

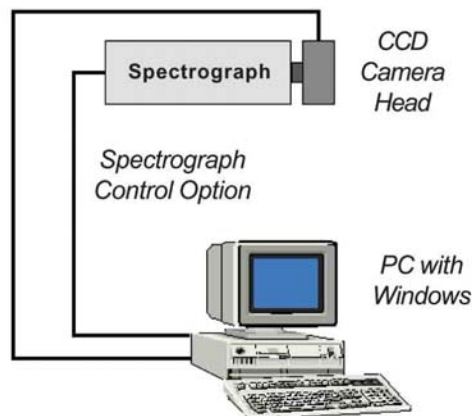
**KestrelSpec for Windows** is designed for data acquisition and analysis using a scientific digital camera, a spectrograph and a computer running Windows. Catalina Scientific developed the Windows software in collaboration with Rhea Corporation, who developed the original KestrelSpec software for the Macintosh.

### Data Acquisition

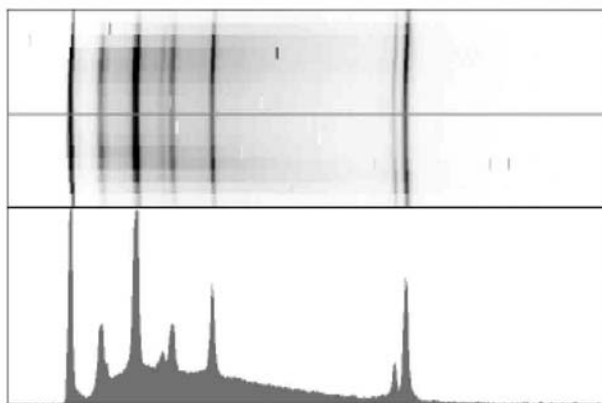
- Various CCD, EMCCD, CMOS and ICCD cameras are supported.
- Select arbitrary areas (subarrays) and pixel-grouping (binning) modes on the CCD for creating spectral data.
- Image data is 32 bits-per-pixel so multiple accumulations (exposures) can be summed to improve signal-to-noise.
- Spectral curve data is 32-bit, single precision floating point.
- Create spectral curves with up to 65,000 points per curve.
- Calibrate spectral data in nm or Raman  $\text{cm}^{-1}$  shift.
- Real-time, dark background and flat-field image buffers. Automatic background subtraction and flat-field correction.
- Automatic flip image horizontal when image is reversed, and automatic flip image vertical when image is inverted.
- Fully adjustable temperature control on all CCD cameras.
- Maximum frames/second depends on binning mode, subarray size, readout rate and number of curves per image.
- Exposure sequences can be programmed with adjustable delay intervals. Most cameras support external triggers to control the timing of exposures.
- Automatic save of images and curves to disk.
- Conversion of data to log or absorbance scales.
- Autoscan and autocalibrate spectra with fully integrated spectrograph control option for supported spectrographs.
- *KestrelScript™* enables other Windows programs, like LabVIEW® from National Instruments, to send commands to and receive data from KestrelSpec via Windows DDE.

### Data Display and Analysis

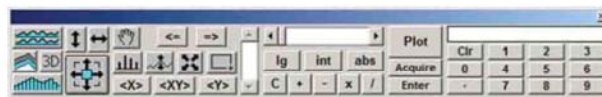
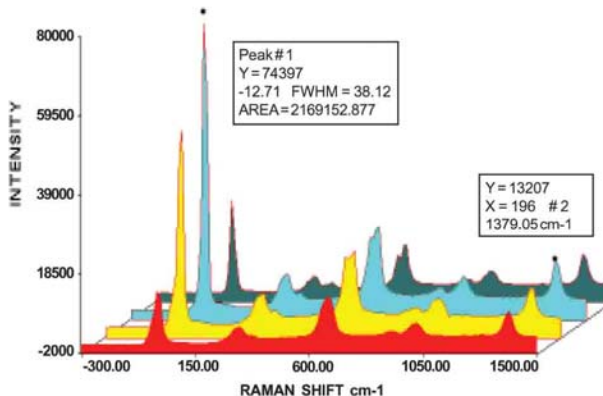
- Image display: gray levels in positive/negative or pseudocolor
- 2-D and 3-D curve overlays or vertically stacked curves.
- Channel profile  $Y(t)$  plot (Z axis slice).
- Catalog of spectral curves with "thumbnail" plots.
- Spectral calibration using least squares, spline or polynomial fit or "one-point" *KestrelCal™* for scanning spectrographs.
- Baseline correction of curves using polynomial regression
- Real-time peak finder for both images and curves.
- "Join" overlapping spectra into a single, linearized spectrum.
- Curve Math: apply one curve to another, or apply a constant
- Smooth curves according to an adjustable threshold.
- Calculate temperature from a reference with *KestrelTemp™*
- Identify elements in a spectrum using NIST tables or user-defined tables of reference wavelengths for each element.



KestrelSpec can control both a CCD camera and a spectrograph to provide a complete spectroscopy system for data acquisition, spectral calibration, data display and analysis.



Raman spectrum by KestrelSpec CCD spectroscopy system.



KestrelSpec has versatile graphing and data analysis options. The Control Palette (above) yields quick access to numeric keypad, peak finder, zooming, panning, XY cursor and other tools.

## Other KestrelSpec for Windows Features

- Export spectral data in delimited, ASCII text format. Exported curve data can be imported into a spreadsheet program or an analysis program like GRAMS or MATLAB®.
- Import/export image data in binary integer, ASCII text, bitmap or grayscale TIF formats. "Swap byte" capability for importing image data created on a Macintosh.
- Print plots and images in grayscale or color. Copy plots or images to the clipboard for pasting into other applications.
- "Batch" export of selected image and spectral curve files to a file type selected by the user.

## Compatibility

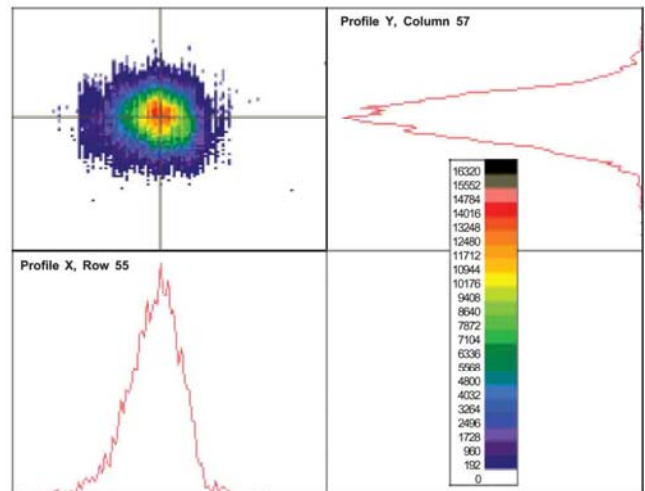
- CPU with 2 GHz minimum speed and at least 4 GB of RAM are recommended for real-time camera control.
- Windows 10 / 8 / 7 / XP (32-bit and 64-bit) are supported.
- KestrelSpec supports CCD/EMCCD/sCMOS cameras from several different manufacturers. Both non-intensified and intensified cameras are supported. The cameras interface with the computer via a USB port, Ethernet connection, or PCI bus. Contact Catalina Scientific or Rhea Corporation for information on supported cameras.
- A spectrograph control option is available for popular scanning spectrographs for automatic wavelength calibration and to change the wavelength setting, grating selection and slit size. Acquisition sequences can be programmed for automatically scanning through a range of wavelengths. Contact Catalina Scientific or Rhea Corporation for information on supported spectrographs.
- KestrelSpec supports echelle-type spectrographs built by Optomechanics Research and by Catalina Scientific. An echelle spectrograph disperses the spectral data into multiple orders across the CCD image plane, which covers a broad wavelength range at high resolution in just one image.
- Each copy of KestrelSpec comes with a hardware key that is connected to a USB port while the software is running. When the hardware key is connected, the software is fully functional. Without the hardware key, KestrelSpec will run in Demo Mode with limited functionality.

## Catalina Scientific Instruments, LLC

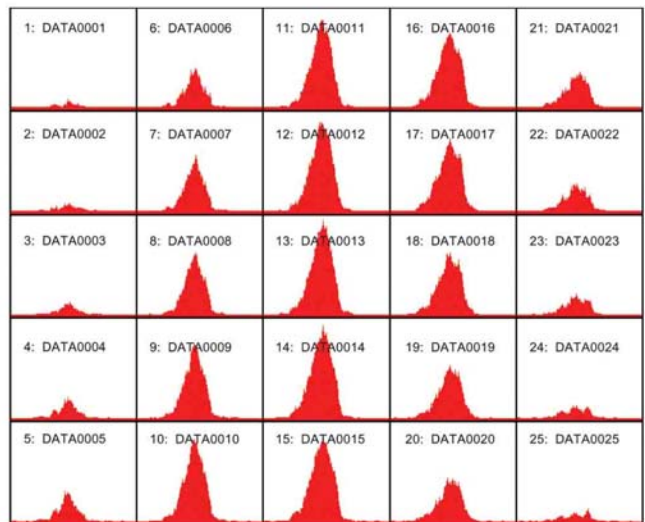
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## Rhea Corporation

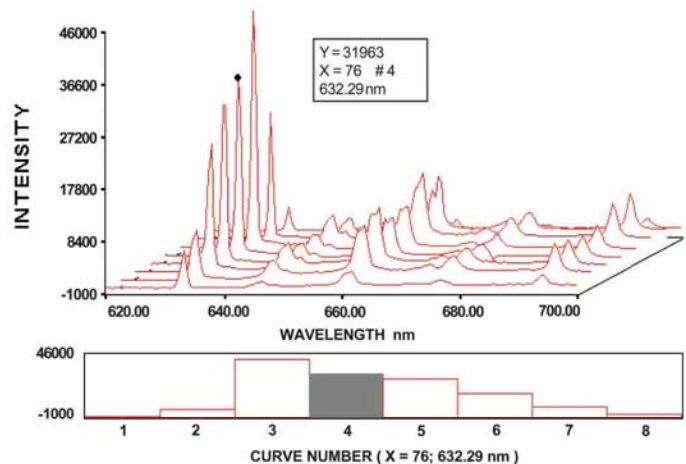
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"Laser beam profiler" display for X and Y cross section plots.



Spectrum Catalog displays up to 25 "thumbnails" in one window to give an overview of current spectral curves in memory. Cut and paste the thumbnails or mark them for deletion. Select a thumbnail plot to be expanded to a full window.



Channel profile graph (bottom) shows a slice at a constant wavelength along the Z axis (time) of 3D spectral curves.