

## SINGLE CRYSTAL X-RAY DIFFRACTION

# PHOTON IV - Unrivalled Data Quality

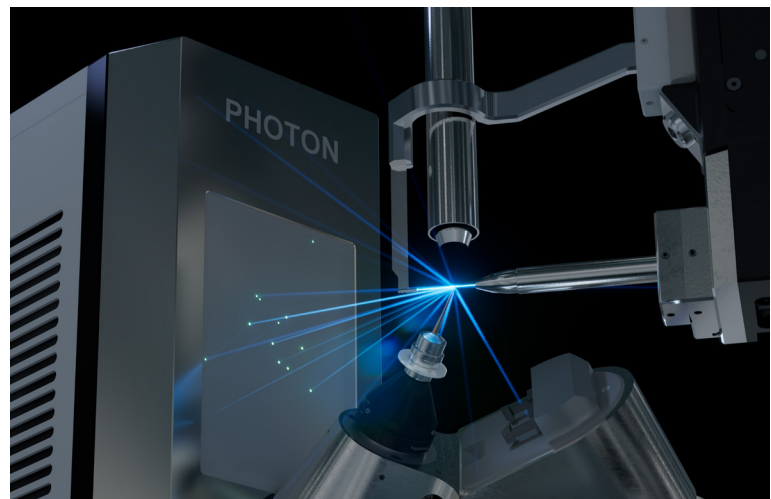
Product Sheet 66

### Introducing the PHOTON IV Detector

Crystallography plays an important role in modern research. Advancements in software and hardware have enabled researchers to routinely investigate smaller and more challenging samples. In addition to accurate goniometers and high-intensity X-ray sources, having a detector that closely approaches theoretical performance is crucial.

The new PHOTON IV detector represents a significant milestone in X-ray detector technology. It is the choice for researchers and professionals in crystallography who require accurate, precise, and reliable detection of X-ray diffraction signals. The PHOTON IV features a large active area, unprecedented sensitivity, and a high dynamic range, all achieved by utilizing the best scientific-grade CMOS active pixel sensors available.

Using proven principles of indirect detection along with a sensor with an ultra-low noise floor, the PHOTON IV elevates X-ray diffraction to a new level of precision and accuracy, all while offering ease of use and reliability.



## Enhanced Dynamic Range

The PHOTON IV takes advantage of our fourth-generation CMOS active pixel sensors. With increased pixel density, greater full well capacity and significantly increased frame rates, the PHOTON IV achieves count rates more than three times higher than previous generations.

This expanded dynamic range allows for the simultaneous measurement of strong and weak reflections in the same image, largely eliminating the need for repetitive measurements, and leads to a significant increase in data collection efficiency.

## High Frame Rate

High-intensity signals benefit from the higher frame rate applied in the PHOTON IV detector. The 112 Hz frame rate enhances the count rate accuracy leading to even more accurate data.

## Superb Count Rate Linearity

In a single-crystal diffraction experiment, counts in each pixel vary significantly as the crystal is rotated. Therefore, the correction of count rate non-linearity in a single-crystal diffraction experiment is far from trivial.

Equipped with the latest generation sensors, the PHOTON IV provides exceptional linearity. Data measured on the PHOTON IV are ultimately accurate, critical for highly demanding applications.

## High-energy Event Discrimination

High-energy background signals are ubiquitous and can have a negative impact on the data quality if not properly eliminated.

The PHOTON IV detector includes an advanced high-energy events discriminator (HEED), which efficiently suppresses these cosmic rays. This feature is particularly important for weak reflections, where the radiation background contributes significantly to the total intensity if not accurately subtracted.

## Large Active Area

PHOTON IV detectors feature a single, monolithic sensor with no gaps or insensitive areas. The large active area enables you to efficiently collect data over a wide angular range in both the horizontal and vertical directions.

The PHOTON IV detector is available in two formats tailored to your specific application needs.

## Best Efficiency for All Wavelengths

The PHOTON IV achieves the highest quantum efficiency for a wide range of wavelengths. This high efficiency for Cu, Ga, Mo, Ag, and In radiation delivers the best results from your experiment.

## Excellent Spatial Resolution

The PHOTON IV employs an ultra-thin absorption layer of less than half the pixel pitch resulting in a point spread of less than a pixel and minimal detector parallax. This means that the PHOTON IV achieves excellent spatial resolution and guarantees accurate intensities are recorded from long unit cell axes, twins and modulated samples.

## Productivity Built In

Bruker AXS has more than forty years of experience in X-ray detector innovation, providing scientists with cutting-edge technologies including Microgap, CCD and CMOS detectors.

Leveraging these decades of experience, PHOTON IV detectors are designed, built, and tested to the highest standards to ensure maximum reliability and uptime. This means that you can collect excellent structures whenever you need them.

For your complete peace of mind, all PHOTON IV detectors are backed by a three-year full-factory warranty.

With its higher dynamic range, improved frame rate, exceptional efficiency, and superior linearity, the PHOTON IV detector offers unparalleled performance and reliability.

These advancements make it an invaluable tool for researchers and professionals who demand the highest quality data.



High Dynamic Range



High DQE



Superb Linearity



Large Active Area



Best Spatial Resolution



High frame rate



Air Cooling

## Features and Benefits

|   | PHOTON IV 8                              | PHOTON IV 16 |  |
|---|--|--------------|--|
| <b>Detection Mode</b>   | Indirect Detection with photon counting. |              | Highest dynamic range for best data quality.   |
| <b>Active area (mm<sup>2</sup>)</b>                             | 111 × 72                                 | 111 × 145    | Large active area detector measures more reflections per frame.                                    |
| <b>Sensor format (pixels)</b>                                   | 1,110 × 720                              | 1,110 × 1450 |  |
| <b>Pixel size (microns)</b>                                     | 100                                      |              | Excellent point-spread function for resolution of large unit cells, twin handling and modulations. |
| <b>Operating energy range [keV]</b>                             | 8... 24<br>Cu, Ga, Mo, Ag, In            |              | Covers the complete range of crystallographic applications.  |
| <b>Quantum efficiency [%]</b>                                   | 100 % Cu<br>92 % Mo<br>73 % Ag           |              | High quantum efficiency with all source wavelengths.   |
| <b>Single photon detection confidence [%]</b>                   | > 99                                     |              | Single photon sensitivity.   |
| <b>Count rate [cps × mm<sup>2</sup>]</b>                        | > 2 × 10 <sup>7</sup>                    |              | Close to zero reflection overflows even for strong scatterers.                                     |
| <b>Frame rate [Hz]</b>  | 112                                      |              | High readout frequency with zero dead time.  |
| <b>Internal transfer band width [Gbps]</b>                      | 6.2                                      |              | Fast and efficient data transfer.  |
| <b>Parallax error for all wavelength (pixels)</b>               | < 1                                      |              | Best data from twins, large unit cell and modulated samples.                                       |
| <b>Total dead area [%]</b>                                      | 0  |              | Single monolithic sensor, no reflections lost due to gaps as in tiled sensors.                     |
| <b>Percentage of active area with charge sharing losses [%]</b> | 0  |              | Accurate data.   |
| <b>Nonlinearity before correction [10 ... 90 % range]</b>       | Better than 1 %                          |              |  |
| <b>Weight (kg)</b>  | 5  | 8            | Low weight detector maintains best sphere of confusion.  |
| <b>Cooling</b>  | Air-cooled, all versions                 |              | Highest reliability, no chiller maintenance.   |
| <b>Dry air consumption [L min<sup>-1</sup>]</b>                 | 0  |              | No air purge needed, no maintenance, highest uptime.   |

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