



TRENCHLESS ASIA 2026

THAILAND

PIPELINE HIGH ACCURACY DETECTION TECHNOLOGY - PANORAMIC QUANTITATIVE ROBOT

ELLA XIAO

WUHAN EASY-SIGHT



www.trenchlessasia.com

Organised by



Official Host Authority



Official Supporting Authority



Supporting Authority



Sponsors



Supported by



Media Partner





Pipeline High Accuracy Detection Technology



Panoramic Quantitative Robot

Wuhan Easy Sight Technology Co.,Ltd.

Catalog



1

The significance of research on high accuracy detection technology

2

Introduction of millimeter-level measurement robot

3

Inspection data analysis and output display

4

Application Cases



The significance of research on high accuracy detection technology



EASY SIGHT

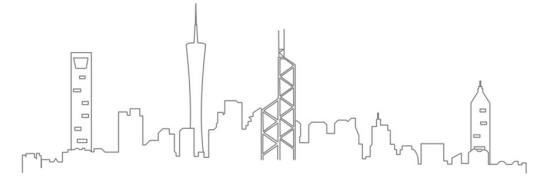
2017-04-21 03:53:36

距离: 21.27 m

X01

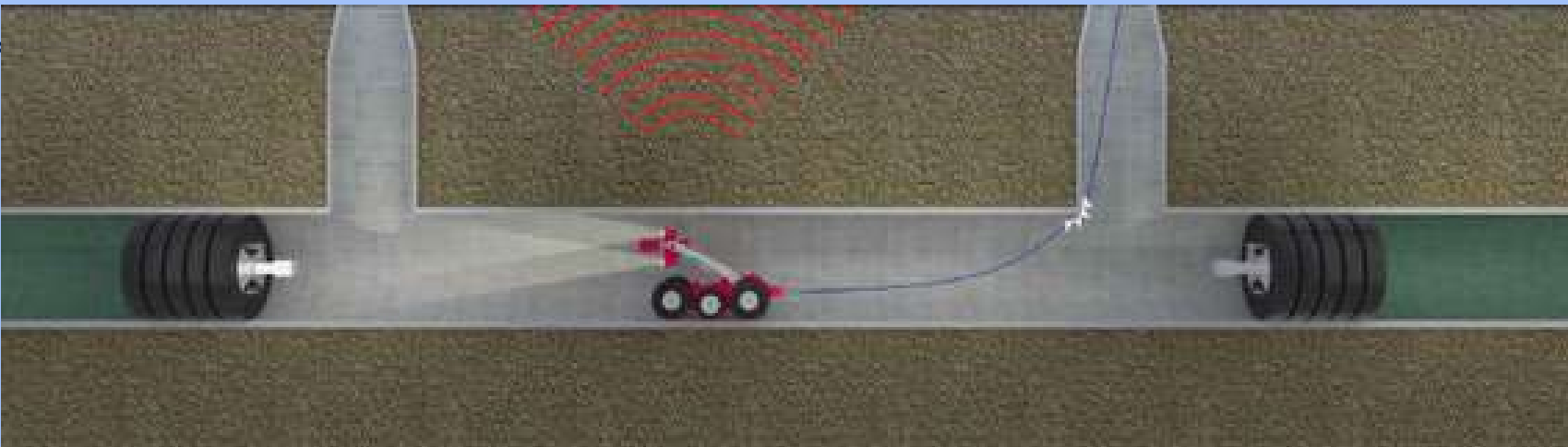


The main disadvantages of current CCTV inspection



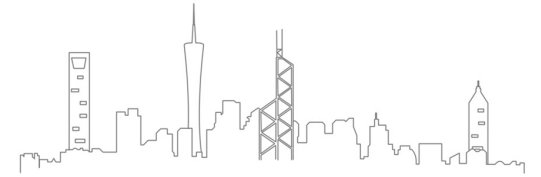
The most common inspection tool at present is the CCTV inspection system, which has the following main disadvantages:

- **Complex operation process:** During the inspection process, the camera head cannot be adjusted to find defects; when defects are found, it is necessary to stop and observe the defects carefully.
- **Low interpretation efficiency:** The staff in the office repeatedly watch the inspection video to interpret the defects. If the defects are missed when recording the video, it will be impossible to interpret.
- **Defect interpretation based on experience:** The size, length, area, etc. of the defect cannot be accurately quantified, and the pipeline assessment score obtained is inaccurate.





Pipeline trenchless repair project



Repair Design

● Technical specification for trenchless repair and renewal of urban drainage pipelines CJJ/T 210-2014

● Technical specification for in-situ curing repair of water supply and drainage pipelines T/CECS 559-2018

5.2.2 内衬管壁厚设计:

1 内衬管与原有管道联合承受外部地下水静液压力及真空压力时, 壁厚可按下列公式计算:

$$t = \frac{D_0}{\left[\frac{2KE_L C}{(P_W + P_V)N(1-\mu^2)} \right]^{\frac{1}{3}} + 1} \quad (5.2.2-1)$$

$$C = \left[\frac{\left(1 - \frac{q}{100}\right)}{\left(1 + \frac{q}{100}\right)^2} \right]^3 \quad (5.2.2-2)$$

$$q = 100 \times \frac{(D_E - D_{min})}{D_E} \quad \text{或} \quad q = 100 \times \frac{(D_{max} - D_E)}{D_E} \quad (5.2.2-3)$$

式中: P_W ——管底位置地下水压力 (MPa), $P_W = 0.00981H_w$;

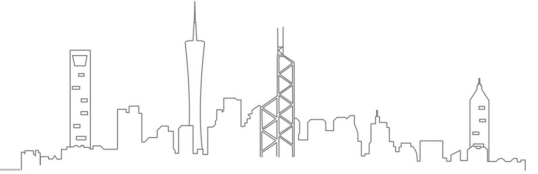
P_V ——真空压力 (Mpa) (根据工程实际取值, 不应小于0.05MPa);

C ——椭圆度折减因子;

N ——管道截面环向稳定性抗力系数 (取值不应小于2.0);



Pipeline trenchless repair project



The liner size is too small: **the liner does not fit the pipe to be repaired**

At a project site, the ordered liner size is DN415, and the actual pipe diameter is DN440. After the curing is completed, the liner does not fit the pipe to be repaired at all.



The liner size is too large: **the liner expands and forms radial extrusion**

At a project site, the ordered liner size is DN300, and the actual pipe diameter is DN270. After curing, there are a lot of circumferential wrinkles inside the pipeline liner.

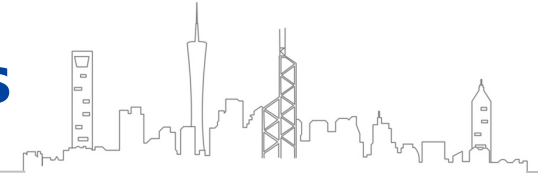


2

Introduction of millimeter-level measurement robot



The Evolution of High Accuracy Measurement Robots



2016

The first one to realize digital high-definition pipeline inspection



2020

Launched laser quantitative detection technology with centimeter-level accuracy



2021

Upgraded to panoramic lidar quantitative detection, comprehensive collection of high-definition video, chromatogram, lidar profile map, and comprehensive analysis



2023

Panoramic lidar inspection technology is fully upgraded to achieve millimeter-level high-precision measurement



X5-HT5 Pipeline Inspection Robot

Inspection Robot

It can perform millimeter-level high-precision measurements of pipeline parameters such as pipe diameter, deformation, deposition, and defect size, providing accurate data support for maintenance and repair operations. It is suitable for engineering measurement tasks that require extremely high accuracy and reliability.

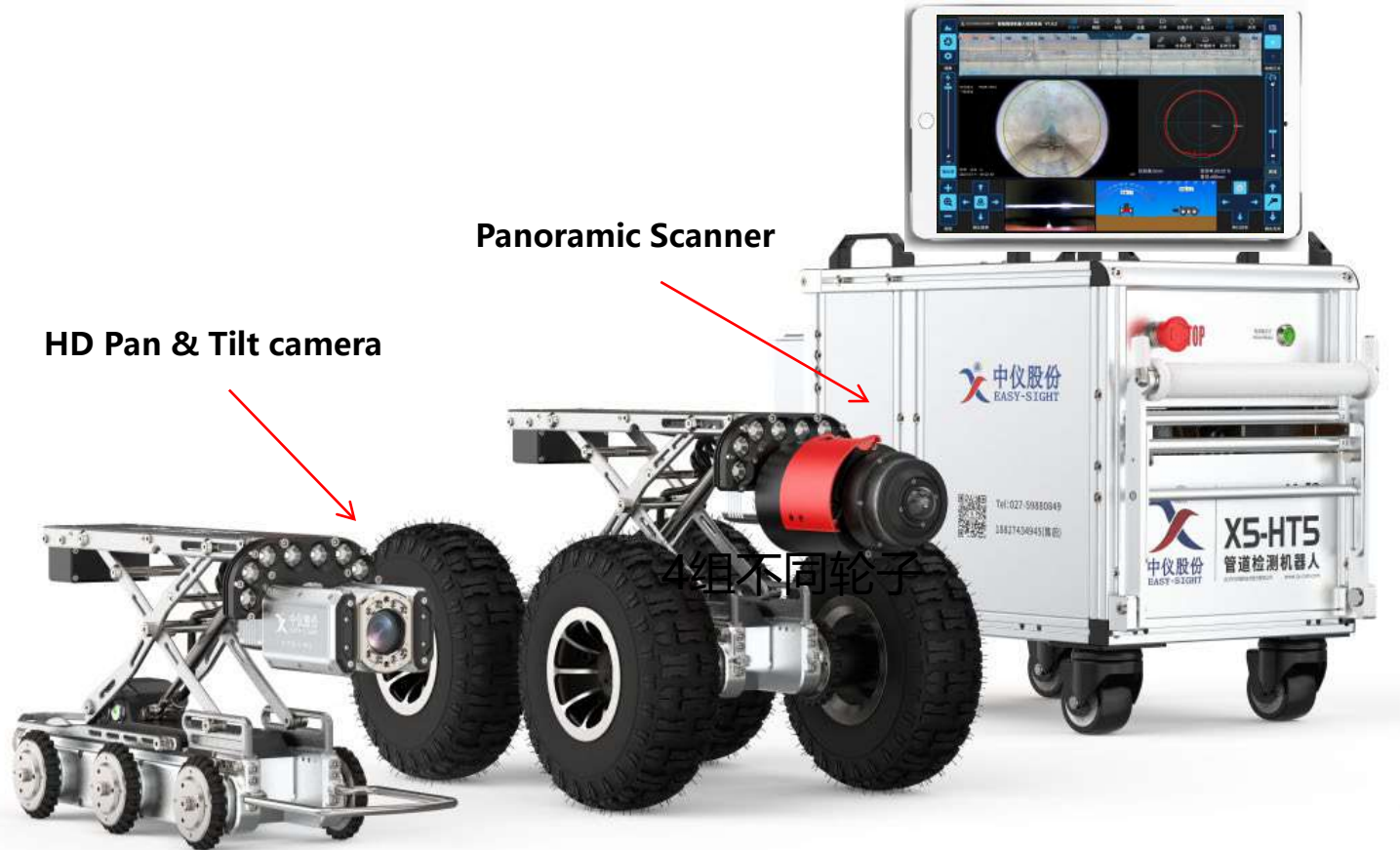
Millimeter-level measurement accuracy

500m long distance detection

190mm height gap X-type electric lift

Driving speed increased by 1.5 times

Quantitative detection speed increased by 2 times





X5-HT5 Pipeline Inspection Robot

Inspection Robot





Technical Features

Inspection Robot



Panoramic display: present the whole view of the pipeline in one picture
Lidar quantification: Defects can be accurately quantified

How to use:

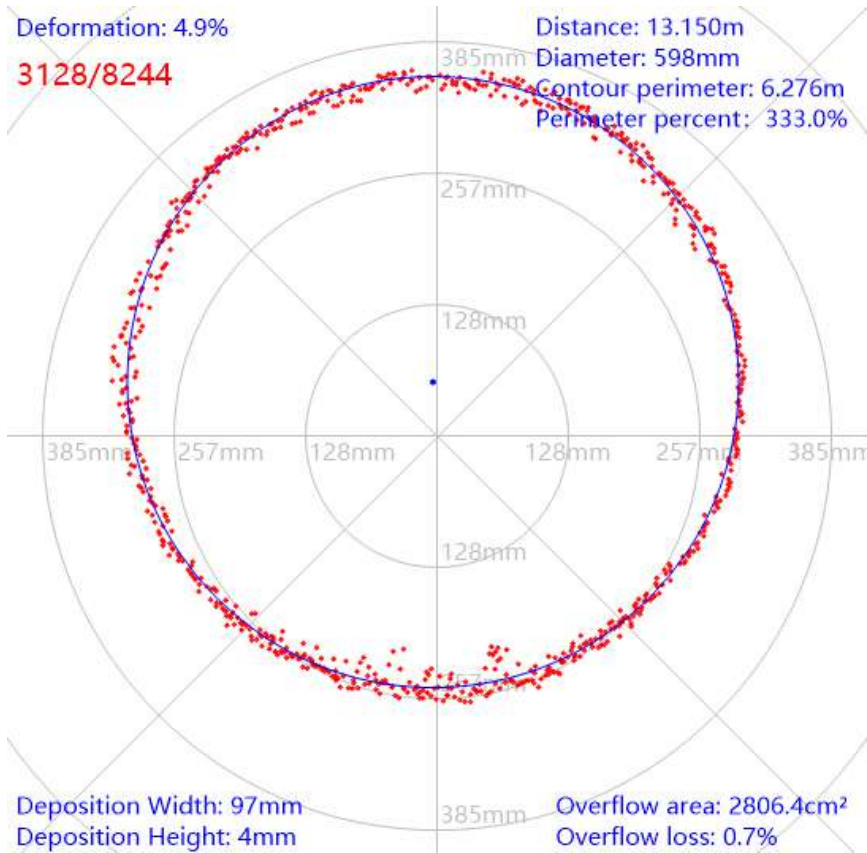
When inspecting, just set the inspection parameters, and the crawler will crawl automatically without stopping, observing defects, or rotating the lens; after the inspection is completed, data is generated and analyzed immediately; When interpreting, interpret and analyze on the pipeline panorama and chromatogram; when clicking on a defect, it will automatically associate with the corresponding video frame and lidar contour data for precise quantification.

Easy synchronization of indoor and outdoor work

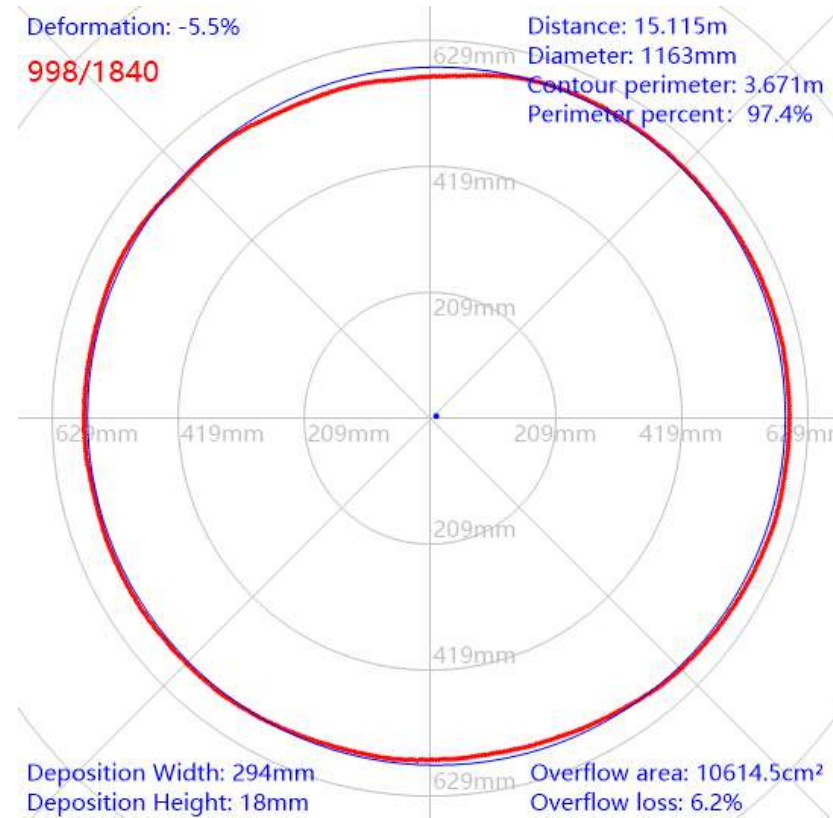


High accuracy lidar

Inspection Robot



Regular lidar (centimeter grade)



High accuracy lidar (millimeter grade)

The high accuracy lidar collects 800 points per frame, eliminating stray points and making the contours smoother.

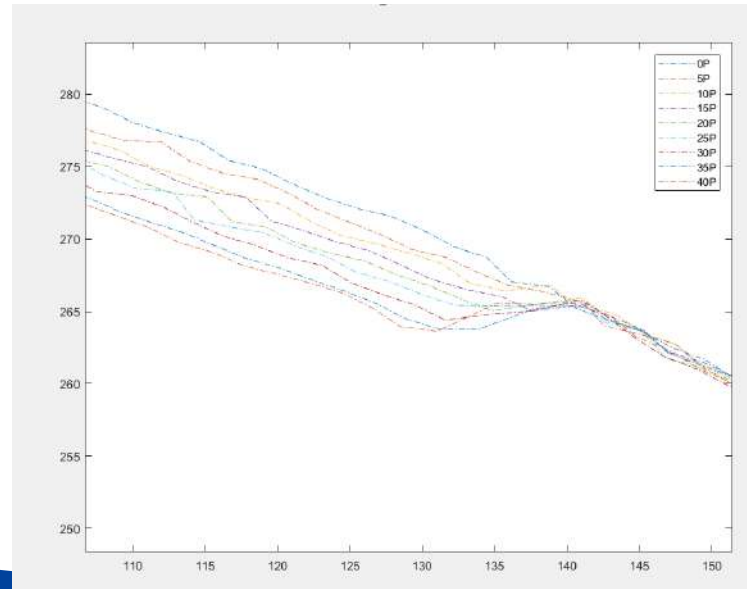
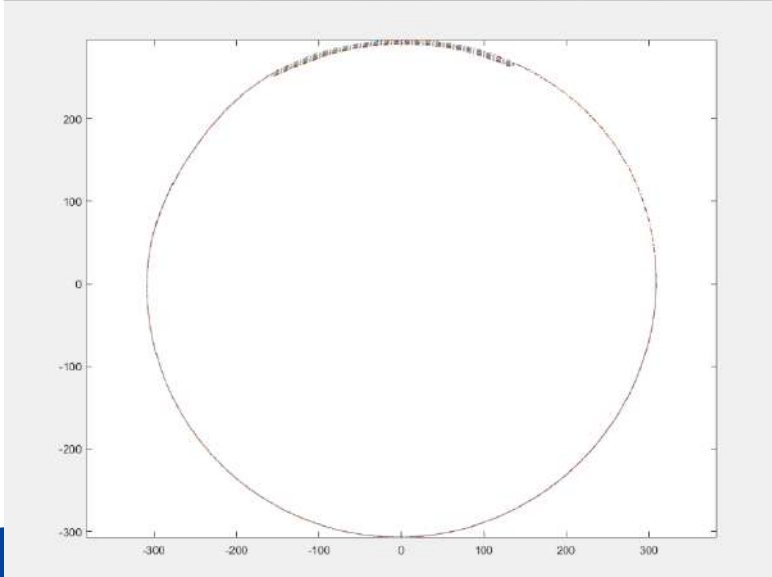


Verification and comparison

Inspection Robot



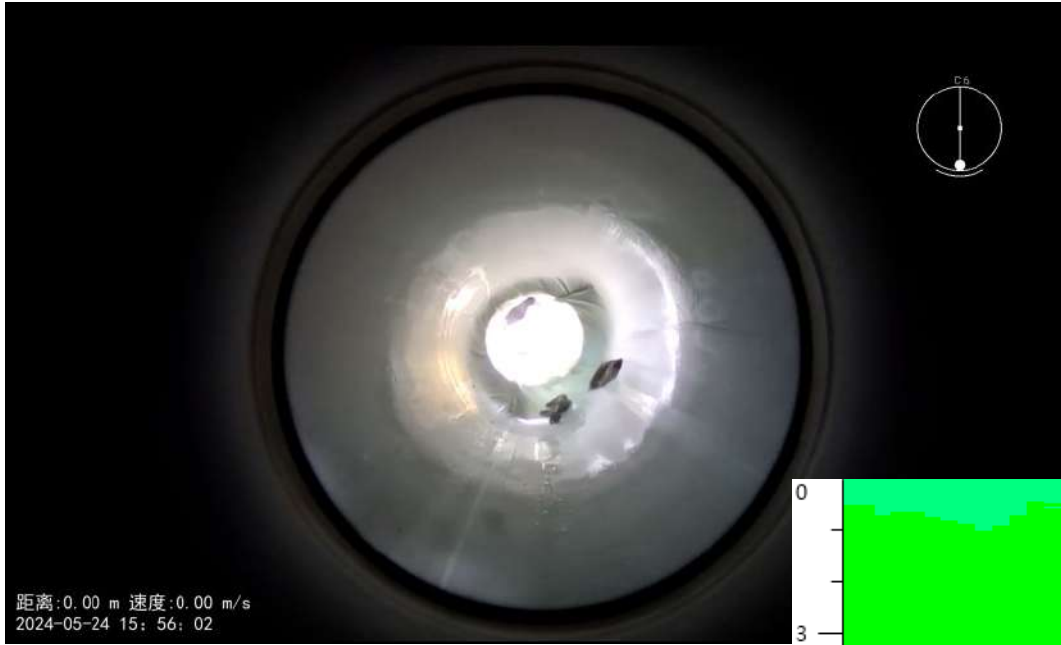
Place the lidar inside the pipe for scanning. Place 5, 10, 15, 20, 25, 30, 35, and 40 A4 papers at the bottom. Measured by caliper, the thickness of 40 papers is 4mm, so the resolution of every 5 papers is 0.5mm.



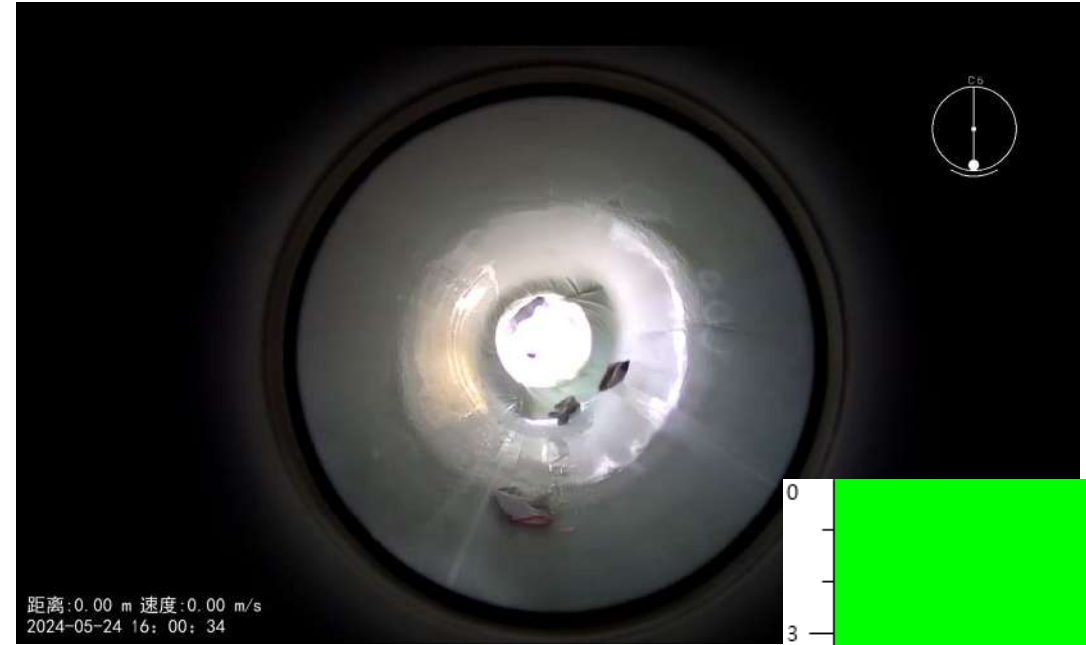
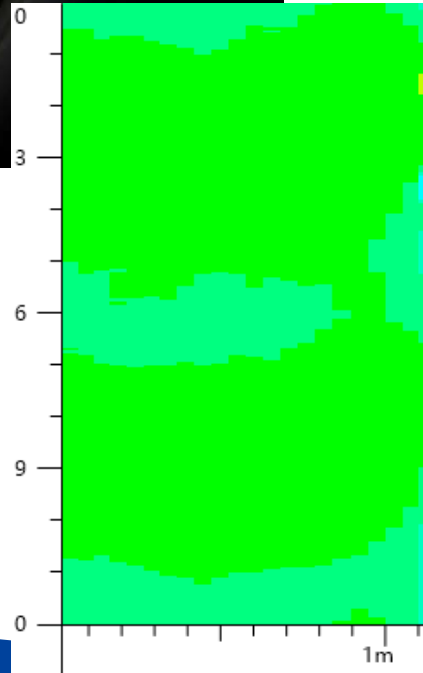
Through data statistics, it was found that there were clear dividing lines between different paper layers, and the display resolution was higher than 0.5mm.



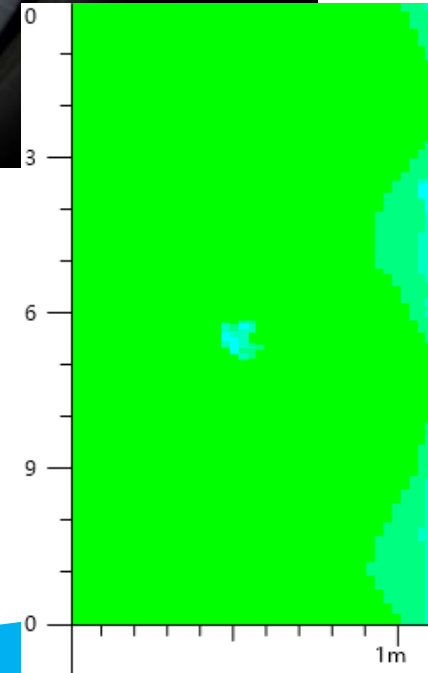
Verification and comparison



Hong Kong Verification:
Light-cured repair material for
DN600 pipe diameter



Chromatogram when three
people are stepping on it

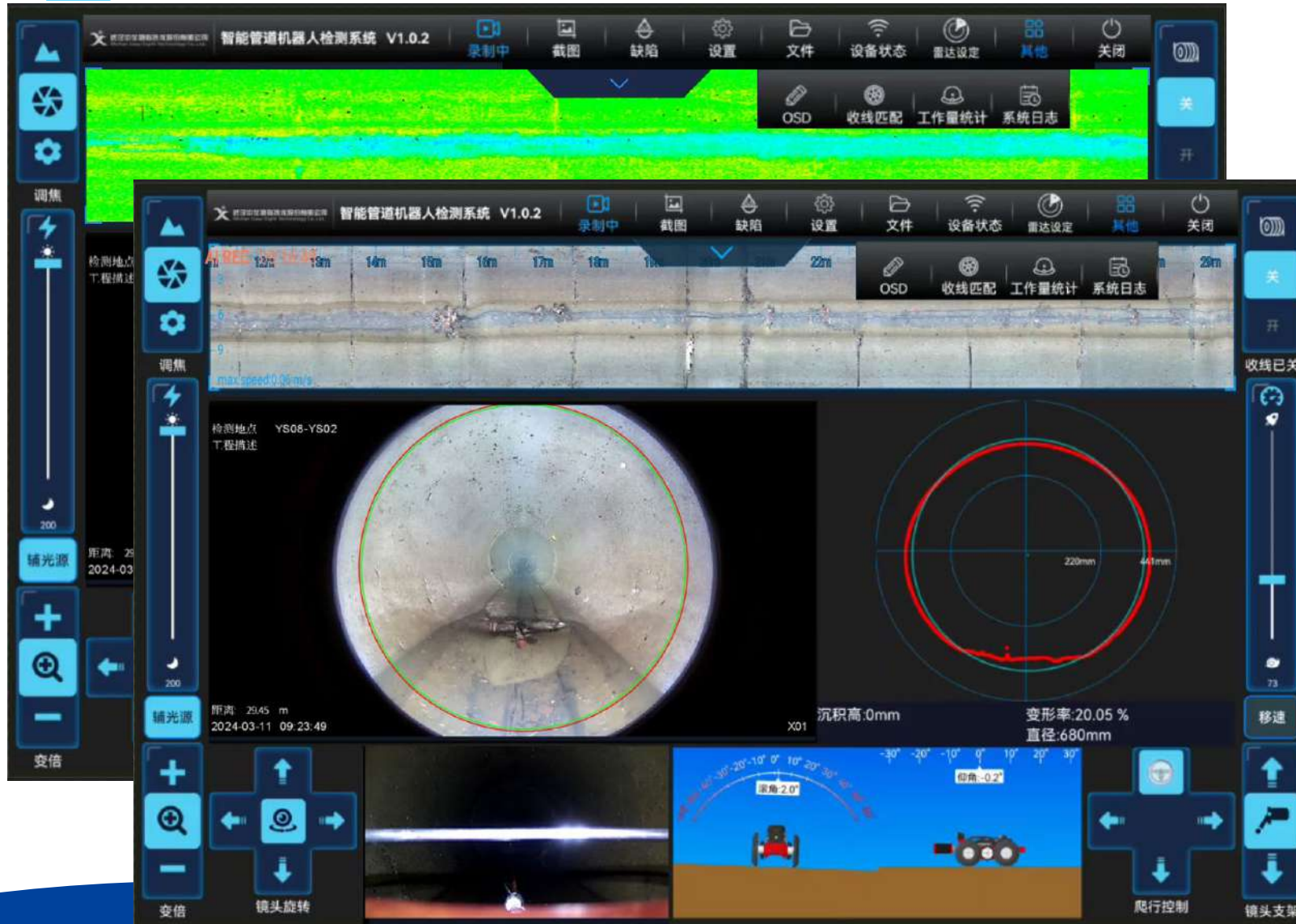


Chromatogram when no one is
stepping on it and one glove is
placed



Data Collection

Inspection Robot



One test, get multiple data:

- ◎HD video
- ◎Lidar Profile
- ◎Panorama
- ◎Chromatogram
- ◎Posture data
- ◎No post-processing required



Data Collection

Inspection Robot

**Inspection process:
complete the whole process
in one time, no need for
operator monitoring:**

- ◎ Non-stop
- ◎ No rotation
- ◎ No Look Around
- ◎ No zoom and focus
- ◎ No need to stop for observation

新厂房5 YS01-YS02
工程描述



2021-04-19 17:25:48

距离: 0.00 m

X01

Video display

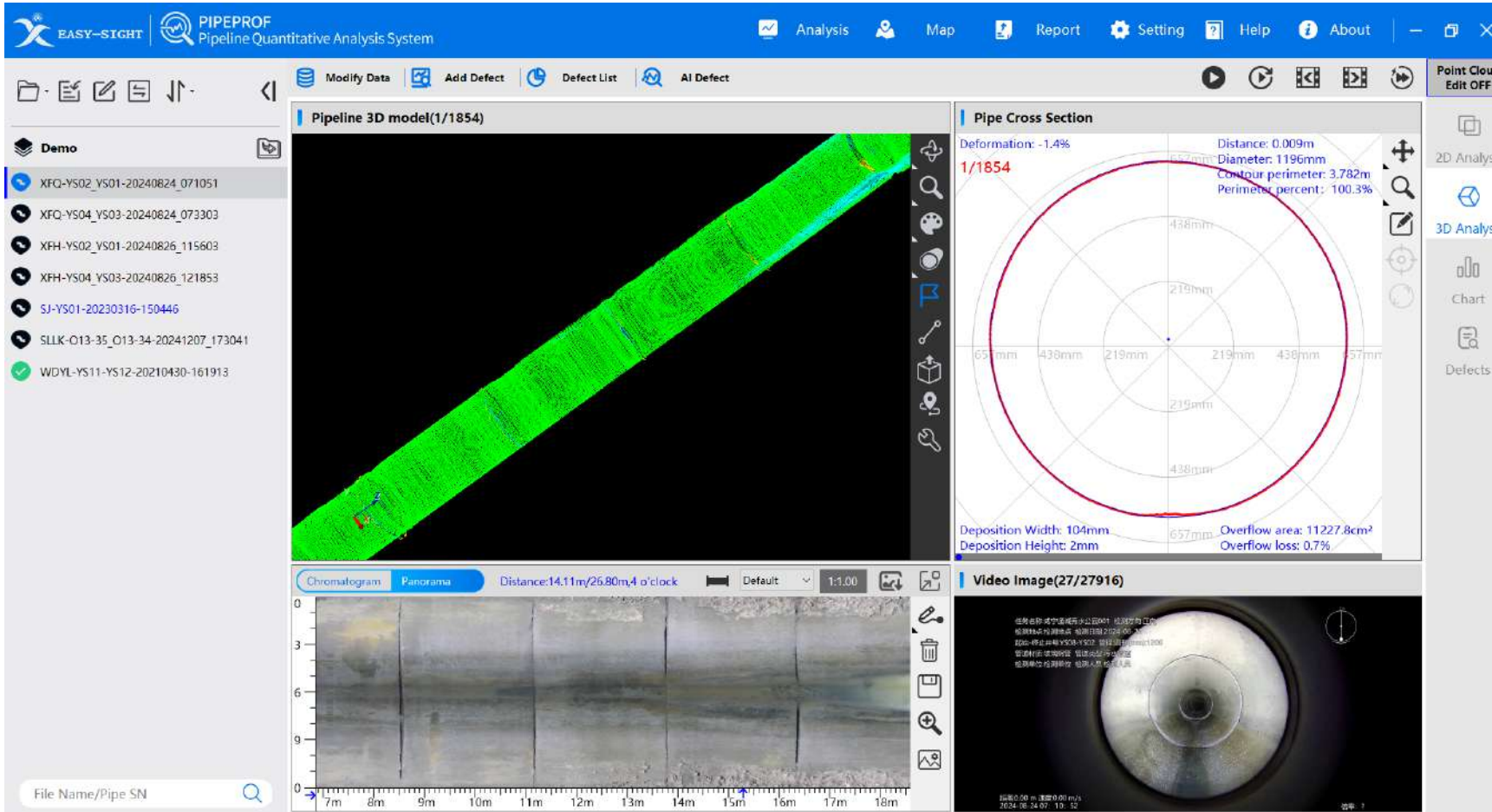


Inspection data analysis and output display



High accuracy lidar

Inspection Robot



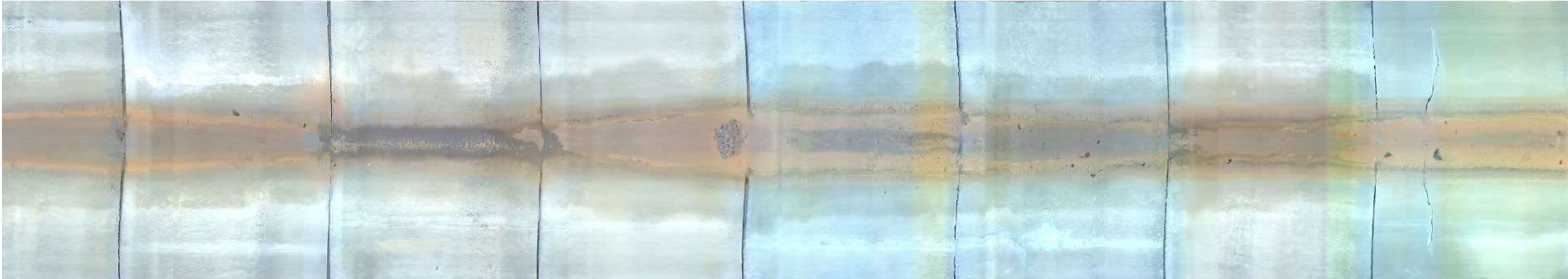
Synchronous analysis of lidar, panoramic, video, IMU and other data.

- Lidar profile, chromatogram, panorama, video linkage analysis
- Automatic calculation of defect size
- Intuitive and simple interpretation



Panoramic expansion of pipeline

Data analysis

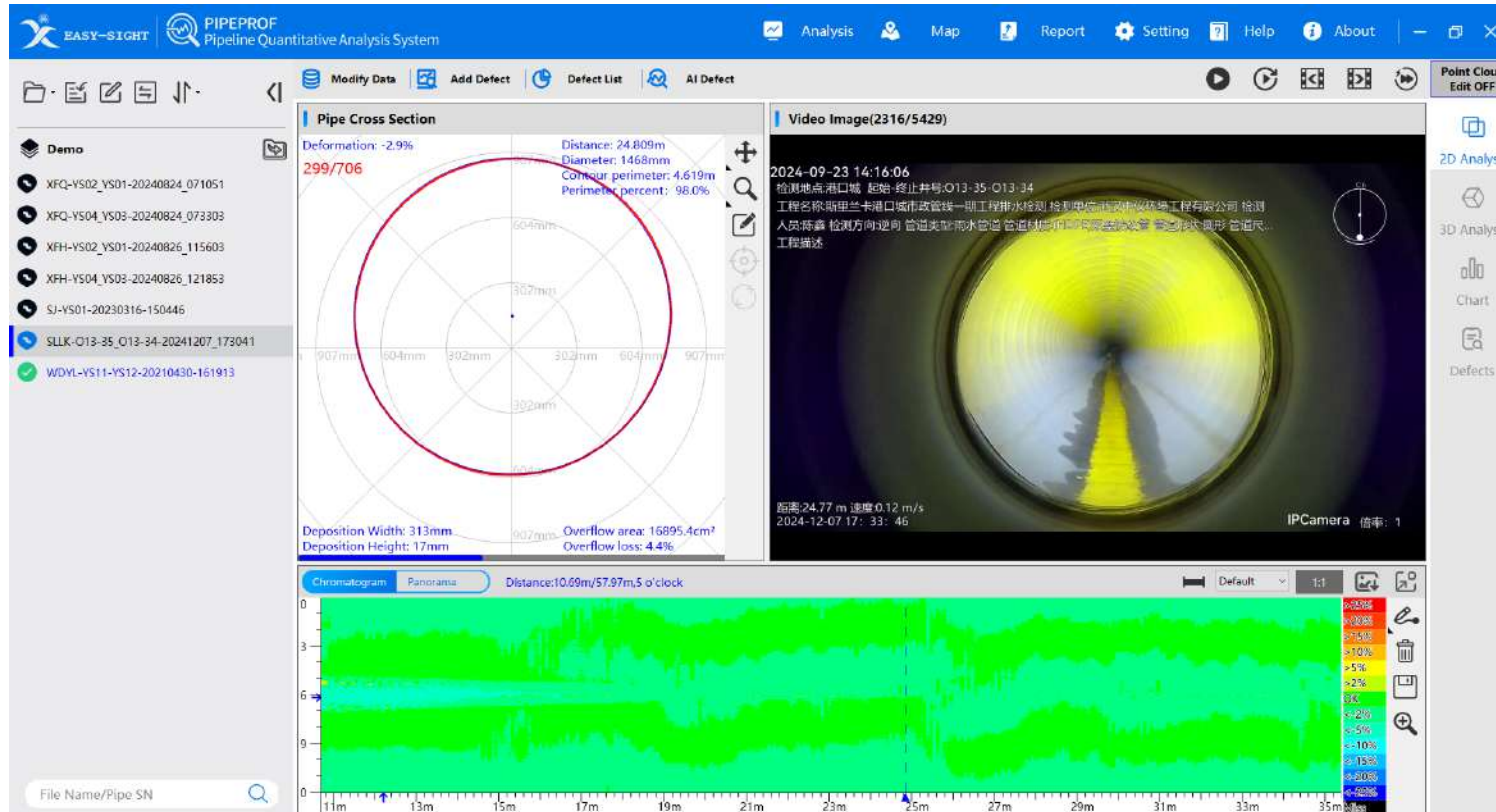


The above picture is a panoramic view of the inside of the pipeline obtained using panoramic quantitative detection technology, which is equivalent to cutting the pipeline open and then laying it flat. From the above picture, you can clearly see the deposits on the bottom of the pipe, cracks on the pipe wall, etc.



Intelligent defect analysis

Data Analysis



Through the conditions set by the user, the defects are automatically judged according to the chromatogram expansion diagram, panoramic diagram, etc., and the automatic identification of various defects is supported.



Defect interpretation

Data Analysis

Defect Interpretation

Penetration of foreign matters-1

Distance: 19.65m

Clock pos: 0710

Defect Length: 13 cm

Defect Property: Structural

Defect Type: Penetration of foreign matters

Defect Class: slight

Remarks: area=173.9cm²,volume=104.1cm³

You can also enter 69 characters.

Distance: 0.05 m Coordinate X: 290 Coordinate Y: 340 Background color: [Black] Font: [Default]

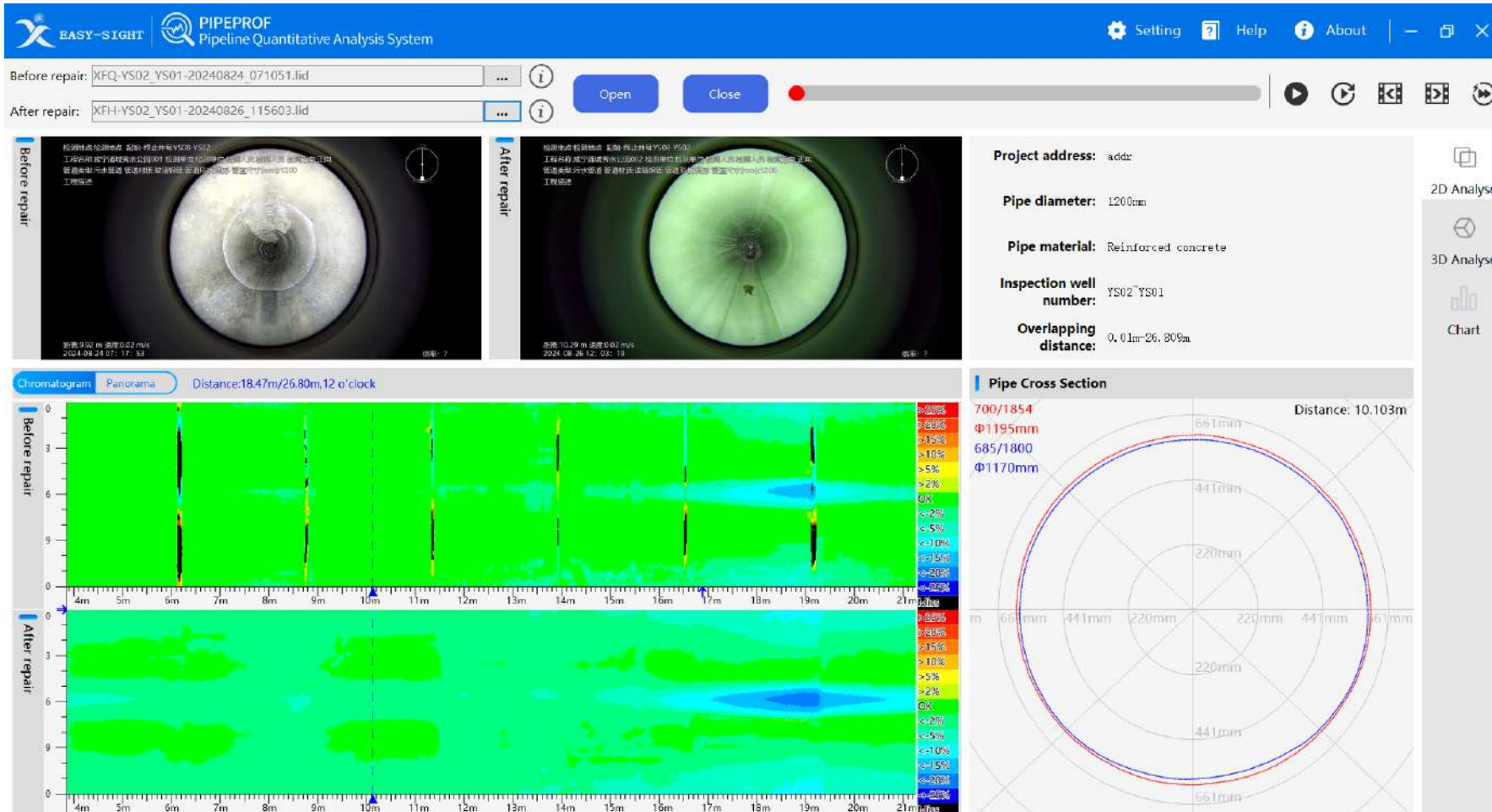
Mark Type: polygon
Start Distance: 19.59m
End Distance: 19.72m
Spacing: 13cm
Clock Pos: 0710

- Automatic quantification (area, volume, size)
- Automatic positioning (distance interval, time of day and time of day)



Comparative analysis before and after repair

Data Analysis



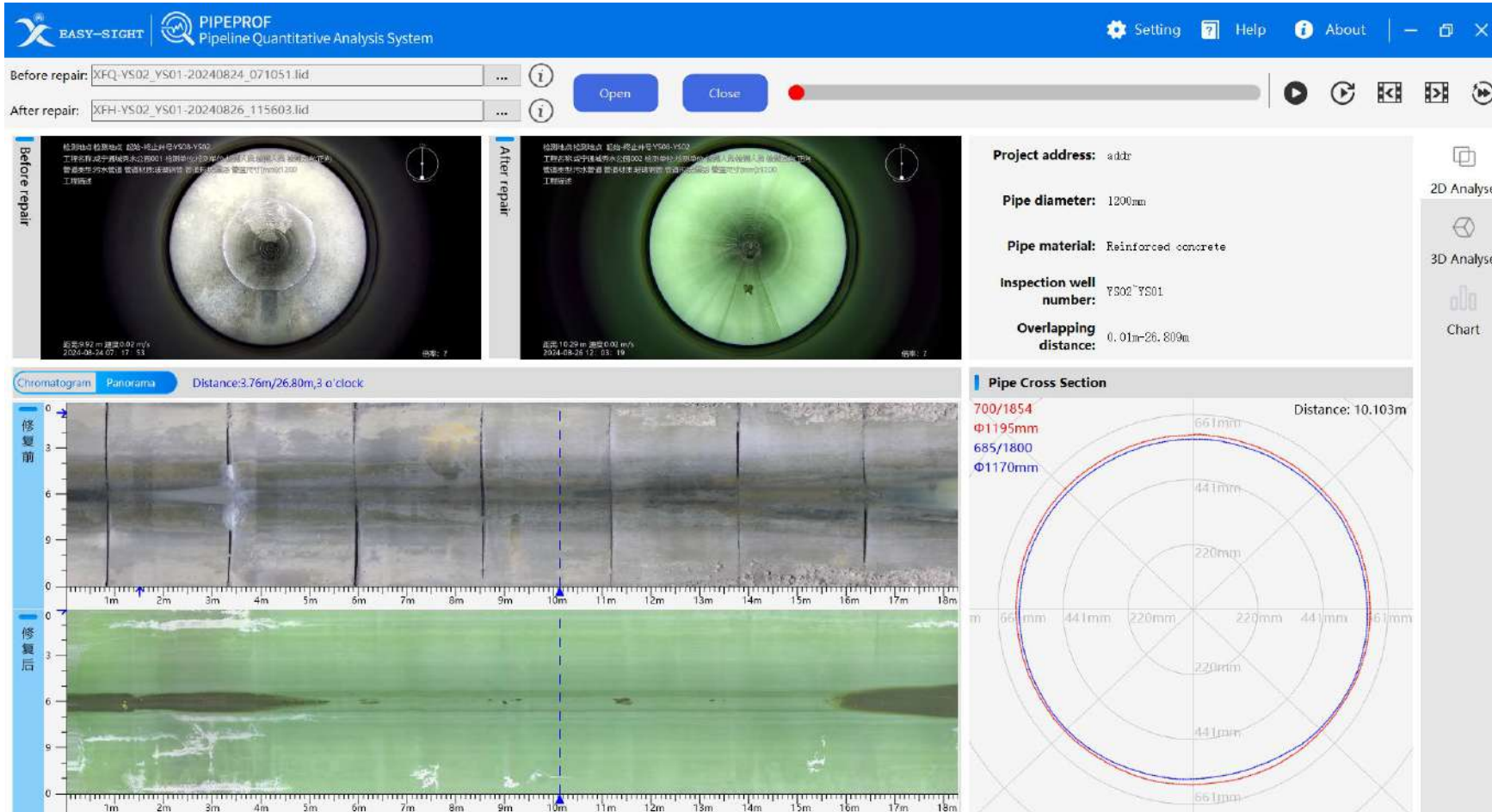
➤ **2D analysis**

It can quickly view the video images before and after the pipeline repair, **the pipeline chromatogram expansion diagram, the pipeline panoramic expansion diagram, and the comparison diagram of the lidar cross-section profile.** It can accurately measure the thickness of the repair material.



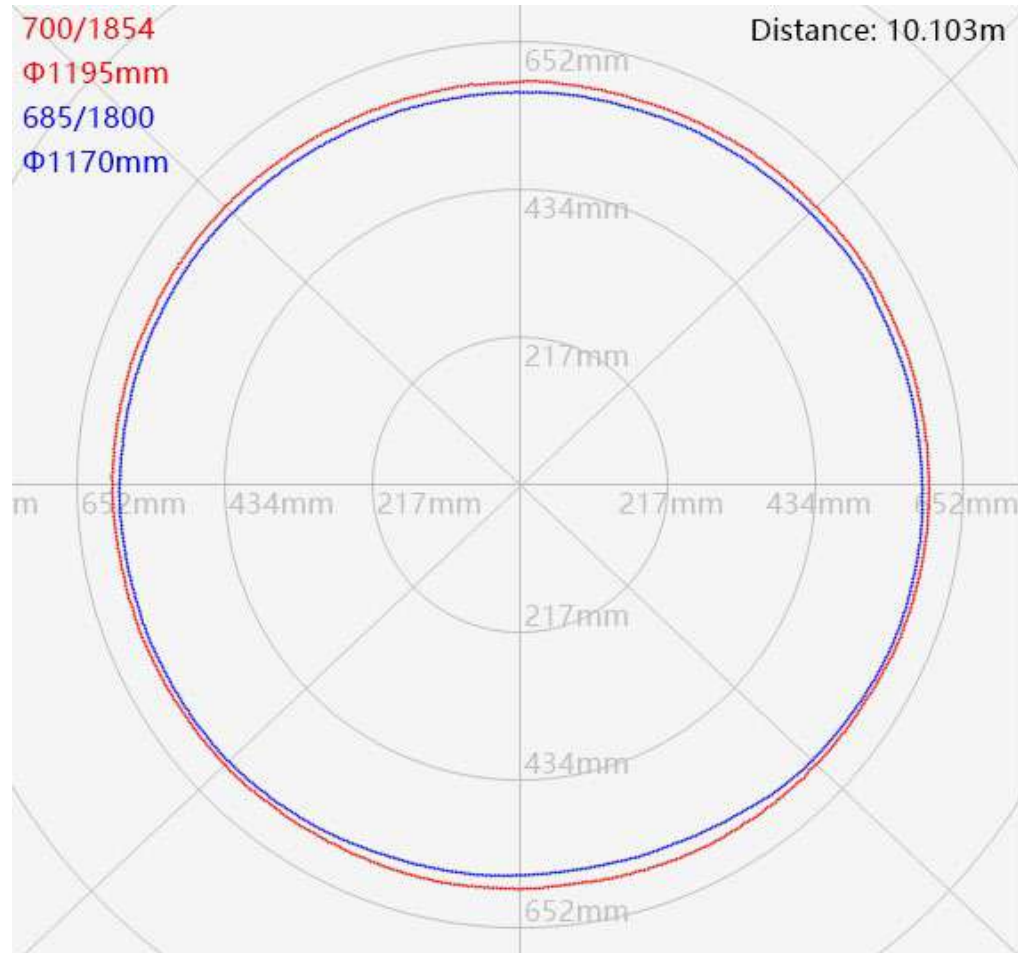
Comparative analysis before and after repair

Data Analysis



➤ 2D analysis

It can quickly view the video images before and after the pipeline repair, the pipeline chromatogram expansion diagram, the pipeline panoramic expansion diagram, and the comparison diagram of the laser cross-section profile. It can accurately measure the thickness of the repair material.



➤ 2D analysis - single frame profile comparison

The red part is the point cloud of the pipeline contour before repair, and the blue part is the point cloud of the pipeline contour after repair.

The distance difference at any clock position can be measured to calculate the wall thickness.

Each frame contour (one frame corresponds to one distance point) can be analyzed.



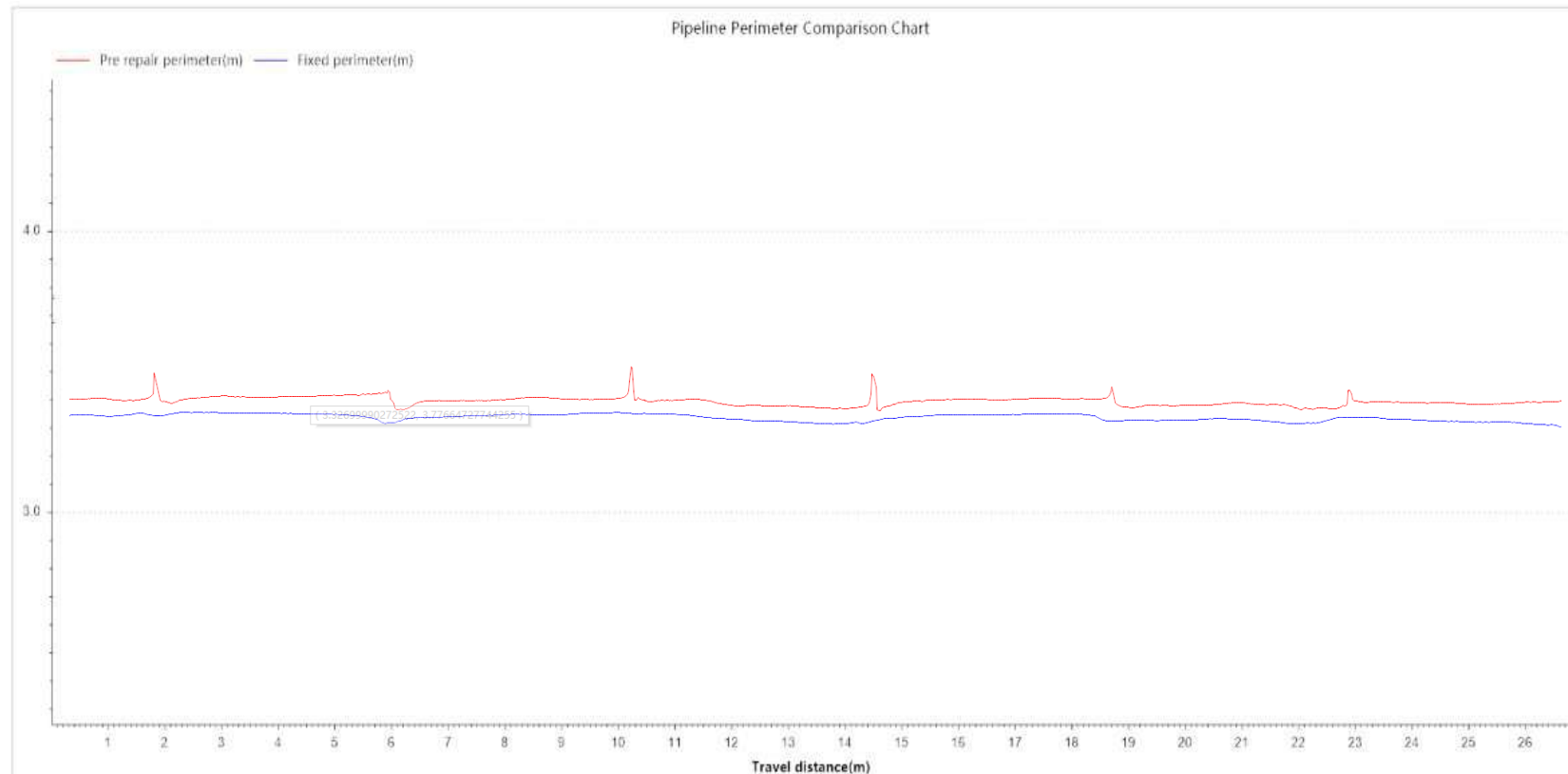
Comparative analysis before and after repair

Data Analysis

➤ Chart Analysis

Comparative analysis is performed from multiple aspects, including the **pipeline contour circumference diagram** before and after repair, pipeline wall thickness change diagram, pipeline contour expansion comparison diagram, etc.

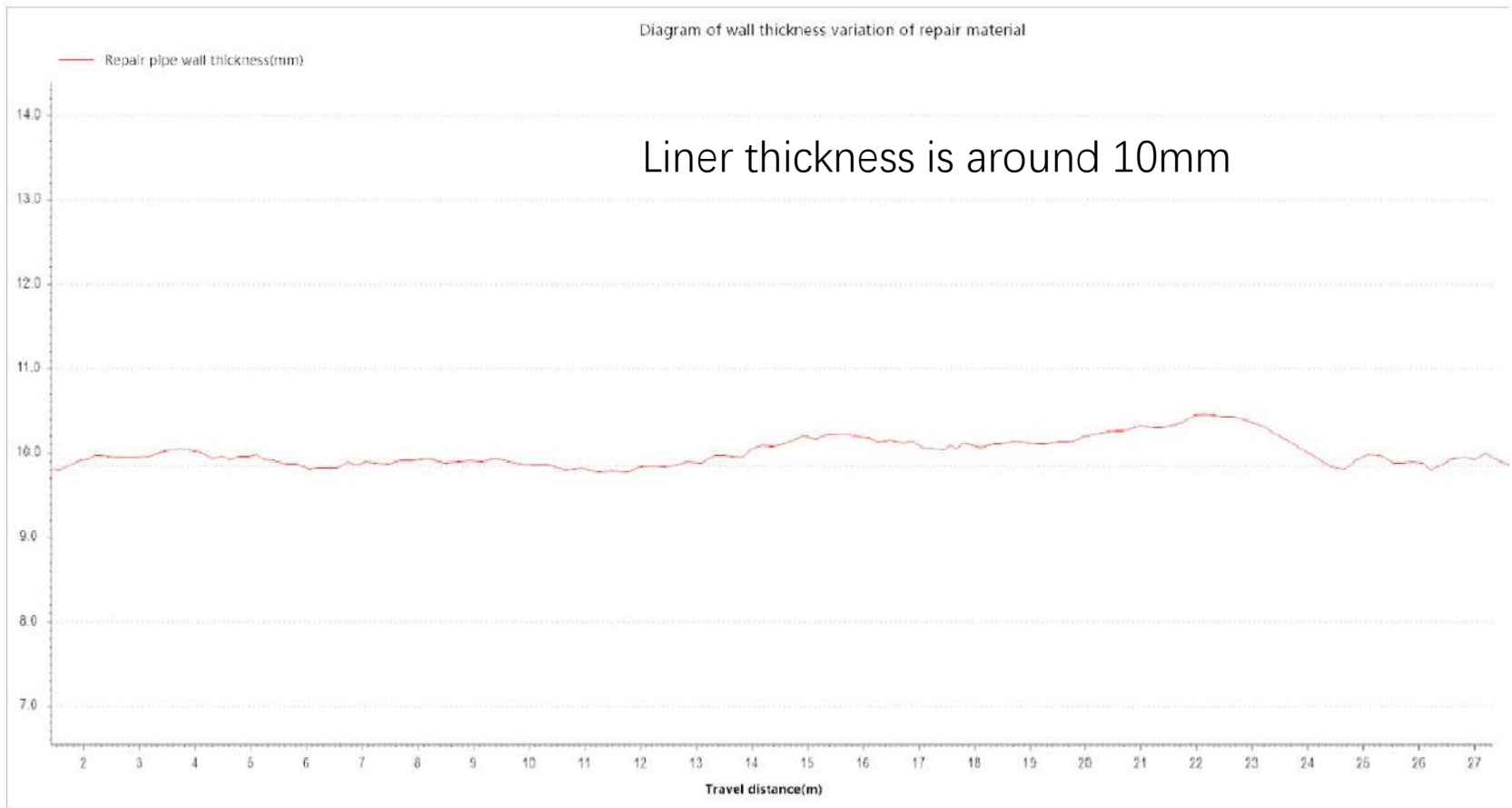
The value interval can be set arbitrarily.





Comparative analysis before and after repair

Data Analysis



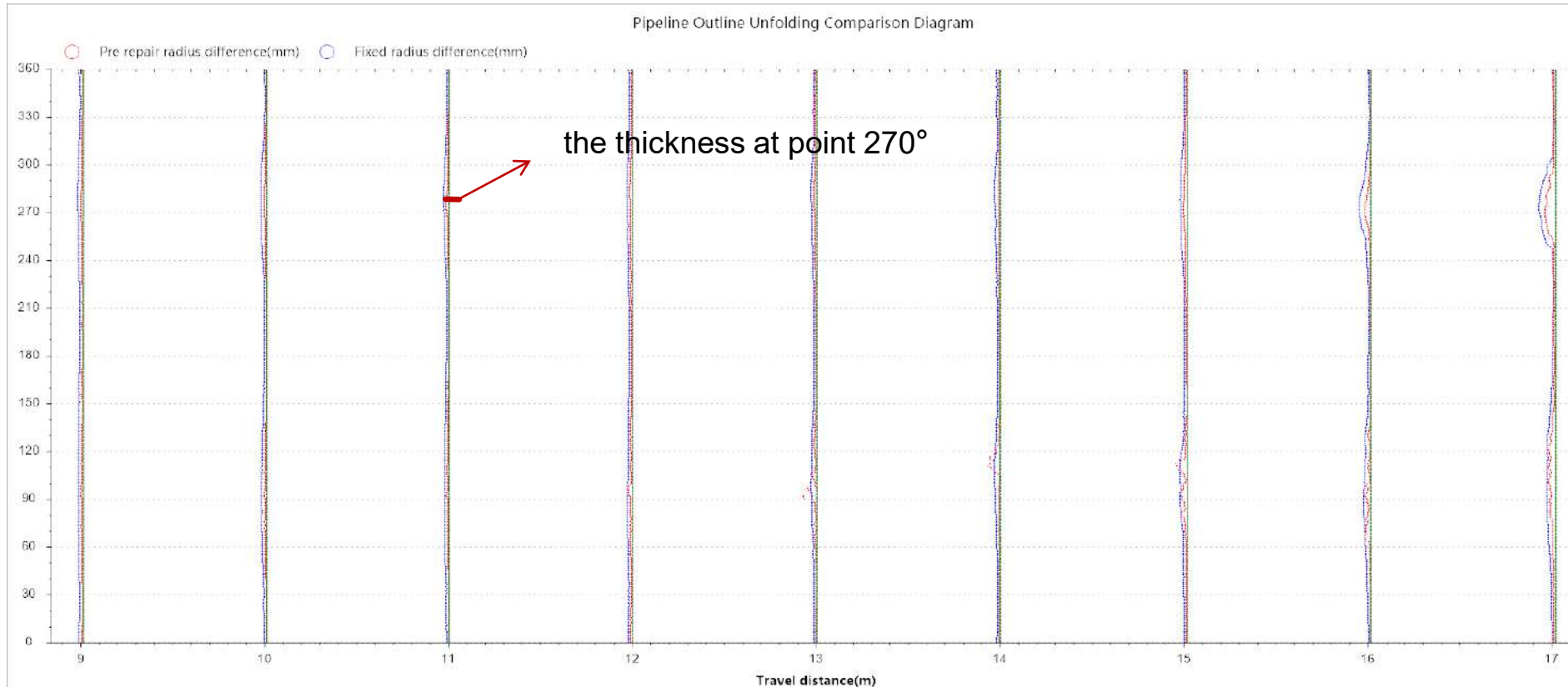
➤ **Chart Analysis**

Comparative analysis is performed from multiple aspects, including the pipeline contour circumference diagram before and after repair, pipeline wall thickness change diagram, pipeline contour expansion comparison diagram, etc. The value interval can be set arbitrarily.



Comparative analysis before and after repair

Data Analysis



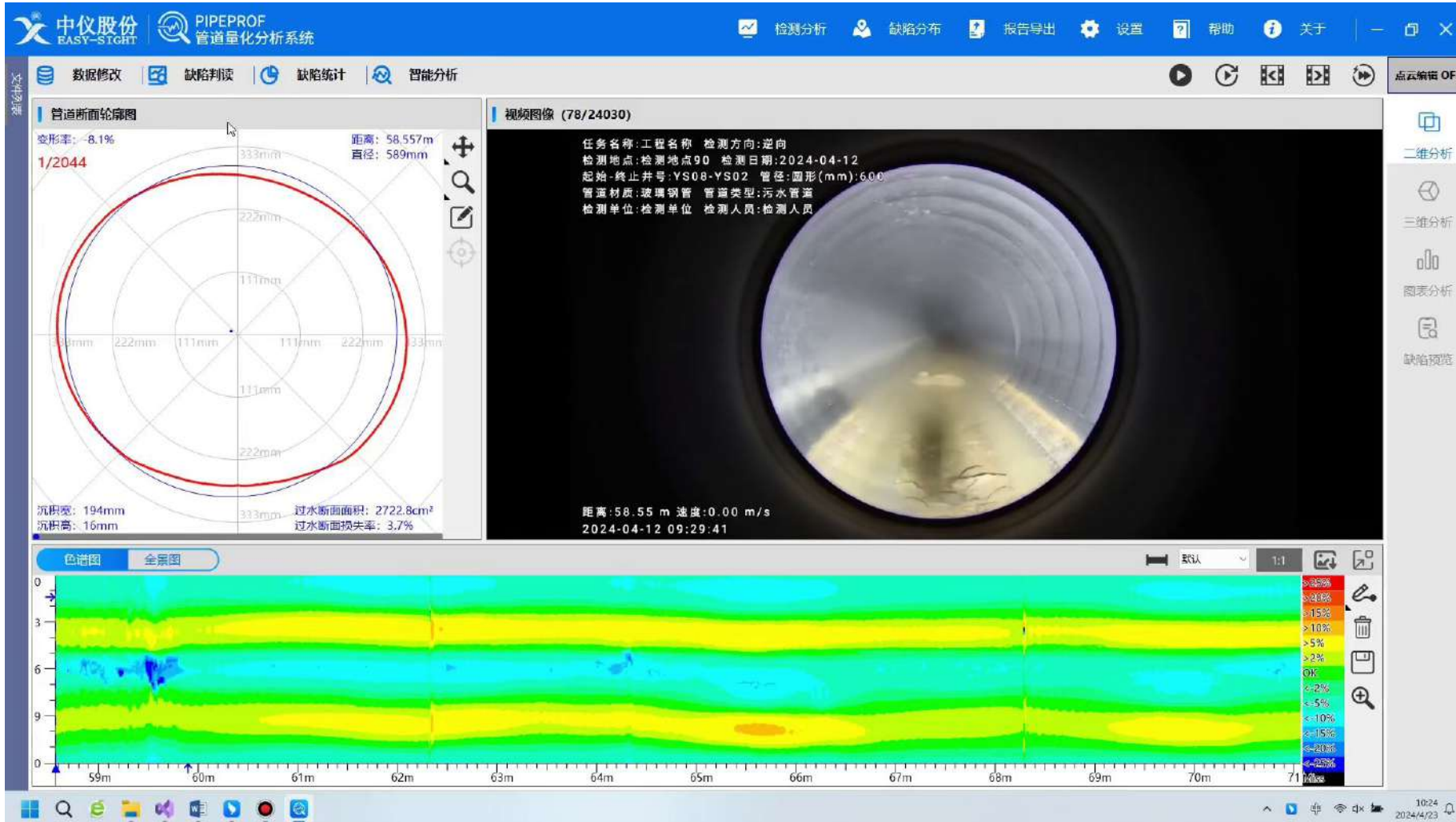
➤ Chart Analysis

Comparative analysis is performed from multiple aspects, including the pipeline contour circumference diagram before and after repair, **pipeline wall thickness change diagram**, pipeline contour expansion comparison diagram, etc. The value interval can be set arbitrarily.



3D Model

Result output



◎Support 3D point cloud and real scene map display

◎3D models can be exported as OBJ format

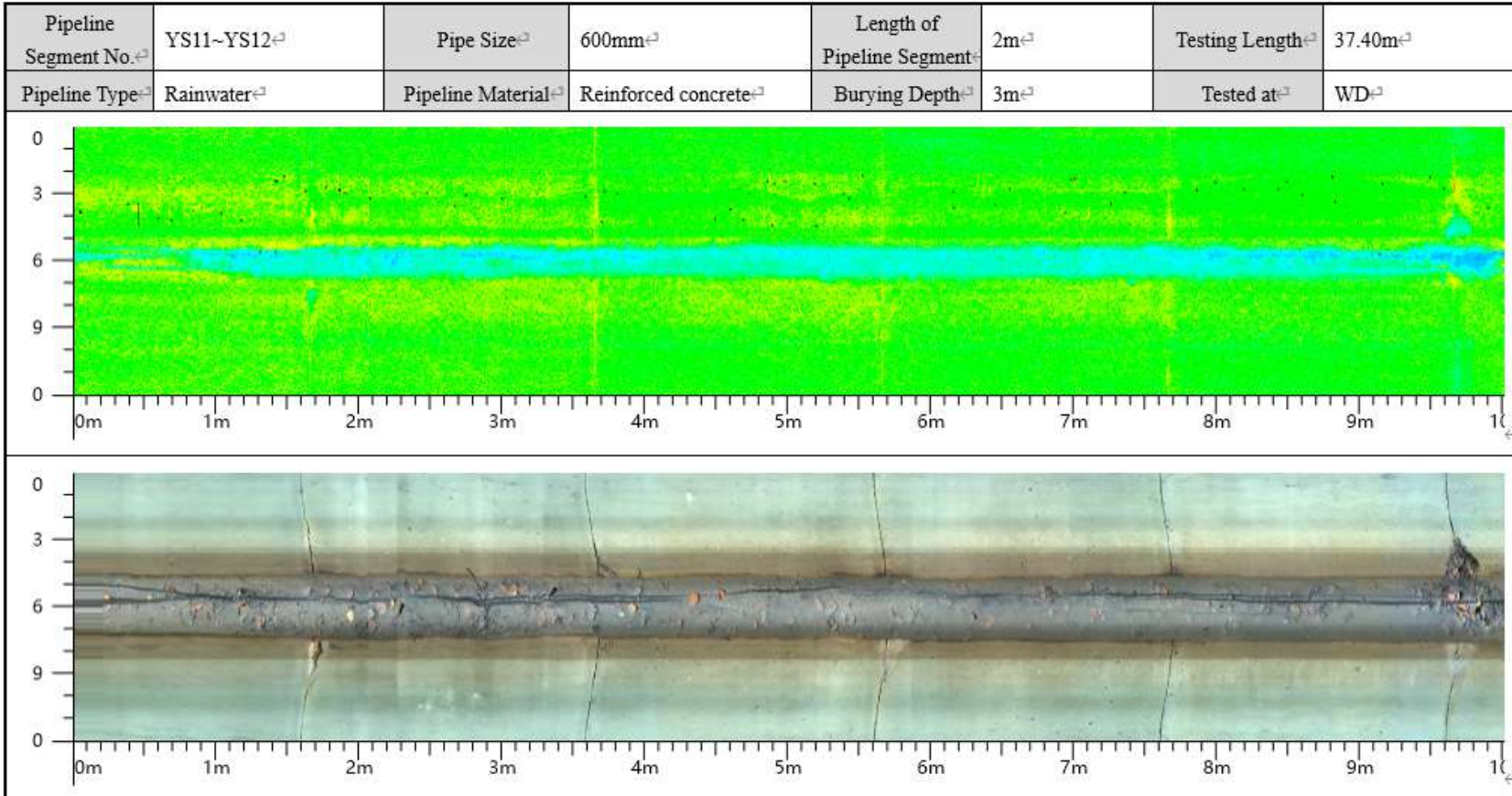
video display



Pipeline expansion diagram

Result output

2.4 Pipeline Expanded View



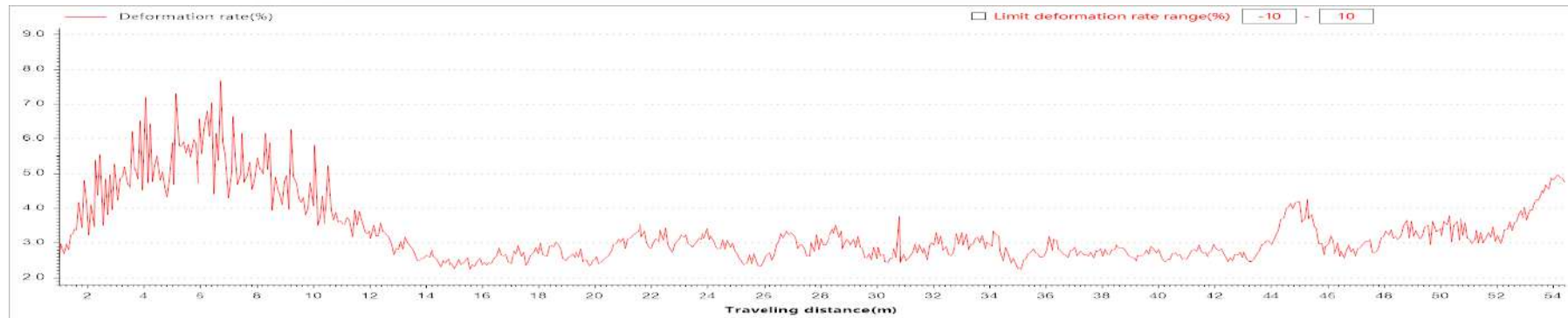
Pipeline expansion diagram, intuitively showing the internal situation of the pipeline, blue indicates slight sediment



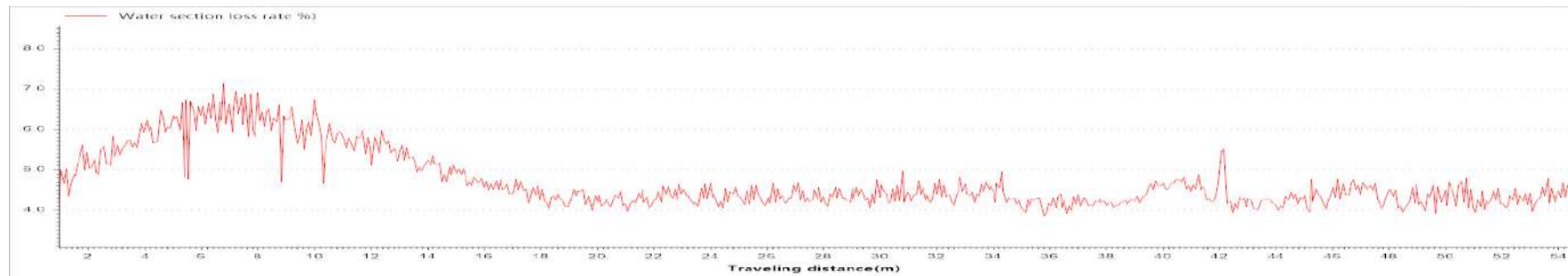
Chart Analysis

Result output

Pipeline deformation rate distribution diagram



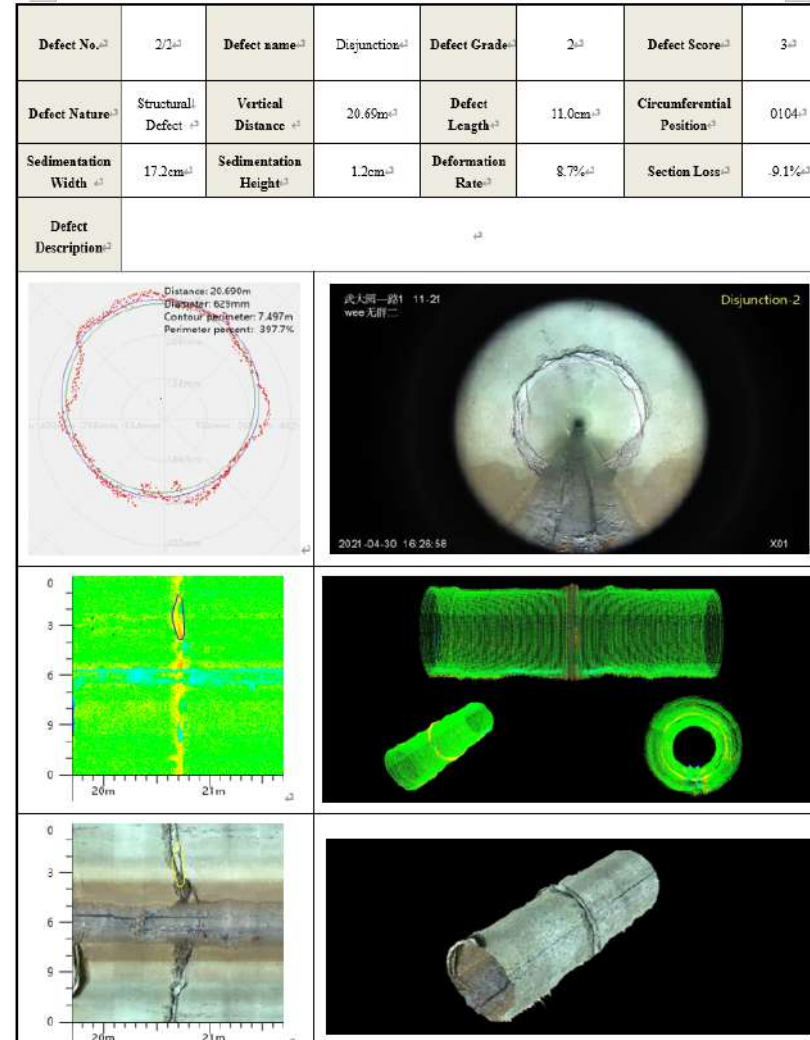
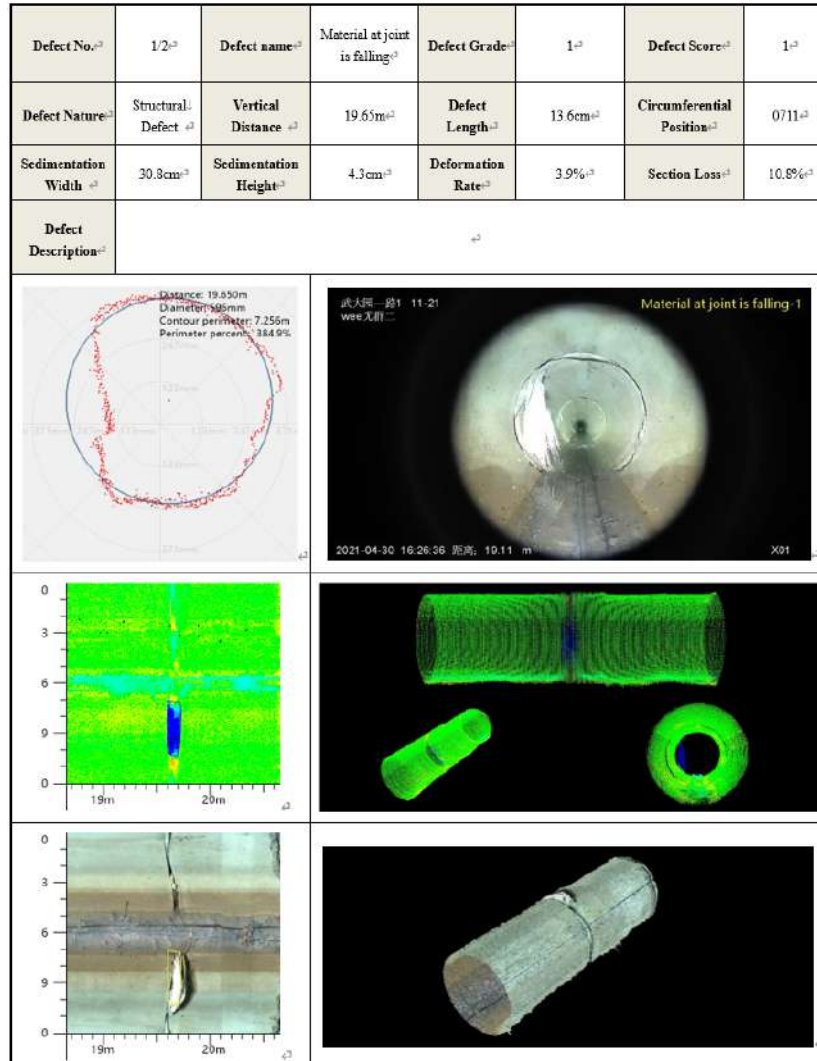
Drainage pipe water section loss rate diagram





Comprehensive presentation of defects

Result output



showing defects from multiple angles



Application Cases



Application cases

Hongkong

The Drainage Services Department of Hong Kong needs to repair a pressurized sewage pipe with a length of about 6KM and a pipe diameter of DN1200. Customized liner is difficult!!





Application cases

Hongkong

The screenshot displays the PIPEPROF software interface for a pipe inspection analysis. The main window is titled '中仪股份 EASY-SIGHT PIPEPROF 管道量化分析系统'. The interface is divided into several sections:

- Left Panel (HK Test):** A list of test locations, including 'CHEUNG TUNG ROAD HK-CH1800_CH2200' and 'CHEUNG TUNG ROAD HK-CH1750_CH1650'. The selected test is 'CHEUNG TUNG RD HK-CH1152_CH1364-逆向'.
- Top Panel:** Navigation and tool icons for '检测分析' (Detection Analysis), '缺陷分布' (Defect Distribution), '报告导出' (Report Export), '设置' (Settings), '帮助' (Help), and '关于' (About).
- Main View (管道断面轮廓图):** A circular cross-section diagram of the pipe. It shows a red outline representing the actual pipe profile and a blue circle representing the nominal diameter. Key data points include:
 - 变形率: -6.8%
 - 距离: 3.546m
 - 直径: 1179mm
 - 56/820 (red text)
 - Dimensions: 830mm, 553mm, 276mm.
 - 过水断面面积: 10932.5cm²
 - 过水断面损失率: 3.3%
 - 沉积宽: 429mm
 - 沉积高: 40mm
- Right Panel (视频图像):** A circular video image showing the interior of the pipe. It includes a scale bar and a compass. Metadata at the bottom reads: '距离: 3.52 m 速度: 0.12 m/s 2024-06-06 23:08:30 倍率: 1'.
- Bottom Panel (色谱图):** A longitudinal color spectrum graph showing the distribution of defects along the pipe length. The x-axis represents distance from 0 to 19 meters, and the y-axis represents depth from 0 to 9 meters. A color scale on the right indicates defect severity levels, ranging from '>25%' (red) to '<-10%' (blue).



Ellipticity analysis

Result output

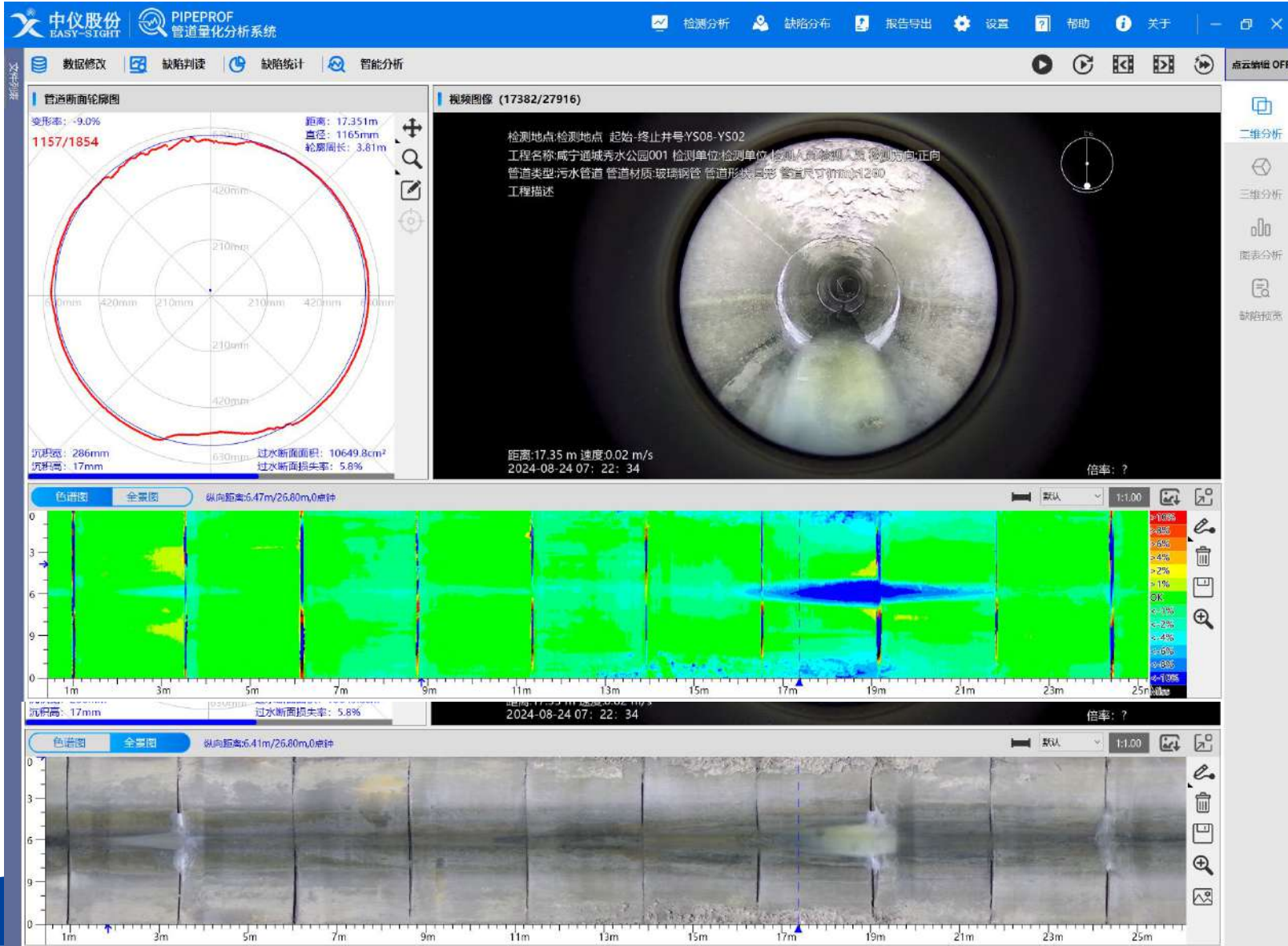
After desilting is completed, the ovality analysis of the different pipe sections can be performed.

Date		06-06-24		Location		CHEUNG TUNG RD HK		Start Manhole		CH1364	Ovality Average		1.096%
Crew members		FORWIN WANG		End Manhole		CH1226		Maximum overall ovality				1.880%	
Distance (m)	Disc Diameter (DD)		1.200		Ovality % - ASTM F1216/ASTM F1741								
	Minimum Diameter (m)		1.179		% Ovality = 100 x (max Dia - ave Dia) / ave Dia or								
	Maximum Diameter (m)		1.223		% Ovality = 100 x (ave Dia - min Dia) / ave Dia								
	Ovality % = 2 x {(Dmax - Dmin) / (Dmax+Dmin)} x 100				Max ovality		2.16%		Average		0.61%		
					Minimum		0.17%		Max vs Ave (%)		Min vs Ave (%)		Max Overall (%)
1.59	Pipe normal	1.216	1.193	1.880%	0.74	1.13	1.13						
1.60	Pipe normal	1.214	1.193	1.742%	0.85	0.89	0.89						
3.50	Pipe normal	1.210	1.194	1.291%	0.61	0.68	0.68						
4.54	Pipe normal	1.198	1.191	0.574%	0.26	0.32	0.32						
5.49	Pipe normal	1.200	1.195	0.427%	0.18	0.25	0.25						
6.49	Pipe normal	1.203	1.189	1.168%	0.40	0.76	0.76						
7.54	Pipe normal	1.208	1.191	1.429%	0.55	0.87	0.87						
8.54	Pipe normal	1.202	1.196	0.515%	0.22	0.30	0.30						
9.52	Pipe normal	1.202	1.198	0.308%	0.17	0.14	0.17						
11.56	Pipe normal	1.201	1.191	0.823%	0.39	0.43	0.43						
12.53	Pipe normal	1.201	1.192	0.812%	0.38	0.43	0.43						
13.53	Pipe normal	1.203	1.190	1.108%	0.47	0.63	0.63						
14.57	Pipe normal	1.206	1.191	1.244%	0.54	0.70	0.70						
15.60	Pipe normal	1.207	1.197	0.807%	0.47	0.34	0.47						
16.62	Pipe normal	1.199	1.188	0.882%	0.31	0.57	0.57						
17.60	Pipe normal	1.202	1.191	0.964%	0.55	0.42	0.55						
18.65	Pipe normal	1.205	1.190	1.181%	0.52	0.66	0.66						
19.64	Pipe normal	1.203	1.193	0.847%	0.38	0.46	0.46						
20.64	Pipe normal	1.205	1.193	0.961%	0.36	0.60	0.60						
21.65	Pipe normal	1.207	1.198	0.779%	0.44	0.34	0.44						
22.64	Pipe normal	1.203	1.195	0.612%	0.31	0.30	0.31						
23.65	Pipe normal	1.205	1.192	1.108%	0.53	0.58	0.58						
24.66	Pipe normal	1.206	1.192	1.212%	0.57	0.64	0.64						



Application cases

Xianning

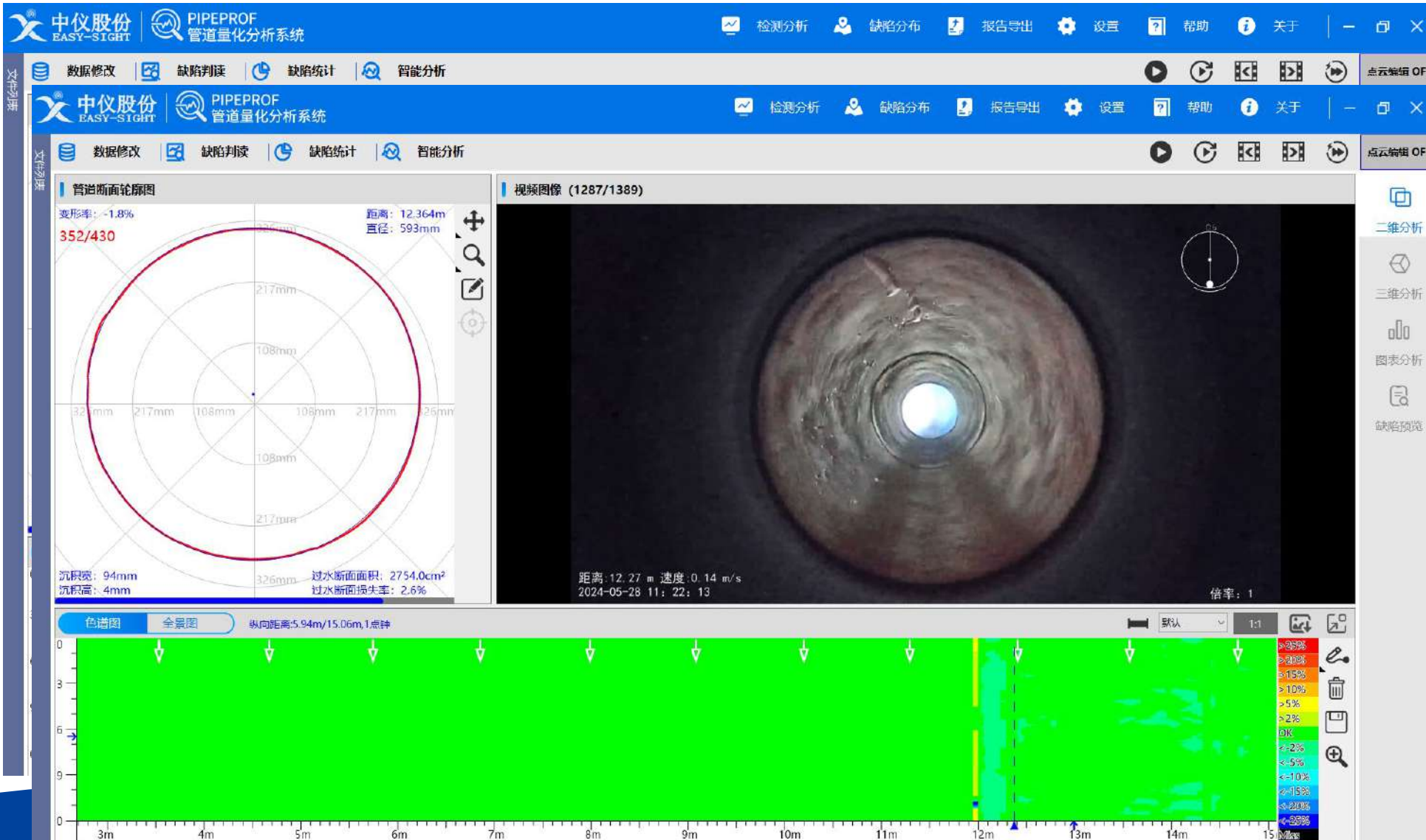


In one park, the pipe diameter is DN1200 and the inspection length is 38m. The pipeline has obvious disconnection, undulation, scaling and other problems.



Application cases

Xi'an

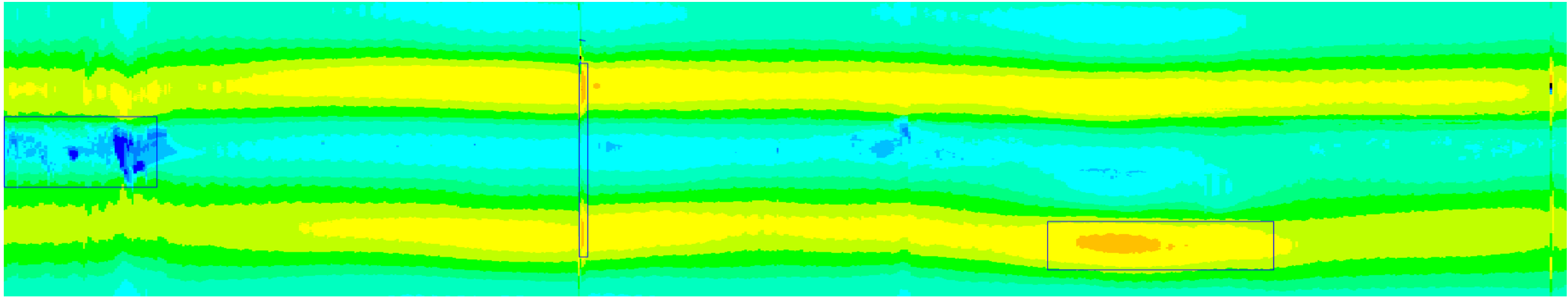


Lay a DN600 water supply pipeline, measure the change in the inner diameter of the pipeline, deformation rate, and other cleaning measures after laying. At 12m is the valve connection pipe, where you can see obvious scratches on the connection pipe and some distortion..



Application cases

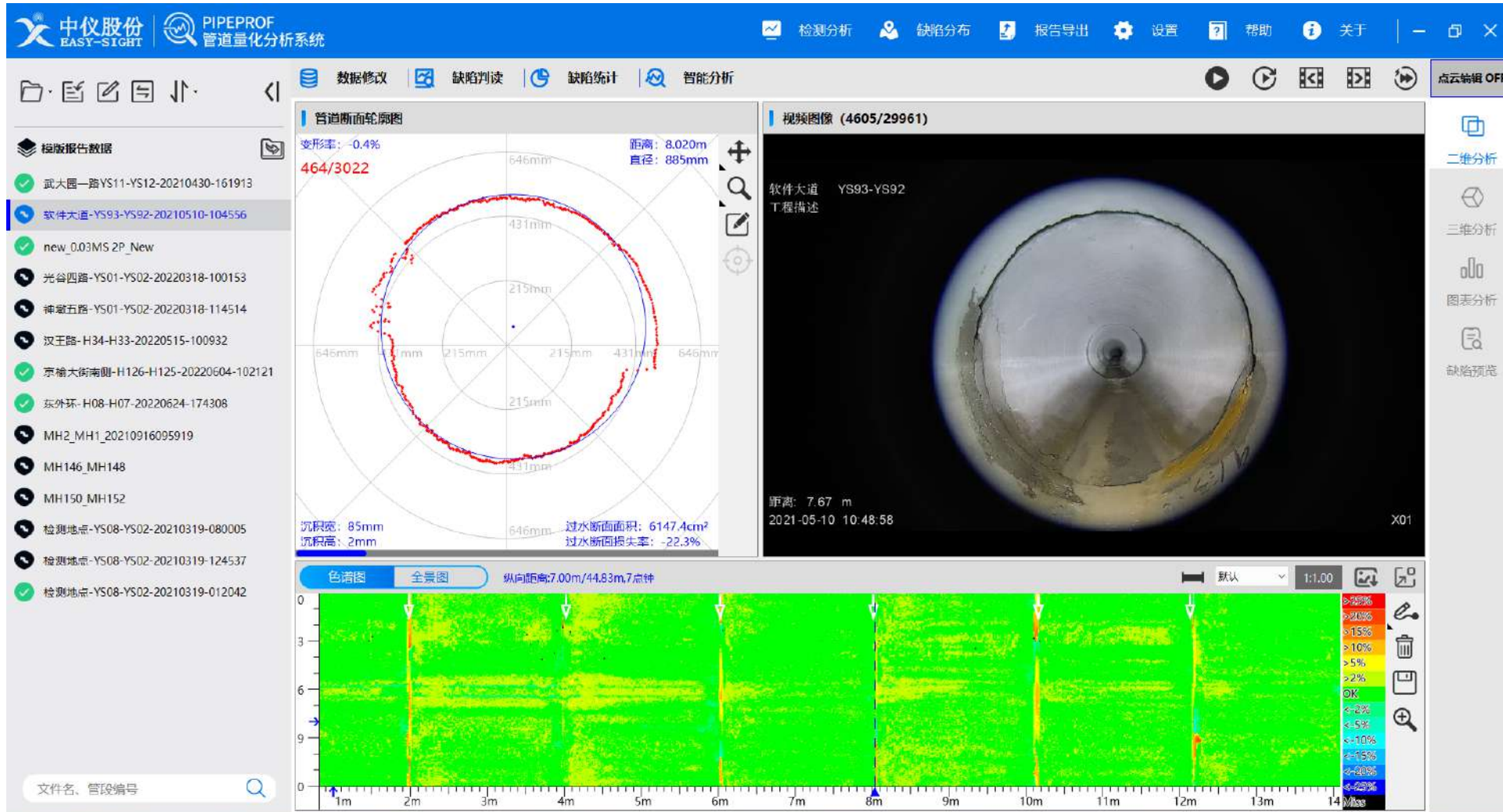
Wuhan





Application cases

Fuzhou

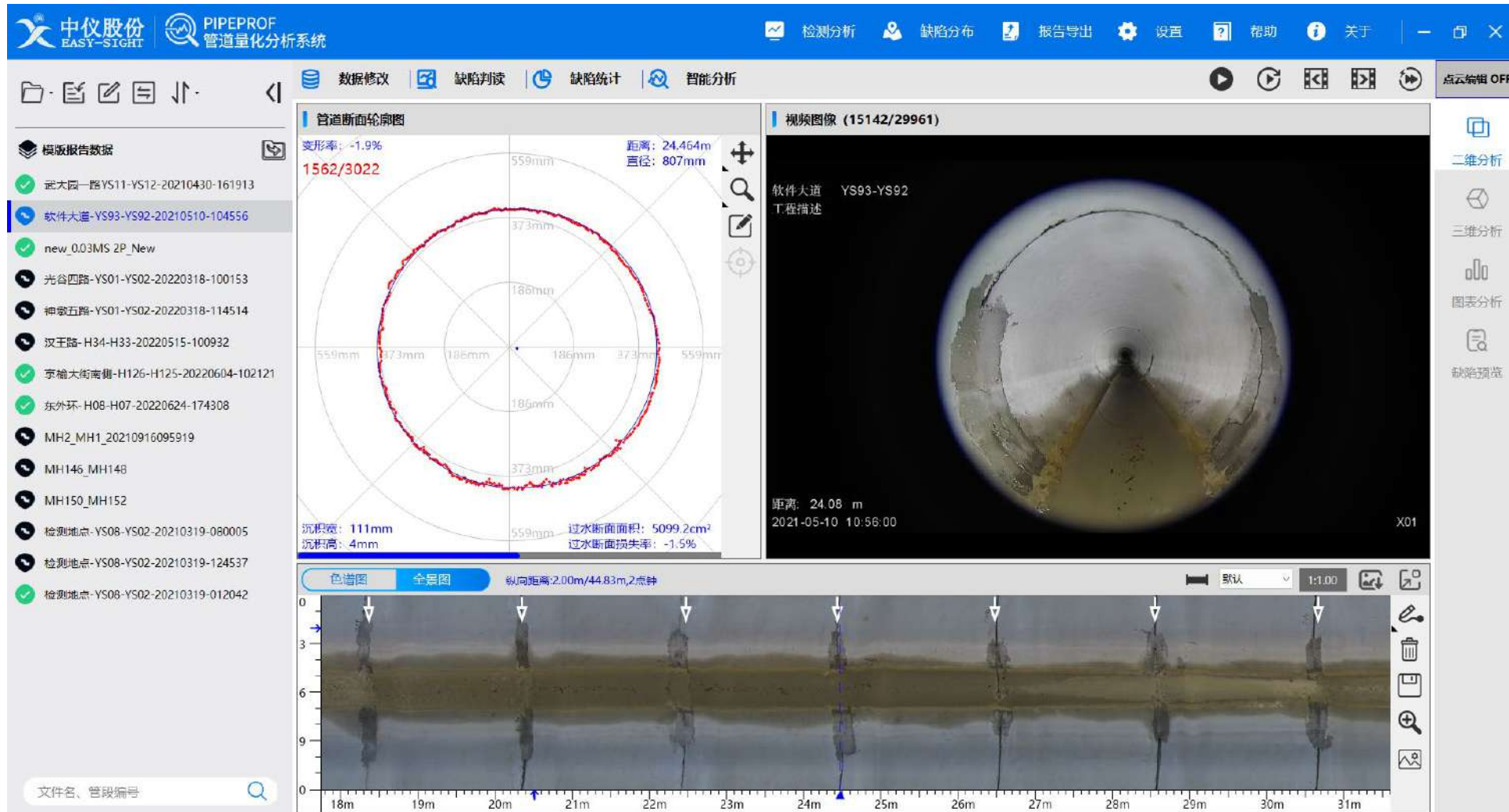


Inspection of DN800 pipeline, length 45 meters. From the chromatogram, it can be seen that the interior of the pipeline is generally good, but the interface has more serious problems, such as leakage at 8 meters.



Application cases

Fuzhou



At 24 meters, the same problem, the interface fell off, and we can see that it has been repaired



Application cases

Fuzhou



Through the panoramic view, we can clearly see that this problem exists at almost every joint of the pipeline, and all have been repaired. Each pipe section is in good health. This is something that cannot be directly observed using current CCTV.



PIPELINE DETECTION AND REPAIR EXPERTS



Wuhan Easy Sight Technology Co.,Ltd.



TRENCHLESS ASIA 2026

THAILAND



TRENCHLESS ASIA 2026 10-11 JUNE

QUEEN SIRIKIT NATIONAL CONVENTION CENTER, BANGKOK, THAILAND

WWW.TRENCHLESSASIA.COM

Organised by



Official Host Authority



Official Supporting Authority



Supporting Authority



Sponsors



Supported by



Media Partner

TRENCHLESSWORKS