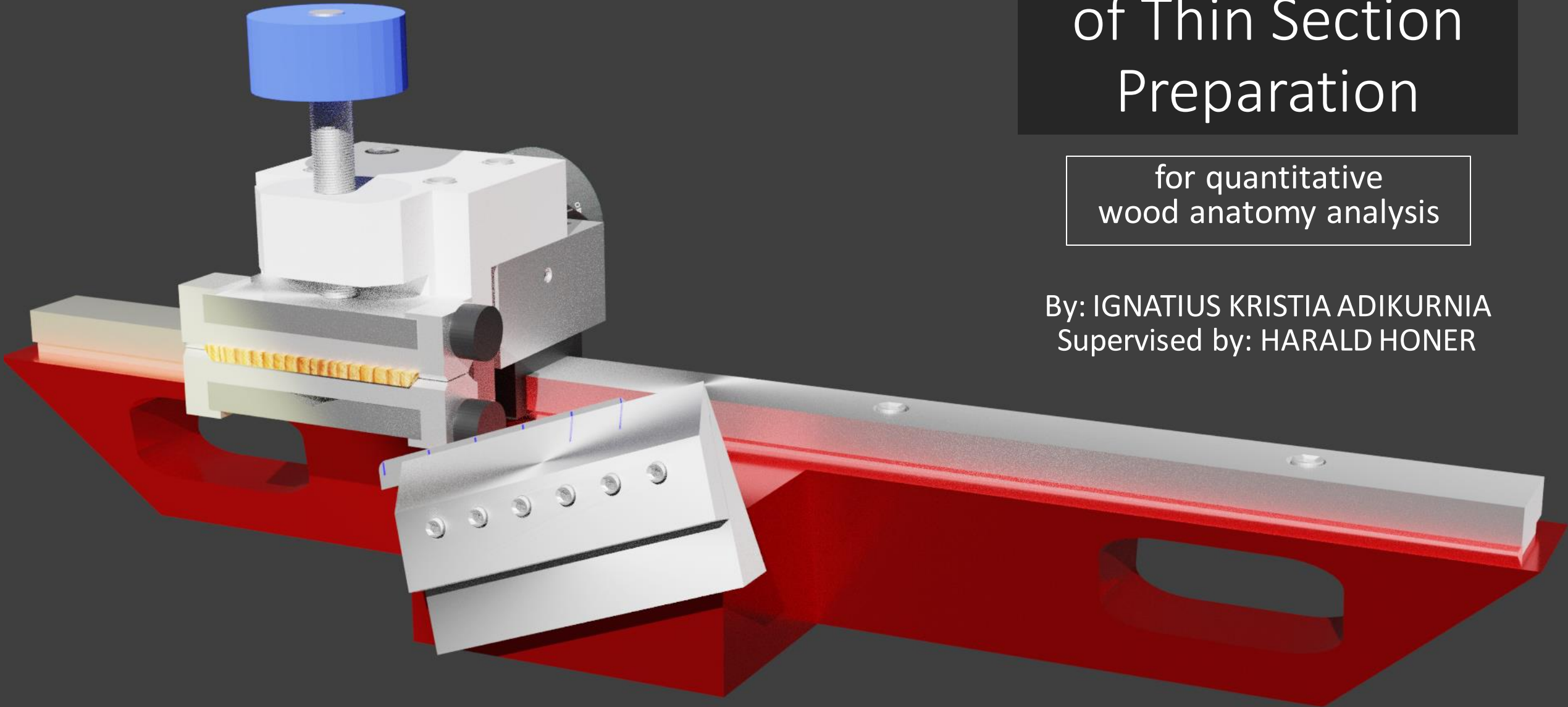


# Optimization of Thin Section Preparation

for quantitative  
wood anatomy analysis

By: IGNATIUS KRISTIA ADIKURNIA  
Supervised by: HARALD HONER



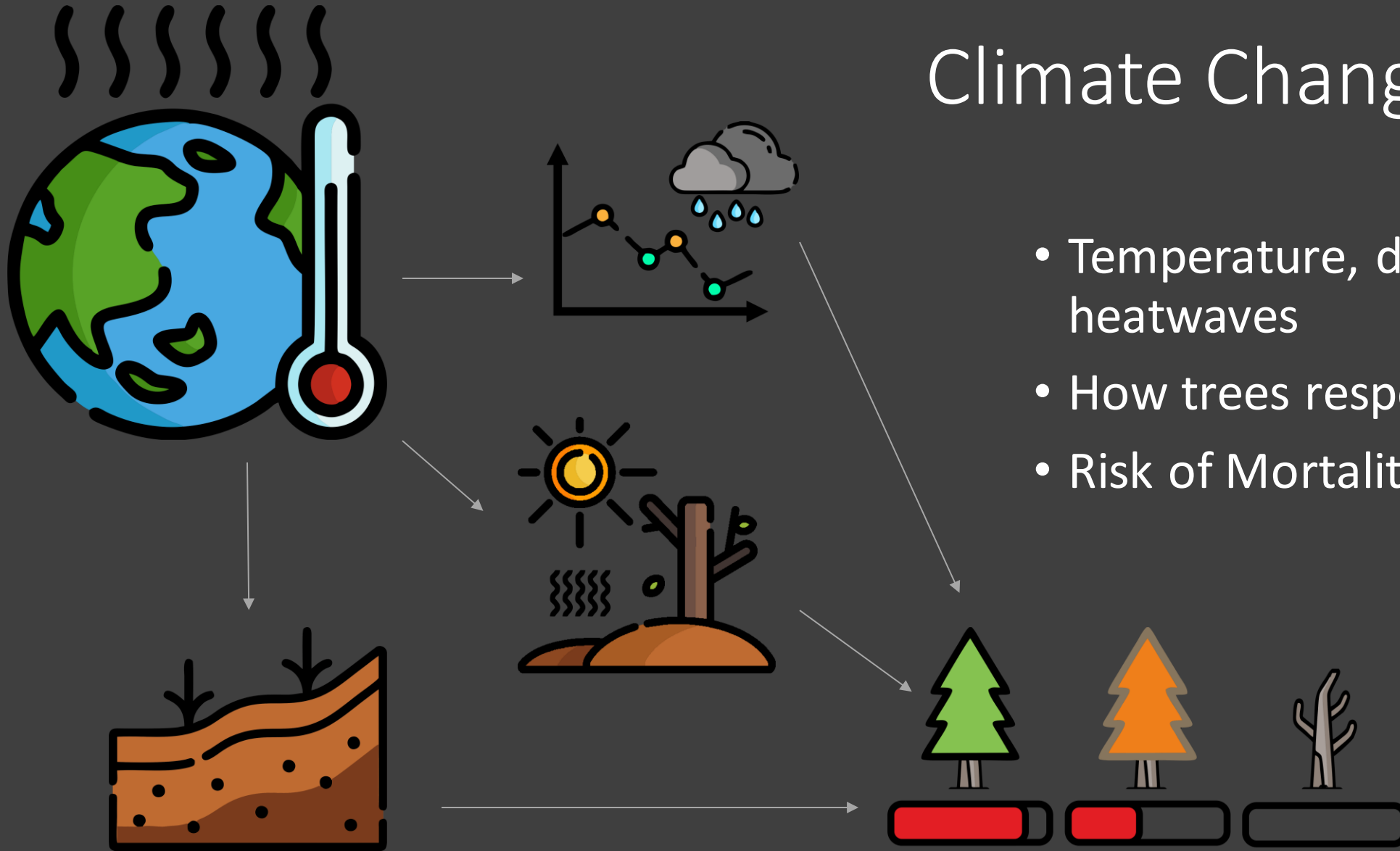
# Background

# KONKLIM

WP1: Water availability and growth plasticity

Investigating quantitative wood anatomy and the hydraulic system of  
Norway spruce, Silver fir, and Douglas fir  
in response to variations in weather and climate

# Climate Change



- Temperature, drought, heatwaves
- How trees respond varies
- Risk of Mortality

# Important Species in the Black Forest

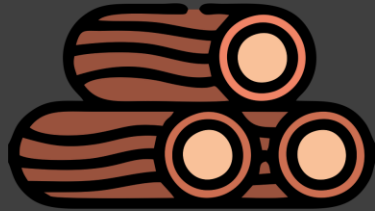
Norway  
Spruce



Silver  
Fir



Douglas Fir



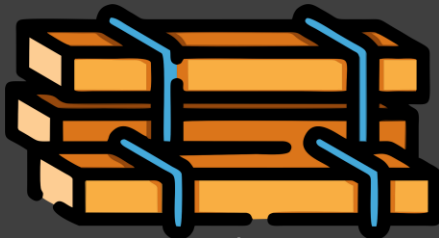
Good yield



Long  
rotation



Climate  
Change



Timber



Uncertainty



Economic

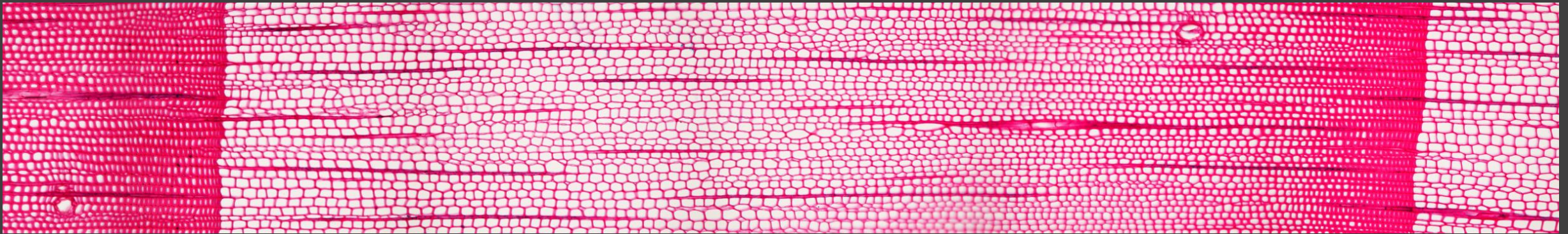
Need to Check:  
**SUITABILITY**

Need to Check:  
**SUITABILITY**

**HOW?**

Study of response to variations  
in weather and climate

- Quantitative wood anatomy
- Cellular level response



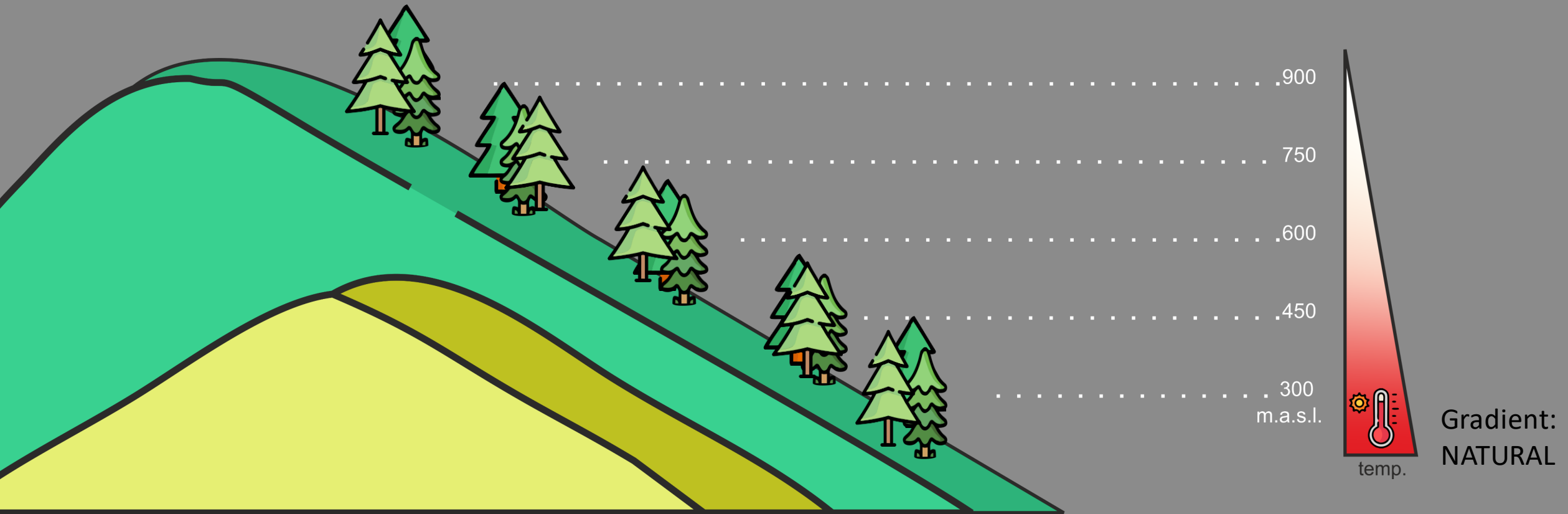
# Methods

The approach:  
“Space-for-time  
substitution”

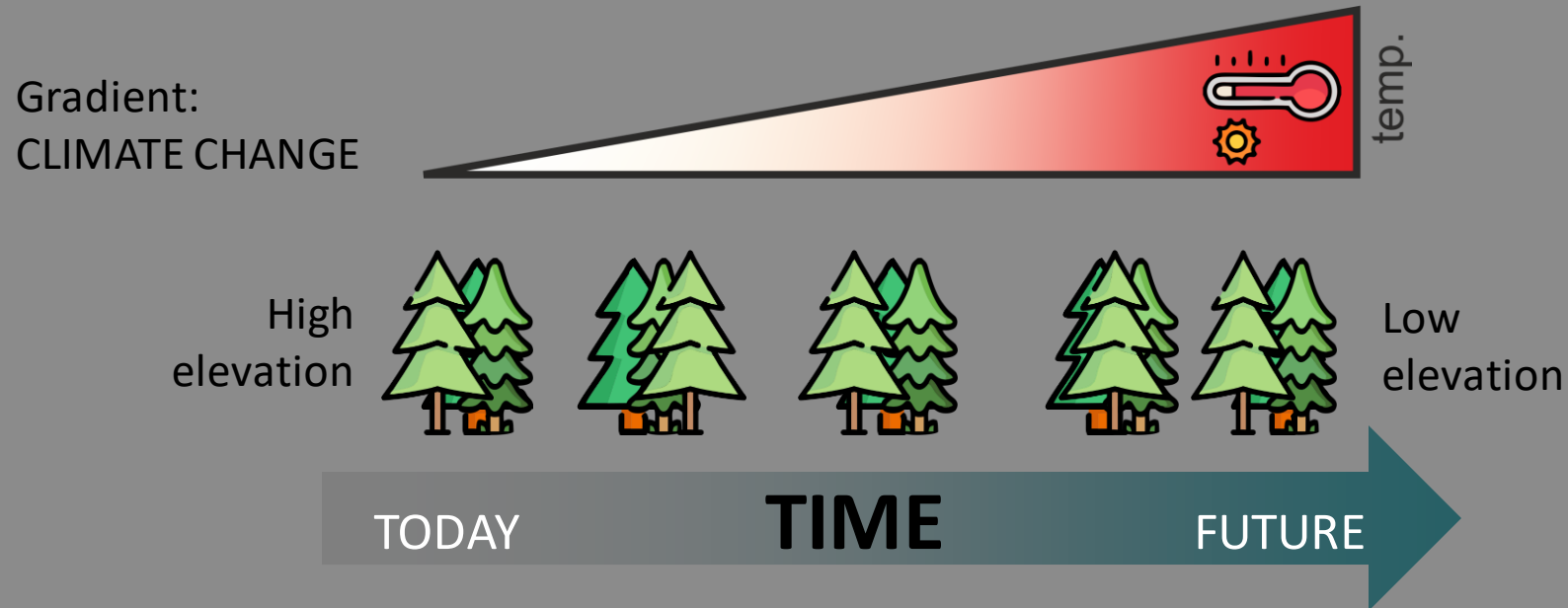
Expected effect of climate change in temporal dimension is tried to be explained using spatial dimension (elevation)



# The approach: “Space-for-time substitution”

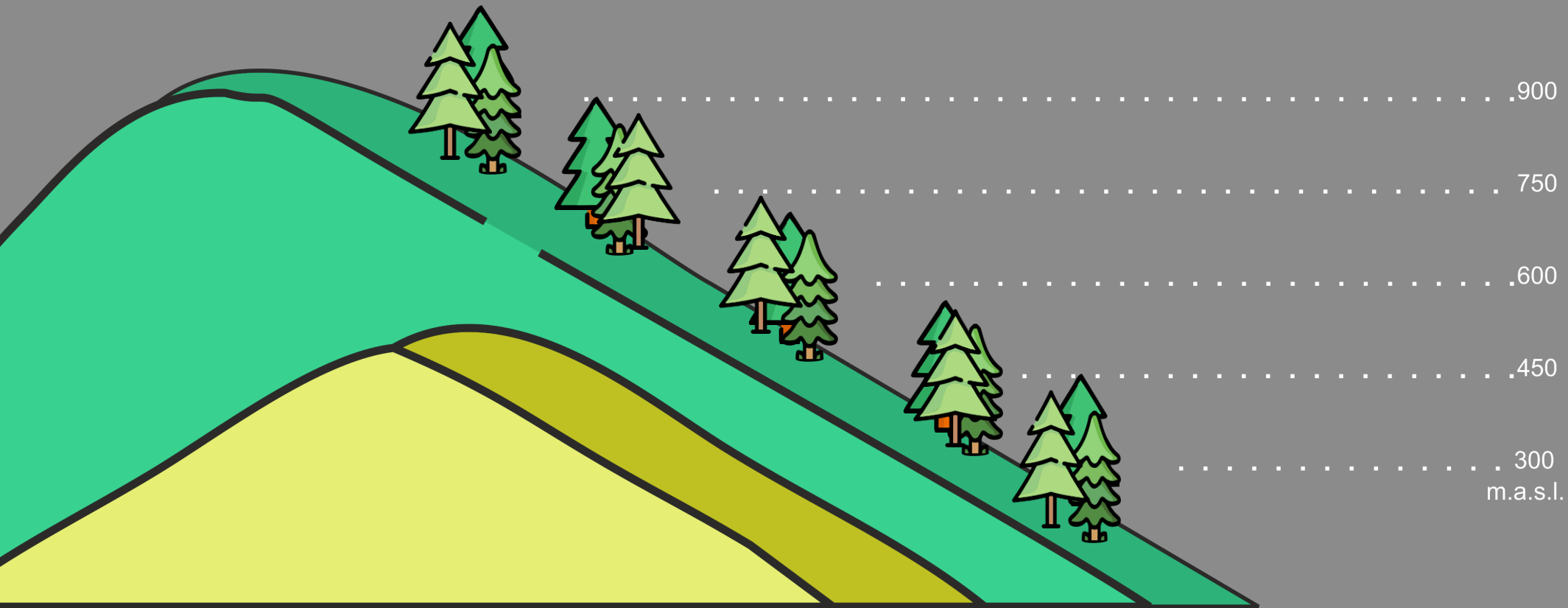


The approach:  
“Space-for-time  
substitution”

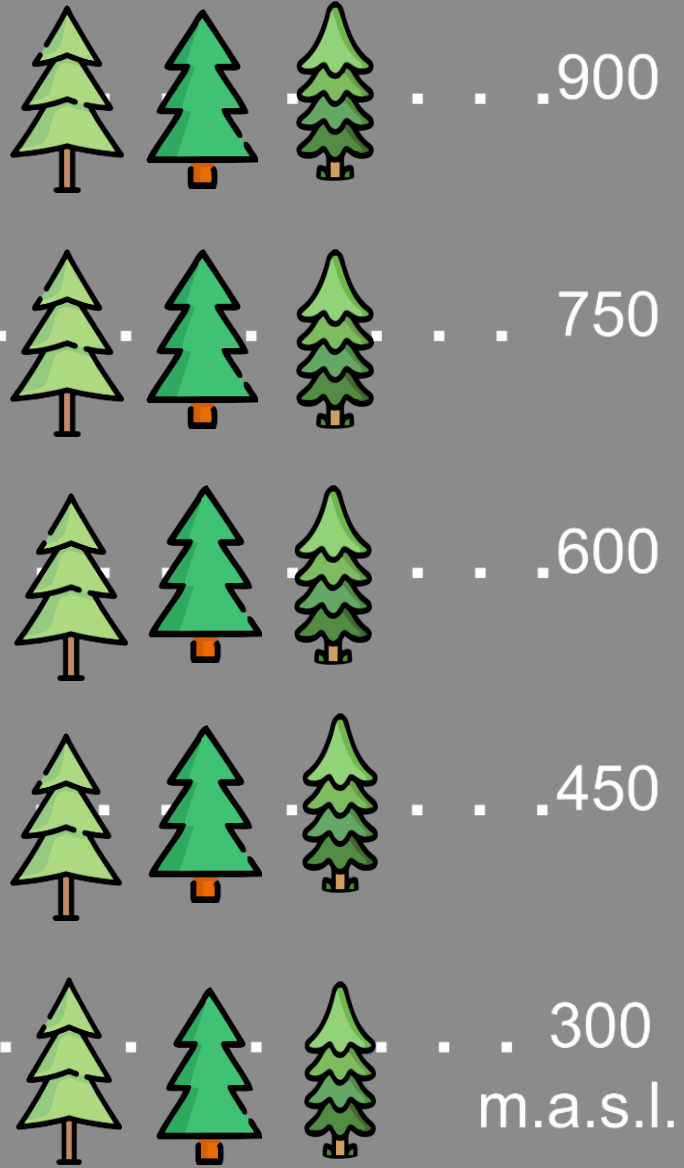


We can create a simulation on how  
these trees responds to variation in weather and Climate

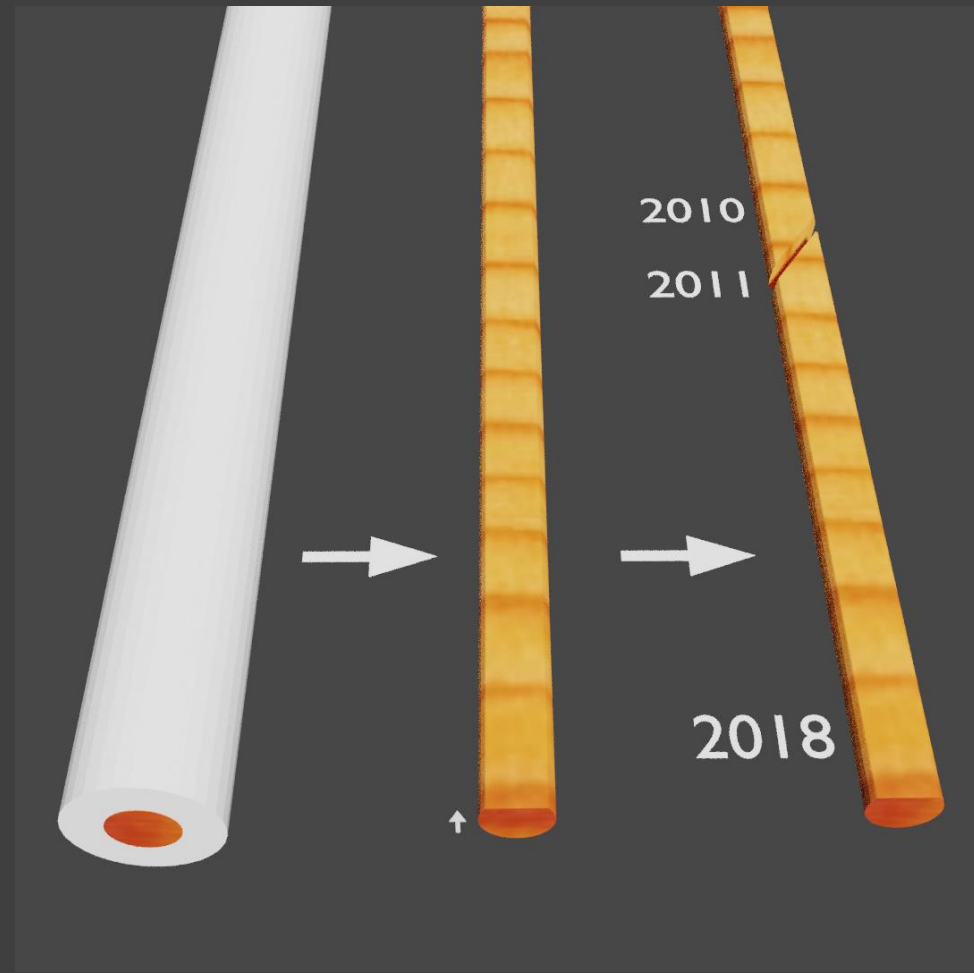
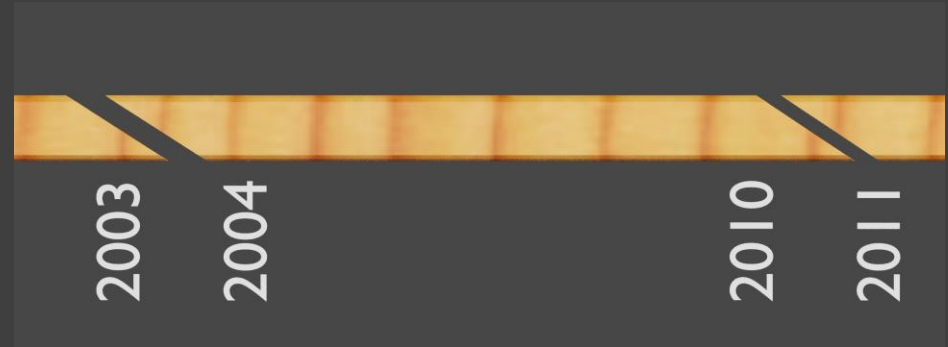
The approach:  
“Space-for-time  
substitution”



# Sampling



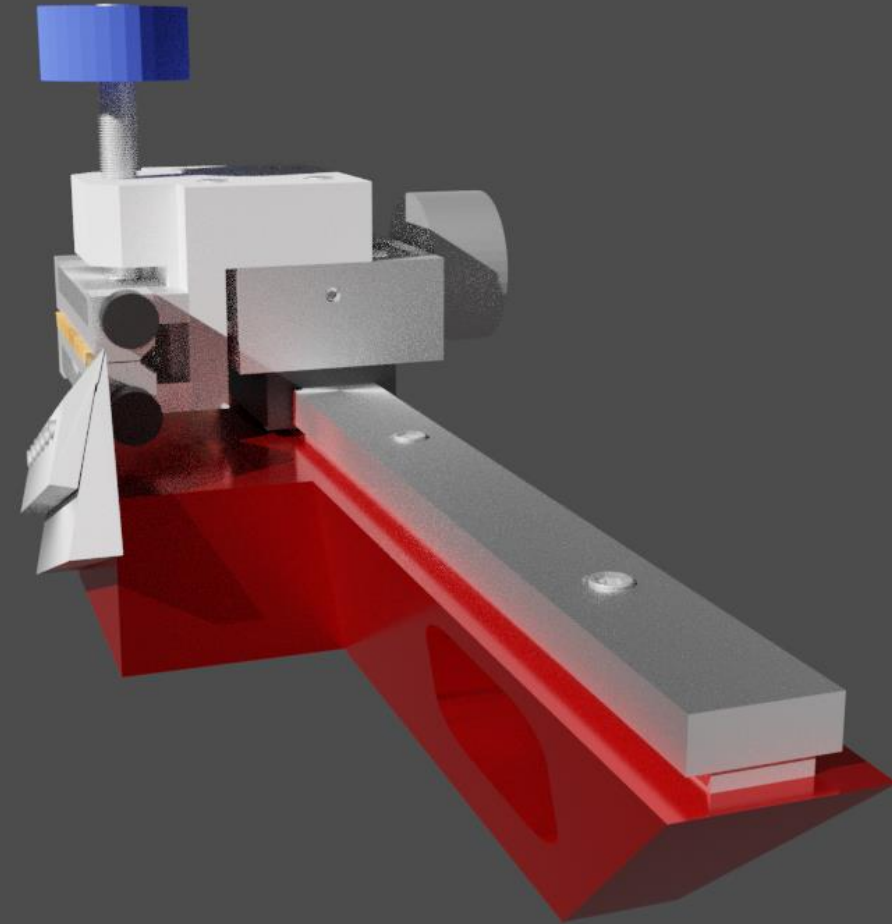
# Sampling collection and preparation



- Increment core
- Drying
- Pre-cutting (diamond flying cutter)
- Segmentation
- Label and storing

RECOMMENDATION

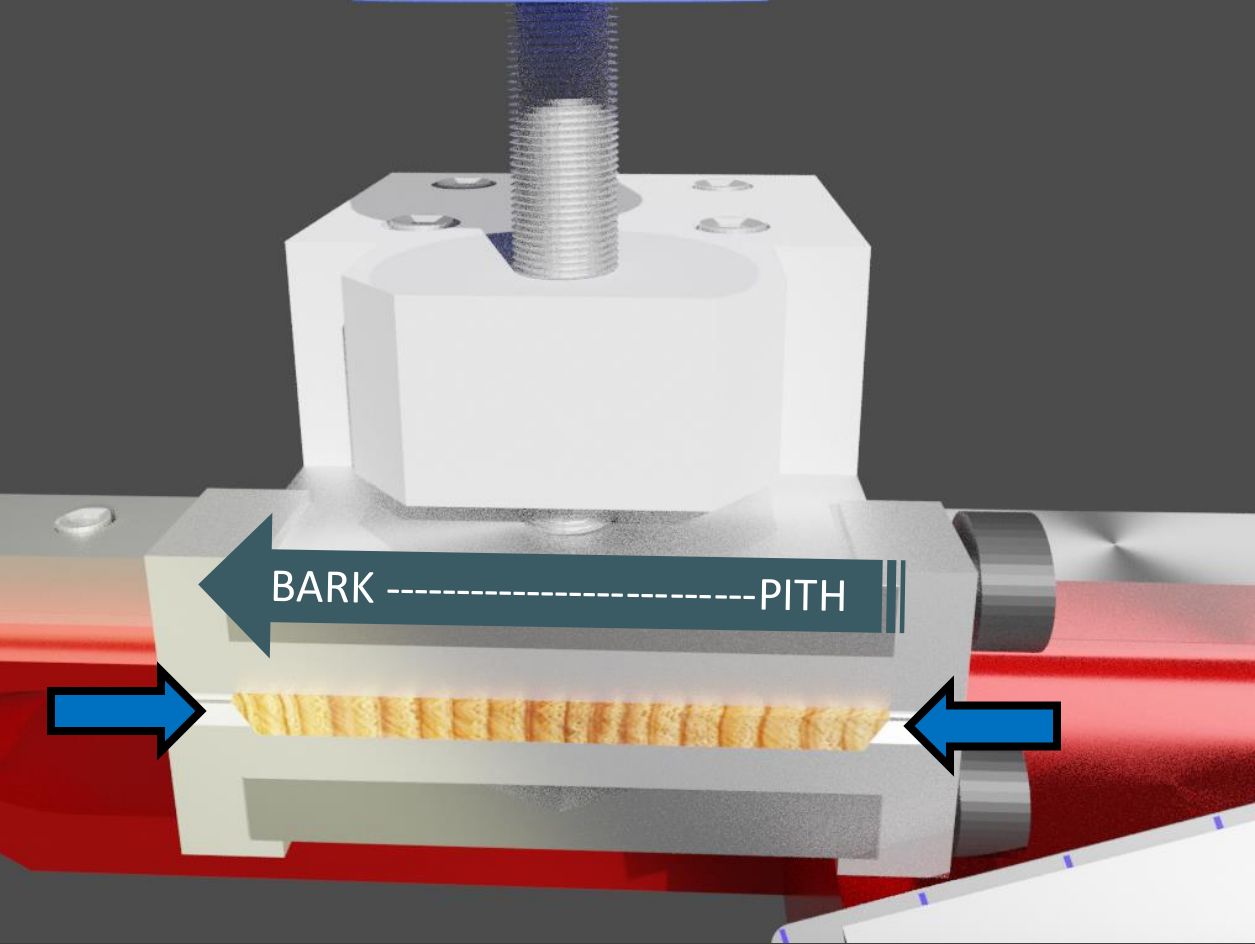
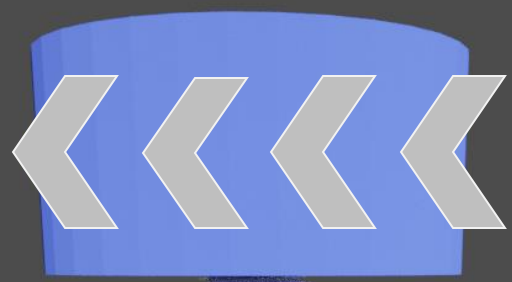
# 7 Optimizations in Sample Preparation



GSL-1 Microtome

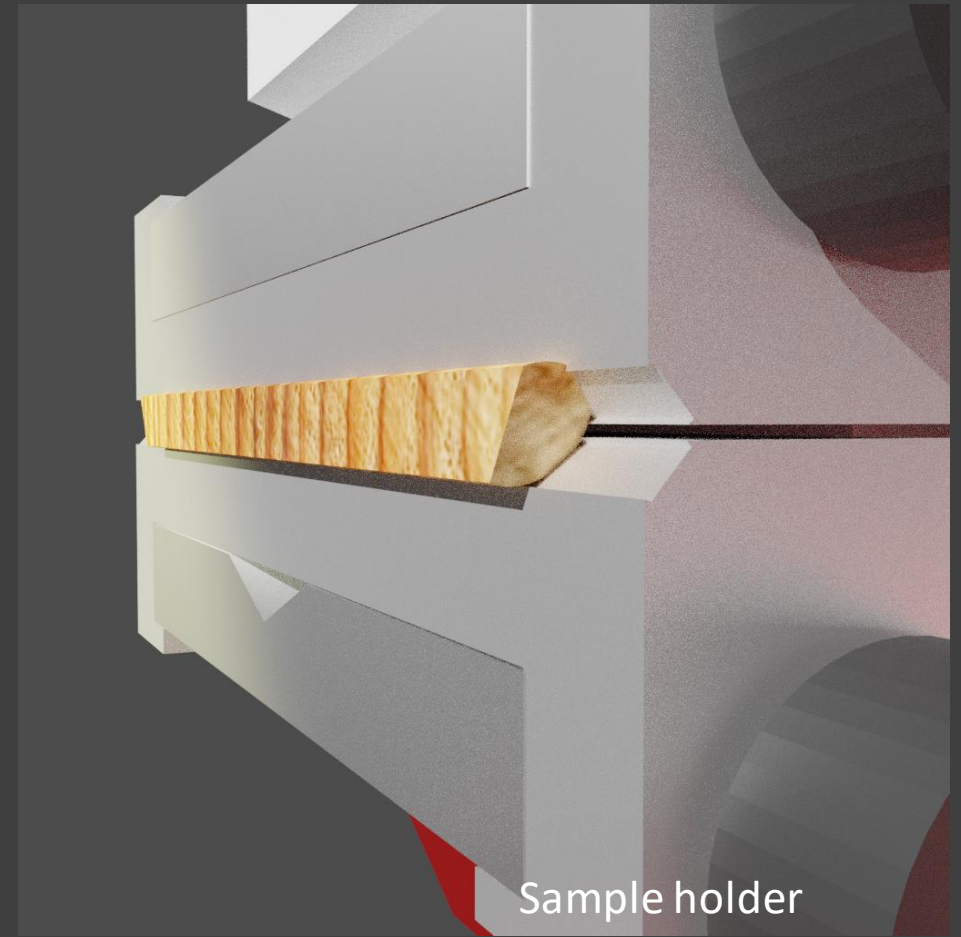


Side view



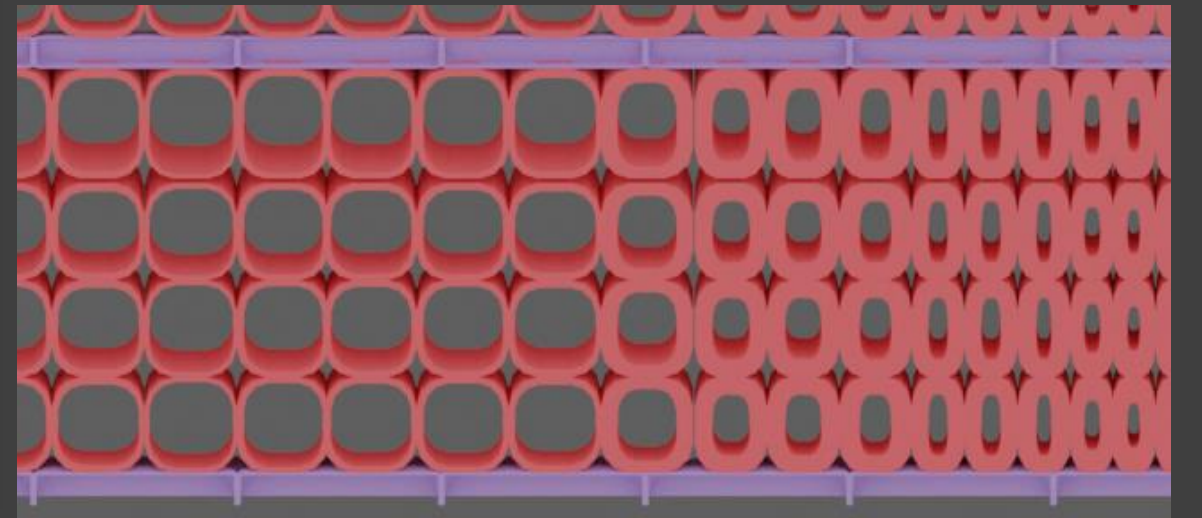
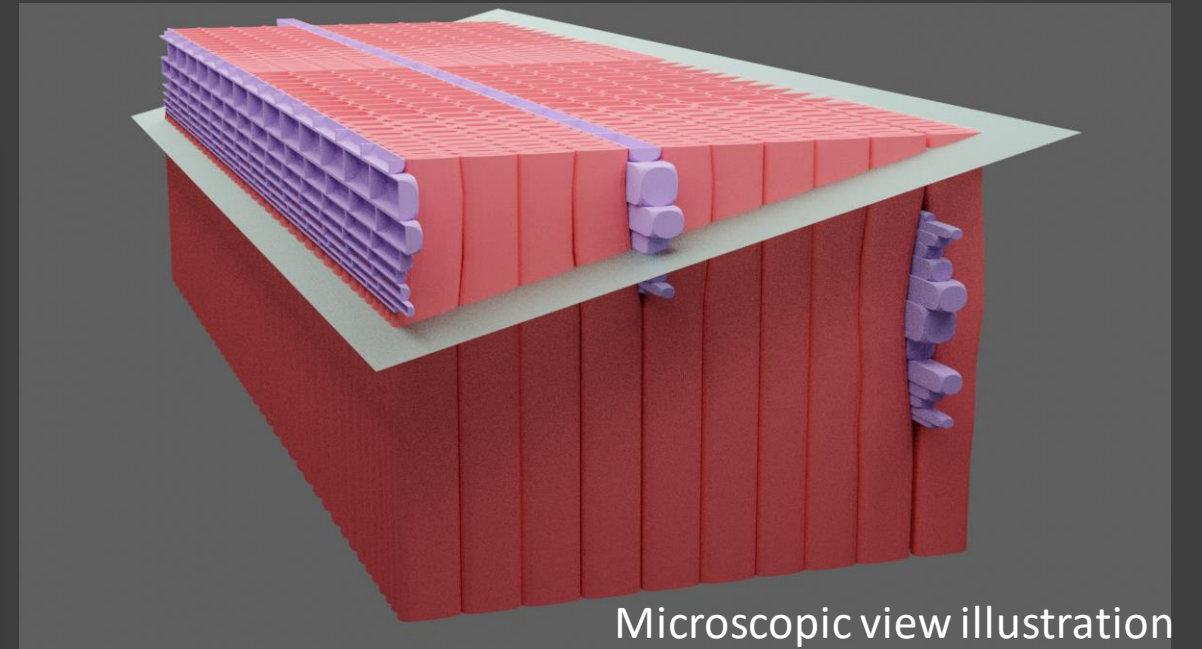
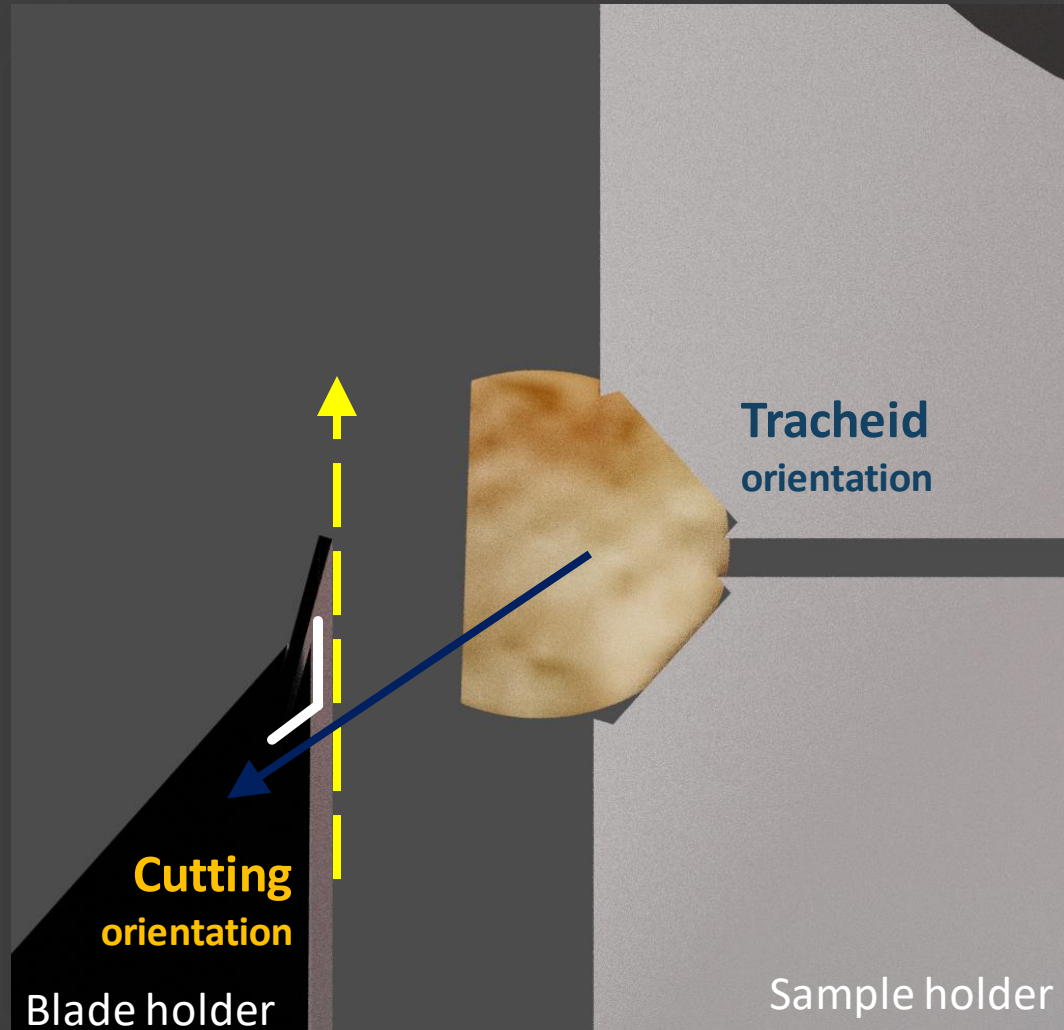
- Middle of Sample holder
- Cut from pith to bark orientation

# 1. Sample orientation



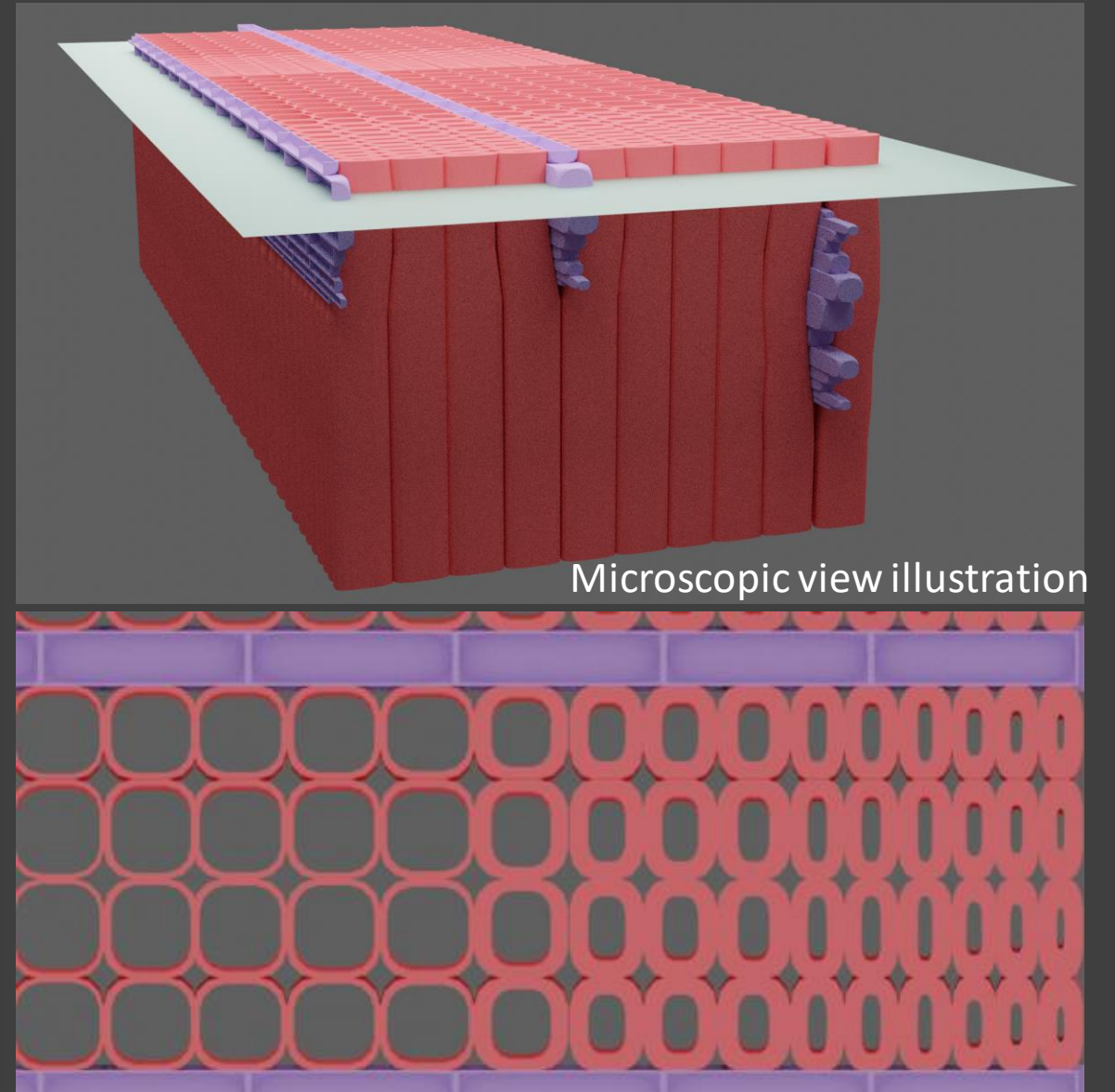
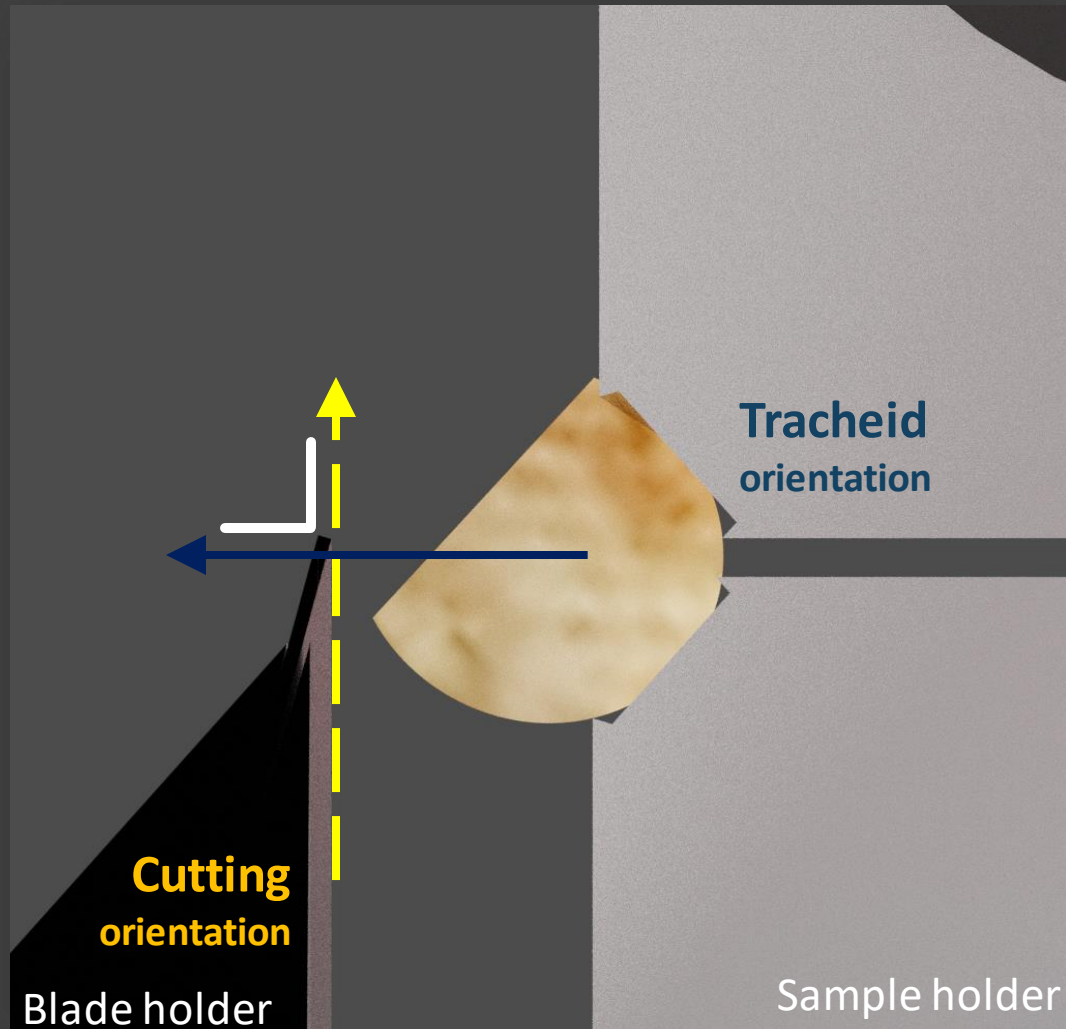
- Tight - recheck
- Alignment?

# Problem: 3D effects

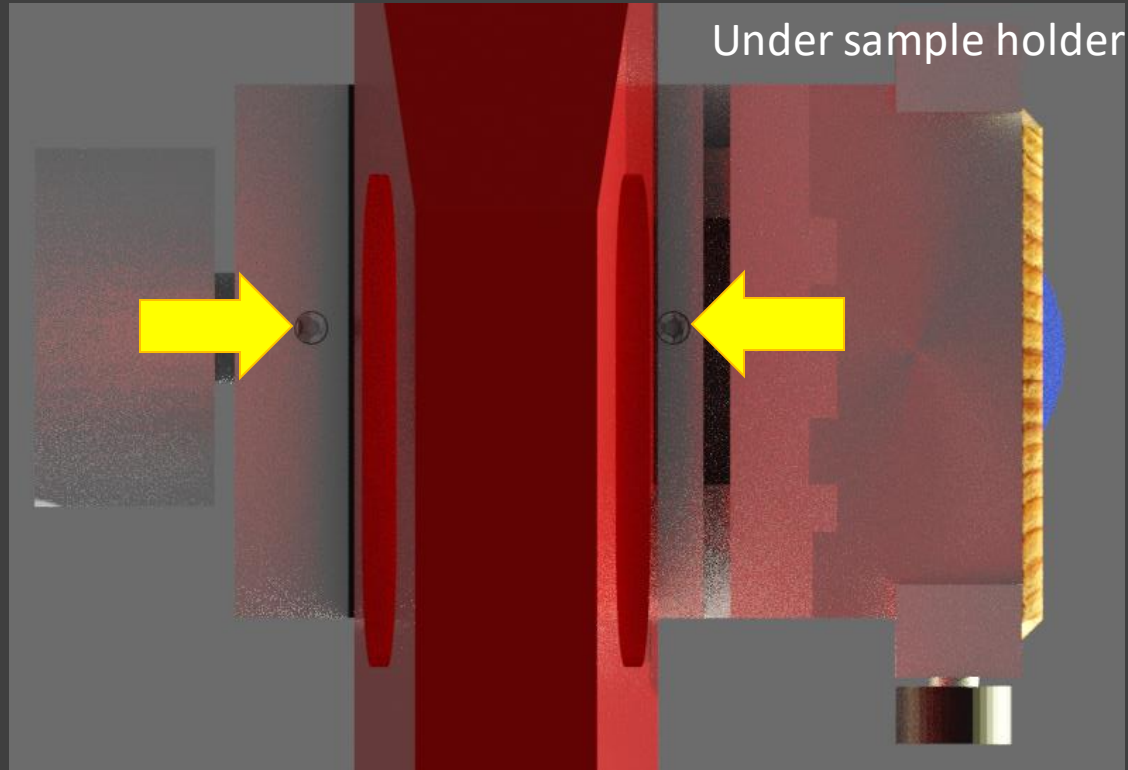




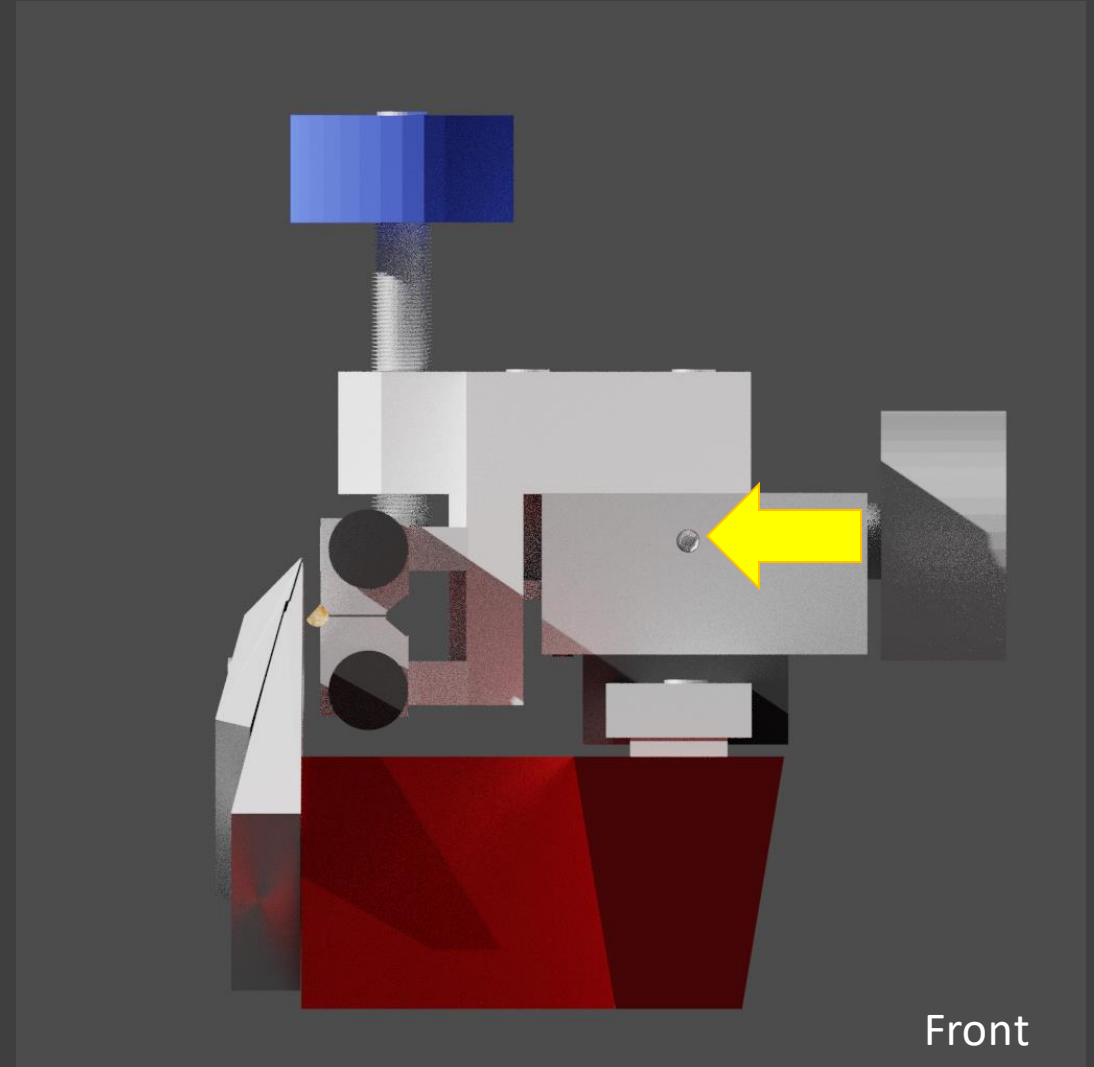
# Problem: 3D effects



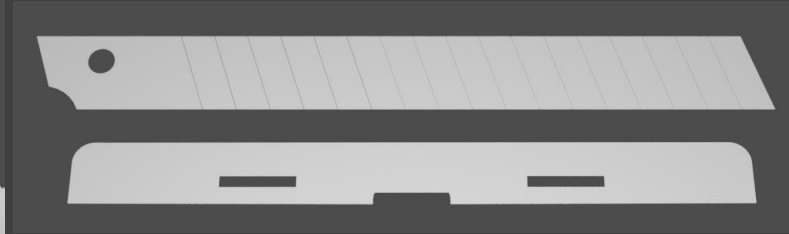
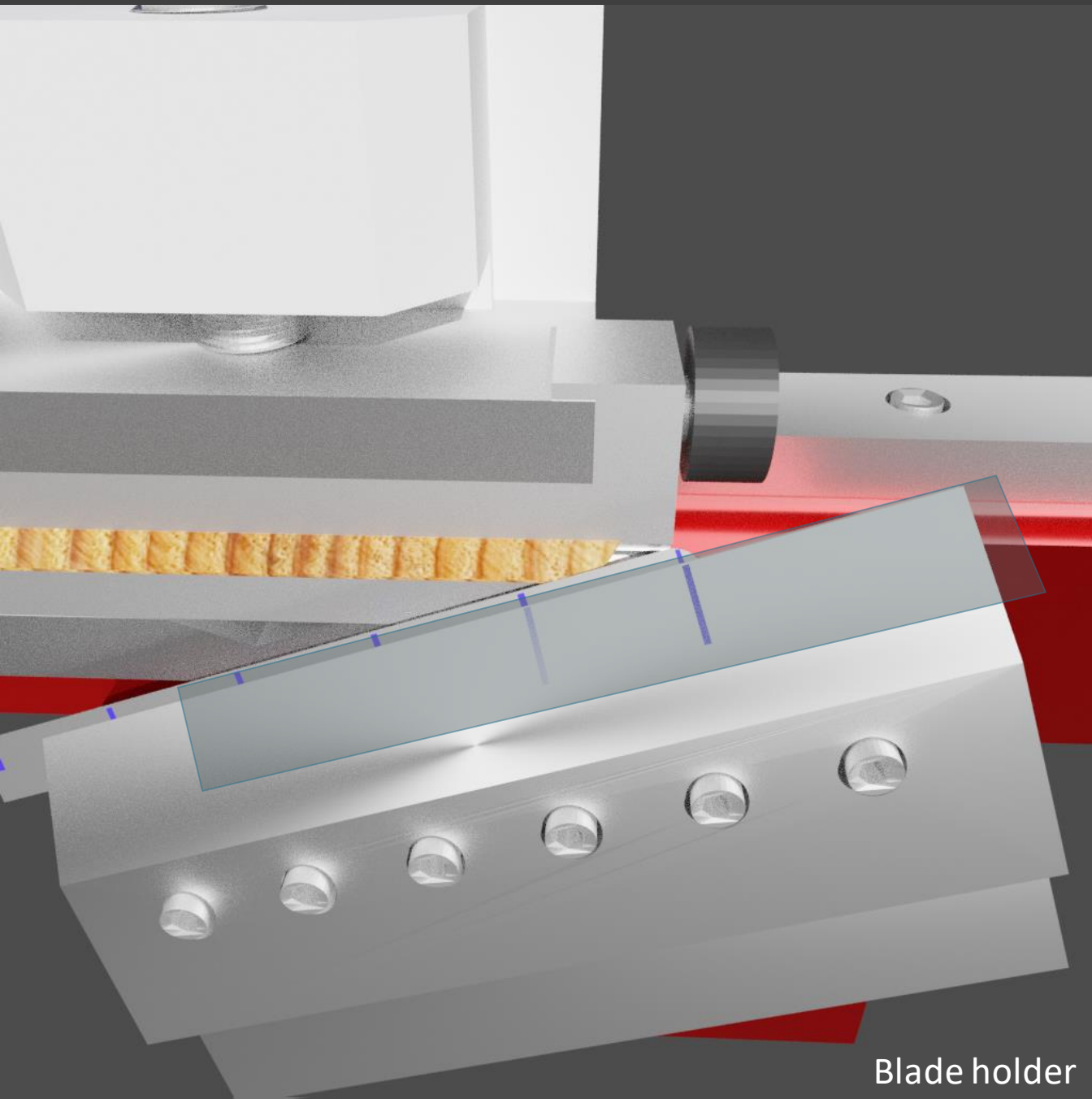
## 2. Microtome settings



- Free-play adjustment
- Tighter setting for thinner section (10 microns)



### 3. Blade optimization



NT cutter

Microtome blade

- Microtome blade: Higher quality, sharpness
- Marking cutting area
- Marking blades
- Utilize every part of the blade
- Cellotape
- Higher quality, speed, cheaper

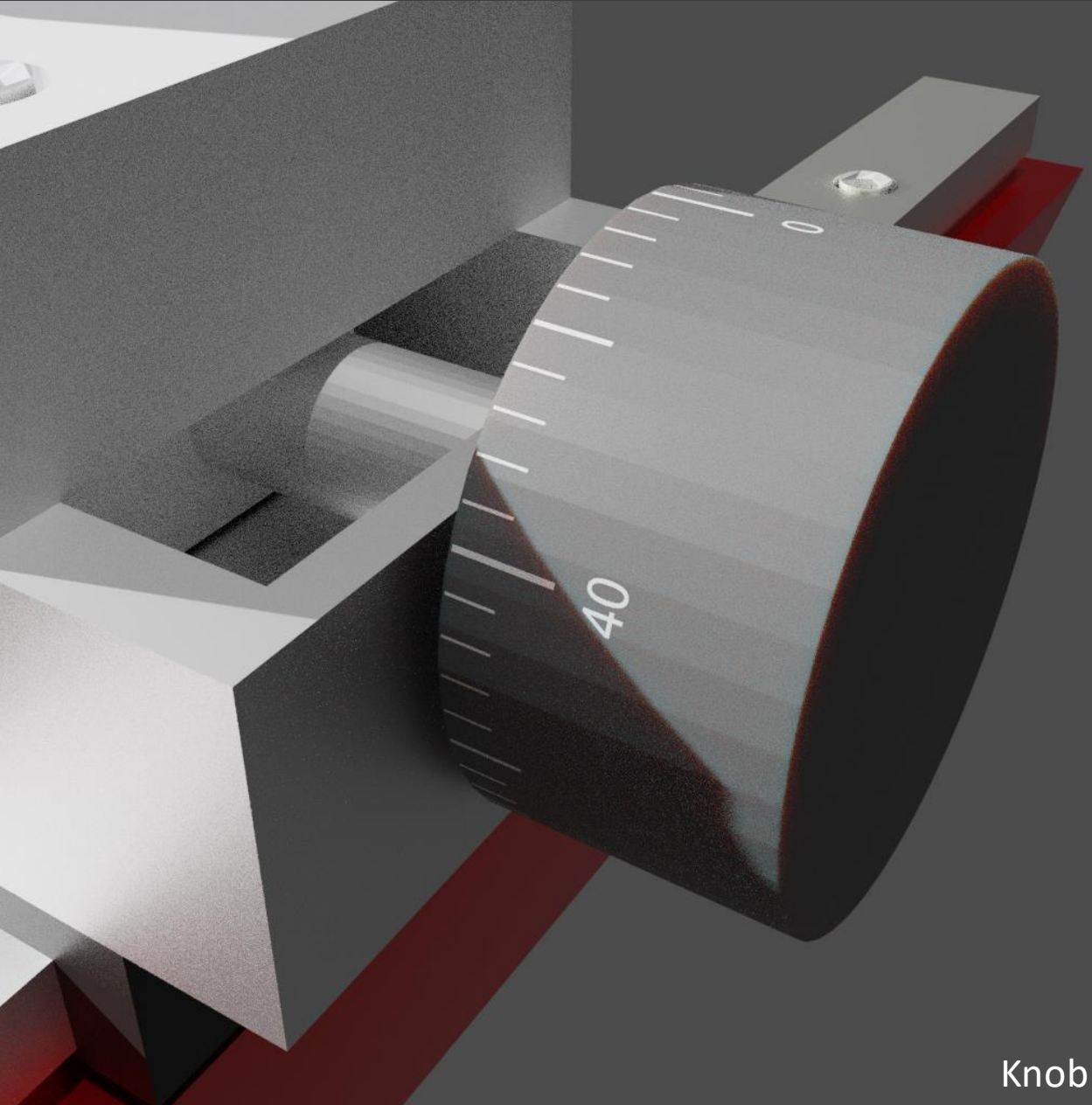
Blade holder



## 4. Thicker Non-Newtonian fluid

- Filling lumen area – better support
- Pushing by finger
- Smoother movement, thus better cutting quality
- Solid – Liquid ?



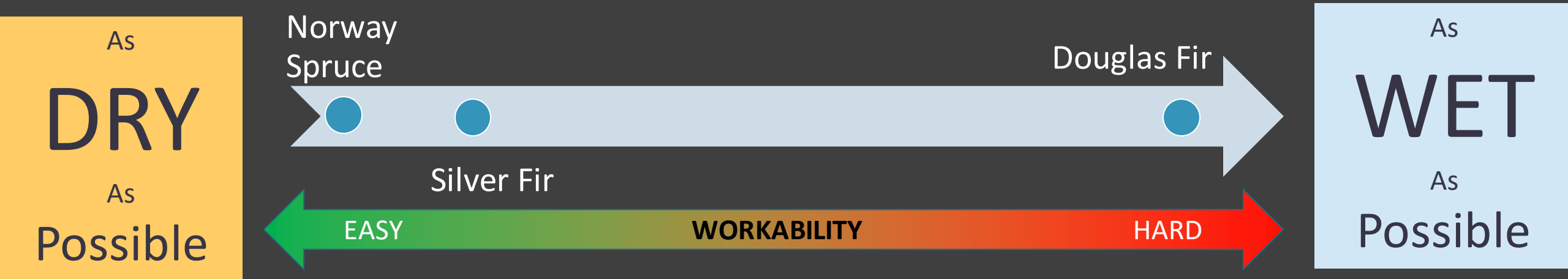


Knob

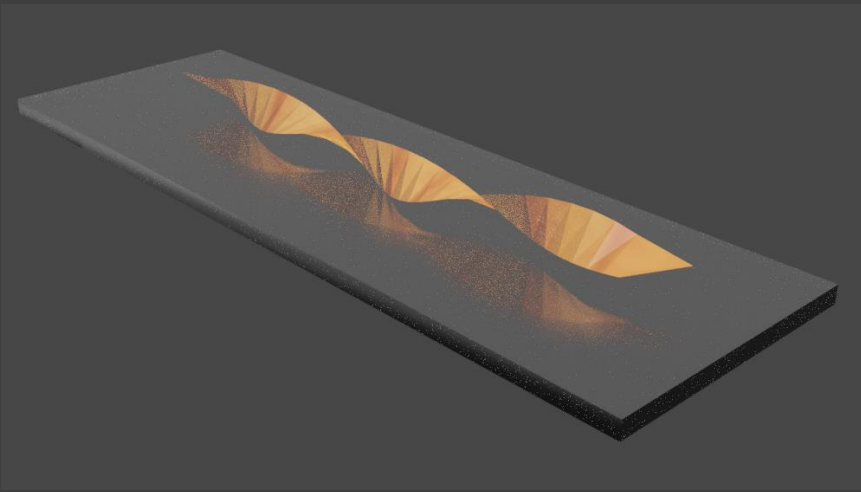
## 5. Cutting thickness

- Uniform as possible
- 15 microns max,  
10 microns is the best
- Avoid blade deformation
- Avoid too much force to the sample

# 6. Dry/wet sectioning

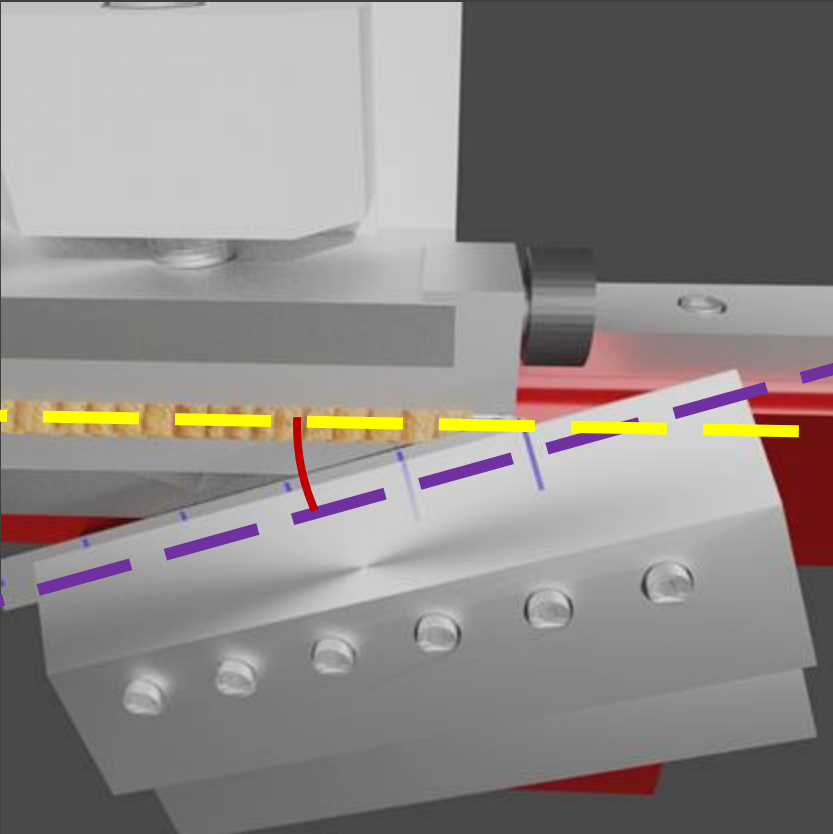


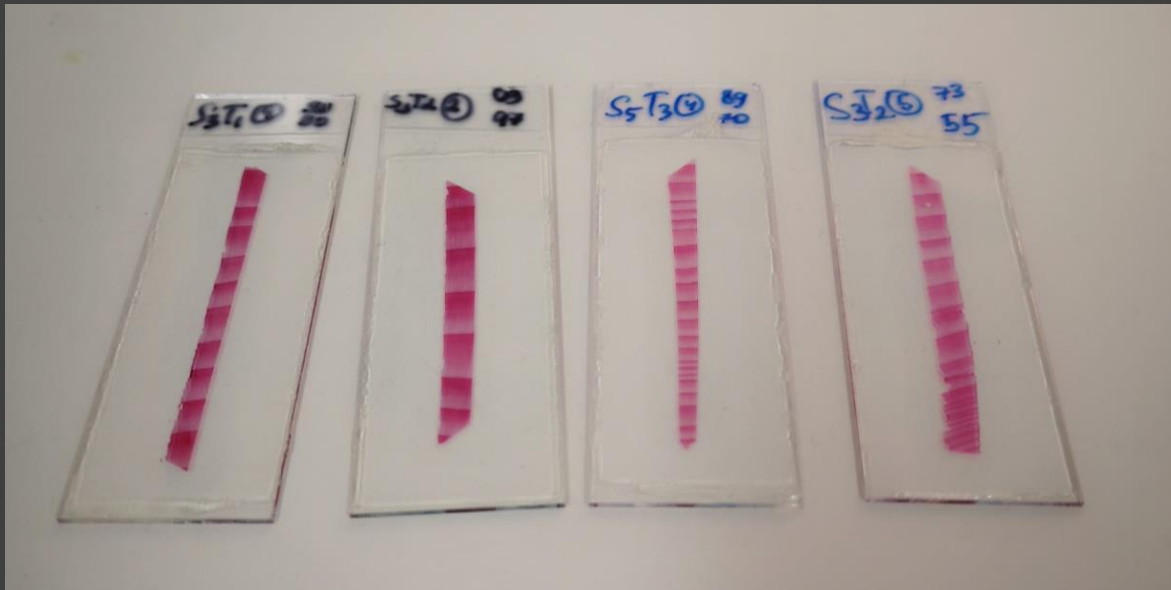
- Species have different workability
- Hardness & Density
- Douglas fir – Soaking in water 24h



## 7. Twisting

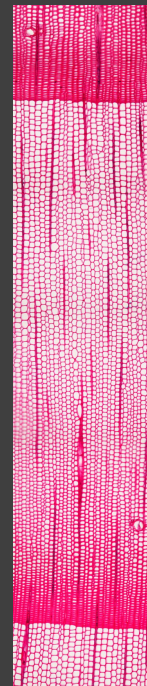
- Always happen due to blade positioning
- Thinner section – easier fix
- Thicker section – harder fix
- Straightening:
  - For Norway Spruce and Silver Fir – on slide
  - For Douglas Fir – on blade holder
- Other option:
  - Utilize water surface tension
  - Cover glasses
  - underwater



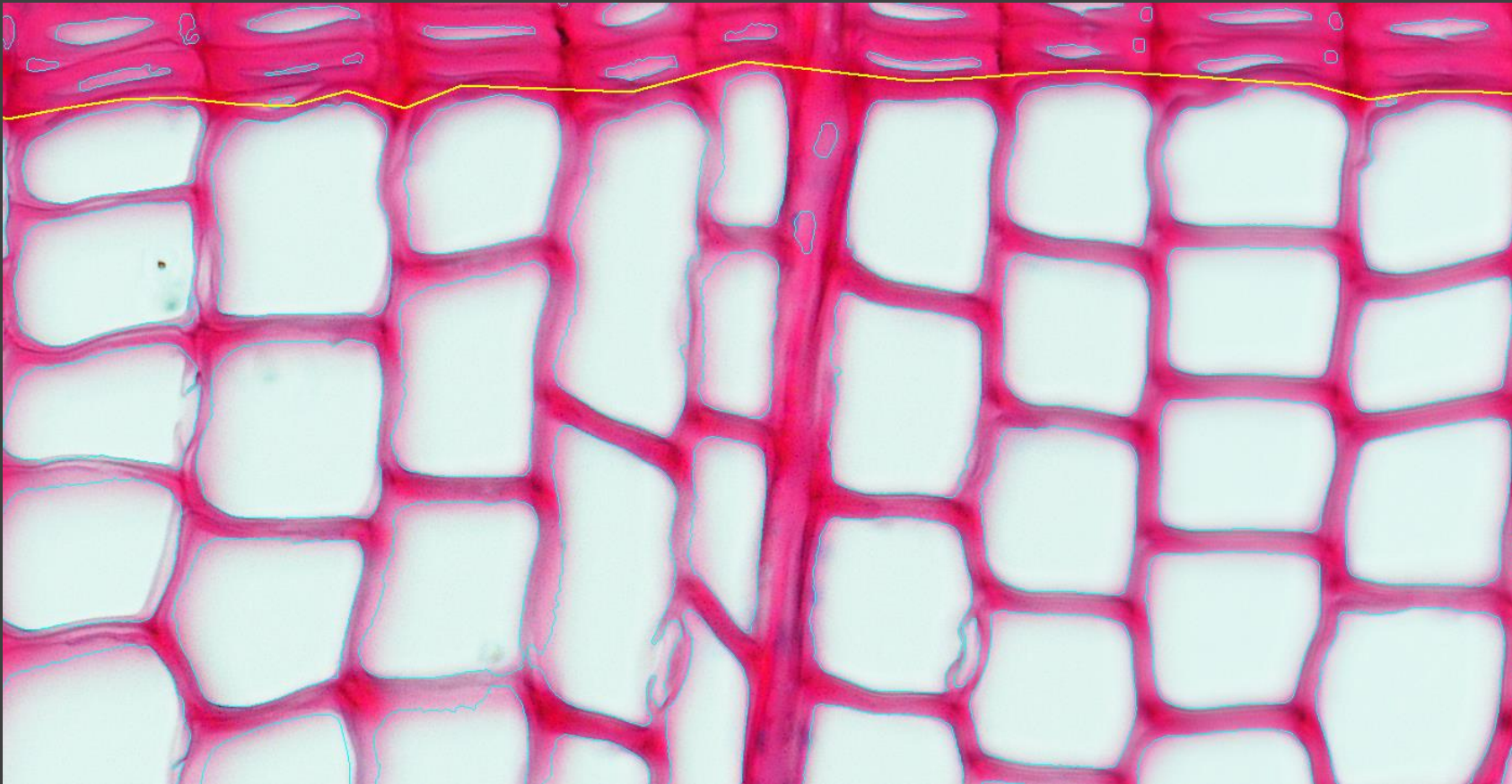


# Next Step

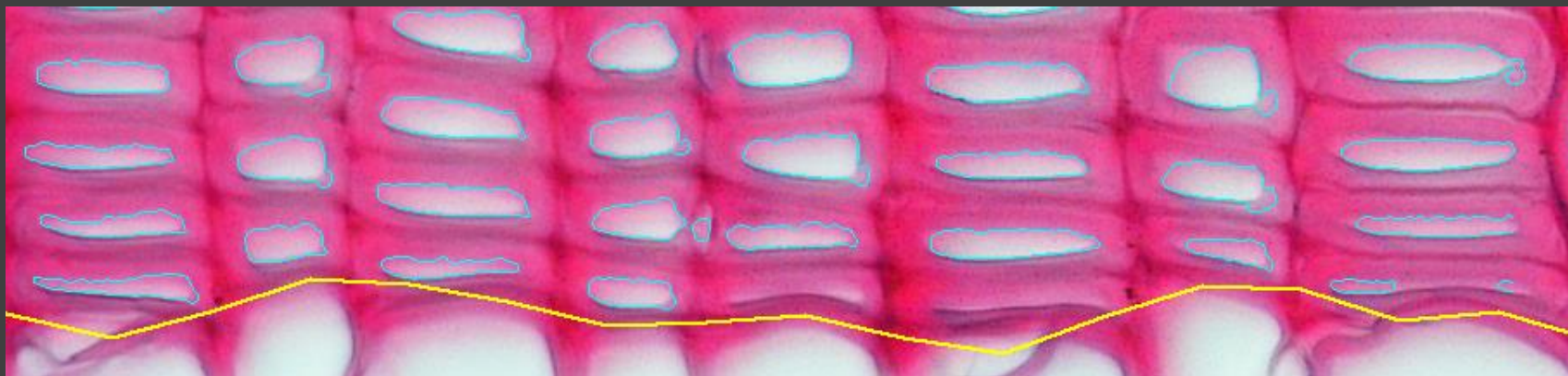
- Cleaning starch
- Double Staining
- Rinsing
- Drying
- Fixing
- Cleaning
- Scanning







Earlywood

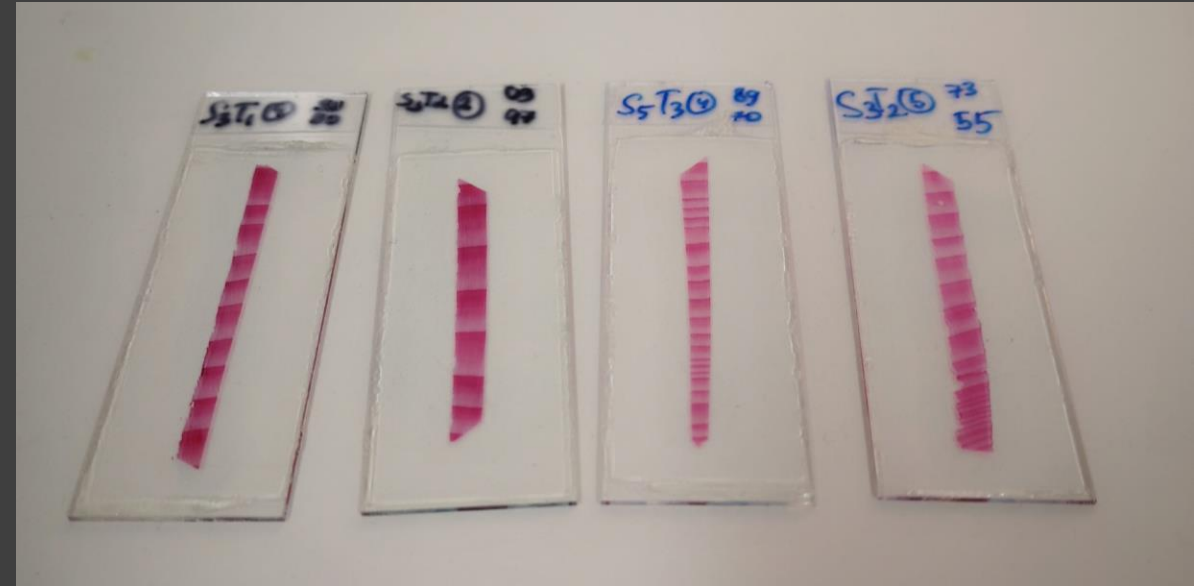


Latewood

Preview  
Data  
Analysis:  
ROXAS

# Up until now..

- 40 trees
- 50 years each -> 2000 tree rings
- 20 days
- 23 blades



# Next..

- Reporting
- Results - analysis ROXAS and RAPTOR
- Correlation – weather & climate data vs wood anatomical parameters