



## Operation of the NeutronOptics HiRes Camera

NeutronOptics cameras can be supplied with various high resolution Peltier cooled [CCD units](#) with various camera dimensions. This CCD unit is connected to a Windows computer via an amplified USB-2 cable up to 30m long. A typical hi-res cooled CCD is shown on a custom camera.

To control this hi-res CCD, use either the native Artemis Capture application (which can be downloaded with the [Atik core software](#)), the ImageJ imaging environment, the LabView graphical instrument control environment, or the Artemis SDK using MS Visual Basic, C++.



- **Sensor Type:** Sony ICX825ALA or ICX694ALG
- **Image size:** Diagonal 11mm (Type 2/3") or 16mm (type 1")
- **Resolution:** 1392x1040 or 2759 x 2200
- **Pixel Size:** 6.45x6.45  $\mu\text{m}$  or 4.54 x 4.54  $\mu\text{m}$
- **Binning:** from 2x2 to 8x8 (improved intensity and read-out)
- **High sensitivity** (QE>75% at 500-600nm), low smear
- **Low dark current** 0.003@-10 °C, excellent anti-blooming
- **Full well capacity:** 20,000 or 40,000 electrons
- **ADC:** 16 bit grey scale image, optional filtering and distortion
- **Readout Noise:** 4 e- typical (slower readout = less noise)
- **Readout Time:** 1-3s
- **Interface:** USB 2.0 High Speed with 10-20m USB cables
- **Power:** 12v DC 0.8A, to EU, UK, US/Japan, AU/CN standards
- **Maximum Exposure Length:** Unlimited
- **Minimum Exposure Length:** 1/1000s (1s at full resolution)
- **Cooling:** Thermoelectric set point with max  $\Delta T = -27^\circ\text{C}$
- **CCD Unit:** 60mm diameter, 122mm length, 400g weight
- **Lens Coupling:** T2-mount, C-mount, F-mount, micro 4/3
- **SDK:** C++, VB Wrapper, .net Wrapper, ImageJ, LabView

### Install the Driver and Artemis Capture software from the CD

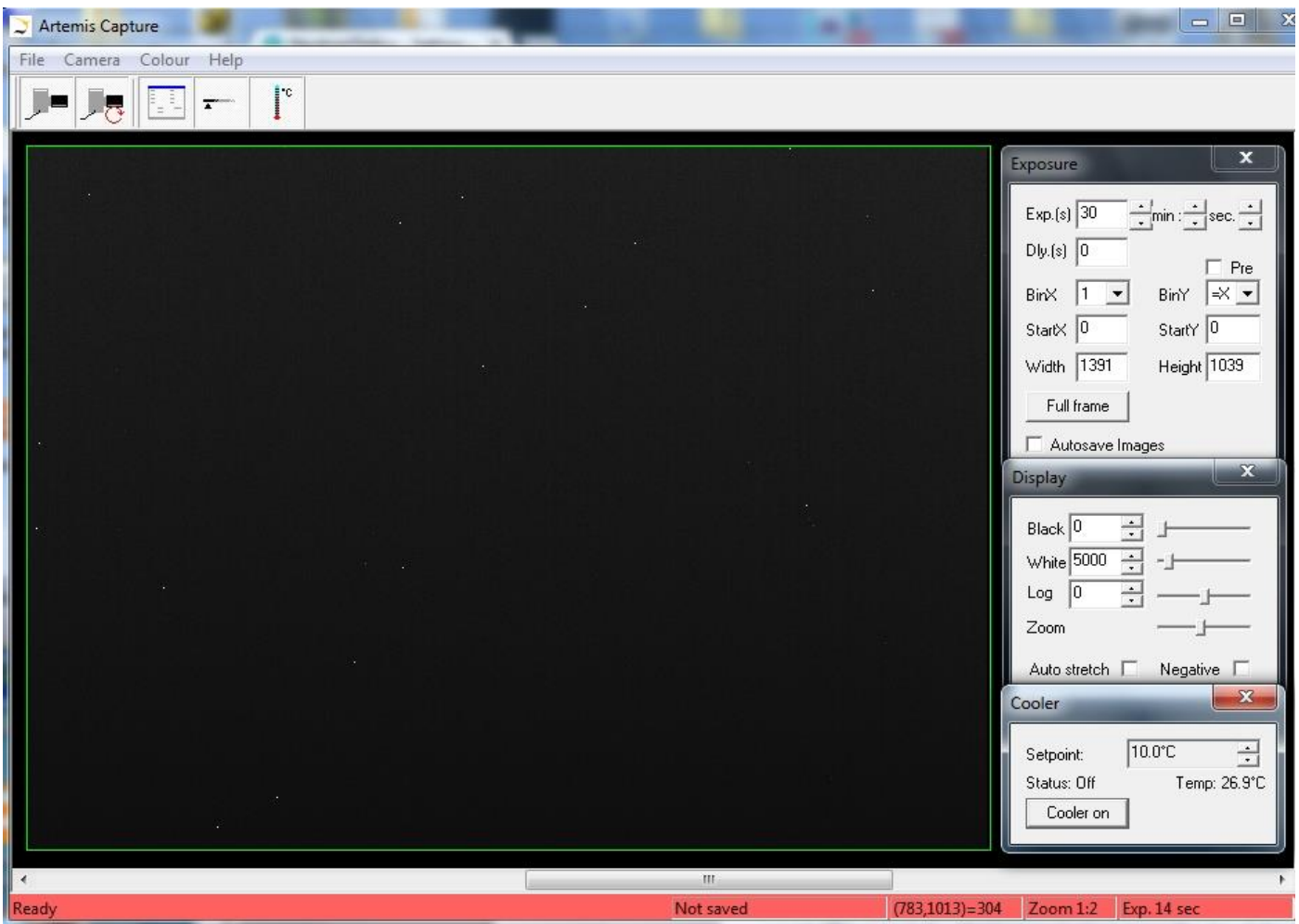
1. Download the [Atik core software](#) or use the NeutronOptics CD.
2. As Administrator, launch "SetupArtemisCamerasUniversal.exe"
3. This installs the driver & "ArtemisCapture" to control the camera
4. Plug the 12V supply into the camera; the fan should start up
5. Connect the camera to a USB port on your computer
6. The computer should automatically search for and install the driver
7. Now launch ArtemisCapture to control the camera (see next section)

8. If the driver is not found automatically, try manual installation:
  - Click the Windows "Start" button and open "Devices and Printers"
  - Double-click the "Unknown Device", select "Hardware", "Properties"
  - Click "Change Settings" under the "General" tab
  - Click "Update Driver" under the new "General" tab
  - Choose "Browse for Drivers" on the Product Software CD
  - Select the 32-bit or 64-bit driver from the drivers folder
  - Click "OK", "Next" then accept and install the camera driver

## Using ArtemisCapture with the High Resolution Camera

Launch ArtemisCapture to display the image and controls. The "File" menu is used to save the last image, "Camera" menu is to connect the camera if it is not done automatically, and the "Colour" menu should be set to "Raw". The icons under the menus launch a single exposure or continuous loop exposures. The three remaining icons open the Exposure, Display and Cooler tabs.

**IMPORTANT: Zoom out to see the green outline of the full CCD.**



**On the "Exposure" tab: (to speed up downloads e.g. when focussing with light)**

- Set exposure time (s) with **BinX=4 and BinY=X** for 4x4 binning and **Dly(s)=0** delay
- Check the **"Pre"** box to reduce the time for noise reduction
- Select a **subframe** "Width", "Height", "StartX" & "StartY" to reduce readout time
- Use **"loop"** exposures of ~0.05s, which are sufficient for light (but not for neutrons)

**On the "Display" tab:**

- Check the **"Auto stretch"** option to select the best 8-bits out of the 16-bits. Note that **scintillator afterglow may be seen for some minutes after exposure to light.**
- **"Zoom"** (or the wheel mouse button) zooms the display window

**On the "Cooler" tab:**

- Set the temperature to -15°C to reduce noise when collecting neutron images
- If the CCD is cold, click **"Warm up"** and wait a few minutes before disconnecting power

## Hints on getting Optimal Performance

- The exposure time depends of course on the intensity of your beam
- 2x2 binning will give x4 the intensity and faster readout, but halve resolution
- You can also speed up readout by limiting it to a "sub-frame" of the full image
- The "Display" panel controls what you see, but has no effect on what you collect
- "Zoom" (and the wheel mouse button) zooms the size of the image display
- "Auto Stretch" compresses the 16-bit range of intensities to 8-bits for display
- But usually you will want to select the black and white display limits manually
- Image display is for guidance. Open the image with ImageJ for measurement
- The CCD can be cooled to reduce noisy pixels. You can also use ImageJ filters
- Fogging may occur if you cool below 0°C (the CCD chamber contains a desiccant)
- The desiccant can be replaced by removing the large screw on the camera shaft
- The center of the image doesn't correspond to the centre of the window because the CCD chip is not centred to better than 0.5mm in its housing

Cooling becomes particularly important for very long exposures to greatly reduce the number isolated hot pixels. Those remaining can easily be removed with the ImageJ Despeckle filter.

You can also use our custom PHD application for simple real-time image capture with the Hi-res camera (without cooling), or the demo Nebulosity3 application, both with either the Atik/Artemis driver or the ASCOM driver.

## Occasional Problems with camera operation

- Be patient. Wait for ArtemisCapture to load and detect the camera
- ArtemisCapture may already be running. Unplug/replug the camera USB
- Check there is an **ArtemisCCD device** in Control\_Panel/Devices\_and\_Printers
- Check that the services **ArtemisHscService**, **ArtemisHSCServiceMonitor** and **AtikCamera Register** are running in the Services tab of the Task Manager
- Try deleting the **ArtemisCapture.ini** file from the C:\Windows folder to reset it
- Try a different USB port, waiting for the driver to be found and re-installed
- Shut down the computer, **remove the power cable** for a few seconds, then reboot
- If all else fails, try using a different computer

## Image Treatment with ImageJ

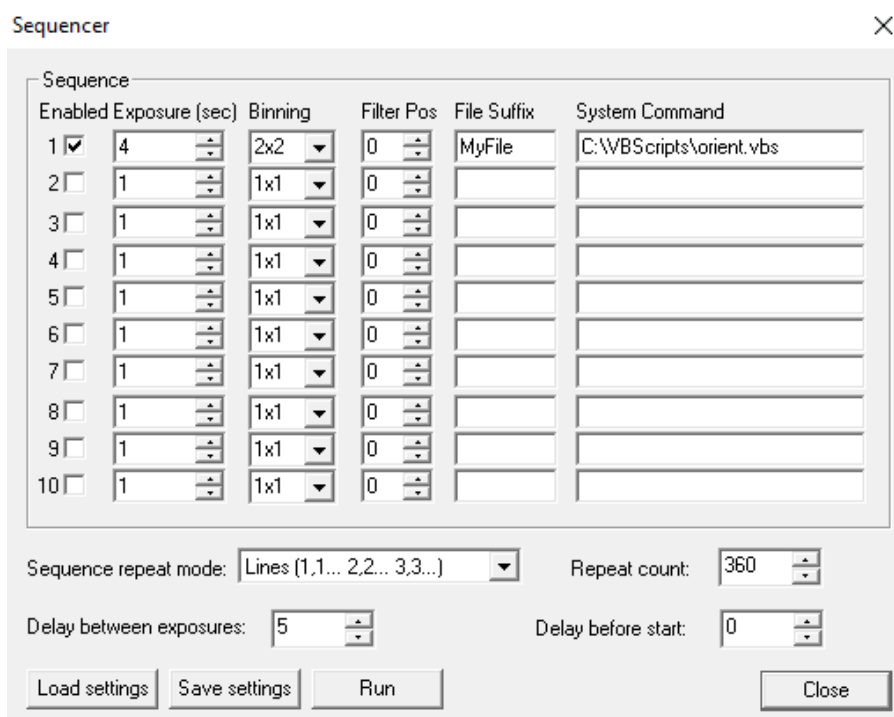
[ImageJ](#) is recommended for image analysis. ImageJ will open the 16-bit raw [FITS](#) files produced by Artemis Capture, remove noise, modify contrast and other properties, and save them in various formats. More importantly, it will allow you to measure intensity profiles and display your data in ways that will make it more meaningful.

Download and install [ImageJ](#) WITHOUT Java then download and install [Java 32-bits](#). (Use the more compatible 32-bit version even if you have a 64-bit computer). Install the [Atik-ImageJ.jar plugin](#) which is designed specifically to control this camera. (These files will be on the NeutronOptics CD that came with the camera). Copy the **ImageJ/Atik Cameras** folder to the **ImageJ/plugins** folder. Also copy **ArtemisDotNetSDK.dll**, **ArtemisSci.dll** and **AtikJNI.dll** files in the Java folder to the **Java/jre/bin/** folder used by ImageJ.

**Warning:** If you installed ImageJ with its own Java environment, this Java folder will be within the ImageJ folder; if you installed Java separately, the Java folder may be under "C:/Program files (x86)/". When you re-launch ImageJ, you should see the Atik cameras options.

## Tomography, Laue Diffraction and ImageJ for ASCOM

**For tomography** you can collect a series of images, calling a script to rotate the sample after each image by using camera/sequencer. In this example we take 360 2x2 binned exposures of 4s (with no filter), writing individual files to "MyFile???.FITS" then executing script "orient.vbs" and waiting 5 seconds before starting the next exposure. You can substitute any type of script or application for "orient.vbs". See also ImageJ-for-ASCOM.



**For Laue diffraction** binning of 4x4 can be used to increase efficiency by a factor of x16 ! Try also the Infinity software, which allows you to see the image as it is built up by stacking shorter exposures.

[ImageJ for ASCOM](#) is also suitable for tomography, Laue diffraction and very low-flux acquisitions. The acquired images are opened directly in ImageJ, and you can easily modify the interface by extending the ImageJ scripts. At the end of each image acquisition, a Windows routine Orient.vbs is launched (if it exists) to eventually re-orient the sample. You can even [simultaneously acquire images from two cameras](#) and stitch them together if you have a 2-CCD Laue camera.

## LabView and Artemis Software Development Kit (SDK)

The camera can also be controlled using [LabView](#), National Instruments' graphical programming environment for instrument control. You can download a [free time-limited version](#) if you want to control our camera together with other instruments. Excellent [LabView on-line tutorials](#) are available, as are a set of [simple LabView programs](#) (\*.vi files) to control the high resolution camera. Note that you also need the [LabView Vision Development Module](#), but you can download a free evaluation version.

We cannot provide support for LabView, for which you must rely on National Instruments or the NI user group, which has posted example files for Artemis cameras. One of our clients used a simple LabView application to control his sample turntable, and then used the ArtemisCapture/sequencer to call that Labview routine after each image acquisition.

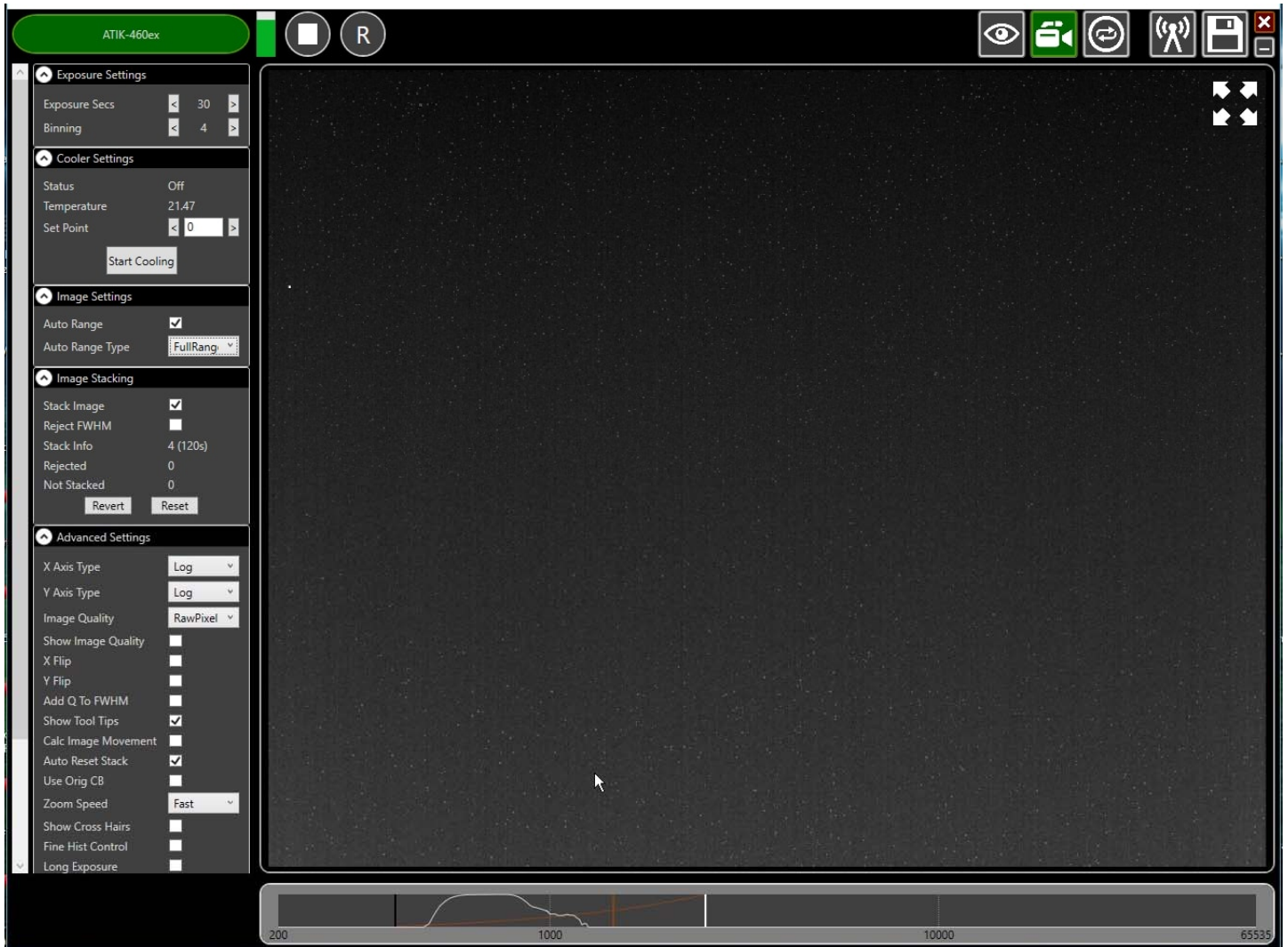
The Artemis SDK Software Development Kit contains C++ support and example files to allow you to develop your own camera acquisition code.

# Camera Control and Image Acquisition with Nebulosity

You can also use the [PHD](#) application for simple real-time image capture with the Hi-res camera (without cooling), or the [Nebulosity3](#) application, with either the Atik/Artemis driver or the ASCOM driver. These applications are also available for macintosh systems.

## Sequential Image Stacking with Artemis Infinity

The Artemis Infinity software, which works for all Atik high resolution cameras, can be installed with the [Atik core software](#); it can collect a series of short exposures, adding them together in real time. You can then **see how a long exposure is progressing**, e.g. with the 1-CCD Laue camera.



- Double-click the top bar to expand/contract the window.
- If connected, the camera name is shown in green
- Set the exposure time and binning (to 30s and x4 for the Laue camera)
- **Advanced Settings: Uncheck "Calc.Image Movement" & Check "Long Exposures"**
- Select the "video camera" icon on the top right to enable stacking
- In the "Image Stacking" dialogue that appears on the left **Uncheck "Reject FWHM"**
- The green triangle starts exposures, turning into a white square to stop exposures
- The "Stack Info" shows the number of images averaged (and the total exposure)
- The bar at the bottom controls the image display range
- Check "Auto Range" in the "Image Settings" and eg "FullRangeMinus"
- Otherwise, drag the vertical markers to bracket the display intensity range
- Noise is evident because we didn't cool. Set Temperature to 5C in "Cooler Settings"
- **If the camera is being cooled, click "Warm Up" before disconnecting power**

For the latest information, please check our web site <http://neutronoptics.com/atik.html>