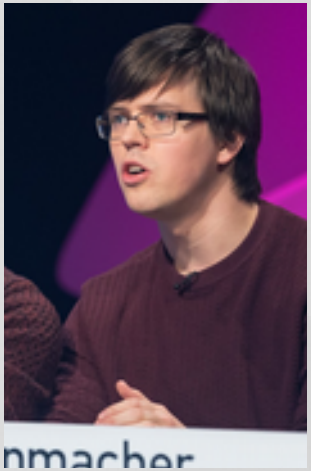
Imperial College London

Previous Gabor Lens and Beam Test: A Brief Overview

Toby Nonnenmacher

Gabor Lens Meeting, 2020/06/18

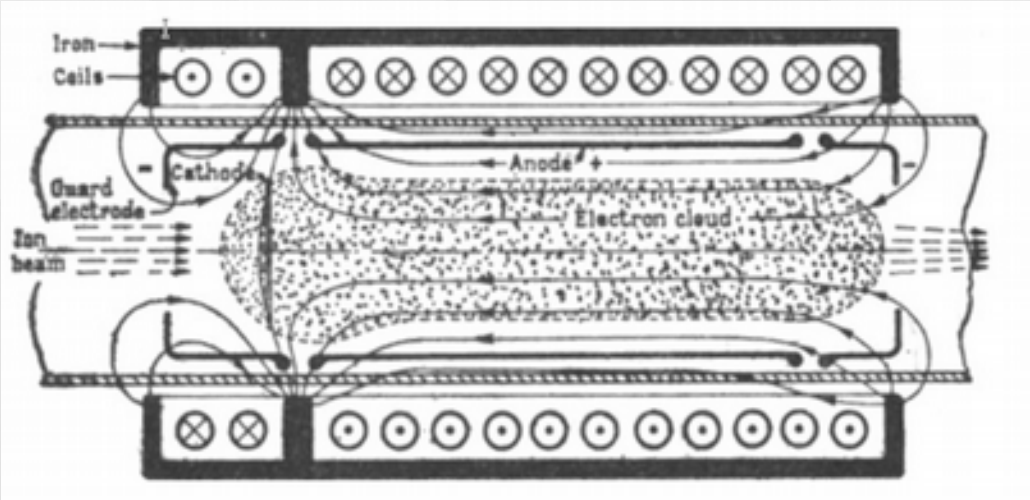


About me (briefly)

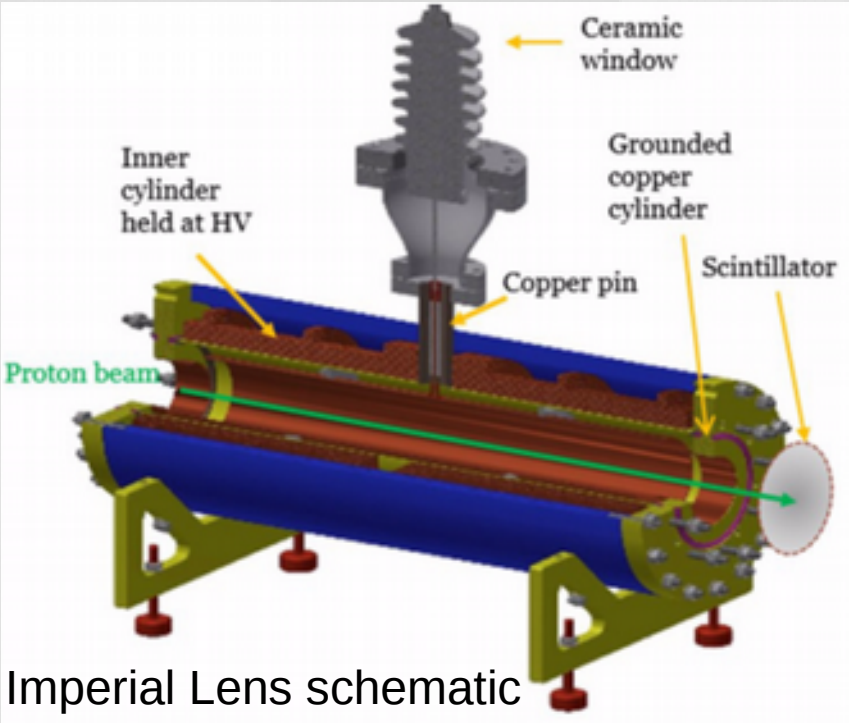
- Worked for ~10 months on the Gabor Lens in 2017 supervised by Juergen Pozimski
- Work culminated in a beam test at the Surrey Ion Beam facility
- Since then have worked on T2K, with some on-off work on analysing the beam test data
- About to submit my thesis

- Seeking to submit a paper on the Gabor Lens beam test written with Juergen

Gabor Lens



Gabor 1947

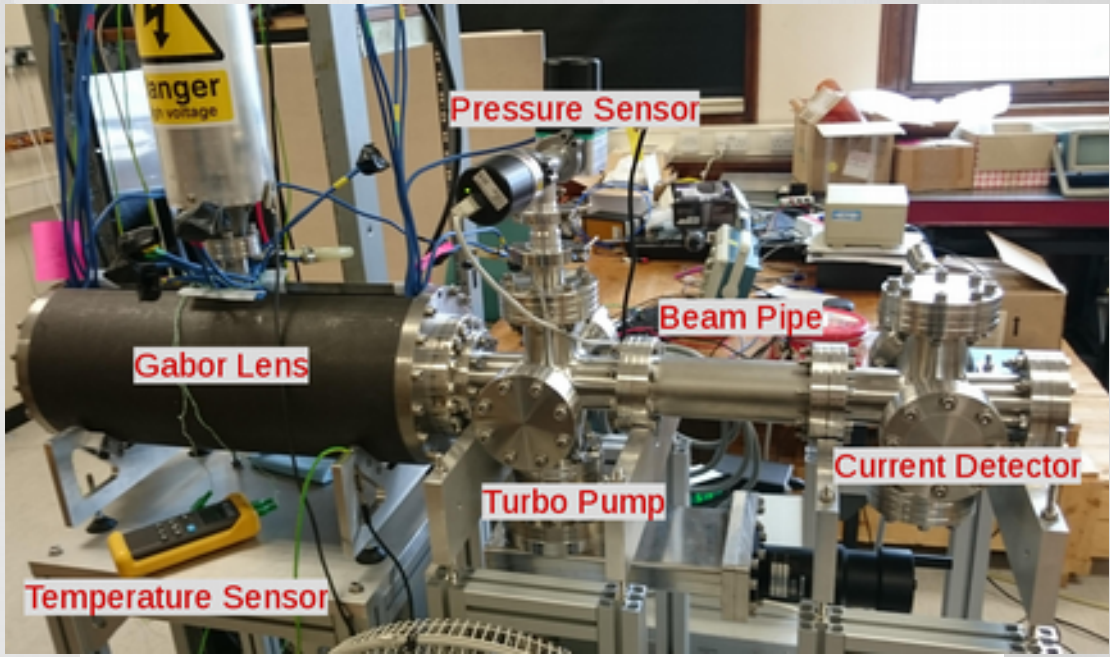


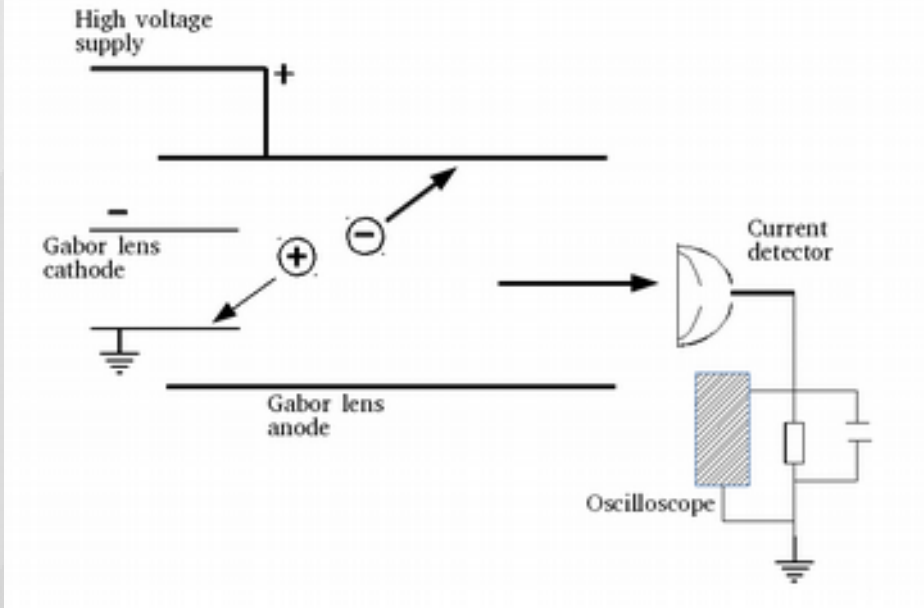
Imperial Lens schematic

- Voltage drop provided by central circular anode and a cylindrical cathode in the area of the axial magnetic field
- This drop constrains the elctrons longitudinally
- If the magnetic field is too high, discharges occur

Lab setup at Imperial

- High voltage and current through magnetic field applied to produce electric and magnetic fields, resepectively
- Measurements of the plasma made with a segmented current detector
- Cooling applied to lens to aid pressure reduction

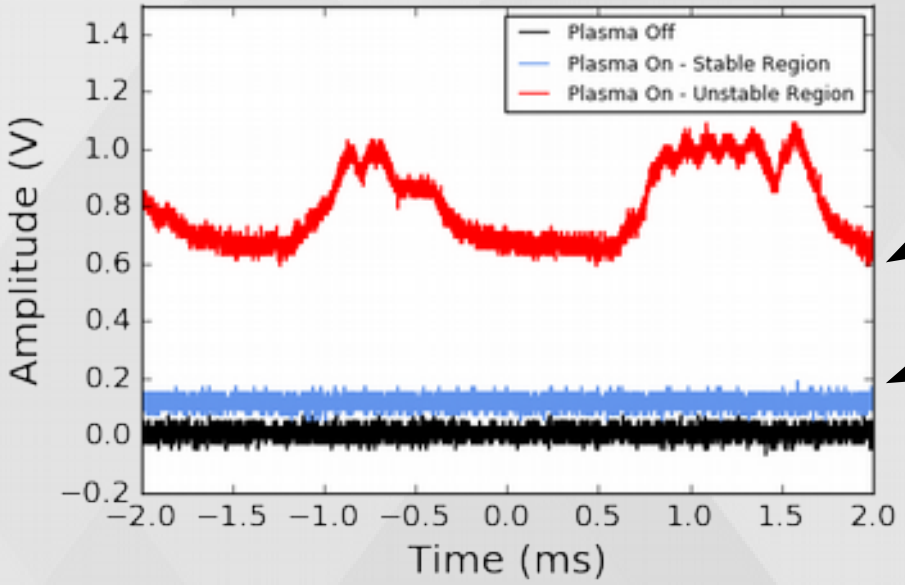




Imperial lens parameters

- Total length of 540 mm
- Central electrode: I.D. = 66 mm and O.D. 89 mm
- Magnetic Field: 55mT
- Electron Density: 5×10^{-7} C/m^3

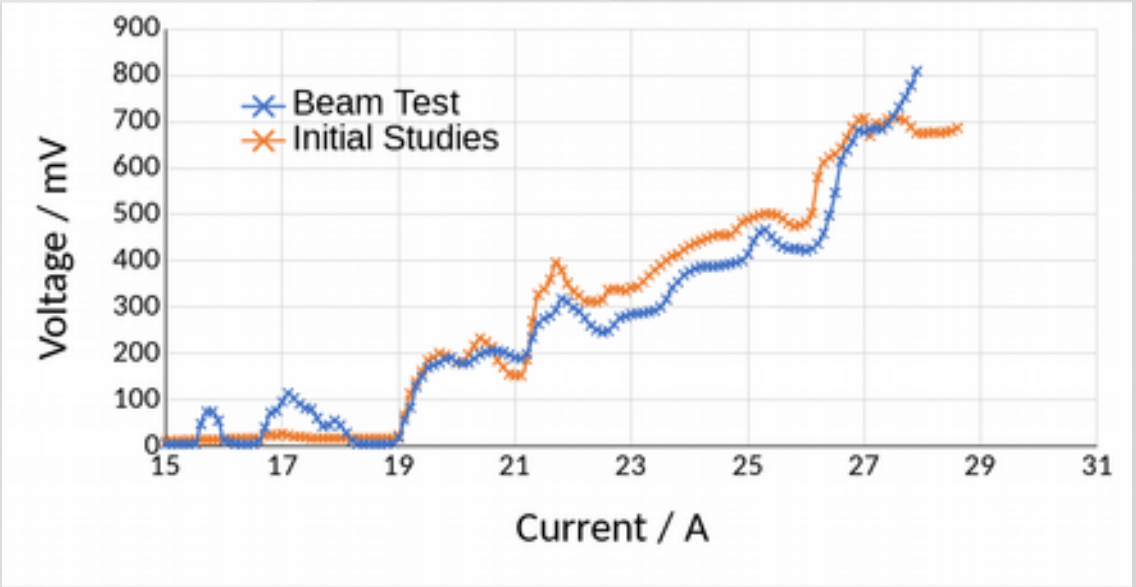
Regions of operation



Unstable at overly high current through the magnetic coils

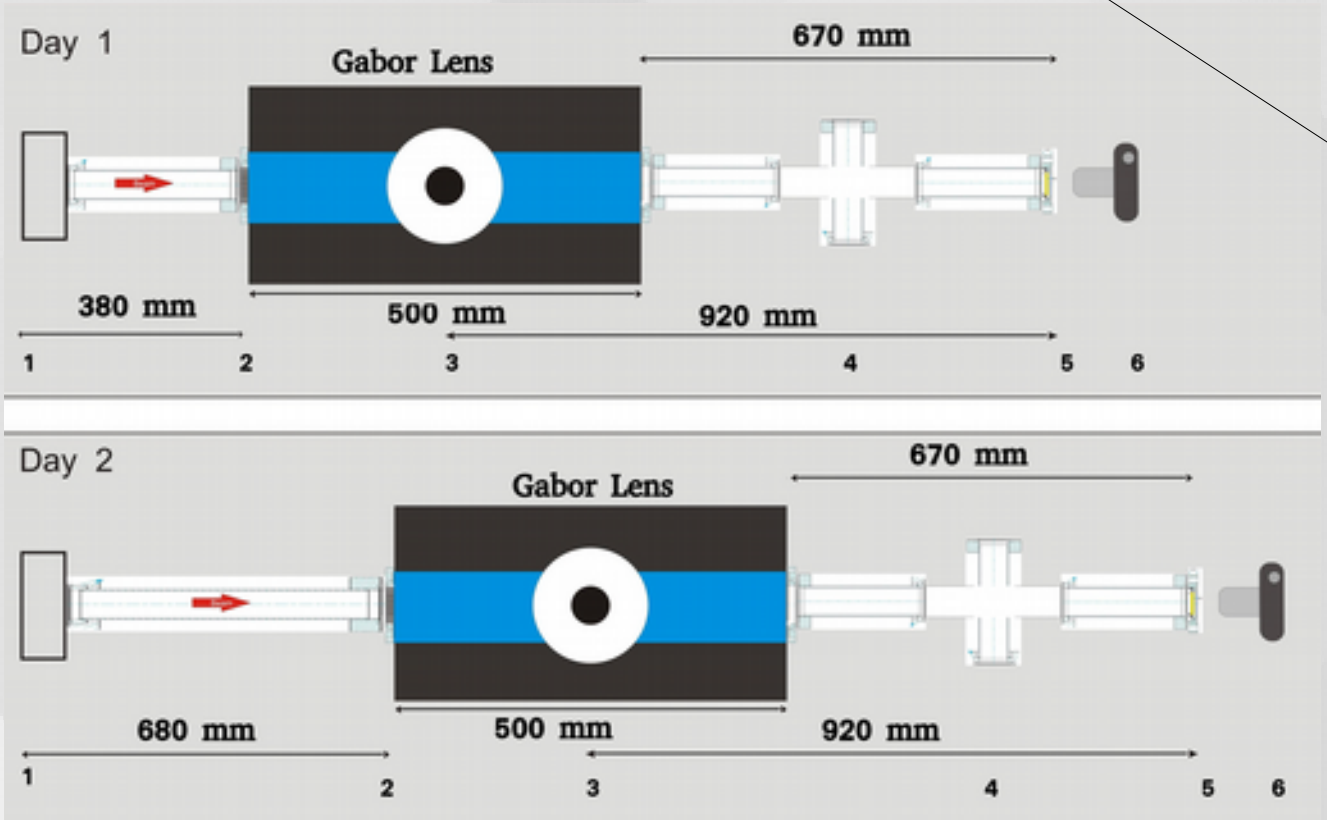
Stable region of operation

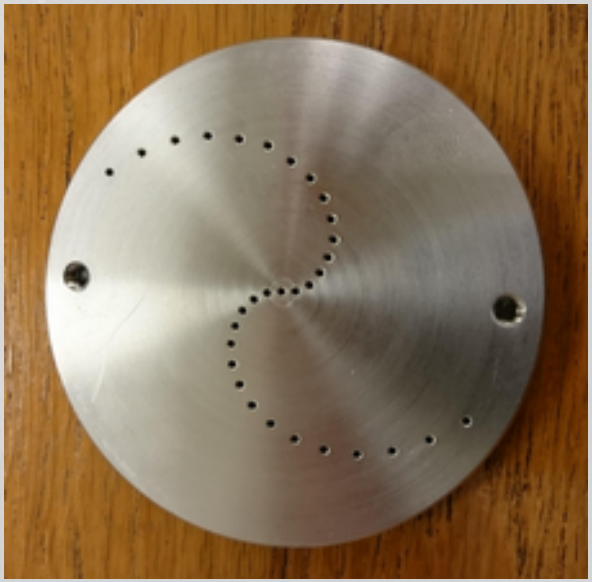
This region (between 14 and 30A) used for beam test



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

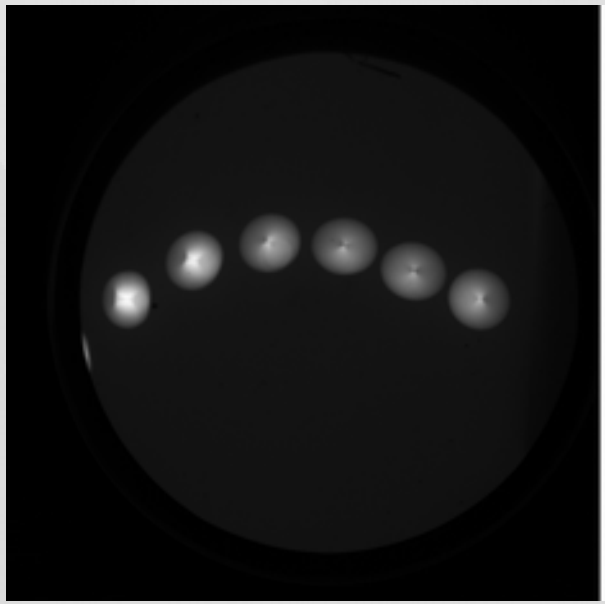




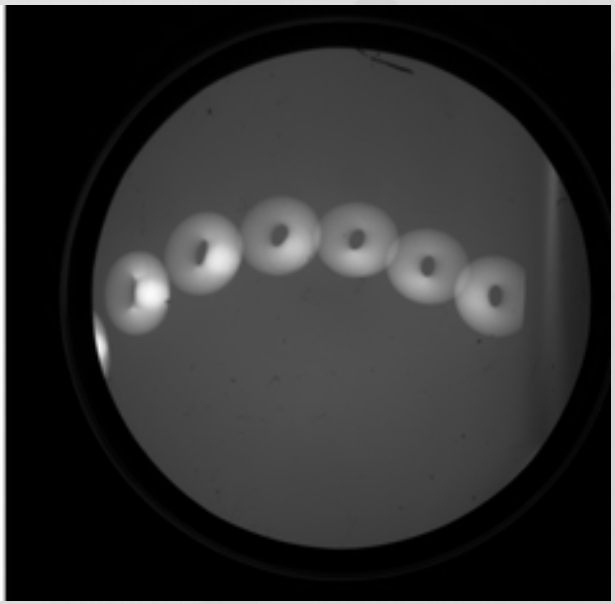
Results

- 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

Status of the paper

Gabor Lens Beam Experiments

Toby Nonnenmacher, Chung Lim Cheung, Juergen Pozimski

June 18, 2020

- A draft of most of the paper has been written
- This includes analysis of the data including theoretical comparison
- Juergen has a clear idea of what he thinks the plasma within the lens looks like, based on results

- However, the paper requires significant additional writing (or rewriting) for clarity/intended by Juergen
- If anyone is interested in working on the paper, I would be very happy to answer any questions (that I can) while Juergen is not available