Beam Profile
Wavelength
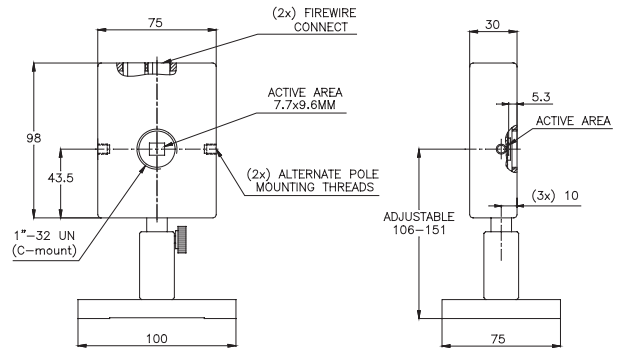# Temporal Profile

BeamStar FX

Firewire CCD Laser Beam Profilers

BeamStar FX 66

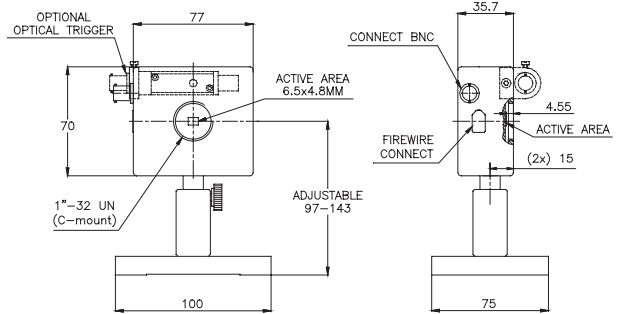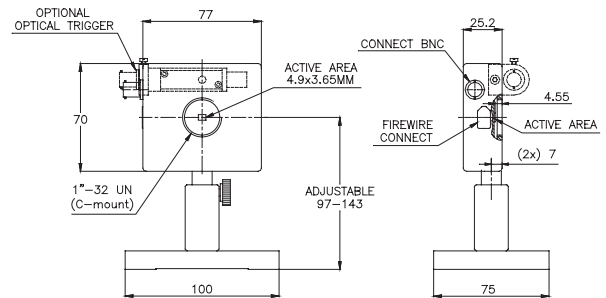BeamStar FX 66 ⅔" Camera

BeamStar FX 50

BeamStar FX 50 with Photodiode trigger

BeamStar FX 50 ½" Camera

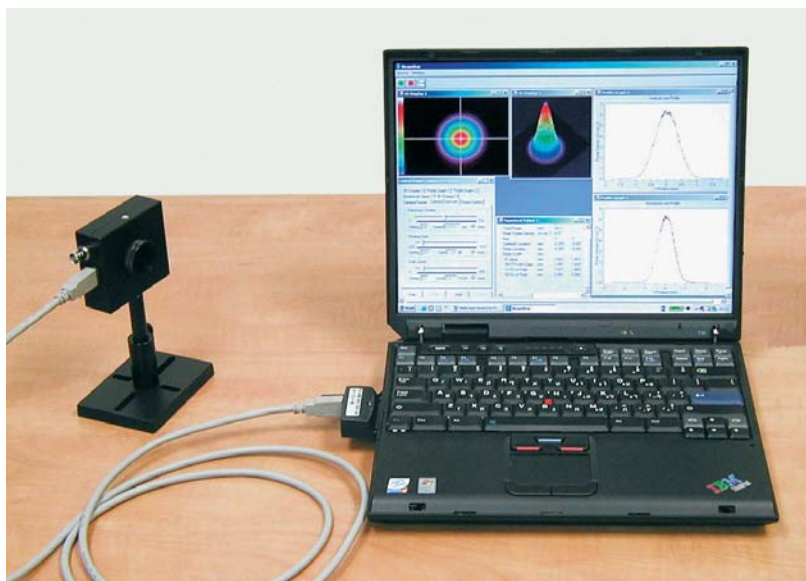BeamStar FX 33

BeamStar FX 33 ⅓" Camera
BeamStar FX 33 ⅓" HD-High Definition Camera

Features

- 10 bit true system dynamic range
- Operates with laptops or desktops equally well
- User friendly - automated gain and shutter control
- Exclusive automated photodiode synch with pulsed lasers
- Spectral ranges: Standard BeamStar: 350-1320nm
                     With UV Converter: 193-360 as well
- User friendly yet sophisticated software for accurate measurement
- Inexpensive firewire interface for multi camera and multi PC operation

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Ophir BeamStar firewire CCD beam profilers provide all you need for beam profiles of both pulsed and CW lasers from μW to Watts. The system consists of a camera, filters, laptop or PC card, software and detailed instructions.

Ophir BeamStar CCD beam profilers have hardware and software features designed to handle pulsed lasers seamlessly. The BeamStar FX 33 and FX 50 series have a trigger input to synchronize with the trigger output from your pulsed laser. In addition, only the Ophir profilers have an exclusive optional photodiode trigger that picks up the scattered laser light and automatically synchronizes with the laser pulses even for nanosecond or shorter pulses. Never has beam profiling been so easy and accurate.

BeamStar FX cameras have automatic continuous shutter and gain control for most accurate measurement and ease of use. The cameras also come with a set of filters, which can easily be mounted and dismounted from the camera. The filter combinations together with the automated gain and shutter control allow effortless measurement of powers from microwatts to watts.

There are a number of accessories available with the BeamStar cameras:

■ The BeamStar U accessories:

These are highly efficient imaging systems that convert UV radiation in the spectral range 193 – 360nm into visible light. They are based on a highly efficient plate that absorbs the UV radiation and reradiates it as visible light. The reradiated light is imaged onto the CCD of the BeamStar FX. The UV plate has a wide dynamic range allowing linear operation of these systems from tens of μJ to hundreds of mJ.
There are 3 versions available: the BeamStar U that reduces the beam size by 4x, allowing UV beams up to 30mm across to be viewed; the BeamStar UX1 that images the beam without change in size and the UV attachment to the 4X beam expander that expands the beam 4X while imaging it.

■ The reimaging 4X beam expander

This is an expanding telescope that images any beam or source at 8mm from the end of the expander onto the BeamStar CCD while enlarging the image 4x. The expander allows the use of the standard BeamStar filters so as to accommodate the camera to a wide range of source intensities. With the beam expander, the effective resolution of the BeamStar is as good as 2μm.

■ The reimaging 4X beam reducer

This is an imaging telescope which takes the profile at the point 30cm in front of the telescope, reduces it by a factor of 4 and images it on the CCD. It is specially designed not to introduce spurious interference effects into the image and to have low aberrations.

■ Various filters and beam splitters are available for reducing the intensity of higher power/energy beams. These allow measurement up to tens of watts. Among the filters is a sliding, continuously variable filter.

The BeamStar software has a wealth of beam analysis features such as:

■ Automatic gain and shutter control
■ Automatic synchronization with pulsed lasers
■ Sophisticated noise and background control
■ Best fit to Gaussian or top hat profile
■ User calibrated power measurement
■ 3 different measures of beam width
■ Numerical data files of profiles
■ Customer set pass/fail criteria
■ M Squared calculation

■ Centroid beam wander screen and tracking
■ 2D contour map with zoom and best-fit ellipse as well as Region of Interest
■ Automation (ActiveX) interface to control BeamStar from your software
■ 3D display viewable from any angle or elevation
■ Store and recall screens in single or video fashion
■ Fully flexible screen format including save configuration
■ Full on line instructions and help
■ Sophisticated report generation including mixed text image reports
■ Beam alignment to XY or major/minor axes

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Examples of Software Features

Main Screen Functions

Sophisticated background subtraction for highest accuracy measurements

Start/stop measurement

Beam Wander screen

Cross hairs for vertical and horizontal profiles. Profile can be linked to cross hair position, centroid, peak or sum profile can be displayed

3D display can be rotated or angled at will. Mouse button-shift moves image, mouse button-alt sizes image. A wealth of display choices is available in the menu

When laser power is entered, the vertical profile graph is shown in meaningful units of W/cm²

Profile graph shows profile chosen in the 2D display. Flexible Ophir system allows user to open as many profile screens as desired and choose X and/or Y profile or sum profile for each. User can even connect several cameras and show profiles from all of them. Shown is the Gaussian fit screen. A top hat fit screen can also be shown
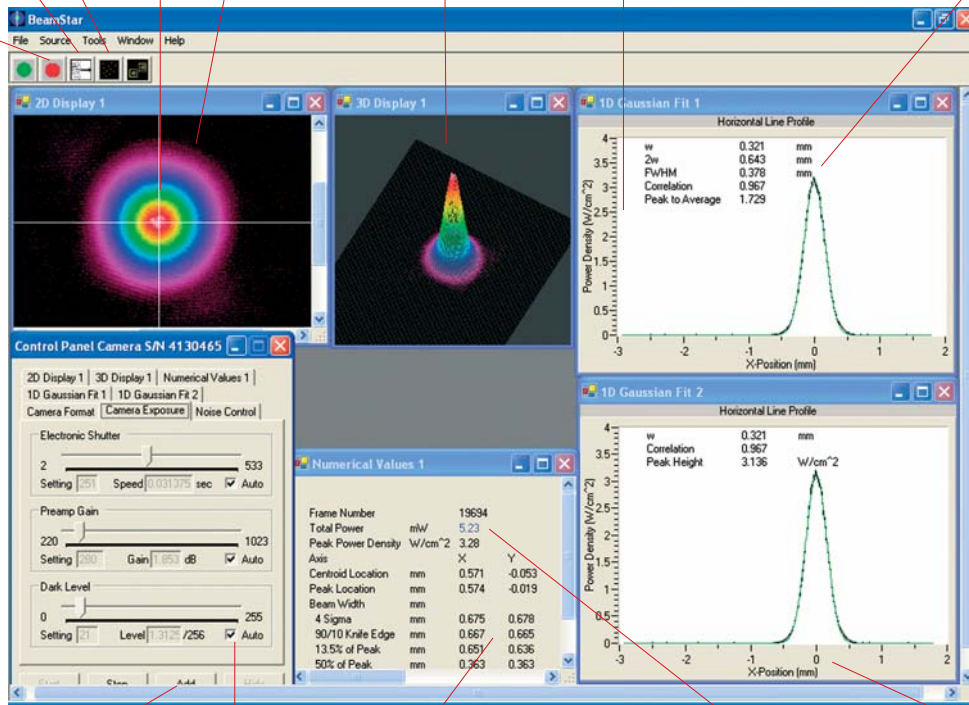
Add button to add additional screens. Ophir's flexible system allows user to totally customize screen even to show different screens for different cameras on same screen

Automated or manual shutter, gain and background control

All numerical values are shown in this compact screen. Note close agreement between 3 different measures of beam width in this unretouched measurement of a HeNe laser

User can click on this and enter laser power. BeamStar will subsequently follow power correctly

Position is centered on CCD center location for ease of use

Description of Some Other Control Pages and Functions

Setup for exclusive Ophir photodiode triggering with no need for connection to laser

Exclusive Ophir pre trigger allows automatic synchronization with even subnanosecond laser pulses
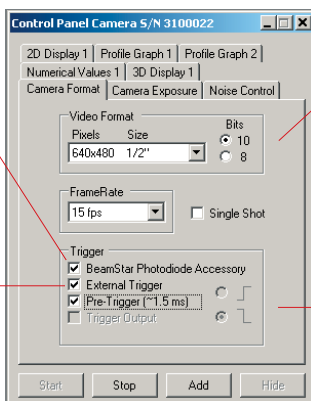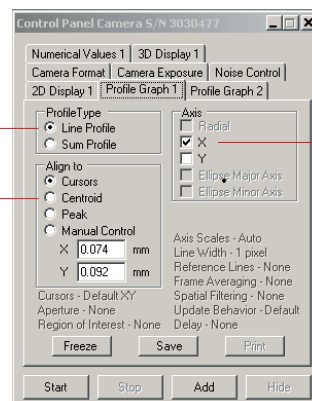
Tailor digital camera format to needs in terms of effective pixel area, dynamic range and pixel density. This allows optimum use of resolution and speed

For pulsed lasers, setup for external electrical trigger or exclusive photodiode self triggering

Choose to display line or sum profiles

With line profiles choose from 3 different reference points or numerical control

Choose whether profile will be x, y or both and whether to align to xy axis or profile axis

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Top Hat Function

Choose which results you wish to display

Pass / Fail

Available for all functions with numerical results. Click on pass/fail and open dialog box

Choose X or Y profile
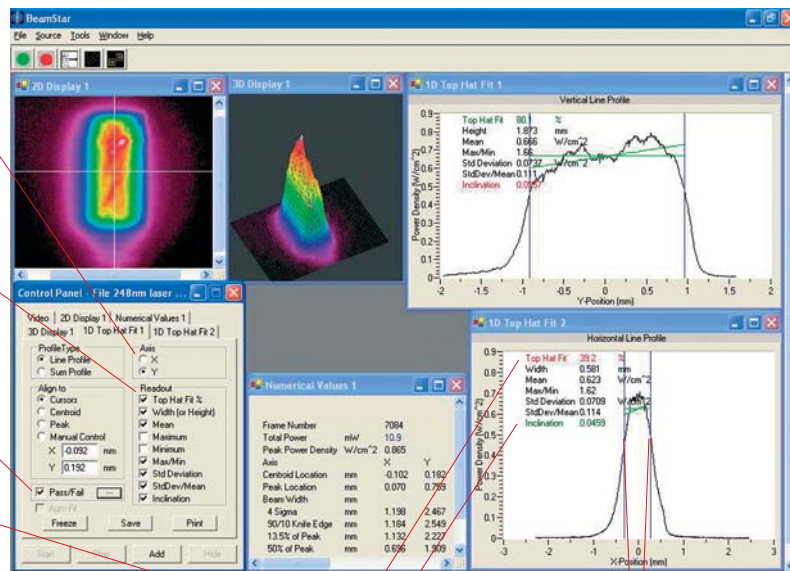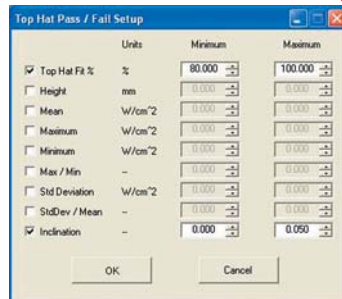
Pass / Fail: values selected in dialog box will show green if pass and red if fail

Top Hat: Choose boundaries for analysis

Major/Minor Axes Alignment and Other Features

Measure the distance from any point to any other point by right clicking on the mouse at the first point, moving to second point then right clicking again.

Mark the position of the peak and centroid on the 2D display

Display can be set to align automatically with major/minor axes of image as well as XY.
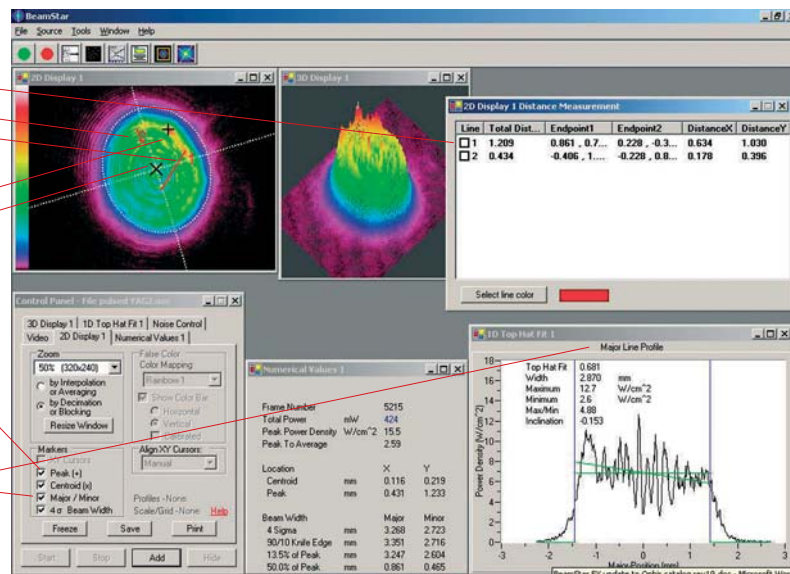
Region of Interest

A region of interest can be selected and then all calculations and pictures will refer only to the selected area. Note how in the picture on the left, the beam width values are meaningless because of the two separate beams while on the right, with region of interest, we get good readings for the beam selected.

The region of interest can also be used to reduce background noise from surrounding areas for small beam and increase measurement accuracy

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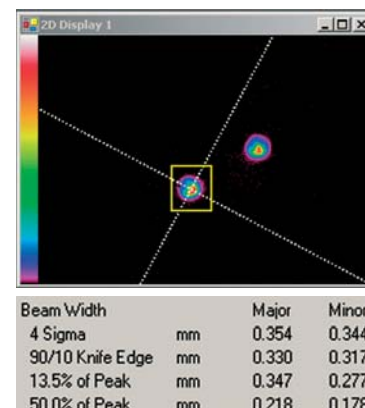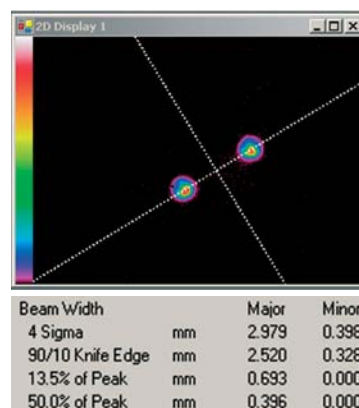
Beam Wander Screen

The BeamStar FX has a sophisticated and easy to use beam wander function allowing you to track and record laser beam position with time.

Choose time limit for measurement

Summary of data shown each period in log file

Concurrent with screen, log data to file in csv or text format
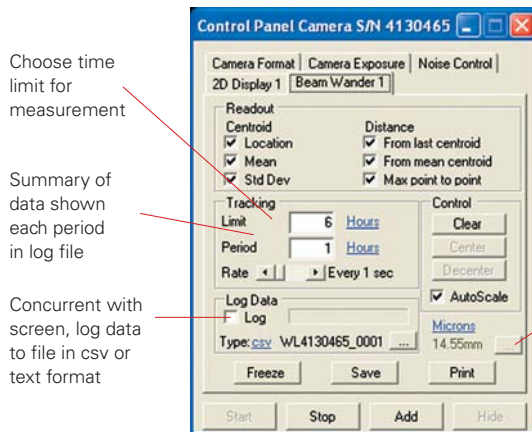
Record data in microns or input distance from source and measure in microradians
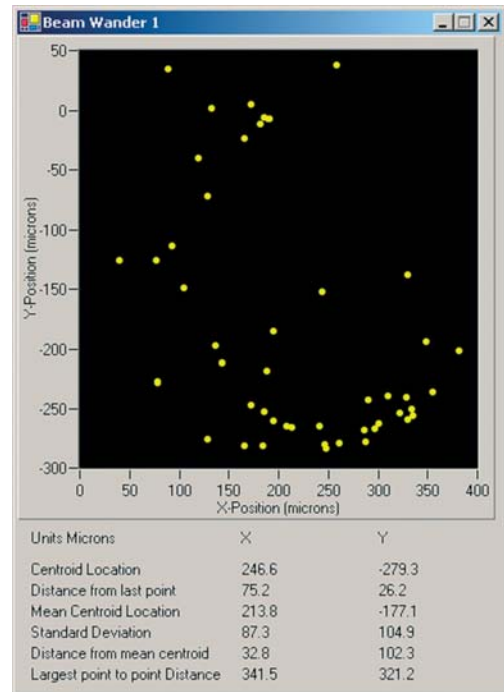
M Squared measurement

You can measure the M² of your laser with high reliability using the BeamStar software.

All you have to do is set up your laser, a focusing lens and the BeamStar camera on an optical rail where you can move the camera and measure its relative position with accuracy.

The M² software does the rest. Step by step it tells you what to do and when you have successfully completed all the measurements required by ISO, it informs you that the measurement is completed.

This M² procedure has been thoroughly tested to give accurate results which are in most cases superior to automated M² measurement systems.

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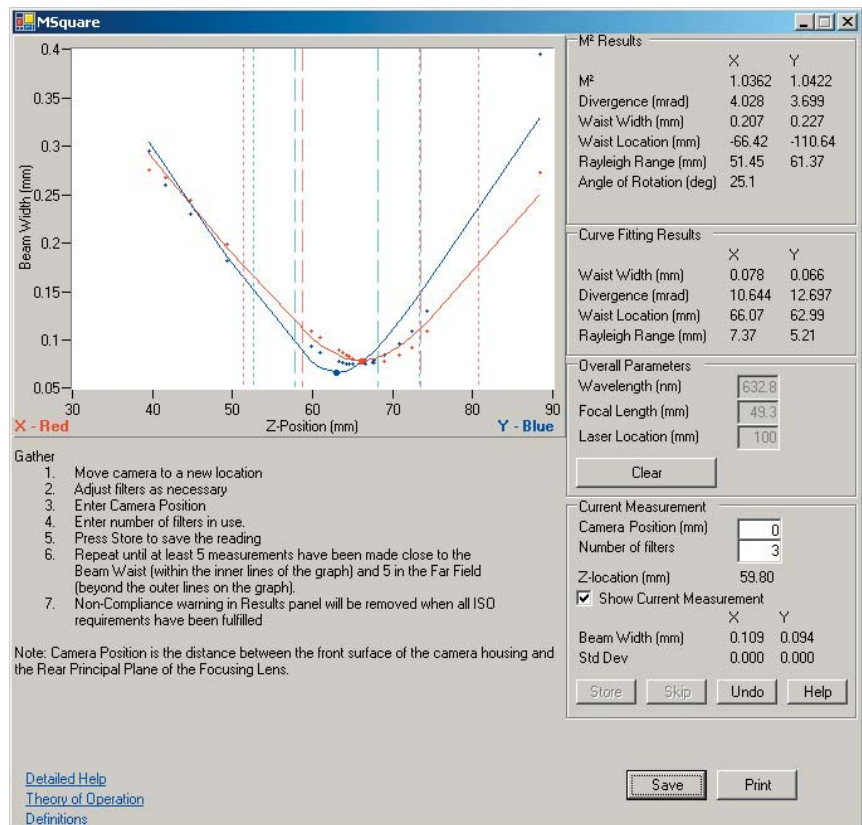
Other BeamStar Products

BeamStar U / BeamStar U X1 accessories for UV lasers
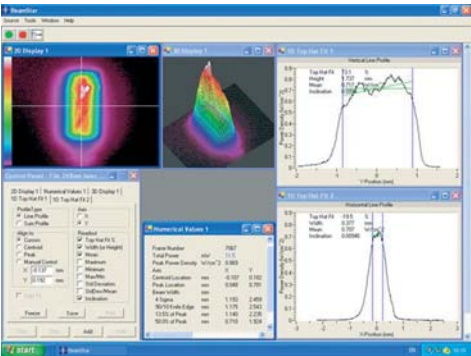
Shown here is a profile of a 248mm Excimer laser beam

The BeamStar U imaging system converts UV radiation into visible and reduces the beam by 4x, allowing UV beams up to 30mm across to be viewed in the spectral range from 193 to 266nm. The BeamStar U X1 for smaller beams is similar to the above but is more compact and does not reduce the beam size.

BeamStar FX with BeamStar U

BeamStar U with Optional Beam Splitter

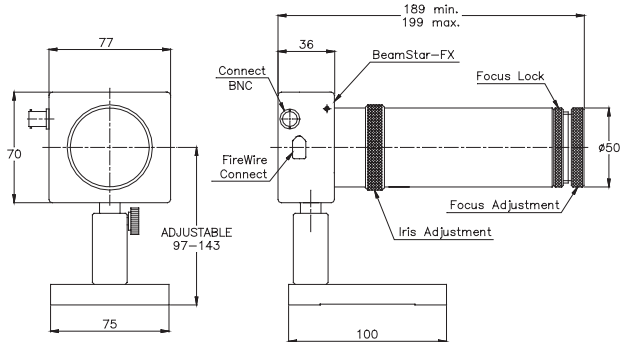| Specifications	BeamStar U	BeamStar U 1X
Beam Reduction	4X ±2%	1X ±2%
Resolution	100μm x 100μm	35μm x 35μm
Spectral Range	193 to 360nm	
Minimum Signal	~50uJ/cm²	
Saturation Intensity	~30mJ/cm² at 193nm, ~15mJ/cm² at 248nm 20 times above values with optional beam splitter	
Effective Aperture	⌀30mm. With BeamStar FX 33 effective aperture is reduced to ⌀20mm due to CCD dimensions	⌀18mm. Effective aperture, however, is limited to the size of the camera CCD (see page 93) since the image magnification is 1:1.
Damage Threshold	100W/cm² or 2J/cm² with beam splitter	
Dimensions	⌀54mm dia x 163mm length	⌀33mm dia x 112mm length

Attenuators and Beam Splitters

The BeamStar FX cameras come with a set of three screw on neutral density filters. These filters are of high quality optically flat glass and are angled to prevent interference effects. Additional filters can be ordered if desired. In addition, a continuously variable filter is available if more control is needed or for even less interference effects than the screw on filters.

If more attenuation is needed, beam splitters can be added in addition. The UV grade fused silica wedge beam splitter fits onto the BeamStar FX and additional wedge beam splitters may be mounted to the first one at right angles as shown. Each beam splitter reduces the intensity of the beam by ~20 times so if the BeamStar FX and its filters can operate with lasers typically up to ~1 Watt, with one beam splitter it can operate up to ~20 Watts and with two beam splitters up to ~400W! Note that even three beam splitters can be mounted in series in this fashion. The damage threshold of the beam splitter is >5J/cm² for 10ns pulses. The beam splitters are mounted over the fixed or variable attenuators with a simple fastening ring and can be oriented in any direction with the beam coming from right, left up or down. The Beam Splitters will operate for wavelengths from 190nm to 2000nm. The wedge angle of 10 degrees insures that only the reflection from the front surface will appear on the camera with no double images. The user must insure that there are beam stops for the transmitted and reflected beams.

Push/pull to vary attenuation

Continuously variable attenuator. Beam splitters or fixed attenuators can be mounted on top of the variable attenuator

Variable Attenuator

Fixed attenuators (3 supplied with camera)

beam path

Beam Splitters
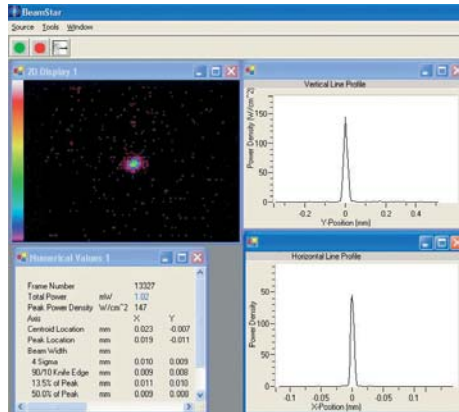
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4X Reimaging Beam Expander

The BeamStar CCD cameras are available with the 4X Beam Expander attachment. This is an expanding telescope that images the beam as it looks at 8mm from the end of the expander onto the BeamStar CCD while enlarging the image 4x. The expander allows the use of the standard BeamStar filters so as to accommodate the camera to a wide range of source intensities. With the beam expander, the effective resolution of the BeamStar is as good as 2 to 3µm.

The 4X Beam expander can also be fitted with a UV converter plate at its object plane so that you can look at small beams in the spectral range 193-360nm and expand them 4X. See ordering information for further details

Shown is an image of the tip of a single mode fiber of 9µm diameter. The beam width as measured on the profiles shows 4X the actual size so we see a resolution of ~ 2µm. With parallel beams, there may be coherence effects that limit the resolution to less than converging-diverging beams.

UV converter assy for 4X Beam Expander

BeamStar FX with 4X Beam Expander

4X Reimaging Beam Reducer

The Ophir 4X Beam Reducer is an imaging system that images the plane 30cm in front of the reducer onto the camera CCD sensor while reducing the size 4 times and inverting it. The beam reducer uses the 3 screw on attenuators provided with the camera. Since the intensity of a beam after reduction will be increased by 4x4=16 times, it is advisable to attenuate the beam more than you would without beam reduction. This can be done with additional external beam splitters and attenuators available from Ophir (see ordering information). Note that the custom designed beam reducer gives better image quality than tapered fibers since it does not introduce graininess or uneven pixel response. Also the image distortion of ~1% is considerably lower than with most tapered fibers.

Shown is an image of an Alexandrite laser with beam diameter of 18mm. As can be seen, it is easily seen with the BeamStar FX50 camera with the 4X beam reducer.
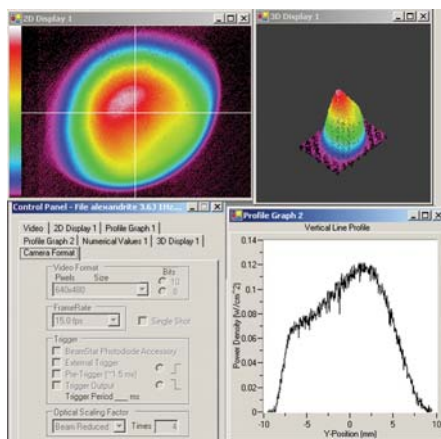
Specifications of 4X beam reducer	
Spectral Range	360nm to 1100nm
Antireflection Coating	Antireflection coating optimized for 1064nm and 532nm
Beam reduction Accuracy	± 3%
Size	Ø60 mm dia x 94mm length
Aperture	50mm
Maximum Beam Size	BeamStar FX 50: 25x19mm, FX 33: 18x14mm, FX 66: 38x31mm
Distortion of Beam	Less than 1% over 80% of diameter

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Specifications of BeamStar Camera as used with Laptop or Desktop PC

Item	Specification			
Camera	**BeamStar FX 66**	**BeamStar FX 50**	**BeamStar FX 33**	**BeamStar FX 33 HD**
Application	**Large beams**	**General purpose**	**Small beams - low cost**	**Small beams high resolution**
Spectral Response:	350 - 1100nm 193 – 360nm with BeamStar U attachment	350 – 1320nm [(2)] 193 – 360nm with BeamStar U attachment	350 – 1100nm 193 – 360nm with BeamStar U ttachment	350 – 1100nm 193 – 360nm with BeamStar U attachment
Maximum beam size:	9.6 mm W x 7.2mm H	6.3 mm W x 4.7 mm H	4.7 mm W x 3.6 mm H	4.8 mm W x 3.6 mm H
Pixel spacing	7.5μm x 7.5μm	9.9μm x 9.9μm	7.4μm x 7.4μm	4.65μm x 4.65μm
Number of effective pixels	1280 x 960 pixels	640 x 480 pixels	640 x 480 pixels	1024 x 768 pixels
Minimum system dynamic range [(1)]	55dB = 600:1 with no averaging. With averaging 65dB=1700:1 or more	60dB = 1000:1 with no averaging. With averaging 70dB=3000:1 or more	60dB = 1000:1 with no averaging. With averaging 70dB=3000:1 or more	60dB = 1000:1 with no averaging. With averaging 70dB=3000:1 or more
Linearity with Power	±6%	±1%	±1%	±1%
Spatial Uniformity	±5%	±0.5%	±0.5%	±0.5%
Accuracy of beam width	±5%	±1% for noise levels <1%		
Frame rates	2.35 to 164 fps, depending on video format	Up to 30 fps (slightly less when synching with external trigger)		Up to 15Hz (slightly less when synching with external trigger)
Shutter duration	From 1/frame rate to 1/2400 s and 1/40000 s depending on video format. Manual or automatic control.	From 1/frame rate to 1/8000s. Manual or continuous automatic control		From 1/frame rate to 1/6000s. Manual or continuous automatic control
Gain control	0dB to 14dB in 64 steps. Manual or automatic control	0dB to 30dB in ~800 steps (each step is ~0.035dB) Manual or automatic control		0dB to 27dB in ~700 steps (each step is ~0.035dB). Manual or automatic control
Trigger	None. Rolling shutter can be synchronized to pulsed lasers by choosing frame rate	1. BNC connector accepts positive or negative trigger signal from 3 to 24V with pulse width 1μs min. LED on camera indicates triggering. Will synchronize with laser repetition rates up to 1KHz but will show frames only to maximum frame rate. Exclusive Ophir pre trigger allows synchronization to even subnanosecond pulses without delay between trigger pulse and laser pulse. 2. Same connector can be software configured to provide trigger out to synch laser 3. Same connector can accept photodiode trigger (see below)		
Photodiode trigger	NA	Optional photodiode trigger plugs into BNC input on camera, picks up scattered laser light and synchronizes camera automatically with laser. Min peak power necessary is ~300μW/cm² at 500nm. Photodiode unit can clip onto camera or be mounted at a distance on a stand. Photodiode trigger will synch camera regardless of laser pulse duration – even for ns or shorter pulses. Max laser frequency for automatic triggering is 500Hz		
Lowest measurable signal:	~40nW/cm² at 600nm.	~5nW/cm² at 600nm [(2).]	~15nW/cm² at 600nm	~40nW/cm² at 600nm
Saturation intensity	~0.5mW/cm² / 1μJ/cm² with no filters installed. With filters installed, this value will increase by a factor of 2x10^4 to 10^ 6 depending on wavelength	~0.1mW/cm² / 1μJ/cm² with no filters installed. With filters installed, this value will increase by a factor of 2x10^4 to 10^ 6 depending on wavelength	~0.1mW/cm² / 1μJ/cm² with no filters installed. With filters installed, this value will increase by a factor of 2x10^4 to 10^ 6 depending on wavelength	~0.5mW/cm² / 1μJ/cm² with no filters installed. With filters installed, this value will increase by a factor of 2x10^4 to 10^ 6 depending on wavelength
Damage threshold	50W/cm² / 1J/cm² with all filters installed			
Dimensions:	75mm x 98mm x 30mm	77mm x 70mm x 35.7mm	77mm x 70mm x 25.2mm	
Operation mode:	CMOS rolling mode	Interline CCD image transfer		
Screw on accessories included	2 - 1mm thick 50:1 ND filters in housing 1 - 1mm thick 10:1 ND filter in housing			
PC interface	PCI (for desktop) or Cardbus (for laptop) IEEE 1394 Firewire Interface. For laptop operation, an external wall plug power supply (supplied with unit) must be attached to the CardBus adapter			
Minimum host system requirements	Pentium-4 1.7GHz (>2GHz for best performance), 256 MB Memory, IEEE 1394 Interface Requires PCI or CardBus Slot. Operating system, Windows 2000 or XP			

(1)   Some vendors claim as much as 14 bit dynamic range but this usually refers to the A/D card dynamic range and not the total system dynamic range including the camera which is usually on the order of 55 – 60dB.

(2)   Useable at 1300nm but with very low sensitivity. Lowest measurable signal ~ 100mW/cm². Recommended to be used with short wavelength blocking filter Ophir P/N 1Z08242.

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| Item	Description	Ophir P/N
Beam Profiler Systems		
BeamStar FX 66 camera with software	BeamStar FX 66 camera with software, Firewire cable, stand and filters. Needs PCI or cardbus interface below	1Z02560
BeamStar FX 50 camera with software	BeamStar FX 50 camera with software, Firewire cable, stand and filters. Needs PCI or cardbus interface below	1Z02561
BeamStar FX 33 camera with software	BeamStar FX 33 camera with software, Firewire cable, stand and filters. Needs PCI or cardbus interface below	1Z02562
BeamStar FX 33 HD camera with software	BeamStar FX 33 HD camera with software, Firewire cable, stand and filters. Needs PCI or cardbus interface below	1Z02565
Firewire Accessories		
PCI IEEE 1394 Firewire card assembly for desktop computers	PCI Firewire card for installation to desktop PC	1E10006
Cardbus IEEE 1394 Firewire card for laptop computers	Cardbus Firewire card for installation to laptop. Includes wall cube power supply which plugs into card	1Z11504
4.5 meter Firewire cable	Special long 4.5 meter length Firewire cable	1E01132
Power supply and adapter	Wall cube power supply and interface to provide camera power when user has a built in laptop firewire port	1Z17014
Accessories		
Optical trigger assembly for BeamStar FX 50 and FX33 series	Optical trigger assembly which can be mounted on head or separately to sense laser pulses and synchronize camera with pulses. Comes with short BNC cable to for mounting on camera and a stand for mounting separately.	1Z17005
Beam Splitter for mounting on BeamStar FX cameras	45 degree angle wedge beam splitter for BeamStar FX which mounts onto camera. Reduces beam intensity by ~20 times. For spectral range 190 - 2500nm	1Z17015
Additional beam splitters for mounting to previous beam splitter	Additional wedge beam splitter as above which mounts at right angles to previous beam splitter. As many as 3 beam splitters can be mounted in this fashion in series, each one reducing intensity by ~20 times.	1Z17016
BeamStar U-V1 range extender/beam reducer for BeamStar FX cameras	Screw on telescope for BeamStar that both sensitizes unit to spectral range 193 – 360nm and reduces beam by a factor of 4. For beam intensities from $50\mu J/cm^2$ to $10mJ/cm^2$	1Z02564
Beam splitter for BeamStar U	45 degree wedged beam splitter to reduce intensities on BeamStar U by ~20X. For beam intensities of up to $300mJ/cm^2$ at 193nm	1Z17007
BeamStar U 1X range extender for BeamStar FX cameras	Same as BeamStar U-V1 but with no reduction in beam size.	1Z02569
Beam splitter for BeamStar U X1	45 degree wedged beam splitter to reduce intensities on BeamStar U X1 by ~20X. For beam intensities of up to $300mJ/cm^2$ at 193nm	1Z17015
4X reimaging beam expander for BeamStar	Screw optical assembly that images the plane 8 mm in front of the expander onto the CCD while enlarging it 4X.	1Z17009
Fiber adapter bracket for 4X beam expander	Screw on bracket to use with Ophir fiber adapters so fiber is held in correct position to image fiber tip onto camera. Will give exact focus with FC type fiber. See page 101 for FC fiber adapter.	1G01649
UV converter assembly for 4X beam expander	Screw on assembly which has UV plate that converts 193 – 360nm radiation to visible. This plate is at the object plane of the 4X expander so it produces a 4X enlarged image on the CCD	1Z17019
4X reimaging beam reducer for BeamStar FX	Screw on beam reducer for beams in the wavelength region 360 – 1100nm that reimages the beam 30cm in front of the unit onto the CCD while reducing the beam size 4X. Entrance aperture is 50mm	1Z17017
Large wedge beam splitter	Large size wedge beam splitter for BeamStar FX which mounts to standard ¼" thread ½" laboratory rod. Reduces beam intensity by ~20 times. For spectral range 190 - 2500nm. Especially for 4X beam reducer	1Z17018
Filters and Fiber Adapters		
Filter holder and 50x50 filter set	Filter holder with set of 4 standard Schott 50X50mm neutral density filters. Useful to reduce intensity before inputting into 4X beam reducer. Mounts to standard ¼" thread, ½" diameter laboratory rod.	1Z08240
Additional 2% transmission filter for BeamStar	Screw on filter for BeamStar or BeamStar 1500 camera with transmission of between 7% and 0.5% depending on spectral range. Two filters are included with camera	1Z08235
Additional 10% transmission filter for BeamStar	Screw on filter for BeamStar or BeamStar 1500 camera with transmission of between 20% and 5% depending on spectral range. One filter is included with camera	1Z08234
Variable attenuator	Continuously variable attenuator for complete control over beam intensity. Especially useful for pulsed lasers. Varies the intensity over more than 4 orders of magnitude between wavelengths 350nm and 1100nm. Mounts to all BeamStar FX cameras	1Z17012
Fiber Adapters	For fiber adapters see page 101	
Filter for 1300nm	The BeamStar FX50 can operate at 1300nm but is quite insensitive there. This filter filters out all light below 1200nm to allow viewing 1300nm radiation without background interference	1Z08242
Filter for 355nm-V2	The BeamStar FX series can see the 355nm 3rd harmonic radiation of YAG. The YAG however usually emits some light at 532nm and 1064nm as well. This filter filters out the other 2 wavelengths to give an undistorted image of the 355nm light	1Z08246

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WaveStar

CCD Laser Spectrum Analyzer
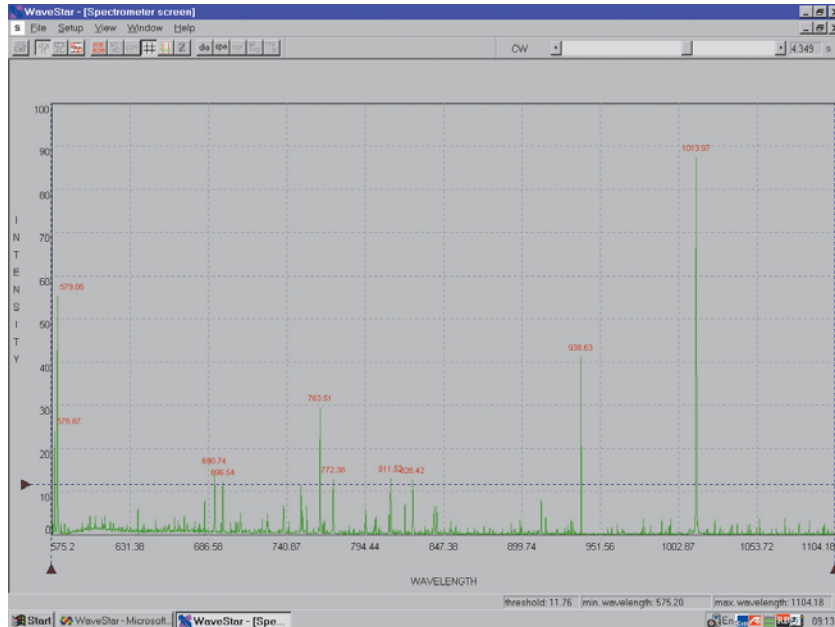
- Unprecedented resolution for a CCD spectrometer - 0.5nm FWHM

- Automatically finds and tags peak wavelengths to 0.1nm accuracy

- Self-contained - plugs into parallel port - no PC card necessary

- WaveStar V 570 -1070nm, WaveStar U 360 -625nm

- Photodiode trigger to capture single shot events

- Complete set of fiber adapters and attenuators available

- True NIST traceable intensity vs. wavelength display

- Active X software included for controlling WaveStar from your software

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The Ophir WaveStar introduces a new level of accuracy and ease in spectral measurements. Just plug into your PC parallel port, install the software and easily and accurately measure spectra from a wide variety of sources including continuous and pulsed sources from microwatts to watts in intensity. The WaveStar program automatically tags the peaks with the wavelength so the result is readily available.

The WaveStar is available with interchangeable filters which together with the variable shutter speed allow you to easily and accurately measure any type of source from fractions of a microwatt to watts in intensity. Fiber adapters are available to connect to fiber sources. The WaveStar has up to four times higher resolution than similar competing instruments due to its innovative optical design (patent applied for). Its sophisticated peak interpolation algorithms allow you to find the peak wavelengths of lines at up to 10 times the accuracy of competing instruments and with greater ease. The built-in intensity calibration insures that the relative intensity vs. wavelength gives an accurate relative curve. This is especially important when measuring broadband sources such as lamps.
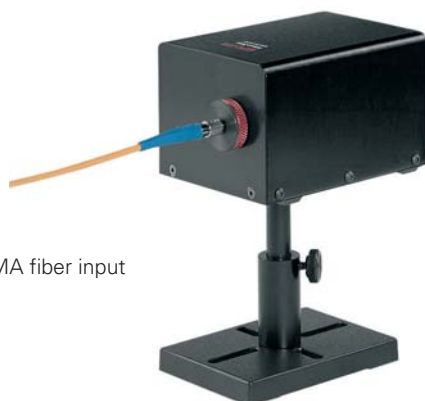
WaveStar with SMA fiber input

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Specifications of WaveStar U and WaveStar V

| Detector	3000 element CCD
Optics	Proprietary optical design
Spectral response	WaveStar-V 570 -1070nm
	WaveStar-U 360 -625nm
Wavelength resolution	FWHM 0.5nm
Wavelength peak detection	Proprietary algorithm interpolates pixels and tags peaks with the wavelength value to an accuracy of 0.1nm. The FWHM of each peak is also shown if desired.
Mounting thread	1/4" threaded mounting hole
Intensity vs.wavelength	The intensity display is corrected for variations in system sensitivity with wavelength to give a relative intensity accuracy of ±10% over spectral region
Dimensions	80mm x 70mm x 100mm
Optional accessories	SMA fiber adapter, diffusers, ND filters
Connections to PC	Connects to standard parallel port via 3 meter cable. No hardware installation in PC necessary.
Trigger	Photodiode trigger allows capture of single shot events.
Minimum host system requirements	Pentium 200 32MB RAM 10MB HD free, Windows 2000, XP, 2MB 16bit color VGA card one free parallel port.
Performance with pulsed sources	Operates with continuous or pulsed sources at pulse rates from <1Hz up. Special trigger photodiode allows measurement of single pulse events.
Temperature dependence	0.025nm/degC

Examples of Software Features

Intensity is corrected for variations in detector sensitivity so spectral curve intensity is proportionally correct

Zoom button blows up wavelength range selected with vertical bars below

Data log with time of peak wavelengths and FWHM

Continuously variable shutter speed from 28µs to 7.3s – a dynamic range of >100,000:1

Automatically tags all peaks with the center wavelength to an accuracy of ±0.1nm. Will show FWHM as well if desired
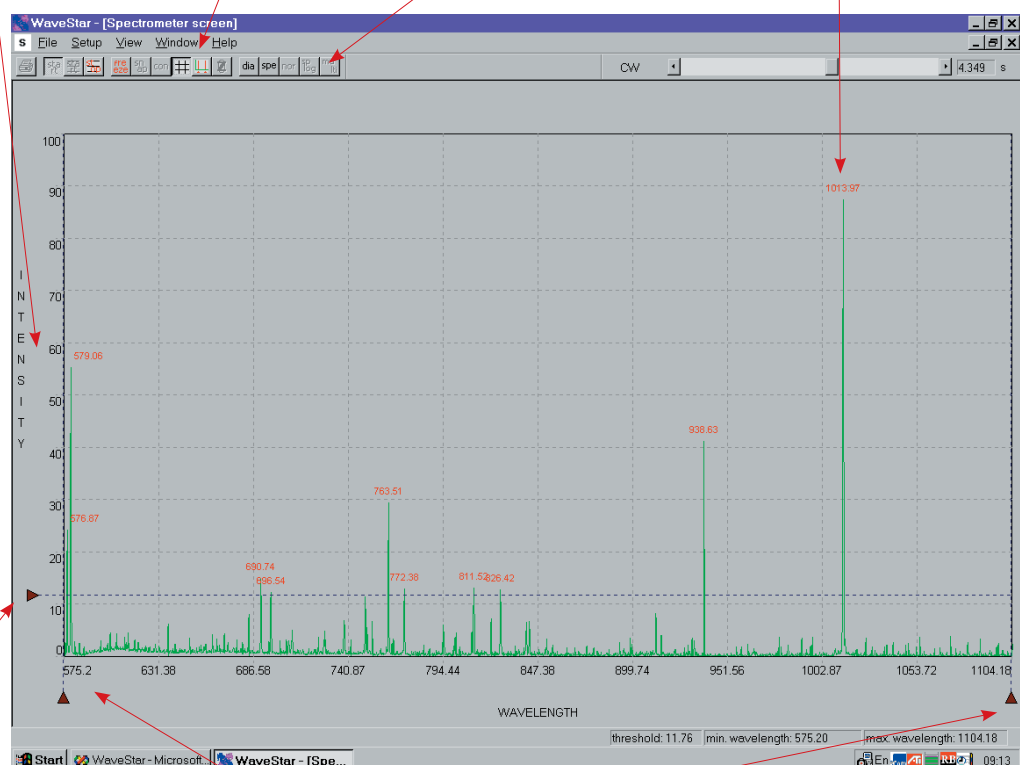
Horizontal bar determines threshold for displaying peak wavelength and FWHM so as not to clutter screen with unwanted data
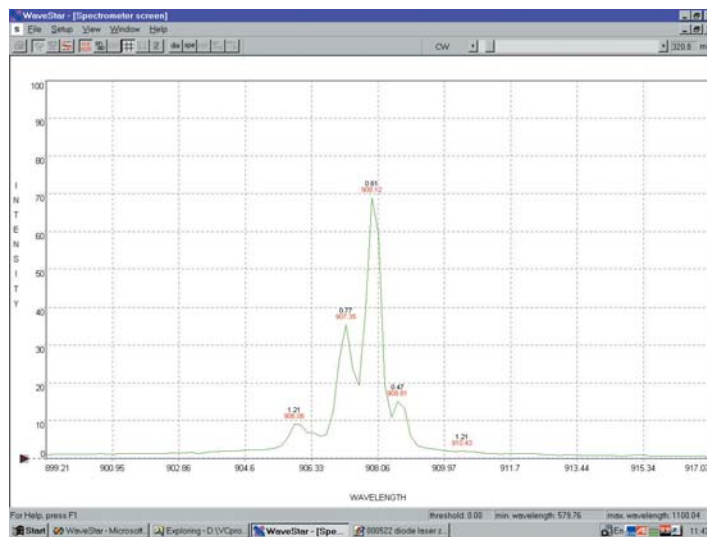
Vertical bars select wavelength region of interest for displaying wavelength and FWHM values and zooming with zoom button

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Example of Expanded Wavelength Scale

The first screen shows the spectrum of a pulsed diode laser where the user has selected the region to zoom with the mouse.
The second screen shows the zoomed picture from the selected region.
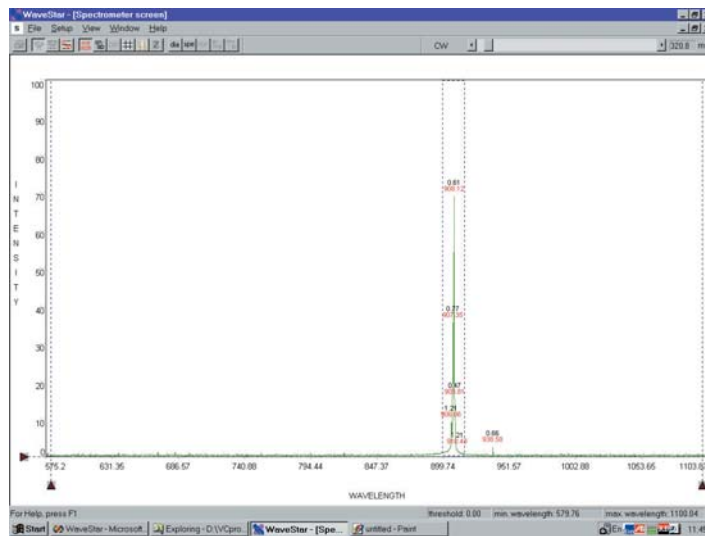

The screen below shows the zoomed region selected in the first screen. Note the resolution of the spectrometer, where the laser longitudinal modes spaced at 1nm intervals are clearly shown. In this view, the FWHM as well as the wavelength is displayed above each peak.

Ordering Information		
Item	**Description**	**Ophir P/N**
WaveStar V unit for 570-1070nm	Complete ready to install system including head, stand, cables, power supply and software	1Z02550
WaveStar U unit for 360-625nm	Complete ready to install system including head, stand, cables, power supply and software	1Z02551
Adapter for SMA fiber input to WaveStar	Adapter for SMA fiber input to WaveStar. For other adapters see page 101	1G01236
Lens assembly for focusing fiber input onto WaveStar slit	For weak signals (below ~100nW for narrow band source, more for broadband source) lens assembly to focus output onto slit. To be purchased together with SMA fiber adapter	1Z08205
Screw-on 50:1 filter for WaveStar	Screw-on filter for WaveStar with attenuation of between 50:1 and 200:1 depending on spectral range	1Z08201
Screw-on 10:1 filter for WaveStar	Screw-on filter for WaveStar with attenuation of between 10:1 and 20:1 depending on spectral range	1Z08200

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Fast Photodetector Model FPS-10

- 2 operation modes – fast and amplified
- Fast mode – 6ns response time, x1 gain
- Amplified mode – 300ns response time, x250 gain
- Spectral range 193nm to 1100nm
- Rechargeable battery inside power supply unit
- Comes with stackable filters to accommodate various laser intensities
- Can be used with fiber input
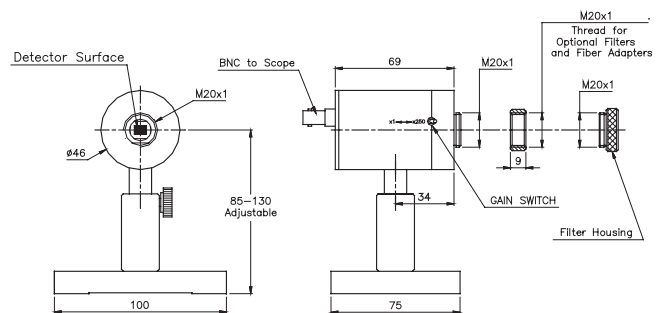
Description

The FPS-10 fast photodetector is designed to measure the temporal behavior of pulsed lasers. The sophisticated high speed circuitry in

the FPS-10 has two modes of operation:

1. x1 gain with 6ns response time for very short pulses with high peak power

2. x250 gain for longer lower peak power pulses.

The FPS-10 comes with additional filters to adjust the sensitivity to the power level of the source. It also comes with a stand and base.

Fiber adapters for the head are also available.

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Specifications of the FPS-10 Fast Photodetector

Detector:	Silicon photodiode	
Spectral range:	0.19 – 1.1µm	
Detector aperture:	4mm	
Performance specifications:	x1 gain	x250 gain
Risetime:	6ns	300ns
Output sensitivity approx (630nm):	20mV/mW Into 50 ohm	10V/mW into 1M ohm
Noise level:	10nW	0.2µW
Input connections:	Direct from laser or from fiber optic cable	
Input adapters:	Accepts standard Ophir SMA and FC adapters and neutral density attenuators.	
Attenuation:	Accepts standard Ophir x10 and x50 ND attenuators. Attenuators may be stacked. One attenuator of each type is included with FPS-10.	
Output connection:	Output: BNC	
Power supply unit:	Power unit is connected to head by telephone cable and runs from rechargeable batteries. Operates 13 hours from batteries before recharge. Wall cube charger is supplied with system.	
Supplied accessories:	Rod and stand, 1-x50 attenuator and 1-x10 attenuator.	
Dimensions:	Head dimensions 46mm dia x 90mm deep	

Ordering Information		
Item	Description	Ophir P/N
FPS-10 Fast Photodetector system	FPS-10 head with power supply and connecting cables. Comes with 1 each of the filters below	18024
Extra x10 filter	ND filter. Attenuation from x10 to x20 from 400-1100nm	1Z08200
Extra x50 filter	ND filter. Attenuation from x50 to x200 from 450-1100nm	1Z08201

Ordering Information for Fiber Adapters							
Instrument	Instrument P/N	Bracket P/N	SMA fiber Adapter	FC Fiber Adapter	LC Fiber Adapter	ST Fiber Adapter	SC Fiber Adapter
WaveStar-V	1Z02550	N.A.	1G01236	1Z08229	1Z08228	1Z08226	1Z08227
WaveStar-U	1Z02551	N.A.	1G01236	1Z08229	1Z08228	1Z08226	1Z08227
BeamStar FX 4X beam expander	1Z17009	1G01649	1G01236	1Z08229	1Z08228	1Z08226	1Z08227
FPS-10	18024	N.A.	1G01236	1Z08229	1Z08228	1Z08226	1Z08227

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