

# Tohoku-Mainz meeting

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- Scintillator cut with a laser processing machine

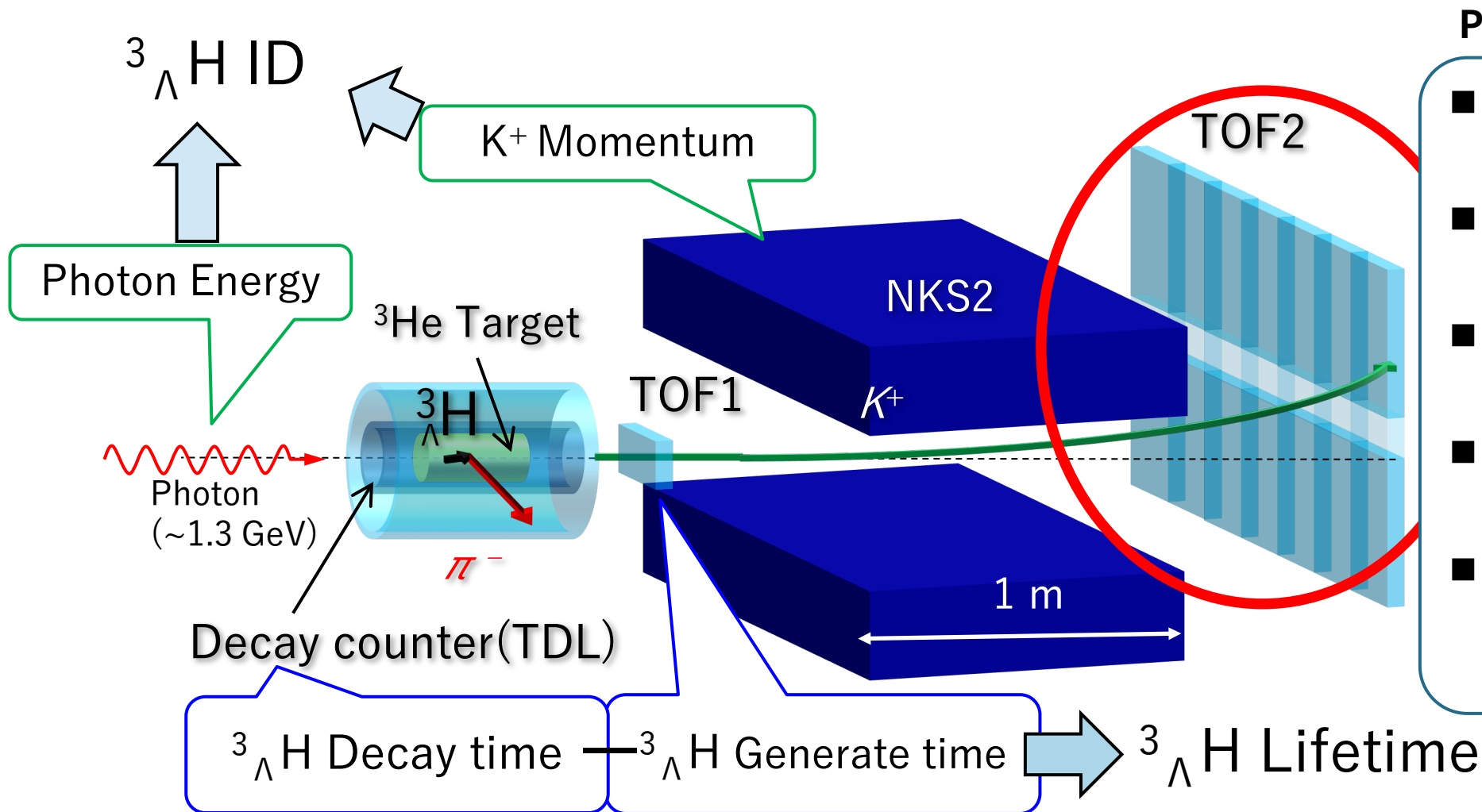
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2020/11/26

# New TOF counter



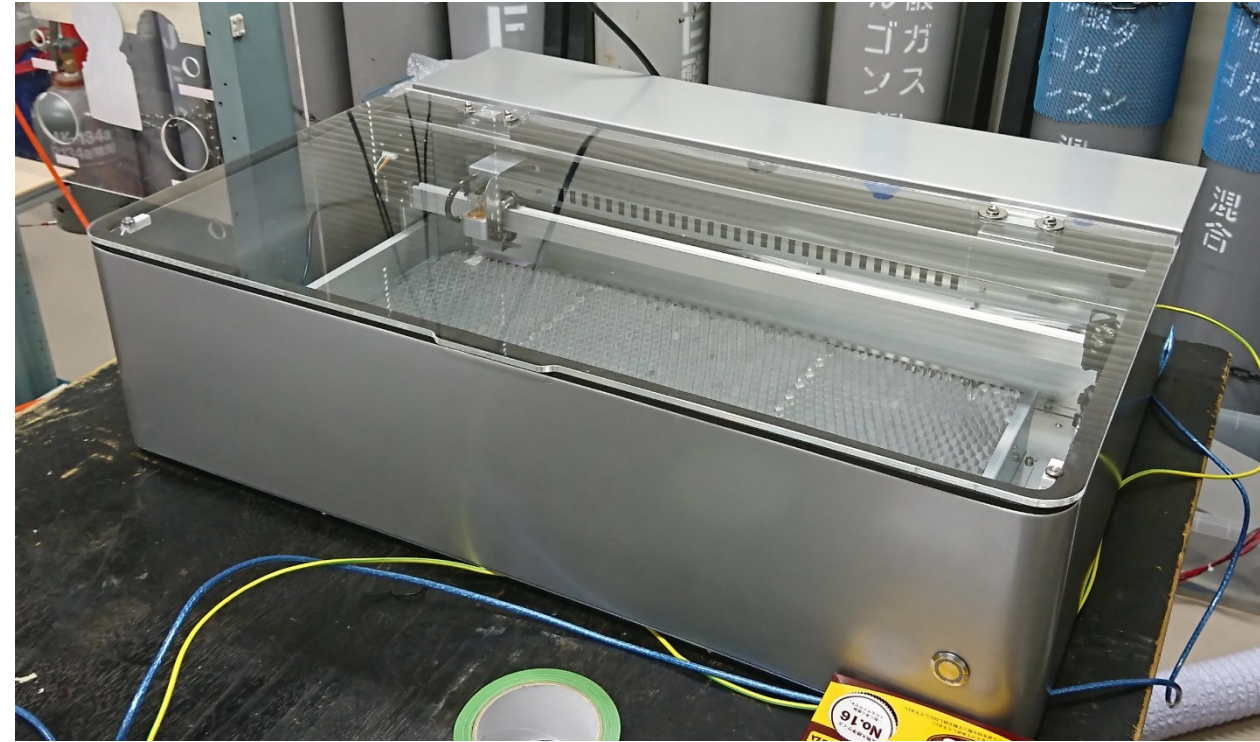
## Plan for mass production

- Array of thin scintillators  $\Rightarrow t \sim 5 \text{ mm}, w \sim 5-10 \text{ mm}$
- We need several 100 scintillators as the total
- Unit price becomes much more expensive
- Cutting scintillators by ourselves saves costs
- Cutting with a milling machine takes long time

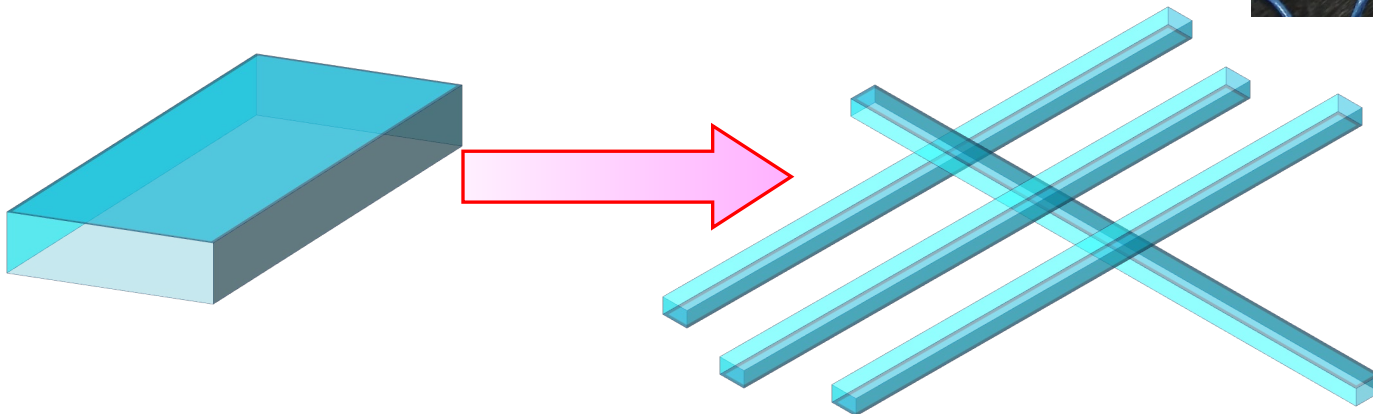
# Laser processing

- We introduced the laser cutter to manufacture scintillators
- CO<sub>2</sub> type laser ( $\lambda \sim 10.6 \mu\text{m}$ ; IR region)
- Our goal  
⇒ To process large scintillator plates ( $\sim 5 \times 100 \times 450 \text{ mm}^3$ )  
into thin scintillator bar ( $\sim 5 \times 5-10 \times 450 \text{ mm}^3$ )

If it works well...  
Prototyping and mass production will make progress very well!



<https://www.podea.net/podea-02>



Param.		
Max power	[W]	40
Maximum processing size	[mm]	600 × 300
Maximum cuttable thickness	[mm]	10

# Image

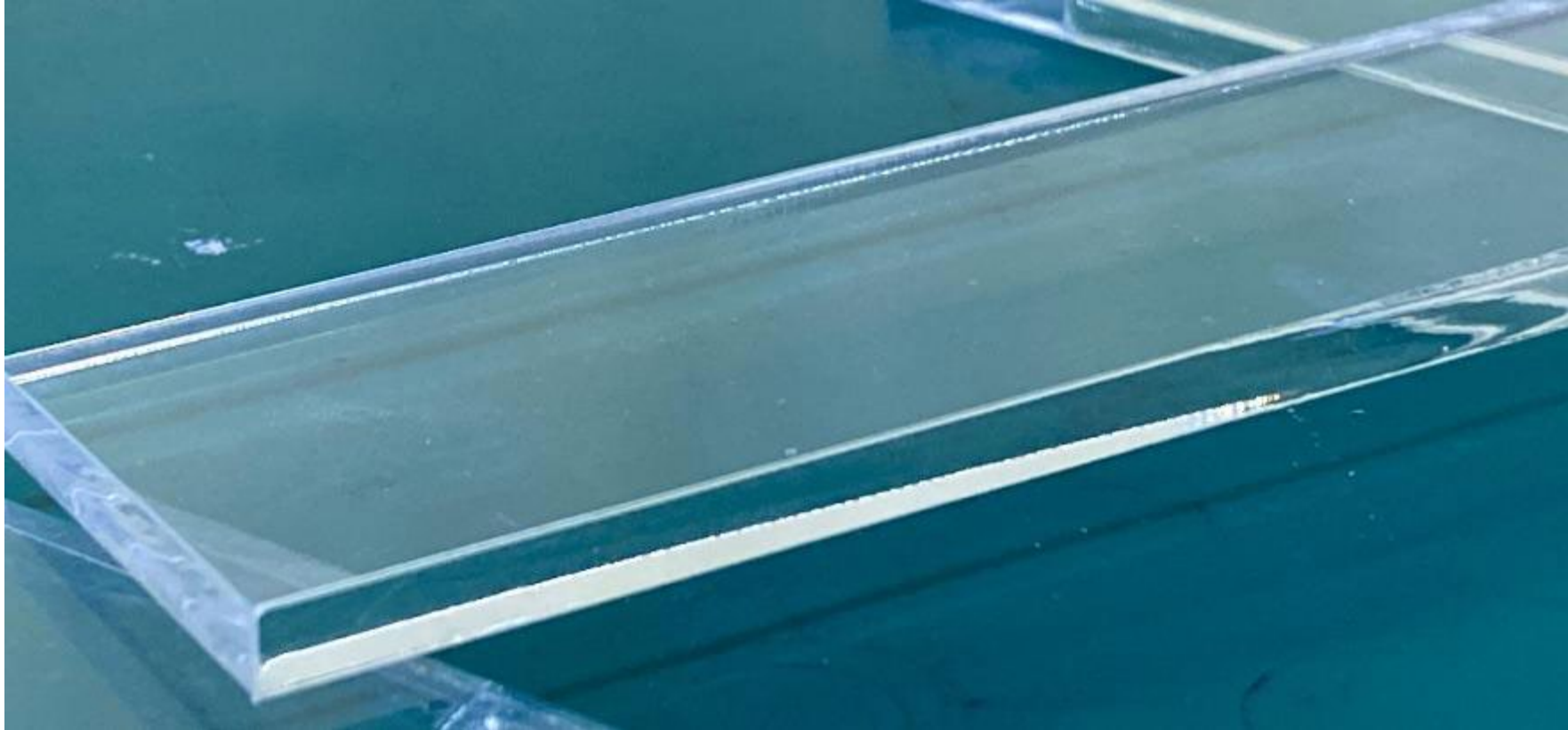
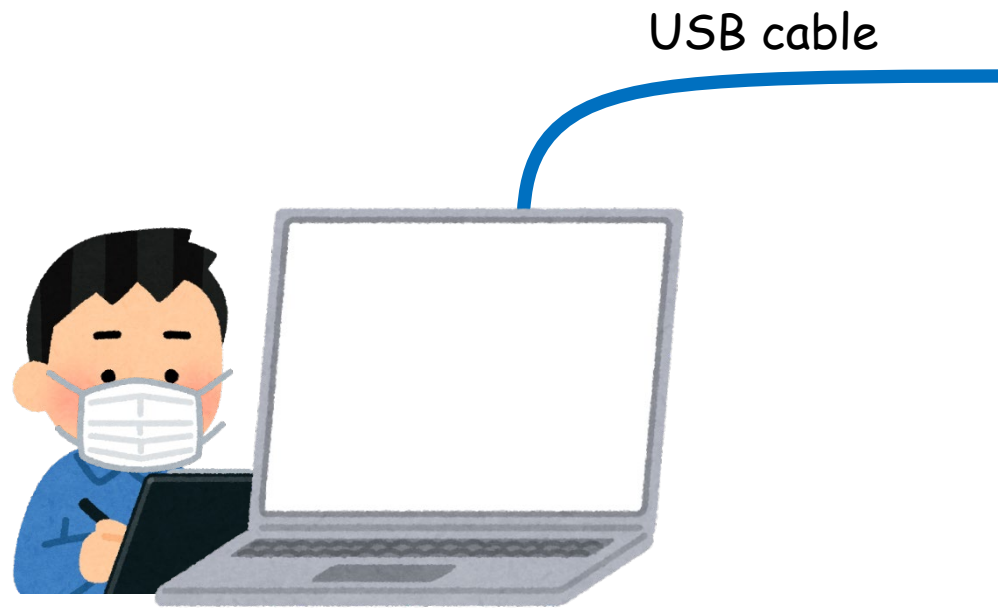


Photo by PODEA

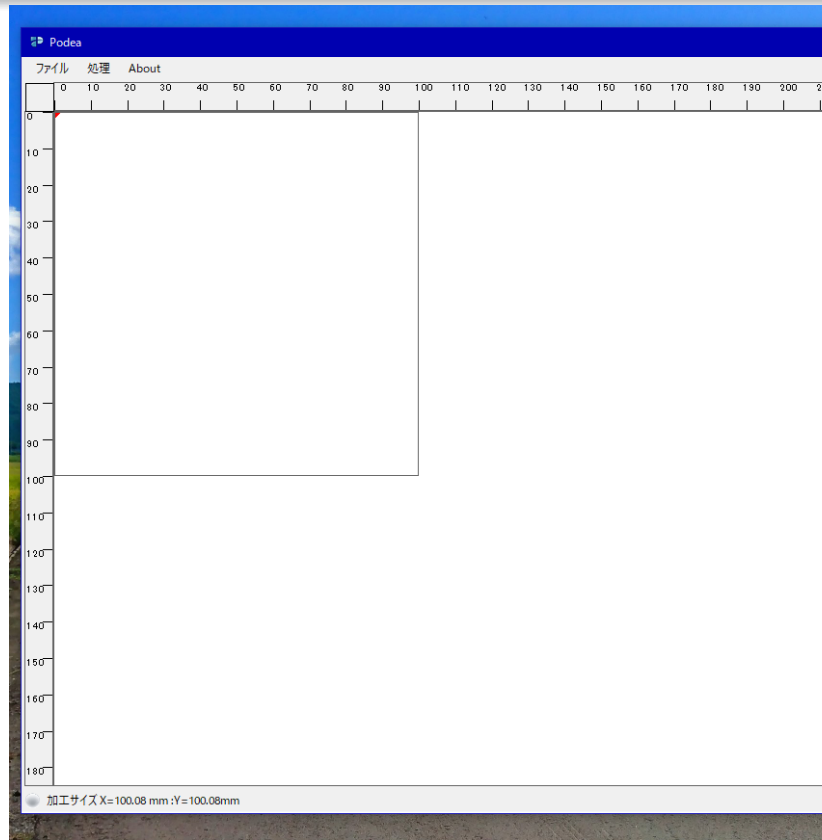


# Software

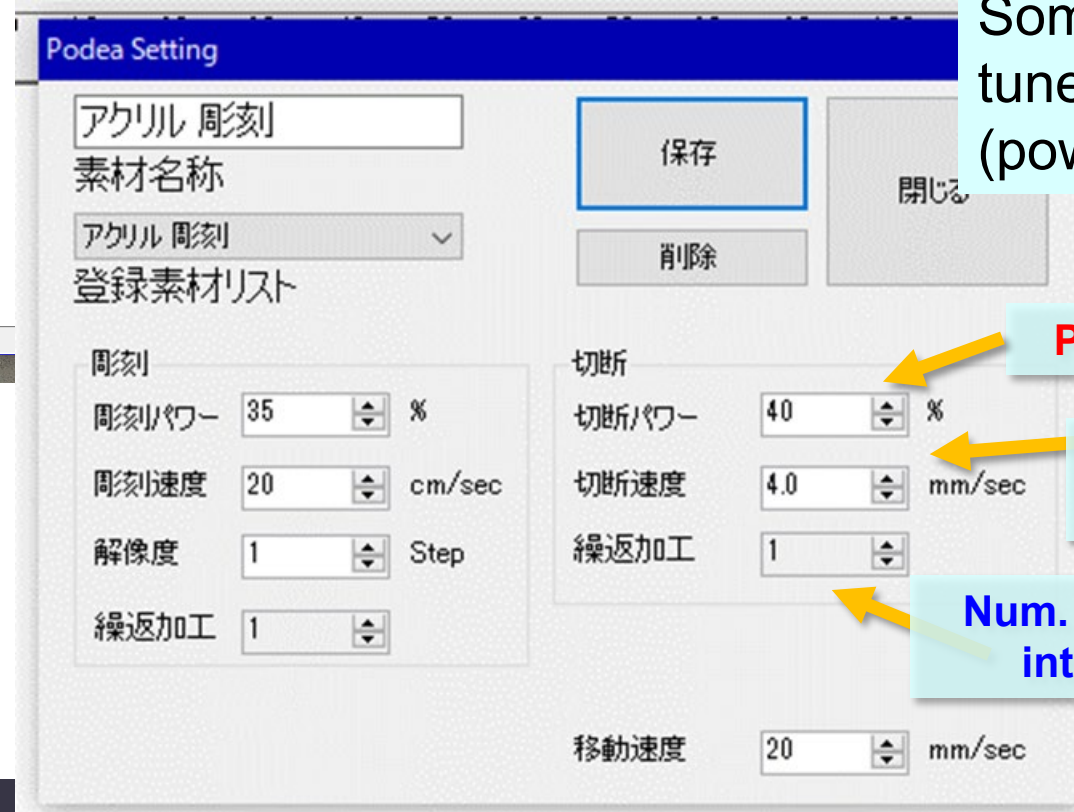


- This machine can be operated from external our PC via Wi-fi or USB cable.
- Illustrator or CorelDRAW is available.
- Decimal application is necessary for the operation.

# Software



turn ON/OFF  
Processing start/stop  
Setting the condition of laser



Some parameters can be tuned as you like.  
(power, speed, etc....)

Power of laser

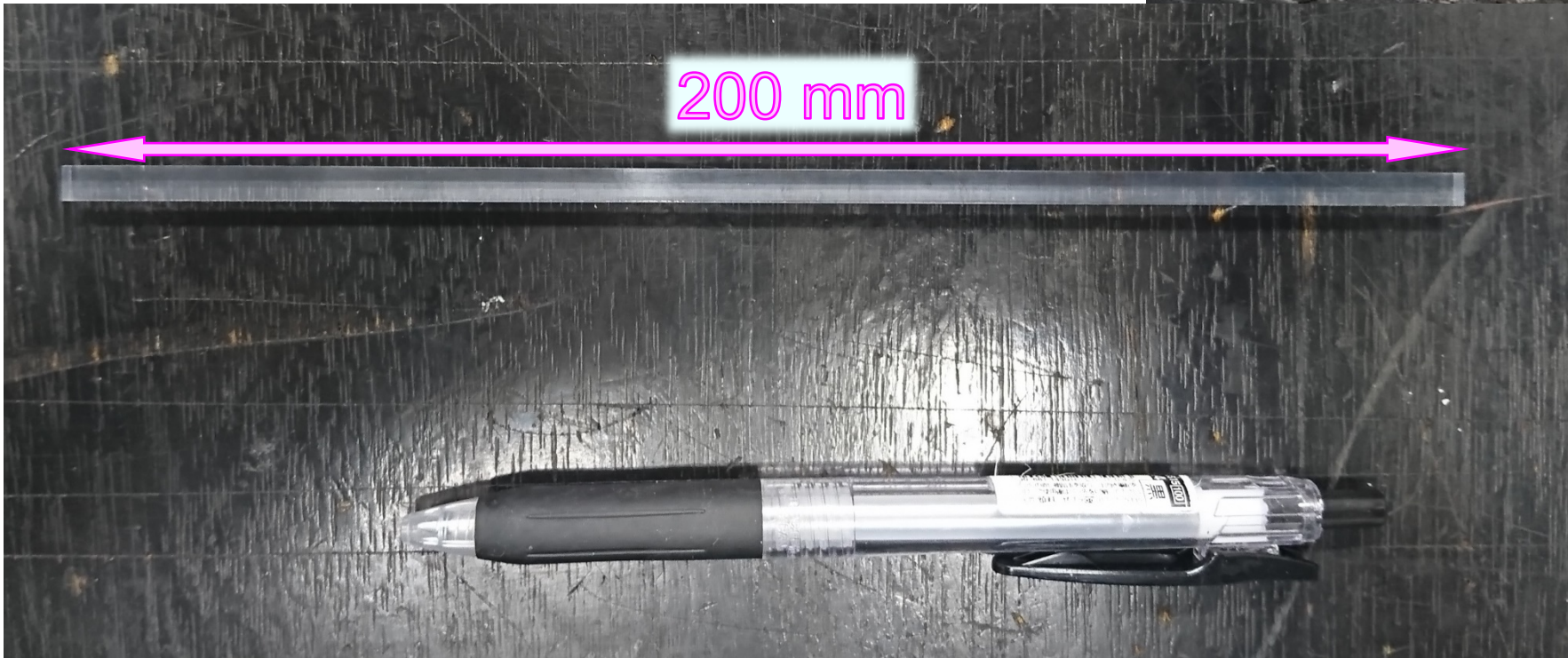
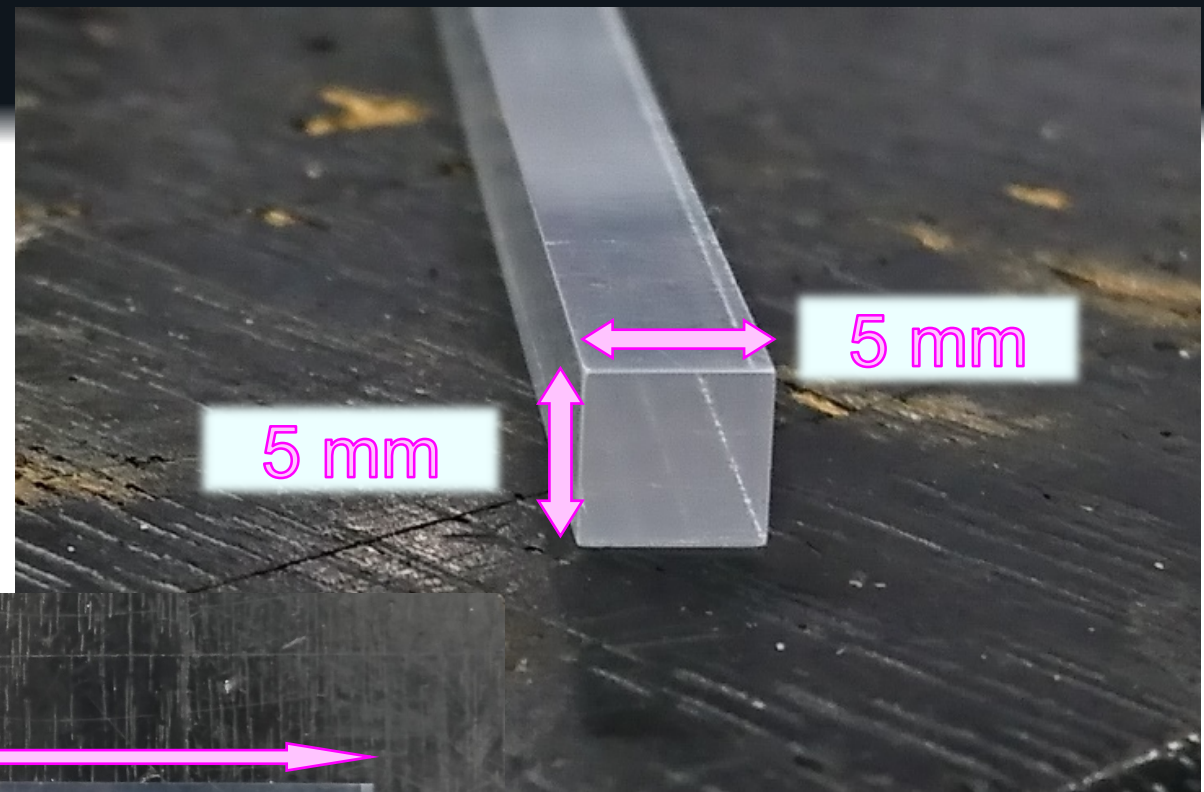
Speed of moving spot introduced laser

Num. iteration of introducing



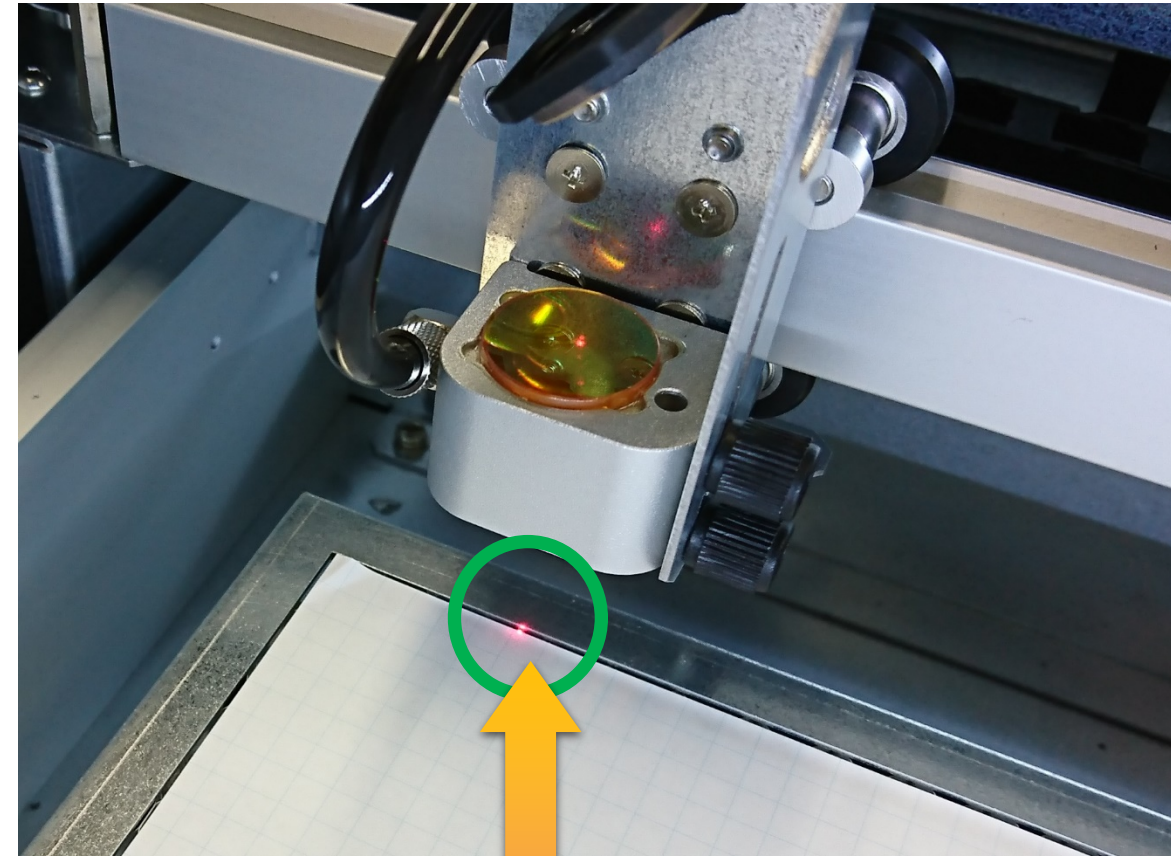
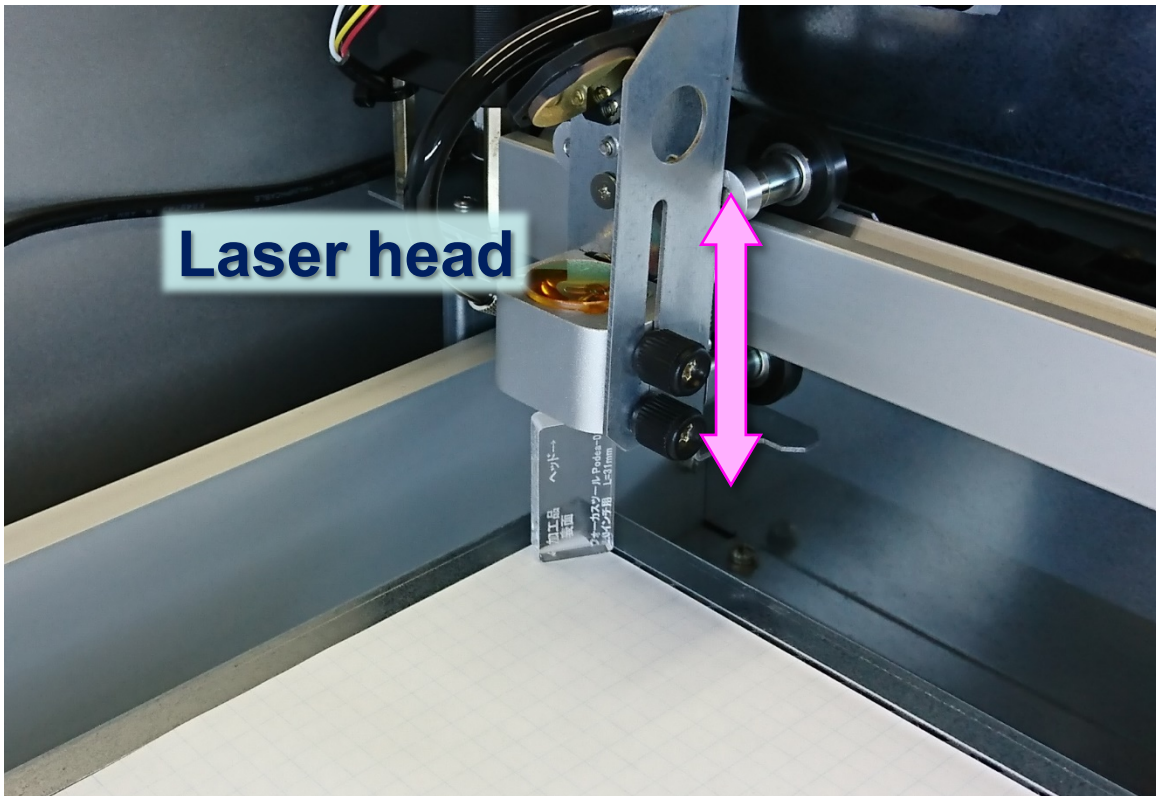
# Sample test

- Now we are testing this machine
- Purpose: to find the best condition to process scintillators



# Sample test

Tune the height of laser head part to laser focus on the surface of the material certainly

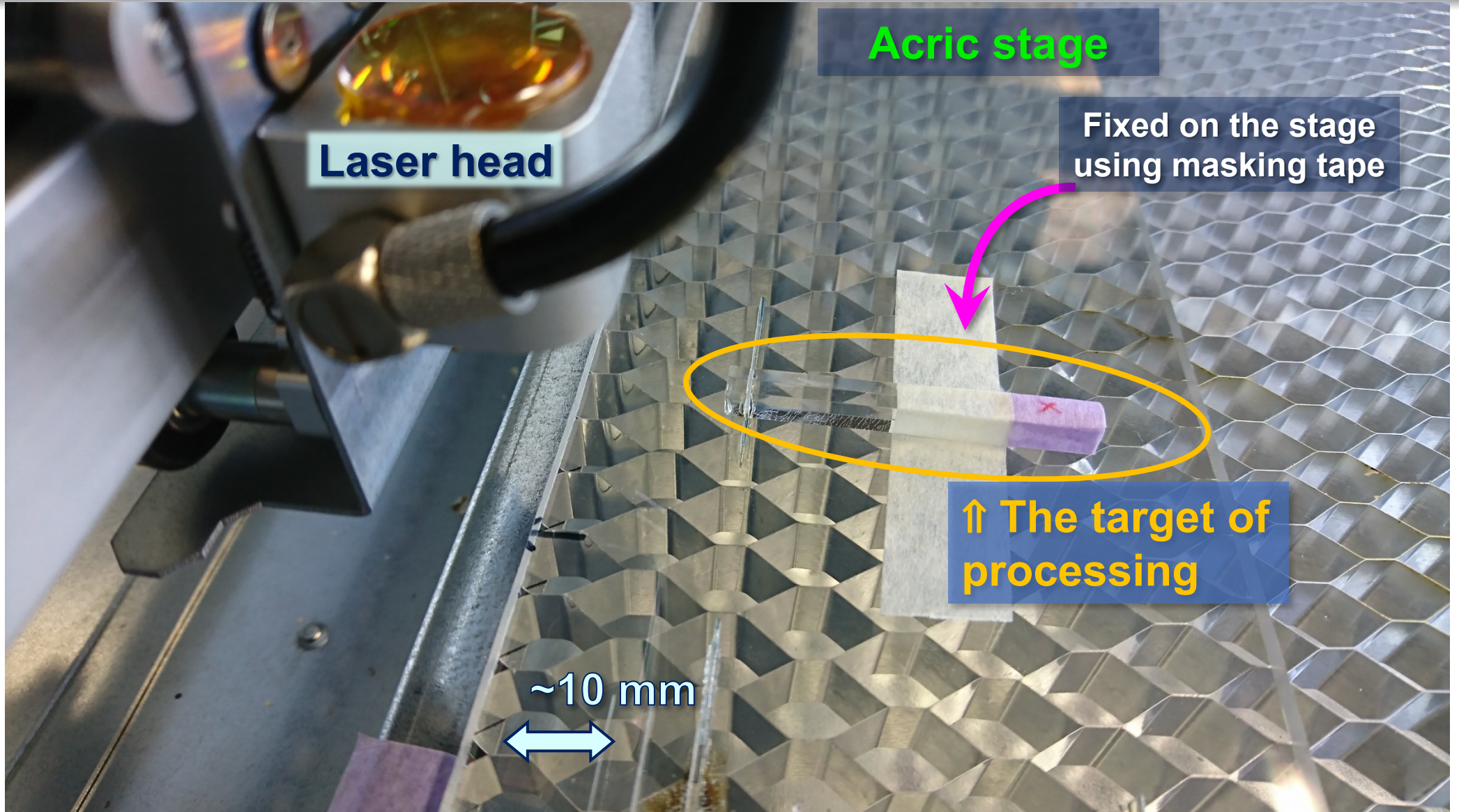


Tune the position of the material using laser pointer



# Sample test

- Setup

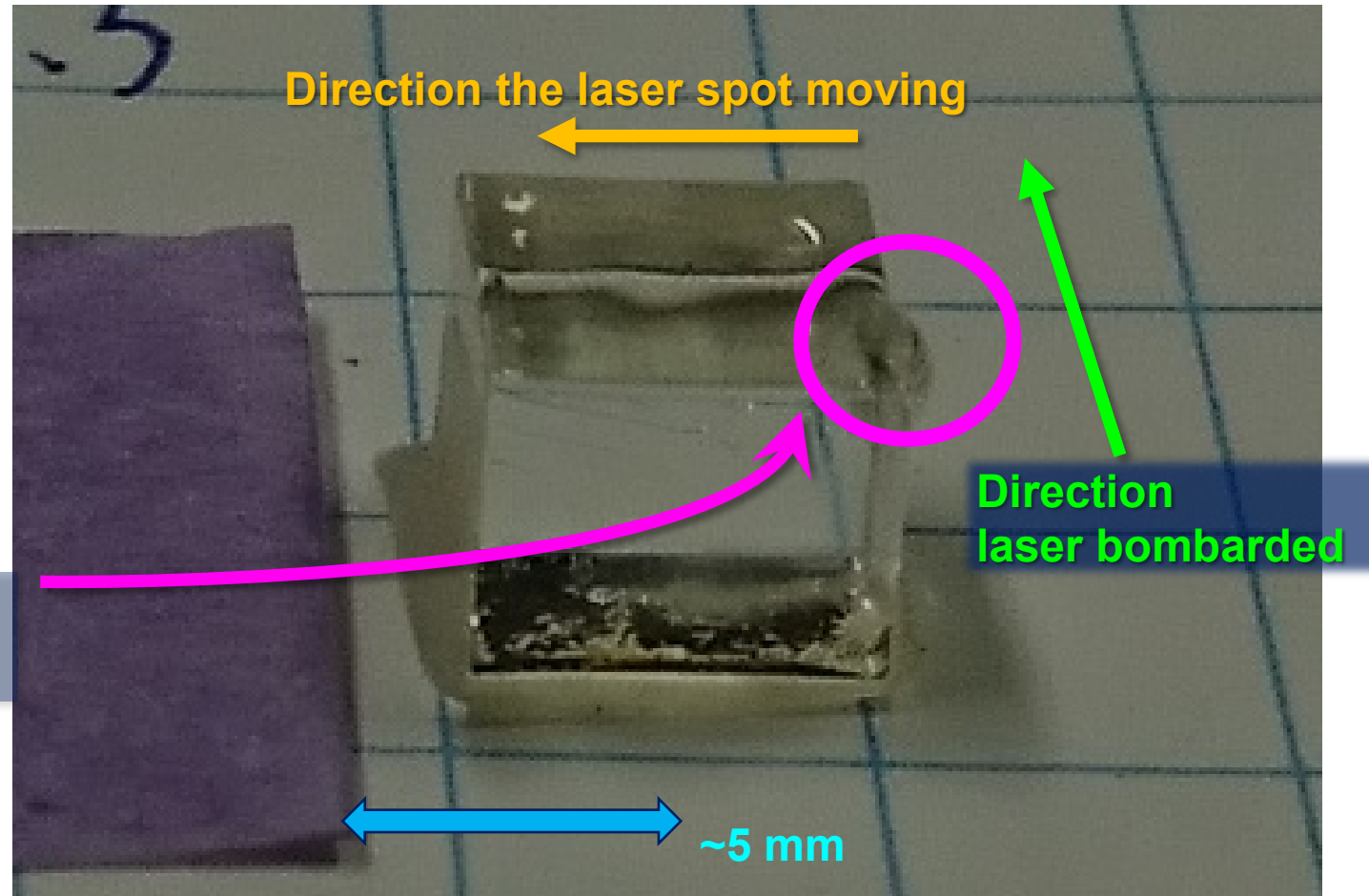


# Result 2

- We tested several combinations

Param.		Val.
Power	[%]	70
Processing speed	[mm/s ]	2.5
Iteration		1

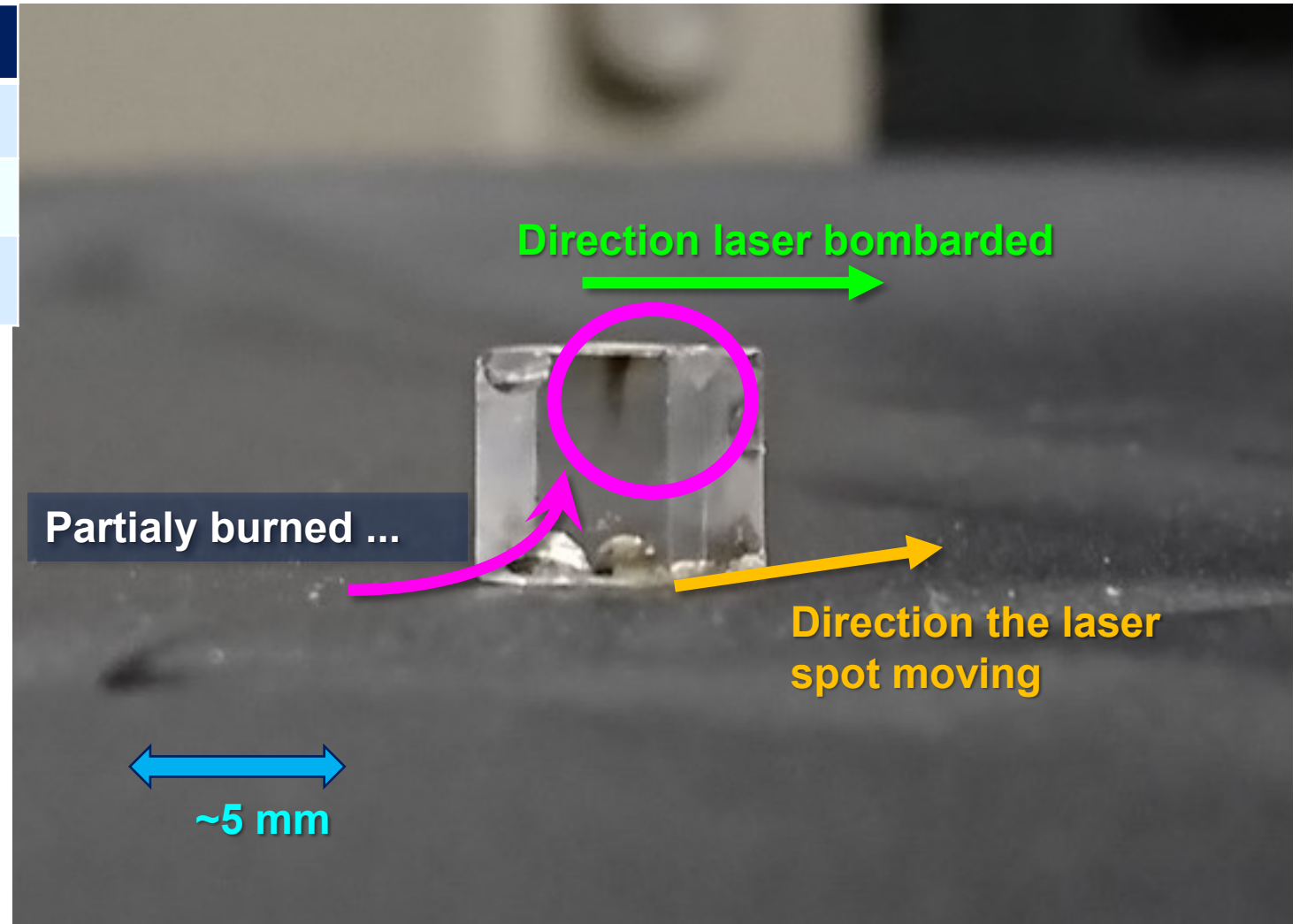
Partially melted scintillator  
⇒ too heated??



# Result 1

- Tested at lower power

Param.	Val.
Power [%]	40
Processing speed [mm/s]	4.0
Iteration	1





# Summary

- We arranged a laser processing machine to cut scintillators.
- The machine from PODEA consists of a CO2 laser, a stage and moving frame, max. power is 40W.
- Laser-cut for an acrylic seems to be good.
- Scintillator-cut for a scintillator does not work well in the same way...
- Some tuning (power, speed, coolant) is necessary.
- Time resolution performance should be checked.