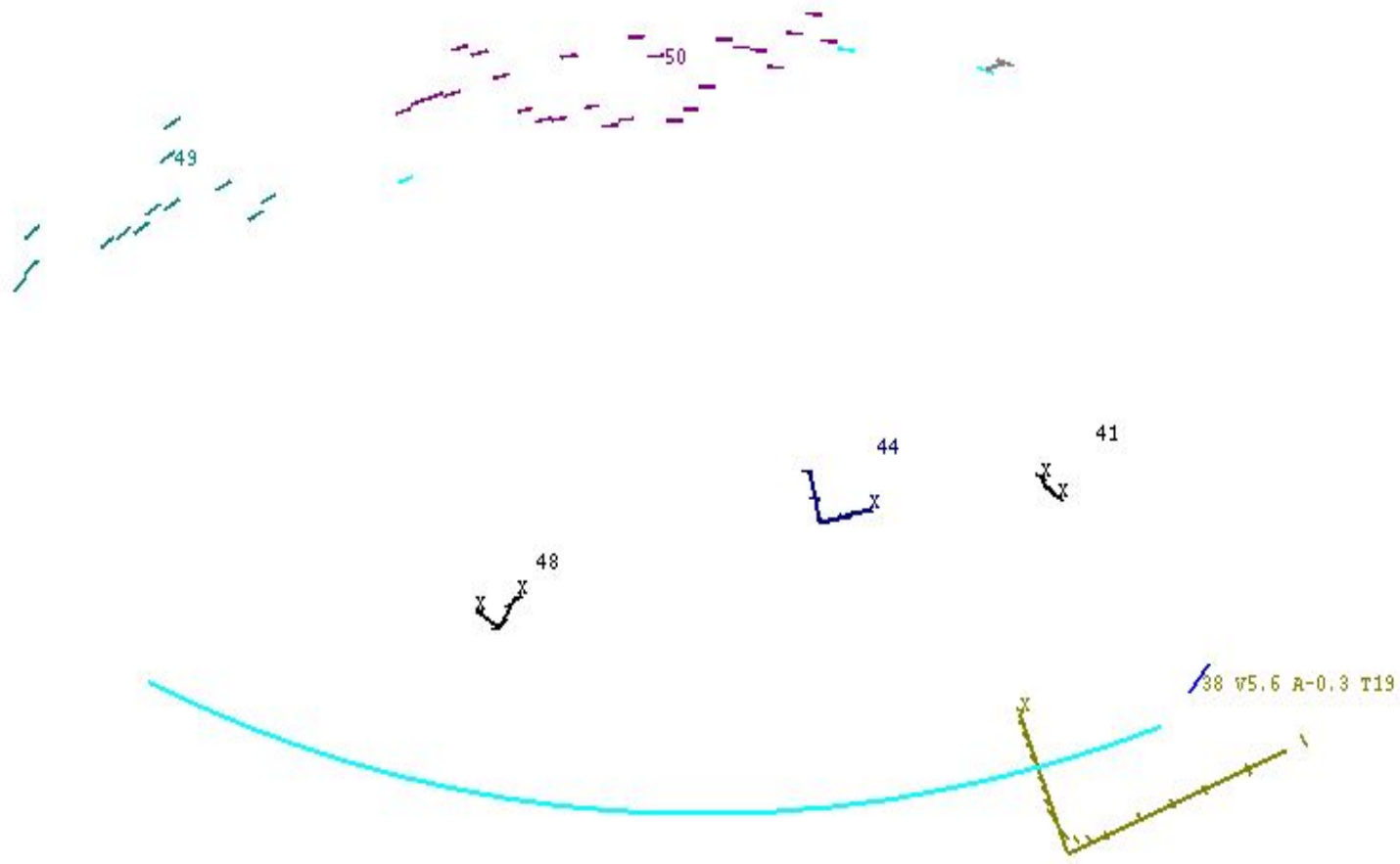# Tracking of Moving Objects from a Moving Vehicle Using a Scanning Laser Rangefinder

Rob MacLachlan

Tracker Output

Why DATMO?

- Moving objects can move into or out of the path.

- If we know the speed and direction, we can predict the future position.

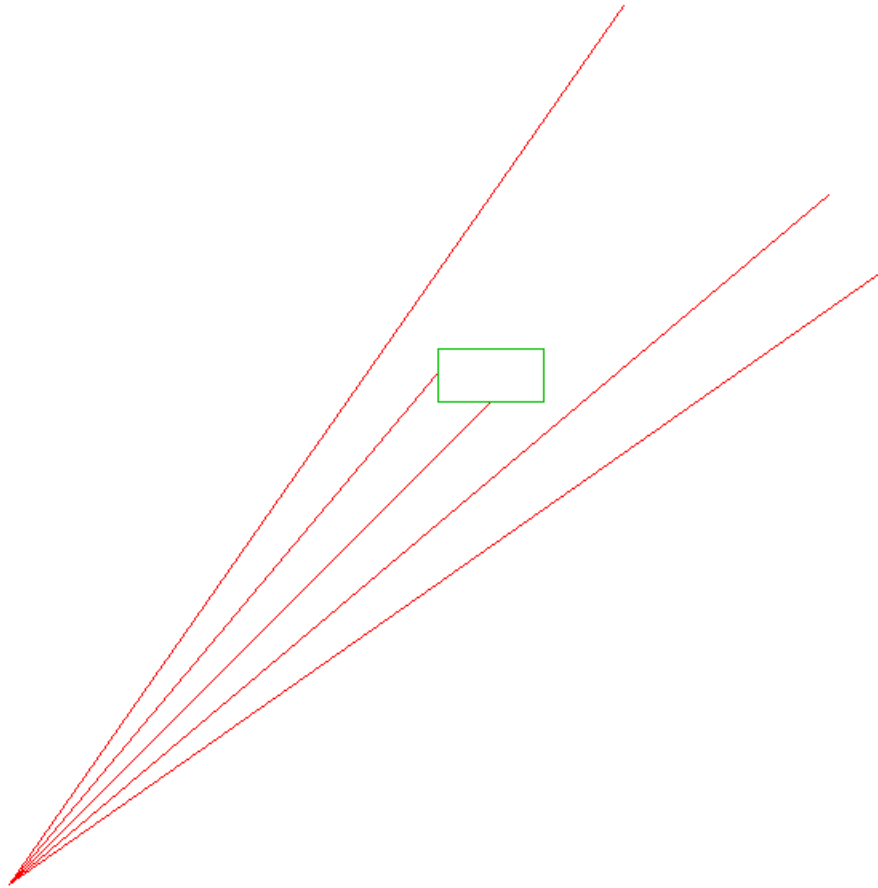- Prediction assumes acceleration and turn rate don't change.

Why is it Hard?

- Available per-scan processing time 0.005 seconds.

- Scanner measures position, not motion:

  – To find motion, find the same object in two scans, then see the change in position.

- When the bus moves, objects appear to change, even if nothing else is moving.

Why does appearance change?

- Seeing different parts of the object
- Poorly defined object boundaries
  - Scanner resolution limits
  - Clutter (objects close together)
  - Vegetation
- 2D scan of a 3D world
- Moving shadows cast by nearer objects
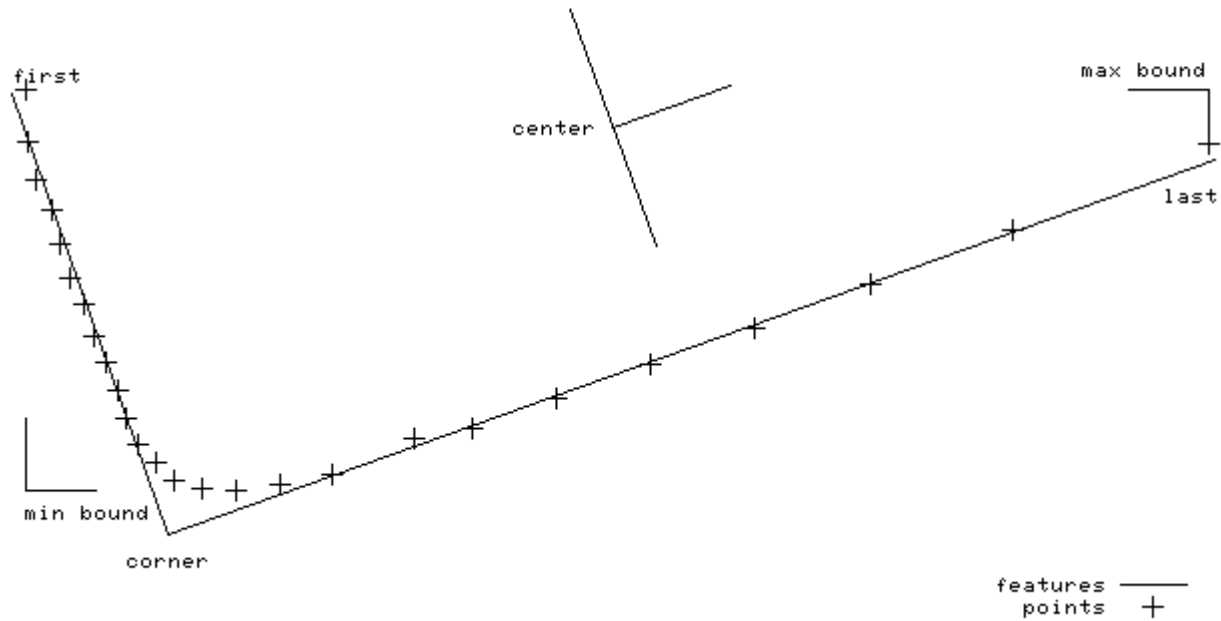
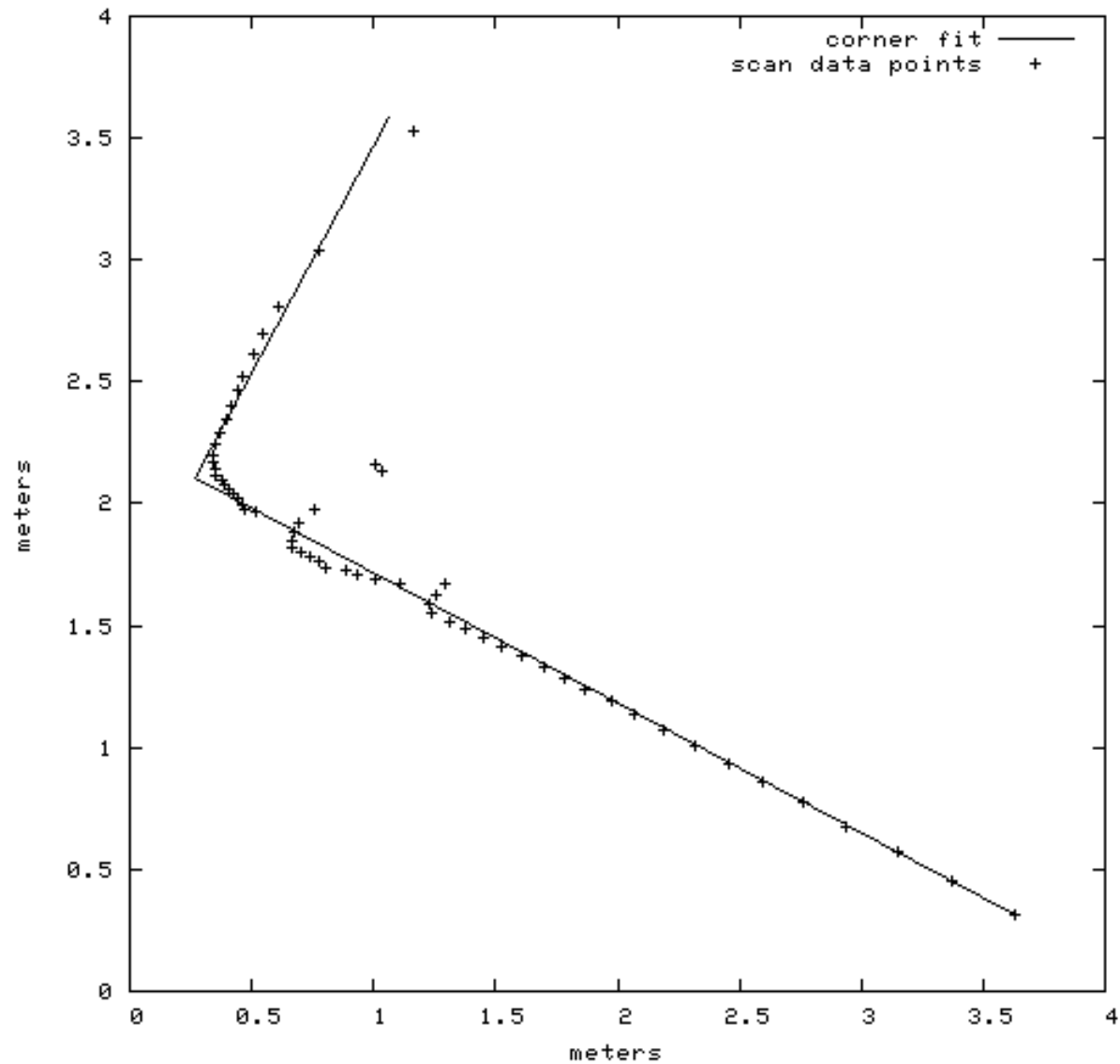# Angular Quantization

Shape Change Demo D1

Tracking Process Overview

- Segmentation and feature extraction: group scanner points by object, fit line and corner features.

- Prior noise model: estimate position error.

- Data association: find the existing track for each segment, creating a new track if there is none.

- Kalman filter: find motion from the raw position measurements.

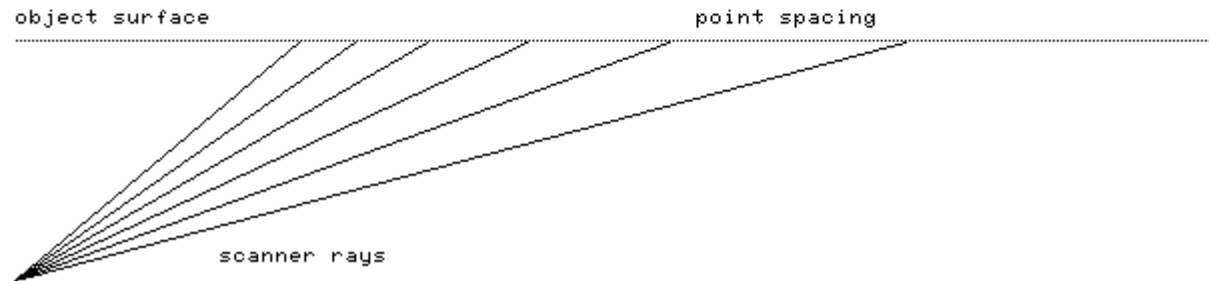- Track evaluation: assess the validity of the dynamic estimate.
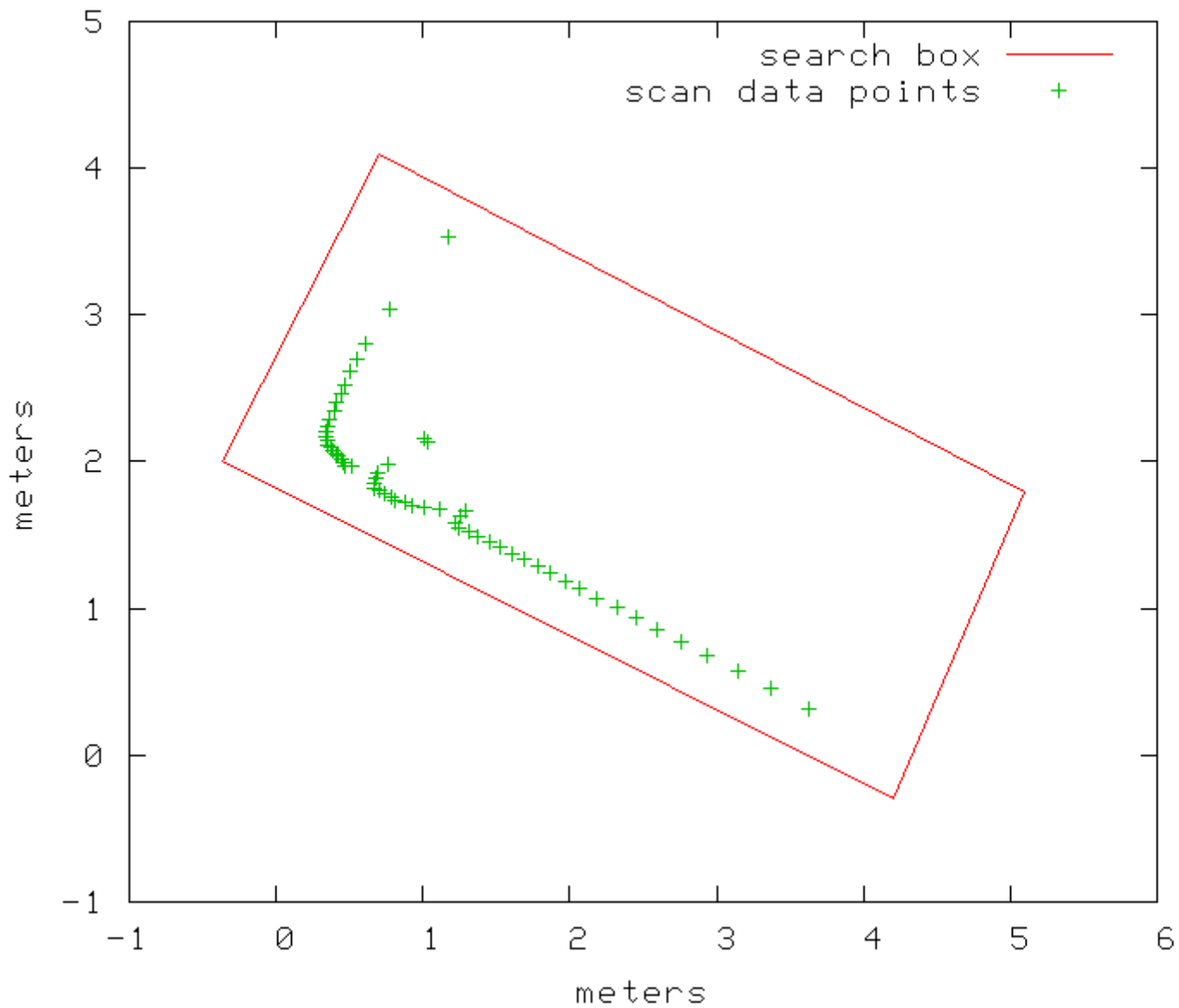
Linear Features

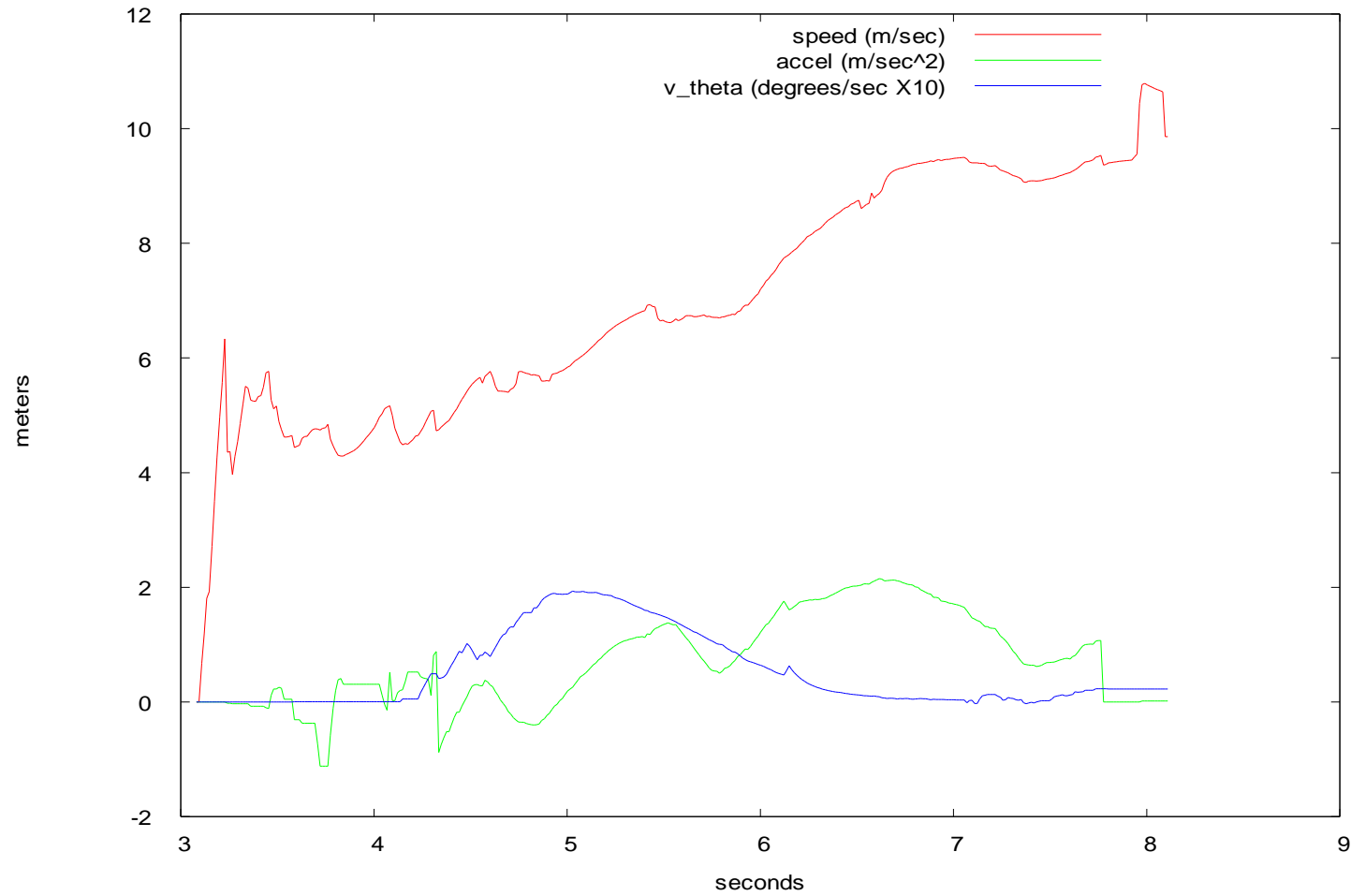# Robust Line Fitting

Point Spacing Effect

object surface   point spacing

scanner rays

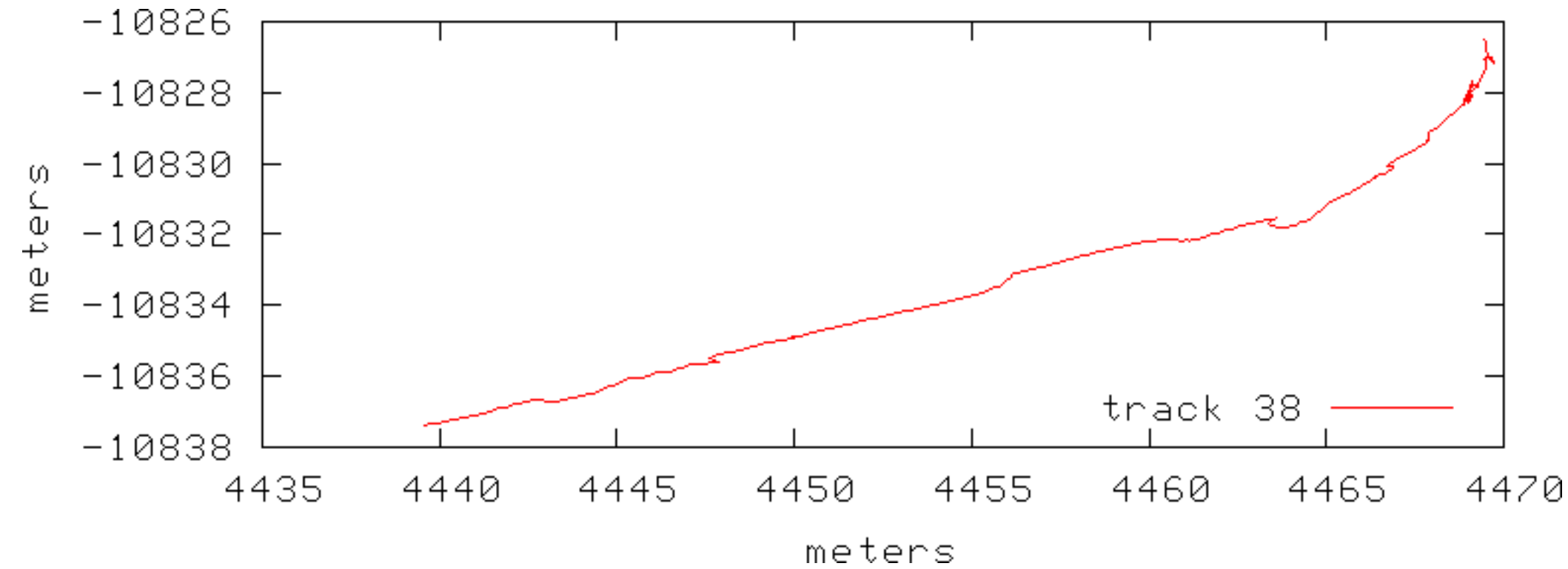# Shape Change & Segmentation D2

Overlap Based Association
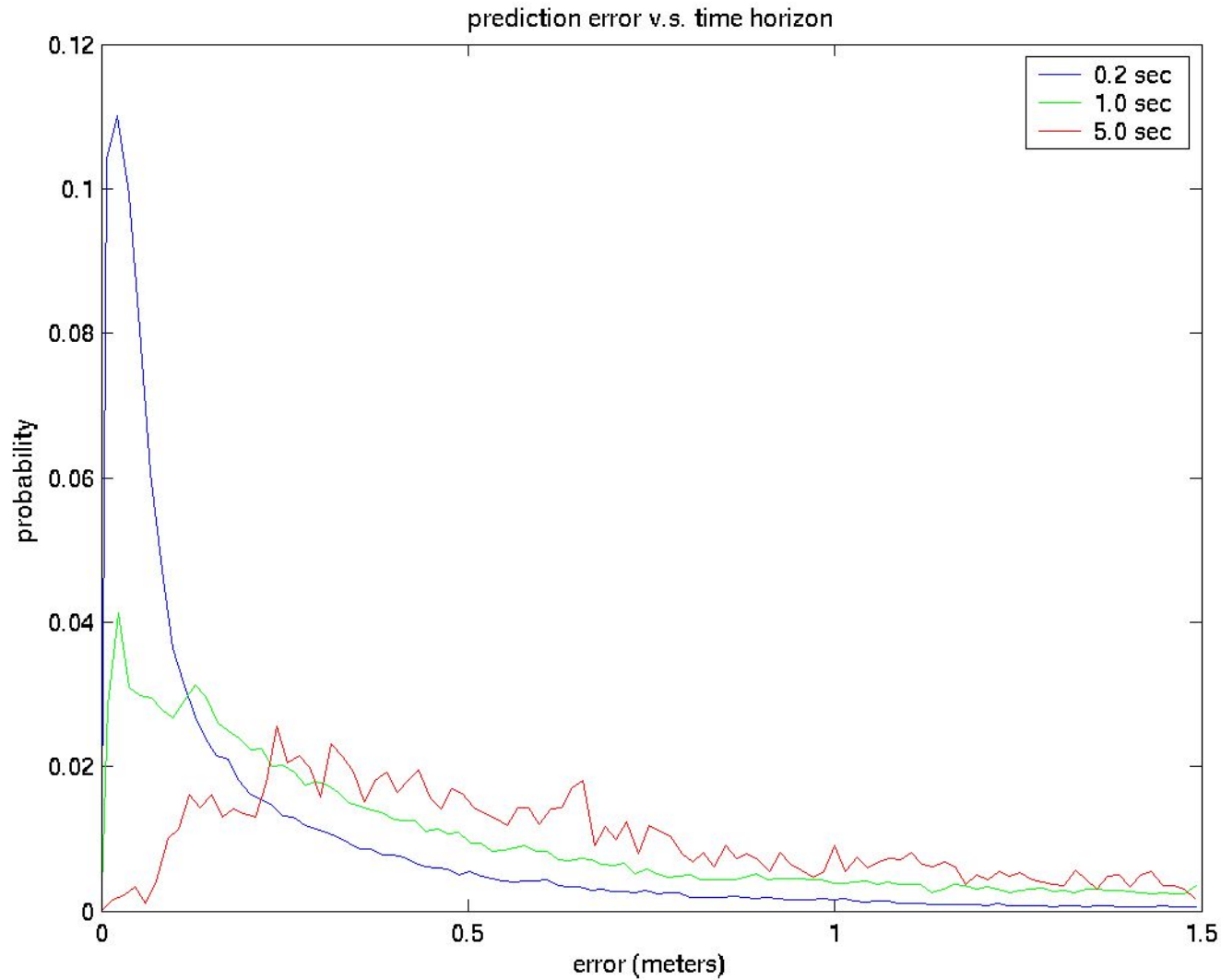
Tracker Dynamics
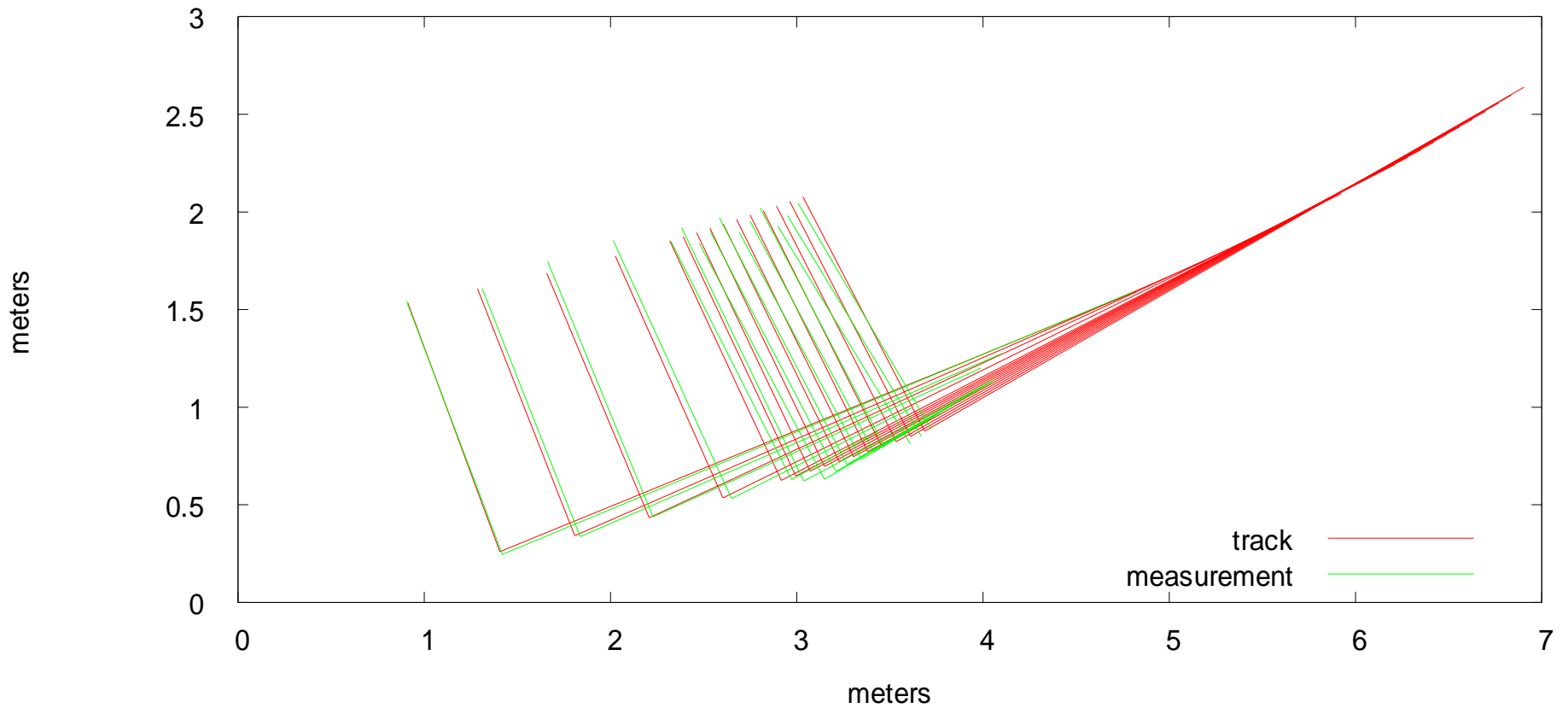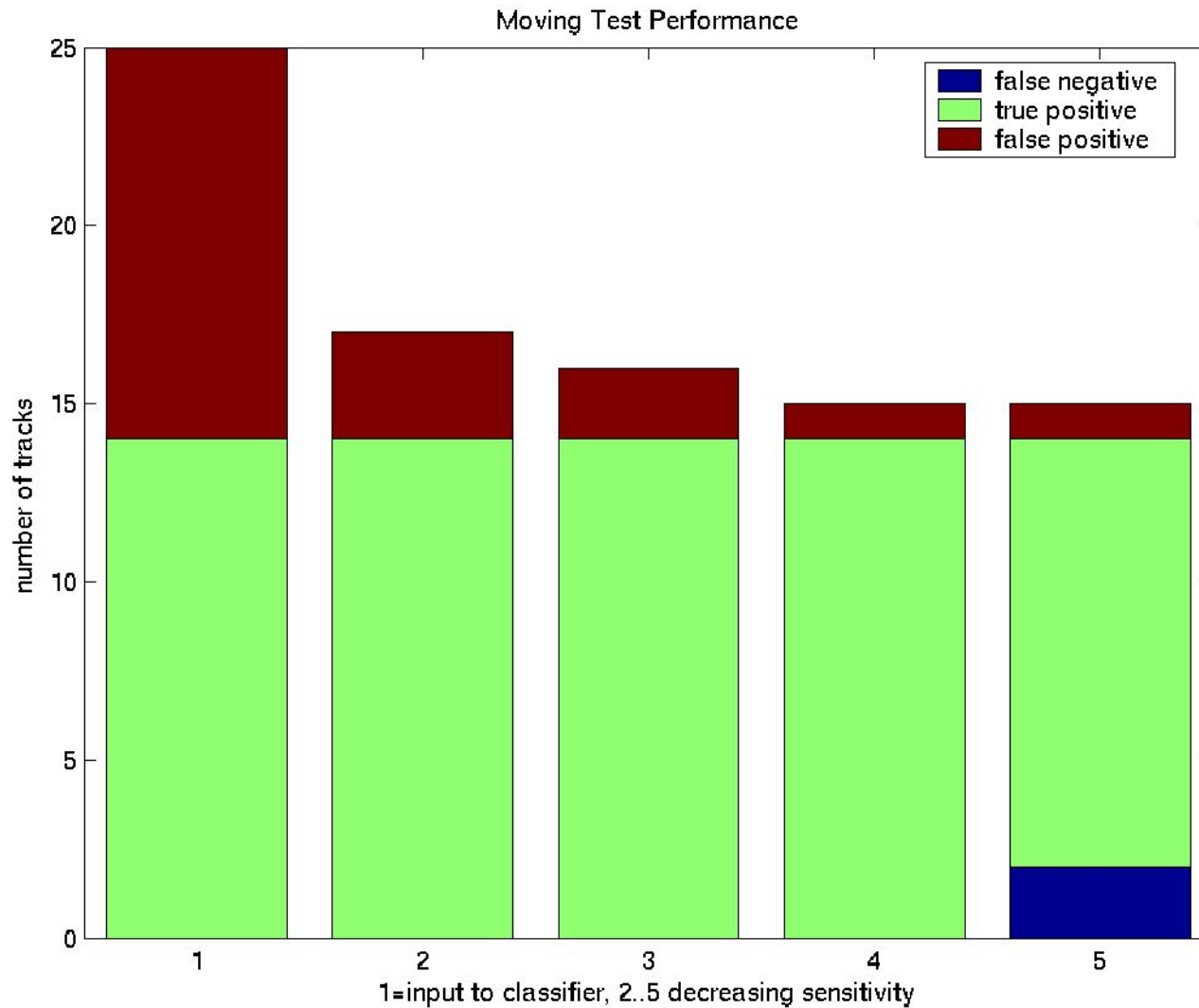
Track Path

Tracker Demo D3, D4

Tracker Performance

History-Based Validity Test

Validity Test Performance

Details...

- ~50 numeric parameters controlling behavior.

- Recognize when tracks split or merge.

- Limit apparent acceleration to reasonable value.

- Weight features by how well they predicted past actual motion.

- Reset features that are tracking badly.

Summary

- Simple linear feature model works well for measuring car motion.

- Tracking works well enough to allow prediction several seconds in the future.

- History-based track validation greatly reduces false motion detections.

- Remaining false positives due to missing returns and ground returns.