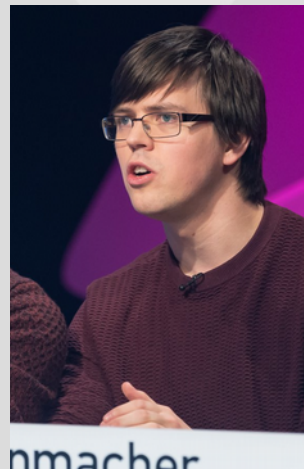


Previous Gabor Lens and Beam Test: Results

Toby Nonnenmacher

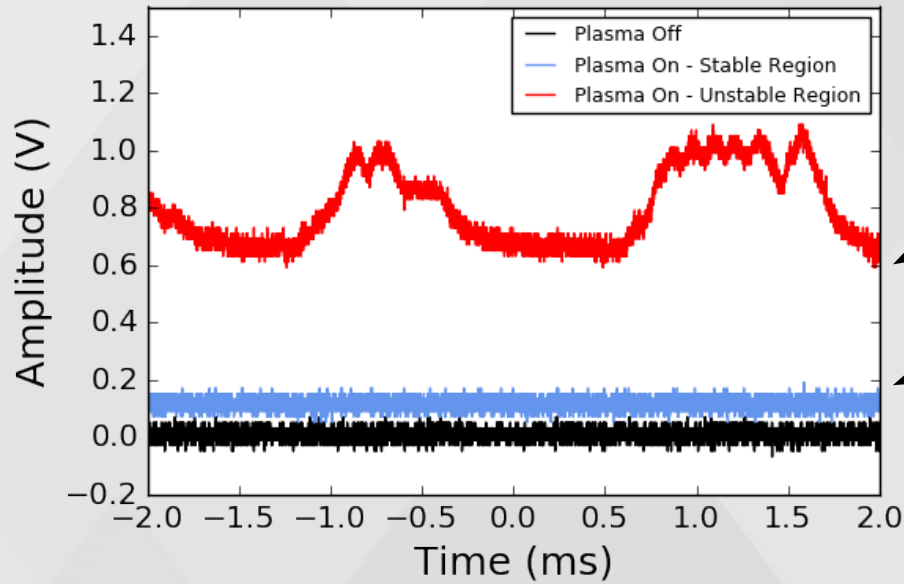
Gabor Lens Meeting, 2020/08/13



Overview

- Results from the beam test showed a non-linearity in focussing
- Interested to see if the unexpected effect can be explained and replicated to any degree in Titus' simulations
- Brief summary of the results shown here

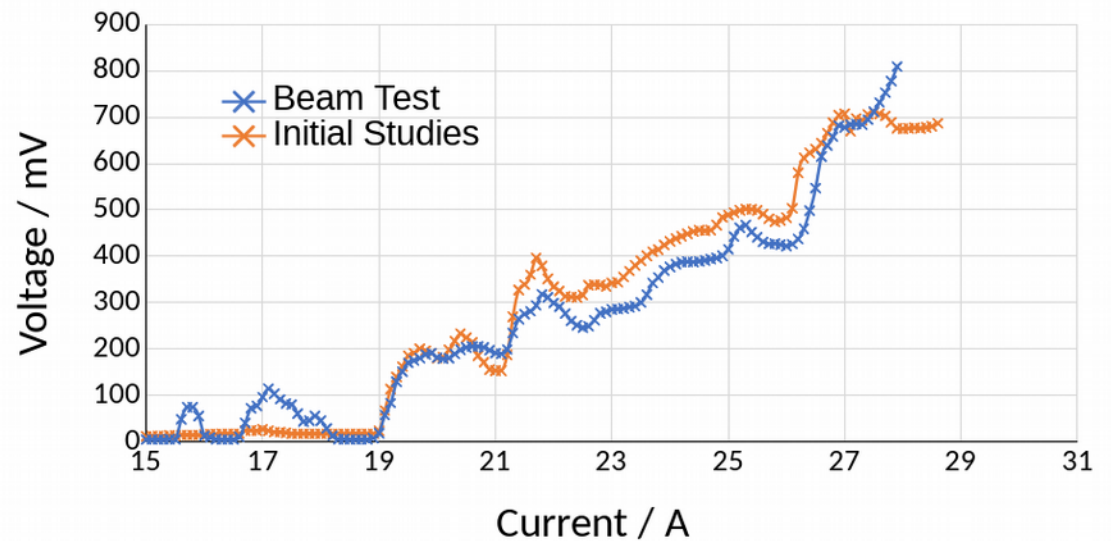
Regions of operation



Unstable at overly high current through the magnetic coils

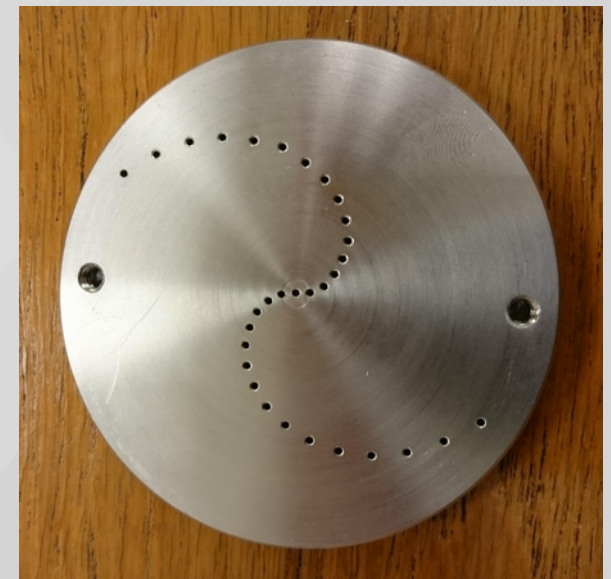
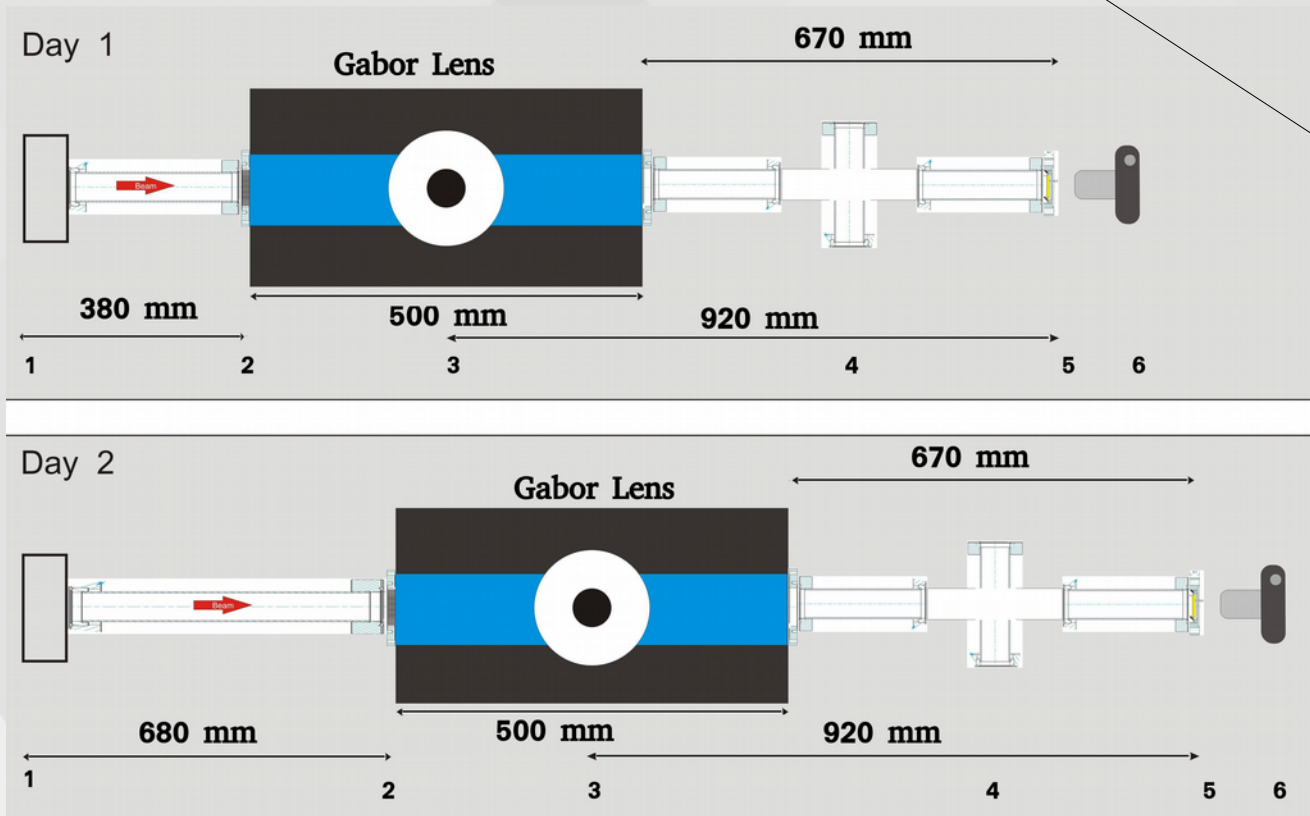
Stable region of operation

This region (between 14 and 30A) used for beam test



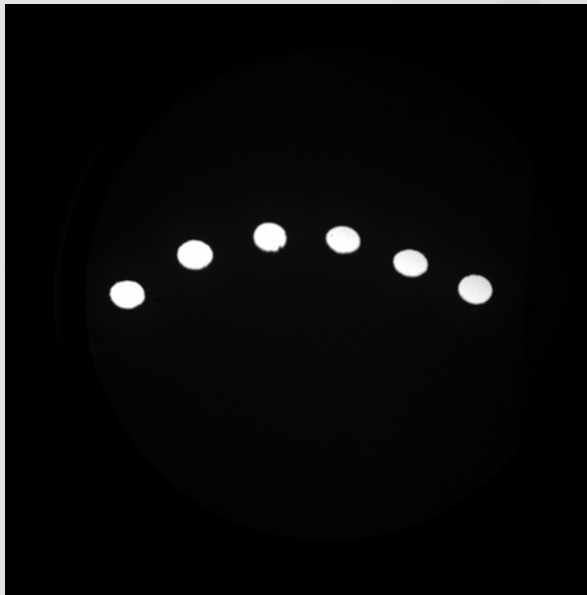
Surrey Beam Test setup

- Beam test held at Surrey Beam Facility for 2 days in October 2017
- Different setups on each day
- Pencil beam of 1.4MeV protons
- Split into beamlets by aperture and imaged with a camera on a phosphor screen

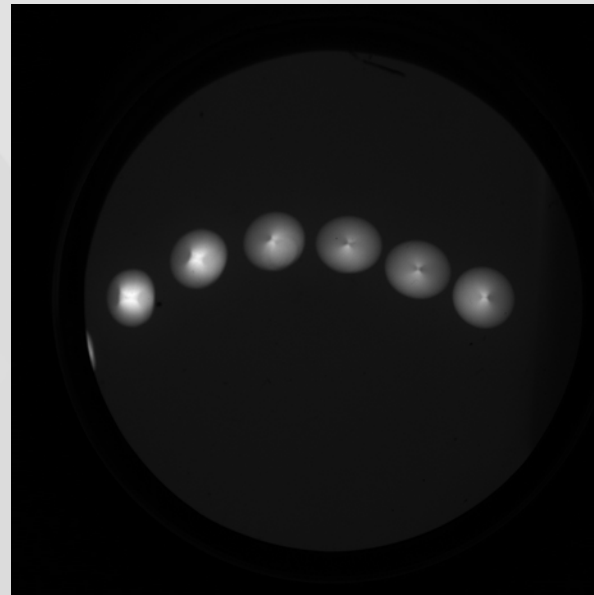


Results

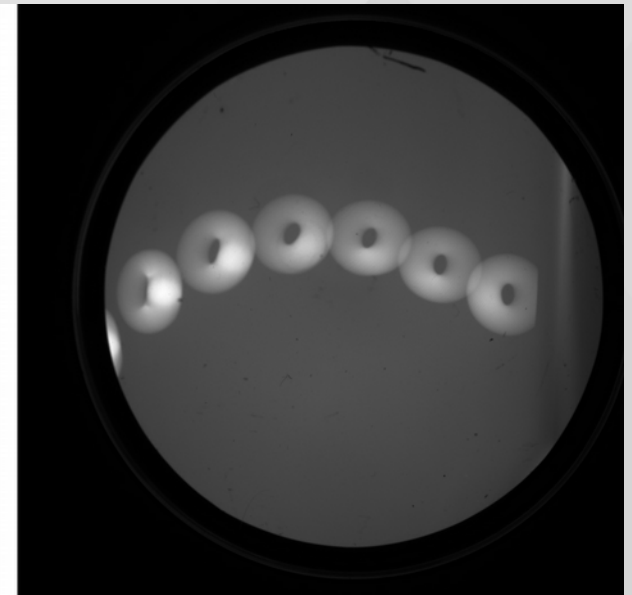
- Focussing by the lens occurs, but beamlets focussed into ring shapes
- Analysis implies non-uniformity of the plasma in the lens, and problem with alignment of the magnetic axis



Unfocussed

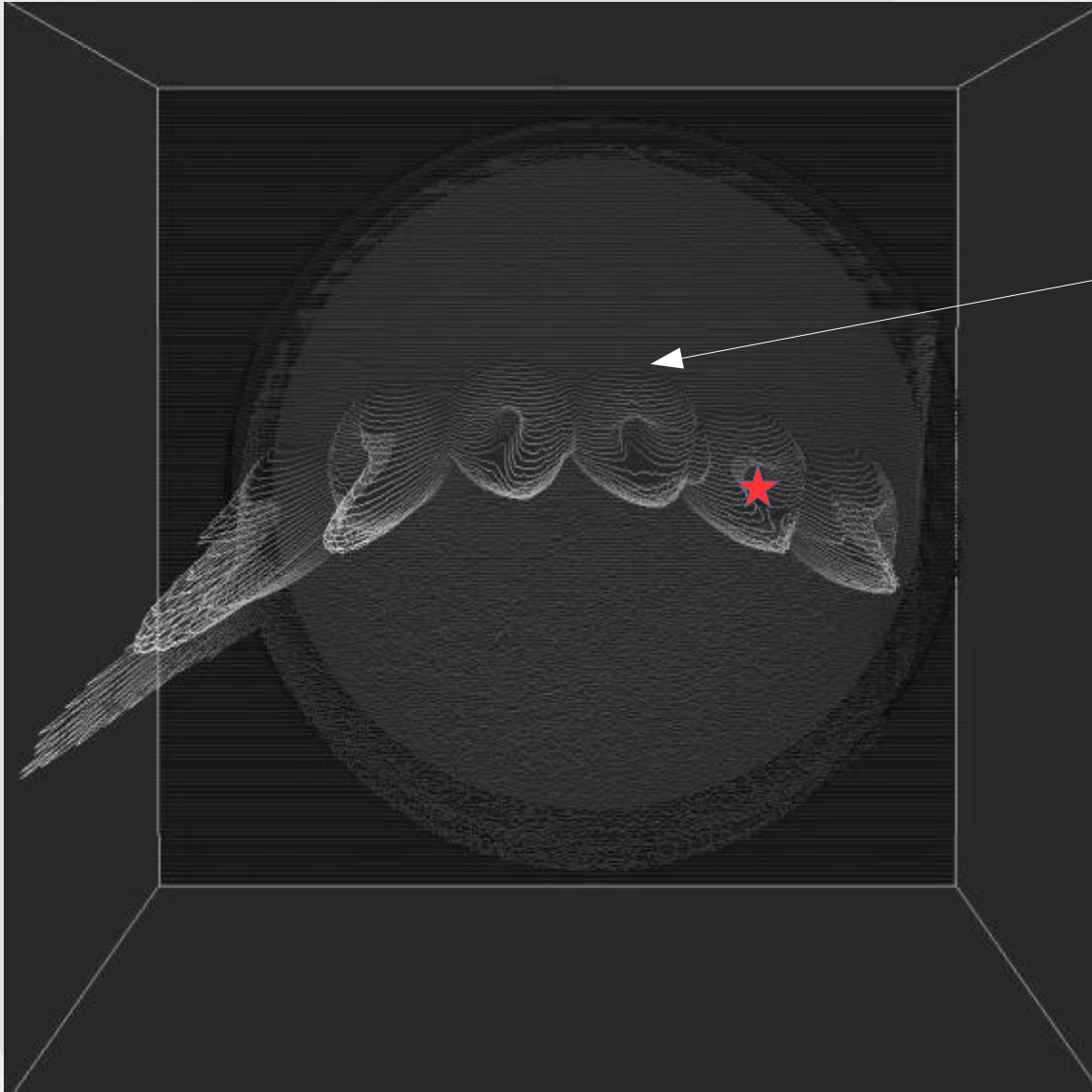


28A through magnetic coils



33A through magnetic coils

3D representation

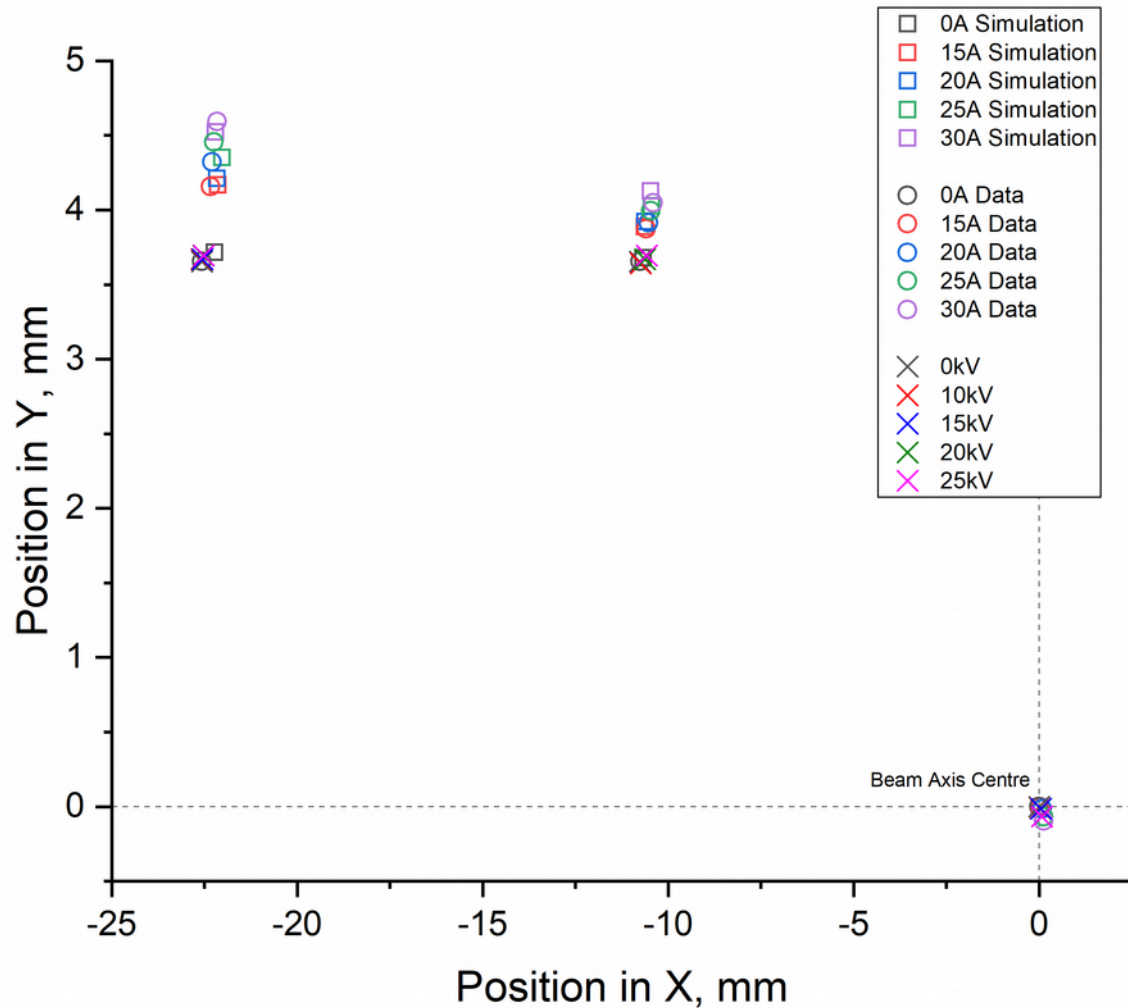


The ring structure is not uniform in intensity

The overall beamlet shape becomes more eccentric at greater radius from the beam axis

Similar seen (but in less detail) in Neuner et al 2000

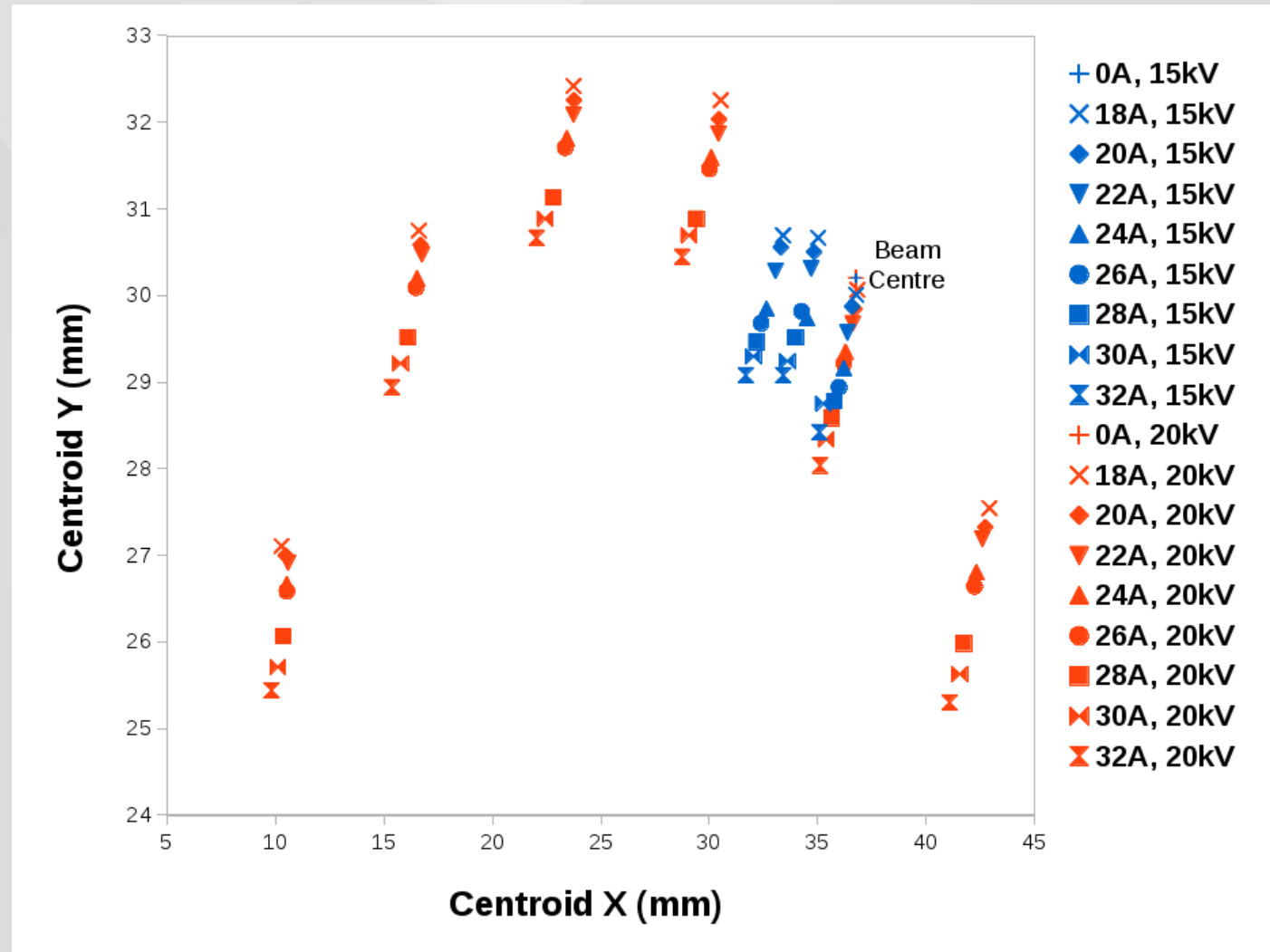
Simulation vs Data, for current or voltage ONLY



Results with current AND voltage

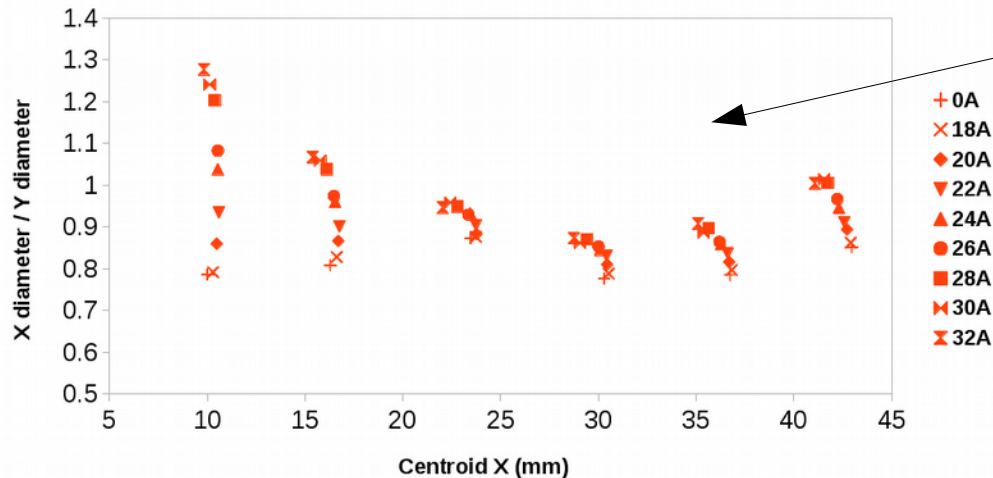
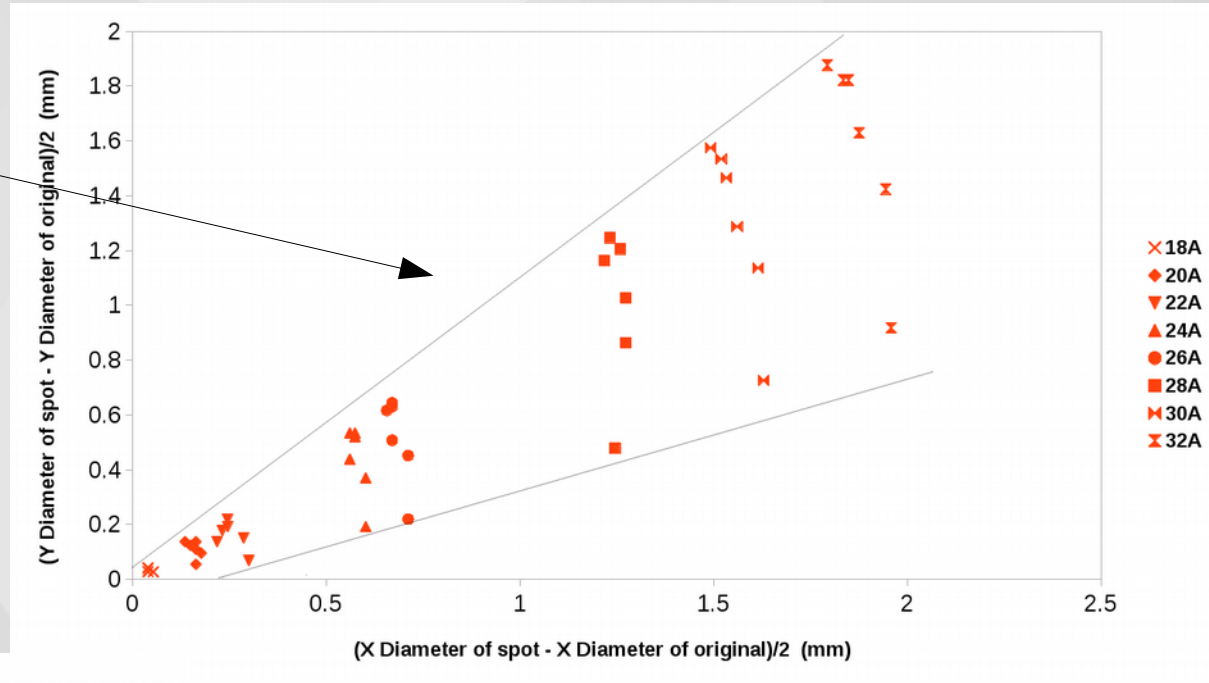
Approximately linear increase with magnetic field, whereas plasma density expected to increase as square of magnetic field.

Therefore alternative limiting factor



Shape of the circles

Higher order effects:
Increase in spot size with magnetic field larger than linear



Forces in X and Y change by different amounts with magnetic field:
Force in X bigger nearer center of the lens

Juergen's Conclusions

- These results imply:
 - Centre of the lens has a low density
 - Further from the lens axis the density increases with radius
 - Some perturbation in the lens with a time dependence, ie. some oscillation in the rotation of the plasma