dConstruct Robotics

COMMERCIAL-IN-CONFIDENCE.

Company & Team Introduction

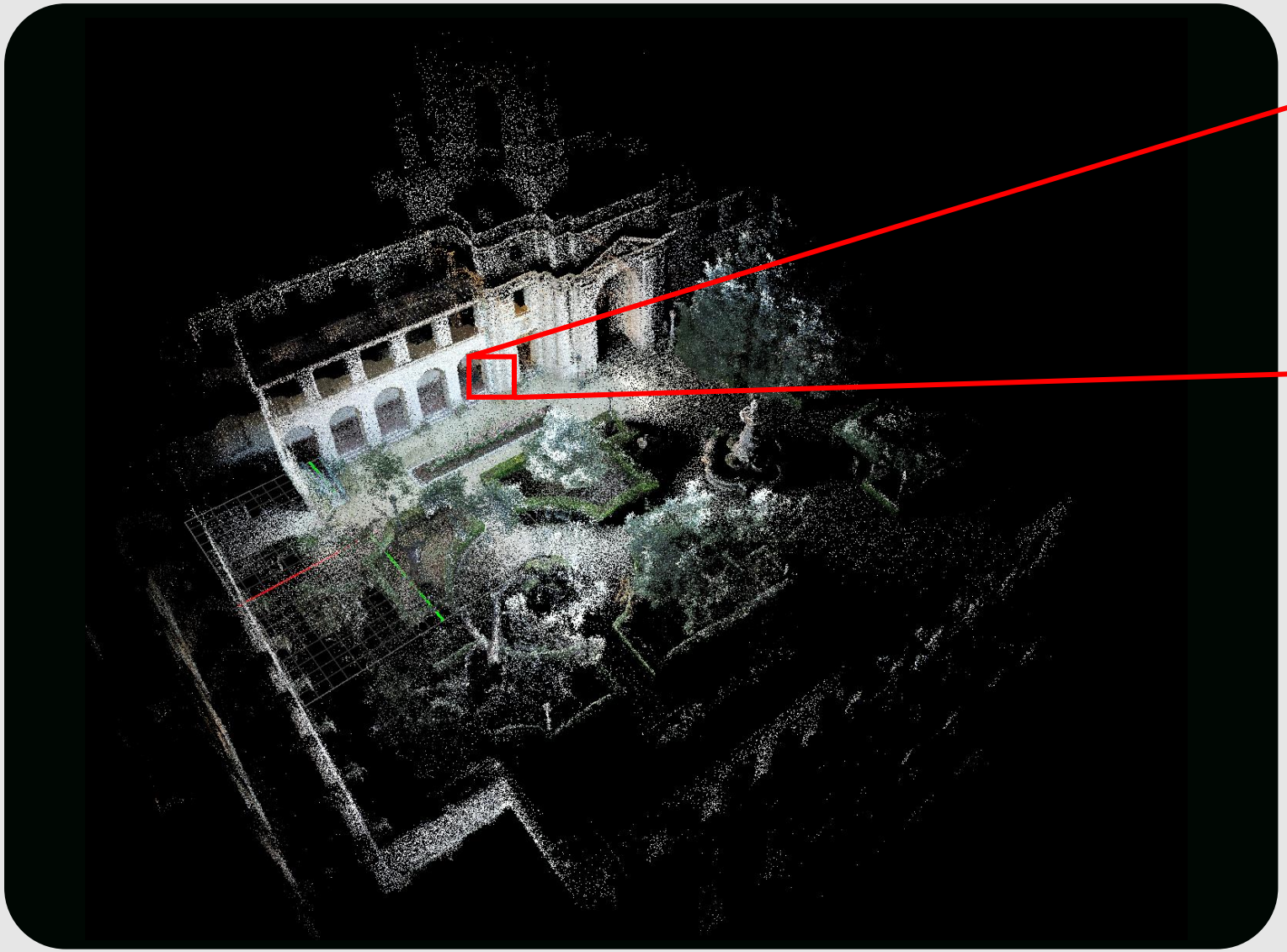
The world's hardest-to-hire jobs are becoming the world's largest robotics market. This is where dConstruct steps in.

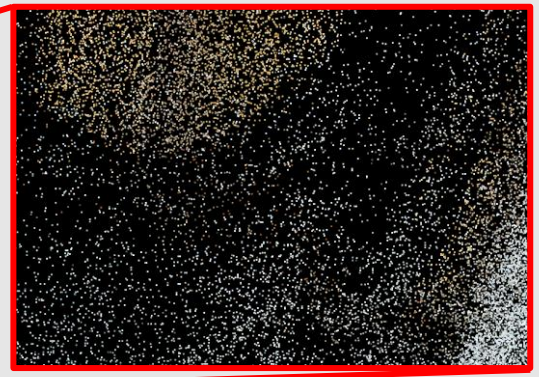
Vision
To shape our world where intelligent robots empower every organisation to deliver more with less.

Mission
We design and build robots that observe like human, think like experts, and act with context – enabling industries to achieve human-level service with machine-scale efficiency.

LiDAR Technology and Application

What is a Point Cloud?

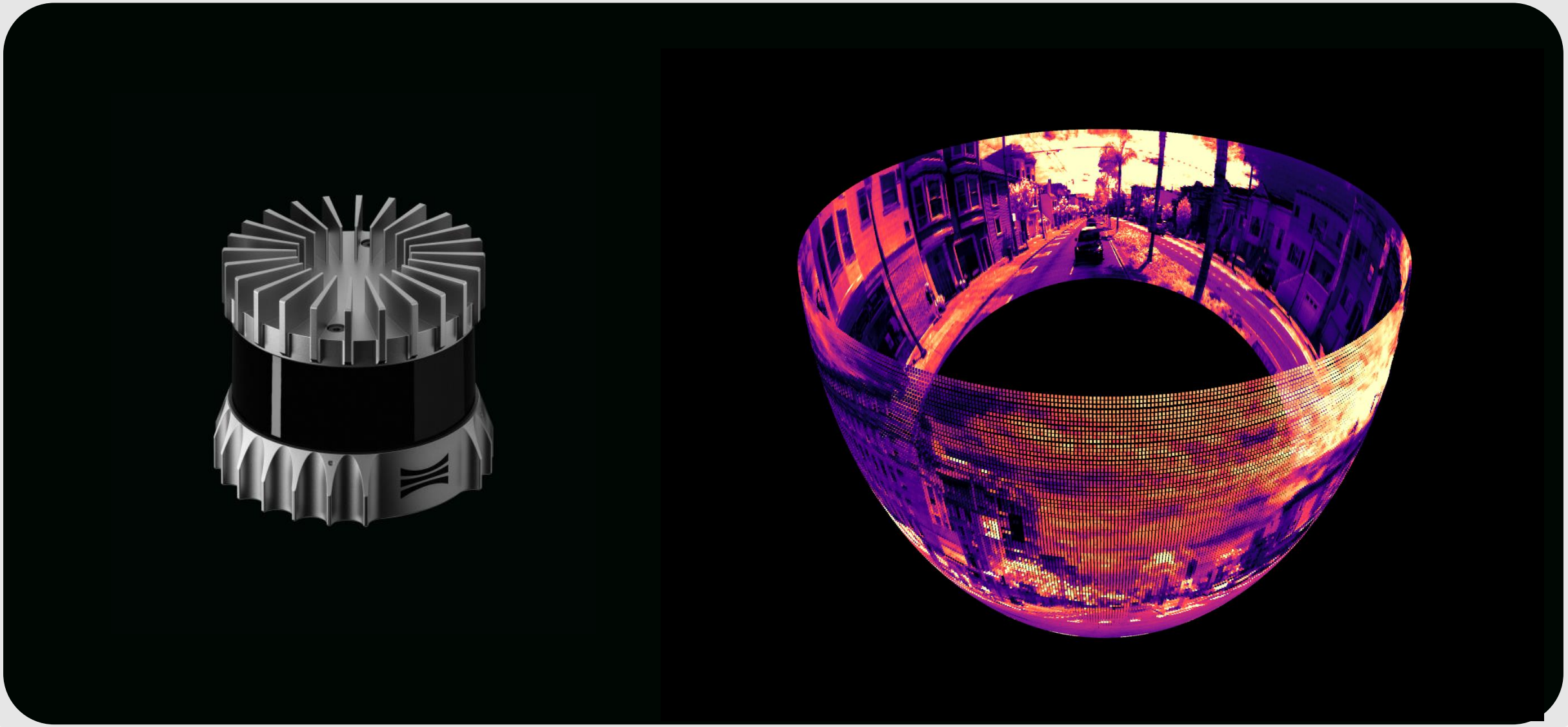




Point Cloud =
Collection of Points

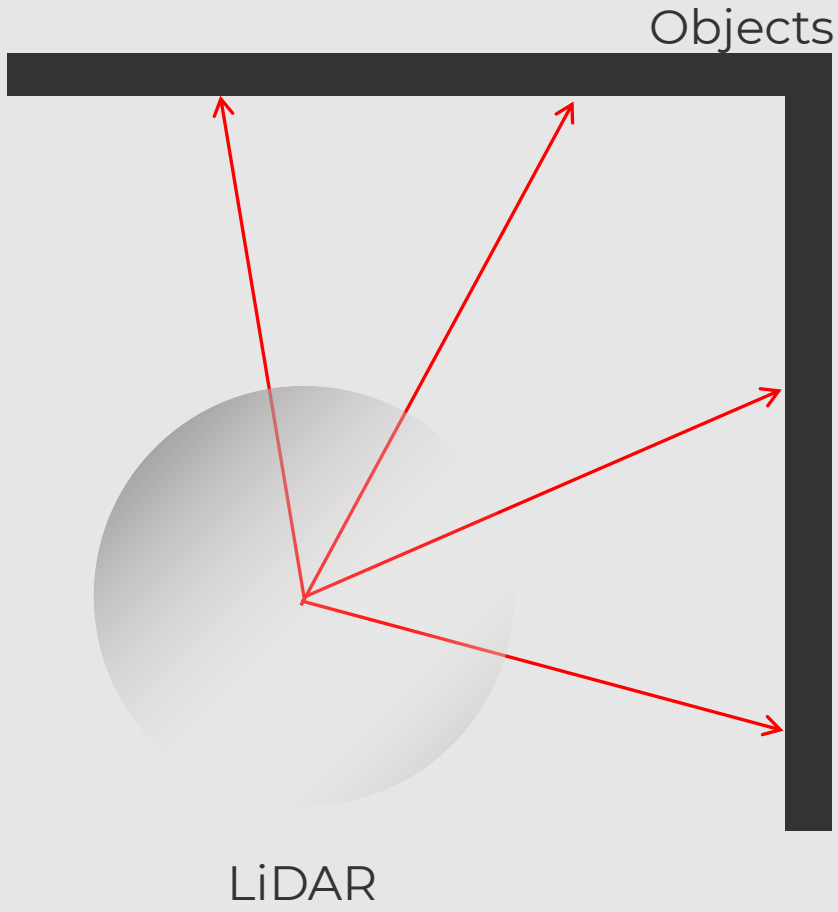
Each point contains
{x, y, z, r, g, b, ...}

What is LiDAR



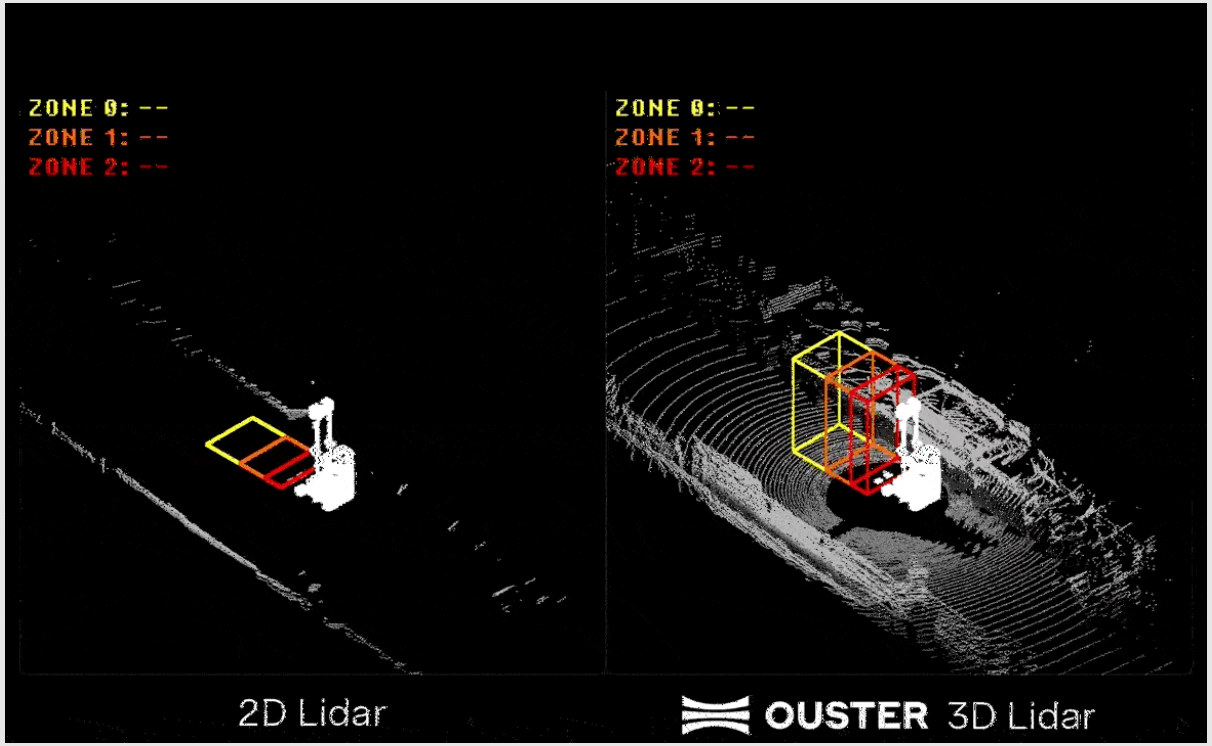
Where is it commonly found?

How does it work?

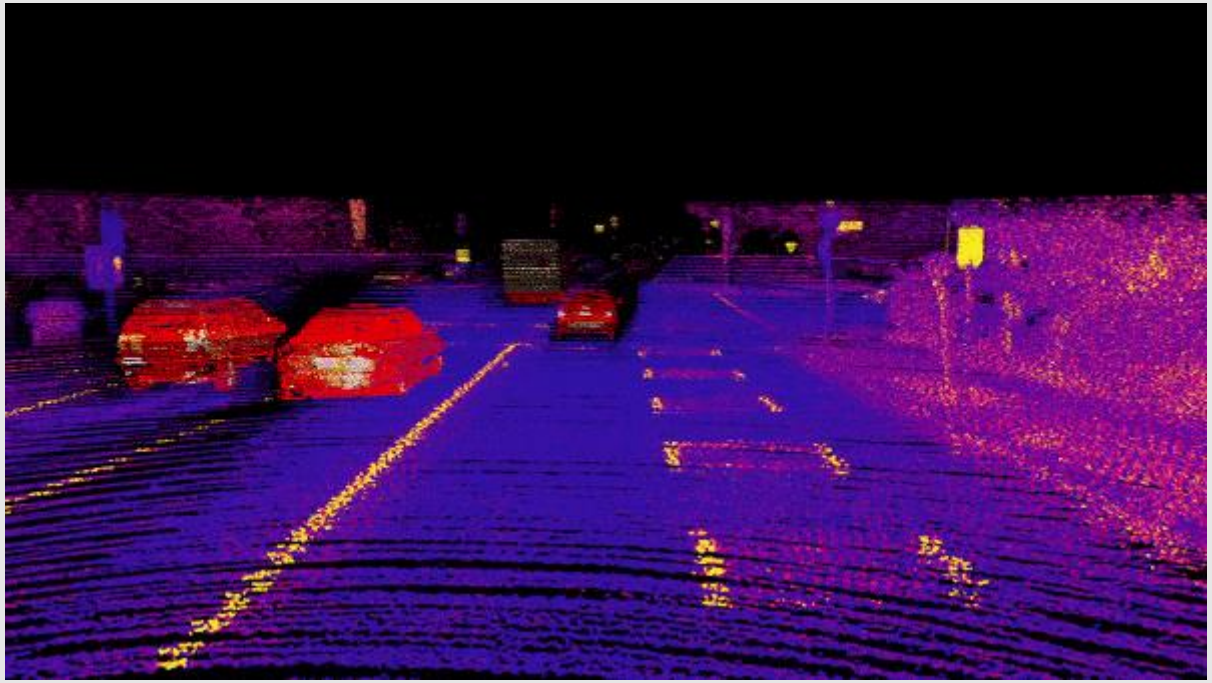


- Similar concept as a measurement laser.
- Measure distance by using distance travelled by laser

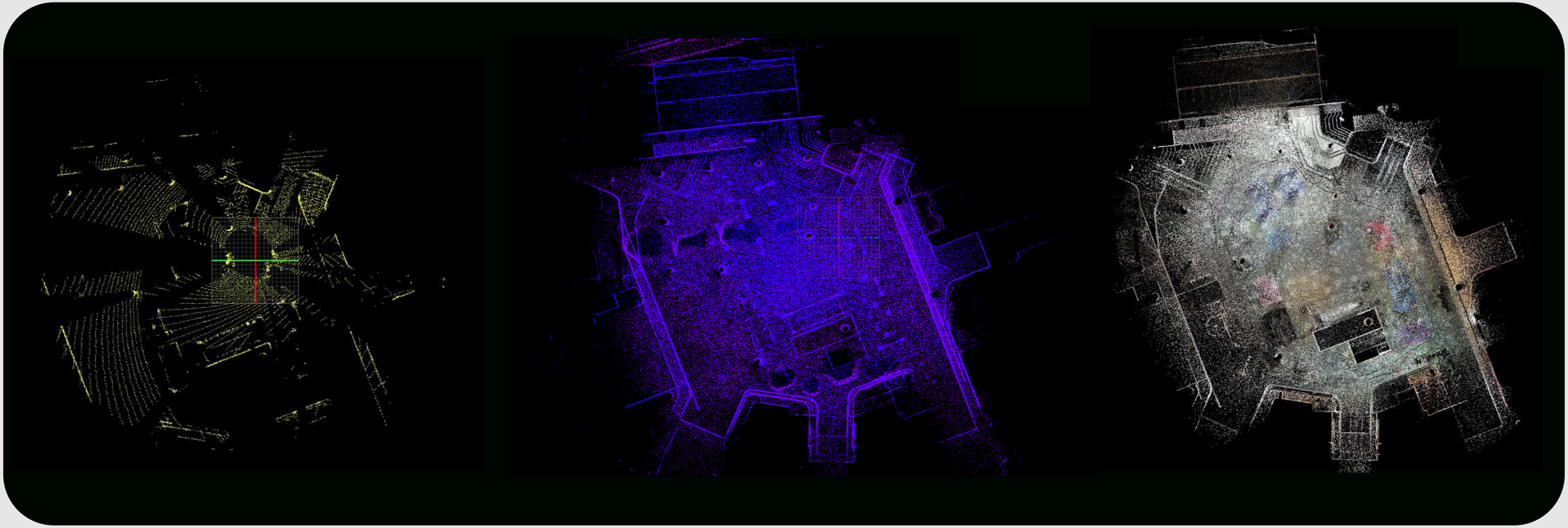
2D vs 3D LiDAR



3D LiDARs provide rich 3D scan of the environment.



How can we make use of the LiDAR readings



Raw LiDAR Readings

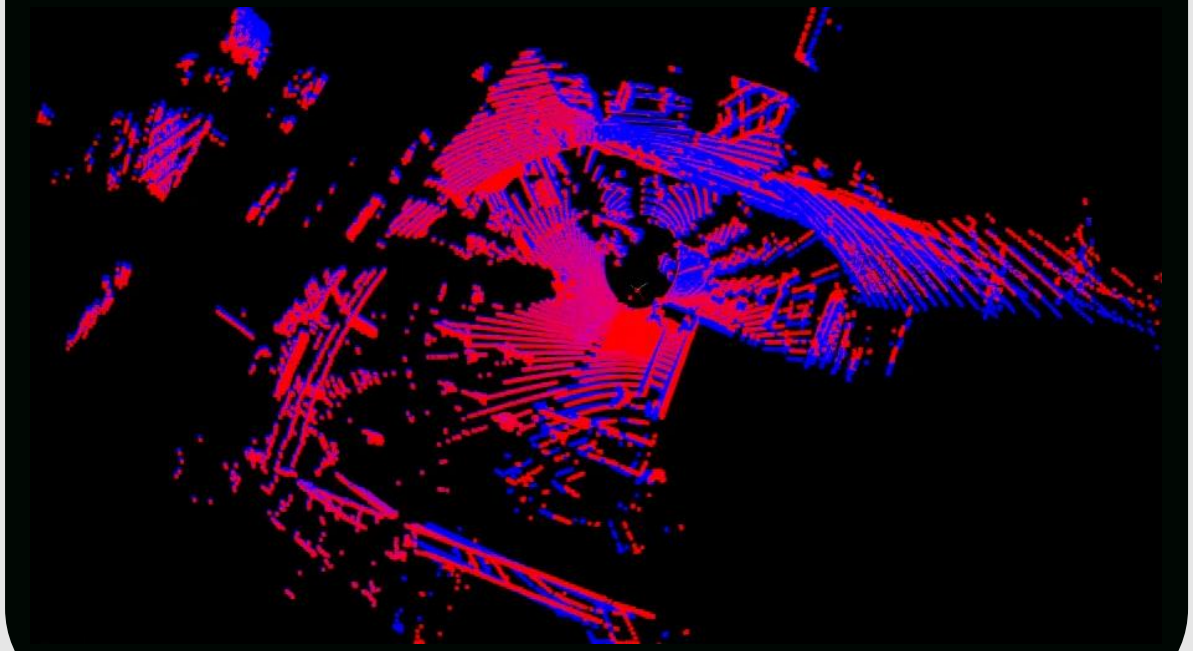
SLAM

Color Point Cloud

SLAM (Simultaneous Localization And Mapping)

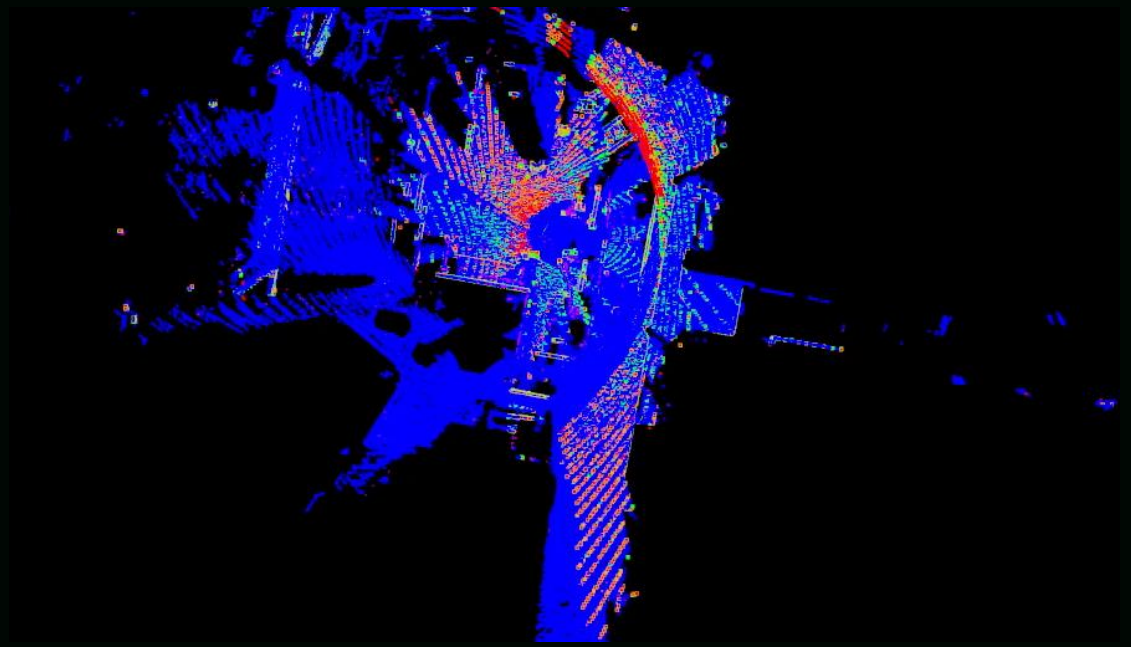
Motion Correction

Raw Sensor Readings

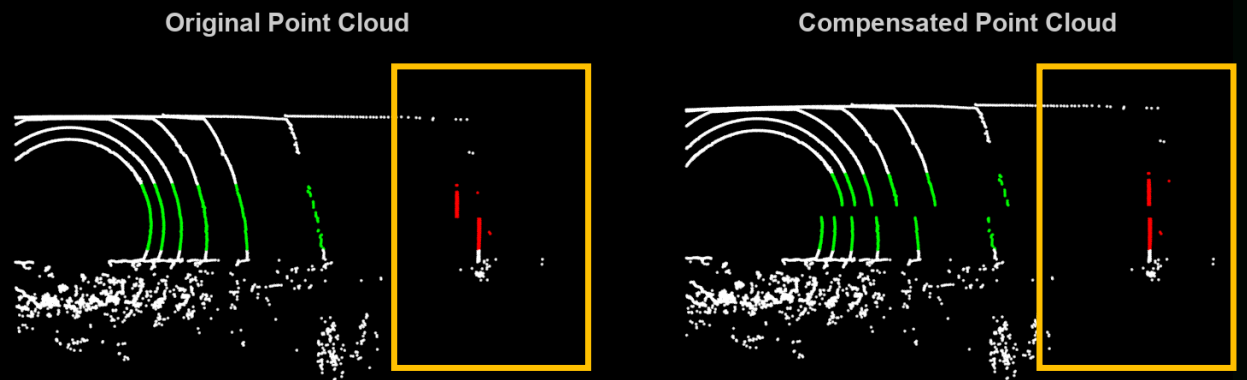


Alignment

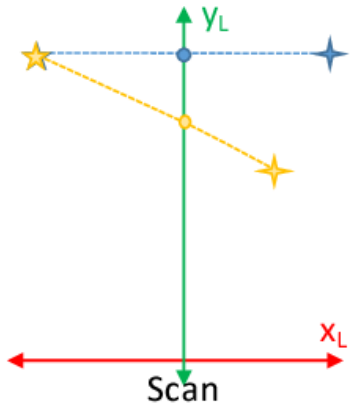
Point Cloud



Motion Correction



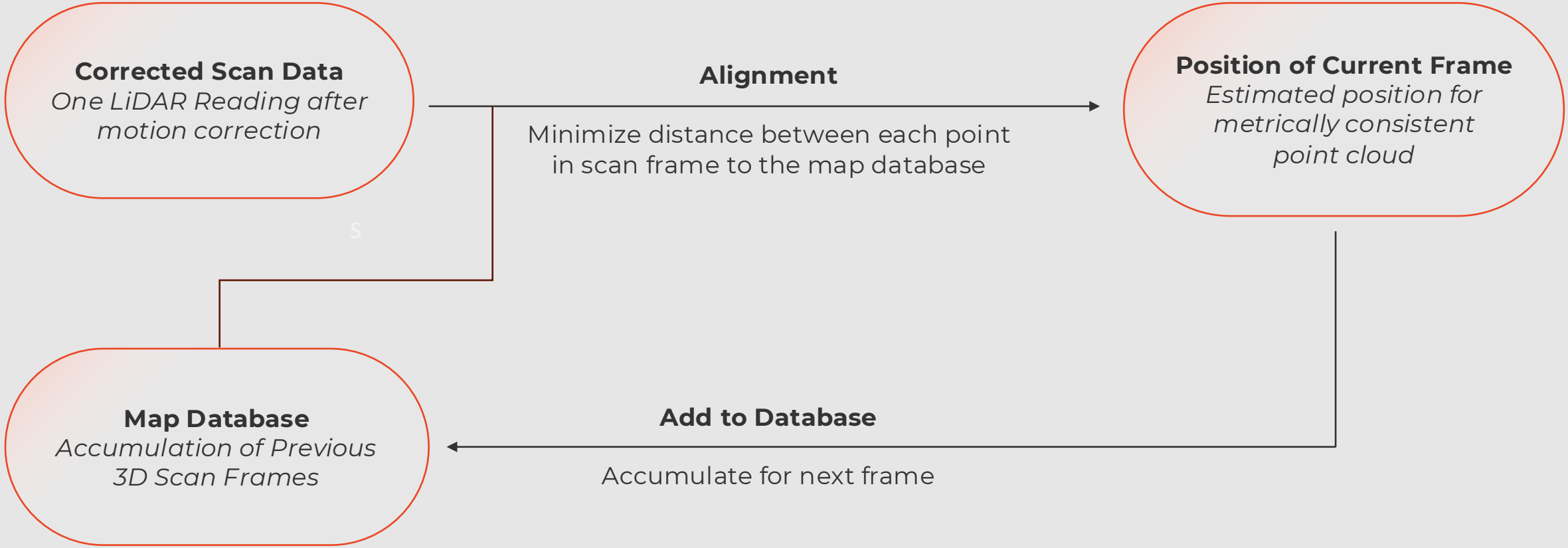
Distorted wall correction



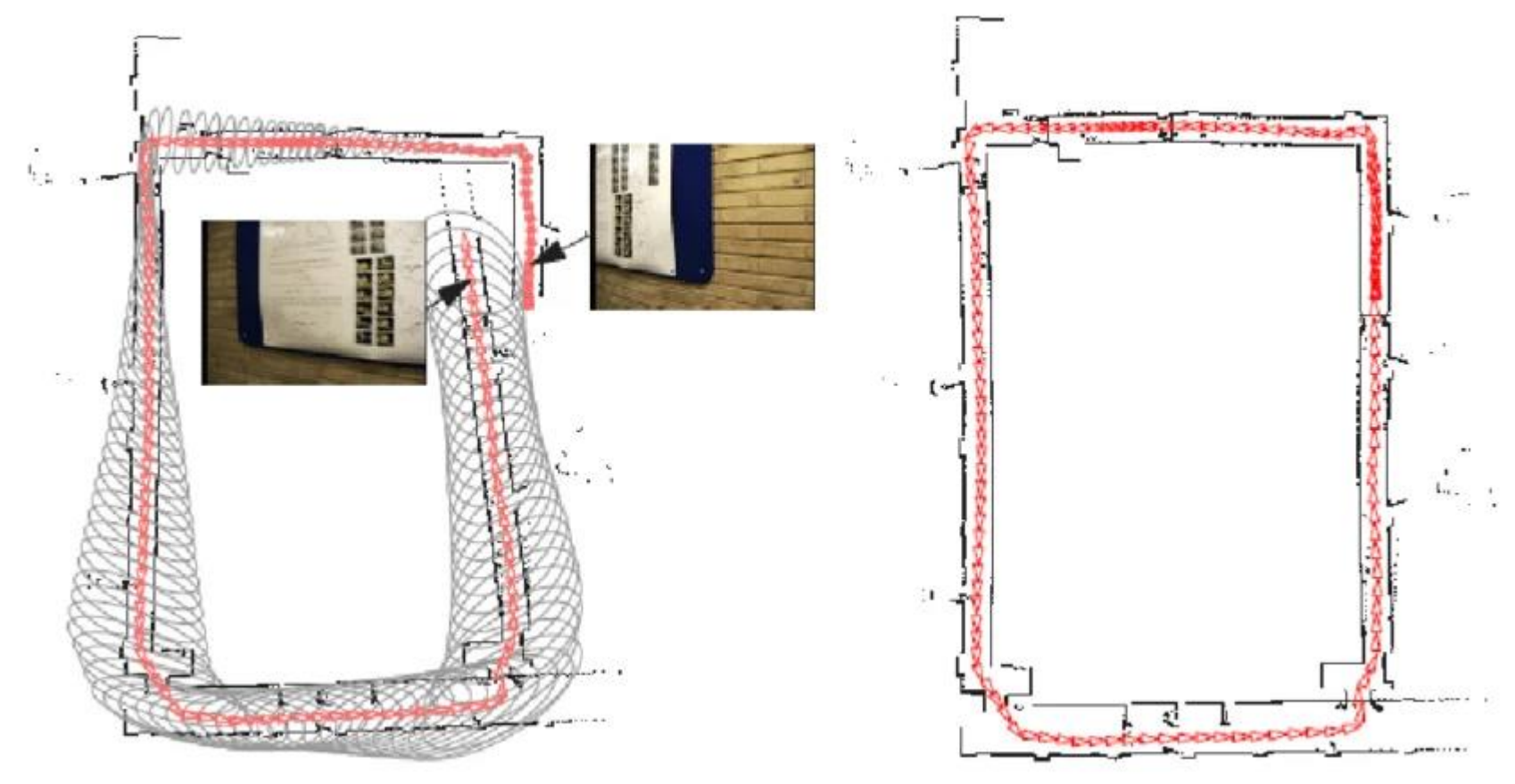
Important steps for mobile scanners to clean up scan information

Al-Nuaimi, A., Lopes, W.B., Zeller, P., Garcea, A., Lopes, C.G., & Steinbach, E.G. (2016). Analyzing LiDAR scan skewing and its impact on scan matching. *2016 International Conference on Indoor Positioning and Indoor Navigation (IPIN)*, 1-8.

Alignment



Loop Closure

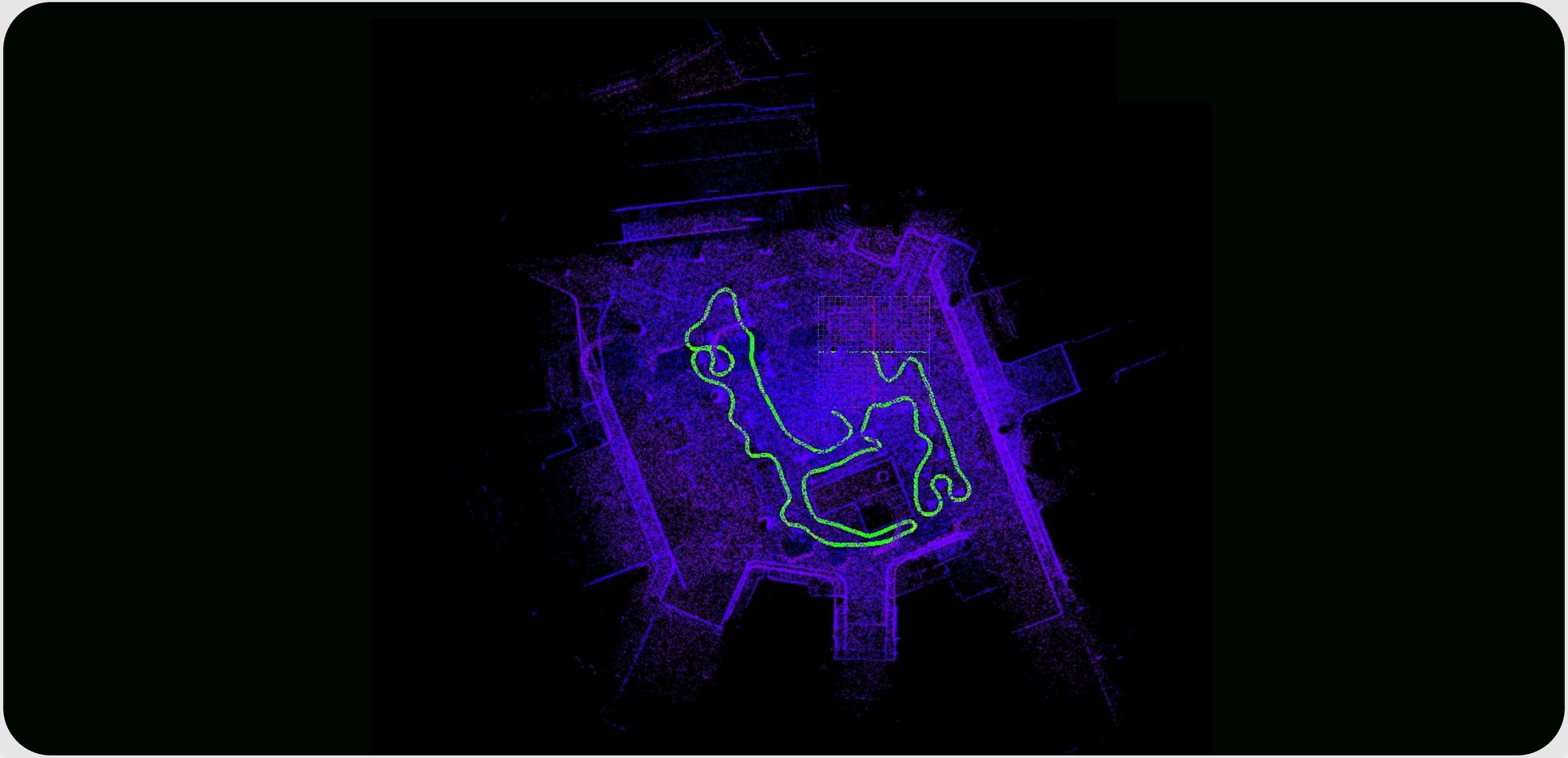


Error accumulates over time

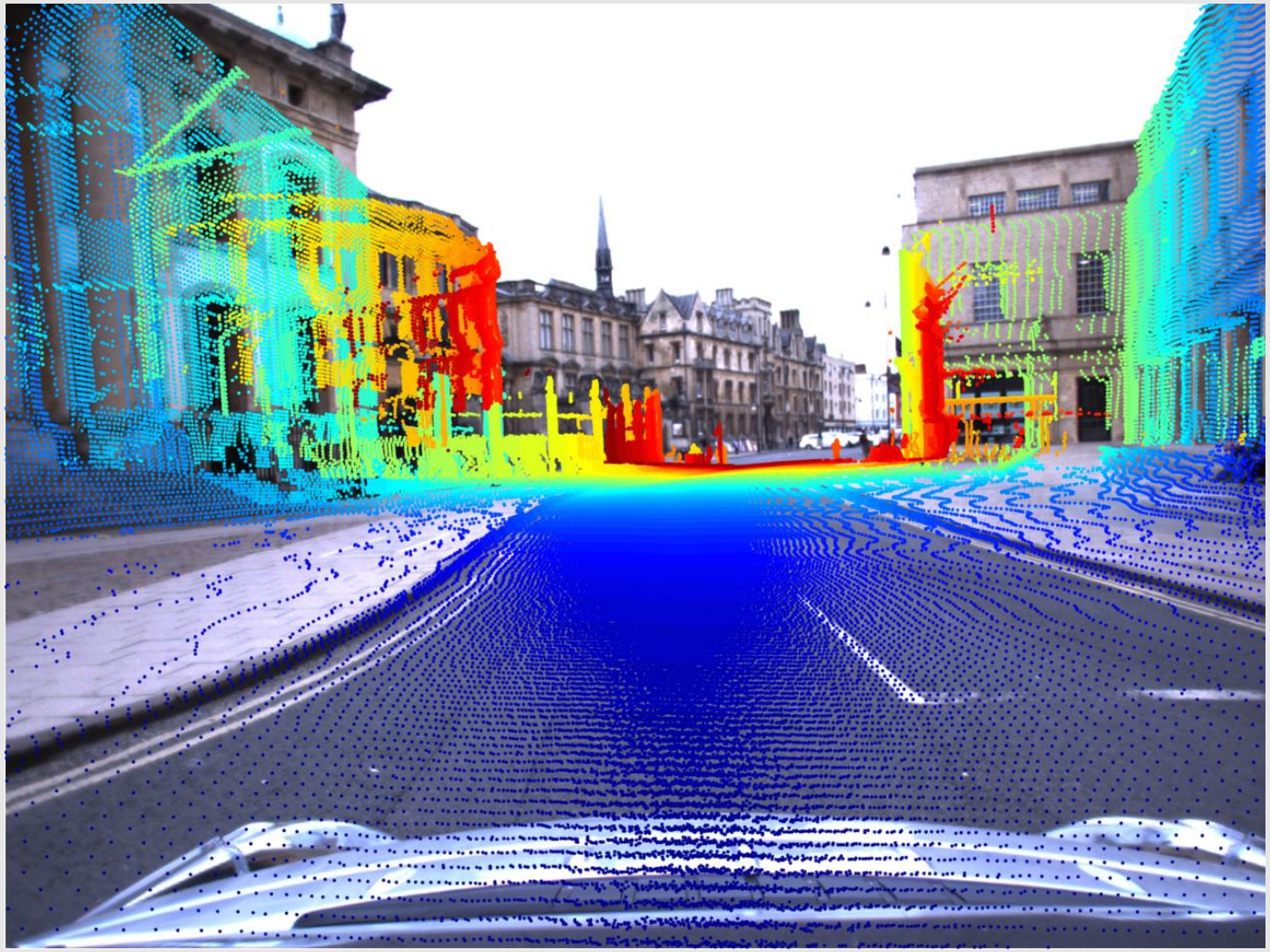
Loop closure corrects the error

- SLAM is an estimation process.
- Error accumulates over time. This is called "drift".
- Loop Closure detects similar Environment and correct all accumulated position error.

SLAM in Action



Colorize Point Cloud



Leverage camera-LiDAR Calibration to colorize point cloud

How's Accuracy measured

Relative Accuracy (Precision)

- Concerns with the dimensions of an object.
- Example: Measurement of chairs, tables, walls
- Comparison between static scanner vs 3D SLAM Scanner
  - Aligned
  - Calculate the nearest distance between the 2 scans

Absolute Accuracy

- True global position in the world.
- Example: position of control points
- Comparison between surveyed control points and 3D SLAM Scan Data

Applications of 3D Point Cloud

Digital Archiving

Have a digital record of physical environment. Present vs Past Comparison

Measurement

Scan -> Make measurement. Time-saving as does not have to measure one by one. At the time, can always refer to existing scan for new measurement

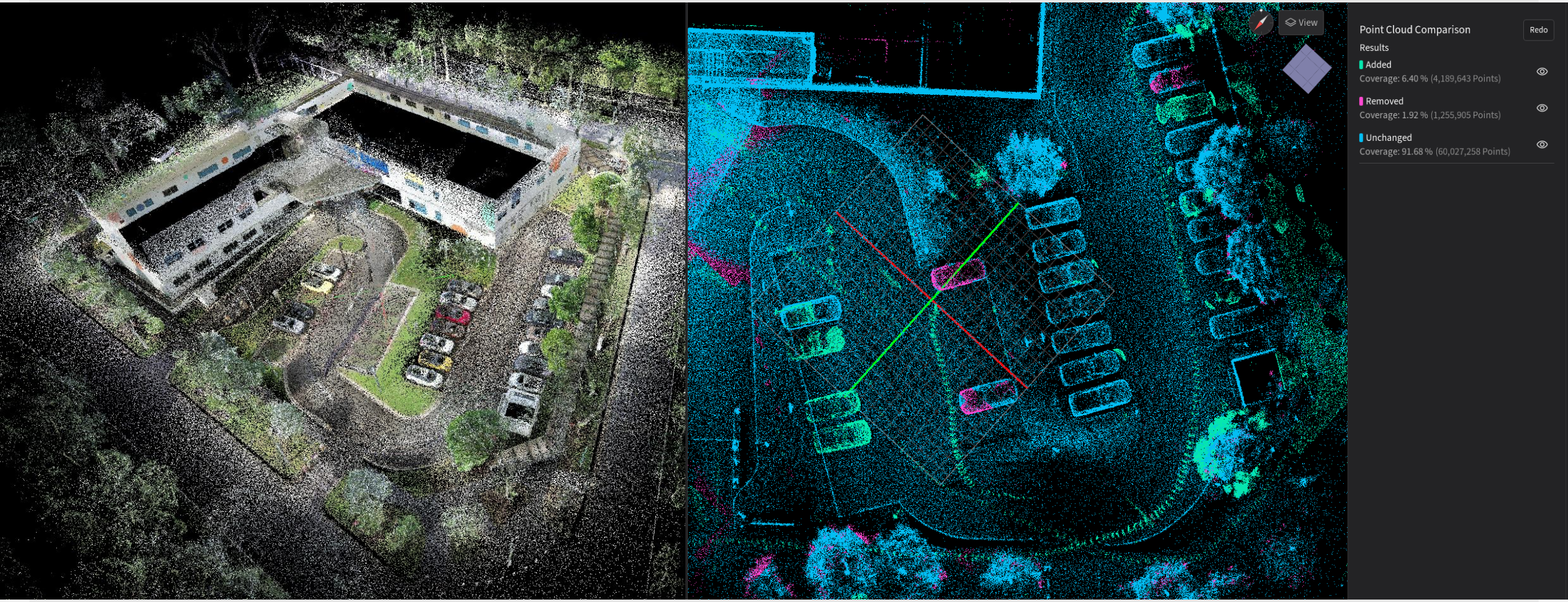
Annotation + Segmentation

Quickly annotate in 3D environment. Automatic classification of objects/classes (eg vegetation, road, building)

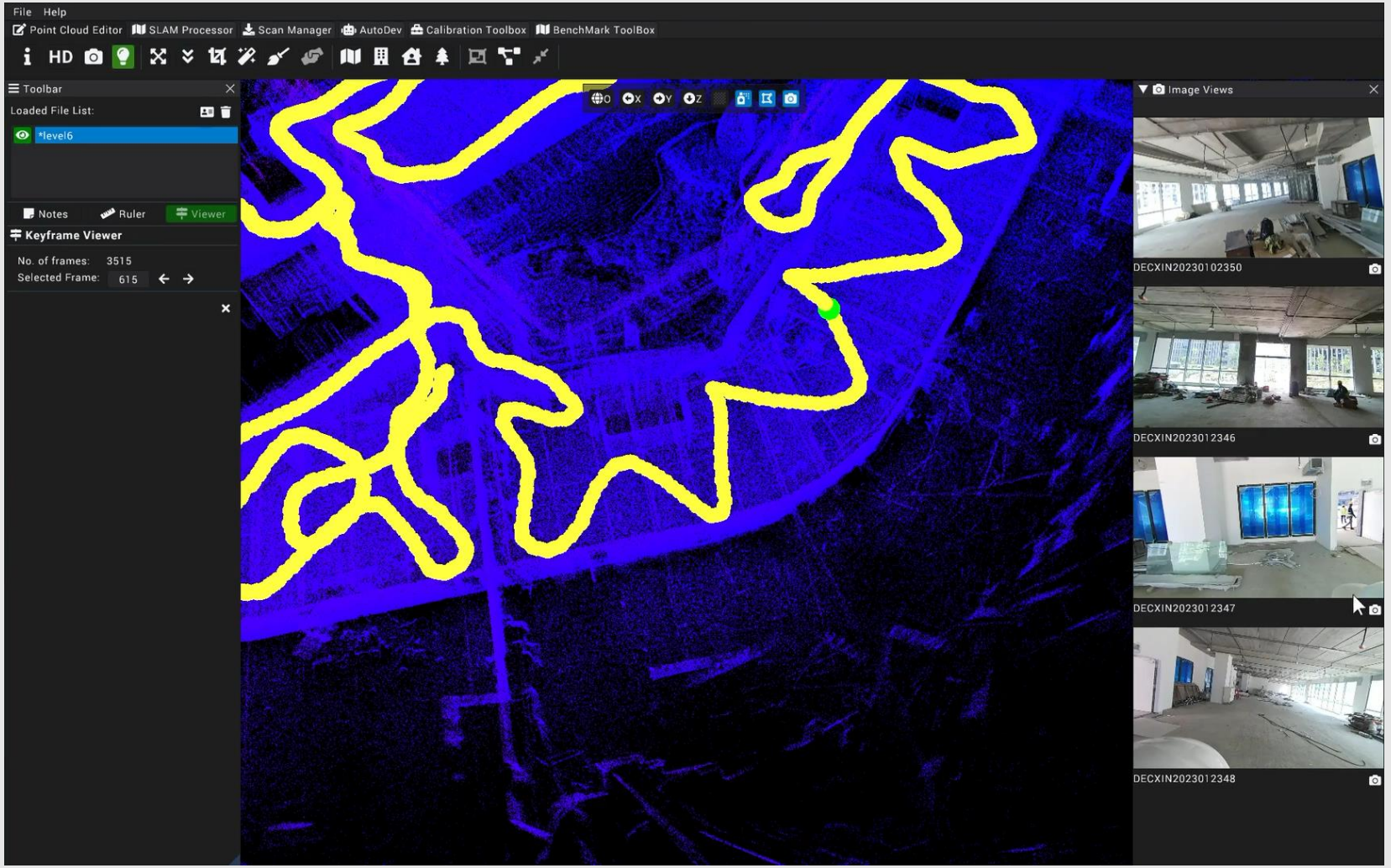
Scan-to-BIM

Quick physical – digital comparison

Digital Archiving (3D Past vs Present Comparison)

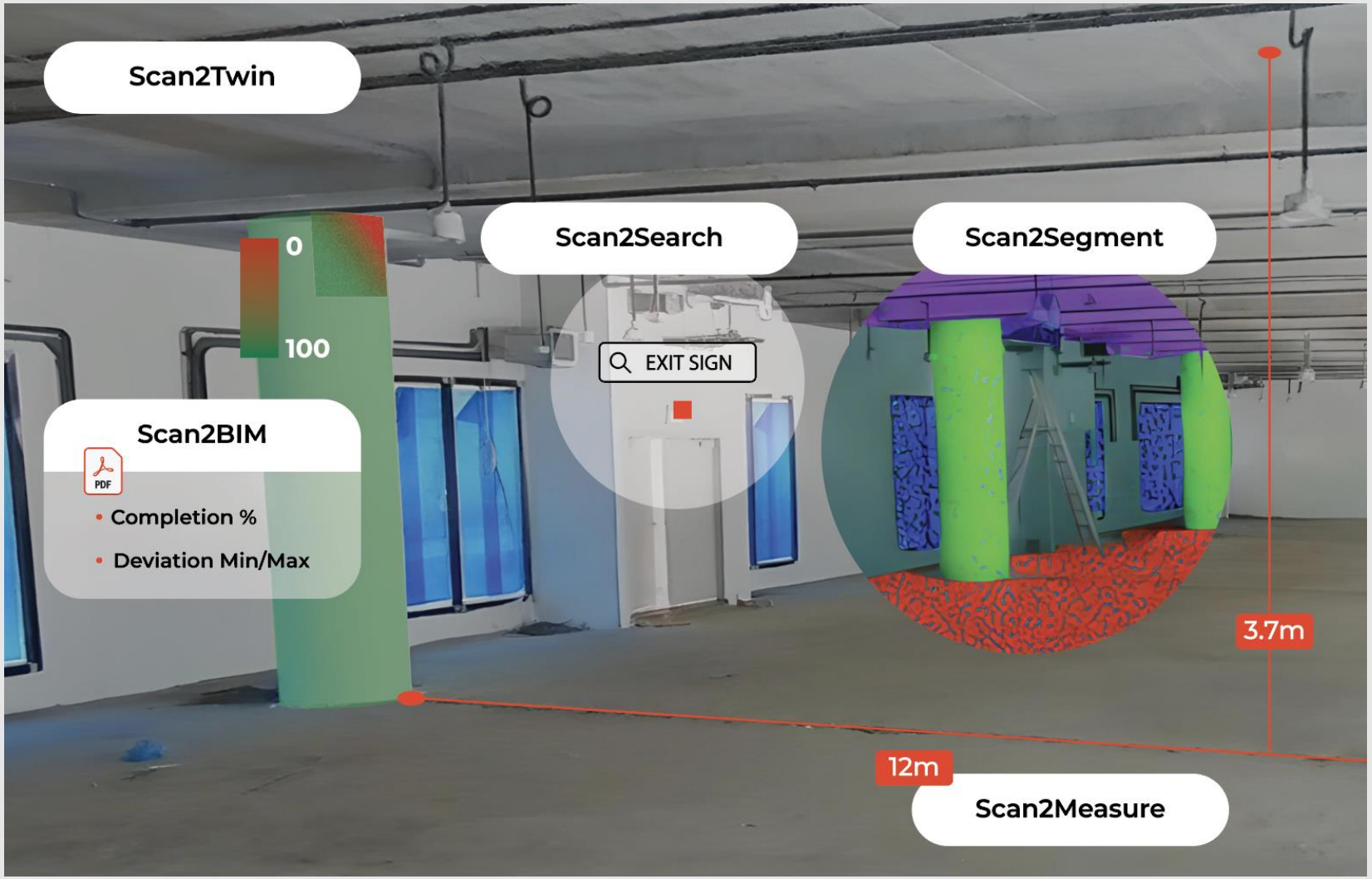


Measurement



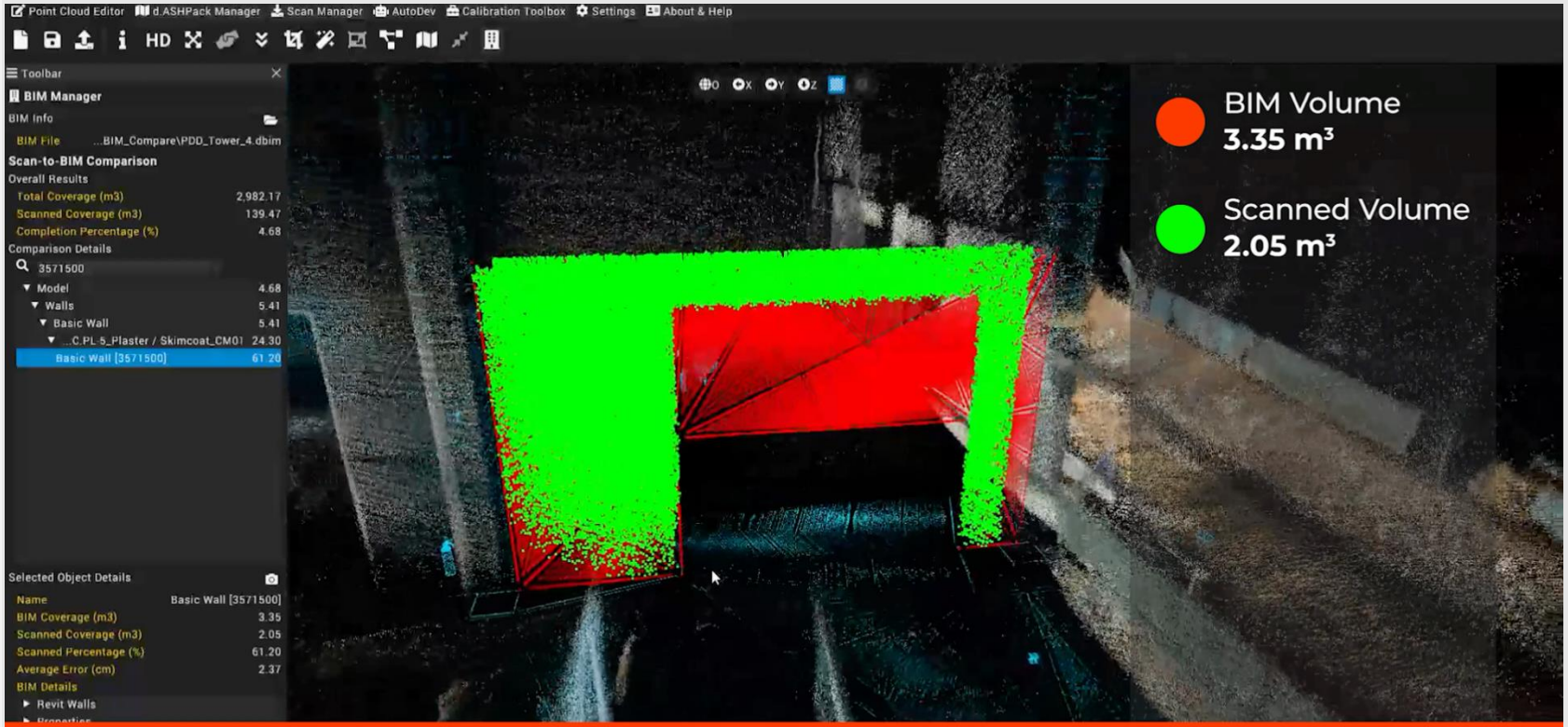
- Insert measurement video
- Scan -> Make measurement.
- Time-saving as does not have to measure one by one.
- At the time, can always refer to existing scan for new measurement. No need to revisit physical sites (which may be inaccessible)

Annotation & Segmentation



- Insert Annotation & Segmentation Feature
- Quickly annotate in 3D environment.
- Automatic classification of objects/classes (eg vegetation, road, building)

Scan-to-BIM



- Insert Scan-to-BIM Comparison Video
- Quick comparison between physical and digital models
- Progress tracking
- Align to specific BIM items

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