ALICE shines at STFC Daresbury Laboratory

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A light source of unprecedented brilliance, the technology of which is poised to be responsible for significant advancements in fields such as healthcare, materials science and sustainable energy and to open up vast new areas for scientific exploration that have previously been inaccessible, has been achieved at STFC's Daresbury Laboratory.

Scientists working on ALICE (**A**ccelerators and **L**asers **I**n **C**ombined **E**xperiments), an R&D prototype for the next generation of accelerator based light sources, have successfully demonstrated Europe's first Free Electron Laser to be operated on an energy recovery particle accelerator, on 23 October 2010.

A Free Electron Laser (FEL) is unparalleled in its capability as a light source, the intensity of light emitted is so strong, and of such exceptional quality, that it can be used to surgically remove a brain tumour without damaging the surrounding tissue and it can even weld metal.

Acting like a conventional laser incorporated into a particle accelerator, the light bounces backwards and forwards between mirrors and can be controlled and manipulated much more precisely than conventional lasers to produce intense, powerful light with extreme precision.

FELs can be used to help us better understand the fundamental processes of life itself as they allow scientists to study chemical reactions in real time, examine how catalysts behave, and increase their understanding of biological processes, such as the behaviour of a virus or the location of a drug on the surface of a molecule.

Particle accelerators themselves normally consume huge amounts of energy and can therefore be very expensive to run. However, as an energy recovery particle accelerator, ALICE is able to recover and re-use a proportion of its energy, making it more efficient and using significantly less energy than a conventional accelerator. Minimum energy is used to create the best possible beams of light.

ALICE's demonstration of the Free Electron Laser in the infra-red region of the spectrum was achieved at 27.5 million electron volts and is Europe's first energy recovery accelerator to do this. The same technology could be used to create light from infra-red through to X-rays.

Professor Keith Mason, STFC's Chief Executive, said: "This is a fantastic achievement and all of those involved in this project have worked tremendously hard to demonstrate this capability, which is the first of its kind in Europe. Reaching this milestone has confirmed the UK's ability to build, develop and demonstrate its scientific skills and techniques in this field and given us some exciting prospects for the future of next generation light sources. This is technology that will change people's lives for the better and make our environment a cleaner place."

Professor Jim Clarke, Head of Magnetics and Radiation Sources Group at STFC Daresbury Laboratory added: "This technology will open up completely new research opportunities for scientists in both universities and industry that were previously inaccessible. The impact of this technology is set to be huge, from studying a drug on a cell membrane to gain a deeper understanding into how drugs behave in the body, to a better understanding of the mechanisms behind solar cells with a view to improving techniques for cleaner energy, this is a giant step in the development of a major FEL facility for the UK scientific community."

Academics at the University of Liverpool are already researching the applications of this 4th generation light source in nanobiology, whilst scientists at Imperial College London want to use the light to manipulate gas molecules into precise orientations at an instant in time.

Liverpool's Professor Peter Weightman, who is

leading biological research on ALICE said: "The completion of the UK's first free electron laser opens the way to sub-cellular imaging of processes taking place in living cells with considerable potential for advances in both fundamental science and the treatment of disease."

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