Predictive Cruise Control and Eco-Roll
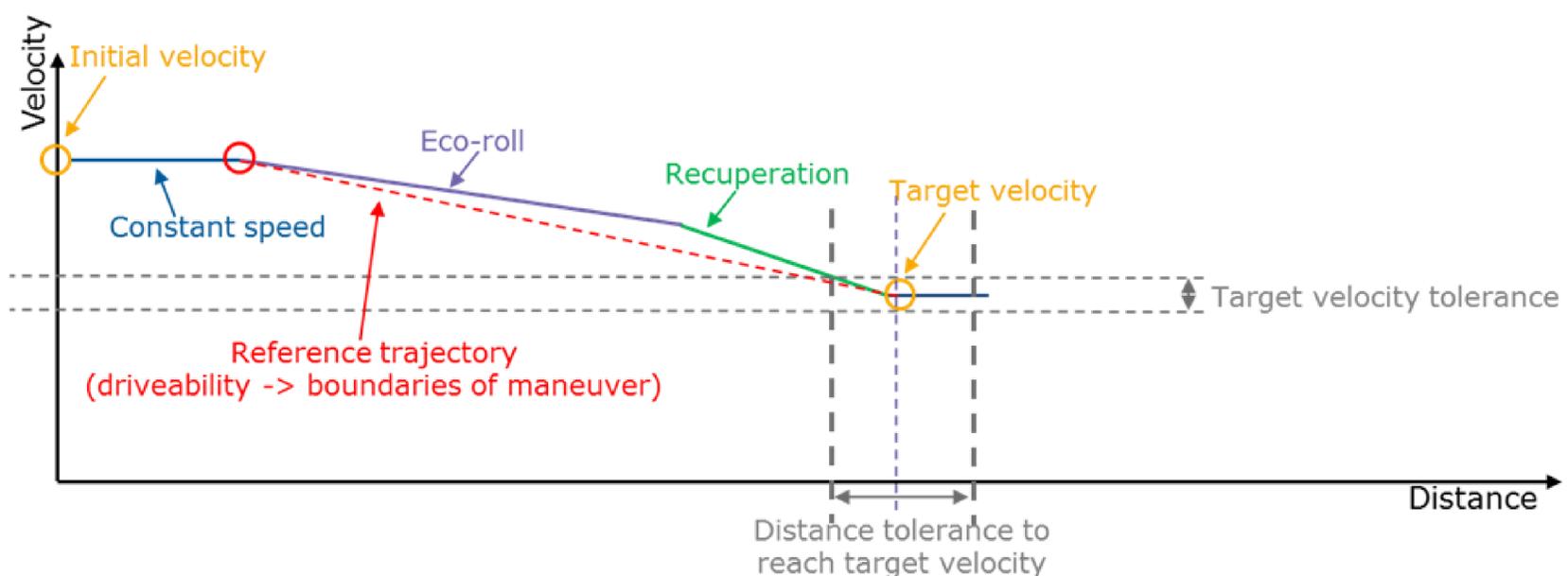
Challenges and solutions:

At the vehicle velocity optimization level, it is possible, that velocity change requests are made. These velocity change requests can come from other optimizers, which use the velocity profile as basis, (e.g. in a thermal optimization loop a higher velocity could be more convenient) or from adaptive cruise control, for example if another slower vehicle is detected by the radar. The information exchange and coordination is handled by the Powertrain Controller. The velocity change request needs to be combined with an efficiency factor or cost. The velocity optimizer can now estimate what following the velocity change request would cost in terms of fuel consumption, and it can update its velocity profile based on this value as well as on the priority.

IMPERIUM's contributions:

The predictions and suggested velocity profile is made available to the Powertrain Controller and all other subsystems or components (e.g. engine, transmission control) that may use this information to make predictions and optimizations of their own. Eco-roll is an online optimization method that automatically finds optimal drive mode sequences for specific situations, which Predictive Cruise Control may not handle on its own. Eco-roll is running on standby while Predictive Cruise Control is active and constantly looks for specific events. Such an event may be the detection of a preceding vehicle, which requires a specific action (e.g. reduce the velocity in a specific way to follow the preceding vehicle at the same speed at a desired distance). Another example for an event may be the detection of an upcoming curve, for which the velocity also has to be reduced in a specific way. Eco-roll in general is not limited to situations where the velocity at the end is lower than at the beginning, though such cases may occur more frequent. If an event is detected by Eco-roll, targets for the velocity, covered distance and travel time are computed. For the example of approaching a curve, that means that the velocity at the beginning of the curve is defined by the "safe cornering speed", the distance is specified by the position of the curve and the travel time is constrained by a driver's acceptance criteria (drivability) and deceleration limits.

On the IMPERIUM demonstrator the Dynamic eHorizon ECU has been installed in parallel to the reference version in order to correctly benchmark the new solution, each system has dedicated antenna but both can coexist on the same network having different CAN ID. IVECO performed several tests to check and confirm the information shared by the new eHorizon, the check was performed by AVL.

Impact / what's next:

Based on the successful validation on the IMPERIUM vehicle, next steps for industralisation are in definition.