# Ion source construction: status update

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# A brief summary of the technique used

- Electron dissociative attachment inside a multi-segment linear Paul trap

$$I_2 + e \rightarrow I + I^-$$

$$I_2 + e \rightarrow I^+ + I^- + e$$

$$CHI_3 + e \rightarrow CHI_2 + I^-$$

- Iodine:
  - Mass 127 a.m.u. (only one natural isotope)
  - Electron affinity 3.06 eV
  - The heaviest 2-atomic, homonuclear molecule
  - Solid at room temperature

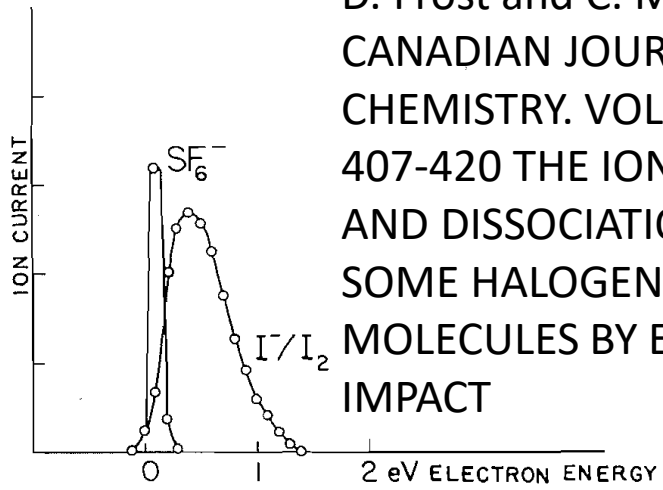
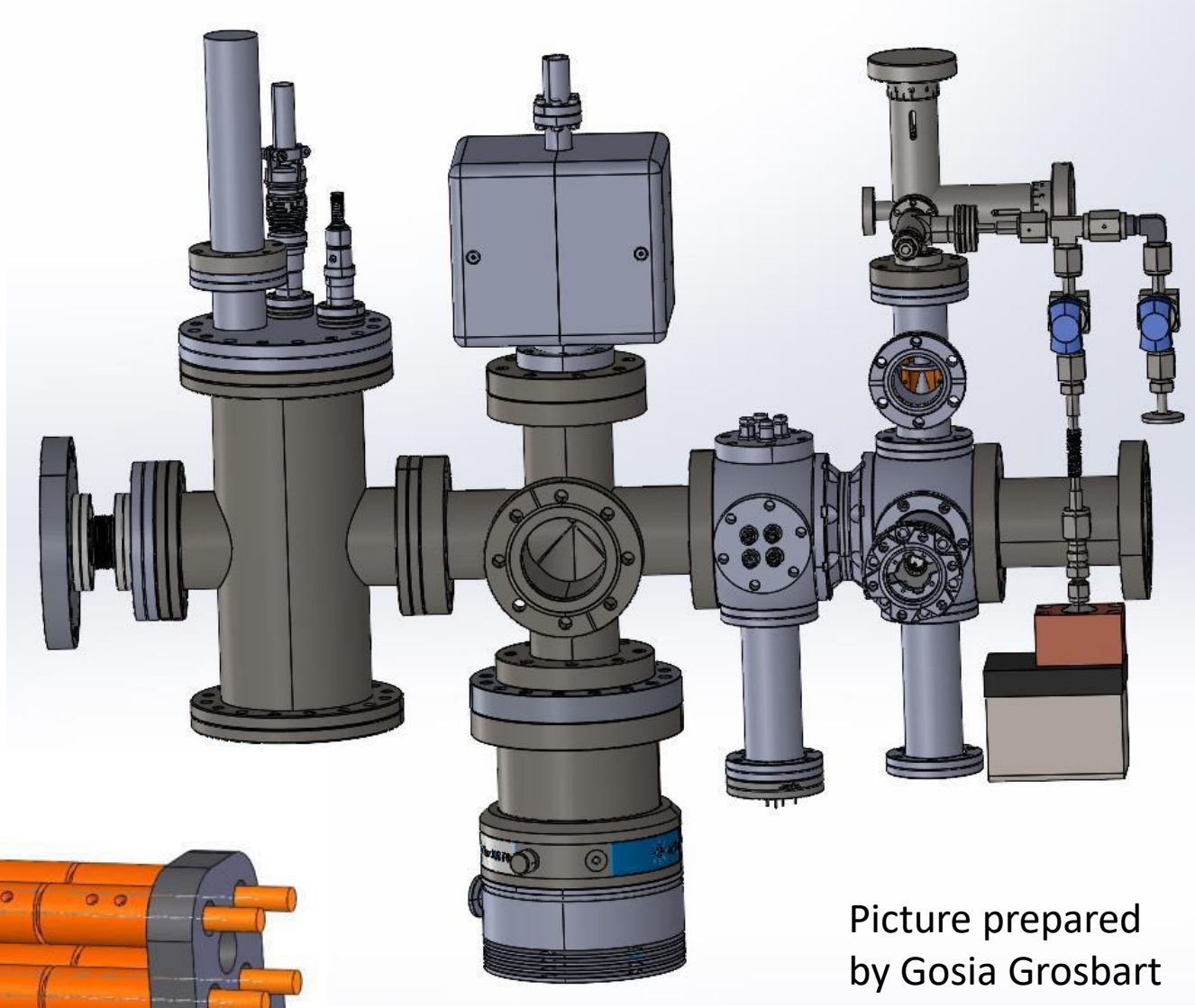



FIG. 14. The resonance capture peak for the formation of $I^-$ from iodine by electron impact.

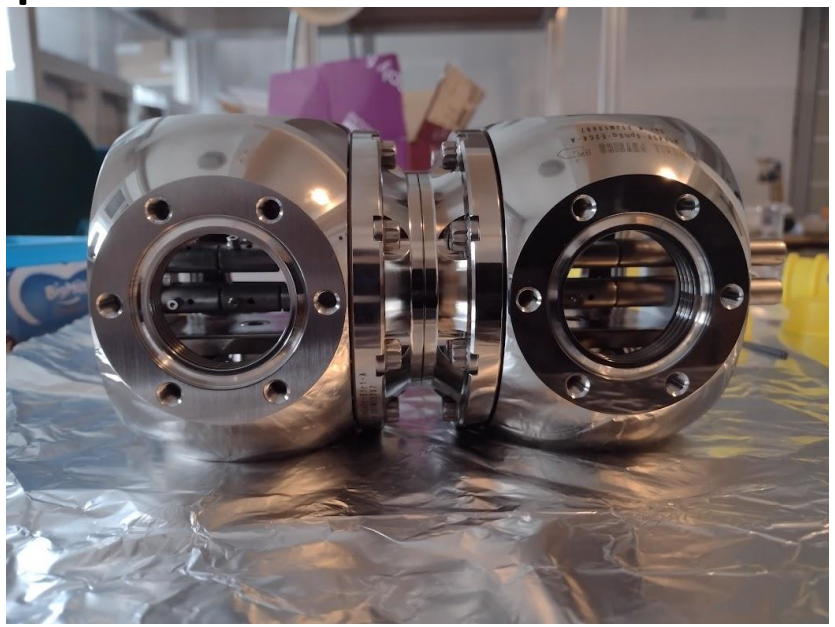
D. Frost and C. McDowell, CANADIAN JOURNAL OF CHEMISTRY. VOL. 38. 1960, 407-420 THE IONIZATION AND DISSOCIATION OF SOME HALOGEN MOLECULES BY ELECTRON IMPACT

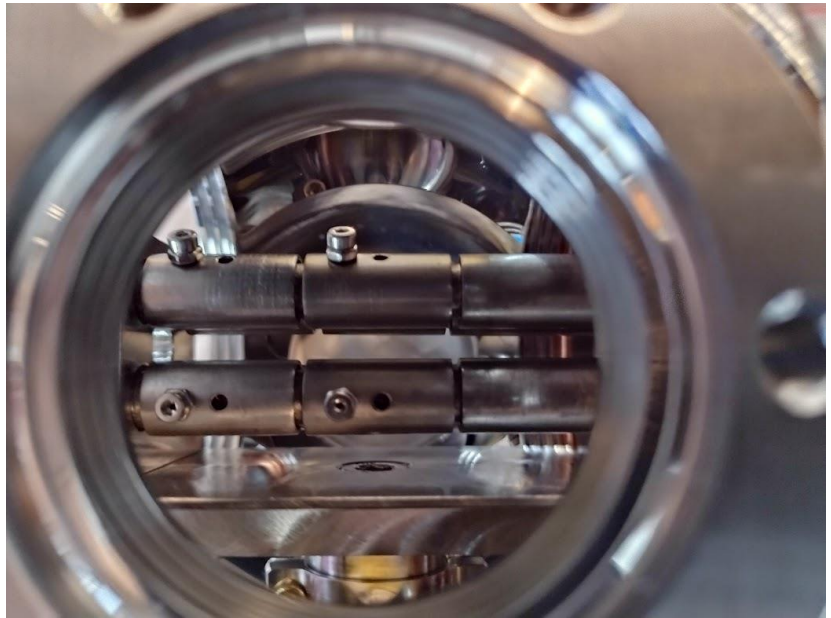
# Design of the device

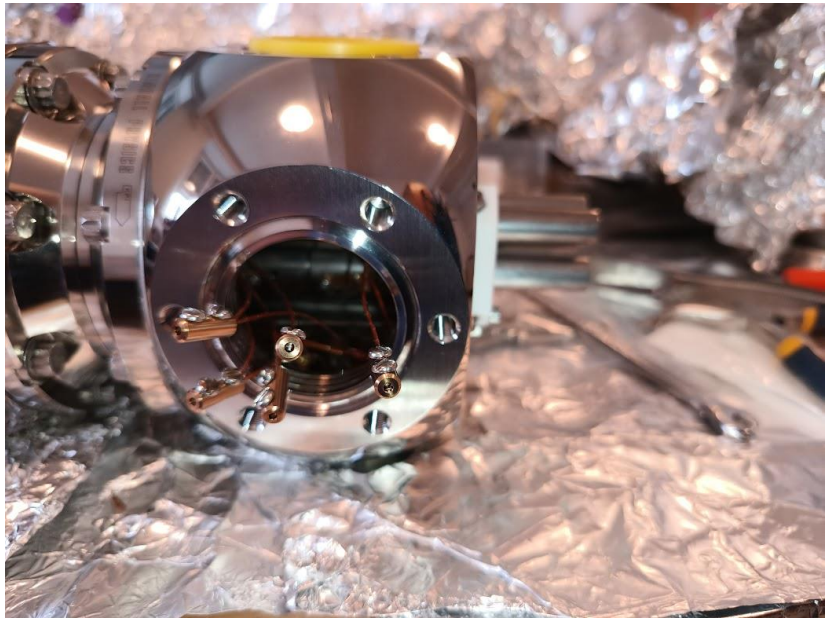


Picture prepared
by Gosia Grosbart

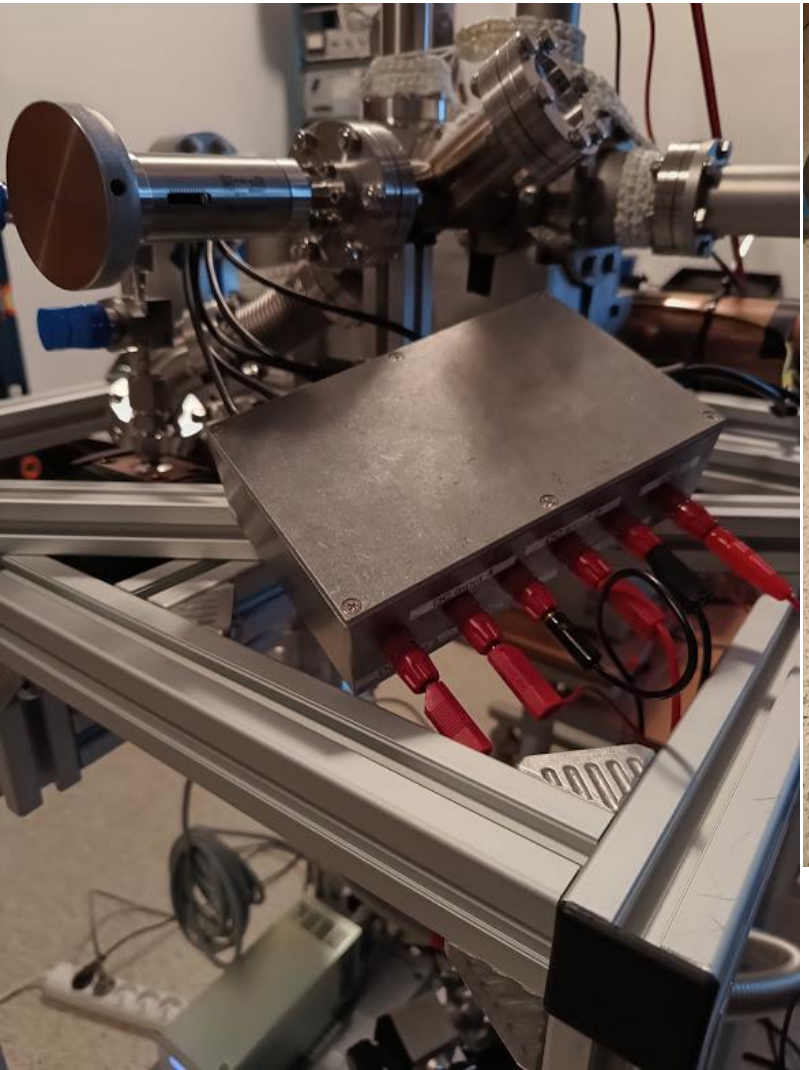
# The linear Paul trap

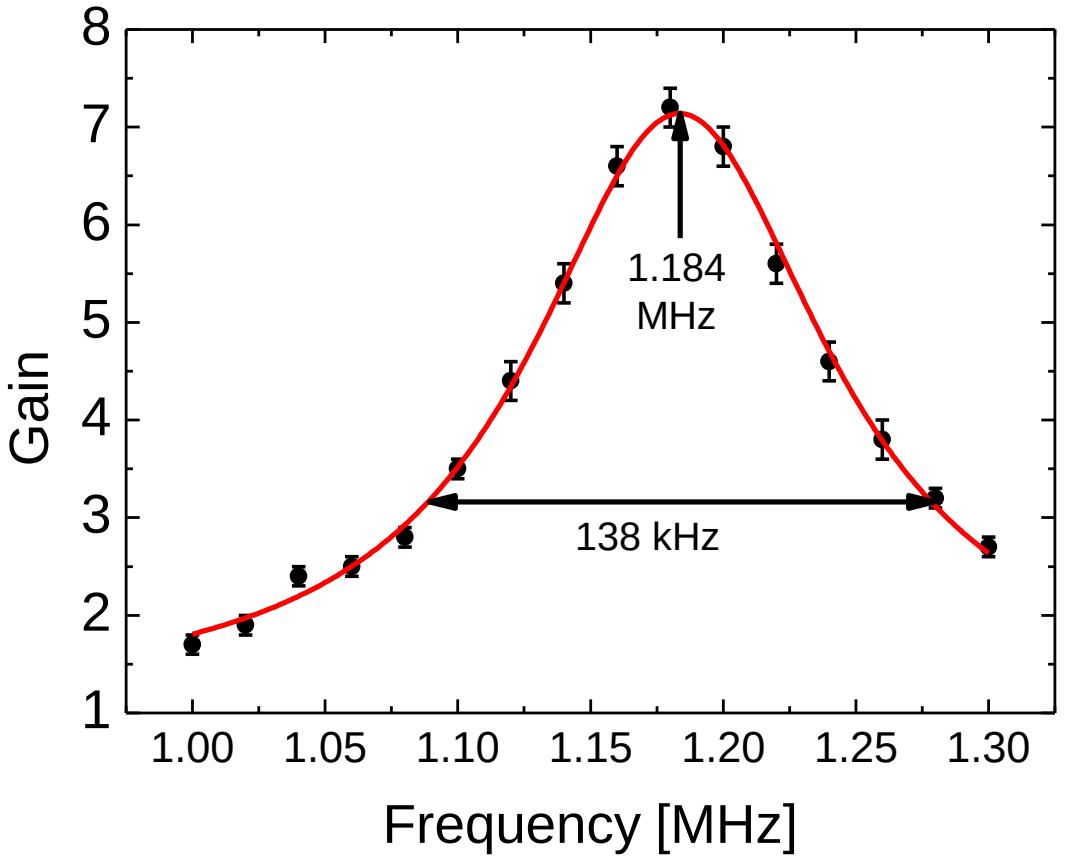




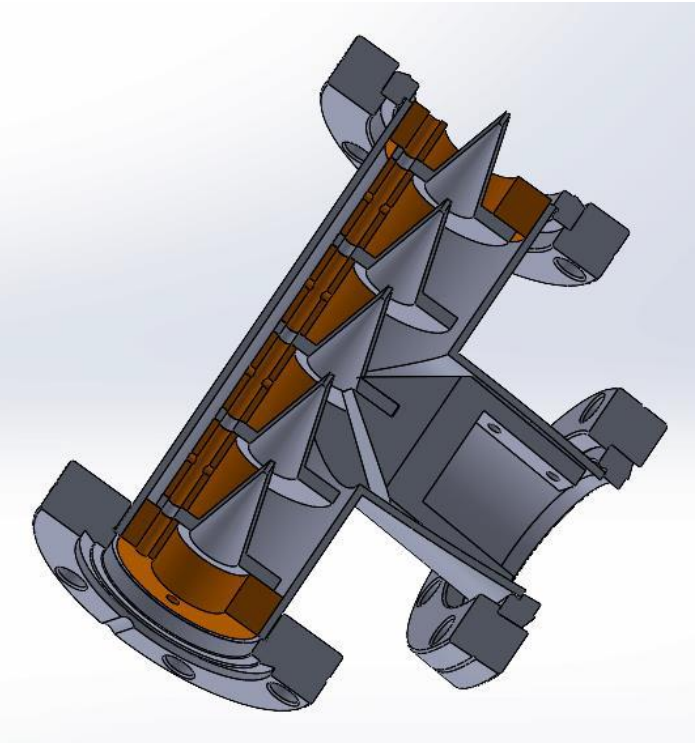


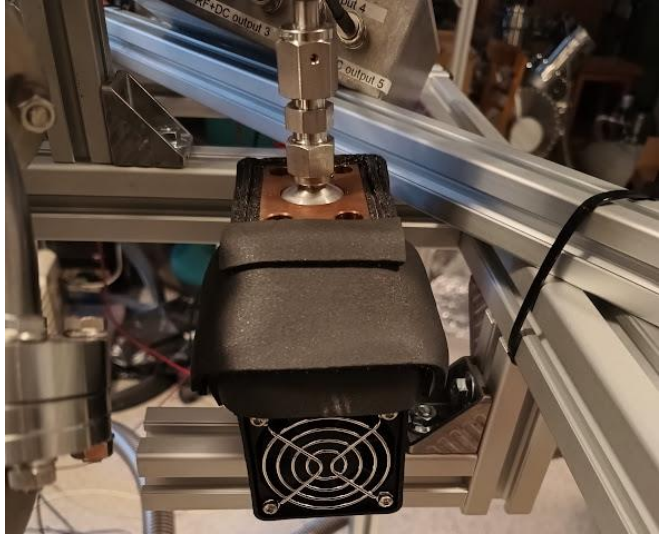
# Temporary voltage supply system



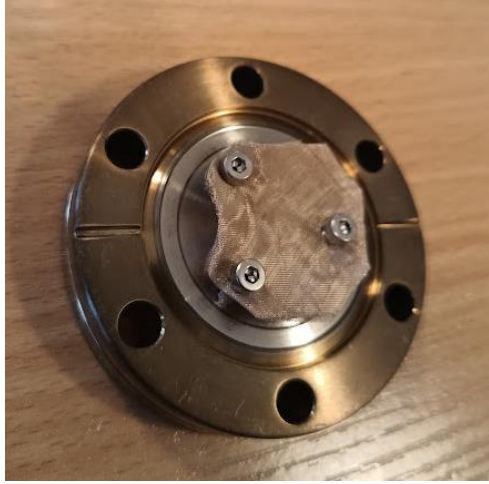


# Molecular beam source

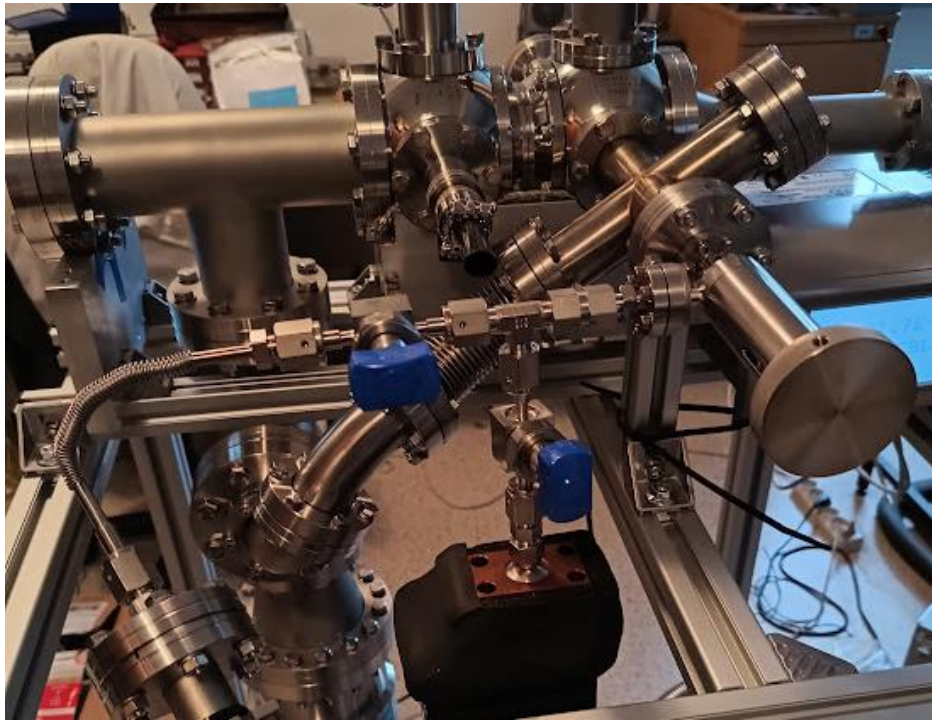




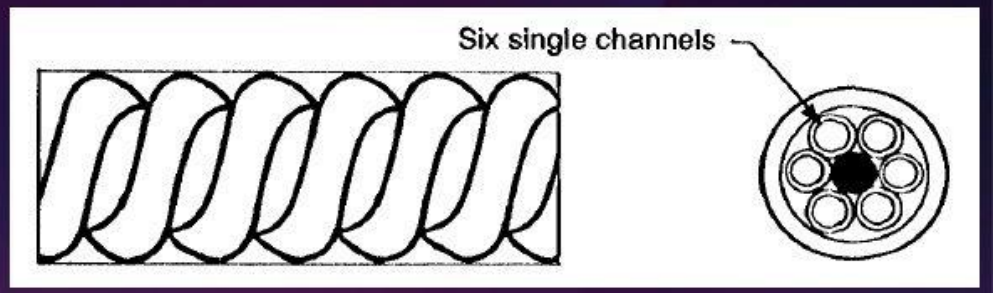
Thermal shielding for the reservoir designed and built by Adam Linek (the driver not presented in the picture)

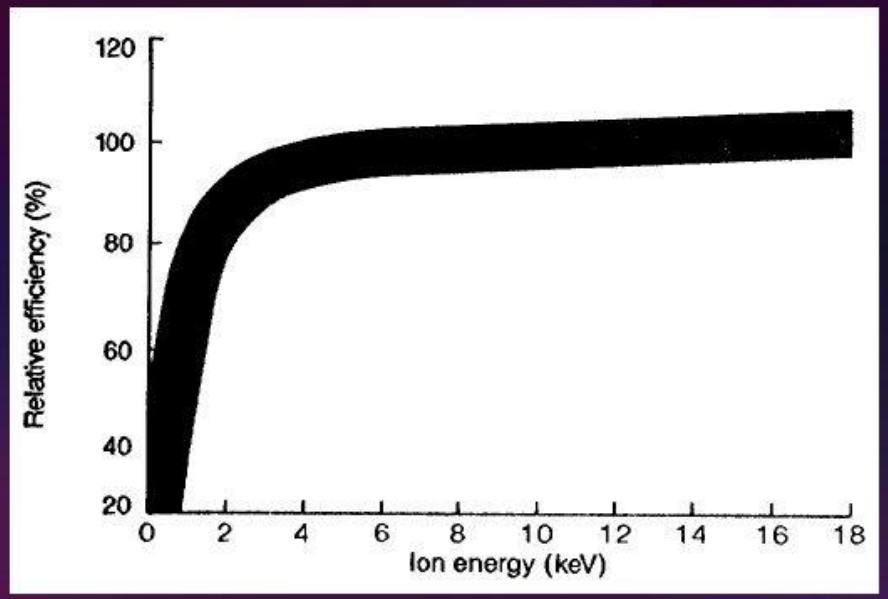


Silver mesh absorber of iodine



# Anion detector (spiraltron)

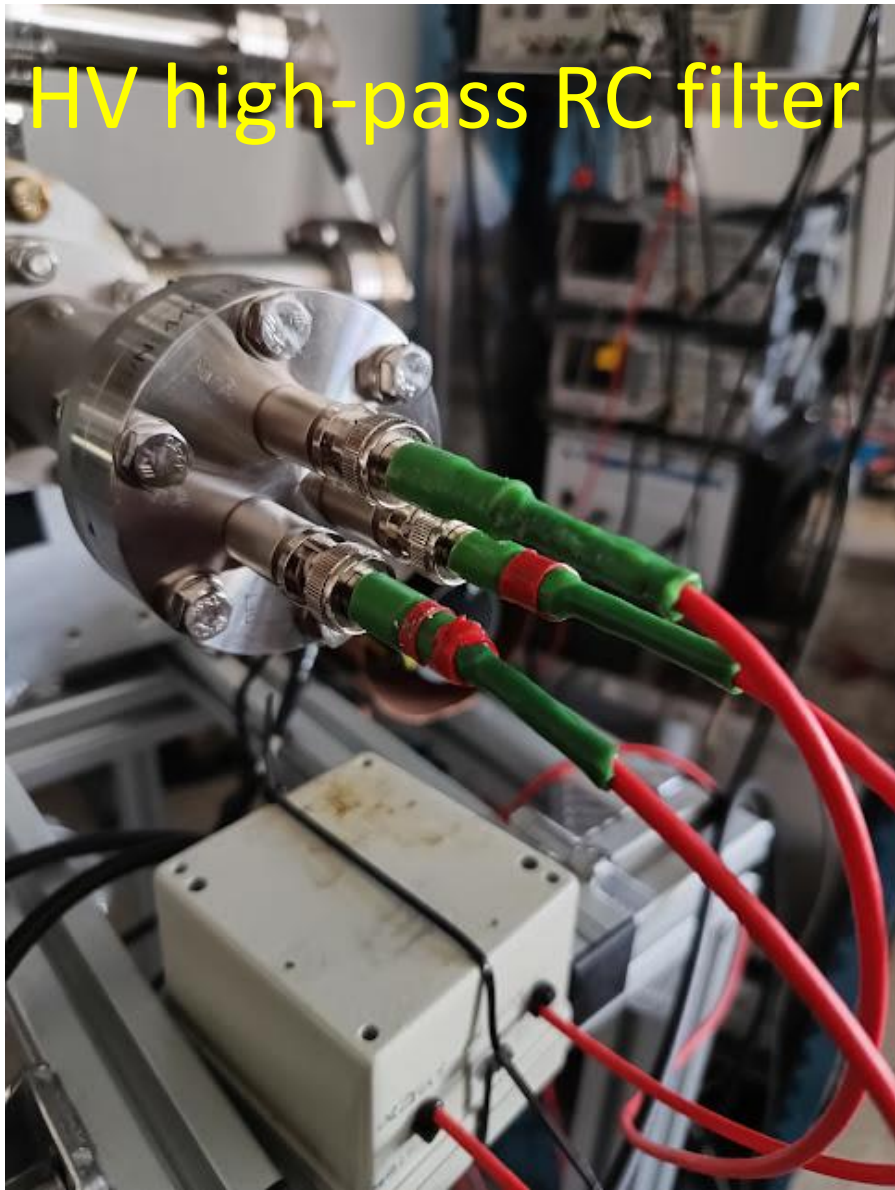



Relative ion detection efficiency curve

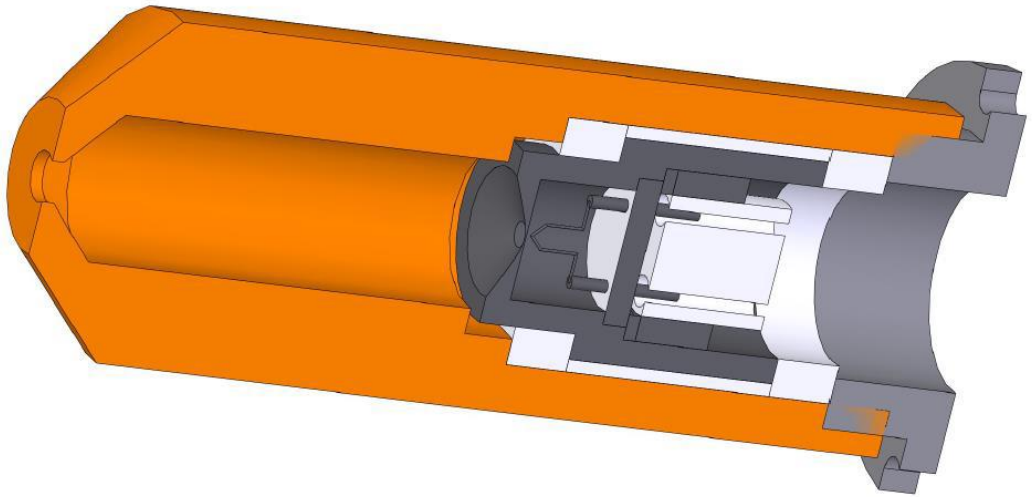
# MHV – SHV compatibility issue (solved!)

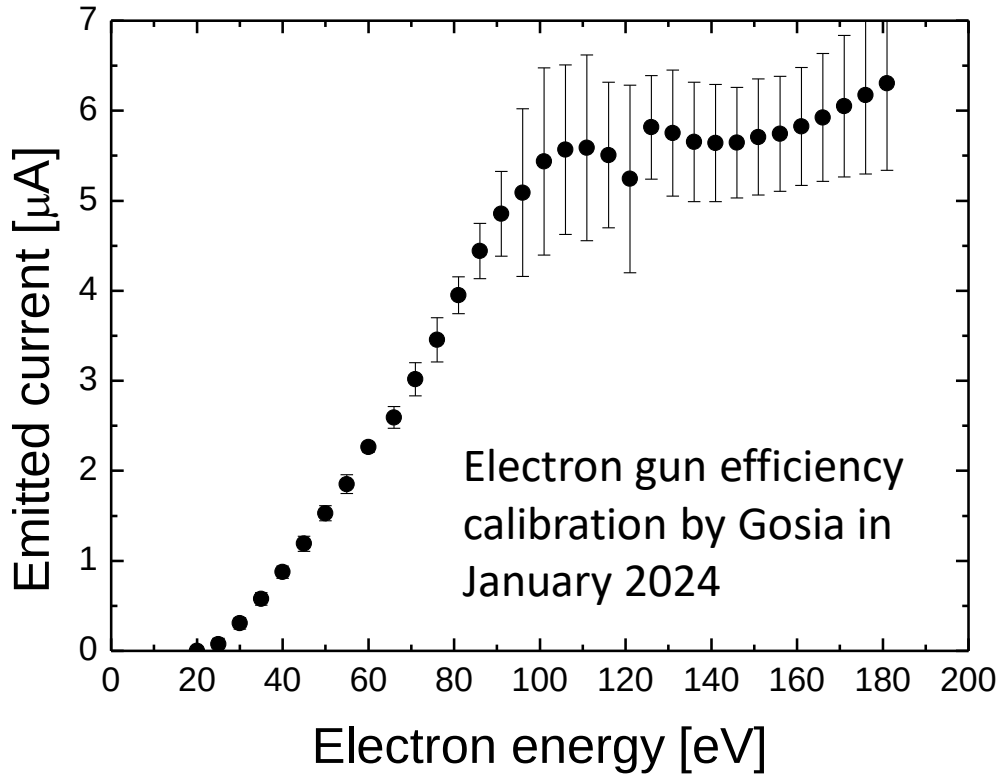
Custom-made HV power supplies



HV high-pass RC filter

# Electron gun





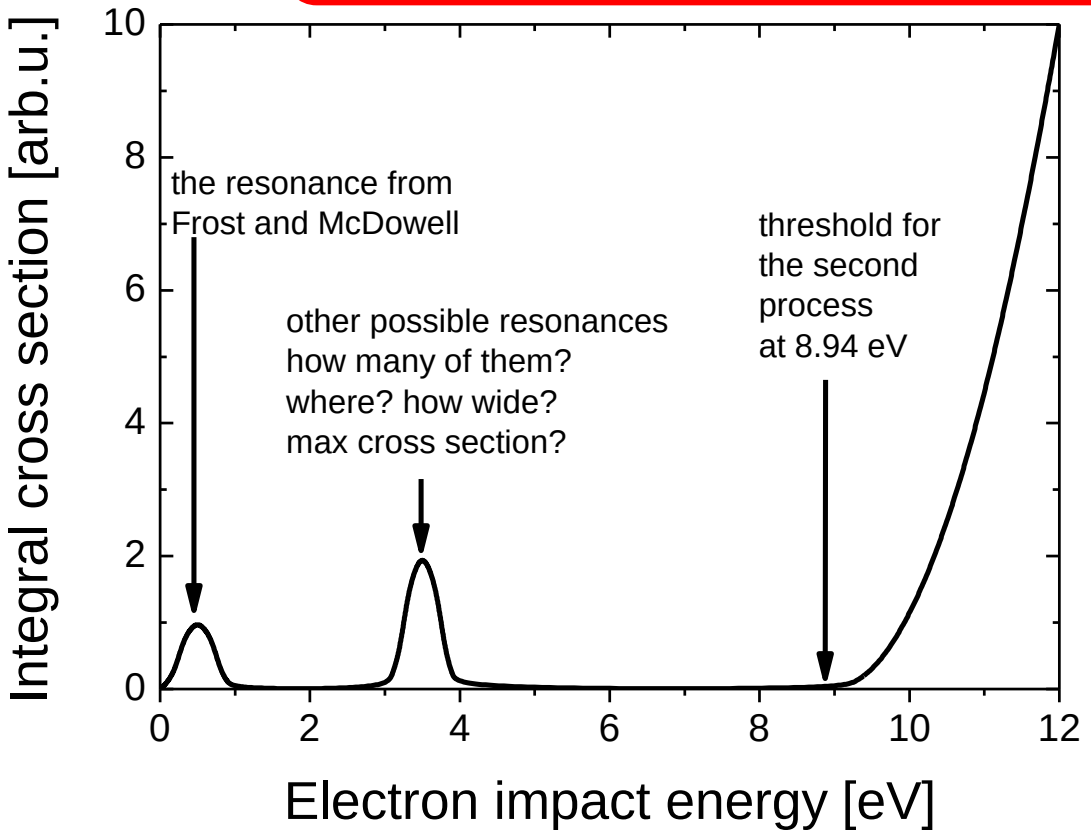
# Expected cross sections and final kinetic energies

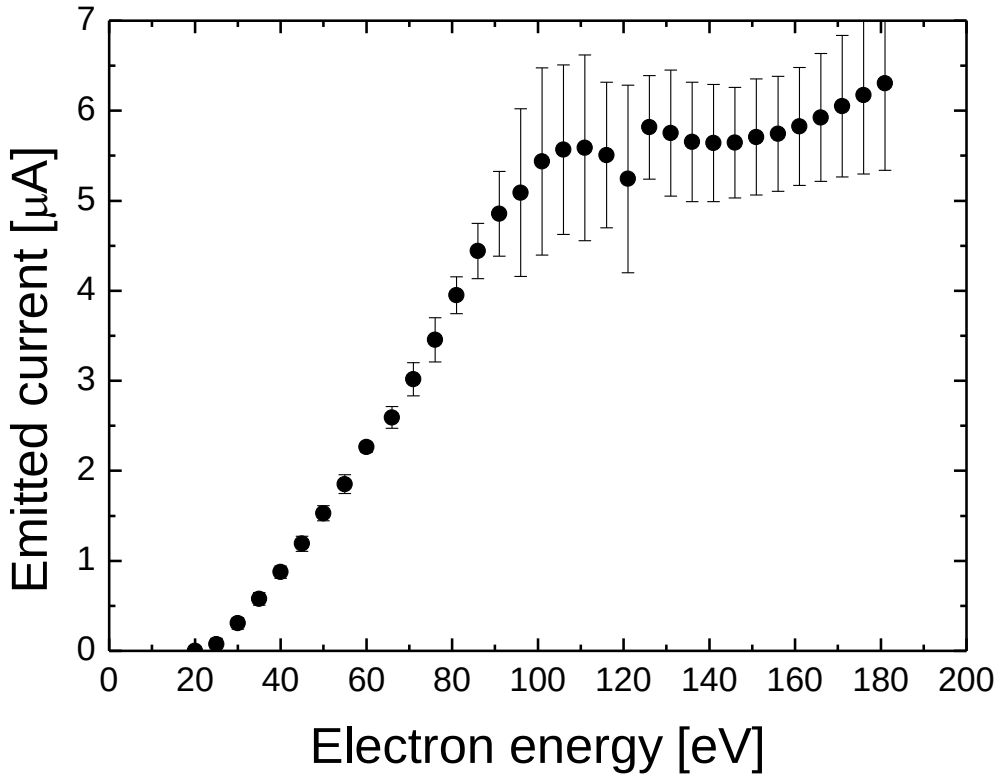
$$I_2 + e \rightarrow I + I^-$$

$$I_2 + e \rightarrow I^+ + I^- + e$$

$$E_{anion} = \frac{E_{electron}}{2} + 0.76eV$$

$$E_{anion} \leq \frac{E_{electron}}{2} - 4.47eV$$

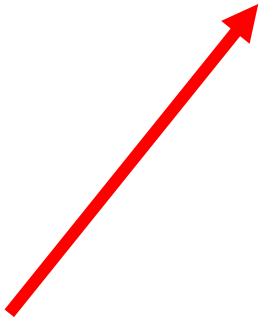


# Cooling of the trapped anions

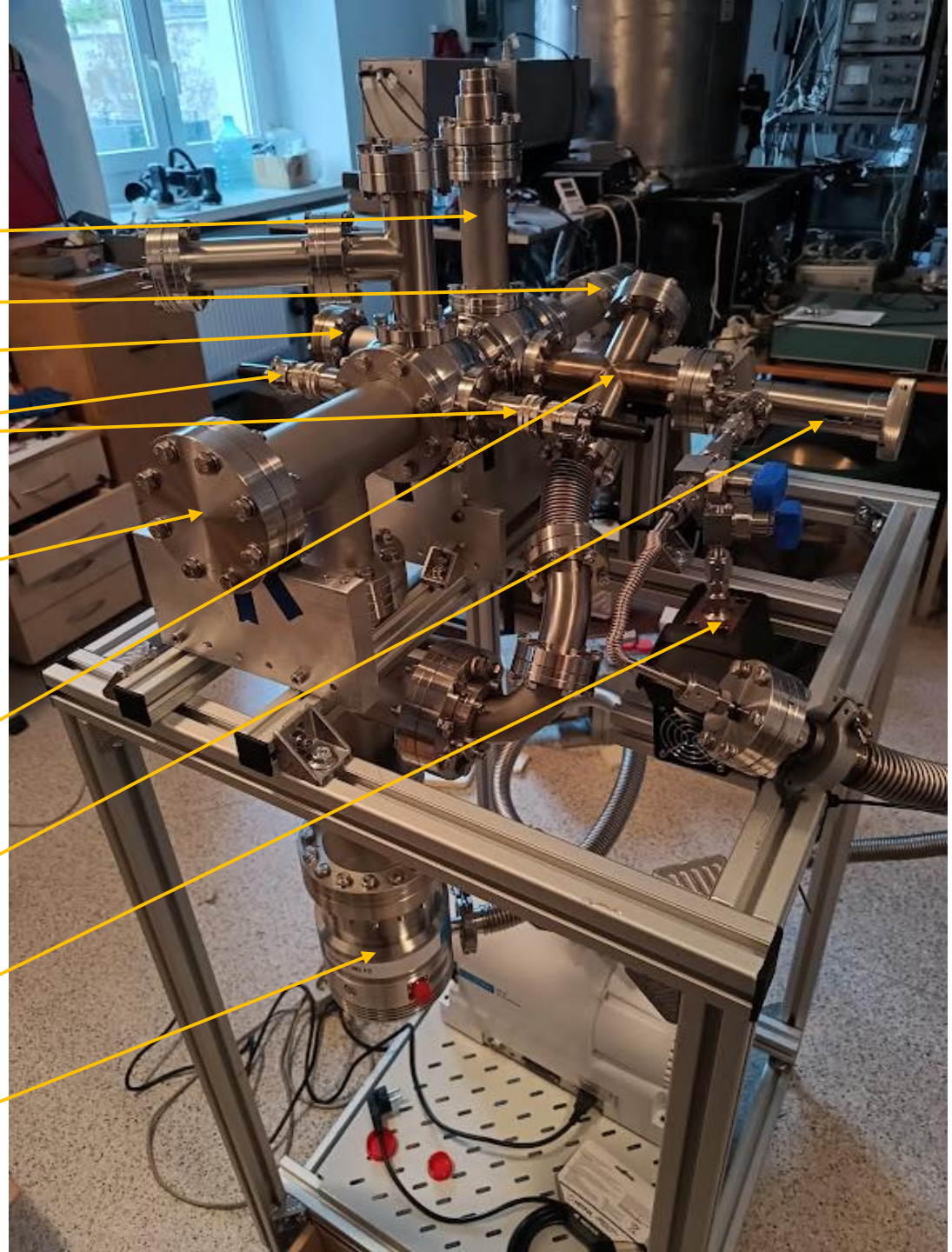
- We need temperatures below 1 eV
- At the room temperature (molecular beam) it is about 0.025 eV
- Two cooling schemes are being considered:
  - RLC resonance resistive cooling
  - Manipulating the depths of both trapping centres (see the presentation by Marek Teske)
- Three-body output will be dominating – do we really need further cooling?

$$I_2 + e \rightarrow I^+ + I^- + e$$



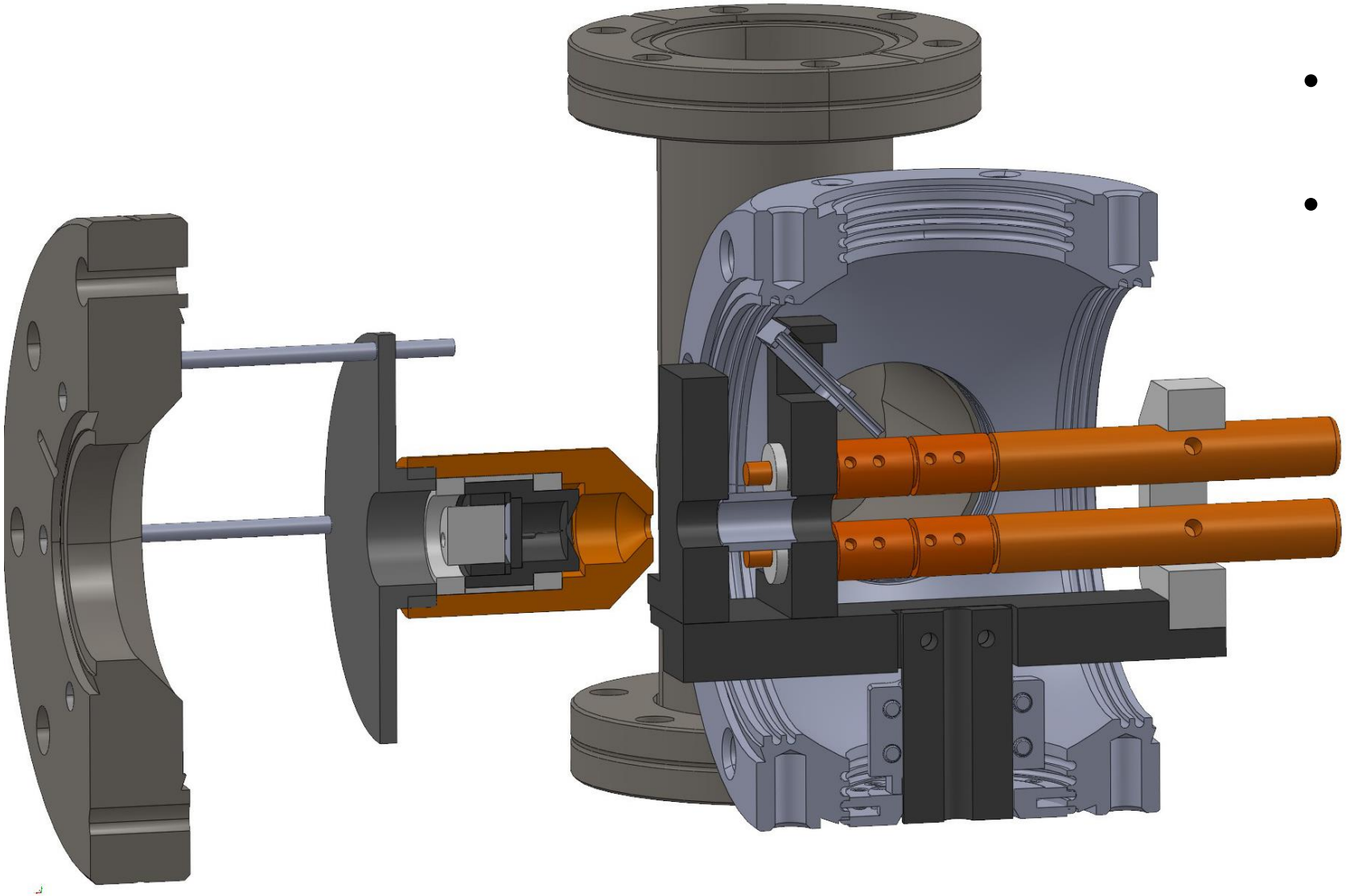
We expect the electron to carry the most of the output energy

# The device assembled together

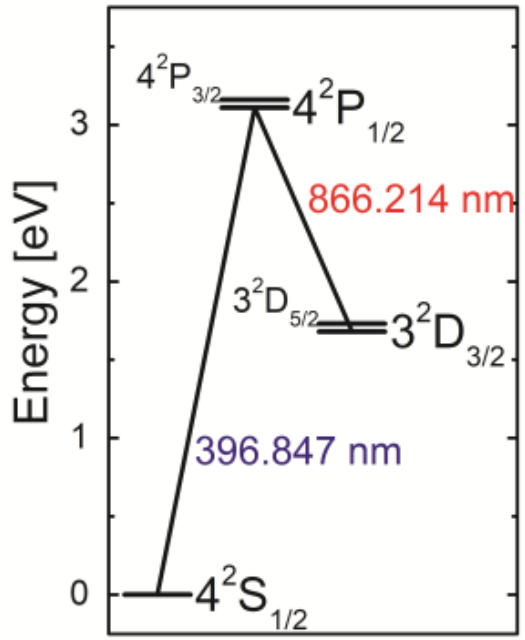


# Calcium source

$$Ca + e \rightarrow Ca^{+} + 2e$$



- Geometry of the trap almost identical with the iodine source
- Electron gun aligned axially in the trap
- Optical access for cooling and detection



# The source components: made by the workshop in Toruń, vacuum cleaned, ready to be assembled

# Summary

## Completed since the December meeting

- Channeltron pulsed electronics (high-pass filter for the signal, premaplifier, constant fracion discriminator, counter) – built
- Custom-designed distance tube for the channeltron
- High voltage source, MHV-SHV adapters connected
- Ion pump – installed
- Safety valve for the transport – insatalled
- Ion cooling simulations (to be presented by Marek Teske)
- Source of Calcium cations
  - Designed
  - All the parts produced, washed
  - Optics for cooling and detection ready in Toruń

## Not yet completed

- Ion signals deteced
- Ion cooling – not confirmed experimentally
- Final version of the Sinara
- Diagnostic cross with the MCP in Toruń with Gosia

Time to arrange the transport!