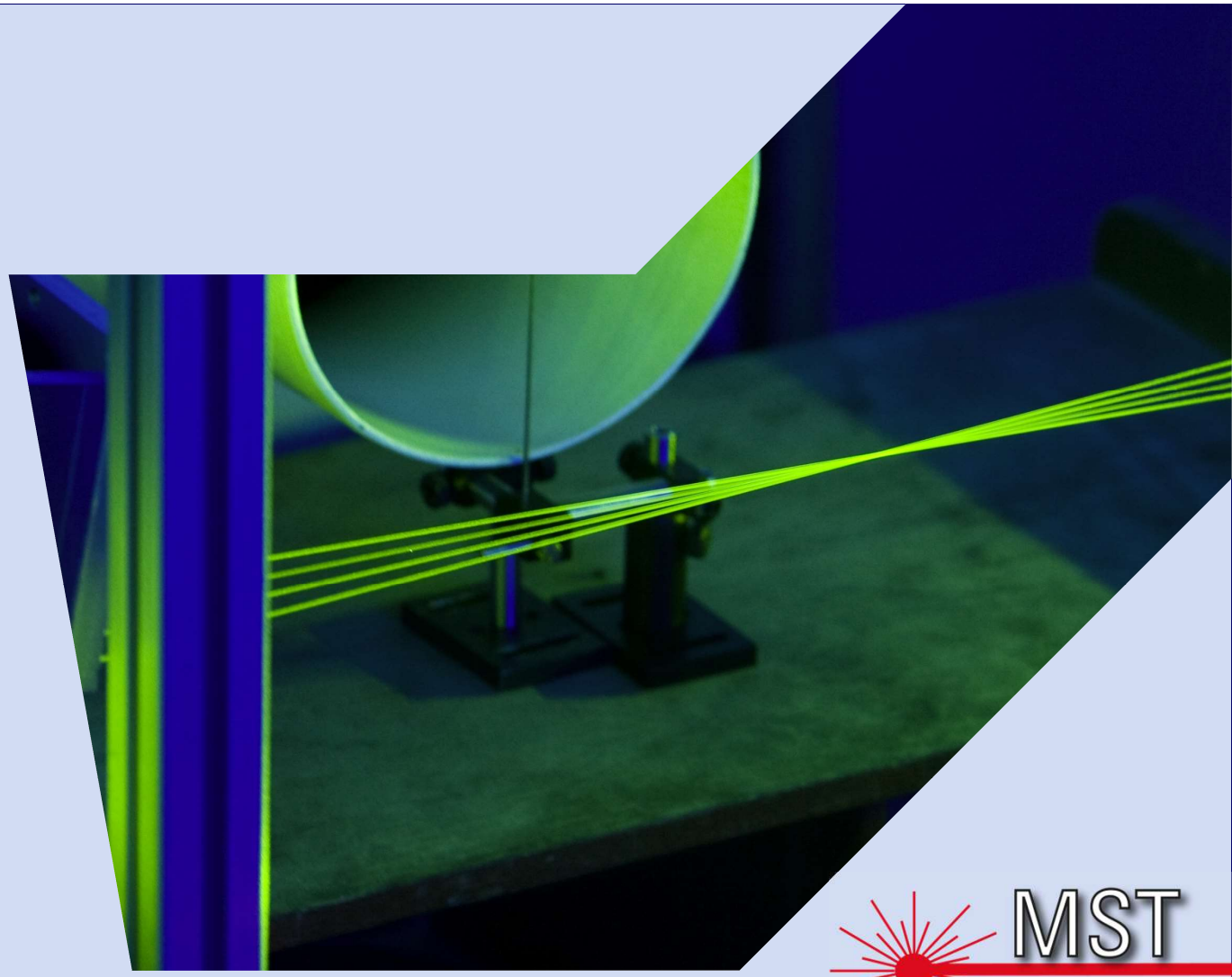
Technische Universität Dresden

Oberseminar & Projekte der MST



MST
Professur für
Mess- und Sensorsystemtechnik

Oberseminar Messsystemtechnik

Teil A: Wöchentliches Seminar → regelmäßig auf Aktualisierungen prüfen

Teil B: Seminararbeit - Betreute Gruppenarbeit à 2-4 Studierenden

Umfang

- 120h für Elektrotechnik; 60h für Mechatronik
- Referat: 20 min Vortrag + 10 min Diskussion; pro Person
- Beleg (nur ET): 6 Seiten (Vorlage auf Website)

Benotung

- ET (4 LP): Modulnote = Referat x 1/3 + Belegnote x 2/3
- MT & RES (2 LP): Modulnote = Referat
- Physik: Modulnote = Referat

Projekt: Optische Prozessmesstechnik (MT)

Projektarbeit - Betreute Gruppenarbeit à 2-4 Studierenden

Umfang

- 3 Tage pro Person + Selbststudium
- Referat: 5 min Vortrag pro Person + 10 min Diskussion
- Beleg: 6 Seiten (Vorlage auf Website)

Benotung

- MT (2SWS): Projektarbeit = ½ x Referat + ½ x Beleg
  → Projektarbeit geht zu 40% in die Modulnote ein (Sensoren und Messsysteme – Vertiefung)

Projekt: Photonische Messsysteme (ET)

Projektarbeit - Betreute Gruppenarbeit à 2-4 Studierenden

Umfang

- 3 Tage pro Person + Selbststudium
- Referat: 5 min Vortrag pro Person + 10 min Diskussion
- Beleg: kein Beleg

Benotung

- ET (1SWS): Projektarbeit = Referat
  - → Projektarbeit geht mit 1/7 in die Modulnote ein (Photonische Messsysteme)

Project: Computational Laser Systems (PoL)

Project work - supervised group work à 2-4 students

Scope

- 3 days per person + self-study
- Presentation: 5 min lecture per person + 10 min discussion
- Receipt: 6 pages (template on website)

Grading

- PoL (2SWS): CLS = 1/2 x presentation + 1/2 x document

Zusammenfassung

	Oberseminar Messsystemtechnik	**Projekt: Optische Prozessmesstechnik**	**Projekt: Photonische Messsystemtechnik**	**Computational Laser Systems**
Studiengänge	ET | MT | RES | Physik	MT	ET	PoL
Modul	Oberseminar Messsystemtechnik	Sensoren und Messsysteme Vertiefung	Photonische Messsystemtechnik	Computational Laser Systems
Umfang	2 SWS	2 SWS	1 SWS	2 SWS
Leistung	Vortrag (+ Beleg für ET)	Vortrag + Beleg	Vortrag	Vortrag + Beleg

Zeitplan

13.04 Themenvorstellung

Bis 19.04 Einschreibung für Themen per E-Mail:

jakob.dremel@tu-dresden.de

Jedes Thema kann nur durch eine Gruppe bearbeitet werden

First Come, First Serve

Ab 20.04 Bearbeitung der Projekte und wöchentliche Seminare

Ab Juni Präsentationen der Projektergebnisse und ggf. Abgabe der Belege

(in Rücksprache mit den Betreuenden)

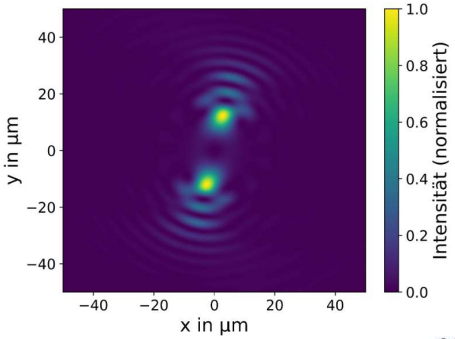
Seminar on Computational Laser Systems (Measurement Systems Seminar/BIOLAS), SoSe 2026

Date: **Monday, 3. DS., 11:10 – 12:40, BAR I88** (regular seminar, extra dates are in red)

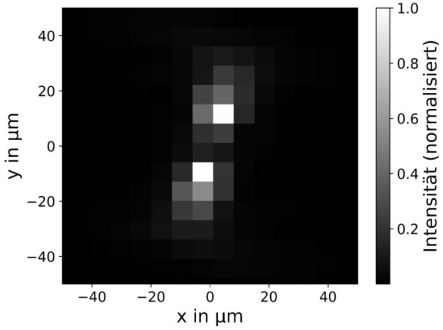
Date	CW	Lecturer	Topic
13.04.	16	Jakob Dremel Dr. Lars Büttner	Introduction to Seminar & Presentation of Topics for Students
20.04.	17	**Elena Goi** FSU Jena	Nanoprinted Neural Networks for High-Content and High-Throughput Classification
22.04 9:20 TOE0315		**t.b.a**	Biomedical Sensors & Actuators
27.04.	18	Qingyuan Zeng Nacef Chaouch	Ultrasound multimode waveguide with slanted geometry *(SA defense, CO)* Simulation of ultrasound propagation in the human brain *(SA defense, CO)*

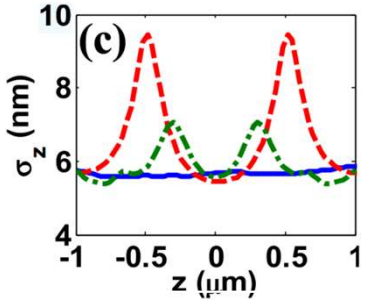
Cramer-Rao Lower Bound for 3D Localization Microscopy with Double-Helix Point Spread Function

Motivation 3D Localization Microscopy enables the three-dimensional localization of an emitter / particle single-shot with only one optical access. For this reason, it is an established technique for microfluidic flow measurements. In order to estimate speed and accelerations of particles, a low localization uncertainty is a strict prerequisite, since differentiating the measured position amplifies measurement noise. In this project, the theoretical limit of the measurement uncertainty (Cramer-Rao Lower Bound) will be investigated by numerical calculations.



Simulated Particle Images





Badieirostami (2010) Vol. *97*, p. 161103

Tasks
- Become acquainted with theory for Cramer-Rao Lower Bound
- Implementation of simulation for imaging process
- Implementation of numerical calculation of uncertainty limit for given boundary conditions

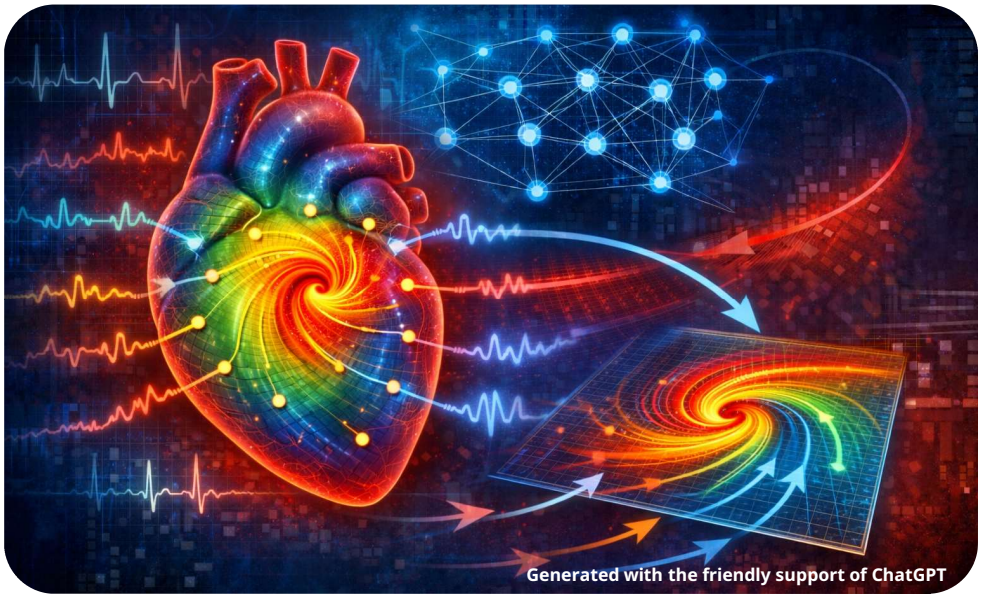
Requirements
- ≥ 4 SWS / Credit Points for Project
- good knowledge of Python and max. 1 person in the group

TUD **Contact** Clemens Bilsing clemens_matthias.bilsing@tu-dresden.de

ET | MT | BMT

Rotor Core Detection Using Neural Networks for Optogenetic Arrhythmia Treatment

Motivation Atrial fibrillation is driven by rotating spiral-shaped contraction patterns in cardiac tissue, disrupting heart rhythm and posing a fatal risk. Over the past decade, optogenetic defibrillation has emerged as a promising approach to restore normal cardiac rhythm by controlling genetically modified cardiomyocytes with designed light patterns. To advance optical defibrillation strategies, a fast and precise rotor core detection method is essential, as computing an optimal stimulation pattern requires knowledge of the core position.



Tasks

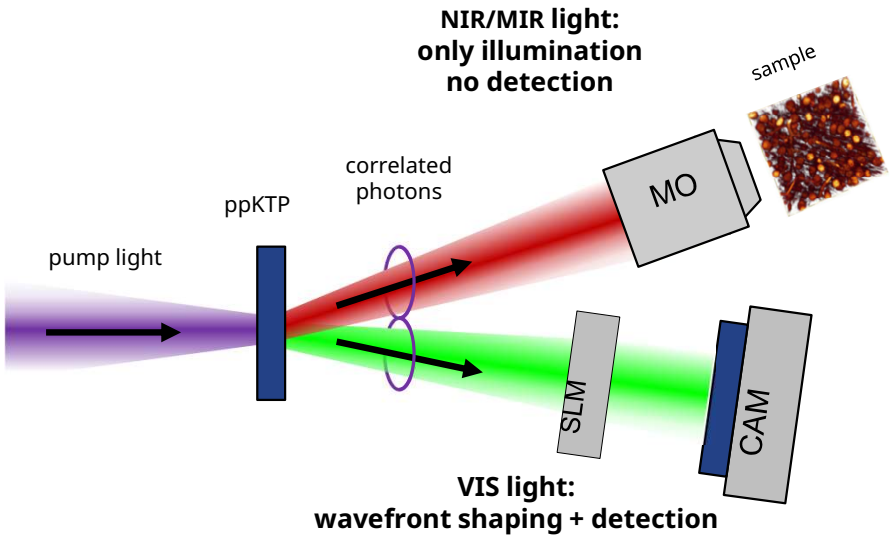
- Review literature and familiarize with an existing simulation environment for cardiac activity
- Train a neural network (NN) to reconstruct rotor core positions from sparsely sampled signals
- Evaluate the performance and robustness of the NN, including systematic hyperparameter tuning

TUD **Contact** Robert Wendland robert.wendland@tu-dresden.de

ET | INF | PHY | POL

Quantum Enhanced Deep Tissue Imaging

Motivation While deep tissue imaging with near-infrared and infrared wavelengths is strongly desired in biological and medical applications, its realization is difficult due to inefficient detectors in this wavelength range. Recent developments in quantum technologies and in particular the use of entangled photons open a way to probe biological samples in the infrared while detecting photons efficiently in the visible. However, the resulting imaging contrast resulting from absorption and phase changes needs to be interpreted with care. In this project, students will apply an existing quantum imaging microscope for deep tissue studies of well known samples. The gained information will be discussed with respect to resolution, contrast and biological applicability. Image correlation will be part of the software assisted analysis routine.



Tasks

- Familiarize with quantum imaging setup for deep tissue applications
- Perform measurements on well known samples
- Image correlation, data analysis and discussion of the results

TUD **Contact** Stefan Krause stefan.krause1@tu-dresden.de

ET | INF | MT | PHY | POL | RES

Themen für das Oberseminar & die Projekte

Themenübersicht	Kürzel	Betreuende
Cramer-Rao Lower Bound for 3D Localization Microscopy with Double-Helix Point Spread Function	3D-Micro	Clemens Bilsing
Rotor Core Detection Using Neural Networks for Optogenetic Arrhythmia Treatment	RoCoNet	Robert Wendland
Quantum Enhanced Deep Tissue Imaging	QuDIT	Stefan Krause

Einschreibung für Themen per E-Mail:
jakob.dremel@tu-dresden.de