Joseph Allcock

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Profile

I am a software engineer and scientist with expertise in spectroscopy for physics research and experience developing user-focused software applications in a commercial setting. I have led spectroscopy projects through each stage of the development lifecycle—from ideation and design to deployment and operation—building automated pipelines for the acquisition and analysis of complex scientific data. Broadly, I like solving tough technical problems in a multidisciplinary environment.

Education

Durham University *Durham, UK*

PhD, physics *2015 - 2020*

- Developed new spectral imaging techniques for measuring plasma conditions inside nuclear fusion reactors (thesis).
- Research group: Centre for Advanced Instrumentation (CfAI).
- Research highlights:
    1. Reduced calibration hardware costs tenfold while maintaining measurement accuracy[2].
    2. Incorporated a novel sensor type, increasing spatial resolution by a factor ∼2[5].
    3. Co-led the deployment of a spectral imaging system on a fusion reactor in China[7].

University of York *York, UK*

MPhys, physics *2011 - 2015*

- Grade: First Class.
- Dissertation: Analysis of x-ray spectroscopy data from a US fusion reactor.

Experience

Foundry *Manchester, UK*

Software Engineer *2022 -*

- Project: Katana, an application for 3-D lighting and look-development in film VFX.
- Tech stack: C++, Qt, Python, OpenGL, Windows, Linux.
- Responsibilities: improving performance, implementing new features, fixing bugs, writing documentation and meeting with customers.
- Modern development practices: scrum, agile, code review, continuous integration, version control and test-driven development.
- Leadership: 'Scrum master' for my team and C++ mentor at Foundry.

UK Atomic Energy Authority *Oxfordshire, UK*

Postdoctoral Research Fellowship *2020 - 2022*

- Project: MAST Upgrade, the UK's flagship 'tokamak' nuclear fusion reactor.
- Responsible for an 11-camera imaging polychromator[6]. I supported the design and testing and then led the installation and operation. I developed a data acquisition and analysis pipeline to process ∼100 GB daily, supporting successful physics investigations (e.g. [3, 4]).
- Responsible for development and testing of novel spectral imaging techniques.
- Supervised successful student research projects: 1x high school, 1x undergraduate and 2x PhD co-supervision (partial).

Kromek *Durham, UK*

Placement student *Summer 2014*

- Tested a portable gamma-ray spectrometer and neutron detector against ANSI standards.

Skills

Languages	Python (10 yr), C++ (4 yr). Some experience with C, JavaScript, Matlab, Fortran.
Libraries	Qt, OpenCV, the Python scientific stack (NumPy, SciPy, Matplotlib, Xarray, Pandas).
Tooling	Shell script, Batch script, git, Gitlab CI, CMake, gtest, pytest.
Optics	Spectroscopy, Polarimetry, Imaging, Interferometry, Ray-tracing, Optical design, Zemax.
Scientific	Data analysis, Statistics, Signal processing, Computer vision, Inverse problems.
Communication	Technical communication for audiences at all levels, internal and external. Public speaking, Data visualisation, LaTeX.
Teamwork	On-site collaboration, remote collaboration, international collaboration, chairing meetings, Scrum master-ing.
Leadership	I have supervised successful student projects from high school to PhD level, have mentored colleagues in technical .

Achievements & Funding

2024 **Q2 Foundry All Star** .
2023 **Editor's pick** in the journal Optics Express[2].
2020 **UKAEA-PPPL postdoc fellowship** A competitive two-year research fellowship co-funded by Princeton Plasma Physics Laboratory.
2018 **University College travel scholarship** £500 from University College, Durham University, to support a PhD research trip.
2018 **Fusion-CDT 'collaboratory' bursary** £3300 to support a PhD research trip.
2014 **Institute of Physics 'Top 40' bursary** £2500 to support an undergraduate work placement.

Volunteering & Outreach

2023 **Maths tutor** Tutored disadvantaged pupils with Action Tutoring.
2021 **Peer reviewer** for Review of Scientific Instruments.
2018 **UKAEA student committee chair** Chaired meetings, organised speakers for weekly talks.
2018 **UKAEA school demonstrator** Taught children about fusion using a gigantic tent shaped like the Sun.
2018 **Conference co-organiser** Co-organised the 'Fusion Frontiers and Interfaces' conference at Uni. of York.
2017 **UKAEA rep. at New Scientist Live** Helped run UKAEA's stall at the 'New Scientist Live' event three years in a row.

Selected Publications

[1] R. S. Doyle, N. Lonigro, **J. S. Allcock**, et al. "Development and calibration of a multi-delay coherence imaging diagnostic on the MAST-U tokamak". In: *Review of Scientific Instruments* 95 (2024), p. 053505. ISSN: 0029-5515. DOI: 10.1063/5.0205584.

[2] **J. S. Allcock**, S. A. Silburn, R. M. Sharples, et al. "Wavelength calibration of birefringent interferometers for 2-D measurement of plasma flow". In: *Optics Express, Vol. 31, Issue 2, pp. 1901-1915* 31 (2023), pp. 1901–1915. ISSN: 1094-4087. DOI: 10.1364/OE.473278.

[3] T. A. Wijkamp, **J. S. Allcock**, X. Feng, et al. "Characterisation of detachment in the MAST-U Super-X divertor using multi-wavelength imaging of 2D atomic and molecular emission processes". In: *Nuclear Fusion* 63 (2023), p. 056003. ISSN: 0029-5515. DOI: 10.1088/1741-4326/ACC191.

[4] K. Verhaegh, B. Lipschultz, J. R. Harrison, et al. "Spectroscopic investigations of detachment on the MAST Upgrade Super-X divertor". In: *Nuclear Fusion* 63 (2022), p. 016014. ISSN: 0029-5515. DOI: 10.1088/1741-4326/ACA10A.

[5] **J. S. Allcock**, S. A. Silburn, R. M. Sharples, et al. "2D measurements of plasma electron density using coherence imaging with a pixelated phase mask". In: *Review of Scientific Instruments* 92 (2021). ISSN: 10897623. DOI: 10.1063/5.0050704.

[6] X. Feng, A. Calcines, R. M. Sharples, et al. "Development of an 11-channel multi wavelength imaging diagnostic for divertor plasmas in MAST Upgrade". In: *Review of Scientific Instruments* 92 (2021). ISSN: 10897623. DOI: 10.1063/5.0043533.

[7] T. Long, **J. S. Allcock**, L. Nie, et al. "Doppler coherence imaging of scrape-off-layer impurity flows in the HL-2A tokamak". In: *Review of Scientific Instruments* 91 (2020). ISSN: 10897623. DOI: 10.1063/5.0005609.