From: STFC Physical Sciences and Engineering Advisory Panel

To: STFC Science Board

Cc: Dr Jennifer Scratcher, STFC Secretariat

Date: Wednesday 3rd February 2016

Issues arising from analysis of Physical Sciences and Engineering Advisory Panel 2015 consultation exercise

1. Introduction

Details concerning the Physical Sciences and Engineering Advisory Panel (PS&EAP) 2015 consultation exercise are outlined in the document "Feedback from Physical Sciences and Engineering Advisory Panel 2015 consultation exercise" (February 2016). As described in that document, upon analysing and discussing topics raised in the survey of Central Facility users active in the areas of Physical Sciences and Engineering, the AP judged the following four distinct topics to be worthy of further scrutiny.

- Concerns over sustained operational capability of ISIS and the ILL;
- Deficiencies of Diamond's provision for researchers in the Physical Sciences;
- An understated role for engineering related research within the STFC portfolio of CFs;
- Current opportunities connected to high power laser systems.

This short briefing document is intended to inform Science Board of the PS&EAP perspective on the four highlighted issues and to request guidance as to whether the AP should follow up on particular aspects of the topics selected.

2.1 Concerns over sustained operational capability of ISIS and the ILL

Real concern was raised on the future operational capability for UK researchers engaged in neutron and muon based research. Both ISIS and ILL are deemed to be world-class facilities that provide the UK research community with unrivalled access to unique neutron scattering facilities. This situation, which has been extant for 20+ years, has enabled the UK to initiate and lead advances in fundamental and applied science. This scenario is the envy of the world. Nevertheless, against this background, as several reports from this AP have illustrated, the sustainability of this most desirable position is somewhat uncertain.

The PS&EAP were pleased to hear that STFC are soon to construct a UK Neutron Strategy; this seems long overdue. On this basis, the PS&EAP felt it did not need to engage directly on this topic at this

time. However, it looked forward to being able to assist SB to evaluate the viability and feasibility of the intended Neutron Strategy as it evolves.

2.2 Deficiencies of Diamond's provision for researchers in the Physical Sciences

Acting as an Expert Panel, the PS&EAP discussed the evaluation feedback from the Photon Sources sub-section of the consultation exercise. In discussion, the following statement was made: "Whereas Diamond is judged to have been a demonstrable success by the Life Sciences research community, up to now, it has not served well the Physical Sciences research community". On discussion within the AP, concern was expressed that the development of capability in certain areas of physical science-related research has been slow, with certain beamlines under-performing in comparison to synchrotron sources throughout Europe and beyond. For example, in certain areas (unspecified), Diamond was deemed to provide a second class experience for users when compared to that accessible at the ESRF. In the recognition that, to a degree, the PS&EAP have a role as the 'eyes and ears' of SB, it was decided to bring these comments to the attention of the parent body. The PS&EAP acknowledge that further investigation is required to justify the validity of these cautionary statements.

2.3 An understated role for engineering related research within the STFC portfolio of CFs

Engineering research inherently has strong *impact* credentials and therefore engineering applications undertaken at CFs provide good opportunities for *knowledge exchange* and *economic impact* that could potentially heighten STFC's credentials within RCUK and BIS. However, in discussion, it was felt that engineering initiatives at the various CFs were under-stated and the AP wondered whether it was opportune to explore further initiatives in this general research area. For example, do particle physics and astronomy have higher status within STFC planning than engineering concerns? Possibly; and the latter grouping is clearly more directly connected to everyday experience. Perhaps it is time to review the status of present engineering research capability and, from there, review future high impact initiatives that could be explored? Industry could be consulted at various stages of such a review. To this end, the PS&EAP could set up a suitably selected sub-committee to review the current predicament.

2.4 Current opportunities connected to high power laser systems

On discussion, it was agreed that development in laser science at the Central Laser Facilities has fallen behind in recent years. From being far and away the leading high power laser facility in the world, the Gemini and Vulcan laser facilities at the Central Laser Facility are now in the process of

being surpassed by numerous facilities around the world, including laser labs in Germany, France, Korea, Japan and China.

An interesting proposal that has recently been funded is the EU 2020 infrastructure development project EuPRAXIA. This is a design project for a laser based accelerator facility. Operating at 5 GeV, the facility would be significantly more compact, and thus cheaper than corresponding light source facilities, since it is based on laser driven acceleration. Though requiring of major developments - laser based accelerators have operated only briefly up to a maximum energy of 4 GeV to date - a successful design could be used in both particle physics applications and, potentially, to drive a next generation free-electron laser. Again, based on the plasma acceleration techniques, it would allow a VUV/x-ray FEL to be produced at a greatly reduced cost - present estimates for a EuPRAXIA FEL are about €100m for the whole facility.

The location of EuPRAXIA has yet to be determined; indeed one of the tasks of the design study is to identify suitable locations. As a world leader in the field of plasma accelerators, the UK is well positioned to offer a site for EuPRAXIA, and a UK consortium has been initiated to investigate this. The development required for EuPRAXIA would allow a new large-scale laser to be built in the UK based on the latest technology, much of which has also been developed in the UK (such as DIPOLE).

3. Future actions?

The PS&EAP seeks guidance from SB as to whether it should set up a sub-committee (or sub-committees) to further examine one (or more) of the four highlighted topics. A sub-committee would report to the PS&EAP, who would ultimately report to SB. The composition of any sub-committee would reflect the topic under consideration. As presently composed, the PS&EAP has the depth and breadth to cover most topics within the domain of Physical Sciences and Engineering research conducted at CFs.

The PS&EAP acknowledge that SB may judge these topics not to be suitable for further investigation at this time. This approach to SB by the PS&EAP was instigated in the spirit of the AP communicating with its parent body and contributing ideas that may be relevant to matters currently in front of SB.

Chair: Professor David Lennon – Glasgow University
Dr Howard Stone (Deputy Chair) - University of Cambridge
Mr Colin Danson - AWE (Aldermaston, Reading)
Prof Mike Fitzpatrick - University of Coventry
Prof Konstantin Kamenev - University of Edinburgh
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Prof Paul McMillan - University College London
Prof Andrew Orr-Ewing - University of Bristol
Prof Paolo Radaelli - University of Oxford

D. Lennon (3rd February 2016).