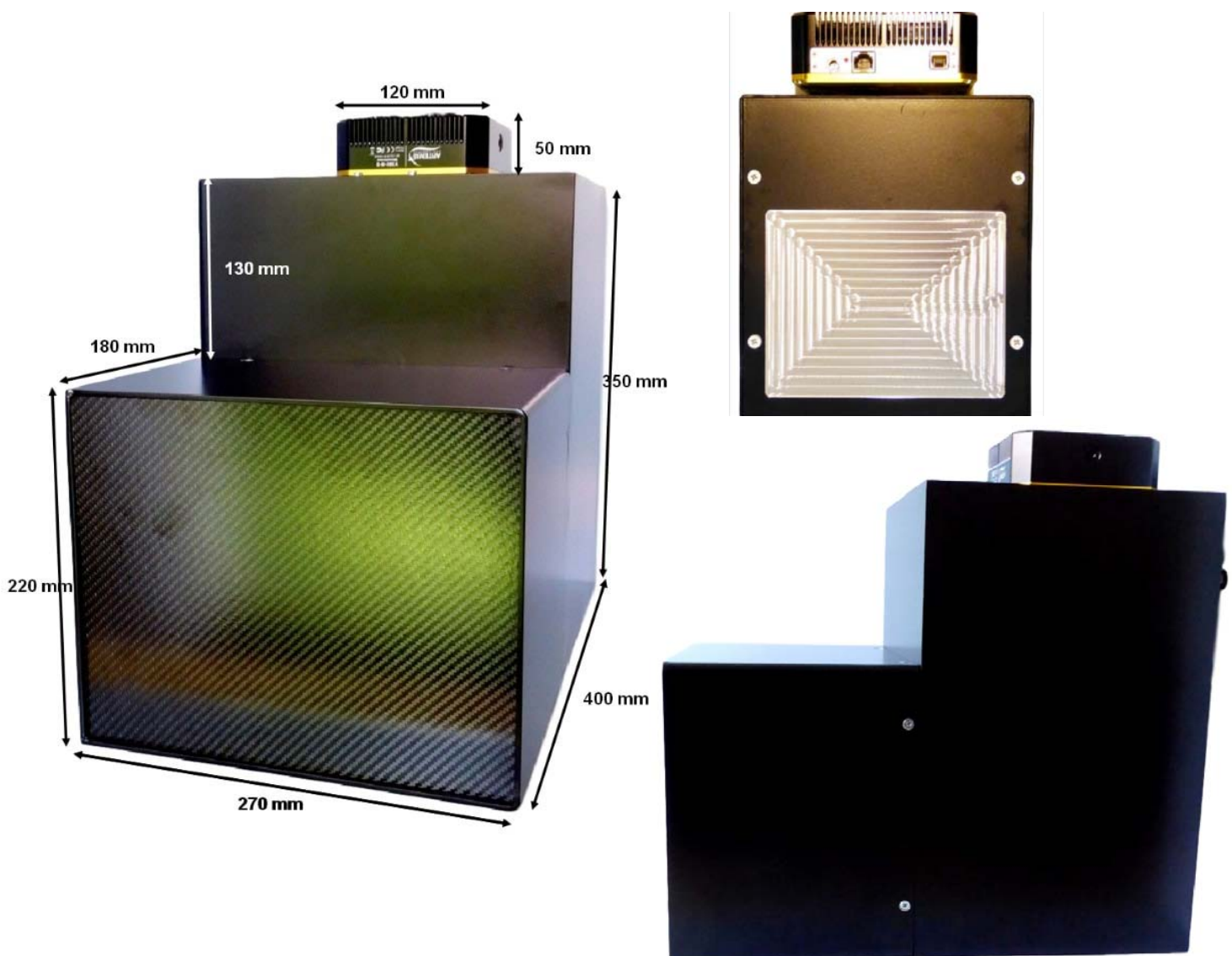


NeutronOptics Fast Imaging Camera Assembly

The NeutronOptics Fast Imaging Camera is shipped partly assembled because of the fragile nature of some components, such as the mirror and the CCD. These components are designed to be fitted quickly and easily by the end-user, and instructions are attached to the camera itself. This section illustrates and expands on those assembly instructions. The illustrations below show this L-shaped camera complete with the CCD and its B₄C/Pb protection on top, with the imaging box containing the scintillator in front of the interior mirror at the bottom.

Some photos show slightly different versions of this camera



Installing the front-surfaced mirror

1. Place the foot of the mirror against the labelled B₄C ledge on the camera back
2. The plastic protected face with its instruction label must be on top
3. Push the top of the mirror into the top labelled B₄C holder
4. When the camera assembly is complete, peel off the protective film
5. The front aluminised face is protected by a transparent SiO layer for 95% reflectivity
6. Do not touch or dirty the surface. If necessary, clean gently with window cleaner
8. If necessary, use cyanolite glue spots for security, or glue a B₄C strip to hold the mirror



Adjusting the lens focus

1. Manual focussing must be done with light, not in the neutron beam
2. Place a paper grid over the scintillator plate being careful not to touch it
3. Slide the scintillator front-end box onto the main camera box
4. Open the lens trap at the back of the camera to allow light to enter
5. Reduce the aperture of the lens to reduce intensity (top lock screw)
6. Connect the CCD cables and loop expose ~0.01s depending on lens aperture
7. Adjust focus to obtain the sharpest image with light (bottom lock screw)
8. When finished, **fully open the lens aperture**, remove the focusing grid & close the box
9. Check that it is light-tight for a long exposure. Note that the camera is very sensitive and **scintillator afterglow may be seen for some minutes after exposure to light.**



Handling the scintillator

The front plate is aluminium for neutrons or carbon fibre for x-rays (very strong with 70% transmission for Cu-K α at 8keV). The aluminium scintillator plate is protected by a white plastic film, which must be removed. Do not touch the scintillator surface inside the box to avoid scratches or dirt.



NeutronOptics Fast Imaging Camera Operation

Fast high resolution thermo-electrically cooled Sony 2750x2200 pixel CCD unit

- **X-ray Scintillator:** Interchangeable fast, fine x-ray scintillator
- **Neutron Scintillator:** Interchangeable high resolution neutron scintillator
- **Optics:** Interchangeable high resolution 25mm f/1.4 low-light lens
- **CCD Sensor:** 1 inch [Sony ICX694ALG EXview HAD CCD II](#)
- **Chip size:** 12.40x9.99 mm, diagonal 16 mm (Type 1")
- **Resolution:** 2750x2200 pixels (**90 µm resolution over 250x200mm**)
- **Pixel Size:** 4.54x4.54 µM (larger pixels & micro-lenses collect more light)
- **Binning:** from 2x2 to 8x8 (for boosted frame-rate and efficiency)
- **Region-of-Interest:** fully variable (for full resolution at higher frame-rate)
- **High sensitivity** (QE~75% at 500-600nm), low smear
- **Low dark current:** 0.002 electron/pixel/sec @ -10 °C
- **Full well capacity:** 20,000 electrons (large dynamic range)
- **A/D Conversion:** **16-bit 65536 levels** in [Flexible Image Transport System](#)
- **LiveView Mode:** 8 bit readout mode for faster readout
- **Digitisation Speed:** 6-12 MPixels/s
- **Readout Noise:** 6 e- at -10°C
- **Interface:** USB 2.0 High Speed with 10-20m amplified USB cables
- **Power:** Regulated 12v DC 2.5A, to EU, UK, US/Japan, AU/CN standards
- **Minimum Exposure Length:** 0.001 seconds
- **Maximum Exposure Length:** Unlimited
- **Cooling:** Regulated dual fan thermo-electric Peltier with max $\Delta T = -35^{\circ}C$
- **External Trigger:** For synchronisation with sample environment
- **CCD Unit:** 120x120mm dimensions, 50mm height, 800g weight
- **SDK:** C++, VB Wrapper, .net Wrapper, [ImageJ](#), [LabView](#) drivers



- 1 - Vcc 3.3V
- 2 - GND
- 3 - GPIO Line 0
- 4 - GPIO Line 1
- 5 - Trigger Input
- 6 - Exposure Output



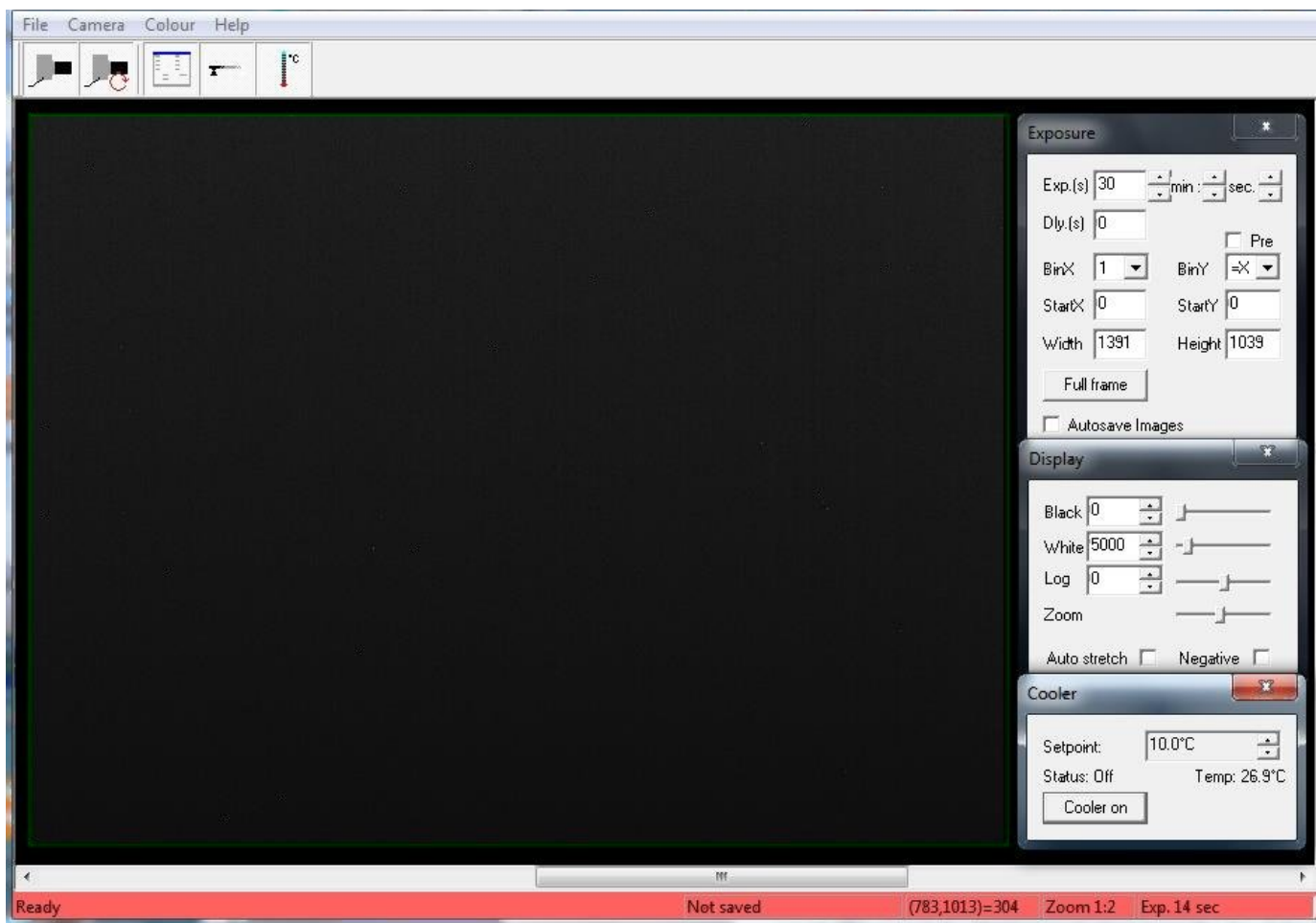
Installing the Driver and Artemis Capture software

1. Browse the CD & launch "SetupArtemisUniversal.exe" or "artemisinstaller.exe"
2. This installs the driver & "ArtemisCapture" to control the camera
3. You can also download and pre-install the [Artemis core software & drivers](#)
4. Plug the 12V supply into the camera; the fan should start up
5. Connect the 10m USB extension to the computer, and wait for its driver to be installed
6. Then connect the camera to this cable, or directly to a USB port on your computer
7. The computer should automatically search for and install the driver. Be patient !
8. The Windows Device Manager should now show an ArtemisCCD USB controller
9. Launch ArtemisCapture to control the camera (see next section)

10. 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" then "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" then "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, the "Camera" menu connects 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.



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

- Set the exposure time (s) with **BinX=4 and BinY=X** for 4x4 binning
- Check the **"Pre"** box to reduce readout time at the cost of **greater readout noise**
- 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 -20°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

- **If the image is black, reduce the exposure to avoid saturation.**
- 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 limit readout to a "sub-frame" region 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

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, with either the Atik/Artemis driver or the ASCOM driver.

Occasional Problems with camera operation

- Be patient when you first launch ArtemisCapture. Wait for it to load and detect the camera.
- If ArtemisCapture complains that it cannot connect to the camera, and the cables are in place, a background copy of the application may already be connected. Unplug the power to the camera - this will close any open connections - then try again.
- Check that an ArtemisCCD device is connected in the USB controller list in the Windows Device Manager, which is accessed by right-clicking MyComputer.
- Try deleting the ArtemisCapture.ini file from the C:\Windows folder to reset Artemis Capture.
- Try a different USB port, waiting for the driver to be found and re-installed.
- USB ports can sometimes become un-responsive. Shut down the computer and remove the computer's power cable for a few seconds. Then re-connect everything and reboot.
- If all else fails, try using a different computer.
- **A black image may simply mean the CCD is over-exposed. Reduce the exposure time.**

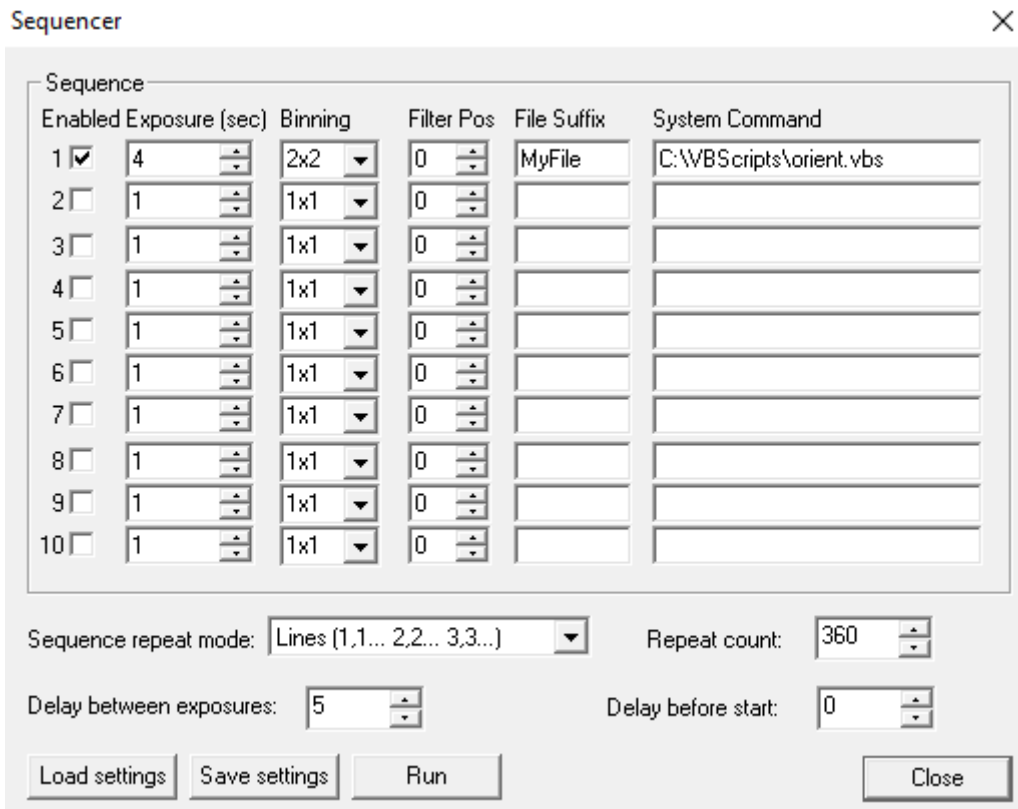
Image Treatment with ImageJ

[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.

A complete ImageJ installation is included on the NeutronOptics software CD under "Extras". Just copy the ImageJ folder to your C: disk and launch ImageJ to set defaults and update ImageJ.

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.



[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.

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.

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