# NITROGEN AND DYE LASERS


***79110 Nitrogen Laser.***

- **Generates short, intense >300 µJ UV pulses**
- **Proprietary sealing technology for long shelf life and $10^8$ shots per fill**
- **Modular, self contained package ideal for OEM applications**
- **Direct trigger model available for critical timing applications**

Our nitrogen lasers are excellent sources of high intensity, pulsed, UV radiation. Add the dye module and you have a pulsed, tunable UV to NIR laser!

### *WHY AN ORIEL NITROGEN LASER?*

Our nitrogen lasers offer significant advantages over others. Look at what you get:

- *High Energy - >300 µJ/pulse @ 15 Hz*
- *High Stability - ±3% peak to peak*
- *Pulsewidth - 5 ns*
- *High Repetition Rates - 50 Hz*
- *Long tube life - $10^8$ shots per fill, and it's refillable!*
- *DC heated thyratron triggered discharge for subnanosecond jitter performance*
- *Compatible Snap-on Dye Laser Module and convenient, pre-measured dyes*
- *Optional Fiber Optic Accessories*

### *NITROGEN-DYE LASER SYSTEM*

We offer nitrogen-dye laser systems. These include a nitrogen laser and the 79120 Dye Laser Module described on page 6. We offer 12 standard dyes which let you tune the laser from ~ 360 to 750 nm. Page 15 lists the dyes and their lasing wavelengths.

### *TECH NOTE*

#### *ABOUT NITROGEN LASERS…*

*Nitrogen ($N_2$) lasers are convenient and economical sources of short, nanosecond, ultraviolet (337.1 nm) pulses. All are based on a fast electrical discharge through $N_2$ gas. Traditional designs required vacuum pumps and flowing gas. Smaller sealed tubes, a more recent variant, are much more convenient but lack the energy of the more cumbersome older systems. They also rely on the inexpensive but limited spark gap switch. Our design represents an advance in laser technology. The sealed tube with the thyratron switch provides the high energy of the conventional models, yet adds all the convenience and portability of the stand alone sealed models.*

*$N_2$ lasers have long been a favored pump for low energy tunable dye lasers. The short pulse duration is ideally suited to dye excitation. The short UV wavelength allows generation of tunable output from 350 nm through the visible and NIR, without any complicated frequency conversion schemes. The high peak power of the $N_2$ laser translates into a high peak power dye laser, adequate power for many non-linear optical phenomena, especially on the micro spatial scale.*

*The short pulse duration is a major advantage of the nitrogen laser. The pulse is completely over in nanoseconds; there is no long trailing edge. We use this property ourselves to test detector response. You can use it as the well defined "starting gun" for a whole host of applications. The UV pulse can create a micro plasma for time-of-flight studies, or a well defined pulse of photoelectrons for condensed matter studies. You can use it as an excitation source for a range of lifetime measuring techniques and for many excite and probe kinetic studies. See pages 9 and 12.*

*The brightness of the $N_2$ laser also gives it an advantage over conventional lamp sources. The basic laser has relatively poor spatial coherence compared with our HeNe lasers, but you can still focus it efficiently to extremely high peak power densities. It is well suited for coupling to fiber optics and for use in microspectrometry where high energy is often a liability.*

*In short, $N_2$ lasers are an economical solution to a wide range of problems. Oriel now brings you this versatile source in a small, convenient, and reliable package.*

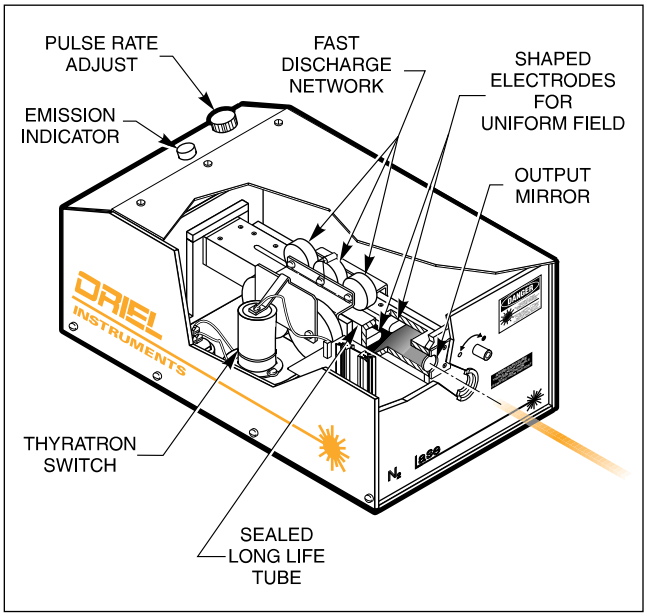



*Fig. 1 Cutaway diagram of the Oriel Nitrogen Laser.*

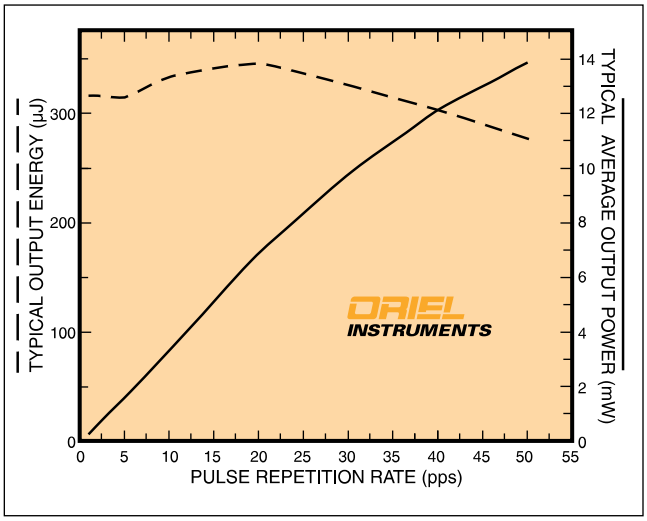



*Fig. 2 An average of the Oriel Nitrogen Laser energy and output power.*

## APPLICATIONS

Nitrogen lasers provide a convenient source of pulsed UV radiation without the hazardous gases that are used in excimer lasers. The short, 337.1 nm pulses have many applications. See nitrogen and dye laser applications on page 9.

- *Time-of-Flight Mass Spectrometry*
- *Laser Desorption*
- *DNA Sequencing*
- *Laser Ablation*
- *Laser Visualization*
- *Pumping dye lasers and fluorescence excitation*
- *Production of fast, dense pulse of photoelectrons for materials testing*
- *Testing scintillator detection systems*
- *Biofluorescence through microscopes*
- *In-vivo tissue fluorescence through endoscopes and other minimally invasive probes*
- *Kinetic spectroscopy*
- *Biomedical diagnostics*

## IDEAL FOR OEM APPLICATIONS

The low cost, high performance, long tube life and simple operation of our new nitrogen lasers make them attractive for OEM applications. There is no flowing gas and very little maintenance is required. The tube is refillable and replaceable (See page 14 for ordering information).

If you have a need, give our Sales Department a call; they'll work with you on modifications, and give you a quotation.

## DIRECT TRIGGER OR COMMAND CHARGE?

We offer two versions of electronics. We call these "command charge" and "direct trigger". In command charge, the trigger starts the charging circuit, produces the high voltage and then fires the laser when the proper voltage is attained. The high voltage is only applied when the laser is to be fired. This extends the lifetime of the high voltage components. This model is useful for applications where the nitrogen laser pulse is the master timing event.

In direct trigger mode, the high voltage is always applied to the laser tube and the discharge network. The direct trigger version minimizes the time delay from external trigger input to light output. Because a voltage is constantly being applied to the laser, the extremely reproducible trigger delay is <1 µs, compared to 10 ms for the command charge. The direct trigger model is most useful for externally triggered timed events.

## INNOVATIVE SEALING FOR LONGER TUBE LIFE

We developed our nitrogen lasers based on a sealed plasma tube design. This design was chosen for the simplicity and convenience it offers. Our lasers give you the highest performance to cost ratio of all sealed nitrogen lasers because of our innovative sealing technology. The tubes are connected to an ultra-high vacuum processing station, to remove all potential sources of outgassing. This vacuum processing is repeated and the residual gas is analyzed to ensure the removal of any and all potential contaminates. The shelf life is thereby increased, and the shot life is better than $10^8$ shots. Though our tubes offer the longest life, we still offer tube refills and replacements. The tube and discharge network are field replaceable. (See page 14 for ordering information).

Another feature of the compact plasma tube is the fast electrical discharge network which is built around the tube. This fast discharge contributes to the high energy that is generated by these lasers. The DC-heated-thyratron switched discharge offers sub nanosecond jitter performance, an important consideration for critically timed events.

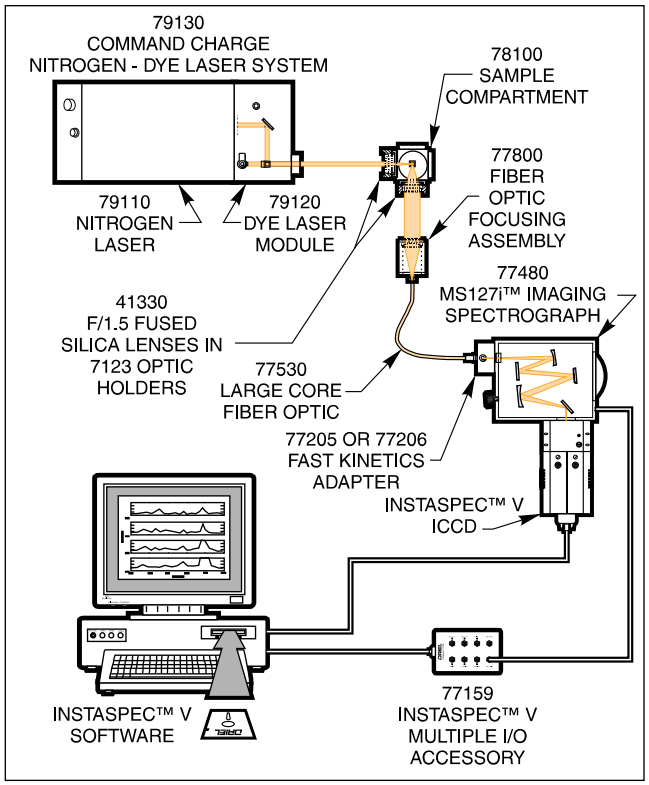



**Fig. 3** ***The Nitrogen Dye Laser is used to excite phosphorescence from a liquid sample. Temporal changes in the spectra are then measured by Oriel's MS127i™ Imaging Spectrograph and InstaSpec™ V ICCD.***

## SELF CONTAINED SYSTEM

Our nitrogen lasers are self contained systems, ready to use. No additional or separate power sources are needed. The power factor corrected AC input circuit design lets you operate these worldwide.

Control of the discharge is via the internal oscillator which has a panel knob for rate adjustment. External TTL level signals may also be used to control the rate. A TTL level output signal is available for synchronizing to the thyratron trigger pulses.

Plasma tubes are prealigned, and mounted for ease of replacement. No optical adjustment is needed for the tube assembly.

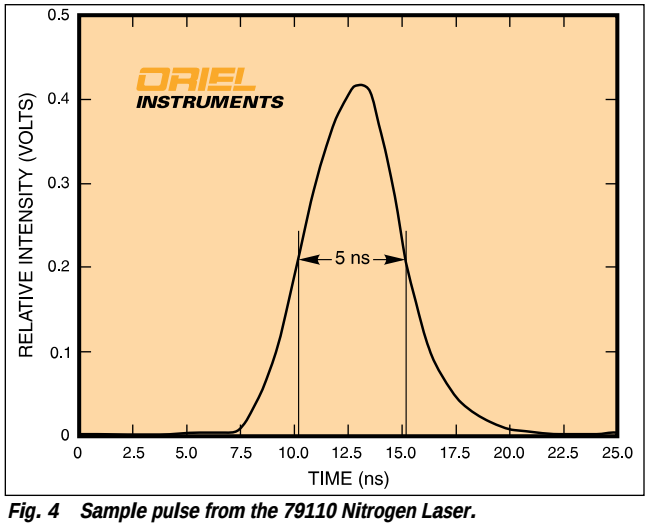



**Fig. 4** ***Sample pulse from the 79110 Nitrogen Laser.***

## SPECIFICATIONS

| | |
|---|---|
| Spectral Output: | 337.1 nm |
| Spectral Bandwidth: | <0.1 nm |
| Pulsewidth: | 5 ns |
| Energy/Pulse: | >300 µJ at 15 Hz |
| Pulse to Pulse Stability: | ±3% |
| Peak Power: | 60 kW |
| Maximum Average Power: | 15 mW at 50 Hz |
| Jitter (see Fig. 5) | |
| **(referenced to Sync output)**: | |
| Model 79110 | <1 ns |
| Model 79111 | <1 ns |
| Beam Dimensions: | 3 x 7 mm (typical) |
| Beam Divergence: | 2 x 5 mrad (typical) |
| Tube Life: | |
| (to 50% of rated energy) | $10^8$ shots |
| Trigger In: | TTL Compatible |
| Sync Out: | TTL Compatible |
| Trigger to Light Output Delay | |
| (see Fig. 5): | |
| Model 79110 | 10 ms, typical |
| Model 79111 | <1 µs, typical |
| Input Requirements: | 90-270 VAC, 50/60 Hz |
| Weight: | 20 lbs (9 kg) |

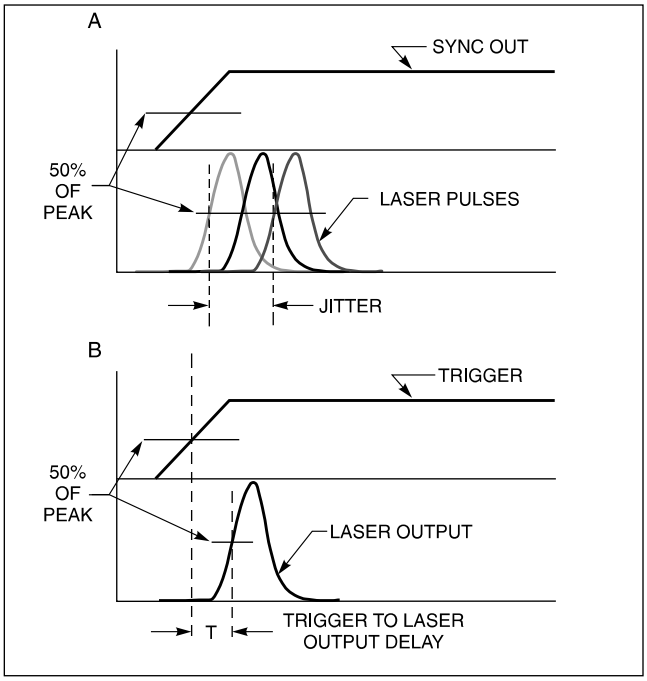



***Fig. 5 A) Jitter is defined as the signal time variation with respect to the sync output. B) Trigger to laser output delay.***

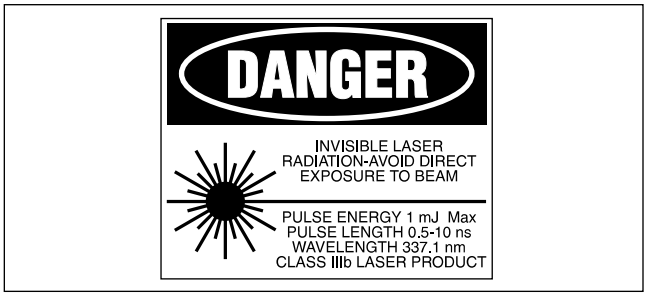



***Fig. 6 CDRH Warning Label for nitrogen laser.***

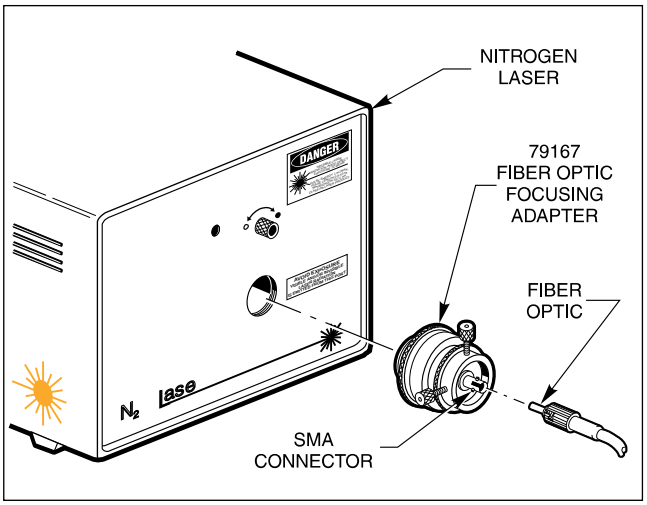



***Fig. 7 The 79167 Fiber Optic Focusing Adapter holds and aligns fiber optics to our nitrogen laser.***

## FIBER OPTIC ACCESSORIES

We offer a focusing adapter to couple the output of the nitrogen laser into SMA terminated multimode fibers of 200 µm in diameter or larger. The 79167 Focusing Adapter screws directly to the output port of the lasers via the 1/32 TPI thread. It uses fused silica lenses with X, Y, and Z adjustments for maximum laser to fiber coupling.

### TECH NOTE

*The focused laser beam from our nitrogen lasers has a peak intensity which can damage standard SMA fiber ferrules during focus optimization. Oriel offers fibers terminated with special high power ferrules for extended lifetime. These fibers, described on the right, fit into the 79167 Adapter described above. See page 14 for ordering information.*

## 1/32 TPI TO 1.5 INCH SERIES ADAPTER

The output port of our nitrogen lasers has an internal 1/32 TPI thread. The 79169 Adapter converts this to a 1.5 Inch Series Quick Connect male flange so you can mate Oriel 1.5 Inch Series accessories such as fiber bundle holders, directly to the laser.

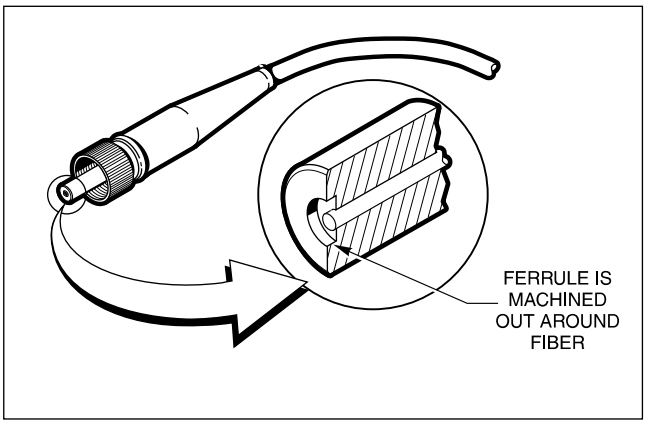



***Fig. 8 Special, "high power", SMA terminated fiber.***

## HIGH POWER FIBERS

These fibers use special SMA terminations which drastically reduce the chance of fiber face damage from high intensity laser beams. With standard fibers, the metal or ceramic ferrule material, and possibly epoxy adhesive, are up against the fiber face. High intensity laser beams can "machine" the ferrule (or the epoxy adhesive) during alignment and focusing when you first couple the laser to the fiber, or when the beam size exceeds the fiber size. The residue can be deposited on the fiber face. Laser radiation is absorbed by this residue leading to high temperatures and possible fiber face damage. There is a decrease in transmittance even if the fiber is not completely damaged.

With our new high power fibers, the ferrule is machined out around the fiber (see Fig. 8). A laser beam, when focused onto the fiber, is then partially defocused when it reaches the ferrule material, decreasing the chances of ablation. Even during focus and alignment, when the potential for ablation occurring is high, the extra distance from the ferrule to the fiber face, and the fact that it is behind it, drastically reduces the amount of material which can deposit on the fiber face. See page 14 for ordering information.

***77681 High Power Optical Fiber.***

## SPECIFICATIONS

| | |
|---|---|
| Numerical Aperture: | 0.22 nominal |
| Minimum Bend Radius: | |
| 200 µm Core Diameter: | 50 mm |
| 400 µm Core Diameter: | 100 mm |


*79120 Dye Laser Module.*

- **Tunable from 360 to 750 nm with available dyes**
- **Compact unit attaches directly to nitrogen lasers - no additional hardware required**
- **Two output ports - switch between nitrogen or dye laser output**
- **Small, bright output beam ideal for coupling into fibers**
- **Magnetic stirrer for high repetition rate performance**

Our 79120 Dye Laser Module adds tunability to our nitrogen lasers. We offer 12 dyes for the 360 to 750 nm wavelength range. Dye specifications are listed on page 15.

The non flowing dye design is compact, versatile, and convenient. The module simply attaches to the output port of the nitrogen laser via a quick connect flange. No set screws or other mounting hardware is required. You can order the components individually, or as a complete system.

### *EASE OF USE*

This module houses a standard 10 mm spectrophotometer cuvette. The 13955 Fused Silica Cuvette has a Teflon® stopper which reduces solvent evaporation, and minimizes accidental spills. A series of dyes in cuvettes with stoppers may be kept on hand. These can then be easily inserted to get a broad range of output wavelengths. The module does not require realignment when cuvettes are changed.

The moveable grating in a Littrow optical configuration allows tuning from 360 nm to 750 nm. A micrometer with digital readout offers repeatable and calibrated wavelength tuning. A 2400 l/mm grating tunes across this range with a ~0.4 nm bandwidth.

This design feature will extend the useful life of the grating. You can also translate the grating if damage ever occurs, with a built-in translation mechanism.

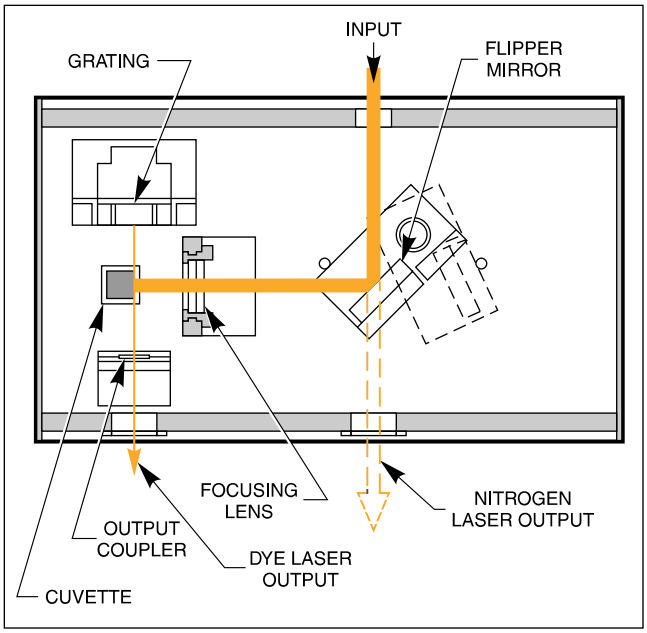
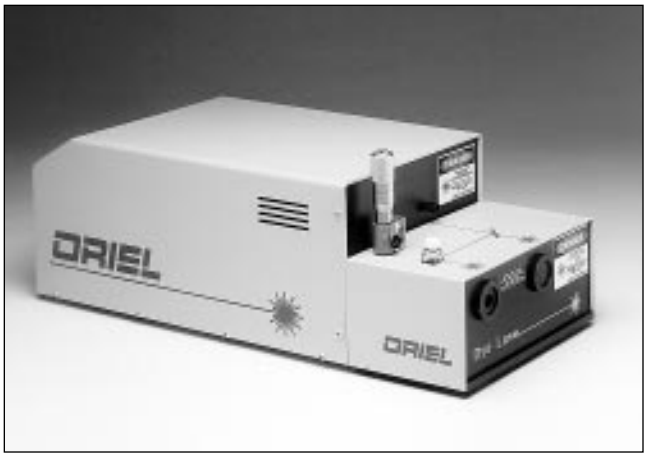



***Fig. 9 Beam path of the 79120 Dye Laser Module.***

### *TWO OUTPUT PORTS*

The 79120 Dye Laser Module has two output ports so you can choose between the nitrogen laser output or the dye laser output. One output port is in-line with the input port to allow the nitrogen laser beam to pass. Turn a knob and the flip mirror directs the input beam into the dye in the cuvette, and the dye laser output appears at the second port. Now you don't have to mount and dismount the dye laser if you want to switch between nitrogen and dye wavelengths. See Fig. 9 for a diagram.




***79130 or 79131 Nitrogen-Dye Laser System.***

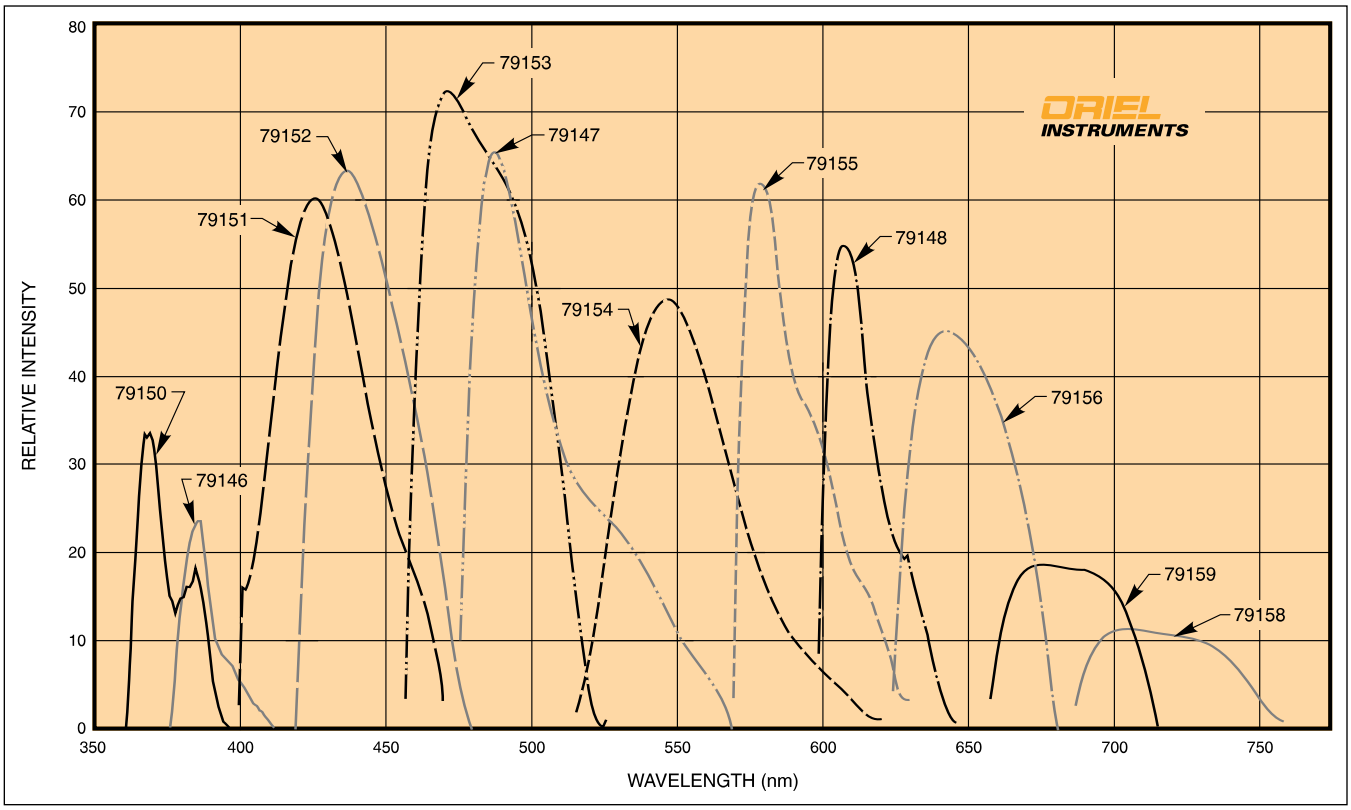



***Fig. 10 Typical lasing wavelength ranges of Oriel Dyes.***

## *TECH NOTE*

### *ABOUT DYE SOLUTIONS…*

*The graph above shows the performance we measured for the premeasured dye solution mixed with the appropriate solvent (See Dyes page 8). If you need optimum performance at a single wavelength then you can experiment with dye concentration and mixtures of dyes for energy transfer.*

*Dye concentration shifts the tuning range, as does alignment. Higher concentration tends to shift the lasing range to longer wavelengths, while lower dye concentrations let you expand the shorter wavelength side of the tuning ranges.*

*Use individual cuvettes for different dyes. Any attempt to reuse a cuvette will affect the lasing performance. This is due to many factors; the most significant is the contamination from previous dye material.*

*79130 Nitrogen Dye Laser System with 79165 Fiber Optic Focusing Adapter, and new High Power Fiber.*

## 12 DYES AVAILABLE

The dyes and cuvettes are not included with the 79120. We offer 12 different premeasured dyes, shipped in a 60 cc bottle. Just fill the bottle with solvent, mix and use. Note, we do not ship solvents with individual dye orders. Order the appropriate solvent separately. The 79120 comes with a magnetically coupled stirrer which mixes the dye solution to improve the efficiency of operation at high rep rates. Five stirring bars are also included; additional bars are sold separately as model 79160.

## DYE LASER ACCESSORIES

### Fiber Optic Focusing Adapters

The dye module has internal 1/32 threaded ports on both outputs. These allow you to mount the 79165 Fiber Optic Focusing Adapter directly. This adapter has a fused silica lens to focus the 0.6 x 1 mm rectangular output beam into an SMA terminated fiber of 200 µm in diameter, or larger. X,Y and Z adjustments precisely position the lens for maximum light collection. We describe our high power fibers on page 5; ordering information can be found on page 14.

### 1/32 TPI to 1.5 Inch Series Adapter

The 79169 Adapter converts the 1/32 TPI port of the dye module into a 1.5 Inch Series Quick Connect male flange. With this flange you can mate Oriel 1.5 Inch Series accessories such as fiber bundle holders and filter holders.

## NITROGEN DYE LASER SYSTEMS

Although you can order the nitrogen laser and dye module as separate components and easily mount them together, we also offer both as a system under a single model number. The 79130 system is the command charge nitrogen laser with this dye module. The 79131 is the direct trigger laser with this dye module. Dyes and cuvettes are not included.

## SPECIFICATIONS

| | |
|---|---|
| Spectral Output: | 360 - 750 nm, dye dependent |
| Spectral Bandwidth: | 0.4 nm, typical |
| Pulsewidth: | 0.5 - 5 ns, dye and nitrogen laser dependent |
| Energy/Pulse: | Up to 20% of pump energy, dye dependent |
| Peak Power: | 0-25 kW, dye dependent |
| Maximum Average Power: | 10 mW |
| Repetition Rate: | 50 Hz, maximum |
| Beam Dimension: | 0.6 x 1 mm, typical |
| Beam Divergence: | 4 mrad, typical |
| Input Requirements: | 90 - 270 VAC, 50/60 Hz |

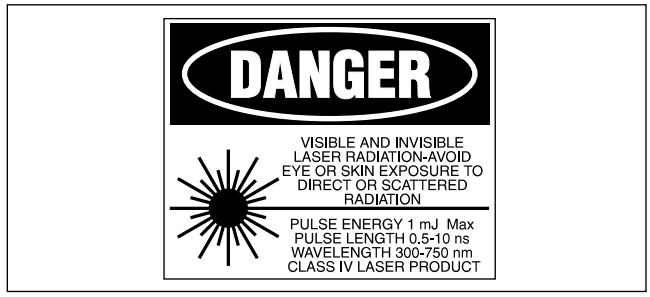



*Fig. 11 CDRH Warning Label for 79120 Dye Laser Module.*

### *LASER USE FOR TIME RESOLVED FLUORESCENCE*

Our nitrogen dye laser systems can be very useful in the laboratory environment. The narrow line of UV output from the nitrogen laser makes it exceptionally valuable in fluorescence studies where the excitation wavelength must be filtered out. In materials that can be distinguished by the changes of fluorescence with time, our nitrogen laser's short pulse length is the key in time-resolved fluorescence. Fitted to a microscope, the laser delivers previously targeted UV pulses for micro excitation. This laser-microscope system, in combination with computer imaging, makes it possible to measure the dynamics of ions in human tissue. This technique is very important for research in metabolism.

Identifying normal from diseased cells can be determined through a technique called laser-induced florescence (LIF)(See Figure 15 page 12). LIF is useful even for measuring low concentrations of fluorophores; the use of our nitrogen laser allows for very efficient pumping of excited states, significantly increasing the amount of fluorescence and enhancing signal strength. In addition, the laser can be used for fluorescence-activated cell sorting, and photo-bleaching. Cells can be stained with a fluorescent dye, irradiated with our nitrogen-dye laser system, and tracked by fluorescence

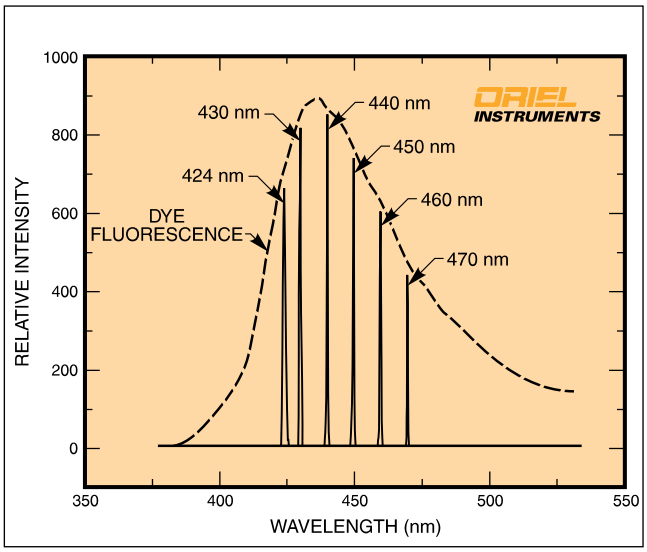
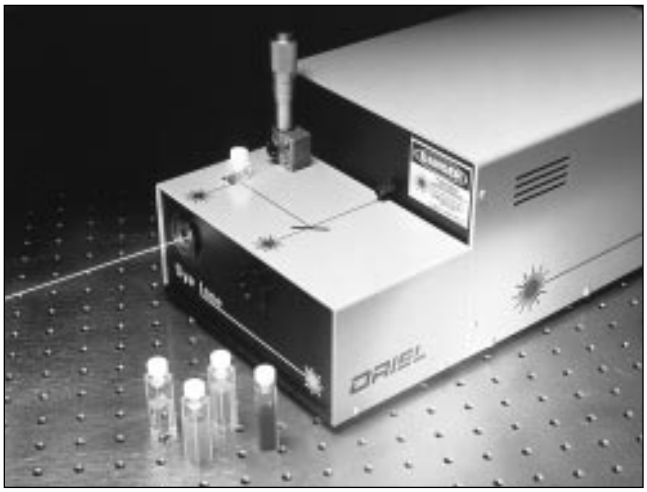



***Fig.12 Dye laser output spectra and the fluorescence from the dye.***



***Our nitrogen-dye laser systems can be very useful in the laboratory environment. The narrow line of UV output from the nitrogen laser makes it exceptionally valuable in fluorescence studies. Cells can be stained with a fluorescent dye, irradiated, and tracked by fluorescence.***

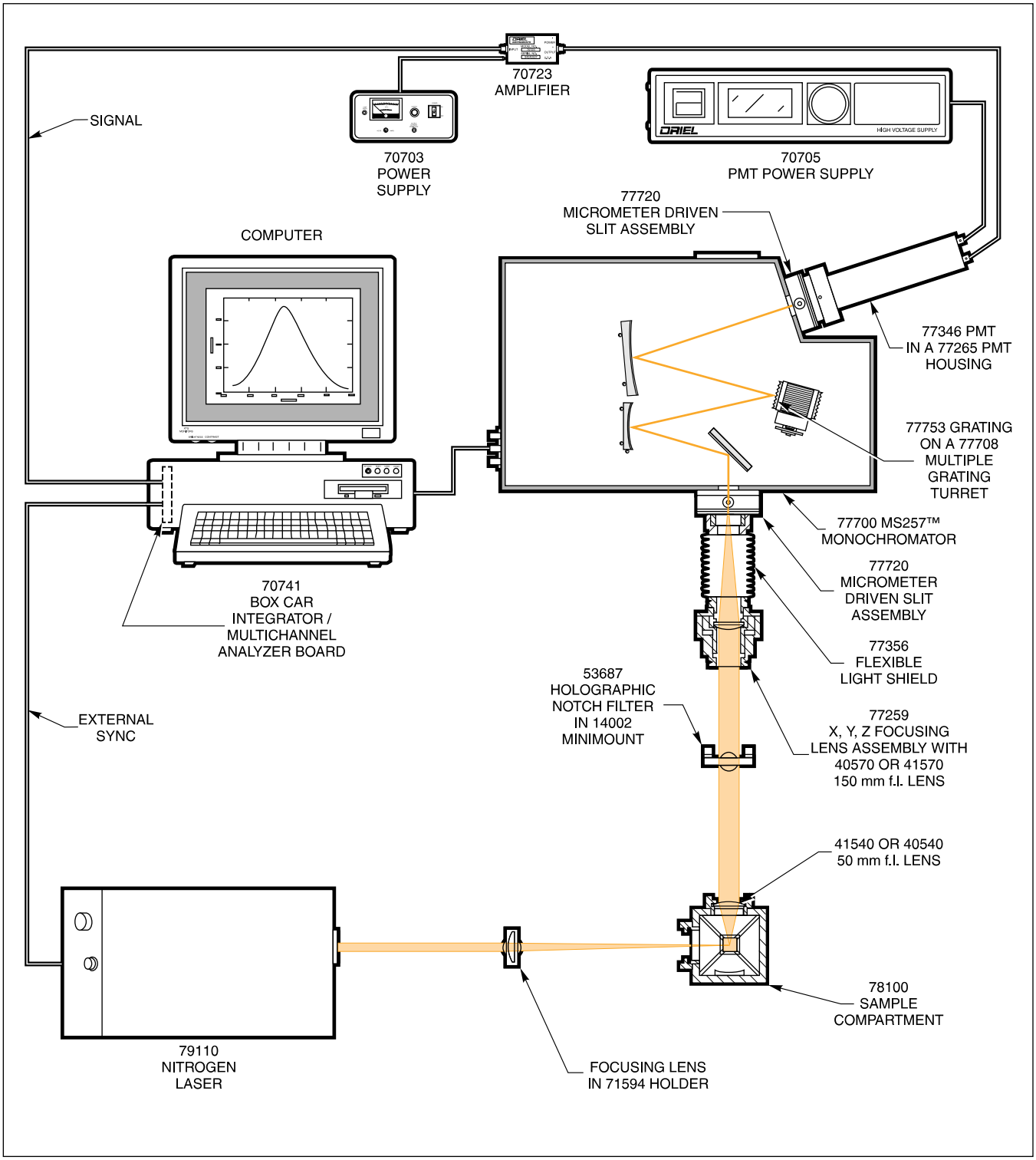



***Fig. 13 The Oriel Nitrogen Laser is an ideal excitation source for fluorescence measurement. In this set-up, the MS257™ Monochromator scans the wavelengths and a PMT detects the fluorescence.***

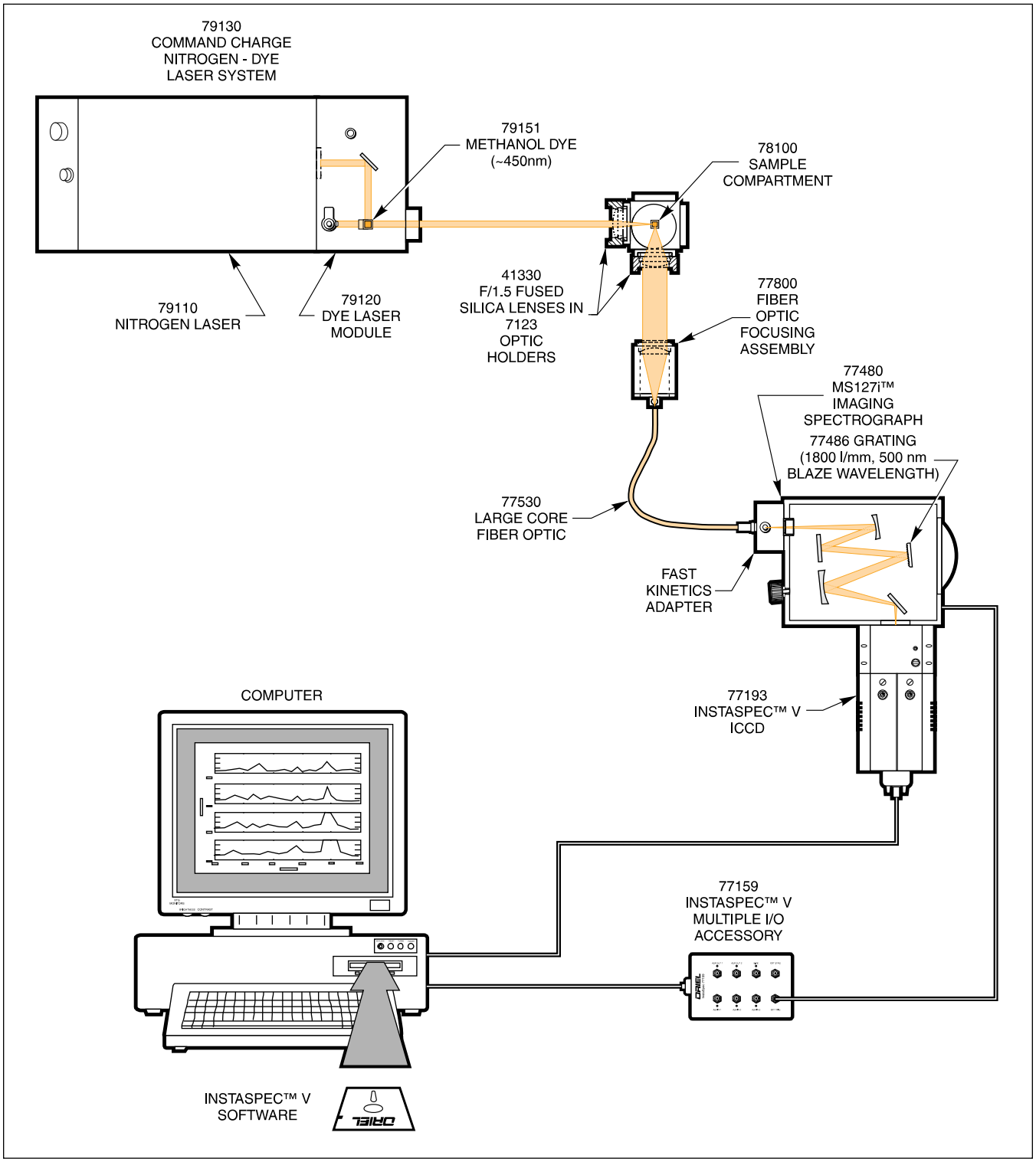



***Fig.14 The Oriel Nitrogen Dye Laser is used to excite phosphorescence from a liquid sample. Temporal changes in the spectra are then measured by Oriel's MS127i™ Imaging Spectrograph and InstaSpec™ V ICCD.***

### *NITROGEN LASERS IN THE MEDICAL INDUSTRY*

Our nitrogen lasers continue to replace traditional mechanical techniques in the medical industry. A focused pulsed laser beam, through a microscope, can provide a precise surgical tool for ablation, stimulation and killing of cells. With a nitrogen laser, precise microcutting and cell surgery allows access to a cell's interior without destroying the entire cell. In addition, the laser's high peak power, in combination with its short pulse durations, ensures maximum effect on target material while minimizing damage to adjacent tissue. The laser technique is extremely valuable in genetic studies where assessing the function of cells, and cell-regeneration investigation of nerves are important.

Our lasers have also been incorporated into instruments that measure the effects of drugs on metabolism and of oxygen on cardiac tissue. In these systems, the nitrogen laser, which minimizes photochemical effects, provides continuous information concerning tissue status, intracellular characteristics, amino-assay analysis, and detection and analyzation of cancerous tumors.

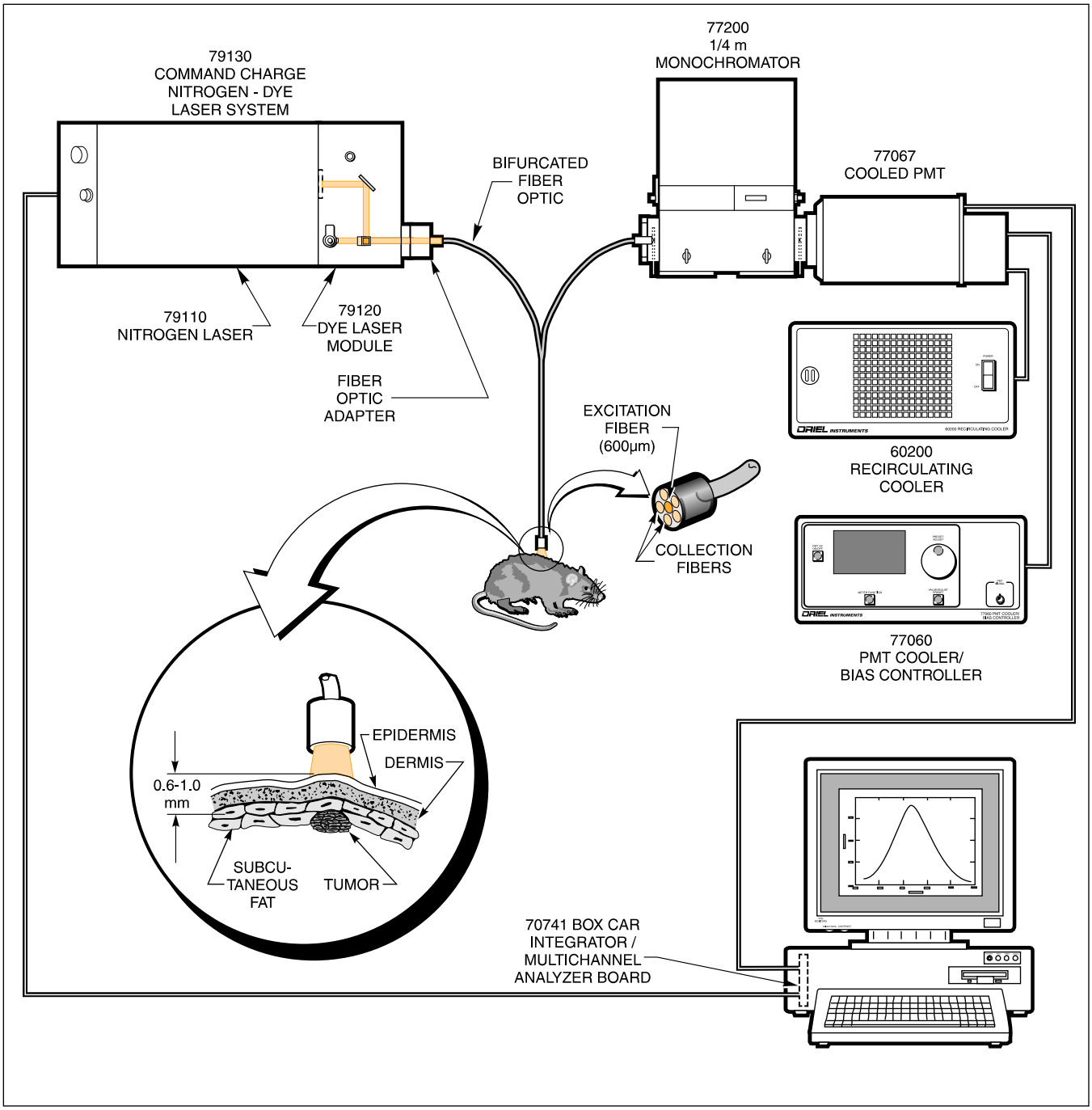



***Fig.15 The Oriel Nitrogen Laser is an excellent source of high peak power, in combination with short pulse duration. In this set-up, an Oriel Nitrogen Laser is used for Laser-Induced Fluorescence (LIF) for cancer detection.***

### *COMPOUND ANALYSIS WITH THE NITROGEN LASER*

The analysis of peptides, proteins and other compounds, which was previously a difficult procedure, is now done on a simpler basis through matrix-assisted laser desorption/ionization (MALDI). MALDI is an ionization technique for introducing large delicate molecules into a mass spectrometer without fragmentation. MALDI works by irradiating an inert matrix supported sample with a short laser pulse and then extracting the photo-ionized molecules from the surface. MALDI is easy to use and can yield very accurate molecular weights in a relatively short time. Its applications over recent years have multiplied dramatically in the commercial market.

To obtain a spectrum, a sample is allowed to crystallize on the laser target. The sample is then irradiated with pulses of laser light, generally from a nitrogen laser. UV energy causes a soft ionization process and a transfer of energy to the sample. The ions are extracted, then injected into a time-of-flight (TOF) mass spectrometer. Here ions are separated according to their mass-to-charge ratio. Ions with the lowest mass-to-charge ratio reach the detector first, those with the highest reach it last. This process allows for direct determination of large biomolecules.

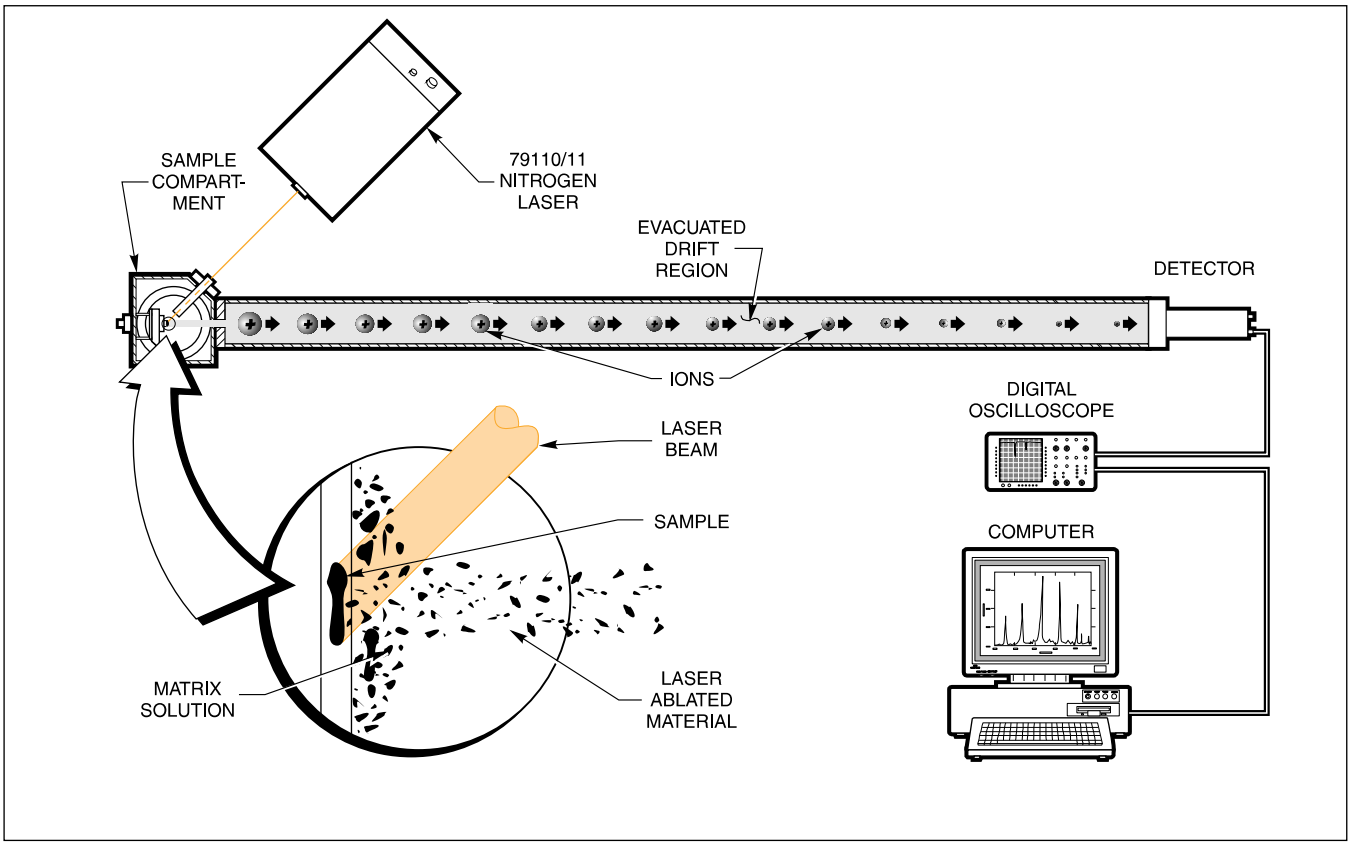



***Fig. 16 The nitrogen laser is key in the analysis of peptides, proteins and other compounds through matrix-assisted laser desorption/ionization (MALDI). This set-up shows a typical MALDI system using an Oriel Nitrogen Laser.***

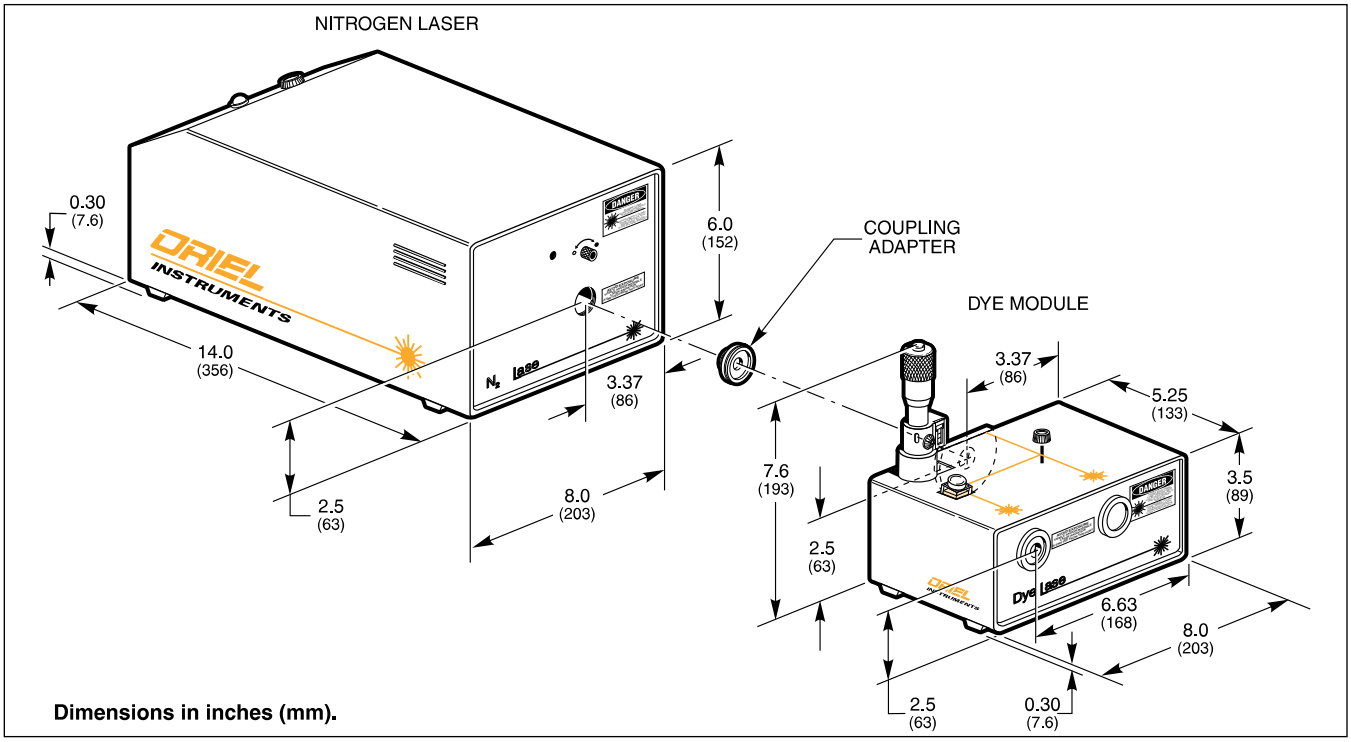



***Fig. 17 Dimensional diagram of an Oriel Nitrogen and Dye Lasers.***

| | | |
|---|---|---|
| **79110** | Command Charge Nitrogen Laser | **$ 5,624.00** |
| **79111** | Direct Trigger Nitrogen Laser | **$ 5,624.00** |
| **79120** | Dye Laser Module<br>Order dyes and cuvette separately from the following page. | **$ 3,750.00** |
| **79130** | Command Charge Nitrogen-Dye/Laser System<br>Includes 79110 Nitrogen Laser and 79120 Dye Laser Module | **$ 9,373.00** |
| **79131** | Direct Trigger Nitrogen-Dye Laser System<br>Includes 79111 Nitrogen Laser and 79120 Dye Laser Module | **$ 9,373.00** |
| **79169** | 1/32 TPI to 1.5 Inch Series Adapter | **$ 95.00** |
| **79125** | Nitrogen Laser Replacement Tube with Discharge Network Assembly | **$ 3,750.00** |
| **79127** | Nitrogen Laser Tube Refill<br>**(**Laser must be returned to Oriel for tube refill) | **$ 1,607.00** |

For more information, look in the Oriel New Products for Light Research catalog.

*See page 1-44 of our **New Products for Light Research** catalog for more information on Laser Safety Eyewear.*

## Fiber Optic Focusing Adapters

| For Laser | Fiber Termination | Model No. | Price ($) |
|---|---|---|---|
| **Nitrogen** | **SMA** | **79167** | **$ 535.00** |
| **Dye** | **SMA** | **79165** | **$ 343.00** |

## Fiber Optics

| | | |
|---|---|---|
| **77681** | 200 µm Core High Power Fiber 3.2 ft. (1 m) long | **$ 304.00** |
| **77682** | 200 µm Core High Power Fiber 6.5 ft. (2 m) long | **$ 319.00** |
| **77683** | 200 µm Core High Power Fiber 9.6 ft. (3 m) long | **$ 337.00** |
| **77684** | 400 µm Core High Power Fiber 3.2 ft. (1 m) long | **$ 319.00** |
| **77685** | 400 µm Core High Power Fiber 6.5 ft. (2 m) long | **$ 354.00** |
| **77686** | 400 µm core High Power Fiber 9.6 ft. (3 m) long | **$ 391.00** |

**For other lengths of fiber, contact our Sales Department at (203) 377-8282.**

## Safety Eyewear

| | | |
|---|---|---|
| **49102** | Premium Protection Spectacles for $N_2$ Lasers | **$ 462.00** |
| **49103** | Premium Protection Goggles for $N_2$ Lasers | **$ 462.00** |

### *Dyes*

These numbers are typical. Adjusting alignment affects tuning range, linewidth, and output level. Dye concentration also shifts the tuning range. Higher concentration tends to shift the lasing range to longer wavelengths while lower dye concentrations let you expand the shorter wavelength side of the tuning range.

Data presented below was obtained with alignment being optimized for each dye. Conversion efficiencies can drop by 10%-50% when you optimize laser alignment for one of the weaker dyes and then use it for all the dyes without further adjustments.

Each dye is premeasured and shipped in a 60 cc bottle. Just fill the bottle with solvent, mix and use.

Note, we do not ship solvents with individual dye orders. Order the appropriate solvent separately.

| Peak Emission Wavelength (nm) | Typical Tuning Range (nm) | Typical Conversion Efficiency (%) | Solvent Required | Dye Model No. | Price ($) |
|---|---|---|---|---|---|
| 370 | 360-390 | 6 | Toluene | 79150 | $ 49.00 |
| 385 | 375-400 | 7 | Methanol | 79146 | $ 49.00 |
| 425 | 400-470 | 13 | Methanol | 79151 | $ 37.00 |
| 435 | 420-475 | 19 | Methanol | 79152 | $ 37.00 |
| 480 | 455-520 | 21 | Methanol | 79153 | $ 49.00 |
| 485 | 475-560 | 19 | Methanol | 79147 | $ 49.00 |
| 545 | 520-600 | 18 | Methanol | 79154 | $ 64.00 |
| 575 | 570-625 | 18 | Methanol | 79155 | $ 49.00 |
| 610 | 600-645 | 12 | Methanol | 79148 | $ 64.00 |
| 645 | 625-680 | 18 | Methanol | 79156 | $ 64.00 |
| 680 | 660-710 | 6 | Methanol | 79159 | $ 49.00 |
| 700 | 690-750 | 5 | Methanol | 79158 | $ 49.00 |

### *Solvents and Accessories*

| | | |
|---|---|---|
| **13955** | Fused Silica 10 mm Path Cuvette With Teflon®stopper | **$ 166.00** |
| **79160** | Additional Stirring Bars (Set of 10) | **$ 88.00** |
| **49145** | Reagent Grade Methyl Alcohol (Methanol) 1 liter bottle | **$ 38.00** |
| **49178** | 100 Disposable Gloves Medium size | **$ 35.00** |
| **49181** | 10 Disposable Polyethylene Aprons For clothing protection | **$ 29.00** |
| **79174** | Cuvette Stand 12 unit capacity | **$ 53.00** |
| **79180** | 20 Plastic Dye Transfer Pipettes | **$ 5.00** |
| **79181** | Polyethylene Tray For Clean Dye Transfer | **$ 10.00** |
| **79182** | 1 liter Polyethylene Bottle For used dye collection | **$ 8.00** |
| **79175** | Small Cuvette Kit 6 cuvettes, 79174 cuvette stand, 79160 stirring bars, 79180 pipettes, 79181 dye transfer tray, 49065 Kimwipes™, 49178 disposable gloves, 79182 bottle, 49181 disposable aprons | **$ 1,232.00** |
| **79176** | Large Cuvette Kit 12 cuvettes, 79174 cuvette stand, 2 of 79160 stirring bars, 2 of 79180 pipettes, 79181 dye transfer tray, 2 sets of 49065 Kimwipes™, 2 sets of 49178 disposable gloves, 2 of 79182 bottle, 2 sets of 49181 disposable aprons | **$ 2,411.00** |
| **79185** | Small Dye Starter Kit 6 dyes (please specify model numbers), 79175 small cuvette kit, 49145 methyl alcohol | **Kit price is 10% less than component prices** |
| **79186** | Large Dye Starter Kit All 12 dyes, 79176 large cuvette kit, 49145 methyl alcohol, 49147 toluene | **$ 2,783.00** |

ORIEL INSTRUMENTS

# FAX BACK

## For more information

*Thank you for using Oriel's Internet Catalog.*

The following pages describe our Nitrogen and Dye Lasers. Our complete family of lasers and other light sources are described in the ***Light Research Product Guide***. If you'd like to receive this catalog, please fill out the section below and fax this form to us today.

### *What else is in the Light Research Product Guide?*

UV-IR Pulsed and CW Sources • HeNes • Diode Lasers • Monochromators • Imaging Spectrographs • UV-IR Detection Systems • PDAs • CCDs • ICCDs • Fiber Optics, and much more.

Even if you don't have an immediate need, send away for the catalog anyway and keep it accessible for a future need or for the technical articles.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B ❑ Manufacturing
C ❑ Quality Assurance
D ❑ University
E ❑ Consultant
F ❑ National Labs
G ❑ Gov't Facility/Military

**I WORK AT THESE WAVELENGTHS:**

A ❑ 100-190 nm
B ❑ 190-320 nm
C ❑ 320-400 nm
D ❑ 400-700 nm
E ❑ 700-1200 nm
F ❑ 1.2-3 µm
G ❑ 3-15 µm
H ❑ Over 15 µm
I ❑ 380-780 nm
J ❑ 180-1100 nm

**I WORK IN THESE AREAS:**

A ❑ Spectroscopy
B ❑ Radiometry
C ❑ Photobiology
D ❑ Solar Simulation
E ❑ Photochemistry
F ❑ UV Curing
G ❑ Pharmaceuticals
H ❑ Material or Chemical Analysis
I ❑ Process Control
J ❑ Microscopy
K ❑ Development/mfg. of semiconductor thin/thick film circuitry, microwave devices
L ❑ Astronomy
M ❑ Integrated Optics
N ❑ Optical Metrology
O ❑ Machine vision/robotics
P ❑ Fluorescence
Q ❑ Environmental Study

**I USE OR MAY USE:**

A ❑ Optical Tables/Benches
B ❑ Optical Mounts
C ❑ Micropositioners
D ❑ Precision Motorized Drives
E ❑ Lasers
F ❑ Arc Lamp Sources
G ❑ Monochromators/ Spectrographs
H ❑ Spectroscopic Instruments
I ❑ Radiometers
J ❑ Detectors
K ❑ Imaging Systems
L ❑ Microscopes
M ❑ Computerized Data Acquisition
N ❑ Single Fibers, Large Core (>65 µm)
O ❑ Single Fibers, Small Core (<65 µm)
P ❑ Fiber Optics, Bundles
Q ❑ Fiber Optics, Imaging Bundles
R ❑ Fiber Sensors
S ❑ Optical Components
T ❑ Multichannel Detectors
U ❑ Quartz Tungsten Halogen Sources
V ❑ Pulsed Light Sources
W ❑ Nitrogen Lasers
X ❑ FFTs (FTIRs)

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❑ ***Please have a Sales Engineer call me.***