



AVL SPA™

Hybrid Calibration: Workflow

Presenter



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Agenda

- 1 About Us**
- 2 Idea of SPA General**
- 3 Virtual Shift Strategy Calibration**
- 4 Virtual Calibration of Hybrid Shifting Strategy**
- 5 Live Demo**
- 6 Summary**



About Us

AVL



Clean Affordable Mobility

AVL is the world's largest independent company for development, simulation and testing in the automotive industry, and in other sectors. Drawing on its pioneering spirit, the company provides concepts, solutions and methodologies to shape future mobility trends.

Facts and Figures



Global Footprint

Represented in 26 countries

45 Affiliates at over 93 locations

45 Global Tech and Engineering Centers (including Resident Offices)

1948

Founded

11,000

Employees Worldwide

12%

Of Turnover Invested in Inhouse R&D

70+

Years of Experience

65%

Engineers and Scientists

2,500

Granted Patents in Force

97%

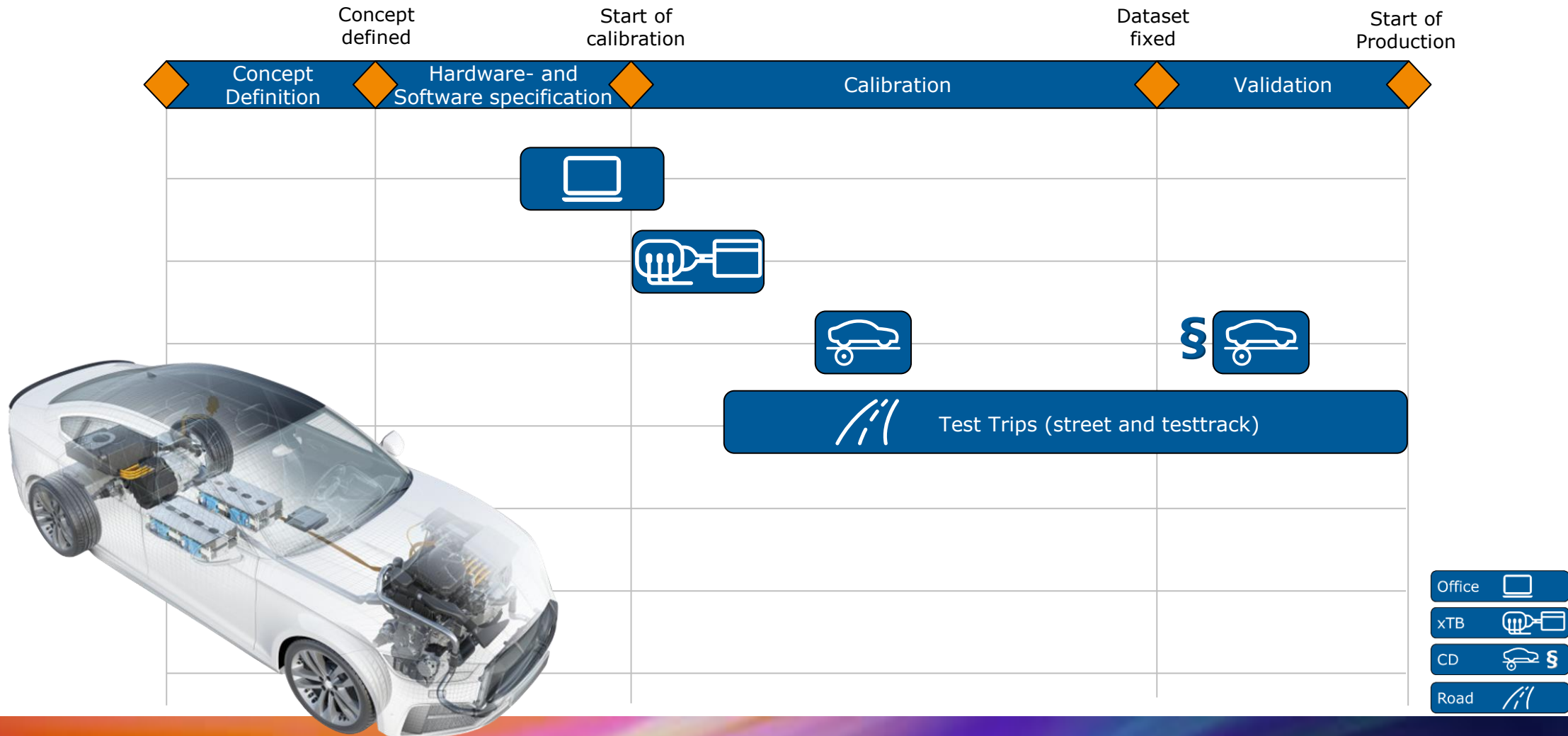
Export Quota



Idea of SPA General

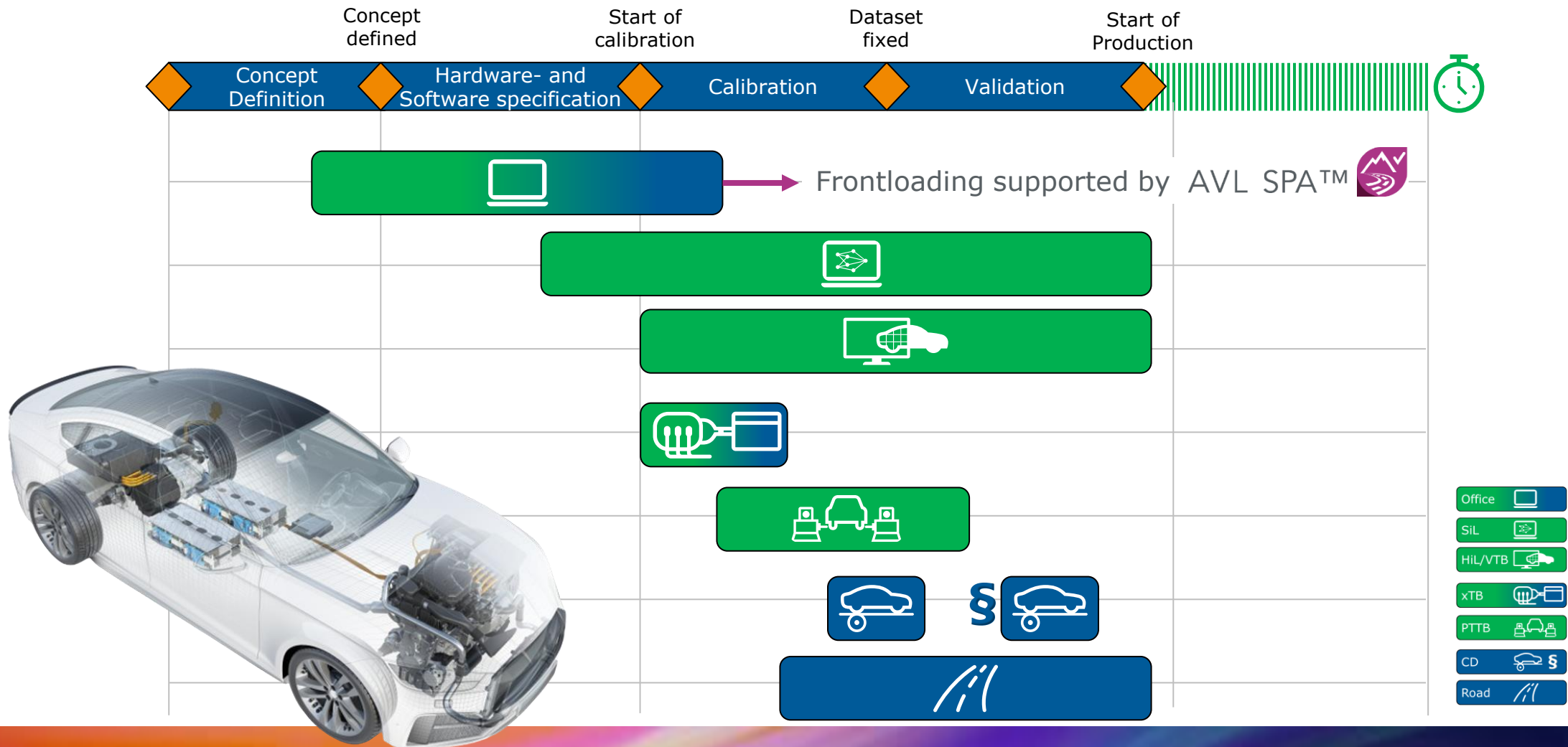
Motivation

Traditional Approach for Powertrain Calibration



Motivation

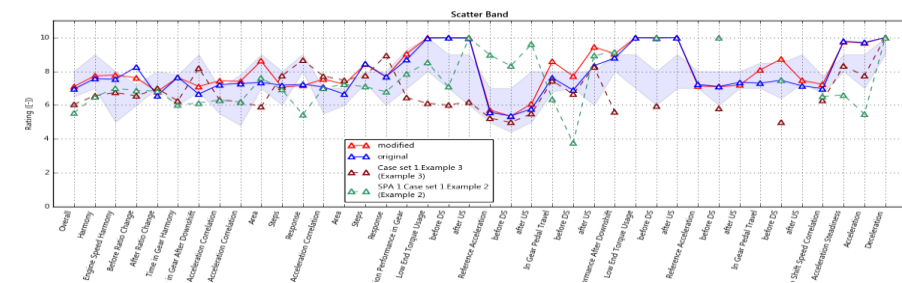
Innovative Approach – Frontloading of Powertrain Calibration by Virtualization





Virtual Shift Strategy Calibration

- More than **25 objective criteria for powertrain strategy**
- **Objective comparison** of internal and external benchmark vehicle
- Target / DNA **definition** with AVL SPA™
- Fleet-drivability **monitoring of supplier** with AVL SPA™
- Transmission **calibration to target** with AVL SPA™
- Immediately assess the impact of parameter changes on the drivability
- Visualize and understand tradeoffs between different powertrain strategies
- Identify weaknesses in the powertrain strategy in very short time



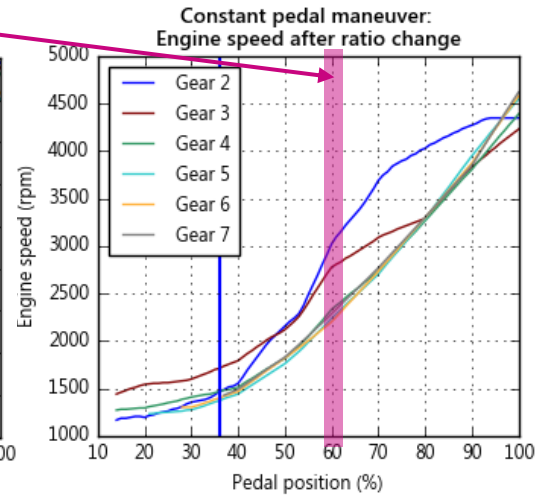
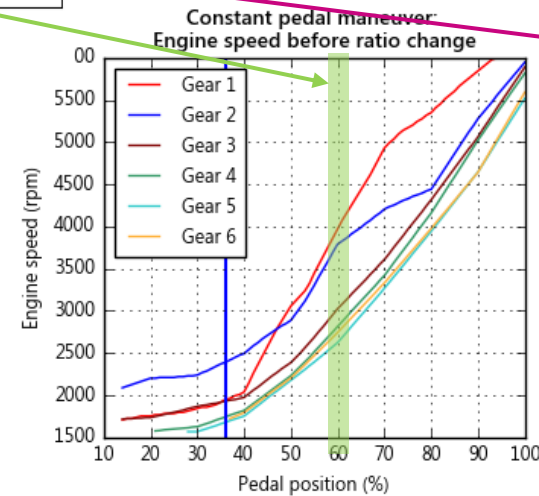
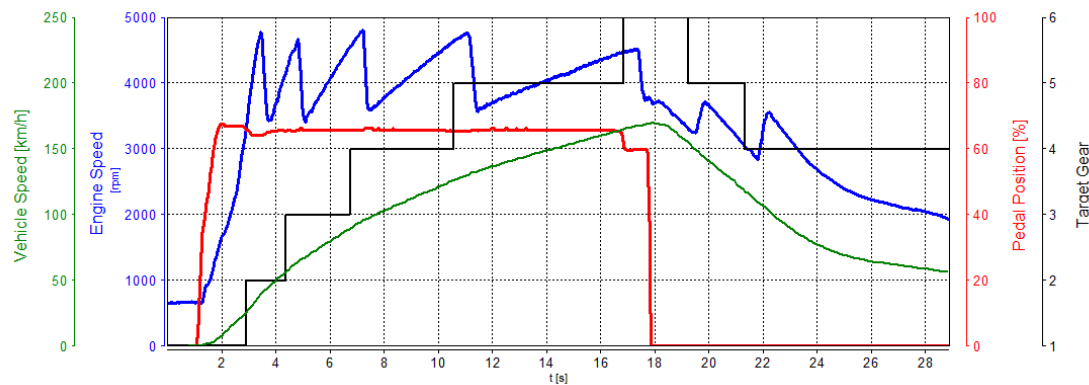
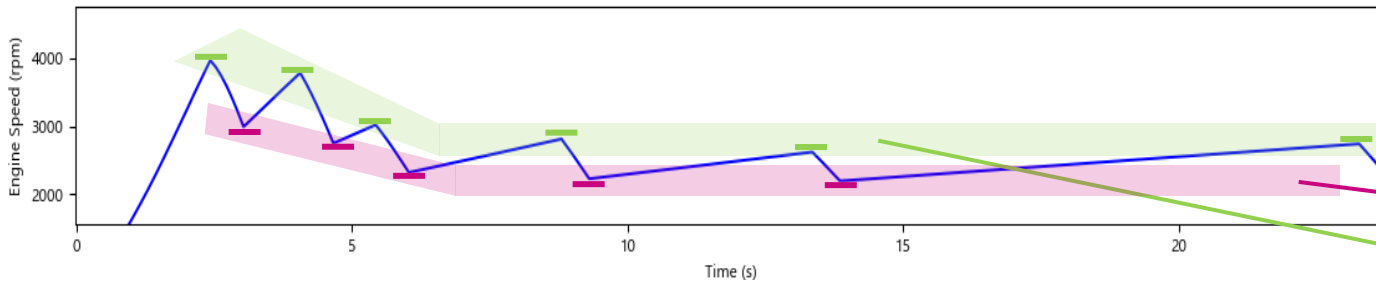
Objective Criteria – Engine Speed Harmony

Example

Evaluation of the harmony of engine speeds before and after ratio change for constant pedal upshifts (accelerator pedal constant at 60 %):

@60 %

	Current
Harmony	6.5
Engine Speed Harmony	6.4
Before Ratio Change	6.3
After Ratio Change	7.0
Time in Gear Harmony	7.1





Virtual Calibration of Hybrid Shifting Strategy

Virtual Calibration of Hybrid Shifting Strategy

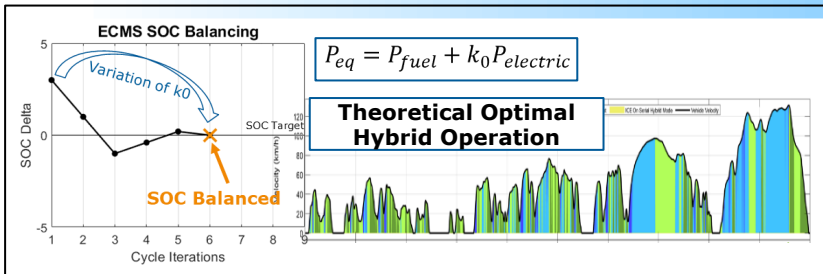
Innovative and Professional

- Find the best shift lines regarding fuel efficiency and use it as a starting point.
- The shift lines are optimized in the virtual world using objective criteria.
- The shift lines can easily be transferred to a detailed simulation environment such as AVL Cruise M™.

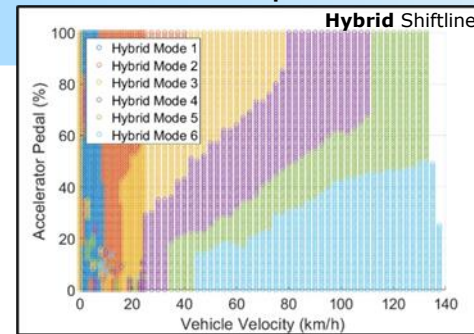
→ Using **innovative** software solutions, it is possible to design the hybrid shifting strategy in a **professional** way and don't leave the results to chance!

AVL SPA™ Hybrid Calibration Add-on Workflow

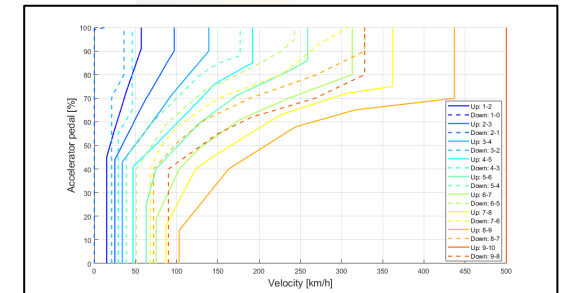
Determination of the theoretical **optimal powertrain operation** during driving cycles



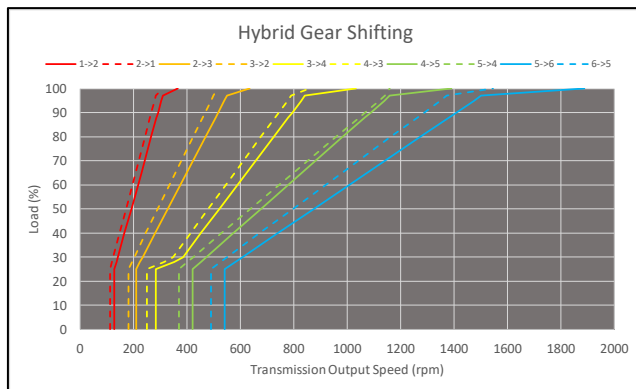
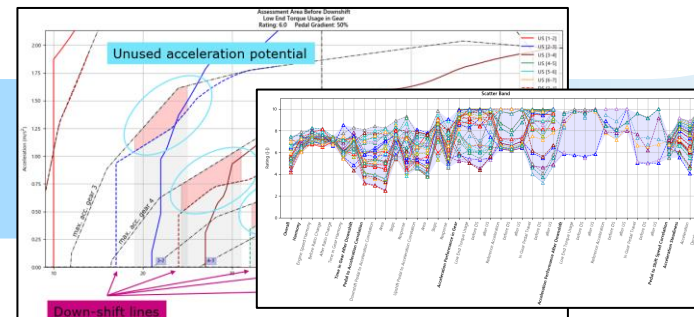
Derivation **the theoretical optimal shifting strategy** for fuel consumption



Consideration **hysteresis** and **kick-down performance**

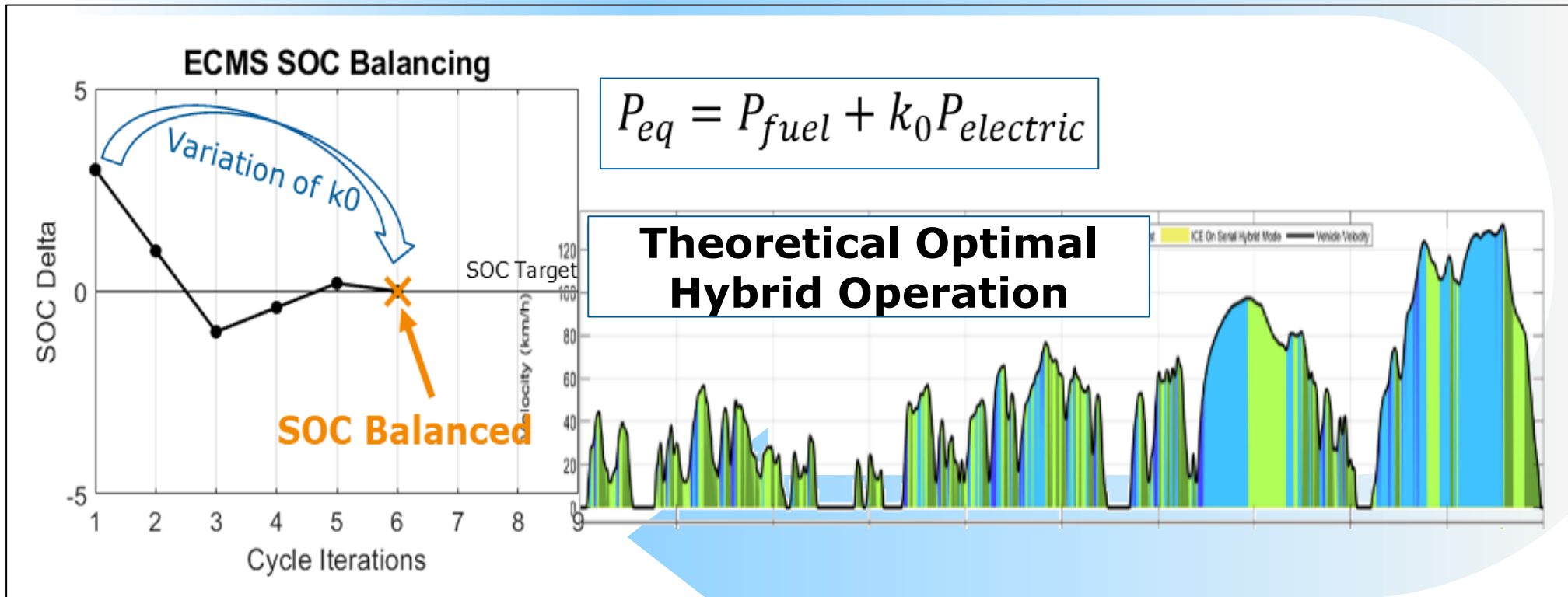


Assessment of **driveability** using criteria evaluation



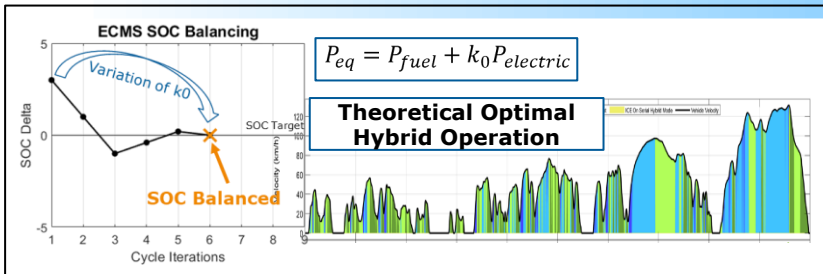
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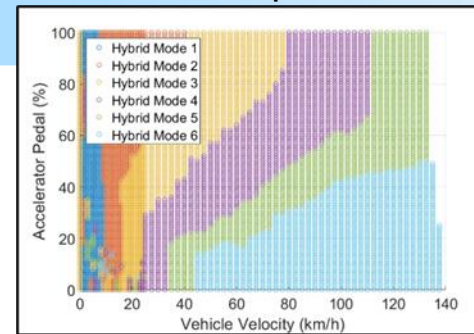


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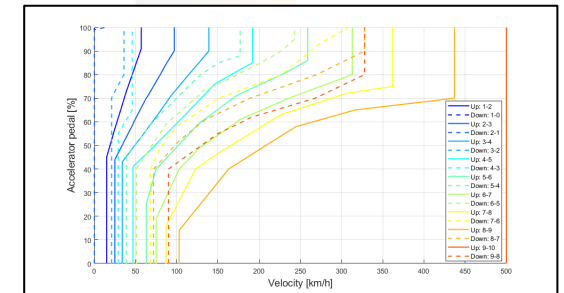
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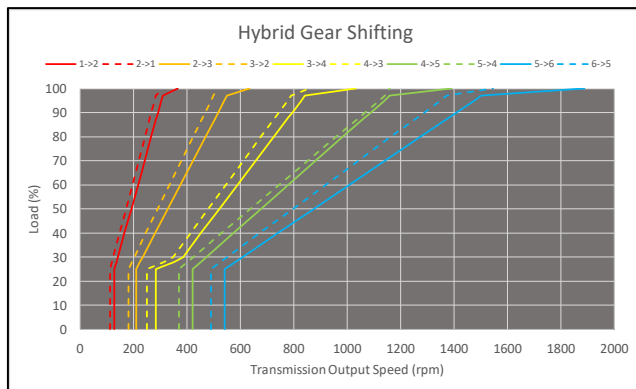
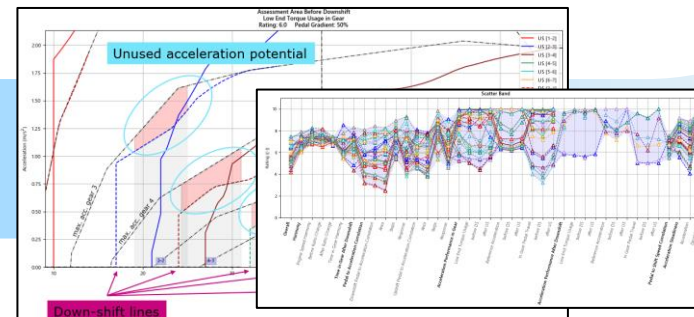
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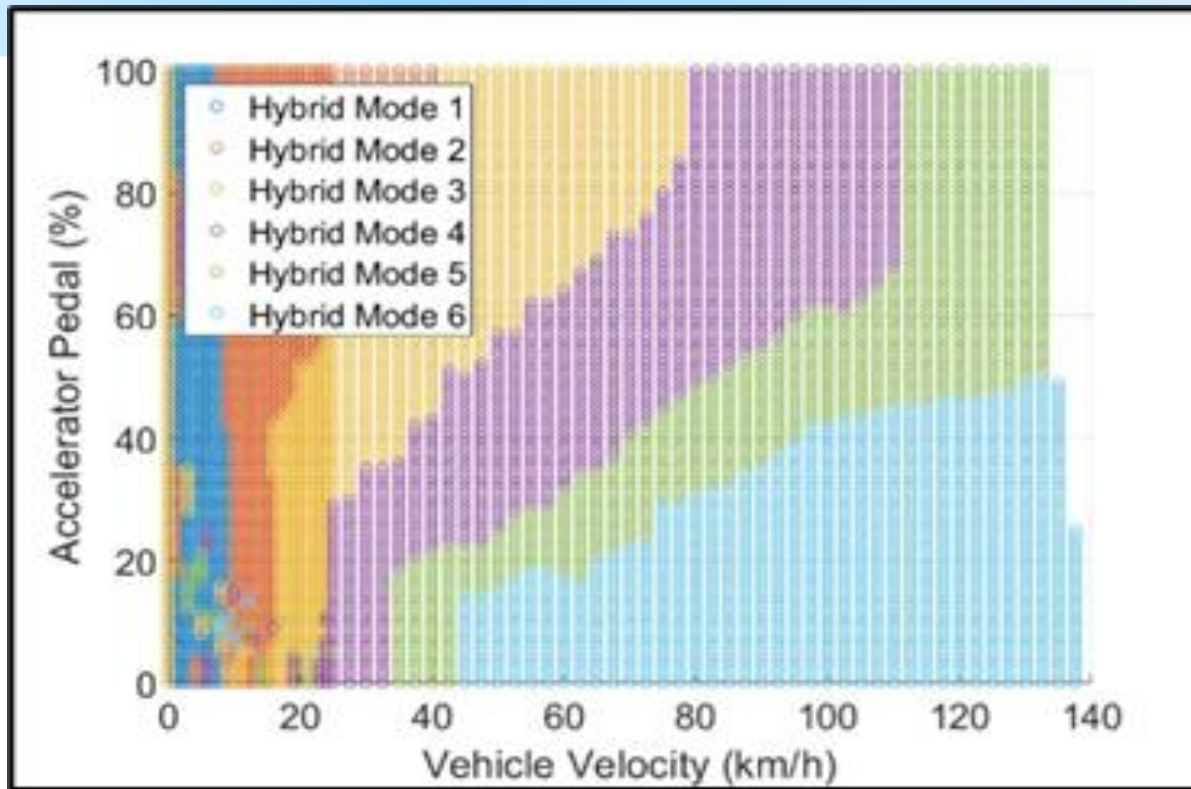
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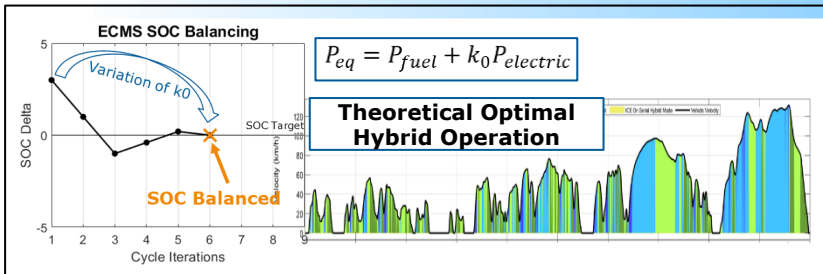
Workflow

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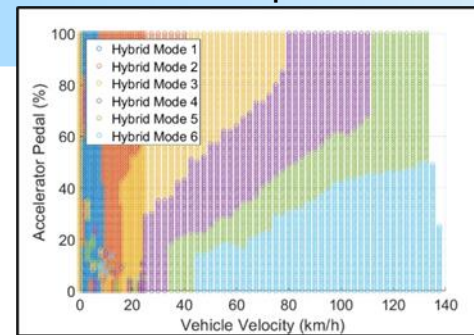


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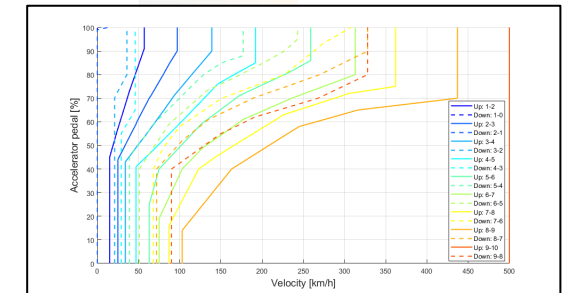
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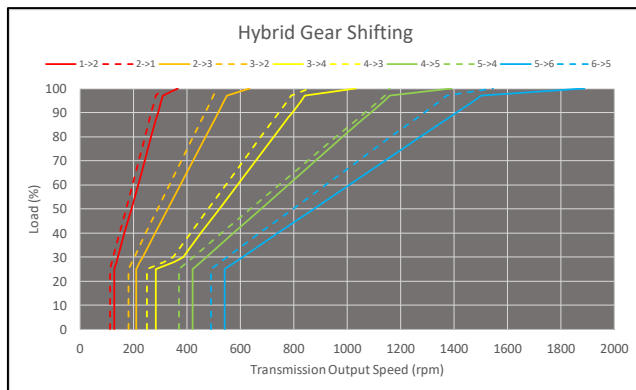
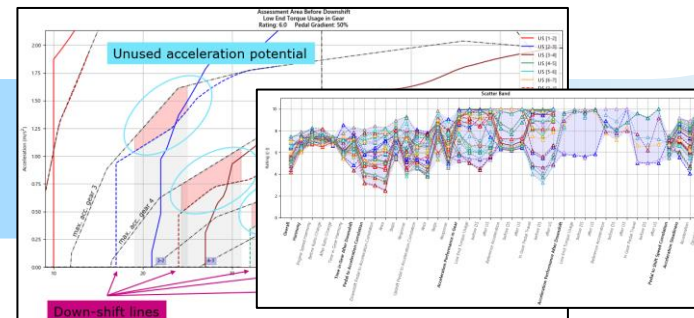
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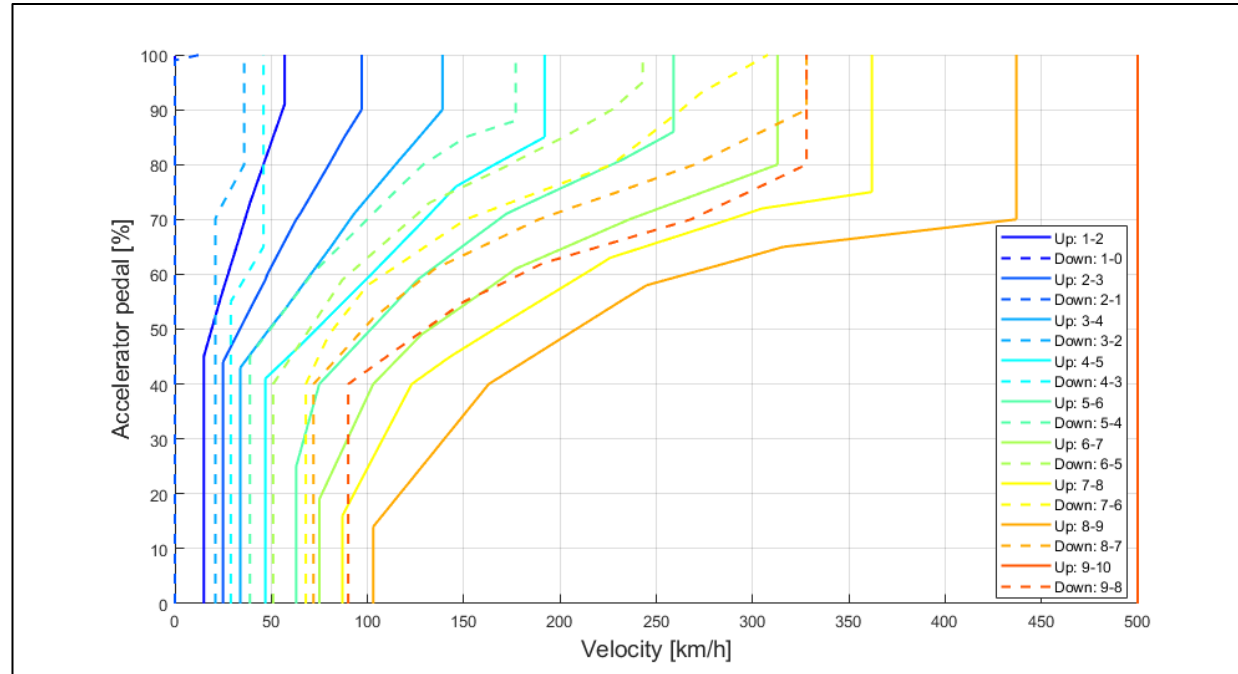
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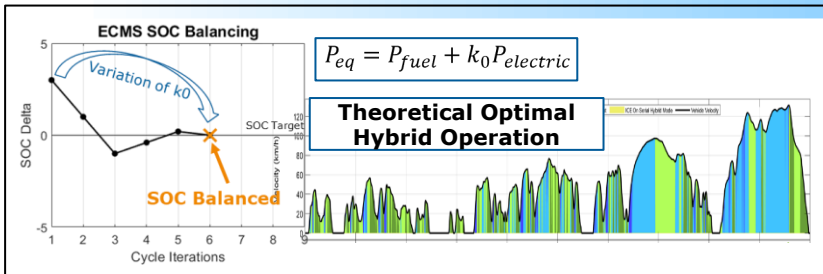
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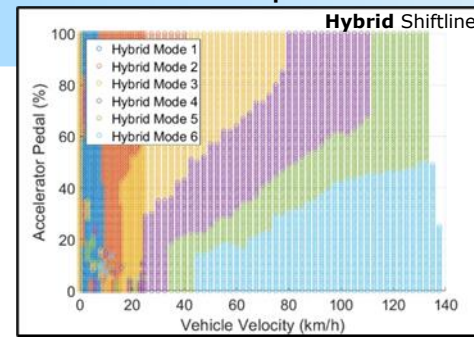
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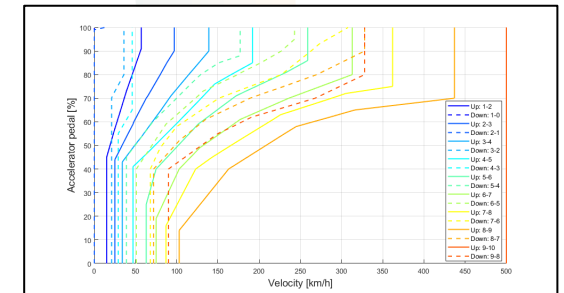
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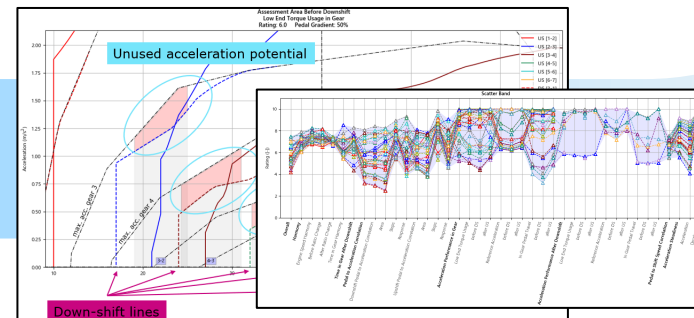
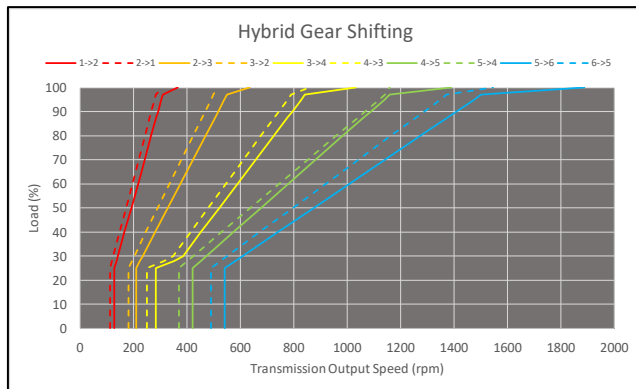
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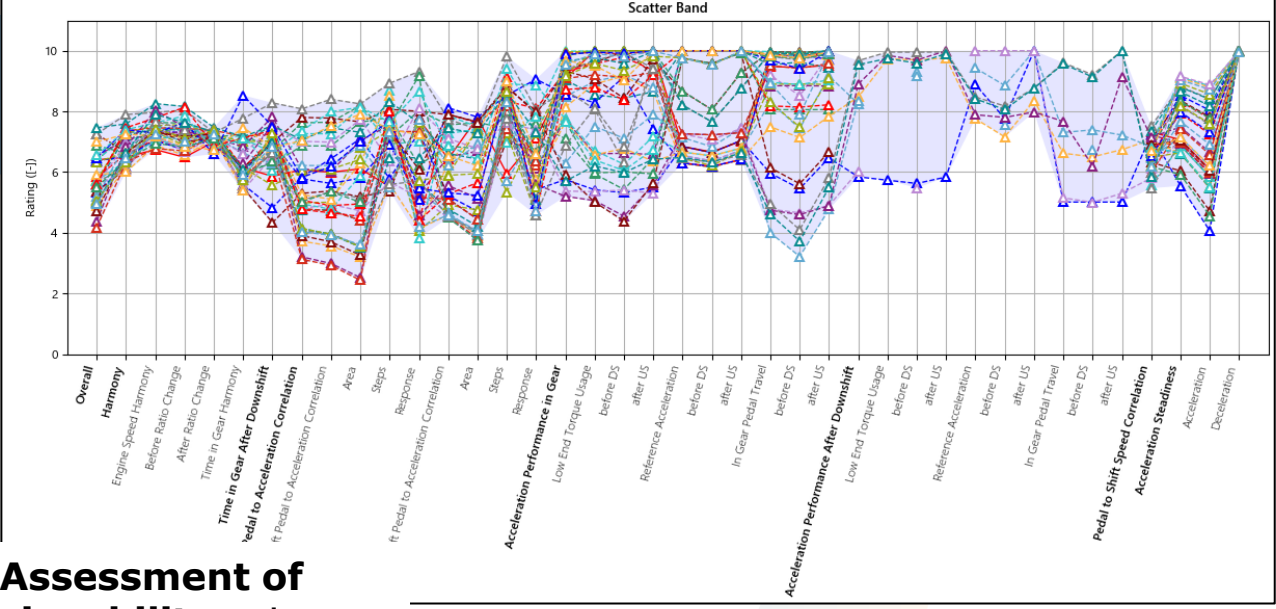
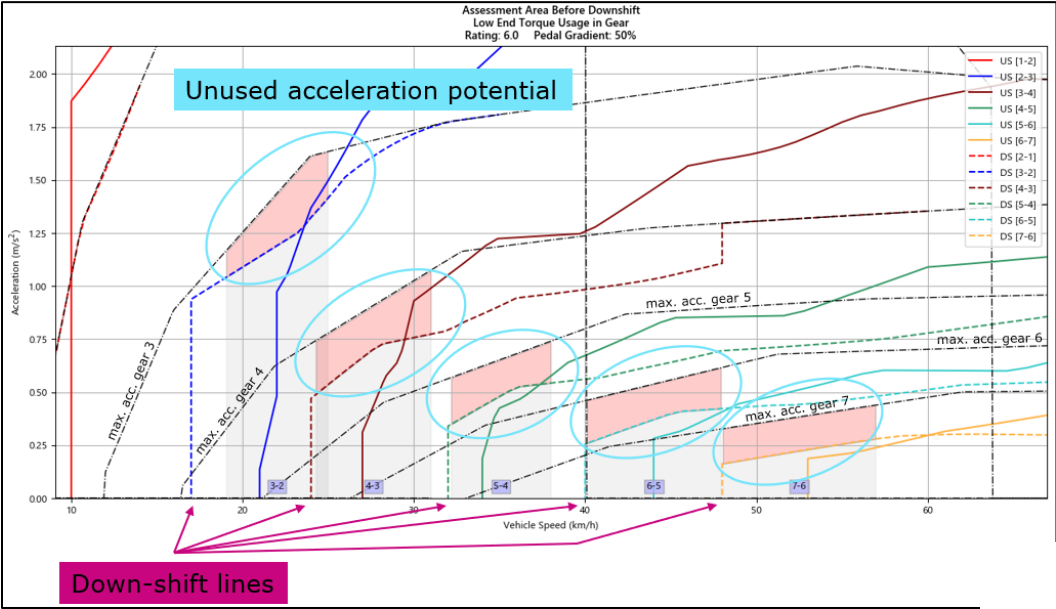


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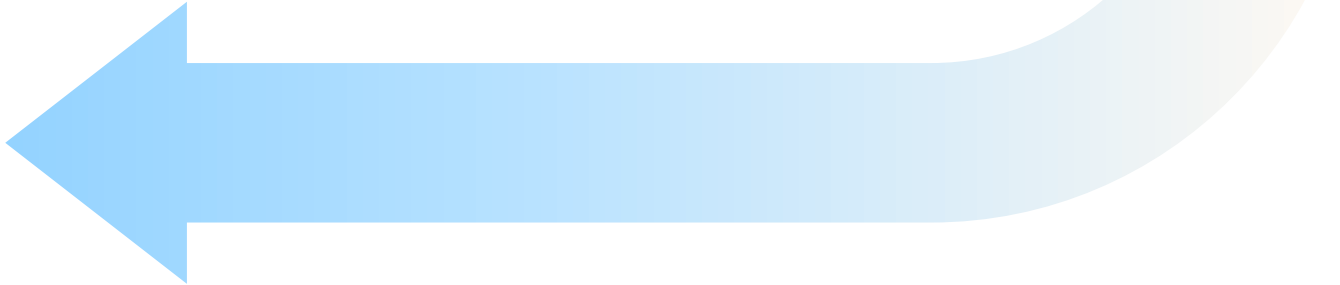


AVL SPA™ Hybrid Calibration Add-on

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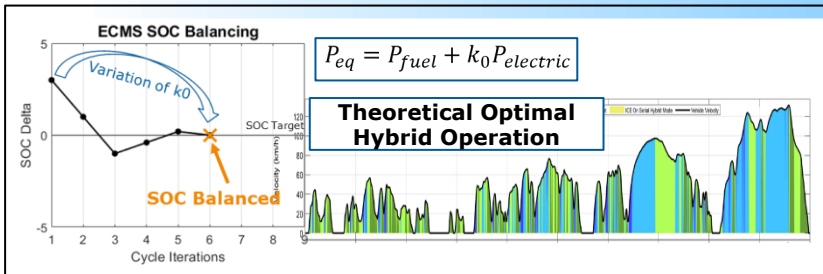


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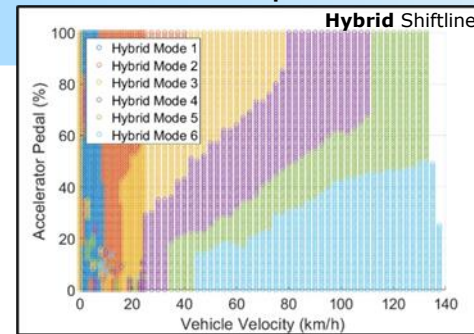


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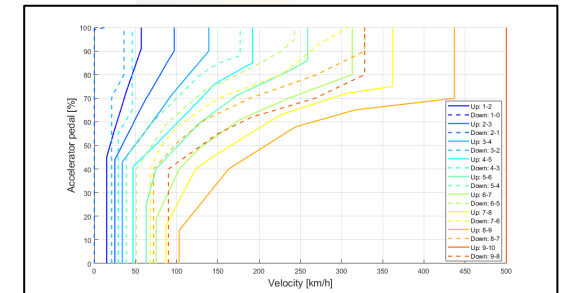
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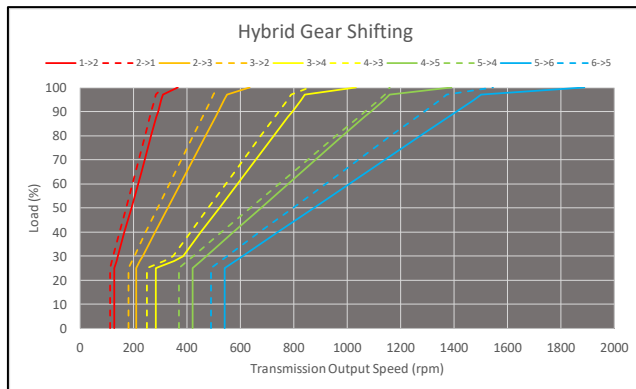
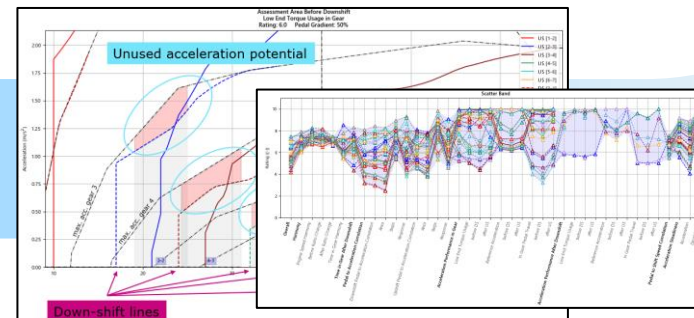
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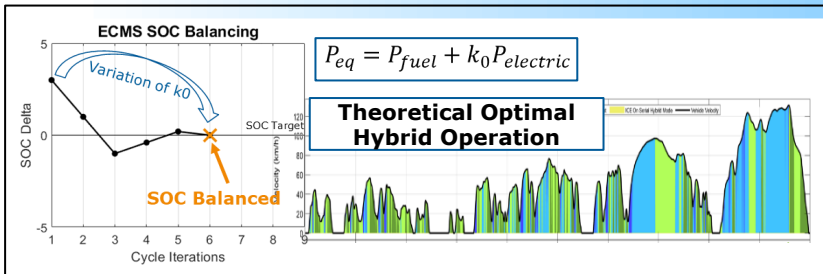


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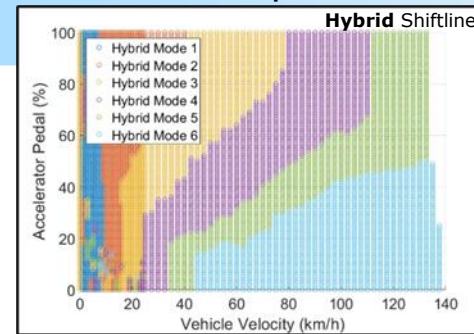


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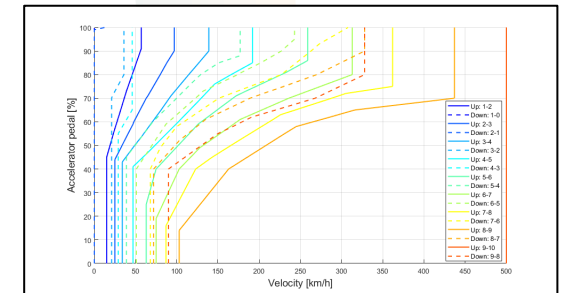
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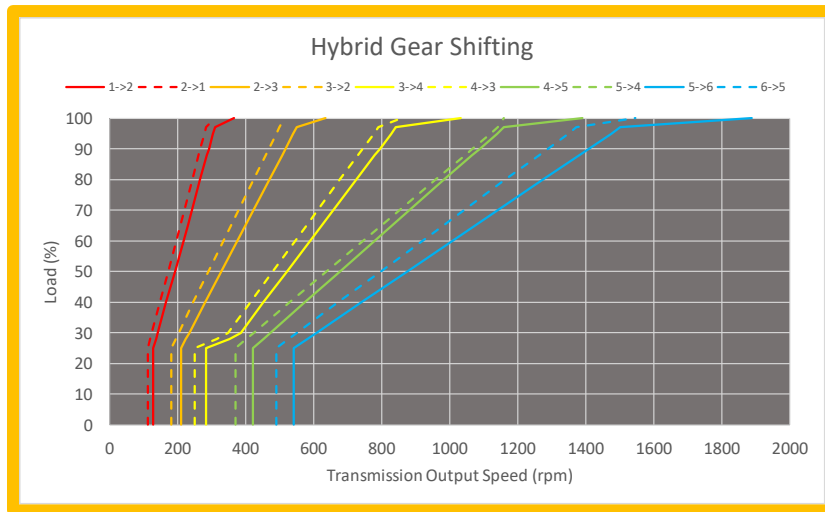
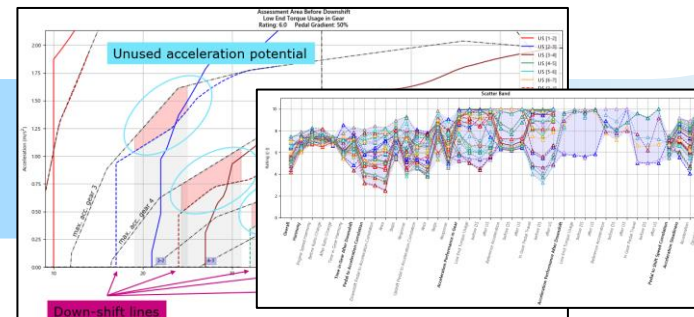
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Assessment of **driveability** using criteria evaluation





Live Demo

AVL SPA™ - Hybrid Calibration Add-On

Summary

Applications

- Conventional applications
- P2 Hybrid applications
- Amount of gears can be freely defined
- Commercial applications

Hybrid Features

- ensuring SOC balanced operation
- No hybrid controller and calibration needed
- Consideration of multiple drive cycles
- For hybrid charge sustaining mode

Advantages

- Automatic generation of shift lines and pedal maps from little input data
- Acknowledging fuel efficiency and driveability
- Brand driveability DNA definition: Benchmarking of different shift line calibrations
- Consumption minimized starting point
- Reduction of pre-calibration time up to ~50 %

Contact Information



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<https://www.avl.com>

Thank you



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