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Design and Manufacture of a High Resolution Orbital-Trapping Mass-Analyser for Secondary Ion Mass Spectrometry (SIMS)

High resolution mass spectrometry has revolutionised the identification of complex biological molecules and given rise to the “omics” revolution. However Static Secondary Ion Mass Spectrometry (SIMS) instruments typically still make use only of time-of-flight analysers. These still have many advantages, but the ability to send ions also to a very high mass resolution ($>100,000$) analyser when needed would be extremely useful.

We have designed and fabricated a high mass-resolution orbital trapping analyser for Secondary Ion Mass Spectrometry (SIMS)[1]. A key issue is the precise machining and alignment of components of the ion trap. We perform finite difference method (FDM) simulations and ion trajectory calculations to establish the precision needed in manufacturing and aligning the trap. Machining of the high-precision mathematically-defined electrode surface was achieved through the use of hand-crafted Gcode segments. The ion trap and transfer assembly, once assembled, were characterised and key dimensions measured, these then being used for SIMION[2] simulations of ion trajectories to check the operation of the device.

[1] J C Hood and P J Cumpson, International Journal of Modern Engineering Research, 6 (2016) 76-83. (www.ijmer.com/papers/Vol6_Issue10/Version-2/J61027683.pdf)

[2] www.simion.com

Primary author: Mr HOOD, James (Newcastle University UK)

Co-author: CUMPSOON, Peter (Newcastle University)

Presenter: CUMPSOON, Peter (Newcastle University)

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