Progress in X-ray Crystallographic Methodology: Shutterless Data Collection

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Instrumentation for single crystal structure analysis has advanced greatly over the last decade. These improvements include the introduction of area detectors, in particular CCD detectors with high dynamic ranges; as well as major software improvements.

In mid-2011 Bruker AXS introduced the PHOTON 100 detector; the first CMOS active pixel sensor for laboratory crystallography. Since then, CMOS technology has been rapidly displacing CCD detectors and a large number of D8 QUEST and D8 VENTURE systems are now used in laboratories throughout the world.

CMOS technology offers numerous advantages compared to CCD detectors:

- CMOS sensors are available in larger sizes
- CMOS sensors have lower power consumption than CCDs and provide excellent signal-to-noise ratios even when only moderately cooled. This allows the design of air-cooled detectors.

CCD detectors and imaging plates operate in the conventional still-image mode involving numerous shutter-open/shutter-close, goniometer ramp-up/ramp-down and detector readout steps. Next to overhead-time this process introduces mechanical jitter. The PHOTON 100 detector can now operate in a completely shutterless read-out mode. This enables continuous data collection without the need to frequently open and close the X-ray shutter, resulting in less mechanical wear and faster, more accurate measurements.

The presentation will focus on the recent progress in charge-density studies