Euro NCAP tests with virtual test drives

Stay Safe on the roads

As customer expectations rise and Euro NCAP requirements get tougher, the cost of developing advanced driver assistance systems threatens to become unmanageable. dSPACE offers the solution: a well-coordinated tool chain for function development, virtual validation and hardware-in-the-loop simulation.

Euro NCAP: Five-Star Safety

The rigorous evaluation criteria used in the European New Car Assessment Programme (Euro NCAP) are presenting carmakers with new challenges. Euro NCAP tests new vehicle models – for example, by performing crash tests – and gives each one a safety rating of up to five stars. The ratings cover four areas: occupant protection for adults and children, pedestrian protection, and safety assist.

> By performing Euro NCAP tests in the simulation, active safety systems can be evaluated in early development phases.

Decisive: Active Safety Systems

Active safety systems are becoming increasingly important for obtaining the highest rating of five stars.
In concrete terms, lane departure warning (LDW) systems and autonomous emergency braking (AEB) for urban use (AEB City) and rural use (AEB Inter-Urban) will be included in Euro NCAP assessments from 2014 onwards. Starting in 2016, autonomous emergency braking will include the detection of vulnerable road users (VRUs) such as pedestrians (AEB/VRU/Pedestrian).
The challenge here is to design safety systems that react as intended in safety-critical situations – such responses are called true positives – but do not overreact and produce false positives, for example, by initiating emergency braking unnecessarily. Only the true positives are currently important for Euro NCAP. dSPACE provides an extensive test environment (figure 2), based on Euro NCAP test protocols, for validating active safety systems by means of simulation.

Testing in Accordance with Euro NCAP

ModelDesk includes a library of ready-to-use Euro NCAP test scenarios that comply with Euro NCAP test protocols for use cases such as AEB City, AEB Inter-Urban and AEB VRU/Pedestrian. Figure 1 shows selected test protocols. Note that the Euro NCAP definitions for active pedestrian protection scenarios have not yet been finalized (information valid as of April 2014). Figure 2 gives an overview of the tool environment for validating the necessary ECU software by MIL/SIL simulations. The associated AutomationDesk project and the visualization of a test scenario in MotionDesk are shown in figure 3. AutomationDesk has a catalog of preconfigured tests that have been designed for easy handling. After loading a test project, users can select the ECU functions to be tested (autonomous braking, collision warning), either together or individually, and specify the planned testing depth according to the Euro NCAP categories. The entire project can be started with just a few clicks.

Automatic Tests and Test Reports

During automatic test execution, the individual components of the test environment are remote-

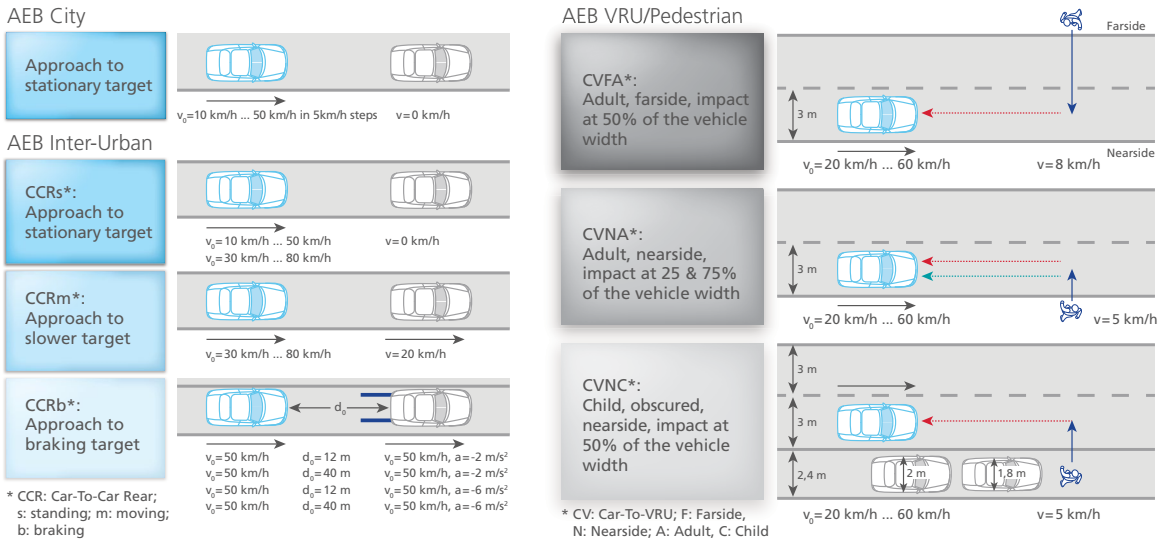
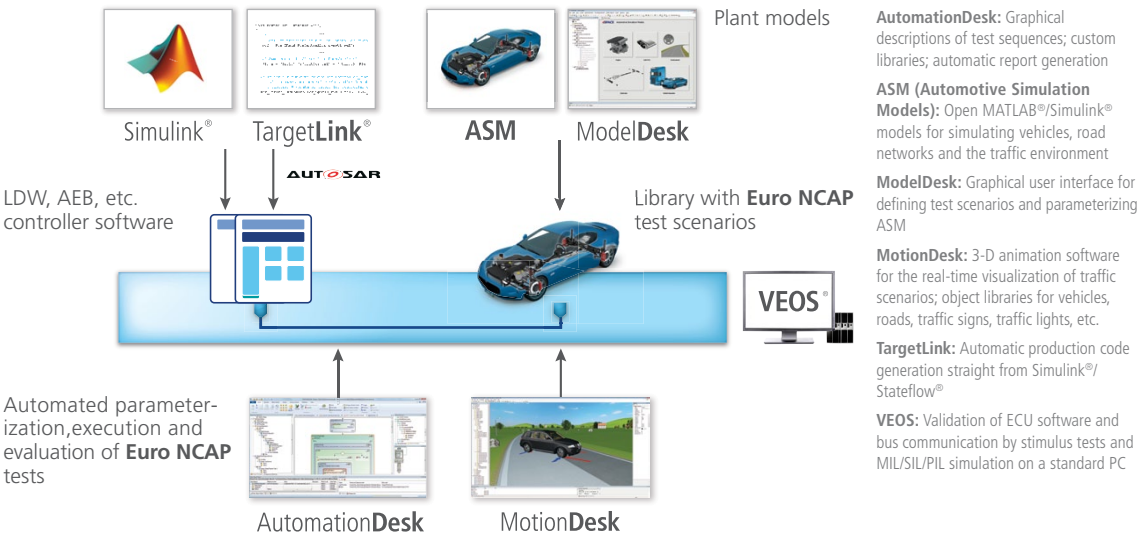


Figure 1: Euro NCAP test protocols for AEB City, AEB Inter-Urban and AEB VRU (vulnerable road user)/Pedestrian.

controlled via associated libraries. The process guarantees that each single test scenario is selected, parameterized, executed, evaluated, and precisely logged in compliance with Euro NCAP. MotionDesk shows developers the progress of each test so that they can assess its plausibility. When test execution completes, AutomationDesk generates a report comprising all the relevant information at three different levels of detail. First there is a concise overview (figure 4) of the total score for a test area (AEB Inter-Urban in this example). It includes graphical descriptions of associated test scenarios and a table of individual scores. Users can navigate to more detailed reports on individual test series from the result tree (on the left of the screenshot). These reports contain the main results of each test run in the test series together with the number of points awarded and the scores. There are also links to detailed reports on the individual test runs themselves. These contain all the details from the individual parameterization to

Figure 2: Simulation environment for executing virtual Euro NCAP tests. The associated AutomationDesk project and its visualization in MotionDesk are shown in figure 3.



tables and graphics of the measurement results, as well as the final score.

Optimized Test Frame for Driver Assistance Systems

Test execution in AutomationDesk employs a test frame that was specially developed for validating driver assistance systems. The frame is extremely easy and convenient to use, and subsequent tests can also be based on it with very little additional effort. Once a user has defined the test scenarios in ModelDesk, it basically takes just three steps to create the final test.

The first step is to configure the test frame so that it fits the test environment, in other words to define the test platform, the signals to be measured, the test parameters, the final ModelDesk test scenario, and so on.

In the second step, the test scenario can be parameterized separately for each individual test run (e.g., speed of the vehicle under test).

For the third step, the test frame provides a special area where users can integrate their own test evaluation and logging setups.

All the other steps necessary for test execution – selecting and activating the test scenarios in ModelDesk, downloading test parameters to the platform, maneuver control, data capture, etc. – have already been performed and the results integrated into the test frame. They automatically start running in the background at the appropriate times.

Thanks to this development environment, test developers can concentrate on their essential tasks and need no other special knowledge, such as how to handle tool automation.

Testing More Than Euro NCAP

System behavior can also be studied at its extreme limits and false positives can be detected by varying appropriate parameters in the available test scenarios. This especially applies to the design of systems for pedestrian detection, where aspects such as pedestrians' direction and speed of walking can also be varied in addition to the Euro NCAP specifications.

The Automotive Simulation Models (ASM) include sensor and object models for simulating these aspects for early system evaluation. Users can then determine the rate of false positives very early on and modify the software accordingly during system design. Yet another feature, planned for the upcoming version of MotionDesk, is very realistic animation of the movements of adults and children. This is particularly important for testing camera-in-the-loop HIL systems. ■

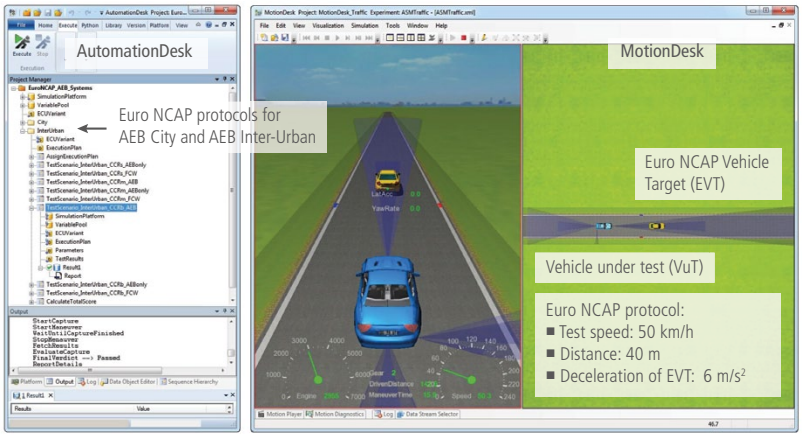


Figure 3: AutomationDesk project (left) and visualization in MotionDesk (right).

Figure 4: Euro NCAP test report generated by AutomationDesk.