New Instrumentation for Surface Roughness and Contamination Control of Nb samples

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- **Motivation**
- **FRT Micro-Profilometer with AFM**
- **Exemplaric results on Nb samples**
- **Outlook**

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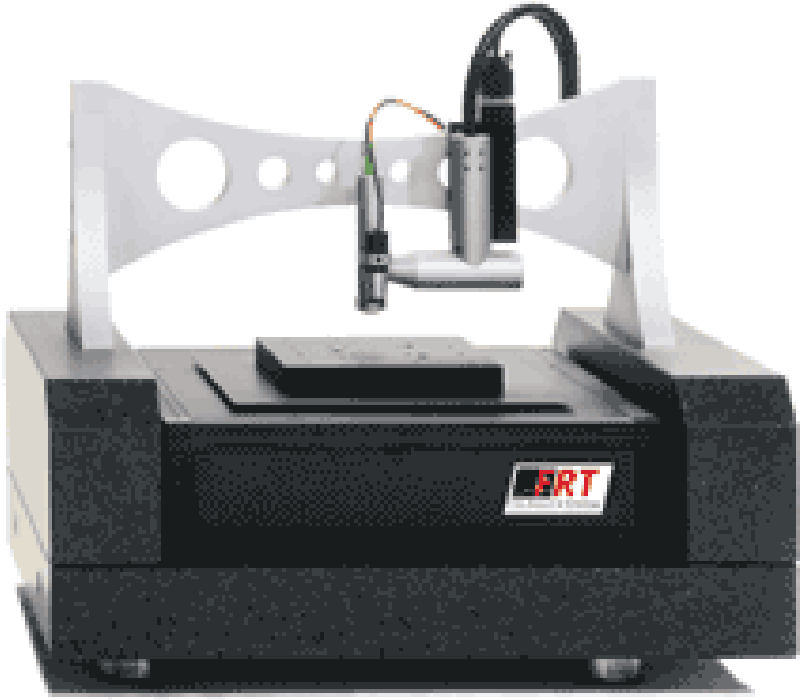
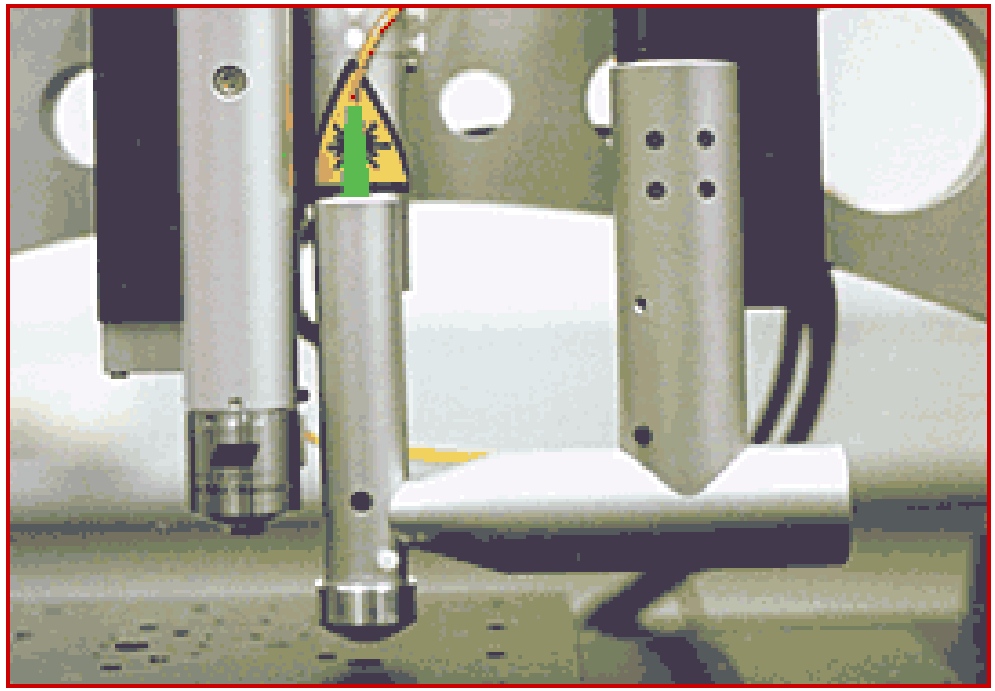
Motivation for FRT Micro-Profilometer with AFM

- Surface conture measurements up to 400 cm^2 size and 50 mm height
- Non-destructive surface shape control of electropolished Nb samples
- Roughness measurements of flat and curved Nb surfaces (CP, EP)
- Zooming scales over 8 orders of magnitude (from dm to nm)
- Fast detection of particulate contaminations (> µm) on Nb samples
- Clear distinction of surface elevations and hollows
- Detection of non-filtered nm-sized particles on smooth surfaces

FRT Micro Profilometer with AFM





Chromatic abberation sensor:

Scanning area up to 200 x 200 mm^2

Scanning speed: 100 mm/s

Measurement distance: 4.5 mm

Lateral resolution: 1 - 2 µm

Height resolution in 300 µm range: 3 nm

Atomic force microscope AFM:

Selected scanning area < 80 x 80 μm^2

Scanning speed: 1-5 lines/s

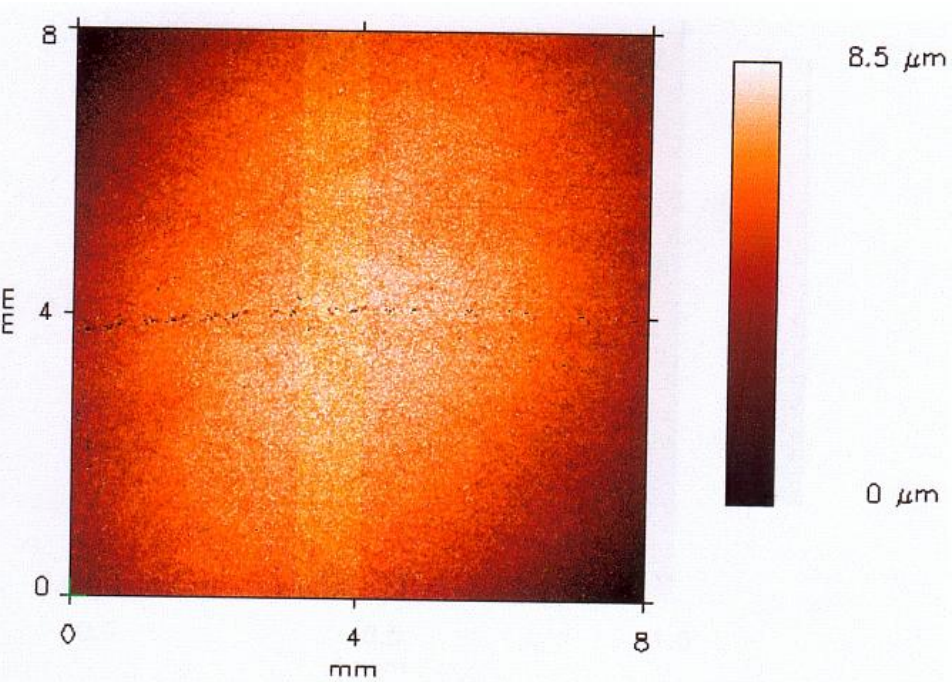
Lateral resolution: typ. 5 nm

Height resolution in 6 µm range: 1-2 nm

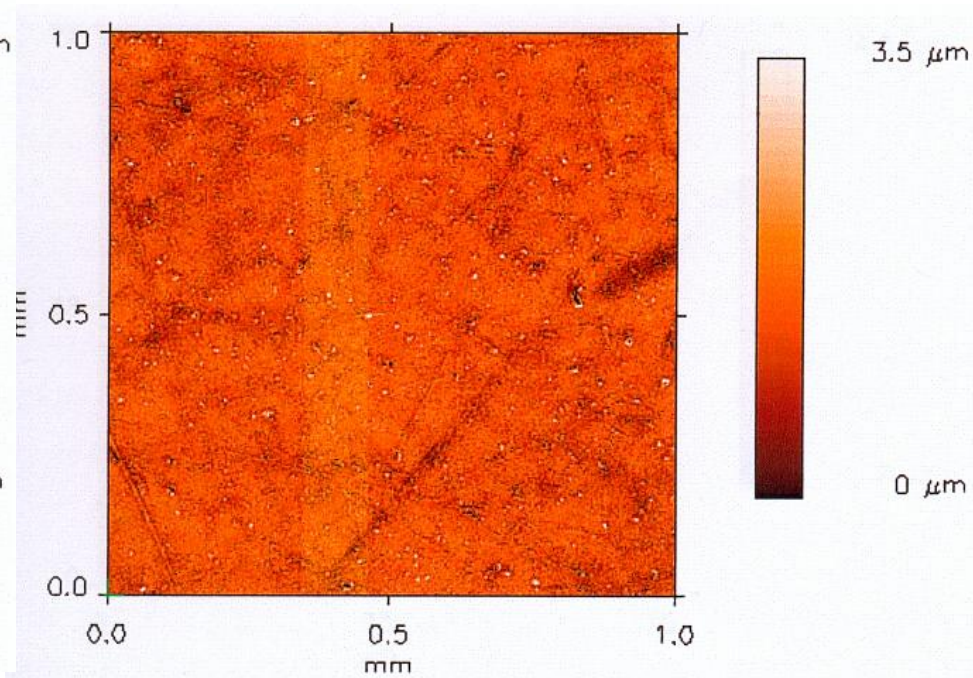
Electrostatic and magnetic force modes

Exemplaric results on electropolished Nb sample

Chromatic sensor image of the sample



Detail image of area 1 x 1 mm²



Convex curvature of surface obvious

~ 8.5 µm over 8 x 8 mm²

Hole trace follows original scratch

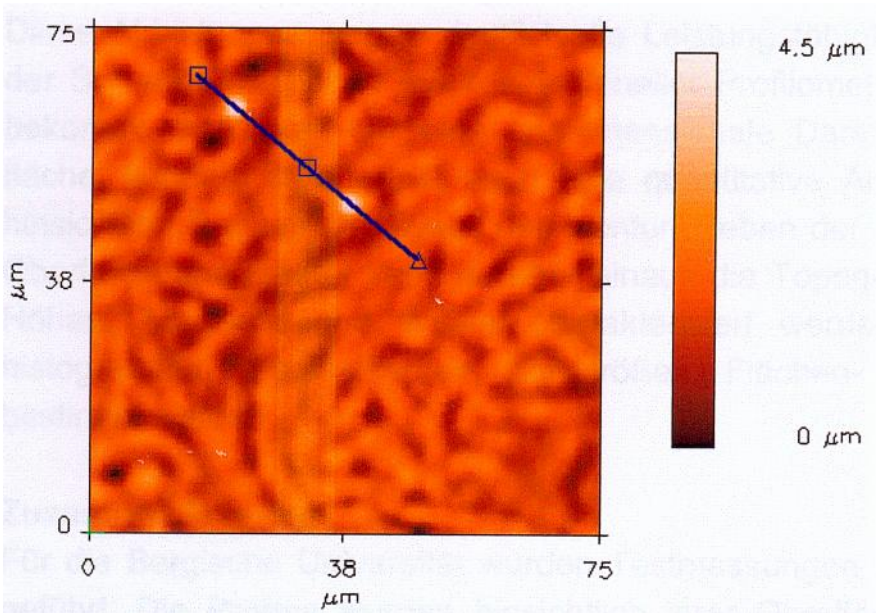
Typical Surface roughness of some µm

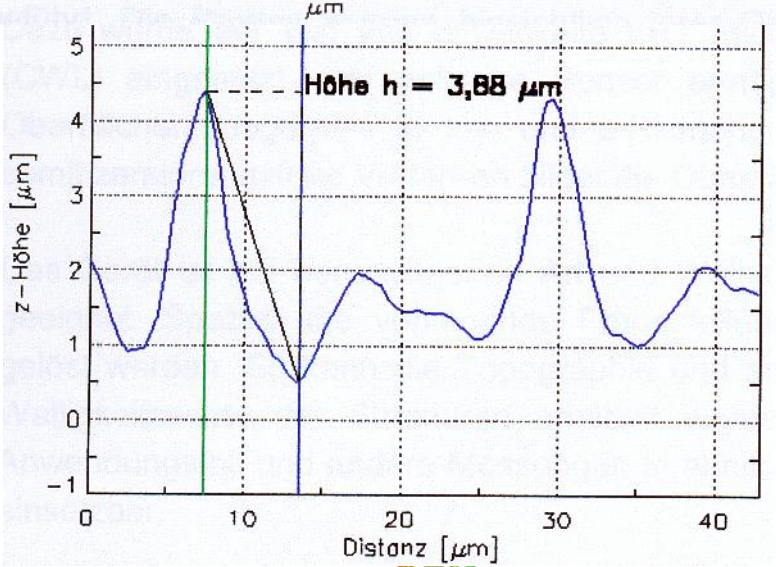
due to ditches of 100 - 500 µm length

Contamination with microsized particles

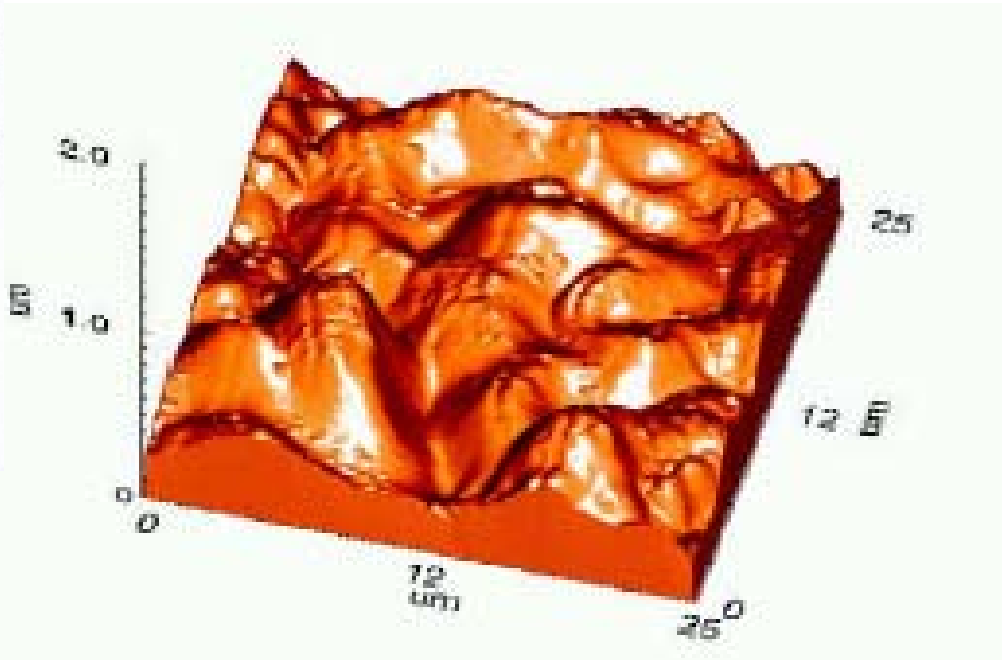
Exemplaric results on electropolished Nb sample ctnd.

Chromatic sensor image of 75 x 75 µm²





AFM image of typical area 25 x 25 µm²



Local surface roughness ~ 0.5 µm

Many nanosized particles on surface

Outlook

- **FRT MicroProf with AFM just ordered**
- **Clean-room environment under construction**
- **Scheduled delivery time at BUW in July 2005**
- **Measurements available after commissioning in September 05**
- **Correlations between surface contaminations and scratches and field emission properties**
- **Correlation between surface roughness and critical magnetic surface fields of Nb ?**