



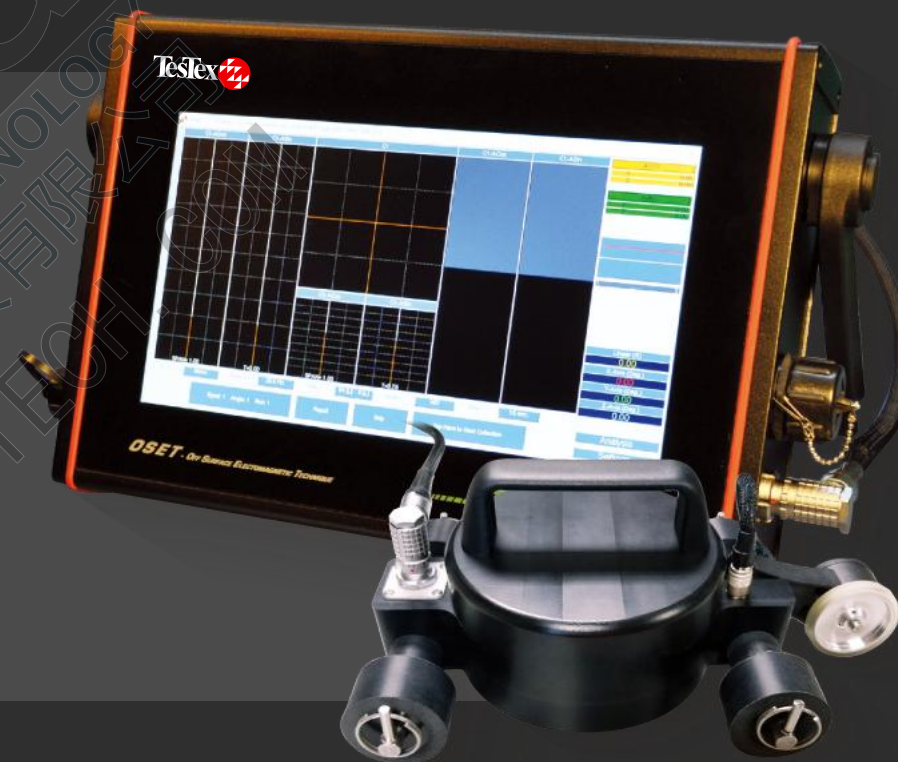
OSET – CUI Detection

Off Surface Electromagnet Technology
离面电磁检测技术 - 保温层下腐蚀检测

SCOUT

Corrosion Under Insulation Detection System

保温层下的
管道腐蚀检测系统



OSET 技术原理



Each excitation coil is used to excite low-frequency electromagnetic fields. The magnetic field will penetrate the insulation layer and outer jacket and directly enter the pipe wall. Defects in the tube wall will cause the magnetic field to deform, and this signal can be detected by the receiving coil. The signals acquired by the system are divided into two channels. The differential signal is used to detect "defects" such as welds and pitting corrosion, while the absolute channel is used to detect large-area corrosion.

Inspection Capabilities of OSET

产品检测能力



Inspection Sensitivity 检测灵敏度

Pits with a diameter of 5 mm, or 10% of wall-loss
5毫米直径的点蚀、10%壁厚减薄



Applicable Defect Types 可检测缺陷类型

- Large Corrosion on internal Surface
内壁较大区域腐蚀
- Surface & Sub-surface Corrosion (wall-loss, pits)
检测表面及内表面腐蚀 (管壁腐蚀、点蚀)
- Wall perforation
检测表面穿透孔
- Weld location detection
检测出焊缝位置



Inspection Efficiency 检测效率

Could change by other variables, i.e. accessibility and pipe's geometric shape
根据容器、管道直径和其他变量而定，如：易接近性和管道形状等



Sub-surface penetration 穿透能力

- Penetration of with thickness of max. 200mm
可穿透保温层最大厚度为200mm
- 可穿透容器、管道最大壁厚为40mm

Inspection Capabilities

检查能力



▼ 目前检测能力 Current Capabilities

护套材质 Jacket material		不锈钢 Stainless	铝 Aluminum	镀锌 Galvanized
护套厚度 Jacket Thickness		2.5 mm	2.5 mm	2.5 mm
绝缘层 厚度 Insulation thickness	焊缝检测 Weld detection	≤ 100 mm	≤ 75 mm	≤ 50 mm
	壁损检测 Wall loss detection	≤ 100 mm	≤ 100 mm	≤ 50 mm
	点蚀检测 Pit detection	≤ 100 mm	≤ 100 mm	不适用 N/A

▼ 检测效率 Productivity

根据管道直径和其他变量，如：易接近性和管道几何形状，目前OSET技术能达到每轮至少1000管的检测效率。

Productivity of up to 1000 linear ft./shift can be achieved, depending on the pipe diameter and other variables such as accessibility and pipe geometry.



Testing Scenarios

检查场景

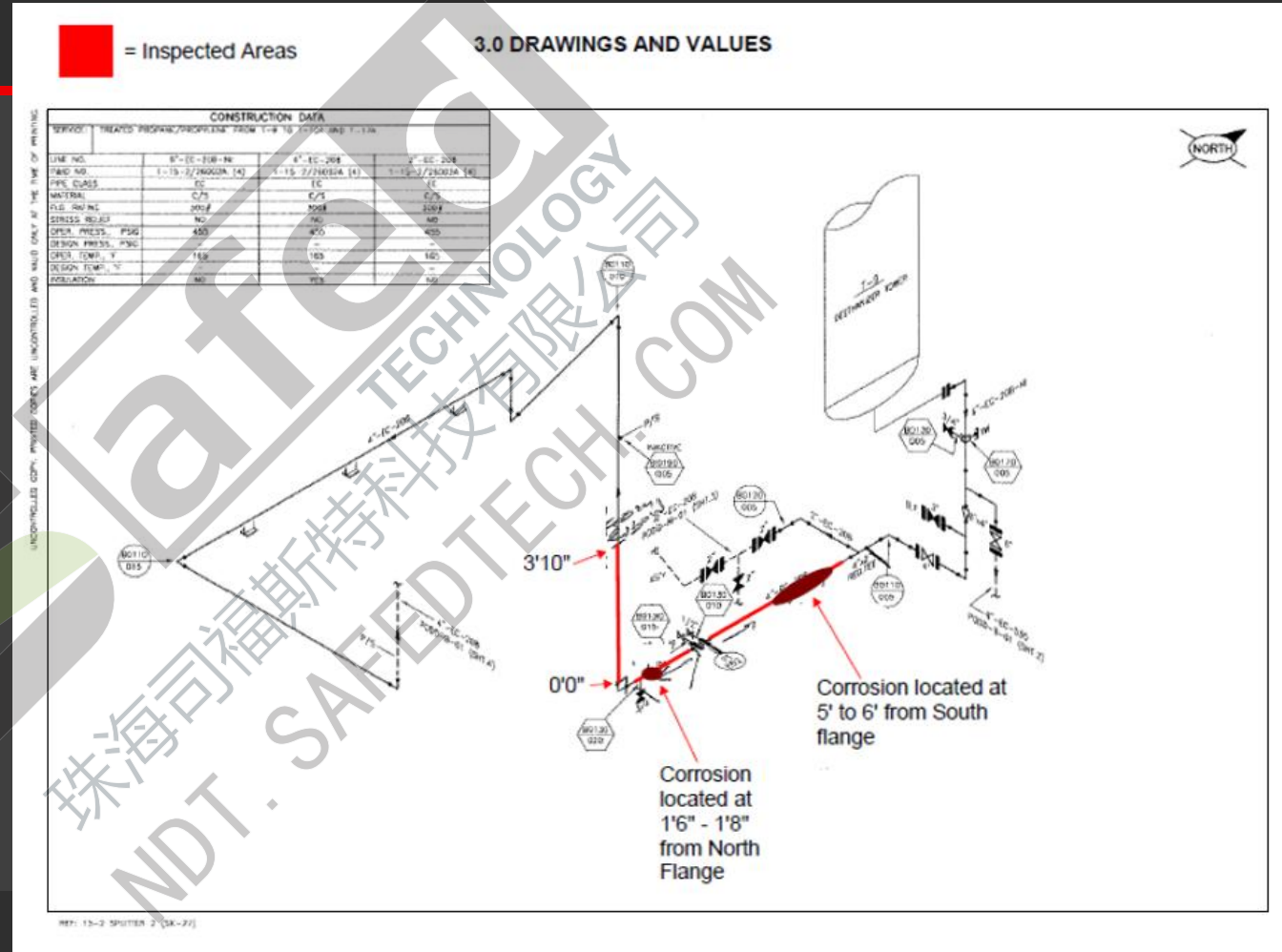


Report Samples

报告示例

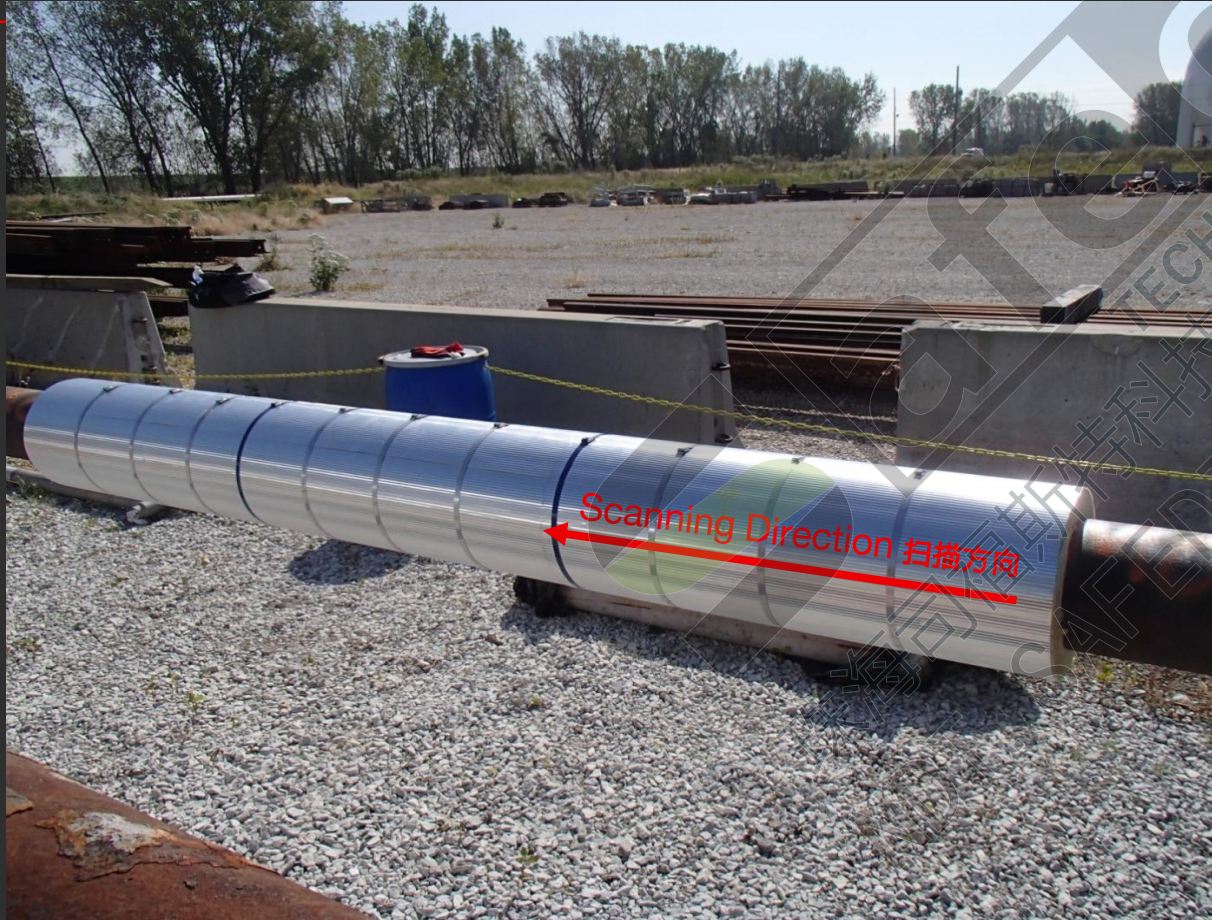
案例中包含被受测管道的图像，被扫描的部分及所有操作者指示的位置。放置在实际管道上的物质也能被标示。

Reports can include drawings of the pipes that were inspected, sections that were scanned, and locations of any indications. Physical markers can also be placed on the actual piping.



Report Samples

报告示例



此照片展示了进行OSET技术测试，扫描部份管道之情形。受测物体为从生产在线移除之管道，管道上有自然腐蚀。

Picture of a pipe scanned as part of a test of the OSET technology. This was a pipe with natural corrosion that was removed from a process line.



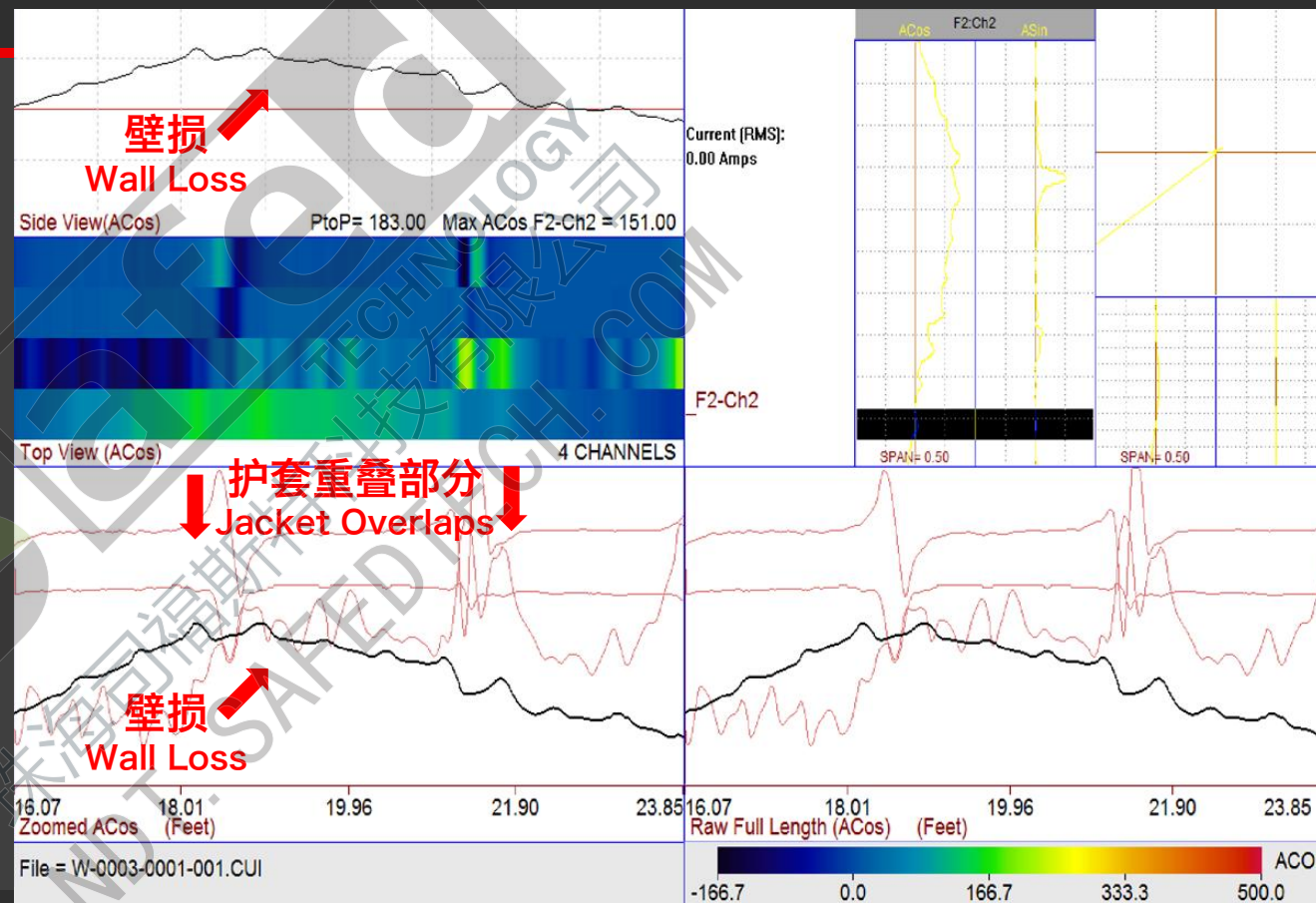
Report Samples

报告示例



Wave form from the scan of the “3:00 O'clock” position of the pipe pictured in the previous slide. Note the fairly large deviation from the base line in the upper left section of the wave form, indicating the corrosion at the 3:00 O'clock position.

此图展示了上一张图中管道「三点钟方向」位置的扫描波形图。注意，在波形图基线的左上方有大幅度的波形偏差，代表该管道三点钟方向的位置有腐蚀。



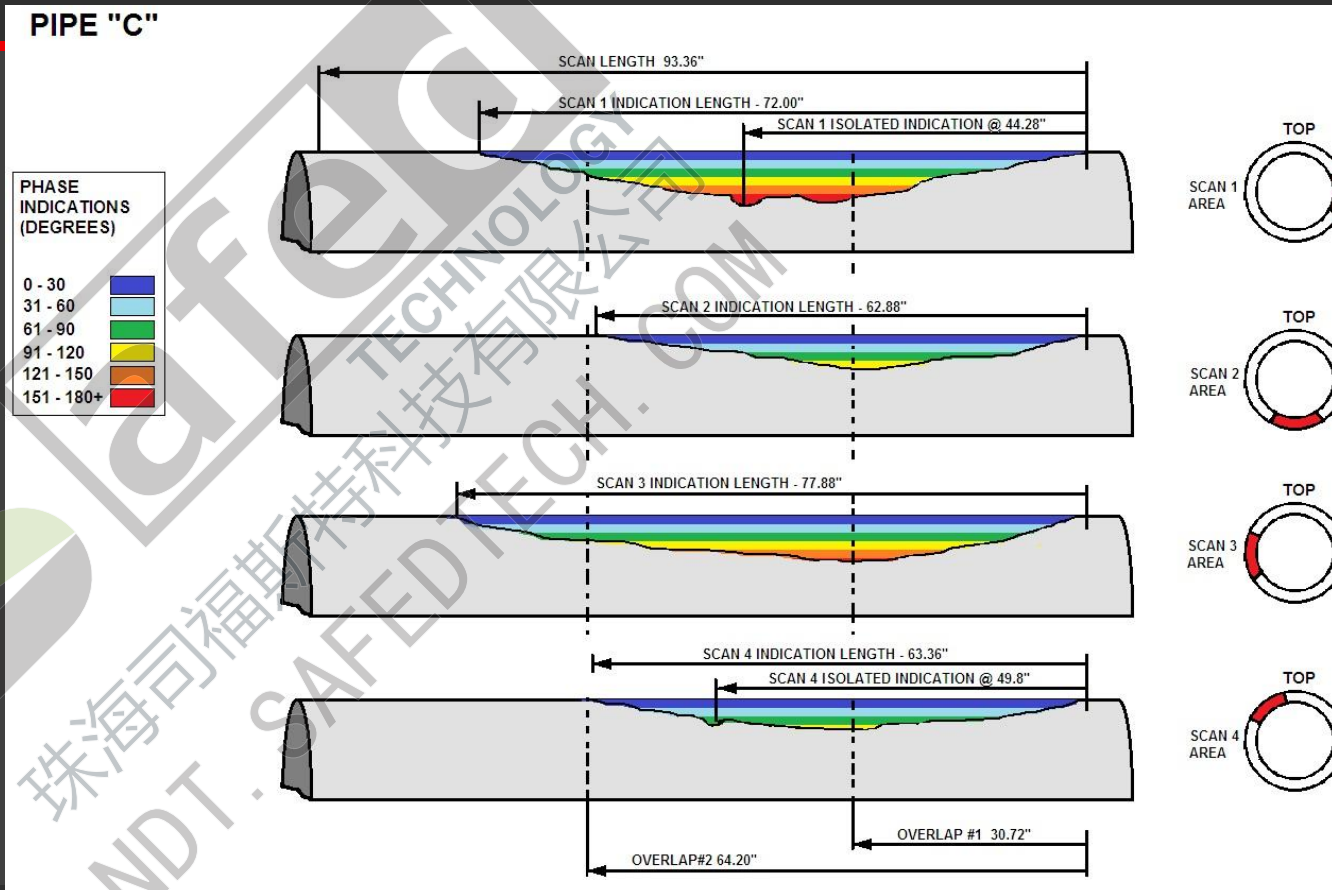
Report Samples

报告示例



This is a representation of the scanned pipe showing wall loss at various scanned clock positions. Note that the corrosion is most extensive at the 3:00 O'clock and 9:00 O'clock positions.

此图展示了在管道上各种位置扫描的壁损示意图。注意，在三点钟及九点钟位置的腐蚀面积最大。



First Tests

验证检测



High Pressure Vessels 高压容器平板

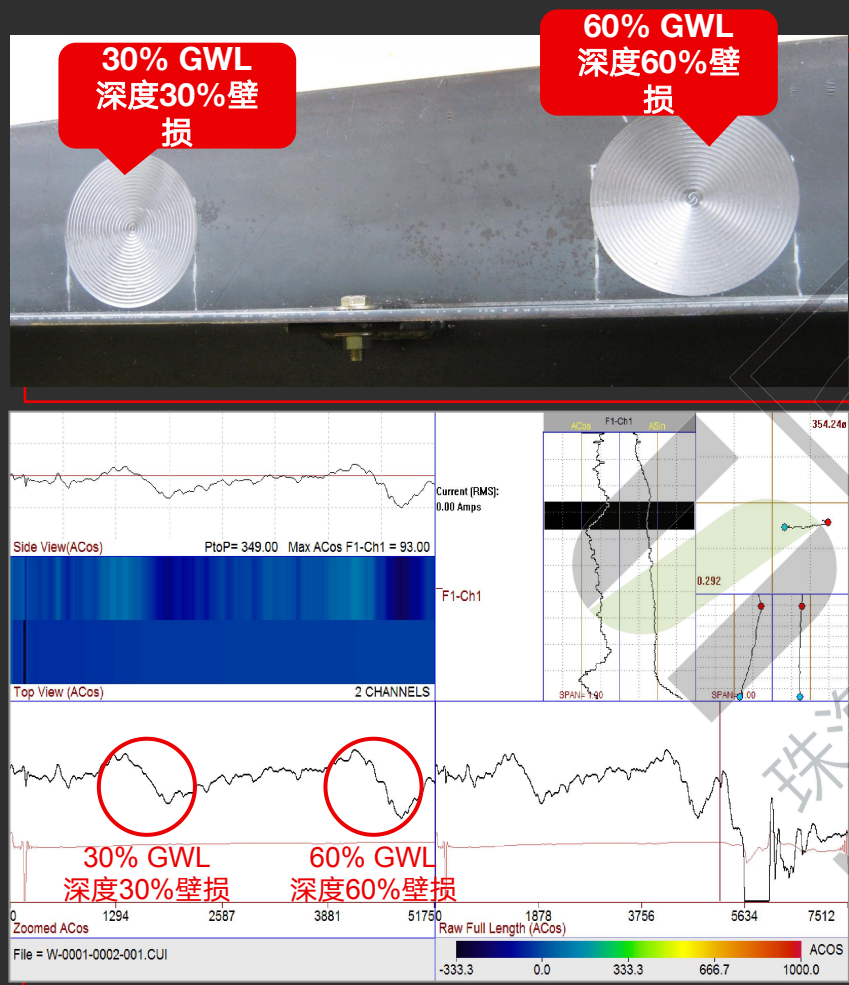
Tests to detect CUI on insulated vessels and tanks. These first tests were designed to find areas of isolated wall loss as shown in the

picture
检测隔热容器与储罐上的CUI。验证测试的目的为扫描到独立的壁损区域，如图片所示。



First Tests

验证检测



- A 38" long x 12" wide by 1/2" thick plate with a 2-1/2" wide support ring to simulate a vessel wall. We had two tapered flaws machined into the surface, one 30% deep and the other 60% deep. The plate was then scanned under 3" of insulation and an aluminum jacket.

一个965mm长、305mm宽、13mm厚的样板，侧边有2-13mm宽的支撑板以模拟容器壁。在板面上加工了两个锥形缺陷，一个深度30%、另一个深度60%；接着将板面在附有3英寸厚的绝缘层与铝套下进行扫描。

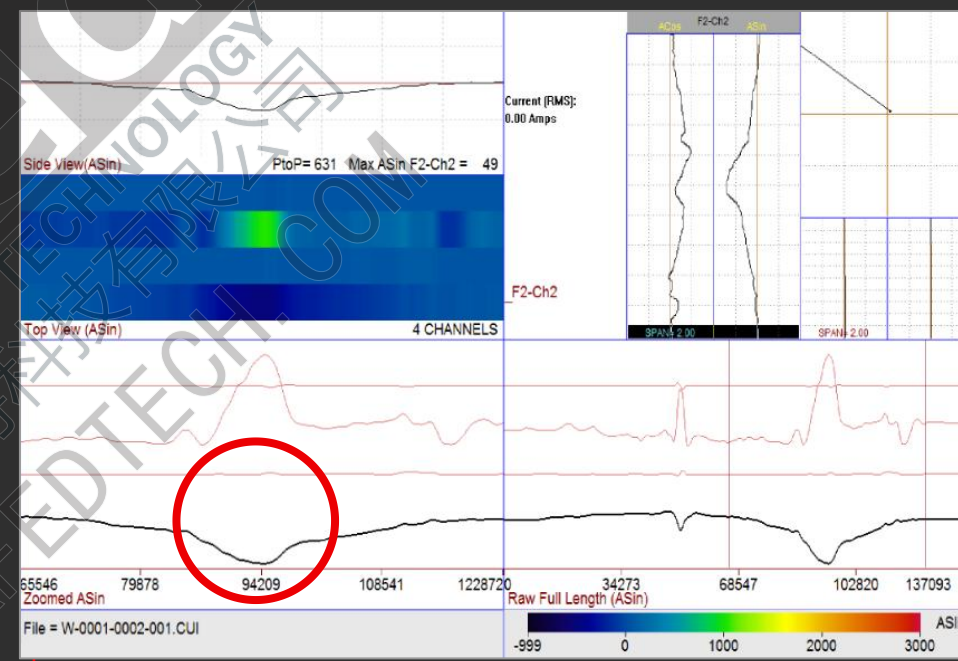
- This waveform shows the response of the OSET system to the two tapered circular flaws. As noted, the indication on the left shows the 30% GWL tapered flaw and the one on the right is the 60% GWL flaw.

此图展示了OSET系统扫描两个圆锥形缺陷的波形图。如图上所示，左侧为深度30%的壁损圆锥形缺陷，右侧为深度60%的壁损圆锥形缺陷。

OSET 实例研究



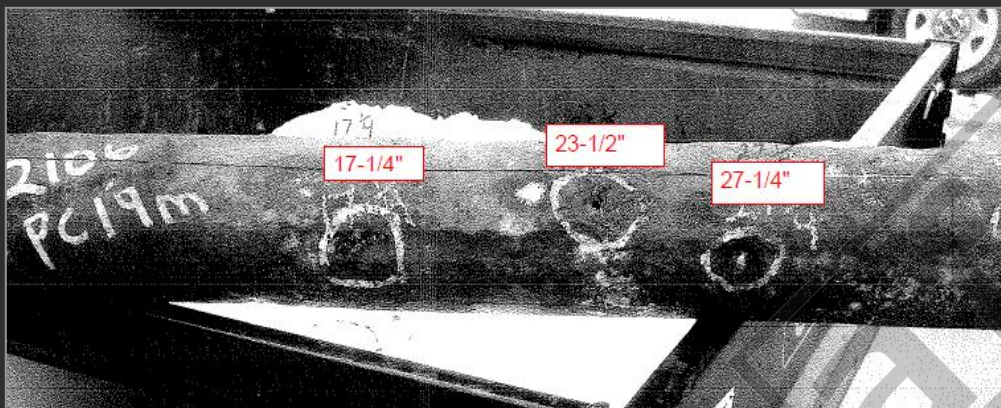
- Pictures of a 4" pipe with suspected corrosion before & after the jacketing was removed.
- 图片展示了一条炼油厂4 英寸管道，左边为移除护套前，右边为移除护套后。



- Wave form from the scan of the pipe above, with the low frequency absolute trace indicating wall loss (red circle). 此图展示了扫描管道后所呈现之波形图，低频波形的绝对值轨迹中红圈区域显示出了壁损。

OSET Case Studies

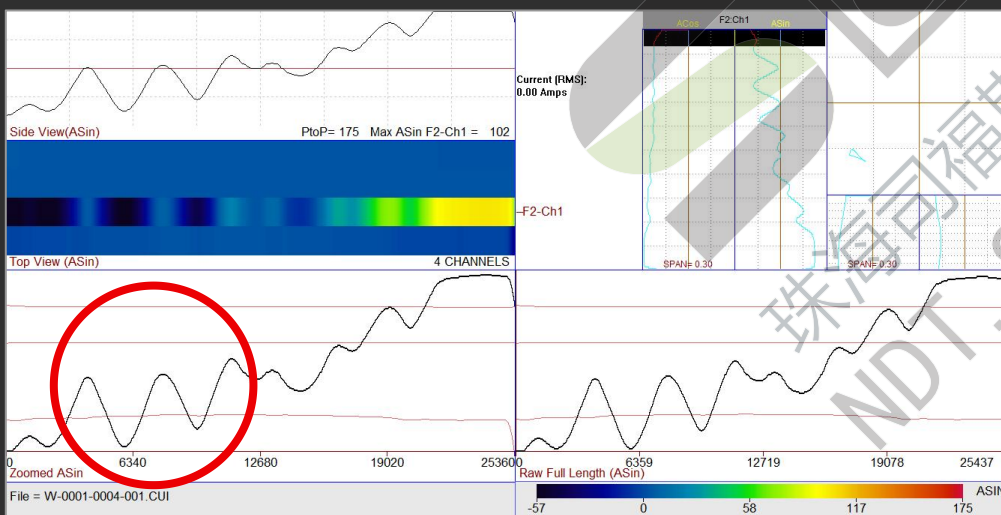
OSET 实例研究



Case 2: Marathon – Catlettsburg

- Picture of 4" naturally corroded test pipe that was removed from a process line at the refinery. In a blind test after new insulation and jacketing were installed, the OSET system detected the pitted areas that are circled, along with other flaws and general wall loss.

此图展示了从炼油厂的生产在线所移除之4英寸管道，管道表面有自然腐蚀的现象。在表面套上新的绝缘层与护套后，进行OSET系统检测，扫描出如照片中所圈示的缺陷区域，以及其他缺陷与一般壁损。



- Wave form from the scan of the pipe above, with the low frequency differential trace indicating the three closely spaced pits (red circle) that are shown in the picture. 此图展示了扫描管道后所呈现之波形图，圆圈所标示之连续三个低频波形，即为壁损区域。