Optische Kohärenztomographie in der Fertigungsmesstechnik

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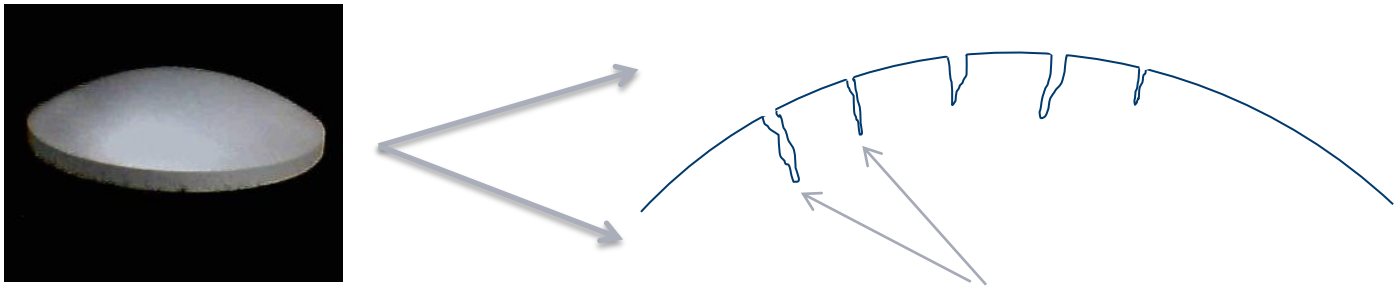
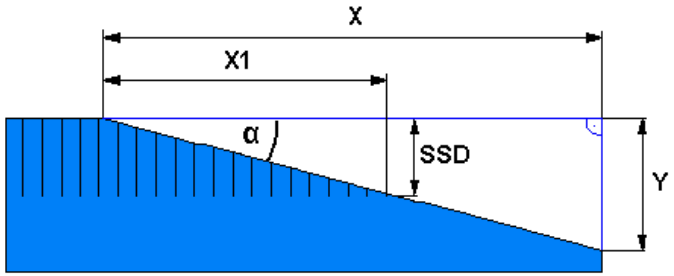
Design → Fabrication → Polishing → Test → Coating → Assembly

Subsurface Damage (SSD)

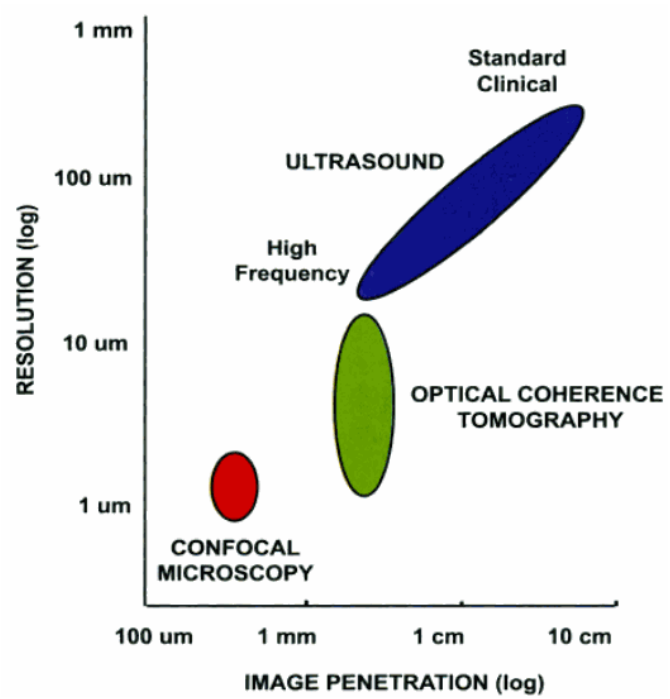


<u>Existierende Methode</u>: Ätzen der Oberfläche mit chemischen Flüssigkeiten

- Messung der Tiefe der SSD unter Verwendung eines Mikroskops



X = Länge des Keils
X1 = Strecke bis zum Rand der SSD
Y = Tiefe des Keils
SSD = Tiefenschädigung
α = Keilwinkel



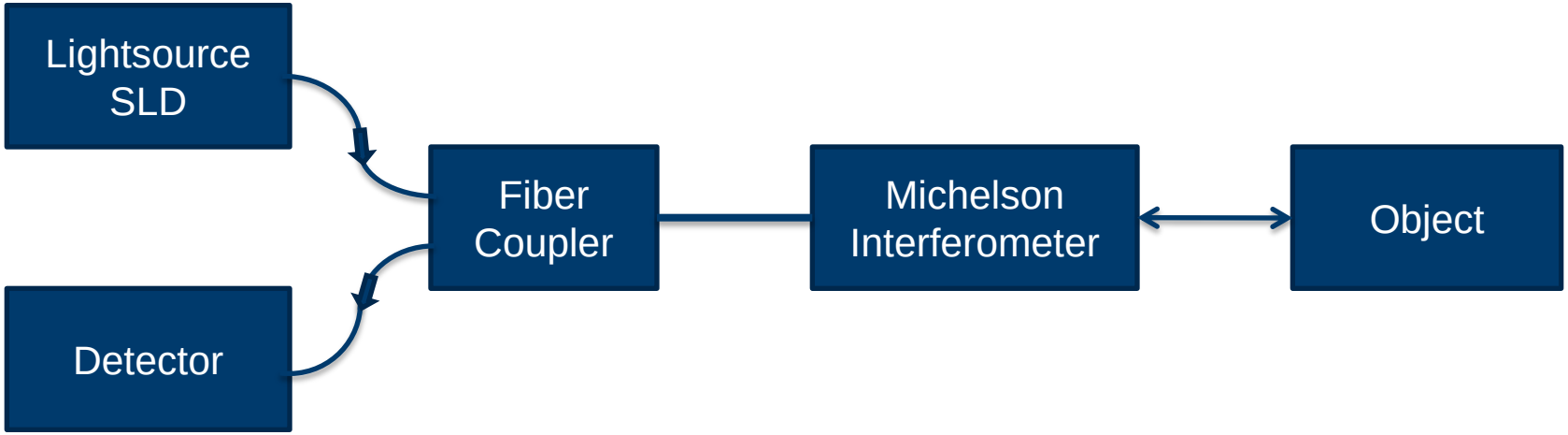
source: W. Drexler / J. Fujimoto: Optical Coherence Tomography

Ursprüngliche Verwendung in den Medizin

(Vermessung der Haut, des Auge, …)

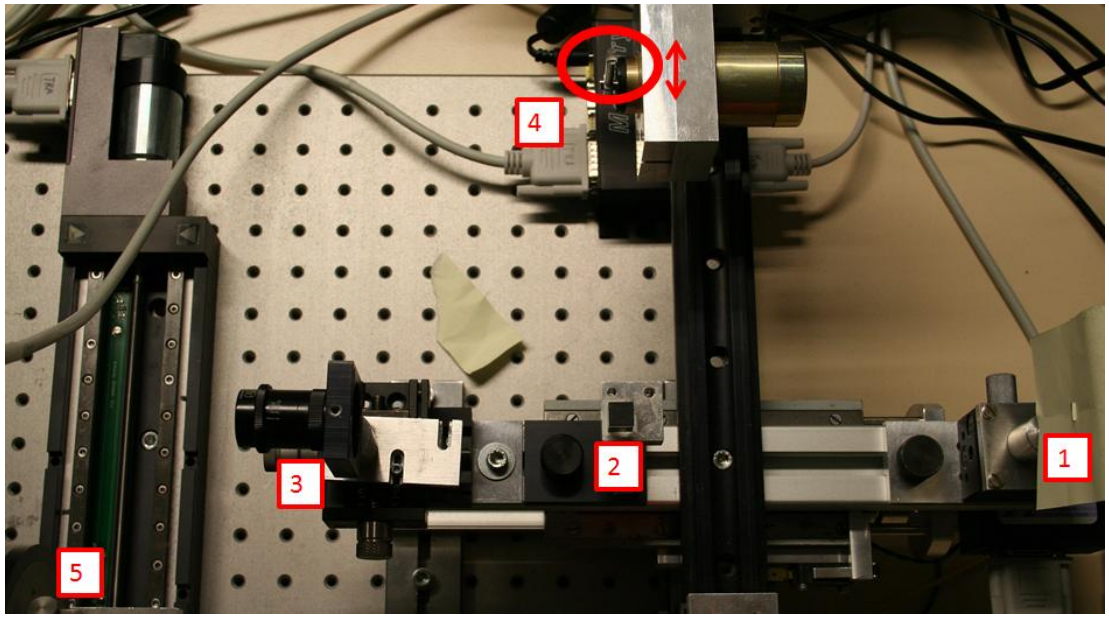
Neue Methode: Optical Coherence Tomography

•Messen der SSD **ohne** die Oberfläche zu beschädigen



State of the Art: Time Domain OCT

	Time Domain
Quelle	SLD
Detektor	Photo-Diode
Max. axial Measure Range	<1.8 mm
Auflösung	<1.4 µm



1: Outcoupling optic

2: Beamsplitter

3: Focusing objectiv

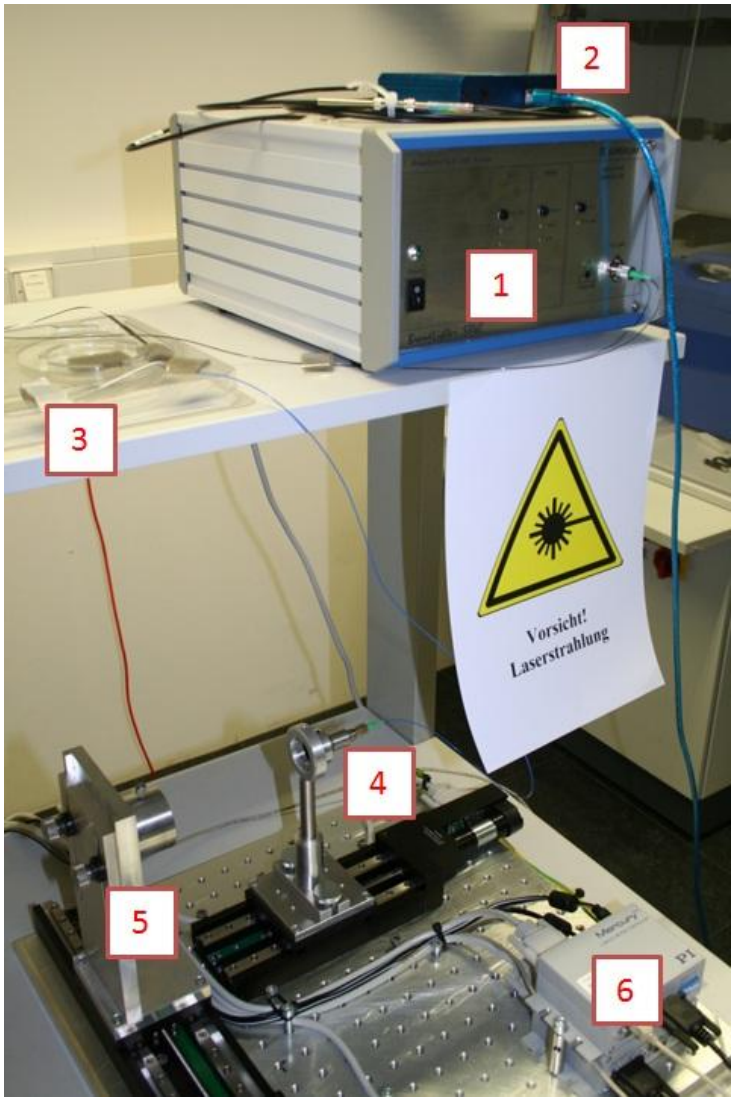
4: Galvoscanner

5: Mount for object

	Frequency Domain
Quelle	SLD
Detektor	Spektrometer
Max. axial Measure Range	<200 µm
Auflösung	<3.3 µm (0.8 µm)

Vorteil:

Schneller und transportabel



1: SLD

2: Spectrometer

3: Fiber coupler

4: Outcoupling optic

5: Mount for object

6: Stagecontroller

Spectra [nm]

~~nm $\rightarrow iDFT \rightarrow$ 1/nm~~

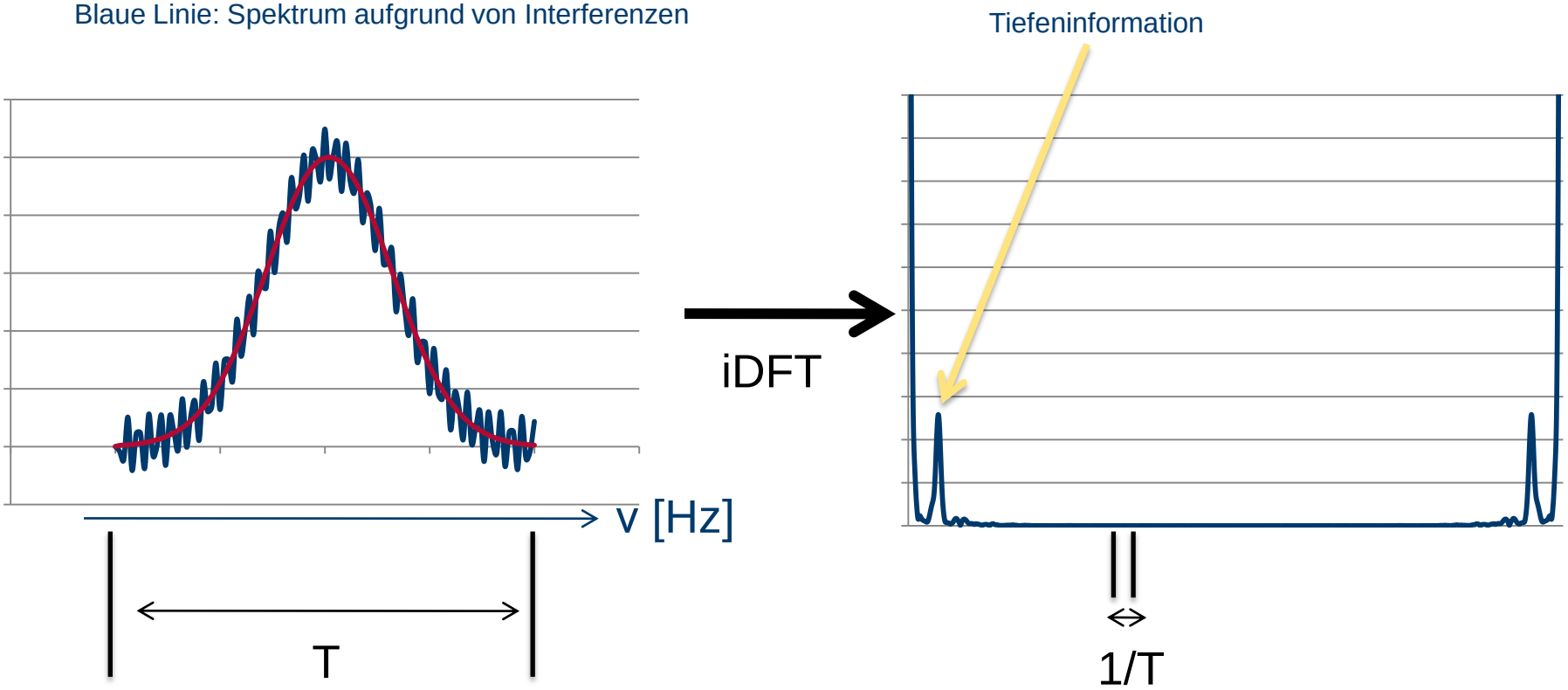
Hz[1/s] $\rightarrow iDFT \rightarrow$ s

Spectra [Hz] $\xrightarrow[\text{Using inverse Fourier}]{}$ Transformed Spectra

Calculating depth

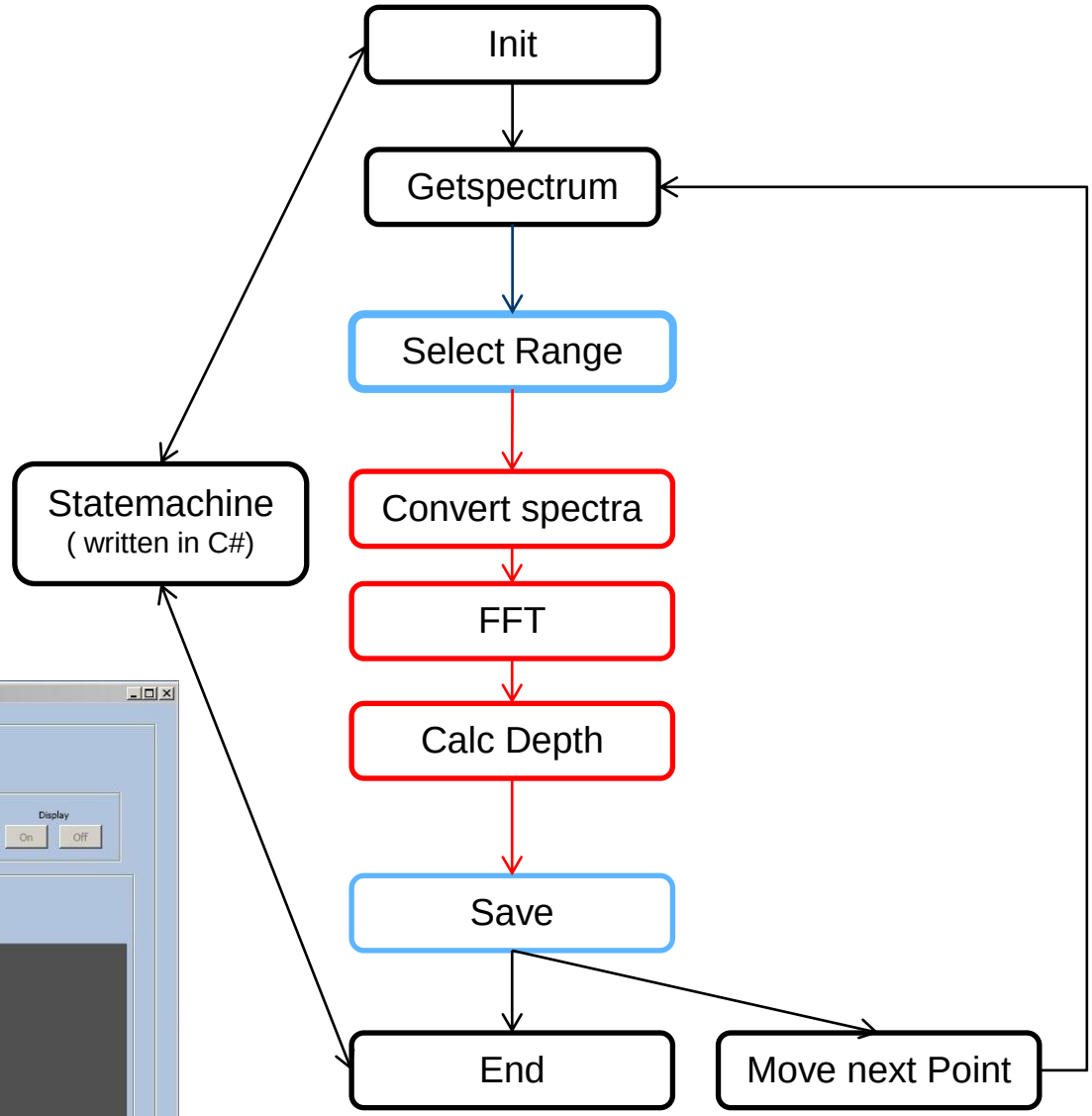
(Using speed of light)

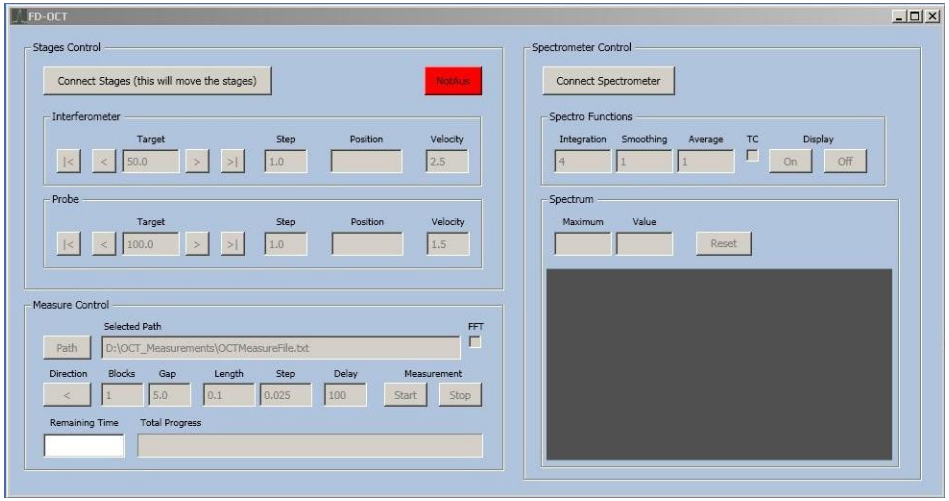
Rote Linie: SLD Spektrum
Blaue Linie: Spektrum aufgrund von Interferenzen



$$T_{\nu[Hz]} \rightarrow iDFT \rightarrow 1/T$$

Frequency Domain OCT Software



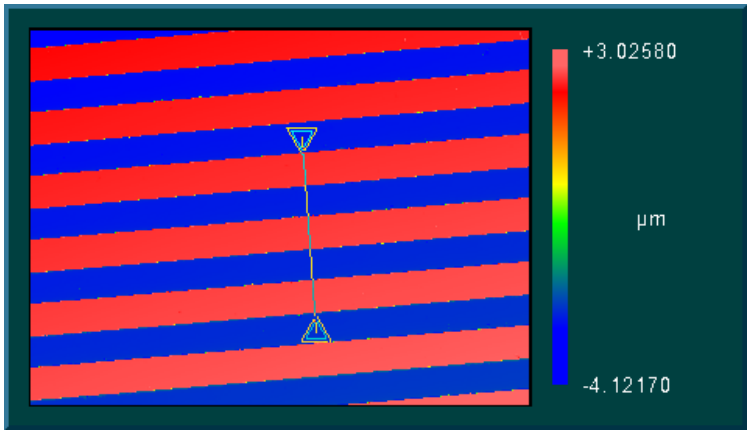


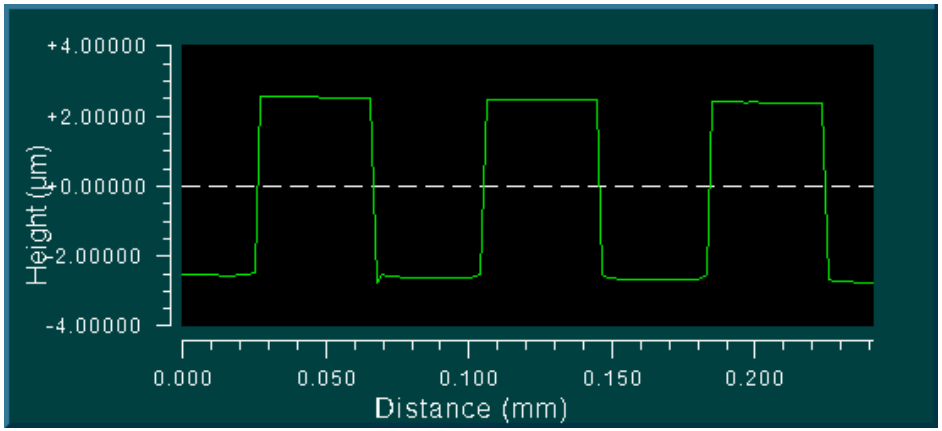
Hochschule Aalen

Benutzung eines sogenannten Referenzwafer

(Definierte Strukturen mit einer Größe von 600µm bis 2 µm)

40 µm Struktur (field of view: 0,62mm x 0,46mm)



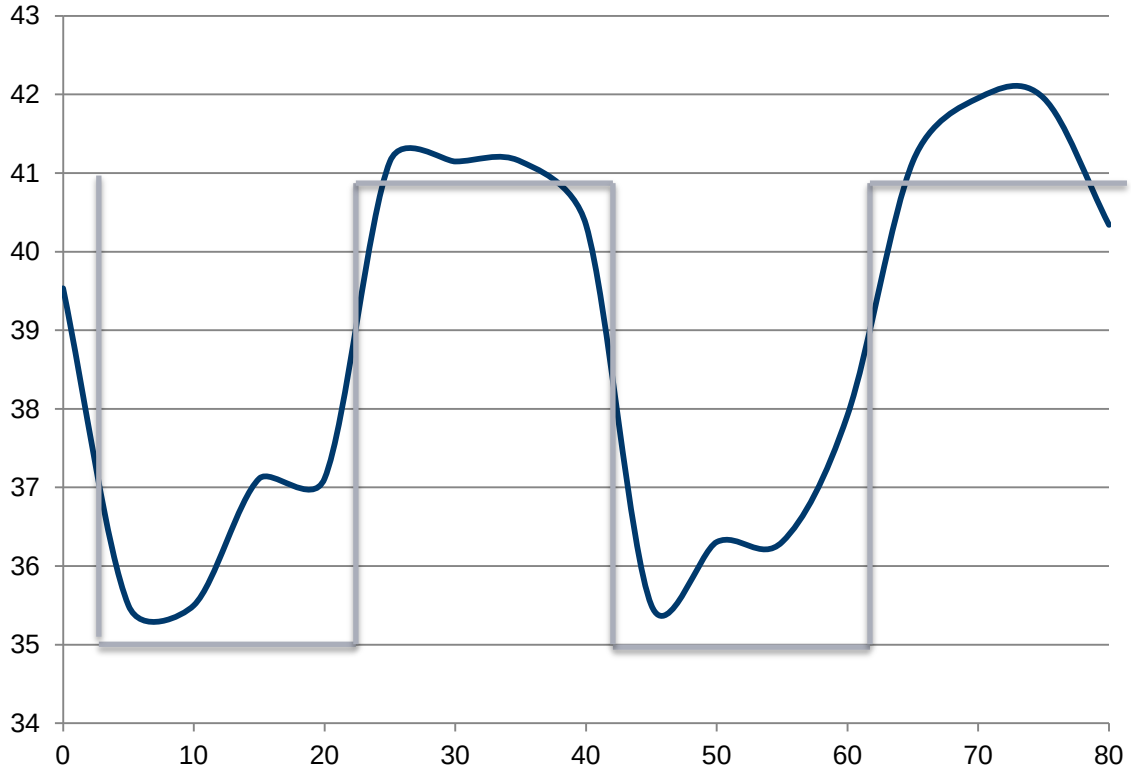


Referenzwafer produziert an der HS Furtwangen

Hochschule Aalen

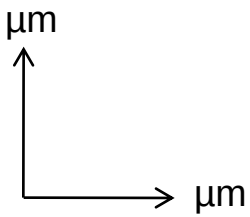
20µm Struktur gemessen mit dem Frequency Domain OCT

(20 gemessene Punkte über eine Länge von 80 µm)



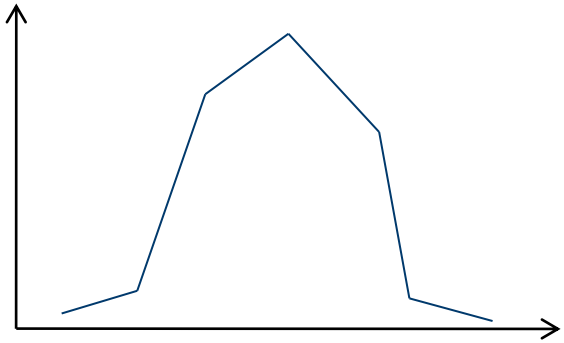
Blau: Gemessene Punkte

Grau: Originale Struktur



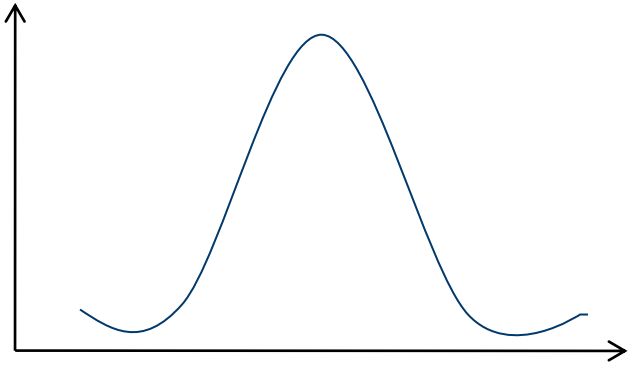
Spectra array (512 values)

800 nm	50
800.25 nm	51
…	…
…	…
900 nm	35



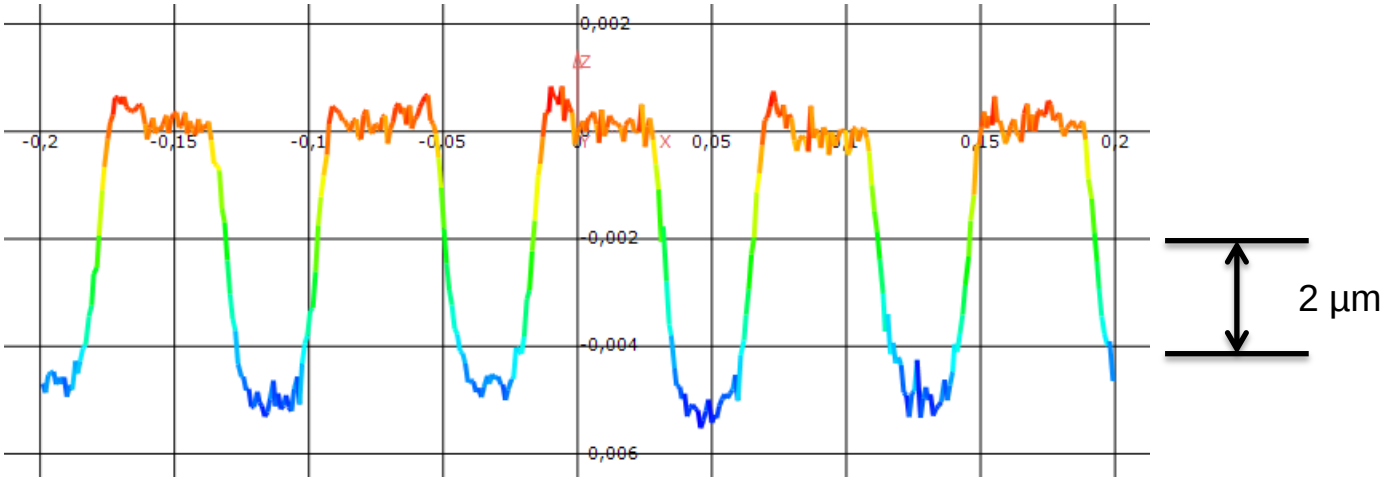
Spectra array (512 values) + Array with zeros [0, 0, 0, 0, 0, 0]

800 nm	50
800.25 nm	51
…	…
…	…
900 nm	35
0	0
…	…
0	0

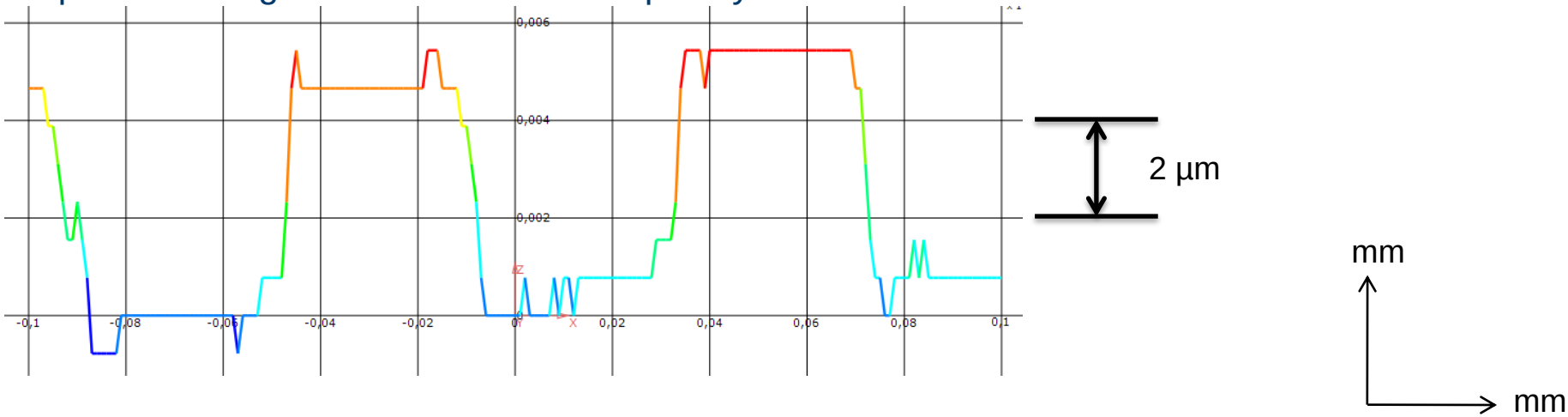


Hochschule Aalen

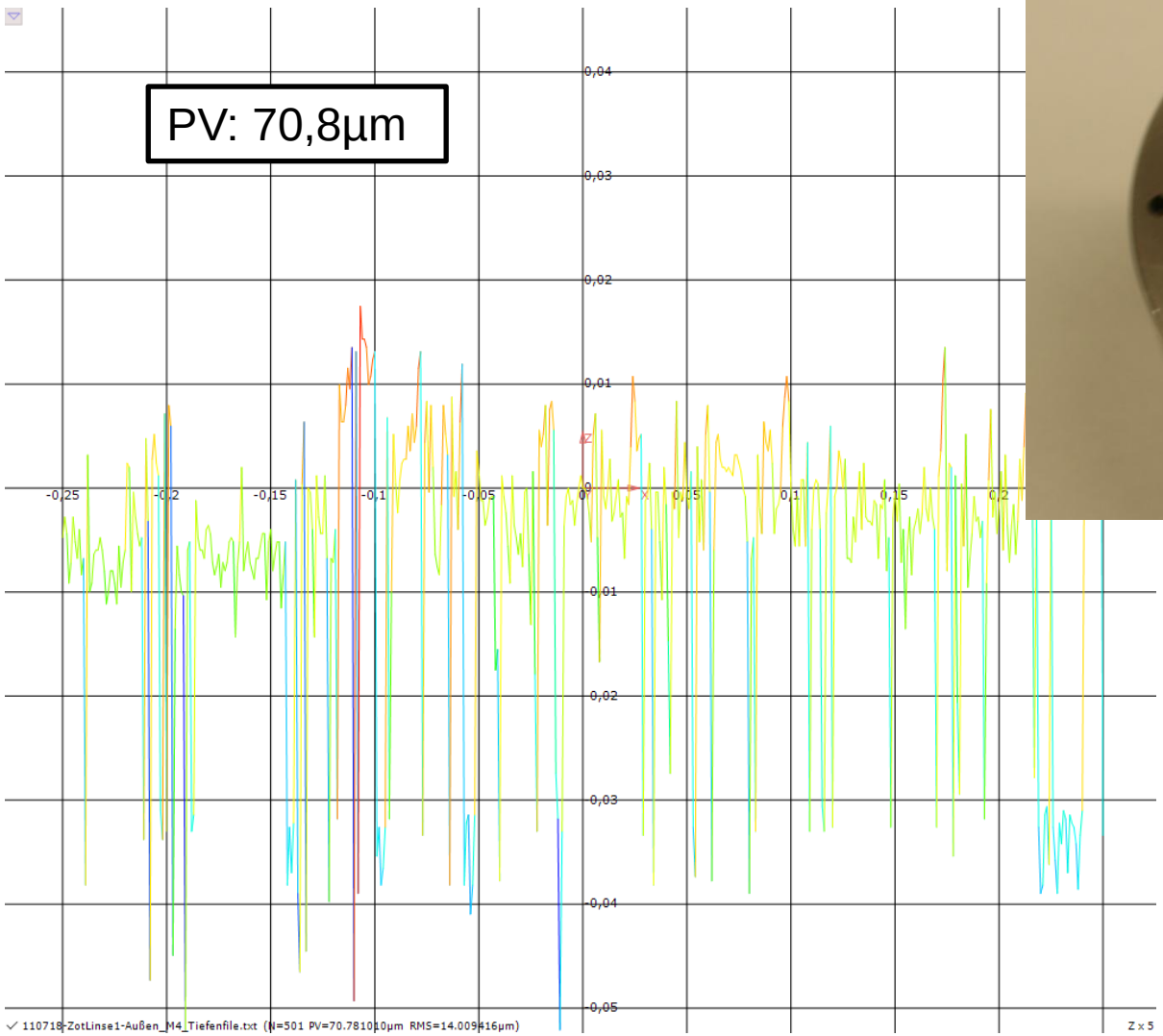
40µm Struktur gemessen mit dem Time Domain OCT

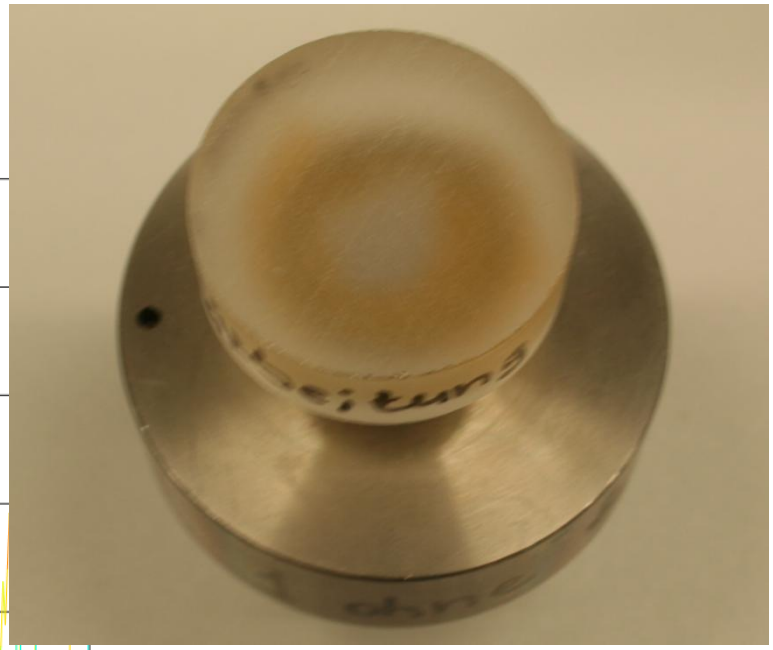


40µm Struktur gemessen mit dem Frequency Domain OCT



Erste Messergebnisse (Zeropadding)





10 µm

mm

mm

Vielen Dank für das Zuhören

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