Development of a new Laser Ablation Platform – the Iridia

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Introduction

Teledyne Photon Machines has always made collaborative research a priority. We believe this to be the only durable way for empowering technological innovations in science. From developing applications that enable our users to make the most out of their instrumentation to developing new tools, both hardware and software, that allow the scientific community to further their research, we have long recognized the true value of the science driven innovation and have diligently cultivated mutually beneficial projects. We have often turned to academia to validate our findings, as well as being strong supporters of academic endeavours.

Laser ablation inductively coupled mass spectrometry (LA ICP MS) elemental mapping has recently changed from being a rather cumbersome and resource-consuming tool mainly used by the earth sciences community, to mainstream technique for analysing anything from biological samples to archaeological artefacts. In order to accommodate this pivotal change, new hardware was needed that would speed up the analytical process, but also yield uncompromised data quality [1]. Based largely on the feedback we received from our user base, we have developed a new, dedicated ablation system that offers unprecedented control over the speed, lateral resolution and analytical sensitivity. Built around the extensively tested Cobalt tube cell [2, 3] and with a completely new design evolved from many years of experience working with Analyte Excite and G2 platforms, the Iridia system is focused on offering the shortest pulse response duration (full pulse signal acquisition of less than 3 ms at FW0.1), the lowest maintenance costs, and the highest sensitivity [4] available.

Iridia

- Incorporates the patented Cobalt Cell optimized for high speed imaging applications
- 500Hz ATL laser, custom optimized for Teledyne Photon Machines to give ultimate reliability and performance with 2 year warranty and 1 billion shot guarantee
- Integrated, fully enclosed and actively vented gas cabinet contains all necessary excimer premix and helium gas bottles
- Patented ExiCheck gas exchange module automatically exchanges the ArF gas on a pre-set interval with no user interaction required
- Dual Attenuation enables stable low energy for bio-imaging applications
- Dual software controlled polarizers for geo-imaging applications
- Patented eQC energy measurement at the point of ablation in the sample chamber.
- Demag optics to increase spot size range
- 'Multi use' optics giving 5 x lifetime for high fluence mirrors
- Full CLASS 1 (Eye Safe) operation, alignment and maintenance
- Pressurised purge (MFC controlled with interlocks) with N2 Generator option

Innovation

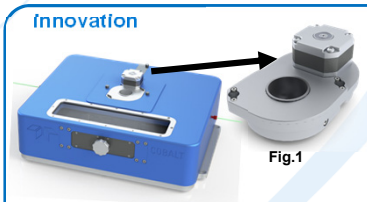


Fig.1

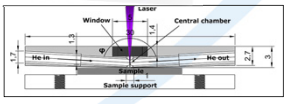


Fig.2

- Dynamic 'Z' tube module to maintain constant distance between sample surface and aperture in Tube Cell (patent pending) (Fig.1)
- Patented Cobalt 'tube cell' geometry to maximise analytical performance, flexibility and ease of use (Fig. 2)
- Patented eQC energy measurement at the sample surface
- Patented ExiCheck gas exchange module automatically exchanges the ArF gas on a pre-set interval with no user interaction required
- Innovative multi-use optics to maximise lifetime of critical reflective components (Fig. 3)

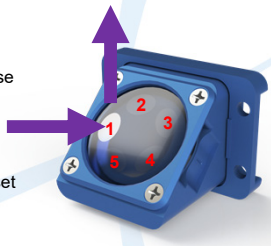
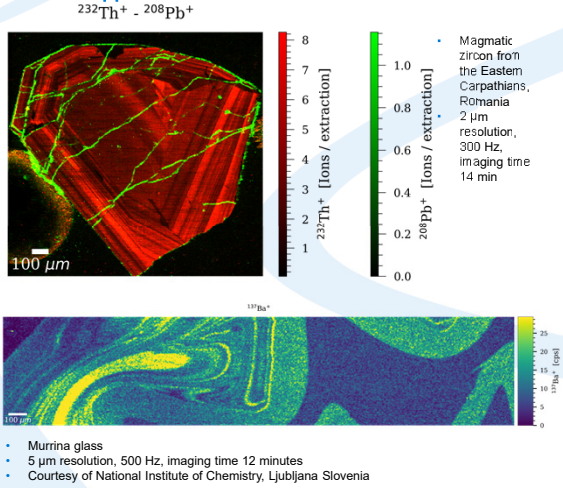
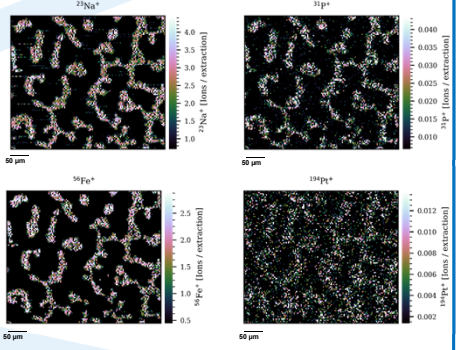


Fig.3

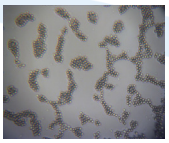
Cobalt Applications



- Magmatic zircon from the Eastern Carpathians, Romania
- 2 µm resolution, 300 Hz, imaging time 14 min



- Murrina glass
- 5 µm resolution, 500 Hz, imaging time 12 minutes
- Courtesy of National Institute of Chemistry, Ljubljana Slovenia



- Red blood cells of a patient after cisplatin chemotherapy
- 2 µm resolution, 100 Hz, imaging time 20 min

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Conclusions

The Iridia has been engineered as a direct result of academic collaborations exploring the real world application needs of high resolution and high speed elemental imaging. The result is a laser system that has been built up on a completely new platform specifically to address the needs of both the geo and bio-imaging communities

The Cobalt cell is the most important aspect of this development, and Teledyne have undertaken over 12 months of analytical testing to evolve and prove the capabilities with Ghent University, TOFWERK and the University of Vienna.

The Iridia represents the most advanced and flexible imaging platform available today

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