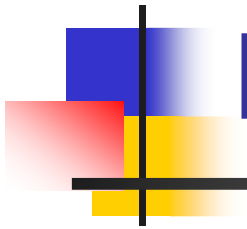

Designing an Effusion Cell for Molecular Beam Experiments

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Background and Motivation

- Attosecond physics

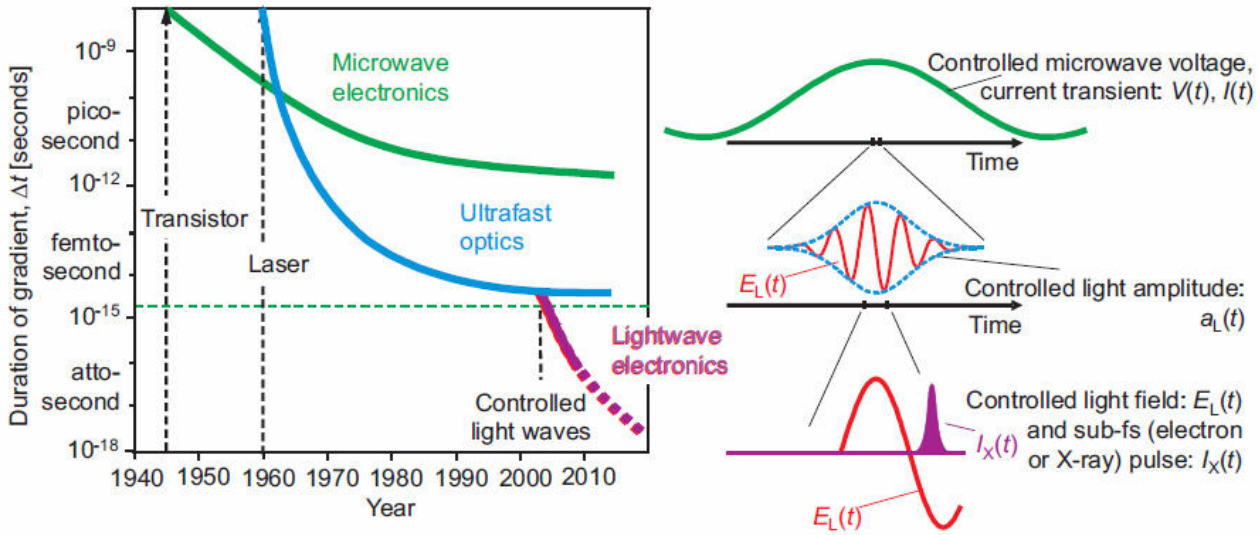

FIG. 5. (Color) Evolution of ultrafast science. The duration of the fastest controlled signal gradients dictates the speed of control and resolution of probing of microscopic processes. Microwave electronics, ultrafast optics, and lightwave electronics offer controlled transient for these purposes on successively shorter time scales, with picosecond, femtosecond, and attosecond gradients.

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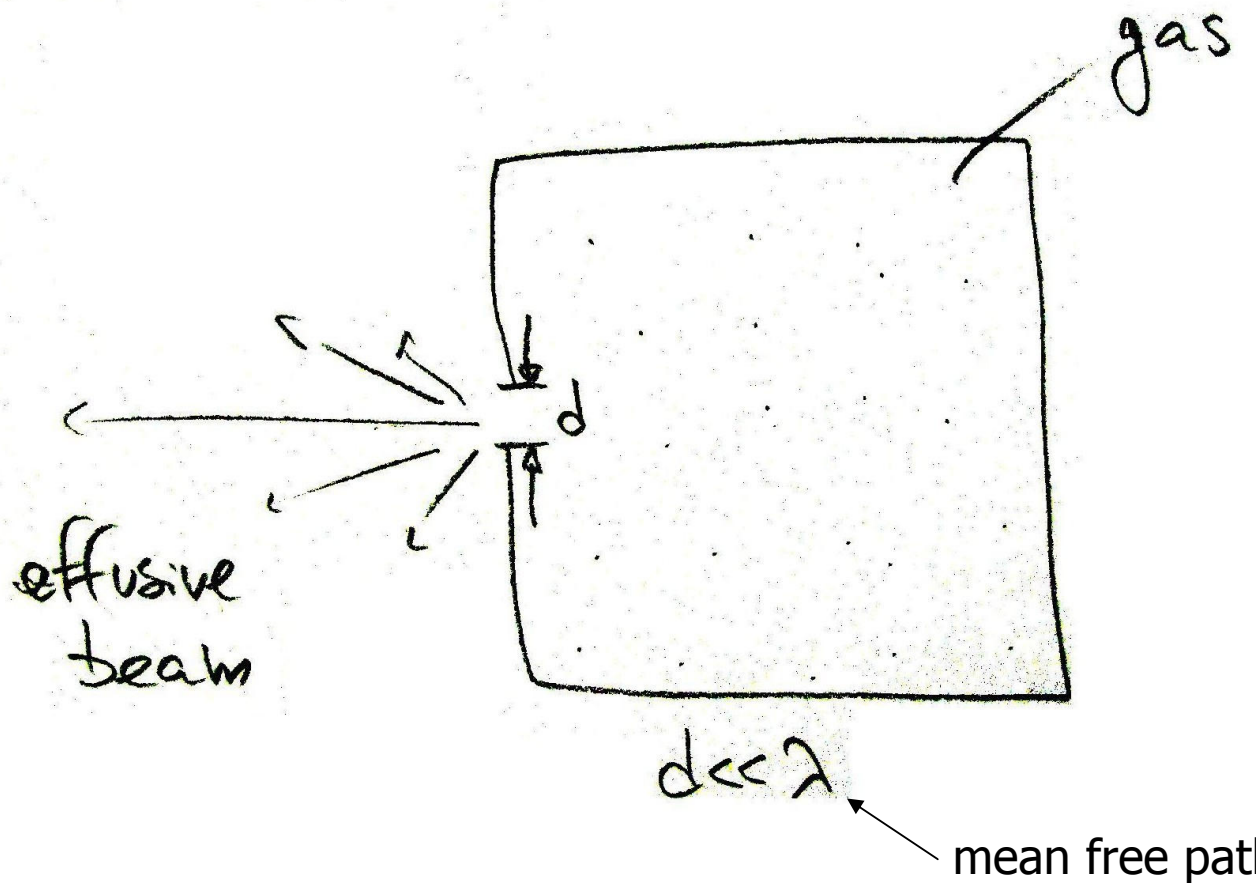
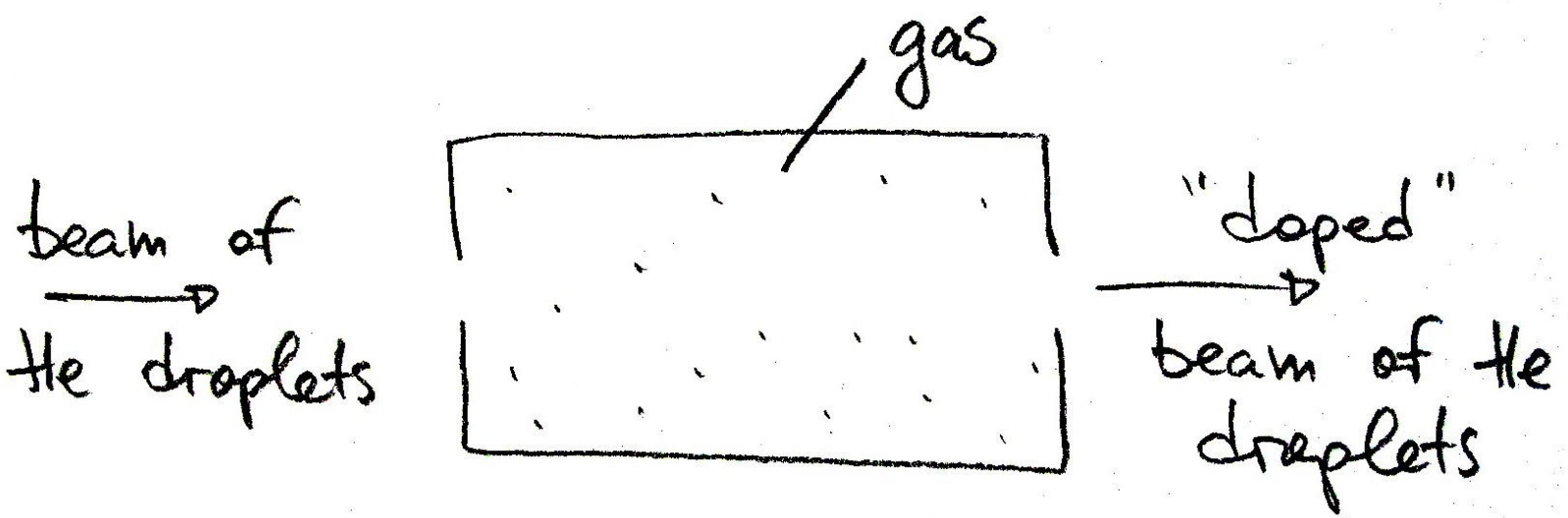
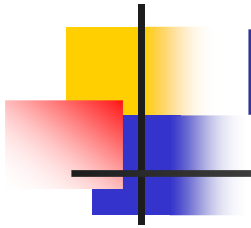
An Effusion cell



Maxwell velocity distribution (useful!): $f_{\mathbf{v}}(v_x, v_y, v_z) = \left(\frac{m}{2\pi kT}\right)^{3/2} \exp\left[-\frac{m(v_x^2 + v_y^2 + v_z^2)}{2kT}\right],$

Pick up cell





Effusion cell design

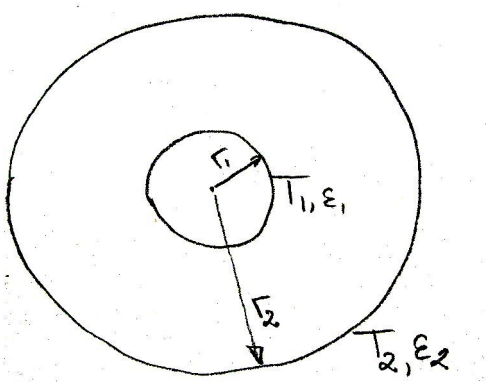
- Considerations
  - Size
  - Power consumption
  - Beam intensity
  - Collimation
  - Possibility for pick-up experiments

Effusion cell design

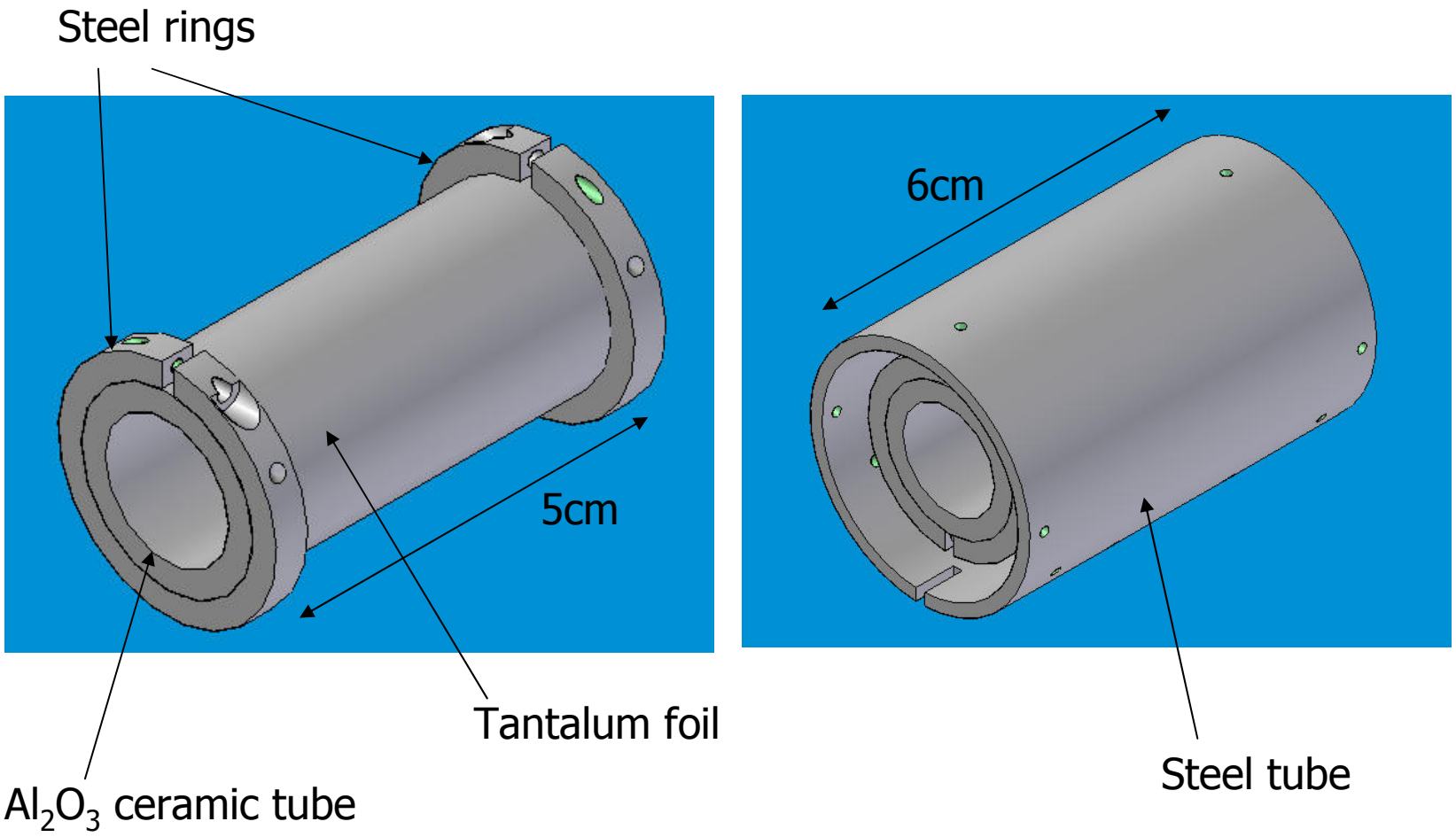
- Power consumption

$$P = jA = \varepsilon\sigma T^4 A$$ (Stefan-Boltzmann Law)

$$P \approx \sigma T_1^4 \frac{A_1\varepsilon_1}{1 + r_1\varepsilon_1(1-\varepsilon_2)/r_2\varepsilon_2}$$ (Stefan-Boltzmann Law + shielding)

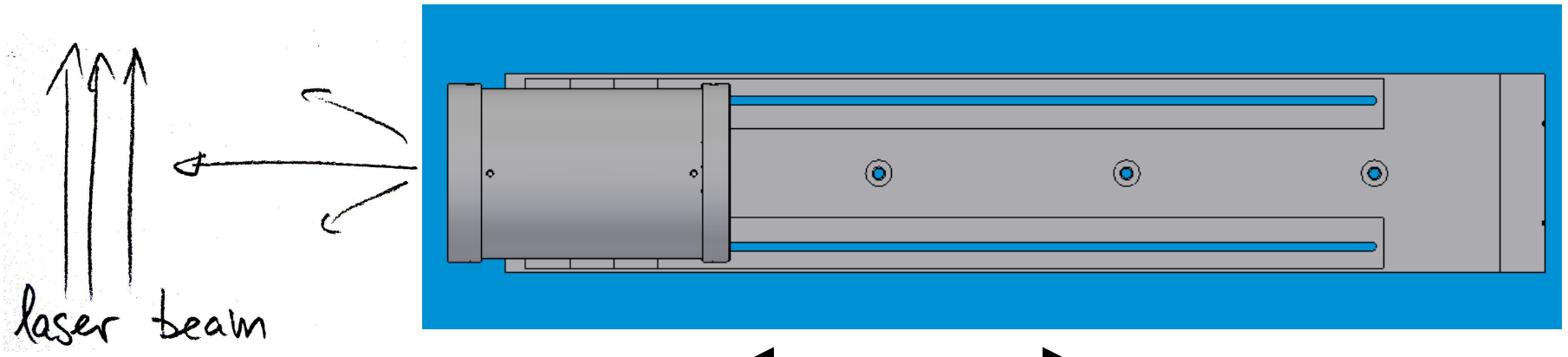


Effusion cell design



Effusion cell design

- Beam-source distance adjustment

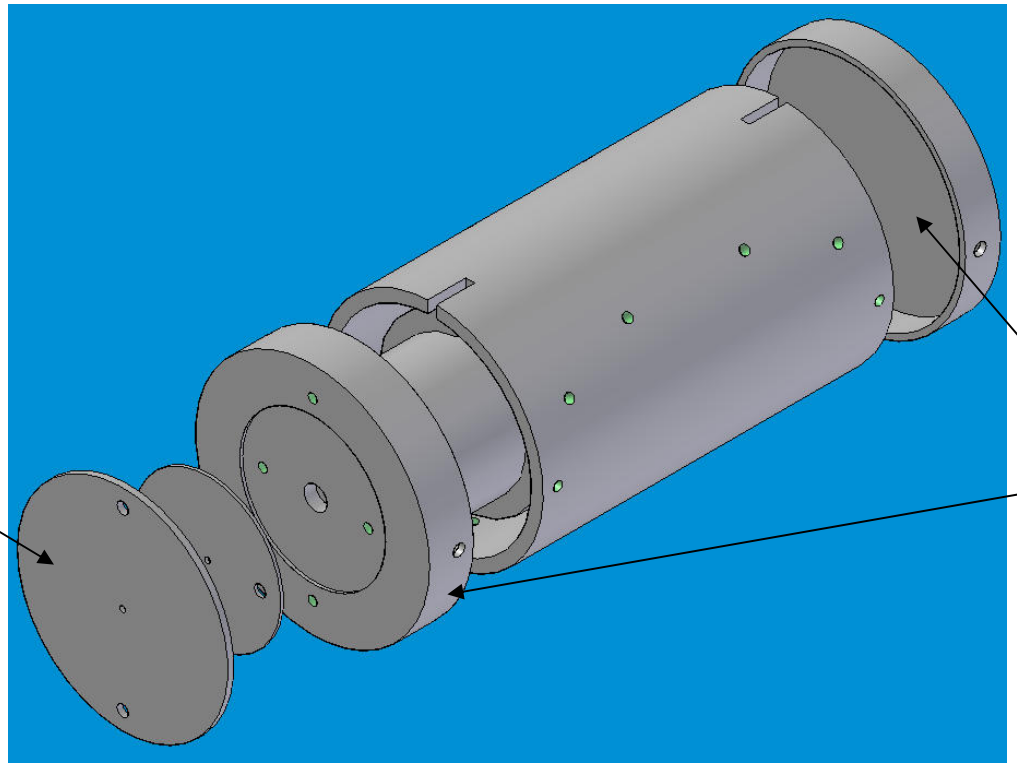


drawing not to scale

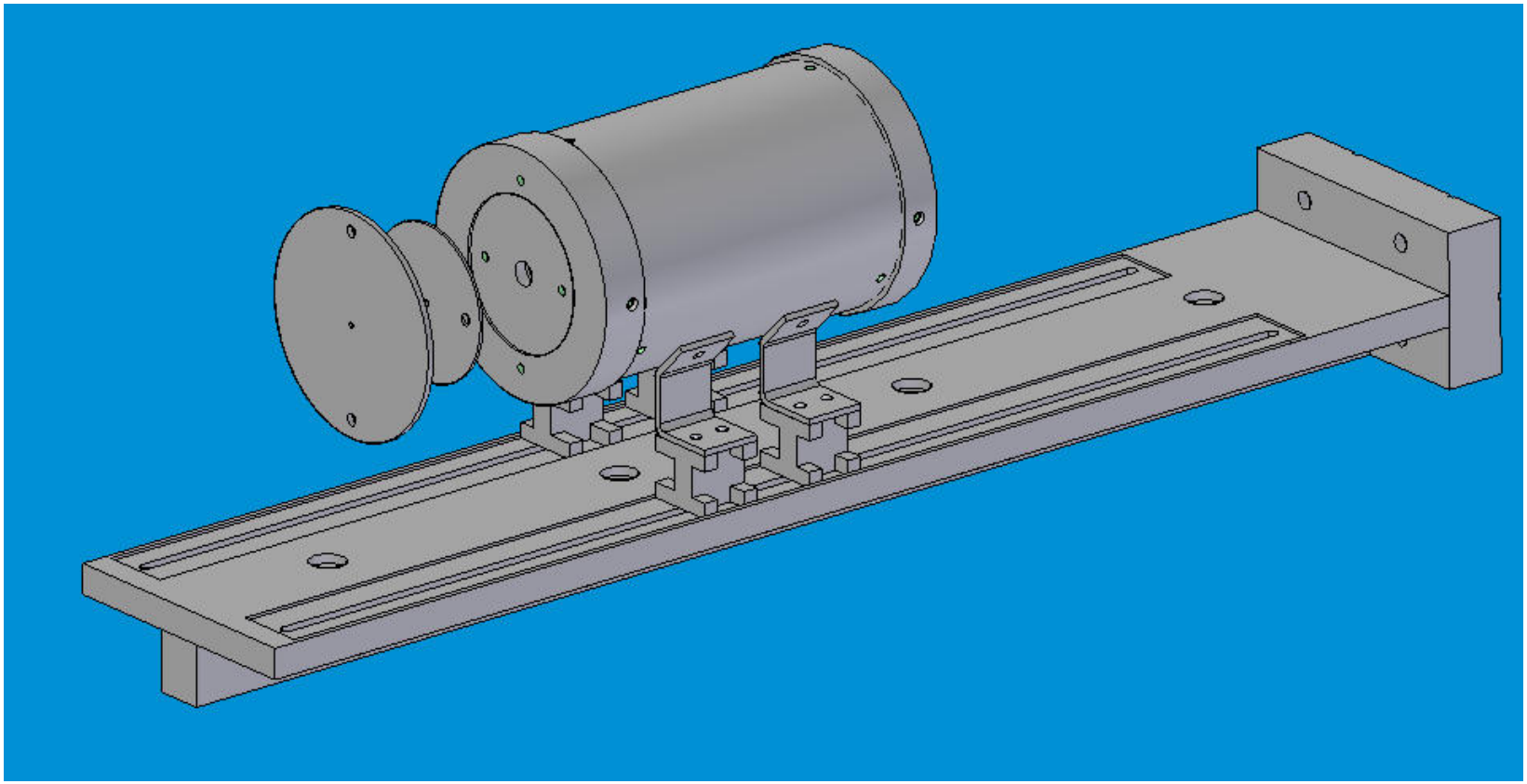
Intensity ~$1/r^2$

Effusion cell design

- Collimation and pick-up experiments

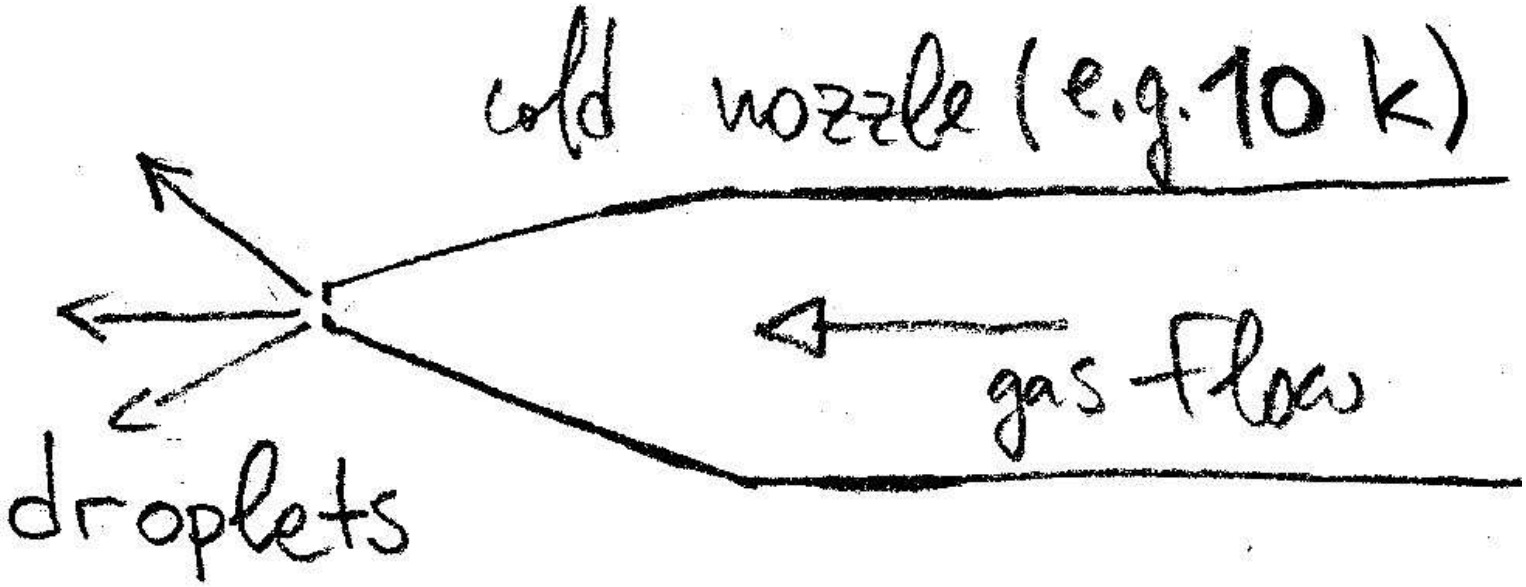


Effusion Cell Design



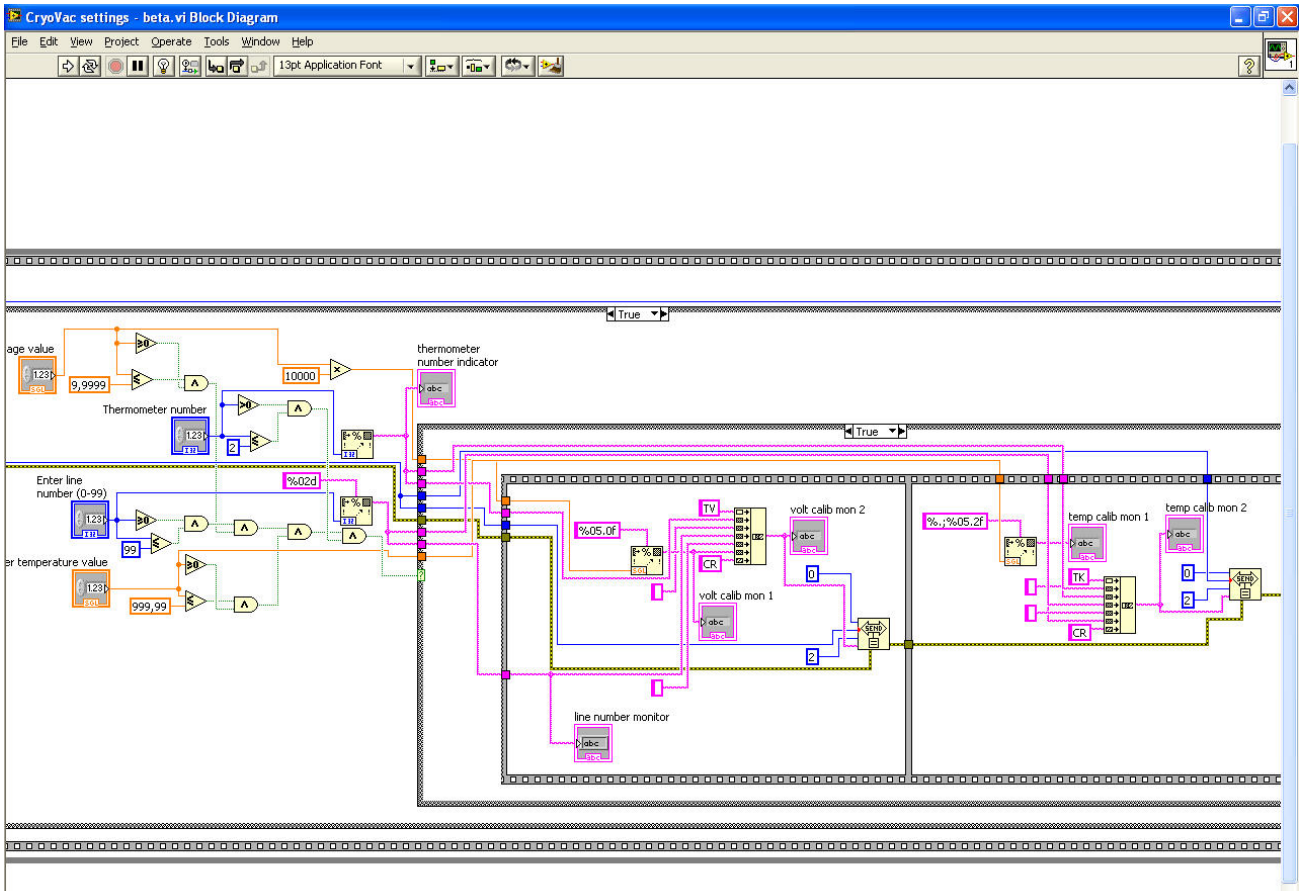
Pick-up experiments

- Producing droplets



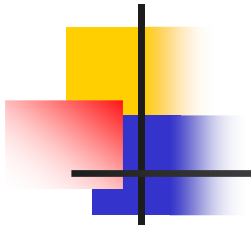
Visual programming

- Communicating with the cryostat: LabView
- Remote control
- Data logging



Summary & outlook

- I learned to work with SolidEdge and LabView
- Effusion cell design drawings now in workshop
- LabView code to be tested in the lab soon



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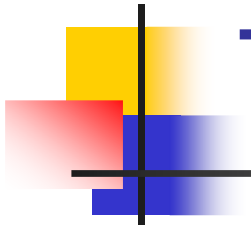
  - Joachim Meyer and Andrea Schrader for coordinating the programme
  - DESY for the financial support



Thanks for listening!