



## Specifications

General	
Detector Type	<i>SUPER</i> Silicon Drift Detector (SDD)
Detector Size	25 mm <sup>2</sup>
Silicon Thickness	500 μm. See Figure 5
Energy Resolution @ 5.9 keV (55Fe)	125 - 140 eV FWHM at 11.2 μs peaking time
Peak to Background	8200:1 (ratio of counts from 5.9 keV to 2 keV)
Background Counts	<3 x 10 <sup>-3</sup> /s, 2 keV to 150 keV
Detector Be Window Thickness	0.5 mil (12.5 μm). See Figure 5
Collimator	Internal MultiLayer Collimator (ML)
Charge Sensitive Preamplifier	Amptek custom design with reset
Gain Stability	<20 ppm/°C (typical)
Case Size	
<i>SUPER</i> XR-100SDD	3.00 x 1.75 x 1.13 in (7.6 x 4.4 x 2.9 cm)
<i>SUPER</i> X-123SDD	3.94 x 2.67 x 1.0 in (10.0 x 6.78 x 2.54 cm)
Weight	
<i>SUPER</i> XR-100SDD	4.4 ounces (125 g)
<i>SUPER</i> X-123SDD	6.7 ounces (190 g)
Total Power	
<i>SUPER</i> XR-100SDD	<1 Watt
<i>SUPER</i> X-123SDD	2.5 Watt (typical)
Warranty Period	1 Year
Device Lifetime	Typical 5 to 10 years, depending on use
Storage & Shipping	Long-term Storage: 10+ years in dry environment Typical Storage & Shipping: -20°C to +50°C, 10 to 90% humidity noncondensing
Operation conditions	0°C to +50°C
OEM	Compatible with all Amptek OEM configurations
<i>SUPER</i> XR-100SDD Inputs	
Preamp Power	±8 to 9 V @ 15 mA with no more than 50 mV peak-to-peak noise
Detector Power	-150 to -200 V @ 25 μA very stable <0.1% variation
Cooler Power	
Current	350 mA maximum
Voltage	3.5 V maximum with <100 mV peak-to-peak noise
<i>Note: The SUPER XR-100SDD includes its own temperature controller</i>	

<i>SUPER</i> XR-100SDD Outputs	
Preamplifier	
Sensitivity	1 mV/keV typical (may vary for different detectors)
Polarity	Positive signal output (1 kΩ max. load)
Feedback	Reset
Temperature Monitor Sensitivity	PX5/X-123: direct reading in Kelvin through software.
Note	
The <i>SUPER</i> SDD requires negative high voltage and produces a positive preamplifier output. This is the opposite of the standard Si-PIN which requires positive high voltage and produces a negative preamplifier output.	
When ordered in an <i>SUPER</i> XR100SDD/PX5 configuration, the PX5 is equipped with a negative high voltage supply. The new PX5 is also equipped with a positive high voltage supply. It can be used with all Amptek detector types, as well as, with many other radiation detectors and preamplifiers, including HPGe detectors and scintillators.	
Use of Collimators	
Most of Amptek's detectors contain internal collimators to improve spectral quality. X-rays interacting near the edges of the active volume of the detector may produce small pulses due to partial charge collection. These pulses result in artifacts in the spectrum which, for some applications, obscure the signal of interest. The internal collimator restricts X-rays to the active volume, where clean signals are produced.	
Depending on the type of detector, collimators can improve peak to background (P/B); eliminate edge effects; and/or eliminate false peaks.	
For more information please see: <a href="http://www.amptek.com/xrspectr.html#edge">http://www.amptek.com/xrspectr.html#edge</a>	
Vacuum Operation	
The <i>SUPER</i> XR-100SDD can be operated in air or in vacuum down to 10 <sup>-8</sup> Torr. There are two ways the <i>SUPER</i> XR-100SDD can be operated in vacuum:	
1) The entire <i>SUPER</i> XR-100SDD detector and preamplifier box can be placed inside the chamber. In order to avoid overheating and dissipate the 1 Watt of power needed to operate the <i>SUPER</i> XR-100SDD, good heat conduction to the chamber walls should be provided by using the four mounting holes. An optional Model 9DVF 9-Pin D vacuum feedthrough connector on a Conflat is available to connect the <i>SUPER</i> XR-100SDD to a PX4 outside the vacuum chamber.	
2) The <i>SUPER</i> XR-100SDD or <i>SUPER</i> X-123SDD can be located outside the vacuum chamber to detect X-Rays inside the chamber through a standard Conflat compression O-ring port. Optional Model EXV9 (9 inch) vacuum detector extender is available for this application. Click here for more information on vacuum applications and options.	
For more information see: <a href="http://www.amptek.com/exv.html">http://www.amptek.com/exv.html</a>	

## Additional System Information and Performance

The *SUPER* XR-100SDD and *SUPER* X-123SDD are new high performance x-ray detector, preamplifier, and cooler system using a thermoelectrically cooled silicon drift detector (SDD). Also mounted on the 2-stage cooler are the input FET and a novel feedback circuit. These components are kept at approximately  $-55\text{ }^{\circ}\text{C}$ , and are monitored by an internal temperature sensor. The hermetic TO-8 package of the detector has a light tight, vacuum tight thin Beryllium window to enable soft x-ray detection.

A SDD is a type of photodiode, functionally similar to a PIN photodiode, but with a unique electrode structure to improve performance. Amptek's *SUPER* SDDs are optimized for X-ray spectroscopy. The key advantage of the SDD is that it has much lower capacitance than a conventional diode of the same area, therefore reducing electronic noise at short shaping times. For X-ray spectroscopy, an SDD has better energy resolution while operating at much higher count rates than a conventional diode. The SDD uses a special electrode structure to guide the electrons to a very small, low capacitance anode.

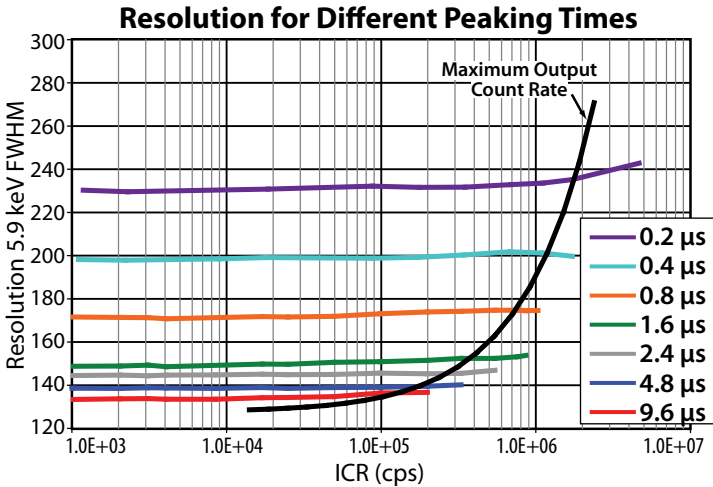


Figure 2. Resolution vs. Input Count Rate for different peaking times for the *SUPER* SDD with the DP5. The plot also shows the curve of maximum output count rate. Operating to the right of that curve results in less throughput than the maximum despite a higher input rate. See Figure 3.

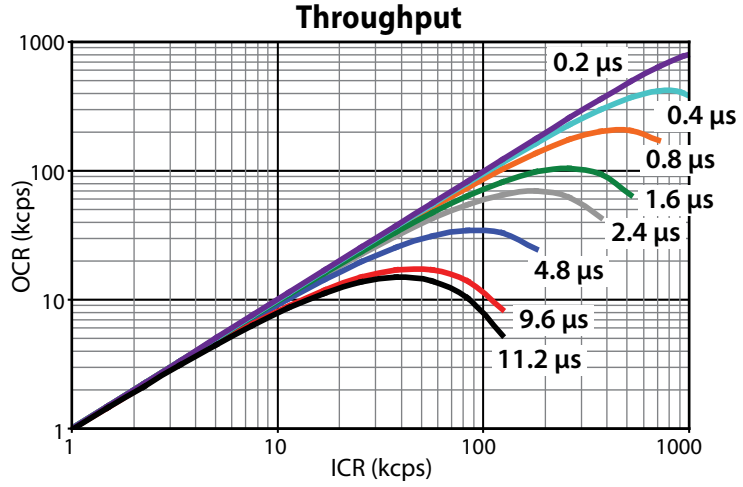


Figure 3. Throughput with the SDD. Due to the detector's smaller capacitance, a much shorter peaking time is used in the shaping amplifier without sacrificing resolution. Typically  $9.6\text{ }\mu\text{s}$  or less is used. This dramatically increases the throughput of the system.

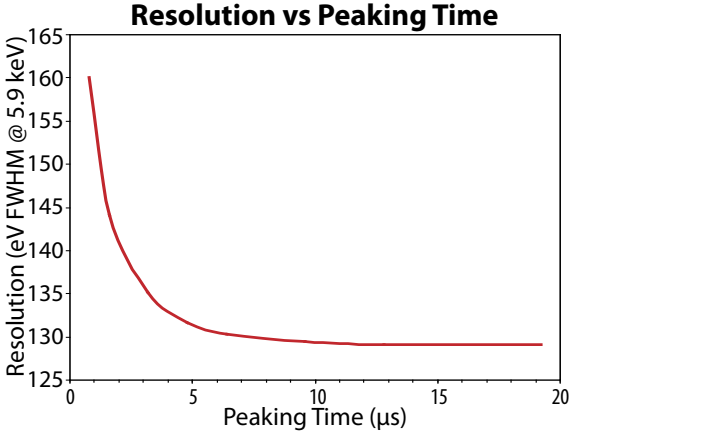


Figure 4. Resolution vs. Peaking Time for the *SUPER* SDD.

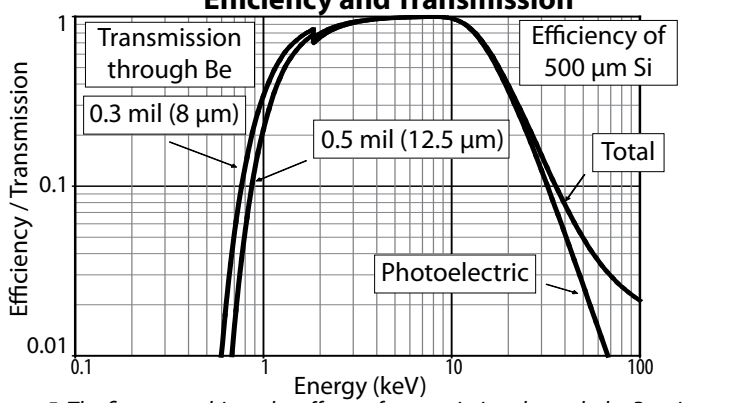


Figure 5. The figure combines the effects of transmission through the Be window (including the protective coating), and interaction in the *SUPER* SDD. The low energy portion of the curve is dominated by the thickness of the Be window - either 0.3 mil ( $8\text{ }\mu\text{m}$ ) or 0.5 mil ( $12.5\text{ }\mu\text{m}$ ), while the high energy portion is dominated by the thickness of the active depth of the *SUPER* SDD -  $500\text{ }\mu\text{m}$ .

### Resolution vs. Peaking/Shaping Time for Si-PIN and SDD Detectors

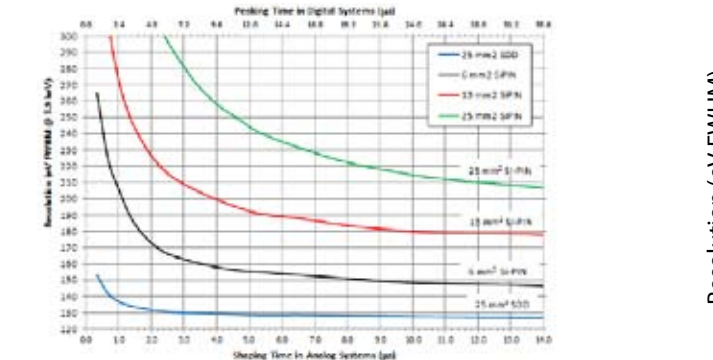


Figure 6. Comparison of Resolution vs. Peaking/Shaping Time for Si-PIN and SDD Detectors

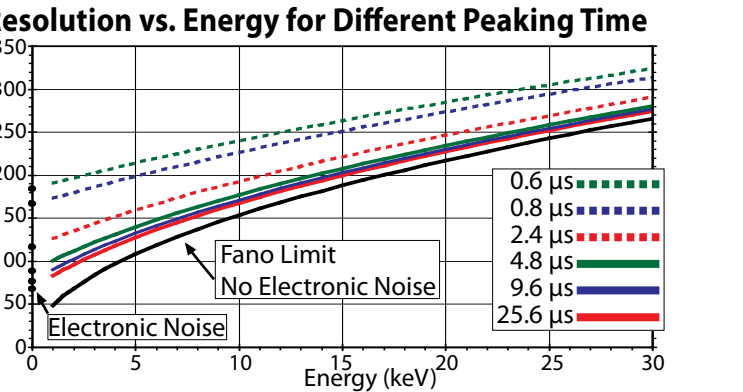
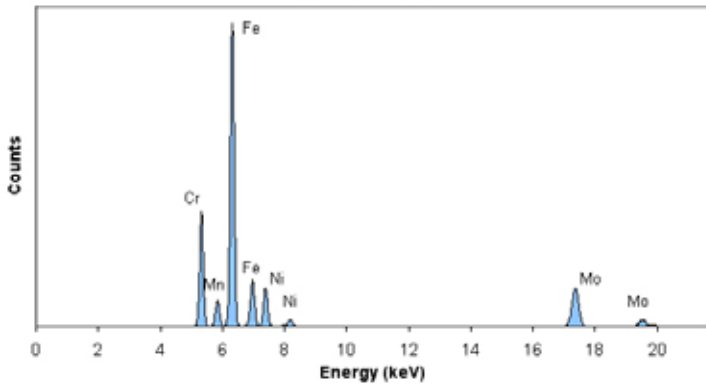


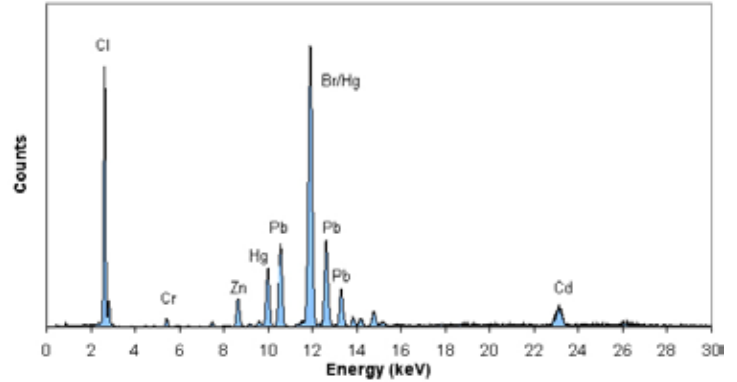
Figure 7. Resolution vs. Energy for Different Peaking Times taken with the SDD.

# Application Spectra

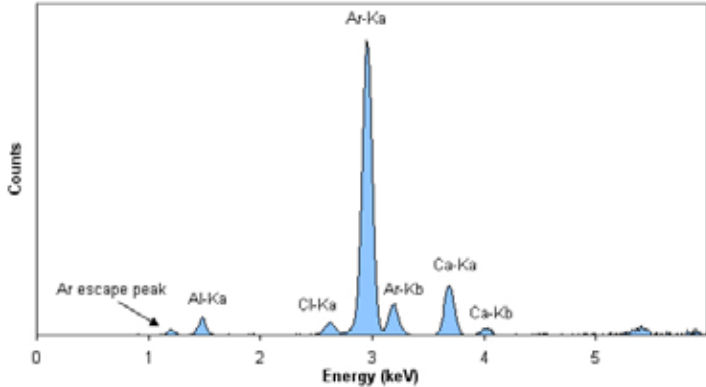
Super SDD: 25 mm<sup>2</sup>/500 μm Silicon Drift Detector  
XRF of SS316



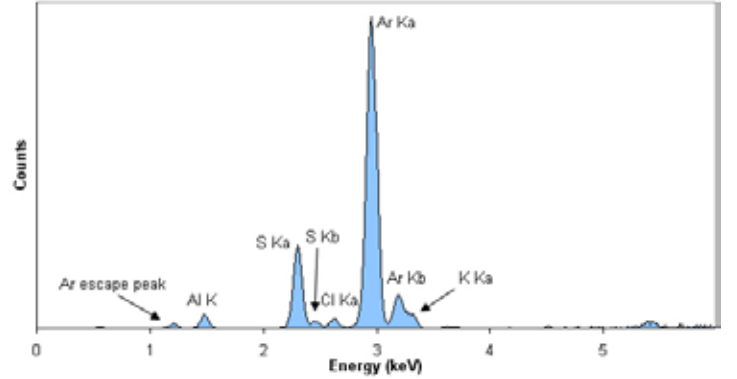
Super SDD: 25 mm<sup>2</sup>/500 μm Silicon Drift Detector  
RoHS/WEEE PVC Sample



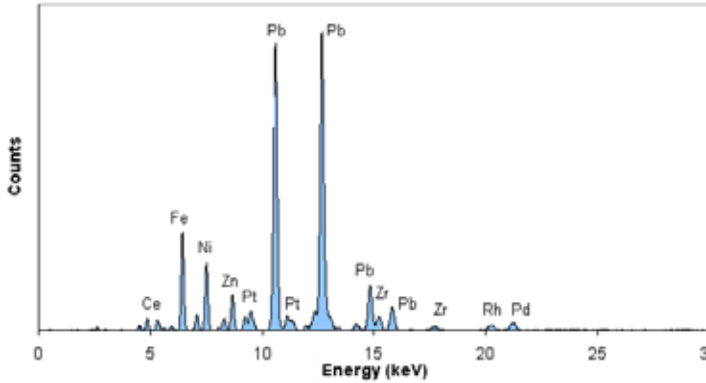
Super SDD: 25 mm<sup>2</sup>/500 μm Silicon Drift Detector  
CaCl<sub>2</sub> in Water (800 ppm Ca, 1200 ppm Cl)



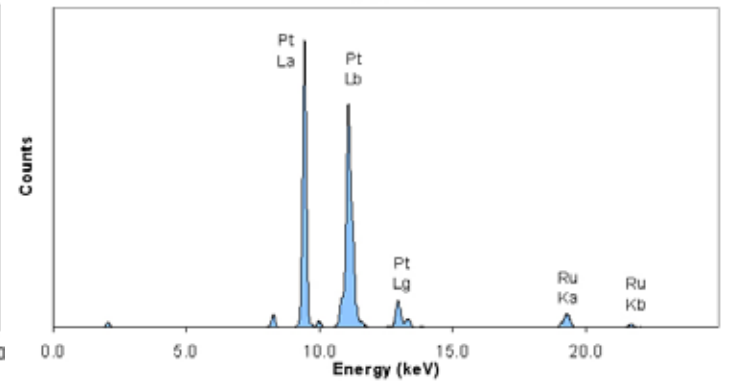
Super SDD: 25 mm<sup>2</sup>/500 μm Silicon Drift Detector  
1100 ppm Sulphur in Crude Oil (some KCl)



Super SDD: 25 mm<sup>2</sup>/500 μm Silicon Drift Detector  
Automotive Catalyst



Super SDD: 25 mm<sup>2</sup>/500 μm Silicon Drift Detector  
Platinum (Pt) Ring XRF



## Experimenter's XRF Kit with SDD

### Complete XRF System Includes:

- SUPER X-123SDD Complete Spectrometer
- Mini-X USB Controlled X-Ray Tube
- XRF-FP Quantitative Analysis Software
- MP1 XRF Mounting Plate



The SUPER X-123SDD and Mini-X on the MP1 mounting plate.

## OEM Components

