FERGIE™

Lever Your Genius

Spectrograph & Accessories Datasheet

Princeton Instruments

FergieSpec.com

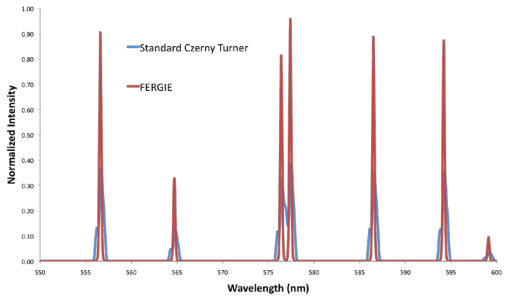
FERGIE

FERGIE is an integrated, aberration-free spectrograph with a built-in, low-noise, cooled detector.

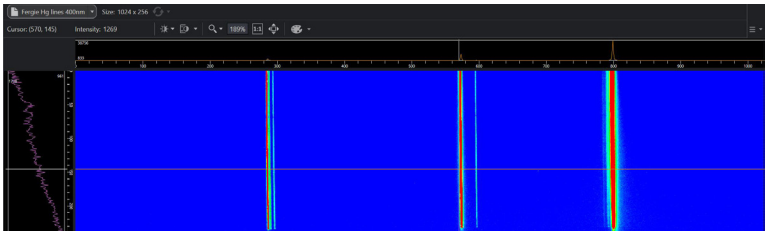
FERGIE has its own specially designed ecosystem of accessories, including elegant light-coupling CUBES, laser sources, fiberoptics, and beautifully designed software.

Aberration-Free Design

No coma, no astigmatism at all wavelengths.



Comparison of spectral data from the optical design of a standard 300 mm Czerny Turner spectrometer and FERGIE.



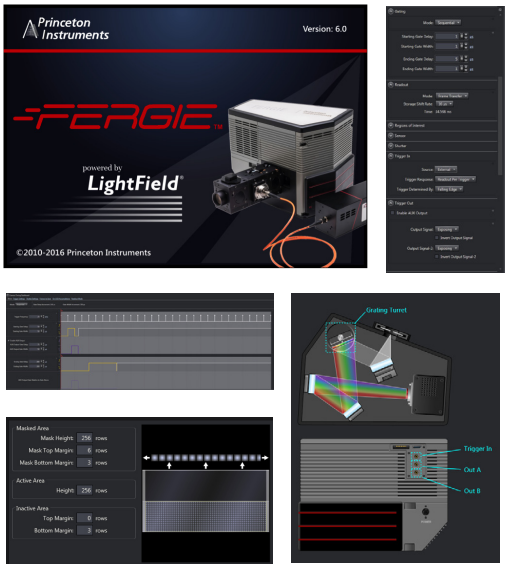
Mercury spectral lines to show aberration-free optical performance of FERGIE.

FERGIE Ecosystem

FERGIE is much more than a spectrograph. It's meticulously engineered ecosystem includes CUBEs, lasers, probes, fiberoptics and more...

FERGIE Software

While FERGIE successfully distinguishes itself with innovative hardware, the beautifully designed software orchestrates all inner workings and makes it a pleasure to use the system day in and day out!



revA3

Features and Benefits

The FERGIE compact, imaging spectrograph addresses many spectral ranges with high sensitivity and low noise - all with a footprint smaller than your lab notebook! A plurality of complex experiments for a wide range of applications can be assembled on top of a desk. For example, a typical Raman spectrum experiment that used to take hours to set up now can be completed in fewer than 90 seconds. FERGIE compares well with longer focal length, physically larger spectrographs with its spectral resolution at 0.16 nm*. Its diffraction limited imaging allows for hyperspectral imaging and multi-channel spectroscopy, with wavelength coverage ranges from 200-1100 nm. For out of the box experience, FERGIE comes fully loaded with full-featured FERGIE software powered by the acclaimed LightField package.

FEATURE	BENEFITS
Custom, aberration-free optical design	Spectral profiles are completely free from coma and other aberrations which in all other mirror based spectrographs results in broadened asymmetric peak profiles.
Perfect imaging performance	FERGIE's proprietary optical design produces diffraction limited images ideal for microspectroscopy applications at wavelengths ranging from the UV to NIR.
Enabling line of accessories	FERGIE's optical input is specifically designed to integrate with Princeton Instruments modular spectroscopy cubes. Spectroscopy cubes enable rapid experiment design with minimal alignment.
Integrated TE cooled, back-illuminated CCD	Extremely high sensitivity with peak quantum efficiency of 95%. TE cooling down to -45° C allows long integration times for detecting faint signals.
Frame transfer CCD architecture	High speed frame transfer CCD detector captures full frame images at 34 frames/sec and spectral rates over 1 kHz (binning 10 rows).
Internal FPGA-based timing generator	FERGIE's internal timing generator with 10 ns resolution makes time resolved spectroscopy nearly turnkey. Two pulse width and delay outputs and one logic input are fully software configurable through an intuitive graphical interface.
Kinetics spectroscopy mode	Custom kinetics readout modes are software configurable allowing microsecond time resolution.
FERGIE software powered by LightField® Windows 10/8/7, 64 bit	Flexible and intuitive software for data acquisition and analysis is included with FERGIE delivering a complete solution that works right out of the box.
High speed USB 3.0	Plug-and-play operation with desktop work stations or laptops

Applications:
Raman, Absorption/Transmission, Microspectroscopy, Time-Resolved Spectroscopy, Fluorescence, and more.

revA3

FERGIE Specs

Model	FER-SCI-BRX	FER-SCI-BX
Sensor type	PI proprietary back-illuminated, deep depletion, frame transfer sensor with eXcelon® and UV coating	PI proprietary back-illuminated, frame transfer sensor with eXcelon® and UV coating
Sensor format	1024 x 256 (1024 x 512 including frame-transfer storage area)	
Focal length	80.8	
Aperture ratio	f/4	
Spectral resolution*	0.16 nm at all points in focal plane typ. (0.18 nm max)	0.19 nm at all points in focal plane typ. (0.21 nm max)
Usable wavelength range	400 - 1100 nm with VIS-NIR option 200 - 1100 nm with UV-NIR option *See Ordering Information for more details*	
Single-exposure wavelength range	540 nm with 295 g/mm grating 268 nm with 600 g/mm grating 135 nm with 1200 g/mm grating *Entire usable range is accessible using computer-controlled, rotatable grating*	
Spatial resolution	38.5 lp/mm @50% contrast over entire focal plane (Nyquist limited)	
Grating mount	Interchangable, rotatable single-grating turret	
Astigmatism/coma aberation	Zero at all wavelengths, grating angles over entire focal plane	
Slits	10, 25, 50, 100, 150, 200, 300, 500 µm; 3.3 mm tall Interchangeable, laser-cut slits	
Wavelenth accuracy*	0.26 nm	
Wavelenth repeatability*	0.13 nm	
Deepest cooling temperature	–45°C guaranteed (specified at ambient temperature of +20°C)	
Maximum integration time**	14.0 minutes	Hours
System read noise	7-10 e- rms @ 1 MHz 20 e- rms @ 5 MHz	
Vertical shift rate	5.6 µsec/row to 35 µsec/row (programmable)	15.2 µsec/row to 95 µsec/row (programmable)
Spectral rate (continuous)	292 spectra/sec (full vertical bin)	124 spectra/sec (full vertical bin)
Spectral rate (burst mode)	>10,000 spectra/sec (spectral kinetics mode with 10 rows binned)	>5,000 spectra/sec (spectral kinetics mode with 10 rows binned)
Non-linearity	<1% @ 1 MHz	
Software selectable gains	1.5 e-/ADU, 3 e-/ADU (typical) Available at all ADC rates	
Data interface	USB 3.0 (3 m interface cable provided)	
I/O signals	Three MCX coaxial connectors: two trigger out, one trigger in Built-in programmable pulse generator	
Operating environment	+5°C to +30°C non-condensing	

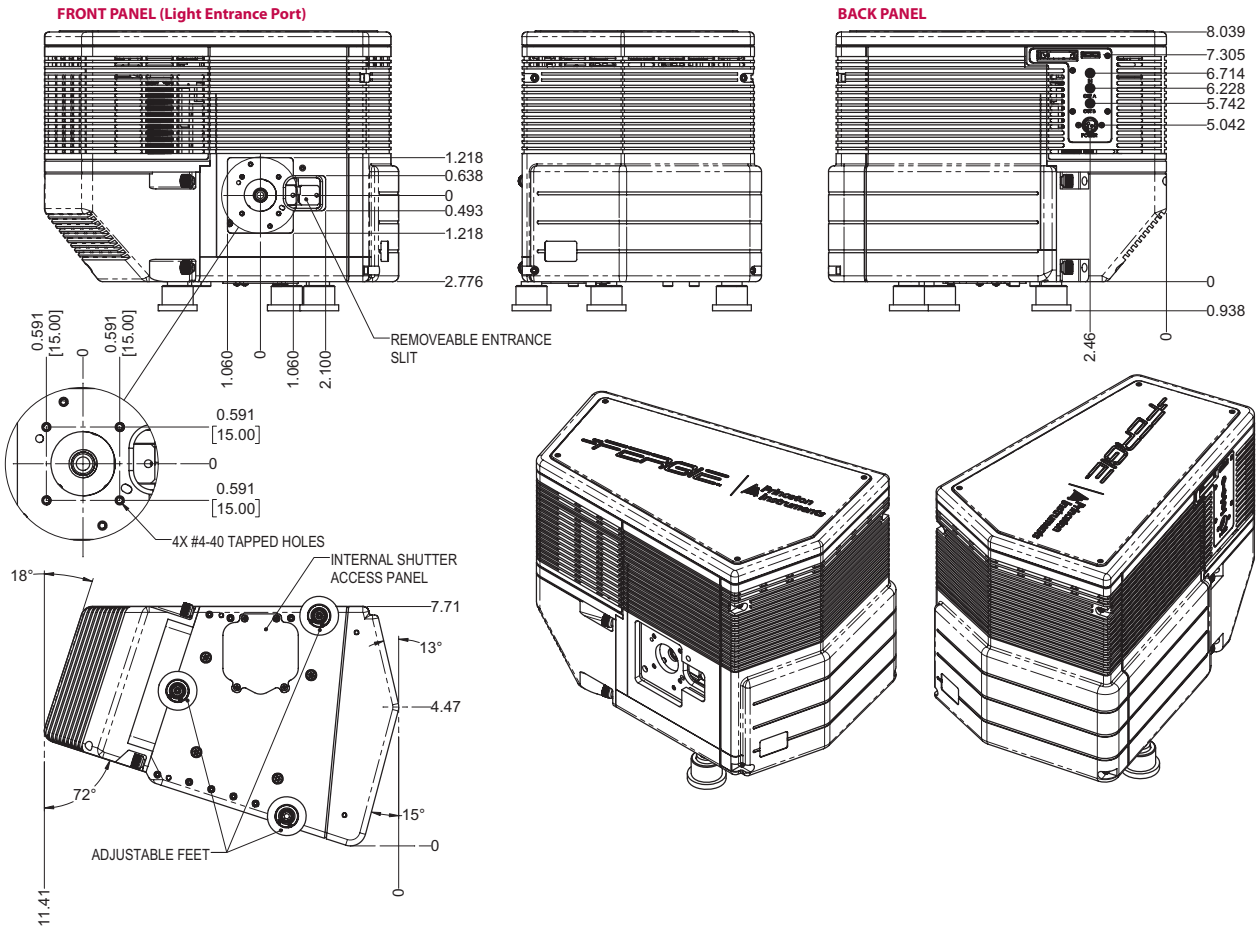
**with 1200 g/mm @ 436 nm*

***50% full well capacity at low gain with 10 rows binning*

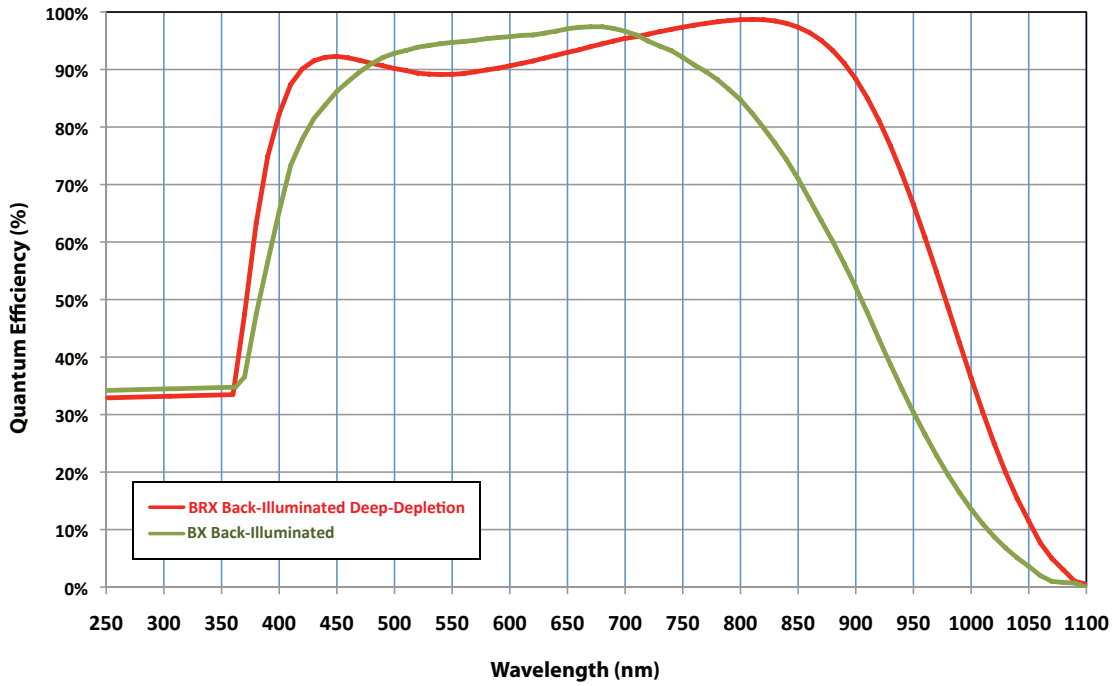
ALL SPECIFICATIONS SUBJECT TO CHANGE. SPECIFICATIONS ARE TYPICAL EXCEPT WHERE NOTED.

revA3

FERGIE Outline Drawings



FERGIE Quantum Efficiency



NOTE: Quantum effieciency curves for eXcelon CCDs with UV enhancement coatings. All FERGIE models have eXcelon and UV coating included.

revA3

FERGIE CUBES

With FERGIE CUBES, interfacing is a cinch! If you've ever spent more time digging through cabinets than conducting your actual experiment, you'll definitely appreciate these CUBES.

- Designed for free space and fiber coupling
- Pre-aligned (stays aligned as more CUBES are added)
- Easy to attach using only a screwdriver
- Compatible with Thorlabs® 30 mm cage system

The following is an initial list of CUBES available with FERGIE. Be sure to check out FergieSpec.com as more CUBES will be added in the future.

CUBE 1: Focusing	Houses an f/4 achromatic doublet lens with precision focusing and translation adjustment to bring light into FERGIE on-axis every time.
CUBE 2: 785 nm Raman Filter	Contains a pre-aligned Princeton Instruments dichroic beam splitter (127 cm^{-1} edge) with a matching OD 6 edge filter and a built-in laser line filter. Raman is now turnkey!
CUBE 3: Sample Chamber	A four-port, two-lens sample chamber designed to house a 12.5 mm cuvette makes measuring liquid-phase samples a breeze. Ideal for Raman, absorbance, and fluorescence spectroscopy.

CUBE 4: Beam Splitter	Contains a precision-aligned 50:50, 70:30, or 90:10 beam splitter cube. Ideal for introducing a witness camera, additional laser line, or absorbance reference line to the optical path. No alignment is necessary. Just connect!
CUBE 5: Filter	Contains an indexing linear slide capable of housing four 1/2 inch diameter filters. Ideal for inserting order-sorting or band-limiting filters into your optical design.

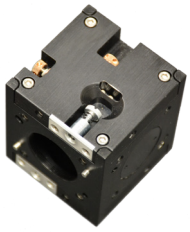
FERGIE Accessories

FERGIE is compatible with a multitude of lasers, fiberoptics, probes and calibration light sources. With optional wavelength (Hg/Ne-Ar) and intensity (QTH) calibration light sources, it's never been easier to acquire accurate and repeatable spectral data. Our new FERGIE software automates the entire calibration procedure to achieve peer-review–worthy data within a matter of minutes.

Say goodbye to manual, post-acquisition data corrections forever!

Wavelength Calibration

Intensity Calibration



revA3

FERGIE Parts List

Part Number	Description
FER-SCI-BX	FERGIE spectrograph: BX back-illuminated eXcelon sensor; CUBE1; SLIT; GRT
FER-SCI-BRX	FERGIE spectrograph: BRX back-illuminated, deep depletion eXcelon sensor; CUBE1; SLIT; GRT
FER-CAL-WL	Ne/Hg-Ar wavelength-calibration reference lamp
FER-CAL-QTH	QTH calibration lamp
FER-CUBE0	Basic CUBE: top/bottom plates for mounting optics
FER-CUBE1-UV	Focusing CUBE: optimized for UV (250 – 425 nm)
FER-CUBE1-VIS	Focusing CUBE: optimized for VIS (400 – 700 nm)
FER-CUBE1-NIR	Focusing CUBE: optimized for NIR (650 – 1050 nm)
FER-CUBE2-785	Raman Filter CUBE: laser line; dichroic; edge filters
FER-CUBE3	Sample Chamber CUBE: 2 lenses; 4 optical ports
FER-CUBE4-50	Beam Splitter CUBE: 50:50; non-polarizing
FER-CUBE4-70	Beam Splitter CUBE: 70:30; non-polarizing
FER-CUBE4-90	Beam Splitter CUBE: 90:10; non-polarizing
FER-CUBE5	Filter CUBE: 4-position linear slide for ½ inch OD filters
Lasers	
FER-LAS-785	FERGIE wavelength-stabilized multimode laser
Fiberoptics	
FER-PROBE-785RAM	FERGIE 785 nm Raman probe
FER-FIBER-LIN	FERGIE linear fiber array: fifty 50 µm fibers; 3 mm tall
FER-FIBER-BI-LIN	FERGIE bifurcated fiber to linear array: 1.5 x 2 mm tall
FER-FIBER-LAS	FERGIE FC/PC: 105 µm fiber for laser excitation
FER-FIBER-PTH	FERGIE FC/PC: 400 µm patch cable
FER-FP-VIS	FERGIE fiber port: couples VIS light into CUBES
FER-FP-NIR	FERGIE fiber port: couples NIR light into CUBES
Slits	
FER-SLIT	FERGIE slit: 10, 25, 50, 100, 150, 200, 300, 500 µm; 3.3 mm tall
Gratings	
FER-GRT	FERGIE grating: mounted and field replaceable; 295 g/mm to 3600 g/mm

revA3

Enquire with factory for additional parts

Ordering Information

Ordering FERGIE is as easy as 1, 2, 3!

1. Select sensor type:

BRX

BRX: back-illuminated, deep depletion, eXcelon sensor
Higher resolution
Faster spectral rate
Superior sensitivity in infrared (750-1100 nm)

or

BX

BX: back-illuminated eXcelon sensor
Lower dark current

2. Select wavelength range:

VIS-NIR

Usable wavelength range: 400 – 1100 nm
Protected silver optics for best throughput
No sensitivity below 400 nm

or

UV-NIR

Usable wavelength range: 190 – 1100 nm
Protected aluminum optics
Larger accesible wavelength range
Less throughput from 400-1100 nm

3. Select grating:

Choose default grating

Grooves / mm	Blaze Wavelength (nm)	Part Number
295	575	FER-GRT-29.5-575
600	500	FER-GRT-060-500
600	750	FER-GRT-060-750
1180	750	FER-GRT-118-750
1200	550	FER-GRT-120-550
1800	250	FER-GRT-180-250
3600	240	FER-GRT-360-240

Optional Accessories:

- Atomic light source for wavelength calibration
- Quartz tungsten halogen (QTH) lamp for intensity calibration
- Field-replaceable gratings
- Slits
- Lasers
- Fiberoptics
- FERGIE CUBES

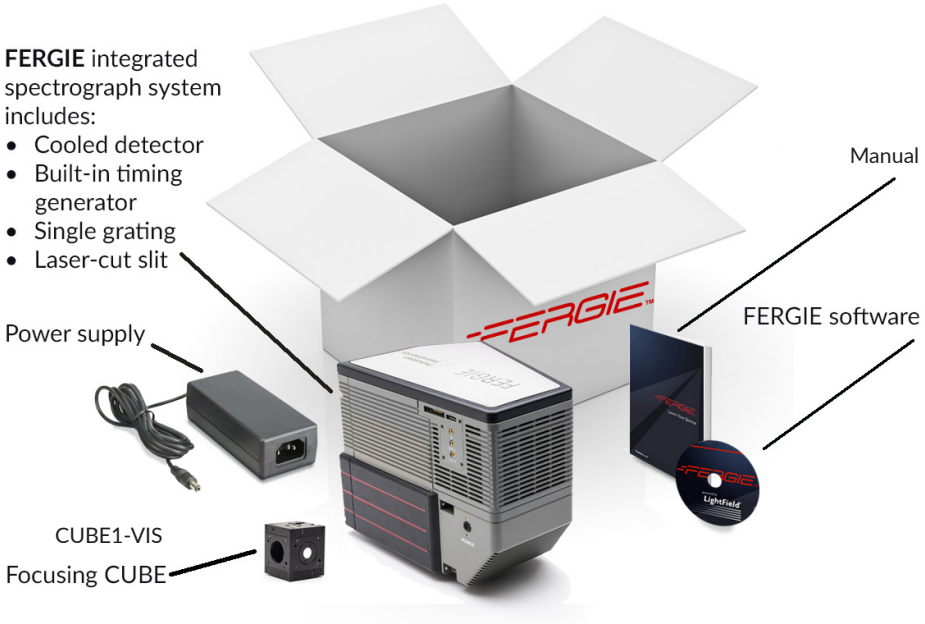
Need help? Send a message to info@FergieSpec.com and a friendly Princeton Instruments representative will be in touch with you shortly!

Contact your sales represenatative to discuss other grating options.

What's in the box?

FERGIE integrated spectrograph system includes:

- Cooled detector
- Built-in timing generator
- Single grating
- Laser-cut slit



revA3

Princeton Instruments

Princeton Instruments - New Jersey
3660 Quakerbridge Road
Trenton, NJ 08619 USA
Tel: +1 609.587.9797
Fax: +1 609.587.1970
info@princetoninstruments.com

Princeton Instruments - Massachusetts
15 Discovery Way
Acton, MA 01720 USA
Tel: +1 978.263.3584
Fax: +1 978.263.5086
info@princetoninstruments.com

China
Princeton Instruments - China
Beijing Office

Room 1001, Sunjoy Mansion
Chaoyang 100020, Beijing, China
Tel: +86 10 6591 6460
Mobile: + 86 185 1862 8083
info_China@princetoninstruments.com

Shanghai Office

Room 601, CENTRAL TOWERS
567 Lan Gao Road
Shanghai, 200333
Tel: +86 21 3377 3532
Mobile: +86 186.2186.5959
info_China@princetoninstruments.com

France
Roper Scientific, SAS

Z.I. Petite Montagne Sud LISSES
8 rue de Forez - C.E. 1702
F-91017 Evry Cedex, France
Tel: +33.1.60.86.03.65
Fax: +33.1.60.86.07.09
info@roperscientific.fr

Germany
Roper Scientific, GmbH

Einsteinstraße 39a
D-82152 Planegg / Martinsried - Germany
Tel: + 49 (0) 89-660 779 3
Fax: + 49 (0) 89-660 779 50
contactus@roperscientific.de

Japan
PI - Japan Regional Office

Nippon Roper, K. K.
Sakurai Building
2-8-19 Fukagawa, Kotu-Ku
Tokyo 135-0033, JAPAN
Tel: +81.3.5639.2741
Fax: +81.3.5639.2775
web_pi_contact@roper.co.jp

Singapore
PI - Asia - Pacific Regional Office

10 Eunos Road 8
Singapore Post Centre #12-06
Singapore 408600

Tel: +65 6408 6240
Fax: +65 6293 3307
pi@roper.com.sg

United Kingdom
Princeton Instruments, UK

25 Nuffield Way
Abingdon, Oxfordshire OX14 1RL
Tel: +44 (0) 7585 676763
info_UK@princetoninstruments.com

FERGIE™
Lever Your Genius

FergieSpec.com

revA3