

# CBGL: Fast Monte Carlo Passive Global Localisation of 2D LIDAR Sensor

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## The gist

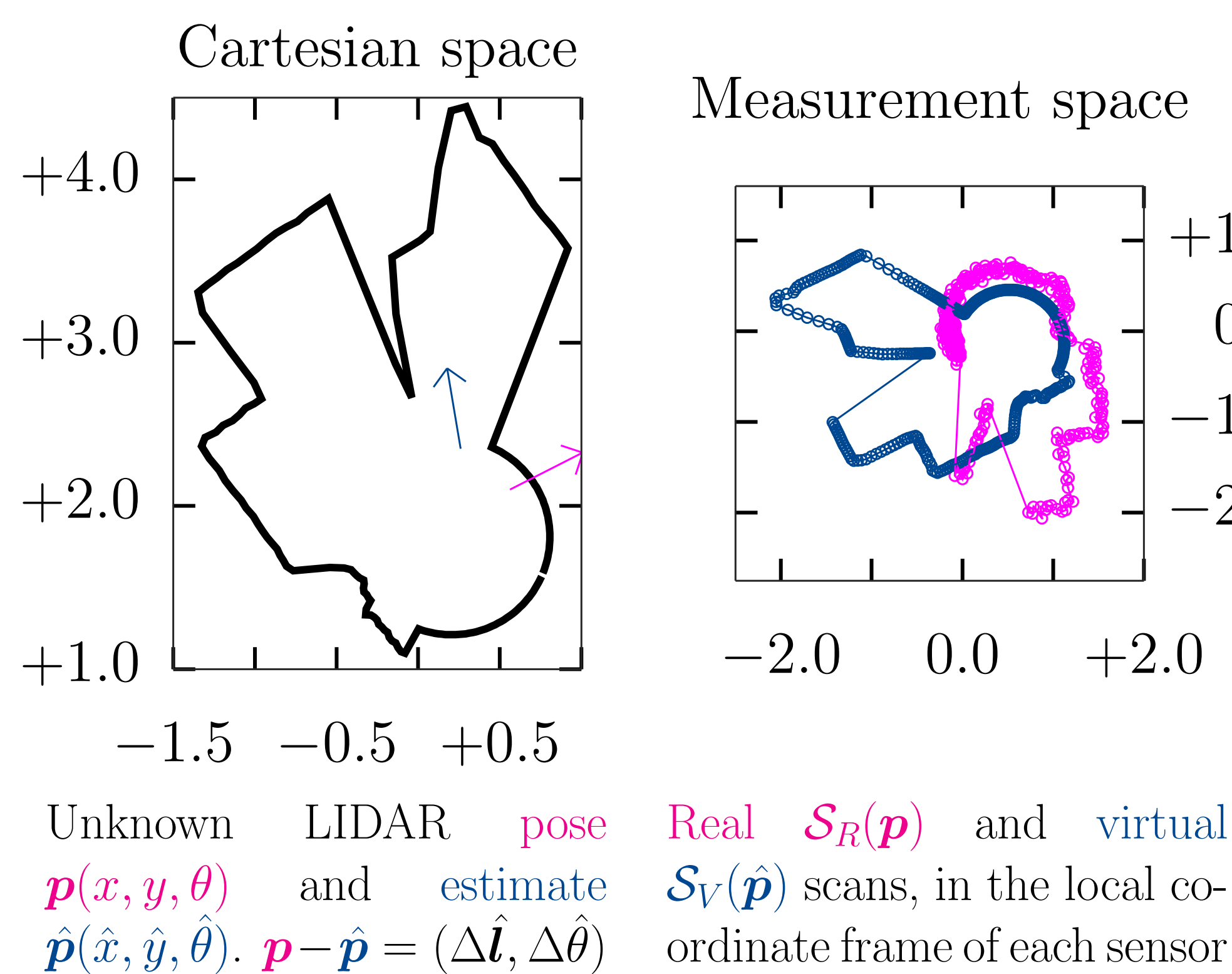
The method estimates the pose of a 2D LIDAR given only a single measurement and the map of the environment, while

- being robust against
  - environment repetitions
  - map distortions
  - sensor noise
  - sensor FOV (radial & angular)
- executing at  $\approx 1$  sec per 100 m<sup>2</sup> of environment area
- requiring no parameters to be tuned
- making no assumptions about the environment

because CAER (eq. (1))

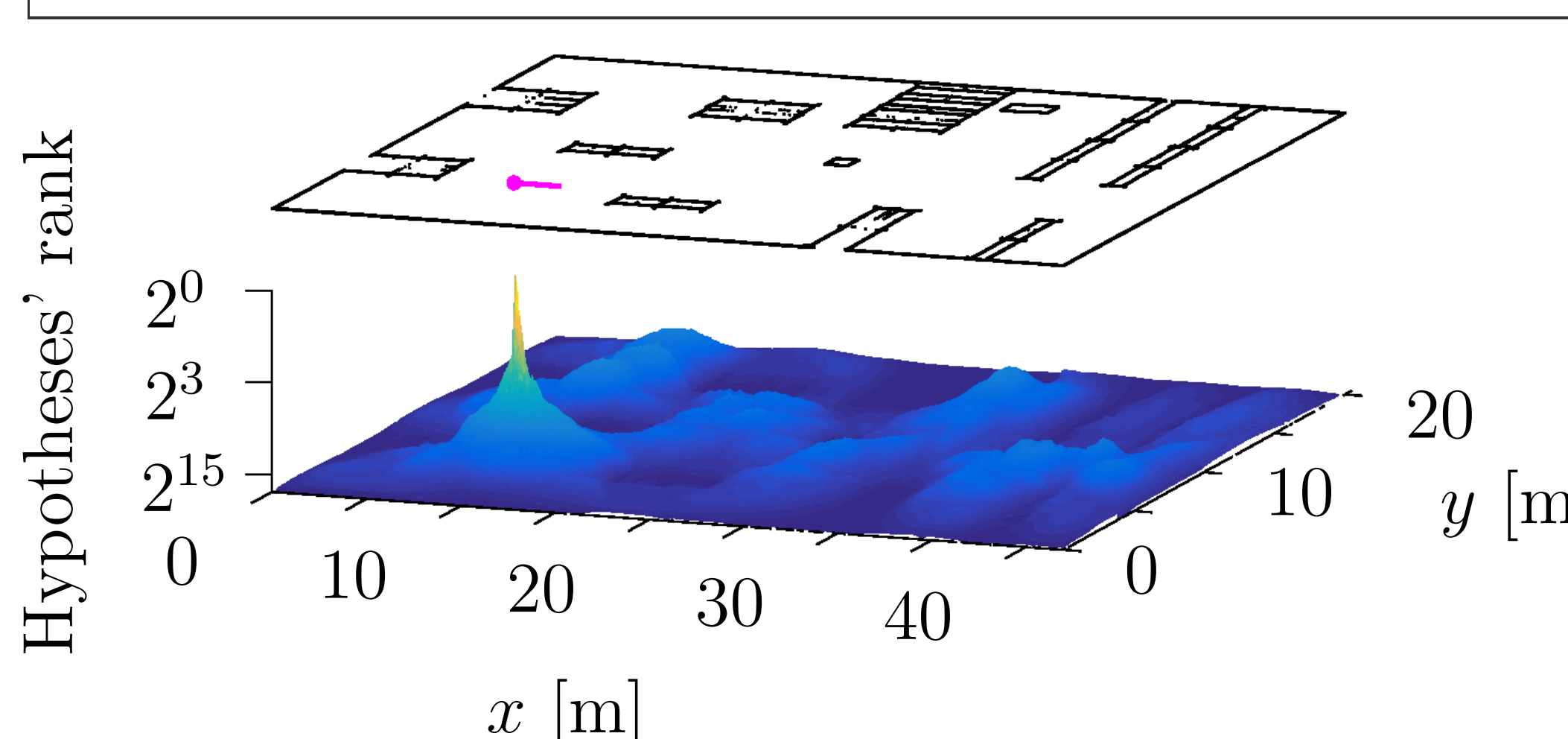
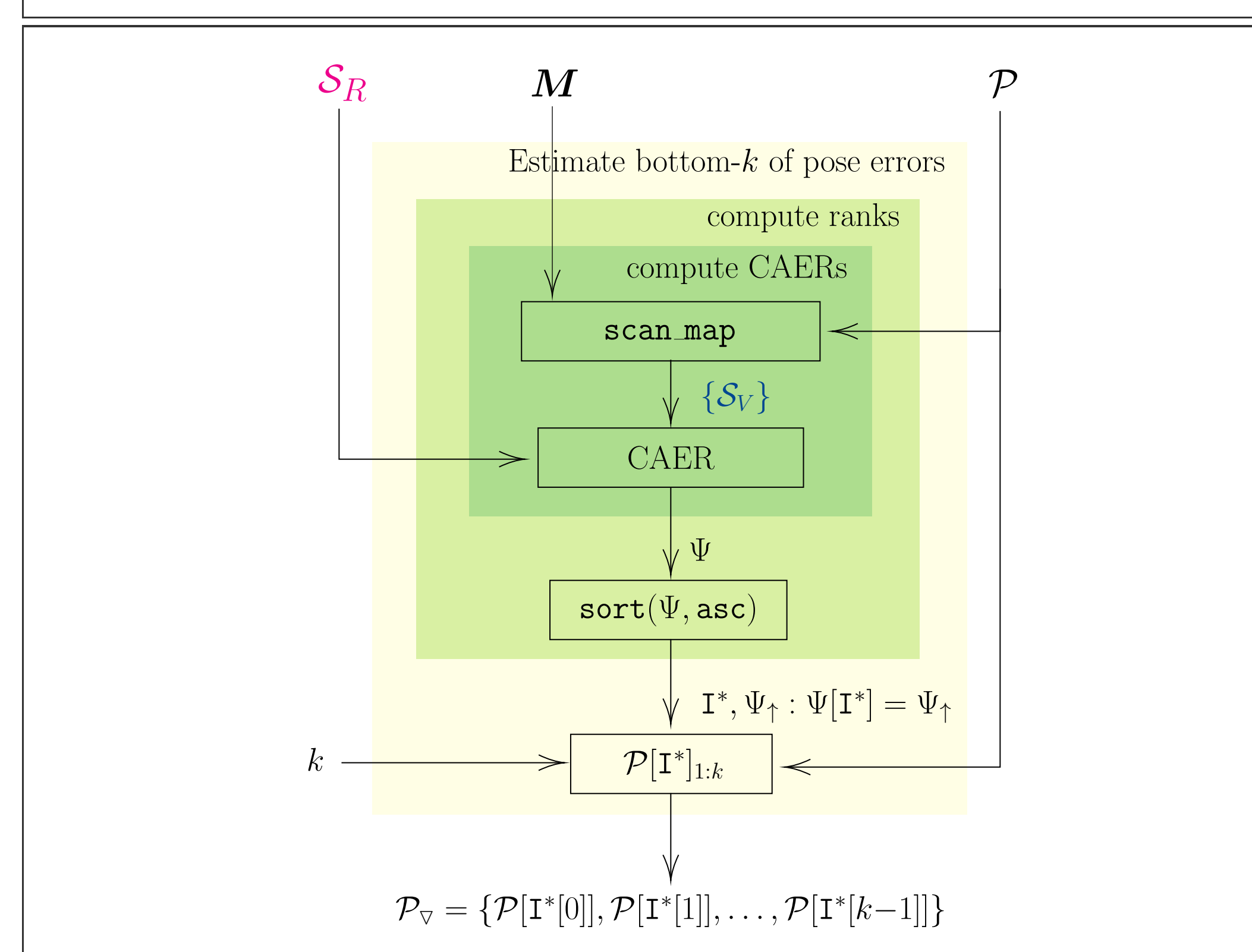
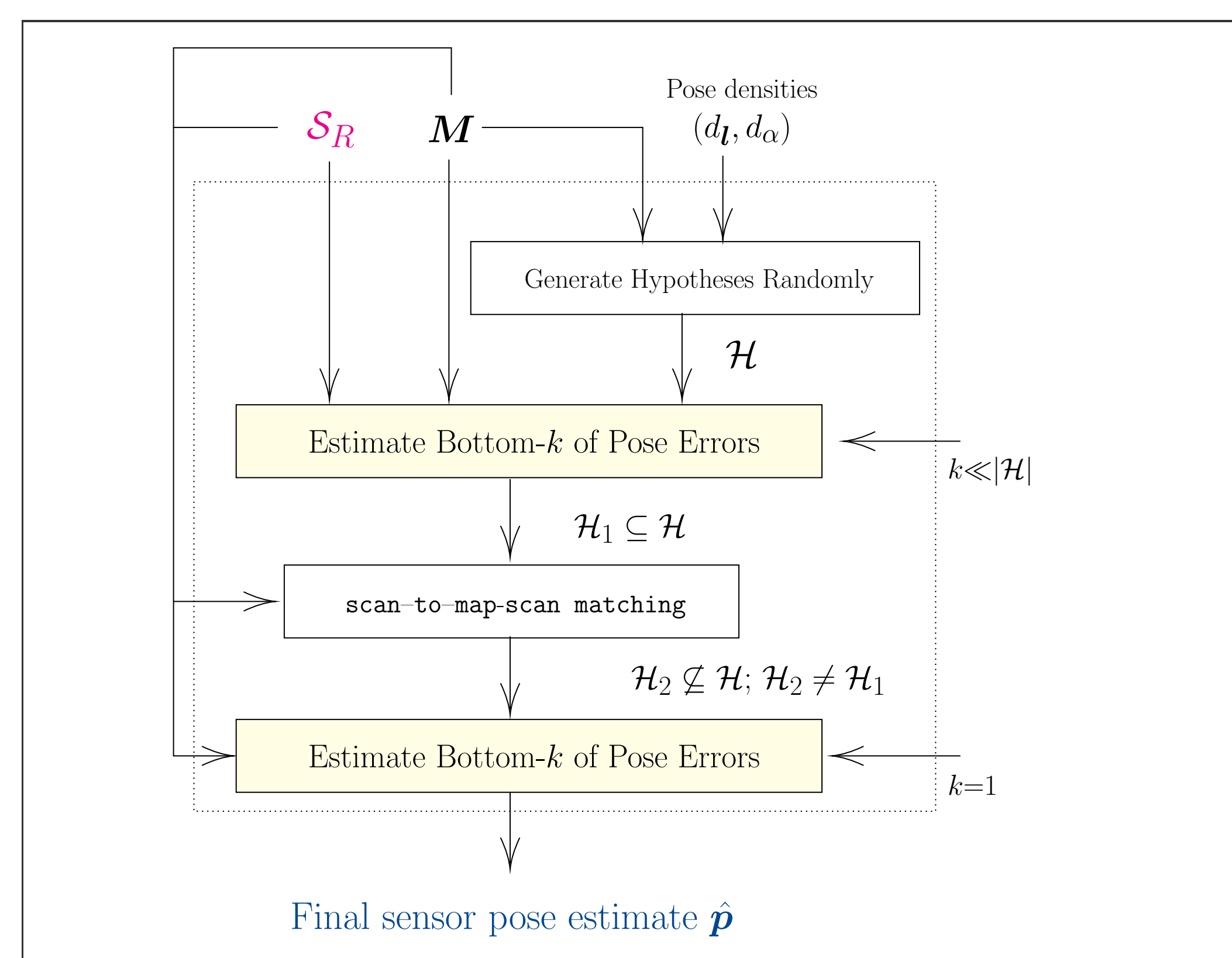
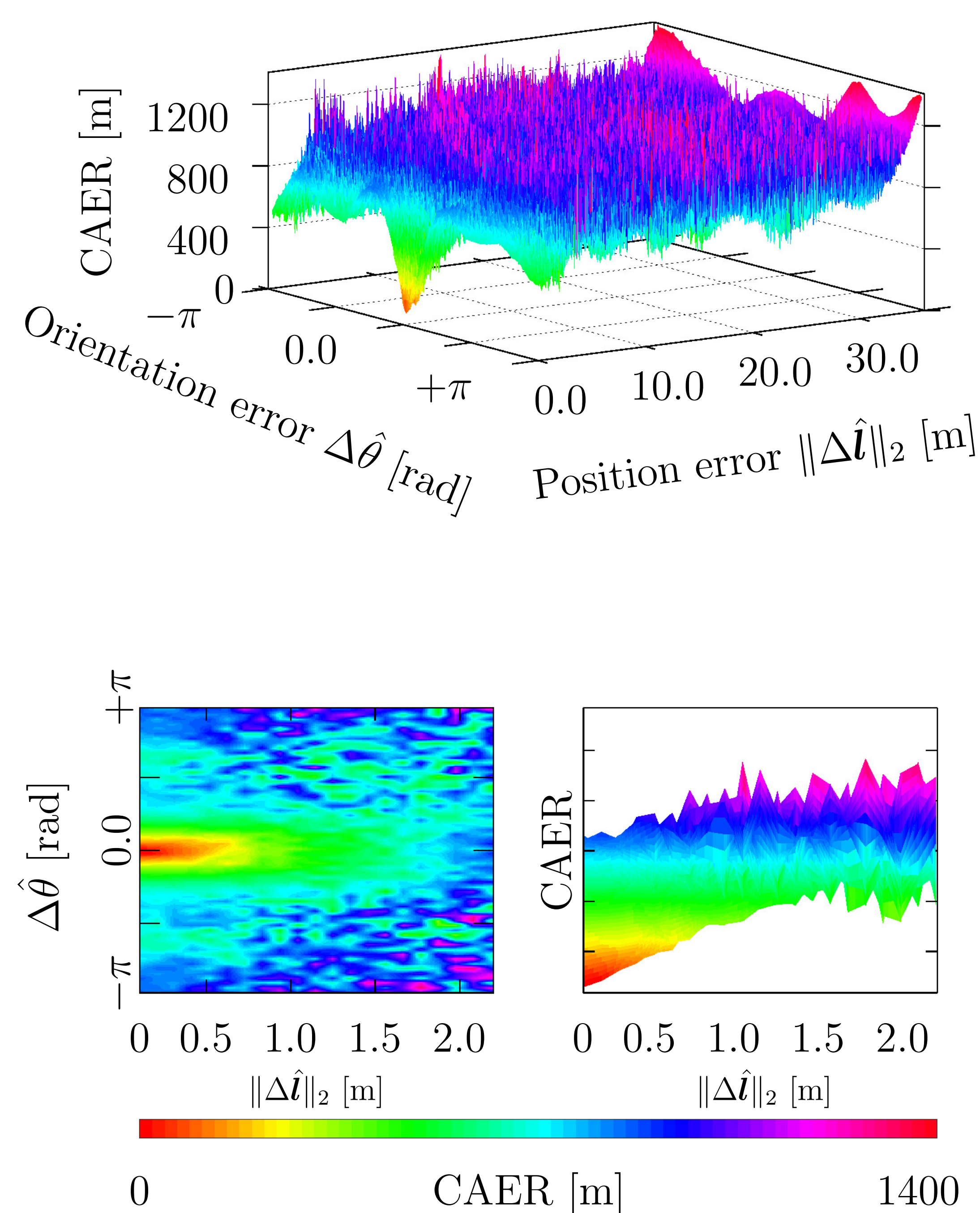
- scales with position and orientation error
- is computationally cheap at  $\sim O(\text{sensor rays})$

## Setup & Motivation



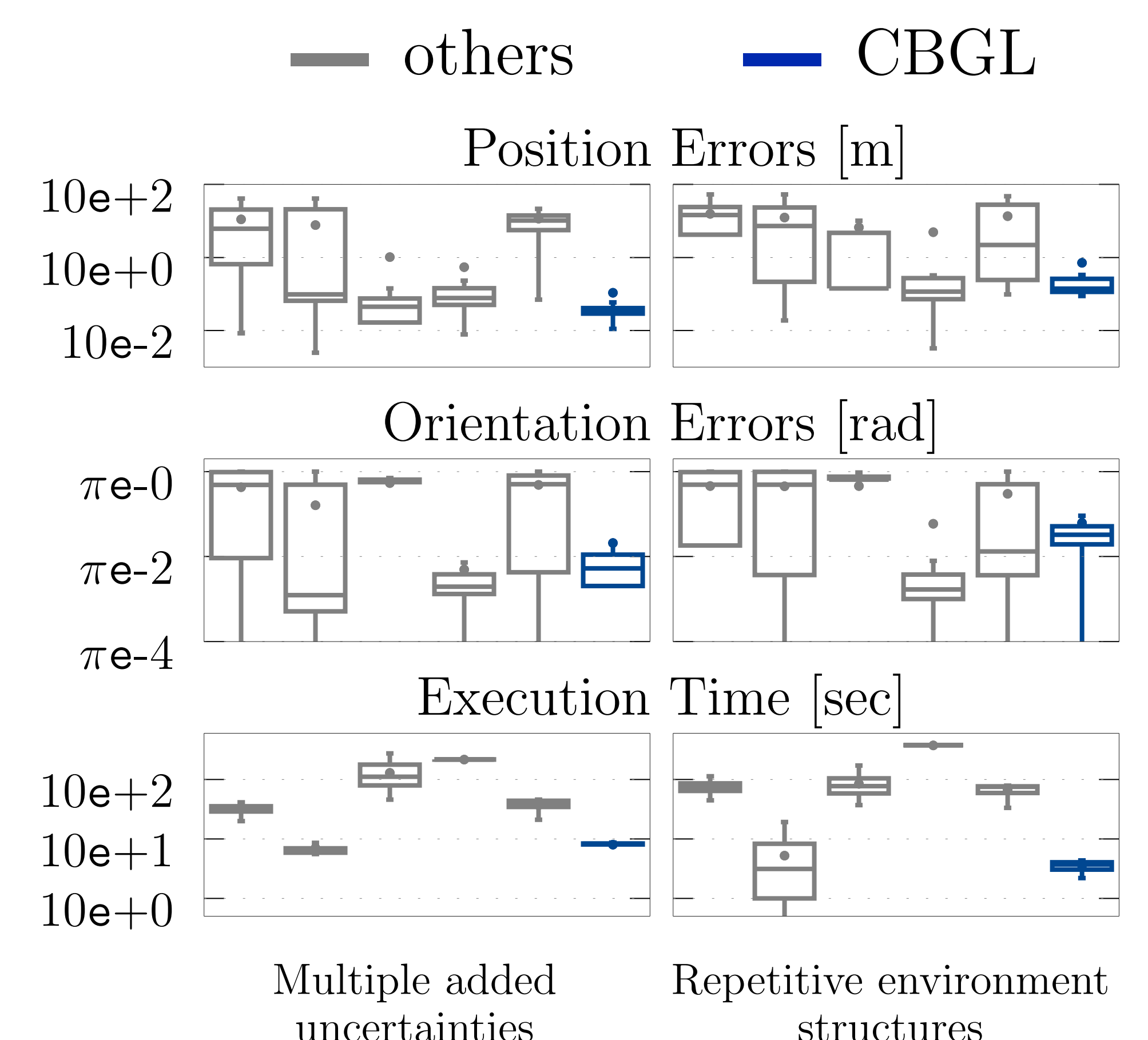
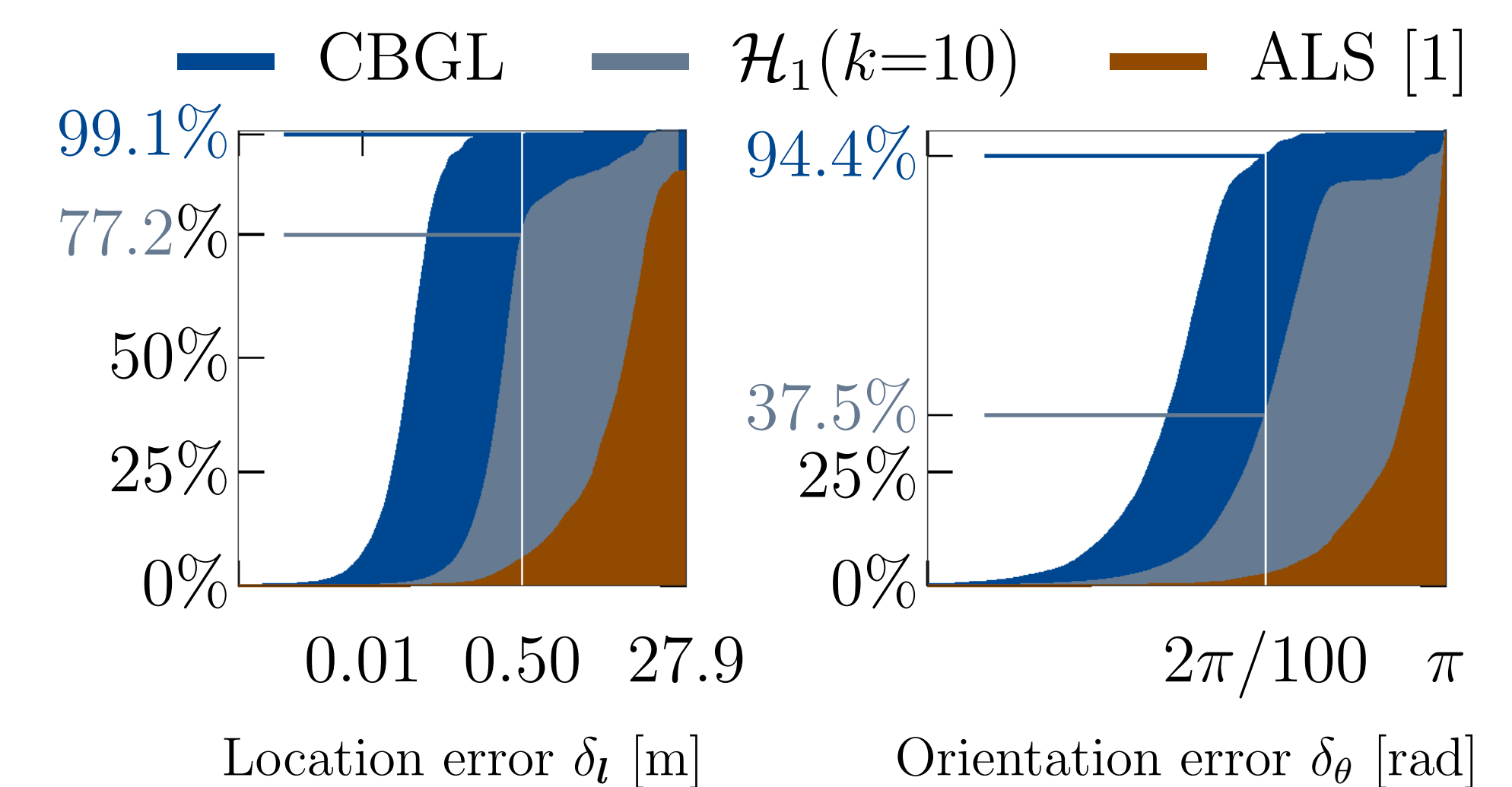
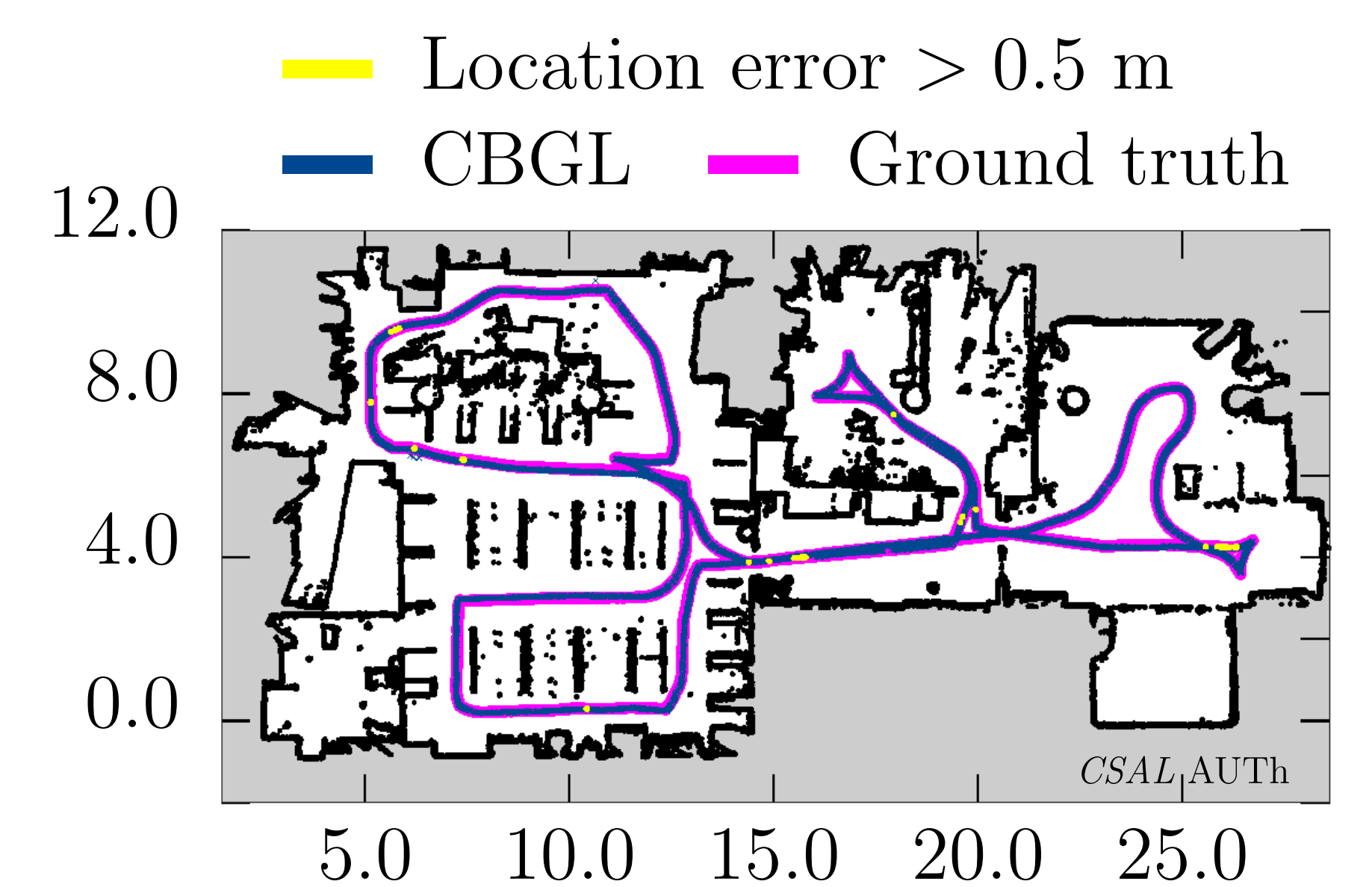
**Definition 1.** The Cumulative Absolute Error per Ray (CAER) metric

$$\text{CAER}(\mathcal{S}_R, \mathcal{S}_V) \triangleq \sum_{n=0}^{\text{scan rays}-1} |\mathcal{S}_R[n] - \mathcal{S}_V[n]| \quad (1)$$



## Experiments with real and synthetic data

In > 6000 attempts	Mean Position Error [m]	Mean Orientation Error [rad]	Mean Execution Time [sec]
ALS [1]	0.500	1.956	6.15
CBGL	0.041	0.011	1.61



[1] Naoki Akai, "Reliable Monte Carlo Localization for Mobile Robots", *Journal of Field Robotics*, 2023