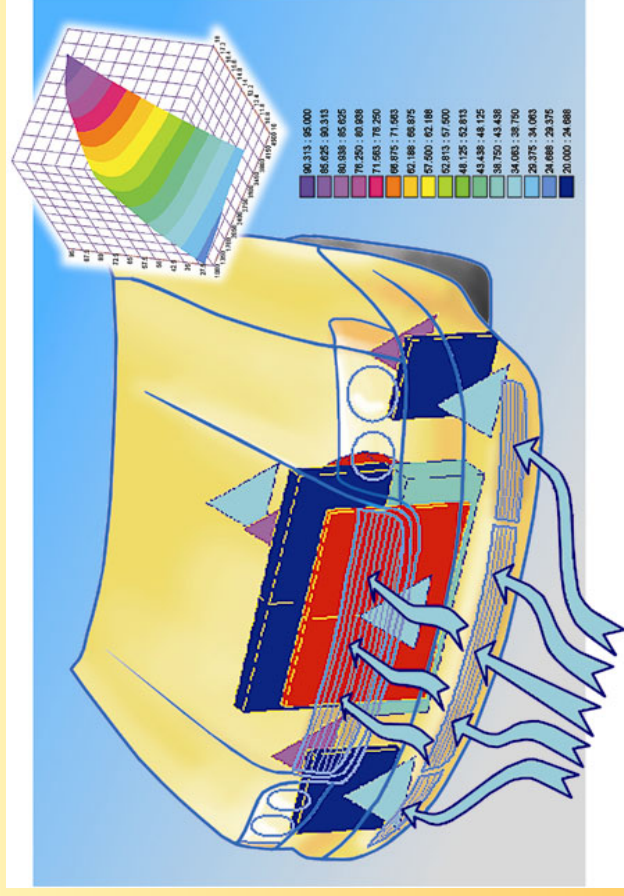


KULI Optimization



**Cooling System
Variants**

**Influence of
Ambient Conditions**

**Simplifying Analysis
of Variants**

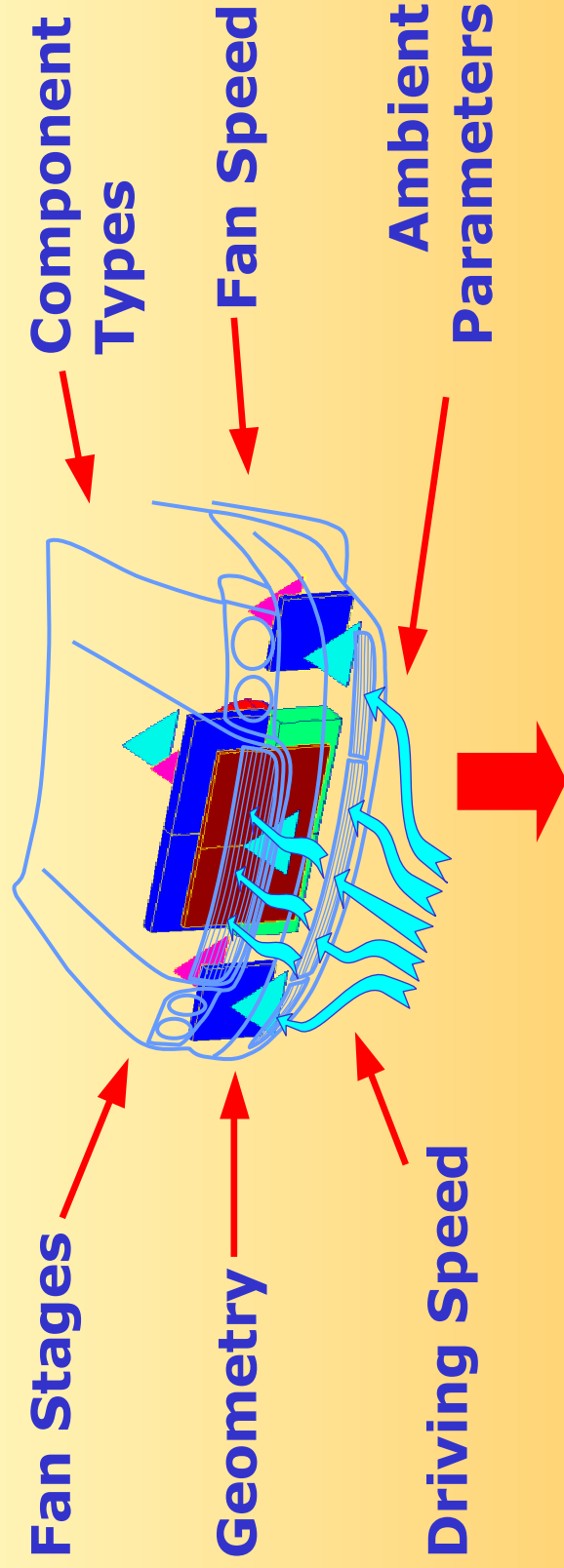
Dipl.-Ing. Franz Pointner
Engineering Center Steyr

Overview

- ◆ KULI State of Art
- ◆ KULI New Feature Optimization
 - Parameter Variation
 - Adjustment of Built-In Resistance
 - Optimization of Fan Speed
- ◆ Conclusion

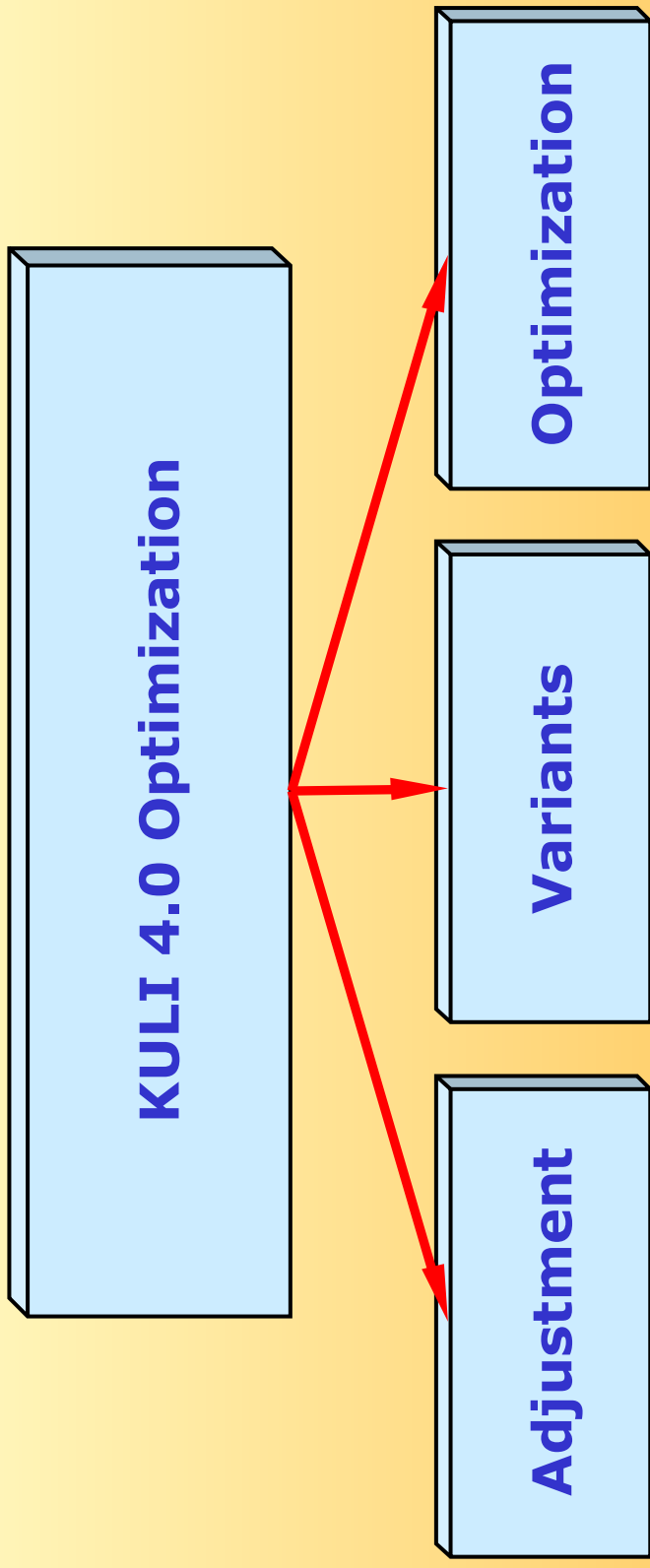
KULI State of the Art

Influence on a cooling system



Different Cooling System Models

KULI New Features



2nd **KULI** User Meeting

KULI Optimization

What to Do with the Optimization

Parameter Variation

Parameter Studies

Comparison of Component
Types

Influence of Ambient
Conditions

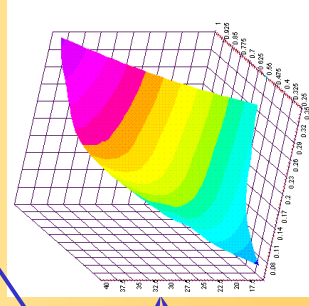
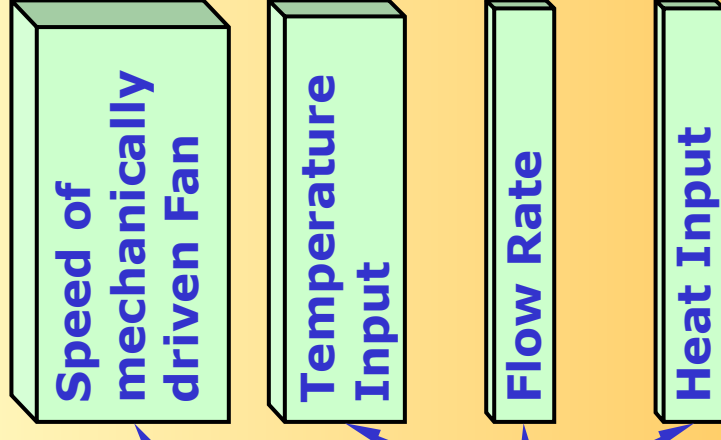
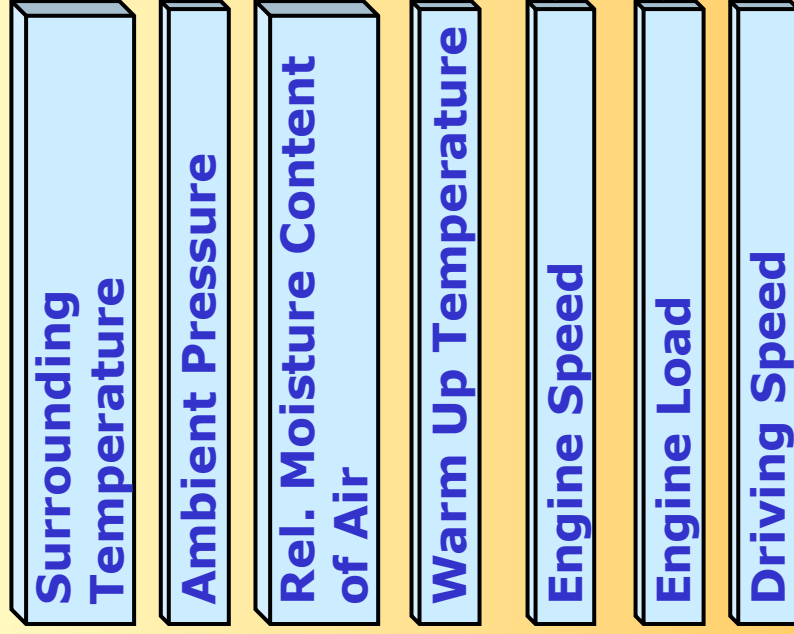
Adjustment of BiR

Faster Build Up of Cooling
System Models

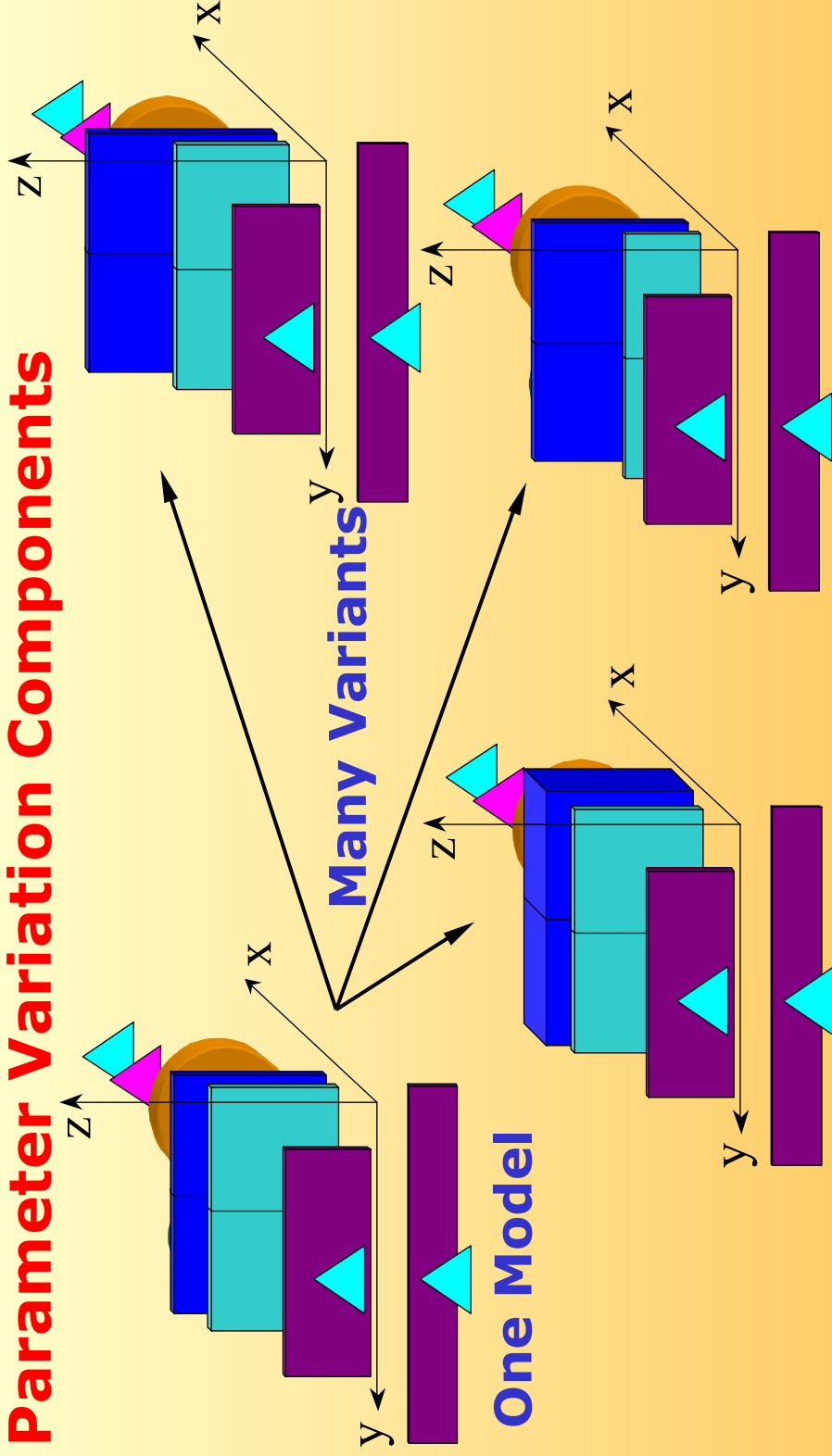
Optimization of Fan
Speed

Fan Speed depending on
Demands

Parameter Variation General Data



Parameter Variation Components



Parameter Variation Components

Cross Flow Heat Exchangers

Height

Width

Component

Mechanically driven Fan

Diameter

Component

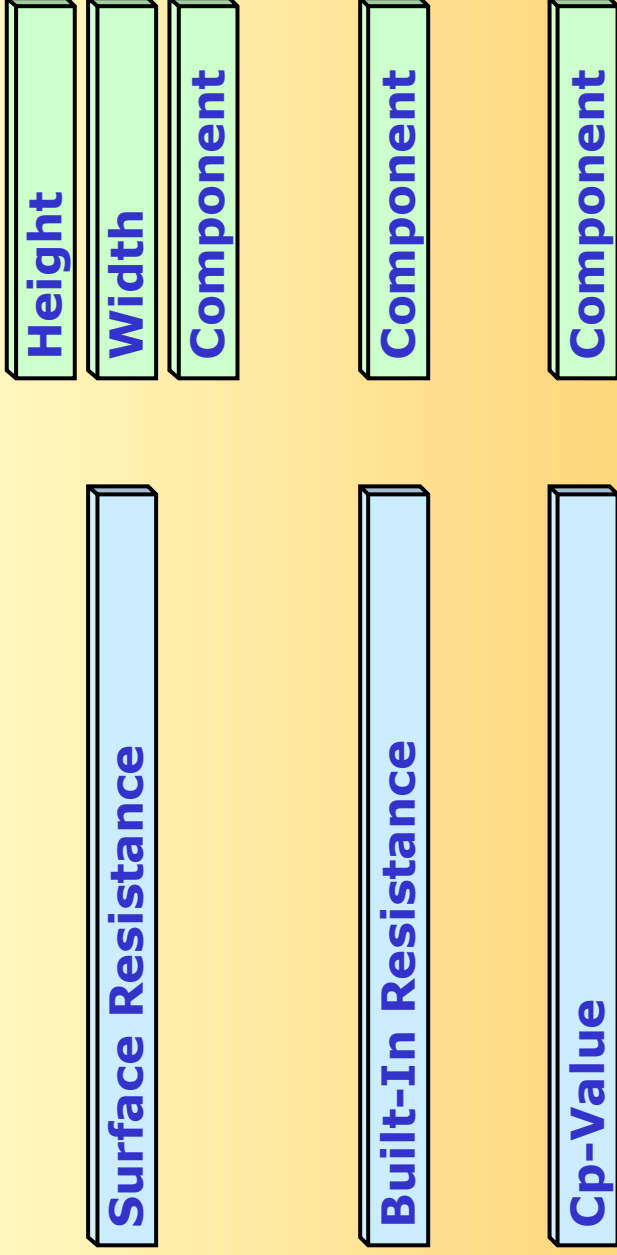
Electrically driven Fan

Diameter

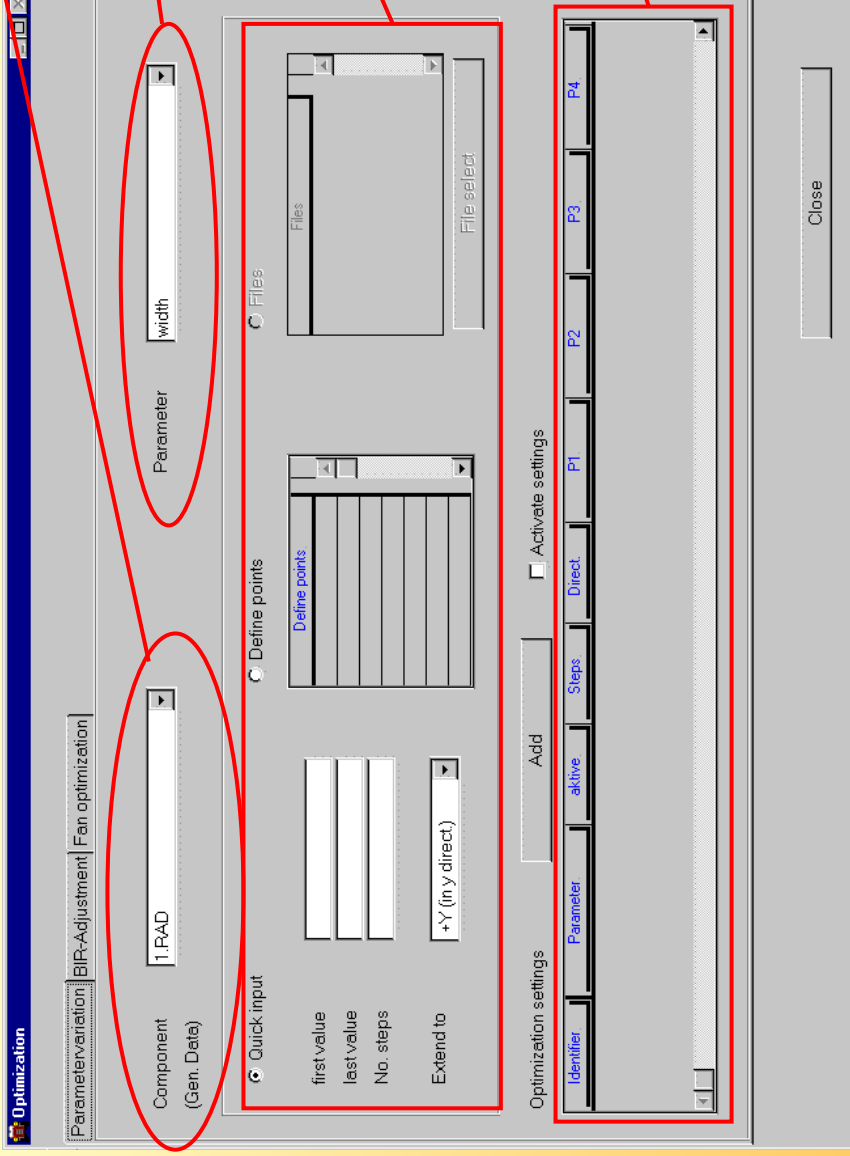
E-Fan Stages

Component

Parameter Variation Components



Parameter Variation



The screenshot shows the 'Parameter Variation' dialog box. Red annotations highlight the following areas:

- Component or General Data:** The 'Component (Gen. Data)' dropdown menu, which currently shows '1.RAD'.
- Type of Parameter:** The 'Parameter' dropdown menu, which currently shows 'width'.
- Definition of Parameter Values:** The 'Quick input' section, which includes fields for 'first value', 'last value', 'No. steps', and 'Extend to' (set to '+Y (in y direct)').
- List of defined Variations:** The 'Optimization settings' table, which lists variations with columns for 'Identifier', 'Parameter', 'active', 'Steps', 'Direct', and 'P1' through 'P4'.

The 'Optimization settings' table is currently empty. The 'Close' button is located at the bottom right of the dialog.

What to Do with the Optimization

Parameter Variation

Parameter Studies

Comparison of Component
Types

Influence of Ambient
Conditions

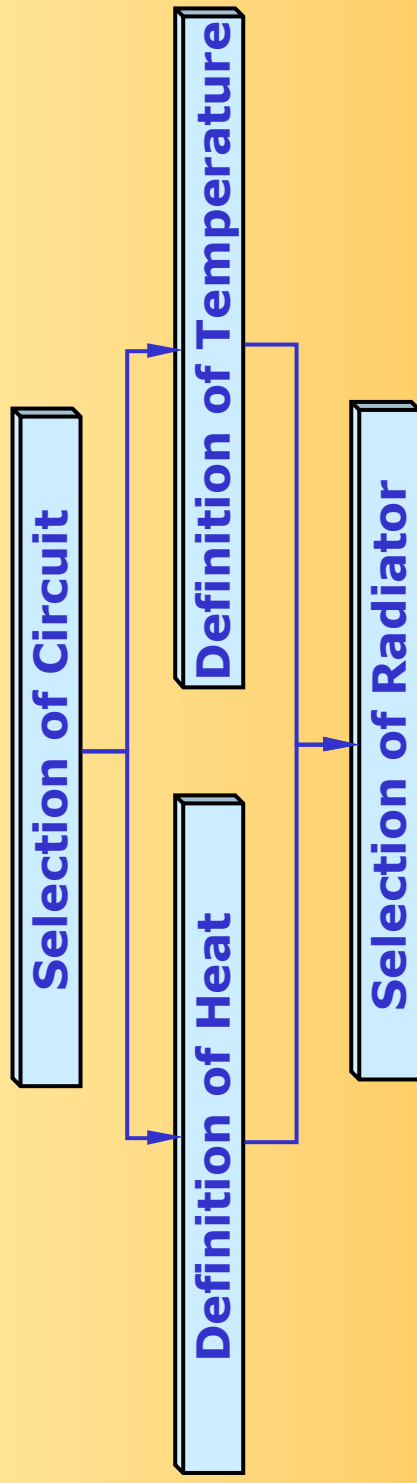
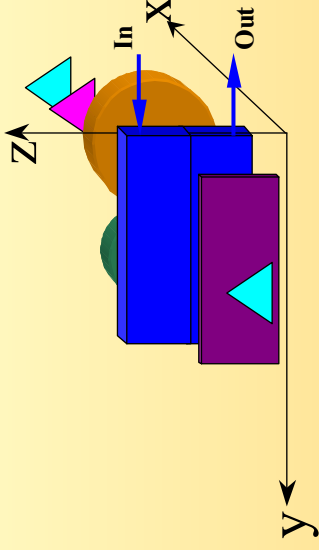
Adjustment of BiR

Faster Build Up of Cooling
System Models

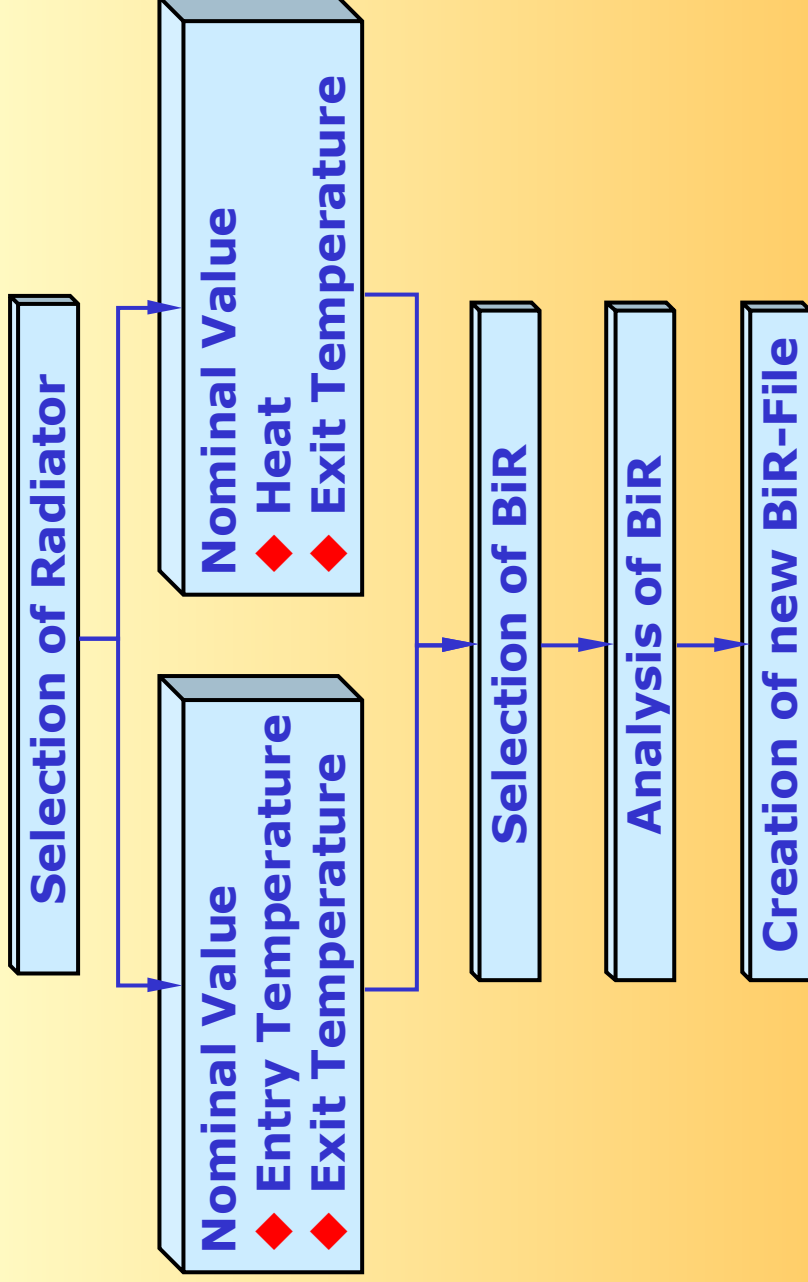
Optimization of Fan
Speed

Fan Speed depending on
Demands

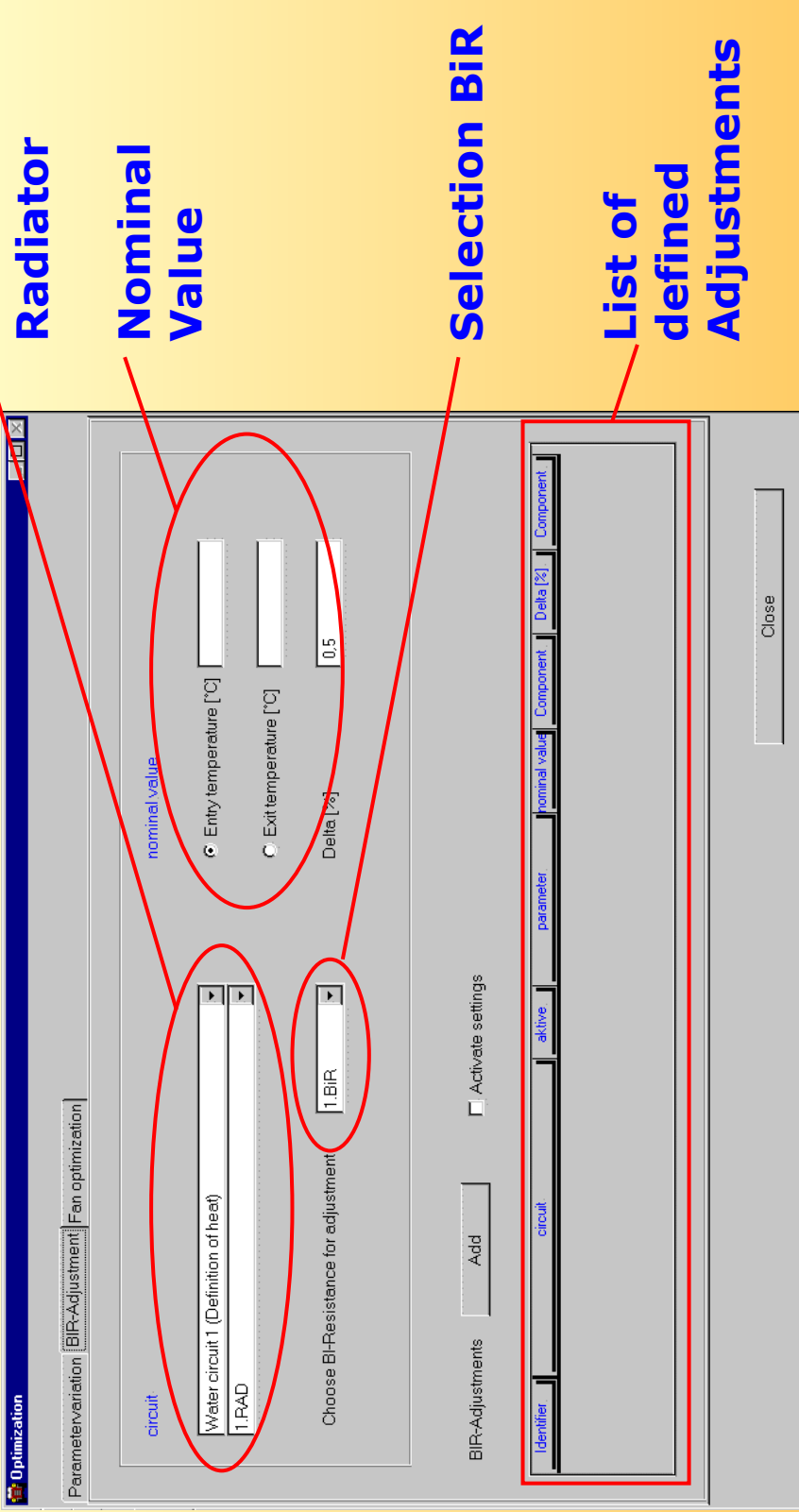
Adjustment of Built-In Resistance



Adjustment of Built-In Resistance



Adjustment of BiR Heat Input



Circuit and Radiator

Nominal Value

Selection BiR

List of defined Adjustments

Optimization

Parameter variation | BIR-Adjustment | Fan optimization

circuit

Water circuit 1 (Definition of heat)

1 RAD

nominal value

Entry temperature [°C]

Exit temperature [°C]

Delta [%]

0.5

Choose Bi-Resistance for adjustment

1 BiR

BIR-Adjustments

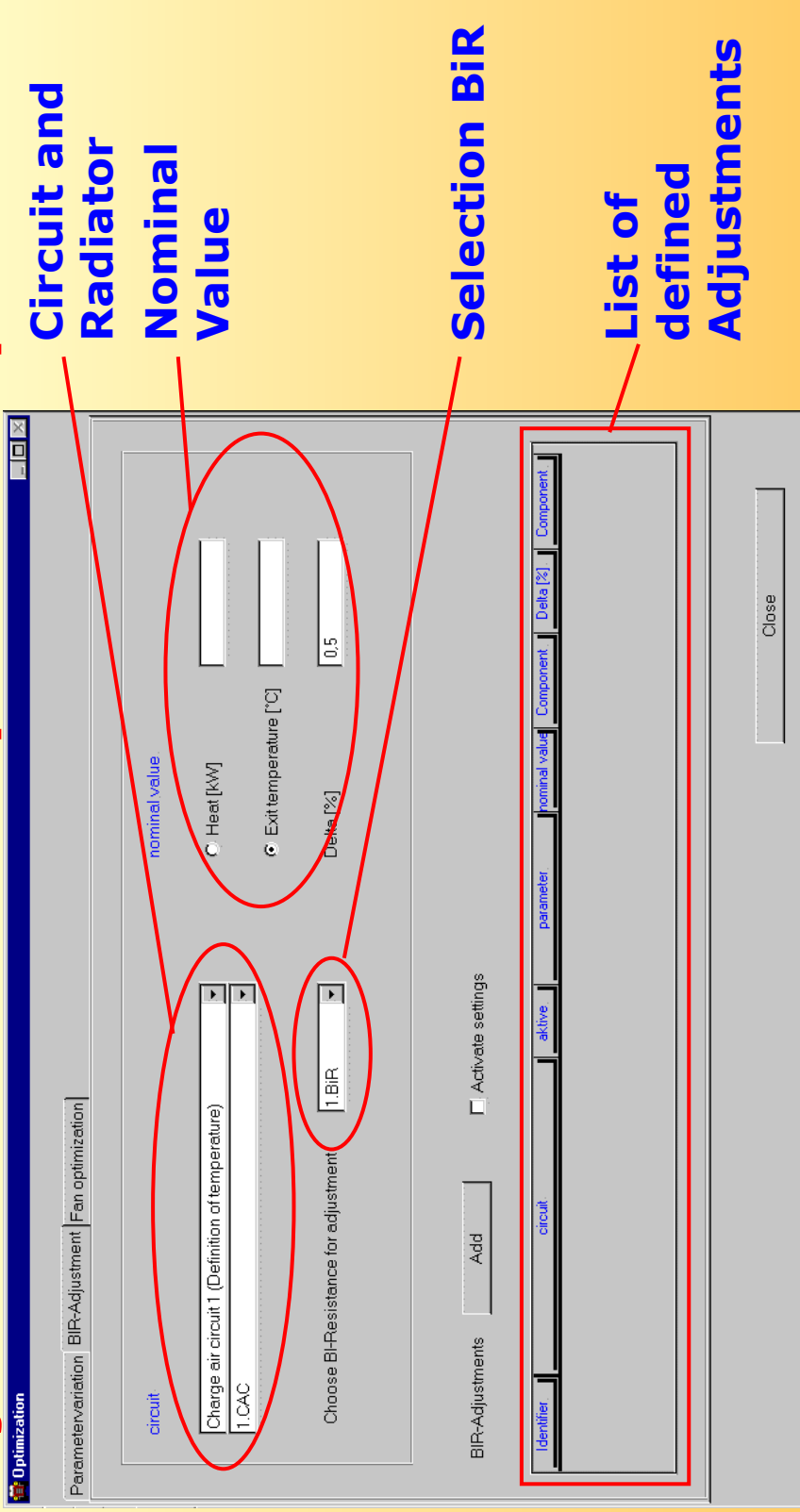
Add

Activate settings

Identifier	circuit	active	parameter	nominal value	Component	Delta [%]	Component
------------	---------	--------	-----------	---------------	-----------	-----------	-----------

Close

Adjustment of BiR Temperature Input



The screenshot shows the 'Optimization' window with the 'BIR-Adjustment' tab selected. The interface is divided into several sections:

- Circuit and Radiator Nominal Value:** This section includes a dropdown menu for 'circuit' (set to 'Charge air circuit 1 (Definition of temperature)') and a dropdown for 'nominal value' (set to '1.CAC'). Below these are two radio buttons: 'Heat [kW]' and 'Exit temperature [°C]' (selected), each with an input field. A 'Delta [%]' input field is set to '0.5'.
- Selection BiR:** A dropdown menu labeled 'Choose Bi-Resistance for adjustment' is set to '1.BiR'.
- List of defined Adjustments:** A table at the bottom lists defined adjustments with columns for 'Identifier', 'circuit', 'active', 'parameter', 'nominal value', 'Component', and 'Delta [%]'. The table is currently empty.

Buttons for 'Add', 'Activate settings', and 'Close' are also visible.

What to Do with the Optimization

Parameter Variation

Parameter Studies

Comparison of Component
Types

Influence of Ambient
Conditions

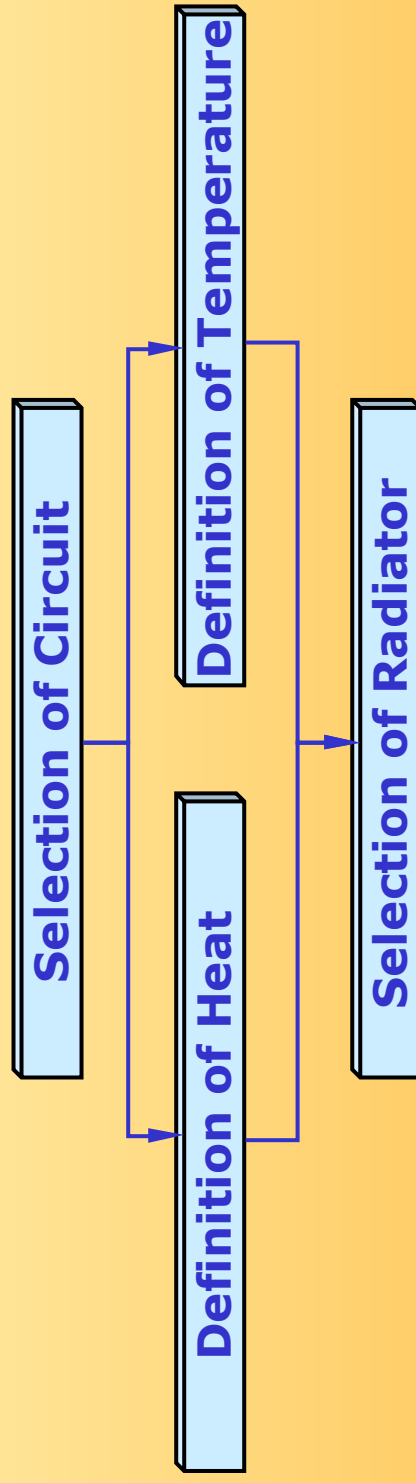
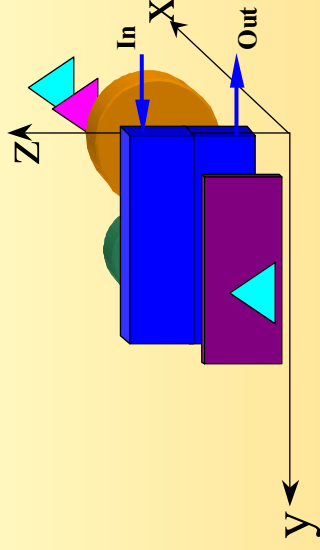
Adjustment of BiR

Faster Build Up of Cooling
System Models

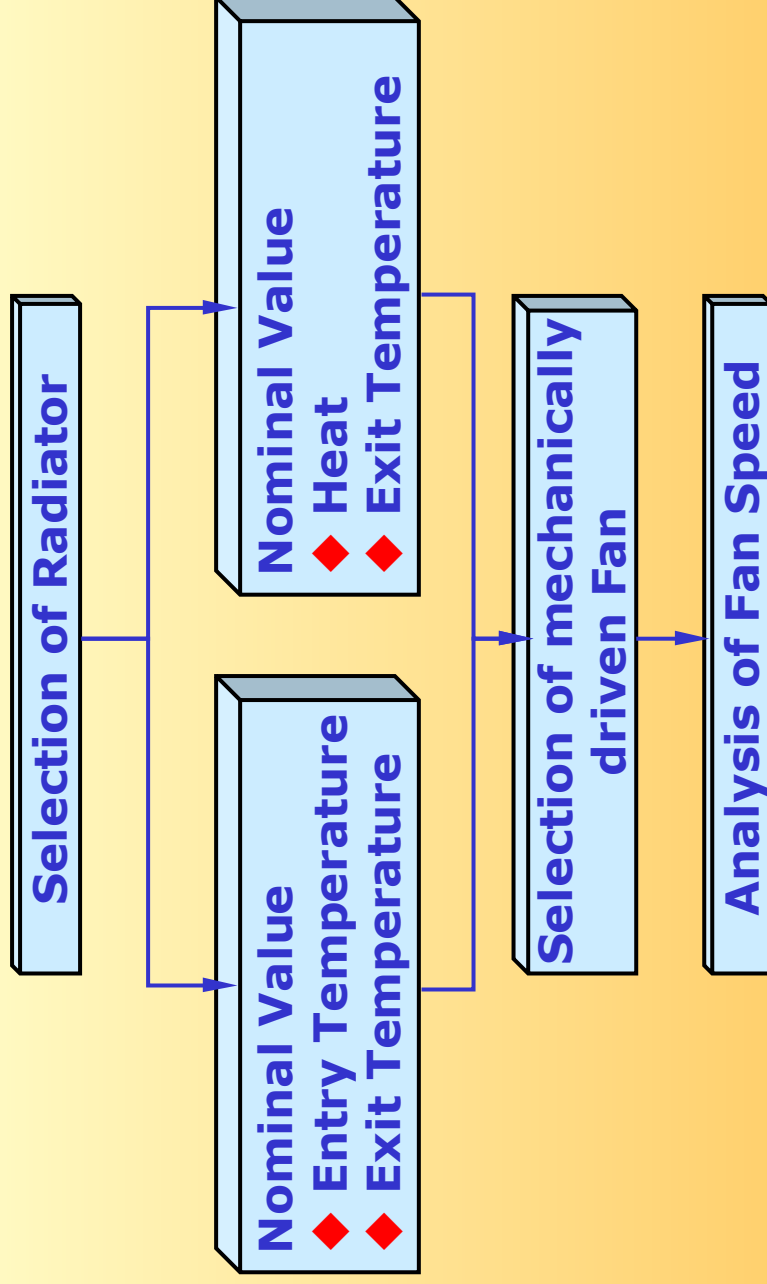
Optimization of Fan
Speed

Fan Speed depending on
Demands

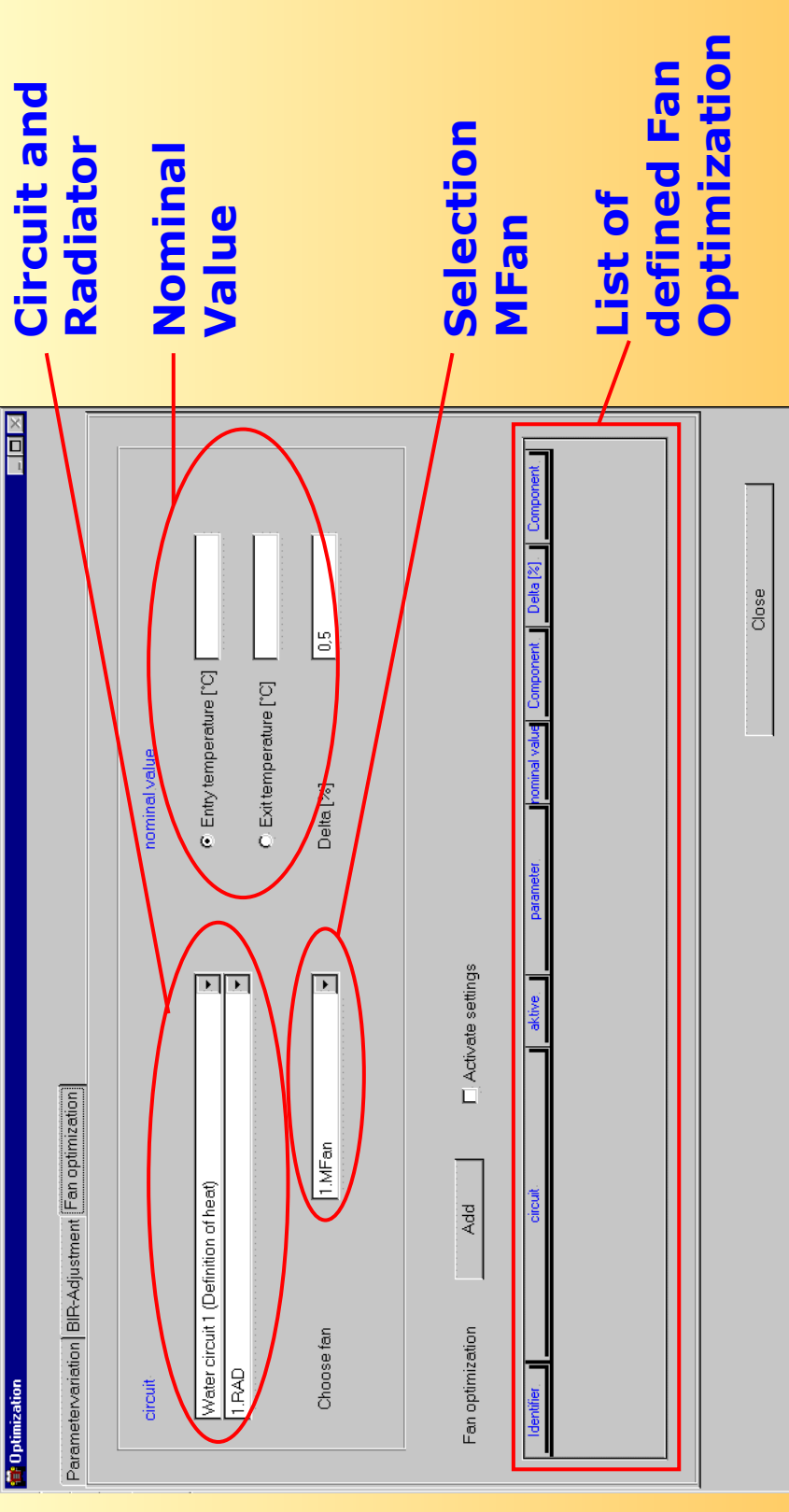
Optimization of Fan Speed



Optimization of Fan Speed



Optimization of Fan Speed Heat Input



The screenshot shows the 'Fan optimization' window. Red circles and lines highlight specific areas:

- Circuit and Radiator:** A red circle around the 'circuit' dropdown menu, which currently shows 'Water circuit 1 (Definition of heat)'. Below it is a dropdown for 'I RAD'.
- Nominal Value:** A red circle around the 'nominal value' label and the 'Entry temperature [°C]' and 'Exit temperature [°C]' input fields.
- Selection MFan:** A red circle around the 'Choose fan' dropdown menu, which currently shows '1.MFan'.
- List of defined Fan Optimization:** A red rectangle around the table at the bottom of the window.

Other visible elements include the 'Fan optimization' tab, 'Add' and 'Activate settings' buttons, and a 'Close' button at the bottom right.

Identifier	circuit	active	parameter	nominal value	Component	Delta [%]	Component

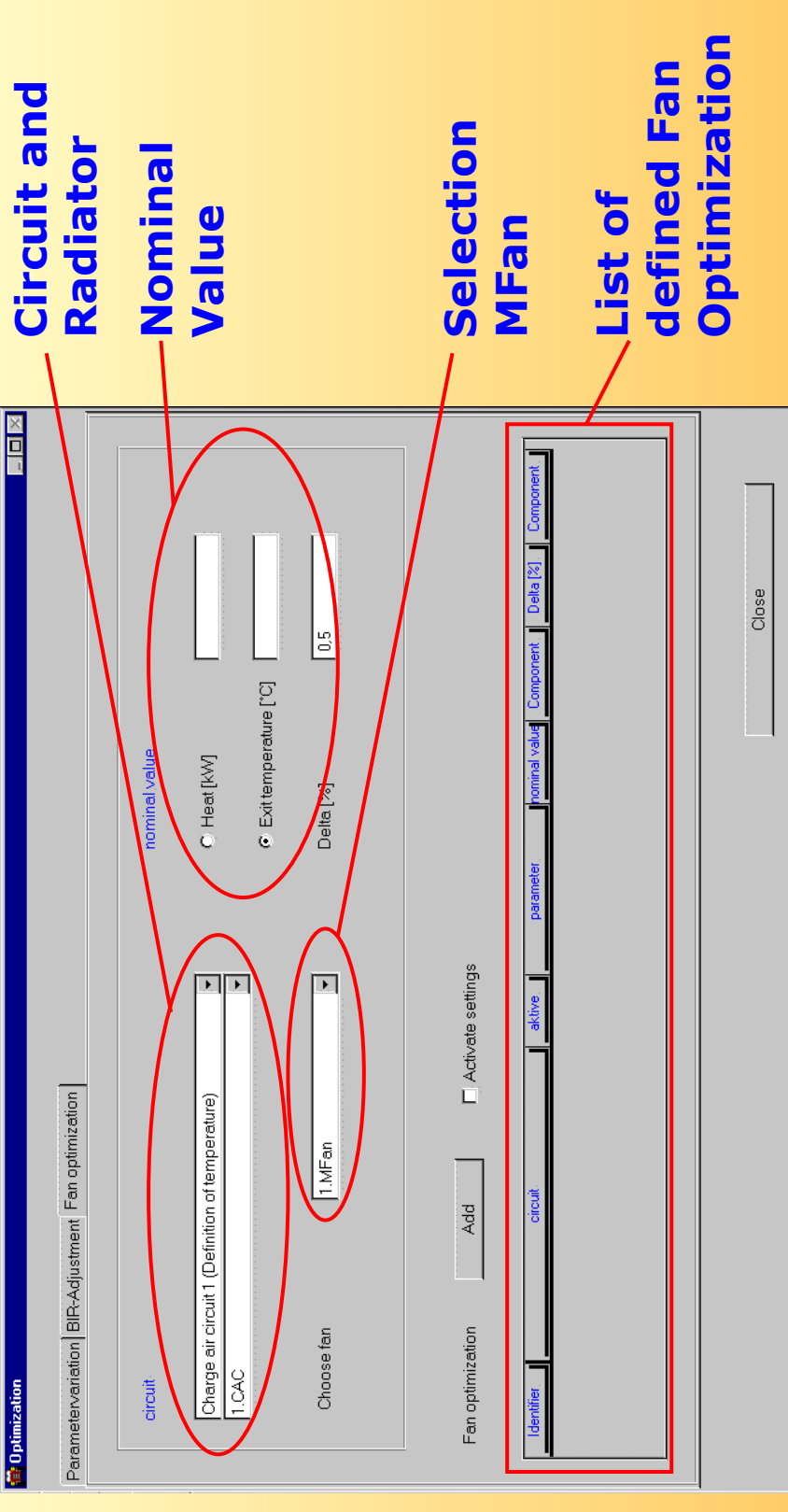
Optimization of Fan Speed Temp. Input

Circuit and Radiator

Nominal Value

Selection MFan

List of defined Fan Optimization



Close

Conclusion

Reducing the Time for Model Equalization

Only one Model for Parameter Studies

Less Time for Model Creation

Reducing the Time of Analysis

Quick Comparison of different Component Types

Easy Consideration of Ambient Influences

Making Influences of System Changes clearer