How EV can use DV-Systems (and vice versa)

ecurieaix
RWTH AACHEN

WHO AM I?

Meet DUSK

- Joined EcurieAix in late 2022/23 season
  - Planning in DV
- Continued in 2023/24 season
  - Driver for EV
  - Driversim (Assetto Corsa)
  - Laptime Simulation & VCU
- Continued in 2024/25 season
  - Head of Vehicle Dynamics
  - DV still in my heart

Contact me: xkleindustin@gmail.com

DV-System in EV

Arwo – 29.03.2025

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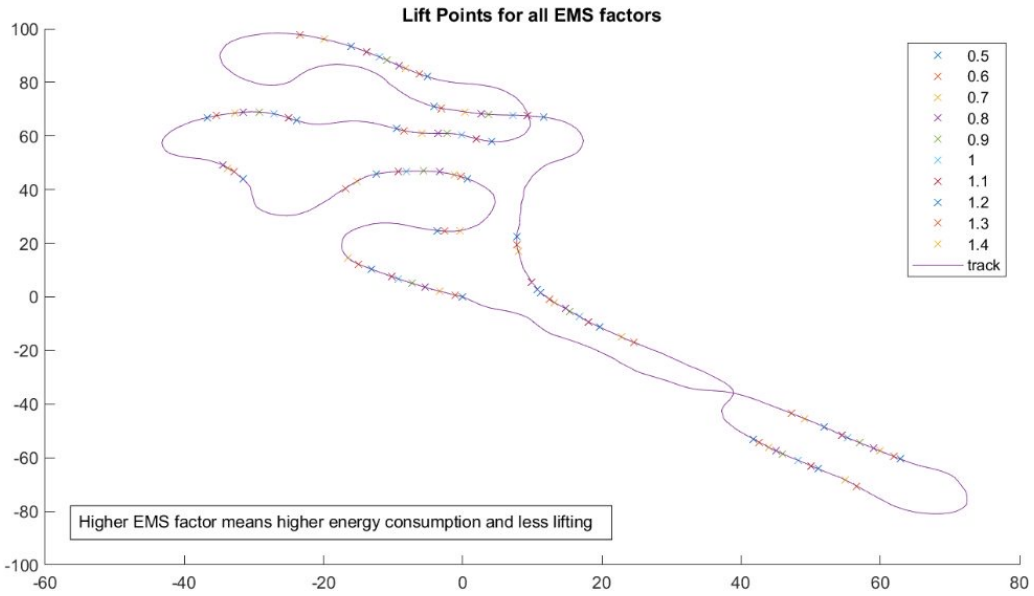
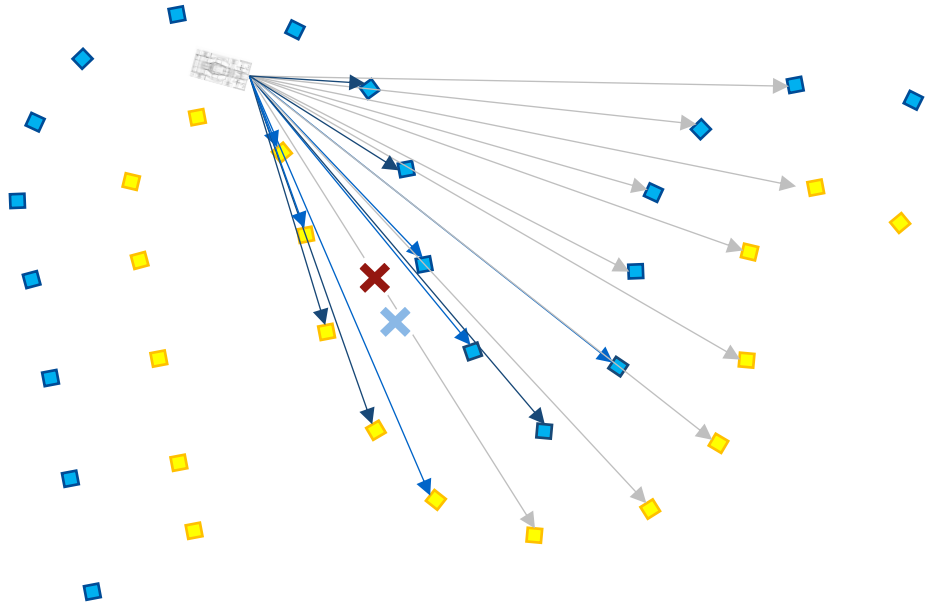
DV-SYSTEMS IN EV

On Track Assistance

- Detect lift points (or other key points on track) for EMS

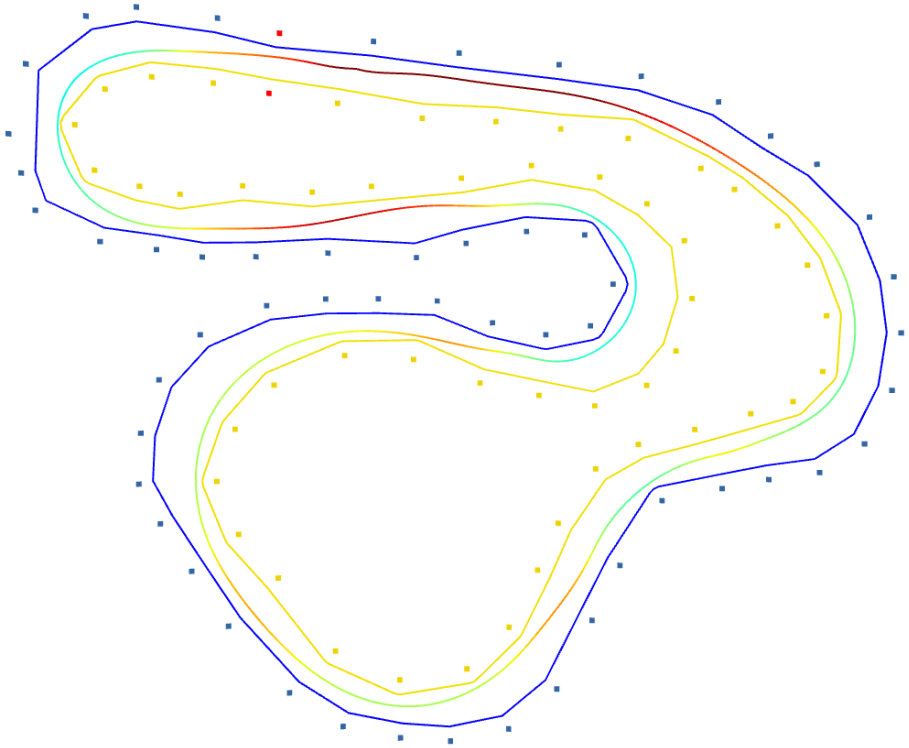




DV-SYSTEMS IN EV

On Track Driver Training

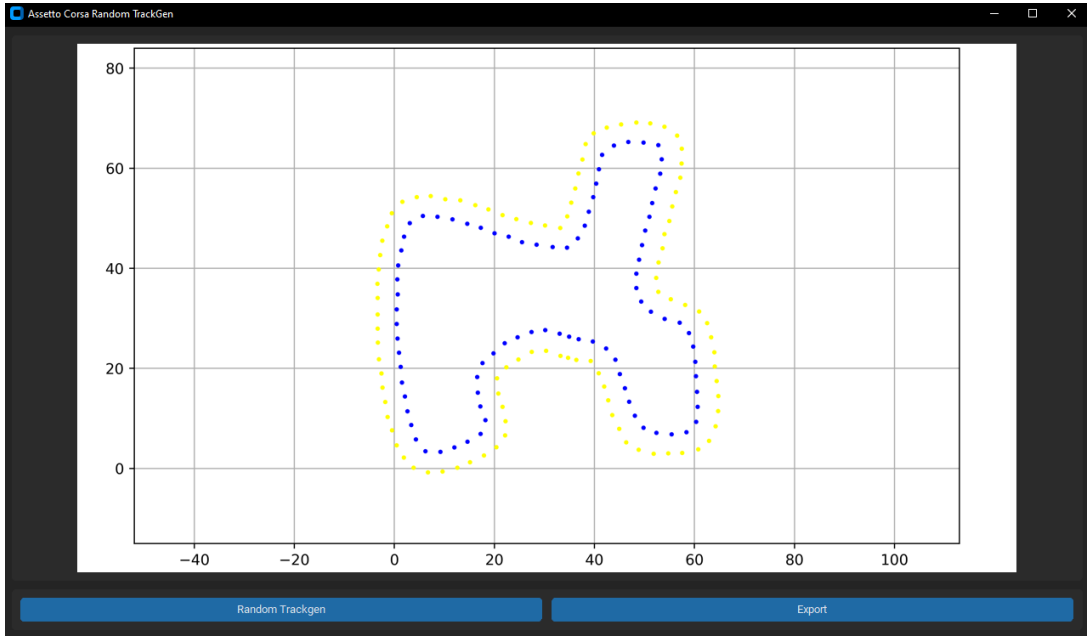
- On Track Driver Training
  - (live) Deviation from optimal trajectory
  - (live) Delta to optimal laptime
  - (live) Delta to last lap
  - Sectors can be freely defined
  - ➢ Immediate Driver Feedback!
  - ➢ Accuracy of ~7ms (KA-RaceIng)



DV-SYSTEMS IN EV

Off Track Driver Training

- Build tracks for Simulator using DV-Tracks



EV-System in DV

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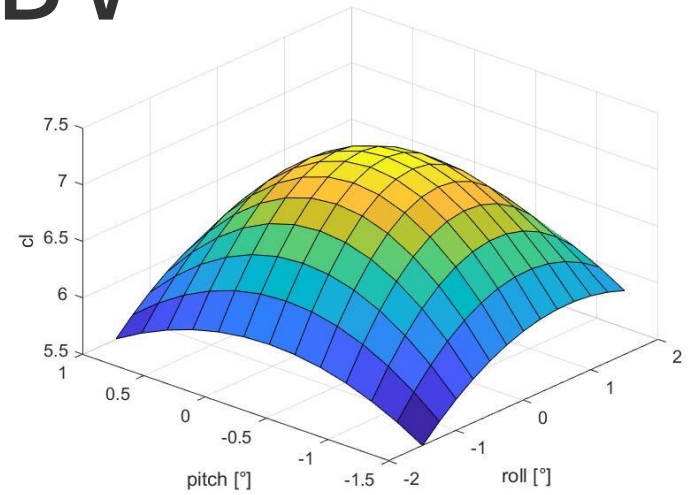
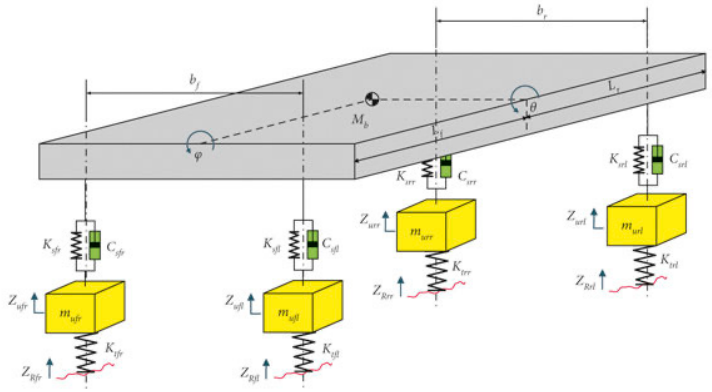
EV-SYSTEMS IN DV

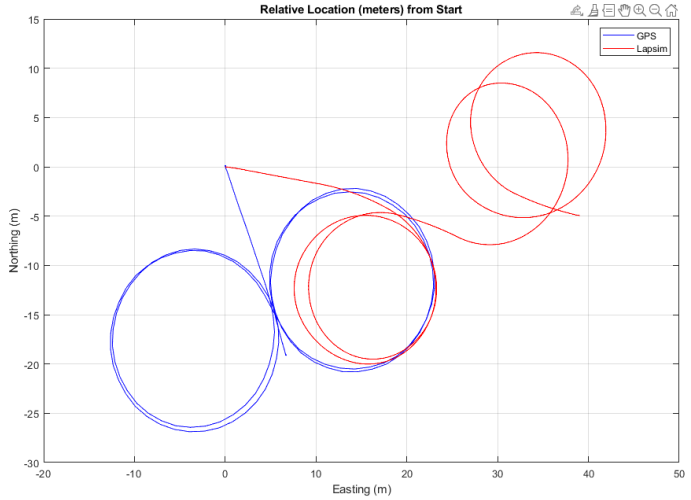
Vehicle Models





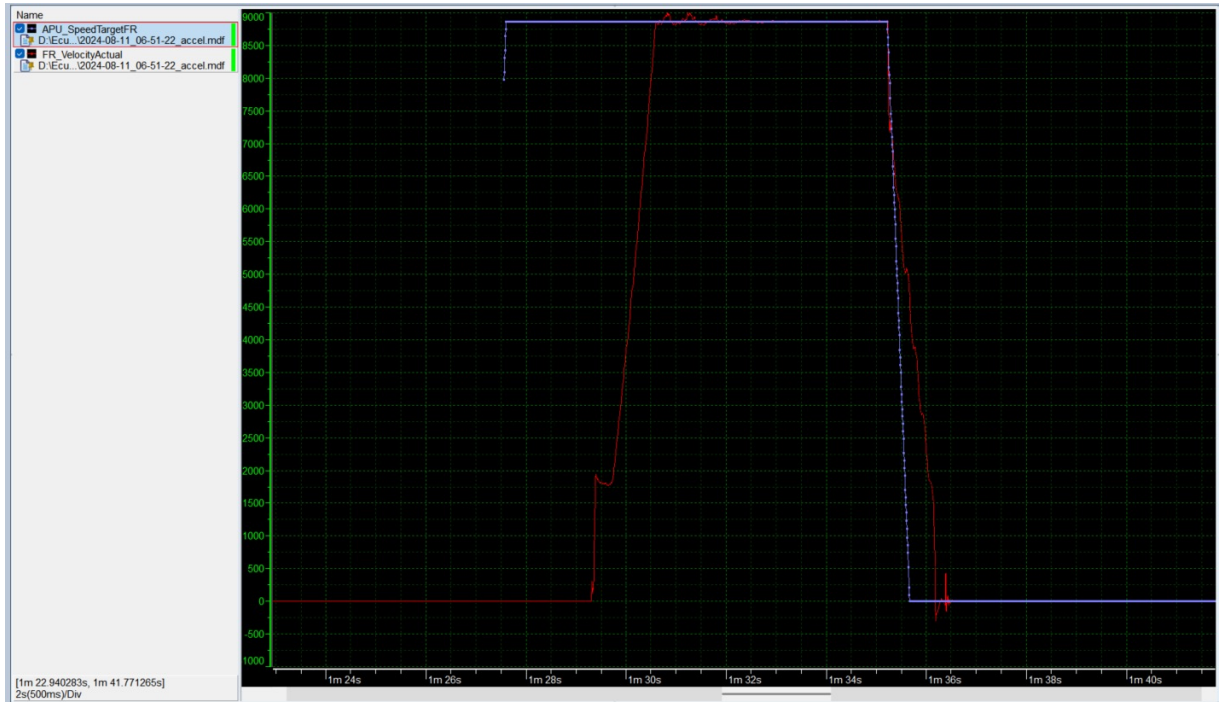
- 7 DOF for normal loads
- Extended two track model
- Validated pacejka parameters
- Aeromaps (body yaw, steering angle, roll, pitch, ride height)
- Dynamic tire radius

➢ Use Lapsim Vehicle Model for State estimation and Control?

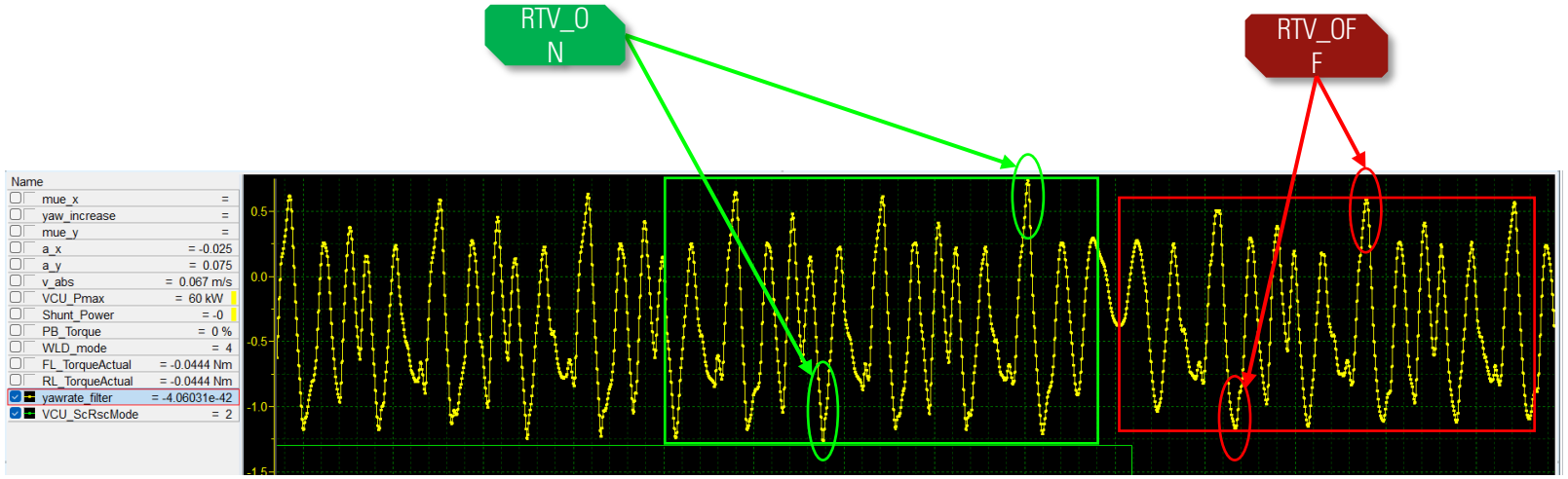


EV-SYSTEMS IN DV

Vehicle Control Unit

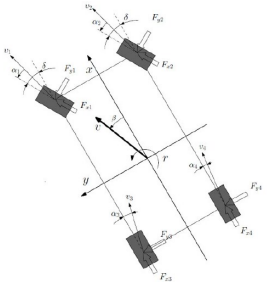


- Use of Control Systems
  - Still in development
  - Acceleration & Skidpad



EV-SYSTEMS IN DV

Trajectory Planning



Vehicle model

MATLAB SIMULINK

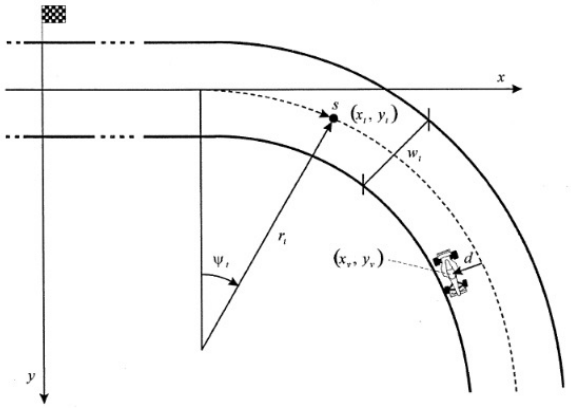
Extended two-track model

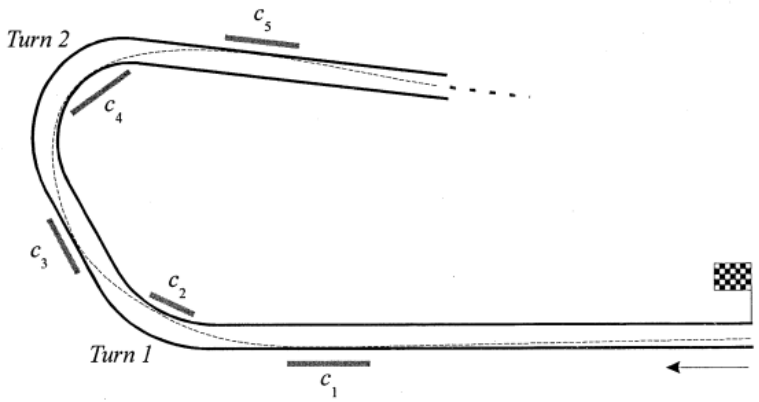
- Trajectory planning
  - Path following or Path optimal

FALCON.m

IPOPT

Numerical optimization of Laptime





[On minimum time vehicle manoeuvring: the theoretical optimal lap, D. Casanova]

What is stopping us?

LIMITATIONS

- Power consumption
  - (2 x 3.6 W (camera) + 20W (LiDaR) + 5W (additional cooling) + 130W (APU)) x 30min = 81.1Wh ⟶ **+ 0.4kg** in cells
- GPS is simpler and already included in IMU
- Planning has to handle slaloms
- DV Packaging

FEEDBACK