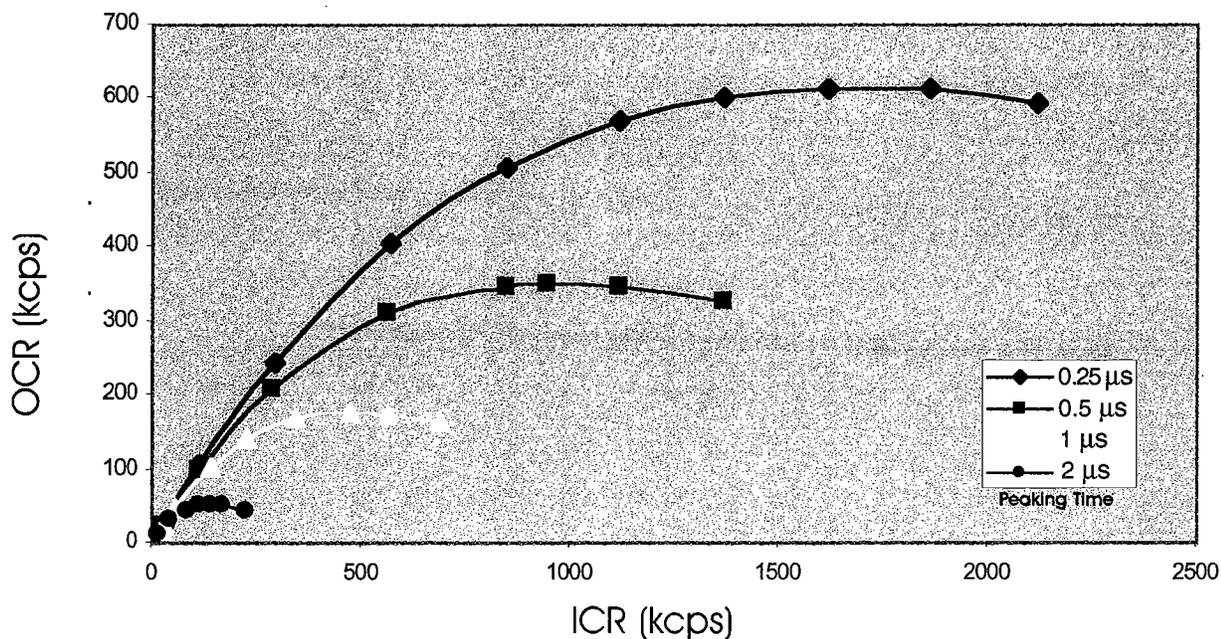
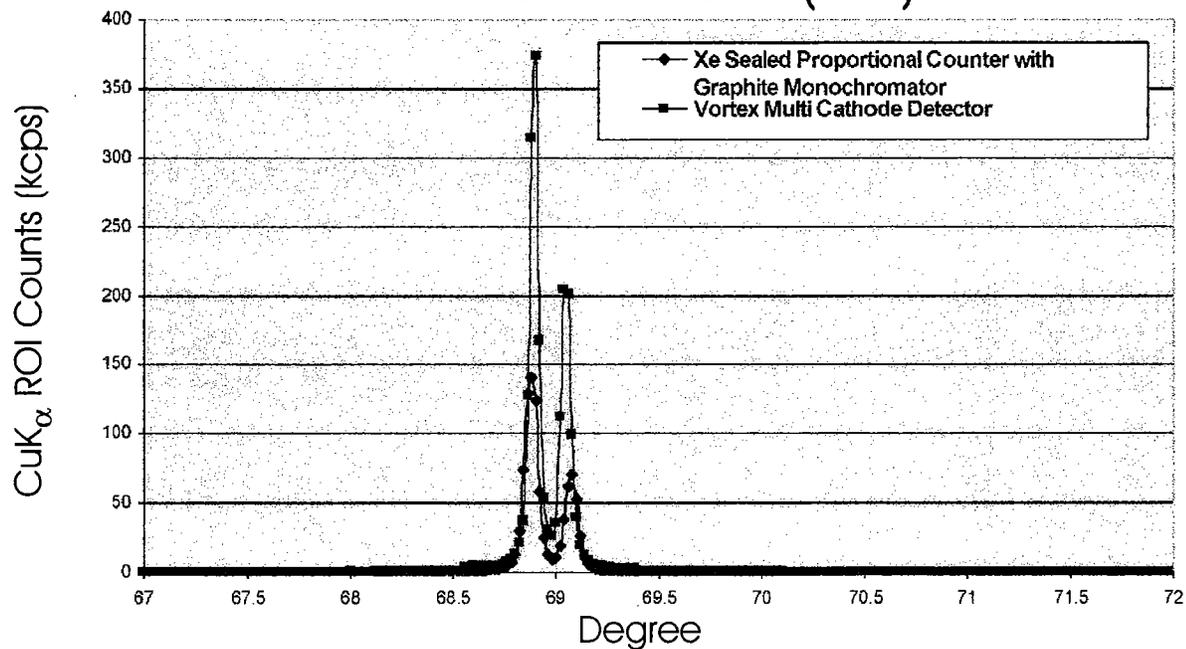


VORTEX™

Vortex Throughput Chart



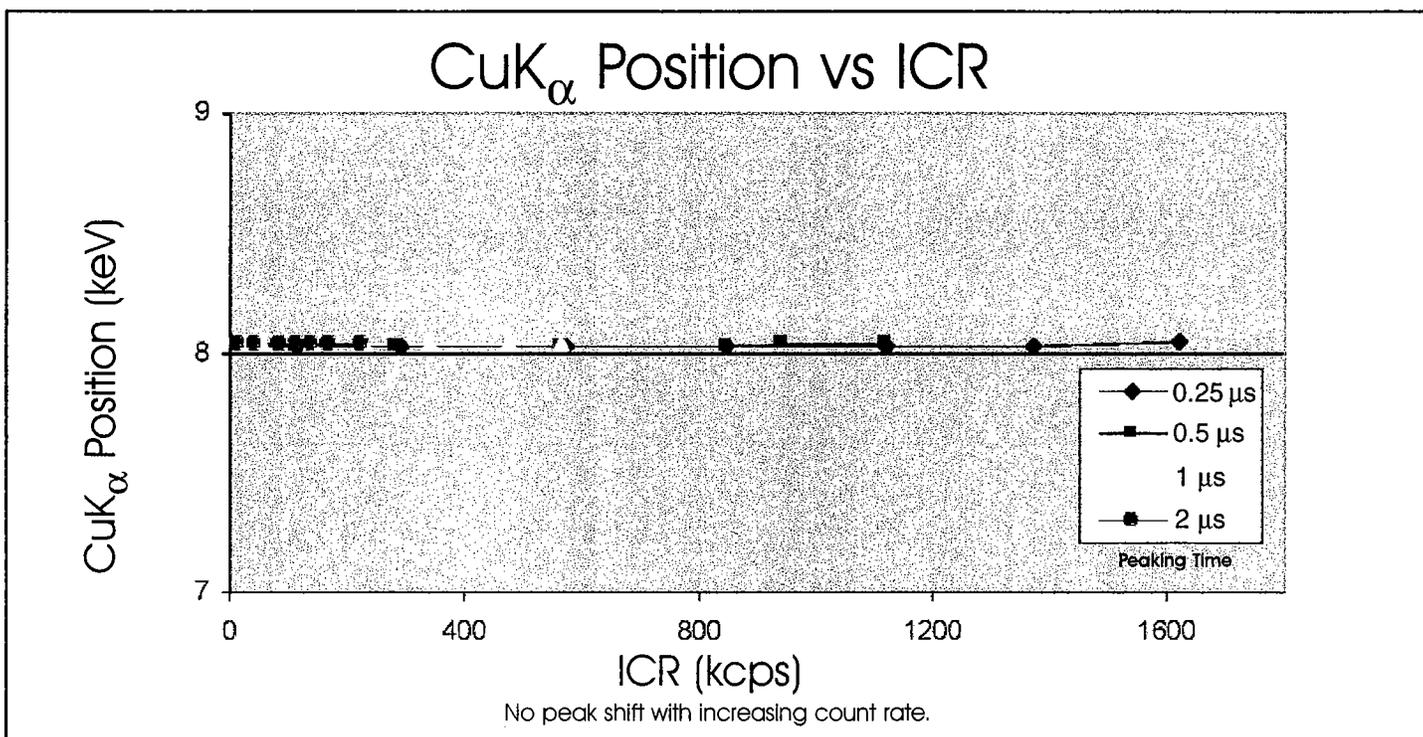
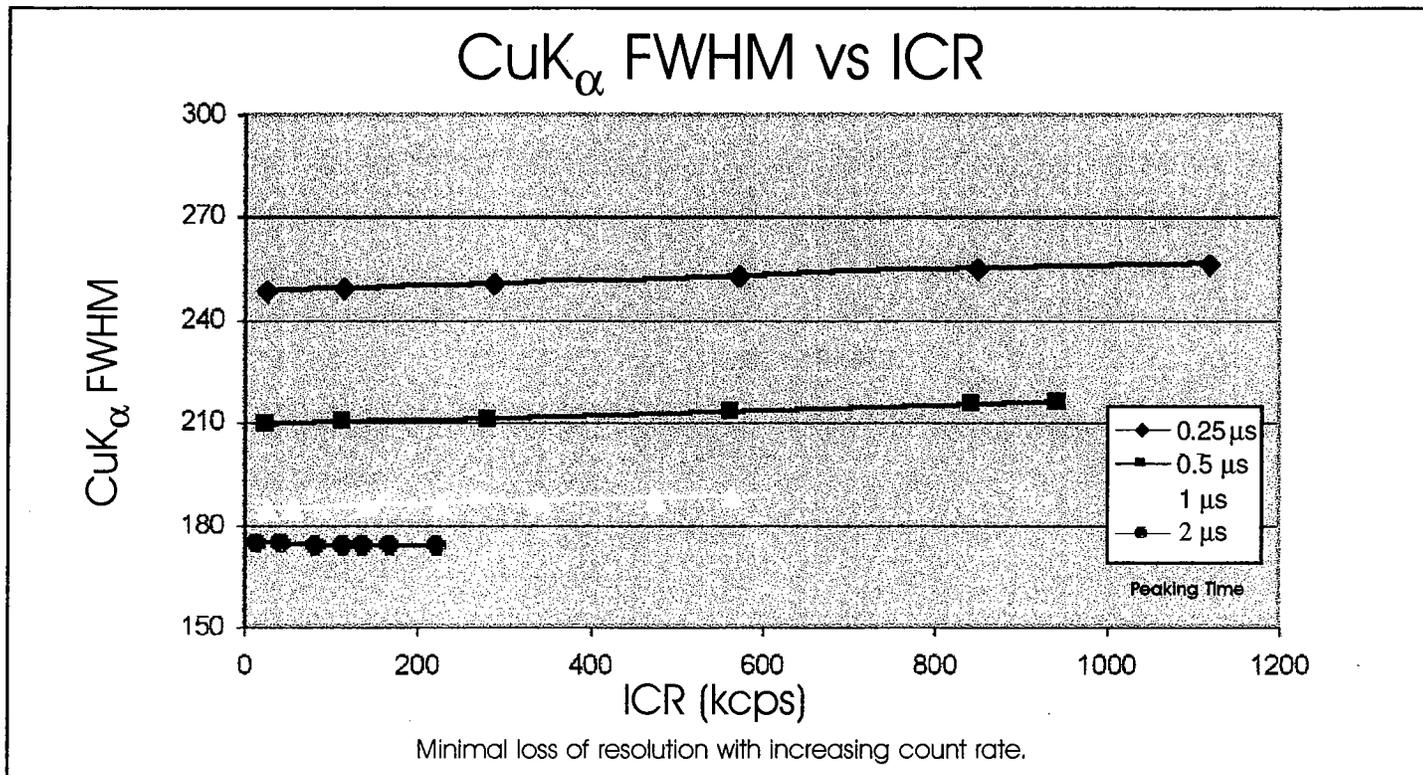
Diffraction Plot Si(100)



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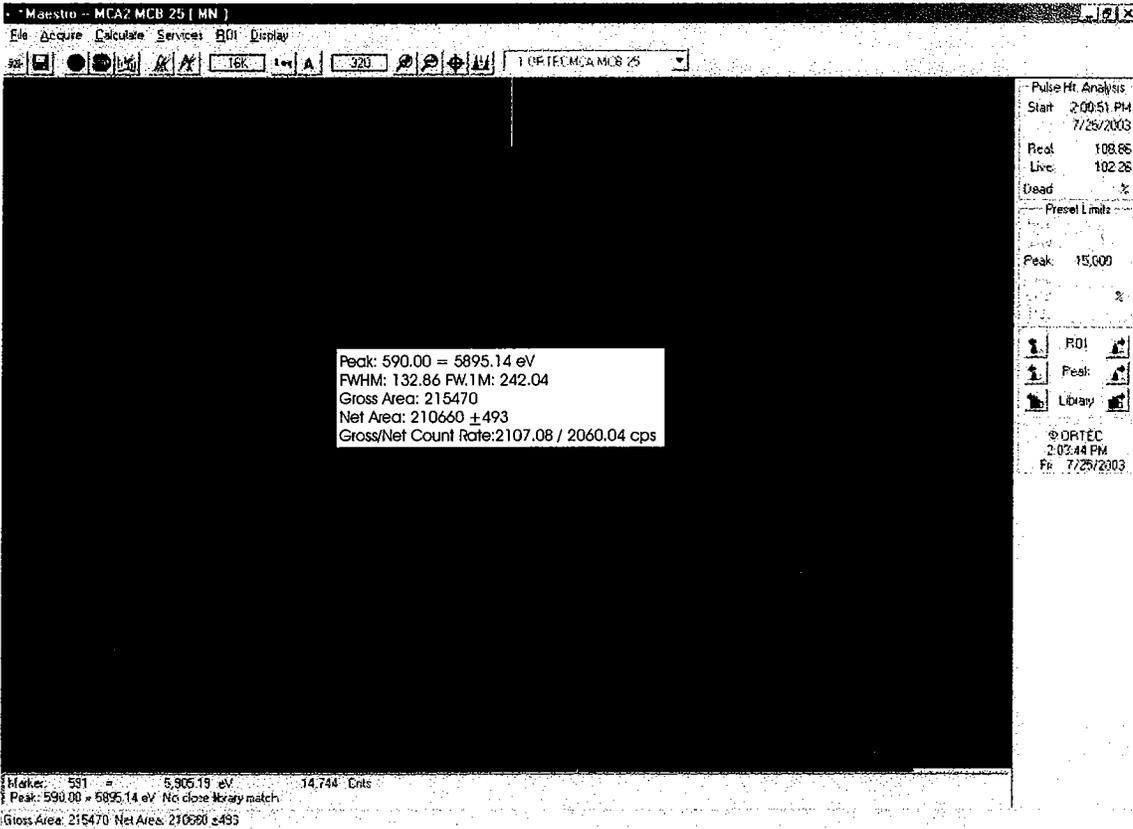
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VORTEX™



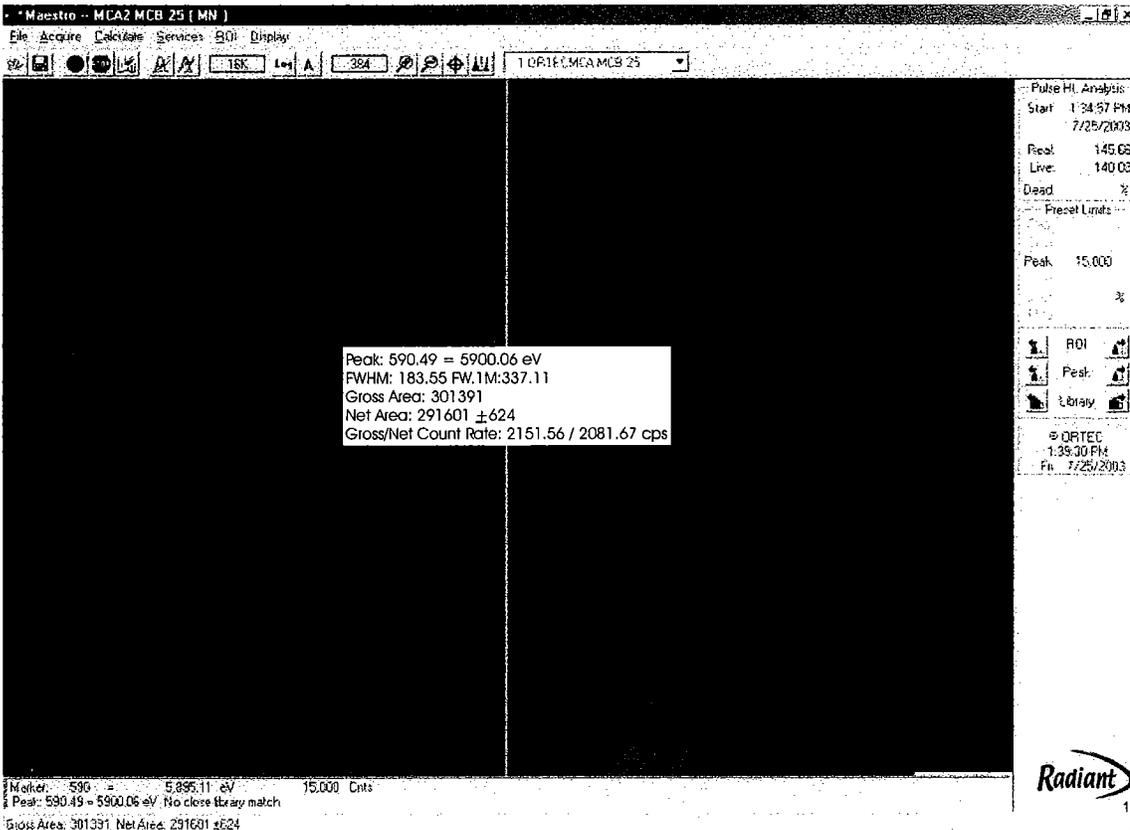
VORTEX™

⁵⁵Fe Performance



⁵⁵Fe spectrum collected with the Vortex at 6 μ s peaking time.

FWHM = 132 eV



⁵⁵Fe spectrum collected with the Vortex at 0.25 μ s peaking time.

FWHM = 183 eV

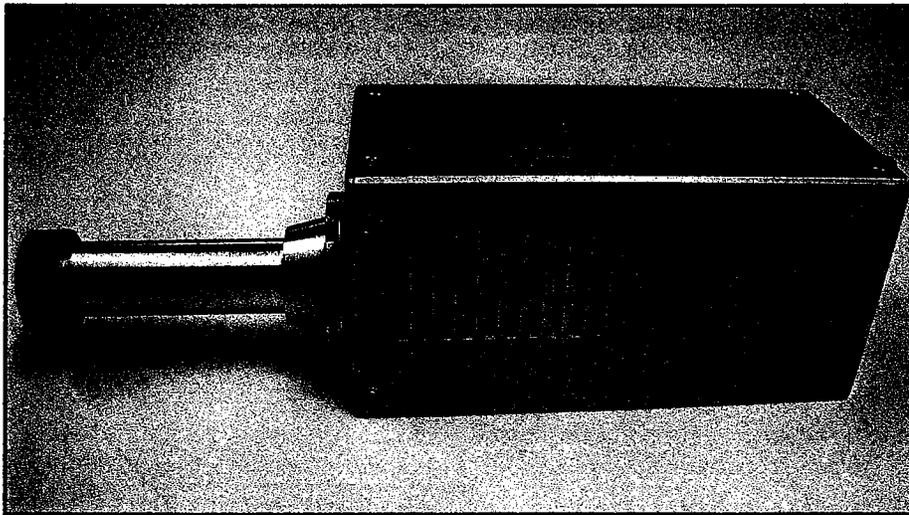
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VORTEX-EX™

New
Extended Probe

Multi-Cathode X-Ray Detector



Features:

- Large single area multi-cathode detector (50 mm²).
- Superb energy resolution.
- Detector temperature stabilization.
- Small and compact package for minimum vibration.
- Additional sizes are available under special contracts.
- Digital pulse processor (DPP).

Vortex-EX™ multi-cathode x-ray detectors (MCD) feature the largest single active area (50 mm²) available of its kind. Vortex-EX detectors are produced from high purity silicon using state of the art CMOS production technology. They feature excellent resolution (<136 eV FWHM is typical) and a high count rate capability (input rate >1 Mcps). At a very short peaking time of 0.25 μ s, an output count rate of 600 kcps is achieved. A unique feature of these detectors is their ability to process high count rates with virtually zero loss in resolution and no peak shift with count rate.

Typical Applications:

- ◆ X-ray fluorescence (XRF) spectroscopy - both bulk and micro-fluorescence.
- ◆ X-ray diffraction (XRD) and fluorescence (XRF)
- ◆ Synchrotron radiation applications.
- ◆ Process control.

The Vortex-EX is operated at near room temperature and cooled by a thermoelectric cooler (TEC) device and can be cycled as frequently as needed without any degradation in detector performance. Cool down times are typically less than 3 minutes.

The Vortex-EX x-ray spectroscopy system includes a detector unit and control box, which includes power supplies for the detector and TEC, a digital pulse processor (DPP), and our PI-SPEC software.

The complete detector also contains a charge-sensitive preamplifier and temperature stabilization system, which eliminates concerns of varying ambient temperature.

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VORTEX-EX™

Multi-Cathode X-Ray Detector

Detector

Crystal material	Silicon
Crystal active area	50 mm ² (nominal)
Crystal thickness	350 µm (nominal)

Window

Material	Beryllium
Thickness	25 µm (alternatives available)

Energy Resolution(FWHM)@ 59 keV

	Typical	Maximum
@ 12 µs peaking time	<136 eV	140 eV
@ 4 µs peaking time	<145 eV	150 eV
@ 1 µs peaking time	<165 eV	178 eV
@ 0.25 µs peaking time	<230 eV	250 eV

Preamplifier

Type	Charge sensitive, 2 mV/keV
Signal polarity	Positive
Reset	Electrical, <1 µs duration

Cooling

Type	Thermoelectrical
Max voltage	8 V
Max current	1.1 A

Power Consumption

Preamplifier	+/- 12V, 0.25 W
Power supply	110 V
Thermoelectric cooler	3.5 W (max)
Cooling fan	0.6 W

Physical Specifications

Detector package weight	900 g
Length	227 mm (probe is 78.8 mm)
Height x width	62 mm x 62 mm
Cable (standard length)	2 m

US Patent Number 6,455,858

Digital Pulse Processor* (DPP)

Digital Controls

Gain	16-bit DAC
Peaking time	0.25 - 64 µs
Preset time	Up to 1717 s

Data Outputs

Spectrum size	1024, 2048, 4096 or 8192 channels
Channel size	10, 20 or 40 eV

Integral Non-linearity 0.1% of full-scale output

Deadtime Correction better than - 0.5% accuracy from 0 to 120,000 cps at 4 µs peaking time

PCB occupies same card rack as Vortex power supply and is powered internally.

Power Consumption (Additional)

DPP	3.2 W
-----	-------

All specifications subject to change without notice in accordance with our drive for continuous improvement.

Software

PI-SPEC software*

Allows user to acquire, manipulate and test spectra. Pentium III or later with 64 MB memory and 30 MB available disk space.

VTXDLL package*

Dynamic-Link Library to facilitate host software communication with the DPP.

Pentium III or later with 64 MB memory and 30 MB available disk space.

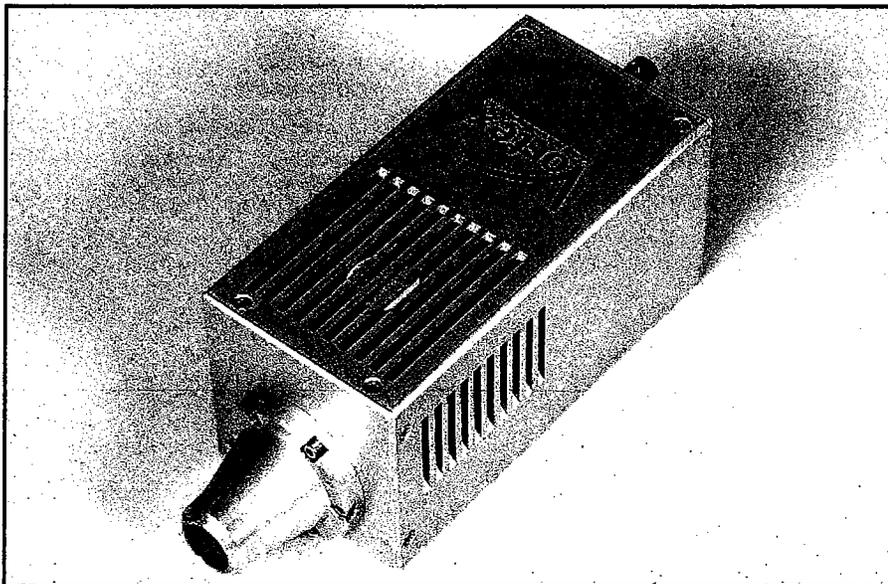
*Requires parallel port running in EPP mode.

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VORTEX™

Multi-Cathode X-Ray Detector



Vortex™ multi-cathode x-ray detectors (MCD) feature the largest single active area (50 mm²) available of its kind. Vortex detectors are produced from high purity silicon using state of the art CMOS production technology. They feature excellent resolution (<136 eV FWHM is typical) and a high count rate capability (input rate >1 Mcps). At a very short peaking time of 0.25 μs, an output count rate of 600 kcps is achieved. A unique feature of these detectors is their ability to process high count rates with virtually zero loss in resolution and no peak shift with count rate.

Typical Applications:

- ◆ X-ray fluorescence (XRF) spectroscopy — both bulk and micro-fluorescence.
- ◆ X-ray diffraction (XRD).
- ◆ Microanalysis and x-ray imaging.
- ◆ Process control.

The Vortex is operated at near room temperature and cooled by a thermoelectric cooler (TEC) device and can be cycled as frequently as needed without any degradation in detector performance. Cool down times are typically less than 3 minutes.

The Vortex x-ray spectroscopy system includes a detector unit and control box which includes power supplies for the detector and TEC, a digital pulse processor (DPP), and our PI-SPEC software.

The complete detector also contains a charge-sensitive preamplifier and temperature stabilization system, which eliminates concerns of varying ambient temperature.

Features:

Large single area multi-cathode detector (50 mm²).

Superb energy resolution.

Detector temperature stabilization.

Advanced vacuum system ensures limitless temperature cycles.

Additional sizes are available under special contracts.

Digital pulse processor (DPP)

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VORTEX™

Multi-Cathode X-Ray Detector

Detector

Crystal material	Silicon
Crystal active area	50 mm ² (nominal)
Crystal thickness	350 μm (nominal)

Window

Material	Beryllium
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Preamplifier

Type	Charge sensitive, 2 mV/keV
Signal polarity	Positive
Reset	Electrical, <1 μs duration

Cooling

Type	Thermoelectrical
Max voltage	8 V
Max current	1.1 A

Power Consumption

Preamplifier	+/- 12 V, 0.25 W
Power supply	110 V
Thermoelectric cooler	3.5 W (max)
Cooling fan	0.6 W

Physical Specifications

Detector package weight	680 g
Length	181 mm (probe is 33 mm)
Height x width	62 x 62 mm
Cable standard length	2 m

US Patent Number 6,455,858

Digital Pulse Processor* (DPP)

Digital Controls

Gain	16-bit DAC
Peaking time	0.25 - 64 μs
Preset time	Up to 1717 s

Data Outputs

Spectrum size	1024, 2048, 4096 or 8192 channels
Channel size	10, 20 or 40 eV

Integral Non-linearity 0.1% of full-scale output

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PCB occupies same card rack as Vortex power supply and is powered internally.

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All specifications subject to change without notice in accordance with our drive for continuous improvement.

Software

PI-SPEC software*

Allows user to acquire, manipulate and test spectra. Pentium III or later with 64 MB memory and 30 MB available disk space.

VTXDLL package*

Dynamic-Link Library to facilitate host software communication with the DPP.

Pentium III or later with 64 MB memory and 30 MB available disk space.

*Requires parallel port running in EPP mode.

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Radiant PI-Spec Software & Digital Pulse Processor

The Radiant Digital Pulse Processor (DPP) is designed for energy dispersive x-ray analysis using our family of detector products. Intended for laboratory or industrial x-ray applications, the Radiant DPP provides everything necessary for our Vortex™ X-Ray Detectors, incorporating one spectrometer channel, detector bias voltage, preamplifier and Peltier Cooler power supplies all in a compact package. Available processor peaking times range from 0.25 to 80 μ sec. The PI-SPEC Software offers complete computer control over the system. The Radiant DPP significantly increases throughput with virtually no deterioration of the performance compared to typical analog systems for comparable energy resolution but at a lower cost. Used with Radiant Vortex detectors the output count rate can reach 600,000 cps at 0.25 μ sec.

HARDWARE SPECIFICATIONS (DPP)

Input (Analog)

The signal input has been optimized for use with the Vortex family of detectors.

Interface

EPP: Enhanced Parallel Port (IEEE 1284). Up to 1 MB/sec data transfer.

Digital Controls (Set via EPP Port)

Gain: 80X range controlled by 16 bit DAC. For use with x-rays up to 50 keV or more and preamplifiers with gains nominally in the 0.1 to 10.0 mV/keV range.

Shaping: Triangular/Trapezoidal. Peaking time and gap (flattop) time set independently: 0.25 - 80 μ s in small steps. Adjustable gap time may be used to eliminate ballistic deficit effects.

Data Outputs (via EPP port)

Spectrum: Up to 8192 channels standard, 24 bits deep. Other: Collection livetime; total counts; pileup rejected counts; baseline statistics.

Bias Outputs: *Pre-amplifier power supply*
Peltier Cooler power supply
Four detector bias voltages (adjustable)

Spectrometer Performance

Resolution: Comparable to best analog units with excellent light element performance.

Count Rate: >1,000,000 cps ICR, >600,000 cps Output Count Rate (OCR).

Throughput: The digital filter processing allows optimal throughput for a given peaking time.

Pileup Inspection: Pulse-pair resolution typically better than 200 ns after tuning to optimize performance on an application specific basis.

Deadtime Correction

Accurate ICR and livetime outputs allow area of reference peak to be corrected to better than - 0.5% accuracy from 0 to 120,000 cps at 4 μ s peaking time. Peak Stability with Rate: < 0.05%, up to four times the point of maximum throughput!

Software

Basic control software (PI-Spec) is provided; a compact dynamic link library (VTXDLL) is available that facilitates and enables the host to develop their own control software.

Features

User friendly software for spectral acquisition and manipulation.

Single unit replaces spectrometry amplifier, multi-channel analyzer and high voltage and preamplifier supplies at significantly reduced cost.

Digital trapezoidal filtering, with programmable peak-to-peak times between 0.25 and 80 μ sec.

High precision internal gain control and light pipe insulation criteria.

Adjustable Input Count Rate (ICR) and livetime reporting for precise deadtime corrections.

All digital control implemented through Enhanced Parallel Port (EPP).

Ordering Information

Power Requirements:

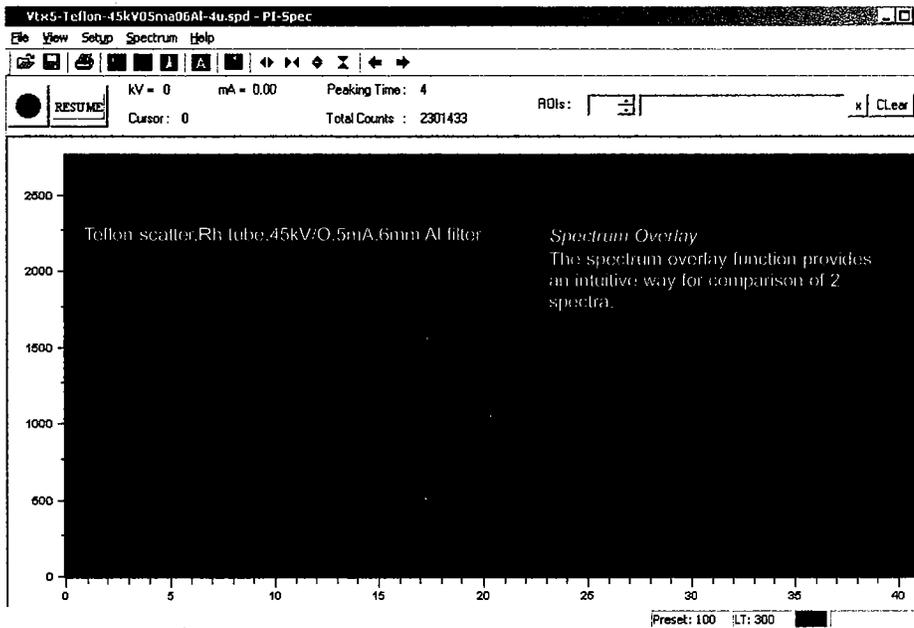
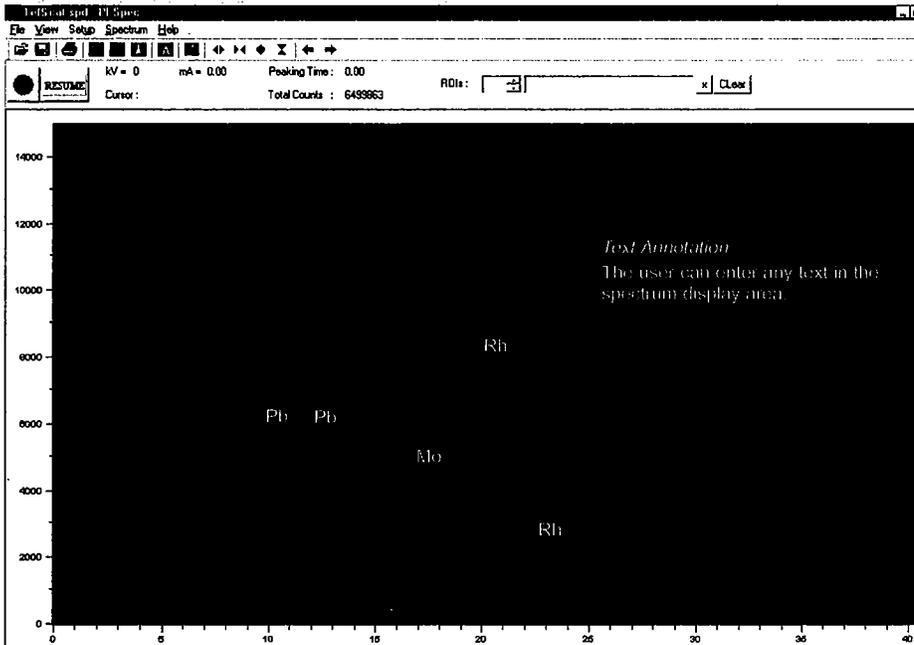
110 V at 0.2 A 50/60 Hz or
220 V at 0.1 A 50/60 Hz.

Dimensions: approx 10.0" W x 8.0" D x 5.0" H

Weight: net weight 11.5 lbs.

Radiant PI-Spec Software

The Pi-Spec interactive graphical user interface is an intuitive window-style interface that provides the user with straightforward access to various functions to acquire or analyze the spectral data. A single window provides spectral display and acquisition controls with a tool bar at the top of the screen for instant access to the frequently used functions.



Features

Basic spectral acquisition software designed and optimized to work with the Radiant DPP.

Can acquire, open/save, export/import, overlay and view spectra or manipulate, annotate, clipboard copy and print a spectrum.

Can evaluate peak resolutions and get ROI (region of interest) counts through manual or unattended operations. Up to 10 ROIs can be conveniently defined with mouse drags.

Automatic energy calibration with a button click.

Client software can control this software through simple Windows messages to set up acquisition parameters, start/stop acquisitions and save the acquired spectra.

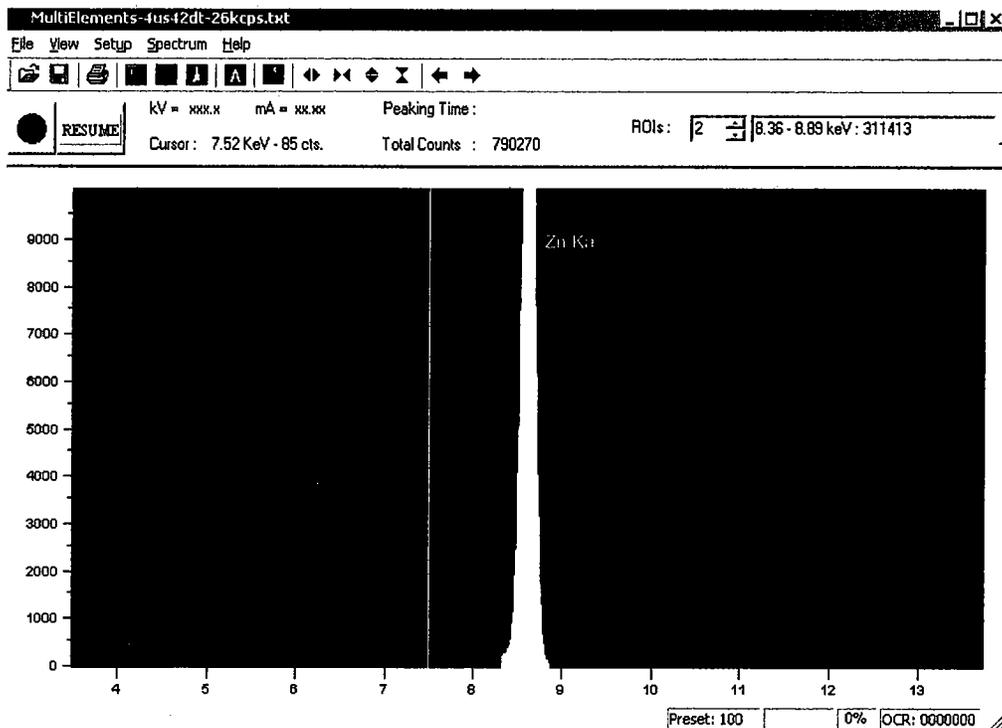
Export function saves the acquired spectrum in text (ASCII) format so that it can be opened by other software for further application specific processing.

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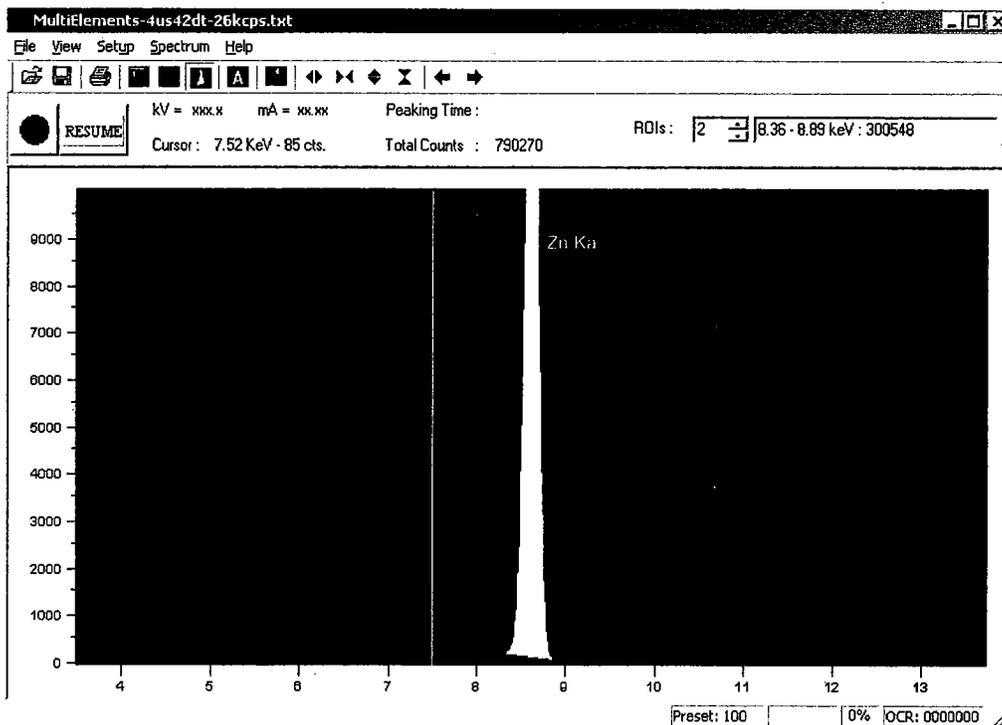
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CONVENIENT ROI HANDLING

Up to 10 ROIs can be conveniently defined using mouse drags. The user can edit and navigate through all the ROIs defined. All the relevant ROI information is displayed during the navigation. The ROI intensities can be displayed as raw or net. The net ROI intensity is background-subtracted intensities. The background correction uses the straight-line model through both the ROI bounds.



ROI display showing raw intensity.



ROI display showing net intensity.

CONTINUOUS ROI ACQUISITION

Raw or net intensity data of up to 10 predefined ROIs can be acquired simultaneously. The acquisition time can be as short as 0.01 second (10 ms). This feature is especially useful in cases where a continuous scan using very short dwell time is needed. One can, for example, get multiple diffraction patterns in just one shot of scan. The use of high throughput Vortex detectors makes this feature even more attractive. Below shows the user interface of this function, where 3 ROI intensity data are acquired in every 0.1 second. The data acquired can be saved into a text file which can be opened and processed later with Microsoft Excel.

1	59	6	67
2	51	18	69
3	50	6	56
4	43	16	59
5	52	9	61
6	55	10	65
7	50	12	62
8	47	11	59
9	57	12	69
10	43	14	57
11	48	16	64
12	56	11	68
13	57	13	70
14	49	16	65
15	52	13	66
16	50	10	61
17	60	4	64
18	54	17	71
19	55	13	68
20	60	14	74

Radiant VTXDLL Dynamic-Link Library

Dedicated Dynamic-Link Library serving as an interface between the user software and the Radiant Digital Pulse Processor (DPP).

The objectives are to encapsulate, or wrap up, the otherwise complicated DPP setup procedures, making the third party software transparent to the DPP. It handles all kinds of communication and spectrum acquisition needs through only 12 functions.

This library also optimizes the DPP's performance under widely varying conditions especially with the Vortex family of detectors.

The user software can assume a shortcut, interfacing with the DPP, without prior knowledge about the latter.

The source code of a sample host interface program (VTXDRV) is provided to facilitate users in developing their own control software.

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