PicoScale: Single point vibration measurement

1. INTRODUCTION

SmarAct's **PICO**SCALE is a contact-free displacement sensor with sub-atomic resolution based on a laser interferometer. The fast data processing allows for high bandwidth vibration measurements. In this application note, the vibrations of a small cantilever are analyzed.

The results show that the **PICO**SCALE can be used for single point vibration analysis. The low noise floor and high resolution allows to study mechanical properties of samples in fundamental RnD. At the same time, the high dynamic range allow to track macroscopic motions and vibrations, qualifying the system for industrial applications and process control at larger scales.

2. SETUP

The setup used for this application note is shown in Figure 1.

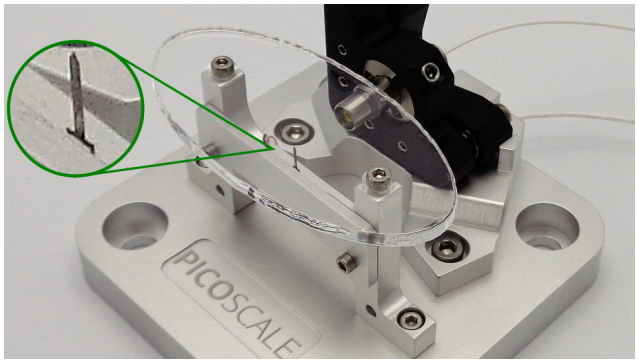

Figure 1. *Experimental setup. The* **PICO**SCALE *probe beam is focused to a tungsten cantilever with a PS-SH-F01-10 sensor head.*

A F01-10 sensor head (focusing sensor head with working distance 10 mm and spot size of about 30 µm) is aligned to a cantilever. The cantilever is glued to a piezo stack to eventually excite vibration modes.

Even though many cantilevers are made from silion, which have low reflectivity at infrared wavelengths, the **PICO**SCALE can be used to measure the displacement. As the measurement beam is focused, this confocal configuration suppresses stray light from other surfaces and only a single surface is analyzed. (This smart concept is employed in the **PICO**SCALE *Vibrometer*, a turn-key solution for full modal analyses of of small samples.)

3. RESULTS

The recorded position data can directly be analyzed using the Fast-Fourier-Transform (FFT) functions of the **PICO**SCALE graphical user interface.

3.1 Thermal spectrum

First, the cantilever is not excited, but a very small peak around 2100 Hz appears, see Figure 2. This peak indicates a mechanical resonance, only excited by surrounding noise or thermal excitations.

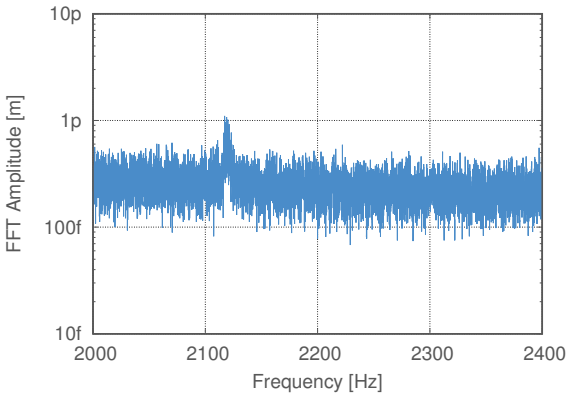

Figure 2. *Thermal spectrum of the cantilever with a small peak around 2120 Hz.*

3.2 Excitation

In the next step, the cantilever's eigenfrequency at 2119 Hz was excited with the piezo, which is driven by the **PICO**SCALE *Breakout Box*. The resonance peak becomes very pronounced.

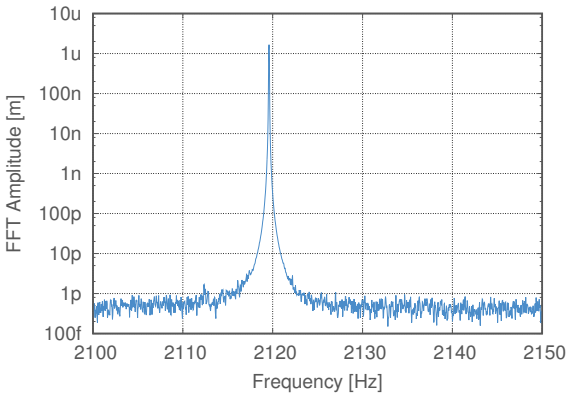

Figure 3. *Resonance peak that is excited with the piezo stack below the cantilever.*

Sales partner / Contacts

Germany

SmarAct GmbH

Schuette-Lanz-Strasse 9
26135 Oldenburg
Germany

T: +49 441 - 800 879 0
Email: info-de@smaract.com
www.smaract.com

France

SmarAct GmbH

Schuette-Lanz-Strasse 9
26135 Oldenburg
Germany

T: +49 441 - 800 879 956
Email: info-fr@smaract.com
www.smaract.com

USA

SmarAct Inc.

2140 Shattuck Ave. Suite 302
Berkeley, CA 94704
United States of America

T: +1 415 - 766 9006
Email: info-us@smaract.com
www.smaract.com

China

Dynasense Photonics

6 Taiping Street
Xi Cheng District,
Beijing, China

T: +86 10 - 835 038 53
Email: info@dyna-sense.com
www.dyna-sense.com

Natsu Precision Tech

Room 515, Floor 5, Building 7,
No.18 East Qinghe Anning
Zhuang Road,
Haidian District
Beijing, China

T: +86 18 - 616 715 058
Email: chenye@nano-stage.com
www.nano-stage.com

Shanghai Kingway Optech Co.Ltd

Room 1212, T1 Building
Zhonggeng Global Creative Center
Lane 166, Yuhong Road
Minhang District
Shanghai, China

Tel: +86 21 - 548 469 66
Email: sales@kingway-optech.com
www.kingway-optech.com

Japan

Physix Technology Inc.

Ichikawa-Business-Plaza
4-2-5 Minami-yawata,
Ichikawa-shi
272-0023 Chiba
Japan

T/F: +81 47 - 370 86 00
Email: info-jp@smaract.com
www.physix-tech.com

South Korea

SEUM Tronics

1109, 1, Gasan digital 1-ro
Geumcheon-gu
Seoul, 08594,
Korea

T: +82 2 - 868 10 02
Email: info-kr@smaract.com
www.seumtronics.com

Israel

Trico Israel Ltd.

P.O.Box 6172
46150 Herzeliya
Israel

T: +972 9 - 950 60 74
Email: info-il@smaract.com
www.trico.co.il