Summary report

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Charge to NAC 2023

- Scientific productivity
  - Analysis of publication status appropriate?
  - Is it appropriate to use “publication productivity” to measure effectiveness of publication?
    - What is a definition of “publication rate”
- Sample environments, detectors and optical devices
  - Is there anything to add to the development currently taking place in the MLF?
  - Developments of polarization devices are adequate?
- Deuteration Lab
  - Is this an appropriate plan for a deuteration lab with limited human resources?
- Target development & maintenance
  - Are life-time of target vessels expectancies appropriate?
  - Is the maintenance plan appropriate?
  - Are the considerations currently envisaged appropriate in realizing a two-year replacement?
- Neutron Instruments & Outcomes
  - What should be done in MLF to improve equipment performance?
- Industrial Use
  - Are J-JOIN initiatives appropriate as measures to promote industrial use?

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Introductory Remarks

The Neutron Advisory Committee (NAC) thanks the participants for the detailed presentations and their helpful and open responses to the discussions and questions

NAC appreciates and thanks J-PARC staff for the clear presentations and fruitful conversations & explanations.

NAC thanks Ms Kuge for her support with the logistics and kind hospitality.

The chair thanks the NAC for their enthusiastic participation.

NAC would appreciate for future meetings receiving copies of the presentations 5 days in advance of the meeting.

NAC-2023 Committee

Jamie Schulz - ANSTO (Chair)
Yoshie Otake - RIKEN
Philip King - ISIS
Bertrand Blau - PSI
Michael Dayton - ORNL
Günter Muhrer - ESS
Christiane Alba-Simionesco - LLB (CEA/CNRS)
Sungil Park - KAERI
Taka-hisa Arima - University of Tokyo
Toyohiko Kinoshita - SPring-8

NAC-2023 Agenda

9-Feb				
9:30		Closed Session	0:30	J. Schulz
10:00	NAC2023-0	Overview of J-PARC	0:30	T. Kobayashi
10:30		Group photographing	0:10	
10:40		Break	0:15	
10:55	NAC2023-1	Overview of MLF & Charge to NAC	1:15	T. Otomo
12:10		Lunch	1:00	
13:10	NAC2023-3	Neutron Instruments & Outcomes	0:30	Y. Kawakita
13:40	NAC2023-4	Industrial Use	0:30	K. Mita
14:10	NAC2023-5	Analysis of Publication Status	0:30	J. Suzuki
14:40	NAC2023-6	Sample Environments	0:30	Y. Sakaguchi
15:10		Break	0:30	
15:40	NAC2023-9	Deuteration Lab	0:20	H. Aoki
16:00	NAC2023-2	Neutron Source	0:45	K. Haga
16:45		Closed Session	0:30	J. Schulz
17:15		Dinner		

10-Feb				
9:00		Closed Session	0:20	J. Schulz
9:20		Break	0:10	
9:30	NAC2023-7	Neutron Detectors	0:20	T. Nakamura
9:50	NAC2023-8	Polarization Devices	0:20	T. Oku & T. Nakamura
10:10	NAC2023-10	MLF2030-neutron	0:30	T. Otomo
10:40		Break	0:15	
10:55		Closed Session	1:15	J. Schulz
12:10		Lunch	1:30	
13:40		Closed Session	1:00	J. Schulz
14:40		Summary session	0:30	J. Schulz
15:10		Adjourn		
		MLF tour		
		Dinner		

General Comments

- The MLF continues to prioritise stable operations which are critical for the user program whilst increasing power in a systematic stepwise approach which has resulted in stable operations for the user community.
- The recent achievement of 800kW with an availability of >96% is commended.
- Clear that MLF has a highly competent and skilled workforce. The MLF needs to pay careful attention to an aging workforce and ensure succession plans are implemented to ensure specialist knowledge is identified, shared and not lost.
- The absence of a plan for the 2023B round is potentially damaging for users who may also seek neutrons internationally if J-PARC does not operate.
    - Recommendation: The NAC urges the MLF to engage with stakeholders to secure additional funds for the increased electricity costs and to clearly communicate the challenges to the user community.
- International demand is at approximately 40% of (overseas PI's). This is a good indication of the reputation of J-PARC.
    - Comment: The MLF may consider to have a policy on overseas usage, in case it becomes necessary to apply country balance to maintain national usage.
    - Comment: The MLF could explore the possibility of international partnerships to support non-Japanese users. Cooperation with some east (southeast)

Asian countries will likely be encouraged in near future, considering the increasing cost for constructing/operating large facilities.

- NAC notes that half of the overseas usage is from China. This is producing excellent science and this demand is likely to continue at high level until new CSNS instruments are operational.

Industry/User Fees and Budget

- Currently industry/user fees that are collected by the MLF are given to the Japanese government and are not used to supplement the MLF budget.
- The NAC understands that other Japanese research facilities, such as SPring-8, are able to keep the industry/user fees to supplement their budget.
    - Recommendation: The NAC recommends J-PARC to continue to explore with the government whether this rule could also be applied to the MLF.
- These fees could be used as a motivation for staff to undertake industry work and to use the fees for upgrading the systems or to support research activities (student scholarships, post-docs etc)
- The NAC also understands that if the results from a proposal are not published within 3 years of an experiment that the user must pay for the beamtime. This philosophy is not consistent with international best practice as per the "Group of Senior Officials (GSO) on global Research Infrastructures" of which Japan is a member (http://www.gsogri.org/)

Long-Term Planning

- In the MLF2030 presentations some of the future plans were provided.
    - Recommendation: The MLF needs to develop a strategy for the instrument suite, in advance (some instrument require 10 years to become optimal); it cannot wait for long term funding, ie MLF cannot wait for the long term funding.
    - Recommendation: An ongoing upgrade program on the instrument suite needs to be developed including detectors, sample environment. This is important in the context of the MLF2030 project and new beam lines.
    - Recommendation: This plan should be developed in consultation with all stakeholders (User community, industry partners, JAEA, KEK, CROSS, Ibaraki Prefecture etc).
    - Recommendation: The MLF should ensure that any significant plans are included in the Japanese national research infrastructure framework.

Scientific productivity

- NAC is impressed and appreciates the analysis undertaken on the MLF outputs (publications per year, per technique, per topic..) and its comparison to other facilities. The NAC appreciates the effort of MLF staff during these few years. The situation is improved very much.
- There is a continuous increase in the number of publications, up to more than 250 in 2021, with on average more than 10 papers/instrument/per year; and correlates with an increase of the number of proposals (more than 600 per year).
- Saturation of the publication rate at 40%, it increases over the years due to a better performance and is very close to what is done elsewhere. Taking their 'publication productivity' - no. papers / no. conducted proposals - then J-PARC is at about 50% (e.g. 200 pubs per year, 400 accepted proposals run per year) - this is comparable to other facilities.
- MEXT specified publication target of 200 publications/year has been achieved.
- MLF seems to be very successful in SANS experiments; which is also a type of instrument requiring the smallest number of days for an experiment; it could be a good example to look at the reasons of high publication rate.
    - Recommendation: The no. of publication for the diffractometers and spectrometers is low in comparison to other facilities although citations of each paper are not so low as the number. It should be investigated why that is.
    - Recommendation: The scientific activities of the local teams should be encouraged and support (financially with students, and with allocated time)

Sample Environments

- It is clear to the NAC that the sample environment team is progressing and increasing support across the facility.
- The NAC congratulates & appreciates the involvement of J-PARC in the International Society for Sample Environment which benefits J-PARC and other international facilities
- Staffing within the SE team is 14 with a reported person effort of 7 FTE. This effort is comparable to other facilities.
- The NAC understands that details of SE equipment is available on the Japanese version of the MLF website.
    - Recommendation: It would be ideal for this information to be available on the English version for international users.

    - Recommendation: The MLF should develop a 5-10 year roadmap for future developments. Inputs to this plan could include user requests, aging existing equipment, trends at other facilities, Japan research priorities & grand challenges etc. These plans may be in different areas, e.g. one for high fields, one for ULT, one for pressure, etc.

- There appears to be limited facilities for gas-handling, for example for catalysis or in-situ H-loading. This maybe OK if there are no aspirations in this area.
- Trends at other facilities include implementation of in-situ simultaneous experiments (eg neutrons + other spectroscopies, Raman, dielectric or NMR; DLS)
- It was difficult for the NAC to determine what is missing since, besides for magnets, very little details were presented.
    - Recommendation: For the next meeting it would be helpful to have a list of sample environments ahead of the meeting.

Detectors and Optical Devices

- The NAC acknowledges the great progress made with detectors, supermirrors & 3He Polarisation systems.
- The NAC supports the J-PARC philosophy to only develop devices that are not available from commercial suppliers.
- The NAC notes the successful development/implementation of the following items:
    - ^{3}He MWPC detector development
    - Impressive scintillation detector - 4 x size increase over the previous generation with verified performance
    - 2nd elliptic focusing supermirror on BL17 with gain factor > 20x
    - Innovative capability developed large polarising supermirror development m > 5.
    - ^{3}He polarisation now fully deployed on 7 instruments (3 more than last year) for user experiments
    - Utilisation of partnerships with Universities for development - supermirror & 3He polarisation
- Recommendation: NAC recommends that a detector development plan for all BL including planned renewal and upgrades is prepared. This will assist in prioritisation, budgeting and resourcing

- It was clearly demonstrated to the NAC that J-PARC is a world leading development of supermirrors. Next phase should be work with BL's to implement on beamlines according to their required specifications (eg m=5 may not be needed in some cases).

Deuteration Laboratories

- Currently 8 staff members contribute to the deuteration labs with a total effort of 1.5 FTE. One staff member is working 100% for the deuteration lab with the remaining 0.5 FTE is contributed by the other 7 staff. This is a very challenging situation.
- To effectively provide user services and additional 2-3 additional FTE would be required. The specialisation of the additional staff should aligned with the needs of the user community
- The 'chemical' deuteration part is working very well and highly productive in critical systems such as ionic liquids essential for many applications. The 'biological' aspect is also proposed but everything cannot be performed on site.
- The lab is collaborating with many university labs and actively involved with the community (workshops and conferences) and is part of the DEUNET network in Europe. NAC encourages them to continue and increase these collaborations by welcoming users, students, and exchanging methodologies and equipment.
- The D-lab is well equipped with good characterisation instruments (400 MHz NMR, Mass spectrometer, etc.) and whole set for synthesis. Be careful with its maintenance which also requires personnel. So far there are no proposal calls for users, only collaborative activities.

Neutron Target Development & Maintenance

Are life-time of target vessels expectancies appropriate? **Yes**

- The countermeasures against pitting damage, especially the effect of the He-bubbler, appear to be appropriate even at this record-high beam power level.
- Further improvement of the bubbler location and the new split arrangement appear to be a promising improvement for the new targets starting with target #15.
- PIE results from target #15 will be critical to give experimental evidence for the impact of this design change and to inform target operational parameters.

Is the maintenance plan appropriate? **Yes**

- The new countermeasures against tritium release during target exchange look promising, however, it seems predictable that the created total amount of tritium will increase with higher beam power and longer operation periods.
- MLF has decided to postpone the replacement of the moderator-reflector assembly by one year to 2024 to have the opportunity for an additional, improved rehearsal and to refine the replacement operation.

Are the considerations currently envisaged appropriate in realizing a two-year replacement? **Yes, but**:

- Recommendation: Attempts should be made to quantify the uncertainties in the cavitation erosion rates as beam power increases to mitigate risk in extended replacement intervals.
- MLF has shown convincing evidence that pitting and radiation damages should stay at an acceptable level for extended operation times of 7632 hrs.
- Recommendation: In order to minimise the risk of a premature target failure (and the associated impact on available user time) during operation of target #16, the NAC recommends to consider at least one intermediate step in between by either reducing the total operating period and/or by limiting the maximum proton power to significantly lower levels.

Neutron Instruments & Outcomes

- High-impact research outputs have been produced. It is noticeable that most of the high impact publications arise through international collaboration.
    - Recommendation: There are ideas for new instruments. The NAC would like to see the process for prioritising these, and development of the mechanisms for community engagement as part of this.
    - Recommendation: Continuous monitoring of the demand trend for each instrument is necessary to make a good plan of instrument restructuring.
- The NAC are pleased to see a wide range of instrument upgrade plans. It is very good to know that the commissioning of spin-polarized spectroscopy has started in BL23.
    - Recommendation: The NAC recommends the maximising and completion of detector coverage on BL23. This has the potential to reduce beamtime allocations per experiment allowing more proposals to be run.
    - Recommendation: Efforts should also continue to reduce instrument background on BL23 and to increase the signal to noise ratio.

- Active support for data analysis by beamline scientists should be considered to improve the productivity.
    - Recommendation: To further improve productivity, the facility should consider hiring dedicated professional software engineers to develop easier to use computing/data analysis environment.
- Data storage, Remote access, online data analysis etc are important to assist in increasing the scientific productivity of MLF.
    - Recommendation: The NAC recommends that MLF should seek to continue with the “Data handling infrastructure” project.

Industrial Use

J-Joint Office for Innovation (J-JOIN)

- The NAC congratulates the launch of J-JOIN to explore new users (13 contacts in 2022)
- J-JOIN initiative has the opportunity to attract more users, by highlighting on-going ‘hot’ topics, in medicine and quantum materials
- It might also be very helpful if the experts involved actively seek out industry relevant to the national initiatives and try to lure them into using the facility.
- It might be helpful to keep track of the human resource effort put into the program and the users it generates to assess the viability of the initiative.

Industrial Users Society for Neutron Application (IUSNA)

- The NAC is impressed with the Industrial Users Society for Neutron Application (IUSNA) that is coordinated by CROSS and has an industry chaired with a good number of industries are represented. The NAC is not aware of a similar industrial users group being formed in other countries or for other facilities.
- While companies tend to be secretive about their R&D, the openness shown by IUSNA is very impressive. For the facility, it will be useful to listen to industry leaders/users at such meetings, and make a list of items to improve at the facility.

Statistics

- Industrial links through academic proposals can be significant.
    - Recommendation: The NAC suggest J-PARC captures industrial links within general (academic) proposals through adding questions to the proposal system.

- The statistics on the industrial users is dominated by one beamline (BL20), which is dedicated to industrial users.
    - Recommendation: To be able to understand the other beamlines better one should look at the data without BL20. This will allow for a better comparison to other facilities.

Methods to boost industrial use

    - Recommendation: To encourage industrial use, J-PARC should ensure instrument scientists see the benefit of industrial work and are incentivised to do industrial work (as publication rates may be lower for industrial work).

- The success at BL20 may be replicated at other beamlines with potential industrial use, though there might be differences in applications and overall usage by industry. It might be a good idea to make a long term plan for such beamlines to match the level of staffing, automation, and support at BL20.