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[Application note – Blackburn Rovers, Ewood park]

Trimble TX8 scan colourisation with iSTAR HDR images

Date: 18 September 2015
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Organisations involved: NCTech, Trimble, Korec Group, Blackburn Rovers
Products used: NCTech Immersive Studio, NCTech ColourCloud and TRIMBLE RealWorks

Using the NCTech iSTAR 360 camera and ColourCloud point cloud colourisation software to provide rapid HDR imaging for Trimble's TX8

The iSTAR 360 degree camera provides rapid, automatic HDR (High Dynamic Range) 360 imaging and can be used as a standalone device or for colourisation of point clouds created by spherical terrestrial scanners. Trimble's TX8 scanner does not provide for internal colour capture so iSTAR can be used as a companion HDR external camera.

A project was undertaken to scan and image the Blackburn Rovers football stadium, Ewood Park using both technologies, to show their combined capabilities. The results of the project showed that iSTAR provides the ability to efficiently capture HDR colour and accurately combine this with the scan data for significantly improved 3D visualisation.

There are two different office workflows that can be used for point colourisation, either in NCTech ColourCloud or TRIMBLE Realworks v.9. Users can choose the option most suitable depending on the project requirements.

01. Software installation
02. Fieldworks
03. Office-work
04. Results
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01. Software installation

Installing NCTech Immersive Studio:
https://www.nctechimaging.com/immersive-studio/

Installing NCTech ColourCloud:
https://www.nctechimaging.com/colourcloud/
Installing TRIMBLE Realworks:
http://www.trimble.com/3d-laser-scanning/realworks.aspx

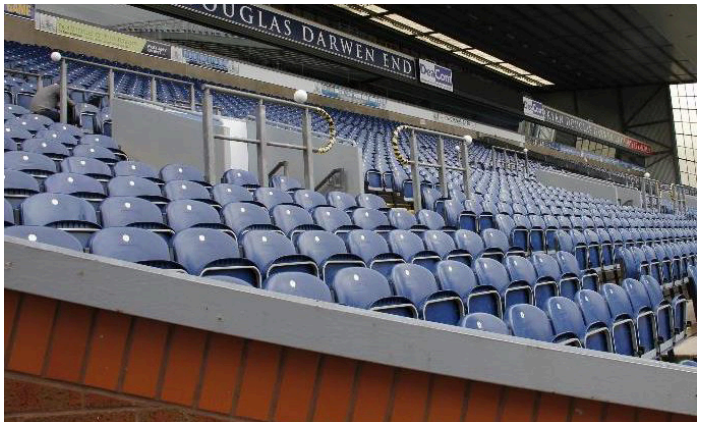
02. Fieldworks

Working with NCTech solutions is the easiest and most accurate method of colouring point clouds with iSTAR images:

02.01. PLANNING SCAN STATIONS requires no change to standard process for scanning with or without colour.

02.02. CAPTURING POINT CLOUDS with the TX8, choose the Laser Scanner resolution you consider most suitable for the job as in normal use. NCTech solutions work well irrespective of scan resolution.

Img. 02.01. Target placements to register point clouds.



Img. 02.02. Common targets between scan stations. At least, 3 common targets are needed to register in TRIMBLE RealWorks point clouds based on targets.

02.03. CAPTURE iSTAR IMAGES by replacing the TX8 with the iSTAR[1] camera at each scan station, and capture 360 images in full HDR colour. NCTech supply adaptor rods with a Tribrach quick release repeatable connector to accurately and quickly locate iSTAR at the same central capture position as the scanner. iSTAR has different HDR modes enabling single exposure, five exposure and nine exposure 360 images to be created. Five exposure HDR imaging was used here. The total iSTAR capture and data save process is approximately90s per scan position, however the camera can be moved after the capture phase completes which is typically around 15-20 seconds. iSTAR's on camera user interface is designed to be like a regular automatic digital camera. Knowledge of photographic techniques is not required with iSTAR automatically calculating the most suitable exposure value taking into account the entire 360 scene.

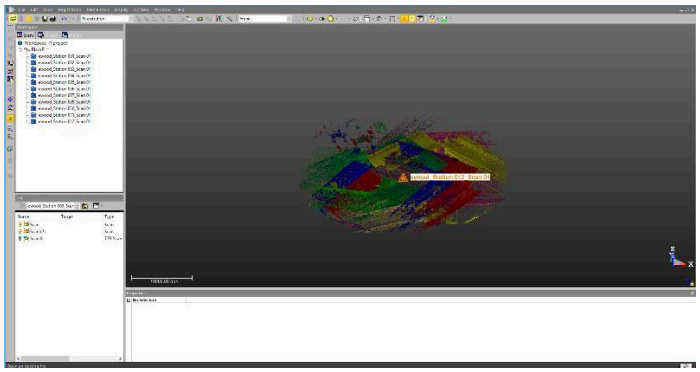
Img. 02.03 and Img. 02.04. LaserScanner and iSTAR station (general).

Img. 02.05 and Img. 02.06. LaserScanner and iSTAR station (detail).

03. Office-work

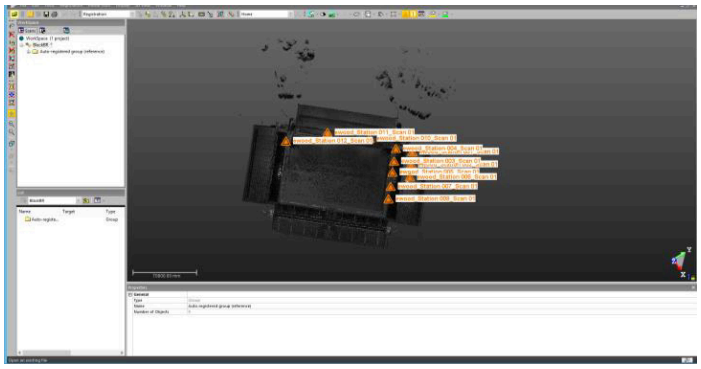
03.A. NCTech ColourCloud v.1.1 with TRIMBLE Realworks v.9.

03.A.01. REGISTER MULTIPLE SCANS. Open your scans (*.tzf format) into TRIMBLE Realworks and register using the ordinary method most suitable for your scan stations (based on targets, cloud-to-cloud, etc).



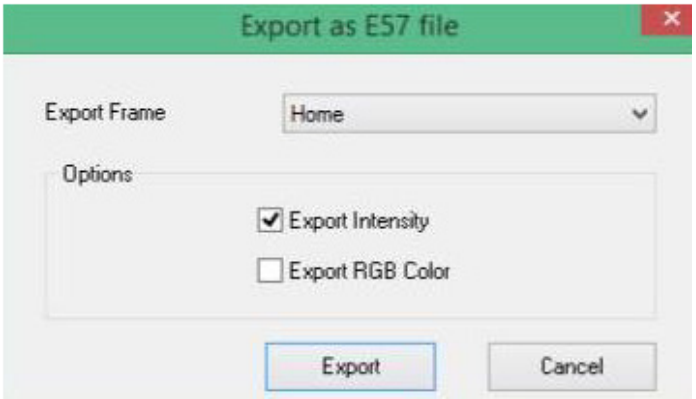
Img. 03.01. Scan Stations open into TRIMBLE RealWorks before registration. Each station appears with different colour.

1 - NCTech recommend using its adaptor poles to accurately locate the camera in the correct position, different adaptors are used for other laser scanning systems (Leica, Faro, Trimble, Topcon, Z_+F, Surphaser etc).

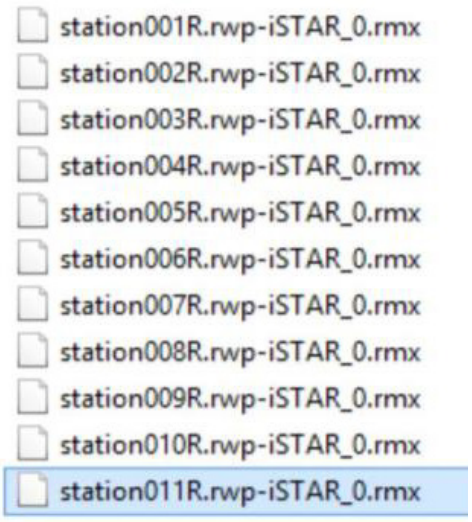


Img. 03.02. Scan Stations open into TRIMBLE RealWorks after registration. Target based and cloud-to-cloud registration methods were used in this study case.

03.A.02. SAVE REGISTER FILE and EXPORT TO *.e57 FORMAT. Save your project register information as *.rmx file and export each scan station into *.e57 format. Notice *.e57 files must be exported with intensity information. Although you choose "save *.rmx data once, a *.rmx file will be created for each station.

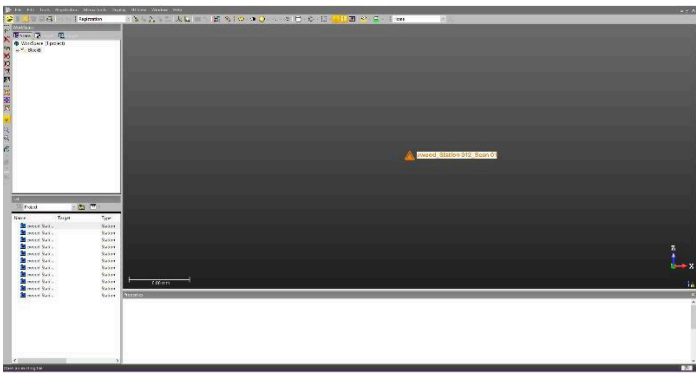


*Img. 03.03. Export Scan Stations from TRIMBLE RealWorks after registration into *.e57 format with intensity values.*

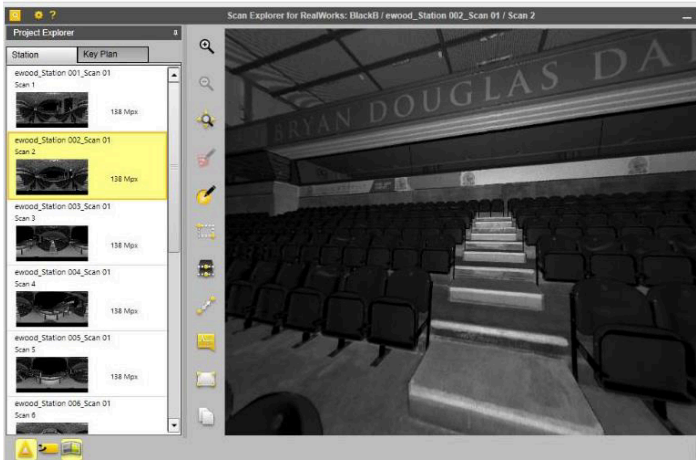


*Img. 03.04. *.rmx files which registration information. There will be a *.rmx file for each station but you only have to "click" save RMX once.*

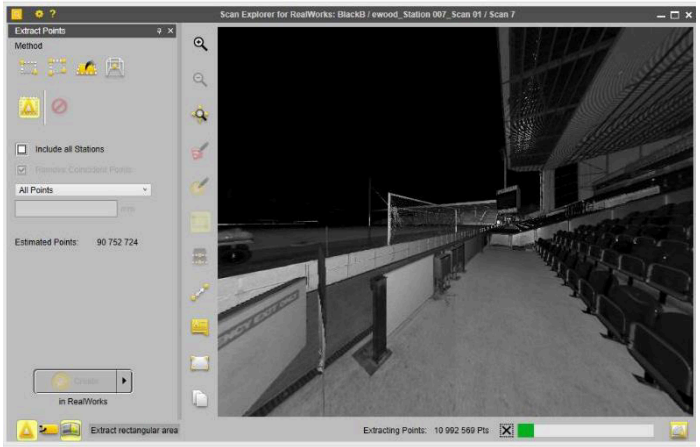
If the scan stations don't appear when you open Realworks, you can load them into Realworks and Export them from "Scan Explorer" window.



Img. 03.05. TRIMBLE RealWorks interface. Scan Stations have been already opened but point clouds cannot be seen in it.

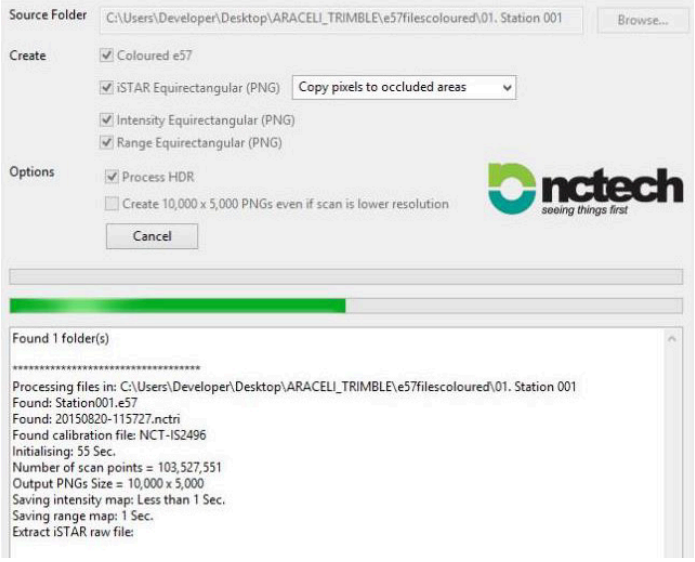


Img. 03.06. TRIMBLE Scan Explorer interface. Scan Station must be chosen to charge its point cloud on TRIMBLE RealWorks interface.

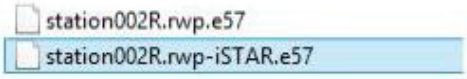


*Img. 03.07. TRIMBLE Scan Explorer interface. *.e57 file exportation.*

03.A.03. COLOUR POINT CLOUDS. Drag and drop into ColourCloud each folder containing the point cloud (*.e57 format) file with the corresponding station iSTAR files (*.yml calibration file and *.nctri raw data file). Simply press 'Process' in ColourCloud, the colourisation process is fully automatic and typically takes around 160s per scan/capture position (point cloud size, resolution and PC specification dependant). Batches of data can be processed together with each scan position folder containing the correct files are all located in one parent folder, which is dropped into ColourCloud. NCTech ColourCloud will save the point cloud with colour in the same directory as your original point cloud without colour. "iSTAR" will automatically be added to the name of your new coloured point cloud (*.e57) file.

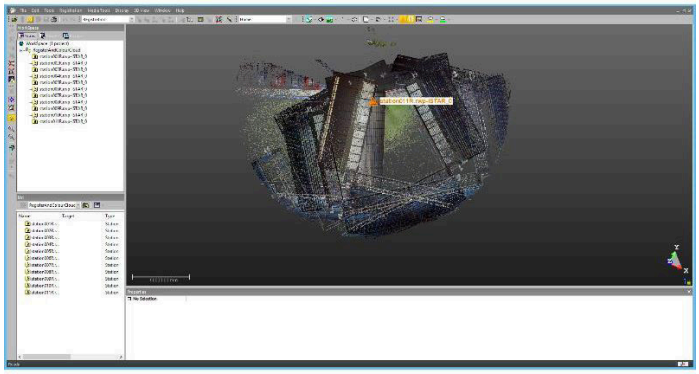


Img. 03.08. NCTech ColourCloud interface after drag and drop.

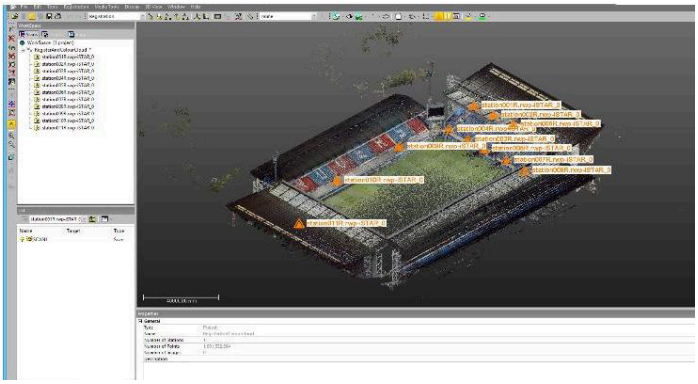


Img. 03.09.*.e57 file automatically created in the original directory. "iSTAR" has been added automatically to the name.

03.A.04. IMPORT point clouds WITH COLOUR AND REGISTER FILE. To continue your works into TRIMBLE Realworks you only have to open and import the coloured point clouds from NCTech ColourCloud and the registered file *.rmx into Realworks. Notice that the name of registration (*.rmx) files and point clouds (*.e57) must be the same in each station.



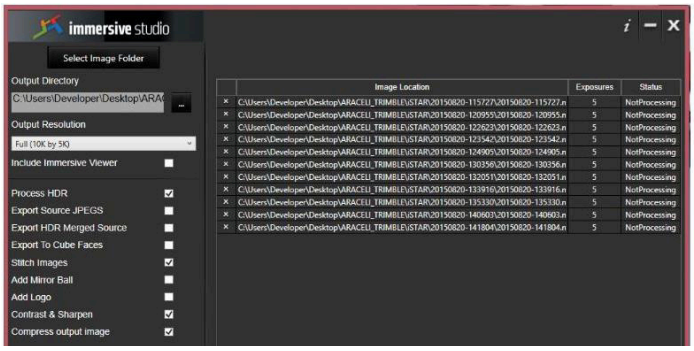
Img. 03.10.point clouds (*.e57 files) coloured by NCTech ColourCloud imported into TRIMBLE RealWorks interface.



Img. 03.11.point clouds (*.e57 files) coloured by NCTech ColourCloud imported into TRIMBLE and previous registration information after import *.rmx files.

03.B. ALTERNATIVE METHOD USING TRIMBLE Realworks & RealColor v.9 FOR COLOURISATION.

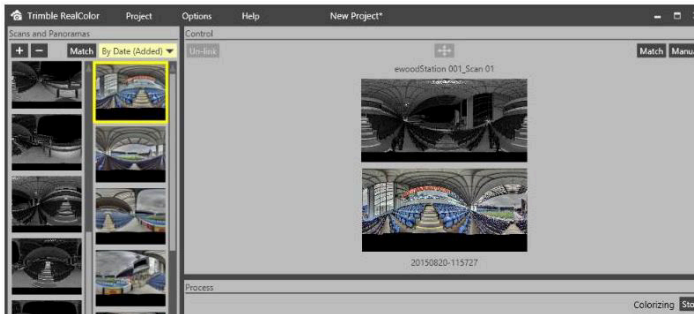
03.B.01.iSTAR PANORAMAS. Process iSTAR images using NCTech Immersive Studio. Simply drag and drop your images folders from iSTAR to NCTech Immersive Studio window, select the operations you want to performance (Stitch images) and "click" "Process". By default, Immersive Studio save the images in the same folder of the images you are processing but you can choose the folder you want.



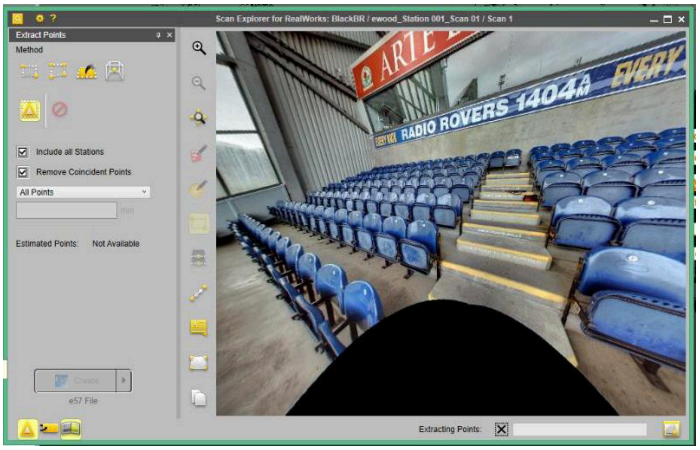
Img. 03.12.NCTech Immersive Studio interface. Stitching images in process.

03.B.02. REGISTER. (only if more than one scan station) Open your scans (*.tzf format) into TRIMBLE Realworks and register using the method most suitable for your scan stations (based on targets, cloud-to-cloud, etc).

03.B.03. COLOUR POINT CLOUDS. Open "RealColor" and import iSTAR panoramas to RealColor workspace. Once they are imported you only have to match each panorama with its corresponding scan station and click on "Process". When complete, revert back to Realworks workspace to continue your project. After the colourising process finishes, you'll be able to navigate into TRIMBLE Scan Explorer interface in colour.



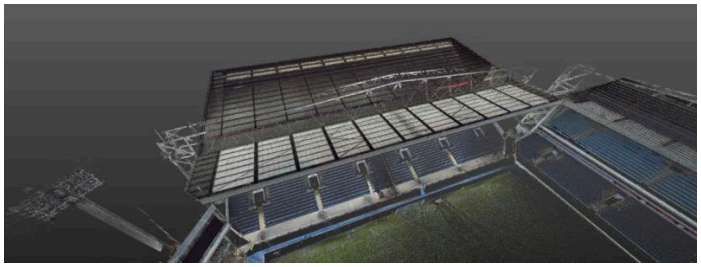
Img. 03.13.TRIMBLE RealColor interface with iSTAR panoramas imported, two of them are matched.

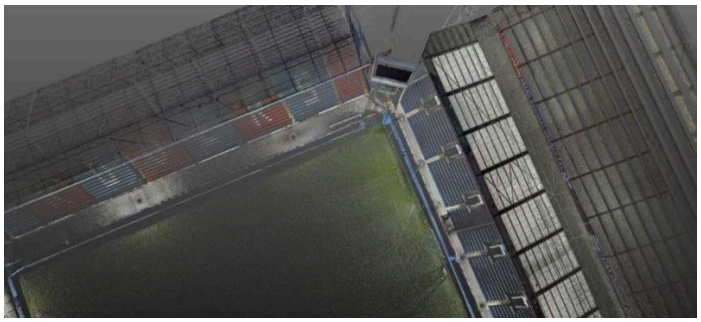


Img. 03.15.TRIMBLE Scan Explorer interface in which navigation in colour is possible after colourising process.

04. Results

Coloured point clouds are obtained following both workflows. 11 Scan and iSTAR stations were used to obtain a merged coloured point cloud of Blackburn Stadium.





Img. 04.01., Img 04.02. and Img 04.03. Coloured point clouds by NCTech ColourCloud in TRIMBLE RealWorks interface.

05. Conclusion

Coloured point clouds can be obtained by using iSTAR for image capture, then following either scan colourisation method as described. The benefits of working with NCTech solutions combined with the TX8 for cloud colourisation are:

Only one iSTAR shot is needed to colour the entire scene at each view instead of multiple shots and images per position. This means less time on site and also eliminates patchy colourisation experienced where individual images are optimised for their omnidirectional view, then combined, which may happen when a single lens camera is used to colour the whole 360 scene.

Knowledge of photography techniques is not needed since iSTAR analyses the whole scene and work out the most suitable camera settings for the full 360 view.

Simple use, minimal training. iSTAR and NCTech software are designed to be highly automated and user friendly, minimal training is required.

Automatic overlay of iSTAR images to point clouds, avoiding having to manually define common points, eliminating user error & enabling batch processing for efficient operation.

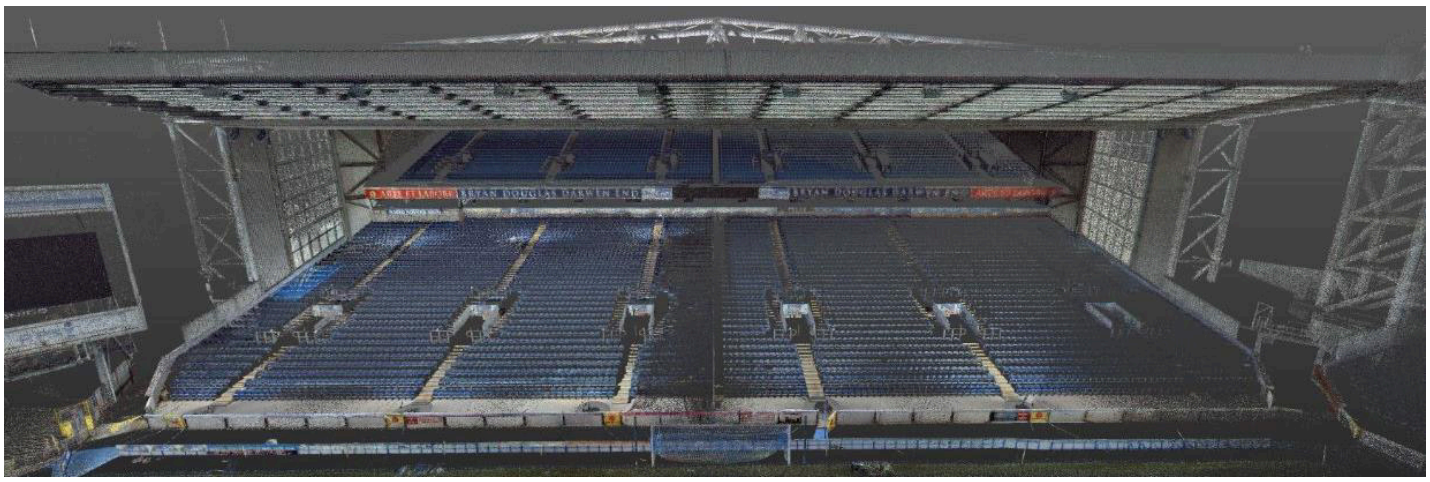
High performance output in difficult lighting conditions. iSTAR can provide high visual quality images in a wide range of lightning environments thanks to automatic HDR settings and EV range of 27 f-stops.

ColourCloud works with standard format *.e57 files, for easy connection with any scanner exporting that neutral format.

06. Acknowledgements

NCTech greatly thanks KOREC Group http://www.korecgroup.com/, especially Richard Shelby, Karen Stone and Anthony Morley for their collaboration and technical support in this Application Note.

For further information about iSTAR or NCTech software visit www.nctechimaging.com or contact us sales@nctechimaging.com



Img 04.04. Coloured point cloud by NCTech ColourCloud in TRIMBLE RealWorks interface.