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centro nacional de energías renovables
national renewable energy centre

The National Renewable Energy Centre of Spain -CENER- is a technology centre specialized in applied research and development as well as the promotion of renewable energies. CENER is divided into six departments: Wind Energy, Photovoltaic Solar Energy, Solar Thermal Energy, Biomass Energy, Bioclimatic Architecture and Renewable Energy Grid Integration.

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OPTICAL CHARACTERIZATION OF COLLECTORS AND CONCENTRATING SYSTEMS

Globally the growing CSP industry demands fast, easy and accurate solar collector's characterization methods in order to:

- Guarantee a better quality control, not only during erection and assembly, but also during the operational life of the plant.
- Improve the knowledge of the influence of structural design in final optical performance of the collector under real working conditions.

CENER with its expertise in CSP technologies has developed innovative procedures for the effective optical characterization of solar concentrator systems.

MEASURING AND ANALYSIS

As a first step, CENER is improving the industrial application of the photogrammetry 3-D measurement technique in the field by designing new tailor-made devices and ad-hoc scientific software for data acquisition, analysis, and processing.

This improved three-dimensional measurement technique is used to obtain accurate 3D-coordinates of mirror facets, and collector structures points. Using in-house developed software the 3D measurement data is processed to generate computational representations of the surfaces of those elements, which are appropriate for detailed optical analysis.

CENER technicians at Alvarado plant (Acciona)

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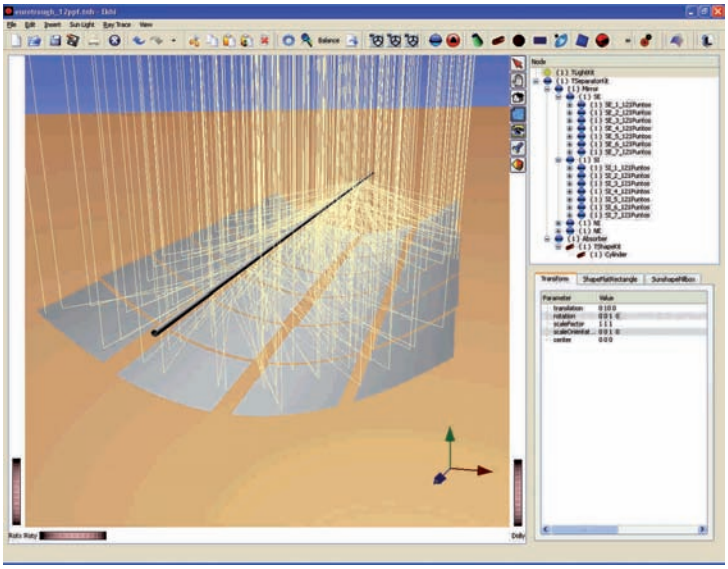
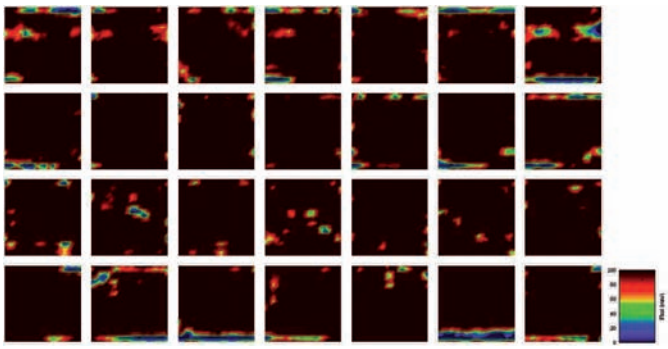
To speed-up and decrease measurement efforts on the field, while obtaining accurate 3D surfaces representation of the solar concentrating elements, the 3D-coordinate data processing software takes into consideration:

- The geometrical boundary conditions.
- The constraints imposed by the material physical properties.

From measured 3D-coordinate data, a Bézier patches representation method of the interpolated surfaces has been developed to produce efficient computational representation of those surfaces. This representation is well suited for optical characterization using Monte Carlo ray tracing techniques.



Surface reconstruction and ray tracing



Interception factor of a parabolic trough

The optical characterization determines the amount of energy that will reach the solar receiver tube as a function of the reconstructed shape of the collector surfaces and their mirror quality, and compares it with the amount of energy that will reach and ideal solar receiver tube from and ideal mirror collector under similar circumstances.

MAIN RESULTS AND CONCLUSIONS

CENER has created innovative procedures for the effective optical characterization of solar concentrator systems. Photogrammetry measurement technique has been improved and a data processing methodology has been developed to:

- Improve data acquisition speed.
- Reduce manpower.
- Simplify infrastructure requirements on the field.
- Provide useful and accurate information regarding the optical characterization of the collectors.

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