BRUKER

Bruker AXS

VÅNTEC-2000

- 2D MikroGap Detector

think forward

X-ray Diffraction

Designed for the Synchrotron…

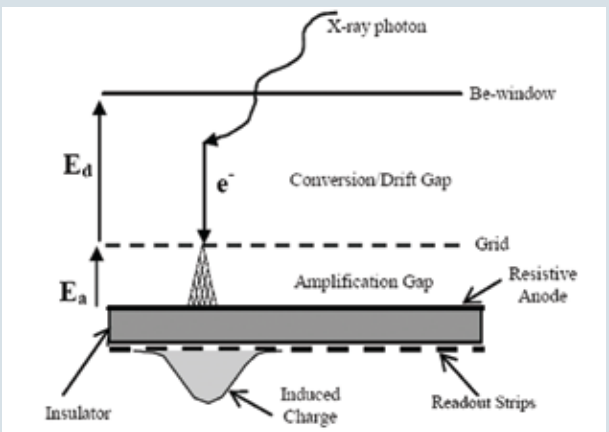
VÅNTEC-2000 combines sensitivity and high performance

Continuous R&D for Better Detector Technology

Around the world, X-ray diffractionists in industry, government and academia rely on Bruker AXS to equip and support their high performance XRD² applications with cutting-edge technology. Bruker AXS is deeply invested in the development of new detector technologies to enhance the scope of X-ray diffraction. Our leadership in creating innovative products and services is driven by growing customer demand for exacting scientific research tools and instruments that deliver superior value and performance.

Our technology teams – including experts from leading labs like the ESRF, CERN and Fermilab – are using the latest findings in the demanding field of high- energy physics to design position-sensitive X-ray photon counting detectors that allow customers to excel where it matters: in continuously-operated, real-world applications corresponding to industrial performance standards.

Theory of Operation



Incoming X-rays generate electrons which are then detected by the patented resistive anode

The VÅNTEC-2000

The VÅNTEC-2000 combines the best features of classic X-ray films and electronic single X-ray photon detection. This large detector grabs as much 2D information as classic film cameras within seconds, without user intervention. At the same time it achieves counting statistics like a scintillation detector by "seeing" and counting individual photons in real time.

The VÅNTEC-2000 operates virtually noise-free, making it the technology of choice for applications requiring low or high count rates. Its speed is ideal for either point and click operation or the collection of X-ray movies. Its flat design provides the flexibility needed for a wide range of experiments, including those where specific sample-to-detector or optic-to-detector distances are use to optimize angular coverage and resolution.

Because of its unique ability to detect individual photons, the VÅNTEC-2000 is ideal for the analysis of both weakly and strongly scattering samples — including small sample traces, single crystals, epitaxial thin films, coatings, rocks, polymers, metals, steel, wood, plastics, liquids, nanomaterials, and much more. The active area of the detector is 14 cm by 14 cm. Its simultaneously recorded angular range, as well as its achievable angular resolution, are supremely sensitive to sample properties, the selected measurement circle diameter, and the applied X-ray wavelength.

Ready for academic and industrial laboratories

MikroGap Technology

The VÅNTEC-2000 detector is based on patented MikroGap™ technology. It offers all the benefits common with gas detectors, such as high signal amplification, and therefore provides a high peak-to-background ratio. In addition, the MikroGap™ technology allows operation at count rates much higher than those typically possible with gas detectors.

Count Rates, Linearity, and Dynamic Range

The main advantage of the parallel-plate design used in the VÅNTEC-2000 is the high local count rate, providing linearity of up to 2400 cps/pixel. Test measurements with the VÅNTEC-2000 have shown maximum count rates of 250 kcps for point-like X-ray signals. The potential overall count rate is very high as well. Due to the high local count rate, the maximum dynamic range (the ratio of maximum count rate per reflection to background fluctuations in the local area) is also very high: 10^9 times the square root of the collection time in seconds. The background count rate is determined by cosmic rays and the material's natural radioactivity. Typically, the background count rate is less than 5 cps over the whole detector area, meaning that the VÅNTEC-2000 operates essentially noise-free.

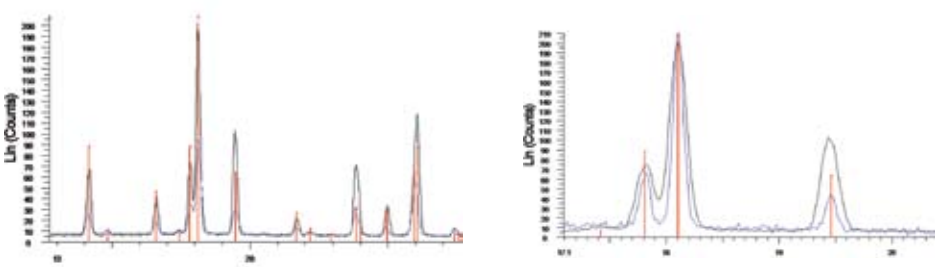
VÅNTEC-2000

2D pattern at low angles collected with the VÅNTEC-2000

Vibration and Radiation Tolerance

The VÅNTEC-2000's design, with its planar, electron-transparent electrode plates, is extremely robust. The detector's most important quality is its radiation hardness, unprecedented among detectors with gas multiplication. No damage occurs up to a cumulative irradiation of 2×10^{12} counts per mm^2, corresponding to a total acceptable irradiation of more than 10^{16} X-ray photons for the detector as a whole. Due to its resistive anode and the stable gas mixture, the VÅNTEC-2000 will tolerate accidental intensive irradiation. In such cases, the anode voltage drops in the irradiated part of the detector, suppressing the multiplication process, and no lasting damage occurs.

Citric acid measured in TM



Integrated diffraction pattern collected with the VÅNTEC-2000 from a powder sample

Technical specifications

Sensor Type

- Xe-based gaseous avalanche detector
- Active area: 14 x 14 cm^2
- Window size: 14 x 14 cm^2
- Number of pixels: 2048 x 2048
- Sensor Pixel Size: 68 µm x 68 µm

Global Counting Rate

- Maximum: 1.6 Mcps
- Linear part (10% deviation from linearity): 0.9 Mcps

Local Counting Rate

- Maximum per a point-like reflection: 250 kcps
- Linear part (10% deviation from linearity): 160 kcps

Background

- < 5 cps per whole area

Maximum Dynamic Range

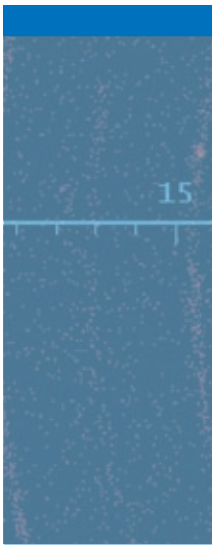
- 10^9 x sqrt(collection time in seconds)

Radiation Hardness

- 10^{12} X-ray photons/mm^2 (10^{16} photons in total)

Accidental Irradiation Intensity

- No limits



Bruker AXS Inc

5465 East Cheryl Parkway
Madison, WI 53711 USA
Tel. +1 (608) 276-3000
Fax +1 (608) 276-3006
info@bruker-axs.com
www.bruker-axs.com

Bruker AXS GmbH

Oestliche Rheinbrueckenstr. 49
D-76187 Karlsruhe, Germany
Tel. +49 (721) 595-2888
Fax +49 (721) 595-4587
info@bruker-axs.cde
www.bruker-axs.de