



Technical Specifications

Rayonix MX 225 HE

225 mm High Efficiency CCD Detector System for X-ray Diffraction

(Specifications subject to change)

1. MX CCD225-HE X-ray Detector System

1.1. 225 mm High Efficiency mosaic CCD detector

- Nine element mosaic CCD X-ray detector optimized for highest possible efficiency, sensitivity, and stability. Especially suitable for microcrystals, low X-ray energies, and/or SAXS.
- Nine 2k x 2k (2048 x 2048 pixels) Back Illuminated E2V 42-40 CCDs; two on-chip readout channels per CCD for simultaneous 18-channel readout
- Each CCD is coupled to phosphor by 2.85:1 fiber-optic taper
- Produces fully corrected, seamless images. Maximum physical gap between adjacent fiber optic taper elements of less than 1 pixel (~ 50 um)
- Active imaging surface : 225 mm x 225 mm square (50,625 mm²)
- Software-selectable on-chip binning yields the following standard supported resolutions:

On-Chip Binning	Resolution	Pixel Size (at phosphor)
2 x 2	3072 x 3072	73 μm
3 x 3	2046 x 2046	110 μm
4 x 4	1536 x 1536	146 μm

1 x 1 binning mode (6144 x 6144 resolution) available as a special option.

- **Readout Modes** – Two readout modes: **Low Noise** (High Gain, Slow Speed, Limited Fullwell Capacity) and **High Speed** (Low Gain, Normal Noise, High Fullwell Capacity)
- **Electro-optical Gain** (electrons/X-ray photon) 11 e⁻/12keV X-ray photon
- **Read noise**

Speed and Noise vs. Mode and Binning

		Resolution (pixel size)		
		3072*3072 73 μm	2046*2046 110 μm	1536*1536 146 μm
Mode (Noise)	Low Noise (3.5 e ⁻ , 0.3 12keV RMS)	3.5 sec	2.0 sec	1.0 sec
	High Speed (7.7 e ⁻ , 0.7 12keV RMS)	1.0 sec	0.5 sec	0.3 sec

- **Baseline Stability** – Two Baseline modes: **Normal** - RMS variation in mean pixel value with no applied signal is approximately 0.1 ADU and **Stabilized** – RMS variation in mean pixel value from image to image of approximately 0.01 ADU (achieved by overscan correction)

Baseline Stability vs. Readout Mode

		Readout Mode	
		Low Noise	High Speed
Stability Mode	Normal	0.2 e ⁻ (0.02 12keV photons)	0.6 e ⁻ (0.05 12keV photons)
	Stabilized	0.02 e ⁻ (0.002 12keV photons)	0.06 e ⁻ (0.005 12keV photons)

- **DQE** (Detective Quantum Efficiency) - DQE up to 0.8 for 8 keV - 12 keV
- **PSF** (Point Spread Function) FWHM ~ 100μm
- **Dark current** (at standard operating temperature of -75°C) ~0.005 e⁻/pixel /second or ~0.0005 12 keV photon /pixel /second
- **Full well capacity** Depends on binning.
At 3072 x 3072 resolution : 350 ke⁻ /pixel = 30,000 12 keV photons/pixel
- **Dynamic Range** (~ Full Well / Noise) 16 bits
Depends on photon energy, binning, and readout rate, but in most cases the dynamic range will be limited by 16 bit A/D converters, 16 bit data format, and the choice of Readout Mode.
For 3072 x 3072 resolution, High Speed Mode → 350 ke⁻/7.7 e⁻ → 45,000
Low Noise Mode → 120 ke⁻/3.5 e⁻ → 34,000
- **Phosphor** Gd₂O₂S:Tb ~40μm thick
Replaceable, but not routinely changeable. High accuracy data requires careful factory calibration after phosphor change.
- **Defects** CCD sensors are selected for low noise and low number of cosmetic blemishes. All defects and spatial distortion are correctable and permanently mapped, and corrected by our factory calibration procedure. Fiber Optic tapers are low thorium glass with extra mural absorption (EMA) selected for minimal geometric and shear distortions.

- **Physical**

- Detector Head

- Dimensions

- H x W x D = 46cm x 32cm x 40cm

- Weight

- approx. 52 kg

- Power Supply/Cooling assembly

- Dimensions

- Rolling cabinet

- H x W x D = 180 cm x 64 cm x 64 cm

- Weight

- approx. 215 kg

- Vacuum Pump

- Dimensions

- H x W x D = 37 cm x 16 cm x 25 cm

- Weight

- approx. 8 kg

- **Locations**

- Between Detector Head and:

- Computer

- Standard = 20 meters Max 2 km

- PS/Cooling

- Standard = 7.5 meters Max 15 meters

- Vacuum Pump

- Standard = 1.8 meters Max 5.5 meters

Non-standard distances require specification at time of order.

1.2. Control and Data Acquisition Software Package

- Menu-driven control program for autonomous data collection
- Graphical user interface (GUI) based on X11 /Motif
- Graphical data display and inspection software
- "Zinger" removal routines (combining two images)
- Combined dark current, flatfield and spatial distortion correction routines
- Software selectable Stability mode to process overscan to reduce baseline drift.
- Optional "Slave" mode API for control by external program

1.3. Control and Data Acquisition Hardware and Computer Workstation

- Proprietary Fiber Optic interface PCI busmaster DMA Controller with kernel level driver
- Direct transfer of data, in real time, to workstation memory with no involvement of workstation CPU
- Optically isolated digital input for external trigger of shutter and/or readout
- Optically isolated digital output as trigger for external shutter controller
- The supplied workstation for control of the CCD is an integral part of the CCD-Camera:
 - Pentium IV Extreme Edition PC with Linux OS
 - Flat-panel Monitor
 - 750 GB Hard disk, 2 GB RAM
 - 10/100/1000 Ethernet Interface
- Networkable (TCP/IP, NFS) to other laboratory computers by Gigabit Ethernet (1000 Mbit/sec).
- Complete Documentation.