

Neue Sensoren für ophthalmologische Geräte



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Aktuelle Entwicklungen
in der Ophthalmologie

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Carl Zeiss Meditec AG

10th Leibnitz Conference of Advanced Science
October 8th, 2010



Ophthalmologische Systeme zielen auf wichtige Augenerkrankungen



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GLAUCOMA



REFRACTIVE



RETINA



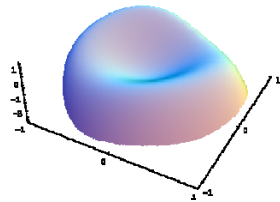
CATARACT

Informations-träger	Wechselwirkungs-beispiele	Entwicklungs-beispiele	Krankheits-bereiche
Licht			
räumliche Phase	Wellenfrontabberationen	CRS-Master	Refraktion
Polarisation	Gewebedoppelbrechung	GDxPRO™	Glaukom (Früherkennung)
Wellenlänge	Fluoreszenz	VISUCAM ^{NM/FA}	Retina (Diabetes, AMD, ...)
Kohärenz	Gewebe-rückstreuung	IOLMaster500, Cirrus™ HD-OCT	Cataract, Retina (AMD, Glaucom, ...)

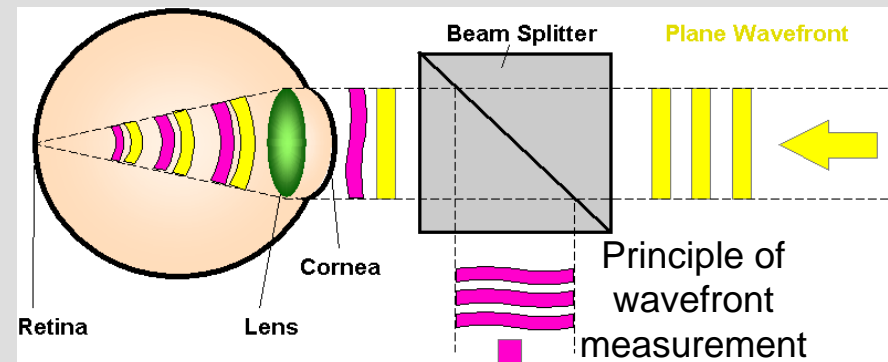
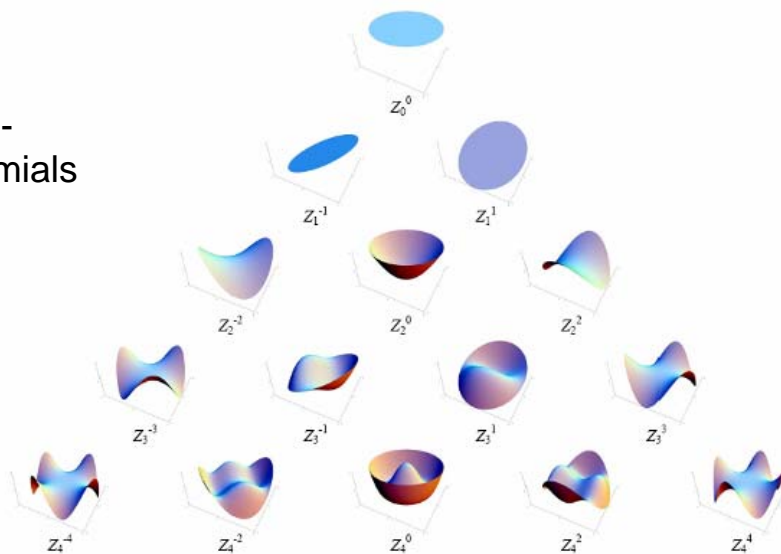


Wavefront measurements at the human Eye

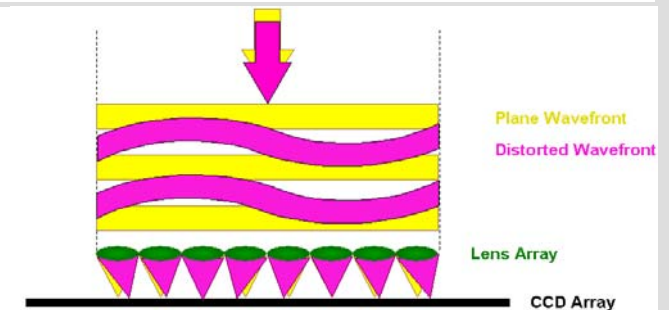
Reconstructed wavefront



Zernike-Polynomials



Distorted Wavefront



Shack-Hartmann sensor

Beside **sphere** und **cylinder** other so called higher order errors compromise our vision, specially at night (wide pupils, large wavefront distortion)

Application of Wavefront measurements – Refractive correction with LASIK



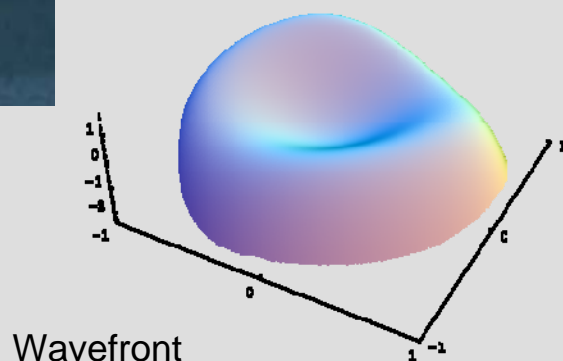
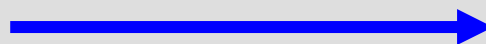
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CRS Master

1. Measurement of wavefront

2. Calculation of optimal
ablation profile



MEL 80

3. Customized ablation

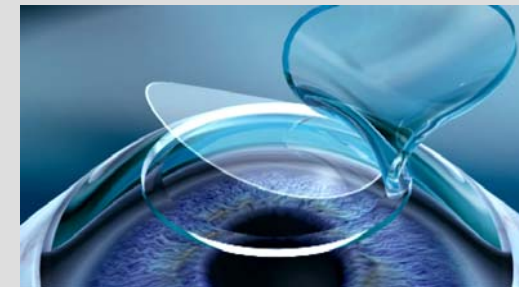
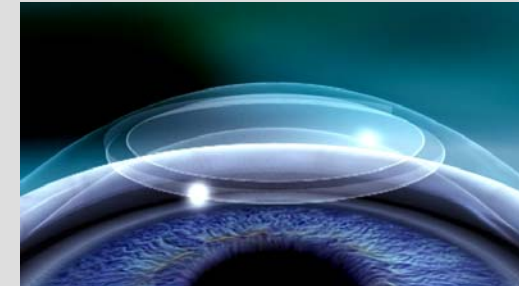
With the data of the [wavefront analyzer](#) a optimized [LASIK](#) procedure is calculated, leading to better vision especially at night. This is called [customized ablation](#)

In addition, Carl Zeiss Vision offers [i.Scription](#) to customize glasses by wavefront data

Application of Wavefront measurements – VISUMAX ReLEx



VISUMAX



Year	Technology	Technique
1991	MEL-60	PRK
1998	MEL-70	LASIK
2003	MEL-80	LASIK
2007	+ Visumax	FS-LASIK
2010	+ ReLEx option	ReLEx

- **Intrastromal fs laser lenticule cut**
- **Tissue removal instead of ablation**
- Fast, Silent, non-smelling
- Fast visual recovery
- High predictability

Sensorik am Auge

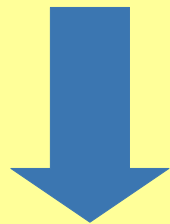


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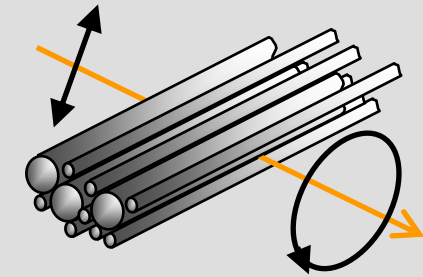
Doppelbrechungsmessung – Grundprinzip Scanning Laser Polarimetry (SLP)

Glaukom verursacht Degradation der
strukturellen Integrität der retinalen
Nervenfaserschicht (RNFL)



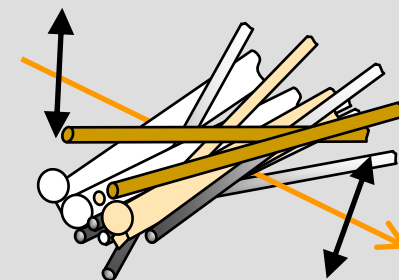
Abnahme der RNFL-Doppelbrechung mit
fortschreitendem Glaukom

Gesunde RNFL



*Faserbündel der RNFL
wirken doppelbrechend*

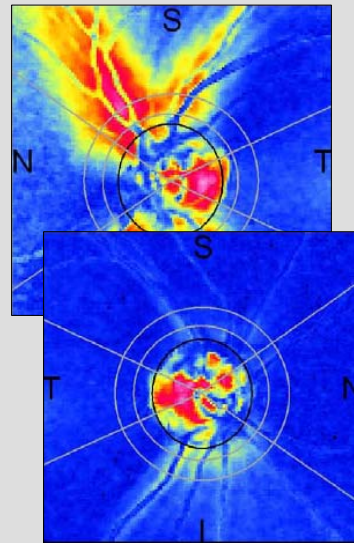
Geschädigte RNFL



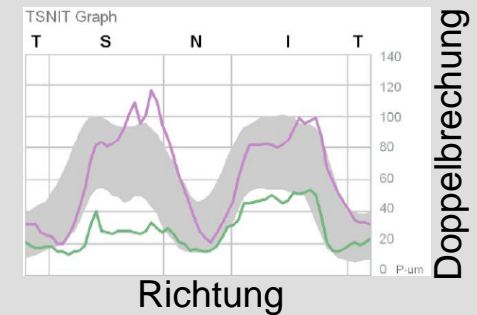
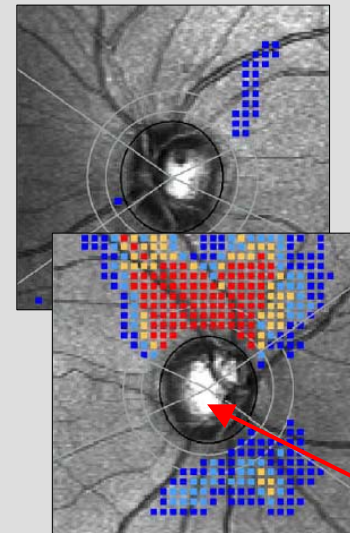
Doppelbrechungsmessung – GDxPRO™



RNFL-Integrität



Abweichungen



Nervenfaserkopf

- Doppelbrechung (Orientierung, Retardation) als Maß für RNFL-Integrität
- Glaukomfrüherkennung und -trendanalyse
- Kompensation der Hornhautdoppelbrechung (ECC™)
- Automatische Registrierung wiederholter Messungen über Gefäße
- Normative Datenbanken und Algorithmen zur Datenbewertung

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FAG - fluorescein angiography

- Excitation in Blue-Green, Detektion in Green (for example 485nm/514nm)
- High-contrast & time-sequenced imaging of near-surface retinal vessel
- Diagnosis of vascular problems (Diabetes,)

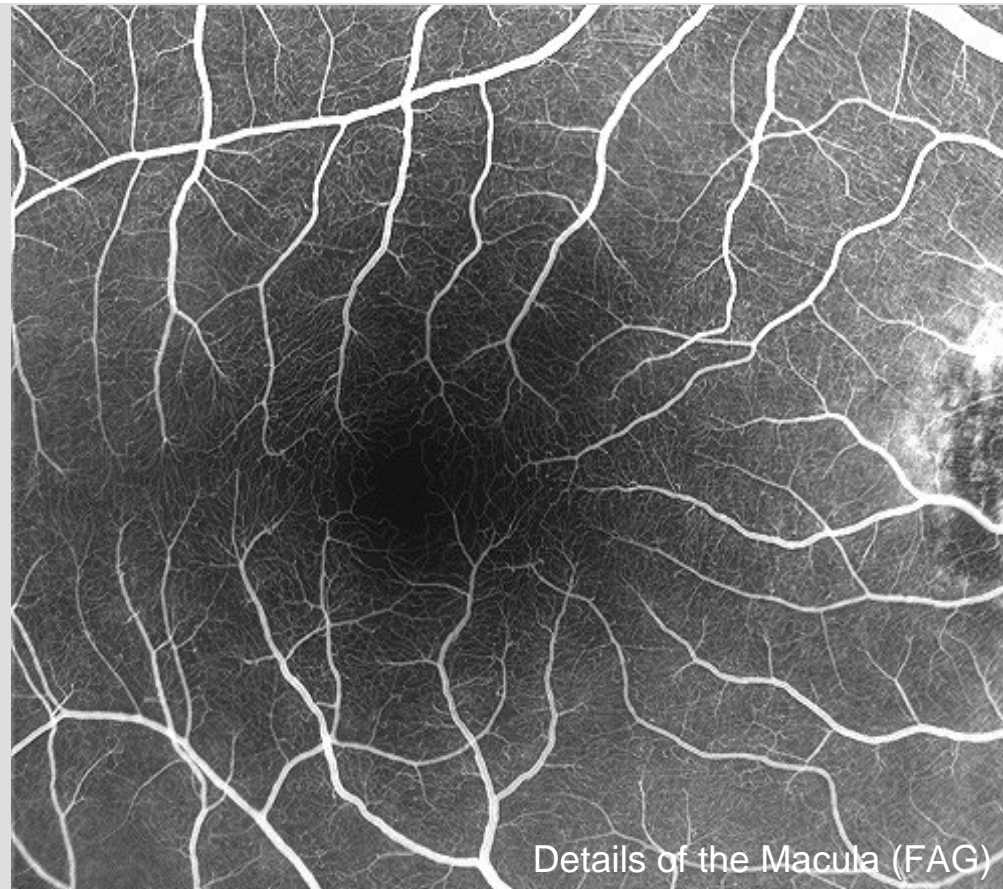
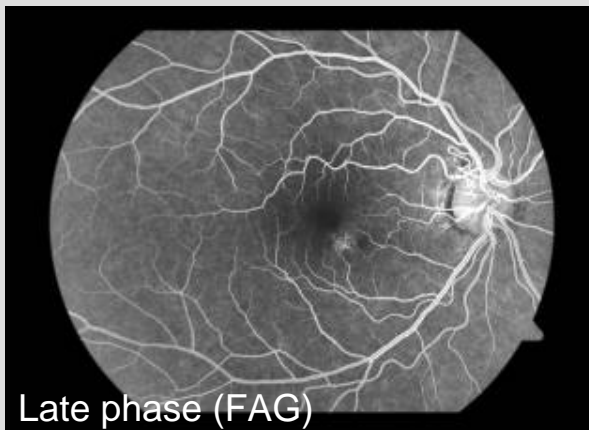
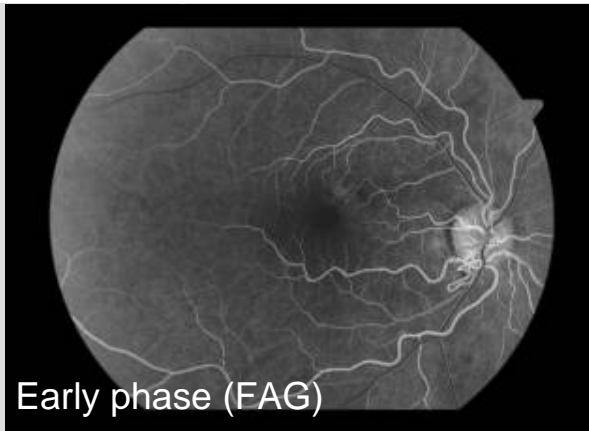
ICG - indocyanine green angiography

- Excitation & Detection in NIR (for example 800nm/830nm)
- High-contrast & time-sequenced imaging of vessels in deeper retinal regions
- Diagnosis of vascular problems (Diabetes,)

FAF-Fundus autofluorescence

- Excitation in Blue or UV, Detection in VIS
- Quantification of pigments relevant in retinal metabolism (Lipofuscin, Lutein...)
- Detection and diagnosis of retinal diseases (AMD, atrophies ...)

Fluorescence detection – Fundus cameras



Fluorescence detection with FAG or ICG makes the invisible visible, e.g. small vessels around the macula

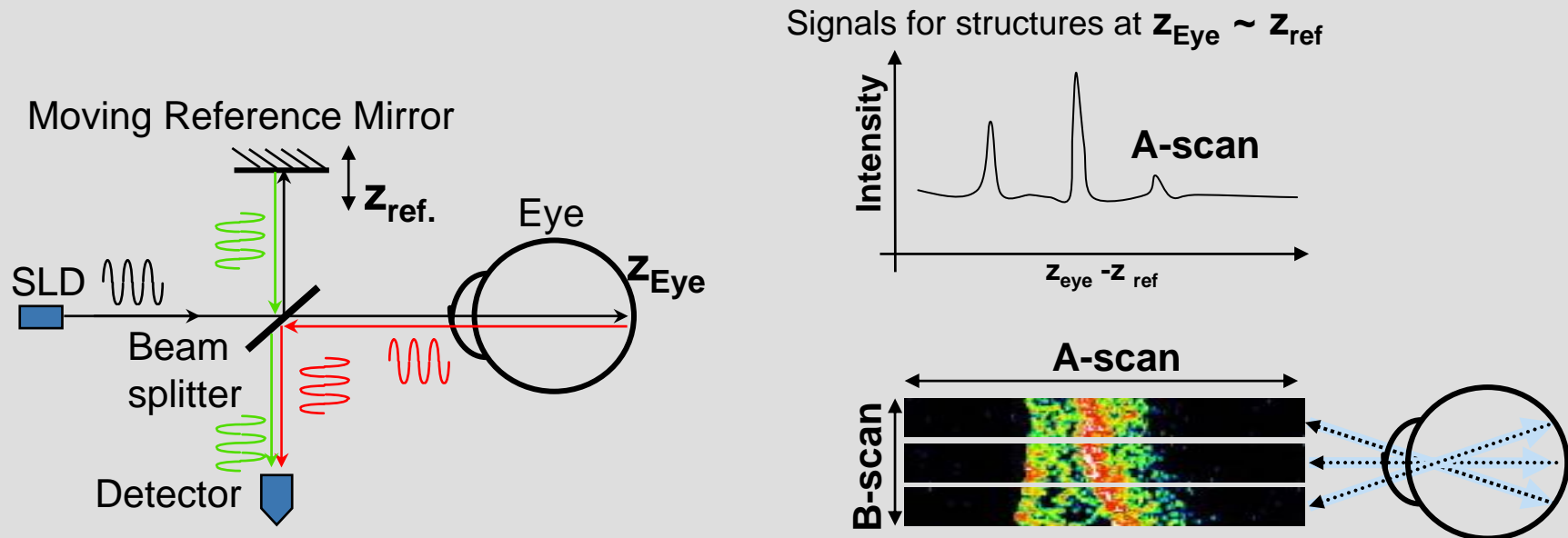
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Backscattering (OCT) – How it works with the eye Time Domain Optical Coherence Tomography



Interferometric measurement of distances to backscattering and reflecting structures

→ non-contact, sensitive, sub-surface, precise

Axial resolution limited only by bandwidth of the source

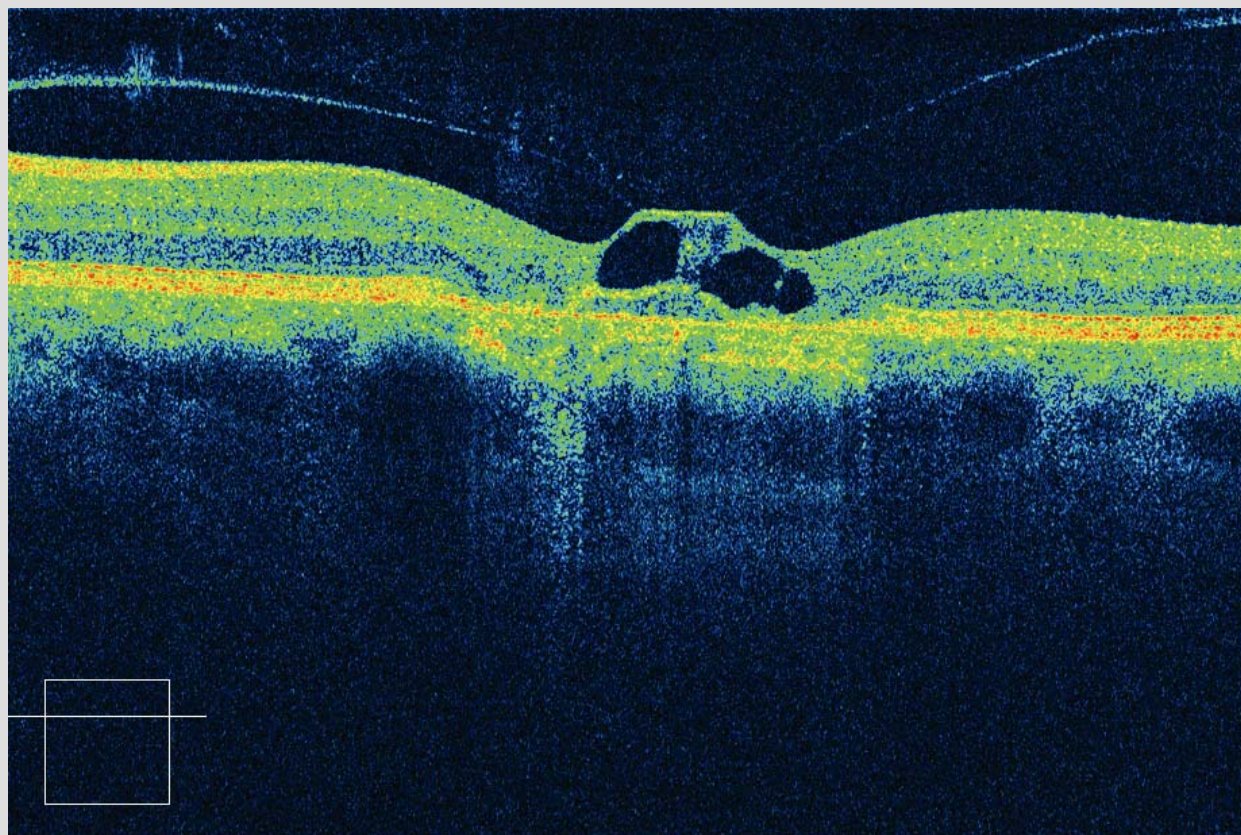
→ decoupled from transverse resolution

→ in contrast to light microscopy where axial and transverse resolution are limited by NA

**Backscattering (OCT) –
Vitreomacular Traction scanned by Cirrus™ HD-OCT**



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Zusammenfassung



Die Carl Zeiss Meditec AG setzt moderne Sensorikverfahren in innovativen Produkten ein, die wesentliche Beiträge zur Steigerung oder Sicherung der menschlichen Lebensqualität leisten.





We make it visible.