

Optical Tweezers

The most comprehensive range of systems are from Elliot Scientific

Whether you seek to start with economical “open architecture” optical tweezers, add optical tweezing capability to your existing microscope, purchase a fully integrated computer-controlled multiple spot tweezers system, or add Force Measurement of single or multiple traps, then Elliot Scientific can meet your needs.

Elliot Scientific manufactures complete systems that work *straight from the box*. We deliver fully integrated working systems, allowing the user to start their research from day one.

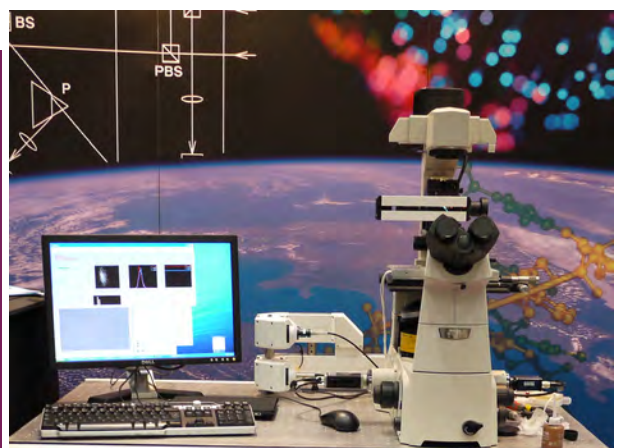
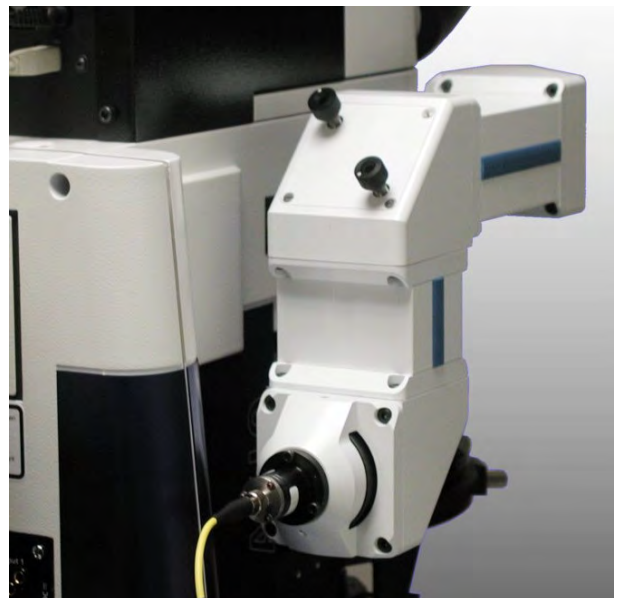
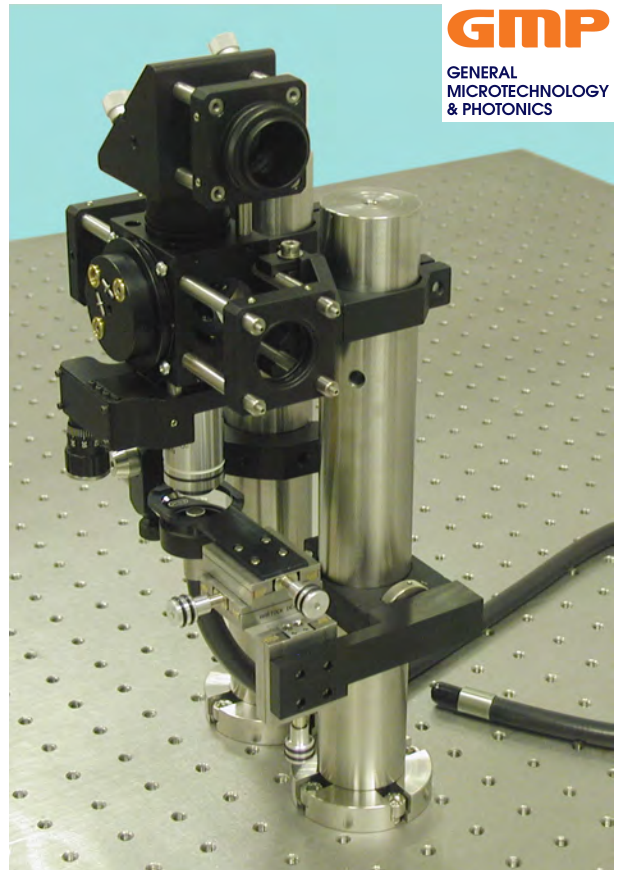
Standard systems include:

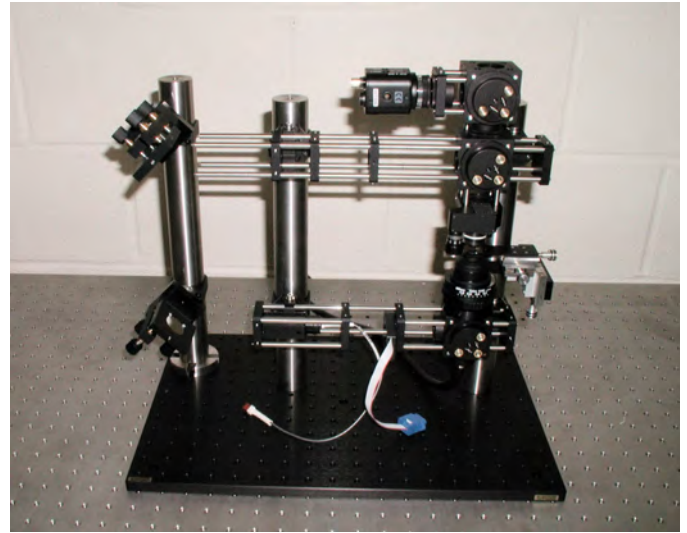
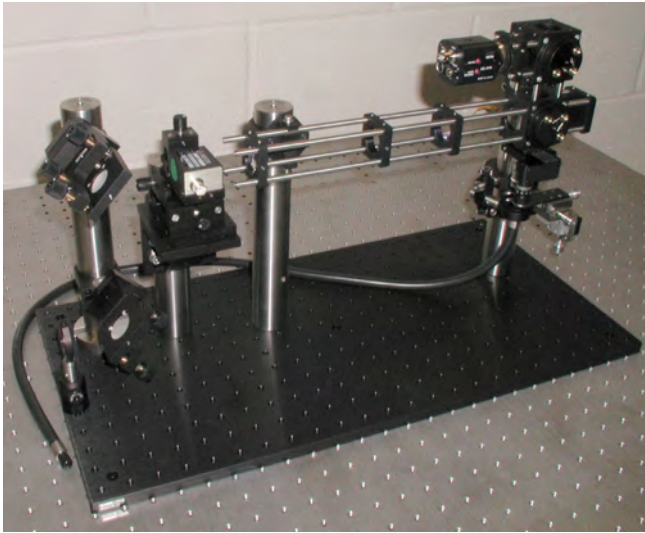
- **Component-based “open architecture” optical tweezers**
- **Single spot optical tweezers for integration with commercial microscopes**
- **Multiple spot optical tweezers under full computer control integrated with commercial microscopes**
- **Force Measurement accessory for single trap stiffness using a Quadrant Photodetector (QPD)**
- **Force Measurement accessory for multiple trap stiffness, multiple particle tracking using Camera Particle Tracking**

We are also keen to work with you to customise our systems for your exacting needs.

Applications

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





E3200 Series component based “open architecture” Optical Tweezers

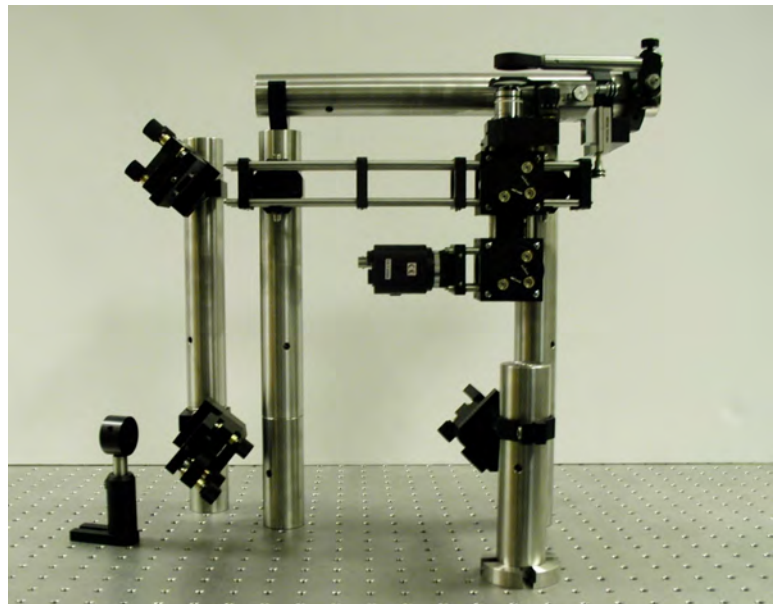
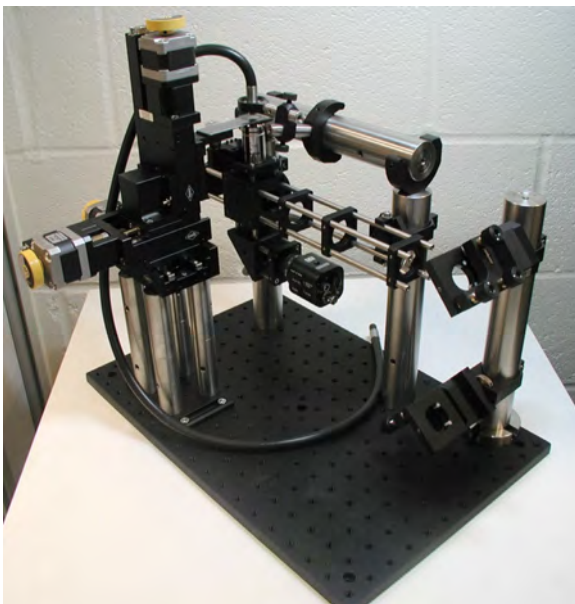
Supplied in kit form or installed in your lab

Elliot Scientific developed a broad range of breadboard-based custom systems using an open architecture format for the laboratory environment after many universities asked us to build kit-style Optical Tweezers for their MSc experiments.

These systems can cater for the many variations needed by users of optical trapping equipment. E3200 custom systems can be supplied either ready assembled or in modular form for the user to set up to match particular requirements. This allows for the economical purchase and installation of a complete optical tweezers experiment rather than technicians having to specify individual parts and build one.

Systems built for laboratory use include:

- **Inverted Systems**
- **Dual Beam Systems**
- **Bessel Beam Systems**
- **QPD Systems**
- **Inverted Raman Systems**
- **Twin Spot AO System**



E3300 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 containing the laser, beam steering optics and the microscope interface.

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 TEM₀₀ beam with an M² 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 in both XY and Z directions. Variable power is available for changing the strength of the optical trap.



Installed on a Leica microscope



E3300 as fitted to a Nikon microscope



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



E3500 Multiple Spot Optical Tweezers

Computer controlled particle trapping and manipulation

Optional force measurement feature

Our flagship E3500 Optical Tweezers 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 high quality commercial microscopes. An optional force measurement feature delivers a *Photonic Force Microscope* capability.



Features

- Cell manipulation using PC controlled acousto-optic beam steering optics or microscope XY 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
- Fully independent control of multiple traps and arrays
- 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 uses two laser sources. One for trapping, and one 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 overlaid 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 Gaussian spot required for efficient optical traps in both XY and Z directions.

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:

E4100 QPD Force Measurement

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

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, such as a HeNe or 633 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.

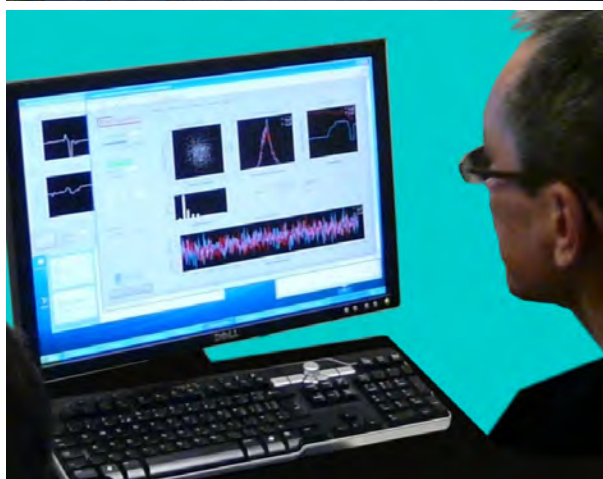
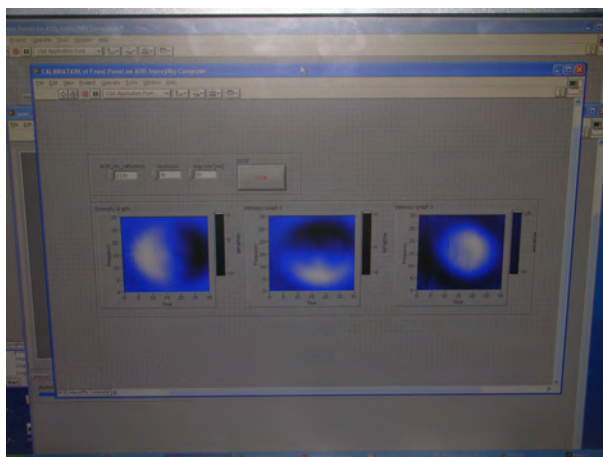
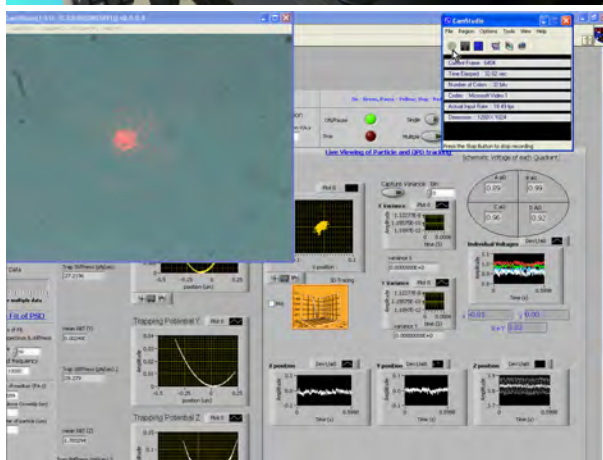
The measurement software, with live video feed, also allows the user to calibrate the motion of a single trapped object and thus makes it possible to infer forces exerted — this makes optical tweezing particularly attractive for a growing number of scientists probing single molecule systems.

Retrofitting to a good quality microscope is a viable alternative if there are budget limitations.

E4500 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 within microfluidic channels**
- **Multiple simultaneous viscosity measurements**





Elliot Scientific is a specialist UK designer and manufacturer of Optical Tweezers, micropositioning, and fibre alignment solutions.

Our Elliot|Martock brand flexure stages and micropositioners are at the core of a comprehensive range of precision engineered mechanical systems and components designed for research and industry.

The popular Elliot Gold series XYZ flexure stage is an evolution of the original version invented by Martock Design. The most stable stage on the market, it is ideal for high precision device alignment, such as fibre launch (pictured right), through to the manipulation of microstructures in bioscience.

The stage can be supplied with a variety of adjusters, in right or left-hand versions, along with a complementary range of fibre optic accessories that includes v-grooves and clamps, vacuum or connectorised holders, fibre rotators and grippers.

The versatile Elliot Gold series XYZ flexure stage can form the basis of much more complex manipulators, such as our 6-axis MDE881 professional workstation for fibre, waveguide, and device alignment.

We also design and manufacture custom solutions for specific applications, and supply piezo-driven stages for microscopy.

Please contact us for details.

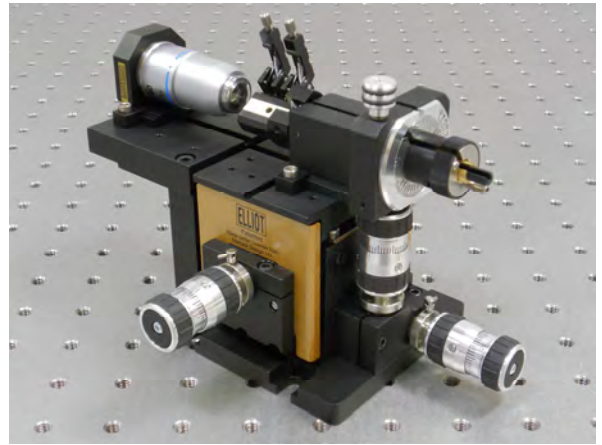


Elliot Scientific Quality

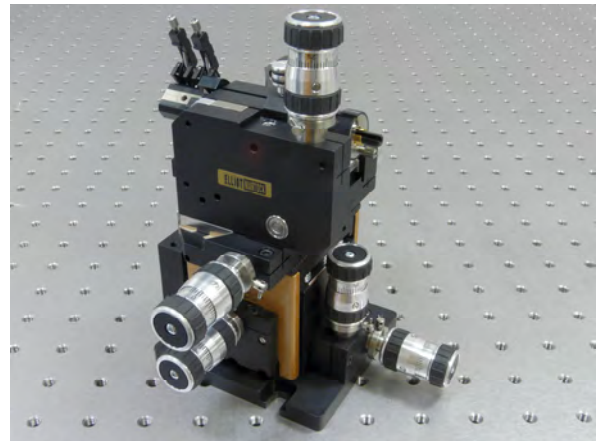
Our commitment to quality stretches back 24 years and has always ensured our standards are the highest in our industry. We are currently certified as ISO 9001:2015 compliant.

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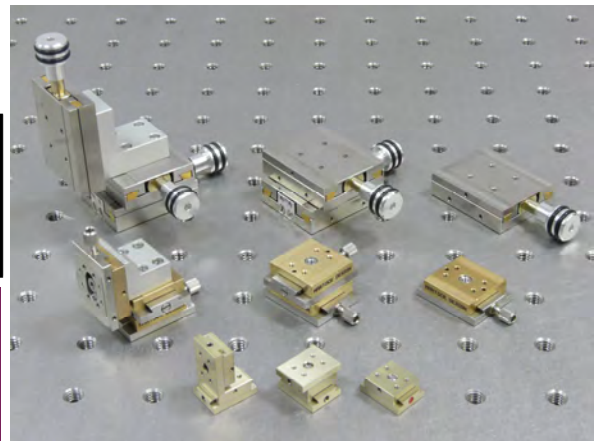
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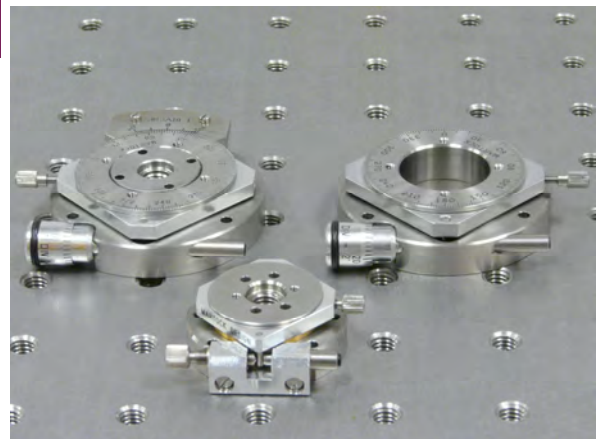
MDE511 Polarisation Maintaining Fibre Launch Stage



Six-axis Positioning Stage



Elliot|Martock Miniature Slides



Elliot|Martock Precision Rotary Stages

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