AppliedPrecision®

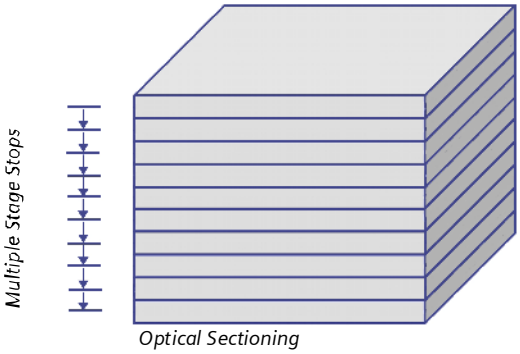
Product Note

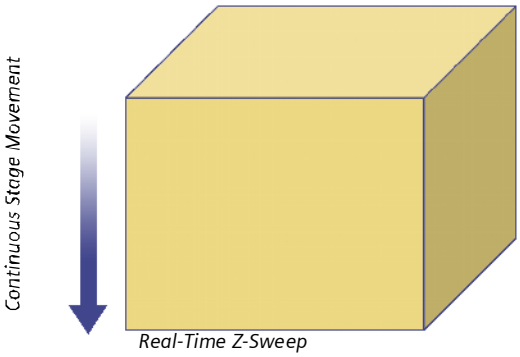
DeltaVision®

# Real-Time Z-Sweep Acquisition

## INTRODUCTION

Real-Time Z-Sweep, a DeltaVision exclusive, is a new approach for acquiring and displaying 3D Z projections. Instead of creating projections from multiple optical sections, it collects and integrates image data throughout a single continuous stage sweep.

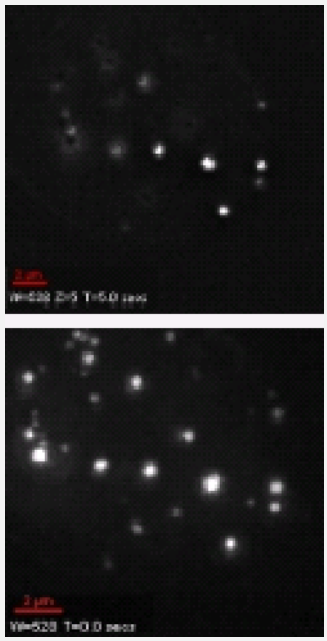



*Instead of acquiring multiple images, Real-Time Z Sweep acquires one image during a continuous stage movement and instantly creates a 3D Z Projection*

Real-Time Z-Sweep has significant advantages for applications such as Leading Edge Motion Analysis, Fast Organelle Dynamics, Microtubule Dynamics, and Fluorescence in situ Hybridization (FISH). It is especially useful for studies of objects that are moving in 3D space (e.g., kinetichores in a cell nucleus or other rapidly moving structures).

### Comparison of a Real-Time Z-Sweep Projection with a Standard 2D Image



This 2D image of endosomes in a HeLa cell (left) and an instant 3D Z projection (bottom) of the same area were acquired under similar conditions.

The additional data in the instant 3D Z projection includes objects that moved out of the depth of field of the 2D image during the data acquisition process.

Real-Time Z-Sweep has several advantages for imaging objects that are moving in 3D space:

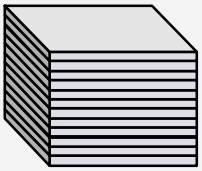
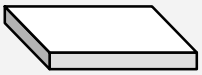
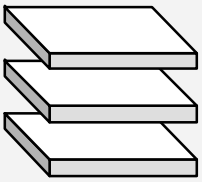
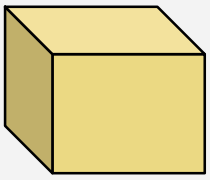
- Complete Z data acquisition collects all data in the interval of interest compared to 2D imaging or Z section sampling where some data is lost during the time of stage movement
- Fast data acquisition provides accurate image registration of rapidly moving objects
- Low total exposure time reduces the risk of damage to the specimen
- Low total read noise (the camera is only read once) improves signal-to-noise ratio

## Traditional Approaches

Prior to Real-Time Z-Sweep, choices for collecting 3D projections of cells moving in 3D space were limited to 1) collecting optical sections, 2) 2D imaging, or 3) sampling optical sections. With live cells, these approaches often require compromises between risk of damage to cell viability, motion artifacts, speed, and loss of data as objects move vertically.

Real-Time Z-Sweep allows you to acquire data without making compromises.

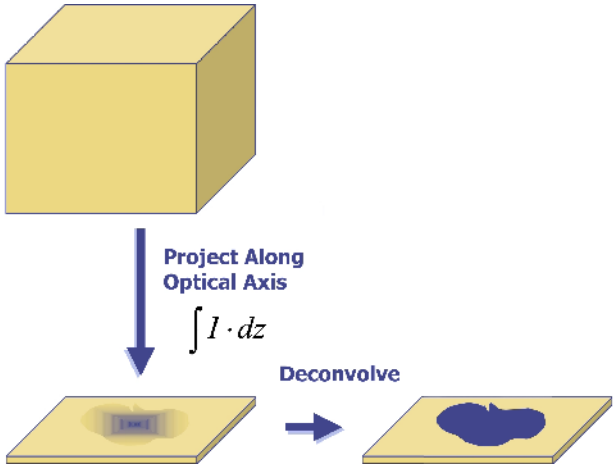
### How Other Methods Compare with Real-Time Z Sweep Acquisition

| Acquisition Methods | Pros and Cons |
|---|---|
| *Full Optical Sectioning* | |
|  | + Complete Z Data<br>- High Risk to Cell Viability<br>- Motion Artifacts<br>- Slow Speed |
| *2D Imaging* | |
|  | + Maximal Cell Viability<br>+ Minimal Motion Artifacts<br>+ Maximal Speed<br>- Minimal 3D Data |
| *Sampling Optical Sections* | |
|  | + Viability Improved<br>+ Fewer Motion Artifacts<br>+ Speed Improved<br>- Incomplete Z Data |
| *Real-Time Z-Sweep Acquisition* | |
|  | + Near Max Viability<br>+ Reduced Motion Artifacts<br>+ Near Max Speed<br>+ Complete 3D Data |

## The Real-Time Z-Sweep Approach

Real-Time Z-Sweep acquisition, combined with real-time 2D deconvolution, is yet another DeltaVision exclusive.

With Real-Time Z-Sweep Acquisition, the image is processed during the acquisition process. As the stage moves along the Z Axis, intensity data is continuously acquired and integrated to create a 3D Z projection and deconvolved instantly! This process is repeated for each channel that is acquired.




*The Real-Time Z Sweep process for creating 3D Z projections*

Real-Time Z-Sweep greatly reduces the risk of cell viability because total exposure time is significantly less (as much as 100 times) than a comparable full optical section.

All of the data in the interval of interest is acquired at full resolution. Although 3D images are not available, 3D Z projections are equivalent to those provided by full sectioning. The high speed of Real-Time Z-Sweep results in less motion artifacts, especially for rapidly moving objects.

**Applied Precision, LLC**
1040 12th Ave NW
Issaquah, WA 98027
Tel: 425.557.1000
**www.appliedprecision.com**