EDX Systems & Upgrades Specifications Summary

4pi's most popular system is its **RevolutionEDX Premium System** for detection and quantification of elements down to Beryllium. Standard features include:

- Premium Performance detector with Moxtek AP3.3 window and Si(Li) crystal with an active area of 10 mm^2 (30 mm^2 for TEM or STEM)
- Universal Spectral Engine
- Revolution Quant/Imaging/X-ray Mapping Software Package (SEM and STEM installations)
  (Revolution Quant Software Package for TEM installations w/o a functioning STEM attachment)

RevolutionEDX Upgrade: includes the Universal Spectral Engine and Revolution software as listed above and described below. Upgrades include a cable to interface the system to the preamp on the existing x-ray detector; and, for SEMs and STEMs, a cable for the scan control interface.

Universal Spectral Engine

Unit has a small footprint (8.5" x 15.5" x 19") and contains digital pulse processor, MCA, digital image acquisition and scan-control hardware, and Ethernet card. Interfaces to any Windows or Macintosh computer that has an Ethernet port.

- Gain (spectrum range): 10keV, 20keV, 40keV, 80keV range
- Gain stability with temperature: 120 ppm/° C or better
- Peaking time: 0.25 - 80 microseconds (Triangular/Trapezoidal shaping)
- Integral Non-linearity: 0.1% or better of full scale output
- Pileup Inspection: pulse-pair resolution typically better than 250 ns
- HV supply: 0-1000V DC negative
- Operation Temperature Range: +5° C to +40° C; LN_2-protect circuitry

Premium Performance SEM X-ray Detectors

- Si(Li) crystal: active area of 10 mm^2 to 80 mm^2
- Resolution: 132eV or better; 131eV is typical with 10 mm^2 crystal
- available with a guaranteed resolution of 129eV or better
- Peak to background ratio: 20000:1
- Manual slide assembly

TEM Premium Performance X-ray detectors

- Si(Li) crystal: active area of 30 mm^2 or 50 mm^2 for improved solid angle
- Angled crystal design for high take-off angle
- Resolution: 136eV or better; 134eV is typical with 30 mm^2 crystal
- Peak to background ratio: 20000:1
- Automatic motorized retraction mechanism to protect the detector from high x-ray and scattered electron fluxes

Standard features on all detectors include:

- Electronic restored FET
- Low-noise preamplifier
- Instrument-specific chamber interface flange
- 7.5 liter LN_2 dewar (additional sizes available on request)

Detector windows that may be specified:

AP3.3: Moxtek's highest performing polymer x-ray window. It is the thinnest window available on the market and provides the best light-element x-ray transmission possible: detection down to beryllium ka x-rays.. The 3.3 window includes a stronger film, stronger support grid, more corrosion resistance, and increased backpressure resistance than the AP1.3.

DuraBeryllium™: Proprietary treated beryllium for high-vacuum integrity for detection down to sodium ka x-rays.

4pi Revolution® Software Features

The software is fully multi-tasking with easy-to-use point-and-click screen tools. Spectra, images and maps can be printed directly from the program. Purchases include free upgrades via download from 4pi's web site.

Highlights

- Hyperspectral Imaging:
  - Principal Components Analysis
  - Maximum Pixel Spectrum: enables detection of rare elemental features in x-ray spectra and maps
  - full spectrum at every pixel: analysis and display
  - Dynamic Elemental Mapping: allows real-time selection of elements and processing parameters while any set of full spectrum-per-pixel x-ray maps is being acquired
- EDX imaging and mapping interface: x-ray imaging toolbar sets a new standard for power and ease of use
- micron marker interface and calibration window: virtually automatic
- click-and-drag measurement tool for all images and maps
- EDX quant engine. The new quant engine improves a variety of tricky analysis issues
- report exporting to Microsoft Word
- fast x-ray mapping

EDX

- spectrum scaling (auto, linear/log), zoom, overlay and color control
- multiple spectra catalogs
- adjustable channel display (up to 4096)
- adjustable preset acquisition (realtime, livetime)
- user-definable color ROIs with ROI sum display
- qualitative analysis using auto or manual
- quantitative analysis: auto or manual; bulk or thin film; with or without standards; mixed
- full text annotation
- FWHM of each identified element is an optional report column
- user control to show/hide every x-ray marker (total of 30: 5 K lines, 13 L lines, 12 M lines) for each of the 100 elements known by the internal database
- line plotting of spectra as well as original histogram style
- KLM markers can be either fixed height or scaled to peak heights with selectable text size for element symbols
- set individual spectrum colors (including KLM markers, KLM/Peak ID element text)
- intelligent labeling for spectrum energy axis (x-axis)
- spectrum math
- export to EMSA 1.0, EMSA 1.0 (XY), Xraytor, JPEG, PICT (Mac), BMP (Windows), ASCII
- export qual and quant results to Excel
- copy spectrum results to clipboard for paste to other applications
- copy/paste spectra between catalogs
- import/export of standards files: up to 50 elements can be added to a standard by editing a text file and importing

Digital Imaging and X-ray/WDS Mapping

- simultaneous acquisition of digital images and maps: WDS and X-ray
- independent preview resolution (2 x 2 to 14k x 14k)
- independent acquire resolution (2 x 2 to 14k x 14k)
- variable aspect ratio
- selectable 8-, 16-bit pixel-depth
- selectable averaging/integrating (frame, pixel)
- acquire status display (x, y, frame, estimated time-to-completion)
- color line-profile display
- selectable real-time display scaling (full, max-min linear, log, square root)
- line-scan capability (single linear)
- user-defined magnification selector menu and optional magnification display in image

- calibrated micron marker in or below image
  - -global and individual calibration factors
  - -optional transparency, reverse video, marker frame, and marker size override
  - -font size and style selection
  - -live on-image display
- scanning control
  - -left-right or up-down scanning
  - -independent adjustable horizontal/vertical retrace delay (0-100 ms)
  - -adjustable pixel-stepping delay (0-800 ms)
  - -line-sync (50 and 60 Hz)
- zoom and pan images
- text annotation
- cross-platform read of 8- and 16-bit grayscale TIFFs
- cross-platform read/write of color TIFFs (RGB 8 bit)
- image level adjust; arbitrary or with presets: applies to front-most image
- cross-platform read of mbd (Revolution native data) files
- SEM Imaging Mode: dedicated mode for acquiring and annotating digital images
- user-defined display scaling for imaging/mapping
- facility, instrument and comments text fields added to append below area

Image Acquisition and Display

- select up to 2 channels for digital imaging (system may be ordered with additional channels)
  - generate image of any external analog signal; suitable for: backscattered electron, secondary electron, absorbed current, cathodoluminescence, EBIC
- adjustable dwell time: 1-1600 μs, sub-μs capability

X-ray Map Collection and Display

- user-definable ROIs, up to 96 (92 pre-defined elements, 4 arbitrary backgrounds)
- save spectrum at every pixel
- grayscale or color maps
- color phase map
- slow mapping (live- or real-time acquisition)
- probe crosshair
- background subtraction
- adjustable dwell time: 1ms-100sec

WDS Map Collection (option; additional charge)

- select up to 4 channels of external TTL signals for WDS mapping
- wide dynamic range: < 1 cps to 500,000 cps
- sequential or parallel acquisition
- adjustable dwell time: 1μs-16sec

Image/Map File Management

- autosave to disk feature with overwrite control
- autoname feature
- printer DPI control
- selectable file formats: JPEG, BMP (Windows), TIFF-PC, TIFF-Mac, PICT (Mac)