

Industry Engagement and Innovation

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Introduction

In the dynamic landscape of scientific innovation, the Central Laser Facility (CLF) has established itself as the hub for collaboration and scientific advancement. This article provides an overview of the CLF's engagements with industrial partners and highlights its innovative initiatives spanning the period from April 2022 to March 2023.

Empowering Industry Engagement

The past few years have seen an increase in industry engagement, with around 20 weeks of facility access extended to industry users across both the high-power laser (HPL) and the laser for science (LSF) divisions during this reporting period. The Industry Partnership and Innovation (IPI) group at the CLF have actively consulted with stakeholders from diverse sectors, including life science, net zero initiatives, and healthcare.

A noteworthy Proof of Concept (PoC) study by Johnson Matthey (JM) yielded promising results. This was carried out utilising Octopus's Fluorescence Lifetime Imaging Microscopy (FLIM) to characterise particulate filters and washcoat layers and understand deposition on the filters. Similarly, Finden, a RAL based company, revisited the CLF for commercial beamtime following successful POC work on the Raman microscope, demonstrating the tangible impact of collaborative research ventures.

Sustained partnerships with academia and industry have resulted in significant advancements. For example, Professor

Jim Thomas's research endeavours, alongside his spin-out company MetalloBio, focused on understanding the mechanism of action of the various antimicrobial complexes to aid further development using the facility's suite of imaging equipment. The researcher was also awarded the 2023 CLF Societal Impact Award at the facility user meeting. Further experiments are planned with MetalloBio in the next financial year.

A collaborative effort has emerged between the CLF and researchers from the University of Kent and Fujifilm-Diosynth Biotechnologies, to explore alternative approaches for extracting functional proteins from *E. coli*, offering promising avenues for enhancing protein mass production processes. Utilising advanced Structural Illumination Microscopy from Octopus, the team delves into *E. coli* membrane structures, aiming for super-resolution insights to enhance protein extraction mechanisms. The goal is to develop scalable techniques applicable to numerous fields like drug delivery, vaccination, and protein storage.

The CLF has also facilitated Proof of Concept (POC) consultations with the STFC Food Network, General Fusion, ConnectomX, UKHSA, Phytoceuticals Ltd, NATA, and SomaServe. These collaborations exemplify the CLF's dedication to fostering long-term relationships and driving meaningful research outcomes.

Fostering Industry Partnership

The CLF continues to prioritize cultivating partnerships with both academic and industrial stakeholders. Under the Innovation Partnership Scheme, collaborations with the University of York, UCB Pharma and the CLF Ultra facility have been instrumental in exploring novel applications of two-dimensional IR spectroscopy as a liquid-biopsy diagnostic technique. These collaborations highlight the transformative potential of interdisciplinary research in driving innovation in healthcare diagnostics. Professor Neil Hunt and his team at the University of York have subsequently been awarded the 2023 CLF Economic Impact Award.

Continuing to build a relationship, consultations were held with LightOx for their next A4i proposal, utilising ULTRA's time resolved IR and transient absorption spectroscopy set-up, to look at the dynamical properties of light-activated probes.

Additionally, the CLF's ongoing partnership with JM, explores advanced techniques on novel materials signifying a commitment to exploring cutting-edge technologies and fostering innovation in industries. The appointment of a new joint research fellow further emphasises the CLF's dedication to advancing research through collaborative efforts.

Driving Innovation and Impact

The CLF's IPI group remains at the forefront of identifying novel concepts and technology transfer opportunities to deliver industrial and societal impact.

Notably STFC and the CLF collaborated with partners including the University of Oxford, Agilent, and Serum Institute of India, funded by WHO, in utilising a specialised laser spectroscopy technique developed at CLF (Spatially Offset Raman Spectroscopy - SORS) for verifying falsified COVID-19 vaccines in supply chains. These efforts emphasize commitment to addressing global challenges

through innovative solutions and collaborative partnerships.

In a momentous occasion in July 2022, the CLF celebrated the completion of the Extreme Photonics Applications Centre (EPAC) building with a diverse array of collaborators present, marking a significant step forward. The completion of EPAC's construction phase in May 2022 paved the way for the installation phase to begin, with full operations anticipated for 2026. EPAC, a shared endeavour between the UKRI, the MoD, academia, and industry, represents a pioneering initiative aimed at harnessing interdisciplinary expertise to develop and apply novel laser-based accelerators and particle sources with unique properties. EPAC is expected to drive scientific breakthroughs and catalyse innovative solutions for complex challenges, and holds the promise of advancing UK science and technology in new areas, bolstering healthcare and fostering a cleaner, more productive economy.

The Central Laser Facility's continued work to develop collaborative partnerships and drive innovation plays a pivotal role in advancing scientific knowledge and addressing global challenges. As projects move forward, these collaborations will continue to shape the landscape of scientific research and technological innovation, propelling us towards a brighter, more sustainable future.

Collaborations such as the Extreme Photonics Innovation Centre (EPIC) between the CLF and the Tata Institute of Fundamental Research, India, highlight the facility's global impact in fostering technological advancements and skill development.