IRIDIA

Engineered by Science

TELEDYNE
PHOTON MACHINES
Everywhereyoulook™

Why does Iridia exist?

To make your life easier.

The sole purpose of the Iridia is to make laser ablation ICP-MS applications faster to run and easier to set up, together with powerful software that vastly simplifies the optimization of both laser and ICP-MS, and offers all the required data reduction tools to guarantee consistently high quality analytical data.

Setting the correct gas flows and Dynamic-Z position for your samples is quick and easy and once set these settings remain stable from day to day, month to month, negating the need for time consuming daily optimizations.

Teledyne Photon Machines employs an "Engineered by Science" approach with all hardware and software products. This means everything we do is designed with the end user in mind, fully field tested in the real world and proven through peer reviewed and published data.

Flexible

One platform, quickly and easily configured for either Bulk or Imaging applications

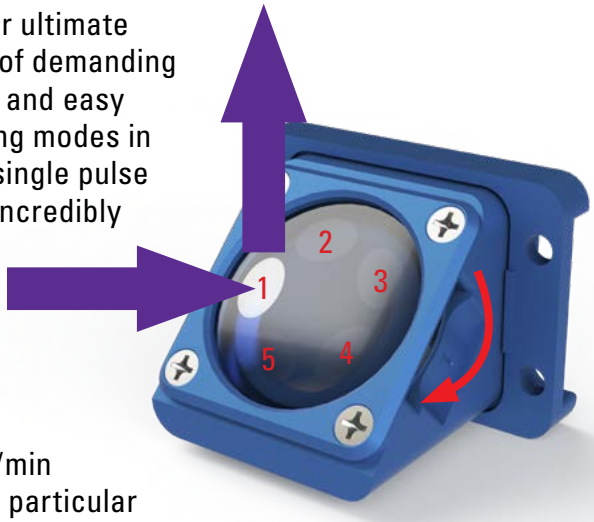
Proven

The only laser ablation system independently proven to generate high quality data at all rep rates up to and including 1kHz

What is Iridia?

FLEXIBLE

Iridia is a purpose-built laser ablation system designed for ultimate flexibility and capable of addressing an increasing range of demanding application needs. Optimization of all parameters is quick and easy and the system can be switched between bulk and imaging modes in less than 5 minutes. Configuring the application specific single pulse responses (SPR) from <1 millisecond to over 1 second is incredibly straightforward and will produce high quality data for everything from bulk analysis to high resolution image applications.



STABLE

Designed to use a maximum total helium flow of just 0.5 l/min ensures the ICP remains stable. Once configured for your particular application the systems setting (gas flows, dynamic Z etc) remain fixed and require little, if any further optimization from day to day.

PROVEN

By adopting an 'Engineered by Science' philosophy the system has been developed in close collaboration with internationally renowned academic partners. The Cobalt sample chamber design is now fully developed, tested and patented and has been independently proven to deliver the highest quality data from 1Hz to 1kHz through numerous peer reviewed publications.

INNOVATIVE

As the first laser ablation system built specifically for high duty cycles and low maintenance the Iridia is the first to include a fully sealed, interlocked, purged, and pressurized beam path. The design allows full alignment of all relevant components without compromising the system's Class 1 integrity. Additionally, the Iridia is the first commercial system to incorporate the latest mirror design allowing off-center alignment of the laser beam and instantly increasing the lifetime of critical optics by 5 times.

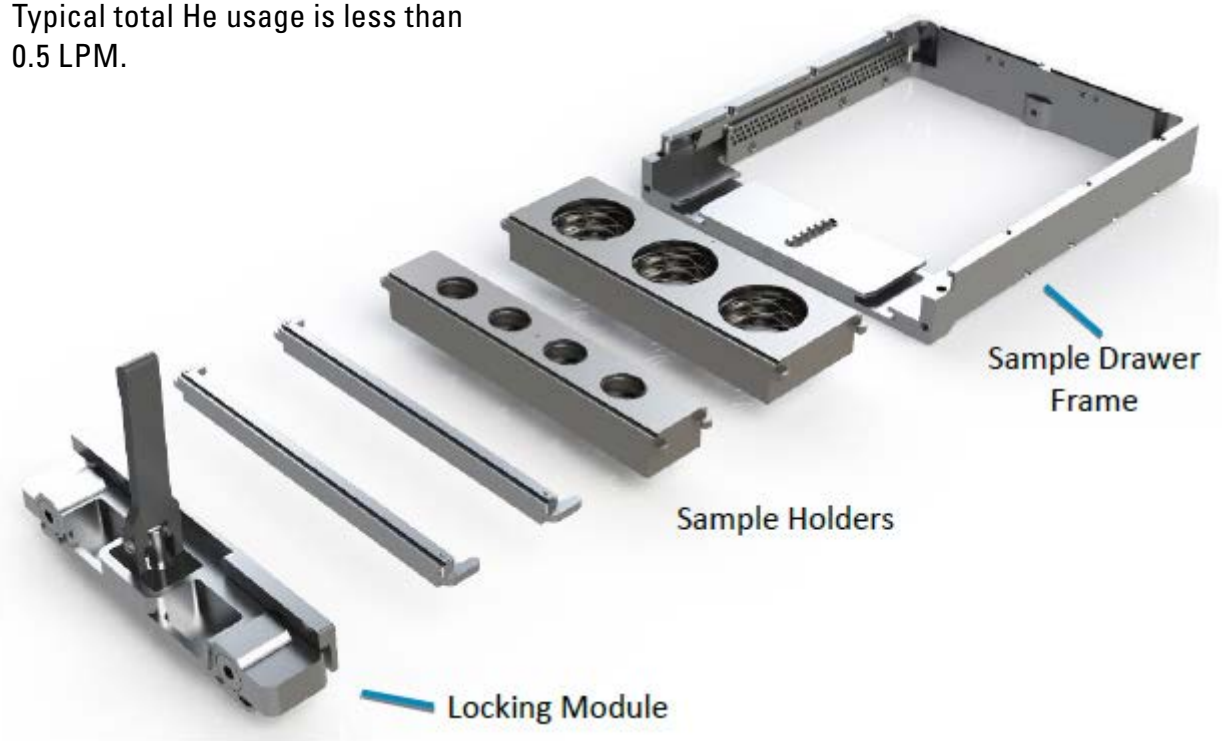
LOW MAINTENANCE

The integrated, fully enclosed, and vented gas cabinet holds all the necessary Excimer premix and helium gas bottles whilst the patented ExiCheck gas exchanger module automatically exchanges the ArF gas on a pre-set interval with no user interaction required, guaranteeing laser performance irrespective of how often the laser is used. The laser head itself is specified to deliver over 1 billion shots before resonator optics require replacement, a process that can easily be carried out in the field.

Analytical Performance

Iridia has high stability laser energy output coupled with highly developed sample chamber flow dynamics enabling high quality analytical performance that can make full use of the rapidly advancing ICP-MS technology.

The patented Cobalt sample chamber offers unrivaled flexibility from single millisecond to over second signal generation. With a 300 Hz, 500 and 1 kHz option, there are configurations for all needs. Compared to all current 2-volume samples chambers, the Cobalt chamber can achieve greater analytical performance with far lower gas usage. Typical total He usage is less than 0.5 LPM.



The analytical performance has been developed through multiple iterations in close collaboration with Prof. Vanhaecke's group at University of Ghent.

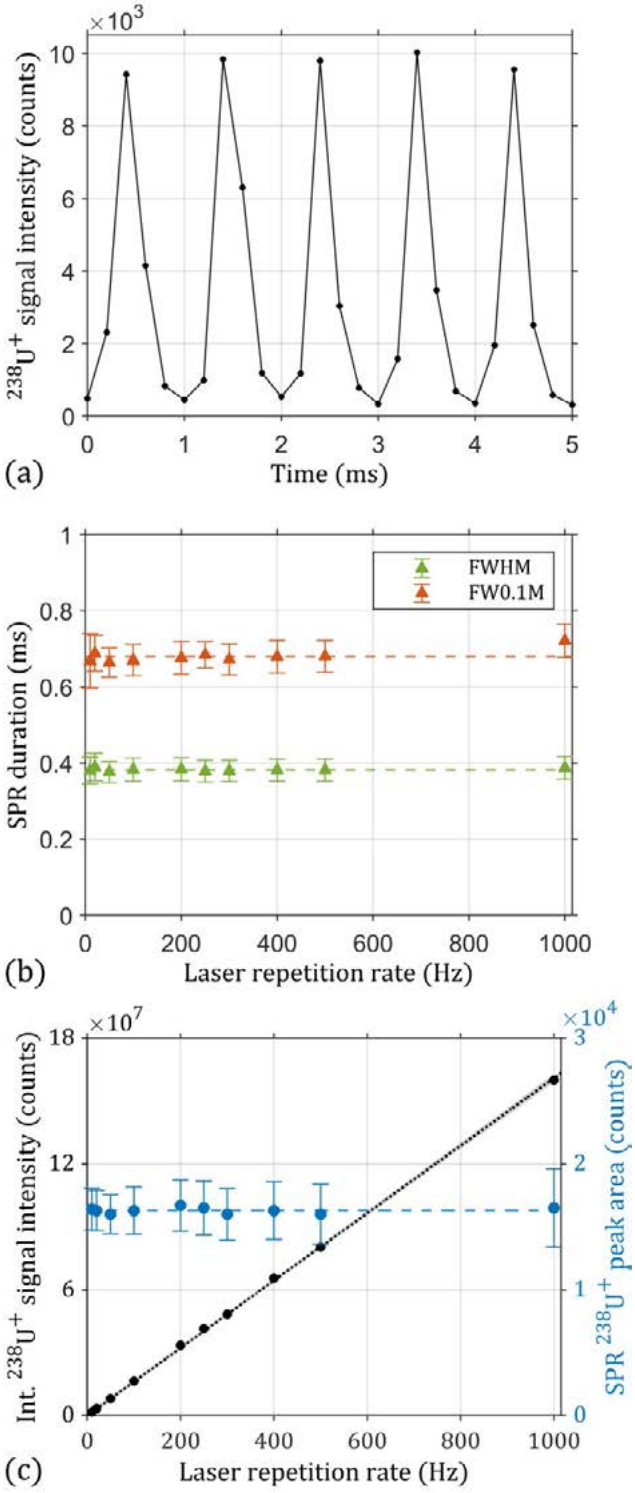
The result is a robust and highly capable sample chamber with independantly proven analytical characteristics presented in an important peer reviewed publication.[1] Data from that paper is presented in the three figures to the right.

Figure (a): Baseline separation of single pulse at laser repetition rates up to 1 kHz are possible, with peakto- peak reproducibility of <5% RSD

Figure (b) shows how consistent the Single Peak Response (SPR) duration is from 1Hz to 1kHz, demonstrating just how robust the cell design is. This is also a sound indicator for consistent analytical performance at all rep rates.

Figure (c) shows a consistent SPR peak area at increasing repetition rates as well as a truly linear increase in sensitivity with increasing rep rate.

These data sets are important as they not only show that the laser ablation system works as intended, but that the whole LA-ICP-MS system works well analyzing 1kHz pulses of aerosol.



1. T. Van Acker, S. J. M. Van Malderen, T. Van Helden, C. C. Stremtan, M. Šala, J. T. van Elteren and F. Vanhaecke, J. Anal. At. Spectrom., 2021, DOI: 10.1039/ D1JA00110H.

eQC In-Situ Energy Detector (patented)

The eQC is a patented energy meter system permanently present in the corner of the sample chamber. It allows a user to check the laser energy being delivered to the sample immediately before and after analytical runs and to confirm that the laser is working as expected. This can be particularly useful where long unattended runs are being undertaken as it gives the analyst the confidence that everything worked as required with consistent ablation parameters being delivered throughout.

WHY IS THIS IMPORTANT?

Energy detectors that are “upstream” of the sample chamber are blind to losses caused by degradation of the laser and beam delivery optics, and other losses in the beam path that result in erroneous readings at the sample.

The eQC energy detector is built-in to the Cobalt sample chamber, at the sample where ablation occurs. Thus, the eQCsees what the sample sees during ablation, providing the only accurate, **true** measurement of energy density.

In addition to providing the most accurate energy & energy density measurements of any laser ablation system, eQC is an on-board diagnostic tool that monitors the health of the system by comparing the energy output of the laser (as measured by excimer laser’s integrated energy detector) with the eQC readings. Any changes from the original factory measurements that occur are immediately apparent and the software automatically calibrates the energy density display within Chromium for user assurance that the desired energy density is truly achieved at the sample surface.

ExiCheck Gas Exchange Accessory (patented)

The patented ExiCheck system allows the user to set the laser system aside, completely powered down (but connected to the mains electricity), and at a time interval defined by the user the unit will switch on just the components required to effect a fresh gas refill of the cavity, after which it is once again be fully powered down.

Using the ExiCheck system keeps the laser in optimum condition whilst also reducing the total annual gas consumption of the whole system.

WHY IS THIS IMPORTANT?

It saves you time and money. The ArF gas used by a 193nm laser has the unusual property of degrading over time. A fresh gas refill is recommended every month but if the laser is unused for extended periods then the gas will go ‘stale’ and significantly degrade the performance of the system.

Unfortunately, the laser cavity can be damaged by stale gas contamination leading to an increase in gas usage as more frequent fills are needed to maintain a stable output. If the system is left for too long without a fresh gas refill then the only way the system can be repaired is by sending the laser head back to the factory for a full refurbishment costing both time and money

FULLY AUTOMATED

All of this is firmware controlled and completely automated . It does not rely on software or require a PC to be running in the background

Dynamic-Z (patent pending)

A key part of the academic studies that underpin the Cobalt sample chamber design focused on optimizing the has flows around the point of ablation.

It was found that the analytical performance of the whole system could be compromised unless both the gas flows AND the distance between the sample surface and the extract point were both correctly configured.

This distance cannot be a fixed distance because it varies depending on the application and optimization parameters needed for the particular analysis. Independant research[2] has shown that a distance of between 60µm and 200µm is needed for the tube cell configuration (can be greater than 200µm for the 'Long Pulse' module) and that the distance needs to be consistent and carefully maintained throughout the run to +/- 10µm of the set point.

It is important to realize that the distance needs to be optimized independently of the laser focus and will be application specific. The laser is focused on the sample surface and then the distance to the extraction point (the hole in the tube cell or at the base of the cup) needs to be optimized independently.

Once set, this can then be coupled to the focus optics to track a surface topography, or fixed independent of the focus point where depth profiling applications are being undertaken. In that case, the laser focus would drive down into the sample but the distance between sample surface and extraction point would remain fixed, and therefore optimized for most efficient sample transport.

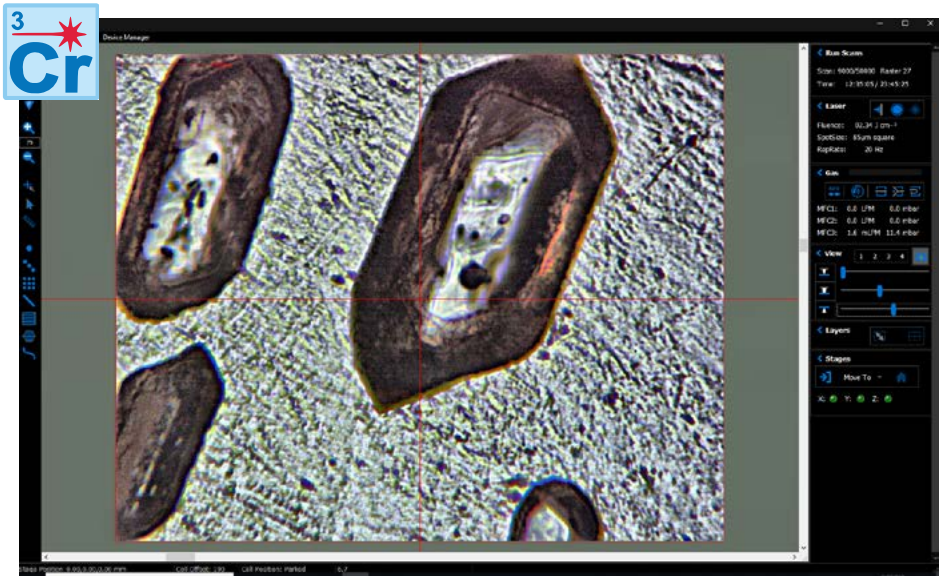
An additional benefit is the ability to hold the laser focus, drive the cup/tube assembly up away from the surface, and then navigate freely around the sample chamber without fear of impacting the sample surface and either damaging the sample or the hardware.

It is important to recognize that the 'Dynamic Z' function is an additional 'Z' drive that operates entirely independently of the existing 'Z' drive that manages the laser focus.

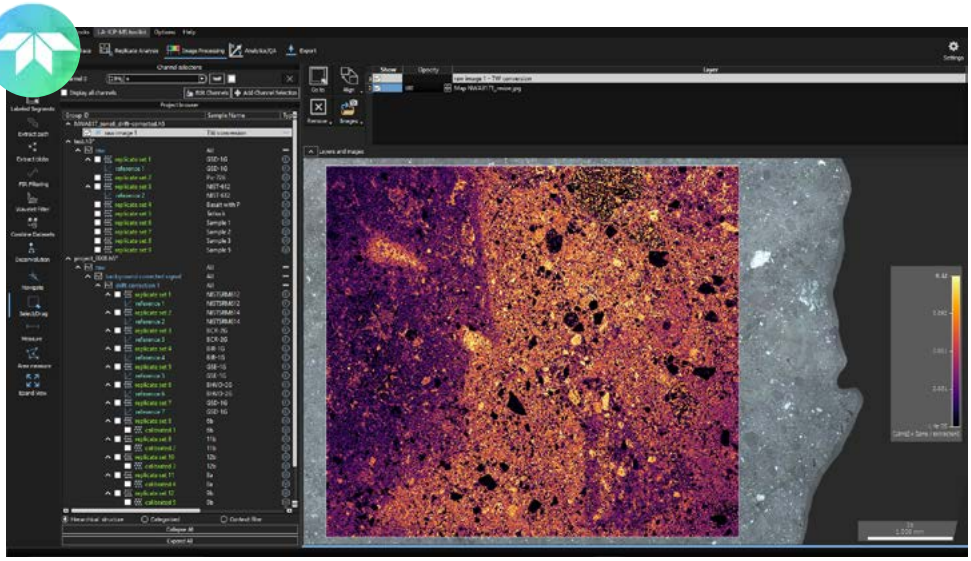
2. Sub-µm nanosecond LA-ICP-MS imaging at pixel acquisition rates above 250 Hz via a low-dispersion setup. Stijn J. M. Van Malderen, Thibaut Van Acker, and Frank Vanhaecke. Anal. Chem., DOI: 10.1021/acs.analchem.9b05056 • Publication Date (Web): 23 Mar 2020

Powerful, Easy To Use Software

The Chromium 3 operating software has been completely re-engineered to provide a streamlined user experience. When coupled to HDIP, the Iridia becomes an incredibly powerful analytical package, offering unrivaled analytical flexibility with increasingly automated data reduction and interrogation modules.



HDIP Mass Spectrometry Data Analysis software suite comes preinstalled on all Iridia systems, with a full license valid for 6 months. An extended community of users is available online, as well discussion forums, training modules, and up-to-date documentation.



IRIDIA Laser Ablation System

The result of more than five years of collaborative academic research

- Patented Cobalt Cell for proven <1ms to >1s flexible analytical performance1
- Quick and easy optimization
- Geo and Bio configuration – or both!
- Dual attenuators available for low energy stability (1 – 0.01 Jcm-2) for proven selective ablation of biological samples2
- Eye-safe class I laser alignment
- MLase laser with enhanced operational lifetime characteristics to minimize operating costs
- Spot sizes from 1 µm - 150µm (up to 210 µm with optional beam expander)
- Fully sealed interlocked optical path with pressurized purge and multi-position mirrors for 5× mirror lifetime
- Software controlled, dual polarizers with geo configuration enabling superior birefringence measurements
- 300 Hz, 500 Hz, and 1 kHz laser options
- Smallest footprint (600mm W, 888mm D, 1413mm H), eQC, ExiCheck
- Proprietary expanded objective array
- Pre-installed demo version of HDIP software
- Pulse-to-pulse highly reproducible analytical data
- High precision analytical data irrespective of single pulse response (SPR) speed
- Baseline separation achieved at 500 Hz
- HDIP significantly advances the performance capabilities currently provided by software plugins
- HDIP generates quality data using peer-reviewed algorithms
- HDIP allows quick and efficient modelling of analytical parameters for highest quality data
- HDIP peak detection module for automated optimization

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