



diamond news

News update from Diamond Light Source



Countdown to operations

With just one year to go before Diamond starts welcoming users, it is amazing to think that the discussions and planning for the facility began some 15 years ago.

The scientific research community has played a big part in shaping the techniques that Diamond will offer. Advisory committees and working groups have helped steer the direction of the facility and Diamond's 232 staff, coupled with a large number of contractors, are proving that with commitment and team spirit anything is possible.

Throughout 2006, everyone working on Diamond is going to be extremely busy. Tight deadlines have to be met on machine installation and beamline commissioning to ensure that the facility will be ready for the user community to embark on experiments in the early part of 2007. During the year new recruits will be joining the team until we are fully staffed with around 300 employees.

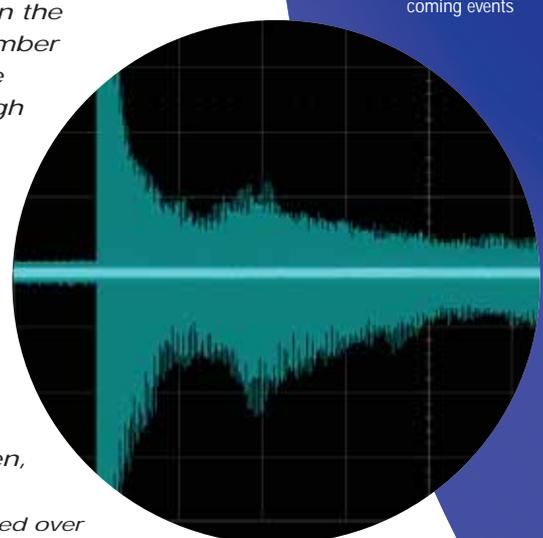
The challenges that lie ahead within the 45,500 square metre synchrotron building involve interlinking the network with many hundreds of kilometres of cabling and assembling, aligning and testing thousands of components throughout the machine.

Prof Gerd Materlik, Diamond's Chief Executive, comments, "Our main priority is

clearly to safely deliver the facility on time, within budget and to specification – a goal common to everyone in our dedicated team. I am delighted to report that we achieved beam in the booster in December 2005, ending the year on a real high note"

"In addition, we have an active programme of outreach planned for both current and potential users so that, once we are open, the facility and
continued over

This image shows an oscilloscope trace of a pickup signal. The time axis extended for 500 microseconds (about 1000 turns). The intensity shoots up as the beam is injected and then decays over about 500-1000 turns. This is evidence that the booster stored the electron beam for this length of time



In this issue

Latest News

Countdown to operations

Diamond measures up

Engineers busy all around the synchrotron

Comfortable user accommodation on its way

The Diamond factor

User Office Manager joins the team

Industry Open Day

Diamond sensors detect the South Asia earthquake



Dates for the diary

A round-up of up and coming events





techniques are maximised to their full potential. Looking ahead, having successfully met all the current challenges, 2007 will be an exciting year for everyone involved in Diamond, particularly our user community. We are very much looking forward to welcoming them and playing our role in helping them to achieve world leading science."



Diamond News caught up with two UK based scientists to find out how synchrotron research is helping them and the impact Diamond will have on their work.

Professor David Stammers from the University of Oxford

leads a group at The Wellcome Trust Centre for Human Genetics where HIV studies form part of the research programme.

"Research on understanding the structure and function of the HIV protein called reverse transcriptase (RT), which the majority of anti-AIDS drugs target, began back in the late 1980's", explains Prof Stammers. "Recent developments in X-ray crystallography methods have helped us to make some important discoveries and various synchrotron facilities around the world have become invaluable tools for the team."

"The crystal structures of HIV RT that have been solved with the help of synchrotron light have gone some way to telling us how the drug resistance comes about. Additionally, the structures have provided the basis for the design of new non nucleoside inhibitors, which retain high potency against existing drug resistant forms of the virus. It is hoped that the inhibitors will form the basis for the next generation of anti-HIV RT non-nucleoside drugs and Diamond's state of the art experimentation facilities will play a big part in the development of important drugs such as these".

In the groundbreaking field of nanoscience, there is much

excitement surrounding the technological developments that could result from research and development at the nanoscale. Scientists at the University of Leicester have been working on the properties of magnetic nanoparticles and, in the last 4 years, their work has caught the attention of the electronics company Seagate.

Prof Chris Binns explains, *"We are now able to create magnetic nanoparticles that are a few hundred atoms in size. Using the European Synchrotron Radiation Facility (ESRF) in Grenoble, we have been able to identify enhanced magnetic moments and develop a recipe for high moment films, which is an exciting breakthrough."*

Seagate see the commercial potential of using high moment materials for magnetic recording, as it will deliver yet higher data recording densities.

Prof Binns adds, *"Diamond's beamlines offer huge possibilities for UK based researchers and we are looking forward to bringing some of our future research questions to the facility and solving them with the help of the in-house scientists".*



On a mission to ensure Diamond measures up

Visitors to the synchrotron often find themselves imagining a fast paced, thrilling James Bond plot unfolding within the 45,500 square metre building. While undercover agents and scantily clad women are unlikely to ever feature heavily at Diamond, Bond would have a great deal of admiration for the achievements of one particular group within the team.

Successful "missions" take a great deal of precise preparation as Diamond's team of Survey and Alignment experts know only too well. They were among the first people to start working on the site back in September 2003, setting up their primary survey network using state of the art measuring equipment to an angular accuracy within 2.5 micro radians.

Dave Wilson is Head of the Survey and Alignment team. *"There are six of us and we are responsible for ensuring that Diamond's accelerators and beamlines are installed and maintained within the design and alignment specification"*, explains Dave. *"Back in 2003 our tasks were to develop a strategy for survey network design, develop the machine alignment philosophy and get involved with the machine and beamline design process."*

The group was also heavily involved on the construction site, measuring and qualifying the primary survey network and establishing reference datum points throughout the accelerator tunnels.

Dave says, *"The efficiency of our measurement process is vital. Survey resources need to be applied in such a*

way that downtime for the user community is kept to a minimum."

"Our tunnel network survey, which takes in the linac, booster and storage ring, has 80 survey stations. To survey the whole machine involves some 3000 measurements. This process is now much quicker thanks to instrument automation software written for us by Tom Hosking, a student who spent a month with us last summer".

"The team is currently in the final phase of storage ring girder pre-alignment. Advanced technology is applied here with the use of high precision laser trackers, which utilise micron accurate distance measurements in determining 3-D co-ordinates to a retroreflective target. Once all girders are installed, a complete storage ring survey will be carried out. Diamond's girder mover control system will then be used to move the girders to their required position, which needs to be within 0.1 mm accuracy to allow the electron beam to circulate".

"2006 promises plenty of exciting challenges for the team. We are also working on the booster to storage ring transfer line, preparing the initial alignment frames and survey references in the beamline hutches, and undertaking pre-installation tasks for beamline components."

I think we can agree that Diamond's survey efforts would make any 007 proud!



Diamond's Survey and Alignment team – (standing – left to right) Sid Meyer, Ric York, William Hoffman, Jason Giles. (seated – left to right) Anthony Mariani, Dave Wilson

news

Engineers busy all around the synchrotron



The Engineering team gathered in the atrium

There is a huge amount of technical expertise currently working on the installation of the synchrotron. Back in the Summer of 2004, when we last caught up with the engineering team, they were busy placing component orders and collaborating with suppliers to overcome design challenges and ensure all parts met Diamond's high specifications.

Today, with a much larger team including 34 Diamond staff, plus support from contractors and CCLRC engineers, there are 60 engineering experts working

on the installation of the machine.

Jim Kay, Diamond's Head of Engineering, explains *"In the past 18 months, we have grown and restructured the group, making sure that all the various engineering aspects of installation are being planned and managed to a high level of detail. We have 3 senior engineers overseeing the electrical and mechanical installation of the accelerators, storage ring and injector. In addition, we have teams looking after the engineering of the insertion devices, front ends and experimental stations".*

"Having spent a long time working off site with our many suppliers, it's really satisfying to see components arriving and the machine coming together within our magnificent building. The engineering team will be involved in some very varied and challenging work in 2006 and we still have a few vacancies for talented mechanical and electrical design engineers who wish to be part of this amazing facility."

For details of engineering vacancies at Diamond, please visit www.diamond.ac.uk or e-mail Jim.kay@diamond.ac.uk

Comfortable user accommodation on its way

Diamond users, along with those using ISIS and the Central Laser Facility, are going to have access to comfortable overnight accommodation located just outside the main security gate near the ATLAS building. Work on the new RAL guesthouse began in November 2005, shortly after Professor Dame Louise Johnson, our Life Sciences Director, cut the first turf.

Phase one of the project, consisting of 60 en-suite bedrooms, will be available by summer 2006. Phases two and three will increase the guesthouse capacity to 180 over the following 18 months.

Speaking to Diamond News at the turf cutting ceremony on 8th November, Louise Johnson said, *"Some users will require overnight accommodation, whereas those working on longer term experiments may need to stay for a week or more. Experiments can run over 24 hours, so to have somewhere for researchers to rest on site is going to be really beneficial."*

Left to right: Prof Dame Louise Johnson, Diamond Life Sciences Director, Bill Kingwill, Divisional Managing Director for the main contractor Mansell, Prof Gerd Materlik, Diamond Chief Executive, and Andrew Taylor, Director ISIS



The Diamond factor



The Diamond synchrotron, which was designed by architects Crispin Wride at Jacobs Engineering, has had a complex build programme with its fair share of challenges to overcome. As the construction phase nears completion, contractors involved with the prestigious project are having their hard work rewarded with high profile trade press coverage and, in some cases, building awards.

Congratulations go to Lakesmere, who provided Diamond's integrated window/walling product and bespoke brise-soleil, which they developed with their key suppliers. Lakesmere has been named Cladding specialist of the year by Building magazine's Specialist Contractor Awards 2005.

Costain, Diamond's main building contractor, is also in the running for recognition of their contribution to the creation of the synchrotron. Construction News has suggested Diamond on a shortlist for one of their Quality in Construction awards, which will recognise the greatest construction project delivered in the UK during the last decade. Other projects on the list include the Eden Project, the Channel Tunnel Rail Link and the Second Severn Crossing so we are in the company of some pretty high profile construction work.

User Office Manager joins the team

In January 2006, Susan Judge joined Diamond as our User Office Manager. Setting up the User Office will be a major task so Diamond News secured an early interview with Susan while her calendar still had some time available!



Susan Judge, User Office Manager

Susan brings a wealth of experience to Diamond and is looking forward to working with the team on the many challenges associated with setting up the User Office. Prior to her recent career break, she was the Technical Support Manager for a market leading engineering software business.

"For over seven years I provided and managed a range of support and training services for our academic and commercial customers", explains Susan. "I will be using this practical experience within Diamond to understand our Users' requirements".

"The User Office will be supporting the academic and industrial researchers from their earliest contact with Diamond through to post-beamtime feedback. The

professionalism of this support is important as we are the first point of contact for all users and conscious of the need to sustain a quality and professional service that reflects Diamond's values".

"An early task is to make sure that the on-line IT systems are in place to ensure beamtime applications can be made by autumn/late summer 2006. We also need to initiate the peer review panels that assess these applications, making sure that appropriate supporting information is readily accessible. By the end of the year, we will be prepared for the arrival of Users, making sure that things such as health and safety training, security and site access, travel and accommodation, and the practicalities of a user working away from their home base are all dealt with. The User Office aim is very simple: the User should be able to concentrate on the science and we will provide the logistical support that ensures the smooth running of their beamtime".

"Whilst we will aim to provide much of the support directly, there is no doubt that the breadth of support needed means that we will work alongside staff from across the company. For example, the detailed and complex enquiries about beamline use will need to be dealt with by the beamline scientists or technicians. So, I am very much looking forward to getting a broad understanding of the whole of Diamond's activities, getting to know people across the community and contributing to the success of a world leading research facility".

Food &
Industry
Precision

Nanoscience

On 6th December 2005 Diamond opened its doors to over 100 visitors from a broad range of industrial sectors, including pharmaceuticals, energy, engineering, environmental and electronics. The delegates came to gain an insight into how the machine will work, to discuss the benefits it will provide to industry, and to put their views forward to the Diamond team.

After a welcome from CEO Gerd Materlik, Sir David Cooksey, chairman of the Diamond Board of Directors, explained how his background as a venture capitalist and former Governor of the Wellcome Trust led to his involvement with the facility. He stressed the importance of Diamond as a national resource, benefiting the UK economy as well as UK science through exploiting new knowledge gathered at Diamond to develop innovative products and processes for the future.

Prof Colin Norris, Physical Sciences Director, described the capabilities of Diamond and explained how industry can gain access to the facility. He emphasised that procedures for industrial users will be flexible, and that he welcomed the input from those in the audience to talk to Diamond staff about their needs and expectations.

Colin then introduced two experienced synchrotron users, Professor Phil Withers of the University of Manchester whose work includes projects with Rolls-



Pharmaceutical

Engineering & Drink y Open Day electronics Environment

Royce plc, and Sir Tom Blundell of the University of Cambridge who is also co-founder of Astex Therapeutics.

Professor Withers covered the impact of synchrotron radiation in his industrial collaborations with the engineering sector. He described several applications, including using the synchrotron as an "X-ray stress-strain gauge", using X-ray

diffraction as a non-destructive tool for analysing what is going on beneath the surface of materials in operational conditions. He concluded that the applications of SR will play an increasing role in engineering research.

Sir Tom Blundell discussed how the use of synchrotron radiation had benefited research in structural biology, developing new

techniques for drug discovery. As well as his professorship at Cambridge, Sir Tom co-founded the company Astex Therapeutics in 1999 to commercialise the use of high-throughput X-ray crystallography in a novel fragment-based approach to drug discovery developed at various synchrotron facilities worldwide.

Finally Dr Malcolm Skingle of GlaxoSmithKline summarised the work of the Diamond Industrial Science Committee (DISCo) over the last 18 months in advising Diamond on industrial engagement to maximise the potential of the synchrotron. This has ranged from promoting the need for hotel-style accommodation, now underway in the development of the Guesthouse, to the

provision of onsite support laboratories and equipment.

The session was rounded off by a lively question and answer session where delegates took advantage of the opportunity to put their questions to the Diamond team, including the cost of beamtime, industrial access procedures and ownership of IP.

Lunch took place in the atrium of Diamond House, as delegates and Diamond staff mingled around an exhibition showcasing the impact of synchrotron radiation in a range of industrial applications. The beamline scientists were on hand to answer technical and practical enquiries, and there were many enthusiastic discussions about what each beamline will offer when the facility comes online in 2007.

Most delegates took up the opportunity of a site tour of the synchrotron under construction.

Diamond aims to provide proactive and flexible support for industry. We welcome your views on how we can help your organisation get the most out of the facility.

Please contact Dominic Semple on 01235 778217 or dominic.semple@diamond.ac.uk



A group of Industry Open Day delegates tour the synchrotron

DATES FOR THE DIARY

General public interest

Diamond & Soleil – Light for Science

25th January 2006

Royal Society of Medicine, London

Contact sarah.repacholi@diamond.ac.uk

Diamond general public/business talks

26th June 2006

Saïd Business School, Oxford

Contact sarah.repacholi@diamond.ac.uk

Scientific & technical interest

Protein Characterisation Seminar

Organised by MicroCal, LLC

& Malvern Instruments

31st January 2006 Diamond House

To register e-mail info@microcal.eu.com

Medical Science Workshop

26th April 2006 – Diamond House

Contact sarah.repacholi@diamond.ac.uk

Diamond sensors detect the South Asia earthquake

Around 4 am on 8th October 2005, a sensor in a first floor office in Diamond House registered a disturbance. The sensor is part of a seismometer, which will be installed in the experimental hall of the synchrotron. The signal it detected stemmed from the earthquake which devastated northern Pakistan 3,800 miles away.

The sensor is currently in the office of Dr Houcheng Huang, senior stress engineer at Diamond. He explains, *"In synchrotrons the stability of the position of the X-ray beam is very important. The stability has to be less than 1 µm at the sample where research will be carried out. Therefore Diamond will be equipped with seismometers, to monitor ground motions of the synchrotron building slab."*

The sensor at Diamond monitors in three dimensions; vertical, north-south and east-west. The amplitude of this event was about 100 µm, which was amplified by the three storey building where it is currently located.

When it is installed in the experimental hall it will detect disturbances from all kinds of sources. Whilst this includes earthquakes, ground motions resulting from human activity are likely to be more significant – if it had taken place during the day the signal may have been obscured by man-made noise.

Quick facts

- The epicentre of the Earthquake, just north of Islamabad, is over 3800 miles from Diamond
- The signal was detected at 4 am, taking 9 minutes to travel through the Earth.
- If the earthquake had happened during the day the signal may have been obscured by background noise
- If only these signals could have been detected in advance of the earthquake, then some of the tragic loss of life and destruction might have been averted. Further advances in technology are needed. Donations to the relief fund can be made through World Vision on 0800 088088

Contact information

Diamond Light Source Ltd
Diamond House, Chilton, Didcot,
Oxfordshire OX11 0DE

Head of Communications:
Isabelle Boscaro-Clarke
Tel: +44 (0) 1235 778130
E-mail: isabelle.boscaro-clarke@diamond.ac.uk

Media Relations Officer:
Silvana Damerell
Tel: +44 (0) 1235 778238
E-mail: silvana.damerell@diamond.ac.uk

Web Manager:
Catherine Gater
Tel: +44 (0) 1235 778420
E-mail: catherine.gater@diamond.ac.uk



diamond

www.diamond.ac.uk



CCLRC

wellcome trust