



EXTERNAL TRAINING

06/05/2024



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006798

3D Points Cloud

3D Scanner

- Training is required to make the scans.
- Slow data capture (4-10 min per scan)
- Assembly process carried out by hand (20 scans 20h).
- Possibility to export as cloud, mesh, whole scan, part of a scan, 3D viewer, etc.
- The generated 3D points cloud is very accurate (1mm).

Photogrammetry

- It is not necessary a previous training to use the camera.
- Quickly data capture (30-40 seg per scan)
- Automatic assembly is given by the camera supplier. (20 scans 12h).
- Visual results only. These results can be exported as a points cloud file (.xyz).
- The 3D points cloud is not very accurate as it is generated from photos (a few cm).

LIDAR

- A short training is necessary to use the lidar.
- Quickly data capture (in 20 minutes it is possible to scan around 250 m^2).
- The supplier's software makes assembly automatic.
- A 3D points cloud is obtained.
- The generated 3D points cloud has an accuracy of 2-3cm.



SCENE SOFTWARE



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CLOUDCOMPARE SOFTWARE



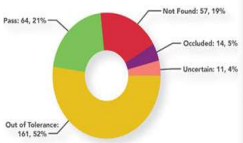
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Our Targets

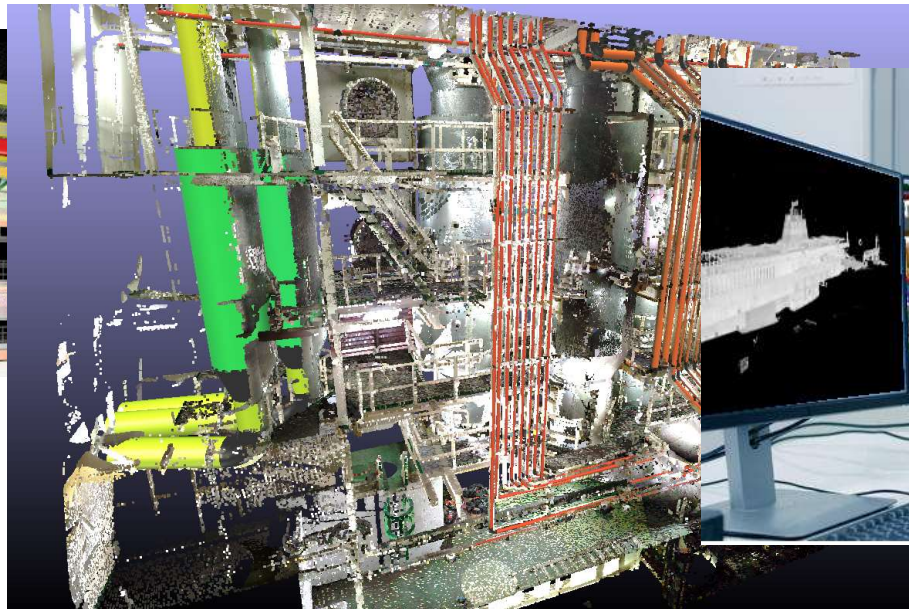
1. Progress Monitoring (Task 10.21)



New building & retrofit



2. Reverse Engineering (Task 13.25)



New building & retrofit

3. Project Documentation Updating (Task 14.26)

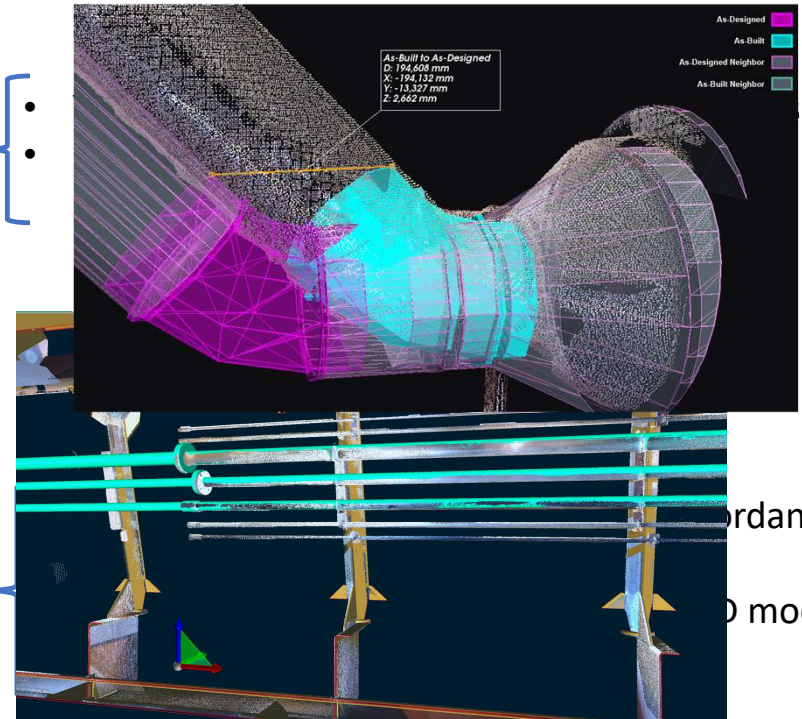
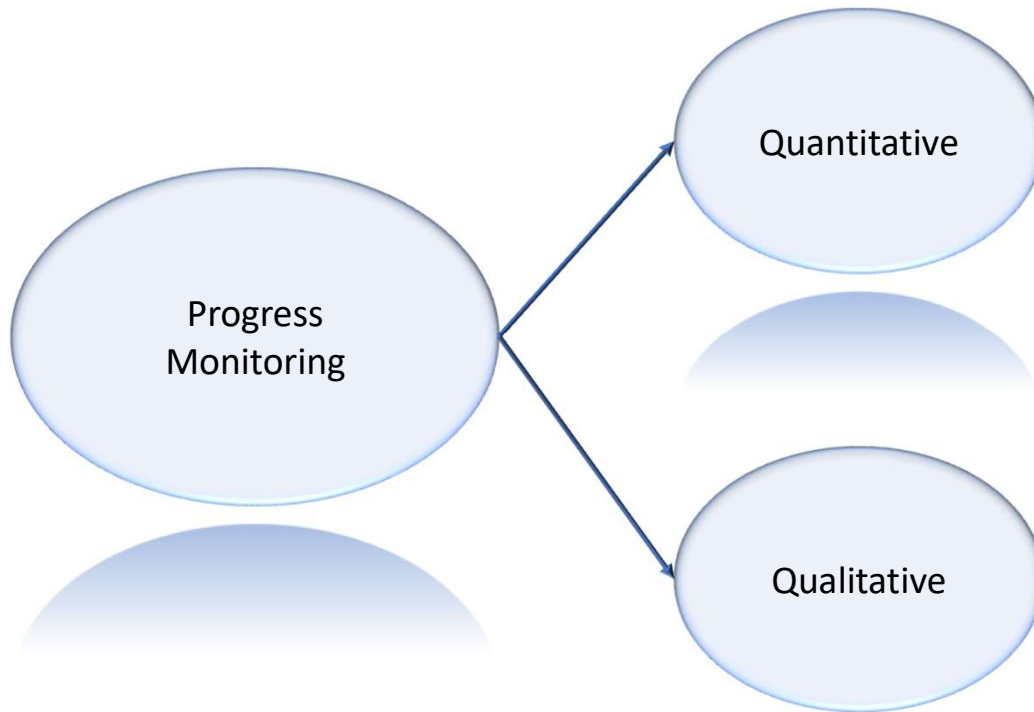


New building & retrofit



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1. Progress Monitoring



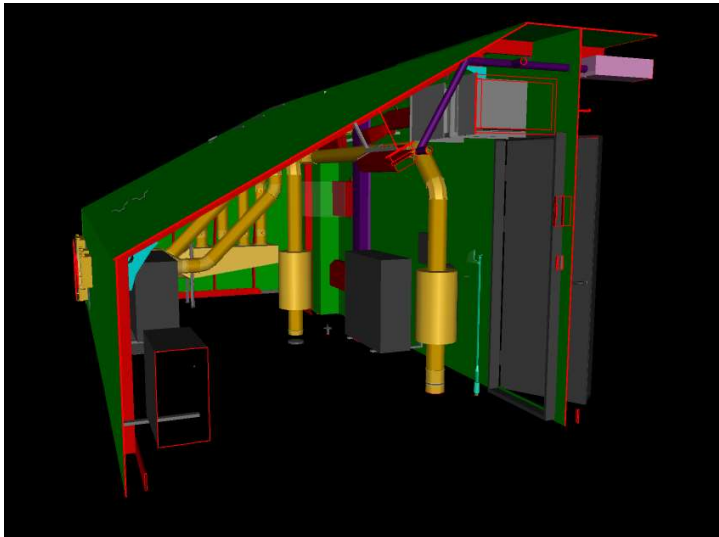
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D model and



Compare the real position of equipment with the 3D model by 3D scanning

3D model



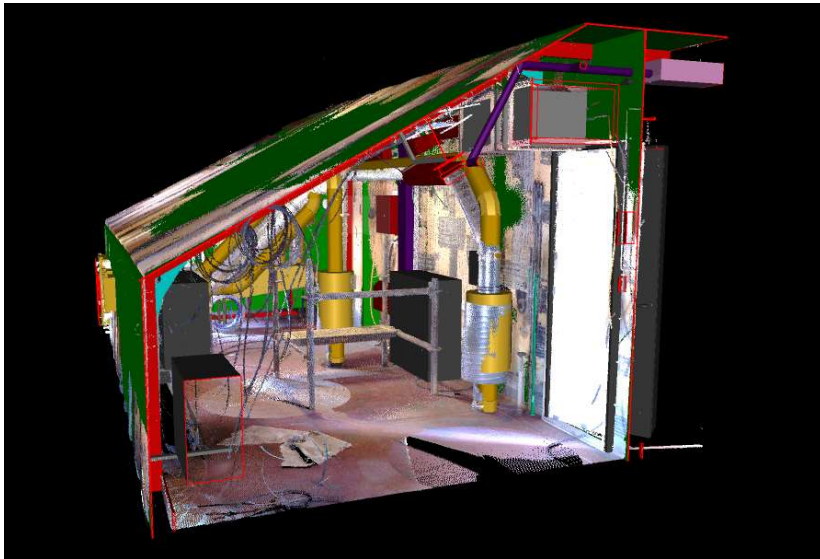
Point cloud from scan



1. Progress Monitoring

Compare the real position of equipment with the 3D model by 3D scanning

Point cloud over scan



MERGING POINTS CLOUD WITH 3D MODEL BRODOSPLIT TEST



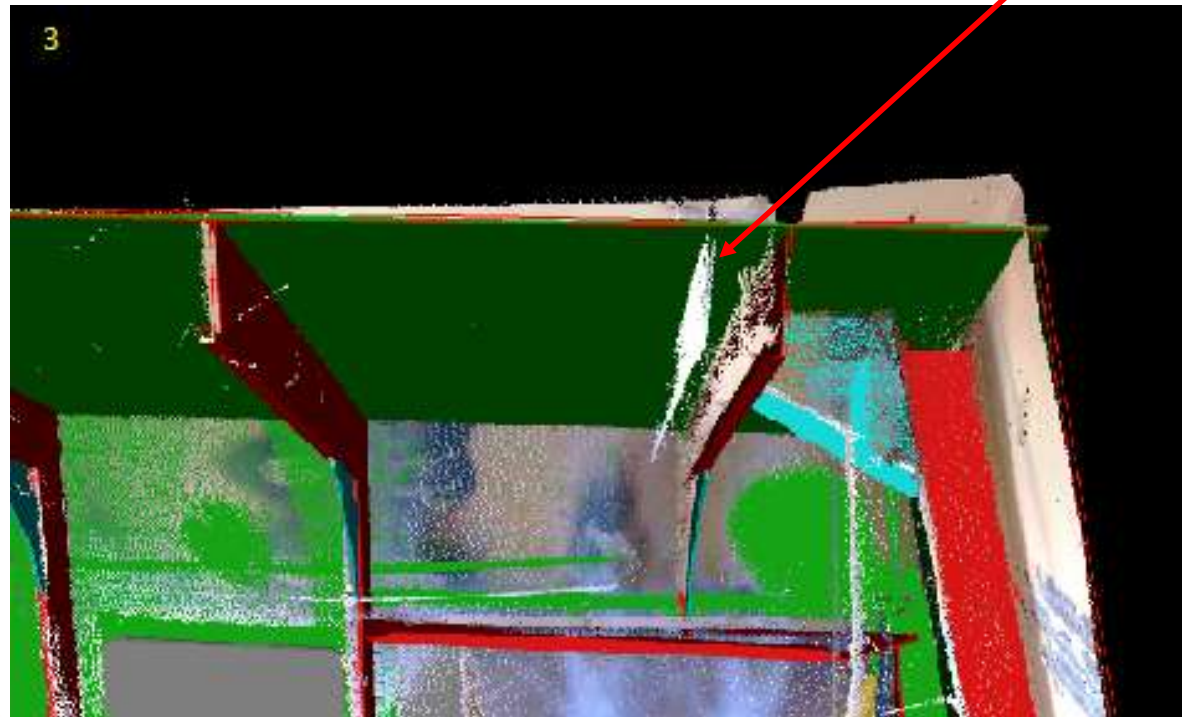
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1. Progress Monitoring

Compare the real position of equipment with the 3D model by 3D scanning

Point cloud over scan details

REINFORCEMENT DISPLACEMENT

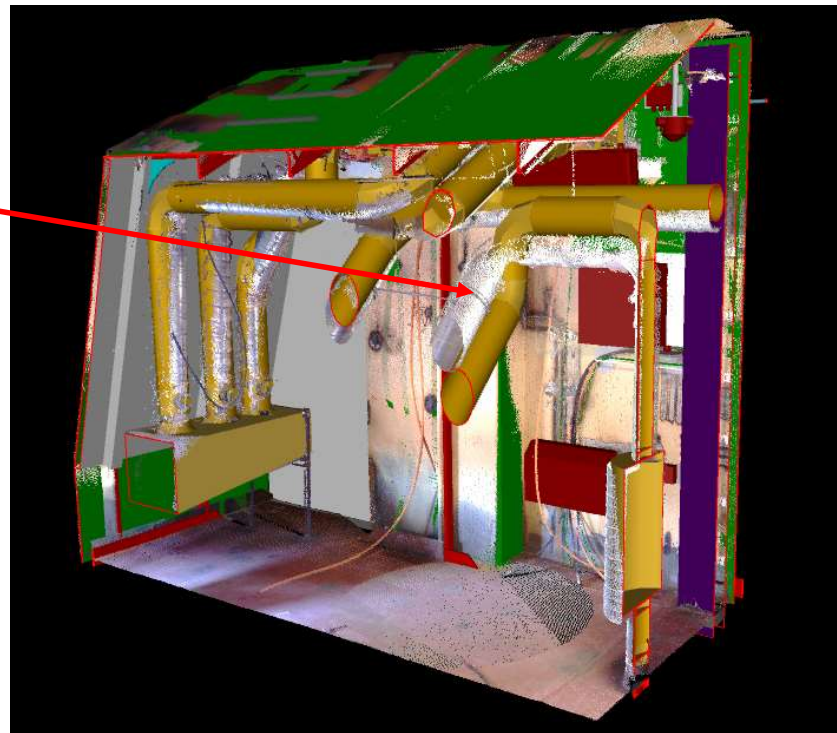


1. Progress Monitoring

Compare the real position of equipment with the 3D model by 3D scanning

Point cloud over scan details

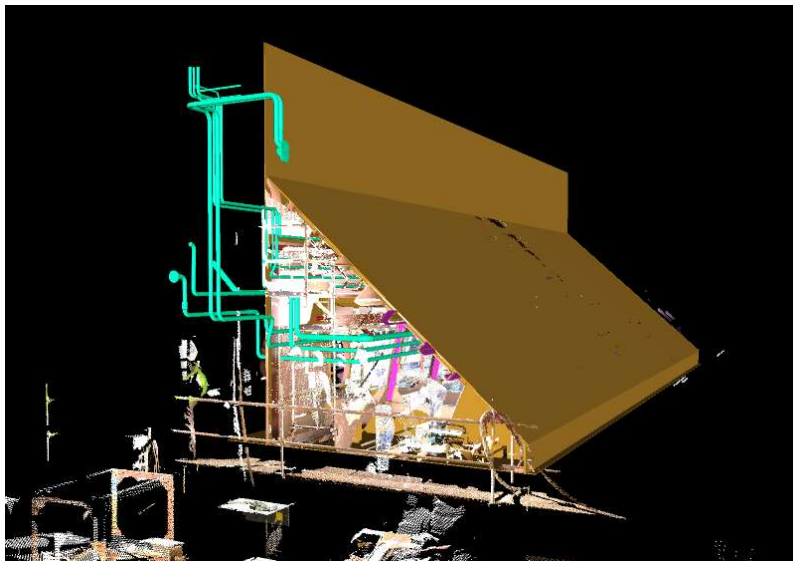
**DUCT NOT IN
DESIGN POSITION**



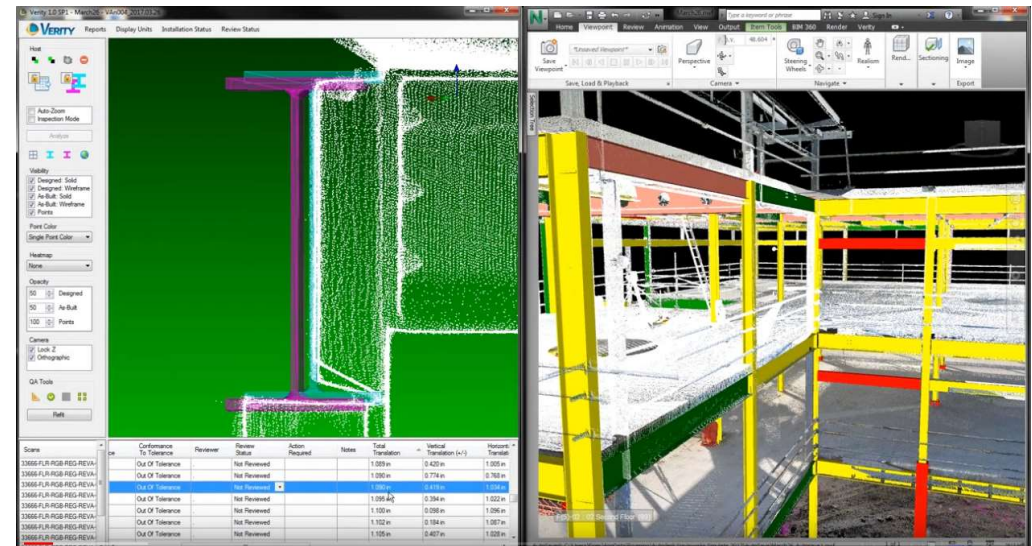
1. Progress Monitoring

Compare the real position of equipment with the 3D model by 3D scanning

Visual method (Navisworks)



Automated method (Verity+Navisworks)



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MERGING POINTS CLOUD WITH 3D MODEL NODOSA TEST



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1. Progress Monitoring

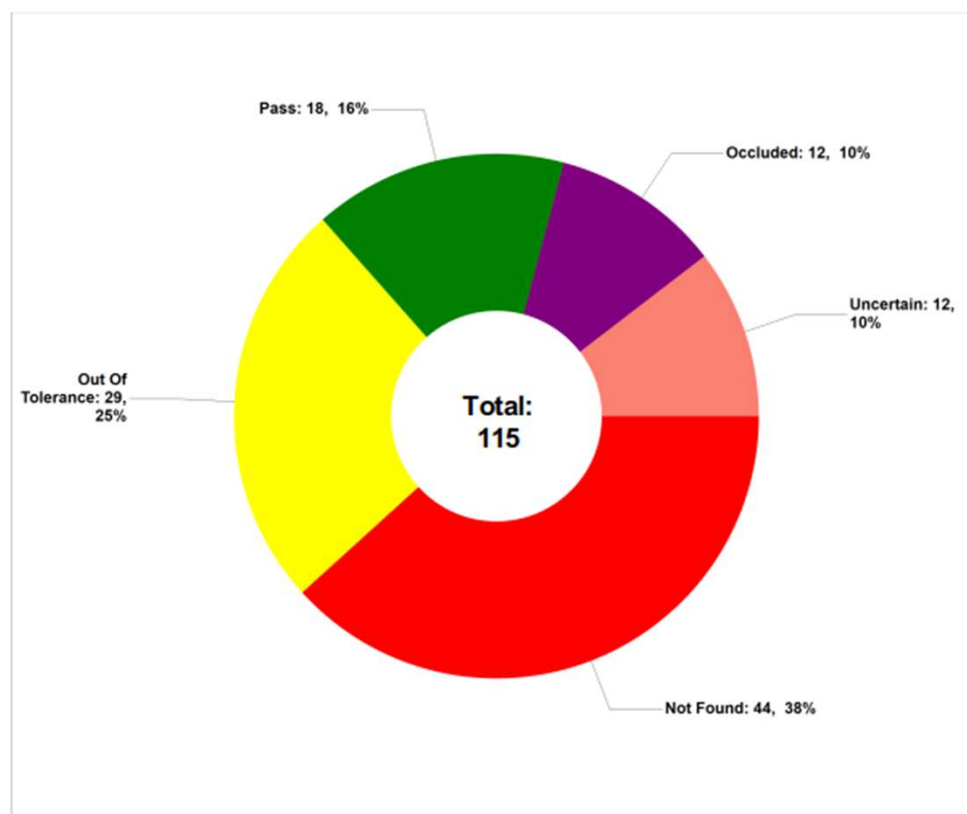
Project:
Brodo_16.11

Analysis:
Van001_2021.11.16

Processing Time:
0:06:19.34 (h:m:s)

Report Date:
16/11/2021 16:28:25

VERITY REPORT SUMMARY



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1. Progress Monitoring

VERITY REPORT
DETAIL REPORT

Report Date: 16/11/2021

Item Table

Element		Status					Maximum Translation			GUID
Item	Host Name	Installation Status	Item Tolerance	Conformance To Tolerance	Reviewer	Review Status	Total	Vertical	Horizontal	
Item 001	TUBE 5 of BRANCH/543-5712E.EM2.301_spiro/B3 Grupo	Installed	50,000 mm	Out Of Tolerance	-	Not Reviewed	88,644 mm	-70,114 mm	54,239 mm	a7cd420d-eba8-4f35-8498-57402af548ed
Item 002	TUBE 6 of BRANCH/543-5712E.EM2.301_spiro/B3 Grupo	Installed	50,000 mm	Out Of Tolerance	-	Not Reviewed	63,281 mm	3,537 mm	63,276 mm	24e5a04d-75aa-4d36-a2ad-f991ad480d04
Item 003	/543-5712E.E07.SA16-600 Grupo	Installed	50,000 mm	Out Of Tolerance	-	Not Reviewed	57,362 mm	-8,442 mm	57,361 mm	3c3da90e-cc93-470f-b6c9-a015c403b2d6
Item 004	TUBE 1 of BRANCH/543-5712E.EM2.201_spiro/B3 Grupo	Installed	50,000 mm	Pass	-	Not Reviewed	16,435 mm	-6,716 mm	15,199 mm	b87d58f9-1687-4ffa-8755-1a97670d7da6
Item 005	TUBE 4 of BRANCH/543-5712E.EM2.201_spiro/B3 Grupo	Installed	50,000 mm	Out Of Tolerance	-	Not Reviewed	131,757 mm	-96,407 mm	94,853 mm	0811fbf1-f811-4289-82d2-5713384fb58e
Item 006	THREEWAY 2 of BRANCH/543-576.401.073/B1 Grupo	Installed	50,000 mm	Out Of Tolerance	-	Not Reviewed	67,935 mm	-64,328 mm	21,988 mm	8412ab0b-05db-4517-a589-9d7524812852
Item 007	/543-5712E.SA16-600.01 Grupo	Installed	50,000 mm	Out Of Tolerance	-	Not Reviewed	57,022 mm	-50,386 mm	27,857 mm	5da14e06-6f4b-4a7b-b2b7-c7bc8e6f7f5f
Item 008	UNION 1 of BRANCH/543-5712E.E07.101spiro/B1 Grupo	Installed	50,000 mm	Pass	-	Not Reviewed	11,049 mm	1,252 mm	10,978 mm	01babf2c-46b6-483f-b9a3-4680407fed07

1. Progress Monitoring

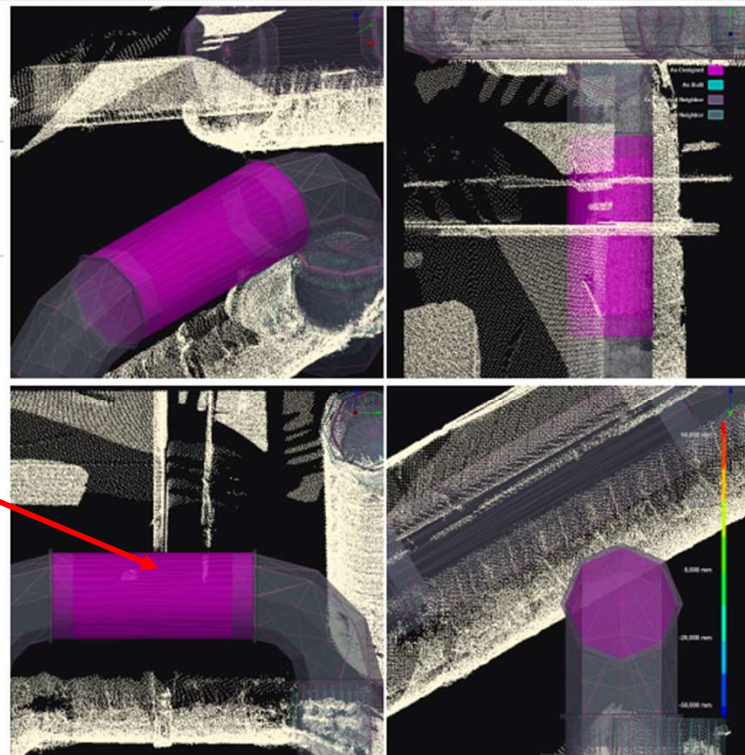
Report Date: 16/11/2021
 Item 102: TUBE 3 of BRANCH /543-5712E.E07.101spiro/B1 || Grupo
 Not Found: N/A - Tolerance: 50,000 mm

Action Required:
-

Notes:
-

Review Status:
Not Reviewed
Reviewer:
-

Location:
 X: 39.799.999 mm
 Y: 1.146.392 mm
 Z: 23.792.286 mm
 GUID:
 c2c6d4d3-cea0-46e3-89b9-486f525d7d3a



VERITY REPORT
IMAGE LINK
PIPE MISSING

Maximum Translation							Rotation (degrees)			
Total	Vertical	Horizontal	X Axis (+/-)	Y Axis (+/-)	Long Axis	Cross Axis	From Vertical	Horizontal	Twist (Sectional)	
-	-	-	-	-	-	-	-	-	-	

1. Progress Monitoring

[VERITY REPORT](#)
[IMAGE LINK](#)
[PIPE IN](#)
[DIFFERENT](#)
[POSITION](#)



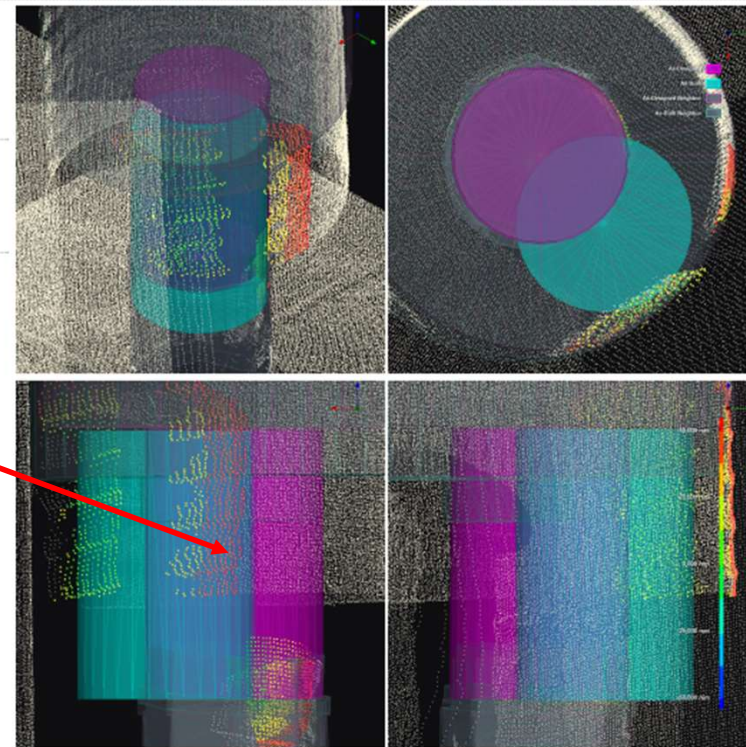
Report Date: 16/11/2021
 Item 098: TUBE 1 of BRANCH /543-5712E.E08.101spiro/B1 || Grupo
 Installed: Out Of Tolerance - Tolerance: 50,000 mm

Action Required:
 -

Notes:
 -

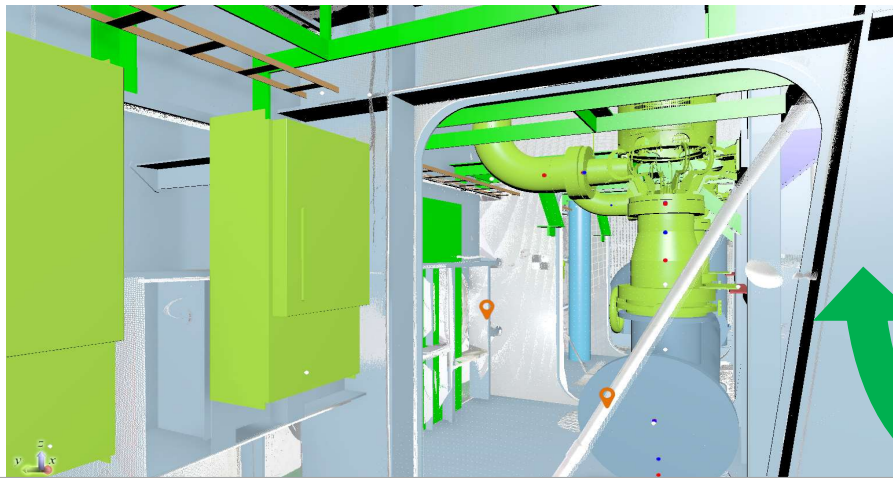
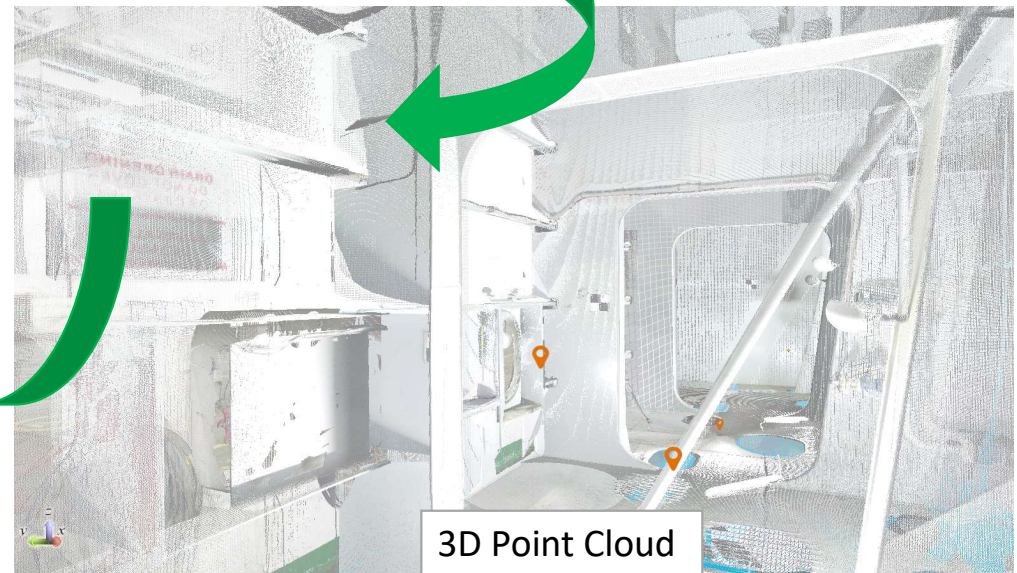
Review Status:
 Not Reviewed
 Reviewer:
 -

Location:
 X: 40.450,001 mm
 Y: -1.065,000 mm
 Z: 22.107,000 mm
 GUID:
 bb9a3576-6961-4953-a160-
 b7415c0cb529



Total	Maximum Translation						Rotation (degrees)		
	Vertical	Horizontal	X Axis (+/-)	Y Axis (+/-)	Long Axis	Cross Axis	From Vertical	Horizontal	Twist (Sectional)
85.560 mm	-0.607 mm	85.558 mm	61.976 mm	59.321 mm	-0.607 mm	85.558 mm	0.313°	0.000°	0.076°

1. Existing Vessel
2. 3D points cloud of the vessel
3. Model based on the 3D points cloud
4. Modification of existing elements or addition of new ones



POINTS CLOUD VIEWER



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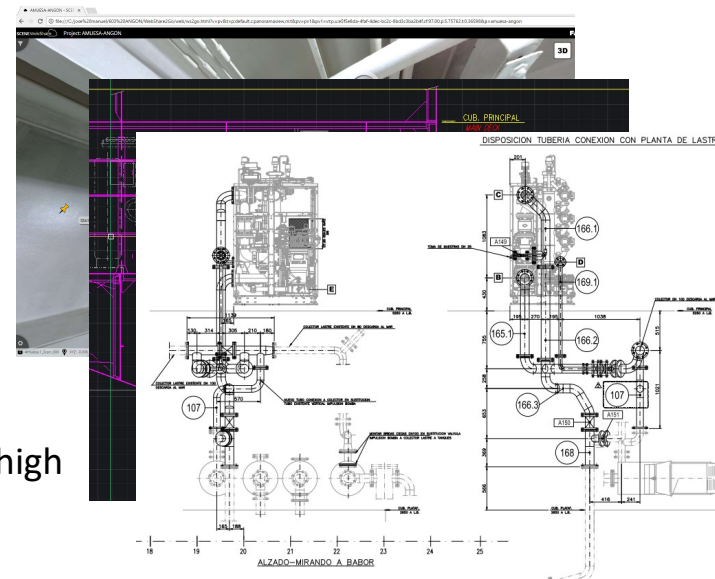
Points cloud viewer + 2D software



Steps:

- Measurements from an scan viewer (3-coordinates X,Y,Z) to place the elements in the different views of the drawing.
- Position the above measurements in the different views to obtain the initial drawing to start the retrofitting.
- Once the existing is represented, the modifications necessary for retrofitting are added and the construction drawings are created manually.

The accuracy of this method is not very high

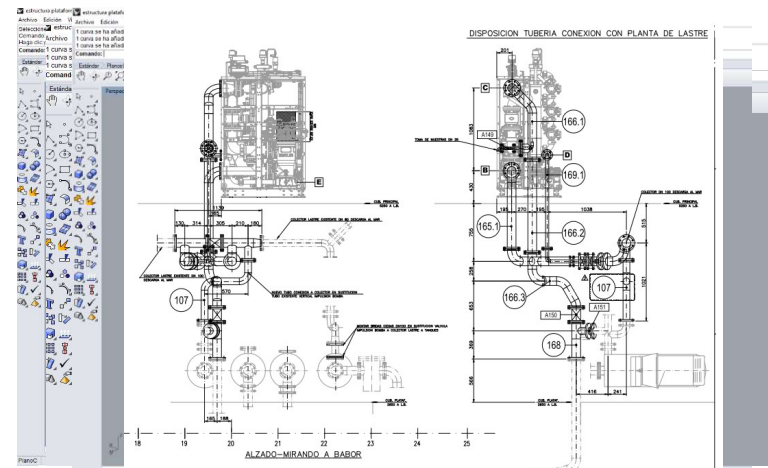


Point cloud viewer + 3D generic software



Steps:

- Import points cloud into the 3D software.
- Adding new elements needed to begin the work like new equipment or new structures for example.
- Execute the work taking into account the points cloud (in blue new pipelines).
- Obtain manually the construction drawings.



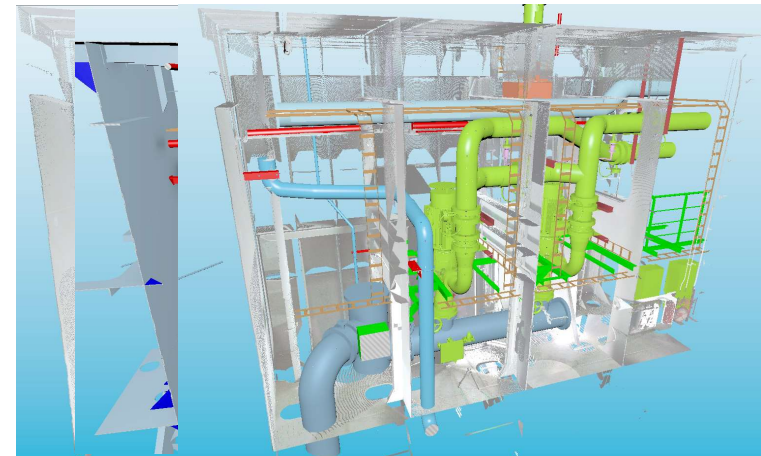
In this case, the advantage is that connections with the existing elements can be seen in 3D and all the clashes that may occur while designing can be detected. Therefore, with this procedure the start of work is faster and the results are more accurate than the previous procedure.

Points cloud viewer + 3D specific software



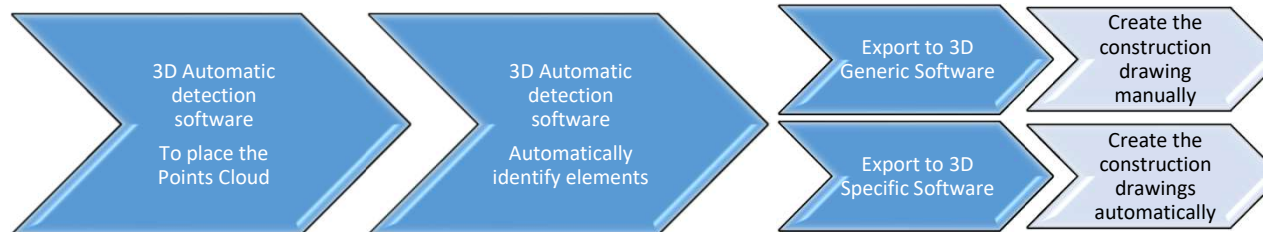
Steps:

- Import points cloud into the 3D software.
- The new piping is routed and the necessary structure is modelled, as well as modelling of the cable trays, platforms and position the new equipment.



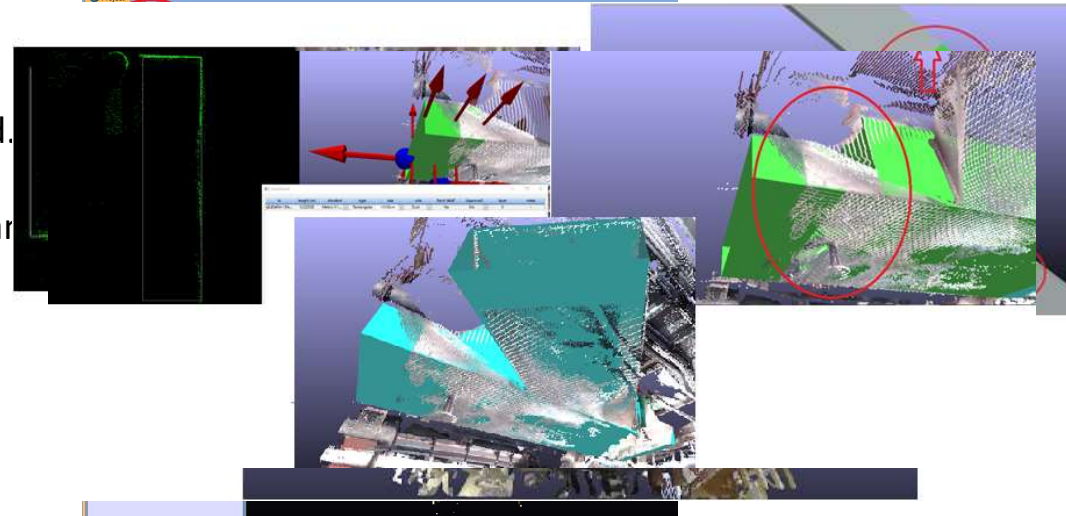
In this case, the advantage is the software since is an specific software to the shipbuilding industry, the tools for the modelling of pipes, structure, etc. are adapted and their use is much faster and easier to perform.

Points cloud + 3D automatic detection software



Steps:

- Insert the points cloud into Edgewise.
- Structured and unstructured points cloud can be inserted.
- Straight pipe sections are identified automatically and structures, gutters, ventilation ducts can be identified manually.
- Export to programs such as Rhinoceros (geometry) or to programs such as Aveva or Cadmatic (geometry with attributes).



In large projects it can be a great time saver to identify elements

Depending on the purpose of the project documentation, different procedures can be done with different tools.

1. Virtual model only for visualization or taking measurements.

Photogrammetry

2. Updating of documents based on the constructed vessel.

Updating during construction → Project monitoring

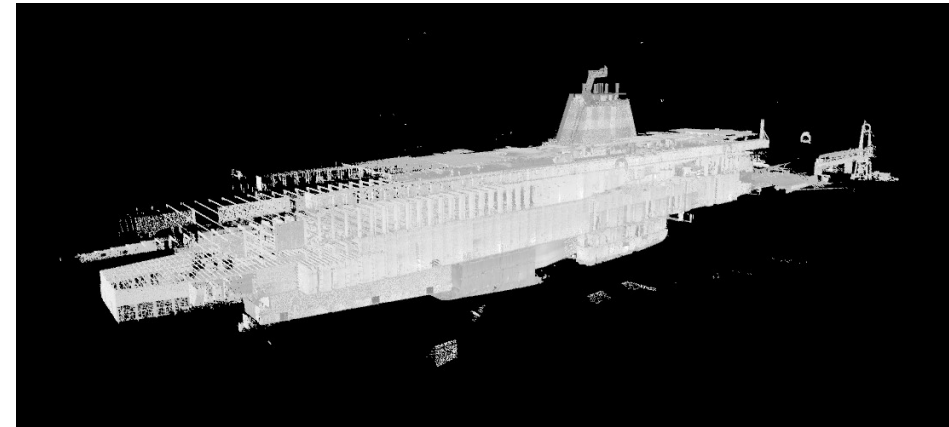
Updating at the end of construction.
Depending on the work to be carried out, a different level of precision will be required.

Tasks that do not involve a great precision, such as updating the arrangement of equipment in a room. → Photogrammetry or LIDAR

Tasks that require high precision, such as drawing piping isometrics. → Fixed laser scan

A large volume of work with different accuracies.

→ Fixed laser scan + LIDAR





MARI4YARD
MARI4ALLIANCE

Thank you for your attention!

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