

# GSCAN

MT in Civil Engineering



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## Atmospheric Muon Flux



~1  $\mu$  per  $\text{cm}^2$  in 1 min

Long measurement time



## MU-RAY TECH Artificial Muon Source

Laser Plasma  
Accelerator

Electron Beam

Converter

Muon Beam

>1000  $\mu$  per  $\text{cm}^2$  in 1 min

Short measurement time

$\mu$

Muons are elementary particles  
Same charge as electrons  
200x heavier than electrons  
Can penetrate meters of material  
Less damaging to tissue than X-ray radiation

System of particle track detectors  
recording the trajectories of  
incoming and outgoing  
muons.



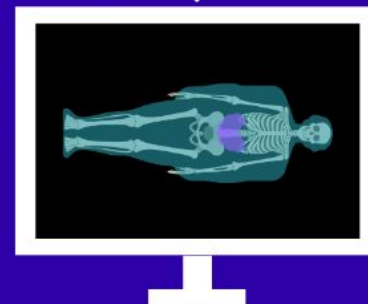
Measured  
Trajectory

Scattering  
Angle

Expected  
Trajectory

Raw data from detectors  
filtered and processed  
into trajectories

Reconstruction algorithm  
produces a 3D model of  
the volume of interest



# GScan in Civil Engineering

- **Team:** 50+ Full Time Employees
- **MT commercial deployments:**
  - 12 bridges
  - 2 tunnels
  - 2 legacy submarine nuclear reactors
- **Countries:**
  - In-service structures — EE, UK, NL, JP
  - Specimens — DE, CH, FR
  - Discussions - FI, NO, AT, UAE, DE, CA
- **Revenue 2025:** €1.6M + grants €1.9M
- **Revenue 2026 goal:** €3.2M + grants €2M
- **Revenue 2027 goal:** €6M



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## Key Developments (past 2 years)

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- Developed fully integrated deployment ready detectors
  - Production of detector fleet
    - L-size (1.7 m<sup>2</sup>) and XL-size (2.1 m<sup>2</sup>)
  - Reconstruction algorithms (analytical and ML)
  - UI interface for operation and results
  - Automated reconstruction pipeline
  - Object detection ML models
  - Detector deployment by external partners
  - Partially automated defect analysis
  - Method calibration and validation (on going)
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# Example: Llanrhystud Bridge

UK's First In-Service Structure to be Inspected by Cutting-Edge Muon Tomography in October 2025

1.2 meters thick concrete  
4 XL detectors  
16 days of acquisition

**"We are very happy with the results GScan have provided; the MFT successfully located all the PT apparatus and steel reinforcement of the area scanned. We are now in a much better position to manage the structure."**

**- Bob Humphreys Principal Engineer at YGC**

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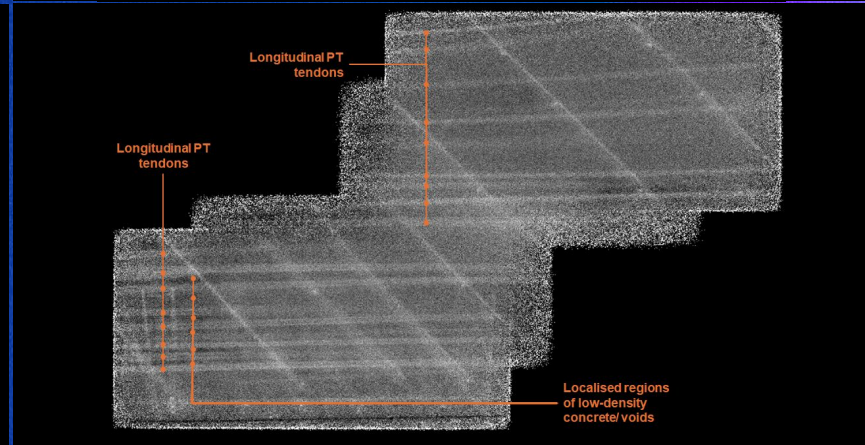
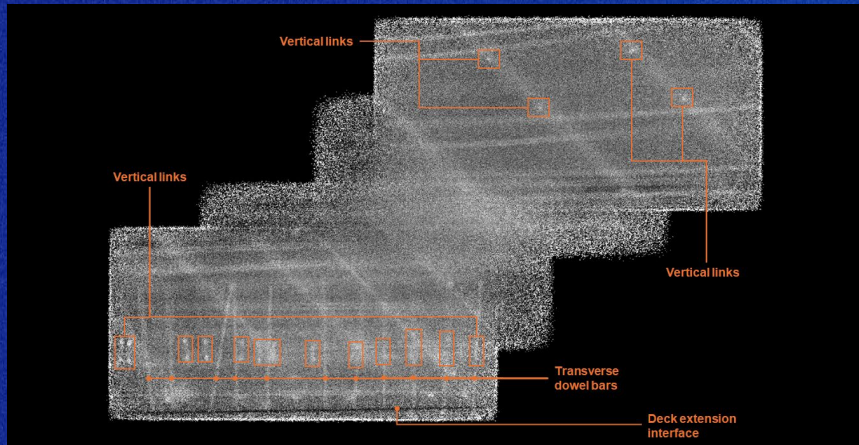
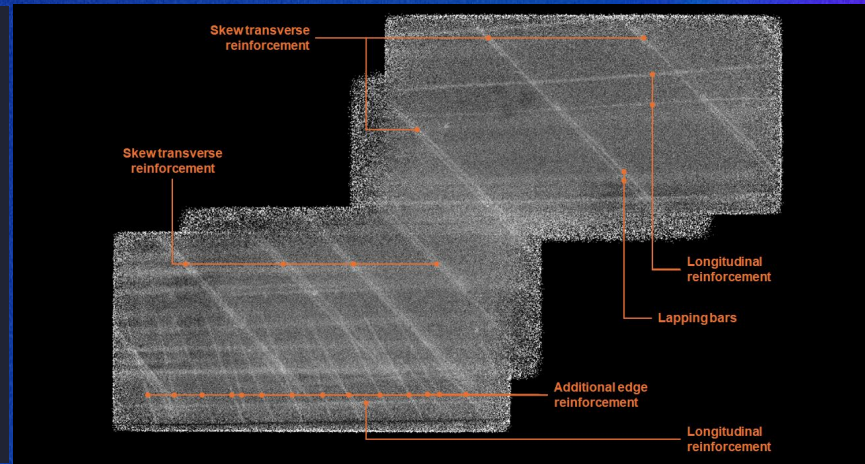
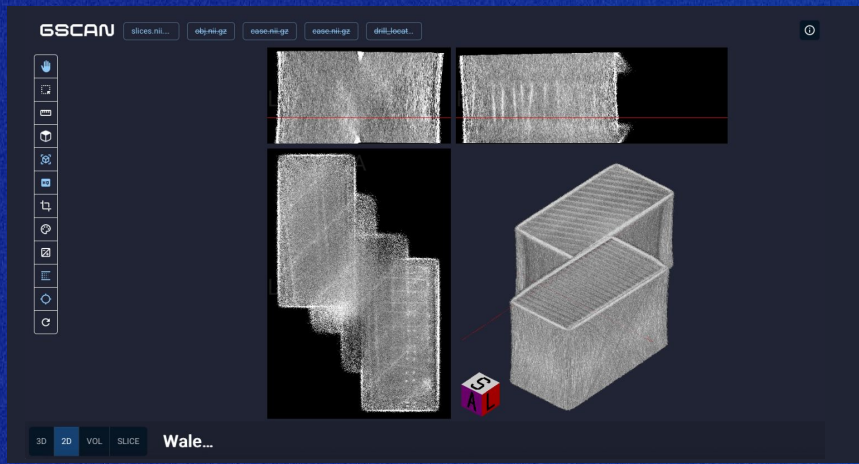
# Particle Detector Installation

GSCAN



# Reconstruction and Annotation

GSCAN



# Object Detection Model for Steel Rebar

GSCAN

GSCAN slices.nii... obj\_nii.gz ease-nii.gz ease-nii.gz drill\_locat...

ⓘ ? New scan ☰

The screenshot displays the GSCAN software interface. On the left is a vertical toolbar with icons for hand, zoom, pan, and other navigation functions. The main area is divided into four quadrants: top-left shows a 2D slice of a scan; top-right shows another 2D slice with a red horizontal line; bottom-left shows a 3D point cloud of the scan; bottom-right shows a 3D wireframe model of a rectangular object with a red bounding box and a small red cube with the number '5' on it. A data panel in the bottom right corner displays the following information:

86 1 0 0
voxel:654 661 74
mm:1962.00 1983.00 222.00

3D 2D VOL SLICE Wale...

# Object Detection

GSCAN

GSCAN slices.nii... obj.nii.gz ease.nii.gz ease.nii.gz drill\_locat...

① ? New scan ☰

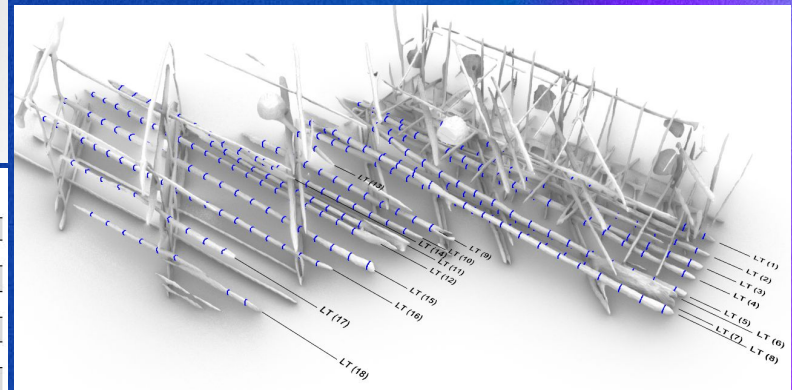
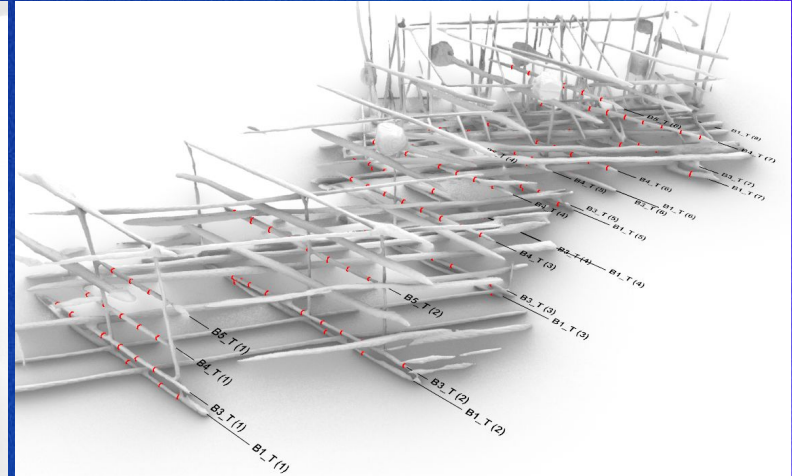
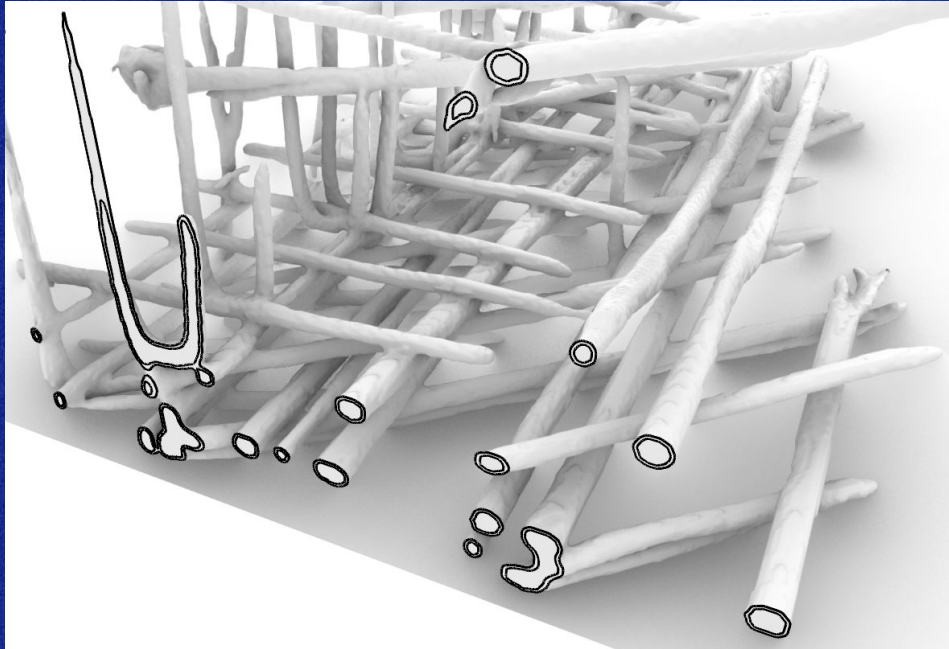
The screenshot displays the GSCAN software interface. At the top, there are file name buttons: 'slices.nii...', 'obj.nii.gz', 'ease.nii.gz', 'ease.nii.gz', and 'drill\_locat...'. On the right, there are navigation icons: a home icon, a help icon, a 'New scan' button, and a menu icon. A vertical toolbar on the left contains various interaction tools like pan, zoom, and rotate. The main area shows a 3D point cloud of a structure with a red horizontal line indicating a slice. Below the 3D view, a 2D slice is shown with a red box highlighting a specific region. In the bottom right corner, technical data is displayed: '86 1 0 0 0', 'voxel:654 661 74', and 'mm:1962.00 1983.00 222.00'. At the bottom left, there are view mode buttons: '3D', '2D', 'VOL', and 'SLICE', with 'Wale...' text next to them.

86 1 0 0 0  
voxel:654 661 74  
mm:1962.00 1983.00 222.00

3D 2D VOL SLICE Wale...

# Diameter Calibration $\pm 2.1$ mm

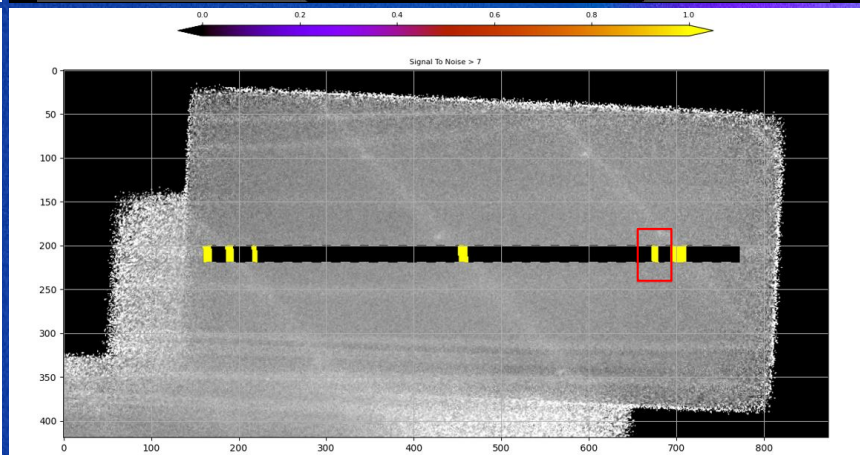
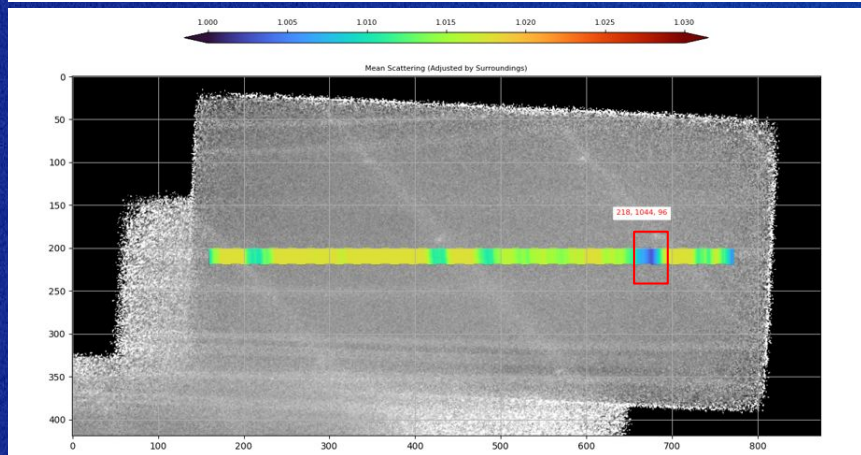
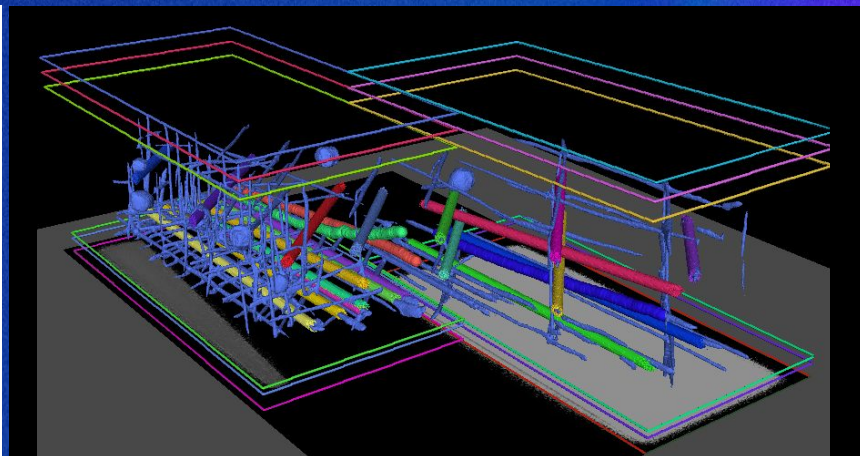
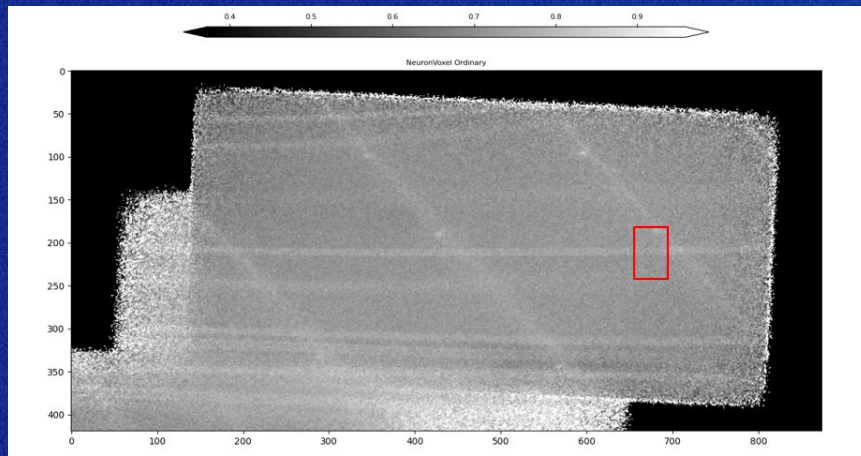
GSCAN



Type	Direction	Location	$\Phi_{max}^{[1]}$ (mm)	$A_{max}^{[1]}$ (mm <sup>2</sup> )	$A_{avg}^{[2]}$ (mm <sup>2</sup> )	$\Phi_{req}^{[3]}$ (mm)	$\Delta\Phi^{[4]}$ (mm)	Combined CSA <sup>[5]</sup> (mm <sup>2</sup> /m)
Reinforcement	Longitudinal	Top mat	16	201	159	14.2	-1.8	375
Reinforcement	Transverse	Top mat	16	201	233	17.2	1.2	728
Reinforcement	Longitudinal	Bottom mat	16	201	184	15.3	0.7	429
Reinforcement	Transverse	Bottom mat	16	201	258	18.1	2.1	1,227
Reinforcement	Vertical <sup>[6]</sup>	-	-	-	118	12.2	-	343 <sup>[7]</sup>
Tendon	Longitudinal	-	29.2	670	635	28.4	0.8	-
Tendon	Transverse	-	-	-	681	29.4	-	-

# Defect Detection

GSCAN



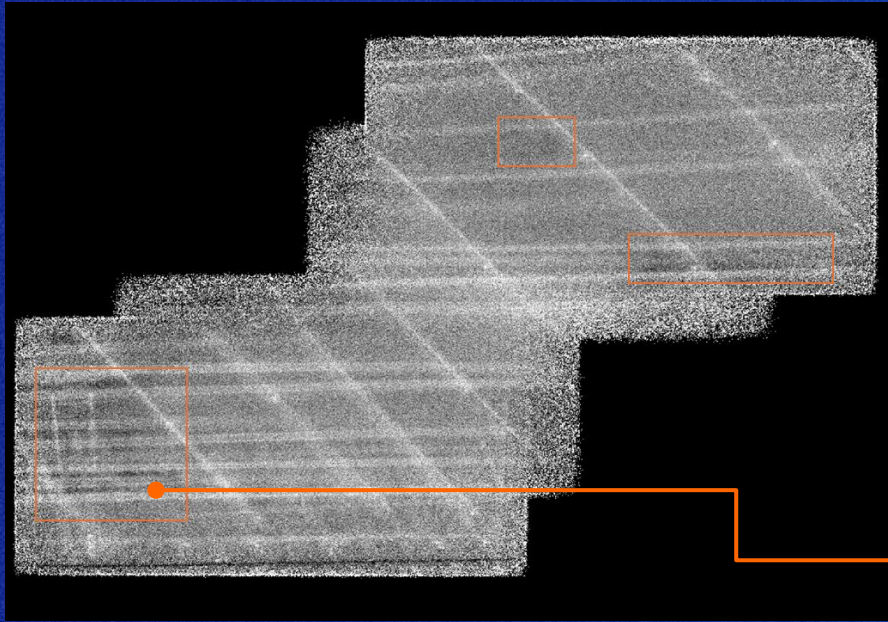
# Tendon Exposures

GSCAN

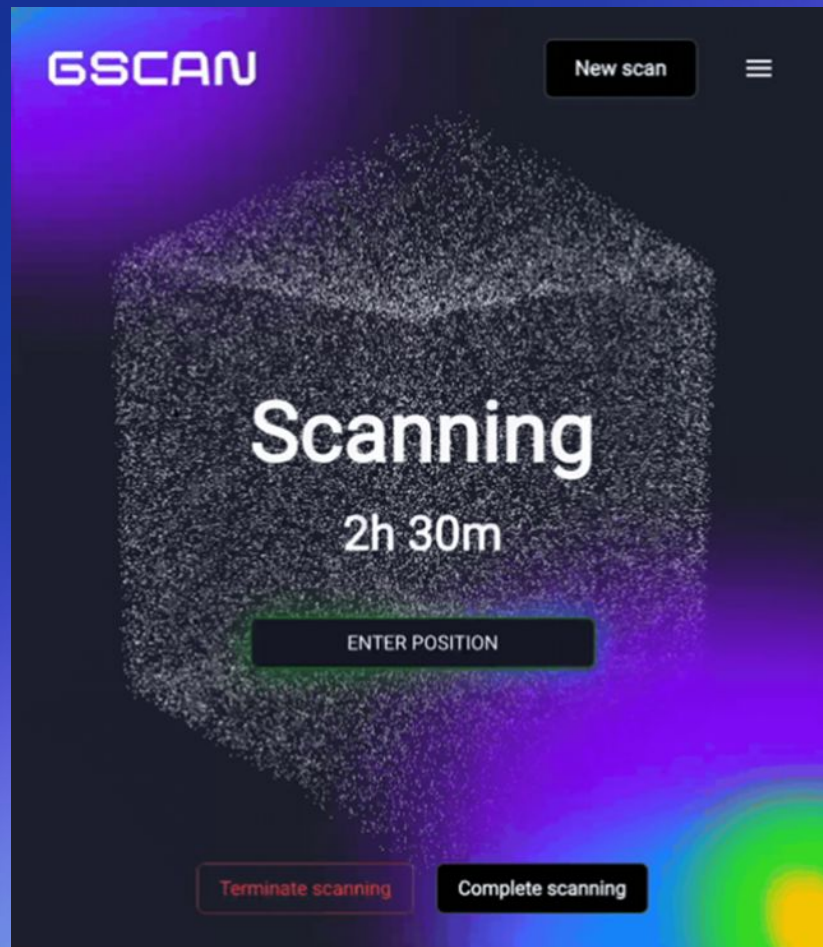


# Confirmation of Concrete Voids

GSCAN



# Thanks



# GSCAN

