

# NPPE Evaluation Summary

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# Outline

History

NP Evaluation 2018: positives, highlights, funding scenarios

The Future

# More recent history

- 1) Programmatic Review of 2013
- 2) Balance of Programmes 2016/7

# Programmatic Review 2013

53. The nuclear physics programme in the UK is strong but relatively small compared with the STFC particle physics and astronomy programmes. Much of the current programme is carried out as the exploitation of equipment development projects at several international laboratories.

**R14 - We recommend that maintaining a balanced nuclear physics programme be a priority for the UK, enabling participation in new projects as well as exploitation of existing facilities.**

86. A flat cash scenario constitutes a reduction in the volume of activity in real terms. As described in Paragraph 80, the STFC programme has been severely reduced over several years. The consequences of further constraining the programme over a prolonged period of time would be catastrophic. The UK would lose leadership and credibility as an international partner on the world's scientific stage. There would be additional damage to the UK economy in terms of loss of scientific expertise both from experienced researchers leaving the UK due to a loss of scientific opportunity and from the reduced ability to train the next generation of scientists and engineers.

# Programmatic Review 2013

89. Within many of the science areas covered by the PPAN programme, the UK is currently at the forefront worldwide and has a correspondingly strong international reputation. In a flat cash scenario, that lead and reputation would be severely at risk as cuts would have to be made in the highest priority areas to maintain some diversity in the programme. This would be particularly noticeable in particle astrophysics, neutrino science, and the LHC experimental programme, where the UK would lose significant leadership. The lack of astronomy technology development investment would also lead to a loss of future scientific leadership and productivity.

# Balance of Programmes 2016/7

3. The Sub Group noted that the BoP exercise has taken place following an extended, non-indexed period of funding. The 2013 Programmatic Review<sup>1</sup> noted that 'flat cash would result in a cumulative 37% reduction in volume if extended over the next four years'. A flat cash environment, imposed on the programme over many years, clearly erodes the UK's ability to deliver broad and high quality science, and to maintain leadership in instrumentation, facilities and exploitation. It has a significant and adverse impact on the UK's underpinning scientific output. It risks disadvantaging the UK's position and reputation on the international scene. It erodes the knowledge-base on which we should anticipate future UK economic and academic returns. In terms of the current BoP exercise, it is important to stress that we are considering a programme that is already under extreme pressure and has lost opportunities and encountered restrictions on its ability to maintain and develop the UK's scientific strengths for some years. Whilst the exercise identifies excellent science in the UK, makes recommendations on a number of key issues, and considers financial scenarios, it must be remembered that this is addressing a programme that cannot be stretched much further.

# Balance of Programmes 2016/7

6. The Sub Group saw no reason to propose major change to the balance but does recommend modest modifications in response to the pressures resulting from the evolutionary changes in the science programme. Several high-level findings requiring action were noted; for Computing support, where demands are growing rapidly, Particle Astrophysics, which is an emerging field that needs to mature into an established element, Nuclear Physics, where support is at a critical level following a poor settlement in the last consolidated grant round, and Accelerator physics, which is also seen to be at a critical level.
  
14. A flat cash environment places great pressure on STFC's programme, and STFC Executive Board needs to be well informed to make any challenging decisions. At the time of the 2013 Programmatic Review it was stated that continuation of flat cash without indexation beyond the Comprehensive Spending Review (CSR) in 2015 would require further decisions as the programme had been developed under the assumption that beyond 2015/16 constant volume would be sustainable i.e. that there would be an increase in budget above flat cash. However, the resource allocation from the Department for Business, Energy and Industrial Strategy (BEIS) in 2016 which gave firm allocations for the period 2016/17 and 2017/18, and indicative allocations for the period 2018/19 and 2019/20, remains flat for all four years and capital will be flat until 2019.

71. The biggest issue facing Nuclear Physics is the limited number of posts that can be supported on the consolidated grants. The previous Nuclear Physics Grants Panel (NPGP) round was required to make a 12% reduction in total FTE numbers for post-doctoral research assistants (PDRAs) (from 18.3 to 16.1 FTE) and a 15% cut in cross-community engineering/technical support FTE (from 12.1 to 10.3 FTE<sup>13</sup>). The number of core posts remained about constant (8 FTE). The reduction was attributed to the flat cash settlement imposed by Council (whereas the 2013 Programmatic Review had recommended maintaining volume), and an over-commitment from the previous consolidated grants round.
  
72. Recognising that this would lead to a major loss of expertise and research capability, the NPGP reduced the length of supported PDRA posts from 38 months to 30 months, in order to maintain the number of posts as far as possible. Principal Investigators have had to work out how to manage the shortfall, and this has been achieved largely because of the expectation that the next consolidated grants round would be able to revert to fully funding the volume of posts. However additional funding sources, such as EU grants, and goodwill arrangements to support PDRA posts locally are running out. A similar issue with the funding of cross community posts was ameliorated by the award of three STFC grants (ALICE upgrade, ISOL-SRS and JLab upgrade), where some cross community posts that would normally be fully covered in the consolidated grant were partially funded from the project grants.

BoP  
2016/7

**R8: Recommendation: We note that Nuclear Physics currently has a critically small level of support. For the 2017 grants round review in process, we recommend that additional funds be used to enable the restoration of fully-funded PDRA positions to the level of the 2011 grants round.**

**R9: Recommendation: We recommend that in any future scenario, the current NPGP grants line be funded at a level required to support the number of fully-funded PDRA posts in the 2011 grants round. This aligns with the community-supported preference to maintain the consolidated grants at least at constant volume, at the expense of new project grants.**

**R10: Recommendation: We recommend that a review of the benefits of FAIR membership be carried out as part of the Nuclear Physics programme review in 2018, in light of delays to FAIR and the adoption of alternative facilities to exploit UK-built equipment.**

**R11: Recommendation: We recognise the near-critical level of support that the nuclear community receives and wish to ensure that this is protected, regardless of financial scenario.**

# BoP 2016/7

207. Our findings assume that all external (non-STFC) funding is continuing at the same level. We have noted that at present there is uncertainty associated with the UK's departure from the EU, and the potential for severe impact on disciplines within PPAN's remit. We recognise that the terms of the UK's exit are yet to be decided and the situation needs to be monitored.

# BoP 2018 Panel Members

Michael Bentley (York)

Jonathon Billowes (Manchester)

Marie Borge (ES: CSIC Madrid)

Alison Bruce (Brighton)

Peter Jones (Birmingham)

Jordi Jose (ES: Barcelona)

Don Pollacco (Warwick)

Paul Stevenson (Surrey)

Office Support: Malcolm Booy, George Madden, Tony Medland

My Aim: A realistic and informed, community led assessment of recent, current and possible future programmes

# Procedure

- 1) 23<sup>rd</sup> March 2018 Telecon: Process and Evidence gathering
- 2) 2-3<sup>rd</sup> July 2018 Face-to-face: Invite to Advisory Panel (Andy Boston presentation), science areas, proforma ranking, flat,  $\pm 10\%$ , funding scenarios, report writing
- 3) 6-7<sup>th</sup> September 2018 Face-to-face: Additional data, computing needs, theory projects, report discussion and recommendations
- 4) 14<sup>th</sup> September 2018 Telecon: final recommendations.

Continued reflection with small corrections

# Many Good Things Going on!

Much world leading Science

Much leadership

Theory investments perceived as a success

Strong impact cases from collaboration with industry.

Relatively small but well focused community.

As an outsider NP seemed a small, friendly, well organized community

# Recommendations:

**Recommendation I:** Reviewing the future needs of the community, in terms of skills, breadth, balance and level of cross community effort, should be embedded into the function of the Cross Community Committee, feeding into the NPGP. This will enable the cross community team to be proactive in supporting new and growing areas of the UK nuclear physics programme.

**Recommendation II:** The Panel welcomed the planned review of the PRD scheme and agreed that STFC should reinstate the PRD scheme and that it should be targeted at demonstration-level technology development.

**Recommendation III:** STFC should review the UK's membership to FAIR prior to the end of the first three years of FAIR operation. At this point it will be timely to obtain the views of the nuclear physics community with regards to the benefits and return of the UK's participation in FAIR.

# Highlights

- 1.3. The nuclear physics programme supported by STFC supports three broad areas: Nuclear Structure and the determination of the structure of nuclear matter at the extremes of stability and angular momentum; Nuclear Astrophysics and the study of key nuclear reactions important for energy generation and nucleosynthesis in a variety of astrophysical sites; and Hadronic Physics and the nature of the strong force within hadrons and the phases of nuclear matter.<sup>1</sup> Together, these three areas address several of STFC's top level science questions, including:
- What governs the structure and behaviour of atomic nuclei?
  - What is the origin of the elements?
  - What is the nature of nuclear matter?
  - How do the properties of hadrons and the quark gluon plasma emerge from fundamental interactions?

# The Programme

- 1) Exploitation: CG's to £15.85M resource and £1.2M over 4years Oct 2017-September 2021. Covers theory, experimental programme and generic R&D, Cross Community effort.
- 2) Development: ALICE upgrade construction (Hadronic physics), £2.7M to Dec 2019  
ISOL-SRS construction, installation & commissioning (nuclear), £3.1M to Mar 2019  
Jlab upgrade construction, installation & commissioning (hadronic physics), £1.5M to July 2018
- 3) Subs, Maintenance, Operations

1.4. The overall nuclear physics funding is £6.2M per annum, distributed as follows:

<b>NP Programme</b>	<b>18/19</b>	<b>19/20</b>	<b>20/21</b>	<b>21/22</b>	<b>22/23</b>	<b>23/24</b>	<b>24/25</b>	<b>25/26</b>
Grants - committed	4.625	4.500	4.500	2.203				
Grants - uncommitted	0.300	0.300	0.200	2.402	4.605	4.605	4.605	4.605
Experiment support – committed (M&O)	0.150							
Experiment support – uncommitted (M&O)		0.150	0.150	0.150	0.150	0.150	0.150	0.150
FAIR operations	0.050	0.175	0.275	0.370	0.370	0.370	0.370	0.370
NP development - committed	0.875	0.350						
NP development - uncommitted	0.125	0.650	1.000	1.000	1.000	1.000	1.000	1.000
Other - committed	0.020							
Other - uncommitted	0.055	0.075	0.075	0.075	0.075	0.075	0.075	0.075
<b>Total (Capital + Resource)</b>	<b>6.200</b>	<b>6.200</b>	<b>6.200</b>	<b>6.200</b>	<b>6.200</b>	<b>6.200</b>	<b>6.200</b>	<b>6.200</b>

Financial forecast of the nuclear physics programme

# CG NP Community support

<b>Consolidated Grants</b>	<b>2011</b>	<b>2014</b>	<b>2017</b>
Academics – Awarded (requested)	46	52 (58) <sup>6</sup>	53 (65) <sup>7</sup>
Academics – Average FTE awarded	14.5%	11%	9%
Academics – Total FTE per year	6.3	5.6	4.5
PDRA – Awarded	29	21	27
PDRA – Total FTE per year	18.3	16.1	18.2
Ratio PDRAs to Academics	0.42	0.31	0.34
Core Posts – Awarded	11	12	9
Core Posts – Total FTE per year	8.3	7.9	6.8
Cross Community - Awarded	13	14	16
Cross Community - Total FTE per year	12.1	10.3 <sup>8</sup>	11.3
Number of Studentships	2	1	3
Technician – Total FTE per year	-	2.1	2.9
Total Number of FTE per year	47 <sup>9</sup>	43	46.7

Size of the nuclear physics community supported on the CG

2.15. The number of PDRAs awarded has increased from 2014 and is now in line with 2011 levels, as per the BOP recommendation. However, comparing the ratios of PDRA FTE to funded academics against the PPAN programmes, the ratio for nuclear physics is higher than PPT but lower than PPE and astronomy (see table below). The Panel agreed that PDRAs have reached a level too low to properly support the programme. Whilst the number of PDRAs was almost restored to the 2011 level, the duration of support given to PDRAs was reduced from 48 months to 24 or 36 months. This risks the programme losing long-term expertise and deterring new talent. Furthermore, to restore the levels of PDRA effort, funding was reallocated from the projects line, thus negatively impacting the project line which may have long term consequences in terms of UK skills, knowledge and leadership.

2.17. The Panel re-affirmed that support for the whole programme remains at a critically low level. To maximise the available support for PDRAs and CC staff, whilst meeting the available budget, the NPGP could not avoid reducing academic FTE and core support. The current level of support for the nuclear physics programme risks the community not being able to maintain programme breadth and the range of world-leading research it performs.

<b>Grants Round</b>	<b>Ratio PDRAs to Funded Academics</b>	<b>Ratio PDRAs to Requested Academics</b>
Nuclear Physics 2011	0.42	0.35
Nuclear Physics 2014	0.31	0.27
Nuclear Physics 2017	0.34	0.28
Particle Physics Experiment 2012	0.37	0.34
Particle Physics Experiment 2015	0.38	0.36
Astronomy 2014	0.55	0.25
Astronomy 2015	0.46	0.17
Astronomy 2016	0.58	0.25
Particle Physics Theory 2013	0.20	0.19
Particle Physics Theory 2016	0.27	0.20

Ratio of PDRAs to academics for STFC Programmes

- 2.18. The broad ratio of the size of the community relative to that of particle physics and astronomy is 1:4:6, respectively. The Panel noted that the low level of academic time paid by STFC is already a concern to some Vice Chancellors who are questioning the cost of nuclear physics. This risks universities not replacing posts as well as not creating new posts, thereby moving support from nuclear physics to other areas. This may disproportionately impact some groups more than others as academic FEC is managed and perceived differently by different universities.
- 2.20. It was noted that there is a general consensus in the community that UK leadership in a number of key technical areas is at risk in the longer term. This includes mechanical design, electronic engineers and detector specialists. There is an ongoing shortage of skilled technical effort to provide professional support across the breadth of the nuclear physics programme for both the development and exploitation programme. Failure to adequately support these posts will ultimately erode the UK's ability to maintain areas of established technical leadership. At an institutional level, this has resulted in a significant reduction in the level of technical support and an increasing reliance on the goodwill of universities to maintain an appropriate level of technical effort.

# Grading of Future Projects that Submitted SOLs

<b>Project</b>	<b>Science excellence</b>	<b>Exploitation</b>	<b>Impact and engagement</b>	<b>Maturity</b>
JLab		G3	I5	Mature
ALICE		G3	I3	Mature
ISOL-SRS		G3	I3	Mature
AGATA	A4		I5	Developing
ACPA	A3		I4	Developing
DRACULA	A3		I3	Developing
Neutrino Nucleus	A4		N/A	Early
Fission	A2		N/A	Early

Ranked and scored nuclear physics projects as agreed by the NPPE

For justification of the ranking see the details in the Evaluation Report.

VII. For the first time the community also submitted theory based projects. The Panel felt that while they both contained good science the PPRP assessment process, which is organised for major new projects such as the development of new instruments or upgrades to existing detectors, was not the appropriate route to consider them. The Panel encourages STFC to produce a more tailored mechanism for their assessment.

# The real issue is funding, still....

- VIII. Given the situation faced by the NPGP in 2017 it is of little surprise that, looking forward in a flat cash or reduced funding scenario, the exploitation or development line (or both) will be damaged as support for the programme would remain critically low.
- IX. In a flat cash scenario, reducing the exploitation line would significantly curtail the range of nuclear physics experiments that can be adequately supported. While a further period of reduced development funding would not only negatively impact on the future programme but also risk reputational damage to the UK.

- X. In a -10% funding situation the Panel considered three scenarios that would protect either the exploitation line, the development line, or try to protect both which would require the UK withdrawing from the FAIR facility. In all cases the reduced support would seriously impact on the health of nuclear physics in the UK.
  
- XI. In the slightly enhanced (+10%) funding scenario the uplift would help to restore the exploitation line to previous levels seen in 2011, partly mitigating the erosion of seven years of flat cash. Some support would also be given to the development line allowing the possibility of an additional project to be supported, such as enabling a theoretical nuclear physics project to be properly considered for the first time.

XII. In summary, the 2017 CG round demonstrated that funding was already at a critical level. At that time decisions were made that if continued beyond the next grant assessment point would leave lasting damage on the community. If a flat or declining budget is expected then we would encourage STFC to form a specialist panel to consider in detail the actual budget available and its detailed implications for the programme. In the case of a slightly expanded budget the main outcomes would be to fully support PDRAs for the CG duration and give slightly stronger support to the development line.

Bottom line is that there is real damage already going on and not “crying wolf”

# Reports are great and words are all very well, but...

Who can predict the future? Has to be said that the situation does not look great, but UKRI/STFC will be preparing for CSR and will have a better feel. However, we need to be ready for a flat settlement... Last para of report:

*If a flat or declining budget is expected then we would encourage STFC to form a specialist panel to consider in detail the actual budget available and its detailed implications for the programme.*

However, new funding is coming into science (GDP 1.7 -> 2.4%) but much of this is appearing with strings attached. Its worth spending sometime on trying to understand these schemes (I know STFC have been).

The challenge for STFC and our communities is to get this funding into the baseline programme.



