

## Optical nm-resolution sensor device, based on superresolution

2nd EPS TIG Hands-on Event for Science, Technology and Interfaces

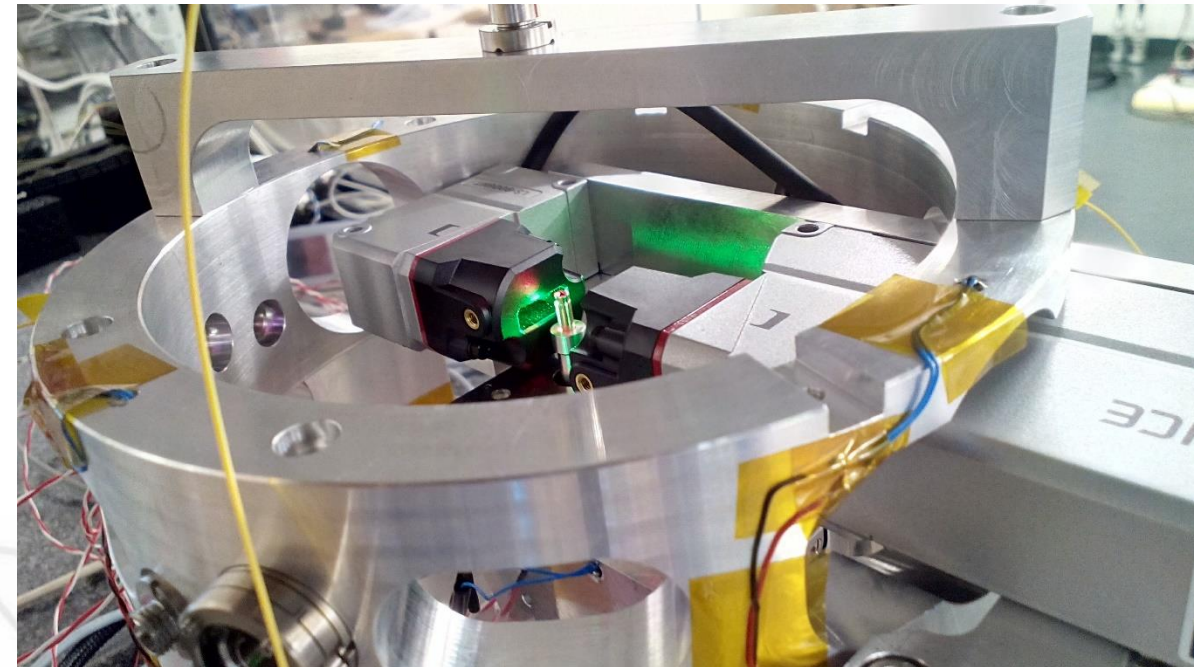
01.10.2022, Ideasquare, CERN

## Why and where would one need nm-resolution ?

Scientific and engineering disciplines dealing with « small » objects ( $10\mu\text{m}$ -> sub-nm) need:

Reproducible interaction with the object and a « probe » in an experimental or production situation

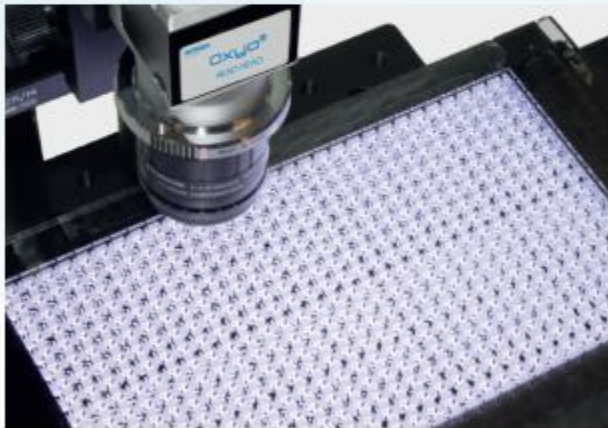
1. Needs to be nm-precise
2. The more dimensions – the better
3. « Absolute » readout - calibration takes time
4. Large dynamic range
5. Time resolution (fast)
6. « Rugged » -for use in hostile environments
7. Compact for integration
8. Affordable



## What ?

Horiba's « OXYO » System satisfies the above conditions – Introduction by one of the inventors  
– Olivier Acher from Horiba

## nanoGPS Oxy $\Theta$ ® Technology



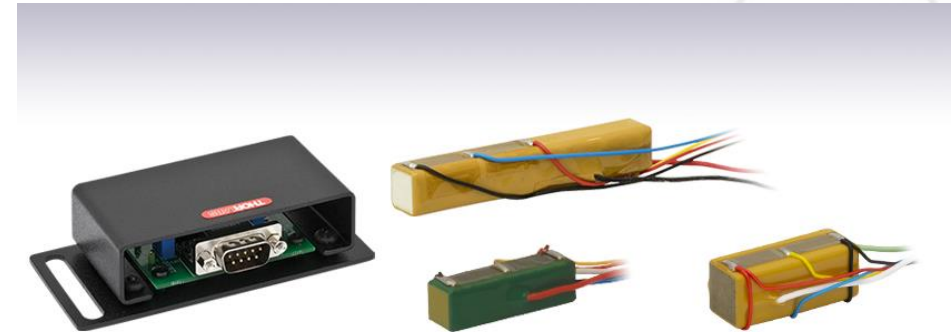
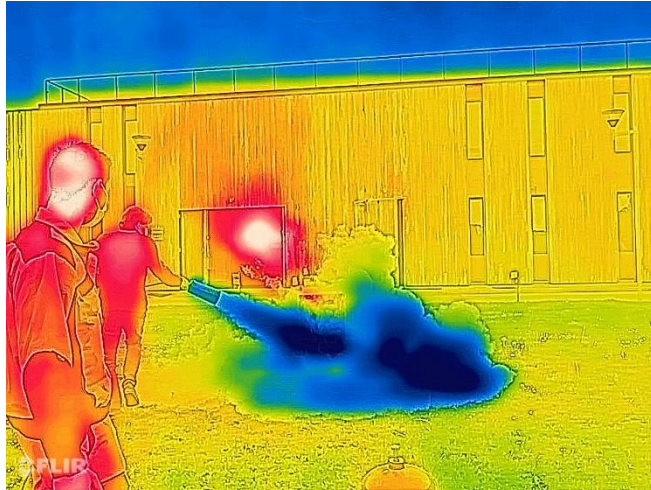
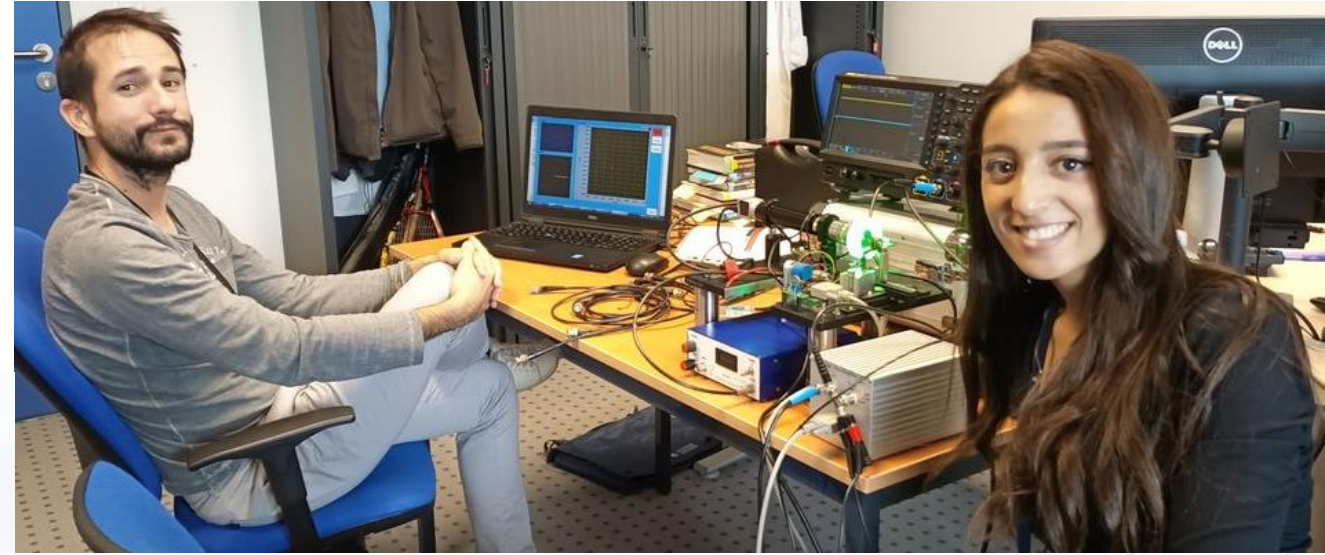
**nanoGPS Oxy $\Theta$ ® technology** is based on taking a picture of a patented patterned substrate, and interpreting this picture into position (x, y) and orientation ( $\theta$ ).

- Identify components of the system, please: What do you see ? What sizes approximately ?

## Project: You enter the nanoworld now – and measure : How ?

- Construct an OXYO position readout system
- Move an object with nm-fine precision, record, analyse and present the trajectory
- Compare the OXYO-based measurement to classical strain gauge measurement
- Make observations on measurement errors and uncertainties (thermal drift, vibration) estimate their impact
- Present the results (~20 mins presentation)





**Please ask for help when you're unsure on how to proceed !**

## Projectwork: Like in an Institute or in Industry !

Subtasks (**groups**) to succeed the project:

1. Computer and software for Camera and OXYO
2. Mechanical design and construction of the test device (OXYO, object-holder and Piezo)
3. Optical design and setup of OXYO for dedicated application
4. Measurement Errors: estimation and thermal measurements (infrared-camera + software)
5. Data analysis and interpretation, setup and recording of strain gauge (1+5 ?)
6. Inter-group communication, logistics, problem solving and presentation of results

- ☐ Collect the material you think you need for each group (instrumentation)
- ☐ Make a plan in each group during a « kick-off discussion meeting », try to elaborate a few « milestones ». Ask for help if you feel you need some.
- ☐ Communicate !
- ☐ Group 6 will need to work a lot on understanding and timing