



## Highlights:

Rapidly convert detailed GT-POWER model to fast running version

Both physically based and mean value based engine models available

GT-SUITE is the only tool that provides two levels of engine models for control development

Incorporate GT-POWER based engine models directly into the control system development process

Crank angle resolved to capture valve events, combustion, tuning

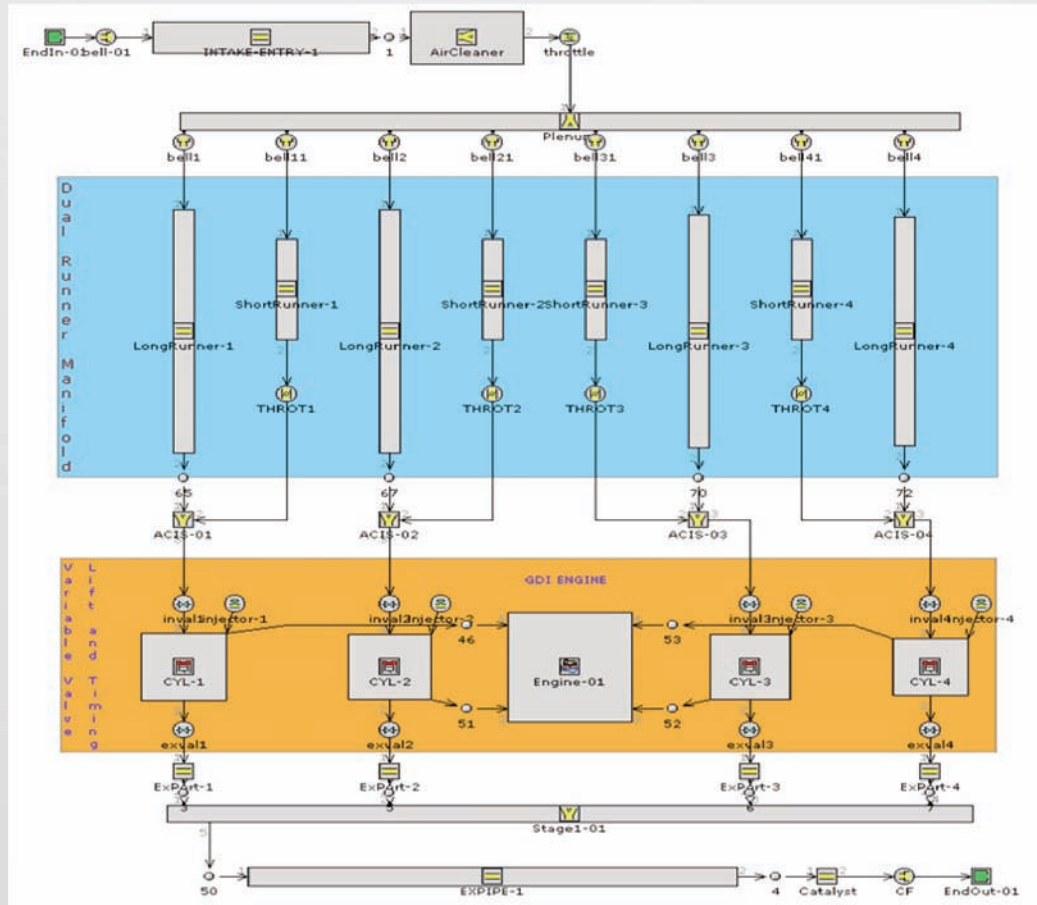
Multi-pulse combustion capable, closed-loop combustion control

Supports both SiL and HiL, including systems from ETAS, dSpace, A&D, NI, Mathworks, and more

## SiL, HiL, and Real-Time Modeling

### Control System Modeling with GT-POWER Engine Models

GT-POWER is the market leading engine simulation software, used by every major engine manufacturer for the design and development of their engines. Now, the same GT-POWER engine models created in the R&D departments can be used by the controls system engineer for ECU development and other controls modeling activities. GT-SUITE includes all the tools needed to **generate a fast running, real time capable engine plant model from the existing GT-POWER model** to produce a fully physical, crank angle resolved model capable of predicting pressure wave dynamics and in-cylinder combustion in either pure software (SiL) or in real time (HiL) applications. Even highly advanced engine models can be quickly created for SiL and HiL applications, such as the dual runner, variable valve timing and lift example shown below, easily derived in less than one day from a detailed GT-POWER model.



## Advanced Features and Applications:

### Advanced Capabilities:

- Variable valve timing
- Variable valve lift
- Full aftertreatment system control modeling, in real time!
- Multi-Wiebe based combustion model
- Variable geometry systems (dual runner, switching valves, etc.)
- Vehicle Model
- Drive Cycles, including new SC03
- Perform Warmup and full vehicle thermal/energy management studies
- More than just an engine model, includes entire vehicle and ancillaries

Supports Controls models in Simulink, ASCET, and Veristand

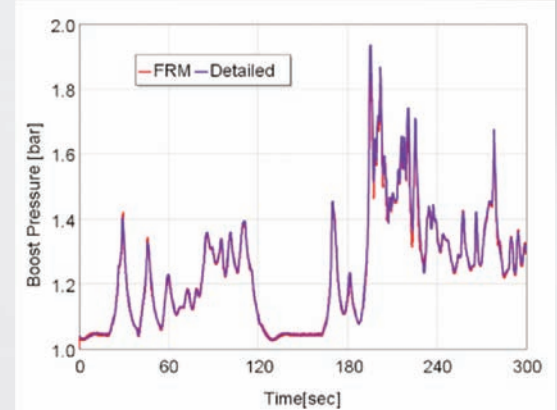
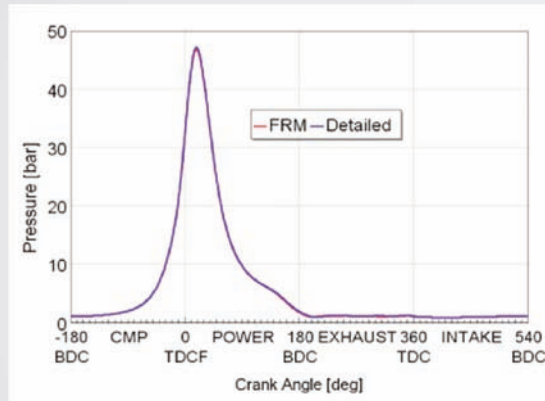
Built in DOE and Neural Network trainer for MV model development

These capabilities included in every GT-SUITE license

## Fast and Accurate Engine (Plant) Models for Control System Modeling

GT-POWER has long been accepted as an industry standard engine modeling tool, with its state of the art Navier-Stokes pressure wave solver, detailed thermodynamics, and advanced combustion models. These same, highly validated solution methodologies are now available for fast running models (FRM's), thus providing a foundation for highly accurate model development that controls engineers can use for their modeling tasks. The GT-POWER FRM's have the advantage of being **based on a physically conservative formulation**, thus it may be used with greater confidence in the results as compared to more simplistic models that have been developed and used in the past.

The FRM's have proven to be highly accurate on both a micro and macro level, as illustrated below via a cylinder pressure comparison (left) and a comparison of boost pressure over a portion of a federal driving cycle (right).



## Multiple Model Levels (Unsteady, MV, Quasi-Steady, Fully Integrated)

GT-SUITE is the only simulation tool to provide multiple model levels for real time applications. Users can choose between fully unsteady, crank angle resolved engine models derived directly from GT-POWER models, or from neural network based mean value engine models. The complete aftertreatment system may also be included within a real time simulation. With the GT-SUITE platform, the entire vehicle system shown below (includes engine, waterjacket cooling detail, oil circuit, underhood 3D model, transmission oil cooling, and controls) may be modeled for SiL applications with run times of just 5-10 times real time.

