

# Leading edge facility to strip history bare

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This is one of the Bronze Egyptian statues owned by the British Museum which they would like to study at Diamond using JEEP. Credit: Copyright Trustees of the British Museum

A new facility opening later this year at the Diamond synchrotron is set to revolutionise world heritage science. A new research platform soon to be available at the leading UK science facility, Diamond Light Source,

will help uncover ancient secrets that have been locked away for centuries. For the first time ever, cultural heritage scientists will be able to scan and image large relics and artefacts up to two tonnes in weight in incredible precision. They will no longer be restricted to examining small items.

Speaking at the AAAS Meeting in Chicago Dr Jen Hiller, Diamond's resident archaeologist, announced that the UK synchrotron will open a powerful new experimental station this autumn. Called the Joint Engineering, Environmental and Processing (JEEP) beamline, it will carry out experiments in a variety of areas including the growing field of world heritage science.

Dr Hiller explains, "Heritage scientists across the world are able to apply to use this unique beamline to delve deep inside precious ancient artefacts to unravel their secrets in a non-invasive way. Never before has it been possible to scan and image such large relics with such precision. Now is the time for researchers in this field to maximise this unique opportunity and consider how JEEP can help to advance their studies. "

"Thanks to the intensity of the X-rays produced by JEEP and its flexible space, researchers will be able to obtain a much higher resolution image, down to the scale of a few microns (less than the width of a human hair), and in significantly less time than the existing methods; we are talking about a matter of minutes as opposed to a number of hours. This finely detailed picture will enable scientists to see right inside an artefact helping them to obtain crucial information to piece together the story of its origin and history." continues Dr Hiller.

Eagerly awaiting the arrival of JEEP is Dr Janet Ambers, a scientist from the Conservation and Scientific Research Department at the British Museum. Along with her team Dr Ambers is currently studying a group of half life-sized Egyptian bronze statues. Until now they have only been

able to examine them in a limited amount of detail leaving many questions unanswered. Diamond's JEEP beamline is set to change that.

Dr Ambers says, "We know that these statues are made up of a number of different parts that have been joined together. The joins are so dense that it is only by using JEEP's intense X-rays that we will be able to penetrate them and see how the statues were made. This will help to answer questions about the technology and materials used to originally produce the statues as well as provide information on how they were modified during 19th century restoration work. We are very excited about having access to this innovative tool because it will allow us to look at our artefacts in a completely new way."

Current analytical methods used by scientists at the British Museum allow them to produce standard 'X-rays' of objects using a static industrial X-ray tube. Alternatively, using a medical facility it is possible to perform a CT scan for relatively light objects. But both of these methods are limited in their precision and the amount of detail that they can provide. The former is incapable of creating a 3D image and the latter is suitable only for non-metallic objects. Neither method can deal with large heavy objects.

Dr Michael Drakopoulos, the Principal Beamline Scientist for JEEP, says, "The versatility of JEEP will open up exciting new opportunities in many fields of science due to its extremely high flux, high energy X-ray beam and its two complementary experimental areas. The larger area coming on line in Spring 2010, will be situated outside, further away from the X-ray source, allowing for a whole new range of exciting experiments currently not possible anywhere else in the world. It's fantastic that JEEP can help not only towards major advances in the environmental sciences and the world of engineering but also can have an extremely positive impact within the field of world heritage science."

Developments like JEEP are crucial to the growing field of heritage science in the UK. This was recently demonstrated by the creation of the Science and Heritage Programme, an £8 million five year research plan funded by the Arts and Humanities Research Council (AHRC) and Engineering and Physical Sciences Research Council (EPSRC) and supported by Research Councils UK. The programme takes forward recommendations made by the House of Lords Science and Technology Select Committee report on science and heritage of November 2006. This concluded that there was a compelling need for a comprehensive national strategy for heritage science. The vision of the Science and Heritage Programme is to increase knowledge and the resilience of our cultural heritage in the face of twenty-first-century challenges.

Combined with techniques available at other complementary facilities, cultural heritage research carried out at the Diamond synchrotron and the advances in the tools it provides will help the UK to maintain its position as one of the world leaders in the field of world heritage science.

Diamond generates extremely intense pin-point beams of synchrotron light of exceptional quality ranging from x-rays, ultra-violet and infrared. For example Diamond's x-rays are around 100 billion times brighter than a standard hospital X-ray machine or 10 billion times brighter than the sun.

Many of our everyday commodities that we take for granted, from food manufacturing to cosmetics, from revolutionary drugs to surgical tools, from computers to mobile phones, have all been developed or improved using synchrotron light.

Source: Diamond Light Source

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