UpNano Nano One 2PP 3D printer
Operational procedure
AggieFab
Texas A&M University

Contents

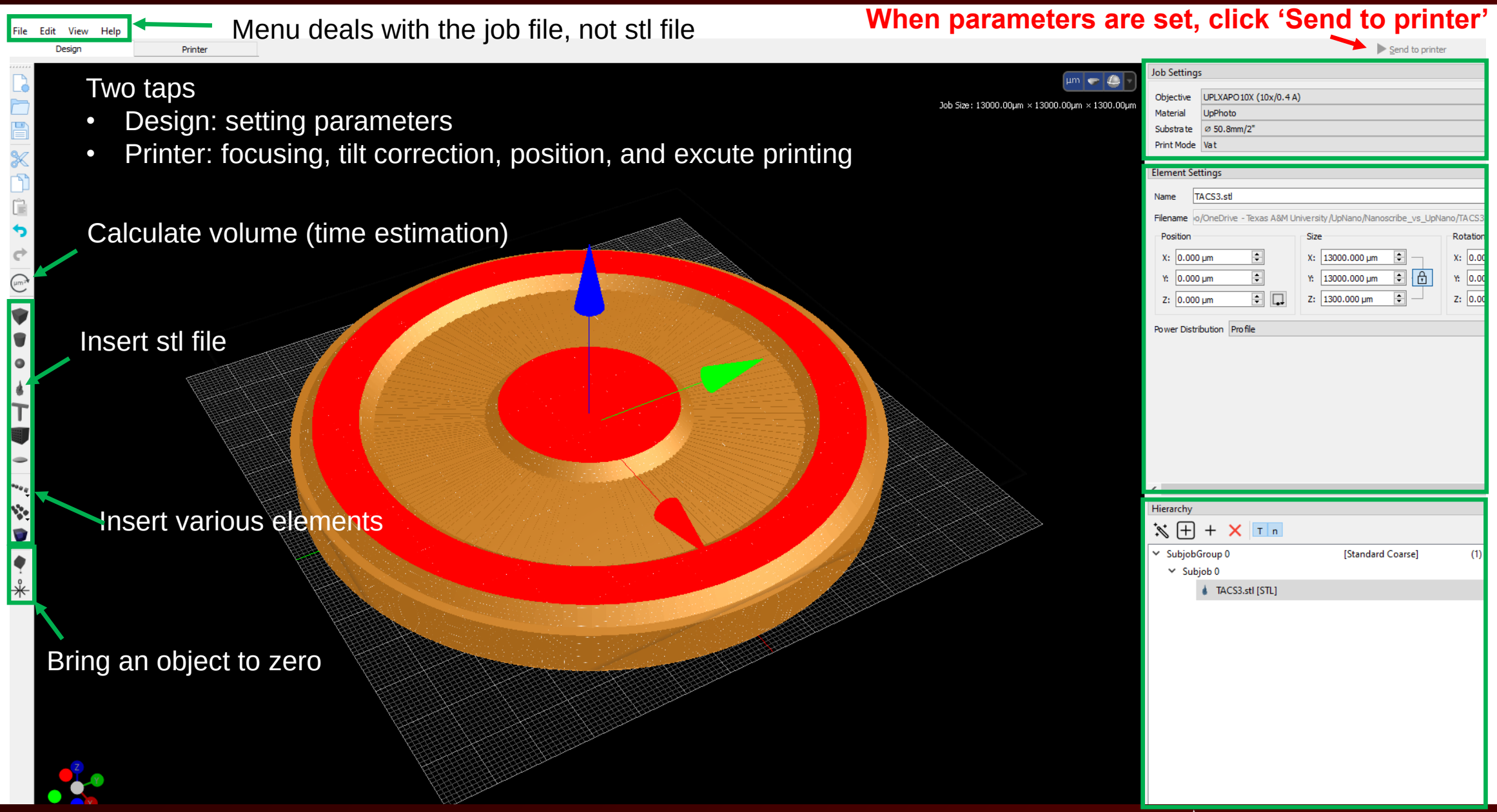
Scope and Safety

- SCOPE
  - The purpose of this document is to describe requirements and basic operating instructions for the UpNano Nano One 3D printing System. The use of this tool is limited to approved processes only.
- SAFETY
  - Be sure that you are trained and signed off to use this equipment.
  - Be sure to keep all doors and protective shields in place before operating this equipment.
  - Refer the materials datasheets for the printing materials.
  - If you are unsure about any procedure or indication while operating this equipment be sure to contact a staff member or trainer for assistance.

General work flow

1. Design & Printing
    - ‘Think 3D’: a software for parameters setting and printing
2. Adhesion promotion (optional)
3. Selecting parts and materials
    - Resin: refer to the material brochure
    - Objective & Stage: resolution and printing volume
    - Vat: Objective type (air or oil) & printing volume
    - Stage inset & substrate holder: substrate type and size
4. Screw in the objective (build room)
5. Insert Vat and stage
6. Insert substrate
7. Print
8. Post process

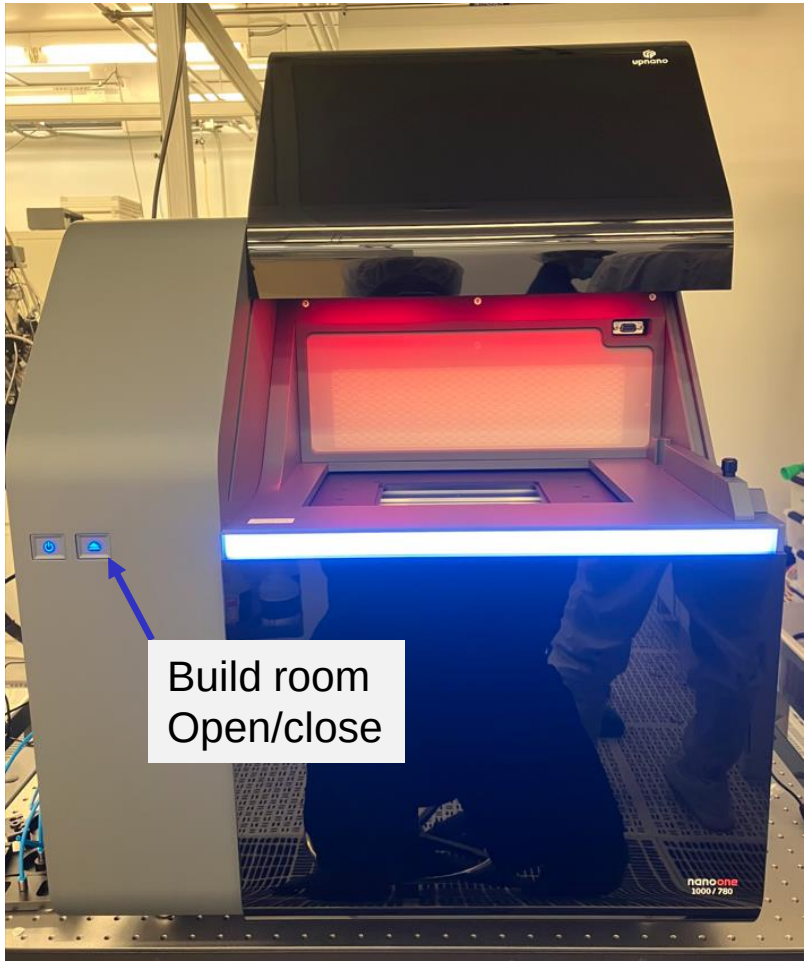
Think 3D – set up parameters



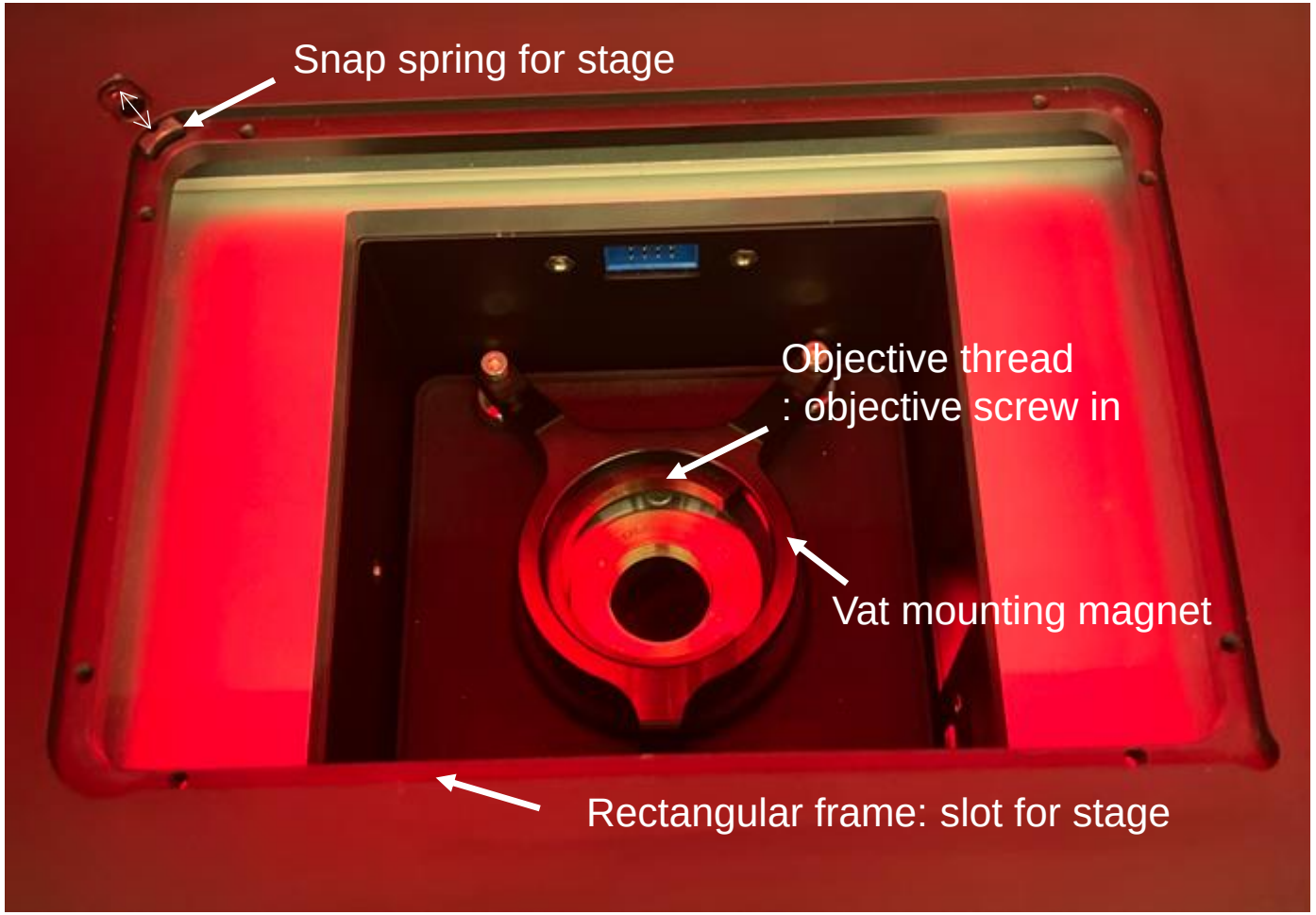
Set up printer

1. Open the build room

Printer: build room opened



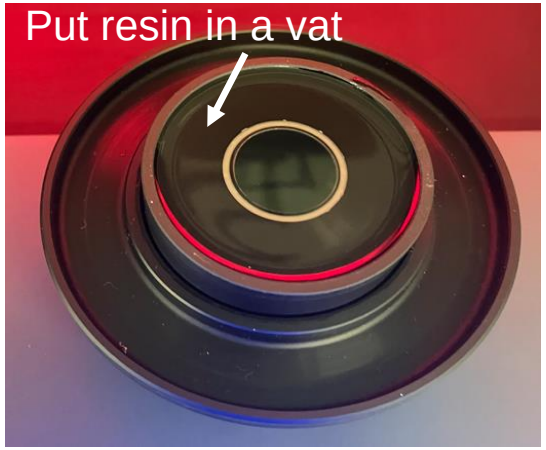
Build room



Set up printer

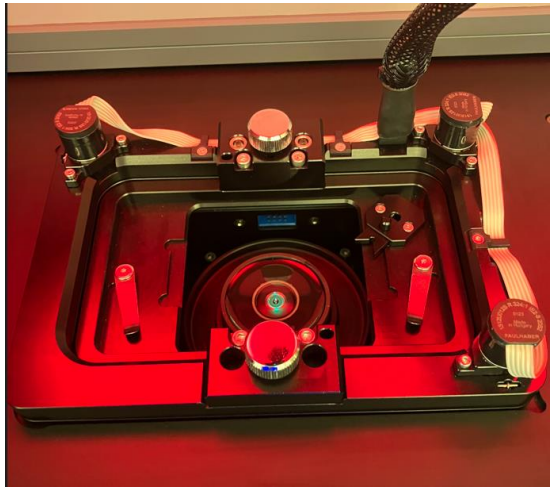
2. Screw in an objective

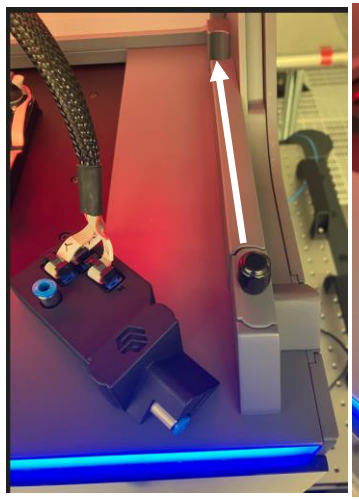
3. Select a vat & put resin

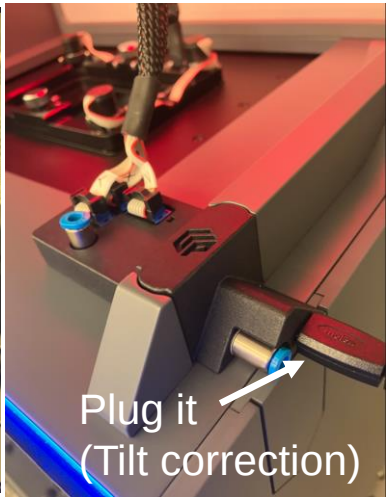


4. Place the vat

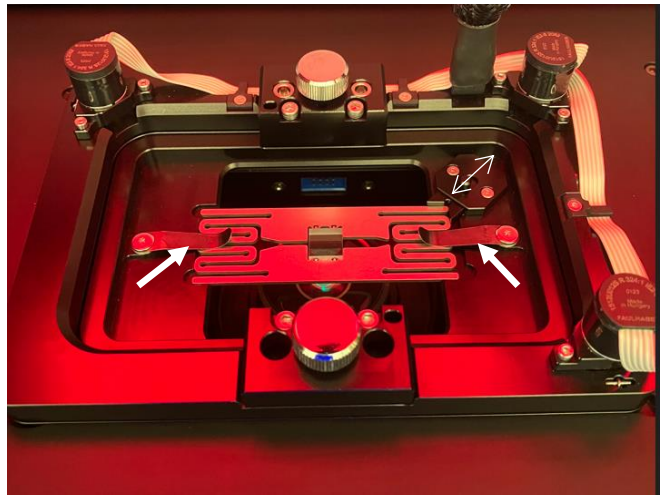
5. Place a stage on the frame





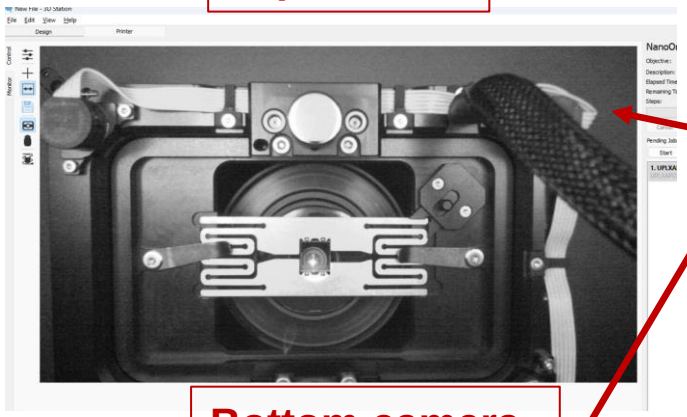


6. Place and secure substrate holder



Think 3D – set up printer

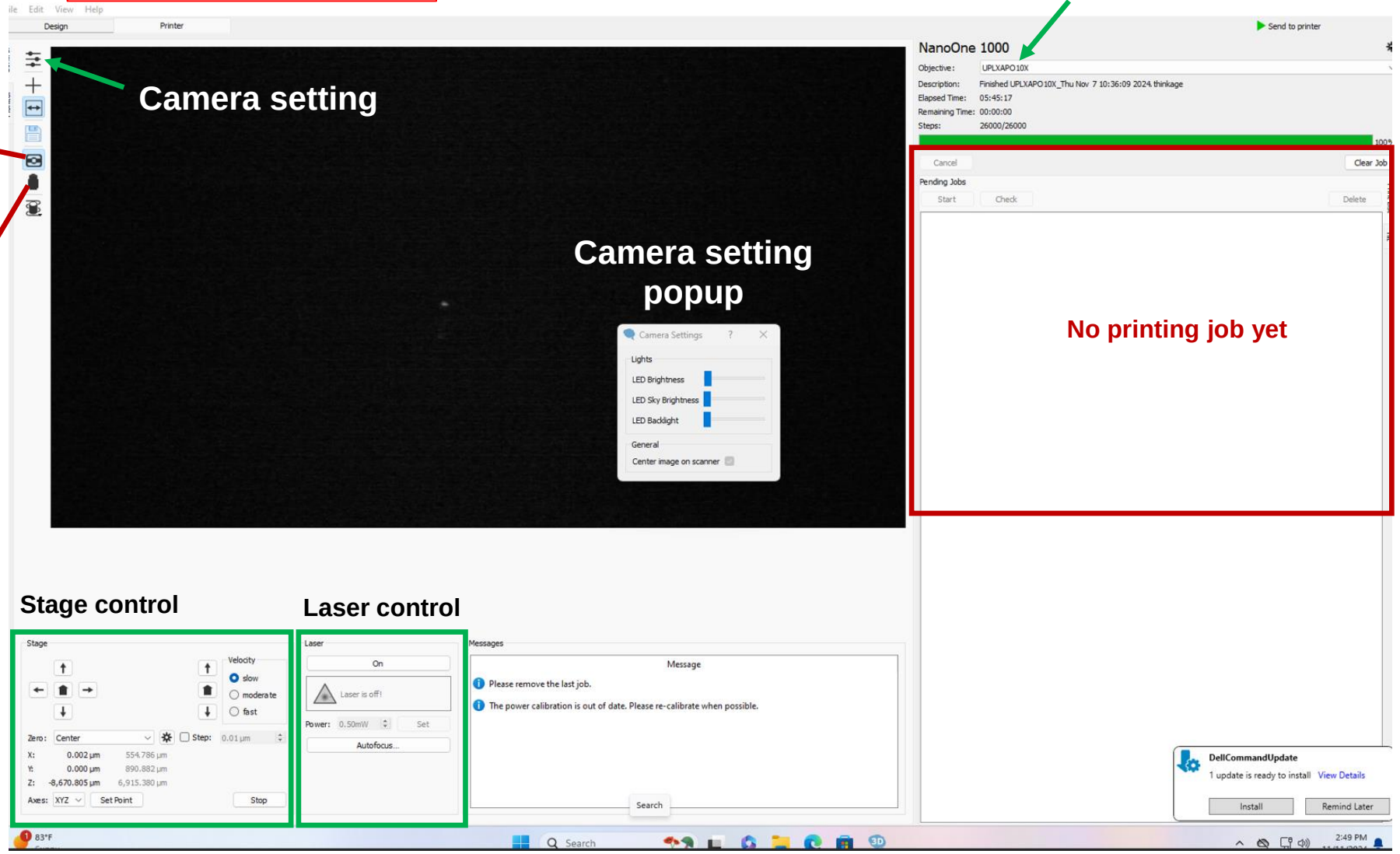
Top camera



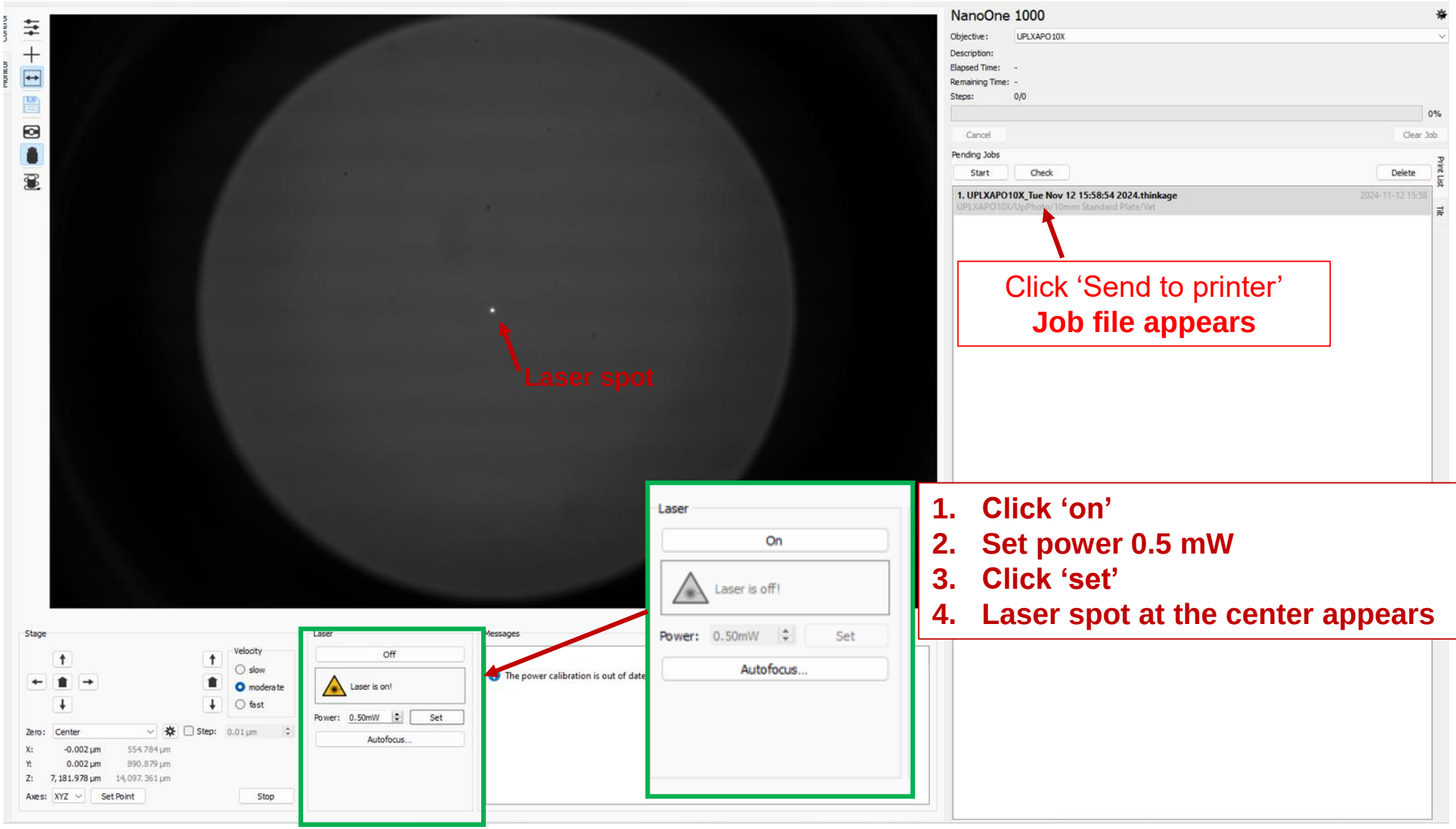
Bottom camera

'Printer' tap screen

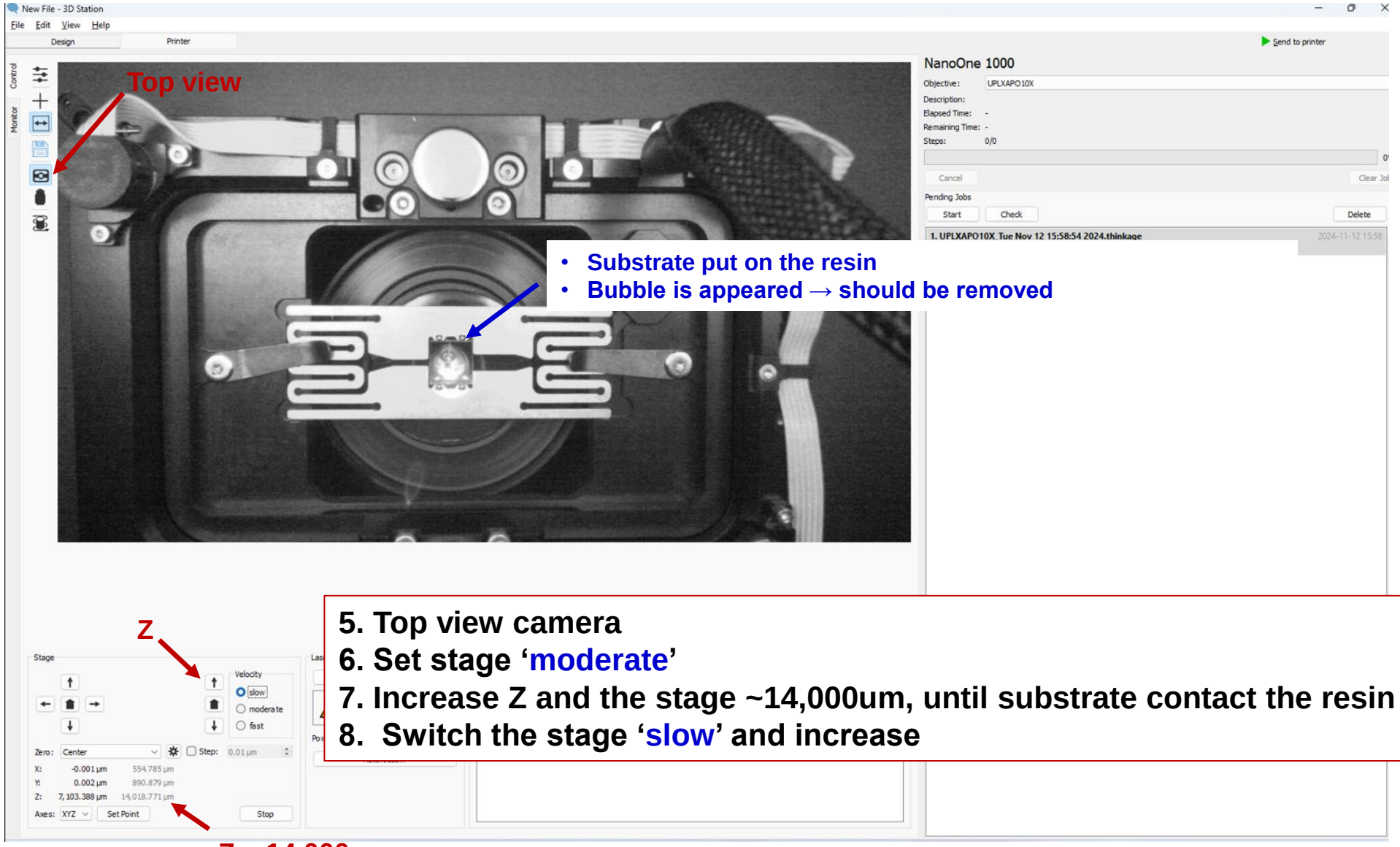
Objective setting



Think 3D – set up printer: focusing on the substrate



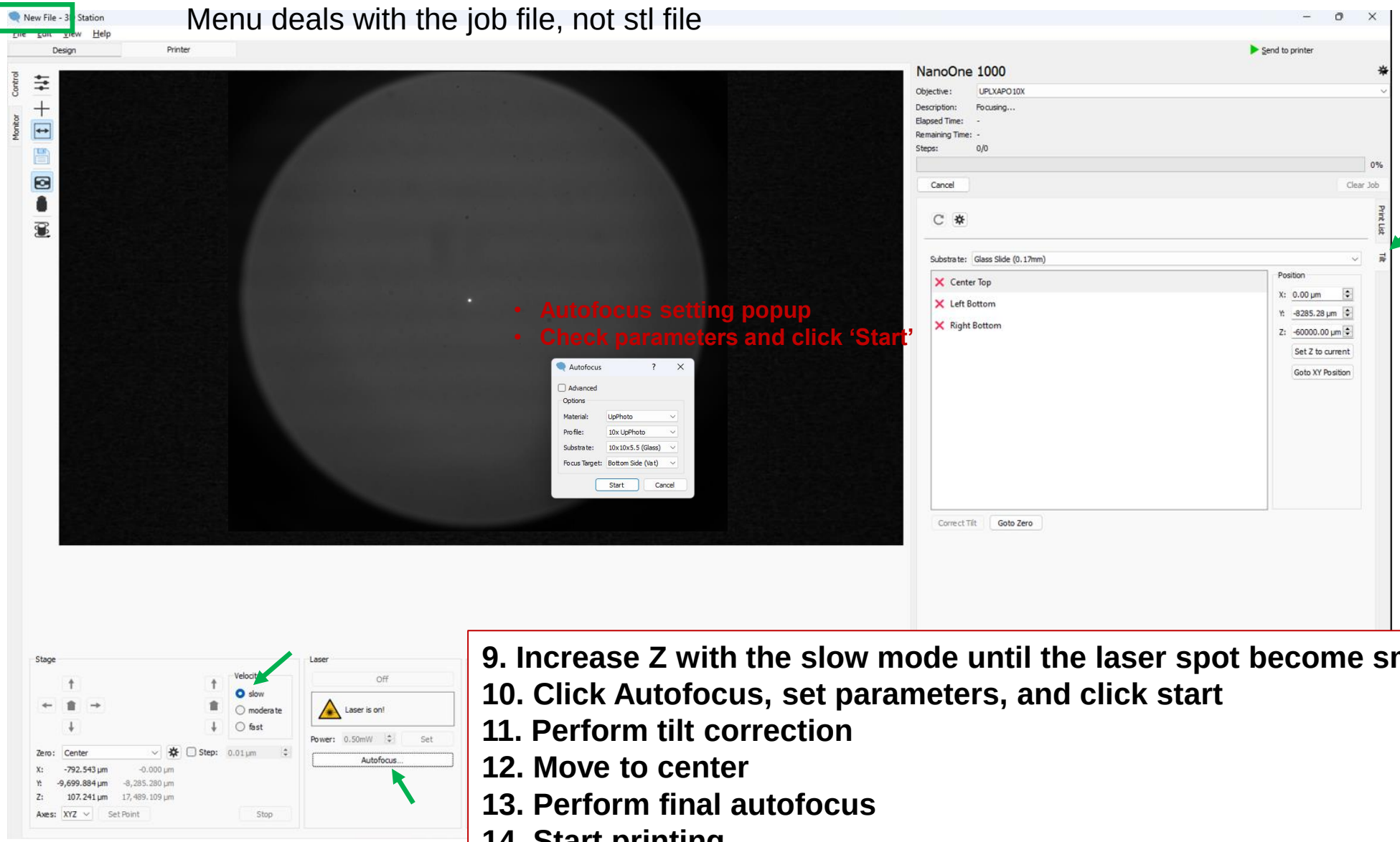
Think 3D – set up printer: focusing on the substrate



5. Top view camera
6. Set stage '**moderate**'
7. Increase Z and the stage ~14,000um, until substrate contact the resin
8. Switch the stage '**slow**' and increase

Think 3D – set up printer: focusing on the substrate

Menu deals with the job file, not stl file



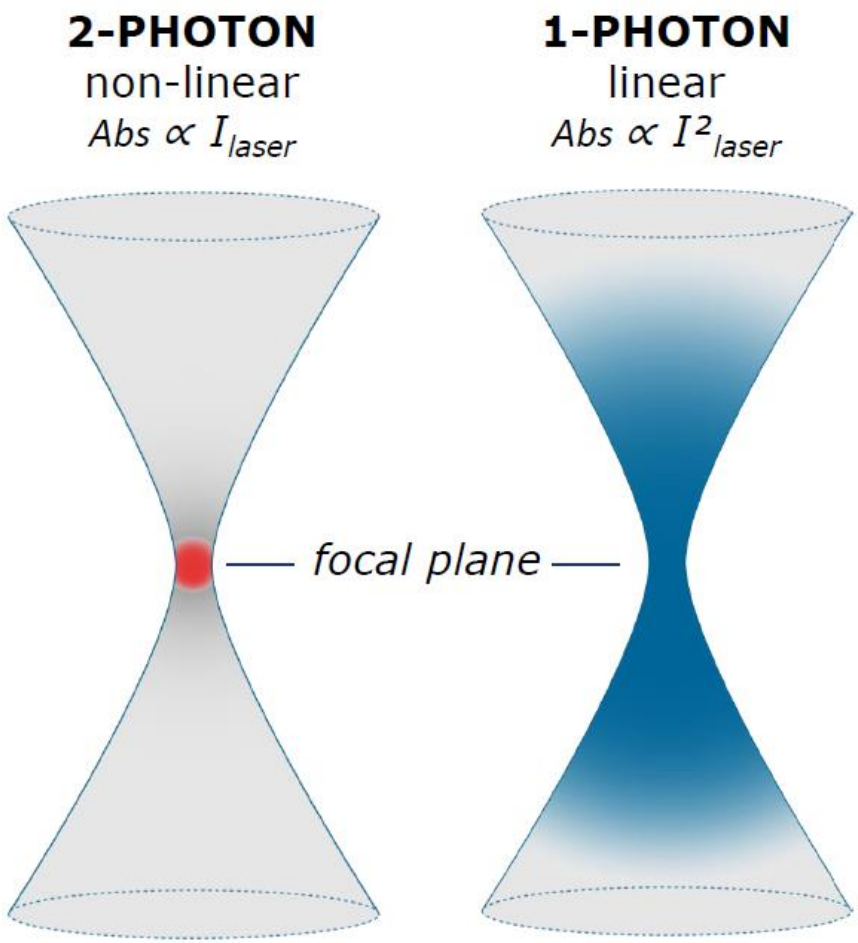
- Autofocus setting popup
- Check parameters and click 'Start'

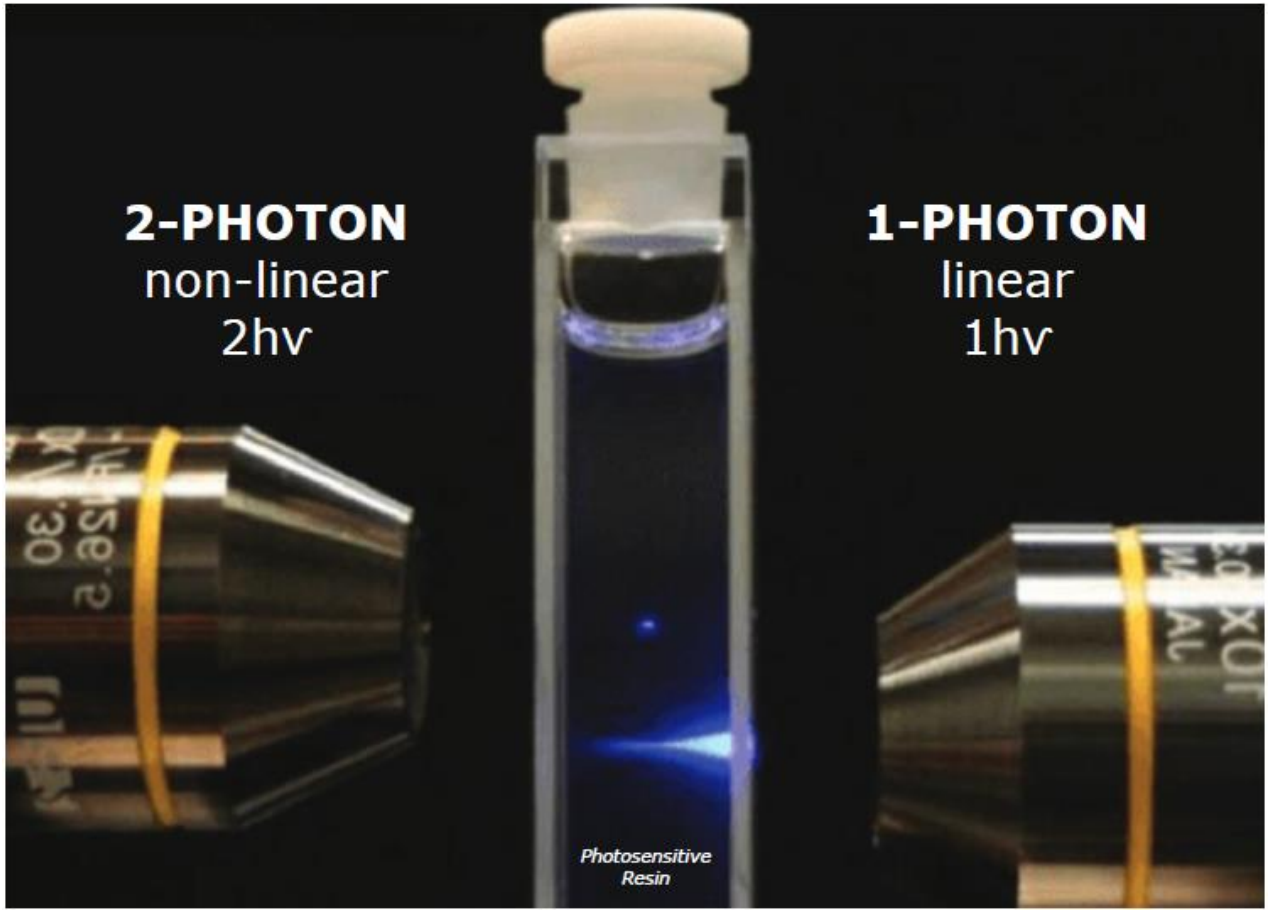
Tilt correction
Set substrate
Double 'Center Top'
Click 'Autofocus'
Click 'Set Z to current'
Repeat for the other points.

9. Increase Z with the slow mode until the laser spot become smaller
10. Click Autofocus, set parameters, and click start
11. Perform tilt correction
12. Move to center
13. Perform final autofocus
14. Start printing

Appendix

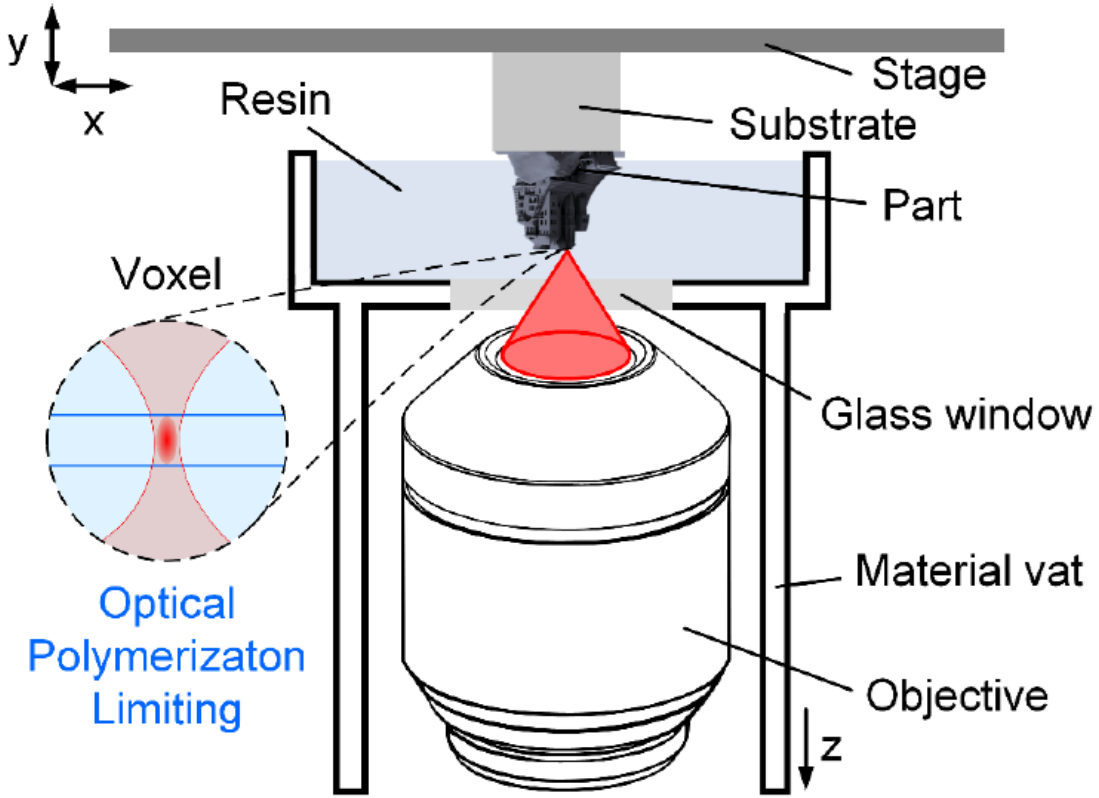
1-Photon vs 2-Photon polymerization





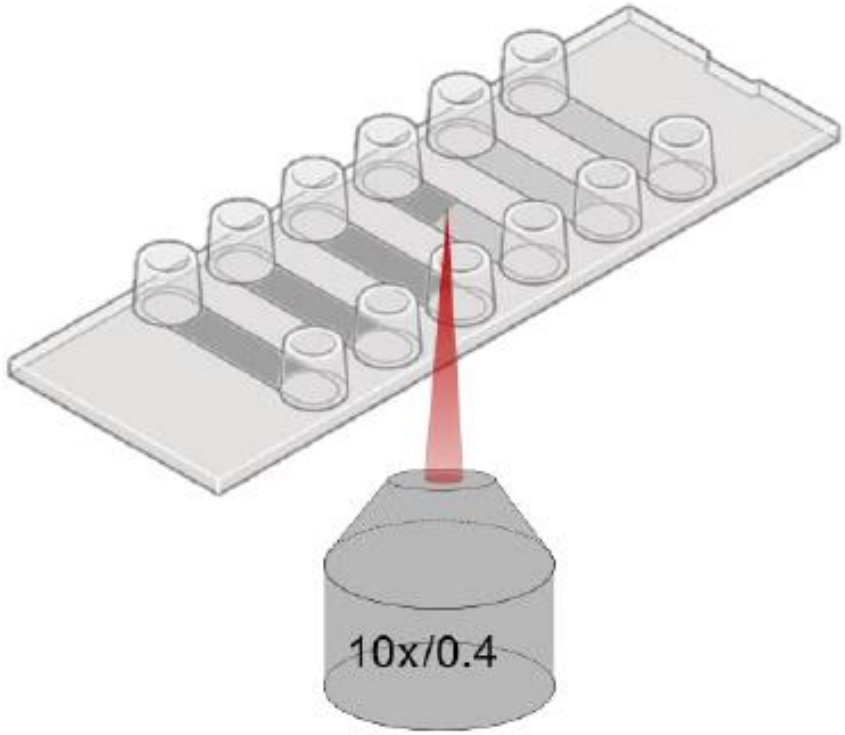
Vat mode

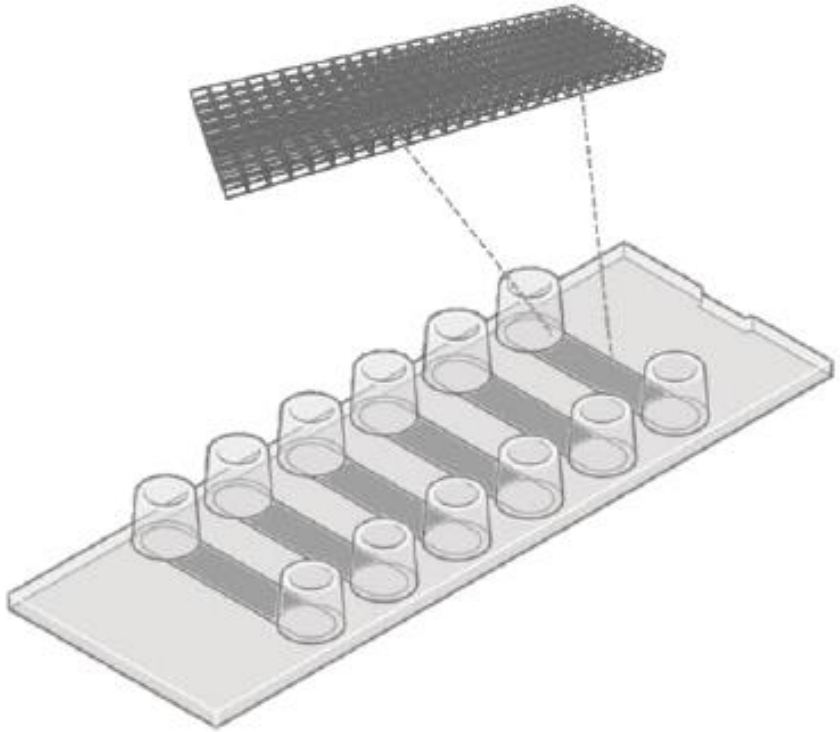
- Combination of various vats and substrates: objective media (oil, air, water) | substrate size
- Printing part height up to 42 mm



Bottom up mode

- Printing into sterile vessels, petri dishes, or any transparent substrates
- Printing from the bottom of the vessel upwards
  - Printed structure height limit because of the scattering of laser through the polymerized resin.





Resins

- Refer the brochure on the desktop

Printing resins

for any application

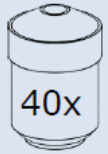
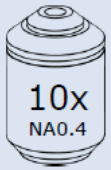
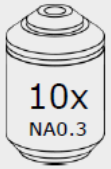
	updraft	upbrix	upsol	upthermo (Powered by cubicure)	upphoto	upopto	upblack	upflow
Common Objective	20x,10x	40x	40x,20x	10x,5x	20x,10x,5x	40x,20x,10x	10x	40x,20x,10x
Fabrication Speed	+++	++	++	++	++	+	++	++
Highly Transparent						++		+
Vat Mode	✓	✓		✓	✓	✓	✓	✓
High Aspect Ratio	✓	✓		✓	✓	✓	✓	✓
Low Viscosity		✓			✓			✓
Low Fluorescence						✓	✓	✓
Low Transmissive							✓	
Refractive Index Matched		✓						
2.5D Structures		✓	✓					
Sub-µm Printing		✓	✓					
Overhangs Smaller 90°			✓					
Bio Compatible*				✓	✓	✓	✓	✓
High Temperature Stability**				✓				

Objectives (1/3)

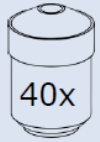
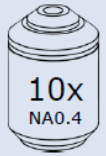
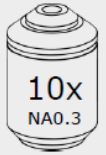
- 5 objectives available
- Select one of them based on the resolution and total size of the printing structure
- Estimation of printing time is available in the 'Think 3D'
  - Refer the excel file on the desktop, 'Print time estimation.xlsx'

Objective	ID	Media	NA	WD (mm)	FOV (mm)	BH (mm)	Max Bottom Up Height (mm)	XY speed (mm/s)	Volume speed (mm^3/s)
5X	Fluar	air	0.25	12.5	2.8	80	3	1200	300
10X	UPLFLN	air	0.3	3.1	1.4	60	2	600	60
10X	UPLXAPO	air	0.4	10	1.4	60	0.7	600	40
20X	UPLSAPO	water	0.7	0.35	0.7	30	0.25	300	2.25
40X	UPLSAPO40XO	oil	1.4	0.13	0.35	10	0.15	150	0.25

Objectives (2/3)

		BOTTOM UP	VAT	VERTICAL	HORIZONTAL		
STANDARD OBJECTIVES	 40x	≤ **150** µm	PART HEIGHT UP TO **40** mm	> **0.8** µm	> **1.8** µm	**150** mm/s	**0.25** mm³/h
	 20x	≤ **250** µm		> **2.5** µm	> **5** µm	**300** mm/s	**2.25** mm³/h
	 10x NA0.4	≤ **700** µm		> **5** µm	> **20** µm	**600** mm/s	**40** mm³/h
	 10x NA0.3	≤ **2** mm		> **7** µm	> **50** µm	**600** mm/s	**60** mm³/h
	 5x	≤ **3** mm		> **12.5** µm	> **200** µm	**1,200** mm/s	**300** mm³/h

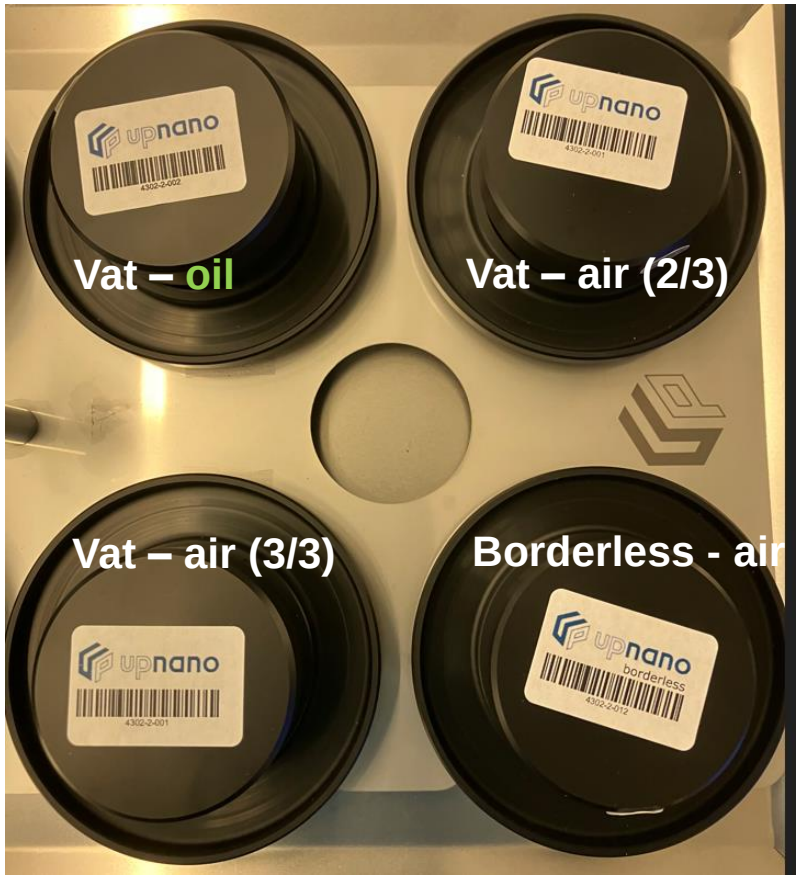
Objectives (3/3)

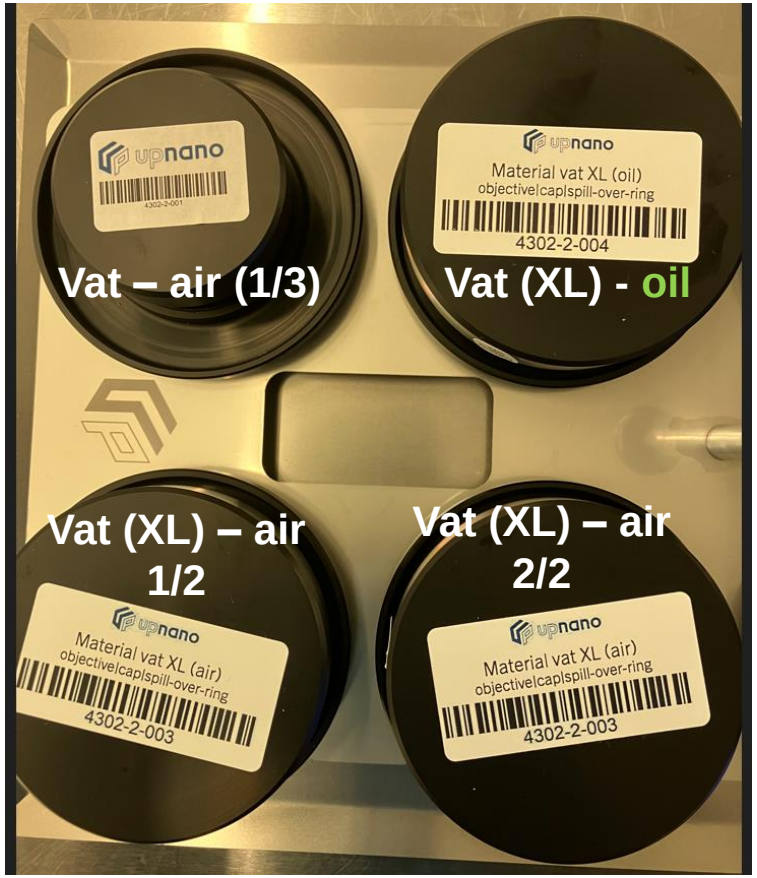
		NA	WD	FOV	BH	IM	FS (XY)	FS (Z)
STANDARD OBJECTIVES	 40x	1.4	0.13	0.35	10	oil	≤ 220 nm	≤ 550 nm
	 20x	0.7	0.35	0.7	30	water	≤ 420 nm	≤ 2.9 µm
	 10x NA0.4	0.4	3.1	1.4	60	air	≤ 730 nm	≤ 9.2 µm
	 10x NA0.3	0.3	10	1.4	60	air	≤ 980 nm	≤ 16.4 µm
	 5x	0.25	12.5	2.8	80	air	≤ 1.2 µm	≤ 23 µm

8.33 x 7.50 in – Numerical Aperture | WD – Working Distance *[mm]* | FOV – Field of View *[mm]* | BH – Block Height *[µm]* | IM – Immersion Media | FS – min. Feature Size

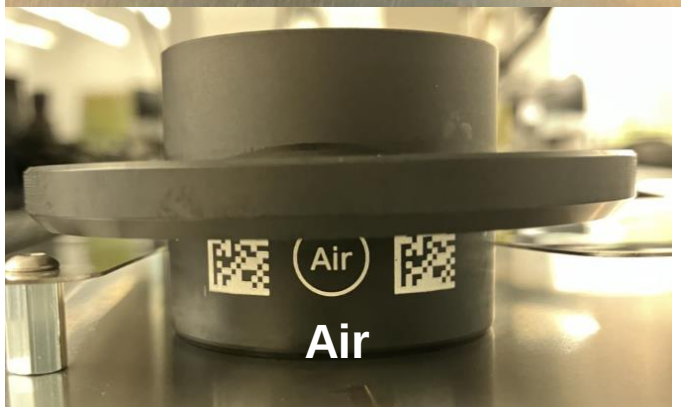
Vat: material tray

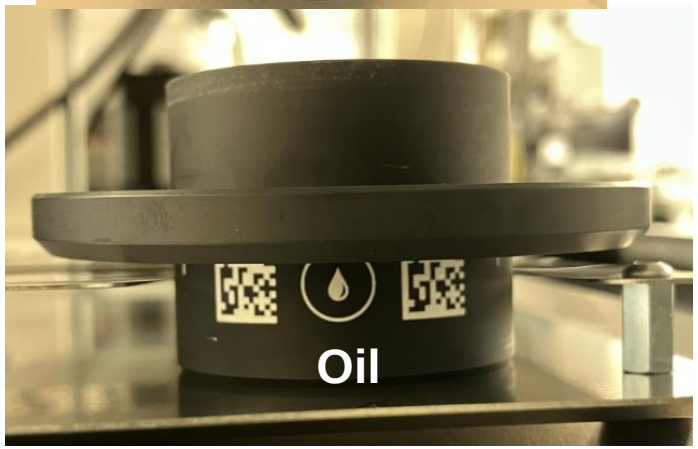
Vat (XXL) - air





Vat: material tray

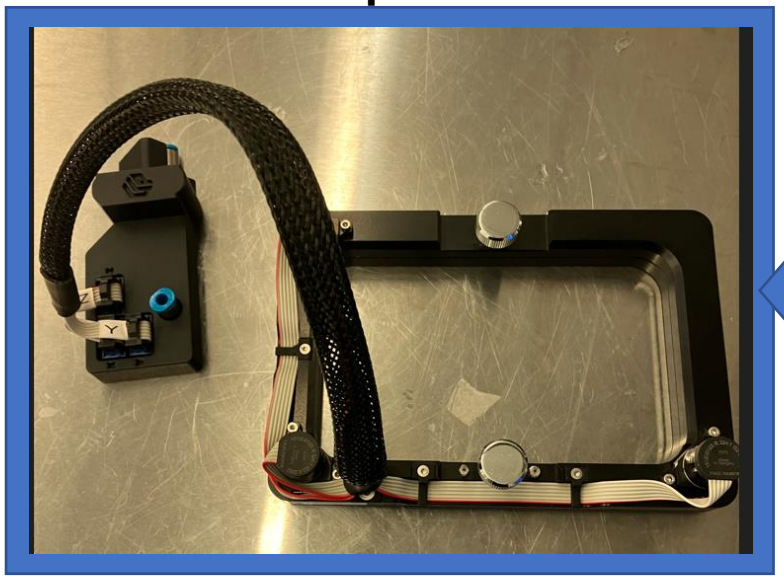




Store resin with label
In the tray

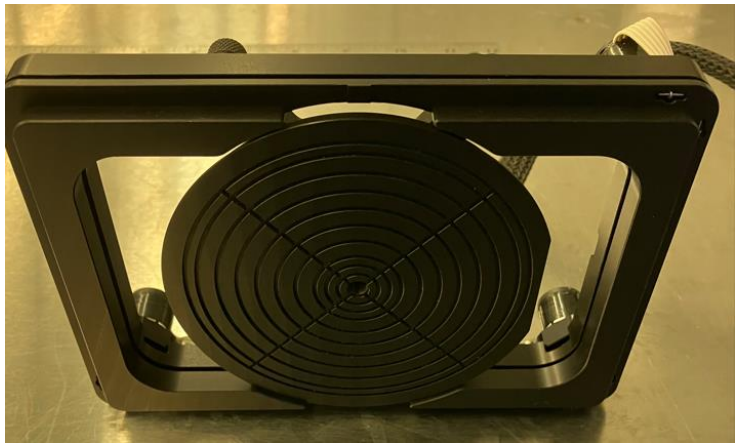
Stages and wafer holders:

Tilt correction stage
– various sample substrate holders

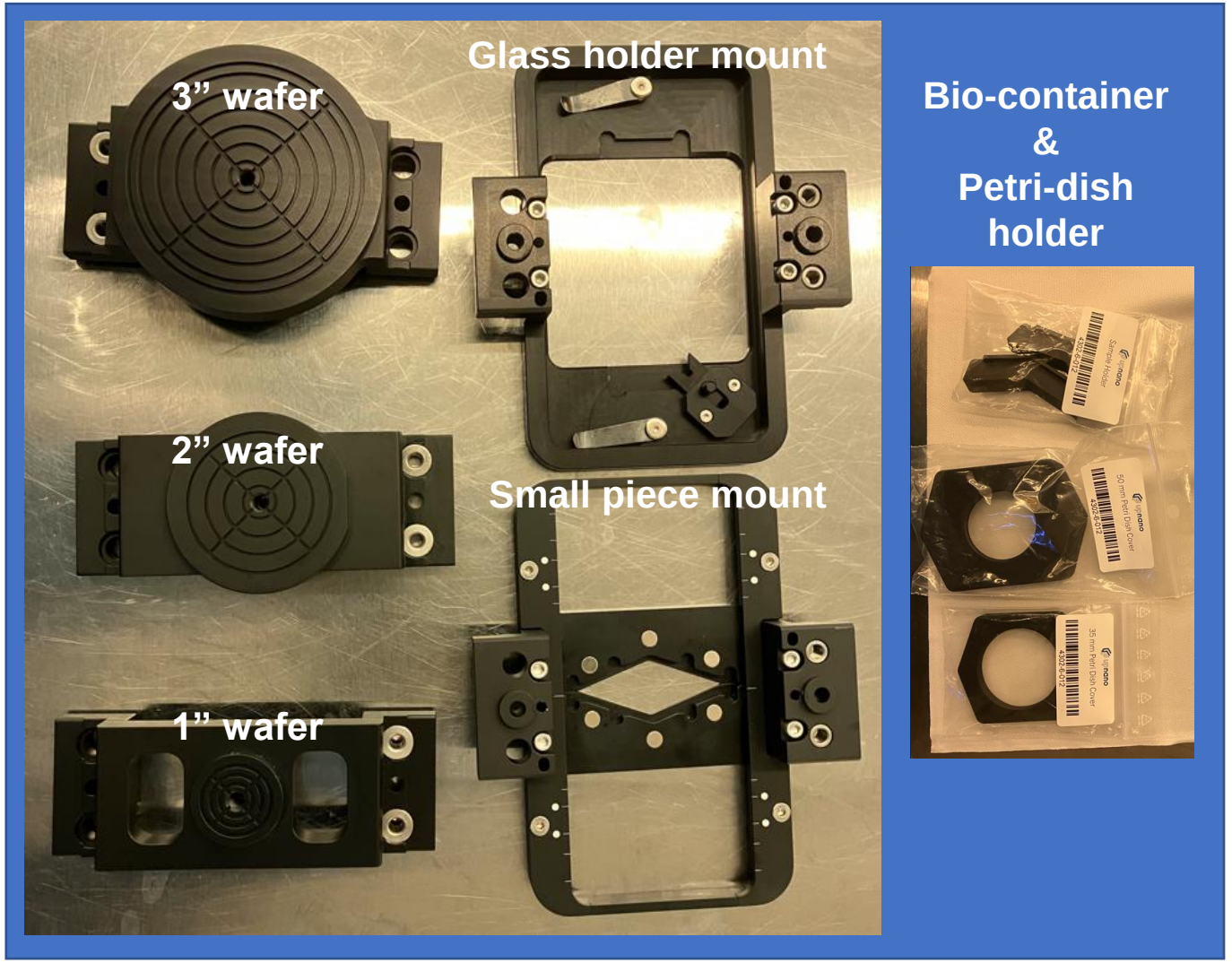


mount

Tilt correction 4”stage



Various sample substrate holders



Glass substrate & holders

Glass substrates

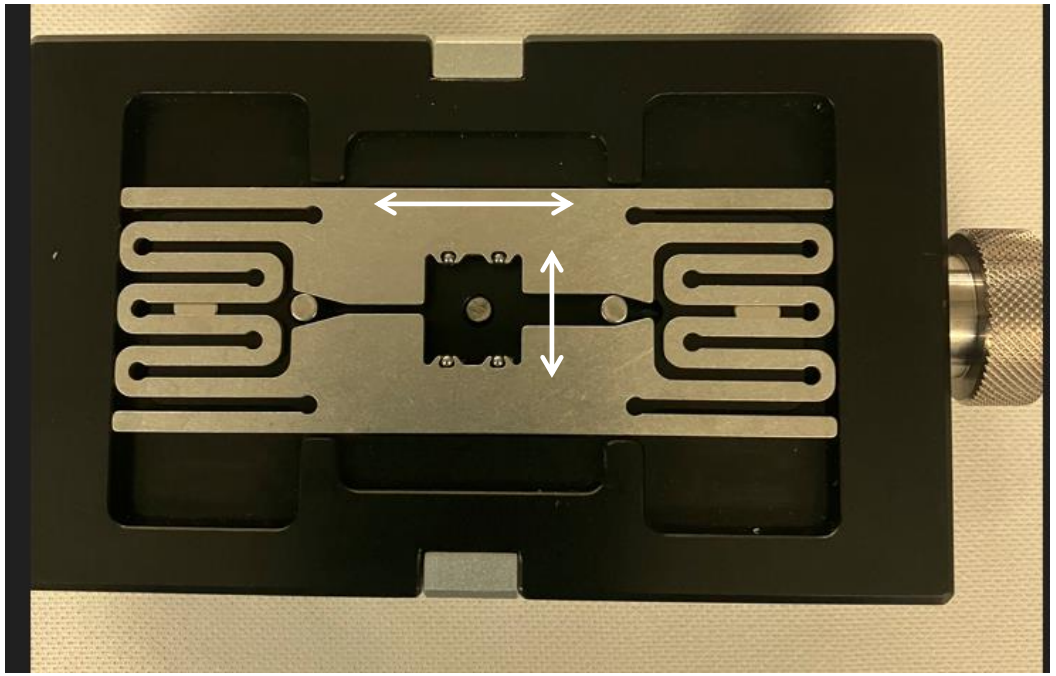
- Square: 10, 20, 40 mm^2
- Round: 1 inch in diameter

Glass substrate holder

Substrate holder manipulation

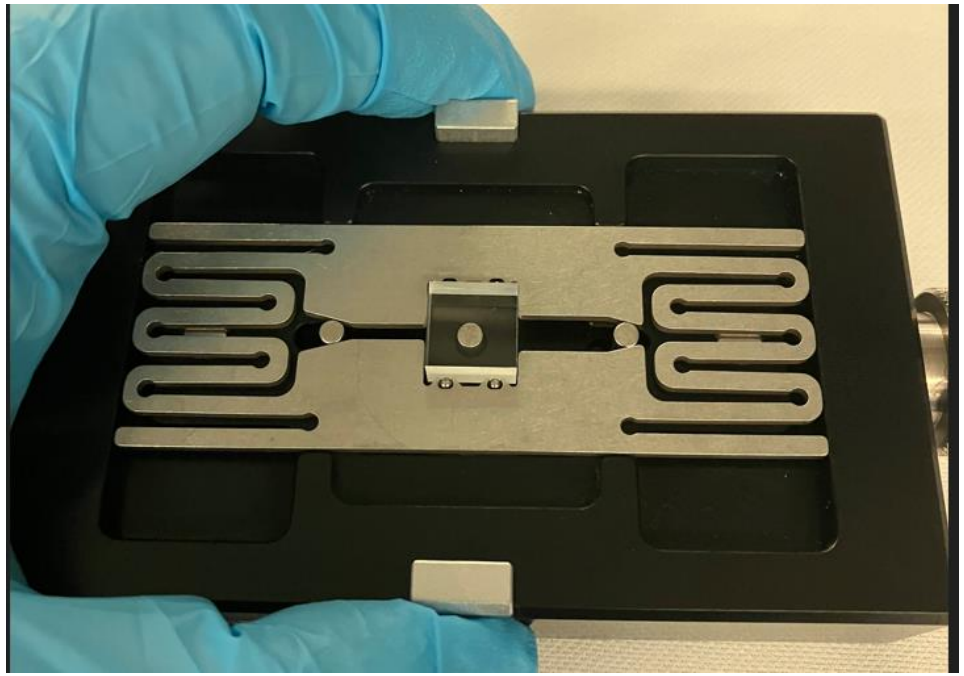
Holding sample

- Place the substrate holder
- Rotate the knob clockwise
- Sample holding square wider
- Place a glass substrate
- Bring back the holder using knob



Knob operation

- Move the stage holder along +X
- Lift up the metal pieces, popping up the glass substrate



Revision history

SIGNATURES AND REVISION HISTORY

1. Original author of this document: Dr. Sung Oh Woo
2. Original author Title or Role: Research Engineer
3. Date of original: 11/12/2024

Approvals:
Technical Manager Signature:_____

Date: _____

Revision	Author	Date
Original Issue	Sung Oh Woo	11/12/2024