

PCB RLC Extraction

China CPS Team

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AppBrief Requirements (Title matches the engineering challenge we are trying to solve (not simulation challenge))

PCB RLC参数提取挑战

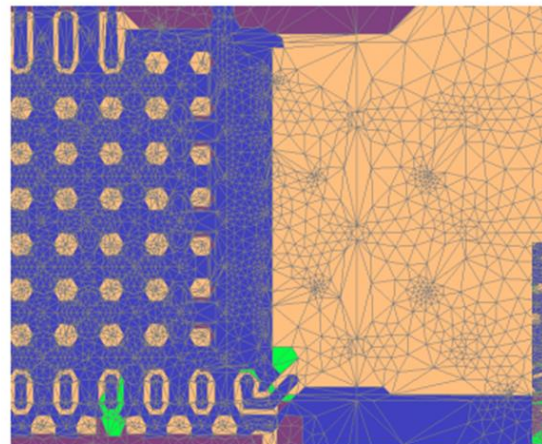
- PCB密度和集成度越来越高，传统的参数提取工具无法满足中型及超大PCB RLC提取的需求；
- 传统的参数提取工具对PCB叠层结构参数提取不准确且求解时间长；

ANSYS解决方案

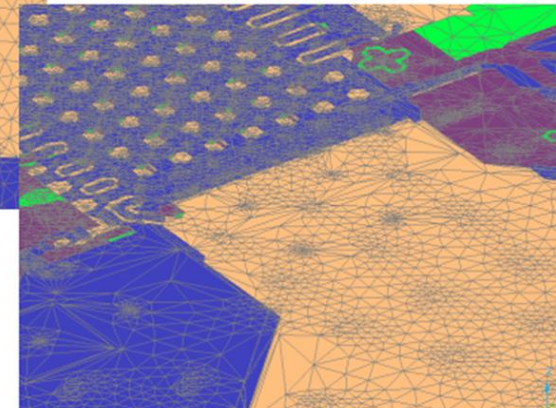
- ANSYS SIwave CPA采用FEM Solver，对信号线以及source和sink的数量没有限制，可以对提取成百上千net的RLC参数，和大规模的PDN结构；
- 包含MoM Q3D Solver，满足高精度参数提取的需求；

Benefits

- 非常高容量的FEM求解器-全封装和PCB结构-上万个source/sink；
- 快速提取（几分钟到几小时-即使对与拥有上万个net的超大PCB结构）
- 适用多种结构：RDL、TSV、层压板PKG、PCB以及多Die等结构；

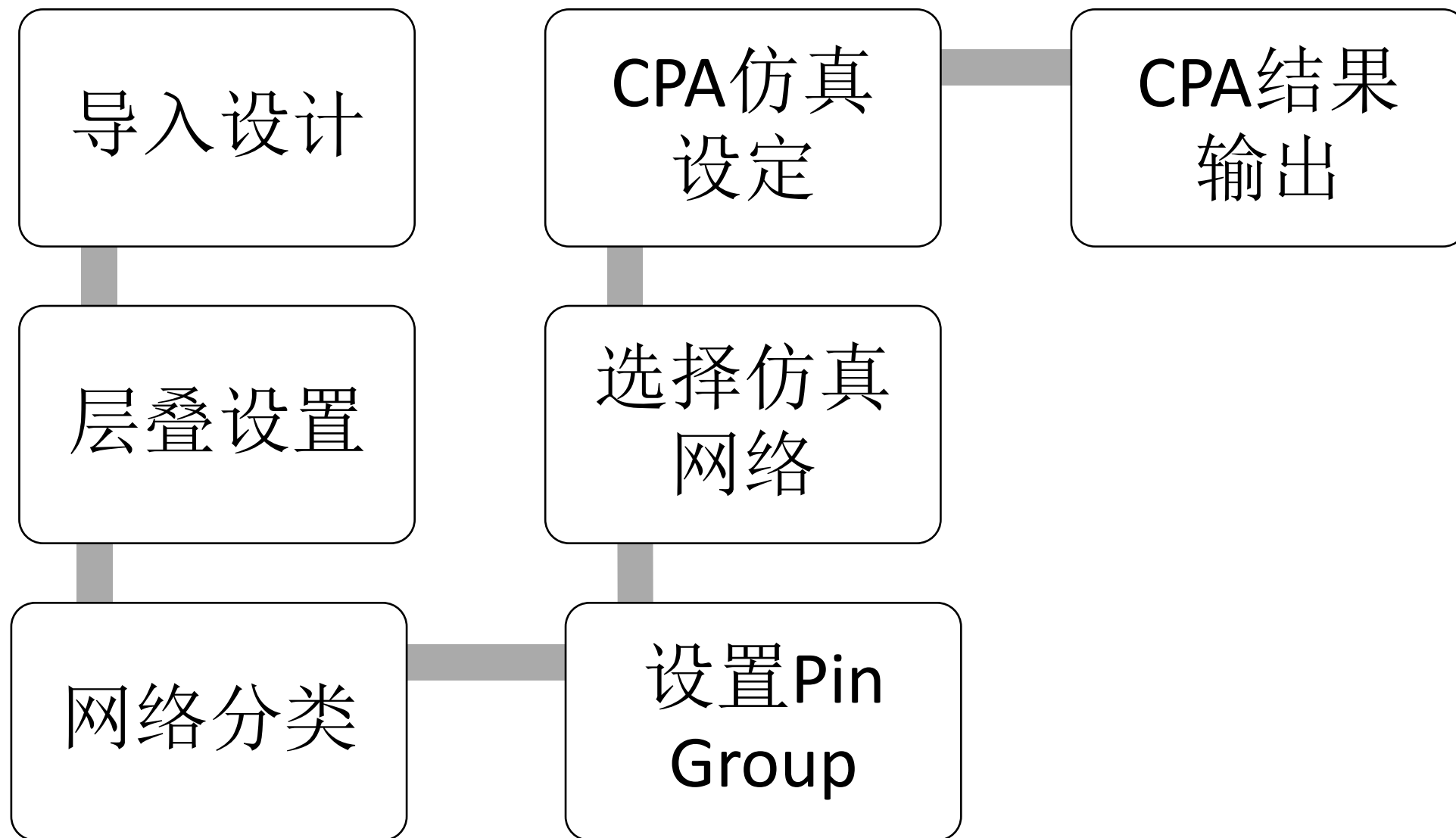


- Conformal composite mesh elements
- Identification of domains and key geometry areas

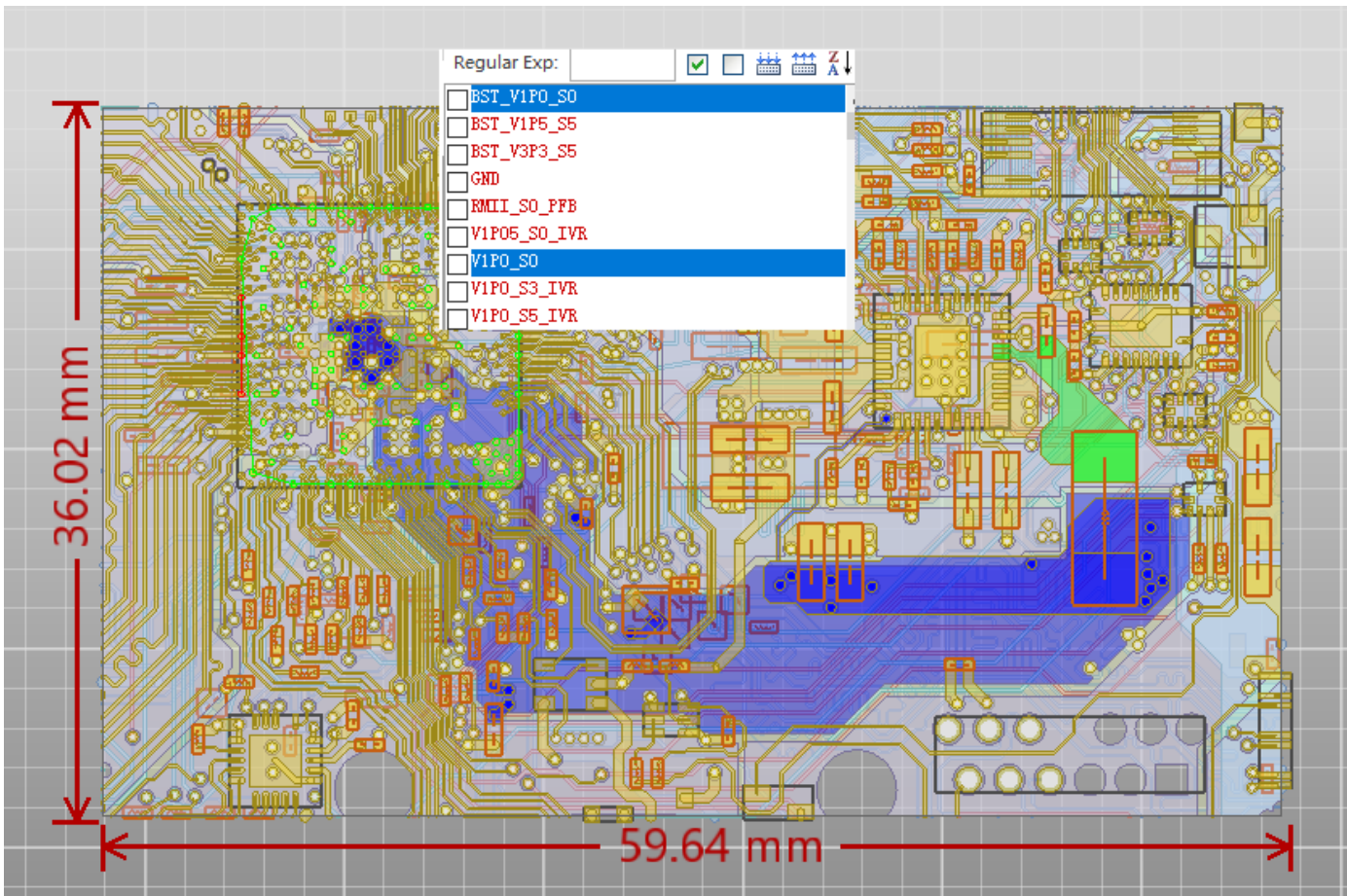


Mesh technology is critical for high-capacity simulations. Proper use of higher-order elements helps in controlling number of unknowns

PCB RLC Extraction Workflow

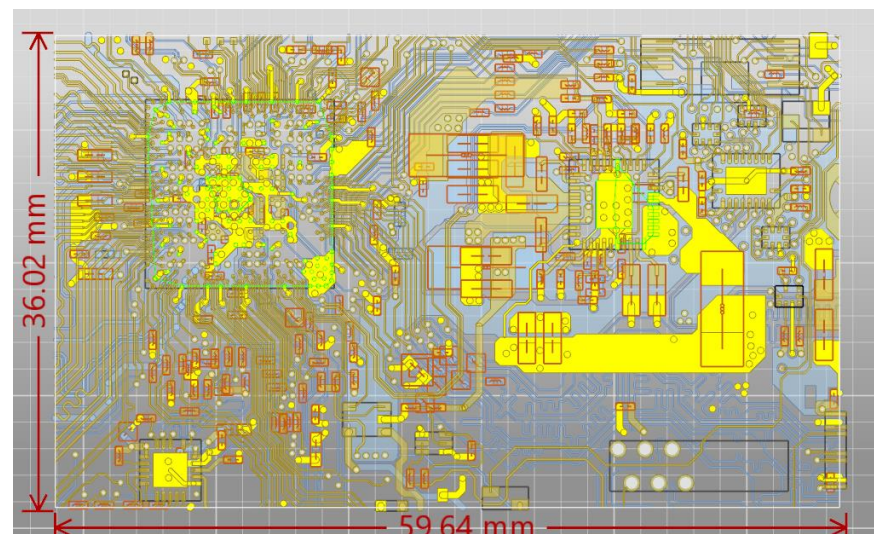
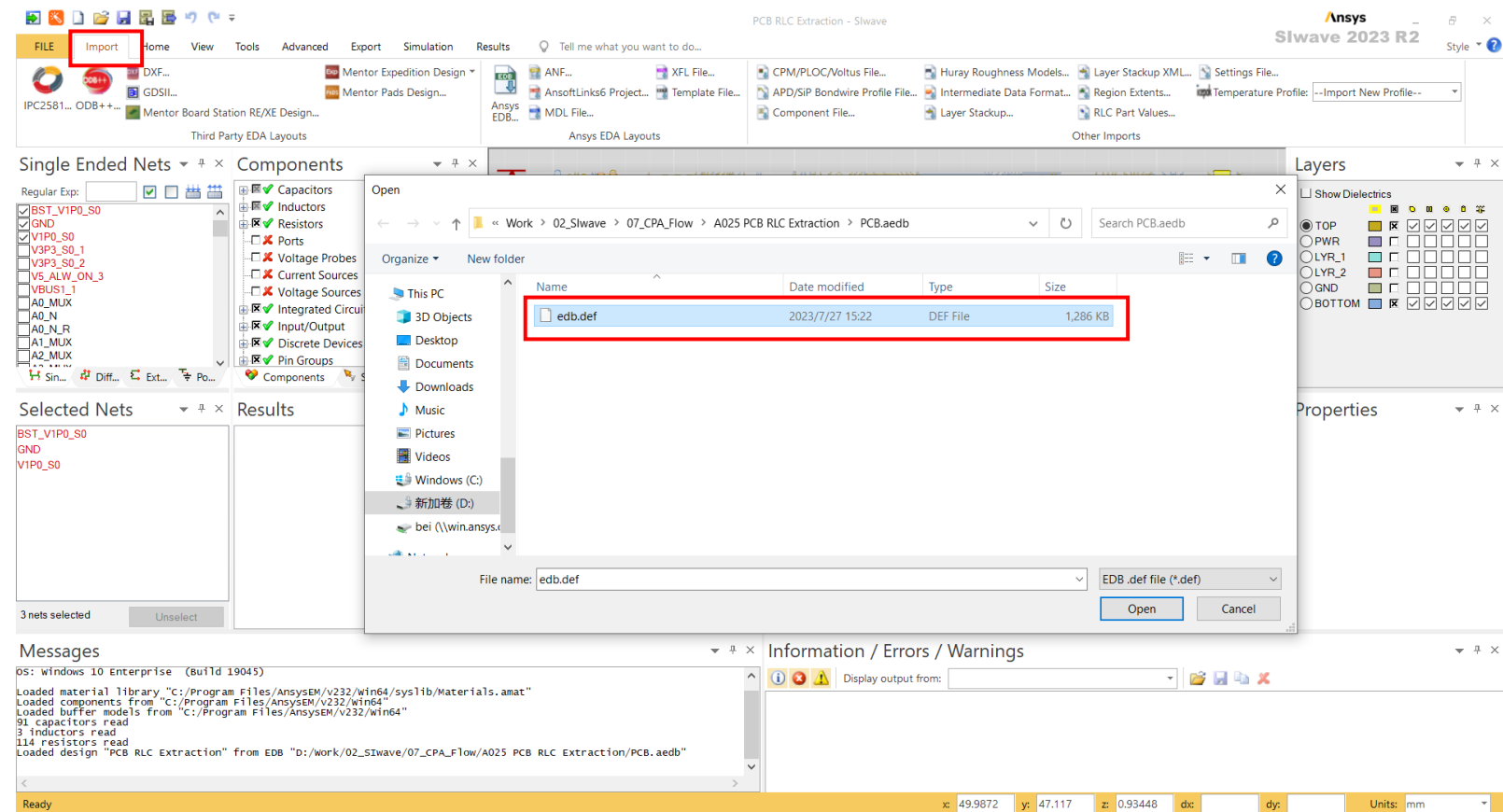


仿真demo背景

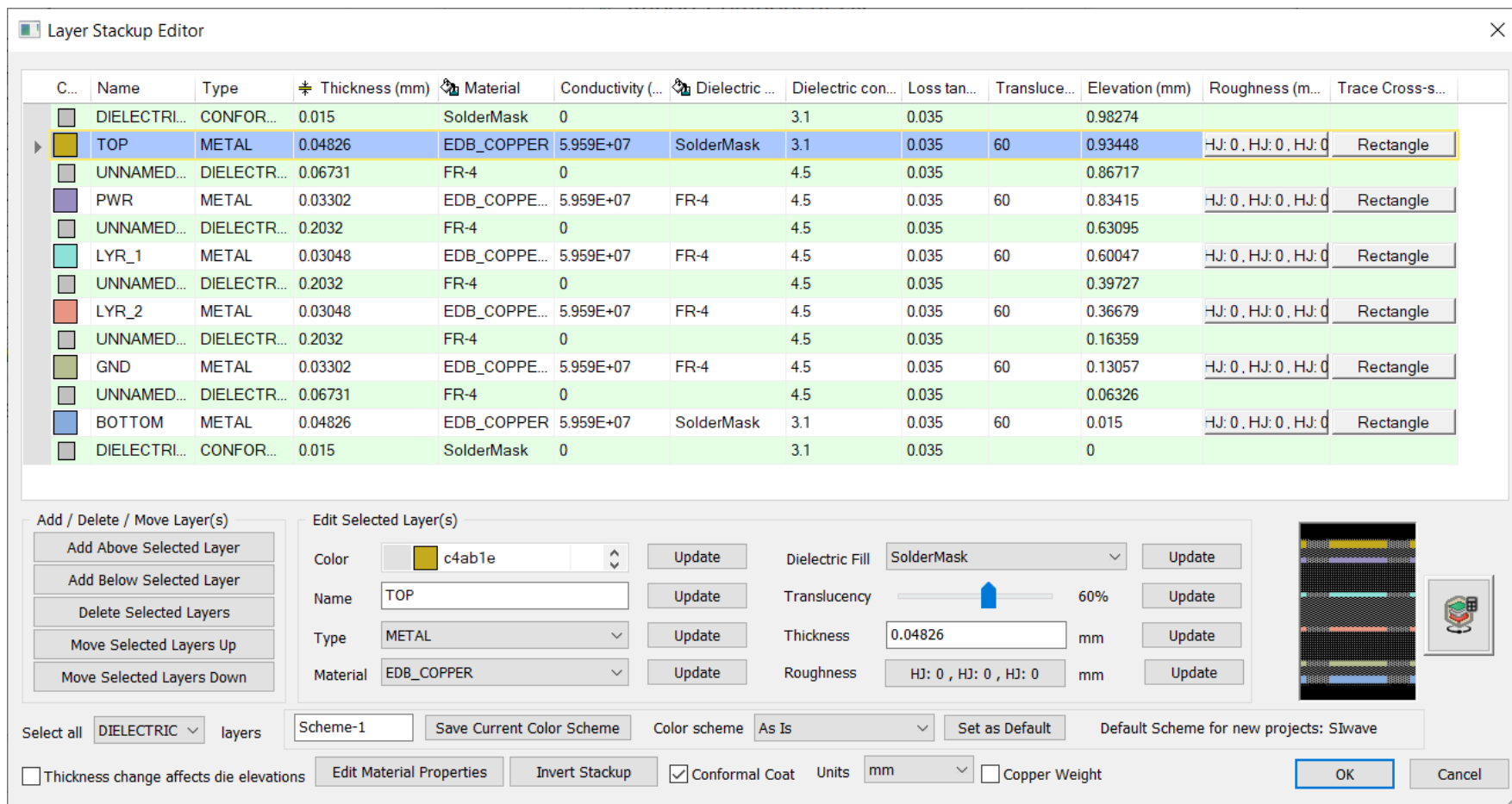
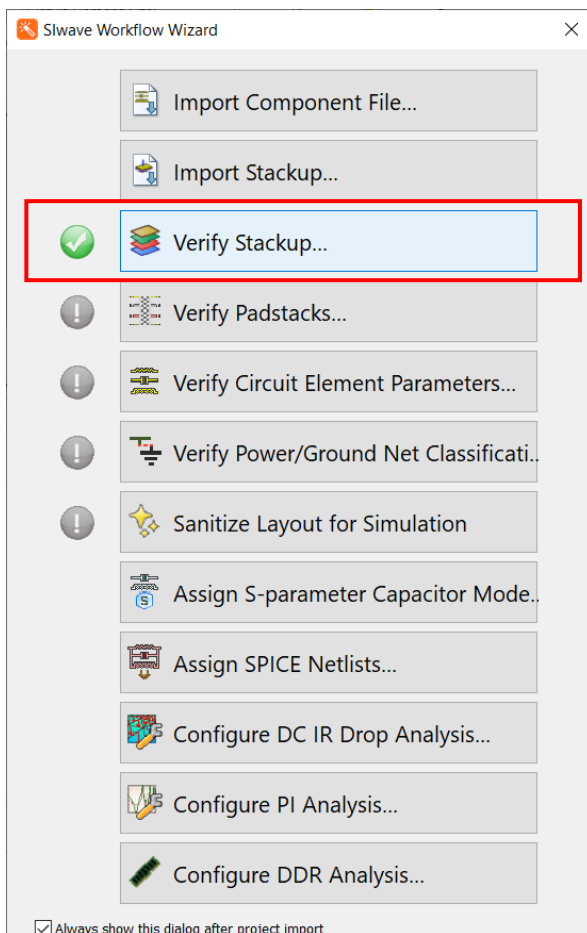


- 准备条件：
 - PCB设计文件
 - 层叠信息
- 仿真目标：
- 提取电源网络BST_V1P0_S0、V1P0_S0以及GND网络的寄生参数

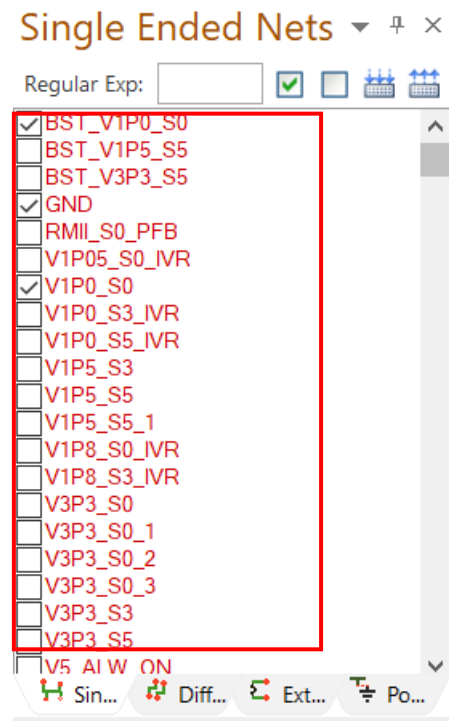
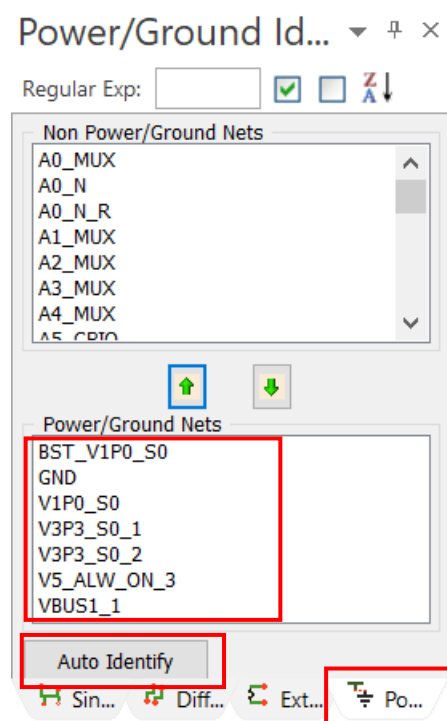
导入设计



层叠设置

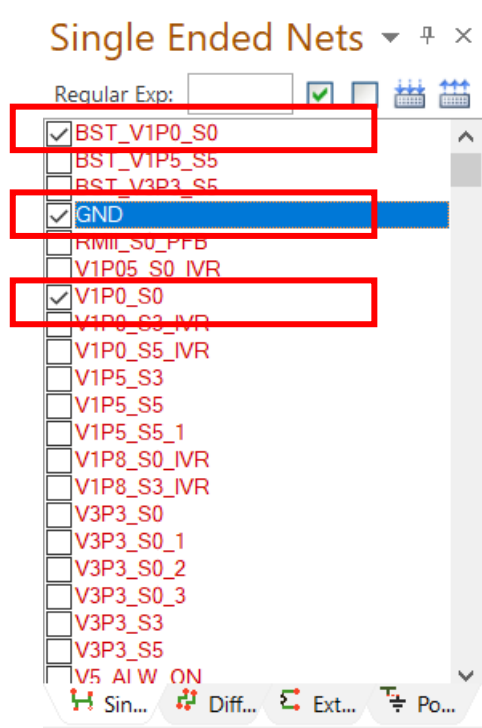


网络分类



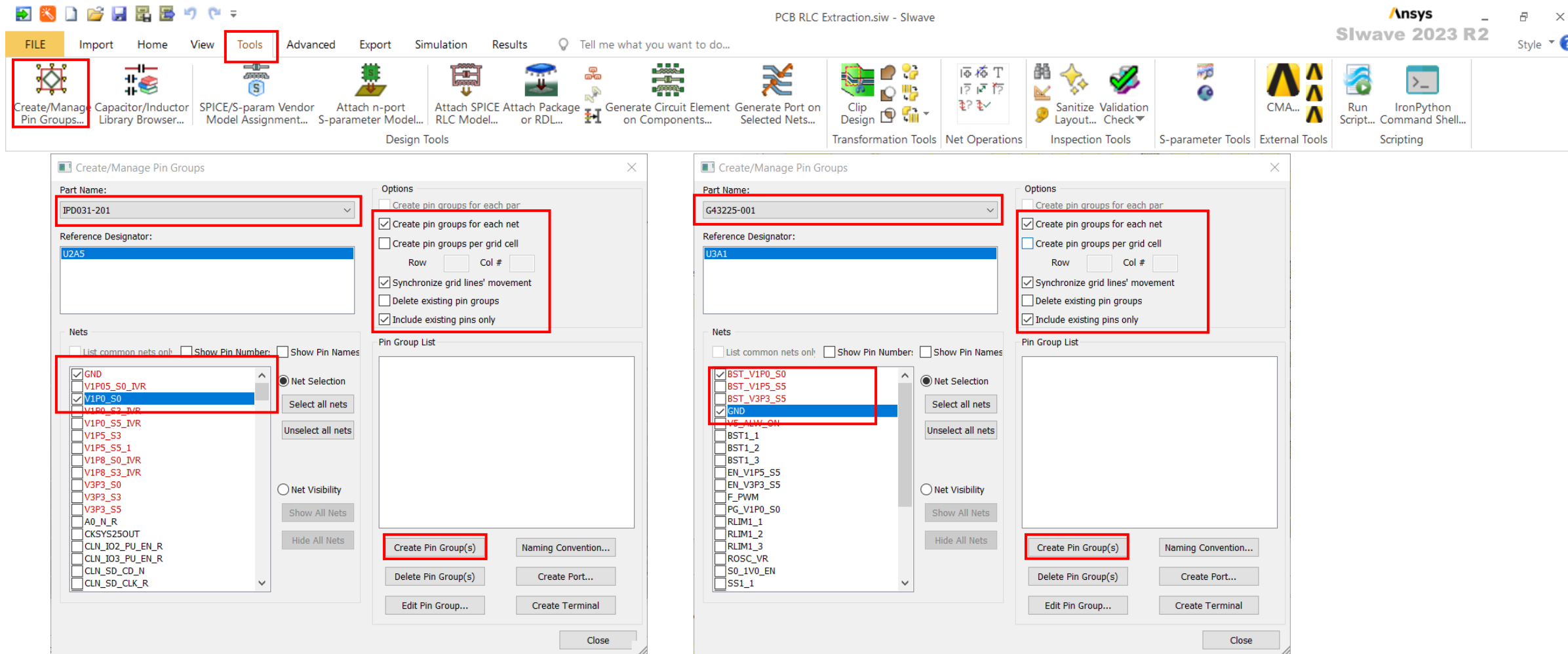
对电源和地网络进行分类

/ 选择要仿真的net



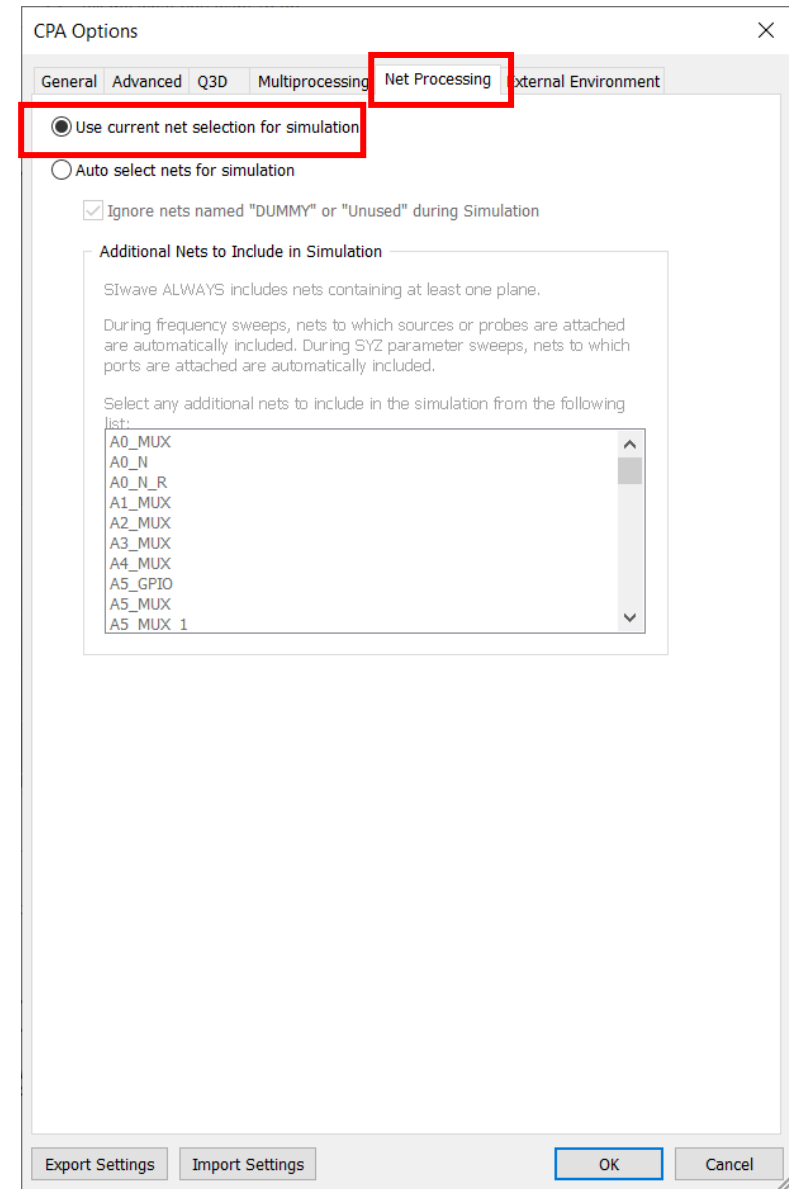
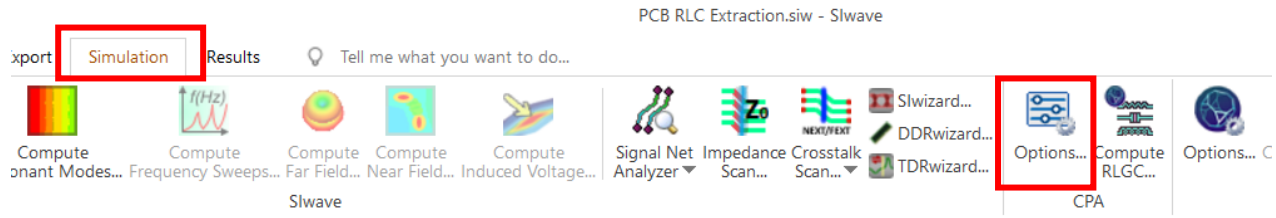
选择电源网络BST_V1P0_S0、V1P0_S0以及GND网络

设置Pin Group

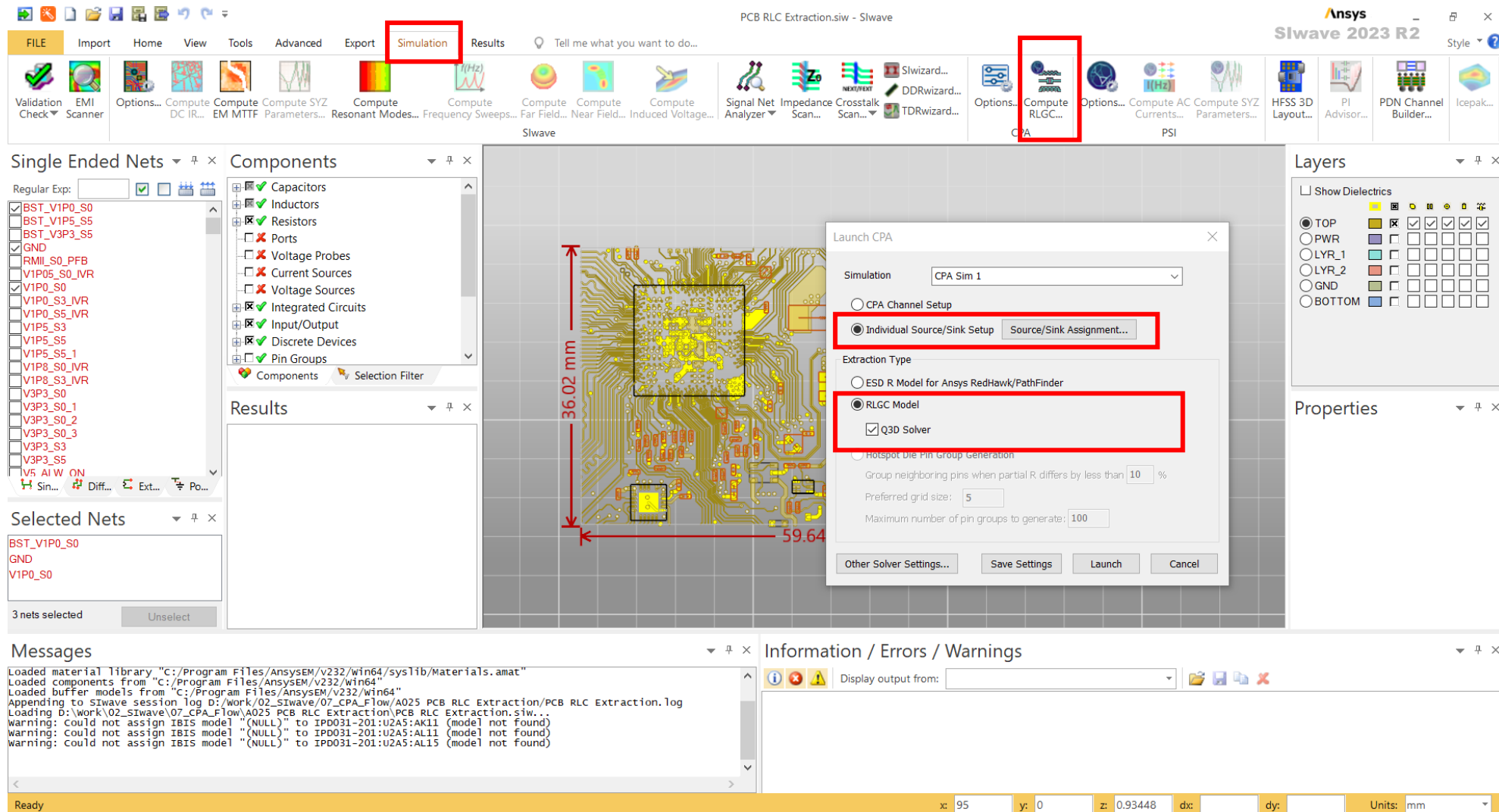


选择对应器件分别对要仿真的Nets进行Pin Group

CPA Option



方法1：选择individual模式：采用Q3D求解器



方法1：选择individual模式：设置source、sink

Terminal Assignment

Assign Node Type

Display Ports

Net	Node (Group)	Component	Node Kind	Node T...
BST_V1P0_S0	U3A1_BST_V1P0_S0_Group	U3A1	Pin Group	Source
GND	U3A1_GND_Group	U3A1	Pin Group	Source
V1P0_S0	U2A5_V1P0_S0_Group	U2A5	Pin Group	Source
BST_V1P0_S0	L4B1:BST_V1P0_S0:1	L4B1	other	Sink
V1P0_S0	L4B1:V1P0_S0:2	L4B1	other	Sink
GND	U2A5_GND_Group	U2A5	Pin Group	Sink
GND	U2:GND:3	U2	other	Float
GND	EU1:GND:11	EU1	other	Float
GND	EU1:GND:21	EU1	other	Float
GND	Q4:GND:2	Q4	other	Float
GND	R3L5:GND:2	R3L5	other	Float
GND	R3M7:GND:2	R3M7	other	Float
GND	R2L20:GND:2	R2L20	other	Float
GND	C3L22:GND:2	C3L22	other	Float
GND	C3M8:GND:2	C3M8	other	Float
GND	C3M7:GND:2	C3M7	other	Float
GND	C3M6:GND:2	C3M6	other	Float
GND	C3M5:GND:2	C3M5	other	Float
GND	C3L25:GND:2	C3L25	other	Float
GND	C3L27:GND:2	C3L27	other	Float
GND	C3M1:GND:2	C3M1	other	Float
GND	C3M2:GND:2	C3M2	other	Float
GND	C3L30:GND:2	C3L30	other	Float
GND	R3L6:GND:2	R3L6	other	Float
GND	R3L7:GND:2	R3L7	other	Float
GND	R2M6:GND:2	R2M6	other	Float
GND	R3L13:GND:2	R3L13	other	Float

Source/Sink Assignment...

Simulation: CPA Sim 1

CPA Channel Setup

Individual Source/Sink Setup

Extraction Type

ESD R Model for Ansys RedHawk/PathFinder

RLGC Model

Q3D Solver

Hotspot Die Pin Group Generation

Group neighboring pins when partial R differs by less than 10 %

Preferred grid size: 5

Maximum number of pin groups to generate: 100

Other Solver Settings...

Save Settings

Launch

Cancel

Source

Sink

Float

Apply

Terminal Validation

Setup is Valid.

OK

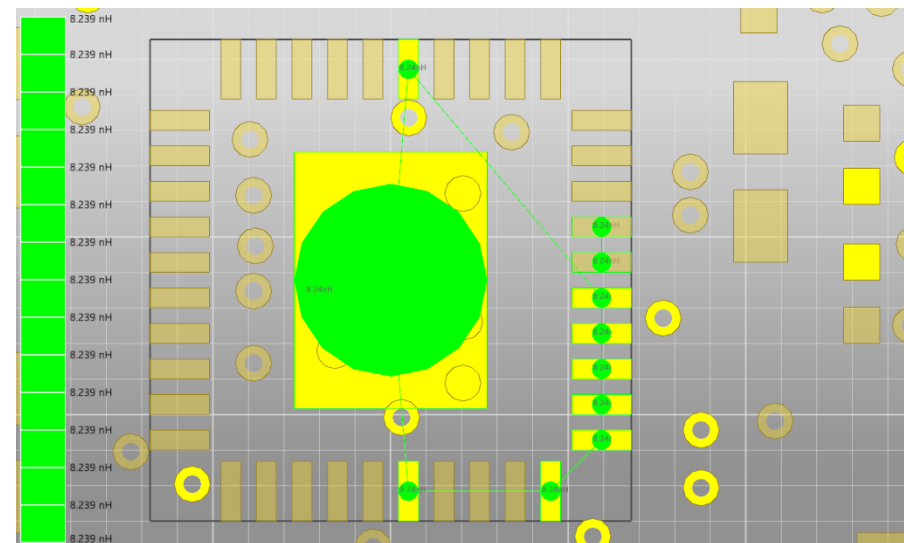
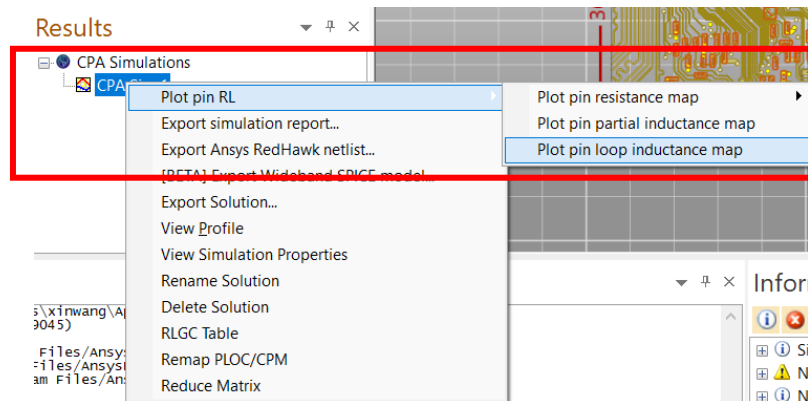
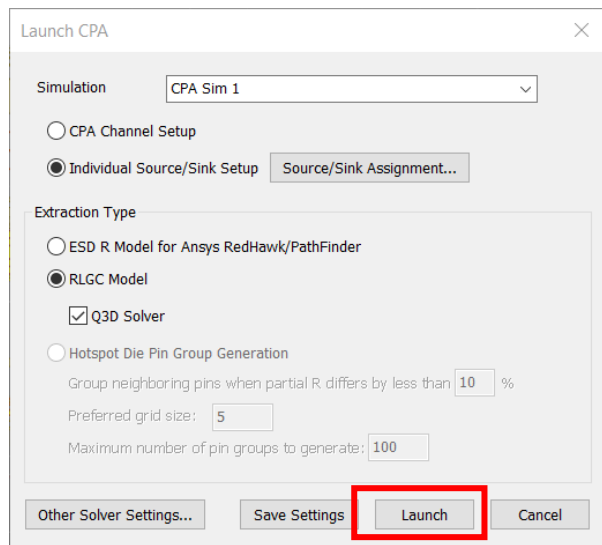
Verify

OK

Cancel

Hide RLCs

方法1：选择individual模式：采用Q3D求解器



Process Monitor (CPA Sim 1)

Display: Messages

E16347-001_C3B17 :: E16347-001
***** EOF Components in the simulation *****

Number of cores = 4

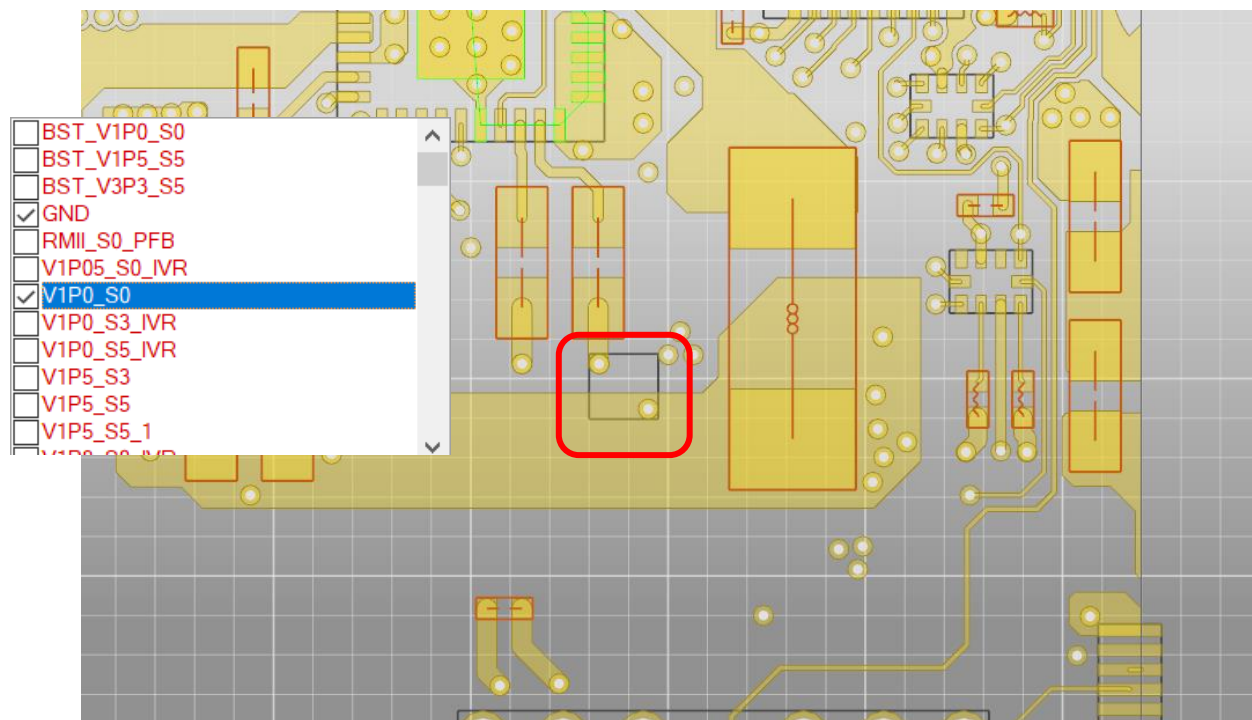
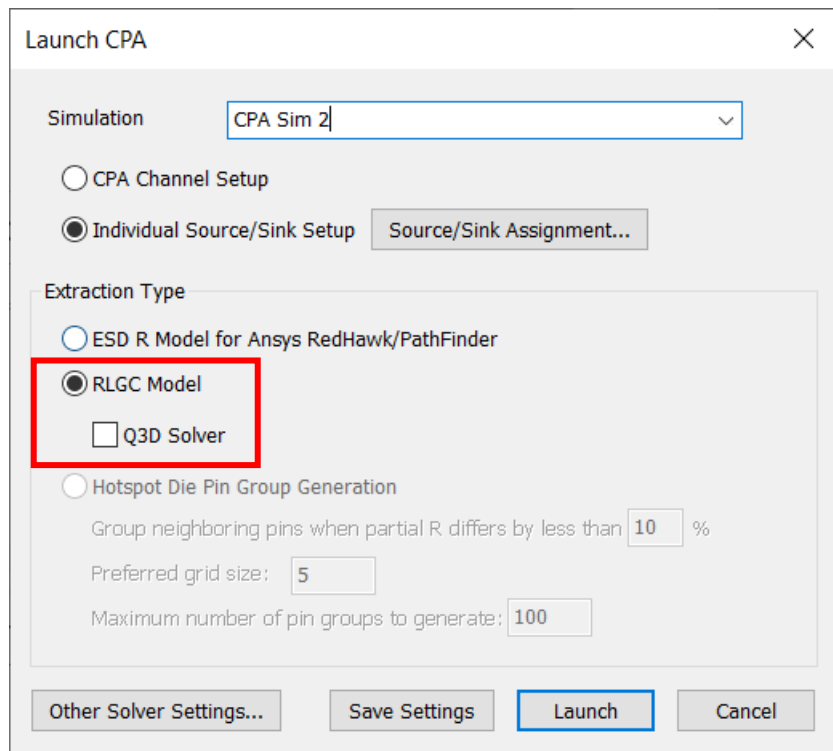
Package EM extraction in progress ...
* CPA-Q3D CG Extraction in progress
CG solve Maximum adaptive passes = 4 Target percent error = 5.000

start CG solution in beixwang

Setup: 100%

Simulation: 10%

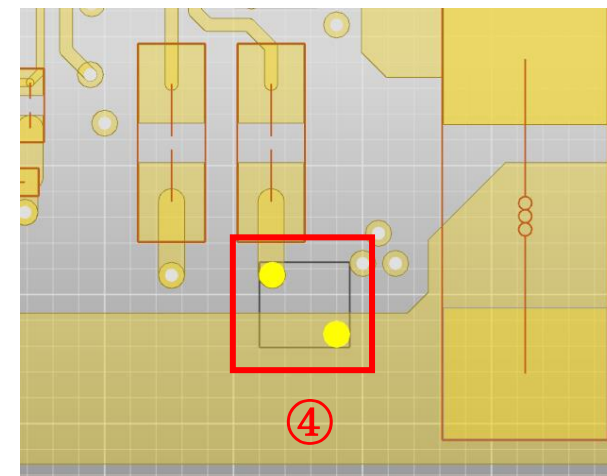
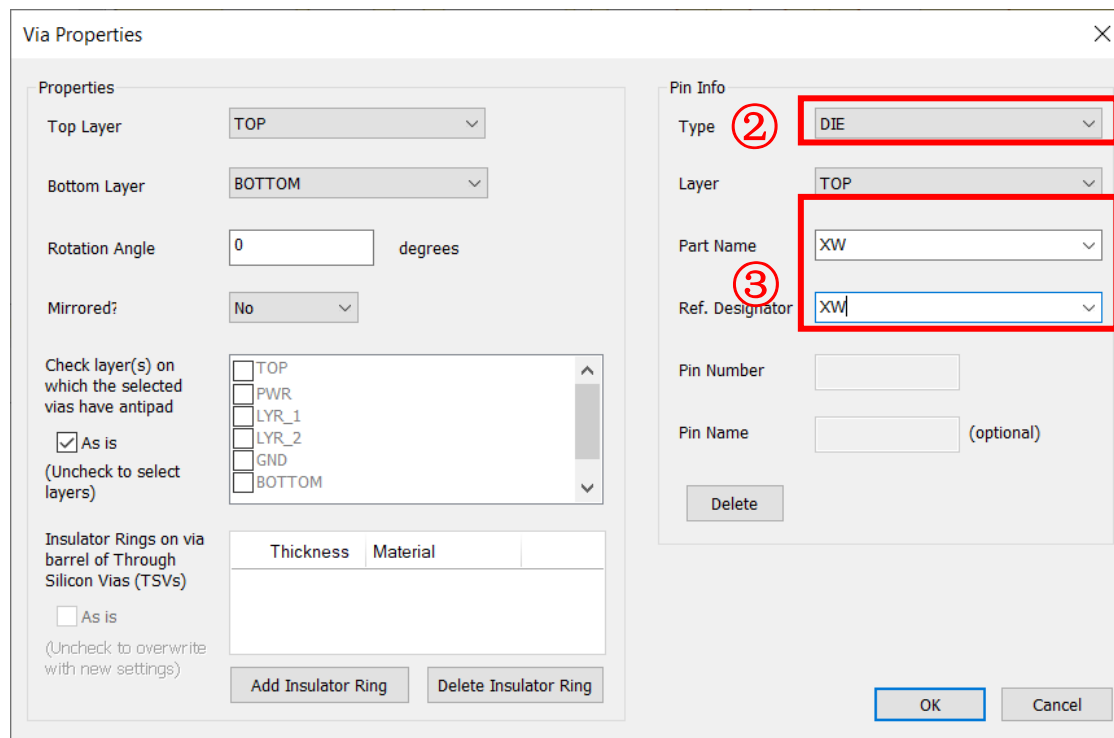
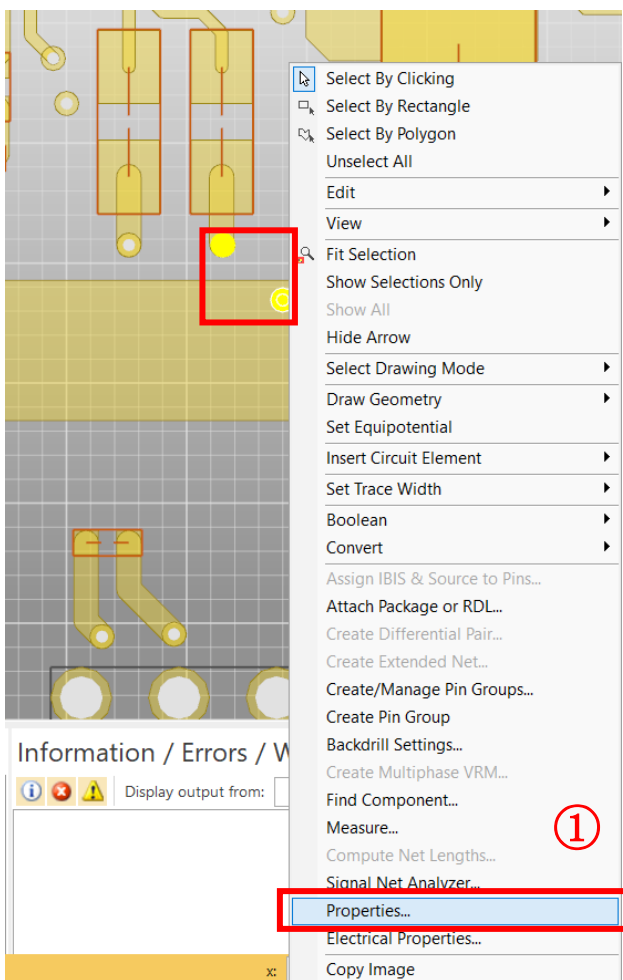
方法2：选择individual模式：采用CPA求解器



以提取V1P0的网络为例，也就是需要在电感下端和附件的GND创建一个假器件

注意：CPA FEM求解器需要计算回路参数，由于中间电感处没有对应的GND引脚，所以没有办法直接运行仿真。软件要求每个信号网络对应的GND网络应该在网络的同一端存在一个器件中，所以可通过添加假器件的方法来解决，分布仿真的方法解决。

方法2：选择individual模式：创建假器件方法



选中要创建假器件的过孔（需要给电源和GND设置source、sink的位置）打开属性框，编辑type和名称，点击OK

方法2：选择individual模式：设置source、sink

Launch CPA

Simulation: CPA Sim 2

☐ CPA Channel Setup

☒ Individual Source/Sink Setup [Source/Sink Assignment...](#)

Extraction Type

☐ ESD R Model for Ansys RedHawk/PathFinder

☒ RLGC Model

☐ Q3D Solver

☐ Hotspot Die Pin Group Generation

Group neighboring pins when partial R differs by less than 10 %

Preferred grid size: 5

Maximum number of pin groups to generate: 100

[Other Solver Settings...](#) [Save Settings](#) [Launch](#) [Close](#)

Terminal Assignment

Assign Node Type

Net	Node (Group)	Component	Node Kind	Node Type
V1P0_S0	U2A5_V1P0_S0_Group	U2A5	Pin Group	Source
GND	U2A5_GND_Group	U2A5	Pin Group	Source
V1P0_S0	XW:V1P0_S0:2	XW	other	Sink
GND	XW:GND:1	XW	other	Sink
GND	U2:GND:3	U2	other	Float
GND	EU1:GND:11	EU1	other	Float
GND	EU1:GND:21	EU1	other	Float
GND	Q4:GND:2	Q4	other	Float
GND	R3L5:GND:2	R3L5	other	Float
GND	R3M7:GND:2	R3M7	other	Float
GND	R2L20:GND:2	R2L20	other	Float
GND	C3L22:GND:2	C3L22	other	Float
GND	C3M8:GND:2	C3M8	other	Float
GND	C3M7:GND:2	C3M7	other	Float
GND	C3M6:GND:2	C3M6	other	Float
GND	C3M5:GND:2	C3M5	other	Float
GND	C3L25:GND:2	C3L25	other	Float
GND	C3L27:GND:2	C3L27	other	Float
GND	C3M1:GND:2	C3M1	other	Float
GND	C3M2:GND:2	C3M2	other	Float
GND	C3L30:GND:2	C3L30	other	Float
GND	R3L6:GND:2	R3L6	other	Float
GND	R3L7:GND:2	R3L7	other	Float
GND	R2M6:GND:2	R2M6	other	Float
GND	R3L13:GND:2	R3L13	other	Float
GND	R3L4:GND:2	R3L4	other	Float
GND	C3L21:GND:2	C3L21	other	Float

☐ Source

☒ Sink

☐ Float

[Apply](#)

☐ Display Ports

Terminal Validation

Setup is Valid.

[OK](#)

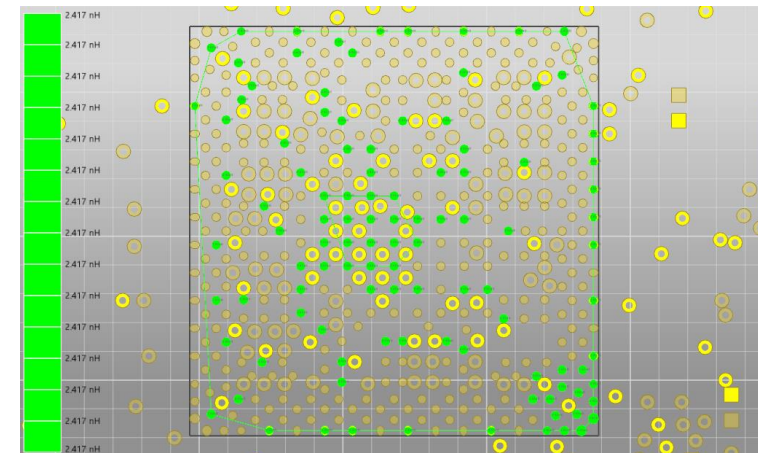
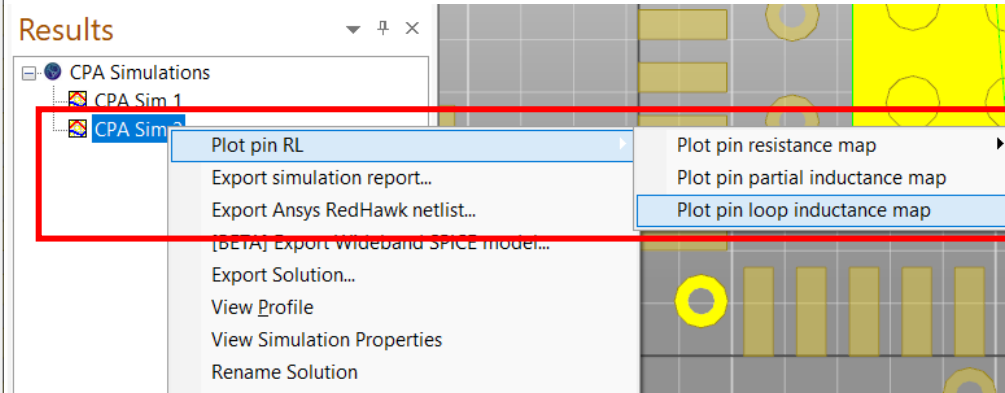
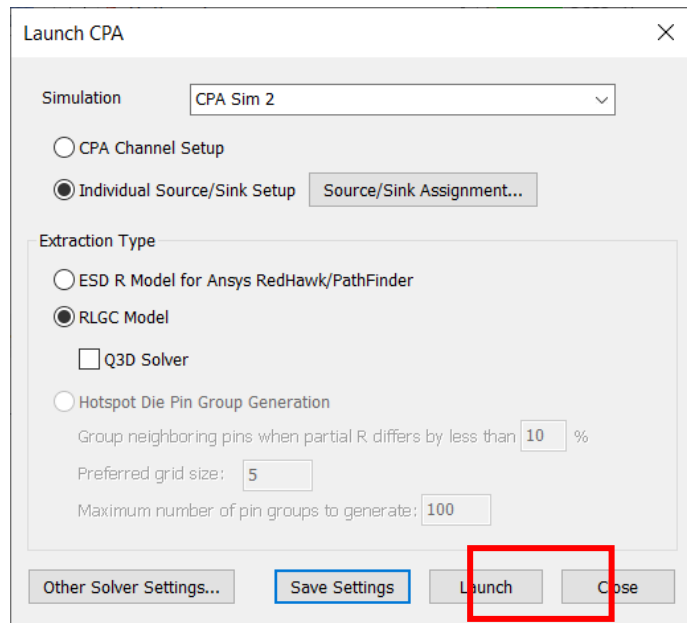
☐ Hide RLCs

[Verify](#)

[OK](#)

[Cancel](#)

方法2：选择individual模式：采用CPA求解器

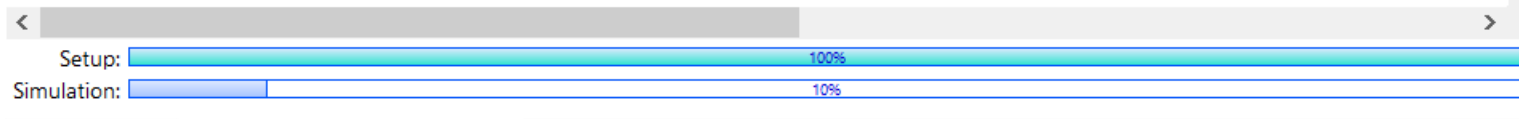


Process Monitor (CPA Sim 2)

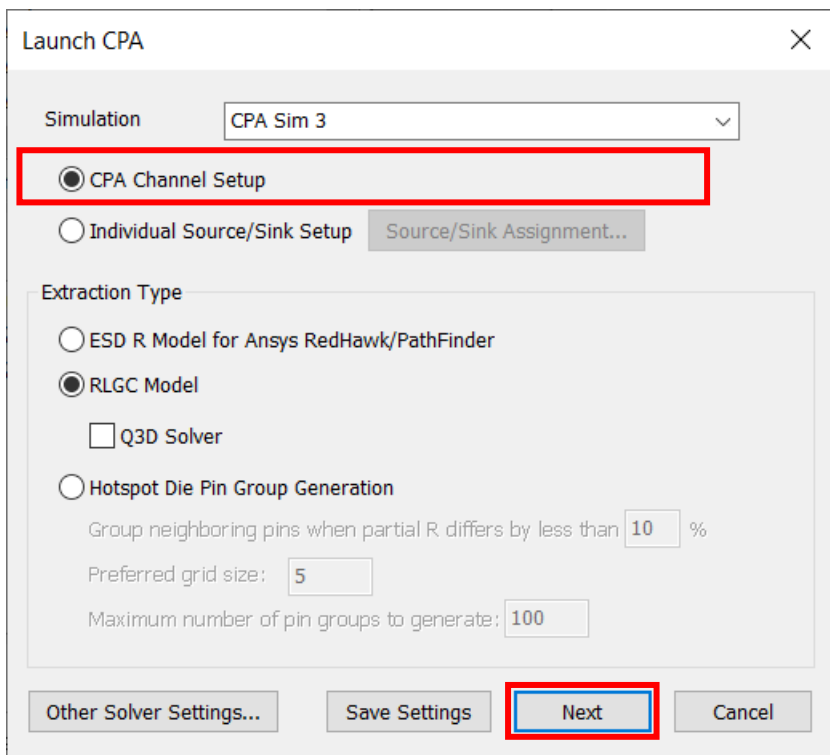
Display: Messages

- * Ref Net = GND
- * Global Die = IPD031-201_U2A5
- * Global VRM = XW_XW
- * Pin groups defined on XW_XW are used for extraction

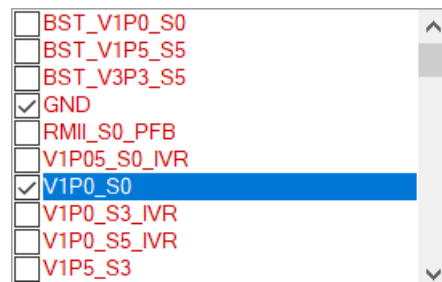
- * Net = v1P0_S0 Sink Comp = XW_XW



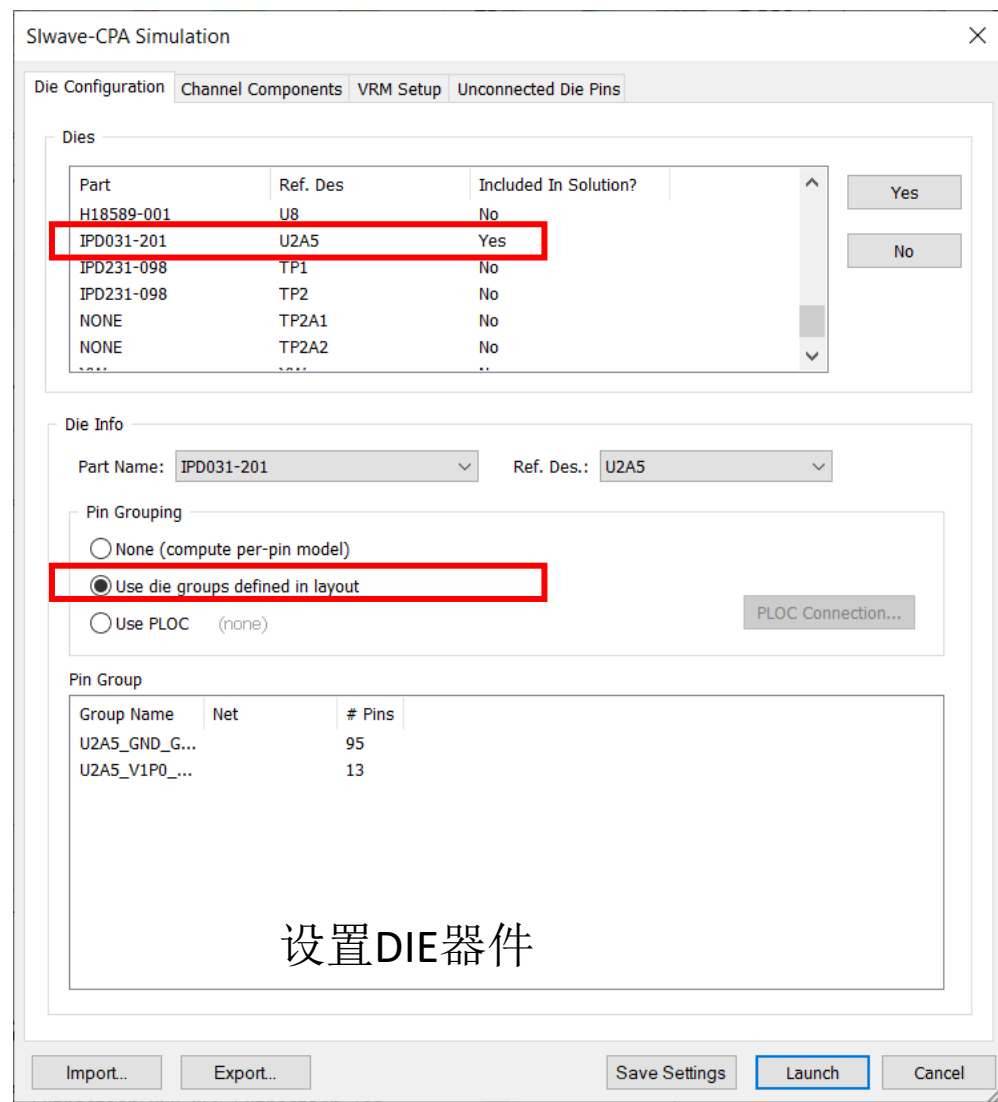
方法3：选择CPA Channel模式：采用CPA求解器



采用CPA channel模式

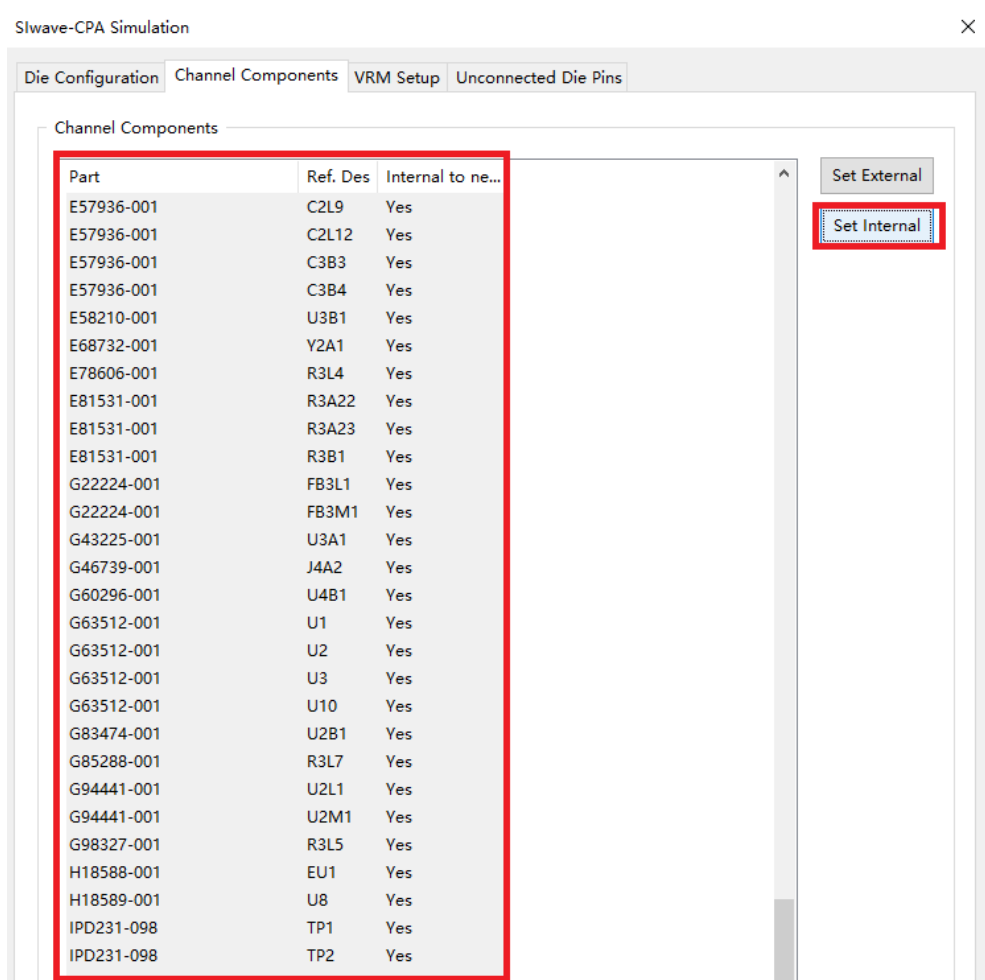


选择仿真网络



设置DIE器件

方法3：选择CPA Channel模式：采用CPA求解器

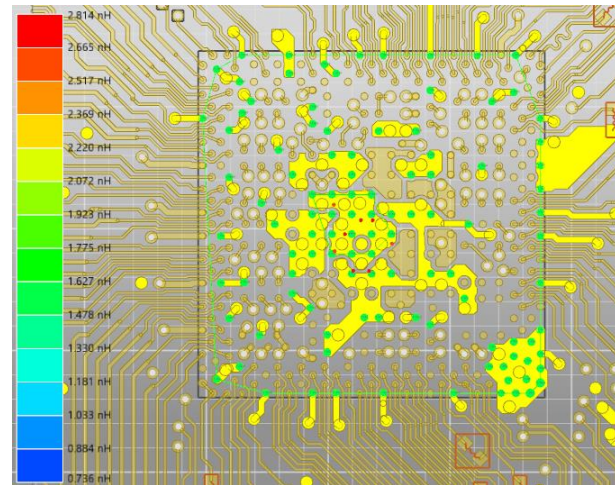
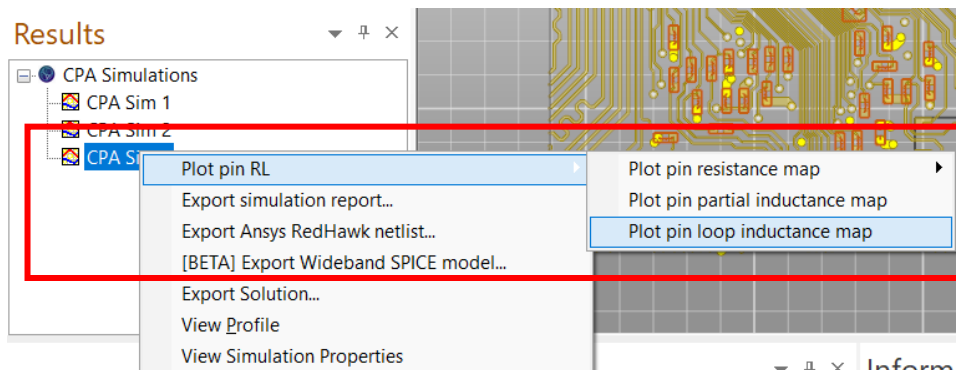
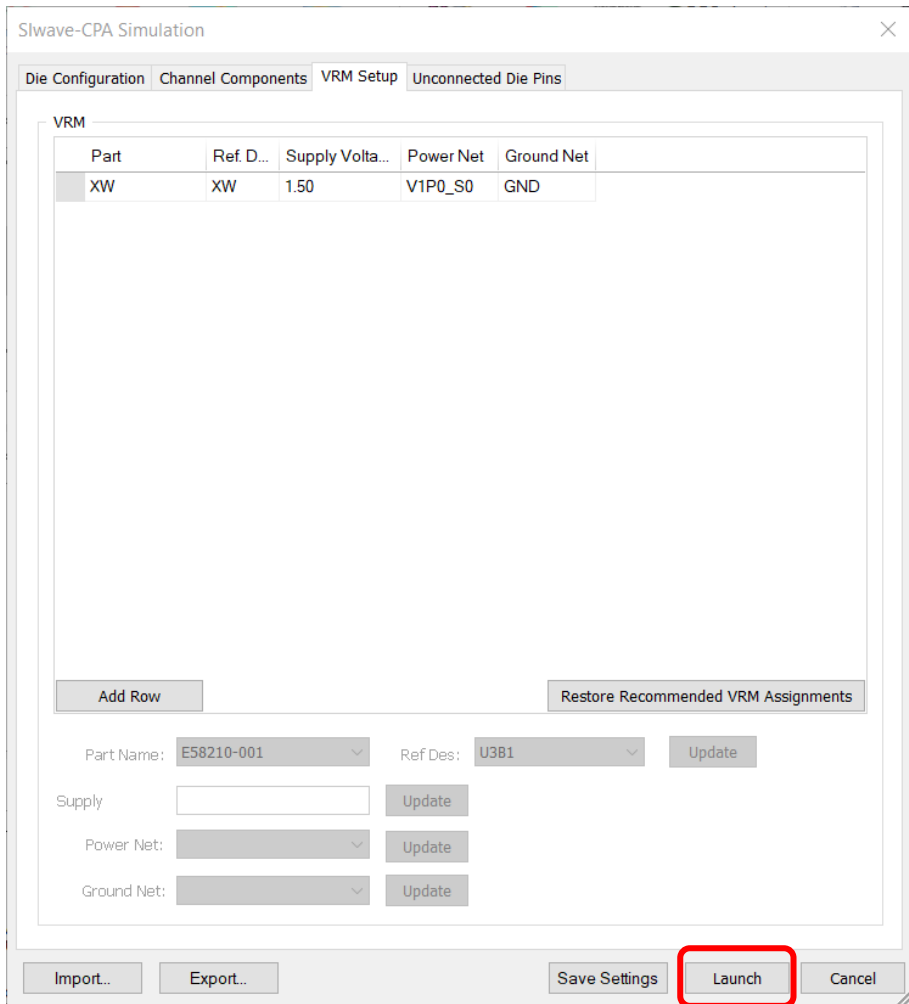


将网络上的元件当成内部元件处理



VRM的设定中，至少或只需要设置一个器件，器件位于仿真的某个网络和GND之间即可。

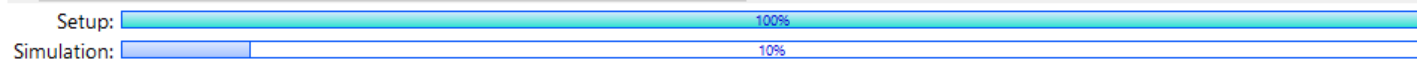
方法3：选择CPA Channel模式：采用CPA求解器



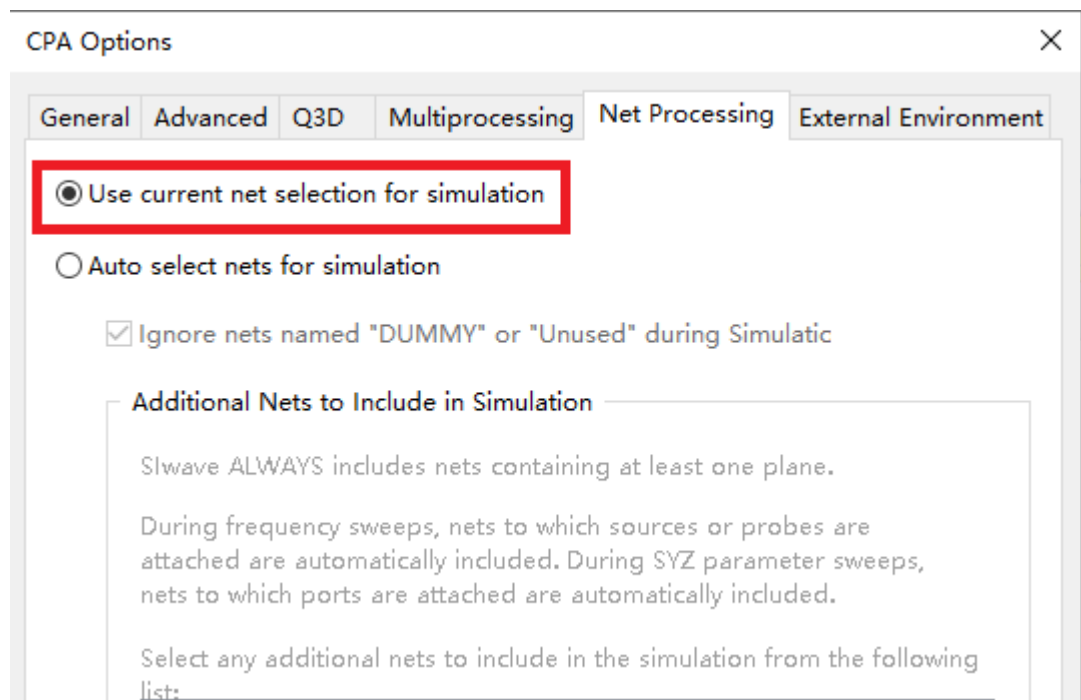
Process Monitor (CPA Sim 3)

Display: Messages

```
C83410-012_C3L29 :: C83410-012
C83410-012_C3L24 :: C83410-012
XW_XW :: XW
C83410-012_C3L20 :: C83410-012
E16347-001_C3B17 :: E16347-001
C97875-001_C3B9 :: C97875-001
***** EOF Components in the simulation *****
```



注意事项



1、CPA设置中设置如上图，对目前选择的网路进行仿真

2、不采用Q3D求解的时候，必须选择两个以上网络
软件需要计算回路参数，需要有网络当成回路。

3、仿真前要对设计进行检查，不能有短断路的情况

4、电源和参考GND需要在网络的两端都有器件连接

Appendix

ALH注册 CPS中文学习室



CPS中文学习室

适用人群：先进封装和系统的SIPI、Thermal、Mechanical工程师。

设计目标：让工程师快速获得最有用、最必要的相关知识（文档、录像、教程）。

主要架构

- 入门必读：包含软件基本功能。每个工程师全部下载并通学。
- 高级技巧：包含最新的高阶流程。需要的工程师专题学习。
- 标准教程：ALH自带标准软件教程。学习软件操作时使用。

进入方式：

- 已有ALH帐号：点击以下链接：

https://jam8.sapjam.com/groups/oOWAdwLABmWAlBpwWDR5uv/overview_page/SJgVYUCTz90LbjxUQLHMSH

- 没有ALH帐号：参考第二页注册ALH账号后进入。

- 联系人：xiaoxia.zhou@ansys.com



/ ALH注册方法

打开下面网址或扫描右边二维码进行注册：

https://www.ansys.com/alhactivation_cn

第13步“是否有激活码”，请选择“否”

第14步“请输入您的激活码”，请填写客户号。

客户号为一串6位或7位数字。

获取方法：

- ❑ 询问Ansys客户经理/技术。
- ❑ 启动软件，观察Help – About - Client License Settings - Customer Number。



The Ansys logo, featuring a stylized orange and black 'A' followed by the word 'nsys' in black.

