Should I upgrade?

Answers to some commonly asked questions on the VÅNTEC-500 upgrade are listed in following. Please contact your local sales representative or call Bruker AXS office directly for more information.

Q: What benefits do I get by upgrading my GADDS to VÅNTEC-500?
A: Many, including larger active area, higher count rate, improved resolution and much better image quality.

Q: How do I know if my system can be upgraded?
A: All D8 based GADDS systems can be upgraded. You can also confirm with your sales representative.

Q: Do I need new software for the upgrade?
A: No, however you will need to upgrade the software you are using (GADDS or PILOT) to the latest version. This is included with the VÅNTEC-500 upgrade.

Q: Do I need training to use the upgraded system?
A: No, all data collection and evaluation operations are the same.

Q: Is the detector calibration the same?
A: There is a slight difference in detector calibration procedure; the user manual can guide you through it.

Q: Can I use the SLAM files created for the HI-STAR?
A: Yes. It is backward compatible. However you may choose to modify your code for the large 2θ coverage and newly available command options.

Q: Do I need to upgrade the other components?
A: No, you don't have to. But it is a good opportunity to upgrade for other reasons, such as increased intensity from an IμS mircofocus source.

Q: What happens to my original HI-STAR detector?
A: The trade-in credit is included in the upgrade package. This is why you get a one-time big discount for the VÅNTEC-500 detector.

Q: How often do I need to re-gas the VÅNTEC-500?
A: Never, due to the design, re-gassing is not necessary. This results in low operational cost and very high up-time for VÅNTEC-500 equipped systems.

Q: My D8 DISCOVER GADDS is part of the workflow for high-throughput screening, integrated by a contractor (Symyx or else). Can I upgrade to VÅNTEC-500?
A: Yes, you can. The upgraded GADDS software is backward compatible, and all the commands used by the workflow will function in the same way.

Q: My GADDS diffractometer has been idle due to the HI-STAR needing re-gassing or repair. Can I upgrade to VÅNTEC-500 from a non-functional HI-STAR?
A: Yes. This probably the best opportunity to get your system revitalized to its full and better capacity.

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Benefits of Area Detector Upgrade from HI-STAR to VÅNTEC-500

As an experienced user of Bruker D8 DISCOVER with GADDS, you have enjoyed many advantages of 2-dimensional X-ray diffraction (XRD^2). In the past one or two decades, the HI-STAR area detector, based on the multiwire proportional counter (MWPC) technology, was the core component for laboratory XRD^2 systems. Recent developments in brilliant X-rays sources and high efficiency X-ray optics provide a beam with the smaller size and divergence with much higher intensity. Correspondingly, the detector used in such a high performance system requires the capability to collect large 2-dimensional images with high counting rate and high resolution. As you may know, Bruker has recently introduced the VÅNTEC-500, a new area detector, based on the patented MIKROGAP™ technology. In addition to the beneficial features of the HI-STAR, such as high detection quantum efficiency, single photon sensitivity, real time readout and low noise, the VÅNTEC-500 adds a larger active area, higher count rates, increased resolution, better uniformity and data quality. Now, Bruker AXS offers a onetime opportunity to upgrade your XRD^2 system by replacing your HI-STAR with the VÅNTEC-500 detector. This will significantly improve the performance of your system and reduce the maintenance cost for the future. The following information will help you to learn the benefits of this upgrade.

Significant Performance Improvement with VÅNTEC-500 upgrade

The VÅNTEC-500 detector maintains all the good characteristics of the HI-STAR, such as high sensitivity, low noise and real time image. In addition, the MIKROGAP™ technology significantly improves all other specifications over the HI-STAR detector with doubled resolution, two orders of magnitude better counting rate, and low maintenance with no re-gassing or expensive wire repairing. Figure 1 shows both HI-STAR and VÅNTEC-500 detectors side by side.

Figure 1. HI-STAR and VÅNTEC-500

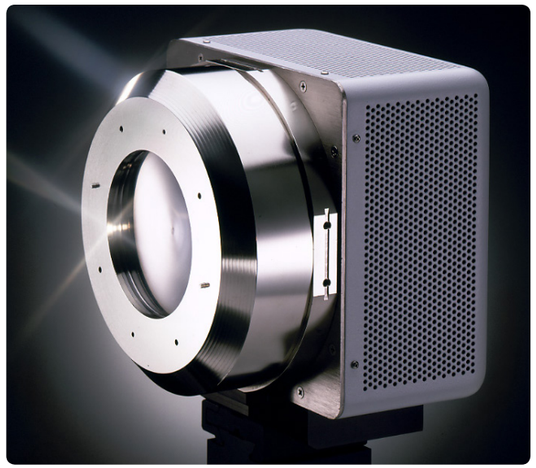
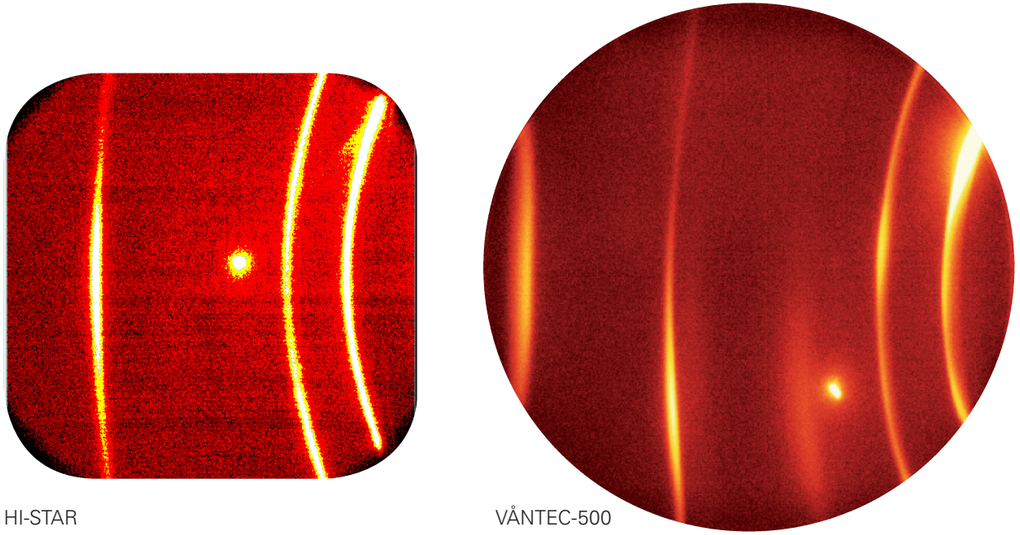
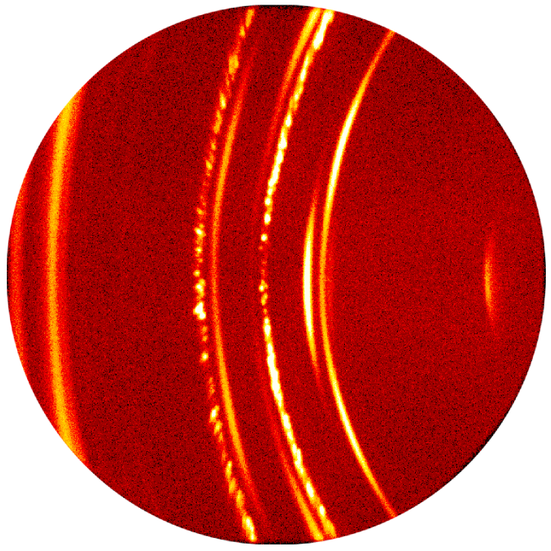


Figure 2. Diffraction image collected by HI-STAR and VÅNTEC-500 (scaled to active area)



HI-STAR VÅNTEC-500

Figure 3. Diffraction image collected by VÅNTEC-500 from a proprietary multilayer battery anode.



The VÅNTEC-500 detector design is optimized with the complete system in consideration. The light weight allows it to be easily mounted to a horizontal or vertical system. The cone-shaped front and larger active area result in coverage of larger 2θ ranges and access to higher 2theta angles. The flat X-ray image projected to the detector plane provides the flexibility for a wide range of sample-to-detector distances to optimize angular coverage and resolution for various applications. Its high speed is ideal for collection of X-ray movies to monitor the real time atomic arrangement changes in a material, such as in-situ phase transformation investigation. The VÅNTEC-500 can detect individual photons virtually noise-free, and at the same time, measures a very strong scattering signal with no loss in linearity. This large dynamic range makes it the technology of choice for analysis of both weakly and strongly scattering samples. The MIKROGAP™ technology can provide a very homogeneous electric field for X-ray detection, therefore, it can collect diffraction frame with better uniformity and data quality. Figure 2 is a comparison of the diffraction frames collected by HI-STAR and VÅNTEC-500 on Cu thin film deposited on Si substrate. The diffraction frame collected with VÅNTEC-500 covers larger solid angle and with much better data quality and smooth background.

Experimental example

Figure 3 shows a diffraction pattern collected on a proprietary multilayer battery anode. The 2θ coverage of 70° is measured simultaneously at 8 cm detector distance. The single diffraction pattern reveals multiple phase, strong texture and large particle size. The large solid angle is imperative for in-situ measurement for chemical reaction, phase transformation or other real-time physical changes.

Comparison of Specs and Application Benefits

Table 2. Comparison of specs between Hi-Star and VÅNTEC-500 and its benefits to your applications.

Specs	HI-STAR	VÅNTEC-500	Upgrade Benefits
Detection technology	Multiwire proportional counter	MIKROGAP™, US Patent 6,340,819	Most advanced large area detection technology
Detection quantum efficiency	80% at 8.04 keV radiation	80% at 8.04 keV radiation	Single photon sensitivity
Detection energy range	3-15 keV	3-15 keV	Suitable for Cu, Co, Fe and Cr radiation
Maximum count rate* Global Local	 35,000 cps 1200 cps	 900,000 cps 160,000 cps	Can handle stronger diffraction spot, such as from Si substrate
Background noise	$<10^{-5}$ cps/pixel	$<10^{-5}$ cps/pixel	Practically noise-free, important for microdiffraction
Maximum dynamic range	10^{6} x square root of collection time in seconds	10^{9} x square root of collection time in seconds	Significantly improved dynamic range
2θ Coverage at various detector distances: 6 cm 10 cm 15 cm 20 cm 30 cm	 65° 46° 35° 28° 18°	 78° 56° 42° 33° 23°	More 2θ measurement range at all distances
Maximum measurable 2θ angle†	160°	165°	Extra 5° for stress measurement on steel (211) with Cr tube
Pixel size at various frame format: 512 x 512 1024 x 1024 2048 x 2048	 210 µm 105 µm N/A	 272 µm 136 µm 68 µm	Improved pixel resolution
Radiation hardness	$<10^{6}$ X-ray photons/mm^2 (can't stand direct beam)	10^{12} X-ray photons/mm^2	No detector damage with accident or short exposure to direct beam
Maintenance	Periodic re-gassing and may require expensive wire repair	No re-gassing is required for normal operation and no consumable parts	Low operation cost and no down time

*10% deviation from linearity. Local: for a point like reflection †15 cm detector distance in stress configuration