The KENS Science Advisory Committee (November 2022)

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Executive Summary

From its inception in late 1970's, KENS has played its role of promoting academic research by using neutron scattering instruments in an exemplary manner. Since moving its operational base to J-PARC MLF from its former Tsukuba site, KENS has constructed world-class instruments with a clever strategy specializing in cross-correlations in material science. It is facing unprecedented challenges, however, due to the large size of the operation, such as providing full-time user service while conducting in-house research at one of the world's flagship neutron research facilities. As pointed out in previous advisory meetings, the number of personnel at such a facility required to operate at full capacity is much higher (up to 6~8 per instrument) than the intermediate neutron flux facility KENS which used to operate in Tsukuba. However, the number of staff is not increasing over the past few years even though the instruments are nearing completion and the neutron source is now close to its promised peak performance. We urge all stakeholders to work together in drafting a long-term plan and acquiring funding to staff the instruments at an adequate level with all means necessary including international cooperation and increased collaboration with domestic universities. Also, we encourage policies to be refined to give stability to S-type projects, which are essential in fulfilling the primary mission of promoting academic development of neutron science.

1. How does the KENS-SAC evaluate the validity of the philosophy of the choice of the KENS instruments?

The philosophy of pushing the limits of neutron scattering to the extreme is perfectly in line with the mandate given to KENS, i.e., promoting academic research at universities. While the neutron flux is on-par with the best instruments at other flagship facilities, KENS instruments are specialized so as to provide unique measurement capabilities to their users. Meanwhile the instruments complement each other in a reasonable way covering most of what neutron

scattering can provide to material science.

While the number of KENS instruments is too small to allow a complete coverage of all instrument methods, we believe that the choices made to complement the JAEA and CROSS instruments results in an excellent overall instrument suite that provides users with the full set of neutron capabilities to be expected at a world-class facility such as the J-PARC MLF. Especially because KENS is pursuing academic excellence, giving priority on one set of science – cross-correlations in material science – and aligning instruments to that science is highly commendable.

2. How does the KENS-SAC evaluate the uniqueness of the performance of the KENS instruments in the MLF and in the world?

Thanks to the philosophy behind the choice of the instruments as mentioned previously, the eight KENS instruments at J-PARC MLF have unique measurement capabilities with great performances which are generally on-par with the best instruments in the world, and occasionally world-leading.

However, some aspects of the instruments still need to be completed. For example, POLANO has yet to complete development of its polarization techniques. Projects are being pursued in several flagship neutron facilities to implement similar capabilities on existing or new instruments. This is an area in which KENS can take international leadership in the field if acted on with sufficient urgency. There also remain opportunities to complete detector coverage on some instruments, as well as providing a broader range of sample environment equipment to support the widest possible range of science applications.

3. Is KENS moving in the right direction? Are the future development items adequate?

KENS has done a great job so far in constructing carefully chosen instruments with great potential, and is already one of the world's most prominent neutron scattering groups in the world as of now. Traditionally KENS excelled in

instrumentation, and the current plans to develop neutron devices and update instruments will make sure the instruments remain competitive for the foreseeable future.

Because of its small group size, however, maintaining its reputation might become challenging in the future. With rising technical complexity in big neutron facilities, the critical mass of a group to remain in leadership is much higher than the current number KENS possesses. To move forward, therefore, it requires more staff and funding – we will elaborate on it in the next section.

4. Any other comments for KENS?

KENS needs to increase its staff to pursue world-class science with its world-class instruments that are being perfected and to accommodate a lot more users as the neutron flux nears its designed peak value. KENS is in a difficult position because of the government's drive to reduce the number of professors in Japanese universities. Lack of human resources is the key bottleneck to reaching the optimal level of scientific throughput from the very expensive neutron scattering instruments. While staff deficit is evident at many levels, the lack of researchers as shown by vacancies in the group structure table and the relatively small number of engineering and technical staff are particularly pronounced. Therefore, we strongly urge all stakeholders working together to draft plans and acquire funding if necessary to staff the instruments at least to the point where the number is on par with other world-class instruments such as at SNS in USA or ISIS in UK.

While increasing KENS staff is the first priority, to further increase output from KENS, along with increased collaboration with domestic universities, international cooperation with regional partners should be pursued in coordination with other stakeholders such as JAEA. KENS is well-equipped to play the role of one of the world's flagship neutron scattering facilities with its powerful neutron source and instruments and well-respected scientists in the scientific community. By attracting talents and resources from regional partners and users from all over the world as well as from domestic universities, KENS will surely be able to help J-PARC MLF to achieve its promised goal of becoming a true world leader in neutron scattering. However, this type of international

cooperation that resembles the Japan-UK program cannot be burdened to KENS staff alone, and coordinated efforts among stakeholders are necessary.

While many strategies adopted by KENS are commendable, the beamtime policy could align better with the organization's primary goal. Currently, S-type projects have to give up beamtime once the general user competition reaches two to one. This policy will increase uncertainty about the beamtime of S-type projects, which is the crux of KENS's academic research. Therefore, KENS should consider awarding a fixed ratio of beamtime to S-type projects. We suggest that instead of imposing a fixed limit to competition, regular review of the effectiveness of beamtime is a better tool to determine the proportion of beamtime between S-type projects and the general users.