J-PARC Neutron Advisory Committee (NAC) 2025

Summary Report

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1. Summary: list of recommendations

In the context of the increasing impact of MLF science, the world-class instruments available at MLF, the significant technical expertise that MLF staff possess, and the strong opportunities for future excellent science and instrumentation development at MLF, the NAC has the following recommendations. These are described in more detail in the remainder of this report.

General

Recommendation 1: The NAC recommends MLF continues to seek additional special budget to mitigate the effects of electricity price increases in order to maximise facility operations.

Recommendation 2: The NAC recommends that MLF seek a sustained, annual budget to enable an instrument upgrade and renewal programme. This will ensure MLF instruments remain world-leading.

Recommendation 3: NAC recommends partnerships between MLF and other facilities for mutual benefit in technical areas. E.g. there are European networks for detectors, polarisation, deuteration, sample environment and software development that J-PARC could become a member of.

Charge 1: Target

Recommendation 4: NAC recommends, in addition to a critical spares list, that a list of components requiring replacement before observed aging is seen is created based on failure likelihood and impact. This list, together with the spares list, can be the basis for an obsolescence funding bid.

Recommendation 5: NAC recommends that a workforce / staffing plan should be developed soon to inform staffing needs and succession planning, and provide material for a funding case to sponsors.

Charge 2: User programme

Recommendation 6: NAC recommends attributing Digital Object Identifiers (DOIs) to each experiment, which must be cited in publication and thesis work. This may enable publications and theses to be found more easily.

Recommendation 7: NAC recommends exploring a mechanism to enable MLF instrument scientists to benefit from industrial income through beamline developments, students or other means to positively reinforce industrial engagement.

Recommendation 8: NAC recommends that MLF consider length of beamtime allocations per experiment to ensure beamtime is being used most effectively.

Recommendation 9: NAC recommends that a variety of ways are explored to encourage Japanese PhD student use of MLF.

Recommendation 10: NAC strongly recommends that MLF employs a variety of approaches to encouraging further domestic use.

Charge 3: MLF roadmap

Recommendation 11: NAC recommends development of a resource plan (people requirements as well as funds) to enable MLF-Double to be taken forward well.

Recommendation 12: NAC recommends MLF includes more world-leading instrumentation capabilities in the MLF-double program. Recommendation 2 is also relevant to this point.

Recommendation 13: NAC recommends creation of key success criteria and an overall vision for MLF and the MLF-double programme, related to funders' priorities.

Recommendation 14: NAC recommends creation of a set of high-level milestones for the MLF-double programme.

Recommendation 15: NAC recommends creating a stakeholder plan to ensure that key messages regarding J-PARC and MLF-double are getting to key funders and lead smoothly to the plan for TS-2.

Recommendation 16: NAC recommends further measures to involve the community in the MLF-double programme.

2. Charge to the NAC

The NAC charge provided by J-PARC consisted of three areas:

1. Target maintenance and developments

- Is the risk assessment of the target system appropriate?

2. User programme

- Is the domestic user utilisation promotion adequate?
- What should be improved at J-PARC compared to user programmes at other facilities?

3. Roadmap

- Is the MLF roadmap attractive for the advancement of neutron science worldwide?

3. Meeting details

The Neutron Advisory Committee (NAC) met on 12th and 13th February 2025 at J-PARC. The Committee consisted of the following people:

Name	Affiliation	Position	Expertise
Taka-hisa ARIMA	RIKEN / The University of Tokyo	Group Director, Center for Emergent Matter Science/Professor, Department of Advanced Materials Science	Condensed matter studies, heavy Fermions, magnetism
Bertrand BLAU	Paul Scherrer Institute (PSI)	Group Leader, Spallation Source Operations Group	Targets, moderators
Michael DAYTON (online)	Oak Ridge National Laboratory (ORNL)	Section Head, Research Accelerator Division, Target & Mechanical Systems	Targets and mechanical systems
Philip KING (Chair)	ISIS Neutron and Muon Source	Associate Director	Neutron and muon sources and science, user programmes

Toyohiko KINOSHITA	Japan Synchrotron Radiation Research Institute (JASRI)	Coordinator of Center for Synchrotron Radiation Research, Chief Scientists	Condensed matter physics
Guenter MUHRER	European Spallation Source (ESS)	Group Leader for ESS Spallation Physics	Neutron targets systems
Yoshie OTAKE	RIKEN (Institute of Physical and Chemical Research)	Team leader, Neutron Beam Technology Team, RIKEN Center for Advanced Photonics	Neutron beam technology, compact source development
Sungil PARK	Korea Atomic Energy Research Institute (KAERI)	Former Senior Vice President	Neutrons instrumentation, magnetism
Judith PETERS	Univ. Grenoble Alpes / ILL	Professor	Neutron scattering applied to biological systems
Jon TAYLOR (online)	Spallation Neutron Source(SNS)	Division Director for Neutron Scattering	Neutron scattering computing and instrumentation

The Committee were very grateful to J-PARC for all the meeting organisation which ensured everything ran very smoothly. The committee were grateful for the clear talks, the additional information provided following requests and the very helpful discussions with MLF staff. In particular, the NAC appreciated in-depth discussions that the target experts on the Committee were able to have with MLF target staff during a separate, dedicated session when current issues with target systems were able to be explored fully.

The Committee appreciated the efforts of Jon and Mike who were not able to attend physically but took part online from the US late into the night.

As ever, the Committee very much appreciated MLF's hospitality throughout the course of the meeting.

4. NAC agenda

The meeting was held over two days:

ver. 2025/1/30
J-PARC Research Building 2F meeting room

NAC-2025 Agenda

12-Feb				
9:30		Closed Session	0:40	P. King
10:10	NAC2025-0	Overview of J-PARC	0:30	T. Kobayashi
10:40		Group photographing	0:10	
10:50		Break	0:15	
11:05	NAC2025-1	Overview of MLF & Charge to NAC	1:00	T. Otomo
12:05		Lunch	1:20	
13:25	NAC2025-2	Neutron Source	1:00	K. Haga
14:25	NAC2025-3	User Program	0:30	Y. Kawakita
14:55	NAC2025-4	Industrial Use	0:30	K. Mita
15:25		Break	0:30	
15:55	NAC2025-5	MLF roadmap update	0:40	T. Otomo
16:35		Closed Session	0:40	P. King
17:15		Move to Katsuta	0:40	
		dinner		

13-Feb				
9:30		Closed Session	1:20	P. King
10:50		Break	0:10	
11:00		Further Q&A	1:00	P. King
12:00		Lunch	1:30	
13:30		Closed Session	1:00	P. King
14:30		Summary session	0:30	P. King
15:00		Adjourn		
15:00		MLF & JRR-3 tour	2:00	
17:00		Move to Katsuta		

5. General comments

Source performance

The NAC congratulates J-PARC on achieving 1MW stable operation to the MLF during 2024 – this is a significant achievement resulting from many years of work by the accelerator and target staff.

The NAC was also impressed to see the results of a great deal of work that has gone into optimising the neutron production target over many years. This has now led to reassurance that 2-year operation of an individual target should be possible, reducing the need for yearly replacement and the costs and downtime associated with this.

Finances

The NAC noted the current financial constraints, including flat operations budget and continued concern over electricity costs. Together, these are likely to lead to reduced operations over the coming years. The NAC strongly supports attempts to maintain at least 7.2 operating cycles each year for MLF, recognising that the aspiration is actually 8 or 9 run cycles annually to maximise the investment in the source.

> **Recommendation 1: The NAC recommends MLF continues to seek additional special budget to mitigate the effects of electricity price increases in order to maximise facility operations.**

The NAC was pleased to see the allocation of an obsolescence budget, essential for a facility of J-PARC's age. Recent failures (scorched component in the Linac, failure of a pillow seal in the target He vessel, failure of a power manipulator for MLF target maintenance, and the need to

replace the Hg circulation pump due to signs of aging) all highlight the need for an adequate maintenance budget and a carefully-considered and prioritised maintenance and obsolescence plan for MLF components (we discuss this further in later sections). The NAC noted that the obsolescence budget does not include any component for the neutron instruments. NAC also noted that procurement of items from outside of Japan will be subject to exchange rate fluctuations which have been largely unfavourable (increasing procurement costs) over recent years.

> **Recommendation 2: The NAC recommends that MLF seek a sustained, annual budget to enable an instrument upgrade and renewal programme. This will ensure MLF instruments remain world-leading.**

The NAC notes the tension between operating as fully as possible and the provision of spares and the obsolescence programme. Overall, the NAC are concerned about the harmful effects on MLF productivity which this tension is likely to produce.

Instrumentation

NAC continues to note that MLF has world-class neutron instruments and instrumentation in many areas. The programme of instrumentation developments remains strong – NAC noted continued improvements in imaging, polarisation, sample environment and detectors. In these areas, and in areas such as neutron targets, MLF has considerable technical expertise. NAC felt that other neutron facilities would benefit from J-PARC's expertise, and vice-versa.

> **Recommendation 3: NAC recommends partnerships between MLF and other facilities for mutual benefit in technical areas. E.g. there are European networks for detectors, polarisation, deuteration, sample environment and software development that J-PARC could become a member of.**

Some of these networks come under LENS, the League of Advanced European Neutron Sources – Michel Kenzelmann at PSI is currently the chair, and Philip King leads the co-ordination group and can put J-PARC in touch with relevant network leaders.

6. Charge 1: Target maintenance and development

Is the risk assessment of the target system appropriate?

The view of the NAC was yes, some of the key risks have been identified. The risk assessment has been divided into several areas by MLF:

- Device Management (inventory management / critical spares)
- Budget Management (procurement priority management)
- Personnel Management (workforce planning)
- Work Safety Management (development of work procedures)

This appears to be a reasonable list, but not exhaustive because important topics like identification of vulnerabilities in single-point failures or precautionary replacement of components seem to be missing. Additionally, a prioritized risk management approach should be employed to best utilize the limited budget available.

> **Recommendation 4: NAC recommends, in addition to a critical spares list, that a list of components requiring replacement before observed aging is seen is created**

based on failure likelihood and impact. This list, together with the spares list, can be the basis for an obsolescence funding bid.

Comments on device management

The latest results from target wall post-irradiation examination of target #15 look very good and are a reassuring experimental validation in favour of the decision to operate target #16 for two years. The procurement plan of target vessels for the coming years appears appropriate to ensure sufficient spares are on hand to support operations.

The issue with insufficient sealing after the replacement by remote-handling of the mercury pump in summer 2024 is concerning but the NAC believes that the countermeasures performed so far and planned further are highly professional.

- At least to PSI standards, tolerated He leak rates of up to 1E-8 Pa m^3/s seem to be rather high. At SINQ, the aim is for leak rates of less than 1E-10 Pa m^3/s for gas-containing systems.
- Better flange alignment, more evenly applied torque to the bolts, and remote handling practice on a mock-up appear to be appropriate countermeasures to tackle the problem. Additionally, procurement of spare jumper pipes should be considered as these replaceable items could be adversely impacting seal performance.
- The data from the stack monitoring is consistent with leakage of isotopes generated in the spallation process.

The explanation given for the unexpected humidity rise in the He vessel appears to be understandable and appropriate countermeasures were taken. Consideration should be given for potential corrosion effects in the vessel due to moisture / nitric acid generation during beam production.

These kinds of problems are good examples of unforeseeable issues which can and will happen in complex and unique facilities like MLF. The sponsors should be aware that increasing funding should be allocated with MLF approaching its adolescent phase (see **Recommendation 4** above).

Comments on budget management

While inflation (and exchange rate variations) is driving up prices, the MLF budget has been flat (though NAC notes the dedicated obsolescence budget). In order to stay within the budget, MLF is considering reducing the availability of the facility, deferring maintenance, and deferring the procurement of spares. Experience from other facilities has shown that this approach cannot be sustained into the future without damage to the long-term health and productivity of the facility and having a negative long-term effect on the user community. MLF is very much aware of this risk, but needs to ensure funders are aware of the risks and consequences of funding pressures (see **recommendations 1-4** above).

Comments on personnel management

MLF target systems will face a significant loss of knowledge and competence over the next 10 years due to retirement of a large fraction of staff. This should be countered by bringing in young staff, training them and ensuring knowledge transfer. MLF management is aware of this risk, but is constrained by the current budget.

Recommendation 5: NAC recommends that a workforce / staffing plan should be developed soon to inform staffing needs and succession planning, and provide material for a funding case to sponsors.

Comments on work safety management

The crane load drop incident was concerning and highlights the need for rigor to ensure personnel and equipment safety. Consideration should be given to development and use of more formal lift plan documents to ensure hoisting and rigging activities are safely performed for critical equipment lifts as a minimum.

7. Charge 2: User programme

Is the domestic user utilisation promotion adequate?
What should be improved at J-PARC compared to user programmes at other facilities?

Publications

The publication record from MLF continues to gain in impact. There is evidence of strong publications in areas such as quantum materials, energy materials and engineering, and other key areas with papers in Science and Nature journals. The NAC noted the low level of thesis numbers - this is likely due to a large under-reporting of theses to the facility (perhaps ~100 per year might be expected).

Recommendation 6: NAC recommends attributing Digital Object Identifiers (DOIs) to each experiment, which must be cited in publication and thesis work. This may enable publications and theses to be found more easily.

There is further explanation of use of DOIs for data on the ILL website; ISIS or ILL could help set this system up.

Industrial use

Use of MLF by industry continues to grow. The industrial user group is impressive and exemplary with 51 members, and the quantum beam analysis group using J-PARC and Spring-8 is also very strong. The NAC notes that instrument scientists can sometimes be less keen on industrial usage if papers don't result. Both ISIS and ILL 'recycle' some industrial income back to instrument scientists for beamline developments, to encourage engagement with industrial usage.

Recommendation 7: NAC recommends exploring a mechanism to enable MLF instrument scientists to benefit from industrial income through beamline developments, students or other means to positively reinforce industrial engagement.

Experiment length

MLF has world-class instruments e.g. DNA, SuperHRPD, Amateras, and now a MW source capability. There are real opportunities for J-PARC to be strongly world-leading in science outputs.

NAC noted that, despite excellent instrumentation and high source performance, the average number of days per experiment looks to be high - around 4.4, compared with 3.5 at ISIS and 2.5 at SNS.

Recommendation 8: NAC recommends that MLF consider length of beamtime allocations per experiment to ensure beamtime is being used most effectively.

MLF may wish to evaluate the instrument performance at 1MW to establish what can now be achieved experimentally within a day. However, NAC also recognises that the average experiment length may be being controlled by staffing availability, in which case MLF may wish to report on the potential gains that additional experiment support would bring.

NAC notes the plan to increase the flux on BL14 through supermirror installation; this should result in reduced allocation times for some experiments and a higher experiment throughput. NAC noted that, to support the above recommendation regarding increasing experiment throughput, additional beamline equipment may be necessary such as automated sample changers.

Domestic use of MLF

NAC noted the decrease in domestic proposals to MLF and echoes the comments from the previous IAC that this would be a concern: whilst overseas use demonstrates J-PARC's international reputation, a strong and healthy domestic user community is a requirement for projects such as the second target station. However, NAC noted that domestic use reduction was focused in particular areas – inelastic scattering being a specific case – and so targeted measures may be appropriate.

A variety of measures is being considered by MLF to address domestic use concerns. NAC comment that some method of giving additional priority to domestic proposals is entirely appropriate – for example, ensuring a given percentage of beamtime is allocated to Japanese applicants.

NAC would like to comment particularly on support for Japanese PhD students and other early career researchers (ECRs). Methods for encouraging ECRs might include:

- Priority in beamtime allocation to proposals involving a domestic student
- Development of mechanisms for cross-appointment of students between KEK/JAEA/CROSS and domestic universities.
- Continuing training events for students, perhaps including a **school** presenting neutron, muon and synchrotron radiation experiments, their complementarities, advantages and disadvantages to answer specific scientific research questions, with practicals on-site and training on proposal writing.
- A 1-day annual meeting just for PhD students can be organised relatively easily and may help students get to know each other, support each other, present their work, etc.
- Domestic internship students could participate for short periods (2 months ?) in experiments, first as observers and learning data analysis.

Recommendation 9: NAC recommends that a variety of ways is explored to encourage Japanese PhD student use of MLF.

Further methods to encourage use of neutrons by domestic researchers that have been employed at other facilities include:

- Invite non-neutron users onto proposal review panels
- Talks at Japanese universities by J-PARC staff - 'lecture tour / roadshow'
- A set of slides made available for users to use at conference talks to describe and promote neutrons / J-PARC
- Impact awards - annual award(s) to members of the community to celebrate user science and highlight the impact of MLF work.
- 'Twinning' programme - inexperienced users get to sit in on an experiment of an experienced user.
- Engage with the community to get their ideas on how to further develop the domestic programme and enlist their help to do this.
- Training to write a 'good' proposal.

> **Recommendation 10: NAC strongly recommends that MLF employs a variety of approaches to encouraging further domestic use.**

[NAC noted a variety of further statistics on the user programme that would be useful at a future meeting. These include statistics on usage of JRR-3 alongside MLF, in order to get a broader picture of the neutron user community in Japan; statistics on usage of KEK-sponsored beamlines; statistics on the Japanese institutions (universities and others) using MLF and whether this is changing over time; and some statistics on current staff levels for user support and how MLF would like to see these evolving].

8. Charge 3: Roadmap

Is the MLF roadmap attractive for the advancement of neutron science worldwide?

The NAC is pleased to see continued development of the MLF-double programme. The NAC notes that this is now an accepted programme, with momentum behind it to enable it to be further developed. Through the MLF-double programme, J-PARC has a real opportunity to continue to lead the way in MW-class neutron science through excellent instrumentation into the future. Such a programme, funded many years into the future, encourages the community to make neutrons a long-term part of their research programmes.

> **Recommendation 11: NAC recommends development of a resource plan (people requirements as well as funds) to enable MLF-Double to be taken forward well.**

NAC noted that, whilst J-PARC does have world-leading instruments, many are now over 10 years old. The MLF-Double plan could include an overall assessment of the instrument suite and whether there are obsolescence needs across the suite, building on the MLF-2030 assessment. This might include whether any instruments should be replaced.

> **Recommendation 12: NAC recommends MLF includes more world-leading instrumentation capabilities in the MLF-double program. Recommendation 2 is also relevant to this point.**

Whilst MLF-double is a strong programme to take forward, the NAC would like to see the future vision for J-PARC and MLF-Double articulated even more clearly. This could be achieved by setting out key success criteria for MLF-double – what would success look like in 5 or 10 years

(e.g. in terms of facility users, or outputs, or science in particular areas, or industrial use, or . . .). These success criteria would benefit from being linked to funders' priorities.

An overall 'vision' document for J-PARC and for the MLF-double programme could be produced, to show to key stakeholders the reasons for MLF-double and what will be achieved. This might be a formal report; it might also be an accessible, 'glossy' document. Again, this should relate to funders' priorities.

Recommendation 13: NAC recommends creation of key success criteria and an overall vision for MLF and the MLF-double programme, related to funders' priorities.

NAC looks forward to seeing ongoing progress with MLF-double in future years. In order to monitor how the programme is going, a set of milestones – high-level, perhaps a small number per year, could be created. Not only does this enable monitoring of the programme, it also enables successes to be celebrated (milestones achieved), acting as a motivator for MLF staff.

Recommendation 14: NAC recommends creation of a set of high-level milestones for the MLF-double programme.

NAC notes that other facilities (e.g. ISIS and more recently NIST) have carried out economic impact assessments of the investment in neutrons. These could be used to further justify investment in the MLF-double programme and, ultimately, the second target station. J-PARC may wish to carry out its own benefits impact assessment of MLF over the past 15 years.

The NAC recognise that a step-by-step process of engaging with the various key stakeholders is necessary. The needs of stakeholders are likely to be different.

Recommendation 15: NAC recommends creating a stakeholder plan to ensure that key messages regarding J-PARC and MLF-double are getting to key funders and lead smoothly to the plan for TS-2.

Key to the MLF-double programme is the involvement of the user community. Measures to involve the community further might be a survey focused on future community needs; development of the MLF-double science case using community experts; establishment of a user community steering or advisory group specifically for the MLF-double programme.

Recommendation 16: NAC recommends further measures to involve the community in the MLF-double programme.

NAC notes that MLF-double paves the way for the second target station (TS-2) project, and feels that this is a key element to fully exploit J-PARC capabilities and excite the community for the future. Such a long-term vision encourages early-career researchers to make neutrons a key part of the experiment programme as they can see a path to long-term investment in neutron capabilities. NAC notes that realising TS-2 may require measures to reduce power consumption within the facility, and MLF / J-PARC may wish to produce a sustainability policy as part of this.

J-PARC NAC, February 2025