IN SITU X-RAY BEAM DIAGNOSTICS IN HEALTHCARE APPLICATIONS

BACKGROUND

Our patented technology addresses the need to fully characterise X-ray beams in terms of their location, shape and intensity distribution without disturbing them, thus representing a unique in situ or transparent beam quality monitoring and control tool. This tool is revolutionising beam diagnostics at intense X-ray sources around the world, for example Diamond Light Source (the UK's national synchrotron science facility, located at the Harwell Science and Innovation Campus in Oxfordshire) with the assistance of our exclusive license holder in this market segment.

A recent detailed investigation in conjunction with an NHS Trust successfully demonstrated the feasibility of utilising the technology for assessment and verification of external beam radiotherapy, widely used in the treatment of cancer.

TECHNOLOGY

With EPSRC funding innovative technology was developed to characterise intense beams of X-rays as produced by specialist sources called synchrotrons. These large-scale facilities serve large communities of scientists and engineers with a non-destructive probe that gives access to structural and chemical composition information down to the atomic scale. Measurement techniques using synchrotron radiation (SR) are amongst the most powerful tools available to science and engineering. Recent advances in focusing techniques have made it possible to achieve focal spots with a size of less than a tenth of the diameter of a human hair. Keeping these beams focused and aiming at microscopic samples has become very difficult due to unavoidable temperature fluctuations, vibration and source stability issues.

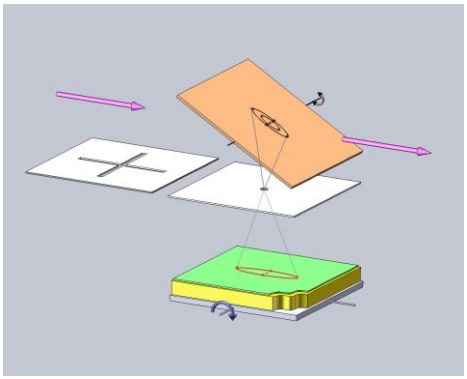

Figure 1: The beam imaging method

The patented solution developed at The University of Manchester allows researchers to measure beam position and shape during the experiments without influencing it and use this data to correct for any drift automatically and therefore stabilising beam delivery. The method relies on a very weakly scattering (highly transparent) foil of a suitable material, which is placed in the beam. The minute scattered radiation is then

collected through a suitable aperture by a highly sensitive X-detector that forms an equivalent of a 'pinhole' image of the (projected) shape and intensity distribution of the source (see figure above). To increase the received flux we use special coded apertures with one example shown next to the pinhole plate.

CURRENT STATUS

Synchrotron Radiation Sector

We were successful in securing further EPSRC funding to create a commercial product in collaboration with our license holder FMB Oxford Ltd., a UK-based supplier specialised in synchrotron radiation instrumentation. Our technology has gone through an extensive five-year campaign of evaluations at several synchrotron radiation sources. This has prompted us to develop a complete package that includes device, real-time embedded processing module and user software. Feedback from the collaborating users and early adopters has been extremely encouraging. The device is now available commercially from FMB Oxford Ltd.

Healthcare Applications

The technology has been proven to work over a wide range of X-ray energies making it valuable for more applications than the synchrotron one.

We have performed a detailed feasibility study at Diamond Light source to verify the performance of the device in the X-ray energy range similar to that produced by hospital radiotherapy sources. We showed that both beam imaging and position measurements could be recorded using the same scatter foil used for lower X-ray energies up to very high energies (>100keV). These energies contribute a substantial part of the spectrum as emitted by radiotherapy sources.

It has long been the intention to provide this technology solution to the healthcare sector but informed by industry experts and users it was evident that the technology would need to be proven in the Synchrotron Radiation sector first. This sector, although small has provided the technology with a credibility and evidence base that would allow future development to enhance the application of the technology into other, larger sectors namely healthcare.

INTELLECTUAL PROPERTY

An International Patent Application has been filed PCT/GB2009/001532.
This application is wholly owned by The University of Manchester and has the priority date 09.07.2008.

COLLABORATION OPPORTUNITY

We now seek to engage an industry partner to guide the development of the technology for use in radiotherapy.

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