SWTEST

PROBE TODAY, FOR TOMORROW

2024 CONFERENCE

When wafer test probes meet Femtosecond Laser micro cutting and turning

posalux®

SWISS MADE

Valentin Beuchat

Posalux SA

Overview

- Introduction
- Wafer Test Probes Definition
- Femtosecond Laser Technology & More
- Technical Specifications
- Applied Research
- Femtosecond Laser Technology Pros
- Conclusion

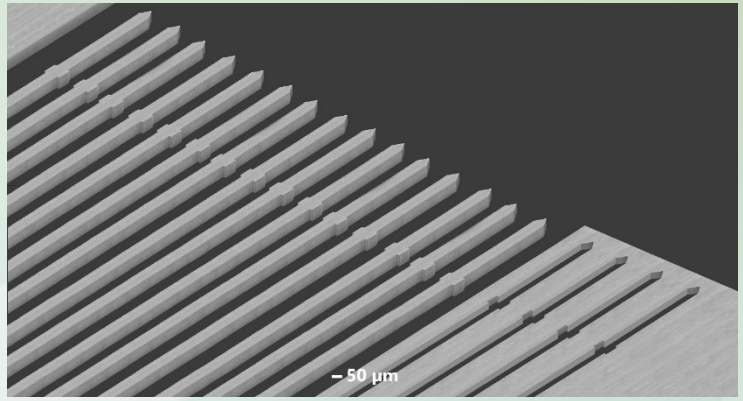
Introduction

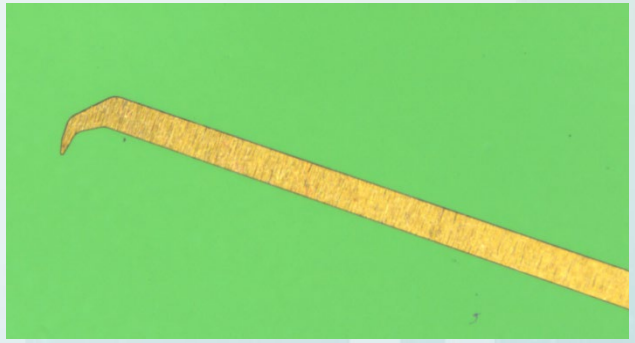
- Probe cards are getting more and more advanced with tighter requirements and tolerances

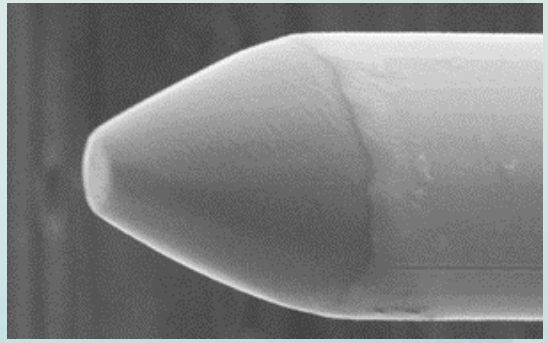
- Wafer test probes follow the same trend
- What can be done to match current and future needs?
- Studies, research, and applications done with Femtosecond laser technology

Wafer Test Probes Definition

- Probe pin is the direct contact interface between the probe card and the wafer
- Three types of probes under study:
  1. MEMS and vertical probes:
     - Square and rectangle holes in the guide plate
     - Cut out of a metal foil
  2. Cantilever probes:
     - Cut out of a metal foil
  3. Wire probes:
     - Round holes in the guide plates
     - Wire of coil



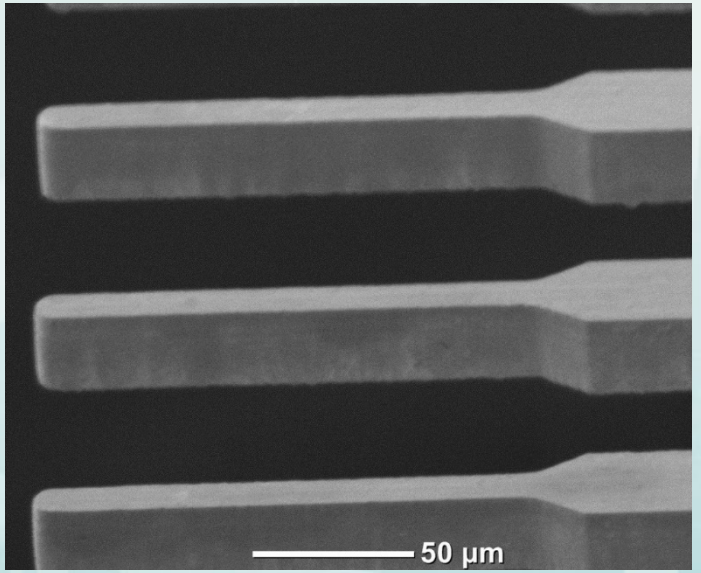


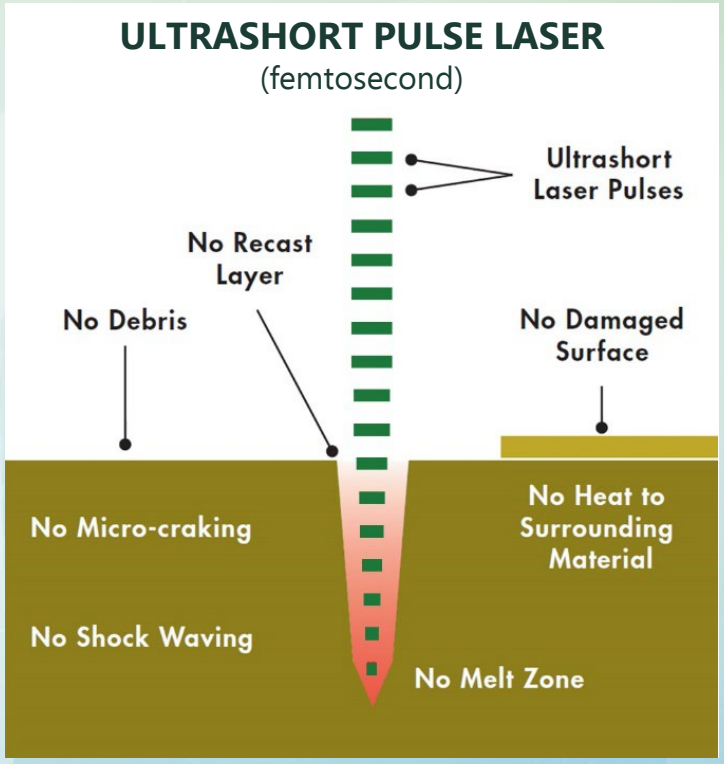


- Common technology used for manufacturing: Femtosecond laser

Femtosecond Laser Technology & More (1/2)

- Ultrashort pulse laser < 500 fs
- No thermal effects
- High quality (no recast debris on surface, good roughness)
- High productivity (high repetition rate)
- Repeatability
- Accuracy (dimensions)

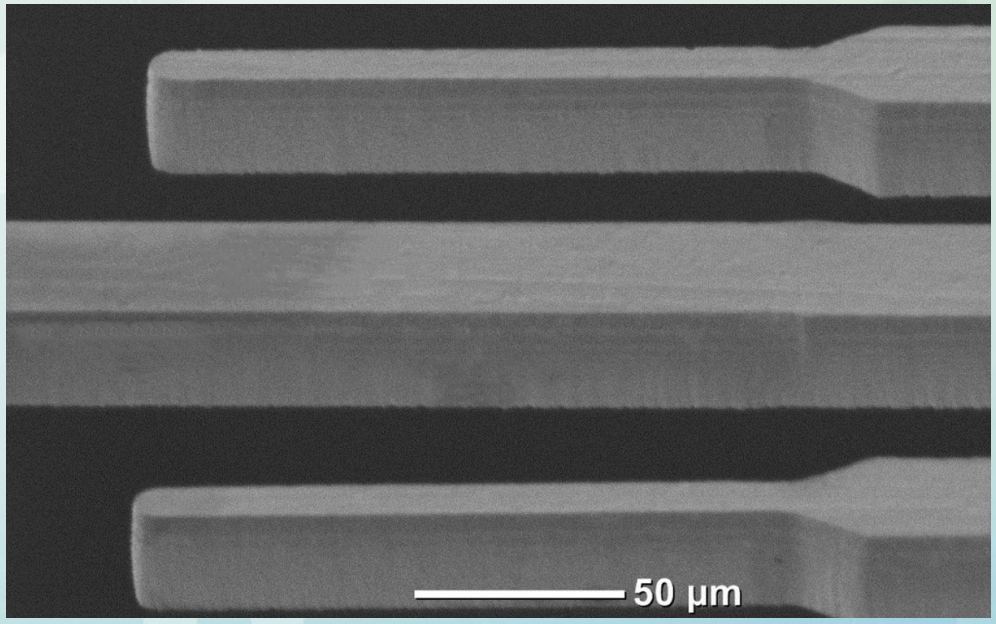




Femtosecond Laser Technology & More (2/2)

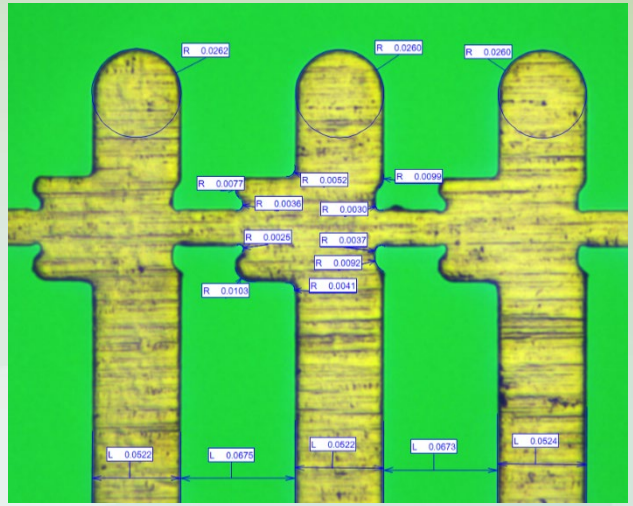
- A Femtosecond laser source alone is nothing without these three other key elements:

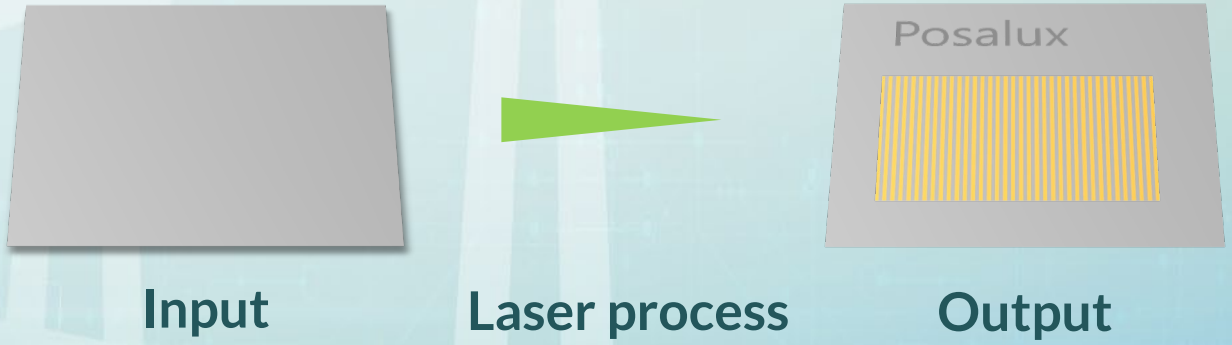
1. Precession scanner
   - Spiral-shaped tilted beam
2. Machine construction
   - Statics, kinematics, dynamics, and thermic
3. Process engineering
   - Know-how and experience



Technical Specifications (1/3)

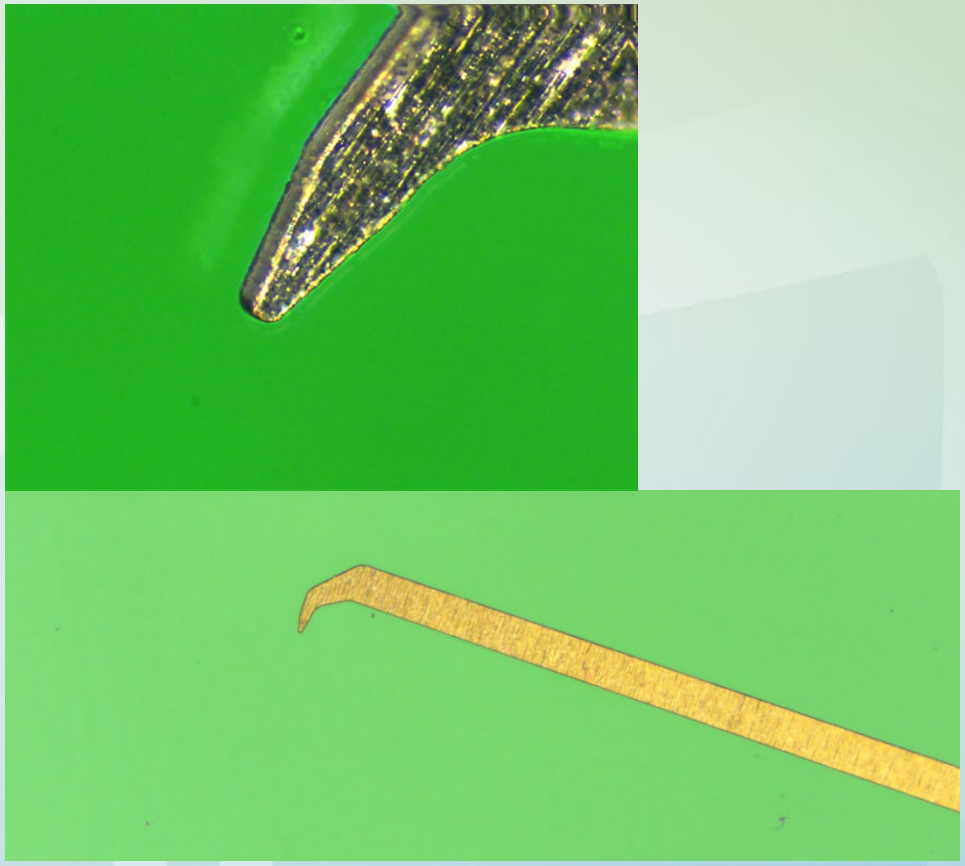
- Vertical and MEMS Probes:
  - Mechanical and electrical functions
  - Pin force
  - Current carrying capacity (CCC)
  - Straightness of side walls
  - Surface roughness
  - Dimensional tolerance
  - Tip shape
  - Concentricity
  - Angle





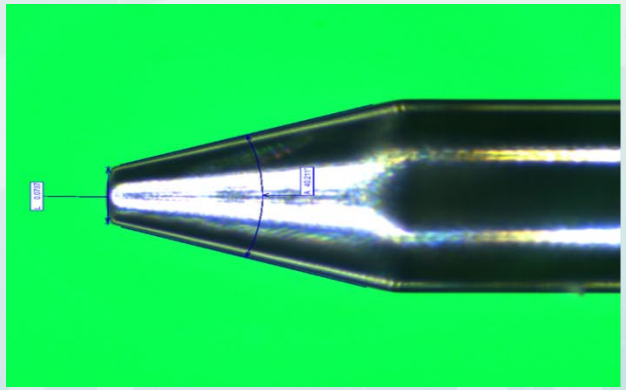
Technical Specifications (2/3)

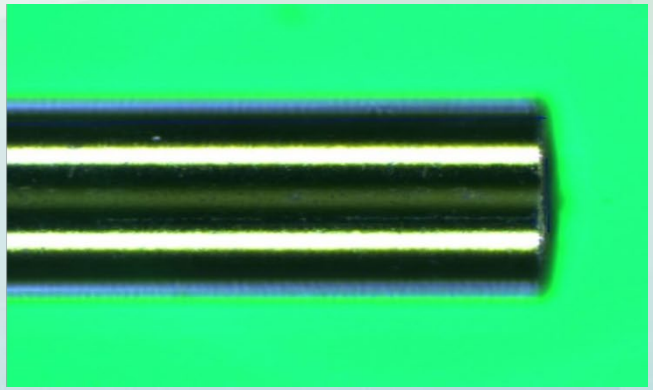
- Cantilever Probes:
  - Similar specs as the MEMS and vertical probes
  - Flexion of the probe body
  - Height between hook and probe body
  - Stroke of the hook



Technical Specifications (3/3)

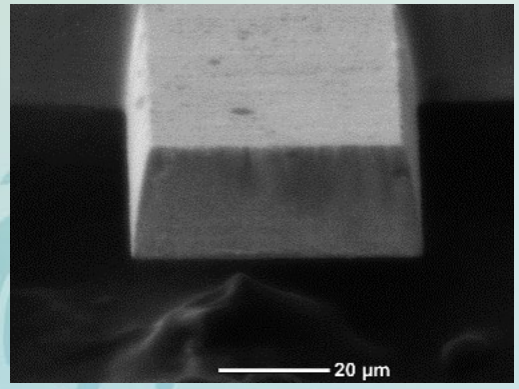
- **Wire Probes:**
  - Straightness
  - Coaxiality/Concentricity
  - Length
  - Angle
  - Tip shape
  - Trimming



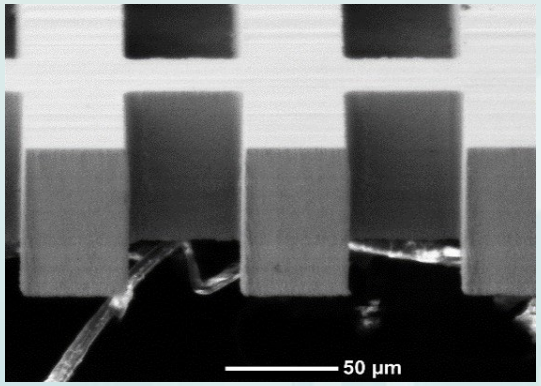


Applied Research (1/6)

- Vertical and MEMS Probes:
  - Straightness of side walls
  - Tip thickness reduction



X-section Before



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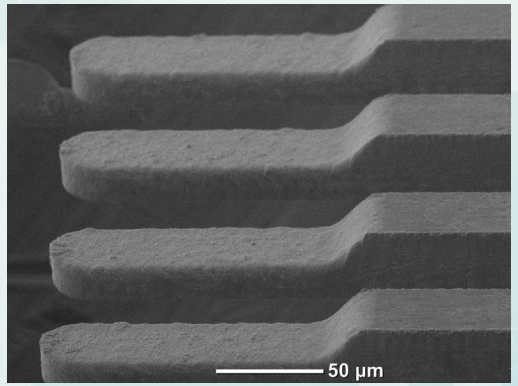
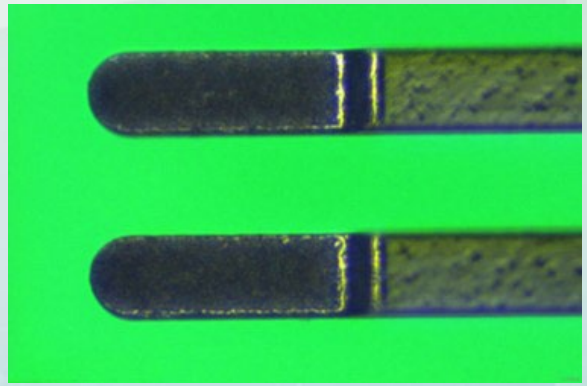


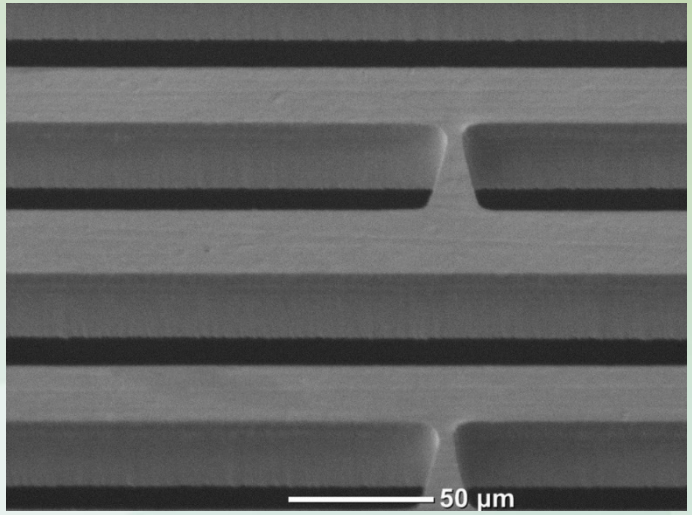
Tip ablation

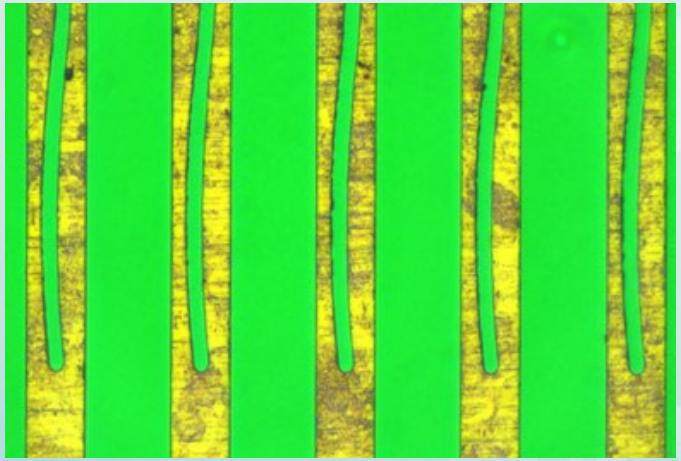


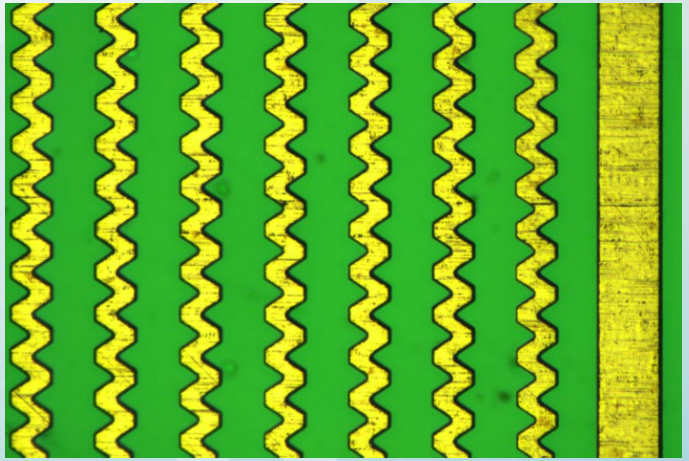
Tip ablation

Applied Research (2/6)

- Vertical and MEMS Probes:
  - Mechanical and electrical functions
  - Pin force
  - Surface roughness
  - Current carrying capacity

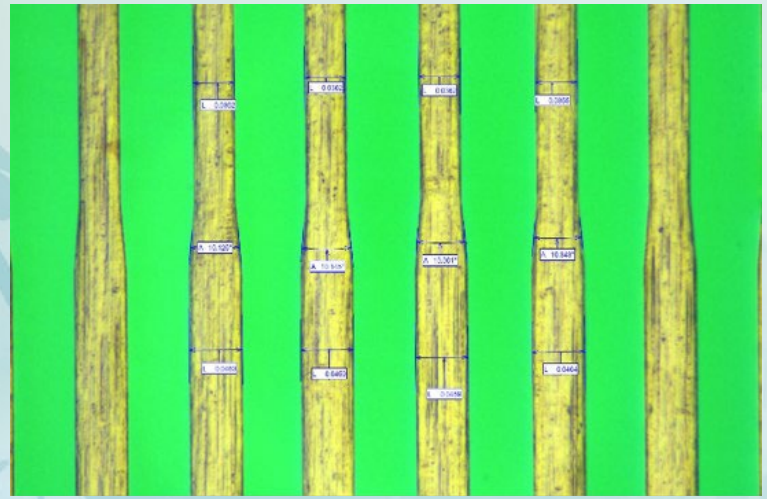


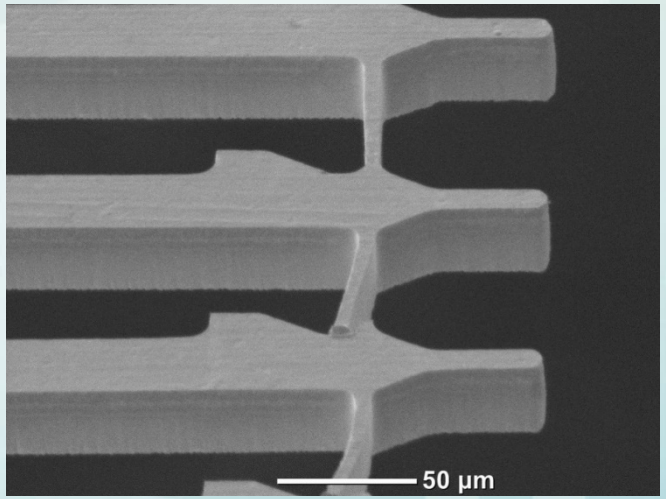




Applied Research (3/6)

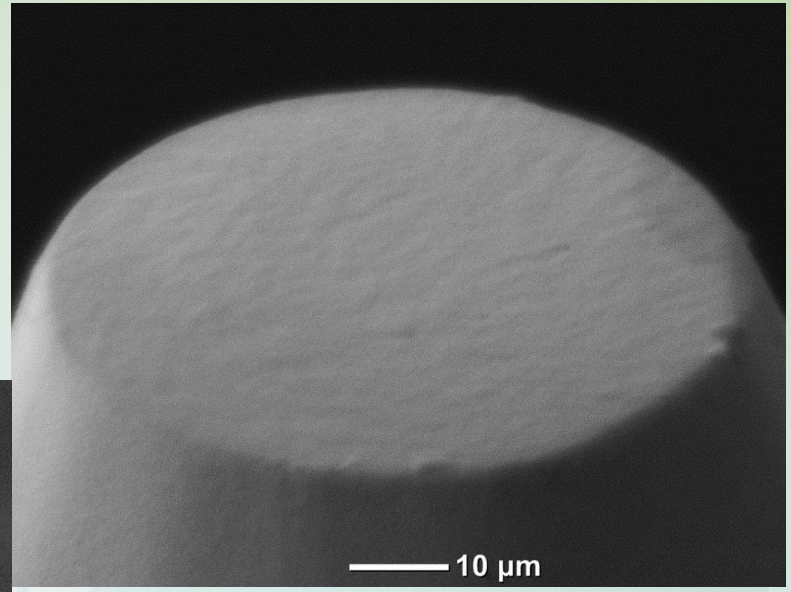
- Vertical and MEMS Probes:
  - Tabs and tabless
  - Size and material thickness

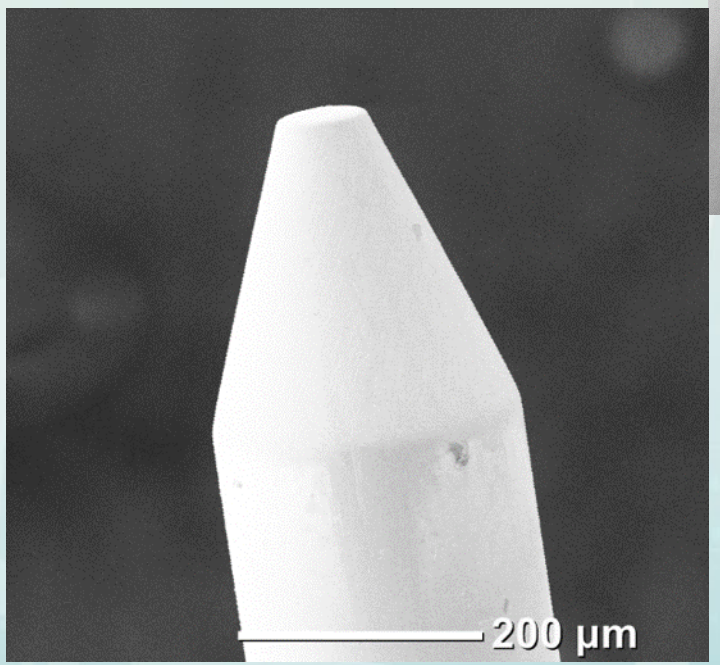




Applied Research (4/6)

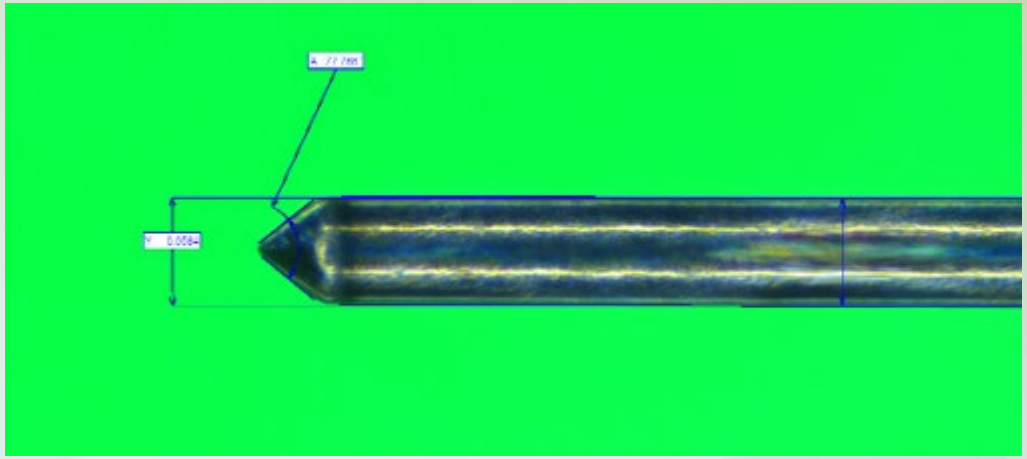
- **Wire Probes:**
  - FTO (Femto Turning Operation)





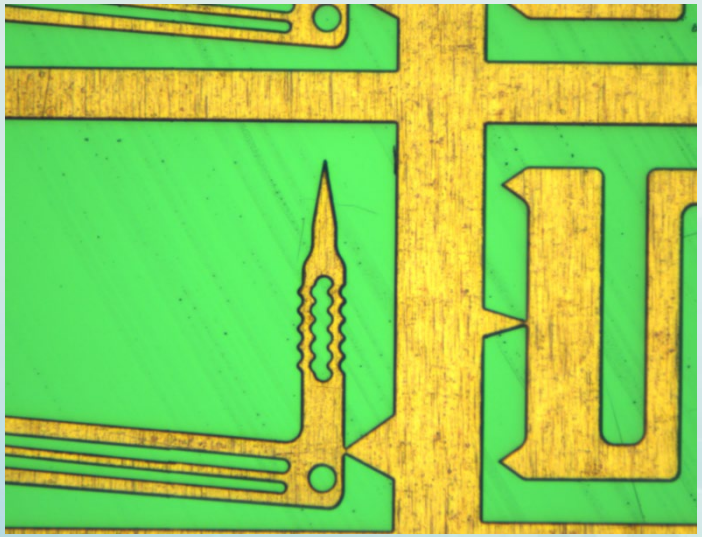
Applied Research (5/6)

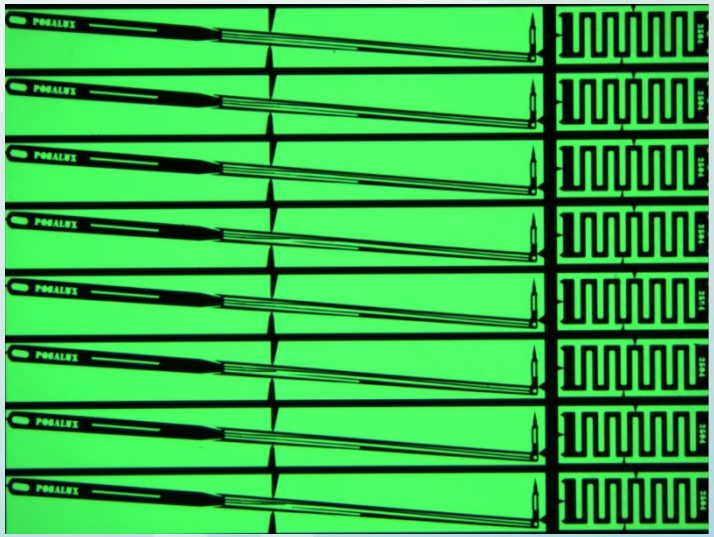
- Wire Probes:
  - Straightness
  - Coaxiality/Concentricity
  - Length
  - Angle
  - Tip shape
  - Trimming



Applied Research (6/6)

- Cantilever Probes:
  - Flexion of the probe body
  - Height between hook and probe body
  - Stroke of the hook





Femtosecond Laser Technology Pros

- Contact-free and dry process
- No thermal effects
- Accuracy
- Flexibility
- No wear of tooling

Conclusion

- We set ourselves some research points and tested them with applications done by Femtosecond laser
- Results show current state of the art
- Additional points and features remain to explore
- Global view of guide plate drilling and probes cutting
- Cutting by Femtosecond laser is one potential innovative way of doing, could it be an alternative to conventional processes?