**Main purpose (A)**: Carry out measurements of a few parameters of confined electron/positron plasmas to compare them with results from PIC simulations. The result should inform us on the suitability of the PIC code to do predictions on the confinement of an electron plasma in the next design iteration of the Gabor lens.

Secondary aim (B)**:** Address some of the questions on the characteristics of the Gabor lens required to achieve the focusing properties called for by the design of LhARA.

Proposed set of measurements

**A1** – Diocotron m=1 mode

Measure the diocotron frequency for a range of plasma lengths, displacements from the axis, densities.

* Load electrons/positrons off-axis in the storage trap.
* Eject particles towards the MCP to determine plasma size, position, number, temperature.
* (Measure the frequency non-destructively before ejection.)
* (For positrons, possibility to vary the number over wider range due to the accumulator).
* Plasma length can be varied by choosing different electrodes as end gates.
* Plasma displacement: positrons – manipulated in the accumulator; electrons – source installed on a linear manipulator.

**A2** – “Equilibrium” plasma profile

Measure the transverse plasma profile for a range of plasma lengths and positron number/density.

* Load positrons from the accumulator at different particle numbers (and temperatures [?]).
* RW turned off.
* Wait for “equilibrium” to establish.
* Eject towards to MCP to determine the line integrated density profile, temperature.
* Range of plasma densities for each plasma length informed by the corresponding simulation times that can be afforded.

**A3** – Positron focusing

Measure the focusing of a positron “bunch” by an electron plasma.

* Positron “beam” from the accumulator by releasing part of the plasma or from the source [?] propagating along the central axis.
* Measure transverse profile of the bunch without and with the electron plasma in the storage trap.
* Needs evaluation of the focusing strength/focal length to see whether the focusing is measurable.
* Thin positron “beam” propagating off-axis from the accumulator – measure the position downstream of the storage trap with and without an electron plasma.
* [Is e+e- annihilation an issue?]

**B1** – Trapping efficiency

Investigate the trapping efficiency (density as % out of the Brillouin limit) for positron/electron densities close to the design plasma density for the Gabor lens.

[How much control there is on the electron density. Does the beam-catching technique allow for accumulation of higher electron densities?]

* Investigate upper limit on electron number in the storage trap with the RW turned off and the corresponding lifetime of the plasma.
* Repeat the measurements above with RW turned on, but with a plasma radius around 1 cm.