

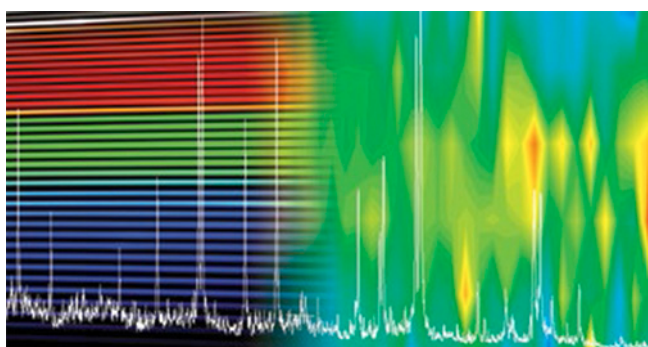
# Software for Andor cameras and spectrographs



"Discover new ways of seeing™" takes its true meaning when the most

sensitive spectroscopy and imaging detection solutions on the market combine with Andor's comprehensive software capabilities. From seamless configuration of spectrographs and cameras to actual data acquisition optimization, Andor Solis software and Software Development Kit offer a truly powerful, yet user-friendly modular approach to spectroscopy and imaging.

**Andor Solis**  
Software for imaging, spectroscopy and time-resolved applications

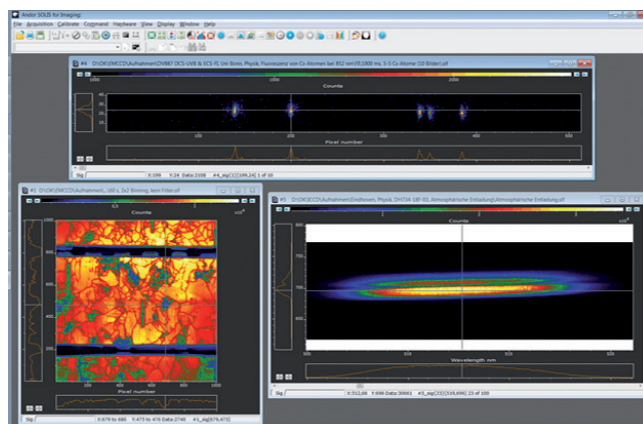


Andor Solis (Solutions for imaging and spectroscopy) is Andor's camera control and analysis software platform, with versions specifically designed to run imaging, spectroscopy, time-resolved cameras and associated accessories. It is easy to install and provides "state of the art" acquisition, display and processing capabilities. This comprehensive software package has an extensive built-in programming language, AndorBasic, which has been specially designed to simplify even the most complex operations. For example, two images can be added and stored in a new data store by simply typing  $\#3 = \#1 + \#2$ . Easy! As AndorBasic can be used to program image acquisitions, automate file storage, communicate with external devices and manipulate data, you can build macros to automate your experiment.

## Features and benefits

- Simple installation wizards depending on your hardware
- Real-time data display ideal for aligning experiments
- Real-time charting capability for optimising your experiment
- Real-time data calculations including background correction, flat-fielding, transmission, reflectance and absorbance
- Advanced virtual memory management allows files >2GB in size to be opened and viewed with minimal performance impact on you PC
- Minimize memory usage and increase frame rate via simple sub-binning and sub-array control
- User selectable triggering options
- Comprehensive display modes – pseudo-colour image, 2D, 3D stacked and overlaid
- Comprehensive AndorBasic programming language
- Compatible with Windows 7, 8 and 10 on 32-bit and 64-bit platforms

## Imaging applications



The Andor Solis software is designed for image capture and analysis and is used in a wide range of scientific fields including fluorescence imaging, Bose-Einstein condensation, X-ray studies, neutron tomography, astronomy, semiconductor analysis and Raman imaging.

Solis contains a comprehensive list of edge-detection algorithms including first derivative (Sobel, Kirsch, Prewitt and Robinson), second derivative and the Roberts Cross edge detector. Smoothing filters include the Mean, Median and Gaussian filters while in the frequency space Solis includes Low Pass and high pass filtering.

# Software for Andor cameras and spectrographs

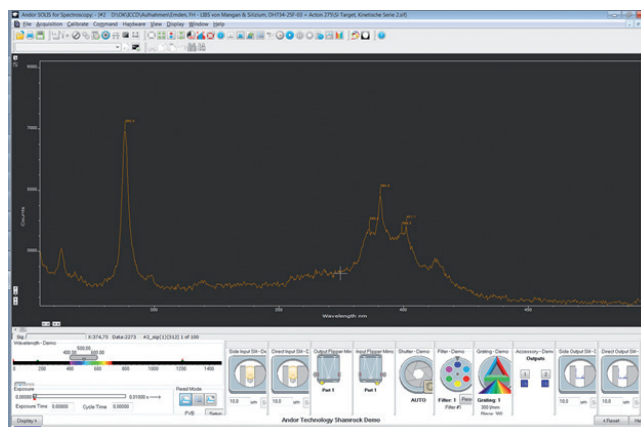
Solis provides the user with full control over the camera including pixel readout rate, horizontal and vertical binning, exposure time, pre-amplifier setting, electron multiplying gain (EMCCD compatible systems) and various triggering options.

The software's region of interest (ROI) feature allows the user to chart in real time such quantities as maximum, mean and standard deviation as a kinetic series of images is acquired.

## Features and benefits

- Real-time image display (video mode) ideal for aligning experiments
- Advanced data spooling direct to hard disk allowing large data sets to be acquired
- Increase your signal above the read noise floor with RealGain™ control (EMCCD compatible systems only)
- Minimize vibrations with "Silent Fan" operation
- Kinetic series recording and playback
- Through-series ROI analysis, simple generation of kinetic plots
- Various real-time and playback display options, including 3D profile
- Comprehensive image analysis operations
- Extensive data save and export options including Andor SIF, ASCII, TIF, FITS, BMP, JPG, DAT, EDF, SPE, AVI and MP4
- Extended AndorBasic programming language
- Real-time X and Y line profile sectioning
- Simple multiple region-of-interest (ROI) selection and sizing
- ROI "hot spot" selection for discrimination of background pixels within ROI
- Intuitive and comprehensive user-defined thresholds and auto-scaling
- Data histogram enabling easy image display data scaling

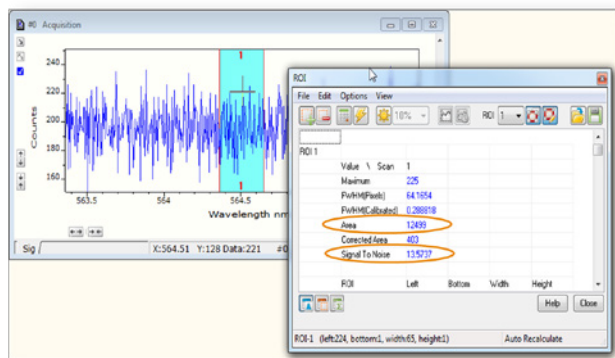
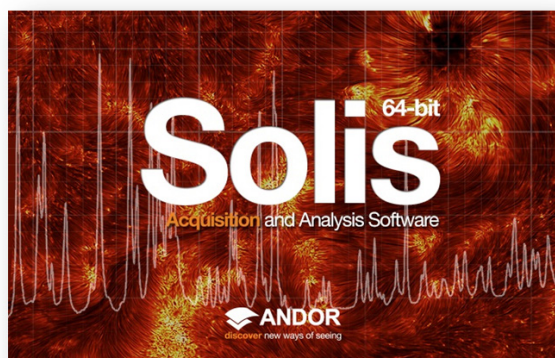
## Spectroscopy applications



For spectroscopy applications, Solis has been specifically tailored to enable the user to quickly configure their acquisition, capture the data and display and process results in a user-friendly manner. The user can also control Andor and 3rd party spectrographs in a direct and responsive manner

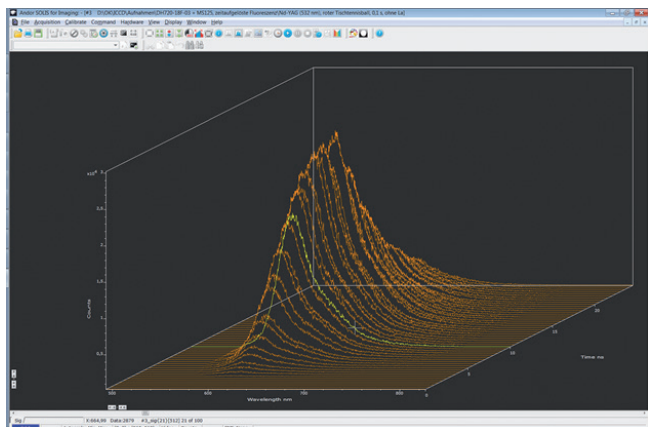
## Features and benefits

- Full spectrograph and camera control within the same package
- Flexible data display: view your data in 2D, 3D, stacked and overlaid
- Data export options Andor SIF, ASCII, TIF, FITS, BMP, JPG, DAT, EDF, SPE, AVI and MP4
- Easy automation of your experiment with additional commands added to the AndorBasic programming language
- User defined background and data colours allow the user to optimise the screen under low light or low contrast monitors



# Software for Andor cameras and spectrographs

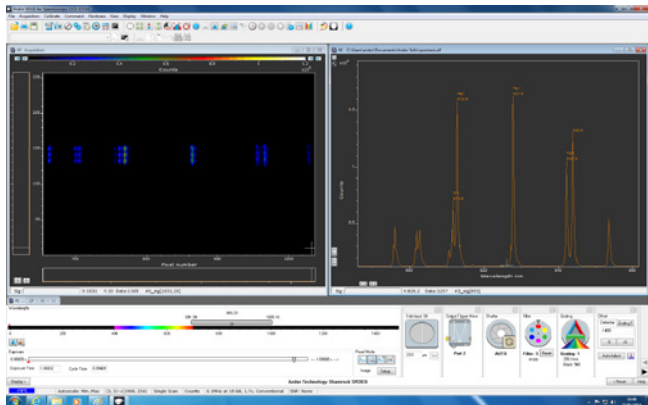
## Time-resolved applications



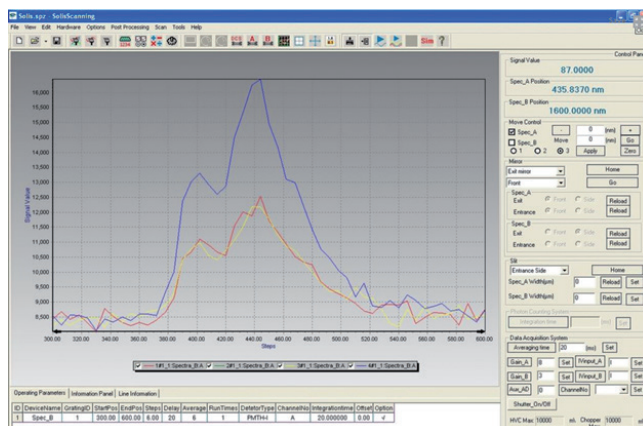
For time-resolved applications, Solis has additional features to enable control of the iStar camera range. Applications include Laser Induced Breakdown Spectroscopy (LIBS), Laser Induced Fluorescence (LIF), combustion and Time-Resolved Raman Spectroscopy.

## Features and benefits

- Easy configuration of the built-in Digital Delay Generator (DDG™) allowing you to fully control your ultra-fast gating requirements with minimum fuss
- Improved signal-to-noise with the “Integrate On Chip” function
- Advanced data spooling direct to hard disk allowing large data sets to be acquired
- Real-time and post-processed photon counting mode enables you to watch your data build at even very low flux levels



## Solis scanning Spectroscopy software for scanning applications



With detection capabilities ranging from UV to the Long Wave IR (LWIR) region through a comprehensive range of single point detectors - including PMTs, PbS and MCT, Solis Scanning offers a dedicated platform for scanning applications

Spectrograph/monochromators, detectors, data acquisition unit, lock-in amplifier/chopper and motorised accessories can all be conveniently synchronised through a series of intuitive interfaces. A single software package features a comprehensive step-by-step experiment building interface for parametring and synchronizing all components of the detection chain. Complex scanning sequences involving multiple gratings filters and up to two monochromators for fluorescence measurements – including a tuneable light source setup – can be seamlessly captured prior to acquisition start and executed without further intervention of the user. Solis Scanning can also handle multiple detectors control and data display for absorption – transmission – reflection spectroscopy, while offering post-acquisition mathematical data processing ranging from simple ratios and lifetime measurements to fast phenomena analysis.

# Software for Andor cameras and spectrographs

## Andor software development kits

Andor offers several Software Development Kits:

- SDK for Windows
- SDK for LabView
- SDK for Matlab
- SDK for Linux



The SDKs give the programmer access to the Andor camera and spectrograph range. The key part of the SDKs is the dynamic link library available as 32- and 64-bit libraries for Windows (7, 8 and 10) and compatible with C/C++, C#, Delphi, VB6, VB.NET, LabVIEW and Matlab. The Linux SDK is compatible with C/C++. The SDKs provide a suite of functions that allow you to configure the data acquisition process in a number of different ways.

The SDKs for Windows and Linux also contain a wrapper with Python commands.

There are also functions to control the CCD temperature and shutter operations, and to save and read files. The driver will automatically handle its own internal memory requirements. To use the SDKs effectively the user must develop a software package to configure the acquisition, provide memory management, process the data and create the software interfaces.

## GPU Express – large data solutions simplified

The Andor GPU Express library has been created to simplify and optimize data transfers from camera to a CUDA-enabled Nvidia



GPU card to facilitate accelerated GPU processing as part of the acquisition pipeline. GPU Express integrates easily with Andor's SDK3 (Windows) library, providing a user-friendly but powerful solution for management of high bandwidth data flow challenges.

GPU offers the advantages of:

- Enhanced convenience, afforded by simple, optimized GPU data management
- Optimal data throughput
- Accelerated real time processing frame rates
- Superb, easily accessible documentation and examples

It is possible to send data to a GPU card for processing without the GPU Express library, via GPU processing library functions (with Nvidia cards, this would be achieved by using the CUDA library). However, for this to occur, the user is required to explicitly manage the buffers required to hold data on the CPU and the GPU.

They also have to copy the data from and to the GPU, via the CPU.

The GPU Express library provides a simpler solution to the user, via the management of all required CPU and GPU buffers to hold and pass the acquired data. The copy functions of the GPU Express library are also optimised to reduce latency during the copies from and to the GPU to achieve acceleration of real time processing frame rates for a given GPU card. As such, non-expert users can achieve this optimisation, and more expert users can focus on the algorithms to be run on the GPU, and use a simplified API for their optimised copies.

## Features and benefits

- ✓ Simple API – provides a clean interface that integrates easily with Andor's SDK3 for Windows library, reducing development time.
- ✓ Accessible and thorough support manual, including tutorial and multiple user scenario examples.
- ✓ Management of all required buffers in the GPU memory space.
- ✓ Management of intermediate CPU buffers for copy to GPU memory from camera.
- ✓ Provision of functions for safe allocation and deallocation (and locking/unlocking) of user output buffers on the CPU side to store the result of GPU processing.
- ✓ Provision of functions for safe locking/pinning and unlocking/unpinning of user output buffers on the CPU side (as required for asynchronous memory copies) to store the result of GPU processing.
- ✓ Support for multiple camera acquisition.
- ✓ Explicit synchronisation call, to ensure that all previous copies and processing within a specified GPU Express Path are complete before continuing.
- ✓ Multiple copy functions - copies to/from GPU and CPU as required for a particular application.
- ✓ Management of CUDA streams - provides overlapping of copies to/from the GPU memory with accelerated GPU processing.
- ✓ Facilitates multiple GPU processing.
- ✓ A CUDA accelerated version of Andor's unpacking library (CUDA\_atunpackerlib.lib) is also provided for fast conversion between Pixel Encoding types and to provide unpacking of data due to granularity restrictions on the row width, as is the case with Camera Link frame grabbers.
- ✓ Includes Nearest Neighbour De-blurring library:
  - The library provides a number of functions implemented in CUDA to apply the well-known 'nearest neighbour' and 'no neighbour' algorithms for 3D and 2D input microscopy datasets respectively.

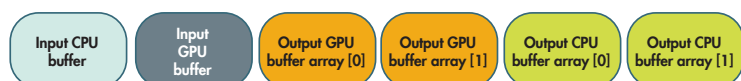
# Software for Andor cameras and spectrographs

- The output from an intermediate de-noising stage of the algorithm is also provided as an option to the end-user.
- The nearest/no neighbour algorithms are based upon improving an image by sharpening the edges of structures, using a sharpening filter called an 'Unsharp Mask'.

## GPU express path

- Provides a means to encapsulate a set of resources managed by the library to aid in the acquisition of a dataset
- Each GPU Express Path references a unique 'Input CPU buffer array', 'Input GPU buffer array', and CUDA stream managed by the library
- Each may also reference an optional array of 'Output GPU buffers', and an optional array of 'Output CPU Buffers'
- Data from either the Input GPU Buffer or an Output GPU Buffer may be copied into an Output CPU Buffer via the GPU Express library API functions

- Copies between buffers within the library are only allowed between buffers within the same GPU Express Path. Each copy within a GPU Express Path takes place within the same CUDA stream
- As each GPU Express Path has its own unique CUDA stream, this provides us with the possibility to concurrently acquire and process multiple datasets within separate GPU Express Paths
- Aids synchronisation, as all operations within a CUDA stream are synchronous with respect to each other and guaranteed to execute in the prescribed order. Therefore all operations within a GPU Express Path take place in sync.
- As each GPU Express Path has its own unique CUDA stream, this provides us with the possibility to concurrently acquire and process multiple datasets within separate GPU Express Paths.
- When utilising the library with the SDK3, a GPU Express 'Set' can be readily configured to manage a number of GPU Express Paths, facilitating performance optimization.



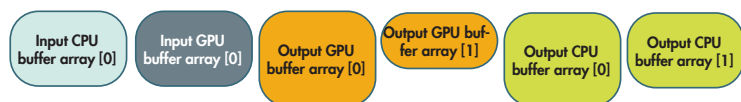
Example layout of a GPU express path containing an Input CPU buffer, Input GPU buffer, 2 optional Output GPU buffers and 2 optional Output CPU buffers. All copies between any buffers in a GPU Express Path take place within the same (library managed) CUDA stream.



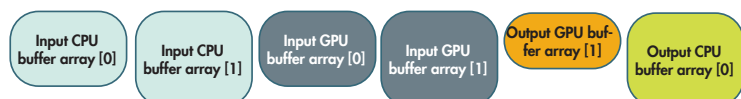
Example layout of a GPU express path containing 1 Input CPU buffer, 1 Input GPU buffer and 1 Output CPU buffer.



Example layout of a GPU express path containing 1 Input CPU buffer, 1 Input GPU buffer, 1 Output GPU buffer and 1 Output CPU buffer. The output buffers in this case are of a different size to the input buffers.



Example layout of a GPU Express Path containing 1 Input CPU buffer, 1 Input GPU buffer, 2 Output GPU buffers and 2 Output CPU buffers. The output buffers in this case are of a different size to the input buffers, and the 2nd buffer in each output array is of a different size to the 1st buffer in the output arrays.



Example layout of a GPU Express Path containing 2 Input CPU buffers, 2 Input GPU buffers, 1 Output GPU buffer and 1 Output CPU buffer. The 2nd buffer in each input array is of a different size to the 1st buffer in the input arrays in this case.










*"I'm really impressed. As with the Andor SDK3, you provide a clean interface, and the library is well designed. I'm particularly amazed about the documentation. Reading through it, it all made complete sense. It seems that lots of the tedious Cuda buffer management should be greatly simplified using GPU Express."*

Dr. Benjamin Schmid  
Huisken Lab, MPI Dresden

# Software for Andor cameras and spectrographs

## Third party imaging software support

Andor has worked with several 3rd party imaging software companies to include support for the Andor range of cameras. The compatibility matrix below shows which of the 3rd party software packages are compatible with Andor products.

Software	Matlab	LabView	MetaMorph	NIS-Elements	Application Suite	EPICS	CellSens	Zen	µManager	SlideBook	Image Pro	Maxim DL	Halcon	WinFluor	StreamPix
															
iXon Ultra 888	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			
iXon Ultra 897	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓
iXon Life 888	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			
iXon Life 897	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓
Sona	✓	✓	✓	✓			✓		✓						
Marana	✓	✓		✓			✓								
Neo 5.5	✓	✓	✓	✓	✓	✓	✓		✓	✓					✓
Zyla 5.5	✓	✓	✓	✓		✓	✓		✓	✓				✓	✓
Zyla 4.2	✓	✓	✓	✓	✓	✓	✓		✓	✓				✓	
iKon-M	✓	✓	✓	✓		✓			✓			✓	✓		✓
iKon-L	✓	✓				✓			✓			✓			✓
iDus	✓	✓				✓			✓			✓	✓		✓
Newton	✓	✓				✓			✓			✓	✓		✓
iStar	✓	✓							✓			✓	✓		✓
iVac	✓	✓				✓			✓		✓	✓	✓		

