41

# Diesel Engine Low-Load Fuel-Efficient Emissions Control

Kalen Vos, Ph.D., Mechanical Engineering
PI: Dr. Gregory Shaver
vos@purdue.edu

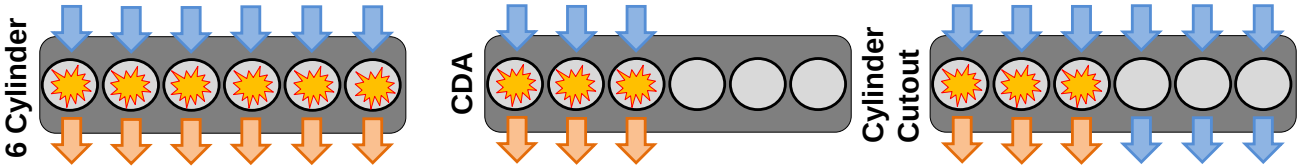
Sponsor: Purdue Research Foundation, Cummins, Eaton Powering Business Worldwide

## Project Description

- Diesel engine aftertreatment systems have higher NOx conversion at higher temperatures
- High backpressure and late injections are sometimes employed at low loads to keep aftertreatment temperatures high, but these require additional fuel consumption
- Unconventional valvetrain strategies have potential to provide high temperatures while conserving fuel

## Approach

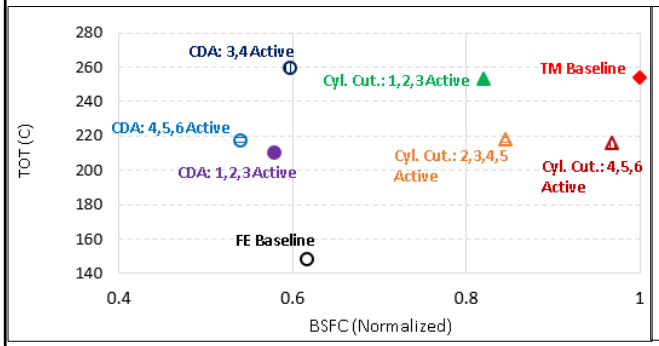
- Tests were conducted using an experimental, medium-duty diesel engine with hydraulically controlled variable valve actuation
- Cylinder deactivation (CDA, deactivating the valves and fueling) and cylinder cutout (CCO, deactivating fueling but not valves) were employed for various numbers of cylinders at low loads, particularly at idle
- Each steady-state idle case was constrained to baseline engine-out emissions
- CDA was tested against the baseline at idle for ability to maintain elevated temperatures in a preheated aftertreatment



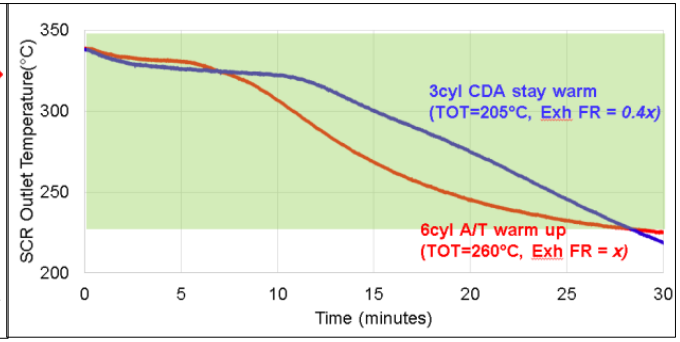

## Discussion

- CDA and CCO can be used to meet steady-state aftertreatment temperature requirements as well or better than a state-of-the-art thermal calibration while providing significant fuel consumption benefits
- CDA can help maintain elevated temperatures in a preheated aftertreatment for a longer duration, which reduces tailpipe NOx emissions compared to the baseline

## Results




CDA and CCO can provide steady-state idle temperatures similar to the baseline with significant fuel savings




CDA can be used to help a preheated aftertreatment stay warm for longer at idle

**Valvetrain flexibility can be used to improve diesel engine thermal management to reduce emissions and save fuel**

Purdue University