Vacuum chamber window

Jun 29 2021

Intro

- We're talking about the vacuum chamber window's material choice, it thickness, its mechanical strength, its radiation tolerance and primarily, how much bkg it will generate (signal is checked to be fine)

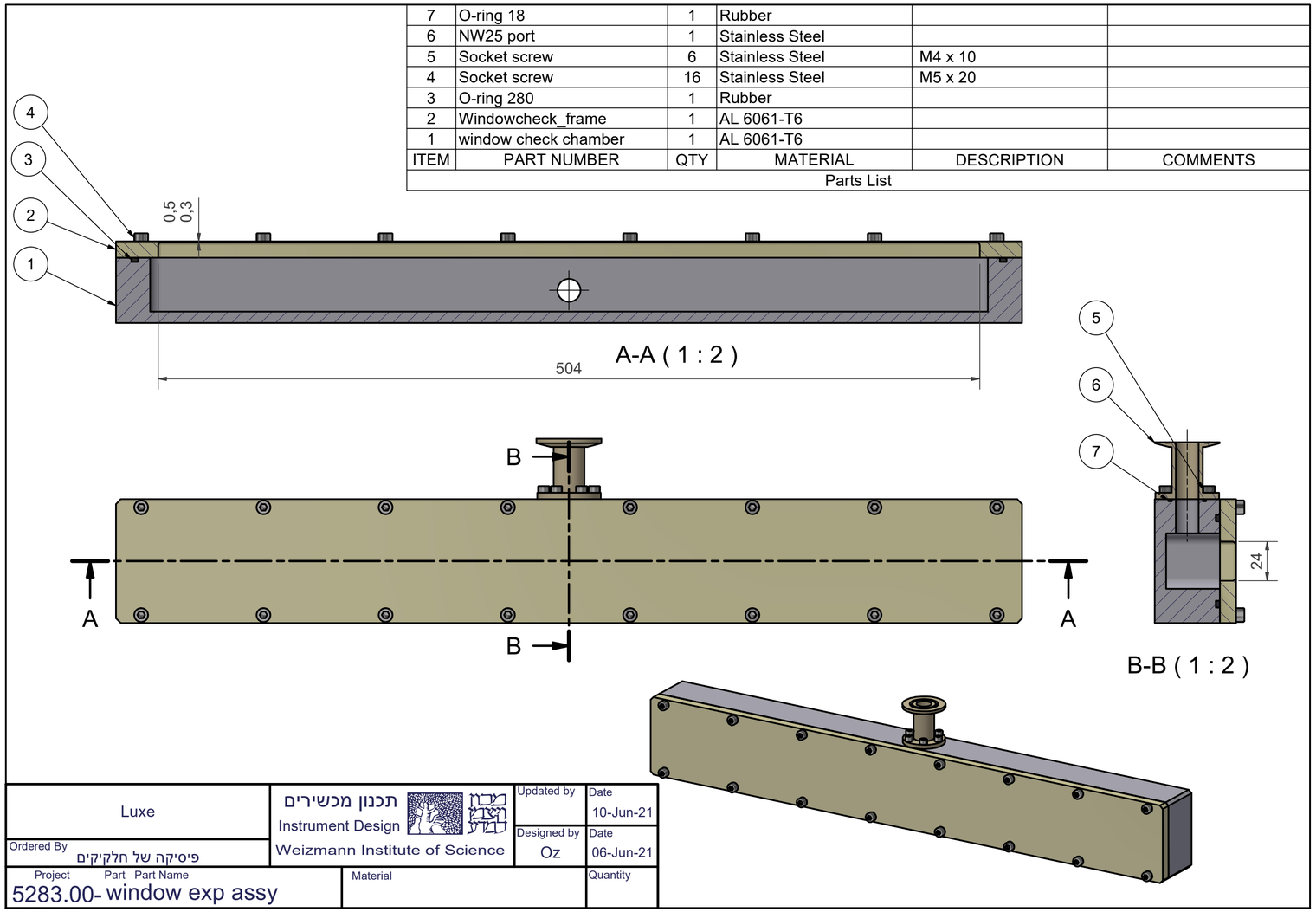
- From Oz:
  - it'd be very difficult to simulate the mechanical stresses and estimate the breaking point and level of deformations
  - on the other hand, it'd be relatively simple and cheap to just produce a mockup and test it…

- We have produced a few pieces and will check the strength and deformation in the coming days

The proposed test

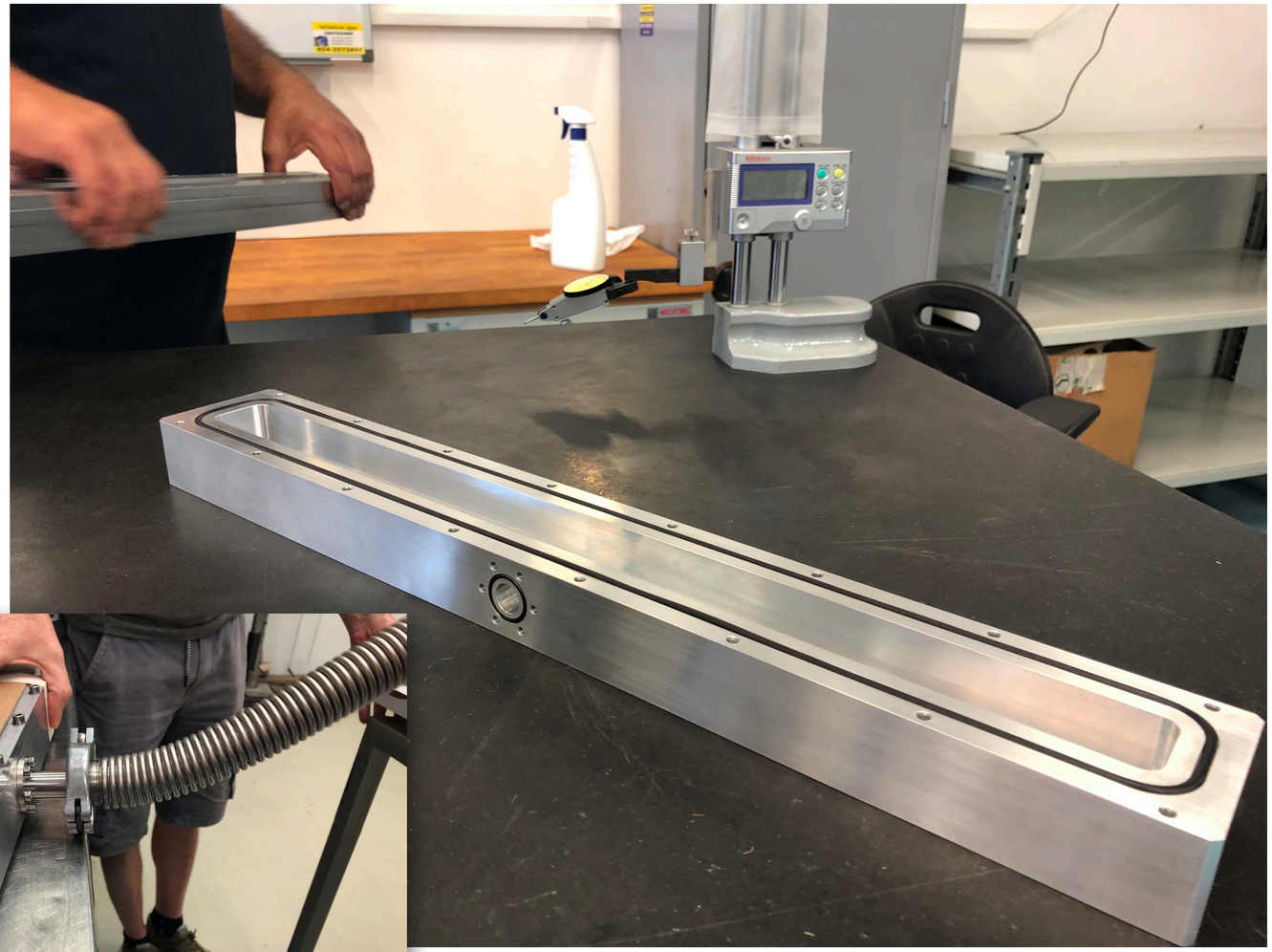
- Build a small mockup chamber with a few proper-sized windows
- Connect the chamber to a strong pump, measure the vacuum and the deformations in a few points across the window before, during and after the vacuum application
- Reasoning: one atmosphere is 1013 millibars, so if we have a pump of:
  - 70 mbar (e.g. in my lab), we will have a pressure difference of 1013-70 = 943 mbar and so, ~93.1% of the pressure that we'll have if we have a perfect vacuum - not good enough!
  - ~5e-3 mbar, we can be at ~99.9995% of the outside pressure that we'd have if we had a perfect vacuum - good enough (window will break already here if it'd break).

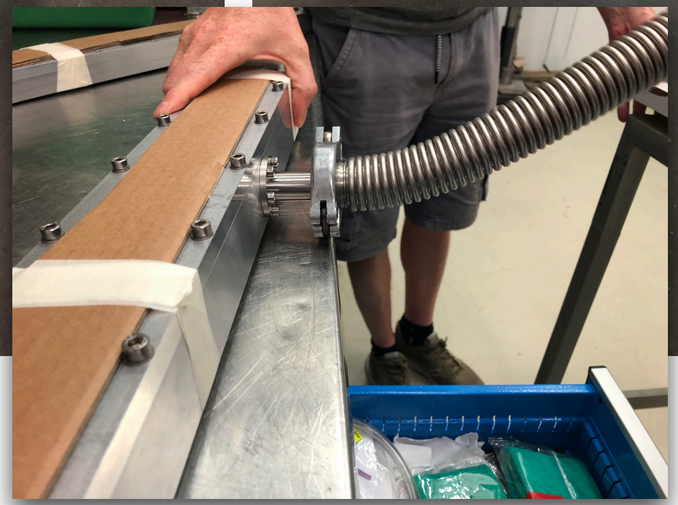
Design of the mockup chamber



- We have produced four windows with thicknesses:
  - 500 um
  - 400 um
  - 300 um
  - 200 um
- All pieces are made of Aluminium 6061

The pieces





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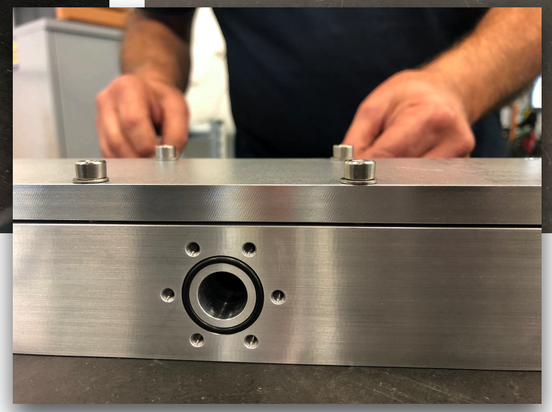
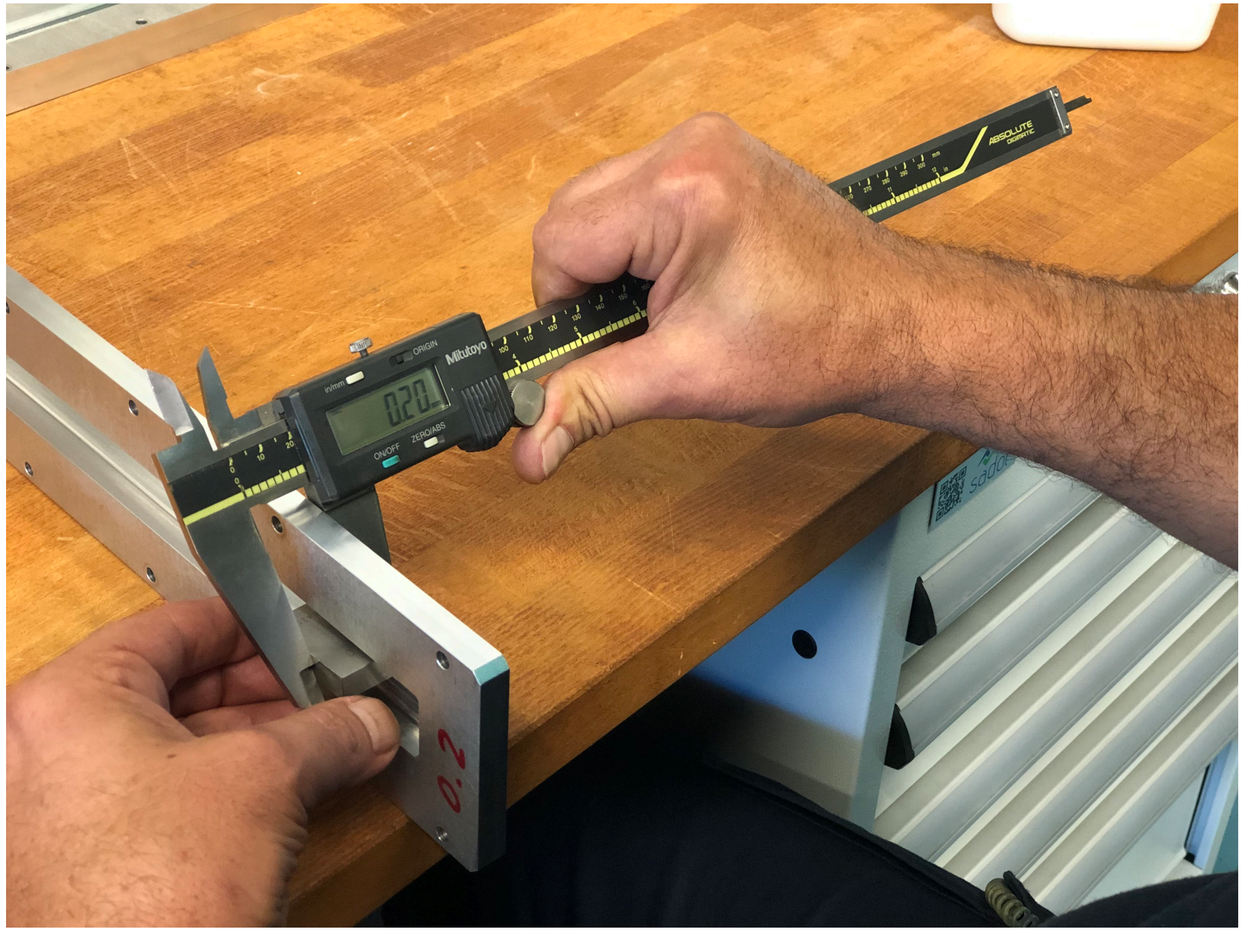


Pre-measurements

- All four windows are within ±20 um from their specified thickness
- This was measured across the full length of the window



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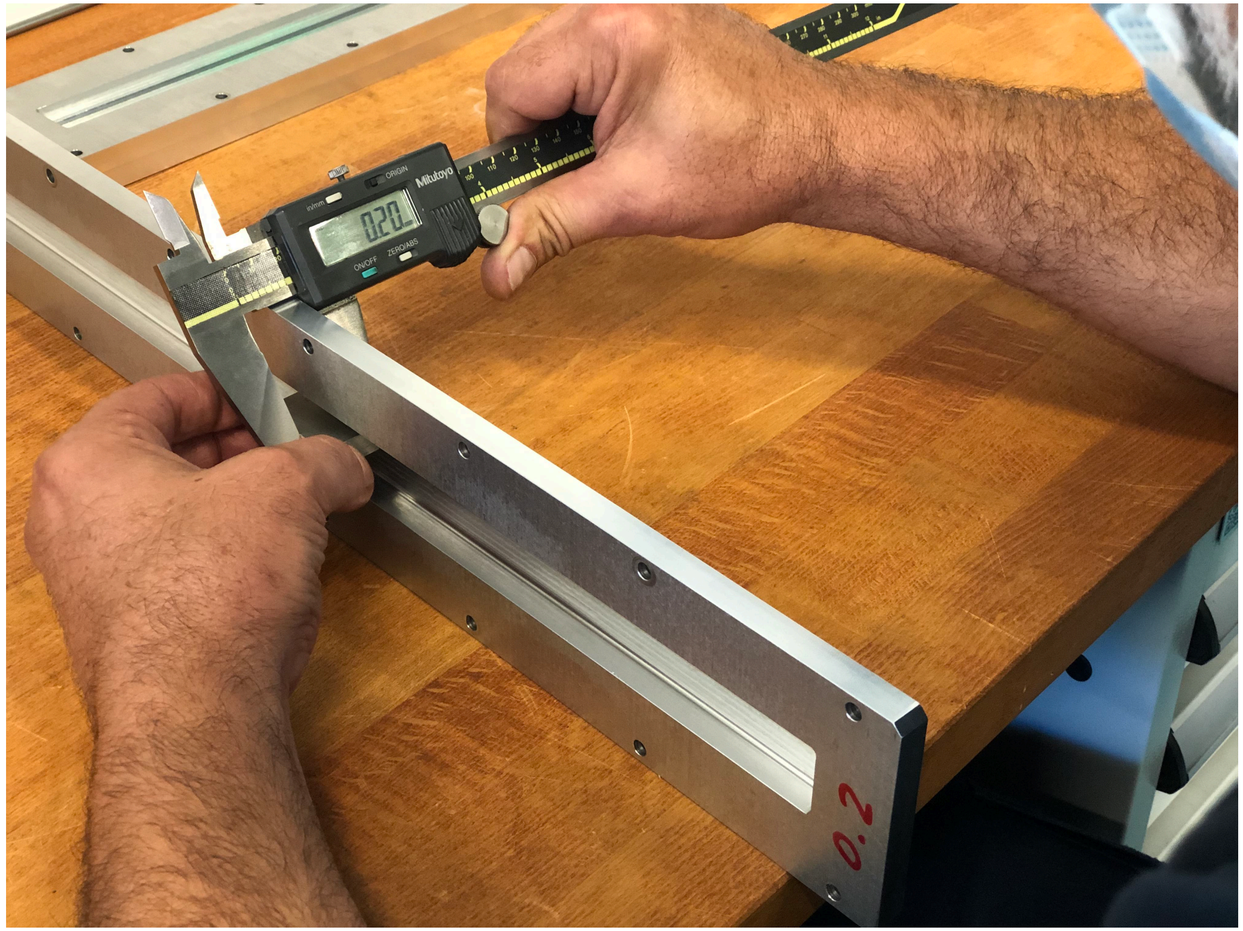
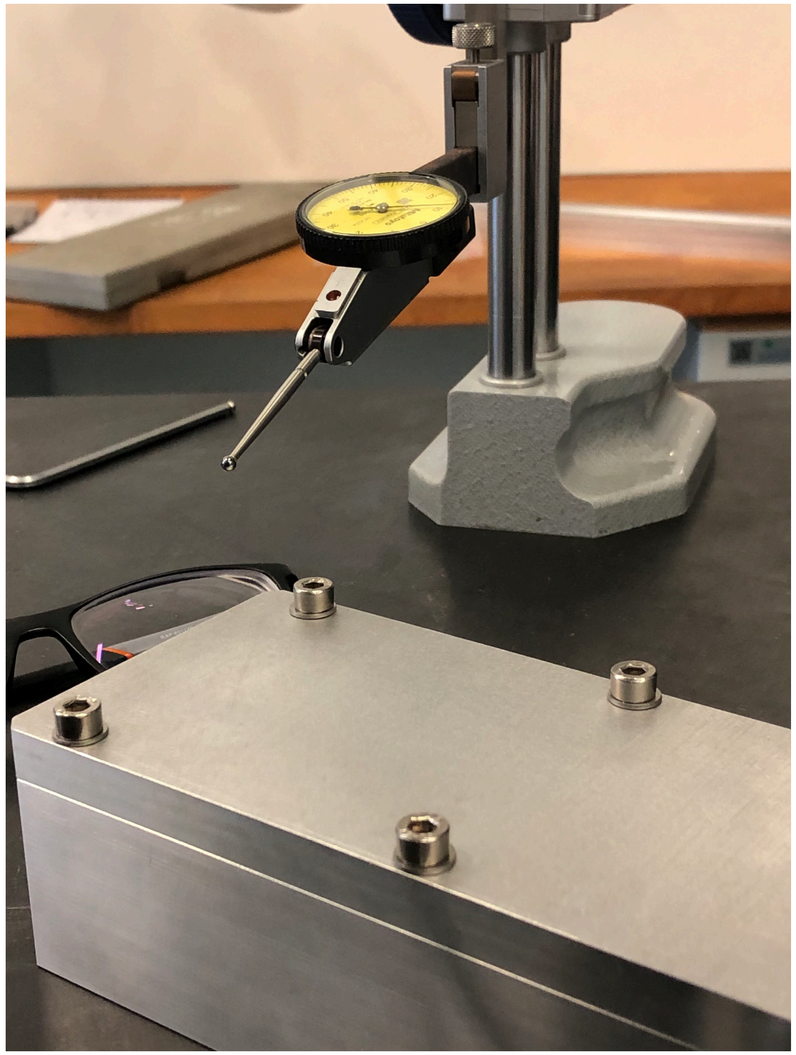
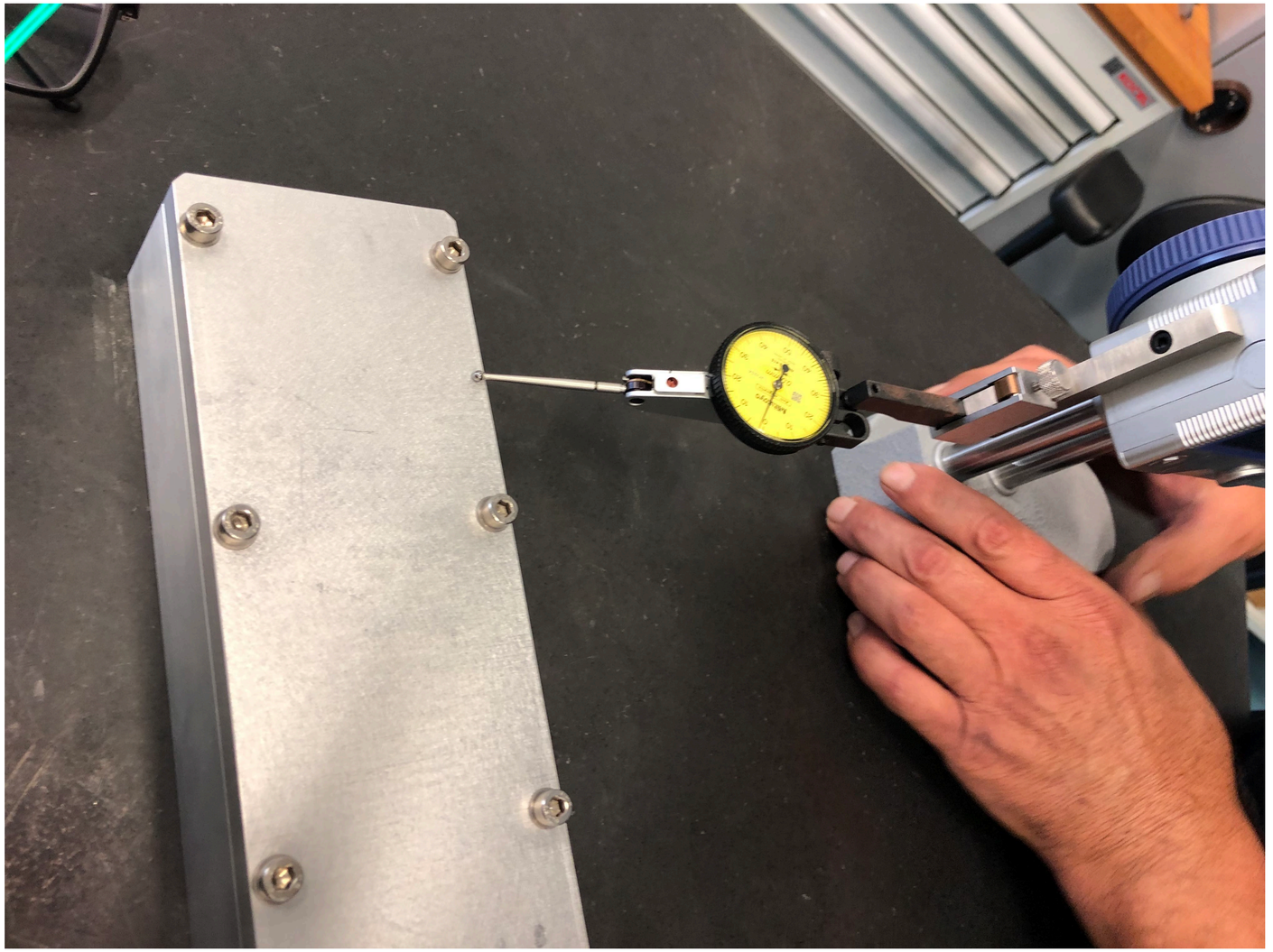


Probing the window





Summary

- Production of the chamber and four different windows is done
- Will now make the test at ~5e-3 mbar initially while measuring the breakup point (?) and the deformations particularly at the 200 um thickness
- This has a large impact on the experiment