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An electrostatic trap for high sensitivity, on-line laser spectroscopy

Collinear laser spectroscopy coupled with optical pumping, within the cooler-buncher, has proved a highly successful technique at IGISOL-4 [1-3], facilitating spectroscopy on manganese, niobium, yttrium and even the doubly charged yttrium ion. The pumping, while highly efficient and well matched to our pulsed laser system, is subject to Doppler and pressure perturbations and collisional relaxation within the gas-filled device. These limitations motivated the development of a secondary electrostatic trap, operating in vacuum, and resulted in the development of the Manchester ConeTrap.

The ConeTrap, pioneered by Schmidt et al. [4], is an electrostatic device that is especially suitable for deployment at the IGISOL [5]. The devices have been shown to successfully contain close to 10^5 ions for time periods exceeding 100 ms (many times the atomic excitation and de-excitation lifetimes) and are well matched to the typical ion plumes released from the IGISOL cooler-buncher. With limited, but critical, modification to the original design a trap suitable for use on the cooler-buncher platform was constructed and deployed at the IGISOL.

While successfully demonstrating the device was operational, initial tests showed that a physically larger trap with matched injection and extraction ion optics provides the desired spectroscopic performance. Such a trap has been developed on a bespoke testbed and will shortly be (re-)deployed at the IGISOL. The design, development, simulation and commissioning of the device along with future spectroscopic opportunities will be presented.

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