

Executive summary

The Science and Technology Facilities Council (STFC) has concluded its latest Programmatic Review and announced a three-year £1.906bn investment programme which keeps the UK at the forefront of scientific excellence.

Programmatic Reviews are valuable exercises undertaken every two years to allow STFC to refresh its science strategy and identify new research priorities and strategic investments.

STFC's programme was endorsed by Science Board on 22-23 May 2008 and approved by STFC Council at its meeting at the Daresbury Laboratory on 1 July 2008. Full details of the programme are contained below.

The Programmatic Review involved a detailed consultation overseen by STFC's Science Board and its advisory panels: Particle Physics, Astronomy and Nuclear (PPAN) and Physical and Life Sciences (PALS). Ten independent specialist panels assessed input from the wider scientific community during a consultation which received more than 1,400 responses from the UK and abroad.

The programme covers exploitation of existing facilities and new initiatives. It does not exclude further projects which may arise during the next two years.

All projects reviewed were judged as having considerable scientific merit. However, support for some existing projects must inevitably be withdrawn to create space for new activities, which are essential if the UK is to retain its long-term scientific competitiveness.

STFC's funded programme is ambitious, scientifically sound and makes excellent use of the resources available.

The funding includes support to universities and research facilities for fundamental science and technology development in nuclear physics, particle physics, neutrino science, neutron scattering, lasers and light sources, space exploration and astronomy.

Highlights include support for UK participation in major new astronomy projects such as the Square Kilometre Array radio telescope and the European Extremely Large Telescope, and in the provision of cutting edge instrumentation such as the SCUBA 2 camera for the James Clerk Maxwell Telescope in Hawaii. STFC will support the forthcoming experiments at the Large Hadron Collider at CERN, take a leading role in the T2K neutrino physics project in Japan, and participate in the AGATA nuclear physics project and the FAIR nuclear physics facility in Germany.

A new programme of advanced detector research and development will safeguard UK expertise in this key strategic area. STFC are carrying out searches for gravitational waves and a broad programme of space science and exploration projects including determining whether life ever developed on Mars.

At the STFC's Rutherford Appleton Laboratory (RAL) in Oxfordshire, the new ULTRA laser will enable UK scientists to monitor biological processes with unprecedented precision. The new second target station at the ISIS neutron facility at RAL is expanding the study of materials at the atomic level into the new research areas of bioscience and soft matter. At the adjacent Diamond Light Source new beam lines will enable researchers to harness a light 10 billion times brighter than the Sun to map atomic and molecular structures.

At the Daresbury Laboratory in Cheshire, STFC will operate the ALICE accelerator facility (formerly the Energy Recovery Linac Prototype). The EMMA project will make use of ALICE to establish the prospects for a new cancer treatment technology. ALICE forms part of STFC's accelerator science and technology programme, which also involves the MICE experiment at RAL and support for the Cockcroft and John Adams Institutes.

STFC will exploit its subscriptions to ESO, ESA and CERN. It will continue to invest in and upgrade ILL and ESRF with its international partners. STFC will become a partner in the new European X-ray Free Electron Laser in Hamburg. It is also negotiating a contribution to the Linac Coherent Light Source at Stanford to secure early access for UK researchers to the new scientific opportunities it will offer.

STFC will continue to support a strong research and development effort in support of future facilities such as the New Light Source (NLS) and the European High Power laser Energy Research project (HiPER).

Taken together with STFC's exciting plans to develop the Harwell and Daresbury campuses as national focal points for science and innovation, a strong commitment to knowledge exchange, economic impact and training the next generation of scientists and engineers, the science programme will ensure that the UK remains at the forefront of scientific excellence worldwide.

2 July 2008

**Science and Technology Facilities Council
Science Programmes Office
Implementation of the Programmatic Review**

John Womersley, Director, Science Programmes

This document describes how we plan to take forward the recommendations of the Science Committees for Particle Physics, Astronomy and Nuclear Physics (PPAN) and for the Physical and Life Sciences (PALS) for the science programme. The programmes recommended by PPAN and PALS incorporate many of the suggestions from the ten independent consultation panels based on community input. The programme was endorsed by Science Board at its meeting on May 22-23, 2008 and approved by STFC Council at its meeting on July 1, 2008.

General comments

- We emphasise again that all the projects in the programmatic review represent good science. Given the need to introduce high priority new projects into the programme, we have had to reallocate funding. The majority of the projects graded alpha 1 by PPAN will therefore not be funded and we will work with the facility directors to deliver the economies proposed by PALS.
- We recognise that it is not practical to stop all funding immediately for projects that are going to be discontinued and we will therefore ramp down funding at an expeditious but appropriate rate in consultation with the PIs/stakeholders. Where possible we will look for ways to ensure that there is a return on our previous investments.
- The consultation panels expressed some strongly felt views on the programmatic review process that was carried out in 2007-8. We believe that the end result of the process is a very reasonable one with considerable convergence between the panel inputs and the PPAN and PALS recommendations, and represents a scientifically sound programme for the next few years. There are however lessons to be learned. Advisory panels for PPAN and PALS will be set up as soon as practicable, and call for nominations for panel members in the PPAN areas is being made. We note the recommendation of Science Board that future programmatic reviews should be conducted with some kind of consultation process as the first step; this could perhaps be done by using the advisory panel inputs.
- We note once again the very detailed and thorough job carried out by PPAN, PALS and the Science Board, and by the consultation panel members, over the past few months. The

panel members operated on a very constrained timescale and had over 1400 consultation inputs to study. They provided considered advice and the programme has benefited significantly from their work.

The remainder of this document explains the actions we will take in each of the programme areas. The italicised text is taken directly from the reports of PPAN and PALS in which they describe their recommendations and their response to the consultation panels; the surrounding text explains our planned science programme and how it relates to these recommendations in each area.

Particle Astrophysics

We will follow PPAN's recommendations for the particle astrophysics programme, specifically:

The highest priority astroparticle projects, Advanced LIGO/GEO600, were confirmed by the consultation panel in this status. A grading of alpha 5 was assigned by PPAN, which noted that the consultation panel concurred with the assessment that UK involvement in the gravitational wave area deserves full support.

The agreed programme of Advanced LIGO/GEO600 will be fully supported.

PPAN and the consultation panel also concur on the priority given to Clover, Inverse Square Law experiments and the Zeplin III experiment. They were graded alpha 4, alpha 3 and alpha 4 respectively by PPAN, reflecting this confirmation of their high importance within the programme.

The agreed programme of Clover, Inverse Square Law test, and Zeplin III will be fully supported.

PPAN and the consultation panel agree on the priority of the Auger project, focusing on the continuing exploitation of the recently acquired data from Auger south, with this being graded alpha 3.

The agreed programme of exploitation of Auger South will be fully supported.

The value of the science carried out by HESS despite the relatively small UK participation, was recognized by both PPAN and the consultation panel. HESS was graded alpha 2.

The currently agreed programme of exploitation of HESS will be supported.

VERITAS was graded alpha 1 and remains in the unfunded band.

We note that we are open to future proposals for participation in high energy gamma ray experiments, and any such proposals will be peer reviewed on their merits when received. We would expect such proposals to build on the current HESS efforts and emphasise work towards the next generation of high energy gamma ray projects (such as CTA).

Astrophysics Theory, High Performance Computing and Astronomical Data Handling

We will follow PPAN's recommendations in this area, specifically:

PPAN is aware of the importance and high profile of astrophysics theory, and recognises its key role in the overall programme. We note that both PPAN and Science Board have theoretical physics representation, and assure the community that all theory grant allocations will be, or have been, carefully scrutinised in relation to the programme.

We note the concern about grant support for theoretical work and emphasise that both STFC and its advisory panels will look carefully at the recommendations of the grants panels to ensure that grant allocations are made in a fair and scientifically optimal way.

High Performance Computing: PPAN noted and accepted the consultation panel's request to apply a finer grading to the ranking of the various HPC projects and re-assessed the HPC program, using the categories provided by the PPRP report. Three HPC lines now appear in the programme. PPAN also used the revised financial planning figures as indicated by the consultation panel.

The top band of HPC projects (Exeter, MIRACLE, UKMHD, UKQCD (1), and Virgo) was judged to be producing world leading research in a strategically important area, and was graded an alpha 4. The second band of projects, HORIZON and UKQCD (2) were judged to be of high priority and graded alpha 3. The final band of fundable projects, COSMOS and Leicester were also judged to be of good quality and graded alpha 1. Although currently below the funding line, we recommend some negotiation within the overall financial envelope to attempt to fund these projects.

We note the extremely useful and proactive work undertaken by the consultation panel in this area and intend to take this forward as the basis for negotiation with university partners over the sharing of HPC operations costs. We accept that the low prioritisation in the earlier ranking may have hindered such efforts and note the revised priorities above. We will make some STFC funds available for HPC operations on a cost sharing basis to facilitate a solution in this area.

Astrogrid, CASU/WFAU: PPAN noted the consultation panel's comments, and reviewed their ranking in the Programmatic Review. In the case of Astrogrid, PPAN noted the consultation panel's input, but after discussion agreed that the project was nonetheless correctly ranked in relation to the rest of the programme.

We intend to follow the panel's recommendations and cease to support Astrogrid, ramping down funding at an expeditious rate in consultation with the PI/stakeholders. We will look for ways to ensure that there is a return on our previous investments.

We also reviewed the ranking of CASU/WFAU, and agreed the science elements of these programmes should be reviewed by the grants panel. These projects were ranked alpha 1.

We will withdraw support for CASU and WFAU activities beyond the support commitments that have been made to ESO and other ongoing programmes. Proposals for the support for activities from which support has been withdrawn can be made through the grants process.

Ground-Based Astronomy

We will follow PPAN's recommendations in this area, specifically:

KMOS and JCMT/SCUBA-2 were ranked very highly by PPAN and the panel. Both projects were thus graded alpha 5.

The agreed programme of KMOS and JCMT/SCUBA-2 will be fully supported.

We noted that the consultation panel agreed with PPAN that both ELT R&D and SKA R&D were of high priority, and we agreed that in relation to other priorities, some reduction or re-phasing to these programmes should occur. Both were graded alpha 4, with a reduction in guideline planned spend over the next 3 years of 25%.

We will follow PPAN's recommendation by reducing the planning provision for ELT and SKA R&D by approximately 25%. The planning provision is an estimate of the outcome of the ongoing peer review process for these projects and we agree that this revision is probably closer to what will be recommended. We are not however setting a firm cap, and PPAN will be asked to make a recommendation on the funding level when peer review is completed.

As noted by the consultation panel, the Dark Energy Survey is well underway and set to produce important results in a strategically important area. PPAN remained of the opinion that DES should be ranked relatively highly, and thus assigned it a grade of alpha 4.

The agreed programme for our contribution to the DES will be fully supported.

Although PPAN was mindful of some of the consultation panel's concerns about the ALMA Regional Centre, we considered that changes recommended by PPRP should address these. Overall, we concluded that the ALMA project was so important that a UK support centre was essential. PPAN therefore did not change the relative ranking of this project and graded it alpha 3.

The agreed programme of the ALMA Regional Centre will be fully supported.

With regard to the ING, the WHT in particular was recognised to be a productive and valuable asset to the UK's ground-based programme in the medium term. PPAN therefore graded it as alpha 3.

Starting with the 2005 PPARC Programmatic Review, we have sought substantial reductions to the UK contribution to ING. A 49% decrease in STFC contribution (and commensurate telescope time) has been negotiated with the Netherlands, Spain and a new contributor (the US-Swiss HARPS Exoplanet consortium) and the extension of the current agreement, with this revised budget, is now being approved through an exchange of letters between partners. The partners have also agreed to formulate a position for the period after 2012, which foresees transfer of ownership from the STFC and new managerial arrangements. Whether the UK will continue to invest in the ING beyond 2012 needs to be confirmed by May 2010.

PPAN agreed with the consultation panel that the Liverpool Telescope had largely fulfilled its role in Knowledge Exchange, however we remain convinced of the quality of the science produced, and it was therefore graded alpha 3.

The agreed programme of the Liverpool Telescope will be fully supported.

We noted the consultation panel's belief that e-MERLIN offered great scientific potential, but we were still concerned in particular over the breadth of the user-base and the impact of the science from this facility, and JIVE in particular. We were very pleased however that STFC is in discussions with other stakeholders including The University of Manchester to seek ways to secure operational funding through the CSR period and thus give e-MERLIN the chance to prove itself. e-MERLIN/JIVE were graded alpha 2.

Given the strategic importance of e-MERLIN to the future of UK radio astronomy and to the highly ranked SKA project, we are working with the University of Manchester and other stakeholders to find a viable way in which e-MERLIN operations can be supported in the medium term on a shared cost basis. We have made provision for STFC support of operations to be made available to facilitate such a solution.

For Gemini, PPAN shared some of the consultation panel's ongoing concerns and agreed that the most important aim was to retain access to Gemini North through the sale of 50% of the UK's overall time. We also agreed with the consultation panel's relative ranking as being below that of ING and graded it alpha 2.

We will continue to pursue the agreed policy with respect to Gemini, aiming to sell 50% of our observing time and by reviewing our future involvement in Gemini and in Gemini instrumentation opportunities in line with the schedule agreed by the Gemini Board and partners.

For UKIRT the panel emphasised the importance of completing UKIDSS. Although PPAN were mindful of the scientific competition that the VISTA surveys will provide, we support the ongoing efforts by STFC to secure international partners to help to ensure that UKIDSS is indeed completed. Overall we graded UKIRT somewhat lower than the consultation panel at alpha 2.

An agreed plan is in place with the Director under which UKIRT will continue to operate as a full-service observatory until December 2008. Discussions with potential partners will continue throughout this period. At that point the options for the future will be re-assessed based on the progress of partnership arrangements. Possibilities include UKIRT continuing as a full-service observatory with reduced STFC contributions, switching to survey mode as part of a partnership related to wide-field imaging or switching to survey mode in order to complete the currently agreed UKIDSS programme as expeditiously as possible. In the last scenario, withdrawal of STFC support for the telescope following the completion of UKIDSS is likely.

Particle Physics

We will follow the recommendations of PPAN for Particle Physics, which in turn reflect the suggestions of the consultation panel rather closely

The top priority projects (ATLAS, CMS, nEDM) were confirmed in this status and were graded alpha 5.

The agreed programme of ATLAS, CMS and neutron EDM experiments will be fully supported.

The 5% reduction on GridPP was confirmed and, after this reduction, the project was also graded alpha 5, reflecting its critical role in exploitation of the LHC.

The GridPP programme will be supported at a level 5% below the planning assumption, as recommended.

The suggested reprofiling of the SuperNEMO project was accepted. PPAN and the consultation panel agree that since this is an R&D project, funding after the current R&D phase is dependent upon the outcome. However, PPAN is of the opinion that there is likely only to be sufficient funding for a credible UK role in a single neutrinoless double beta decay experiment on this timescale, and SuperNEMO is the current baseline UK project. The project was graded alpha 4.

The agreed programme of SuperNEMO R&D will be fully supported. Funding for construction is dependent on the outcome of the R&D phase and of course subject to future peer review. PPAN's assessment of the priority of SuperNEMO does not preclude the submission of other proposals for neutrinoless double beta decay experiments.

The priority given to T2K was reconfirmed. The project was graded alpha 4.

The agreed programme of the T2K experiment will be fully supported, including the ECAL.

The suggested reprofiling of the LHC upgrade projects was accepted, though the panel noticed this increased the funding risk in the third year. LHC detector upgrades as a planning line were graded alpha 4.

R&D for the ATLAS and CMS detector upgrades is foreseen to be supported through the PRD (Project R&D) funding line, subject to the normal PRD peer review process. Planning provision has been made for the construction phase of these projects, subject to peer review at the appropriate time.

LHCb was graded alpha 4, reflecting its importance to the Particle Physics programme. PPAN was persuaded that the proposed level of reduction to LHCb (25%) would do unacceptable damage to the physics output of the experiment, and therefore we recommend a reduced cut level of 5% in the first year and 10% in the subsequent years, noting that the final year and a half of the project will be subject to review by the PPGP.

The revised prioritisation of LHCb is accepted. LHCb will be supported at a level 5% below previous planning in the first year and 10% below thereafter, as recommended by PPAN.

The status of CDF, D0 and eEDM was reconfirmed, and they were graded alpha 3.

The agreed programme of the CDF, DØ and electron EDM experiments will be fully supported.

PPAN noted the planned extension of MINOS running in the US, and also the fact that in the initial prioritisation by PPAN, MINOS had dropped into the “lower priority” category late in the review due to funding constraints. It was therefore very happy to take advantage of the savings allowed by other suggestions from the consultation panel, and restore funding to MINOS at the 50% level to allow the UK groups to participate in the experiment over the next few years, albeit at a sub-optimal level. MINOS was graded alpha 2.

We will work with the PI to reduce funding for MINOS to a level roughly 50% of the current, in order to allow continued UK participation through to the end of the presently planned running period.

PPAN noted the huge impact of the sudden termination of LCFI and CALICE. Expert teams had been built up in these projects with detector development skills with applications well beyond the ILC. It was therefore agreed that, given the savings identified elsewhere, it would be possible and desirable to explicitly introduce a detector R&D line as suggested by the consultation panel, to protect some of the investment made in building up the CALICE and LCFI teams. This planning line was assigned a grade of alpha 3, reflecting the strategic importance attached to this activity. Some extension of the CALICE and LCFI ramp down was also agreed, motivated by similar considerations.

We have assigned a planning line at the level of £1M per year to support advanced detector R&D work as recommended here. Statements of Interest for ongoing activities in this area are currently being solicited from the CALICE and LCFI groups and will be considered by PPAN at its July meeting, with a goal of progressing them rapidly through the PPRP. We are working with the CALICE and LCFI groups to make the transition from current levels of effort to this future programme.

Regarding Babar, the project was graded alpha 1, and the panel could not, in competition with other more highly rated projects, justify restoring resources to the collaboration as suggested by the consultation panel, and reluctantly had to leave the project terminating rather abruptly, recognizing the loss of science this would incur.

We intend to follow the panel's recommendations and withdraw support for BaBar, ramping down funding at an expeditious but reasonable rate in consultation with the PI/stakeholders. We will look for ways to ensure that there is a return on our previous investments.

In the case of the ILC related projects and BaBar, where support will be withdrawn, it is expected that any existing specific project grants will be phased out and the level of the existing rolling grants reduced accordingly. For particle physics projects due to continue at a reduced level, such as MINOS and LHCb, the reductions will be made following discussion with the collaborations.

Solar Physics & Solar Terrestrial Physics

We will follow PPAN's recommendations in these areas, namely:

PPAN still regards Solar Orbiter to have a higher priority than STEREO and Hinode, rather than an equal priority as the consultation panel suggested. PPAN agreed a grading of alpha 4 for Solar Orbiter.

The agreed programme of developments for Solar Orbiter will be continued subject to on-going support for this proposed mission within the ESA programme.

PPAN was willing to accept the consultation panel's advice of moving STEREO above SOHO and Cluster. PPAN agreed a grading of alpha 4 for STEREO.

The agreed programme of support for STEREO PLS will be continued.

Since the original PPAN ranking of Hinode, new information has become available, namely publication numbers and calibration status. As a consequence, PPAN assigned Hinode a grade of alpha 4.

The agreed programme of support for Hinode PLS will be continued.

For Cluster, SOHO and UKSSDC, PPAN agreed that each project should receive a grading of alpha 3.

The agreed programme of support for Cluster, SOHO PLS and the UKSSDC will be continued.

We will continue to review all of our commitments to post-launch support across the programme on an ongoing basis to make sure that the level and duration of support are appropriate.

The consultation panel recommend an STFC-wide review of data-curation across all science areas with the aim of identifying synergies and economies of scale. PPAN agreed with this recommendation.

We are considering how to take this recommendation forward.

PPAN graded Bison Operations alpha 1.

We intend to follow PPAN's recommendations on the scientific priority of BiSON and withdraw support, ramping down funding at an expeditious but reasonable rate in consultation with the PI and stakeholders. We will look for ways to ensure that there is a return on our previous investments.

We note that while the consultation panel recommended that BiSON should not have been considered in the Programmatic Review, PPAN could not accept this recommendation, believing all projects should be evaluated. That is correct: the Programmatic Review is intended to cover all projects and facilities in the STFC science programme.

The consultation panel accepted the inevitability of UK withdrawal from the EISCAT subscription in 2011, but wanted the AGP to be advised that this did not imply ALL ground-based STP research should not be funded. PPAN accepted this comment and agreed to advise the AGP that ground-based STP grants should be considered on their individual scientific merits. PPAN confirmed that reduced support was appropriate in line with the continued subscription and this was graded alpha 1.

We intend to follow the panel's recommendations. EISCAT is supported until 2011 and until this time proposals for its exploitation will be considered on their merits. Proposals for the support of ground-based STP will also be considered on their merits.

Looking ahead, many of the arguments made for the topicality of this area of research because of its links to climate and the environment suggest that it would be appropriate to involve additional funding partners. (It is interesting to note that ESFRI has classified the EISCAT-3D upgrade project as an environmental, rather than a physical sciences, facility.) We encourage the community to pursue other sources of funds, including the cross-council Living with Environmental Change programme, and we will seek to play an enabling role in any such discussions.

Space Science & Exploration

We will follow the PPAN recommendations in this area, specifically:

The consultation panel commented on the projects which they felt should be at the highest priority. The consultation panel argued that support for these upcoming, very high profile missions in which the UK had important roles should be at the highest priority. PPAN agreed with this and graded JWST/MIRI, Planck PLS and Herschel PLS alpha 5 recognising the future potential of the science from these missions.

The agreed programme of support for JWST/MIRI, Planck PLS and Herschel PLS will be continued.

The consultation panel argued that VENUS Express should be prioritised below JWST/MIRI and Planck PLS. While recognising the excellent science return from this mission, the consultation panel felt that the future science return would have less impact. PPAN accepted this argument and graded the mission PLS alpha 4.

The agreed programme of support for Venus Express PLS will be continued.

The consultation panel also argued that future science return from SWIFT PLS was potentially lower impact than its previous output, and suggested a lower ranking for SWIFT. PPAN assigned a grade of alpha 4 for SWIFT PLS.

The agreed programme of support for SWIFT PLS will be continued.

The consultation panel agreed the high priority assigned to LISA/LISA Pathfinder which was graded alpha 4.

The agreed programme of support for LISA Pathfinder will be continued. PPAN recommended to support LISA on June 10, following peer review of the detailed LISA proposal by PPRP. Given this prioritisation, their recommendation was accepted.

PPAN and the consultation panel both agreed the strategic importance of investment in the ExoMars programme, and the programme was graded alpha 4. PPAN had recommended a reduction of 25% to the planned spending line for ExoMars and, after receiving no strong arguments against this from the consultation process, this reduction was confirmed.

We note the recommendation on ExoMars and will use the prioritisation as input in our discussions with ESA over the future scale of the programme.

PPAN and the consultation panel agreed the priority for the GAIA mission which was graded alpha 4.

The agreed programme of support for GAIA will be continued.

The consultation panel confirmed PPAN's assessment that support for PLS of the XMM Newton mission should be continued as there are still important science returns expected from the mission. The XMM Newton PLS was graded alpha 3.

The agreed programme of support for XMM Newton PLS will be continued, subject to regular review as noted above.

The consultation panel confirmed PPAN's assessment that support for PLS on the Cassini mission should be continued as there are still important science returns expected from the mission. The Cassini PLS was graded alpha 3.

The agreed programme of support for Cassini PLS will be continued, subject to regular review.

The consultation panel concurred with the importance of support for Roadmap to XEUS. PPAN assigned a grade of alpha 3 for this project, and noted that in future it would be considered together with funding for the ESA Cosmic Vision programme.

Roadmap to XEUS will be considered along with other Cosmic Vision projects in due course.

The priority given to BepiColombo was confirmed by both the consultation panel and PPAN, and the project was graded alpha 1.

Notwithstanding the prioritization of BepiColombo, we note that the contribution of the UK to the MIXS instrument is subject to an MOU with the Agency and will be respected..

The consultation panel agreed the priority for Integral, and PPAN confirmed that the project remained in the unfunded band with a grade of alpha 1.

We intend to follow the panel's recommendations and withdraw support for Integral, ramping down funding at an expeditious rate in consultation with the PIs/stakeholders. We will look for ways to ensure that there is a return on our previous investments.

Nuclear Physics

We will follow PPAN's recommendations in this area. Most refer to facilities that are exploited through grants, and are therefore subject to recommendations of the Nuclear Physics Grants Panel. However, specific projects addressed were:

The AGATA project was graded by PPAN using the [...] Programmatic Review criteria and PPAN is satisfied that it warranted funding. It was [...] ranked as Alpha 3.

The AGATA proposal has already been peer reviewed by PPRP. Given PPAN's recommendation, funding for AGATA is therefore to be approved.

On ALICE, the case was made that this had suffered as a consequence of timing. The switch of the nuclear group at Birmingham from STAR to ALICE had greatly enhanced the already strong UK effort, but had happened after the nuclear physics community had generated its community strategy. PPAN had in fact already recognised this issue and were pleased that the consultation panel was able to give a strong recommendation for the importance of this science to the nuclear physics programme. This was reflected in the PPAN grading of alpha 3.

Funding for ALICE exploitation was subject to recommendations of the Nuclear Physics Grants Panel. The Panel presented its report to PPAN on June 10, and ALICE exploitation was recommended for support.

PPAN was supportive of the suggestion that the profile of capital investment for FAIR be examined to try and free up additional funds in the grant line at this crucial start-up point.

While we agree that this is a reasonable suggestion, we have already pushed the profile as late as possible consistent with the currently planned construction schedule and further delay would negatively impact the science to be done at FAIR. We do not therefore plan to make any further change to the planned spend profiles for the PANDA and NUSTAR projects at FAIR, though we note that these are still subject to an ongoing peer review process.

Synchrotrons and Free Electron Light Sources

PALS made specific programmatic recommendations for SR and FEL facilities as below:

Diamond Phase I & Operations – Diamond should be operated within the operating budget proposed by STFC Executive but should consider, if necessary, delaying non-capital investment on some enhancements to focus effort on the current operation and in gaining an appropriate level of delivery in terms of facilities and support to the user community. This implies a focus in the short-term on those beamlines that are operational, and those that are due to be operational in the next year. These beamlines must be made available for the greater benefit of the user community. This is especially important given the imminent closure of SRS.

We will continue to work closely with Diamond to ensure an emphasis on both reliable operations and the appropriate rate of commissioning of new beamlines. It must be remembered that the capital funding is already assured but we must still remain within a sustainable spend profile for the non-capital element of costs.

We are working with DIUS to develop a spending profile for the capital funding of phase III and will need to ensure that eventual operations funds (which fall beyond this CSR period) are properly matched to this profile.

New Light Sources – priority is given for the development of a proposal for the next light source project, to be led by the Photon Science Institute. This must be led by the development of a science case. Review of the science case will be made by PALS in Autumn 2008.

We are working closely with the NLS Project Leader and his team to monitor progress and to define the milestones that are expected this autumn for the science case.

Diamond Phase II beamlines – capital funding is earmarked through the LFCF and PALS recognises the importance of this programme in delivering an internationally-competitive instrument suite. There has been much comment on the position of Diamond Phase II in the prioritisation list – we stress that Diamond Phase II is a vital development. However, there is a spend profile on the capital and therefore a staged delivery of the wide range of beamlines within Phase II. PALS recognises the desire for Diamond to bring all Phase II beamlines on-line as soon as possible; however, within the proposed operating costs the delivery timescales of Phase II beamlines that are not close to completion could be reprofiled, in turn deferring increases in operating costs. The recommendation is to give priority to Phase II beamlines that are closest to operation for the benefit of the user community.

See comments above on Diamond.

LCLS – Linac Coherent Light Source (at SLAC). A time critical recommendation has been made for a £1-2M one-off payment for this new facility, to fund a 5th end station, resulting in of order 10% access to LCLS as a whole for UK users, including users supported by other RC's. There is a compelling scientific case to support this; it will be a cost-effective opportunity for the UK community to access FEL technology and applications. It can play a critical role in capacity building for XFEL and a future NLS. Investment was recommended,

but should be negotiated with a view to a reduced or reprofiled contribution or a possible contribution in kind.

We are actively negotiating with SLAC with the aim of investing £1-2M in the High Energy Density Science end station at LCLS in return for a level of preferred access to the whole facility. We are close to agreement and given the recommendation of PALS, it is now proposed to move forward on this.

ESRF Upgrade – the ESRF upgrade programme is a 10-year project that will keep the facility in a world-leading position. PALS recognises and supports the need for the UK to remain fully engaged in ESRF, particularly given its outstanding record of delivering high profile publications. The upgrade will require careful scrutiny regarding overlap with Diamond beamlines. Complementarity is important for the UK user base and the upgrade must prioritise those aspects that map more closely with UK priorities. The upgrade, provided its remit is appropriate for UK science is supported by PALS, and STFC should consider investment at the minimum level negotiable with partners and only invest if the overall benefit to the UK scientific community is clear.

We emphasise that we remain fully committed to UK participation in ESRF. We accept the advice of PALS concerning the upgrade and will aim to ensure that the benefits to the UK community are clear, and that we invest at the appropriate level.

ERLP accelerator development – the contribution of this facility in future accelerator development for light sources was raised in the consultation. A review of the future STFC investment in ERLP/ALICE is dependent on the approval of the scientific case for the New Light Source project. The application of this accelerator as an injector to the EMMA facility should also be considered by STFC when considering the appropriate level of support.

While noting the degree of caution expressed by PALS, it is nonetheless our intention to operate ERLP/ALICE for the period of the spending review in order to support the EMMA project and as part of the accelerator science and technology programme. Since the funding available from this programme is limited, we intend to pursue co-funding opportunities with other stakeholders including NWDA in order to sustain an increased level of operation of ALICE and a greater return on the investment made so far.

Neutron Sources

PALS made specific programmatic recommendations for neutron facilities as below:

ISIS Target Station 2 Phase I & ISIS Operations – completion and commissioning of the TS2 Phase I beamlines should proceed as a high priority; TS2 is a flagship UK programme that will maintain and enhance forefront capabilities in this area. The delivery of TS2 Phase II beamlines, funded through the LFCF, offers the potential for staging of non-capital spend. Priority should be given to beamlines that are close to delivery. We note the concerns of the community emphasising the loss of capacity from any reduction in ISIS operations. PALS encourages ISIS to operate within the operating budget proposed by the STFC Executive, but to aim for maximal delivery of research.

We will work closely with the ISIS Director to understand how best to use the funding available in his agreed operations budget to deliver the best science programme possible.

ISIS TS1 developments should be considered in the context of the ongoing Facility Development Fund. In response to concerns raised as part of the community consultation, PALS notes it was never the intention to exclude TS1 projects from this scheme, nor to exclude potential Third Party developments of TS1, e.g. through funding from international partners.

We confirm that the Facility Development Fund will remain in place and is available to support instrumentation enhancements at any of the facilities.

ILL Upgrades beyond 2013 – the UK is a full partner in the current ILL Millennium Upgrades programme, funded through 2013; this is the element of clarification that was missing from the original PALS statements regarding ILL upgrades. ILL Management has development plans for the succeeding period, but these will not impact on funding in this CSR period.

We remain fully committed to our participation in ILL and in its currently funded upgrade programme.

Laser Facilities

PALS made specific programmatic recommendations for Laser Facilities as below:

VULCAN Upgrade & Operations (CLF) – the upgrade is needed to keep this facility as world-leading. The intention is for the VULCAN upgrade programme, as was earlier planned by CCLRC, to be proposed within the Facilities Development (capital) budget following the completion of the current design phase. This proposal must be tensioned against other activities that can bid into this budget, and against other calls on STFC capital investments.

We note the high priority assigned to the VULCAN upgrade and confirm that it should be a call on the Facilities Development budget.

Lasers for Science Facility (LSF). The CLF Director has embarked on a reprioritisation and refocusing of LSF activities in terms of both operations and science programme. PALS sees these as the first steps in the appropriate reprofiling of these activities into a more focused facility. Through the panel consultation, strong support from the community for LSF was noted. This needs to be reflected in the appropriate recognition of the LSF by user output; there needs to be a tensioning between LSF led and user-based laser experiments. PALS will review progress in June 2009. The overall role of LSF requires to be defined for the benefit of its user community in order that both can achieve maximal output and deserved recognition. PALS note that their recommendations have already taken into account aspects of productivity such as knowledge exchange and the resource of resident expertise within CLF.

We note the strong community support for the LSF, showing the value placed on this facility by the researchers. We believe that the Director of Photon Science's reprioritisation and refocusing of activities within this area is appropriate and addresses many of the concerns raised. It would be reasonable to assess progress in a year's time, as suggested.

Facilities Development Fund

PALS made recommendations for the Facilities Development Fund:

Facilities Development Fund – a key existing funding scheme that facilitates peer-reviewed multidisciplinary collaboration with the user community. It covers all the UK based Facilities. PALS recommends continued investment in FDF (Formerly FDAB) in line with the STFC plan, with a call for proposals in 2009. The capital line earmarked as potential continuation of the VULCAN upgrade will be tensioned in a competitive environment against other capital projects. Any potential ISIS TS1 developments should also be considered in this competition.

We note and will follow these recommendations.