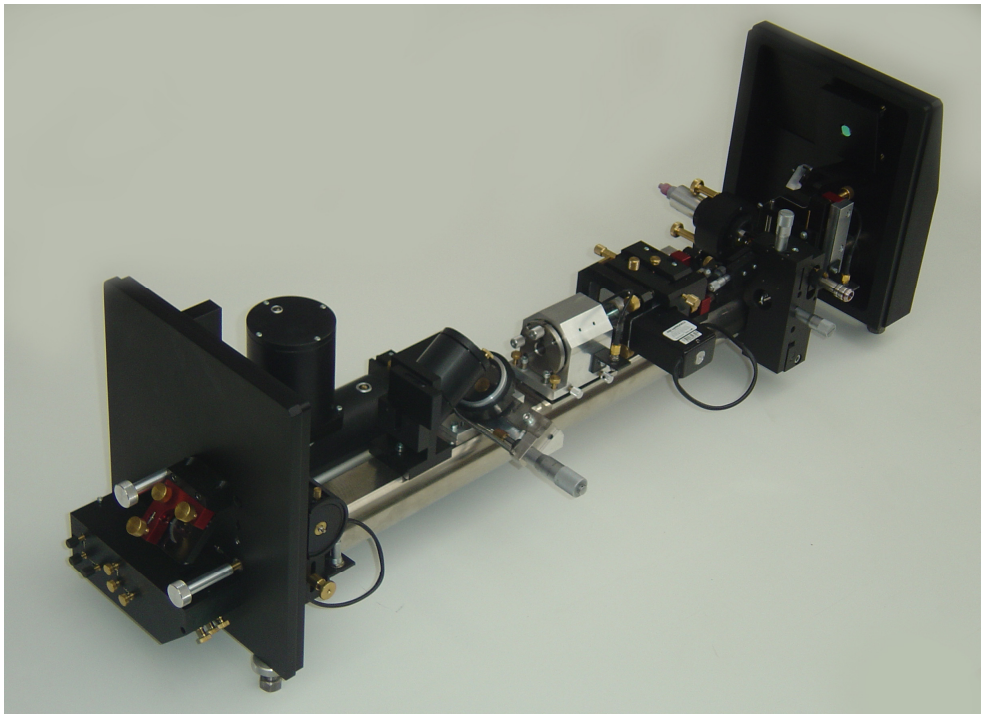
Radiant Dyes Laser
Accessories GmbH

Actively Stabilized Scanning Single-Frequency

Ti:Sa /Dye Ring Laser

External Doubling Ring

Ti:Sa /Dye Standing Wave Laser



Ring Laser with the following options

Broadband Ring Laser

Passively Stabilized Scanning Single-Frequency Ring Laser

Actively Stabilized Scanning Single-Frequency Ring Laser

Digital Scan Generator

Control Box

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Actively Stabilized Scanning Single-Frequency Ring Laser

Radiant Dyes has more than 20 years of experience in Laser Dyes and Dye Laser development. We are, together with Lambda-Physik, the oldest existing manufacturer of tuneable lasers and laser accessories. We are the first address for dye lasers and laser accessories. Now we have designed a new laser system.

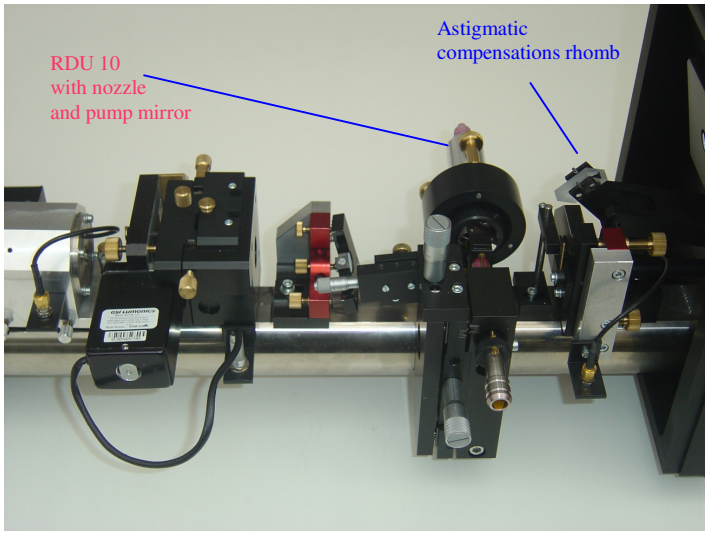
Our new carefully designed and optimised single mode ring resonator guarantees – in any configuration - high performance, stability and easy operation. We will offer this laser in three different configurations:

- **as a Broadband Ring-Laser**
  with a three plate birefringent filter, linewidth 2 GHz,
- **as a passively Stabilized Scanning Single-Frequency Ring Laser**
  with thin etalon and servo controlled thick etalon, linewidth 20 MHz, scan range 30 GHz with full electronic control and scan operation as analog and/or digital electronic control
- **as a actively Stabilized Scanning Single-Frequency Ring Laser**
  the same as passively stabilized ring laser but with an additional single reference cavity, linewidth 1MHz

Specifications of the Dye / Ti:Sa Single-Frequency Ring Laser

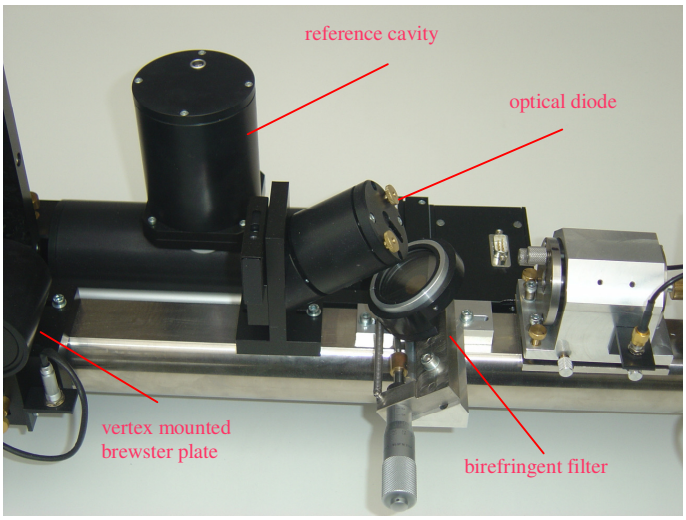
- Tuning range (Dye): 400 nm - 850 nm
- Tuning range (Ti:Sa): 700 nm - 950 nm
- Linewidth: 1 MHz
- Frequency drift: 100 MHz/h
- Scan range: 30 GHz
- Noise: (10Hz-1MHz): 2.5%
- Mode: TEM00
- Polarization: vertical

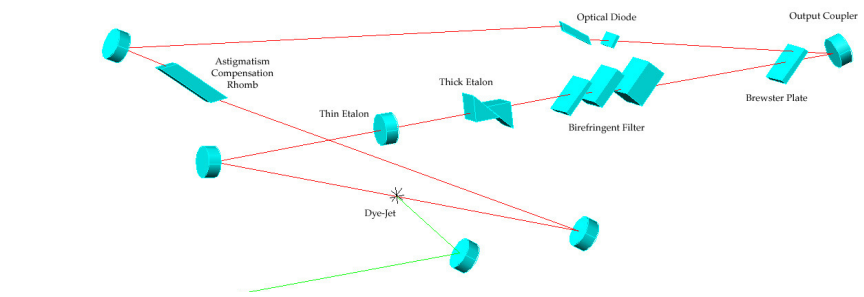
All optical elements, including the dye jet and titanium:sapphire are mounted on an extremely rigid 58 mm diameter Invar rod. This extremely rigid, high thermal mass structure reduces system sensitivity to vibration and temperature changes. The dye nozzle assembly is based on our very successful high stable RDU 10 and our interferrometrical proved stainless steel nozzle.



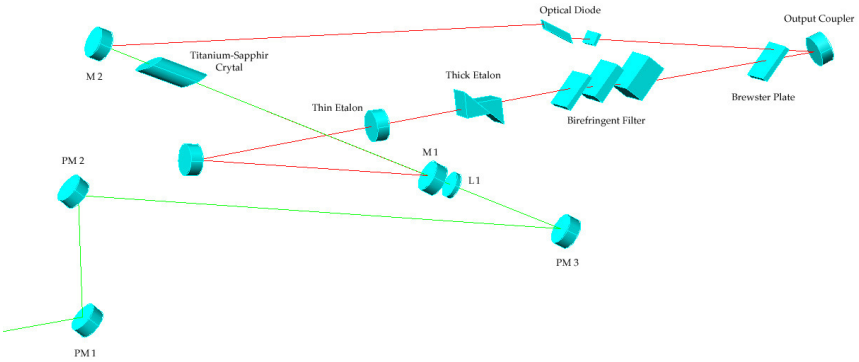
The addition of a single reference cavity provides the error signal for frequency stabilization to within 1 MHz rms. The cavity length of the ring laser is actively stabilized by low-frequency corrections to the vertex Brewster plate and by high-frequency corrections to a PZT-mounted fold mirror. Because the Ring Laser is designed as an upgradeable system, the basic resonator for broadband operation fulfills the most demanding requirements of stabilized, single-frequency operation in titanium: sapphire and dye.

Titanium-doped sapphire is a solid-state gain medium with superior laser performance from approximately 700 nm to 950 nm. Our Ring Laser units the high output power and exceptional convenience of titanium:sapphire (Ti:Sa), together with the flexibility, visible and UV performance of dyes. This combination provides continuous tunability from 200 nm in the UV (with frequency doubling) to approximately 950 nm in the IR. The Ti:Sa and dye exchange units can be easily interchanged for quick conversion.





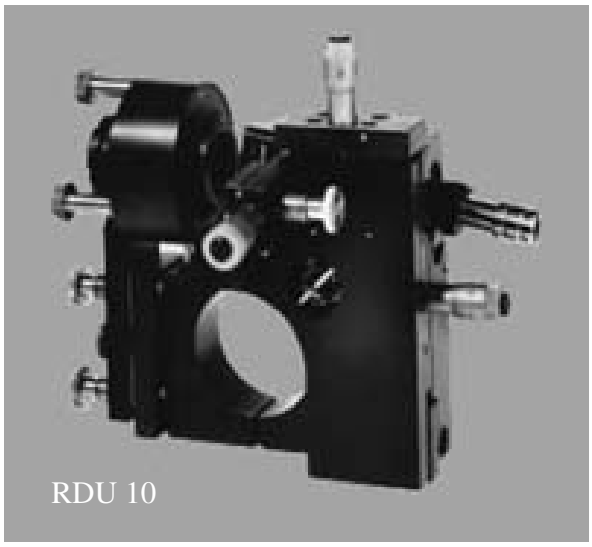
cw-Ring Laser with dye jet



- cw-Ring Laser with Titanium:sapphire -

Advantage of our new laser system against conventional products of our competition:

The upper folding mirror and output coupler can be adjusted from outside with high precisely 175 µm fine tuning screws. We use large and thick solid plates as support of fold mirror and output coupler. They guarantee more stability what is very important for alignment. All inner optics are mounted on the flat surface at the top side of an Invar pole (Ø = 58mm).



To optimize the adjustment, the pump mirror is based on the RDU 10 exchange unit that we offer for more than 15 years and has been sold more than 100 times. The relative ease of alignment of a CW laser depends critically upon the pumping geometry. This is especially true of Ti:Sa configurations, which require collinear pumping. The lateral and angular positions of the pump beam, as well as the position of the pump beam waist, must precisely match that of the resonator. For this the ring laser has separate, orthogonal controls for angular, lateral, and waist positions of the pump beam to provide faster, more consistent alignment.

We also use our high pressure dye-nozzle (interferometrically tested from 2.5 to 8 bar) and the high pressure dye-circulator. The thick and thin etalon can be used and adjusted separately, what is nessessary to get best beam quality. The thin etalon is fixed on a cross roller bearing and moveable relative to the laser beam. We also have designed an optimized mount for the Brewster plate (reproducible in-/out-movement and Brewster angle is settable) which guarantees an optimized output power.


dye nozzle

Advantage of our scan-electronic against conventional products of our competition:

Our system has two possibilities to tune the laser. One is a analog scan controller that can scan the laser over a range of 30 GHz. But our system would also be offered with a digital scan generator that has the following function: It's possible to scan in both directions, with continuous and manual tuning. The scan can stop on each position, can be continued from stop position (manually or digitally) and scan works depending on scan time or depending on scan speed. The reference cavity is used to convert any frequency excursions into an error signal. This signal is fed back to two elements, the PZT mounted fold mirror (the “tweeter”) and the scanning Brewster plate, to control the cavity length.

Advantage of our doubling system against conventional products of our competition:

We use an extra cavity doubling unit with loop electronic to find the best doubling efficiency. The principle of this method is given by Hänsch and Coulliaud. The signal which would be detected by two photodiodes can be used to get an electronic signal for finding the correct cavity length. With the difference photodiodes we get a dispersive signal, which zero point we use to get the maximum signal in resonance. An amplifier and an integrator builds the servo-electronic which tunes the piezo-actuator element. This we use to hold the resonator on the frequency of the fundamental light.

External Doubling Ring

Advantage of our doubling system against conventional products of our competition:

We use an extra cavity doubling unit with loop electronic to find the best doubling efficiency. The principle of this method is given by Hänsch and Coulliaud. The signal which would be detected by two photodiodes can be used to get an electronic signal for finding the correct cavity length. With the difference photodiodes we get a dispersive signal, which zero point we use to get the maximum signal in resonance. An amplifier and an Desintegration builds the servo-electronic which tunes the piezo-actuator element. This we use to hold the resonator on the frequency of the fundamental light.

Frequency Doubling Unit for RD cw

The unit RDFD is an inexpensive external frequency doubling unit for the laser dye Rhodamine 6G. The compact configuration of the unit allows a comfortable adjustment of the optical components with a closed cover. The completely covered separate unit avoids allows a long operation period without having to clean the optical components.
The standard system is supplied with an electronic control unit which guarantees an automatic temperature adaption of the doubling crystal and the resonator length to the frequency of the pump laser.

Advantages of the frequency doubling system:
Resonant enhancement of the fundamental wave is carried out in the ring resonator, therefore

- high efficiency
- no back reflections in the pump laser
- UV emission only in one direction

Electronic stabilization to the pump beam according to Couillard and Hänsch, therefore
automatic following of the changes of the fundamental frequency
certain elimination of interferences such as frequency jitter of the fundamental laser or mechanical disturbances

Indexmatching by electronically controlled temperature of the crystal, no complicated angle adjustment of the crystal.
Easy adjustment without opening the laser housing

Technical datas (Rhodamine 6G):

Optical resonator length: approx. 1500 mm

Doubling crystal : BBO, $LiJO_3$, $LiNbO_3$, ADA (range: 290 - 305 nm), etc.

Output power : 10 mW with 500 mW pump power

Linewidth : given by the fundamental laser

Dimensions (W x H x L) : approx. 180 x 220 x 600 mm