




Hydraulic Variable Cam Phasing Systems

Challenges:

- ▶ Large volume of oil required
- ▶ High-oil-pressure requirements
- ▶ Parasitic losses
- ▶ Low-temperature operation



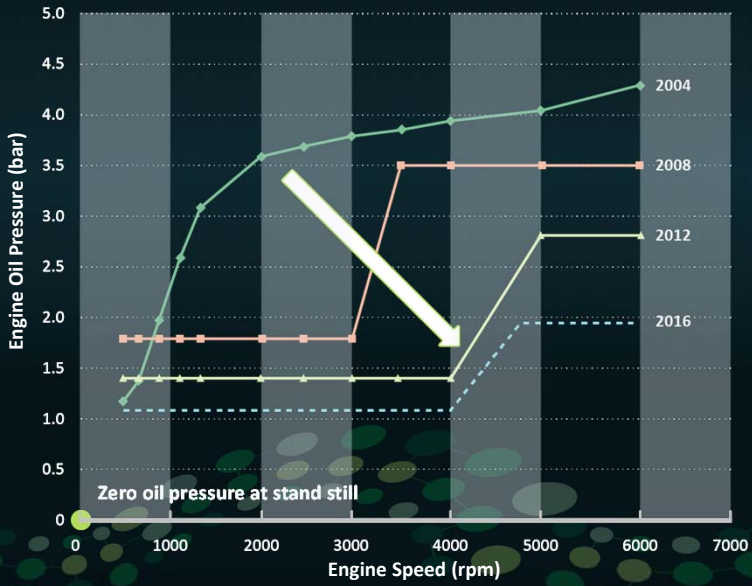
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Trend to Lower Oil Pressures in the ICE

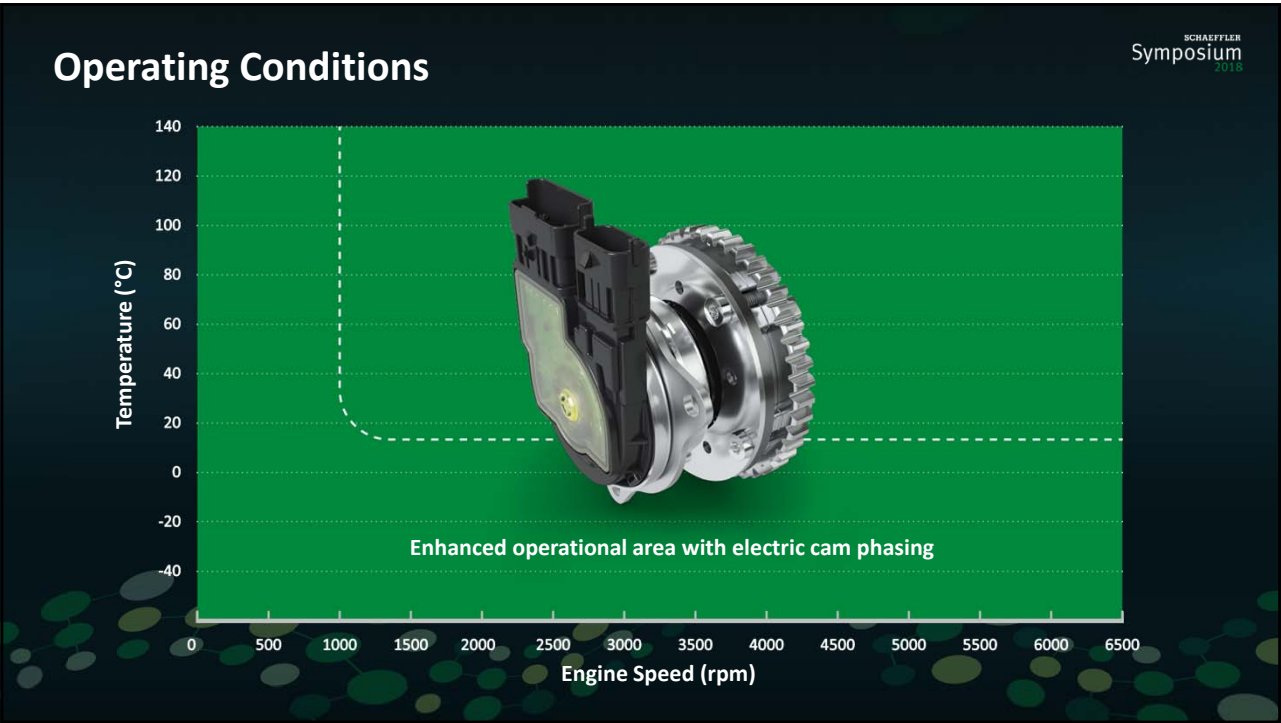
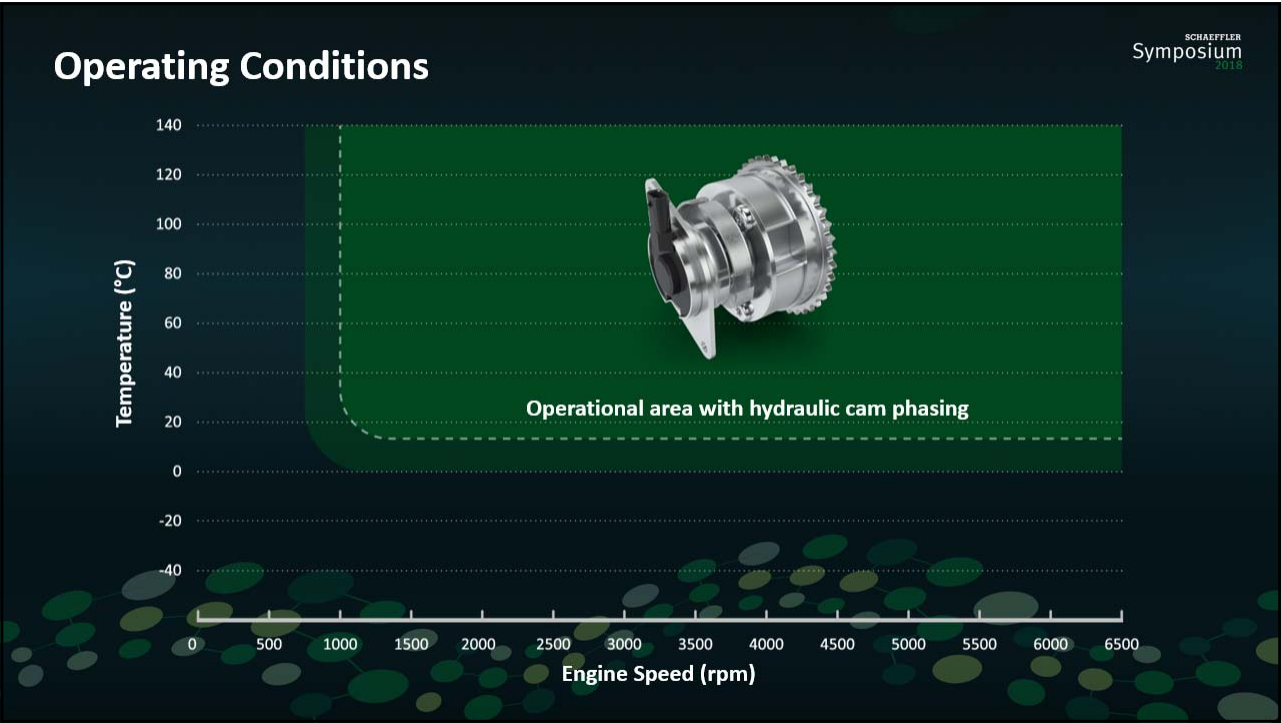
▶ No oil pressure at stand still and cranking

▶ Oil pressure reduction to optimize fuel economy

▶ Hydraulic cam phasing relies on oil pressure for function




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Electric Cam Phasing

- ▶ Compact design
- ▶ Clearance free
- ▶ Light weight
- ▶ Brushless E-Motor
- ▶ High ratio 1:70

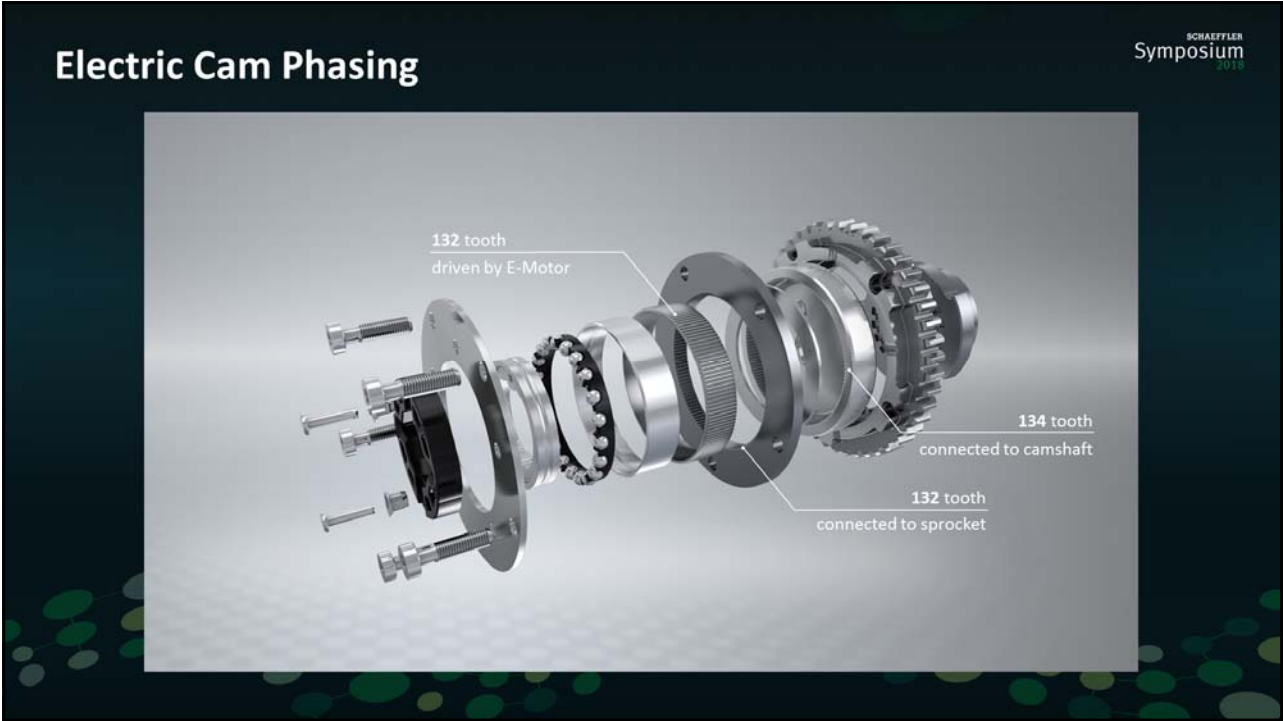
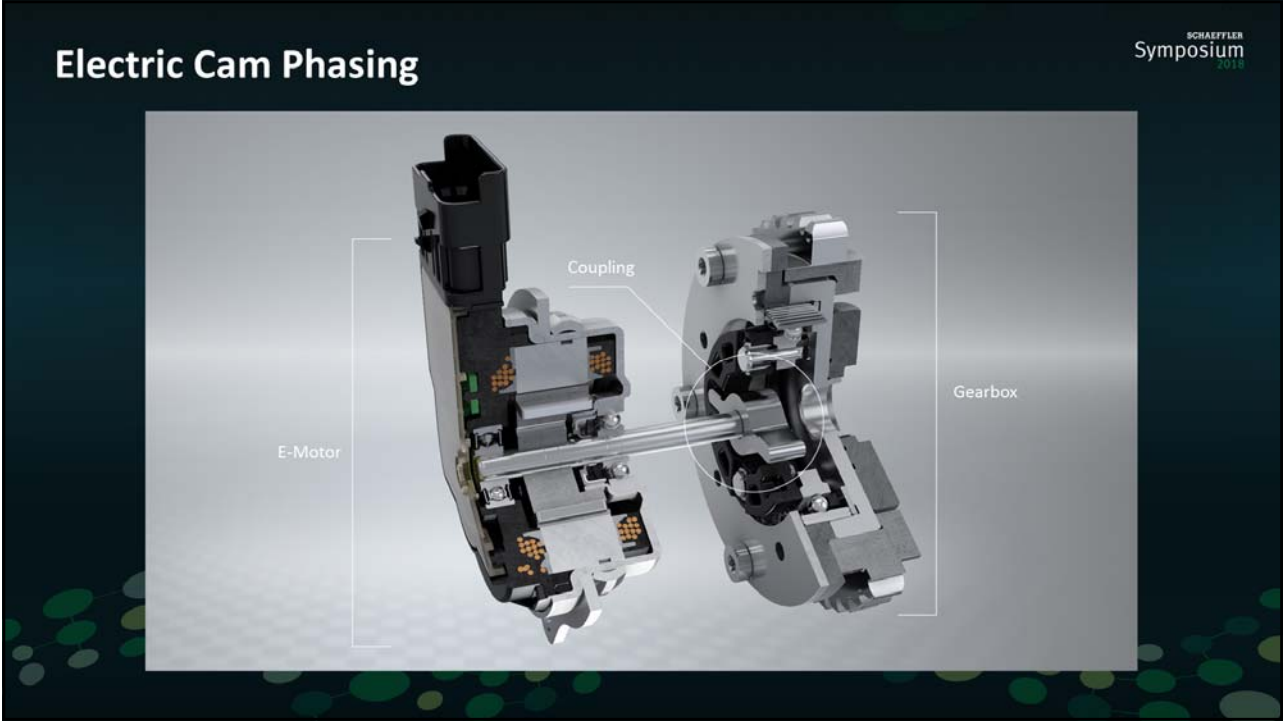


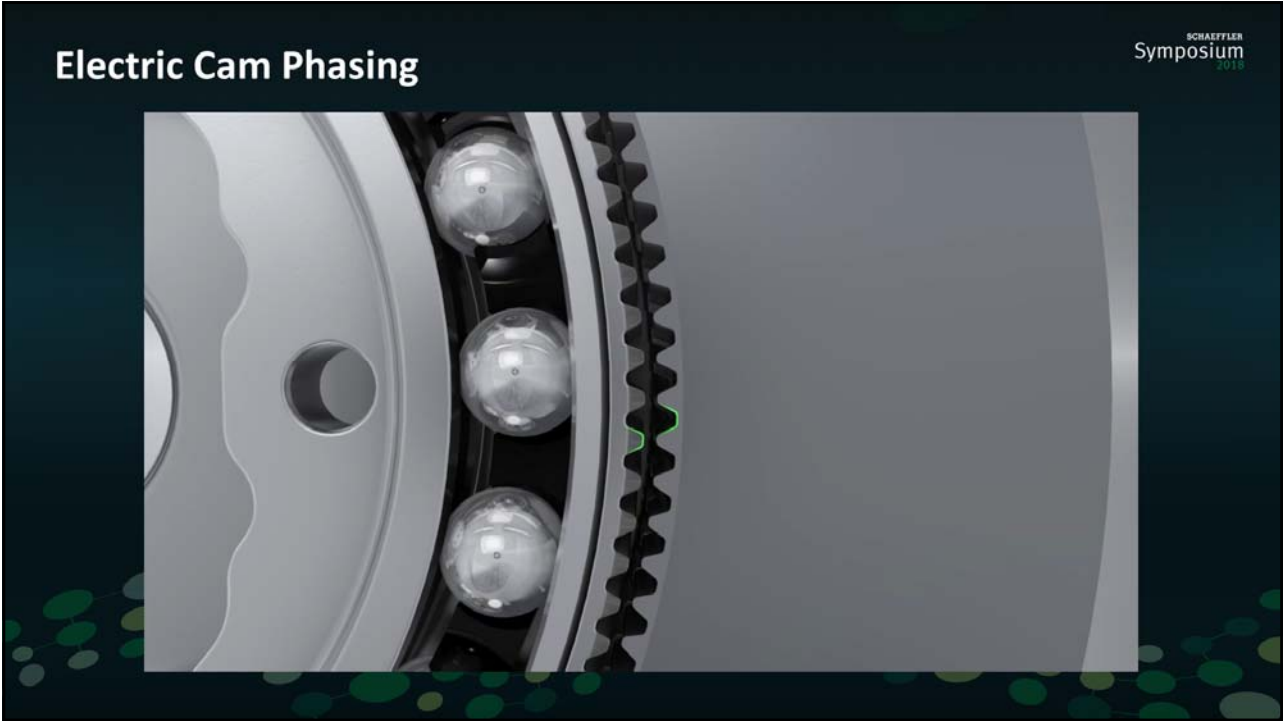
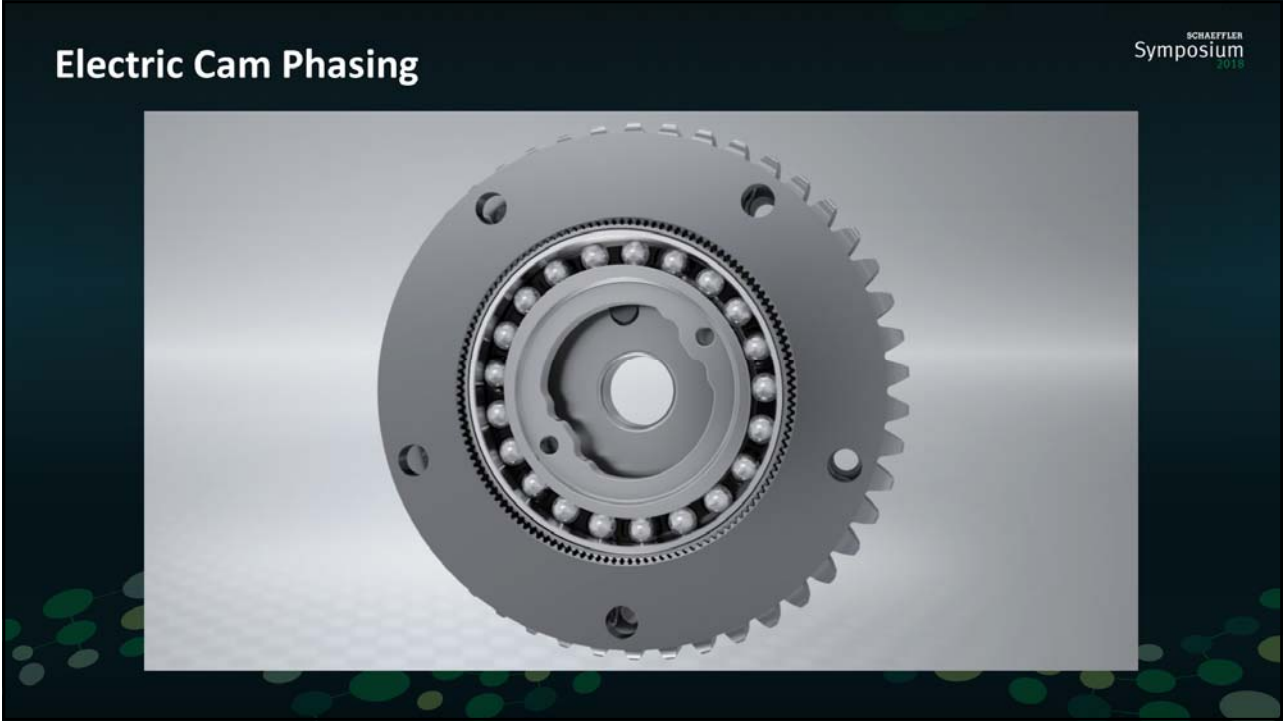
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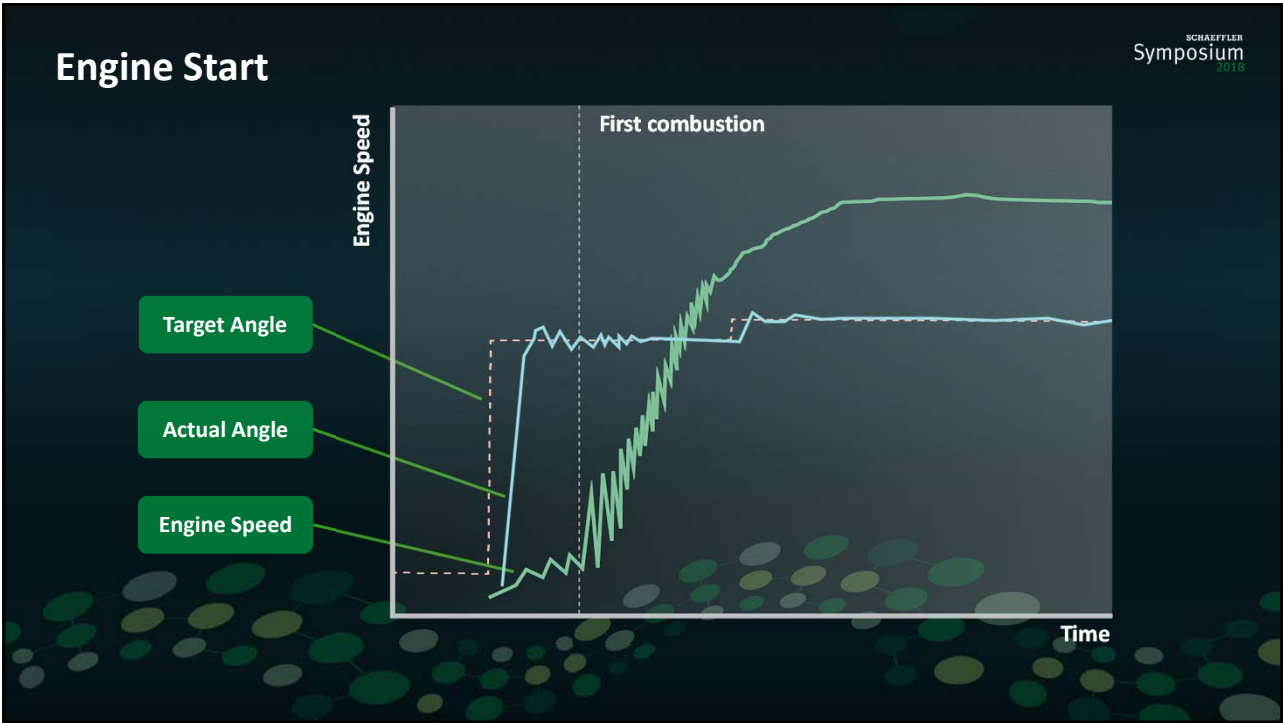
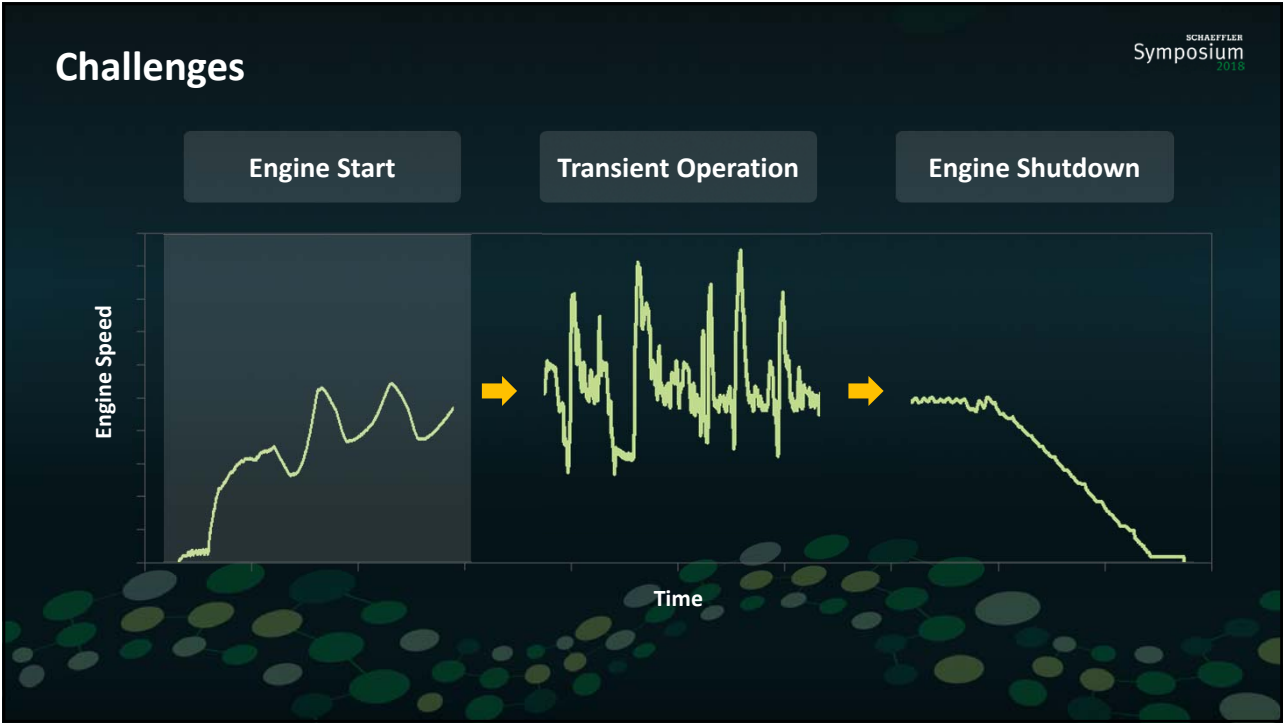
Electric Cam Phasing

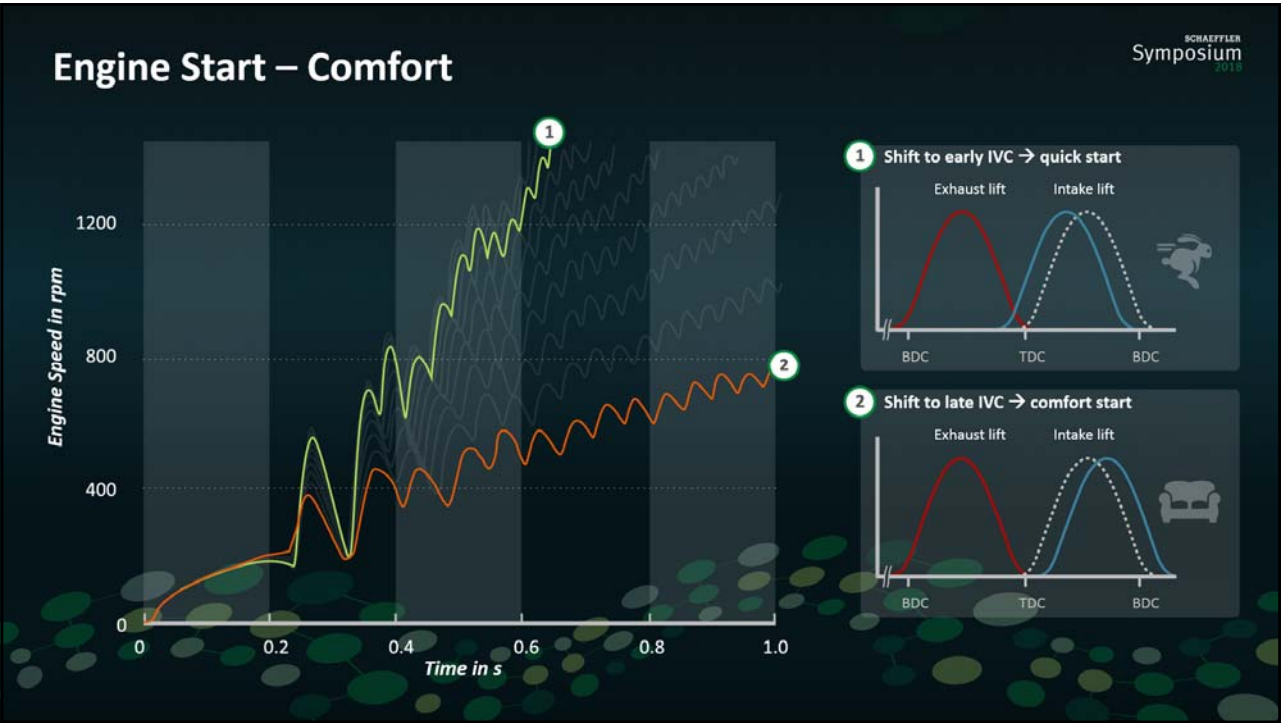
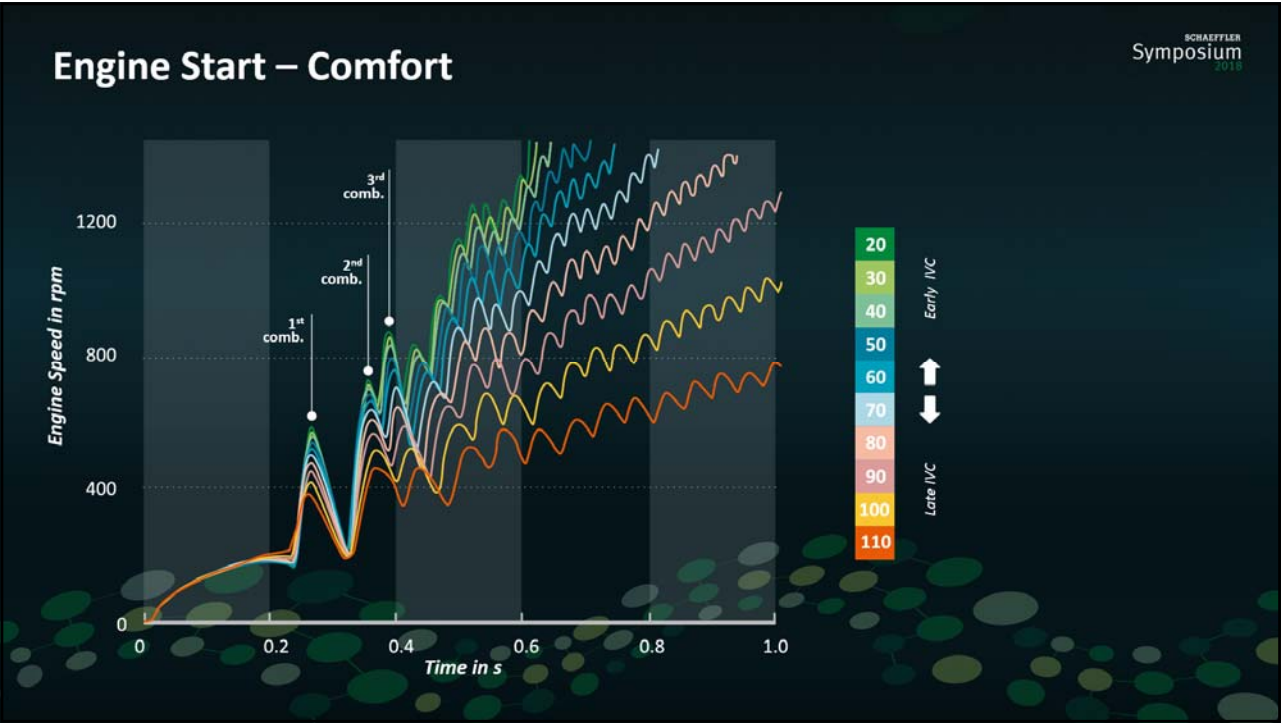


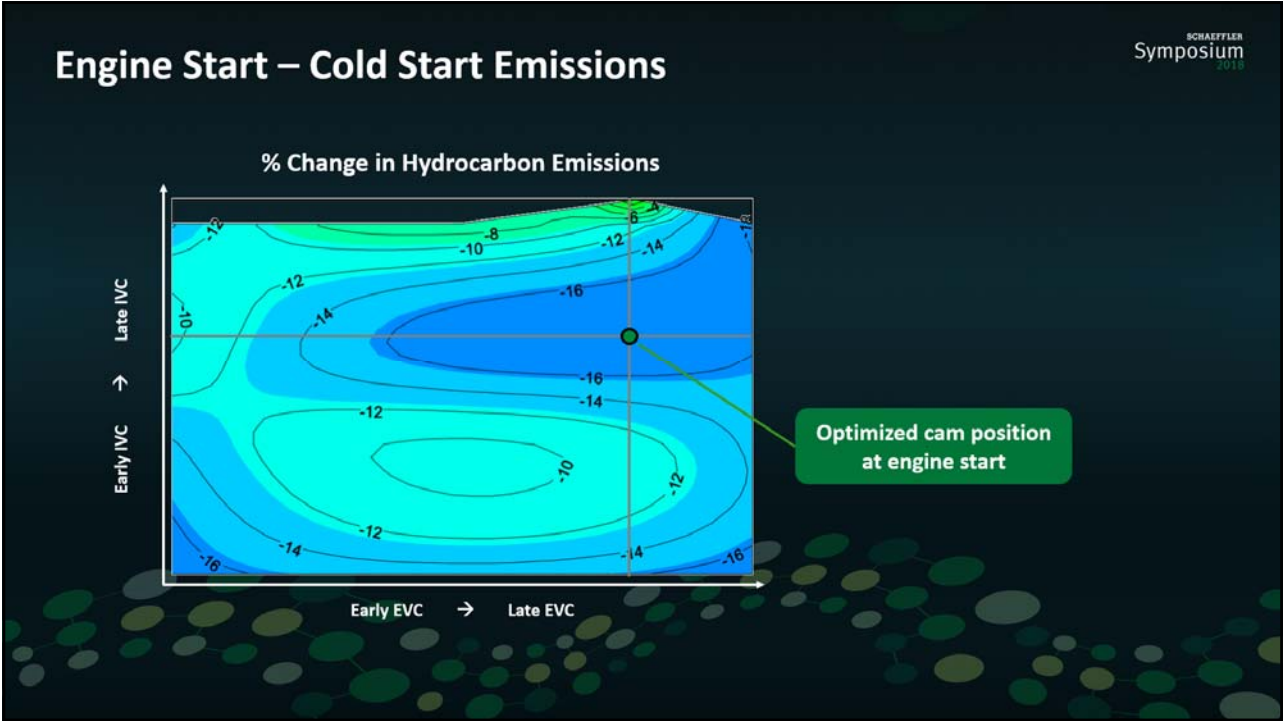
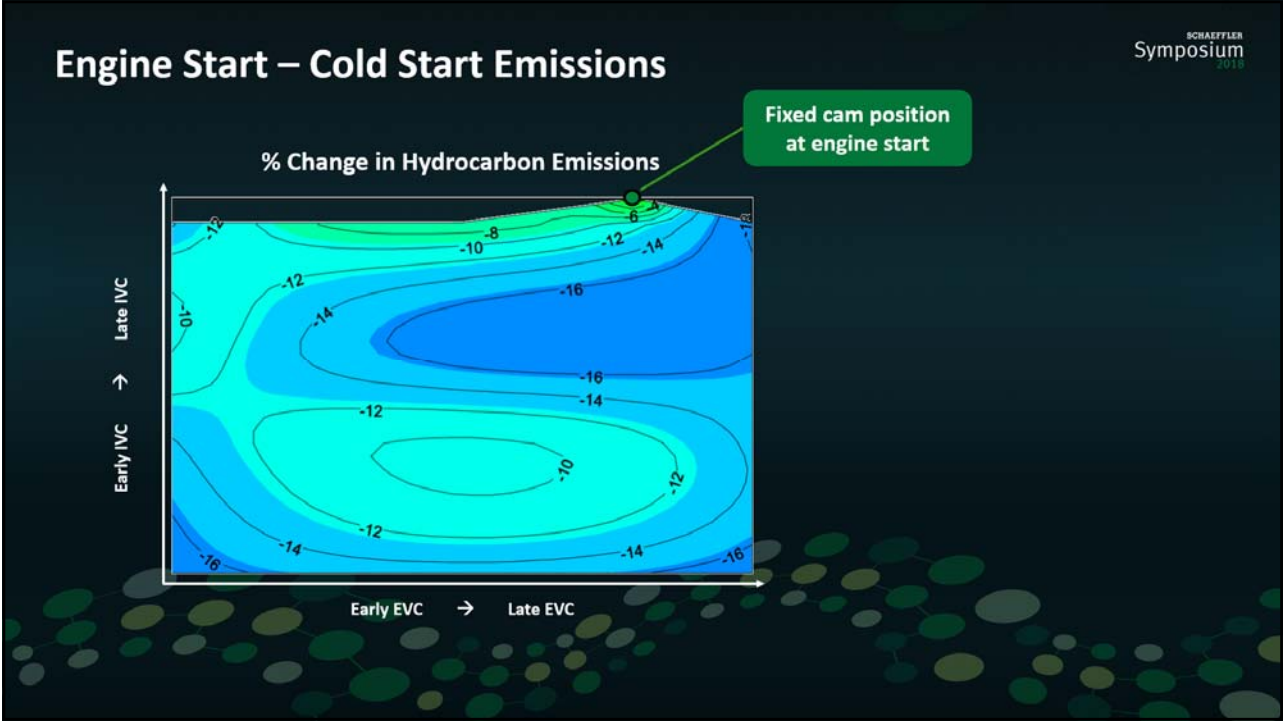
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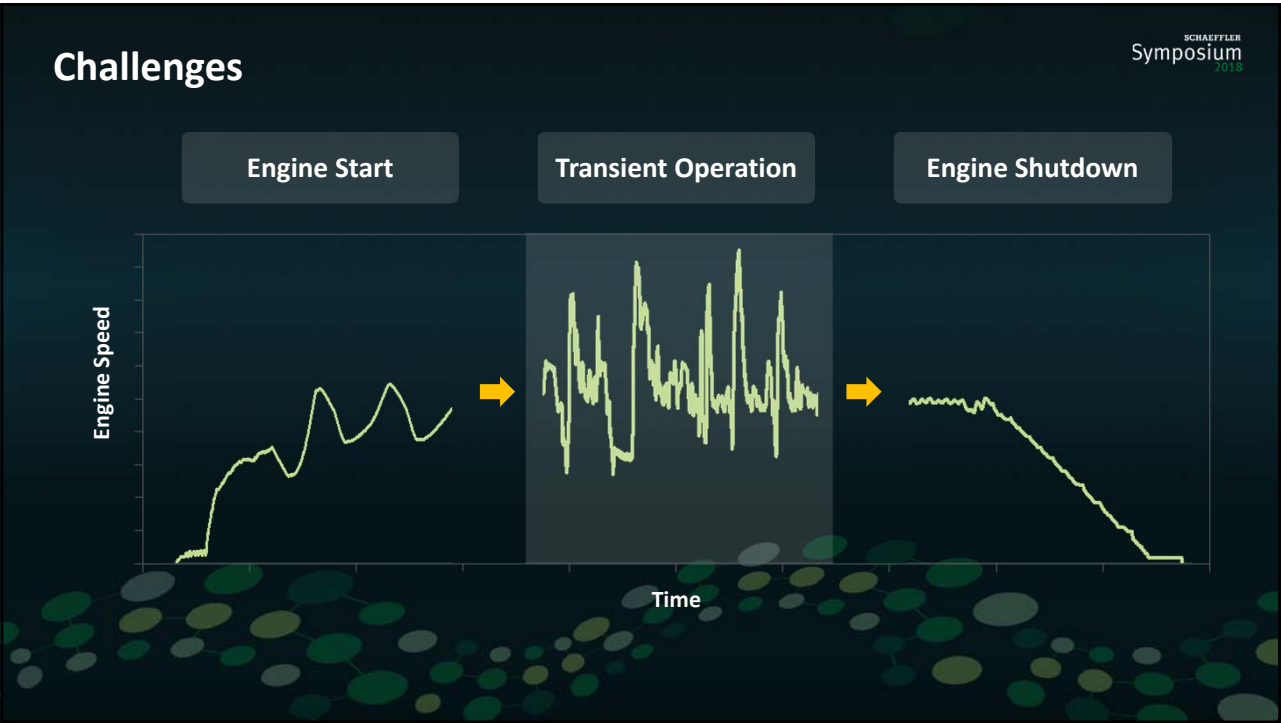
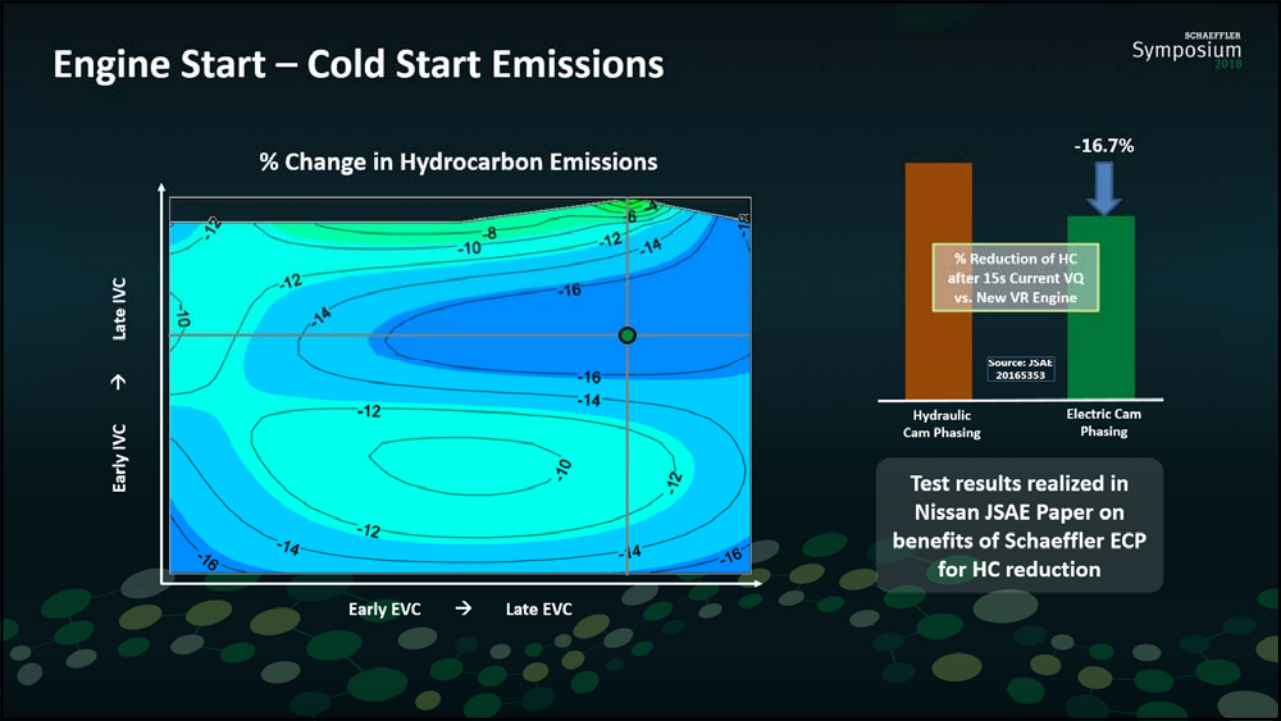


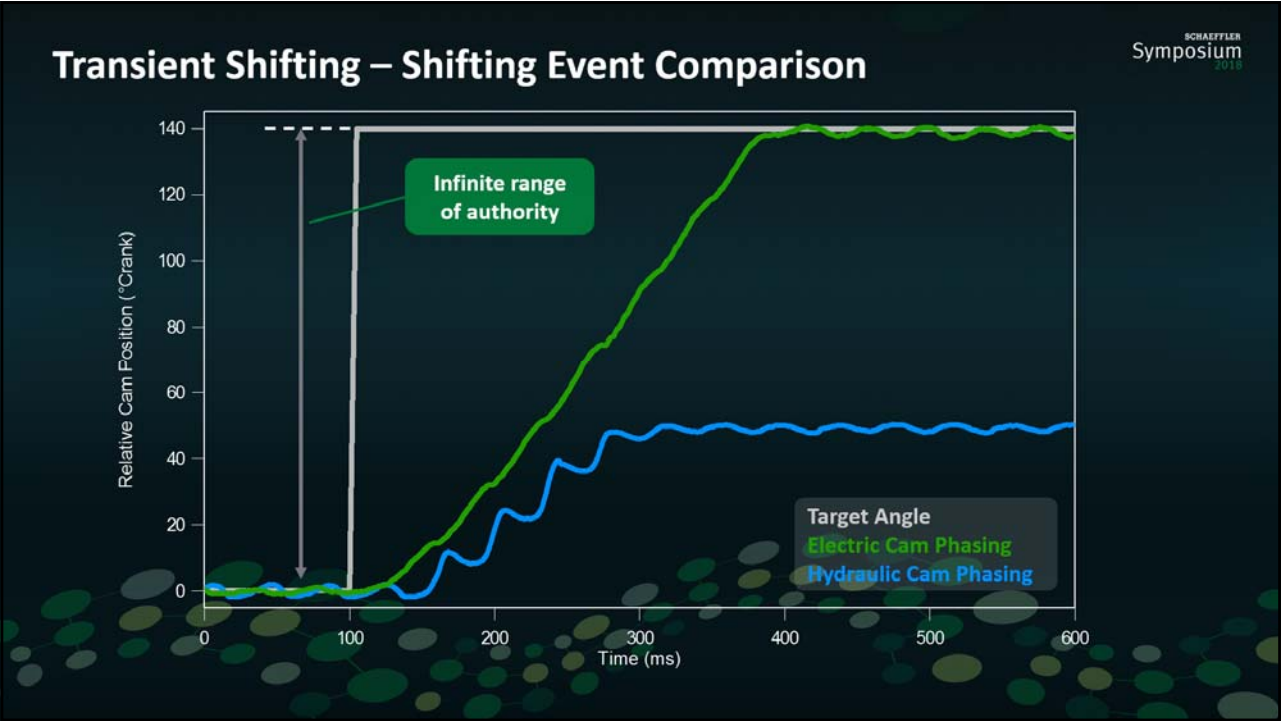
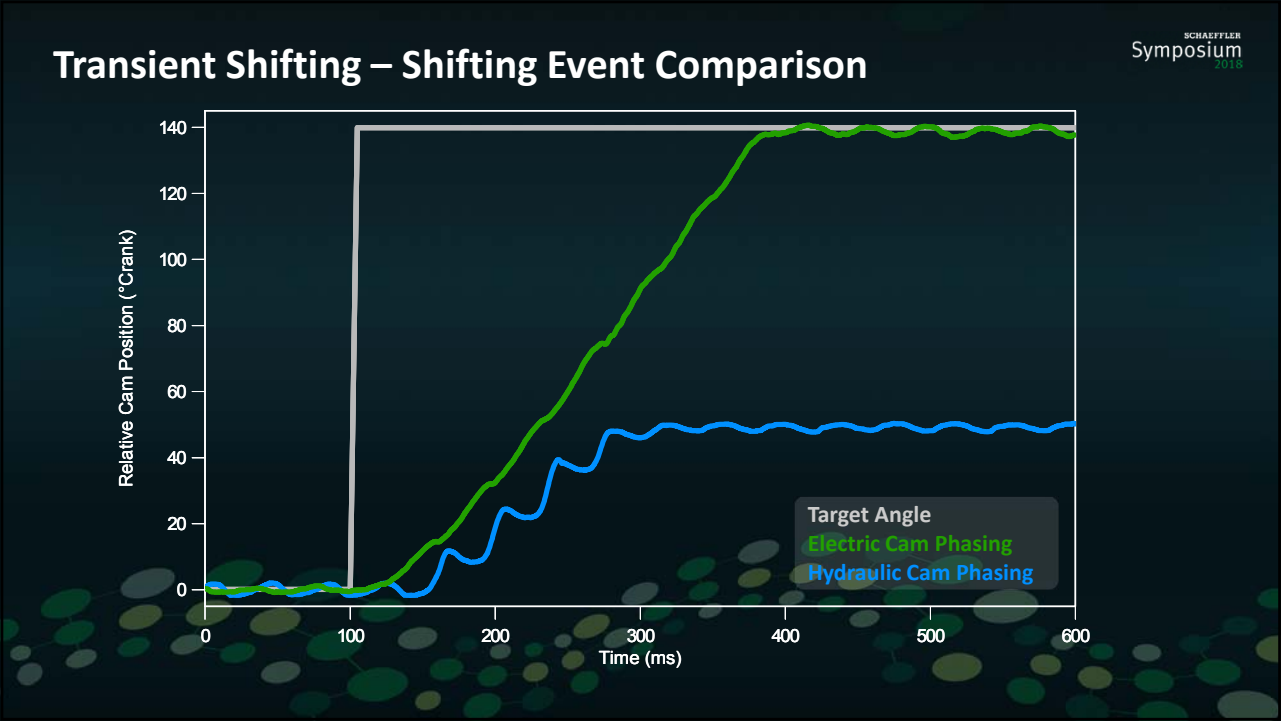


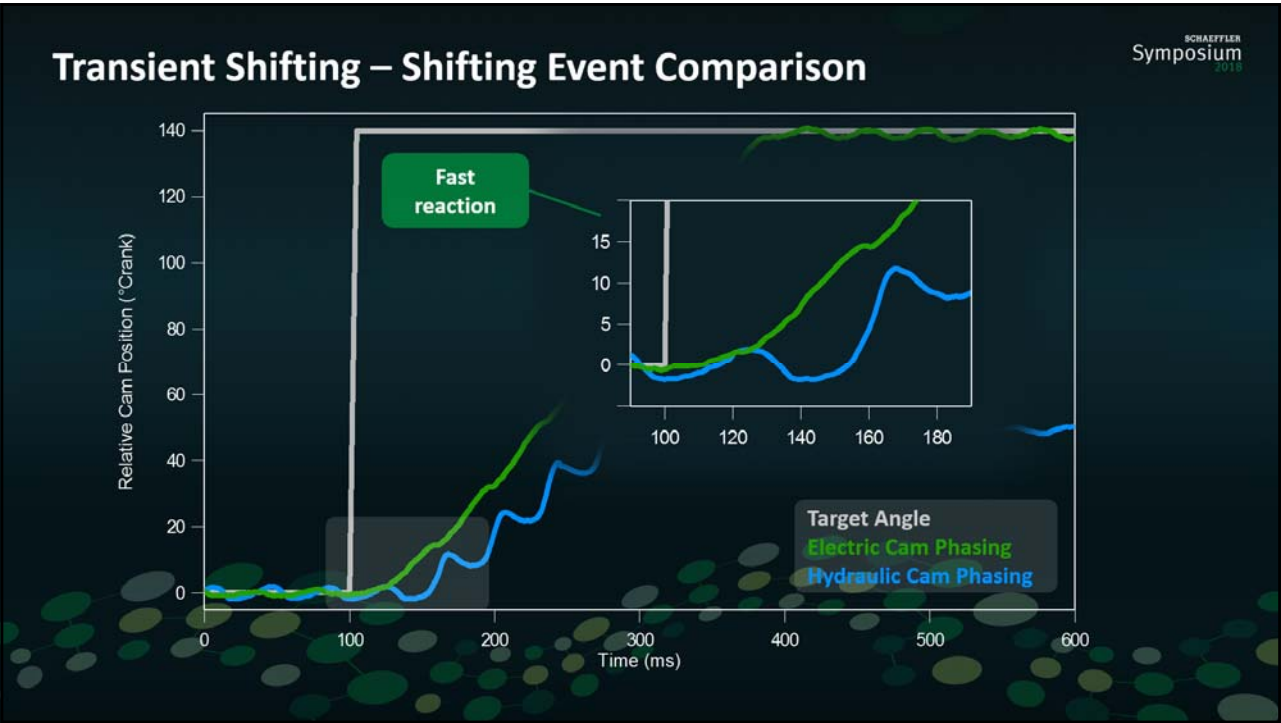
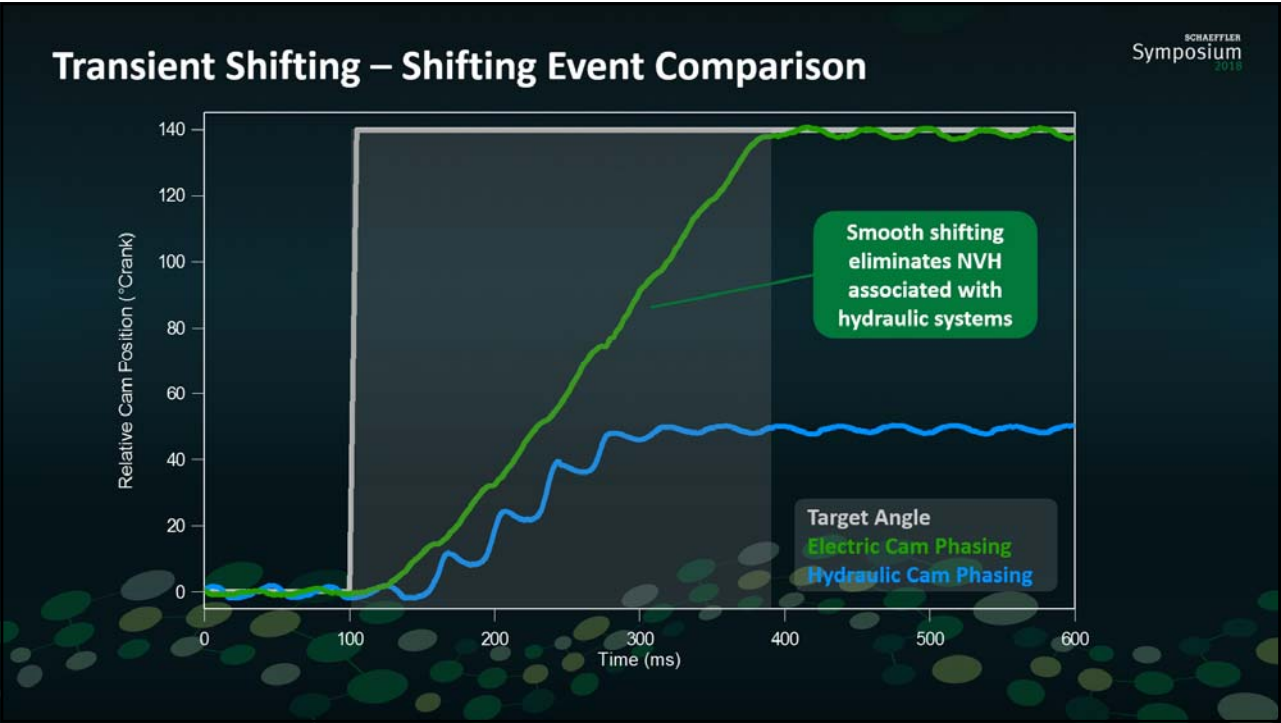


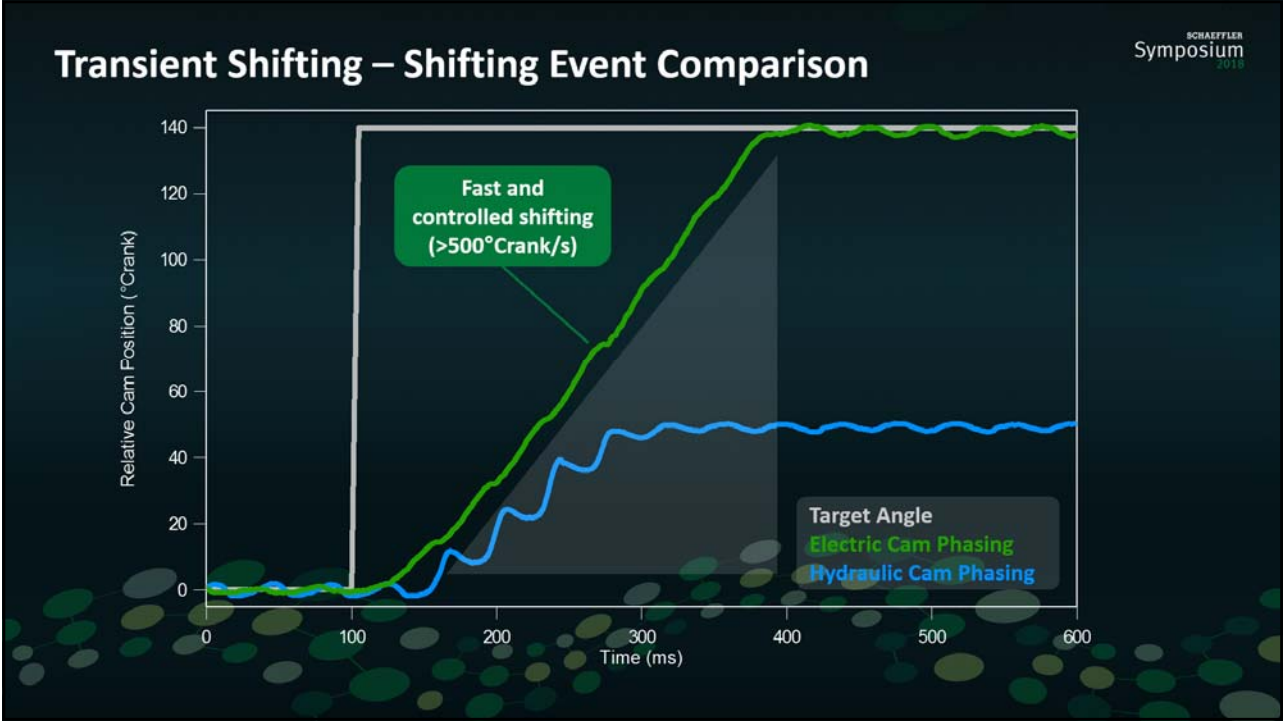


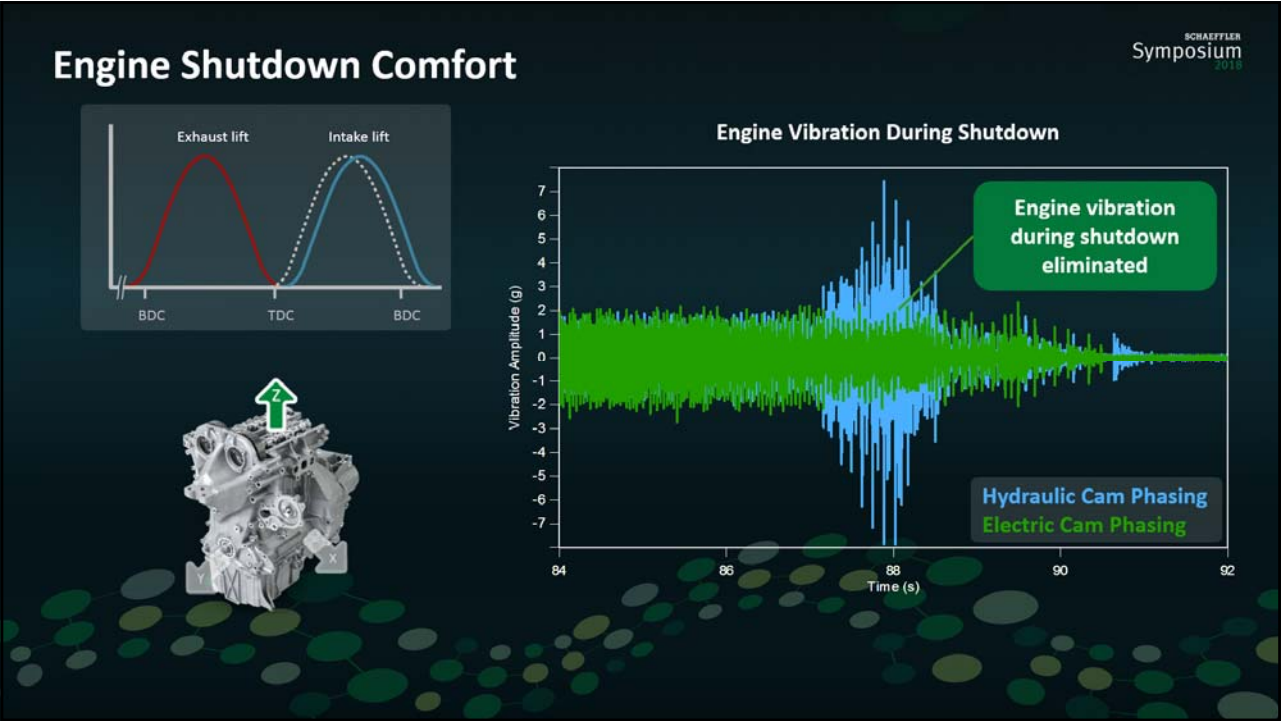
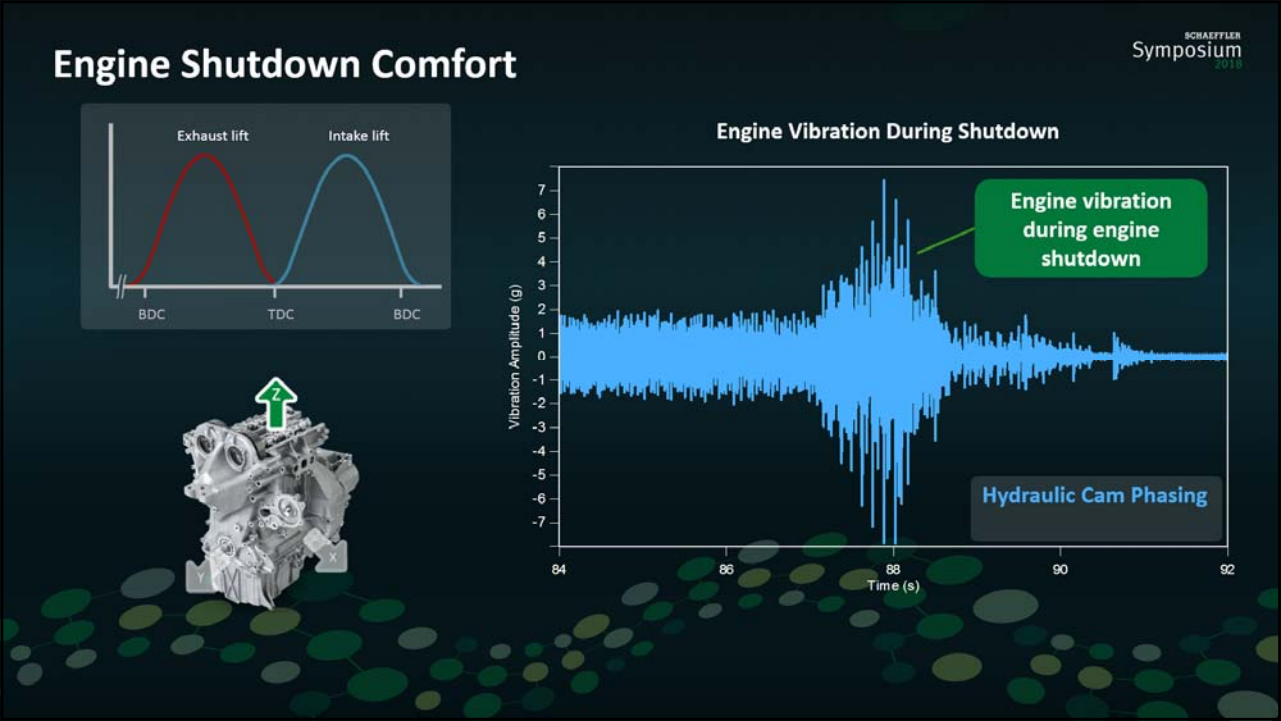




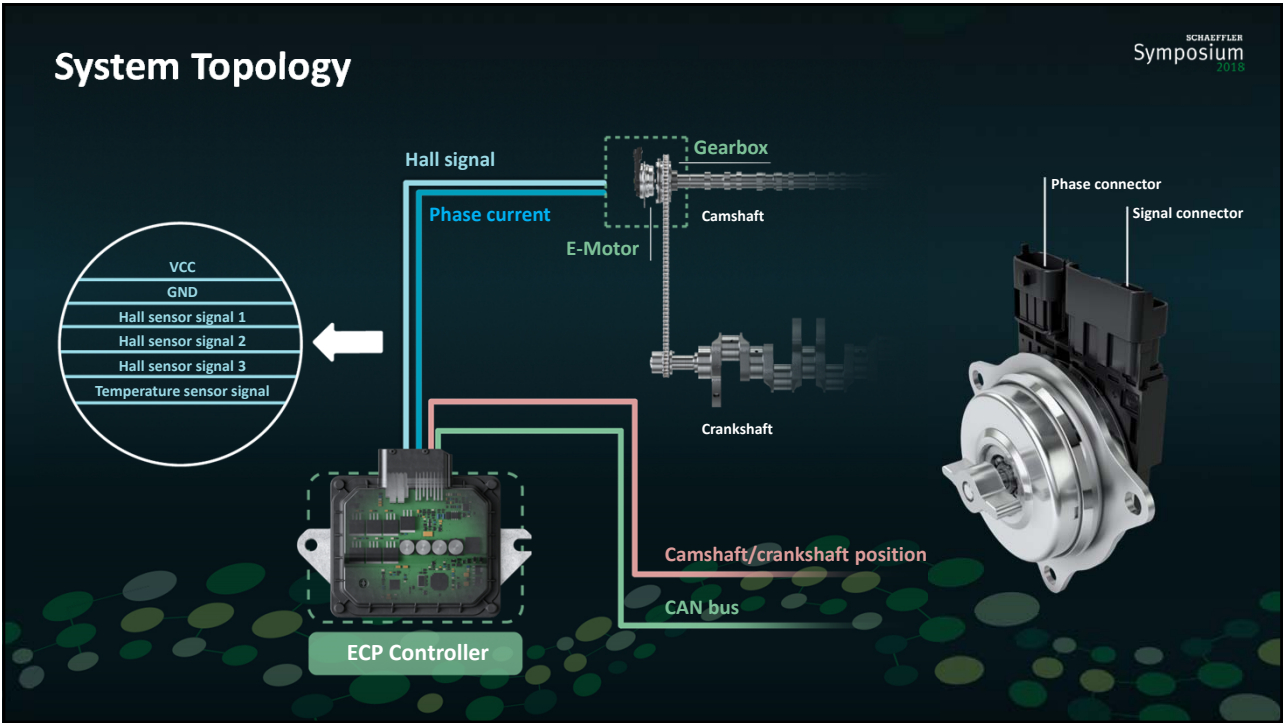
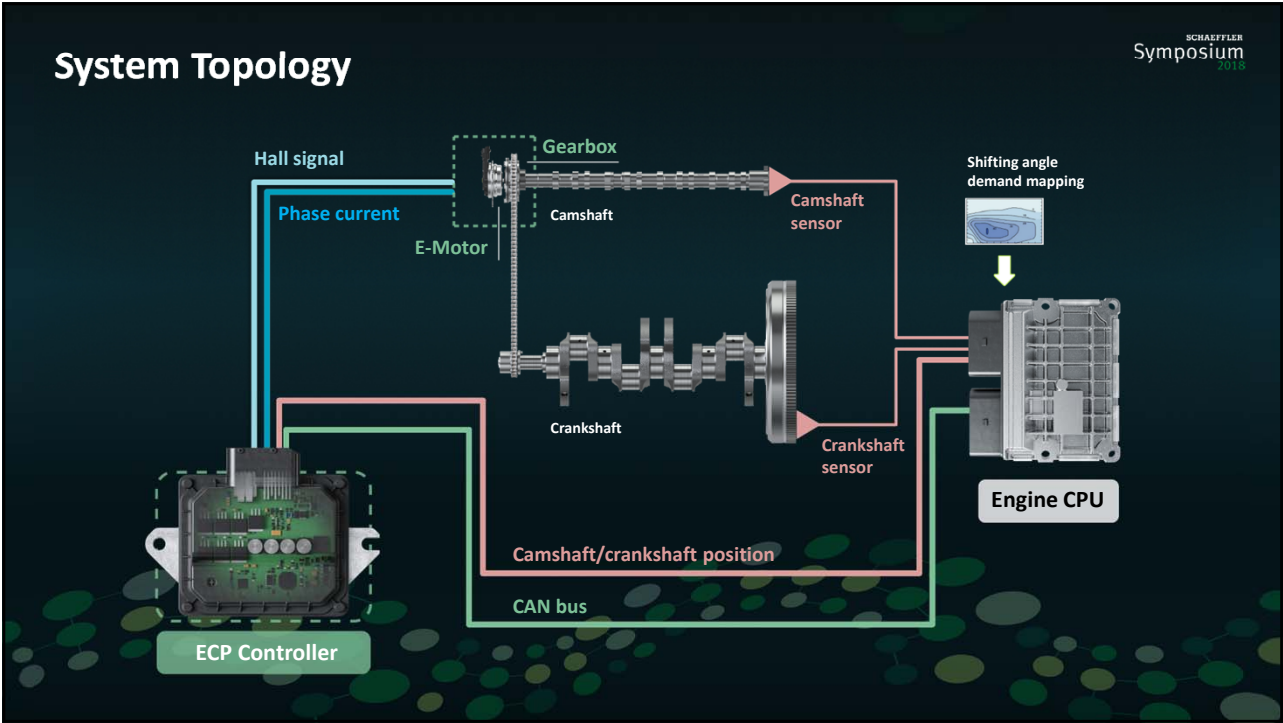


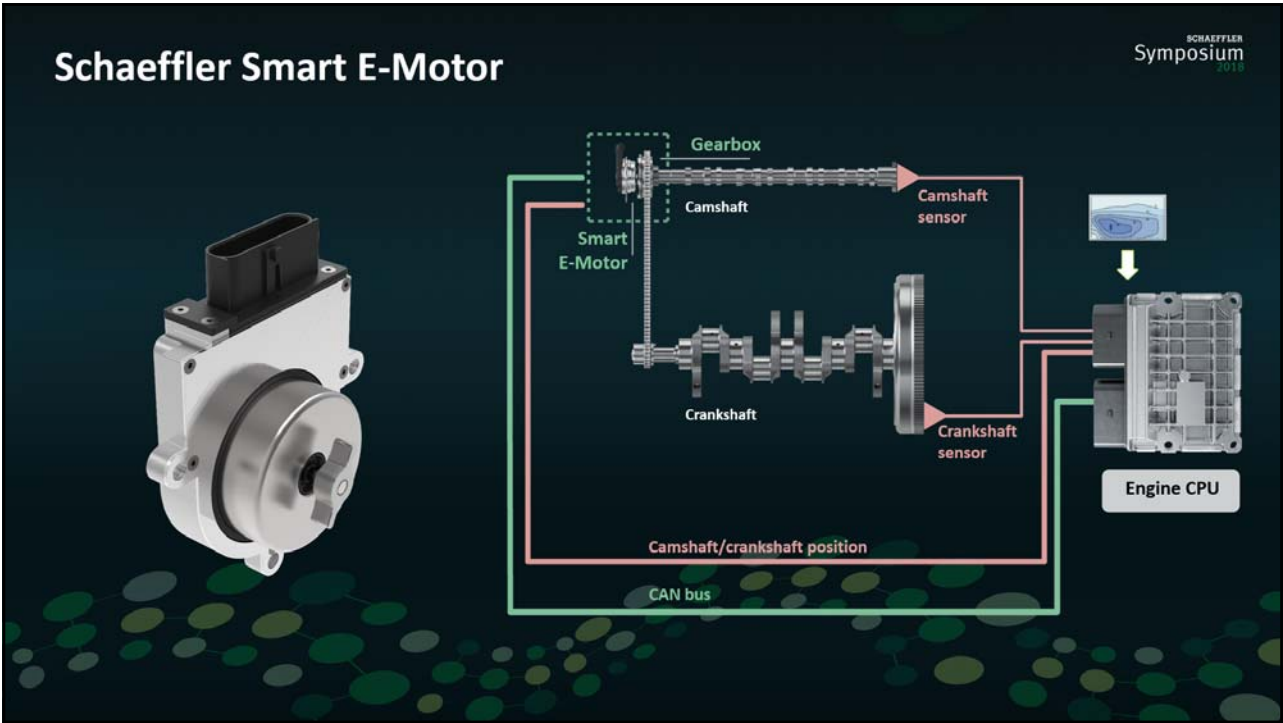
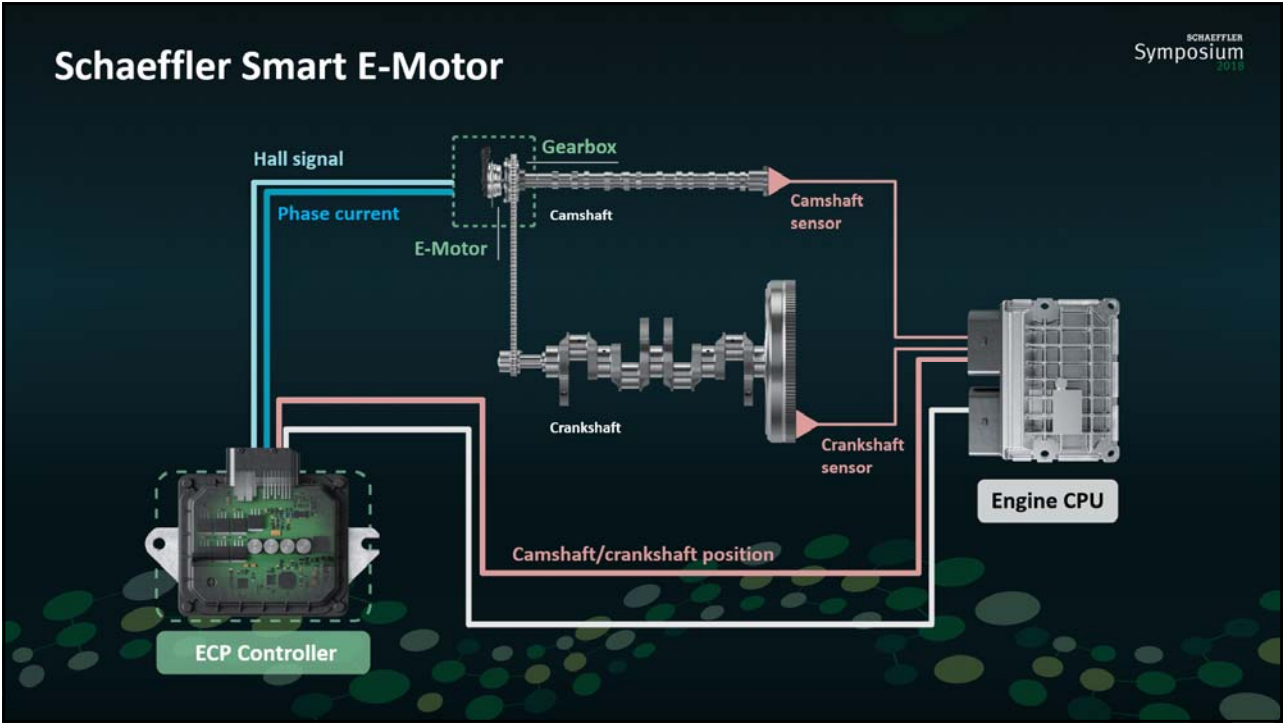












Schaeffler Smart E-Motor

- ▶ Combination of electric motor and controller
- ▶ Contains Schaeffler ECP control software and high current motor drivers
- ▶ Reduces cost and complexity of system
- ▶ Allows further integration of ECP controls on engine ECM

The diagram illustrates the Schaeffler Smart E-Motor system. It shows a cross-section of an engine with a Smart E-Motor (dashed box) connected to the Camshaft. The Camshaft is linked to the Gearbox. The Crankshaft is also shown. A Camshaft sensor and a Crankshaft sensor are positioned to monitor the camshaft and crankshaft respectively. These sensors are connected to the Engine CPU via a CAN bus. The CAN bus is labeled 'Camshaft/crankshaft position' and 'CAN bus'.

Summary

- ▶ Oil pressure independent operation
- ▶ Flexible start position
- ▶ Comfort engine shutdown
- ▶ Direct replacement for hydraulic VCT systems

A close-up image of the Schaeffler Smart E-Motor component, showing its black plastic housing and the internal gear mechanism.

