

An abstract circular graphic on the left side of the slide. It features concentric circles with various segments in shades of blue, green, and white, resembling a stylized eye or a complex optical diagram. The background of the slide is a soft, out-of-focus image of a human eye.

# Imaging Assisted Femtosecond Laser Surgery

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VP Technology and Strategy



# A Laser System for Ophthalmology





## Use Context





## A Surgery Example

# Live Surgery

Prof. Szurman

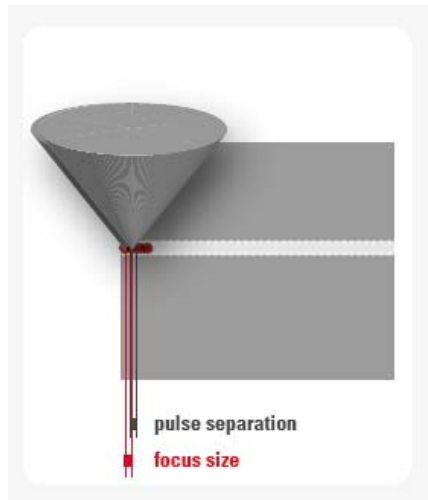
Transmitted to DOC  
Congress



From a scientific Perspective it's a...

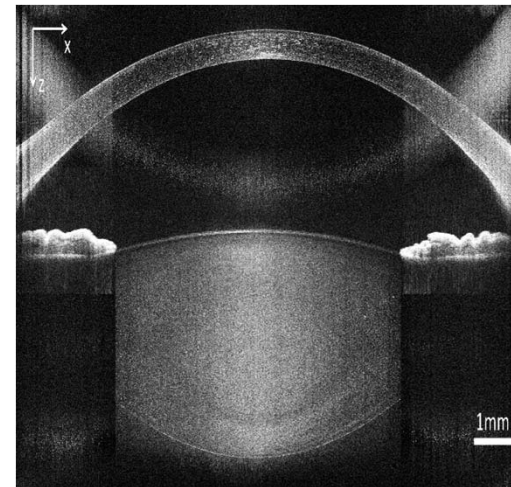
## Combination of two fundamental innovations

### Ultra Short Pulse Laser Technology



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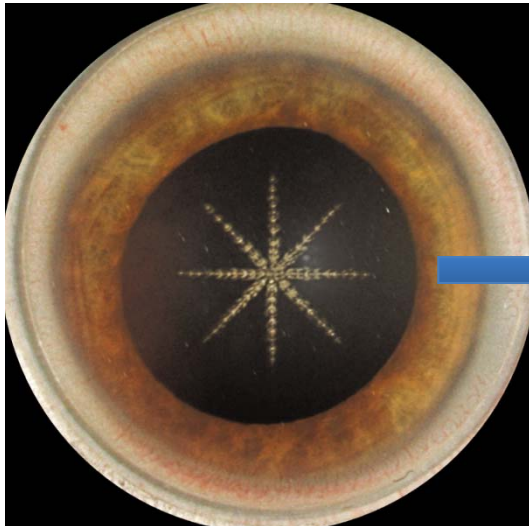
### Low Coherence Interferometry



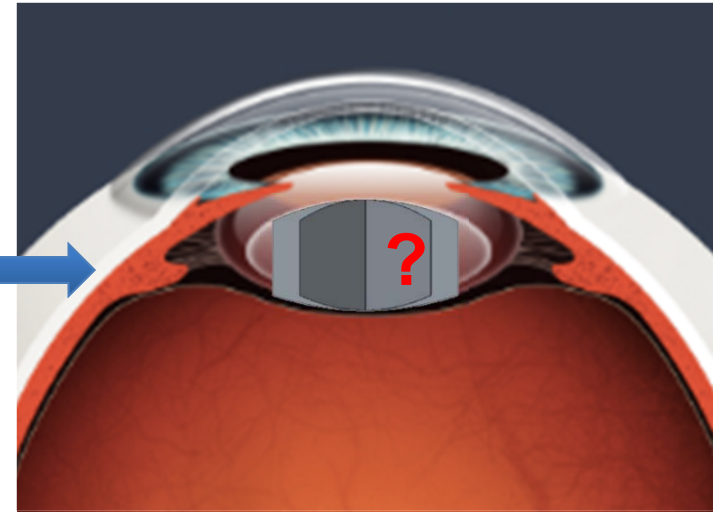
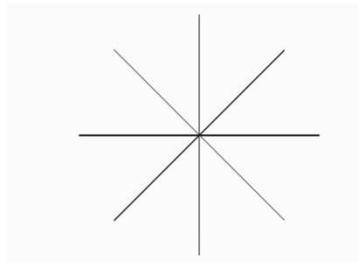


## Surgical Task

Break the lens into pieces for  
disassembly



Lens  
Fragmentation  
Laser Scan Pattern



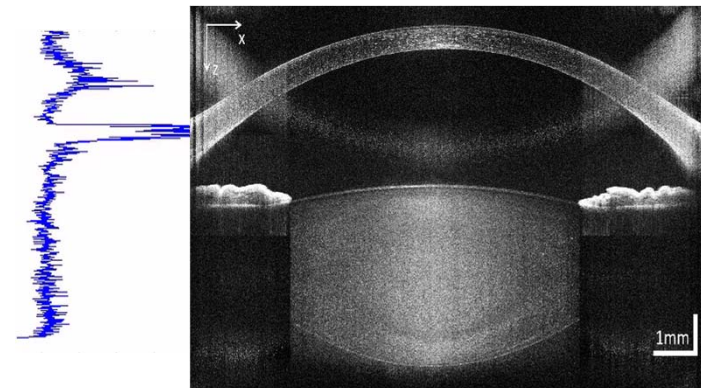
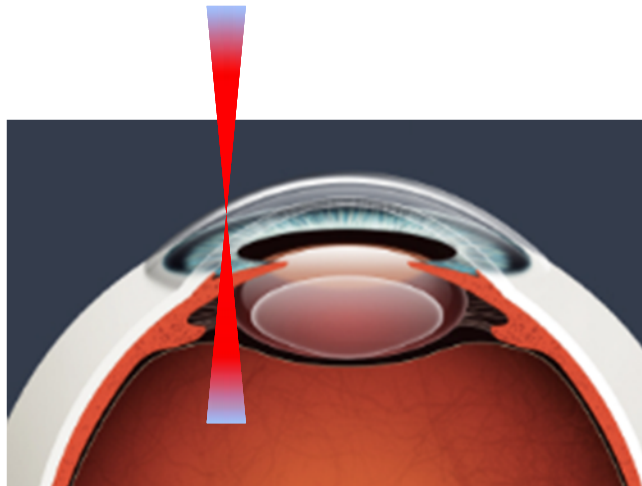
Each Eye is different:  
Depth visualization needed





# Optical Coherence Tomography

- ▶ OCT is best suited for Eye Surgery
- ▶ OCT is a scanning method
- ▶ How to integrate OCT in the laser system?





## Design Challenge

### Upgrade of an existing Laser Platform

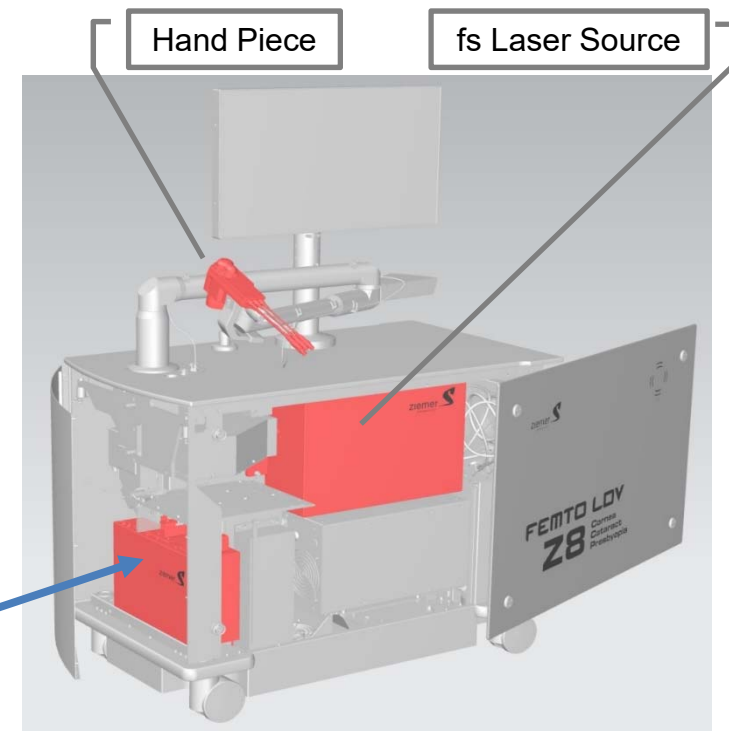
- ▶ Severe Space Limitations
- ▶ Hand held device with movable optics
- ▶ Robustness: Shock, Vibrations and Temperature
- ▶ Power Consumption

No commercial solutions available

Custom-made low power Image Processor



Custom-made OCT-Module







# Performance

OCT Scans

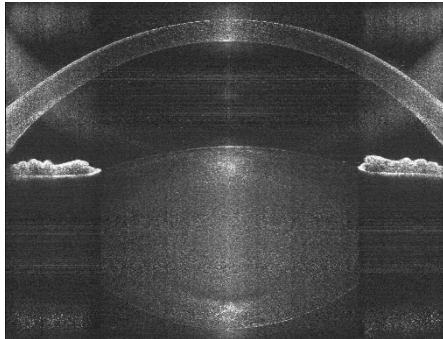
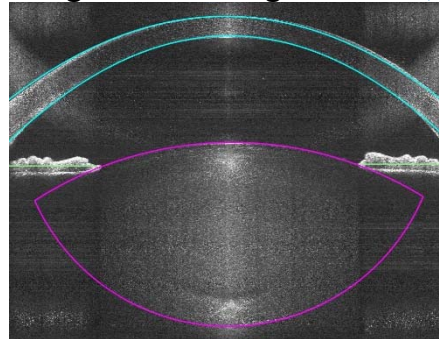
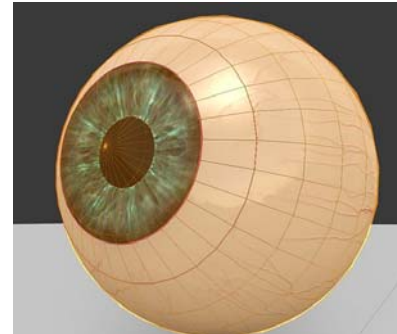


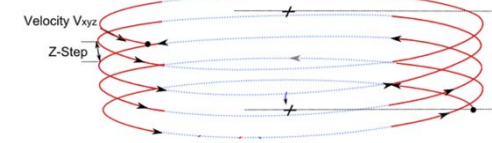
Image Processing



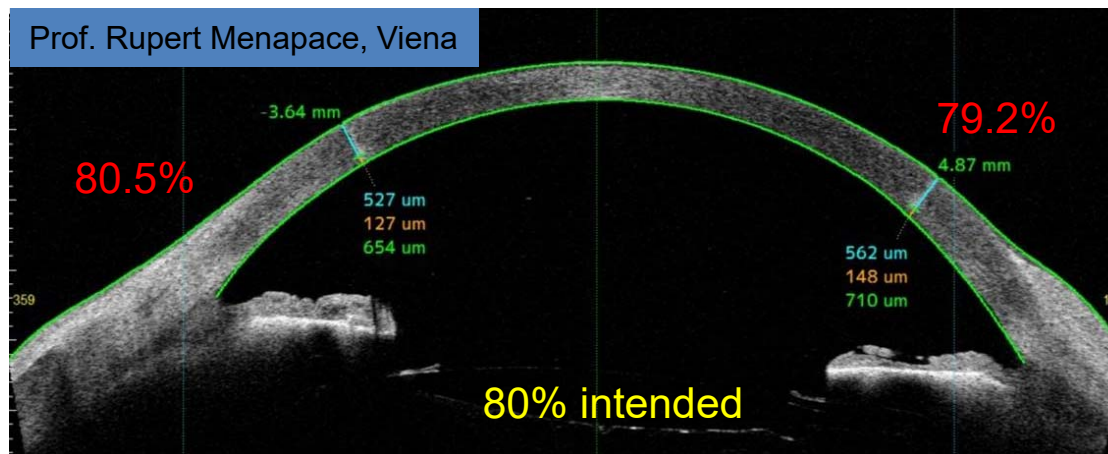
Patient 3D-Model



On the fly trajectory generation



Calibration  
Requirement:  
better  $10^{-4}$



Better 1%  
of  $\sim 550$   
 $\mu\text{m}$ :  
i.e.  $< 5 \mu\text{m}$



## Summary



- ▶ Imaging Assistances enables new application in Eye Surgery
- ▶ Key Aspects
  - ▶ Robust Precision Optics
  - ▶ Very tight Calibration
  - ▶ Substantial Developement in Software and sophisticated Algorithms
- ▶ Ziemer is the sole company offering
  - ▶ Truly Multi-Purpose imaging assisted Laser Systems
  - ▶ Mobile Femtosecond Laser Technology
  - ▶ Robust, portable OCT Technology



## Competitive Landscape



- ▶ Billion \$ corporations with very powerful marketing and sales
- ▶ Our key success factor: superior and different technology