

## MiRob Rapid Identification of Bacteria and Fungi



Petri dish infeed

Fraunhofer Institute for  
Factory Operation and Automation IFF

Director  
Prof. Michael Schenk

Sandtorstrasse 22  
39106 Magdeburg  
Germany  
Tel. + 49 391/40 90-0  
Fax + 49 391/40 90-250  
info@iff.fraunhofer.de  
http://www.iff.fraunhofer.de

Contact  
Department of Robotic Systems  
Dr. Oliver Lange  
Tel. +49 391/40 90-219  
Fax +49 391/40 90-250  
http://www.iff.fraunhofer.de  
oliver.lange@iff.fraunhofer.de

Commercially available automated technology that prepares samples for microbial analyses directly from the Petri dish is rarely satisfactory. In particular, the entire process of using mass spectrometers (e.g. MALDI-TOF) to rapidly identify samples and constituents and matching them with a database (e.g. SARAMIS) needs to be speeded up.

Sample preparation in particular is time consuming and even hazardous since humans manually transfer a highly concentrated microorganism colony from the agar surface to the target of analysis.

### The Project: Automatic Colony Picking and Sample Preparation in Microbiology

**The objective** is to automatically prepare samples to determine microbe species by using mass spectrometry. The identification of species is based on the detection of key proteins. The masses of proteins are matched with a database instead of a specific biochemical reaction. The robot reduces the setup time for 100 samples to less than one hour. In the process, it additionally establishes a pure culture in a microtiter plate. Along with using a database to easily trace a sample, a microorganism can consequently be accessed for subsequent analyses.

**The procedure:** A conveyor belt feeds the Petri dishes to the robot. A vacuum sucker takes off the cover and the grip arm lifts the plates from the belt and places them on a table with three degrees of freedom. The table positions the dishes extremely precisely so that even pinpoint colonies of 0.5mm in diameter can be reliably identified, measured and sampled. The cell material is stripped

off on the target or suspended. Afterward, the same inoculating rod inoculates the culture medium prepared in the microtiter plate. The inoculating rod is designed to be disposable and is automatically replaced. After the cover has been put on, the conveyor belt again transports the Petri dishes out of the robot station.

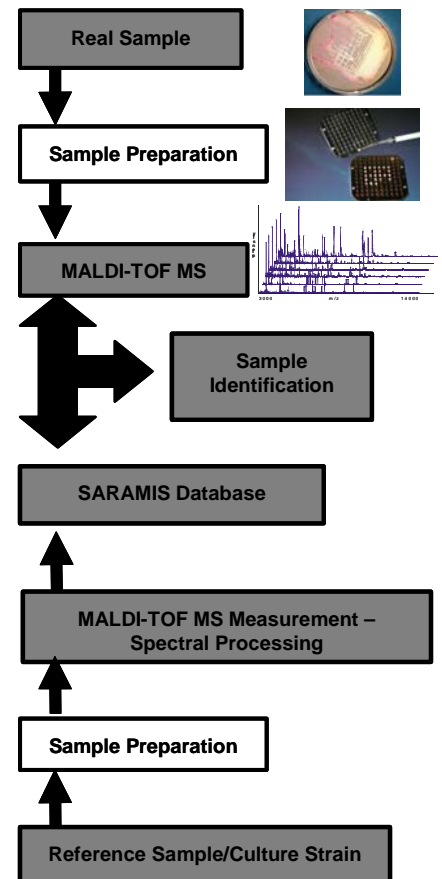




Table with three degrees of freedom with revolving mirror, microtiter plate and MALDI-TOF target

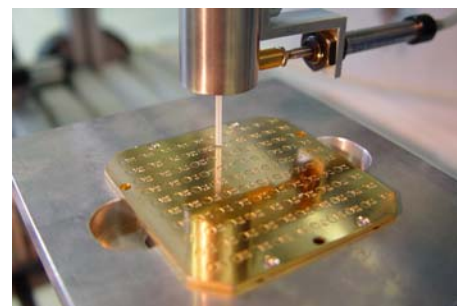
**Material flow control** is essential for mass screening to ensure results are clearly assigned to the sample. The barcodes employed are applied laterally on the bottom microtiter plate so that they do not interfere with the image processing. Since their curvature makes small dishes difficult to read with a barcode scanner, a camera-based solution was integrated. A revolving mirror makes the barcode visible for the image processing camera. Commercially available software covers a broad range of common barcodes. The robot generates a corresponding database entry for every sample.

The user programs the **imaging**. Afterward the robot categorizes the colonies based on size, color and surface structure, which is then the basis for taking samples. It is also possible to extract all samples or only one. In order to ensure the culture is pure, non-circular colonies can be excluded from sampling. Parameters for minimum size and safe distance between two colonies also exist. Thus, taking a mixed sample is improbable.

When selection is semi-automatic, the lab specialist programs the positions being picked on the monitor. The advantage is that no one has to be physically present in the lab since the procedure can be executed just as well over a network.

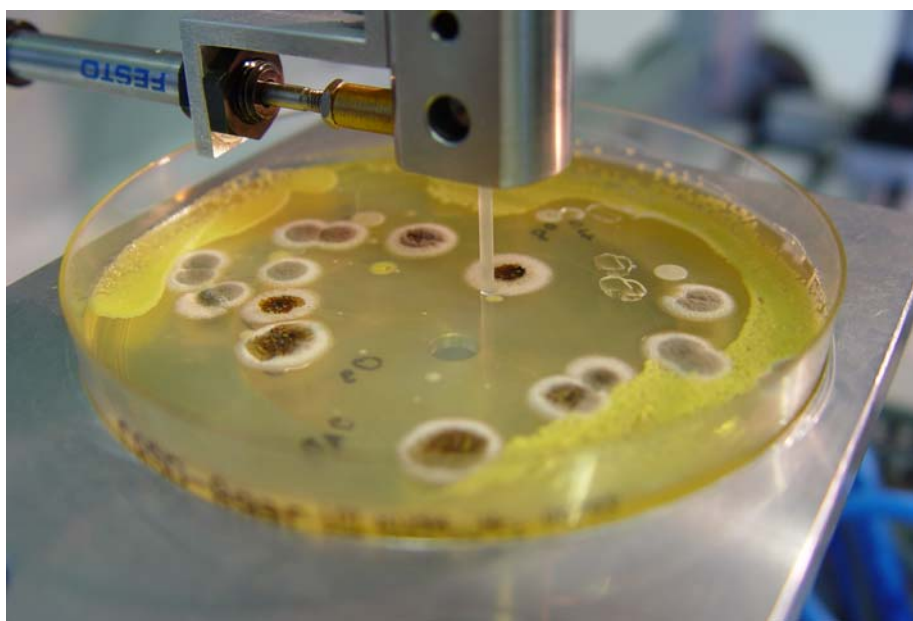
The inoculating rod is positioned roughly above the colony (approximately 5–10 mm) and then released. The rod drops the short distance and is seized again. This guarantees there is contact without additional precision sensors and the agar remains intact. The rod vibrates and/or is moistened with water beforehand. Preliminary tests have demonstrated that this makes it possible to take up sufficient cells even from hard or encrusted colonies.

The sample is deposited in a similar manner. The deposition point is moistened with water beforehand so that the rod's vibrations create a suspension. Should the analyses equipment be on the verge of becoming overloaded, this is cut back by repeated deposition. Lastly, the microtiter plate is inoculated. The inoculating rod is ejected and a new one from the storage container is automatically inserted in its place from above.



Depositing the sample on the MALDI-TOF target

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Sampling with disposable inoculating rod