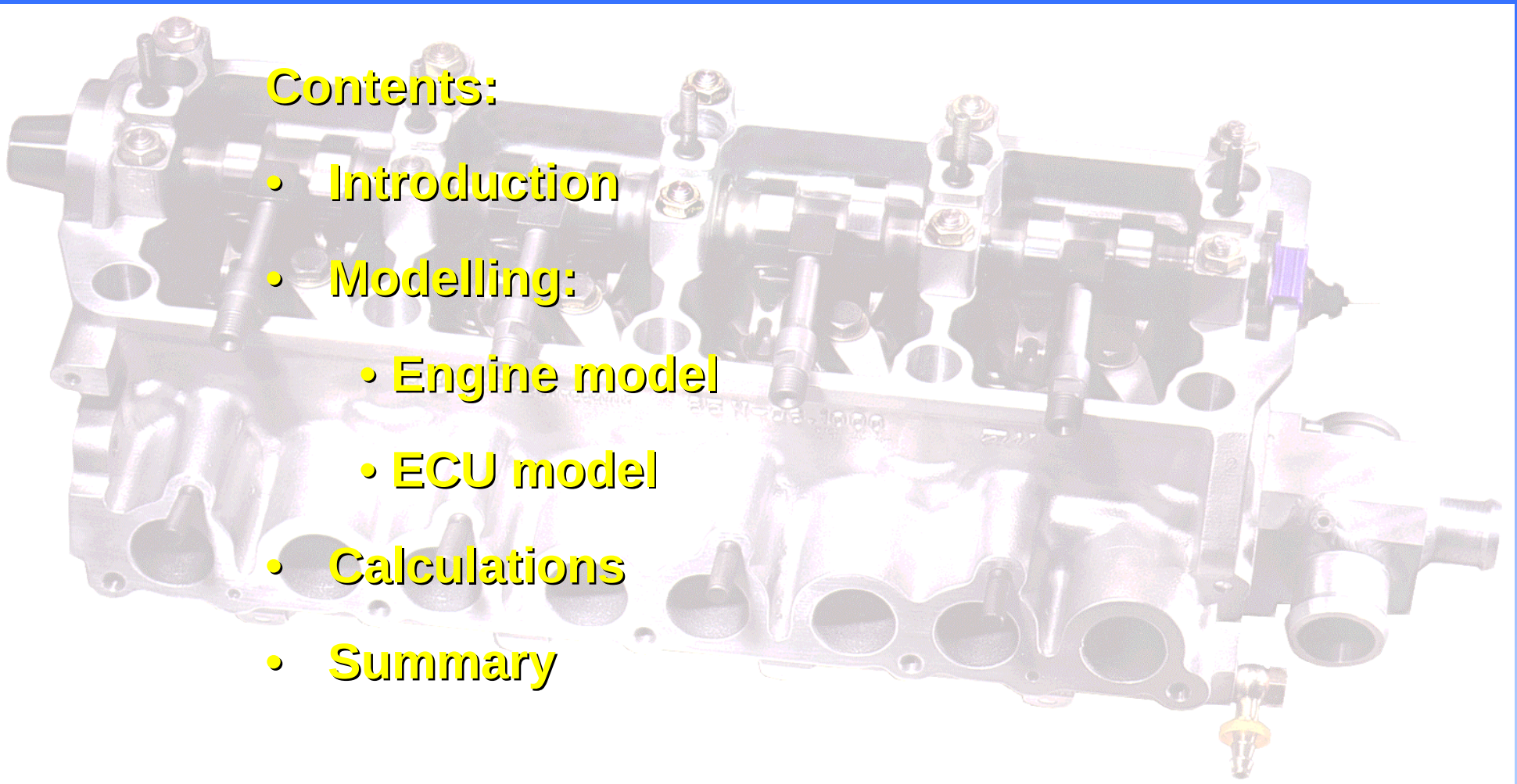
GT-Suite Users Conference 1999

Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

M. Rauscher, Ch. Schernus, K. Fieweger, O. Lang, P. Adomeit.
FEV Motorentechnik GmbH

B. Kinoo
Aachen University of Technology, Institute for Combustion Engines

Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration



Contents:

- Introduction
- Modelling:
  - Engine model
  - ECU model
- Calculations
- Summary

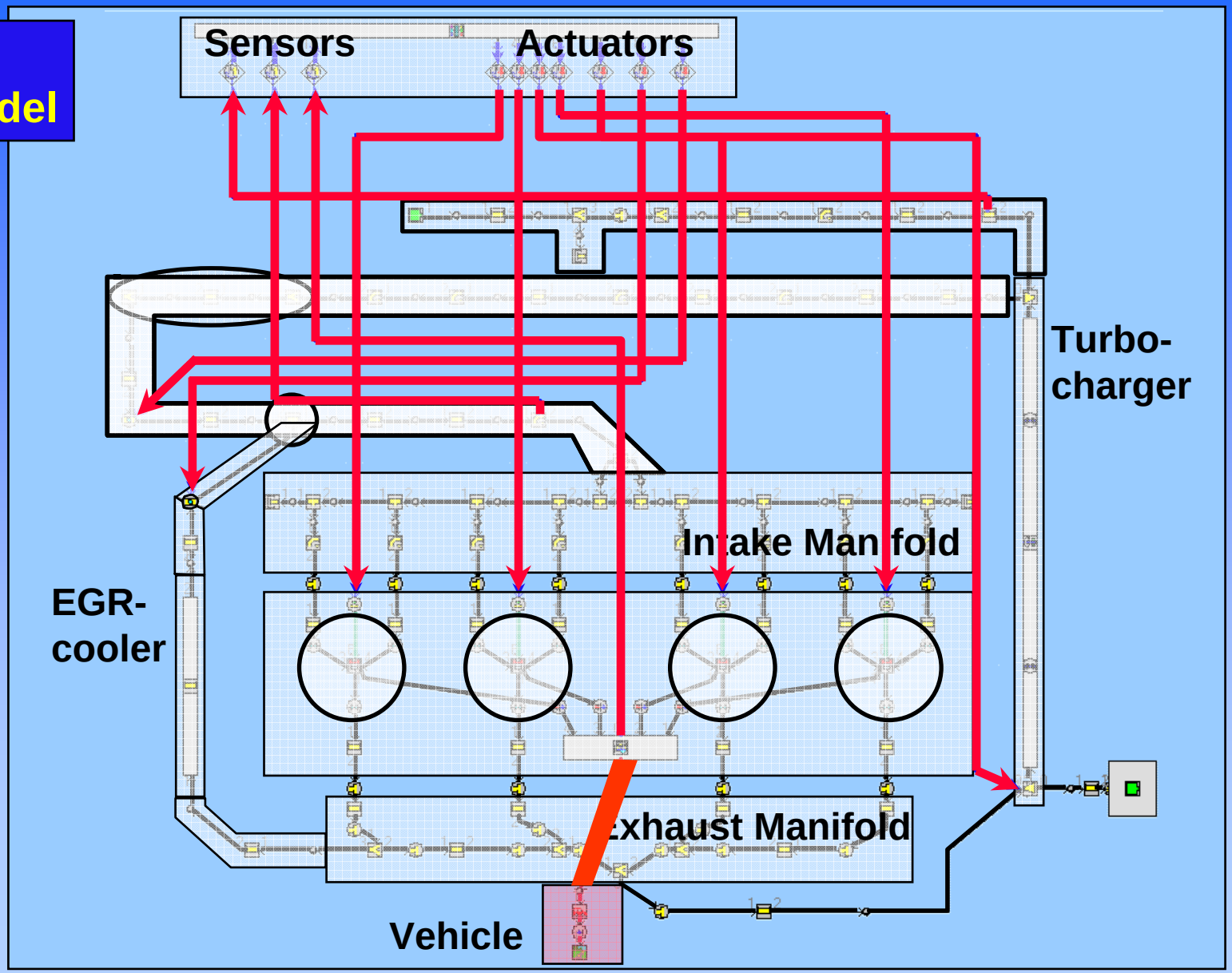
Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

Aspects of transient engine simulation:

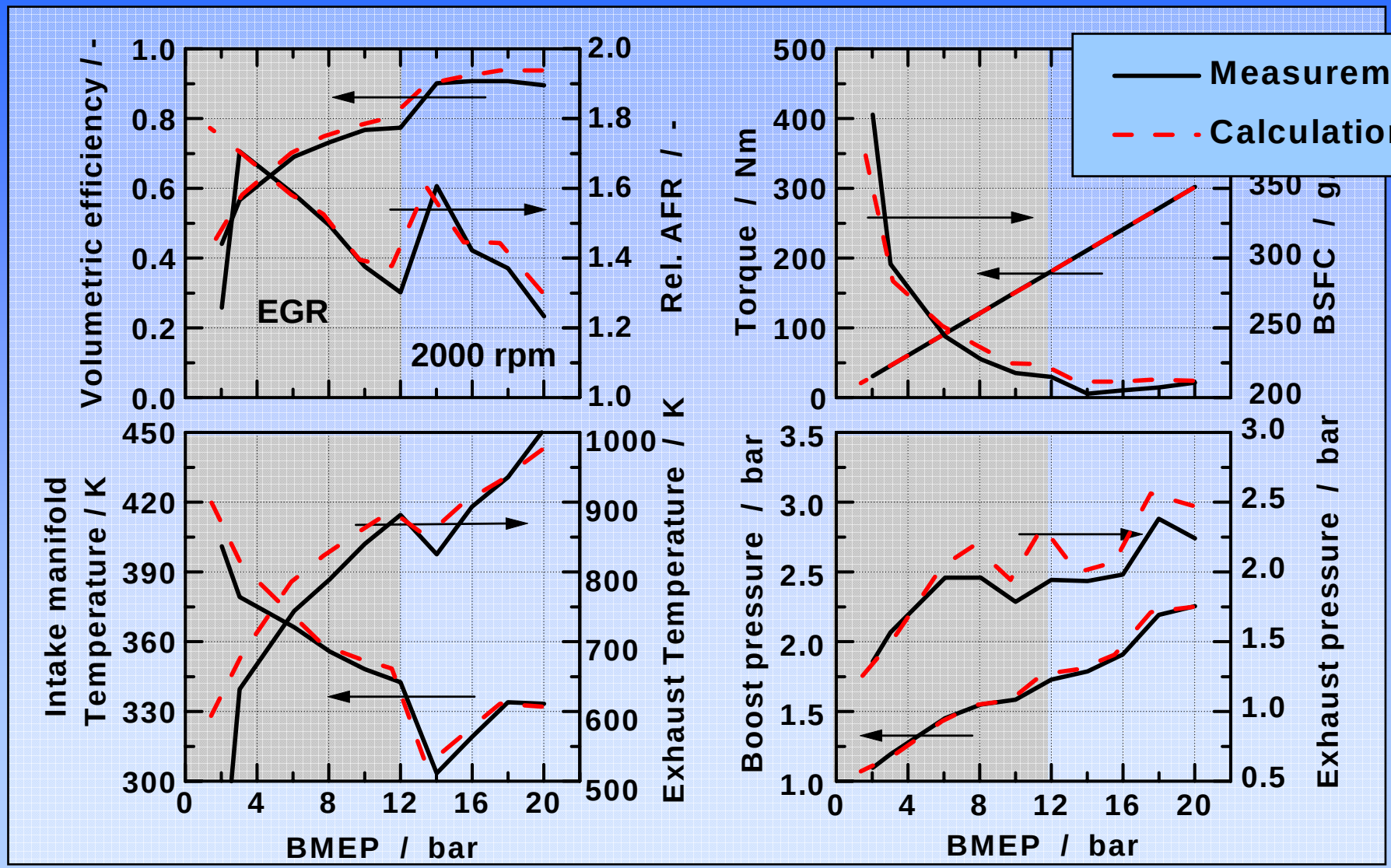
- Combustion should be calculated or be given as a table versus engine speed and load
- Combustion with rel. AFR below 1.0 has to be taken into acount
- Wall heat losses have to be calculated transiently, taking into acount heat capacities of the walls
- Turbocharger modeling

Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

GT Power engine model

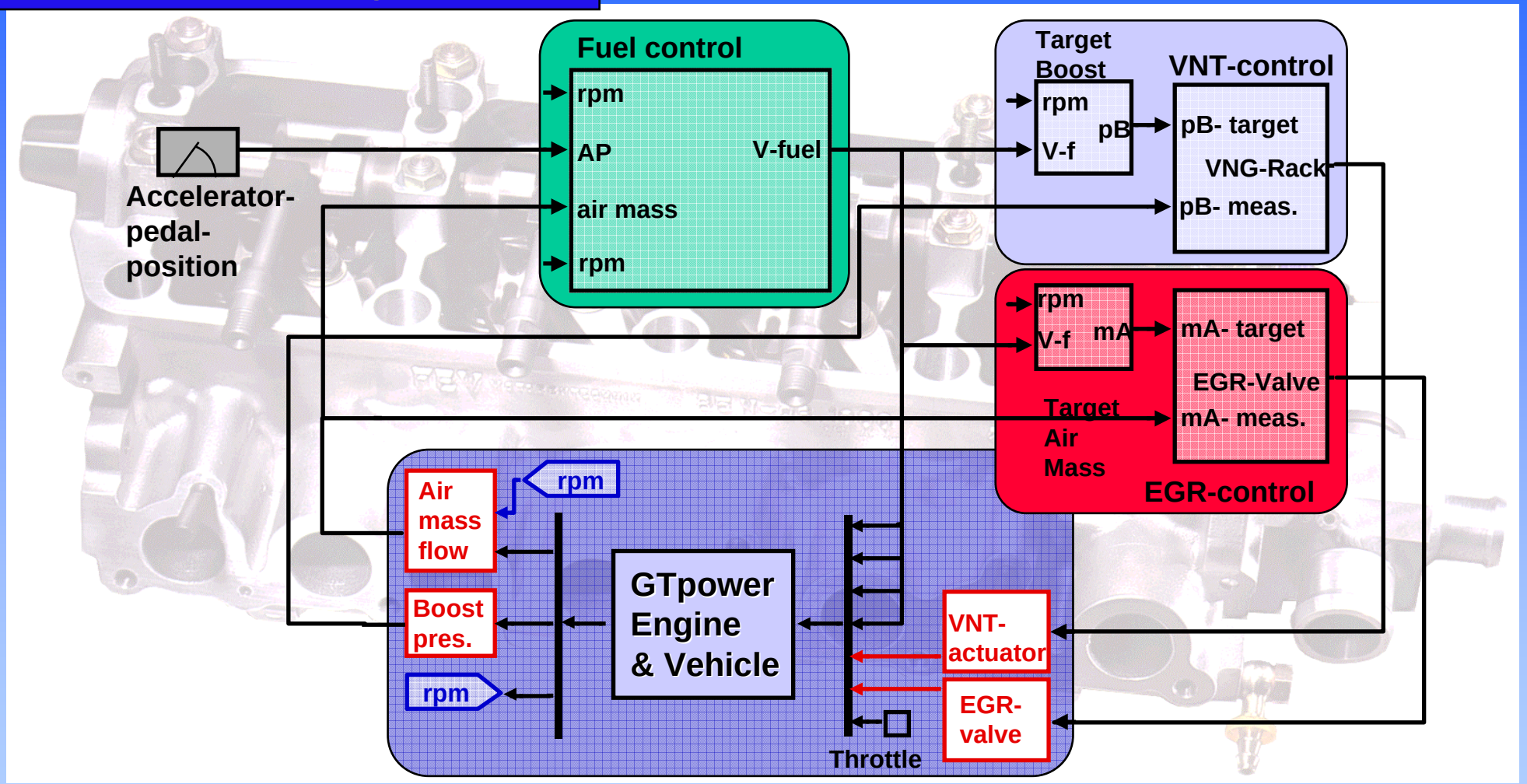


Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration



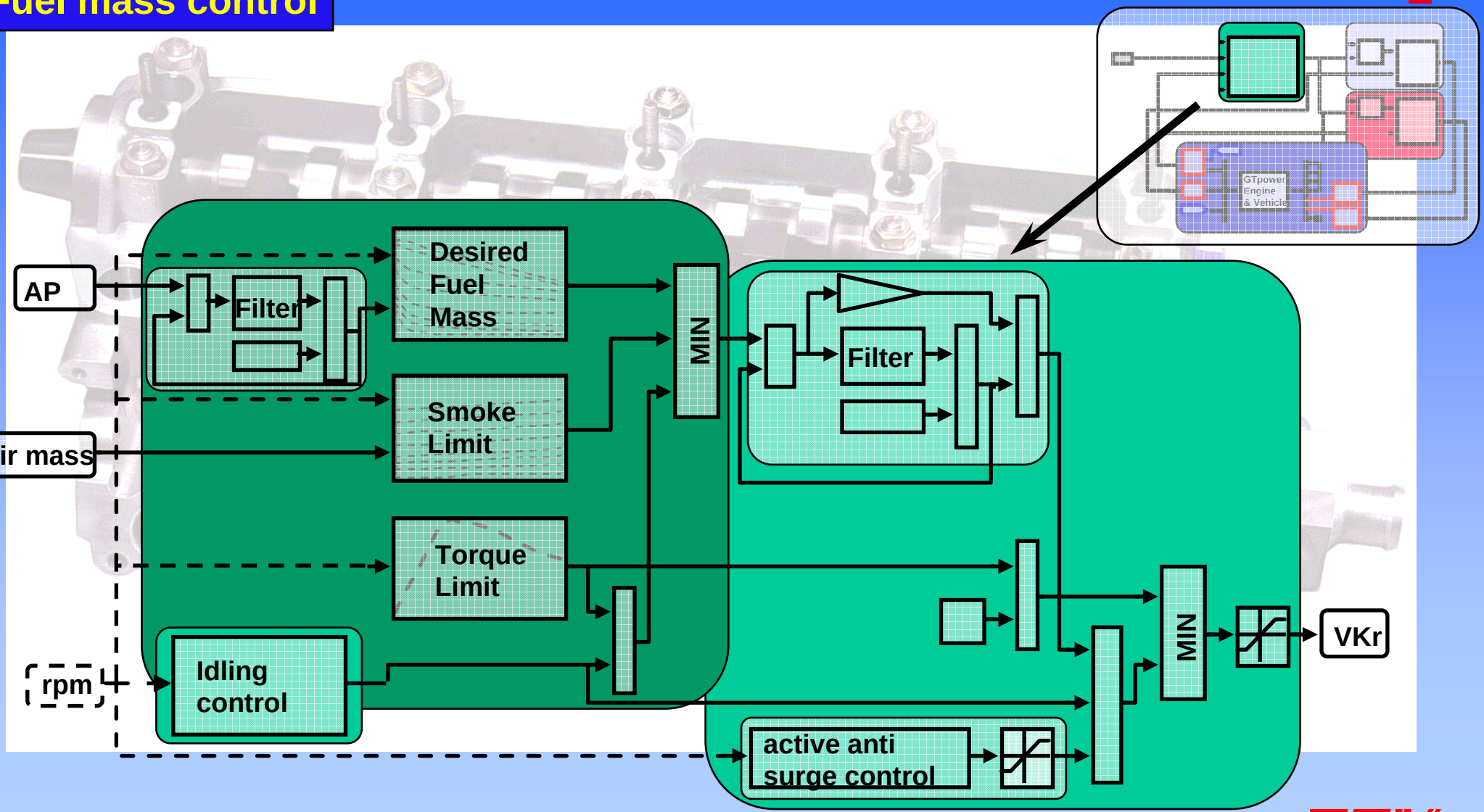
Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

Linked ECU and engine model



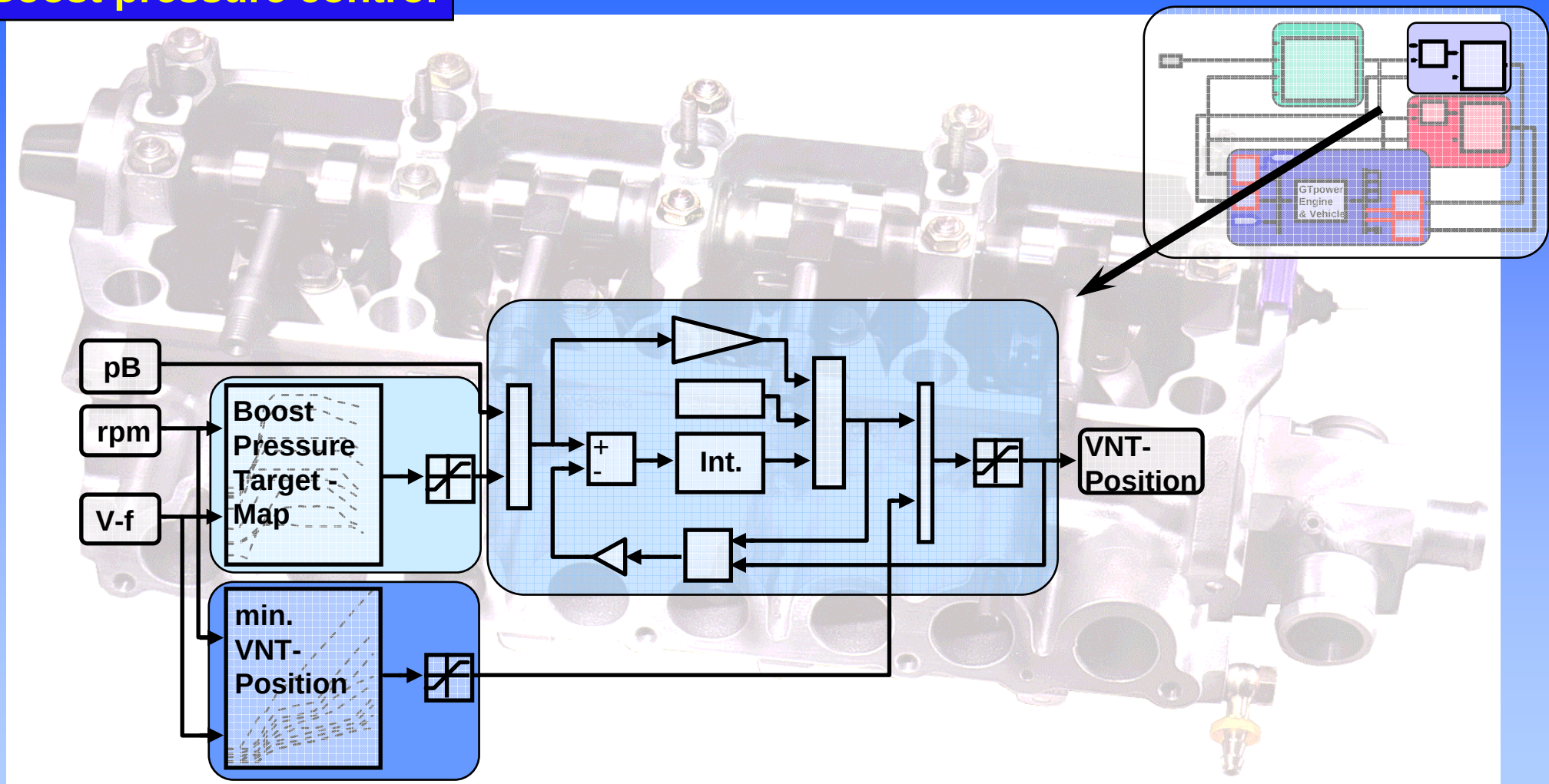
Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

Fuel mass control

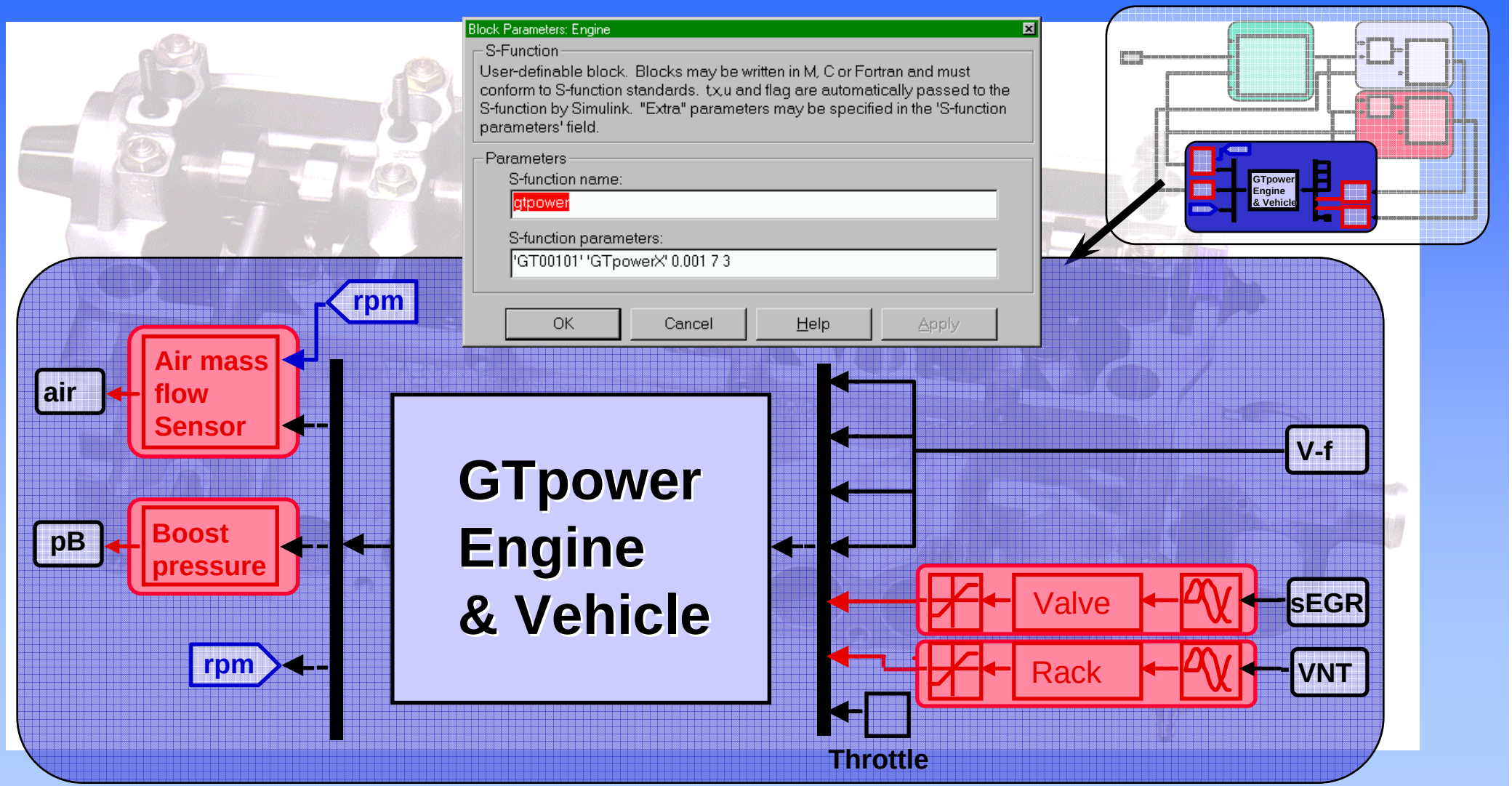


Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

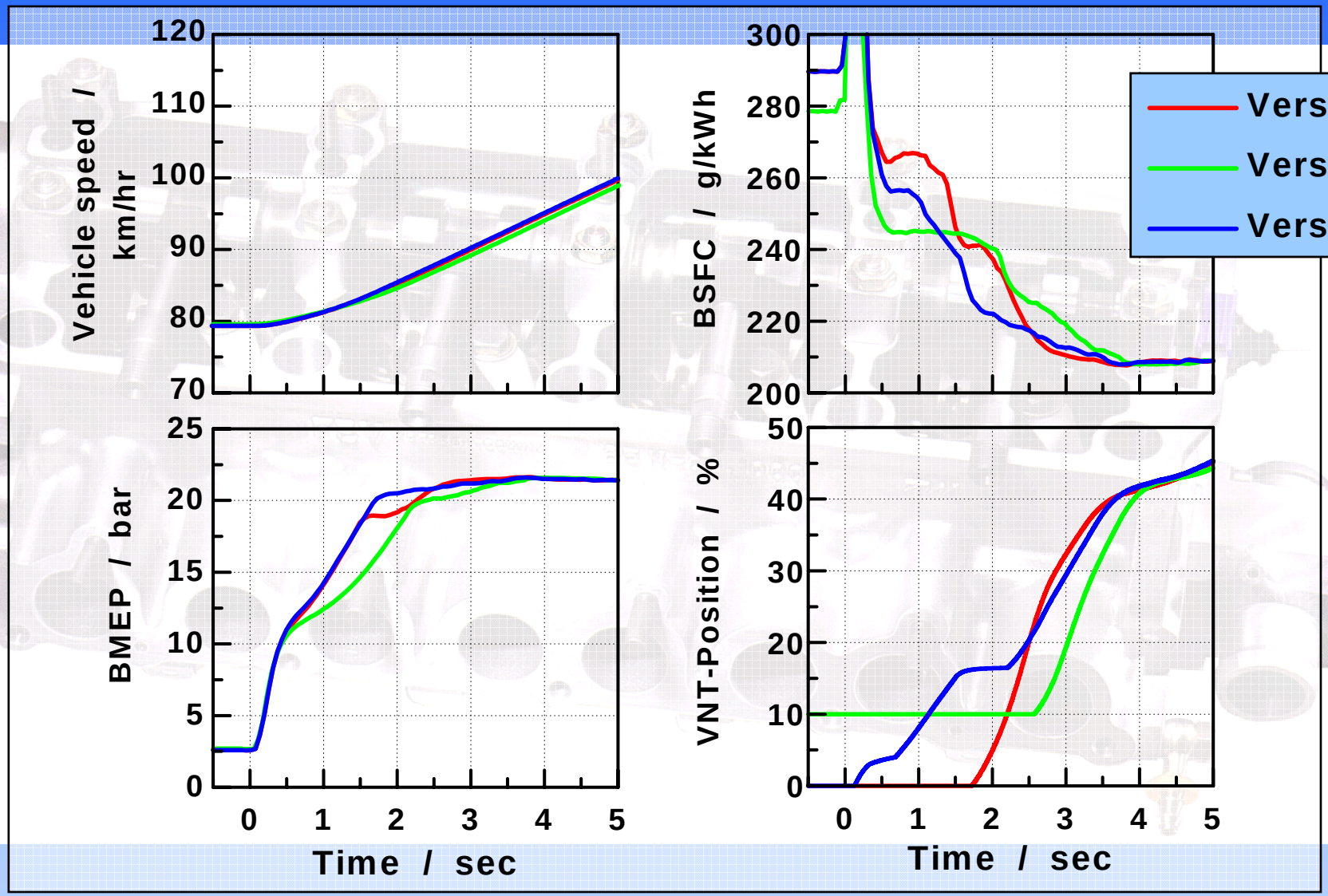
Boost pressure control



Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

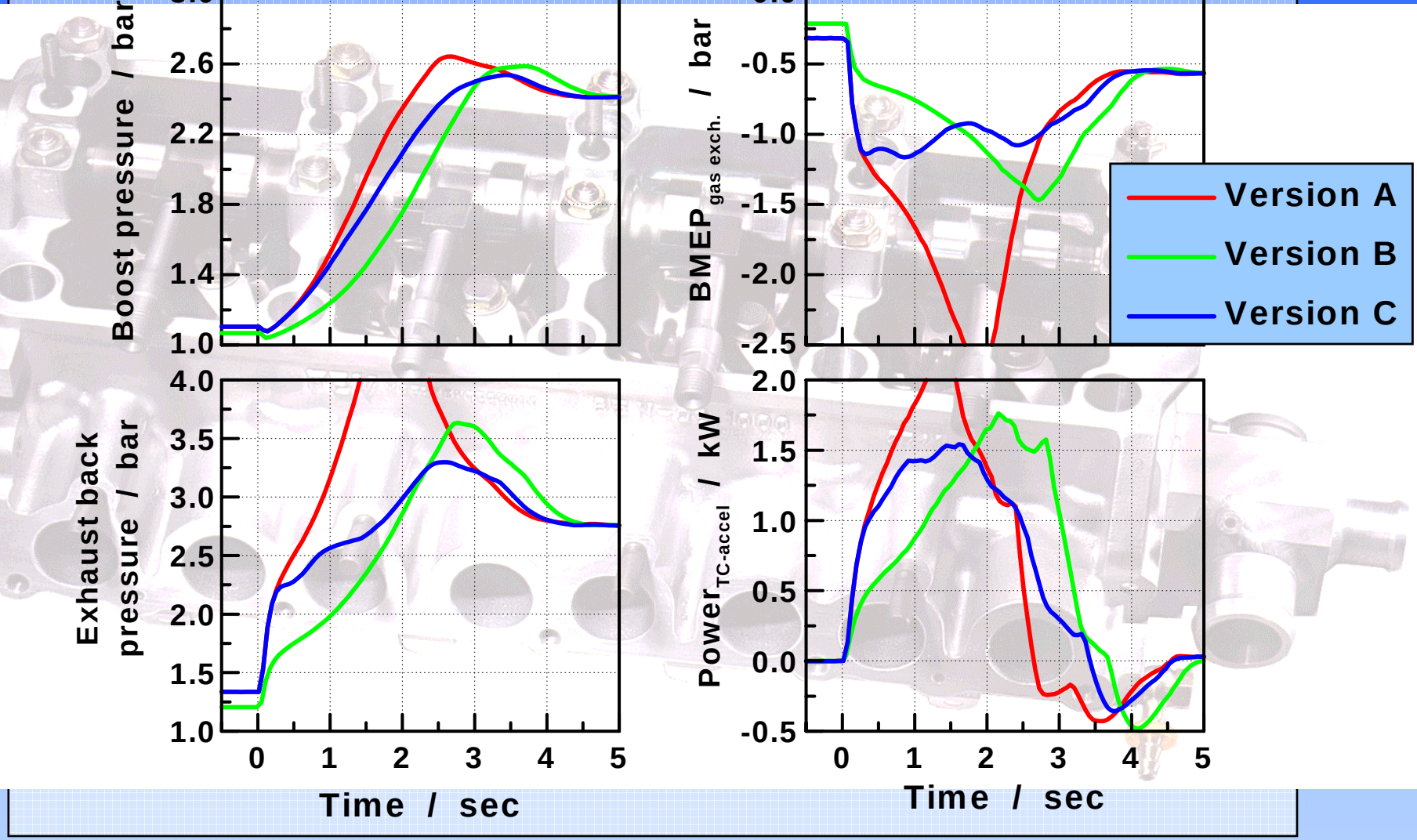


Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration



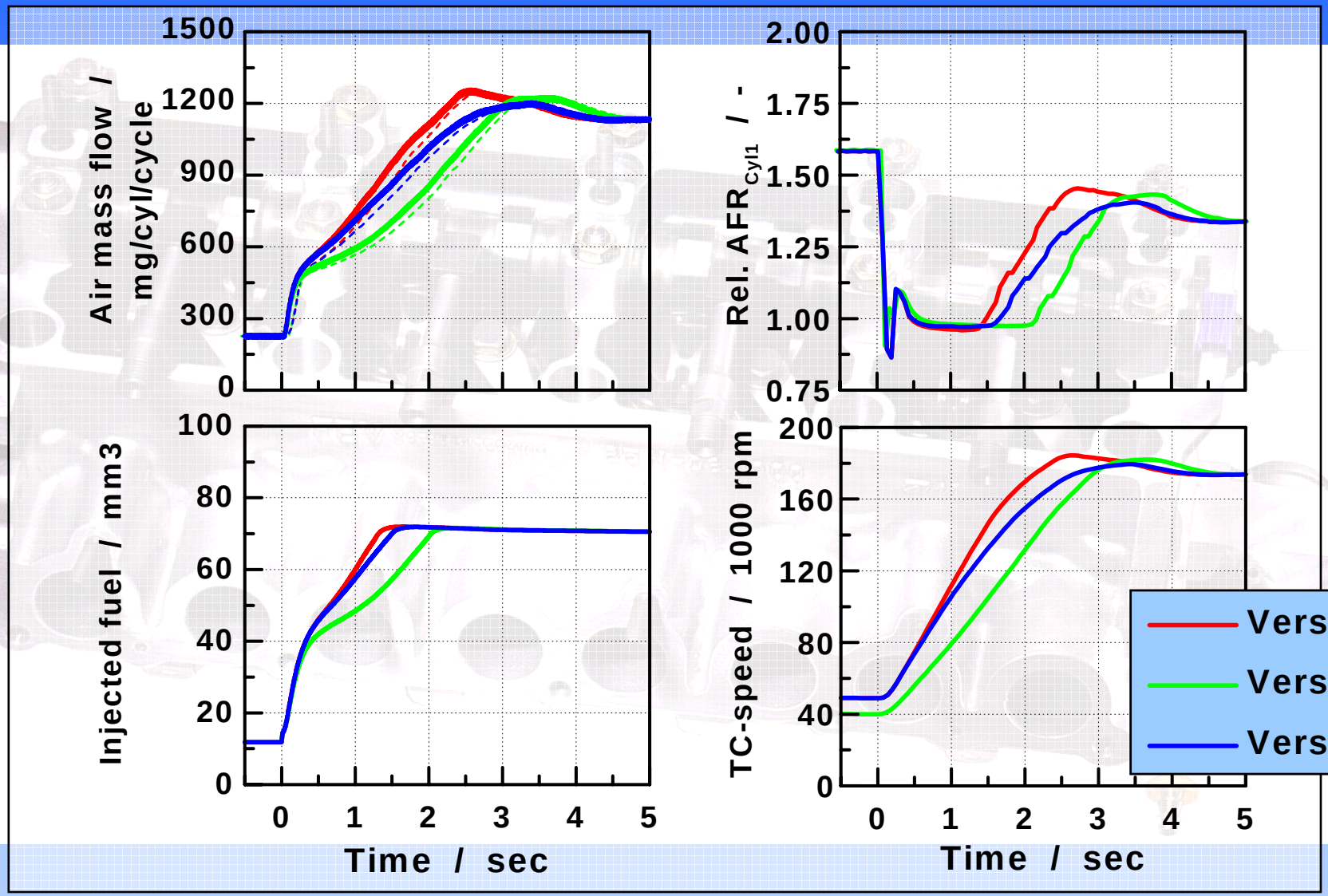
FEV

Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration



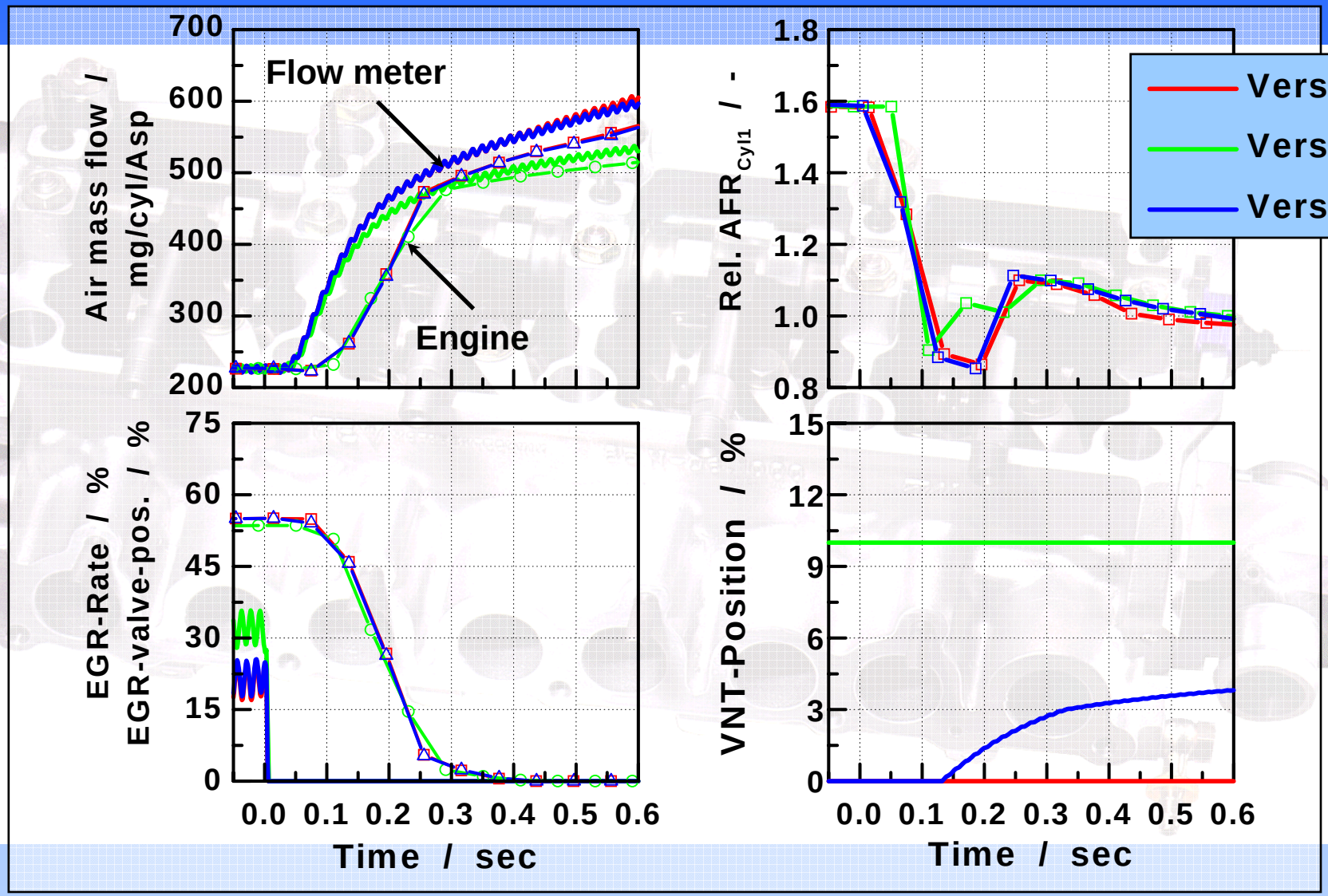
FEV

Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

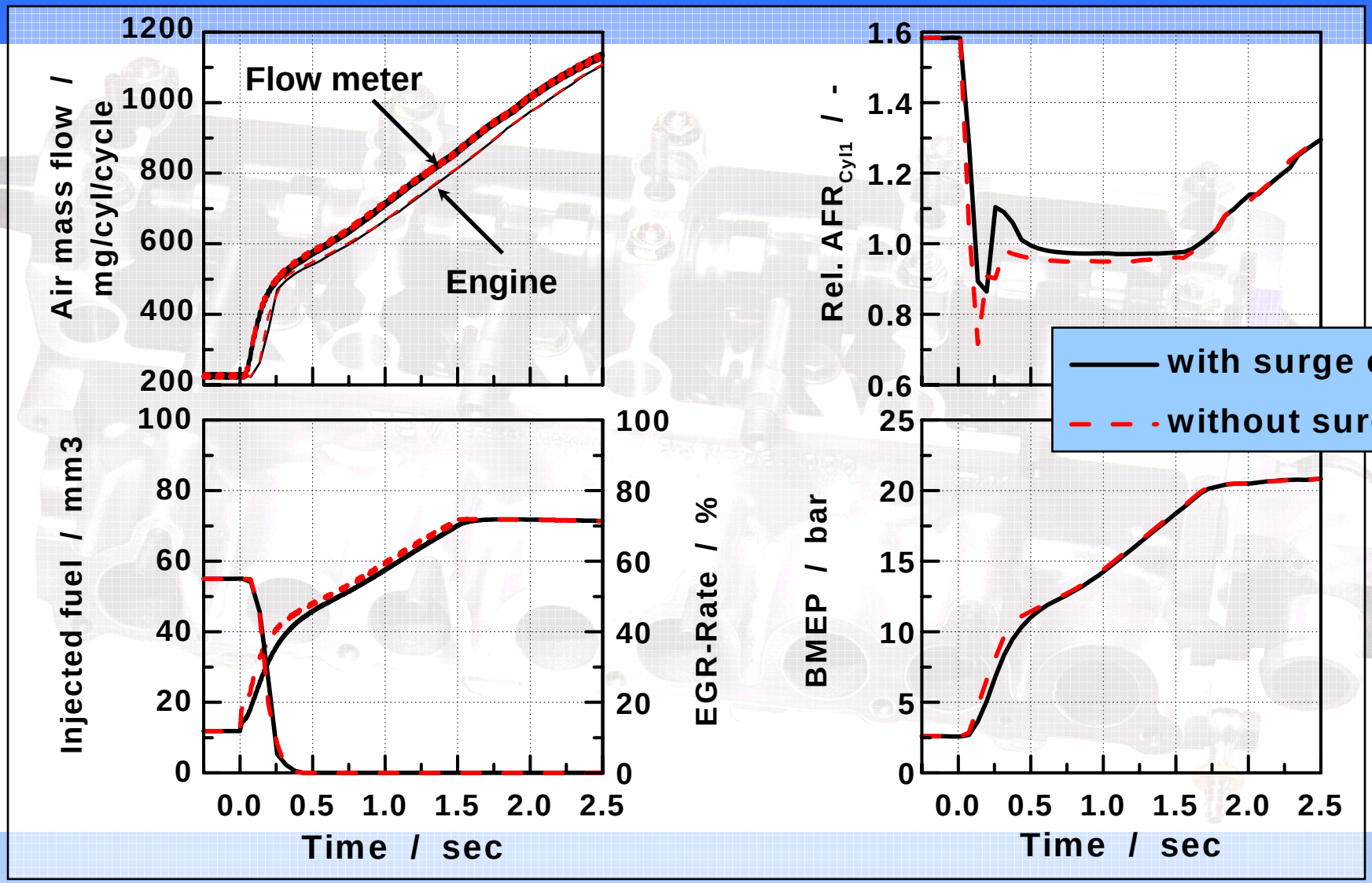


FEV

Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration



Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration



FEV

Transient Simulation of a Diesel Engine as a Tool for Virtual Calibration

Summary:

- An application of CPOWER was shown.
- The linked calculation of GT-Power and Simulink models the transient behavior of turbo-charged passenger car diesel engine.
- The integrated simulation of engine and ECU helps to analyze the transient engine behavior more detailed than it was possible up to now.
- This tool helps to pre-optimize control strategies and to design model-based controllers, such as
  - VNT actuation
  - fuel rate dependence on
    - > EGR scavenging and
    - > boost pressure rise