Building a sample chamber for measuring the optical properties of detector materials

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TU Delft Nikhef

Dark matter, what do we think it is and how are we trying to detect it?

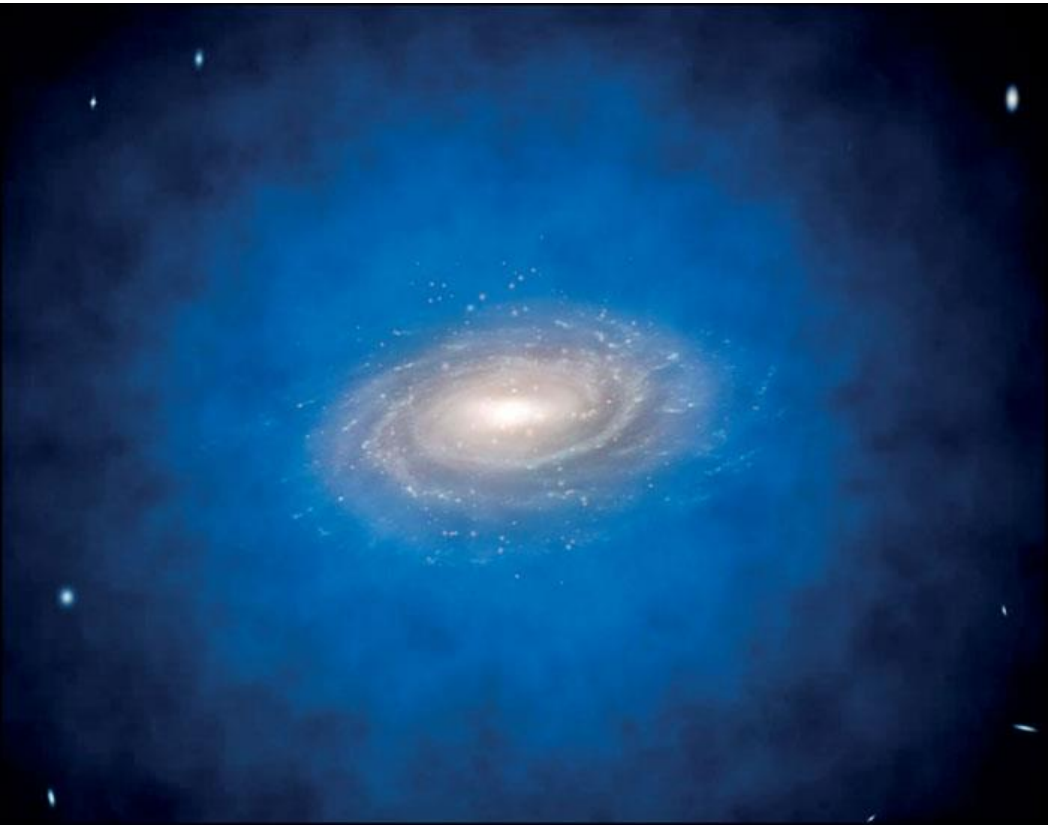

Image credit: ESO/L Calçada.

Image credit: XENON1T.

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Are VUV photons reflected on the detector wall before reaching the photon detectors?

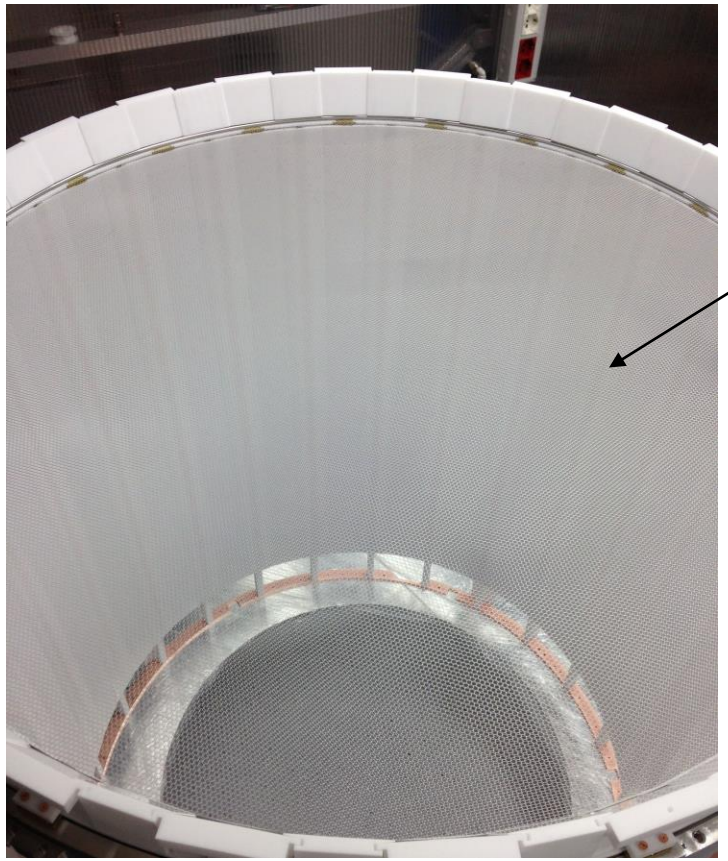
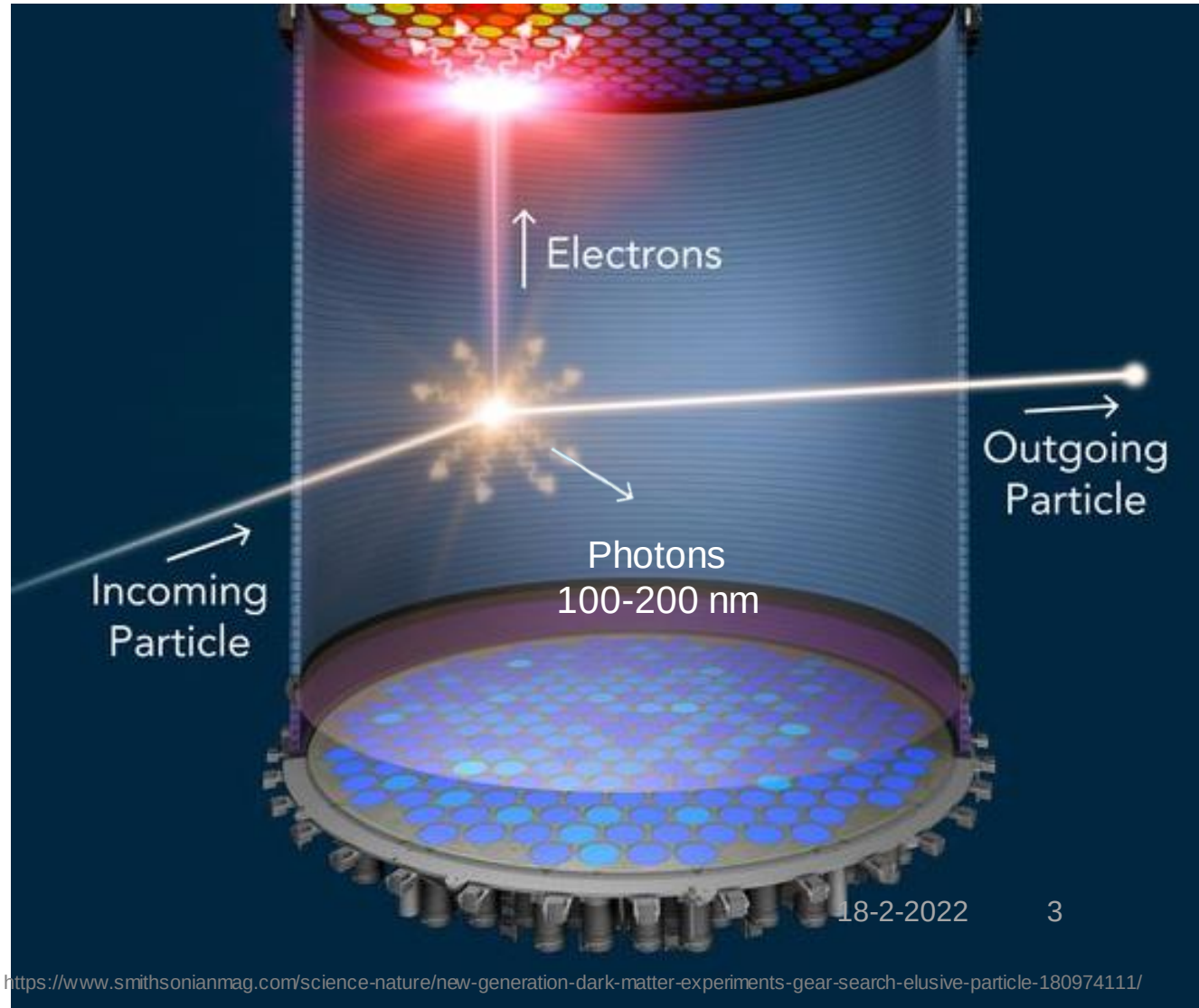


Image credit: XENON1T.



https://www.smithsonianmag.com/science-nature/new-generation-dark-matter-experiments-gear-search-elusive-particle-180974111/

The optical properties: reflection and transmission of photons on PTFE

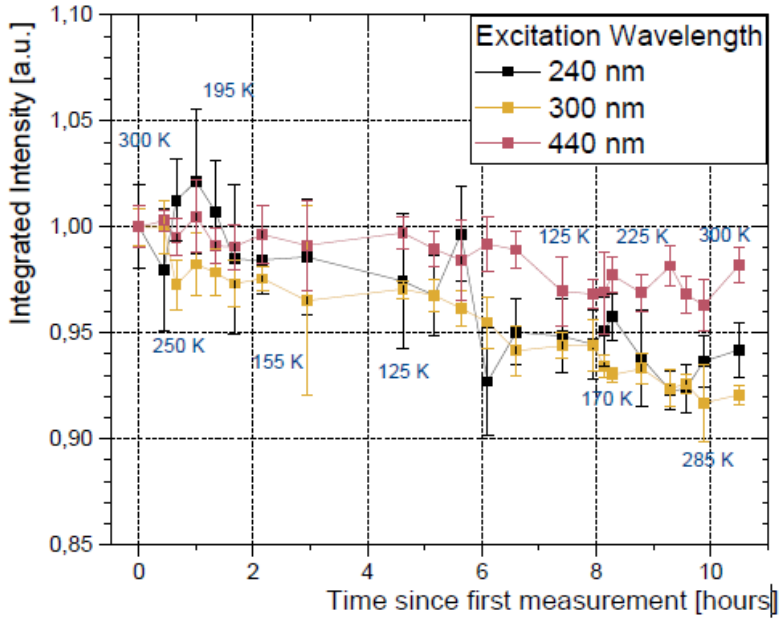
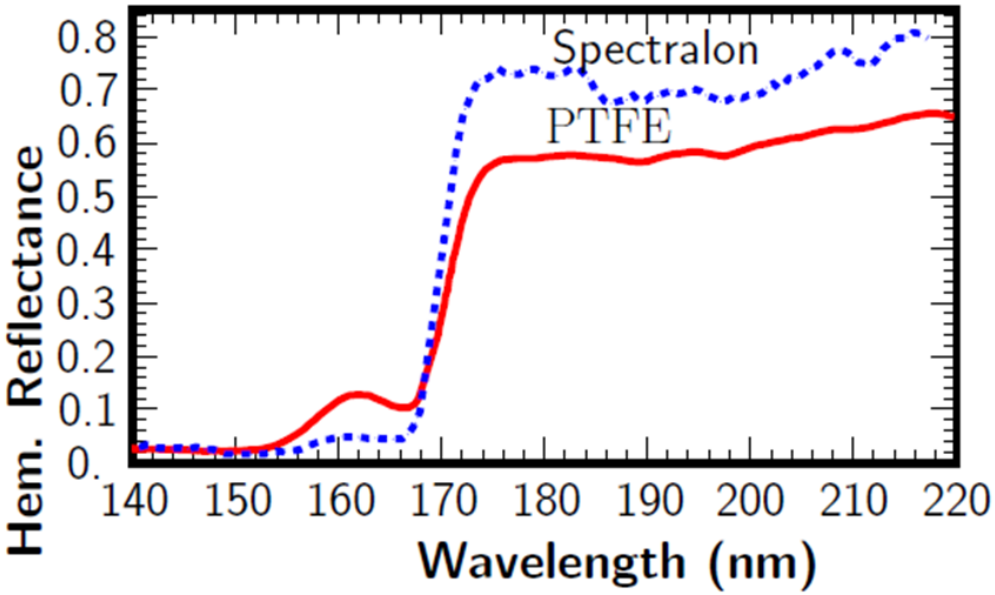


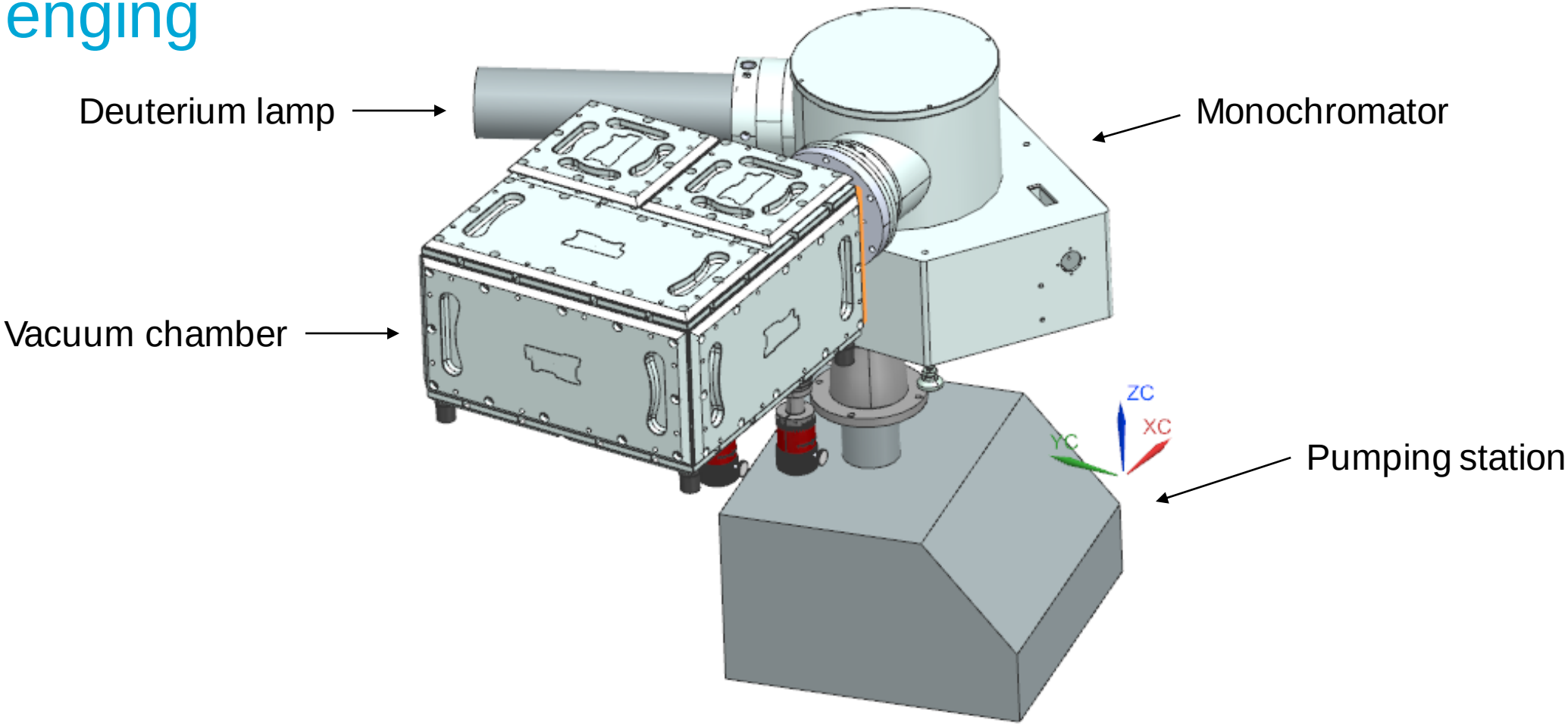
Figure 5.11: Intensity of reflected light on PTFE sample for 240 nm, 300 nm and 440 nm excitation wavelength during the cooling cylce. The sample temperature at different stages is displayed next to the data points (blue). The errors bars indicate the statistical uncertainties from the dark noise correction and system fluctuation.

Image credit: Andreas Leonhardt.

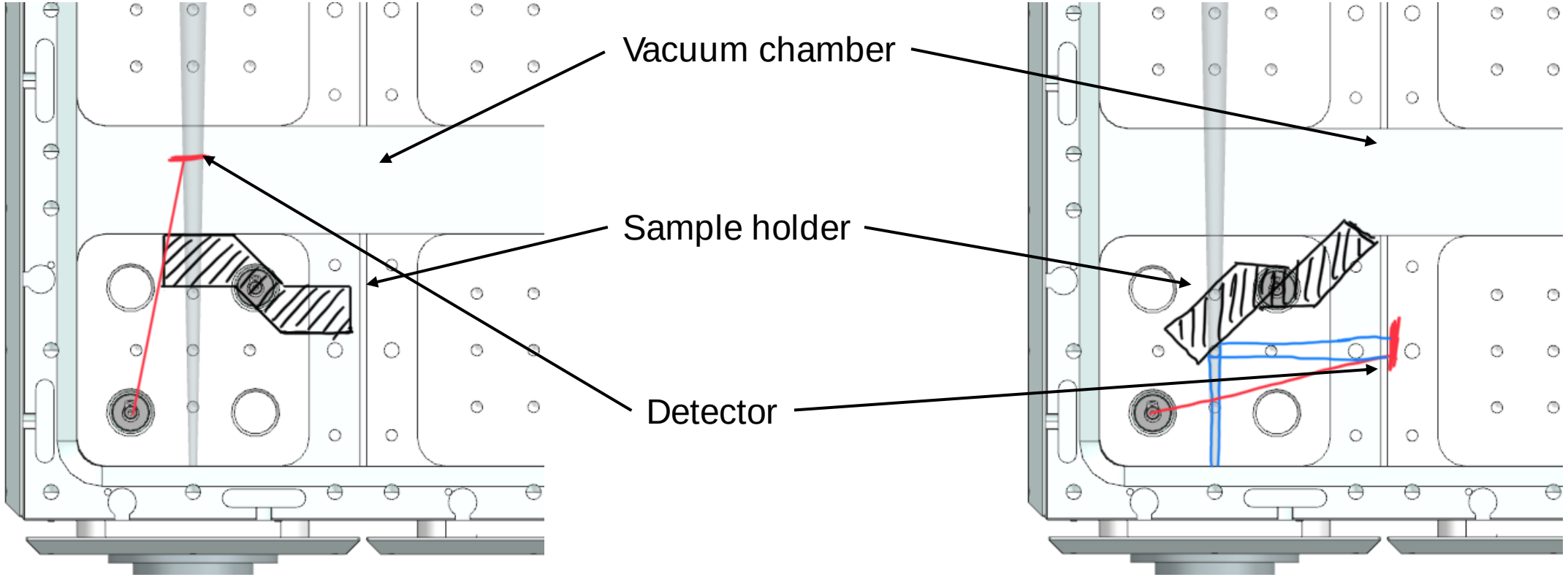


(Kadkhoda et al, SPIE, 3578, 544)

Designing the experimental setup and what makes it challenging



What would the experiment look like on the inside of the vacuum chamber?



transmission

Reflection

To what research questions lead these problems?

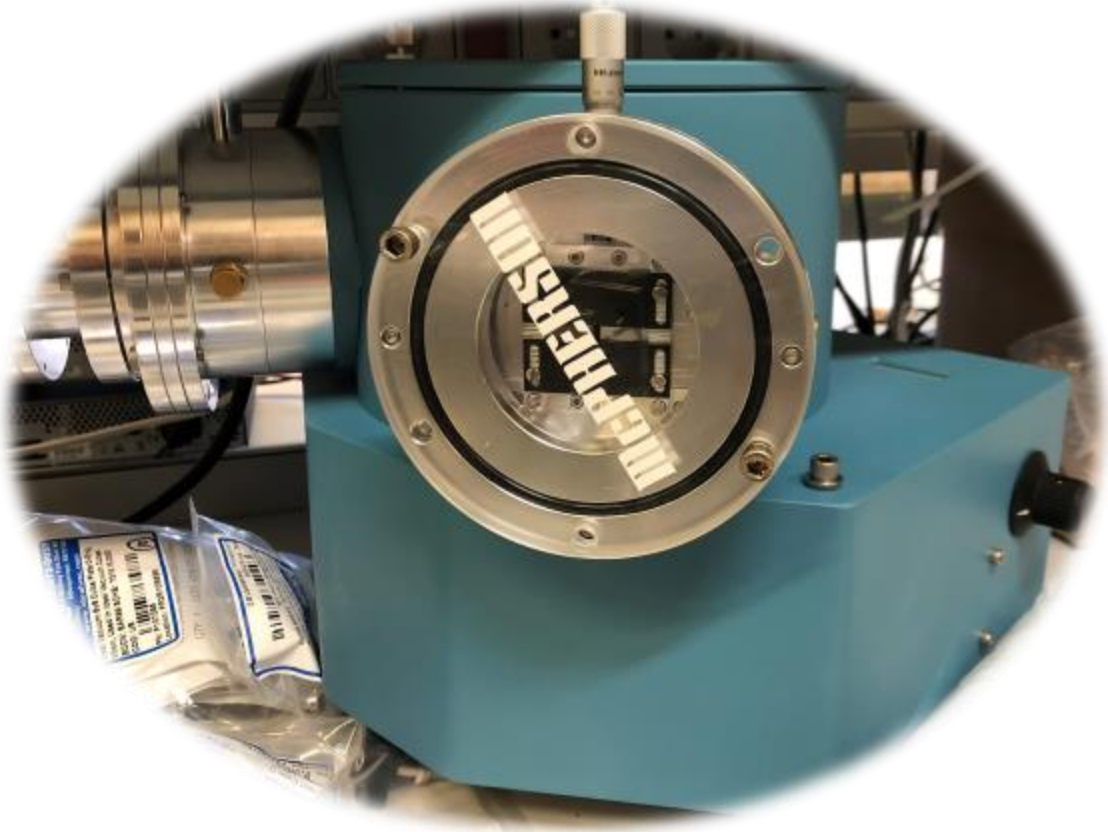
- Are the specifications to which this experiment is designed correct?
- Using the standard prefabricated vacuum components, what configuration of the vacuum chamber can fulfil the specifications?
- What is the best way to record data from temperature and photon sensors located inside the vacuum chamber?
- How will PTFE that is cleaned with different methods reflect or absorb VUV?

Optional:

- How will coated samples reflect or absorb VUV?

Solving the problem of the photon generation

Deuterium lamp

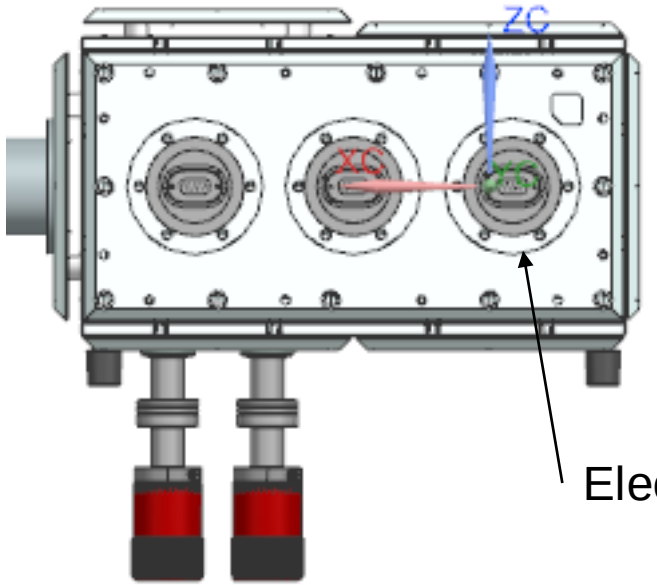


Monochromator

Solving the problem of oxygen and other possible particles

Pumping station

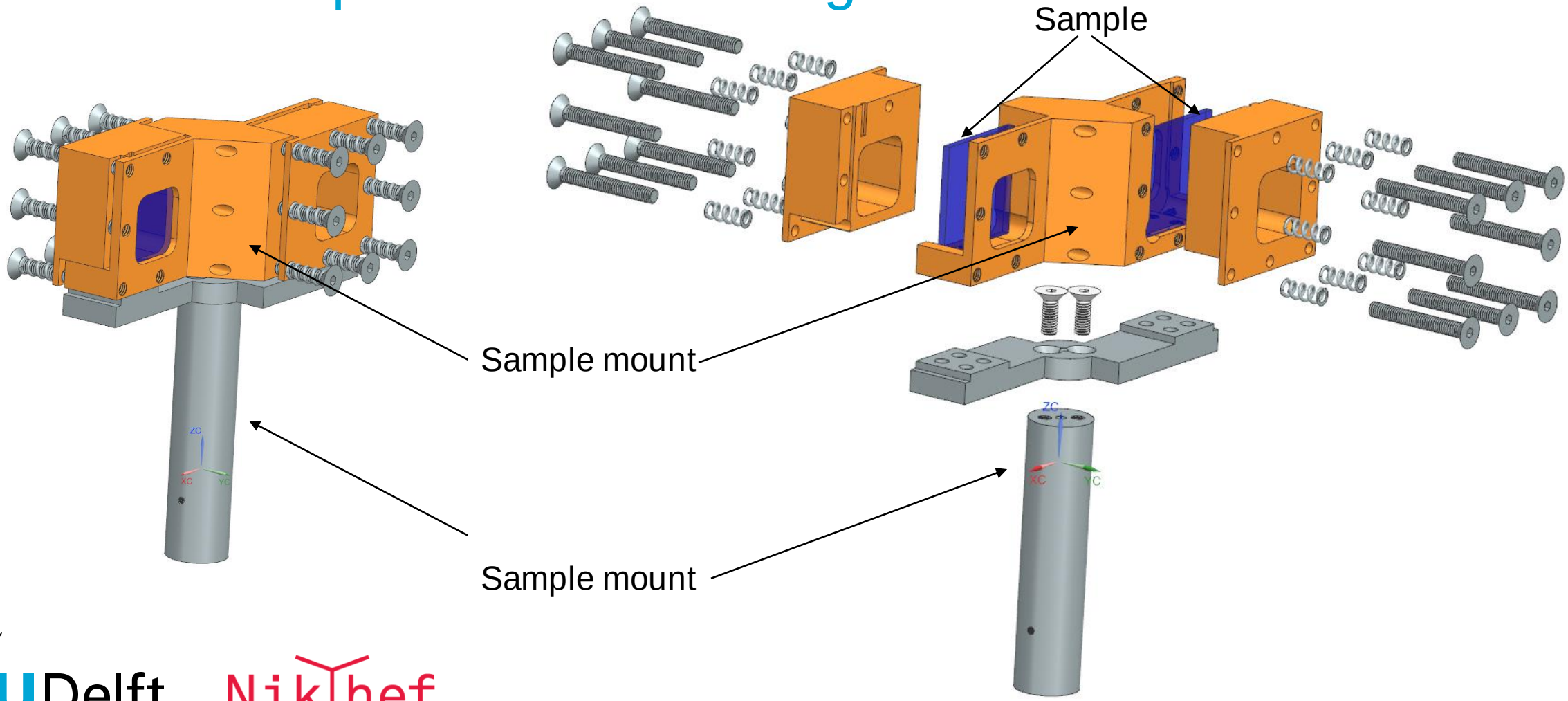
Vacuum chamber



Electrical feedthrough

Rotary feedthrough

I designed a sample holder that will hold a sample and a reference sample without breaking vacuum



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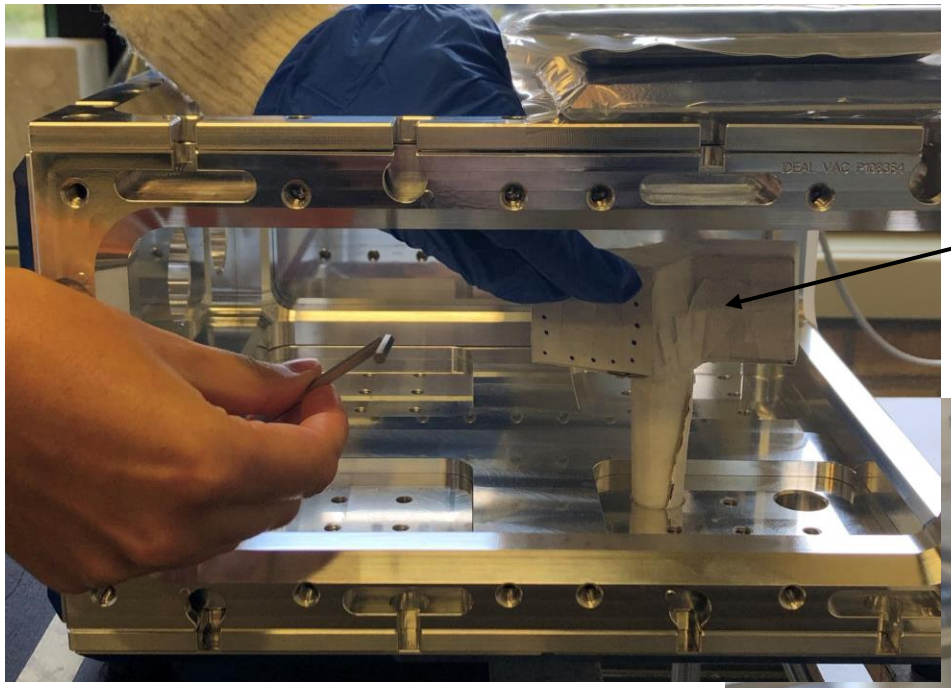
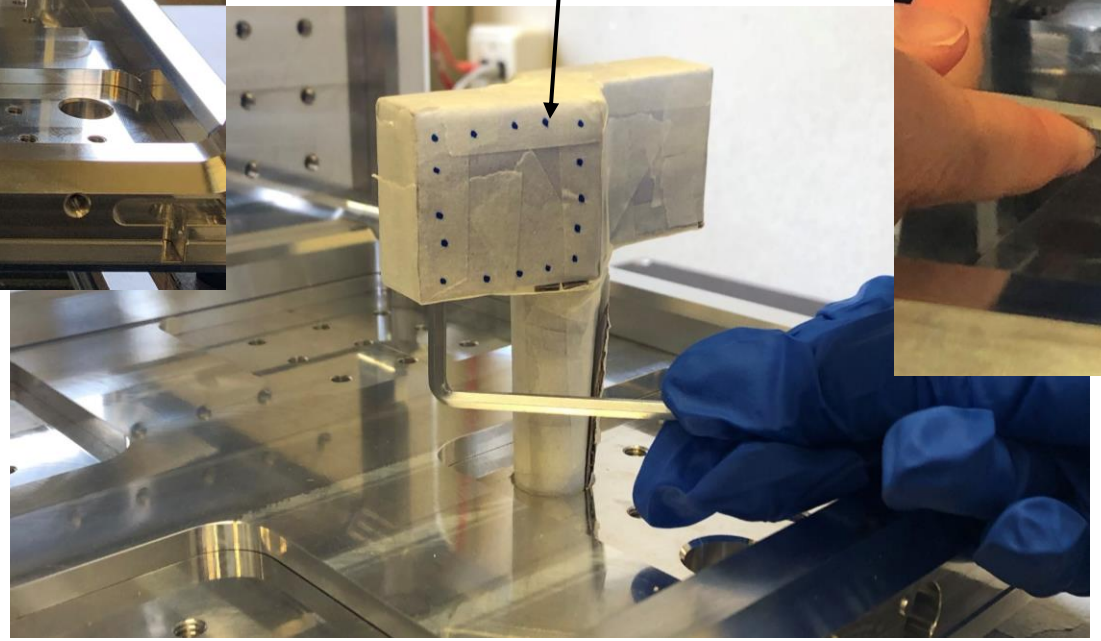
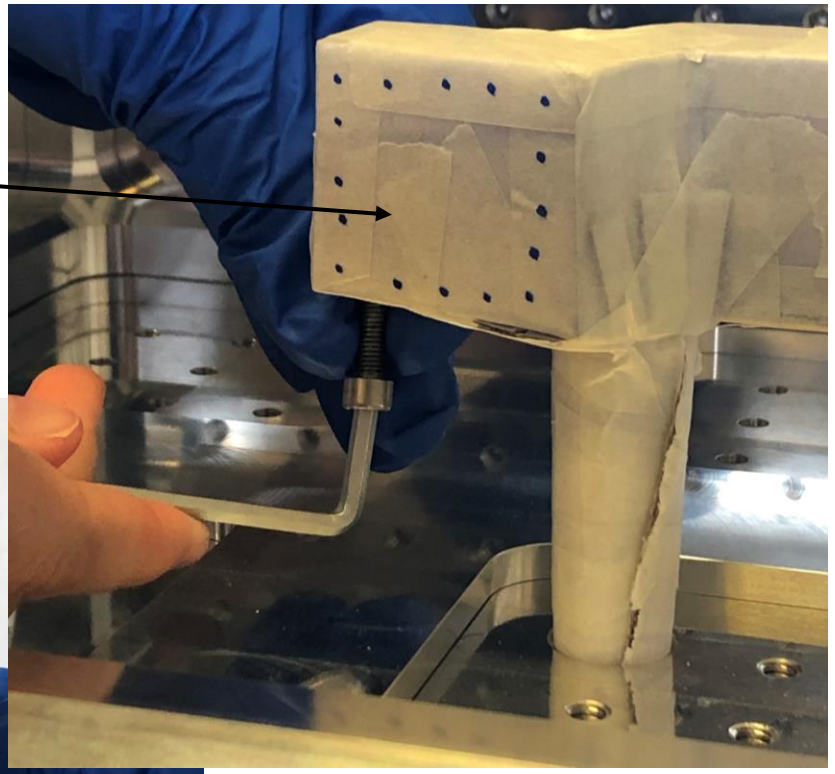
How usable would the sample holder be when installed?

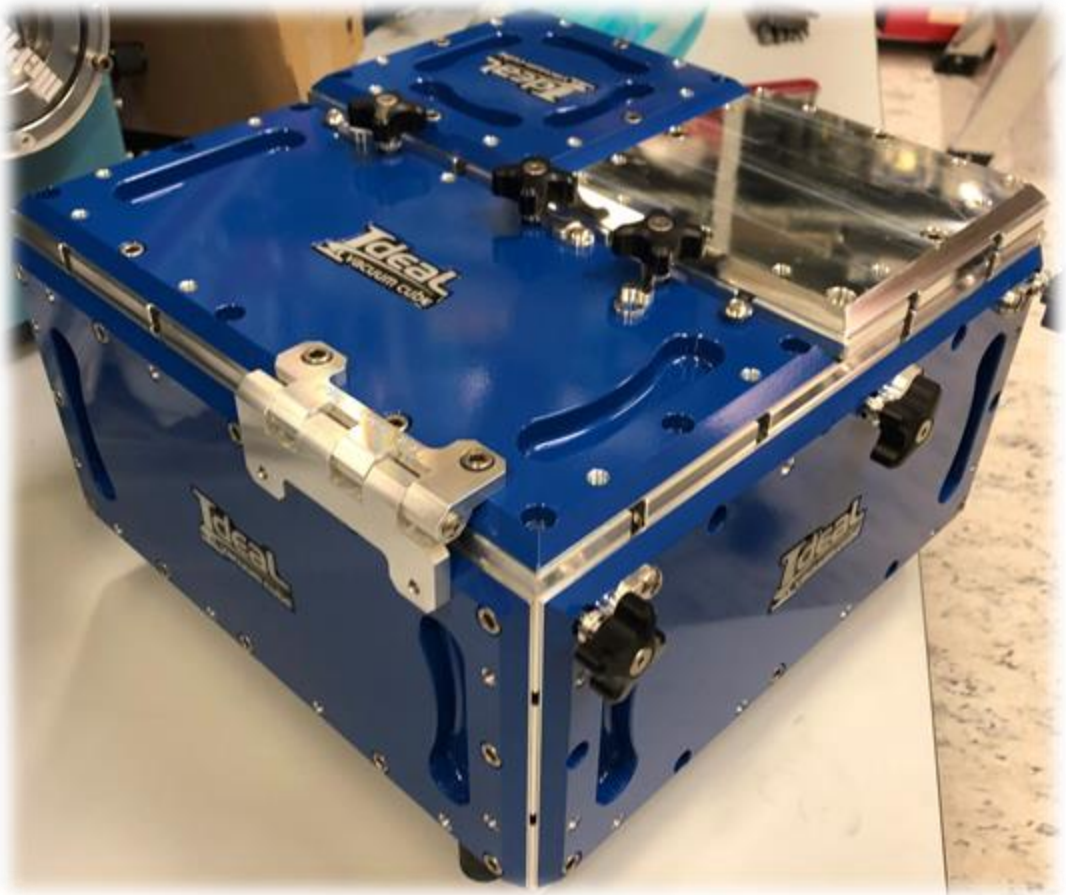


Sample holder muck-up

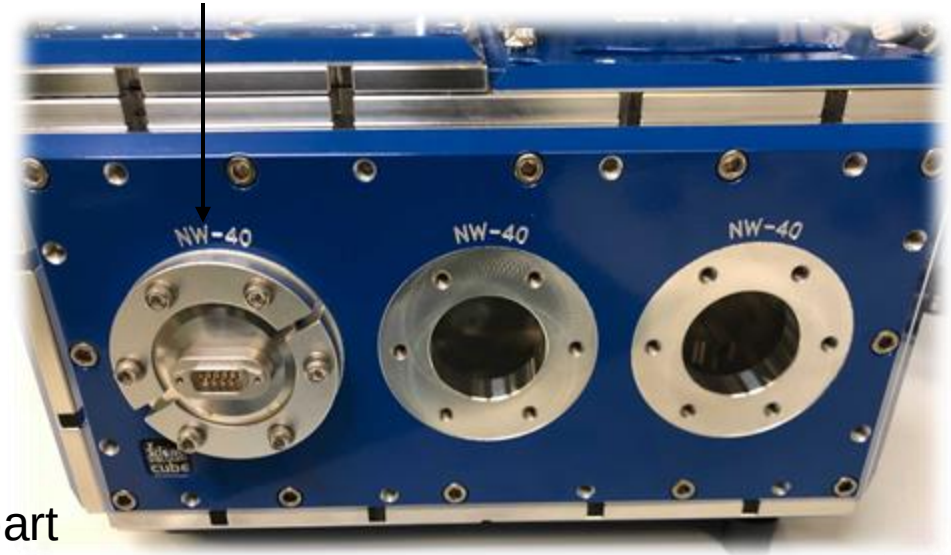




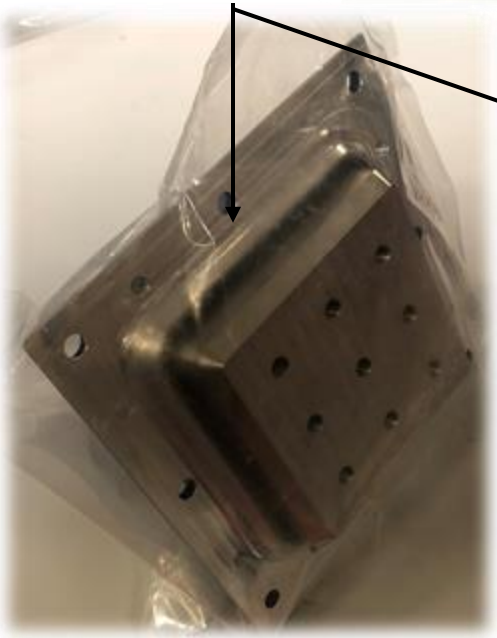
What lies in front of the experiment?



Electrical feedthrough



Cooling part



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Thank you for your attention

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