

Automated High-Resolution Microscopy

Next-Generation Drug Discovery

Our mission

The Automated High-Resolution Microscopy group at the Fraunhofer ITMP TNM in Göttingen is a team of highly experienced researchers specialized in developing and applying sophisticated microscopy techniques to advance drug discovery and research in the life sciences. Focusing on **super-resolution microscopy** methods such as **MINFLUX**, **STED**, **SMLM**, and **SIM** the group achieves nanoscale visualization of cellular structures, protein distributions, localizations, and interactions. In combination with genetic engineering of cell lines and AI-driven data analysis we provide the complete workflow from conceptual planning of high-throughput experiments to the evaluation of imaging data.

High- and super-resolution microscopy

Conventional microscopy is constrained by its optical resolution, making it incapable of detecting structures and changes smaller than 200 nm. With decades of expertise, the group specializes in the development and application of super-resolution microscopy methods, particularly STimulated Emission Depletion (STED) microscopy to overcome this limitation and to tackle complex questions in cellular biology. This advanced technology provides unparalleled detail, visualizing the effects of drug compounds on cellular targets at sub-cellular and even sub-organelle levels.

Integrated solutions are available to enable autonomous operation of microscopes, acquiring super-resolved images of samples continuously, 24/7. While STED microscopy serves as the cornerstone of the teams' capabilities, access and support are offered for a broad range of fluorescence microscopy methods from conventional imaging techniques to highly advanced

super-resolution approaches. Our portfolio includes widefield, (spinning-disc) confocal, Structured Illumination Microscopy (SIM), Single-Molecule Localization Microscopy (SMLM), and MINFLUX microscopy.

By working closely with our clients, the most suitable imaging technology is identified and applied to meet the specific requirements of each project, ensuring tailored and optimal solutions.

We offer:

- **Outstanding expertise:** Decades of experience in the application of super-resolution microscopy in single cells and tissues as well as live and fixed samples
- **Automation:** Automated imaging of samples on coverslips and in multiwell plates
- **Comprehensive solutions:** From concept, to acquisition, to evaluation of imaging data
- **Conventional microscopy:** Widefield, laser scanning confocal
- **Spinning disk confocal:** Standard resolution, high frame rate, live and fixed samples
- **Structured illumination microscopy (SIM):** Resolution down to ~100 nm, high frame rate
- **Stimulated emission depletion (STED):** Resolution down to ~30 nm
- **Single molecule localization microscopy (SMLM):** Resolution down to molecular-scale

Generation of cellular model systems

The value of screening outcomes largely depends on the choice of the model system. To overcome the limitations of off-the-shelf systems, we offer tailored solutions by generating custom cell lines through **targeted genome editing** technology or employing patient-derived **iPSCs**. For instance, where target protein antibodies are lacking, we incorporate genetic tags endogenously to enable fluorescence microscopy. These custom-designed cell models elevate the accuracy and biological significance of super-resolution microscopy compound screening, ensuring reliable and impactful results.

We offer:

- **Outstanding expertise:** Long-standing and extensive knowledge in targeted genome editing
- **Custom generation** and phenotyping of iPSC disease models on iPSCs and conventional cell lines

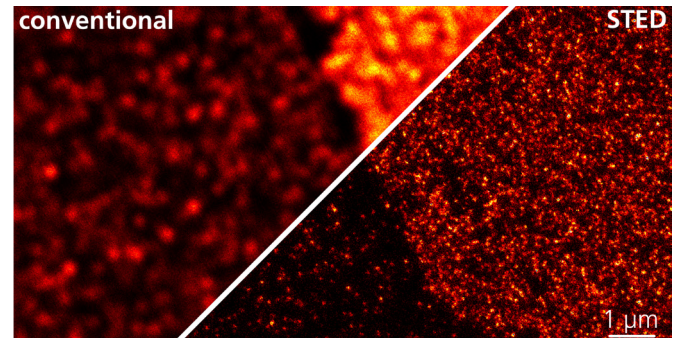
Data analysis

Our data scientists and mathematicians are committed to continuous improvement of our workflows. By leveraging a custom automation software and AI-supported algorithms, we can efficiently process substantial volumes of images and data. These

innovations enhance the reliability and scalability of our analysis pipeline, enabling the resolution of even the most complex microscopic challenges in a robust and effective manner.

We offer:

- AI-supported data and image analysis
- Supervised and unsupervised deep learning



Distribution of growth factor receptors on cancer cells visualized with conventional and super-resolution STED microscopy.

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Further information

Fraunhofer Institute for Translational Medicine and Pharmacology ITMP:

<https://www.itmp.fraunhofer.de/>

Fraunhofer ITMP Translational Neuroinflammation and Automated Microscopy TNM:

<https://www.itmp.fraunhofer.de/en/institute/locations/goettingen>

Contact

Prof. Dr. Stefan Jakobs
Automated Microscopy

Phone +49 (0)551 201 2531
stefan.jakobs@
itmp.fraunhofer.de

Dr. Christian Brüser
Automated High-Resolution
Microscopy

Phone +49 (0)551 39 63478
christian.brueser@
itmp.fraunhofer.de

Fraunhofer ITMP
Location TNM
Waldweg 33
37073 Göttingen
www.itmp.fraunhofer.de

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