How Vortran Laser Technology Reduces Lead Times and Increases Stability for Laser Diode Systems

We Explain How We Create Simple Solutions for Complex Problems™ Across the Life Sciences and Other Markets

Introducing Vortran Laser Technology

At Vortran Laser Technology, our products serve the high-end laser market, supplying both OEM companies and end users. We pride ourselves on our fast turnaround times (we can manufacture some lasers in less than three hours) and the advanced stability and reliability of our laser systems.

Our primary focus is in the life sciences market where our laser technologies serve applications in cell biology, optogenetics, microscopy and imaging, flow cytometry, DNA sequencing, optical tweezers, spectroscopy, pharmaceutical drug discovery, and well plate reading, to name a few. We also supply the industrial market including semiconductor manufacturing and defect detection.

All of these applications require a very stable laser beam output along with long term reliability and stability.

In this whitepaper, we look at the challenges associated with overcoming these issues for both these markets and how Vortran Laser Technology provides complete photonics solutions to our customers worldwide.

The Markets and Challenges

In the life sciences market, we sell to both instrument manufacturers and end users. The majority of our systems are used in cell imaging and microscopy setups. These include applications such as spinning disk setups, laser scanning, light sheet, fluorescence lifetime, and various other cell imaging techniques.

We also have designed and developed light engines for flow cytometry, disease diagnostics and DNA sequencing.

Within the industrial applications market, our lasers have been used in LCD manufacturing, semiconductor test and measurement, and various other applications such as replacing gas lasers (Ar-Ion, HeNe, and HeCd) in existing instruments.

The biggest challenge with any laser design is allowing for enough adjustment to align the optics, without compromising the long-term stability of the laser system.

When designing such systems, engineers often adjust the design to account for certain instabilities but fail to understand the fundamentals for stable designs.

For example, many manufacturers use epoxy to fix lenses in a space. This is a simple solution but it fails to account for the stresses that are added while curing and the creep of the epoxy over time. Thus, many lasers (where this fix is applied) require realignment or readjustment throughout their lifetime.

At Vortran Laser Technology, we have designed and developed lasers for highly sensitive applications for many years, without any adjustment needed whatsoever. We'll discuss some of these solutions in our next section.

There are other stability considerations, where traditional mechanical engineering approaches can over constrain the system, inducing stresses and other artifacts that can adversely affect the laser performance.

These issues are often only identified when the laser system is in use. While these systems tend to perform sufficiently well in bench top lab situations, when they are put into enclosures or harsher environments, the beams will move due to thermal changes or the beam quality will change due to mechanical stresses being transferred into the optics.

The electronics driving the systems present further challenges, often with unintended effects on the laser performance. Many systems are designed using lab power supplies with very precise inputs to the laser. One very large manufacturer even specifies lab quality power input into its laser for industrial applications in order to keep the laser stable. Such designs cause further stability issues, affecting the beam quality and end results.

With many decades of electronics design experience, our engineers design the necessary components to allow our customers to use normal power supplies, which are found in any instrument or production line making our laser systems far easier to implement.

Our Solutions

Our Stradus® laser modules and systems are built on a platform technology that has a proven best-in-market reliability. With our blue (375nm to 514nm) systems, we have yet to have a laser diode fail in the field with many of these systems being used 24/7/365.

A range of factors and design considerations have helped us achieve this success. Our beam accuracy, for example, is better than any other manufacturer. This also makes the system design and build processes much more straightforward. Also, in the rare cases that it occurs, this simplifies field replacement as the beam is where one expects, without having to perform any significant adjustments.

A major key benefit of the Stradus system is the simplicity of manufacturing, which reduces lead times. In fact, we can manufacture a new laser in less than three hours.

This achievement is in stark contrast to our competitors where standard lead times were of between four and six weeks for similar laser systems, until we entered the market.

This focus on speed and stability is a natural consequence of our ethos, which is to use very basic engineering principles. So, our designs are based on simplicity not complexity. This leads to one of our taglines of 'Simple Solutions for Complex Problems' ™.

We do not add external measuring devices or use other 'tricks' to make up for designs that are inherently unstable, reducing your operation and maintenance responsibilities during the useful lifetime of the laser. This feature is valuable for multi-wavelength combiner systems and other higher-level designs, which are often affected by such complexity issues.

For example, when looking for mirror holders for beam combiners in our systems, we found many commercially available off-the-shelf holders were not stable enough to hold the necessary precision over time and across different temperatures. Therefore, we designed our own holders to overcome the inherent instability of the others. The design uses different materials that are more resilient to stress, including across the optics, to enhance the positional stability for the beam alignment.

With our standard lasers, the same principles apply. After our engineering team designed the CUBE diode laser module at Coherent, for example, they understood how a number of optical and mechanical improvements could reduce manufacturing complexity, while increasing the stability and long-term reliability of the device.

We decreased certain optical angles to increase stability compared to previous designs, while reducing complexity and eliminating the use of epoxy in the device, wherever possible. The laser module also has a defined optical bench to optimise beam alignment.

In Conclusion

With these improvements, we can say with confidence that our lasers are the most stable and reliable in the marketplace.

At the time of writing, we are yet to see one of our blue (375-514nm) laser diodes fail in the field. With more than 4,000 units deployed using these wavelengths, not one laser diode has had a failure for any parameter we specify.

This is especially impressive when looking at the near-UV wavelengths, which are susceptible to contamination and degradation over time.

This is mainly due to our patented Sealed Optical Cavity which protects all of the critical optics from environmental conditions. Many of these units in the field have well over 50,000 hours of continuous operation without issue.

If you'd like to find out more about Vortran Laser Technology and our work, please go to www.vortranlaser.com or contact one of our team at sales@vortranlaser.com.