Scanning Thermal Microscopy with FlexAFM and AppNano VertiSense
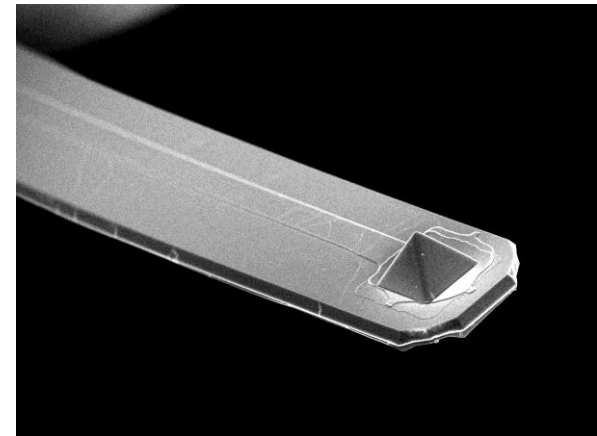
2014

Nanosurf AG, Switzerland

VertiSense thermal probes

- The thermocouple sensor is located at the apex of the tip

- Material surrounding tip sensor is thermally insulating to prevent heat loss from the tip to the cantilever and substrate

- Available in two types:
  - VTP200: k_{nom} = 9.9 N/m, 107 kHz
  - VTP500: k_{nom} = 0.63 N/m, 17 kHz

Thermal imaging modes

- Probes can be used in:
  - Temperature mapping mode (TMM)
  - Conductivity mapping mode (CMM)
- Mode is set by laser alignment:
  - TMM: laser set slightly back from cantilever end (solid line)
  - CMM: laser at very end of cantilever (dashed line)

Thermocouple at tip
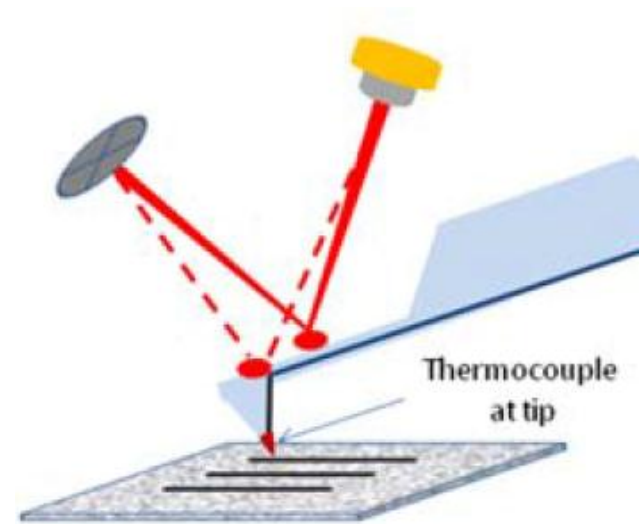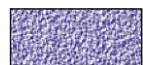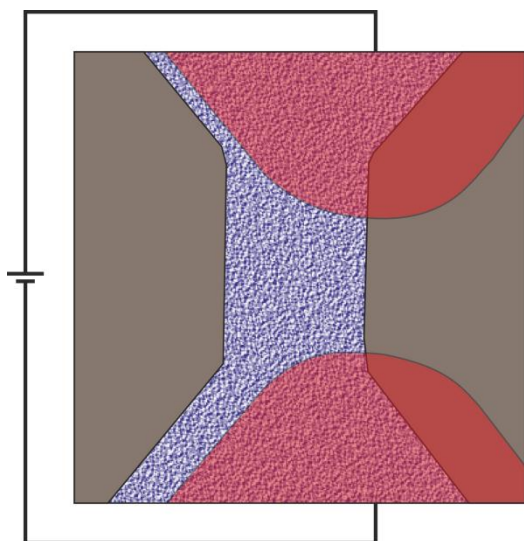
Laser Positioning:
TMM :
CMM :

Test object: Ion-doped silicon wafer

▭ Si	▭ High dose implanted Si overlap with Si
▭ Low dose implanted Si	▭ High dose implanted Si overlap with low dose implanted Si



Layout

10 µm

Remnants from removed conductive path
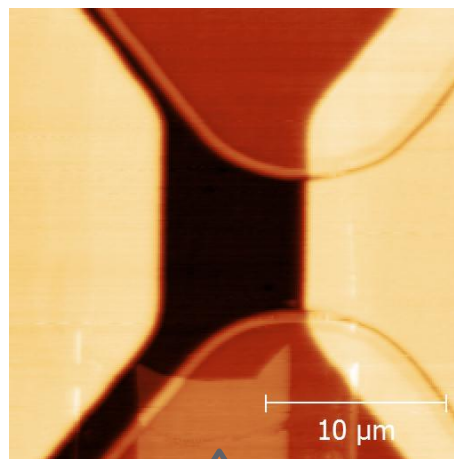
Topography

- A voltage can be applied between the two high dose implanted Si tongues to causing a temperature increase at the low dose implanted Si in between
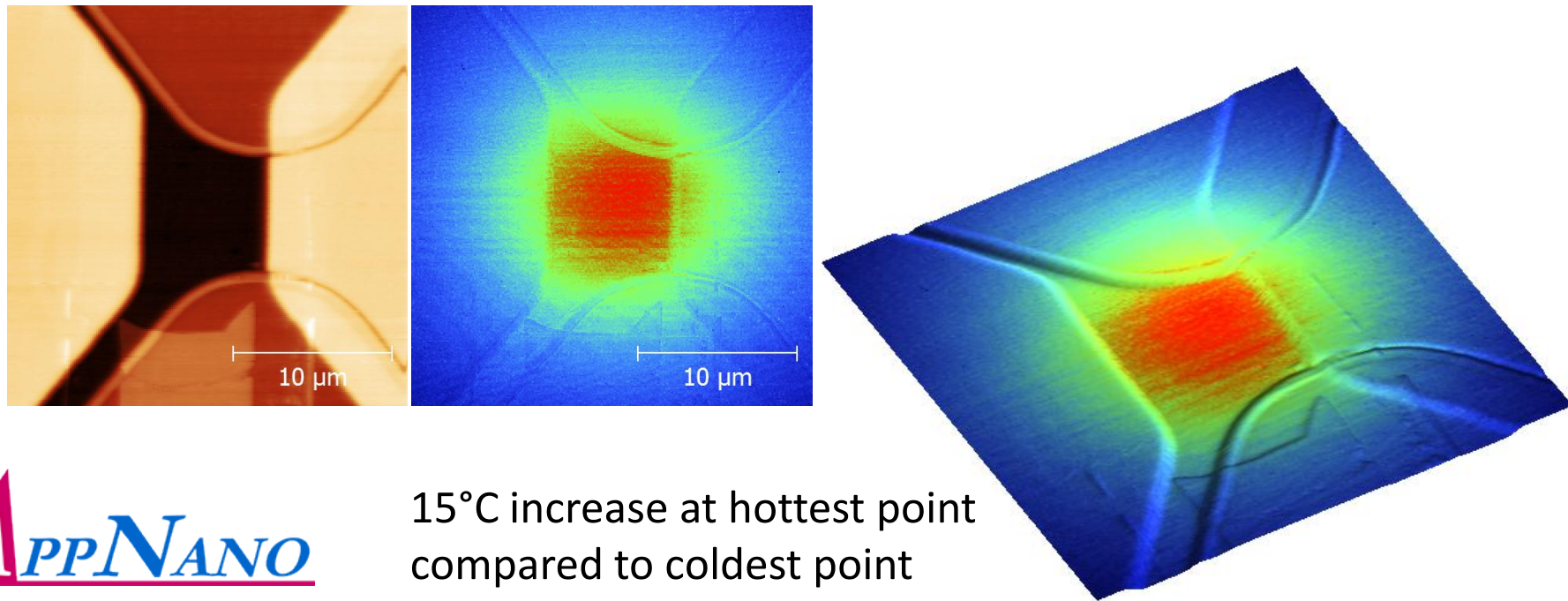
Ion-doped silicon wafer in temperature mapping mode (TMM)

- Layout (left), temperature map (middle)
- To create a temperature gradient a voltage is applied between the two high dose implanted Si tongues
- 3D topography with temperature overlaid as color (right)

10 µm

15°C increase at hottest point compared to coldest point
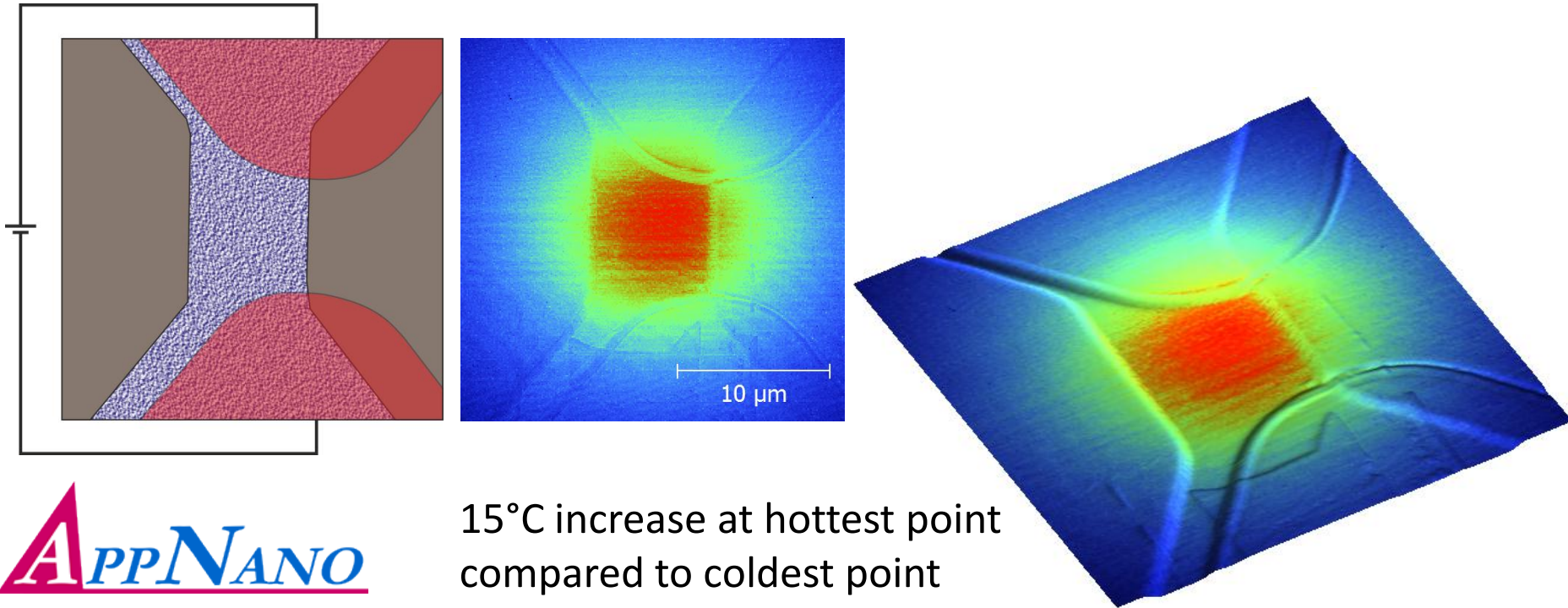
Ion-doped silicon wafer in temperature mapping mode (TMM)

- Topography (left), temperature map (middle)
- 3D topography with temperature overlaid as color (right)

15°C increase at hottest point compared to coldest point

Ion-doped silicon wafer in thermal conductivity mapping mode (CMM)

- Laser is focused directly above the thermal couple
- No voltage applied on the sample
- 3D topography with color coding overlaid as color
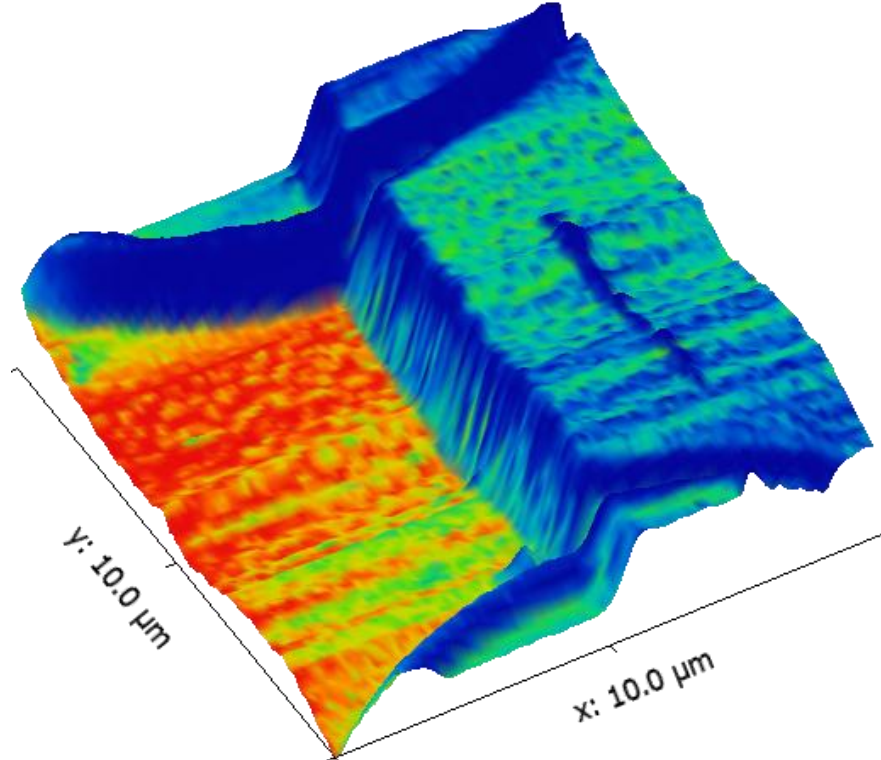
Connection of VertiSense Imaging Amplifier

- Compatible with FlexAFM equipped with SThM cantilever holder
- Analog connection to user input channel
- Compatible with EasyScan2 controller with signal module
- Compatible with C3000 (no signal module required)
- Conversion into temperature directly over user input configuration

Laser Positioning:
TMM : ▬▬▬▬
CMM : ▪ ▪ ▪ ▪ ▪ ▪