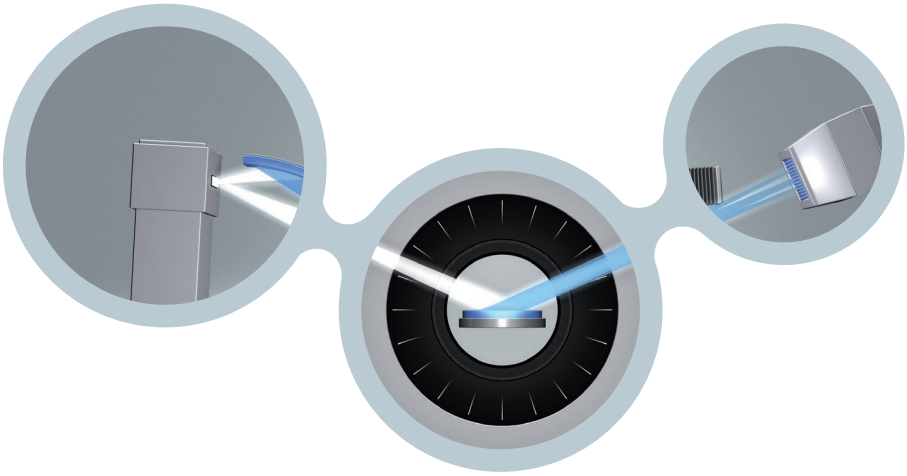

Spec Sheet XRD 27

LYNXEYE – Super Speed Detector
for X-ray Powder Diffraction

The LYNXEYE™ is a 1-dimensional detector for X-ray diffraction, based on Bruker AXS' compound silicon strip technology. Compared to a simple point detector the LYNXEYE dramatically increases measured intensities – without sacrificing resolution and peak shape. A Diffraction Solution equipped with a LYNXEYE records a typical powder pattern in approximately 1/200th of the time required using a point detector, with identical data quality.

The LYNXEYE fits to all Bruker AXS D4 and D8 DIFFRACTION SOLUTIONS. The LYNXEYE can be easily exchanged by any other point, linear, or 2-dimensional detector. There is no need for counting gas, cooling water or liquid nitrogen, making the LYNXEYE a compact, robust and maintenance-free detector.

The LYNXEYE is the perfect detector for all applications in X-ray powder diffraction, including phase identification, quantitative analysis, size-strain analysis, structure determination and refinement, as well as texture and strain analysis.

Fig. 1: D8 ADVANCE with LYNXEYE detector.

Fig. 2: LYNXEYE detector.

High Quality Data Collection with Super Speed

The excellent performance of the LYNXEYE detector can be best seen by comparison with a scintillation point detector. For this purpose, systematic measurements have been performed on the NIST standard reference materials SRM 1976 (corundum) and SRM 660a (LaB_6). Instrument configuration and measurement parameters are given in Table 1.

Figure 3 shows the measurement results obtained on SRM1976 in the angular range from 20° to 80° in 2θ using a scintillation counter and the LYNXEYE, with the D8 goniometer always running at the same speed. The relative intensities are scaled to the 100% reflection. The magnification highlights the angular range from 56° to 62° in 2θ. As can be seen both detectors provide nearly identical resolution, peak shape and peak-to-background ratio, but the intensity gain observed for the LYNXEYE detector is almost 200 comparing the integrated intensities underneath the reflection!

Figure 4a displays SRM 660a measured with both detectors from 20° to 145° in 2θ and fitted with TOPAS. As expected, the observed full width at half maximum (FWHM) over the entire angular range is virtually identical for both detectors. In Figure 4b the 011 reflection of SRM 660a is shown for the LYNXEYE. Note the high resolution of about 0.037° and the excellent, almost symmetric line profile shape, indicating that this detector is ideal for profile analysis work.

Table 1: Instrument and measurement parameters for SRM 1976 and 660a investigations.

D8 ADVANCE	
Radius	250 mm
Tube Power	40 kV / 40 mA
Soller slits	2.5°, prim. & sec.
Scan speed	3° 2θ / minute
Scintillation counter:	
Divergence slits	0.5°, prim. & sec.
Detector slit	0.1 mm
LYNXEYE:	
Divergence slit	0.5°, prim.
Detector window	3° 2θ

LYNXEYE

- Super Speed data collection - no compromises
- Fits into D4 ENDEAVOR and D8 DIFFRACTION SOLUTIONS
- Perfectly suited for Bragg-Brentano para-focusing and pure $K\alpha_1$ Vαrio1 focusing geometries
- Outstanding intensity gain of up to a factor of almost 200, allowing extremely fast measurements
- Excellent resolution and line profile shape virtually identical to point detector measurements
- Fluorescence background suppression
- No gas, cooling water or liquid nitrogen
- Maintenance-free detector
- With the LYNXEYE hours of data collection become minutes – without compromising data quality

When investigating iron or cobalt containing samples using Cu-radiation the peak-to-background ratio *(ptb)* suffers due to an increased background caused by sample fluorescence (fig. 5a). When switching to Co-radiation or an energy dispersive detector such as Sol-X is inopportune the *ptb* ratio can be significantly improved by optimizing the energy discrimination window. The LYNXEYE provides a fully software supported capability for setting both the lower level and discriminator width. The user can optimize the *ptb* improving the data quality (fig. 5b) while maintaining the measurement speed provided by the 1-D LYNXEYE detector. By optimizing the discriminator settings the *ptb* ratio could be improved from about 4 to 30 for the hematite measurement.

Table 2: Instrument and measurement parameters for hematite investigations.

D8 ADVANCE	
Radius	250 mm
Tube Power	35 kV/ 45 mA
Soller slits	2.5° primary and secondary
Divergence	0.5° primary
Scan speed	11° 2θ / minute
LYNXEYE window	3° 2θ

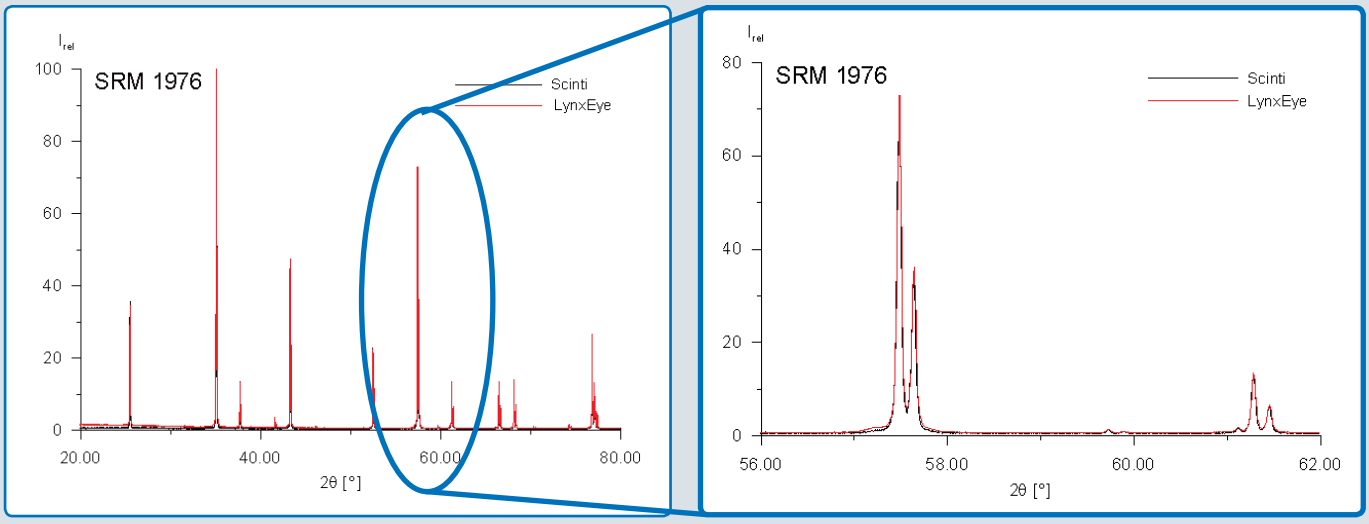

Fig. 3: NIST SRM 1976 measured with both a scintillation counter (black line) and a LYNXEYE (red line).

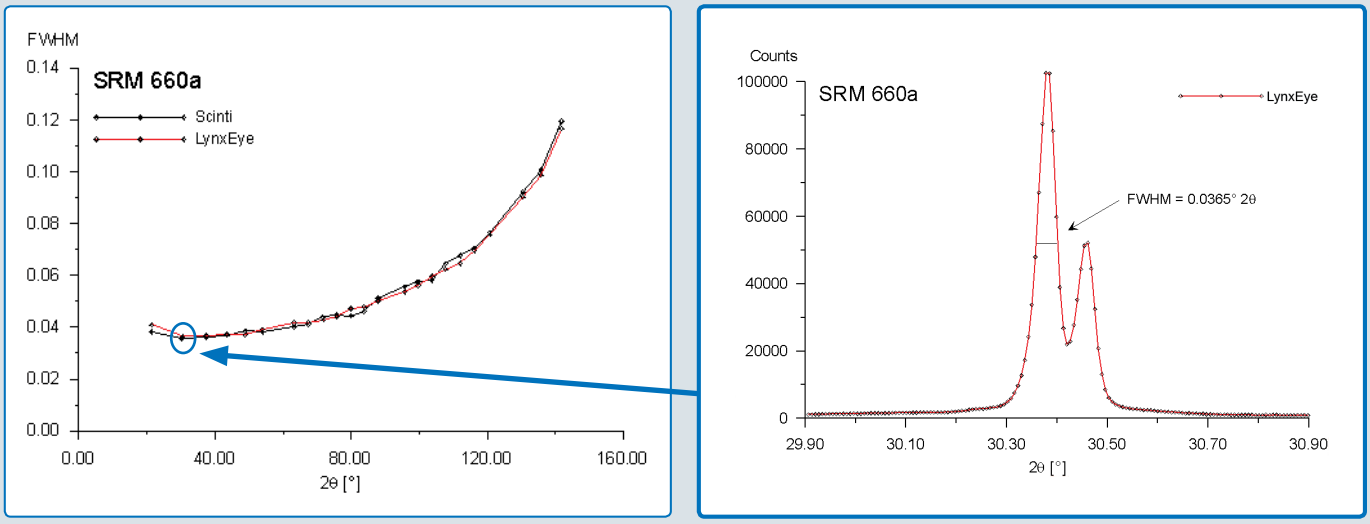

Fig. 4a: NIST SRM 660a peak widths (FWHM) versus 2θ as fitted with TOPAS.

Fig. 4b: 011 reflection of SRM 660a and TOPAS fitting result (red line).

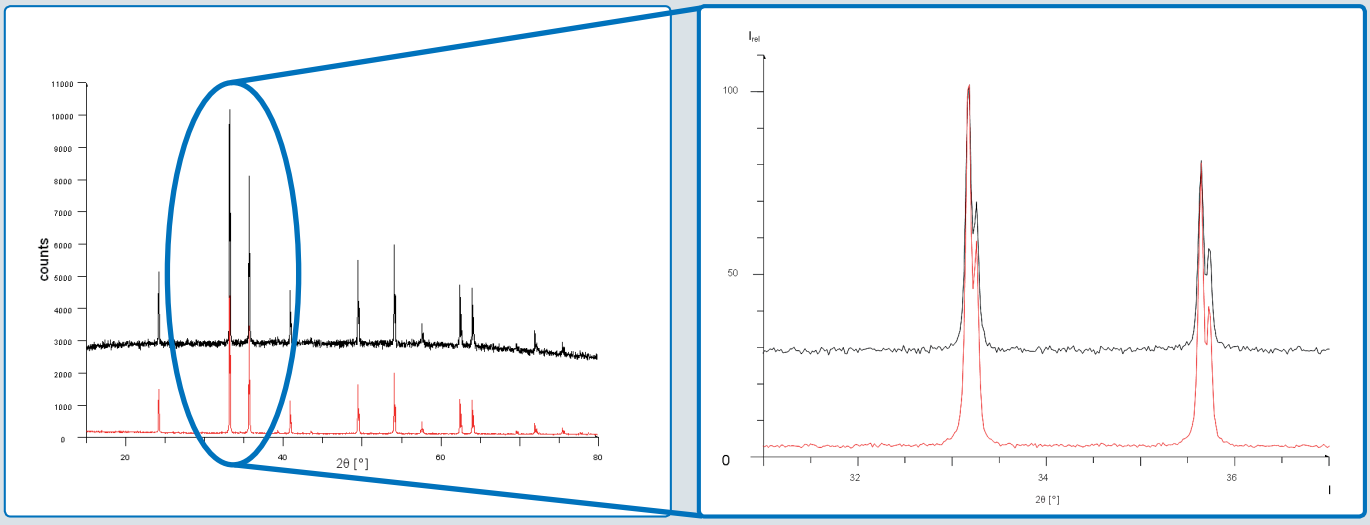

Fig. 5a: Measurements recorded on a hematite sample with standard (black line) and optimized discriminator settings (red line).

Fig. 5b: Zoomed scan range at the 100% reflection. The data are normalized to the maximum intensity.

LYNXEYE – A Sharp X-ray Look at Your Sample

The LYNXEYE was developed to meet the increasing needs of higher sample throughput. It perfectly complements the previous achievements in the development of SUPER SPEED SOLUTIONS™ with the Turbo X-Ray Source™ and detectors such as the VÅNTEC-1™.

The LYNXEYE is based on the silicon strip detector technology introduced by high energy physics [1, 2] and transfered to XRD applications [3, 4, 5]. Together with the innovative front-end electronics, its compound silicon strip technology provides optimum tuning of the silicon strip sensor to the requirements of the X-ray energy from 6 keV to 15 keV. The LYNXEYE allows a clear and sharp X-ray look at your powder sample.

The 192 strips of the LYNXEYE detector act as 192 individual detectors, perfectly explaining the intensity gain presented in this publication. An additional gain of intensity can be predicted when using the LYNXEYE with a SUPER SPEED SOLUTION. While sealed tubes are typically operated at about 2 kW, a Turbo X-ray Source can be operated at up to 18 kW, providing another intensity gain of about a factor of 9. In all, a SUPER SPEED SOLUTION with the LYNXEYE detector can give a factor of above 1500 of intensity gain compared to standard diffraction systems, when operating with identical measurement speed. This gain can either be used for an incredible increase of sample throughput, or for a tremendous increase in data quality or sensibility due to increased statistical relevance of the measured data.

Literature

[1] Belau et al., Nucl. Instr. Methods, 214 (1983)

[2] J. Kemmer, Phys. Bl. 41, 117 (1985)

[3] D. Loukas et al., IEEE Trans. Nucl. Science, 47, 3 (2000)

[4] A. Zieba et al., Applied Cryst., Proc XVIII Conf. (2000), p. 130

[5] W. Dabrowski et al., Nucl. Instr. Methods, A 512 (2003) 213

Technical Data	
Active area	14 mm x 16 mm (in and perpendicular to the scattering plane) (implemented 0-D mode)
Maximum capture angle	4° 2θ at 401 mm measurement circle diameter
Wavelength range	from Cr- to Cu-radiation (Mo-radiation with limitations)
Efficiency	>98% (Cu-radiation)
Energy resolution	typically 20% FWHM at Cu-radiation (with fluorescence suppression capabilities)
Maximum global count rate	>100,000,000 cps
Compatibility	D2 PHASER, D4 ENDEAVOR and D8 FOCUS D8 DIFFRACTION SOLUTIONS and SUPER SPEED SOLUTIONS
Accessories (optional)	1.5° Soller slit 4.0° Soller slit Anti-scatter slit extension LynxIris: Motorized anti-scatter slit assembly Kß-filter for other wavelengths and different absorption coefficients Switch mount, 90°

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