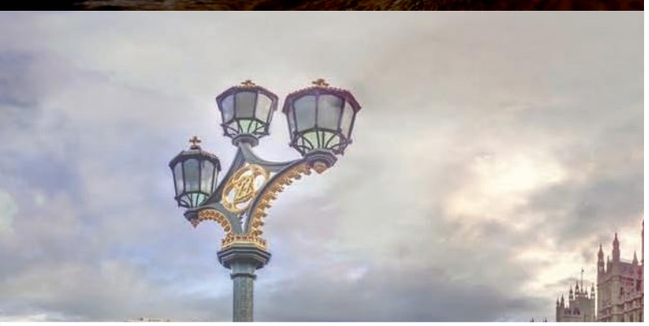
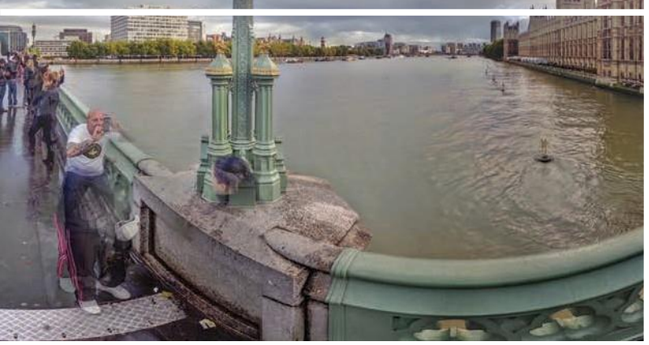
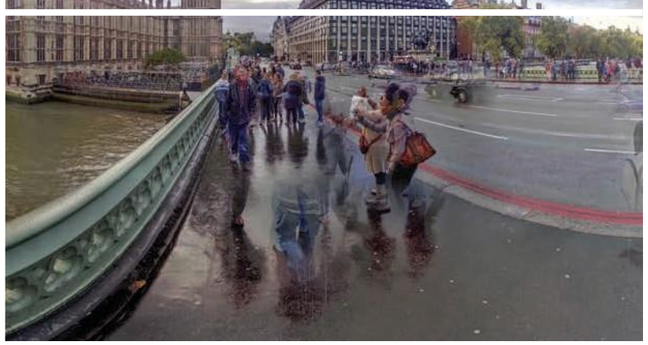
How we build reality

Zoller+Fröhlich

wipco
3D Scan & Solutions

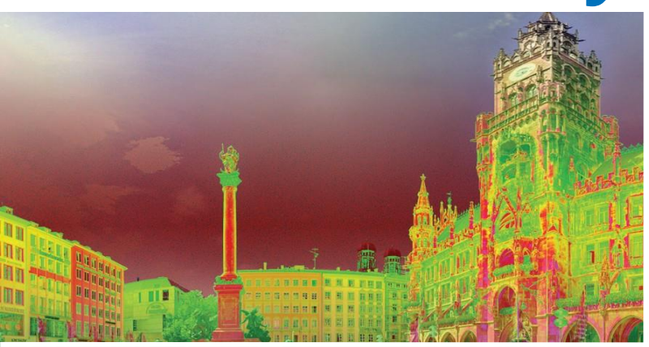






Case Study

High Dynamic Range



Company Overview

Z+F is one of the world's leading manufacturers in the field of non-contact laser measurement technology. Due to years of research, development and numerous successful engineering projects, Z+F is the forerunner in this field with a wealth of knowledge, experience and success.

When it comes to implementing future developments Z+F has always encouraged innovative thinking and open-minds. Our loyal and long-standing customers appreciate our cont inual innovations, support and the services we provide.

High Dynamic Range

Everybody knows the problem: When taking a picture of a scene with a high contrast, (e.g. picture 1a) the photo usually contains some overexposed and u nderexposed areas and one has to de cide which part to expose correctly. St andard cameras aren't equipped with s ufficient dynamic range to feature all intermediate stages between the lightest and darkest pixel. If one brightens up or darkens the area later with the help of image processing, one will not be able to restore the details.

1a) standard picture in a high-contrast scene

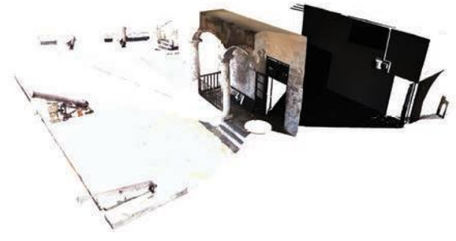
1b) underexposed areas in pink

1c) overexposed areas in red

Z+F HDR point cloud of the Z+F IMAGER® 5010C, Ghana, by the Zamani Project, South Africa

For a HDR picture, several images with different exposures are made and combined (see above).

3D scan with HDR colour



3D scan without HDR colour

Z+F HDR point cloud of the Z+F IMAGER® 5010C

What is HDR?

HDR offers a solution to display homogenous colour information.

Therefore serveral pictures of the same scene are taken with different exposure times, including intentional underexposed and overexposed pictures, in order to capture every contrast area correctly. Even those areas which would be underexposed are captured (e.g. picture 1b, 1c, page 2). After this process all pictures are merged into one high dynamic range picture, displaying an ideal result (e.g. top picture, page 2).

HDR is not a new technology, but Z+F is the first manufacturer to integrate this capturing technique into a 3D laser scanner. Until now the HDR workflow was very time consming. Usually a reflex camera, equipped with a wide-angle lens is being used. The camera is mounted onto a nodal point adapter and then onto the tripod, replacing the scanner. This process takes a lot of valuable time and may be inaccurate.

The Z+F IMAGER® 5010C executes this entire workflow automatically. Just activate the camera and the scanner takes all required photos.

The HDR picture is being generated in the Z+F LaserControl® software and combined with the point cloud automatically. Compared to the manual method, Z+F's HDR procedure does not require any previous knowledge in the field of photography, e.g. about aperture and exposure time, and allows a simple and quick 3D documentation of the surrounding area.

Comparison between a Z+F HDR result and a standard picture

HDR point cloud of the Z+F IMAGER® 5010C in the harbour of Cape Town, South Africa. The colour of the pipes indicate their content and condition. Source: Satmap Solutions/HORTS Solutions, South Africa

Industry

Existing factories and industrial plants ca n be surveyed in detail and three- dimen sionally.

CAD modelsoftheactual stateofa factory or plant (e.g. pipes, steel beams) can be generated out of the 3D scan data. By using 3D models it is possible to plan plant expansions ormodifications.

2D construction plans can be de- rived from the millimeter accurate point coord inates of the scans. In addition col- our a llowes to asses the condition of pipes and valves (e.g. rust etc.). And as pipe- work can be pretty complex with lots of shad owing, HDR technology guarantees perf ect colour results, even in very narrow are as colouring, especially with HDR tech- no logy can help tremedously with classi- fi cation and differentiation of pipes, wires and otherobjects.

Very often the following colour combina- tions are used on pipes:

- red = warm
- blue =cold
- yellow= gas

Scan of the Zeppelin NT-Hangar

Point cloud of a site with strong backlight. Source: Satmap Solutions/HORTS Solutions, South Africa

Point cloud with an overlaid CAD model, Zeche-Zollverein, Essen, Germany

Z+F HDR point cloud of "Fort St. Jago", Ghana taken by the Zamani Project, South Africa

Cultural Heritage

Documenting cultural heritage sites (e.g. castles) is quite a difficult task due to the high level of details which have to be captured.

In many cases plans and layout documents do not exist and need to be generated from scratch.

3D documentation is the ideal foundation for reconstructing very delicate structures, including fragile stuccoworks. The recorded data can be stored in a database, which allows the reconstruction and interactive interrogation of the data at any given time in the future.

Colour information adds an important value to point clouds especially in the field of heritage preservation because of the high documentation emphasis. In addition, it allows the recognition and evaluation of decay and presence of flora such as moss, mould and fungus.

By using the HDR technique, objects are being displayed perfectly exposed irrespective of the strong contrasts. This makes it easier to distinguish between different material and creates a more realistic impression.

HDR point cloud of "St. Martins Church", Wangen im Allgäu, Germany

Z+F HDR point cloud of the streets of Amsterdam, Netherland

Architecture

Z+F 3D phase based laser scanners enable a detailed condition and damage assessment even of complex structures.

Thus, 3D data is an ideal planning base. Simulations to create new studies of the objects are being supported by documenting sites with laser scanners.

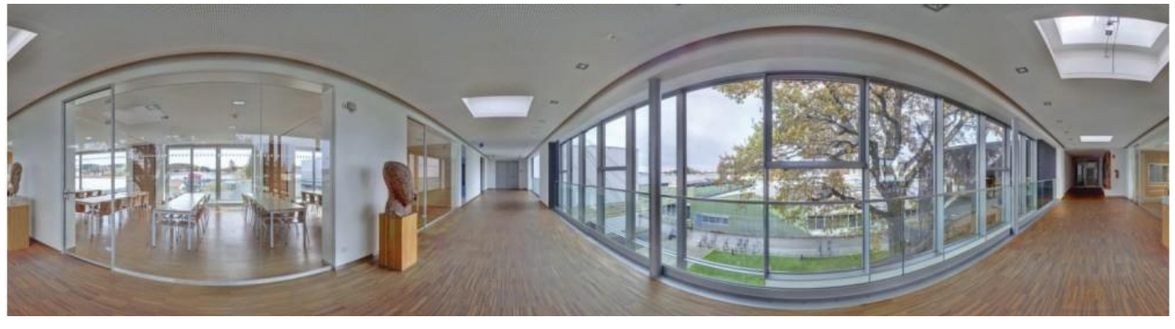
The Z+F IMAGER® 5010C generates an exactspatial modelofcomplexstructures and their surrounding areas. With HDR, even details in small shadowed areas on facades, such as roof overhangs and cornices remain visible.

Even colour scans in high contrast scenes inside of buildings with big glass fronts can be captured with HDR.

HDR Point Cloud, Hotel "The Broadmoor", Colorado Springs, USA

HDR orthophoto of a wall, derived of the above scan

Z+F HDR point cloud of the streets of Valparaíso, Chile



The Z+F HDR technology is simple to use even in scenes with high contrasts.

HDR point cloud allows the objective documentation of crime scenes. Even black objects on dark background can be identified.

Forensics

Just within minutes, the Z+F laser scanners provide correct and objective spatial data of a crime scene and accident scenes, whether indoor or outdoors.

The data helps the crime scene units to document and to “freeze” the scanned scenes.

The measurement methods based on laser scanners and the evaluations of the data are accepted in court and used by the FBI and the police every day.

Z+F HDR and the interegated automated white-balance process allows the simple, reliable, objective and fail-safe acquisition of colour information, even in direct sunlight.

HDR point cloud with a Z+F IMAGER® 5010C of a simulated crime scene

HDR point cloud from above in 3D

3D modell of an accident scene

Chile

Z+F HDR scans Around the World

Germany

Sam O. Hirota, Inc, Hawaii

Tunisia

Austria

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