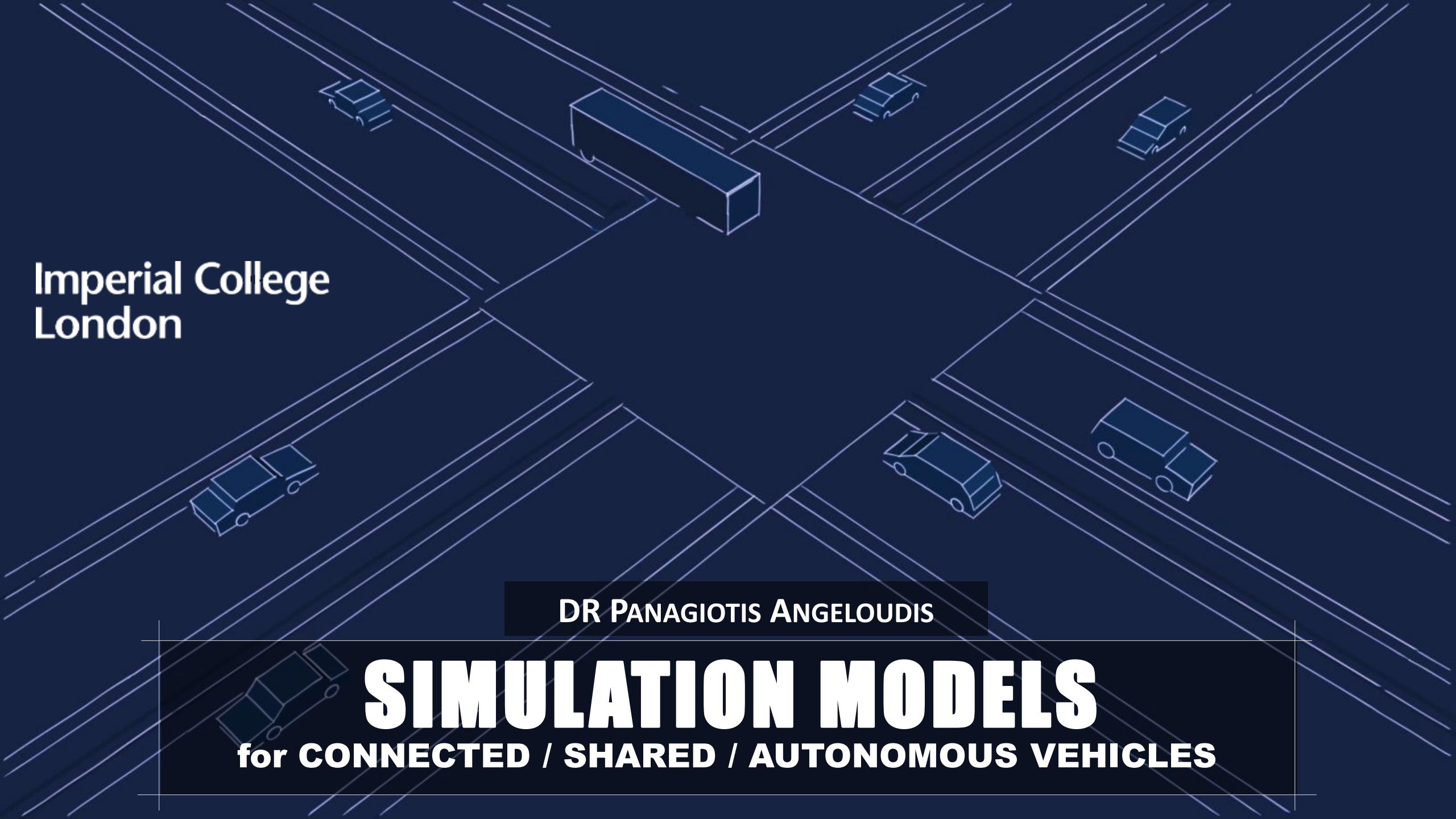


Imperial College London

DR PANAGIOTIS ANGELOUDIS

SIMULATION MODELS

for CONNECTED / SHARED / AUTONOMOUS VEHICLES

Research in Connected, Shared & Autonomous Vehicles

Dr Panagiotis Angeloudis

Senior Lecturer in
Transport Systems & Logistics

Intelligent Systems,
Network Optimisation,
Autonomous Driving,
Infrastructure Design

Dr Marc Stettler

Lecturer in
Transport & Environment

Transport Emissions,
Energy Recovery Systems,
Connected Vehicles

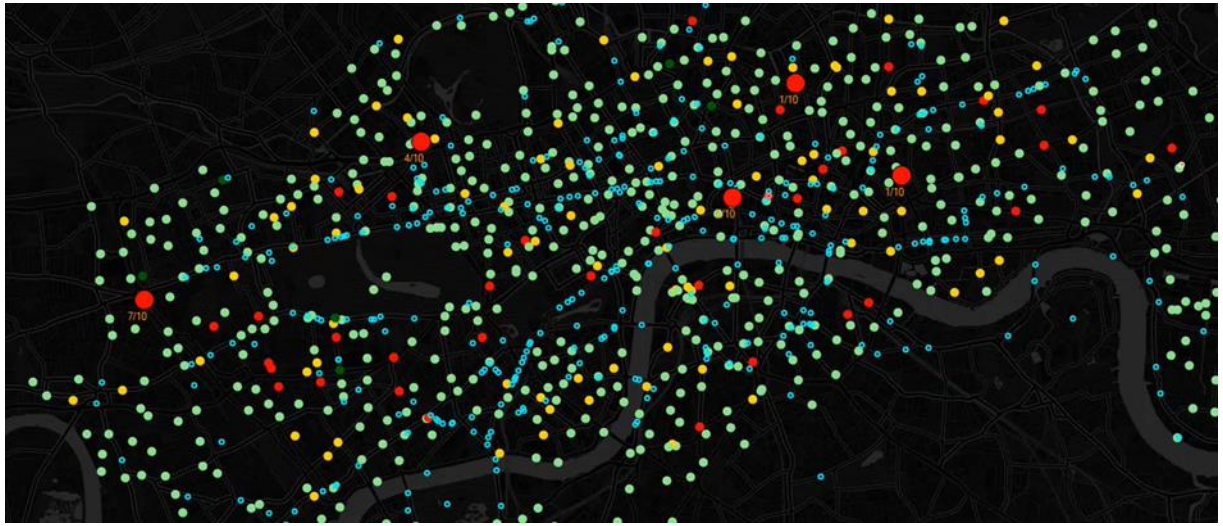
ACES Simulation – Modelling Streams

Traffic & Dynamics

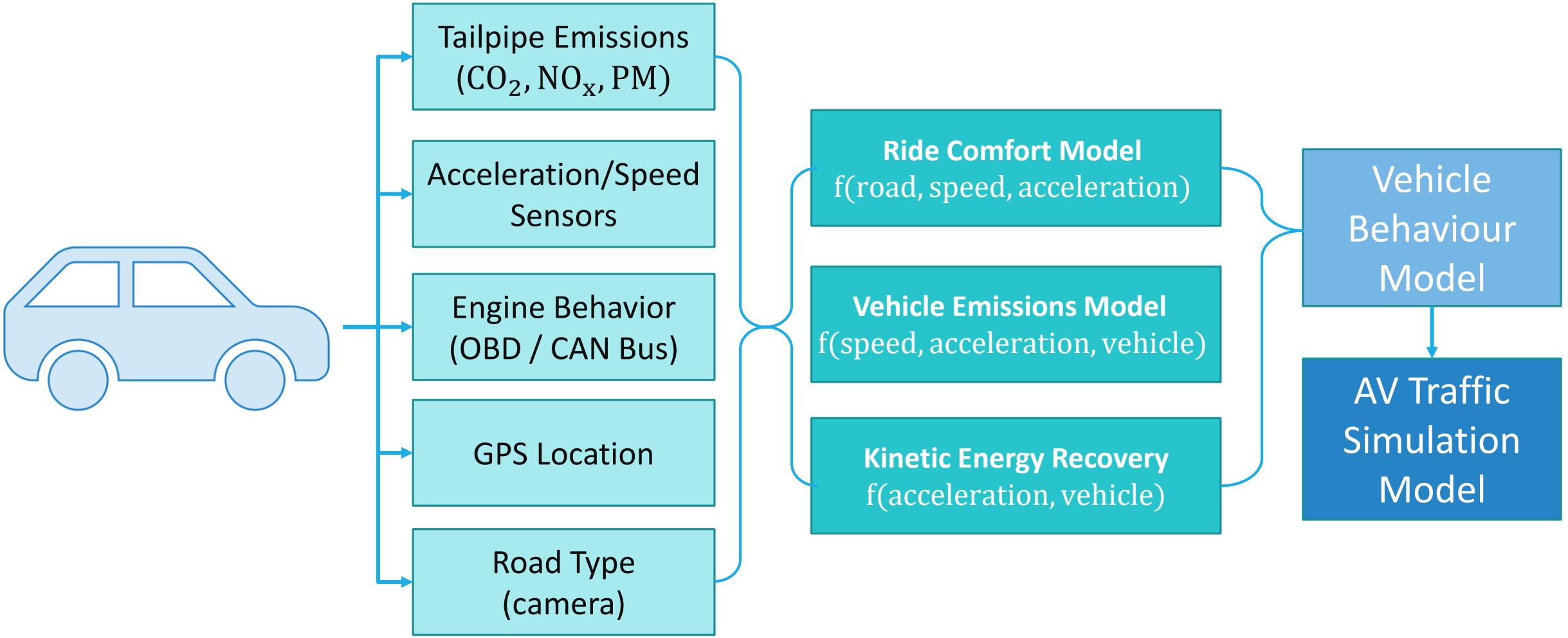
- **Operational / Tactical Level**
- **Tools:** VISSIM, Advisor CarMaker, etc.
- Driver behaviour and vehicle dynamics
- Traffic control & ITS
- Vehicle emissions, Energy consumption

Logic & Interactions

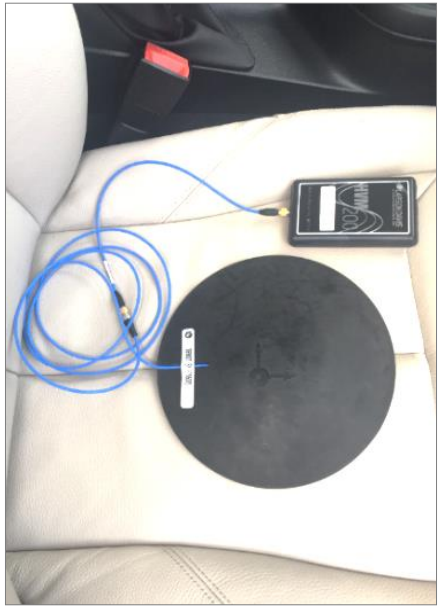
- **Tactical / Strategic Level**
- **Tools:** Delos (bespoke & developed at ICL)
- Emphasis on Agent Logic & Interactions
- Concept of Operations Driven
- Infrastructure Interdependencies

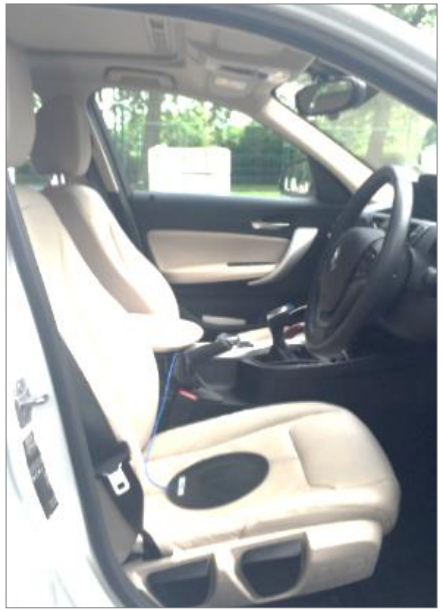


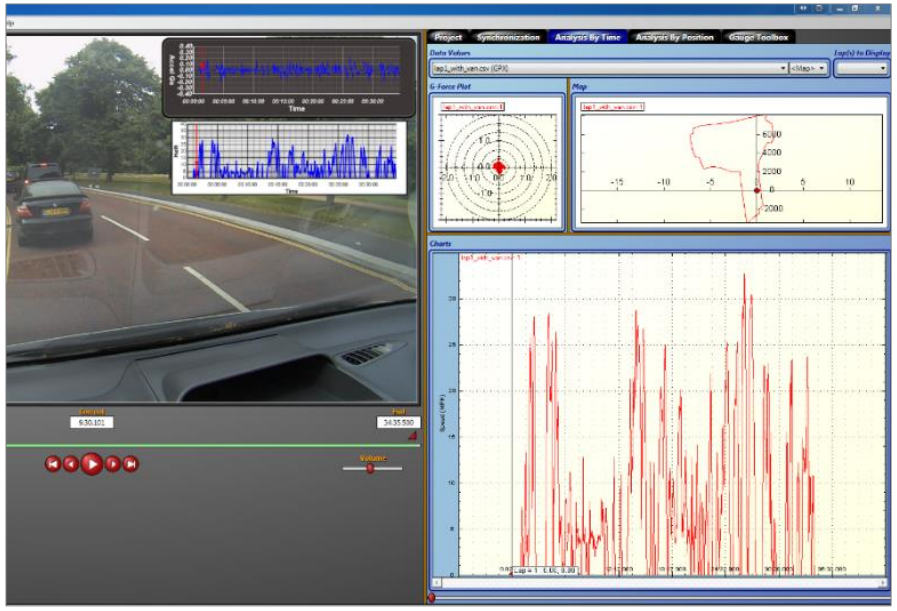
Model Development – Data Collection



Model Development – Data Collection

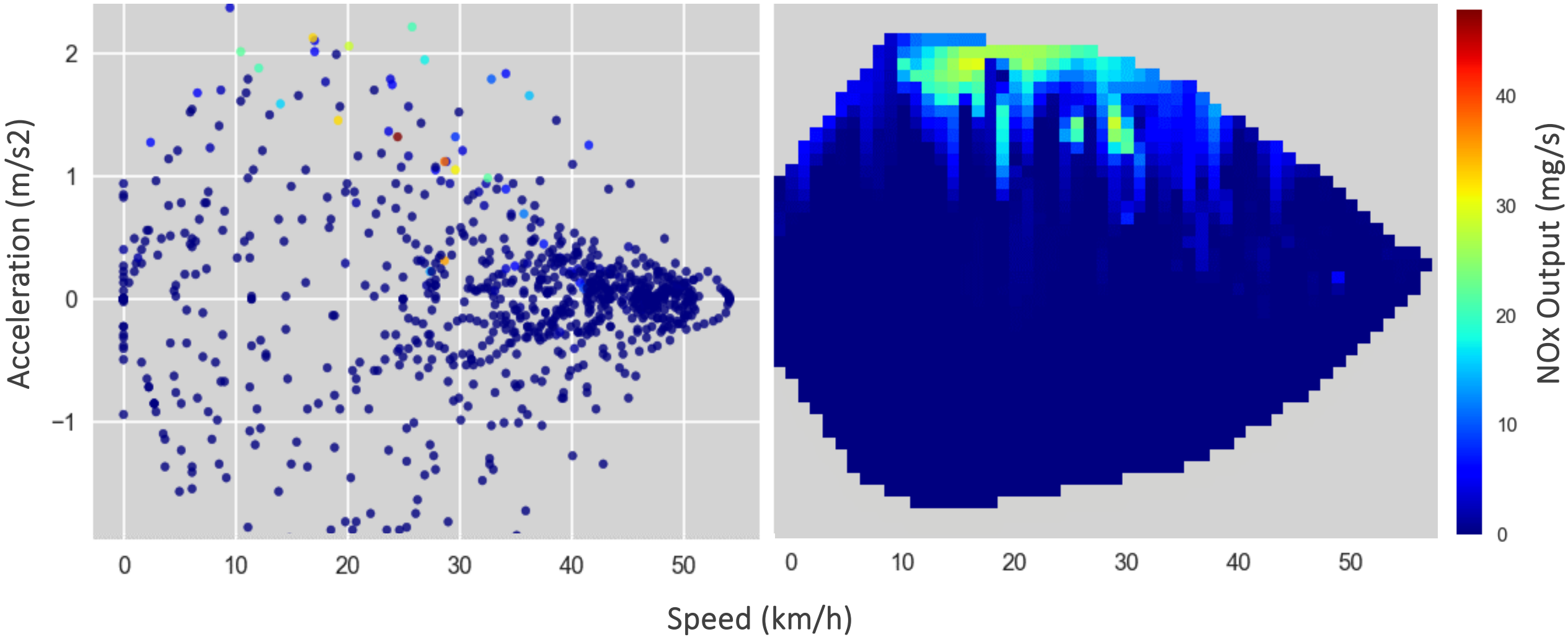






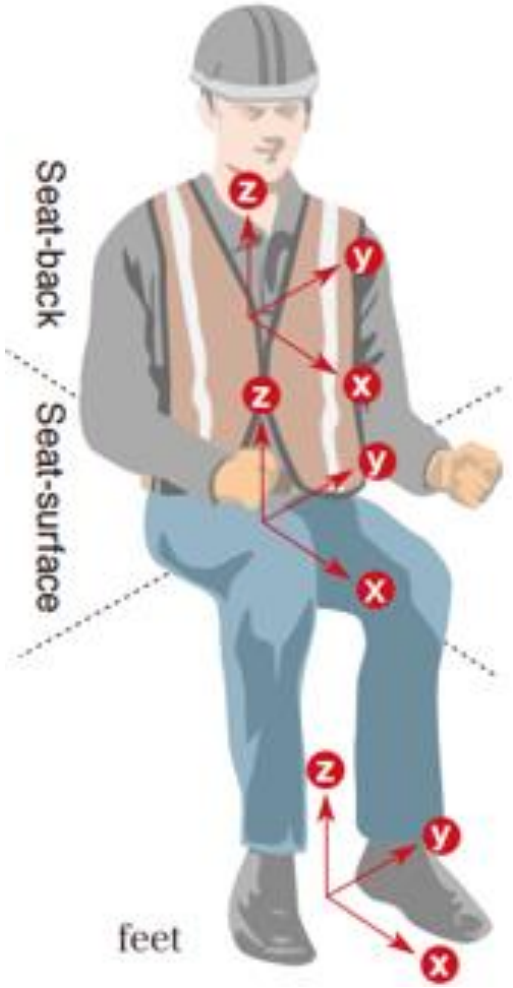
- Emission data (PEMS)
- Ride comfort data (HVM200)
- Driver perception (Questionnaires)
- GPS Traces (Speed, Trajectories)
- CAN bus / OBD feeds (Vehicle Systems)

PEMS Emissions – Data Analysis



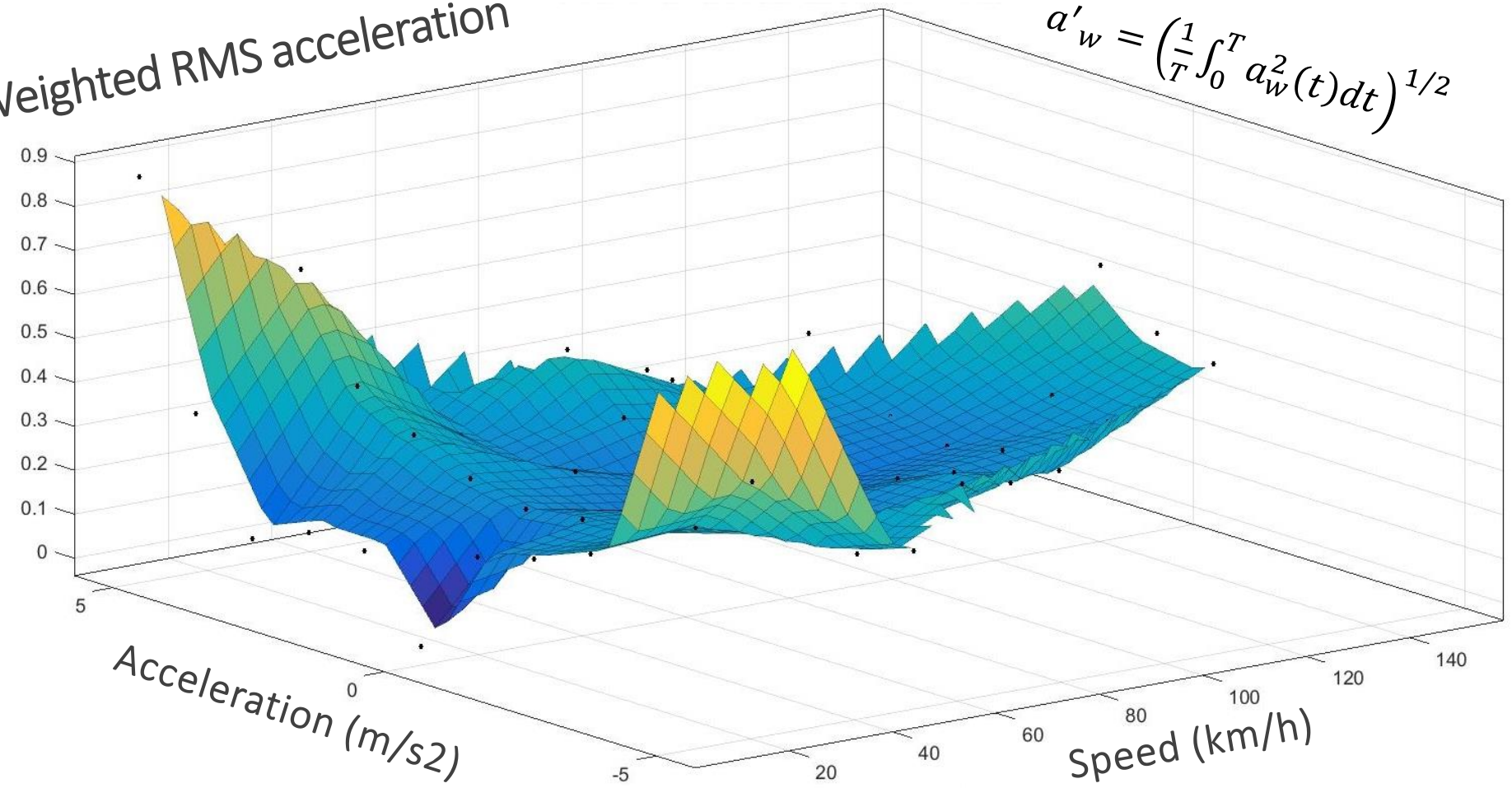
Ride Comfort– Data Analysis

Basicentric Axes



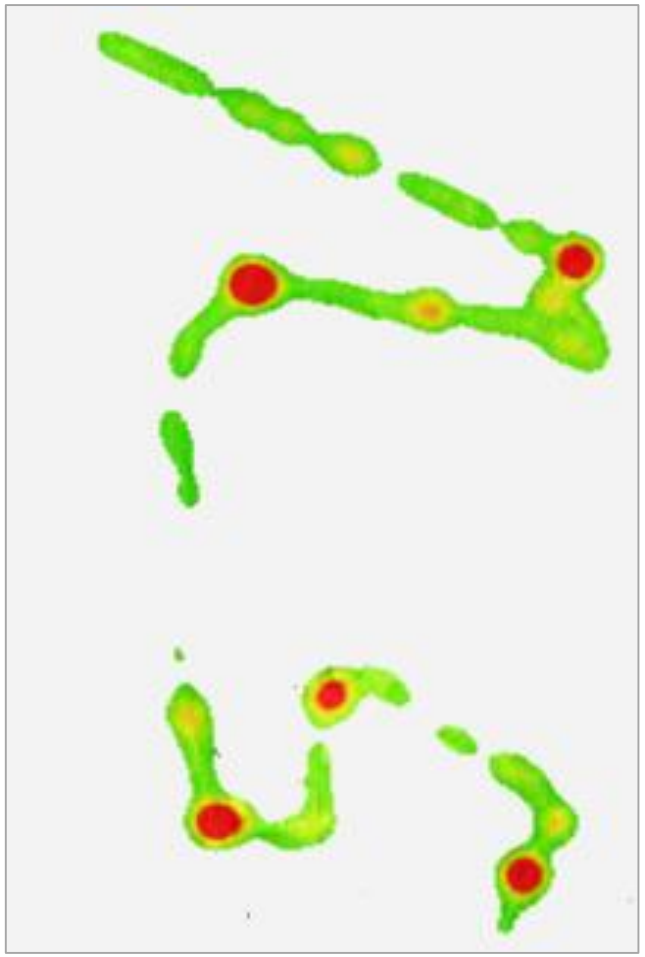
Weighted RMS acceleration

$$a'_w = \left(\frac{1}{T}\int_0^T a_w^2(t)dt\right)^{1/2}$$

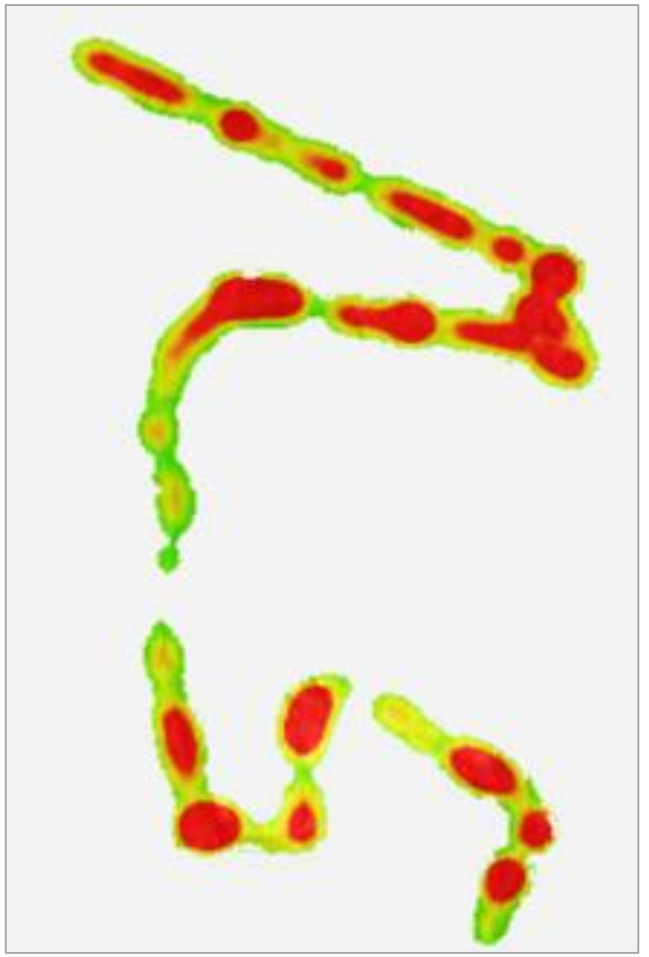


Model Calibration - Emissions

Network Geometry



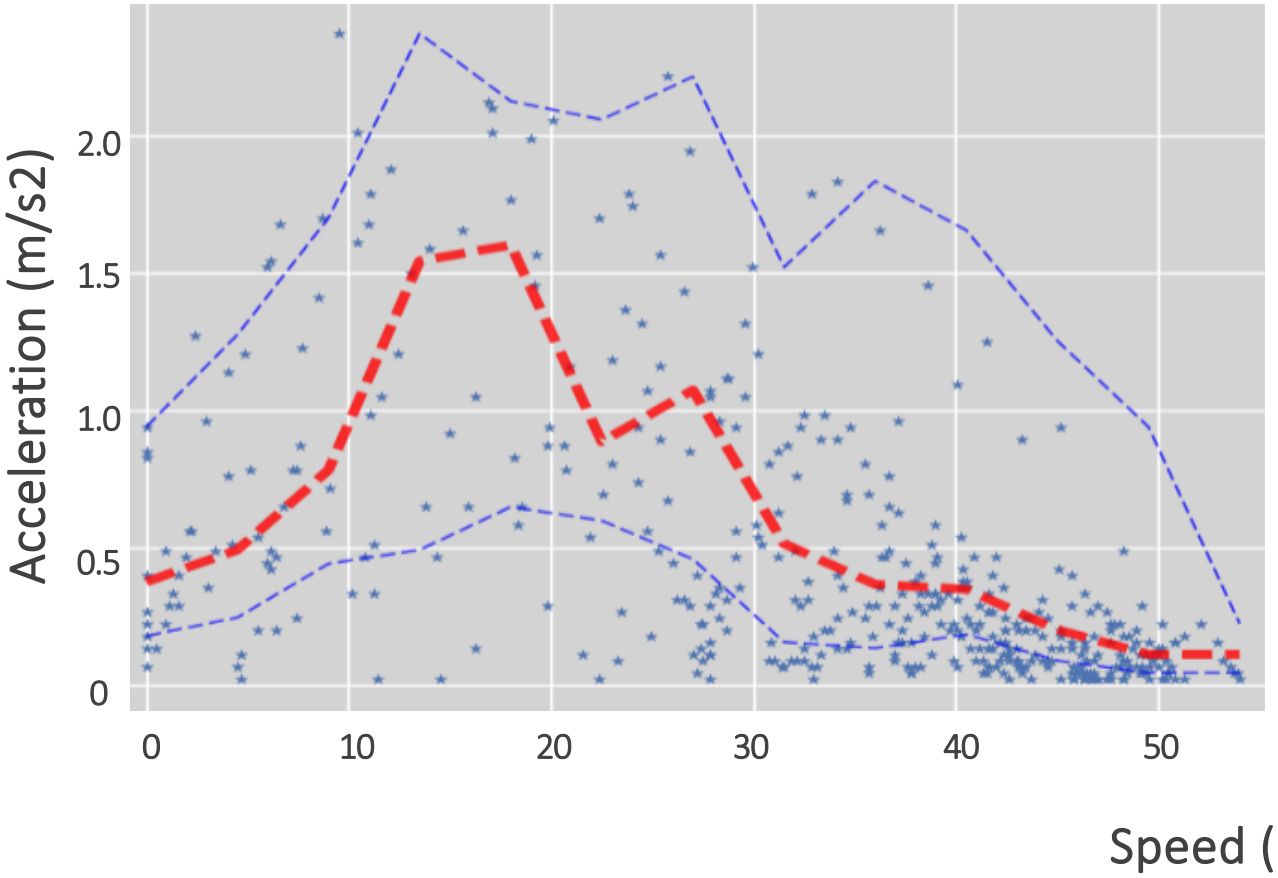
NOx emissions



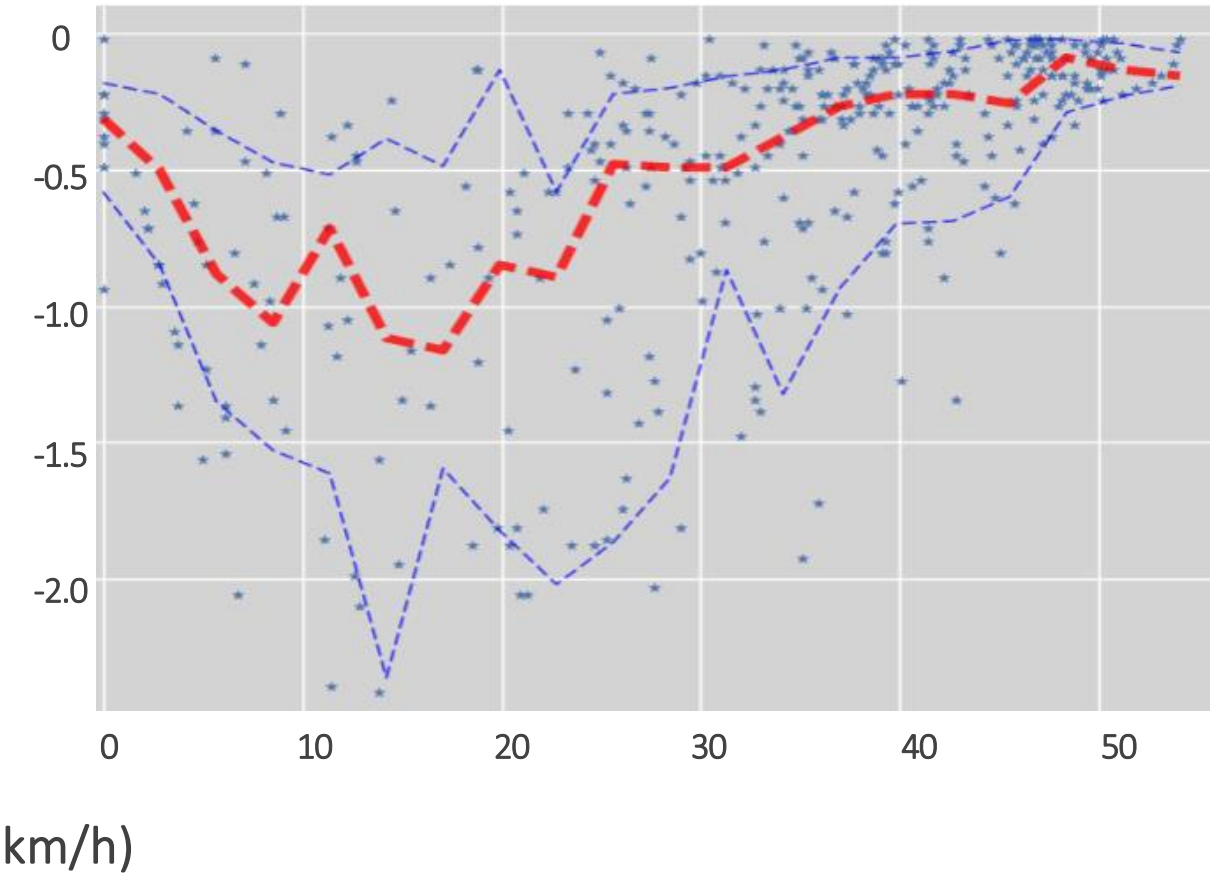
CO2 emissions

Model Calibration - Vehicle Dynamics

Acceleration / Speed Profile



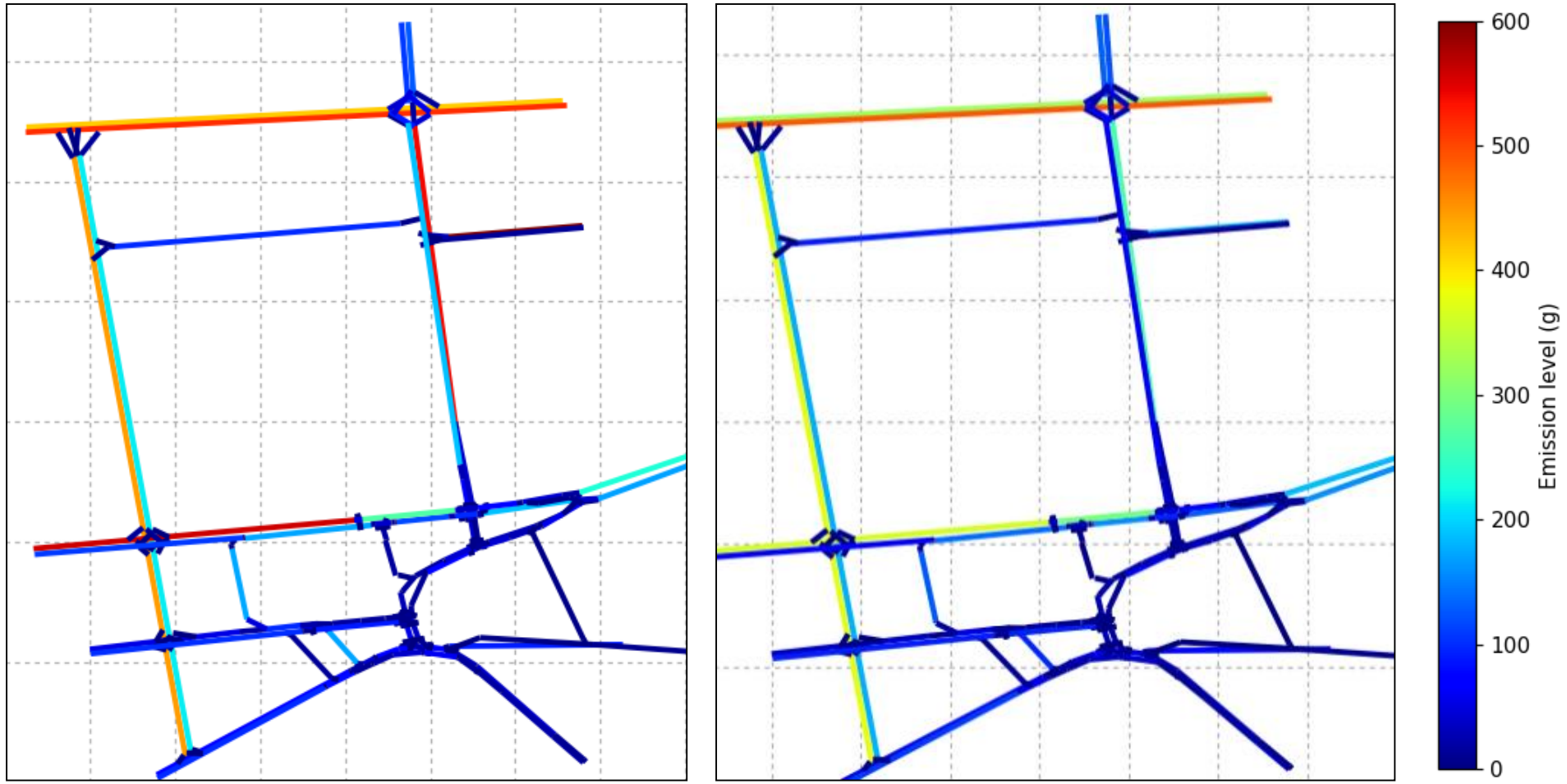
Deceleration / Speed Profile



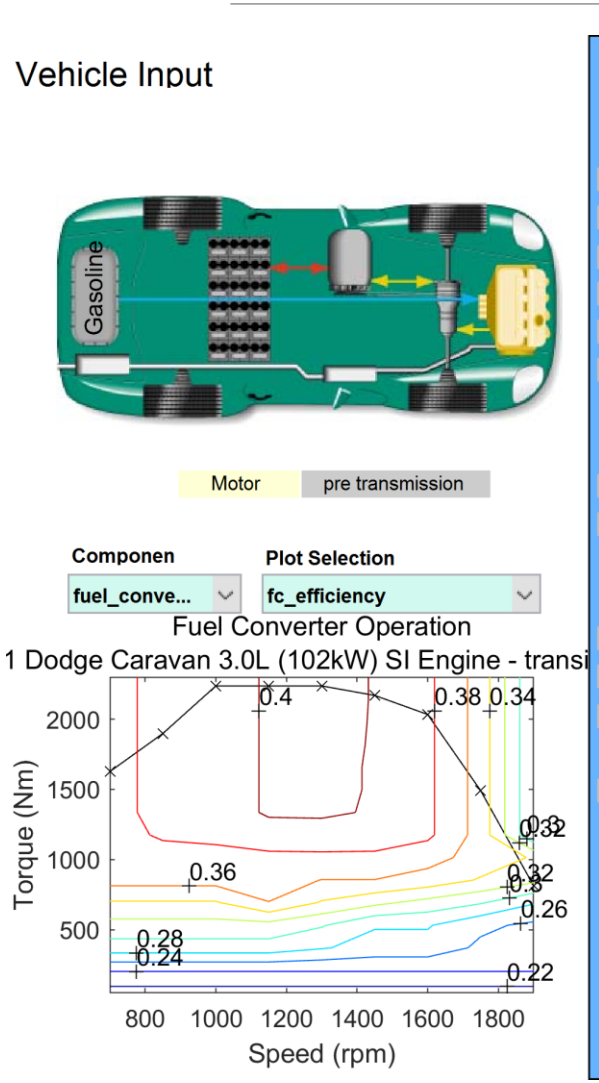
Penetration Rate Modelling

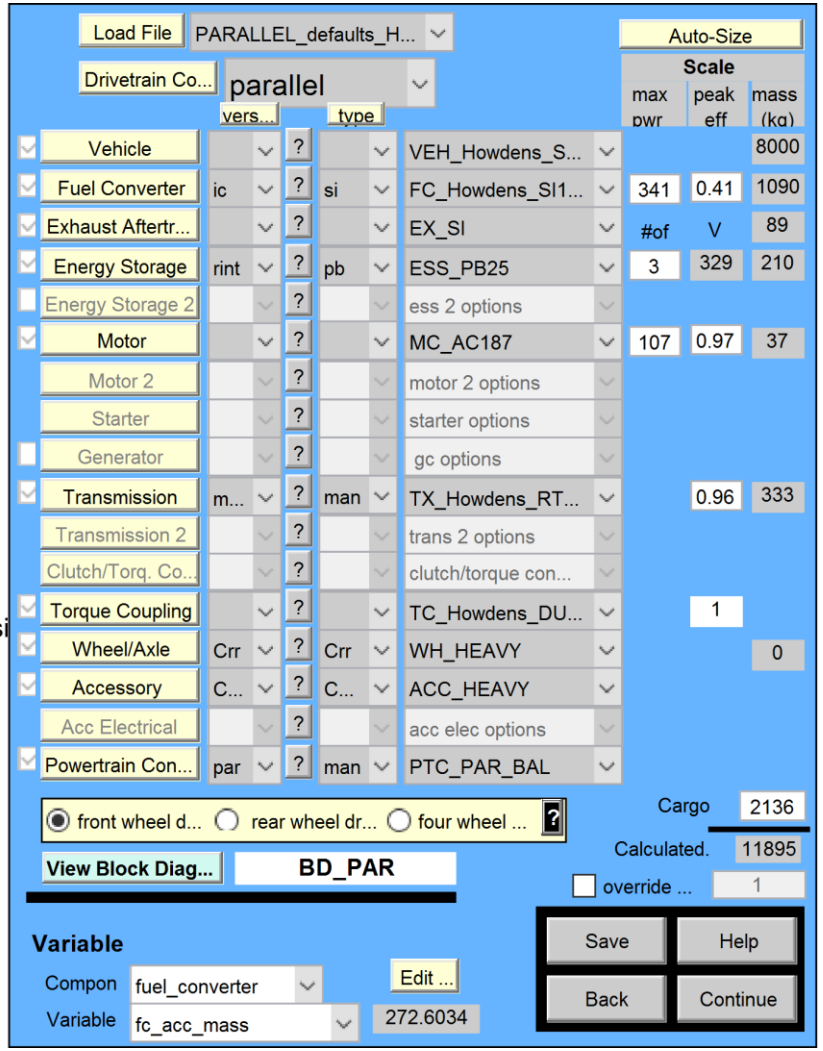
O% CAV

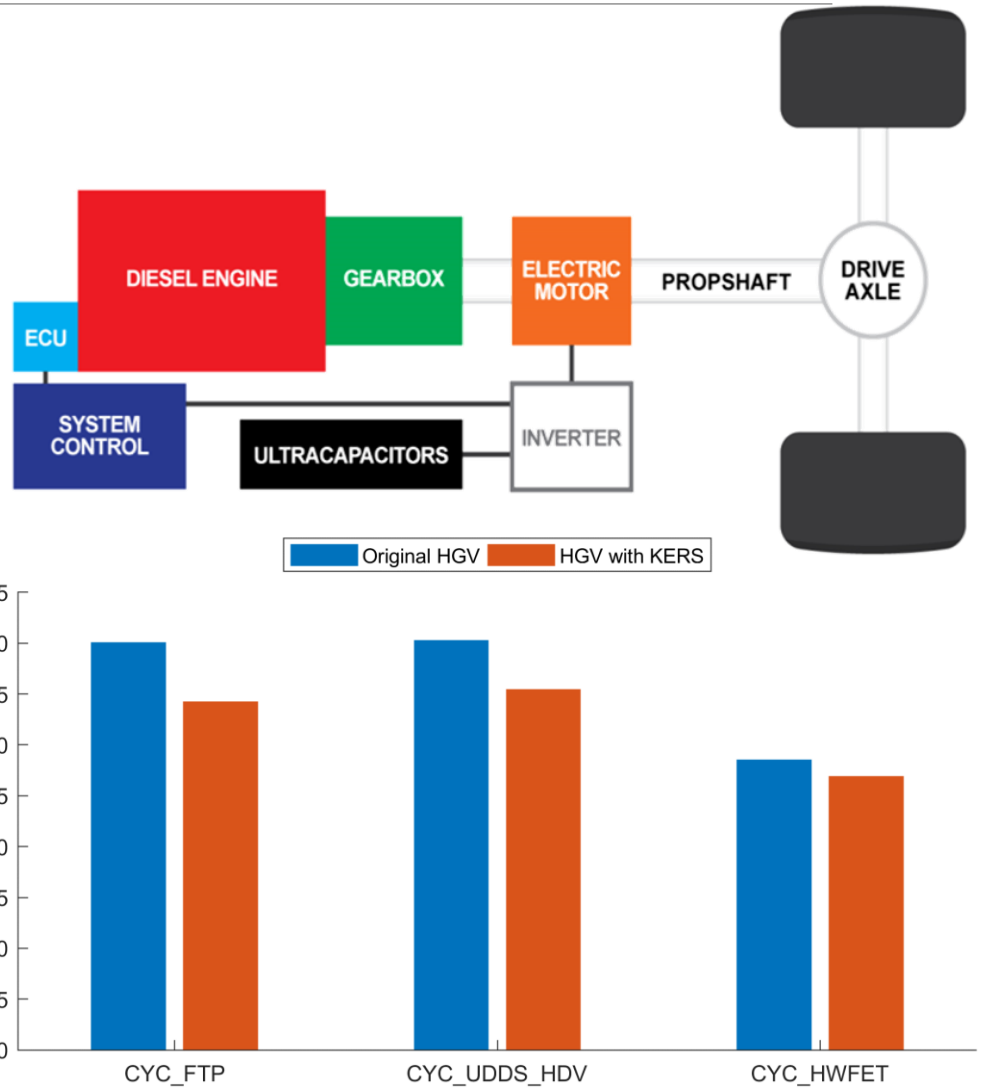
100% CAV



Hybrid – Electric Propulsion for HGVs







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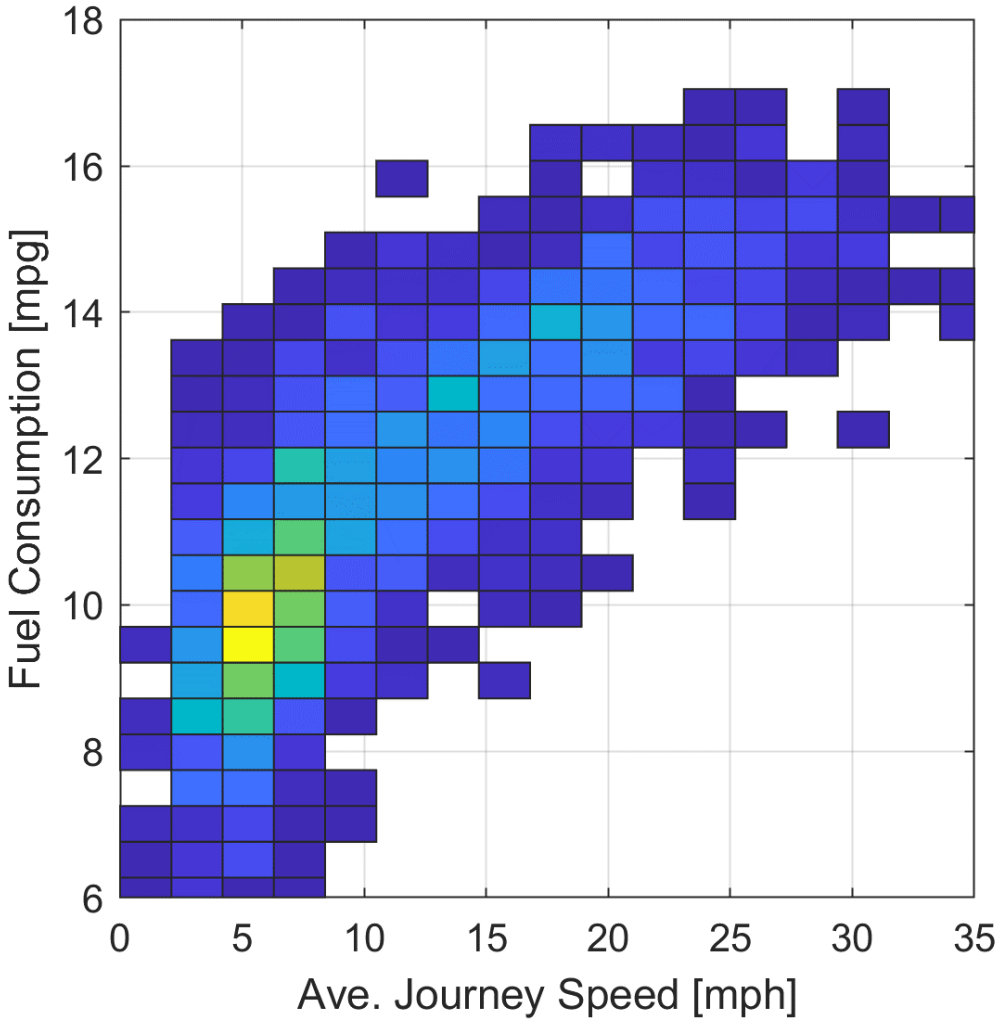
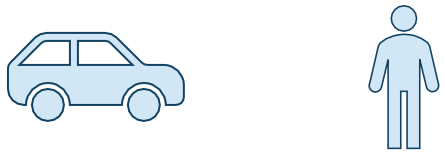


(A)CES Platform Design Aspects

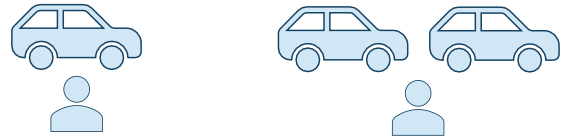
Agent Behaviour

Mode Choice, User Preferences, Vehicle Dynamics



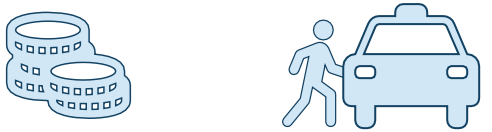
Competitive Behaviour

Market Structure (Monopoly / Competition)



Tariff Structure

Pricing Mechanisms – Surging Behaviour

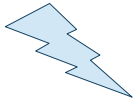


Interaction with Public Transport Modes

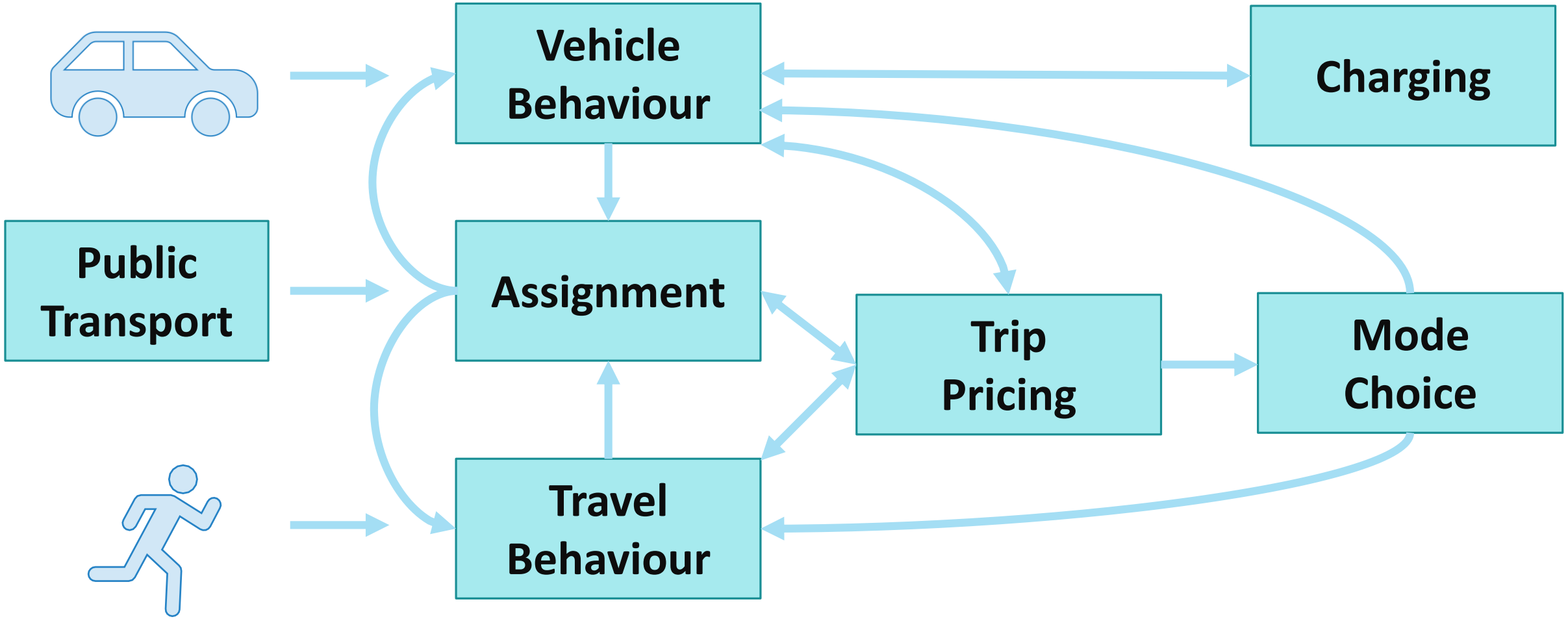
Integration, Competition, Mode Choice

Energy Management

Refuelling, Recharging, Infrastructure Interactions



Information Flow Modelling



Ongoing Case Study – TNC Pricing

Assignment

Optional Ride-Matching

Pricing

Adaptive Surge Pricing Heuristic

Mode Choice

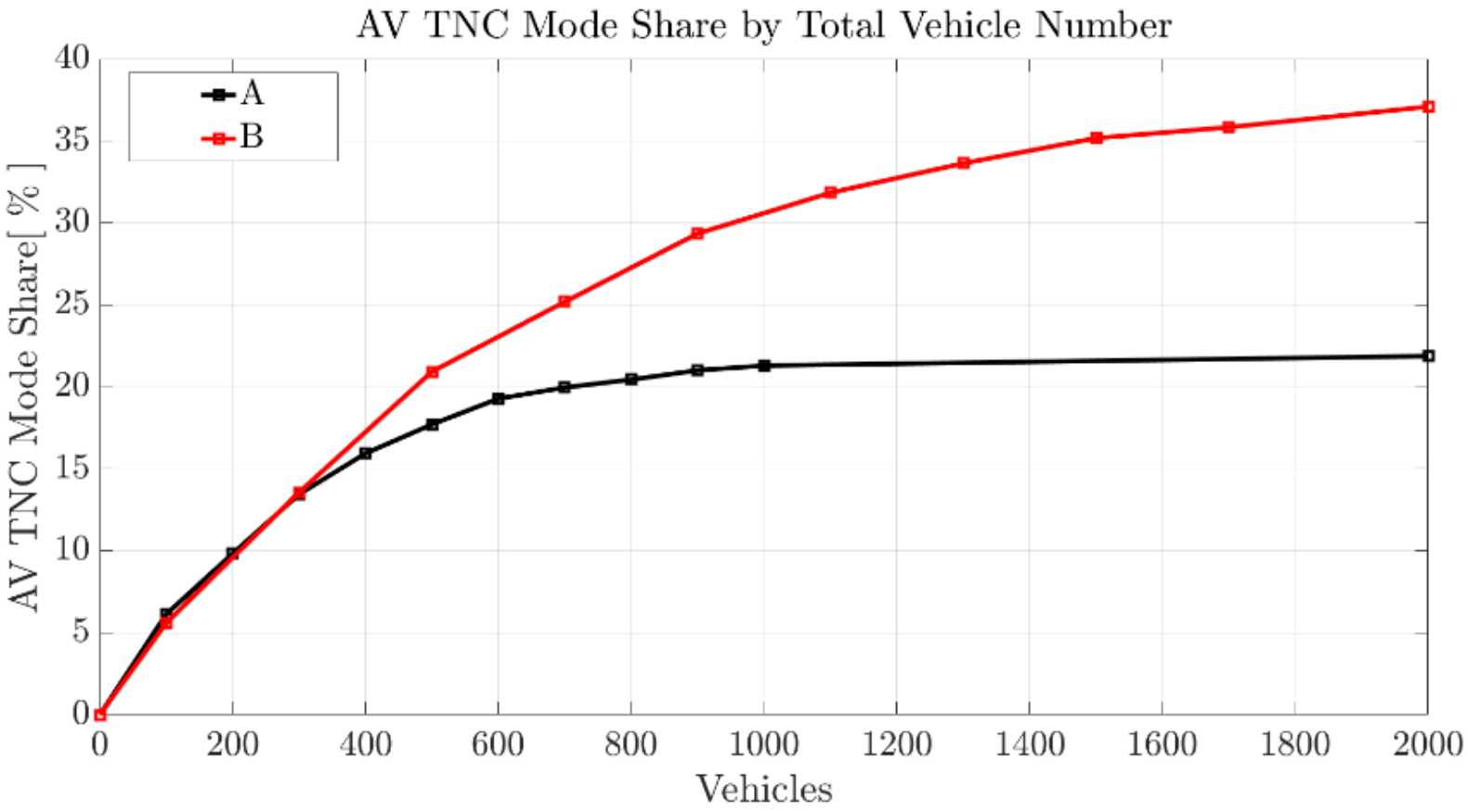
Nested Logit (Private, Shared, PT)

Market Structure

TNC Monopoly + Public Transport

Routing

ClusterStar



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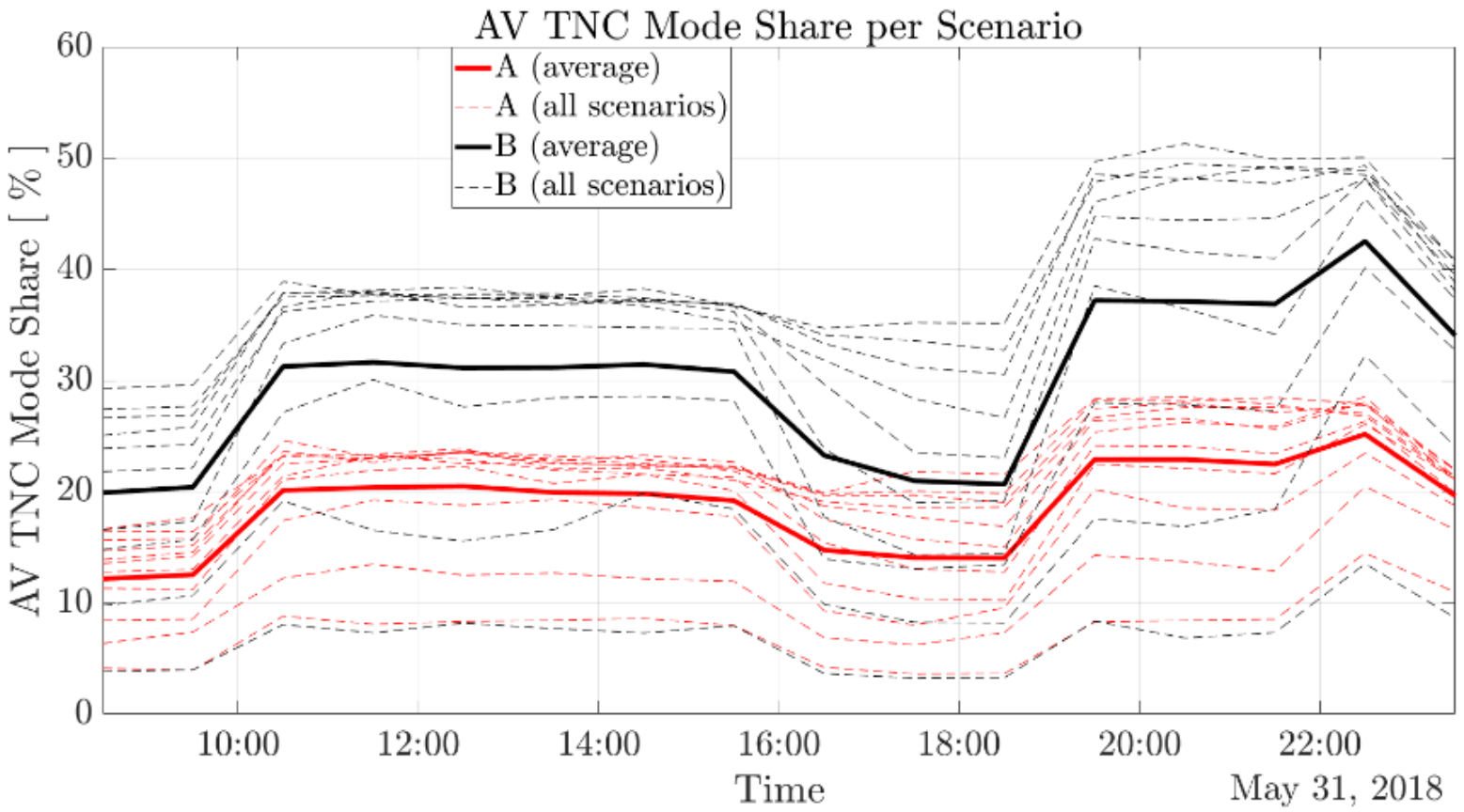

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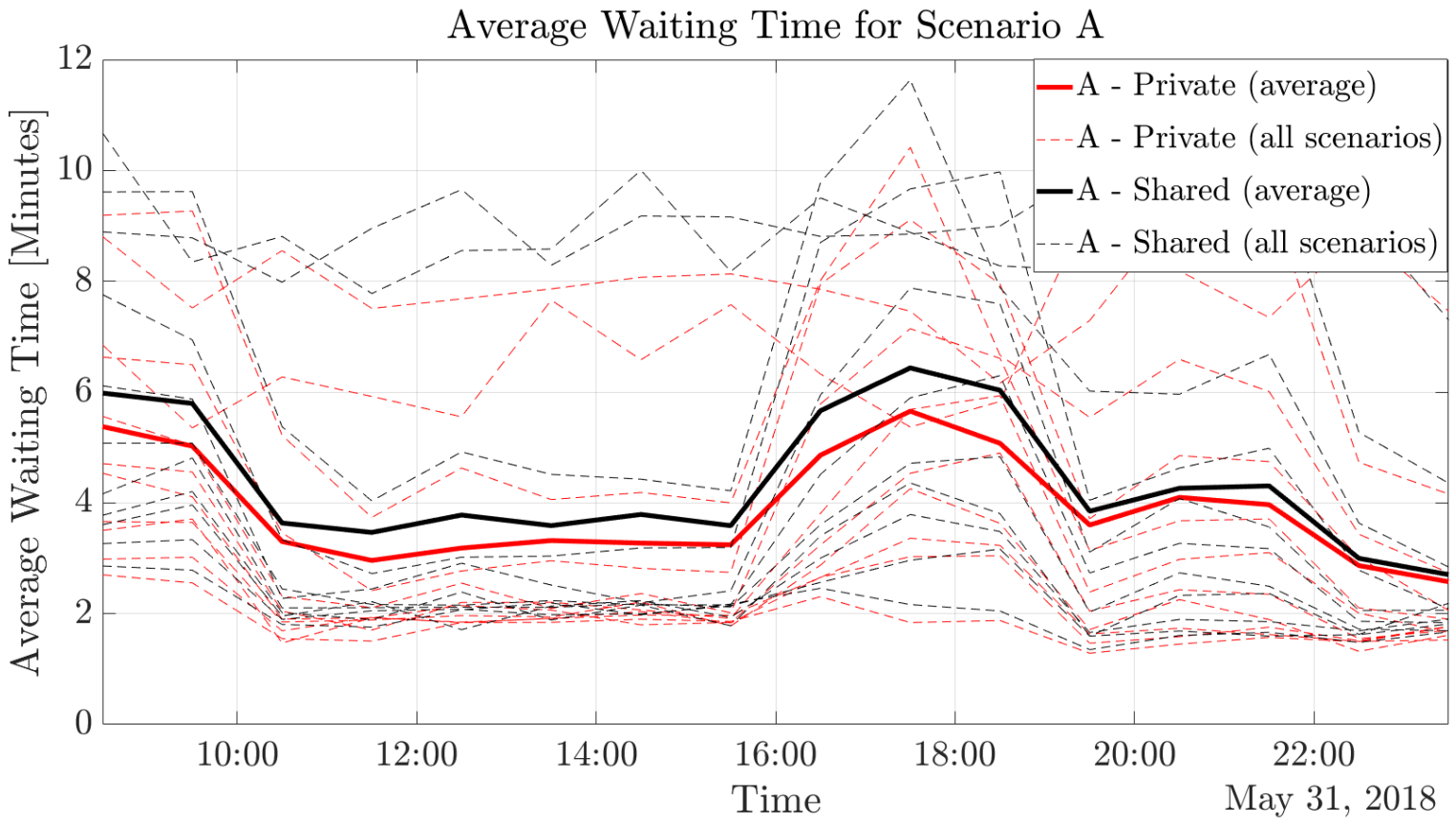

THANK YOU

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