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Charge to NAC 2021

- Review our efforts to strengthen the facility
  - How to keep a balance between neutron target maintenance/upgrades and user program
- Evaluate the appropriateness of the science promotion efforts
  - Outcomes
  - Industrial use
  - Instrument upgrades
  - Device and detector developments
- Any suggestions on the user program under COVID-19 (we want to hear NAC members experience)
  - Ensuring safety and continuing user program
  - Problems of mail-in service and possible solutions
  - Safety regulation for remote access experiment
- Review our efforts to develop “business model” in MLF suitable to 1MW facility.
- Any suggestions for improvements are appreciated. Our particular concerns include but not limited to the followings:
  - Strengthening of collaboration with universities and research institutions
  - Improving paper production rate
  - Promotion of industrial use
  - Human resource development

General comments

The committee thanks MLF for the organisation of the meeting, the presentations, the answers to the many questions and the discussion. This has worked well. Those of us in European time zones thank everyone else for bearing with the early/late hours. But we look forward to the return of 'life as normal' when we can all meet together in person!

We extend our welcome to the renewed MLF management team and our thanks to Naohito Saito who will end his term as J-PARC Director at the end of March 2021. We wish him all the best in his future endeavours.

The NAC congratulate MLF for handling experiments during COVID-19, continuing upgrades of the instruments and developing new projects, and the MLF2030 plans for the future.

Target development and accelerator ramp up are extremely systematic. This has resulted in 3 years of stable user operation with steadily improving performance. Excellent work.

Instrument upgrades continue to be innovative and to push the development of new technologies. This has always been a strength of MLF.

Only 13 operating days lost so far during the COVID pandemic, and 47 days limited use, is a remarkable achievement. This must have required considerable dedication from staff at all levels.

There is strong evidence of user demand, including from industry. However, unique user numbers are high (~50 per beamline per year) and the proportion of new users is also high (~60%), which must put a lot of strain on staff. The average number of publications per beamline per year is steadily increasing but the level could still be improved. A more detailed understanding ('map') of the user community is needed, together with an analysis of which experiments do not lead to visible outcomes (e.g. publications).

Review our efforts to strengthen the facility

– How to keep a balance between neutron target maintenance/upgrades and user program

The committee would like commend J-PARC and the MLF on their recent demonstration of stable beam operation at 600kW with 93% availability. This stable operation looks very promising for the planned power increase to 700 kW this year and then up to 1MW. A successful test of 1MW for 1.5 days indicates systems are capable of performing at this beam power and gives even more confidence.

As the measured beam window damage depth found in PIE of target #11 is significantly smaller than predicted, the constraint-free target design can be regarded as being very promising and should give enhanced confidence that the target team is on the right track with this design. The envisaged power ramp-up schedule to the design goal of 1MW operation, as presented in the updated target management and operation plan, appears quite realistic.

Management of the spare targets should be integrated in the overall target management plan as problems with the connections of target #13 have shown that having spare targets at hand is critical to mitigating the impacts of unexpected delays.

The sound measurement diagnostic system seems to be working well and providing information that correlates well with PIE results. However, it is not clear to the committee how effectively the sound measurement diagnostics can be compared across different target designs. Additionally, re-establishment of the LDV system is encouraged to provide correlation.

Target disassembly as a means to reduce storage volume is a good solution to reduce the storage constraints given by the restricted space available in the RAM building. It is suggested that a risk/benefit analysis be performed to investigate the obvious advantages of the target disassembly with the additional risks incurred by changing the design.

The strategy of the proposed countermeasures in the event of recurrent needle valve clogging of the helium bubbler is still not clear to the committee. It seems there is some operational risk due to not fully understanding the issue and operating in the mode of relying on the bypass valves.

It was unfortunate that the cooling pipe misalignment resulted in a delay during target replacement. It is recommended that an “extent of condition” review also be performed on the other target interfaces that may require better control and inspection during fabrication.

The tritium release issue still seems to persist and this is a risk. It is not clear to the committee which of the countermeasures have been effective, as the tritium release in the non-irradiated target #13 exceeded all but one of the previous targets. Further

investigation may be required to fully understand the sources of the tritium and the mechanisms for its release.

It is concerning that operation above 600 kW may be constrained by the ability to provide adequate cooling to the RF/RCS systems during certain conditions of high ambient temperatures and humidity. This constraint has the potential to impact planned power increases to 700 kW and beyond.

For the target lifetime extension plan, careful risk assessment including possible new fatigue issues is required to ensure its usefulness.

Evaluate the appropriateness of the science promotion efforts

- Outcomes
- Industrial use
- Instrument upgrades
- Device and detector developments

Industrial use at an average 25% seems quite high. However, the statistics are not easy to understand because they are dominated by a single beamline, iMateria. The committee would recommend that the iMateria statistics are separated.

Where there is a concern about industry users 'not returning' we recommend to ask them directly – why not?

The industry-university-MLF (functional polymer) consortium seems to be a promising approach. The formal structure of the consortium (we assume there is a contract/agreement since funding is provided), and the dedicated additional effort are probably helpful in providing some structure and pressure to produce timely outputs. The committee would recommend to extend this approach to other consortia, both with and without industry involvement.

Any suggestions on the user program under COVID-19 (we want to hear NAC members experience)

- Ensuring safety and continuing user program
- Problems of mail-in service and possible solutions
- Safety regulation for remote access experiment

The NAC recommends that MLF clearly define different types of 'remote' access:

- Mail-in: users mail samples and instrument scientists undertake short well defined measurements for users, e.g. powder diffraction in standard sample environment
- Remote access: users mail samples, instrument scientists mount/load samples and users may be able to view the experiment and data
- Remote control: users mail samples, instrument scientists mount/load samples and users are able to view the experiment and data and remotely control some aspects of the experiment.

Many neutron scattering facilities have been running Mail-in measurements for some years. Requests are normally approved quickly, outside of the usual proposal mechanism.

Many facilities have transitioned to Mail-in or Remote access experiments during COVID.

Remote control has been implemented in most facilities for instrument scientists but is not normally available for users due to local safety and/or cyber security rules. However, some facilities have enabled limited remote control for some users/instruments during COVID.

MLF are commended for ensuring that users have also been able to undertake experiments via a Mail-in/remote access program during COVID. While COVID restrictions continue, and the response is necessarily reactive, some beam time will inevitably be lost and experiments that cannot be undertaken remotely cannot be indefinitely postponed. Users should be asked about any constraints when their experiment is approved.

For the future MLF should seek to understand the needs/wishes of the user community with regards to mail-in and remote experiments. An efficient Mail-in programme should be able to meet some of the user needs.

However, MLF should consider the long-term potential impacts of a high proportion of remote experiments:

- Excessive workload on staff
- Difficult for complex experiments or on site sample preparation
- Not training users or developing their technical skills
- Loss of user community & relationship building between facility staff and users

If a larger proportion of the user community are not visiting MLF then they need to be kept engaged, e.g. through regular communication, e-training, webinars etc.

Some more detailed considerations for Mail-in/Remote experiments are:

- Sample transportation. There needs to be good clear guidance for users and a policy on mailing/importation costs.
- Sample preparation for experiments. Loading and unloading from cells/cans and mailing back to users. Consider additional support for high throughput experiments, e.g. having a dedicated person (e.g. a Laboratory Technician) to streamline the process and minimise the workload on instrument scientists.
- Instrument configuration and sample environment. Consider sample changers/automation for high throughput experiments.
- User involvement during an experiment requires good communication between user and instrument scientist, and ideally the ability for users to remotely view/analyse data being collected.
- Reduction of data and provision to user means an additional workload for instrument scientists. Consider automated/online data reduction, which would also be of use in non-COVID times.

Any suggestions for improvements are appreciated. Our particular concerns include but not limited to the followings:

- Strengthening of collaboration with universities and research institutions
- Improving paper production rate
- Promotion of industrial use
- Human resource development

A better understanding of the 'dynamics' of the user community should help to target efforts aimed at improving outcomes. As noted, the annual turnover of users seems quite high. The NAC recommends creating a 'user map', e.g. of top user institutions, groups, PIs, new users/groups etc. This should be updated each year.

Journal publications are now about 7 per beamline per year and gradually improving. But MLF should probably be aiming for twice this number. We recommend a detailed analysis as to why experiments do not lead to outcomes. e.g. Unsuccessful experiment? Needs more time/data? Data not analysed? Paper not written? This may well differ between beamlines.

To develop staff and promote scientific collaboration, it is important that MLF staff can develop active links with a University, for example through some form of position. It is therefore important that MLF encourages this type of activity. Furthermore joint supervision of thesis students can lead to good outcomes for MLF – eg community engagement, publication outcomes, staff satisfaction.

With an increased proportion of staff working from home it is important to maintain the communication between them and staff working on site.