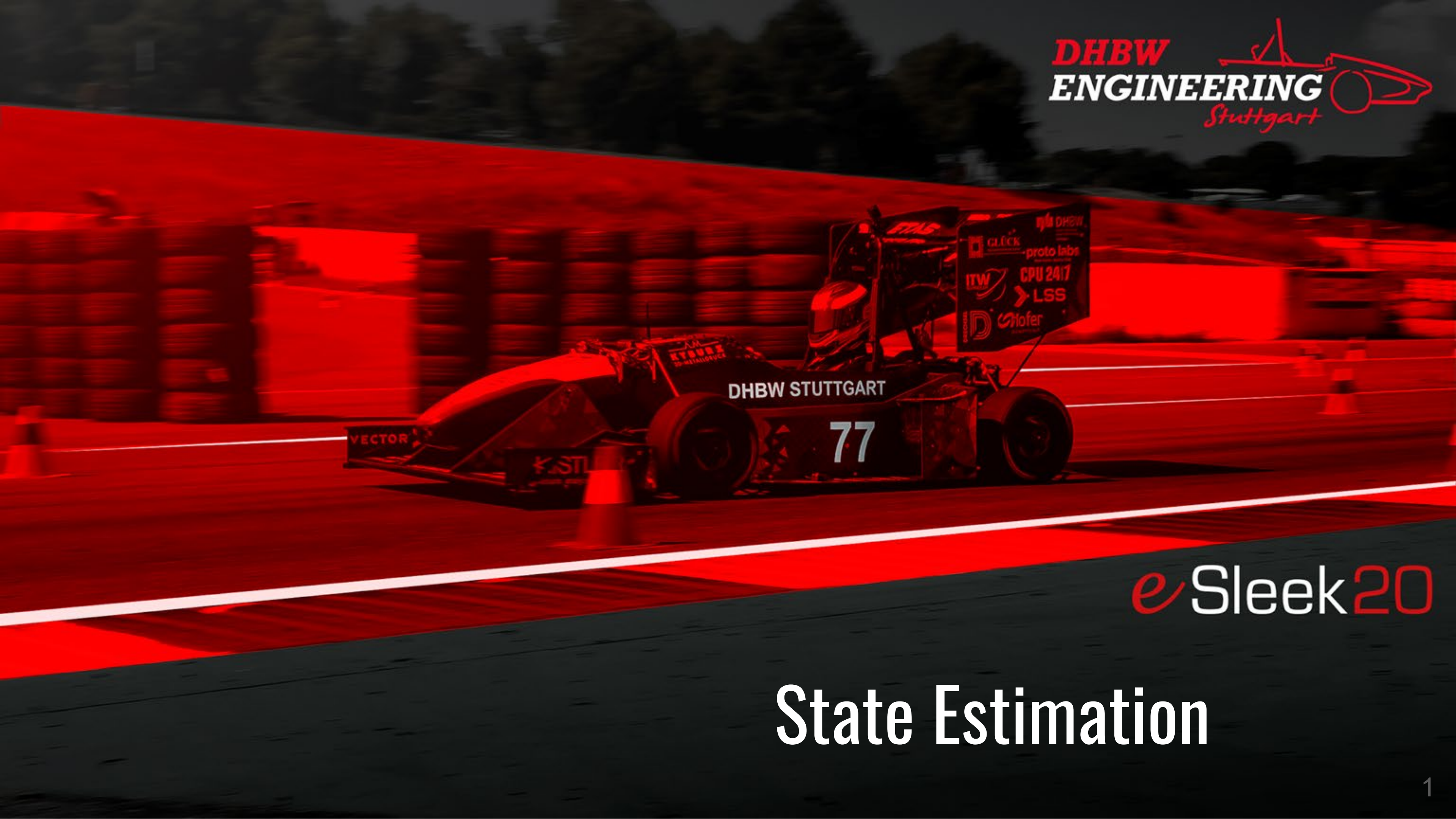
DHBW ENGINEERING Stuttgart



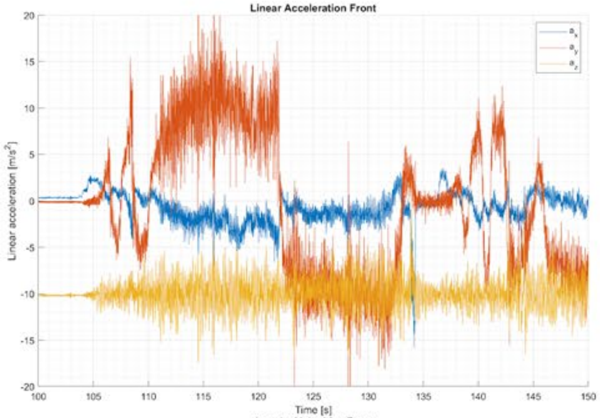
eSleek20

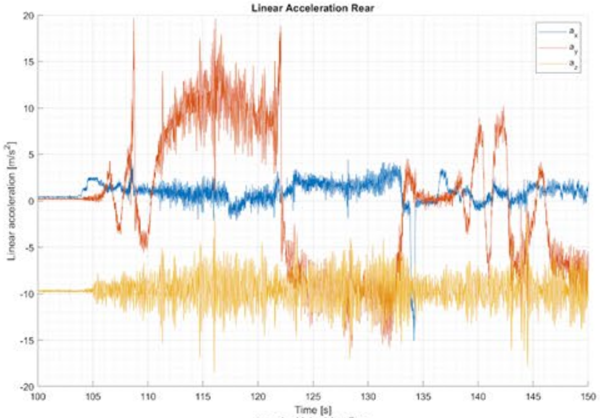
State Estimation

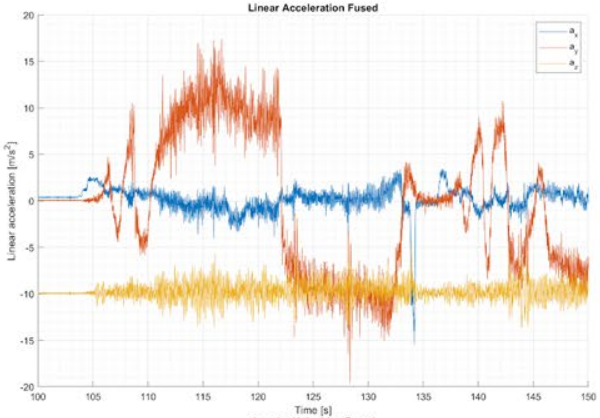
Done

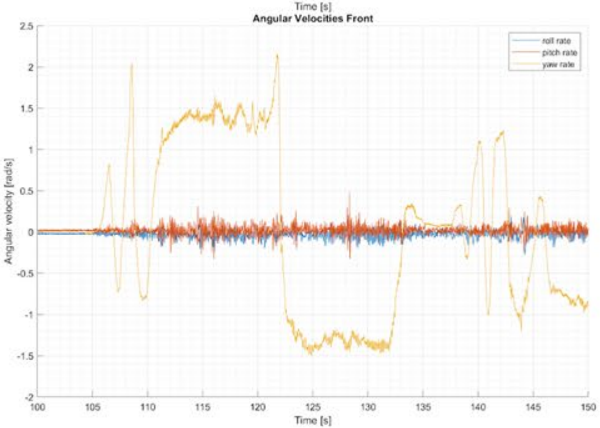
- Implement two generic IMU fusion algorithms
  - Mean-based
  - Maximum likelihood
    - https://doi.org/10.1109/TSP.2016.2560136
  - Work with an arbitrary number of IMUs
    - At least 3 IMUs required for estimation of angular acceleration
  - Identical interface:
    - Measurements for a and omega
    - IMU positions

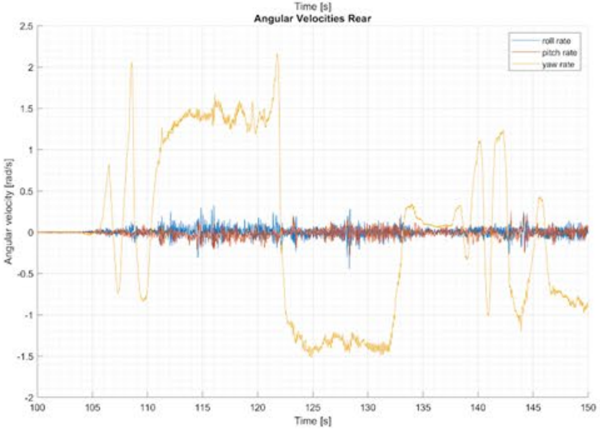
Mean-based with real data

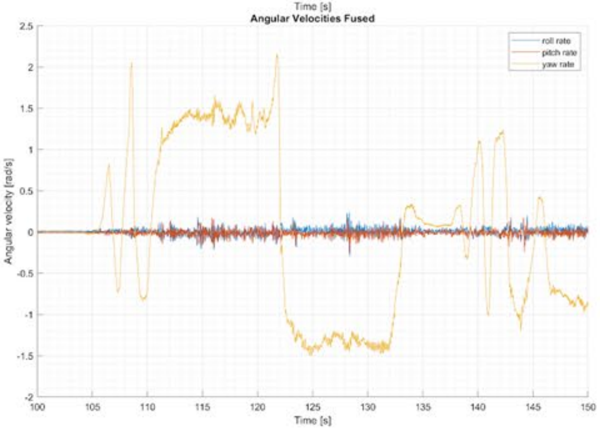




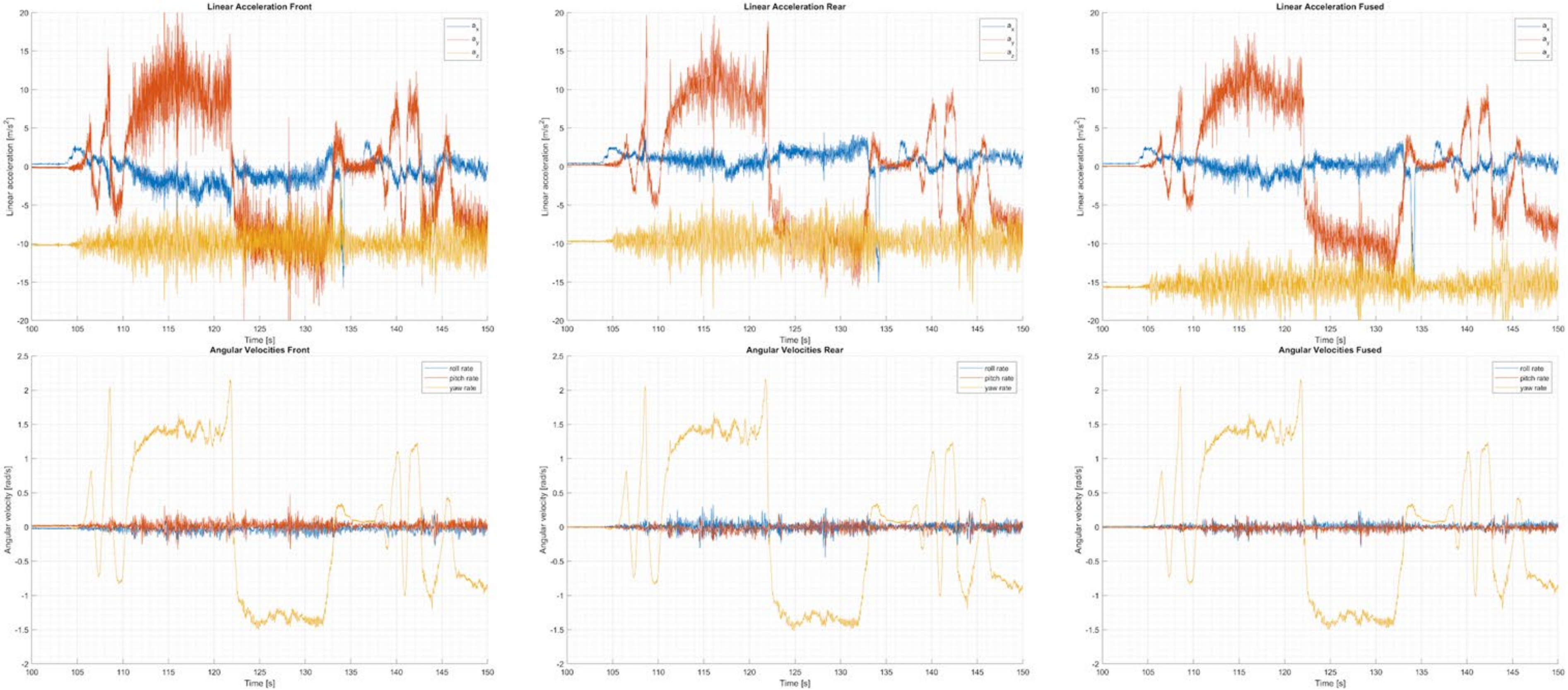




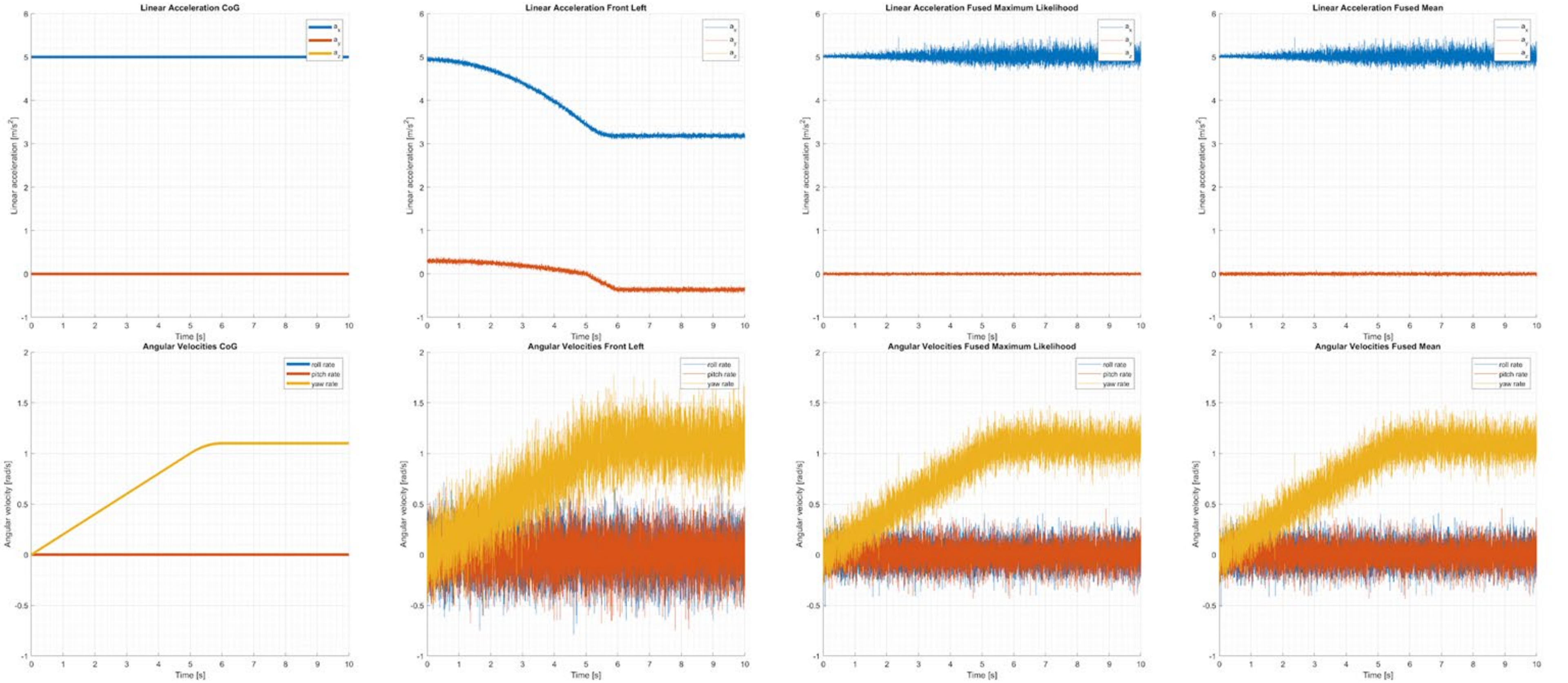




Max. likelihood-based with real data



Both with simulation data



Next steps

- Fix a_z for max. likelihood estimator
- Implement IMU fusion with motion model
  - https://doi.org/10.23919/ICIF.2018.8455269
- Add basic IMU outlier detection
  - Connectivity Check
  - Range
- EKF input switching
- Improve velocity estimation from wheel speeds

Studienarbeit Gliederung

- Introduction (10%)
    - FS + eSleek
    - Problem + Motivation (why a good SE is important)
    - Scope (what will be covered)
- Background (30%)
    - Vehicle Dynamics (basic models)
    - Estimation Algorithms (EKF vs ...)
    - Outlier Detection
- Design (25%)
    - Requirements (flexible, robust, DV support, sensors)
    - Design (Architecture, Preprocessing, EKF, Outlier Detection, IMU Fusion)
- Implementation (Simulink, Matlab, VDC Integration, testing) (15%)
- Evaluation (15%)
    - Results (plots, plots, plots)
    - Discussion (impact of results on eSleek)
- Conclusion (summary, future work) (5%)