

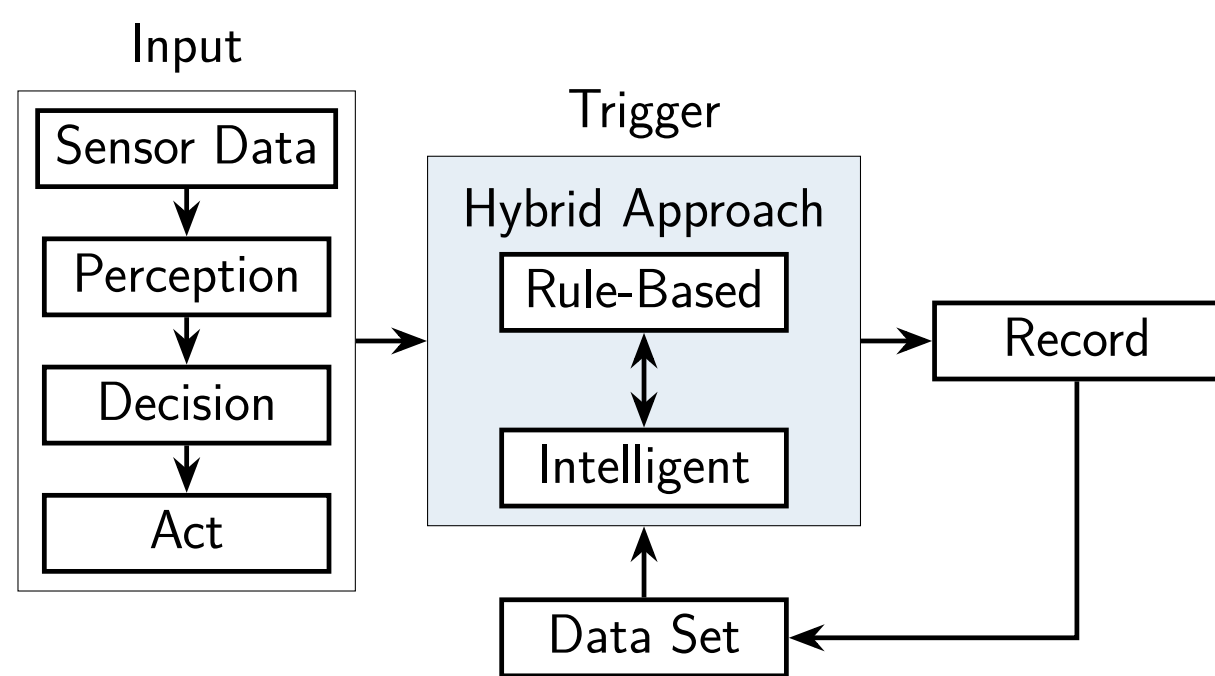
IDA Intelligent Data Recording for Automated Driving

Overview

- Validation of autonomous vehicles
- Statistical proof of being safer than a human would require billions of driven km
- Identifying relevant/important scenarios can help reducing required validation resources
- Using rule-based and intelligent trigger logic

Concept

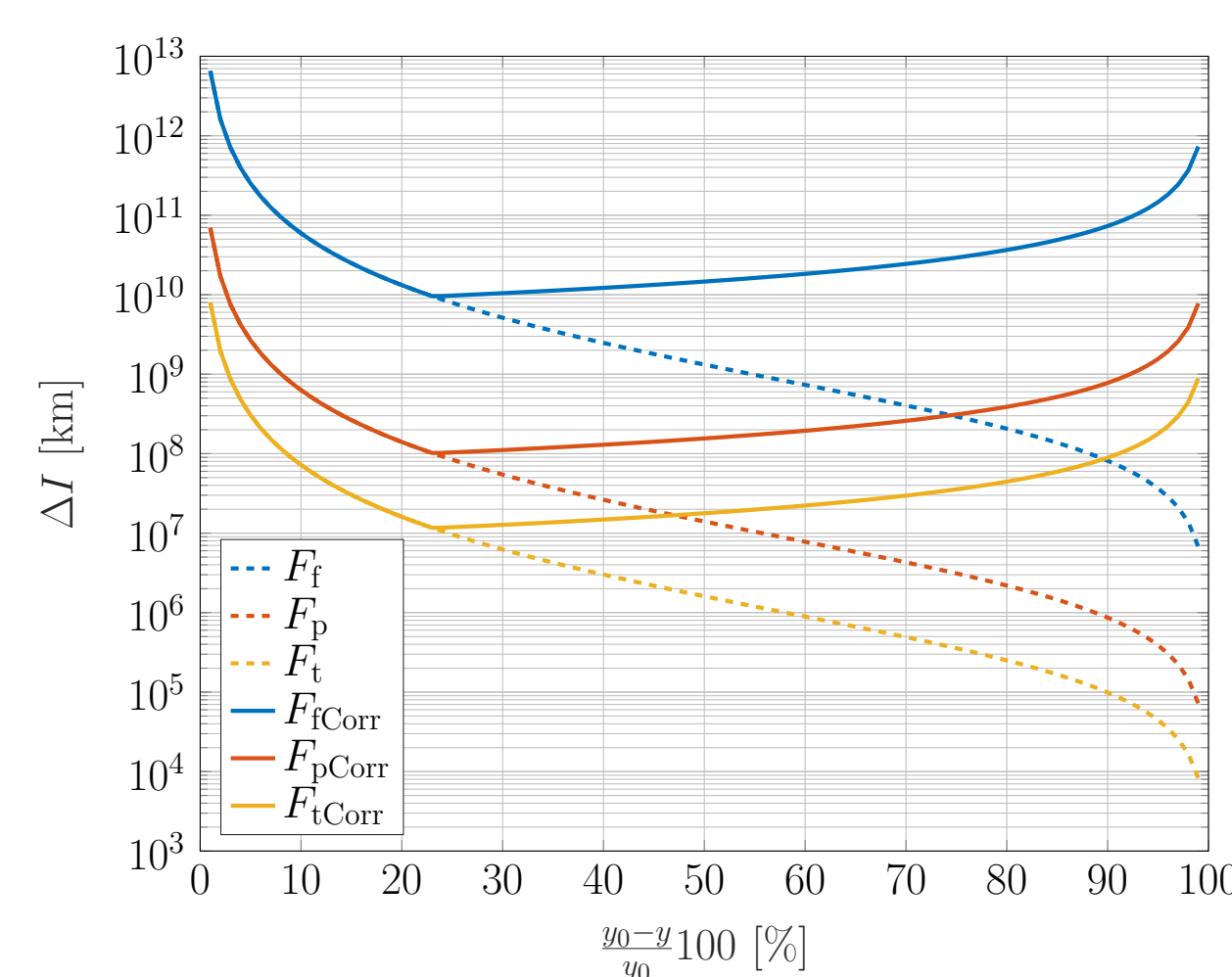
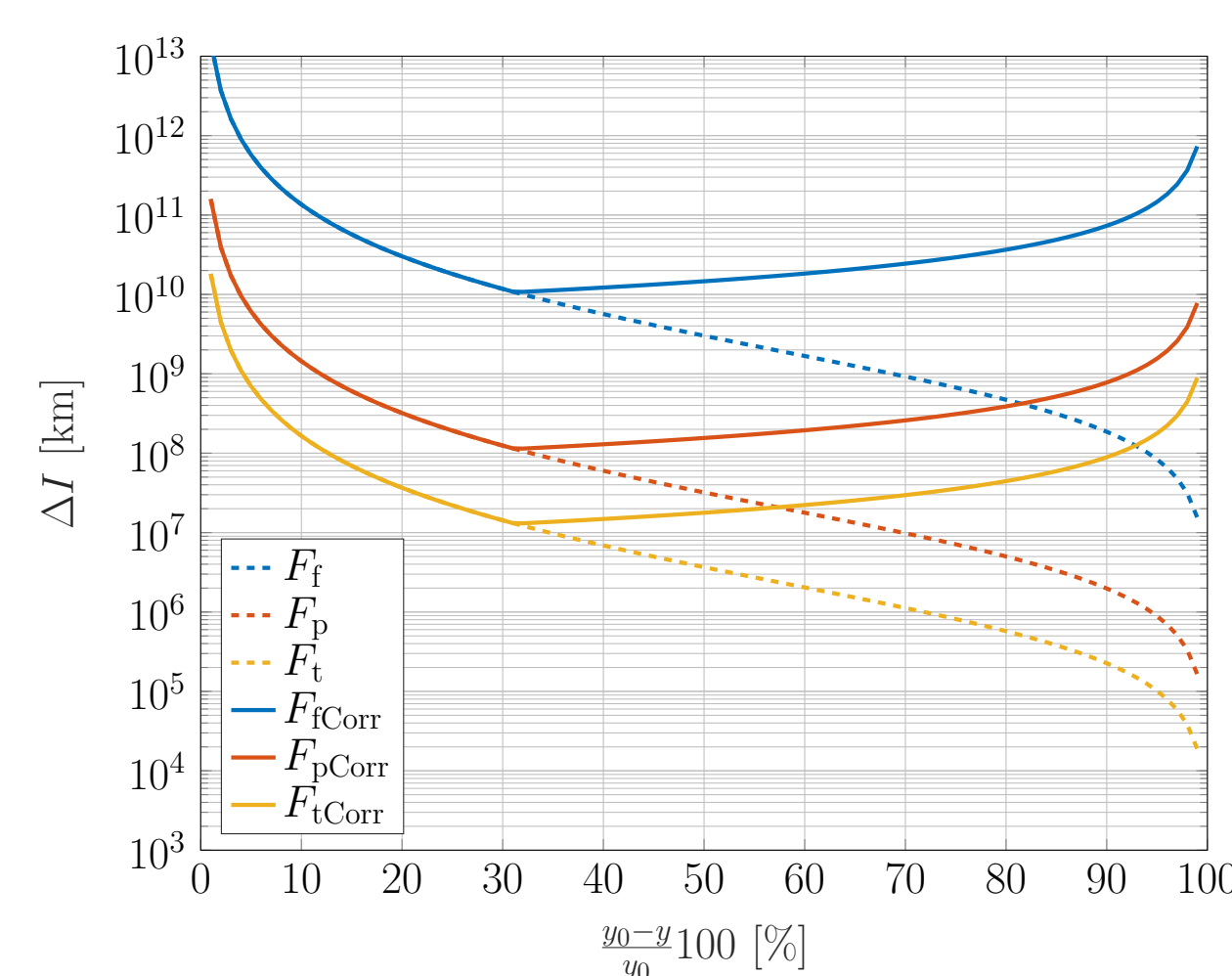
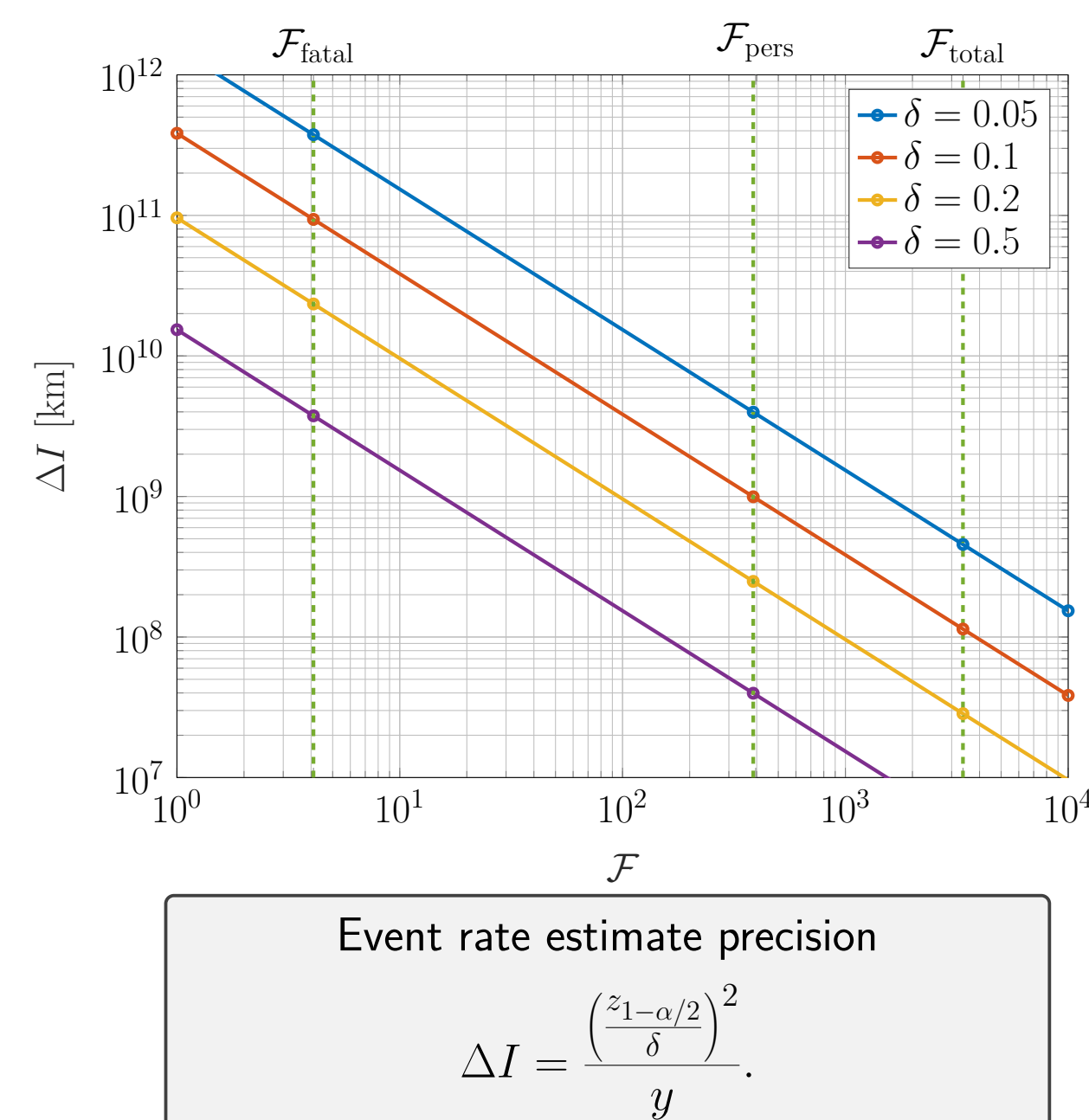
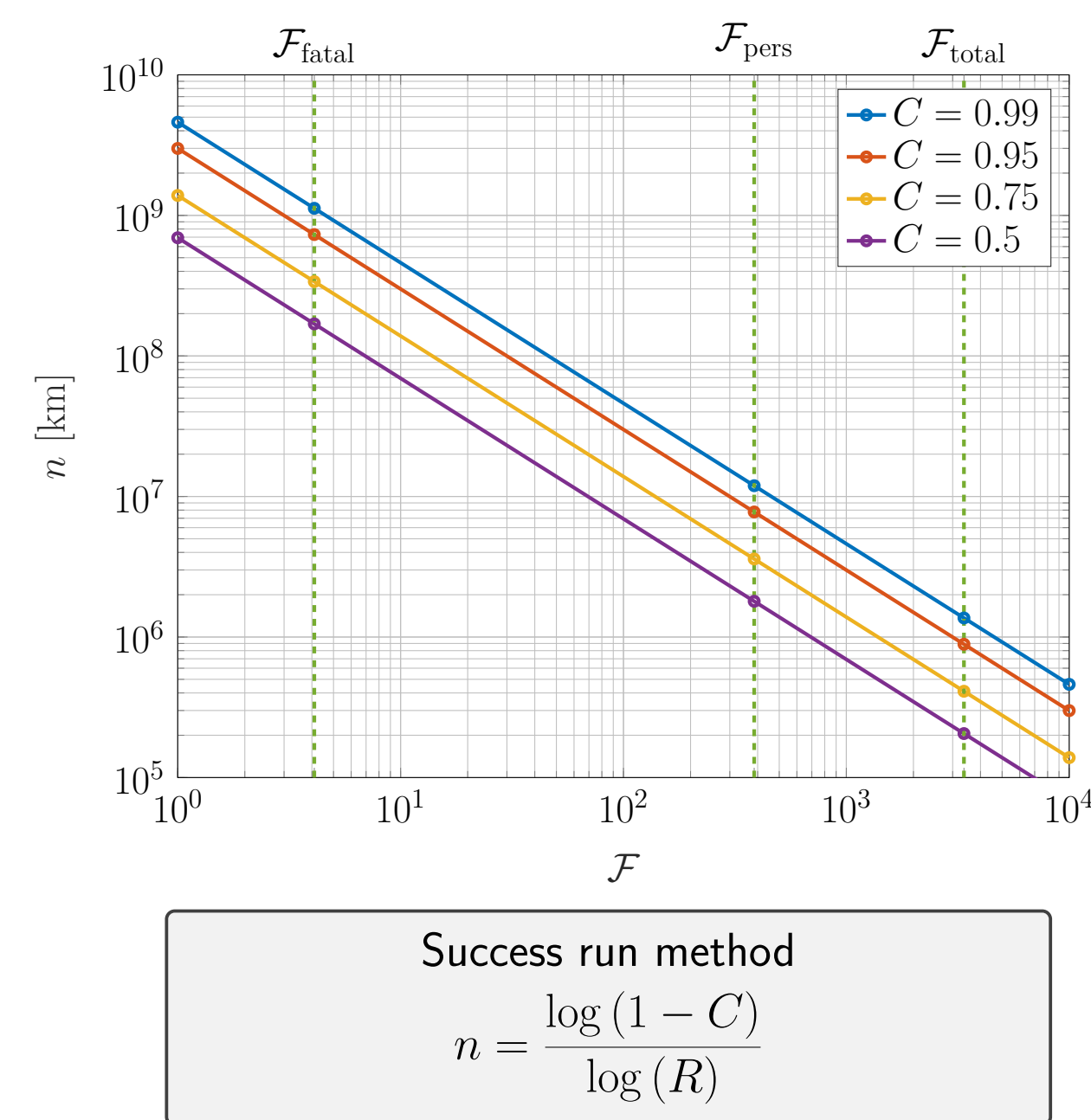
- Identify relevant/important scenarios



- Rule-based triggers
 - Criticality, dynamics
 - Driver vs. autonomous vehicle
 - Fusion discrepancies, errors
 - Categories (weather, light, ...)
- Intelligent triggers
 - Measure for relevance/novelty of a scenario
 - Clustering, dimensionality reduction, outlier detection

Results – How many kilometers?

- Statistical proof of being safer than a human [1]
- German traffic statistics [2]

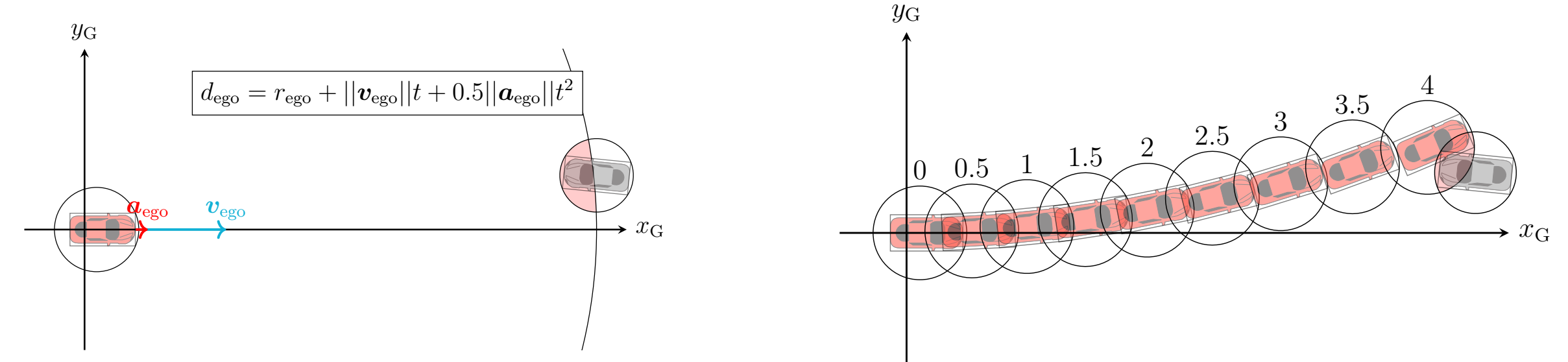


→ Pure driving of required kilometers is infeasible

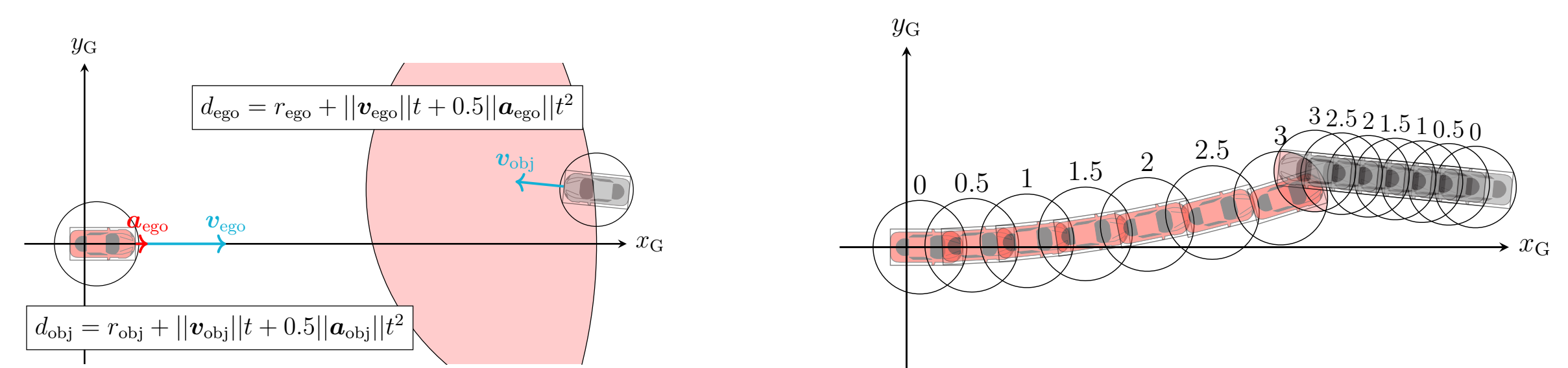
Results – Criticality and Dynamics Triggers

Criticality Trigger: TTC and THW based on trajectories

- THW



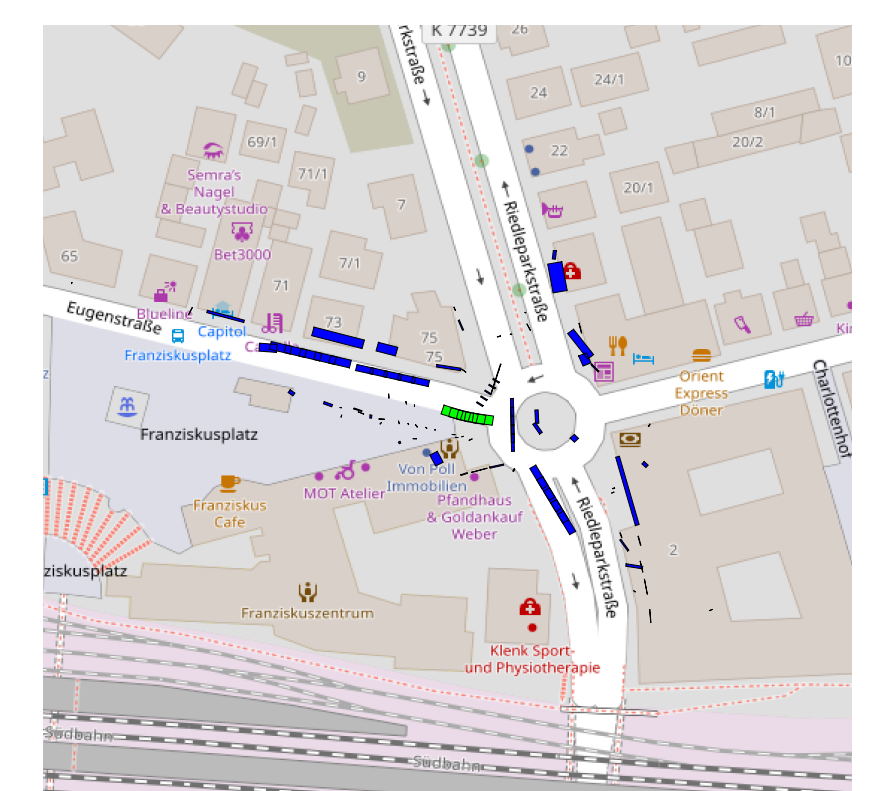
- TTC



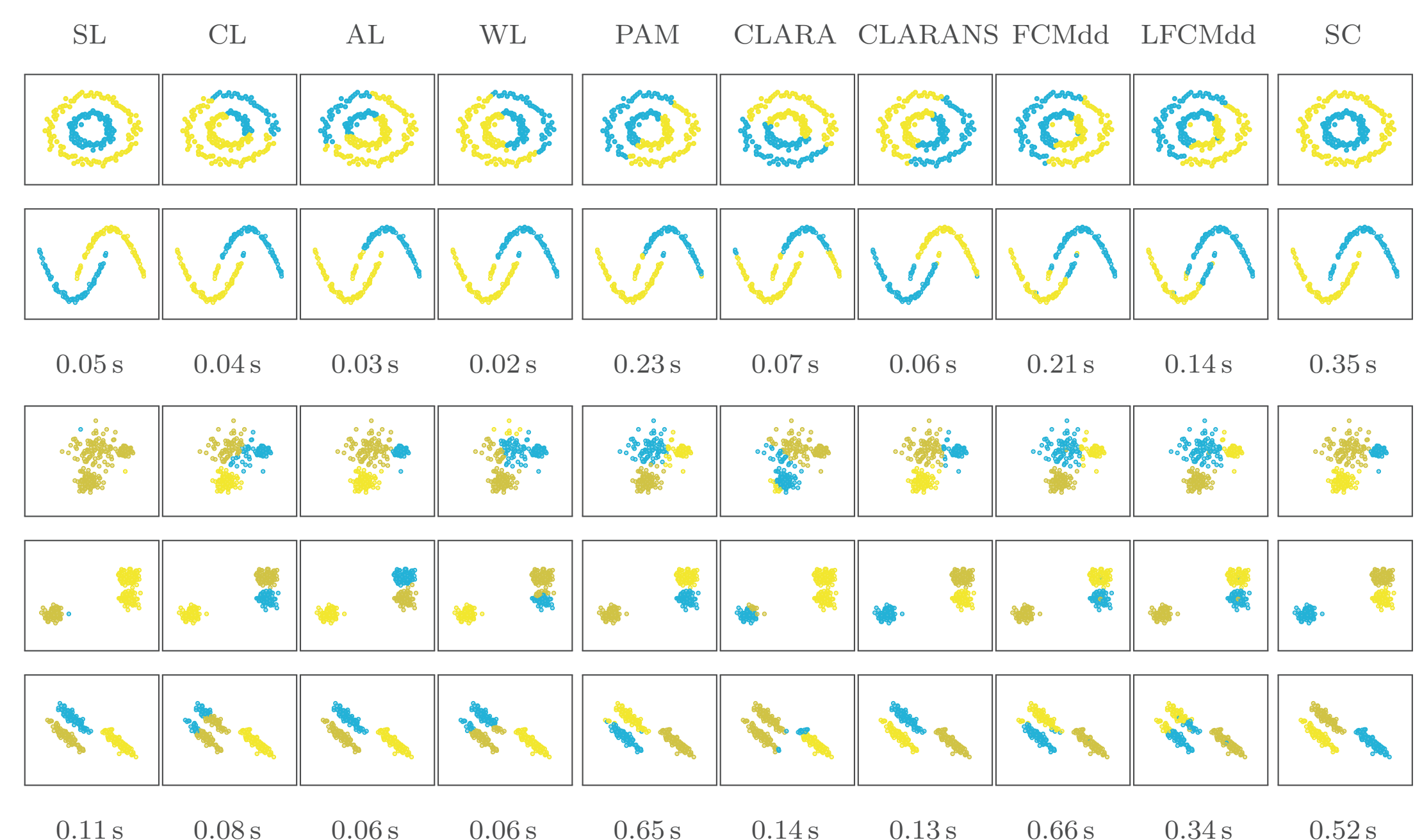
Dynamic Trigger: Acceleration

- Decoupled a_x and a_y
- Conditions and limits
 - $|a_x| \geq a_{x,lim}$, $a_{x,lim} = 0.6g$ [3]
 - $|a_y| \geq a_{y,lim}$, $a_{y,lim} = 0.7g$ [3]

Application: Both Triggers



Clustering Methods



Outlook

- Further rule-based triggers
- Dimensionality reduction
- Clustering techniques

References

- [1] Nidhi Kalra and Susan M. Paddock. Driving to safety: How many miles of driving would it take to demonstrate autonomous vehicle reliability? *Transportation Research Part A: Policy and Practice*, 94:182 – 193, 2016.
- [2] Statistisches Bundesamt. Verkehrsunfälle 2016. Technical report, Statistisches Bundesamt, 2017.
- [3] T. A. Dingus, S.G. Klauer, et al. The 100-car naturalistic driving study, phase ii – results of the 100-car field experiment. resreport DOT HS 810 593, National Highway Traffic Safety Administration, 2006.