

Volocity

Introduction

A confocal microscopy dataset, an image “stack”, contains all the information needed to perform three- and four-dimensional reconstruction of the imaged sample. However, this isn’t possible without image reconstruction software which allows the user to take the raw data and use it to produce still images and videos of the dataset. The user can then perform in-depth four-dimensional analysis of the sample as well as produce images that can be used educationally at universities and teaching institutions. It is therefore important that this software contains a powerful set of image handling tools, but also provides a user-friendly interface that makes the tools simple to find and use.

Volocity is an innovative, high performance 3D imaging software product designed specifically for Life Science research. It allows the user to visualize, explore and analyze multi-channel 3D volumes over time, providing information that is difficult to obtain in any other way. It’s a complete imaging package that consists of four unique, totally integrated products that provide a suite of tools for 2D, 3D and 4D imaging. These tools are coordinated through Volocity’s unique Library format, which acts as a user-friendly image database for raw and quantified images.

Volocity Imaging Suite

The four products that make up the Volocity imaging suite are:

- Volocity Acquisition for high speed, 3D image capture
- Volocity Visualization to provide rapid, interactive, high resolution volume rendering of multi- channel 3D and 4D data sets
- Volocity Quantitation, which provides a comprehensive range of options to analyze structure and function in 3D and 4D image data
- Volocity Restoration, which provides a choice of proven deconvolution algorithms

Volocity Acquisition

Volocity Acquisition provides a flexible image capture interface which supports a wide range of cameras, microscopes and associated hardware so users don’t need to compromise on the most suitable hardware items for their application.

Once the hardware has been configured in the preferences, capture protocol parameters can be simply constructed using the clear and easy to use Acquisition Setup dialog. The acquisition protocol can include any combination of multiple channels, time points and multiple point scanning on a well plate or slide, all performed in 3D, with Z step control using a motorized focus drive or piezo focus device. All images captured are saved directly to the Library,

allowing users to organize images as they are acquired. Protocols can then be saved for repeated use and named so that they can be easily identified by anyone using the system.

When using Volocity to acquire images over time, it isn't necessary to wait until the end of the experiment to see the results; the data can be reviewed as soon as the first time point has been captured. This means that users can be sure that their protocol is working correctly right away and valuable hours aren't wasted acquiring a data set that has failed to develop as expected.

Volocity Visualization

Volocity Visualization puts the user in full control of the way that the 3D data is viewed, offering a choice of rendering options to achieve the best results. The high-resolution rendering of the data is fully interactive which enables the user to rotate, zoom and fly through the rendered object in real time so the data can be explored in new and exciting ways.

A large range of file formats can be imported from wide field and confocal microscopes and movies can be created quickly and easily to publish and share.

Volocity Quantitation

In Volocity Quantitation, objects can be identified, measured and tracked in 2D, 3D and 4D. Objects and tracks can then be viewed as overlays to image data which is ideal for relating structure to function, especially in time-lapse data sets.

It works by creating a measurement protocol to detect the objects to be measured or tracked. The protocol is made step-by-step using a combination of criteria such as intensity, size and shape. Feedback to the images is displayed in the Measurement view so the protocol can be refined quickly and easily. Protocols can be saved and applied to multiple volumes as a batch process, which is very useful when, for example, working with time lapse data.

Volocity is designed to analyze and display all data as a volume, ensuring that direct measurements of object size and location are done in 3D. It also includes functionality to analyze colocalization, FRET images and ratioed images.

Volocity Restoration

Volocity Restoration provides a choice of proven deconvolution algorithms to quickly and easily convert standard wide field fluorescence microscope images into superior confocal quality data, removing out-of-focus haze and producing exceptional results.

When light from a fluorophore passes through the optics of a microscope, diffraction causes the light to spread. The signal captured from light originating from a single point will take on a characteristic shape known as the Point Spread Function (PSF). Every photon that is detected by the camera has been spread in this characteristic way. This is represented mathematically by the convolution of the 'true' image made up of the physical locations of each fluorophore and the PSF. Deconvolution is the process of reducing the influence of the PSF on the image, through an intensive computational post-processing step.

Volocity Restoration can be used to improve images from both confocal and wide field data.

Volocity's Library Format

Finally, Volocity is an ideal tool for scientists who need to manage, organize and review digital images quickly and easily. Raw images, quantification data and presentation images are all coordinated through Volocity's Library format, a personal imaging database. This Library can be further organized with internal folders so that experiments and associated information can be appropriately grouped.

Images can be imported through a simple drag and drop, either of individual images or entire folders. As images are catalogued, data is extracted and stored and a thumbnail image is constructed from the original image. Images from a wide variety of image sources can be easily imported from other software packages, including most confocal scanner formats (retaining metadata), as well as standard image formats such as TIFF, JPG, TIFF, LIFF and OME-TIFF.

Once imported, images can be analyzed, deconvolved and visualized using any of the tools available in Volocity.

Conclusion

The Volocity suite is a powerful, fully integrated acquisition and analysis program with a strong focus on a user-friendly interface. It's a simple to use, intuitive program and we believe that it is a great solution for anyone doing spinning disk confocal microscopy. We're very pleased that Velocity supports the Prime 95B, the world's first back-illuminated scientific CMOS camera, and we would encourage researchers to try these products together to see how the quality of their imaging could be improved.