

ANSYS



仿真  
新时代

2017 ANSYS用户技术大会

中国·烟台

# Design Exploration 在大型商用空调机组减震器位置优化中的应用

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英格索兰亚太研发中心/上海

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    - Define optimization: Design parameter, Constraints, Objective
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- **Summary & Action in next 总结及展望**

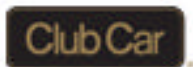
# 英格索兰亚太研发中心

- Ingersoll Rand

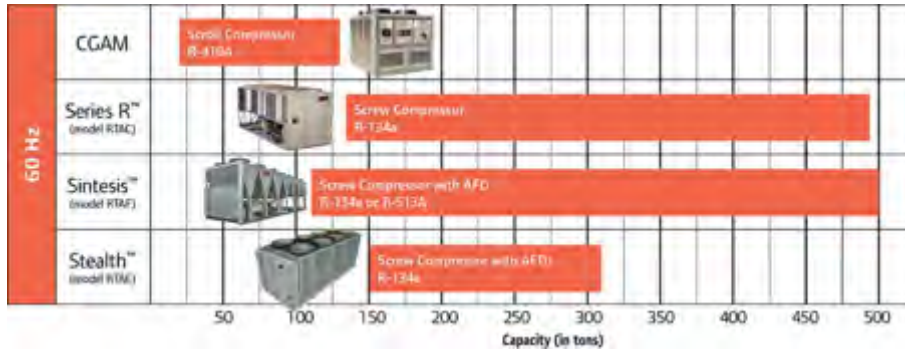
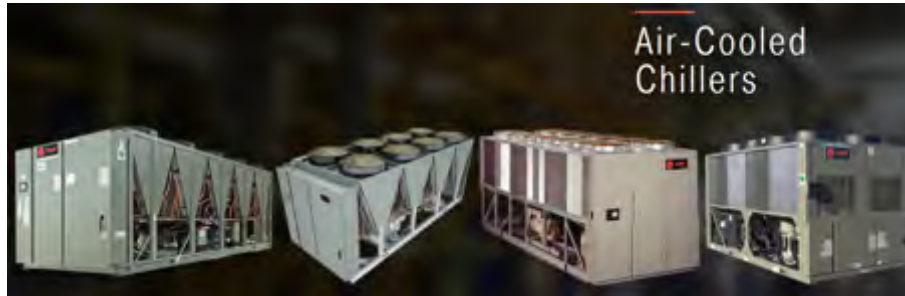
- 1871年成立, 1922年进入中国上海;
- 多元化的工业制造企业, 其旗下品牌Trane, Thermo King, IR, Club Car.

- ETC-AP

- 400工程师, 英格索兰全球最大工程技术中心;
- 研发能力基于暖通设备, 向工业设备扩展.



# Product Introduction - Air-cooled Chiller



机组安装在楼顶上

主要用于商场，医院，酒店，工厂，数据中心



# Background and problem

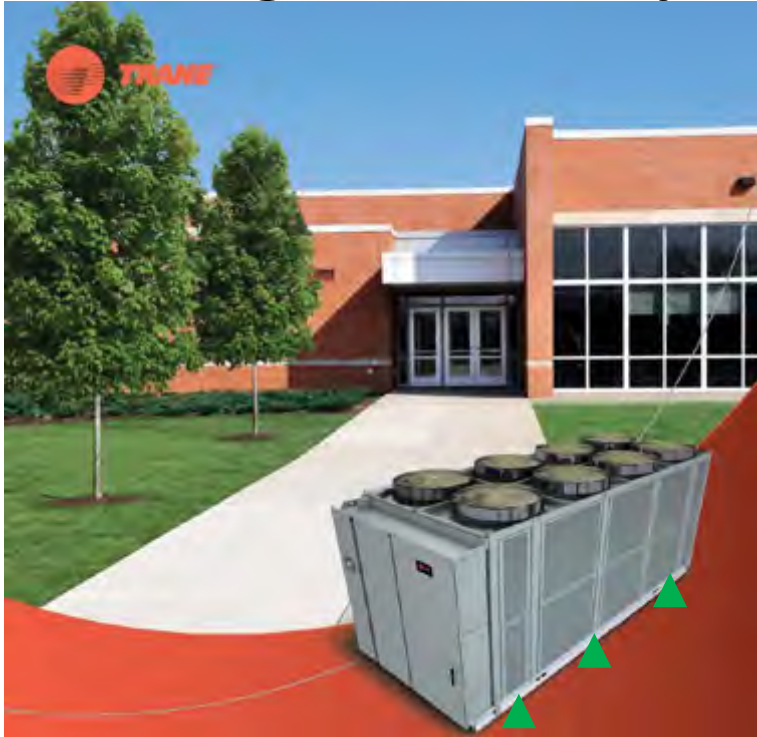


Figure 18. Isolator (good)



# What is Design Exploration?

## What is Design Exploration?

- **WI** Design Exploration is a powerful approach used by DesignXplorer for designing and understanding the analysis

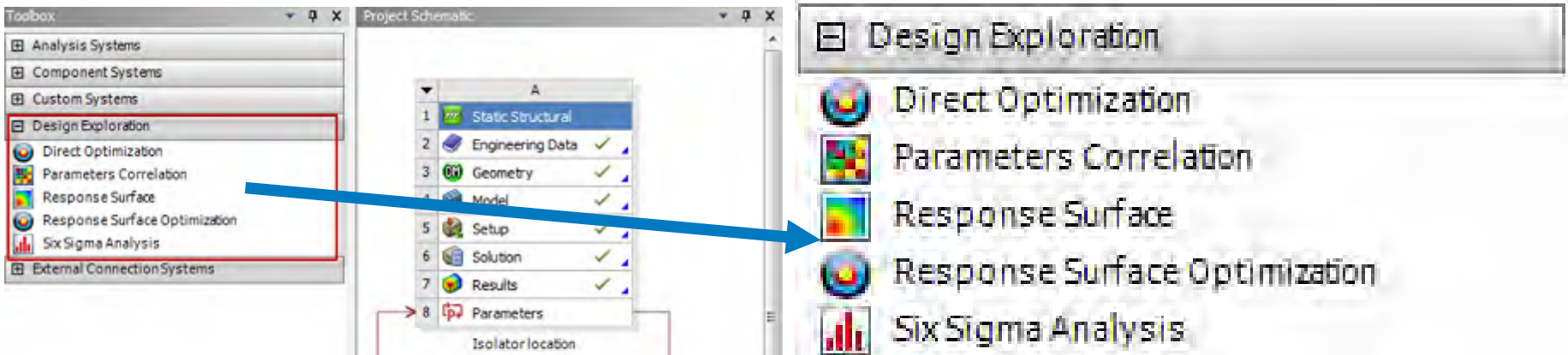
ANSYS design exploration tools lead the way  
to Simulation-Driven Product Development.

Harness the power of parametric analysis to increase innovation  
and improve the return on your simulation investment.

perform a six sigma analysis on your model



# ANSYS Design Exploration

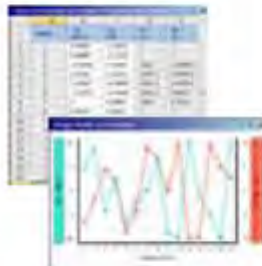


## ANSYS Design Exploration

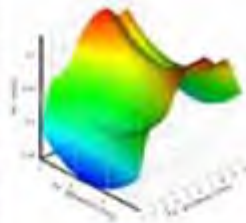
### Parameterized CAD



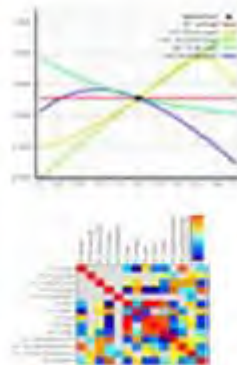
### Design of Experiments



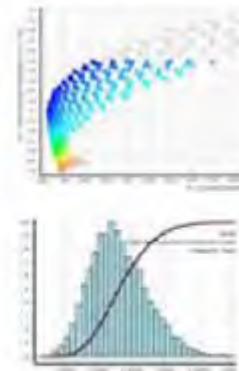
### Response Surface Methods



### Sensitivity/Correlation Analysis



### Optimization/Robust Design/Six Sigma



### Report Generation





# Application of Design Exploration

- Parameterize analysis model

Input Parameters	
Isolator location (A1)	
P13	Iso_1
P14	Iso_2
P15	Iso_3
P16	Iso_4
P17	Iso_5
P18	Iso_6

Input parameter

Output Parameters	
Isolator location (A1)	
P23	Iso_1A Maximum Y Axis
P24	Iso_2A Maximum Y Axis
P25	Iso_3A Maximum Y Axis
P26	Iso_4A Maximum Y Axis
P27	Iso_5A Maximum Y Axis
P28	Iso_6A Maximum Y Axis
P29	Iso_1B Maximum Y Axis
P30	Iso_2B Maximum Y Axis
P31	Iso_3B Maximum Y Axis
P32	Iso_4B Maximum Y Axis
P33	Iso_5B Maximum Y Axis
P34	Iso_6B Maximum Y Axis

Output parameter

- Define optimization

- Objective
- Constraints
- Domain

Outline of Schematic B2: Optimization			
	A	B	C
1		Enabled	Monitoring
2	Optimization		
3	Objectives and Constraints		
16	Domain		
29	Raw Optimization Data		
30	Results		

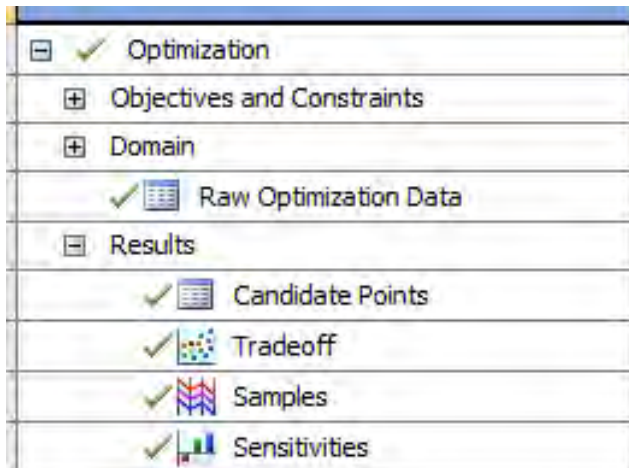
Input Parameters			
Name	Lower Bound	Upper Bound	
P13 - Iso_1 (mm)	700	945	
P14 - Iso_2 (mm)	1300	3000	
P15 - Iso_3 (mm)	3000	4200	
P16 - Iso_4 (mm)	4200	5245	
P17 - Iso_5 (mm)	5545	7945	
P18 - Iso_6 (mm)	8150	9300	

Outline of Schematic B2: Optimization			
	Objective	Target	Location
1	Seek P23 = 7200 (0.000) => P23 (A1 Maximum Y Axis)	7200	1000
2	Seek P24 = 7200 (0.000) => P24 (A1 Maximum Y Axis)	7200	1000
3	Seek P25 = 7200 (0.000) => P25 (A1 Maximum Y Axis)	7200	1000
4	Seek P26 = 7200 (0.000) => P26 (A1 Maximum Y Axis)	7200	1000
5	Seek P27 = 7200 (0.000) => P27 (A1 Maximum Y Axis)	7200	1000
6	Seek P28 = 7200 (0.000) => P28 (A1 Maximum Y Axis)	7200	1000
7	Seek P29 = 7200 (0.000) => P29 (A1 Maximum Y Axis)	7200	1000
8	Seek P30 = 7200 (0.000) => P30 (A1 Maximum Y Axis)	7200	1000
9	Seek P31 = 7200 (0.000) => P31 (A1 Maximum Y Axis)	7200	1000
10	Seek P32 = 7200 (0.000) => P32 (A1 Maximum Y Axis)	7200	1000
11	Seek P33 = 7200 (0.000) => P33 (A1 Maximum Y Axis)	7200	1000
12	Seek P34 = 7200 (0.000) => P34 (A1 Maximum Y Axis)	7200	1000
13	Seek P23 = 7200 (0.000) => P23 (A1 Maximum Y Axis)	7200	1000
14	Seek P24 = 7200 (0.000) => P24 (A1 Maximum Y Axis)	7200	1000



# Application of Design Exploration

- Optimization results



Optimization

- Objectives and Constraints
- Domain
- Raw Optimization Data
- Results
  - Candidate Points
  - Tradeoff
  - Samples
  - Sensitivities

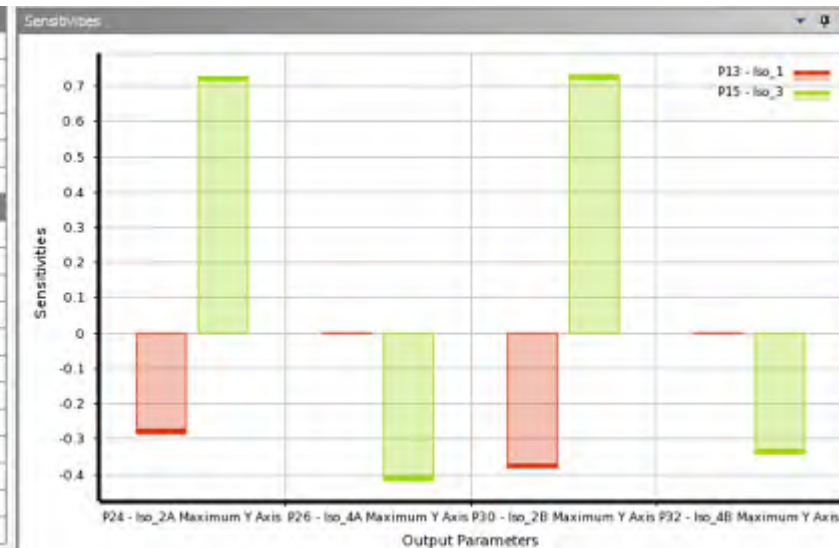
Candidate Points

Table of Schematic E2: Optimization, Candidate Points

	A	B	C	D	E	F	G	H	
1	Reference	Name	P13 - Iso 1 (mm)	P14 - Iso 2 (mm)	P15 - Iso 3 (mm)	P16 - Iso 4 (mm)	P17 - Iso 5 (mm)	P18 - Iso 6 (mm)	
2									
3		Candidate Point 1	DP 256	927,5	2654,6	3803,5	5162	6584,7	8221,4

Sensitives chart

Input Parameters	
P13 - Iso_1	<input checked="" type="checkbox"/>
P14 - Iso_2	<input type="checkbox"/>
P15 - Iso_3	<input checked="" type="checkbox"/>
P16 - Iso_4	<input type="checkbox"/>
P17 - Iso_5	<input type="checkbox"/>
P18 - Iso_6	<input type="checkbox"/>
Output Parameters	
P23 - Iso_1A Maximum Y Axis	<input type="checkbox"/>
P24 - Iso_2A Maximum Y Axis	<input checked="" type="checkbox"/>
P25 - Iso_3A Maximum Y Axis	<input type="checkbox"/>
P26 - Iso_4A Maximum Y Axis	<input checked="" type="checkbox"/>
P27 - Iso_5A Maximum Y Axis	<input type="checkbox"/>
P28 - Iso_6A Maximum Y Axis	<input type="checkbox"/>
P29 - Iso_1B Maximum Y Axis	<input type="checkbox"/>
P30 - Iso_2B Maximum Y Axis	<input checked="" type="checkbox"/>
P31 - Iso_3B Maximum Y Axis	<input type="checkbox"/>
P32 - Iso_4B Maximum Y Axis	<input checked="" type="checkbox"/>
P33 - Iso_5B Maximum Y Axis	<input type="checkbox"/>
P34 - Iso_6B Maximum Y Axis	<input type="checkbox"/>



# Summary & Action

- Application of Design Exploration

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Line weight location optimization

Line design optimization

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感谢聆听



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