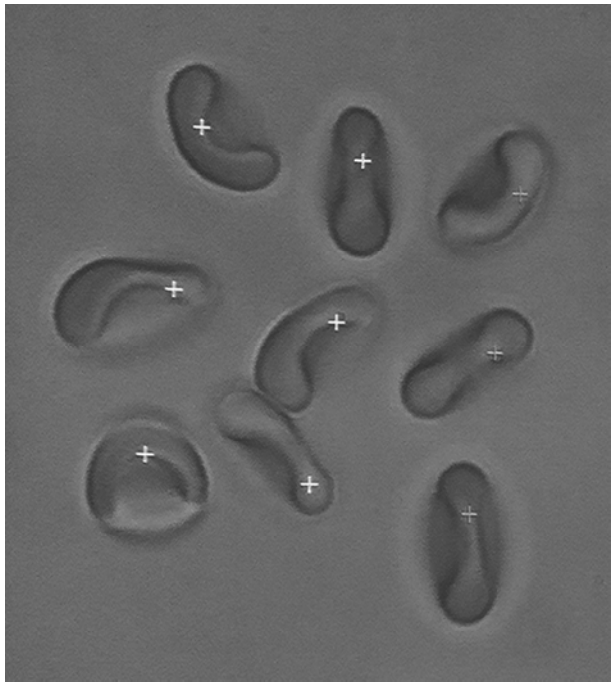
Optical Tweezers



Capture, manipulate, measure and image micro-scale cells, particles and beads. The most comprehensive range of Optical Tweezers are from Elliot Scientific

Elliot Scientific originally developed the complete, stand-alone Optical Tweezers to help researchers eliminate the necessity of building one from scratch, and spending significant time and cost in implementing this enabling and powerful technology.

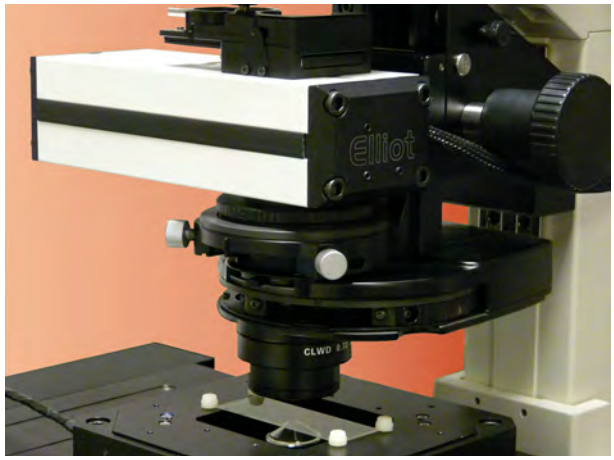
This award-winning system was derived from open architecture designs but now, in its third generation, Elliot Scientific Optical Tweezers accessible fully integrated systems for laser trapping. Comprising microscope, lasers, imaging system and specialist software all in one integral package.

Our standard systems include:

- **Single spot optical tweezers/capture**
- **Multiple spot optical tweezers under full computer control**
- **Force Measurement option for single trap stiffness using a Quadrant Photodetector (QPD)**
- **Force Measurement option for multiple trap stiffness and multiple particle tracking using Camera Particle Tracking**

Supplied as complete systems or, in many cases, as an upgrade to your existing microscope. (Please contact us for details).

We are also keen to work with you to configure our systems to match correctly your exacting needs.



Applications

- **Cell biology**
- **Cell particle interactions**
- **Single biomolecules & biopolymers**
- **Micromanipulation of components**

Single Spot Optical Tweezers

Integrates with commercial microscopes

The E3300 Optical Tweezers has been designed to be attached to a quality commercial microscope to enable single spot trapping and manipulation of micron sized particles. It can be supplied purely as an add-on for an existing microscope, or as a complete fully integrated system with a microscope.

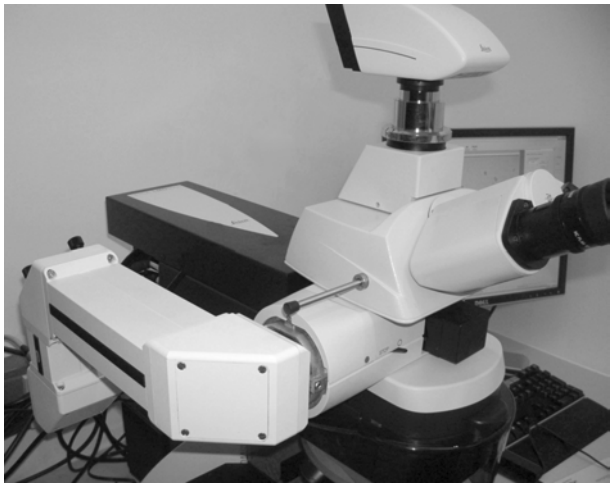
The ease of use and flexibility of the system allow many optical trapping experiments to be undertaken, especially in mechanobiology and biomechanics. Applications include cell sorting and microrheology in biophysics, colloid research in chemistry, and particle spectroscopy in physics.

The E3300 upgrade attachment is for researchers wishing to undertake simple single particle trapping and manipulation experiments. It is suitable for working with micron sized particles and can be used for cell manipulation using either the conjugate beam steering optics or the microscope XY sample stage.

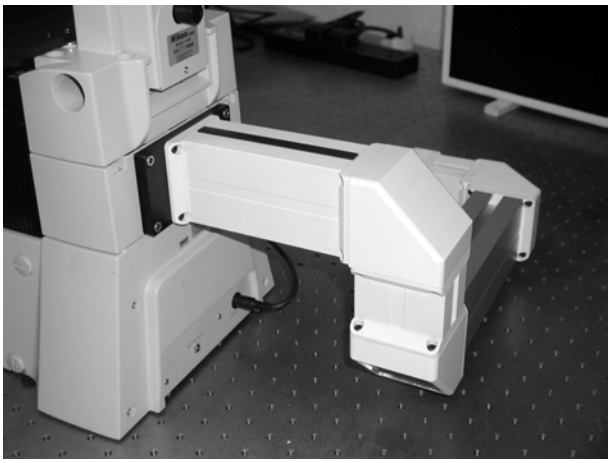
The laser beam containing the trapped particle can be directed any where within the field of view by manually steering the conjugate optics. Alternatively, the particle can be held trapped in place and the bulk sample moved around it using the precision XY stage.

For applications involving rotation of birefringent particles, an optional polarisation optic and rotation mount can be added.

The system comprises an optical module, complete with a microscope interface, that contains the laser and beam steering optics.



Installed on a Leica microscope



Fitted to a Nikon microscope

The optical module attaches to the microscope either through an additional module such as an epi-fluorescence attachment or a camera port. A range of interfaces are available depending on the make and model of microscope.

The 1070 nm fibre laser gives a stable high quality TEM_{00} beam with an M^2 of 1.05. This high beam quality when used with high NA microscope objectives gives the tightly focused Gaussian spot required for efficient optical traps it both XY an Z directions. Variable power is available for changing the strength of the optical trap.

Features

- Z trapping using microscope focus stage
- Attaches to camera/epi-fluorescence port
- 1070 nm fibre laser with variable power
- Uses microscope camera and illumination
- Rotation of birefringent particles optional
- Cell manipulation using conjugate beam steering optics or microscope XY stage

Multiple Spot Optical Tweezers

Computer controlled particle trapping and manipulation

Optional force measurement feature

The flagship E3500 is a fully functional computer controlled unit for the multiple spot trapping and manipulation of micron sized particles. It is designed to be attached to research-grade commercial microscopes. An optional force measurement feature delivers a *Photonic Force Microscope* capability.

Features

- Individual particle/cell manipulation using software controlled acousto-optic beam steering or whole field movement with the microscope stage.
- Linear or circular trapping arrays with variable spacing and rotation
- Graphical user interface for mouse control of optical traps
- Attaches to microscope camera or epi-fluorescence port
- Mouse control of individual or groups of optical traps
- 1070 nm fibre laser with variable power for traps
- Z trapping via focus stage
- High speed camera
- Force measurement options

The E3500 system comprises an optical module containing the beam steering optics, external laser source, control module with the drive electronics, microscope interface, PC and unique software. The epifluorescence or camera port of the microscope is used to interface with the optical module and a range of interfaces are available, depending on the make and model of microscope.

Beam control is provided by high-speed acousto-optic beam deflectors. The unique design of the software and control electronics allow for the creation and independent manipulation of multiple optical traps anywhere within the field of view.

The Quadrant Photodetector (QPD) option typically uses a second laser source additional to the one for trapping. This is for particle tracking and force measurement.

With the Camera Particle Tracking (CPT) option, a high-speed GigE interface camera allows visualisation of the trapped particles through the computer interface. The trap positions are overlayed on the video image to allow easy manipulation of particles.

The 1070 nm fibre laser gives a stable, high-quality TEM00 beam with an M2 of 1.05. This beam, in conjunction with the high NA microscope objective, gives the tightly focused near diffraction limited Gaussian spot required for efficient optical trapping in three dimensions.

PHOTONICS Spectra
Circle of Excellence Award Winner

The E3500 is the culmination of many years of development work since our original award-winning E3100 of 2004.

The E3500 system can be supplied with one or both of the following options:

QPD Force Measurement

Many researchers wish to measure trapping force and by utilising a forward scattered interference pattern of a second laser on a quadrant photodetector (QPD), along with dedicated software, an operator can monitor the position of a trapped particle to nanometre resolution.

QPD Force Measurement via the E4100 accessory can be added to any of our Optical Tweezers. Powerful software detects and measures the single trap stiffness of a captured particle. Most customers choose a separate probe beam from a 640 nm fibre-coupled laser.

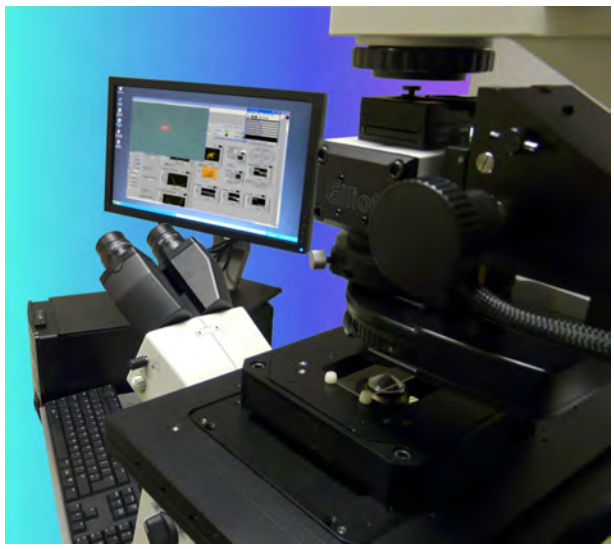
Several different configurations to match possible user requirements are available within the E4100 range. Elliot Scientific can supply a complete Force Measurement Optical Tweezers *plug'n'play* system, or this capability can be added to an existing Optical Tweezers installation.

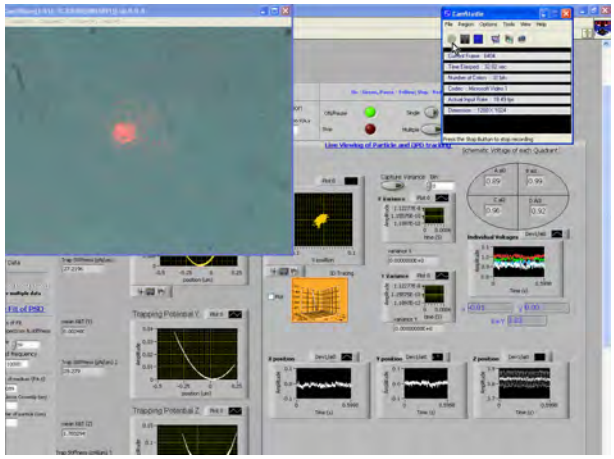
The measurement software, with live video feed, also allows the user to calibrate the motion of a single trapped object and thus makes it possible to infer forces exerted — this makes optical tweezing particularly attractive for a growing number of scientists probing single molecule systems.

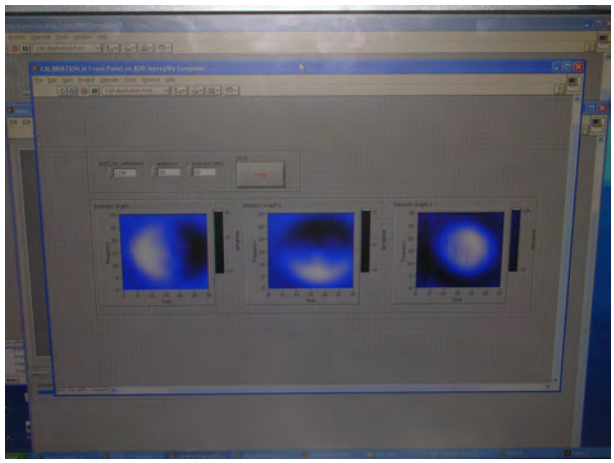
Camera Particle Tracking

Current systems can only measure the force exerted on one particle, but CPT technology used on the E4500 Optical Tweezers enables the collection of data from multiple particles at a higher rate. This allows for:

- **Multiple trap stiffness measurement**
- **Convenient trap calibration by thermal analysis**
- **Improved trap stiffness measurements**
- **Multiple particle tracking**







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