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OPENPASS

SC WORKSHOP

03.12.2019

TUAN DUONG QUANG



AGENDA



12:00 – 13:00 Lunch

13:00 – 13:15 Get together

13:15 – 13:30 Review of the roadmap (Tuan)

13:30 – 14:30 Use Cases of PCM (Jan)

14:30 – 14:45 Break

14:45 – 16:15 Prioritization and release planning of the remaining high-level targets (all)

16:15 – 16:30 How to write good user stories (Tuan)

16:30 – 16:45 Renaming openPASS (all)

16:45 – 17:00 Next workshop and further steps

USE CASES OF PCM

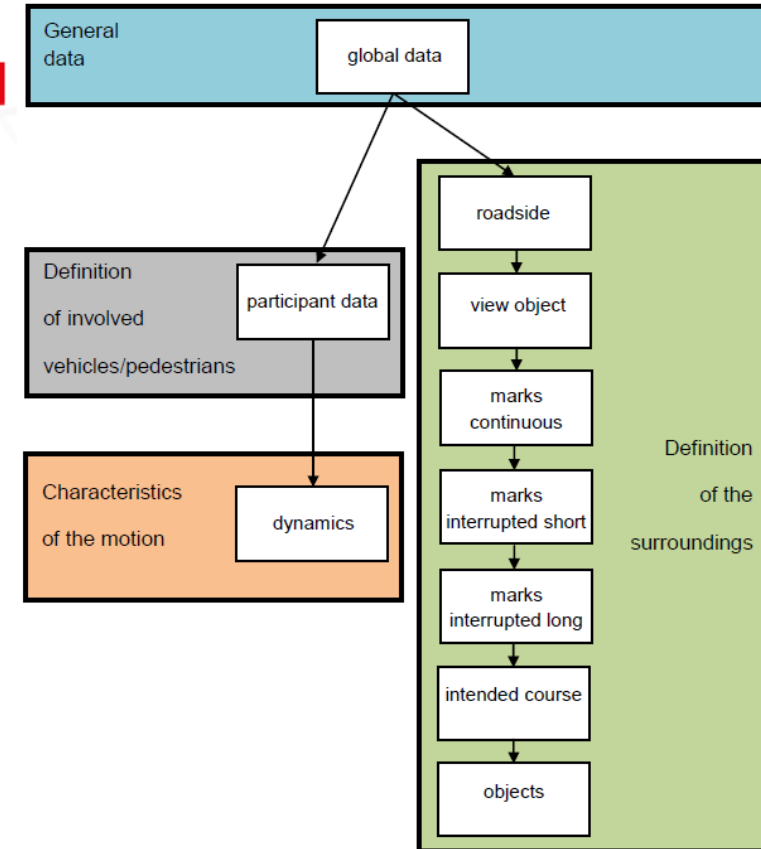
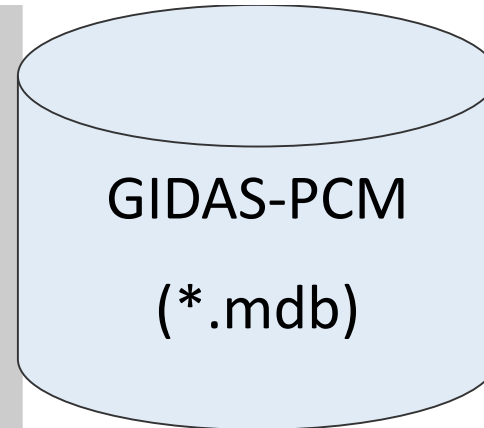
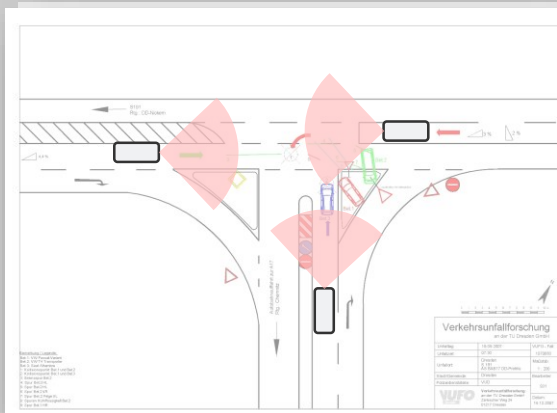
OPENPASS

PCM SIMULATION WITH OPENPASS

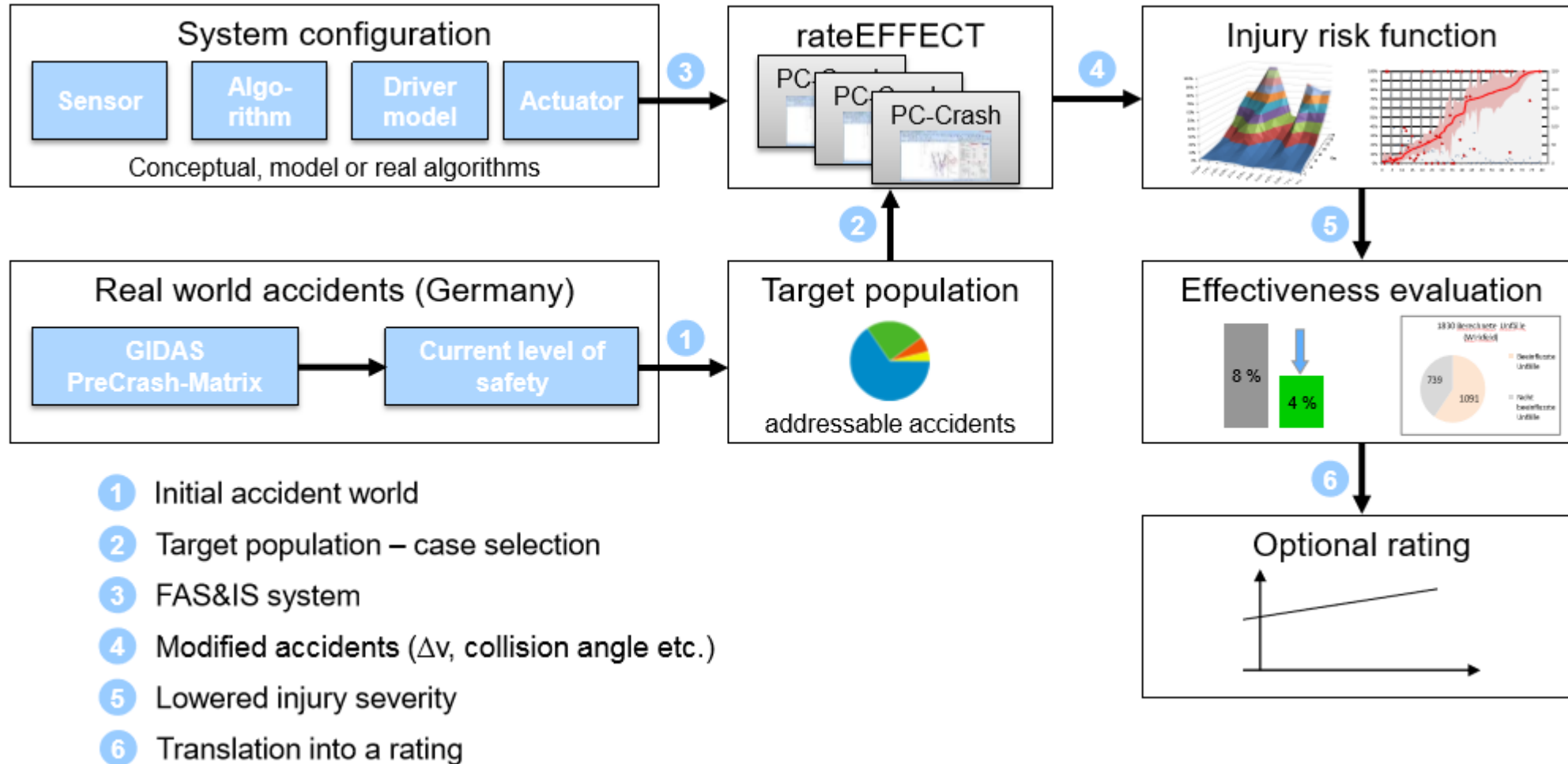


PCM DATA FORMAT

GIDAS sketches/
reconstruction



COMPARISON WITH RATEEFFECT



Source: https://bast.opus.hbz-nrw.de/opus45-bast/frontdoor/deliver/index/docId/672/file/33_Wille_rateeffect.pdf

OPENPASS SYSTEMCONFIG.XML & GUI/EDITOR



openPASS 0.5

New System Load System Save System Save Screenshot

openPASS

PCM-Simulation
PCM-Evaluation
System

EgoSensor		..	+	-
100	/ 0	/ 10	/ 0	
EgoPositionX				
EgoPositionY				
EgoVelocityX [m/s]				
EgoVelocityY [m/s]				
EgoVelocityAbsolute [m/s]				
EgoAccelerationX [m/s^2]				
EgoAccelerationY [m/s^2]				
EgoYawAngle [rad]				
FrictionCoeff [1]				

Init_Agent		..	+	-
200	/ 0	/ 0	/ 0	
Trajectory				
Weight				
Wheelbase				
DistanceFrontAxleToCOG				
Width [m]				
Distance to COG from Leading Edge [m]				

Algorithm_RouteControl		..	+	-
10	/ 0	/ 10	/ 0	
Driver aggressiveness	1,000			
Max. engine power [W]	100000,0			
Min. brake torque [Nm]	-10000,0			
Kp of the pedals PID control	-0,500			
Ki of the pedals PID control	-0,400			
Kd of the pedals PID control	0,000			
Kp of the steering PID control	-18,000			
Ki of the steering PID control	-0,600			
Kd of the steering PID control	0,000			
+ - Agent's x-coordinate [m]				
+ - Agent's y-coordinate [m]				
+ - Agent's pointing direction [rad]				
+ - Agent's longitudinal velocity [m/s]				
+ - Desired trajectory				
+ - Total mass [kg]				
Throttle pedal				
Brake pedal				
Steering angle [rad]				

Algorithm_DriverReaction		..	+	-
20	/ 0	/ 10	/ 0	
Probability for left evasion	0,000			
Probability for right evasion	0,000			
Probability for braking	0,000			
Probability for sleeping	100,000			
Reaction time [s]	0,000			
Brake intensity	0,200			
Steering derivative [degree/s]	15,000			
+ - Throttle pedal				
+ - Brake pedal				
+ - Steering angle [rad]				
+ - Collision warning				
Modified throttle pedal				
Modified brake pedal				
Modified steering angle				

Sensor_Collision		..	+	-
200	/ 0	/ 10	/ 0	
penetrationTime_ms [ms]	30			
CollisionOccured				

Algorithm_Selector		..	+	-
40	/ 0	/ 10	/ 0	
+ - Driver Throttle Pedal				
+ - Driver Brake Pedal				
+ - Driver Steering Angle [rad]				
+ - Cpa active				
+ - Cpa Brake Pedal				
+ - Lane Assist active				
+ - Lane Assist BrakeSuperpose				
+ - Evasive Steering Assist active				
+ - Evasive Steering Angle [rad]				
+ - collisionOccured				
Resulting Throttle Pedal				
Resulting Brake Pedal				
Resulting Steering Angle				
Resulting BrakeSuperpose				

Dynamics_Collision		..	+	-
1	/ 0	/ 10	/ 0	
+ - CollisionOccured				

Dynamics_TwoTrack		..	+	-
3	/ 0	/ 10	/ 0	
Radius of the tires [m]	0,300			
Tire's max. mu	1,200			
Tire's slide mu	1,000			
Tire's slip at max. mu	0,100			
Engine power [W]	100000,0			
Max. brake torque [Nm]	-10000,0			
+ - Throttle				
+ - Brake				
+ - Av. front wheel angle				
+ - Superposed brake				
+ - Vertical force on tires				
Inertia force vector				

Dynamics_Chassis		..	+	-
2	/ 0	/ 10	/ 0	
Spring coefficient	1200000			
Damper coefficient	12000,00			
+ - InertiaForce [N]				
VerticalForce [N]				

Actions

- Dynamics_Chassis
- Dynamics_Collision
- Dynamics_CopyTrajectory
- Dynamics_TwoTrack

Algorithms

- Algorithm_BrakeAssist
- Algorithm_CollisionPrediction
- Algorithm_Cpa
- Algorithm_DriverReaction
- Algorithm_EvasiveSteering
- Algorithm_LaneAssist
- Algorithm_MPC
- Algorithm_RouteControl
- Algorithm_Selector
- Algorithm_TimeToBrake
- Algorithm_TimeToSteer
- Algorithm_TrajectoryFollower

Sensors

- EgoSensor
- Init_Agent
- Sensor_CameraAgent
- Sensor_CameraMarks
- Sensor_Collision
- Sensor_Radar

Components

„PCM SIM“ PLUG-IN: GENERATE V0.5 CONFIGS FROM PCM DATABASE



The screenshot displays the openPASS 0.5 software interface. On the left, a sidebar lists simulation cases from 2000000 to 2000010, categorized under PCM-Simulation, PCM-Evaluation, and System. The main window is divided into several sections: Input (PCM Database selected, PCM File: case.mdb), Output (Result Folder: ../MyResultFolder, Log Level: Error), System Configuration Files (Car1, Car2, and Other fields with file paths), and Variation (Random Seed, Trajectory Shifting, and Velocity Scaling options). Three callout boxes provide additional context: 'Re-load existing config xmls (no need for MDB)' points to the Input section; 'Select agent configurations' points to the System Configuration Files section; and a larger box at the bottom lists variation options: 'Variation of trajectory coordinates', 'Variation of speed', 'Select random seed (const or case specific)', and 'Define number of variations'.

Load cases from MDB for re-simulation

Re-load existing config xmls (no need for MDB)

Select agent configurations

Variation of trajectory coordinates
Variation of speed
Select random seed (const or case specific)
Define number of variations

VOLKSWAGEN

AKTIENGESELLSCHAFT

KONZERNFORSCHUNG

OPENPASS OSI USE CASE:

HOW TO PERFORM A PCM SIMULATION?

PERFORMING A PCM SIMULATION WITHIN THE OSI USE CASE

–HOW TO SETUP THE CONFIGS

- define 2 agent profiles (ego and opponent, no traffic)
- export PCM trajectories to required XML format
- use trajectory follower for ego and opponent (**note:**

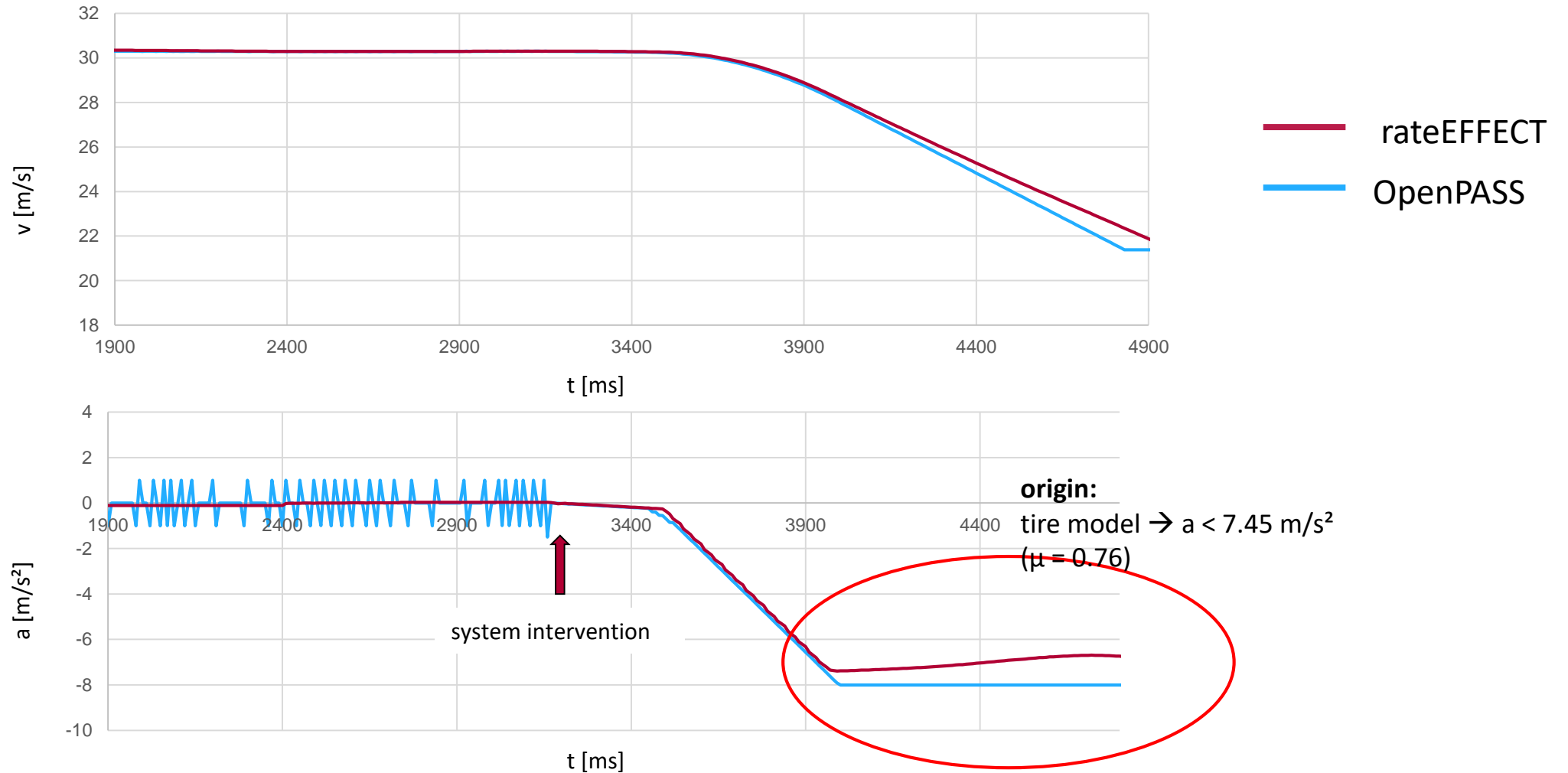
```
<VehicleProfile Name="EgoVehicle">
  <Model Name="Golf_template1"/>
  <Components>
    <Component Type="AEB">
      <Profiles>
        <Profile Name="AebOSI" Probability="1.0" />
      </Profiles>
      <SensorLinks>
        <SensorLink SensorId="0" InputId="Camera"/>
        <SensorLink SensorId="1" InputId="Camera"/>
      </SensorLinks>
    </Component>
    <Component Type="Dynamics_TrajectoryFollower">
      <Profiles>
        <Profile Name="EgoTrajectoryFollower" Probability="1.0" />
      </Profiles>
    </Component>
  </Components>
```

- use driver models with $v = 0$, i.e. drivers decelerate at the end of the trajectory
- incorporate ADAS into ego (so far, only AEB)
- scenery: so far huge 2000 m x 2000 m area

```
<DriverProfiles>
  <DriverProfile Name="EgoDriver">
    <String Key="Type" Value="AlgorithmAgentFollowingDriverModel"/>
    <String Key="AlgorithmLateralModule" Value="Algorithm_LateralAfdm"/>
    <String Key="AlgorithmLongitudinalModule" Value="Algorithm_LongitudinalAfdm"/>
    <Double Key="VelocityWish" Value="0.0"/>
    <Double Key="MaxDeceleration" Value="8.0"/>
  </DriverProfile>
  <DriverProfile Name="Regular">
    <String Key="Type" Value="AlgorithmAgentFollowingDriverModel"/>
    <String Key="AlgorithmLateralModule" Value="Algorithm_LateralAfdm"/>
    <String Key="AlgorithmLongitudinalModule" Value="Algorithm_LongitudinalAfdm"/>
    <Double Key="VelocityWish" Value="0.0"/>
    <Double Key="MaxDeceleration" Value="8.0"/>
  </DriverProfile>
</DriverProfiles>
```

PERFORMING A PCM SIMULATION WITHIN THE OSI USE CASE

-SIMULATION RESULTS: COMPARING OPENPASS AND RATEEFFECT



PERFORMING A PCM SIMULATION WITHIN THE OSI USE CASE

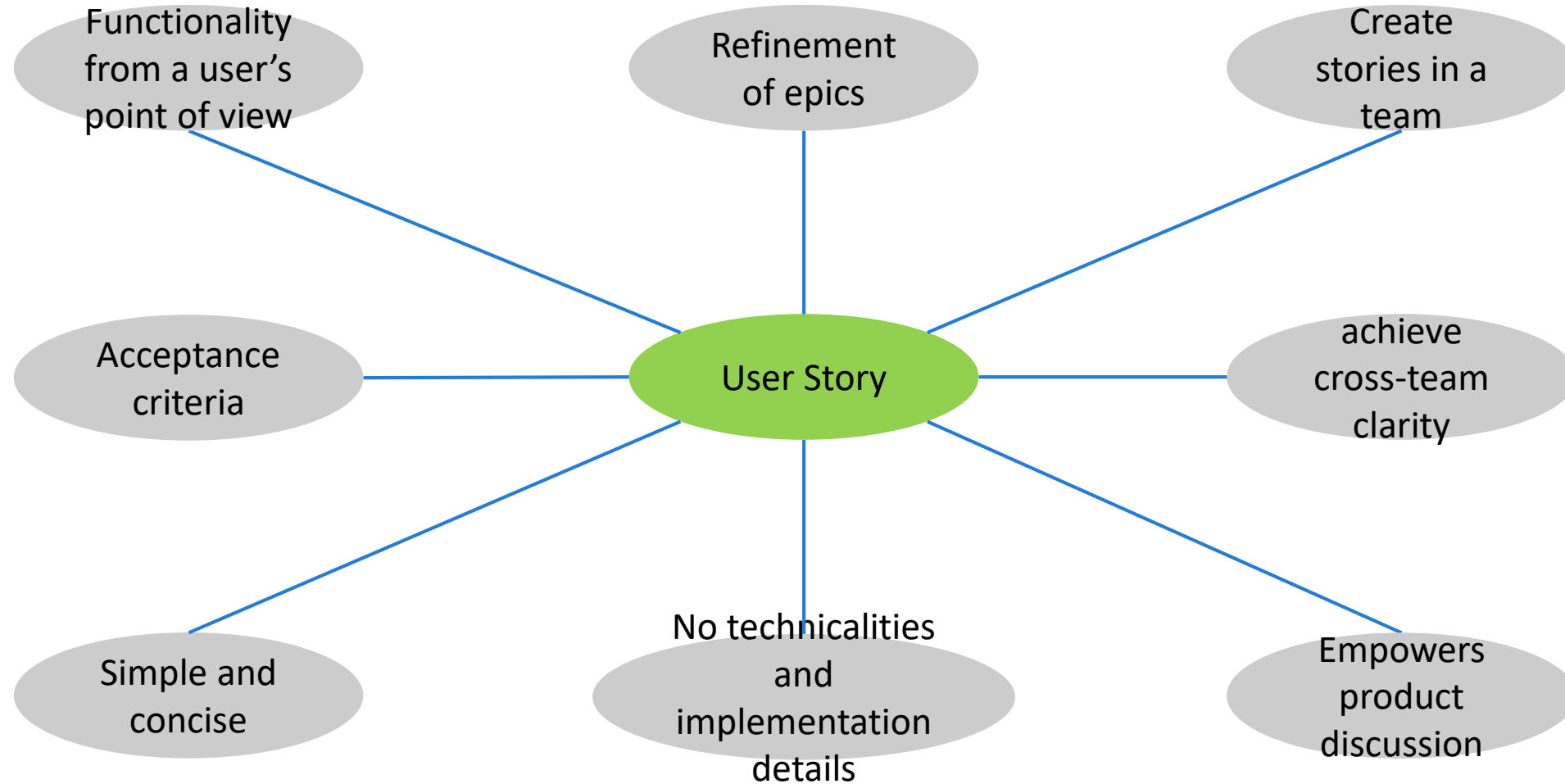
–SUMMARY

- protocol for PCM simulation via trajectory follower and
- interventions by ADAS can be incorporated if limited to longitudinal acceleration (i.e. no lane keeping support so far)
- main deviation from internal tool: technical limitations due to tire model
- next steps:
 - incorporate correct road network (openDRIVE)
 - extending the trajectory follower module to consider technical limitations → PID controller from PCM plugin?
 - allow for lateral accelerations in order to simulate lane keeping support as well

BREAK

PRIORITIZATION AND RELEASE PLANNING OF THE REMAINING HIGH-LEVEL TARGETS

HOW TO WRITE GOOD USER STORIES



HOW TO WRITE GOOD USER STORIES



Good user stories:

- As a new user, I want to get guided through the GUI by a tutorial such that I can start my first simulation without having read the documentation. Acceptance criteria: The user can start further simulations based on the knowledge he learned in the tutorial.
- As a regular user, I want to see a global top view visualization of the simulation run such that I have a better imagination of the simulated scenario. Acceptance criteria: Visualization which shows the moving agents in a road environment.

RENAMING OPENPASS



Open Platform for Assessment of **Safety Systems**

→ Open Platform for Assessment of **System Safety**

TO DOS AND FURTHER STEPS



Tasks:

- Formulate User Stories out of the high-level targets

Next Workshop:

- User story refinement meeting