

**TRAINING BROCHURE**

# **Metrology and Calibration of Mechatronic Systems training**



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## Metrology and Calibration of Mechatronic Systems

**Price:** € 2,780 excl. VAT \*

**Duration:** 3 consecutive days

**Contact:** [training@hightechinstitute.nl](mailto:training@hightechinstitute.nl), +31 85 401 3600

**Score:** 8.6 ★★★★★☆

### Intro

This course focuses on the various aspects related to metrology and calibration of precision modules/systems. Participants will acquire theoretical background and practical insights incl. do's & don'ts - both on system design level as on detailed engineering level - related to metrology and calibration that are essential to successfully develop and build precision modules/systems.

*This training is available for open enrollment as well as for in-company sessions.*

### Objective

After completion of the course, the participants understand the basic aspects, risks and concepts related to metrology and calibration and are able to judge solutions and implications on system level.

### Target audience

This course is intended for mechatronics designers, system engineers and architects who are involved in the multi-disciplinary development of accurate motion modules/systems in which metrology and calibration play an important role in the overall system accuracy.

Prerequisites: Technical education (BSc or higher), with at least two years of experience and preferably completion of the course "Mechatronics system design" (Metron1&2) or the former Philips-CTT course Metron.

The course attracts participants from both the Netherlands and abroad, creating an international atmosphere that fosters valuable knowledge exchange. If you're traveling from outside the country, you can find useful travel information [here](#).



### Certified by



### Certification

This course is certified by the European society for precision engineering & nanotechnology ([euspen](#)) and the Dutch Society for Precision Engineering ([DSPE](#)) and leads to the [ECP2-certificate](#).

### Course leader

[Dr. Rens Henselmans](#)  
[Dr. Adrian Rankers](#)

### Trainers

[Dr. Rens Henselmans](#)  
[Dr. René Klaver](#)  
[Jef Horijon MSc](#)  
[Dr.ir. Jeroen de Best](#)

*\* Prices are subject to change. Price correction will be applied at the end of the year.*

Keep me posted



## Program

### Day 1

Introduction: Metrology definitions

- SI system and traceability
- Definitions (repeatability, reproducibility, uncertainty etc.)
- Components of a measurement system

Short range sensors

- Sensor terminology (range, resolution, sensitivity etc.)
- Sensor types (capacitive, inductive, optical etc.)

Long range sensors

- Displacement interferometry (principle, components, error sources etc.)
- Encoders (theory, various types)

### Day 2

Case introduction

- Measurement machine for freeform optics
- Case will be used and developed throughout course
- Analysis of existing solutions
- Performance estimation (uncertainty calculation)

Mechatronic context

- Control theory summary
- Influence of sensor properties
- Influence of sensor placement
- Applying corrections

Metrology on system level

- Design principles for low uncertainty
- Error types
- Rules of Abbe and Bryan
- System loops
- Quantity of concern
- Error budgeting basics

### Day 3

System calibration

- Calibration terminology
- Calibration instruments & artefacts
- Self-calibration and reversal techniques
- Application examples
- Use of calibration data

Machine Vision: Case SMT system

- Vision metrology
- Calibration of series products
- Data logistics for field replacement units

## Methods

Participants will acquire a mix of conceptual background, do's and don't s and practical insights via lectures, video's and live demonstrations of sensors and measurement equipment in combination with individual and group assignments.

## Frequency

Once per year

Read the interview:



Remarks from participants:

- "Most important items I have learned: Broad overview of calibration strategies." > Peter Schaap , ASML
- "Well organized, nice lecturers, good material." > Niels Bosch , ASML
- "Good training that gives the theory about why we need calibrations." > Dat Hoang , Sioux Technologies
- "Very nice training with a nice practical case that acts as a common thread throughout the course." > Glenn Roumen , Sioux Technologies
- "Interesting training, covers a lot of aspects." > Thomas Lembrechts , Sioux Technologies