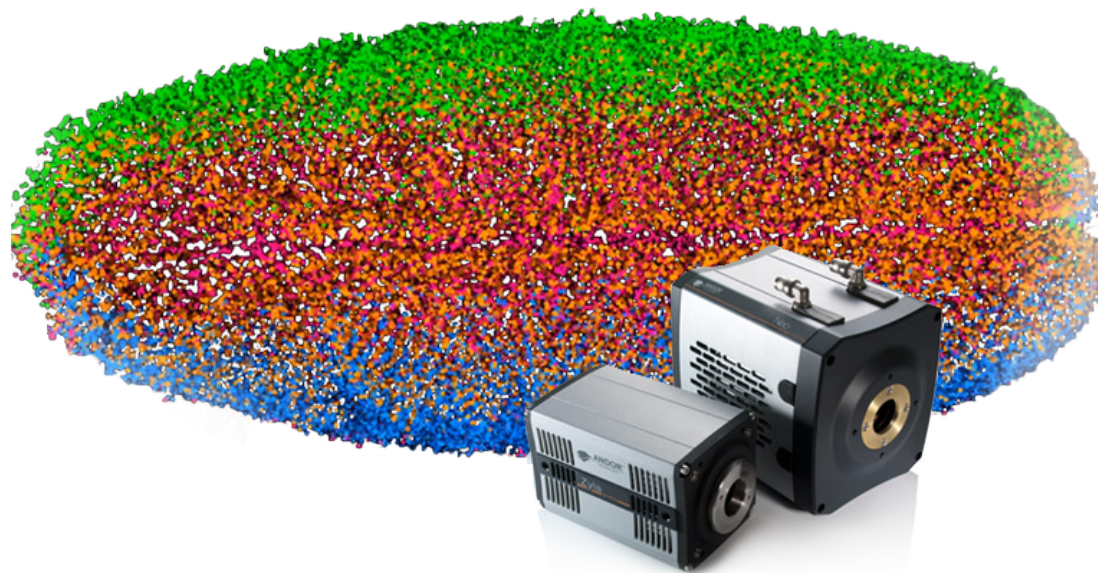


Micro-Manager Software Guide

Version 1.9 rev 14 Jan 2015

μ Manager



for Andor sCMOS



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INTRODUCTION

In order for the camera to work to its full specification it is necessary to perform the installation as described in this User Guide. This Guide covers Andor Neo 5.5, Zyla 5.5 and Zyla 4.2 sCMOS camera models (Camera Link and USB 3 variants).

TRADEMARKS AND PATENT INFORMATION

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REVISION HISTORY

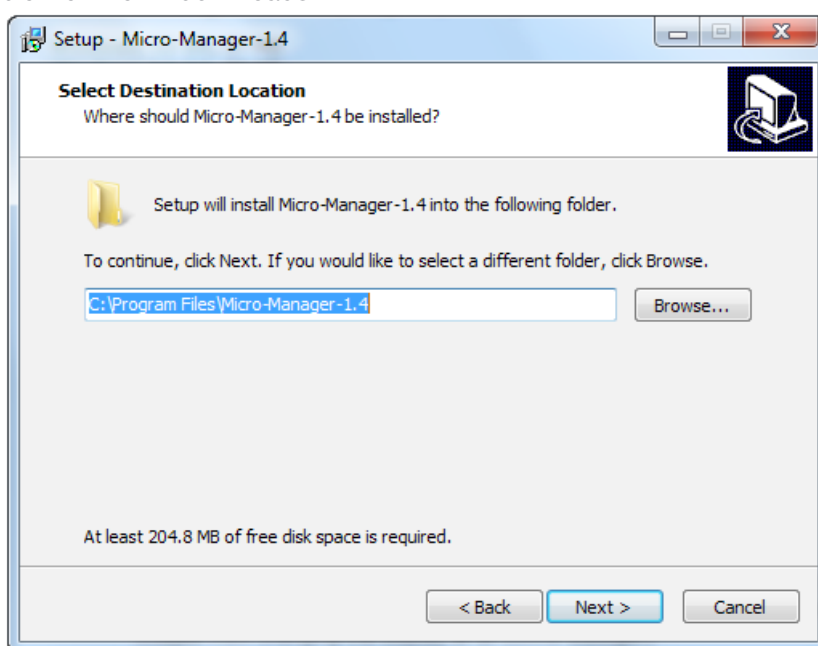
Version	Released	Description
1.0	20 Sep 2012	Initial Release of Neo version
1.1	05 Jul 2013	Combined Neo and Zyla software guides. Updated content to match corresponding software changes, updated frame rate information and improved presentation.
1.2	22 Jul 2013	Added frame rate information for Zyla 10-tap model (Section 3.4)
1.3	09 Oct 2013	Updated procedure for installation of Andor driver Pack (Section 1.3)
1.4	20 Jan 2014	Added information to cover Zyla 4.2 model. Updated frame rate information for Neo 5.5 (Section 3.4)
1.5	28 Jan 2014	Update to Andor Driver Pack downloads link to avoid issue with 'micro' and 'mu' symbol (Section 1.3).
1.6	21 Mar 2014	Updates for release 1.4.16
1.7	28 Apr 2014	Added Feature Matrix (Section 3.5) Updated document template to enhance presentation
1.8	29 Aug 2014	Installation steps edited to remove version specific steps and reduce user guide update frequency.
1.9	14 Jan 2015	Added Frame rate data for USB 3.0 models (Section 3.4)

SECTION 1: INSTALLATION STEPS

This section outlines how to install μ Manager (Micro-Manager) on your PC for use with the Neo 5.5, Zyla 5.5 and Zyla 4.2 sCMOS cameras (Camera Link and USB 3 variants).

1.1 INSTALLING MICRO-MANAGER FOR THE FIRST TIME

1. Download the latest full release of μ Manager http://valemm.ucsf.edu/wiki/Download_Micro-Manager_Latest_Release or alternatively the latest nightly build <http://valelab.ucsf.edu/~MM/nightlyBuilds/1.4/Windows/> from the 'Downloads' section of www.Micro-Manager.org.
2. Run the executable file when it downloads.



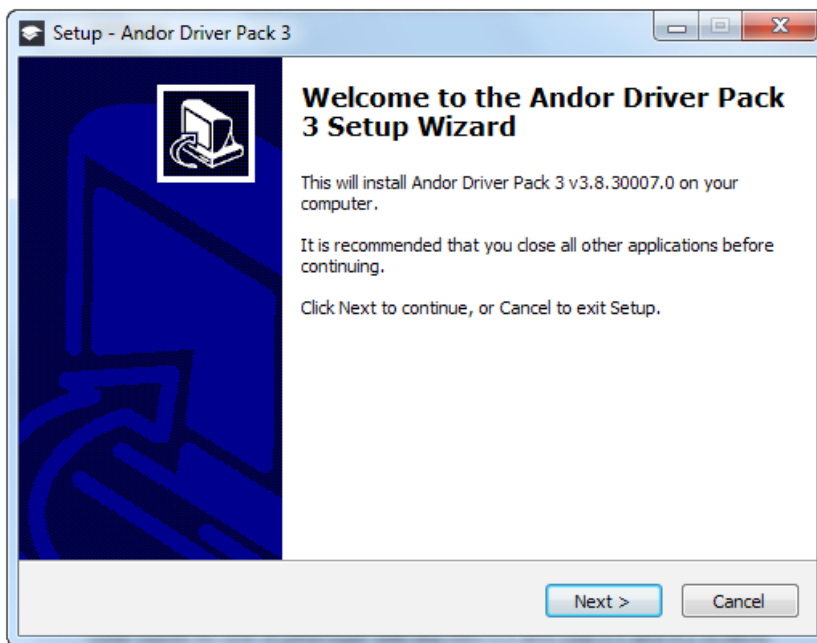
3. Follow the steps in the setup wizard until μ Manager is installed.
4. Once μ Manager has been installed, uncheck the box that says 'Launch Micro-Manager'.
5. Click 'Finish'.

1.2 INSTALLING MICRO-MANAGER WHEN MICRO-MANAGER INSTALLED PREVIOUSLY

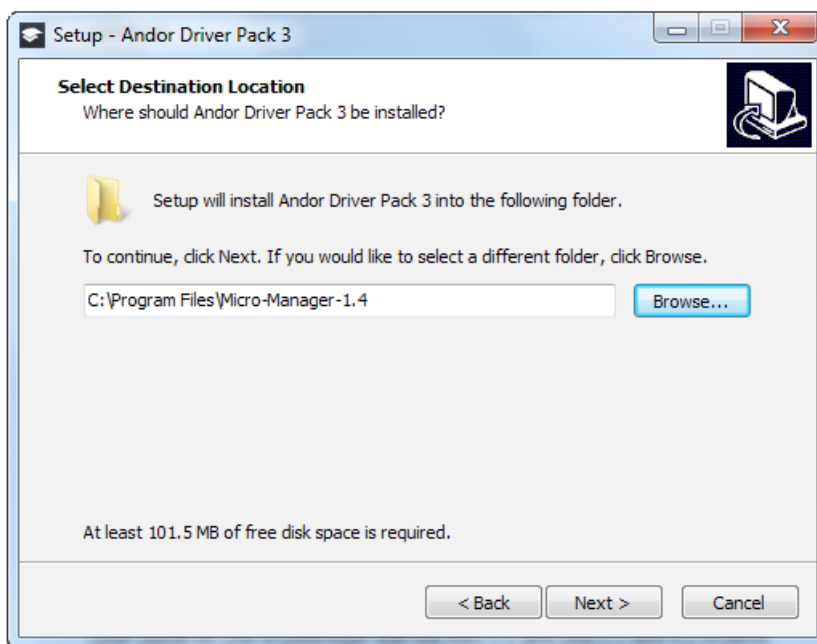
1. If an older version of μ Manager is already installed, download the latest full release of μ Manager http://valemm.ucsf.edu/wiki/Download_Micro-Manager_Latest_Release or alternatively download the latest nightly build of μ Manager (<http://valelab.ucsf.edu/~MM/nightlyBuilds/1.4/Windows/>) from the 'Downloads' section of www.Micro-Manager.org.
2. Install μ Manager to a new folder in the directory, ensuring that a different name is given to distinguish it from a previously installed version of the software, e.g. C:\Program Files\Micro-Manager-1.4.16
3. Once μ Manager has been installed, uncheck the box that says 'Launch Micro-Manager'.
4. Click 'Finish'.

1.3 INSTALLING THE ANDOR DRIVER PACK

1. Download the latest Andor Driver Pack for sCMOS (minimum 3.8.30005) from the following link: <http://www.andor.com/downloads?src=micro>



2. Start the installation and install to the Micro-Manager directory. Note: It is very important that the driver pack is installed to the Micro-Manager Directory. If it isn't, then the Andor SDK3 driver will not be visible in the set-up configuration of Micro-Manager.



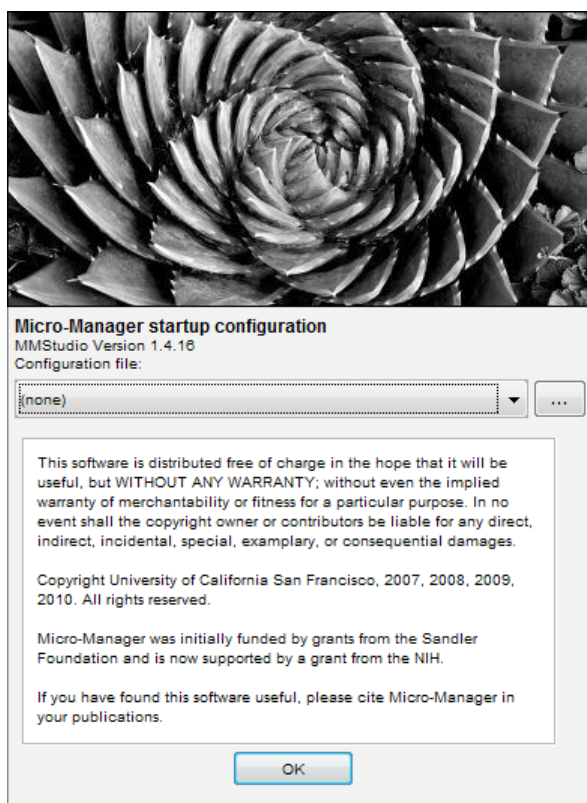
3. Complete the installation steps and click **Finish**.
4. Select "Yes Restart the computer now".

Additional information about Andor SDK3 and μ Manager can be found here: <https://www.micro-manager.org/wiki/AndorSDK3>

SECTION 2: CONFIGURING MICRO-MANAGER

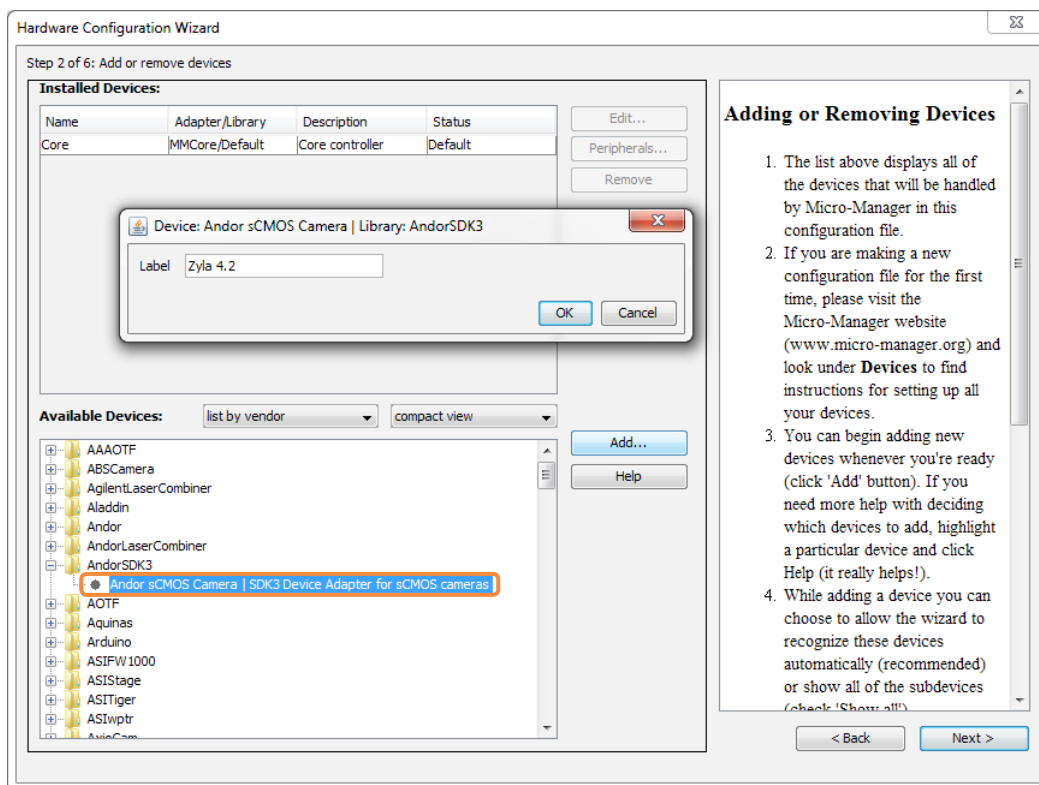
2.1 CONFIGURING HARDWARE IN MICRO-MANAGER

1. Power on the Neo 5.5, Zyla 5.5 and Zyla 4.2 sCMOS.
2. Run μ Manager from the **Start Menu>Programs**.
3. A dialog box allows the user to load a camera from a configuration file on start-up.



4. Initially you won't have any configuration files so select '(none)'.
5. Click 'OK'.

6. To load a camera open the Hardware Configuration Wizard by clicking **Tools->Hardware Configuration Wizard**.
7. In the first screen select 'Create new configuration' and click 'Next >'.
8. In Step 2 expand the 'AndorSDK3' folder, select 'Andor sCMOS Camera' as shown and click 'Add'.



9. Rename the camera label to 'Neo 5.5', 'Zyla 5.5' or 'Zyla 4.2' as required.
10. Click OK to return to the Hardware Configuration Wizard.
11. Continue to click 'Next >' until Step 6 of 6.
12. Enter a suitable configuration filename to save these settings to and click 'Finish'.

2.2 MEMORY CONSIDERATIONS

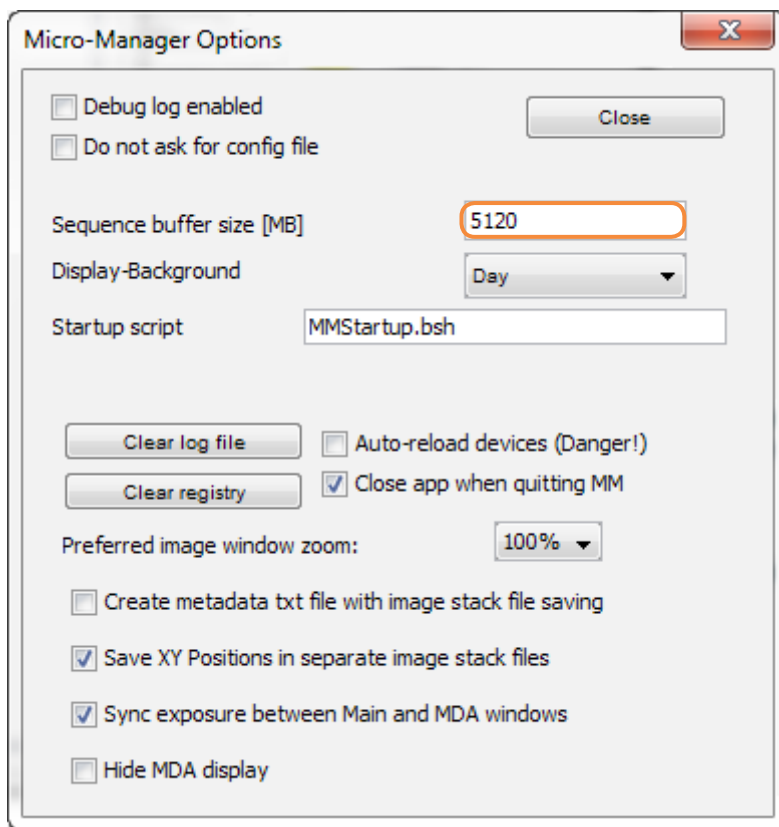
Due to the very high acquisition rate of the Neo 5.5, Zyla 5.5 or Zyla 4.2 it is not uncommon for μ Manager to run out of 'Circular Buffer' memory during sequence acquisitions (50+ images). The circular buffer is where images wait when they've been taken off the camera, but haven't yet been processed by μ Manager. In this case an error message is displayed.

This problem can usually be avoided by increasing the circular buffer size (refer to Section 2.2.1).

2.2.1 INCREASING CIRCULAR BUFFER SIZE

Increase the circular (sequence) buffer size as follows:

1. Click **Tools->Options**.
2. Increase 'Sequence buffer size [MB]'.



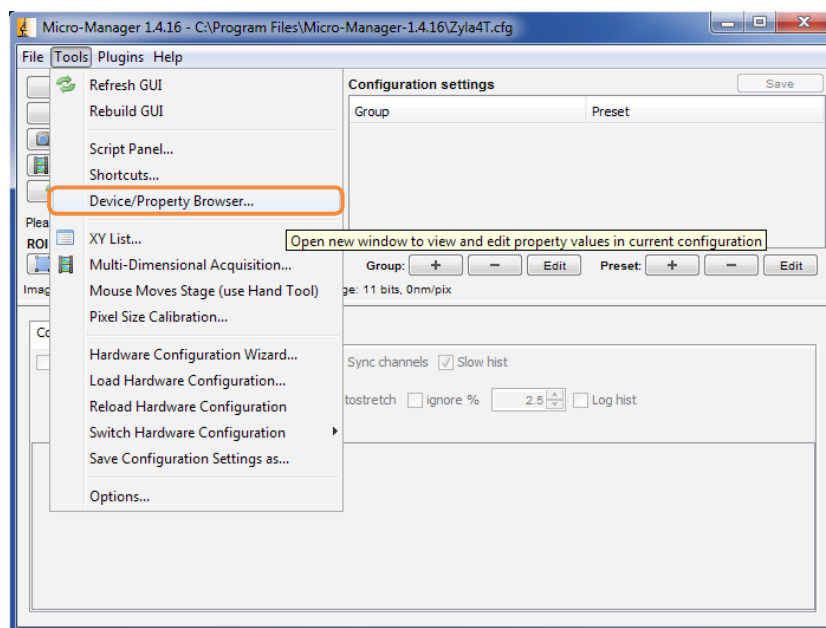
5120 MB of sequence buffer is shown in the screen shot above. The PC used in this instance had 32 GB RAM.

If the PC has smaller RAM the sequence buffer also needs to be reduced. For example, **you cannot** set your sequence buffer to be 5120 MB if the PC only has 6 GB of RAM. In this case, 2GB is sufficient.

SECTION 3: USING MICRO-MANAGER TO CONTROL YOUR SCMOS CAMERA

3.1 CONFIGURING THE CAMERA AND DEVICE PROPERTIES

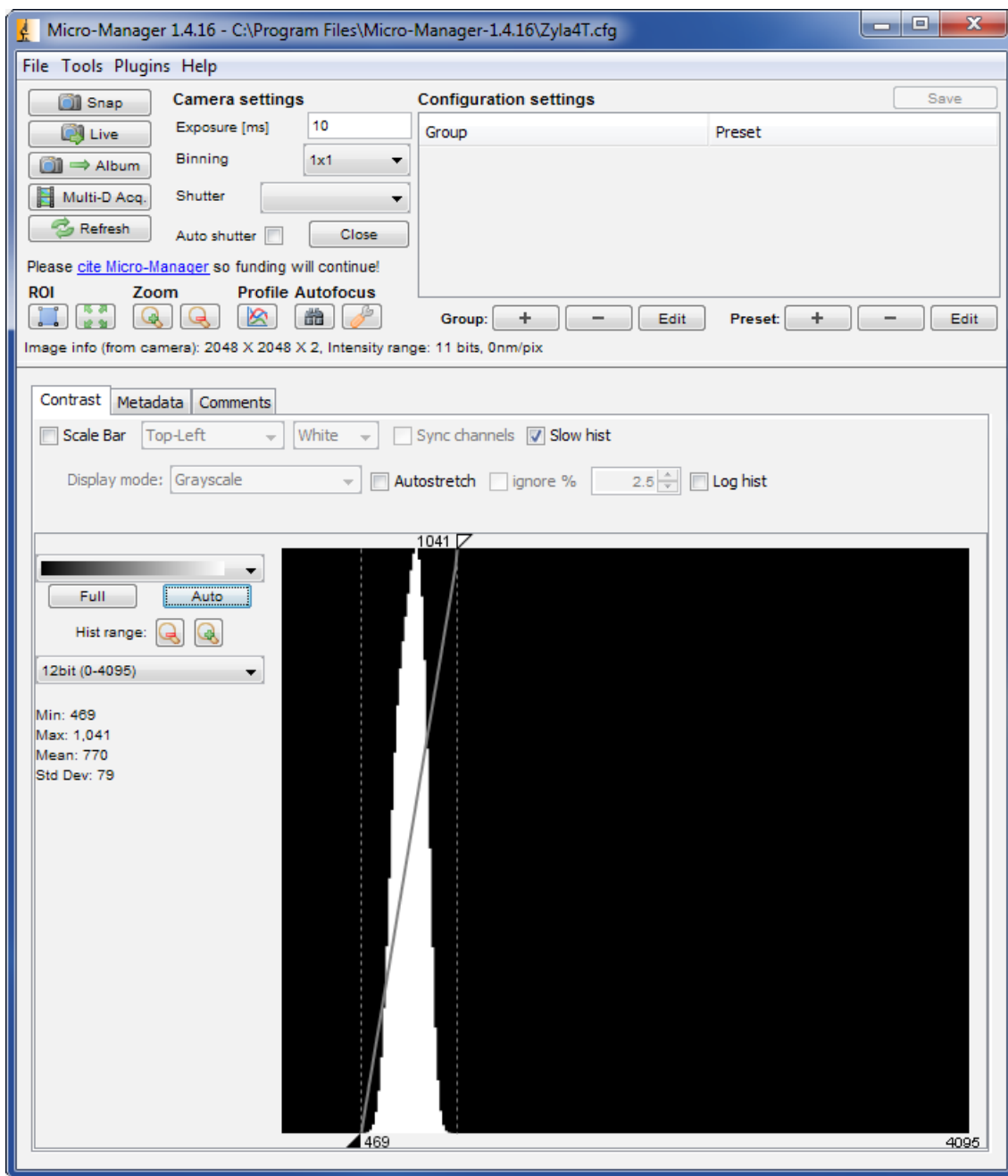
1. Open μ Manager.
2. To access camera settings open the Device/Property Browser by clicking **Tools->Device/Property Browser**.



Property	Value
Andor sCMOS Camera-AccumulateCount	1
Andor sCMOS Camera-AcquisitionWindow	Full Image
Andor sCMOS Camera-Binning	1x1
Andor sCMOS Camera-CameraFirmware	13.9.30.16
Andor sCMOS Camera-CameraID	VSC-00870
Andor sCMOS Camera-CameraModel	ZYLA-4.2-CL10
Andor sCMOS Camera-CameraName	Zyla CL 10 Tap
Andor sCMOS Camera-CurrentSoftware	3.7.30004.0
Andor sCMOS Camera-Description	SDK3 Device Adapter for sCMOS cameras
Andor sCMOS Camera-ElectronicShutteringMode	Rolling
Andor sCMOS Camera-Exposure	34
Andor sCMOS Camera-Ext (Exp) Trigger Timeout[ms]	5,000
Andor sCMOS Camera-FanSpeed	On
Andor sCMOS Camera-FrameRate	29.4118
Andor sCMOS Camera-FrameRateLimits	Min: 29.41176 Max: 29.41176 Max Sustain: 132.89...
Andor sCMOS Camera-Overlap	On
Andor sCMOS Camera-PixelEncoding	Mono12Packed
Andor sCMOS Camera-PixelReadoutRate	540 MHz - fastest readout
Andor sCMOS Camera-RollingShutterGlobalClear	Off
Andor sCMOS Camera-Sensitivity/DynamicRange	12-bit (low noise)
Andor sCMOS Camera-SensorCooling	On
Andor sCMOS Camera-SensorTemperature	8.79
Andor sCMOS Camera-SpuriousNoiseFilter	On
Andor sCMOS Camera-TemperatureControl	0.00
Andor sCMOS Camera-TemperatureStatus	Cooling
Andor sCMOS Camera-TransposeCorrection	0
Andor sCMOS Camera-TransposeMirrorX	0
Andor sCMOS Camera-TransposeMirrorY	0
Andor sCMOS Camera-TransposeXY	0
Andor sCMOS Camera-TriggerMode	Internal (Recommended for fast acquisitions)

3. Once you have input the acquisition settings for your Neo 5.5, Zyla 5.5 or Zyla 4.2 you can close the Property Browser window.

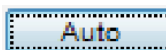
THE MAIN MICRO-MANAGER WINDOW.



For a **continuous live view** click the 'Live' button and ensure that the software trigger is selected in the Device/Property browser.



To **acquire a snapshot** click the 'Snap' button on Acquisition/Live window.

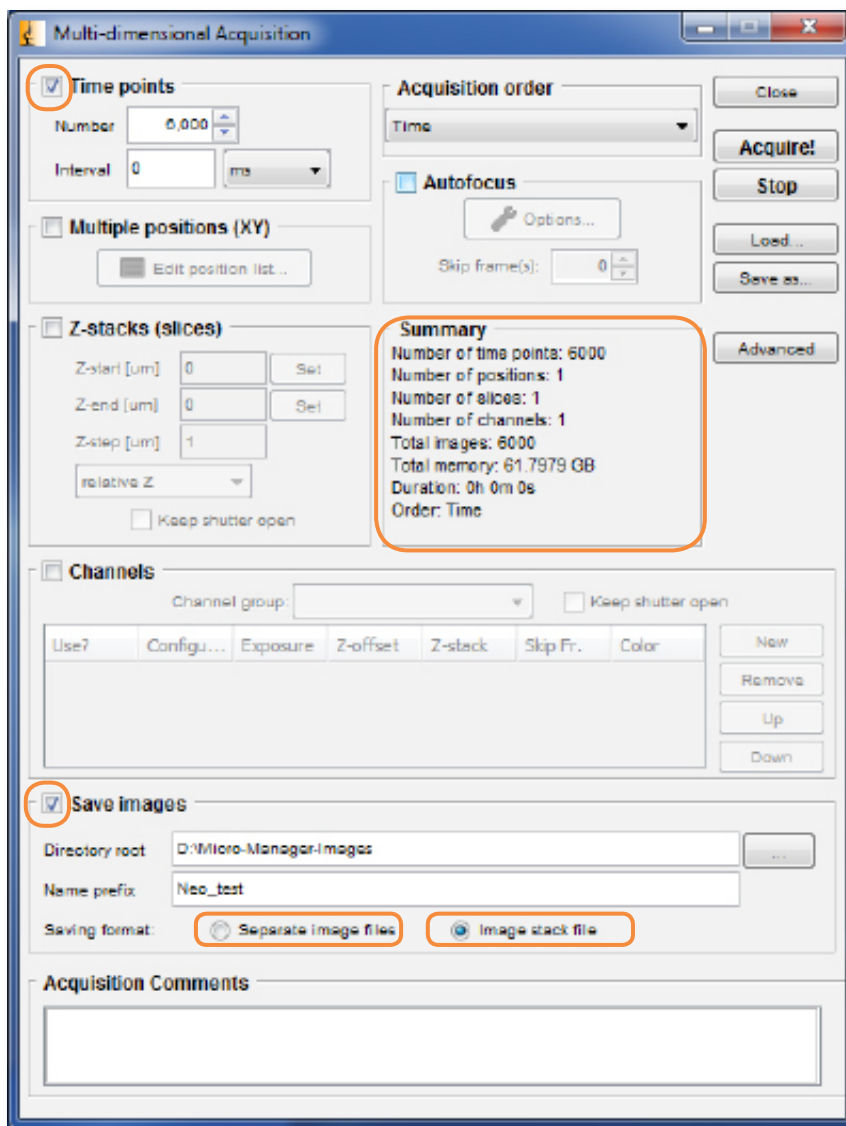


Note: If no image is visible when you select the live mode, auto-scale the image by pressing Auto on the main acquisition window.

3.2 SETTING-UP A KINETIC SERIES/TIME-LAPSE EXPERIMENTS

 **Multi-D Acq.** To set up a kinetic series/time-lapse experiment select the **Multi-D Acq** button.

1. The summary section of the Multi-D Acquisition window provides information as to the number of images/frames in the acquisition and the total memory required to store these.



2. Select 'Time points' and input the number of frames/time points you want to capture and set the interval between frames. Within this box, if the interval is set longer than the exposure time then μ Manager will acquire images at its own rate via software triggers. If the interval is less than the exposure time then μ Manager calls the camera to do a sequence acquisition and therefore the interval time is ignored and the camera acquires images at the frame rate set up through the Device/Property Browser.
3. Press Acquire to start the acquisition
 - The kinetic series/time-lapse can be saved as 'separate image files', where each frame/timepoint is an individual file or as 'Image Stack file' where all the frames/time points will be contained in one file.
 - Both file formats can be imported into ImageJ after acquisition in μ Manager and processed as required.

3.2.1 VIEWING AN ACQUIRED KINETIC SERIES/TIME-LAPSE EXPERIMENT

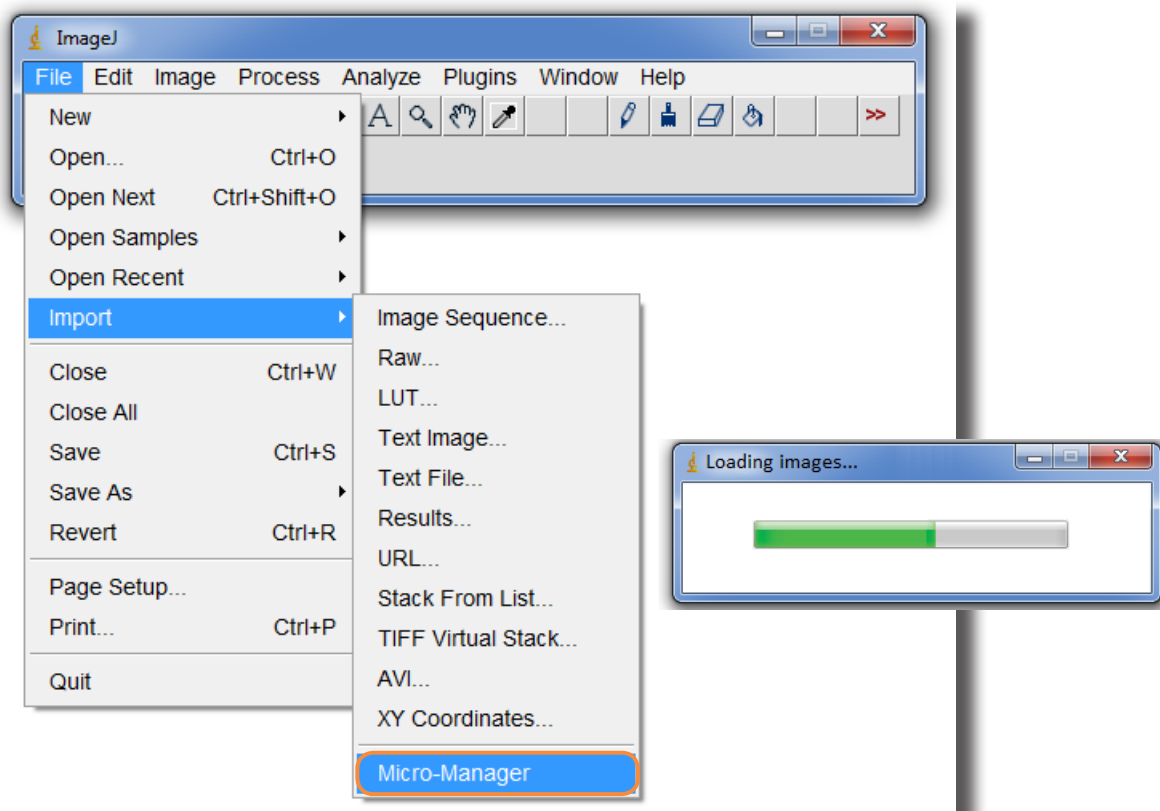
You may require an additional plugin to process images in imageJ, to view the acquired kinetic series/time lapse experiment the latest version of Image IO for ImageJ needs to be downloaded (refer to Section 3.2.1.1).

3.2.1.1 DOWNLOADING THE IMAGEJ I/O PLUGIN

1. You can download the ImageJ I/O plugin from the following link: <http://ij-plugins.sourceforge.net/plugins/imageio/>. Follow the download link and then look for ij-ImageIO.jar with the highest release number.
2. Copy this file into the plugins directory which you will find in the µManager folder in the program files in the C-drive.
3. Restart ImageJ to load newly installed plugins.

3.2.1.2 VIEWING THE KINETIC SERIES/TIME-LAPSE

1. Once the plugins have been installed open **ImageJ>File>Import>Micro-Manager**.
2. Choose the folder where the kinetic series/time-lapse was saved to and select the first file of the single-image (separate image) files or the multi-image (Image Stack) file as saved previously for the acquisition.



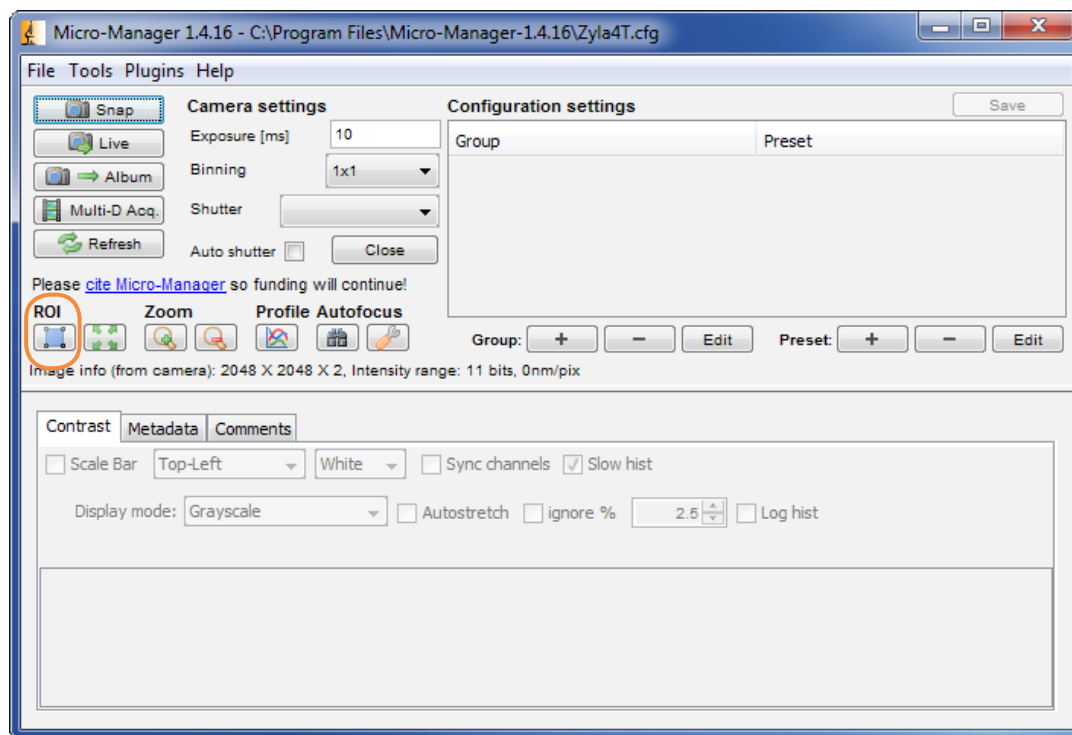
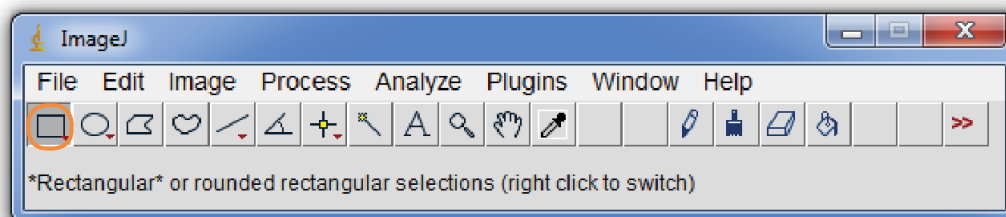
3. Both will be imported to ImageJ and can be subsequently saved as a .avi file.

3.3 SETTING A CUSTOM REGION OF INTEREST (ROI) IN MICRO-MANAGER

In order to achieve the fastest frame rates at any ROI in μ Manager the ROI selected must be centred on the sensor.

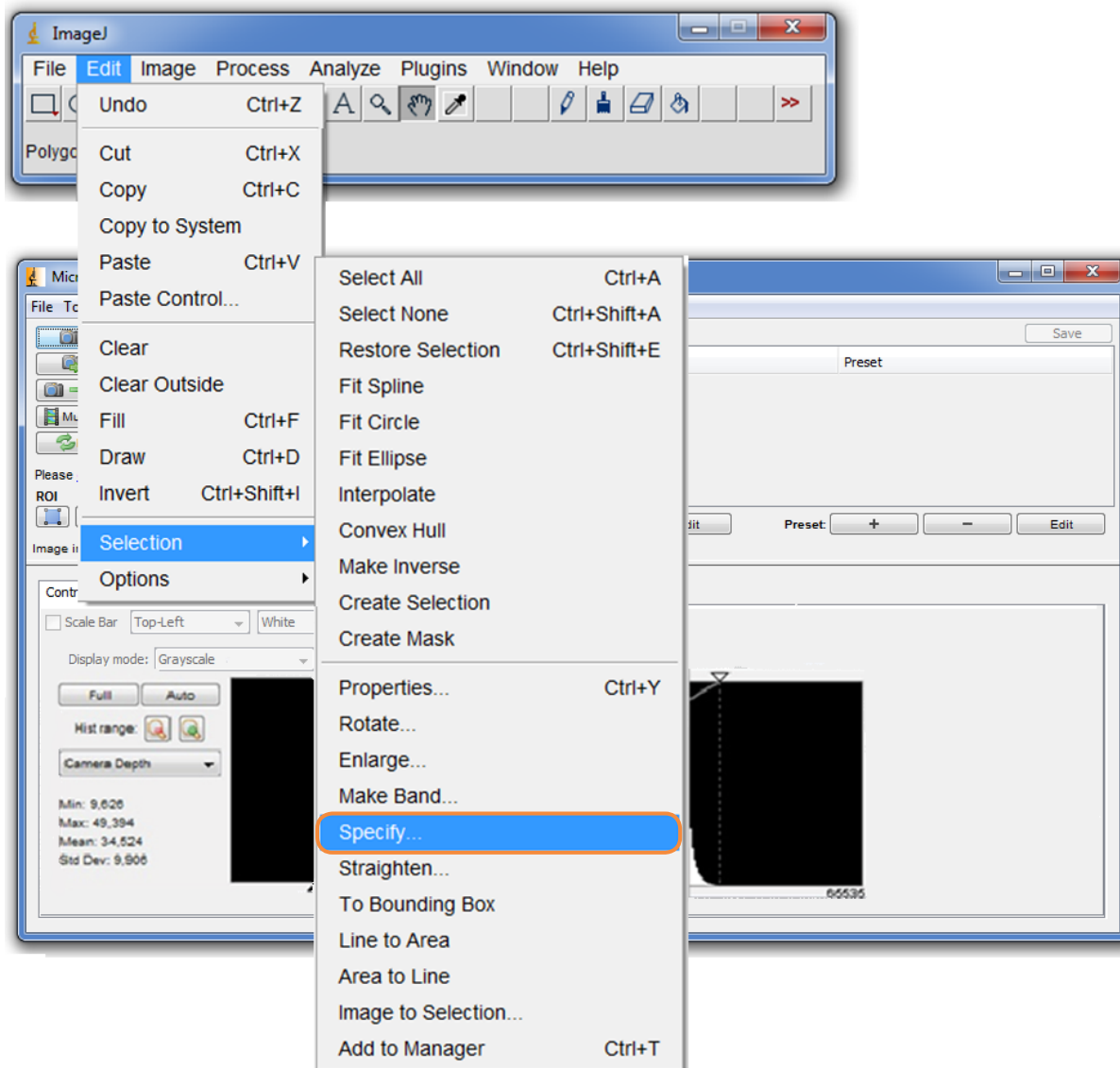
To define a custom ROI follow the instructions below:

1. Go Live to see the full field of view and 'snap' an image.



2. To define the ROI use the rectangular drawing tool in ImageJ and draw a region onto the snapped image.
3. Select 'ROI' to define this as your new image size.
4. 'Go Live' to see the new ROI.

- To further define the ROI with specific width, height and position on the sensor, go to **ImageJ>Edit>Selection>Specify**



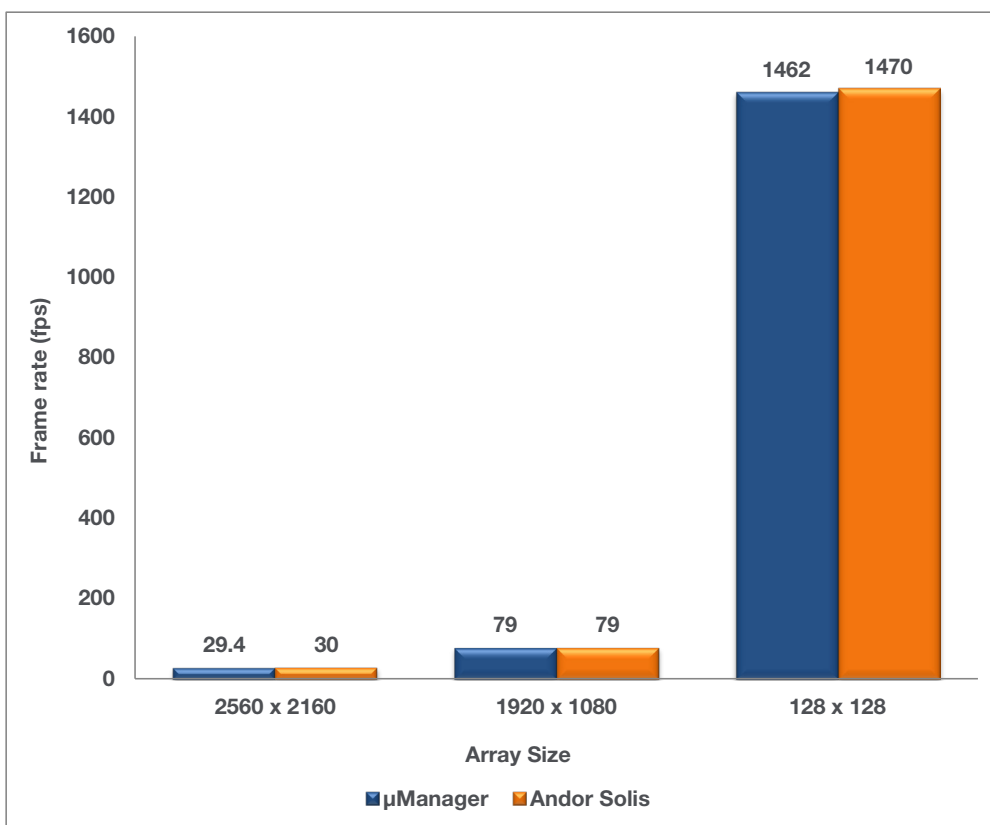
NOTE: Centre the ROI vertically to ensure the fastest frame rates are achieved at this ROI.

3.4 SUSTAINED FRAME RATES FOR THE NEO AND ZYLA IN MICRO-MANAGER

The sustained frame rates for the Neo and Zyla models in Micro-Manager are compared with Solis at different ROI sizes in the following figures. The PC used to test sustained frame rates in Micro-Manager is the following: HP Z420, 32 GB RAM, 64-Bit OS.

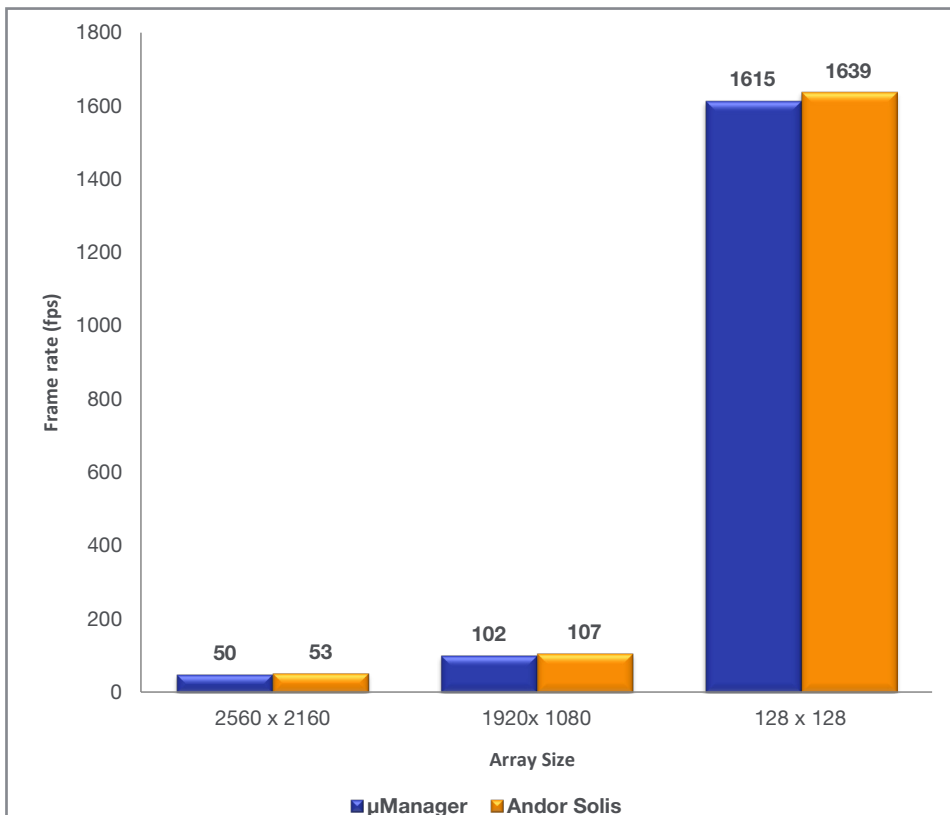
NEO 5.5

The acquisition speeds of the Neo 5.5 in μ Manager are consistent with Andor Solis (shown in the graph below).



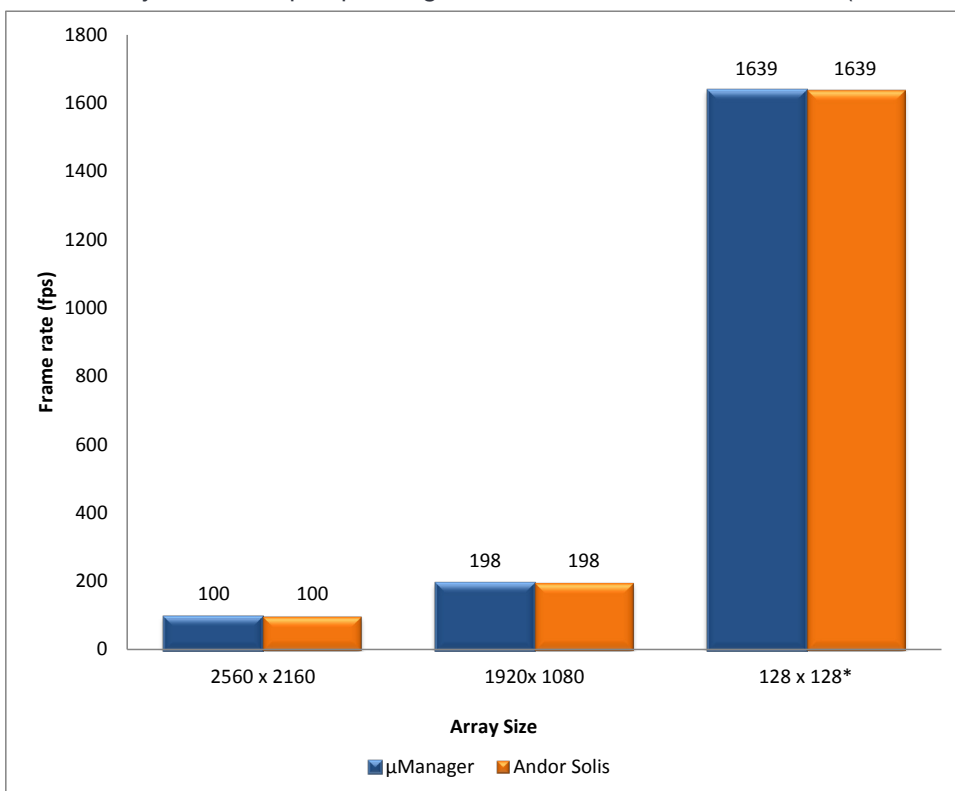
ZYLA 5.5 USB 3.0

The acquisition speeds of the Zyla 5.5 USB 3.0 in μ Manager are consistent with Andor Solis (shown in the graph below).



ZYLA 5.5 10-TAP

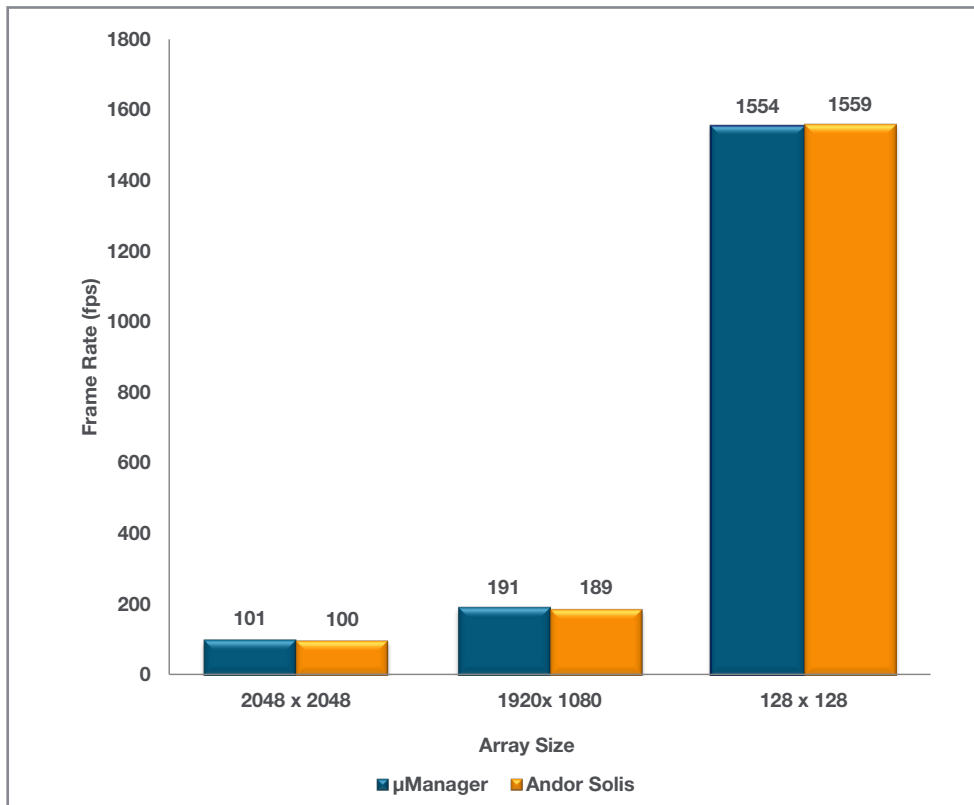
The acquisition speeds of the Zyla 5.5 10-tap in μ Manager are consistent with Andor Solis (shown in the graph below).



*This frame rate was achieved in μ Manager at ROI of 128x128 for 140,000 frames.

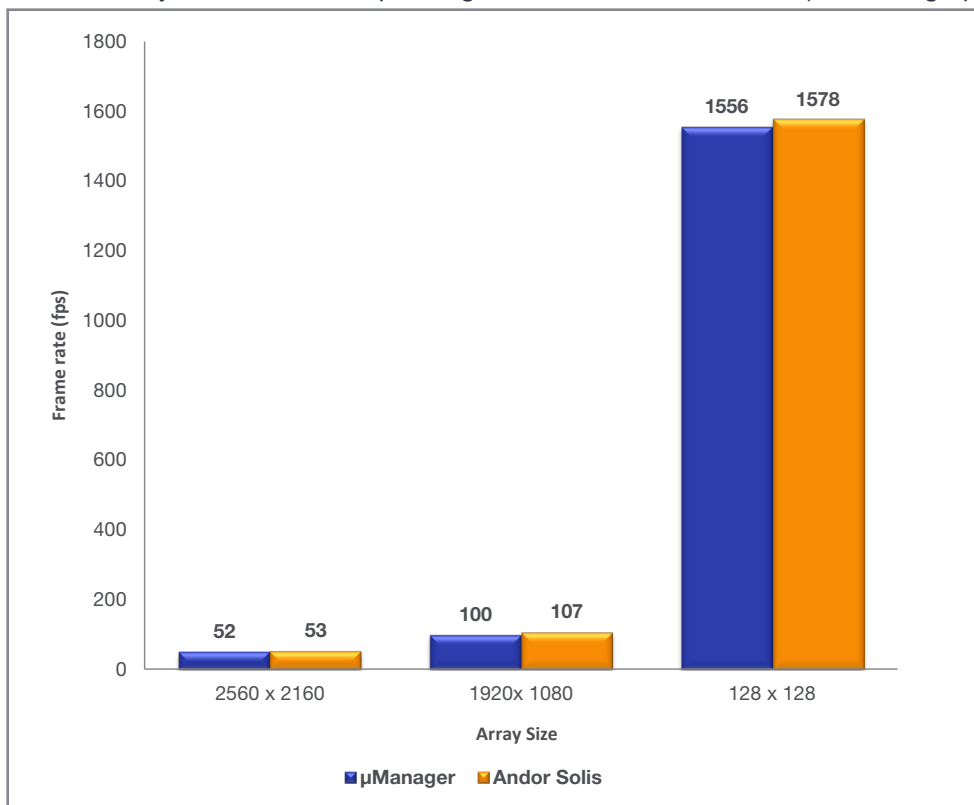
ZYLA 4.2 10-TAP

The acquisition speeds of the Zyla 4.2 10-Tap in μ Manager are consistent with Solis (shown in graph below).



ZYLA 4.2 USB 3.0

The acquisition speeds of the Zyla 4.2 USB 3.0 in μ Manager are consistent with Solis (shown in graph below).



3.5 NEO & ZYLA FEATURE MATRIX IN MICRO-MANAGER

	Neo 5.5	Zyla 5.5	Zyla 4.2
Trigger Modes			
Internal	✓	✓	✓
External	✓	✓	✓
Software	✓	✓	✓
External Start	✓	✓	✓
External Exposure	✓	✓	✓
Acquisition Modes			
Fixed length - specify the number of images required	✓	✓	✓
Continuous - camera acquires until aborted.	✓	✓	✓
Frame Rate Control	✗	✗	✗
Software Accumulation - specify number of images to accumulate	✓	✓	✓
Readout Modes			
Imaging - Full Image Readout from Sensor	✓	✓	✓
Fixed ROI support (centred) - 2048x2048, 1920x1080, 512x512, 128x128	✓	✓	✓
ROI - Single Arbitrary Region of Interest Selection on sensor	✓	✓	✓
Camera Binning - 1x1, 2x2, 3x3, 4x4, 8x8	✓	✓	✓
Metadata			
Timestamp	✓	✓	✓
On-Camera Correction			
Spurious Noise Filter	✓	✓	✓
Fan Speed Control			
On, Off	✓	✓	✓
High, Low	✓	✗	✗
Operating System Support			
Windows 7 - 32-bit	✓	✓	✓
Windows 7 - 64-bit	✓	✓	✓
Recommended Application Features			
Easy Vertical Centering of ROI for fastest acquisition	✗	✗	✗