



KEMM
KAYNAK EĞİTİM VE MUAYENE MERKEZİ

NDT GÜNLERİ
“XII. Kaynak Kongresine Giderken”
9 Ekim 2021 Cumartesi / BAÖB Yerleşkesi - BURSA

Görsel Muayenede 3-Boyutlu Ölçüm Teknolojisi



NDT ELEKTRONİK CİHAZLAR
MÜMESSİLLİK İTHALAT İHRACAT
LTD.ŞTİ.



Waygate
Technologies

a Baker Hughes business

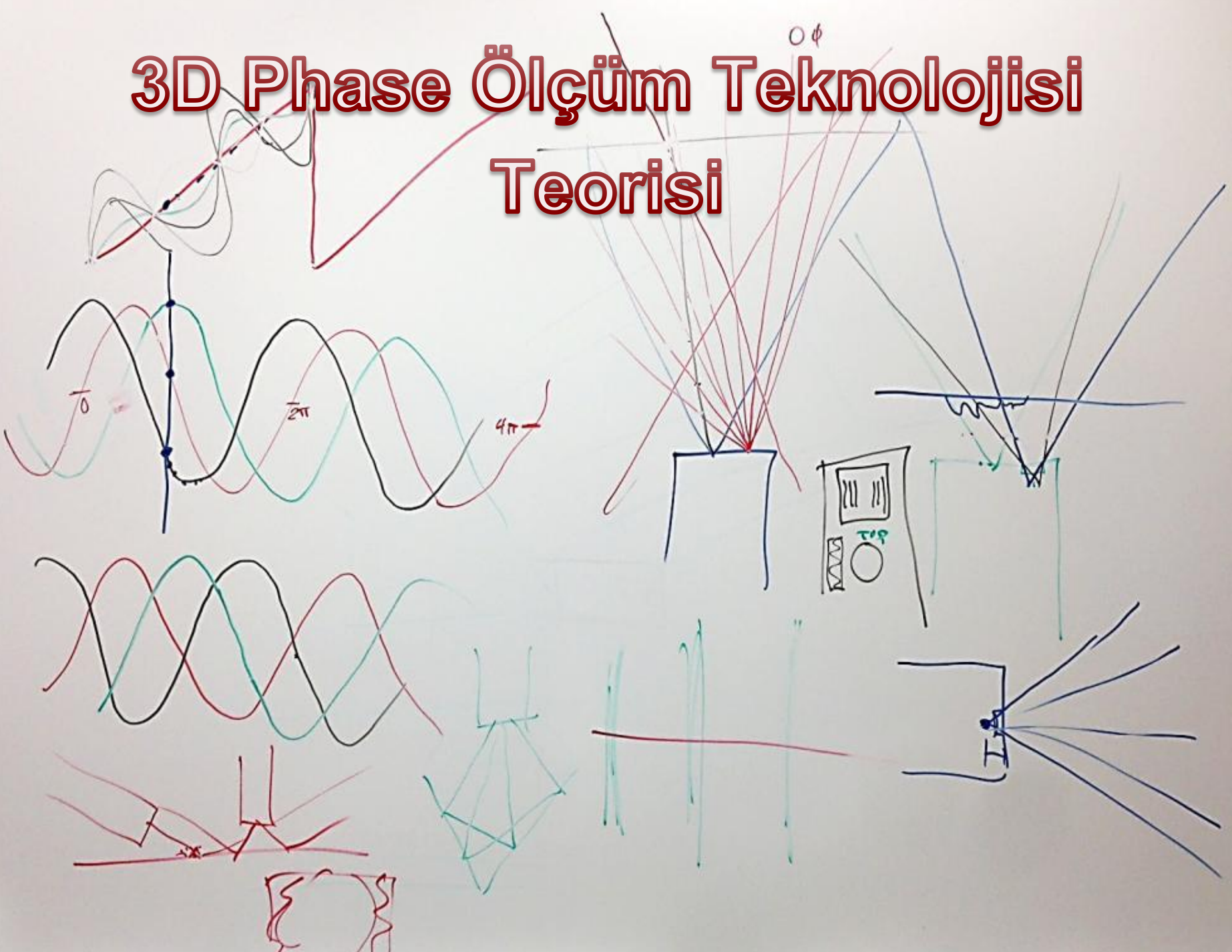
Görsel Muayene Teknolojisi

- ❑ Makinaların, dönen ekipmanların kurulum ve altyapıların içerisinde yüzey hatalarının Tahribatsız Muayenesi
- ❑ Görsel Tabanlı Teknoloji
- ❑ Görüntü | Ölçüm | 3-Boyut
- ❑ MVIQ| Mentor Flex | XL Detect



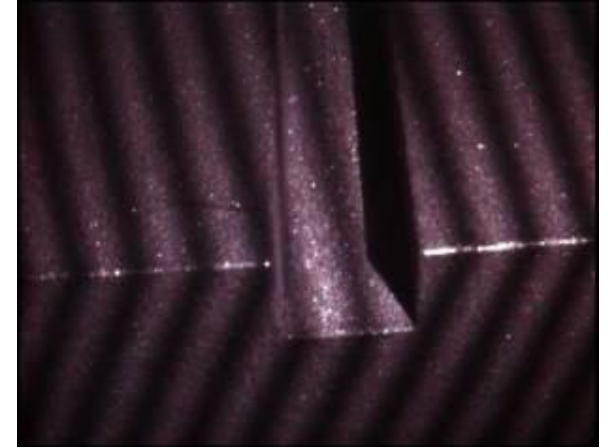
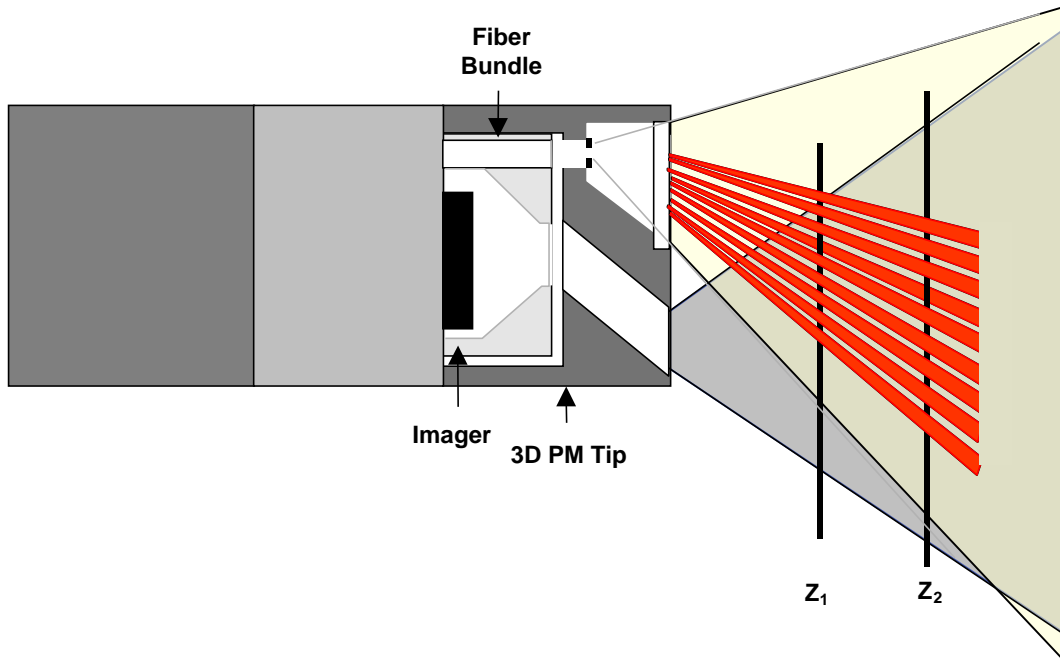
3D Phase Ölçüm Teknolojisi

Teorisi



3D Phase Ölçüm Teknolojisi

Kırmızı LED Işık yüzeye saçılır

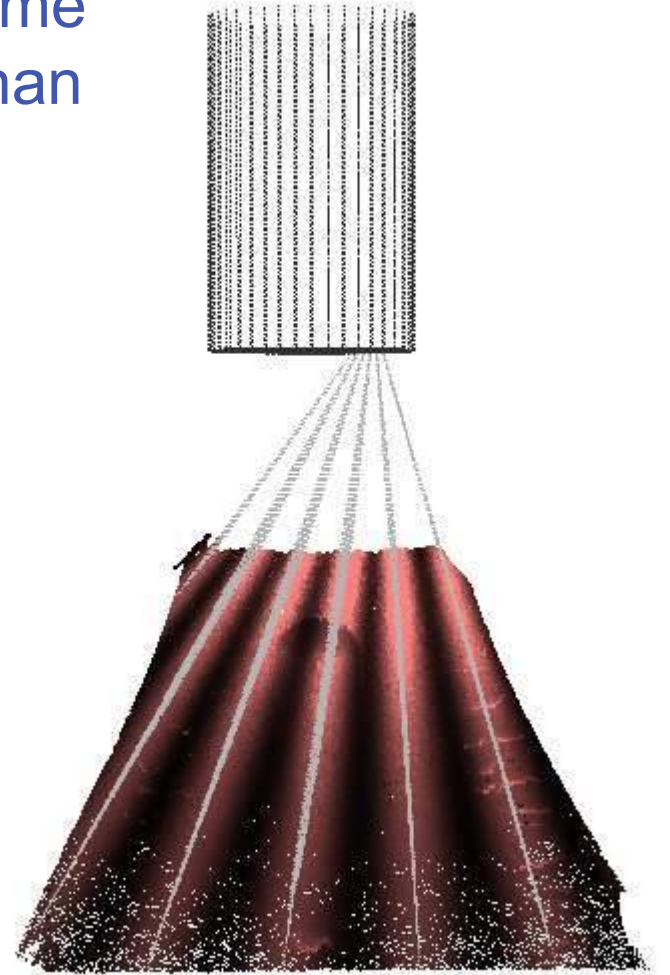


Saçılan bu ışık yapısal bir ışıktır:

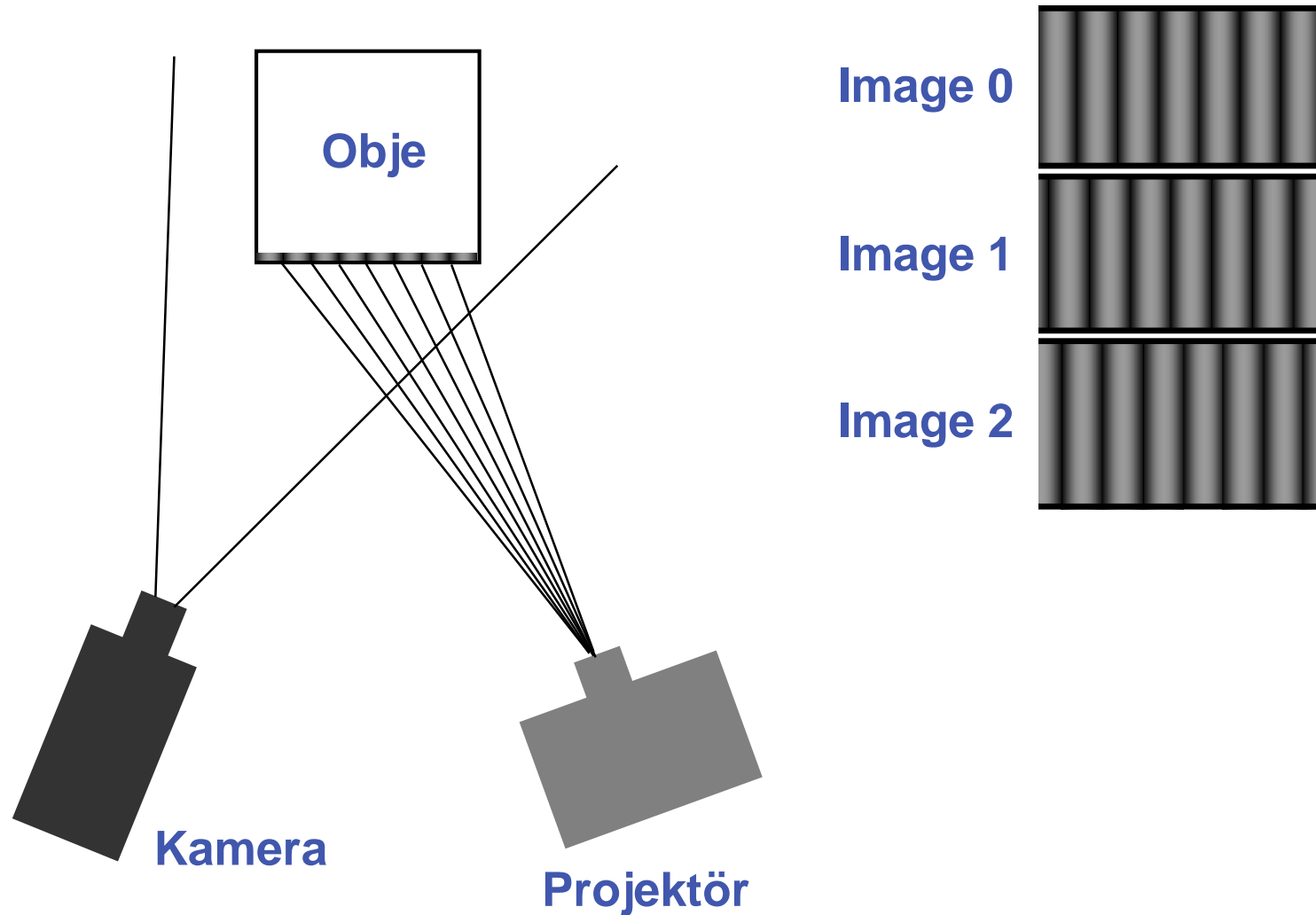
- 120 derece faz değişimi
- Sinusoidal Yoğunluğa sahiptir.

Optik Konfigürasyon

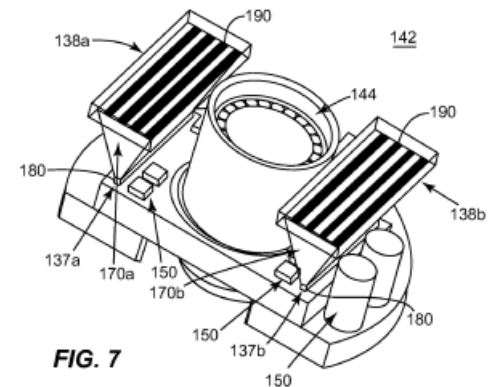
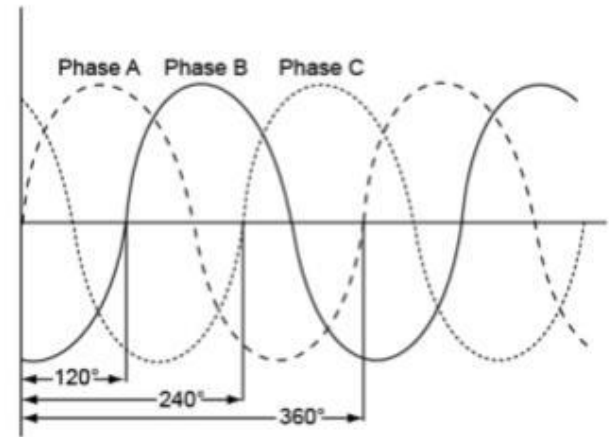
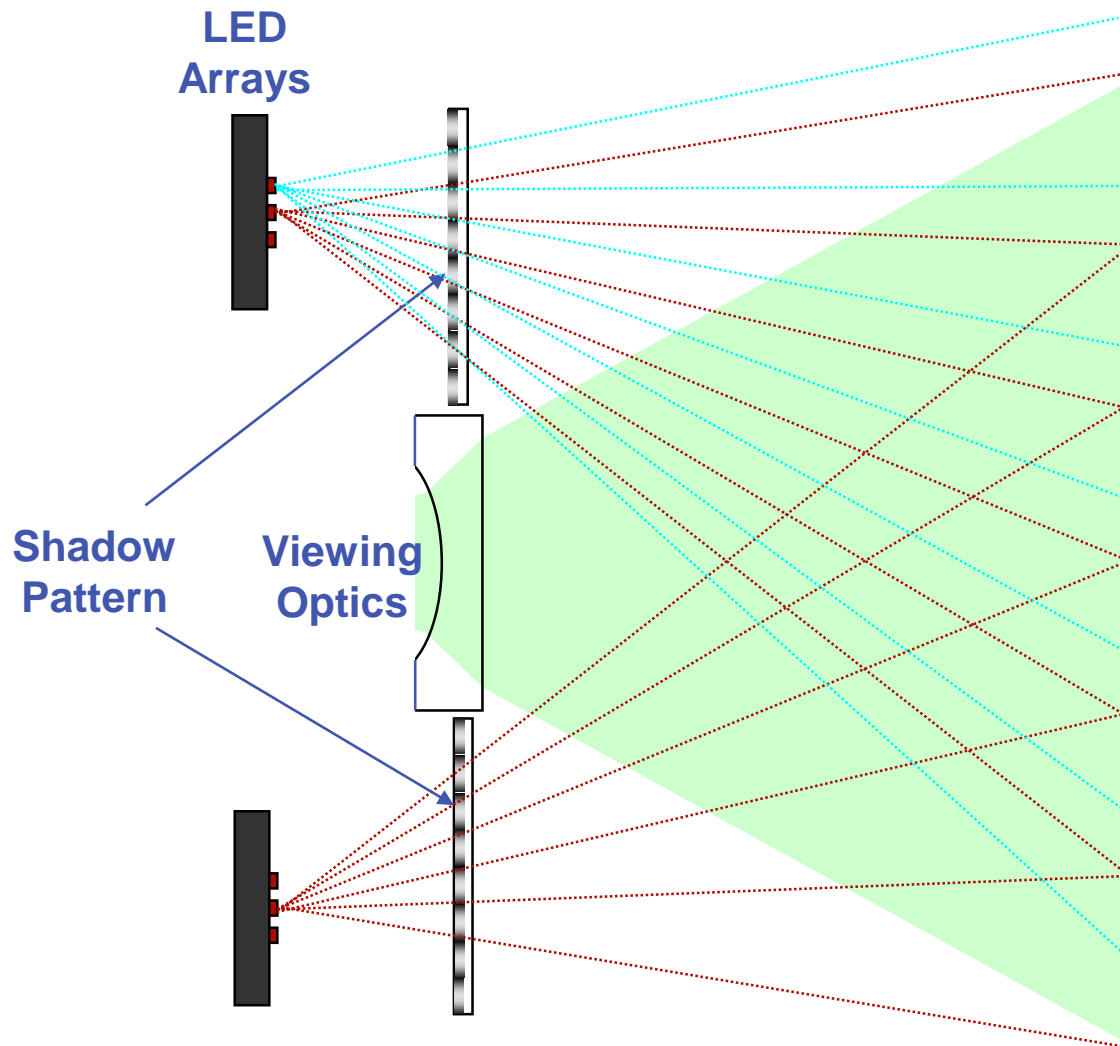
- ❑ Saçılan LED paternler, görüntüleme optiklerinin her iki tarafında bulunan 2 set LED kullanılarak yansıtılır.
- ❑ Her noktadaki obje mesafesi, kalibrasyondan bilinen model yörüngeleri (nirenge) kullanılarak hesaplanır.



Phase Shifting Tarama



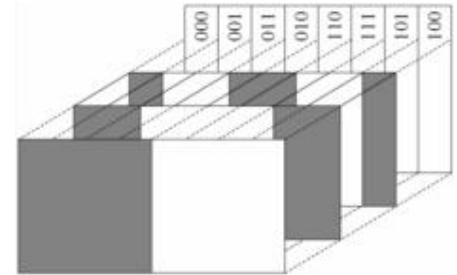
Phase Shifting in Mentor Visual IQ



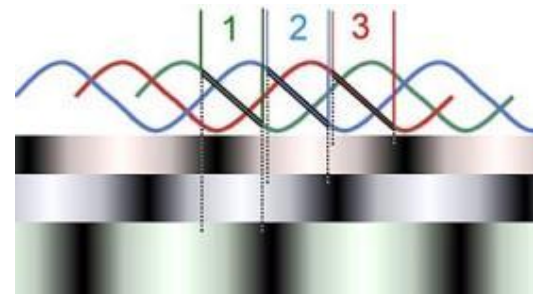
Phase Shifting Teknolojisi

Referanslar

- ❑ http://en.wikipedia.org/wiki/Structured-light_3D_scanner
- ❑ http://en.wikipedia.org/wiki/3D_scannerArea
- ❑ <http://www.vrac.iastate.edu/%7Esong/publications/papers/2006-oe-realtime.pdf>
- ❑ <http://patents.com/us-7821649.html>



By projection of a sequence of binary coded stripe patterns, the subsequent light levels for each scene pixel are forming a unique binary word revealing the individual stripe number. To minimize the effect of bit errors, the stripe patterns are designed to change only one bit per stripe (Gray codes)



At least 3 phase shifted gray gradient patterns are needed for a precision analysis of position from the gray values. Three simultaneous color patterns are also used in certain applications.

Fringe Phase Images



Fringe Phase Images

A grayscale image showing a curved surface, possibly a lens or a dome, with a series of interference fringes. The fringes are curved and follow the contour of the surface, indicating a phase shift across the field of view. The background is dark, and the fringes are lighter, creating a high-contrast pattern.

Fringe Phase Images

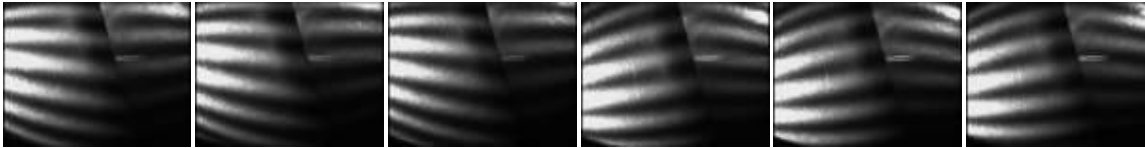


Image Capture

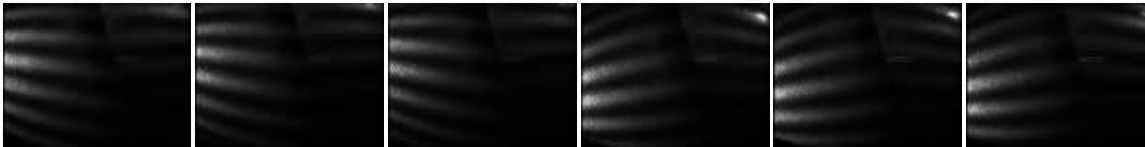
Test Fields



Middle Set x 3



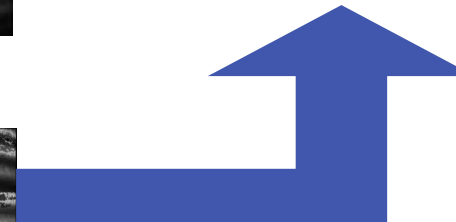
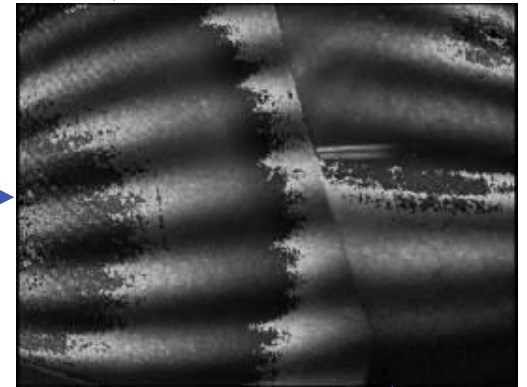
Dark Set x 1



Bright Set x 2



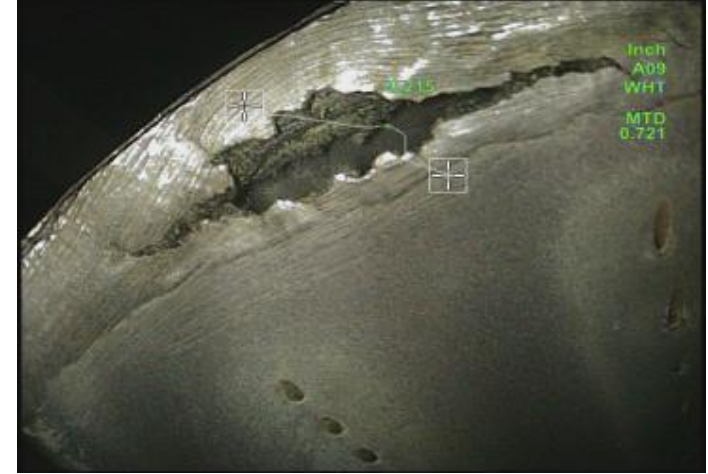
Merged Set



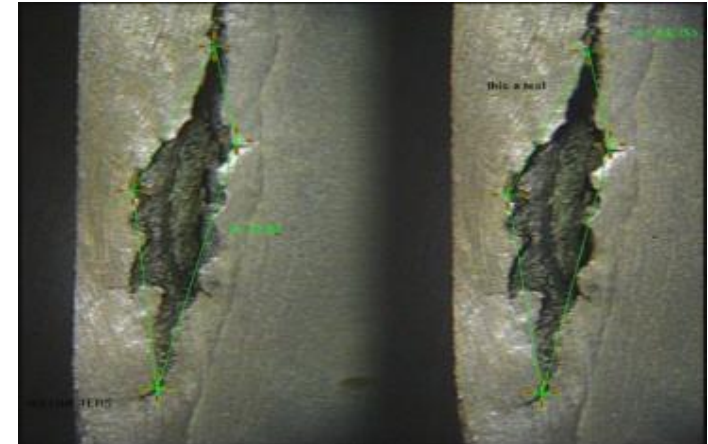
3D Yüzey Tarama Ölçümleri

Avantajlar:

- Hassas Ölçüm
- Bakış Açısı farketmeksizin Ölçüm
- Geniş Açılı 105° Görüş Açısı
- Otomatik Tip Tanıma
- 6 dan fazla Ölçüm Tipi



3D Surface Scan Measurement
(full-screen view)

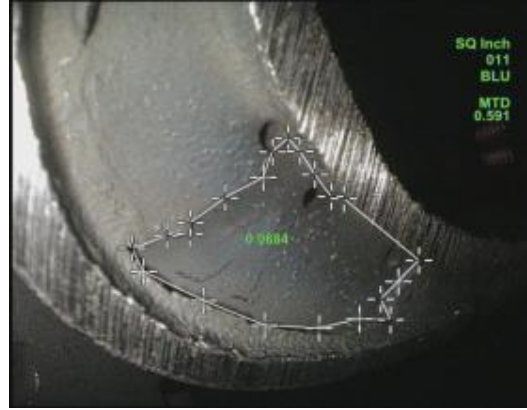


Stereo Measurement
(two half screen views)

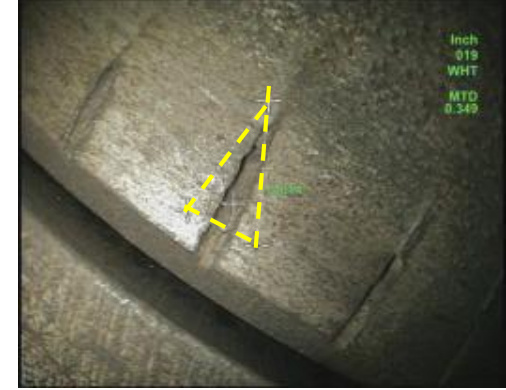
3 Boyutlu Yüzey Taraması Ölçüm Tipleri



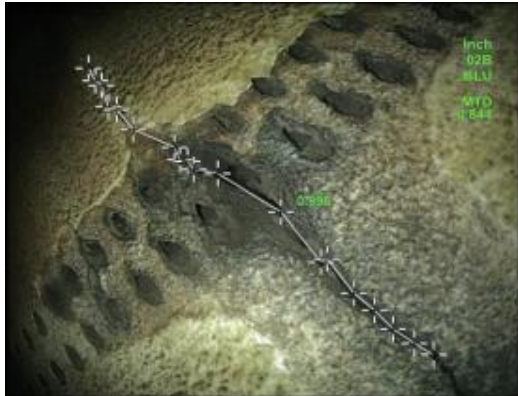
Mesafe



Alan Ölçümü



Derinlik Ölçümü



Çoklu Nokta / Çatlak Boyu Ölçümü

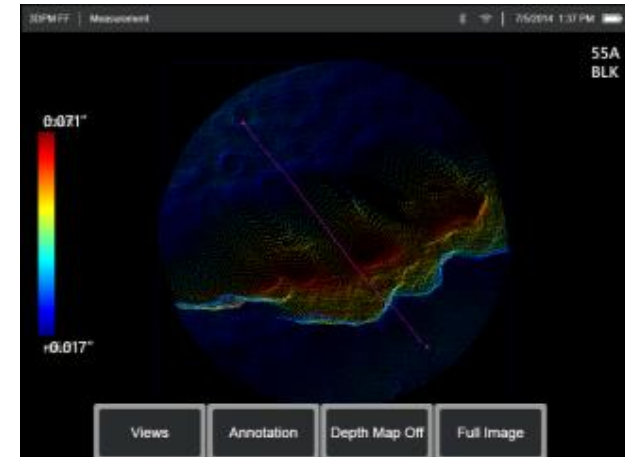
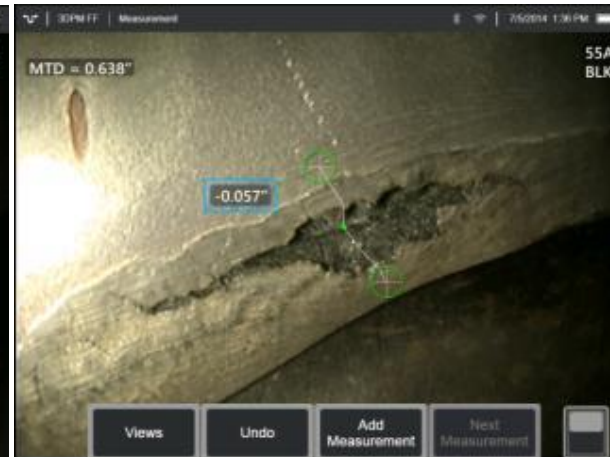
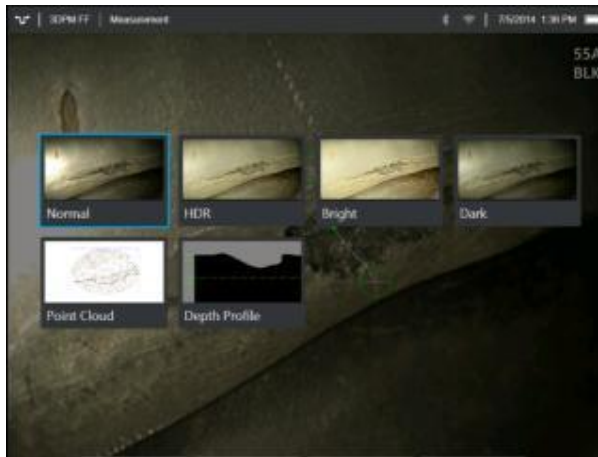
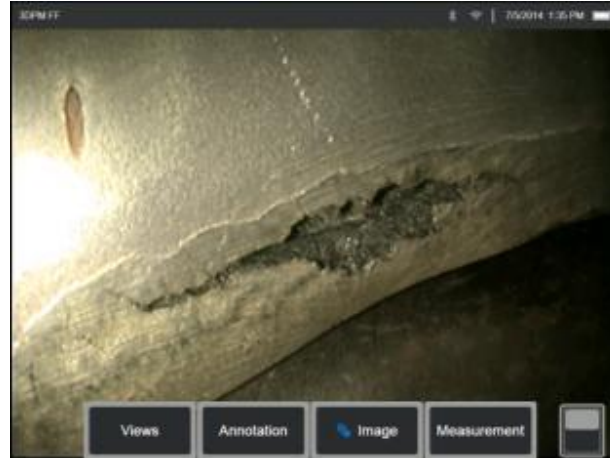


Nokta-Çizgi Mesafe Ölçümü



Derinlik Profili Ölçümü

MViQ – Kullanıcı Ölçüm Arayüzü



3DPM ÖRNEK ÖLÇÜMLER

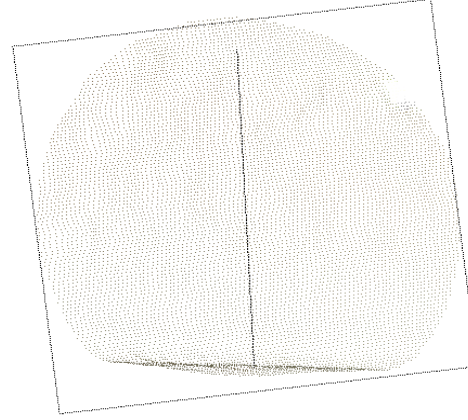


1/8/2018 6:32 AM

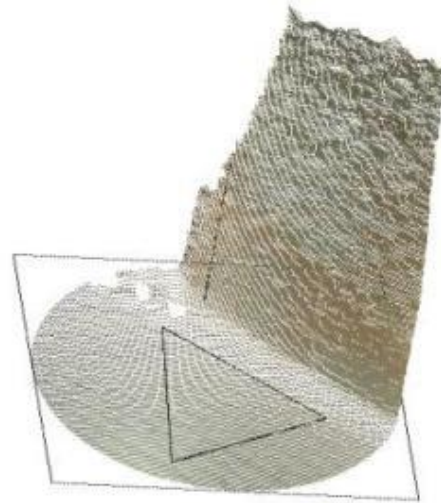


Nokta Bulutu Teknolojisi

Alınan Noktaların Doğrulanabilmesi ile – Ölçüm Hatalarının Önlenmesi



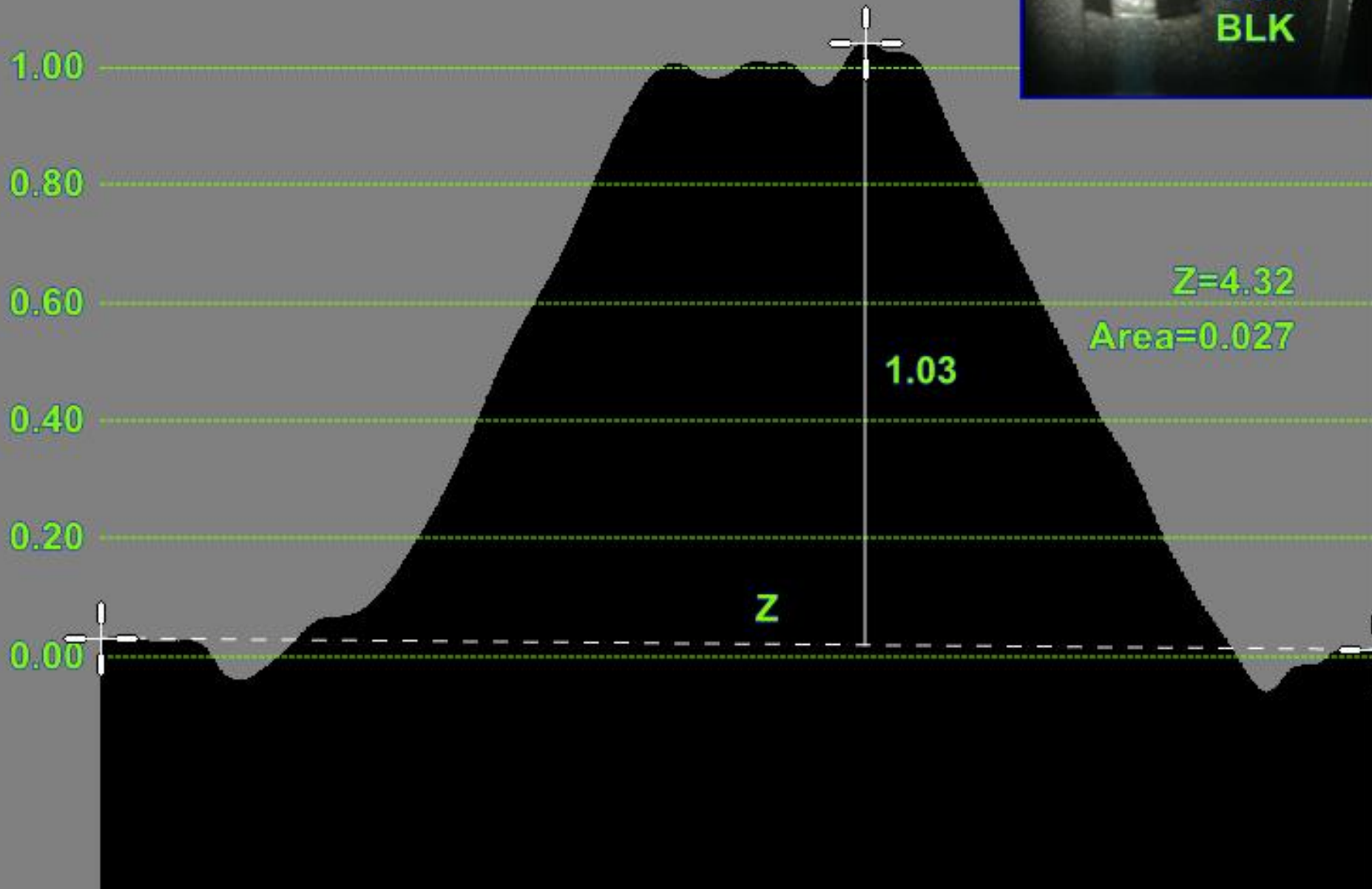
Yanlış !

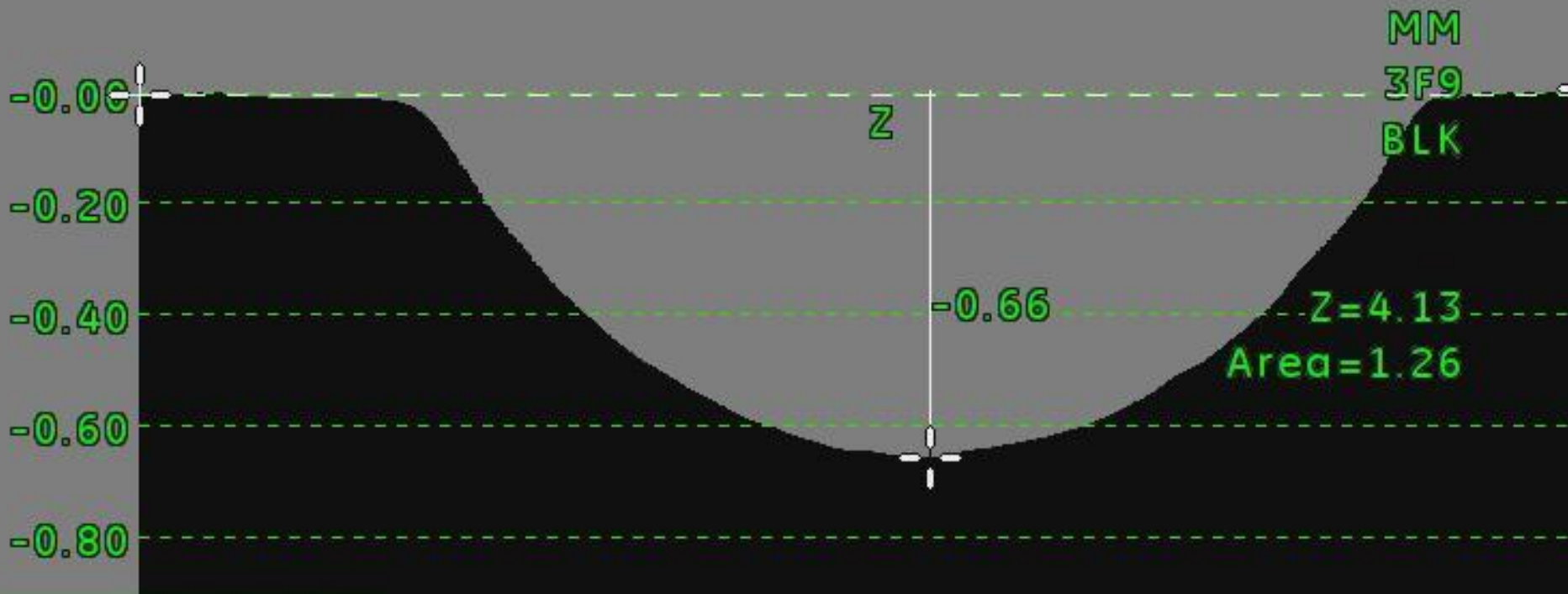


Doğru !



Profil Kesit Görüntüsü



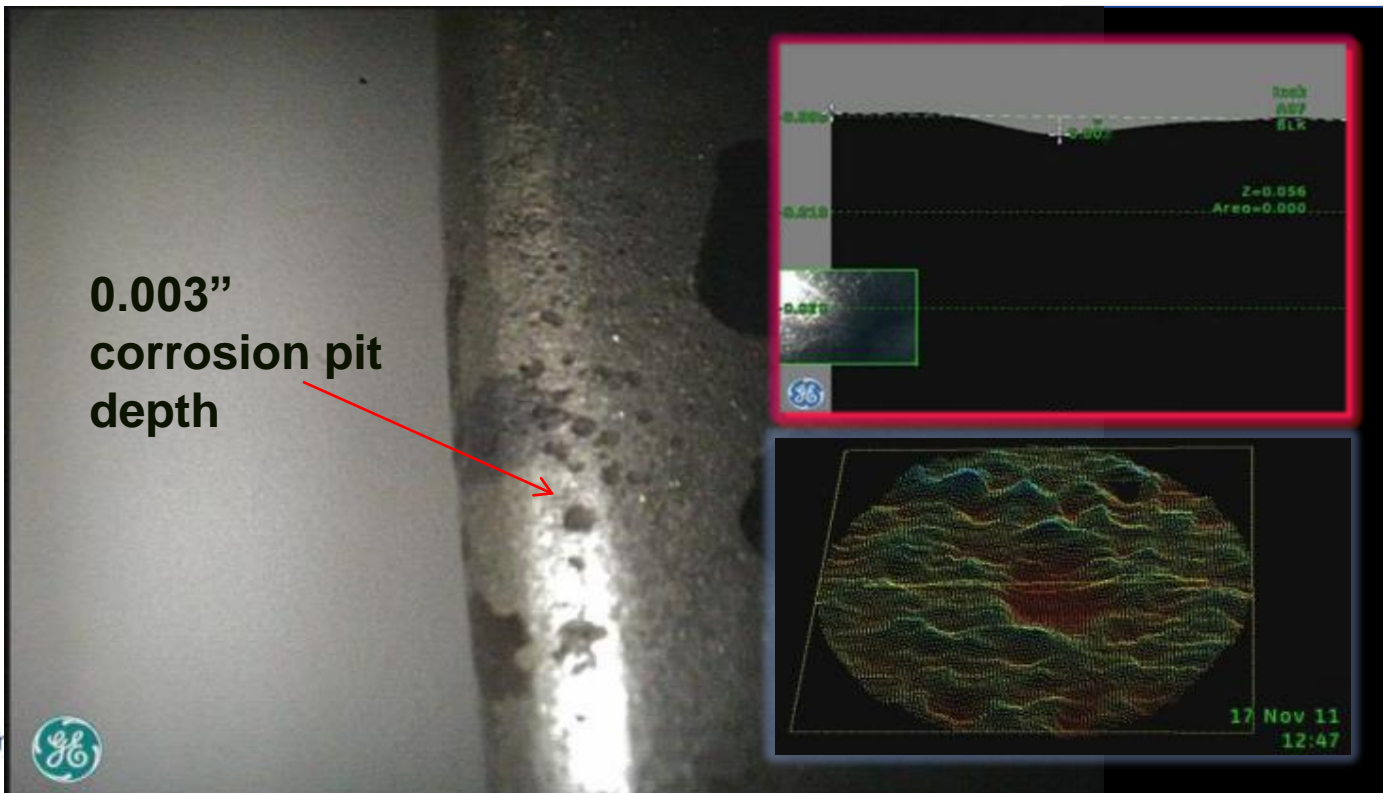


18 Mar 14
21:55



3 Boyutlu Yüzey Taraması

Korozyon Pitting Derinliği Ölçümü Profile View & Depth Map ile Ölçümü Doğrula



Görsel Muayenede 3DPM Uygulamaları

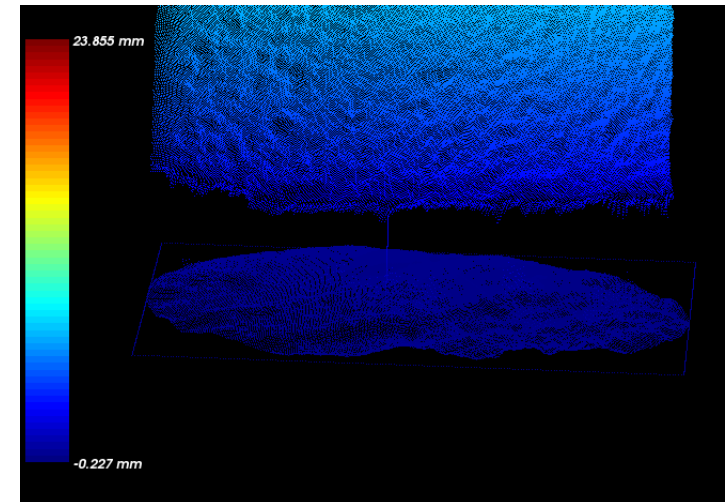
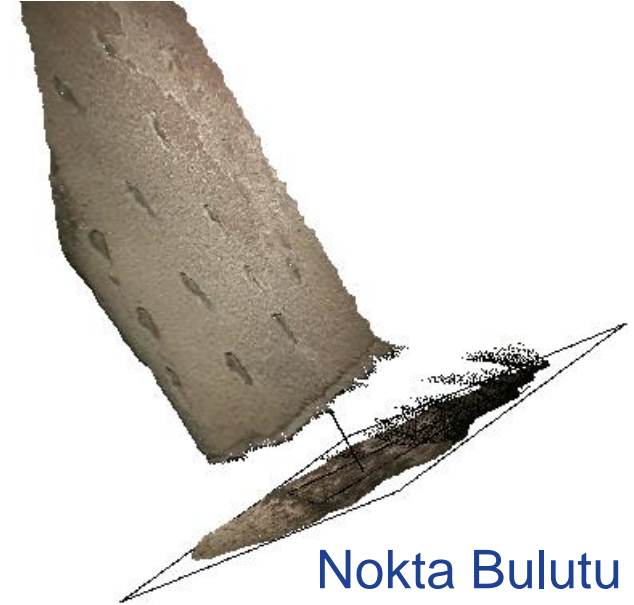


10.12.2020 12:06

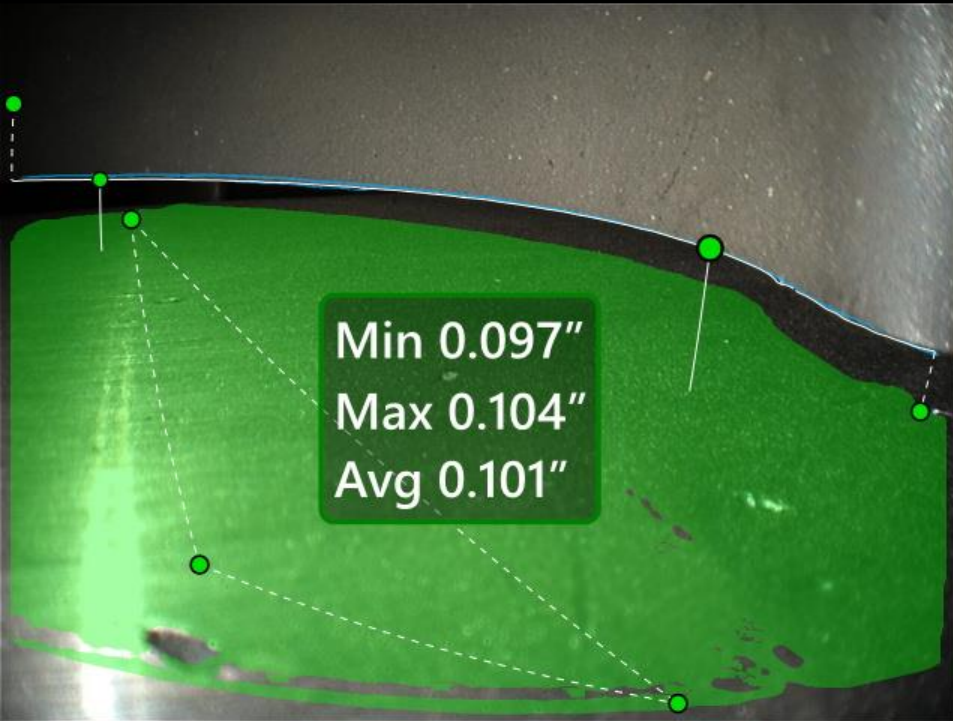
Dönen Ekipmanlar



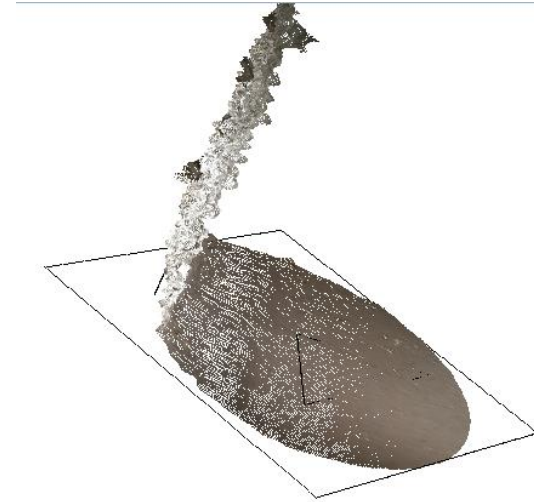
Türbin Kanat Uç Açıklık Ölçümü – PW4000



MTD = 0.833"



Yanma Odası tabandan 2mm yüksekteki hataların ölçümü



Nokta Bulutu



Çatlak Yolu Uzunluğu Ölçümü



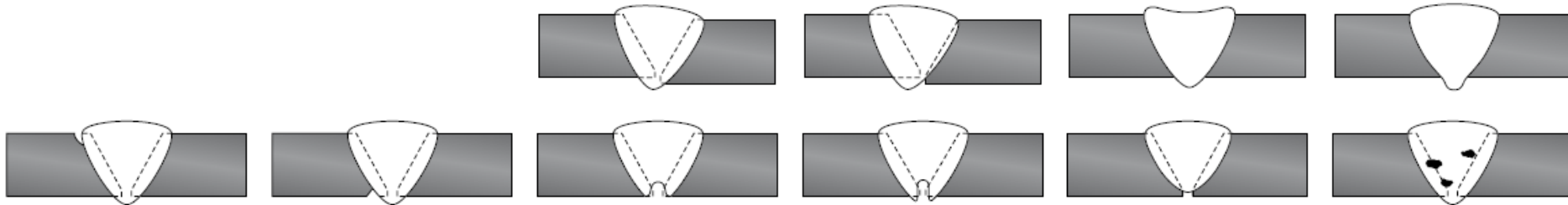
Nokta Bulutu

Kaynaklar



Kaynakların Görsel Muayenesi

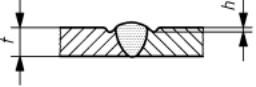
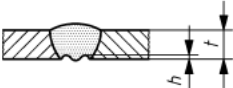
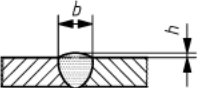
- ❑ Eksik nüfuziyet
- ❑ Undercut (Yanma Oluđu)
- ❑ Porozite (Yüzey)
- ❑ Çatlak
- ❑ Sıçramalar



Kaynak Ölçümleri

TS EN ISO 5817

Tabelle 1 (fortgesetzt)

Nr.	Ordnungs-Nr nach ISO 6520-1:1998	Unregelmäßigkeit Benennung	Bemerkungen	t mm	Grenzwerte für Unregelmäßigkeiten bei Be		
					D	C	
1.7	5011	Durchlaufende Einbrandkerbe Nicht durchlaufende Einbrandkerbe	Weicher Übergang wird verlangt. Wird nicht als systematische Unregelmäßigkeit angesehen. 	0,5 bis 3	Kurze Unregelmäßigkeit: $h \leq 0,2 t$	Kurze Unregelmäßigkeit: $h \leq 0,1 t$	
	5012			> 3	$h \leq 0,2 t$, aber max. 1 mm	$h \leq 0,1 t$, aber max. 0,5 mm	$h \leq 0,05 t$, aber max. 0,5 mm
1.8	5013	Wurzelkerbe	Weicher Übergang wird verlangt. 	0,5 bis 3	$h \leq 0,2 \text{ mm} + 0,1 t$	Kurze Unregelmäßigkeit: $h \leq 0,1 t$	Nicht zulässig
				> 3	Kurze Unregelmäßigkeit: $h \leq 0,2 t$, aber max. 2 mm	Kurze Unregelmäßigkeit: $h \leq 0,1 t$, aber max. 1 mm	Kurze Unregelmäßigkeit: $h \leq 0,05 t$, aber max. 0,5 mm
1.9	502	Zu große Nahtüberhöhung (Stumpfnah)	Weicher Übergang wird verlangt. 	$\geq 0,5$	$h \leq 1 \text{ mm} + 0,25 b$, aber max. 10 mm	$h \leq 1 \text{ mm} + 0,15 b$, aber max. 7 mm	$h \leq 1 \text{ mm} + 0,1 b$, aber max. 5 mm



Kaynak Muayenesi Konvansiyonel Metotlar

- ❑ Sertlik Ölçüm
- ❑ Özel gereçler
- ❑ CMM

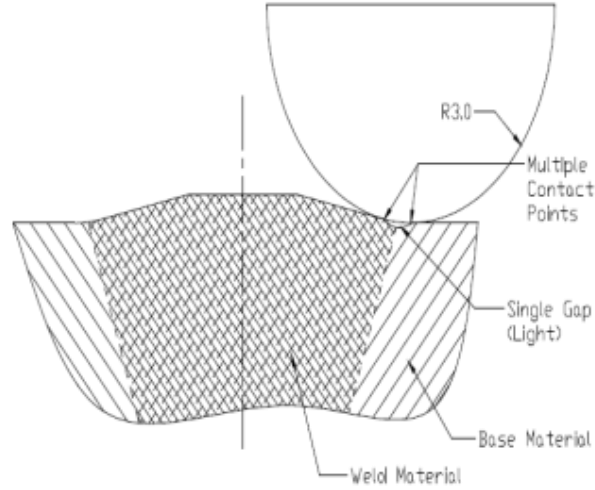


Figure 7.3 Unacceptable Radius Profile



Kök Paso Sonrası İç Yüzey Kaynak Görşel Muayenesi



Kaynak Ölçümü



Example

Sub-Sea Weld Spec Requirement

7.2 CRA Clad CS Pipe Girth Weld Supplementary Criteria

For CRA clad carbon steel pipe the internal CRA layer / integrity shall be guaranteed under all conditions. The field applied inspection method for sentencing of the defect shall be as qualified during PQT. Acceptance criteria shall include:

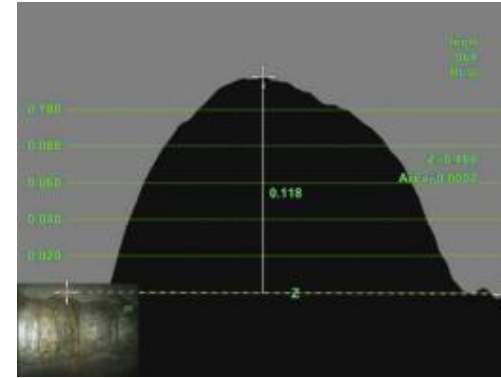
7.2.1 For Laybarge welding

- Root penetration shall not exceed 3 mm.
- Root concavity shall not exceed 1 mm smoothly merging.
- Misalignment shall not exceed 1 mm.
- Undercut shall not exceed 0.5 mm.
- Lack of penetration / fusion shall not be permitted.
- Cracks shall not be permitted.
- Burn through shall not be permitted.
- Surface breaking porosity within the root pass shall not be permitted.
- Discolouration / Oxidation level as per WPQR.
- Clad base material indications 0.5 mm.

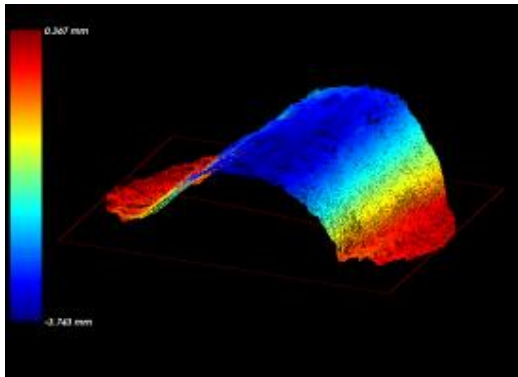


3B Yüzey Profili

- ❑ Profil Kesit
- ❑ Nokta Bulutu
- ❑ Derinlik Haritası
- ❑ Derinlik Profili



Kaynağın “B Tarama Görüntüsü”



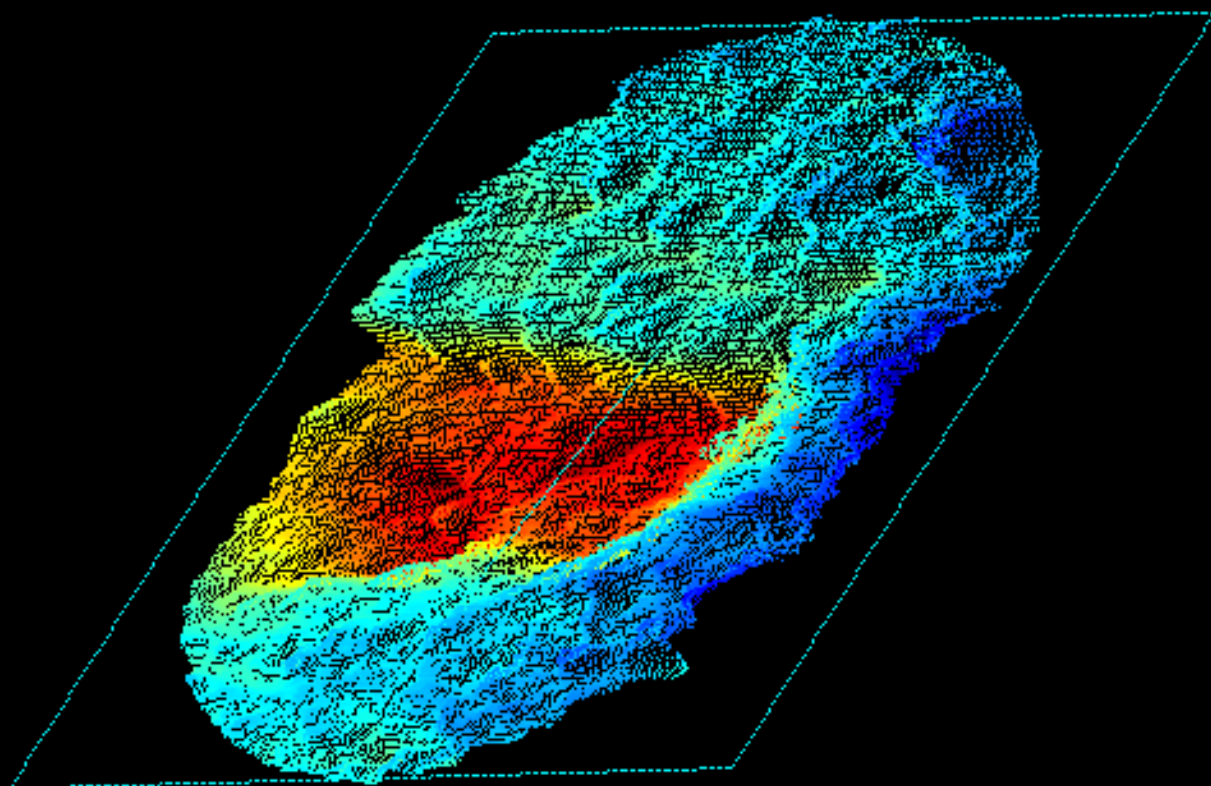


06 Mar 13
15:15



1.492 mm

-0.872 mm



Kaynak Kep Yükseklik Ölçümü

MM
29A
BLK
MTD
17.53

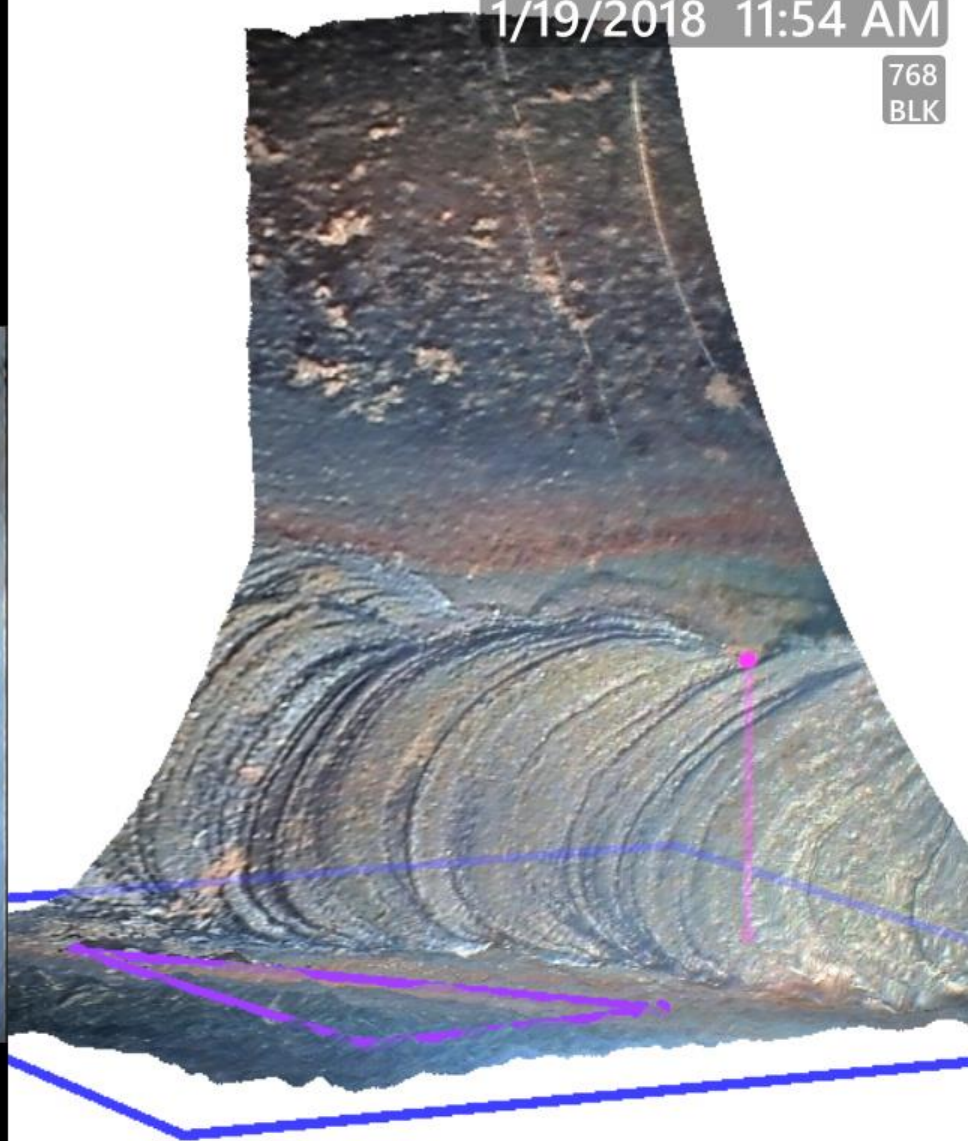
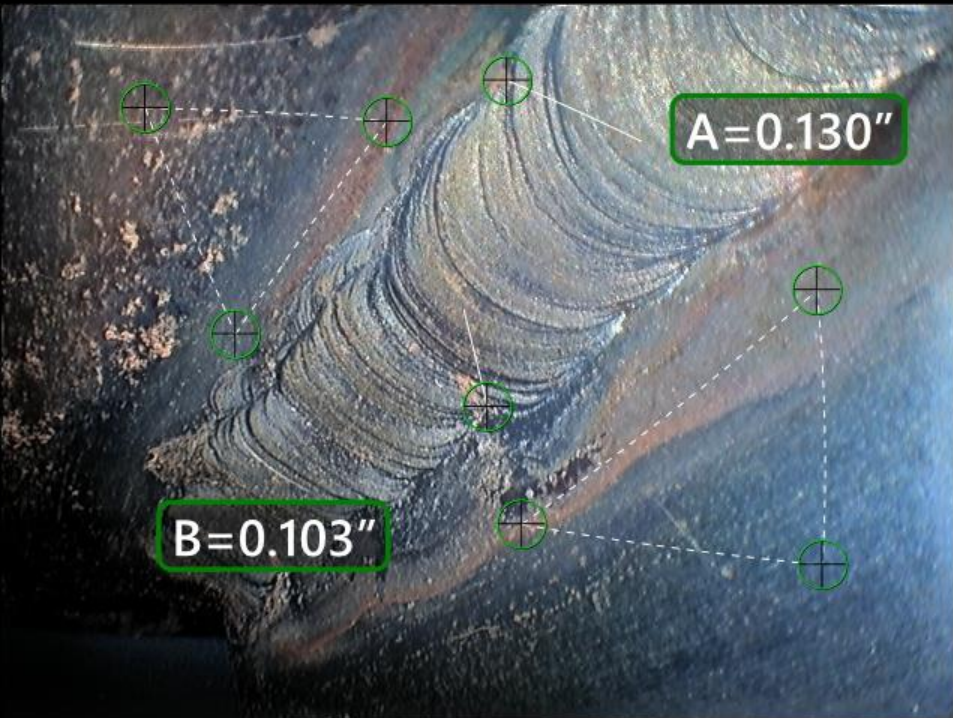
0.77

01 Mar 13
14:59



1/19/2018 11:54 AM

768
BLK



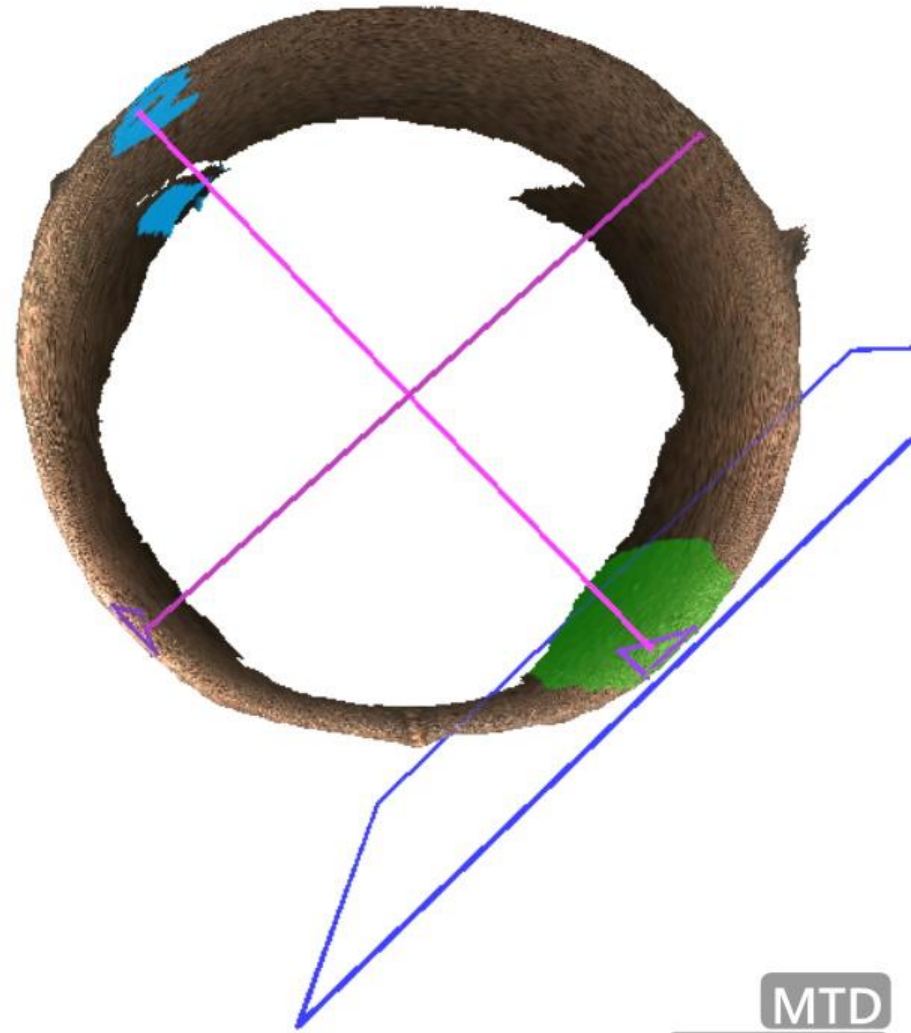
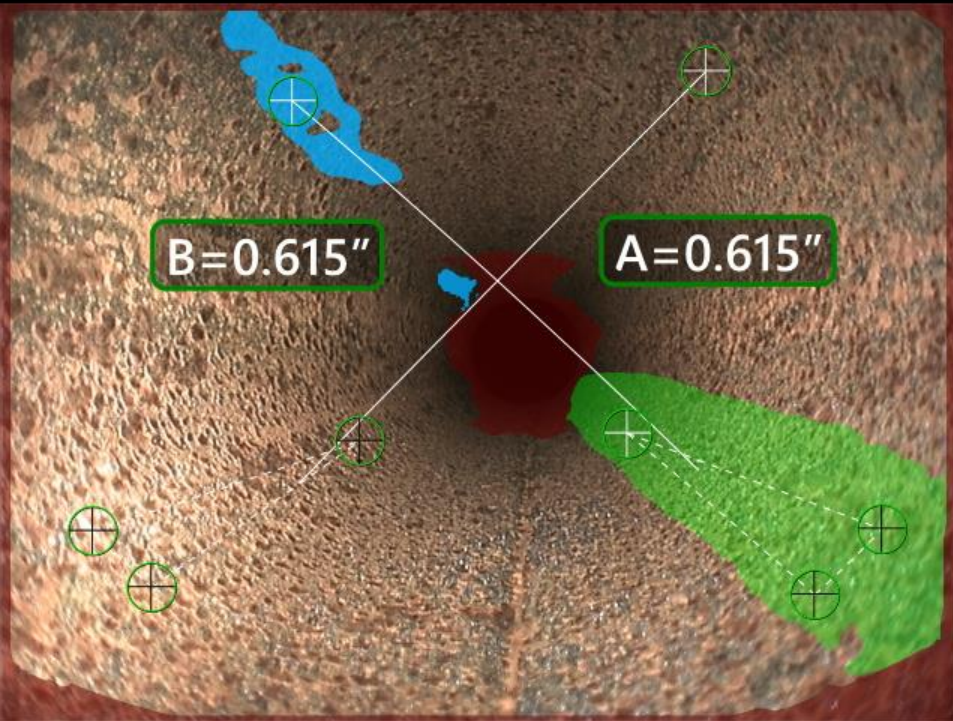
MTD

$A=0.584''$

$B=0.653''$

Kazan Boruları Korozyon Ölçümü





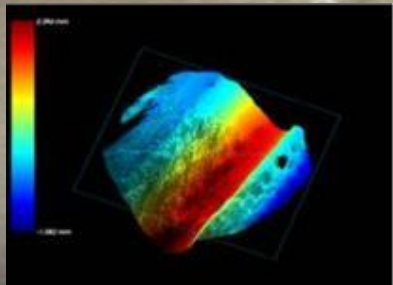
MTD
A=1.077"
B=1.298"

Kazan Boruları Korozyon Ölçümü

MM
016
BLK
MTD
15.28

-2.30

11 Sep 13
15:12



Boru Hatları Korozyon Analizi

11 Aug 12
16:07



Aşınmalar

Inch
054
BLK
MTD
0.346

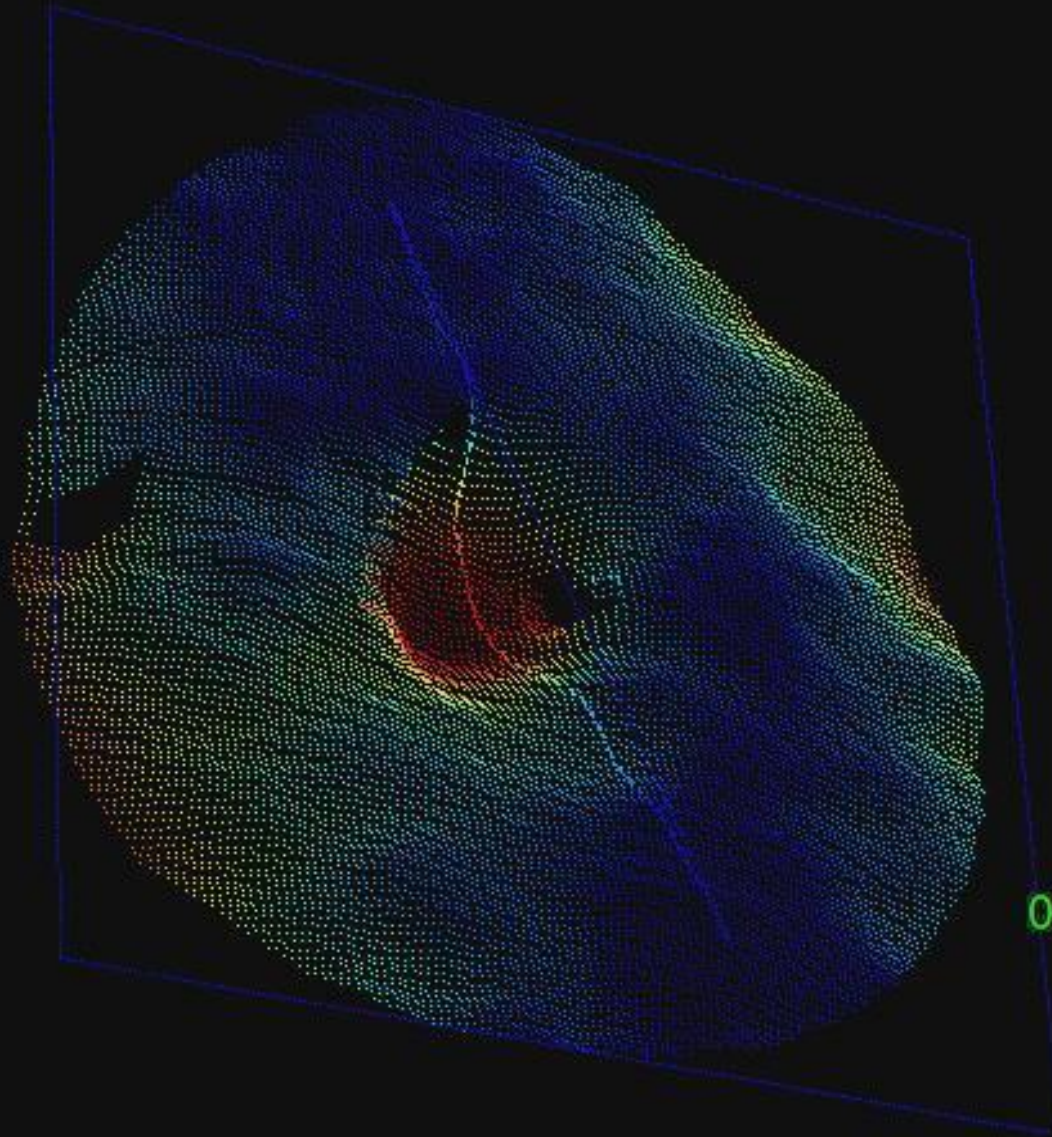


TUBE 78 ROW 26

Pitting

0.006 in

-0.001 in



044
BLK

02 May 11
14:37



Videoprobe Metroloji Optik Değerler

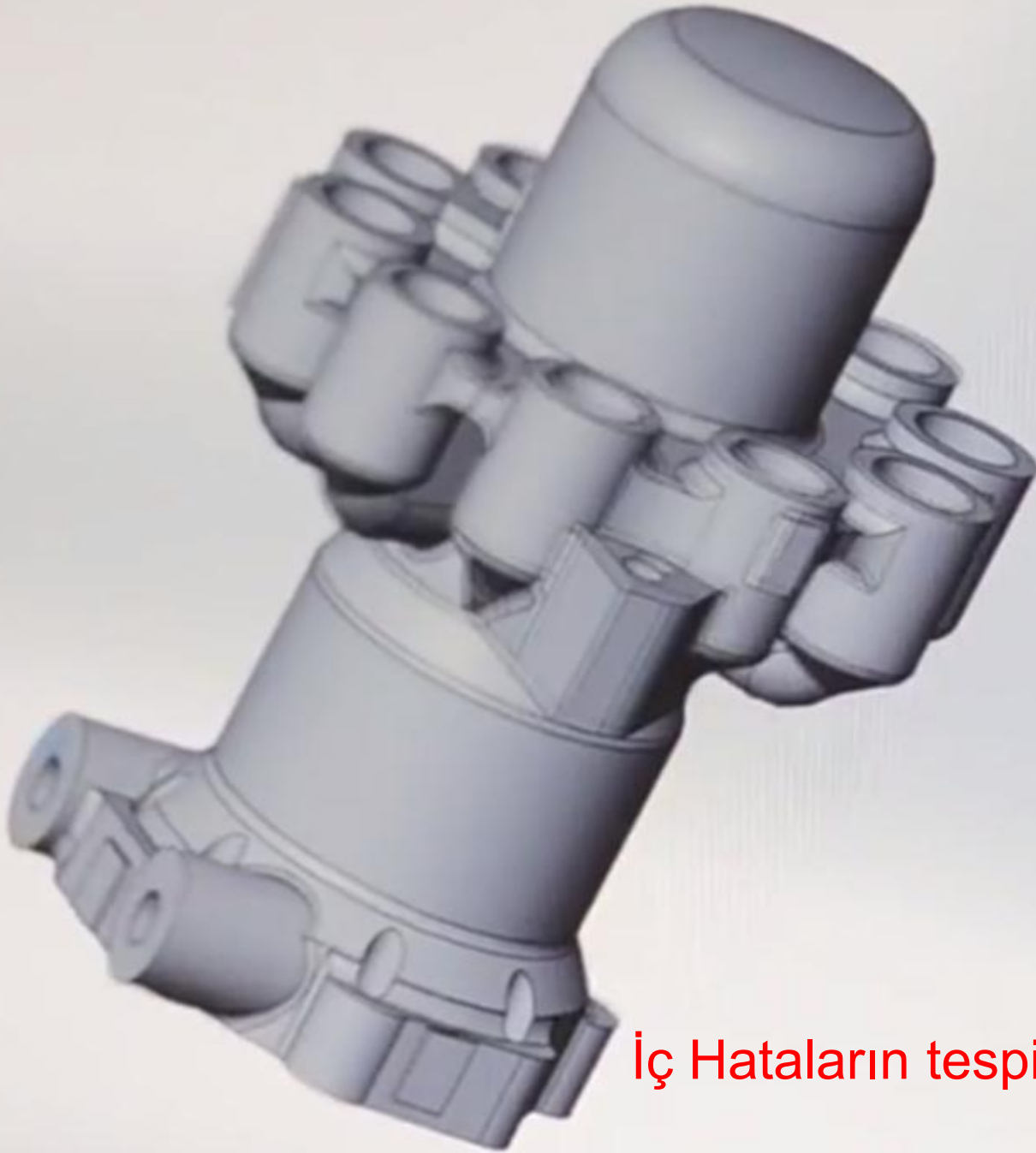


Part Number	Color	DOV	FOV	DOF	Description	Mag on G3 monitor ("full screen")
XL4TM611 05SG	Blue	Side	105°	6 - 250mm (0.24 – 9.84 in)	Standard Side 3DPM tip	11 (8mm)
XL4TM611 05FG	Black	Forward	105°	8 - 250mm (0.31 – 9.84 in)	Standard forward 3DPM tip	11 (8mm)
XL4TM611 05FN-8651	Orange	Forward	105°	3 - 120mm (0.12 – 4.72 in)	Close-focus forward 3DPM tip	24(3mm)



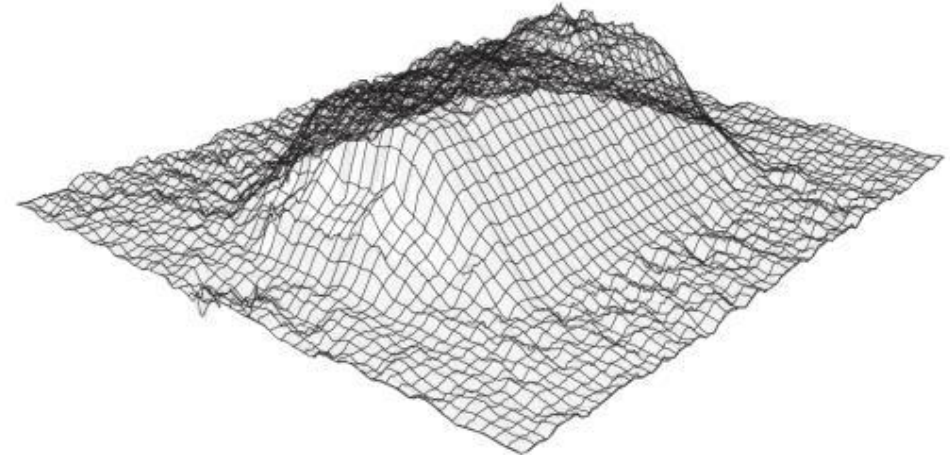
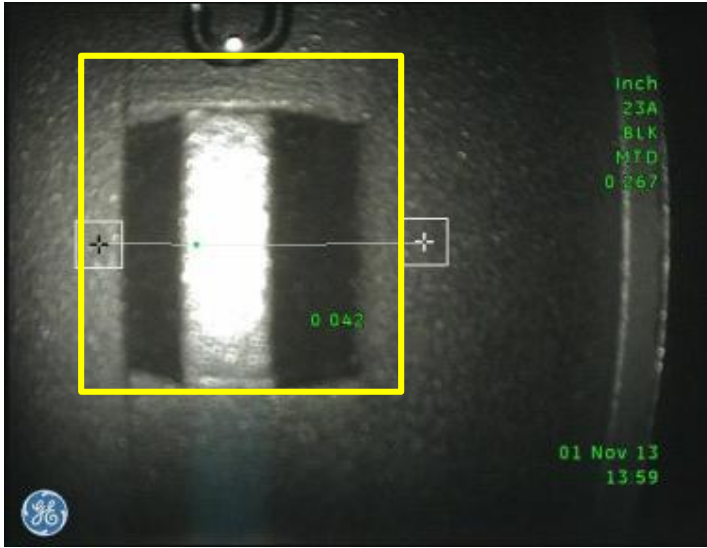
Tersine Mühendislik





İç Hataların tespiti için çözümler

3DPM GÖRÜNTÜLERİNİN CAD DOSYASINA DÖNÜŞTÜRÜLMESİ



Volume = 6.54016694 cubic mm

