LYNXEYE XE

High-Resolution Energy-Dispersive 1-D Detector

The LYNXEYE XE is the first energy dispersive 1-dimensional detector operating at room temperature for ultra fast X-ray diffraction measurements.

Developed on the base of the „compound silicon strip" detector technology, the LYNXEYE XE is particularly optimized to meet the increasing demands in X-ray diffraction in terms of highest count rate capabilities, best angular resolution (FWHM), and best energy resolution.
The unique combination of sensor chip and front-end electronics as realized in the LYNXEYE XE makes it the highest performing detector on the market in terms of both data quality and manufacturing quality, as manifested by

- high-speed data acquisition up to 450 times faster than a conventional point detector system
- superb energy resolution making Kß filters and secondary monochromators redundant
- operation with all common characteristic X-ray emission lines (Cr, Co, Cu, Mo, and Ag radiation)
- enabling outstanding angular resolution (FWHM) and perfect line profile shapes
- no defective strips at delivery time - guaranteed

Naturally, the LYNXEYE XE is maintenance-free and does not require any counting gas, cooling water or liquid nitrogen.

LYNXEYE XE

Specimen fluorescense? You don't need a secondary monochromator!

Secondary monochromators are intensity killers. A typical secondary monochromator causes intensity losses ranging from more than 70% for point detectors and up to more than 90% for one-dimensional detectors, compared to unfiltered radiation. At such losses, a one-dimensional detector loses all its advantages and operates at intensity levels close to traditional point detectors. Counting statistics are poor, resulting in noisy patterns and thus very poor lower limits of detection.

The new LYNXEYE XE overcomes these issues thanks to its excellent filtering of fluorescense and Kß radiation. This is demonstrated in Figures 1-3 for a natural hematite specimen (Fe-fluorescense with Cu-radiation) by comparing data acquired with the LYNXEYE XE and a scintillation counter with secondary monochromator. The same instrument and specimen with identical instrument and measurement parameters have been used.

Figure 1 demonstrates the superb filtering of Kß and fluorescense radiation, at a loss of only 25% of peak intensity, compared to unfiltered radiation. The secondary monochromator data are even not visible at the linear scale of this figure due to the dramatic intensity difference. Figure 2 shows a zoomed region from Figure 1 in square-root scale to also show the secondary monochromator data for the most intense peaks. The enormous advantage of the LYNXEYE XE in terms of counting statistics and thus lower limits of detection is demonstrated in Figure 3. A second phase, calcite, is easily detected using the LYNXEYE XE, but is far below the detection limit in the secondary monochromator data.

The LYNXEYE XE offers lower limits of detection which are greatly improved compared to any other detectors currently in use.

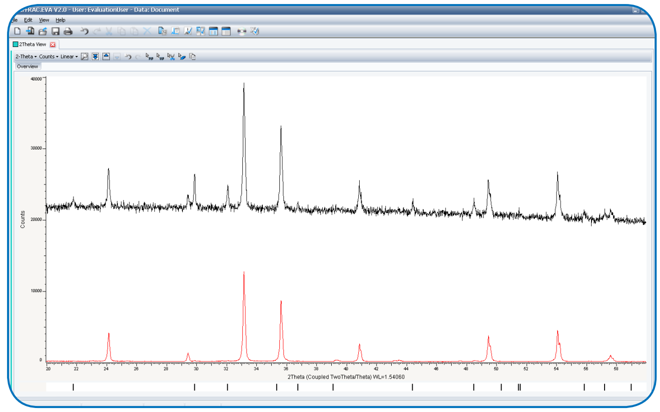

Figure 1: Unfiltered (black line) and filtered (red line) demonstrating the superb filtering of Kß and fluorescense radiation by the LYNXEYE XE. The black stick pattern underneath indicates Kß peak positions. The secondary monochromator data are not visible at that intensity scale.

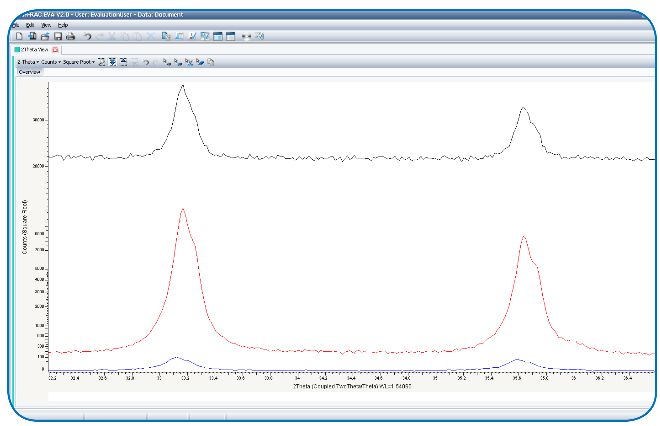

Figure 2: Zoomed region from Figure 1 (32.3° - 36.6° 2θ, square-root scale) to also show the secondary monochromator data (blue line) for the most intense peaks.

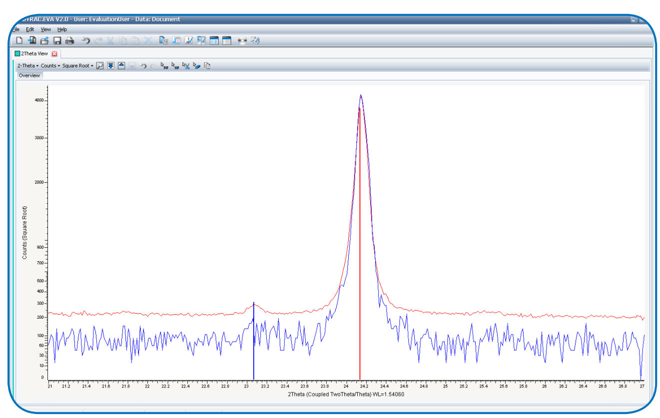

Figure 3: Zoomed region from Fig. 1 (21° - 27° 2θ, square-root scale) illustrating the unparalleled lower limits of detection capabilities of the LYNXEYE XE. Secondary monochromator data (blue line) scaled to the same maximum peak intensity as the LYNXEYE XE data (red line). Calcite (blue stick) is clearly below the detection limit for the secondary monochromator data.

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No more Kß filter artefacts in your data!

There is almost no greater nuisance in diffraction data than artefacts introduced by the Kß filter, specifically absorption edges at the high energy tails of Kα diffraction peaks. Despite that Kß-filters are the most frequently used devices for monochromatization, as secondary monochromators do not represent a true alternative due to the very high intensity losses discussed earlier. As a consequence, absorption edges frequently prevent accurate profile fitting specifically of peak tail regions and the background, and thus often represent a major part of the remaining misfit to the data, specifically for high intense peaks at low angles 2θ.

With the LYNXEYE XE this is no longer the case. This is demonstrated in Figures 4 and 5 for the same two datasets of corundum, NIST SRM 1976a, using Mo radiation. The first dataset (black line) has been acquired with a standard 0.02 mm Zr Kß filter, and exhibits significant absorption edges, accompanied by remnant Kß peaks. Also seen are two corundum peaks sitting right on top of absorption edges, with their intensities being falsified by the edges. The second data set (red curve) has been acquired by taking advantage of the excellent Kß filtering capabilities of the LYNXEYE XE. The data is completely free of absorption edges, furthermore Kß is filtered below the detection limit. In addition the total background is significantly reduced due to improved filtering of white radiation (Bremsstrahlung), resulting in improved peak to background ratios.

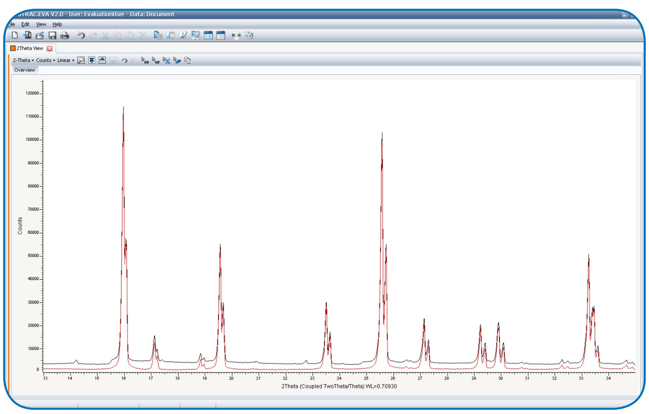

Figure 4: Comparison of corundum data (NIST SRM 1976a) obtained with the LYNXEYE XE detector with a) Zr-Filter (black line) and b) using the LYNXEYE XE filtering capabilities (red line). The improved filtering of white radiation is obvious.

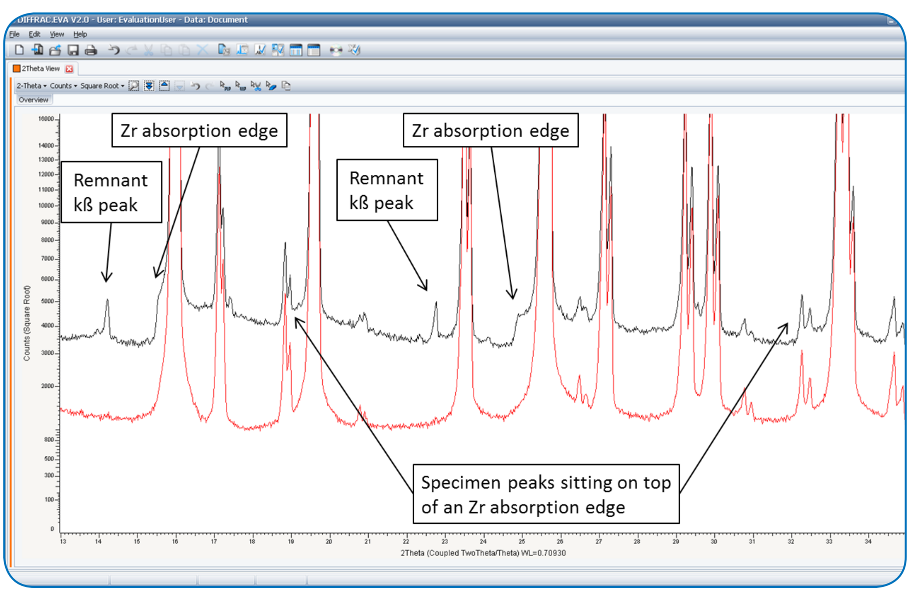

Figure 5: Zoomed region from Figure 4 (square root scale) illustrating remnant Kß peaks, sharp absorption edges and a non-continuous background for the Zr-filtered data (black line). Note the two distorted peaks sitting right on-top of absorption edges at ~18.8° 2θ and ~39.3° 2θ (arrows). The LYNXEYE XE filtered data (red line) are free of issues.

LYNXEYE XE

The highest performance detector in X-ray powder diffraction

Modi of operation:
Scanning 1-D mode for fast data collection
Fixed 1-D mode for ultra-fast measurements
Fixed 1-D mode and turned by 90° for ultra-fast non-coplanar measurements
0-D („point detector“) mode for high-resolution parallel-beam geometry
0-D mode and turned by 90° to cover an extremely large dynamic range

Technical data:
„compound silicon strip“ detector with 192 strips, all strips guaranteed to work at delivery time Up to 15 steps sub-sampling, giving 2880 (15x192) apparent channels
Active window: 14.4 mm x 16 mm
Spatial resolution (pitch): 75 micrometer
Maximum global count rate: >100,000,000 cps
Cr, Co, Cu, Mo, and Ag radiation. Factory settings are optimized for Cu-K-alpha
Efficiencies are >99% for Cr and Co radiation, >98% for Cu radiation, ~40% for Mo radiation and ~20% for Ag radiation
Energy resolution <680 eV for Cu radiation at 298K (energy resolution invariably depends on environmental laboratory temperature)
No maintenance
No counting gas, cooling water or liquid nitrogen

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