UltraMicroscope Blaze
The automation of light sheet microscopy
Discover our fully automated light sheet microscope UltraMicroscope Blaze for imaging multiple or very large samples with subcellular resolution. Explore microscopy at a different level to accelerate your projects and pave the way for new insights. The combination of our pioneering UltraMicroscope technology with the latest developments in the field of light sheet optics and sample preparation guarantees best data quality.

**Easy handling based on full automation**
The UltraMicroscope Blaze enables seamless switching between different objectives and magnification lenses, and automated sample release with the click of a button, whilst keeping images sharp with the autofocus feature.

**Image multiple samples together**
Accelerate your research by imaging multiple samples together. The large sample holder can either host a whole cleared mouse model or up to five samples at once, which can then be imaged sequentially and effortlessly. See the big picture without losing the subcellular details.

**Next level light sheet imaging**
Cutting-edge illumination optics guarantee homogenous excitation, and the specially developed MI Plan objective series delivers unprecedented image quality.
The UltraMicroscope Blaze originates from a decade of experience and is designed to expedite your research projects. Our users’ feedback has been the driving force to create this new member of the UltraMicroscope family.

Loading a sample into the microscope and switching between different magnifications has never been easier. Enter the fast lane with the new UltraMicroscope Blaze and pave the way for new insights.

**Easy handling based on full automation**

**Autofocusing**
Keep your images sharp after sample and objective exchanges.

**Automated magnification changer**
Software-controlled exchange of magnification from 0.6× to 2.5×.

**Motorized turret:**
From overview to subcellular imaging
Switch automatically between our MI Plan objective lenses.

**Automated sample release**
The large sample chamber can be automatically released for sample exchange. It can hold a whole cleared mouse or up to five samples that can be imaged together.
Image multiple samples together

The new UltraMicroscope follows a simple rule: “Enable the easiest imaging of multiple or large samples for best data quality”. Now you can reduce time-consuming sample exchanges and avoid sectioning artifacts to increase your output on high quality data. Load all of your samples at once and run a pre-set program overnight. The UltraMicroscope Blaze will do the rest and your high quality 3D data will be ready for you the next morning.

Figure 1: UltraMicroscope Blaze sample holder hosting five samples at the same time.
Next level light sheet imaging

The combination of our successful UltraMicroscope technology with the latest developments in the field of light sheet optics guarantees the best data quality. The flat-field correction in addition to long working distances makes the MI Plan objective series well suited for high-resolution imaging of large samples. In addition, they are compatible with all imaging solutions from water to solvents with high refractive indices. Explore our broad range of magnification options, from panoptic imaging at 0.66× to subcellular imaging at 30×.

The UltraMicroscope Blaze uses cutting-edge illumination optics to slightly tilt 2×3 bidirectional light sheets with their Rayleigh lengths overlapping in the entire field of view (FOV). The Rayleigh length is where the light sheet is thinnest and where detection takes place. This helps to generate homogenous illumination and high image quality. Get the most out of your sample with improved optical sectioning.

The UltraMicroscope Blaze allows us to see every single cancer metastasis in the whole bodies of transparent mice and we can also see if drugs are targeting all those tiny micro-metastases. The UltraMicroscope Blaze will be a powerful tool for drug development in oncology.

Dr. Ali Ertürk, Director of iTERM, Helmholtz Zentrum München, Germany

Figure 2: The MI Plan objective lens series is optimized for high-resolution light sheet microscopy.

Figure 3: Intensity profile of the 2×3 bidirectional light sheets showing an overlap in the FOV. This optimized illumination generates uniform excitation that can achieve higher image quality and excellent optical sectioning.

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Obtain new insights in biology in three steps

With its cutting-edge optics, smart engineering, and intuitive interface, the UltraMicroscope Blaze offers a new perspective on organisms, how they are built, and how they function. Visualizing the three-dimensional architecture of complex biological systems is effortless thanks to the high-speed and automated imaging process. Since appropriate sample preparation is essential for this workflow, Miltenyi Biotec offers a complete portfolio of validated antibodies and antibody-fluorochrome conjugates, and an easy-to-use clearing kit. Start your experiments with the right tools to get the best results.

01 STAINING
Unique antibodies for reliable and reproducible staining. Explore our portfolio of REAfinity™ Recombinant Antibodies, validated for light sheet microscopy and optimized for our MACS® Clearing Kit.

02 CLEARING
The MACS Clearing Kit provides a clearing process that is straightforward to use: fast, non-toxic, cost-effective, and easy. Clearing renders the optical properties of opaque organs, like brains and tumor tissues, and even entire mouse models, transparent while keeping their structure intact.

03 AUTOMATED IMAGING
Multiple cleared samples can be imaged at once; each sample is excited by six focused light sheets and the resulting fluorescence is recorded. One sample after another is moved through the focal plane, exciting fluorophores at each layer and creating 3D image stacks while keeping photodamage and bleaching to a minimum.
Visualize details inside tumor cells in whole animal models and organs

The UltraMicroscope Blaze has many applications in immuno-oncology, such as:

- Visualization of single disseminated cancer cells in whole animal models.
- Drug target identification for cancer treatments in a whole mouse body.
- Section-free 3D histological analysis.

Cellular and molecular probing of intact human organs.

Deep learning reveals cancer metastasis and therapeutic antibody targeting in the entire body.

Locally renewing resident synovial macrophages provide a protective barrier for the joint.

Glioblastoma multiforme restructures the topological connectivity of cerebrovascular networks.

Correlated MRI and Ultramicroscopy (MR-UM) of brain tumors reveals vast heterogeneity of tumor infiltration and neoangiogenesis in preclinical models and human disease.

Tumor uptake of anti-CD20 fabs depends on tumor perfusion.
Mapping the fine-scale organization and plasticity of the brain vasculature.

Circuit asymmetries underlie functional lateralization in the mouse auditory cortex.

GABAergic inhibition in dual-transmission cholinergic and GABAergic striatal interneurons is abolished in Parkinson disease.

Three-dimensional study of Alzheimer’s disease hallmarks using the iDISCO clearing method.

Mapping of brain activity by automated volume analysis of immediate early genes.

Whole-brain imaging with single-cell resolution using chemical cocktails and computational analysis.

Understand the complex orchestration of neural circuits with whole-brain imaging at subcellular resolution. The UltraMicroscope Blaze offers many applications in neuroscience, such as:

• System-level identification of neuronal circuits in whole brains at subcellular resolution.
• 3D study of Alzheimer and Parkinson pathology in whole brains in unprecedented detail.
• Holistic visualization of affected areas in the central and peripheral nervous system after stroke and traumatic brain injury.
Specifications

The UltraMicroscope Blaze comes in two configurations. The zoom configuration is equipped with a manually controlled zoom optics reaching from 1.26× to 12.6×.

The automated objective (AO) configuration can host the MI Plan objective lenses and provides a total magnification from 0.6× to 30× thanks to its automated magnification changer. Both versions can be equipped with either 4.2 MP or 5.5 MP sCMOS camera.

Figure 4: Overview of the UltraMicroscope Blaze configurations.
## UltraMicroscope Blaze specifications

### Sheet optics
- **Illumination**: Uni- and bidirectional
- **Number of light sheets**: 1–6
- **Thickness**: 4–24 μm
- **Width**: 1–20 mm
- **Numerical aperture**: 0.0135–0.135
- **Focus positioning**: Dynamic

### Detection optics
- **Objective lenses**: 2×, 1.1×, 4×, 12×
- **Zoom/Magnification changer**: 1.26–12.6×, 0.66–2.75×, 2.4–10×, 7.2–30×
- **Resolution at detector**: 4.8–19.6 μm, 1.3–5.4 μm, 0.44–1.8 μm
- **Numerical aperture**: 0.5, 0.1, 0.35, 0.53
- **Working distance**: >5.7 mm, ≤17 mm, ≤16 mm, ≤10.9 mm
- **FOV diagonal (5.5 MP camera)**: 1.7–17.3 mm, 7.9–33 mm, 2.2–9.1 mm, 0.73–3 mm
- **Emission filters**: Seven filters Ø 32 mm, Seven filters Ø 43 mm
- **Chromatic correction**: Dynamic 400–850 nm

### Image chamber
- **Imaging solution**: Aqueous buffers and organic solvents
- **Sample travel range (x, y, z)**: 12.5 mm, 43.7 mm, 25 mm
- **Chamber size**: 129 mm × 51 mm × 64 mm
- **Multiple sample capacity**: Up to five samples at once
- **Refractive index matching**: 1.33–1.56

### General information
- **Dimensions (w×h×d)**: 67 cm × 91 cm × 52.5 cm
- **Weight**: 98 kg (w/o controller and laser)

### Light sources
- **Laser BC**: Max. 5 laser lines (405, 488, 561, 639, 785 nm)*, 50–100 mW per diode
- **Supercontinuum WLL**: 460 nm–800 nm, 1 mW/nm–3 mW/nm

*Five out of eleven available laser lines can be chosen for the Beam Combiner.

### Camera specifications
- **Detector**: 4.2 Megapixel sCMOS camera, 5.5 Megapixel sCMOS camera
- **Active pixels (w×h)**: 2048×2048, 2560×2160
- **Pixel size**: 6.5 μm × 6.5 μm, 6.5 μm × 6.5 μm
- **Sensor size**: 13.3 mm × 13.3 mm; 18.8 mm diagonal, 16.6 mm × 14 mm; 21.8 mm diagonal
- **Readout noise**: 0.8 med e–, 1 med e–
- **Maximal frame rates**: 100 fps, 100 fps
- **Maximum quantum efficiency**: 82%, 60%