KEK/J-PARC-PAC 2011-5
July 10, 2011

J-PARC Program Advisory Committee

for the

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

Minutes of the 12th meeting held on
Friday, Saturday and Sunday, 8-10 July 2011

OPEN SESSION (8,9-July-2011):

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. Status of the MLF muon beam lines: N. Kawamura (KEK)
5. E11(T2K) status report : T. Kobayashi (KEK), C.K. Jung (SUNY Stony Brook)
6. T32 status report (Liq Ar detector): A. Rubbia (ETH, Zurich)
7. P34 status report (A New Measurement of the Muon Anomalous Magnetic Moment *g*-2 and Electric Dipole Moment at J-PARC): N. Saito (KEK)
8. RCS beam quality: K. Yamamoto (J-PARC)
9. P41 presentation （Proposal of an Experimental Search for mu-e Conversion in Nuclear Field at Sensitivity of 10^{-14} with Pulsed Proton Beam from RCS） (update): A. Aoki (Osaka)
10. Status of hadron beam lines: K.H. Tanaka (KEK)
11. E14(KOTO) status report : T. Yamanaka (Osaka)

12. P40 presentation (Measurement of the cross sections of Σp scatterings) (update):
K. Miwa (Tohoku)

13. Status of the SKS spectrometer and experiments at K1.8: T.Takahashi (KEK)

14. Status of the experiments at K1.8BR: T. Suzuki (Tokyo)

15. E06 (TREK) status report: J. Imazato (KEK)

16. Status report of Muon Task Force (MTF) and E21(COMET):
Y. Kuno (Osaka)

CLOSED SESSION(8,9,10-July-2011):

Present: A. Gal, M. Ieiri(Secretary), 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,
R.Tschirhart, K.Tokushuku (Chairperson), H.Yamamoto
*) Part of the time

1. PROCEDURE

This was the first J-PARC-PAC meeting since the earthquake on March 11 and the members of the committee expressed their sympathy for this tragedy along with their hope for a speedy recovery. The effect of the earthquake to the Japanese people and infrastructure in general and to the KEK and J-PARC labs specifically has touched everyone. The Committee hopes that we can do our small part in helping to start up the J-PARC scientific program that we all feel has such great potential for measurement and discovery.

The minutes of the eleventh J-PARC-PAC meeting (KEK/J-PARC-PAC 2010-20) were approved.

2. REPORT FROM THE IPNS DIRECTOR

On March 11th, both KEK-Tsukuba and J-PARC sites experienced tremors exceeding 6 on the Japanese seismic intensity scale. This caused a significant amount of damage to both facilities. The details will be reported in the following presentations. There was serious subsidence and cracks appearing in the surrounding roads, with some movement of the accelerator/detector buildings. Fortunately, however, there has been no observed serious damage to the accelerator and detector devices based on visual inspections.

About 60% of the equipment budget of this fiscal year has been allocated for the recovery and renewal of the damaged equipment. The PAC's recommendations will be directed to the assignment of the remaining budget. The recovery of civil infrastructure has been in progress using the general budget. A supplementary budget is being requested to MEXT for further supports. The budget for operations (such as electricity costs) is not yet known.

With the limited resources, the recovery work is been performed with the following priorities: 1) restorations of the infrastructure for safety, electricity and water and the repair of the buildings; 2) recovery of the accelerators; 3) the recovery of the fast and slow extracted beamlines. Work on improvement of the accelerator and beamlines will have a lower priority in this fiscal year.

All accelerators are to be ready for beam commissioning in December, 2011 when beam studies will start. If these studies are successful, user operation will start in the middle of January. This implies that there will be almost a one-year delay in the J-PARC physics program.

The installation of the 400-MeV linac was planned during the long summer shutdown in 2012. After the earthquake, the schedule has been revised to have the maximum beam for users in 2012. There will be a normal 3-month shutdown in summer 2012 and the linac installation will be delayed till summer 2013.

The period from January to February, 2012 will mostly be devoted to tuning and testing of the whole accelerator and beamline complex. Afterwards, the plan is to assign thirteen months to the experiments before the summer 2013 (March-June, 2012 and October, 2012-June, 2013). The PAC has been requested to set the priorities for experiments in these periods by the next PAC meeting.

The director informed the Committee of the status of the P36 proposal (Measurement of $\Gamma(K\rightarrow e\nu)/\ \Gamma(K\rightarrow \mu\nu)$ and Search for Heavy Sterile Neutrinos Using the TREK Detector System). Stage-1 approval was recommended in the previous PAC meeting, but has not been acted on yet. Knowing that the experiment cannot be started so soon considering

the situation of the beam line and beam power, the director would like the PAC to re-evaluate the experiment's systematic uncertainty, which is claimed by the experiment to be at the 0.1% level. This re-evaluation will be done at the next PAC meeting where the proponents will provide further information.
In this PAC meeting, updates on the two proposals (P40 and P41) were received. No new proposals were received. The director asked the PAC to evaluate P40 and P41 for Stage-1 approval and to comment on the progress of the other proposals and experiments.
The PAC took note of these requests and made them part of the discussions and deliberations during the meeting.

3. REPORT FROM THE J-PARC PROJECT DIRECTOR

The J-PARC Center Director S. Nagamiya presented the status of J-PARC.
Before the earthquake on March 11th, the J-PARC accelerators were in quite good shape. The main ring (MR) operated for the T2K experiment with 145kW of beam power. The rapid cycling synchrotron (RCS) was routinely operated at 200kW and a long-run test with at 400kW was performed. First results from the experiments were highlighted such as the preliminary results of pentaquark search (E19) as shown in the previous PAC meeting. Of particular note were the six electron-neutrino candidates observed in the Kamiokande detector, which was announced in the recent KEK seminar on June 15th.
The damage from the earthquake of March 11th was large. The main buildings were relatively less damaged since they were supported on bedrock with many long underpins. Many adjacent utility buildings and surrounding roads were, however, severely damaged as well as the cables and pipes connecting buildings. The major accelerator components and experimental apparatus in the hadron hall and neutrino hall appear to have little damage from visual inspections and more tests are going on. On the other hand, the alignment of the accelerator and beam line components will require major work over the next several months.
The current plan is to start beam commissioning in December 2011, followed by 2 cycles (i.e. about 2 months) of the user operation in this fiscal year. A full 9-cycle operation period will be requested of the funding agency in the next fiscal year.
The PAC sends their heartfelt condolences to those who suffered from the earthquake and tsunami. The PAC was thankful to hear that there was little serious damage so far found to the accelerator and experimental equipment. The Committee was also

impressed with the hard work of the Labs and experimental groups working on the recovery.

4. REPORT ON THE J-PARC ACCELERATORS

T. Koseki reported on the status of the accelerators.

There were many improvements in the accelerator before the earthquake. A test in the RCS demonstrated that it was ready for 400kW beam delivery to the MR, so that high-power tests for the MR could be started. The ion source was operated, in November-December, 2010 and in January-February 2011, for more than 1000 hours at or above 16 mA without maintenance. The maintenance for the source has required regular shutdown every three weeks, which is a large fraction of the machine dead time. This test showed the strong possibility to reduce this down time.

The machine cycle of the MR was shortened for the fast extraction (FX). It was 3.52 seconds at the beginning of 2010. But after summer shutdown, it was reduced to 3.2 seconds and then to 3.04 seconds. With this shorter cycle time, as well as the other improvements reported in the previous PAC meeting, the beam power reached 145 kW in March 2011. Above 4×10^{11} ppb intensity, coherent oscillations of a betatron sideband were observed. The oscillation was damped by tuning the chromaticity and by activating a bunch-to-bunch feedback system. The latter also helped to reduce the beam loss during the acceleration. For 145kW operation, the beam loss at injection was 150 W and, during the acceleration, was 70 W. Without this feedback, the latter loss went up to 11 kW.

Among the scheduled running time of 5550 hours from April, 2010 till March, 2011, 61% was used for the user experimental running and 33% was taken for accelerator tuning and conditioning. The remaining 6% was associated with down time caused by machine trouble.

It was fortunate that the big earthquake caused no permanent damage to the accelerators. Still there is much restoration work that will be required. Recovery of conventional utilities such as cranes, cooling water systems, and air conditioners will take time and are key issues in the restoration schedule of the linac and RCS. Re-alignment of the accelerators is also a major issue. The maximum displacement of the linac was ~ 30 mm horizontally and ~40 mm vertically. The alignment work has just been started. It has been decided to change the beam axis to that adjusted for the large floor displacement, and not to the original position. The displacement of the MR is about 15 to 20 mm and

will be aligned back to the original position. All work expected to be finished by the end of November so that the commissioning with beam can start in December.
In parallel to the recovery work, many improvements are planned this year. The beam loss capability of the MR collimators will be increased from 0.45 to 2kW by installing extra shields and collimators during this and the next summer shutdowns. New injection kicker magnets of the lumped constant type will be installed by December. Additional 7^{th} and 8^{th} RF cavities will be installed. The transverse RF system, which is needed for improving the spill structure of the slow extraction, will run more stably after installing solenoid coils to reduce the discharge. An SX collimator will be installed to absorb protons which are scattered by the ribbons of the electrostatic septum.
R&D for the longer term improvements are also going on. New higher impedance metal alloy cores (FT3L) are being developed. A full-scale prototype of the new magnet power supply will be built in 2011/12. The construction of the 400-MeV linac is in progress.
There are still many uncertainties in predicting the beam power in the future, but, in 2012, ~200kW operation for the FX and ~10kW operation for the SX seem possible if the recovery work can be accomplished.

5. REPORT ON THE BEAM LINE STATUS

K.H. Tanaka reported on the status of the beam lines in the hadron hall. The most severe damage in the hadron hall caused by the earthquake was on the east outside wall. The repair work has started and will continue till August. Due to this work, the access to the near-by area is limited.
The largest displacement of the primary beam line was about 16mm. The exit point of the MR and the position of the target station will be used for the new reference points. All components will be aligned to these references, which will take three months. The work will then continue for the secondary beam lines.
The experimental area of the K1.1 beamline is temporarily being used for space to store the shielding blocks during the work on primary beam line and, therefore, this beam line will be back in operation later than the others.
The new platinum target for high power operation (30kW) is already produced and will be installed before the beam is back.

6. PARTICLE AND NUCLEAR PHYSICS RESEARCH OPPORTUNITIES WITH THE H-LINE AT THE J-PARC MLF MUON SCIENCE (MUSE) FACILITY:

N. Kawamura reported on the status of the muon beam lines in the Material and Life Science Facility.

Development of the H-beamline at the MUSE facility presents an exciting opportunity for particle and nuclear physics researchers in Japan and worldwide. With commendable foresight KEK has funded the construction of the two critical beamline elements (a radiation-hard solenoid and dipole) that will be installed in the H-line nearest the MUSE high-power target before the target area becomes highly activated. These critical elements are now being fabricated by Japanese industry and are expected to be ready for installation by the summer of 2012. The IMSS/KEK Muon PAC (M-PAC) has recently recognized, with Stage-I approval, the scientific potential of three experiments that can be mounted from the MUSE H-line: the Hyper-Fine Splitting experiment (Mu HFS, K. Shimomura et. al), the (g-2) experiment (P34 for the J-PARC PAC), and the DeeMe experiment (P41 for the J-PARC PAC). These three proposed experiments use novel experimental approaches that have been developed and led by Japanese researchers and that have attracted considerable international interest. These three research teams have together developed an advanced conceptual design for the full H-beamline, where the remaining costs to finish the beamline for a joint facility are similar to the KEK funds now invested in the upstream critical elements. It is possible that some of the remaining beamline elements could be provided as in-kind contributions from interested institutes world-wide, and the PAC encourages the potential H-line experiments to pursue this. The PAC also encourages KEK, JAEA and the collaborating institutions associated with these three experimental proposals to work together toward funding and the timely completion of the H-beamline, which has the potential to substantially broaden the J-PARC research program. The J-PARC PAC would welcome the opportunity to work with the M-PAC to understand and promote particle and nuclear physics research opportunities associated with the growing and promising MUSE facility.

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

1. **P40:** (Measurement of the cross sections of Σp scatterings)

   In the presentation, the proponents have responded well to the questions raised at the previous PAC meeting by the Committee.

   The significance of obtaining new data on the phase shift by measuring the differential cross section at 90 degrees in the c.o.m. has been studied in detail by comparing the most up-to-date theoretical models (fss2 and ESC08) for the Σ-p interaction. It showed that the measurement of the phase shift to a precision of five degrees is feasible, and demonstrated that this level could discriminate among models. This is an important measurement that is sensitive to the quark Pauli effect specific to the ΣN(I=3/2) $^3S_1$ state.

   The importance of the systematic measurements of the Σ^+p and Σ^-p elastic scatterings and the $\Sigma^-p \rightarrow \Lambda n$ reaction was also described in the presentation. Enough statistics will be obtained for each channel in the proposed beam time.

   The collaboration showed a new detector setup optimized for the scattering measurement. The new design enlarged the detector acceptance and reduced the low-energy threshold, which greatly improved the expected statistics.

   The detector R&D for the scintillating fiber tracker and its readout system is in progress with recently obtained grant-in-aid funding. A feasibility test experiment with the fiber tracker system together with a BGO calorimeter has already demonstrated good angular resolution of the tracker and good energy resolution of the calorimeter. The Committee appreciates these efforts toward a final detector configuration design.

   While the final statistics will depend on the experimental setup and performance, important data for understanding the baryon-baryon interaction would be obtained in the wide angular acceptance and wide momentum range of this experiment. The wide range of scattering data will provide useful information for detailed theoretical analyses. Given the fact that the information on the ΣN interaction so far has been mainly obtained through Σ-hypernuclear spectra and Σ^--atom X-rays, it is very important to have the direct experimental information on the two-body interaction. It will be also important and timely to compare the experimental result with recently developing theoretical calculations of baryon-baryon interactions based on the Lattice QCD techniques. Thus, the Committee recommends that the proposal should be given Stage-1 approval.

A realistic detector design should be made before the Stage-2 approval after completing the R&D for the fiber tracker system including the readout. Operation of the detector system in a high beam-rate environment of ~$1x10^7$/s is a key issue to be addressed. While an estimate on the rate dependence of accidental hits in the fiber tracker was shown in the presentation, the Committee encourages the collaboration also to study the rate capabilities of the calorimeter.

2. **P41:** (An Experimental Search for μ^--e^- Conversion in Nuclear Field at Sensitivity of 10^{-14} with Pulsed Proton Beam from the RCS (The DeeMe Experiment))

   The PAC heard a progress report from the DeeMe collaboration at J-PARC. The collaboration aims to improve, at modest cost, the experimental sensitivity of detecting muon-to-electron conversion by one to two orders of magnitude below the current measured limit. The PAC reiterates the scientific merit of a timely realization of such measurements.

   The collaboration reported important progress in all of the issues raised by the PAC at the previous meeting:

   (1) The collaboration is now concentrating on the H-beamline and a conceptual design of the beam line has been developed. The PAC supports the lab's decision to move forwards with installation of the most upstream magnets of the beam line. (This issue is also discussed in the Section 6 of these minutes.)

   (2) It was demonstrated by Monte Carlo simulation that the high-end spectrum of the decay-in-orbit (DIO) electrons could be measured together with the signal spectrum, which extends beyond the DIO. It serves as a real time monitor of the number of produced muonic atoms within the acceptance. The spectrum of the prompt background by after-protons extends further into higher momentum and may be experimentally evaluated. A further study on the background including the radiative muon captures is necessary.

   (3) Methods to calibrate the spectrometer by placing a degrader and a thin stopping target in the middle of the beam line were proposed. More technical details and further studies will be needed to demonstrate feasibility for this method.

   (4) According to the preliminary estimate, the SiC target may double the neutron background as well as the surface muon yield and, therefore, the impact on other experiments may be modest. Discussion with the MLF community should continue.

   (5) A preliminary study to evaluate the rate of after-protons by monitoring the beam

loss counters was reported by K. Yamamoto of the RCS group. The results look very promising but are not totally convincing. A further study with an improved setup was planned but cancelled by the earthquake. The PAC considers it necessary to continue the studies in cooperation with the RCS group to show that an after-proton rate below 10^{-17} is plausible.

Reflecting on all the above progress, the PAC still regards the DeeMe proposal as premature for Stage-1 approval because the following studies have not been adequately completed: (a) studies of the after-proton rate, and (b) studies on background including radiative muon captures. The PAC strongly encourages the proponents to continue the R&D studies for all aspects of the experiment and the extinction study in particular.

3. **T32:** Liquid Argon TPC Test Experiment at J-PARC

The PAC heard a progress report from the T32 liquid argon test experiment that had a first run in the K1.1BR beam during October 24-November 1, 2010. The combination of a gas Cherenkov, Fitch Cherenkov, and time of flight system gave excellent particle identification allowing for a very pure kaon sample. The preliminary run used a single phase, 2-dimensional readout of a 250 l liquid argon time projection chamber (TPC) and collected the world's largest sample of low-momentum charged kaon (~100,000) and pion (~70,000) tracks in a LAr TPC. The collaboration is now using the data sample for developing reconstruction software and making data to Monte Carlo comparisons.

The collaboration is now requesting 2 weeks of beam before the summer 2012 shutdown with an upgraded dual-phase, 3-dimensional readout LAr TPC system housed in a new cryostat. This will be a substantial upgrade to the existing prototype detector and, thus, will require a commissioning and validation campaign with cosmic rays before taking beam data. The PAC supports the plan for this second run if the detector can be commissioned with cosmic rays and if there is minimal interference with the existing experimental program.

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

The PAC congratulates the Labs and T2K collaboration on their recent electron neutrino appearance result. The observed 6 events with an expected background of

1.5 events (a 2.5σ signal) has made a major impact on the field and is the first significant indication that the θ_{13} mixing angle is non-zero with a value greater than 5° at 90% CL. Such a large mixing angle, if confirmed with higher statistics data, makes the prospects for measuring CPV delta and mass hierarchy with future neutrino oscillation programs excellent and indicates that real progress will be made over the next decade in understanding the details of neutrino masses and mixings. With further confirmations, it is likely that this T2K result will go down as one of the watershed results in particle physics.

Before the earthquake, the T2K near detector was fully operational with good data from all systems. The beam was also working well and running stably at 145 kW. It appears that the damage from the earthquake to the neutrino beam and near detector was not extensive and repairs are expected to be completed by the beginning of December, 2011. The plans for the neutrino focusing horns include replacing the first horn with the available spare and removing the second and third horn for inspection. At this point, the three installed horns will have no spares and, therefore, a program to procure new spare horns should be initiated.

It is now important for T2K to collect a larger data sample to substantiate and to more accurately measure the size of θ_{13}. The current analysis has shown that the measurement will be statistics limited even with data samples several times larger than the current T2K sample. There is competition for making a more accurate measurement from the reactor experiments (Double Chooz, RENO, and Daya Bay), and the NOVA long baseline experiment, so it is important for T2K to collect a larger data sample as soon as possible. The current plan is to have the fast-extracted beam and T2K near/far detectors ready for data taking at the end of December, 2011. With four months of 150 to 200 kW running before the summer 2012 shutdown, the T2K experiment would triple the current data set and could confirm the observed signal at the 4σ level if the measured value remains at the current $\sin^2 2\theta_{13} = 0.11$ value. With further running of about 6 months in the following year at 250 kW, the combined data samples would provide a positive θ_{13} signal at the greater than 5σ discovery limit for the current T2K central value.

The PAC endorses these goals for T2K and encourages the Labs to make every effort to realize the collection of this important data. To reach these goals, it is important that the accelerator group continue to work on improving the beam power available for the experimental program as well as keeping the machine operating efficiency high.

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

The KOTO experiment aims to achieve a single event sensitivity corresponding to the standard model prediction of BR($K_L \to \pi^0 \nu\bar{\nu}$) = 2.5 $\times 10^{-11}$, and the first benchmark is to reach the so-called Grossman-Nir limit $\Gamma(K_L \to \pi^0 \nu\bar{\nu}) < \Gamma(K^+ \to \pi^+ \nu\bar{\nu})$, or BR($K_L \to \pi^0 \nu\bar{\nu}$) < ~1.4$\times 10^{-9}$, below which effects of new physics could appear.

The PAC is pleased to know that the damages to the CsI calorimeter caused by the March 11 earthquake turned out to be manageable. The CsI stack was still standing even though the endcap nearly ran off the rail. No damage to crystals were found while some crystals lost optical contacts to the PMTs. Cosmic ray tests were performed and the longitudinal uniformities and gains of the units were found to be not severely affected or otherwise repairable with reasonable effort.

By the end of 2011, the collaboration plans to have the CsI calorimeter repaired and complete the preparation for a calibration run with the spectrometer, which had originally been scheduled for April 2011. They are, therefore, now requesting a calibration run of 2.5 to 3 weeks in early 2012, which will be followed by removal of the spectrometer and completion of the KOTO detector. In order to reach the Grossman-Nir limit before the 2013 summer shutdown for the linac upgrade, the collaboration requests a physics run of 4 weeks at 10 kW around May to June of 2013 preceded by 4 weeks of engineering runs.

This estimation reflects the K_L yield that was found to be factor of 2.3 larger than the prediction used in the proposal and use of a platinum target whose yield is twice that of a nickel target in the proposal. The PAC supports this plan, and considers that a calibration run for KOTO in early 2012 before May 1st is highly desirable. In addition, the PAC would like to point out that providing more than 10 kW for the engineering and physics runs would reduce the time requirements and mitigate the conflicts of beam time allocation.

6. **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 of branching fractions expected by many well-studied new physics models such as SUSY-GUT. As such COMET could become a flagship experiment for J-PARC and Japanese physics later in the decade. The collaboration is continuing to develop a Technical Design Report that will define the remaining milestones and present a cost and schedule for the required modifications to the accelerator complex, the COMET detector systems, and the necessary Hadron Hall facility modification costs.

The PAC was pleased to receive a detailed presentation from COMET and the Muon Task Force (MTF) on the three complex superconducting solenoids systems (Capture Solenoid, Transport Solenoid, and Detector Solenoid) that are critical to the success of the experiment. As reported at the last PAC (PAC-12) meeting, the high yield of stopping-muons/incident-proton expected in the Capture and Transport solenoids is central to both the Fermilab/Mu2e and COMET experiment designs, and data recently collected from the MUSIC facility at Osaka supports the plausibility of these high yields. Realizing these high yields require that the solenoid systems operate very reliably in a high radiation field and under enormous mechanical stress induced by the high magnetic fields. The COMET collaboration and MTF are well underway in developing an engineered design for the solenoids, and the committee looks forward to the development of an associated cost and schedule analysis of these magnet systems.

The PAC was pleased to receive a written report from the MTF and the COMET collaboration on beam extinction studies. The extraordinary beam extinction (fraction of residual protons between bunches incident on the muon production target) required by the experiment (1×10^{-9}) is one of the most important performance parameters and is critical to the eventual success of the experiment. The MTF presented a refined analysis that extinction in the 10^{-7} range for extracted beam from the Main Ring (MR) is plausible, and that beam systems external to the MR can likely reduce the extinction to the required level of 1×10^{-9}.

The COMET collaboration and the MTF task force are making good progress toward the TDR, and recognize that the TDR must be a comprehensive analysis of both experiment and facility requirements, costs, and schedules. Much work remains to be done to develop engineering-level cost and schedule estimates for the detector systems and the facility design. The PAC supports this careful and comprehensive

approach to the TDR and encourages the laboratory to continue working closely with COMET through the MTF to realize the COMET TDR in a timely manner.

7. Experiments at K1.8BR

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

Before the earthquake, the kaon tuning of K1.8BR was almost done at 0.9 GeV/c, and the commissioning of the Cylindrical Drift chamber System (CDF) was performed, showing that Λ and the K^{0}_{s} were successfully reconstructed. The R&D of the ^{3}He target system for the E17 was also finished.

The earthquake seriously damaged the D5 magnet and the upper-stream drift chamber. All the beamline detectors have been removed. No damage has been found for the CDS and the ^{3}He target system including the silicon drift detectors (SDD) after the earthquake. All the detectors will be re-installed promptly after the realignment of the K1.8/K1.8BR beam elements is completed in December.

The presentation also showed some modified goals for E17 following recent news from DAΦNE at Frascati of a possible large isotope shift between ^{3}He and ^{4}He, which were shown in the previous meeting. A working plan was outlined for the E15 and E17 to share beam tuning runs with low beam intensity at a few kW in the first half of 2012, and physics runs with approximately 10 kW beam intensity following the summer 2012 shutdown.

The PAC is pleased to hear about the good recovery work done so far. With respect to the modified goals of E17, the collaboration is asked to provide, for PAC review, an addendum including some theoretical estimates of the expected isotope shift.

For the proposed working run plan, recognizing the particular discovery potential of E15 in kaon-nuclear physics, the PAC advises that the plan be revised such that the E15 running time is maximized as soon as it is ready for tests and physics runs. The PAC will assess the running plan of the E15 and E17 experiments in the next meeting.

8. SKS experiments

The SKS collaboration reported the effects of the earthquake to the SKS. The safety system for the cryogenic system worked fine so that the liquid helium was safely released and the high-Tc power lead was not damaged.

The cryogenic system including all refrigerators, pumps and chiller were already tested and no abnormal behavior was found down to 100K.

The support frame of the SKS was badly shaken and the bolts, which fixed the SKS to the frame, were broken. This resulted in a relative movement between the SKS and the support frame of a few centimeters.

Fortunately, apparent damage was not found for components. The relative position of the SKS to the frame will be simply fixed by welding or clamping and the whole system will be re-positioned in K1.8 beamline. The SKS position change relative to the frame will be corrected in the analysis code. Detector packages were dismounted from the system for inspection and again no serious damage was found except for broken aerogel tiles for Cherenkov counter, which have already been replaced with new ones.

Since the wall of the hadron hall needs to be repaired first, recovery work for the SKS will start at the end of August 2011. All recovery work including positioning of the SKS magnet and installation of detectors will be finished by January 2012. After the beam commission of the K1.8 beamline and SKS, the collaboration will be ready for carrying out the originally planned experimental program with the feasibility check of the proton tagging technique for E27 (A search for K^-pp bound state in the $d(\pi^+,K^+)X$ reaction) and E19 (The pentaquark search) with a momentum of 2.0 GeV/c.

The PAC encourages the collaboration to restore the SKS on schedule and endorses the original K1.8 experiment plan after the beam recovery.

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

The PAC heard a status report from the g-2 collaboration at J-PARC. 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 of the muon possibly reaching $d_\mu=1.0\times10^{-22}$ e·cm. The proposed measurement will improve the precision of the previous experiment at BNL, E821, 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 from the E821 limit of $d_\mu < 1.9 \times 10^{-19}$ e·cm. The collaboration aims to submit a Conceptual Design Report (CDR) to the laboratory prior to the PAC-13 meeting in January 2012 and reported good results on muonium production and laser-ionization R&D, and reported the following progress on the muon-linac, the facility infrastructure, and the detector R&D:

(1) The collaboration is studying an alternate linac technology ("Interdigital H-mode") which accelerates the dissociated cold muons from muonium to 100 MeV and injects them into the precession detector solenoid. The Interdigital H-Mode technology may be more cost-effective up to 100 MeV, and a new institution in the collaboration, Tokyo Tech, is providing leadership for the analysis and development of this alternative linac technology in collaboration with the accelerator division of KEK. The collaboration is proposing to test elements of this linac technology at the MUSE facility.
(2) The collaboration is working closely with the Hyper-Fine Splitting (HFS) experiment, which has Stage-1 scientific approval by the M-PAC and aims to improve the measurement of the Lamb-shift in muonium. The HFS experiment would precede (g-2) in developing the H-beamline and would employ precision solenoid tracking technology, which can serve as an important prototype to the g-2 precision solenoid tracker.
(3) The tracker group is investigating Double Sided Silicon Detector (DSSD) technology for the tracker which is being developed by the Belle-II collaboration. The g-2 collaboration now also includes membership in the Silicon for Lepton Colliders (SiLC) collaboration, which can bring particular expertise in silicon front-end readout technologies.

The PAC is pleased to see progress for the H-line, the P34 experiment and collaboration growth and is looking forward to reviewing the CDR at a future PAC meeting.

10. **E06:** Measurement of T-violating Transverse Muon Polarization in $K^+ \rightarrow \pi^0 \mu^+ \nu$ Decays (The TREK Experiment)

The goal of the TREK (E06) experiment is to measure the T-violating transverse polarization P_T of the muon in $K\mu_3$ decays to 10^{-4}. Some new physics models predict P_T in this range, which is much greater than the standard model prediction without conflicting with existing experimental results, and, thus, the physics case of TREK

is strong. Since the beam power requirement for TREK is high (>~100 kW), the PAC recommended that the proponents advance the interim physics goals of measuring the lepton universality parameter R= $\Gamma(K\rightarrow e\nu)/\ \Gamma(K\rightarrow \mu\nu)$ and searching for sterile heavy neutrinos through high sensitivity measurements of $K^+ \rightarrow \mu^+ N$. The experiment can utilize essentially the same detector as TREK. The proposal (P36) has thus been presented in the previous two PACs, and Stage-1 approval was recommended. In following up on P36, a detailed systematic error analysis is to be presented at the next PAC for review by the Committee.

At this meeting, the PAC heard a presentation responding to the previous request that the proponents give a detailed plan of collaboration responsibilities for the construction of the necessary detector components. The planar and cylindrical GEM detectors are the responsibilities of the US groups (Hampton and MIT) and the CsI(Tl) readout is the responsibility of the Russian group (INR). These groups are currently applying for funds that will cover these systems. The Canadian groups (TRIUMF and UBC) are in charge of the total target assembly, and their efforts have been funded over the recent years. In general, the PAC is pleased that good progresses is seen for these key elements of the detector.

A Kakenhi fund application in 2011, however, was not successful, and will be tried again in 2012. The PAC regards a successful fund application in Japan for the construction of the detector to be a critical step toward realization of the experiment, and encourages the proponents to aggressively pursue this goal.

8. RECOMMENDATIONS FOR BEAM TIME ASSIGNMENT AND PLANNING FOR THE FUTURE

The PAC reiterates that the two issues 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. After the observations of 6 electron-neutrino event candidates in the previous runs of T2K, the most urgent physics goal of the J-PARC is to substantiate and more accurately measure the size of θ_{13}.

The PAC endorses the re-commissioning plan for the accelerators in December 2011 and in January 2012. As soon as the injectors and MR are ready, tests of the fast

extraction will start, which will at least take one week. The commissioning of the slow-extraction will follow for more than two weeks. The experiments on each beam line should be ready for beam studies during these periods.

For the experiments in the hadron hall after commissioning, the priority set in the previous PAC meeting was as follows. For the K1.8 line, a pilot run for E27 and the second run of E19 with a 2GeV/c pion beam are scheduled. In addition, beam tuning for E15/E17 in the K1.8BR line and the beam extinction test led by the MTF group should be arranged. In the K0 beam line, the PAC strongly supports the calibration the CsI calorimeter by the KOTO experiment.

The beam time assignment will be decided in the next PAC meeting, after assessing the status of MR and the re-evaluation on the physics goals of the K1.8/K1.8BR experiments.

9. DATE FOR THE NEXT J-PARC PAC MEETING

The date for the 13th meeting is 13-15 January 2012. In the meeting, the PAC would like to hear presentations on the middle term plans in the hadron hall and the muon facility in at the MLF. For the hadron hall, two major issues should be addressed; 1) usage of the south area where conflict between the beamlines (K1.1, high-p and COMET) are foreseen and 2) usage of the SKS and other magnets in the K1.8 beamline.
The tentative agenda is;

- Status report on J-PARC
- Plan of the muon beamlines and their experiments
- Plan of the south area of the hadron hall
- Plan of the SKS spectrometer
- Revised proposal of E17 and running plan of E15
- Status Reports from the KOTO and T2K experiments
- Report from the MTF and COMET collaboration
- Report from the *g*-2 collaboration

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

- Minutes of the J-PARC PAC meeting held on 14-16, January 2011 (KEK/J-PARC-PAC 2010-20)
- Document for the J-PARC PAC from P40 (KEK/J-PARC-PAC 2011-1)
- Report on the Experimental Search for mu-e Conversion in Nuclear Field at Sensitivity of 10^{-14} with Pulsed Proton Beam from RCS (DeeMe) (KEK/J-PARC-PAC 2011-2)
- Letter of Intent for J-PARC: Search for H-dibaryon with a Large Acceptance Hyperon Spectrometer (KEK/J-PARC-PAC 2011-3)
- Progress Report of Experimental Search for Lepton Flavor Violating mu-e Conversion at Sensitivity of 10^{-16} with a Slow-Extracted Bunched Proton Beam (COMET) (KEK/J-PARC-PAC 2011-4)