IDAJ
integrated digital advanced solution

GT-SUITE整车性能仿真平台介绍及演示

艾迪捷信息科技（上海）有限公司
IDAJ-China

目录

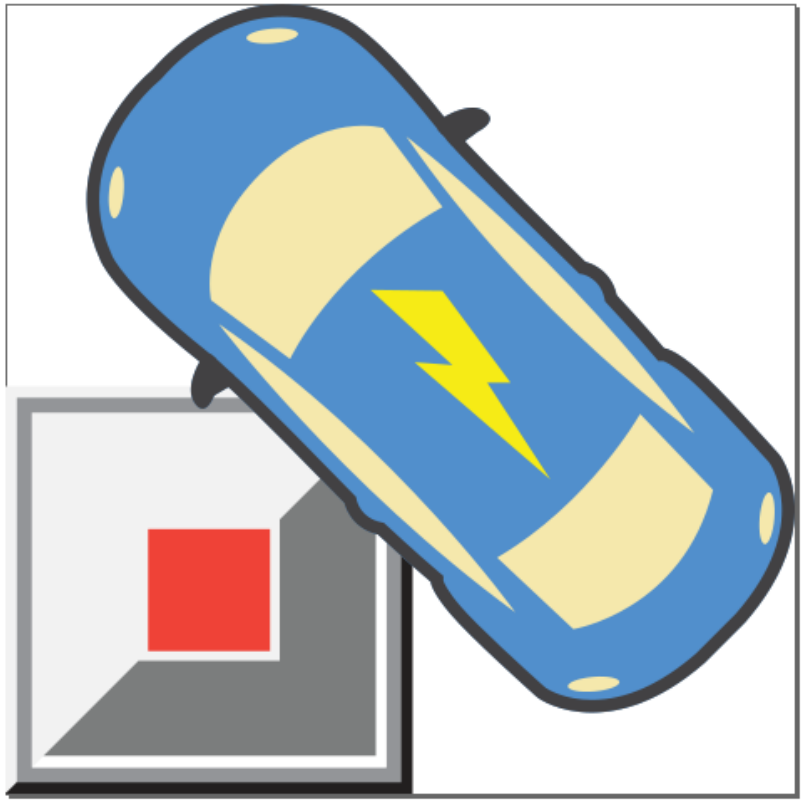
- GT-DRIVE+
- GT-SUITE架构师
- 新一代系统仿真模式

目录

- GT-DRIVE+
- GT-SUITE架构师
- 新一代系统仿真模式

什么是GT-DRIVE+？

- GT-DRIVE+新一代的系统仿真建模方式
- 主要解决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

Log-in | Register

Search

HOME | GT-SUITE | INDUSTRIES | APPLICATIONS | EVENTS | SUPPORT | ABOUT/CONTACT | CAREERS

Home | Videos | Blog | Release | Webinars | Publications | Events

Don't Miss!

Tech Tip

Libraries

目录

- GT-DRIVE+
- **GT-SUITE架构师**
- 新一代系统仿真模式

什么是架构师？

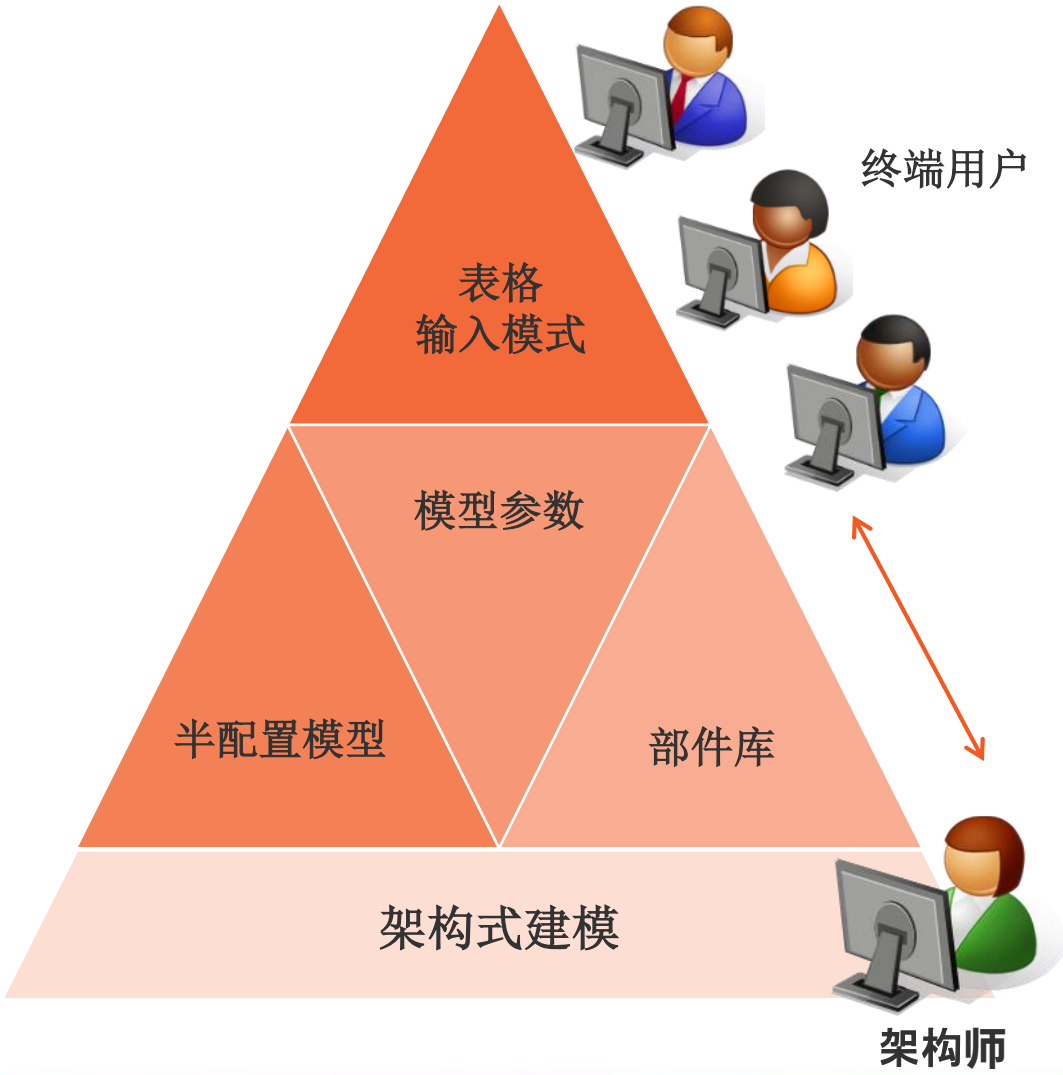
- 将来仿真工程师的两种工作模式：

终端用户：

- 快速建模
- 参数输入
- 计算分析

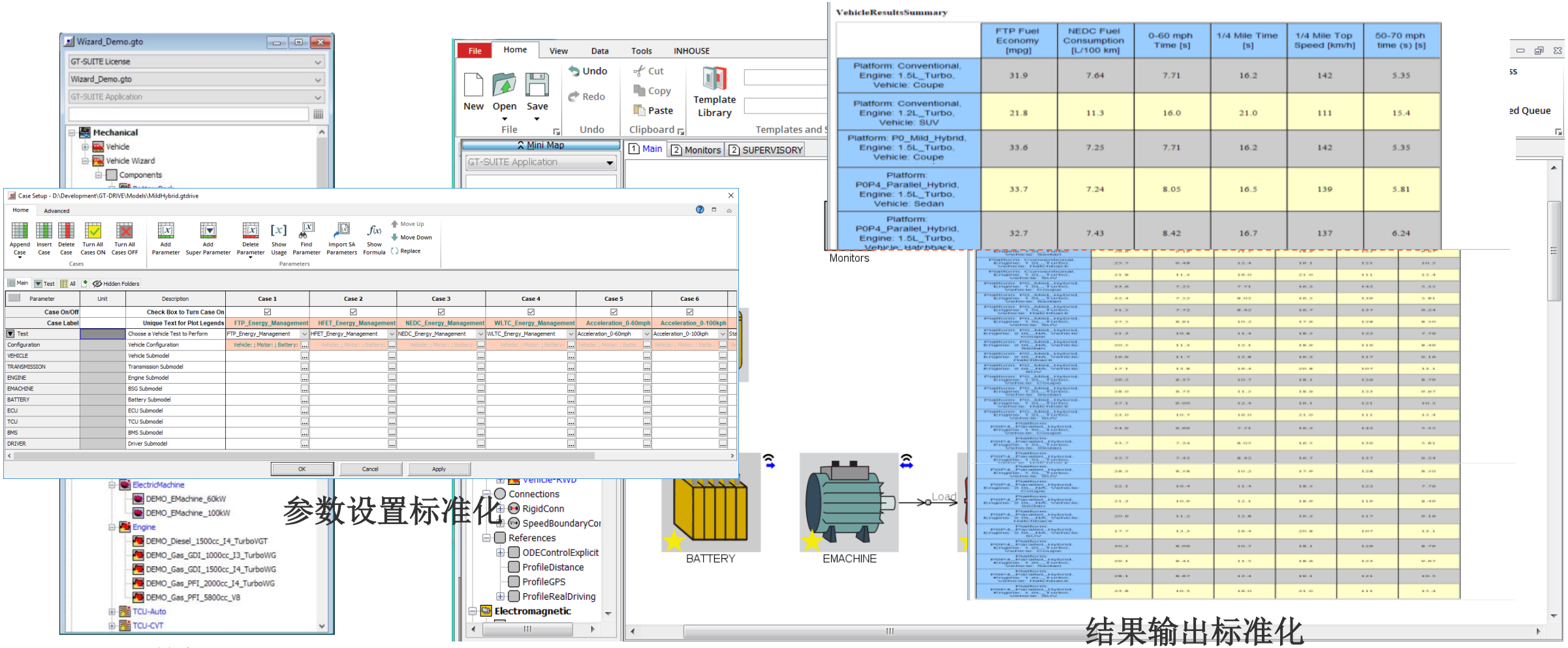
架构师：

- 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



架构师工作内容

■将系统仿真专业化、流程化、标准化：



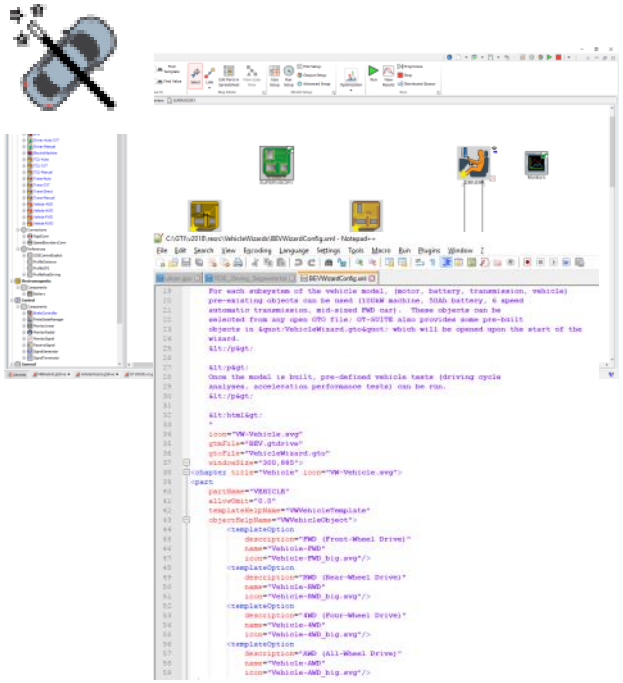
参数设置标准化

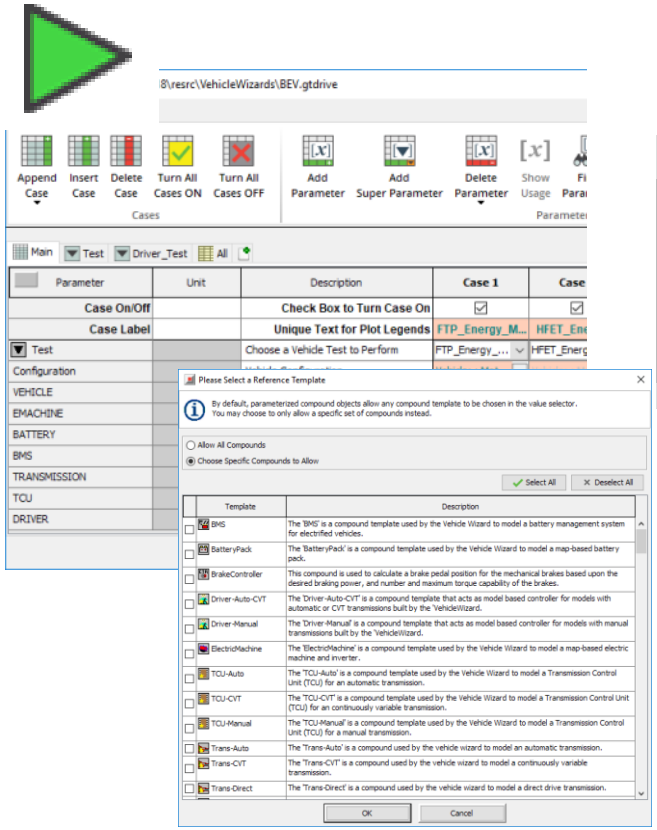
部件标准化

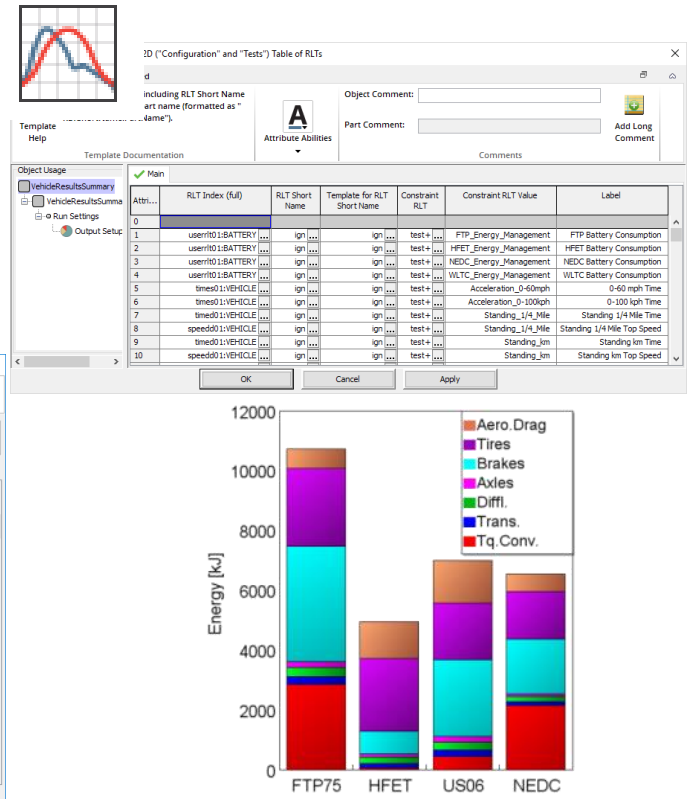
结果输出标准化

整车架构标准化

如何成为架构师？







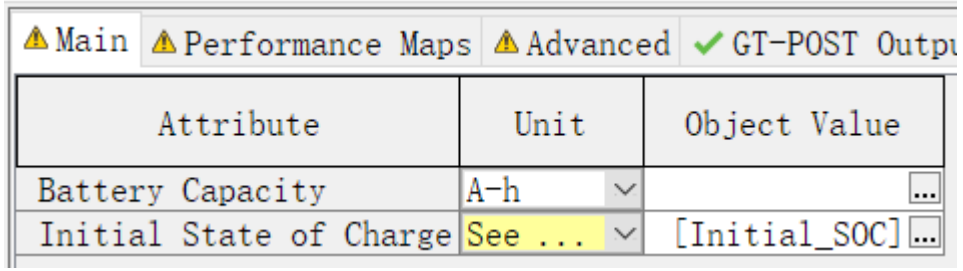
制定模块库 → 制定构架 → 输入、计算 → 分析模板

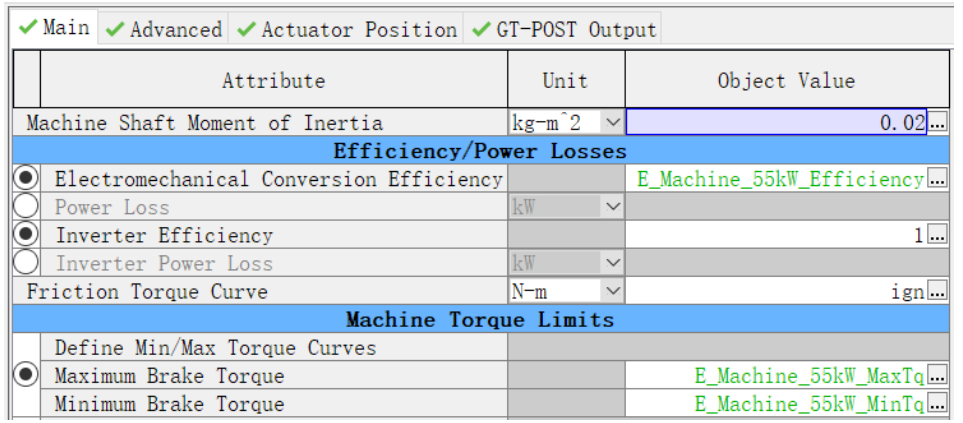
变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

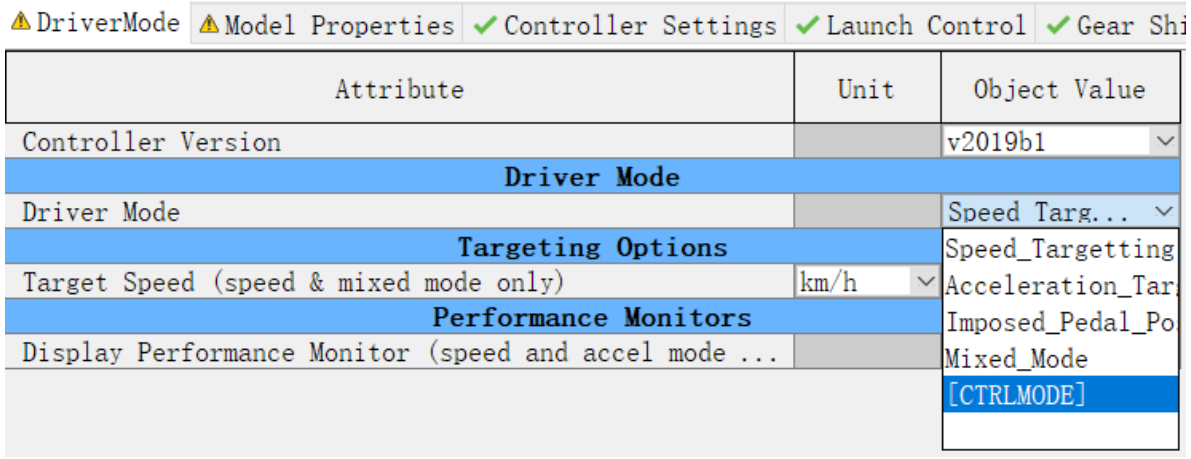
1. 参数变量：soc、转速、车速、仿真时间。。。

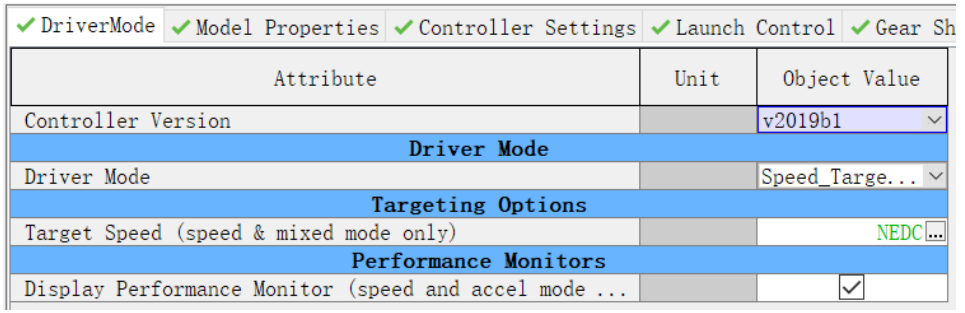
2. 对象变量：路谱、曲线、map、材料、介质。。。

3. 状态变量：驾驶模式、控制模式、分析模式。。。







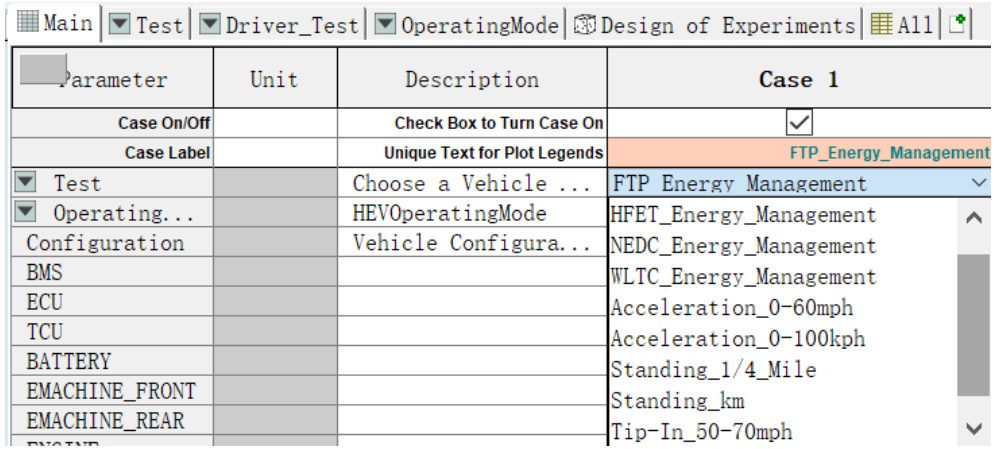


变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

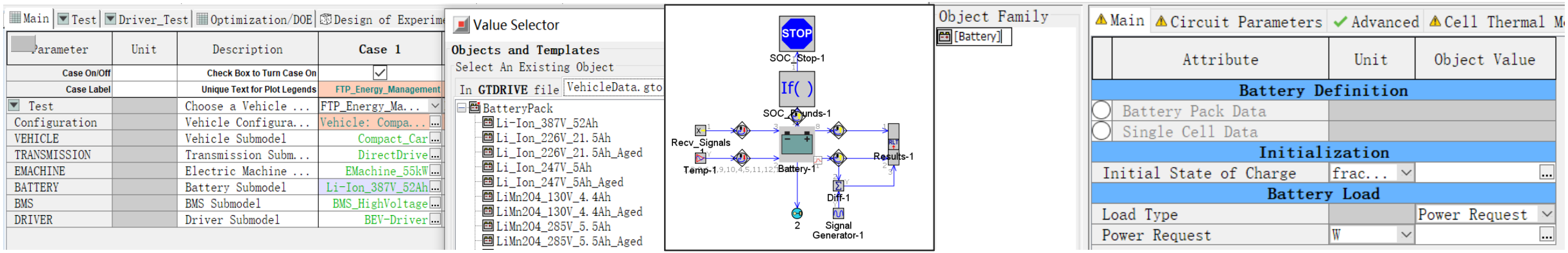
4. 超级变量：自定义变量集合

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)

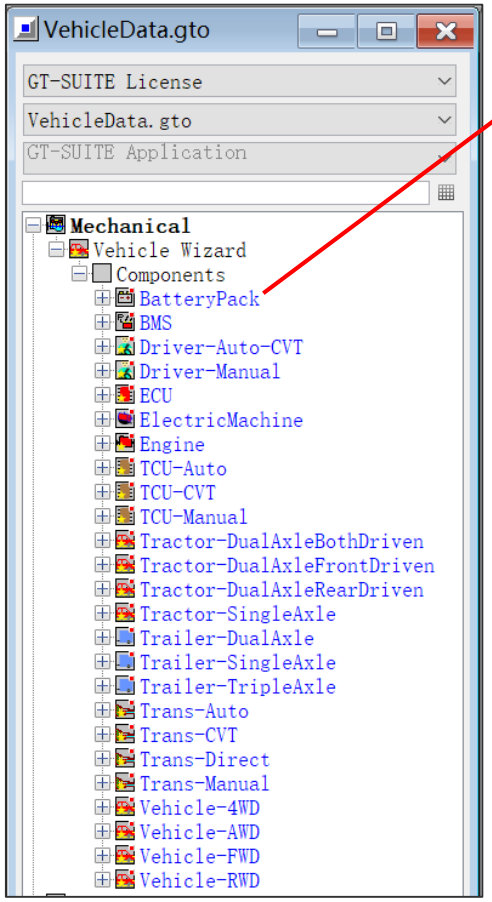


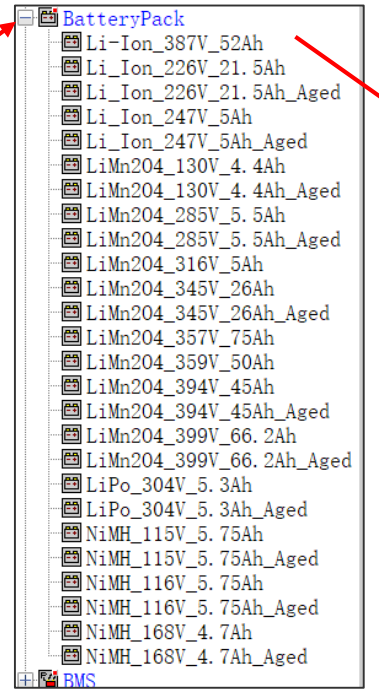
变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

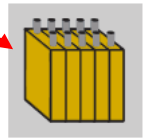
制定的模块（Compound Template）将以.gtc格式存储并支持工程师随时直接调用。

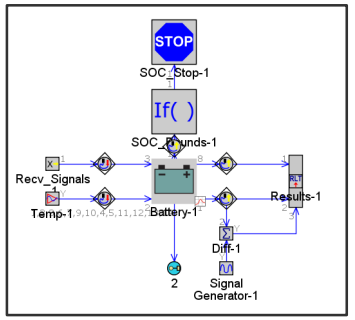
哪些可以制定成模块：

- ✓ 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





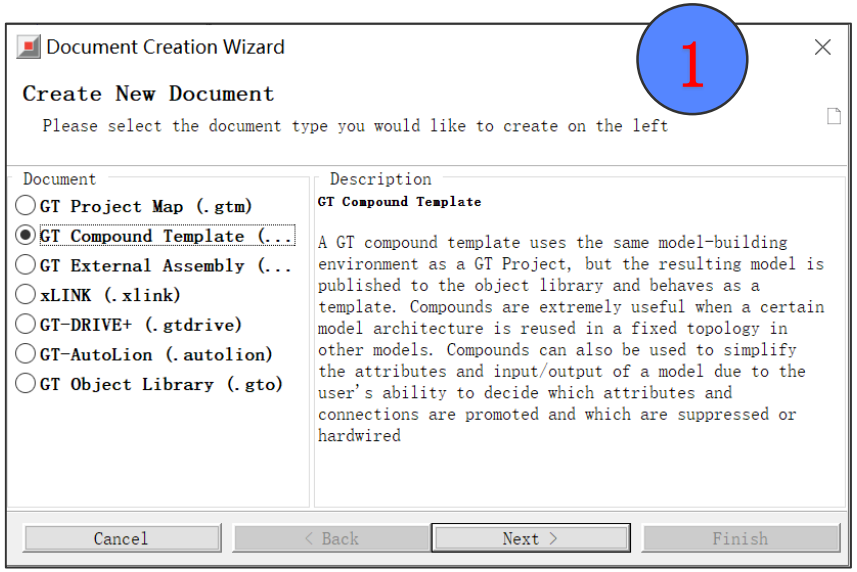


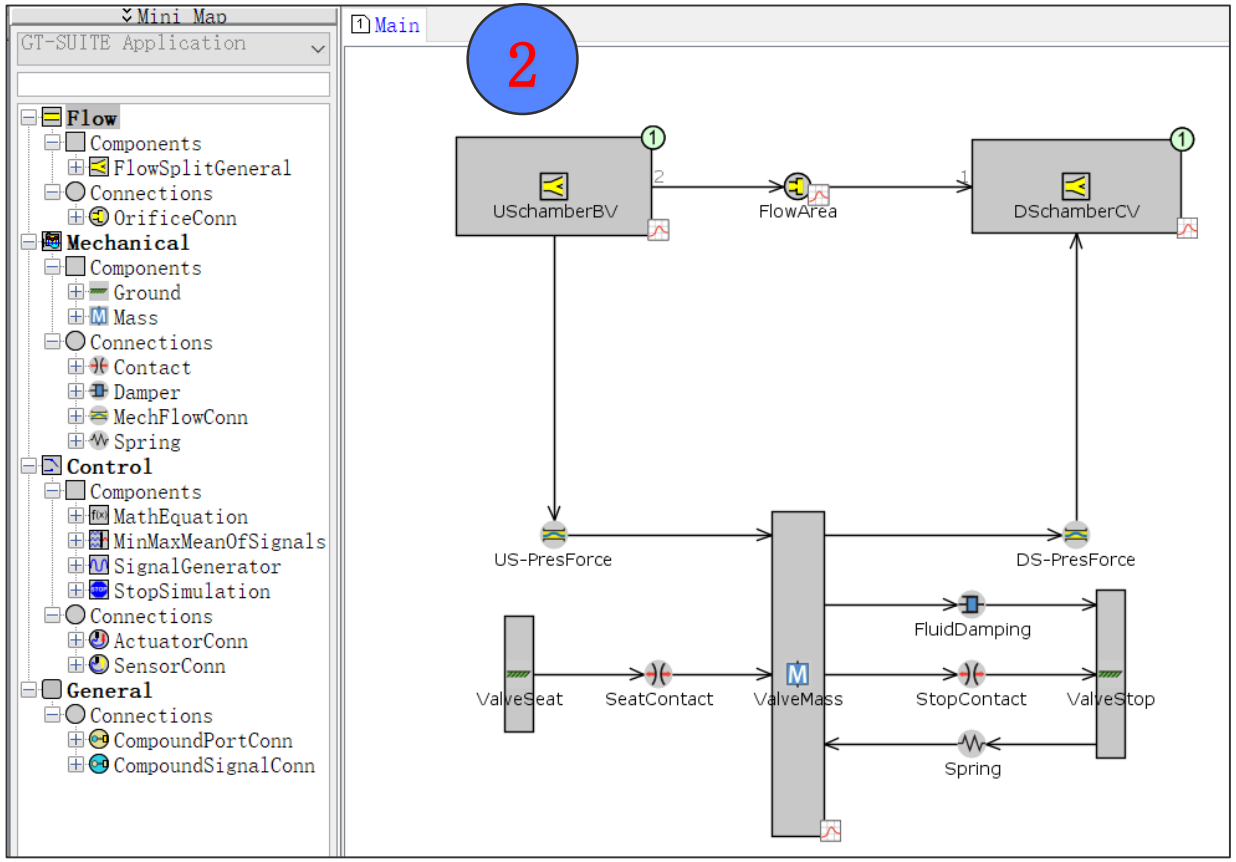


变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

a).新建Compound Template

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



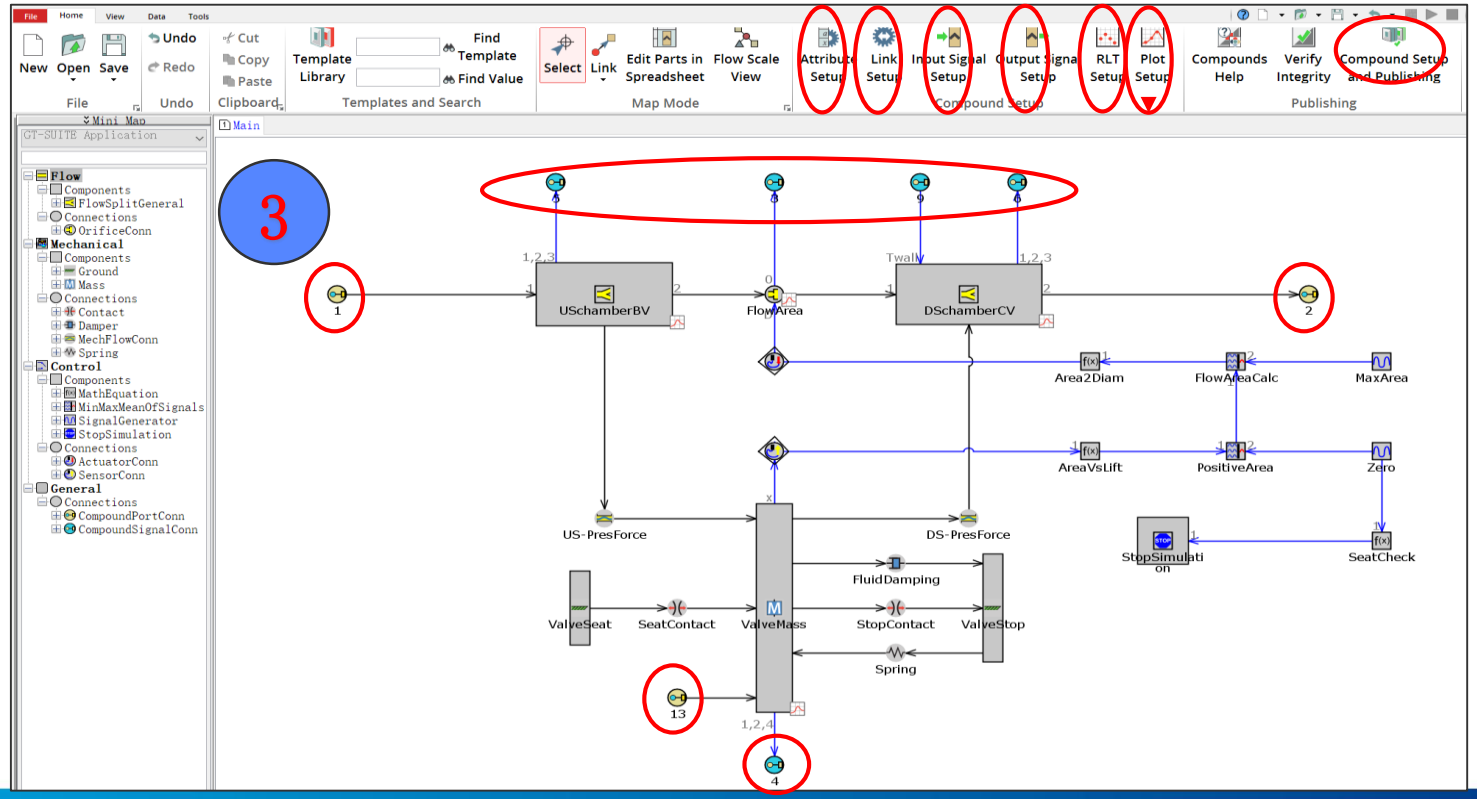


变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

a).新建Compound Template

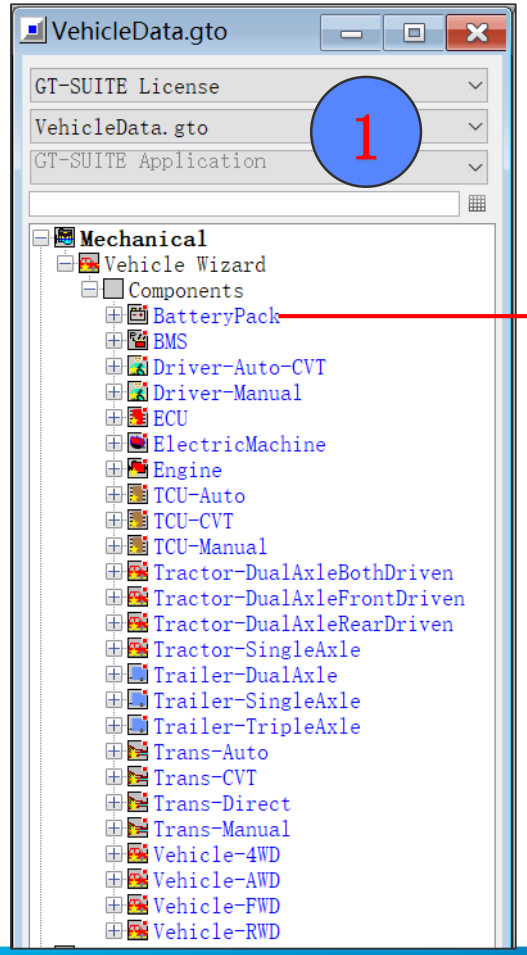
3.设置相应的控制、输入、输出模板及信号；

4.保存，发布（ Publishing ）。



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

b). 直接在系统自带模块基础上修改

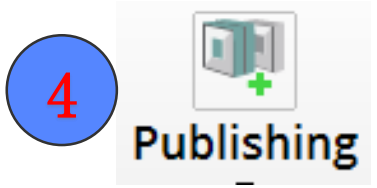


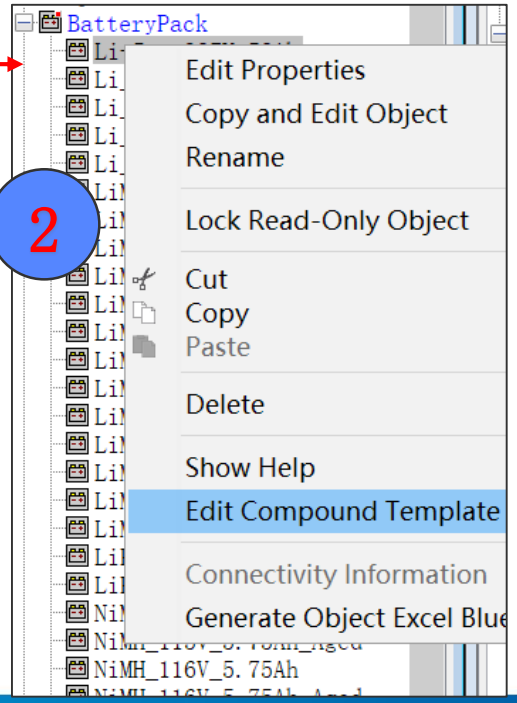
1. 在Libraries里面找到相应的模块（Compound）；

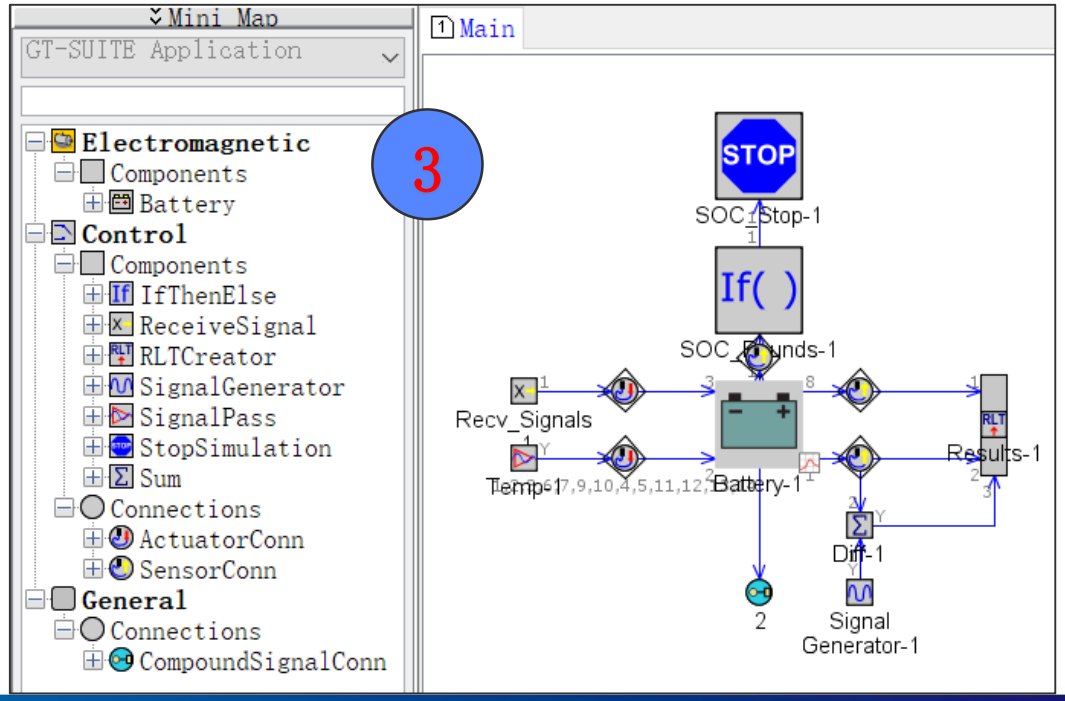
2. 右键选择Edit Compound Template,打开对应的模块；

3. 修改、设置、另存；

4. 发布（Publishing）。





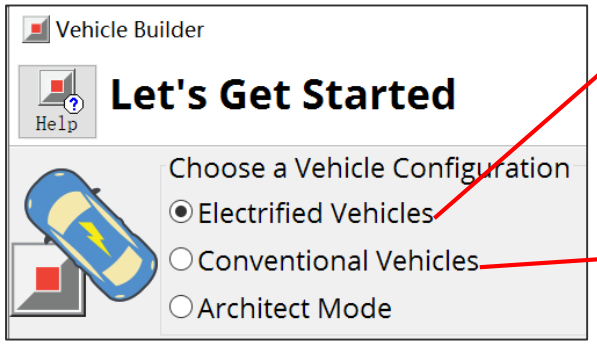


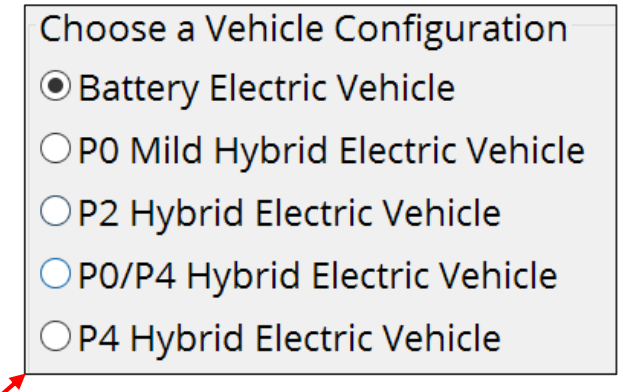
变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

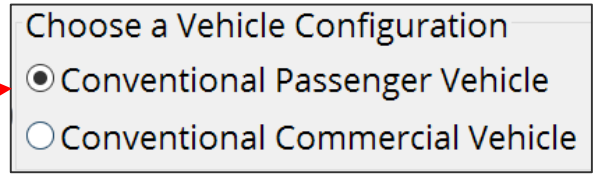
制定的架构将以.gtdrive格式存储，写入Drive+后用户能快速搭建相应架构的模型。

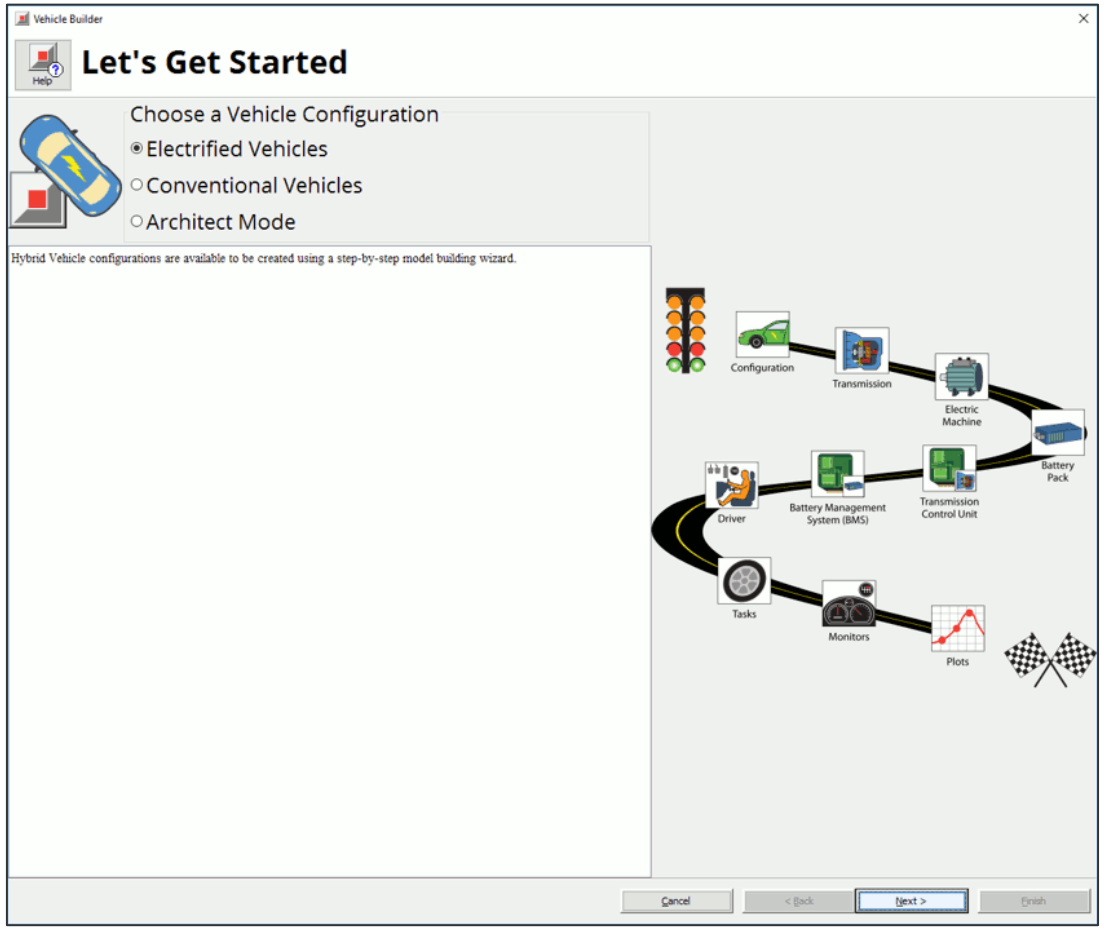
支持哪些架构：

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



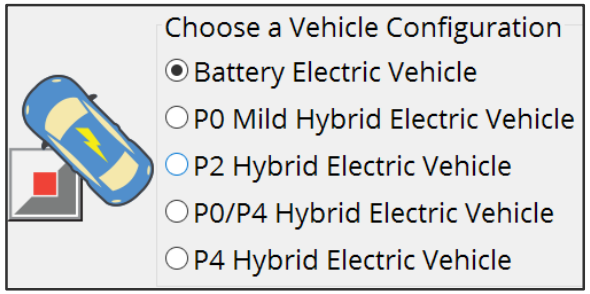


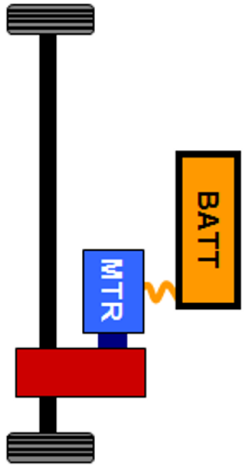


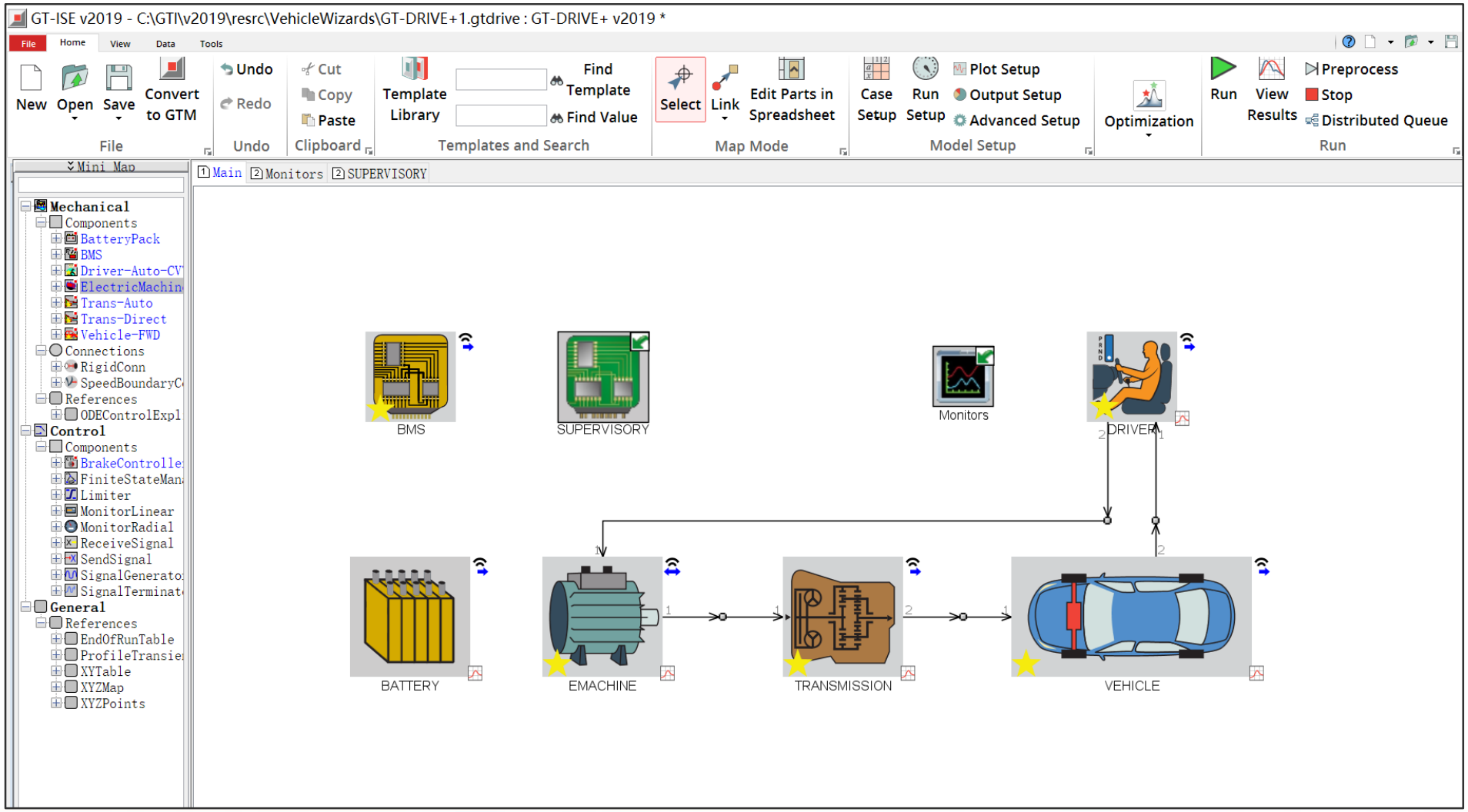


成为架构师

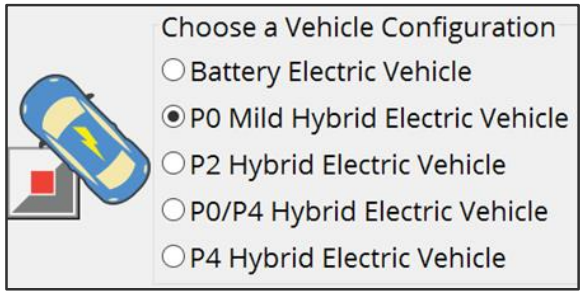
变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

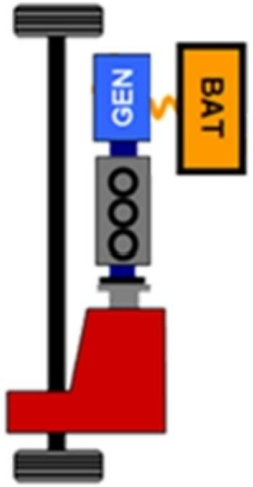


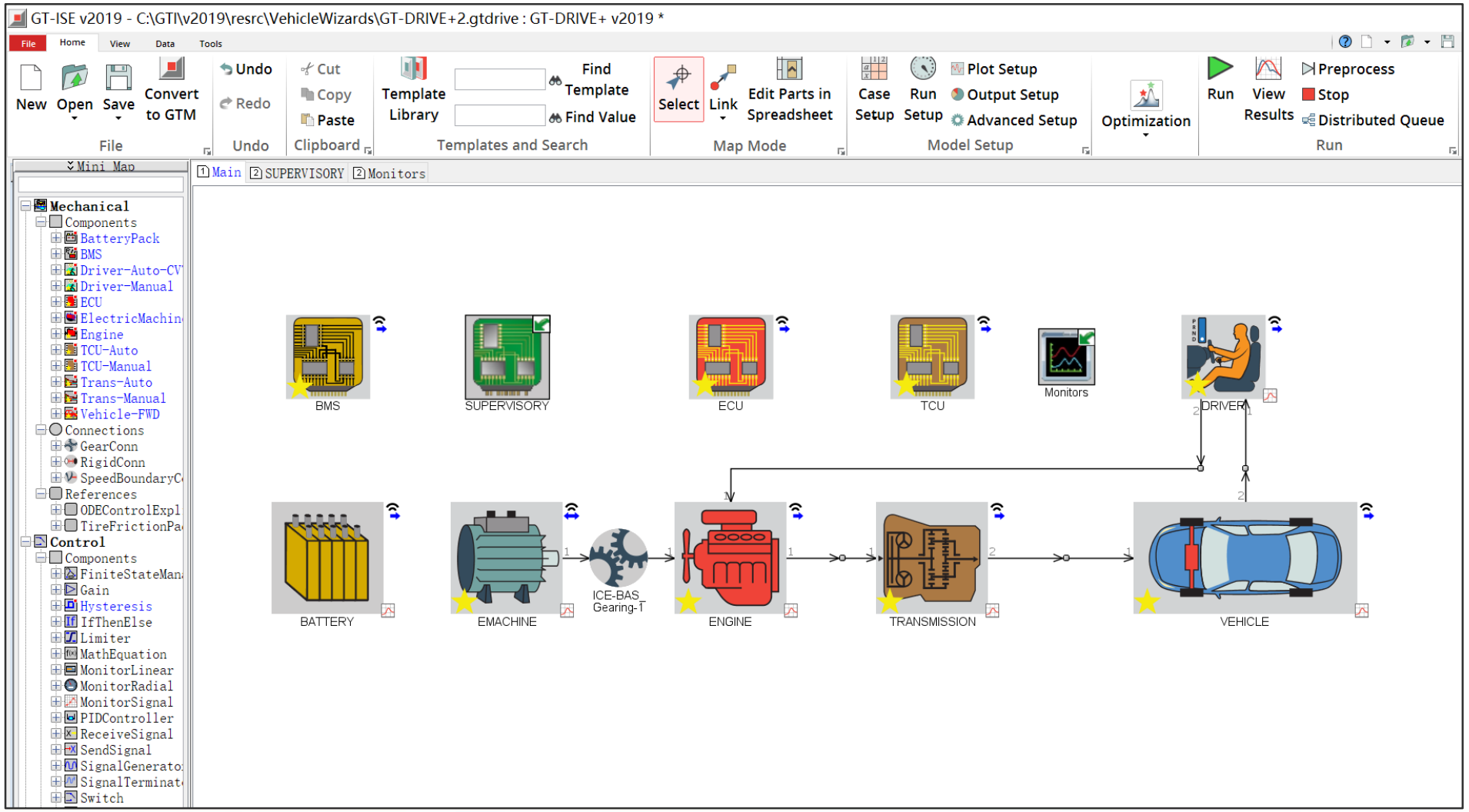




变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

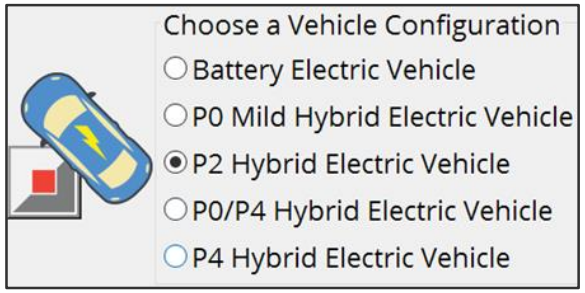


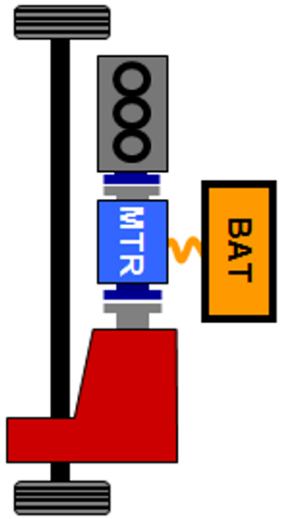


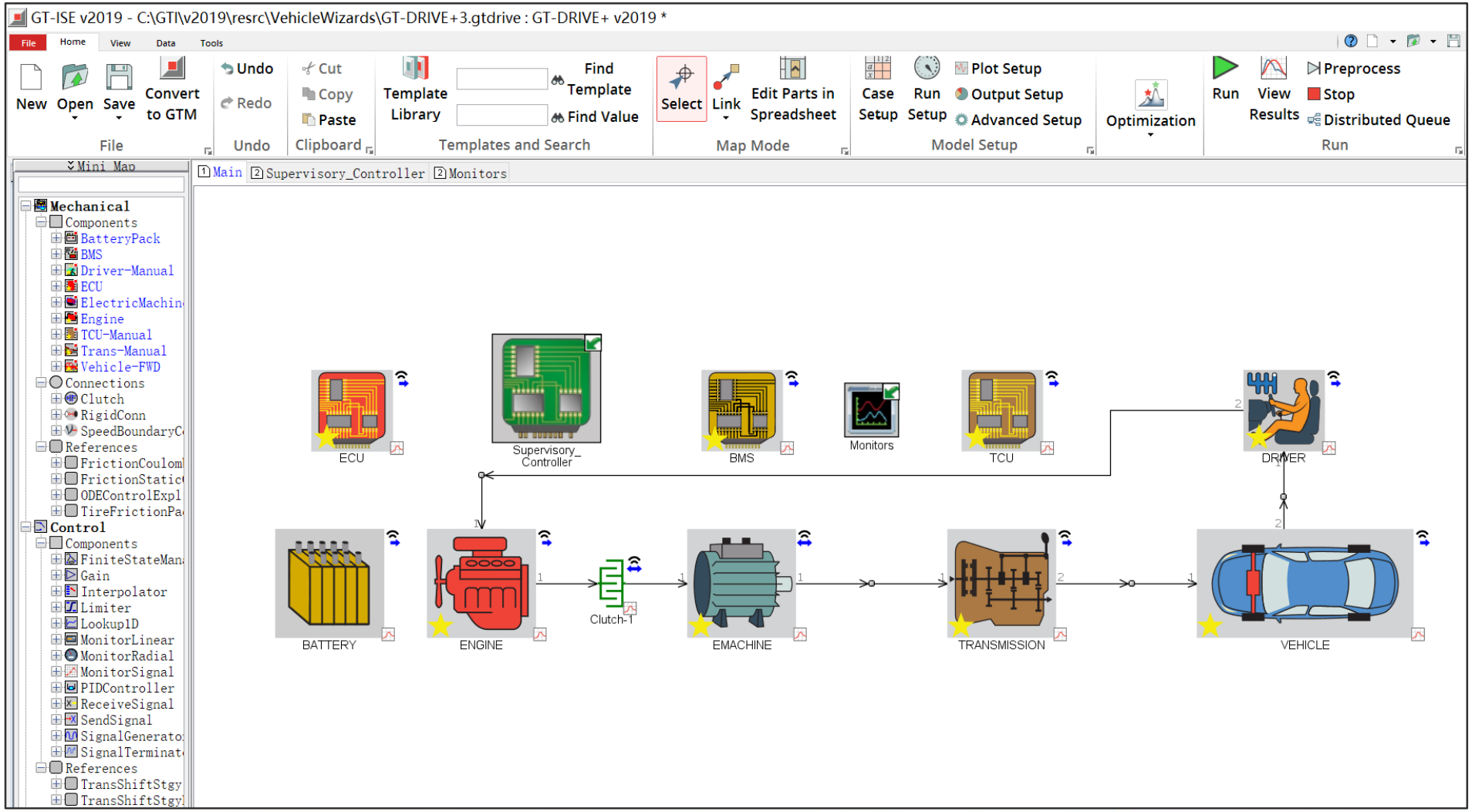


成为架构师

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

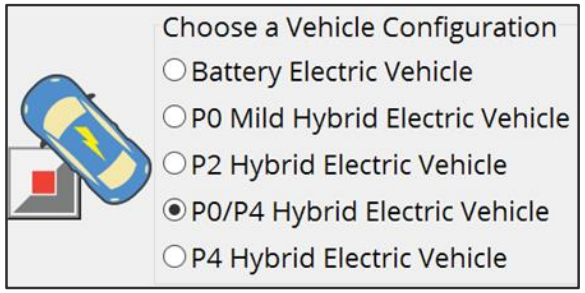


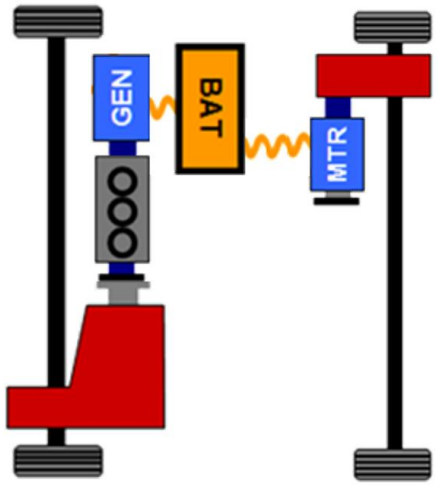


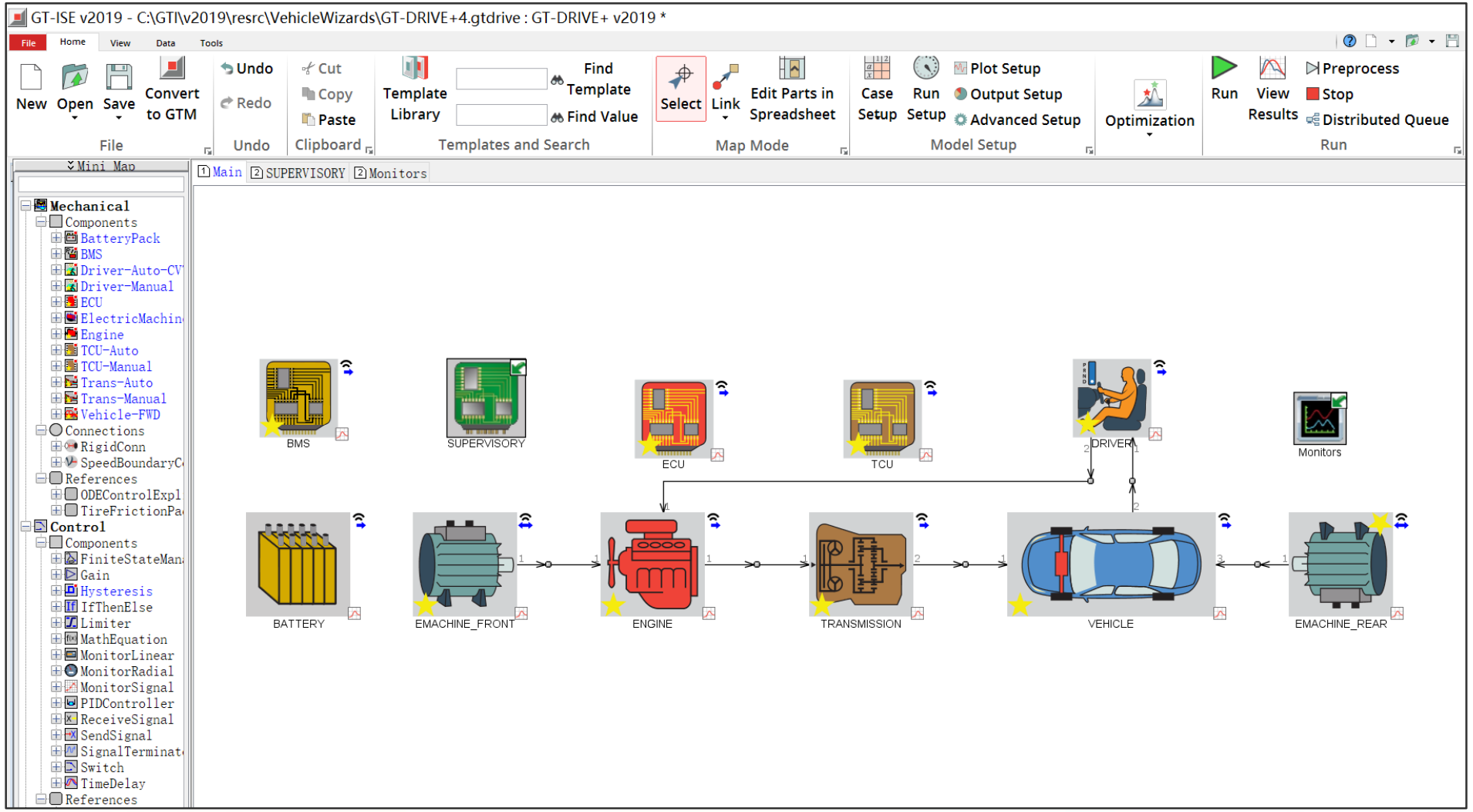


成为架构师

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

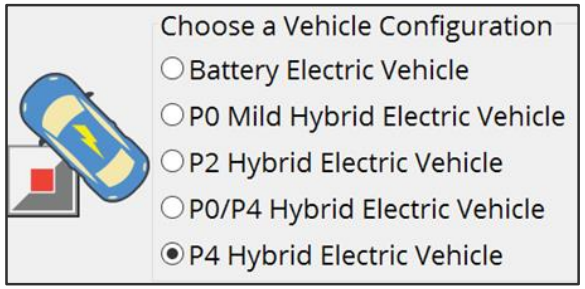


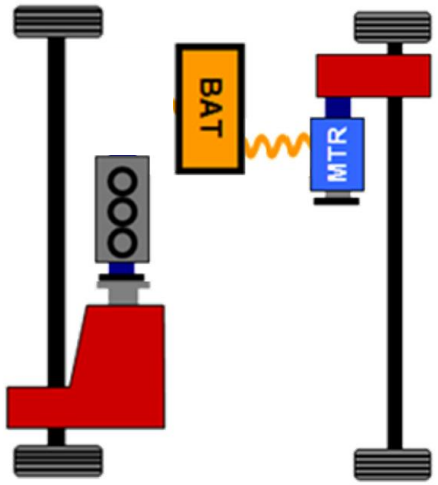


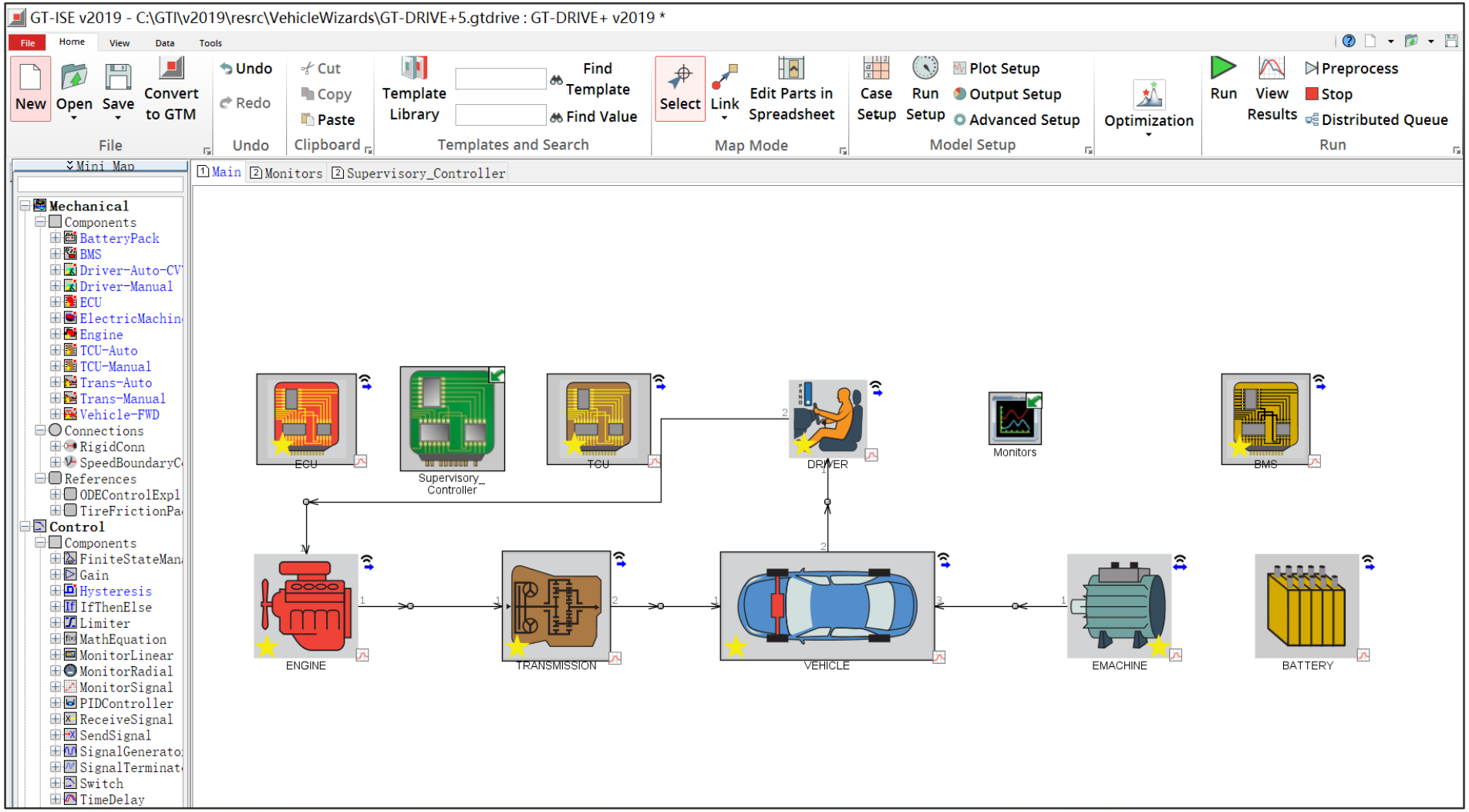


成为架构师

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

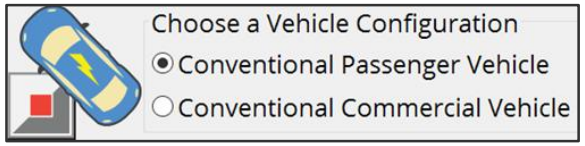


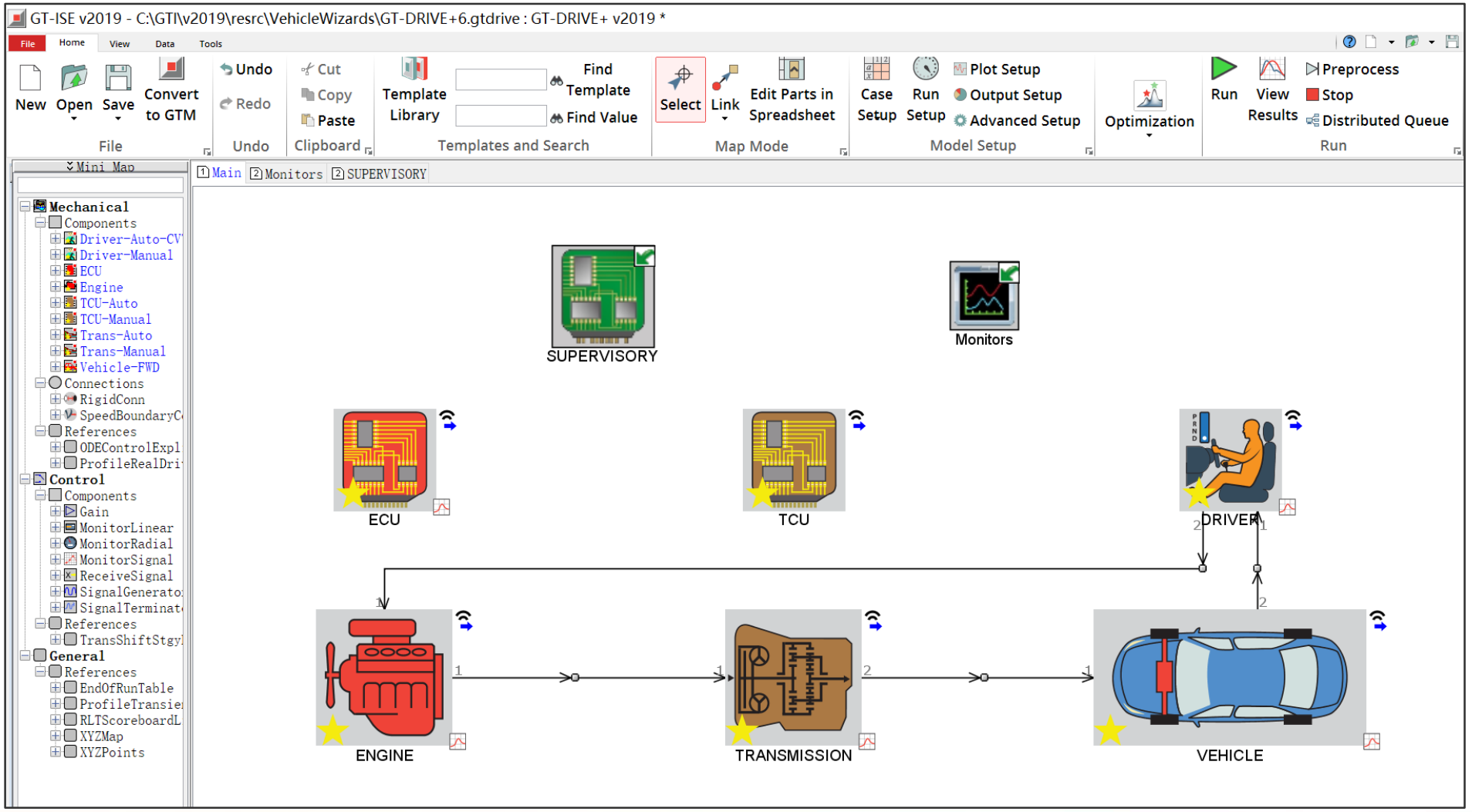




成为架构师

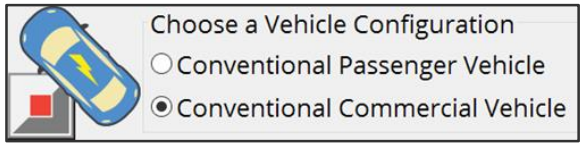
变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

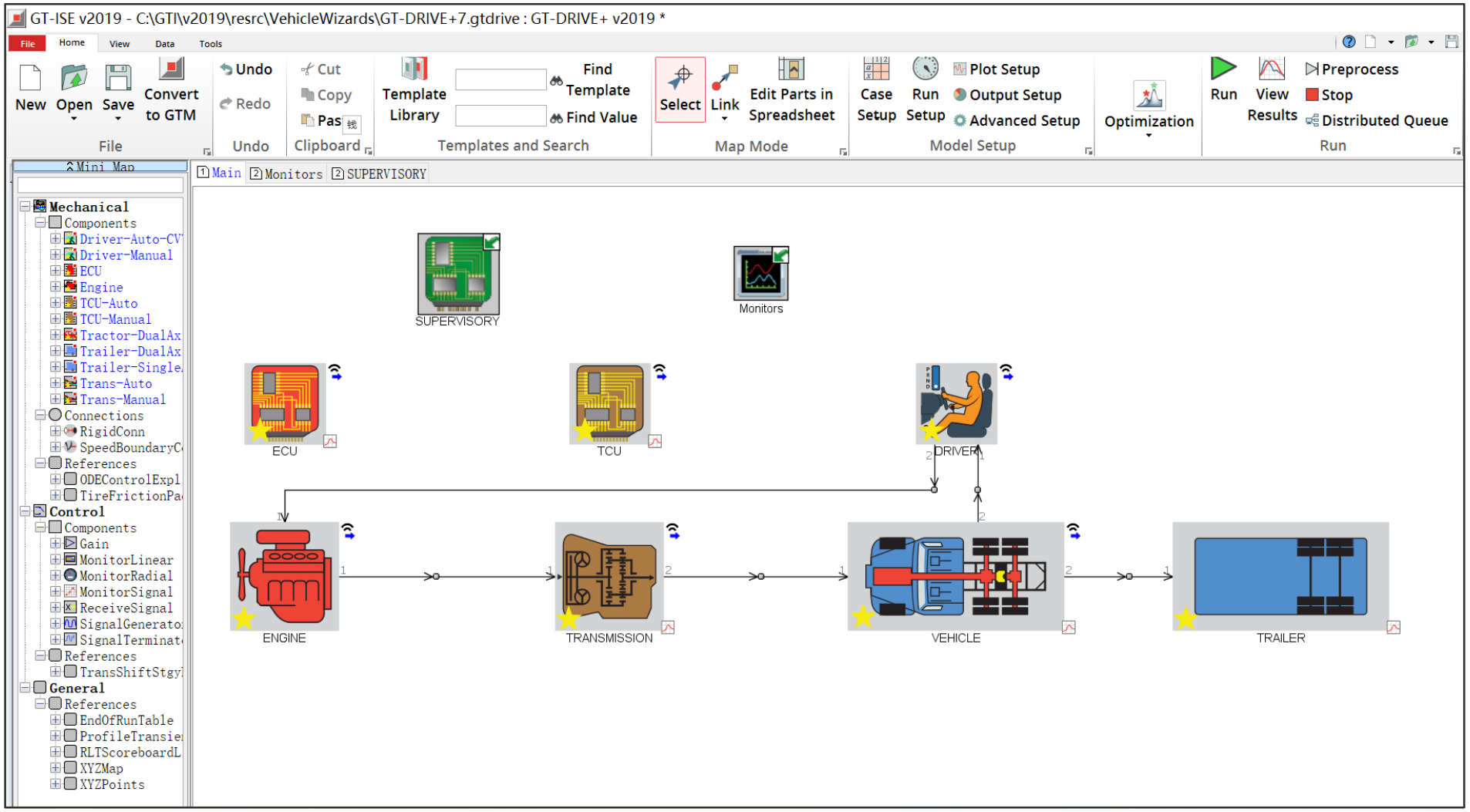




成为架构师

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



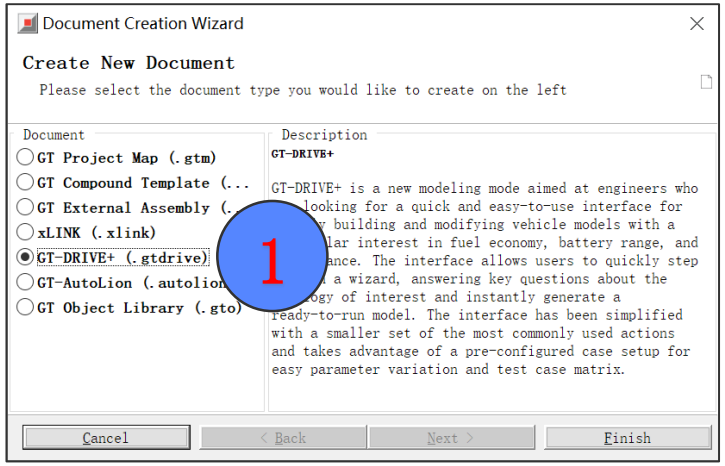


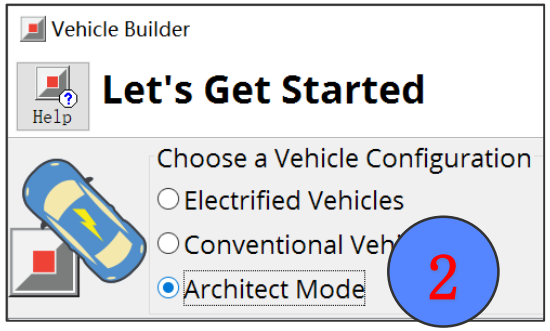
变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

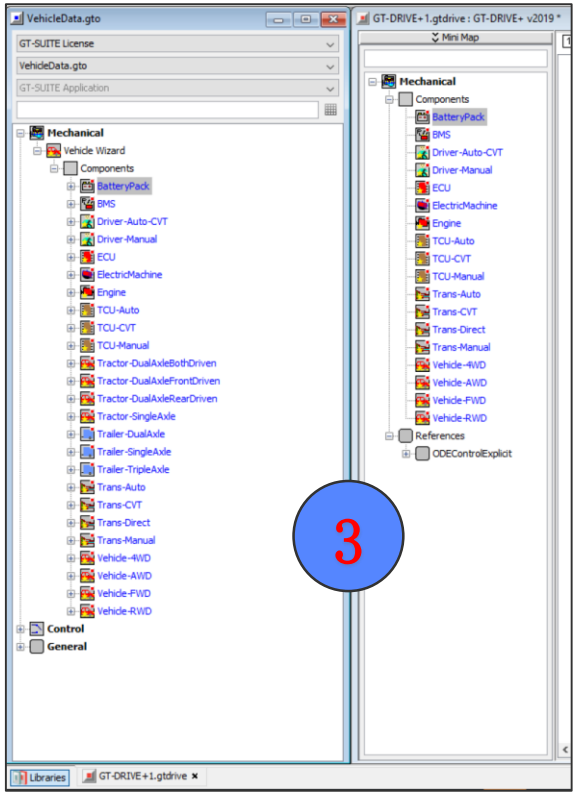
1. New→GT-DRIVE+ →Architect Mode；

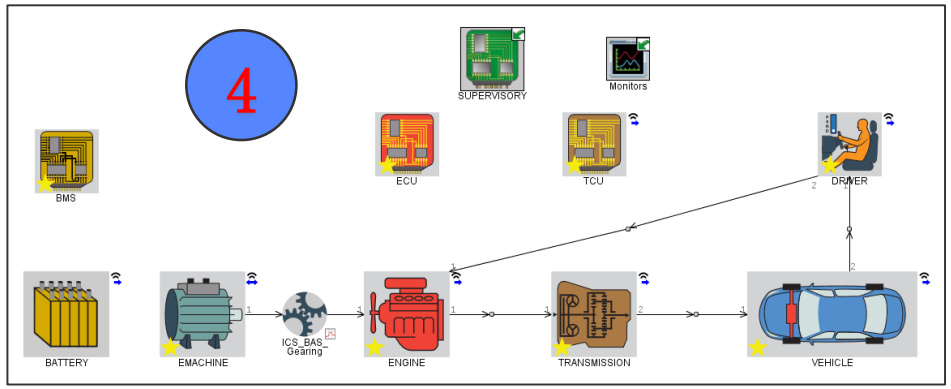
2. 将需要的模块拖入；

3. 搭建架构模型



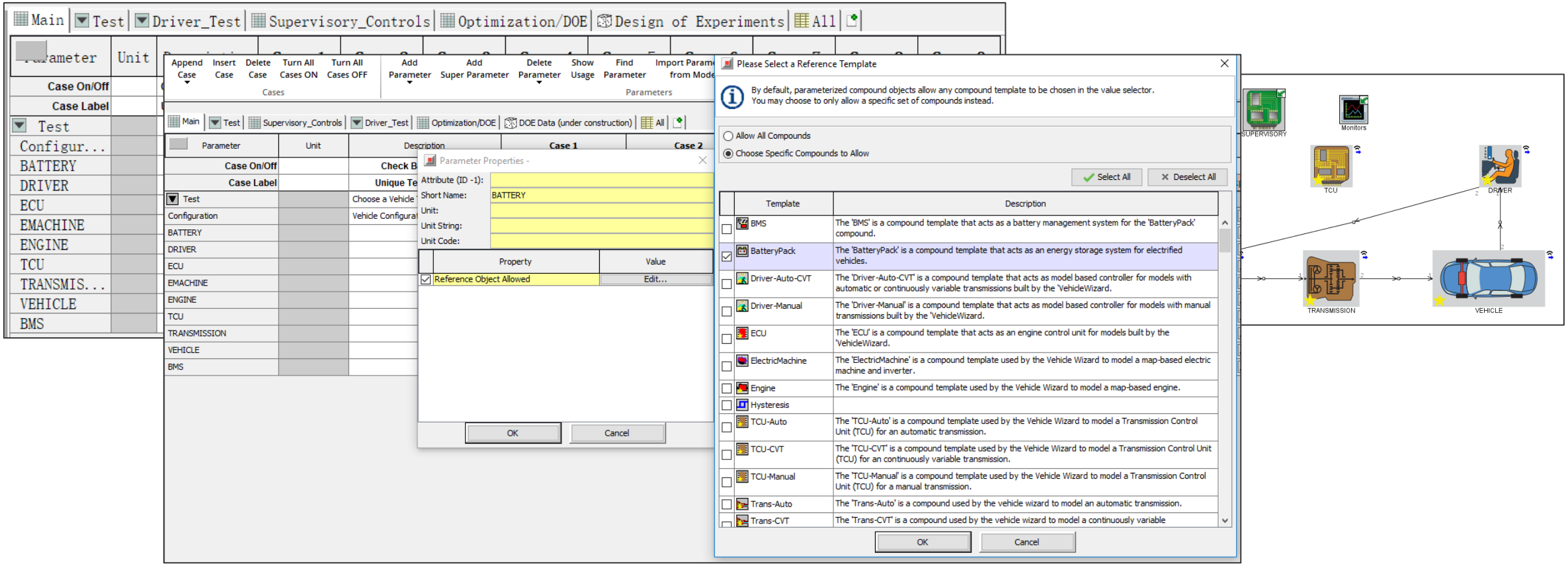






变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

4. 设置模块变量。



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

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

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. 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

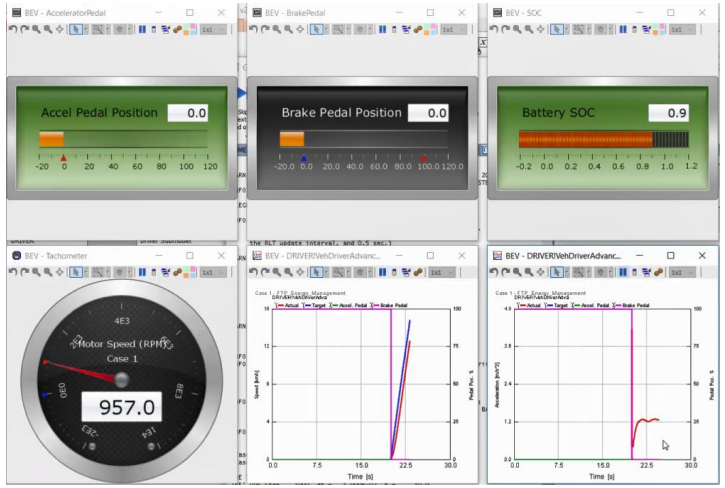
Dependent Par...	Unit	Description	Option #1	Option #2	Option #3	Option #4	Option #5	Option #6	Option #7	Option #8	Option #9
Option Values			FTP_Energy...	HFET_Energ...	NEDC_Energ...	WLTC_Ener...	Acceleration...	Acceleration...	Standing_1/...	Standing_km	Tip-In_50-70...
MODE		Control Mode	Brake...	Brake...	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

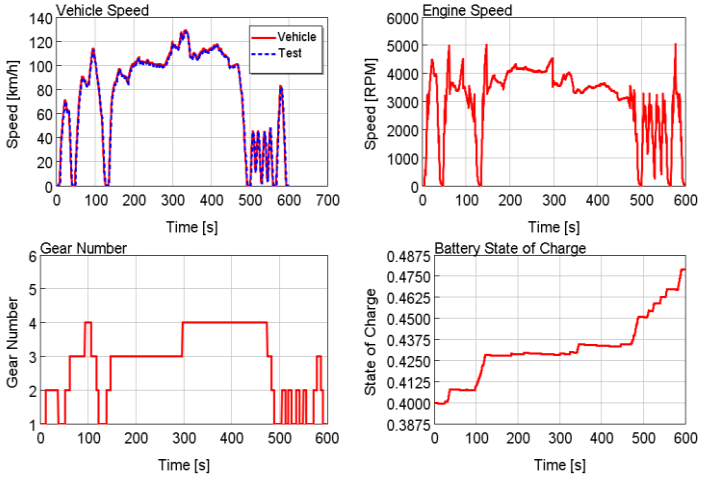
变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

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。

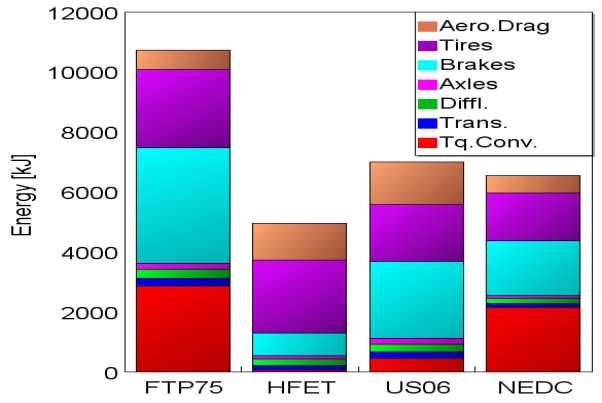
可以定制哪些输出？

- ✓ 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

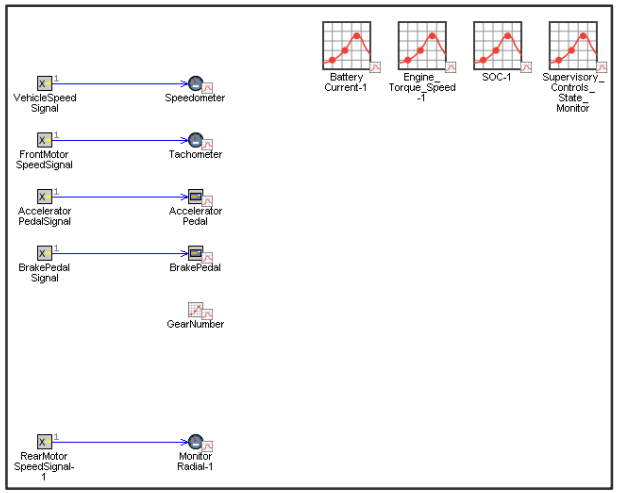


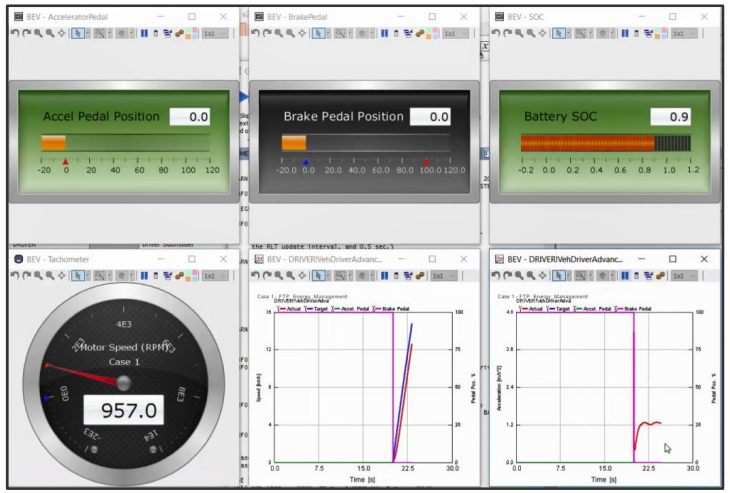
变量	A.定制模块	B.定制架构	C.定制计算	D.定制输出	E.修改脚本

1. 设置监控参数；

2. 设置Plots输出；

3. 设置整车能量损失输出；



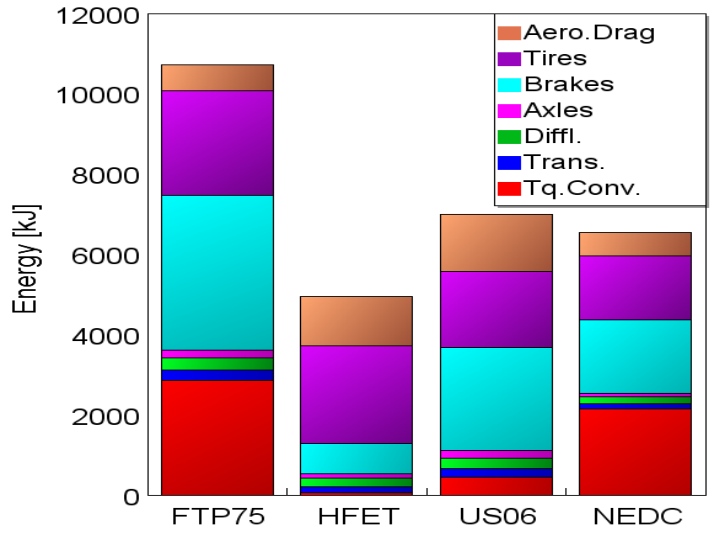


Main | Advanced | Actuator Position | GT-POST Output | Plots

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)	☑



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

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

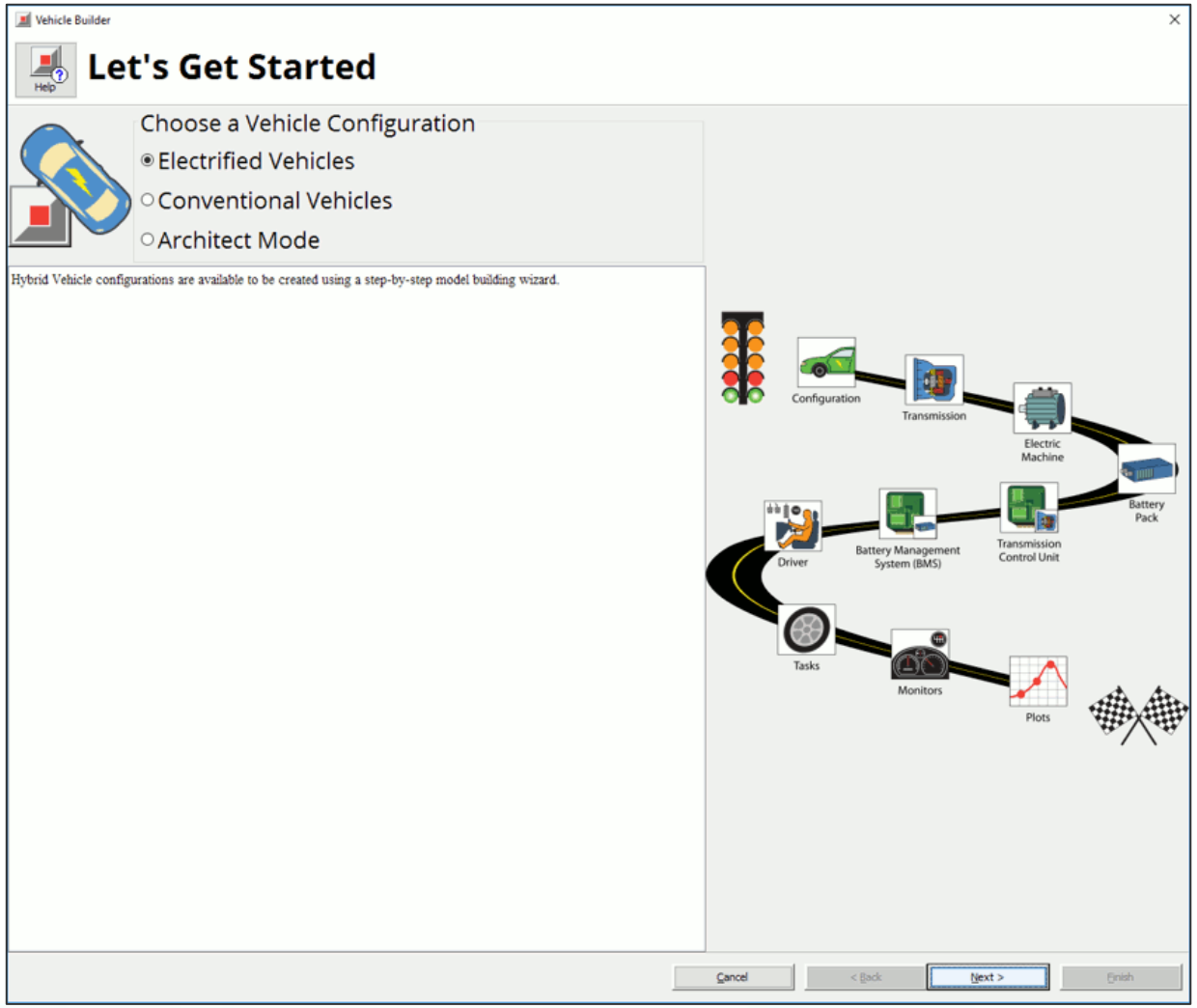
Attribute	Object Value
EndOfRunTables are designed for displaying RLTs from single o...	
Location of Model Configuration Sweep	1xN Table Only (no sweep)
Parameter Defining Configurations	Configuration
Results for each Model Configuration...	Column
EndOfRunTable Object 1	VehicleResultsSummary
EndOfRunTable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

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

前面建立的.gtdrive即可直接当做架构模板供用户使用。

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。



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

```
    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

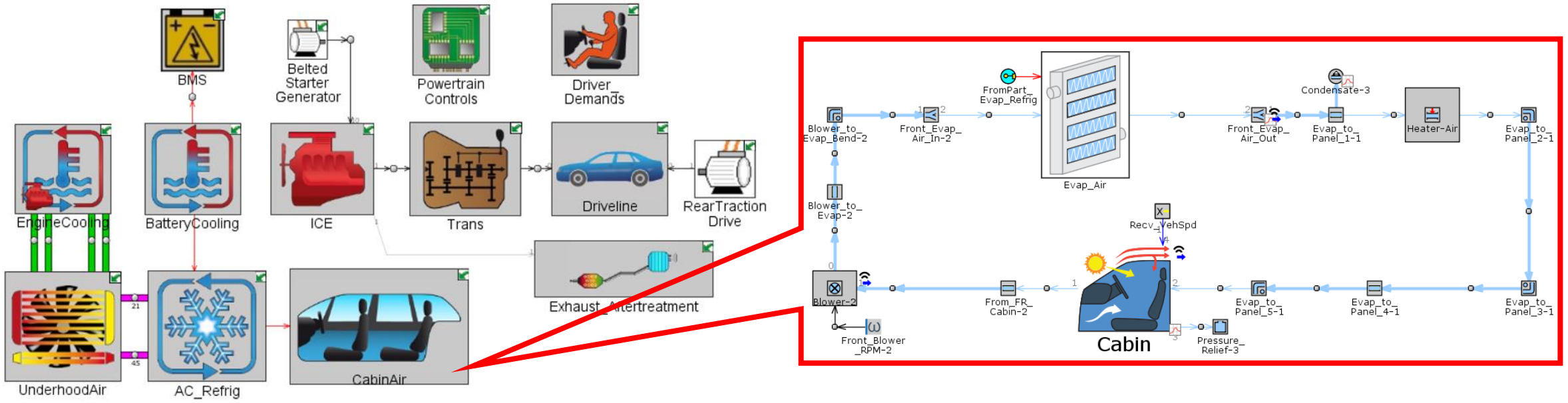
- GT-DRIVE+ 是新一代车辆仿真方式，旨在处理新一代复杂的车辆架构
- GT-DRIVE+ 能够提供可随时搭建车辆特征和建模流程，显著提高用户工作效率
- GT-DRIVE+ 为架构师提供了高效搭建和维护车辆模拟的平台，供终端用户使用
- GT-DRIVE+与架构师一起将系统仿真专业化、流程化、标准化

目录

- GT-DRIVE+
- GT-SUITE架构师
- **新一代系统仿真模式**

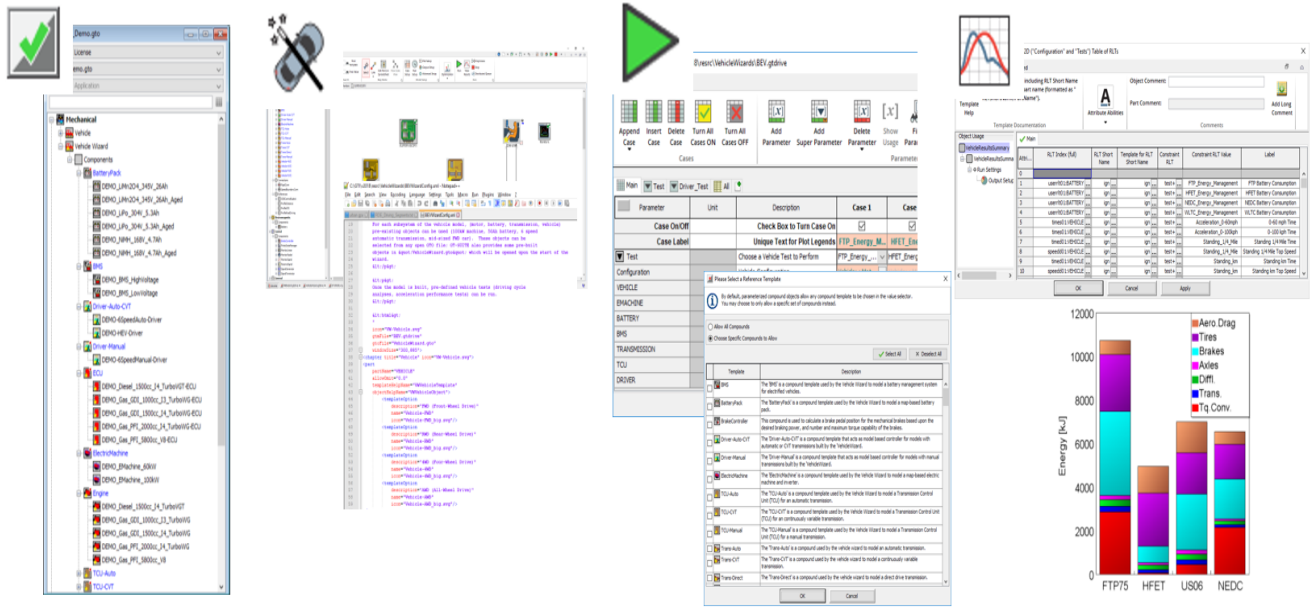
新一代系统仿真模式

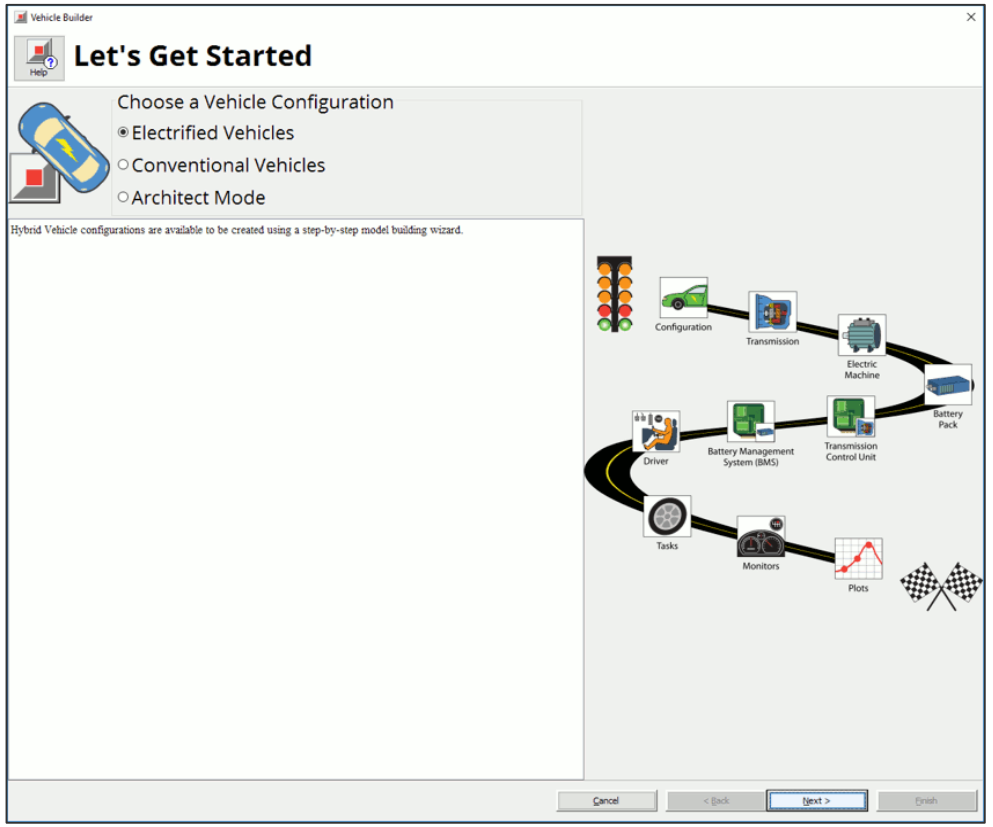
- GT-DRIVE+实现了整车动力性、经济性的架构式建模及分析
- GT-DRIVE+的思路和方法并不局限于整车动力性经济性模型的搭建
- 可以通过Compound模块、模块级变量及.gtdrive文件实现任意类型及数量的子系统/模块模型的耦合架构式建模及分析



新一代系统仿真模式

- 新一代系统仿真模式：客户可根据产品的特点进行架构式模型的搭建，根据子系统/模块特点进行子系统/模块的封装，建立自己的模块库，供用户进行流程化建模及分析的仿真模式。





新一代系统仿真模式

- 企业可以根据产品特点制定不同系统架构
  - ✓实现企业级的规范化、标准化建模
  - ✓便于子系统模型的管理
  - ✓便于仿真模型库和仿真数据库的建立
  - ✓显著提高各阶段的仿真分析效率和响应速度
  - ✓进一步提高产品开发效率和缩短开发周期

新一代系统仿真模式

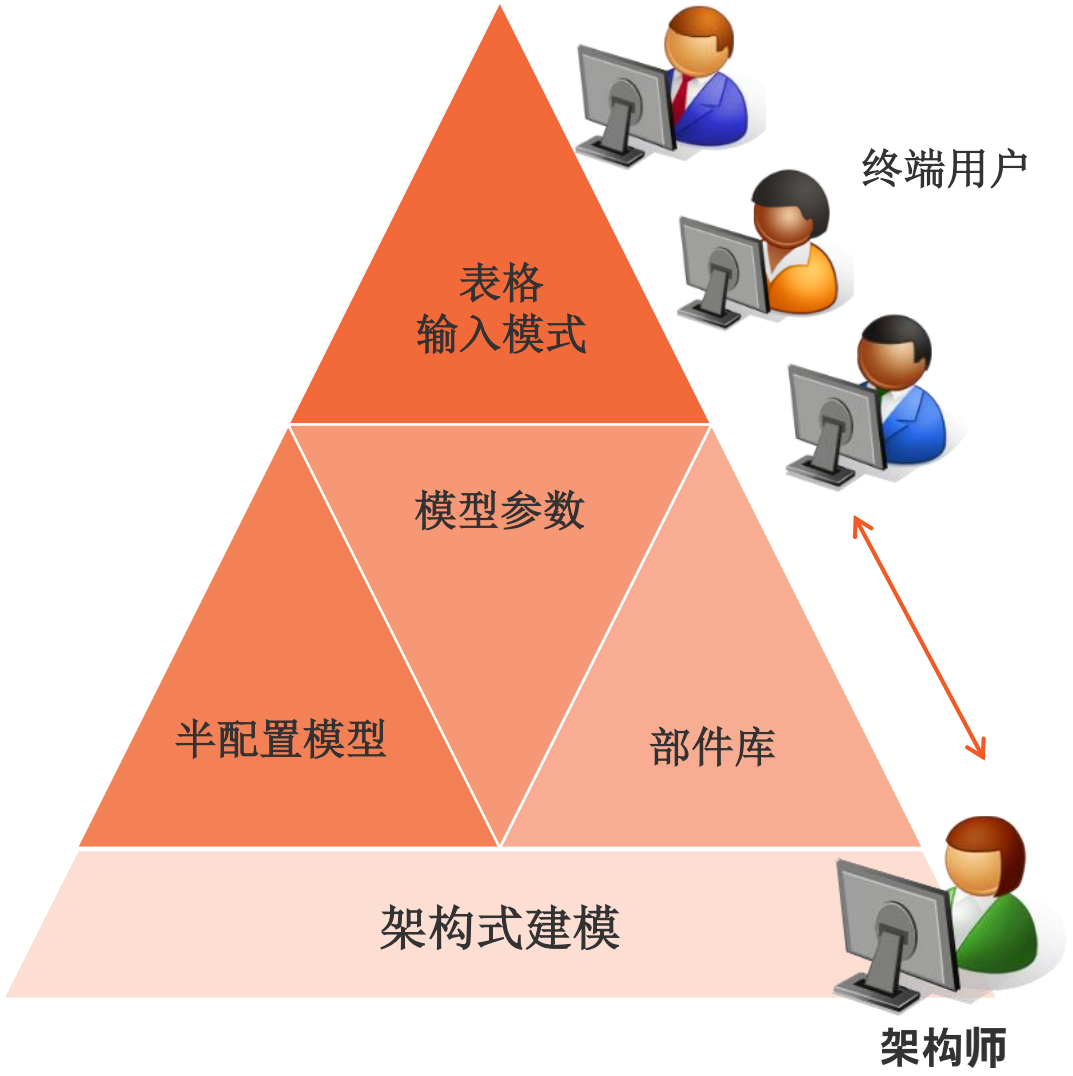
- 部门可以根据研究方向制定不同系统模块
  - ✓实现系统级的规范化、标准化建模
  - ✓便于子系统及部件模型的管理
  - ✓便于仿真模型库和仿真数据库的建立
  - ✓便于部门间多系统的耦合仿真，减少数据沟通环节
  - ✓显著提高各阶段的仿真分析效率和响应速度
  - ✓进一步提高产品开发效率和缩短开发周期

新一代系统仿真模式

- 对于仿真工程师：
  - ✓仿真分析任务更明确（仿真架构工程师、仿真标定工程师、仿真计算工程师）
  - ✓上手更快、效率更高、专业性更强
  - ✓仿真任务流程化、标准化
  - ✓便于仿真模型库和仿真数据库的建立
  - ✓显著提高各阶段的仿真分析效率和响应速度
  - ✓进一步提高产品开发效率和缩短开发周期

新一代系统仿真模式

- 系统仿真架构工程师：
  - ✓各级子系统模块的制定
  - ✓产品相应架构模型的制定
  - ✓各类计算任务、输入、输出的制定
- 仿真标定工程师：
  - ✓各子系统及模块模型的建立及标定
  - ✓多系统耦合模型的标定
- 仿真计算工程师：
  - ✓具体仿真任务的计算
  - ✓仿真计算的分析及输出



总结

- GT-Suite是进行多物理场系统耦合仿真分析最理想的工具
- GT-DRIVE+实现了整车动力性、经济性的架构式建模及分析
- GT-SUITE支持子系统及功能模块的自定义和封装
- GT-SUITE支持架构式模型的搭建
- GT-SUITE提供的新一代系统仿真模式能降低系统仿真的难度，有助于解决仿真工程师任务的划分、模型库和仿真数据的建立等问题，并将系统仿真专业化、流程化、标准化，提高仿真效率，进一步缩短产品开发周期，降低开发成本

期待与您的进一步合作 ☺

IDAJ-China官方微信公众号

扫码关注获得：

- 获得海内外最新CAE资讯/干货
- 免费参加培训/市场活动
- GT-SUITE产品专栏
- 直播视频回顾

联系我们

- https://www.idaj.cn/
- support@idaj.cn
- 021-50588290；010-65881497