

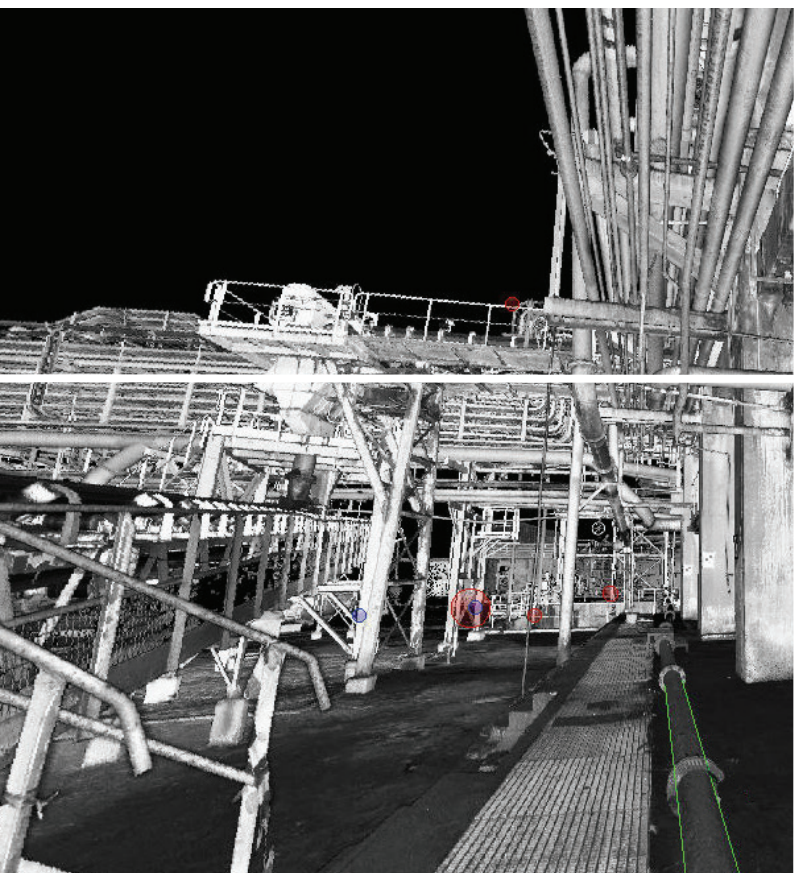


How we build reality



# Case Study

Scanning in Explosive Environments  
Offshore



## 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 continual innovations, support and the services we provide.

In cooperation with Ramboll





*\* Image courtesy of H-L-Andersen*

## Background

Previous case studies have highlighted the fact that engineers working in offshore environments are taking huge risks, and this exercise has now proven to be one of the most difficult and technical of all.

Consequently, operating a scanning process in hazardous environments can constitute a very difficult task for them :

- difficult access to the rigs
- very little space to manoeuvre the equipment
- highly unpredictable weather conditions

Finally, another aspect which makes the scanning process an even greater challenge is the fact, that engineers may be operating in a highly explosive environment.

Only experienced professionals are qualified enough to define a potential explosive environment. However, various sources define an explosive atmosphere as “an area where the risks of gas emissions are high”. Hence, explosive proof environments always occur when drilling offshore.

This case study focuses on the challenges and opportunities that are related to scanning in these hazardous environments.

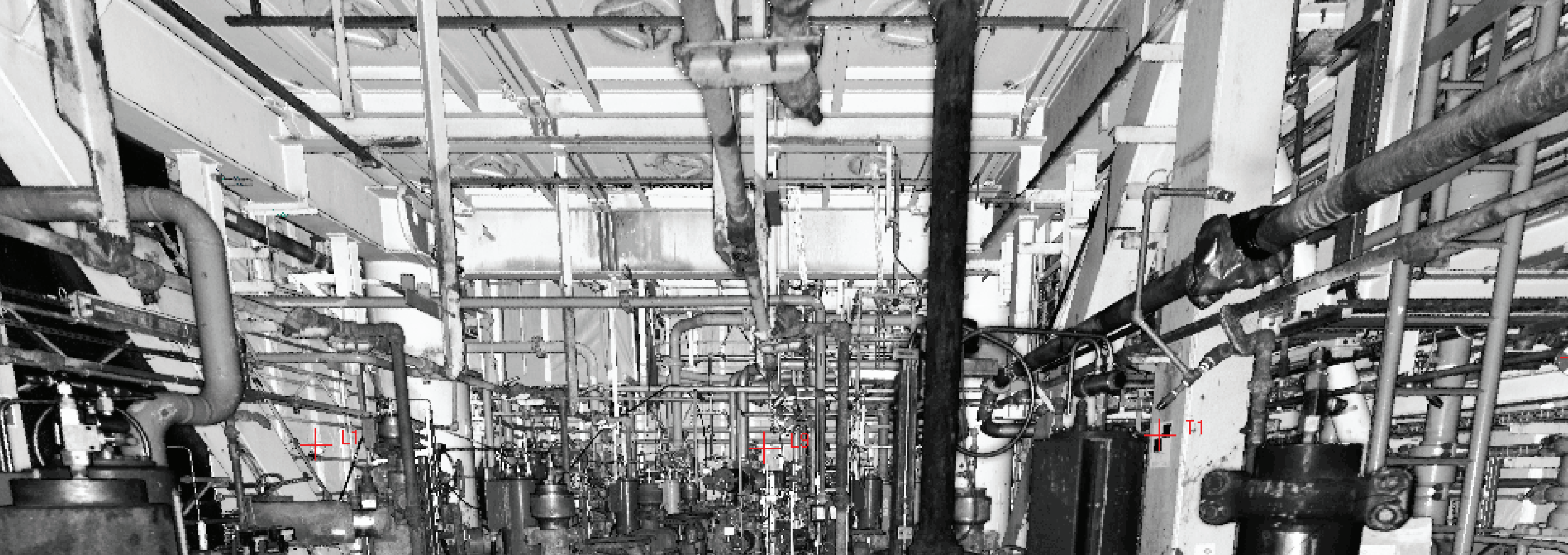
# RAMBOLL

### Company Overview Ramboll

Ramboll Oil & Gas have been in partnership with Z+F since taking their first Z+F IMAGER® in 2010.

Ramboll Oil & Gas delivers engineering consultancy services to the Oil and Gas industry. As part of the consultancy service, Ramboll Oil & Gas has a 3D Scanning and Survey department, which is based in Esbjerg, Denmark and performs 3D scanning and survey, both offshore and onshore.

The 3D scanning is used for as-built documentation in a design process.



BubbleView® of the Tyra East

# Introduction

## Scanning in explosive environments

### Brief

It is almost impossible to conduct a survey in hazardous environments with traditional scanning and surveying equipments, due to the high explosive risk.

Certain conditions are likely to cause operational difficulties, and this requires extreme care and preparation: sometimes, it is even necessary to use explosion proof scanning and survey equipment.

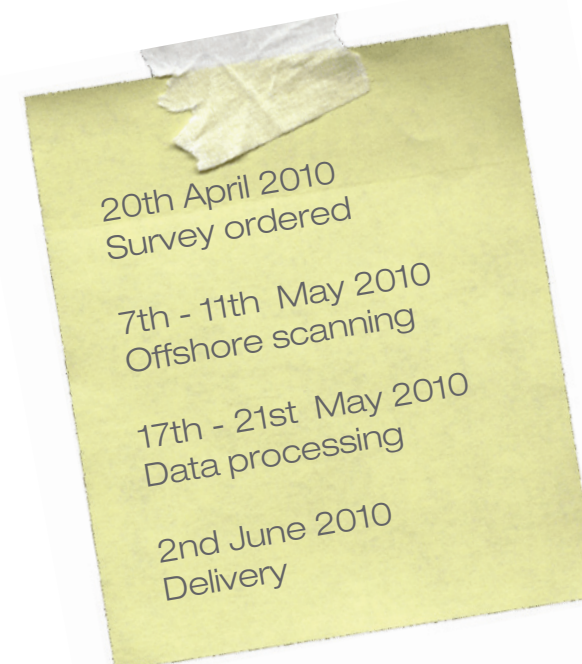
### Scope

A scanning project was performed by Ramboll on Tyra East, a Maersk Oil platform in the Danish part of the North Sea. The scope of the work was:

- Maersk Oil wanted to install gas lifts on 4 wells on Tyra East
- Design for the gas lift system was performed by Ramboll Oil & Gas Qatar
- Laser scanning was requested to ensure complete as-built documentation of the existing layout on Tyra East Platform B

### Tyra

Tyra Field is regarded as the largest gas condensate field in the Danish Sector of the North Sea<sup>1</sup>. Tyra Field has two production complexes named Tyra West and Tyra East (which the case study will focus on), connected by pipelines. It is operated by Maersk Oil. Tyra East is the main gas export hub to Denmark, accounting for 90 percent of the DUC gas production<sup>2</sup>.



### Ramboll

Ramboll Oil & Gas based in Esbjerg, Denmark were awarded this major contract to scan the platform.

The area was highly explosive due to active drilling in the location, which meant it had to use highly safe and modern 3D laser scanning techniques in order to capture, in high resolution, the as-built environment for further remedial works. No existing data was available due to its hazardous area classification.

The resultant data will be used to aid further investigation and modifications to the platform. It will also offer the client accurate records of the as-built environment for the first time in digital format.





*IMAGER® 5006EX used by a member of the Ramboll team*

# Methodology

## Instruments and Software

The IMAGER® 5006EX was used due to the fact that it is the world's only explosion proof 3D laser scanner. This scanner was developed in cooperation between Z+F GmbH and DMT GmbH & Co. KG.

The LFM software package was also used for the orientation of the scans, modeling of tie-in points and generating the NetView™ solution.

## Data collection & processing

Due to great complexity in the area that had to be scanned, 49 scans were performed within an area of 15x15 meters and on two decks. Since the IMAGER® 5006EX is a phase based scanner, each scanning only took

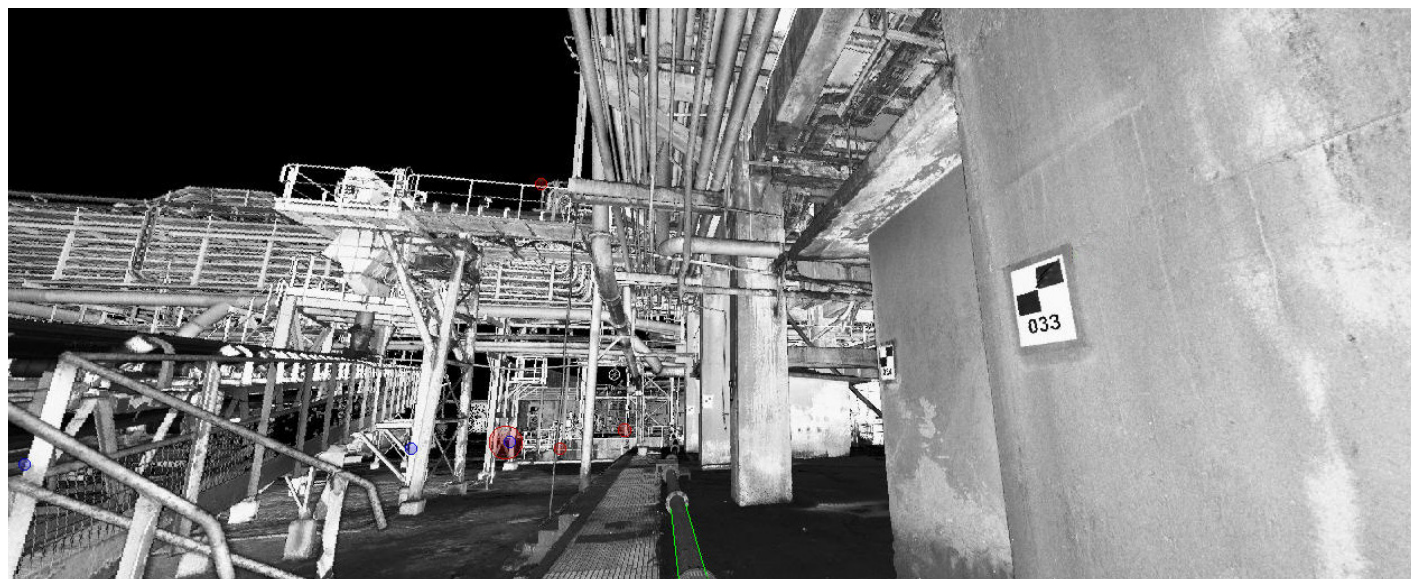
approximately four minutes. This scanner can also interface with LFM software standard tools for data evaluation.

## Challenges

The orientation of the scans was the first obstacle to encounter when working in an explosive environment. Normally the scans are oriented by targets, surveyed with a total station and calculated in the platforms module system. But no explosion proof total station is currently available and it was necessary to use a different method.

## Using Bundle Adjustment

The orientation of the scans was performed in two steps. Targets were distributed within the area as usual making sure flat a minimum of five targets was visible in each scan.



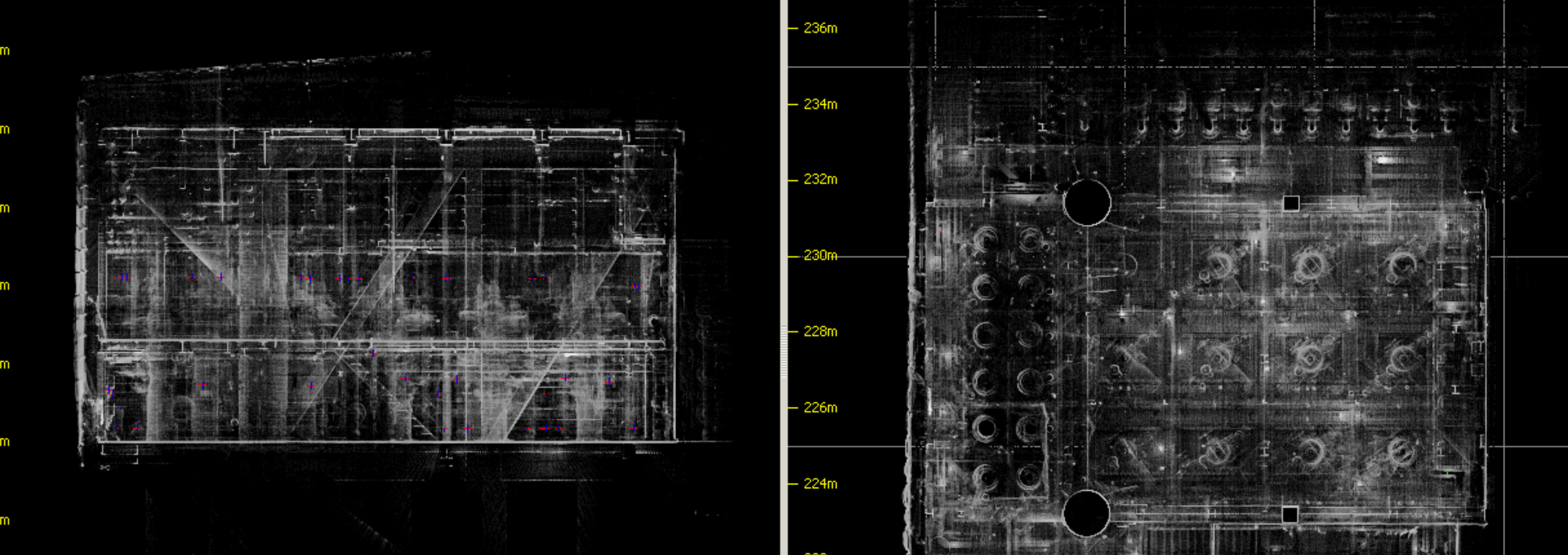
*LFM NetView™ project*

In step one, all scans were orientated to each other, using the "bundle adjustment method".

The bundle adjustment was performed in a local coordinate system, defined by the orientation software. After the bundle adjustment the orientation of the scans was locked and all scans are further on handled as one scan (a cluster). In step two, the cluster was transformed into the platforms module system. But as no survey with total station was possible, seven targets surveyed on previous jobs were used.

Based on the orientated scans, modeled tie-in points, as well as a point cloud for clash check and a LFM Netview™ solution could then be delivered.





# Deliverables

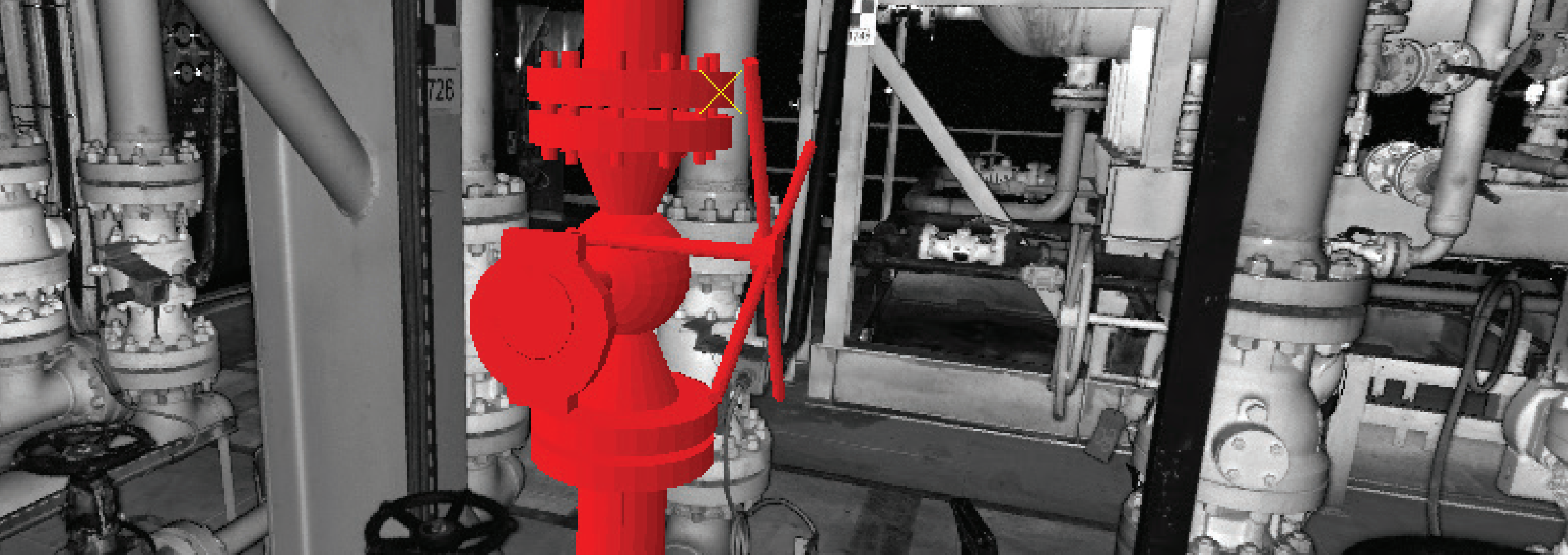
The final deliverable was to supply detailed accurate point cloud data in true coordinates of the rig.

From start to finish, Ramboll utilised new technologies in both, hardware and software to enable data to be finally used within a design environment.

For the first time Maersk Oil was able to gain invaluable data from the platform, to enable the much needed design work on the existing plant, modelling pipes and valves for future tie- ins for upgrades to the platform and modifications in the future.





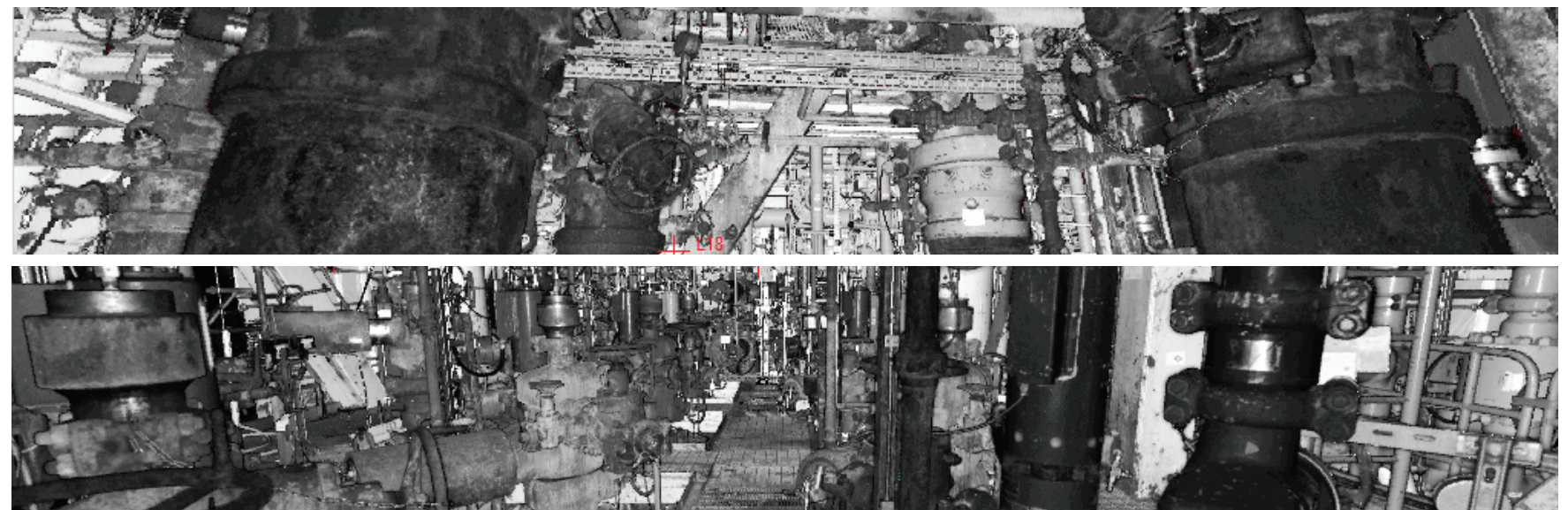


*Textured 3D view of the plant with a new object (red), super-imposed.*

## Pictures



*The Z+F IMAGER® 5006EX and a detailed view of its display.*



*BubbleViews® of the industrial plant, displayed with grey tones.*





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