

GP



# Food Microbiology

## MALDI Biotyper<sup>®</sup>

- AOAC-OMA & ISO 16140-part 6 validated

# In Food Microbiology, Speed and Accuracy Matter

## MALDI Biotyper<sup>®</sup>

### Confirmation and identification of microorganisms by their molecular fingerprint

The MALDI Biotyper identifies microorganisms using MALDI-TOF (Matrix-Assisted Laser Desorption/Ionization Time of Flight) Mass Spectrometry to determine the unique proteomic fingerprint of an organism. The characteristic spectrum pattern of this proteomic fingerprint is used to reliably and accurately identify a particular microorganism by matching thousands of reference spectra from microorganism strains.

Integrating the MALDI Biotyper into routine testing workflows results in a significant consolidation of resources, as it replaces multiple traditional and biochemical identification methods, and eliminates the burden of multiple steps, workstations and metrology requirements of DNA sequencing.

Additionally, the MALDI Biotyper can be conveniently used as a fast and easy pre-screening method, prior to deeper strain characterization by the IR Biotyper<sup>®</sup>, by sequencing or another DNA fingerprinting technique.



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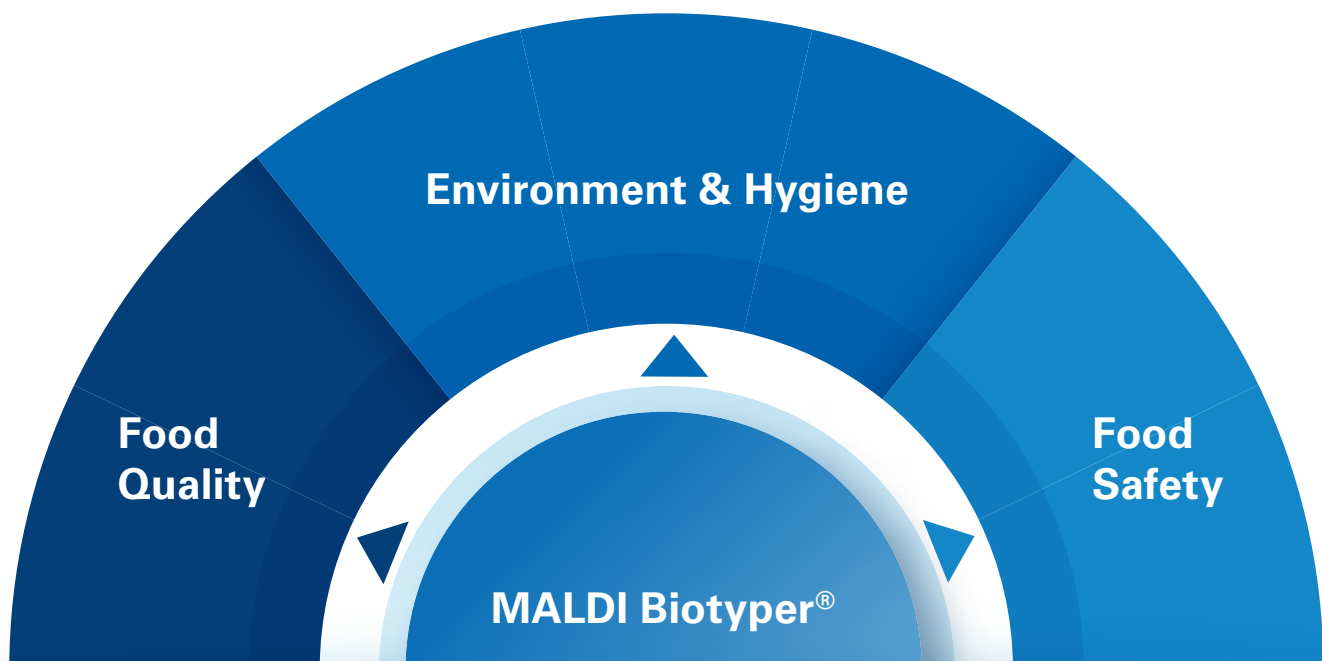
# Ensure Customers Trust Your Brand

The MALDI Biotyper can be used in microbial laboratories as a reliable rapid test method for hygiene monitoring, food and ingredients quality control, pathogen detection, plus food safety related analytical questions.

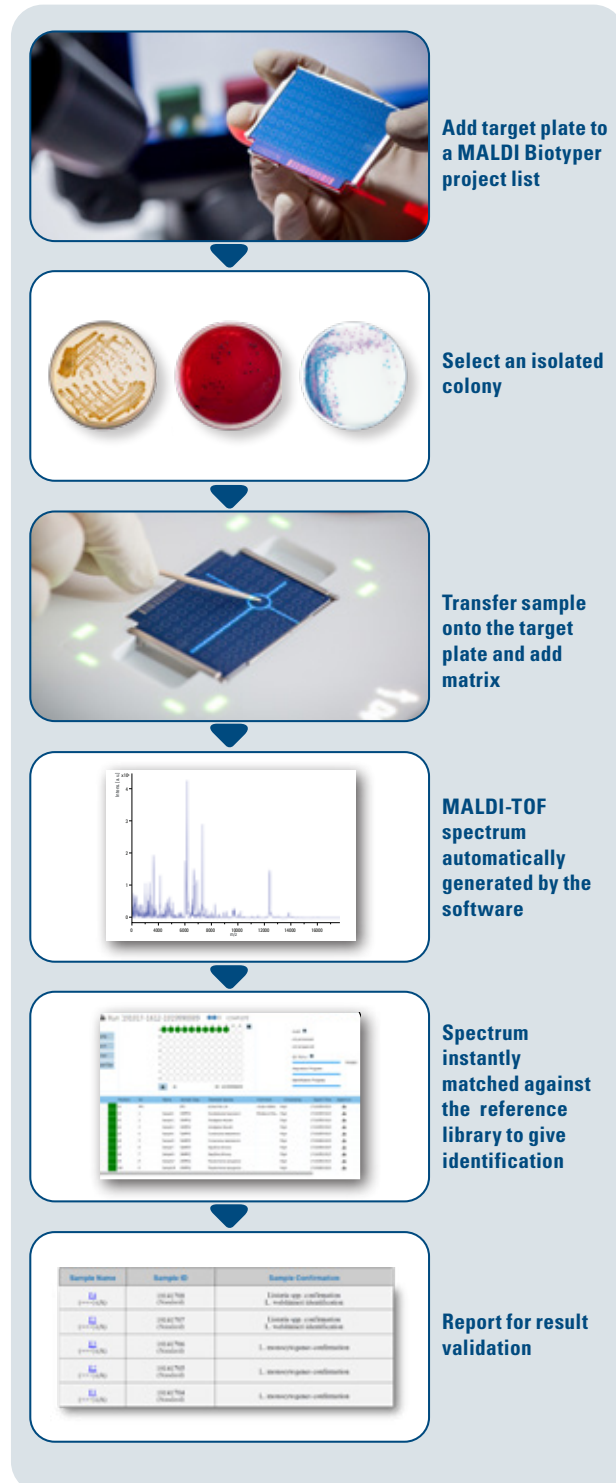
The versatile system can also be applied in environmental monitoring, control of food production strains, detection of animal or plant pathogens or water analysis.

On top of that, plenty of research topics benefit from using the MALDI Biotyper, such as projects on microbiomes, probiotics, beverages or new food. As an example, meat and milk alternatives are a major global trend and raise new questions in microbiology.

The MALDI Biotyper offers quick identification of bacteria, yeast and molds in minutes, starting from colony material. Conveniently, all gram-positive and gram-negative bacteria, yeast and molds can be measured in parallel, in one run; there is no need for many assays or different reaction plates.



# A Simple Procedure for a Sophisticated Platform



## Bacteria, yeast or molds: one workflow for all

The MALDI Biotyper system workflow has been designed to be efficient and easy. No previous experience with mass spectrometry is required. As shown, the straightforward, fully traceable workflow requires only a few simple steps to generate high quality microorganism identification.

Typically, no more than one single isolated colony from a culture is required.

Our dedicated microbiology software automates the process of acquiring the mass spectrum and performing the match against the extensive reference library. The results, presented using a 'traffic light' color scheme, are effort-less to interpret.

The hands-on time per isolate is only 20 seconds for 95% of the microorganisms. The short time-to-result allows investigation of a full 96-spot target plate in 30 minutes. The MALDI Biotyper simplifies and shortens the confirmation and identification step, facilitating and harmonizing the workflow with only one system.

Sample preparation hands-on time:

- 1 isolate ~20 seconds
- 95 isolates < 20 min

Time-to-Result including sample preparation:

- 95 isolates + 1 QC sample: ~30 min



# AOAC-OMA & ISO 16140-part 6 Validated for Food Microbiology

The AOAC-OMA (Official Method of Analysis by AOAC International) and ISO 16140-part 6 (MicroVal) validation studies have clearly shown the reliability and reproducibility of the MALDI Biotyper.

The certifications, issued in 2018, have recently been expanded by the certification bodies to include now as well the newest MALDI Biotyper sirius systems and the latest MBT Compass HT software version.

The certifications are valid when using the MALDI Biotyper in combination with the reference library version 2016, or any later released version. The MBT Compass Library is annually updated and expanded; version 2021 covers close to 3900 species.

The certificates and the reports of the ISO 16140-part 6 validation studies are available on [www.microval.org](http://www.microval.org).

The AOAC-OMA #2017.09 and AOAC-OMA #2017.10 protocols are available on [www.eoma.aoc.org](http://www.eoma.aoc.org).



Analyte	Certification Body	Claim	Agars used in evaluation (selective and non-selective)
<b><i>Cronobacter</i></b>	MicroVal Certificate N° 2017LR72	Confirmation of <i>Cronobacter</i> from various agar plates	TSA, ESIA, CCI
<b><i>Salmonella</i></b>	MicroVal Certificate N° 2017LR73	Confirmation of <i>Salmonella</i> from various agar plates	TSA, XLD, BGA, RAPID'Salmonella, Brilliance Salmonella, ASAP, CASE Agar
<b><i>Campylobacter</i></b>	MicroVal Certificate N° 2017LR74	Confirmation of <i>Campylobacter</i> from various agar plates	CBA, mCCDA, RCA, CCA, CampyFood, RAPID'Campylobacter
<b><i>Listeria spp &amp; Listeria monocytogenes</i></b>	MicroVal Certificate N° 2017LR75	Confirmation of <i>Listeria spp &amp; Listeria monocytogenes</i> from various agar plates	TSYEA, Oxford and modified Oxford, OAA, PALCAM, RAPID'L. mono
<b>Gram-negative organisms</b>	AOAC OMA #2017.09	Confirmation and Identification of <i>Salmonella spp.</i> , <i>Cronobacter spp.</i> , <i>Campylobacter spp.</i> , and other gram-negative organisms	Equivalent to the Microval list
<b>Gram-positive organisms</b>	AOAC OMA #2017.10	Confirmation and Identification of <i>Listeria monocytogenes</i> and <i>Listeria spp.</i> , and other gram-positive organisms	Equivalent to the Microval list

# Food Relevant Applications and Strains

Typical food industry bacteria, yeast and molds, covered by the MALDI Biotyper



## Milk & Dairy

*Lactococcus, Lactobacillus, Staphylococcus, Listeria, Salmonella, Cronobacter, Brucella*



## Meat & Egg

*Salmonella, Campylobacter, E. coli, Listeria, Staphylococcus, Yersinia*



## Fruits & Vegetables

*E. coli, Listeria, Leuconostoc, Salmonella, Enterobacter, Klebsiella*



## Cocoa & Confectionary

*Salmonella, E. coli, Staphylococcus, Aspergillus, Penicillium*



## Beverages

*Alicyclobacillus, Lactobacillus, Pediococcus, Zymomonas, Candida, Saccharomyces*



## Drinking Water

*Legionella, E.coli, Pseudomonas, Enterococcus, Alcaligenes, Lelliottia, Campylobacter*



## Probiotics and Starter Cultures

*Lactobacillus, Bifidobacterium, Streptococcus, Saccharomyces, Propionibacterium*



## Veterinary

*Salmonella, Staphylococcus, Streptococcus, Candida, E. coli, Campylobacter*



## Flour & Milling

*Salmonella, E. coli, Bacillus, Aspergillus, Penicillium*



## Seafood

*Listeria, Vibrio, Salmonella, Streptococcus, Aeromonas*

# The Core of the MALDI Biotyper

## A continuously updated reference library

The principle behind identification of microorganisms with the MALDI Biotyper is the comparison of the mass spectrum of an unknown organism with a library of reference mass spectra. As the extent and quality of this library is key to successful identification results, Bruker is fully committed to the continuous development of the reference library. An active program of reference spectra generation culminates in regular library updates for MALDI Biotyper users. These updates focus on strains from various origins being primary production, raw materials and food products, environmental samples, veterinary samples etc.

## Taxonomy becomes easy

The metadata of the MALDI Biotyper Reference Library facilitate the access to taxonomical information, such as synonyms and taxonomical modifications.

## Tackle the filamentous fungi challenge

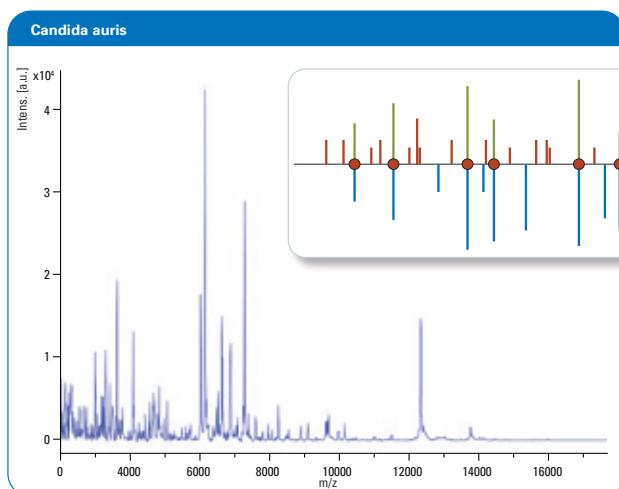
The MALDI Biotyper is perceived as the most promising alternative for molds identification. A dedicated MBT Filamentous Fungi Suite (software module and library) is available to facilitate the identification of this group of microorganisms. The standard direct transfer of a sample onto the MALDI target can be used in the majority of the cases if front mycelium is available for harvesting.

## Identification of highly pathogenic microorganisms

A dedicated small library is available for identification of highly pathogenic species such as *Brucella melitensis*, *Vibrio cholerae* and *Clostridium botulinum*.

## Create your own libraries and run your data comparison

Laboratories that need to create their own libraries can easily compile customized microorganism entries by software tools and share or export libraries. These might be libraries with site-specific isolates and/or entries for important starters used for production. For further investigations, software tools – such as dendrogram analysis – are available.



## The Main Spectra concept

Reference library entries in the MALDI Biotyper system are stored as Main Spectra (MSP). These MSPs are based on multiple measurements of a single defined strain to ensure that the true biological variability of an organism has been captured.

Unknowns are then compared to the MSP library using a superior pattern-matching approach. This includes peak positions and intensities, ensuring the highest possible levels of accuracy and reproducibility across the complete range of microorganisms.

# MALDI Biotyper Subtyping Module

## Applications dedicated to primary production and food testing

### Seamless and fast workflow

To acquire a typing result, no additional sample preparation is required once the samples are directly transferred to MALDI target plates. When the bacterium has been identified, the software automatically performs the typing and result reporting for the applications covered by the MBT Subtyping Module.

### Fast microorganism identification combined with instant typing

The prerequisite for the automated typing process is high confidence identification of the bacterium in the MALDI Biotyper workflow. For species differentiation the MBT Subtyping Module then looks for decisive peaks in the mass spectrum.

### Facilitating differentiation of closely related *Listeria* species

Differentiation of *Listeria* species is now as easy as can be!

The MBT Subtyping Module supports the differentiation of *L. monocytogenes* from the other closely related *Listeria* species and starts automatically when a high identification score is achieved by the MALDI Biotyper.

This enables food microbiology laboratories to implement routine confirmation on *Listeria* spp. and *L. monocytogenes* in the daily workflow, directly from culture without any major effort. Additionally, the identification of the other *Listeria* species is provided: *L. grayi*, *L. innocua*, *L. ivanovii*, *L. seeligeri* and *L. welshimeri*.

### Instant resistance marker detection in primary production

The rise of antimicrobial resistant strains of bacteria is observed in livestock and in environmental samples. Surveillance and epidemiological studies are currently of major concern in food animal production.

The MBT Subtyping Module enables fast detection of specific resistances in an automated workflow. The software searches for peaks of proteins associated with antibiotic resistance and, if present, reports the respective bacterium as presumptive resistant.

Some of the available applications are of interest, such as MRSA subtyping. MRSA (Methicillin-resistant *Staphylococcus aureus*) strains are resistant to beta-lactam antibiotics, and are more and more encountered in primary production. MRSA surveillance is currently increasing, e.g. in dairy cattle and raw milk, veal calves and pigs.

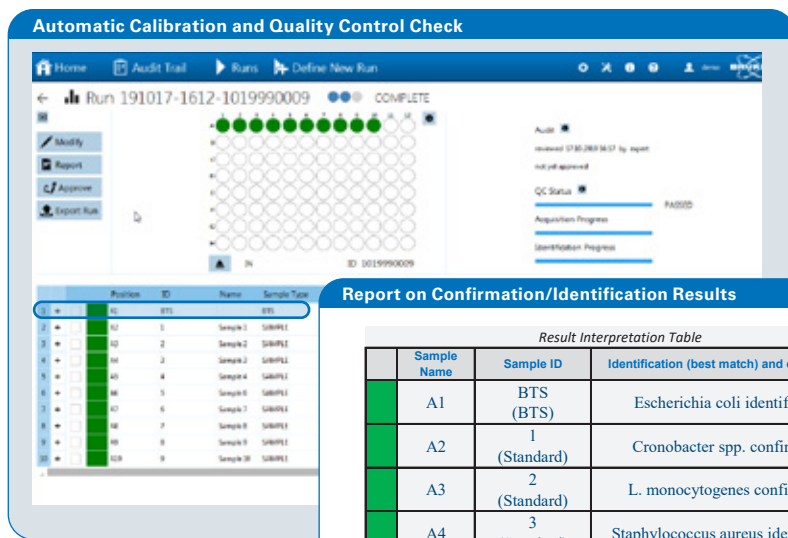




# Easy-to-Use Software

Dedicated to routine testing, easy export to the LIMS

In just a few steps, the simple-to-use software guides users through the set-up of samples for analysis.



◀ The MALDI Biotyper system is automatically checked using Bacterial Test Standard (BTS) before each use. When the check is successful, the system automatically begins the measurement process.

**Report on Confirmation/Identification Results**

Result Interpretation Table		
Sample Name	Sample ID	Identification (best match) and confirmation
A1	BTS (BTS)	Escherichia coli identification
A2	1 (Standard)	Cronobacter spp. confirmation
A3	2 (Standard)	L. monocytogenes confirmation
A4	3 (Standard)	Staphylococcus aureus identification
A5	4 (Standard)	Campylobacter spp. confirmation
A6	5 (Standard)	Enterococcus faecalis identification
A7	6 (Standard)	Salmonella spp. confirmation

After the acquisition of the spectral data has been completed, a report is generated. The result for each sample is clearly listed under „Identification (best match) and confirmation“.

The MALDI Biotyper report for food microbiology directly provides the final interpretation of the results: pathogen confirmations and other identifications are clearly listed.

## Open microbiology concept

The MALDI Biotyper allows for smooth integration with existing laboratory informatics. The results are converted into a format that can easily be exported to the LIMS.



# One System - One Workflow

## Food Quality

### Fast identification of microbial contaminants or spoilage organisms, technological strains and good bacteria during quality control

Accurate quality controls along the fermentation and ripening processes, or during storage, are fundamental to guarantee the stability of starters and the absence of unexpected microbial contaminants. This is crucial to ensure the organoleptic qualities or the probiotic benefits of your fermented products.

Reliable identification of microbial spoilers reveals their heat resistance and growth parameters. This helps in optimizing food formulations, production processes and storage conditions to prevent microbial growth. In addition, a relevant screening plan of raw materials and other ingredients can easily be developed.

## Environment & Hygiene monitoring

### Fast identification of microbes in food and veterinary processing environments, and efficacy-control of general cleaning and sanitation

Surface sampling and related colony counts help in controlling potential biofilm development. However, identifying the involved bacteria is usually key to establishing appropriate corrective plans.

Processing plant personnel or small animals (e.g. rodent pests, or insects) are also potential contamination sources in the food processing facility in many respects.

Environmental swabbing involves the microbiological testing of food preparation surfaces, water tanks, storage facilities, soils and ceilings of breeding facilities, equipment and utensils, using various swab techniques to find out if pathogens are present. It is also used to verify whether a food business' cleaning and sanitation programs are effective (known as cleaning verification).

Easy and minimal handling

1 isolate  
~20 sec

Short time-to-result

1 isolate  
~15 min

1



1 colony



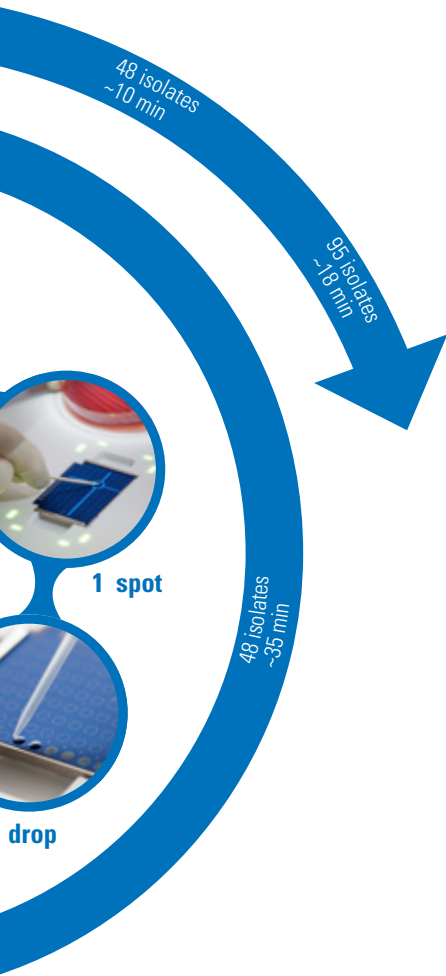
1 system

95 isolates  
~60 min

**1 colony • 1 spot • 1 droplet • 1 system  
for all samples**

Gram-positive and gram-negative bacteria, yeasts and molds, can be measured in parallel, in one run; there is no need for various assays or different reaction plates.

# Decision-making Driven by Real-Time Results



## Food Safety

### Fast confirmation of pathogens

Using the same workflow and the same consumables, confirmation of *Salmonella* spp., *Cronobacter* spp., *Campylobacter* spp., *Listeria* spp. and *Listeria monocytogenes* can reliably be performed in no time, from various agar plates. The flexible and low cost workflow encourages convenient testing of multiple colonies in one run, gaining crucial time for confirmation.

The AOAC-OMA and ISO 16140-part 6 validation allows confirmation of the above mentioned pathogens and quality indicators from validated culture media. Furthermore, the AOAC-OMA allows identification of bacterial isolates from any of the validated culture media mentioned for isolation of foodborne pathogens and quality indicators.

### Confirmation and identification available within minutes

A fast confirmation result allows for timely actions, such as food batch withdrawal or release of safe food batches.

Implementing the system in the laboratory workflow can directly translate to significant cost savings by accelerated testing along the entire process chain.

### One System – One Workflow

The MALDI Biotyper system can be employed in all of these different application fields with one single easy workflow for bacteria, yeasts and molds, providing rapid and reliable identification of positive microflora and microbial contaminants. The results can then automatically be transferred to the LIMS.

In addition to using the standard MALDI Biotyper Reference Library, the open concept of the system offers the flexibility to build your own reference library with your starter cultures or site-specific contaminants.



# The Best Technology from the Experts in Mass Spectrometry

## A platform suited to your needs

Being the leader in MALDI-TOF technology, it is of great importance to Bruker to design robust, compact, high performance platforms intended for extensive and routine usage in the microbiology laboratory. Continuous hardware development has led to the 4<sup>th</sup> generation of Bruker's benchtop MALDI Biotyper systems.

Bruker offers laboratories the opportunity to choose the MALDI-TOF mass spectrometer that best fits their needs:

- The new **MALDI Biotyper sirius one GP System** with Bruker's proprietary lifetime\* smartbeam™ solid state laser technology at 200 Hz repetition rate and positive ion mode. System improvements, including the newest electronics and high performance vacuum system, generate fast target exchange times for accelerated time-to-result - even faster than before.
- The **MALDI Biotyper sirius GP System** with Bruker's 200 Hz smartbeam™ laser and latest developments in electronics allowing for positive and negative ion detection. The additional capability of analysis in negative ion mode allows the MALDI Biotyper sirius to broaden the research applications, such as the analysis of lipids.

## Resolution meets sensitivity

Resolution and sensitivity are tailored to the needs of microbiologists. Due to Bruker's patented PAN™ resolution the MALDI Biotyper achieves optimal results from a compact benchtop instrument.

## Highly reproducible results

The quick and simple Bacterial Test Standard quality check performed before each run ensures the highest standard of run-to-run reproducibility.

## Accelerated data acquisition

With Smart Spectra Acquisition™, data generation is accelerated by minimizing the number of laser shots per sample needed to acquire a meaningful spectrum. An additional benefit of this function is the optimal exploitation of the laser lifetime.

## Continuous operation

The integrated ion source cleaning permits continuous high performance with minimized maintenance requirements. Cleaning the source using the separate IR-laser is performed easily under push-button operator control, without breaking vacuum.



# Compact Benchtop Systems – No Performance Compromise

## True benchtop solutions

Low-noise operating systems with low weight and requiring less than 1 m / 4 feet of counter space offer flexibility in meeting laboratory needs for compact system solutions. Both systems need only a 220 V / 110 V electrical supply which results in very minimal heat output.

	MALDI Biotyper sirius one GP System	MALDI Biotyper sirius GP System
Laser	Bruker's proprietary lifetime* smartbeam laser <ul style="list-style-type: none"> <li>• 200 Hz repetition rate</li> <li>• ~600 samples/hr</li> <li>• 500 million laser shots</li> </ul>	
Polarity	Positive ion mode only	Positive and negative ion mode
Mass range	0-500.000 Da; with MALDI Biotyper applications focused to: <ul style="list-style-type: none"> <li>• 0-1000 Da (resistance detection)</li> <li>• 2.000-20.000 Da (microorganism identification)</li> </ul>	
Vacuum system	High capacity turbomolecular pump <ul style="list-style-type: none"> <li>• high pumping capacity</li> <li>• very fast target exchange</li> <li>• minimal down-time after maintenance</li> </ul>	
L x W x H	500 x 710 x 1070 mm / 19.7 x 28.0 x 42.2"	
Weight	75 kg / 165.4 lb	
Common features	LED strip to remotely observe system status Perpetual Ion Source™ with IR-laser based self-cleaning functionality Whispermode™ Oil-free membrane pre-vacuum pump and turbo pump <60 dB under normal operating conditions Patented PAN™ technology for high mass resolution over a wide mass range Voltage: 220 V / 110 V	
Noise	< 60 dB	
Temp Range	16 - 30°C 61 - 86°F	
Operating Humidity	20 - 75% non-condensing	

\* Lifetime means: 500 million laser shots or seven years (whichever occurs first)

# MALDI Biotyper System Overview

## Benchtop MALDI-TOF system

- **MALDI Biotyper sirius one GP System,**  
with 200 Hz smartbeam™ laser and positive ion mode or
- **MALDI Biotyper sirius GP System,**  
with 200 Hz smartbeam™ laser and positive and negative ion detection

All MALDI Biotyper systems are running under Microsoft WIN® 10 Operating System.

## Routine identification of gram +/- bacteria, yeasts

### Software

- MBT Compass HT Software
- MBT Compass Library
- MBT Subtyping Module
- Security Related Library for identification of highly pathogenic microorganisms (optional)

### Consumables

- Matrix HCCA-portioned
- Bacterial Test Standard
- MBT Biotarget 96

## Filamentous fungi identification (optional)

- MBT Filamentous Fungi Suite

## Certification/Validation

- Recognized as an Official Method of Analysis by AOAC International
- ISO 16140-part 6 validated by MicroVal

## Accessories for workflow optimization (optional)

- MBT Shuttle ergonomic target holder
- MBT Pilot® for guided sample transfer

Please contact your local Bruker sales representative for availability of the optional MBT system components in your country.

# MBT Consumables for Basic Identification

## Bacterial Test Standard (BTS)

The BTS is an *E. coli* extract spiked with two high molecular weight proteins and has been developed for the quality control process of the MALDI Biotyper system. Its specific composition covers the entire mass range of proteins used for precise identification of microorganisms.

Content: One box consisting of 5 tubes providing 50  $\mu$ L per tube / Part No 8255343



## HCCA Matrix, portioned

The instant HCCA matrix enables easy and convenient preparation of HCCA matrix solutions. The matrix is soluble in standard organic solvent, easy to handle, and enables highly sensitive measurements.

Content: One box consisting of 10 tubes providing 250  $\mu$ L per tube / Part No 8255344

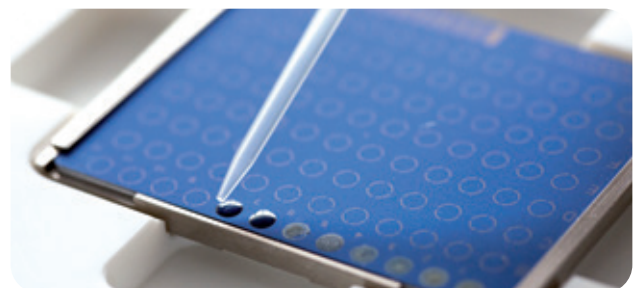


## Disposable MBT Biotargets

The ready-to-use disposable MBT Biotargets offer 96 positions and a unique barcode for full traceability in paperless workflows. Disposable MBT Biotargets render the same level of performance as reusable MALDI target plates without the need for time-consuming cleaning.

### MBT Biotarget 96

Set of 20 individually barcoded disposable MALDI target plates with 96 positions / Part No 1840375



### MSP adapter for MBT Biotarget 96

Adapter required to use MBT Biotargets with benchtop MALDI Biotyper systems / Part No 8267615

# Changing Food Microbiology

## A seamless solution for microorganism confirmation/identification and strain typing

Are you also in need for rapid strain typing methods for real-time quality control and source tracking?

Bruker's IR Biotyper system allows same-day strain typing of colonies, based on FT-IR spectroscopy. The easy-to-use benchtop system enables fast and cost-effective microbial typing with high discriminatory power. With the IR Biotyper, fingerprinting and data analyses are performed in less than 3 hours, allowing real-time monitoring of technological processes and source tracking. Needing only 30 minutes for the sample preparation of a maximum of 30 isolates, Bruker's typing solution is easy to implement in a routine laboratory workflow.

Software connectivity with the MALDI Biotyper enables easy upload of sample data from MALDI Biotyper to IR Biotyper.

Summarized, only some benchtop space equipped with the dedicated MALDI Biotyper solution for food microbiology, complemented by the IR Biotyper, is needed for confirmation/identification and strain typing of microorganisms, in just 3 hours.



## Enabling Smarter Food Safety

MALDI Biotyper®, MBT Pilot® and IR Biotyper® are registered trademarks of the Bruker group of companies.

Not for use in clinical diagnostic procedures.

Please contact your local representative for availability in your country.

**As of May 2021, Bruker Daltonik GmbH is now Bruker Daltonics GmbH & Co. KG.**

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