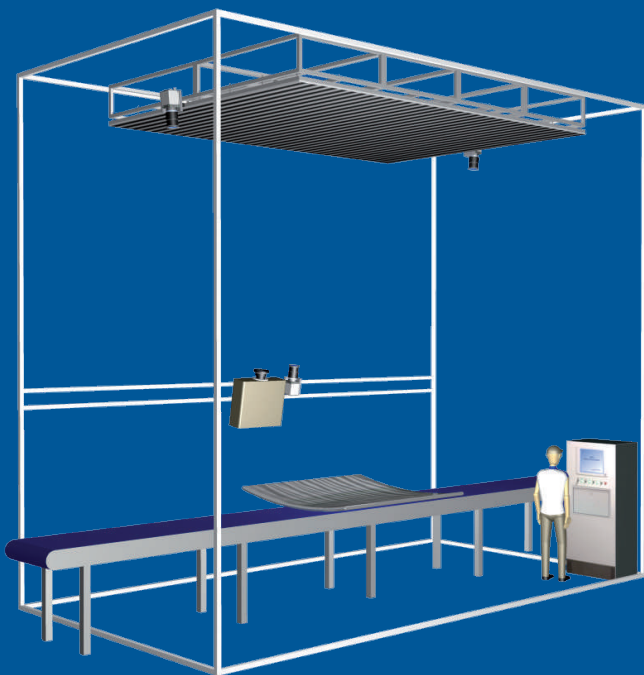


DEFLECTOMETRIC MEASUREMENT SYSTEM QDEC

Quality Control of the Shape of Solar Concentrators

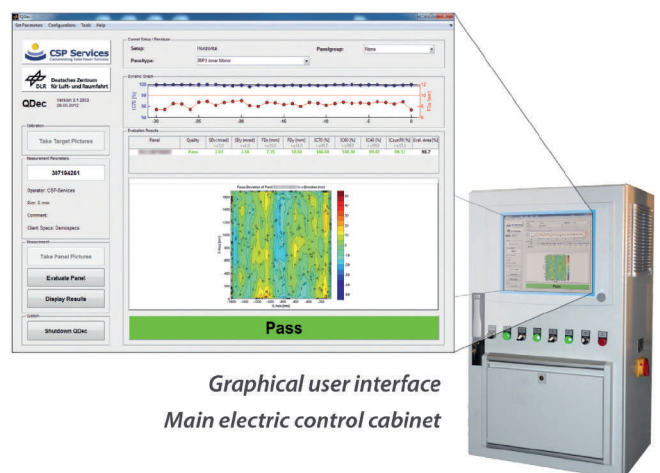


QDec is an optical measurement system for control of the shape accuracy of solar reflector panels and concentrators. It is used for industrial production quality control as well as in R&D environments. QDec provides high resolution and high precision measurement results of the shape deviations of curved or flat reflector panels of a wide range of geometries. It uses a non-contact optical measurement and digital image processing technique based on the deflectometric measurement principle (distortion of reflected patterns). This technique is particularly well suited to quantify the relevant geometric quality parameters for CSP reflector panels in production control and quality assurance.

Initiated at the German Aerospace Center (DLR) and further developed by CSP Services, QDec has become the standard tool in solar reflector panel measurements worldwide. It is in application in most industrial reflector panel production lines and in the DLR QUARZ Test Center.

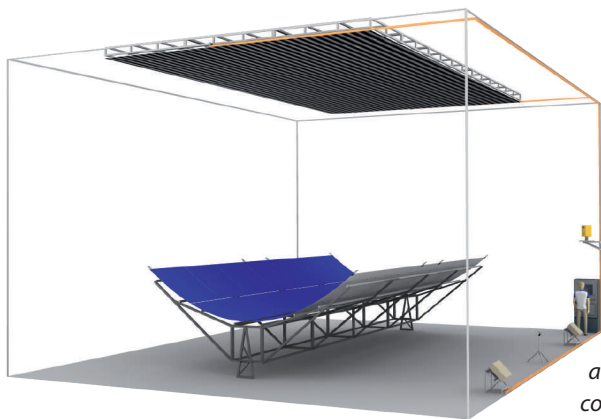
Exceptional system features are its easy operation, short measurement time, high spatial resolution, high measurement precision and a post-processing specially adapted to solar concentrator specifications.

The system is equipped with an electrical control cabinet with touch panel and high-end components prepared for industrial working environments. The software features a graphical user interface that allows comfortable operation of the system, automatic data evaluation, display of the results and automated quality reports.

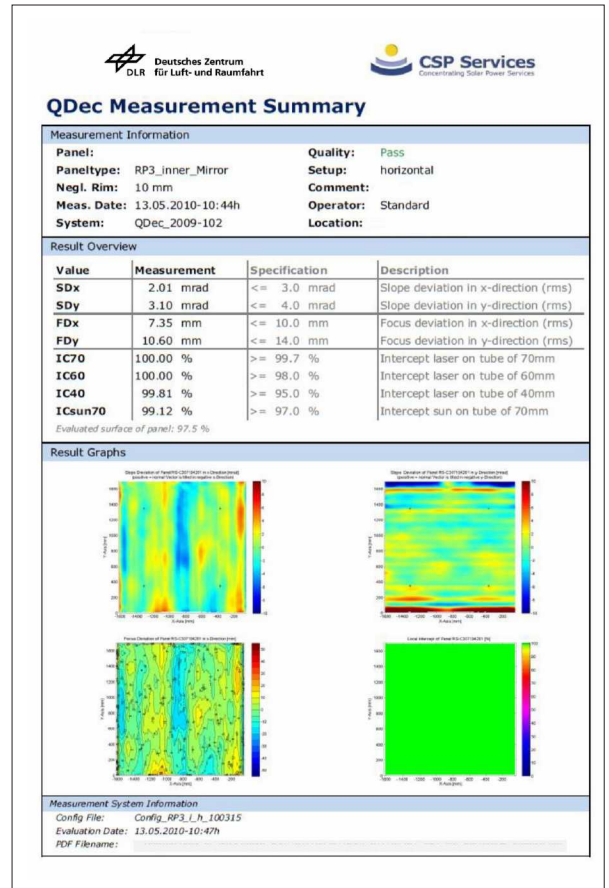


Graphical user interface
Main electric control cabinet

The QDec system can be flexibly adapted to a large variety of reflector panel geometries, measurement orientations and customer requirements. It is suited for inline process monitoring in glass bending lines up to 100% control. Apart from reflector panels, the system can also be applied to control the optical quality of entire heliostats, dishes and parabolic trough modules. The software offers a variety of features specifically developed for CSP applications, such as calculation of focus deviation, ray tracing simulation considering real sunshape, display of local intercept, display of flux distribution, reverse ray tracing to detect and assess local panel deviations and more.



QDec-M for automatic quality control of mirrored parabolic trough modules



QDec measurement summary example

QDec System Features

	QDec Offline	QDec Inline
Measurement time	< 30 s	< 5 s
Evaluation time	< 40 s	< 10 s
Number of measurement points (standard / maximum)	≈ 250'000 / ≈ 1'000'000	≈ 250'000 / ≈ 1'000'000
Measurement uncertainty local spot / global value (RMS)	< 0.5 mrad / < 0.2 mrad	< 0.5 mrad / < 0.2 mrad
Numerical output	SDx, SDy, FDx, FDy, IC, ICsun, etc.	SDx, SDy, FDx, FDy, IC, ICsun, etc.
Graphical output	local slope deviation (x/y), local focus deviation, local intercept factor, local height deviation, standard quality report (pdf)	local focus deviation
Output database formats	standard: .csv optional: .xls / SQL	standard: .csv optional: .xls / SQL
Optional output (with increase of evaluation time)	Flux distribution, reverse ray tracing, matrix data in ASCII file (.csv)	graphical output of local slope deviation (x/y), local focus deviation, local intercept factor, local height deviation, standard report (pdf), flux distribution, reverse ray tracing, matrix data in ASCII file (.csv)

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