FJDynamics

# Section Analysis

FJD Trion Product Solution

2025.06

# CONTENTS



PART

# 01

# Background

# Traditional Measurement Methods

| | | |
|---|---|---|
| Low efficiency & Long time | Inadequate data density | Poor report for reading |
| Gaps in data utilization | Risks in decision-making | Interference in complex scenes |

PART

# 02

# Solution

# Integrated hardware-software solution

- A combination of FJD Trion 3D LiDAR scanners and self-developed data processing software enables the streamlined "scanning - modeling - analysis - reporting" workflow. This integrated hardware-software solution facilitates efficient, safe, intelligent and digital tunnel analysis.

**Device** **Trion P1/S2**

Field data scanning, with real-time point cloud result.

**Control App** **Trion Scan**

Real-time trajectory viewing, point cloud preview and project files downloading.

**Software PC/iPad** **Trion Model**

Post-processing point cloud and tunnel section analysis.

# FJD Trion 3D Lidar Scanner

- The FJD Trion 3D LiDAR scanners are equipped with leading SLAM algorithms, enabling rapid collection of spatial point information for efficient and accurate reverse modeling of real world.
- High-precision LiDAR is adopted to acquire and process 3D point cloud data, allowing tunnel scanning without reliance on GNSS positioning.
- Integration with robotic dogs enhances autonomous navigation and inspection in challenging areas such as construction sites, disaster zones, and underground facilities—improving safety and efficiency by minimizing human intervention.

**S2**

**Robotic Dog**

**P1**

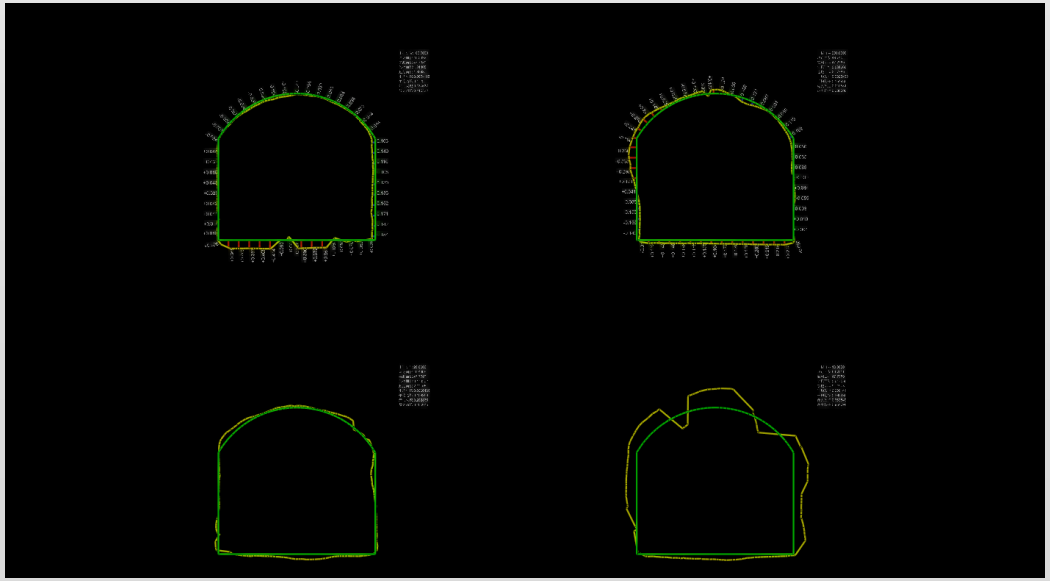
# Specifications

| | S2 | S2 Pro | S2 Max | P1 |
|---|---|---|---|---|
| Scanning range | **120m** | **120m** | **300m** | **40 m @10% reflectivity**<br>**70 m @80% reflectivity** |
| Integration method | Integration | Integration | Integration | Integration (no camera) |
| Dimensions | 107×118×398mm | 107×118×398mm | 107×118×398mm | 160×120×270mm |
| Lidar FOV | 360°×270° | 360°×270° | 360°×270° | 360° x 59° |
| Power supply | Handheld battery | Handheld battery | Handheld battery | Handheld battery |
| Points per second | **320,000** | **640,000** | **640,000** | **200,000** |
| Camera pixels | 2 X 12.33MP | 2 X 12.33MP | 2 X 12.33MP | 5760×2880 @ 30 fps (external) |
| Real-time view | **Colored Point Cloud** | **Colored Point Cloud** | **Colored Point Cloud** | **Point Cloud** |

# Data processing software FJD Trion Model

- FJD Trion Model is a point cloud data processing software independently developed by FJDynamics. It is used for visualizing and processing point cloud obtained from scanners. It supports basic point cloud data processing, such as point cloud mapping, coloring, and visual inspection of point clouds.

- The Section Analysis module designed for tunnel design mainly deals with issues such as reference cross - section line design based on 3D point cloud, extraction of actual cross-sections, over or under excavation analysis, and report exporting.

# Workflow

01

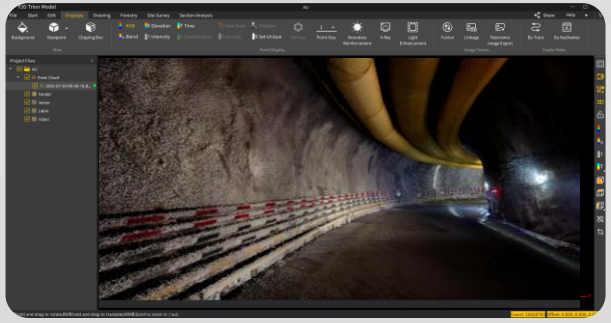
## On-site survey

02

## Data acquisition

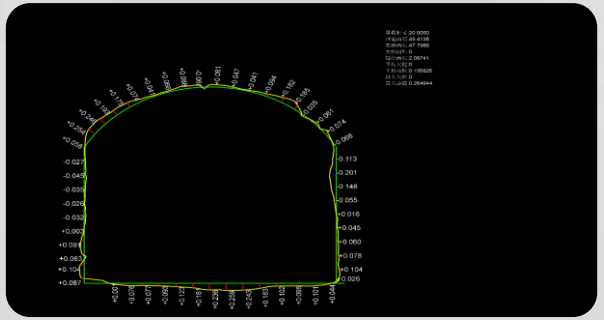
03

## Data processing



04

## Section analysis



# On-site survey

## Risk Inspection

- Safety detection of toxic, flammable and explosive gases.
- Structural stability inspection
- Emergency plans

## Protection

- Tunnel environment is complex, so protective measures should be taken before scanning work.

## GCP layout

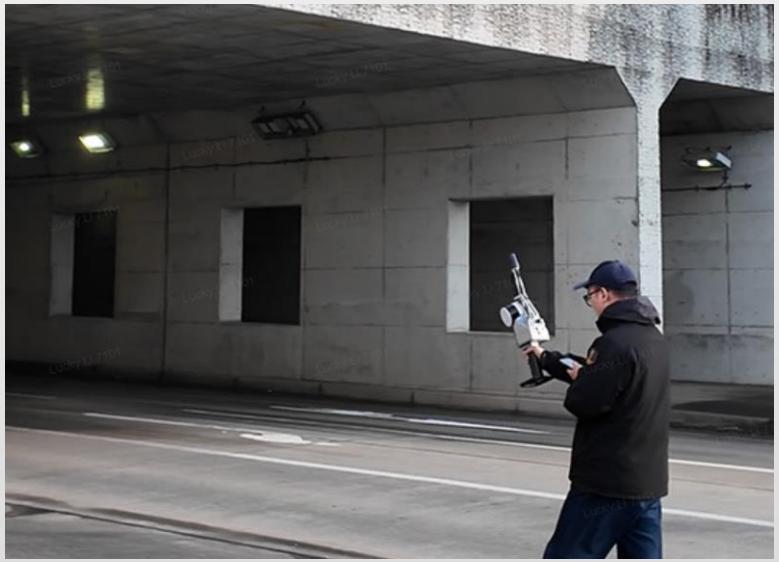
- If the tunnel has abundant features, control points are not necessary; if features are insufficient, using GCPs (in and out) will improve final data accuracy.

# Data acquisition

## GCP collecting (total station)

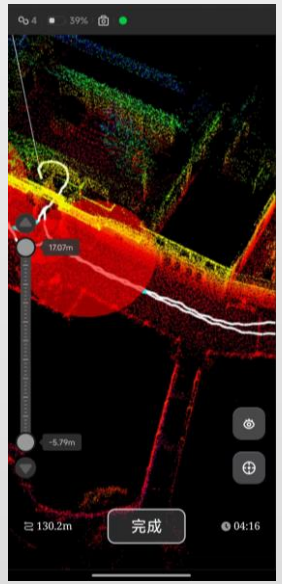
- Use a total station to measure and record the coordinate information of GCPs.

## 3D scanning (FJD Trion S2/P1)



- Use FJD Trion scanner to scan the tunnel and obtain 3D point cloud and image data.
- For long tunnels, enough overlap areas for facilitating point cloud stitching.
- Inspect real-time point cloud and restart if any issues are found.

## Data download (FJD Trion Scan)




- Download raw data from FJD Trion Scan (fjslam&insv).
- Files can be downloaded via a USB drive or wire connection.

# Notice

**1.Segmented scanning**: For scanning long-distance tunnels, it is recommended to split the scanning into multiple segments. Each segment ranging from 200 to 300m in length. Each scan needs to overlap with the previous one (recommended overlapping distance is 50 to 100m).

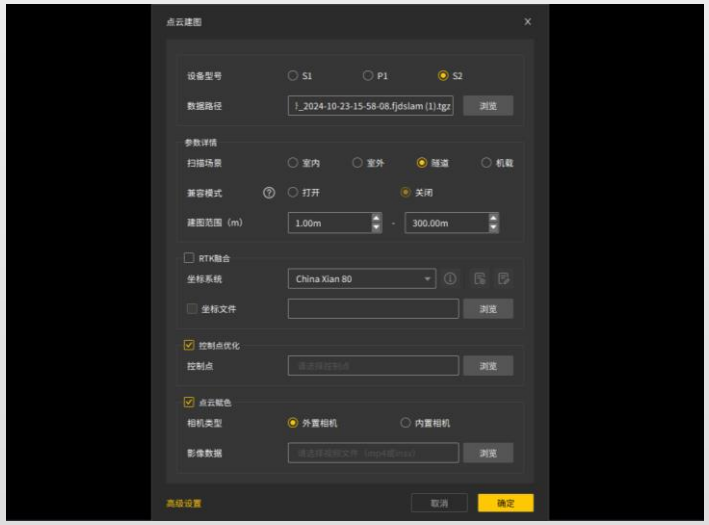
**2.GCP arrangement**: Arrange a control point every 50m. It is better to be placed them on the ground not on the wall. If control points have to be on the wall, it is better to put the scanner head in the forward direction (rather than upward) when the scanner is collecting coordinates.

**3.Adding features**: If there are large boxes (with side lengths of 15-20 inches), they can be placed scattered in the middle of the tunnel. It is best to place them in front of control points or at turning positions. This can increase the features in the tunnel and help obtain high-quality point cloud.

**4.No need for close loop**: When scanning the tunnel, there is no need to scan back or turn around to scan. Just walk through it once. There is no need to close the loop or walk the same route in the reverse direction, as this can easily lead to registration errors**.**

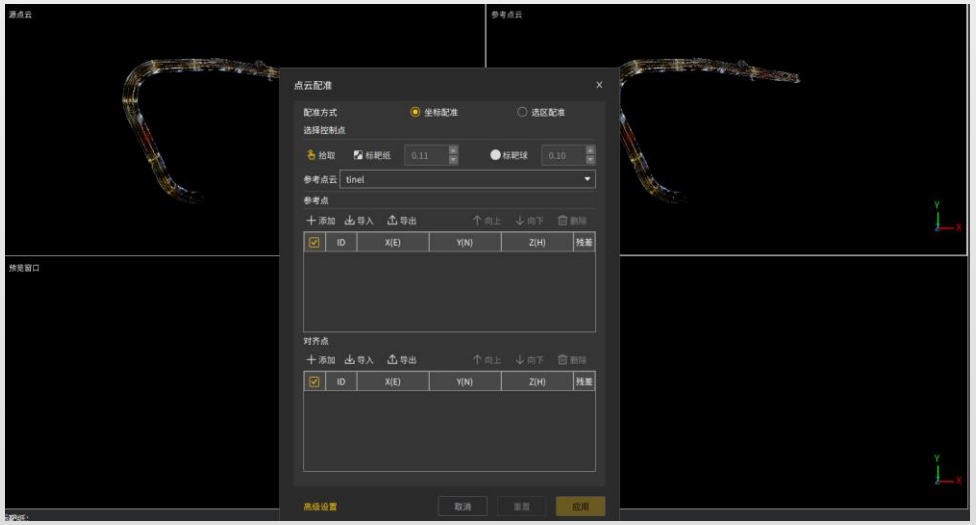
# Data processing

## Point cloud mapping



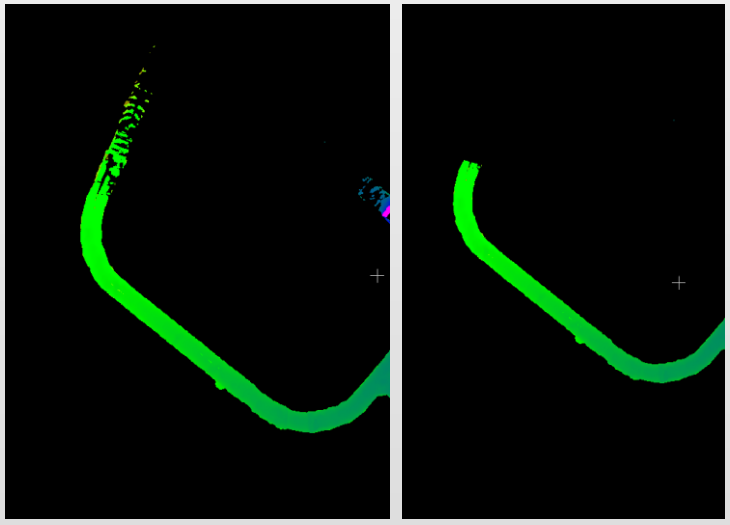

- Import the raw point cloud data, control point files, and image data into the FJD Trion Model for point cloud mapping.

## Continuous scanning/Registration




- Run continuous scanning for splicing on multiple sets of scanned data to merge them into a complete tunnel.
- If there is enough overlap area, use the point cloud registration to stitch multiple sets of point clouds.

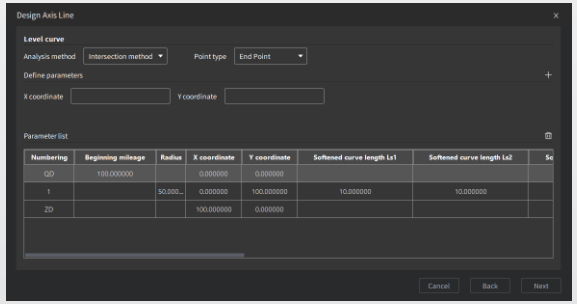
## Clipping

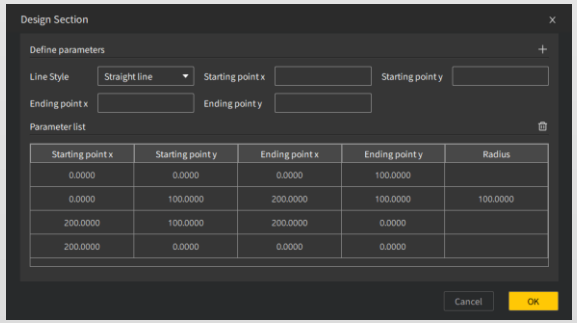


- Use the clipping function to remove noise and useless areas, retaining the effective tunnel area.

# Section analysis

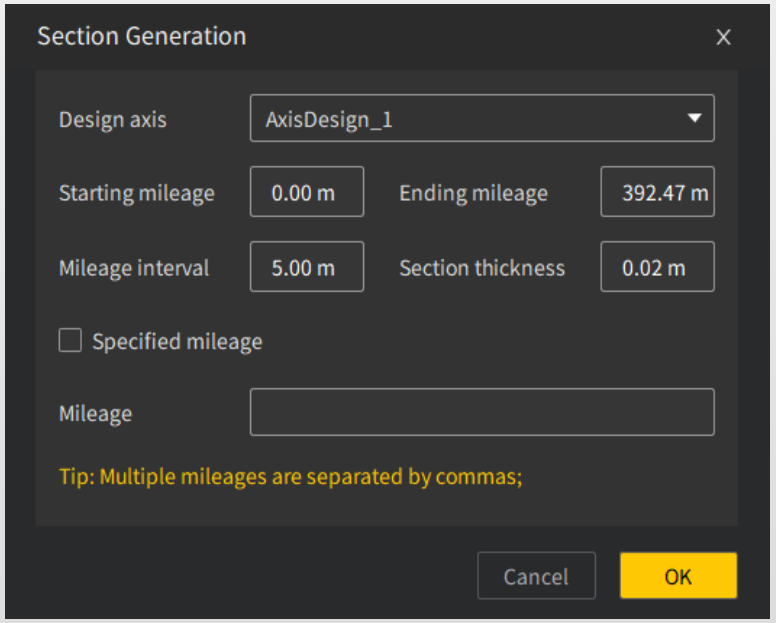
## Design Axis Line



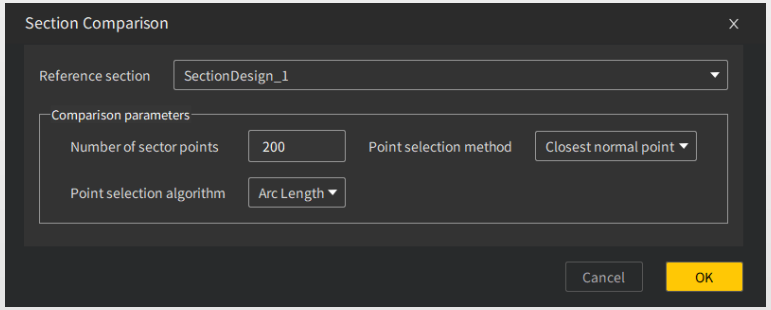

- Create the design axis and design cross-section based on the tunnel parameters (provided by the design party).

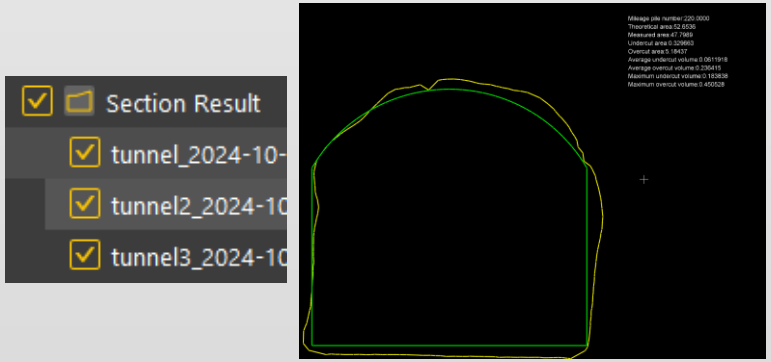
## Section Generation




- Generate cross-section based on point cloud.
- Select information such as the design axis, starting mileage, and ending mileage, and the software will automatically generate the actual tunnel cross-section.

## Section Comparison




- Compare the cross-section data with the design documents.
- The results will display over and under excavation data, and export the cross-section analysis report.

# FJD Trion 3D Lidar Scanner & FJD Trion Model Section Analysis


- High-efficiency data acquisition and shorten survey time
- High-accuracy results to ensure construction quality and minimize rework load
- Automated analysis and comprehensive report
- Enhance safety by reducing personnel entry into hazardous areas
- Compatibility with third-party software to promote information sharing

PART

# 03

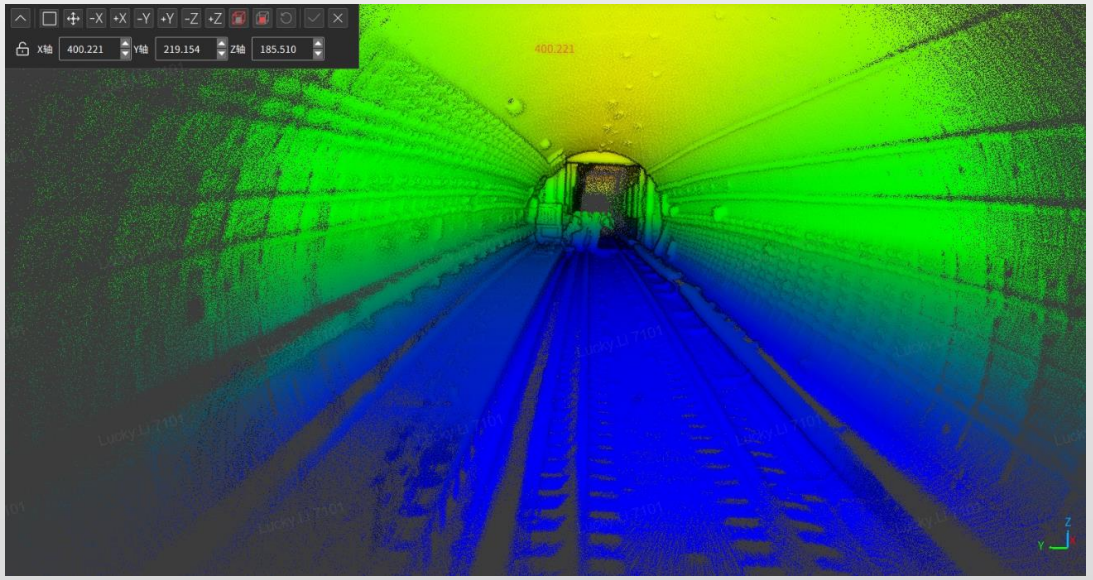
# More Application

# Mining industry applications

- Section analysis guides the adjustment of mining schedule, enabling an increase in the effective utilization rate of cross-sections, as well as enhancing mining safety and improving efficiency.

# Rail transit construction application

- In the rail transit construction field, tunnel cross-section analysis technology has been deeply integrated into the entire process of engineering construction, enabling high-precision archive data storage and facilitating the digital development of transportation construction.

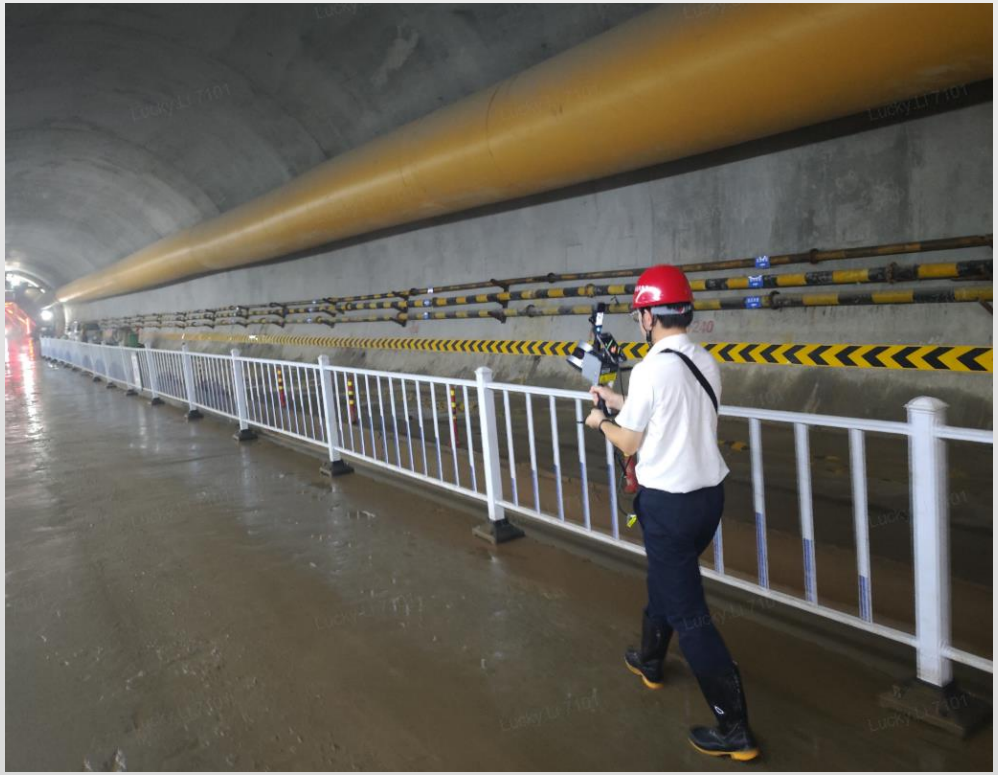


# Underground space safety application

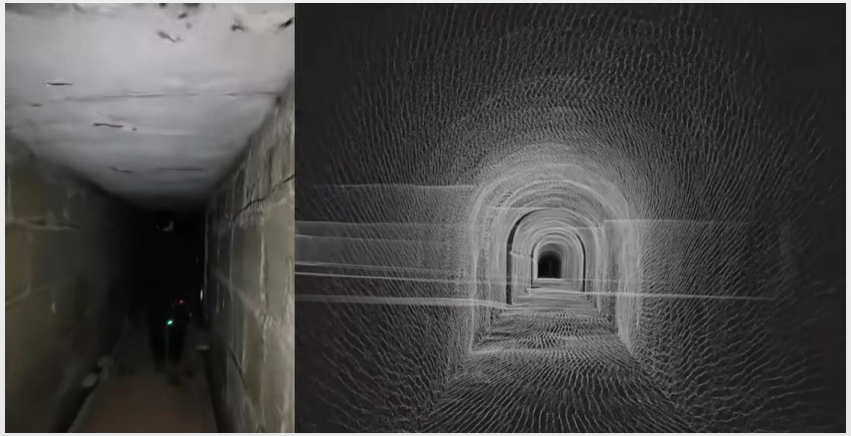
- Build an all-day 3D safety prevention and control system to support underground projects such as rail transit and utility tunnels in upgrading their intelligent operation and maintenance methods from "passive emergency repair" to "active maintenance".

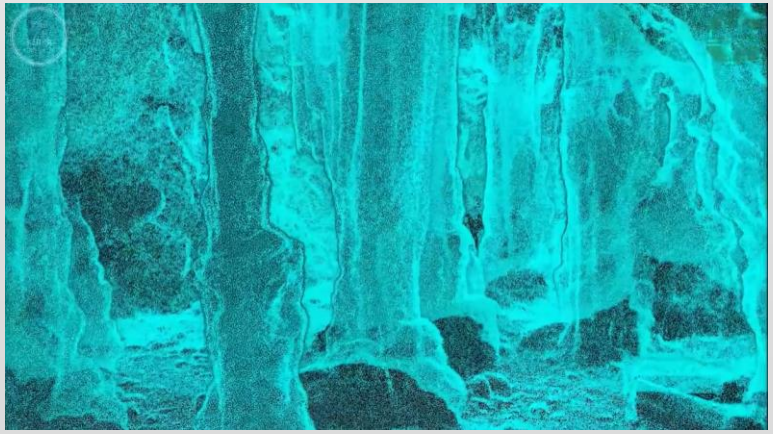
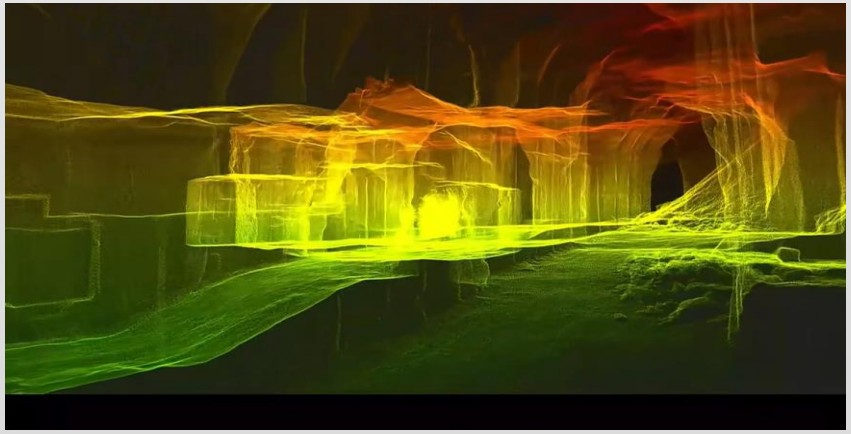
# Water Conservancy and Hydropower Engineering

- Through 3D spatial data collection and intelligent analysis, it provides accurate decision-making basis for engineering design optimization, construction management and control, and safe operation and maintenance.



# More potential


FJDynamics

# Create for a Better World