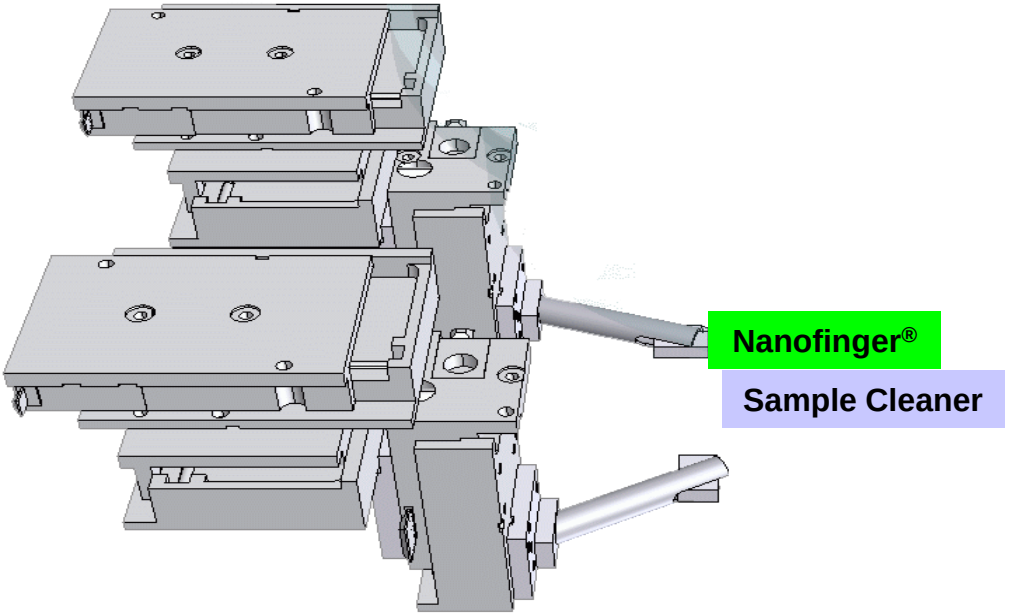
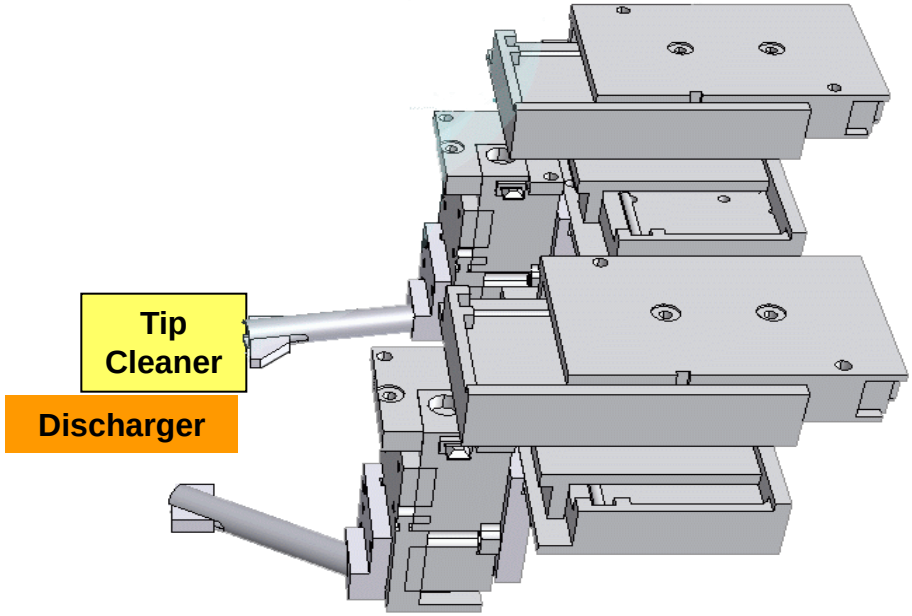
NanoCleaning:

Removing Particles inside SEM/FIB systems with the Nanoworkbench from Klocke Nanotechnik

NanoCleaning

Nanoworkbench Configuration:





1. Nanomanipulator equipped with: Probe tip for sample cleaning
1D-Nanofinger® as Scout

2. Nanomanipulator equipped with: Sample Discharger
Tip Cleaning module

- Standard Software Package: Macro Executor, Live Image Positioning, Assistants, Sequencer

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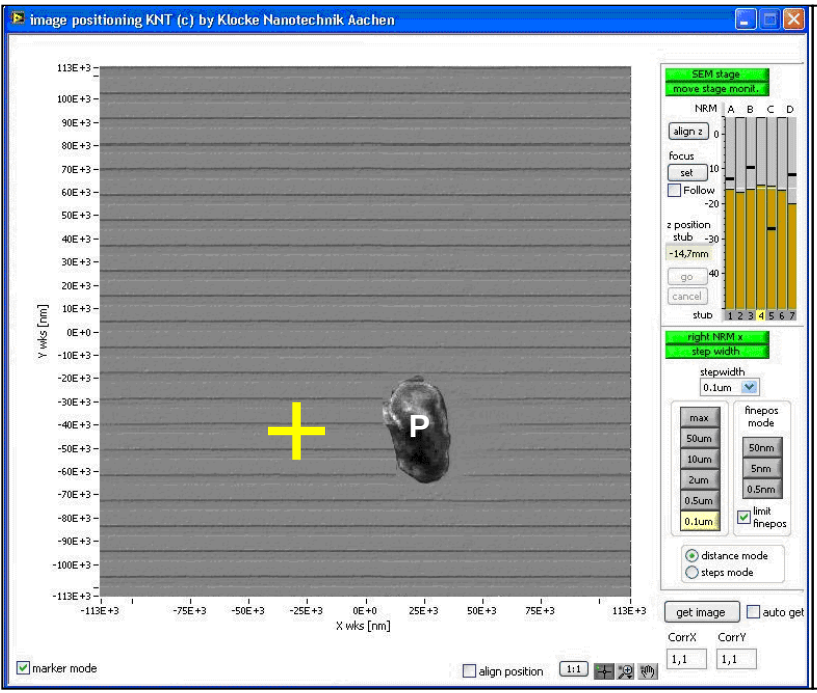
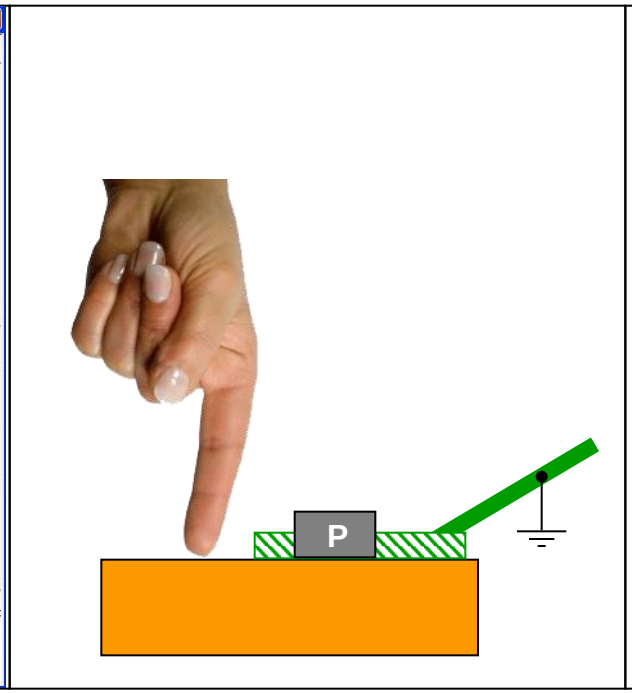
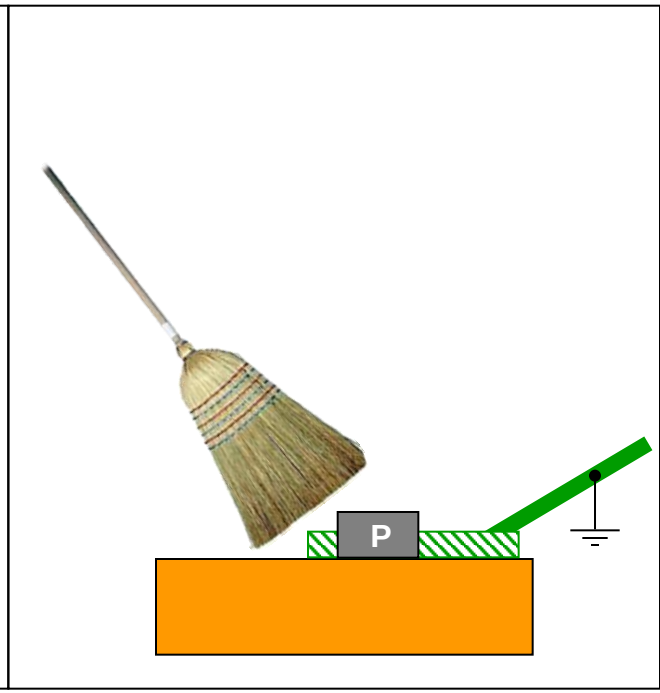
NanoCleaning

Surface Cleaning Process







Live Image Positioning: select target position

1D-Nanofinger®: lands Sample Cleaner

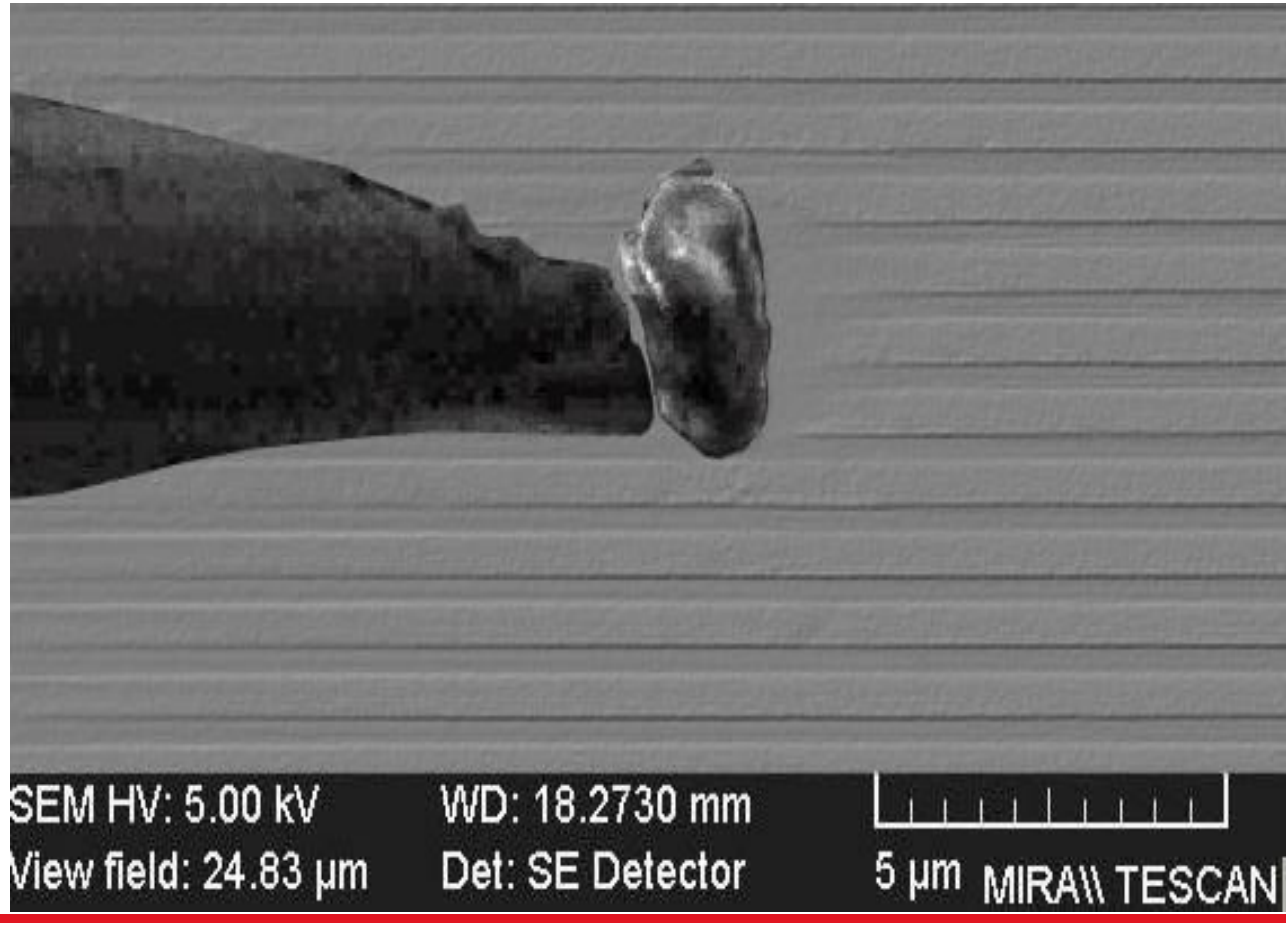
Sample Cleaner: removes particle

Sample Discharger: avoids charging without flood gun

NanoCleaning

Surface Cleaning Process

- Automatic Sample Cleaner approach by 1D-Nanofinger®
- Discharge Module at second manipulator avoids charging of isolators like this glass master



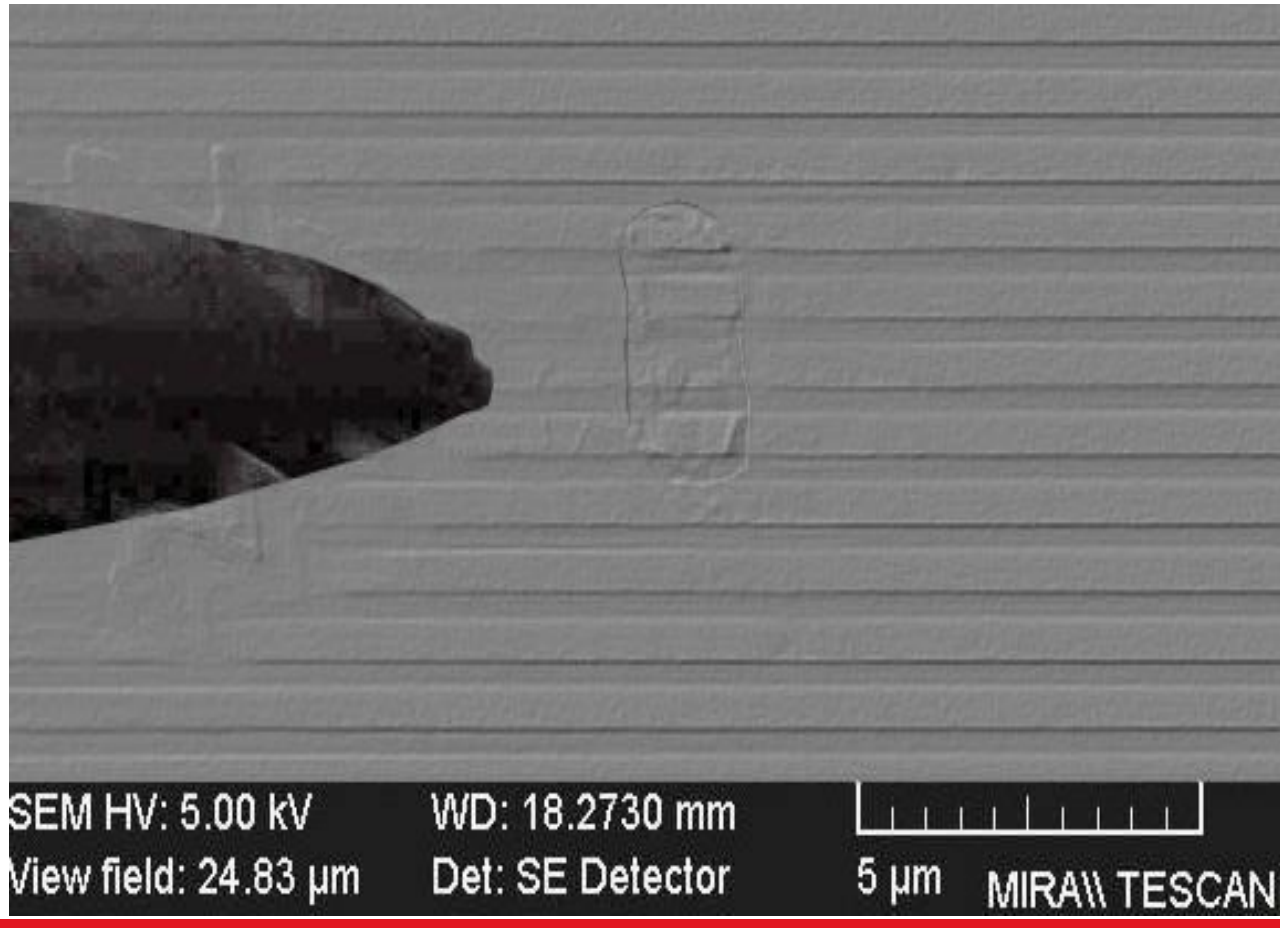
NanoCleaning

Surface Cleaning Process

- Remove the particle by a step of the tip,

or

- Collect the particle with the tip (e.g. by charge) and lift it up.



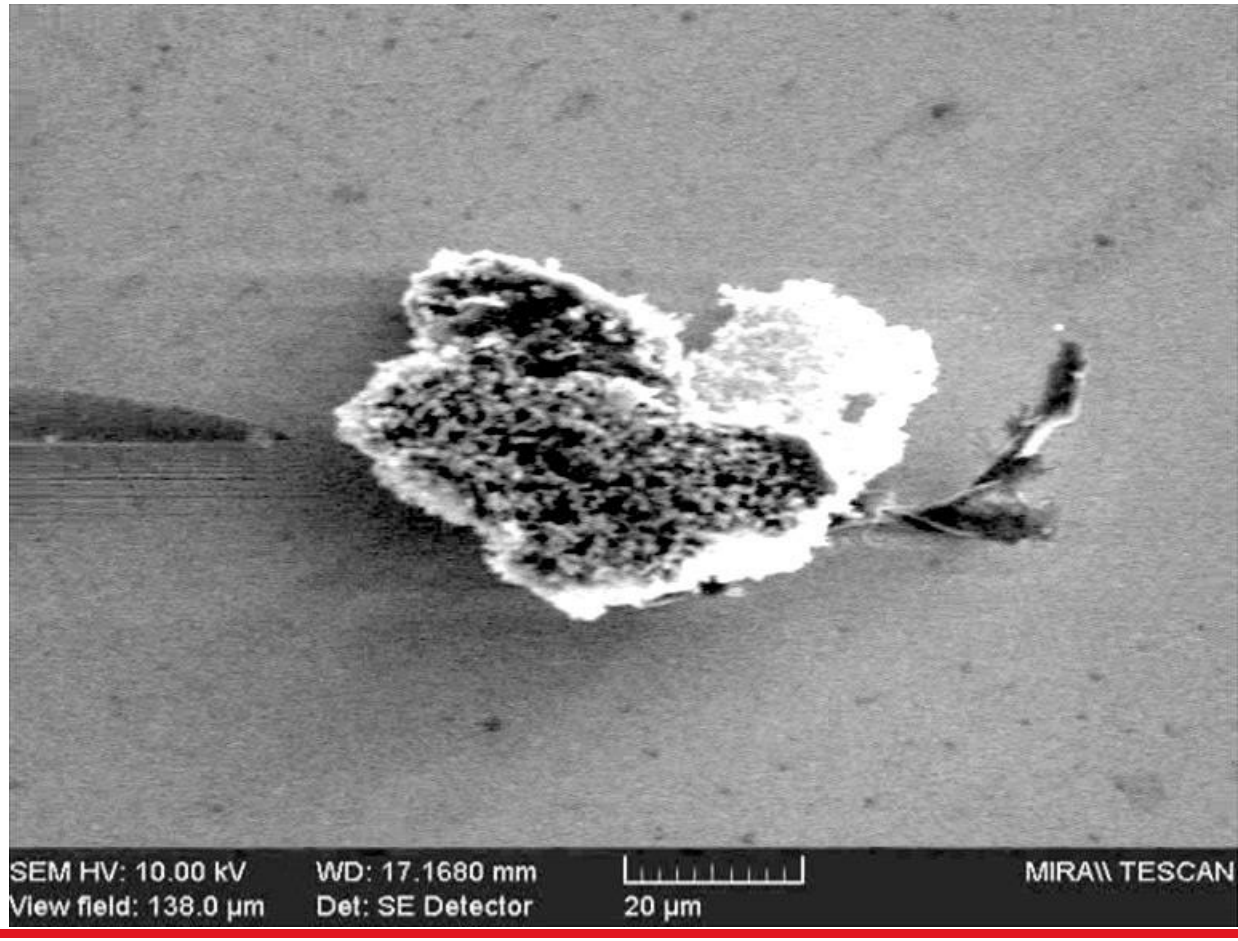
NanoCleaning

Surface Cleaning Process

- Remove the particle by a step of the tip,

or

- Lift up the particle by placing the tip underneath the particle and moving it upwards.



NanoCleaning

Surface Cleaning Process

- Remove the particle by a step of the tip,

or

- Collect the particle with the tip (e.g. by charge) and lift it up.

Tip Cleaning

As part of NanoCleaning

The Task:

- After using probe tips e.g. for manipulation, cutting, cleaning or Force-Distance measurements these tips may be contaminated.
- The exchange of contaminated tips is time consuming and expensive.
- Cleaning used tips in air is risky, and only after checking them in the SEM/FIB again the doubtful result gets visible.
- The task is to realize an automatic tip cleaning process within the SEM/FIB

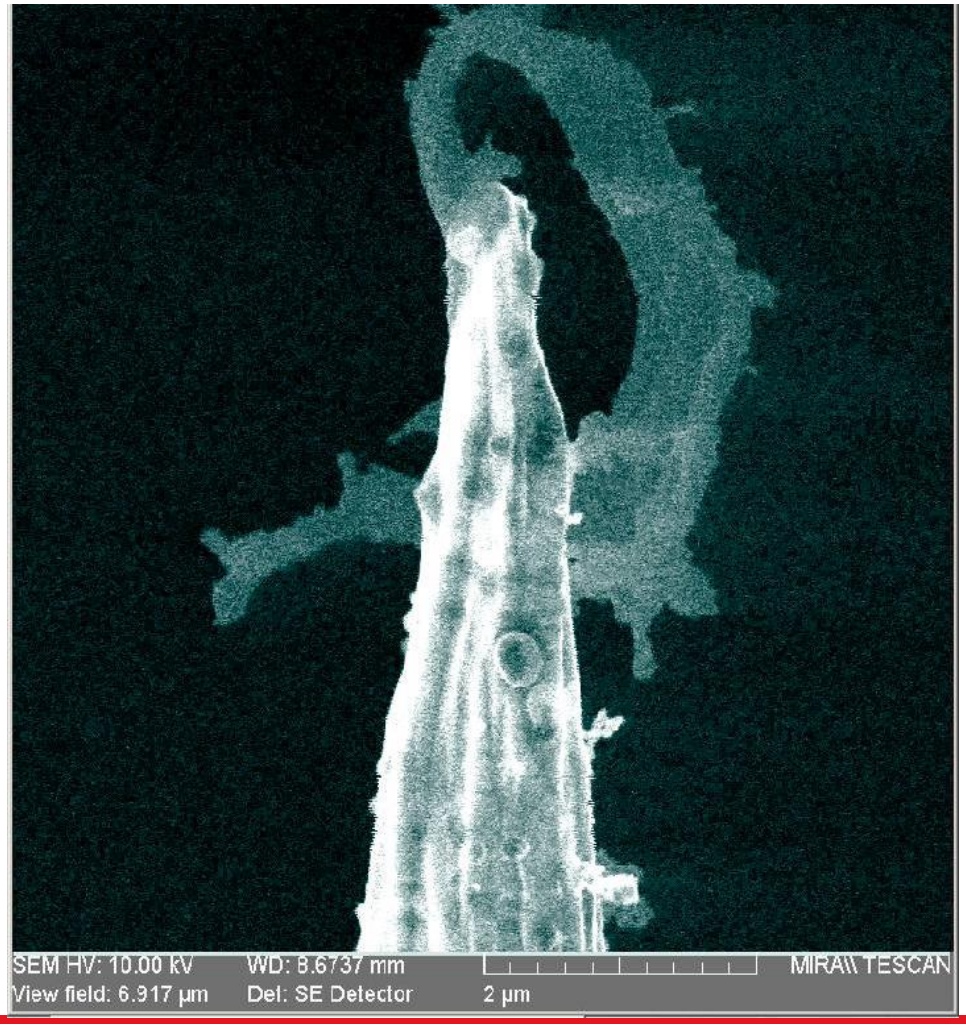
Tip Cleaning

in automation

Automatic Tip Cleaning

- After several particle removals the tip gets contaminated.

- Image of a contaminated tip before tip-cleaning



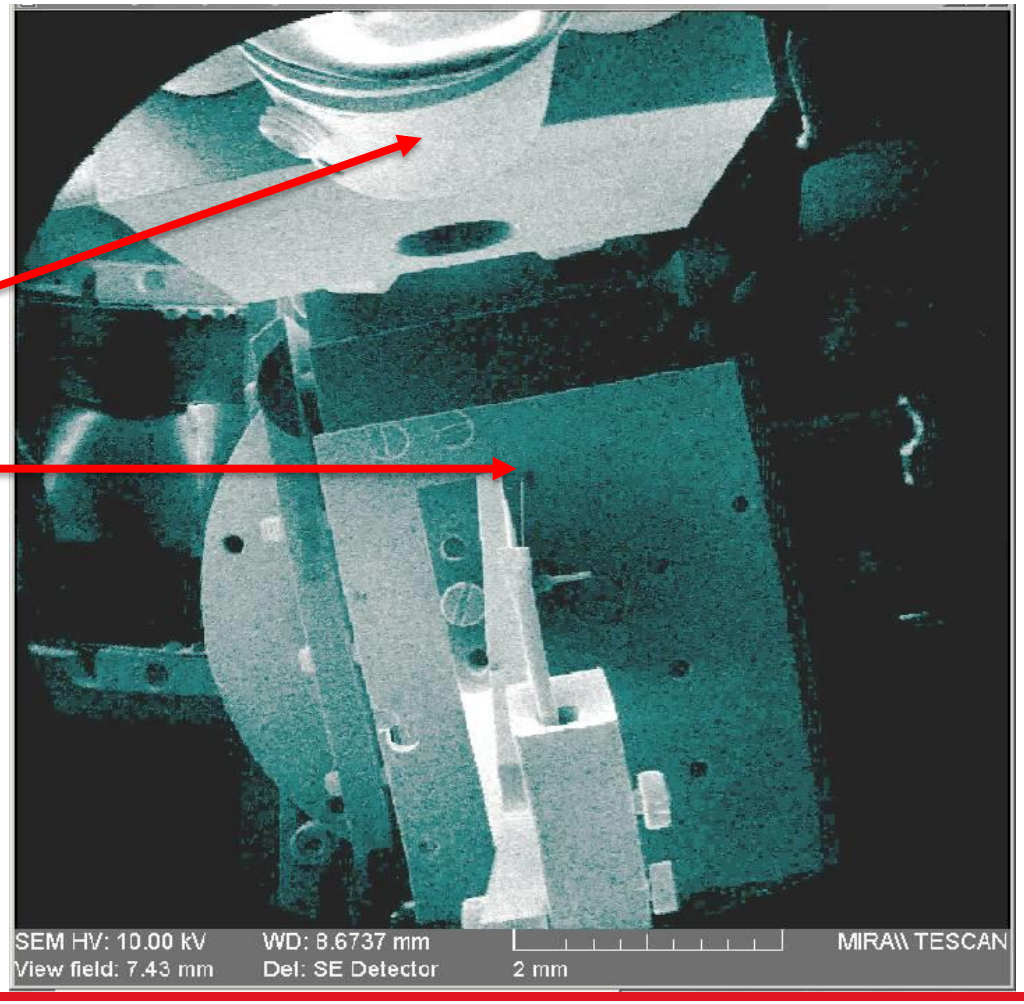
Tip Cleaning

in automation

Cleaning the tip

Arrangement in wide field view:

- Tip cleaner on top of the image
- Tip is in the centre of the image
- The tip moves automatically to the cleaner and back.

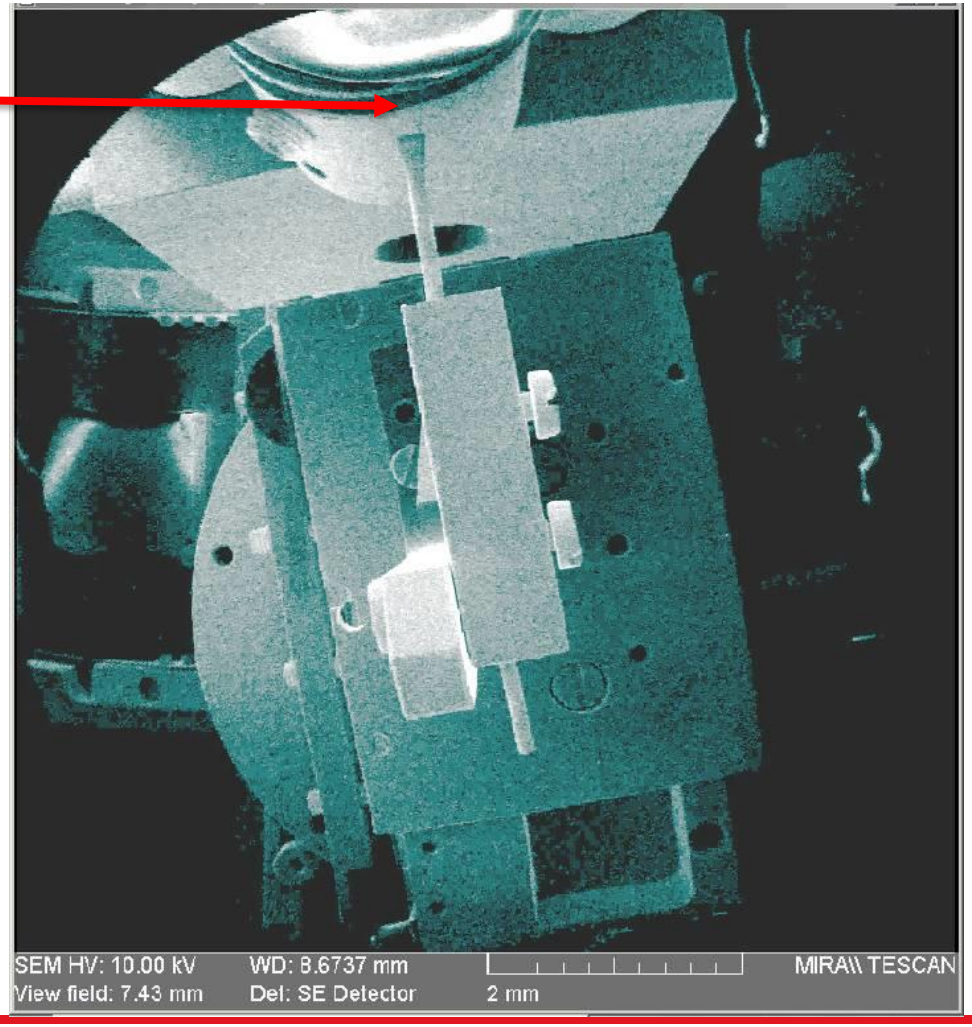


Tip Cleaning

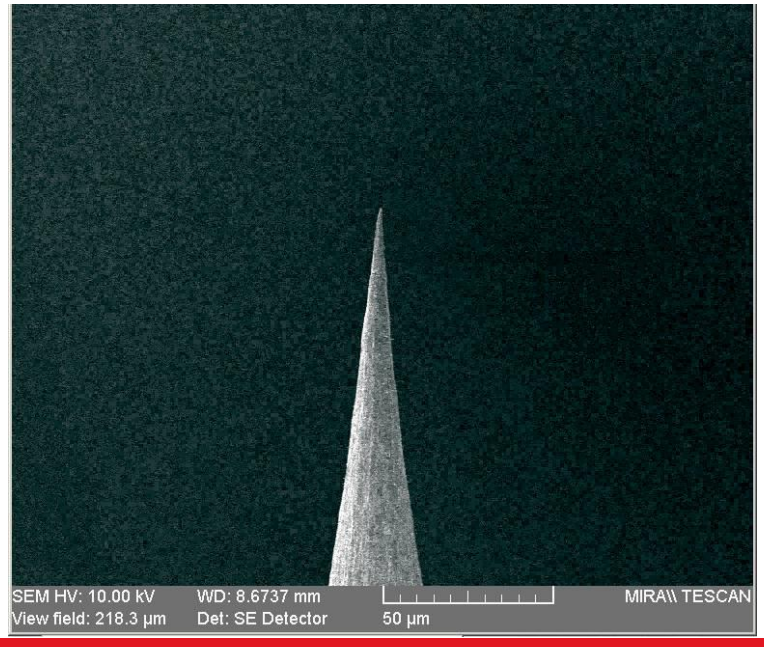
in automation

Cleaning the tip

- Tip moved into the cleaner

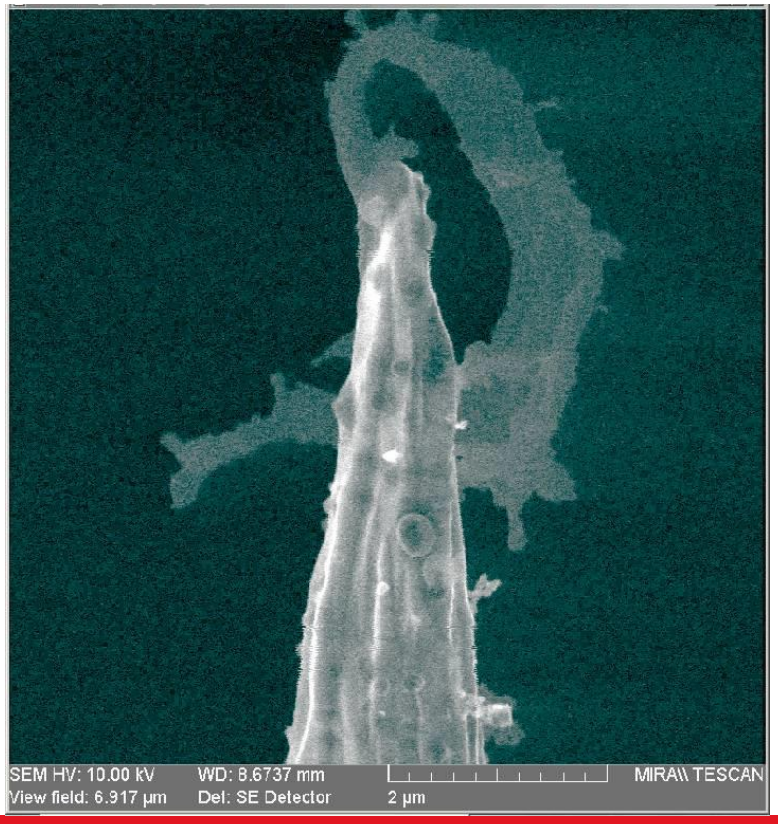


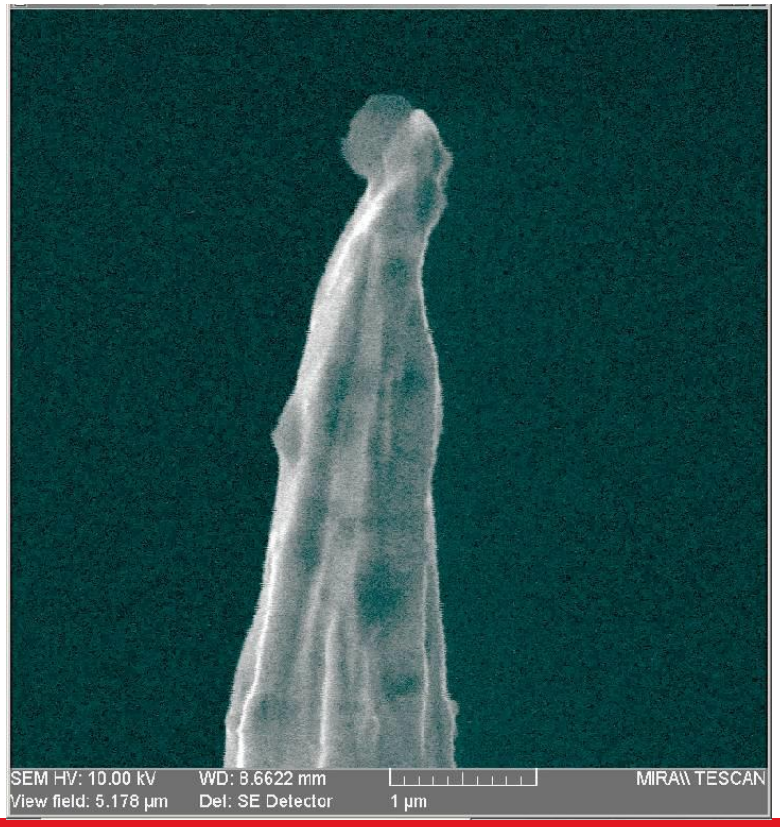
- After cleaning: move back and zoom in automatically:

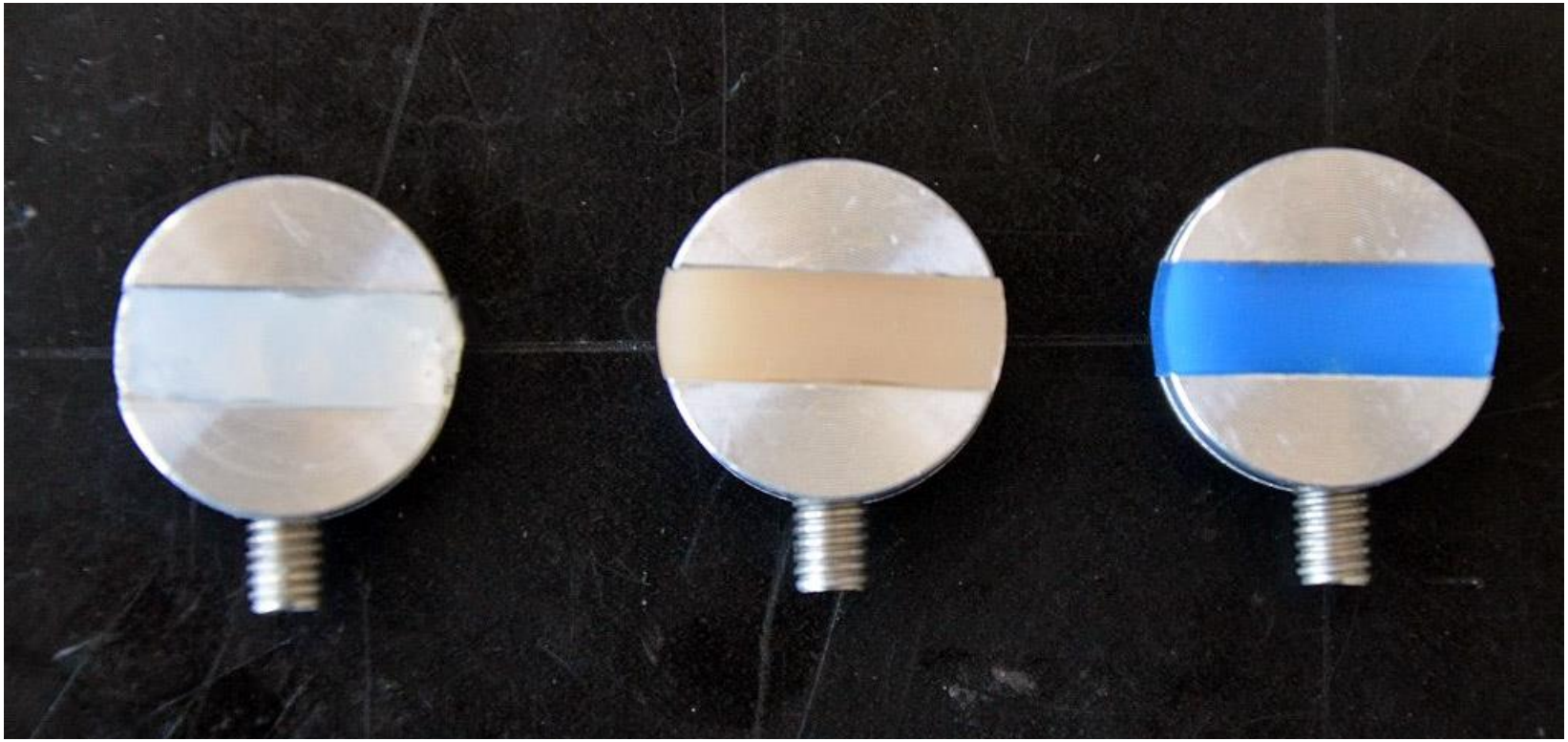


Cleaning the tip

- The contaminated tip in the left image compared to the clean tip in the right image



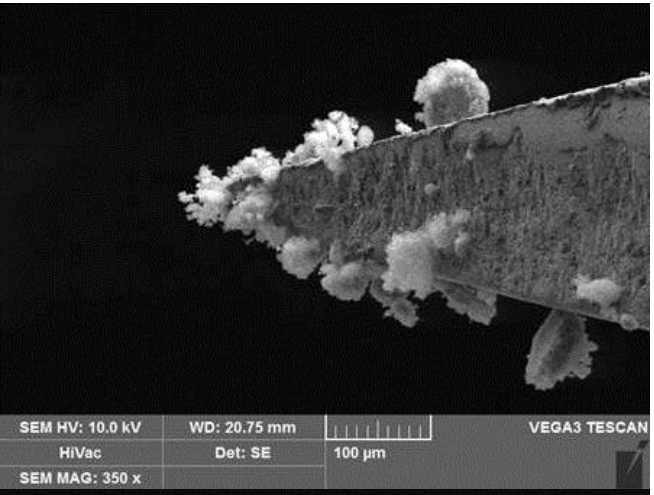




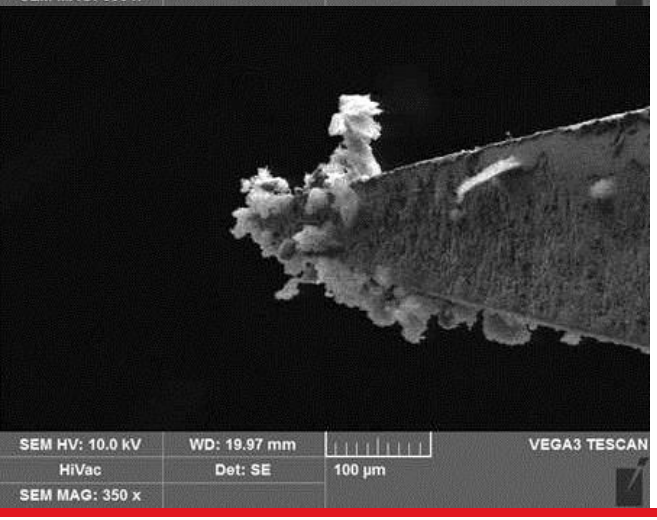
Cleaning stubs for automatic in-situ cleaning of cutters

NanoCleaning

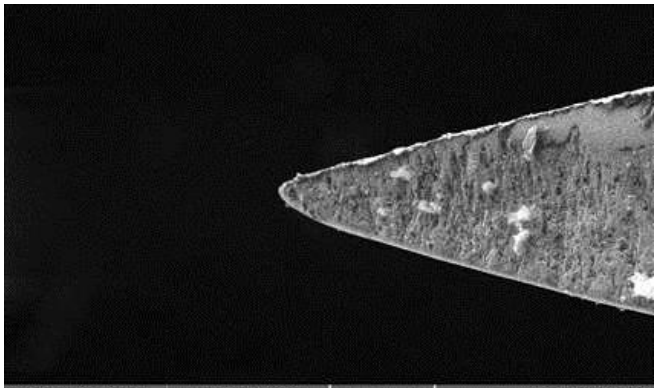
In-situ Cutter Cleaning Module

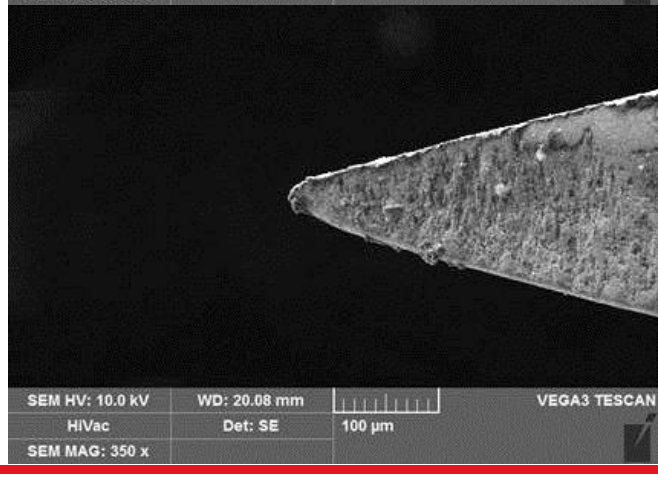


Left:
***contaminated* cutters**



Right:
Same cutters after in-situ cleaning



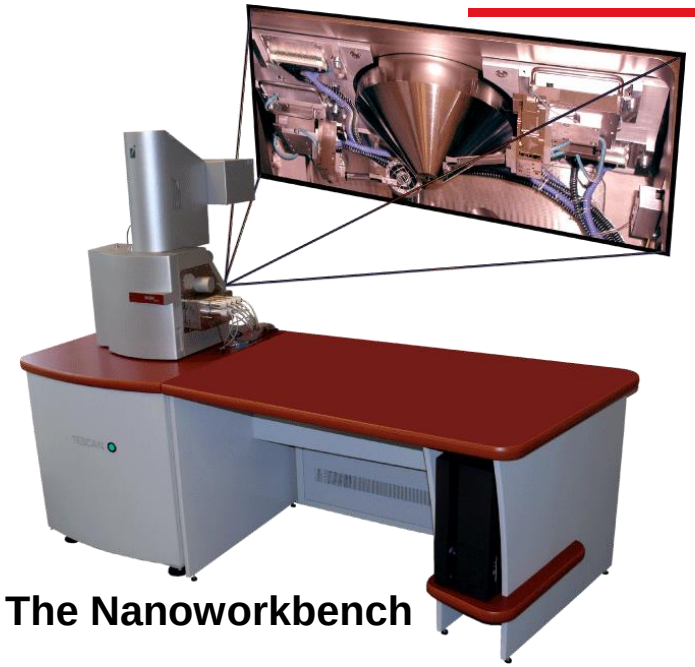


Summary

- With the Nanoworkbench from Klocke Nanotechnik particle removal is very fast and easy.
- The Nanofinger® operating as Scout allows a fast and safe automatic tool approach to the sample.
- The internal cleaning process of the tools avoids the time consuming and expensive exchange of contaminated tools.

The Nanoworkbench

and its Application Packages



The Nanoworkbench

NanoCleaning …

is one out of several "Standard Application Packages"

of our Nanoworkbench.

The Nanoworkbench enables the **hand-eye coordination**

as used at Light Microscopes now in any SEM/FIB,

together with automation of the SEM/FIB **(@ZEISS, FEI, TESCAN)**

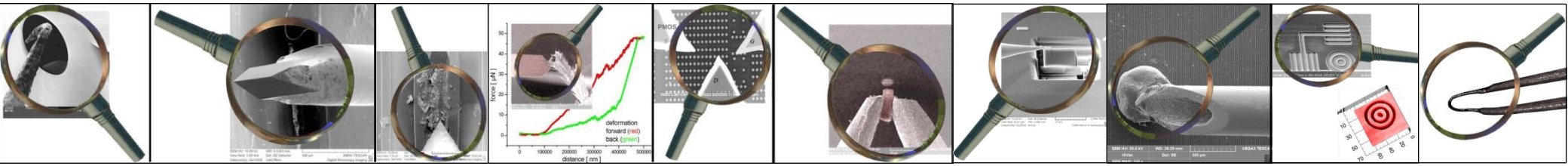
At Light Microscopes it is natural for everybody to use tool sets like tweezers, knives, hooks, probes and several different measurement tools, so it is with the Nanoworkbench.

The Nanoworkbench

One Product for all applications

The Nanoworkbench Standard Packet includes:

- The basic application package “Nanomanipulation” and
- one additional “Application Package” out of:



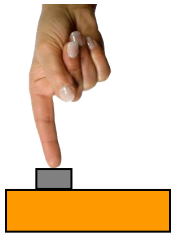
Manipulation, NanoCleaning, NanoProbing, TEM-Lamella, 3D-Nanofinger
NanoCutting, Force-Distance, Particle sorting, NanoFriction Spot-Heating

Each application package includes a standard tool, a standard sample and pre-defined processes as source-code and origin for own projects.

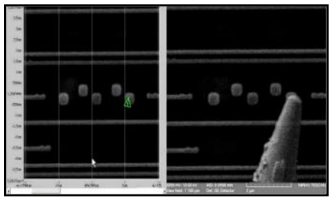
- **The following set of modules for easy usage an application control:**

The Standard Packet

Hand-eye coordination:

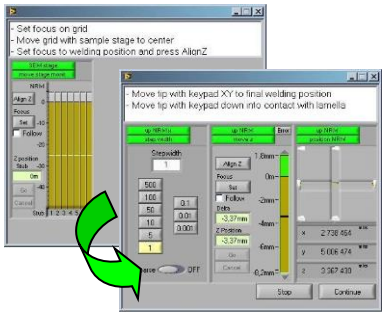


Nanofinger® as Scout, guiding the Nanoworkbench Tools,

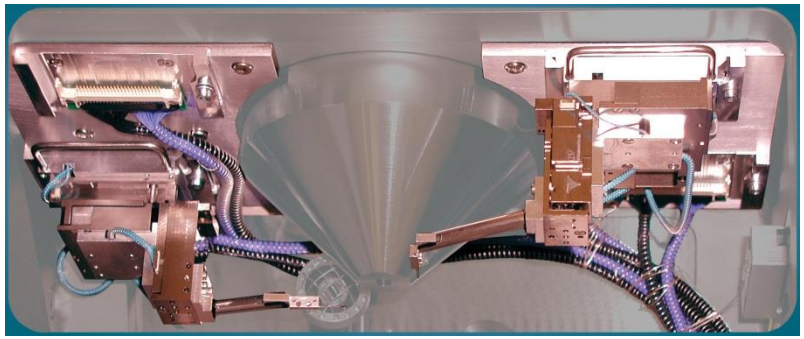


Live Image Positioning,

Sequencer for automation,
Macro Executor,
Remote Control,
…



Assistants
(Wizards),



2 Nanorobotics Manipulators
with docking stations

More information?

Please ask for the leaflet "Nanoworkbench"

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