

KEK/J-PARC-PAC 2007-7

7 July 2007

J-PARC Program Advisory Committee
for the
Nuclear and Particle Physics Experiments at the J-PARC 50 GeV Proton
Synchrotron

Minutes of the 3rd meeting held on
Friday and Saturday, 6-7 July 2007

OPEN SESSION (6-July-2007):

1. J-PARC Status: S. Nagamiya (J-PARC)
2. E11 (T2K) Report : General Status : D. Wark (IC London)
3. E11 (T2K) Report : Neutrino Beam Line Status: T. Kobayashi (KEK)
4. E11 (T2K) Report : ND280 Status : T. Nakaya (Kyoto)
5. E06 (TREK) Report : J. Imazato (KEK)
6. K0 and K1.1 beamline Status : K. Tanaka (KEK)
7. E14 (K0) Report: T. Yamanaka (Osaka)
8. SKS Status Report: T. Nagae (Kyoto)
9. P04 Presentation (Measurement of High-Mass Dimuon Production at the 50-GeV Proton Synchrotron) : J. C. Peng (Illinois)
10. LOI Presentation (A letter of intent to extend T2K with detector 2 km away from the J-PARC neutrino source): T. Kajita (ICRR, Tokyo)

OPEN SESSION (7-July-2007):

1. FIFC Report on E03, E06, E10, E14 experiments and the K0, K0.8 beam lines: J. Haba (KEK)

CLOSED SESSION(6,7-July-2007)::

Present: A. Ceccucci, H. En'yo, K. Hagiwara, E. Hiyama, Y.B. Hsiung,
K. Inoue*, J. Imazato (Secretary), T. Ishii, T. Kishimoto*,
S. Nagamiya (J-PARC Center Director)*, T. Nakano,
K. Nishikawa (Secretary), H. Nozaki (IPNS vice director),
J-C. Peng, M. Shaevitz, F. Takasaki (IPNS director)*,
K. Tokushuku (Chairman), H. Yamamoto

*) Part of the time

1. PROCEDURE

The chairman welcomed the new member Hitoshi Yamamoto to the Committee. The chairman thanked the outgoing member, Takayoshi Ohshima, for his invaluable assistance as a member of the J-PARC PAC.

The minutes of the second JPARC-PAC meeting (KEK/J-PARC-PAC 2007-1) were approved with the following two modifications. In point 3-3) (FIFC Beamline detector), the experiments being referred to should be E05, E13 and E19. In point 3-4) (FIFC Human resources), the referenced experiments should be E05, E13, E19 and E07.

2. DISCUSSION ON J-PARC GENERAL STATUS

The PAC heard the status of the J-PARC from the J-PARC project director, Shoji Nagamiya in the open session.

- Significant progress has been made in the accelerator construction. The first beam was successfully injected and extracted from the linac on January 24th. The technical problems previously reported, such as those in the RF cavities, have almost been solved.
- The construction is almost on schedule and the construction budget is staying at a reasonable level. Two experimental halls (for hadron and materials/life sciences) were completed. The construction budget has peaked in JFY2006 and an operational budget has been created for subsequent years partially by closing the KEK-PS operation.
- The J-PARC Center started in February 2006 and was expanded significantly in April, 2007.

- The review of J-PARC by a committee appointed by the government was held starting in December 2006. Nine meetings were held and a concluding report was published this June. Highlights from the report include:
 - The current structure and organization of the PAC was endorsed.
 - There will be no charge for beam time for academic research at J-PARC or KEK.
 - The committee strongly recommended increasing the linac energy immediately after the completion of Phase 1.
 - For phase 2 items, the committee was favorable to proceeding by assigning an explicit priority among the proposed items.
 - The Committee accepted the size of the yearly operational budget, estimated to be around 18.7 billion yen. However, an effort to reduce the cost was also recommended.

- The timely completion of the K0 and K1.1 beamlines depends on the budget status in the coming years. Scientific evaluation of the demand for these beamlines is needed in order to assess priorities by listening to the opinions from the community.

- The expansion of the hadron hall, which is one of the phase-2 projects, will cost 5.9 billion yen. The hall will be expanded from 60m to 100m and a second production target will be installed. The scientific evaluation by the PAC of this project is desirable. The budget proposal will be submitted for JFY2009 provided that support from the community and approvals from the various committees are secured.

Overall, the PAC congratulates the J-PARC team for the enormous progresses in the construction of J-PARC. The PAC takes note that there are many positive recommendations in the previously mentioned governmental review. As part of future planning, the J-PARC Center Director requested to hear from the PAC an assessment of the phase-2 projects at the next meeting. The procedure for this assessment will be developed by the director and the PAC chairperson.

3. REPORT FROM THE FACILITY IMPACT AND FUNDING COMMITTEE (FIFC)

The PAC heard presentations and received reports from the FIFC. The reports covered four stage-1 approved experiments (E03, E06, E10 and E14). In addition, the FIFC evaluated the K0 and K1.1 beamlines.

The PAC appreciated the thorough review made by the FIFC. The review has provided key input to the PAC for its deliberations. The FIFC's comments on each of the experiments were taken into considerations for the evaluations of the proposals and hence are described in the next sections.

The FIFC have four recommendations to the experiments with the SKS spectrometer;

- In order to understand the beam intensity, coordination between the machine and the experiments should be made, especially for optimizing the spill structure of the slow extraction.
- Commissioning strategy of the K1.8 beam should be presented.
- The progress of the SKS and the K1.8 beam line will be monitored at every FIFC meeting.
- The FIFC will hear the status of the standardization of readout system among the experimental groups.

The FIFC has a major concern about the possible conflicts related to the schedules of the E06 and E14 construction and the commissioning of the slow extraction line, the T1 target and the following K1.8 beam lines. The access to the T1 area will be very difficult once primary beam is introduced in the area. The first four magnets of the K1.1 beam line and the collimators of E14 need to be installed in this area.

The PAC shares the concern on the beam line construction schedule and therefore would like to hear the detailed schedule of the installation of the beamline components and the commissioning plan at the next PAC meeting. This issue will again be discussed in section 6 of these minutes.

The PAC takes note on the FIFC's continuous monitoring on the SKS experiments. The PAC would like to hear from the FIFC or the experiments when the major progresses are made.

4. PROGRESS REPORT FROM THE SKS EXPERIMENTS.

The PAC heard in the open session the progress for coordination between the experiments with the SKS spectrometer.

- R&D for the new cooling system for the SKS magnet is proceeding. The cooling power of a newly developed GW-JT cryo-cooler was measured. With a thermal shield and an anti-convection device, the cooling power was measured to be 3.6W, which exceeded the requirement (3.32W) with 3 coolers on the SKS magnet.
- The budget for the new cooling system and the transportation of the spectrometer from KEK to the J-PARC has been secured.
- The design of the additional normal conducting magnet for Ξ -hyper-nucleus experiments is progressing. They are to be fabricated in the JFY2007.
- The R&D for the beam line chambers was reported. They are 1mm spacing multi wire proportional chambers (MWPC). Discharge at the edge of the chamber was observed in the first prototype. The structure will be modified to weaken the field at the edge for the next prototype. The R&D for the readout electronics are also progressing.
- Acting on recommendations from the PAC and FIFC, the standardization of the gaseous detectors for the SKS experiments is under discussion. Several meetings were held in the past six months leading to the possibility to use common drift chambers in the downstream region.
- The task sharing among the experimental groups was discussed and the current assignments were presented. The groups are encouraged to continue these efforts.
- The experiments have the following requests to KEK.
 - Support for travel expenses to send people to the J-PARC site.
 - Budget allocations for facility-oriented support, such as trailer houses and a stock room for electronics and other materials.
 - Support for an experiment preparation area
- The E05 experiment will be ready by April 2009 and for the first beam in the K1.8 beamline in September 2009. For commissioning of the detectors, the

group requests the component test in K1.8BR beamline in January-March of 2008

The PAC congratulates the experiments on their progress and preparation and the swift reaction to the committee's recommendations. The standardization of detectors will make the program much better, but the PAC would like to hear the impact on the physics if this leads to compromises in performance. As for the request to the KEK, the PAC would like to hear from KEK on the status and plan for the support structure in the laboratory including the experiment coordination office we requested in the previous meeting. The PAC will review the other approved experiments in K1.8 and K1.8BR beam lines to assess the planning toward the first beam.

5. PROPOSAL EVALUATION

1. E03: Measurement of X rays from Ξ^- Atom

The PAC considers that the following issues pointed out by the FIFC need to be clarified before recommending stage-2 approval.

- It was pointed out that the DAQ dead time is high due to the slow signal of the germanium detectors. Optimization of the overall efficiency should be worked out including the DAQ, the layout of the Ge detectors and the choice of the spectrometer magnet.
- Methods for the online calibration should be worked out, considering the signal overlap due to the high rate and slow response of the Ge detectors.
- Estimation of the continuous X-ray background needs to be further studied.

The PAC should hear reports from the experiment in an upcoming PAC meeting before discussing a stage-2 recommendation.

2. P04: Measurement of High-Mass Dimuon Production at the 50-GeV Proton Synchrotron

This experimental group aims to study sea quarks in the nucleon via high-mass di-muon production. In response to the comments from the PAC at the first

meeting, the proponents reported on the status of a similar experiment that has been approved at Fermilab (E906) and on a physics study of a J-PARC experiment with 30-GeV protons, when the 50 GeV beam is not available.

The Fermilab E906 experiment with a 120-GeV beam was fully approved and funded. The physics run will be carried out in 2009-2011. The experiment at J-PARC will therefore be planned to be mounted after the completion of the E906 when the spectrometer will be moved to the J-PARC.

It was shown that the J/Ψ production at 30-GeV gave unique physics since the production was dominated by the $q \bar{q}$ annihilation sub-processes. The PAC judges that this is interesting but the interpretation of the data is model-dependent and less clear than the Drell-Yan process at higher energies. Therefore, this measurement alone cannot justify the experiment at J-PARC.

The PAC would like to hear a report and reassess, at an upcoming meeting, the physics case for the Drell-Yan experiment using a 50-GeV proton beam possibility augmented with a polarized beam and target. In addition to the experimental accuracy of the measurements, the report should include the impact of these physics measurements on the parameterization of the parton distribution function of the nucleons and nuclei.

3. **E06: Measurement of T-violating Transverse Muon Polarization in $K^+ \rightarrow \pi^0 \mu^+ \nu$ Decays**

The JPARC-PAC heard an update on detailed systematic studies and on the progress for E06 (TREK) experiment. The PAC recognizes the unique physics reach, high scientific merit and potential physics impact of a T-Violating transverse muon polarization measurement in a stopped K^+ decay at the sensitivity of 10^{-4} . The proponents of the E06 (TREK) collaboration have shown that with the new active polarimeter a gain of a factor of 10 in acceptance and a 20-fold increase in beam intensity ($2.1 \times 10^6 K^+/s$) can be achieved in a one year run for a total number of incident $K^+ = 3 \times 10^{13}$. With these statistics, the experiment could achieve a statistical sensitivity to the level of 1.2×10^{-4} for a conservative *forward+backward* integral analysis. Detailed systematic studies have also been shown that the systematics can be improved to be less than 10^{-4} . The collaboration has grown since the 1st PAC meeting and several R&D projects have been started related to a

detector upgrade. Based on these progresses, the group requested the stage-2 approval.

While the E06 (TREK) collaboration has made significant progress from the stage-1 proposal towards the measurement, the PAC still has several concerns related to the radiation hardness of the new detector elements due to the large background rate and to the high rate capability of the detector elements. The PAC is also concerned that there are several potential conflicts and interferences between the K0 beamline and K1.1BR beamline designs, as mentioned in the FIFC report. The discussion on the stage-2 recommendation will be made after we hear from the IPNS/J-PARC management on the realistic plan of the beam line installation as discussed more in section 6 of these minutes. The PAC strongly recommends that the IPNS/J-PARC management should develop a workable plan and solution for the installation of both beamlines. The PAC encourages the E06 (TREK) collaboration to establish a conditional MOU between their foreign collaborating institutes and IPNS/J-PARC management for the contributions, funding and scheduling profile based on the current scenario of J-PARC operations funding profile.

4. E10: Production on Neutron-Rich Lambda-Hypernuclei with the Double Charge-Exchange Reaction

The PAC received a report from the FIFC, which indicated no major concerns on the experimental feasibility for E10. **Therefore, the PAC recommends stage-2 approval for E10.**

5. E11: Tokai-to-Kamioka (T2K) Long Baseline Neutrino Oscillation Experimental Proposal

The PAC heard three reports on the T2K project. The first gave an overview of the experiment and preparations for the start of data taking, the second described the status of the neutrino beam and the third gave the status and schedule for the ND280 detector.

The PAC commends the collaboration and IPNS/J-PARC for the progress that has been made in preparing the beam and detectors for data. The Super Kamiokande detector has been completely rebuilt and upgraded electronics for deadtimeless

readout and data acquisition is being developed. This new system is to be completed in July 2008 giving about a year for commissioning.

A detailed schedule for the beamline and near detector has been developed. This includes an integration plan for the ND280 detector to address the late access to the detector hall in February 2009. The collaboration has also adopted an International Collaboration Agreement which sets up a governing structure and organization for all aspects of the experiment.

The funding is fairly well secured but there are some deficiencies associated with the installation and integration of the ND280 detector and the barrel ECAL. The collaboration is working to make sure that these deficiencies do not impact the requirements for the beginning of beam. An International Finance Committee for the experiment would help for organizing the funding for T2K. **The PAC recommends that KEK management work with the collaboration towards forming such a committee.**

Construction of the beamline and beamline components is going well. The schedule is tight but is expected to be completed for turn-on in April 2009. The superconducting and normal magnets as well as all other components are being manufactured. Installation of all elements should be completed in FY2008.

The T2K experiment has joined the NA61 experiment to make pion and kaon production measurements with 30, 40, and 50 GeV protons using the T2K type production target. This information will be used in conjunction with the ND280 near detector to make precise predictions of the neutrino event rates in Super-K. The PAC appreciates the importance of obtaining these measurements and encourages the collaboration to make this project a success.

A detailed schedule including development, production, and integration is being worked out for the ND280 detector. The INGRID neutrino beam monitor will be ready before first beam in April 2009 and an almost complete ND280 detector is expected to be available for the high intensity running in fall 2009. Prototypes for all of the detector components are underway. The detector hall will not be completely available until April 2009 so a carefully worked out plan for installation needs to be in place. A critical path item for completing the detector hall is that the installation of the UA1 magnet yoke, coil, and magnet moving system before April 2008. The transportation from CERN along with the installation must be

completed before the detector hall can be finished. The PAC would like to hear the progress on the detector prototypes and installation plan at the next meeting.

The full simulation for the ND280 detector is being developed and first results are expected in the fall of 2007. Studies are beginning on isolating the water cross sections, improving the π^0 measurements, and understanding particle identification. A report on these studies should be planned for the next PAC meeting and if possible should include new information on the systematic error studies for the Super-K detector.

The PAC notes the rapid progress that the collaboration and IPNS/J-PARC are making in preparing for running in 2009. Now that a detailed production and installation schedule has been worked out it would be good to prepare a list of milestones that can be tracked over the next several years. The PAC requests that a report on the progress towards these milestones be presented at future meetings.

6. LOI to Extend T2K with a 2km Detector

The PAC received a Letter of Intent from the T2K collaboration to extend the experiment to include new detectors 2 km from the JPARC neutrino source. The main motivation of the new detectors is to reduce the systematic uncertainties in the predicted electron and muon neutrino rates at Super-K. The proposed detectors would include a water-Cherenkov detector patterned after Super-K and a fine-grained liquid argon detector. The PAC finds the idea of a 2 km detector system to be interesting and does see the merit of making measurements of the neutrino events at a near location. At this point, it is not clear how much such a system will improve the systematic uncertainties and whether the proposed detector is the best size and layout for accomplishing the goals. The PAC recognizes the potential of a 2 km near detector and encourages the continuing design and development.

7. E14: Proposal for $K_L \rightarrow \pi^0 \nu \bar{\nu}$ Experiment at J-PARC

Significant progress was reported by the E14 experiment. Most aspects of the E391a pilot experiment relevant to E14 are understood in good detail and the step-by-step approach towards Standard Model sensitivities on $K_L \rightarrow \pi^0 \nu \bar{\nu}$ appear now to be plausible.

The PAC heard a report from FIFC concerning the proposed beam-line and the experimental technique. No stoppages were identified. The current financial situation of J-PARC does not allow for the construction of the beam-line before 2010. The Collaboration will need to find external means to fund the beamline elements for the beam survey which is deemed to be very important.

Given the importance of this experiment to keep the breath of the J-PARC scientific program, the PAC recommends stage-2 approval for the E14 experiment. This is especially important to start securing resources from the international collaborators.

6. COMMENTS FROM THE IPNS DIRECTOR AND PRIORITY OF THE BEAMLINES IN THE HADRON EXPERIMENTAL FACILITY.

At the beginning of the closed meeting, the PAC heard from the IPNS director, F. Takasaki, on the budget situation of KEK and J-PARC. The budget is tight and the priority is for timely commissioning of the slow extraction beam (Dec 2008), commissioning of the fast extraction beam (April 2009), and delivery of the beam to the K1.8 beam line in Fall 2009. Delays are foreseen to complete the infrastructure for the other beam lines, including K0 and K1.1.

The PAC was requested to give an assessment of the physics case for these experiments in the context of these tight budget constraints.

After discussion, the PAC concluded the following;

- The PAC strongly feels that the conclusion made in the first meeting still hold. The PAC endorses the current strategy that the K1.8 beam line is to be built with the highest priority. After the good progress of the experiments over the last year, the PAC feels that the physics case in the proposals for the K0 and K1.1/K1.1BR beam line is even stronger. These beam lines will give unique opportunities for nuclear and particle physicists from Japan and around the world to perform excellent experiments with neutral kaons and with low momentum charged kaons. The PAC recommends that these beam lines be realized as soon as possible. The committee notes that the experiments using primary proton beam are also important, and, therefore, a plan to construct the high momentum beam line should be worked out.

- Taking account of the tight schedule and limited resources in money and manpower, the PAC considers some delay in the completion of the K0, K1.1, and high momentum beam lines would be acceptable. A short delay in the start of the E06 and E14 experiments does not weaken the physics cases, since there are no competing experiments in these areas.
- The PAC considers that it is important for the IPNS/J-PARC management to develop a realistic plan for the completion of the beam lines. This plan should take into consideration the costs, manpower estimates, overall commissioning requirements, radiation safety and other complications associated with the nature of these projects. The PAC requests to hear a report on this plan at the next meeting, with the following guideline:
 1. Timely commissioning of slow extraction to the K1.8(BR) line and fast extraction for the neutrino program should be the highest priority.
 2. In the completion of the other beamline, the safety aspects especially associated with radiation issues should be seriously considered.
 3. In the case that a step-by-step plan is required due to limited resources, the PAC considers the K0 beam line to be second priority, the K1.1BR+K0.8 beam lines for the E06 third priority followed by the high momentum and K1.1 lines as lower priority. As mentioned above, the upstream magnet installation should be planned carefully due to the safety aspects. Several of the K1.1BR magnets can be installed prior to the K0 beam line components, if this significantly improves the schedule and interference issues.

7. DATE FOR THE NEXT J-PARC PAC MEETING

The date for the next meeting is 7-9 January 2008. The tentative agenda is;

- Financial status of J-PARC and plans for JFY2009
- Report on the beam line commissioning plans
- Description of the J-PARC Phase-II strategy
- Report from the SKS experiments, E15 and E07.
- Report from E03 and the discussion of phase-2 approval
- Status report from T2K, K0 and TREK experiments.

Tentative dates for the coming meetings are,

5-7 June, 2008, then in September 2008 and in February 2009.

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

- Draft Minutes of the second J-PARC PAC meeting held on 10-12, January 2007
- Progress Report to the 3rd J-PARC PAC meeting by E06 Collaboration (KEK/J-PARC-PAC 2007-1)
- LOI: A letter of intent to extend T2K with detector 2 km away from the J-PARC neutrino source (KEK/J-PARC-PAC 2007-2)
- Report to the 3rd J-PARC PAC meeting by E14 Collaboration (KEK/J-PARC-PAC 2007-3)
- Addendum to the Proposal Measurement of High-Mass Dimuon Production at the 50-GeV Proton Synchrotron (P04) (KEK/J-PARC-PAC 2007-4)
- LOI: Spectroscopy of η Mesic Nuclei by (π^-, n) Reaction at Recoilless Kinematics. (KEK/J-PARC-PAC 2007-5)
- Facility Impact and Funding Committee (FIFC) Report
(KEK/J-PARC-PAC 2007-6)