DAIMLERCHRYSLER

DaimlerChrysler Powersystems

Thermal Management Simulation to Optimize Fuel Efficiency of Commercial Trucks

preprocessing:

analysis of fuel consumption:

STAR-CD
(3d-flow)

trimming

KULI
(1d-flow)

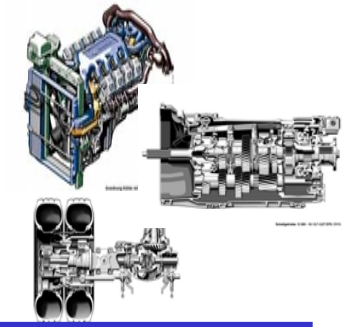
input data

verification
steady state flow

1d - simulation transient

Thermal Management
Fuel Efficiency

vehicle

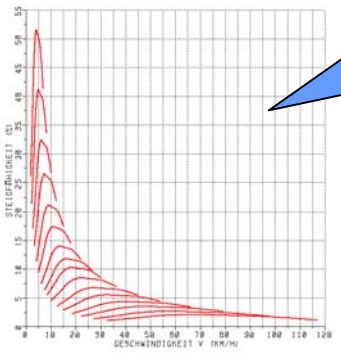


aggregate

route

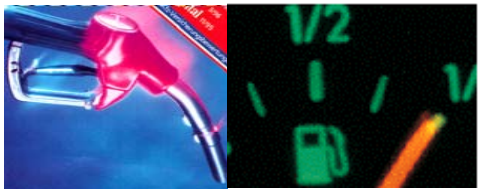
driver

LDYN FAHRLIN

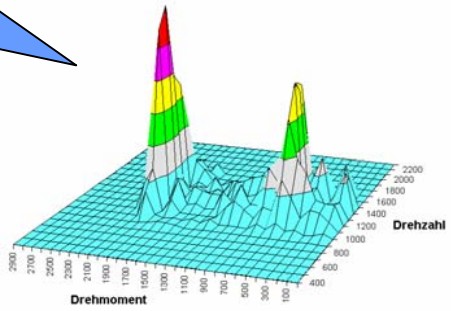


driving performance

speed



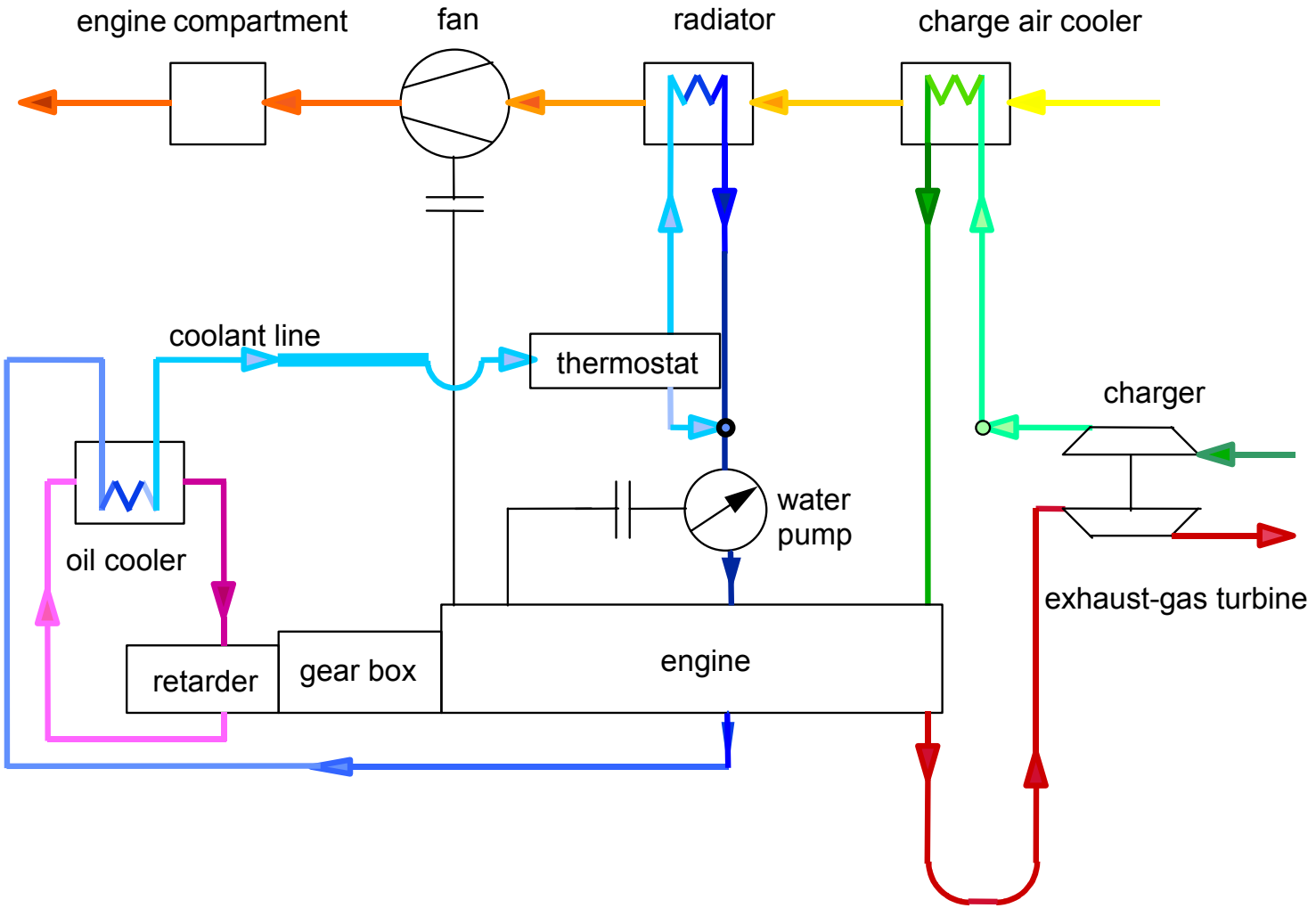
consumption



load population

Transient Simulation LDYN

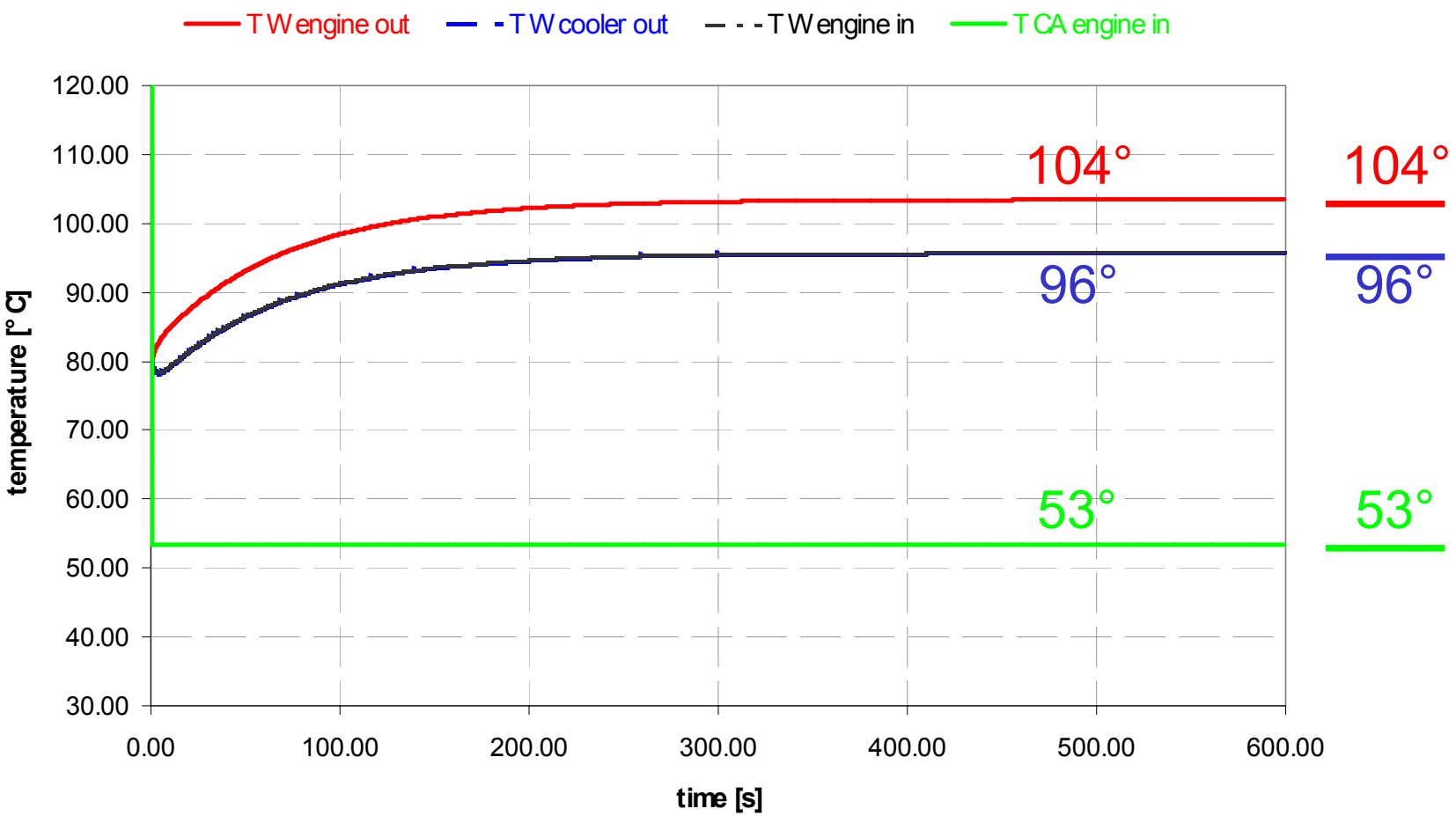
Analysis of Fuel Consumption



Simulation Cooling System LDYN

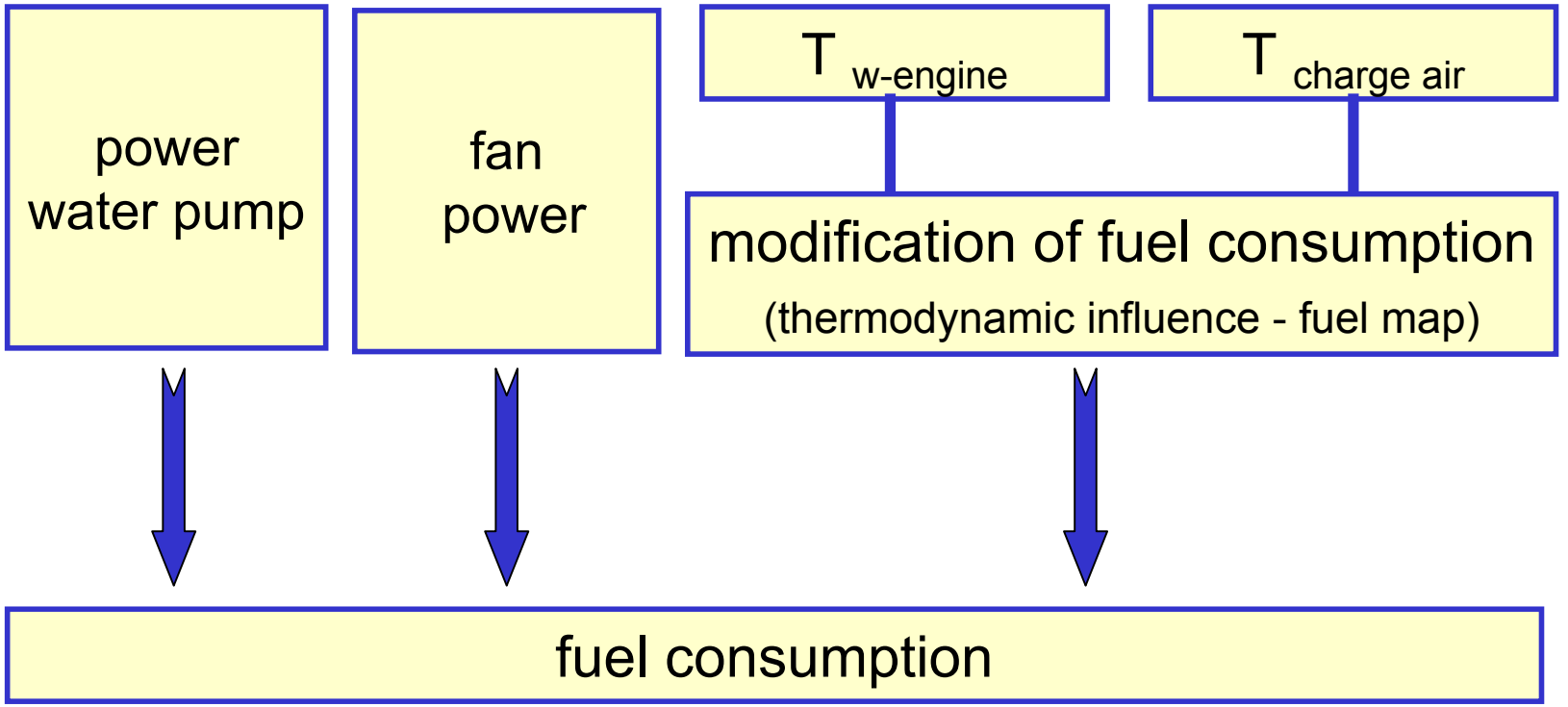
Cycle Pattern

LDYN KULI



Transient Simulation

Verification steady state flow

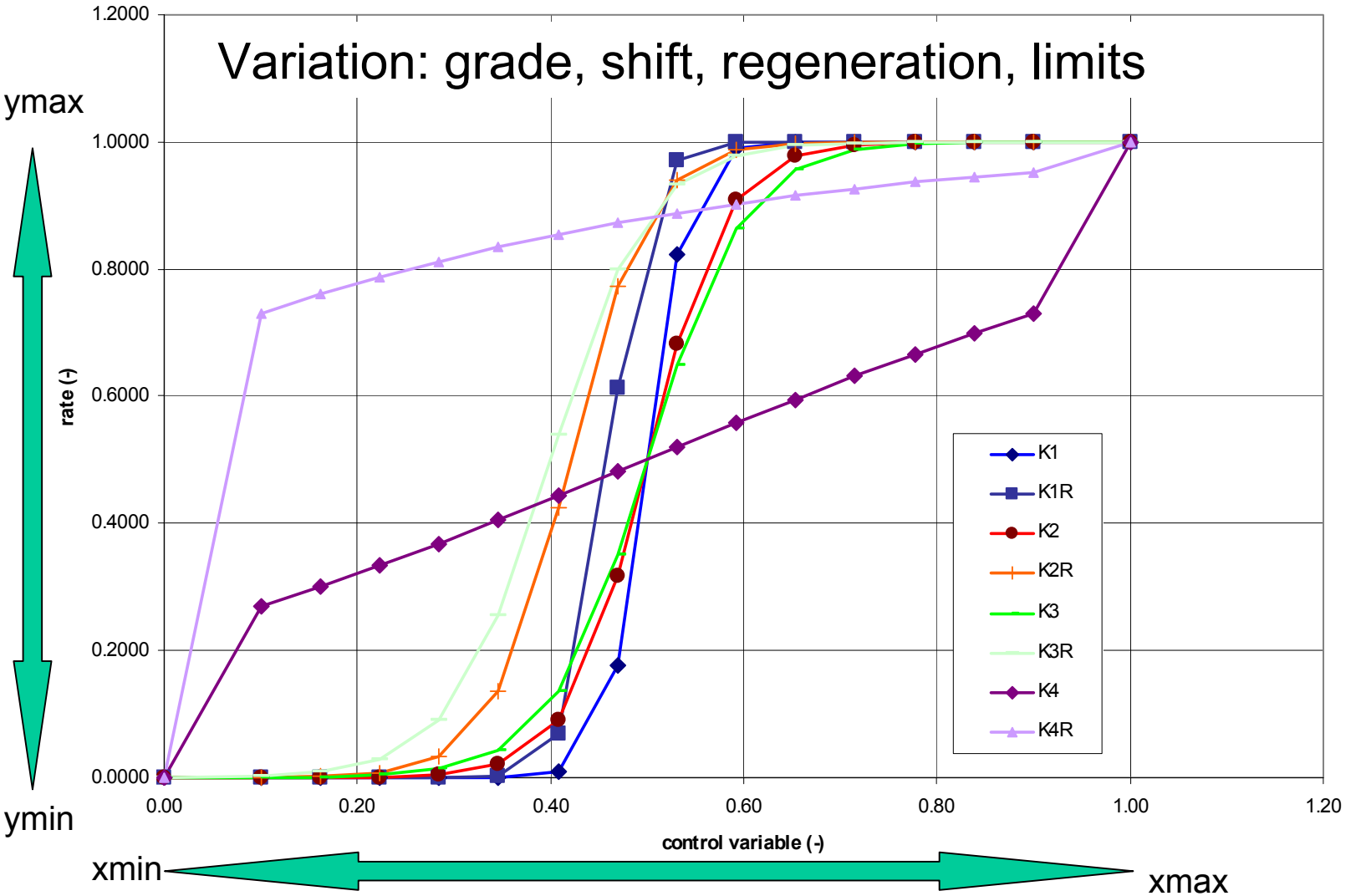


Analysis of Fuel Consumption
Effects of the Cooling System

Input variables:

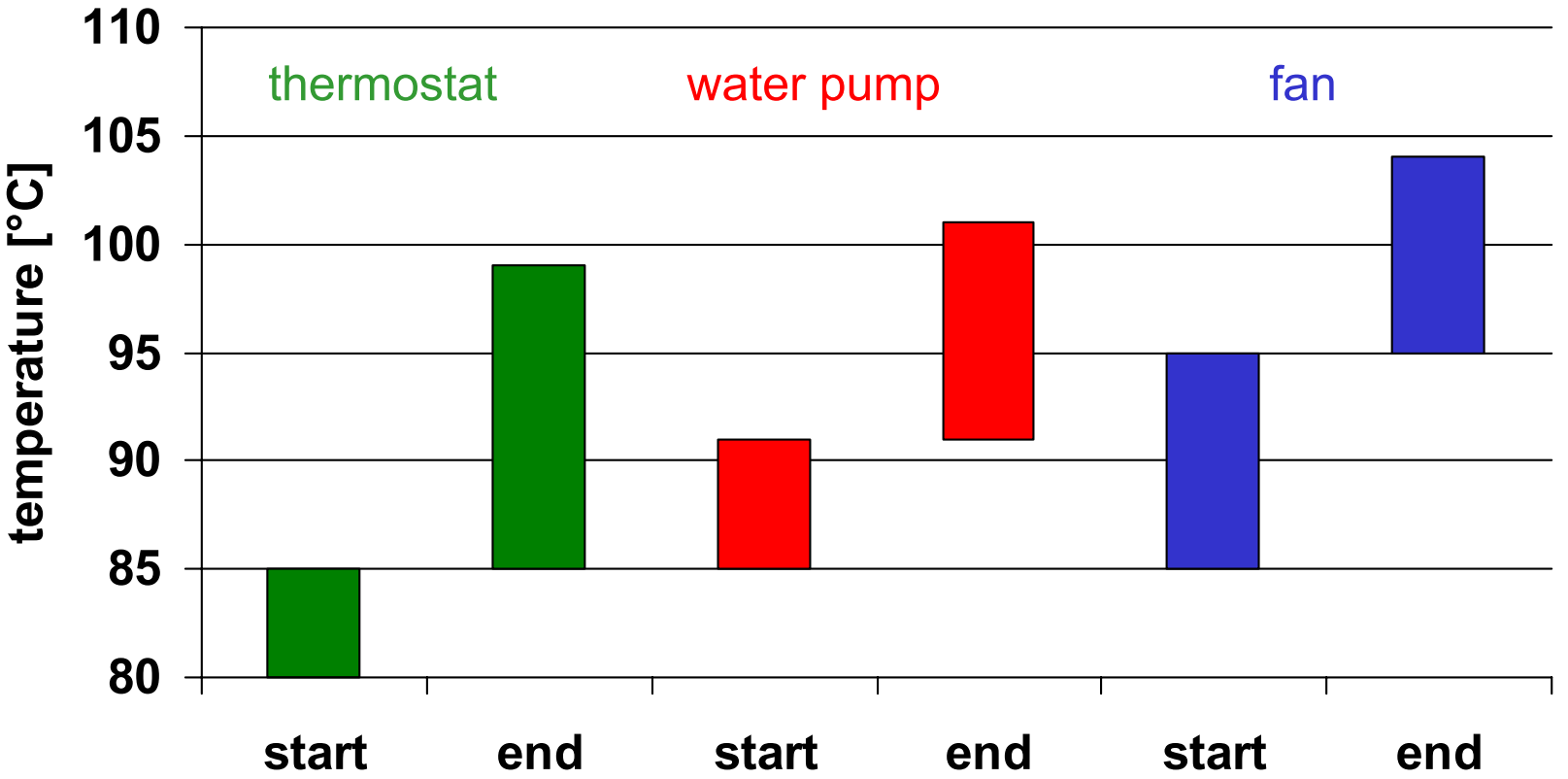
- thermostat
  - variation of hysteresis loop - thermostat due to water temperature
- fan clutch
  - variation of hysteresis loop - fan rpm due to water temperature
  - variation of hysteresis loop - fan rpm due to charge air temperature
- water pump
  - variation of hysteresis loop - water pump due to water temperature

Thermal Management
Variation of Input variables



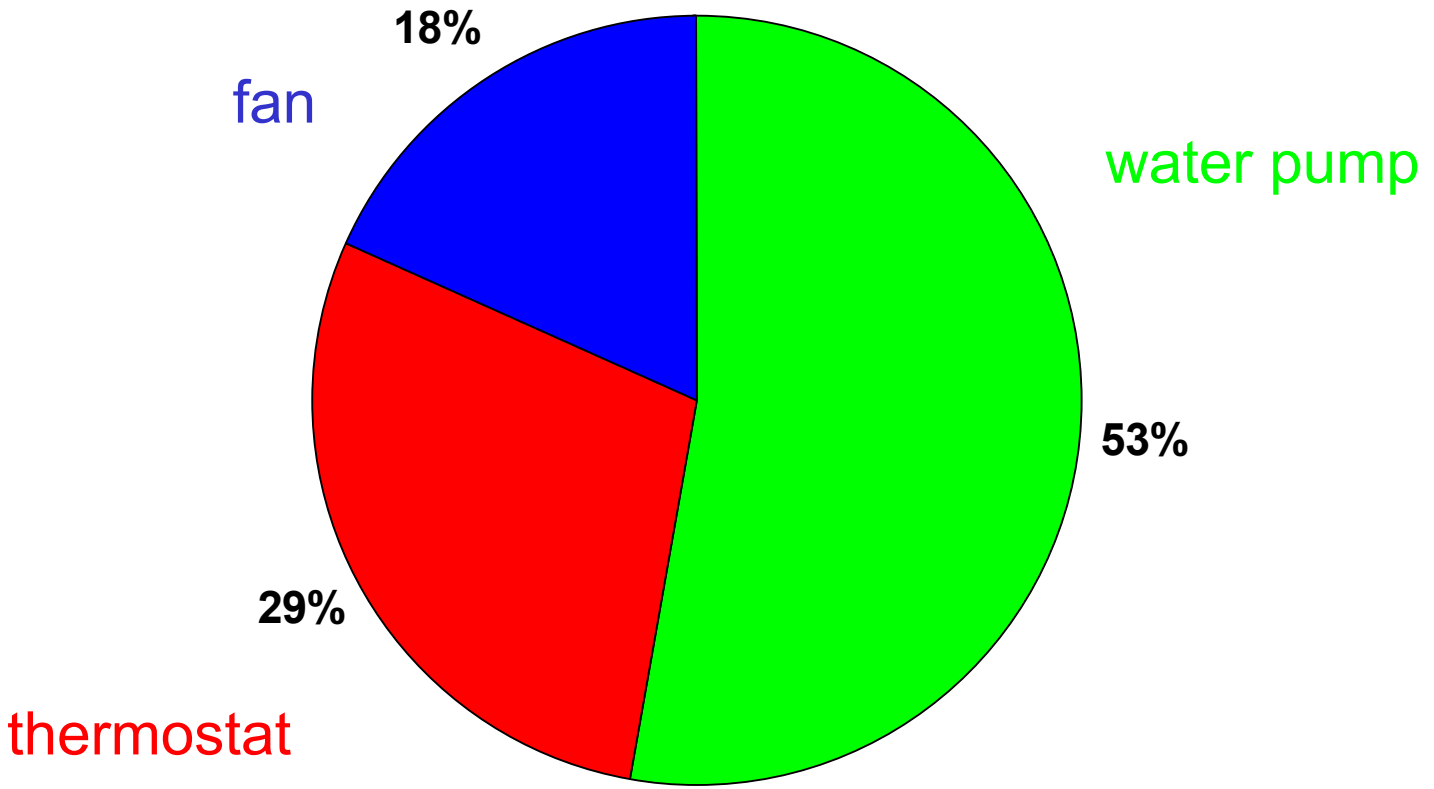
Hysteresis Loops Variation

Total Variation



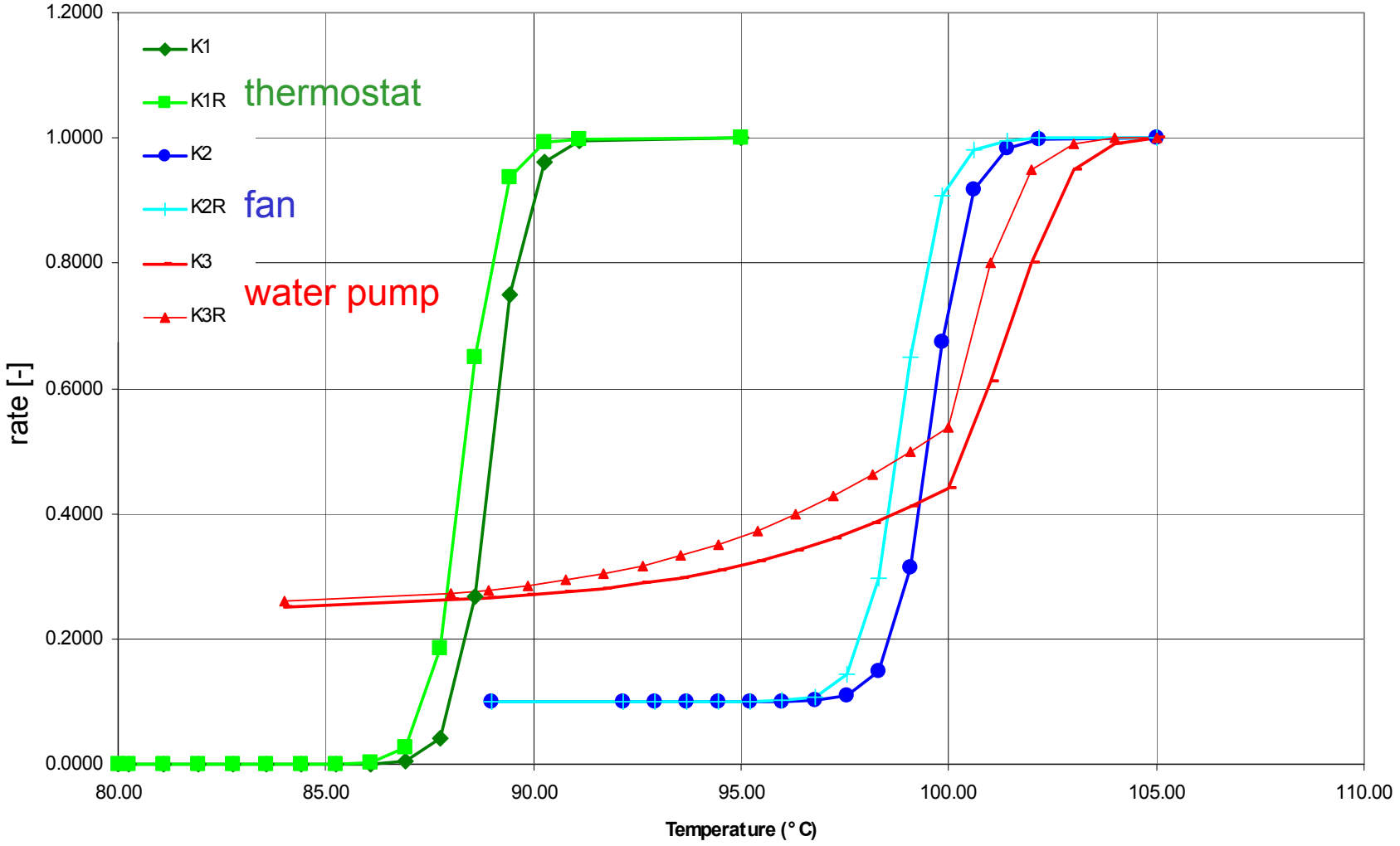
Thermal Management

Range of Hysteresis Loops



route 2, 25°C

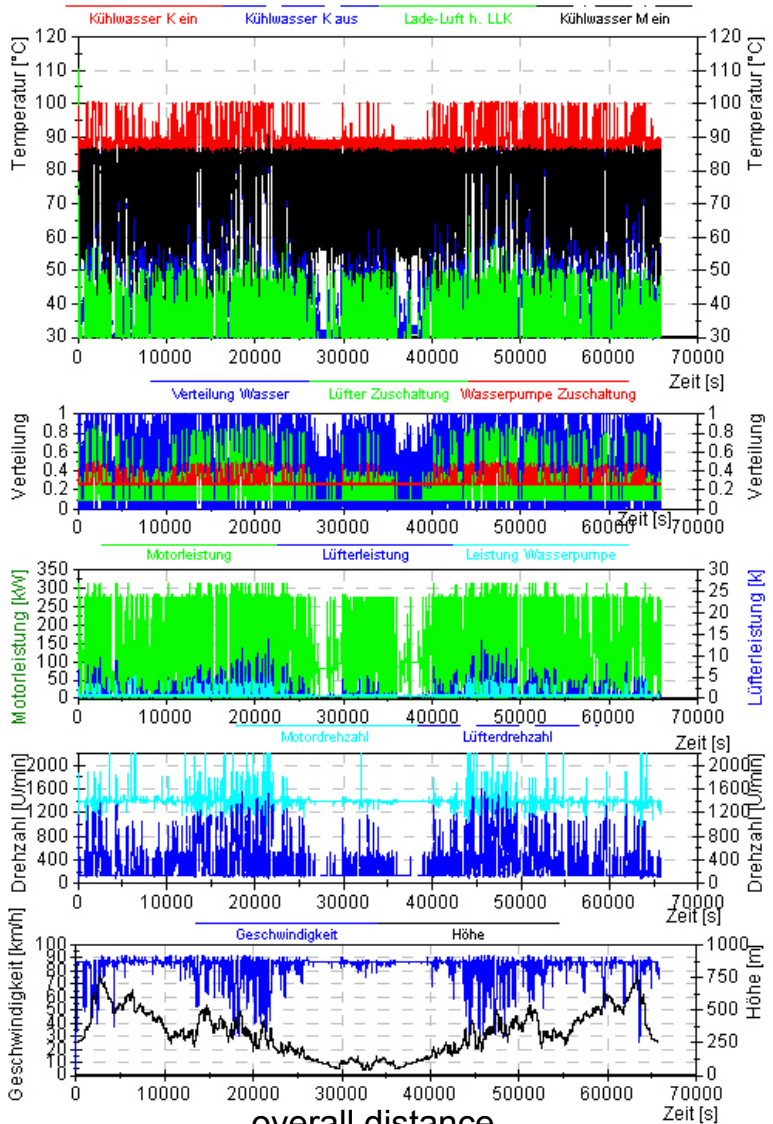
Sensitivity
Fuel Consumption



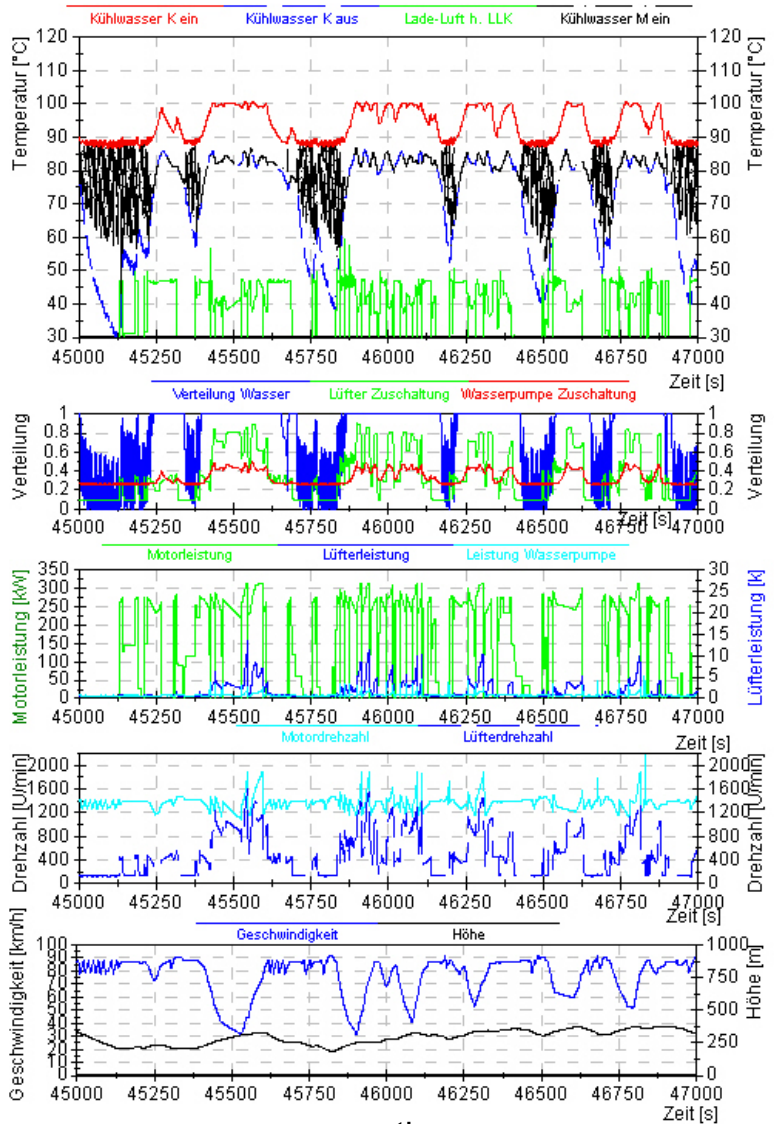
route 2, 25°C

Thermal Management

Optimized Loops



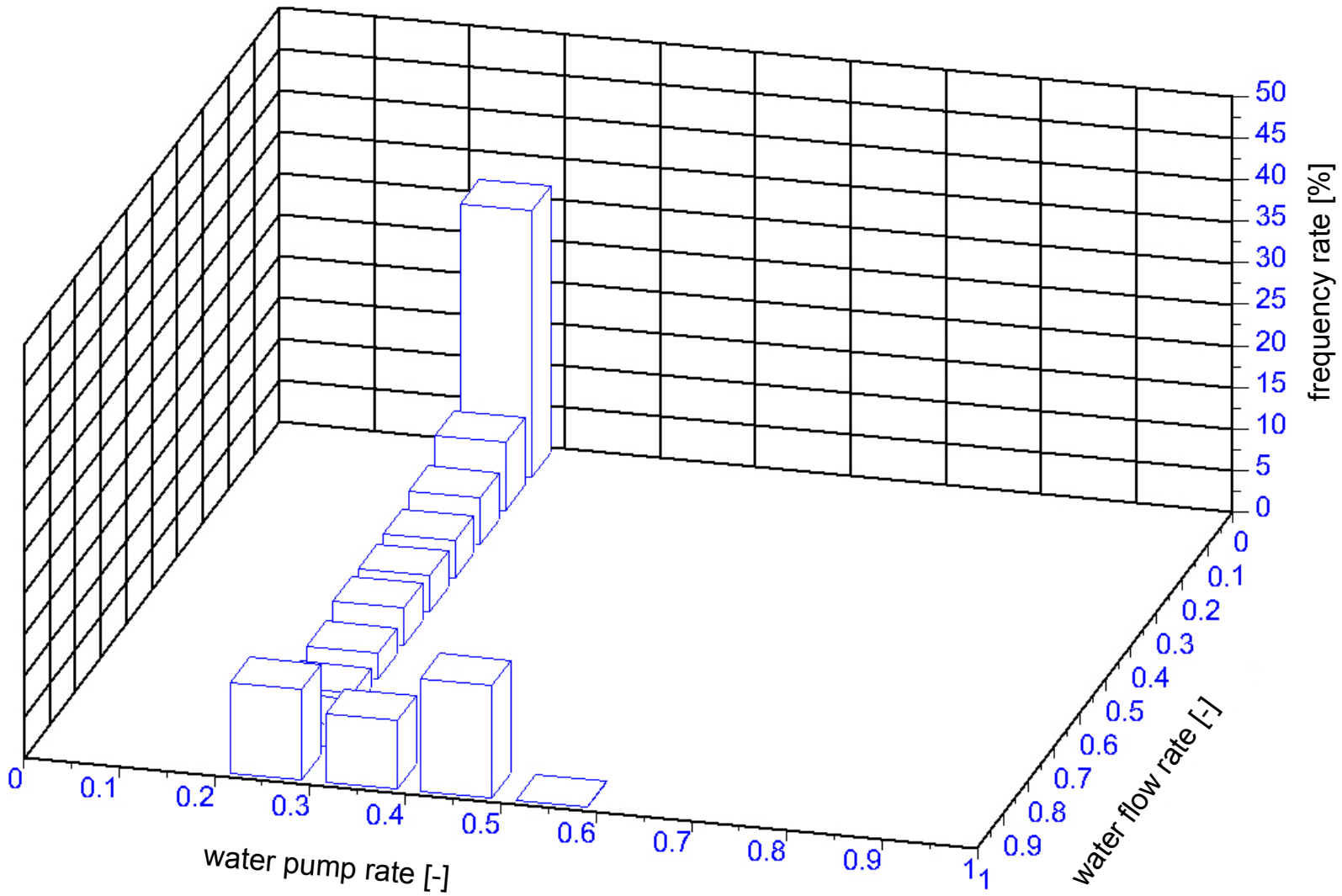
overall distance
route 2



section
route 2

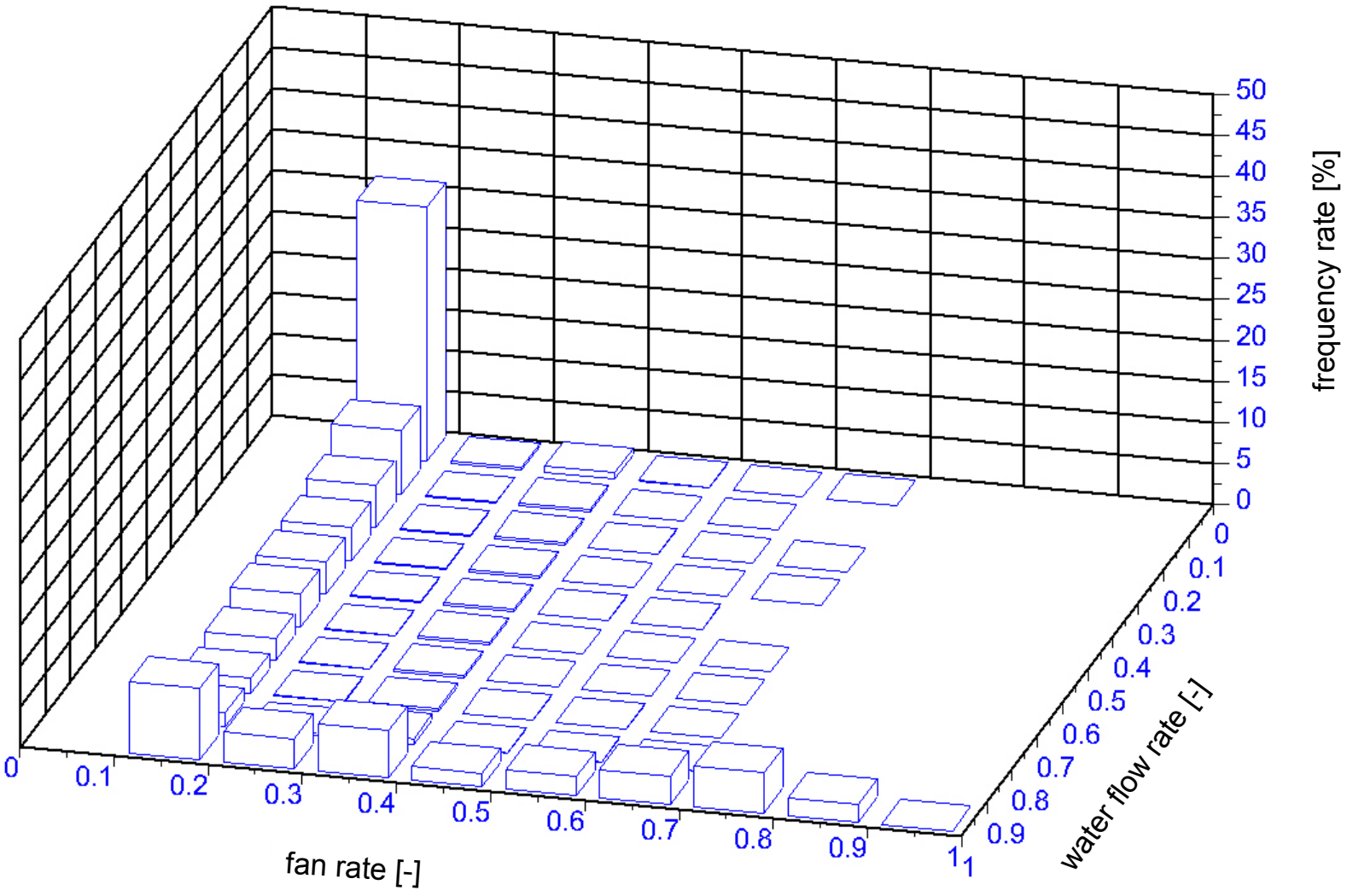
Transient Results

Online Report



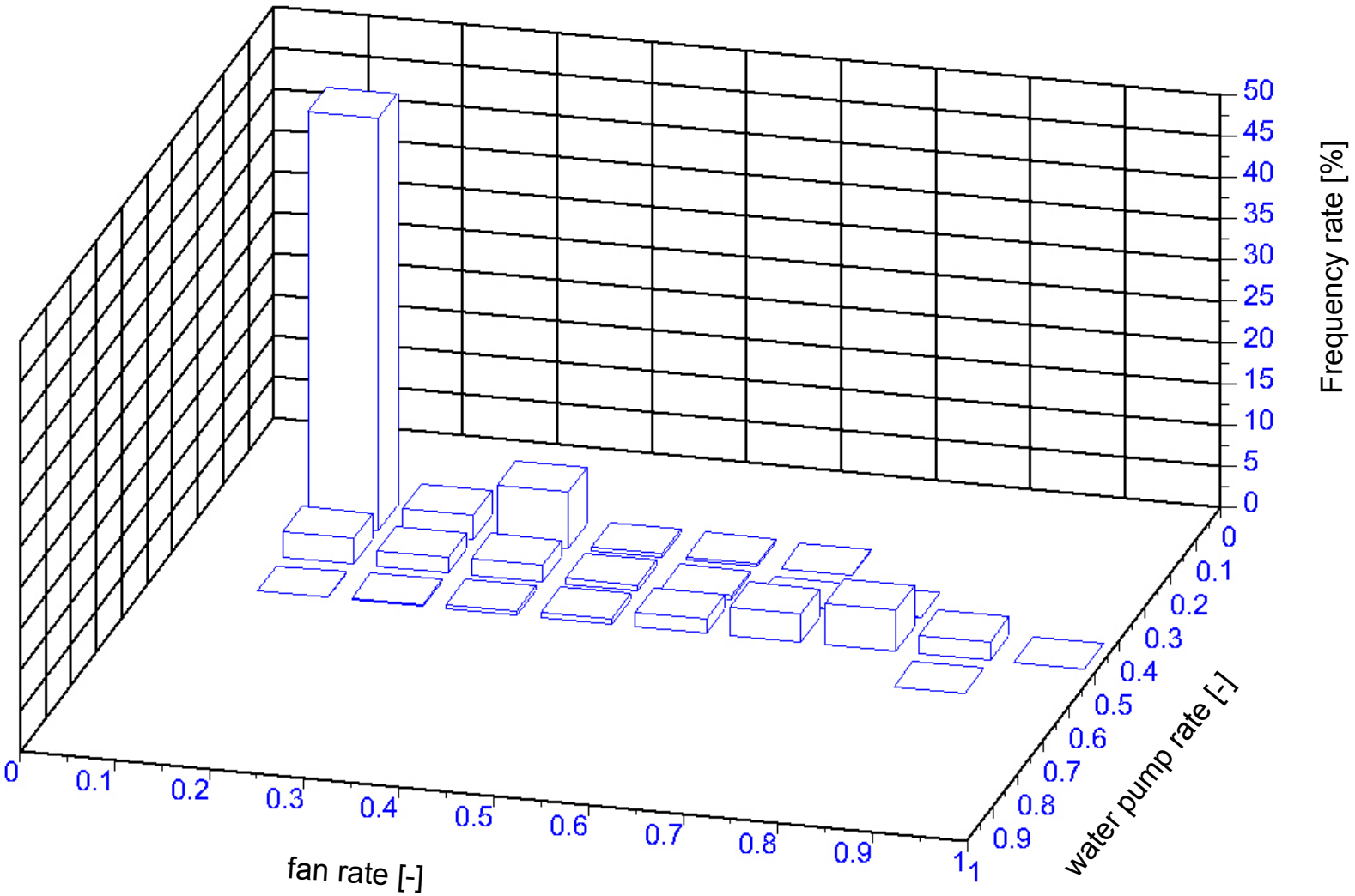
Evaluation Cooperation

Waterpump - Thermostat



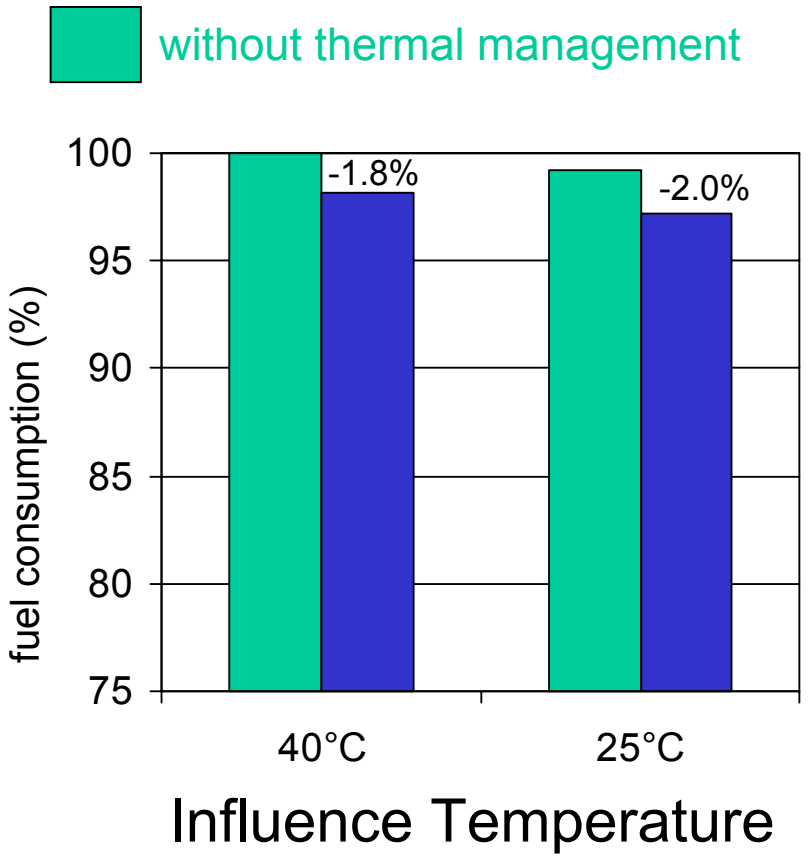
Evaluation Cooperation

Fan Clutch - Thermostat

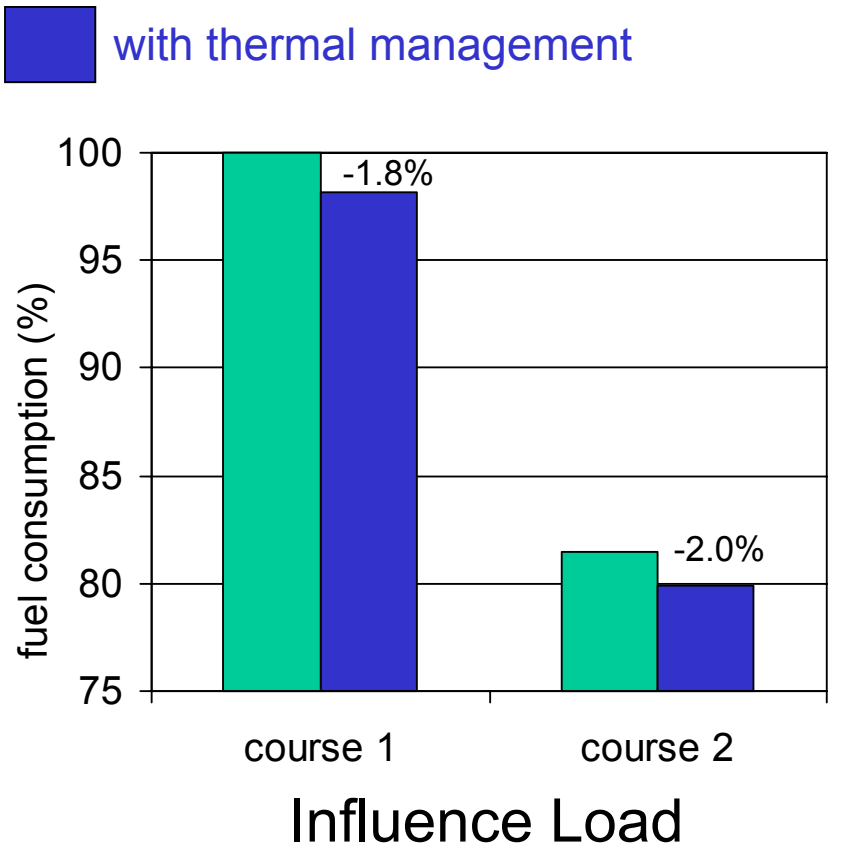


Evaluation Cooperation

Fan Clutch - Water Pump



Influence Temperature



Influence Load

Thermal Management
Fuel Efficiency

Summary:

- fuel saving up to 2 % compared to conventional cooling
- results dependent on: ambient temperature, route
- verification by measurements has to be done

Thermal Management
Summary