# OMX V4 Imaging System

The OMX V4 system is an advanced, multimode, super-resolution microscope based the design invented at UCSF exclusively licensed to Applied Precision. The OMX V4 system offers an advanced and highly flexible opto-mechanical design that can be employed for multiple imaging applications.

# Multi-Mode Imaging Capability.

The OMX V4 system is a highly flexible configuration and is capable of multiple imaging modes such as widefield, timelapse imaging, deconvolution or TIRF illumination. As such there is little restriction on the capabilities of this platform and it is fully expandable to meet future imaging needs.

## Structured illumination light path for 3D-SIM imaging

## Widefield illumination light path for conventional fluorescence imaging

## Transmitted light path for DIC imaging

## Optional TIRF illumination light path

# Proven Technology

The OMX V4 system was introduced in early 2008 and since that time we have shipped and installed almost one system each month. To date there are over 20 publications utilizing and describing 3D-SIM imaging on the OMX platform with more appearing weekly. Typical delivery time is 8-12 weeks and installation and training takes 5-8 days.

## Proven technology based on the world’s first 3D-SIM capable microscope

## Over 20 installations world wide

## Over 30 peer reviewed publications covering range of application areas

# Exclusive OMX Optical Platform Design.

Traditional microscopes do not have the precision, alignment or stability required to properly perform 3D SIM super resolution imaging. The unique design of the OMX optical module is developed specifically to create a highly stable, multi-channel, imaging platform for advanced microscopy applications. The design of this system, both hardware and software, is exclusively licensed by Applied Precision.

## OMX optical platform, exclusively licensed to Applied Precision

## Multiple illumination modalities, SIM, WF, TIRF (Optional)

## Extremely stable optical platform

## Lateral and axial drift <20 nm over 3 hours with no active temperature control

# Full 3D-SIM Super Resolution Technology.

The OMX V4 structured illumination light path generates an illumination pattern in three dimensions giving a twofold resolution improvement in the X, Y and Z therefore providing an eight fold increase for a 3D volume. This configuration consists of a diffraction phase grating that produces a multi-beam pattern which is then utilized to generate a 3D interference in the sample. This is essential as simple line gratings cannot generate the necessary pattern to allow full three dimensional super resolution reconstruction.

## 3D-SIM imaging at 90-120 nm lateral and 220-300 nm axial resolution (wavelength and optics dependant)

## Light path design to allows simultaneous multi-wavelength structured illumination imaging

# Multi-Camera, Simultaneous Acquisition.

The unique design of the OMX V4 optical platform can enable simultaneous acquisition on up to 4 cameras, with chromatically corrected light paths, without switching any optical elements, filters or prisms. Multiple cameras operating simultaneously enable imaging of multiple fluorescent probes with no time delays which is critical for applications such as high speed widefield live cell imaging or FRET imaging.

## Configure up to four custom liquid cooled sCMOS or EM-CCD cameras

## Simultaneous multichannel or sequential acquisition modes user selectable through software

## Custom designed optical path with high scatter light suppression systems for low background imaging noise

# High Speed Widefield Imaging

In addition to its super-resolution capability, the OMX V4 system is capable of high speed widefield imaging using our exclusive custom designed solid state illumination system. Coupled with the OMX V4 unique multi-camera capability and fast sCMOS cameras this allows the OMX V4 to image at blazing speeds.

* ***API Exclusive 6 color solid state illumination system with capability of 4 simultaneous excitation wavelengths***
* ***Imaging speeds over 400 frames per second, simultaneously on 4 channels (camera and optical configuration dependant)***

# Entire System Environmental Enclosure.

The entire OMX V4 system imaging module is enclosed in a special cabinet that helps control temperature fluctuations, room vibrations and acoustic noise that are critical when imaging at the sub-micron level. This also allows the system to be operated in any room environment eliminating the need to darkrooms or special facilities.

## Entire system enclosure enables operation in a normal laboratory environment

## Safety interlock system to protect against accidental laser exposure

# Integrated Electronics And Laser Control Cabinet.

The enable faster control of the system timing and trigger events the OMX V4 system utilizes a custom programmable gate array that allows simultaneous control and activation of multiple system events. The result is extremely low operational overhead allowing the system to operate at speeds beyond typical microscope acquisitions. All these electronics are housed in a dedicate enclosure that also contains the laser table, computers and interface controllers. The system is equipped with safety interlocks that prevents opening of the laser table when the lasers are active.

* ***Laser table configurable with up to 6 user selected lasers***
* ***High speed shutters and 6 position neutral density filter wheels for intensity control***
* ***Custom built programmable gate array controller for hardware control and acquisition timing (OMX Integrated Controller)***
* ***Dedicated camera computers for high speed readout and acquisition***

# OMX V4 Blaze Option

The OMX V4 system can be configured with an upgrade option that features Applied Precisions patented Blaze light engine technology. Blaze is a high speed SI pattern generation technology that allows structured illumination imaging in sub-second time frames making OMX V4 Blaze the first 3D-SIM imaging platform capable of imaging events in live cells.

* ***Exclusive structured illumination pattern generating system***
* ***Capable of 3D imaging at 1 micron slice (240 images) in >1 sec (depending on exposure time)***
* ***Capable of 2D-SIM imaging at 20 reconstructed frames per second ( 9 frames per section, depending on exposure times)***

# Advanced TIRF Design

The OMX V4 system can also be fitted with an optional TIRF module that incorporates and novel design exclusively licensed to Applied Precision from Yale University. The TIRF give rapid wavelength switching with optimized TIRF illumination for each wavelength. Also included is the ability to rapidly switch between Photoactivation, TIRF and widefield imaging modes.

* ***Applied Precision exclusive TIRF design***
* ***Multi-wavelength capable with rapid switching***
* ***Photokinetic and Photoactivation capability***

# Monet™ Localization Microscopy

When equipped with our exclusive TIRF illumination system the OMX V4 platform becomes an ideal system for utilization of our Monet™ localization microscopy technology. Unlike traditional localization techniques the Monet algorithm is capable of localizing fluorophores in dense overlapping signals. This allows for more rapid data analysis and acquisition than typical localization techniques.

* ***Patented localization technique and algorithm***
* ***Optimized hardware and software controls***
* ***Works with PALM or STORM data or techniques.***

# Hardware Autofocus Option

An additional option for the OMX V4 platform is a hardware autofocus system, similar to the UltimateFocus™ technology found on our DeltaVision Elite™ imaging systems. The laser based hardware autofocus enables our exclusive focus finding feature that can quickly bring a sample to focus then lock on to track the focal position long term.

* ***Patented design laser based hardware autofocus***
* ***Exclusive FocusAssist system for rapid acquisition of focal plane***

# Applicable Patents

The original OMX system, API improvements and applications are covered under exclusive agreements with UCSF and the following patents.

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| **USCF licensed patents** |
| **Number** | **Title** | **Date** |
| 5,671,085 | Method and apparatus for three-dimensional microscopy with enhanced resolution | 9/23/1997 (issue) |
| RE38,307 | Method and apparatus for three-dimensional microscopy with enhanced resolution | 11/11/2003 (reissue) |
| **Applied Precision Inc. filings** |
| **Number** | **Title** | **Date** |
| 12/964,708 | Method and system for fast 3D SIM imaging | 12/9/2010 (filing) |
| 12/751,816 | Dense stochastic sampling imaging | 3/31/2010 (filing) |
| 12/765,756 | System and method for continuous, asynchronous autofocus of optical instruments  | 4/22/2010 (filing) |
| 13/091,941 | Means to reduce laser speckle | 4/21/2011 (filing) |
| 61/447,708 | Variable orientation illumination pattern generator | 3/1/2011 (filing) |
| 61/447,711 | Laser shuttering and power control using adjustable beam translation into single mode fiber launch | 3/1/2011 (filing) |
| 61/500,958 | 3D SIM half wave plate polarization control | 6/24/2011 (filing) |
| **Yale University patent filings** |
| **Number** | **Title** | **Date** |
| 7,835,076 | Optical system for illumination of an evanescent field | 11/16/2010 (issue) |
| PCT/US2009/001868  | Optical system that selectively provides either of a collimated light beam or a convergent light beam | 3/25/2009  |