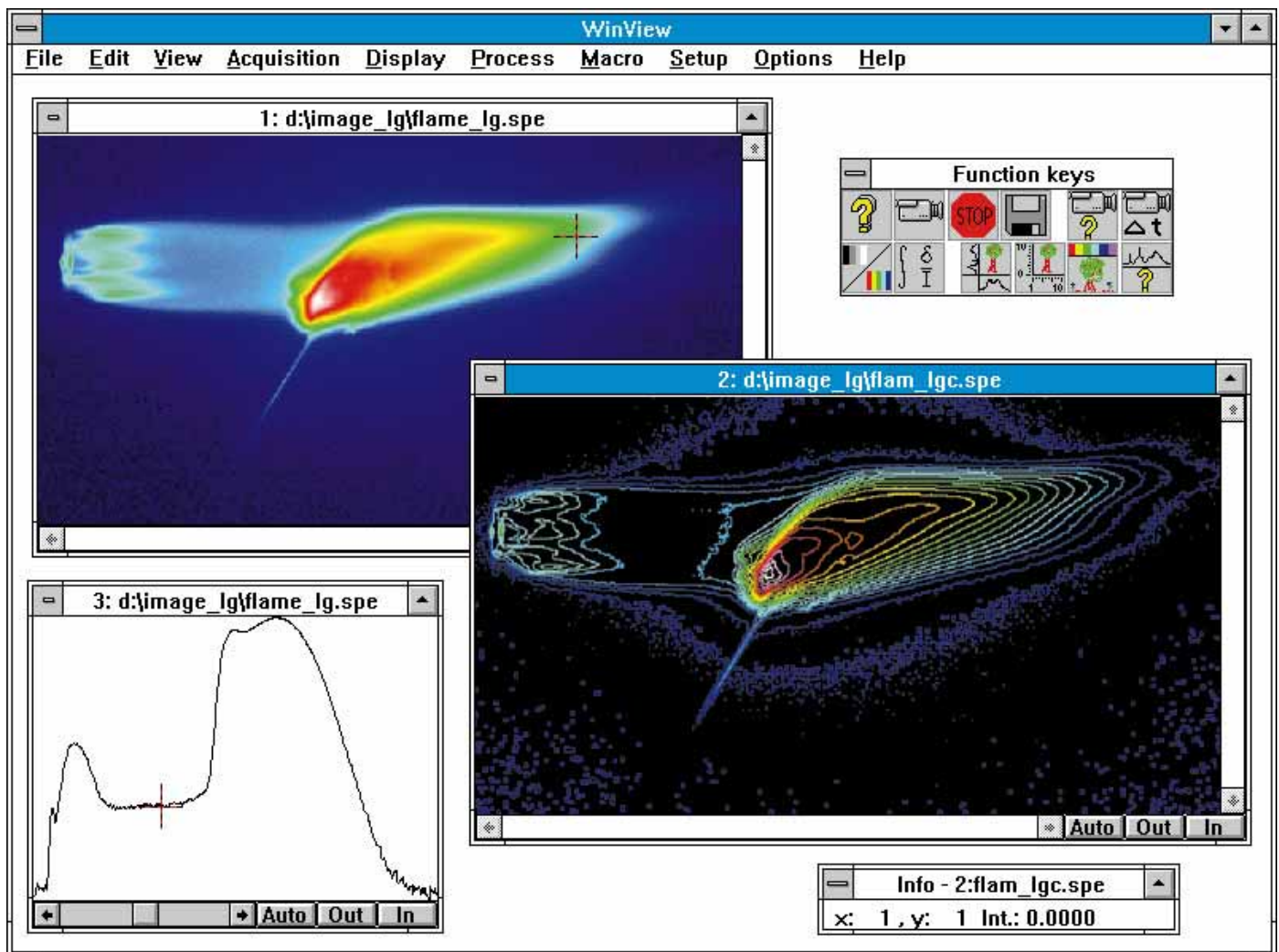


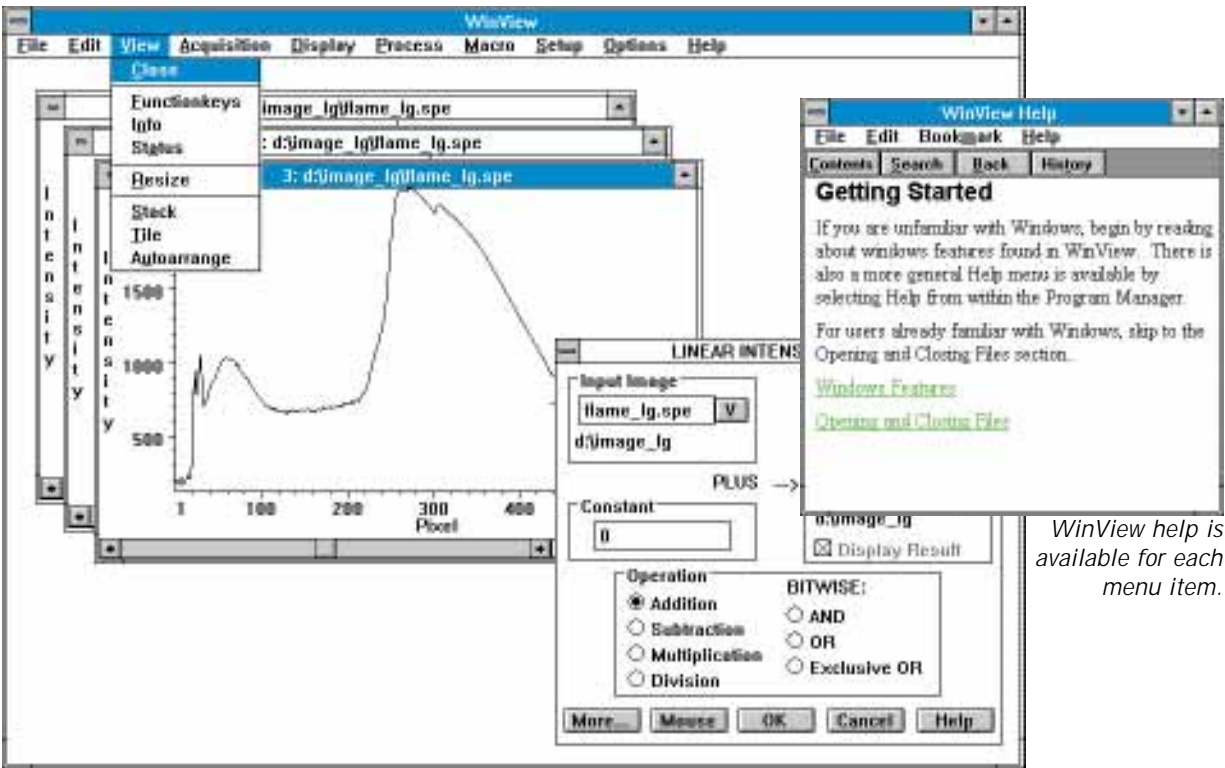
WinView: Imaging Software for Princeton Instruments Cameras

WinView is a high performance software package written specifically for acquisition and analysis of images using Princeton Instruments cooled digital CCD cameras. It operates under the Microsoft Windows system, the standard image processing interface for IBM and compatible personal computers, and supports all Princeton Instruments cameras, including all high speed models.



WinView Imaging Software Features

- ❑ Operates with IBM AT compatible computers using Microsoft Windows 3.1.
- ❑ Supports real time image acquisition, including 12-16 bit data display and dual A/D converters for optimal speed and precision.
- ❑ Full support of all Princeton Instruments hardware, including large, small, and rectangular camera formats, kinetics imaging mode, and the complete line of PentaMAX Cameras.
- ❑ Full featured image processing, including Sobel edge enhancement, iterative morphological operations, and user defined kernels.
- ❑ 16 and 32 bits per pixel native file formats; export to several standard formats available.
- ❑ Extended memory access, for full speed image acquisition directly to RAM.
- ❑ Record and playback macro system offers fast customization of multi-step acquisition and processing sequences.



WinView help is available for each menu item.

Windows can be organized on the screen manually, or positioned using standard stack/tile options. WinView menu structure conforms to Windows' standards.

Microsoft Windows Based Software

WinView operates under Microsoft® Windows™, the standard image processing interface for IBM compatible personal computers. Full advantage is taken of the many features of this interface. Multiple windows can display many different images, or many views of the same image. As data are processed, windows are updated.

Real-Time Interactive Acquisition

During live image acquisition, WinView provides an interactive approach, allowing you to zoom in, scroll, and autoscale images. As the display changes, the system is automatically reprogrammed to optimize the display rate. For large CCD arrays the difference between the number of pixels on the CCD and the number of pixels on the

monitor can be a factor of four or more. Exact readout and image display rates are a strong function of the exact hardware equipment.

Camera operation for precision image acquisition requires a different set of operational parameters. As a part of its support for interactive data acquisition, WinView can automatically move from the alignment/setup mode to the precision image acquisition mode and back, reprogramming and optimizing the system as necessary.

As live images are collected, windows can display cross sections, the color lookup table, and the scaling of the image. Additional windows provide such information as cursor position, individual pixel intensity, and system status.

Images can be displayed on the screen using a variety of automatic graphics lookup tables, including direct and inverse gray scales, log scaling, and pseudocolor. At reduced resolution, up to 10 frames per second can be collected, autoscaled, and displayed on a Super VGA screen.

This interactive approach to camera setup allows you to get results much faster than scientific CCD systems that cannot display images in real time.

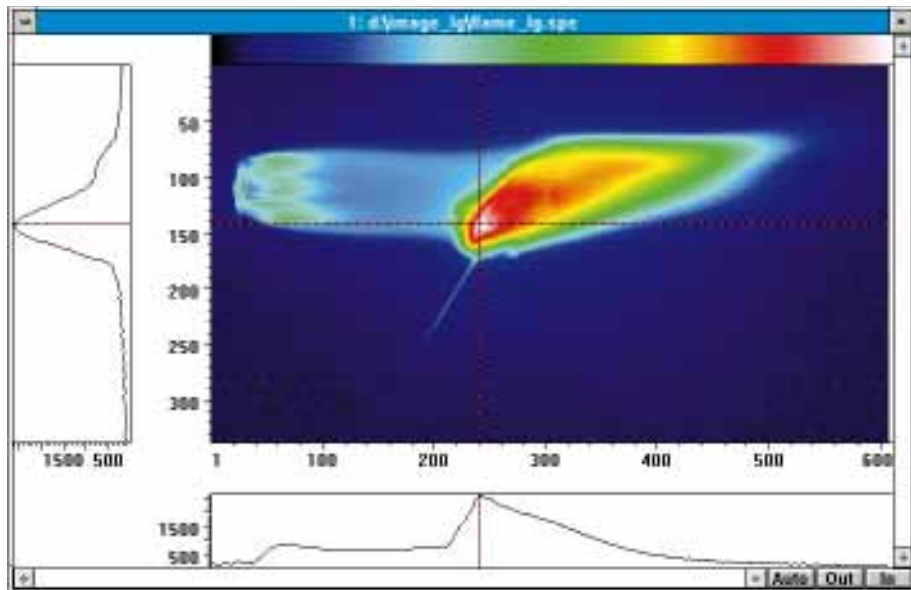
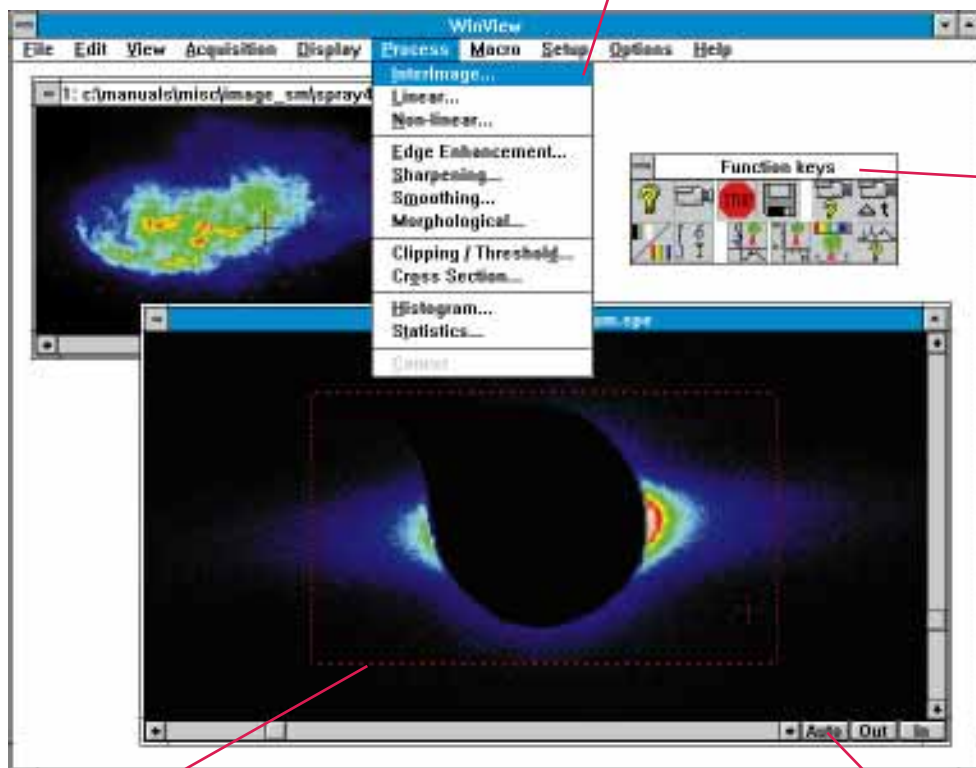


Image scaling and cross sections are available during live time acquisition.

Pull down menus are accessible through the mouse or the keyboard.



Function keys allow fast icon-based access to frequently used functions. User-defined macros can also be assigned icons for fast access through the mouse.

Regions of interest can be selected with the mouse, allowing immediate analysis and modification.

Image window buttons allow the user to zoom in and out, scroll or resize the image, or adjust the intensity scaling.

Multi-Step Image Processing

In addition to automatic background subtraction and flatfield correction, sophisticated postprocessing options are available with WinView. These include:

- Standard or User-Defined Filters: A full range of 3 x 3 kernels are provided, or the user can define their own.
- Thresholding and Clipping: By setting the proper image threshold or clipping values, a certain range of intensity values can be studied individually. Clipped images can also be recombined with the original image using other processing tools.
- Linear and Nonlinear Operations: Simple mathematics can be used to calibrate a series of images, redistribute the image histogram (by squaring each pixel value, for example), or normalize image data to appropriate units.
- Smoothing and Sharpening: Several standard filters are available for image smoothing, to reduce photon shot noise or other fluctuations, or for image sharpening, to enhance small variations in grayscale intensity.
- Edge Enhancement: Similar to sharpening, these filters enhance regions of high contrast and at the same time reduce in intensity areas of little or no contrast. The Sobel edge enhancement algorithm is also available.
- Morphological: These filters are helpful in experiments where it is necessary to distinguish between overlapping or nearly overlapping objects. Iterative open, close, erode, and dilate functions are included.
- Binary Image Operations: When used in combination with thresholding or other processing steps, these functions can automatically delineate odd shaped regions of interest.
- Interimage Operations: A great variety of image processing requires comparison of two or more images. This menu provides basic arithmetic as well as binary interimage processing.
- Cross Sections: In addition to the option to display image cross sections in real time, WinView can also calculate and save cross sections for separate processing and evaluation.
- A Histogram of a full image or region of interest allows the user to evaluate the distribution of signal.
- Statistical analysis of entire images or small subregions: Statistics such as area, center of mass, average intensity, and sigma can be exported as a text file.

For multi-step image processing, sequences can be preprogrammed and executed via the toolbar. Visual or audio signals indicate the progress of the processing, and completed images can be displayed and stored automatically.

A separate section of this catalog, *Image Processing Software for PI Cameras*, explains several of the techniques above in greater detail. See this section also for examples of smoothing, flatfielding, and statistical analysis.

Simple and Powerful Automation

WinView has a record and playback macro system, which allows fast automation of custom operation sequences. Once a macro is recorded it can be attached to an icon for single click (or single key) access from the Function Keys window.

WinView creates macros by generating programs with its built in programming language, Macro-Basic. This provides a simple method for writing Macro-Basic programs, which can then be edited to add more sophisticated functions (e.g., looping, branching, etc.) that are difficult to create via a record-for-playback method alone.

Macro-Basic, modeled after the standard computer language Basic, is built on a foundation of over 300 functions. These functions include all of the image acquisition and processing options in the menus, as well as additional functions specifically defined to support system automation.

A built-in text editor allows Macro-Basic programs to be edited on-line, during WinView execution. This allows very rapid implementation of dedicated user-specific image acquisition and analysis programs. Programs are saved as ASCII text, for editing or printing from any text editor.

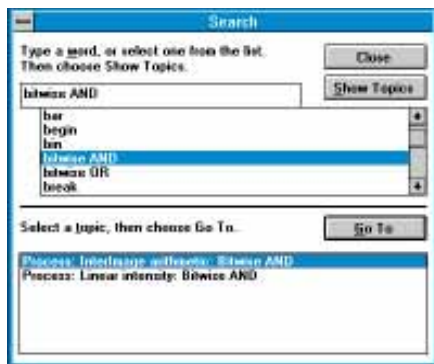
Multiple File Formats

WinView can store data on disk using all the data types supported in RAM: 8, 16 and 32 bit integer and 32 bit floating point. It also supports the image file format of our earlier software package CSMA. Export is available to several standard image formats, including BMP, FITS, GIF, PCX, TGA, and TIFF.

On-Line Help Available

On-line Help, another Windows standard, is available for each menu item. Each Help button accesses a specific manual section, eliminating time consuming searches.

Alternatively, users can consult the main help menu, which lists items by topic, or the index, which lists topics and keywords alphabetically. Hypertext-like browsing is also supported. The above image shows some of the automatic indexing features.



WinView Help.

Extended Memory Access

Using the 32 bit memory addressing support built into Microsoft Windows, WinView can acquire data to RAM beyond the normal 16 Mbyte limit. It has been used with computers having up to 40 Mbyte of RAM.

This allows long image sequences and very large images to be acquired and manipulated entirely in RAM, at much higher speeds than can be achieved when operating via disk. With the current cost and widespread availability of SIMMs, high performance image processing in memory is surprisingly affordable. Of course, for less demanding frame rates, images are automatically stored to disk, where they can later be retrieved and processed.

Equipment Supported

WinView is well suited to operate Model ST-138, ST-133, and ST-130 Camera Controllers. The ST-138 and ST-133 Controllers support advanced features of WinView, including dual A/D converters, 1 MHz operation at full speed, and frame transfer imaging mode. The ST-130, a more economical camera controller, does not support these features.

Also supported is the full line of PentaMAX cameras, with A/D rates of up to 5 MHz. See the separate section of this catalog for more information.

For intensified CCD cameras operating with PG-200 Pulse Generators, WinView provides completely integrated gating control. Pulse width, delay, and other options are set via software. This is the only fully integrated ICCD pulse generator on the market to date.

Hardware Requirements

- IBM AT or compatible personal computer, 80386 or higher microprocessor. Computers with 80486 or higher microprocessors are recommended.
- DOS 3.3 or higher.
- Microsoft Windows 3.1.
- Math coprocessor (required for 80386 generation processors, and on 80486SX models)
- For images up to 1024 x 1024; 32 Mbytes. For larger CCDs contact the factory
- Super VGA card with at least 512 kbytes RAM (1 Mbyte or more can dramatically improve performance) and 256 color capability. This must be supported by a Microsoft Windows 3.1 or higher driver.

A minimum of 600 x 800 resolution at 256 colors is recommended for 512 x 512 images, and Super VGA boards are now available with resolutions of at least 1280 x 1024 at 256 colors.

All camera resolutions can benefit from higher screen resolution, as it allows more images to be compared simultaneously on one screen.

- Color graphics monitor to support displays from the above graphics card.
- Two button Microsoft compatible serial mouse or Logitech three button serial or bus mouse.
- Serial ports for a mouse and any optional equipment, such as HV pulsers, printers, etc.

Dynamic Link Library

Princeton Instruments has taken the camera control routines of the WinView software and repackaged them as a Dynamic Link Library for customers who wish to control a Princeton Instruments camera system from their own software, providing that it is written under Microsoft Windows. This DLL has been written using a modern object oriented design, but it can be called from conventional, non-object oriented customer software. Please see pages 100-101 for more details or call the factory.