Laser Alignment System

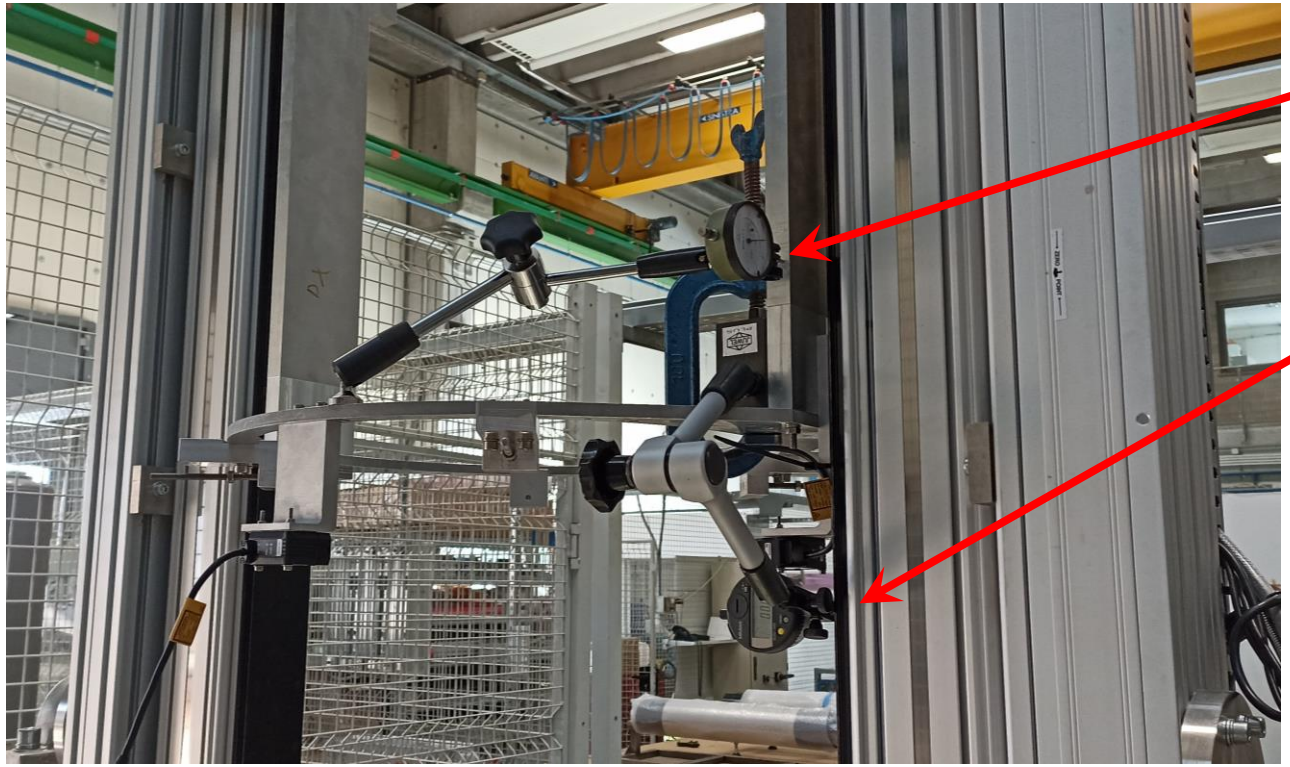
Status Update

Outline

- VIM Modifications
- System Installation
- Interface Update
- Test of the System
- Next Steps

VIM Modifications

Check of the VIM Movements



Measures the deformation of the flange with respect to the rod

Measures the displacement of the rod with respect to the rail

Deformations up to 0.08 mm
Displacements up to 0.06 mm

Some modifications to the flange are needed to limit unwanted movements

Flange Modifications

Fixed end

- Rod extension bolted independently
- Added pins to uniquely define the coupling

Free end

- Rod extension bolted independently
- Cut openings for the stud bolts
- Added PTFE shims to reduce friction
- Lubricated using WD-40

The free end nuts must only be accosted and not tightened
The free end must be kept lubricated, CR safe lubrication needed for final commissioning

A Word of Caution

The modifications greatly reduce flange deformation:

<0.01 mm over a ~70 cm travel

This still **largely depends on careful handling of the flange's free end!!!**

Rod displacement with respect to the rail was not addressed

Still uncertain if due to real movement or to the rail's uneven surface

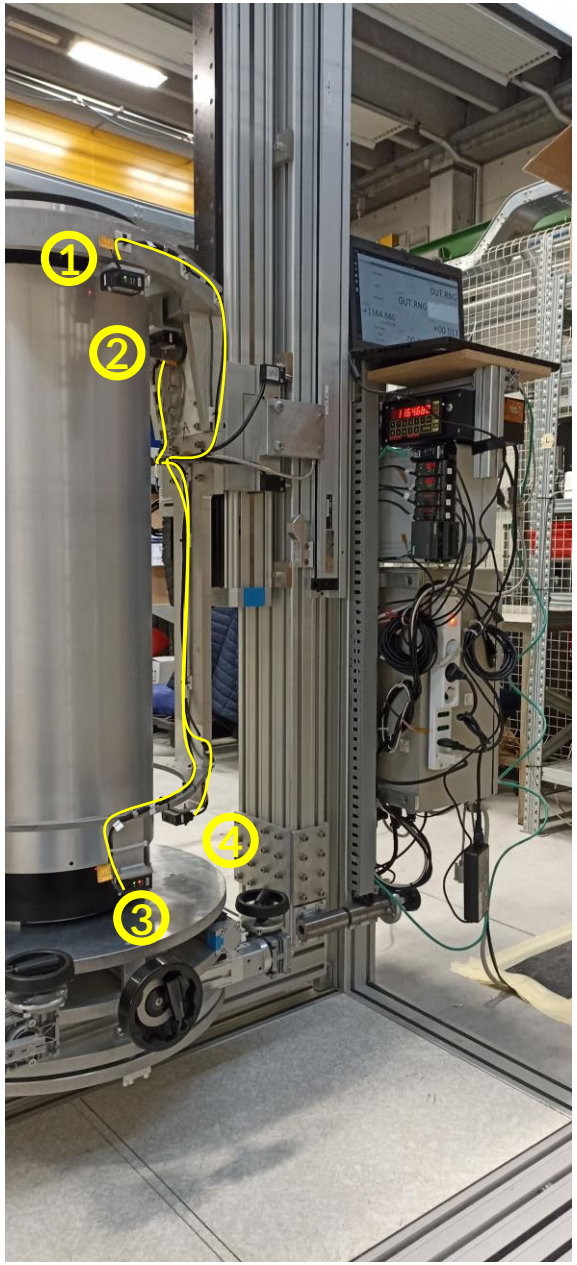
System Installation

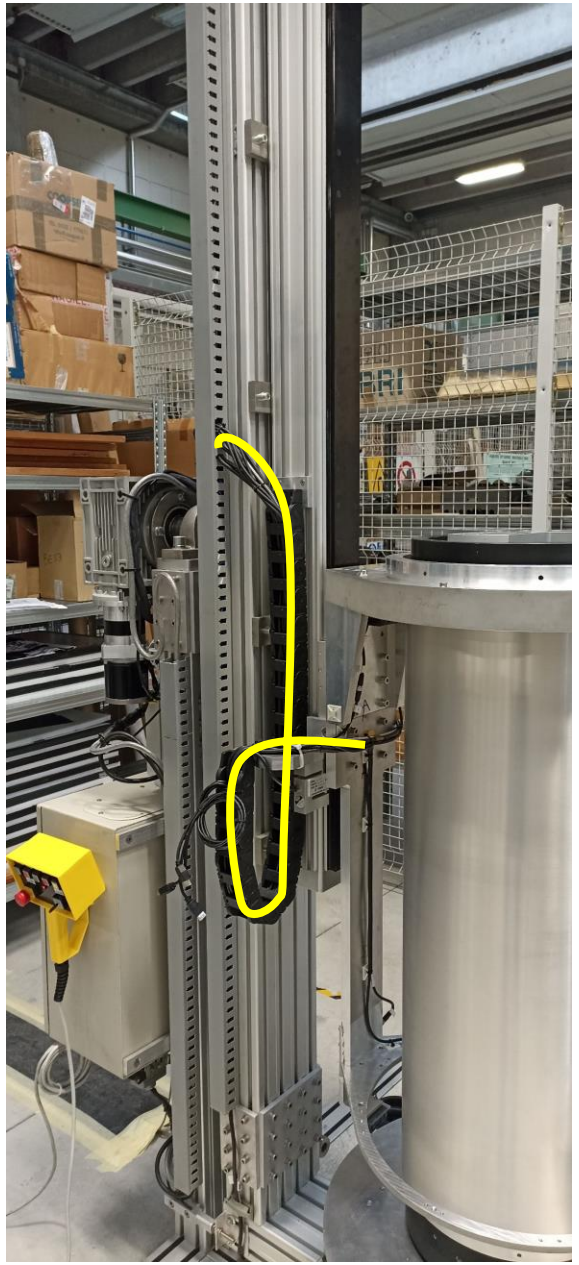
Cabling

To do list:

Better grounding connection for laser controllers and optical line visualizer

Enclose controllers and the extra length of the cables in an **electrical box** for more cleanliness when in CR

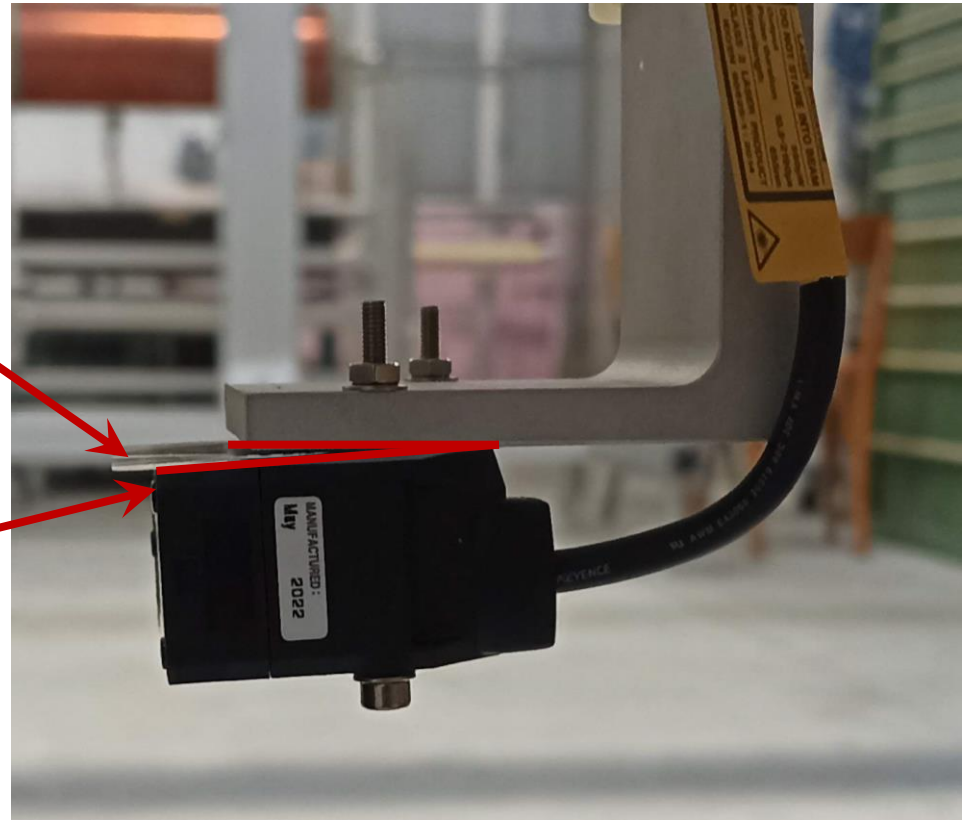




Sensor mounting

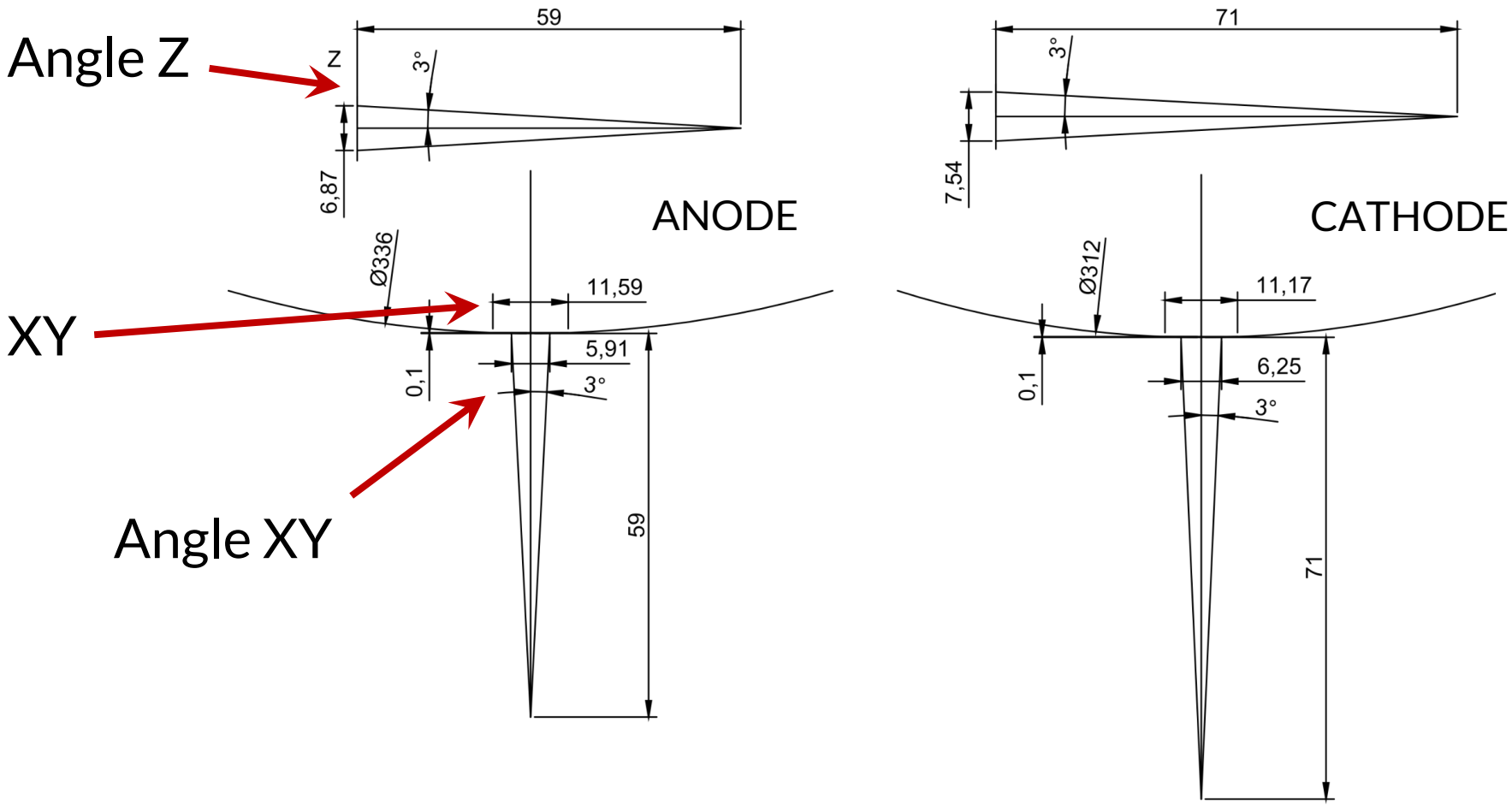
This insulation should be here according to the instruction manual but I do not know why

Bad sensor placement, not an issue for the bottom lasers such as this one

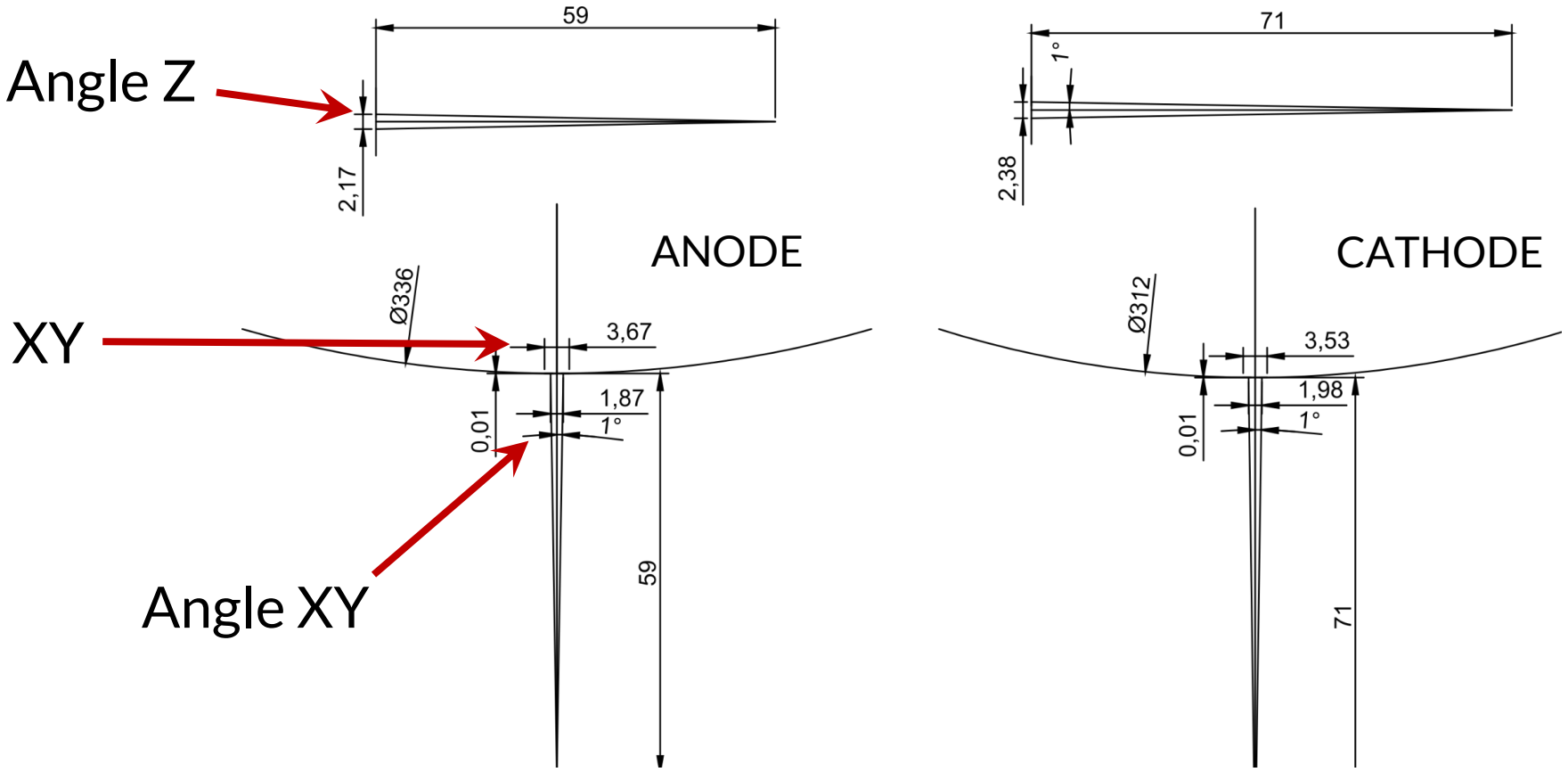


Check top lasers position when reinstalling

Minimum Top Lasers' Positioning Requirements Alignment

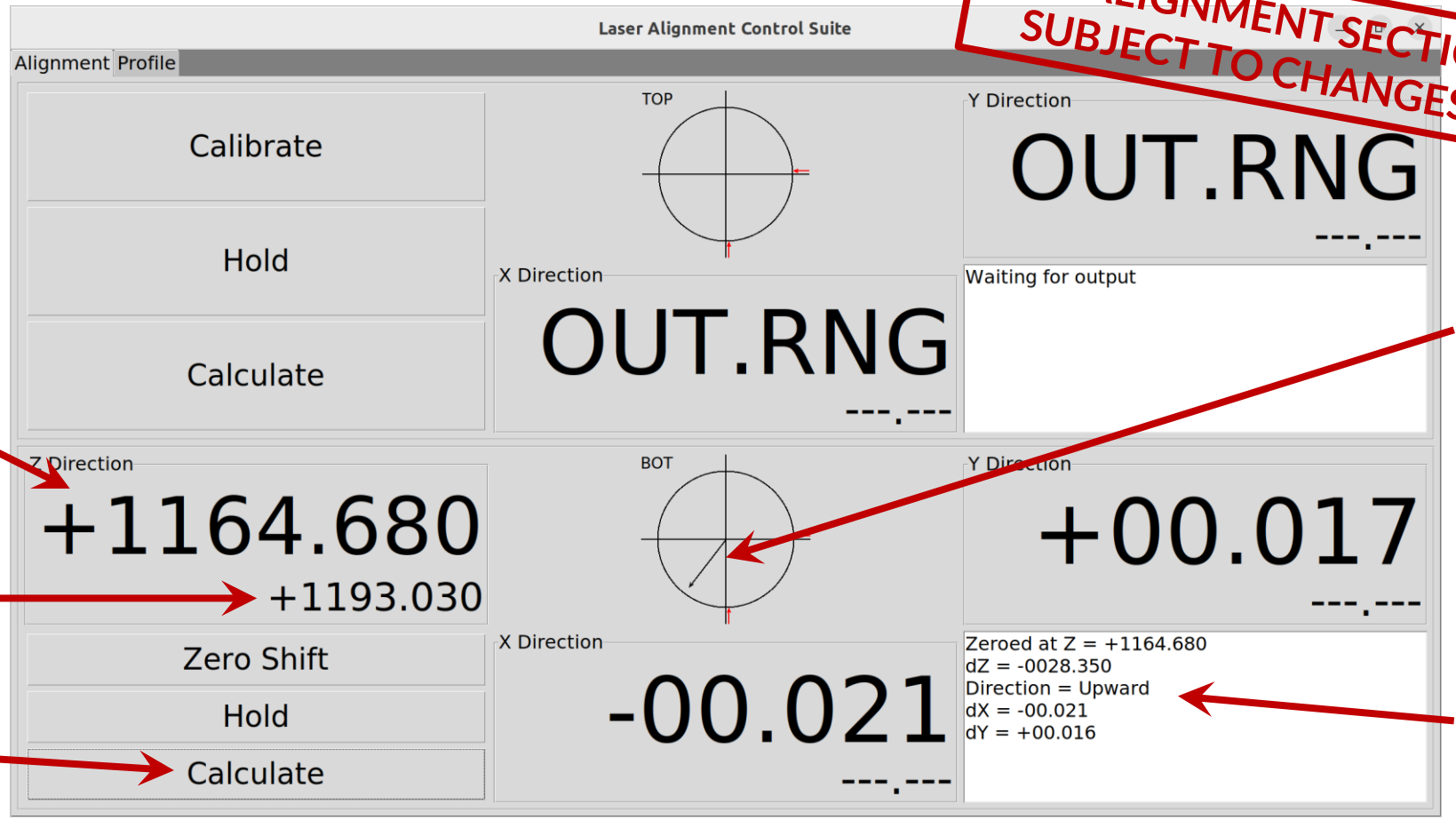


Ideal Top Lasers' Positioning Requirements



Interface Update

Alignment Tab



Current Z position

Previous zeroing position

Calculate visual aid

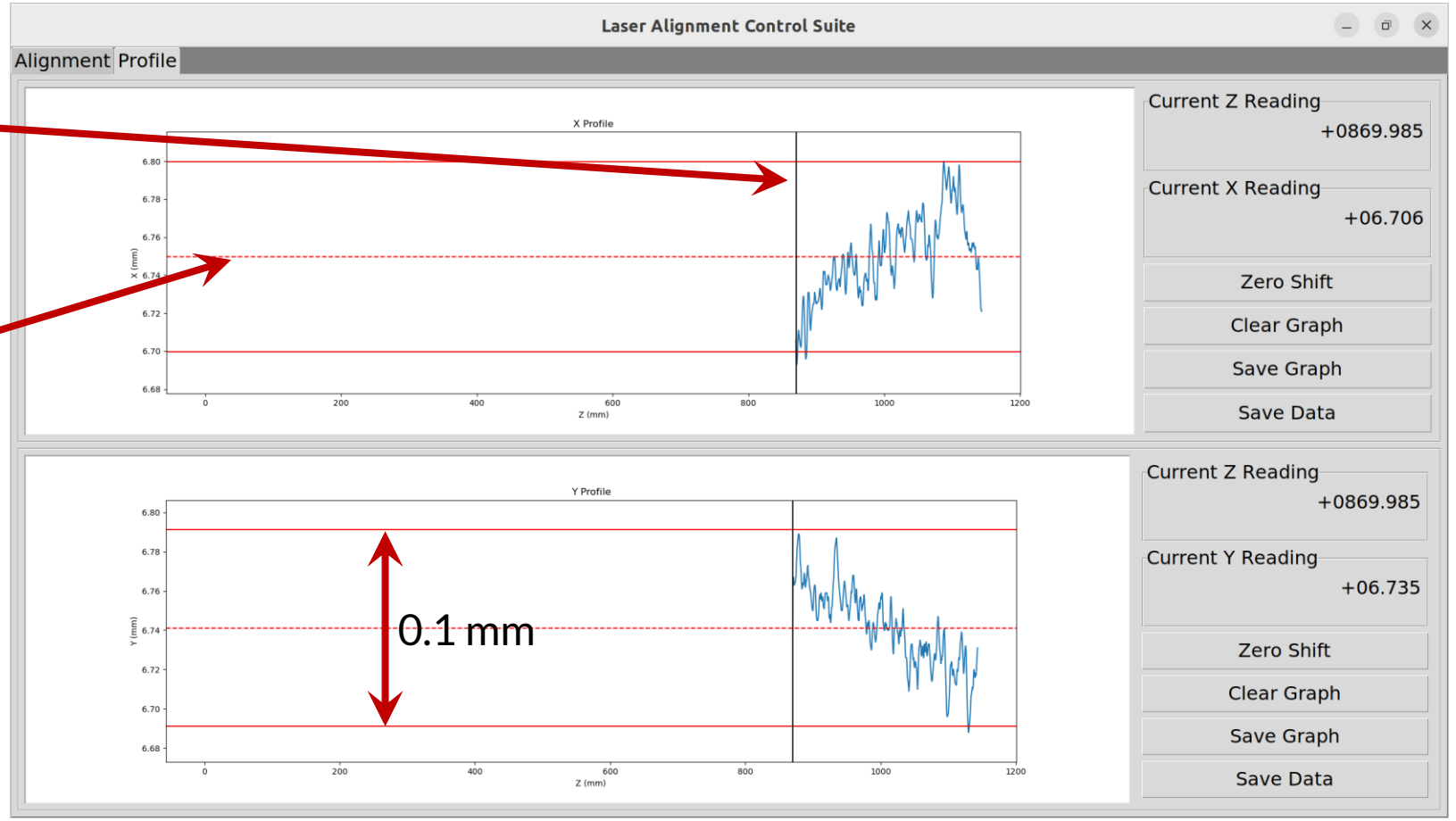
Where the mold's top end should go

Output of the calculate button

Profile Tab

Current Z position

Average of displayed measurements



Test of the System

Thermal Drift

The lasers cannot be used right away after turning them on:

Thermal Drift		
	After 30'	After 30' more
ΔX	0.048	0.003
ΔY	0.068	0.000

Necessary to wait at least 30-45 minutes after turning the lasers on before starting to measure

Lasers VS Comparators

Measured on the PTFE surface

Slightly different path for the two instruments

Going Downward		
	Comparators	Lasers
ΔX	-0.303	-0.275
ΔY	-0.20	-0.152
Going Upward		
	Comparators	Lasers
ΔX	0.306	0.262
ΔY	0.19	0.138

Laser Alignment Test

- Zeroed on the mold's bottom black end
- Moved upward towards the mold's top black end
- Adjusted the tilt control screws at the base
- Moved downward towards the mold's bottom black end
- Checked the results of the alignment

Laser Alignment Test		
	Before	After
ΔX	0.362	-0.004
ΔY	0.15	0.006

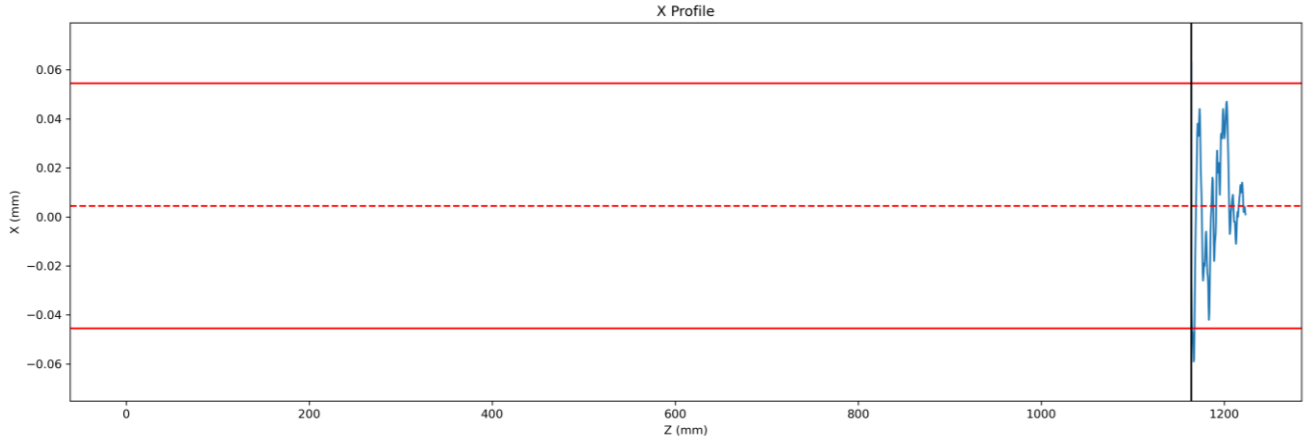
Laser Alignment Check	
ΔX	ΔY
-0.031	-0.062

The alignment is within the acceptable tolerance, still I expected better repeatability

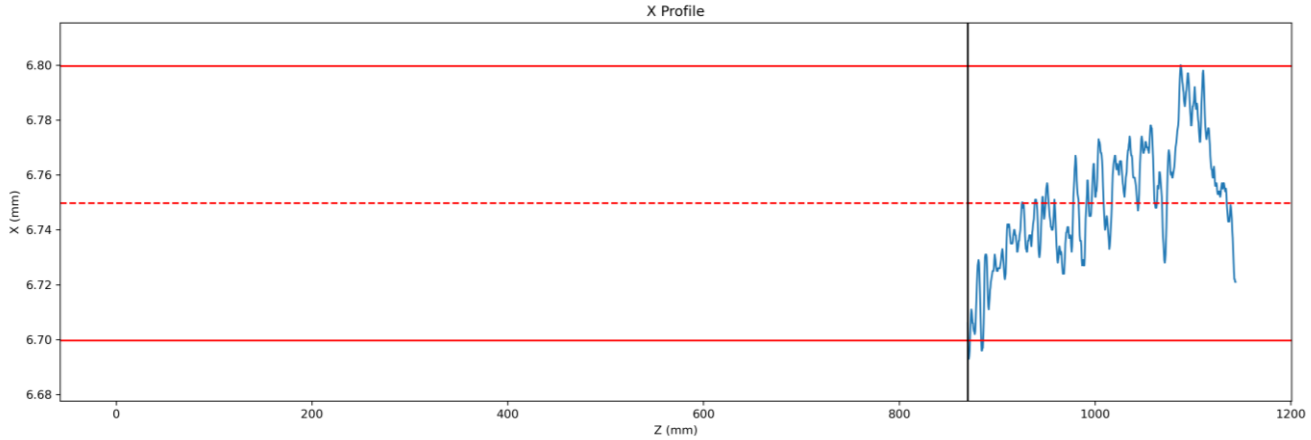
Measurements taken on the anodized aluminum surfaces show much more variance than the ones taken on the Teflon surface...

Surface roughness? Reflectivity? Can it be mitigated with better grounding of the sensors?

Variance and Profiles



Bottom anodized surface



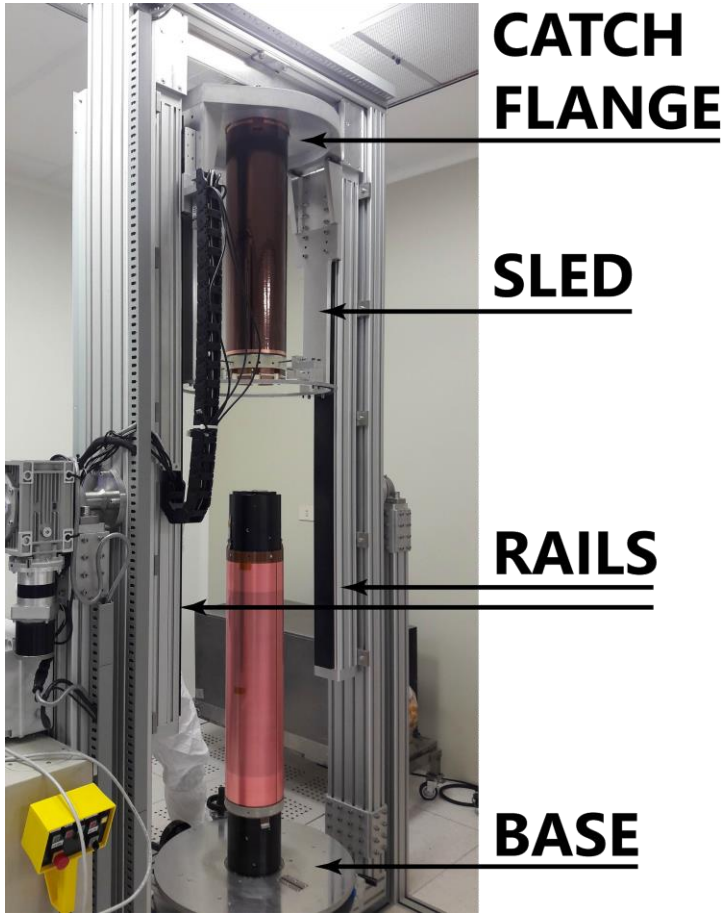
Bottom PTFE surface

Next steps

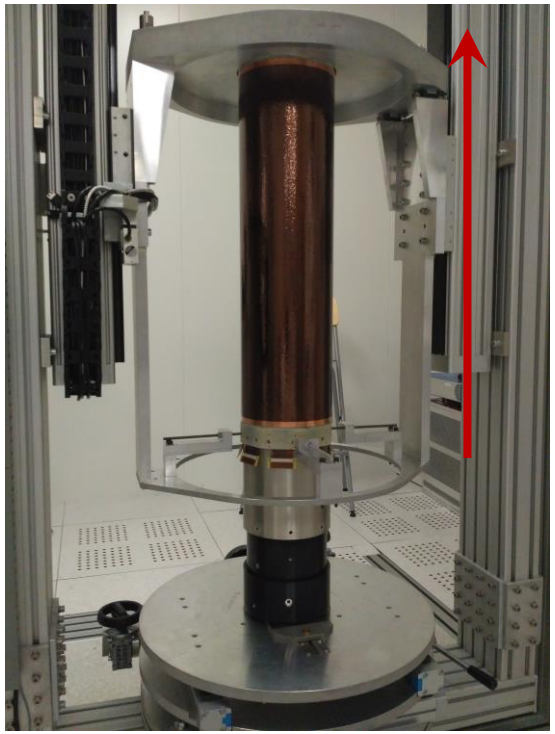
- Check variance when measuring on different roughness/reflectivity surfaces
  - Tape different materials on the molds and collect profiles
- Check variance when moving at slower speed
  - Take a profile on the anodized and PTFE-coated surfaces using the VIM control software to move
- Alignment repeatability test and assessment of the positioning error
  - Lift the mold, place it back down, is it still aligned?
- Proceed to the XY alignment test
  - Using the top lasers, the mold's top black end, and some sort of mechanical aid (or a caliper)
- Alignment of the other molds
  - Remove the shims from under the flanges, place them in the VIM, are they already aligned?

Backup

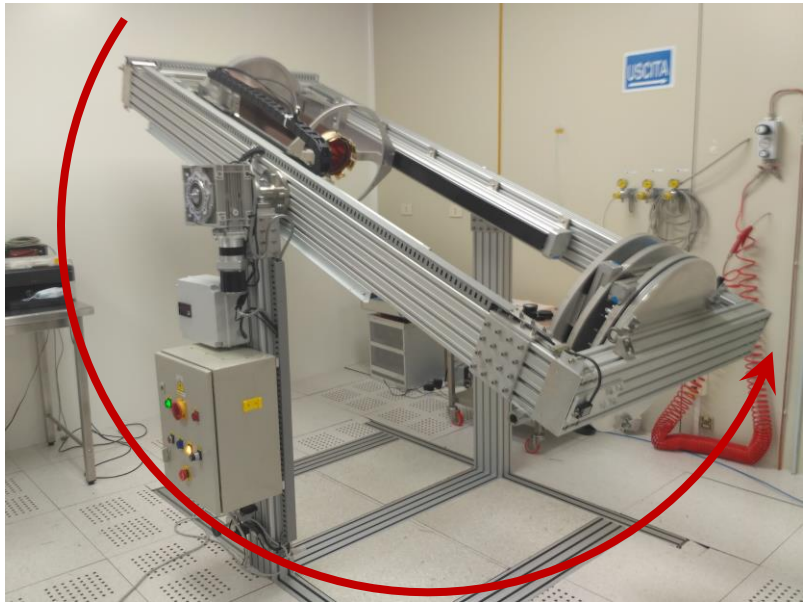
VIM Parts and Movements



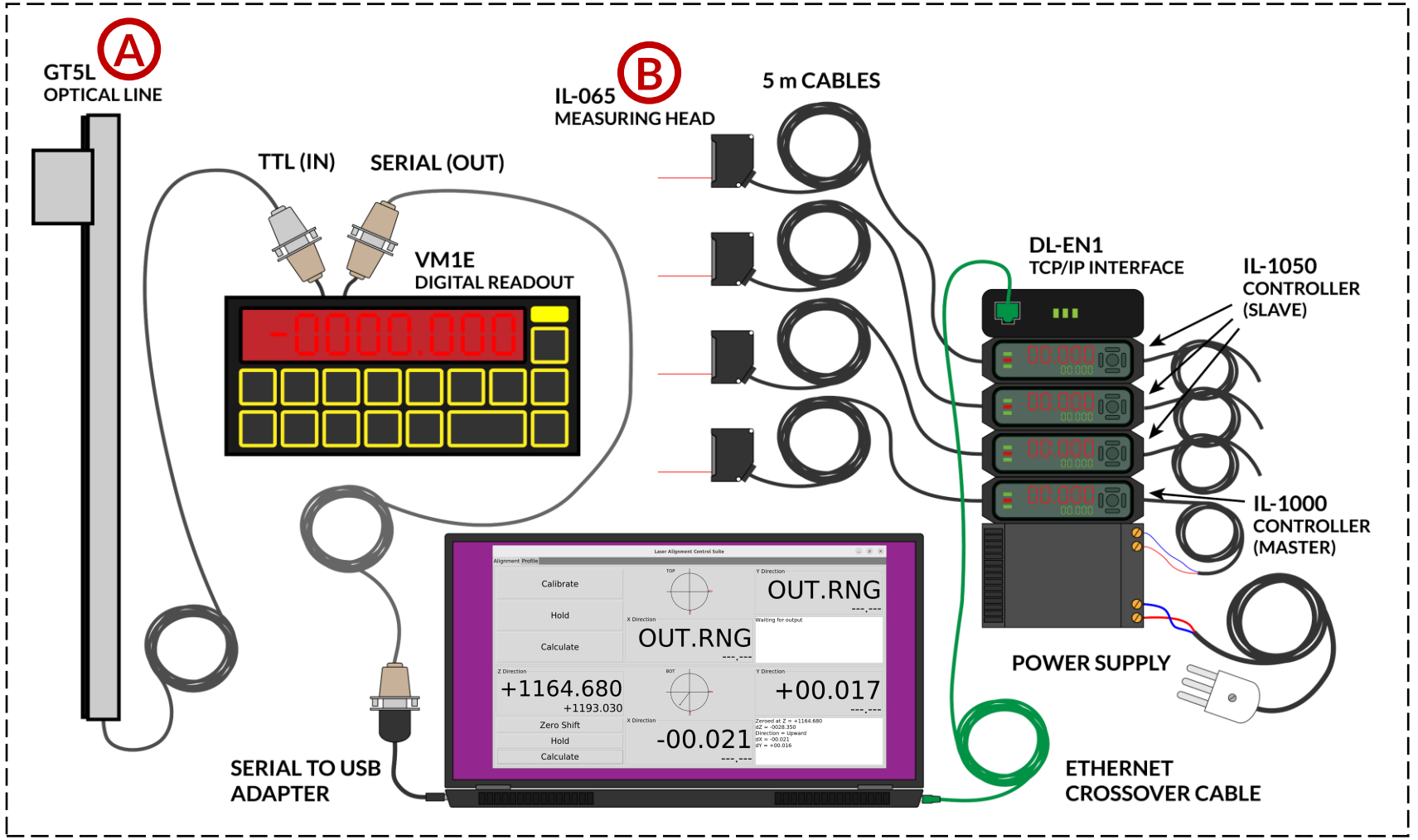
EXTRACTION

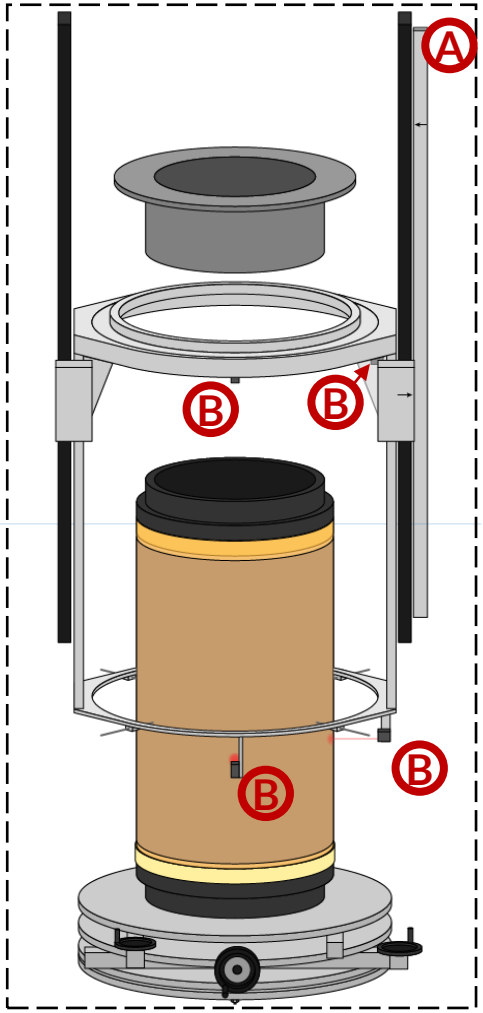


ROTATION



System Schematics





Network and Serial Settings

The **computer**'s IP is set to **192.168.0.0**

The **TCP/IP adapter**'s IP is set to **192.168.0.1**

The **serial port** used for the optical line is **COM1**