



MORE PRODUCTION - LESS RISK!

ADVANTAGES OF PHOTOGRAMMETRY FOR DIMENSIONAL CONTROL OF COKE DRUMS AND OTHER LARGE VESSELS

DÜSSELDORF - OCTOBER, 2011

Presented by:

JULIO ABLANEDO (FCP)

julio.ablanedo@fcp.durofelguera.com

With the collaboration of:

ANTONIO PEREZ (METRIA)

aperez@metria.es



felguera
calderería pesada, s.a.



FCP OVERVIEW



TOTAL SURFACE	76.000m ²
UNDER ROOF SURFACE	21.000m ²
OUTDOORS STORAGE/TESTING	55.000m ²

FCP OVERVIEW

- **FOUNDED 1968 – 40+ YEARS OF EXPERIENCE**
- **HIGH QUALITY / 100% DELIVERY FULLFILMENT**

**Large
Equipment
Shipped in
one piece**



**Heavy
Wall &
Special
Reactors**



**Coke
Drums**



**Unit
Packages**



FCC Units



**Nuclear
Equipment**



COKE DRUMS

Latest Jobs

Destination	Material	Thickness [mm]	Diameter [mm]	Weight [t]
ARGENTINA	SA 387 Gr11 + AISI 410S	38 + 3	8682	380
BELARUS	SA 387 Gr11 + AISI 410S	45 + 3	8600	430
GERMANY	SA 387 Gr12 + AISI 410S	48 + 2	9250	501
USA	SA 387 Gr11 + AISI 410S	49 + 3	8939	427
SPAIN	SA 387 Gr11 + AISI 410S	40 + 3	9230	457
SPAIN	SA 387 Gr11 + AISI 410S	35 + 3	7800	284
BRASIL	SA-387 Gr11 + AISI 410S	28 + 3	7350	240
USA	SA-387 Gr22 + AISI 405S	29 + 2	6158	168

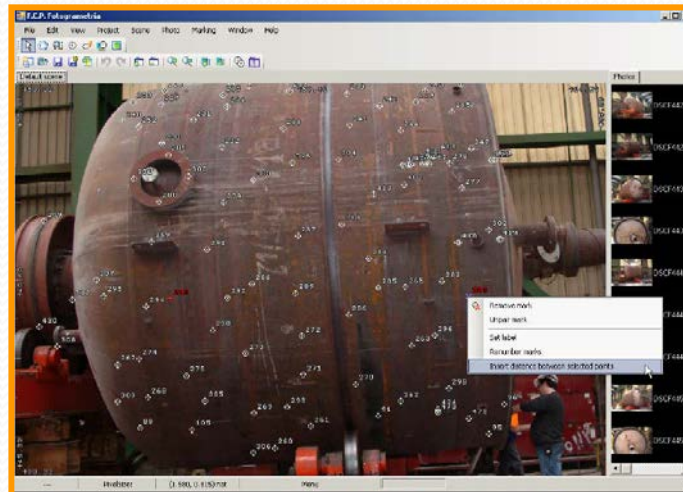
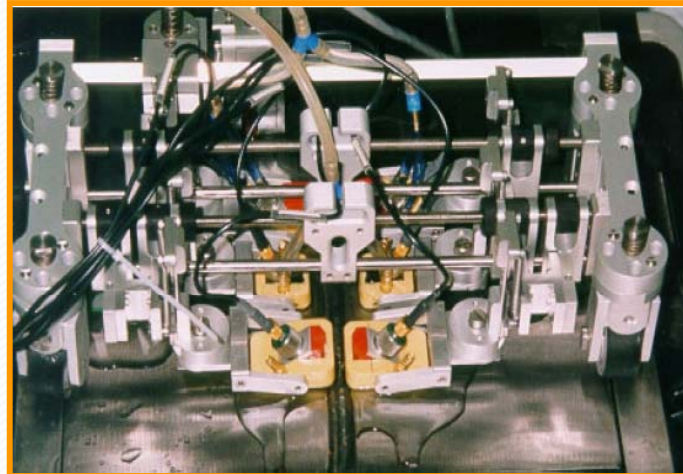


felguera
calderería pesada, s.a.



COKE DRUMS

ALWAYS AT THE FOREFRONT OF TECHNOLOGY



felguera
calderería pesada, s.a.



PHOTOGRAMMETRY

7

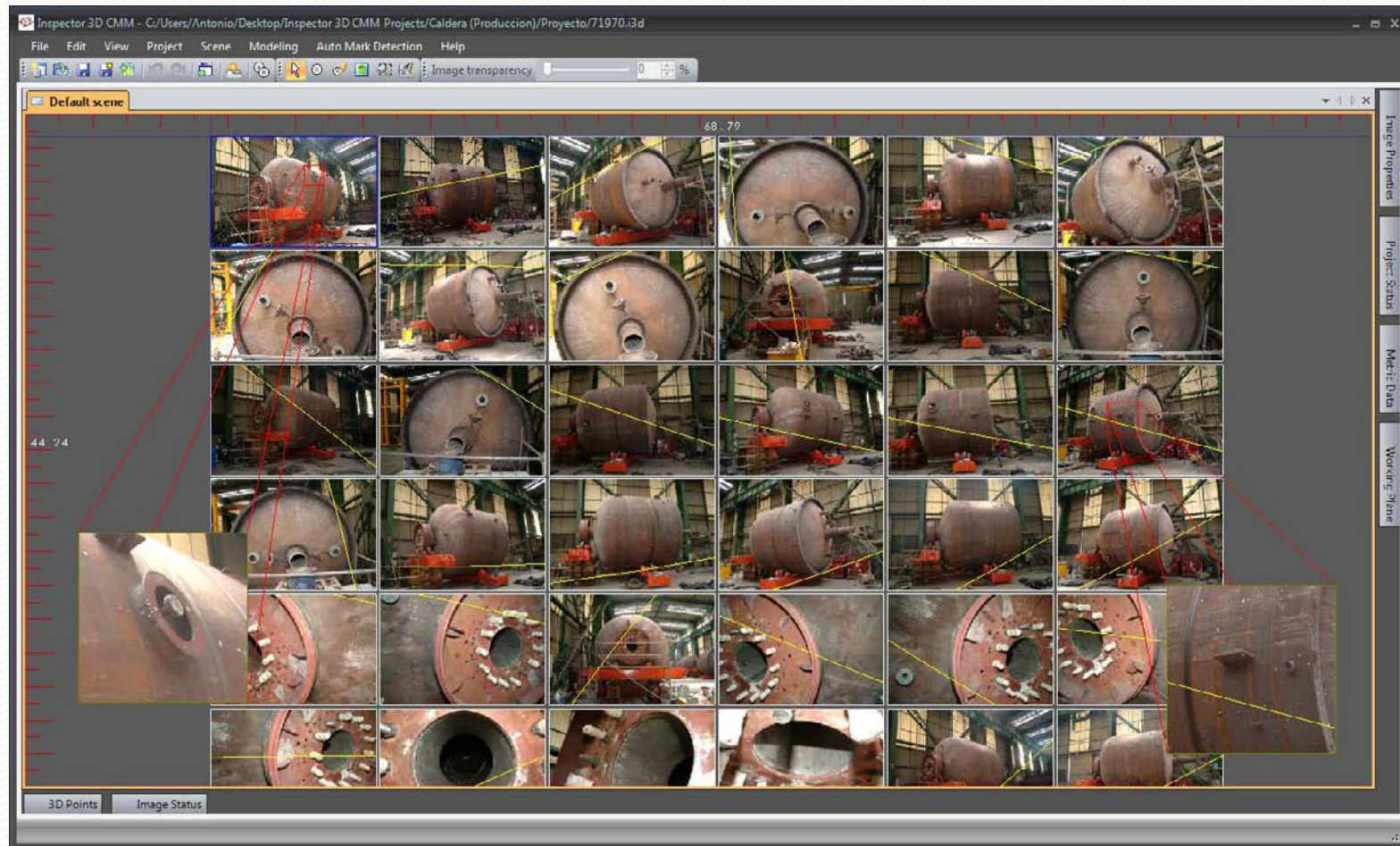
3D MEASUREMENT SYSTEMS COMPARISON

<i>Method / Aspect</i>	<i>Speed</i>	<i>Accuracy</i>	<i>Object size</i>	<i>Cost</i>	<i>Mobile</i>	<i>Validity</i>	<i>Limitations</i>
Manual	Low	Low	Max: 15 m.	Low	No	In Situ	Accesible object
Total Station	Low	High	Min: 1 m.	High	No	In Situ	System setup
Coordinate Measurement Machine (CMM)	Low	High (µm)	Min: 0,1 m. Max: 4 m.	High	No	In Situ	Object smaller than CMM
Optical and acoustics triangulation	High Low	Low High	Max: 5 m.	Low High	No	In Situ	Environment sensibility
GPS	High Low	Low High	Indep.	Low High	No	In Situ	“Coverage”
Laser / white light scanner	High	High	Indep.	High	No	In Situ	High power laser b. o. Data post-processing
Classic photogrammetry	Low	High	Indep.	High	Yes	Indep.	Complex geometries
Close-range photogrammetry *	High	High	Indep.	Low	Yes	Indep.	“Structured” objects

This software metrological capacity has been validated by the National Spanish Metrology Center (CEM). Accuracy: 1/25000 (typical)

PHOTOGRAMMETRY

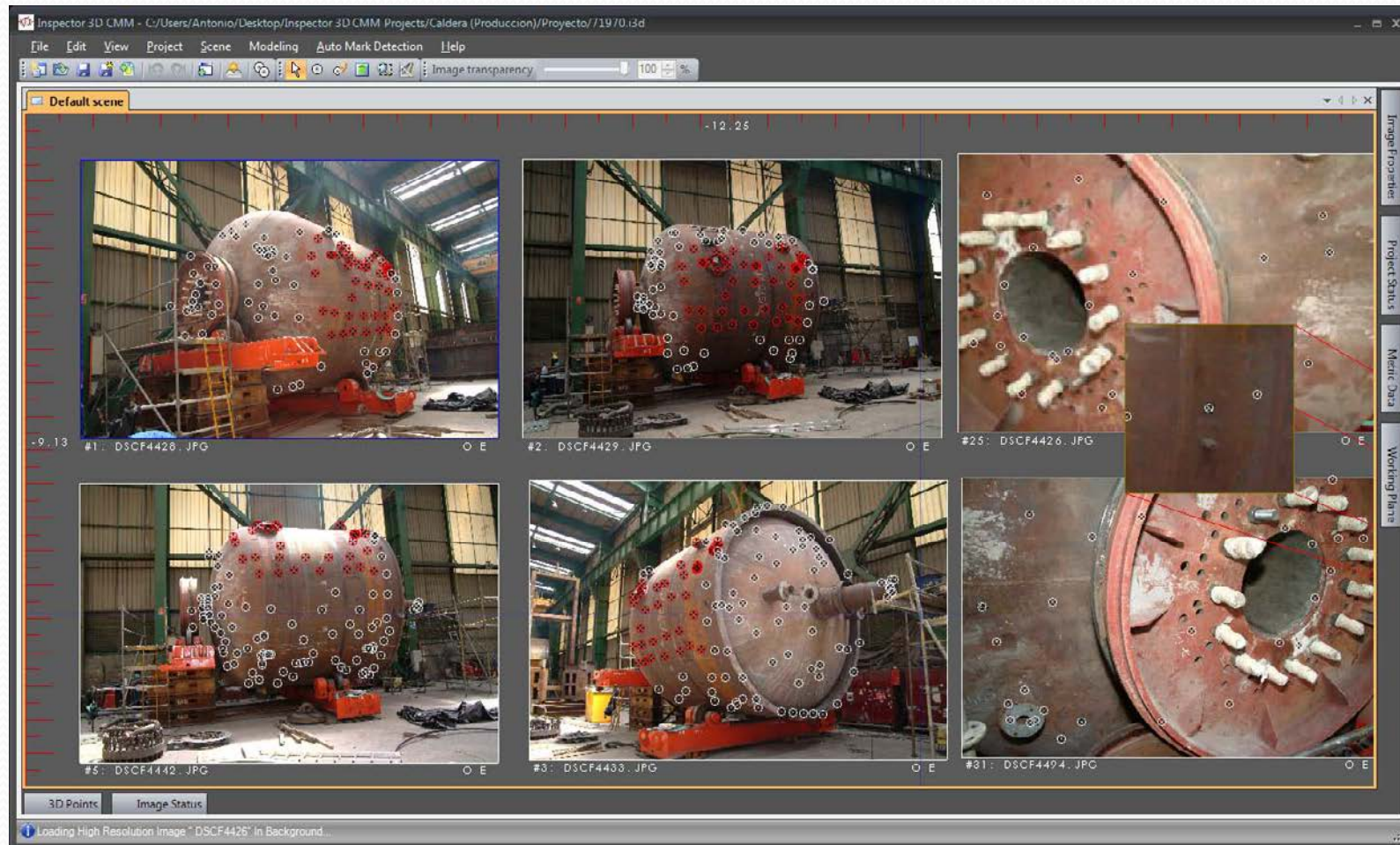
8



A set of images is taken during the manufacturing process.
No need to stop such process

PHOTOGRAMMETRY

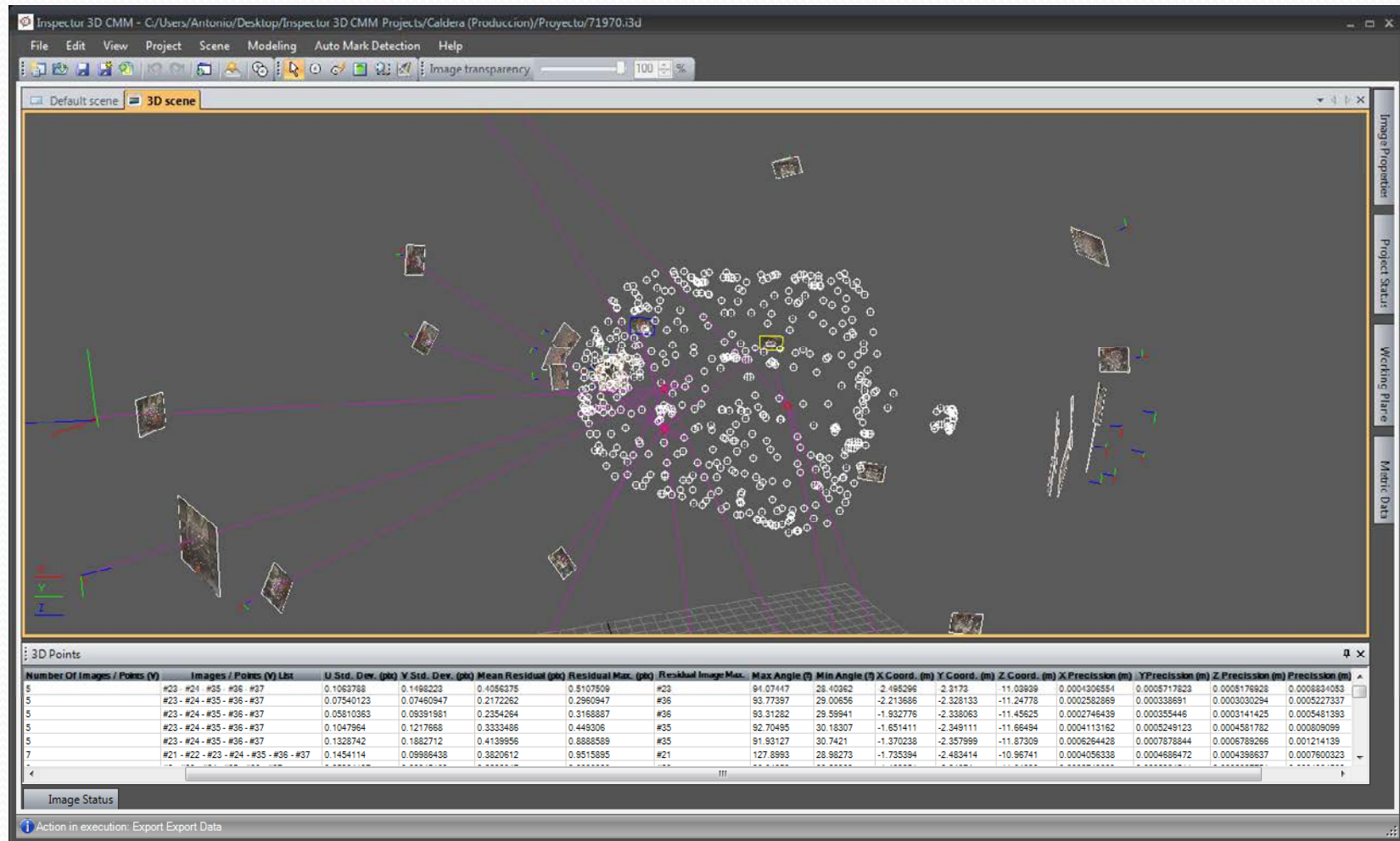
9



The features to be inspected are automatically detected on the photographs.

PHOTOGRAMMETRY

10



A xyzrgb 3D model built with the features is automatically generated.

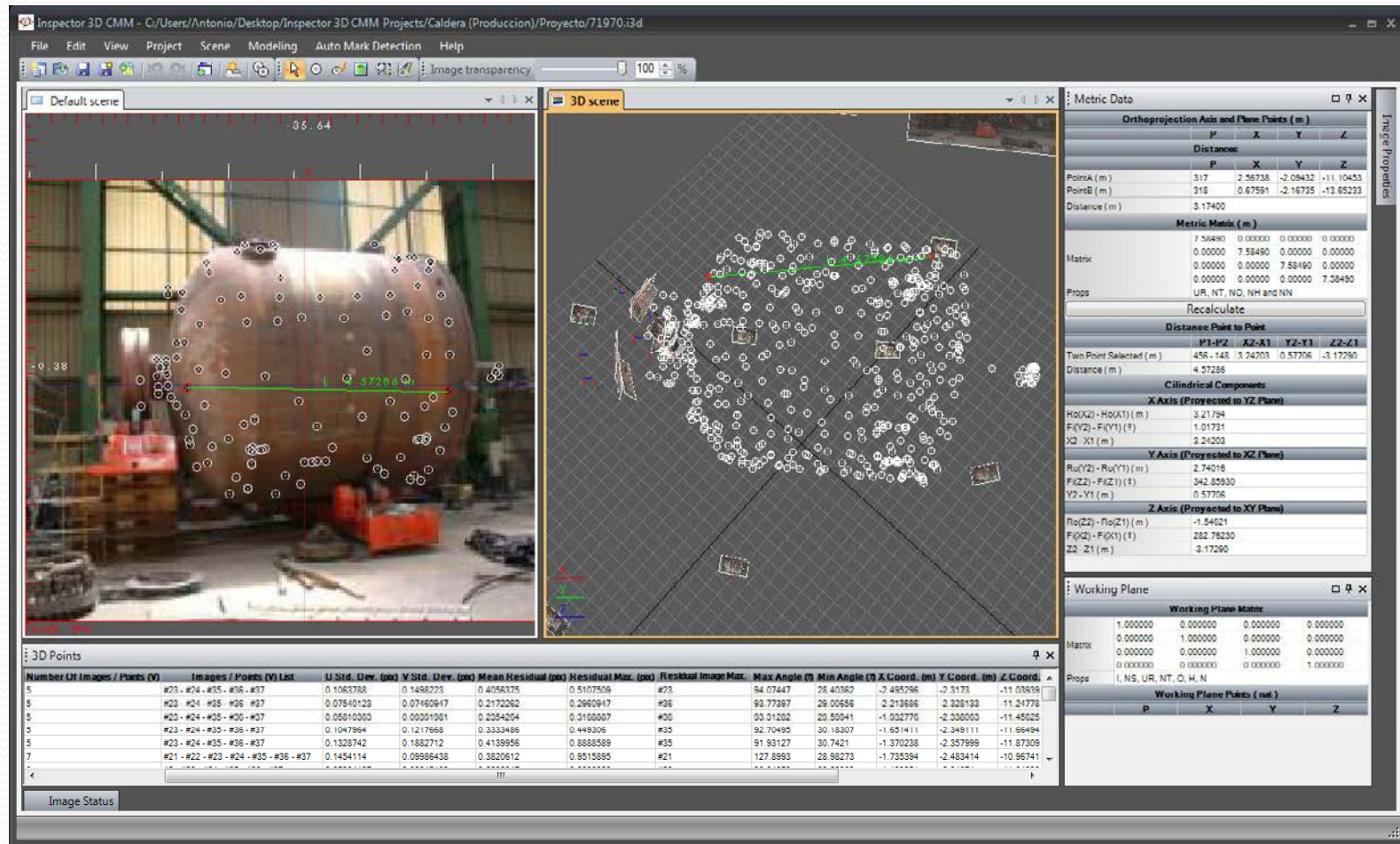


felguera
calderería pesada, s.a.



PHOTOGRAMMETRY

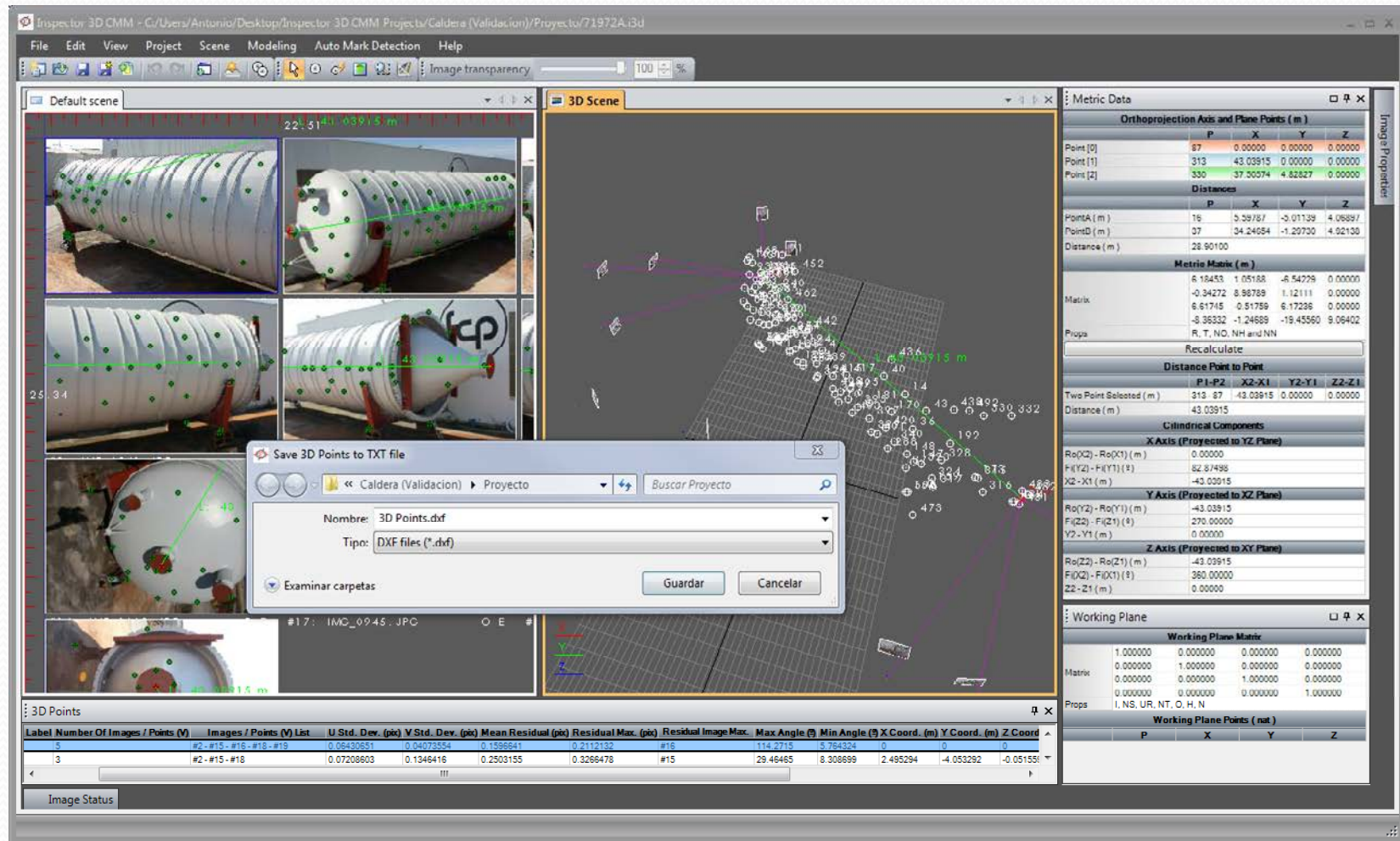
11



Any 2D/3D measurement can be carried out using both the 3D model and the set of images.

PHOTOGRAMMETRY

12



All the data can be easily exported to standard
CAD/CAM systems for CAD comparison

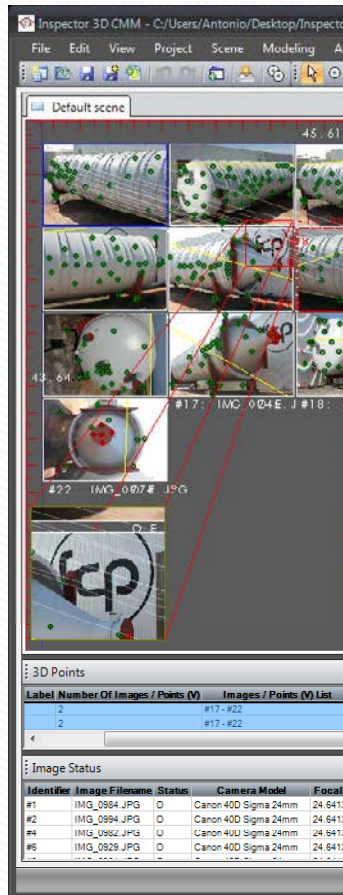


felguera
calderería pesada, s.a.



PHOTOGRAMMETRY

13



METRIA DIGITAL, S.L.
Tel. +34 985 263 043 info@metria.es www.metria.es



1.- IDENTIFICACION DEL MESURANDO

Denominación: Fotogrametría digital monoscópica convergente

Cámara fotográfica

Sensor: CMOS de f

Resolución emplea

Formato de las ton

Lente: Sigma

Longitud focal: 50

Luminosidad: 1:1,4

Patrón de escala: E

Trazabilidad: La b

de Enero de 2007.

Software de restit

Fabricante: METR

Trazabilidad: Deel

de acuerdo con el p

conclusiones recog

- Validación :

2006-29)

- Mejora de l

técnicas de

Sistema Fot

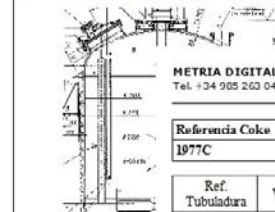
METRIA DIGITAL, S.L.
Tel. +34 985 263 043 info@metria.es www.metria.es



5.- RESULTADOS DE LA MEDICIÓN

INSPECTOR 3D CMM ©

Ref. Coke: 1977C (1)



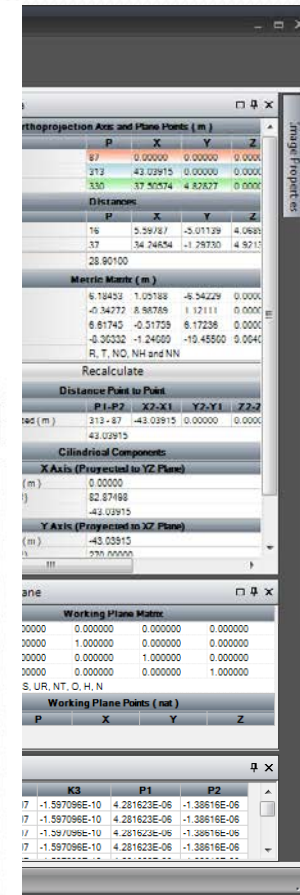
METRIA DIGITAL, S.L.
Tel. +34 985 263 043 info@metria.es www.metria.es



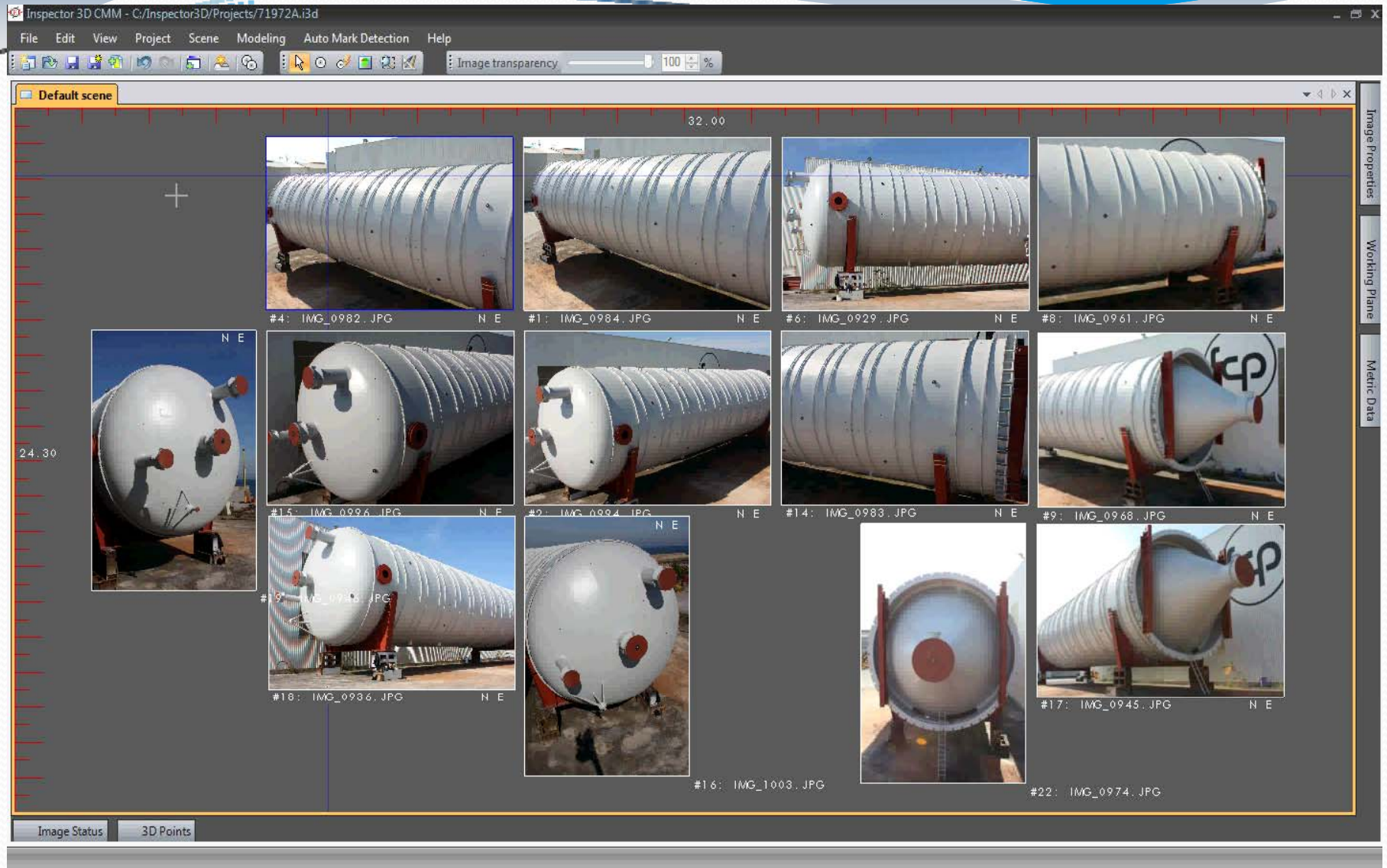
Referencia Coke	Fecha	Hora
1977C	27/11/10	11:55:00

Ref. Tubuladura	Valor Real	Valor Nominal	Tolerancia Superior	Tolerancia Inferior	Desvio (V.R. - V.N.)
S	1287,11	1275,00	11,00	-11,00	12,11
O	1288,85	1275,00	11,00	-11,00	13,85
K4/Z4	1291,22	1275,00	11,00	-11,00	16,22
P1	1336,61	1325,00	11,00	-11,00	11,61
F	1285,44	1275,00	11,00	-11,00	10,44
A3	1287,26	1275,00	11,00	-11,00	12,26
Z5	1333,70	1325,00	11,00	-11,00	8,70
K3/Z3	1286,47	1275,00	11,00	-11,00	11,47
M4	397,87	400,00	6,00	-6,00	-2,13
N1	2208,17	2170,00	25,50	-25,50	38,17
H	2170,61	2172,00	13,50	-13,50	-1,39
J3	1334,94	1325,00	11,00	-11,00	9,94
S	1287,11	1275,00	11,00	-11,00	12,11
O	1288,85	1275,00	11,00	-11,00	13,85
K4/Z4	1291,22	1275,00	11,00	-11,00	16,22
P1	1336,61	1325,00	11,00	-11,00	11,61
F	1285,44	1275,00	11,00	-11,00	10,44
A3	1287,26	1275,00	11,00	-11,00	12,26
Z5	1333,70	1325,00	11,00	-11,00	8,70
K3/Z3	1286,47	1275,00	11,00	-11,00	11,47
M4	397,87	400,00	6,00	-6,00	-2,13
N1	2208,17	2170,00	25,50	-25,50	38,17
H	2170,61	2172,00	13,50	-13,50	-1,39
J3	1334,94	1325,00	11,00	-11,00	9,94

Todos los valores están expresados en unidades milimétricas.



The metrologic report is ready to be exported.



PHOTOGRAMMETRY

15

ADVANTAGES

- Complete record of the vessel in several manufacturing stages
- Measurement is done *in situ* without stopping the production process
- No need to use platforms or scaffoldings
- Obtaining real registers of the equipment dimensions and status
- Reduction of inspection times (equipment and materials)
- More reliable measurements, more accurate system ($\sim 1/25,000$)
- Fast data acquisition and measurement procedures
- Exporting data to standard CAD/CAM systems for CAD comparison
- Dimensional control can be checked by customer and third parties
- END record embedded in final product documentation: traceability



THANK YOU