

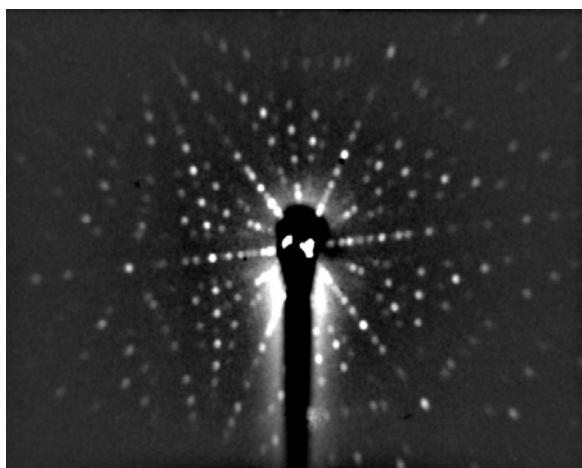


## Orienting Crystals with the 1-CCD Laue Camera

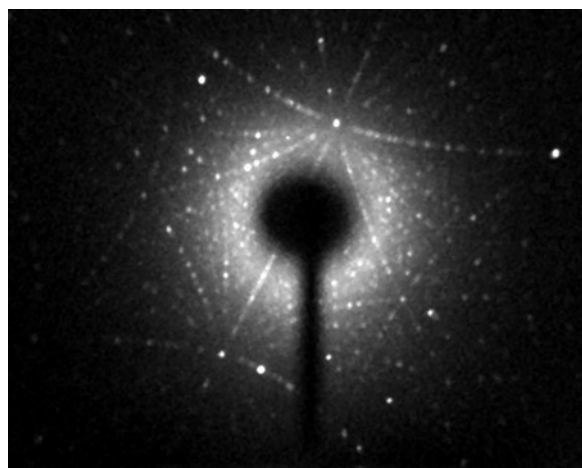


- Sensor Type: Sony ICX825ALA or ICX694ALG
- Image size: Diagonal 11mm (Type 2/3") or 16mm (type 1")
- Chip size: 8.98x6.71mm or 12.49x9.99mm
- Resolution: 1392x1040 or 2759 x 2200
- Pixel Size: 6.45x6.45  $\mu\text{m}$  or 4.54 x 4.54  $\mu\text{m}$
- Binning: from 2x2 to 8x8 (improved intensity and 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

## Backscattered Laue with the 1-CCD Laue Camera



a) Si (Dean Hudek, Brown University USA).



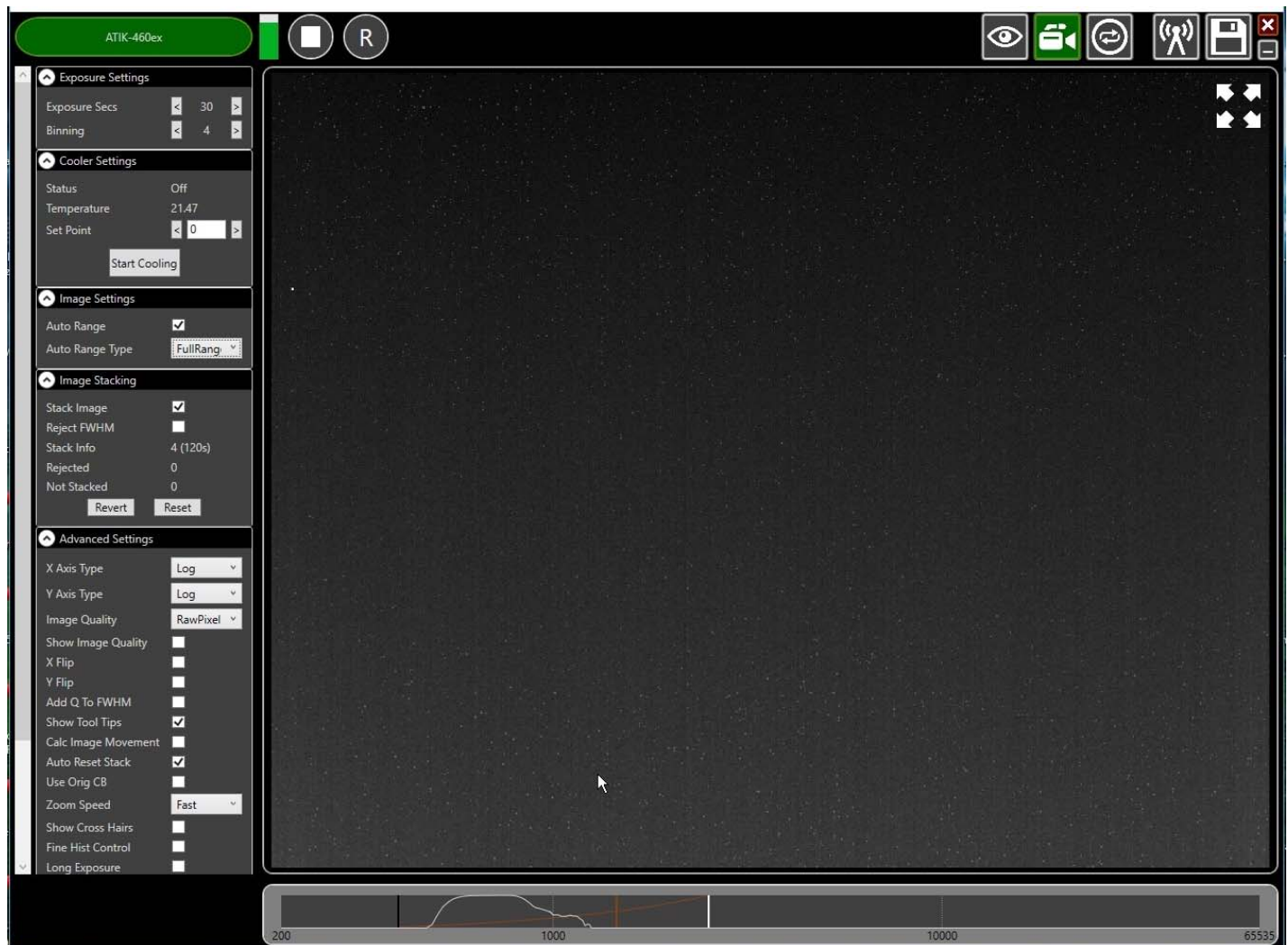
b) Sm<sub>2</sub>Fe<sub>17</sub> (Léopold Diop T.U. Darmstadt)

## Installing the Driver and Artemis Capture software

- Browse the CD & launch "SetupArtemisUniversal.exe" or "artemisinstaller.exe"
- Install the driver & "Artemis Infinity" and "ArtemisCapture" to control the camera
- You can also download and pre-install the [Artemis core software & drivers](#)
- Plug the 12V supply into the camera; the fan should start up
- Connect the 10m USB extension to the computer, wait for its driver to be installed
- Then connect the camera to this cable, or directly to a USB port on your computer
- The computer should automatically search for and install the driver. Be patient !
- The Windows Device Manager should now show an ArtemisCCD USB controller
- Launch "Artemis Infinity" or "Artemis Capture" to control the camera (next section)
- Read the [manual for the Hi-res camera](#) for more details and troubleshooting

## 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.



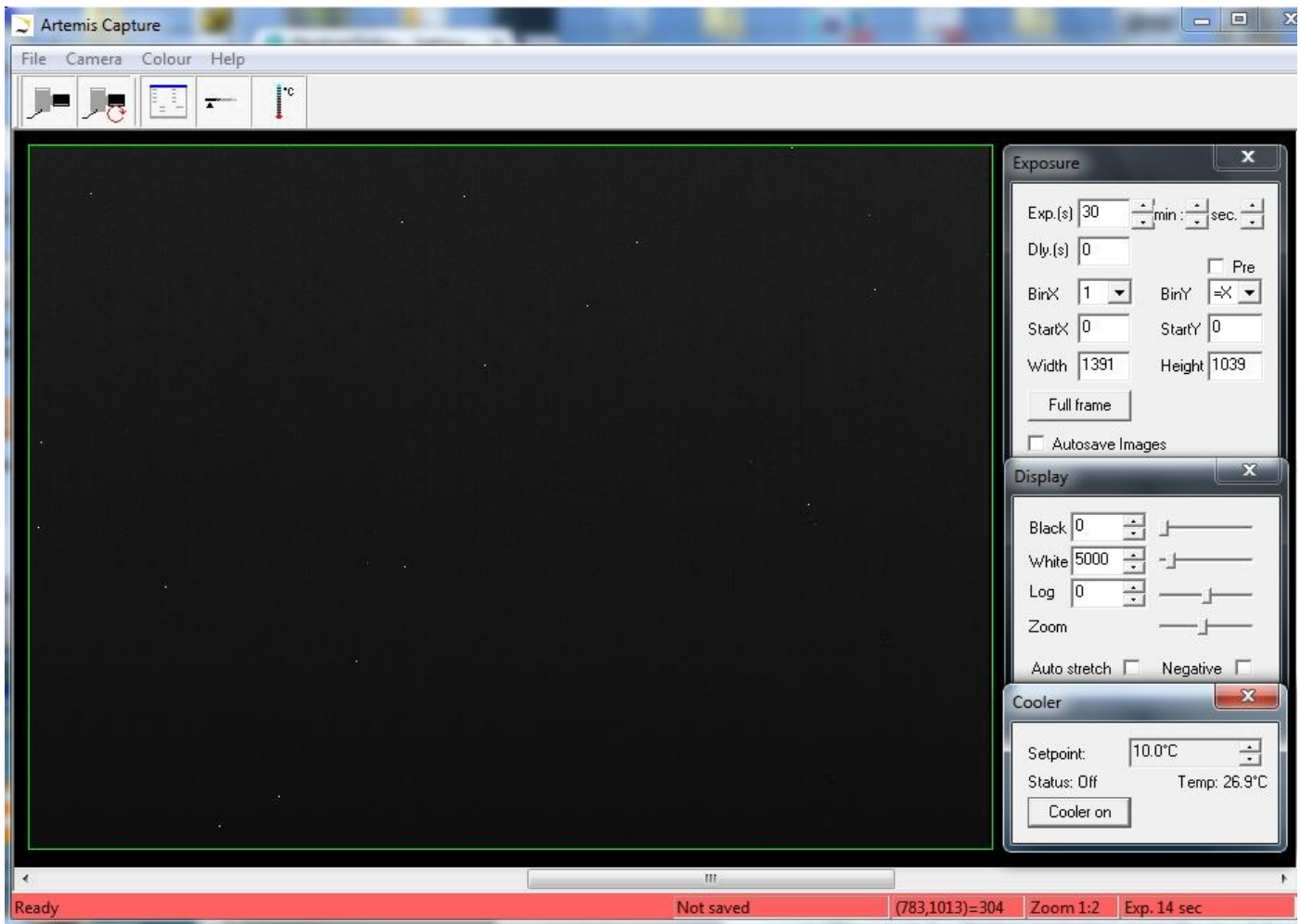
- Double-click the top bar to expand/contract the window.
- If connected, the camera name is shown in green
- Set the exposure time and binning (to 30s and x4 for the Laue camera)
- **Advanced Settings: Uncheck "Calc.Image Movement" & Check "Long Exposures"**
- Select the "video camera" icon on the top 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**

## The alternative Artemis Capture for long exposures

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:**

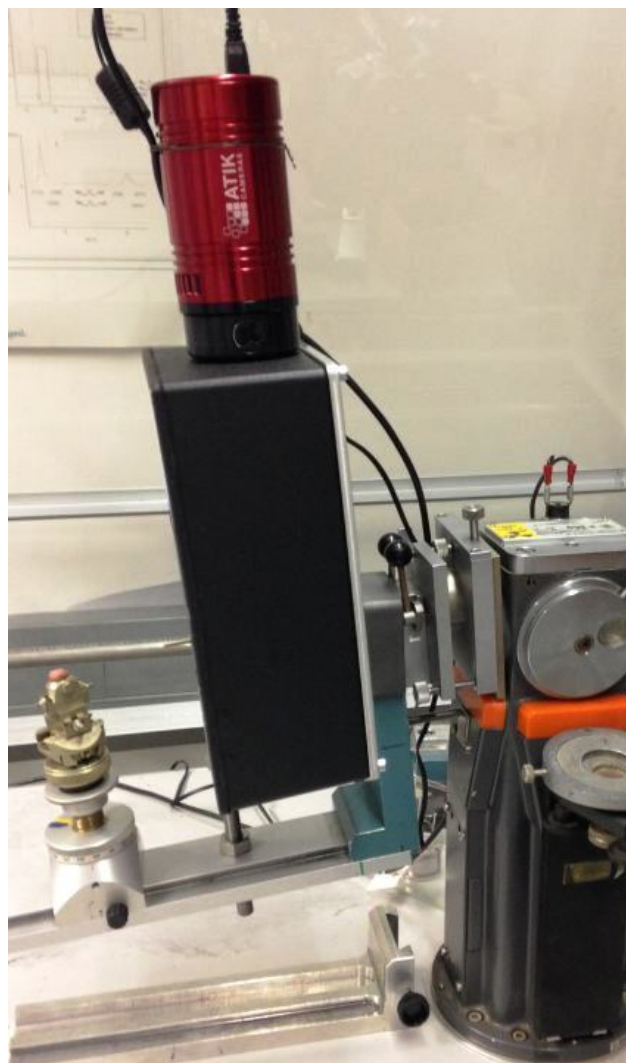
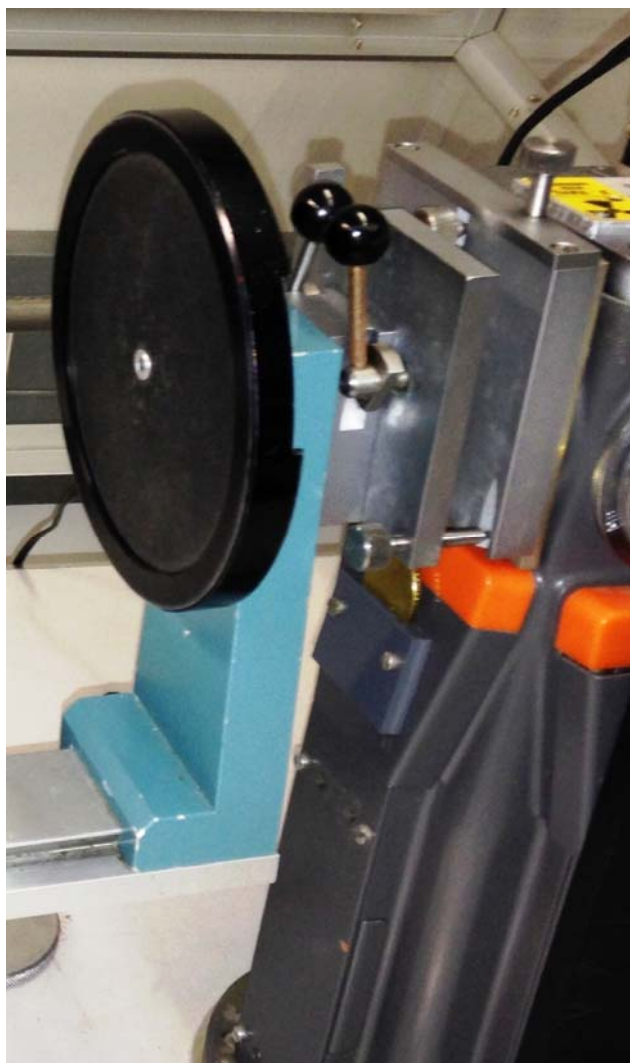
- Check the **"Auto stretch"** option to select the best 8-bits out of the 16-bits. Note that **scintillator afterglow may be seen for some minutes after exposure to light.**
- **"Zoom"** (or the wheel mouse button) zooms the display window

**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

## Setting up the NeutronOptics1-CCD Laue Camera

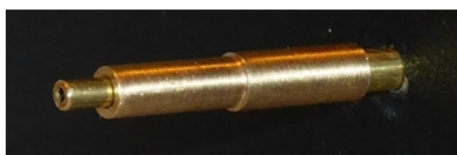
The photos below show how **Prof. W. Donner and Dr L. Diop at the T.U. Darmstadt** converted a Huber Image Plate Laue camera (left) to use the NeutronOptics 1-CCD Laue camera (right).



**Left photo:** The Huber IP camera is the circular disk mounted on a blue support on a guide rail. The collimator is locked and the beam shutter opened with the two black knobbed levers on the double-metal plates that form the [Huber-800](#) alignment mechanism, which is mounted on a 1960's Philips X-ray generator. The screw at the top, and two at the bottom, adjust the height and tilt of the collimator.

**Right photo:** The Huber-800 unit is retained, together with the blue camera support, when the Huber IP camera is replaced by the 1-CCD camera. An additional support bolt on the rail under the bottom left supports the heavier camera. The new collimator is aligned in the Huber-800 mechanism for maximum intensity, and the camera is then bolted on using an aluminium plate and four M4 bolts.

### 3mm Collimator-tube adapter



**1mm Collimator nose**

Mount the camera as close to the source as possible using the 4mm bolt holes at the back; minor adjustments to position and orientation are necessary. Before inserting the 1mm collimator tube into the camera, check that it fits the source exit and allows no x-ray leakage. You will need to make a **small adapter** (top left) to take the 3mm collimator tube, depending on your source. The 1mm collimator slides into the 3mm tube (bottom left), with the nose extending toward the crystal ~30mm from the window.

The carbon fibre window & scintillator are not fragile.

The camera and collimator must be precisely aligned, and the source voltage and current set for maximum x-ray intensity through the collimator. Our [mini i-Cam camera](#) could be used to align the beam and position the sample, otherwise use the Laue camera itself to check beam transmission.

Typical exposure times for backscattered Laue are ~300 seconds. But first try a shorter exposure with no beam to check that everything is working - you should see background noise. You can also try forward scattered Laue, where exposure times are much shorter.

**Binning is important** for faster exposures with backscattered Laue, since very high resolution is not needed. Typically binning of 4x4 increases efficiency by a factor of x16 !

## Hints on getting Optimal Performance

- Use a Windows-7 or -10 computer with 2GByte of memory eg an [Intel NUC](#)
- If necessary, close other applications and windows that may use memory
- Try a short exposure to check that it works before starting a long exposure
- Check the files that are created in your image directory
- Image display is for guidance. Open the saved image with ImageJ for measurement
- Note that the ImageJ lens distortion correction is not perfect far from the centre
- The CCD can be cooled to reduce noisy pixels. Also use ImageJ's despeckle filter
- 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
- Try unplugging and re-plugging the USB cable
- Try re-booting your Windows computer :-)

## Indexing and orienting the Laue pattern

You may first want to use ImageJ's "**Process/Noise/Despeckle**" to filter out electronic noise and perhaps "**Process/FFT/Bandpass filter**" to emphasise the peaks, before using ImageJ to convert to the various formats used for indexing. A number of Laue indexing applications are freely available. The [Cologne Laue Indexing Program \(CLIP\)](#) is one of the best, along with the [QLaue Indexing Program](#). Older applications such as [OrientExpress](#) and the ambitious new [ESMERALDA Laue suite](#) might also be tried.

For the latest information, please check our web site <http://neutronoptics.com/laue-1CCD.html>