

# 2023/2024 Opportunities

## NuSec Network Technical Workshop, London 9th October 2023

Our free **Annual Technical Workshop** will focus on current and future technical research challenges in nuclear security detection. It will also provide an opportunity to hear and discuss the latest NuSec-funded project research results.

Technical topics will cover the following areas:

- Nuclear Security detection systems
- Algorithms and Autonomous Decision Making
- Applications of detection systems in Nuclear Security
- Results from the NuSec/AWE Sigma Data Challenge project

Short presentations will be followed by Q&As with all attendees. A joint NuSec & NuFor Reception will then follow, providing further discussion and networking opportunities for those attending in person. A summary of proposed presentations can be viewed in the **Workshop Programme**.

Presentations will be available for viewing on the **Workshop Indico Webpage**.

The workshop will be co-located at the same venue as the **NuFor: Nuclear Forensics 2023 Conference 10-12th October 2023** so people can also attend both events.

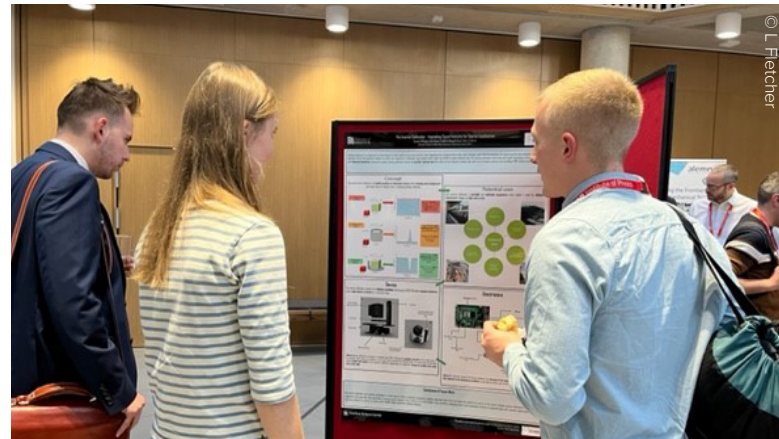
## Personal Development Grant Applications

We are continuing to seek applications from Nuclear Science Early Career Researchers (ECRs) based either at a University, Research Establishment, or a Company within the UK to support the development of their research and innovation capacity. Personal Development Activities eligible for funding include attending a Research Conference or Training Course or undertaking an Industrial Placement. We offer grants of up to £1,000 to Researchers based either at a University, Research Establishment, or a Company within the UK. 50% matched funding will normally be required, except for PhD students and ECRs. The closing date for all NuSec PDG Applications is now one month before the start date of the proposed personal development activity. Applicants will be informed of a decision usually within 1-2 weeks of each submission.

For an application form, further guidance or a summary of our previous PDG awards, please visit the **Funding page of our NuSec Network website**.

## Summer Pilot Projects 2024

We hope to be able to issue a funding call in Spring 2024 for early-stage research projects that could enhance the field of nuclear security and be undertaken by an undergraduate student for 2-3 months during Summer 2024.



## Nuclear Threat Reduction Network (NTR-Net)

**NTR-Net** will build on the success of the **NuSec Network** and **NuFor**, as an academic network with enlarged scope to cover Nuclear Threat Reduction. Over the past seven years, the NuSec Network has demonstrated the importance of driving a subject with focused meetings, training support and seed corn funding while NuFor has successfully brought diverse people together around an emerging subject.

The scope of **NTR-Net** will encompass both these groups and also include an International treaties theme.

**NTR-Net** will provide post-graduate research in a Centre for Doctoral Partnership (CDP) cohort structure with important network elements of focused meetings and training. Close integration with AWE will maintain a clear application steerage of Nuclear Threat Reduction for its partner universities. There will be the opportunity for other universities to join as close partners or affiliates and enjoy the recognition working on this high national impact challenge.

For further details of **NTR-Net**, please contact [info@ntr-net.uk](mailto:info@ntr-net.uk)



# Welcome

Welcome to the 7th edition of our annual newsletter, aimed at Academic, Industrial and Government, scientists and engineers working in Nuclear Security Science. In this edition, we summarise our 2022-23 Achievements in Nuclear Security Detection and our 2023-24 NuSec Funding, Research, Training and Collaboration Opportunities.

## Our Role

The NuSec Science Network promotes research and technology in Nuclear Security Science, with an emphasis on radiological detection methods. The Network acts as a forum to support collaborations and capability amongst Academic, Industrial and Government stakeholders working in nuclear security and in other related areas.

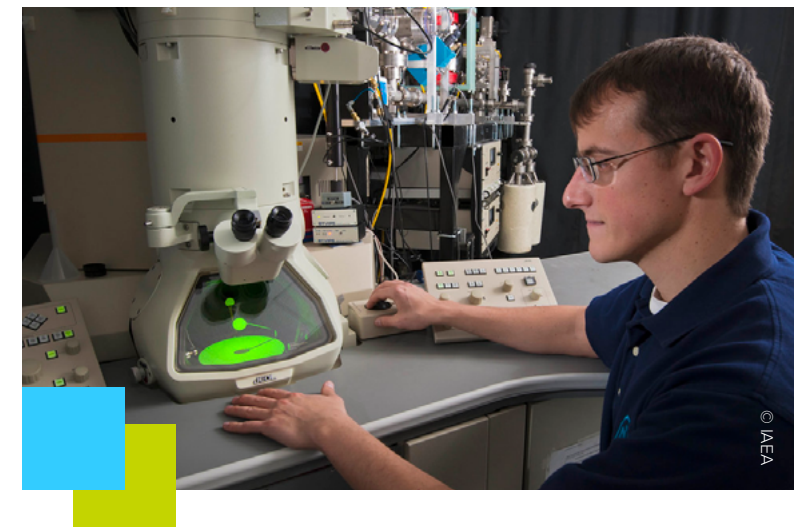
The Network was established in 2016, as a 3-year project led by the University of Surrey in partnership with AWE and funded by the Science and Technology Funding Council (STFC) 21st Century Global Challenge Networks Programme. Government sponsorship and oversight comes from the Home Office, DSIT (formerly BEIS), DfT, CPNI, MoD, Department of Health, Industrial oversight from AWE, the NNL and Knowledge Transfer Network, and Academic leadership from the Universities of Liverpool, Manchester, Surrey, and Sheffield.

The Network has continued to receive additional funding from the STFC and AWE to support dialogue and research collaborations with academic researchers within the STFC Academic Community, Industry and Government through the award of grants for UK & US Collaborative Research, A Sigma Data Challenge, PhD Studentships, Personal Development Grants and Summer Student Pilot Projects.

The NuSec Network currently has over 470 registered network members with 55% from Academia, 33% from Industry and 12% from Government Departments and funded Agencies.

If you would like to join the network membership and receive regular network updates on our funding and research opportunities, please contact [info@nusec.co.uk](mailto:info@nusec.co.uk).

The NuSec Network will formally end on 31st March 2025 and elements of the Network will be delivered by the new **Nuclear Threat Reduction Network (NTR-Net)**.



## 2023 Achievements

**Awarded** 11 Collaboration Grants to support PDRA, Research Visits and Travel between UK and US NNSA Consortia/ DTRA URA University researchers working on nuclear security and non-proliferation research. Total value of ~£469K

**Hosted** 65 people at a Technical Research Workshop, London 2022, allowing 22 presenters to share and discuss findings from their NuSec funded research projects.

**Funded** 4 Summer Pilot Projects to support development of early ideas, small proof of concept and feasibility studies in nuclear security science. Total value of ~£15.2K

**Funded** 3 Sigma Data Challenge Research Projects. Total value of ~£10.1K

**Awarded** 3 Personal Development Grants (PDG) to support the presentation and discussion of nuclear detection research to European and International Audiences. Total value of ~£2.7K

## Join Us

If you would like to receive regular network updates please contact [info@nusec.co.uk](mailto:info@nusec.co.uk)  
For more information about our Nuclear Security Science Events, Funding and Research Opportunities visit: [www.nusec.uk](http://www.nusec.uk)



# NETWORK ACTIVITIES IN 2022-2023

## Collaboration Grants Research Visit 2023 Awards

Our eleven Collaboration Grant Awards have supported partnerships between UK and NNSA Consortia/ DTRA URA Universities and Laboratories working on security and non-proliferation.

Our PDRA awards have enabled UK ECRs to undertake 3-12-month research projects within the UK and with members of the NNSA & DTRA URA consortia on new detector and non-proliferation technologies.

They have facilitated researcher visits to UK & US laboratories to undertake novel scientific research, obtain a first-hand insight of UK & US detection hardware, data collection & management, and analytical methods.

Working collaboratively with other experts has helped to improve researcher understanding of their results, and built confidence to try alternative approaches. Researchers can also demonstrate and refine new developing detection technologies to potential future end users in the US and UK.

Our travel awards have enabled UK researchers to visit the US and other European Countries to deliver face-to-face presentations of their research findings. Conferences and meetings provide an opportunity to share experiences, discuss solutions to technical challenges and agree next steps for research projects.

Projects that have completed their research in 2023 will share their results at our [Technical Workshop, London, 9th October 2023](#).

University	Project	Award	Collaboration UK/ NNSA Consortia/ DTRA URA	Collaborator
Sheffield	A Boron Loaded Opaque Scintillator for Low-Cost Directional Neutron Sensing	PDRA	UK	Kings College London
Bristol	Advanced UAV-based radiation and dosimetry determinations using solid-state LiDAR combined with gamma spectrometry.	PDRA, Research Visit	NSSC	Florida International University, University of Nevada, and DoE Airbourne Radiometric Team
Manchester	Develop and refine a fast and portable camera for detection and monitoring of nuclear materials	PDRA, Research Visit, Travel	NSSC	Brookhaven National Laboratory
Bristol	Enhancing 'Big-Data' Visualisation and Presentation in Data-Rich Nuclear Security Scenarios	PDRA, Travel	ETI	Pacific Northwest National Laboratory
Bristol	Identifying Opportunities for UK-US Collaborations in Micro-Particle Nuclear Forensics	Research Visit	ETI	Pacific Northwest National Laboratory
Surrey	Isomer cross sections	U/G Summer Student	N/A	N/A
Surrey	Large area CsPbBr3 Perovskite detectors for Nuclear Security Applications	PDRA, Travel	IIRM	Applied Radiation Laboratory at Penn State University.
York	Neutron Detector Development Using Novel 3He Encapsulated Foils	PDRA	N/A	N/A
Bristol	Optimisation of drone-based aerial mapping sensors for distinguishing NORM from anthropogenic gamma sources	PDRA	NSSC	University of Nevada and US Govt. Dept. of Energy NISA
Surrey	Sigma Data: Data evaluation and optimisation for threat response	PDRA, Travel	N/A	N/A
Glasgow	Test an Organic Scintillator EJ-276, and an Inorganic Scintillator CLLBC, on a Detector Prototype using both the neutron generators (D-D and D-T) and alternative radioisotope neutron sources	Research Visit	MTV	University of Michigan

## Technical Research Workshop, London 2022

[Our workshop](#) was attended by 65 people in person and online presentations were given by our NuSec funded PhD students, UK-US Collaboration Grant awarded, undergraduate Summer Pilot Projects student. The event provided an opportunity to share and

discuss results from their research projects and also launched the Sigma Data Challenge. Workshop Presentations can be viewed on our NuSec Website [Events page](#) and the pilot project posters on our [Publications page](#).

## Sigma Data Challenge

Our Sigma Data Challenge is a pilot project for academic researchers to access and analyse large gamma ray spectra data sets collected from multi-site radiation detectors in London during 2017/2018.

10 research groups from UK & USA Universities as well as Government Laboratories responded to this Challenge call. Over the past year, they have been exploring and analysing the Sigma Data using a variety of methods, including algorithms and machine learning models to identify threatening radioactive material/isotopes, and to assess the distribution and quality of the short duration spectra data from mobile and fixed radiation sensors.

Fuzzy Logic Methodology has also been applied to combine outputs from Sigma detectors

in geographical proximity to enhance confidence in decision-making. An investigation has also been carried out to assess whether Training, Validation and Testing sets can be created from the Sigma Data to facilitate the use of a convolutional neural network and identify anomalies in sparse and/or noisy spectra.

A signal-processing algorithm has been developed to test whether a cosmic shower (a multi-detector signature) could be detected.

The latest results from the Sigma Data Challenge will be presented by various research groups at our [Technical Workshop, London, 9th October 2023](#).



## Summer 2023 Nuclear Security Pilot Projects

Following an external competition in Spring 2023, the NuSec Science Network made four awards to universities for early-stage research on topics that could enhance the field of nuclear security. The value of each award was up to ~£4,000. Research was undertaken in the Summer 2023 by undergraduates and supervised by senior Academics.

University	Pilot Project Title
Lancaster	Advancing Helium-3 alternative Detector Technologies for Nuclear Security
Liverpool	Background measurements at Hartlepool Nuclear Power Station to assess the viability of on-site antineutrino detection
Lancaster	Susceptibility of SD Memory Cards to Neutron Damage
Liverpool	The Development of Position-Sensitive LaBr3(Ce) Detectors for Compton Cameras

Industry were also involved in some projects providing expert advice, access to & loan of research facilities and equipment. These projects will build the foundations for further research & development and funding applications. Posters summarising the research methodology, results and recommendations for each project will be presented at our [Technical Workshop, London, 9th October 2023](#) and can also be viewed on our NuSec website [Publications Page](#).

## Personal Development Grant Awards

We have awarded 3 Personal Development Grants (PDG) to three ECRs at two universities to support the presentation of nuclear detection research at a European and International Conference.

Our awards have/will help to support discussions between European and international researchers who can provide helpful insights or advise on other relevant research fields.

They also provide an opportunity for researchers to build their professional networks with other instrumentation developers, and explore future potential career opportunities.

Awardees	PDG Award & Activity
UCL	RAD11 conference International Conference on Radiation Natural Science, Medicine, Engineering Technology and Ecology Conference 19-23 June 2023, Montenegro. <i>A new approach to directional radiation detection using a Monte Carlo based study</i> ; joint oral presentation.
Sheffield and UCL	IEEE Nuclear Science Symposium (NSS), 4-11 November 2023, Vancouver, Canada. <i>Novel borehole detectors for oil and gas formation research and the Development of novel CsPbBr3-polymer composites for radiation detection</i> ; oral presentations.

## PhD Studentships

Our six NuSec funded PhD studentships support research in detection systems and related technologies for nuclear security applications. 2023 was the final year of NuSec funding for 3 PhD studentships. Our funding covered the first 21 months of research costs, matched funding from industrial and academic partners provides financial support for the remaining research period.

NuSec funded PhD Students will provide a progress update on their research at our [Technical Workshop, London, 9th October 2023](#).

University	PhD Title	Project Duration
Bristol	Developing the next-generation of shipping container scanning systems	October 2020 - June 2024
Sheffield	Development of mixed field radiation detection techniques for oil and gas well logging	October 2020 - June 2024
UCL	Larger area semiconductor detectors based on novel inorganic polycrystalline perovskite materials	October 2021 - June 2025
Glasgow	Development of compact neutron detectors using next-generation scintillator materials	October 2021 - June 2025
Queen Mary London	Evaluating the suitability of Organic Semiconductor Detectors for Nuclear Security	October 2021 - June 2025
Bristol	Real time identification and tracking of radioactive materials carried by humans	October 2021 - Sept 2025