LightField®
Scientific Imaging and Spectroscopy Software
The future of imaging and spectroscopy software is here – LightField!

Princeton Instruments LightField® is a scientific imaging and spectroscopy software package that provides a cutting-edge user interface and the powerful functionality needed to set up and perform complex optical diagnostic experiments.

This unique and revolutionary tool lets researchers around the world realize the true potential of their advanced Princeton Instruments low-light-level cameras and spectrographs.

MATLAB and LabVIEW compatible

100+ user enhancements

watch our videos on your computer, tablet or mobile device
www.princetoninstruments.com/lightfield
Princeton Instruments has pioneered state-of-the-art technology and instrumentation for more than three decades, including:

- IsoPlane® imaging spectrographs – spectroscopy reimagined
- PI-MAX® 4 intensified CCD cameras – the ultimate in precision and intelligence
- NiRvana® NIR-II/SWIR cameras – designed by scientists, for scientists
- ProEM®-HS EMCCD cameras – our fastest yet, with single-photon sensitivity
- Patented eXcelon® technology – minimizes etaloning and improves sensitivity

Combined with our award-winning spectroscopy and imaging products, LightField is a game changer, destined to become the benchmark for scientific imaging and spectroscopy software.

Welcome to LightField ...from the world leader in low-light imaging, spectroscopy, and x-ray detection.

LightField is an integral part of the best all-around hardware/software solutions on the market today.

Whether you’re involved in Raman spectroscopy, fluorescence, combustion, quantum imaging, astronomy, or x-ray imaging, you’ll appreciate LightField’s power and flexibility.
Time for a change!

Whether analyzing properties of nanomaterials or observing celestial objects, scientists require the best optical diagnostic tools.

At Princeton Instruments, we believe true innovation comes from a deep understanding of what’s important to researchers. Now there’s LightField. Say farewell to disappointment and frustration. The excitement is here to stay!

We’ve raised the bar.

At the beginning of the LightField design project, Princeton Instruments had a fundamental choice to make... to modify or to invent!

Everything from user experience to performance has been built from the ground up. The result is a powerful software package that performs elegantly and efficiently, creating an ecosystem together with our award-winning spectroscopy and imaging products.

Whether you are working in physical or life science research, LightField provides the flexibility and power to propel your experiment.

The result is nothing less than remarkable!

It’s all about the data.

LightField’s power derives from its simple but surprisingly novel guiding principle: “Provide researchers with reliable data as quickly as possible.”

Reproducibility of experiments is the cornerstone of all research. LightField allows you to recreate any experiment from previously acquired data, with just one click. All system information and settings are stored. No need to take lengthy notes. What’s more, you can quickly differentiate between experiments and settings.
NEW in LightField 5

Powerful Math Engine

LightField is true 64-bit software, which means you can now acquire gigabytes of data. Using its powerful, built-in math engine that processes data as you acquire, LightField can analyze large datasets and provide immediate feedback.

It also automatically exports data as you acquire, in the format of your favorite analysis software package, including TIFF, FITS, ASCII, AVI, IGOR, and Origin, just to name a few.

Quickly monitor the intensity of a spectral peak over time and do the same with a region of interest in an image. Or, select the equation editor to use built-in functions or build your own complex formula. Use the same expression even after the data is acquired.

Integration with LabVIEW® and MATLAB®

A typical experiment requires the integration of hardware and software, often from different vendors.

If you use LabVIEW or MATLAB, LightField makes integration easy, allowing you to command the software directly from whichever program you prefer.

Simply drop the supplied LabVIEW or MATLAB samples into your project and start integrating camera and spectrometer controls immediately. LightField takes care of all the hardware details.
The power of LightField unfolds with a modern, intelligent interface that puts control of your system at your fingertips.

**Drag and Drop Devices**
Yes, simply drag and drop to create your experiment configuration. For spectroscopy, control the light path by directly clicking the mirrors!

**A Virtual Oscilloscope**
A special dashboard appears whenever a compatible PI-MAX4 ICCD camera is connected. Take complete control of gate delays, widths, and trigger input/output signals!

**The Best Bar**
View the status of hardware and acquisition settings at a glance!

**Gray is Great**
LightField's muted gray background minimizes interference with light-sensitive experiments. If complete darkness is required, LightField can automatically turn off monitors during acquisition.
See the Stats
The Online Statistics window gives you a quick overview of key measurements.

All Shall Be Revealed
Want a better look? Use the Image Histogram function to adjust image contrast.

Images Everywhere
Go ahead and work on multiple display monitors! A single image or an entire data viewer can be relocated to a secondary monitor.

LightField allows you to compare live and previously acquired data quickly!
LightField: Your Complete Spectroscopy Solution

LightField is an intelligent and easy-to-use software package loaded with powerful spectroscopy features. This full-feature “command center” gives you complete control of your spectrometer system, camera operation, spectral acquisition, data processing, and more.

LightField is Smart

LightField’s plug-and-play interface makes it easy to add hardware. Simply plug in the USB or GigE cable and LightField automatically adds the device. Unplug the cable and LightField removes the device. When a camera or spectrometer is connected, LightField automatically recognizes Princeton Instruments hardware and sets up all the controls you require.

LightField is Easy To Use

LightField’s intuitive user interface puts system controls at your fingertips. Select experimental controls from the convenient pull-down menus or use “smart search” to find controls you need.

Spectroscopy Settings and Controls:
- Exposure time
- Exposures per frame
- Shutter control
- Sensor temperature
- ADC
- Spectrometer center wavelength
- Step and glue
- Grating selection
- Background correction
- Multiple regions of interest (ROI)
- Formulas
- Wavelength calibration
- Find center wavelength
- Auto-offset calibration
- Trigger in/out
- Time stamping
- SuperSynchro timing for PI-MAX4 ICCDs

LightField puts system controls at your fingertips.

LightField’s interactive system builder
Powerful Data Acquisition and Processing Features

Display Your Data
- Spectra
- Images
- Spectra plus images
- Spectral overlays
- Zoom
- Synchronize spectra with images for dynamic evaluation of your data
- Half-width (FWHM)
- Peak wavelength

Data Statistics
- Peak position
- Maximum intensity
- Intensity under the curve
- Average intensity
- Std. deviation
- Center of mass

LightField Formulas
- Data processing options:
  - Live acquisition
  - Post-processing
- Pre-defined formulas:
  - Absorption
  - Reflectance
  - Transmission
- Create your own formulas with the easy-to-use formula builder

Calibration: LightField includes the tools you need to ensure that your system is precisely calibrated, including automated offset and wavelength calibration across the focal plane.

LightField is also fully compatible with Princeton Instruments’ exclusive IntelliCal® wavelength and intensity calibration system for up to 10x improvement in wavelength accuracy and instrument-independent intensity calibration.
LightField is smart. Just connect your Princeton Instruments camera or spectrograph, launch LightField, and you’re ready to start capturing data. It’s that simple! LightField gives you control of key functions right from the photorealistic graphical interface — an unparalleled user experience.

**New in LightField 5**
The improved “smart search” function quickly directs you to the controls you want as you are typing. You can even build your own custom settings dock to access frequently used settings.

We understand how important your data is. LightField automatically saves every acquisition to your chosen folder and keeps track of all experiment settings in the file header. It even saves your raw data when the post-processing feature is applied.

**New in LightField 5**
LightField can automatically export data into your favorite file format as you acquire it... TIFF, FITS, ASCII, AVI, IGOR, and Origin, just to name a few.

Often, Princeton Instruments cameras and spectrographs are used by multiple researchers in the same lab. LightField provides an easy “experiment setup” save/load function that quickly loads your experiment settings for you. Simply bring up the data file to apply the same system settings that were used previously.

Repeating experiments could not be easier!
5. The power of spectral calibration — IntelliCal

Utilizing NIST-traceable IntelliCal light sources, LightField provides up to 10x more accurate wavelength and intensity calibration, free of instrument/optics bias.

Traditional spectral calibration approaches can be plagued by a host of spectral artifacts. Our intensity calibration routine automatically corrects these artifacts for the broadest spectral range.

6. Friend of LabVIEW® and MATLAB®

New in LightField 5
LightField allows seamless integration of hardware controls and direct data acquisition into National Instruments’ LabVIEW and MathWorks’ MATLAB. No need to master the complexity of hardware control. LightField comes with easy-to-use examples that you can utilize right away.

7. Intensified CCD cameras and LightField — a match made in heaven

When users first encounter LightField’s ICCD camera interface — inspired by a simple “oscilloscope” display — the reaction is nothing short of amazement.

Simply drag and adjust the gating width/delay or design entire time-resolved experiments graphically.

8. Streams data in many formats — even when you’re not there

New in LightField 5
Thanks to its native 64-bit architecture, LightField is not only able to utilize all the memory (RAM) available on your computer, it can stream multi-gigabyte pixel data directly onto the hard drive — all without missing a beat.

LightField can automatically export data as you acquire into your favorite format automatically: TIFF, FITS, ASCII, AVI, IGOR, and Origin, just to name a few.

LightField can send you periodic email updates — very useful if you are running an unattended extended experiment.
TOP 10 Features

9. Compare and contrast

LightField takes data review to a new level. With intuitive controls for spectral overlay, peak find, view, and playback, it is now easier than ever to look back at your data.

New in LightField 5
When you need to review multitudes of images or spectra, a "synchronized" view allows you to quickly compare the same region or peak in two or more datasets.

10. Powerful, yet easy to use

LightField allows complete control of Princeton Instruments cameras and spectrographs.

All available readout modes are supported: frame transfer, kinetics, spectra kinetics (microsecond time resolution), and custom chip (>10 kHz frame rates).

Make it your own!

Customize, customize, customize...

Fancy your own user interface or post-processing tools? Need to integrate LightField with other software packages? No problem. LightField has powerful add-ins and automation features built in so that you can get what you really want. All you need is familiarity with programming languages. We even provide more than 20 examples of add-in programs to get you started!

Add-ins: These are user-written utilities or tools that customize the LightField experience. For example, you can modify/add toolbars and tabs, add post-processing or real-time functions (e.g., filters), or change display types.

Automation: You can run LightField from a third-party software program either in the background or the foreground. This is a convenient way to automate routine tasks from familiar programs.

Software SDK: For OEMs and system integrators, a comprehensive PICAM application programming interface (API) is provided for free. Programmers will love the example programs with source code that we have included in the software development kit (SDK).
Key Features List

Acquisition
- Improved “drag-and-drop” system builder
- Interactive hardware icons
- One-click “quick acquire”
- Single frame / sequence
- Direct-to-hard-drive streaming
- Saturation warning
- Live export (see File Formats section)
- Auto-filename increment
- Time stamp / frame tracking
- No-gap “live-to-store” acquisition
- High-speed acquisition (ProEM only)
- Kinetics / spectra-kinetics readout modes
- EMCCD gain calibration

Supported Hardware
- Spectrographs: SpectraPro®, IsoPlane®, LS-785
- CCD cameras: PIXIS, PyLoN®, Quad-RO, PI-MTE
- EMCCD cameras: ProEM®, ProEM-HS
- ICCD cameras: Pi-MAX®4
- InGaAs cameras: NIRvana®, PyLoN-IR
- Accessories: IntelliCal™ light sources, filter wheels, motorized slits, motorized mirrors

Intensified CCDs (ICCDs and emCCDs)
- “Oscilloscope-like” timing interface
- SuperSynchro / SyncMaster timing
- Sequential / repetitive gating
- Color-matched timing traces
- Gate delay / gate width tracking
- On-CCD accumulations
- RF modulation with random sequence
- DIF (Double Image Feature)
- Intensifier and emCCD gain
- Software safety mode

Math Engine (Live and Post-Process)
- Add / subtract / multiply / divide
- Power / exponential / log / square root
- Minimum / maximum / average / standard deviation / sum
- Background / flatfield / orientation
- Derivative / threshold
- Combine frames
- Fast Fourier Transform / Inverse Fourier Transform
- Software binning
- Pre-built formulas
  - Absorption / reflectance / transmission
  - Pair-wise frames
  - Derivative
  - Formula templates

View / Display
- Streamlined data windows
- Improved “smart search”
- Auto-scale / contrast / brightness
- Pseudocolor
- Pan / zoom
- Display as graph, image, auto
- Spectral overlay
- Live multi-view (simultaneous)
- Multiple-monitor support
- Auto-turnoff of display during acquisition
- Playback
- Synchronized view (pan / zoom)
- Synchronized wavelength / image display
- “Oscilloscope-like” timing interface
  - (Pl-MAX4 only)
- File information

Processing / Corrections
- Background and flatfield
- Cosmic ray removal
- Sensor blemish removal
- Image / spectra orientation
- Cross-section (X-, Y-, Frame-) and extract frames
- Live math (see Math Engine section)
- Online statistics
- Software binning
- Frame combination

Spectroscopy
- Interactive system builder
- Smart auto-detect
- Support for IntelliCal — wavelength and intensity light sources
- Peak find
- Synchronized wavelength / image display
- Spectral overlay
- Save / recall calibration for multiple gratings and multiple users
- Automated grating offset adjustment
- Step-and-glue acquisition over extended wavelength range
- Multiple-fiber / multiple-work spectroscopy

Sharing / Reporting
- Save / load experiment setup
- Recall / apply experiment from SPE file
- Easy comparison of experiment setups
- Experiment updates via email
- Batch export (see File Formats section)
- Copy / paste as text, picture, table
- Shortcut “function” keys

File Formats (Export)
- Princeton Instruments SPE
- CSV text file (csv)
- TIFF (tif)
- FITS (fits)
- AVI (avi), MPEG-4 (mp4)
- Origin® (OriginLab Corporation)
- IGOR text file (txt) [Wavemetrics, Inc.]
- GRAMS™ (Thermo Scientific)
- Batch export supported

Third-Party Software Compatibility
- LabVIEW™ [National Instruments Corporation]
- MATLAB® [The MathWorks, Inc.]
- EPICS synchrotron software
- Microsoft® Excel®, Word, Paint (copy / paste)
- Batch export (see File Formats section)

Operating Systems and SDKs
- Microsoft Windows® 7 / 8 (64 bit)
- PICAM 64 SDK®
- Addin .NET SDK®
- Automation SDK

*Inquire for WoW (Windows-on-Windows) compatibility

**Bold items are new in LightField 5**
## Computer System Requirements

**Supported Operating Systems:**
- Microsoft Windows 7 Professional & Ultimate – 64 bit

**Minimum Requirements:**
- 2 GHz dual-core processor
- 4 GB of RAM
- 2 GB of available hard-disk space required for installation; additional hard-drive space required for data acquisition/storage
- DVD drive
- One or more of the following interface ports:
  - USB 2.0 (for PIXIS, spectrographs, IntelliCal light sources)
  - IEEE-1394a (for Quad-RO)
  - GigE (for ProEM, PI-MAX4, PyLoN)

Specifications are subject to change. Please contact Princeton Instruments or your local Princeton Instruments representative for the latest information pertaining to LightField.

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**Download a FREE evaluation version and view feature-specific videos.**

[www.princetoninstruments.com/lightfield](http://www.princetoninstruments.com/lightfield)

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