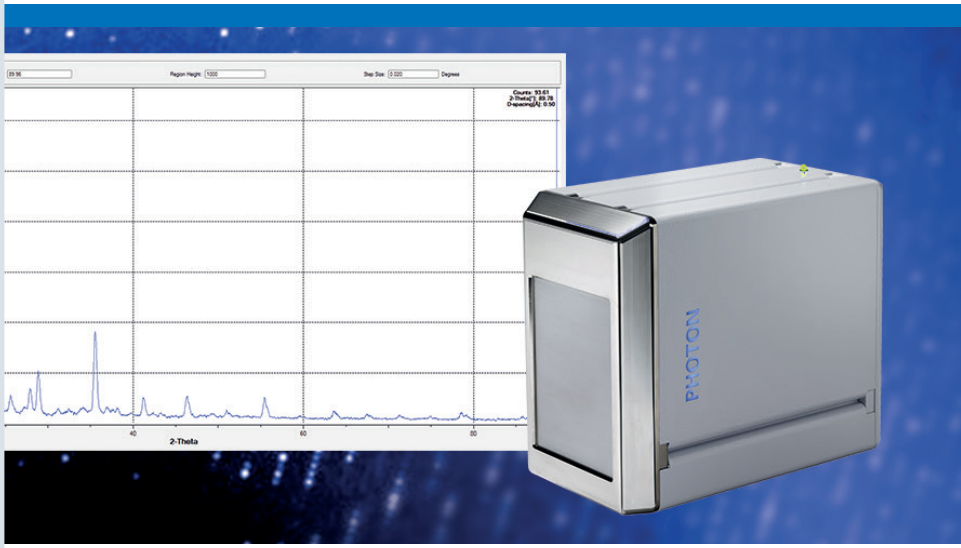
Upgrading to Bruker's PHOTON III detector has significantly improved the X-ray lab's capability to perform fast phase identification from small amounts of powder samples.

Dr. Peter Müller
Director X-ray facility – Massachusetts Institute of Technology (MIT), Cambridge, MA, USA



Case Study 6
Powder Diffraction Experiments with the PHOTON III

High Sensitivity and Large Area

Upgrading the PHOTON II to a PHOTON III detector dramatically improved the X-ray lab's capability to perform high quality phase identification studies.

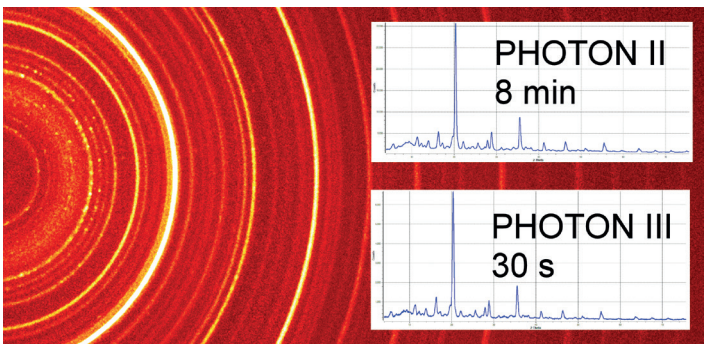
- Improved sensitivity for better signal to noise ratio and speed
- High Energy event discrimination (HEED) to remove spurious events
- Large area and good spatial resolution for efficient data collection

Phase identification

A typical powder diffraction experiment on a dedicated instrument is performed in reflection mode. Preparation requires a relatively large amount of sample (ca. 0.5 g) and usually one is limited to Cu radiation and room temperature. The advantages of using a single crystal diffractometer in transmission mode are that much less sample is required (in the microgram range) and, because most single crystal instruments are equipped with a low-temperature device, one can collect powder data at e.g. 100K. In addition, with a standard dual-wavelength setup one can collect data using Mo radiation, which is extremely useful to cover a larger q-range, e.g. for PDF analysis.

Product Benefits

The upgrade to the PHOTON III detector has proven to increase the productivity of the lab by not only providing faster and better single crystal structures but also by improving the quality of powder diffractograms for phase analysis. Both, higher sensitivity and zinger suppression make a tremendous enhancement. Most notably, the photon counting mode allows for powder data collection with unparalleled speed. In under a minute one can check for sample consistency and collect good quality powder data.



Ultra-rapid powder diffraction with photon counting

Phase identification by means of powder diffraction can be time consuming and challenging if only small amounts of sample are available. A single crystal instrument with a brilliant, highly focused X-ray beam and equipped with PHOTON III detector can make all the difference in such cases. The figure above shows powder data collected on a 100×100×100 µm³ sample using Mo radiation. The PHOTON III detector achieved the same high data quality in just 30 seconds compared to 8 minutes for the PHOTON II.

The PHOTON III upgrade was straight forward and quite affordable. The upgrade has improved the capability of the X-ray lab significantly.