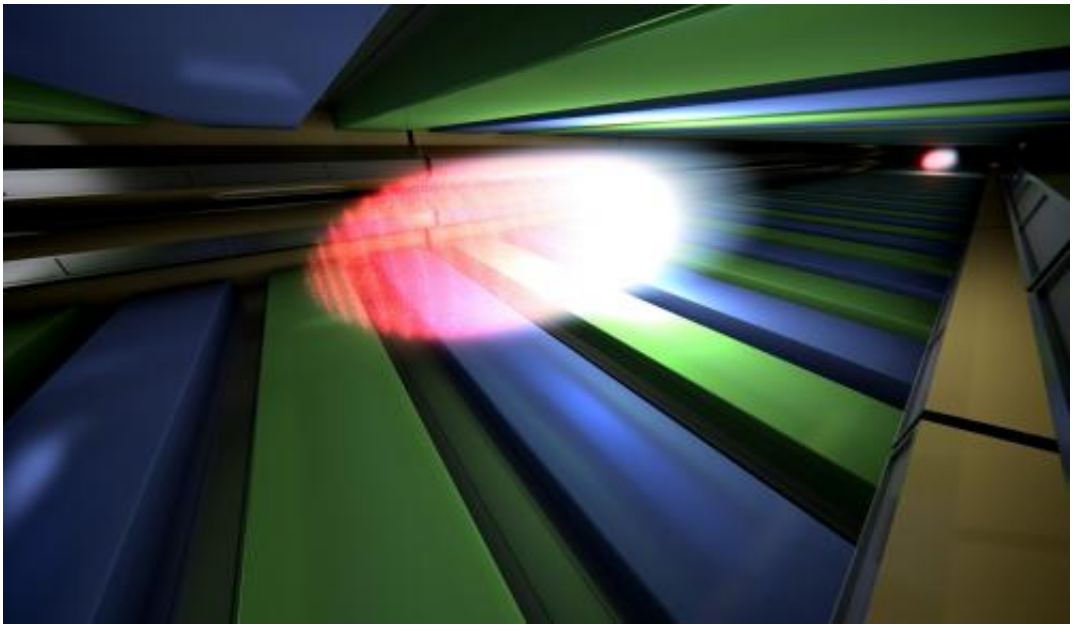
New X-ray camera will reveal big secrets about how chemistry works

July 27 2011



Generation of X-ray laser flashes in an undulator. To generate the extremely short and intense X-ray laser flashes, bunches of high-energy electrons are directed through special arrangements of magnets (undulators). Credit: European XFEL

Designed to record bursts of images at an unprecedented speed of 4.5 million frames per second, an innovative X-ray camera being built with STFC's world-class engineering expertise will help a major new research facility shed light on the structure of matter.

The unique device will be delivered to the billion-euro European XFEL (X-ray Free-Electron Laser) next year and will contribute to drug discovery and other vital research once this facility starts operating in 2015.

The go-ahead for continuation of the £3 million prototype collaboration contract for the camera's construction has been confirmed following a visit to STFC by a delegation from the European XFEL's Detector Advisory Committee.

The decision to entrust construction of this crucial piece of equipment to STFC recognises the organisation's outstanding capabilities in advanced microelectronics and the design of high-tech imaging devices (e.g. for the Large Hadron Collider at CERN).

Now under construction near Hamburg in Northern Germany, the European XFEL is a 2-mile-long facility that will use superconducting accelerator technology to accelerate electrons which then generate X-ray flashes a billion times brighter than those produced by conventional X-ray sources. Each flash will last less than one hundred million billionth of a second. With the properties of laser light, these short, intense flashes will, for example, make it possible to take three-dimensional X-ray images of single molecules.

Current leading-edge X-ray cameras are designed to capture images when matter is bombarded by a constant beam of X-rays. But the extreme brevity and intensity of the flashes produced by the European XFEL means such cameras will not be suitable for use at the new facility.

STFC's new device, which is being built in collaboration with University of Glasgow, is specifically designed to work in conjunction with hyper-short, hyper-brilliant X-ray flashes. It will be installed in one of the first

experimental endstations incorporated in the European XFEL.

The device will help ensure that the European XFEL provides a unique opportunity for science and industry to understand matter and its behaviour, mapping the atomic details of viruses, for instance, or pinpointing the molecular composition of individual cells.

Dr Tim Nicholls of STFC says: "We're delighted that the European XFEL has turned to STFC to build this pioneering camera. It demonstrates how the UK can provide the high-tech excellence that world markets need, leading to scientific advances that make a real difference to people's lives."

Dr Markus Kuster, Group Leader of European XFEL GmbH's Detector Development says: "The European XFEL will represent a major step forward in equipping Europe with a new generation of research infrastructure that can meet the requirements of the 21st century. STFC's unique skills are creating an imaging device which will help this remarkable facility realise its vast potential".

Provided by Science and Technology Facilities Council