KI WISSEN
Automotive AI Powered by Knowledge

KI Wissen Final Event | 21-22 March 2024

Demonstration of Trajectory Prediction and Planning

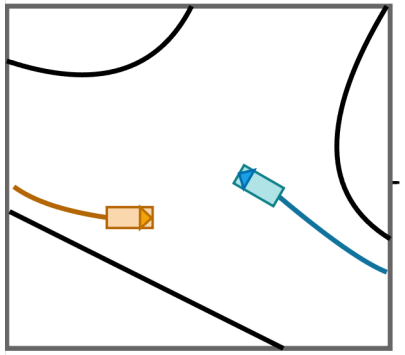
Yue Yao, Mohamed-Khalil Bouzidi | Continental

1

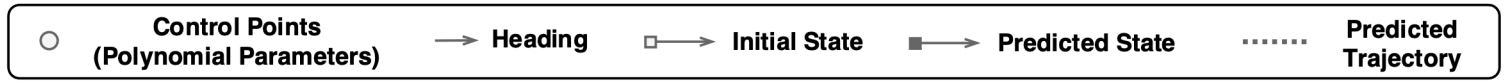
Introduction

Recall of Knowledge Building Block

Trajectory Prediction



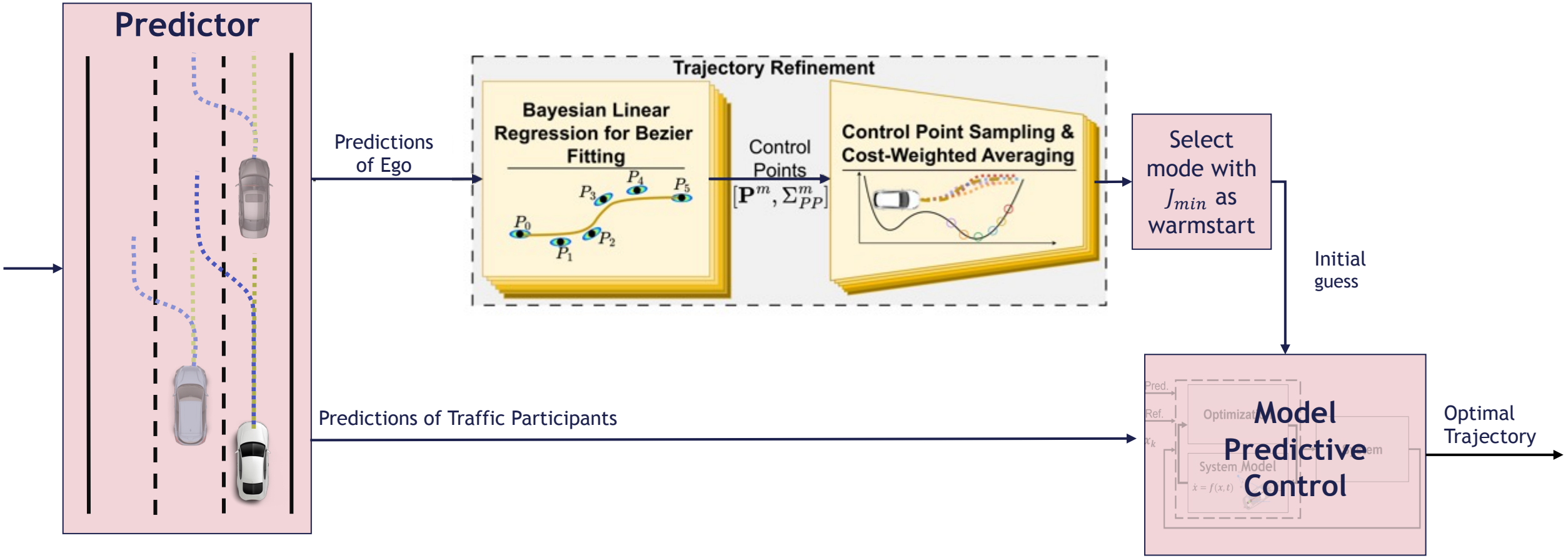
Traffic Scene



Our proposed model architecture. Agent histories and road geometry are both represented via polynomials. The current object kinematics and future kinematic states predicted by the model are fused into one continuous polynomial trajectory prediction. (© Continental AG)

Recall of Knowledge Building Block

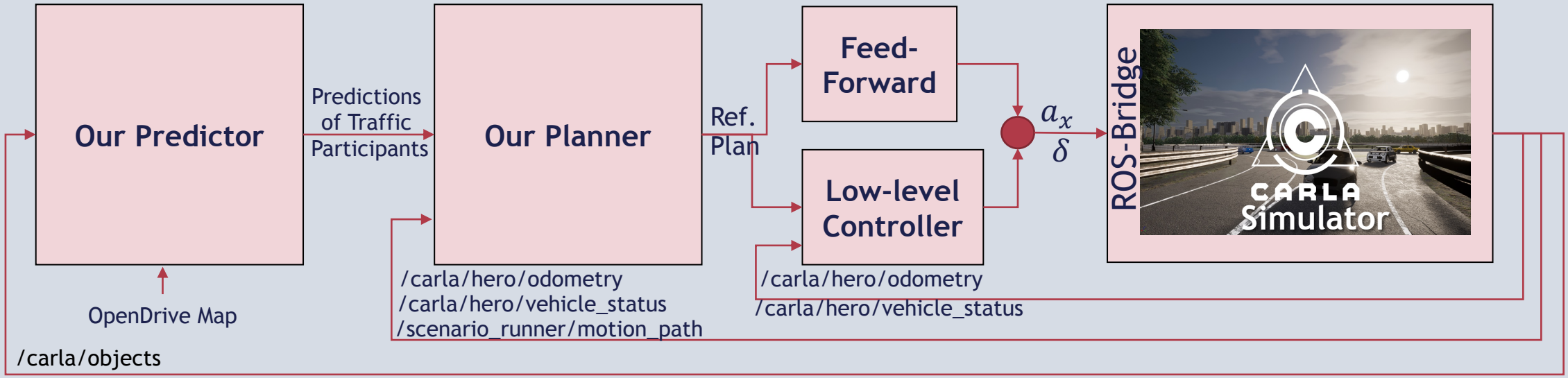
Trajectory Planning



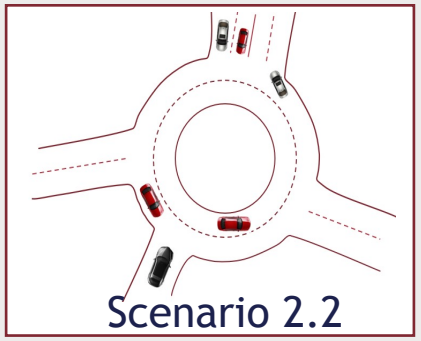
Integration to Carla Simulator

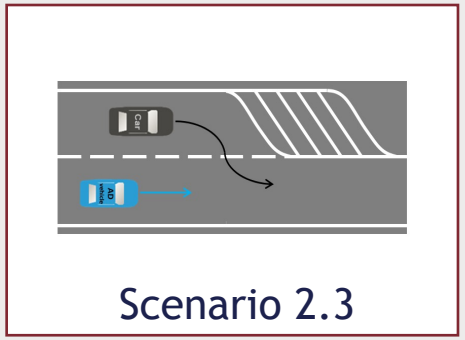
System Setup

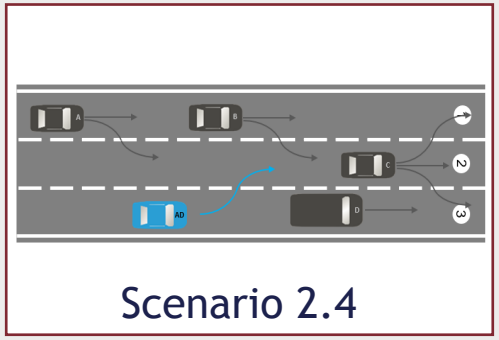
a_x: /carla/hero/ackermann_cmd/acceleration
δ: /carla/hero/ackermann_cmd/steering_angle

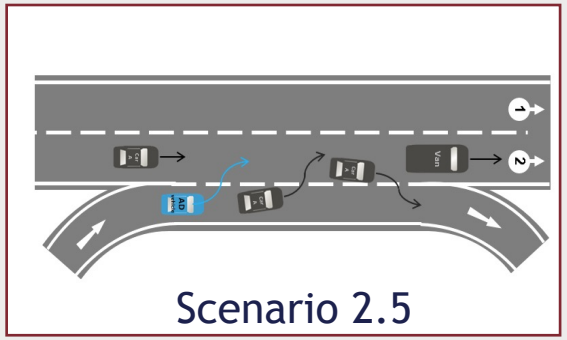


Use Cases


Scenario 2.2


Scenario 2.3


Scenario 2.4

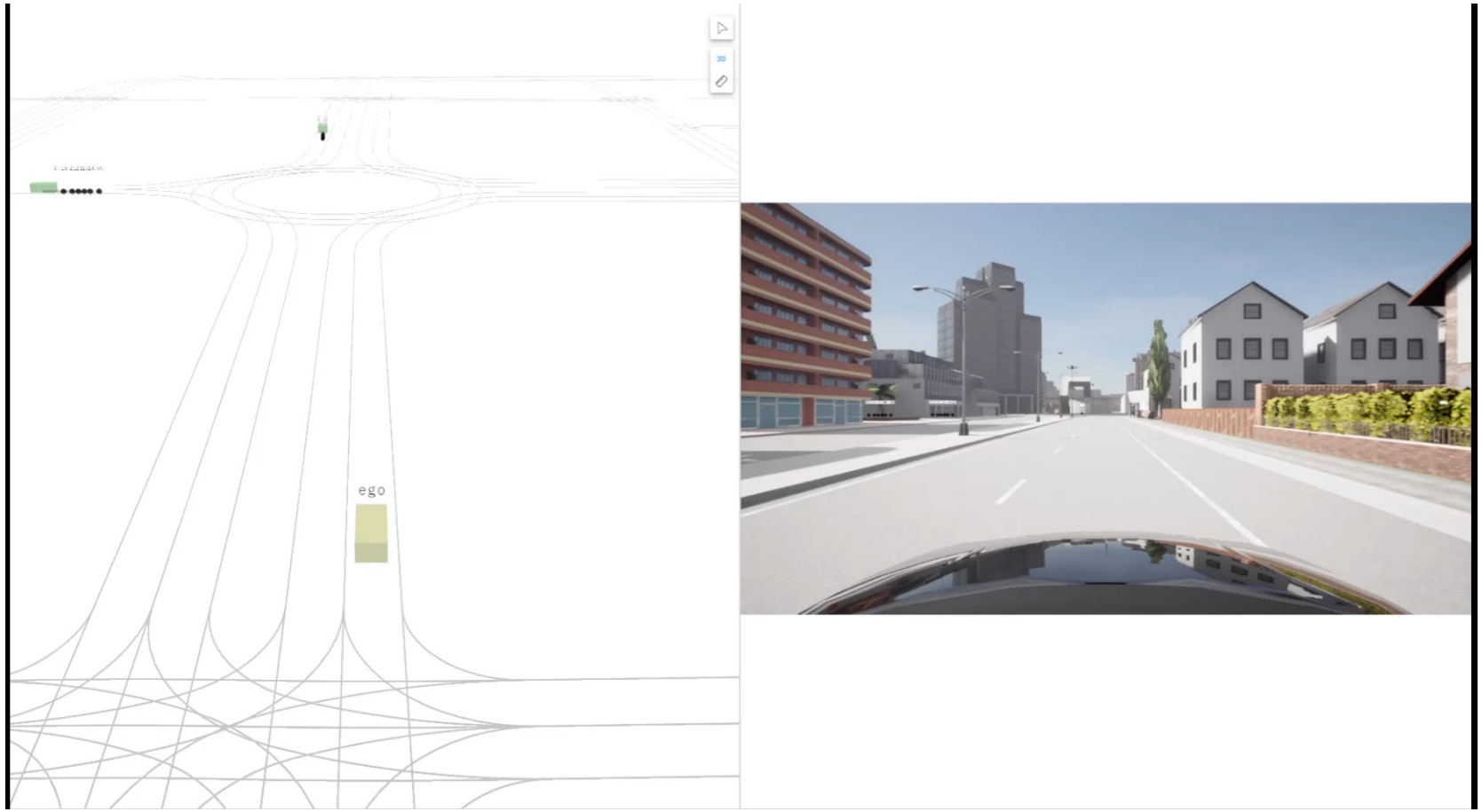

Scenario 2.5

2

Demonstration of Trajectory Prediction

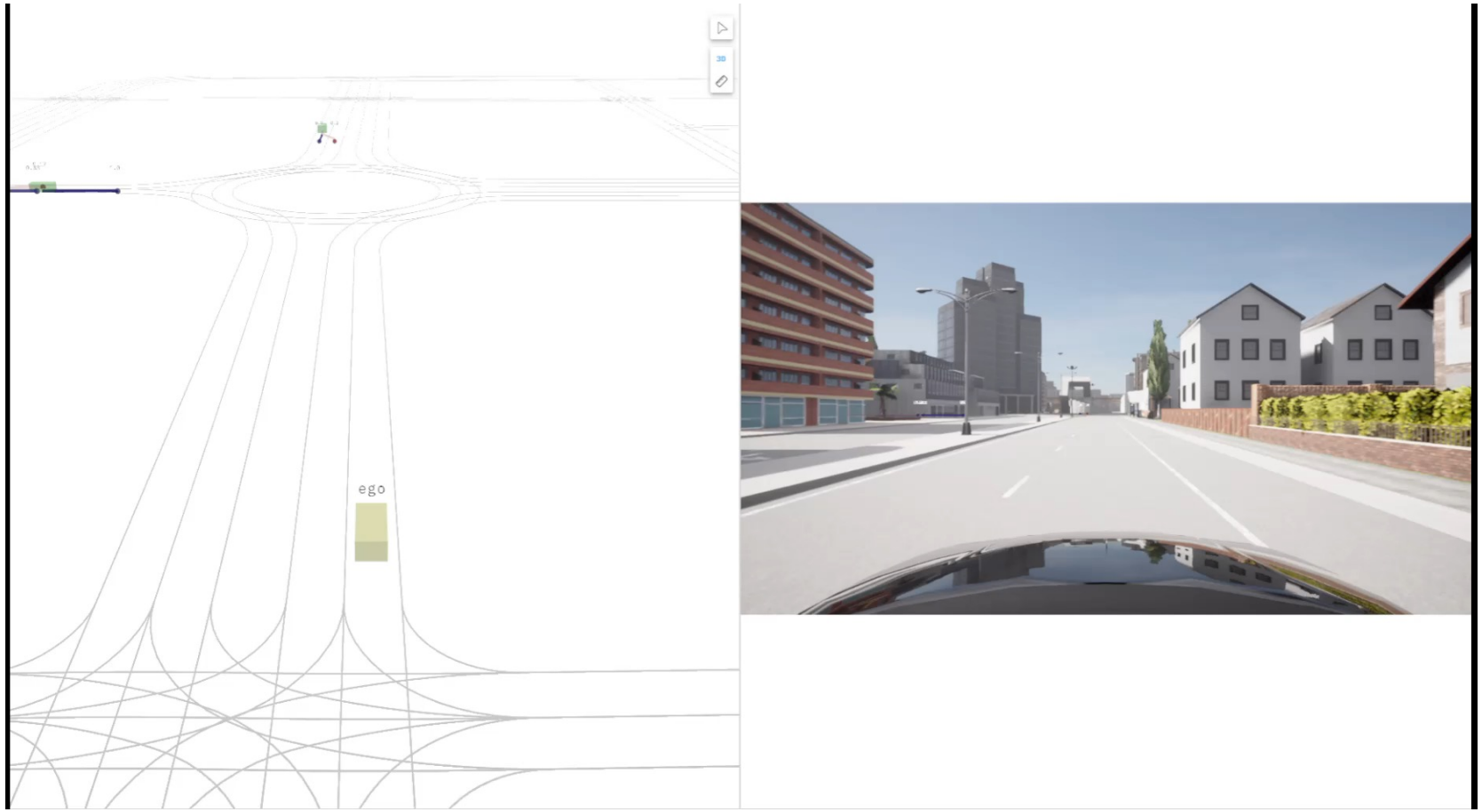
Use Case 2.2.1

State-of-the-Art: HiVT (CVPR2022 Argoverse 1 First Place)



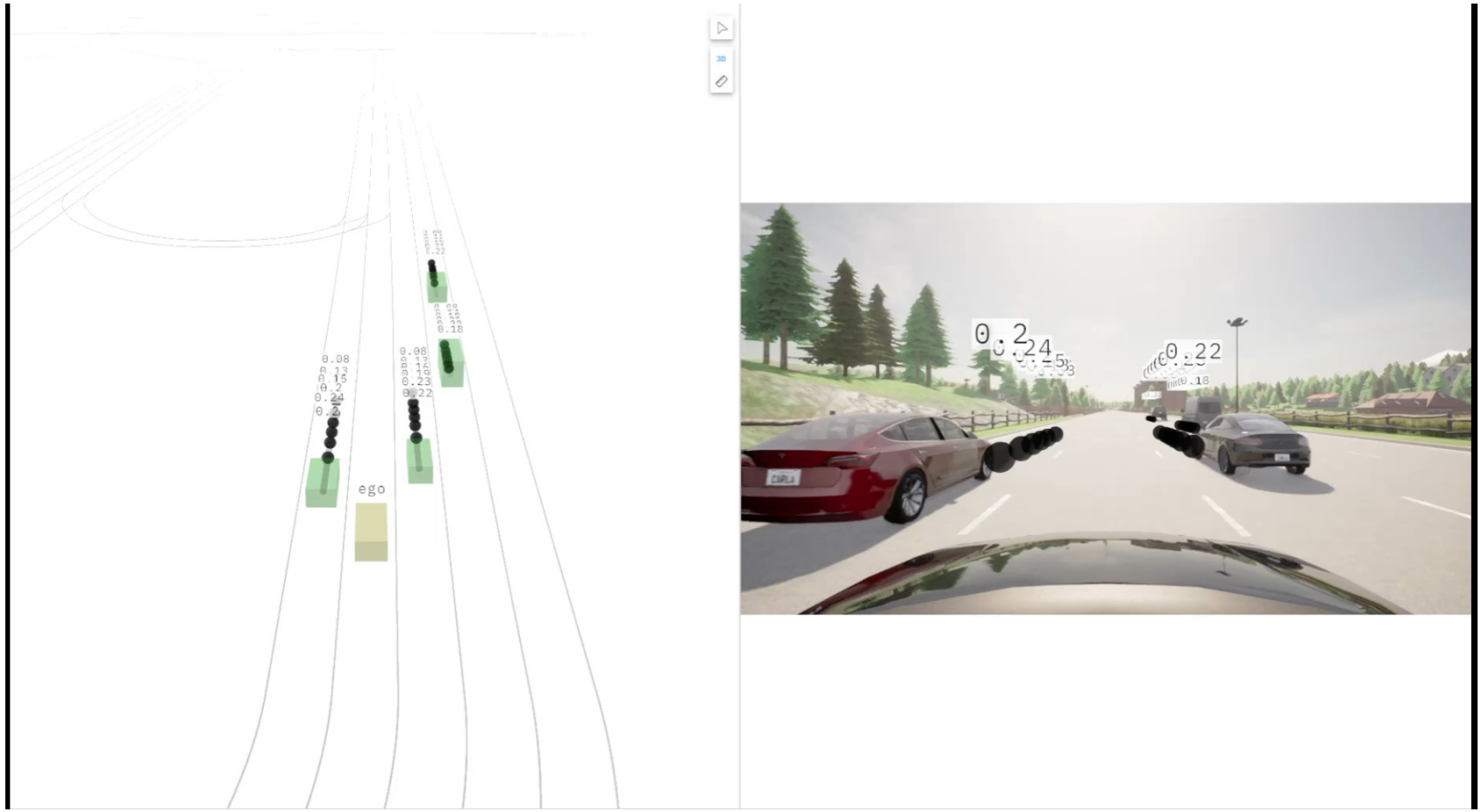
Use Case 2.2.1

Our Approach



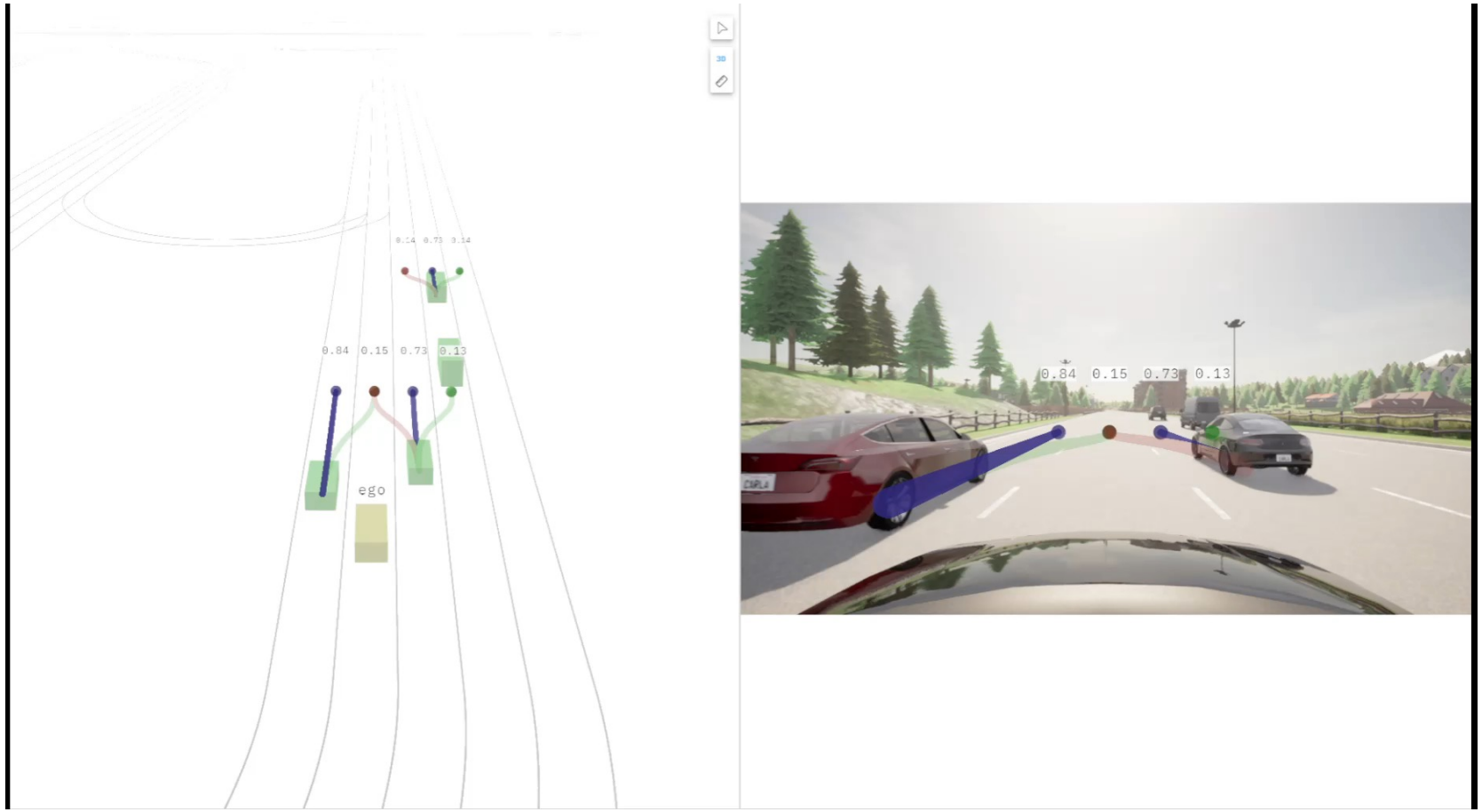
Use Case 2.3.1

State-of-the-Art: HiVT (CVPR2022 Argoverse 1 First Place)



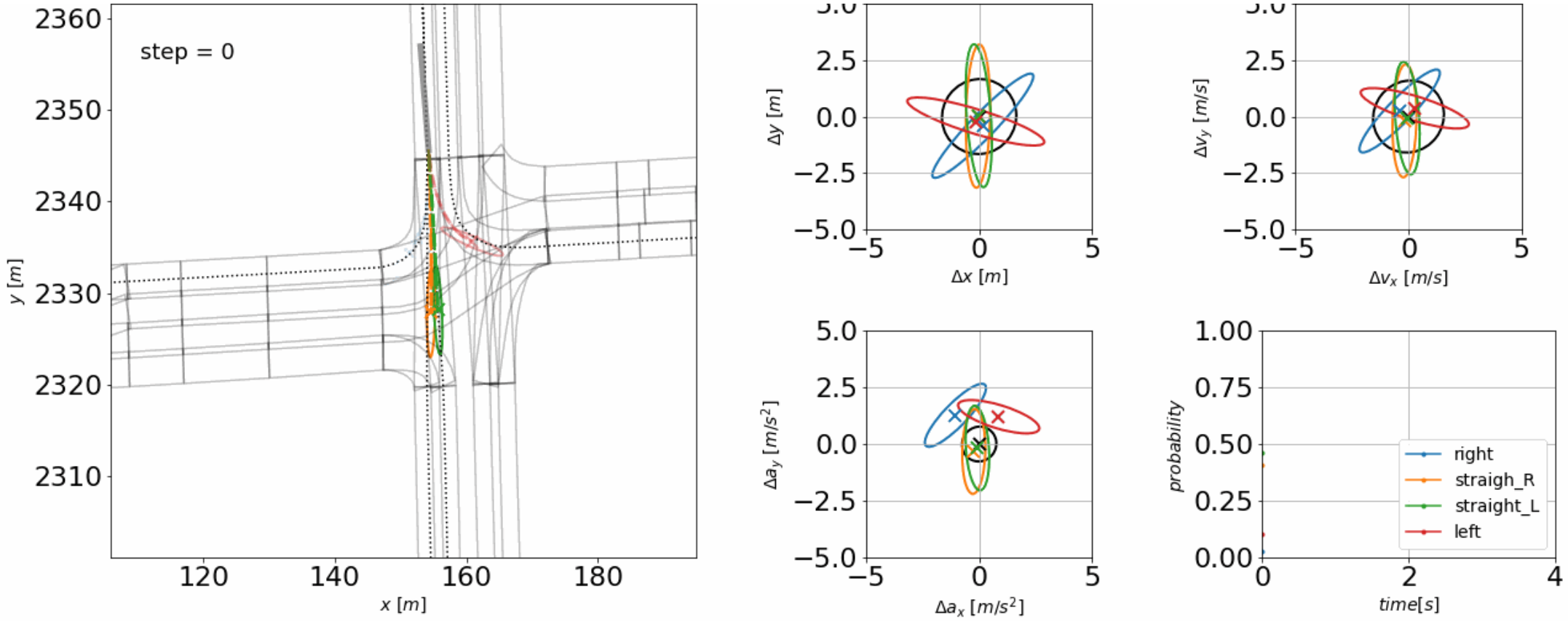
Use Case 2.3.1

Our Approach

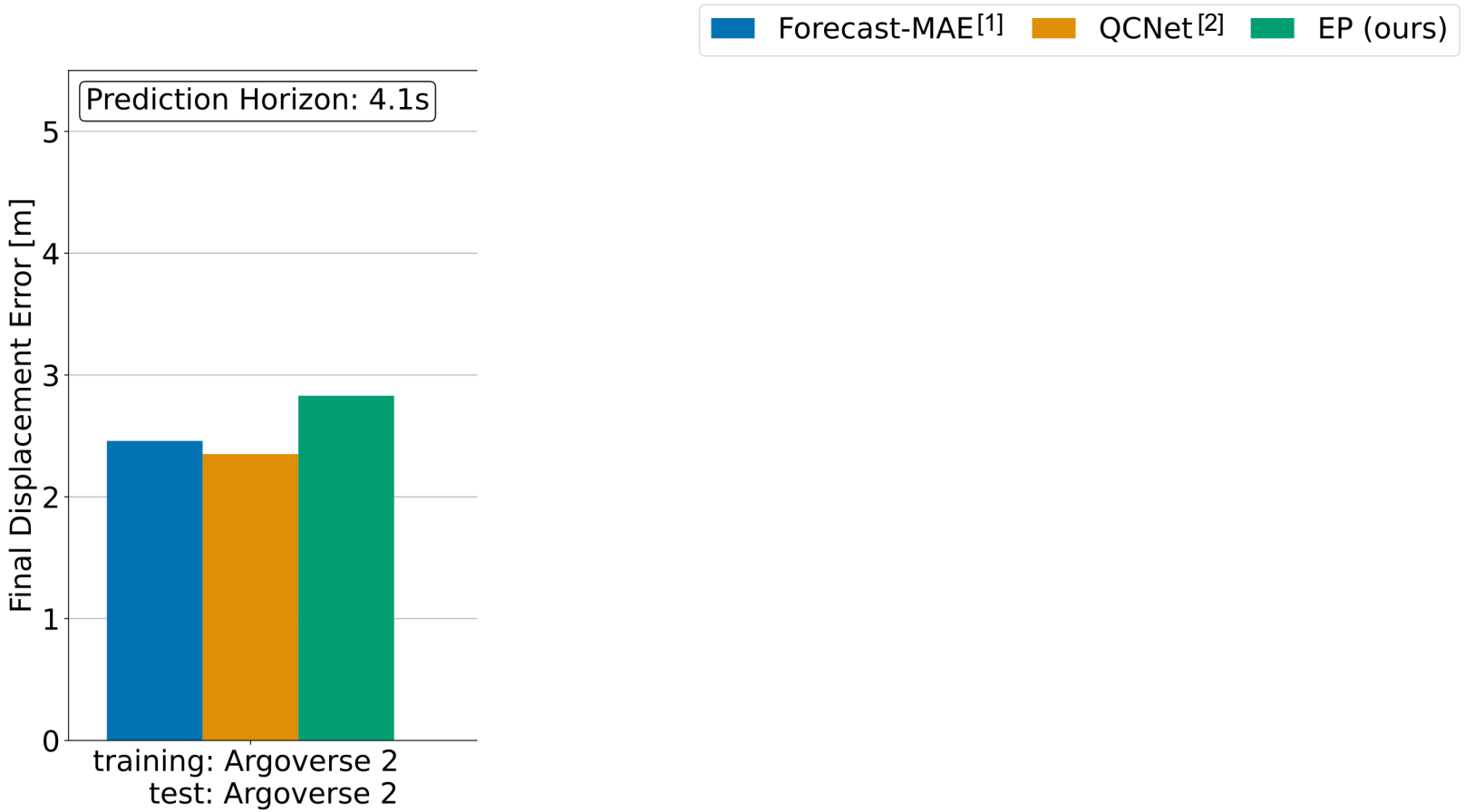


Demo on Argoverse 1 Motion

Our Approach



Quantitive Results



[1]: Cheng et al., Forecast-MAE: Self-supervised Pre-training for Motion Forecasting with Masked Autoencoders, ICCV 2023
[2]: Zhou et al., Query-Centric Trajectory Prediction, CVPR 2023

3

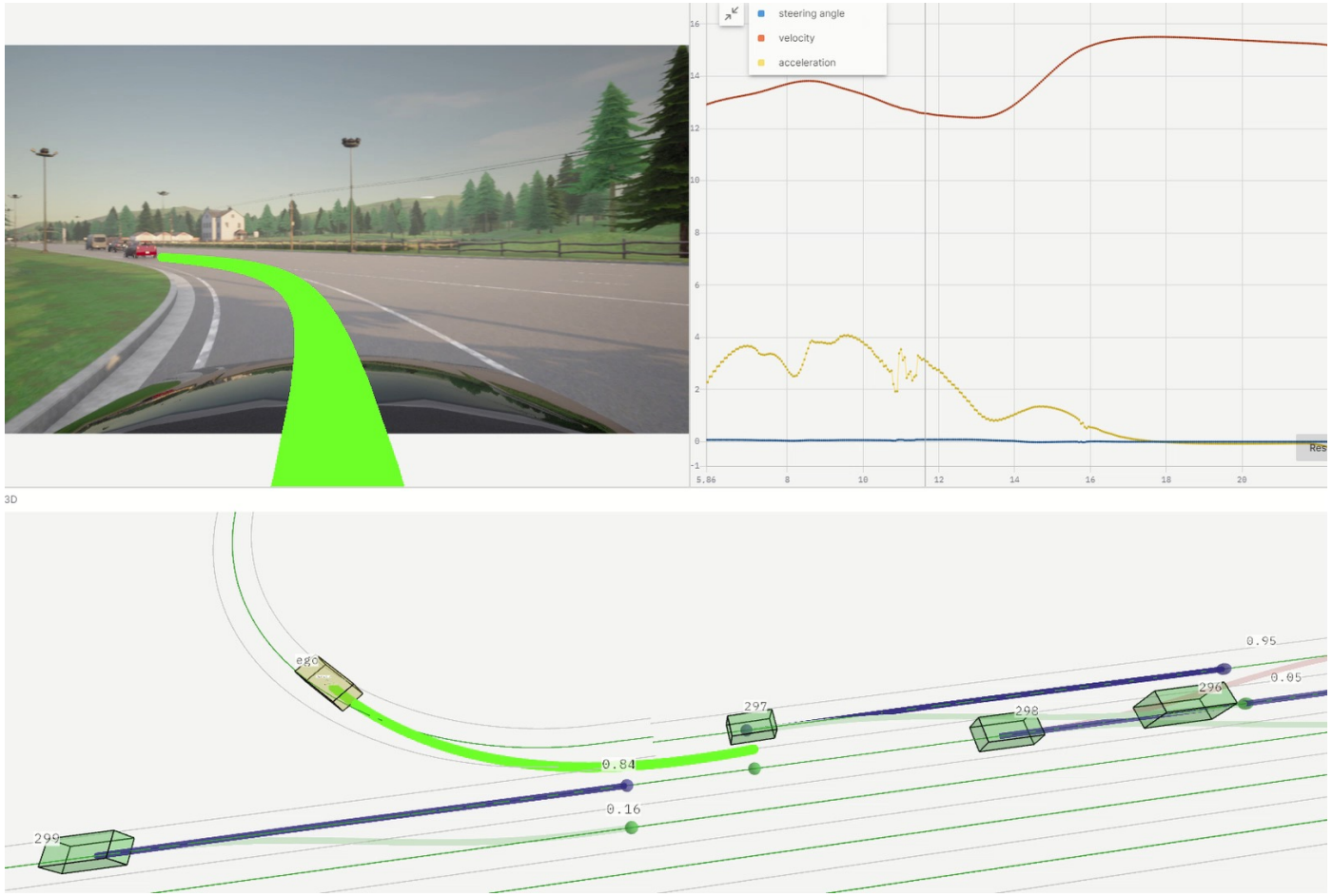
Demonstration of Trajectory Planning

Use Case 2.4.1

Integration of Predictor and Planner

Use Case 2.5.1

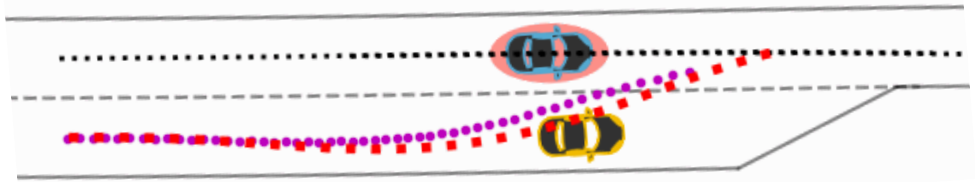
Integration of Predictor and Planner



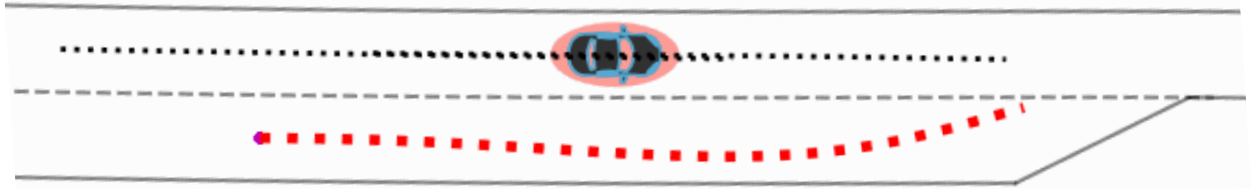
Use Case 2.5.1

Examples from the Evaluation

I.) Baseline

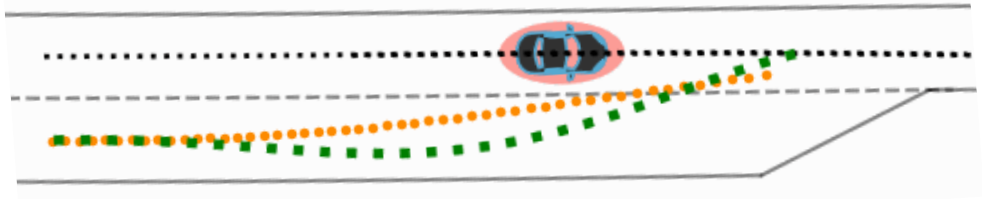


II.) Baseline

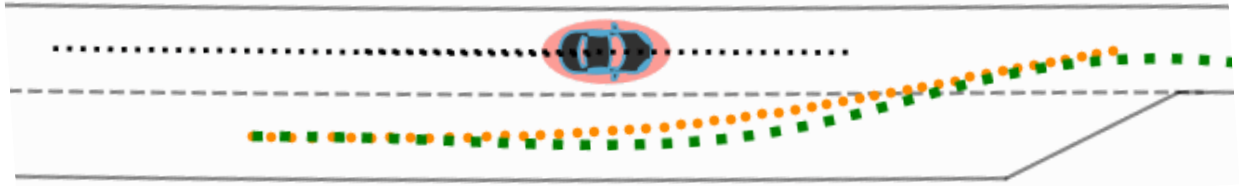


Baseline:	Warmstart	Plan	Behavior	
Our Framework:	Warmstart	Plan	Behavior	
	Ego	Obstacle	(Prediction)	

I.) Our Framework



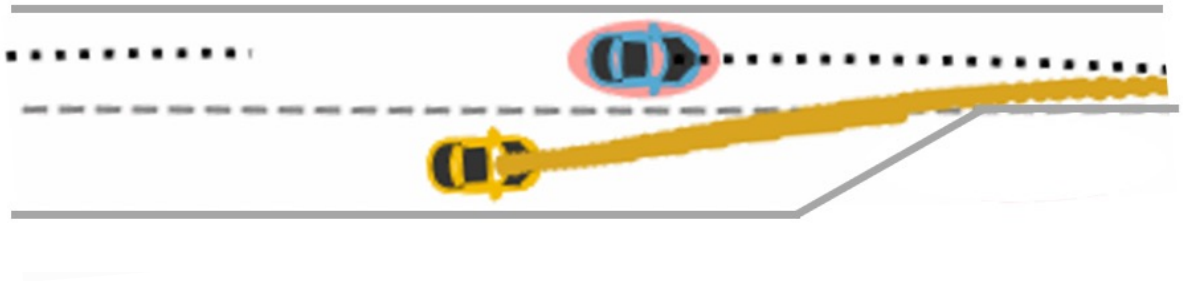
II.) Our Framework



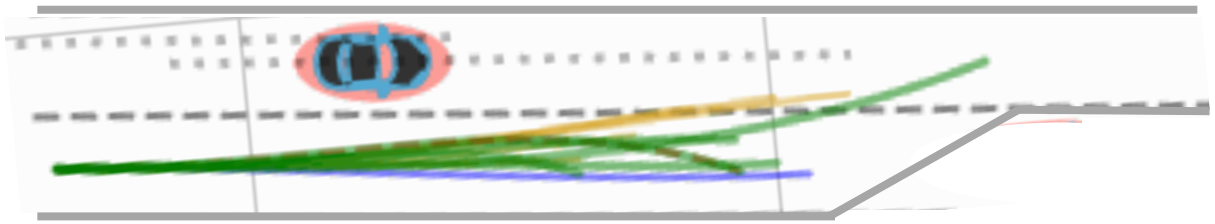
Use Case 2.5.1

Deep Dive Demonstrations Learning-Aided Warmstart

1. Trajectory Proposals from Predictor



2. Refinement and Selected Warmstart

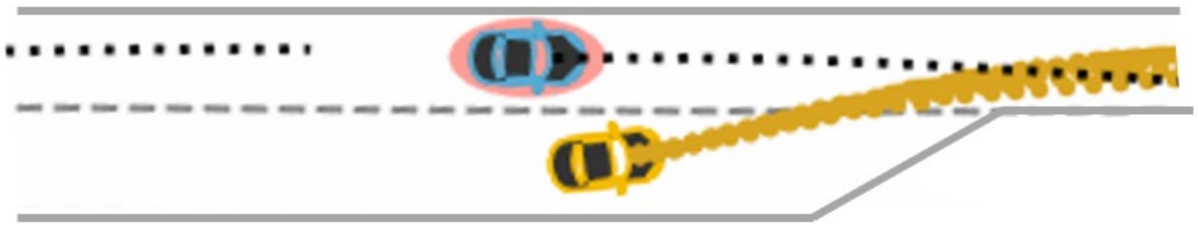


- Ego vehicle
- Obstacle
- Obstacle Predictions
- Ego Predictions
- Refined Proposals
- Selected Warmstart
- Optimal Trajectory

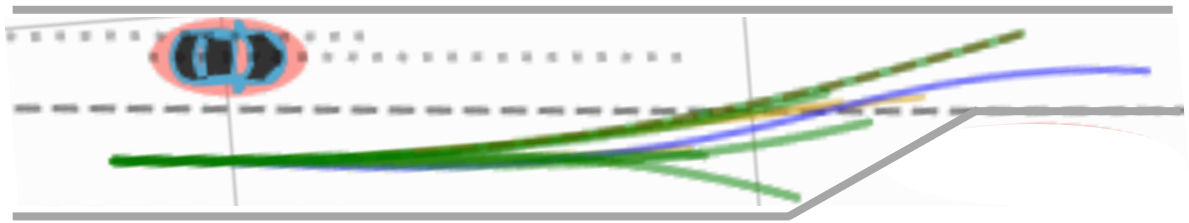
Use Case 2.5.1

Deep Dive Demonstrations Learning-Aided Warmstart

1. Trajectory Proposals from Predictor

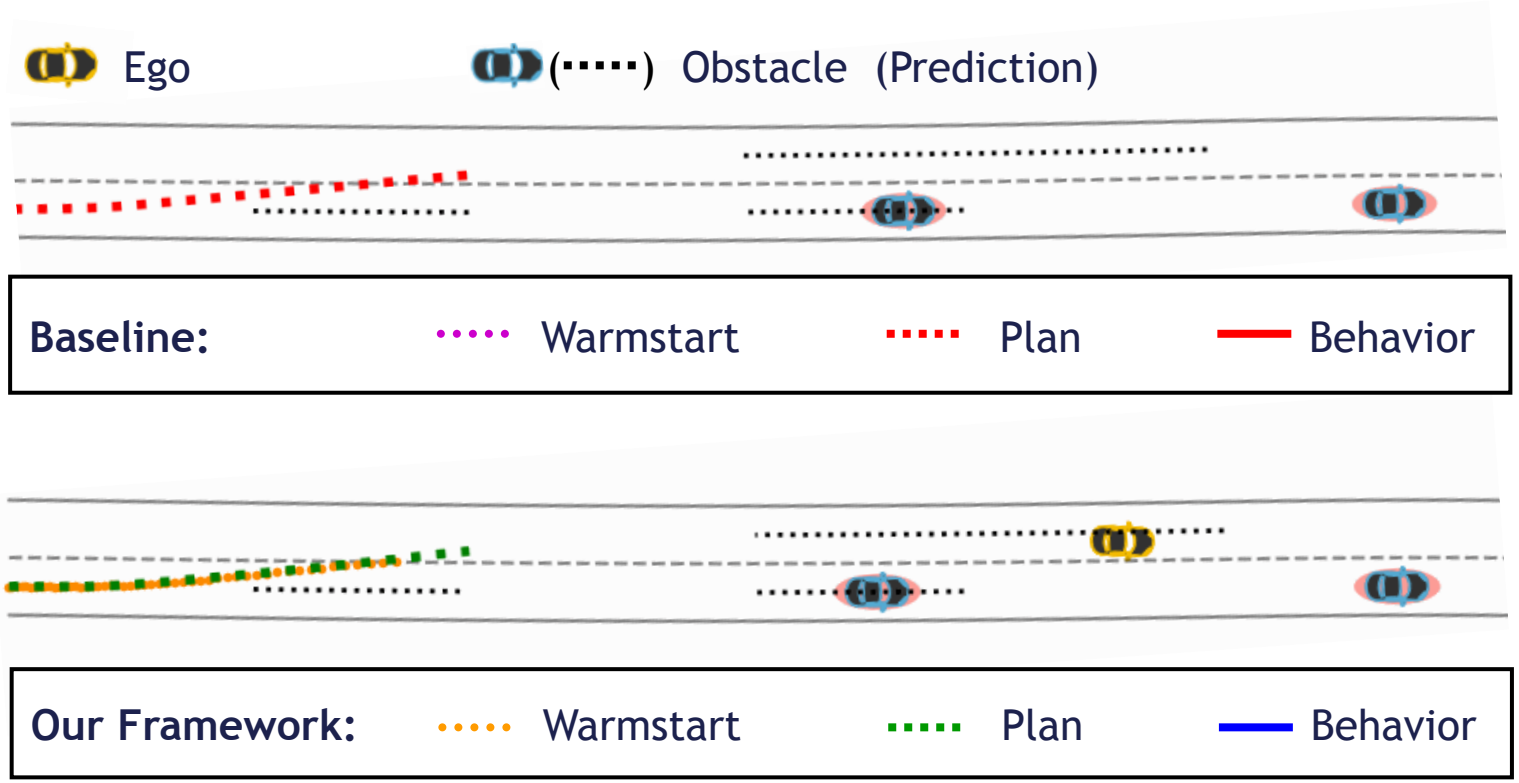


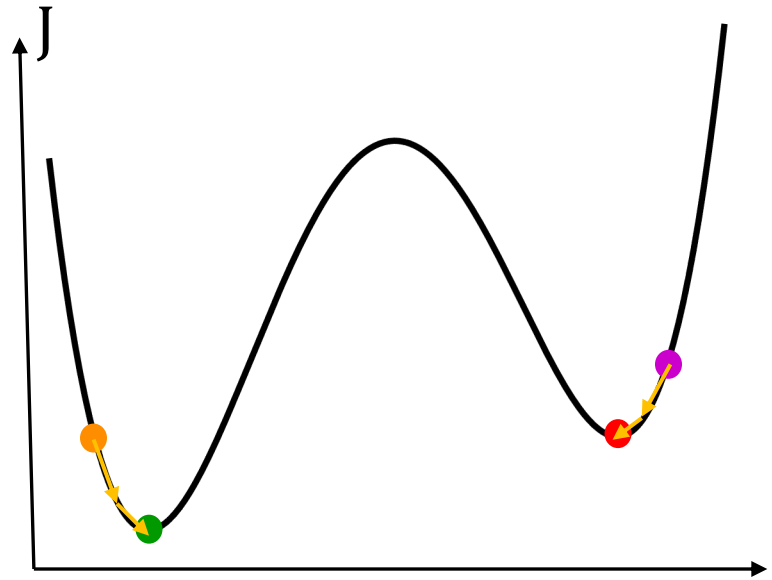
2. Refinement and Selected Warmstart



- Ego vehicle
- Obstacle
- Obstacle Predictions
- Ego Predictions
- Refined Proposals
- Selected Warmstart
- Optimal Trajectory

Demonstration MPC in Non-Convex Problems

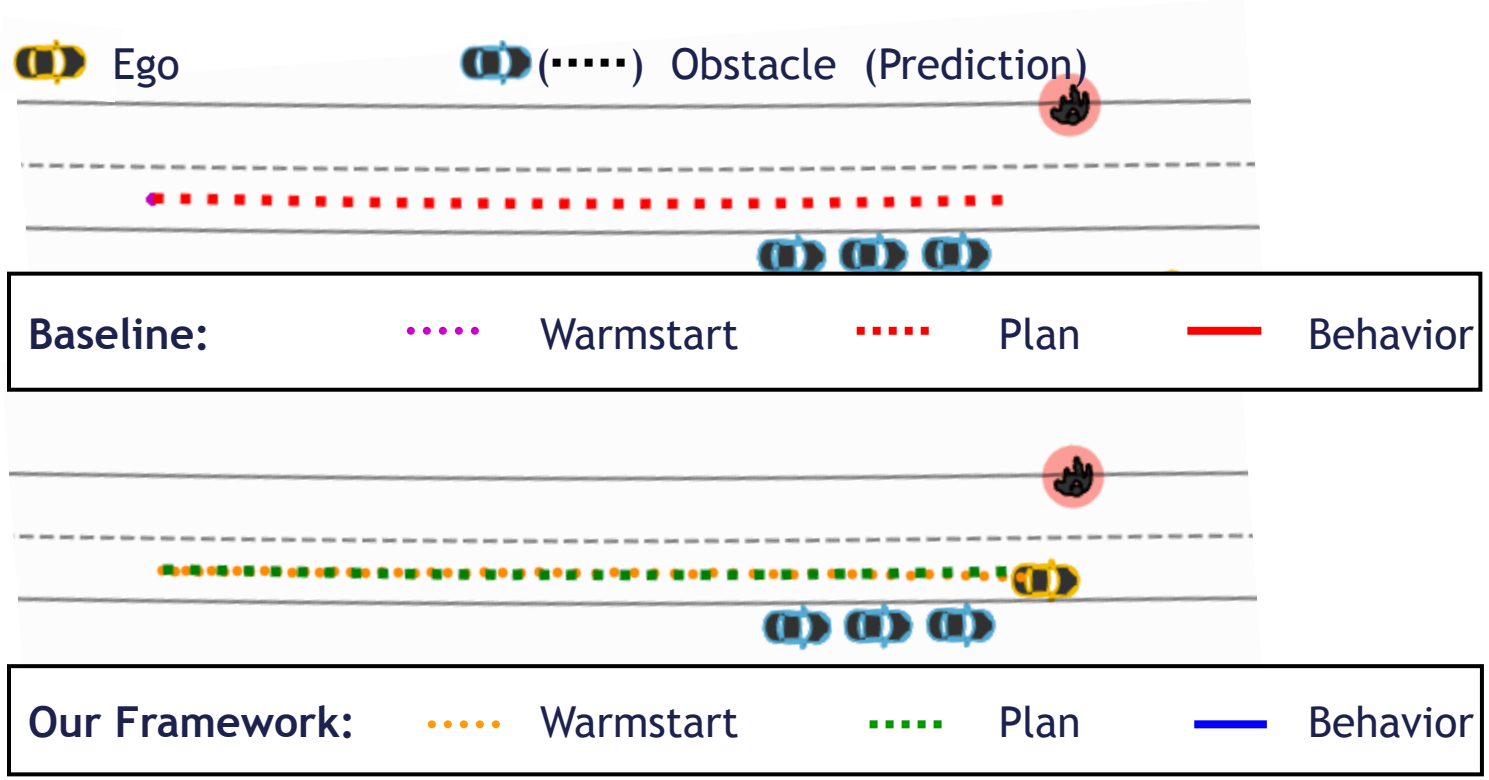


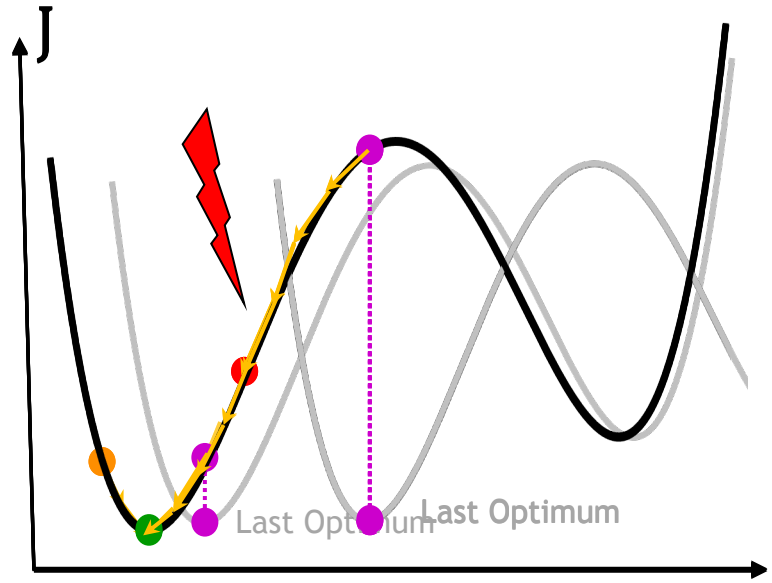


Limitations of MPC adressed by our approach:

1. Convergence to local optimum if initial guess too close
   - Problematic especially in crowded environments since obstacles cause multiple local minima

Demonstration MPC in Uncertain Fast-Changing Traffic





Limitations of MPC adressed by our approach:

2. Slow convergence if Optimum is too far from initial guess (many optimization steps)
   - Problematic especially in unknown fast-changing environments where last optimum is far from new one

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Automotive AI Powered by Knowledge

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KI Wissen is a project of the KI Familie. It was initiated and developed by the VDA Leitinitiative autonomous and connected driving and is funded by the Federal Ministry for Economic Affairs and Climate Action.

KI FAMILIE

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