



D-Matrix

Gamma Ray Imaging
Detectors

The D-Matrix Detector Module Platform offers a modular and scalable gamma ray imaging detector design approach, enabling performance differentiation and configuration flexibility.

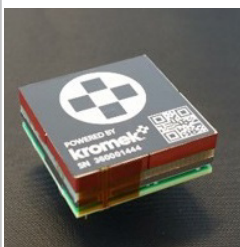
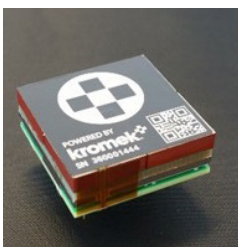
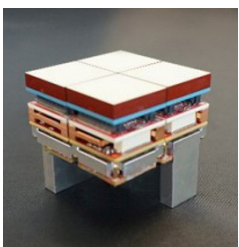
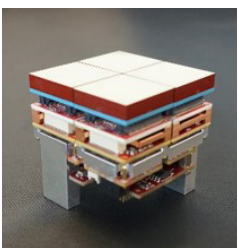
The D-Matrix platform is comprised of 2D scalable detector modules each consisting of 4 CZT detector tiles, either 20mm or 22mm square, with 2.0 or 2.46mm pixel pitch.

The detector modules are enabled by fully-featured ASICs offering a range of performance and optimization functionality options including charge-sharing and depth-of-interaction corrections. For medical imaging applications, the D Matrix G1 through G6 modules offer scalable solution for gamma ray applications including whole-body and cardiac SPECT, hand-held surgical cameras, as well as thyroid, breast, veterinary, pre-clinical molecular imaging.

For security screening applications, D-matrix modules enable X-Ray Diffraction based detection and identification solutions for optional secondary screening or integrated to primary identification systems.

Applications	
Medical Imaging	Optimized spatial and energy resolution along with count uniformity drives improved patient outcome through superior image quality, dose and scan time reduction
Security Screening	High count rate with best-in-class energy resolution allows for enhanced threat detection for x-ray diffraction based screening solutions
Nuclear Threat Detection	Isotopic identification enabled through superior material properties and spectrum enhancement achieved through advanced ASIC functionality
Research and Development	Flexible demonstrator platforms of G2, G4, and G6 platforms enables immediate experimental deployment

D-Matrix Features
Direct energy conversion, room-temperature photon spectrometer with nominal energy resolution < 2% FWHM at 662 keV (uncorrected)
Integrated detector electronics modular design
Scalable 2D arrays at customer selectable crystal thickness
Leakage current compensation, baseline restoration, coincident timing, and positive and negative charge amplification on all anode and cathode channels

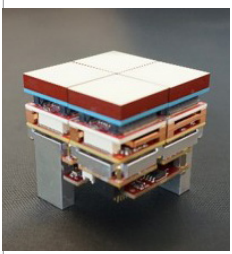
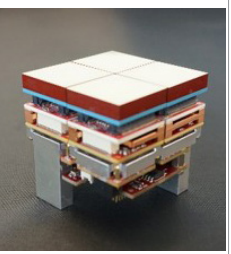
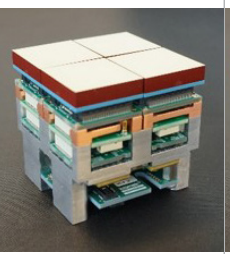
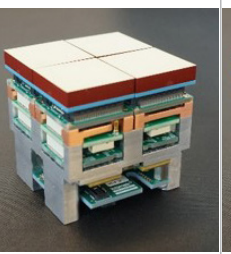
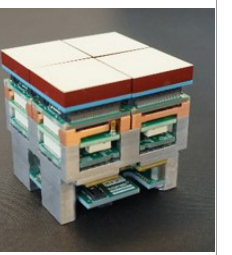
				
Physical	G1 - 500	G1-730	G2-500	G4-500
Module Dimensions (X,Y)	40mm x 40mm	40mm x 40mm	44mmx44mm	44mmx44mm
CZT Detector Thickness (Z)	5mm	7.3mm	5mm	5mm
Pixel size	2.46mm x 2.46mm	2.46mm x 2.46mm	1.975mm x 1.975mm	1.975mm x 1.975mm
Pixel pitch	2.46mm	2.46mm	2.045mm	2.045mm
Pixel Qty / Detector Module	256	256	484	484
Max Non Conf Pixels per DM	5	5	24	24
Detection				
Energy Resolution	<6.5% @ 122keV	<6.5% @ 122keV	90% of pixels have < 7% at 122keV	90% of pixels have < 7% at 122keV
Energy range	30-250keV	30-250keV	25-250keV	25-250keV
Count linearity in sparse mode	8% from linear at 500cps/pixel	8% from linear at 500cps/pixel	8% from linear at 500cps/pixel	8% from linear at 500cps/pixel
Read-Out Electronics				
ASIC - Type and Qty	HPL - 2 per DM	HPL - 2 per DM	HPL - 4 per DM	HPL - 4 per DM
Cathode Signal	Not enabled	Not enabled	Not enabled	Optional
Cathod Signal Resolution (241Am)	N.A.	N.A.	N.A.	N.A.
FPGA	Included	Included	Not Included	Included

D Matrix Demonstrators			
D Matrix Demonstrator Kits	Number of CZT Detector Tiles	Typical Segmentations	Notes
DMR1: based on G4 DMs	1	1 DM	DMR1 and DMR2 system
	2	1 DM	DMR1 and DMR2 system
	4	1 DM	DMR1 and DMR2
DMR2: based on G6 DMs	16	1x4 DM 2x2 DM	DMR1 and DMR2 DMR1
	custom, scalable	custom	
Electronics	Electronics package includes high voltage power supply		
Interface	Ethernet or custom digital output interface options are available		
API	Correction algorithms are available in the form of an Application Program Interface (API) for full integration		

Kromek uses a proprietary optimization process to grow CZT ingots. Ingots are sliced, diced, polished and fabricated into detector tiles with very thin metalized electrodes deposited on the detector surfaces.

The metals used for electrodes are chosen to match the detector application. The detector electrodes are electrically biased creating an electric field within the detector volume. When ionizing radiation interacts with the CZT crystal, many pairs of electrons and holes are created, with the number of pairs proportional to the energy of the incident photon.

System Spec	Details
Input Power	5V DC & 13V DC
IO interface	Gigabit Ethernet
HV Control	Integrated; On/Off & set point
Beam Entrance	1.60mm carbon fiber
Global Gains	20, 40, 60, 120 mV/fC
Peaking Times	0.25, 0.5, 1.0, 1.5, 2.0, 3.0, 6.0, 12.0µs
Counting Rate	5% from linear in 140keV ±7.5% window at 200 cps/p
Uniformity	>50% or <200% of median across all pixels
Housing / Weight	Fully enclosed Al box @ 7.2lbs
ASIC Spec	Details
Type	121 anode + 1 cathode, analog out, event by event list mode data
Features	<ul style="list-style-type: none"> Leakage current compensation baseline restoration coincident timing positive and negative charge amplification on anode channels test pulse

					
Physical	G4-1000	G4-1500	G6-500	G6-1000	G6-1500
Module Dimensions (X,Y)	44mmx44mm	44mmx44mm	44mmx44mm	44mmx44mm	44mmx44mm
CZT Detector Thickness (Z)	10mm	15mm			
Pixel size	1.975mm x 1.975mm	1.975mm x 1.975mm	1.975mmx1.975mm	1.975mmx1.975mm	1.975mmx1.975mm
Pixel pitch	2.045mm	2.045mm	2.045mm	2.045mm	2.045mm
Pixel Qty / Detector Module	484	484	484	484	484
Max Non Conf Pixels per DM	16	16	16	16	16
Detection					
Energy Resolution	90% of pixels have < 3.5% at 622keV	90% of pixels have < 3.5% at 622keV	average FWHM < 3% at 122keV	average FWHM < 3% at 622keV	average FWHM < 3% at 622keV
Energy range	25-400keV	25keV-3MeV	15keV-3MeV	15keV-3MeV	15keV-3MeV
Count linearity in sparse mode	8% from linear at 500cps/pixel	8% from linear at 500cps/pixel	2% from linear at 500cps/pixel	2% from linear at 500cps/pixel	2% from linear at 500cps/pixel
Read-Out Electronics					
ASIC - Type and Qty	HPL - 4 per DM	HPL - 4 per DM	KHR - 4 per DM	KHR - 4 per DM	KHR - 4 per DM
Cathode Signal	Optional	Optional	Optional	Optional	Optional
Cathod Signal Resolution (241Am)	<25%	<25%	<25%	<25%	<25%
FPGA	Included	Included	Included	Included	Included



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