

**MAG**  
INSTRUMENTS



# Magneto- & Bacteriodrome

[www.mag-instruments.com](http://www.mag-instruments.com)

## Digital microscopes with integrated magnetic field generation

Magneto- and Bacteriodromes are integrated optical systems with comprehensive magnetic field control.

Observe the influence of variable magnetic fields on magnetic compounds and organisms. Manipulate microrobots, magnetotactic bacteria, colloidal nanoparticles, and more..

### Key features

#### ✔ Digital Microscope

At the heart of every Magneto- and Bacteriodrome is a microscope with a digital camera or digital zoom lens used to observe the motion of microscopic particles or organisms.

#### ✔ Integrated magnetic field generators

A magnetic field source is built around the observation area allowing to precisely control the intensity and direction of the magnetic field that is applied to a sample.

#### ✔ Precise sample movement

A non-magnetic motorised stage allows for smooth control of the sample's location.

#### ✔ Advanced control software

The system is operated with a user-friendly software that allows controlling the magnetic field and supports advanced vision processing, motion tracking, video recording, and more.

## Setup examples

#### Digital camera

Camera for image processing inside the magnetodrome control software.

#### Magnetic field source

Integrated Helmholtz coil setup to generate uniform magnetic fields. Field direction can be adjusted in two or three dimensions depending on the coil setup.

#### Inverted optical microscope

Olympus CKX53 with 20x, 100x, 400x magnification (or custom solutions).

#### Custom stage

Static or motorised stage to control the position of the specimen.

**Bacteriodrome**

#### Magnetic field source

Four adjustable electromagnets to generate uniform or gradient magnetic fields.

#### Control Electronics

USB interface for PC connection



**Magnetodrome Custom setup**

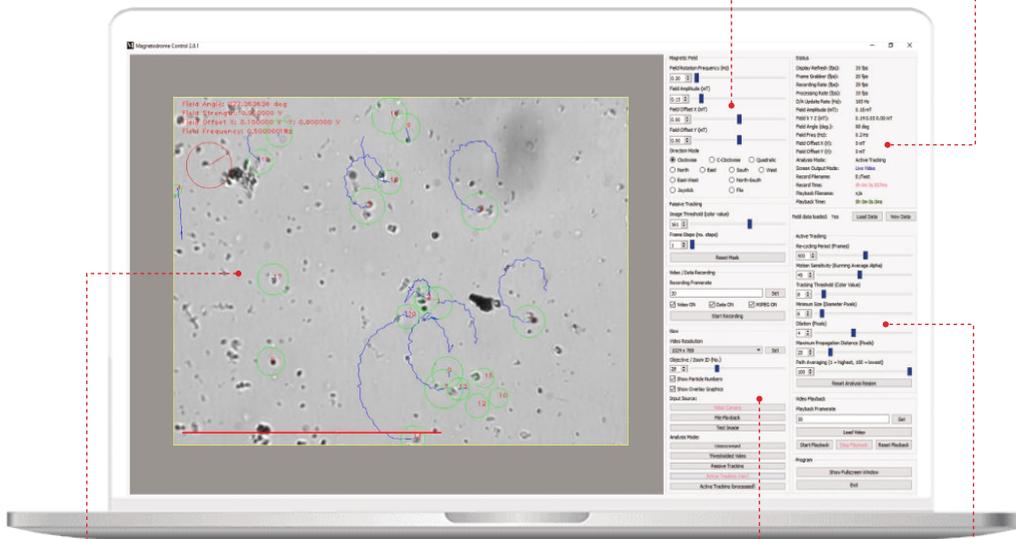
## Comprehensive software for real-time image processing and precise magnetic field control

### Magnetic Field settings

Flexible control of the magnetic field strength and direction, including circular field rotation, variable frequency and more.

### Status bar

Live view of all relevant system parameters.



### Video features

Settings for video recording, playback and vision processing.

### Camera live view

Live View of the microscope camera, with optional motion tracking results.

### Active motion tracking

Control of vision processing parameters to optimise the identification of particles of interest.

## Software



### Magnetic field control

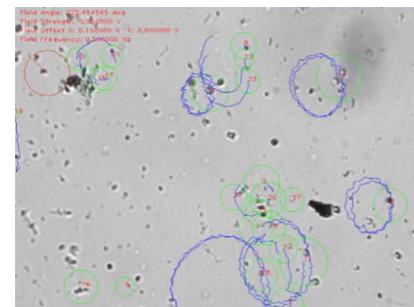
- ✔ Circular rotation of the field with variable frequency.
- ✔ Constant switching between North-South, East-West, or up-down.
- ✔ Manual control of the field through the included joystick or mouse.
- ✔ User-defined sequence of automatic field variation.



### Image processing

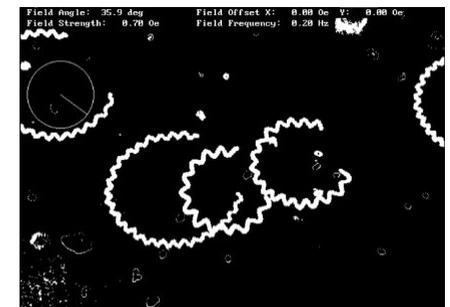
- ✔ Active tracking with optional export of trajectories
- ✔ Counting of moving objects
- ✔ Threshold view for passive tracking of moving objects.

**Additional software functionality can be added upon request.**



### Active tracking example

Moving particles are recognised, counted, and their trajectories are plotted.



### Passive tracking example

Threshold view and image stacking to visualise the motion of moving particles.

## Specifications and available configurations

| Bacteriodrome                |                                      |                                      |                        |
|------------------------------|--------------------------------------|--------------------------------------|------------------------|
| Model                        | Basic                                | Advanced                             | Custom                 |
| <b>Optical system</b>        | Inverted microscope<br>Olympus CKX53 | Inverted microscope<br>Olympus CKX53 | Custom                 |
| <b>Magnification</b>         | 20x, 100x, 400x                      | 20x, 100x, 400x                      | Custom                 |
| <b>Magnetic field source</b> | 2-axis Helmholtz coils               | 2-axis Helmholtz coils               | 3-axis Helmholtz coils |
| <b>Maximum applied field</b> | 1 mT                                 | 1 mT                                 | Up to 5 mT             |
| <b>Non-magnetic stage</b>    | Static                               | Motorised                            | Motorised              |
| <b>Digital camera</b>        | Customisable                         | Customisable                         | Custom                 |

| Magnetodrome                 |  |                                 |  |
|------------------------------|--|---------------------------------|--|
| Model                        | Basic                                  | Advanced                        | Custom                                 |
| <b>Optical system</b>        | Inverted microscope<br>(Olympus CKX53) | Zoom lens<br>(Keyence VH-Z100T) | Custom                                 |
| <b>Magnification</b>         | 20x, 100x, 400x                        | 100-1000x                       | Custom                                 |
| <b>Magnetic field source</b> | 2-axis electromagnets                  | 2-axis electromagnets           | Up to 3 axis electromagnets & HH coils |
| <b>Maximum applied field</b> | Up to 100 mT                           | Up to 100 mT                    | Up to 100 mT                           |
| <b>Non-magnetic stage</b>    | Motorised                              | Motorised                       | Motorised                              |
| <b>Digital camera</b>        | Customisable                           | Customisable                    | Custom                                 |

## Application examples



### Biomagnetism

Our Magneto- and Bacteriodromes have been originally developed to investigate and manipulate magnetotactic bacteria. These microbes are common in aquatic environments worldwide and are important for the magnetisation of natural sediments. Internal permanent magnets cause a passive alignment of the microbes in magnetic fields resulting in directed locomotion.



### Microrobotics

In the emerging field of magnetic microrobotics, precisely controlled magnetic fields are used for locomotion of tiny robots through wireless power transfer, or by direct motion control via magnetic force or torque. These techniques can be applied small-scale transporting and mixing of chemicals, microfluidics, bioengineering or nanorheology. Medical applications include targeted drug delivery and minimal invasive surgery.

**Bacteriodrome:** Through rotating or oscillating homogeneous magnetic fields produced with triaxial Helmholtz coils, magnetic micro-propellers or microbeads, can be precisely navigated, mimicking the motion of microorganisms in fluids.

**Magnetodrome:** Direct propulsion of magnetic microrobots can be achieved by magnetic field gradients produced with an arrangement of electromagnets.



### Material Sciences

Controlled magnetic fields are used in colloidal science, for the self-assembly and aggregation of para- or ferromagnetic nanoparticles, into ordered structures. The technology is used to develop and fabricate novel functional materials, with extensive applications in the chemical industry, biotechnology, pharmaceuticals, and nanotechnology.

# MAG



## INSTRUMENTS



Based in Munich, Germany, Mag-Instruments was founded in 2014 by robotics engineer Dr. Przemyslaw Kryczka and a group of specialists in geophysics, mechatronics, and robotics to bring state-of-the-art technology into magnetic measurements.

We develop and manufacture innovative scientific equipment. Our constantly-growing product line includes state-of-the-art magnetometers, magnetic field generating instruments such as Helmholtz coil setups, and demagnetising equipment.

[www.mag-instruments.com](http://www.mag-instruments.com)

**Mag-Instruments UG**  
(haftungsbeschränkt)

Kistlerhofstr. 170  
81379 Munich Germany

**info@mag-instruments.com**