nu_\mu}$ disappearance be identical, so that if a difference is observed, then it may indicate a problem with the event simulation and the treatment of nuclear effects.

At the next PAC meeting, the committee looks forward to seeing ND and FD results from the 2013 run, progress in determining oscillation parameter sensitivities, the optimal plan for antineutrino running, and the 2014 run plan. Overall, T2K has a very strong physics program of ν_e appearance, ν_μ disappearance, and neutrino and antineutrino cross section measurements, and T2K should have some sensitivity for measuring δ_{CP} if the goal of 7.8E21 POT can be achieved.

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

The committee congratulates the KOTO Collaboration on the successful installation of their detector in the experimental area. After an impressive amount of work, the detector is now being pumped down, and the group seems ready to take full advantage of the run plan endorsed by PAC-15:

- a short engineering run under vacuum in January 2013;
- a short physics run (~ 2 weeks) in March 2013 followed by a 1 month period for analysis and repairs;

- a main physics run of 30 days at 15kW plus an additional five days.

If no events are observed, this exposure will result in a 90% C.L. upper limit below the Grossman-Nir bound $B(K_L \rightarrow \pi^0\nu\nu) < 1.4\times10^{-9}$. This result will be valuable, and we reiterate our strong support for reaching this goal before the 2013 shutdown.

After a few days of pumping down, the vacuum level in the detector is still two orders of magnitude worse than planned. Although the vacuum level should improve over time, even at its current level, the number of background events from the residual gas (~0.2 events) would not degrade the sensitivity for this year's run.

The group reported on studies of the cable outgassing that damaged the UV transparency of silicon cookies used to couple the CsI crystals to phototubes. For this run, they have baked the cables for three days, reducing the problem by a factor of two. For future physics runs, the group will replace the current cables with ones that do not damage the cookies.

The PAC endorses the laboratory's beam schedule, which accommodates the proposed KOTO run plan. We wish the KOTO experiment no unexpected backgrounds, and look forward to seeing the first KOTO physics data at the next PAC meeting.

3. **E10:** (Study of neutron rich hypernuclei by double charge-exchange reactions)

The J-PARC E10 experiment aims to produce neutron-rich Λ hypernuclei via the double-charge-exchange (π^-,K^+) reaction at 1.2 GeV/c. By using ^{6}Li and ^{9}Be targets, they could produce $^{6}_{\Lambda}$H and $^{9}_{\Lambda}$He, respectively. In the case of $^{6}_{\Lambda}$H, the core nucleus ^{5}H is unbound, while $^{6}_{\Lambda}$H is expected to be bound because of the glue-like role of the Λ. In addition, it is suggested that the ΛN-ΣN mixing would be also effective for this binding in such a core nucleus with isospin. Just recently the FINUDA collaboration reported three candidate events of $^{6}_{\Lambda}$H in the ^{6}Li(K^-stop, π^+) reaction. It would be timely to experimentally verify this observation with better statistics and good precision at J-PARC. Stronger binding is expected for $^{9}_{\Lambda}$He since in this case the nuclear core is already bound to start with.

The K1.8 beam line together with the SKS spectrometer is a suitable place to conduct the measurements. Good energy resolution of about 2.5 - 3 MeV (FWHM) will be achieved for spectroscopic studies. However, the production cross section

will be about 1/1000 of that for normal Λ hypernuclei produced in the (π^+,K^+) reactions. Therefore, a high-intensity π- beam is required to perform the measurement. The experimental group will handle the high-intensity 10 M/spill beam by installing scintillation fiber trackers, silicon strip detectors, and a new trigger hodoscope. Recent improvement of the spill duty factor of the primary proton beam also helped significantly. The PAC commends these efforts to run at higher intensity.

In December, 2012, the experimental group took ^{6}Li(π^-,K^+) data for about 100 hours. With an additional 6-day run in January 2013, they will be able to integrate about a total of 1.36 T pions on the target. The PAC supports this run schedule and looks forward to a presentation of the results at the next meeting.

4. **E27:** (Search for a nuclear Kbar bound state K^-pp in the d(π^+,K^+) reaction)

The experiment is motivated by the quest for the possible existence of a quasi-bound K^-pp cluster and by the ongoing discussions about signals observed previously in FINUDA and DISTO measurements. The PAC heard a status report on the analysis of data that resulted from the E27 pilot run.

A semi-exclusive measurement of d(π^+,K^+)X was performed, where the hyperon-proton final state X = Yp with Y = Λ, Λ∗, Σ, Σ∗ was further constrained by reconstructing decays with a second proton together with a pion, two pions or πγ, respectively. The measurement performed with a Range Counter Array (RCA) was designed so as to suppress quasi-free background.

Successful data taking was reported for d(π^+, K^+) and p(π^+, K^+) at 1.7 GeV/c, as well as a p(π^+, K^+) run at 1.58 GeV/c for calibration. Data using 3M π^+/spill over 7.6 days have been analyzed and compared with simulations incorporating all relevant S = -1, B = 2 final state channels. These simulations are based on an assumed 1% sticking probability of the Λ* and an estimated 20% branching into non-mesonic decay channels.

The preliminary analysis of both one- and two-proton tagged missing-mass spectra shows systematic enhancements with respect to simulations in the signal region between 2.2 and 2.4 GeV/c^2. While a connection with a proposed K^-pp quasi-bound cluster is not obvious (nor can even the presence of a sub-threshold anti-kaon be identified in this process), this preliminary analysis does indicate a non-trivial structure in the strangeness S = -1, baryon number B = 2 system. It is of great

importance to clarify the situation and to continue collecting data at an improved level. Further studies on tagging efficiencies are required. The original proposal had requested 5M π+/spill and 40 days of running, aiming at up to ten times the level of statistics that has been achieved so far. Ideally, the experiment should be continued with high priority before the summer shutdown. However, given the existing commitments and beam time allocations up to the shutdown, it is more likely that the next E27 run can only be staged thereafter. In this case the PAC strongly encourages a scheduling of the experiment in the earliest possible period after the shutdown. An updated joint report of results produced so far by both E15 and E27 should be presented at the next PAC meeting.

5. **E36:** (Measurement of Γ(K→eν)/ Γ(K→μν) and Search for heavy sterile neutrinos using the TREK detector system)

   The proposal for E36 was granted official stage-1 status after the 15th PAC's recommendation.

   S.Shimizu presented the progress report of the collaboration, which now has 44 members from Japan, Canada, USA, Russia, Korea and Vietnam. Several new detector parts have been designed and tested since PAC-15, in particular three particle identification detectors for the suppression of fake μ tracks: an aerogel Cherenkov counter, a time-of-flight counter array, followed by lead glass counters adapted from the TOPAZ experiment. This triplet of PID detectors has been tested at TRIUMF in a 240 MeV/c $(e, \mu)^-$ beam. The overall mis-identification probability was evaluated by multiplying the separately measured rejection factors to be less than 10^{-6} . The active segmented target, adapted from E246, will be assembled and tested at TRIUMF until October 2013. The K1.1BR beam was tuned and tested in December 2012. From the beam tuning result, a K^+ rate of 200 kHz with a K/π ratio of 4 is expected for 30kW SX operation, much better than assumed in the proposal.

   Critical questions by PAC about the systematic error estimate, in particular about the influence of the radiative corrections on the ratio of acceptances for Ke2 and Kμ2, were answered in the closed session on Jan.10.

   Applications for research grants were made in Japan, Canada and the US.

The PAC congratulates the collaboration for the progress made since PAC-15. Concerning the PID, possible correlations between rejection factors should be evaluated. In addition, it would be very desirable to schedule an engineering run for a full-system test with all detector components.

Progress of the experiment now depends on the outcome of the funding requests.

6. **E21:** An Experimental Search for Lepton Flavour Violating mu-e Conversion (The COMET experiment)

The COMET experiment received stage-1 status in 2009.

It follows a staged approach with two phases. COMET phase I has a beamline with a $\pi/2$ bend while COMET Phase II has an C shaped beamline. COMET phase I is now in the design and R&D phase and plans a first engineering run in 2016. Phase I should achieve a μ-e conversion limit a factor of 100 below the SINDRUM result while Phase II (engineering run in 2020) will reach a single event sensitivity of 3 x 10^{-17}, which is comparable to the Fermilab Mu2e experiment.

The COMET collaboration is growing and now has 117 collaborators from 27 institutes spread over 12 countries. It now has set up a modern organizational structure and has regular group meetings.

The experiment is seeking new sources of international funding. Phase I proposes to use both a drift chamber (based on the Belle II CDC with a helium based gas) AND a straw tube detector (to be developed by JINR Dubna). In phase I, the CDC will be used for the μ-e conversion search and the straw tubes will be used for background measurements. These two tracking systems do not conflict geometrically although a clear, detailed and up to date detector geometry figure was not shown. Phase II must use a straw tube detector since the tracker must operate in vacuum. The operation of straw tubes in vacuum should be carefully investigated.

The COMET building construction will begin in 2013. Beam tests of crystal calorimeter prototypes are underway. A μ capture R&D experiment at PSI is planned in 2013 to measure proton emission after muon nuclear capture on aluminium. R&D in the RCS for 8 GeV MR operation has started. It is difficult to accelerate a single bunch with high intensity since the RCS was designed for two bunch operation.

There are also issues with 8 GeV operation of the MR, extraction and transport to the Hadron hall. Lower energy beam operation is crucial to avoid backgrounds from anti-proton creation. On the other hand, to maintain high intensity with a lower energy beam one has to overcome radiation issues mainly coming from the large beam size. An initial study on reducing the beam size was carried out on the basis of simulation. After further simulation studies of the MR and beam transport, an experimental test of the proposed technique is necessary. This may require optimization of beam energy and beam size. Modification of the beam energy from the requested 8 GeV value will have a large impact on the COMET detector design.

As requested by the last PAC, COMET provided an updated construction schedule. A technical design report (TDR) is being prepared and will be available at the next PAC. The TDR will be reviewed by a special technical review committee formed by IPNS.

The PAC recommends a beam test by the accelerator group with lower energy as soon as possible in the next running period in 2014.

7. **Report from high-p beamline workshops**

The PAC heard a report on the high-momentum (high-p) beam line workshops. After the previous PAC meeting, several workshops have been planned in Japan. Various topics are discussed concerning the physics program to be investigated at the high-p beam line, including the internal structure of hadrons and form factors, modifications of hadron properties in nuclear systems, hadronic physics with charmed quarks, etc. The discussions at the workshops emphasize the importance of close communication between theorists and experimentalists in order to develop the physics goals to be achieved with the high-p beam line.

The PAC reiterated the importance of internationalizing the discussions concerning the high-p beam line physics program. It took note of an international workshop hosted by the KEK theory center, to be held during the week after the PAC meeting. In the future, establishing an active J-PARC theory group closely connected to experimental developments was considered to be an important issue.

8. **P50:** (Charmed Baryon Spectroscopy via the (π D*) reaction at high-p beam line)

A proposal for a new experiment to detect charmed baryons in the (π^-, D*) reaction at the high-momentum beam line was presented to the PAC by H. Noumi.

At present only a few charmed baryons (Y_c) are well established. The goal of P50 is to perform a systematic study of charmed baryon spectroscopy, improving the existing data especially for the higher excited states. This study could provide valuable information about non-perturbative aspects of QCD. In particular, it could help to clarify the role of the diquark binding of light quarks within the (quasi-static) chromo-magnetic field generated by the heavy quark inside these hadrons. The PAC recognizes the physics interest of this project. However, concerns about the feasibility of the proposed measurement have been raised.

The main strategy of the measurement is the identification of the Y_c states from the missing-mass spectrum in the $\pi N \rightarrow D^* Y_c$ reaction, where the D* is fully reconstructed via the decay chain $D^* \rightarrow D \pi \rightarrow (K^+ \pi^-) \pi$ and the proton from the Y_c decay chain is also detected.

Using this strategy P50 estimates 1000 signal events for each Y_c assuming a reference production cross sections of 1 nb (for each excited state). The expected mass resolution is ~ 5 MeV/c^2, resulting in a good S/B for all the states with narrow widths (5 sigma significance assuming $\Gamma < 20$ MeV). The two main concerns of the PAC are: i) the overall level of the signal; ii) the reliability of the background estimate.

As far as the signal level is concerned, the PAC notes that the $\pi N \rightarrow D^* Y_c$ reaction has never been observed; it is not clear how to estimate it reliably from the theoretical point of view. The reference value assumed by P50 is a rough estimate obtained using a Reggeon model, extrapolating results from the strange baryon production (where the cross sections are about five orders of magnitude larger). Even employing such a model, a significant reduction for the cross section of the excited states relative to the ground state is expected close to the kinematical threshold; this effect has not been taken into account in the simulations presented so far by P50.

As far as the background estimate is concerned, P50 claims a 10^{-7} background suppression in the missing mass spectrum after imposing kinematical cuts on the D* and D^0 masses. This estimate is based on a MC simulation performed using the JAM code. As shown by P50, if the background suppression were only 10^{-6} the signal would be barely visible at the reference cross section of 1 nb.

Before any step forward in this proposal, the PAC recommends further studies in order to gain more confidence on these two critical points. Possible strategies to reach this goal are listed below:

i. The background simulation should be tested against existing πN data in similar kinematical conditions. In particular, detailed comparisons of all the available kinematical distributions should be presented. Moreover, an attempt to estimate the MC uncertainty (for the background) should be made using different MC codes and/or different tuning of the MC codes. This uncertainty should be taken into account when estimating the S/B ratio.

ii. In order to validate the estimate of the signal cross section, and its uncertainty, alternative models to describe the $\pi N \rightarrow D^* Y_c$ reaction should be analysed (in addition to the Reggeon model). Attempts should also be made to validate the theoretical models against related processes with available data, such as J/ψ production or inclusive charm production in πN and γN reactions (even if this comparison require non-trivial extrapolations). The dependence of $\sigma(\pi N \rightarrow D^* Y_c)$ on the Y_c structure (with the unavoidable suppression of the production cross section for the highly excited states) should be taken into account in estimating the S/B ratio.

iii. In order to further increase the S/B ratio, more extensive studies about the impact of a more complete detection of the Y_c decay products should be performed, even taking into account possible modifications of the proposed experimental set-up.

iv. In order to establish the physics potential of this new proposal, P50 should provide a detailed comparison of the results expected on each Y_c state relative to those already available from the B factories.

9. **P45 (**3-Body Hadronic Reactions for New Aspects of Baryon Spectroscopy**)**

The PAC heard replies to the questions, which were posed at the previous PAC meeting. The proponents answered all the questions well: 1) Some examples of theoretical analysis of the data with a coupled-channel dynamical calculation were quantitatively shown. 2) In a full simulation with GEANT4, they showed the proposed experimental setup will work sufficiently well; the particle ID is feasible, the missing mass resolution is good with a 2.0 T magnetic field, the acceptance is reasonable and the trigger inefficiency is about 2% with 32 segmented scintillator hodoscopes. 3) The modification of the experimental setup from E42 was clearly explained: the design of

liquid hydrogen target and the modification of TPC were shown. A two-particle trigger is realized with the hodoscope mentioned above. 4) The scintillator hodoscope system developed by Ohio University will be used in the trigger for both E42 and P45. The PAC was satisfied with these responses.

A systematic study of N* resonances with the proposed experiment including πN -> ππN channels will contribute significantly to the data base for PWA and coupled channel analysis of baryon spectroscopy. All technical issues have been addressed. Therefore, the PAC recommends stage-1 status for this proposal. PAC also requests a time schedule for construction of the additional detector components.

10. **E31:** (Spectroscopic study of hyperon resonances below $\overline{K}N$ threshold via the (K^-, n) reaction on deuteron)

This proposed experiment is to study the I=0 Λ(1405) resonance with in-flight K- initiated production reaction, K^-+d→ n+Λ(1405). Recently, the line shapes of the πΣ invariant mass spectra for the Λ(1405) have been actively studied both theoretically and experimentally. This experiment should help to resolve the nature of Λ(1405).

The proposal was granted stage-1 status at PAC-9.

The proponent described the readiness of the experimental apparatus, which is nearly the same as that used for E15 with the exception of the target. The detector performance results from the E15 pilot run were reported in the previous PAC. The PAC has confirmed the readiness of the experimental apparatus.

The PAC recommends stage-2 approval for this proposal.

The proponent showed the expected line shapes of the three Λ(1405) decay channels for the proposed beam time request of 40 days with a 27 kW proton beam, depending on the position of the spectral maximum. The line shapes of πΣ spectra in the Λ(1405) region have been measured at SPring-8, Jlab, COSY, and GSI recently. It is now important to take data with high statistics. The proponent requested to a 20kW week of running before the summer shutdown.

Since E31 uses the same detector as E15, the PAC understands that E31 requests a run following E15 before the summer shutdown. To assure competitive physics results, however, high statistics data for the three decay modes are necessary. If time is available in the final phase of the hadron beam time period, the PAC agrees that a pilot run of E31 should be scheduled before the summer shutdown; even a 10kW week is worthwhile. The priority of E31 is, however, lower than that for E13 and E15.

11. **E34: (A New Measurement of the Muon Anomalous Magnetic Moment g-2 and Electric Dipole Moment at J-PARC)**

The PAC heard a progress report from the g-2/EDM collaboration. The collaboration aims to measure the anomalous magnetic moment, aμ, of the muon with a precision of 0.1 ppm and the electric dipole moment (EDM) of the muon reaching a limit of $d\mu=1.0\times10^{-22}$ e•cm. The proposed measurement will improve the precision of the previous E821experiment at BNL by a factor 5 for aμ from 0.54 ppm to 0.1 ppm and by more than a factor 100 for dμ as compared to the E821 limit of $d\mu<1.9\times10^{-19}$ 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.

The collaboration reported that the upstream magnet close to the H-line target has been installed successfully by the MUSE group at HB1 and that the cabling for this H-line element will be completed in the summer of 2013 before activation levels become too high.

R&D activities were presented for instrumentation projects that align with the critical project milestones formulated in the g-2/EDM CDR presented to the PAC in January 2012:

i. Cold muonium production: a test facility to study cold muonium production has been setup at the MUSE D line. Compared to the previous test station located at TRIUMF this will facilitate more frequent iterations in the search for the optimum momentum bite, muonium formation target material and geometry. The laser systems have been setup successfully and are being studied. Currently the power yield from the laser is a factor of 7 below the performance goal. At the same time it is estimated that the cold muonium yield from the formation target is a factor of 2 above the nominal value. With this there is an overall shortfall of a factor of 3.5 compared to the cold muon production rate originally proposed. The PAC agrees with the collaboration that the cold muon source R&D is of highest priority and is looking forward to hearing about the progress that will be achieved with the new test station at the D line and the new laser systems at the next PAC meeting. In addition to reaching maximum rates for the cold muon yield it also will be important to confirm the level of polarization of the cold muon beam.

ii. Reacceleration of positive muons: the collaboration has decided to use the H-line for a test setup for the LINAC. The decision allows more space for the setup compared to possible tests at the U-line. The initial stage RFQ has been identified and simulation studies show that the emittance growth is from 2.4 to 2.9 μm mrad and the beam transmission is about 58% for the RFQ. Since small emittance growth and low losses in the reacceleration are critical in achieving the required cold muon beam intensities for the experiment the PAC encourages the collaboration and the laboratory to provide the resources needed to advance the LINAC R&D parallel to the cold source development.

iii. and iv. Magnet, kicker and field measurement systems: A first integrated design of the magnet system and the injection kicker was shown and R&D for the kicker as well as the precision field measurement system has been started. The PAC agrees that the impact of the injection tunnel in the yoke on the field homogeneity requires careful study. It also will be important to study the impact on the precision field of eddy currents induced by the kicker fields and the impact from changes in the yoke hysteresis in case of a full current quench. The PAC strongly endorses the US/Japan funded collaboration with Dr. David Kawall of UMass and Drs. Bill Morse and Yannis Semertzidis from BNL in the development of the precision field measurement. They will contribute important expertise from E821 at BNL in this area.

v. Detector systems: a first prototype with the ASIC for the front-end board has been tested successfully. Tests of the distribution system of the high precision and stability clock to the frontend are underway as well as tests studying the impact of detector components and electronics on the precision field. The g-2 team has collaborated on the setup of the Belle-II Si-detector facility at IPMU. The approach to develop the Si-detectors in collaboration with Belle-II appears a promising approach to share technology expertise and to reduce cost.

The PAC commends the excellent progress the g-2/EDM collaboration continues to make in all areas of R&D. However, the PAC notes that the successful realization of the experiment continues to require major advances of experimental technology and significant resources to pursue the challenging R&D tasks. High priority steps include the demonstration of the ionization yields of the cold muonium cloud downstream of the stopping target with the high power laser system and the evaluation of the beam phase space widening during re-acceleration in simulation and experiment.

The PAC emphasizes that the success of the experiment requires continuous high levels of support for the R&D effort from IPNS as well as timely construction of the H1 beam line in MLF. The PAC is looking forward to reviewing the R&D progress for g-2/EDM in the next meeting and recommends a presentation that includes a detailed outline of the R&D project schedules and milestones. The presentation also should identify the resources needed to meet the project schedule.

12. **Test Beam plan of IPNS**

IPNS plans new test beam lines in the J-PARC Hadron hall.

As demand for test beams is very high in recent years for detector R&D in particle and nuclear experiments, IPNS is planning to construct two test beam lines.

One is the line designed in the original Hadron hall plan using a beam hole directed at the T1 target at an angle of 50°, which was built in the existing shield north of the K1.8 line. By introducing a new set of magnets, the (π1.0) line will provide 1k particles/pulse up to 1 GeV/c from the 50kW SX beam. Another facility (π8.0) is planned to facilitate the test beam experiments upstream of the COMET beam line. It will provide 1k particles per pulse with momenta up to 8 GeV/c.

The PAC understands the importance of the test beams in J-PARC and fully supports the construction plan for those beam lines. It is noted that a wider space for the test experiment area would be highly appreciated.

6. EVALUATION OF TEST BEAM EXPERIMENT

PAC heard the evaluation result of new test beam proposals by the sub-committee as described in the director's report and acknowledged them.

7. RECOMMENDATIONS FOR BEAM TIME ASSIGNMENT AND PLANNING FROM OCTOBER 2012 TO THE SUMMER 2013

IPNS and J-PARC arranged the extension of user beam time by one additional month by operating the machine until the end of July. LINAC upgrade work, which was originally scheduled to start from July 2013, would be delayed by one month. With this extension, the total user beam time starting from October 2012 amounts to 226.5 days

including accelerator studies, before the long shutdown scheduled in FY2013. JPNC allocated this user beam time with SX:FX sharing in the ratio 1:2 (75.5 days : 151 days). The pion-based experiment E10 in the Hadron hall was scheduled first to accommodate the gradual increase in beam power. The PAC appreciates efforts of IPNS and J-PARC to realize this extension by one month and recognizes the beam allocation, which meets the guideline set by the previous PAC.

In the Hadron hall, the approved (stage-2) experiments with kaon beams in the queue are E05, E13 at the K1.8 beam line, E15, E17 at the K1.8BR beam line, and E14 at the KL beam line. The detailed status reports and run plans were submitted from each proponent at the previous PAC. E14(KOTO) at the KL requested three separate runs: an engineering run, a short physics run, and a run to reach the Grossman-Nir limit, at intervals separated by more than one month. At the K1.8 beam line with SKS, the 1st phase of E13 required moderate beam power well suited to the accelerator's intensity plan, whereas the 1st phase of E05 required 30 kW. E13 also required 2 months to change over from E10. At the K1.8BR, E17 claimed that it needs 3 months to change over from E15. Since the 1st phase of E15 received higher priority at the 13th PAC than E17, it appears to be difficult to assign a run slot for E17 before summer.

The PAC heard the beam allocation for the slow extraction by JPNC, which handles the request by E14 and change-over time of experiments on the K1.8 line. The PAC supports the JPNC assignment for the E14 physics run and the 1st phases of E13 and E15 assuming a reasonable increase of beam power. The PAC recognizes possibilities for a pilot run of E05 with SKS and a slot for the K1.8BR experiment around the end of scheduled slow extraction run before summer.

The PAC reiterates the need to make further efforts to increase the beam power and stable operation to satisfy the T2K's requested POT and to manage the 1st phases of experiments at the Hadron hall before summer 2013.

The schedule after the long shutdown will be discussed at the next PAC meeting.

8. DATES FOR THE NEXT J-PARC PAC MEETINGS

The next PAC meeting will be held on 25-27 September 2013.
The PAC would like to hear the status of the experiments running in 2013. The beam time plan and reconfiguration of the equipment in the Hadron hall for 2014 will be reviewed.

FOR THIS MEETING, THE J-PARC PAC RECEIVED THE FOLLOWING

DOCUMENTS:

- Minutes of the 15th J-PARC PAC meeting held on 13-15 July 2012
  (KEK/J-PARC-PAC 2012-15)

- Test of Lead-glass EMC and GEM Tracker for the J-PARC E16 Experiment
  (KEK/J-PARC-PAC 2012-16)

- Test of Aerogel Cherenkov counter for the J-PARC E36 experiment
  (KEK/J-PARC-PAC 2012-17)

- Test for 250L Liquid Argon TPC
  (KEK/J-PARC-PAC 2012-18)

- Charmed Baryon Spectroscopy via the (π,D*) reaction
  (KEK/J-PARC-PAC 2012-19)

- Letter of Intent for J-PARC: A new approach to study the X(1835) via the d(pbar,n) reaction ~ towards pbar bound nuclear system
  (KEK/J-PARC-PAC 2012-20)

- Reply to the J-PARC PAC's questions on proposal P45
  (KEK/J-PARC-PAC 2012-21)

- Preparation status for the E31 experiment
  (KEK/J-PARC-PAC 2012-22)