



Short-term Training for technical staff and scientists

Optical Measurement and Simulation of Functional Surfaces for Concentrator Optics

Location: Germany – Freiburg – Fraunhofer ISE

Date: June 22-23, 2022

Target group: The course is designed for engineers, researchers and representatives from the European CSP community who want to be trained on real CSP hardware.

Objective: Sharing expertise in the theoretical and practical competences needed for optical characterization and measurements on solar collectors.

Trainers: Scientists and specialists from Fraunhofer ISE

The training will include visits, procedures, standards and best practices, theoretical and experimental 'hands-on' experience and cover the following topics:

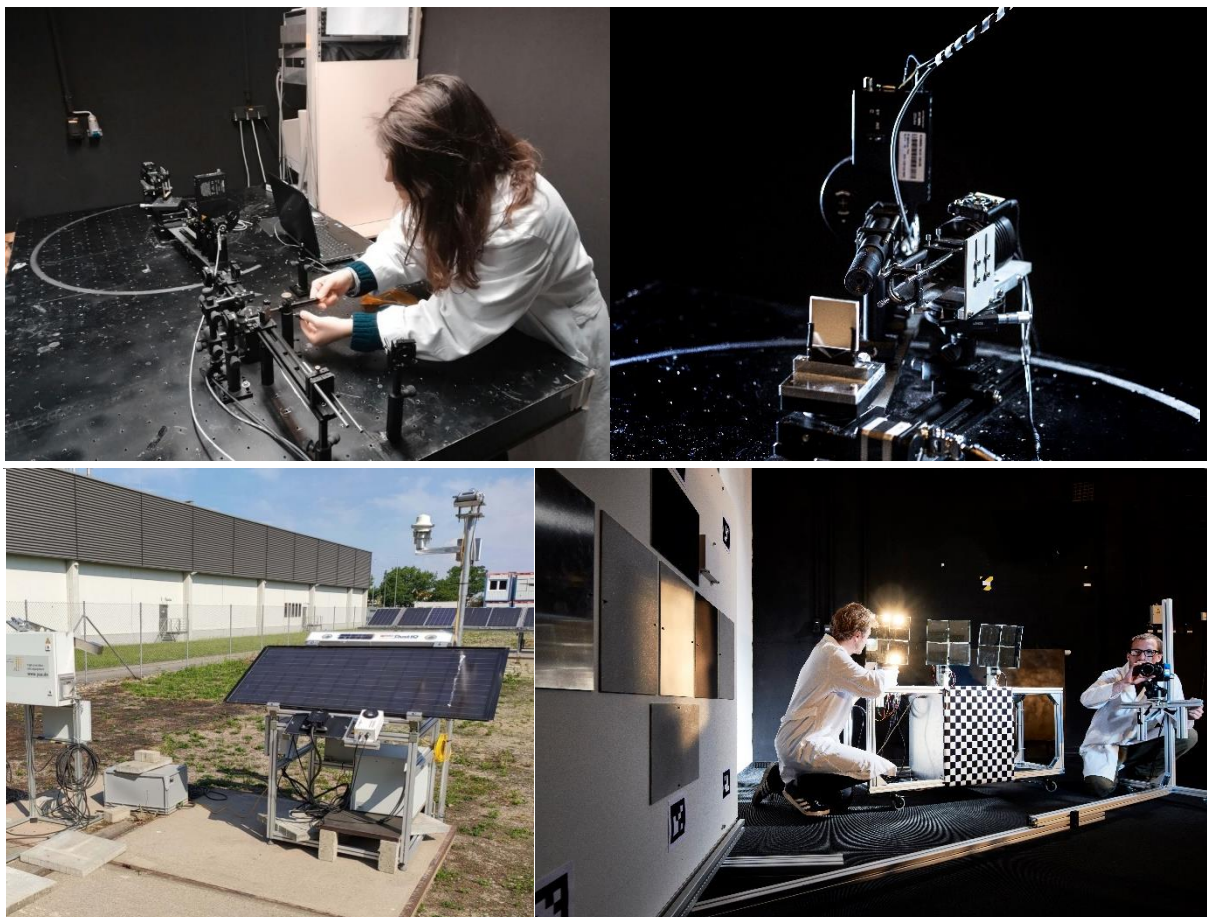
- Optical modelling tools
- Optical laboratory characterization facilities
- Optical portable characterization facilities in field
- Practical test cases

About the Lab & Test Field

The optical laboratory is equipped with instruments for characterization of CSP relevant materials, including solar reflectors (shape and reflectance), receiver coatings or refractory materials. With the VLABS instrument, specular reflectance and beam spread can be measured for acceptance angles up to 30 mrad and incidence angles between 8° and 60°. Shape and slope of solar mirrors are measured with deflectometry (with a resolution from 1 μm to 1 cm, and sample sizes from 5x5 cm² to 6x2 m²) or photogrammetry. For a detailed experimental examination of the scattering and absorptance characteristics of various dust types on solar mirrors, artificial soiling can be carried out in the lab. With the developed handheld device pFlex, fast and precise reflectance measurements can be performed on the samples. A broad equipment of camera-based measurement systems allows the realization of a wide range of measurement techniques to assess the angle-dependent reflectance behavior of relevant surfaces, in the lab as well as outdoors.

For validation and impact assessment, we conduct optical simulations with ray-tracing (from components up to system simulations for Linear Fresnel (LFC), Parabolic Trough (PTC) and Tower systems).

The outdoor test ground offers testing of heliostats, heliostat tracking, focal point tests, and outdoor exposure of solar mirrors and testing of soiling on curved and flat mirror facets. It is equipped with a heliostat, a flexible target for focal point analysis and exposure racks and parabolic trough mirror facets for soiling assessment.



Agenda

First day

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|---------------|--|------------------------------------|---------|
| 09:15 – 09:45 | Welcome coffee | | 30 min |
| 09:45 – 10:00 | Introduction of Agenda | Peter Schöttl | 15 min |
| 10:00 – 11:00 | Optical Modelling Tools - Raytrace3D, DevISE – material models | Peter Schöttl | 60 min |
| 11:00 – 11:15 | Coffee break | | 15 min |
| 11:15 – 12:15 | Introduction Optical Labs, mirror and absorber characterization | Gregor Bern / Moritz Bitterling | 60 min |
| 12:15 – 13:15 | Lunch Break | | 60 min |
| 13:15 – 14:15 | Lab Visit | Thomas Schmidt | 60 min |
| 14:15 – 14:30 | Break | | 15 min |
| 14:30 – 16:30 | Optical Labs: hands on experiments – Deflectometry mirror shape assessment, VLABS reflectance measurements | Gregor Bern / Thomas Schmidt | 120 min |

Second day

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|-------------------|--|--|---------|
| 09:00- 09:15 | Welcome coffee | | 15 min |
| 09:15- 10 :00 | Introduction Field Instrumentation – Camera based reflectance measurement and 3-D laser scanning for the assessment of concentrating collectors | Gregor Bern / Moritz Bitterling | 45 min |
| 10 :15- 12 :15 | Visit and measurements at field lab – hands-on experience | Thomas Schmidt / Gregor Bern / Moritz Bitterling | 120 min |
| 12 :15- 13 :15 | Lunch Break | | 60 min |
| 13:15- 14:30 | Discussion and wrap up | Gregor Bern | 75 min |

MEETING PLACE & ACCOMMODATION

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| Training place | Fraunhofer Institute for Solar Energy |
| Address Training Location | Heidenhofstraße 2, 79110 Freiburg im Breisgau |
| How to get to the Training place from the airport | Airport Shuttle from EuroAirport Basel, Mulhouse, Freiburg to Freiburg |
| Restaurant place | On site |
| Accommodation | Hotel close to Fraunhofer ISE We will send a list of suitable hotels after confirmed registration |
| Contacts for the Training | Peter Schöttl peter.schoettl@ise.fraunhofer.de Lina Graf noa.lina.graf@ise.fraunhofer.de |
| Participation confirmation for the Training | SFERA III website: https://sfera3.sollab.eu/events/list/ |