



IEPPG

Innsbruck Experimental Plasma Physics Group

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The Innsbruck Q-machine
Investigations and Management (Part B)
Schwerpunkts Meeting 2006 Ionen-/Plasmaphysik

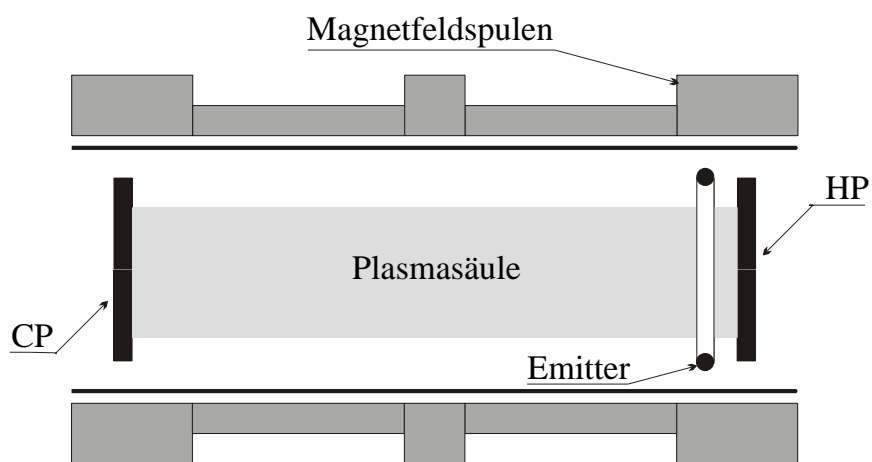
Version A,3



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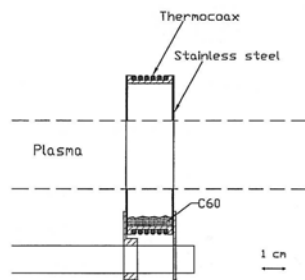
The Q-Machine a Simple Concept



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The Q-Machine a Simple Concept

- Plasma with negative C_{60} ions



- Oven heated up to 500°C
- $C_{60} + e^- \rightarrow C_{60}^-$ $\sigma \approx 10^{-14} \text{cm}^2$
- 70% reduction of electron density
- Dusty space plasma
- Impurities in plasma
- Effect of C_{60} anions on the PRI [1]

The Plasma Source

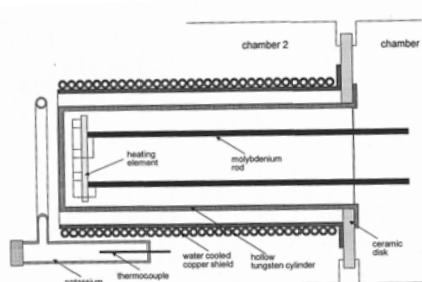


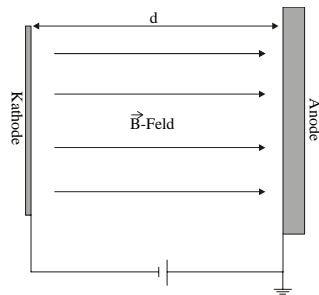
Fig. 3.3: Schematic of the IIP and the potassium oven.

- Density profile
- Plasma density
- Efficiency of the experimental setup
- Downtime
- Maintenance



The Plasma Source

- Concept: Anode cathode system



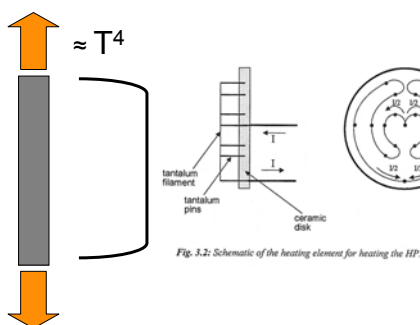
- Forces on wire due to magnetic field
- High evaporation from the tungsten wire due to high cathode temperature
- Uniform electron emission
- Uniform density profile

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The Plasma Source

- Increasing diameter of the tungsten plate to 6 cm



- Radiation lowers temperature at the edge of the plate
- Filament needs a dense arrangement of wire
- Construction of a filament on a ceramic disk

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The Plasma Source

- Plasma profile

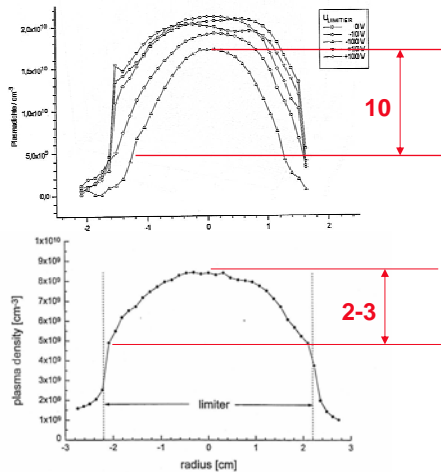


Fig. 3.4: Typical radial density profile obtained with the upgraded Q-machine.

- Optimization of the profile

- Typical parameters

- $I = 18 \text{ A}$
- $U = 1\text{-}2 \text{ kV}$
- $T = 2150 \text{ K}$

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Future Investigations

- Optimizing the cathode by using LaB_6 heated by back radiation
- More electrons at lower cathode temperature
- Focus on less downtimes
- Focus on data management of the Q-Machine

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References

- [1] D. Strele „Effect of C60 Anions on the Potential Relaxation Instability and the Ion Heating by the Inhomogeneous Energy Density Driven Instability in a Q-Machine Plasma