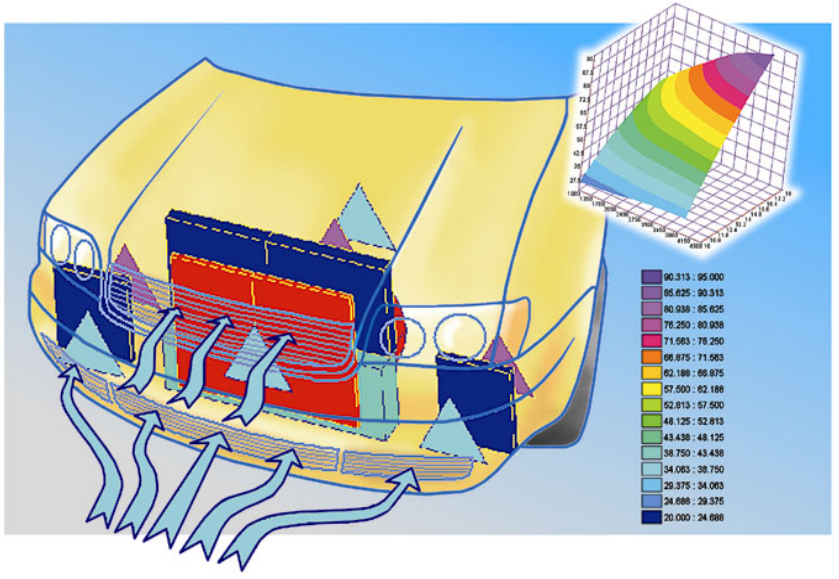
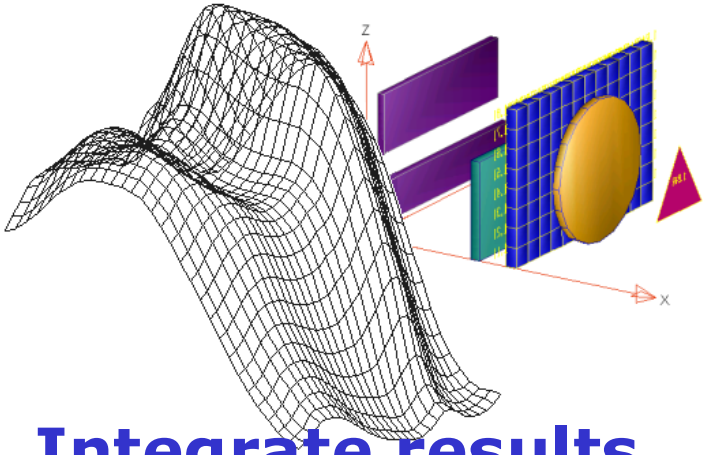
KULI CFD Interface



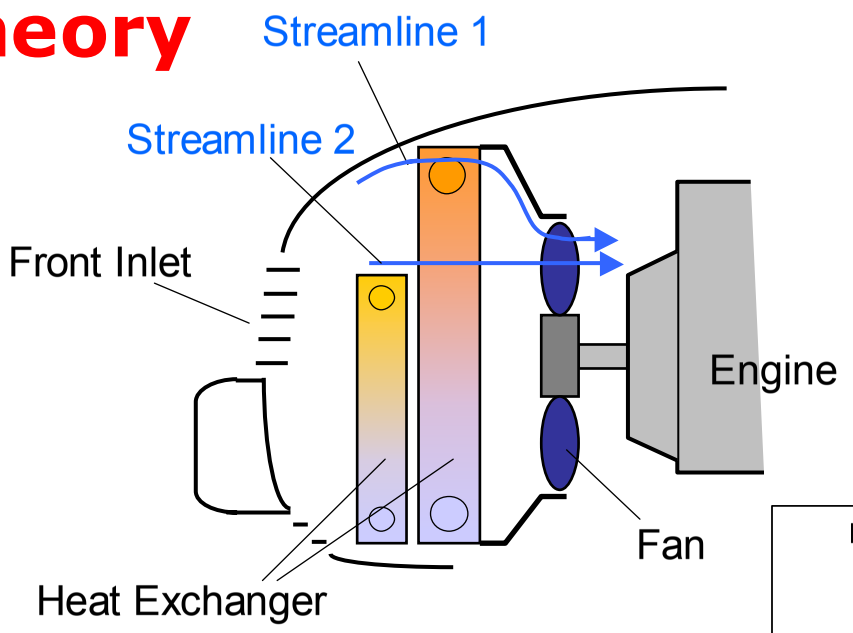


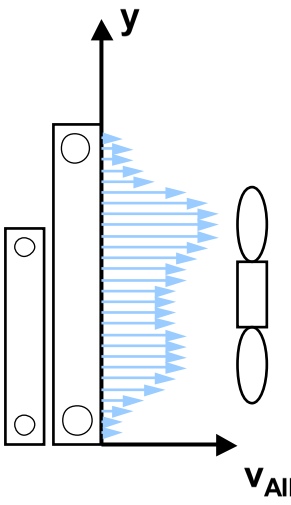
Integrate results from CFD analysis into KULI

Overview:

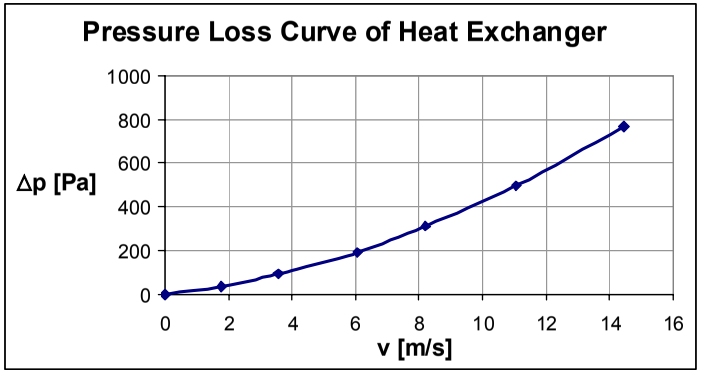
- Theory
- Use CFD Data in KULI
- Results
- Optimizing Cooling Air Path

Theory



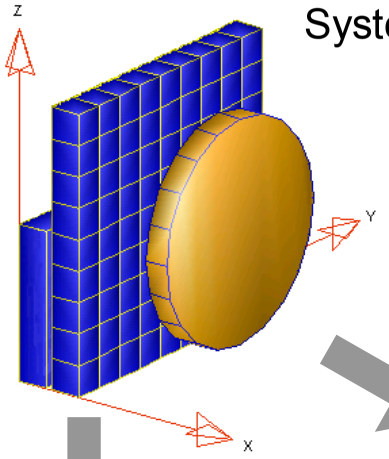


$$\zeta\text{-value}: \quad \zeta = \frac{2\,\Delta p}{\rho\, v^2}$$



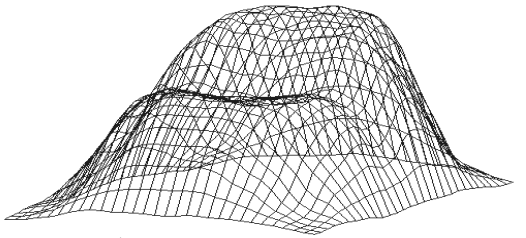
Theory

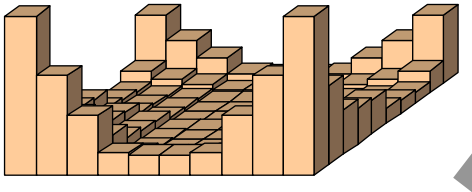
Cooling System



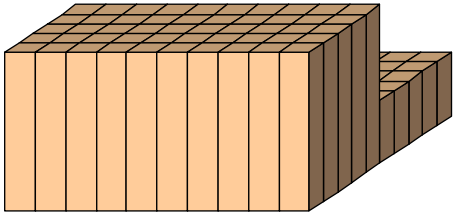
Air flow in block

Air velocity distribution from CFD analysis

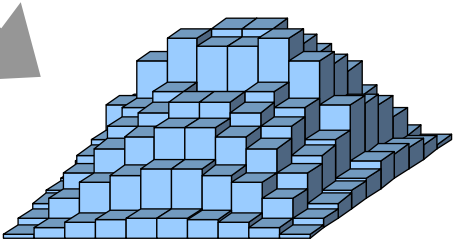




ζ -values of resistance matrix



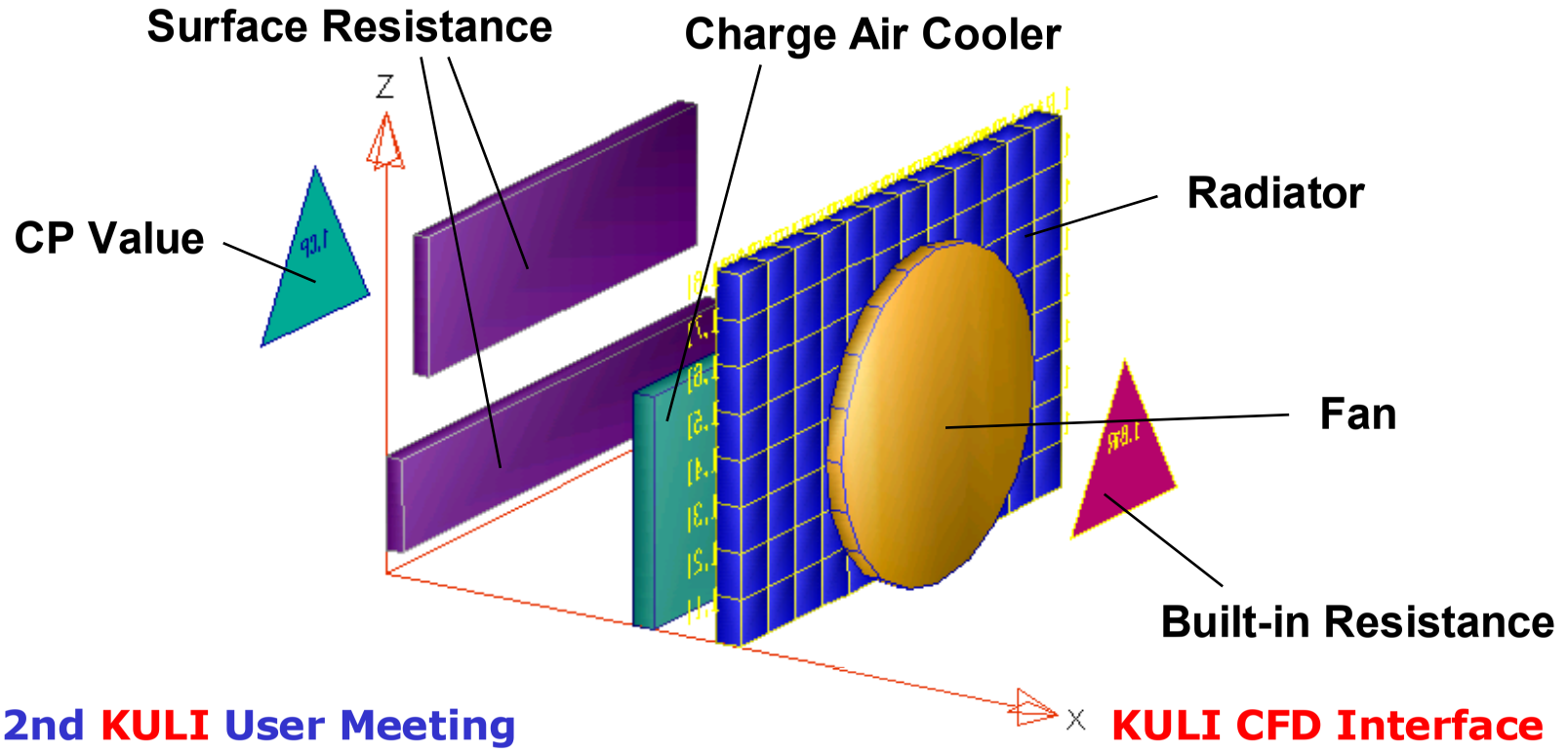
ζ-values of block elements



Air velocity distribution on cooling system block

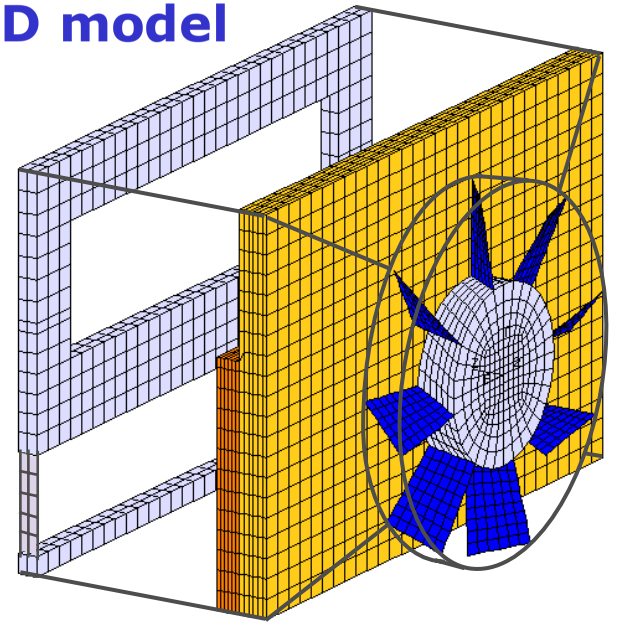
Use CFD Data in KULI - Example 1

Cooling System

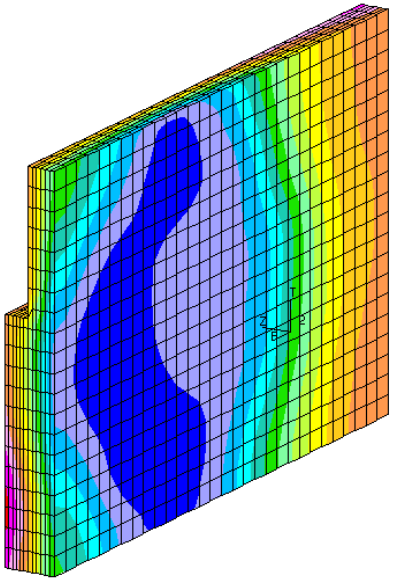


Use CFD Data in KULI

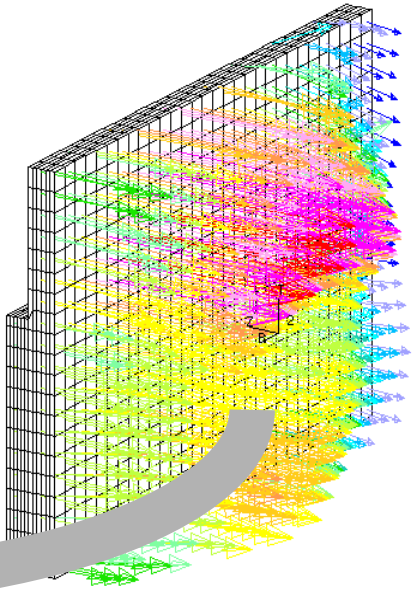
CFD model



Pressure distribution

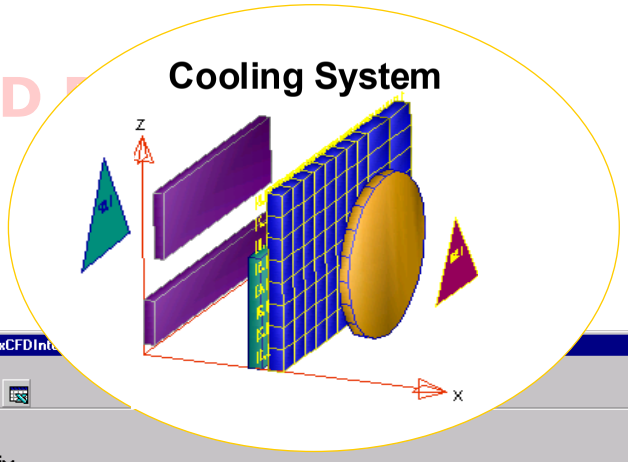


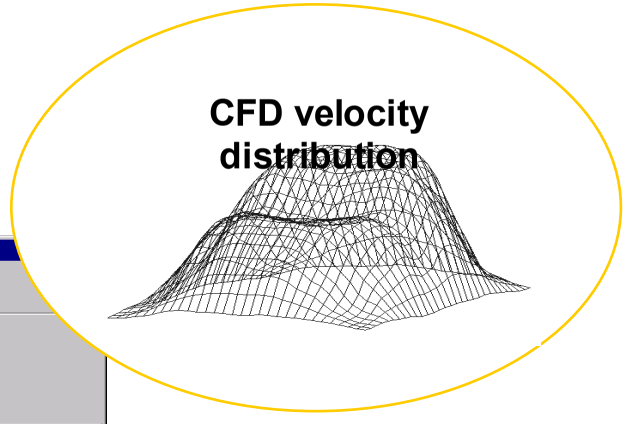
Velocity distribution

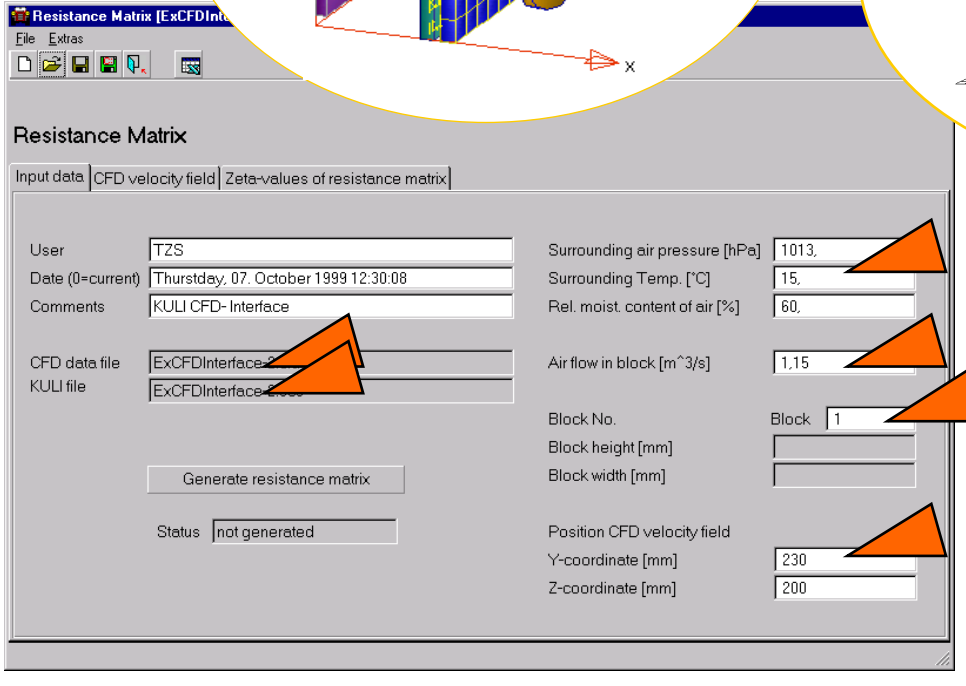


CFD data file

Use CFD I

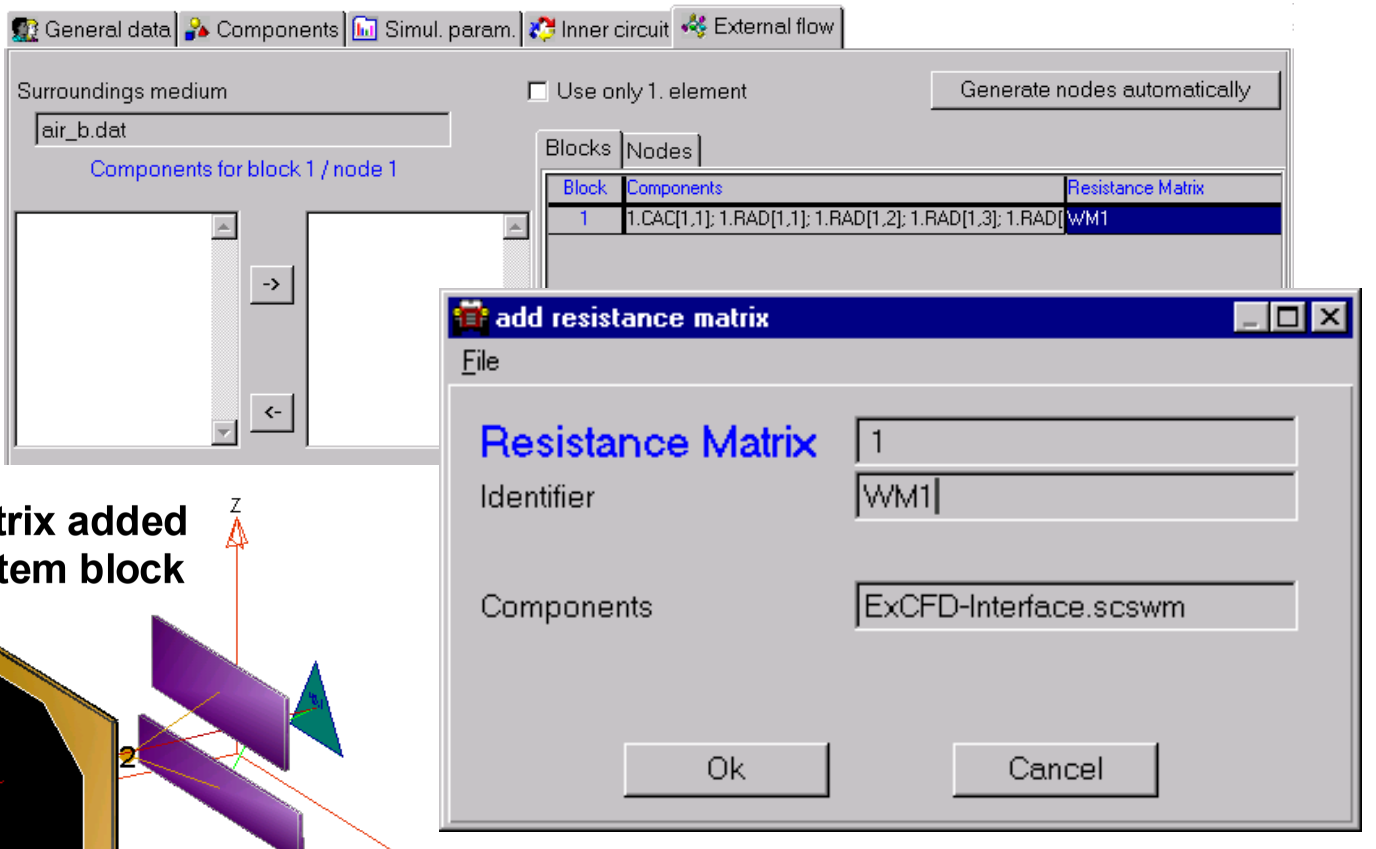






- **KULI file**
- **CFD data file**
- **Material properties**
- **Air flow (optional)**
- **Block number**
- **Position CFD velocity field**

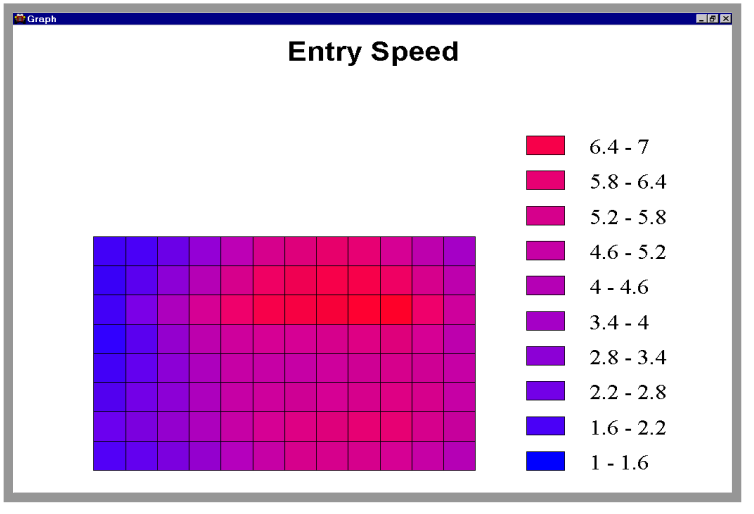
Use CFD Data in KULI

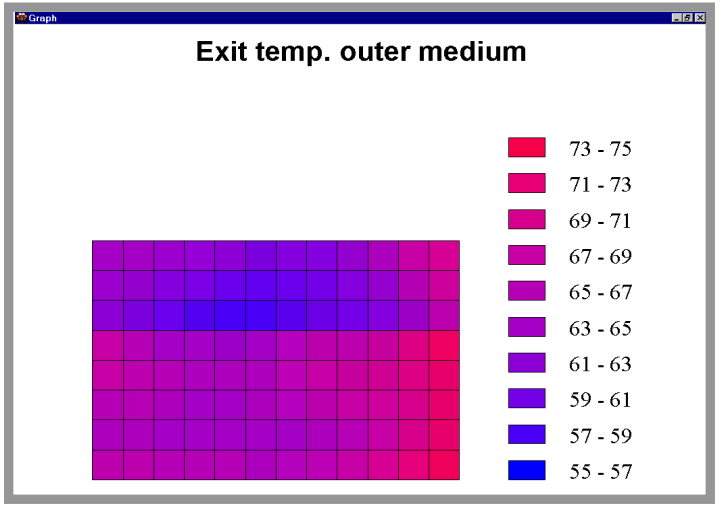


Resistance Matrix added to cooling system block

Results

Air velocity distribution on block

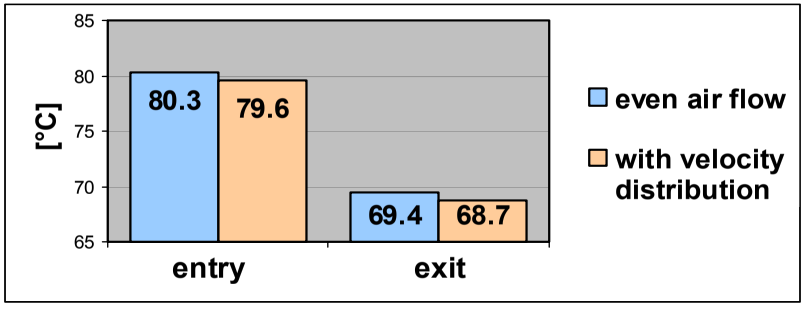


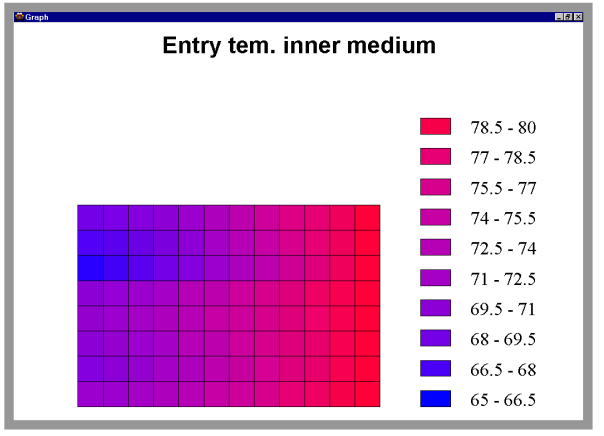


Exit temperature of cooling air

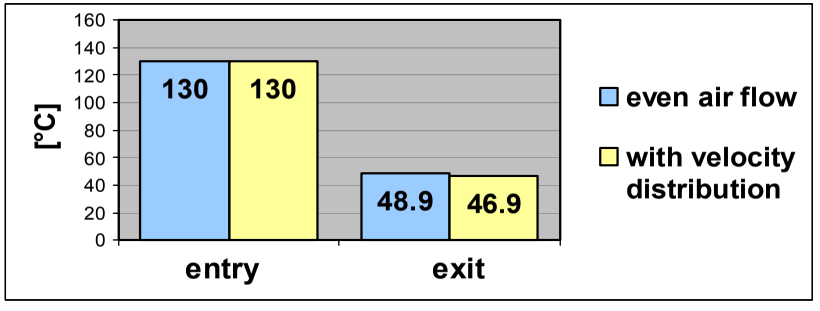
Results

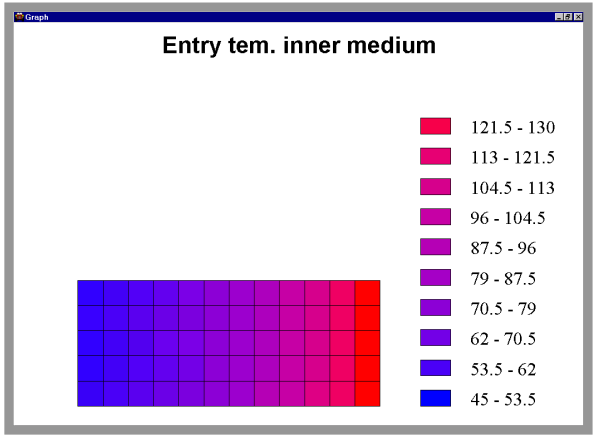
Coolant temperature in radiator



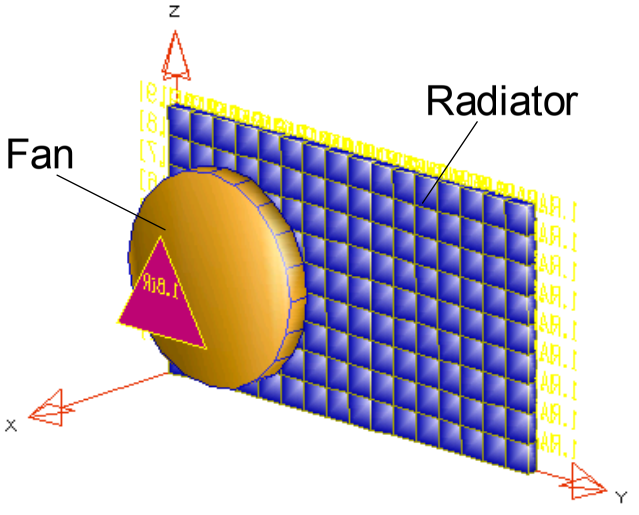


Charge air temperature in charge air cooler

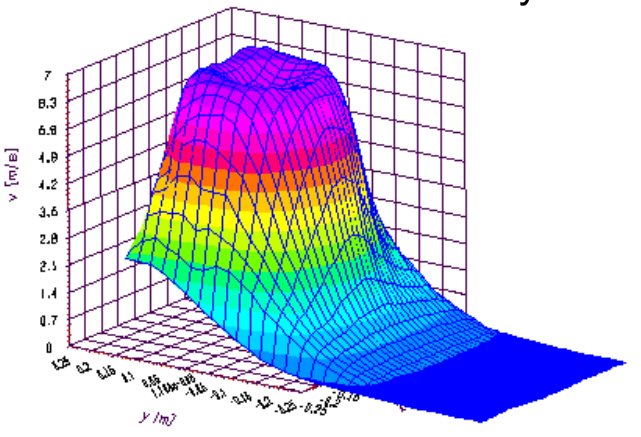




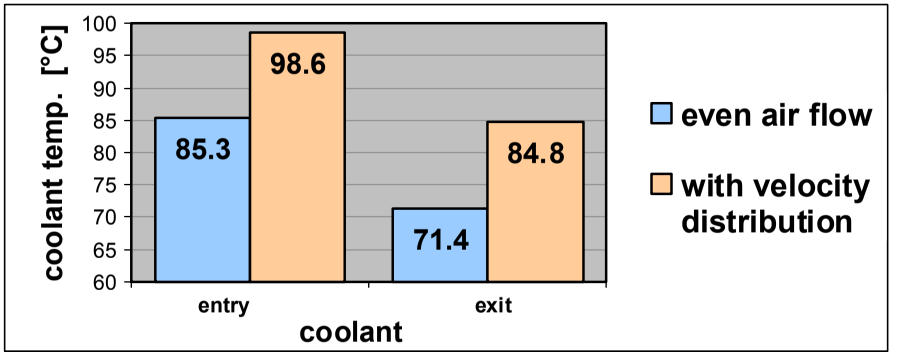
Example 2



Air Velocity Distribution

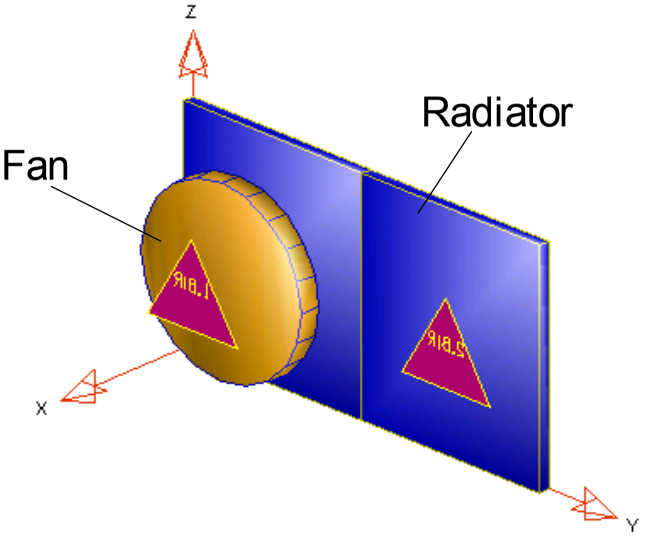


Coolant temperature in radiator:

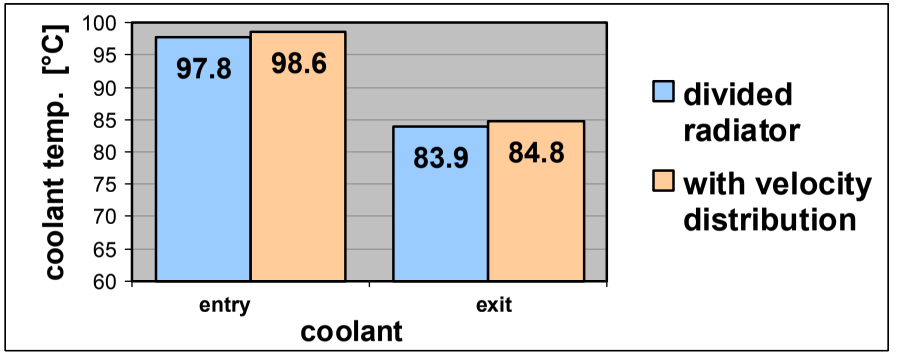


Example 2

In previous KULI versions the uneven air flow could be approximated by dividing the radiator:

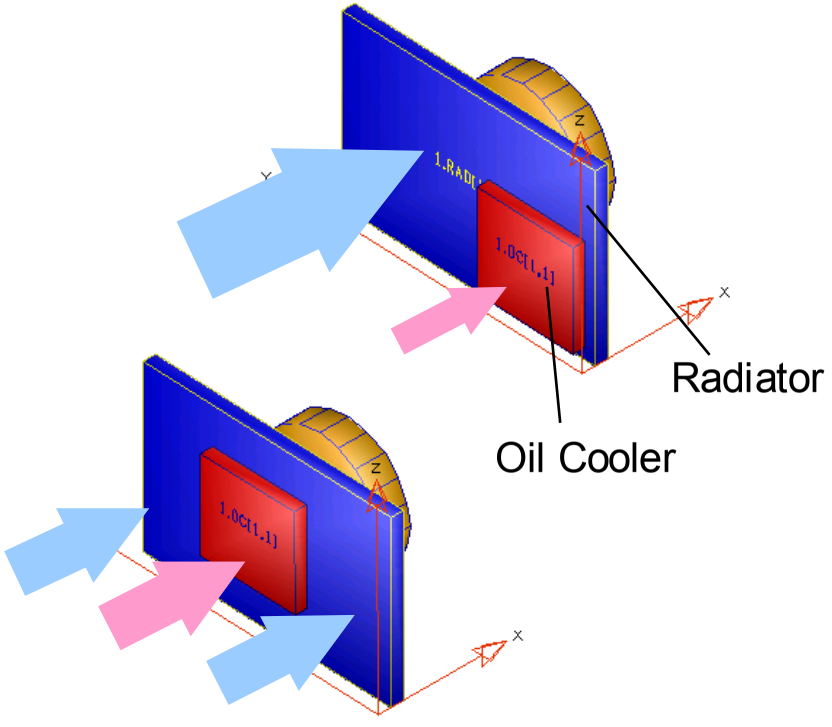


Coolant temperature in radiator:

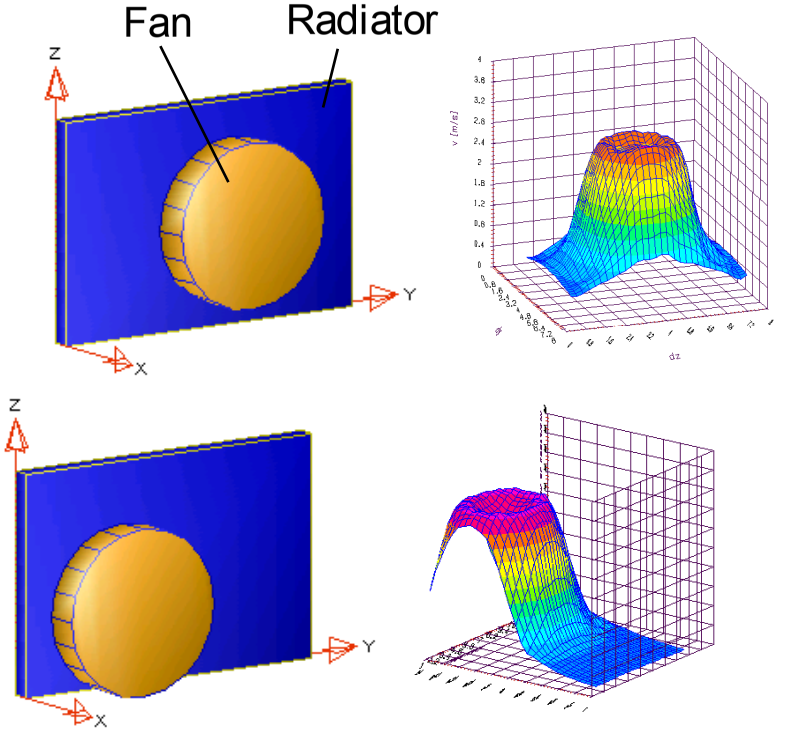


Optimizing cooling air path

Position of heat exchangers



Position of fan



Advantages

- Combine quick KULI simulation with accuracy of CFD analyses
- Effect of air flow distribution on heat transfer
- Optimizing cooling air path
- Interface to STAR CD