

# Optical Performance Assessment Of A Solar Collector With A Static Concentrator

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## Abstract

In this paper a specific version of radiation collecting troughs is investigated. The trough arrangement has a shape which is a combination of a circular arc and adjacent parabolic curve pieces based on a paper by Tripanagnostopoulos [1]. An absorbing tube can be placed at varying positions depending on the solar incidence angle.

It is investigated how the absorbed solar radiation depends on tube for different incident angles. The analysis consists of different steps. Using MATLAB the reflection of parallel entering ray bundles are investigated. This first step gave a first insight into the distribution of rays.

Zones inside the trough are identified where reflected rays concentrate.

Holding the trough fixed optimal positions for the tube move along an inclined line.

Then a detailed ray tracing analysis was done with the COMSOL software. COMSOL contains powerful tools (geometrical optics) to follows the rays through transparent media with reflecting and absorbing boundaries.

Using 2-D models the distribution of the radiation fluxes along the tube surface and along an enclosing envelope were calculated. For different incident angles results are presented giving the radiation fluxes in detail.

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## Figures used in the abstract

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**Figure 1** : Ray paths at 30° incidence angle

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**Figure 2** : Path of optimised tube positions

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**Figure 3** : Presentation of ray paths and collecting surfaces at 0° incidence angle