

# Robotec GPU Lidar

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ROS 2 Hardware Acceleration Working Group

# Introduction

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- Robotec.ai deals with modern ROS and simulation for robotics.
  - We typically deal with performance demanding use-cases.
- We value open source, and we contribute to ROS.
- I will be talking about GPU accelerated Lidar simulation.
  - I contributed but its leading author is Piotr Rybicki.
- This talk is valuable for anyone interested in simulating robots.

# Simulation for robotics

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## Application fields:

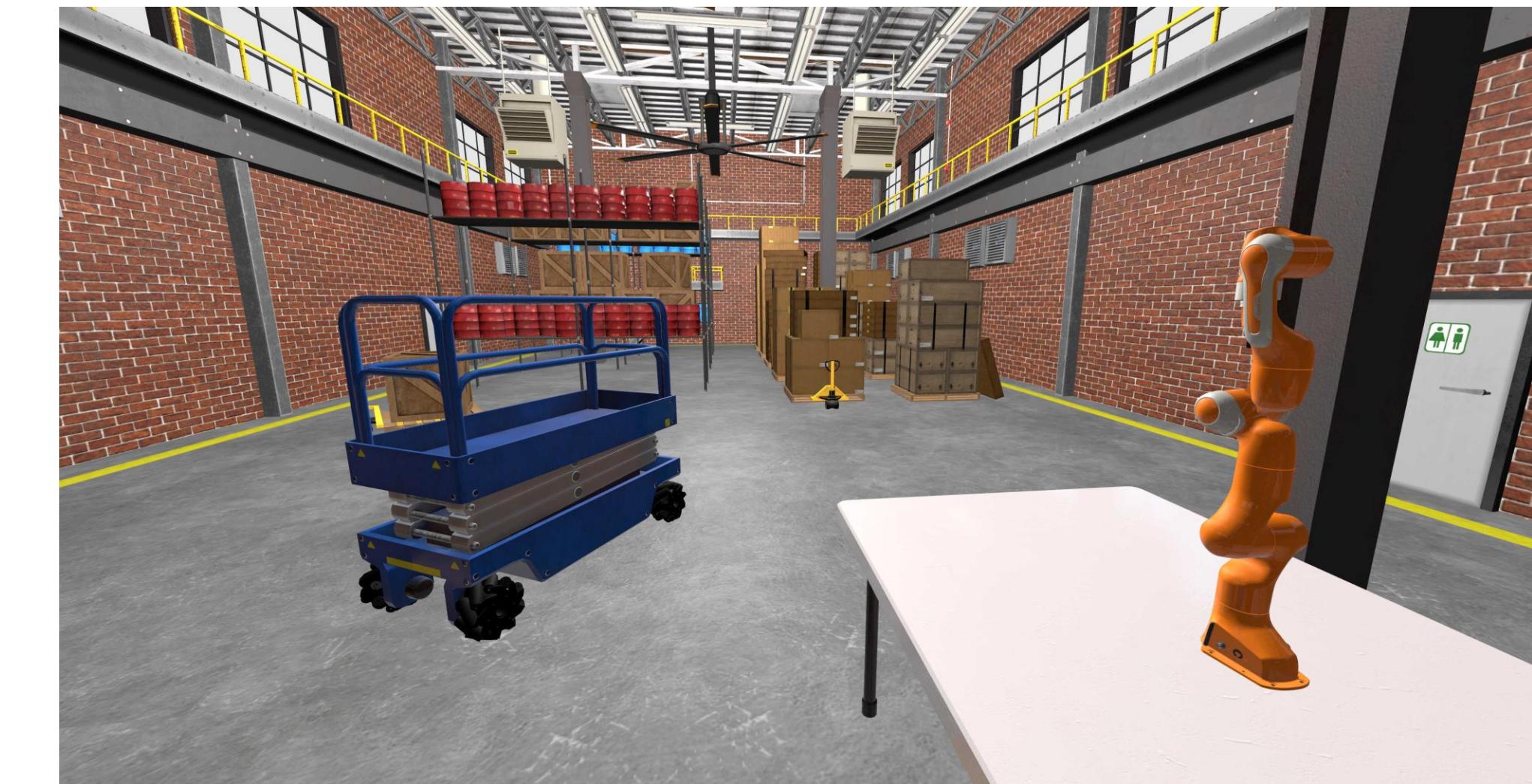
- Academia
- Automotive
- Manipulators
- Logistics, fleets of robots
- ...

## Goals:

- Prototyping, development
- Validation & testing (including scenario runners)
- Synthetic data for machine learning

# Simulation for robotics

- Gazebo & Ignition.
- Built on closed-source game & simulation engines (Unreal & Carla, Unity3D & AWSIM).
- Open-source engines – O3DE.
- Other proprietary solutions.



*Gazebo Ignition*  
(<https://github.com/topics/ignition-gazebo>)



*O3DE Apple Orchard demo*  
<https://github.com/o3de/ROSConDemo>

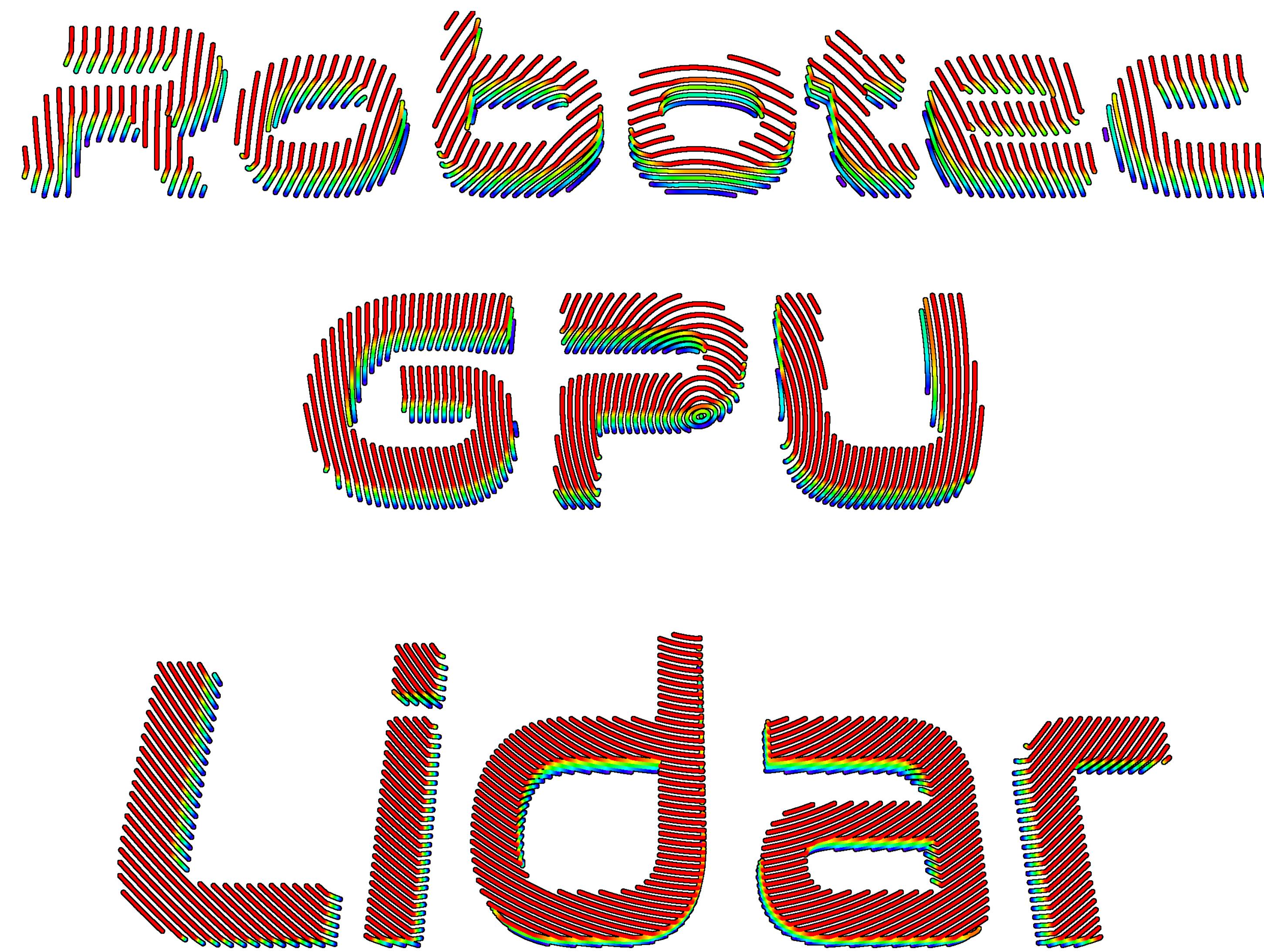


*AWSIM*  
<https://github.com/tier4/AWSIM>

# Performance matters

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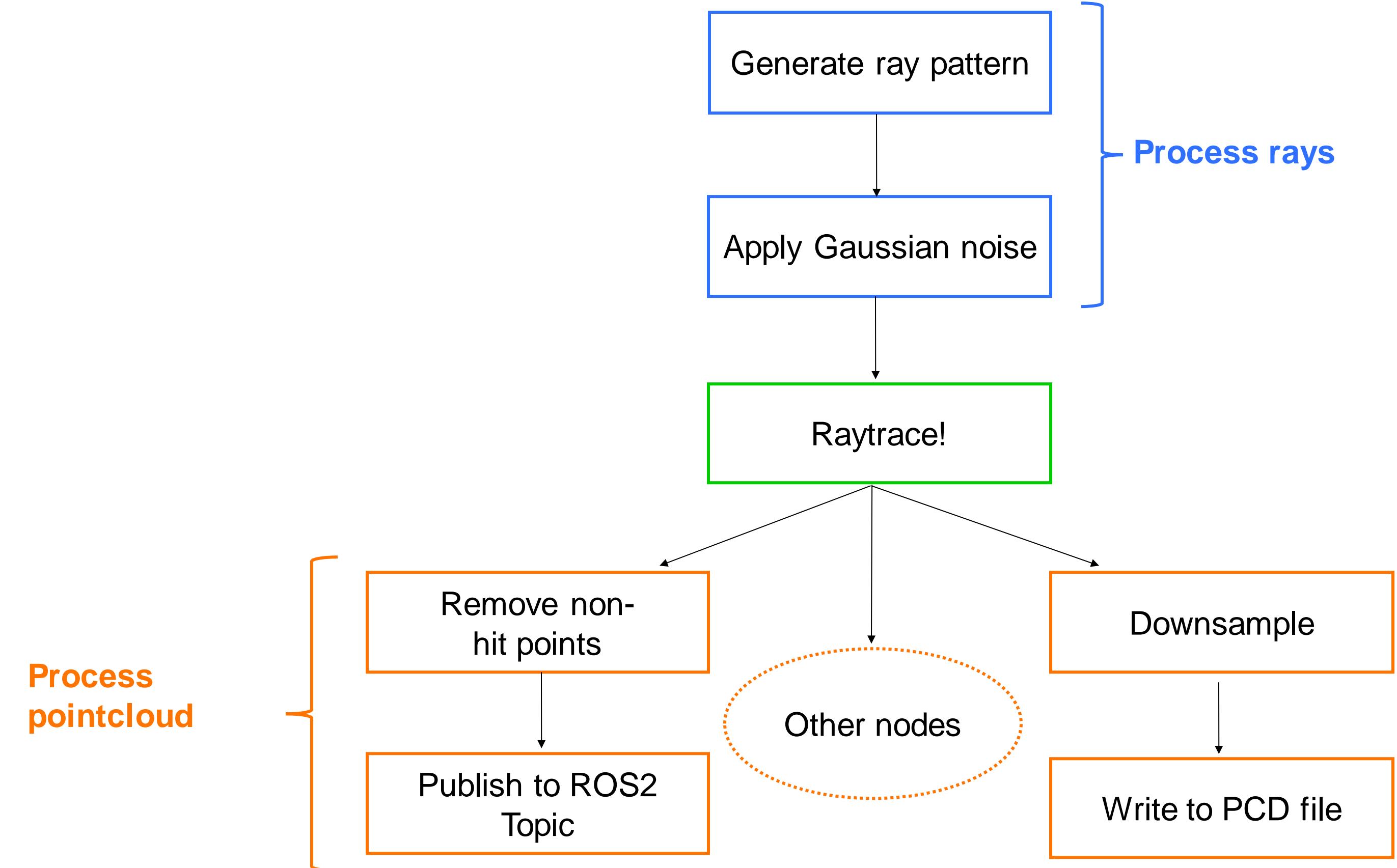
- Some applications require simulating multiple robots, sensors, real-time.
- For some common setups, even strong desktops are challenged.
- Lowered performance often degrades usefulness of simulation.
- Hence, acceleration matters.
- Example: Helios vs Robotec GPU Lidar.
- We will talk about our GPU Lidar: <https://github.com/RobotecAI/RobotecGPULidar>.

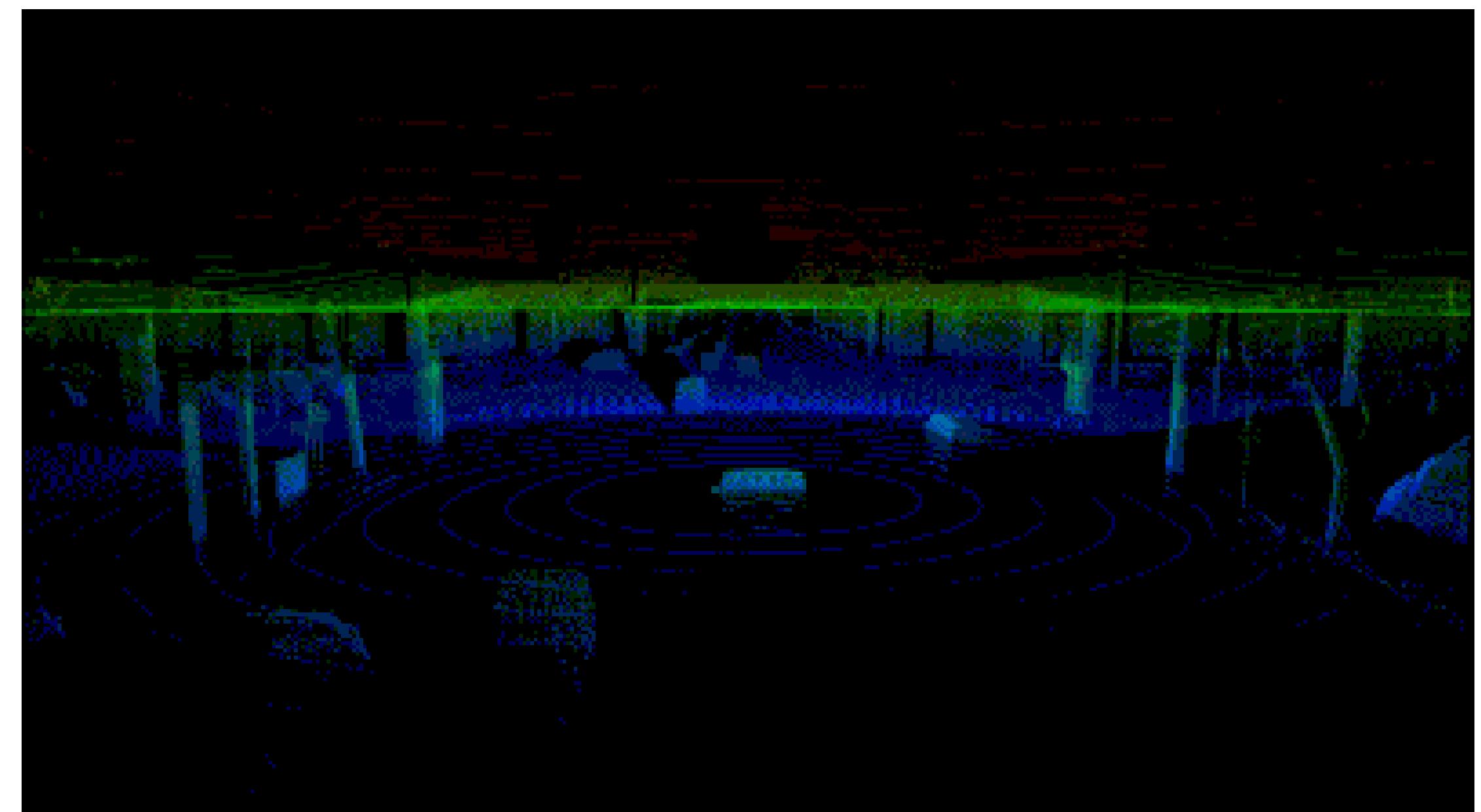
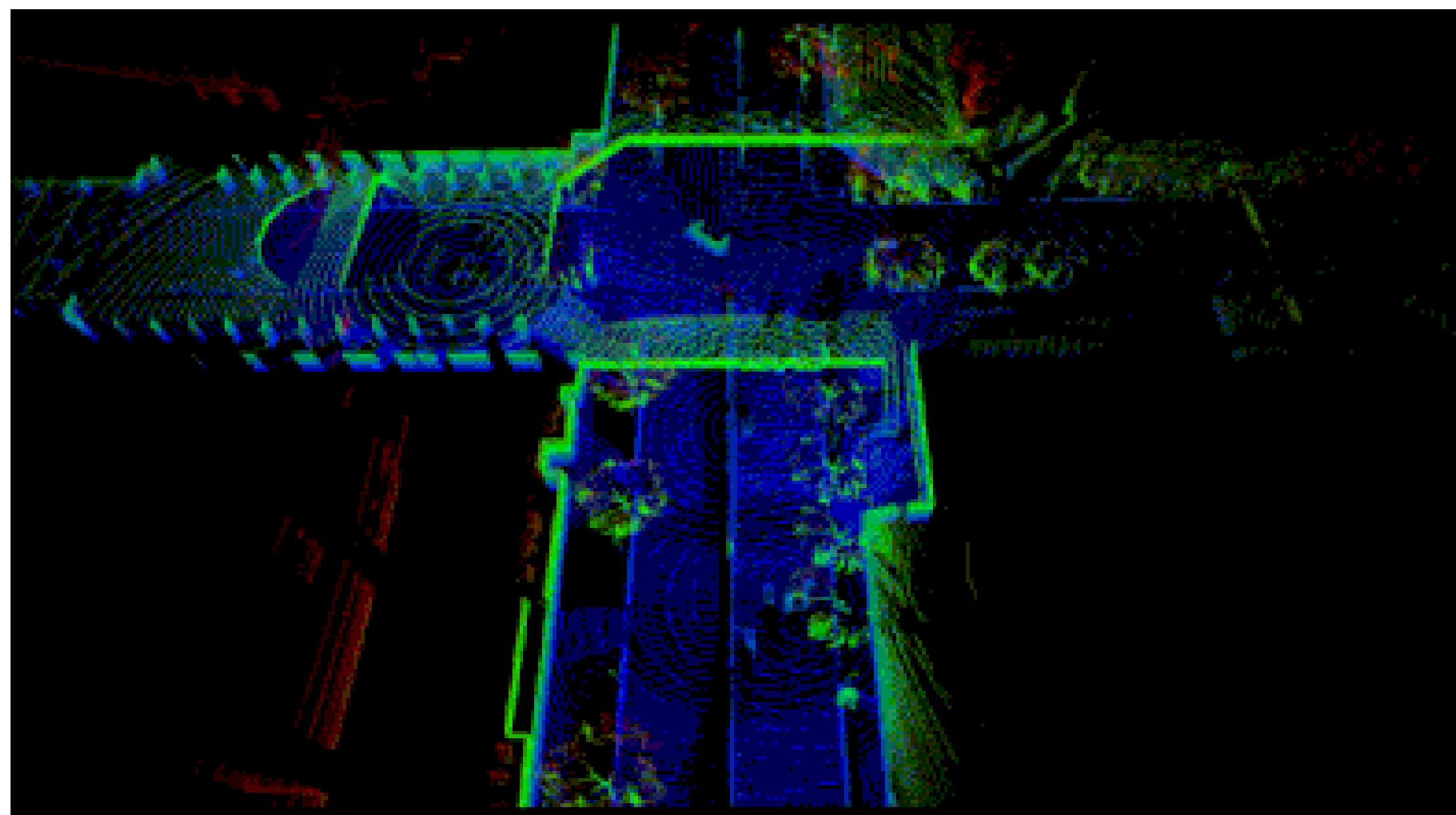
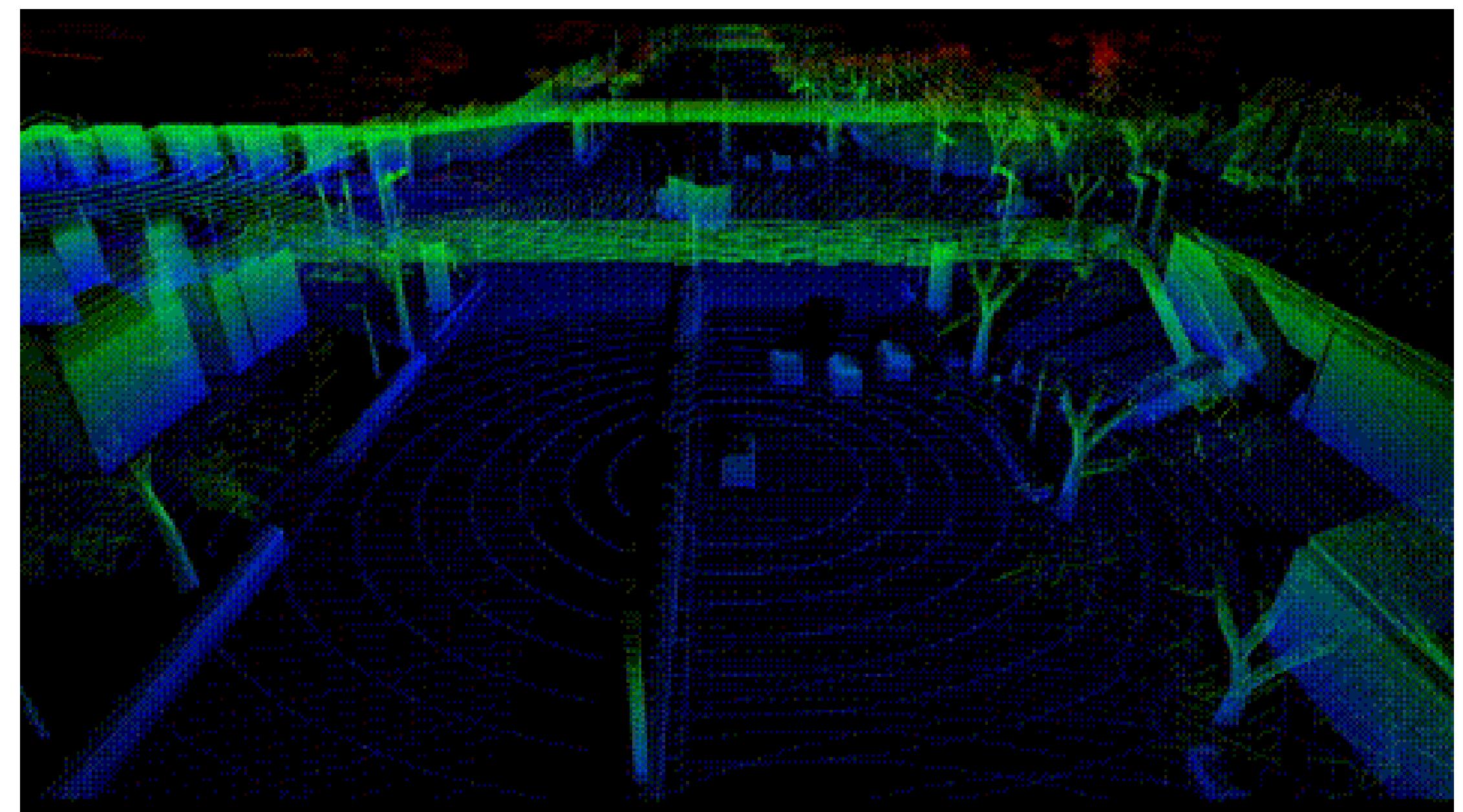
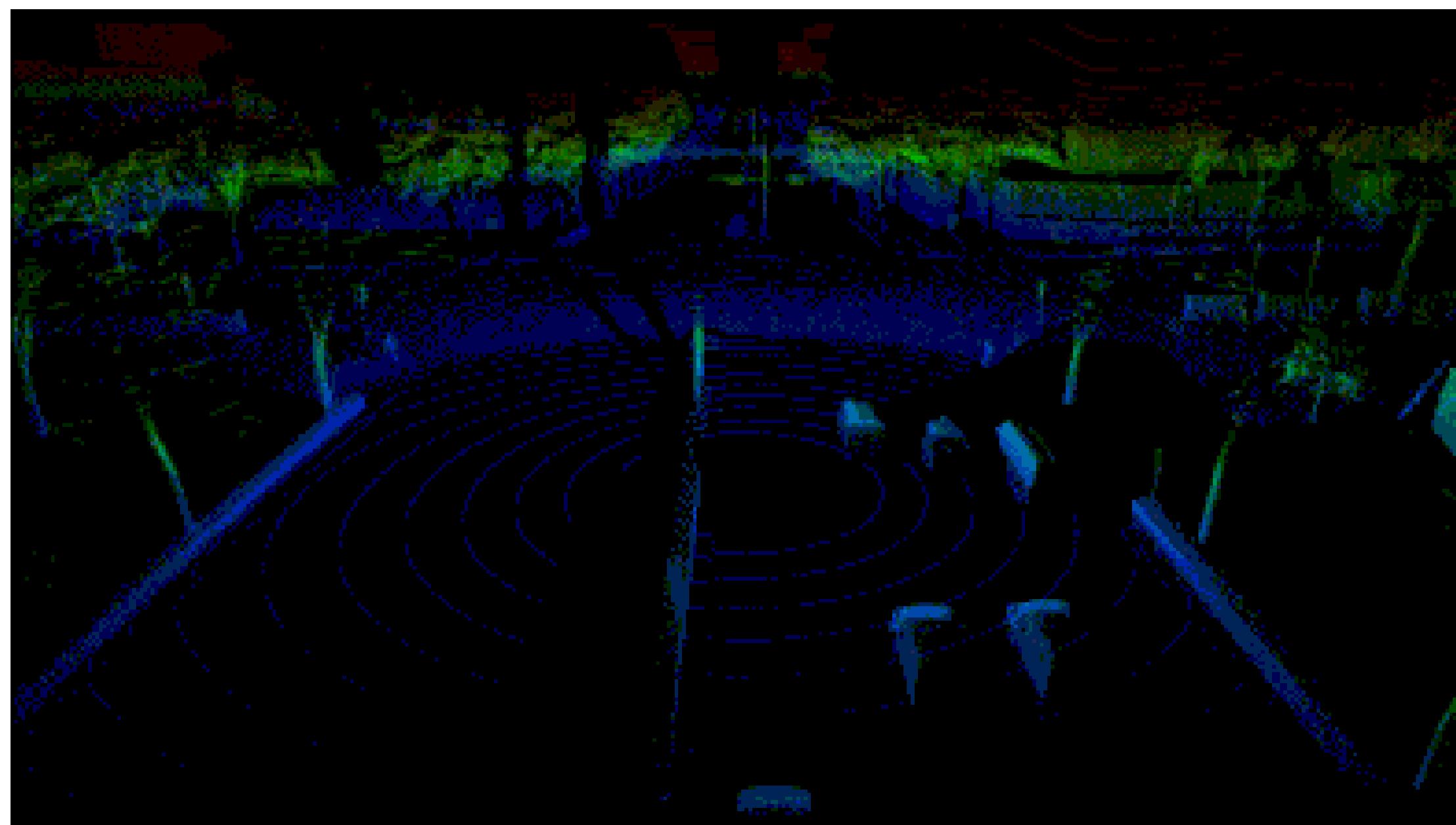


*Raytraced logo of Robotec GPU Lidar*

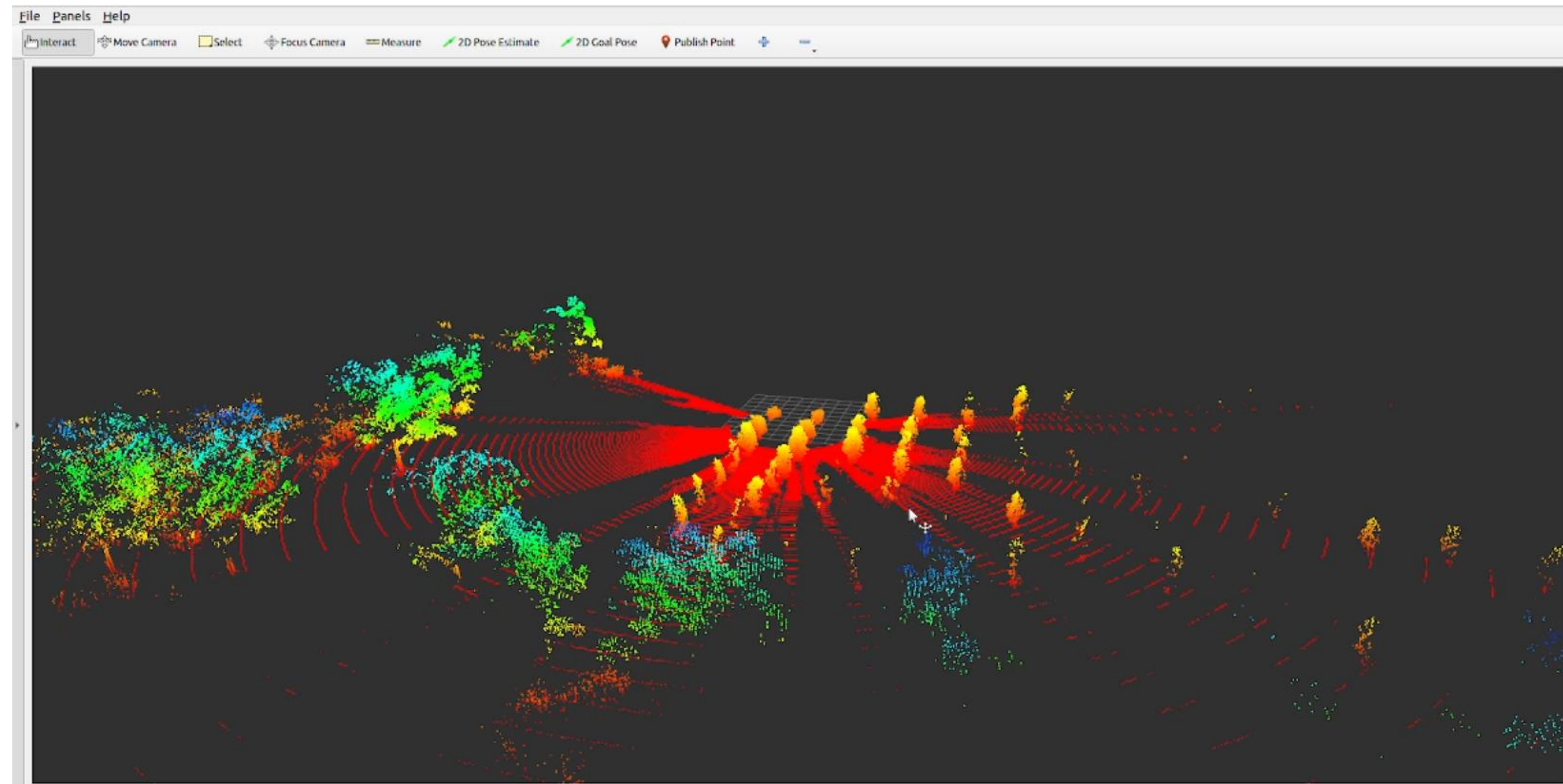
# Robotec GPU Lidar

- Open-source, Apache 2.0.
- For Linux and Windows.
- GPU-accelerated:
  - Uses CUDA and OptiX.
  - Will use RTX cores if available.
- C-API for easy bindings:
  - Can plug it into variety of simulators.
- Flexible pipeline creation.
- With useful utilities:
  - Can publish to ROS2 topics
    - Ubuntu. Windows - a fix is pending.
  - Downsampling.
  - Writing to PCD file.
- High performance:
  - 350 mln rays/second.
  - Still room for improvement.



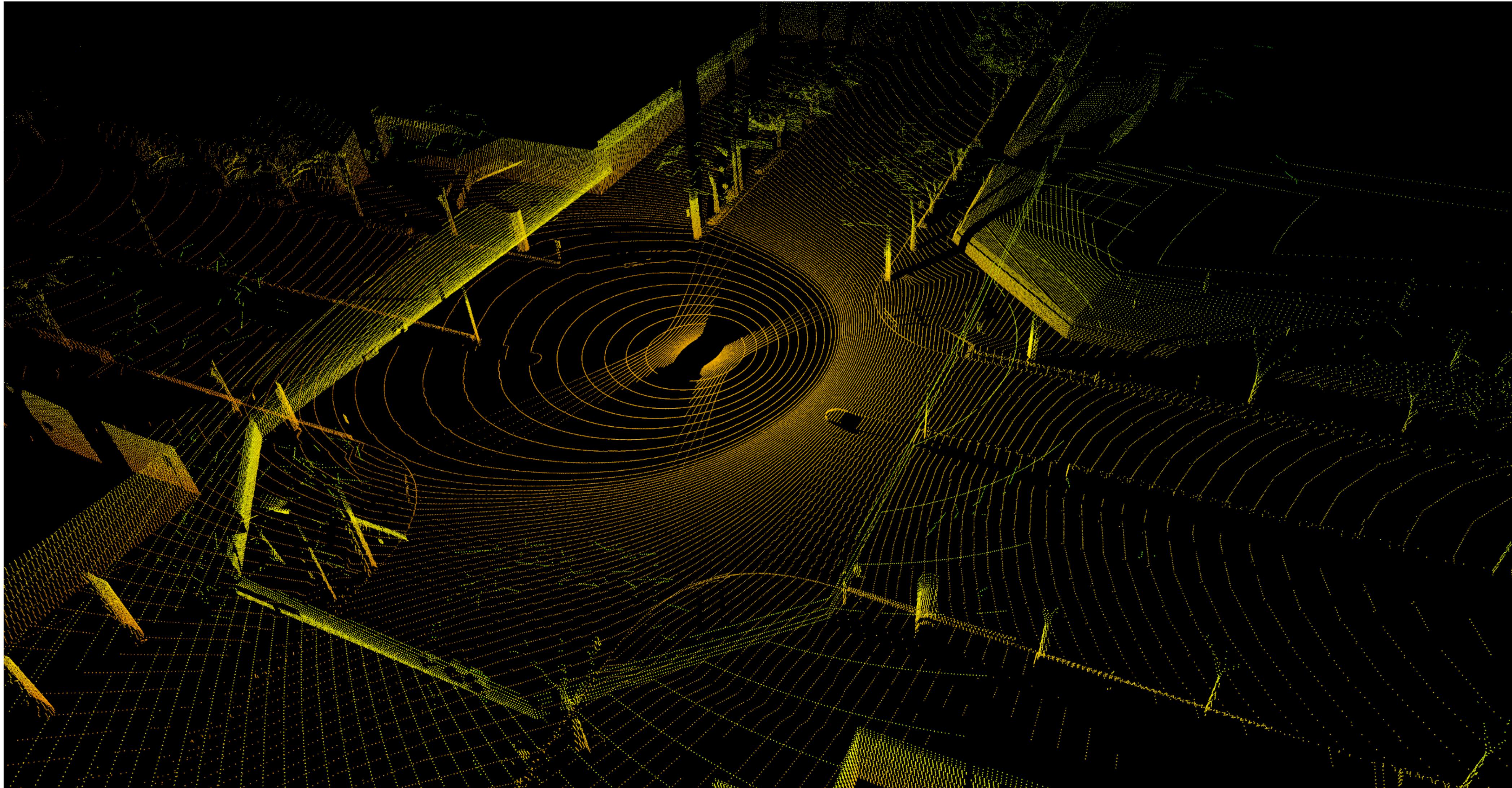


# Examples



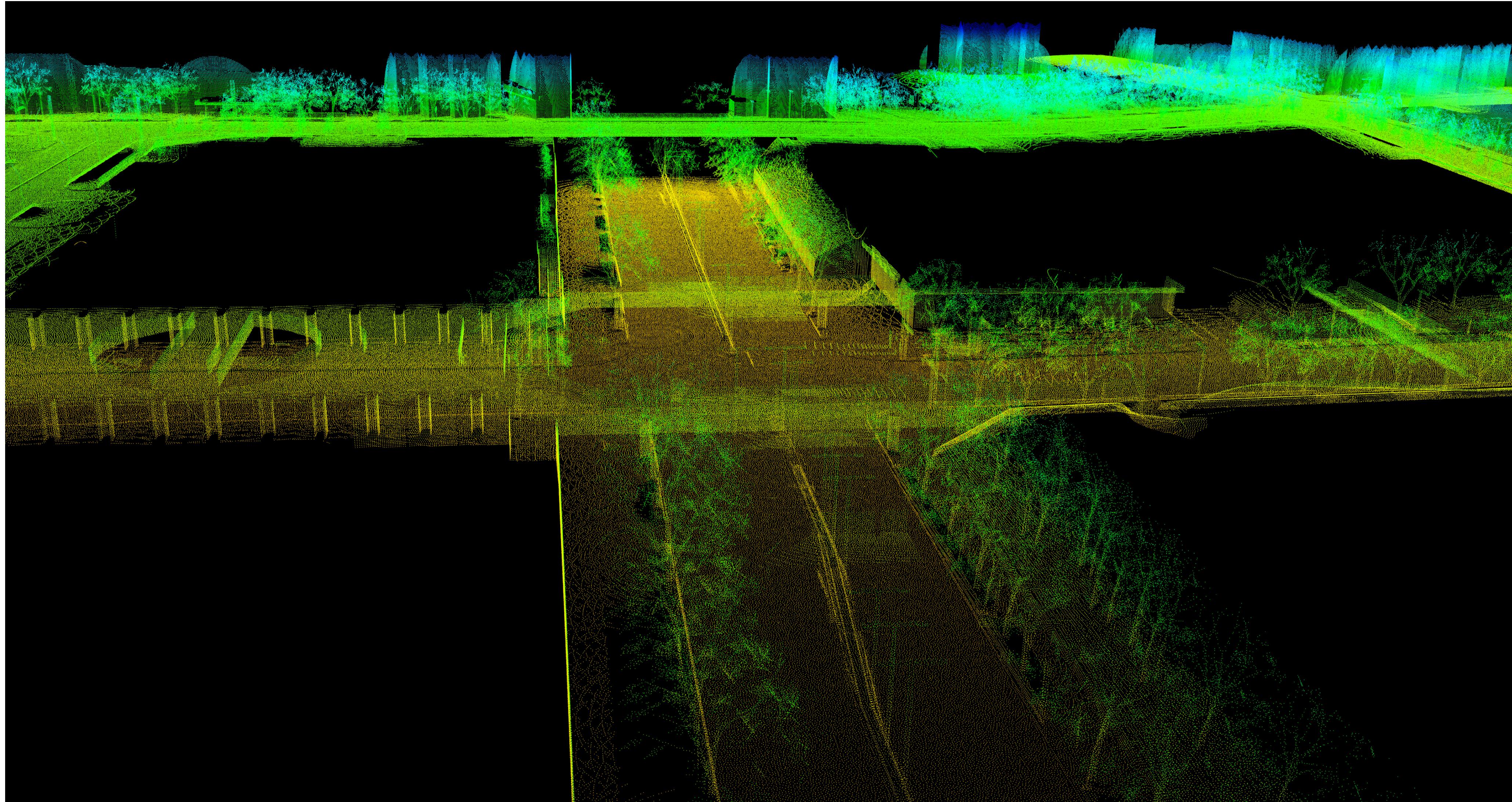
Robotec GPU Lidar running in an agricultural simulation demo in O3DE

# Examples



Real-time AV Lidars simulation in AWSIM (Autoware simulator)

# Examples



*Whole-scene point cloud map generated using AWSIM*

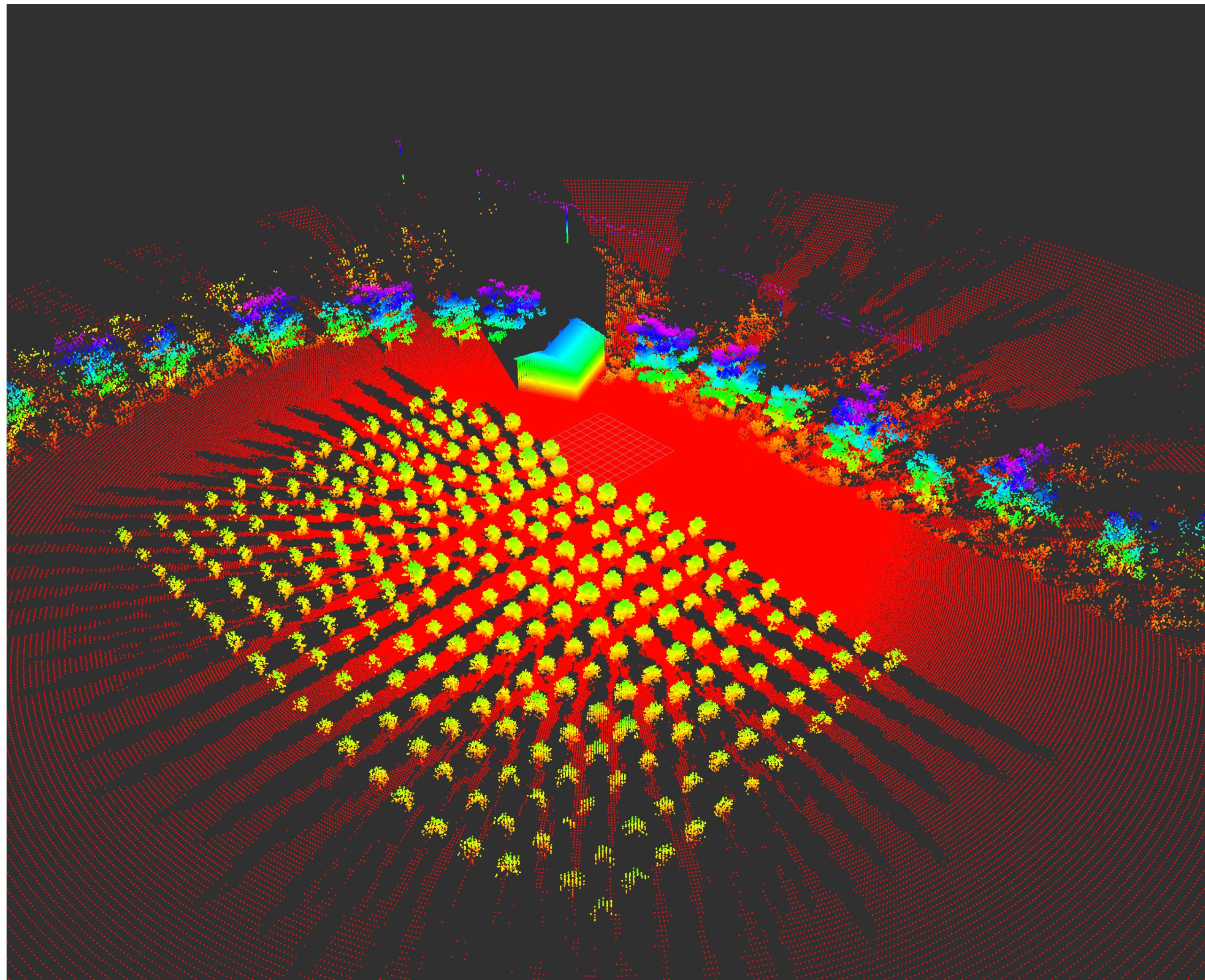
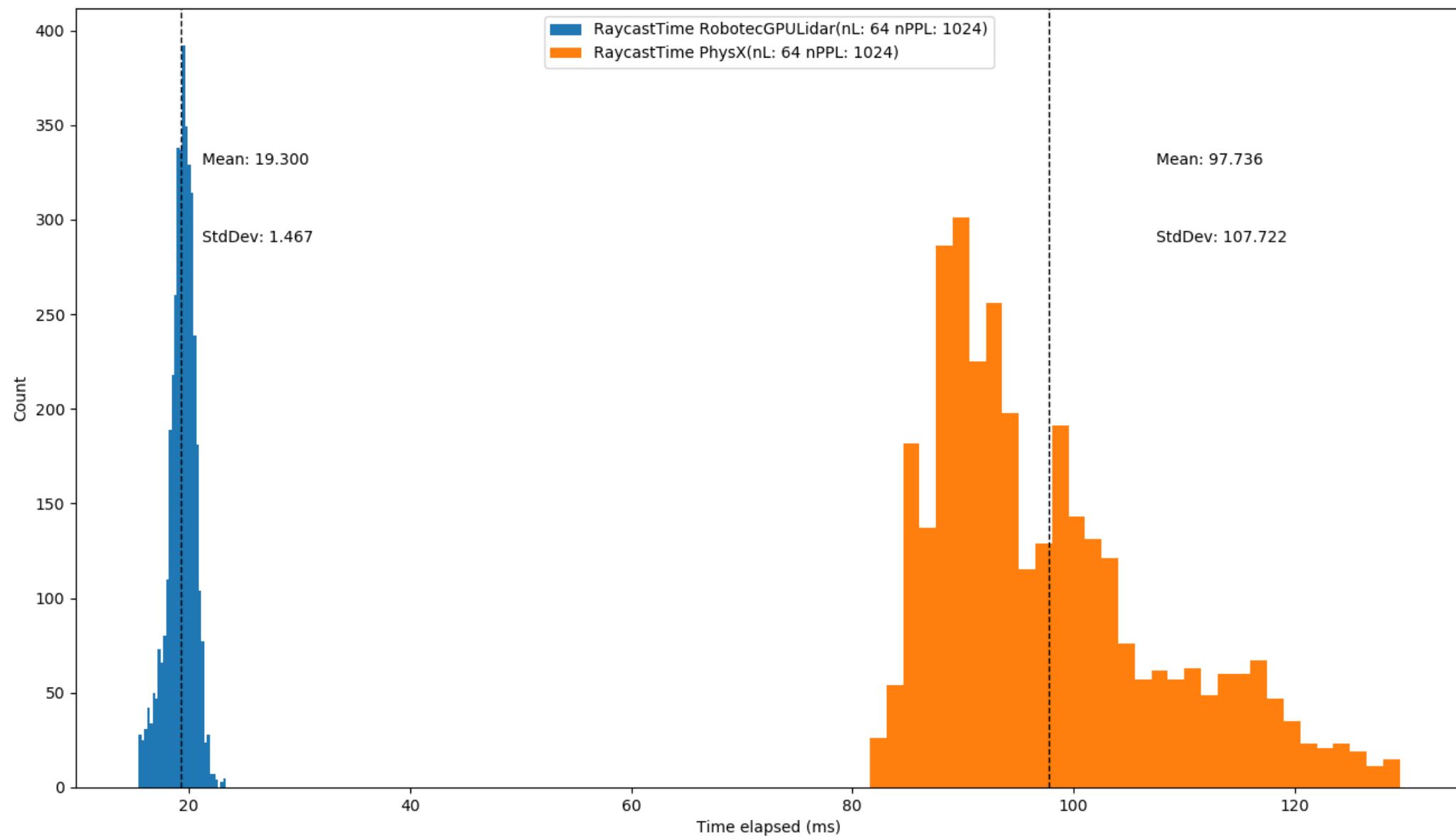
## Current roadmap

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- Intensity simulation
  - Information channel that may be used by AI.
- Instance segmentation
  - Additional information to train AI on.
- Point cloud skew (distortion)
  - More realistic data for AV use-cases.
- Further optimization

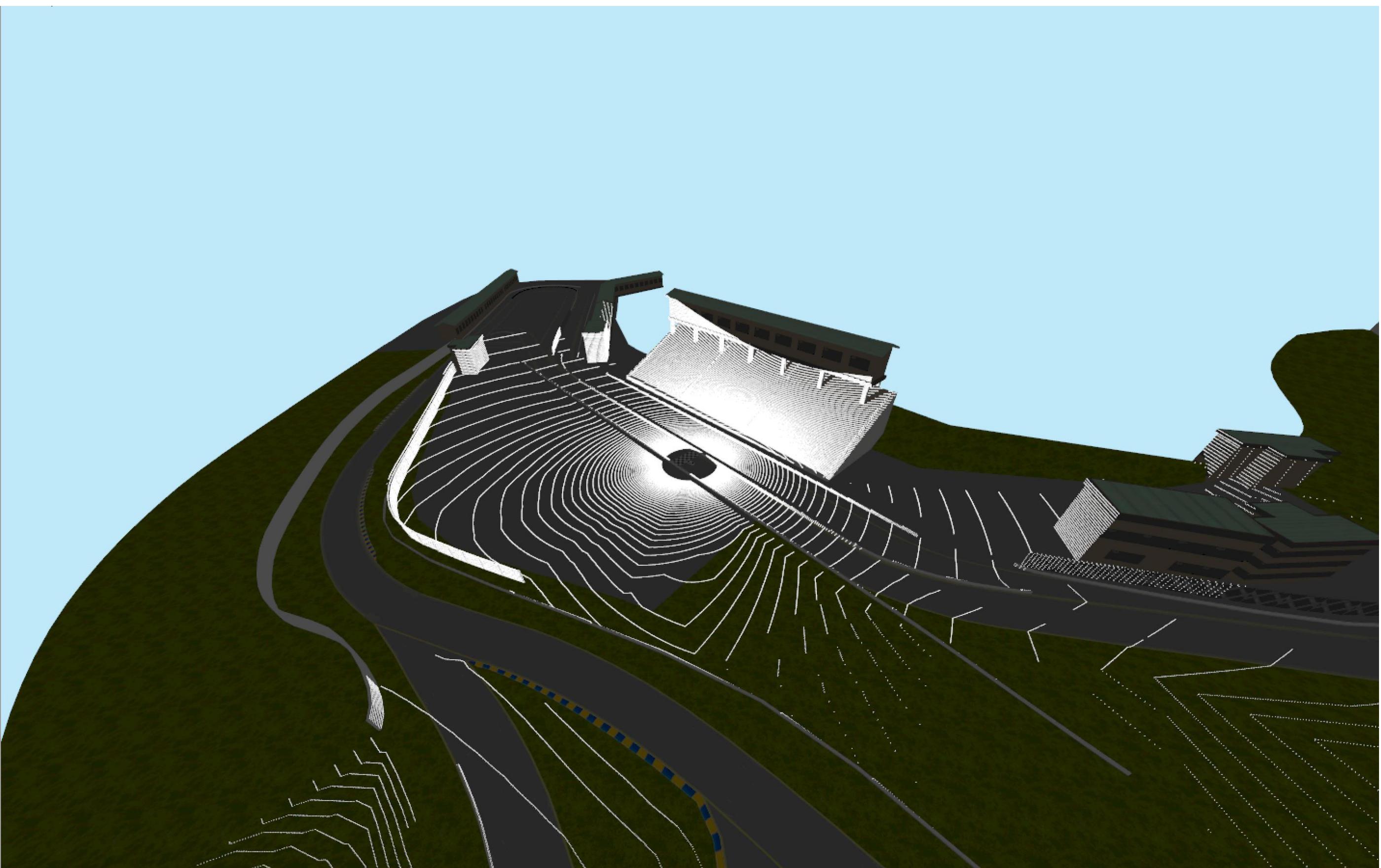
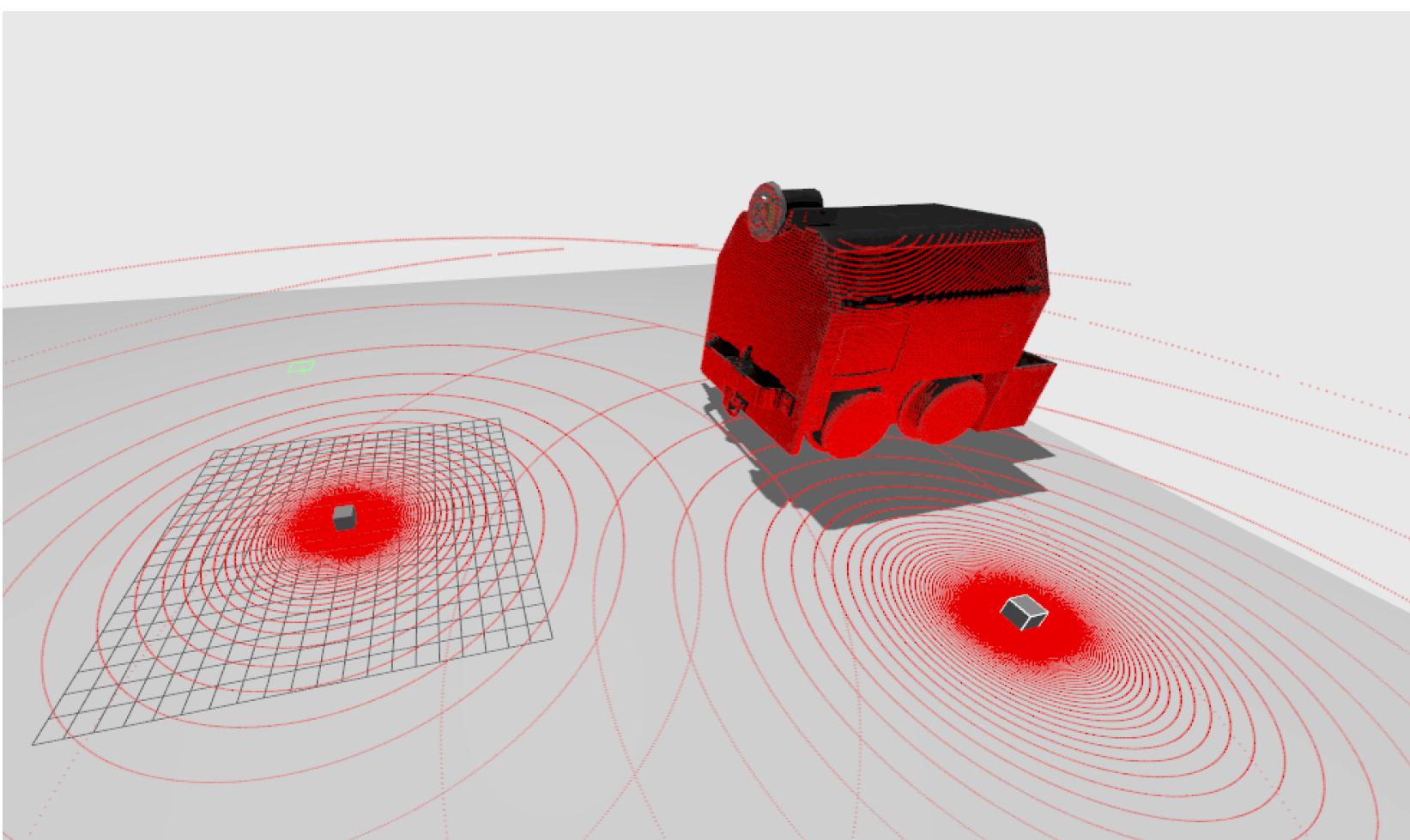
# O3DE Plugin

- In internal review currently.
- First version expected by end of year.
- Working with O3DE ROS 2 Gem.



# Gazebo Plugin

- Interest in Gazebo Integration.
- Aiming for a release in January.
- We aim to integrate it with  
**gz-sensors** to make it available  
out-of-the-box.



# Summary

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- Robotec GPU Lidar links:
  - [GitHub repository](#)
  - [Post on our blog](#)
- Plugins for Gazebo and O3DE are coming soon.
- Feedback and feature suggestions are welcome!
- Invitation to contribute – features & plugins.
- Contact us:
  - Adam Dąbrowski: [adam.dabrowski@robotec.ai](mailto:adam.dabrowski@robotec.ai). [LinkedIn](#).
  - Piotr Rybicki: [piotr.rybicki@robotec.ai](mailto:piotr.rybicki@robotec.ai). [LinkedIn](#).



# Questions & Discussion