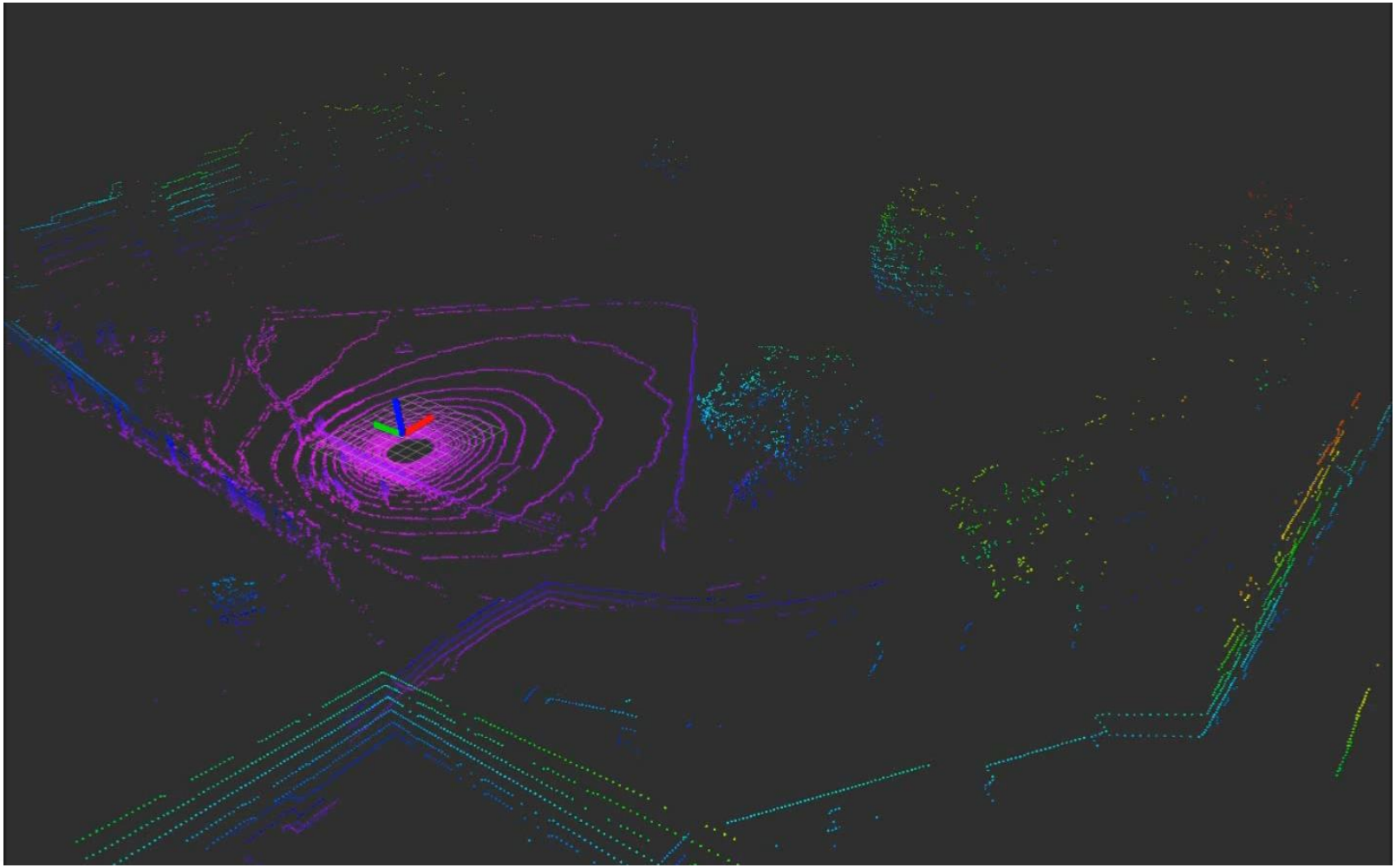
SLAM Examples| MCPTAM

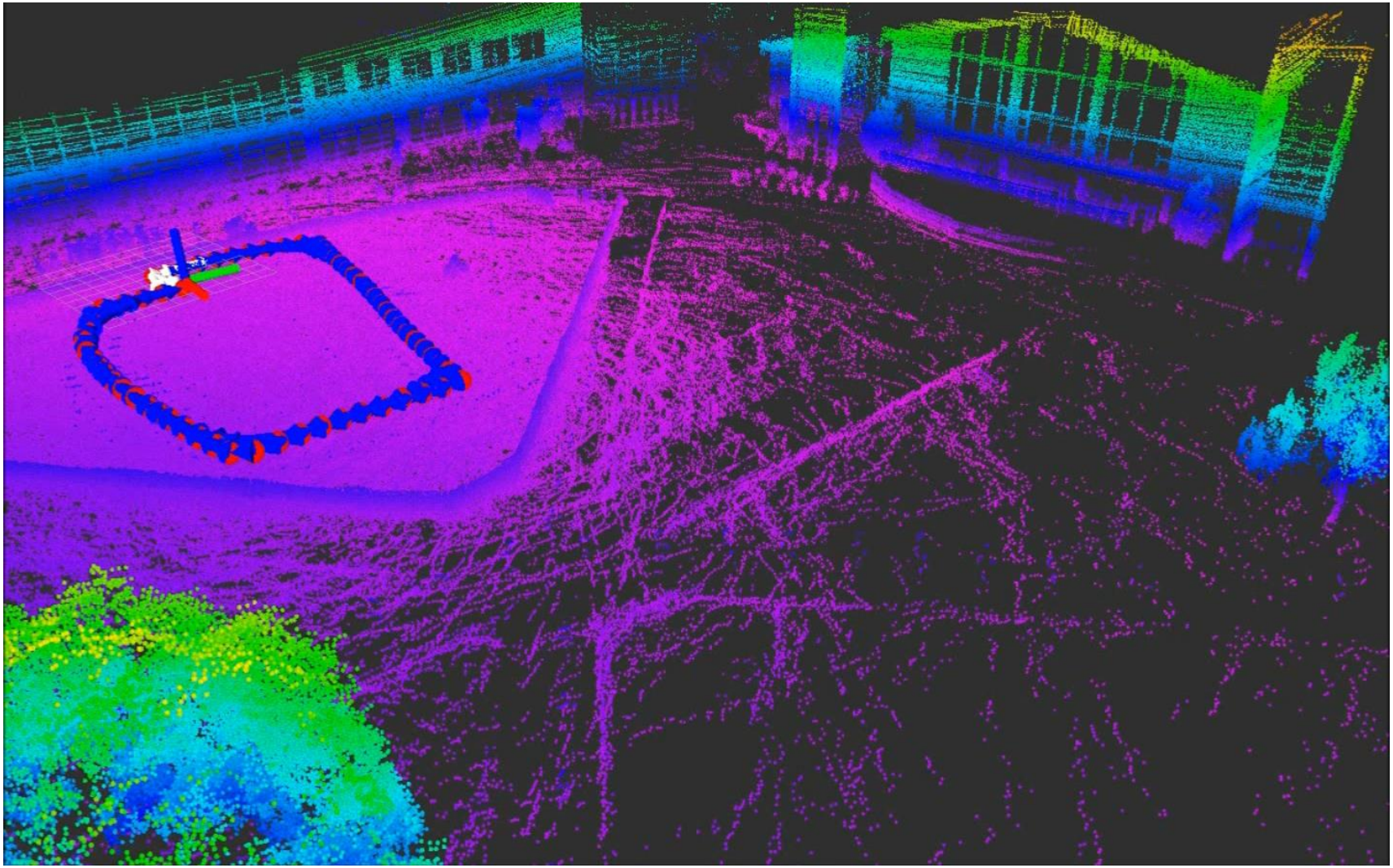
WAVE LABORATORY

SLAM Examples| Laser SLAM



WAVE LABORATORY

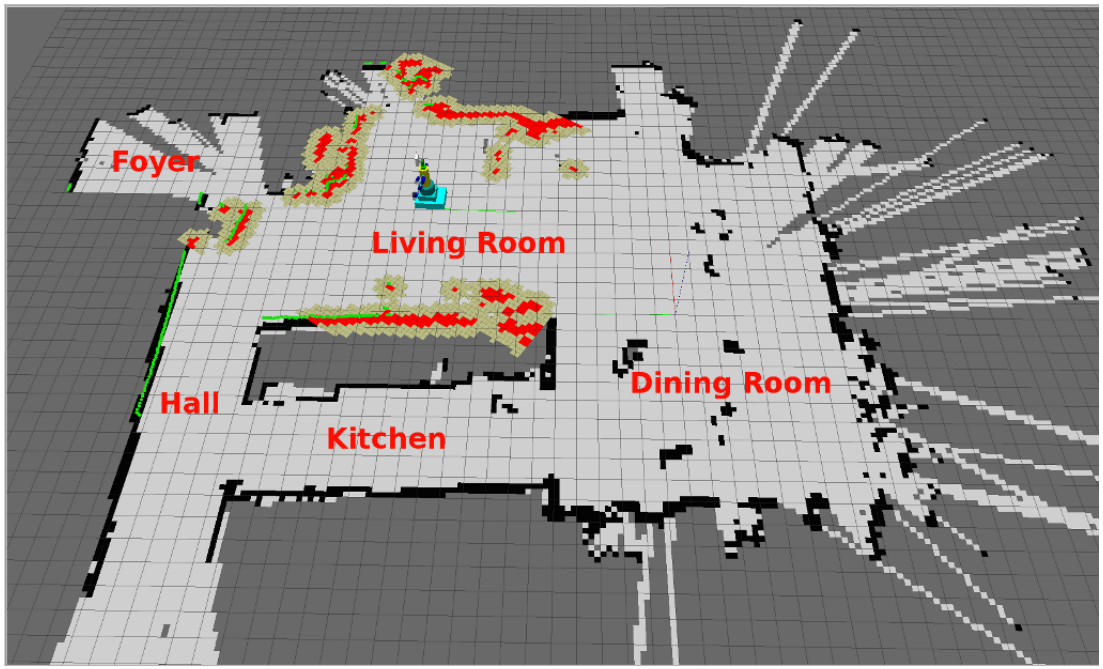
SLAM Examples| Laser SLAM



WAVE LABORATORY

What is SLAM?

Simultaneous Localization and Mapping

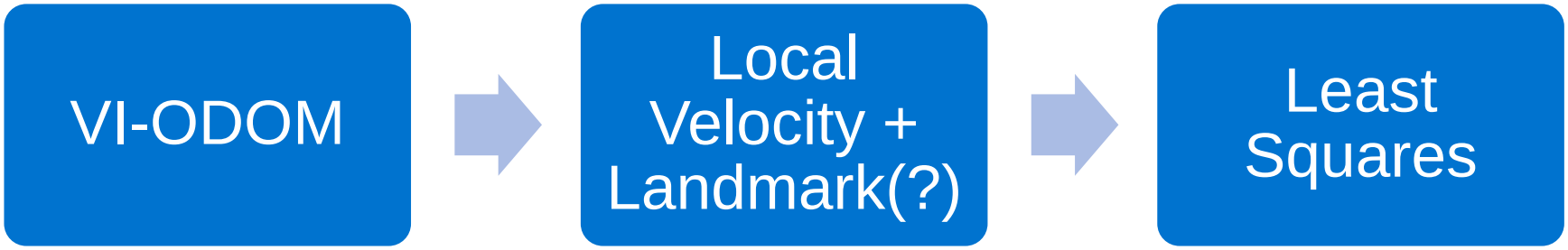


What is SLAM?

We are building a SLAM Library

Related Objectives

Related Objectives



Related Objectives

Related Objectives

Related Objectives

Related Objectives

Related Objectives

What is SLAM?

We are building a SLAM Library

What is SLAM?

~~We are building a SLAM Library~~

We are building a (Nonlinear) Least Squares Framework*

***for robots**

Core Components | Math Library

- Initialize and apply rotations and transformations.
- Explicit notation.
- Interpolation on vector space and manifolds.
- `*andJacobian()` functions.

Core Components | Residual Builders

Residuals: Terms we wish to minimize.

- Implement residual functions for different sensors:
  - IMU Pre-integration.
  - Lidar scan matching.
  - Camera re-projection.
  - Camera dense / photometric error
- Implement kinematic models between states:
  - PC Velocity/Acceleration
  - Bicycle model
- Jacobians for all residuals.

WAVE LABORATORY

Core Components | Measurement Container

- Data structure that organizes measurements
  - Add / Remove/Query based on:
  - Time stamp
  - Sensor ID
  - Landmark ID

Core Components | State Container

- Container that manages estimation states
  - Query by type, timestamp, sensor ID, etc.
  - Mapping from key to Jacobian columns
- May just need to wrap existing library functions (GTSAM, Ceres, etc.)

Core Components | Solver

- Solves the nonlinear estimation problem
  - Wrap an existing solver
  - Provide interface for solver to generate system Jacobian given a set of linearization points

Core Components | Calibration Server

- Reads and serves calibration information for ALL vehicles.
- Given a timestamp, vehicle, and query, read calibration information and return Transformation for queried frames.

Core Components | Visualization Tools

- Given a trajectory / landmarks saved in a state container, output point cloud / path to RVIZ

Core Components | Front End Tools

- Pre-processing / feature matching between frames
- Similar for laser / other sensors

Development Flow: VI-SLAM

Batch Estimator: Laser + GPS

Development Flow: VI-SLAM

Batch Estimator: Laser + GPS

SW Estimator: Laser + GPS

Development Flow: VI-SLAM

Batch Estimator: IMU+Camera+GPS

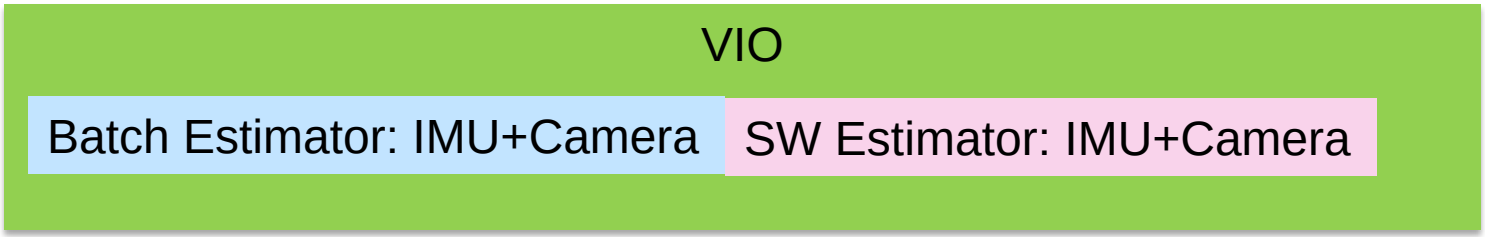
SW Estimator: IMU+Camera+GPS

Development Flow: VI-SLAM

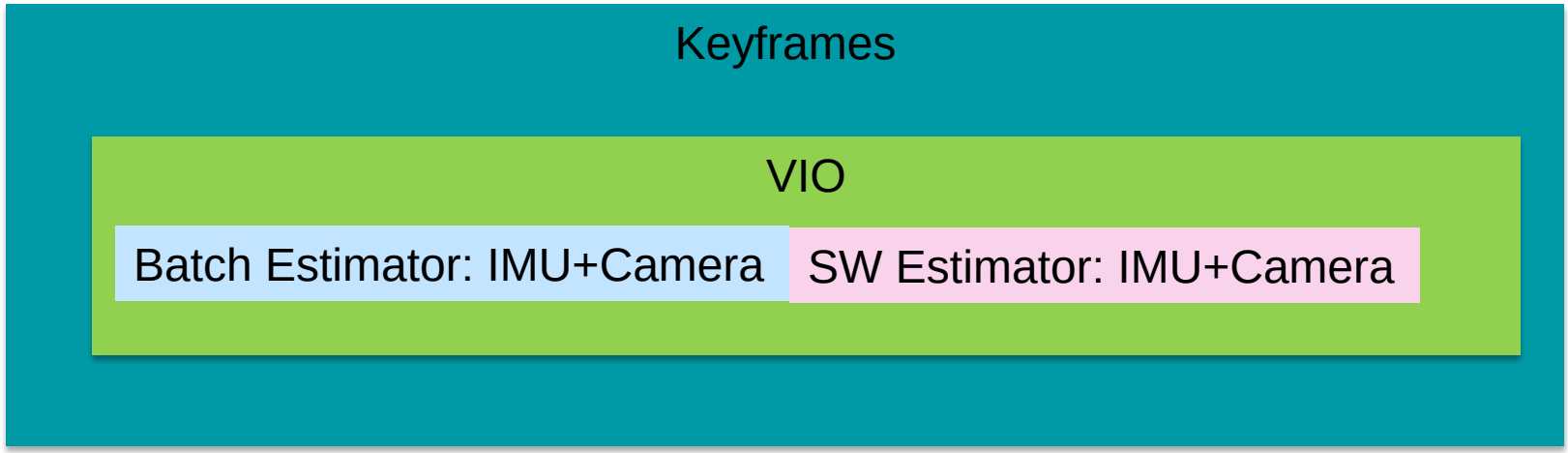
Batch Estimator: IMU+Camera

SW Estimator: IMU+Camera

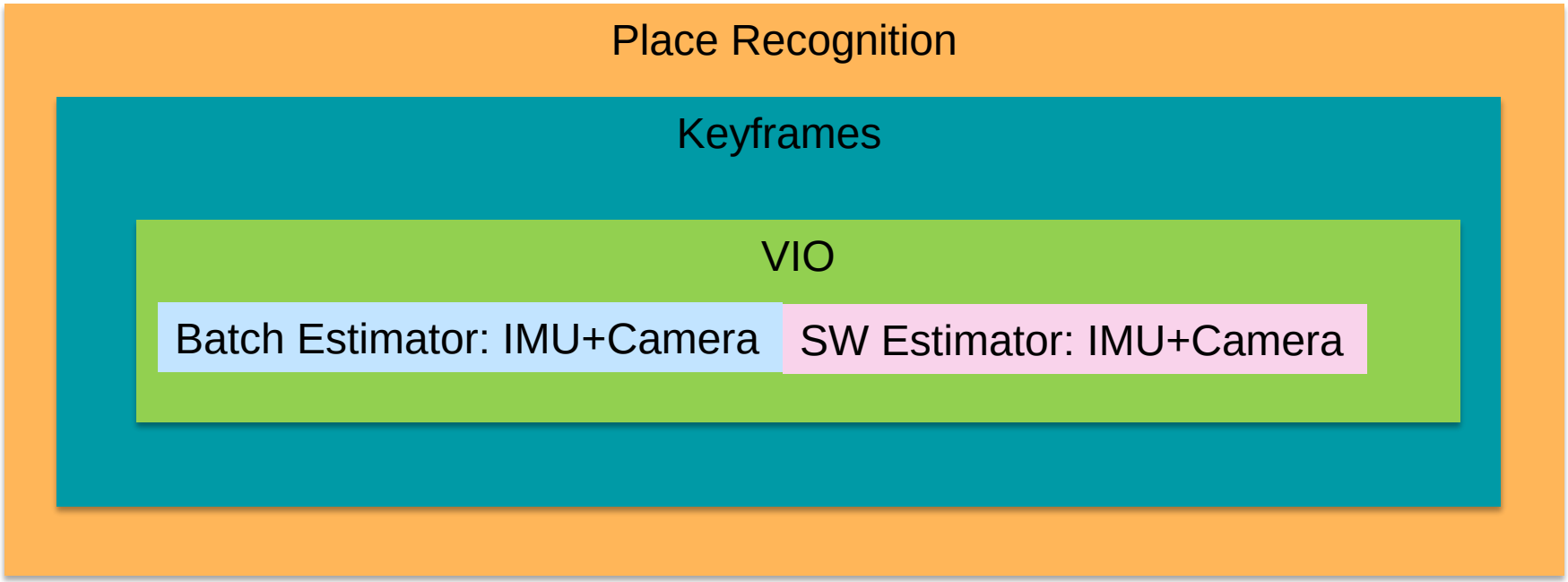
Development Flow: VI-SLAM



Development Flow: VI-SLAM



Development Flow: VI-SLAM



Planning

- Knowledge Level: Weekly / Biweekly whiteboard sessions?
- First Major Milestone?
- Availability:

The End