ICSC 2019

Core Competence Enhanced by MBD

IDAJ CAE Solution Conference

GT-DRIVE+架构师建模

IDAJ中国
技术部　GT 刘建雄

原计划

演示如何快速建立整车动力性/经济型模型，并得到对应的结果

演示不同新能源车辆架构模型定义

如何加载并定制化计算任务

演示定制化输出计算结果

与优化软件联合制输出

实际安排

什么是GT-drive+？

- 介绍GT-drive+
- 演示整车快速建模、计算，及修改

什么是架构师？

- 架构师工作及流程介绍

成为架构师

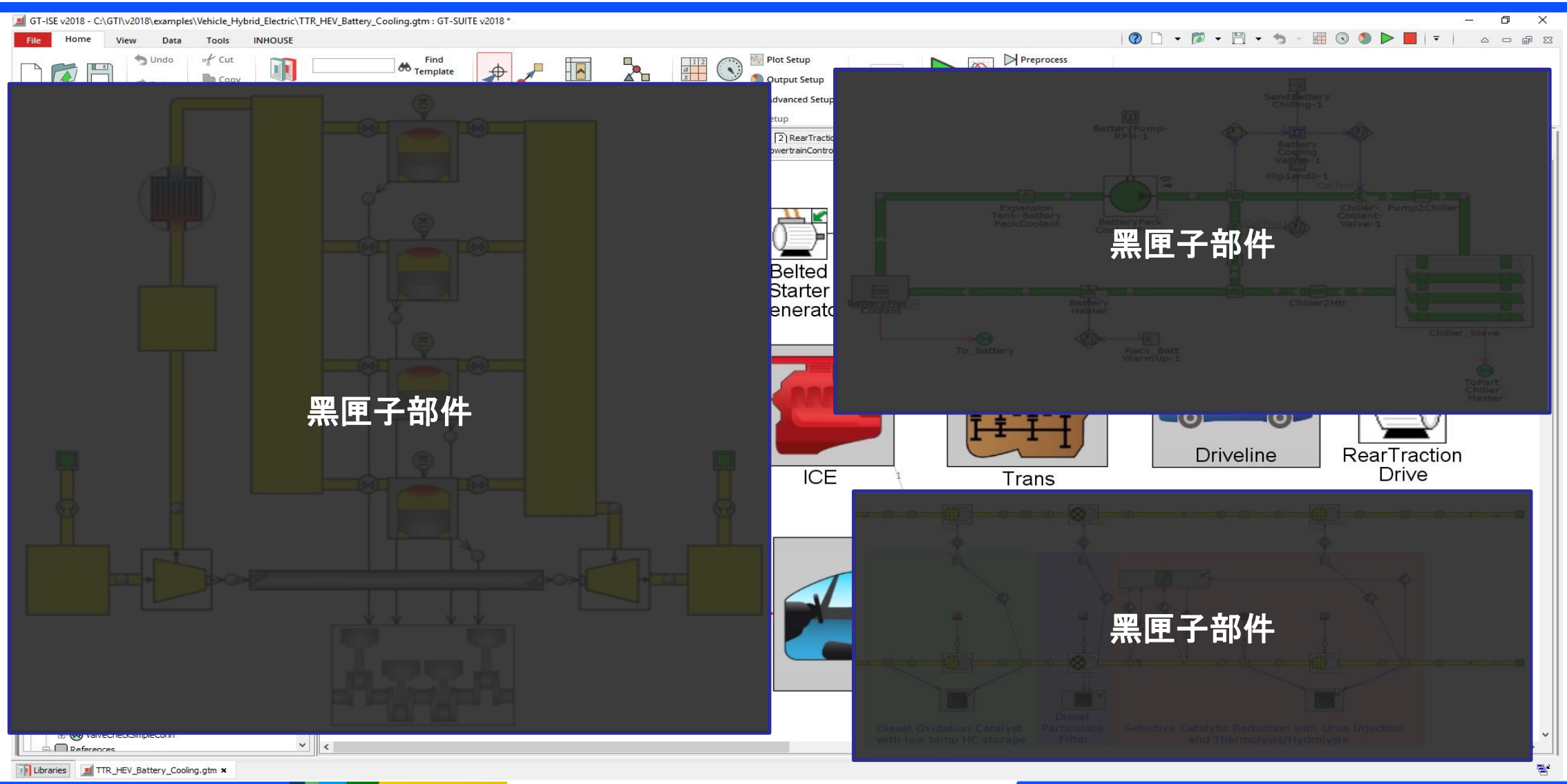
- 介绍GT中变量的定义，引入.gtc文件的创建
- 介绍系统级变量的定义和使用
- 介绍并演示整车架构的创建、及如何嵌入GT-drive+
- 介绍如何在同一模型实现多任务的计算
- 介绍如何定制输出计算结果

GT&MF联合仿真介绍

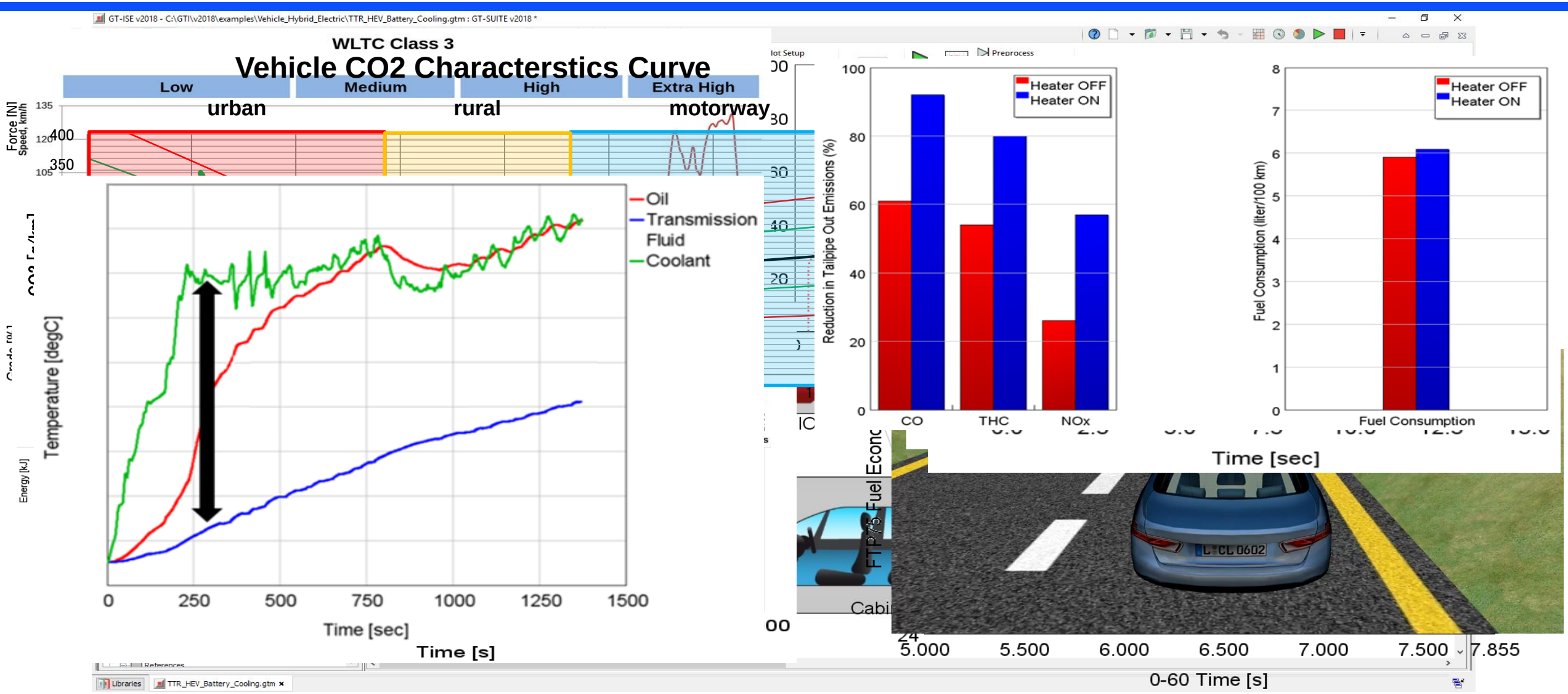
目录

- 什么是GT-DRIVE+？
- 什么是架构师？
- 成为架构师
- GT&modeFRONTIER联合仿真介绍

什么是GT-DRIVE+？



什么是GT-DRIVE+？



什么是GT-DRIVE+？

GT-DRIVE+ 是GT-Suite新一代整车建模方式

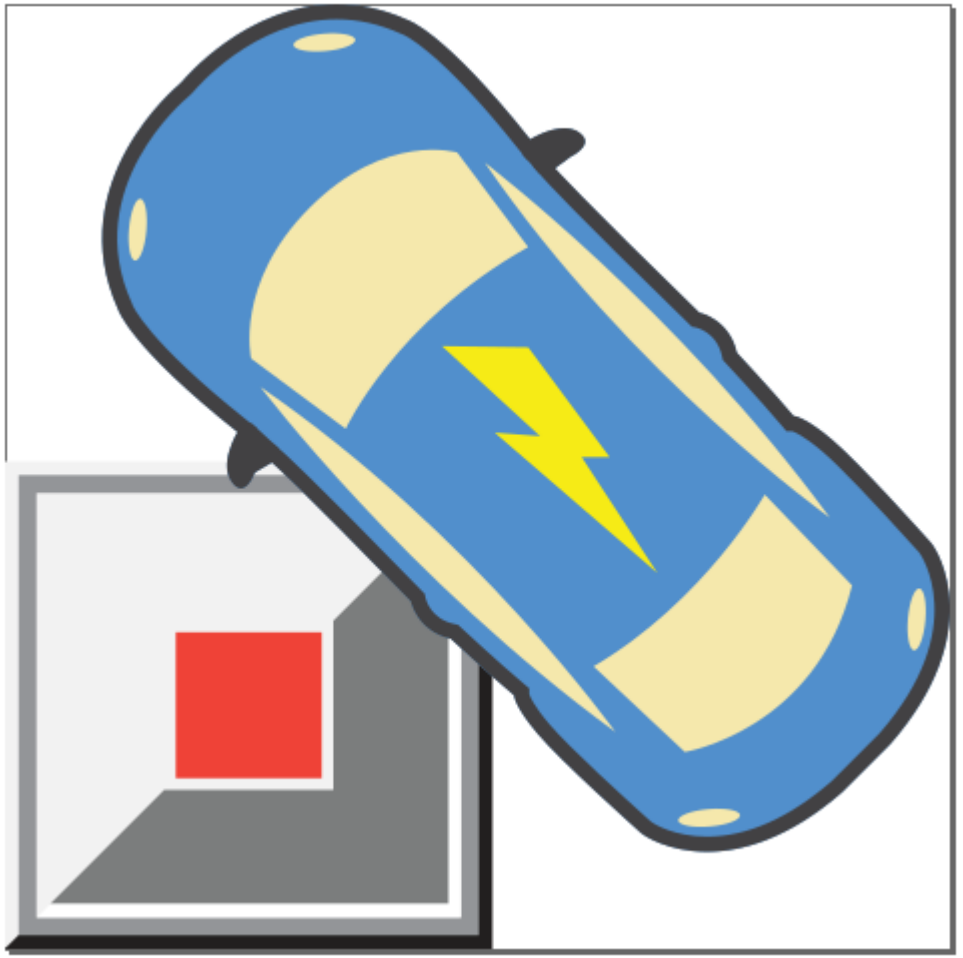
其独特的设计使用户能够快速搭建不同类型的汽车模型

- ✓ 传统车辆
- ✓ 新能源汽车 (HEV, PHEV, BEV, FCEV)

满足不同开发阶段、不同开发部门的仿真需求

- ✓ 动力性、经济型
- ✓ 热管理、能量管理
- ✓ 控制优化

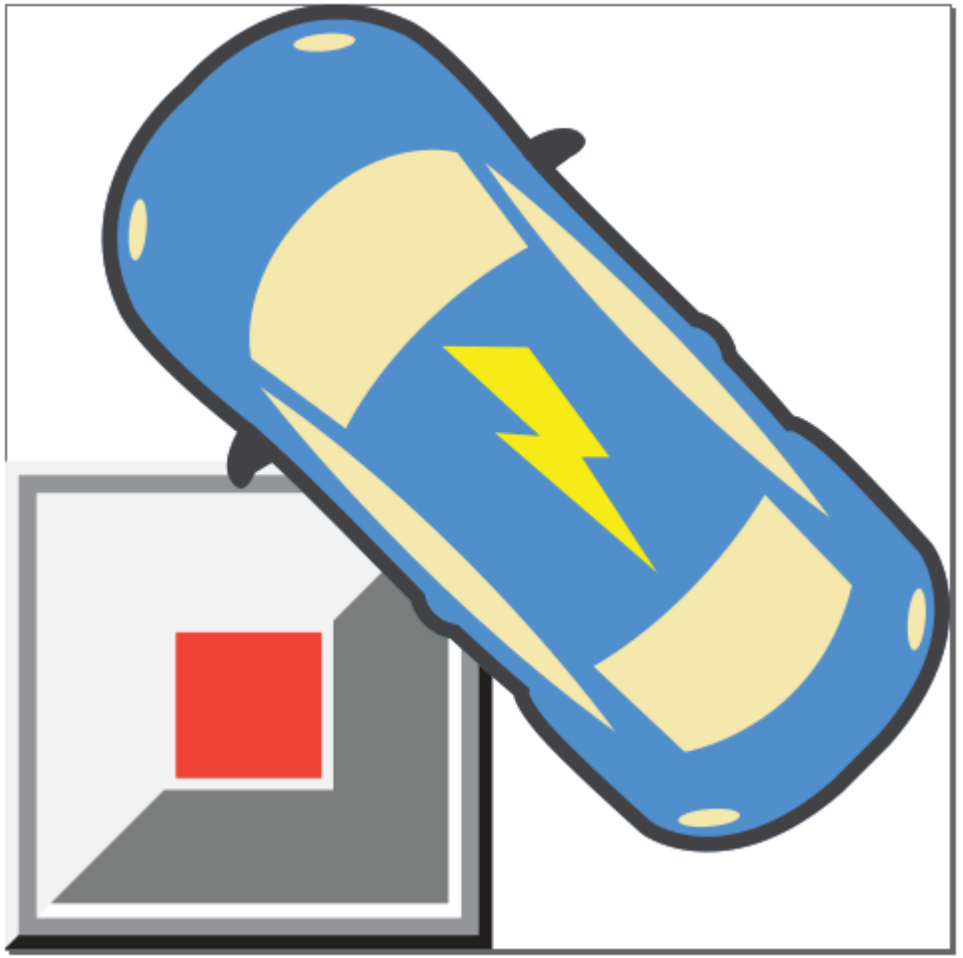
重点关注操作界面的友好性、标准化和自动化的建模流程



什么是GT-DRIVE+？

GT-DRIVE+解决了车辆仿真中的关键挑战，包括：

- ✓ 建模过程繁琐
- ✓ 多系统耦合调试困难
- ✓ 整车构架多样
- ✓ 计算需求类型多样
- ✓ 信号、参数定义不统一
- ✓ 子系统、整车构架通用性不强



GT-ISE v2018

File | Home | View | Data | Tools | INHOUSE

Save
Save As
Open
Close
Change License
Recent
Send And Import
Info
Resources
Examples
Tutorials
Manuals
Help
Print
Advanced
Options
Exit

Create New...

Model | Compound | Library
Subassembly | xLINK | GT-DRIVE+

GT-SUITE Applications

GEM3D | COOL3D | VTDESIGN
GT-SpaceClaim | GT-POST | CONVERGE Lite (3D-CFD)

GT-SUITE Utilities

Convert to FRM | Calculate Fluid Properties | Configure Default Units
GT Excel Sheet

User Shortcuts

Click here to add a shortcut

https://www.gtisoft.com/gt-suite-dashboard/ | Set as Home

GT

The Leading CAE Platform for Multi-Physics System Simulations

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Don't Miss!

Tech Tip

Libraries

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什么是架构师？

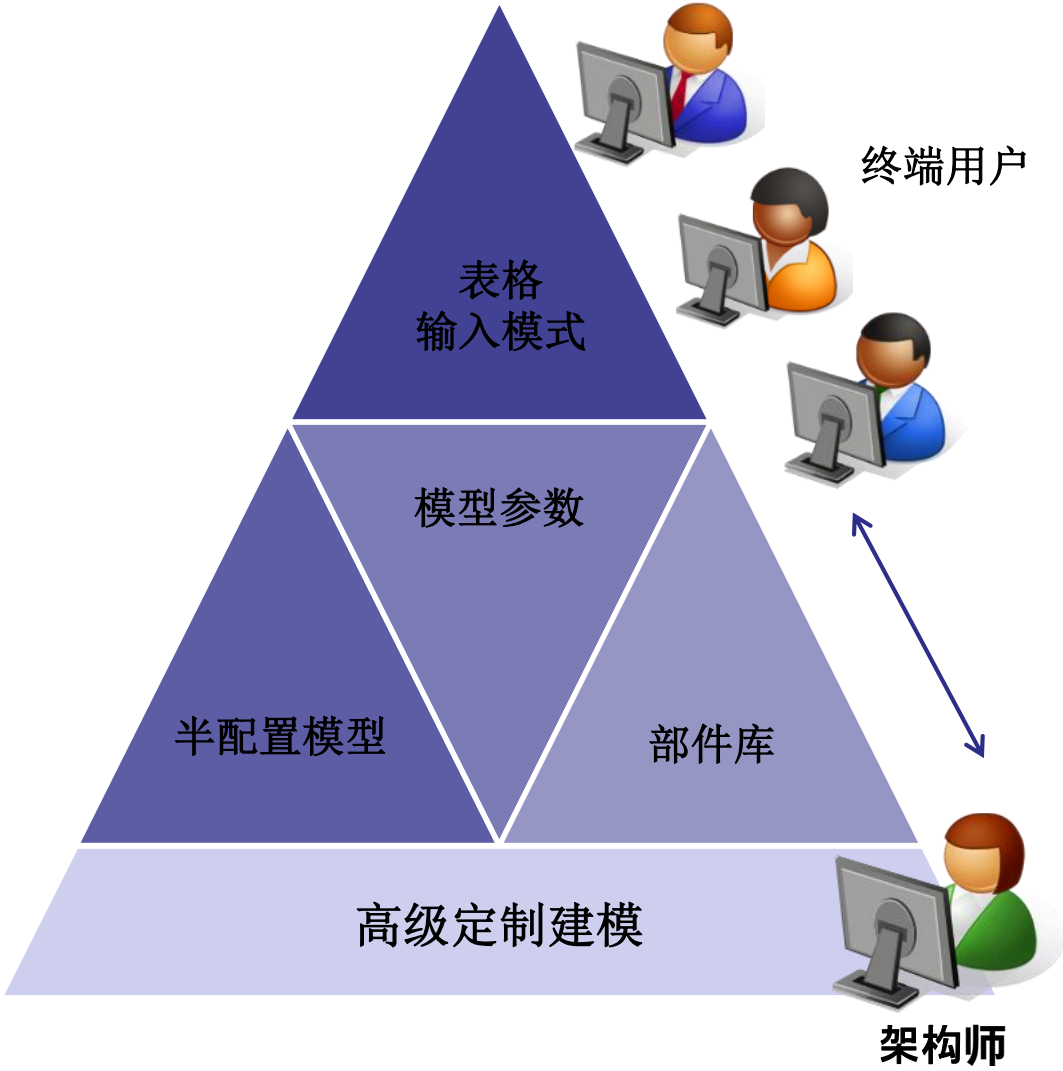
两种工作模式

终端用户：

- 快速建模
- 参数输入
- 计算分析

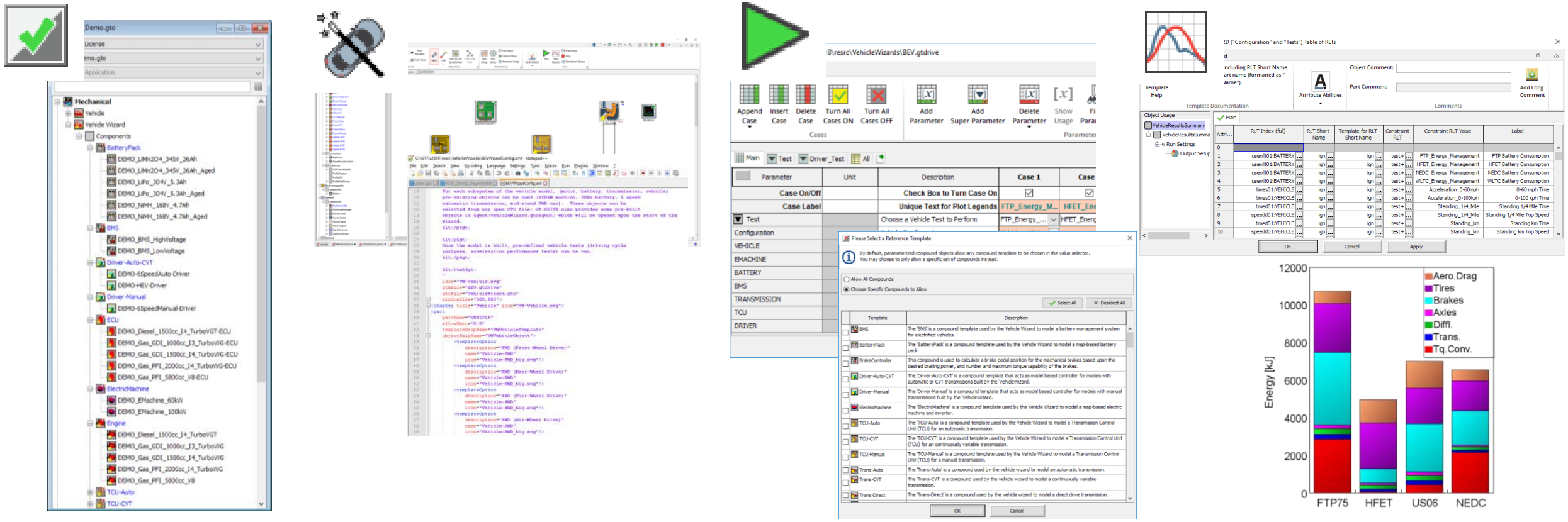
架构师：

- 制定部件及子系统级模块
- 制定输入、计算及输出模板
- 制定整车架构



什么是架构师？

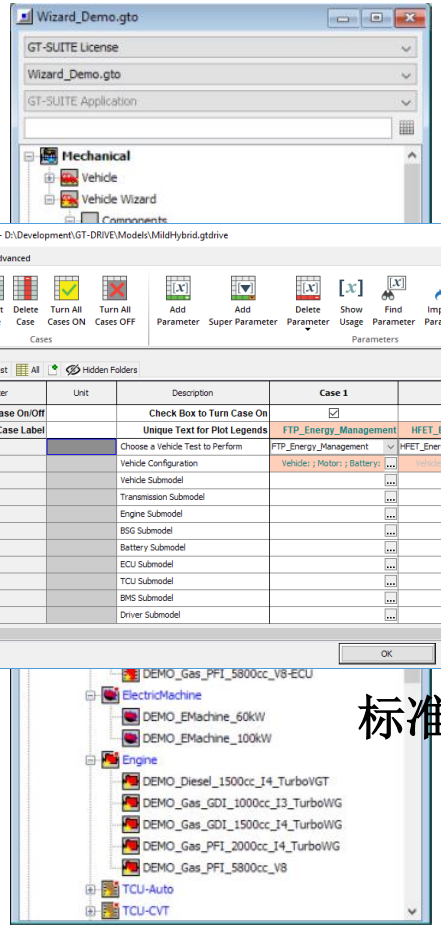
架构师工作内容：



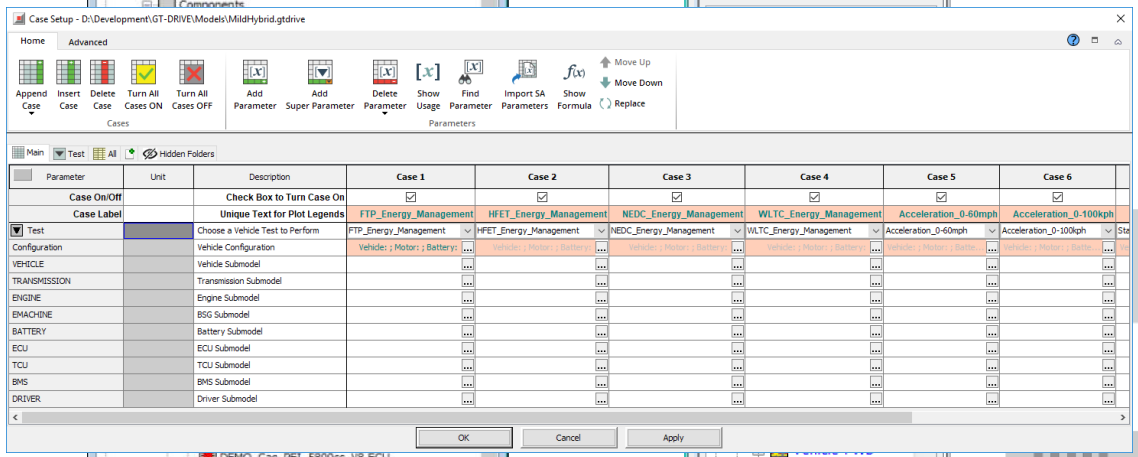
制定模块库 → 制定构架 → 输入、计算 → 分析模板

什么是架构师？

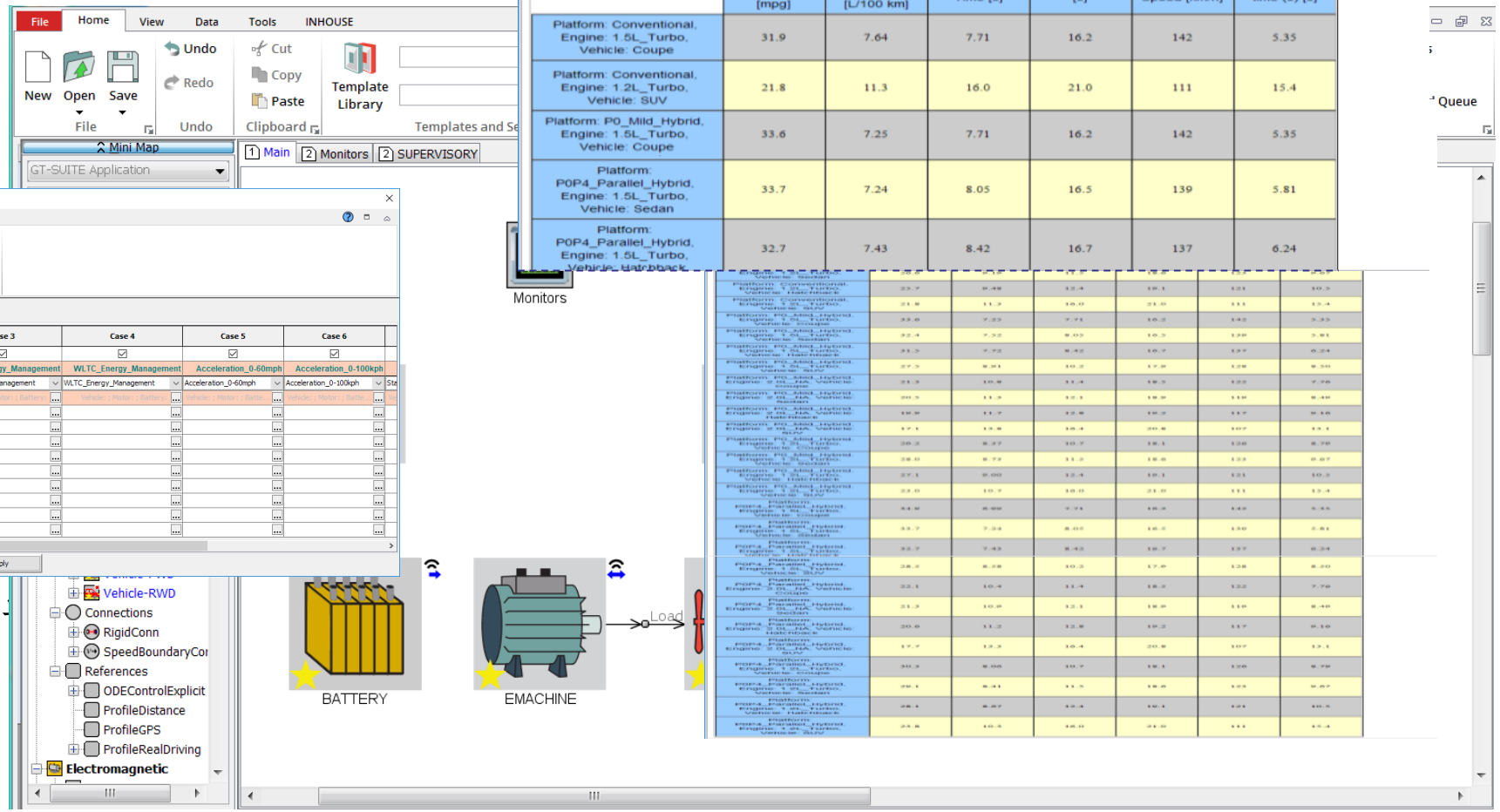
将系统仿真专业化、流程化、标准化：



标准化部件



标准化模型



VehicleResultsSummary

	FTP Fuel Economy [mpg]	NEDC Fuel Consumption [L/100 km]	0-60 mph Time [s]	1/4 Mile Time [s]	1/4 Mile Top Speed [km/h]	50-70 mph time (s) [s]
Platform: Conventional, Engine: 1.5L_Turbo, Vehicle: Coupe	31.9	7.64	7.71	16.2	142	5.35
Platform: Conventional, Engine: 1.2L_Turbo, Vehicle: SUV	21.8	11.3	16.0	21.0	111	15.4
Platform: P0_Mild_Hybrid, Engine: 1.5L_Turbo, Vehicle: Coupe	33.6	7.25	7.71	16.2	142	5.35
Platform: P0P4_Parallel_Hybrid, Engine: 1.5L_Turbo, Vehicle: Sedan	33.7	7.24	8.05	16.5	139	5.81
Platform: P0P4_Parallel_Hybrid, Engine: 1.5L_Turbo, Vehicle: Hatchback	32.7	7.43	8.42	16.7	137	6.24

标准化整车配置

目录

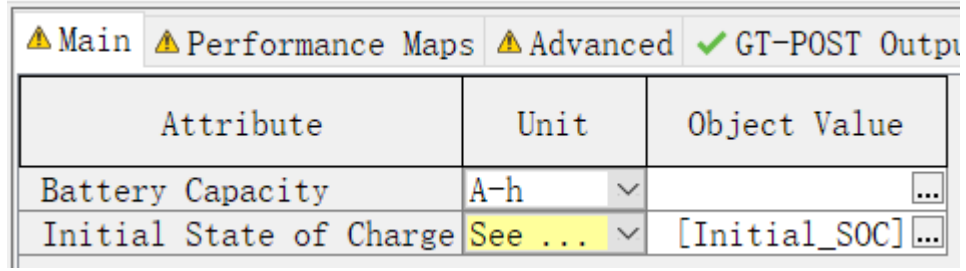
成为架构师

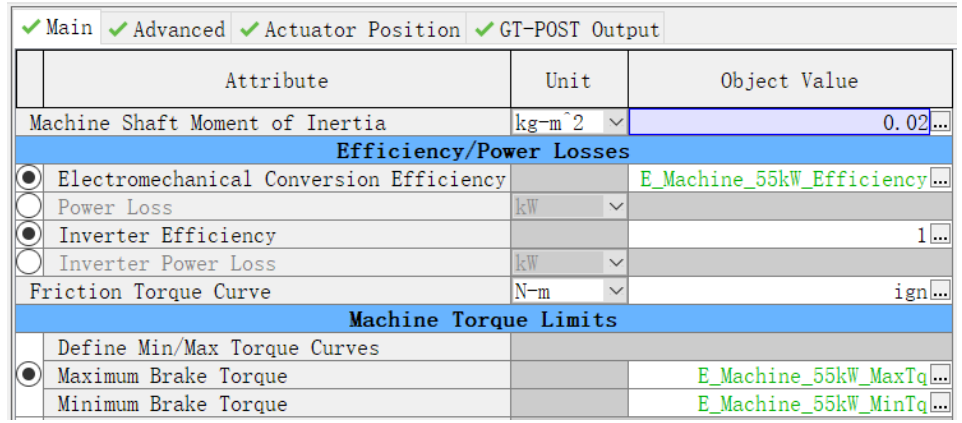
变量 | A.定制模块 | B.定制架构 | C.定制计算 | D.定制输出 | E.修改脚本

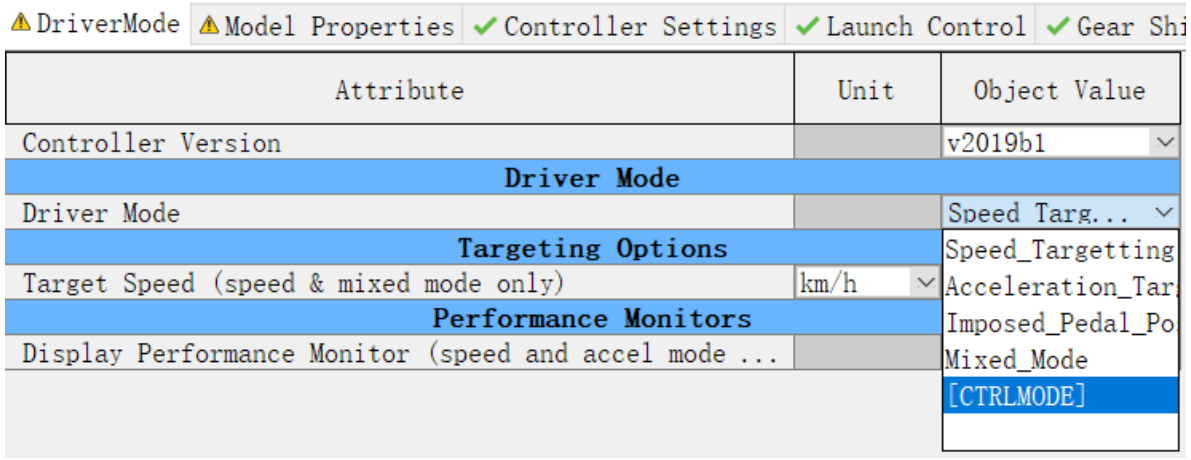
1. 参数变量：soc、转速、车速、仿真时间。。。

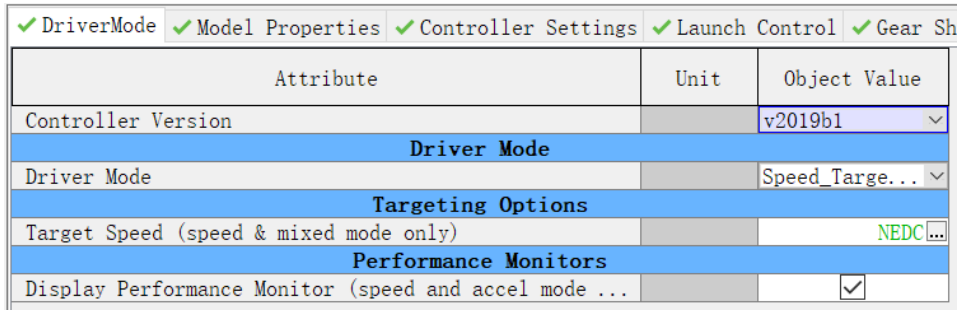
2. 对象变量：路谱、曲线、map、材料、介质。。。

3. 状态变量：驾驶模式、控制模式、分析模式。。。







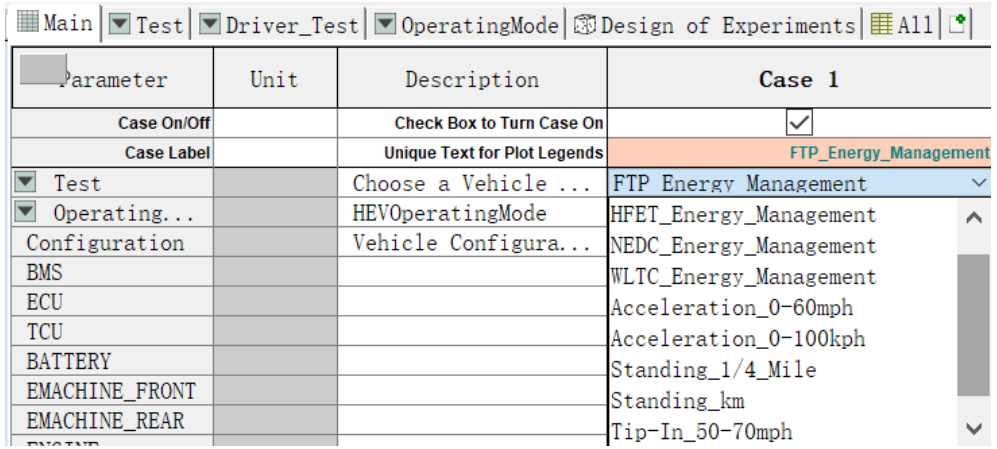


成为架构师

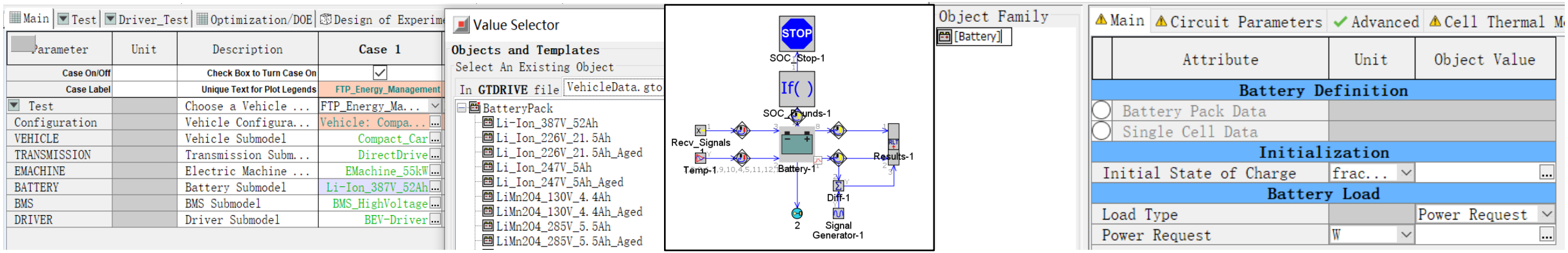
4. 超级变量：自定义变量集合

5. 模块变量：电机、电池、发动机、变速箱。。。

6. 系统变量：发动机系统、电机系统、控制系统。。。



Compound Template(.gtc)

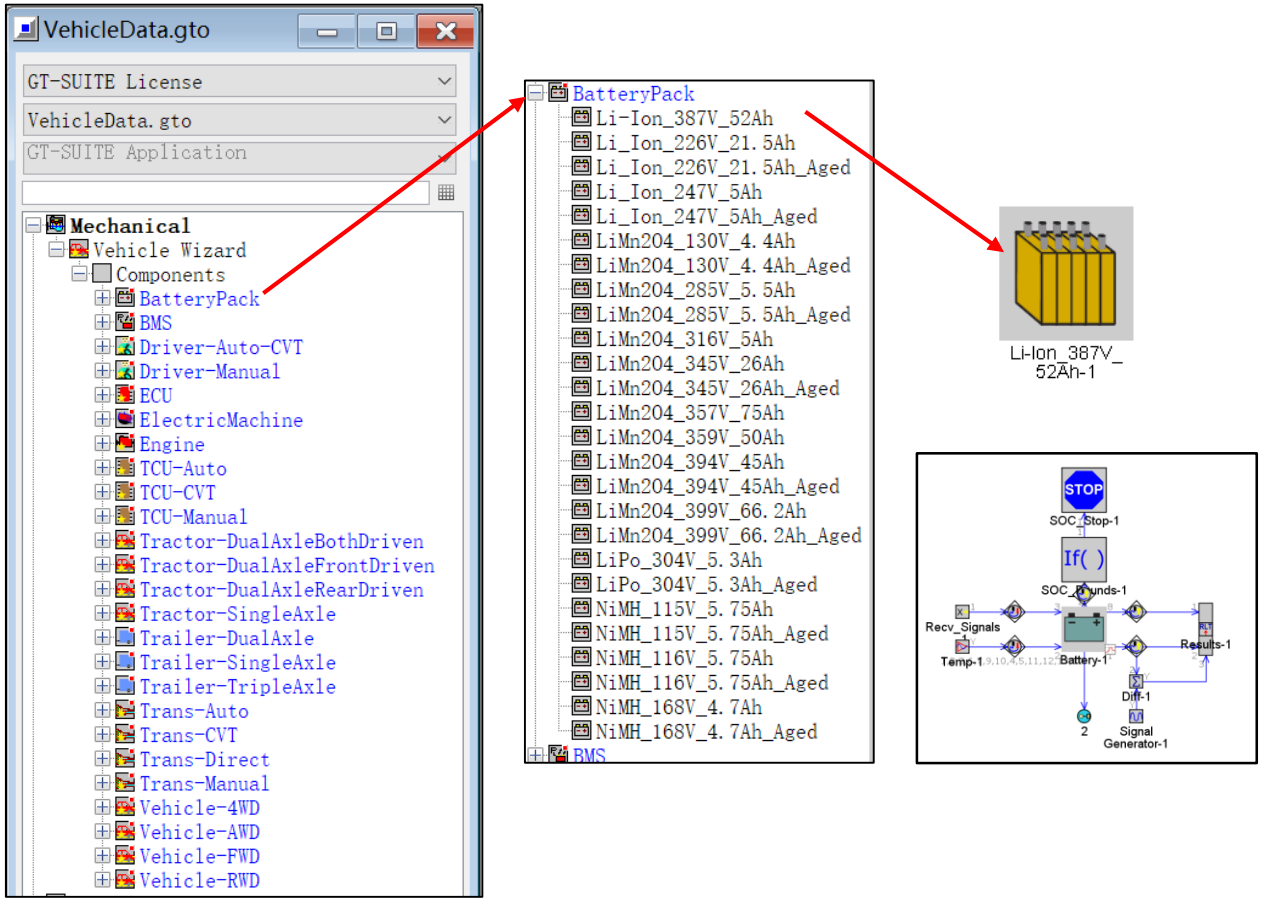


成为架构师

制定的模板（Compound Template）将以.gtc格式存储并支持工程师随时直接调用。

哪些可以制定成模块：

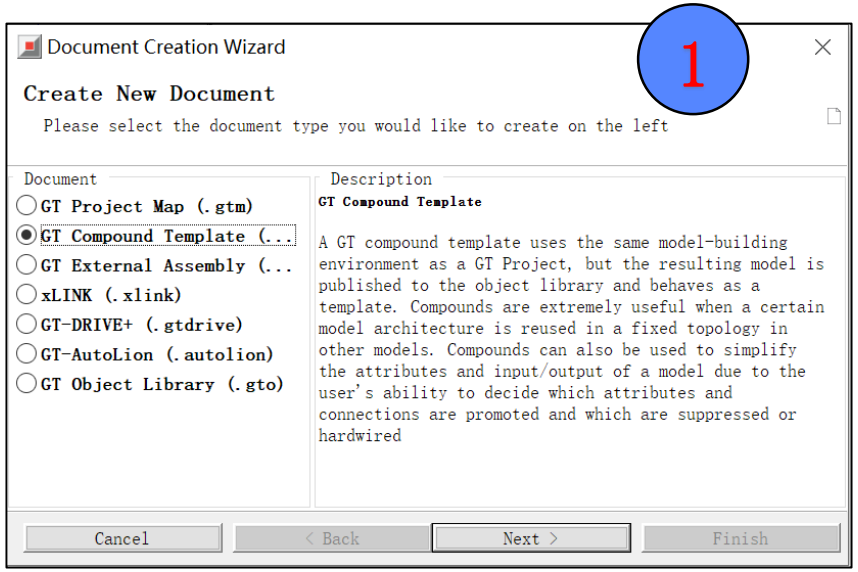
- ✓ 部件（电机、电池、压缩机等）
- ✓ 3D模块（进排气管、消声器、动力舱、乘员舱等）
- ✓ 子系统模型（空调系统、水冷系统、PTC回路等）
- ✓ 控制系统（BMS、TCU、ECU、VCU等）
- ✓ 计算
- ✓ 统计、输出模板

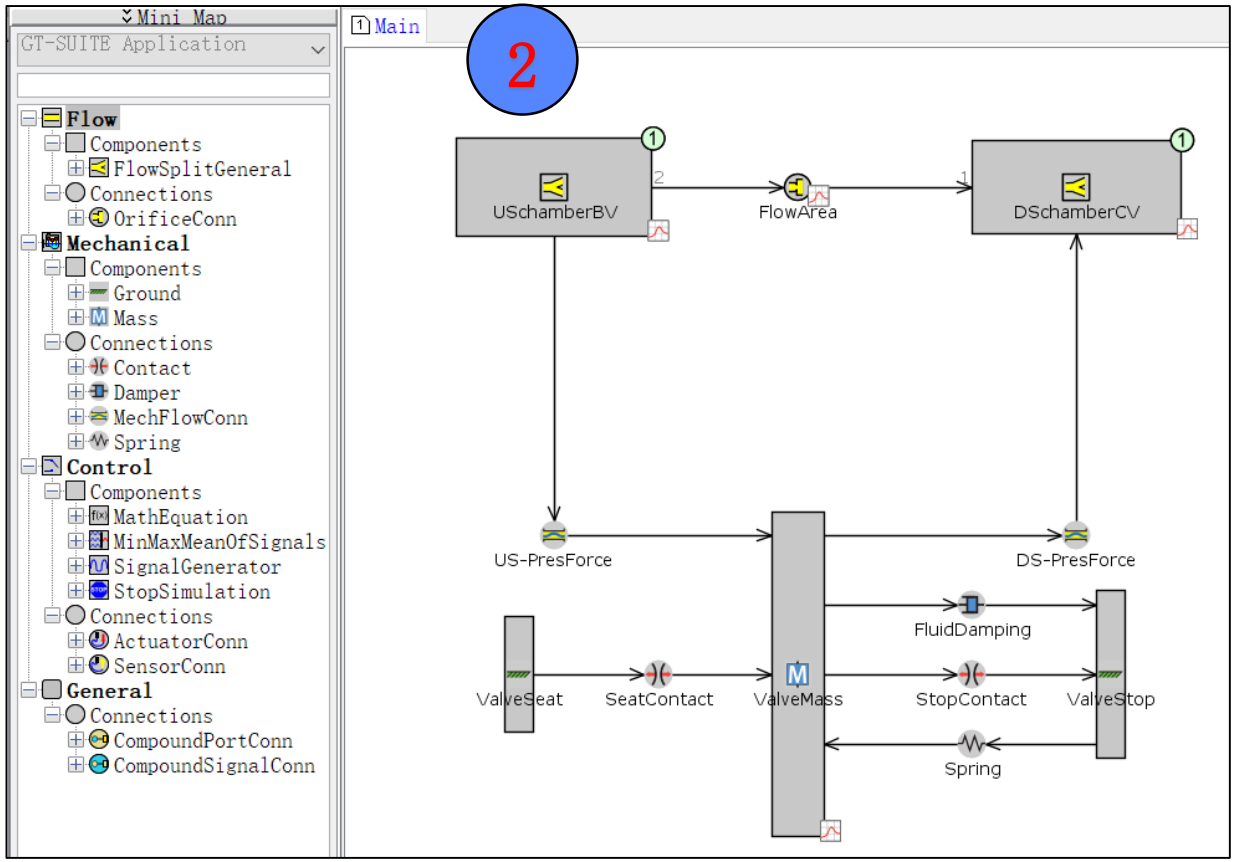


成为架构师

a).新建Compound Template

1. New→GT Compound Template；
2. 按需求搭建相应的基础模型



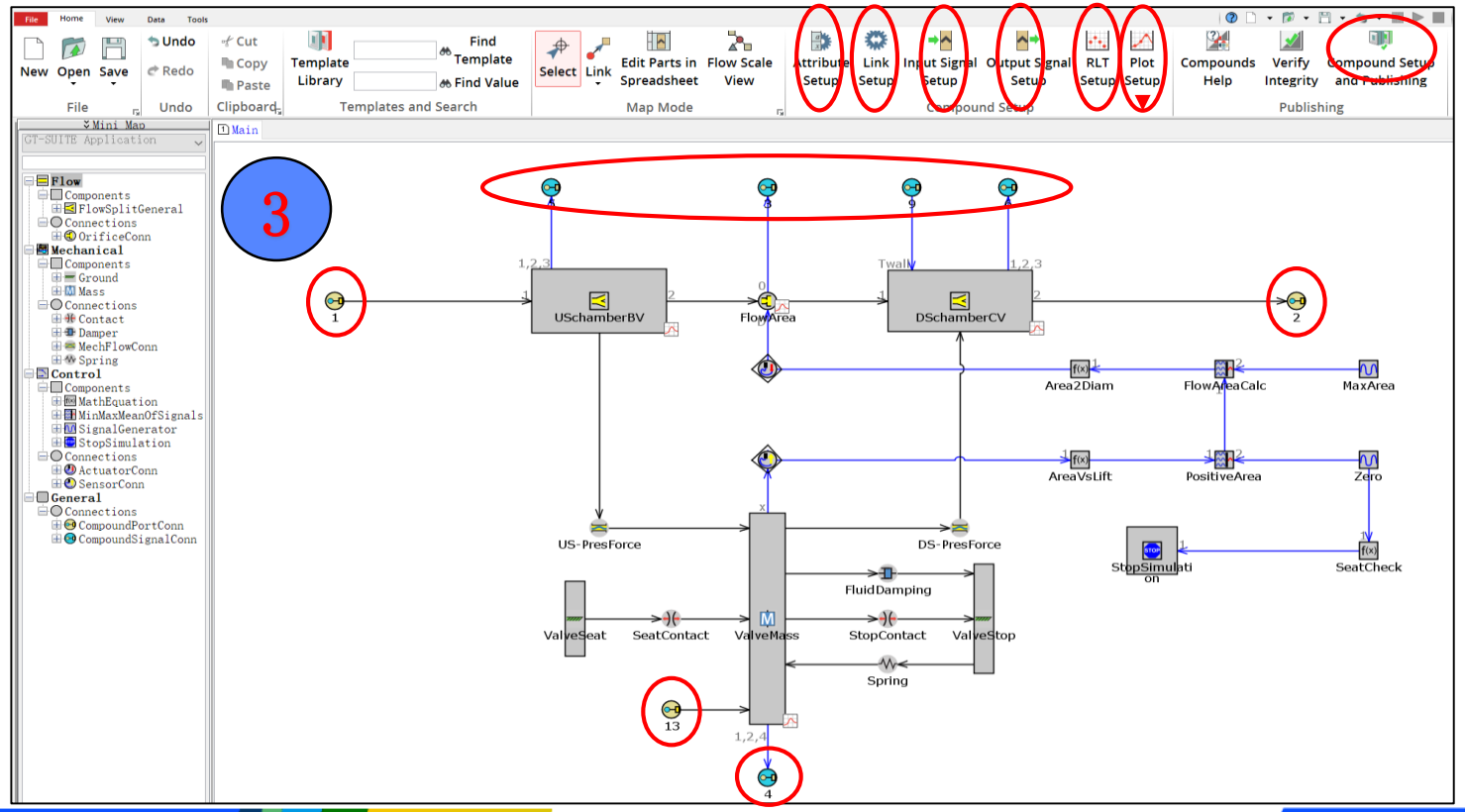


成为架构师

a). 新建Compound Template

3. 设置相应的控制、输入、输出模板及信号；

4. 保存，发布（ Publishing ）。



发布 4

设置输入模板

设置连接需求

设置信号输入

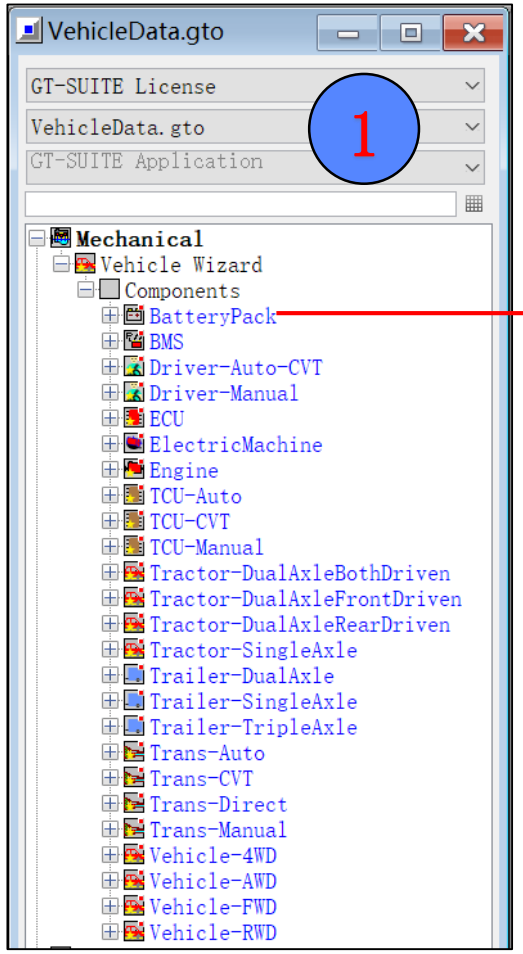
设置信号输出

设置RLT输出

设置Plot输出

成为架构师

b). 直接在系统自带模块基础上修改

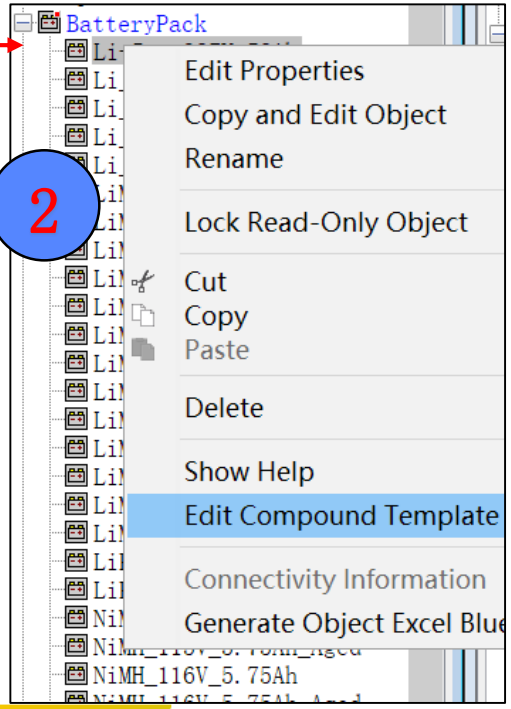


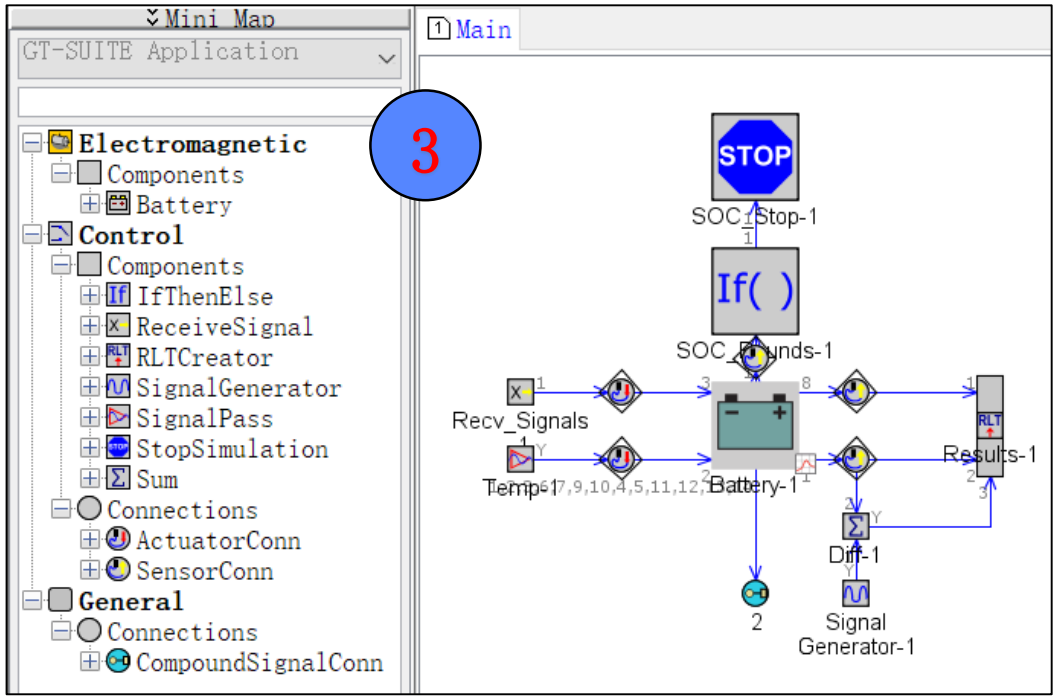
1. 在Libraries里面找到相应的模块（Compound）；

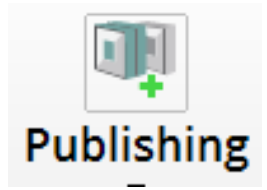
2. 右键选择Edit Compound Template,打开对应的模块；

3. 修改、设置、另存；

4. 发布（Publishing）。





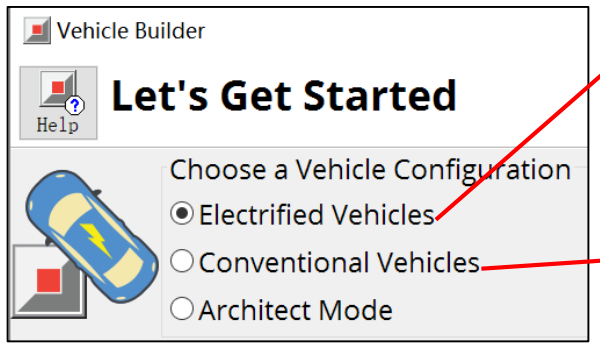


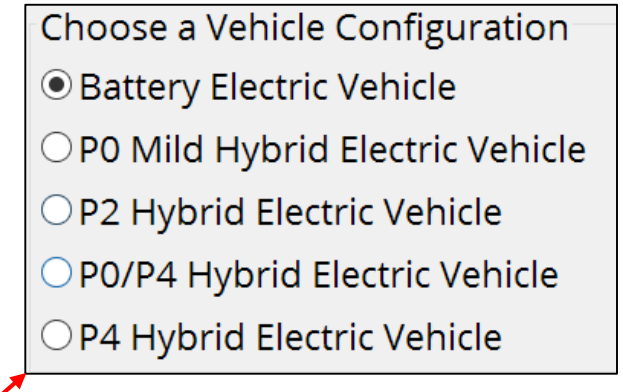
成为架构师

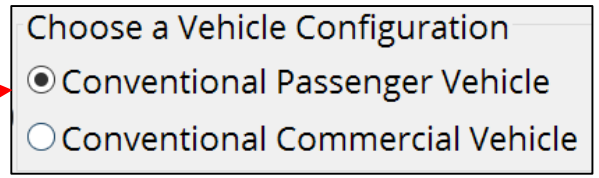
制定的架构将以.gtdrive格式存储，写入Drive+后用户能快速搭建相应架构的模型。

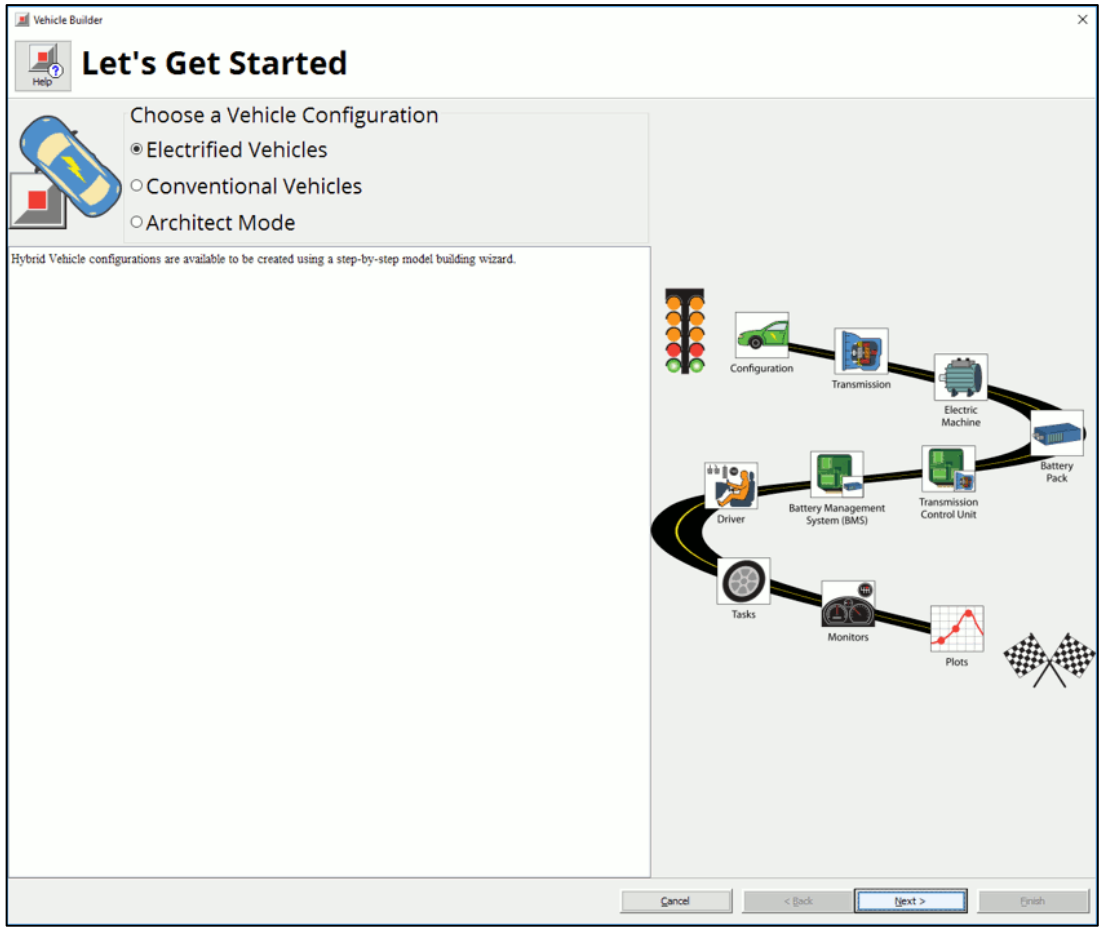
支持哪些架构：

- ✓ 传统车
- ✓ 电动车
- ✓ 混动
- ✓ 燃料电池汽车
- ✓ 动力性+排放+热管理



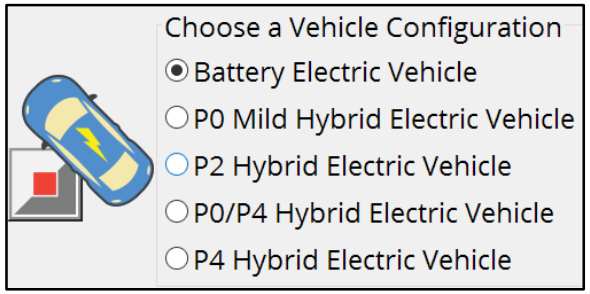


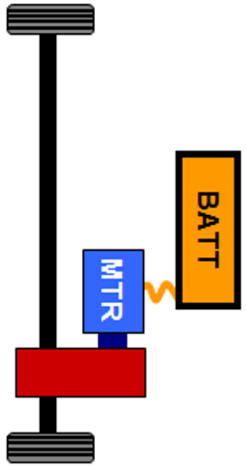


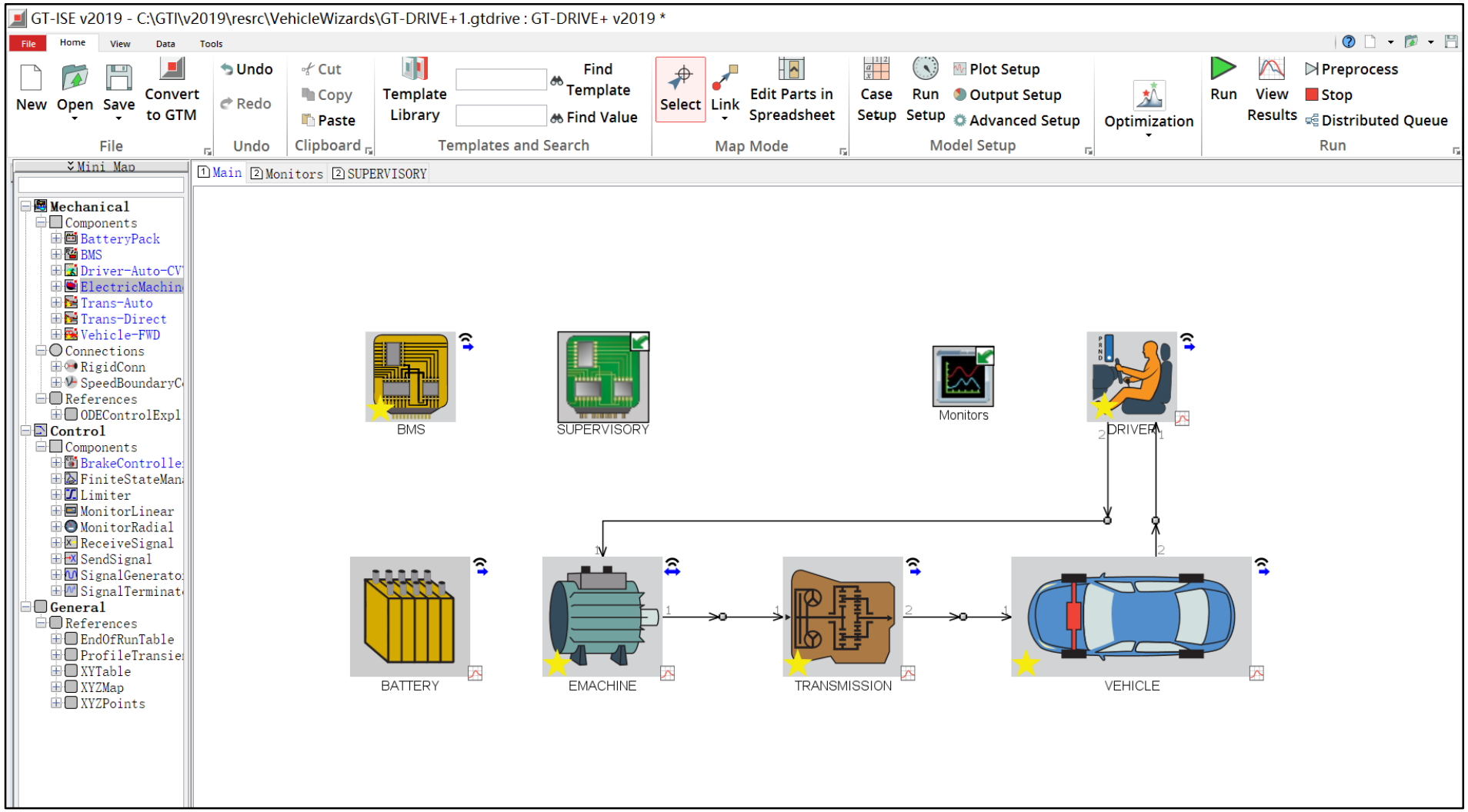


成为架构师

变量 | A.定制模块 | B.定制架构 | C.定制计算 | D.定制输出 | E.修改脚本







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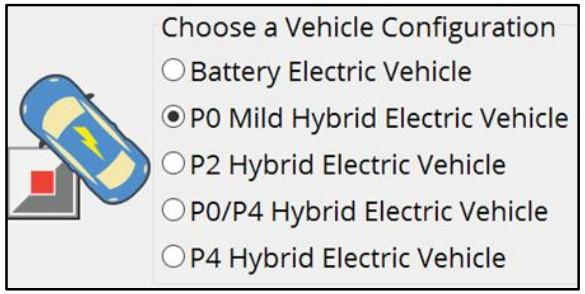

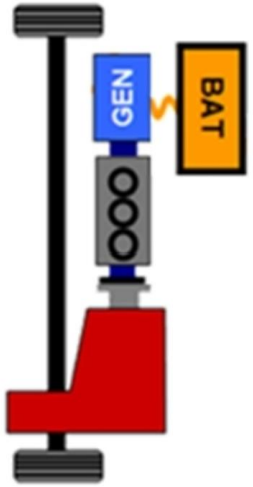

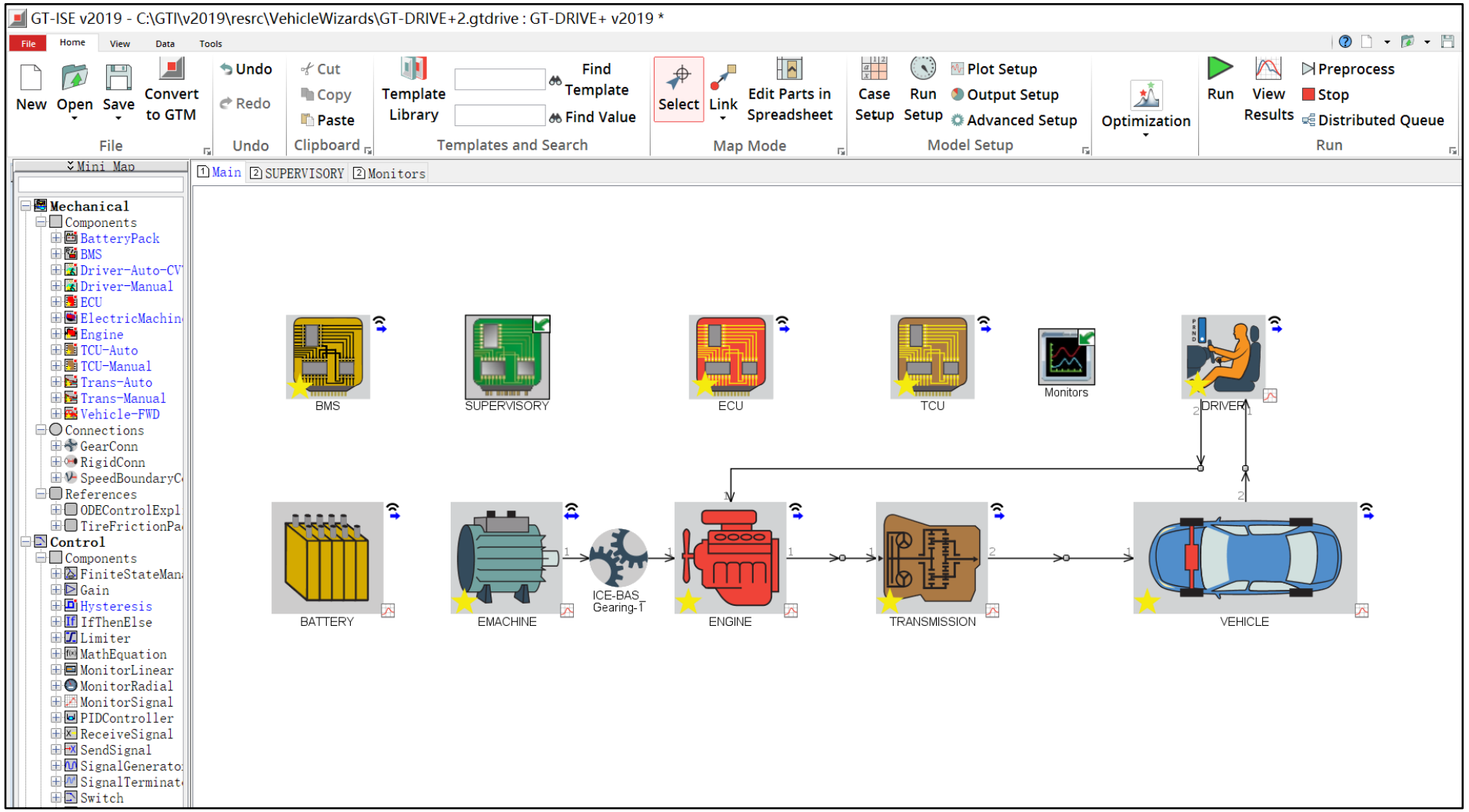

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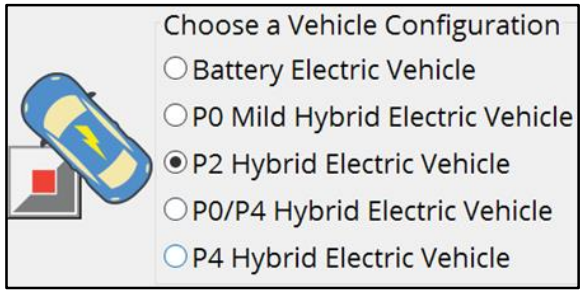

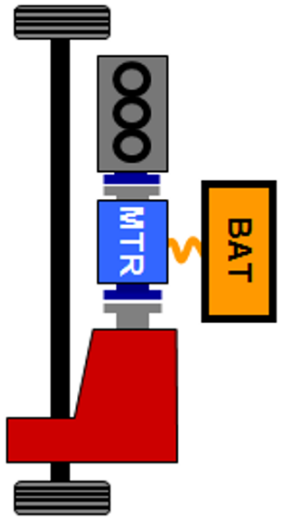

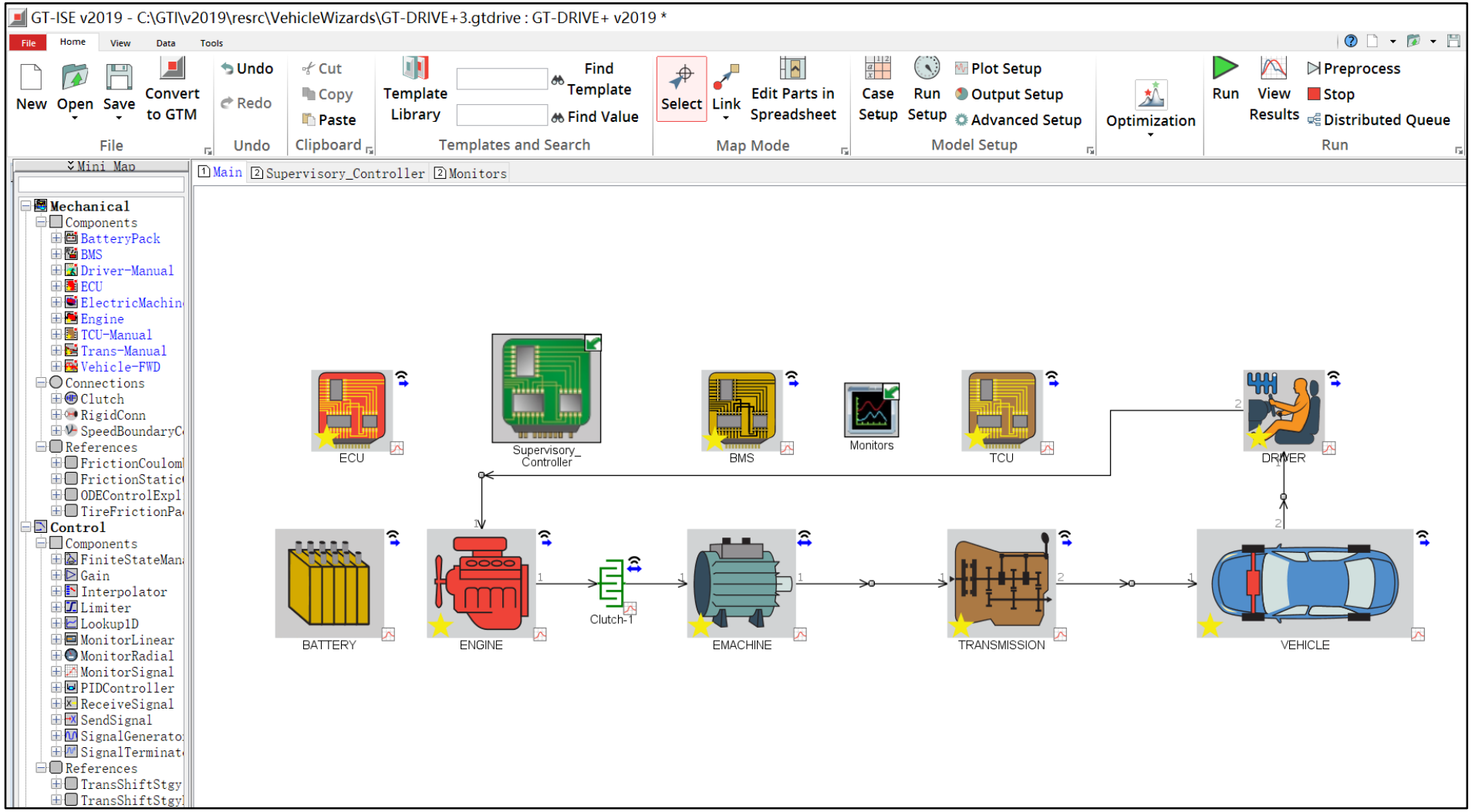

成为架构师

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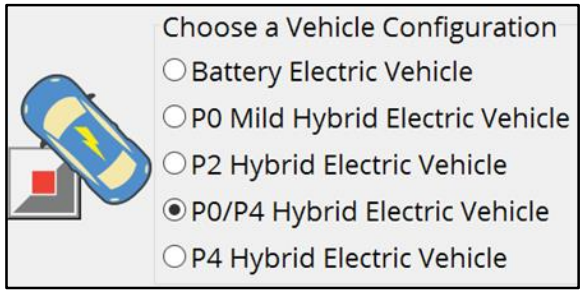
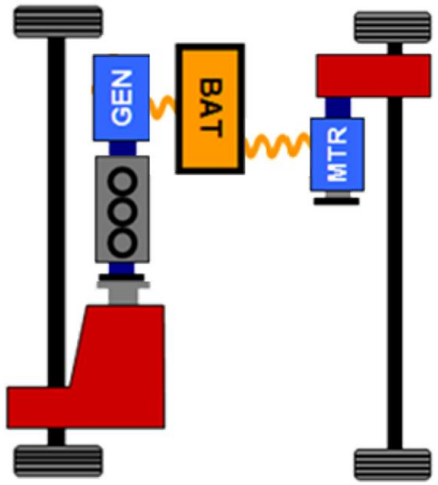
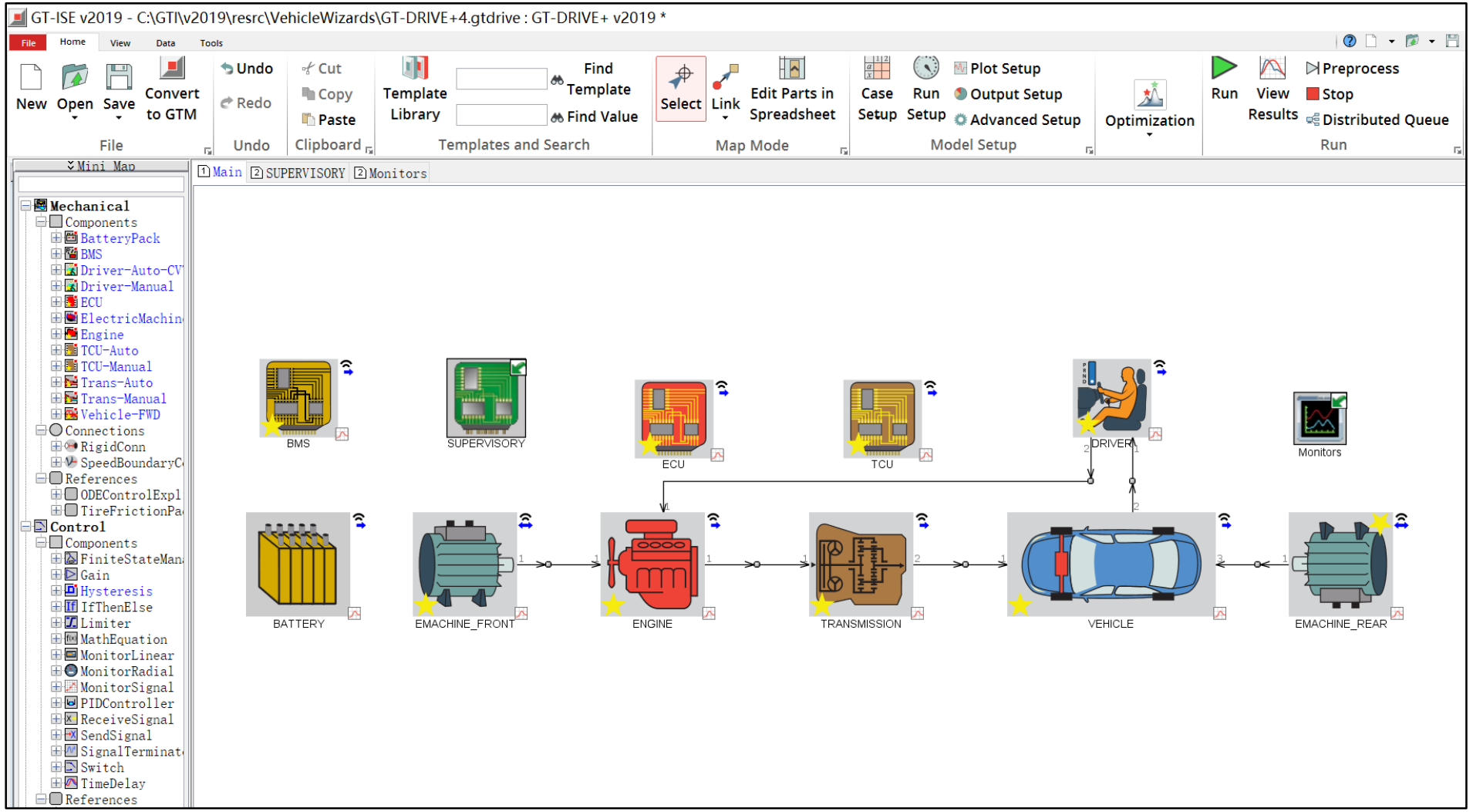
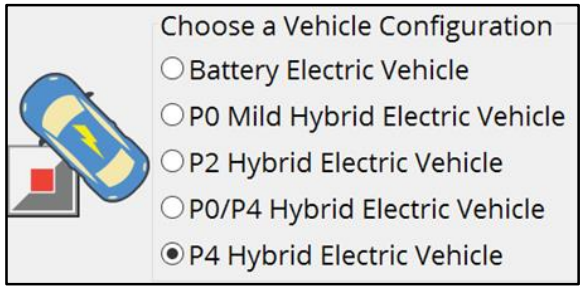


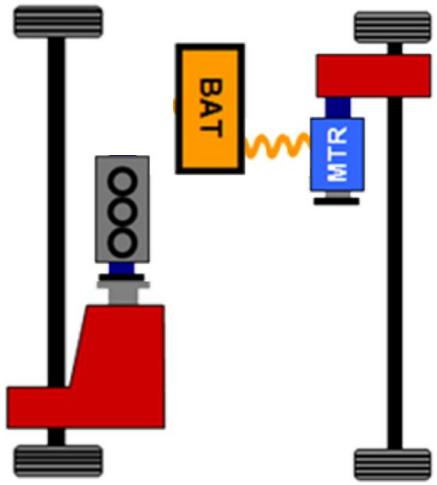


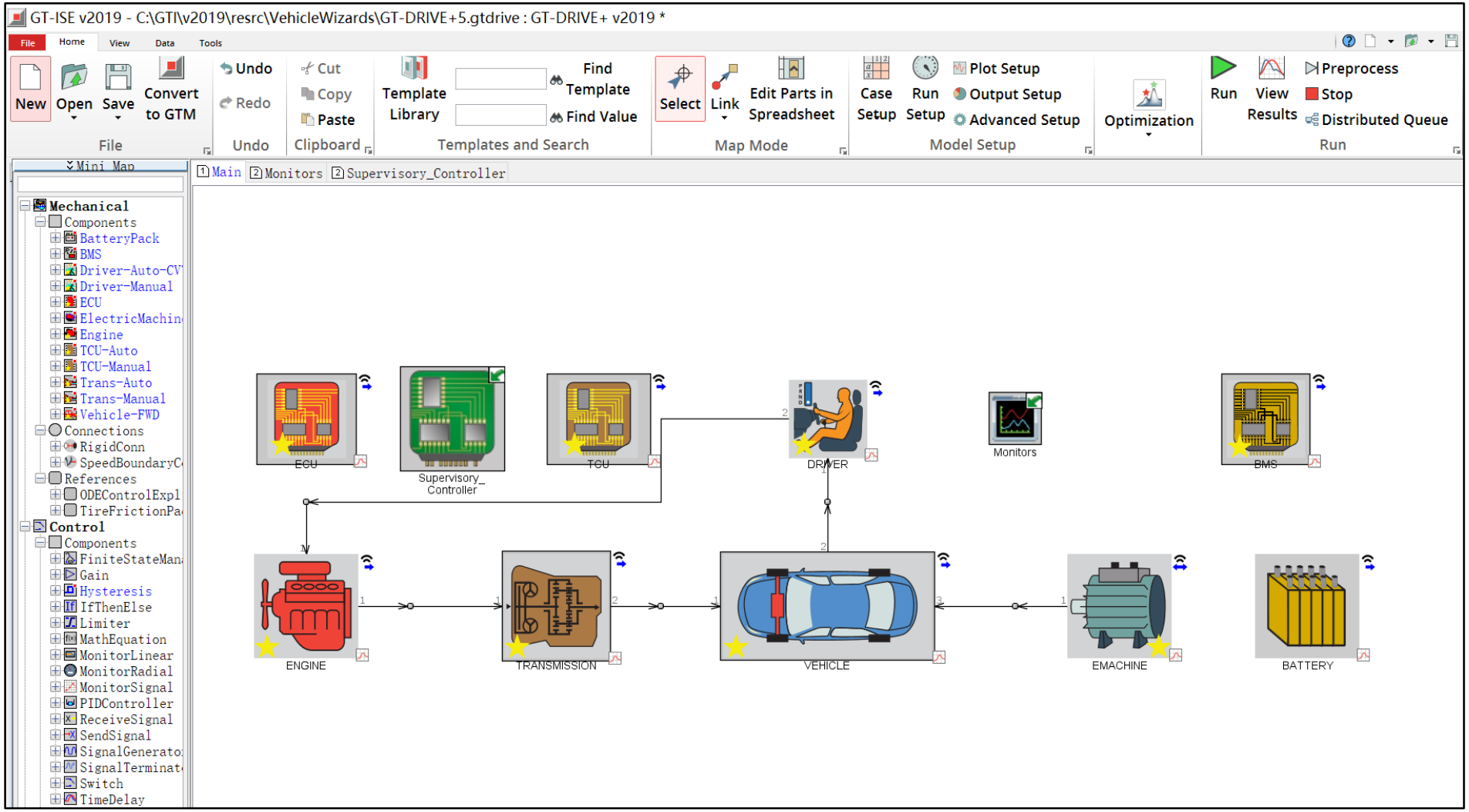


成为架构师

变量 | A.定制模块 | B.定制架构 | C.定制计算 | D.定制输出 | E.修改脚本

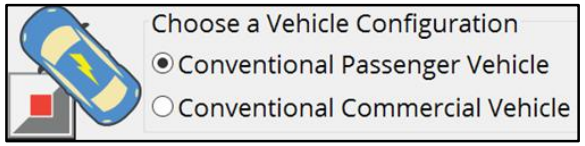


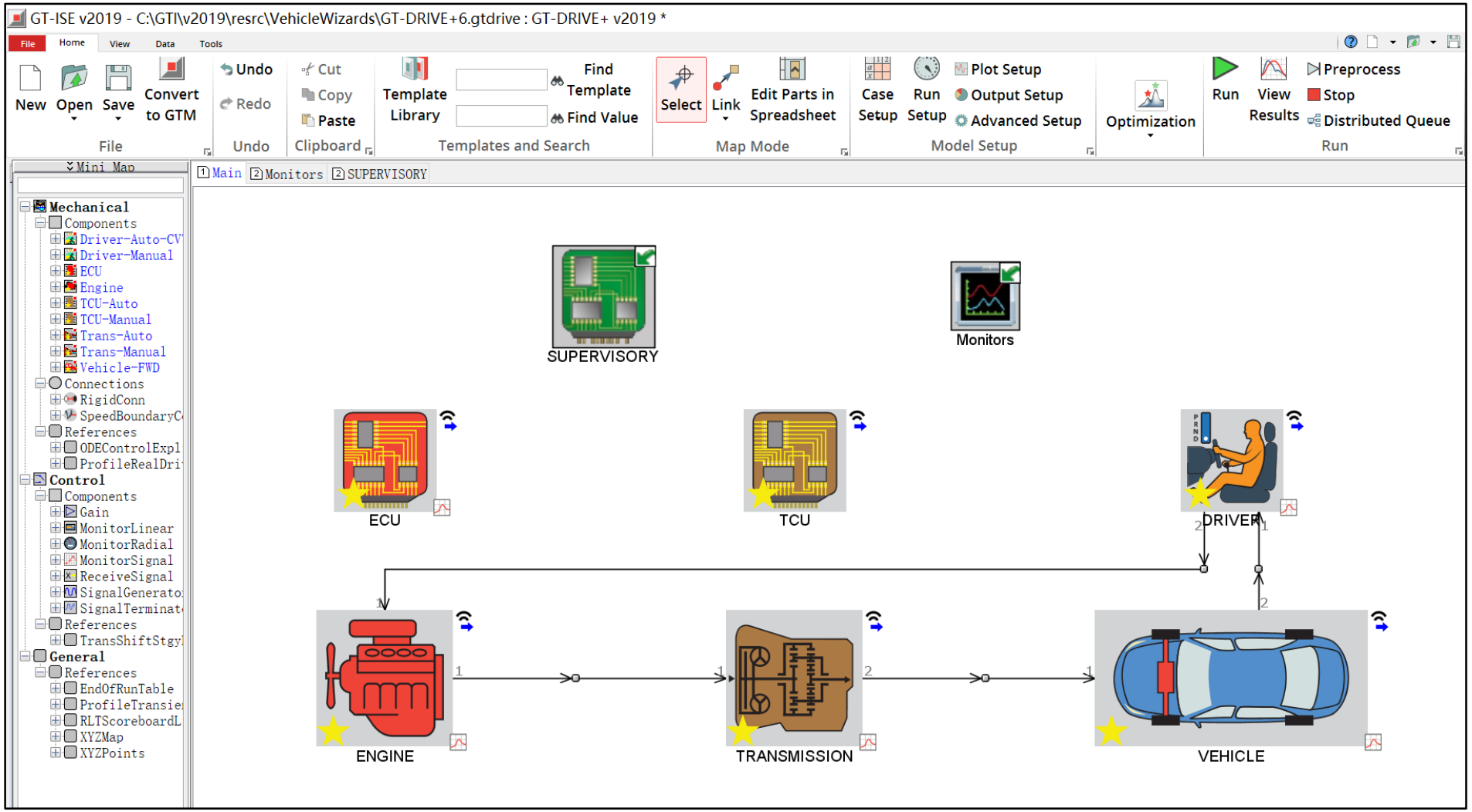




成为架构师

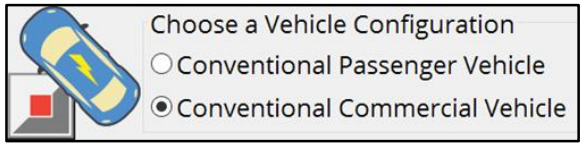
变量 | A.定制模块 | B.定制架构 | C.定制计算 | D.定制输出 | E.修改脚本

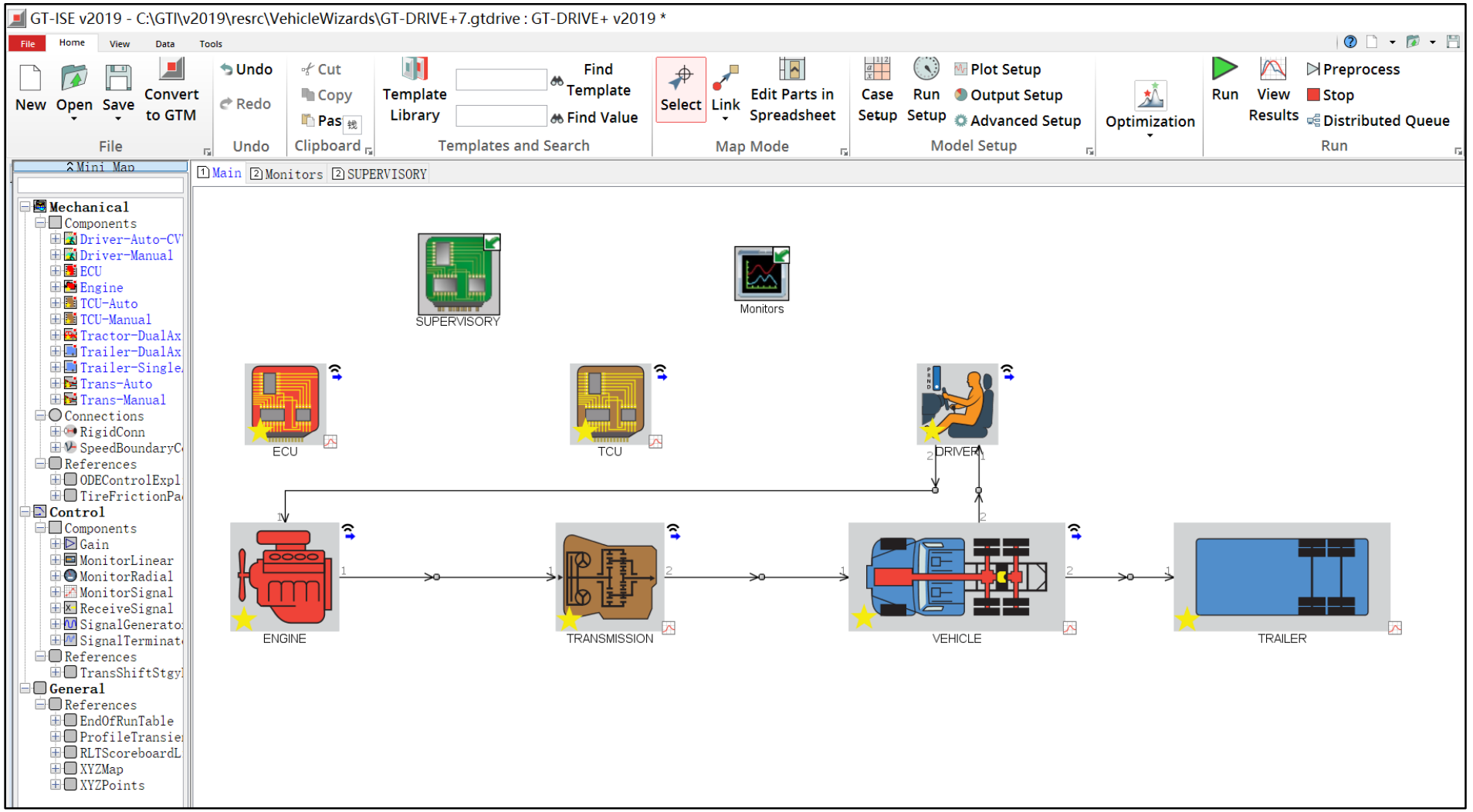




成为架构师

变量 | A.定制模块 | B.定制架构 | C.定制计算 | D.定制输出 | E.修改脚本





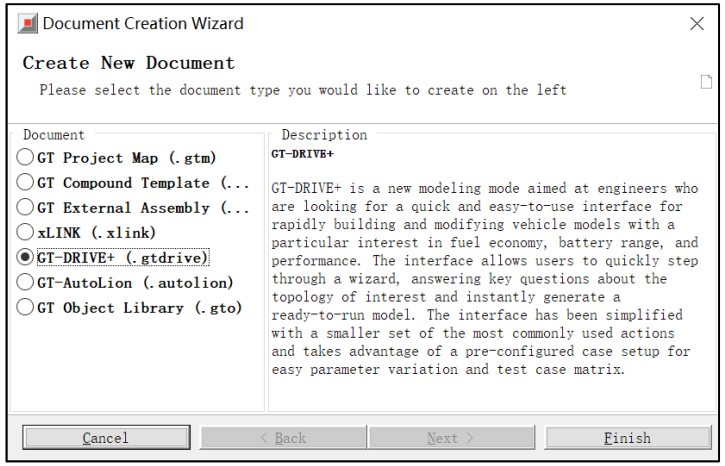
成为架构师

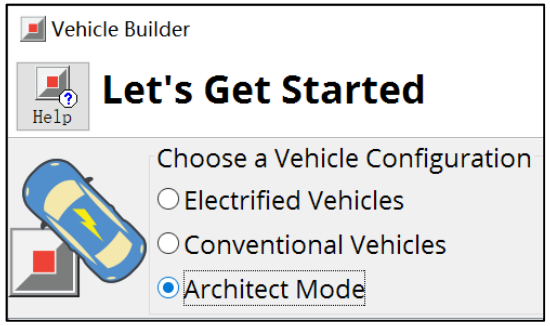
变量 | A.定制模块 | B.定制架构 | C.定制计算 | D.定制输出 | E.修改脚本

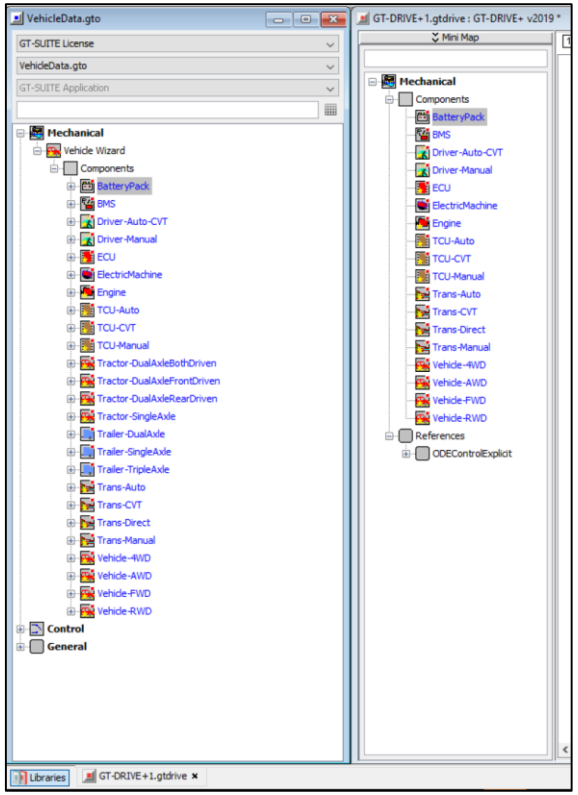
1. New→GT-DRIVE+ →Architect Mode；

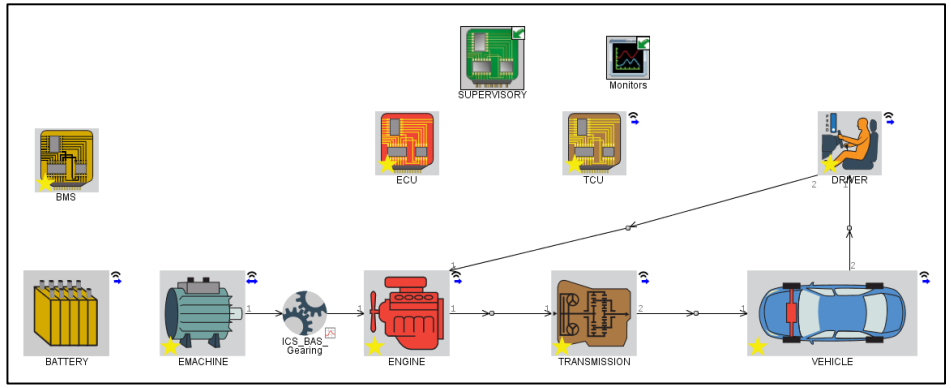
2. 将需要的模块拖入；

3. 搭建架构模型



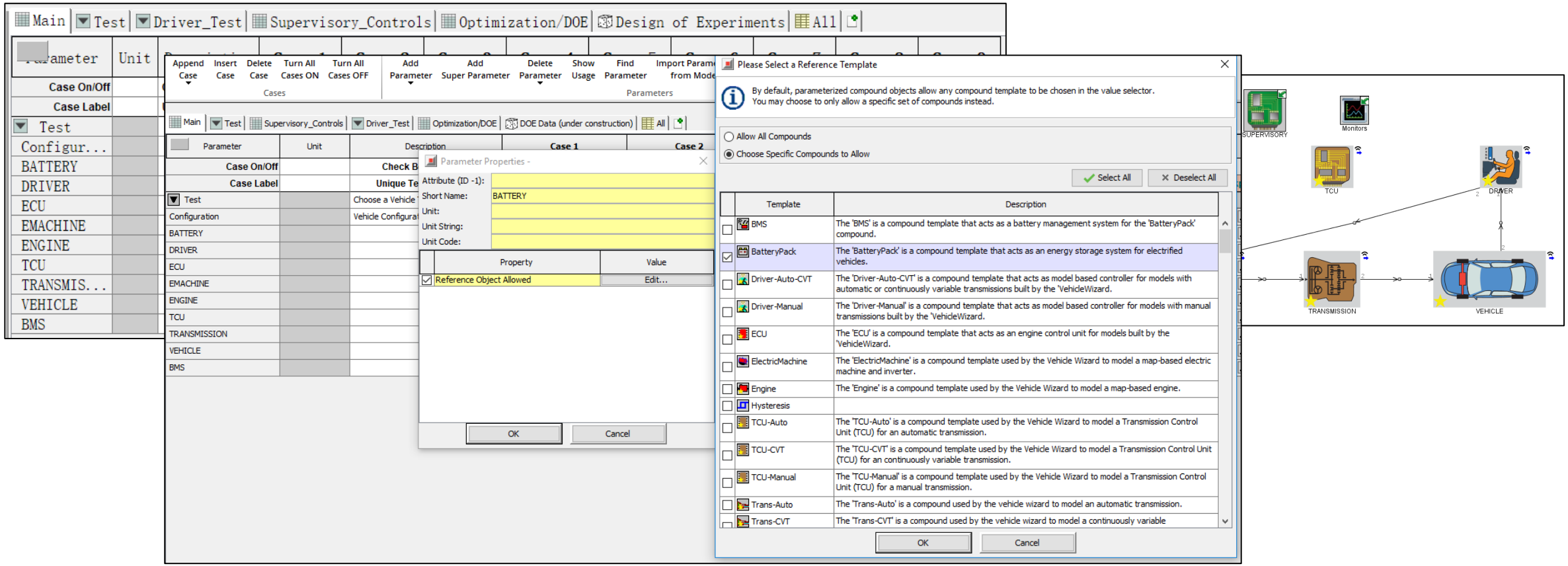






成为架构师

4. 设置模块变量。



成为架构师

计算任务的制定，是为了让同一个模型能执行多种计算任务，并使计算的设置和选择更方便、更友好。

可以定制哪些计算？

- ✓ 100公里加速
- ✓ 400米加速
- ✓ 60~80公里、80~100公里加速
- ✓ 定速巡航、定速爬坡
- ✓ 最大车速、最大爬坡度
- ✓ NEDC、WLTC、RDE、自定义路谱测试
- ✓ 循环路谱、定速续航里程
- ✓ 等等

Main | Test | Driver_Test | Supervisory_Controls | Optimization/DOE | Design of Experiments | All

Dependent Par...	Unit	Description	Option #1	Option #2	Option #3	Option #4	Option #5	Option #6	Option #7	Option #8	Option #9
Option Values			FTP_Energy...	HFET_Energ...	NEDC_Energ...	WLTC_Ener...	Acceleration...	Acceleration...	Standing_1/...	Standing_km	Tip-In_50-70...
MODE		Control Mode	Brake...	Brake...	Brake...	Brake...	Brake...	Brake...	Brake...	Brake...	Brake...
Driver_Test			Dynam...								
ITMTYPE		Tire Traction...	Rigid	Rigid	Rigid	Rigid	Slipping	Slipping	Slipping	Slipping	Slipping
TargetSpeed	km/h	Target Speed	FTP75_kph	HWY	NEDC	WLTC_C...	400	400	400	400	ign
Simulation_D...	s	Maximum Simul...	1874	765	1180	1800	60	60	60	60	30
ImposedAccel...	%	Imposed Accel...	ign	ign	ign	ign	100	100	100	100	100
ImposedBrake...	%	Imposed Brake...	ign	ign	ign	ign	0	0	0	0	0
Initial_Vehi...	mi/h	Initial Vehic...	0	0	0	0	0	0	0	0	80.46713
Initial_Gear...		Initial Gear ...	1	1	1	1	1	1	1	1	4
Initial_Gear...		Initial Gear ...	3	3	3	3	3	3	3	3	3
SimHault_Speed	mi/h	Vehicle Speed...	ign	ign	ign	ign	96.56056	100	ign	ign	112.65399
SimHault_Dis...	mi	Vehicle Dista...	ign	ign	ign	ign	ign	ign	0.4023325	1	ign
Performance_...	mi/h	Vehicle Speed...	ign	ign	ign	ign	96.56056	100	ign	ign	112.65399
Performance_...	mi	Vehicle Dista...	ign	ign	ign	ign	ign	ign	0.4023325	1	ign
TimeStep		Maximum Integ...	0.01	0.01	0.01	0.01	0.001	0.001	0.001	0.001	0.001
Initial_Engi...	RPM	Initial Engin...	1000	1000	1000	1000	1000	1000	1000	1000	def
Speed_Flag		Initial Speed...	0	0	0	0	0	0	0	0	0
BAS_RATIO		Gear Ratio	0	0	0	0	0	0	0	0	1
Aux_Torque	N-m	Engine Auxili...	def	def	def	def	def	def	def	def	def

成为架构师

1. 定义变量；
2. 设置超级变量；
3. 设置计算任务。

Main | Test | Driver_Test | Supervisory_Controls | Optimization/DOE | Design of Experiments | All

Parameter	Unit	Description	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9
Case On/Off		Check Box to Turn Case On	☑	☑	☑	☑	☑	☑	☑	☑	☑
Case Label		Unique Text for Plot Legends									
.			0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
.			0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
.			0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
.			0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
.			0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
.			0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69

Main | Test | Driver_Test | Supervisory_Controls | Optimization/DOE | Design of Experiments | All

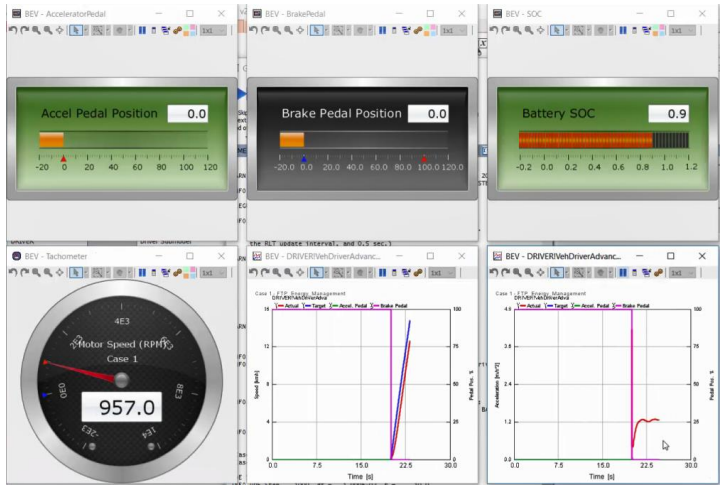
Dependent Par...	Unit	Description	Option #1	Option #2	Option #3	Option #4	Option #5	Option #6	Option #7	Option #8	Option #9
Option Values			FTP_Energy...	HFET_Energ...	NEDC_Energ...	WLTC_Ener...	Acceleration...	Acceleration...	Standing_1/...	Standing_km	Tip-In_50-70...
MODE		Control Mode	Brake...	Brake...	Brake...	Brake...	Brake...	Brake...	Brake...	Brake...	Brake...
Driver_Test			Dynam...								
ITMTYPE		Tire Traction...	Rigid	Rigid	Rigid	Rigid	Slipping	Slipping	Slipping	Slipping	Slipping
TargetSpeed	km/h	Target Speed	FTP75_kph	HWY	NEDC	WLTC_C...	400	400	400	400	ign
Simulation_D...	s	Maximum Simul...	1874	765	1180	1800	60	60	60	60	30
ImposedAccel...	%	Imposed Accel...	ign	ign	ign	ign	100	100	100	100	100
ImposedBrake...	%	Imposed Brake...	ign	ign	ign	ign	0	0	0	0	0
Initial_Vehi...	mi/h	Initial Vehic...	0	0	0	0	0	0	0	0	80.46713
Initial_Gear...		Initial Gear ...	1	1	1	1	1	1	1	1	4
Initial_Gear...		Initial Gear ...	3	3	3	3	3	3	3	3	3
SimHault_Speed	mi/h	Vehicle Speed...	ign	ign	ign	ign	96.56056	100	ign	ign	112.65399
SimHault_Dis...	mi	Vehicle Dista...	ign	ign	ign	ign	ign	ign	0.4023325	1	ign
Performance_...	mi/h	Vehicle Speed...	ign	ign	ign	ign	96.56056	100	ign	ign	112.65399
Performance_...	mi	Vehicle Dista...	ign	ign	ign	ign	ign	ign	0.4023325	1	ign
TimeStep		Maximum Integ...	0.01	0.01	0.01	0.01	0.001	0.001	0.001	0.001	0.001
Initial_Engi...	RPM	Initial Engin...	1000	1000	1000	1000	1000	1000	1000	1000	def
Speed_Flag		Initial Speed...	0	0	0	0	0	0	0	0	0
BAS_RATIO		Gear Ratio	0	0	0	0	0	0	0	0	1
Aux_Torque	N-m	Engine Auxili...	def	def	def	def	def	def	def	def	def

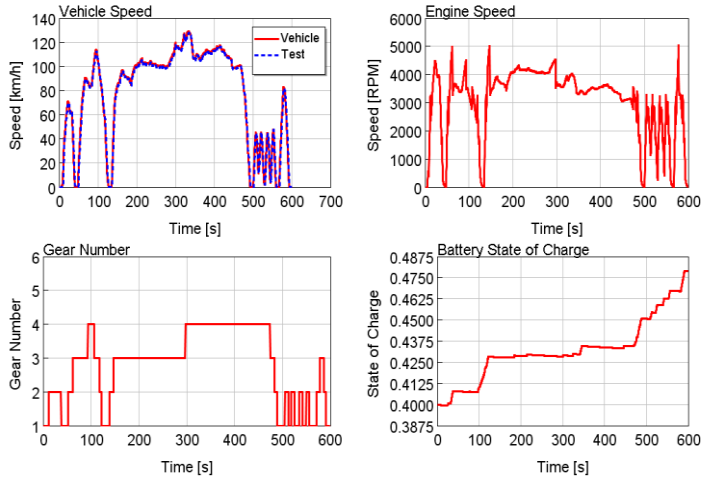
成为架构师

计算结果输出的制定，是为了在模型计算过程中监控需要的结果，和模型计算完成后直接汇总需要的结果并输出。

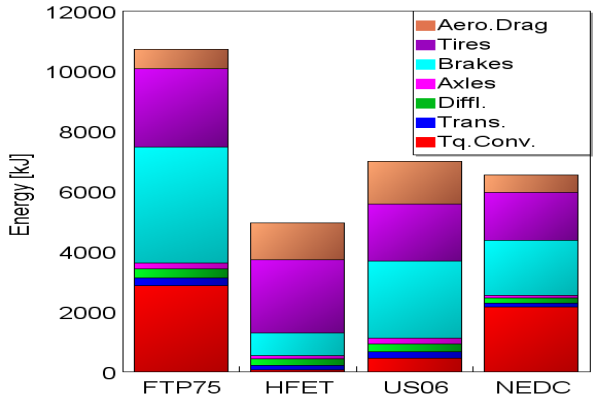
可以定制哪些输出？

- ✓ 仪表盘，计算过程中监控关键参数
- ✓ 曲线
- ✓ 表格
- ✓ 能量损失分布
- ✓ 等等





	Engine:1.5L_Turbo Vehicle:Coupe	Engine:1.5L_Turbo Vehicle:Sedan	Engine:1.5L_Turbo Vehicle:Hatchback	Engine:2.0L_NA Vehicle:Coupe	Engine:2.0L_NA Vehicle:Sedan	Engine:2.0L_NA Vehicle:Hatchback
FTP Fuel Economy [mpg]	31.8	30.8	29.9	19.6	18.9	18.3
NEDC Fuel Consumption [L/100 km]	7.66	7.94	8.15	11.9	12.4	12.8
0-60 mph Time [s]	7.46	7.83	8.22	11.2	12.0	12.7
1/4 Mile Time [s]	16.0	16.3	16.6	18.4	18.7	19.1
1/4 Mile Top Speed [km/h]	142	139	137	122	119	117
50-70 mph time (s) [s]	5.35	5.81	6.24	7.76	8.49	9.16

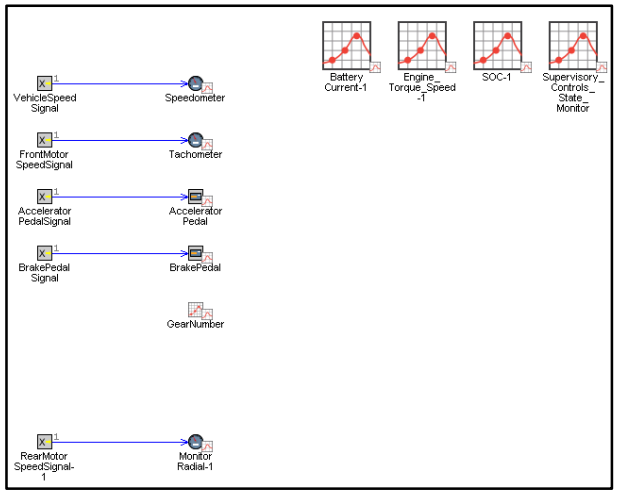


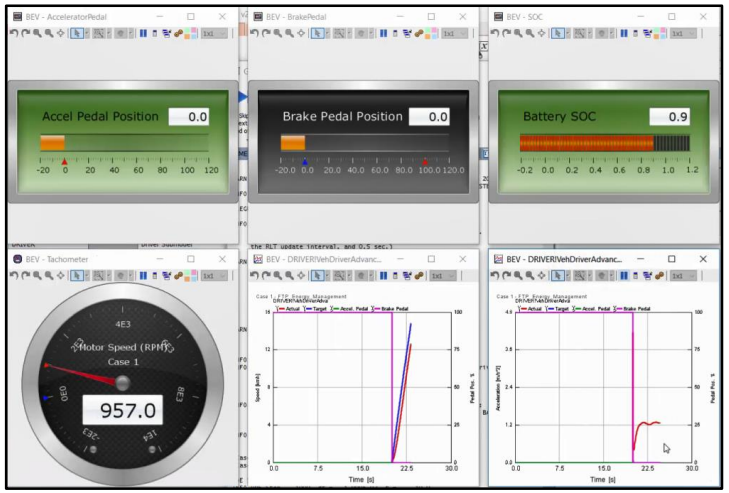
成为架构师

1. 设置监控参数；

2. 设置Plots输出；

3. 设置整车能量损失输出；



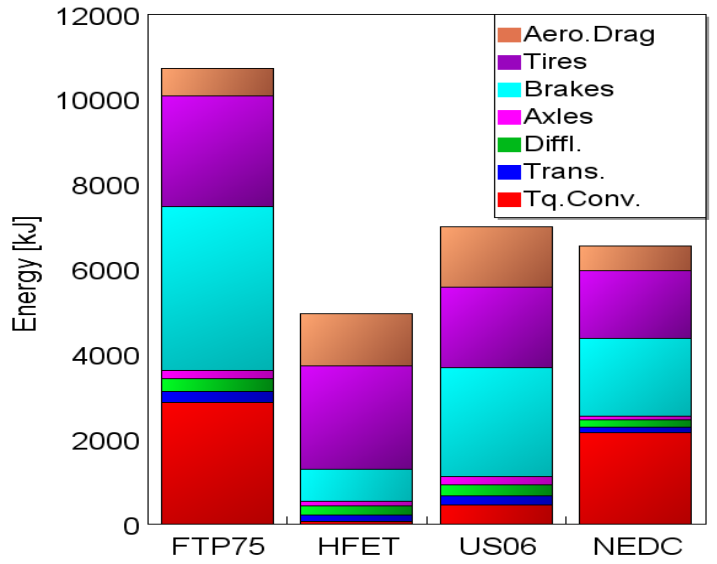


Main | Advanced | Actuator Position | GT-POST Output | Plots

Select / Unselect All Plots	✓	Max Plot...	Plot Range
Machine Speed	✓	def	def
Brake Torque	✓		
Brake Power	✓		
Electrical Power	✓		
Efficiency	✓		
Losses	✓		
Temperature	✓		

ScoreboardRLTs | UserScoreboardRLTs | EndOfRunTables | Data_Storage | General | GT-POST_Setup | Flow | ODE-Mech

Attribute	Object Value
Legend for Plot Header (OBSOLETE)	
Timestep Plot	✓
Store RLTs for Tracking Memory (RAM) Consumption	
Vehicle Energy Use and Loss Plots	✓
Suppress .brf file (file not available in future)	✓



成为架构师

4. 制定输出表格。

Template: EndOfRunTable - 2D ("Configuration" and "Tests") Table of RLTs

Home | Data | Advanced

Template Help | Constraint RLT index used in combination with the... | Template Documentation | Connectivity Information | Show Examples | Help | Attribute Abilities | Object Comment: | Part Comment: | Add Long Comment | Comments

Object Usage

- VehicleResultsS
  - VehicleResul
    - Run Setting
    - Output S

Main

A...	RLT Index (full)	RLT Short Name	Template for RLT Short Name	Constraint RLT	Constraint RLT Value	Label
0						
1	userrlt01:BATTERY	ign	ign	test+	FTP_Energy_Management	FTP Battery Consumption
2	userrlt01:BATTERY	ign	ign	test+	HFET_Energy_Management	HFET Battery Consumption
3	userrlt01:BATTERY	ign	ign	test+	NEDC_Energy_Management	NEDC Battery Consumption
4	userrlt01:BATTERY	ign	ign	test+	WLTC_Energy_Management	WLTC Battery Consumption
5	times01:VEHICLE	ign	ign	test+	Acceleration_0-60mph	0-60 mph Time
6	times01:VEHICLE	ign	ign	test+	Acceleration_0-100kph	0-100 kph Time
7	timed01:VEHICLE	ign	ign	test+	Standing_1/4_Mile	Standing 1/4 Mile Time
8	speedd01:VEHICLE	ign	ign	test+	Standing_1/4_Mile	Standing 1/4 Mile Top Sp...
9	timed01:VEHICLE	ign	ign	test+	Standing_km	Standing km Time
10	speedd01:VEHICLE	ign	ign	test+	Standing_km	Standing km Top Speed
11						

Data_Storage | General | GT-POST_Setup | Flow | ODE-Mech | ScoreboardRLTs | UserScoreboardRLTs | EndOfRunTables

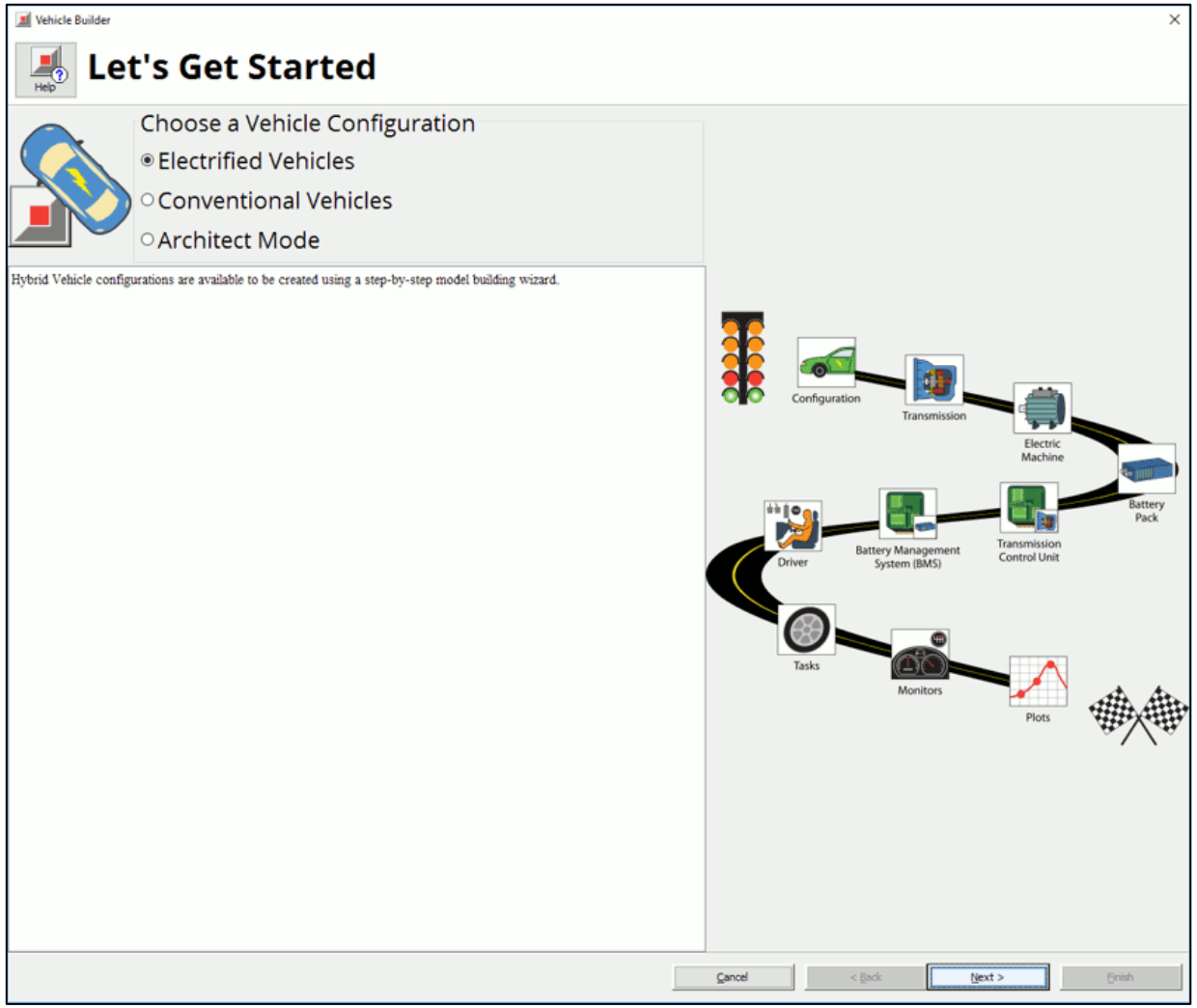
Attribute	Object Value
EndOfRunTables are designed for displaying RLTs from single o...	
Location of Model Configuration Sweep	1xN Table Only (no sweep)
Parameter Defining Configurations	Configuration
Results for each Model Configuration...	Column
EndOfRunTable Object 1	VehicleResultsSummary
EndOfRunTable Object 2	ign
EndOfRunTable Object 3	ign
EndOfRunTable Object 4	ign
EndOfRunTable Object 5	ign

	Engine:1.5L_Turbo Vehicle:Coupe	Engine:1.5L_Turbo Vehicle:Sedan	Engine:1.5L_Turbo Vehicle:Hatchback	Engine:2.0L_NA Vehicle:Coupe	Engine:2.0L_NA Vehicle:Sedan	Engine:2.0L_NA Vehicle:Hatchback
FTP Fuel Economy [mpg]	31.8	30.8	29.9	19.6	18.9	18.3
NEDC Fuel Consumption [L/100 km]	7.66	7.94	8.15	11.9	12.4	12.8
0-60 mph Time [s]	7.46	7.83	8.22	11.2	12.0	12.7
1/4 Mile Time [s]	16.0	16.3	16.6	18.4	18.7	19.1
1/4 Mile Top Speed [km/h]	142	139	137	122	119	117
50-70 mph time (s) [s]	5.35	5.81	6.24	7.76	8.49	9.16

成为架构师

前面建立的.gtdrive即可直接当做架构模板直接供用户使用。

但若要实现GT-Drive+将建模流程化的功能，还需要修改.xml脚本文件。



成为架构师


```
    wizard.
  &lt;/p&gt;

  &lt;p&gt;
  Once the model is built, pre-defined vehicle tests (driving cycle
    analyses, acceleration performance tests) can be run.
  &lt;/p&gt;

  &lt;/font&gt;
  &lt;html&gt;
  "
  icon="vw_p0_intro_page.png"
  gtmFile="P0MildHEV_Liujx.gtdrive"
  gtoFile="VehicleData.gto">
<!--This marks the beginning of new chapter. Progress Image, Title and Icon Image c
<chapter progressImage="vw_p0_vehicle.png" title="Driveline" icon="VW-Vehicle.svg">
<!--This marks the beginning of new Part. Part Name can be specified as shown on li
be skipped by selecting None. User needs to select from one of the template options
be linked for Template help and Object Help by specifying its name as shown on line
<part
  partName="VEHICLE"
  allowOmit="0.0"
  templateHelpName="VWVehicleTemplate"
  objectHelpName="VWVehicleObject">
    <templateOption
      description="FWD (Front-Wheel Drive)"
      name="Vehicle-FWD"
      icon="Vehicle-FWD_big.svg"/>
    <templateOption
      description="RWD (Rear-Wheel Drive)"
      name="Vehicle-RWD"
      icon="Vehicle-RWD_big.svg"/>
```

1. 在软件提供的架构脚本基础上进行修改并指向前面生成的.gtdrive架构文件。

Welcome Guide | configurations.xml

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<wizardlist>
<!--This marks the beginning of new Category. Title, Description and image can b
  <category title="Electrified Vehicles" description="Hybrid Vehicle configurati
  <configfile name="P0HybridWizardConfig.xml"/>
<!--This marks end of category-->
  </category>
</wizardlist>
```

2. 再修改Drive+配置脚本，指向前面的架构脚本。

<configfile name="P0HybridWizardConfig.xml"/>

GT-DRIVE+ 架构师加速产品开发

GT-DRIVE+ 是新一代车辆仿真方式，旨在处理新一代复杂的车辆架构

GT-DRIVE+ 能够提供可随时搭建的车辆特征和建模流程，提高用户工作效率

GT-DRIVE+ 为架构师提供了高效搭建和维护车辆模拟的平台，供终端用户使用

GT-DRIVE+与架构师一起将系统仿真专业化、流程化、标准化

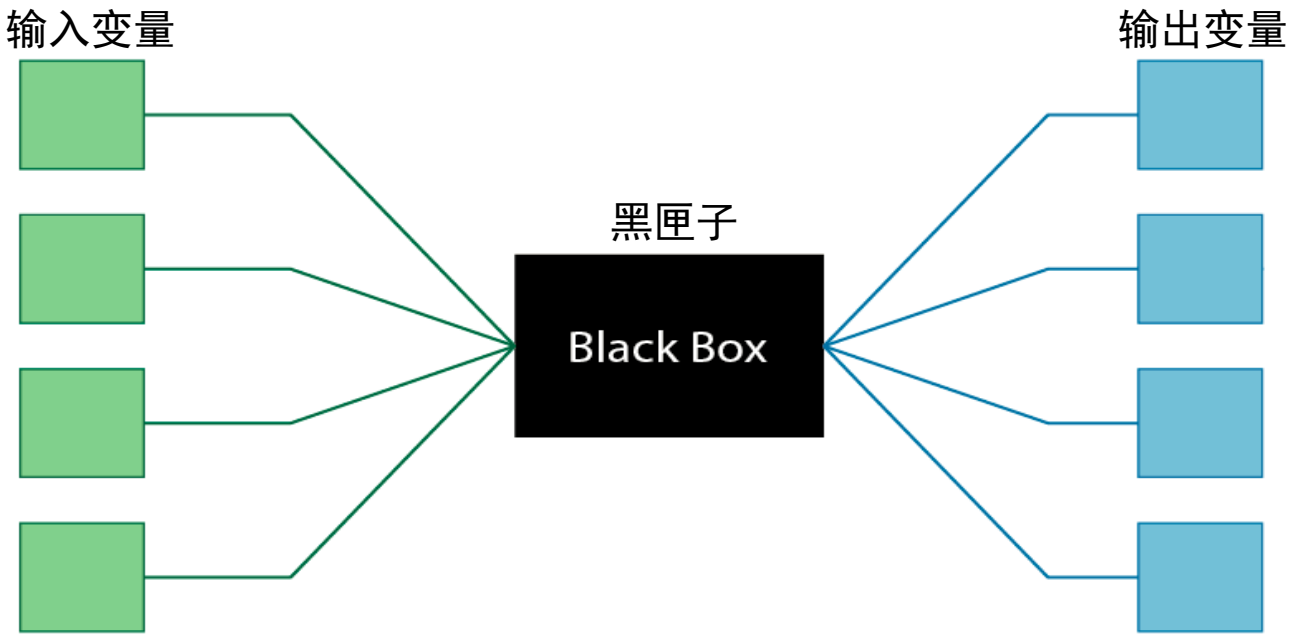
目录

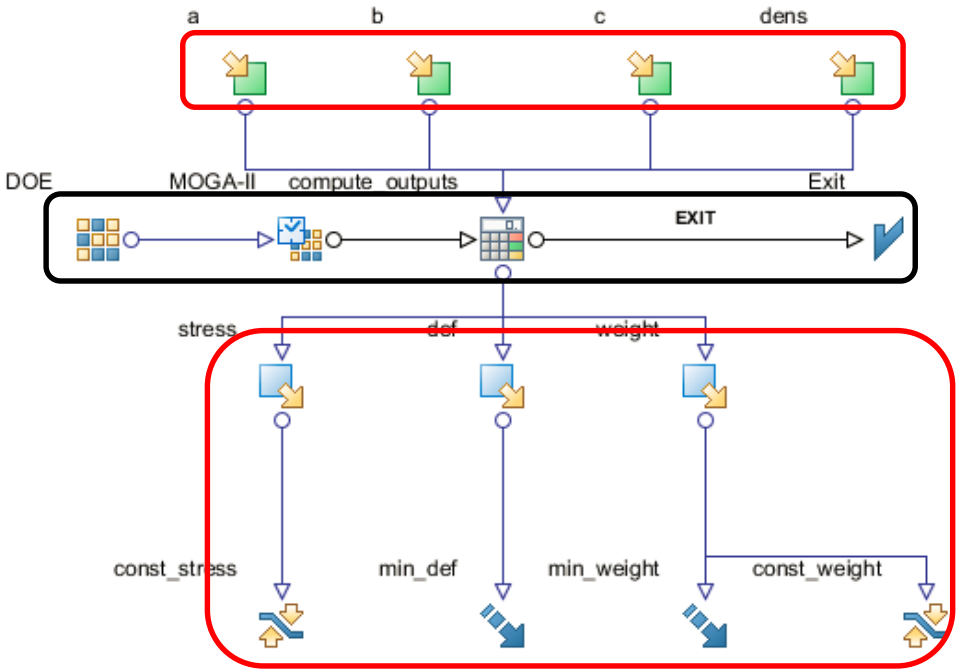
- 什么是GT-DRIVE+？
- 什么是架构师？
- 成为架构师
- GT&modeFRONTIER联合仿真介绍

GT&MF联合仿真介绍

modeFRONTIER简介

modeFRONTIER是一个通用的多目标及多学科的优化软件，可以实现与诸多第三方仿真工具的无缝集成，来完成设计仿真流程的自动化，以及优化决策的分析。

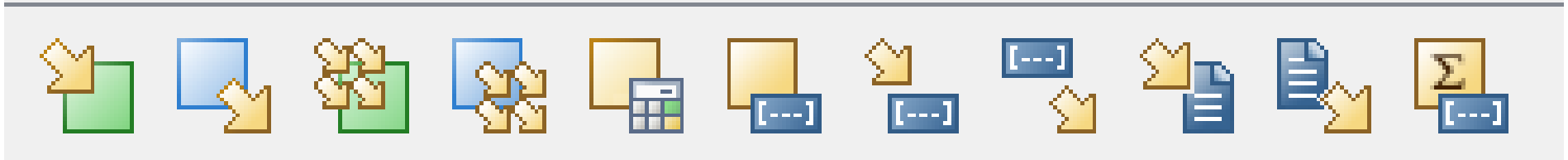




GT&MF联合仿真介绍

输入变量

- 自定义（连续、离散）
- 外部导入
- DOE生成

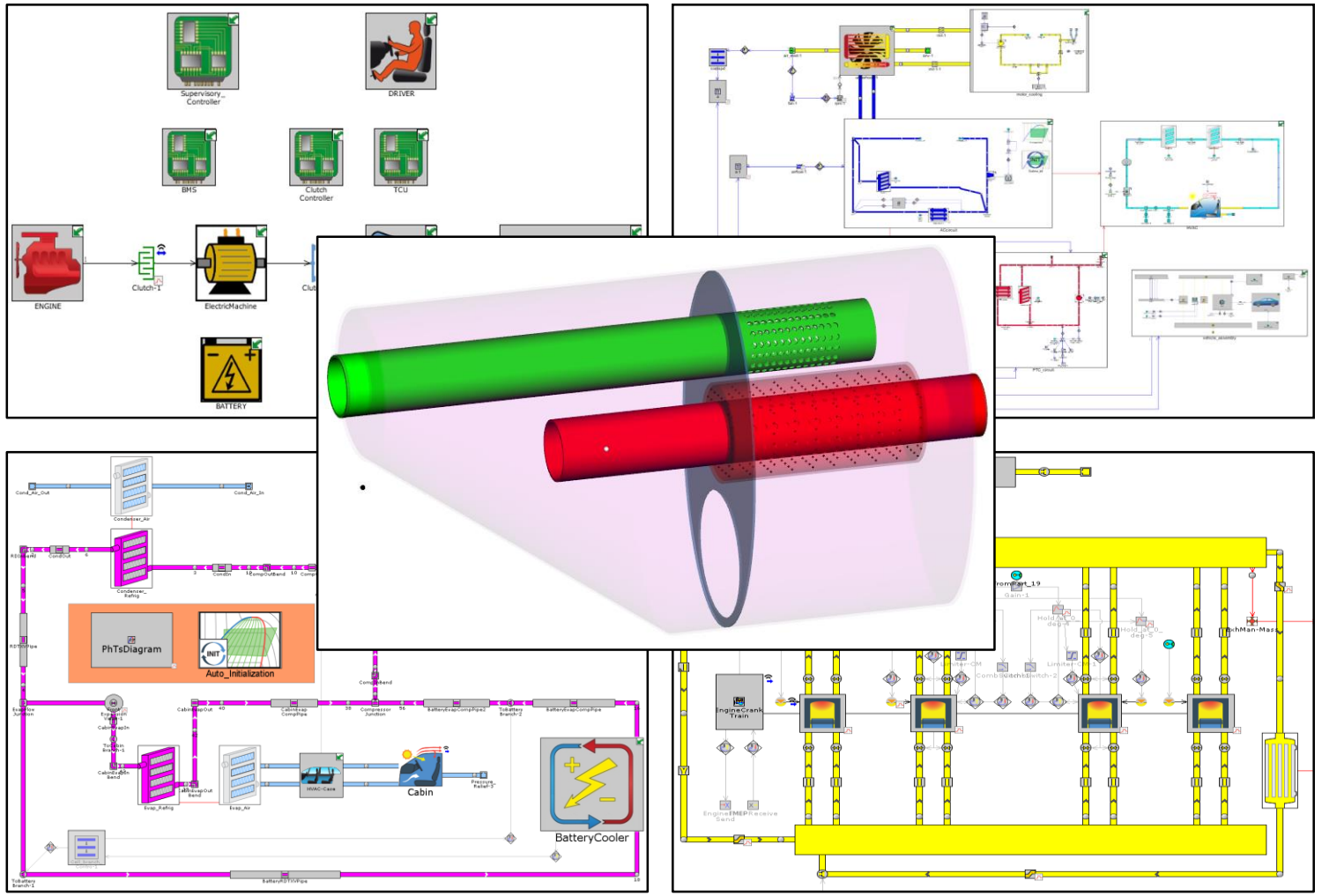


GT&MF联合仿真介绍

黑匣子

GT模型

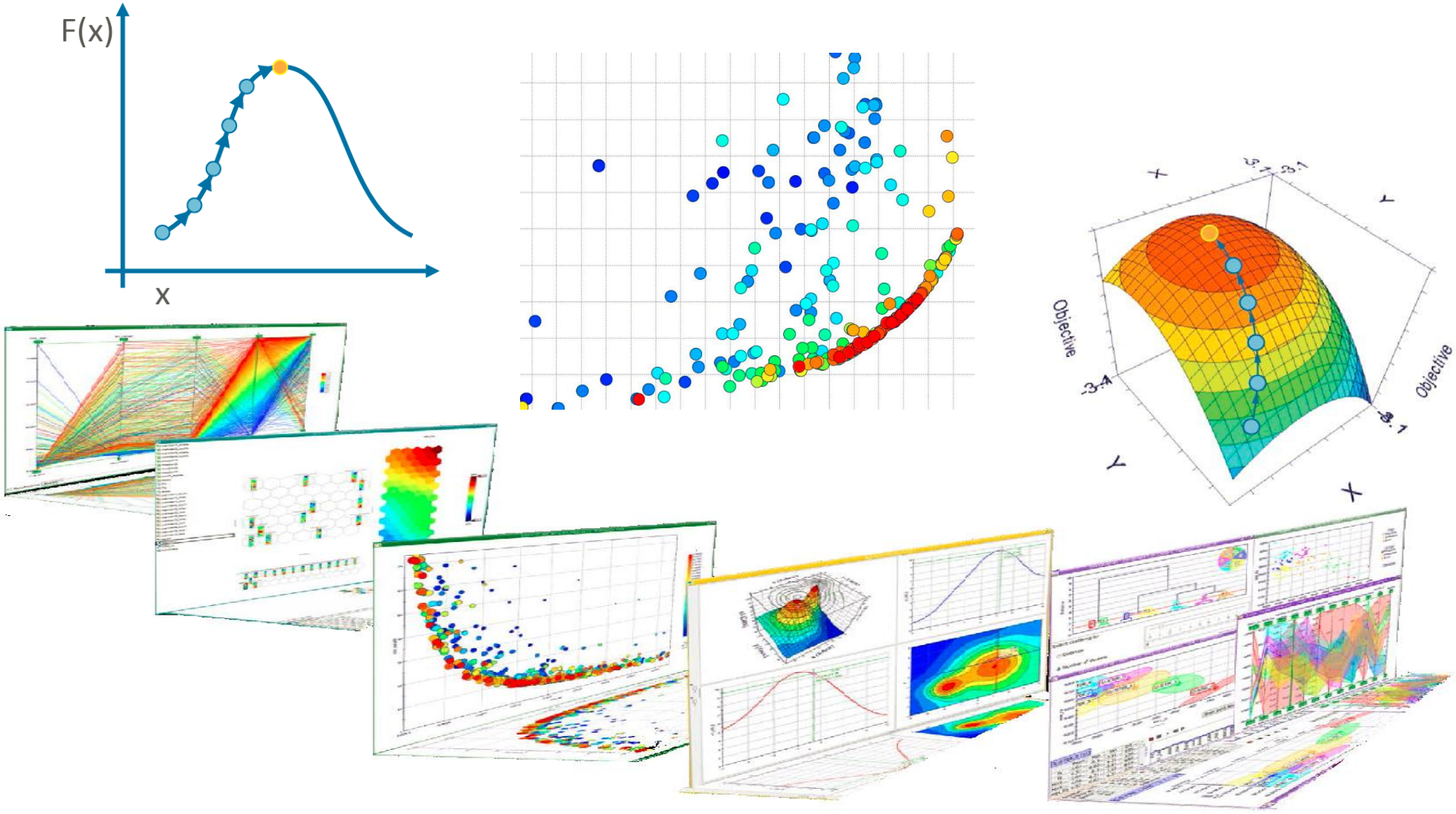
- 整车动力性/经济型模型
- 热管理模型
- 空调系统模型
- 发动机模型
- 消声器模型
- 等



GT&MF联合仿真介绍

分析输出

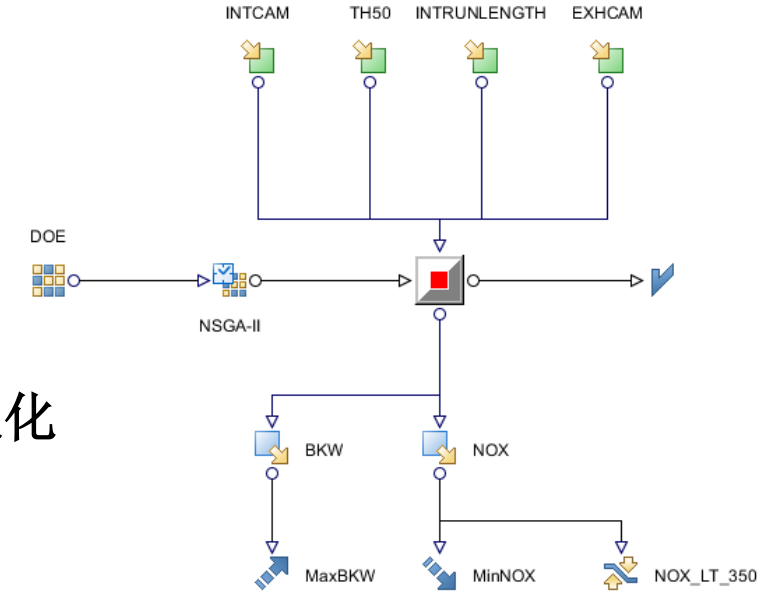
- 单目标优化
- 多目标优化
- 响应面生成
- 优化分析

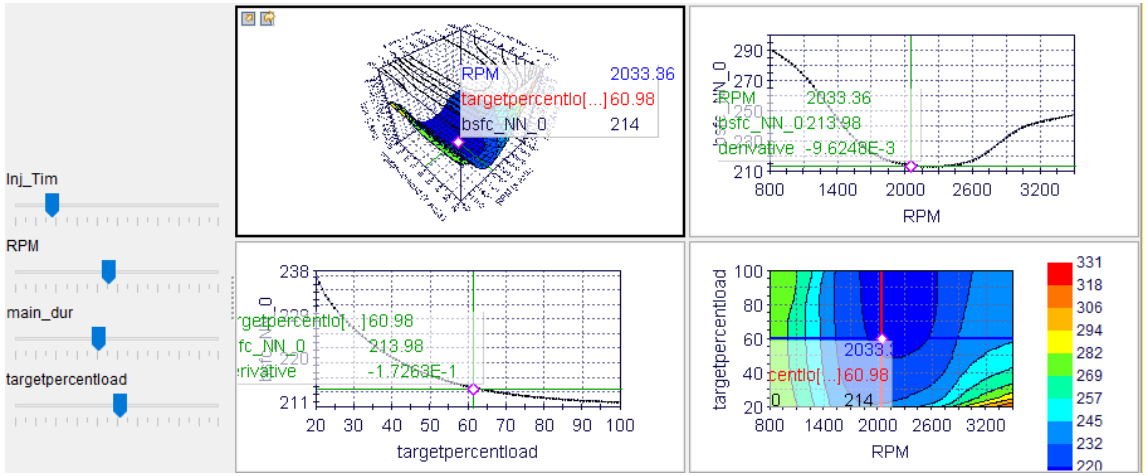


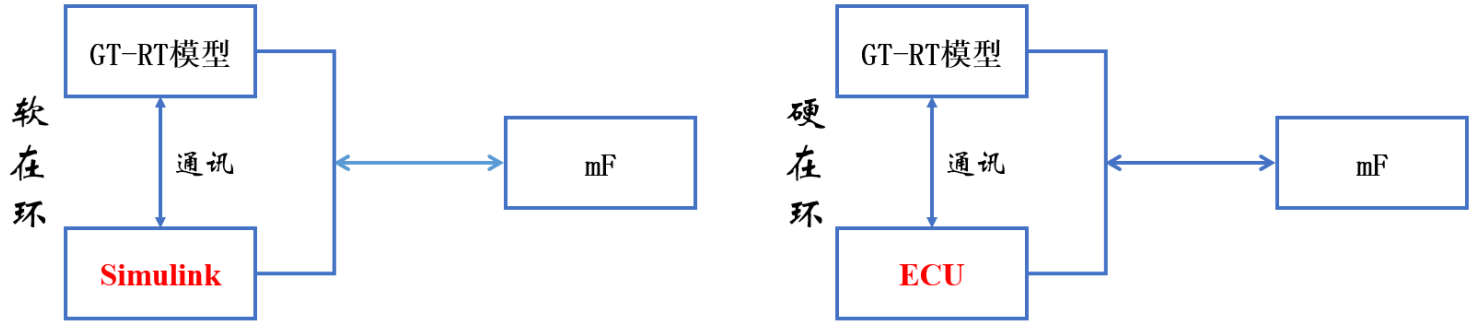
GT&MF联合仿真介绍

能解决的难题：

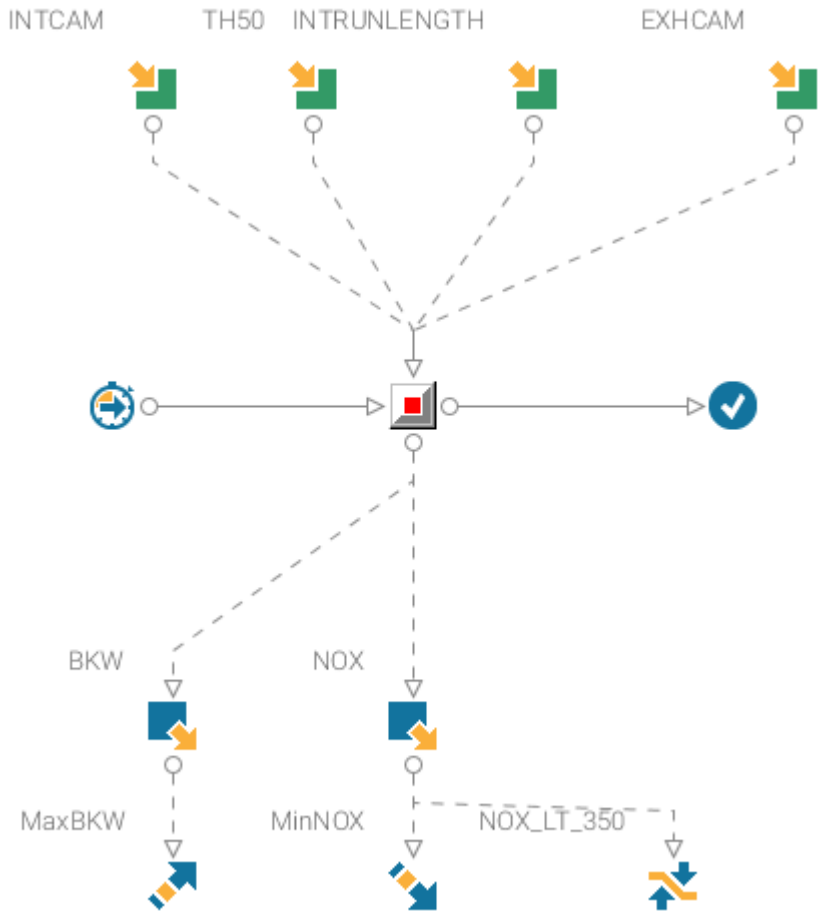
- 模型标定
- 敏感性分析
- 多参数、多目标优化
- 建立响应面
- 大数据分析
- SiL/HiL

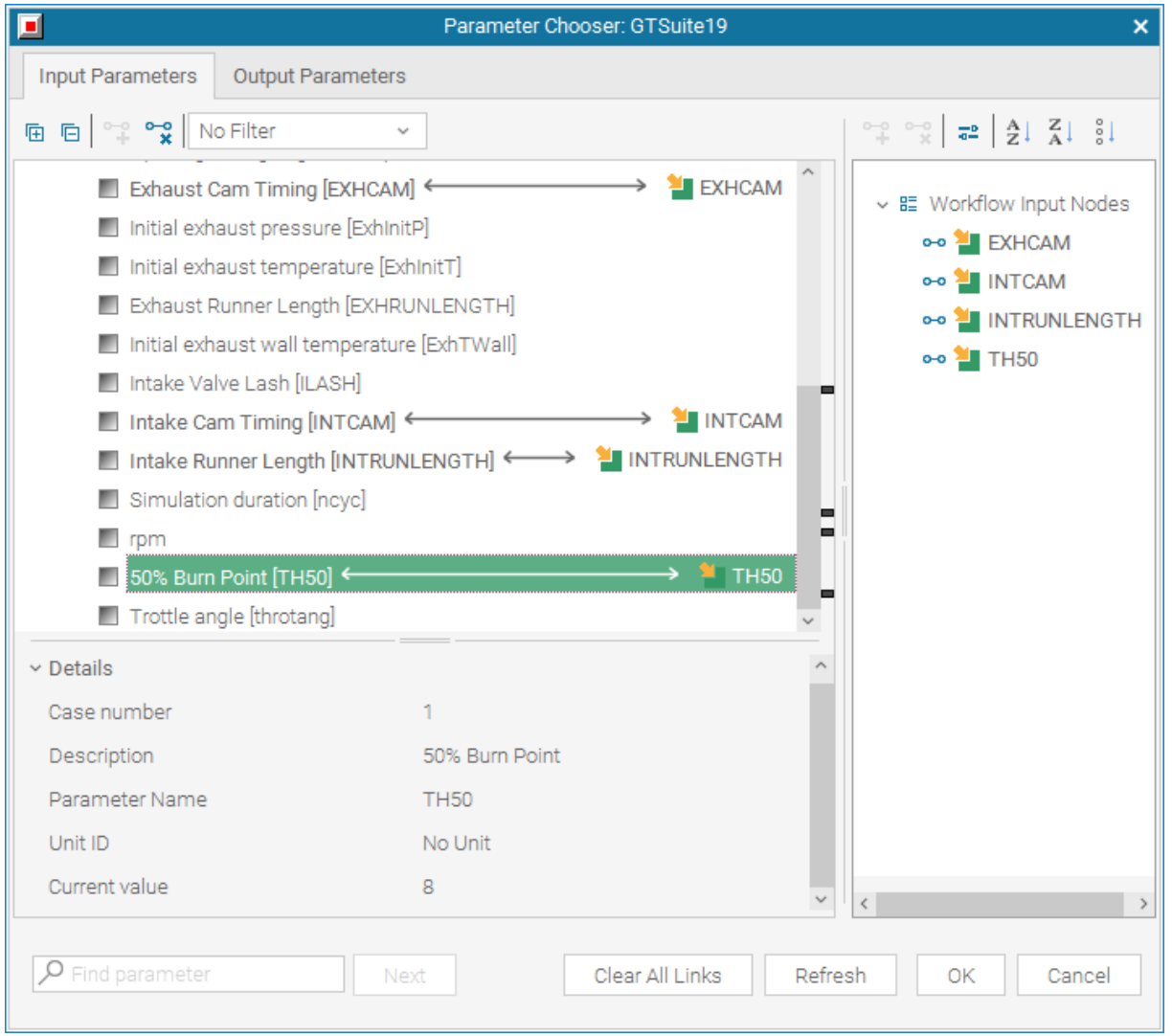




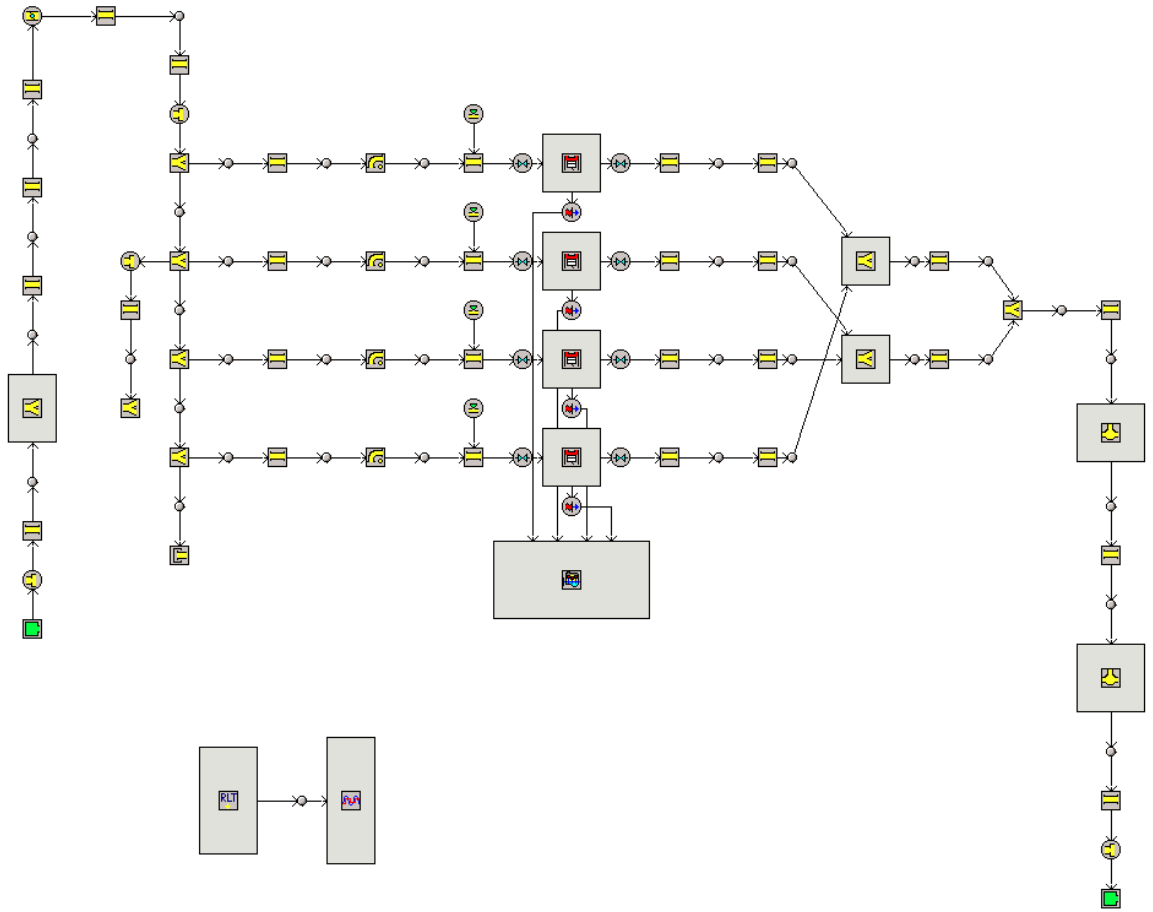


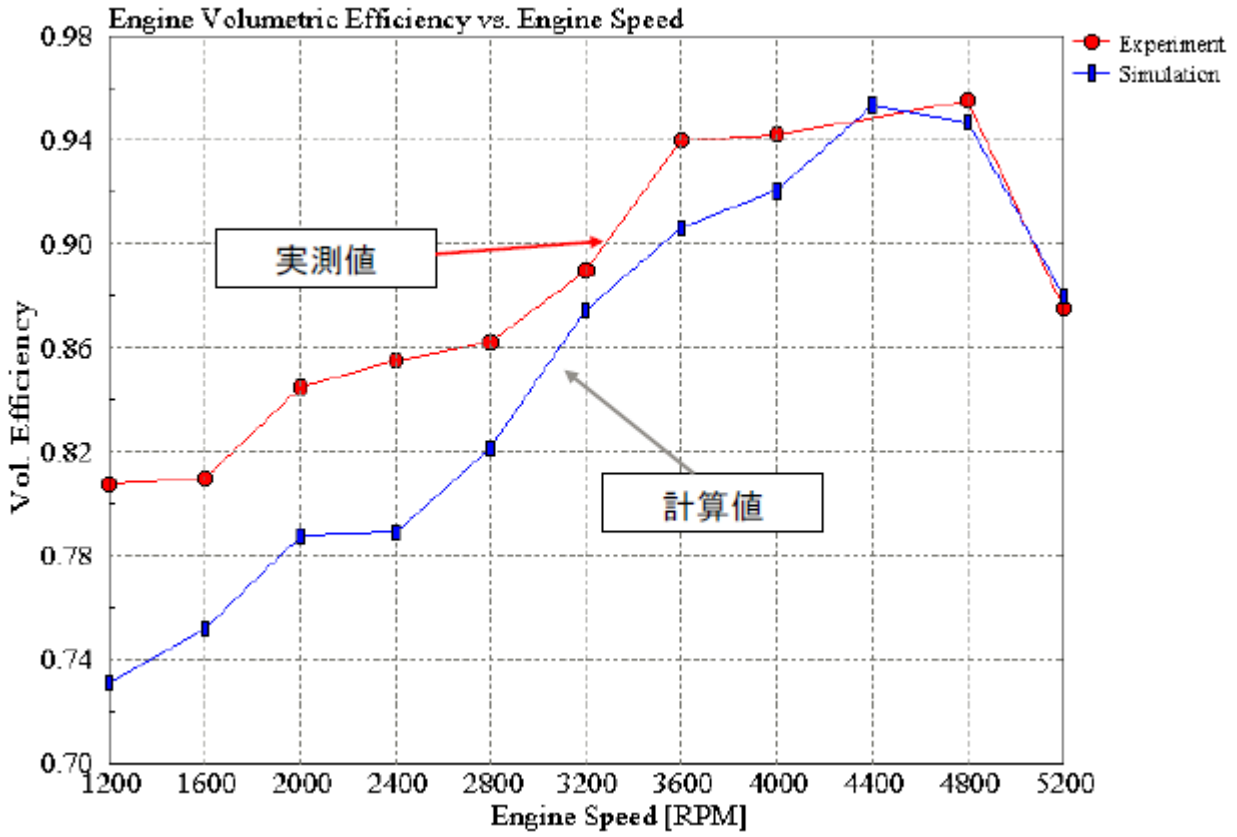
案例1：modeFRONTIER集成GT





案例2：modeFRONTIER集成GT实现参数反演





GT 能提供完整的系统解决方案

多学科: 流体、传热、力学、电学、化学、控制,..

物理: 从详细的预测到系统级，具有不同的保真度

Productivity: 分布计算，优化，自动化，脚本

开放性: Co-sim平台，Co-sim接口，模块化

企业级: Plm 链接，CAD 导入，从 CAD 建模

感谢倾听
期待与您的进一步合作 ☺

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