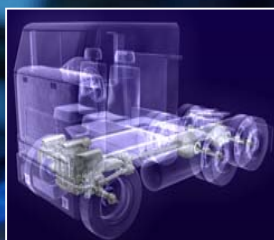
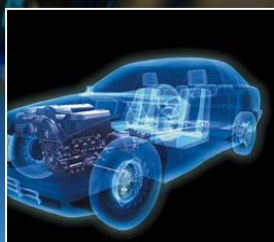
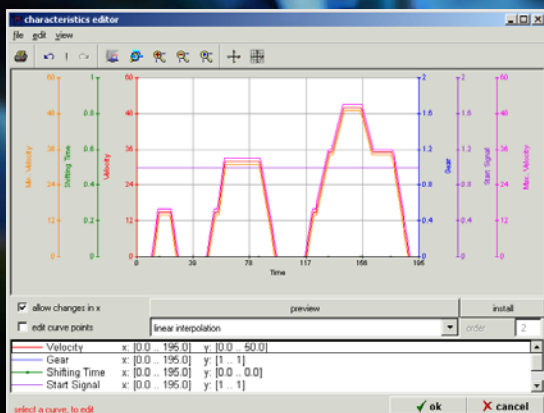




CRUISE-KULI® Interface

E. Loibner
AVL List GmbH



- 2003.06 | Page 2

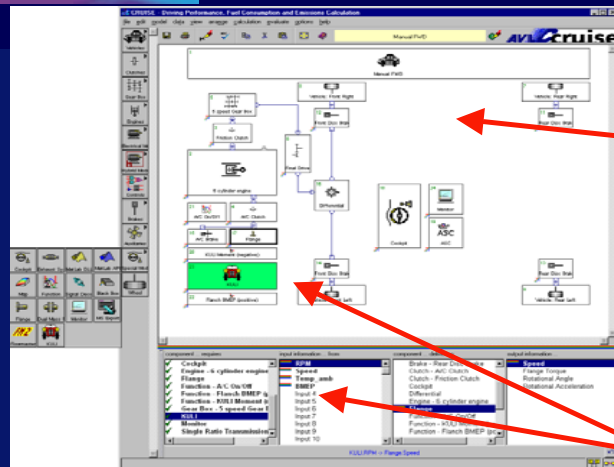
Main reasons for establishing the link

- **CRUISE is a highly flexible vehicle simulation platform which represents an ideal working environment for the integration of KULI® models**
- **KULI® is widely used in the automotive industry for simulation of engine cooling systems, A/C systems and other fluid systems**
- **Flexible coupling software mechanisms are available on both sides**
- **The link provides both software packages with an extended field of applications opening completely new perspectives in virtual automotive design**

Some basic characteristics of the link

- **CRUISE - KULI® link is designed for a transient co-simulation in time domain**
- **The link is easy to understand and straightforward to implement**
- **Interface is controlled by CRUISE and can exchange up to 100 signals in both directions in each time step**
- **CRUISE can record up to 10 input and output variables**
- **KULI® generates a complete set of results viewable in KULI® post-processor**

Creating CRUISE - KULI® link



1. Creating CRUISE and KULI® models

2. Defining connecting points

KULI®:

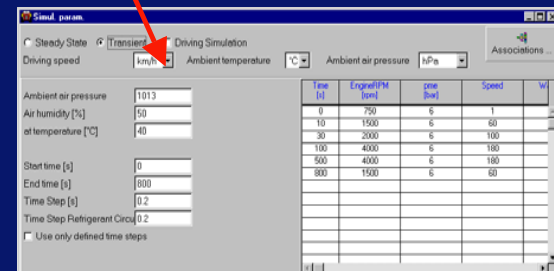
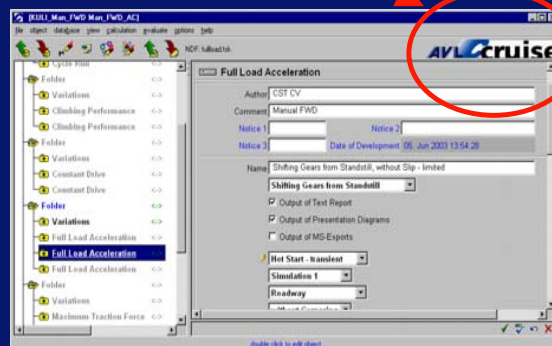
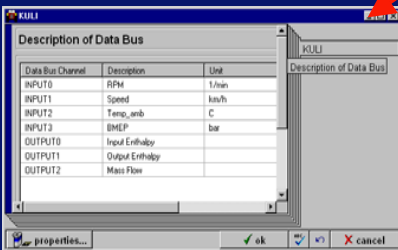
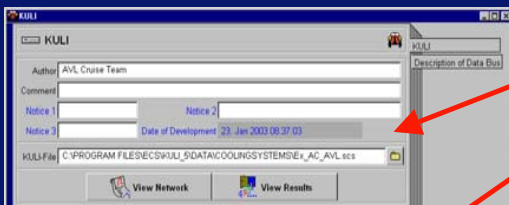
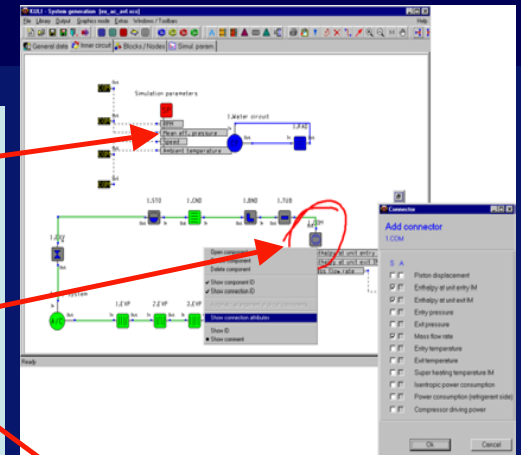
1. Selecting import/export components and variables.
2. Attaching COM components and defining labels and units

CRUISE:

1. Adding KULI® component in CRUISE model and connecting it with other components
2. Referencing KULI® model
3. Defining labels and units as in KULI®

3. Setting Calculation Parameters

4. Starting Simulation

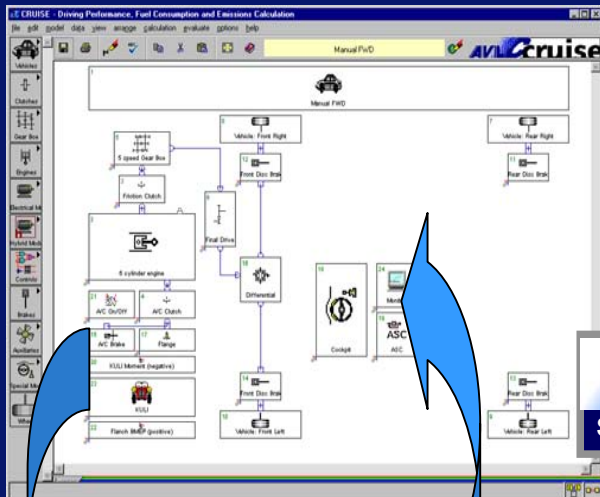


CRUISE - KULI® Application Example

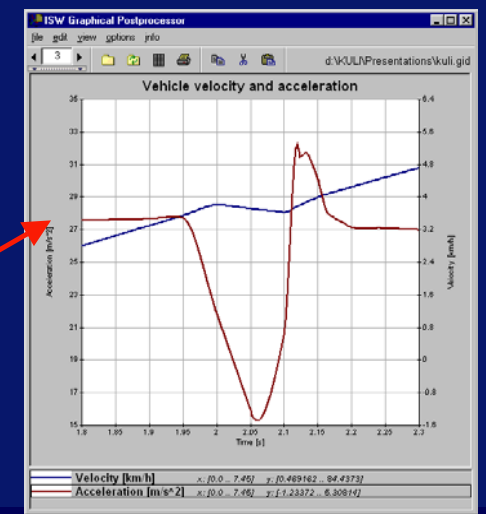
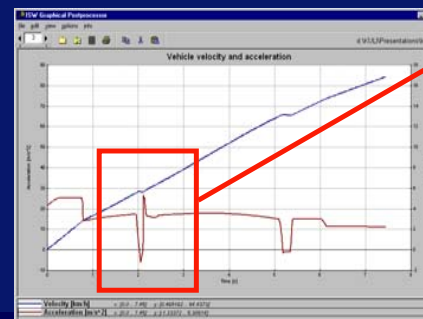
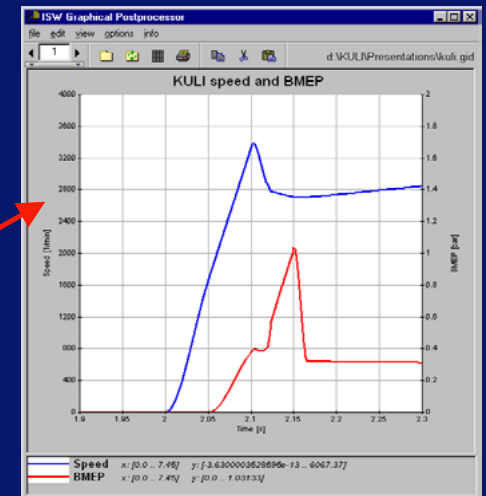


Analyzing transient A/C effects

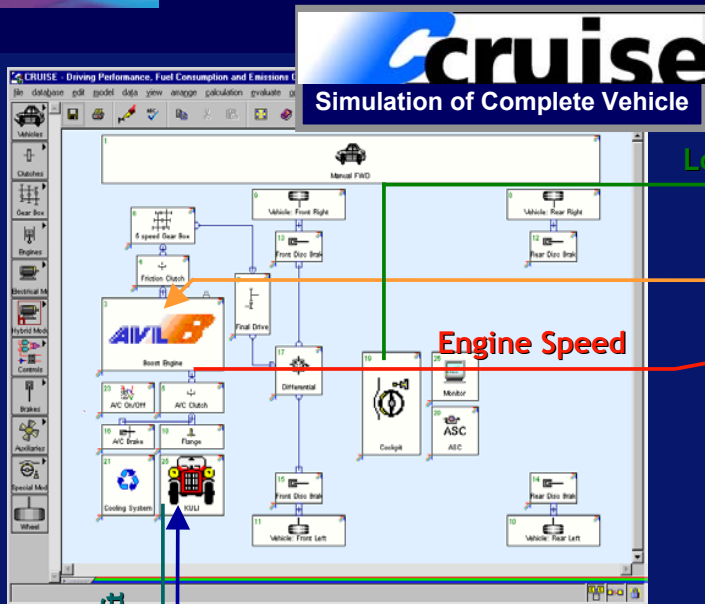
- Incorporating KULI A/C system in a CRUISE standard manual FWD vehicle model
- Simulating full load acceleration test
- Switching on A/C system after 2 sec.



cruise
Simulation of Complete Vehicle



Outlook: Integrated 1-D VTMS system



Load Signal

Engine Torque

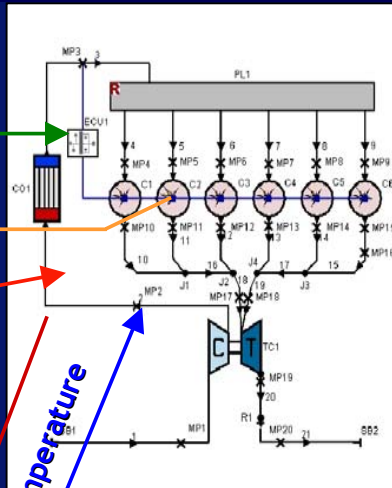
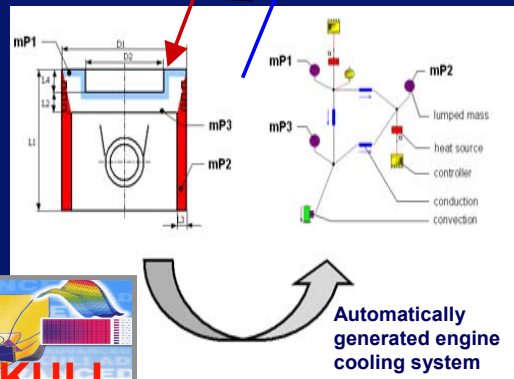
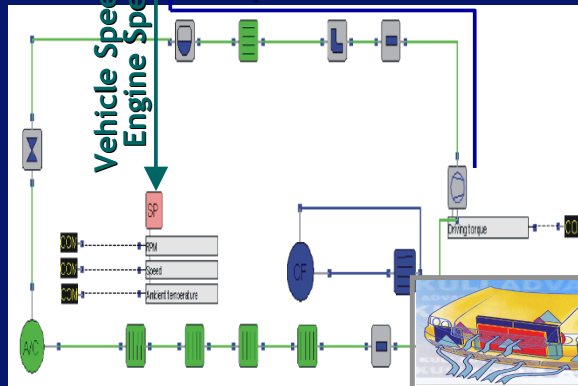
Engine Speed

Heat Released

Wall Temperature

Compressor Power

Vehicle Speed & Engine Speed



boost
Thermodynamic Cycle Calculation

Result: Engine Outlet Coolant Temperature

