



laserline

Come and see Coherent at **LASER 2001**
You will find us in hall 3, booth nr. B3.261



LASER 2001, the most important laser exhibition in the world, runs from June 18–22 in Munich in the new exhibition area. In this issue of the »laserline« you will find a selection of the new and exciting products Coherent will present at this exhibition. In previous years, we were present at two locations, this time Coherent will exhibit in one large booth in hall B3, booth-nr. B3.261. Our strong presence at LASER 2001 underlines the broad range of laser, optics and instrumentation technologies Coherent brings to a diverse set of Scientific and Industrial markets.

Coherent at LASER 2001

DeMaria ElectroOptics Systems (DEOS) acquired

Sapphire™ – A Revolutionary Solid-State 488-nm Laser

New AZURE™ at LASER 2001

High Power Laser Diodes

New ModeMaster PC M² Beam Propagation Analyzer

VECTOR™ family of Q-Switched OEM Lasers

Introducing the AVIA 355-4500

AVIA Ultra



In April this year Coherent acquired DeMaria ElectroOptics Systems, Inc (DEOS), located in Bloomfield, Connecticut.

The company, now named Coherent-DEOS, designs and manufactures carbon dioxide lasers used for electronics packaging, material processing and research applications. These lasers compliment Coherent's existing Diamond line of sealed-off, slab design CO₂ lasers.

The **GEM series** sealed off, low cost CO₂ lasers are very compact, efficient and available in both aircooled and watercooled packages. These are OEM models

meant for customer integration. The 100 Watt model is the only air cooled, single resonator laser on the market! Furthermore, Coherent-DEOS is developing a line of Q-switched CO₂ lasers based on the GEM series. These products look very promising for processing ceramics and other materials.

With the combined support and distribution network Coherent-DEOS is able to offer a further improved service to its existing and prospective customer base.



Sapphire™ A Revolutionary Solid-State 488-nm Laser

Coherent Laser Division (CLD) at Laser 2001 in Munich will show its recently introduced first commercial solid-state 488-nm laser.

The new Sapphire™ 488-20 is a diode-pumped semiconductor laser that provides 20 mW of output power at

488 nm. Designed to enable a new generation of analytical instrumentation, Sapphire is free from the limitations associated with the 488-nm air-cooled argon-ion lasers now ubiquitous in that marketplace. For many years researchers and com-

mercial companies have sought to exploit the power of diode-pumped solid-state laser technology at blue-green wavelengths. In particular, bio-instrumentation techniques have been based on air-cooled argon ion lasers that emit at 488 nm. But argon-ion >>>

488 nm

lasers are large and electrically inefficient, and until now there has not been a solid-state equivalent. The all-solid-state Sapphire exceeds the performance characteristics of air-cooled argon-ion lasers, while being an order of magnitude more compact and efficient. Sapphire 488-20 is Coherent's first product in a class of Optically Pumped Semiconductor Lasers (OPSL) based on a special type of Vertical External Cavity Surface-Emitting Laser (VECSEL). Specifically, while electrical current drives a conventional VECSEL, within an OPSL a semiconductor laser

optically pumps the semiconductor gain medium (called the OPS chip). At the heart of this proprietary OPS chip are quantum-well structures that provide gain at 976 nm. An intracavity frequency-doubling crystal converts the emission to the desired 488 nm wavelength. Sapphire produces a TEM₀₀ beam profile and optical noise less than 0.25 % rms. Unlike aircooled argon-ion lasers that show beam degradation over time the Sapphire shows stable and superior beam performance over its entire lifetime. This inherent advantage of diode-pumped solid state technology will result in a new class of longterm stability not only in OEM instruments. Additionally, because Sapphire doesn't use ionized gas as a gain medium, there's no residual plasma glow to interfere with sensitive detection systems and the signal to noise ratios are further improved. The ease of integration will allow substantial improvements of analytical instruments:

Sapphire's compact laser head can be brought close to the sample, eliminating the need for costly, complicated and alignment sensitive fiber coupling schemes

Sapphire's laser head heatload is minimal enough to dissipate by conduction only, no need for space-consuming and vibration-prone forced-air ventilation

Although Sapphire is new, it is an assembly of proven subcomponents, all of which have well-quantified performance characteristics. Moreover, mature technologies such as Coherent's semiconductor growth process and clean-room robotic assembly will allow to produce very robust 488-nm lasers for applications ranging from bio-instrumentation and digital imaging to inspection. Sapphire is a breakthrough for OEM integrations. It is a milestone in laser technology that will produce a new era of user-friendly, compact, efficient and reliable instruments. After successfully finishing the beta testing phase earlier this year, Sapphire production is set to fulfill fast-growing market demands.

90% less space requirement*
98% less energy consumption*
98% less heat dissipation*
* than a comparable argon-ion laser

100% performance



gene sequencing > cytometry > semiconductor inspection > digital imaging > drug screening

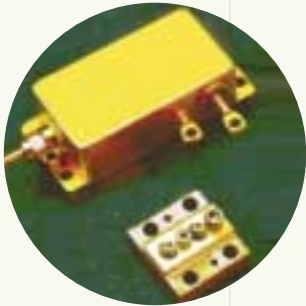
See the new AZURE™ at LASER 2001



The Azure™ is an ultra-low noise diode-pumped solid-state deep UV laser operating at 266 nm with > 200 mW output. Designed for demanding industrial applications such as Wafer Inspection and DVD Mastering, the Azure is manufactured with Coherent's unique Permalign™ technology ensuring that the system is never misaligned as a result of either equipment vibration or large deviations in room temperature. The Azure uses a Verdi™ single longitudinal mode laser as the pump source that is frequency doubled to 266 nm in a resonant enhancement cavity. The single mode output in the deep UV exhibits similar ultra-low noise and stability characteristics as the Verdi.

To meet the stringent requirements of the Semiconductor industry, we developed on-board controls called the Sentinel™ system. The Sentinel system automatically maintains the output power to within 1 %, actively stabilizes beam position and controls the crystal position. The performance of the Azure makes it ideal for industrial applications requiring a hands-free CW 266 nm laser source.

High Power Laser Diodes by COHERENT[®] SEMICONDUCTOR GROUP



At LASER 2001 a wide variety of High Power Laser Diodes (HPLD) and their applications will be shown by Coherent Semiconductor Division.

On our booth, we will display OEM components of HPLD, as well as fiber coupled turn-key systems for single stripe laser diodes and laser diode arrays up to 80 W cw at the fiber end.

Wavelength range covered are 650...670...690 nm, 770...840 nm, 885 nm, 920...940 nm and 970...990 nm.

The output power of single stripe laser diodes covers from 250 mW at 650 nm to 3 W cw at 810 nm.

CW output power of conduction cooled laser diode arrays are from 5 W in the red, up to 50 W in the near-infrared. Using water-cooled submounts even higher output powers are possible in the near-infrared.

Vertically stacked laser diode arrays are available with up to 1 kW QCW in the near-infrared.

Most of the laser diodes are available as fiber coupled laser diodes, offering flexible and easy to use handling of the laser light.

Accessories like optical imaging units and tapers help customers integrating the HPLD into their systems.

Our High Power Laser Diodes are in actual use in applications like solid-state laser pumping, direct material processing, repro-graphics, medical, instrumentation & sensing and many more.

Some of these applications require a laser diode respectively systems uptime of 24 hours/7 days a week.

Based on the Molecular-Beam-Epitaxy and the proprietary Aluminum-free-technology, using Coherent Semiconductors High Power Laser Diode solutions, gives our customers the possibility to offer superior systems performance to their end-customer markets.

Please contact your local Coherent Representative or contact Coherent Semiconductor Division Europe:
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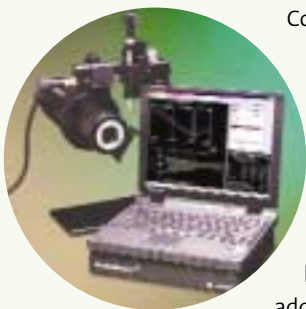
New ModeMaster PC M² Beam Propagation Analyzer

Coherent Auburn Division has been introducing a new ModeMaster PC Beam Propagation Analyzer recently. The new ModeMaster PC includes a Universal Serial Bus (USB) Control/Interface Console and MS Windows software for use with PC computers supporting USB (MS Windows 98, ME and Windows 2000). Customers will need to supply their own compatible computer or purchase a computer platform from Coherent separately.

Coherent pioneered M² beam propagation analysis with the ModeMaster stand-alone system a decade ago. The new ModeMaster PC is compatible with all existing ModeMaster Scan Heads already in the field for use on a personal computer system meeting the minimum PC computer requirements.

The new ModeMaster PC combines all the ISO compliant accuracy and powerful features for measuring M² and other beam propagation analysis functions for CW lasers, with the added flexibility and value using a Personal Computer to provide optimum user control data processing, storage and results display.

Datasheets with complete product information and specification are available.



What's new in the ModeMaster PC software (version 2.00):

User-friendly MS Windows User Interface support including MS Windows 98, ME or 2000

Compatibility with all existing ModeMaster Scan Heads

New File Management for Profile Data, Pointing Stability Data, Second Moments Data and Focus Run Data. These data files are in text format and are easy to use with external software such as MS Excel

Measurement cursors for precision analysis or graphical data

Multiple Focus collection capabilities for statistical analysis

Comprehensive On-line help

Complete MS Windows Printer support

VECTOR™ family of Q-Switched OEM Lasers

1064 & 532 nm



Coherent is proud to introduce the VECTOR™ family of diode-pumped, solid-state, Q-switched lasers that offer a choice of two different types of Nd-doped laser crystals: Nd:YAG for low repetition-rate systems below 10 kHz, and Nd:YVO₄, which expands pulsed solid-state lasers to the 10 kHz to 200 kHz repetition-rate range. Infrared (1064 nm) and frequency-doubled (532 nm) versions are available. Specifically designed for use with scanning systems, the air-cooled, low-power-consumption VECTOR™ lasers are ideal for the widest variety of applications in both materials processing and instrumentation.

VECTOR™ generates extremely short pulses, yielding the high peak power needed for materials processing. Applications include removing thin films such as ITO on different base components; marking (on diamond, as well as on plastics such as smart cards and chips); scribing on solar cells; zone texturing; airborne mapping; and trimming a wide range of electronic components including resistors, capacitors, quartz oscillators, and circuits. VECTOR™ lasers are designed as the ideal laser component for OEM integration featuring an ultra-compact laser head and a convenient 19" rack mountable power supply.

Features:

- Several models available with different power levels
- All models are air cooled
- Cleanroom manufactured using patented Permalign™ technology for a ruggedised permanently aligned laser head
- Ultra-compact and sealed laser head
- Aluminum-free Active Area (AAA™) laser diodes for unmatched lifetime
- Cost effective and flexible platform concept: Identical power supply supports all different laser heads
- Versatile control options via RS232 interface, analog interface or frontpanel
- Light Loop control and first pulse suppression provide stable output power to the application

Introducing the AVIA 355-4500

Originally introduced in 1997, and designed with direct feedback from the PCB industry, the AVIA has been the market leader from its inception as a 1.5 W product. In order to succeed in the PCB market, the AVIA has had to demonstrate value in every installation – and it has. According to our customers, the AVIA product line has an unprecedented record for up time and field-deployed reliability.

With the addition of the AVIA 355-4500, the high power AVIA product line now includes 1.5 W, 1.8 W, 3 W, and 4.5 W diode-pumped, solid-state Q-switched UV lasers.

The AVIA 4500 has the same footprint and control interface as the AVIA 355-3000, 355-1800 and 355-1500. Differences from the AVIA-3000 include: power (4.5 W rather than 3 W), beam diameter (3.5 mm rather than 2.7 mm), maximum power occurs at a higher repetition rate (25 kHz), and the laser head has more stringent cooling requirements.

Consistent with the AVIA-355-3000, the power supply is air-cooled and houses two 40 W diode bars (25 W FAP-I). The laser head can be operated air-cooled or water-cooled.

The chiller and water-cooled mounting plate for the laser head are offered as an option.

Engineering drawings and specifications can be provided to customers who wish to supply their own cooling plate. Note: Chill plate and chiller are not included in the price of the laser.

AVIA Ultra

Coherent introduces the latest addition to the AVIA family of lasers. The new AVIA Ultra series is a compact low power AVIA designed for high repetition rate operation. Ideally suited for stereo-lithography, cold marking and materials processing, the AVIA Ultra has received high marks for ease of integration and ease of use.

The AVIA Ultra is optimized for high rep-rate performance. At 40 kHz the AVIA Ultra-355-250 and Ultra-355-400 are specified for 250 mW and 400 mW, respectively. The AVIA Ultra features long service-free lifetime, easy integration and automatic optimization routines for years of optimized performance.

The AVIA Ultra-400 and the AVIA Ultra-250 have a footprint 50 % smaller than competitive UV lasers. Both feature a single FAP-I pump, and the same control interface as the rest of the AVIA family in a smaller, less than 20 cm tall power supply.

Like the other members of the AVIA family, the AVIA Ultra has two consumables: the THG crystal and Diodes (in this case, a single FAP-I). The AVIA Ultra's third harmonic crystal (THG) contains 10 user selectable positions, which can be accessed in seconds with one twist of the position selector. (A single axis non-motorized position selector was chosen to reduce cost, and make crystal shifts simple and fast.) Each crystal position delivers > 1000 hours of consistent UV performance.



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inline

»CORONA« pumps high average power Ti:Sapphire laser

Abstract: Using a special cavity design a record high average power of 22.8 W could be generated from a gain-switched Ti:Sapphire laser with a slope efficiency as much as 44 % at 10 kHz repetition rate using Coherent's new generation diode-pumped laser CORONA

Summary:

Radiation from high average power intense short pulse lasers is needed for different applications in science, industry and medicine. High repetition rate laser systems based on broadband

laser material like Ti:Sapphire could be good candidates to meet these requirements in the near future. In this short communication we present first results which have been achieved using Coherent's new-generation diode pumped Q-switched and frequency doubled solid state laser »Corona« as a pump source for a high average power Ti:Sapphire laser. The goal of this experimental investigation was to establish some upper limits for the pumping level and the achievable output powers of a Ti:Sapphire laser. For the experiments described here we

used a cooled Ti:Sapphire rod which was placed in a 3 mirror cavity consisting of two focusing mirrors and an output coupler. The rod was end-pumped through one of the focusing mirrors. We could use the radiation from »Corona« up to 55 W of absorbed power without damaging the Ti:Sapphire rod. Fig. 1 shows the measured output power of the Ti:Sapphire laser in dependence on the absorbed pump power for 2 different output couplers (30 % and 10 %). The maximum achieved output power at 780 nm was 22.8 W with a slope efficiency of 44 %.

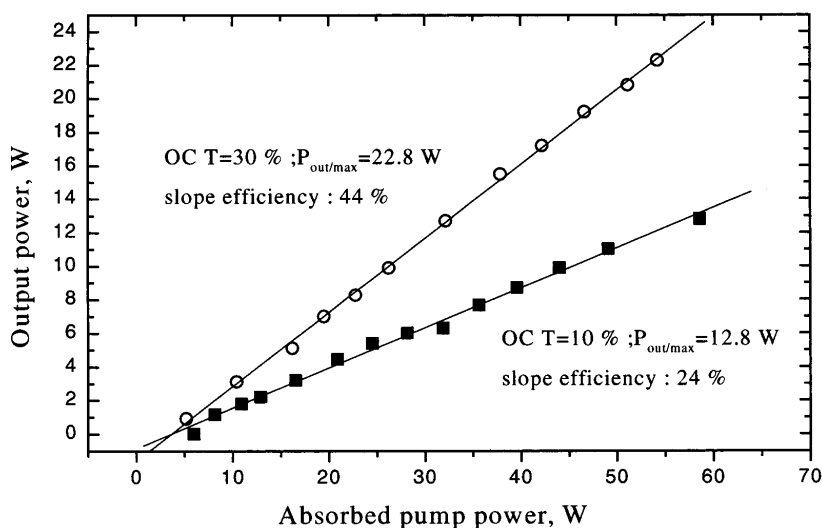


Fig. 1.

Output power of the developed Ti:Sapphire laser pumped by Coherent's »CORONA« frequency doubled diode pumped Nd:YLF laser operated at 10 kHz

To establish the output parameters of the laser cavity we have changed the repetition rate between 10 kHz and 22 kHz. The Fig. 2 shows the corresponding dependence of the output power. This graph proves that the laser can be working at repetition rates over 20 kHz with reasonable output powers. We have measured a maximum output power of 4 W at 22 kHz for the highest pumping level.

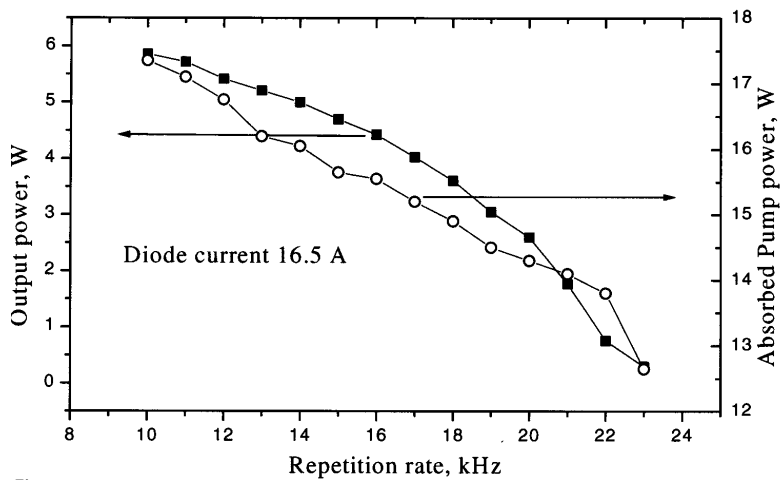


Fig. 2
Dependence of the output power of the Ti:Sapphire laser on the repetition rate

The measured pulsedwidth of the Ti:Sapphire laser at the maximum pump power is depicted on Fig.3. A FWHM of 27 ns was found for the pulse in this laser configuration with a pulsedwidth of the pump pulse about 80 ns. We estimated a net small signal gain of 2.52 for one round trip from the lasing built-up time and pulse width. Such gain coefficients look quite promising for the development of advanced high-power amplifiers for ultrashort pulses efficiently operated at much higher repetition rates.

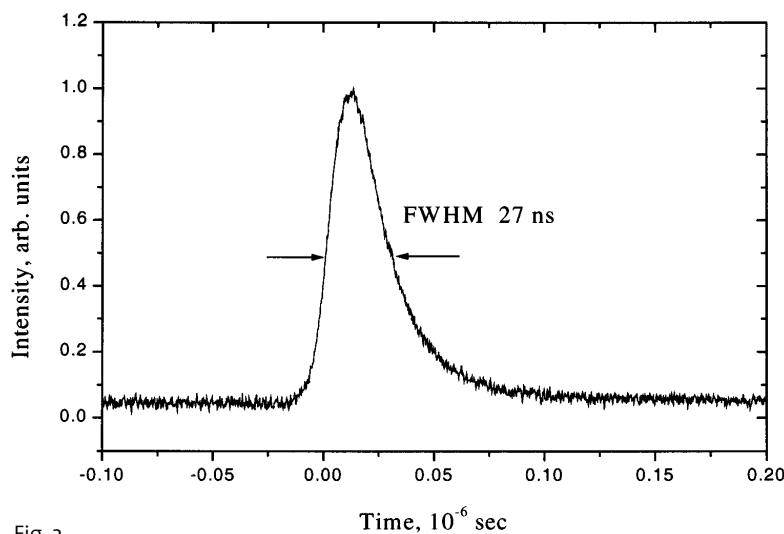


Fig. 3
Pulse duration of the Ti:Sapphire laser at the maximum output power of 22.8 W at 10 kHz

We were also able to run »Corona«-laser with various repetition rate up to 100 kHz using external triggering. The results are depicted on Fig. 4.

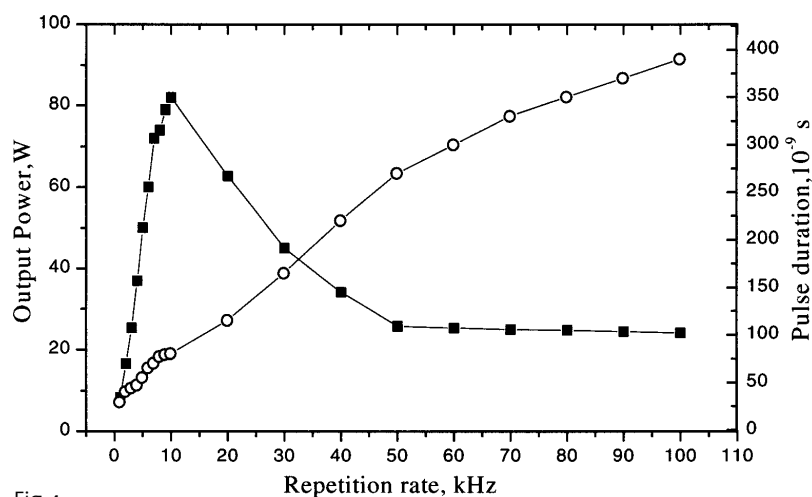


Fig.4.
Output power and pulse duration for the »Corona« at various repetition rates

The first results on the use of the new Corona laser shown in this short communication are very promising for advanced development of high average power tunable lasers and short pulse amplifiers based on Ti:Sapphire.

The authors would like to thank Coherent for the loan of the »Corona« laser. The presented data are the results from a three day experimental effort at the MBI-Berlin.

Contact for more information

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LASERTEC on the Move!

Site move for Lasertec allows for expansion

Following its acquisition by Coherent during 2000, Lasertec bv has now moved to larger premises. Although only small in distance, this move has large implications for Lasertec, increasing its building size by over three times and providing the infrastructure required for its rapid growth. The facility is located very close to Rotterdam airport and less than an hour's drive away from Amsterdam airport.



Key process knowledge

Based near Rotterdam, The Netherlands, Lasertec was founded in 1992 as a relatively small contract laser processing company. Over the last nine years it has grown in both size and reputation into an organisation dedicated to developing laser process solutions for industrial clients and then implementing these solutions into manufacturing environments. The key expertise of Lasertec lies in an in-depth knowledge of the laser process itself. Using its own laser work-stations Lasertec's engineers are able to characterise laser processes precisely and to develop customer specific processing routines. The specialised software engineers at the company translate these routines into a software system capable of controlling both the laser process and the external (motion, diagnostics) systems.

Integrating reliable Coherent lasers

Lasertec has always concentrated on high-end applications rather than acting as a general laser systems integrator. In this role it has pioneered in developing certain applications for a number of Coherent's laser products, especially the Avia ultra-violet DPSS system. Today Lasertec works with Coherent's full product range and regularly meets customer specifications previously considered unreachable. Lasertec's customers can depend on the quality of Coherent lasers and its reputable world-wide support network.



Systems used under demanding conditions

Lasertec systems are currently installed across Europe and in the Far East and are operated on a daily basis in critical 24/7 manufacturing operations. These systems are generally based around a Coherent industrial laser, coupled to a robust scan head and then supplied with the necessary housings and control electronics. Usually offered as OEM-type subsystems for integration onto new or existing production lines, they can also be supplied as turn-key stand-alone systems. Customisation of hardware and software is more a rule than an exception.



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UV Laser Systems

Many key Lasertec applications are based around the use of UV and incorporate Coherent's Avia family of lasers. Take the following example:



Cold Marking of Plastics with UV

Laser marking of plastics is widespread in industry – but commonly uses infra-red lasers. Here the heat from the laser is used to locally char the plastic to leave a mark. If this damage isn't acceptable, then (expensive) additives can be used which change colour permanently when heated by the laser. In any case, the marking process is a battle to achieve a mark before causing unacceptable damage to the material. And, getting this balance right can make the process very sensitive!

To solve this problem Lasertec has pioneered photochemical marking with ultra-violet lasers, using the high photon energy of ultra-violet to chemically change fillers and pigments already present inside **standard** plastics. For instance, brilliant white plastics use titanium dioxide to whiten them and this turns dark grey when illuminated with UV, leaving a high quality mark but without any damage or thermal stress to the host plastic. And, because this happens at laser powers well below those that would damage the plastic, the process window is large, so marking this way is insensitive to set-up, to material, to product flatness ...

Packaging

Lasertec systems are already used in production marking of medical and food (packaging) products, where there is high value to the combination of a very good quality mark, lack of thermal damage to the surface and the ability to mark standard materials.

Siemens Hearing Aids

Several Lasertec systems using Coherent Avia lasers are in production at Siemens, marking hearing aid devices on critical production lines. This equipment has been integrated into Siemens' parts handling line and Lasertec's software controls both the code being marked as well as external motion systems that present the parts in different orientations, allowing marks to be placed on several different aspects of the same component. For Siemens, Lasertec cold marking equipment brings the same flexibility as their infra-red marking systems, but now gives a high quality damage-free mark without the need to reformulate the used materials to optimise them for marking.



Other applications

Lasertec continues to develop new and exciting applications for Coherent lasers. Whether it be cold marking, engraving of hard metals or ceramics, glass marking, non-metal processing in the packaging industry, Lasertec can offer the system solution that enables the use of Coherent industrial lasers in your application.

For more information about Lasertec products and services, contact your local Coherent sales representative.