



## The Slim Lodestar or Ultrastar USB CCD Option

NeutronOptics x-ray or neutron cameras can be supplied with an optional slim CCD unit, with either 752x580 (lodestar) or 1392x1040 (ultrastar) pixels. The slim CCD has far higher 16-bit intensity resolution compared to only 8-bits from the original "video" CCD. This CCD unit cannot be Peltier cooled, and is connected to a Windows computer via a single USB-2 cable used both to [control the camera](#) and collect the image. Amplified 10m cable extensions can be supplied.

The [mini i-Cam](#) is the simplest form of this camera. The following instructions apply, but first remove the O-ring holding the carbon window and scintillators to check the focus of the camera using the focussing grid with ambient light. Select one scintillator and cover it with the C-window and O-ring. Thinner scintillators give higher resolution but lower intensity: the neutron scintillator is yellow.



- **Sensor Type:** Interline EXView [ICX829ALA](#) or [ICX825ALA](#)
- **Image size:** Diagonal 8 mm (Type 1/2") or 11 mm (type 2/3")
- **Resolution:** 752 x 580 or 1392x1040
- **Pixel Size:** 8.6 x 8.3  $\mu\text{m}$  or 6.45 x 6.45  $\mu\text{m}$

### Common features:

- **Binning:** from 2x2 to 8x8 (improved intensity & read-out )
- **High sensitivity** (QE>75% at 500-600nm), low smear
- **Low dark current** (<0.1 e/s ambient), anti-blooming
- **Full well capacity:** >50,000 electrons (dynamic range)
- **ADC:** 16 bit grey scale, optional filtering and distortion
- **Readout Noise:** 10 e- typical
- **Readout Time:** ~0.15s
- **Interface:** USB 2.0 High Speed with 10-20m USB cables
- **Power:** 12v DC 0.8A, for EU, UK, US/Japan, AU/CN
- **Maximum Exposure Length:** Unlimited
- **CCD Unit:** 32mm diameter, 72mm height, 50g weight
- **Lens Coupling:** CS-mount
- **SDK:** C++, VB Wrapper, .net Wrapper, ImageJ, LabView

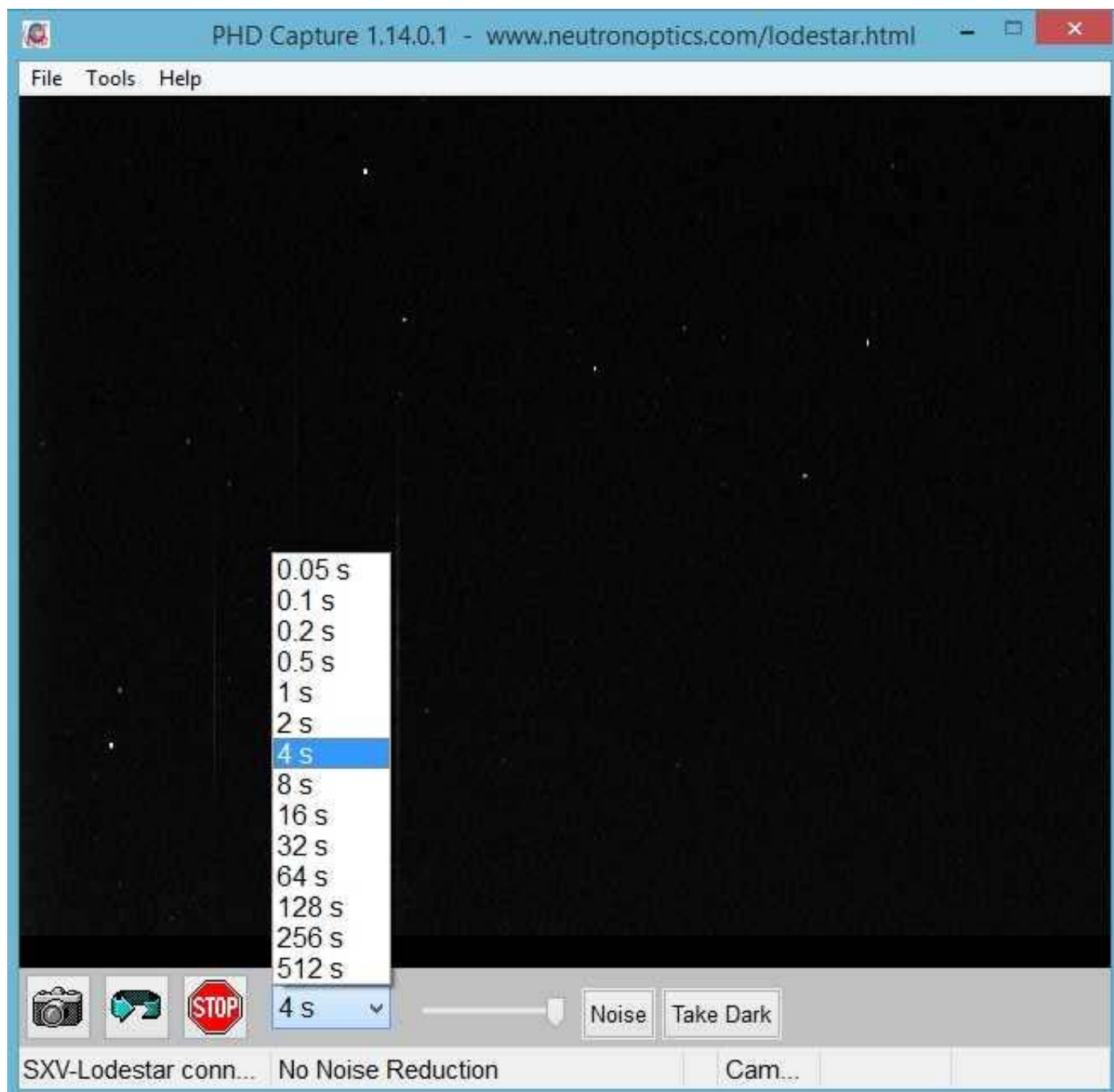
## Install the Driver and Artemis Capture software

1. Browse the CD & launch "Install Drivers.exe" for your 32-bit or 64-bit system
2. Connect the camera to a USB port on your computer
3. The computer should automatically search for and install the driver
4. The Windows Device Manager should now show a Starlight Xpress CCD

## PHD for Simple Real-time Imaging with the Slim Lodestar USB Camera

If you just want to see your sample in the beam, with cyclic exposures of from 0.05s to 512s, you can install this simple free application for which you just click the Loop/Stop buttons after selecting the camera. The 16-bit image is updated in real time, and you can save it then open it with [ImageJ](#) to remove noisy pixels and enhance it in other ways.

- Download and install the free [PHD Guiding](#) application.
- Download our [custom PHD.exe](#) to overwrite PHD.exe in the PHDGuiding folder.
- Launch our custom PHD.exe to display the image and controls.



- Click the camera icon and select the SXV Lodestar Slim CCD camera
- Click the LOOP icon to start exposing for the selected time
- Click STOP to stop the loop at the end of the current acquisition (wait for it)
- File/Save Image saves the 16-bit image
- The slider changes display contrast
- Try the 3x3 median Noise filter
- Try Take Dark background subtraction
- Open the saved images using ImageJ

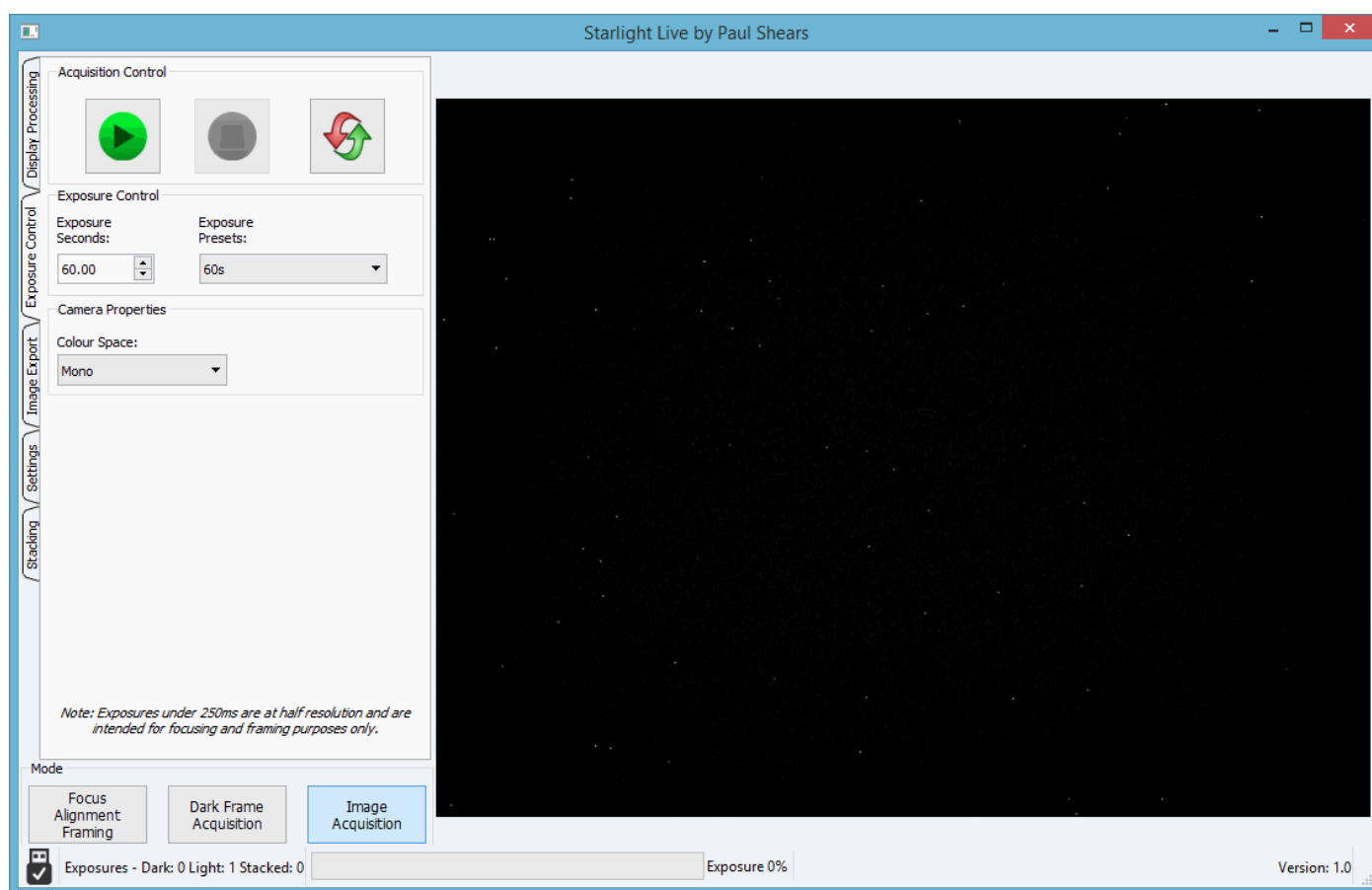
Use the [ASCOM](#) driver for sharper images, better noise reduction, and hardware binning, which will increase intensity at the expense of resolution. You should also install the [ASCOM Platform 6](#) environment. The ASCOM driver is installed in C:\Program Files\Common Files\ASCOM\Camera and you can use *Control Panel/Programs or the ASCOM Profile Explorer* to remove it.

In the ASCOM camera chooser, select "Starlight Xpress Lodestar or Ultrastar Guider", click on "Properties" and un-select all options. Click on "Noise" to filter out hot pixels (see Hints below).

## Starlight Live Image Capture with the Slim USB Camera

Starlight Live automatically collects a series of images. It is also good for focussing. The 16-bit images can be opened with [ImageJ](#) to remove noisy pixels and de-interlace.

- Download and install the [Starlight Live](#) camera capture application.
- For Macintosh systems, use the [OSX version](#) of Starlight Live.
- Launch Starlight Live to automatically connect to the Lodestar/Ultrastar camera.

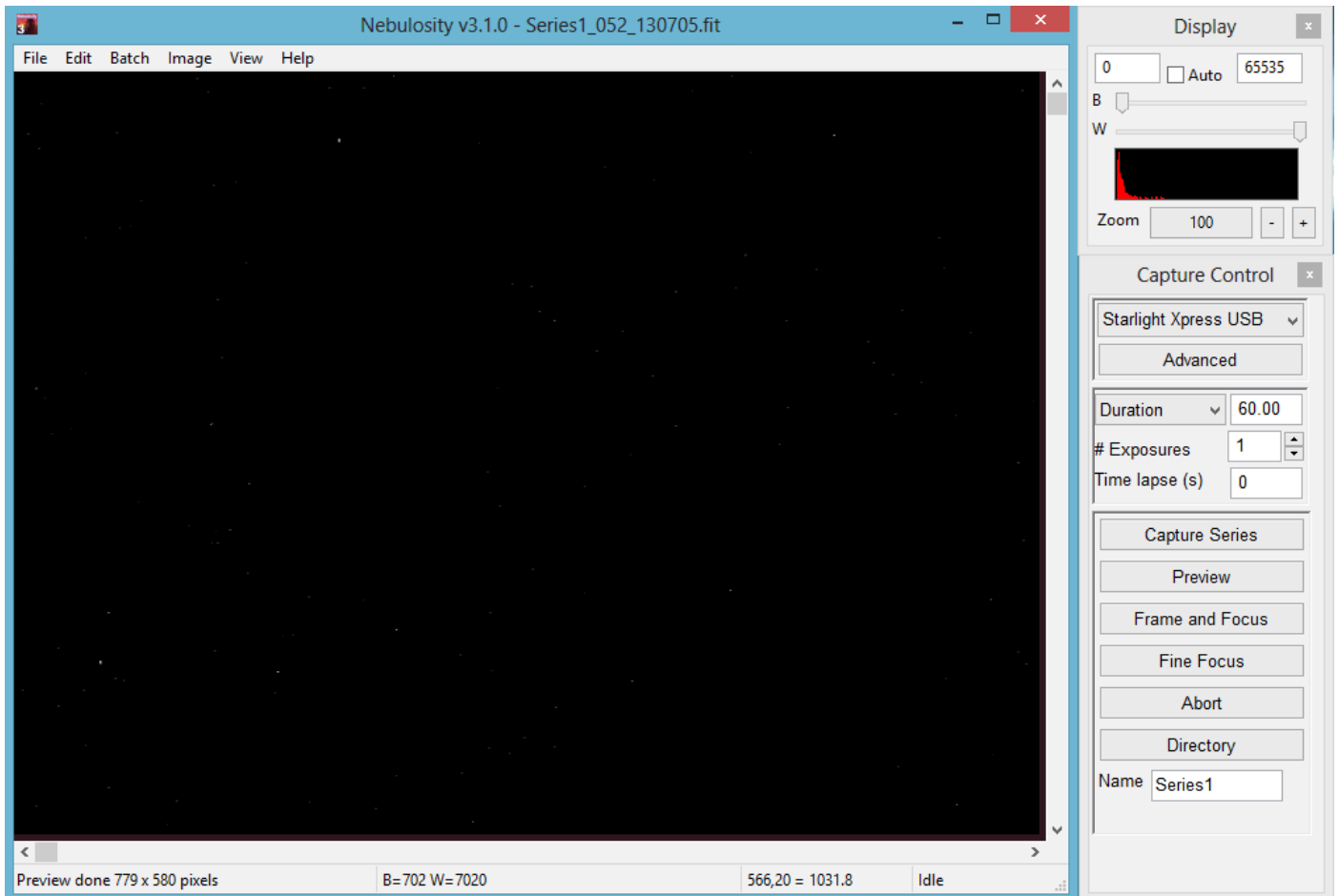


- Select the Exposure control tab (left)
- Enter the exposure Duration
- Click the Green button to Start...
- A series of captures
- Click the Red button to Stop
- The Image Export tab saves images
- The Display tab adjusts the display
- The Stacking tab sums the images live
- But use ImageJ to first filter noise

# Nebulosity3 Image Capture with the Slim USB Camera

Use Nebulosity to collect images for unlimited exposures, collect a series of images etc. The 16-bit images can be opened with [ImageJ](#) to remove noisy pixels and de-interlace.

- Download and install the [Nebulosity3](#) camera capture application
- Launch Nebulosity3 to display the image and controls. Enter a [blank licence key](#).
- A [licence key](#) can be purchased; the free mode just adds bars to the saved image.



- In the Capture Control box select the Starlight Xpress USB camera
- "Advanced" controls binning & read out
- Enter the exposure Duration and the Number of exposures
- Click *Capture Series* or *Preview*
- Menu File/Save Current File or use the shortcut Ctrl-S
- The *Display* Control adjusts the display
- Try Image/Adaptive noise reduction

## ASCOM Camera Control and Treatment with ImageJ

[ImageJ](#) is recommended for image analysis. ImageJ will open the raw [FITS](#) files, then 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.

If you install the [ASCOM Platform 6](#) environment, and the [sxASCOM camera driver](#), you can control the camera directly using [ImageJ for ASCOM](#). This has advantages in that sequentially acquired images, eg for tomography, are opened directly in ImageJ.

You can even [simultaneously acquire images from two cameras](#) and stitch them together.

When installing the [sxASCOM camera driver](#), choose to install a "Starlight Xpress Standalone Guide Camera", then choose a "Starlight Xpress LodeStar Guide Camera" (or Ultrastar). There is no need to install ASCOM drivers for the other cameras.

After choosing the "Starlight Xpress LodeStar/Ultrastar" Guider" in the [ASCOM chooser](#), click "Properties" and unselect every option, but choose "Double Exposure Short".

## 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
- Use the "Process/Noise/De-speckle" filter in [ImageJ](#) to remove noisy pixels
- The slim Lodestar (not Ultrastar) CCD is interlaced to obtain very fast readout
- If this appears to be a problem, try the [ImageJ](#) de-interlace filter
- Copy the [de-interlace](#) filter [Deinterlace .class](#) to ImageJ\plugins & apply it
- But de-speckle the raw image first, before de-interlacing or blurring
- "Gaussian blur" from Options/Execute makes it difficult to remove noisy pixels

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