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DISSERTATION

# Cool Science

ausgeführt am Atominstitut



der Technische Universität Wien  
Fakultät für Physik

unter der Anleitung von  
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# 1 Next Steps

To conclude this report, we will point out some of the next steps that need to be taken in order to advance the electron beam setup.

**Beam current stability:** The most important challenge at this moment is the ability to produce a reproducible, stable, and sufficiently strong beam. In order to achieve this, more research on cathodes and their susceptibility to oxygen poisoning needs to be conducted. It may also prove useful to add another high voltage power supply to the setup in order to tune the filament potential independently from the Wehnelt cylinder.

**Spot size characterisation:** As previously mentioned, our original attempt was, to probe the electron beam's profile using a thin piece of wire on the wobble stick. However, we have observed that the beam got warped when passing close to conductive materials, therefore a different approach is needed.

**Heating mechanism:** As high currents will degrade the filament and cathode, it is desirable to be able to tune the heater current down to 0 mA continuously. Such a power supply needs to support a bias voltage of around  $-2\text{ kV}$ .

**Lissajous Curves:** Regarding the deflection electronics, the first issue that needs to be addressed is the fact that it is not possible to produce a clean sine wave when a bias voltage is applied to the center tapped transformer. Furthermore, it is recommended to implement the over voltage protection described previously with very low capacitance diodes. In the future, the setup should be able to produce Lissajous curves at the potassium-39 hyperfine transition frequency of 461.7 MHz.