Active Perception using Light Curtains for Autonomous Driving

Webpage: http://siddancha.github.io/projects/active-perception-light-curtains





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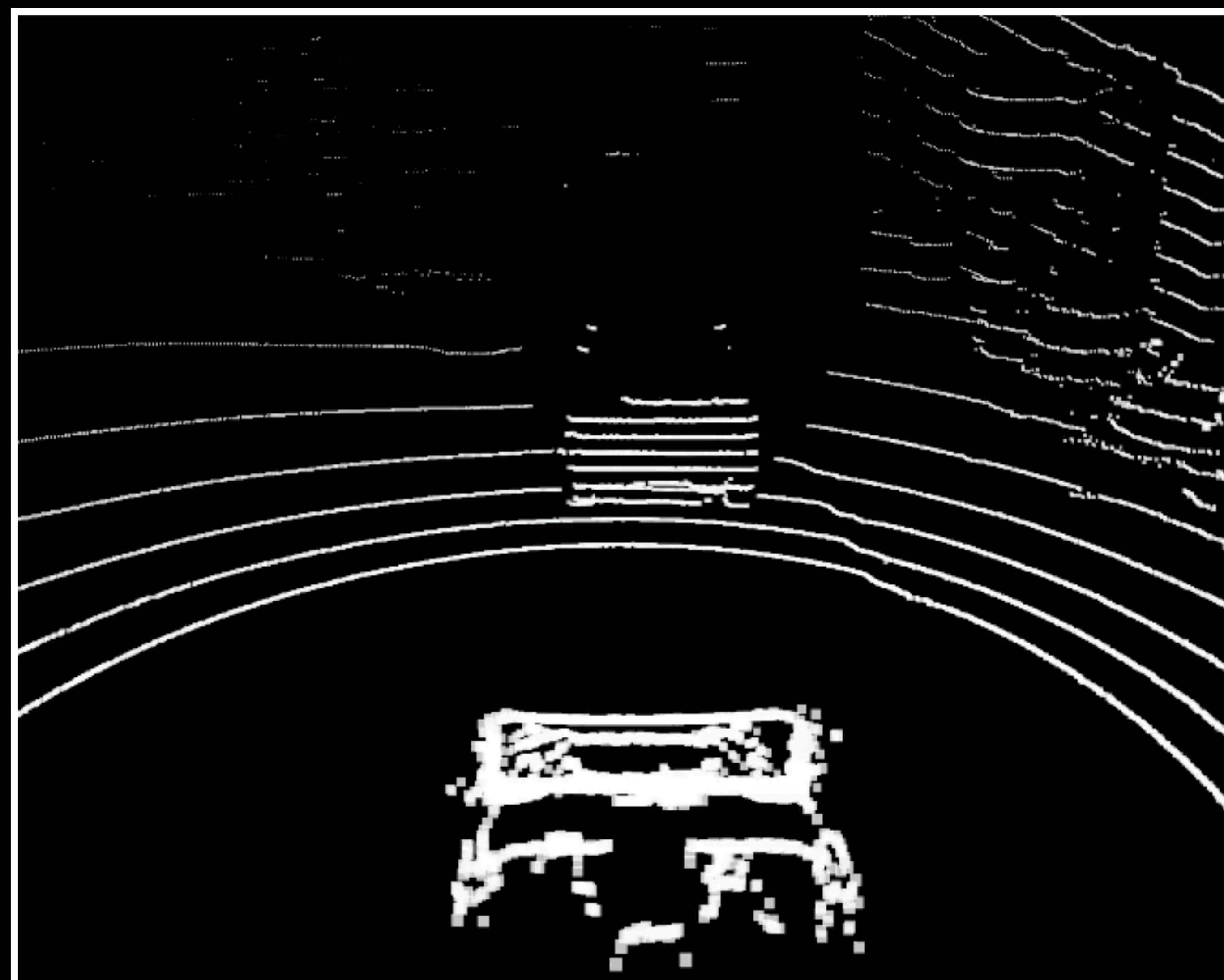
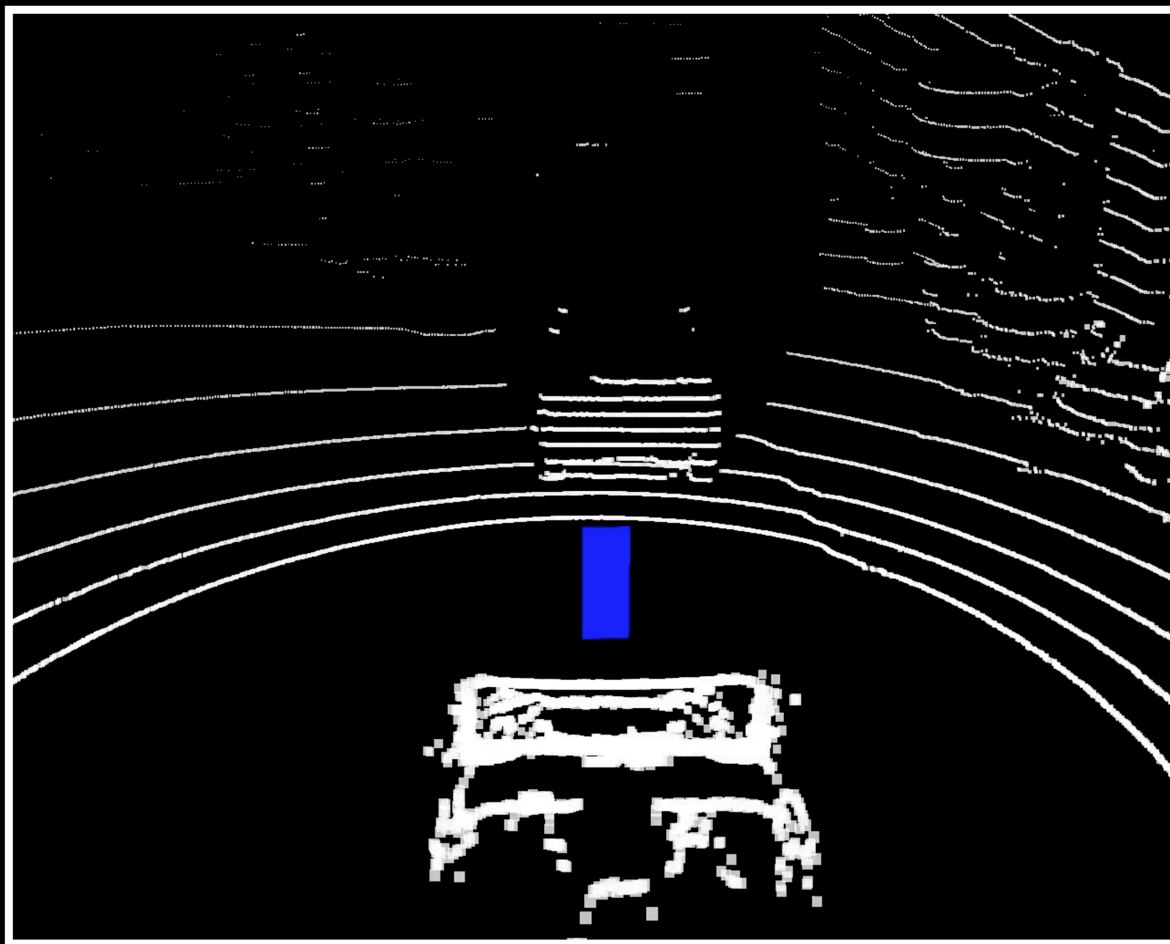
LiDARs perform fixed scans

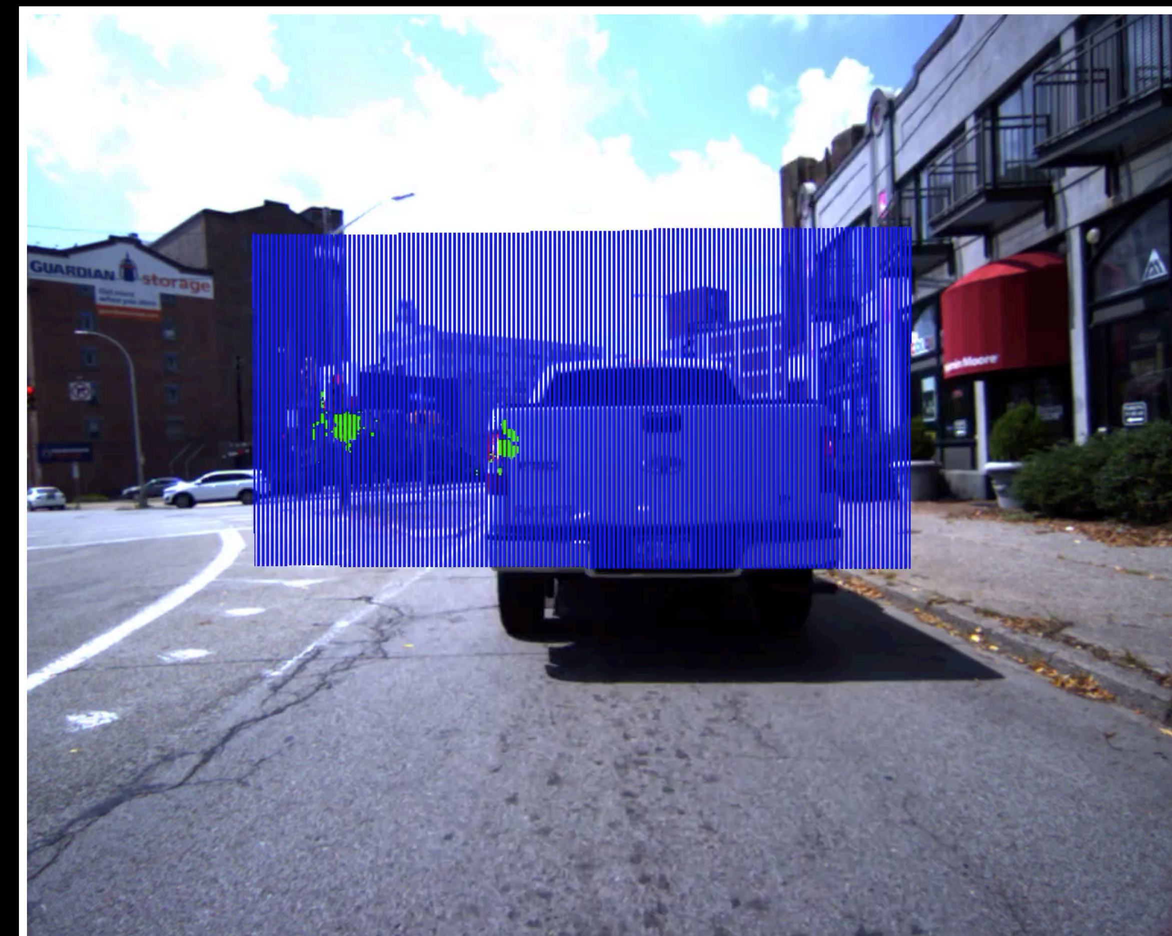


LiDAR

- Sparse point clouds.
- Expensive: Velodyne 64 beam LiDAR can cost > $80,000.

Light curtains are *controllable*





LiDAR

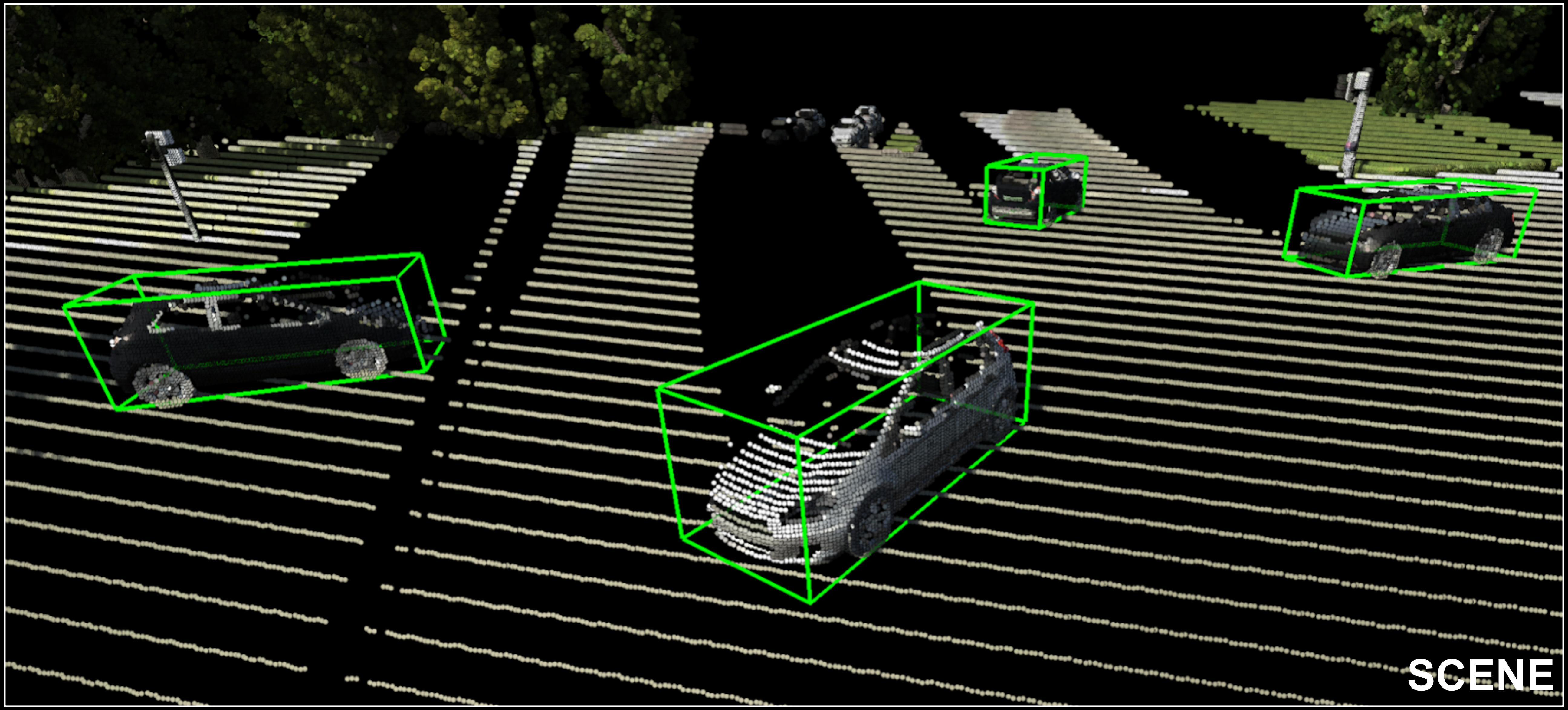
- **Sparse point clouds.**
- **Expensive: Velodyne 64 beam LiDAR can cost > $80,000.**

Light Curtain

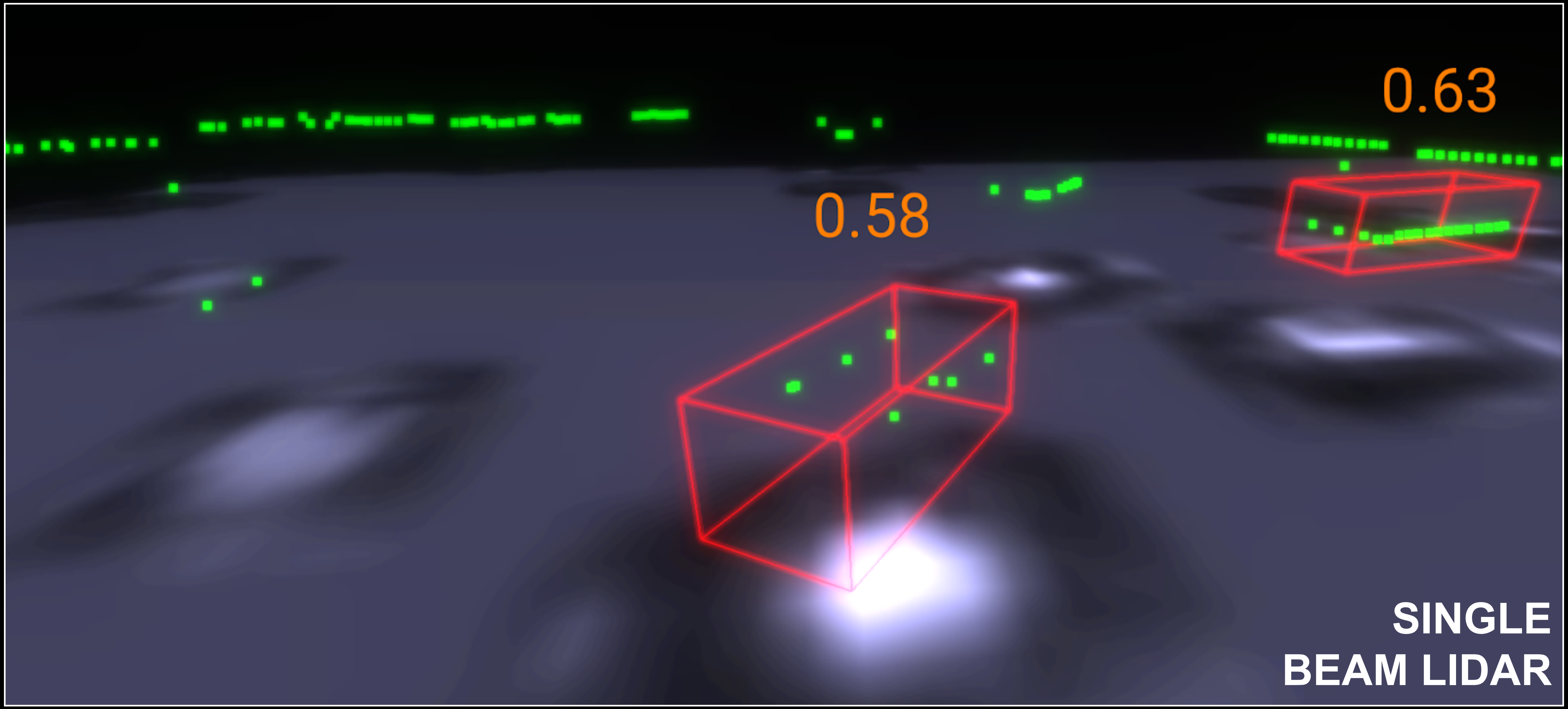
- **Dense point cloud where curtain is placed.**
- **Inexpensive:**
  Lab-built prototype costs ~$1000.

**Agile Depth Sensing Using Triangulation Light Curtains,* Bartels et. al. 2019

Active Detection using Light Curtains

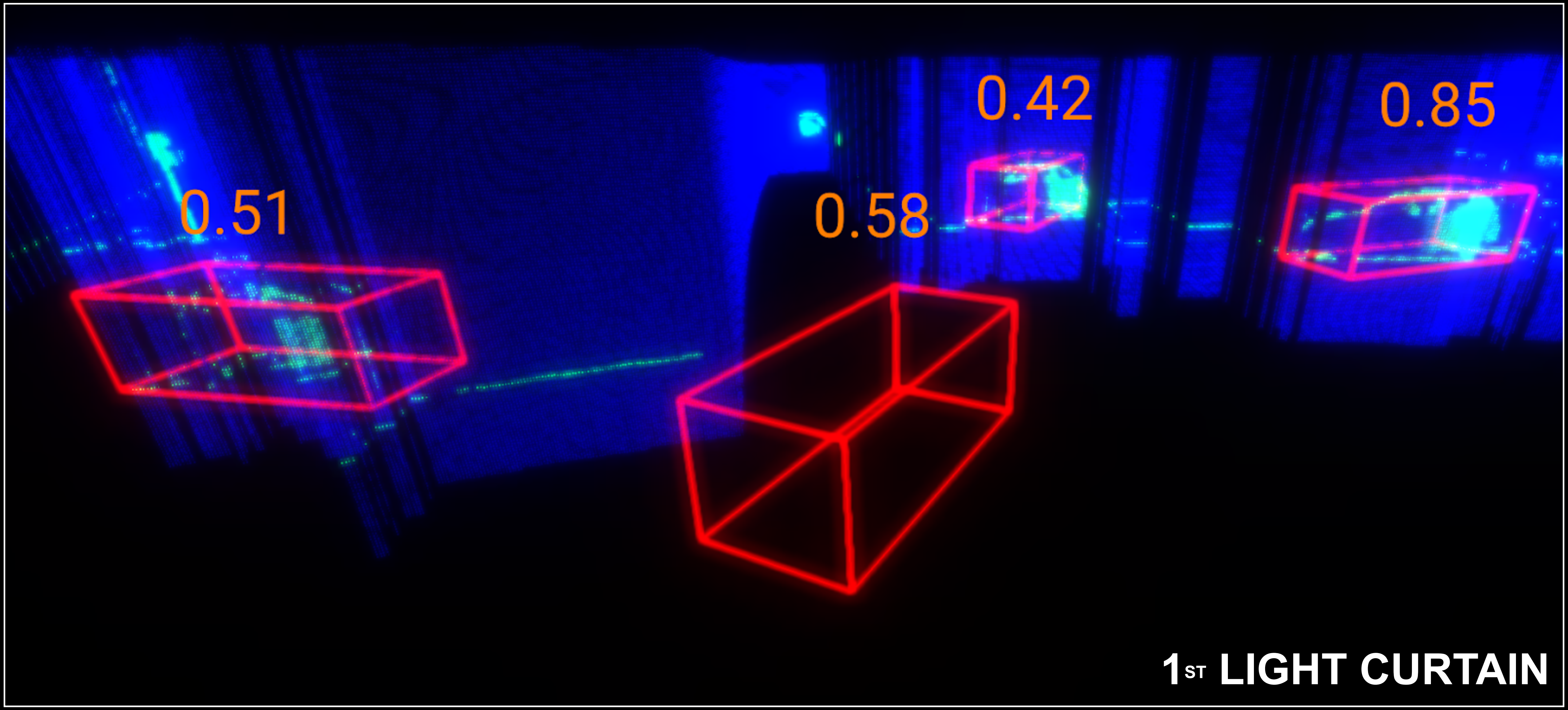


Single-beam LiDAR produces sparse points

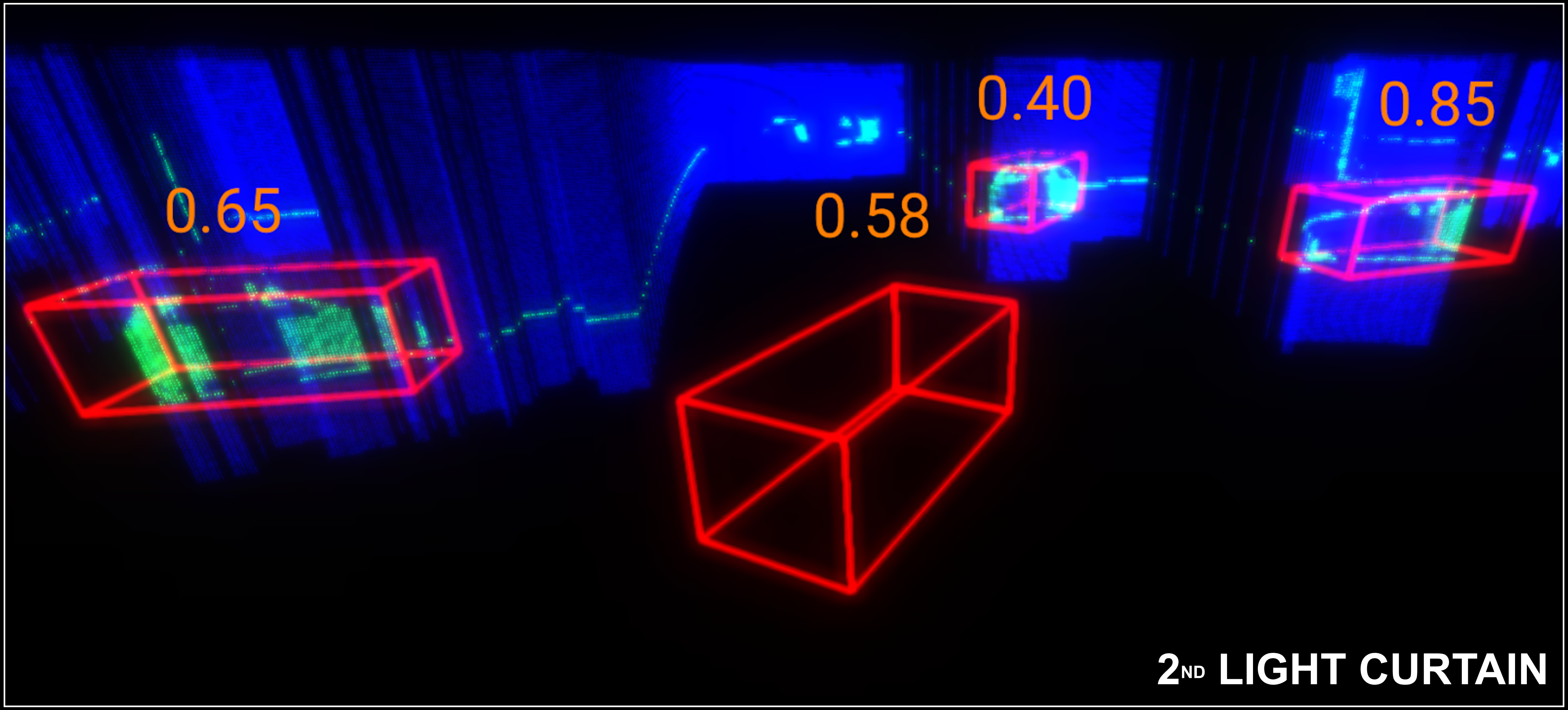


*White: more uncertain   Black: less uncertain

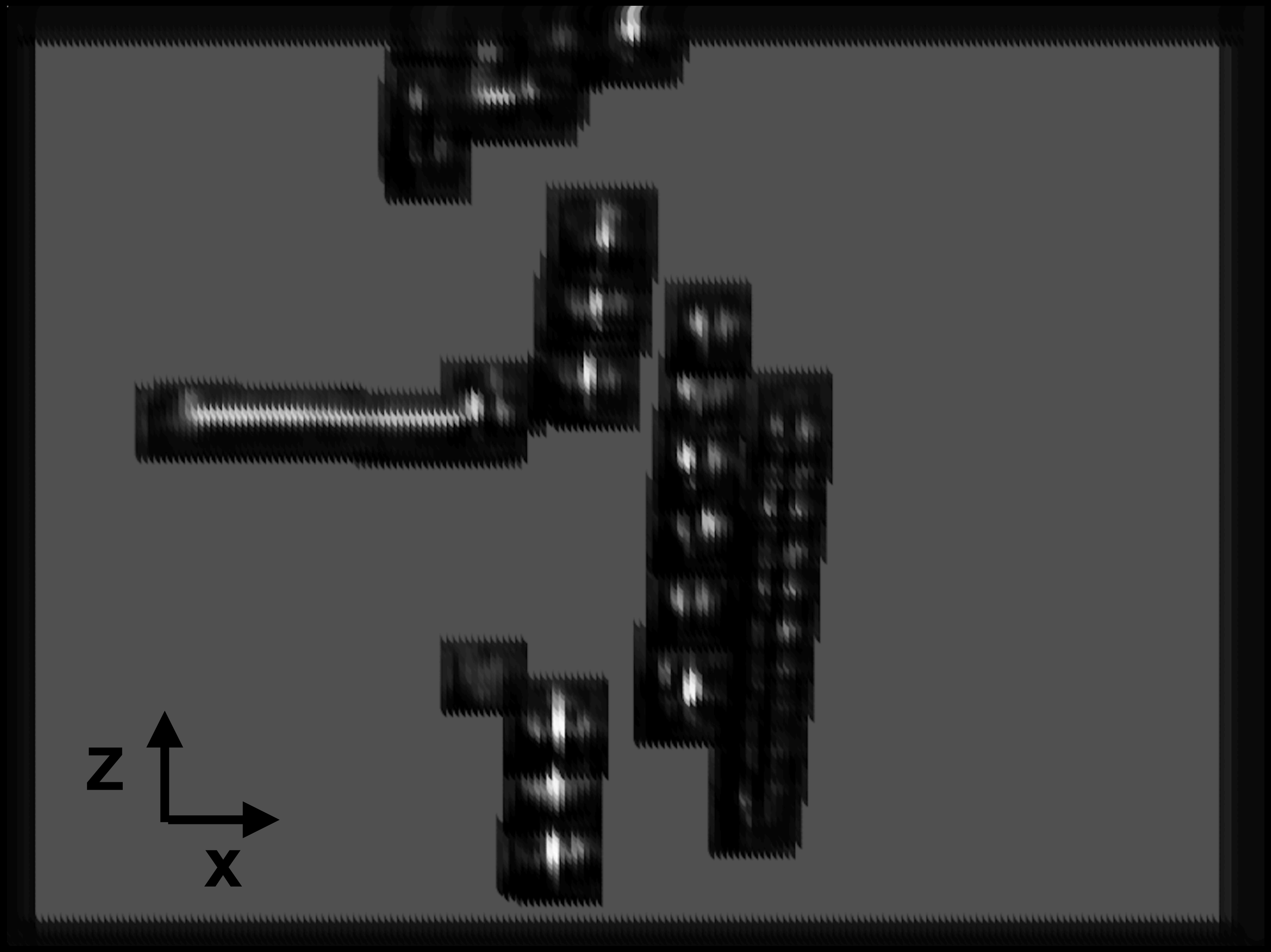
Light curtain improves detection



Light curtain improves detection



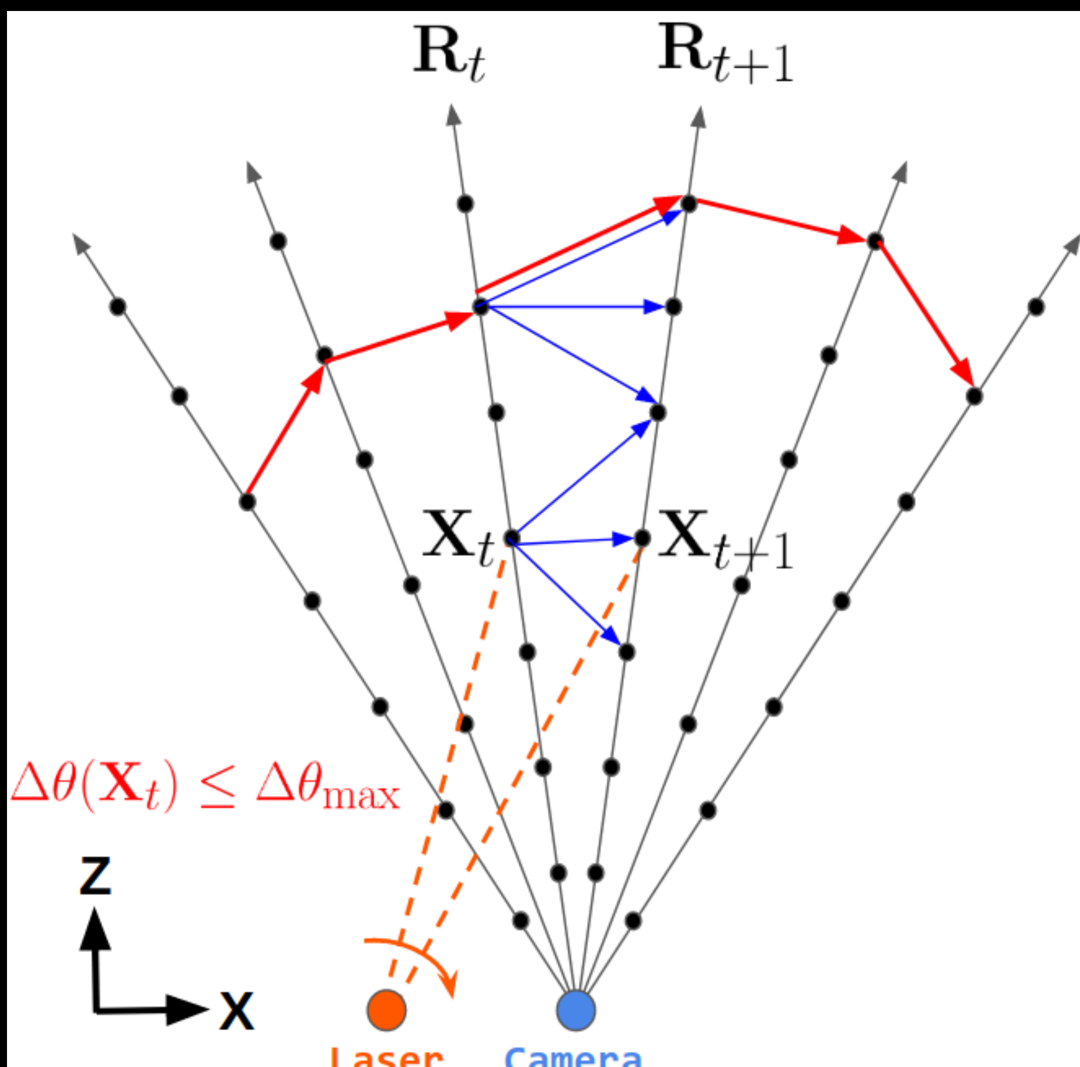
Where to place the light curtain?



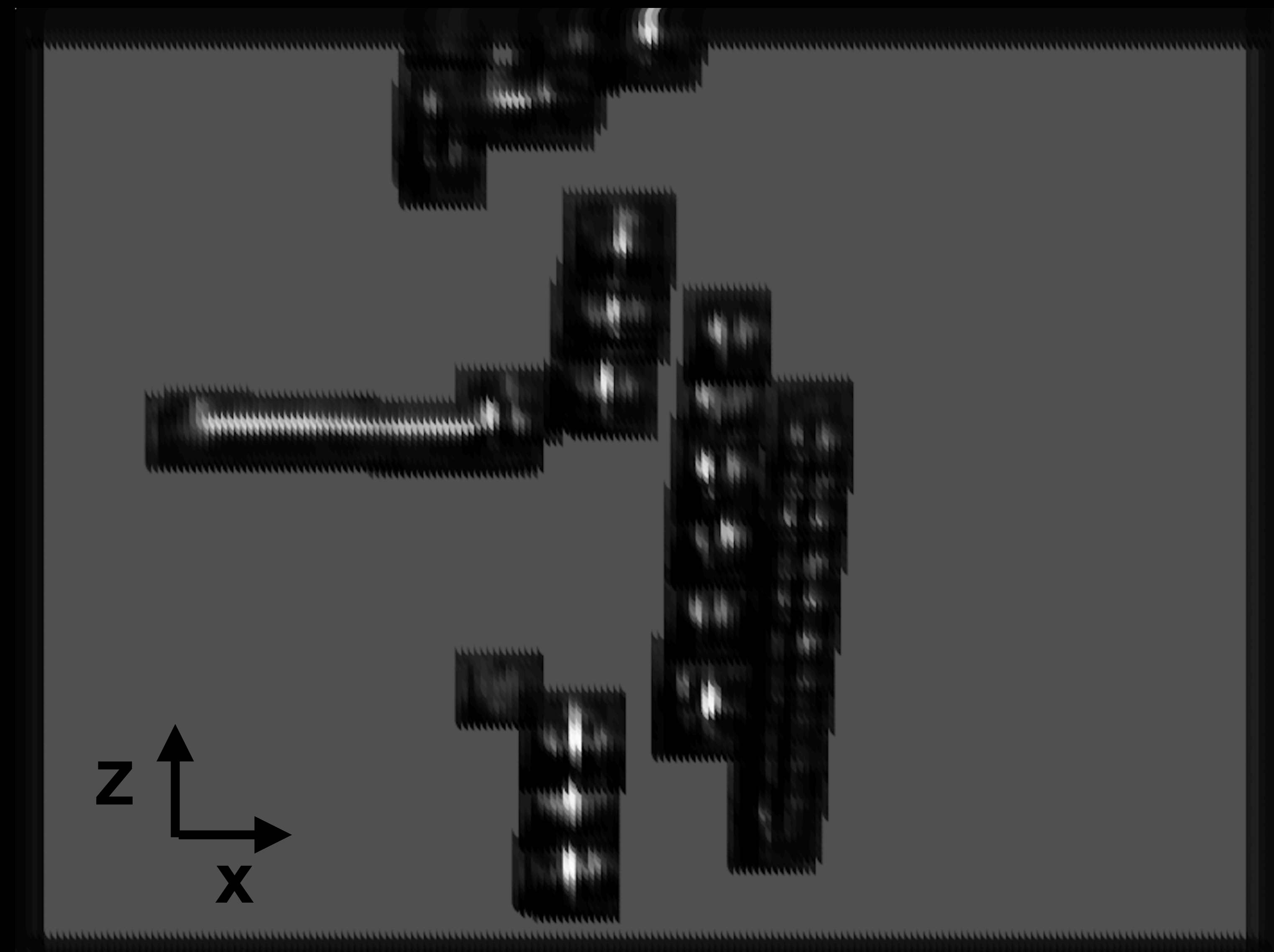
Uncertainty map

(top-down view)

Incorporate physical constraints



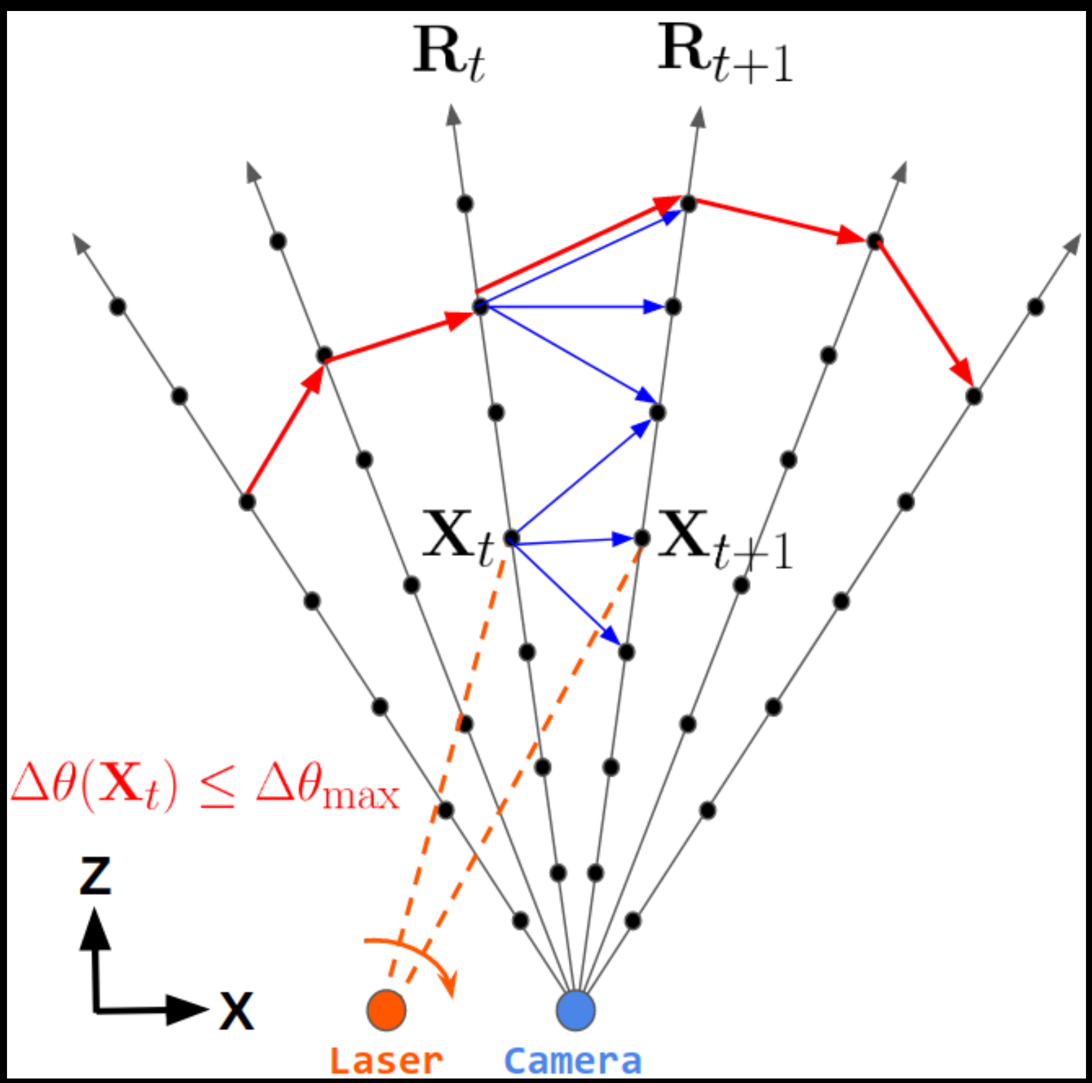
Constraint graph



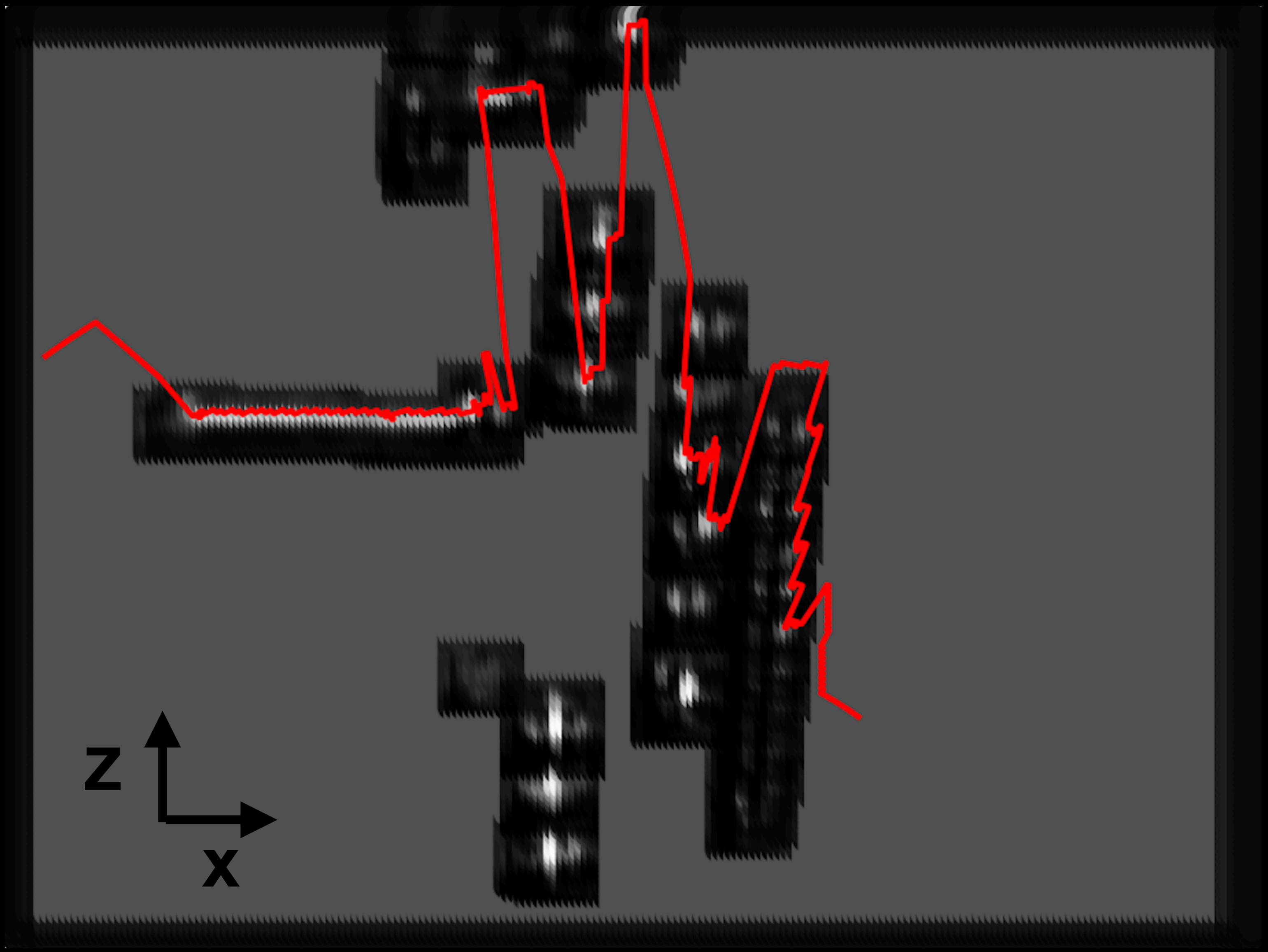
Uncertainty map

(top-down view)

Maximize sum of uncertainty



Constraint graph

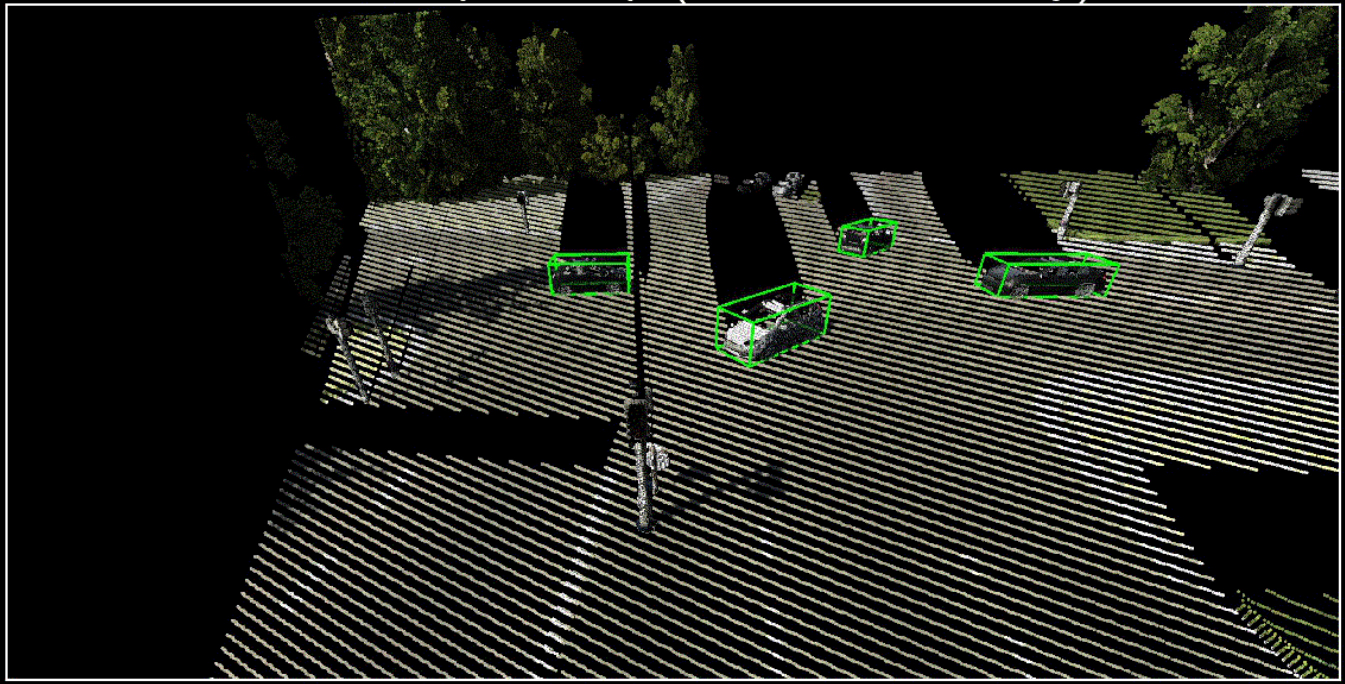


Uncertainty map

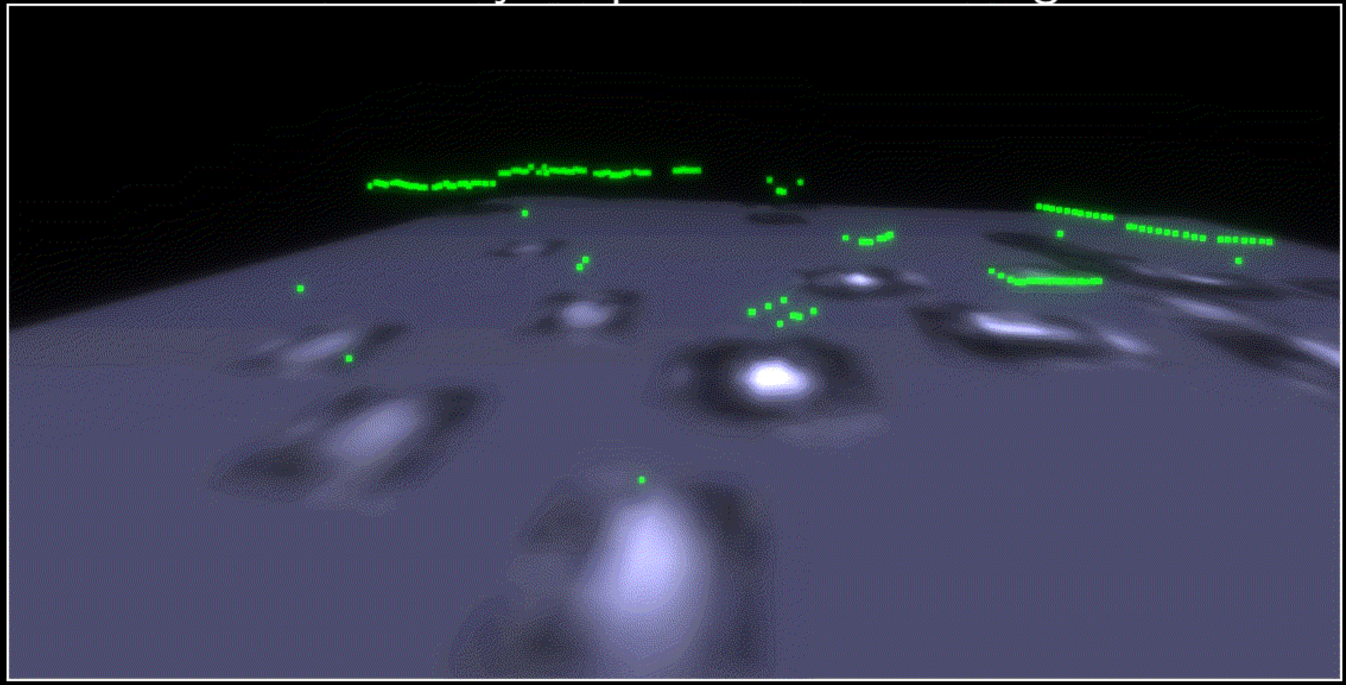
(top-down view)

Detecting false negatives missed by LiDAR

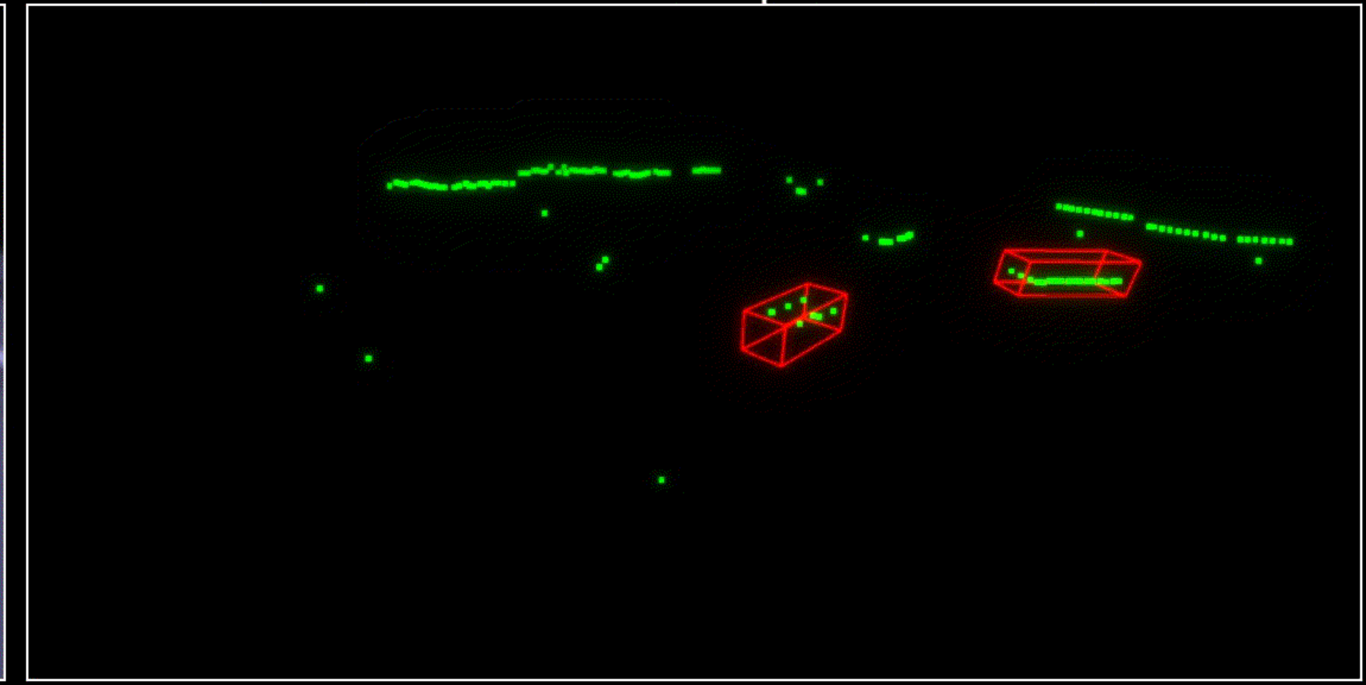
Dense Depth Map (visualization only)



Uncertainty Map + Sensor Readings



Cumulative Detector Input + Detections



Single Beam LiDAR

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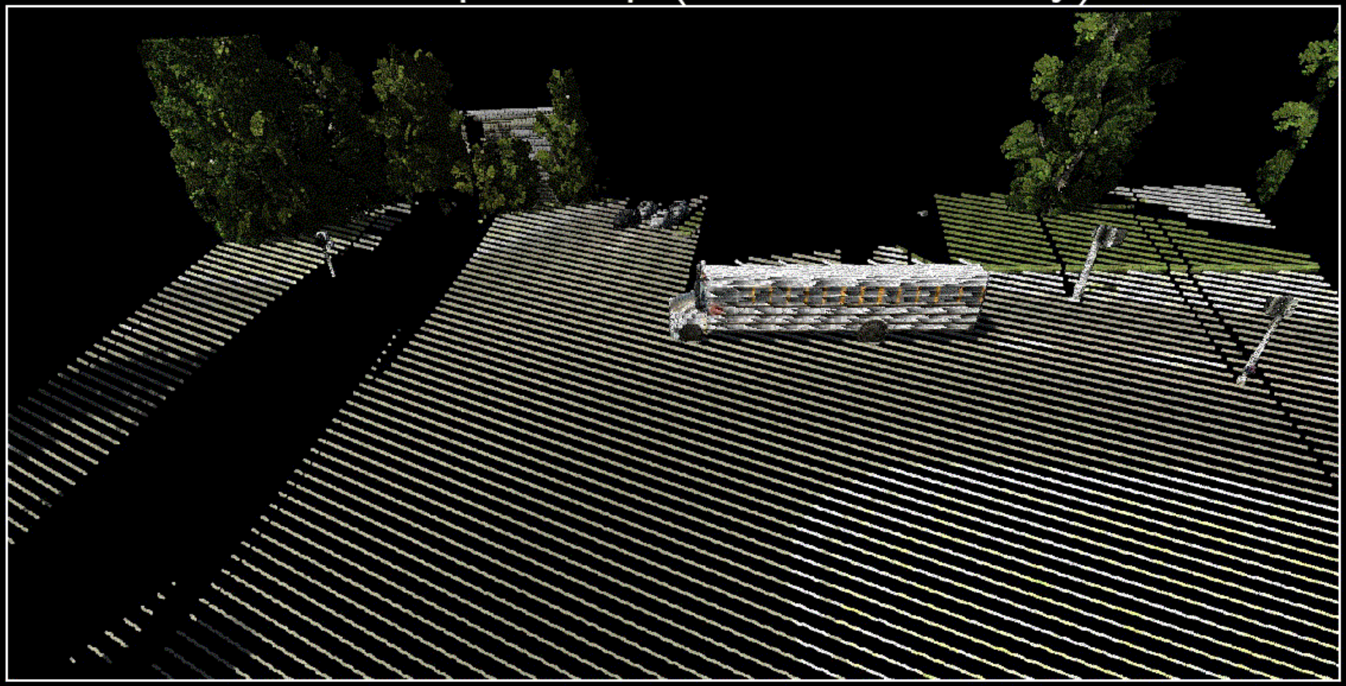
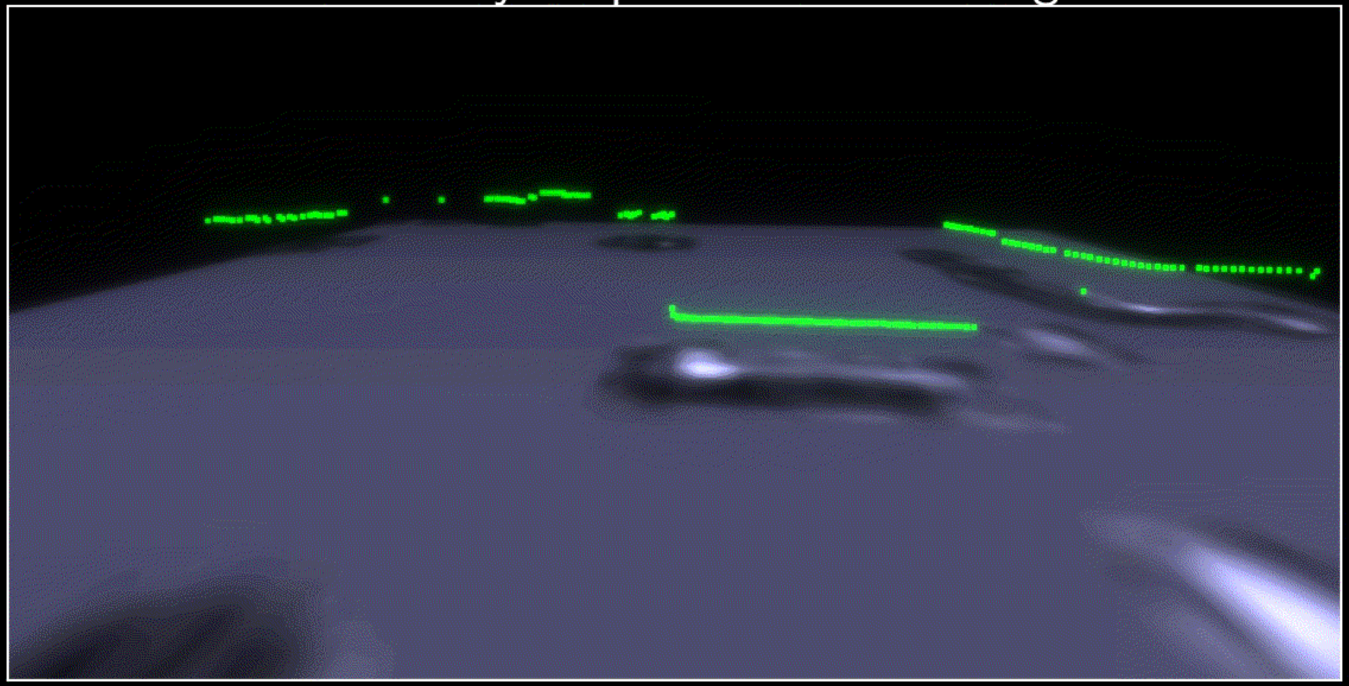
Removing false positives detected by LiDAR

Dense Depth Map (visualization only)



Uncertainty Map + Sensor Readings



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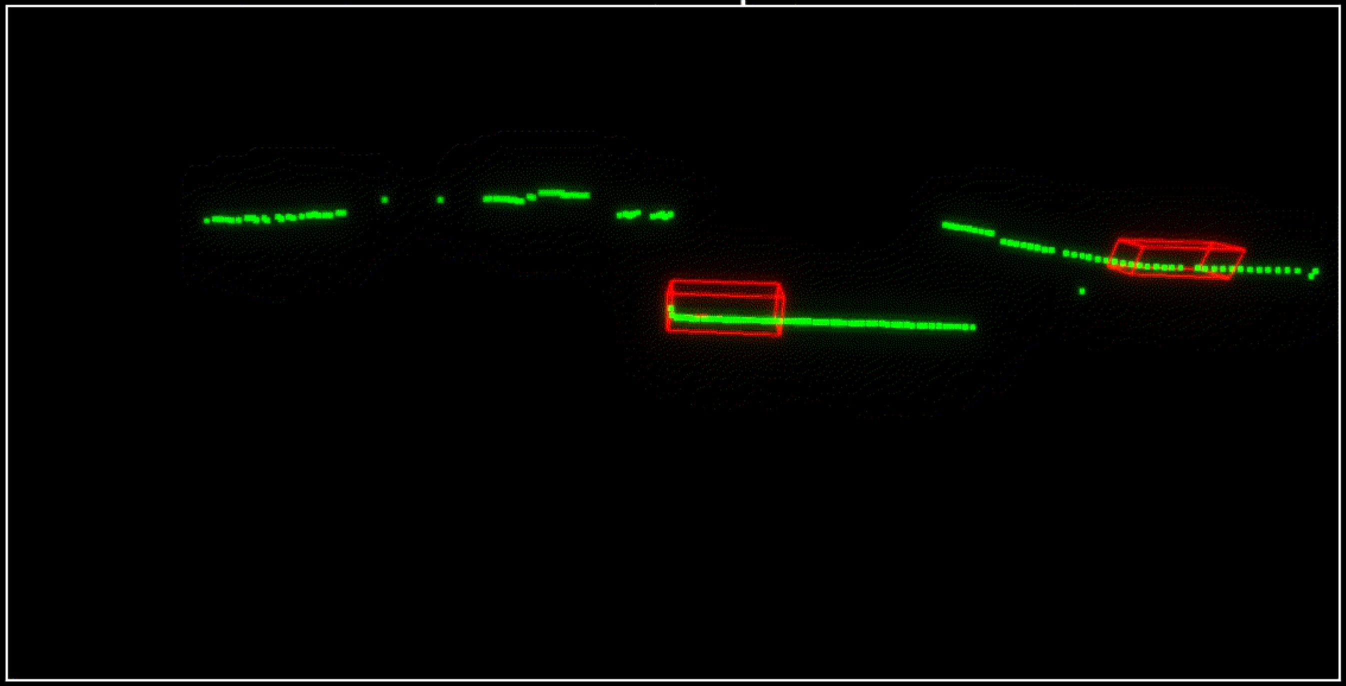

Single Beam LiDAR

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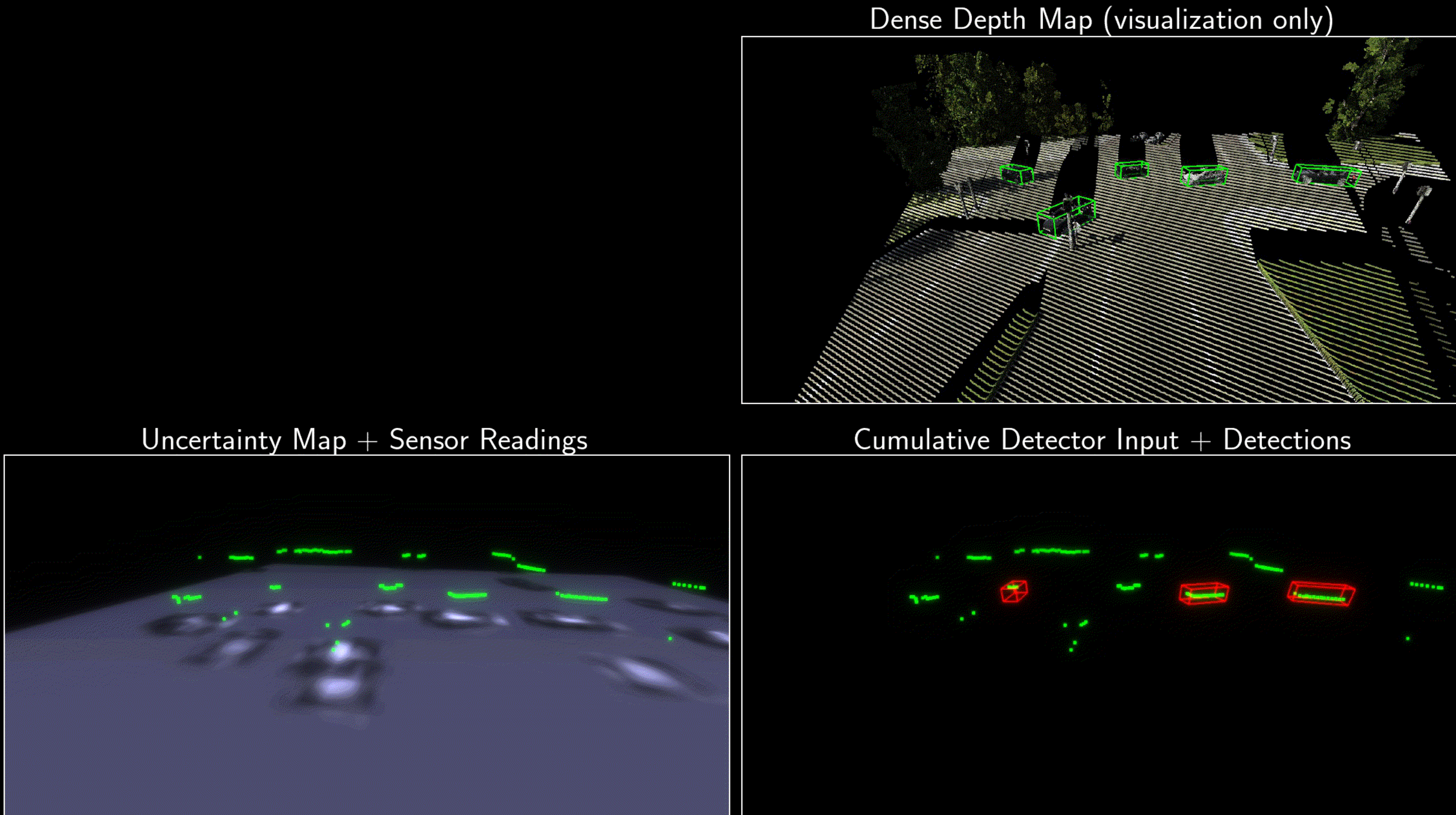
Correcting misaligned detection



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