

Report by the subcommittee on condensed matter.

The committee consisted of:

Prof. Jun'ichiro Mizuki (Chair /Japan Atomic Energy Agency)

Prof. Masaki Takata (RIKEN/JASRI)

Prof. Katsuya Shimizu (Osaka University)

Dr. John Hill (BNL)

Prof. Robert Feidenhans'l (University of Copenhagen)

Dr. Yanbin Wang (University of Chicago)

John Hill was unfortunately not able to attend the meeting.

The group met at the Photon Factory March 1-2 2011, see the attached schedule. The committee was in general very pleased with the presentations, and the material provided and the assistance during the meeting. The committee was impressed by the amount and impact of the work performed in the condensed matter group, in particular in the correlated electron systems and extreme condition areas. The presentations reflect a high level of activity with many user groups. The condensed matter group has a high reputation with an international competitive standing in the areas of correlated electron systems and extreme conditions. This is for instance reflected in the many high-impact publications.

The competitiveness of the condensed matter group critically depends on access to high quality x-ray beams and corresponding instrumentation at the research frontier. The high international standing of the group can only be maintained if this access also can be assured in the coming decade. The committee notes that the Photon Factory is a second-generation synchrotron radiation facility which cannot compete with third generation sources in terms of source qualities like emittance or brilliance. The committee heard a briefly presentation of the future plans for a compact Energy Recovery Linac (ERL) to be commissioned in 2013 and possible plans for starting construction of a larger energy ERL in the 3-5 GeV energy range about 2015. The committee would like to encourage the KEK management to continue to support such plans. An international facility like the Photon Factory needs to have such plans secured

on a roadmap in order to stay competitive and attractive for top scientists and top users groups in a time where many other second and third generation sources are being upgraded and refurbished like APS, SSRL, ESRF or PETRA III. In the coming decade when no new drastic source improvements can be expected at the Photon Factory the KEK management is encouraged to secure stable operations of the Photon Factory and in addition put stronger efforts on the instrumentation development program at the beamlines. Other facilities like the SLS have shown that a strong detector developments program with 2D dimensional detectors can make as big an impact as large as source improvements. We strongly suggest that such an instrumentation development route is taken at the Photon Factory in the period where no new sources are to be expected to come into user operation in the next 5 years. This will assure keeping the best users groups at the Photon Factory.

Concerning the more detailed questions to the Condensed Matter Subcommittee:

Question 1 Are the scope and strategies of the Condensed Matter Group suitable in the domestic and international contexts of SR research?

The condensed matter group focuses clearly on two issues (i) correlated electron systems and (ii) extreme conditions. The committee finds this focus excellent. The group should focus on a few key areas and do it well – exactly as it does. This strategy will attract the best user groups from the universities as also was demonstrated by the highlight talks. The strategy requires the beamline staff to have a strong scientific profile and a strong in-house research program. This is the case at the moment, but the committee is concerned whether this will be the case in the future as the number of the beamline staff is below the critical level of sustainable user support team, as will be discussed below. Another issue is burn out of the beamline scientists due to under staffing (see below). This will clearly also effect the scientific program of the beamlines.

The group has a high output of publications with many high impact publications in Nature and PRL etc. The strongly correlated electron system work is of very high quality. The work on resonant soft x-ray work should be emphasized and is very well

suiting to the Photon Factory. This type of science also fits well to the science on correlated electron systems. The committee also notes very good collaboration with theory groups at universities.

The committee finds the new Mössbauer measurements on beamline NE1A exciting, this is the first time such experiments are performed in a multi anvil cell. The committee also notes that the deformation experiments are very promising although they were not explicitly mentioned in the presentations.

Question 2 The beamline (BL) instrumentation and user operation

(A) Are the scope and strategies of BL instrumentation developments satisfactory?

(B) Staffing issues: Is the level of user support sufficient?

A: The scope of the BL instrumentation developments is satisfactory, but more emphasis should be put on 2D detectors and the corresponding data handling and data storage. We are informed that KEK has a strong detector group and we would very much like to encourage more and closer collaborations between the Photon Factory and the KEK detector. This could be of great benefit for both parties as it is witnessed at other facilities like DESY or PSI. The committee also notes the high number of beamlines compared to the low number of staff. As the staffing cannot be expected to increase, decommissioning of old beamlines should be accelerated in order to free funding for upgrading remaining beamlines and give better service to the users. The committee urges the management to focus on quality rather than quantity. Another strategy would be to bring in strong user groups that would develop instrumentation. One such an example is the deformation experiment, which is brought in by an external user group to enhance the capabilities of the beamline NE-7A.

B: Staffing. We are very concerned with the staffing. It is well below the average and might hurt the competitive edge of the PF. We are wondering whether there is sufficient staffing to help new user groups get started. We note that there were 25% new PIs in every proposal round. This is very healthy, but will not last in the future if the new user groups will not receive sufficient support. Synchrotron radiation users of today go for service not necessarily only the best beam. The focus of the user support should be to

think all the way from the source to the science including the necessary user support in instrumentation, data handling and data analysis, which requires sufficient staffing. Reducing the numbers of beamlines would help the staffing issue. A particularly bad example was the high pressure group, where apparently one beamline scientist manages 3-4 beamlines. This is a place where new young scientific talent is required to further develop the field.

Question 3 Assessment of science outputs from users (including the level and impacts of the scientific presentations)

The scientific output from the beamlines organized by the CM group is excellent. We are very impressed by the number of high impact publications. Judging from the number of accepted proposals there is a healthy number of active user groups on most beamlines.

Question 4 External grants: is the future secure? Should we seek applied research projects or an industrial use?

Funding outlook is rather dark because the budget heavily depends on external funding, which will terminate in three years. Therefore the CM group and the PF are urged actively to look for possibilities of large external grants to secure future funding, and the best way seems to encourage collaboration with universities. Beamline scientists are encouraged to submit own research proposals to relevant funding agencies.

Since the field which the CM group focuses on is very basic science oriented, it would be hard to attract industry. The committee therefore recommends that no special effort to attract industry should be made. The manpower should rather be put in supporting the academic users.

Question 5 Is the cooperation between the Condensed Matter Group and research groups in other organizations satisfactory?

There exist many collaborative projects between the PF and University of Tokyo,

University of Tsukuba, NIMS and AIST. The committee is especially pleased to see collaboration with theorists.

Question 6 Future prospects

(A) Complementary use of X-ray and Soft X-ray in resonant scattering experiments

(B) Future plans of BL-3A, BL-4C, BL-8A, BL-8B, AR-NE1A

(C) Decommission plans of some beamlines

Regarding beamlines 10A and 4B1, we encourage the management to proceed with the decommissioning plans and accelerate them. Research activities at beamline 10A can be moved to single crystal beamlines 8A or 8B without major problems. This would close one beamline (10A) while keeping the user community it attracts. Beamline 4B1 is a bending magnet beamline which has a small user community with limited publication outputs. We suggest that management initiate discussion with the beamline 4B1 user groups to see whether the experiments could be accommodated on other beamlines or other facilities. Both high photon energies and use of micro beams employed at 4B1 are not well suited to PF bending magnet, where the brilliance is too low.

Beamlines 3A and 4C are doing very well, with many high impact publications.

Beamlines 8A and 8B are good working beamlines with similar capabilities. However, 8A seems to have fewer active proposals and a lower publications rate than 8B. New collaborations with universities should be exploited to attract new user groups. For instance, beamline 8A could be marketed better by emphasizing time-resolved x-ray scattering in the msec regime, as the management plan suggested.

AR-NE1A is a high-pressure beamline, with laser heated diamond-anvil cell, including Mössbauer capabilities. The Mössbauer experiments in the mini DIA multianvil cell is a pioneering work and is strongly encouraged. The optics of the beamline seems rather temporary and reflects the difficult funding situation of PF. We strongly support combining Mössbauer, EXAFS, and diffraction experiments in the same station.

General comments:

We saw good evidence of collaboration between x-ray and neutrons.

We would like to encourage more organic collaboration between the groups, for instance at the PF between the Electronic Structure group and the Condensed Matter group. Such collaborations were not mentioned in the presentations.