

# Structuration au coeur des matériaux transparents

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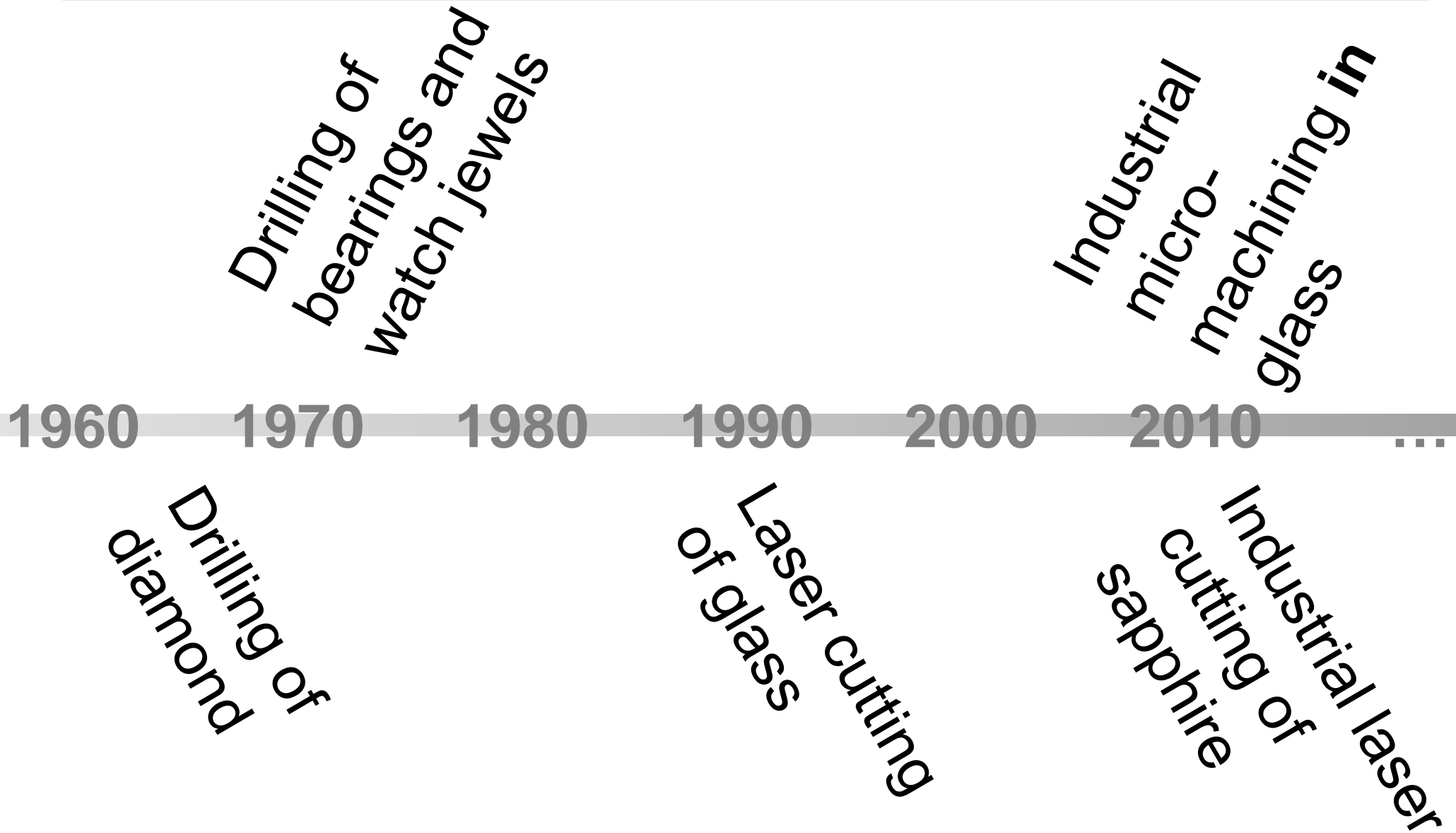
[www.fhnw.ch/technik/ippe](http://www.fhnw.ch/technik/ippe)

# Structuration au coeur des matériaux transparents

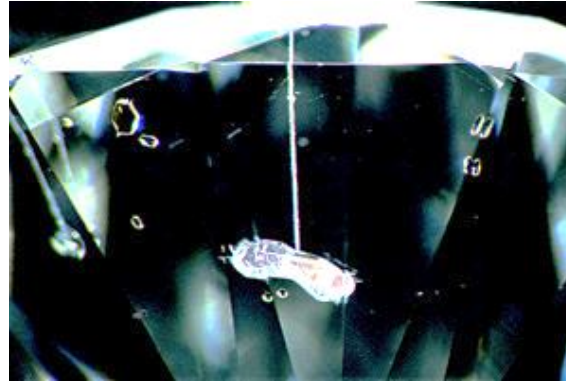


- ▶ History
- ▶ New challenges
- ▶ Example
- ▶ Surfaces
- ▶ Applications
- ▶ Outlook
- ▶ Q & A

1960 1970 1980 1990 2000 2010 ...



Drilling of bearings and watch jewels



Industrial micro-machining in glass

1960 1970 1980 1990 2000 2010 ...

Drilling of diamond

Laser cutting of glass

Industrial laser cutting of sapphire

Drilling of bearings and watch jewels



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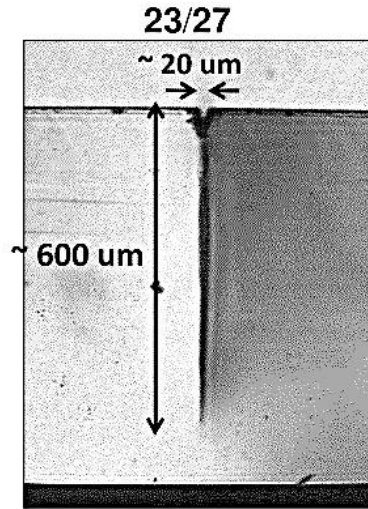
Drilling of diamond

Laser cutting of glass

Industrial laser cutting of sapphire



Drilling of bearings and watch jewels



Industrial micro-machining in glass

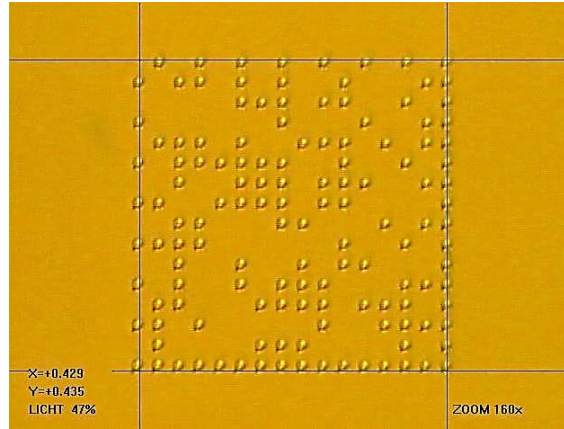
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Industrial laser cutting of sapphire

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Industrial micro-machining in glass

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Drilling of diamond

Laser cutting of glass

Industrial laser cutting of sapphire

## Modify optical properties

Windows with lamellae

Optical gratings

Optical filters

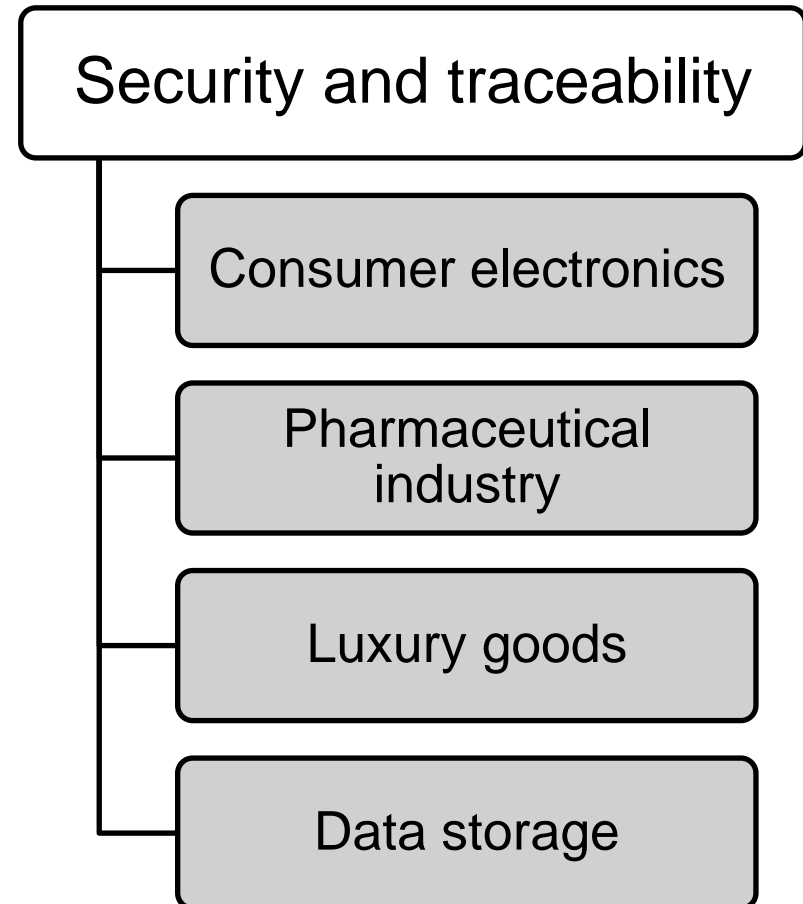
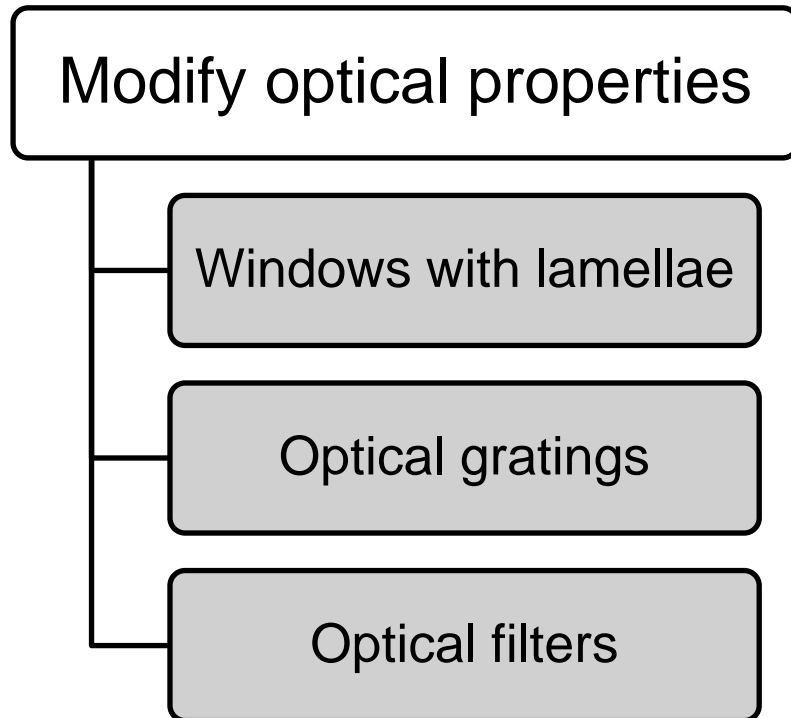
## Security and traceability

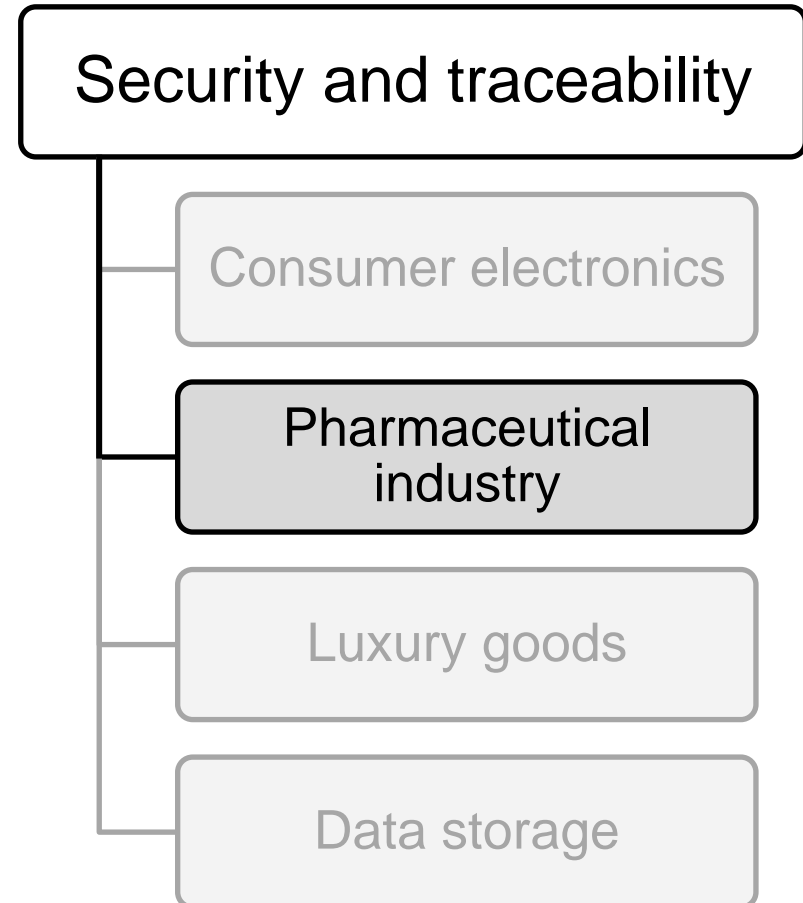
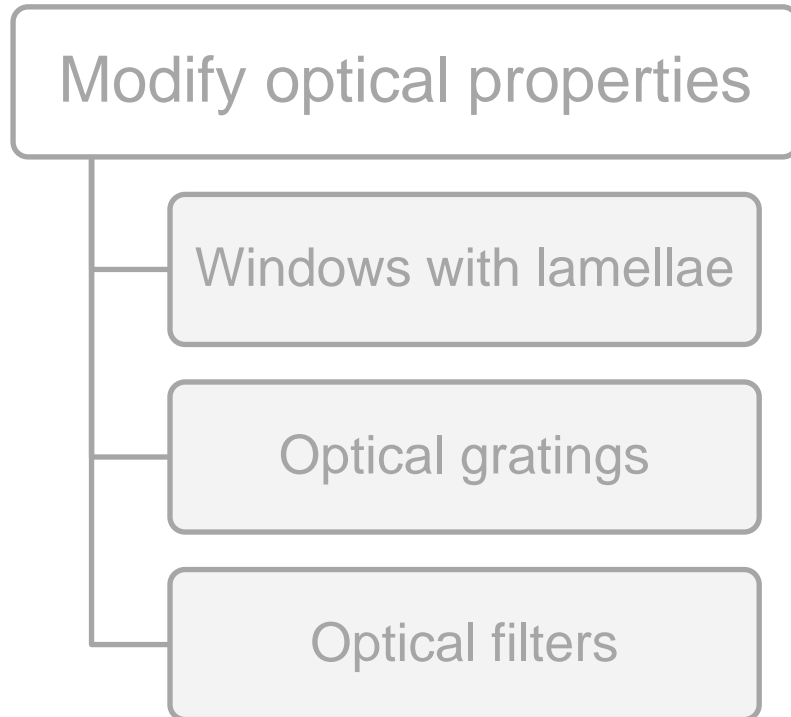
Consumer electronics

Pharmaceutical  
industry

Luxury goods

Data storage





- European commission
  - «EU Fights Fake Medicines» (2011)
  - «Europe, putting patient first» (2011)
  - «Safe medicines for the EU» (2012)
- New guidelines (2011/62/EU)
- Implementation by 2018

[http://ec.europa.eu/health/human-use/falsified\\_medicines/index\\_en.htm](http://ec.europa.eu/health/human-use/falsified_medicines/index_en.htm)

## Disposable syringes 1.0 ml



### Typical applications

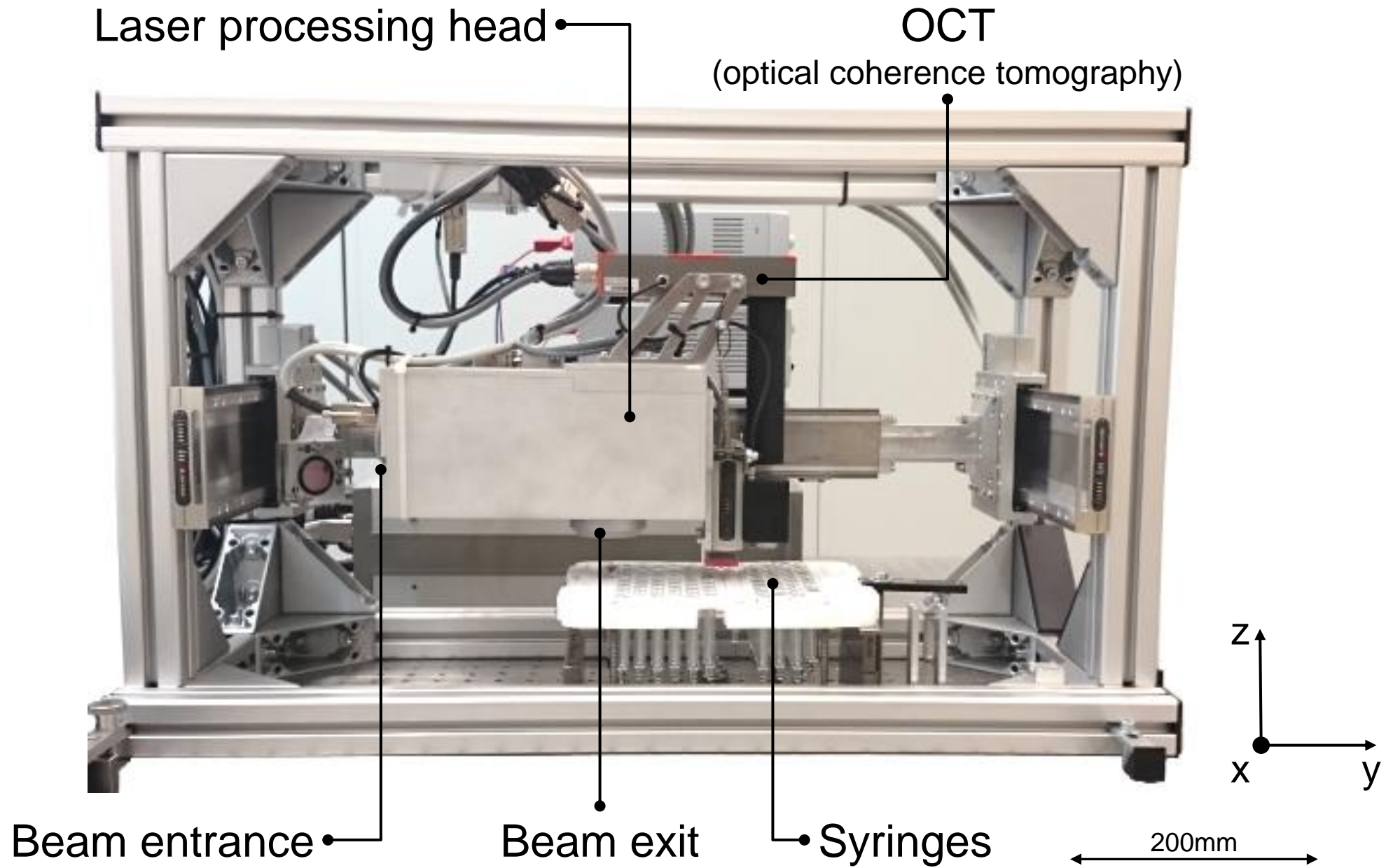
- EPO
- Insulin
- etc.

### Competences IPPE

- Writing security code
- Reading security code

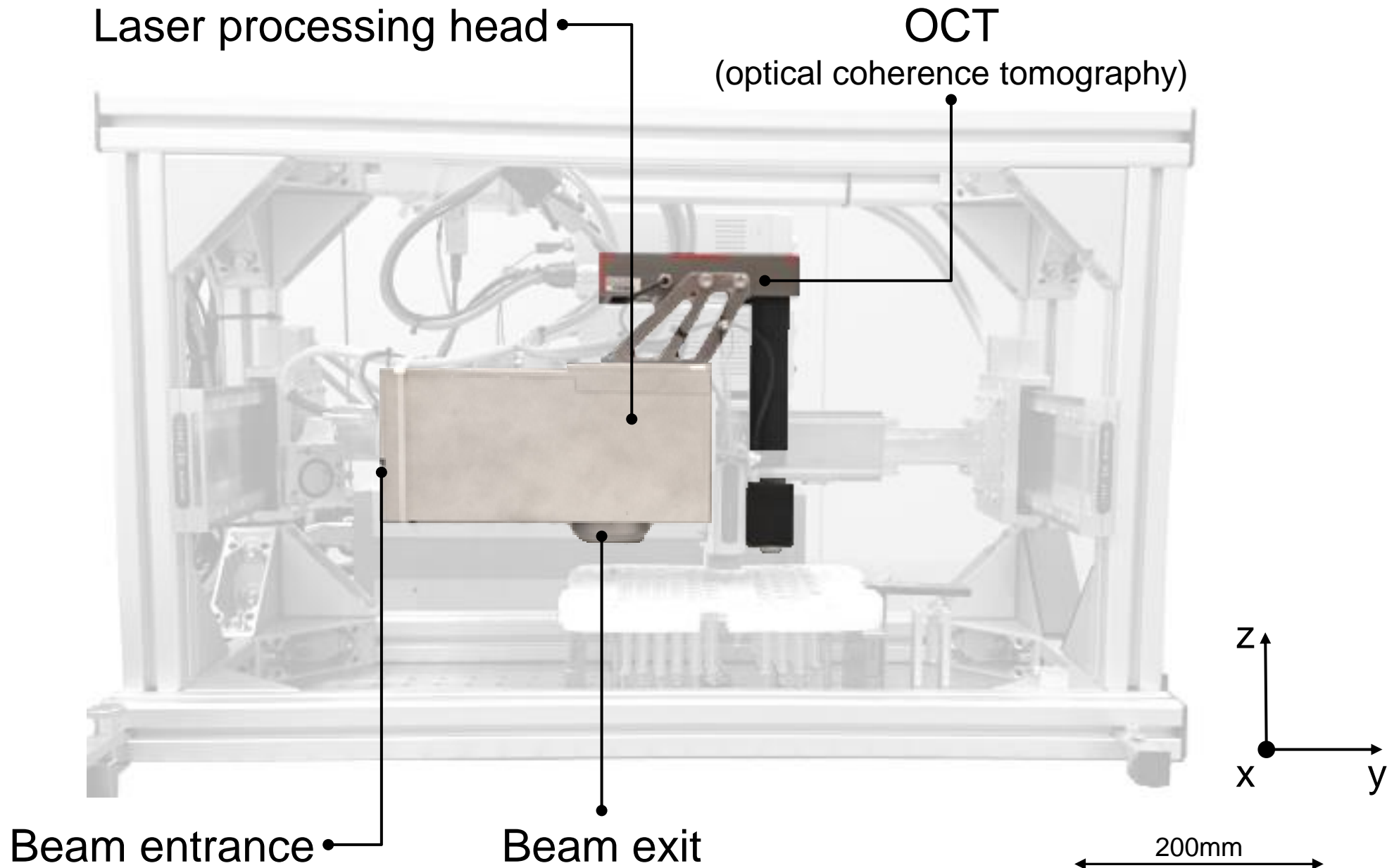
**SCHOTT**

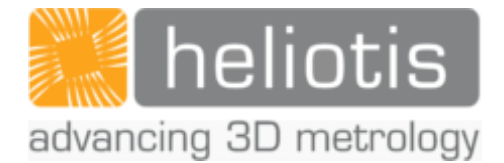
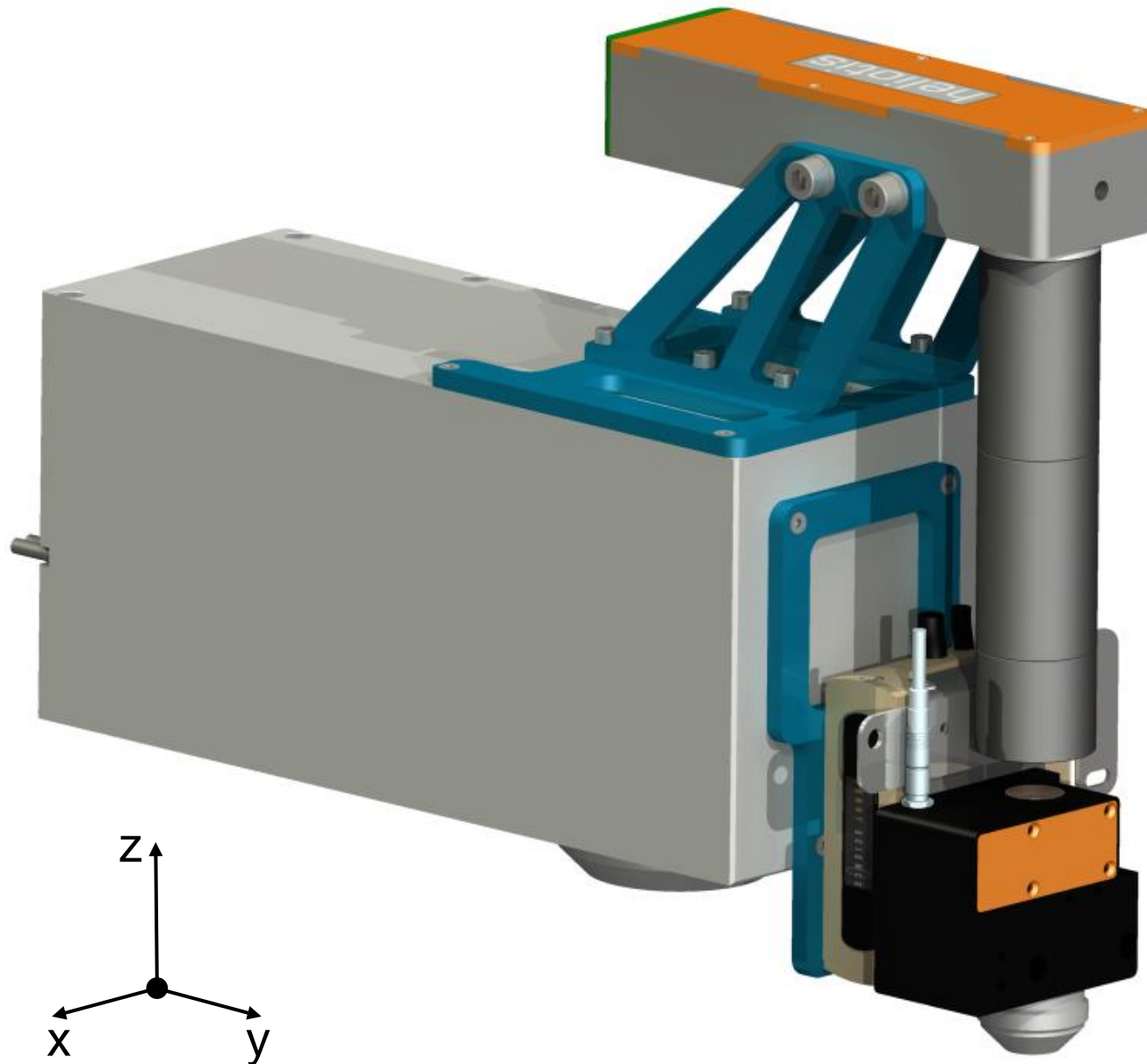
# Example





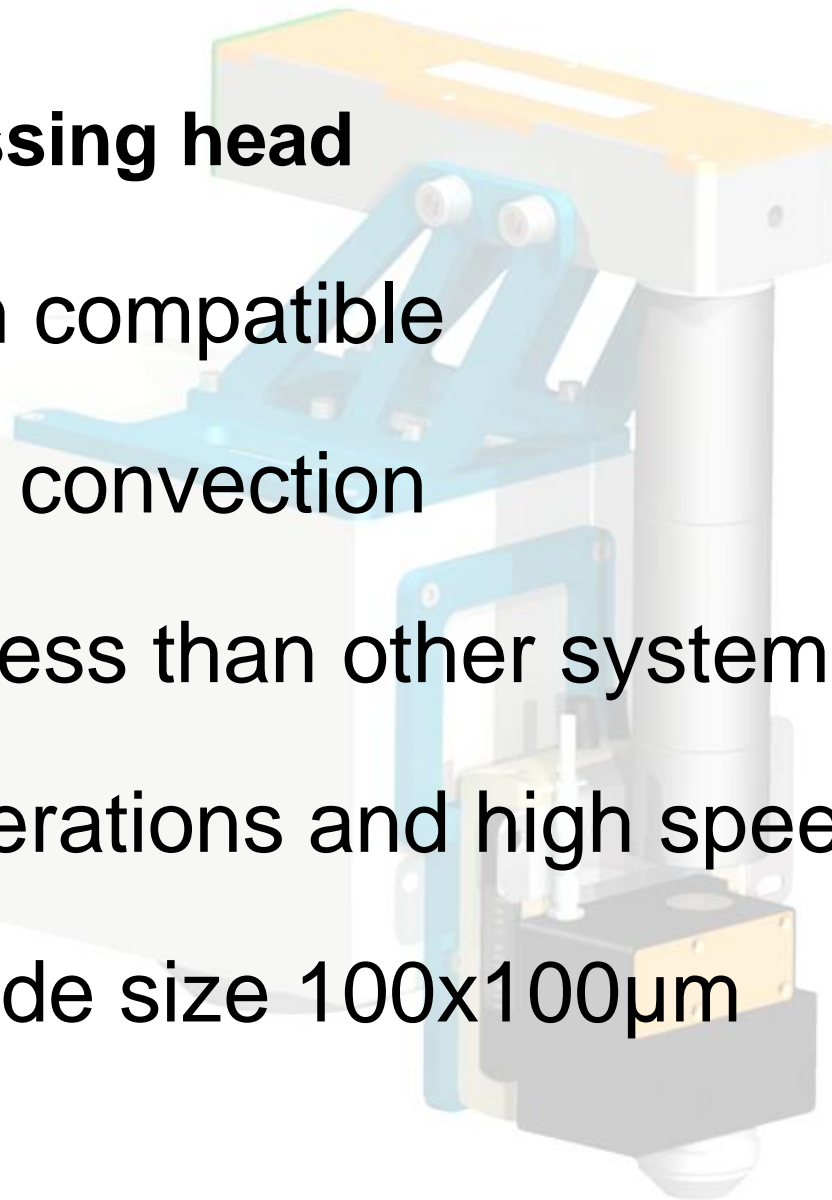
# Example



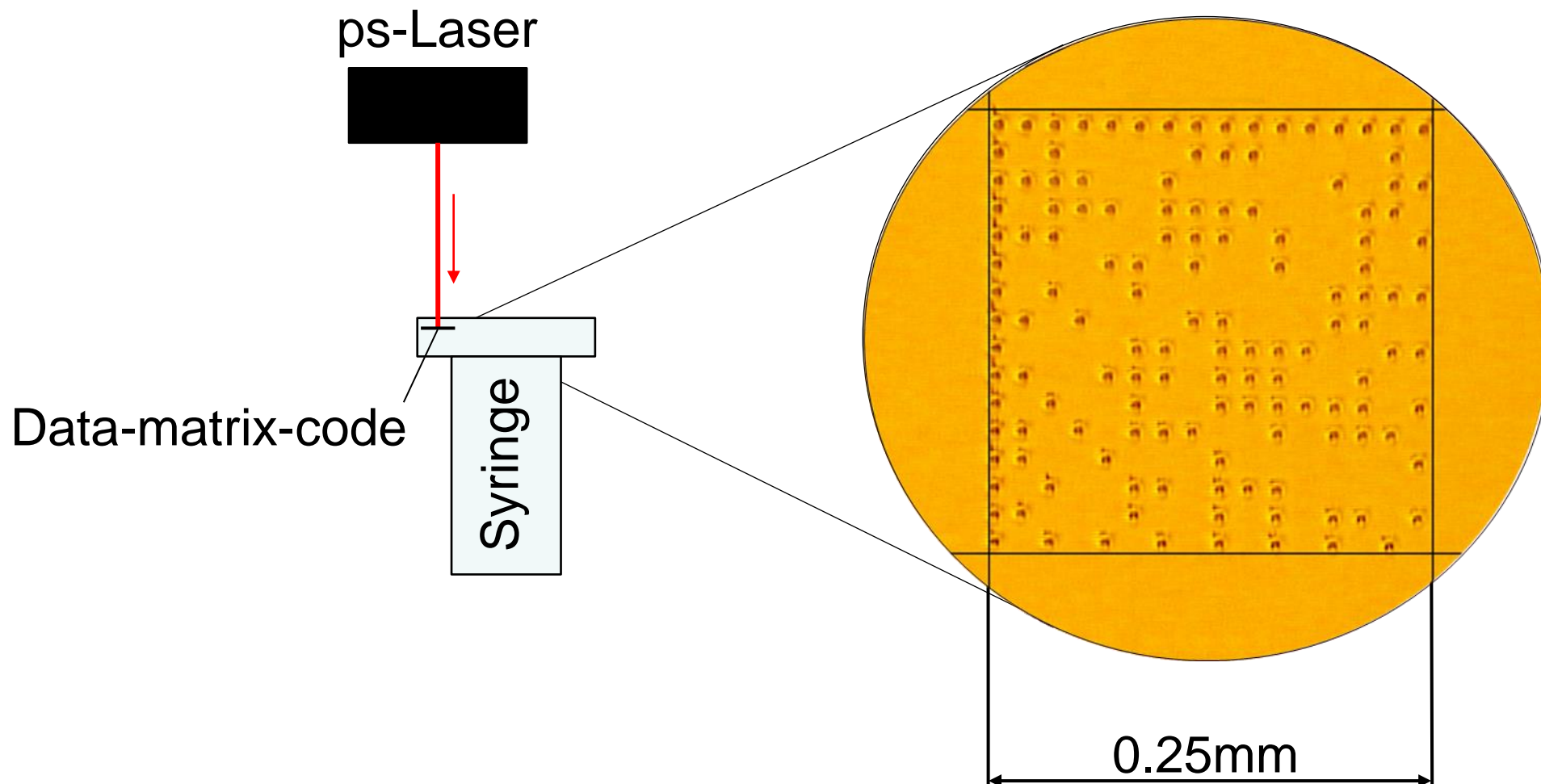


## Laser processing head

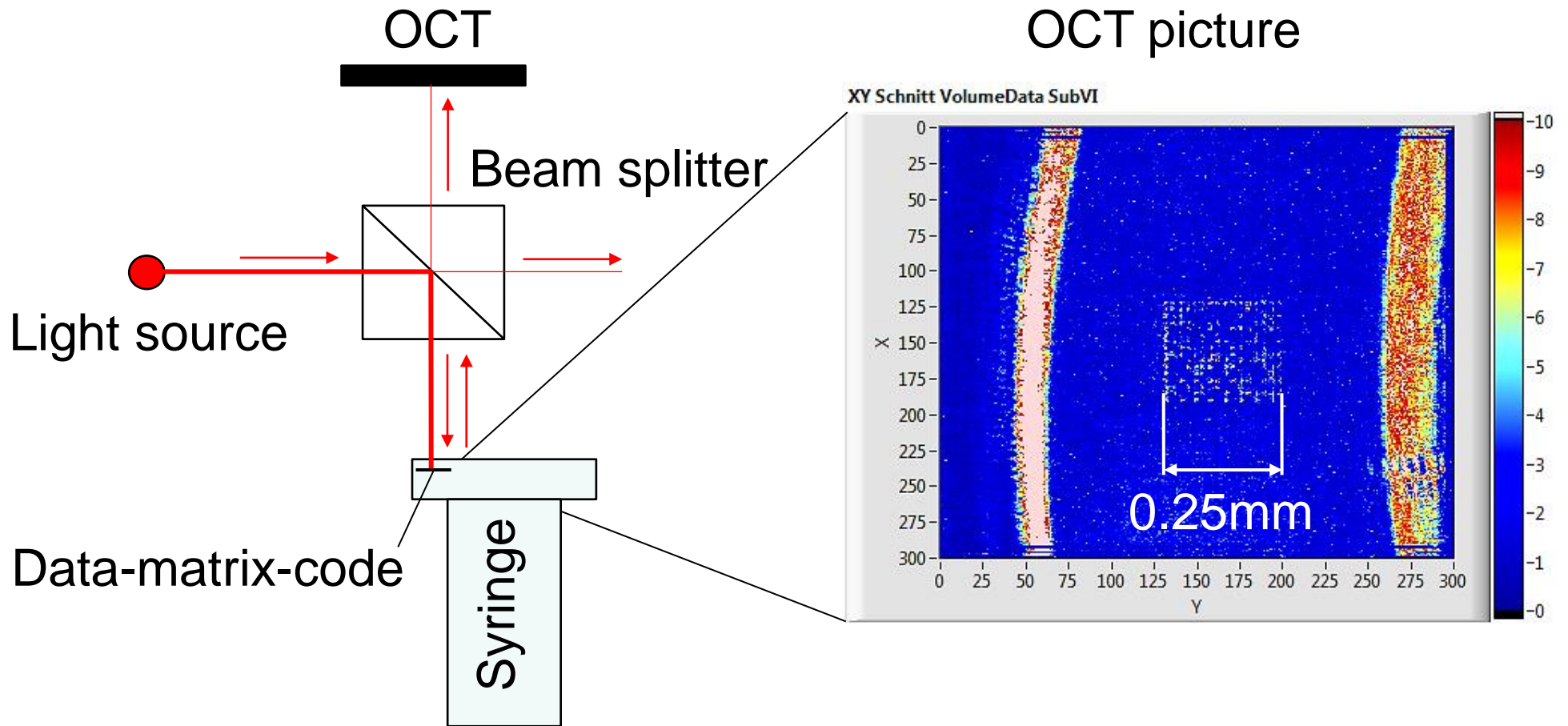
- Cleanroom compatible
- Cooling by convection
- 3kg (25% less than other systems)
- Fast accelerations and high speeds
- Minimal code size 100x100 $\mu$ m



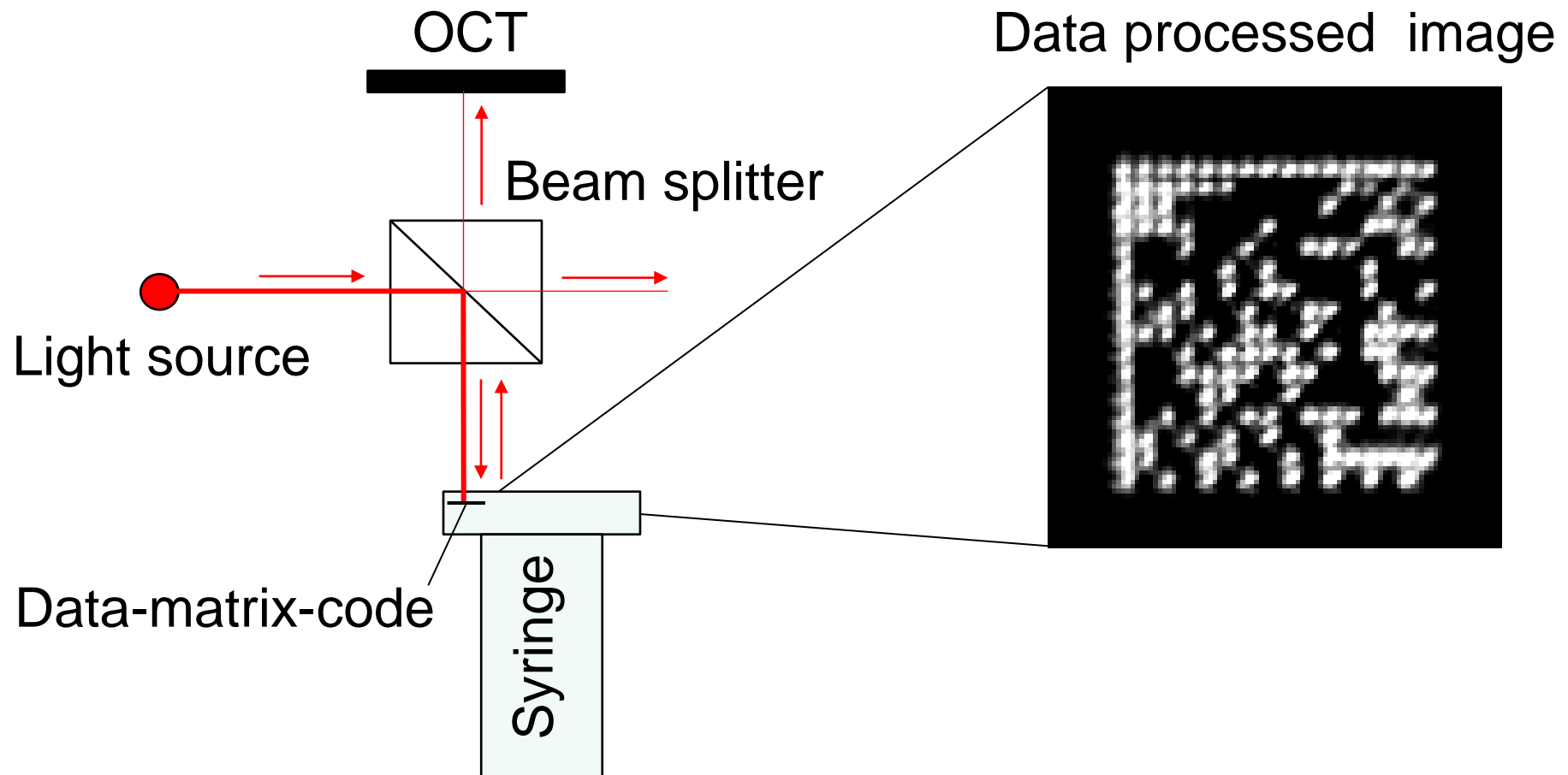
## Code-writing process



# Code-reading process

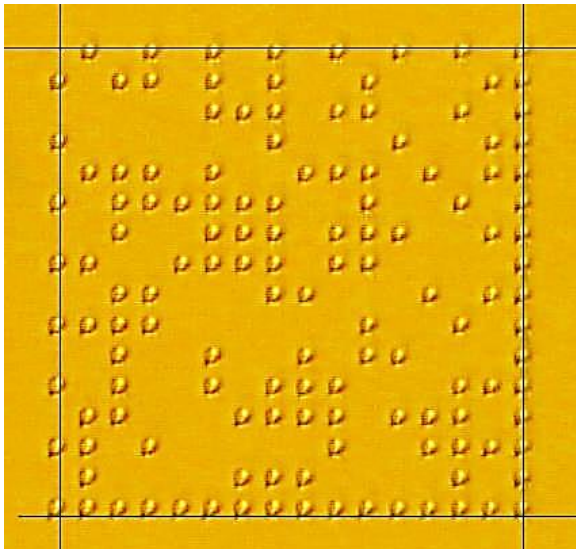


## Code-reading process



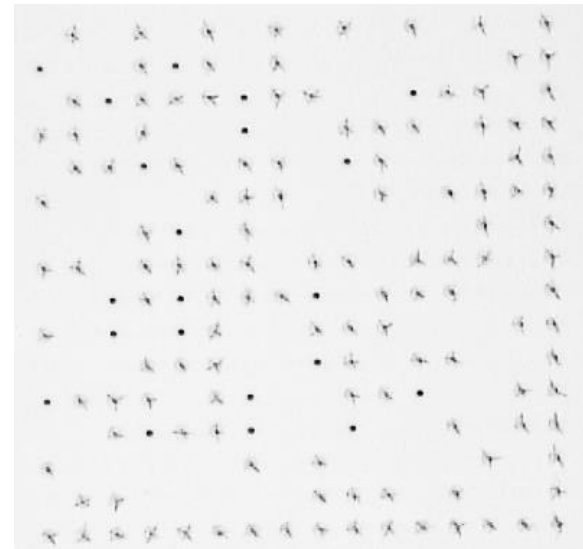
## We make dots, not cracks!

### Micro dots



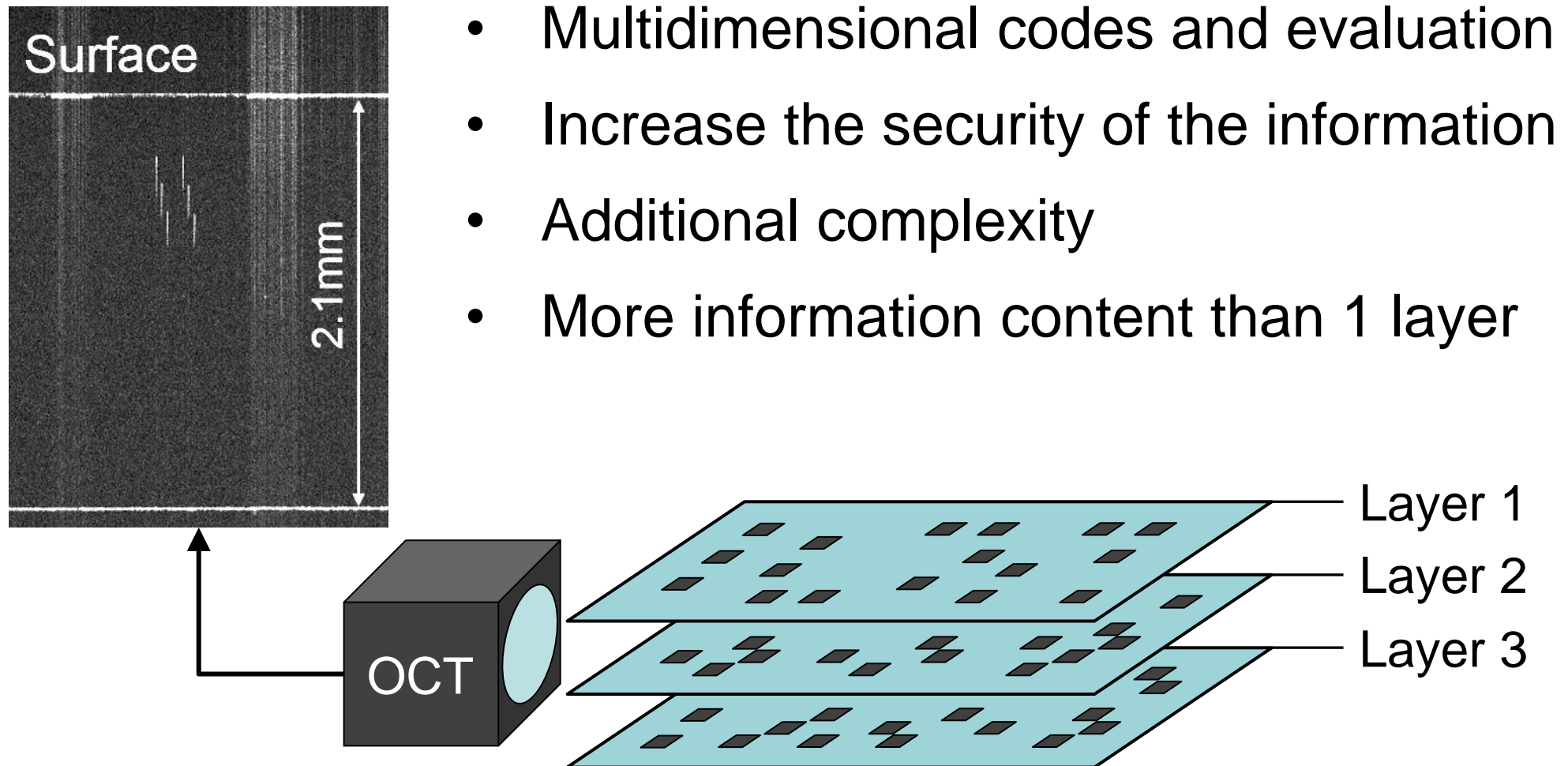
- «cold process»
- No loss of stability

### Cracks



- Too much energy
- Internal tension
- Complete break under load

## Multiple layers





## **Challenging surfaces**

- Caused during the production

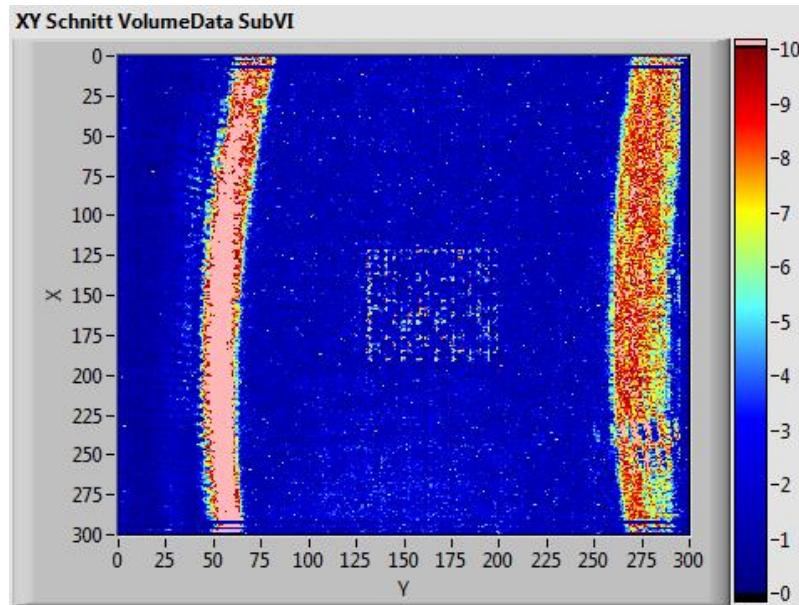
*Scratches*

*Pores, Cavities*

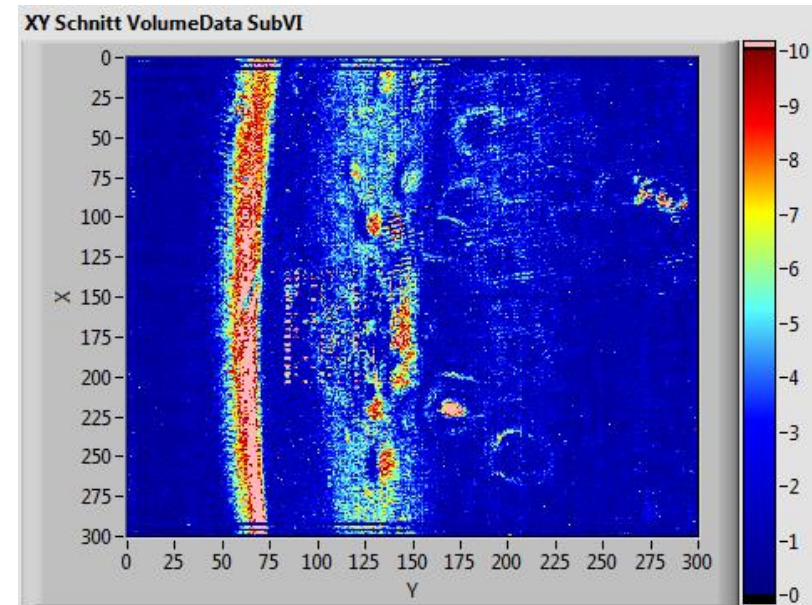
- Can be tackled by IPPE

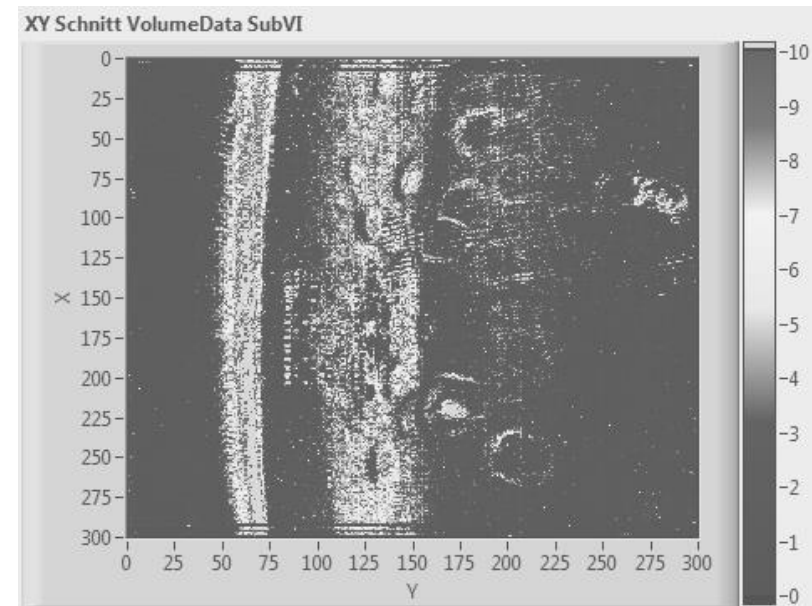
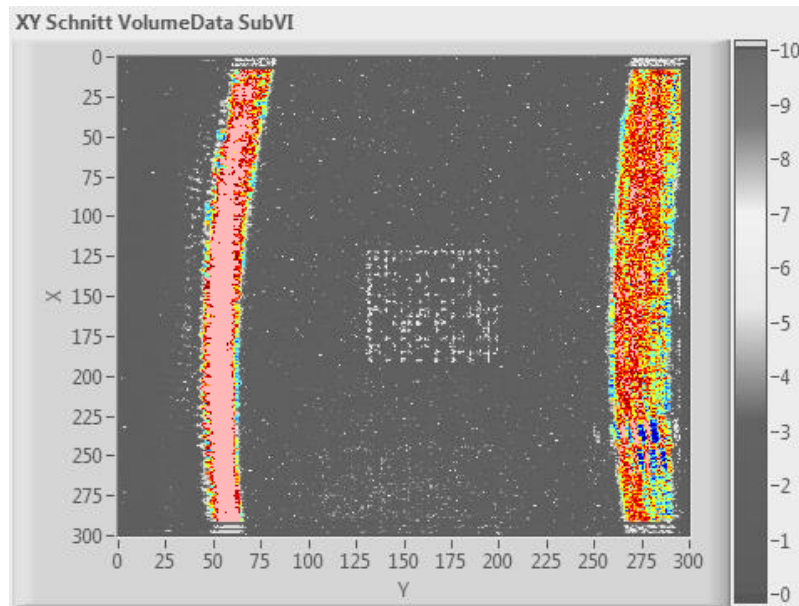
*Surface geometry*

## Good surface quality

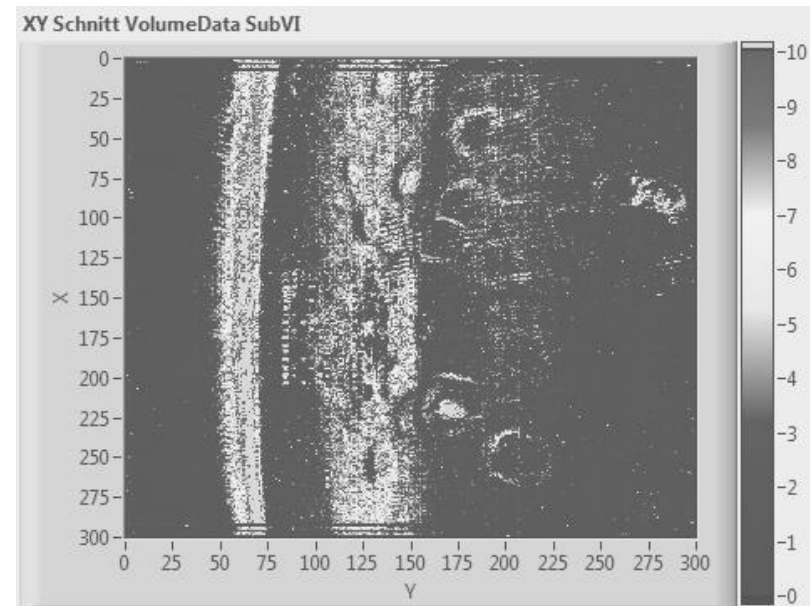
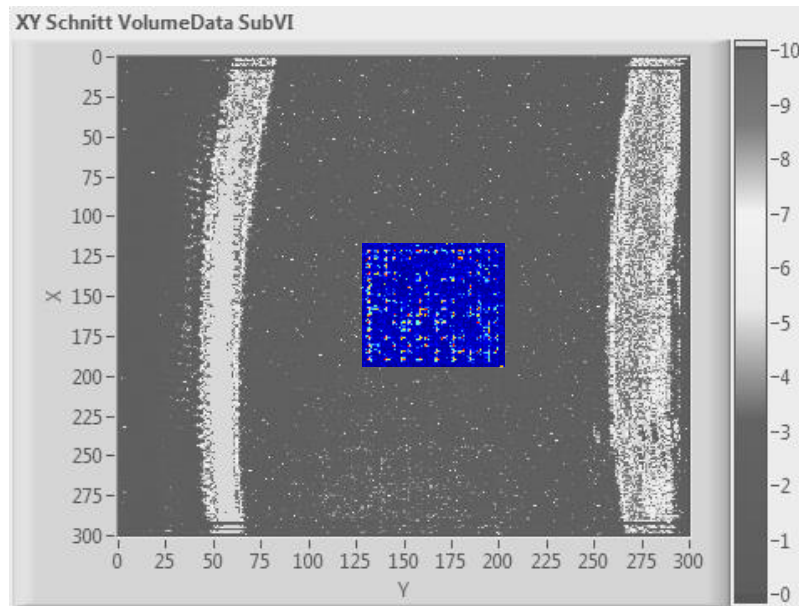


## Bad surface quality

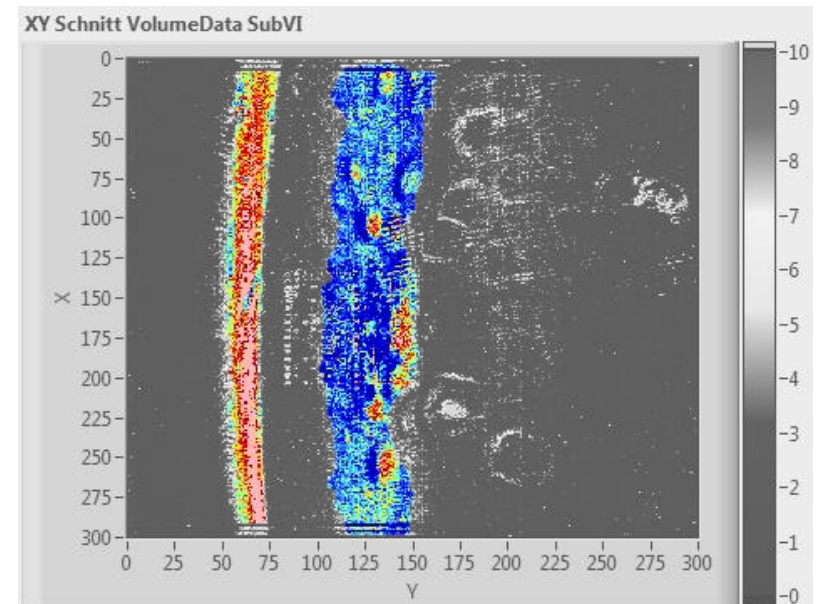
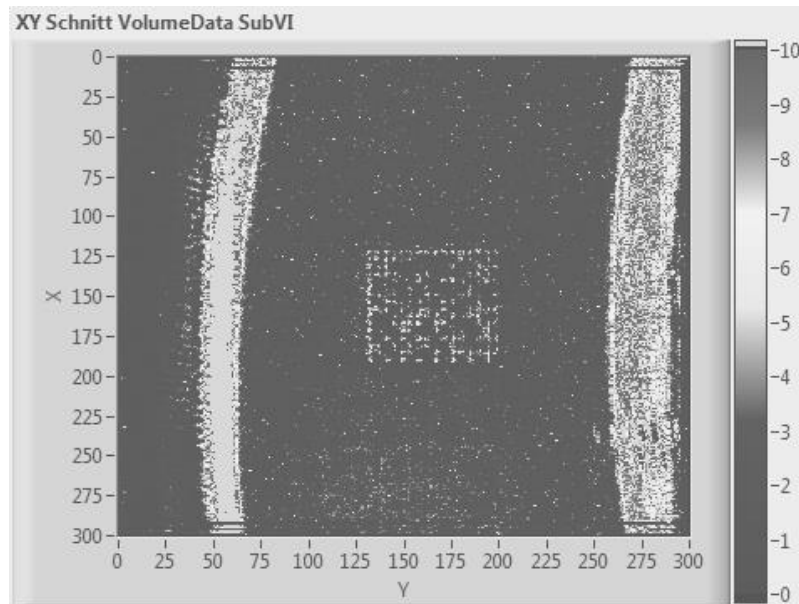




- Syringe-flange edges (red)

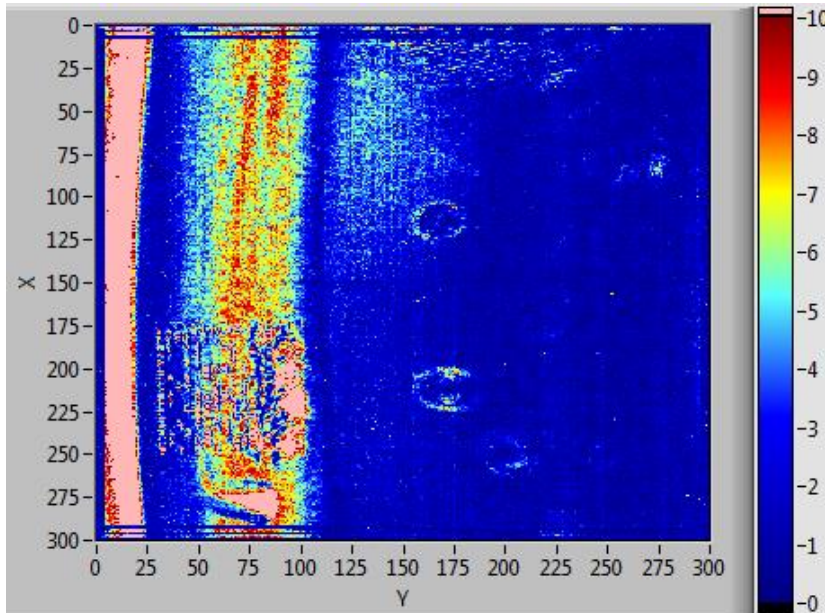


- No scratches
- No pores or cavities
- Very clear picture (blue)



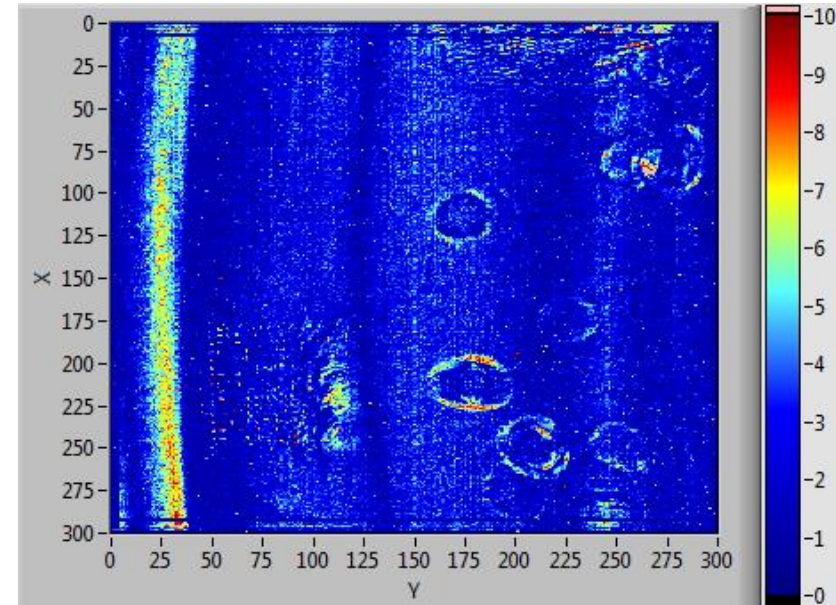
- Syringe-flange edge (red)
- Polarization (blue)

## Without polarizer

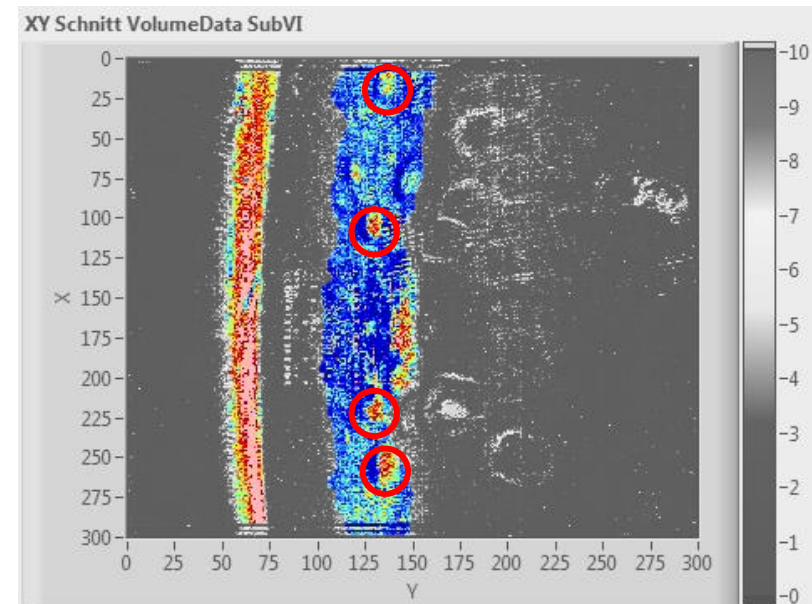
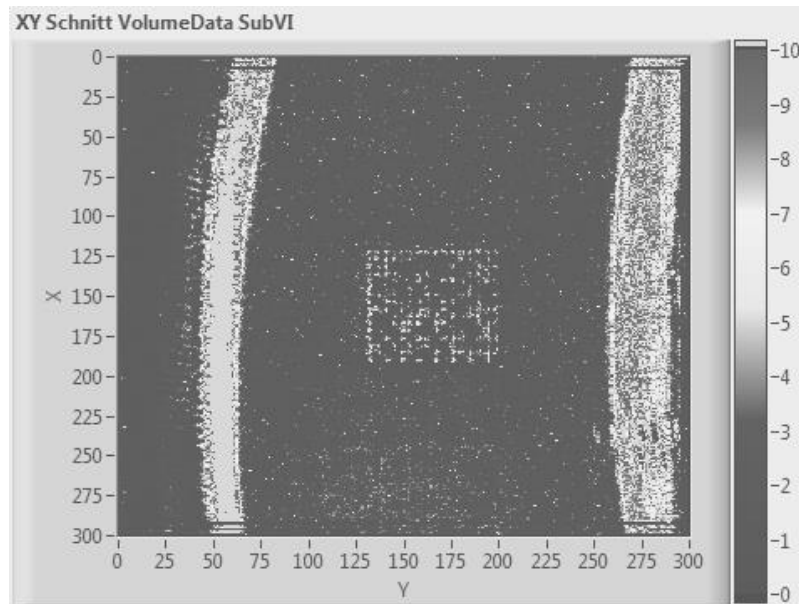


- Hidden code by polarization

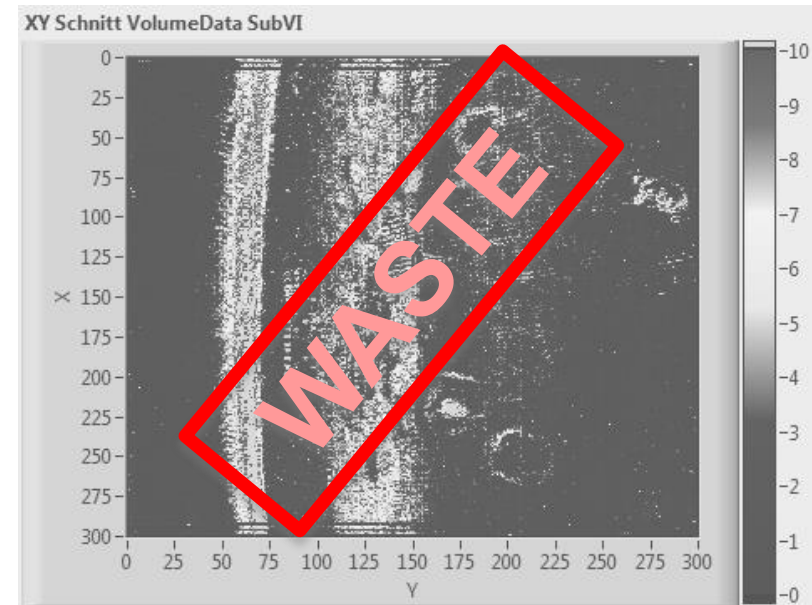
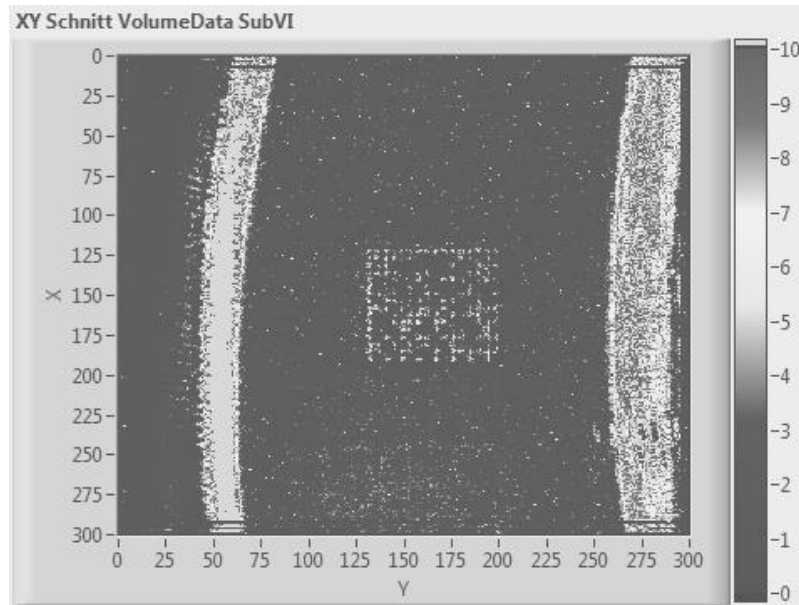
## With polarizer



- Visible code



- Pores and cavities (red-rings)
- Impossible to read the code

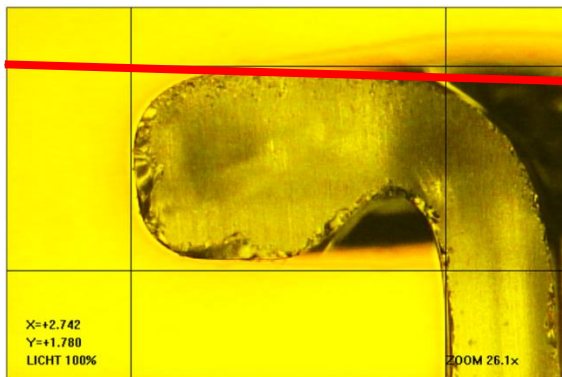


- Pores and cavities (red-rings)
- Impossible to read the code



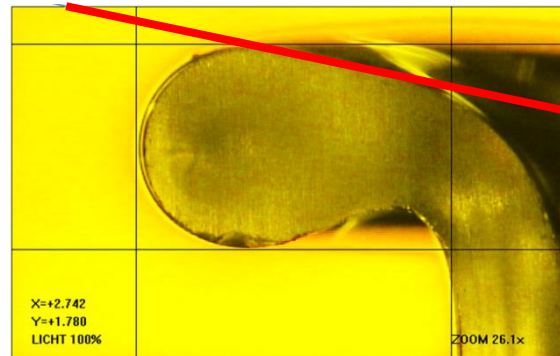
## Surface types / syringe flanges

### Plane



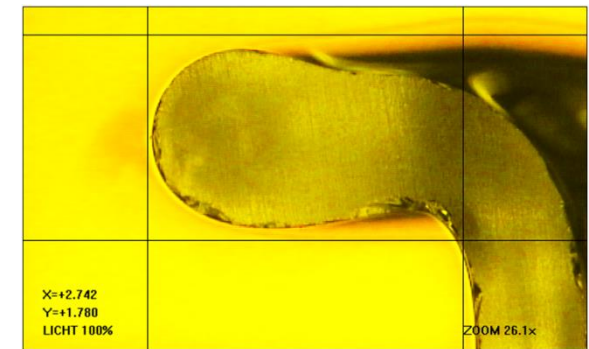
- Best conditions
- Wide range

### Angle

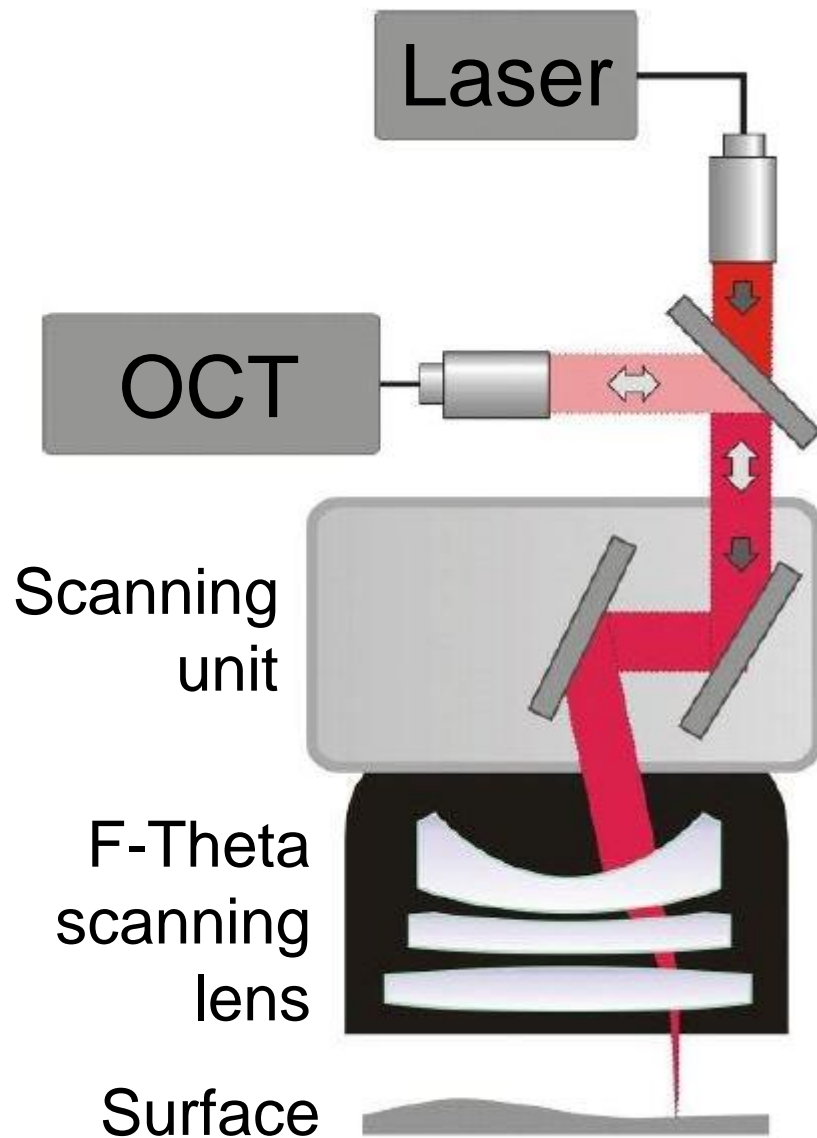


- Suitable conditions
- Limited range

### Undefined

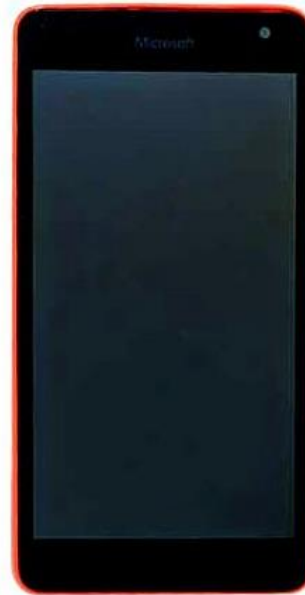


- Difficult conditions
- Undefined range

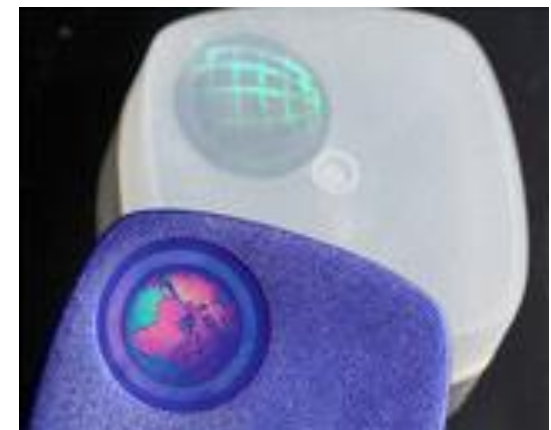


- Automatic process initialization (before)
- Adaptive machining (during)
- Inline control (during)
- Quality management (after)

source: WZL/Fraunhofer IPT



- Colored codes in transparent materials
- Functional structures
- Rotating polarizer to prevent polarization
- Improve the process of laser structuring in transparent materials



**Thank you for your attention**

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