Science Board
12 and 13 December 2018

Minutes of the Sixty Eighth Meeting
Rutherford Appleton Laboratory

Present: Professor Jayne Lawrence (Chair) – University of Manchester
Professor Tara Shears (Deputy Chair) – University of Liverpool
Professor Bill Chaplin – University of Birmingham (item 3 onwards)
Professor Bill David – STFC RAL/University of Oxford
Professor Gavin Davies – Imperial College London (Day One only)
Professor Karen Edler – University of Bath
Professor Chris Hawes – Oxford Brookes University
Professor David Ireland – University of Glasgow
Professor Ofer Lahav – UCL
Professor Paul McKenna – University of Strathclyde (Day Two only)
Professor Andy Parker – University of Cambridge
Professor Robin Perutz – University of York
Professor Don Pollacco – University of Warwick (Day One only)

Apologies: Professor Stewart Boogert – RHUL

In attendance: Dr Chris Lee – Chief Scientist/Head of Science Programmes, UK Space Agency (item 4)
Professor Julian Osborne – University of Leicester and Chair of PPRP (items 8 – 9)

STFC: Professor Grahame Blair – Executive Director, Programmes Directorate (item 8)
Chris Carlton – Secretary, PPRP (items 8 – 9)
Dr Adrian Cole – Strategy Manager, Research and Innovation Strategy (item 6)
Professor John Collier – Director, Central Laser Facility (items 10 - 11)
Professor Robert McGreevy – Director, ISIS (item 11)
Tony Medland – Head of Particle and Nuclear Physics (item 9)
Trish Mullins – Secretary, Science Board
Professor David Newbold – Director, Particle Physics Department (item 5)
Dr Janet Seed – Interim Executive Director, Strategy, Planning and Communications (from item 8 onwards)
Dr Colin Vincent – Head of Astronomy (item 8)
Dr Victoria Wright – Acting Head, Research and Innovation Strategy (item 6)
1. Agenda Item 1 – Welcome

The Chair welcomed everyone to the meeting, particularly Professor Davies, Professor Ireland and Professor Perutz, who were attending their first meeting. There were apologies from Professor Boogert. Professor Davies and Professor Pollacco would join for Day One only and Professor McKenna for Day Two only (by teleconference). Dr Seed would join from agenda item 8.

1.2. The Chair reminded Science Board that STFC regularly shared sensitive information and, as a result, it was essential to maintain confidentiality at all times. It was also essential to declare all conflicts of interest and, for the benefit of new members, it was agreed that the Secretary would circulate the Science Board guidance on conflicts of interest. [Secretary’s note: for completeness, this guidance is attached as an Annex to these minutes]

1.3. The Chair reminded everyone that requests for information and feedback received by Science Board from the community must be directed to STFC for attention.

2. Agenda Item 2 – Minutes and Actions (SB.18.67)

2.1. The minutes of the meeting held on 25 and 26 October were approved.

2.2. Actions from the meeting were reviewed. Actions that were incomplete were discussed and Science Board updated them, as appropriate.

3. Agenda Item 3 – Updates from the Chair and Deputy Chair

3.1. The Chair updated Science Board on her attendance at the recent Council meeting (20 November).

3.2. The Chair of Science Board no longer attended Council for the whole meeting although the presentation from Science Board and the science highlights remained an important and much appreciated agenda item. At Council the Chair had highlighted Particle Physics Grants Panel (PPGP)
funding issues and the effect on grants of the increase in university indirect costs due to changes to TRAC\(^1\) methodology.

3.3. Council had also considered a short report on the Science Board extraordinary meeting on 11 October.

3.4. Science Board asked that the presentations given by the Chair at Council be made available from the Science Board extranet.

3.5. Science Board had been invited to present an overview of its activities at the Nuclear Physics Town Meeting to be held on 7 January and Professor Shears had agreed to present this. Science Board was invited to put forward messages to be delivered at the Town Meeting.

3.6. For the benefit of new members, Professor Shears gave an overview of the Balance of Programme (BoP) exercise and the current programme evaluations. Professor Pollacco and Professor Lahav outlined the main messages from the Nuclear Physics and Computing programme evaluations respectively, the reports of which had been considered by Science Board at its last meeting. The evaluation for Particle Astrophysics was ongoing, while the evaluations of Astronomy and Particle Physics were in their early stages. The programme evaluations reflected the different cultures of each community although Science Board hoped that it would be possible to share best practice across STFC once all the reviews had been completed. The Chair thanked Professor Shears, Professor Pollacco and Professor Lahav for their input and hard work.

3.7. Science Board noted that the review of STFC’s consolidated grant mechanism, chaired by Professor Davenport, had started.

3.8. Professor Pollacco gave an overview of his attendance at the UKSA’s Science Programme Advisory Committee (SPAC) on which he was the Science Board cross-member. SPAC met up to four times per year to consider the Astronomy Grants Panel (AGP) report and in advance of European Space Agency (ESA) meetings to agree the UK’s stance in ESA discussions. For the benefit of new members, Professor Pollacco clarified the criteria for funding for STFC and UKSA. As a result of SPAC membership, Professor Pollacco also attended EPSRC’s Engineering Strategic Advisory Team meetings and felt there might be lessons to be learned from the way in which other Research Councils undertook the development of strategy.

\(^1\) Transparent Approach to Costing
3.9. Science Board discussed issues to be raised later in the meeting with the representatives of the UK Space Agency (UKSA), the Director of the Particle Physics Department (PPD), Executive Director of Programmes Directorate, and the Directors of ISIS and the Central Laser Facility (CLF).

4. **Agenda Item 4 – Space Science at UKSA – Challenge and Opportunity**

SOME REFERENCES IN THIS SECTION HAVE BEEN REDACTED AS OFFICIAL SENSITIVE

4.1. The Chair welcomed to the meeting Dr Lee, Chief Scientist/Head of Science Programmes for UKSA. Dr Lee explained that the role of Chief Scientist was a new role within UKSA that had been developed to provide strategic leadership on science and to lead coordination of science issues across UKSA’s work.

4.2. The focus of UKSA was to recognise the utility of science within the space arena. UKSA conducted world class frontier science with the recognition that it had strategic benefits and would drive innovation and skills in the space sector.

4.3. Approximately 40% of UKSA’s budget could be considered as “science expenditure”. A limited budget is available for bilateral missions.

4.4. In practice:

4.4.1. For space science – most space instruments are funded through the national UKSA programme, with satellite and key technology funded via the ESA subscription. Key TRL 1-5 and exploitation of data is funded by STFC;

4.4.2. For exploration (including life science and microgravity) – instruments, satellite and access to technology is largely funded via the ESA subscription. Exploitation of data is funded by UKSA through both the national and ESA programmes;

4.4.3. For earth science – instruments, data, satellite and technology is largely funded via the ESA subscription.

4.5. Dr Lee highlighted that there were a number of current ESA astrophysics missions including JWST\(^2\) (just observing first light), Euclid, Cheops and

\(^2\) James Webb Space Telescope
Plato. ESA solar system missions included the recently launched Bepi Colombo, JUICE and SMILE\(^3\), which was a joint mission with China.

4.6. A number of missions continued to generate data after the main operations were finished (including Lisa Pathfinder, Herschel and Planck). ESA continued operating these craft with STFC funding the community exploitation. The timing for many future missions had become challenging with delays and cost overruns.

4.7. Ariel had been selected as ESA’s M4 mission (currently scheduled for launch in 2028). This is of particular importance for the UK as the PI is UK-based and RAL Space is a key engineering partner. A Science Board expert panel had recently considered the three M5 candidate missions, all with significant UK academic capabilities.

4.8. ESA was considering a new one-off “Fast” mission (F mission), designed to take account of increased capacity on the current launcher. ESA felt this would be an ideal opportunity for those ESA partners that do not have a large national programme (this includes the UK). Six proposals have been invited with four of these including a strong UK instrument team. ESA will wish to understand quickly whether host nations would support each mission and STFC/Science Board will be consulted on this.

4.9. Dr Lee highlighted the considerable number of ESA Missions of Opportunity. Traditionally, many of these had been collaborations with NASA but increasingly other partner countries were involved. These gave opportunities for academics to be involved in a wider selection of missions.

4.10. There were many challenges facing the space programme, not least due to the complexity and technology risk of missions that often led to them being over budget at a time when budgets were not rising. The national UK science budget was almost entirely committed to ESA, which meant that, in spite of pressure from the community, there was little funding for other bilaterals.

4.11. A number of ESA members wished to ensure that the level of ESA subscriptions remained as low as possible in order to release funds for other non-ESA space funding. ESA membership subscriptions had been held at flat cash levels for a number of years, which had resulted in delays in missions.

\(^3\) Solar Wind Magnetosphere Ionosphere
4.12. At the most recent ESA interim ministerial, ESA had sought a significant uplift in funding to reverse the long-term decline. As part of this, the intention was to have two flagship projects in progress at the same time (Athena and LISA) and this would cause a “spike” in the funding needed. It was also hoped that an increase in funding would mean that the F-mission could become a more regular exercise.

4.13. Over the last few years, the government focus on industrial strategy had greatly influenced UKSA which had looked to open up markets using science and building up its industrial relationships.

4.14. UKSA was trying to encourage the Space Action Network (SPAN), which was an academic forum aimed at coordinating space-related science. The intention was that the network should work more closely with industry and be able to provide a balanced response to government. Science Board noted that Professor Carole Mundell, an extragalactic astronomer at the University of Bath (and former Chair of STFC’s Skills and Engagement Advisory Board), had been appointed as Chief Scientific Advisor to the Foreign and Commonwealth Office.

4.15. In discussion, a number of issues were raised:

4.15.1. The technology required for ESA missions was complex and challenging. In other areas, ESA has technology programmes to ensure the development of the necessary future technology. In the space area, this is not the case and ESA was exploring better routes for providing future instrument technology in this area. One option might be to have a larger national programme that would fund generic technology;

4.15.2. ESA had already considered expanding its membership as one option to increasing its budget. However, the major European space collaborators were already involved;

4.15.3. Science Board asked whether ESA had categories of members with differing access (e.g. in the same manner as CERN). The ESA membership fee allowed access to all programmes although some members only had access to optional programmes (e.g. Canada). ESA was exploring whether such members would be willing to pay additional costs to be involved in specific large missions;

4.15.4. UKSA felt that, when the science of a mission was compelling, the interplay between UKSA and STFC (dual support) worked well. The challenge came when it was less compelling. UKSA was
concerned that the F-missions might not have sufficient UK interest to gain STFC (or another RC’s) support;

4.15.5. UKSA was seeking to ensure that work on big data was more joined up as there was expertise in earth observation teams and space science teams that was not necessarily shared. UKSA was also looking at other areas in which expertise could be shared across domains;

4.15.6. UKSA was working to limit cost overruns on missions;

4.15.7. The number of staff within UKSA working on the EU Galileo satellite system had grown.

4.16. Dr Lee stressed that he was happy to discuss any aspect of UKSA’s work outside of the meeting and that Science Board members should feel free to contact him. The Chair thanked Dr Lee for the insightful update.

5. Agenda Item 5 – Update from the Particle Physics Department

5.1. The Chair welcomed to the meeting Professor Newbold, newly appointed Director of the Particle Physics Department (PPD).

5.2. Professor Newbold outlined the PPD mission, which included support of all aspects of the current UK experimental programme. He stressed that PPD was not equivalent to a super-sized university group; it was complementary to university groups but its mission and structures were different.

5.3. Science Board noted the major activities with which PPD was involved including ATLAS, CMS and DUNE and the Tier 1 computing centre. One concern within PPD was that support for future R&D was at a very low level and that relationships with some university groups had become difficult as PPD was viewed as being in competition for funding.

5.4. Professor Newbold felt that PPD was in good shape but the expectations of the community and the funding available to PPD did not match.

5.5. A number of short term actions were required to prepare the group for the future. A scientific advisory board was being appointed reporting to Professor Newbold and to EB. A mechanism was being developed for agreeing PPD’s formal, written science strategy and Science Board would be involved in the approval process. The strategy development would start with a review of the programme with input from the PPD advisory board and the community.
5.6. Steps were being taken to professionalise internal financial and project management.

5.7. The shape of the PPD programme is changing as the group is involved in both exploitation of experiments and in designing new upgrades. The need to do such very different activities in parallel was challenging. New projects will continue to be developed in the community and it will be essential for PPD to find the capacity to be involved in these. PPD would need to be more agile to plan and take leadership where appropriate; however, it was recognised that funding things fully may mean being involved in fewer activities. One exciting development was the potential for a major particle physics activity at Boulby.

5.8. In discussion, a number of issues were raised:

5.8.1. It was essential that PPD staff had the skills needed in the future e.g. for quantum sensors;

5.8.2. Engagement with industry and leveraging industrial funds was one way of bringing in additional funds. However, building up relationships with industry would take time and there was insufficient headroom for PPD to do this at the current time. Daresbury Laboratory had a very successful history of industrial engagement and PPD would look to learn from this;

5.8.3. It had proved challenging for PPD to engage fully with STFC CDTs as it was not possible to support a sufficiently large student cohort. However, successful studentships had been based in PPD.

5.9. The PPD Advisory Board would be established by April 2019 and it was intended that the draft science strategy would be available by that date. The intention was that, at the very least, the emerging messages from the strategy would be available to Science Board at its meeting in October 2019 (and this would work well as it coincided with the likely delivery of the report from the Particle Physics programme evaluation). Science Board would be invited to approve the PPD science strategy by early 2020.

5.10. The Chair thanked Professor Newbold for the very informative update.

6. Agenda Item 6 – Detectors and Instrumentation Strategic Review

6.1. The Chair welcomed to the meeting Dr Cole, Strategy Manager, Research and Innovation Strategy, and Dr Wright, Acting Head, Research and Innovation Strategy.
6.2. Dr Cole reminded Science Board that it had seen the emerging recommendations of the Strategic Review at its last meeting. Science Board had confirmed that the draft recommendations were appropriate and had suggested that the review panel include a view on priorities in its final report. This view had been shared by EB following its consideration of the draft report. The review panel had initially been reticent to define priorities as it felt that priorities should be driven by science rather than by technology.

6.3. The report was now in its near final stage and had made a number of recommendations. The panel had used the categorisation used in the Project Research and Development (PRD) scheme in order to reflect the potential for science and technology gain.

6.4. Dr Cole asked Science Board to focus its comments on any aspects of the report about which it had reservations particularly any areas that required further evidence and/or justification prior to publication. Science Board felt that the report had improved greatly since the consideration in October. A number of issues that might be improved were raised and Science Board members agreed to email suggested improvements to Dr Cole.

6.5. Science Board noted that the recommendations would be shared with the Chairs of the relevant advisory panels as these panels had played a vital role in the development of the report. The report would be considered by Council early in 2019 with publication planned for March/April.

6.6. The Chair thanked Dr Cole for opportunity to be involved with the further development of the Strategic Review.

7. **Agenda Item 7 – Statement of Interest: DarkSide (SB.18.68.02)**

SOME REFERENCES IN THIS SECTION HAVE BEEN REDACTED AS OFFICIAL SENSITIVE

7.1. The introducer outlined the proposal which requested a total of £4.878M over four years to capitalise on the current UK leadership roles. The proposed UK roles included leading on the liquid argon (Ar) veto readout, photosensor calibration (in particular, for the uniformity calibration and correlated noise identification) distributed computing and searches for dark matter (DM) beyond weakly interacting massive particles (WIMPs).

7.2. DarkSide seeks to detect DM particles via scattering on Ar, with a sensitivity reach that may be more than two orders of magnitude beyond current results at 1 TeV/c^2 DM mass, which is above the energy scale accessible at the Large Hadron Collider (LHC). Current UK investment in DM has largely related to the US DM programme and investment in DarkSide offered a
potential opportunity for the UK to gain leadership within a European DM programme.

7.3. Science Board noted that exploring the nature of DM had been identified as a leading science priority in the 2018 Particle Physics Advisory Panel (PPAP) roadmap and in the 2017 Balance of Programme (PPAN). It was noted, however, that DarkSide had not been one of the priorities put forward by the relevant community as part of the recent ‘priority projects’ exercise (Developing a World Class Research Programme).

7.4. The construction phase for DarkSide was scheduled to be 2019 – 22, with physics operation from 2023 – 28. The proposal related to the construction phase in the UK (October 2019 to September 2022) and Science Board noted that the timing of the SOI submission might lead to time pressures in the peer review of any full proposal. Science Board agreed that the timing of the submission had been the choice of the applicants and it was not reasonable to take this time pressure into account in coming to a decision.

7.5. Science Board noted that there was no funding currently available in the STFC core programme for the support of DarkSide. In the light of this, Science Board agreed not to invite a full proposal at this time. It was noted that STFC was in the process of undertaking detailed programme evaluations for the Particle Astrophysics and Particle Physics programme areas that will be completed in 2019. It was agreed that the proposal should be considered and prioritised as an element of these evaluations. This would allow the proposal to be tensioned against other emerging opportunities.

8. Agenda Item 8 – Planning for the Frontier Science Programme
SOME REFERENCES IN THIS SECTION HAVE BEEN REDACTED AS OFFICIAL SENSITIVE

8.1. The Chair welcomed to the meeting Professor Blair, Executive Director, Programmes Directorate. Dr Seed joined the meeting.

8.2. Professor Blair outlined that STFC has been managing the effects of flat cash for some time. Although STFC is still supporting excellent science, the impact of flat cash has been significant. One clear impact has been the pausing of the PRD scheme. STFC is taking the opportunity to undertake a review of this scheme. There have been opportunities this year to pump prime projects to ensure that STFC has projects that are well positioned to apply to UKRI funding schemes. STFC would conduct an analysis of this pump priming to assess its effectiveness. STFC’s research community had identified the requirement for equipment with the result that STFC had held a very successful capital call this year.
8.3. STFC had additional financial exposure due to currency fluctuations. While BEIS had provided some protection from this (specifically for international subscriptions), there was no protection for other elements of the programme. The scientific and reputational damage of leaving collaborations such as CERN and ESO would be immense.

8.4. Science Board agreed that it was essential that any process for future decisions had buy in from the community. One option might be for the community to determine the priorities although it was recognised that, in previous exercises, some communities had found it very challenging to set clear priorities.

8.5. Science Board was asked to consider what information, in addition to the priorities set out in the programme evaluations and BoP, should be sought in consultation with the Advisory Panels and grants panels.

8.6. It was suggested that, as part of the overall context, STFC should explore the effect of the loss of European Research Council (ERC) funds, particularly which areas of science would be most at risk in the event that ERC funding was no longer available. Science Board noted that high level negotiations had been taking place within government relating to ERC funding.

8.7. STFC had undertaken an exercise (Developing a World Class Research Programme) to ensure that it had a number of priorities in each area that could be put forward should funding be available, for example, from the Strategic Priorities Fund (SPF) or Fund for International Collaboration (FIC), and STFC had already had some successes from these funding streams. It was essential to ensure that STFC continued to have sufficient projects in this funding pipeline. It was intended that any process to refresh the current cohort would be “business as usual” rather than a lengthy exercise.

8.8. It was also essential that sufficient resource funding was available to support new projects to avoid the “batteries not included” position that often had a significant impact on core budgets.

8.9. Professor Blair updated Science Board on the restructuring of some of the senior posts within Programmes Directorate.

8.10. The Chair thanked Professor Blair for the informative update.

**SOME REFERENCES IN THIS SECTION HAVE BEEN REDACTED AS OFFICIAL SENSITIVE**

9.1. The Chair welcomed to the meeting Professor Osborne, University of Leicester and Chair of PPRP, Dr Vincent, Head of Astronomy, and Mr Carlton, the newly appointed Secretary of PPRP.

9.2. There were no conflicts of interest.

9.3. Professor Osborne gave an overview of the proposal. Gaia is a European Space Agency (ESA) cornerstone mission measuring the positions, velocities and distances of billions of stars in our Galaxy and beyond with a measurement precision that is unprecedented. This will allow our Galaxy to be mapped, for the first time, in three dimensions. It will clarify the origin and formation history of our Galaxy.

9.4. The international Data Processing and Analysis Consortium (DPAC) is responsible for Gaia data processing and consists of nine coordination units. Coordination Unit 9 (CU9) is responsible for preparing the data for release to the science community. It is a European consortium with the UK contributing ~25%.

9.5. UKSA has provided support for the Gaia mission and for lower-level data processing preparation activities. UKSA and STFC have jointly agreed that UK funding for CU9 is the responsibility of STFC. Gaia commenced data taking in 2014; two data releases have already taken place with two further releases planned – DR3 early in 2021 and DR4 around 2023/24 that will provide the full five-year mission dataset. The mission is expected to end around 2024 when consumables are likely to be exhausted.

9.6. PPRP has previously recommended support for 5 years from 2014. This current request extends the work of the earlier grant, seeking resources for optimal data availability for UK science exploitation. It is an integral part of the DPAC. However, it is significantly greater than the funding envelope outlined to the applicants.

9.7. The objectives for the UK contributions to the CU9 activities include the organisation of, and access methods to, the archive, the coordination of the documentation, further development of the TOPCAT software for data types and volumes typical for Gaia, and outreach to the science community and to the public.

9.8. Science Board agreed with the PPRP view that the Gaia mission will deliver unparalleled precision astrometry and photometry with significant science
impact. There is a strong community support with key UK management roles. The applicants are world-leaders in this field with strong delivery experience and host leading astronomy survey units. CU9-UK is well integrated in the Gaia DPAC. The proposal is a natural development of current activities.

9.9. Science Board noted that, as the request was significantly higher than the budget, PPRP had considered descope options.

9.10. In addition the schedule and scope of DR4 is insufficiently firm so that significant technological development could be expected beforehand. PPRP therefore recommended a 4-year award rather than a 5-year award to support DR3. PPRP recommended a mixed descope to maximise science value within the funding envelope.

9.11. Dr Vincent outlined the planning guidelines.

9.12. Science Board asked for clarification of the potential overlap with UKSA support. UKSA had provided a report describing its activities and PPRP had been satisfied that there was a clear distinction between the activities funded by UKSA and STFC.

9.13. Science Board recommended support for Gaia at the level recommended by PPRP.

10. Agenda Item 10 – PPRP Report: The A+ Upgrade: Expanding the Advanced LIGO Horizon (SB.18.68.04)

SOME REFERENCES IN THIS SECTION HAVE BEEN REDACTED AS OFFICIAL SENSITIVE

10.1. The Chair welcomed to the meeting Mr Medland, Head of Particle and Nuclear Physics. Professor Osborne and Mr Carlton remained from the previous item.

10.2. Professor Osborne gave an overview of the proposal. The Laser Interferometer Gravitational Wave Observatory (LIGO), based at two sites in the US, is the leading facility for the measurement of gravitational radiation. Following the upgrade to Advanced LIGO (aLIGO) in 2015, the first colliding black holes and neutron stars were discovered leading to the award of the 2017 Nobel Prize. The UK has contributed key technologies to aLIGO (including low-noise silica mirror suspensions that substantially reduce noise in the main detection frequency band).

10.3. The A+ upgrade should be operational by 2024 and aims to improve sensitivity and increase detection rates by a factor of 4 – 7. It will use existing structures, replacing some elements, and will thus extract maximum
value at modest risk. A+ is foreseen as the final upgrade of the current facility, beyond which the community is discussing the twin interferometer Einstein telescope design.

10.4. The PAAP roadmap had assigned the highest priority to the exploitation of, and development and implementation of initial upgrades to, aLIGO and the need to expand the observable GW horizon was widely recognised by the astronomy, astrophysics, cosmology and relativity communities. It was recognised that the science case would be completely transformative.

10.5. A+ was reviewed by the NSF\textsuperscript{4} in May 2018, with US funding starting in September 2018.

10.6. The top level objectives of the proposal were to:

10.6.1. Supply replacement interferometer mirrors with enhanced coatings having reduced thermal noise (Work Package (WP) 1);

10.6.2. Suspend these mirrors from the existing UK supplied suspension systems using enhanced fused-silica fibres (WP6);

10.6.3. Design and supply detector subsystems to reduce optical loss and increase the effectiveness of the interferometric readout (WP2, 3, 4 & 5)

10.7. PPRP felt that the proposal was coherent, well written and fully integrated with the US project. The PPRP process had included an observer from NSF who had provided a fuller context for the proposal.

10.8. Science Board agreed with the PPRP view that A+ has a very strong, high profile science case that builds on previous UK investment. The UK teams are leaders in the area and are making unique and essential contributions, directly linked to the science.

10.9. The UK contribution to A+ was viewed as a coherent package and any reduction in the funding would add risk to the wider project delivery with the potential for substantial scientific impact. In the light of this, and given the level of FIC funding, PPRP recommended that the project should be funded in full.

10.10. Science Board agreed with the PPRP recommendation that the proposal should be funded at the proposed level.

\textsuperscript{4} US National Science Foundation
11. Agenda Item 11 – Tour of the Central Laser Facility

11.1. Science Board received a tour of the Central Laser Facility (CLF).

11.2. Science Board expressed its appreciation of the opportunity to learn more of CLF’s activities.

12. Agenda Item 12 – Facility Directors

SOME REFERENCES IN THIS SECTION HAVE BEEN REDACTED AS OFFICIAL SENSITIVE

12.1. The Chair welcomed to the meeting Professor McGreevy, Director of ISIS, and Professor Collier, Director of CLF.

12.2. Professor McGreevy and Science Board paid tribute to Professor Steigenberger, former Director of ISIS, who died on 12 December.

12.3. ISIS is now a 30 year old accelerator, however due to a number of improvements, it continued to become more efficient and provide for user requirements. A major issue was radiation damage caused by beam loss and a number of measures had been put in place to mitigate this. One of the major costs related to power supply to the magnets and developments had taken place as part of a long-term plan to ensure energy costs were minimised.

12.4. In 2020 a year long ISIS shutdown was scheduled that would allow the replacement of the Linac tank 4. As the work involved high levels of radioactivity, it would be very challenging. At the same time, the opportunity was being taken to replace the target 1 moderator system with more modern equipment and install ventilation upgrades. Target Station 2 (TS2) would also shut down for 6 months but the two shutdowns will ensure ISIS is in a good position to run for a longer period afterwards.

12.5. Professor McGreevy highlighted developments on the major instruments ZOOM and MARI. ZOOM, a small angle neutron scattering instrument for TS2, was just coming into operation. MARI, a chopper spectrometer for studies including quantum fluids and liquid dynamics, had recently been upgraded. These developments would significantly enhance the ISIS instrument suite.

12.6. ISIS had also enhanced the polarisation analysis on LET (a cold neutron multi-chopper spectrometer for the study of dynamics in condensed matter) and the use of polarisation was a significant step forward. Significant improvements had also taken place in compressing the proton bunch at extraction from the synchrotron, thus producing shorter muon bunches. This
allowed a wider range of fields to be measured and better quality data. As a direct result, muon experiments sped up 1 - 5 times.

12.7. ISIS had contributed four priority projects to the Developing a World Class Research Programme exercise.

12.8. Professor McGreevy highlighted a further project, the Front End Test Stand (FETS), which was a high energy pulsed proton driver. This was not yet operational but had been developed as part of an international collaboration looking at beam chopping. The project aims to reduce energy costs and will also be used to do front end testing of issues such as gradient accelerators. Associated work was being undertaken on Fixed Field alternating gradient accelerators (FFA) with Kyoto University.

12.9. Now that Zoom was close to operation, there were no other short term plans to build further instruments at ISIS (for the first time in its history). The Endeavour programme aimed to build new instruments and was essential to retain capability and instrument staff. ISIS was currently building instruments as part of the UK’s in-kind contribution to the European Spallation Source (ESS). One of the instruments for which the UK was responsible, Loki, was scheduled to be one of the first instruments available at ESS. Much of the scientific software developed at ISIS would be used at ESS with data acquisition testing now completed.

12.10. The user programme had received over 600 proposals for each of the last three rounds (634 proposals across 31 instruments in latest round) together with 80 rapid proposals per year. Demand from the UK remained constant with increasing demand from India, China and Sweden. This demand would need to be managed during the shutdowns. ISIS continued to have a number of very successful international partnerships including that with RIKEN in Japan where the refurbished RIKEN instruments would be operated by ISIS.

12.11. ISIS had very successful collaborations with India and China funded as part of the Newton programme. This had resulted in an increased number of users; however, it was not certain that this funding would be extended. There was a much smaller Newton programme with Indonesia and discussions were at an early stage with Thailand.

12.12. In the UK, ISIS was adapting to allow users to undertake more complex experiments. In particular, enhancements were being made to the sample environment. The NeuNMR project (funded by EPSRC) allowed users to use NMR at the same time as conducting neutron experiments. This would enhance the understanding of the structure and kinetics or processes occurring in heterogeneous catalysis, something that was very important for
industry. ChipIr, a commercial beamline, was proving to have significant impact world-wide.

12.13. Professor Collier gave an overview of the work of CLF highlighting the Extreme Photonics Applications Centre (EPAC) that had received approval for a major new investment (£81.2M) from the SPF, based at the Harwell campus. The new national centre would further the development of laser-driven accelerators and sources and allow the UK to retain its globally-leading position in this field. The aim was to provide a successor to the Gemini facility and to bring together academia, industry and defence communities in a national laboratory environment. The facility builds on dipole technology developed at CLF as applied to short pulse high power laser applications and would have minimum of a 10Hz petawatt laser. It was envisaged that this facility will lead to future opportunities such as the establishment of UK Free Electron Laser (FEL) or provide a platform for the ELI5 4th pillar. Although the case for funding was focussed on industry and applications, EPAC would have a significant role for science, too.

12.14. The Artemis facility was being moved to be closer to the Research Complex at Harwell (RC@H) as it was closely aligned to the RC@H and to Diamond. The move had given the opportunity to upgrade the system to allow higher photon energies, smaller XUV focus and enhanced data acquisition and coherent imaging. These developments will be available in approximately 12 months’ time.

12.15. The OCTOPUS6 Imaging Cluster was being developed to allow super-resolution cryo-microscopy using a technique developed at the facility using special optics. It was planned to submit a more detailed proposal for funding to UKRI.

12.16. A leading edge DiPOLE laser built by CLF will be delivered to XFEL later in the year. The 100 J, 10 Hz laser will be used on the high-energy density end-station of XFEL and will be used to compress matter to extreme pressures (such as those found within giant planets). By using isentropic compression which applied pressure in a gentle way, it was possible to conduct experiments without damaging the sample.

12.17. Vulcan is a petawatt (PW) laser system first developed in 2002. Since that time, the requirement for a 20 PW facility (Vulcan 2020) had been developed to allow the enhancement and development of Vulcan required by the

5 Extreme Light Infrastructure
6 Optics Clustered to OutPut Unique Solutions
community. The combination of the proposed power increase and energy enhancement would be internationally unique. Although a business case for Vulcan 2020 had been considered by BEIS, the project was not yet funded.

12.18. In discussion, a number of issues were raised:

12.18.1. CLF felt that its relationship with the RC@H was developing well and there was good cross funding of staff. The relationship would be greatly enhanced once the Artemis move was completed. A recent quinquennial review of RC@H was very positive;

12.18.2. Universities also faced the challenge of recruiting and retaining technical staff and had developed the ‘Technician Commitment’, which aimed to ensure recognition and career development for technical staff. STFC was looking to join this initiative and was also exploring whether its science graduate trainees could receive training in technical issues;

12.18.3. The Facilities might wish to host PhD students from the STFC CDT centres (particularly those interested in image processing) and STFC agreed to provide contact details for the leads of the CDTs to the Facilities.

12.18.4. Science Board felt that the development of EPAC was very exciting, particularly the development of high powered laser systems to complement synchrotron investment. This complementarity had considerable advantages.

12.19. The Chair thanked Professor McGreevy and Professor Collier for the informative updates.

13. Agenda Item 13 – Update from STFC (SB.18.67.01)
SOME REFERENCES IN THIS SECTION HAVE BEEN REDACTED AS OFFICIAL SENSITIVE

13.1. Science Board received an update from Dr Seed on STFC activities, including the appointment of Professor Geddes as the Executive Director National Laboratories, Science and Technology, the outcomes of the submissions to the SPF and planning within UKRI relating to the UK’s decision to leave the EU (plans for underwriting EU funding programmes and discussions around ERICS⁷).

⁷ European Research Infrastructure Consortium
13.2. The STFC Strategic Delivery Plan was being developed and would be a merger of the former Corporate Strategy and Delivery Plan. The intention was that this document would be signed off by the UKRI Board and published in April 2019. UKRI was currently identifying cross cutting issues included in the Strategic Delivery Plans, together with other priority themes, for submission to the CSR.

13.3. In discussion of the meeting paper (SB.18.68.05), a number of issues were raised.

14. Agenda Item 14 – Information Papers

14.1. There were no information papers.

15. Agenda Items 15 and 16 – Any Other Business and Meeting Close

SOME REFERENCES IN THIS SECTION HAVE BEEN REDACTED AS OFFICIAL SENSITIVE

15.1. Science Board asked whether it was possible for have further discussions relating to ERC and EU funding. For the benefit of new members, it was agreed that the paper setting out an analysis of funding through Horizon 2020 considered for information at Science Board’s May meeting would be recirculated. STFC would provide an update on this paper and would provide an update on EU funding issues at the February meeting.

15.2. Science Board agreed that it was timely to consider the format and content of PPRP reports and grant panel reports. It was agreed that an initial discussion would take place at the next meeting.

15.3. The Chair reminded Science Board of the importance of extending apologies for Science Board meetings with sufficient notice to allow the invitation to the meeting of non-core members or other expert attendees with the necessary core skills, should the need arise.

15.4. Science Board noted that its next meeting would be 18 and 19 February 2019 at the Daresbury Laboratory.
Annex

SCIENCE BOARD: Conflict of Interest

In the context of peer review of project proposals or grant applications, a conflict of interest is normally deemed to arise:

a. when a panel member is a signatory to the proposal or application under consideration;

b. where a panel member is from the same institution as the applicant;

c. where a panel member has a commercial interest in the proposal;

d. where a member of the panel member's family or household would benefit from the success of the proposal.

For Science Board, when considering proposals:

i. all conflicts of interest should be declared;

ii. the expectation is that, where any committee member has a conflict of interest (either personal or institutional), they should withdraw for the specific discussion of that project;

iii. where the conflict is institutional and withdrawal would be detrimental to the quality of the discussion (in other words, withdrawal would not be in the interests of informed discussion), the individual may remain with the agreement of the Chair.