

INSPECTION REPORT

Client: Example

Facility: Platform Legs

Item Inspected: B2, K2 and K3

Inspection Method: SLOFEC™/ UT

Date Commenced: 15th January 2012

Date Completed: 24th January 2012

Type of Report: Final

Report Number: K123-11



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SLOFEC™/UT Inspection of Platform Legs

Prepared for

Client

Report: K123-11

Approval

Rev	Document	Author		Checked		Approved By		Date
		Initials	Signature	Initials	Signature	Initials	Signature	
0	Issued to Client	OS /AB		AB		AB		27-Jan-12

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Scan 8- Leg K3 Track 1a
Scan 9- Leg K3 Track 2
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1. Introduction

The client has assigned Innospection with the inspection of the Platform legs during an ROV vessel campaign in January 2012. The campaign had the target to inspect the Platform legs, potentially the Platform legs and the Flare legs. However the Platform leg inspection was described as highest priority. The eight platform legs were subject of the inspection with the crawler scanner “MEC-Combi” containing the magnetic eddy current SLOFEC™ technique and the ultrasonic technique.

2. Discussion

The inspection scope was originally defined for the area from +5 metres to -5 metres. The leg dimension in the anticipated scope of the inspection is OD of 1.38m and nominal wall thickness 22.2 mm.

This report describes the inspection result of the achieved coverage at the Platform during the campaign in January 2012 at Leg B2, K2 and K3. The inspection of the tracks at the legs B2, K2 and K3 were performed between 15th and 17th January 2012.

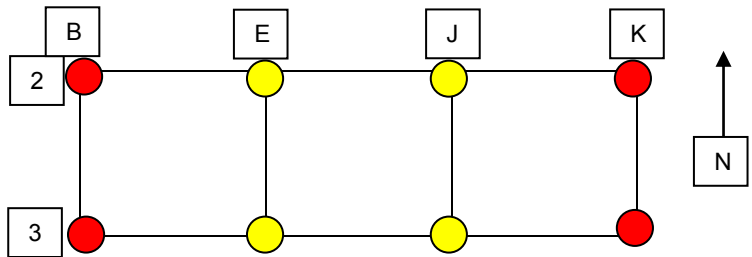


Figure 1 and 2: Pictures of Platforms.

The inspection scope required four individual stripe scans of the 4 outer legs at the 12 (north), 3 (east), 6 (south) and 9 (west) O Clock positions from -5m to +5m LAT.

- Platform
 - o Outer Legs B2 / B3 & K2 / K3 1384mm x 22mm
 - o Inner legs E2 / E3 & J2 / J3 1384mm x 22mm

The leg arrangement is as follows:



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The original scope was to inspect all eight legs at the Platform for its wall thickness condition in the area between +5metre and -5metre. To use the SLOFEC/UT combi crawler for the inspection, the heavy marine growth needed removal at least to allow crawling from lowest point up and down again.

During the campaign it was recognized, that the marine growth at the legs in the splash zone area was that heavy and the effort to clean the legs for inspection was more time consuming than envisaged which provided left limited time for the inspection. In addition past construction fitting etc which were not recorded on the drawings or visible from the previous inspections, were encountered. Therefore the opportunity for conducting the cleaning and subsequent inspection was curtailed. The scope reduction was agreed with the Project Integrity Engineer.

In fact only legs B2, K2 and K3 were able to be scanned during the campaign due to the limited cleaning chances. The below table displays the scanned tracks along the legs B2, K2 and K3 and its result as a first overview. The full scan report data is provided in the attached SLOFEC & UT Scan reports.

The scans performed were however only achieved below the workscope required scan of -5m to +5m.

The nominal Wall Thickness in the area from -5m to +5m is 22mm and therefore critical to be accessed. The Wall Thickness in the scanned areas below is higher (some 37mm some 43mm).

The individual scan reports describe more resolution details, however the quality of inspection data achieved in the areas scanned were good and have delivered as an overview no significant wall loss either from inside or outside of the legs inspected . This was confirmed with the ultrasonic absolute wall thickness reading and with the SLOFEC scans for localized wall loss detection.

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Leg	Track no.	Scanning position			Brief Result
		Axial Direction		Track position from true North (deg)	
		START (approx. Below LAT in metres)	END (approx. Below LAT in metres)		
B2	1	4.5	11.5	310	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
B2	2	4	11.4	340	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
B2	3	4.5	11.5	320	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
B2	4	4.5	8	350	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
K2	1	4.5	11	320	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
K2	2	5	11	313	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
K3	1	8.5	11	155	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
K3	1	4.4	7.8	130	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
K3	3	7.7	10	160	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT
K3	3	6	10	120	No significant general wall loss detected Minor localised indications detected, maximum wall loss displayed 20% of the nominal WT

The table 1 above provides an inspection overview of the Inspection. All SLOFEC™ and UT Scans are shown in Appendix 1.

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3. SLOFEC™ Equipment Setting

In general, the SLOFEC™ system is calibrated using sample test samples with artificial reference defects. The reference samples should be of the same material and thickness as the surface to be inspected.

In the case of a coating being present on the surface to be inspected, the average thickness of the coating (if applicable) should also be simulated on the reference sample for the calibration.

Typical reference defects that are used are flat bottom holes or conical bottom holes are with a diameter of 5mm, 10mm and 20mm.

The depths of the artificial reference defects are typically 20%, 40%, 60%, 80% and 100%.

For calibration, the SLOFEC™ system is driven over the reference defects and the channels are set (one sensor per channel) to give a sufficient sensitivity level for the detection of topside and underside corrosion defects.

The calibration is performed at beginning, after breaks, at the end of every shift or in the case of changes to the equipment.

The calibration results and reference defect data from the calibration sample, is always stored in the system.

The Eddy Current signal analysis is done online. The computerised equipment and the software allow the analysis of the signal amplitude [in div.] and signal phase [in °].

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4. SLOFEC™ Equipment Calibration

Equipment Calibration

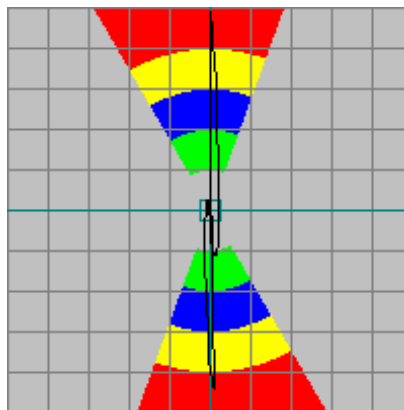
For external corrosion detection, the differential mode was used. The frequency setting used for Channel 1-8 (differential mode) was 80 - 100 KHz.

The amplitude of the signals was set so that the artificial reference defect (Ø 25mm 60% depth) was set to 8 screen divisions. This is only classed as the initial pre-calibration setup and may then be further adjusted when the first true indication is detected and evaluated for depth, this by utilising the Ultrasonic pulse echo technique.

Optimum signal/noise ratio and signal phase separation between the internal defect indications and other indications were considered when selecting a suitable test frequency.

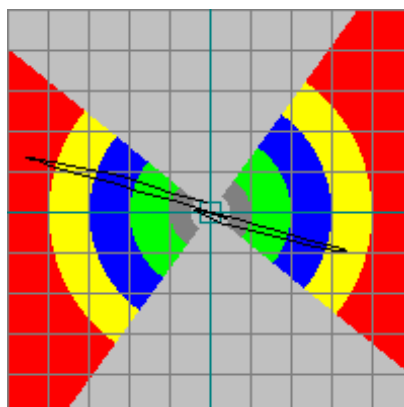
The differential channels of all the sensors were set so that external defects were indicated in the vertical signal phase direction as shown in the diagram below. By moving the scanner in the reverse direction, the external defect signal would show the first peak down, followed by the second peak up with an upward movement.

Sample signal display of internal defect



Subsequently internal defects are indicated in the horizontal signal phase direction as shown below. Moving the scanner in the reverse direction, the internal defect signals have a the first peak left followed by a right movement with the second peak right.

Sample signal display of external defect



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1.1) Calibration Control

The general setting and calibration was performed at the beginning of the inspection, with all calibration data being stored digitally. Calibration controls were performed at the beginning and end of each working shift and after any other significant interruption (i.e. breaks or lunch). Re-calibration is also deemed necessary when significant changes are made to the settings of the equipment.

Calibration samples are used for the initial set-up and for the random check of operator's settings. Accuracy of sensitivity settings can only be evaluated and achieved, when the first true indication found on the item undergoing the test is verified by a U/T operator, with the corresponding depth of indication and SLOFEC™ sensitivity being adjusted accordingly. With this setting, external corrosional defects would be detected and distinguished by phase separation from the internal defects.

1.2) Calibration Samples

The calibration samples are manufactured by Innospection Ltd in accordance to the setting standard requirements.

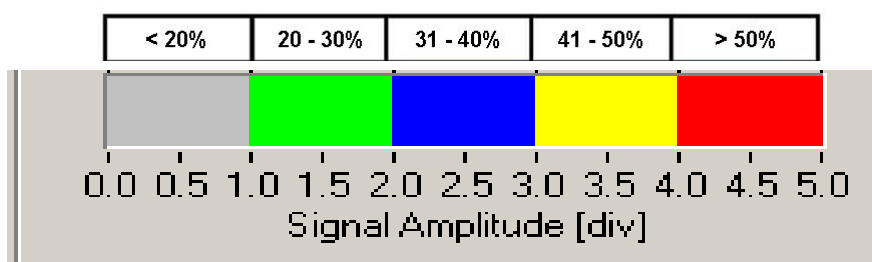
1.3) Change of Settings

In the event of any scanner adjustment, re-calibration is performed.

1.4) Sensitivity Setting

The general overview of the inspected areas with its results is presented in the attached colour scan reports with wall loss represented in colour classes as below: -

Wall Loss Legend



Below 20%	Wall Loss	- Grey
20-30%	Wall Loss	- Green
31-40%	Wall Loss	- Blue
41-50%	Wall Loss	- Yellow
Above 50%	Wall Loss	- Red

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Note

Eddy Current inspection is an evaluation method of NDT; hence all results obtained are based upon the test piece used. Material and wall thickness of the test piece should be as near as reasonably practicable to the item under inspection. Artificial defects should be as near in size and shape as to the type sought.

Because SLOFEC™ signal amplitudes are an indication of defect depth and volume, the defect depth analysis by signal amplitude can only be done in comparison with varying depth artificial reference defects.

5. Inspection Procedures

The inspection was performed according to the following valid procedure:

- Slofec Marine M-RPEC Procedure No. InnoMSloRPEC-001-08-Rev-4.pdf
- Slofec Caisson Procedure No. InnoCSloCAS-001-08-Rev-4.pdf
- Ultrasonic Inspection Procedure No. InnoUT-001-10Rev-1.pdf

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6. Ultrasound Theory

Ultrasonic sensors work by very precisely measuring how long it takes for a sound pulse that has been generated by a probe called an ultrasonic transducer to travel through a test piece. Because sound waves reflect from boundaries between dissimilar materials, this measurement is normally made from one side in a "pulse/echo" mode, where the gage measures the round trip transit time of a pulse that reflects off the far side or back wall of the test piece.

The transducer contains a piezoelectric element which is excited by a short electrical impulse to generate a burst of ultrasonic waves. The sound waves are coupled into the material and travels through it until they encounter a back wall or other boundary. The reflections then travel back to the transducer, which converts the sound energy back into electrical energy. The calculate thickness using the simple mathematical relationship

$$T = (V) \times (t/2)$$

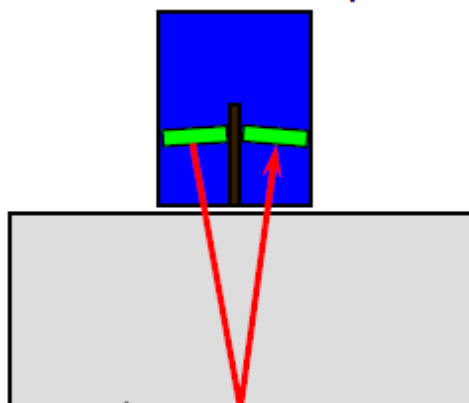
where

T = the thickness of the part

V = the velocity of sound in the test material

t = the measured round-trip transit time

It is important to note that the velocity of sound in the test material is an essential part of this calculation. Different materials transmit sound waves at different velocities, generally faster in hard materials and slower in soft materials, and sound velocity can change significantly with temperature. Thus it is always necessary to calibrate an ultrasonic sensor to the speed of sound in the material being measured, and accuracy can be only as good as this calibration.



The above diagram demonstrates the ultrasound wave propagating through the material and picking up the back wall pulse to determine the wall thickness of the material.

The Ultrasonic testing will depend in its measurement capability on the surface cleanliness to allow sufficient couplant. For this reason the surface preparation is required to allow such penetration. The Scanner unit has the Ultrasonic probe capable to be pressed against the surface by hydraulic cylinder.

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7. Documentation

The inspection result, parameters and data are stored in the Innospection Limited archive database system.

8. Signatures

NDT Project Engineer Level 2 ET
Innospection Limited

NDT Engineer Level 3
Innospection Limited

Reporting Engineer
Innospection Limited

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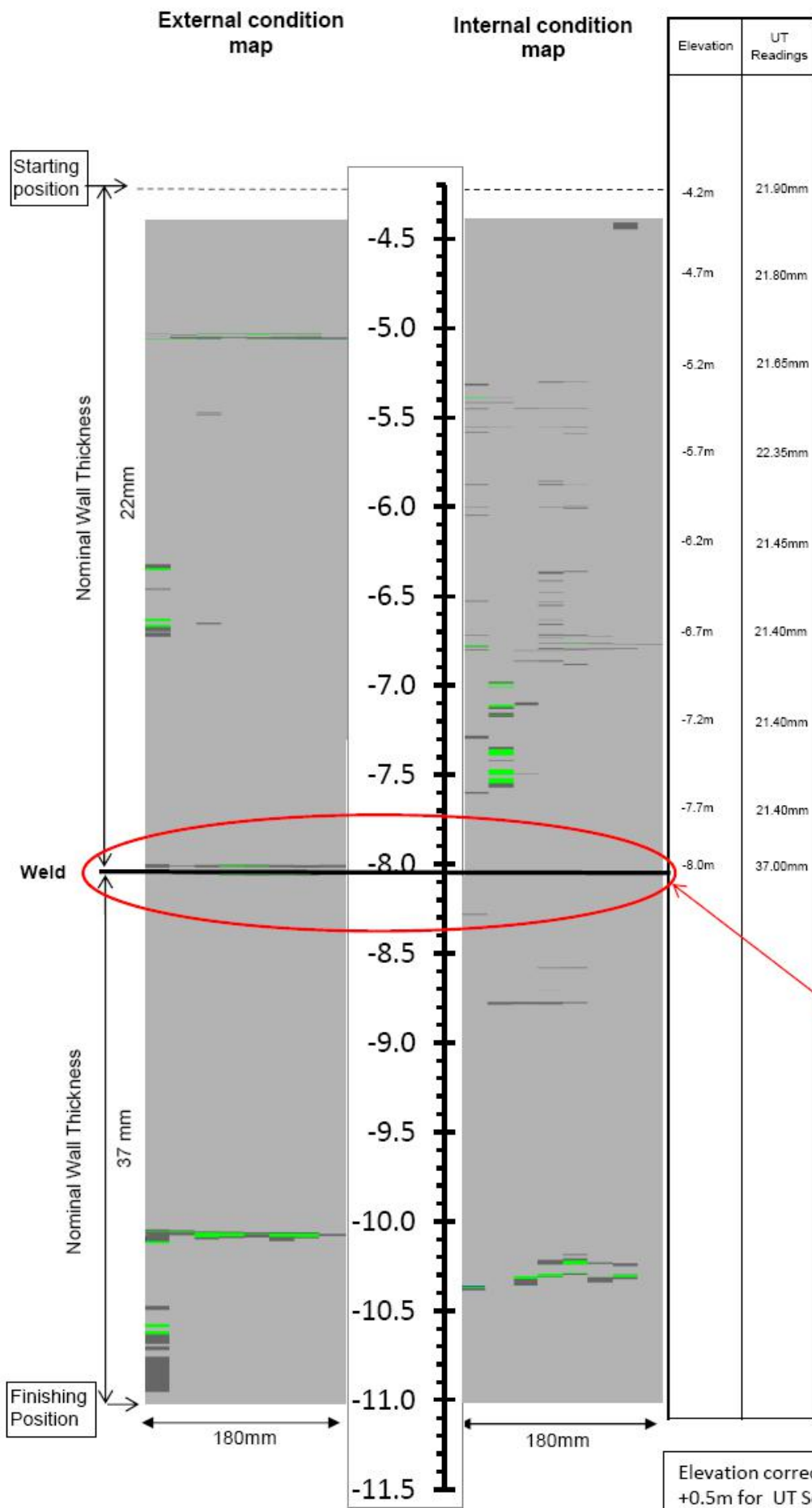


APPENDIX 01

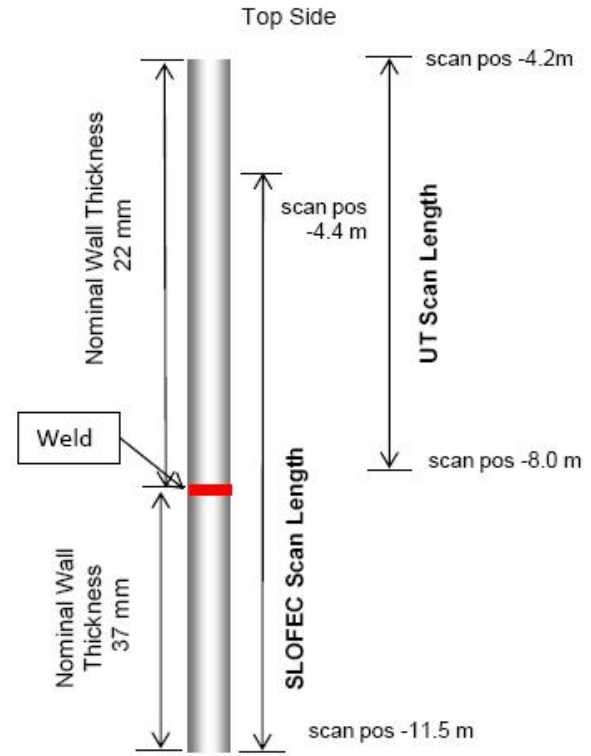
SLOFEC Scans

- Scan 1- Leg B2 Track 1**
- Scan 2- Leg B2 Track 2**
- Scan 3- Leg B2 Track 3**
- Scan 4- Leg B2 Track 4**
- Scan 4- Leg K2 Track 1**
- Scan 4- Leg K2 Track 2**
- Scan 7- Leg K3 Track 1**
- Scan 8-Leg K3 Track1a**
- Scan 9- Leg K3 Track 2**
- Scan 10-Leg K3 Track3**

SLOFEC and UT - Scan Report Leg B2 Track 1



Section Position Detail



Above image is from the ROV during the inspection of Leg B2. Note the weld is clearly displayed

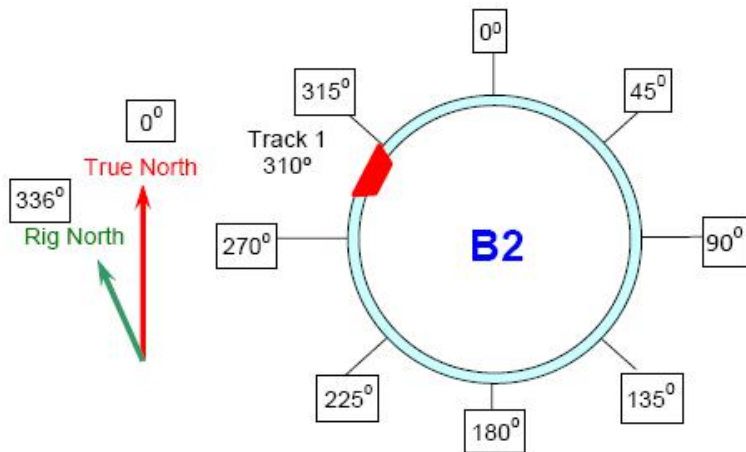
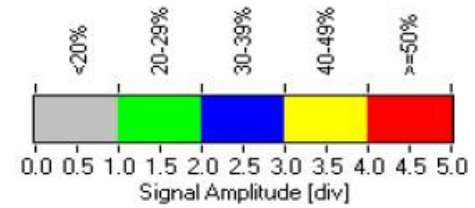
REMARKS:

Signals were analysed and no defects were detected. No severe wall loss detected as the indicated signals were above tolerance levels.

No severe external or internal wall losses detected.

Elevation corrected +0.5m for UT Sensor

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth information

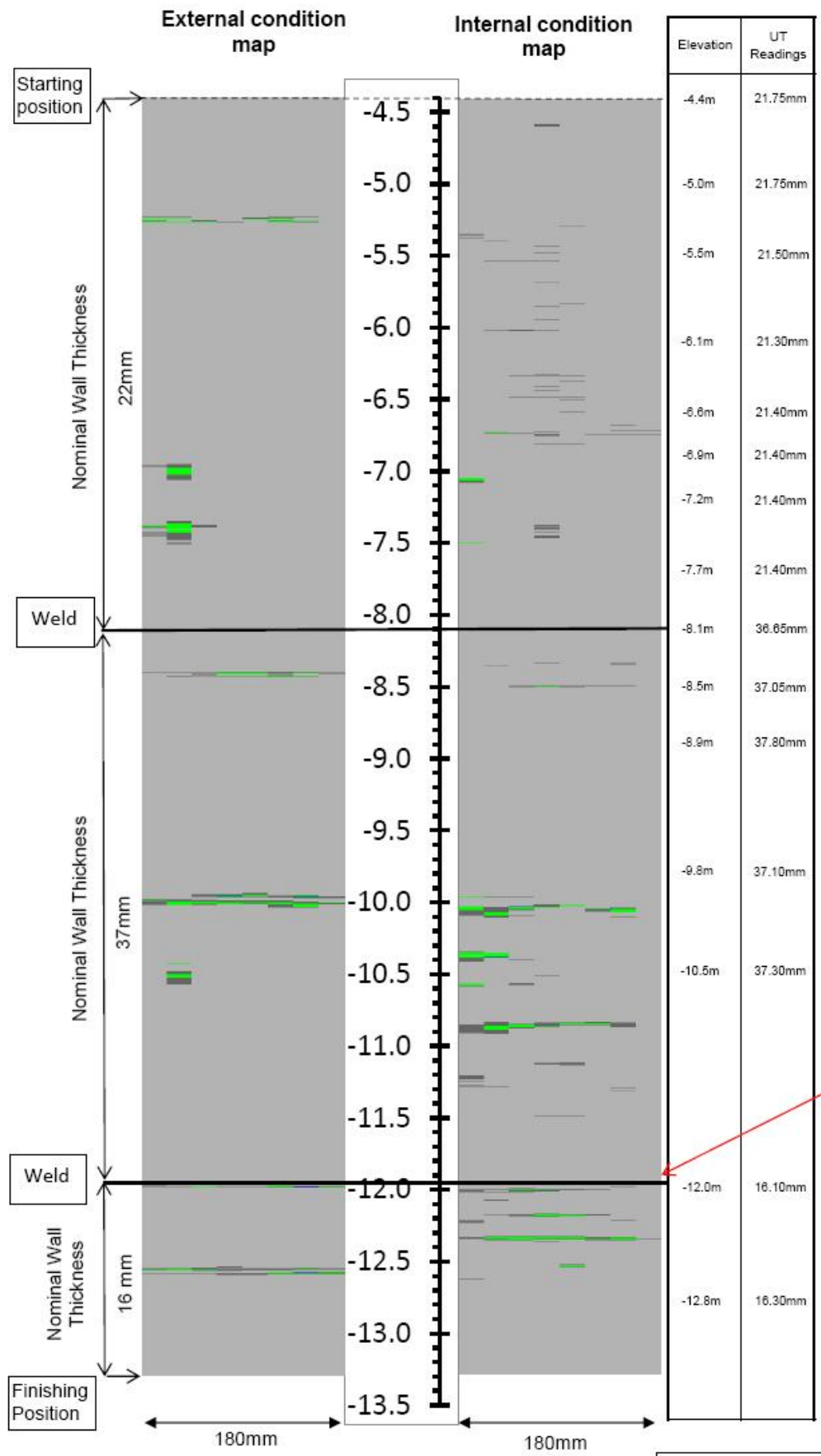


The above diagram utilizes True North readings.

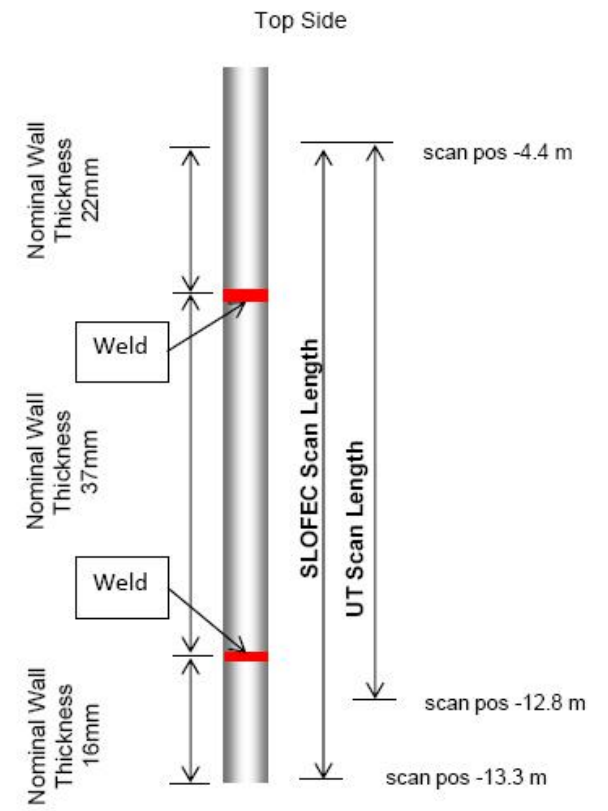
Client: North Sea
 Location: Leg K3
 Leg Identification: K3
 Leg Section: 1300 mm
 Date: 15/Jan/12
 Report number: K0123-11
 Job number: 1701



SLOFEC and UT- Scan Report Leg B2 Track 2



Section Position Detail

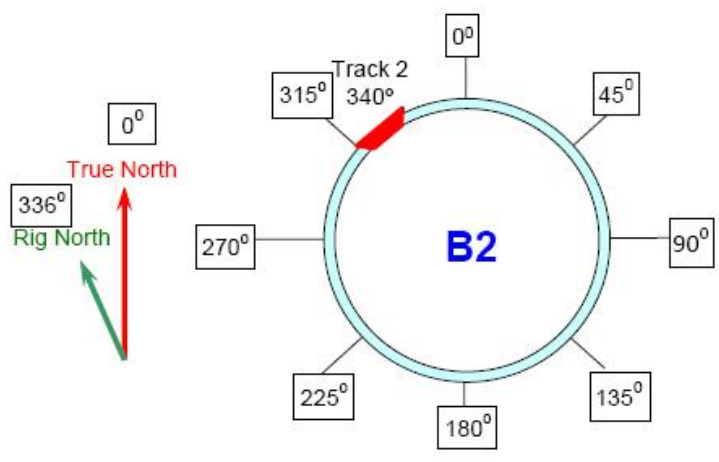
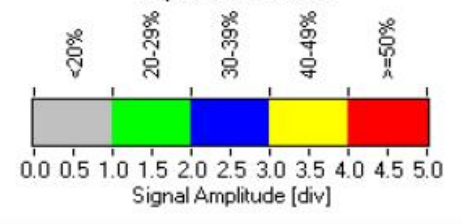


Above image is from the ROV during the inspection of Leg B2. Note the weld is clearly displayed

REMARKS:
 Signals were analysed and no defects were detected. No severe wall loss detected as the indicated signals were above tolerance levels.

Elevation corrected +0.5m for UT Sensor offset

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth information

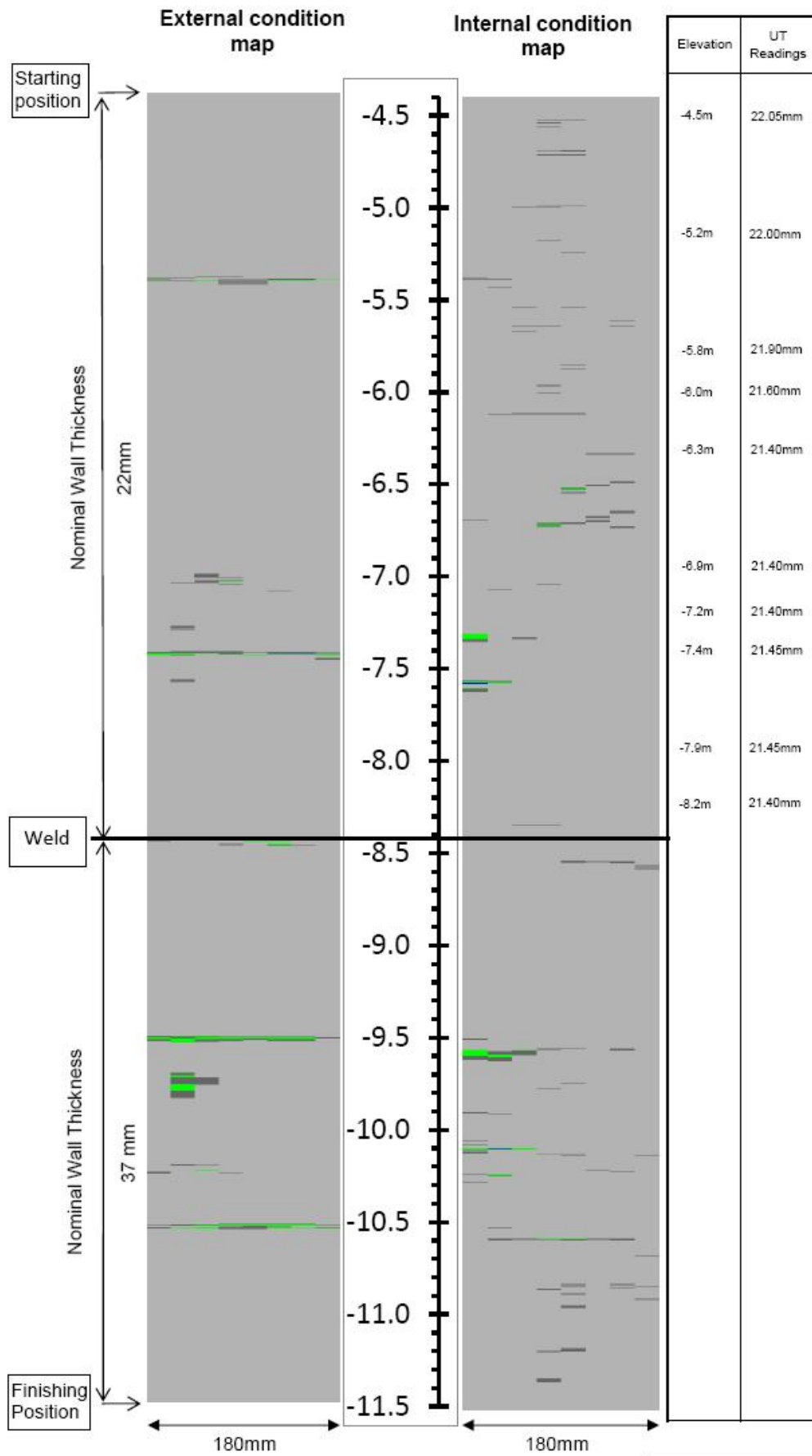


The above diagram utilizes True North readings.

Client: North Sea
 Location: Leg K3
 Leg Identification: K3
 Leg Section: 1300 mm
 Leg Dimension: 15/Jan/12
 Date: K0123-11
 Report number: 1701
 Job number:

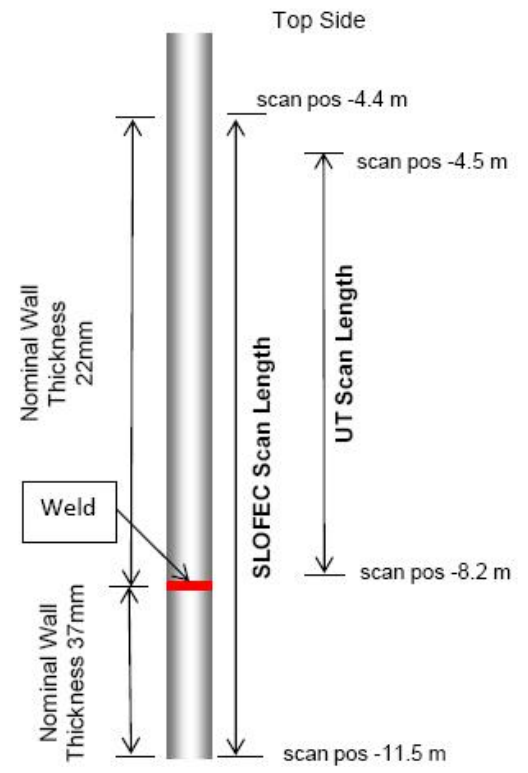


SLOFEC and UT- Scan Report Leg B2 Track 3



Elevation corrected +0.5m UT Sensor offset

Section Position Detail

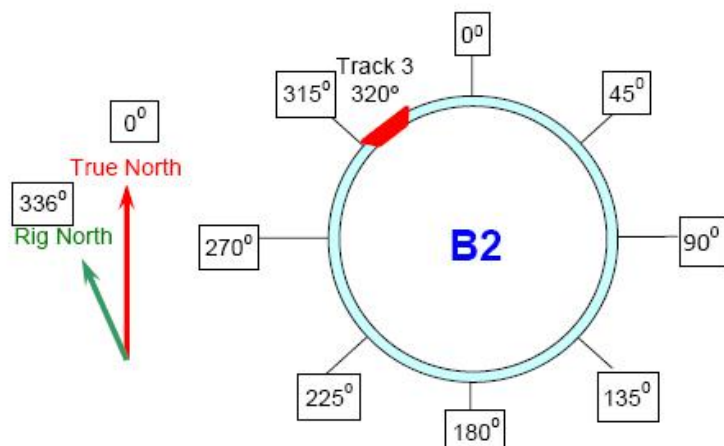
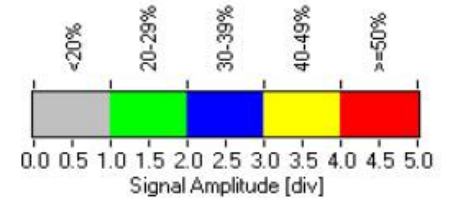


Above image is from the crawler during the inspection of Leg B2.

REMARKS:

Signals were analysed and no defects were detected. No severe wall loss detected as the indicated signals were above tolerance levels.

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth information

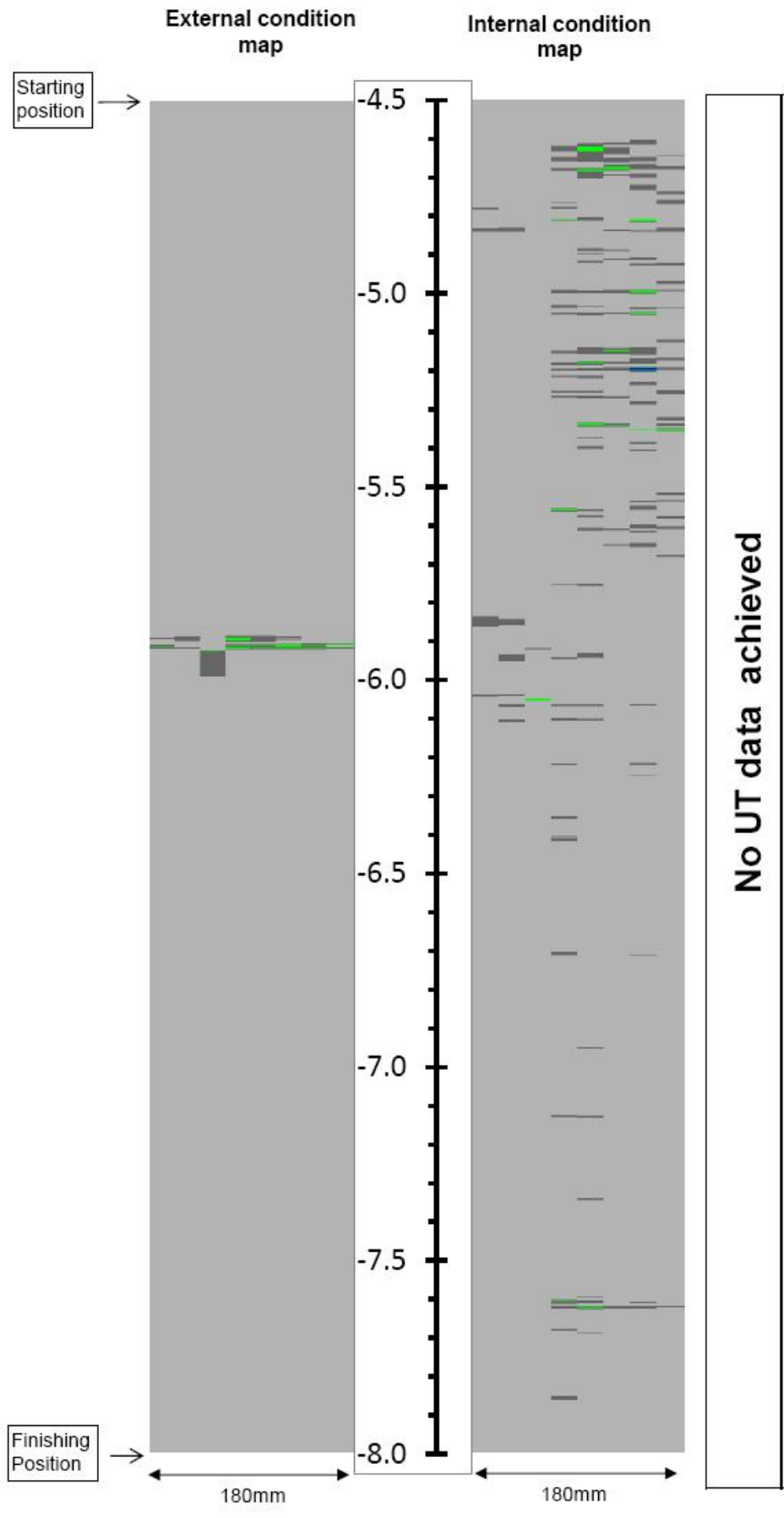


The above diagram utilizes True North readings.

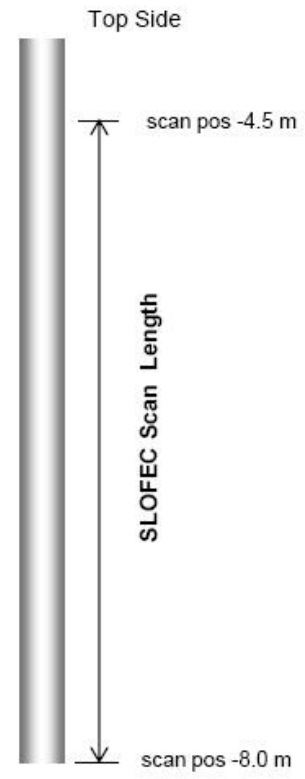
Client:	Client
Location:	North Sea
Leg Identification:	Leg K3
Leg Section:	K3
Leg Dimension:	1300 mm
Date:	15/Jan/12
Report number:	K0123-11
Job number:	1701



SLOFEC and UT- Scan Report Leg B2 Track 4



Section Position Detail

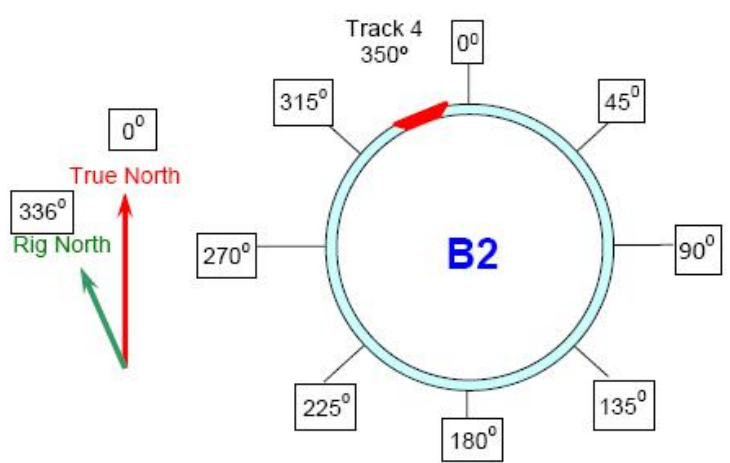
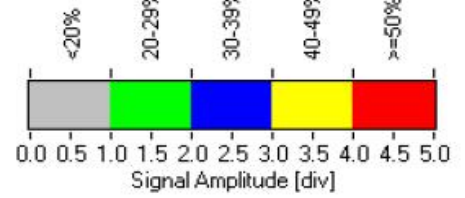


Above image is from the crawler during the inspection of Leg B2.

REMARKS:

Signals were analysed and no defects were detected. No severe wall loss detected as the indicated signals were above tolerance levels.

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth information



The above diagram utilizes True North readings.

Client:	Client
Location:	North Sea
Leg Identification:	Leg K3
Leg Section:	K3
Leg Dimension:	1300 mm
Date:	15/Jan/12
Report number:	K0123-11
Job number:	1701



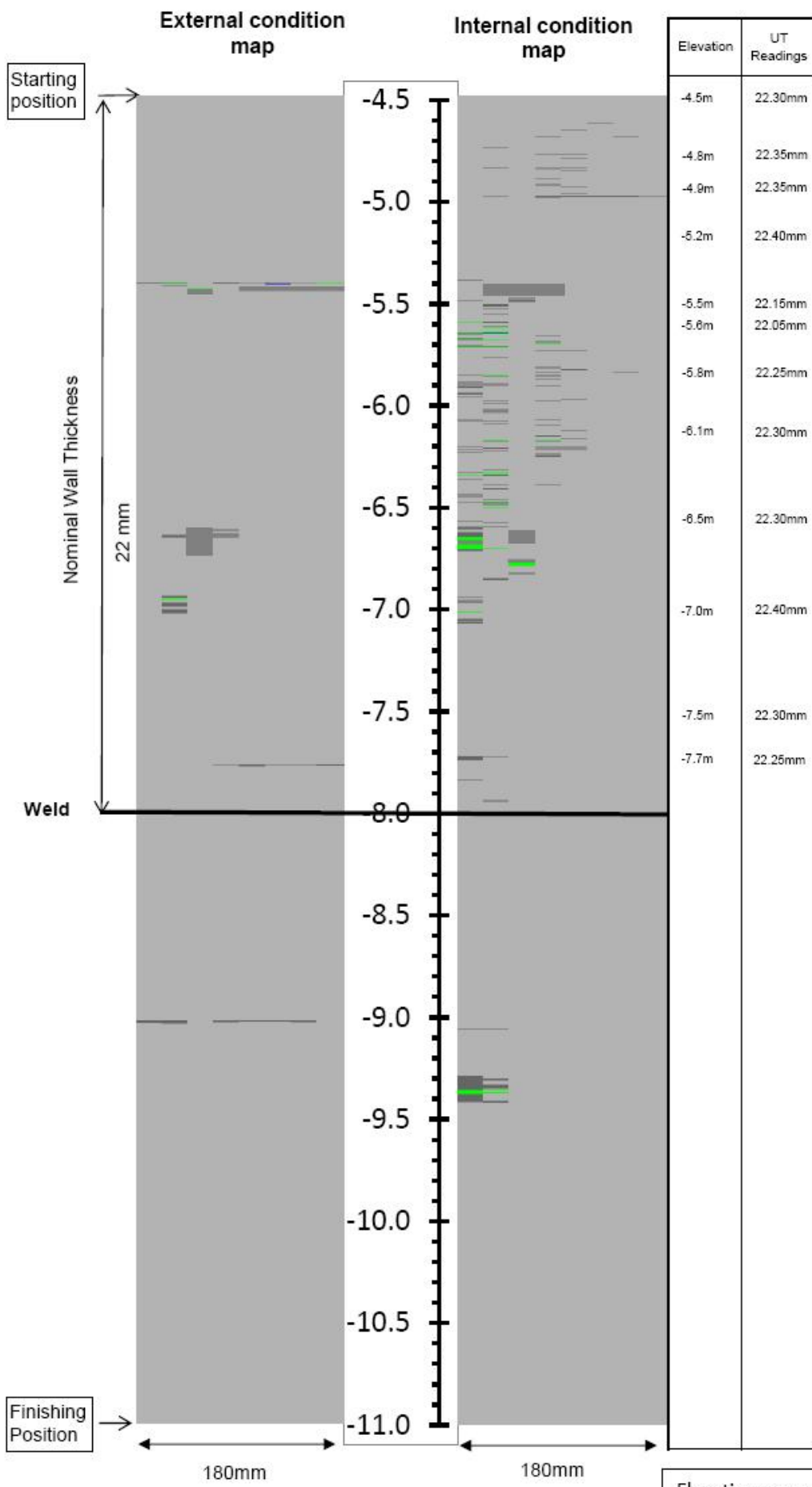
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Leg K2 Track 1

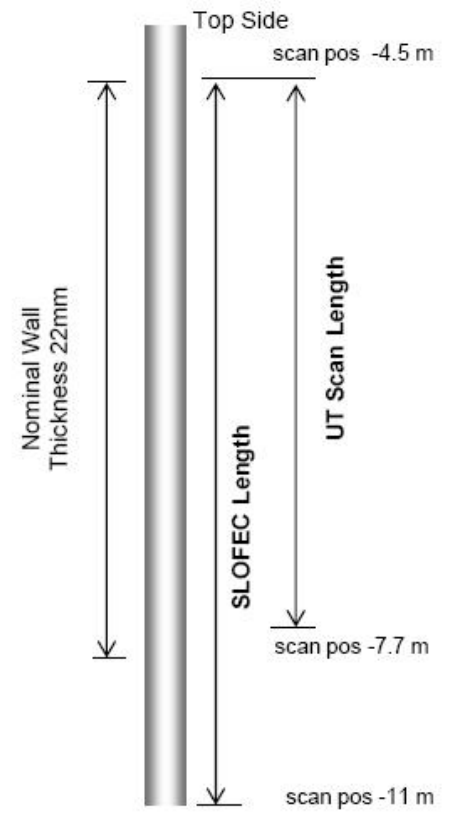
Leg K2 Track 2

SLOFEC and UT - Scan Report Leg K2 Track 1



Elevation corrected +0.5m for UT Sensor offset

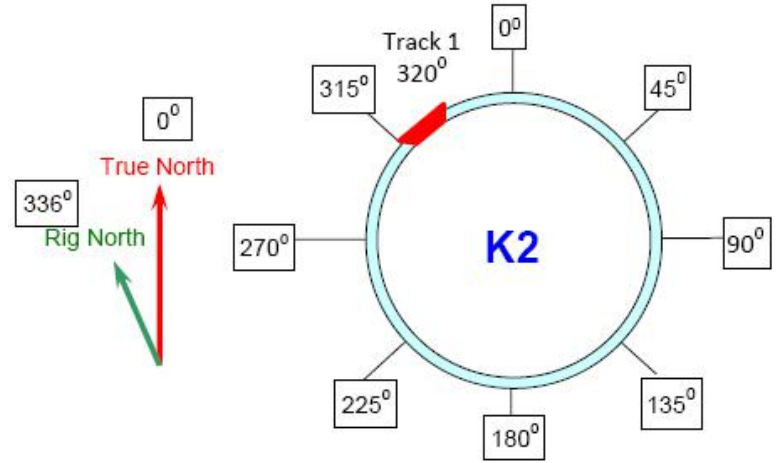
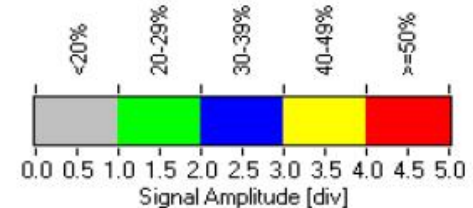
Section Position Detail



Above image is from the ROV during the inspection of Leg K2.

REMARKS:
 Signals were analysed and no defects were detected. No severe wall loss detected as the indicated signals were above tolerance levels.

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth information

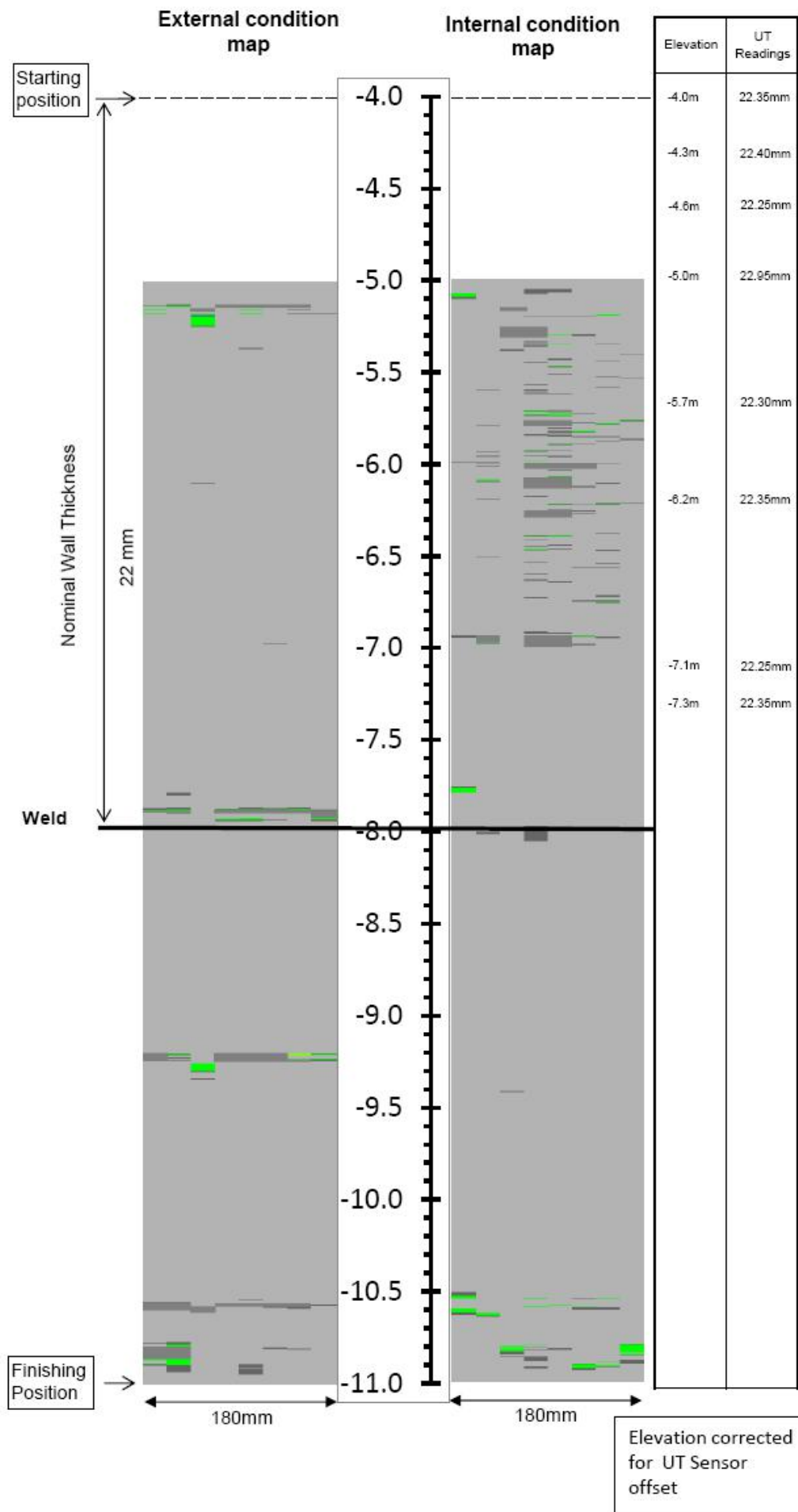


The above diagram utilizes True North readings.

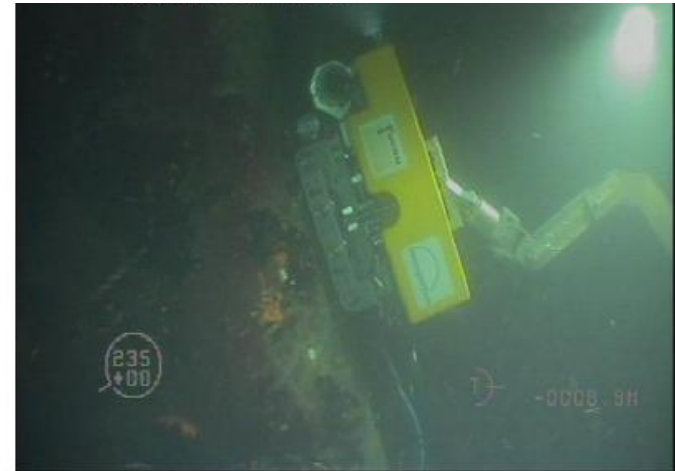
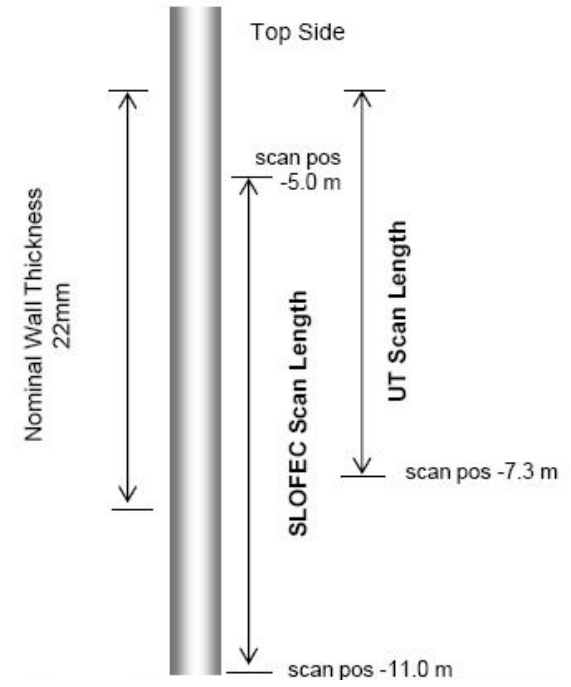
Client: North Sea
 Location: North Sea
 Leg Identification: Leg K3
 Leg Section: K3
 Leg Dimension: 1300 mm
 Date: 15/Jan/12
 Report number: K0123-11
 Job number: 1701



SLOFEC and UT- Scan Report Leg K2 Track 2



Section Position Detail

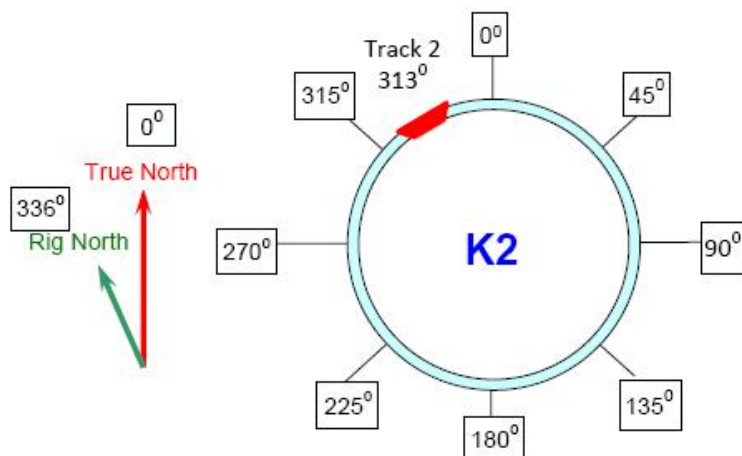
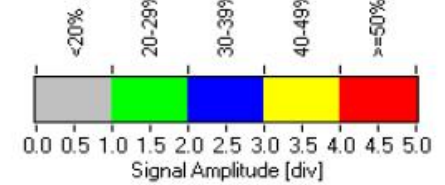


Above image is the crawler about to be deployed on Leg K2 for inspection.

REMARKS:

Signals were analysed and no defects were detected. No severe wall loss detected as the indicated signals were above tolerance levels.

Signal Y-component / angle analysis window set for indication of internal defects with approx.



The above diagram utilizes True North readings.

Client: North Sea
 Location: North Sea
 Leg Identification: Leg K3
 Leg Section: K3
 Leg Dimension: 1300 mm
 Date: 15/Jan/12
 Report number: K0123-11
 Job number: 1701

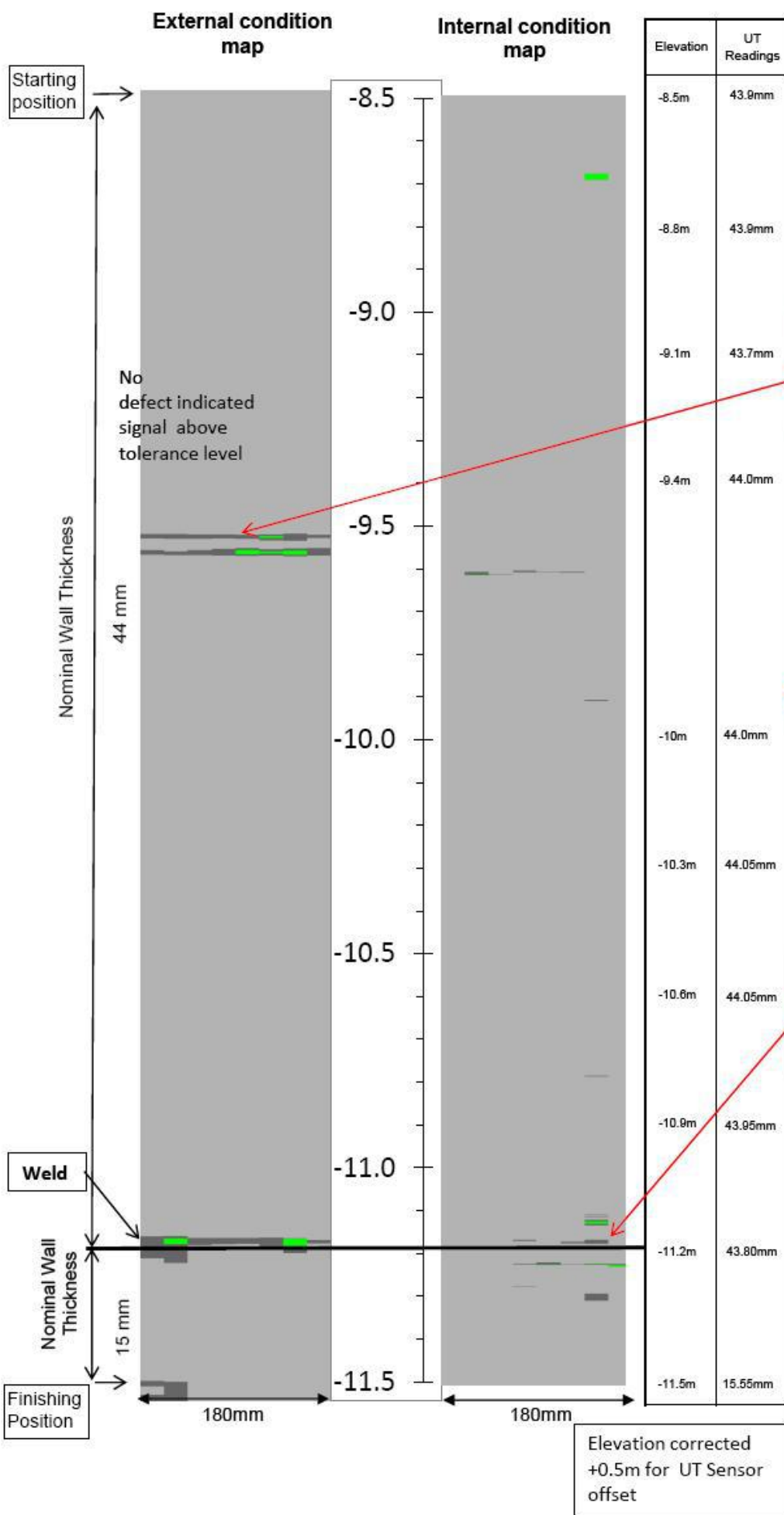


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Leg K3 Track 1
Leg K3 Track 1a
Leg K3 Track 2
Leg K3 Track 3

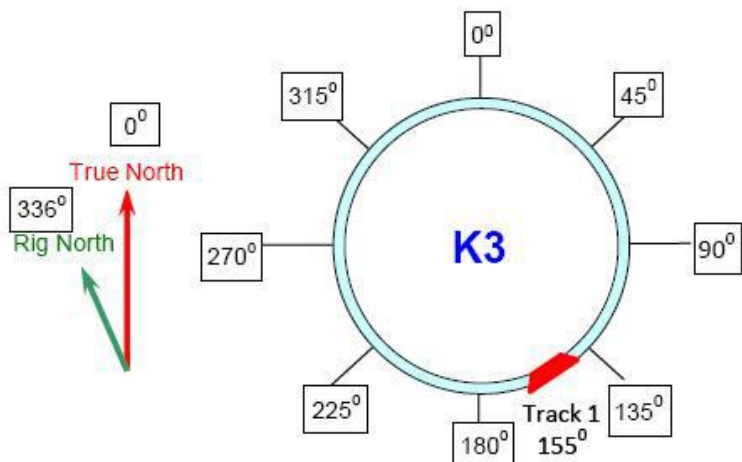
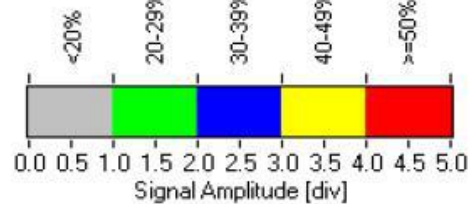
SLOFEC and UT- Scan Report Leg K3 Track 1



REMARKS:

Signals were analysed and no defects were detected. No severe wall loss detected as the indicated signals were above tolerance levels. No severe external or internal wall losses detected. Area scanned is approx 3 m long. The scan starts at minus 8.5 m to minus 11.5 m. The nominal wall thickness in the scanned area is 44 mm. The area scanned was the cleanest part of the run. Unable to scan higher as surface not clean enough. Area was jet cleaned by Lynx and not by the Fugro crawler as this was unsuccessful. We will not be doing anything above the splash zone at this time.

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth information

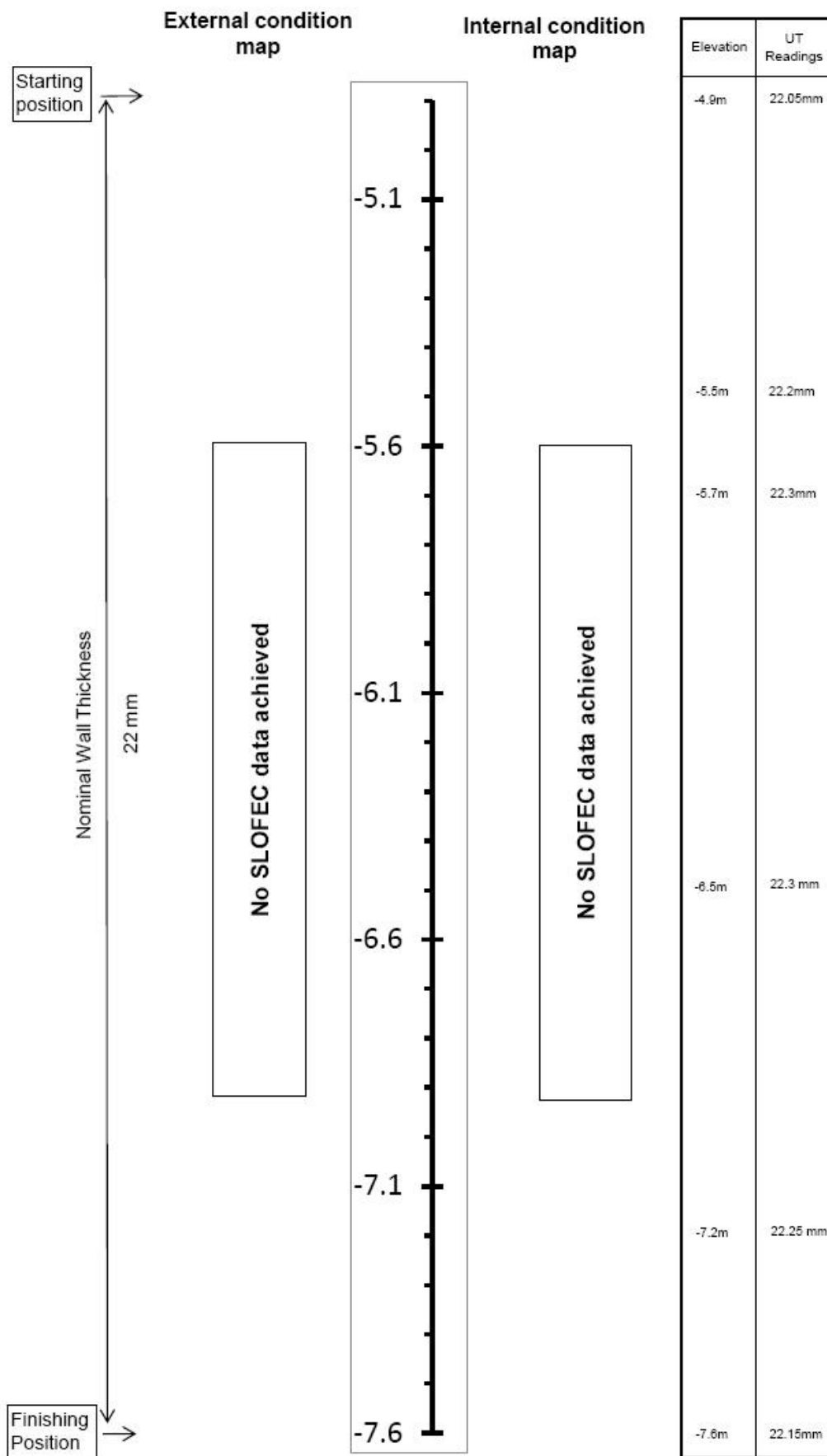


The above diagram utilizes True North readings.

Client: North Sea
 Location: Leg K3
 Leg Identification: K3
 Leg Section: 1300 mm
 Leg Dimension: 15/Jan/12
 Date: K0123-11
 Report number: 1701
 Job number:

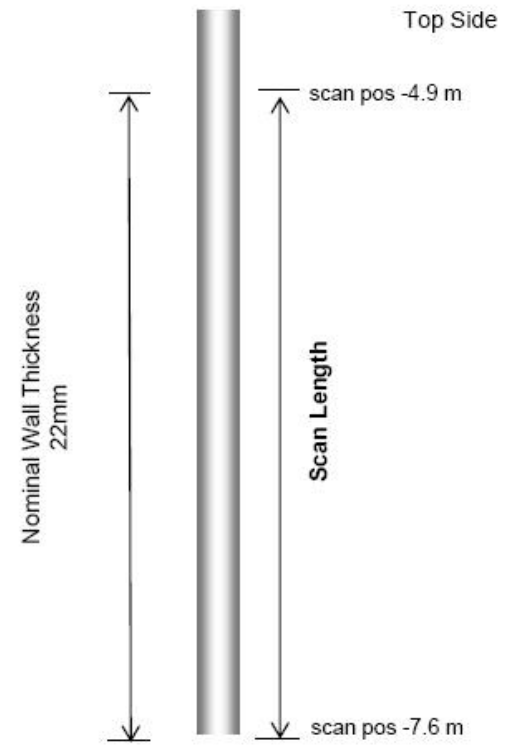


SLOFEC and UT - Scan Report Leg K3 Track 1a



Elevation corrected +0.5m for UT Sensor offset

Section Position Detail

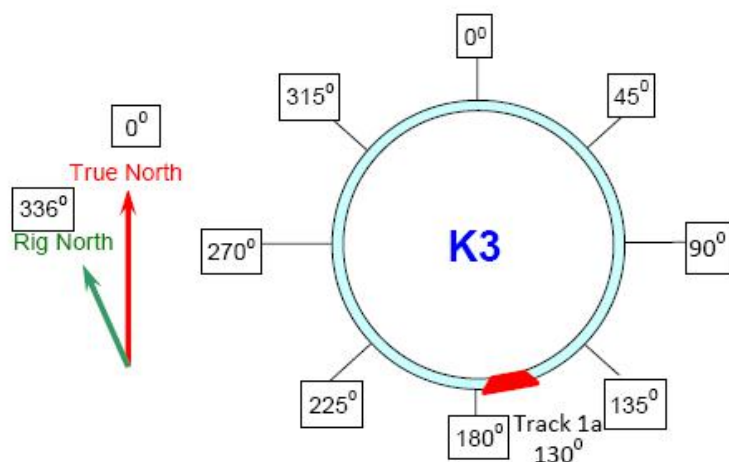
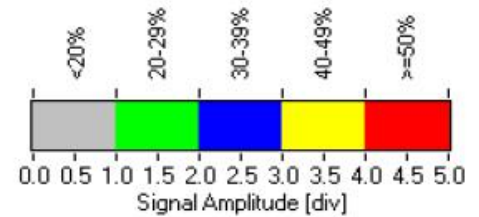


Above image is the crawler deployed on Leg K3 for inspection.

REMARKS:

Signals were analysed on other tracks and no defects were detected.
No severe wall loss detected as the indicated signals were above tolerance levels.

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth

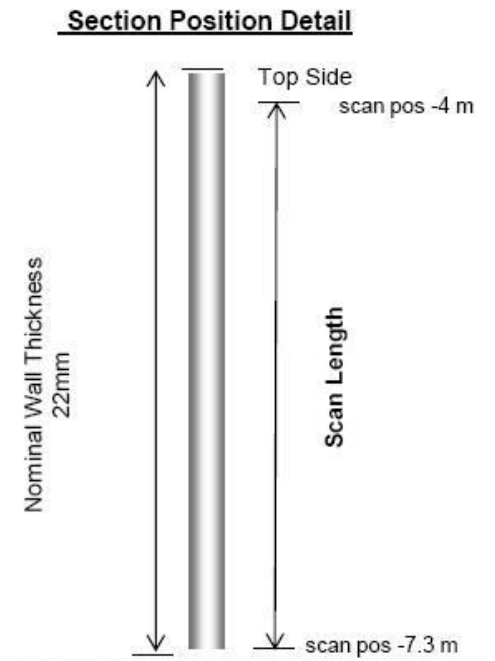
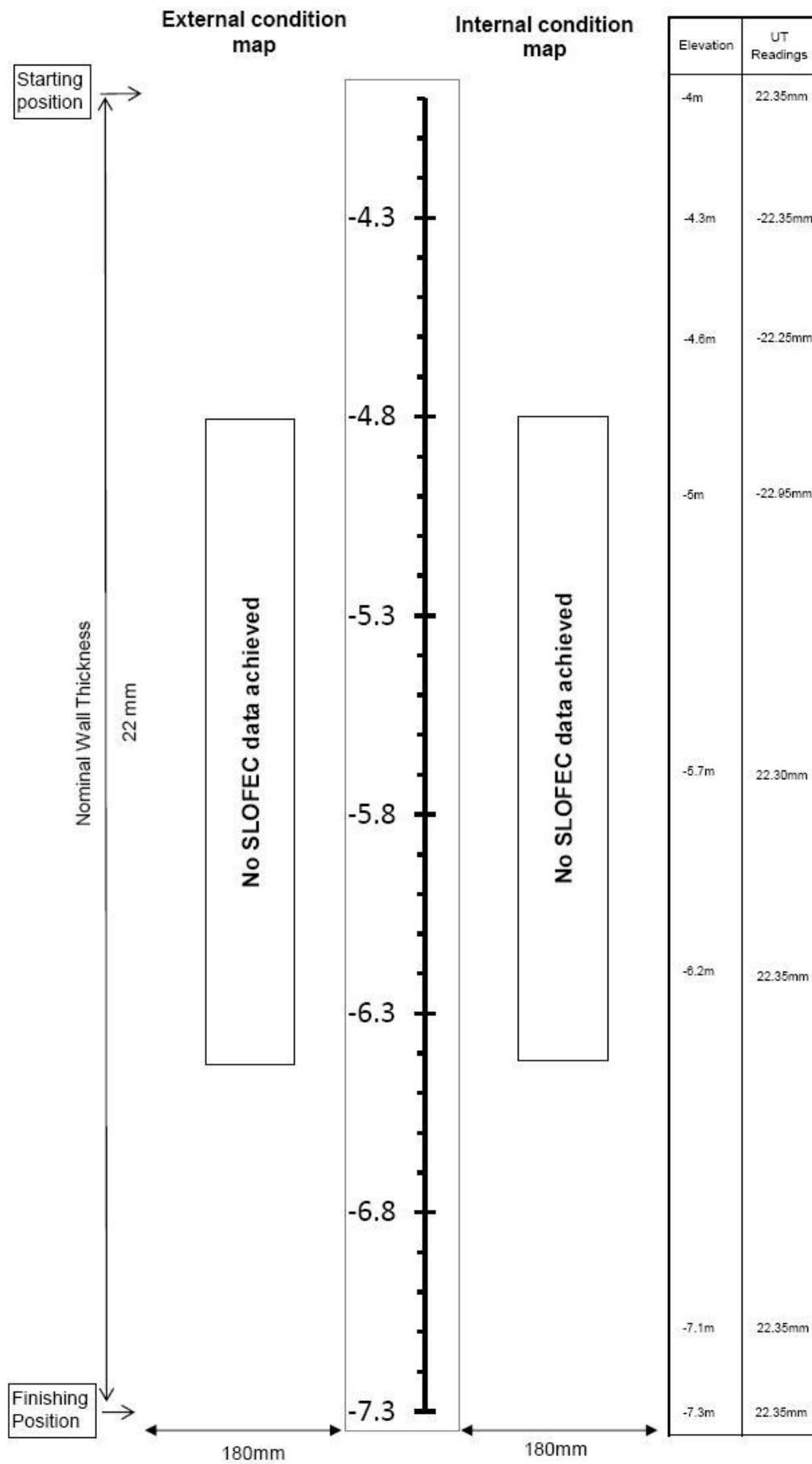


The above diagram utilizes True North readings.

Client: North Sea
Location: Leg K3
Leg Section: K3
Leg Dimension: 1300 mm
Date: 15/Jan/12
Report number: K0123-11
Job number: 1701



SLOFEC and UT - Scan Report Leg K3 Track 2

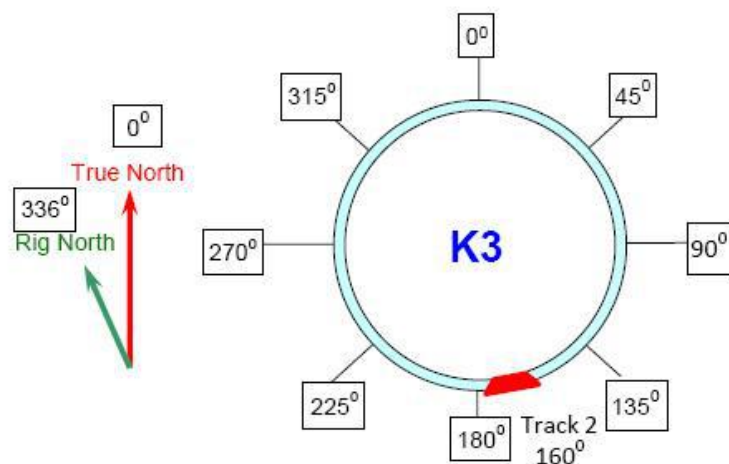
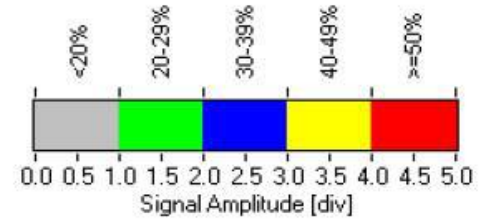


Above image is the crawler deployed on Leg K3 for inspection.

REMARKS:

Signals were analysed on other tracks and no defects were detected.
No severe wall loss detected as the indicated signals were above tolerance levels.

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth information

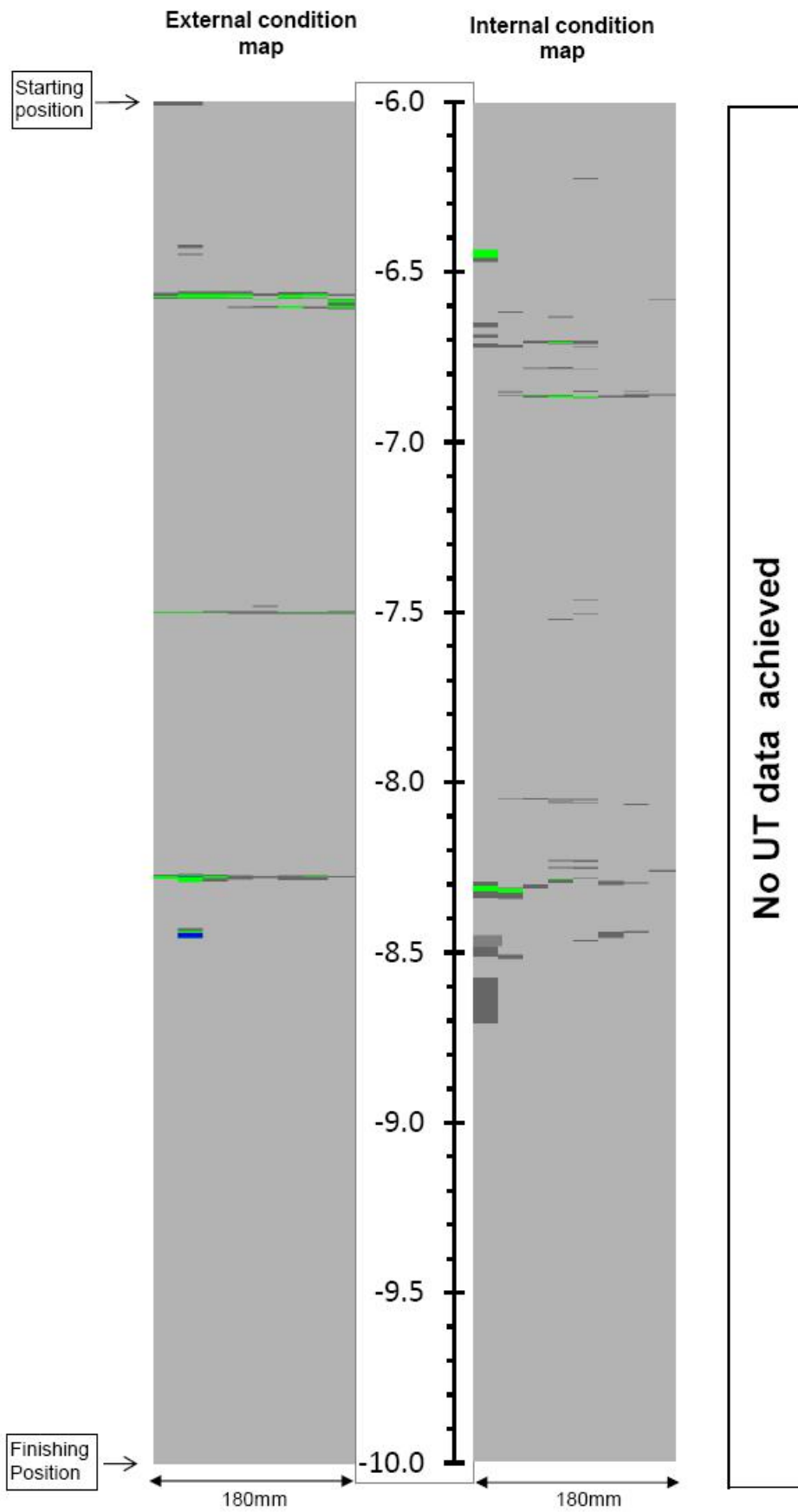


The above diagram utilizes True North readings.

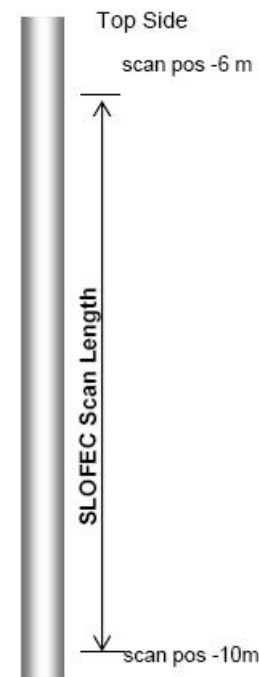
Client:	Client
Location:	North Sea
Leg Identification:	Leg K3
Leg Section:	K3
Leg Dimension:	1300 mm
Date:	15/Jan/12
Report number:	K0123-11
Job number:	1701



SLOFEC and UT - Scan Report Leg K3 Track 3



Section Position Detail



Above image is from the ROV during the inspection of Leg K3.

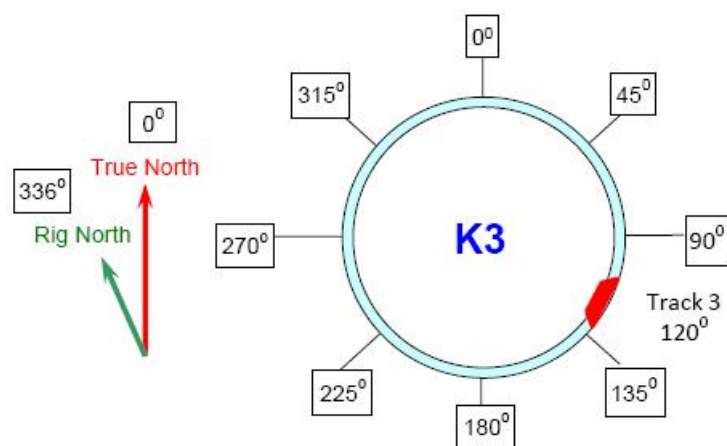
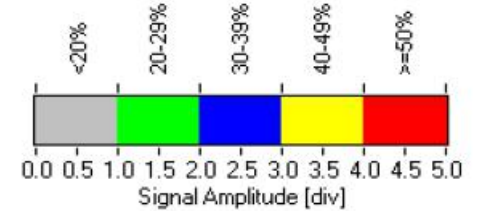
REMARKS:

Signals were analysed and no defects were detected. No severe wall loss detected as the indicated signals were above tolerance levels.

No severe external or internal wall losses detected.

No UT readings, Tool fell off after -10 m

Signal Y-component / angle analysis window set for indication of internal defects with approx. depth information



The above diagram utilizes True North readings.

Client:	Client
Location:	North Sea
Leg Identification:	Leg K3
Leg Section:	K3
Leg Dimension:	1300 mm
Date:	15/Jan/12
Report number:	K0123-11
Job number:	1701

