High Sensitivity, Fast Scanning, Sector Field ICP-MS – Improving Sensitivity for Laser Ablation with the Jet Interface

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ABSTRACT
The long term trend in laser ablation (LA) coupled to inductively coupled plasma mass spectrometry (ICP-MS) has been to:

• Use smaller spot sizes to increase spatial resolution
• Intensify elements at lower and lower concentrations
• Improve isotope ratio precision.

In order to achieve all of these aims the result has been a need to significantly improve the sensitivity of ICP-MS technology. Sector Field ICP-MS has the potential to deliver significantly higher sensitivity than other mass analyzers but is often limited by the sensitivity of the detector. Here we report the sensitivity (as high capacity dry interface pump and a companion set of sector field ICP-MS, especially for dry plasma. It consists of a HR-ICP-MS greatly increases the sensitivity of fast scanning, quantification and detection (LOQ and LOD). Of the ICP-MS vital in order to achieve useable limits of ablated. These limitations in sample size make the sensitivity imaging has also led to a reduction in the amount of sample zones it is highly desirable to ablate as little sample material as possible. The trend towards higher resolution LA-ICP-MS bio-imaging has also led to a reduction in the amount of sample ablated. These limitations in sample size make the sensitivity of the ICP-MS vital in order to achieve usable limits of quantification and detection (LOQ and LOD).

The Jet Interface for the Thermo Scientific Element XR SF-ICP-MS greatly increases the sensitivity of fast scanning, sector field ICP-MS, especially by dry plasma. It consists of a high capacity dry interface pump and a companion set of specially designed cones. Here we report the sensitivity (as sample ion yield) of the Element XR when equipped with the Jet Interface option. We then compare the sensitivity to two other ICP-MS for the LA-ICP-MS U-Pb analysis of two common zircon reference materials.


TRADEMARKS/ LICENSING
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RESULTS
Table 1. Sample ion yield (%) for seven elements across the total mass range.

<table>
<thead>
<tr>
<th>Element</th>
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<th>Fe</th>
<th>Nb</th>
<th>Hf</th>
<th>Pts</th>
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<tbody>
<tr>
<td>Mean</td>
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Figure 1. Plot of sample ion yield (%) against mass for seven elements. 1 ppb of each element was aspirated through an Apex Omega desolvating nebulizer system to produce a dry aerosol analogous to a laser ablation aerosol. Due to the mass response of a sector field mass spectrometer the greatest sample ion yields were for the heaviest elements.

MATERIALS AND METHODS
ICP-MS
Three ICP-MS systems were used:

• NEPTUNE XT (multi collector ICP-MS, with Jet Interface)
• ELEMENT XR (single collector Sector Field ICP-MS), equipped with Jet Interface option
• iCAP TQ (single collector quadrupole based ICP-MS), equipped with high sensitivity cones and insert recommended for laser ablation analysis

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U-Pb isotopic analysis of two reference zircons: comparison between iCAP TQ, Element XR (Jet Interface) and Neptune XT

The 207Pb/206Pb signal for the 91500 reference zircon was used to compare the three LA-ICP-MS systems (Figure 2). The Element XR with the Jet Interface option was 21 times more sensitive than the quadrupole-based ICP-MS (The Neptune XT, also equipped with the Jet Interface and the benefits of multicollocation was a further 3.5 times more sensitive).

CONCLUSIONS
The Jet Interface for the Element XR SF-ICP-MS gives:

• Over 20 times LA sensitivity compared to Q-ICP-MS

REFERENCES

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