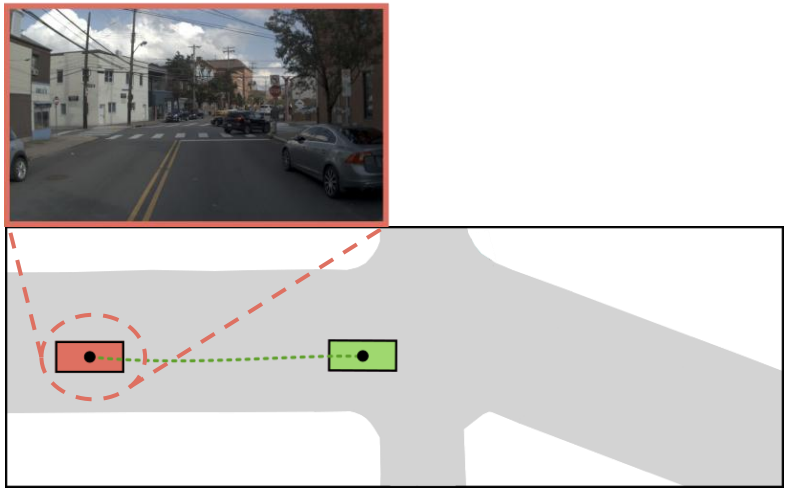
NAVSIM v2: Pseudo-Simulation for Autonomous Driving

Open-Loop Evaluation

+ On real data

+ Compute-efficient

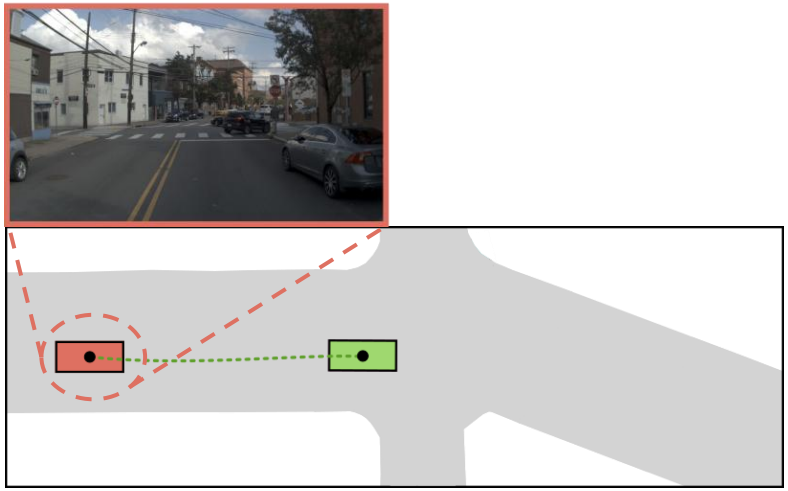
- No sensor rendering
- Allows parallel model inferencing



Open-Loop Evaluation

+ On real data

+ Compute-efficient



- Doesn’t model compounding errors

- Doesn’t model causal confusion

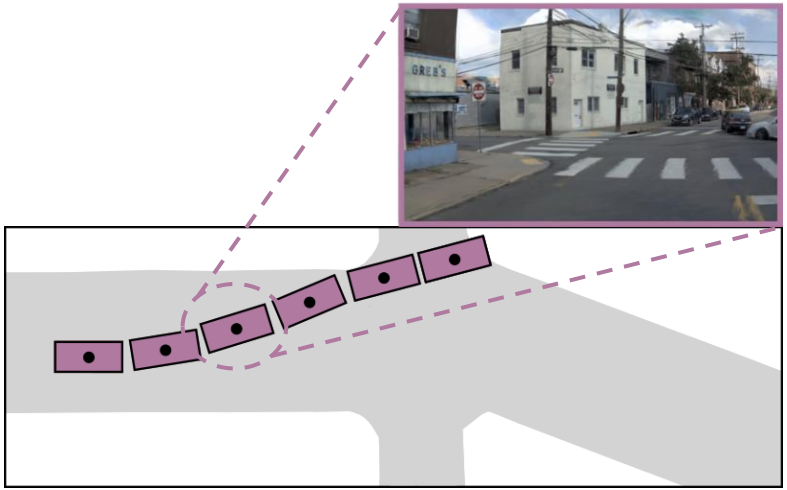
Closed-Loop Evaluation

+ Models compounding errors

- Subsequent inputs become more challenging with poor initial actions

+ Models causal confusion

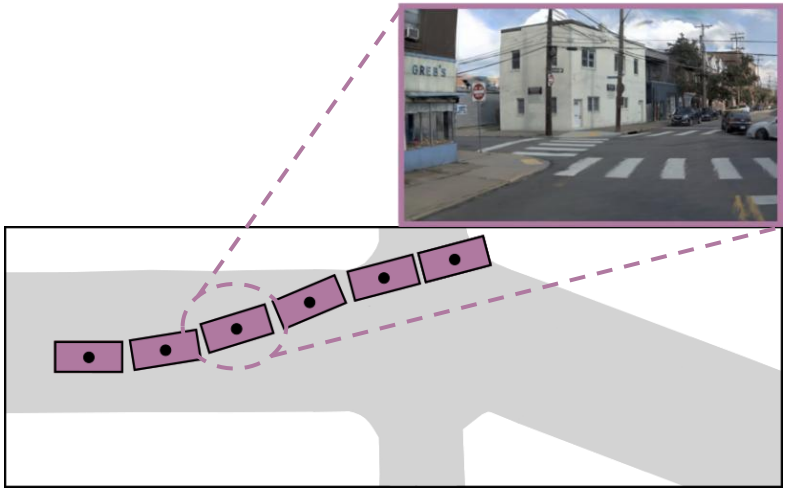
- Historical motion insufficient for planning



Closed-Loop Evaluation

+ Models compounding errors

+ Models causal confusion

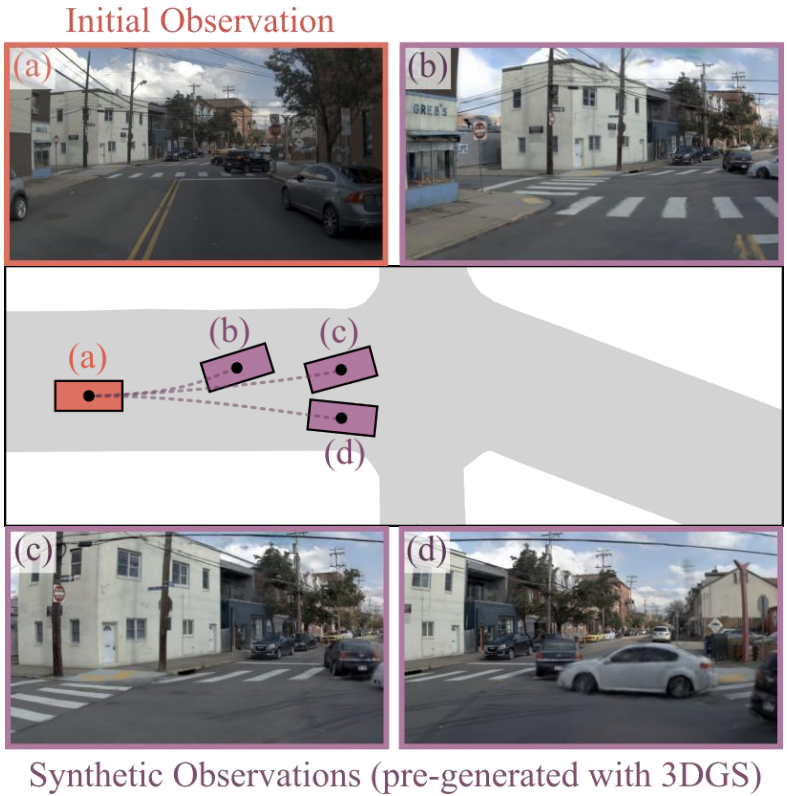


- On synthetic data

- Compute-intensive
  - Sequential sensor rendering
  - Sequential model inferencing

Pseudo-Simulation

+ On real and synthetic data

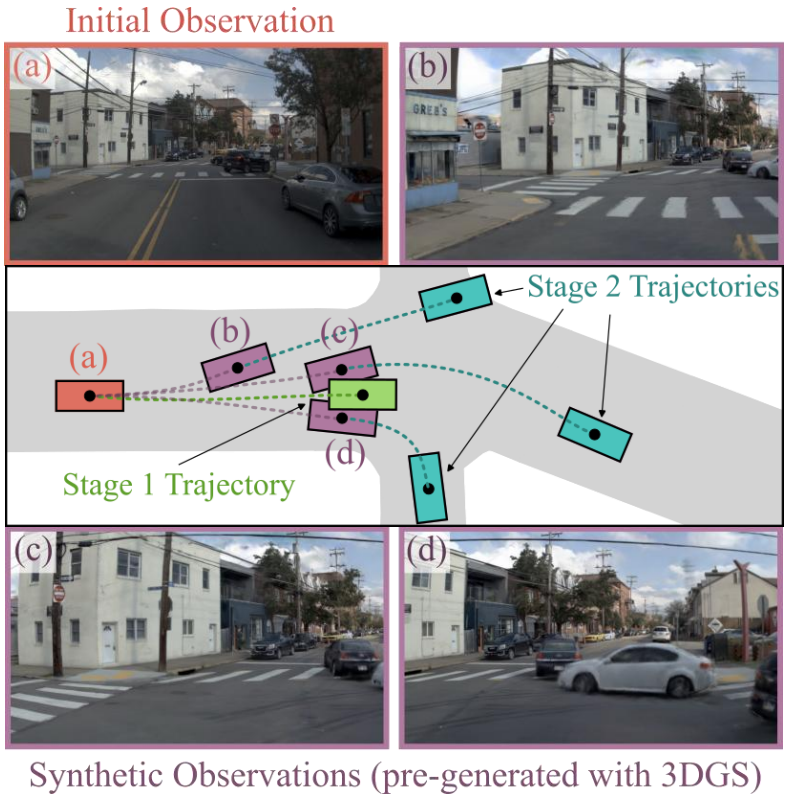


Pseudo-Simulation

+ On real and synthetic data

Stage 1:

- **Real-world observation based planning**



Pseudo-Simulation

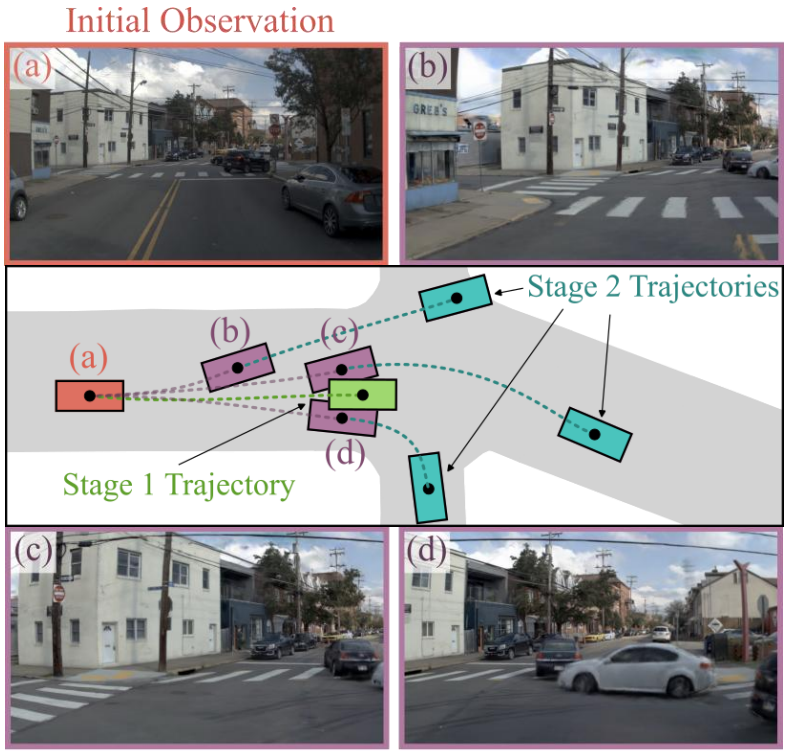
+ On real and synthetic data

Stage 1:

- Real-world observation based planning

Stage 2:

- Pre-generated synthetic observations based planning



Extended Predictive Driver Model Score (EPDMS)

$$\text{EPDMS} = \underbrace{\prod_{m \in \mathcal{M}_{\text{pen}}} \text{filter}_m(\text{agent}, \text{human})}_{\text{penalty terms}} \cdot \frac{\sum_{m \in \mathcal{M}_{\text{avg}}} w_m \cdot \text{filter}_m(\text{agent}, \text{human})}{\sum_{m \in \mathcal{M}_{\text{avg}}} w_m}$$

No at-fault Coll. (NC)
Drivable Area Compl. (DAC)
Driving Direction Compl. (DDC)
Traffic Light Compl. (TLC)

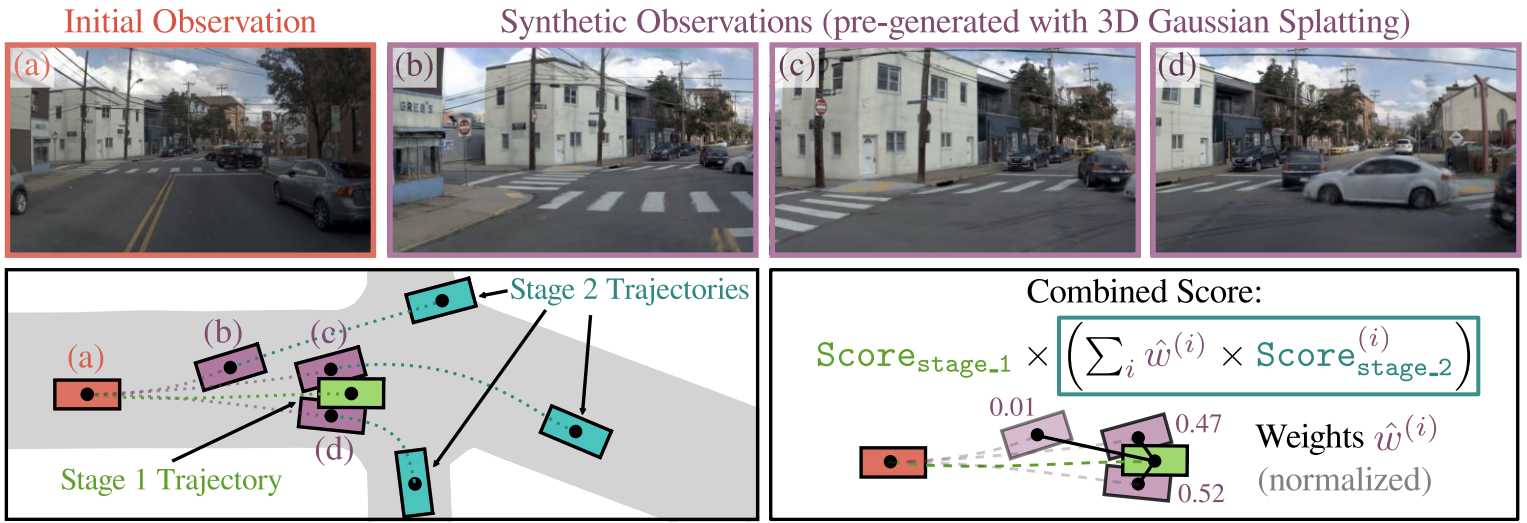
Extended Predictive Driver Model Score (EPDMS)

$$\text{EPDMS} = \underbrace{\prod_{m \in \mathcal{M}_{\text{pen}}} \text{filter}_m(\text{agent}, \text{human})}_{\text{penalty terms}} \cdot \underbrace{\frac{\sum_{m \in \mathcal{M}_{\text{avg}}} w_m \cdot \text{filter}_m(\text{agent}, \text{human})}{\sum_{m \in \mathcal{M}_{\text{avg}}} w_m}}_{\text{weighted average terms}}$$

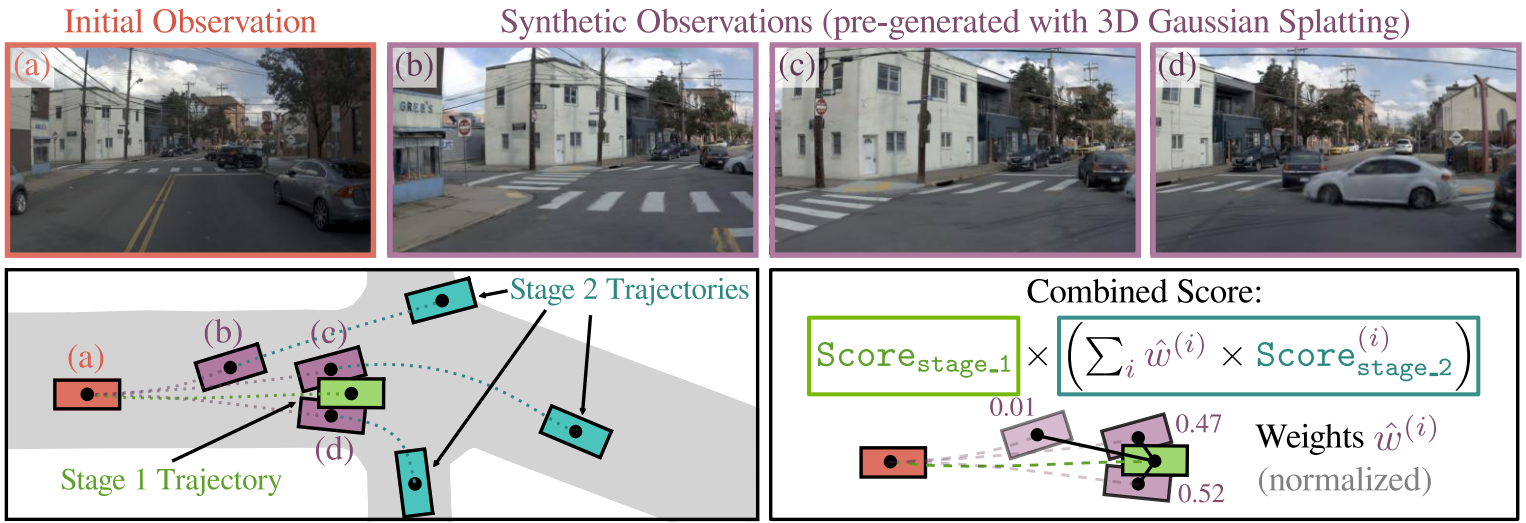
No at-fault Coll. (NC)
Drivable Area Compl. (DAC)
Driving Direction Compl. (DDC)
Traffic Light Compl. (TLC)

Ego Progress (EP)
Time to Collision (TTC)
Lane Keeping (LK)
History Comfort (HC)
Extended Comfort (EC)

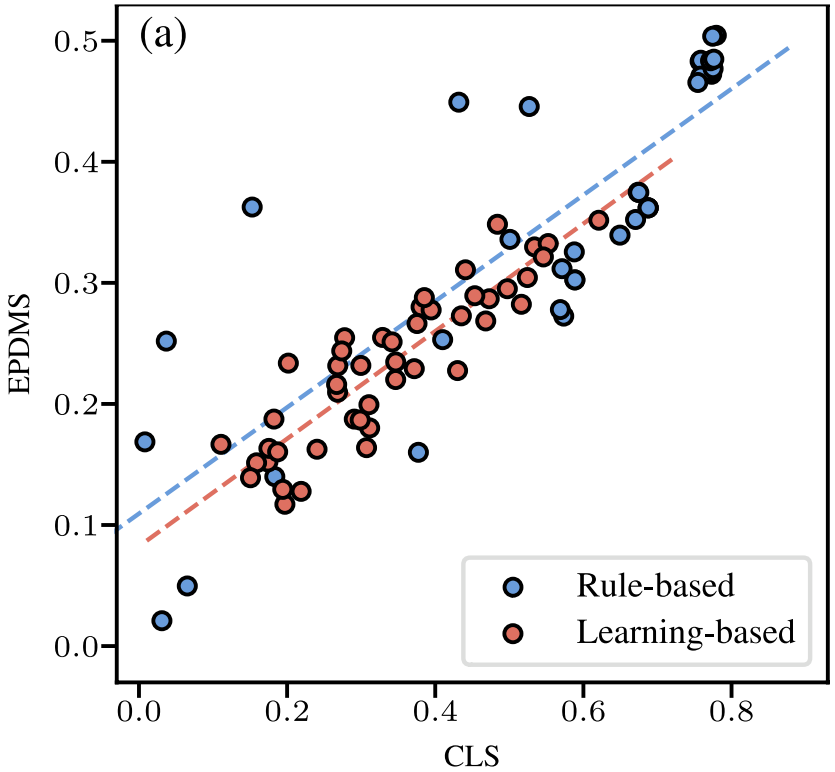
Final Combined Score



Final Combined Score



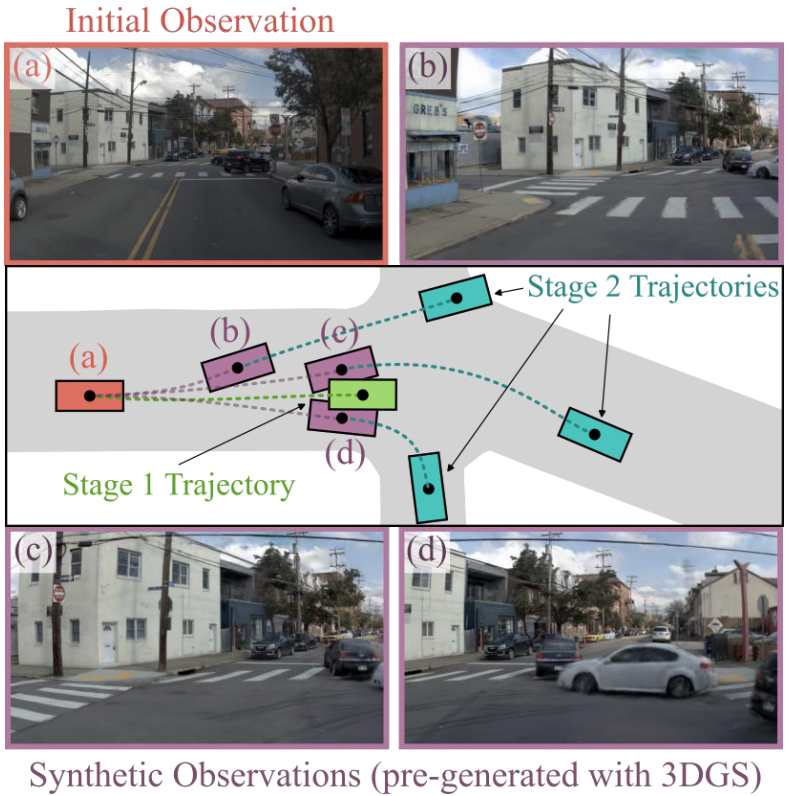
Pseudo-Simulation (R^2 = 0.8)



Pseudo-Simulation

+ On real and synthetic data

+ Compute-efficient



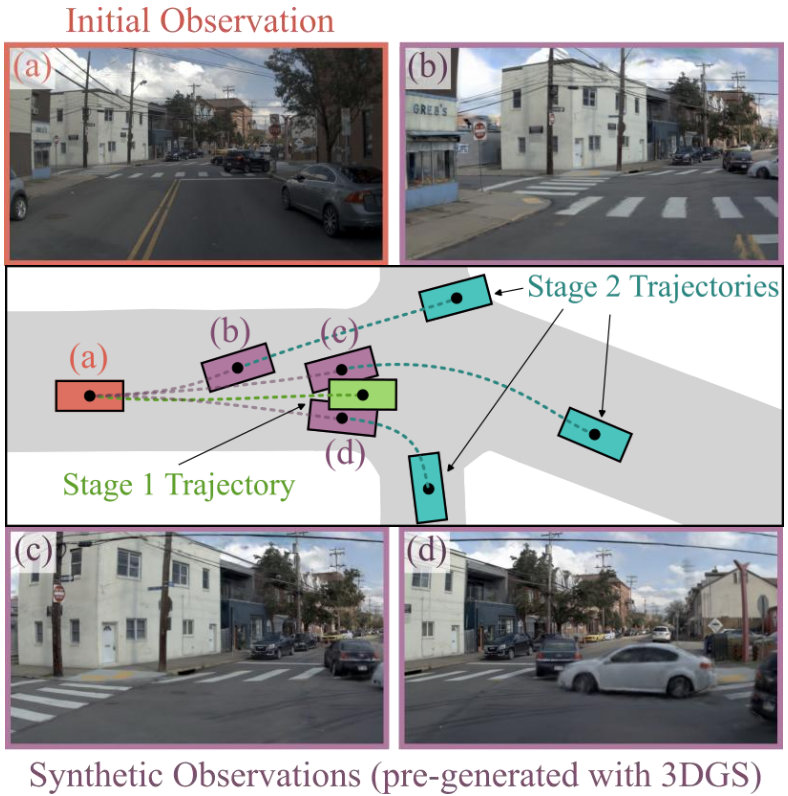
Pseudo-Simulation

+ On real and synthetic data

+ Compute-efficient

+ Models compounding errors

+ Models causal confusion



Team

Wei Cao

Marcel Hallgarten

Tianyu Li

Daniel Dauner

Xunjiang Gu

Caojun Wang

Yakov Miron

Marco Aiello

Hongyang Li

Igor Gilitschenski

Boris Ivanovic

Marco Pavone

Andreas Geiger

Kashyap Chitta

ICCV 2025 Challenge

Learning to See: Advancing Spatial Understanding for Embodied Intelligence

Prize:

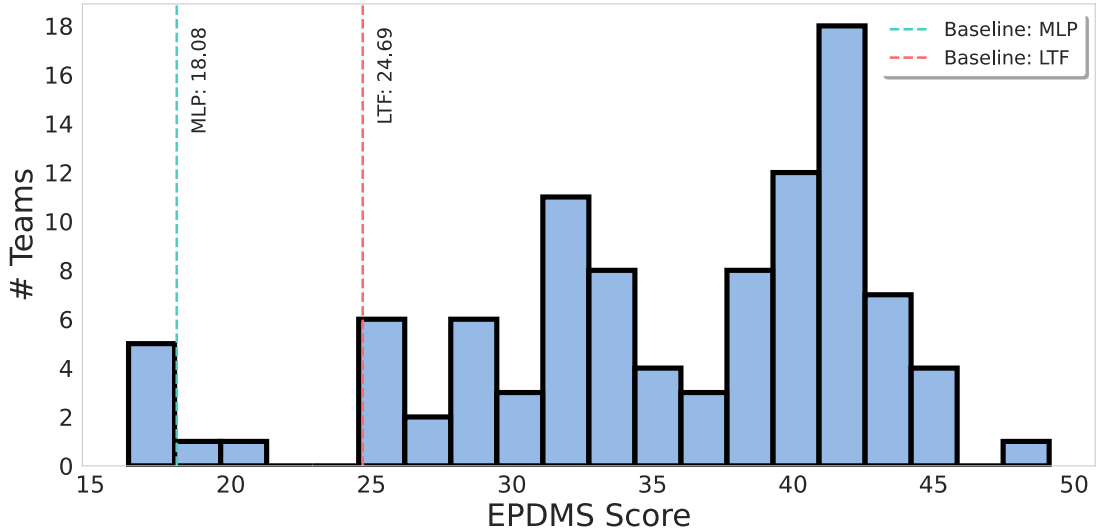
- **Innovation Award:** USD 5,000
- **Outstanding Champion:** USD 3,000
- **Travel Grants:** USD 1,500

Paper

Workshop

Submission Deadline: Sep. 20

Winner


Baseline: MLP
Baseline: LTF
MLP: 18.08
LTF: 24.69
Teams
EPDMS Score
0
2
4
6
8
10
12
14
16
18
15
20
25
30
35
40
45
50

Winner

Rank		Institution	EPDMS ▼	Team Name	
1		NVIDIA, Fudan University	**49.1124**	NVIDIA	-
2		Bosch CR, Tsinghua University	**45.0070**	RB	-
3		HAOMO.AI Technology Co., Ltd, Tsinghua University	**44.5438**	HAOMO.AI	-