MANCHESTER 1824
The University of Manchester

Case Study: FMB Oxford Ltd

Award-winning light beam monitor pushes boundaries of science

The challenge

Many of the everyday commodities that we take for granted, from revolutionary drugs to mobile phones, have been developed or improved using synchrotron light. Synchrotrons use electromagnetic fields to accelerate particles in a cyclic path, causing them to radiate a unique spectrum of light. This light source can be harnessed to emit extremely intense X-ray beams (around 100 billion times brighter than a hospital X-ray machine) at points around the synchrotron. Scientists use the X-ray beams in cutting-edge experiments, pushing the boundaries of what is possible in fields such as structural biology, energy research and engineering.

Increasingly complex experiments investigate samples that can be smaller than a micrometre in size, requiring detailed real-time X-ray beam alignment information to consistently target the sample. Current beam monitoring devices provide scientists with measurements of the X-ray beam position and total intensity, at the cost of placing a barrier in the beam path. Such measurements are invasive and cannot provide real time information on the shape of the beam cross section.

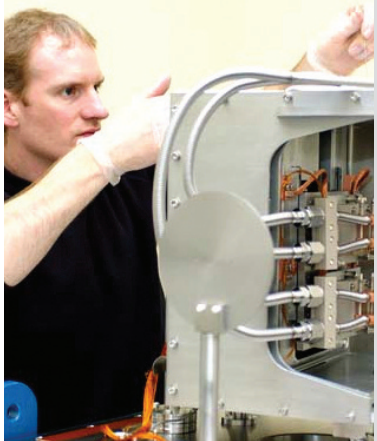
> “Dr. van Silfhout and his team provided excellent insight into the needs of the scientific x-ray community. We relied on their technical expertise to deliver a capable solution for these needs.”
>
> *Steve Syme,*
> *Business Manager, Detectors and Diagnostics,*
> *FMB Oxford Limited*

The University of Manchester solution

Driven by the demands of synchrotron scientists, FMB Oxford Ltd required a technology that could provide live images of the beam without obstructing it, allowing real-time detailed information on the position, intensity and shape of the beam. In order to do this they required in-situ beam imaging expertise and turned to Dr Roelof van Silfhout and his colleagues at The University of Manchester. Funding from the Engineering and Physical Sciences Research Council (EPSRC) enabled the collaborative team to transform an early prototype into a high quality licensed product.

- A joint approach to all aspects of invention, ranging from mechanical design to user manuals, led to efficient knowledge exchange
- Comprehensive evaluation and trials with selected end users steered the prototype design towards market requirements
- After realising strong commercial potential, the innovative technology was protected by the University’s intellectual property office (UMIP Ltd)

The partnership resulted in an entirely novel technology with unique diagnostic capabilities. The fully operational, portable system provides non-invasive, real-time information on the shape of beam cross section, with better quality images and lower noise profiles for beam intensity and position than previous systems.



2013 R&D 100

FMB Oxford

FMB Oxford is a leading supplier of instrumentation to the scientific community with over 20 years of experience in the global synchrotron industry. Based in Oxford, the company has 50 employees specialised in the design and manufacture of instruments for fundamental research.

www.fmb-oxford.com

MANCHESTER 1824
The University of Manchester

Image courtesy of Canadian Light Source Inc.

The benefits

Upon completion of the project, the commercially ready instrument was licensed to FMB Oxford Ltd, which is now being marketed under the name NanoBPM. In addition to an expected increase to year-on-year revenue of over £100k with both existing and new customers, the collaborative venture has led to numerous wider benefits:

- **UK based product manufacture and assembly has led to highly skilled job creation, with direct contribution to the domestic economy**
- **Further revenue will continue to be created through training, maintenance and upgrades to both firmware and user software**
- **Advanced knowledge covering all elements of the commercial instrumentation has been embedded within the University, enriching future research and the undergraduate teaching programme**
- **In 2013, the University and FMB Oxford Ltd were honoured with a R&D 100 Award which recognises and celebrates the year's top technology products from industry, academia and government-sponsored research projects**
- **More efficient use of synchrotron time due to better experimental control leading to reduced energy usage and environmental impact per experiment**

Support from the Engineering and Physical Science Research Council (EPSRC) has facilitated the partnership to translate fundamental research into a fully realised product. "Technology transfer is so much more than providing the commercial partner with drawings, software and papers," says Dr Roelof van Silfhout, The University of Manchester. "Without collaborative funding the process of actual knowledge exchange would have been extremely difficult."

The cutting-edge instrument is unique in its ability to use real-time measurement to apply fast corrections to beam shape, position and intensity. Being highly transferrable, it will benefit all scientific experiments conducted at synchrotron facilities, irrespective of methodology or x-ray wavelength. The underlying technology will have a huge impact on the quality and precision of research conducted with x-rays, and has the potential to support new techniques in the fight against illnesses such as Parkinson's, Alzheimer's and many cancers, where precision beam position is essential for effective treatment.

> "Working with FMB Oxford to turn our prototype into a commercial product has been a very rewarding experience, and we've significantly benefited from understanding how to transfer research into commercially ready products."
>
> *Dr Roelof van Silfhout,*
> *Reader,*
> *The University of Manchester*