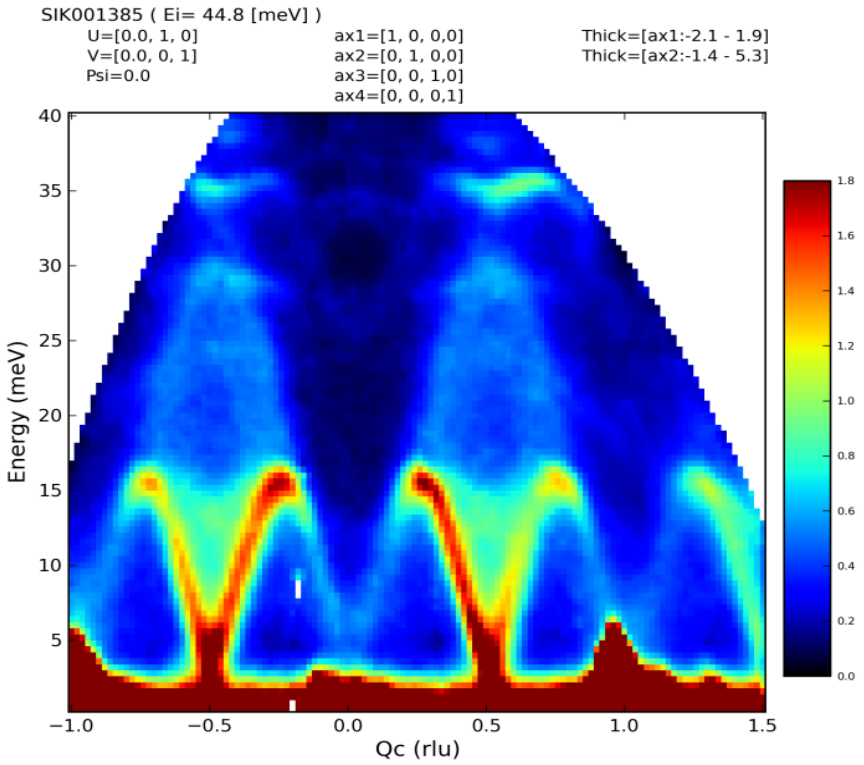
THE INTERNATIONAL ADVISORY COMMITTEE ON THE J-PARC PROJECT

REPORT

Meeting held February 25th – 26th, 2013

Tokai, Japan



Highest quality data from the 4SEASONS spectrometer at the MLF

April 10th, 2013

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EXECUTIVE SUMMARY

The International Advisory Committee (IAC) for the J-PARC project met on February 25th and 26th, 2013 at the J-PARC centre, Tokai and toured the main J-PARC experimental facilities on the 26th.

The IAC thanks the J-PARC Director Dr. T. Ikeda for providing a comprehensive view of the laboratory through detailed presentations from his staff.

The J-PARC project has moved quite effectively towards routine science production as the accelerator complex delivered a superb performance in terms of beam delivery to users. The road towards the designed specification is known and reasonably secured with a five year plan and associated funding requirements well understood. The energy upgrade is on track for installation of the new ACS LINAC this summer and the intensity upgrade of the front end (ion source and RFQ) could also be ready. However, the combined commissioning efforts of these two major new components may be too ambitious for the one month set aside.

There was a strong growth in data taking in all area of science and major impact publications are emerging indicating the strong potential of the J-PARC accelerator complex and its instruments. The user community is growing and with it increasing demands for support to help mount experiments effectively and analyse data in a timely fashion.

The users are starting to recognize the value of the facilities and it is important to establish J-PARC as a true user facility by reducing or absorbing the complex management issues under a uniform user interface. The IAC noted with pleasure the strong financial commitment made by the partners KEK and JAEA, MEXT, and JSPS funding agencies to complete and upgrade the installations. Operation funding is still tight and may become more so in a few years when the facility is operating a full complement of beams and beamlines. The best way to defend a strong operating budget is to deliver exceptional science and show its relevance to society.

The IAC is convinced that J-PARC is on the right track as the phase transition from construction and commissioning to science production has occurred and that the reputation of the laboratory will continue to attract users from both Japanese and international community. For the next few years, the strain of completing the installation to designed values and improving the scientific productivity will be a challenge that the strong J-PARC team will face. But the performance so far is a good indicator of the confidence that the goals will be achieved.

Focusing on user issues while maintaining the high reliability of the accelerator system is very important to keep the science flowing. The planned route towards design performance is reasonable and should now be followed with great care and quality control to minimize the risks associated with operating a very powerful machine.

SUMMARY OF THE RECOMMENDATIONS BY SECTIONS IN THE REPORT

Management and budget

Recommendation #1

The IAC reaffirmed the need to present a unified interface to J-PARC users in an effort to streamline the access to J-PARC facilities and extract science most effectively.

Recommendation #2

The IAC urges J-PARC management to focus on science delivery with the goal of supporting adequate operation funding requests in the coming years.

Accelerators

Recommendation #1

Consider delaying the installation of the 60 mA ion source and RFQ III by one year. This would allow for thorough testing at high power levels of RFQ III with the 60 mA ion source in the test area.

Particle and Nuclear Physics

Recommendation #1

The IAC encourages the T2K collaboration to develop quantitative models of joint future sensitivity to neutrino parameters which will valuable in communicating with the broader scientific community.

Recommendation #2

We recommend that J-PARC and the hadron user community together re-examine the slow extraction program, trying to optimize the physics results in light of current and expected future conditions and clearly define with the users what they can realistically expect over the next 5 years.

MLF

Recommendation #1

The IAC strongly encourage management to extend the scope of CROSS further to provide a 'wrapper' for all instruments, regardless of ownership and thus ensuring a uniform user experience.

Recommendation #2

The IAC recommends that a strategic plan be established for ensuring that all instruments have adequate scientific and technical support and that progress against it be monitored by providing annual reports. The plan should also include the development of user infrastructures needed to facilitate on site experience like the proposed Science Building, Computational Support and User Facilities.

Recommendation #3

The IAC recommends that highlights together with statistics of publications of the MLF be benchmarked against those of its peer-Institutions like ILL, SNS, ISIS, etc and be used as a tool to make strategic decisions regarding the optimal exploitation of the MLF beamlines and instruments . In this context IAC also recommends MLF and CROSS collaborate to establish a scheme to seek for scientific advice from the wider scientific community to identify truly pioneering research targets.

MUSE facility

Recommendation #1

The IAC recommends identifying carefully a number of trail blazing experiments with USM that would clearly establish the unique potential of the MUSE USM beams. The IAC strongly supports the initiatives envisaged to engage the community in the short term.

Recommendation #2

A mechanism for providing user support to muon users must be developed as new ports become operational. The full integration of MUSE and MLF should be aimed at in term of user access and support.

Transmutation

Recommendation #1

The IAC supports the development of a strong proposal for TEF-T facilities at J-PARC focusing on material testing for ADS and including as many partners as possible. Opportunities for funding from grants in aid or other mechanism should be explored.

Recommendation #2

An explicit joint program between the MYHRRA project and TEF-T should be agreed upon and should form the basis of a Japanese – European collaboration with targets and deliverables.

Recommendation #3

The present TEF-T proposal has been re-optimized for cost effectiveness and advancing its scheduled operation in the context of the ADS material irradiation program as its prime mission. The committee supports this approach and recognizes that other potential users should be consulted to construct the most versatile facility compatible with the primary goal.

Recommendation #4

The committee supports an aggressive R/D effort to better define the key technologies needed for TEF-T to firm up its budget requirement and to produce a comprehensive schedule taking into account other lead time items like licensing and safety issues.

GENERAL STATUS OF THE PROJECT

The International Advisory Committee (IAC) for the J-PARC project met on February 25th and 26th 2013 at the J-PARC centre, Tokai and toured the main J-PARC experimental facilities on the 26th.

Presentations on the status of the laboratory by the Director- Dr. Y. Ikeda and on the status of the technical facilities were supplemented by science presentations highlighting the recent scientific achievements. The IAC heard also reports from the Accelerator Technical Advisory Committee (A-TAC) which had just met a few days earlier and from the Neutron and Muon Science Advisory Committee (NAC and MUSAC). The IAC thanks Dr. Ikeda for also including presentations by representatives of the main users groups who shared their user experience at J-PARC in a very candid way. Hence the IAC had a very global view of the project on which to formulate its recommendations.

Dr. M. Nomura, KEK trustee, gave an overview of the short and long term planning at KEK. He pointed out the present substantial commitment made by KEK to J-PARC but warned of the potential "budget cliff" for operation once the Super B factory becomes operational in 2015.

Dr. H. Yokomizo presented the JAEA mission post-Fukushima in view of the Japanese government reassessment of its nuclear strategy, outlining JAEA's commitment to help with waste disposal issues and monitoring of the contamination in the Fukushima region. The development of the TEF-T and TEF-P programs are linked to these new commitments.

Dr. K. Hara from MEXT had to cancel his appearance in person at our meeting but his presentation was read by the Director. It reaffirms the vision that MEXT has for J-PARC as a strategic science initiative which must continue to justify its support by the excellence of its science delivery to its users and to society.

The committee noted with great satisfaction that the accelerators had been performing extremely well delivering more that 93% of the scheduled beam time, a very high performance level for a new accelerator system which had just been re-commissioned after the severe earthquake of March 2011.

This allowed users to collect extensive data sets and produce exciting new results. The last year can be characterized as the first global science production year at J-PARC, as all areas of the complex were producing and publishing scientific results.

The committee was pleased to see evidence of the growing number of users and correspondingly of significant publications. This is a measure of the quality of the beams and of the instruments available to the community at J-PARC creating also a special attraction of foreign users.

The committee also noted that the funding agencies were committing new funding either as part of the supplementary budget or in grants in aids to researchers to complement the facilities and initiate targeted strategic programs. This is also a vote of confidence for J-PARC.

The main technical difficulties are now either solved or in the process of being solved with the energy upgrade being implemented during the next 6-month shutdown and the intensity upgrade remaining close to schedule. The effort of management is focusing rightly so in improving the user experience at J-

PARC and the IAC heard about new funded initiatives to improve further on that , in particular the construction over the next two years of a user office building and cafeteria near the MLF complex as well as the doubling of the dormitory rooms.

MANAGEMENT and BUDGET

The Director described the organisation that he has put in place to operate J-PARC. Several new group leaders have been appointed and the renewed team is very functional. The committee structure has remained in place while an effort to harmonize the user interface is being pushed actively. The funding sources for J-PARC are spread across several partners, mainly JAEA, KEK, CROSS, Grants in Aid program under the purview of MEXT and support from the IBARAKI prefecture. IAC heard from several user representatives that they should not have to know whom they talk to but the corresponding J-PARC facility coordinator. It is important to continue the effort to harmonize the whole user interface for the purpose of proposal submission, experimental and data analysis support, housing and travel support etc.

On the other hand, users should be given the correct phrasing to be used to acknowledge supporting institutions in their publications.

The committee heard from the two founding partners, JAEA and KEK. Both institutions presented their current vision and strategic plans. JAEA is reformulating its mission according to new government policy on Nuclear Power and it is clear that J-PARC could add an active element for this new strategy on nuclear waste disposal and waste transmutation beyond the important materials research and nuclear outreach activities. KEK is operating the photon factory and building a super-B collider on the Tsukuba site while operating the J-PARC Main Ring (MR) program and some of the MLF beamlines (Muon and Neutron). KEK has also put a strong bid for hosting the future International Linear Collider. Although KEK is capable of supporting a strong program at J-PARC while constructing the Super-B collider and SuperBelle detector, it is anticipating a crunch in funding when both J-PARC and Super-B will be operational (>2015).

From the J-PARC point of view it is most important that an excellent portfolio of results be assembled to support the operating funding request in the coming years. Hence, the emphasis that the IAC is placing now on science delivery.

Recommendation #1

The IAC reaffirmed the need to present a unified interface to J-PARC users in an effort to streamline the access to J-PARC facilities and extract science most effectively.

Recommendation #2

The IAC urges J-PARC management to focus on science delivery with the goal of supporting adequate operation funding requests in the coming years.

STATUS OF THE ACCELERATOR SYSTEMS

Two years after the earthquake of March 11, 2011, nearly the entire infrastructure has been restored and the beam powers to the MLF and MR have reached record levels. The J-PARC staff is to be congratulated for this remarkable achievement.

It is very encouraging to see a beam power of 539 kW from RCS even though it was limited to only 35 seconds to prevent damage to the Hg target. To demonstrate the stability of the machine operations, including the target, it would be useful to test high power operation for a more extended period before this summer shutdown. There should be a coordinated plan of the beam power upgrade of the RCS and the Hg spallation target power capability.

The installation of the 400 MeV ACS linac upgrade was delayed by one year to 2013 due to the 2011 earthquake and now coincides with the installation of the a new high intensity RF ion source and RFQ-3. The J-PARC staff prepared a comprehensive schedule for the 6-month installation period, as requested by A-TAC and IAC last year. The A-TAC is still concerned with the very large workload during the shutdown and with the difficulty of simultaneously commissioning a new front end, a new linac section, and a new injection into the RCS. In the energy upgrade plan, the beam commissioning time for the new LINAC is estimated to be one month. This looks very tight for a device with a new type of the accelerating structure (ACS) and so many cavities. It is suggested to examine the possibility of making a longer term schedule for accelerator machine study and to increase beam power step by step as a way to minimize the risks associated with such an intense beam machine.

The IAC agrees with this concern and supports the ATAC recommendation to install the RF ion source and RFQ-3 one year later during the 2014 summer shutdown.

Recommendation

Consider delaying the installation of the 60 mA ion source and RFQ-III by one year. This would allow for thorough testing at high power levels of RFQ III with the 60 mA ion source in the test area.

SCIENTIFIC PROGRAMS

PARTICLE AND NUCLEAR/HADRON PHYSICS

Particle physics experiments

The IAC congratulates J-PARC and the research community on the continued strong growth of operations and the scientific productivity of the Particle and Nuclear/Hadron experiments which are now clearly established as a world-class "Intensity Frontier" research program. The particle and nuclear physics programs are primarily supported by the Main Ring (MR) fast extracted beam for the neutrino program, and the MR slow extracted beamlines for experiments in the Hadron Hall. Two additional beams support particle and nuclear physics programs; these are the MLF (MUSE) H-line that supports muon measurements and the LINAC beam that could support future neutron Electric Dipole Moment (EDM) measurements. Funding for the construction of an additional MR target station and a high momentum beamline has recently been secured which opens up an exciting new domain of research in hadron physics and supports the timely staged development of the muon-to-electron conversion experiment (COMET).

The scientific productivity of the Intensity Frontier research program depends critically on both the quantity and quality of the high power beams delivered to experiments. Beam power in excess of 250 kW is now routinely delivered to the MUSE facility and the long-baseline fast-extraction neutrino experiment and in excess of 15kW of high quality slow-extracted beam to the Hadron Hall facility. An extended shutdown will commence in August of 2013 to upgrade the LINAC energy from 180 MeV to 400 MeV and upgrade many other accelerator systems which will enable eventual Megawatt class operation of the MUSE facility and the long-baseline fast-extraction neutrino experiment and in excess of 100kW of high quality slow-extracted beam to the Hadron Hall facility.

Neutrino Experiments

The T2K collaboration with about 500 members from 62 institutions in 12 countries is a strong international collaboration. The T2K experiment, directing a muon neutrino beam from the Main Ring toward the Super-Kamiokande detector, is a central player today in the highly competitive international neutrino physics scene. The IAC congratulates the J-PARC/KEK team and the T2K collaboration for this continuous progress and success.

A leading pursuit in particle physics today is the search for physical phenomena beyond the so called "Standard Model". Even in the context of the recently discovered Higgs Boson, a central feature of the Standard Model, neutrino physics is the only experimental venue today that has revealed phenomena beyond the Standard Model through the existence of massive neutrino states. An intense world-wide program to measure the mixing properties of neutrinos has continued to surprise us, and the emerging pattern of large mixing between neutrino species is now providing intriguing hints of possibly other new physics beyond the Standard Model. Recent reactor-based experiments have provided strong evidence through precision disappearance measurements for large mixing of electron neutrinos with other neutrino species. With existing data to date the T2K experiment has provided highly cited evidence for the corresponding appearance of electron neutrinos in an intense muon neutrino beam. The 2013 run

plan for J-PARC will enable T2K to definitively establish the mixing of electron and muon neutrinos which is important to validating the 3x3 mixing model of neutrinos. The 2013 running will also permit T2K to make the most precise disappearance measurement muon neutrinos which appear to mix maximally with other neutrino species. Demonstration of maximal mixing may in fact unveil a new symmetry of nature that could further point beyond the Standard Model. The IAC strongly endorses the 2013 T2K run plan.

For the remainder of this decade the international neutrino community will closely follow the combined power of the T2K experiment and the Fermilab long-baseline neutrino experiment NOvA for measurement of neutrino mass ordering (mass hierarchy) and evidence of matter-antimatter asymmetry (CP violation) within the neutrino sector. T2K will require about 400kW of beam power to match the expected instantaneous sensitivity of the NOvA experiment which will commence operations in the fall of 2013 with a near term plan of 5000 hours/year of operations. Matching the sensitivity of the T2K and NOvA programs will optimize the sensitivity of the joint world-wide program through the decade. The IAC endorses the vision of T2K working in a long-term international collaborative pursuit of the next frontier of neutrino physics: mass ordering and matter-antimatter asymmetries.

Recommendation #1
The IAC encourages the T2K collaboration to develop quantitative models of joint future sensitivity to neutrino parameters which will valuable in communicating with the broader scientific community.

Experiments in the hadron hall

The experimental program in the hadron hall took very significant steps in 2012.

- The beam power delivered to the hall was increased by a factor of 4.5 and the duty factor of the extracted beam was dramatically improved to 45%.
- The first hypernuclei at J-PARC were detected.
- The first hadron physics results, a limit on pentaquark production in pion-induced reactions, were published.

Data were accumulated on several other experiments with pion beams and this phase of research is being brought to a close. The engineering run of the KOTO experiment ($K^0 \rightarrow \pi^0 \nu\bar{\nu}$) was successful. The KOTO experiment is pursuing discovery and measurement of the ($K^0 \rightarrow \pi^0 \nu\bar{\nu}$) process which explicitly violates matter-antimatter symmetry and is very sensitive to new physics models beyond the Standard Model. The successful engineering run in 2012 has positioned KOTO with running in 2013 to reach a sensitivity for the ($K^0 \rightarrow \pi^0 \nu\bar{\nu}$) process that surpasses indirect limits (so called Grossman-Nir bound) inferred from other processes and become directly sensitive to new physics contributions beyond the Standard Model. The IAC strongly supports the proposed 2013 running for KOTO necessary to reach the Grossman-Nir bound in advance of the LINAC upgrade.

In terms of future experimental capabilities, the funding of the new COMET beamline to search for lepton flavor violation and the high momentum beam line giving access to much higher energy meson and primary proton beams was a very significant step forward. The construction of the S-2S spectrometer for the

Ξ-hypernuclear program is proceeding with expected installation in 2014.

The program plans to focus on kaon beams in 2013 and a number of experiments will take significant data samples including a search for deeply bound K^-pp states, experiments detecting hypernuclear γ-rays in light hypernuclei, and KOTO.

Even with this significant progress, there is concern that the slow extracted beam program has come on-line quite slowly as a consequence of J-PARC priorities. This remains the program where the beam intensities are farthest from the design goals. Intensities are limited by beam losses in the main ring and production target issues. Each of these along with the effective duty factor must be a focus of effort for the next year to continue to make progress. We look forward to a report on the positive impact of the titanium ducts and vacuum chamber on the activation issues. We note that one proposed solution for the production target power issues is actually expected to reduce the number of K^-'s per incident proton. The slow extracted beam program is the program most affected by the reduction of the nominal beam energy from 50 to 30 GeV and will experience only modest improvement (25%) with the longer term plan to increase the accelerator ramp rate from 2.5 s to 1 s.

Further progress with slow-extraction experiments in the Hadron Hall also relies on improving the instantaneous spill quality (duty factor) of delivered beam as well as average intensity. Excellent progress has been made in improving the duty factor toward what is required by the high intensity experiments. Further progress is required, and the IAC strongly encourages effort toward realizing beam quality comparable to quality realized at the KEK Proton Synchrotron.

As a consequence of the slower start, the hadron program has a significant backlog of experiments that were originally proposed many years ago. Future COMET running requiring a dedicated 8 GeV proton beam from the MR will further impact this. It would seem to be an appropriate time to re-examine the slow extraction program, trying to optimize the physics results in light of current and expected future conditions and clearly communicate with the users what they can expect over the next 5 years.

Ultimately, a significant expansion to the hadron hall is needed to increase the number of simultaneous users and to allow for more permanent installation of major pieces of equipment without substantially constraining other physics goals. However there is a chicken and egg situation where exciting physics results are needed to demonstrate the value of the hadron program, new instruments are needed and scientists need to be seeking grants in aid to develop them, but without new space to install them, new instruments would have to displace current science programs. Once again, a coherent plan for future, both for physics and facilities would help. A positive observation is the renewed interest in significant RIKEN involvement in the future program.

Recommendation #2

We recommend that J-PARC and the hadron user community together re-examine the slow extraction program, trying to optimize the physics results in light of current and expected future conditions and clearly define with the users what they can realistically expect over the next 5 years.

FUNDAMENTAL PHYSICS WITH MUONS

The case for new physics beyond the Standard Model at the TeV mass scale and higher remains strong, and recent limits on this new physics from direct searches at the LHC strongly compels the case for probes with even high mass scale sensitivity. Fundamental physics research with muon probes answers this call, and will be enabled by the (MUSE) H-line that that is under development and construction of an additional MR target station and a high momentum beamline that will support the timely staged development of the muon-to-electron conversion experiment (COMET).

The MUSE H-line can support a rich program of muon physics including precision (hyperfine) measurements of muonium, and new techniques developed by the J-PARC research community to pursue muon-to-electron conversion (DeeMe), the anomalous magnetic moment of the muon and the search for a muon electric dipole moment (g-2). Proponents of these new techniques have continued to make progress, and the IAC encourages the development of new techniques to advance the field.

The opportunity to advance the muon-to-electron conversion experiment (COMET) experiment in a staged manner is an exciting development for the world-wide program of muon physics. Stage-1 of COMET will perform a critical survey of background processes that will define the search sensitivity of future muon-to-electron conversion experiments and presents an opportunity to inform the design of future experiments. The COMET collaboration has also made a strong case that Stage-1 will also substantially improve the current limits on the muon-to-electron conversion in advance of the Fermilab competition (Mu2e) which is aiming for higher sensitivity but will run after Stage-1 of COMET.

The IAC strongly endorses the staged plan for COMET and is looking forward to continued progress in the development of this important particle physics experiment.

MATERIAL AND LIFE SCIENCES

The IAC noted that the evolution of instruments and infrastructure and the momentum of the MLF is on a steeply rising curve, with significant progress since the last time it met, and congratulated its Director, Dr. Masa Arai and his staff for this achievement.

The IAC was very pleased to see the new science building established as central to strategy to support better a user community that was expected to grow in size and breadth. It welcomed too, the establishment of an organization – CROSS (Comprehensive Research Organisation for Science and Society) – to provide significant additional personnel for outreach, to aid the beam time application process, and to provide additional technical or scientific support for their experiments. The IAC was also concerned that this additional support was only provided for the *public* neutron instruments, and not the rest of the neutron suite, nor the muon facilities**.** It did express some concern about the apparent complexity of the organisation of the MLF with regard to CROSS, though it was reassured to some extent to be told that the users see only a single structure with a single point of entry.

Recommendation #1

The IAC strongly encourage management to extend the scope of CROSS further to provide a 'wrapper' for all instruments, regardless of ownership and thus ensuring a uniform user experience.

The IAC noted that if the user numbers continued to rise strongly – indeed a rather ambitious trebling in demand was predicted for the next 5 years – those instruments that were less well supported would find it very hard to respond as effectively. It was suggested that such pressure might be alleviated to some extent through improvements to software to handle data, and improved sample environment – particularly for automated sample changes. Nevertheless, the IAC strongly believe that *all* instruments require adequate scientists and support staff if the potential of the MLF is to be fully realized.

The IAC notes the ambition of the MLF to be more international – though the current level of international participation at around 10% is already impressive for an organization at this stage of its development. The IAC is confident that international users will come in even greater numbers as the reputation of the facility gets stronger. Such an increase will impose much greater demands on local infrastructure such as transport links with the airport, and accommodation so action should be taken as a matter of some urgency to mitigate against such strain.

Turning to the source and neutron instruments, the IAC noted and in some cases discussed the observations and recommendations presented in the last report of the Neutron Advisory Committee (NAC - Feb.2013).

- The Spallation Target continued to perform very reliably (93%) as power continues to be raised; damage to the target by shock-waves appears to be mitigated efficiently by bubbling He gas.
- It is encouraging to see that the quality of the cryogenic moderators (realization of 100% p-hydrogen) has been maintained even at such high source power
- The strong developing safety culture was praised, though it was also noted that the application of very stringent checks on all irradiated samples was very time consuming and resource intensive. There is a need to evolve more efficient procedures through the formation of a dedicated safety team and a streamlining of procedures.
- The expansion of the instruments continues to be rapid, with 4 more to come on stream in the next 5 years; concern was expressed that with 21 out of 23 beamlines now assigned, the room for maneuver with respect to future strategic, scientific, or technical developments was reduced. Future flexibility could be found through revision of the instrument suite following periodic performance reviews, allowing underperforming instruments to be replaced. The IAC stressed the need for strong engagement with the user community in the choice of new instruments.
- The need to develop sample environment and software for data visualization, analysis, and modeling to exploit new instruments optimally was emphasized. Such developments should not be carried out just in J-PARC but rather in collaboration with other neutron centers that shared similar challenges, and in some cases were already developing good solutions (e.g. the MANTID project, launched by ISIS). Strenuous effort should be made to ensure that such infrastructure and support is made available uniformly across the instrument suite, regardless of ownership.
- The IAC applauds the commitment to the development of enabling neutron technology, in particular a replacement for area-detector technology based on ^{3}He, as well as improved technology for neutron polarization – both SEOP and MEOP – also based on ^{3}He.

Recommendation #2

The IAC recommends that a strategic plan be established for ensuring that all instruments have adequate scientific and technical support and that progress against it be monitored by providing annual reports. The plan should also include the development of user infrastructures needed to facilitate on site experience like the proposed Science Building, Computational Support and User Facilities.

A number of examples of neutron scattering measurements performed at J-PARC were presented. Some of these served to illustrate the rapid rate of improvement of new instruments as they are refined. For example, the time-of-flight spectrometer 4SEASONS has seen huge gains in the signal/noise as the background has been brought down greatly through the provision of more shielding and the addition of the T0 chopper. This has enabled low and high energy features of the excitations in various strongly correlated electron systems, including LSCO, $CuCrO_2$ and $CuGeO_2$ to be picked out in exceptional detail. The IAC suggested that the performance of such instruments should be benchmarked against appropriate instruments elsewhere so that somewhat more precise and quantitative comparisons can be made in future –an exercise that the IAC anticipate would show the J-PARC instruments in a very good light.

The presentation of science also included new research, some in high-impact journals (and in general, the number of publications is rising steadily, and is at a level that is entirely in keeping with the early stages of exploitation of a world-class neutron facility). Neutron scattering studies of enzymes containing labile hydrogen that might replace platinum compounds in low-cost fuel cells had recently appeared in Science, while the discovery of a new rare-earth hydride that formed at high pressure and that was observed for the first time on the high intensity total diffractometer NOVA, had appeared in Physical Review Letters in 2012; this could also have consequences for the development of more environmentally friendly ways to generate and store energy. These and several more strong examples of new science delivered through neutron scattering at J-PARC hint at what the future could bring if this facility continues on its current upwards trajectory.

Recommendation #3

The IAC recommends that highlights together with statistics of publications of the MLF be benchmarked against those of its peer-Institutions like ILL, SNS, ISIS, etc and be used as a tool to make strategic decisions regarding the optimal exploitation of the MLF beamlines and instruments . In this context IAC also recommends MLF and CROSS collaborate to establish a scheme to seek for scientific advice from the wider scientific community to identify truly pioneering research targets.

Feedback from the user community

T. Kanaya of Kyoto University represented the views of users on their experience of J-PARC, and also drew on personal experience to compare it with that at other neutron centres, notably at ILL and ISIS.

A number of recent improvements were described, in particular the stronger, integrated support for many instruments provided through CROSS, and the provision of much better facilities for sample preparation. However, a number of significant problems remained and required urgent ***action***:

- Radioprotection rules and practices as applied to powder and liquid samples in the experimental halls were far too restrictive and often caused significant loss of effective experimental time.
- There are severe restrictions in access to data from outside of J-PARC, causing significant problems in analysis after experiments. This problem was partially solved for the large neutrino user community and should be addressed for all users.
- Many instruments still had very few staff assigned to them for support and in some cases the situation appeared close to breaking point in terms of those staff being able to handle increasing demands on their time as more users arrived, particularly if they are not expert users.
- Despite the improvements to user access with the establishment of CROSS, there was still room for improvement in simplifying procedures, and ensuring more uniformity in applying for beam time at KEK and J-PARC instruments.
- Access to J-PARC was difficult for Japanese users – and much of the information available on such issues was still only in Japanese so difficulties are surely more acute for non-Japanese users. Transport between the experimental areas, the user office and places to eat or sleep was not satisfactory in view of the not-insignificant distances involved.

T. Kanaya was questioned about the emphasis that should be given to intensity as opposed to stability of the source, to which the response was that it depended on the type of experiment. However, it was noted that now the source is sufficiently stable for users to have confidence in doing kinetic experiments that required continuous measurements over a significant period of time.

The IAC interaction with the Neutron users community representative was very informative and the IAC thanks management for including these presentations in the agenda. Cleary the specific action items identified above must be addressed urgently to improve the user experience at J-PARC

The MUSE facilities

Thanks to extra funding and very hard work, the front elements of the four muon channels in the proton tunnel of the MLF were installed during the summer shutdown. This is a major achievement and was required to minimize the dose to personnel in the future. It had been a major recommendation of previous IAC. The high intensity U line was completed and commissioned demonstrating that record muon fluxes would be produced allowing for the generation of high intensity ultra slow muon (USM) beams by laser ionization of muonium. The USM systems funded by a MEXT grant are being installed and first operation is anticipated for the beginning of FY13. This is a major development and is anticipated to place J-PARC in a unique situation for mounting state of art material experiments. A workshop is planned for the summer to unveil the USM facilities and publicised its capabilities to Japanese and international communities.

Recommendation #1

The IAC recommends carefully identifying a number of trail blazing experiments with USM that would clearly establish the unique potential of the MUSE USM beams. The IAC strongly supports the initiatives envisaged to engage the community in the short term.

The surface muon beamlines (S –Line) received a major supplementary budget from KEK and it is now possible to contemplate a physics program soon when a new spectrometer is available for the first end station. This is very welcomed by the muon users community and will create more demands for user support in the future. Moreover, a new strategic initiative from Professor Hosono-san of the Tokyo Institute of Technology has been funded and will support a multi probe effort into new functional materials without toxic or rare elements, making use of the unique availability of photon, neutron and muon beams provided by KEK.

On the H-line three fundamental physics experiments are being developed and will be seeking stage 2 approval in the future.

With such a major influx of funding and support from the KEK management, the MUSE facilities have made a tremendous jump forward while supporting a strong science program on the existing D line. Some 15% of all the MLF publications are already coming from that line. It is now clear that the science program will expand rapidly as the U Line and S line come into production over the next year or two. The already critical manpower crunch will continue and user support will become key to delivering the science. The MUSE team is still carrying a heavy burden in facility building while starting a more ambitious science program. The IAC is concerned that both cannot be delivered simultaneously without increasing substantially the user support. Ideally a full integration of MUSE into the MLF operating mode for user access and support would be needed. The CROSS model for user operation is the standard to be adopted in the long run.

Recommendation #2

A mechanism for providing user support to muon users must be developed as new ports become operational. The full integration of MUSE and MLF should be aimed at in term of user access and support.

NUCLEAR TRANSMUTATION

The presentation from Dr. H.Oigawa and Dr. T.Sasa gave a survey of the recent development both strategic and technical regarding the Accelerator Driven System (ADS) program at JAEA.

Since the Fukushima-Daiichi accident, the Japanese government has been revising its official policy regarding nuclear power in Japan and in particular its official policy on the waste disposal problem which has to be dealt with irrespectively of the termination or not of nuclear power generation in Japan. The contribution of an ADS system is being evaluated and there is a window of opportunity to push for a test facility at J-PARC. JAEA has pledged to get involved in the waste disposal research effort and a proposal to build a test facility, TEF-T, was submitted to the government for funding last year but, in part due to the shifting policy situation, it was not funded. The group of Dr. Oigawa has formulated a dual road map combining a strong collaboration with the European MYHRRA project and the construction of TEF-T. The in-house contribution of the Japanese collaborators will be focused on the material testing with a 400MeV, 250kW proton beam from the J-PARC LINAC. It is planned to involve other key Japanese partners (industrial and universities based) in this program.

The mission of TEF-T should be very focused and fully integrated into JAEA's global strategic plan. It should be seen as being central to JAEA's objective regarding nuclear waste research. At the same time, opportunities could be offered to other groups to take advantage of this test facility for other research objectives. A strong commitment from JAEA is necessary to get this facility of the ground and already R/D funds have been secured to produce a winning proposal and participate in the MYHRRA project. TEF-T has the priority as an engineering test facility, but it should be followed with the TEF-P facility which is for reactor physical testing using high energy proton.

Recommendation #1

The IAC supports the development of a strong proposal for TEF-T facilities at J-PARC focusing on material testing for ADS and including as many partners as possible. Opportunities for funding from Grants in aid or other mechanism should be explored.

Recommendation #2

An explicit join program between the MYHRRA project and TEF-T should be agreed upon and should form the basis of a Japanese – European collaboration with targets and deliverables.

Recommendation #3

The present TEF-T proposal has been re-optimized for cost effectiveness and advancing its scheduled operation in the context of the ADS material irradiation program as its prime mission. The committee supports this approach and recognizes that other potential users should be consulted to construct the most versatile facility compatible with the primary goal.

Recommendation #4

The committee supports an aggressive R/D effort to better define the key technologies needed for TEF-T to firm up its budget requirement and to produce a comprehensive schedule taking into account other lead time items like licensing and safety issues.

CONCLUSIONS

The IAC was pleased to notice the definite transition from a building focus to a science focus in most of the experimental areas. In particular, the excellent beam delivery performance of the accelerator complex is remarkable for such a new facility. The only area which is still behind expectations at this time is the MR slow extraction although significant progress is being made.

A major effort is planned for the long summer-fall shutdown to increase the injection energy to the RCS. This and the shortening of the MR repetition rate will allow to ramp up the proton beam intensity towards the design value in all areas.

New users are being attracted to the site and the publication record is improving as more experiments receive their allocated beam time. Several major efforts are underway to improve the user experience at J-PARC and new funding for a User building and more dormitories are very welcomed. The academic environment is also improving with a new colloquium and seminar series which can bring together the wide variety of users and in particular students and young postdocs. The success of J-PARC as an national and international facility will also depend on the quality of the user environment (technical as well as human).The user environment must continue to be a focus for management's effort.

The laboratory is continuing to develop as a world leading facility under the new management and such a smooth transition is always a sign of the great depth of talent in the team.

Appendix I

Agenda for the International Advisory Committee Meeting of J-PARC in 2012

Agenda for the International Advisory Committee Meeting of J-PARC in 2013

Date: February 25 (Mon) and February 26 (Tue), 2013
Place: IQBRC

February 25 (Mon)

Executive Session (closed)			
8:45 – 9:00	(10 + 5)	Charge to the Committee	Yujiro IKEDA
Opening			
9:00 – 9:40	(30 + 10)	Report from the Director	Yujiro IKEDA
Accelerator			
9:40 – 10:20	(30 + 10)	Progress and Prospects	Kazuo HASEGAWA
10:20 – 10:50	(20 + 10)	A-TAC View of Accelerator Activities	Thomas ROSER
10:50 – 11:05	(15)	Coffee	
Material and Life Science -I			
11:05 – 11:40	(25 + 10)	Overview of MLF Division	Masa ARAI
11:40 – 12:00	(15 + 5)	Neutron Science at J-PARC	Hideki Seto
12:00 – 12:20	(15 + 5)	Muon Science at J-PARC	Ryousuke Kadono
12:20 – 12:40	(15 + 5)	View from Muon User	Jun SUGIYAMA
12:40 – 13:30	(50)	Lunch	
Particle and Nuclear Physics			
13:30 – 14:05	(25 + 10)	Overview of Particle and Nuclear Physics Division	Kazuhiro TANAKA
14:05 – 14:35	(20 + 10)	Hadron Physics at J-PARC	Tomofumi NAGAE
14:35 – 15:05	(20 + 10)	Neutrino Physics at J-PARC	Chang Kee JUNG
15:05 – 15:35	(20 + 10)	Muon Particle Physics at J-PARC	Naohito SAITO
15:35 – 15:50	(15)	Coffee	
Views from Host Institutes and Funding Agency			
15:50 – 16:15	(20 + 5)	KEK and J-PARC	Masaharu NOMURA
16:15 – 16:40	(20 + 5)	JAEA and J-PARC	Hideaki YOKOMIZO
16:40 – 17:05	(20 + 5)	J-PARC: Expectations from MEXT	Katsuhiko HARA
Executive Session (closed)			
17:05 – 18:05	(60)	Review and Discussion	IAC Members
Banquet			
18:30 – 20:30	(120)	Reception	

February 26 (Tue)

Material and Life Science -II			
9:00 – 9:20	(15 + 5)	View from Neutron User	Toshiji KANAYA
Accelerator Driven Transmutation Research			
9:20 – 10:00	(30 + 10)	ADS Project	Hiroyuki OIGAWA
Executive Session (closed)			
10:00 – 11:30	(90)	Review and Discussion, Drafting Recommendations	IAC Members
Close out			
11:30 – 12:00	(30)	Reccomendations	Jean-Michel POUTISSOU
12:00 – 13:45		Lunch	
14:00 – 16:00		Site Tour	

Appendix II

IAC Committee members for 2013

List of J-PARC International Advisory Committee (IAC) members

(FY2012－2013)

	name	organization	title	field
1	Jean-Michel Poutissou (chair)	TRIUMF	Special Advisor, Nuclear Medicine	Muon
2	Hiroshi Amitsuka	Graduate School of Science, School Of Science Hokkaido Univ.	Professor	
3	Thomas Roser	Brookhaven National Laboratory	Chair of the Collider-Accelerator Department	ACC
4	Fu Shinian	Institute of High Energy Physics Chinese Academy of Science	Deputy director, Accelerator Center, IHEP	
5	Sergio Bertolucci	CERN	Director of Research and Scientific Computing	Particle
6	Robert Tschirhart	Fermi National Accelerator Laboratory	Associate Head, Scientific Computing Division	
7	Hugh Montgomery	Thomas Jefferson National Accelerator Facility (Jefferson Lab)	Director	Particle/ Nucl
8	Donald F. Geesaman	Argonne National Laboratory	Distinguished Argonne Fellow/former Director of the Physics Division	Nucl
9	Horst Stoecker	GSI	Scientific Director	
10	Hajimu Yamana	Research Reactor Institute Kyoto Univ.	Professor	ADS
11	Hamid Aït Abderrahim	Belgian Nuclear Research Center	Deputy Director-General	Neutron
12	Kelly J. Beierschmitt	Oak Ridge National Laboratory	Associate Laboratory Director for Neutron Sciences	
13	Hidetoshi Fukuyama	Tokyo University of Science	Vice-President	
14	Andrew Harrison	Institut Laue-Langevin (ILL)	Director	
15	Andrew Dawson Taylor	Science and Technology Facilities Council	Executive Director, National Laboratories	