KTH ROYAL INSTITUTE
OF TECHNOLOGY

Valve Strategies and Exhaust Pulse Utilization

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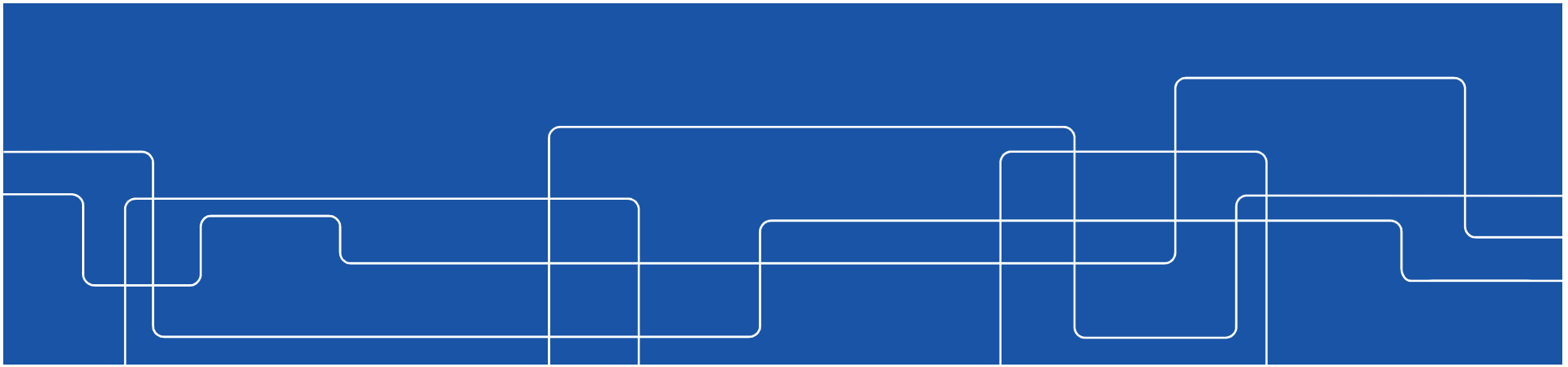
07.09.2017, CCGEx – Research Day

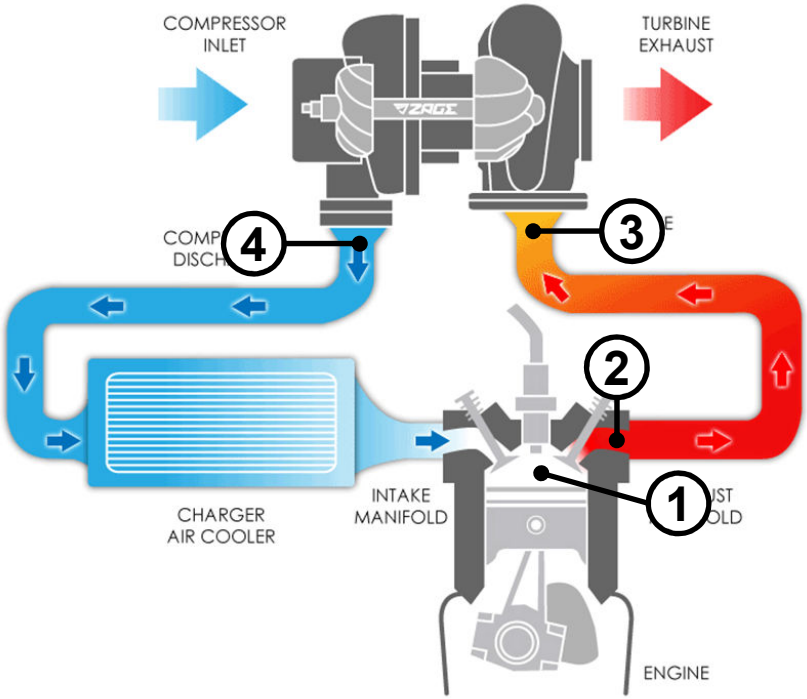


Outline

- Project
- Earlier Work
- Work in Progress (WIP)
- Near-Future Plans

Project

- Increase exhaust energy utilization in a turbocharged engine by varying the exhaust valve profile

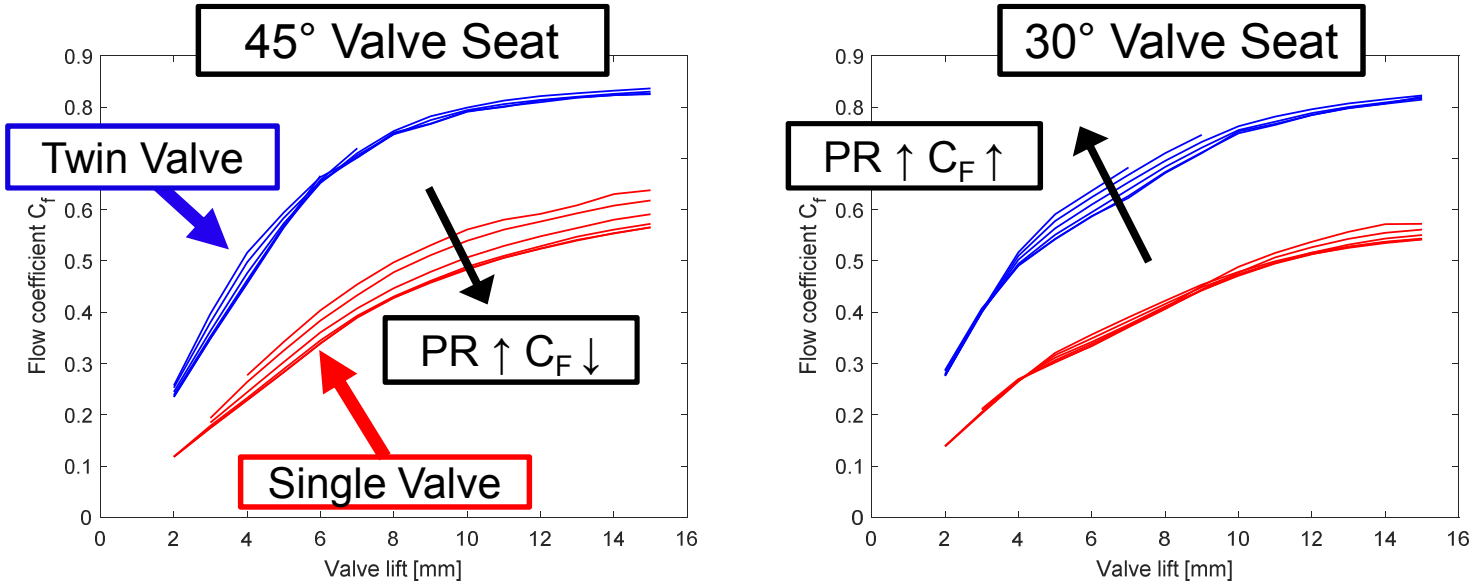


- 1→2: Cylinder → Exhaust Port
- 2→3: Exhaust Port → Turbine Inlet
- 3→4: Turbine In → Compressor Out

Lower Pumping loss → Improved Engine Efficiency

Earlier Work

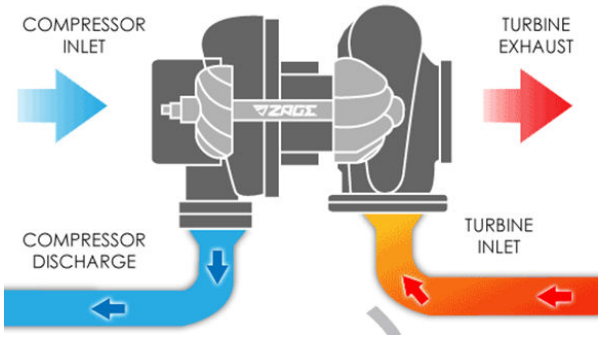
- Cylinder → Exhaust Port
- Exhaust Valve: Flow coefficients in 1-D
- Influence of pressure ratio on flow coefficients



- SAE paper: 2017-01-0530

WIP: Background

- Turbine Inlet → Compressor Outlet



- Evaluate turbine efficiency for different exhaust pulse shapes

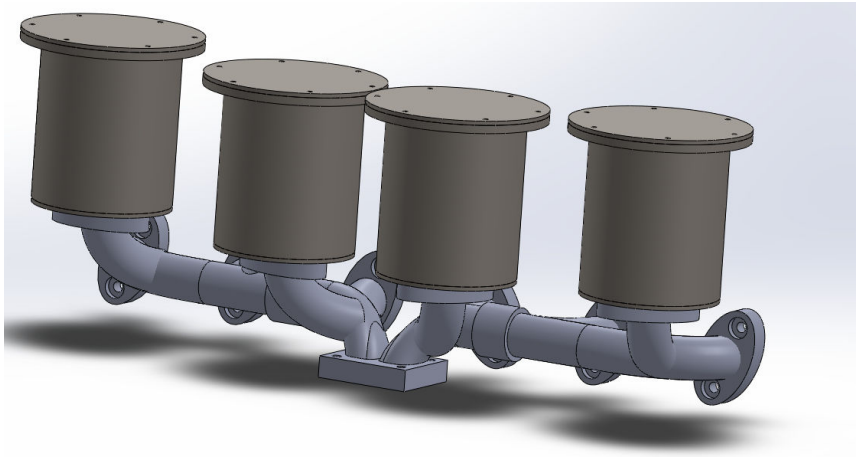
Conventional method

- Pulsating-flow Gas Stand
- Steady-flow Gas Stand → Turbine Map → 1-D simulation software

WIP: New Approach

- Engine as a gas generator
  - Engine speed constant
  - Extracted power constant (boost pressure) / Injected fuel constant

- Modify pulse shape by varying exhaust manifold volume



- **Hypothesis:** Turbine efficiency decreases with increasing pulse amplitude

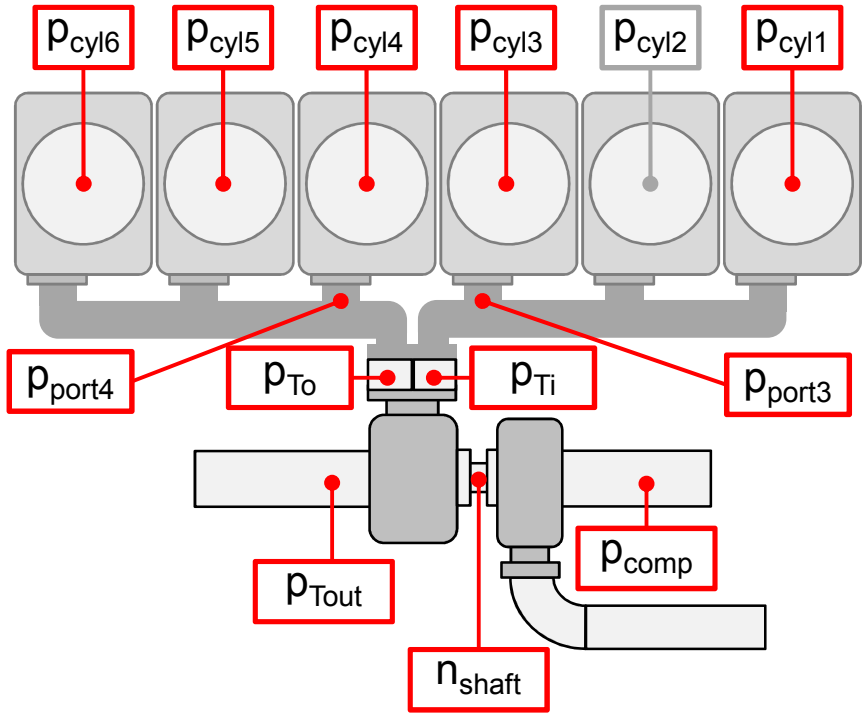
WIP: Experimental setup

- Volumes 4x4liter, Original Exhaust Manifold ~2liter

- Scania DC13
- GT4594

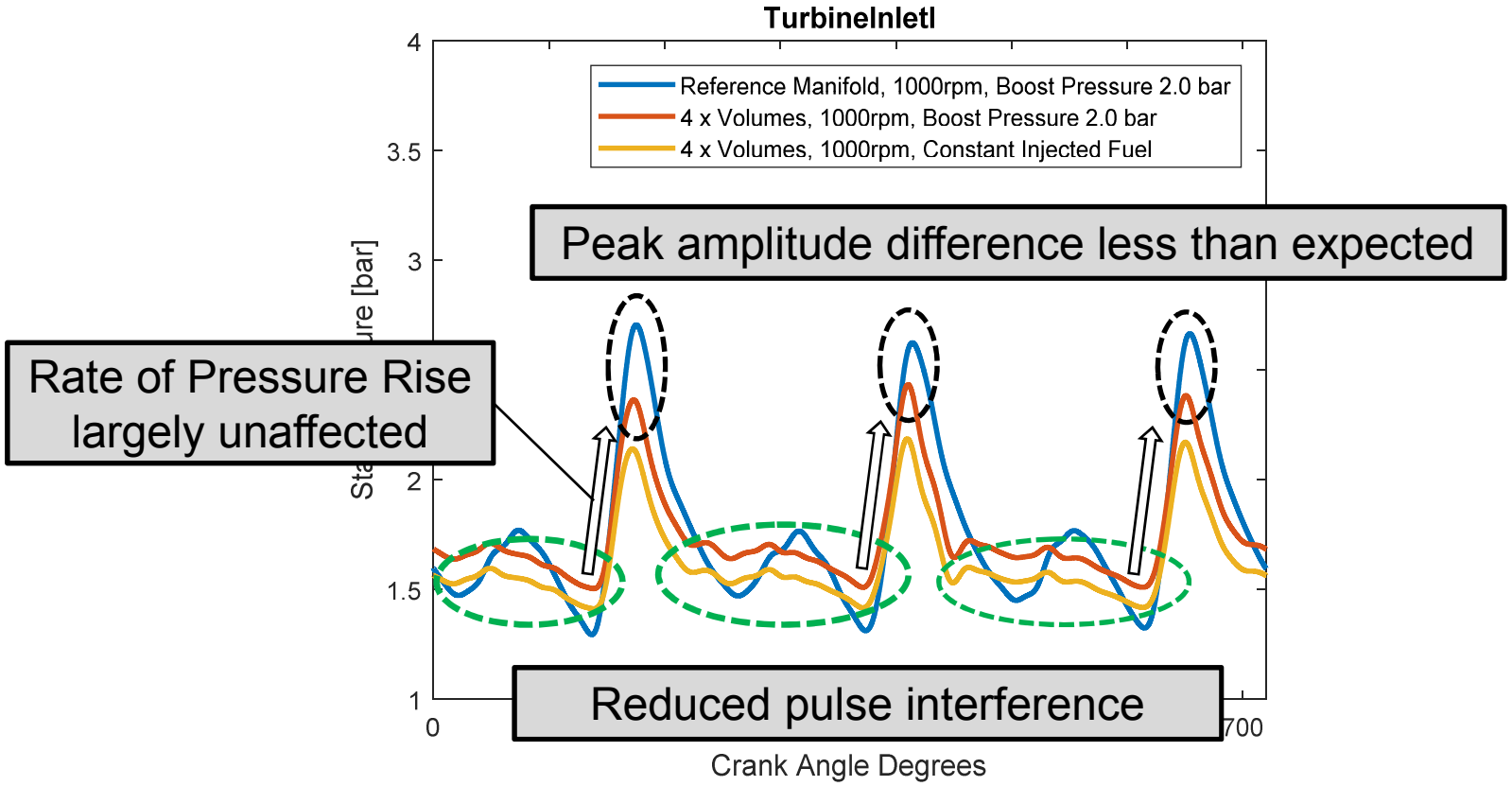
WIP: Measurement setup

- Fast sampling system (200kHz)



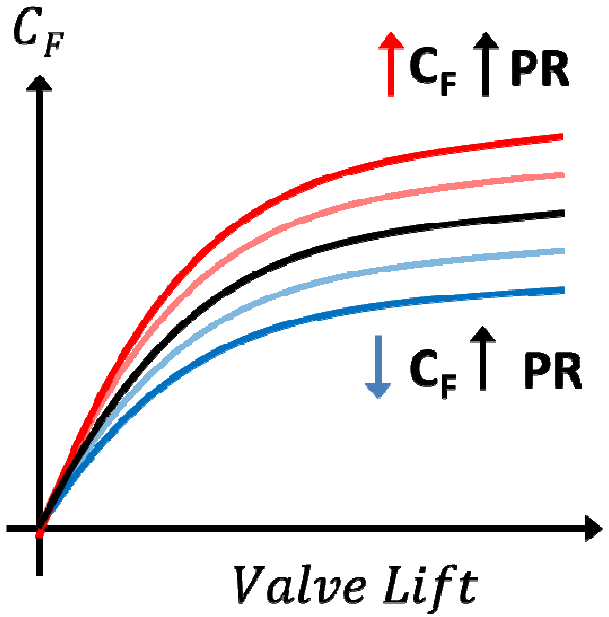
WIP: Preliminary Results

- Abstract submitted to SAE WCX18



Near-Future Plans

- Sensitivity study in GT-Power of pressure dependent C_F
- Continuation from first experimental campaign
- 2 Days a week at Scania until New Year



Thank you for your attention!

- Questions?

Competence Center for Gas Exchange

CC GEx

”Charging for the future”