Engineering for Remote Sensing

Micos Engineering GmbH
Überlandstrasse 129
CH-8600 Dübendorf
Switzerland

www.micos.ch

email: micos4u@micos.ch
Phone: +41 44 533 80 00
Fax: +41 44 533 80 01

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TABLE OF CONTENT

1 MICOS BACKGROUND

Micos Engineering GmbH (Micos) is a Swiss independent advanced engineering SME that focuses on system engineering for optical instrumentation serving the European space market. As industrial partner Micos has capabilities and heritage in the area of design, engineering, AIT (assembly, integration and testing) and services for optical measurement systems. In addition, Micos also offers development of highly reliable products for industrial applications in synergy with its technology/product know-how for scientific and commercial space-borne missions.

The multi-disciplinary team runs joint space projects within professional networks with industrial and institutional partners. Micos offices and facilities are embedded in the very premises of the Swiss Federal Laboratories for Materials Science and Technology (Empa) in Dübendorf, Switzerland (Figure 1), which notably augments the quality and range of our services to customers and partners.

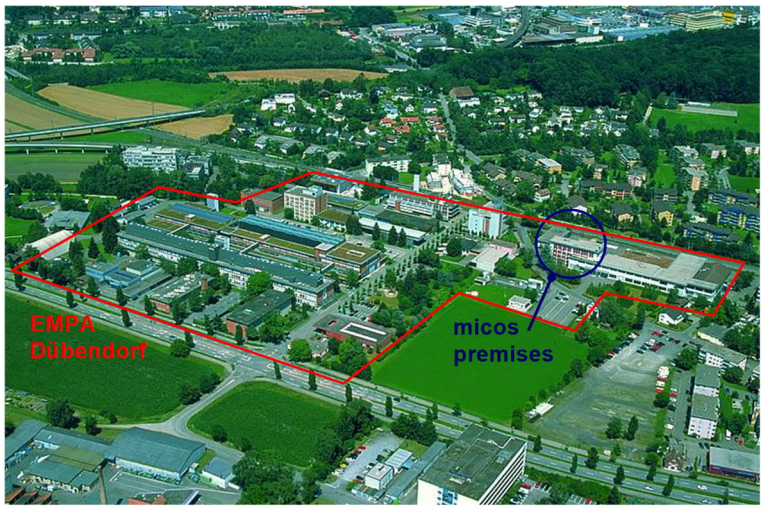


Figure 1: Micos premises are well embedded into Empa Dübendorf.

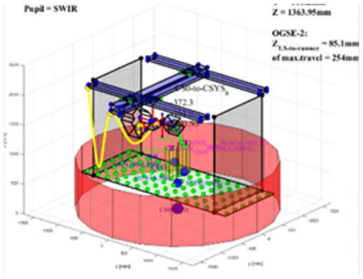
Micos capitalizes on the extensive heritage and experience of its key personnel. Micos' multicultural team integrates more than 20 patent applications, more than 30 man years of project management experience and more than 200 man-years of experience and expertise in the area of instrumentation for industrial and space applications, including participation in scientific and operational missions at various development phases from concept proposals to full optical systems. Key personnel having joined Micos have long track experience originated within companies as Leonardo (IT), RUAG (CH), Media Lario (IT), COMDEV (CA), NASA (US) and ABB (CA and CH).

Micos has primarily the core competences and knowledge in the domain of spectroscopy systems, opto-mechanical systems and allied technologies for space devoted applications. Before funding or joining Micos, key personnel has participated in various space projects for European and Canadian Space Agencies and different prime contractors. Micos capabilities range from feasibility studies, to research and development to turn-key one-off systems.

2 INTERNSHIP OPPORTUNITIES

2.1 KINEMATIC SOFTWARE AND HIGH ACCURACY CHARACTERIZATION OF A POSITIONING STRUCTURE

The 3MI calibration support equipment (OGSE+MGSE) relates to a complex optomechanical structure which is dedicated for the calibration of 3MI, an imaging polarimeter. The mechanical structure consists of a Gantry portal and a motorized turret (six axes in total) which require to execute a given motion choreography and high accuracy (micrometer and arcseconds) motion calibration.



During this internship, you will support software development and calibration operations. The work has multiple facets to be be executed:

- Conversion from Matlab implemented kinematics scripts to Labview scripts.
- Practical testing on rotary and linear stage hardware for translation validation.
- Execution of motion characterisation operations, collection of data, elaboration and organisation of characterisation data.

Duration:

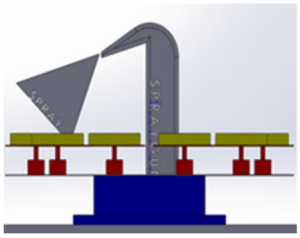
Requirements:

- Experience with Matlab + Labview
- Use of laboratory metrology (theodolite, autocollimator, etc…)
- Interest in mechanical systems, motion control and coordinate transformation over various reference systems, optical metrology
- Availability at Micos Engineering in Dübendorf preferred, but not mandatory at least for part of the work
- Languages: English should be at C1 minimum. German, Italian or French are a plus.

Contact: Apply by email at micos4u@micos.ch ; Send “RBL Internship Opportunities” within the email subject.

2.2 AUTOMATION OF A PAINT SPRAYING SYSTEM FOR SPACE STRUCTURES

Some space structures require specific paints and coatings on highly complex geometries. Depending on the applications, the coating thickness might require to be as evenly distributed as possible on highly irregular geometries. In addition, the coating process should be repeatable in an automated and controlled way and compliant to ECSS processes. Particulate contamination control requires HEPA filtering. Scalability of the process also comes into play.



During this internship, you will design the automatic paint spraying system, from its concept and scope, to the mechanical layout to the motion control. The following set of activities is envisioned:

- Exploration of coating options and definition of repeatable processes to ensure a controlled coating layer thickness on a complex geometry
- Experimentation on spray gun systems and their automated actuation, active motion control of the part of interest, spray system motion options
- Design and build of an experimental setup to coat up to 10 identical parts within a repeatable, automated process

Duration: 2-3 months full time

Requirements:

- Hands-on experience on mechanical design and Arduino (or similar simple electronics systems)
- Experience in motor control and position automation (to millimetre and degree accuracy)
- Process design experience
- Familiarity with various types of paints and their properties is a plus
- Languages: English should be at C1 minimum. German, Italian or French are a plus.

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2.3 DESIGN OF A SHOCK TABLE

With the introduction of Shock Response Spectrum (SRS) as standard test practice for space flight hardware, the possibility to test shock by means of sinusoidal pulses as defined in many previously existing standard (e.g. MIL) is not accepted any more. The use of SRS requires introducing high frequency pulses into the supporting structure in order to excite the unit under test up to 10 kHz. Differently from standard sinusoidal pulses, the shock is not defined by means of a directly measurable "bump" as such, but from the convolution of the response of an ideal 1 DOF over the spectral range of interest to the "bump".

During this internship, you will follow up on the progress in the design, manufacture and characterization of a shock facility to test equipment according to Shock Response Spectrum (SRS) profiles. This activity is a relatively broad one, and depending on the progress achieved from previous work and internship time, it may account:

- Analysis of the hammer mechanisms in order to avoid double hits and to be able to tune introduced force and impact duration
- Analysis of the ringing plate to determine the test areas allowing the possibility of achieving representative shock levels with a representative mass of the unit under test (indicatively 10 to 20 kg)
- Mechanical design of the hammer mechanisms and of the ringing plate
- Definition of the required supporting equipment (accelerometer, acquisition boards, etc)
- Definition and coding of the acquisition and analysis algorithms (in matlab, python or labview)
- Supply management of the mechanism and structure
- Integration and test of the equipment

Duration:

Requirements:

- Languages: English should be at C1 minimum. German, Italian or French are a plus.

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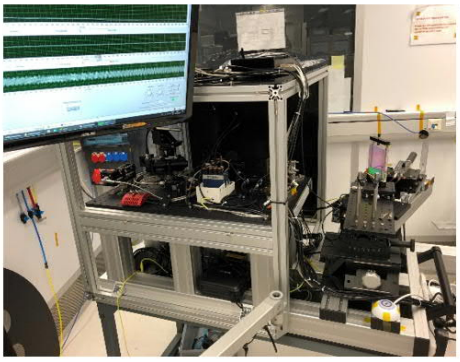
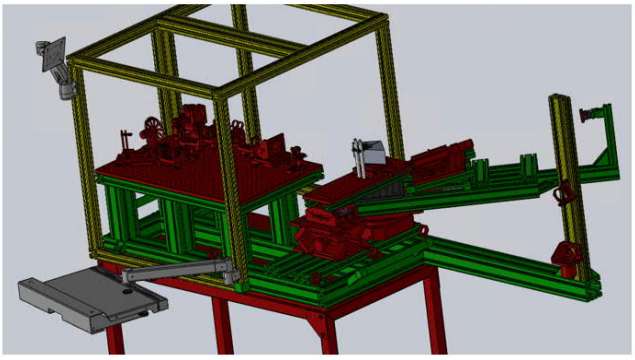
2.4 STRAYLIGHT CHARACTERIZATION SETUP, OPTICAL PHYSICS

The straylight setup at Micos is for measuring bidirectional scattering distribution function of any optical sample, but especially gratings or highly polished space optics requiring significant dynamic range. It is the only setup worldwide to be specialized for gratings, as it is measuring in collimated space on a wide range of output angles.

The optical design, mechanical design, main assembly, first alignment and tests are already done, but plenty of improvement and verification tasks remain until it is an internationally accepted and sought for characterization system.

During this internship, you may carry out the following activities:

- Upgrade the straylight setup, assembling new mirrors, and optics protection systems among other improvements. You will operate in a cleanroom ISO6 environment
- Optical alignment of subsystems after upgrades
- Tests of components (e.g. detector dark current and noise characterization, laser power, polarization and wavelengths stability characterization).
- Detailed mechanical analysis and characterization activities such as angular range, resolution, repeatability calculations and calibrations
- Trial measurements of known materials for BSDF, cross comparison with other straylight facilities worldwide.

Duration: minimum 2 months full time, 6 months part time.

Requirements:

- Languages: English should be at C1 minimum. German, Italian or French are a plus.
- Working in a clean room is required, being able to lift 15 kg is required
- Understanding of ESD concepts is required for the work, can be learned at the start
- Labview, Python or Matlab or VBA knowledge is an advantage, at least one code example is required in application.
- Physics and optics education (ongoing) is required, Excel proficiency is required
- Experience with mirror alignment, optics cleaning, theodolites is an advantage
- Experience with CAD design is an advantage

- Clear and concise communication in writing is required, example physics laboratory report is required with application.

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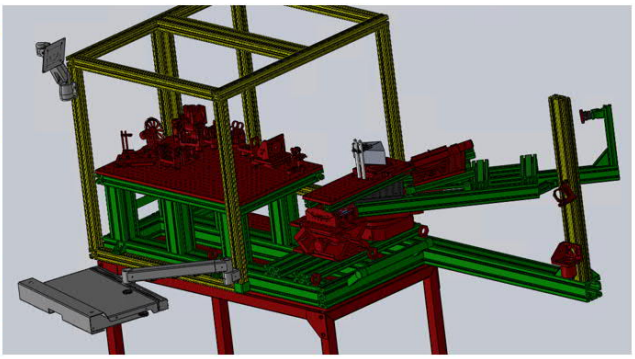
2.5 STRAYLIGHT CHARACTERIZATION SETUP, SOFTWARE AND AUTOMATION

The straylight setup at Micos is for measuring bidirectional scattering distribution function of any optical sample, but especially gratings or highly polished space optics requiring enormous dynamic range.

The system is comprised of laser sources, laser modulation, motion control and detection subsystems, each with dedicated control electronics and software.

During this internship, you will focus on the control of the system, improving its integration at software level. Depending on the internship durarion, the following activities may be carried out:

- Review and analysis of current software components: Labview control program, Python script for task file generation, Excel macro for data ingestion and manipulation.
- Review of current hardware control electronics, especially the stepper motor controller.
- Selection of stepper motor controller to replace the current one or resolving the difficulties with the current stepper motor controller.
- Better gain selection algorithm implementation for the optical detector and amplifier system.
- Feature implementation for the Labview control program, ideally incorporating the functionality of the Python task file generation script.
- Python program implementation for the replication and improvement of the Excel macro based data analysis, but storing the intermediate and end results in Excel or CSV formats.

Duration: minimum 2 months full time, 6 months part time.

Requirements:

- Programming languages: Labview is required, Python and Matlab are advantages.
- Labview code example is required with application.
- Stepper motor control experience: advantage
- Experience with NI hardware: advantage
- An engineering background is required, electrical engineering student preferred
- Languages: English should be at C1 minimum
- Working in a clean room is required, being able to lift 15 kg is required
- Clear and concise communication in writing is required, example software documentation report is required with application (pdf format, written in MS Word similar, could be Powerpoint).

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2.6 PRT LAYOUT DESIGN AND CHARACTERIZATION FOR SPACE INSTRUMENTATION

Specific applications require temperature knowledge at the millikelvin level. For this purpose, potting or integration solution of temperature sensors (PRTs), PRT routing for heat sinking, adequate characterisation test definition and equipment to minimize parasitic effects are elements at focus.

Following our indications, the student should design the PRT routing, manufacture sample tests to conduct manufacturing and bonding tests. In a next step the student could/should support the execution of characterisation tests on a batch of PRTs and generate characterisation reports.

During this internship, you may carry out the following activities:

- Thermo-mechanical design sensitivity to understand thermal properties, their testing and design needs and implement them.
- Hand-on spirit to perform the bonding operations based on procedures to be jointly developed.
- Documentation ability to consolidate experience into processes, procedures and reports.

Duration: 4-6 Months full time

Requirements:

- The student should have a balanced mix and interest for hands on work, thermal design, sensitivity for accurate measurements and data elaboration (in python, excel or matlab).
- Languages: English should be at C1 minimum.

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2.7 HIGH EMISSIVITY RADIATION SOURCES MODELLING FOR SPACE INSTRUMENTATION

Micos is involved into the development of new high emissivity infrared radiation sources (blackbodies).

During this internship, the following activities may be carried out:

- Support the development by understanding the modelling approach, by executing simulation work on a dedicated software for IR sources design, by conceiving and assessing sources concept designs based on data available at Micos
- Working on the CAD definition of the cavity based on performance modelling results guidelines provided by Micos
- Follow the manufacturing process and document it
- Document the design and manufacturing phases into processes, procedures and reports.

Duration: 6+ M full time

Requirements:

- The student should have a balanced mix and interest for hands on work, thermal design, sensitivity for accurate measurements and data elaboration (in python, excel or matlab).
- Willingness to learn new modelling tools
- Knowledge of PTC creo preferable.
- Languages: English should be at C1 minimum.

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2.8 CALIBRATION IMPROVEMENT FOR A HIGH ACCURACY ANGULAR POSITION SENSORS

Micos is involved into the development of high accuracy angular positioning sensors (position encoders). When chasing microradiant values, each bias and uncertainty source influence the calibration outcome.

During this internship, based on the results of a test campaign already executed, the intern may carry out the following tasks:

- Elaborate the angular position data collected during the test campaign
- Understand the dedicated processing to be applied for the correction of the angular position
- Apply the processing scheme to the available data and derive residual calibration errors.

Duration: 2-3 M full time

Requirements:

- The student should have a interest for data processing, data elaboration and correction schemes and sensitivity for accurate measurements, ability to document the work.
- Programming skills (Python or Matlab).
- Languages: English should be at C1 minimum.

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