



3DEXPERIENCE®

We Shape The World
—CATIA软件简介

目录

- 1 行业的先行者 - CATIA发展史简述
- 2 行业的集大成者 - CATIA全线产品介绍
- 3 行业的领导者 - CATIA的先进性介绍
- 4 行业的领跑者 - CATIA的未来发展
- 5 结语

行业的先行者 - CATIA发展史简述

Before 1981

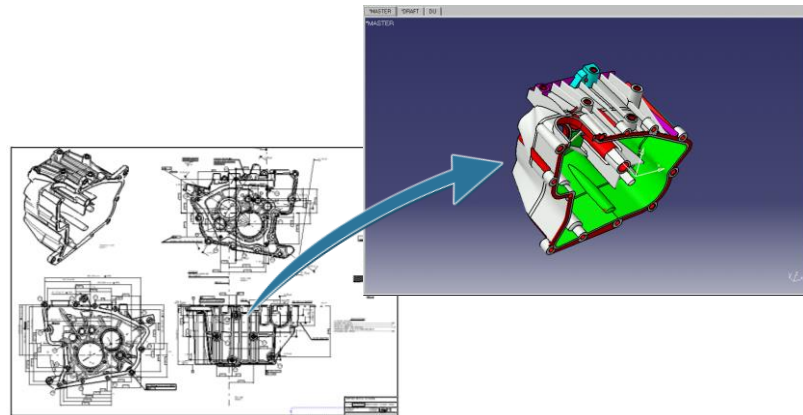
- ▶ 1963, 美国麻省理工开发了第一套计算机绘图系统, 名为 Sketch Pad, 开创了计算机绘图技术的先河。
- ▶ 1974, 洛克希德公司研发了CADAM软件 (Computer-Augmented Drafting and Manufacturing), 这是一种二维的CAD/CAM软件。



几何建模+应用模块

1981-1997

- ▶ 1975, 法国著名飞机制造商Avions Marcel Dassault (AMD)成为第一个CADAM用户
- ▶ 1977, AMD公司开始研发一套新的三维CAD/CAM软件, 后来成为著名的CATIA软件 (Computer-Aided Three-Dimensional Interactive Application)
- ▶ 1981, 达索系统公司成立
 - ▷ 同年, 展开和BMW, Mercedes和Honda的合作
- ▶ 1982, 发布CATIA V1
 - ▷ 作为一个add-on product, 面向3D design, surface modeling和 NC programming



1981-1997

► 1984, 发布 CATIA V2

- ▷ 1986年, 成为Boeing的主流CAD软件
- ▷ sees CATIA become the world' s leading application for aeronautical design.

大公司总是最先注重CAD技术并引领CAD技术的先行者。

► 1988, 发布CATIA V3

- ▷ 在UNIX和大型机上提供了AEC功能
- ▷ sees CATIA become the world' s leading application for automotive design.

► 1993, 发布CATIA V4 (CATIA-CADAM Solutions Version 4)

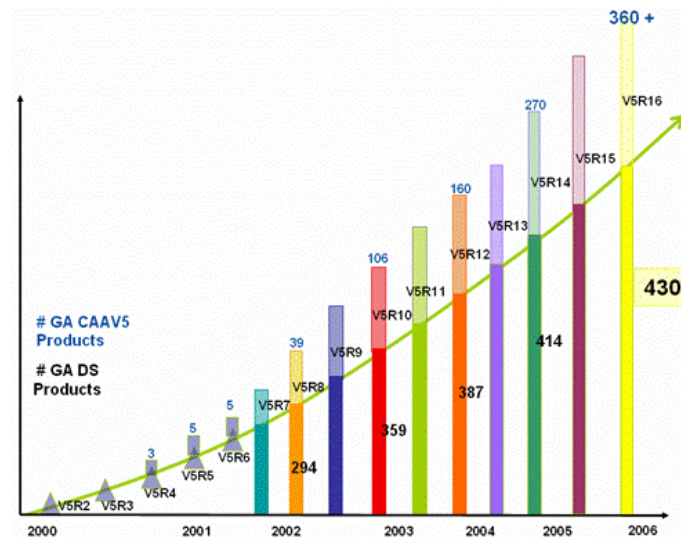
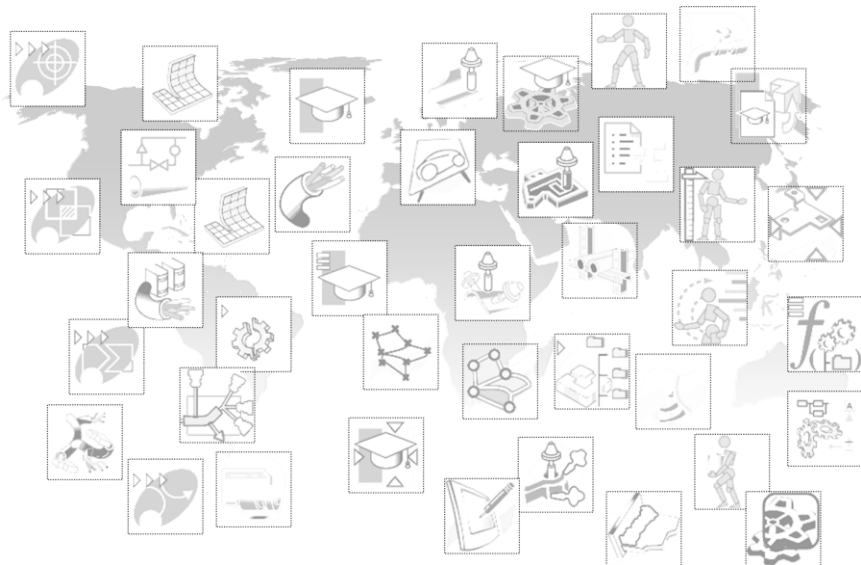
- ▷ 1992年, 收购CADAM
- ▷ 1997年, 收购Deneb
- ▷ 1998年, 收购IBM PDM assets, 成立Enovia公司
- ▷ 1999年, 收购Matra Datavision development laboratory, 成立Dassault Systèmes Provence

产生三维数据后, 就需要管理这些数据。这种需求一直很强烈。

1998-2011

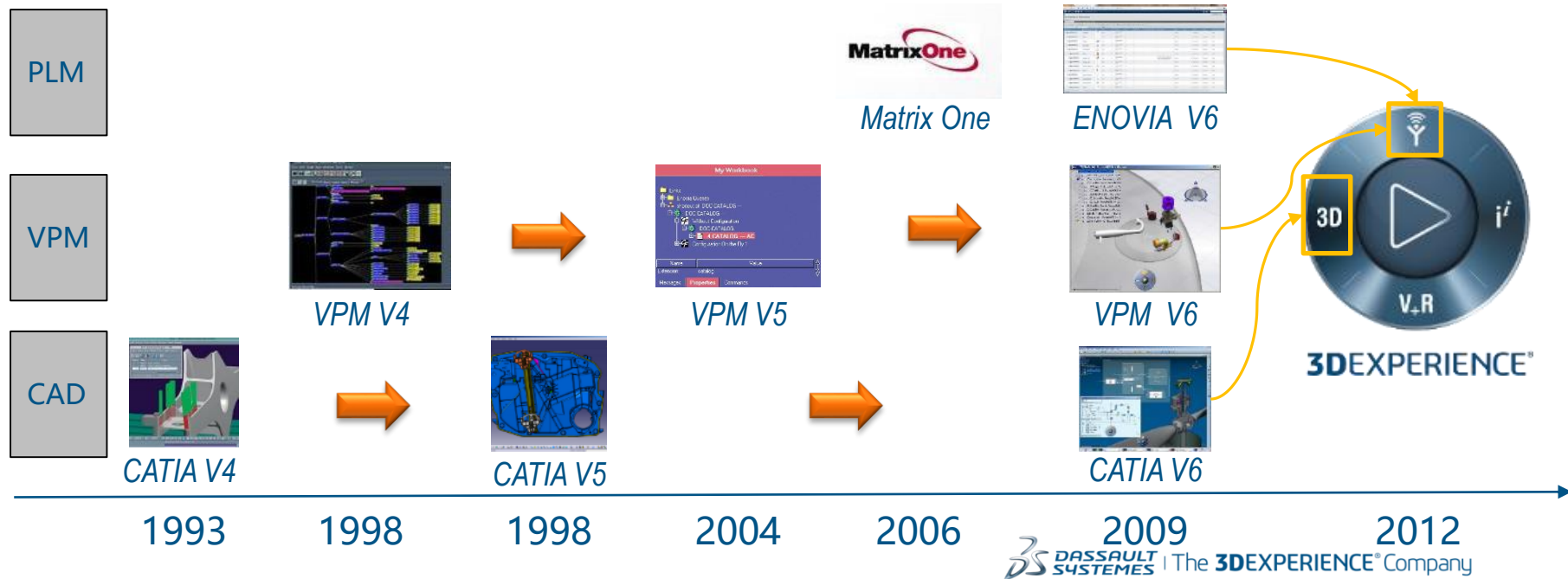
► 1998, 发布CATIA V5

- ▷ 2000年, 赢得Airbus S.A. 的订单
- ▷ 2002年, 赢得Toyota Motor Corporation和Volvo Group的订单
- ▷ 2003年, 赢得BMW Group, Ford Motor Company, AVIC的订单

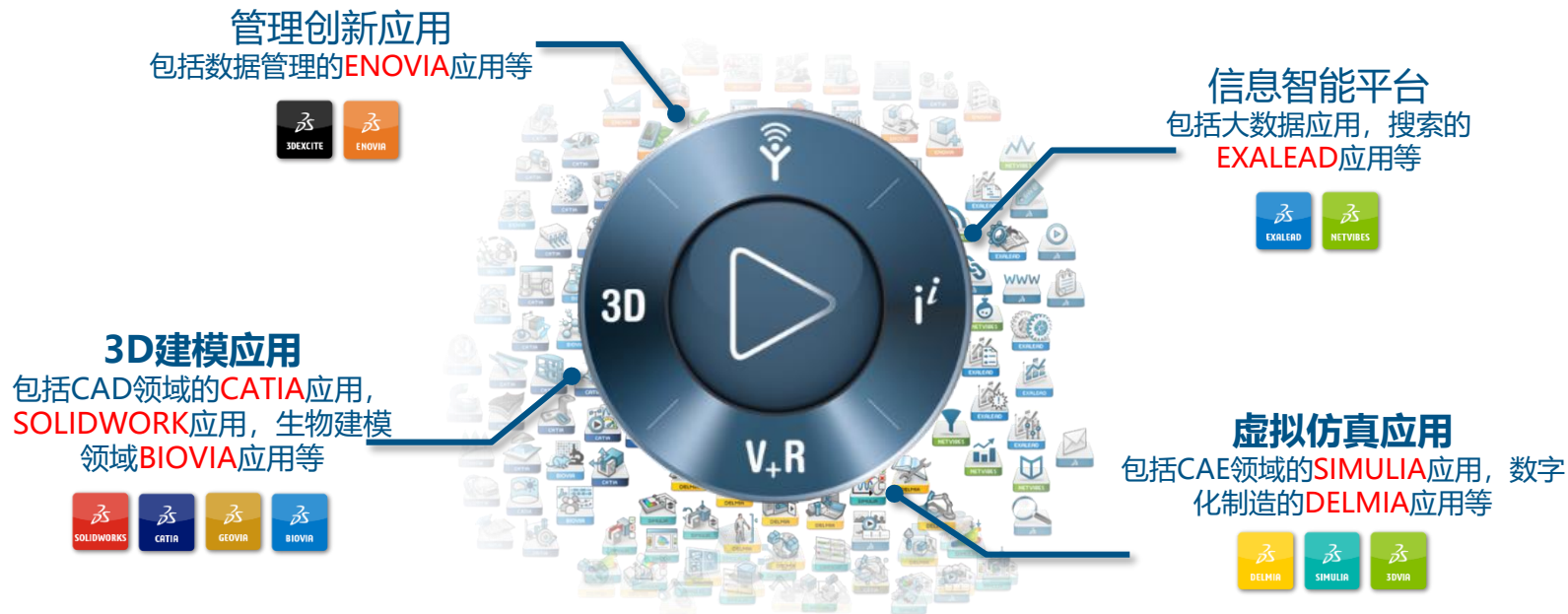


2012 – NOW: 新一代研发平台3DExperience平台

- ▶ 2009, 发布CATIA V6
- ▶ 2012, 发布3DExperience平台



3DExperience平台整合了12个品牌的软件，形成统一的研发平台



3DExperience平台是一个包括设计、仿真、分析工具（CATIA、DELMIA、SIMULIA、.....）、协同环境（VPM）、产品数据管理（ENOVIA）、社区协作（3DSwym）、大数据技术（EXALEAD）等多种应用的一体化平台。

3DEXPERIENCE平台整合了12个品牌的软件，形成统一的研发平台

提供500多个标准App; App之间互联互通; 支持自定义扩展App



3DExperience平台带来了全新的协同设计模式



行业的**集大成者** - CATIA全线产品介绍

行业的集大成者



系统架构



系统仿真



流体



电气



建筑工程



工业设备



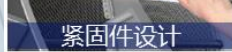
知识工程

知识工程

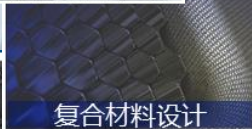


核心CAD建模

核心CAD建模



紧固件设计



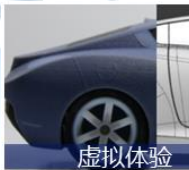
复合材料设计



塑料件设计



钣金设计



虚拟体验



工业造型



船舶行业



汽车行业



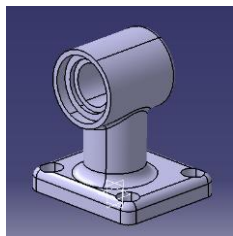
航空航天行业

专业CAD应用

行业CAD应用

核心CAD建模

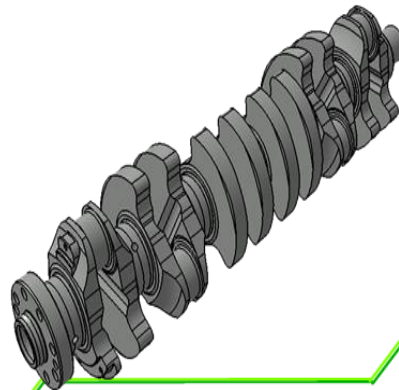
零件设计



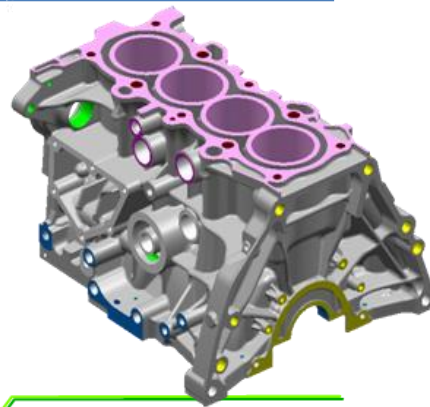
*Prismatic
parts*



*Hybrid
prismatic
parts*



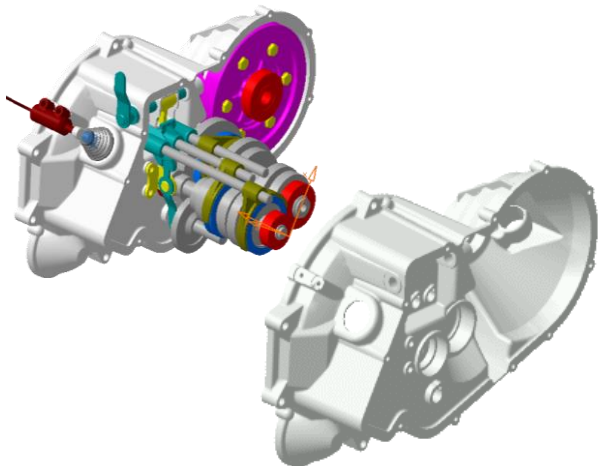
*All Complex
parts*



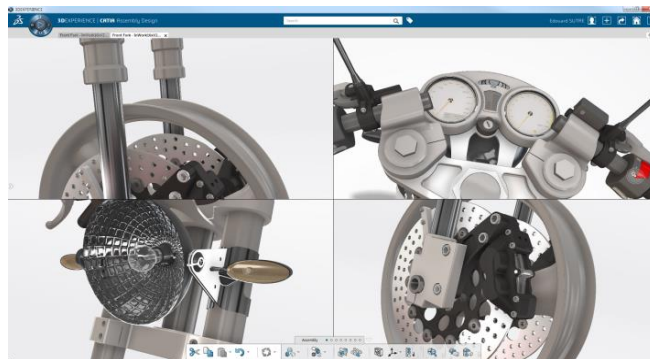
*Dedicated
advanced
Functionalities
Process oriented*

核心CAD建模

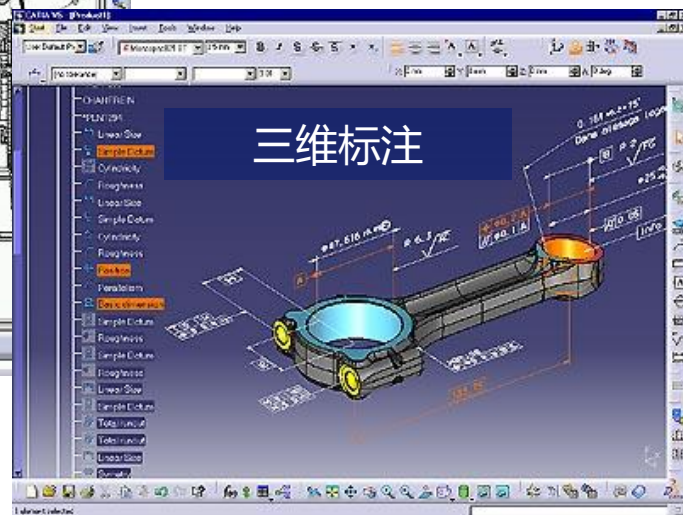
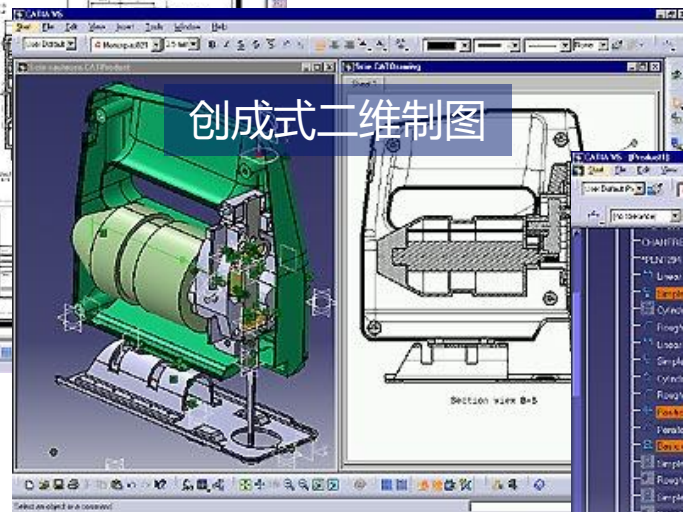
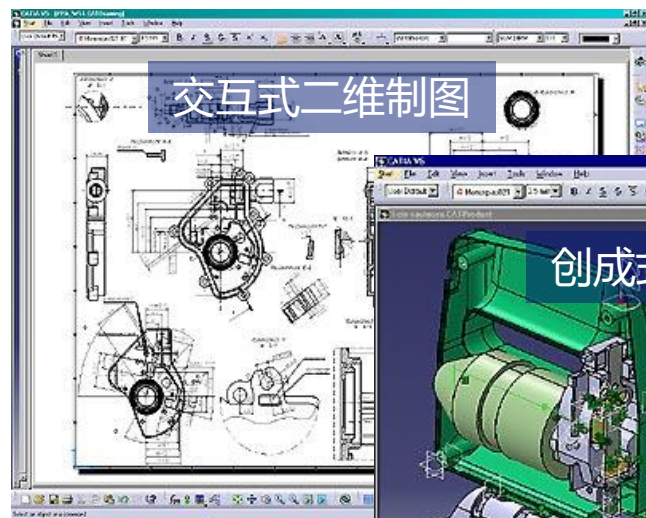
装配设计



- Easy to defines and manages assembly structures.
- Easy to defines and manage large assembly structures
- Interoperability with full CATIA Portfolio
- Easily establish assembly constraints
- Parts can be easily dragged or snapped into position.
- Generates exploded views and detects collisions and clearance limitations.
- Generates bills-of-material



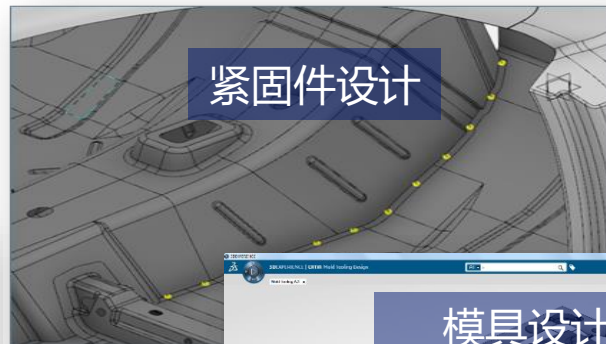
核心CAD建模



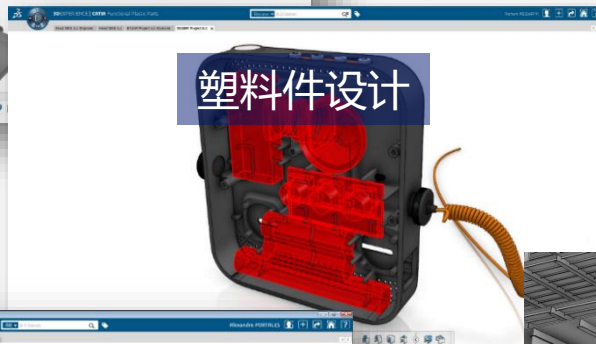
专业设计



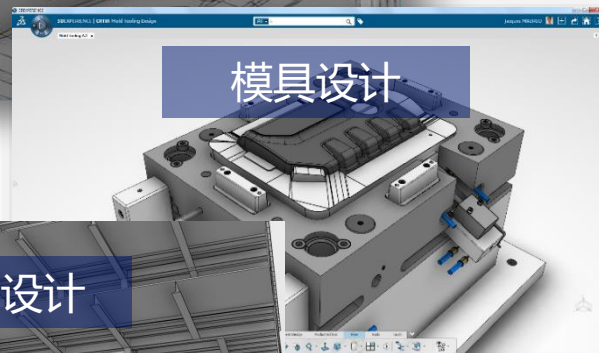
钣金件设计



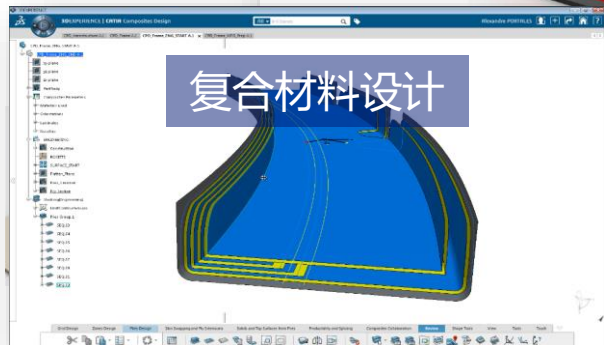
紧固件设计



塑料件设计



模具设计

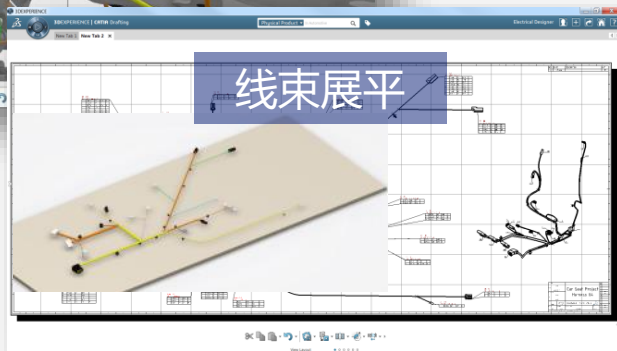
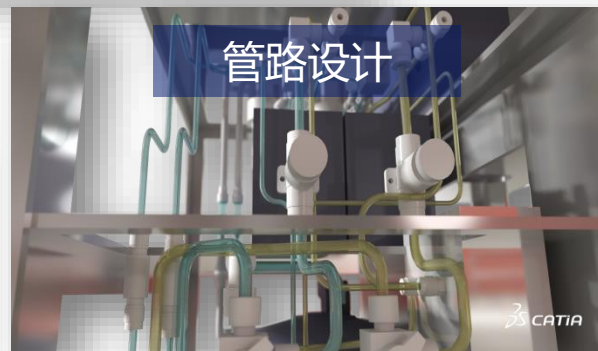
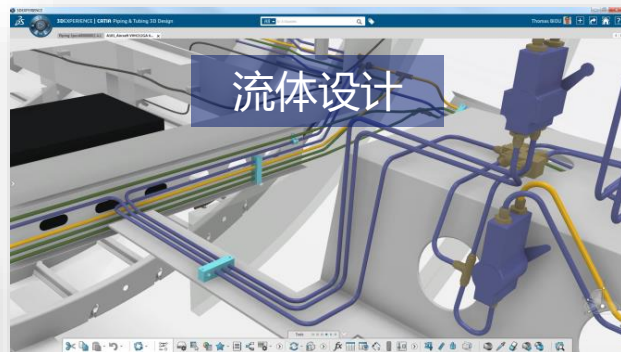


复合材料设计



钢结构设计

专业设计

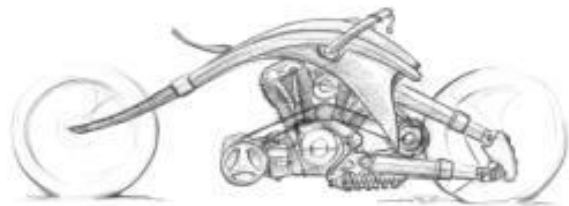


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工业造型

三维草绘



A面建模



逆向建模



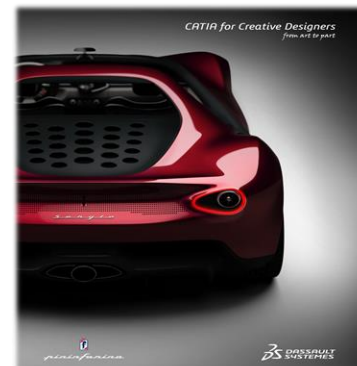
创意设计



自由曲面建模



虚拟体验



系统工程

System of Systems

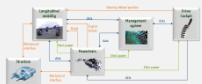


Multi-systems contractual architecture and services



Cyber Physical System Architecture

Multi-physics system architecture (plant)



Cyber system architecture (controller)



System



conceptual
implemented

Geometrical Architecture

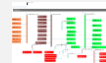


Electrical Electronics System Architecture

Components architecture of System



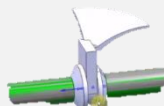
Software applications architecture of System



Mechanical components



Fluid components



Electrical components



Electronic components

Hardware



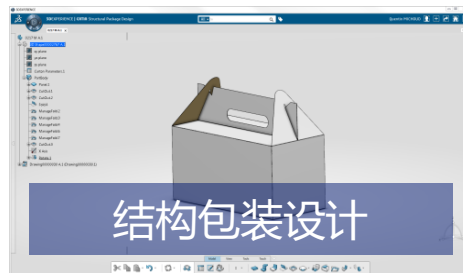
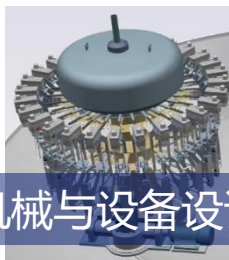
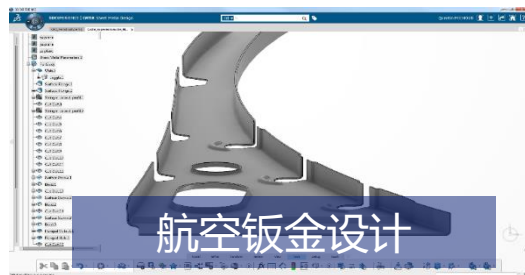
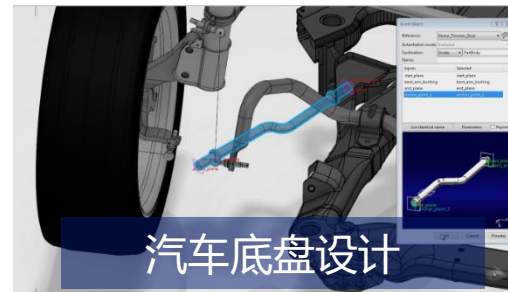
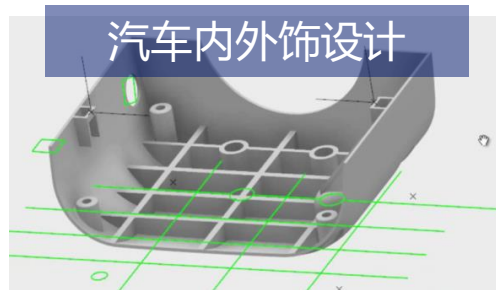
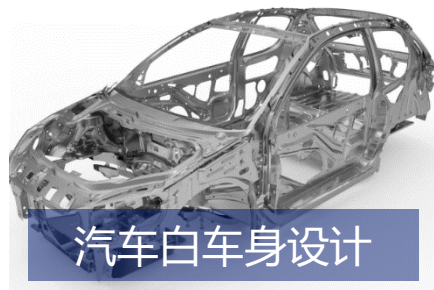
Software



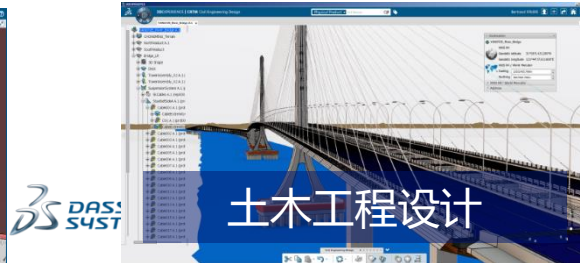
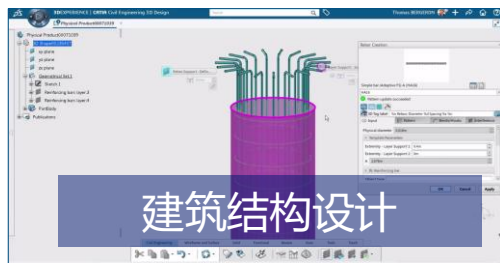
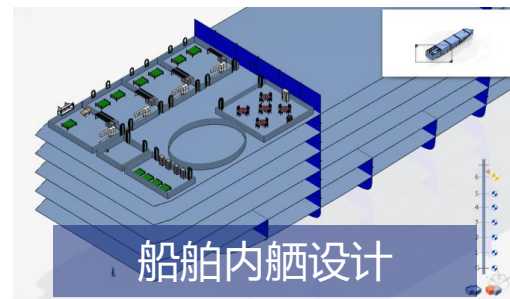
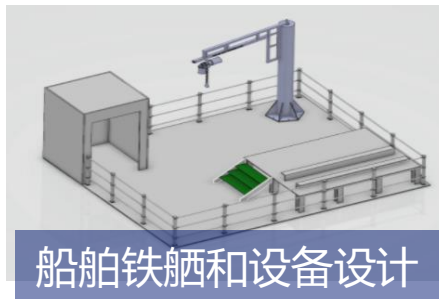
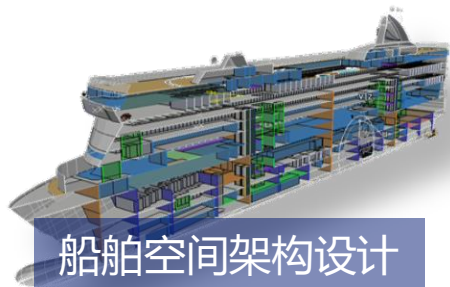
Component



行业设计



行业设计



行业的集大成者

DESIGN (13)



Styling: 4
Creative Designer
Product Industrial Designer
[Aesthetical Shape Modeler]
[Shape Morphing Modeler]

V + R: 5
Visual Experience Designer
[Immersive Visual Experience]
[Immersive Collaboration Experience]
Virtual & Physical Prototyper
Product Experience Presenter (CA)

Transport & Mobility: 3
Transportation Designer
Class A Modeler
[Class A Expert]



Aerospace & Defense: 1
Aerospace Surface Modeler



ENGINEERING (57)



Essential Mechanical Engineering: 12
My3DEXPERIENCE for CATIA V5
My3DEXPERIENCE for CATIA V5 Pro
CATIA Xdesign
3D Concept Designer (CA)
3D Designer (CA)
3D Master Conceptual Designer
Mechanical Tooling Designer
Sheet Metal Designer
[Mechanism Simulation Designer]
[3D Master Designer]
[Mechanical Part Designer]
Design Review and Preparation

Multi Discipline: 19
Composites Designer
Composites Manufacturer
Composites Engineer
[Composites Designer & Manufacturer]
[Composites Laser Projection Operator]
Composites Braiding Designer
Composites Forming Designer (CA)
Hydroformed Sheet Metal Designer
Fasteners Designer
Mold & Tooling Designer
[Mold Designer]
[Reverse Shape Optimizer]
Stamping Die Face Designer
Plastic Mechanical Designer
Structure Designer
Steel and Equipment Layout Designer
Space Allocation Architect
Accommodation Designer
Weight & Balance Analyst

Transportation & Mobility: 3
Powertrain & Chassis Designer
Body In White Designer
Interior Designer



Industrial Equipment: 2

Machine & Equipment Designer
Shaped Machine & Equipment Designer



Architecture, Engineering & Construction: 6

Concept Building Designer
Concept Architectural Designer
Concept Structural Designer
Building & Civil Coordinator
Architectural Detail Designer
Building Structure Designer
3D MEP* Designer
Civil Engineer



CPG: 1

Structural Package Designer



High Tech: 1

Product Enclosure Designer



SYSTEMS (20)



Systems Engineering: 11
Systems Architect
Dynamic Systems Engineer
Mechatronic Systems Engineer
[Systems 3D Architecture Designer] (CA)
Report Template Designer
Report Generation
Systems Traceability Designer (CA)
[Systems Multi Views Architect]
Electrical and Electronics Architect
Systems Quality Analyst (CA)
Systems Safety Analyst (CA)

Multi-Discipline Automated Engineering: 5
[Template Designer]
[Best practices Designer]
[Product Optimization Designer]
Design Apps Developer
[Design Apps User]

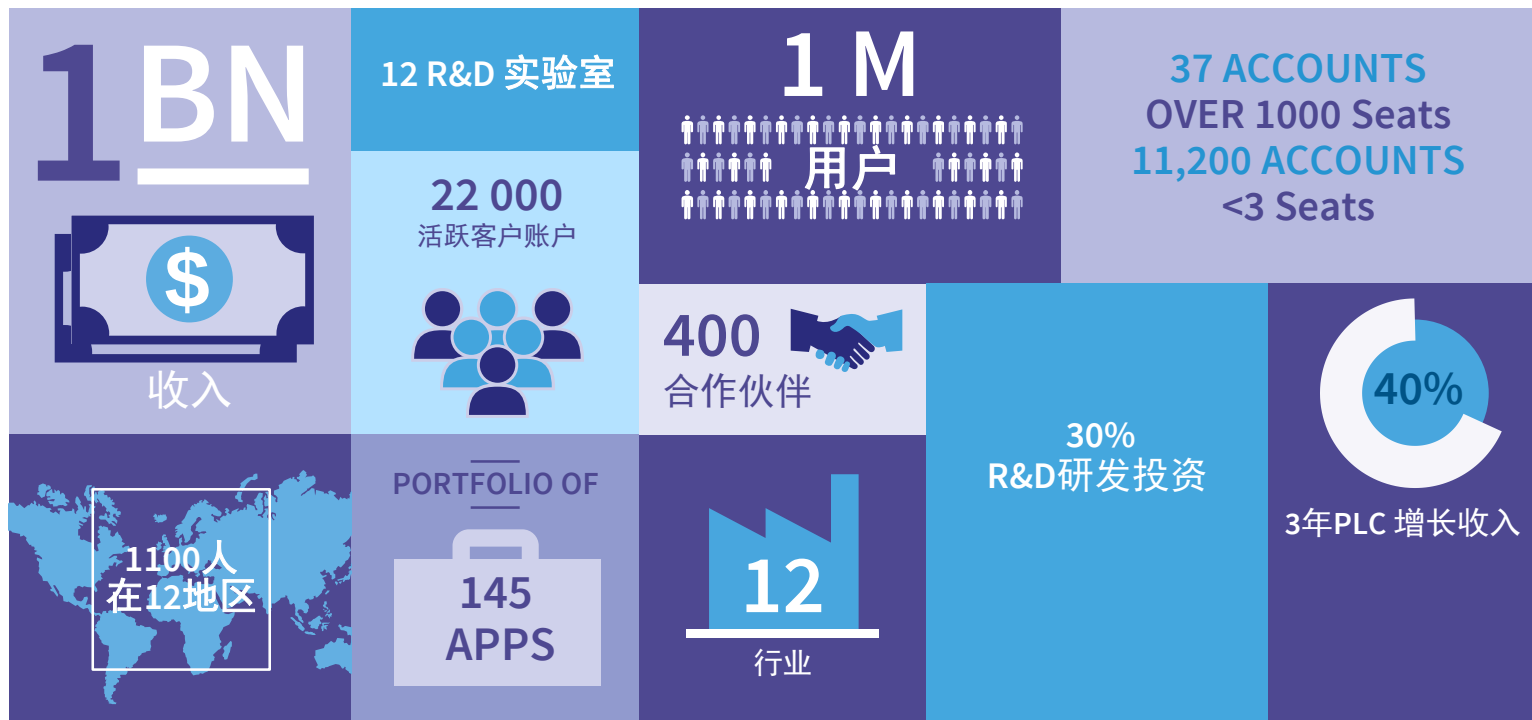
Electrical & Fluids: 9

Systems Schematic Designer
Electrical 3D Systems Designer
[Electrical Designer]
[Cabletray 3D Systems Designer]
[Electrical Harness Manufacturing Engineer]
Fluid 3D Systems Designer
[Tubing Designer]
Printed Circuit Board Designer
[Rigid Flex Circuit Board Designer]

90 Commercial Roles in R2018x (Golden)

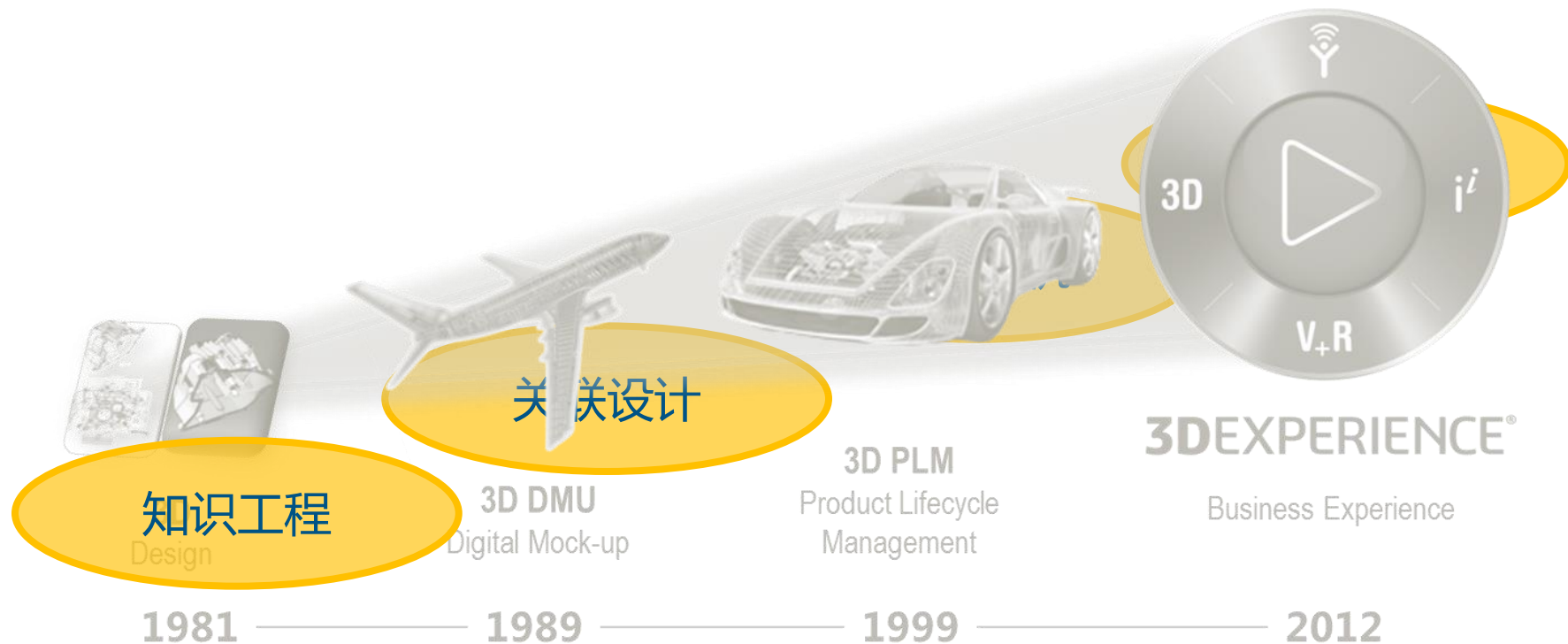
DASSAULT SYSTEMES | The **3DEXPERIENCE**® Company

行业的集大成者

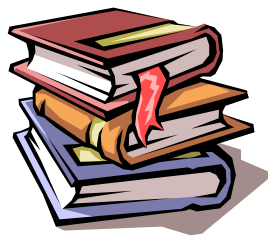


行业的领导者 - CATIA的先进性介绍

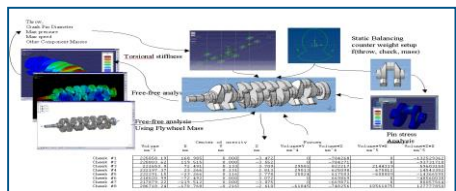
行业的领导者 - CATIA的先进性介绍



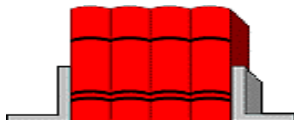
什么是知识？



只有爱因斯坦才有知识？



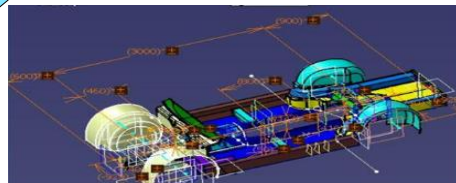
标准与规范



设计手册

If Tube_Length > 150mm
Number_of_Stiffeners=4

既有的经验公式



既有的设计

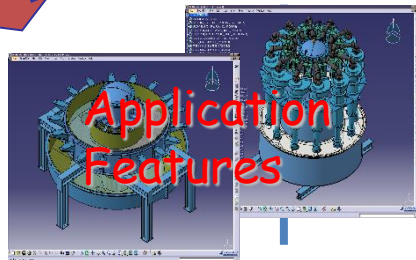
知识工程的五大应用

- ▶ 既有设计的变更 — Morphing
- ▶ 既有知识的重用 — Template
- ▶ 基于标准和既有经验的校核 — Verification
- ▶ 优化 — Optimization
- ▶ 设计流程的标准化定制

既有设计的变更 — Morphing

1) CAPTURE

1: create a Component with V5 interactive applications



2: add Knowledge features to enable morphing

- ✓ Requirements
- ✓ Rules, constraints
- ✓ Design intent and goal
- ✓ Component behavior



Expert

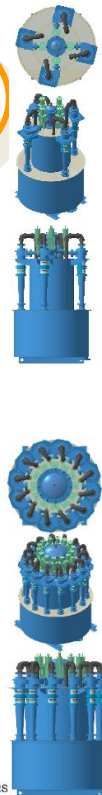


User

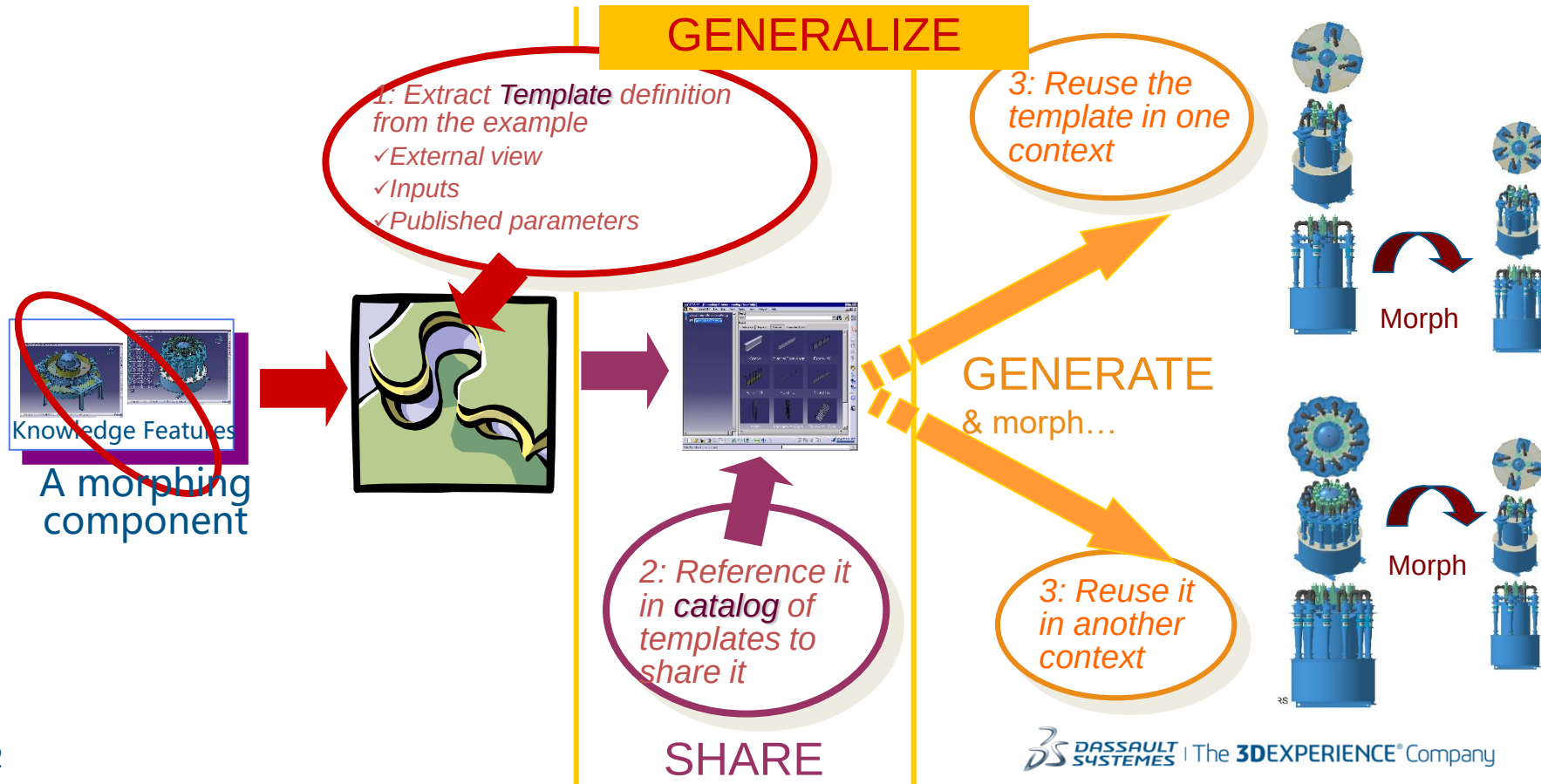
2) REUSE

Reuse the template in one context

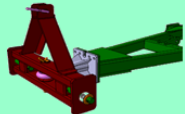
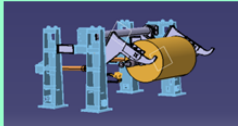
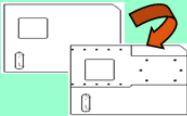
Reuse it in another context



既有知识的重用 — Template



既有知识的重用 — Template

Tow Hook Design 	Design creation 4 hours 10 min	Design modification 1.5 hour 2 min	✓ Publishing, assembly templates ✓ Parameters, rules and checks
Solid Separation Assembly Family 	Design creation 3 days 1 day	Design modification 1 day 10 min	✓ parameters, formulas, rules and checks ✓ Assembly features
Rolling Assembly Family 	Design creation & modification 30% savings		✓ parameters, formulas, rules and checks ✓ Design Table ✓ Catalog
Manufacturing Assembly Drawing 	Design creation & modification 50% savings		✓ parameters, rules ✓ VB macros

既有知识的重用 — Template

↑
Complexity
Knowledge

•Process :

BiW Detailing, Interior Detailing, Die Face, ...

•Technology :

Powercopy, User defined Feature, Knowledge

•Reusability :

High : 100%

•Benefits :

Up to 30% reduction on Part detailing

FEATURE Template



•Process :

BiW Conceptual design, Interior Conceptual Design

•Technology :

Publication, Replace, Knowledge

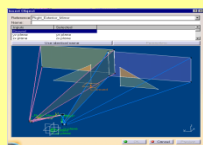
•Reusability :

Medium : 60 % average

•Benefits :

Up to 60% reduction on BiW panel design

PART Template



•Process :

Vehicle Architecture, Tooling

•Technology :

Product template

•Reusability :

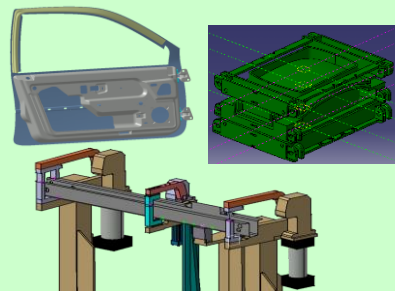
High : 80%

•Benefits :

Vehicle Architecture : Better quality and fast concept validation

Tooling : Cost reduced thanks to standardization

PRODUCT Template



•Process :

Vehicle Architecture

•Technology :

BKT : Business Knowledge Template

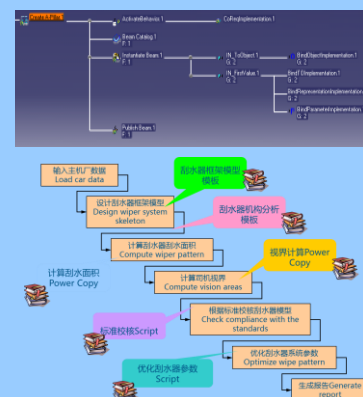
•Reusability :

High : up to 100%

•Benefits :

No Customer experience on a real production program (only evaluation)

PROCESS Template



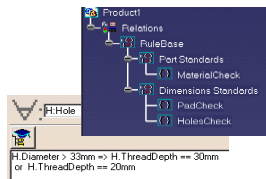
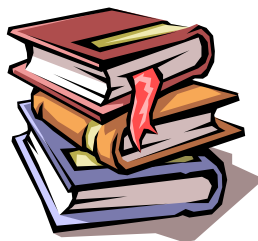
Technology

基于标准和既有经验的校核 — Verification

- ▶ provides the core infrastructure for the validation process
- ▶ Partners provide dedicated content & dedicated user interface



*Content
providers*



*Shared
Repository*



*Unique
Validation
process*

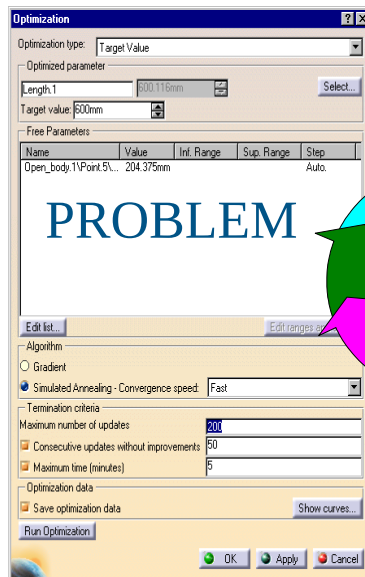
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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

*Shared
results*

优化 — Optimization

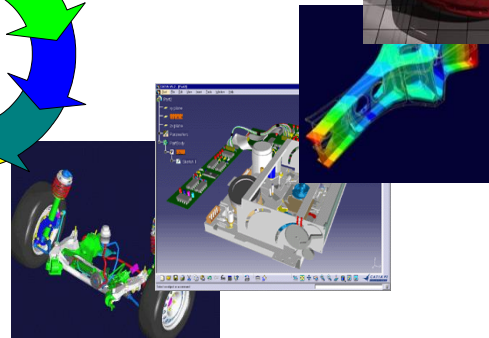
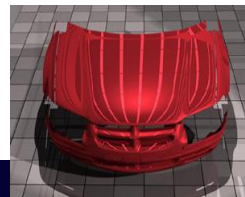
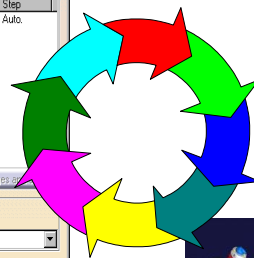
► Product optimization convergence

- ▷ Optimization : Min, Max
- ▷ Design of Experience
- ▷ Constraint Satisfaction

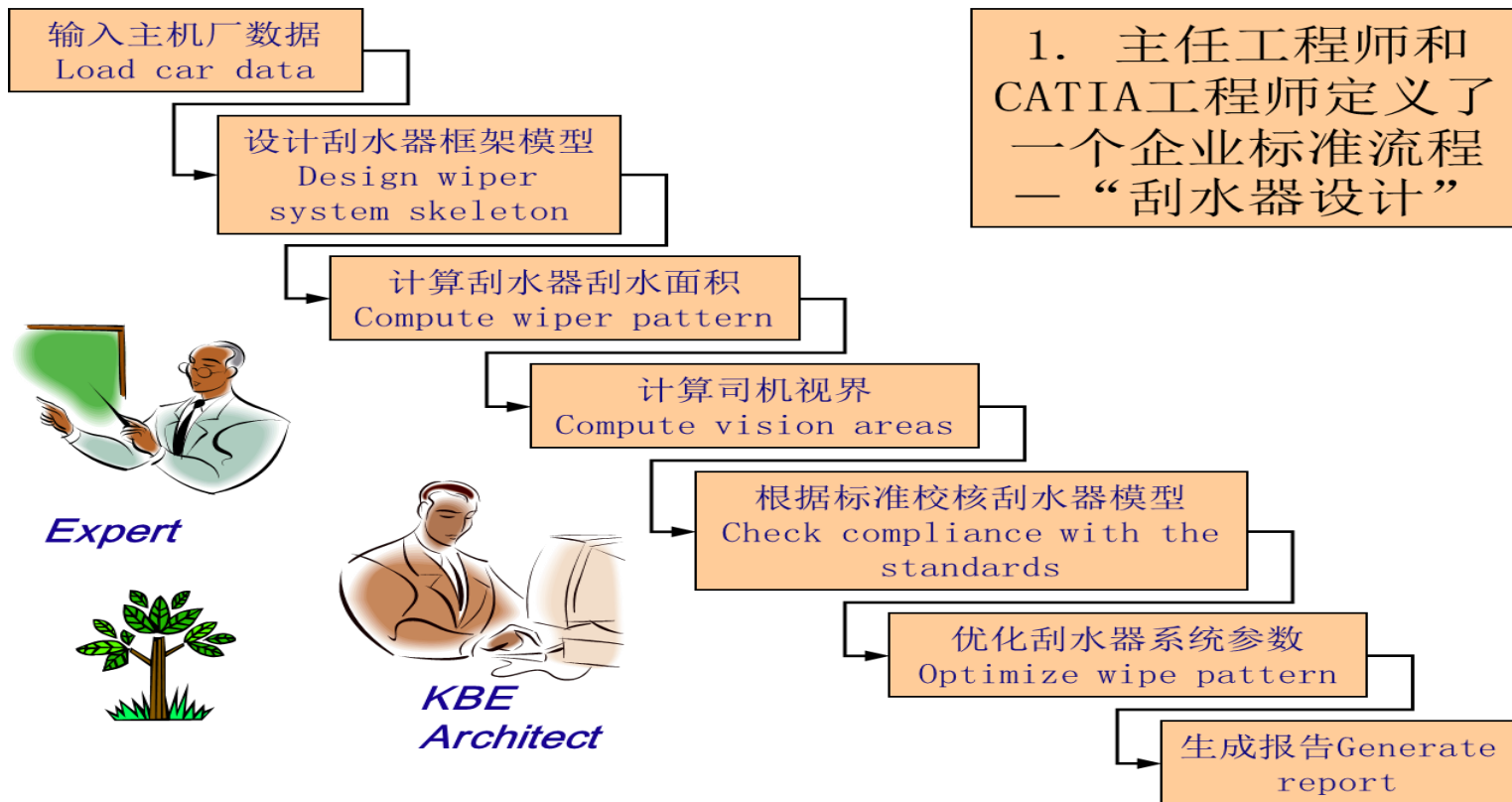


PROBLEM

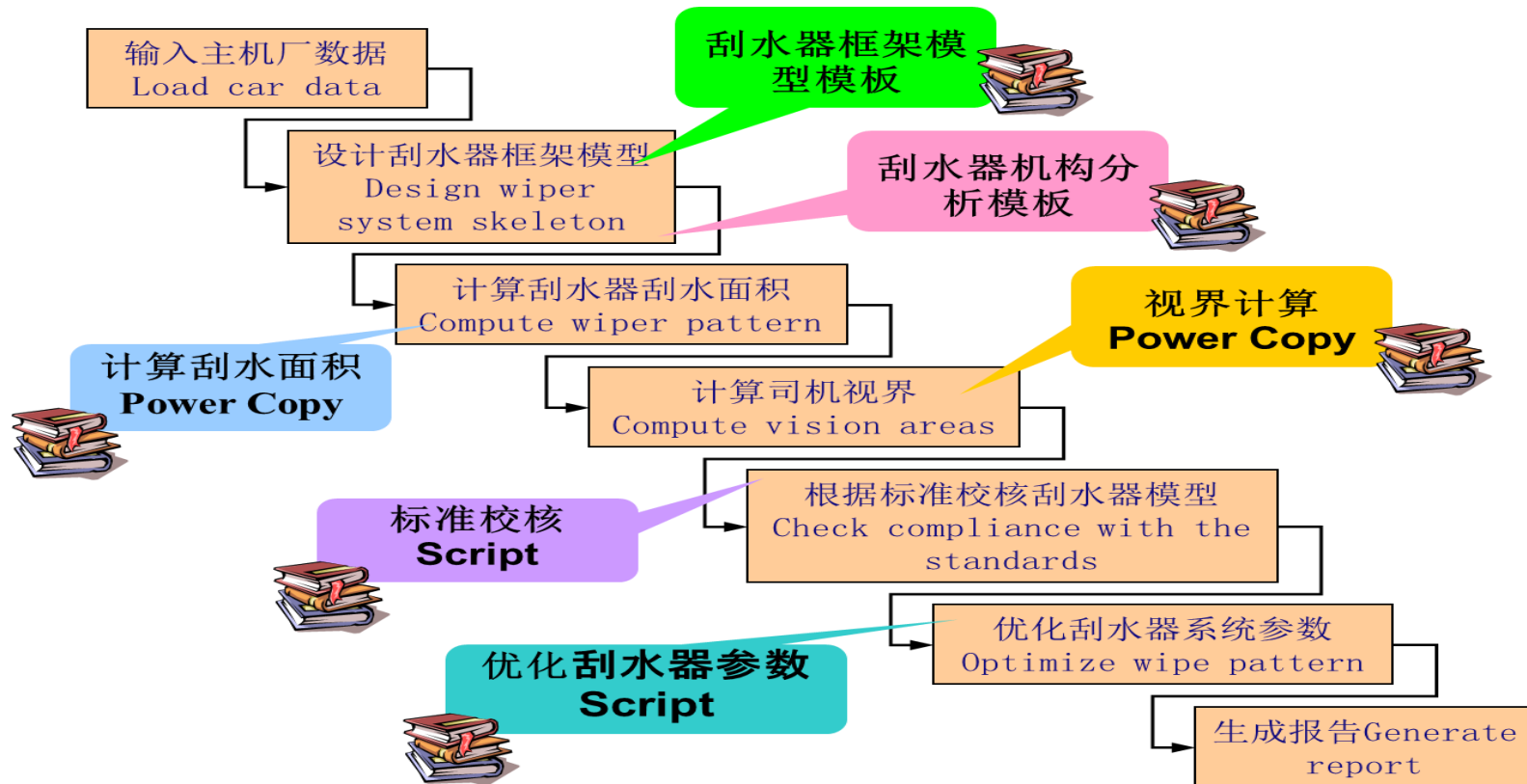
DESIGN



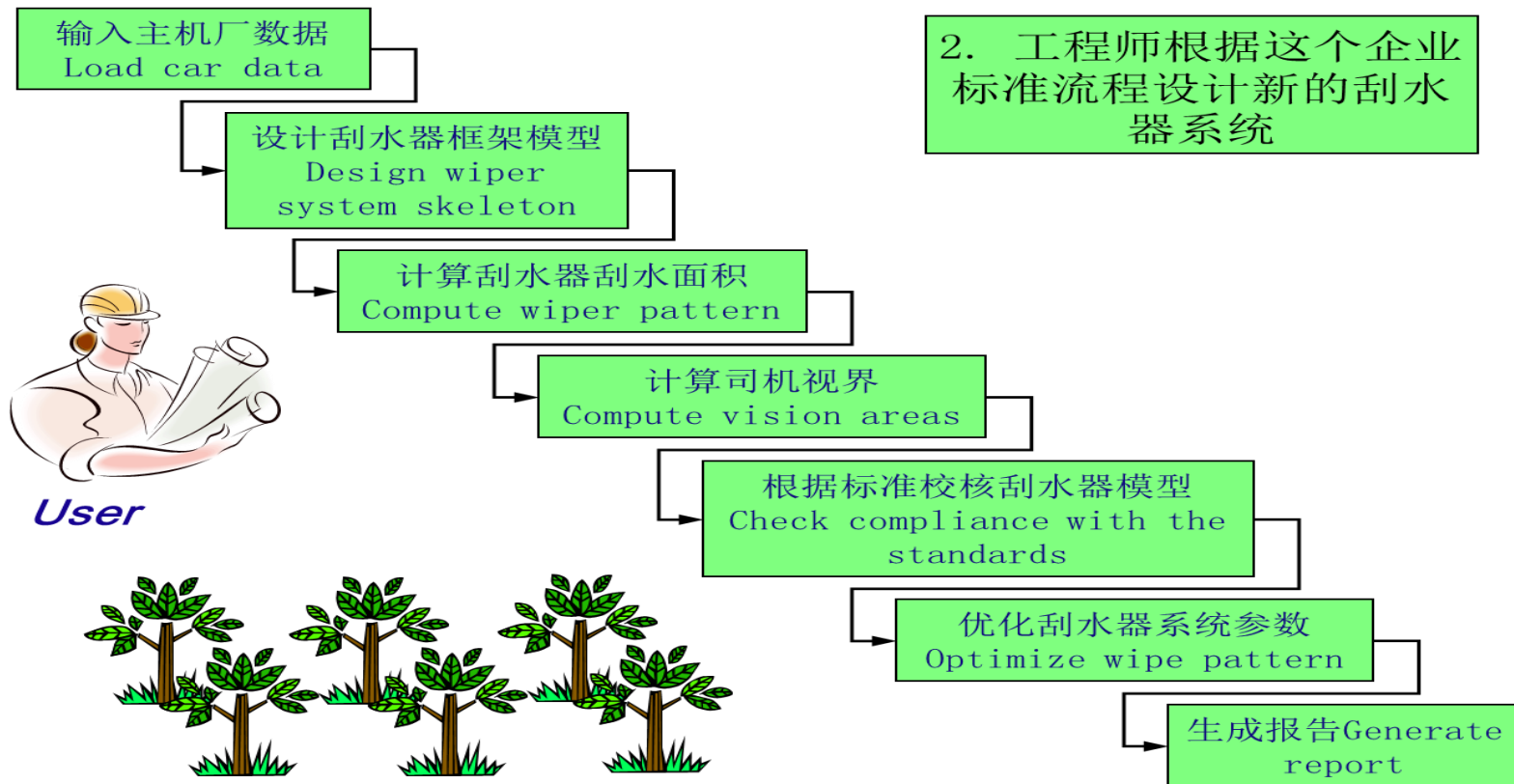
设计流程的标准化定制



设计流程的标准化定制



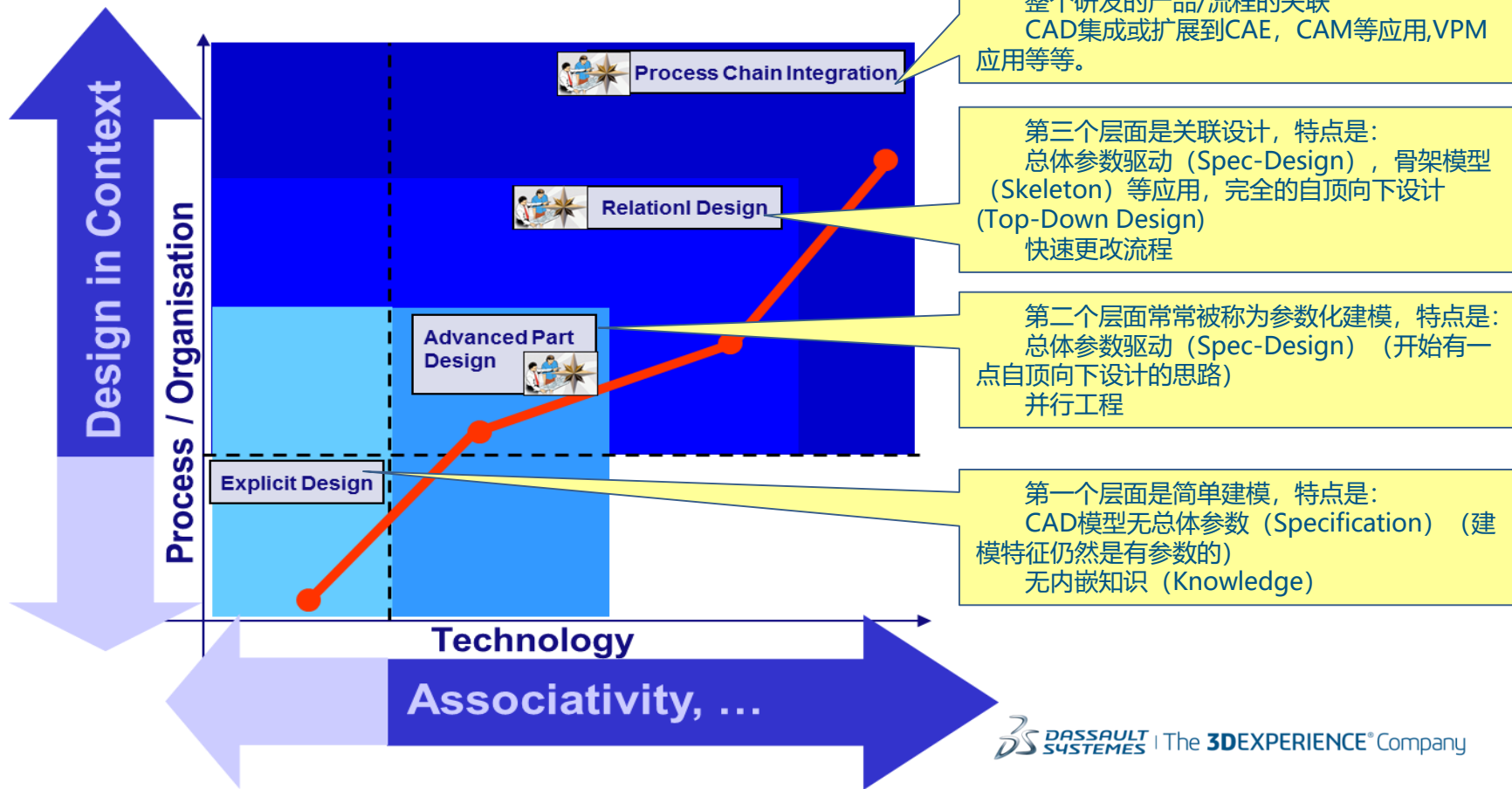
设计流程的标准化定制



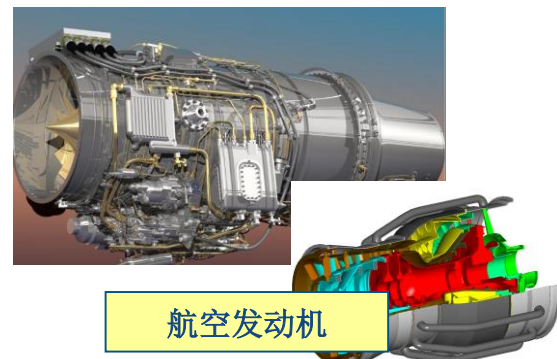
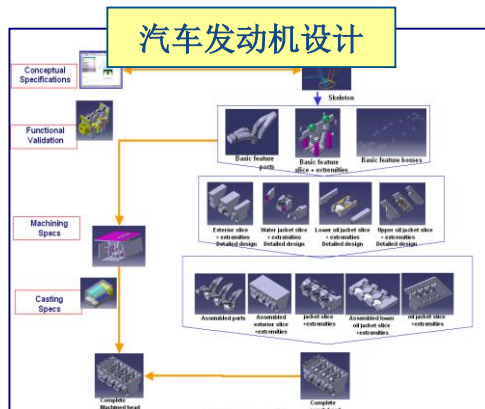
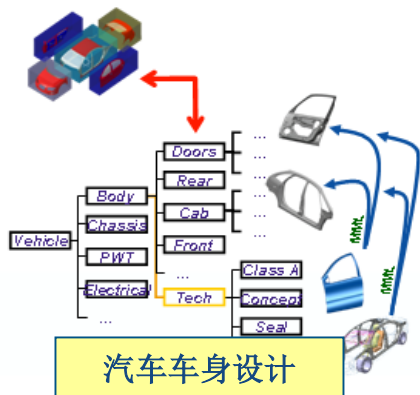
行业的领导者 - CATIA的先进性介绍



CATIA应用的四个层面



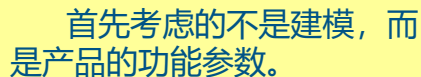
关联设计的广泛应用



关联设计的主要内容

- ▶ 面向设计，而不是建模
 - ▷ Spec-Driven Design
- ▶ 从总体设计到详细设计是一个从简至繁的过程
 - ▷ Skeleton方法
- ▶ 设计复杂产品的关键
 - ▷ 参数化曲面建模能力，优秀的复合建模能力...
- ▶ 快速更改，多方案优化的关键
 - ▷ 优异的Publication功能

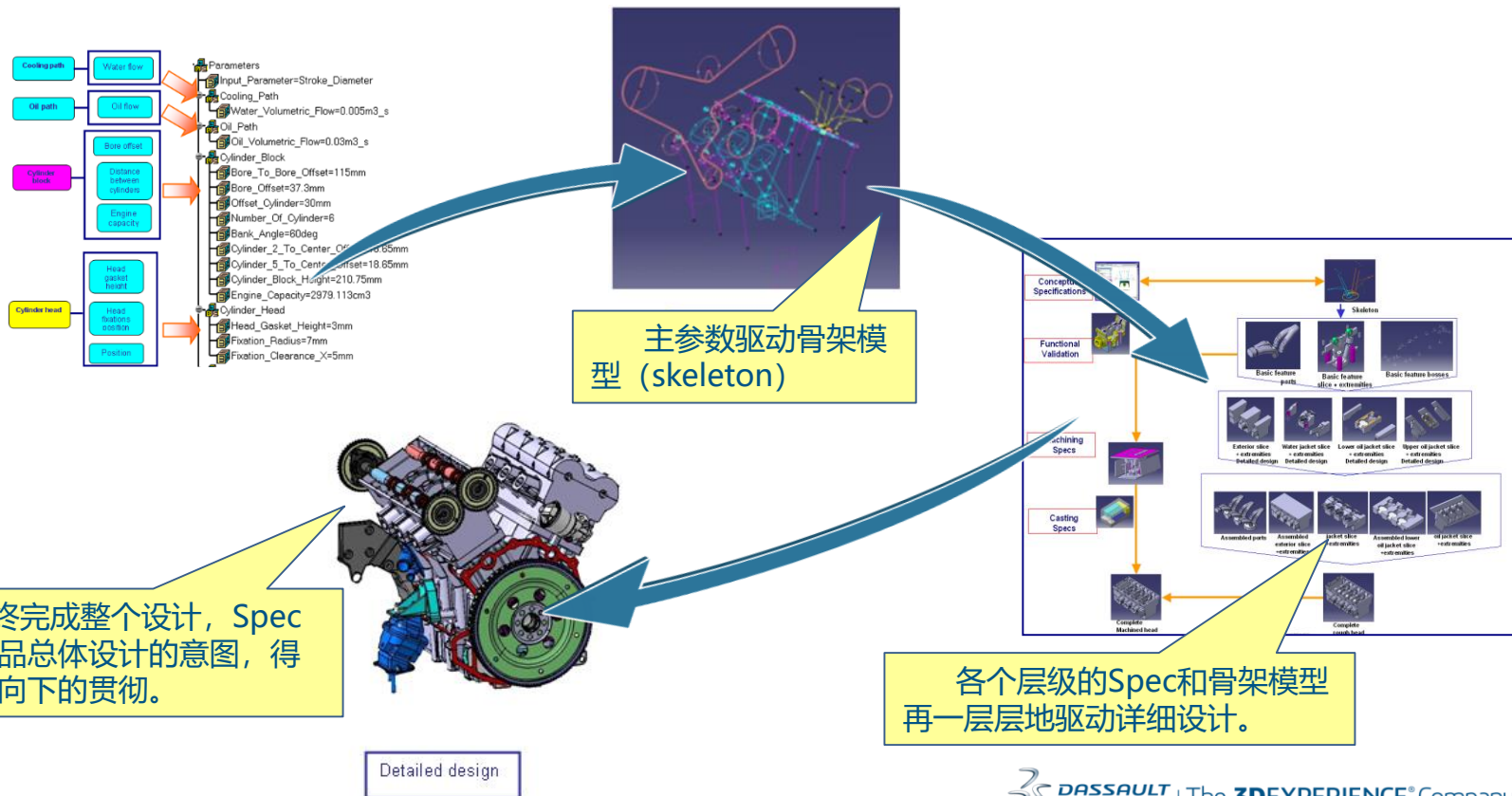
3DS.COM © Dassault Systèmes | Confidential Information | 9/7/2020 | ref.: 3DS_Document_2015



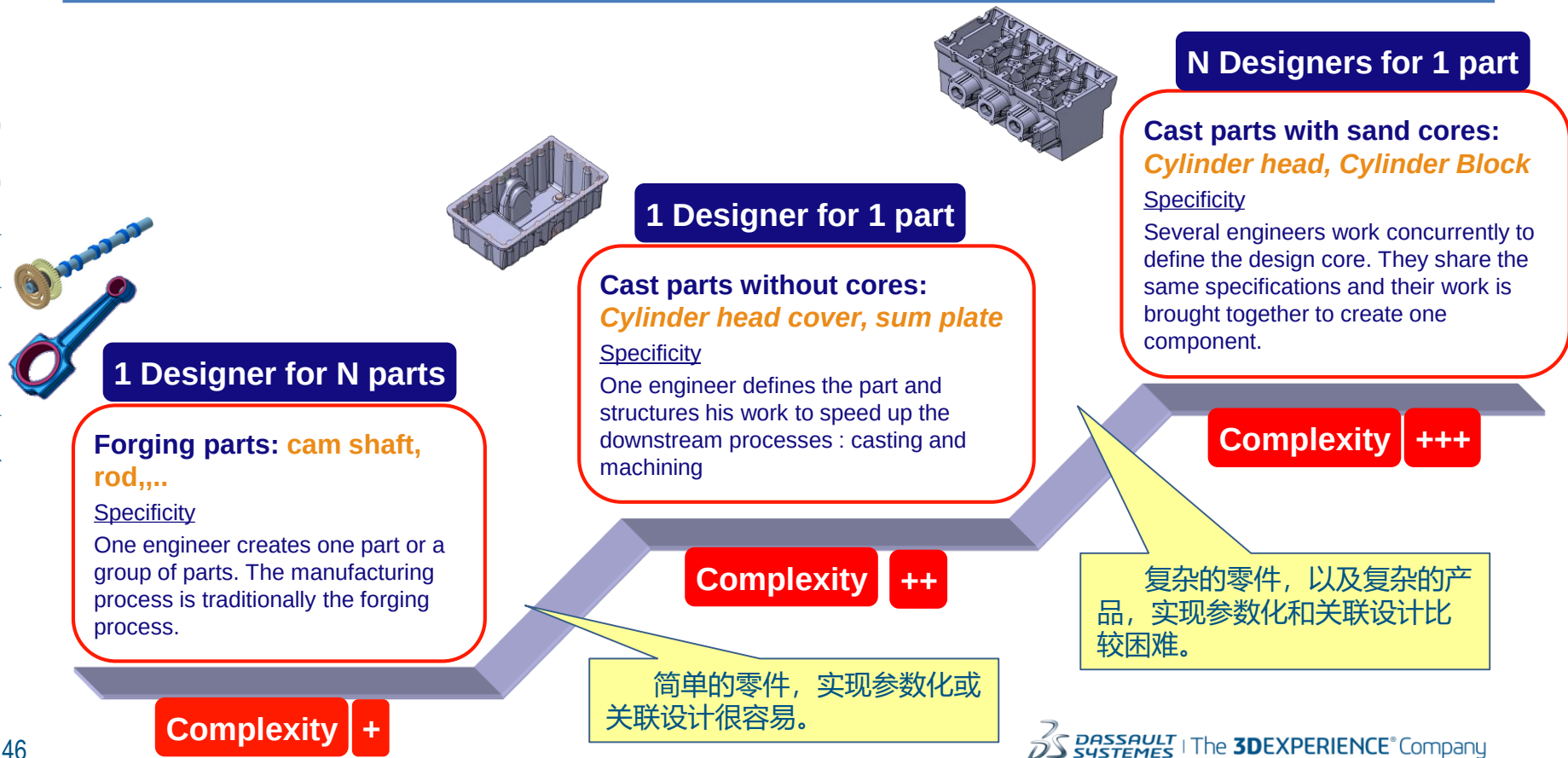
然后定义这些功能参数的架构



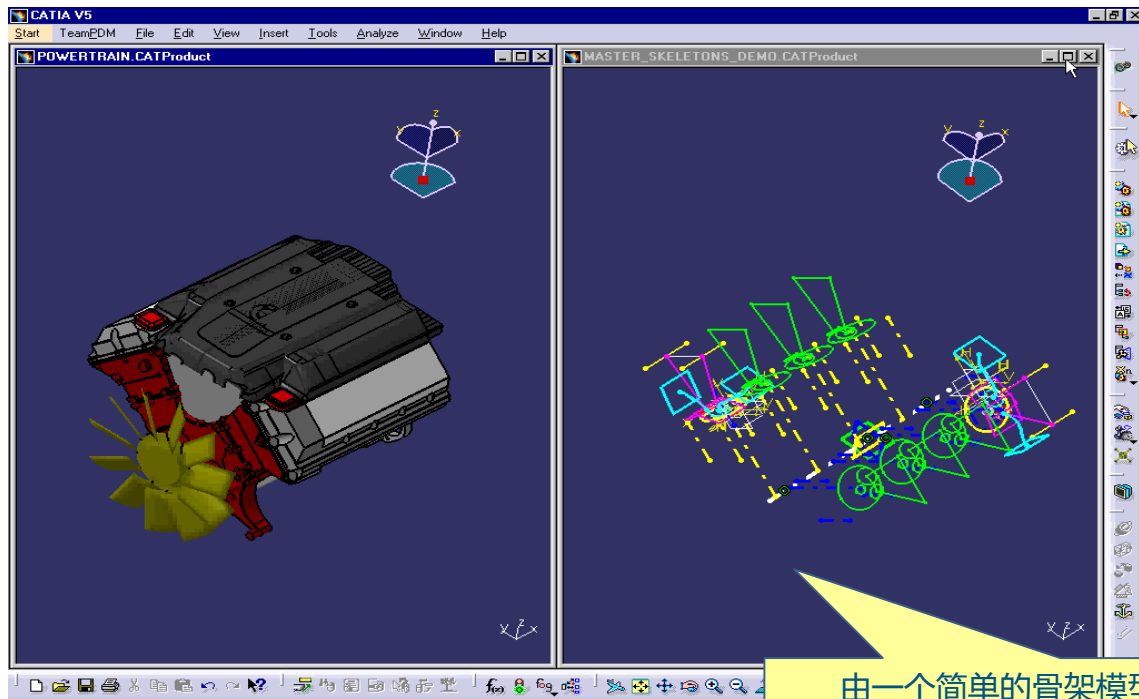
面向设计，而不是建模：Spec-Driven Design



从简至繁的过程：Skeleton方法

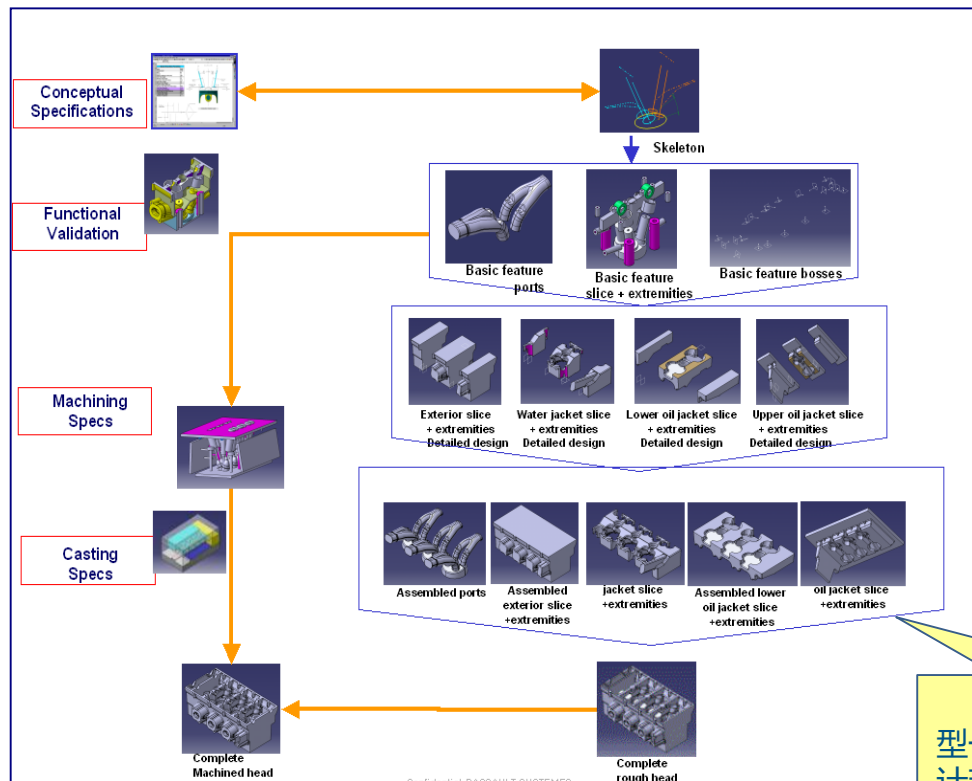


从简至繁的过程：Skeleton方法



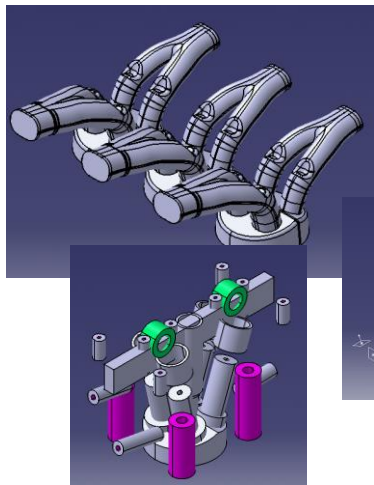
由一个简单的骨架模型，去控制复杂的整个产品模型，实现参数化和关联设计就比较容易些，这就是Skeleton方法的本质。

从简至繁的过程：Skeleton方法

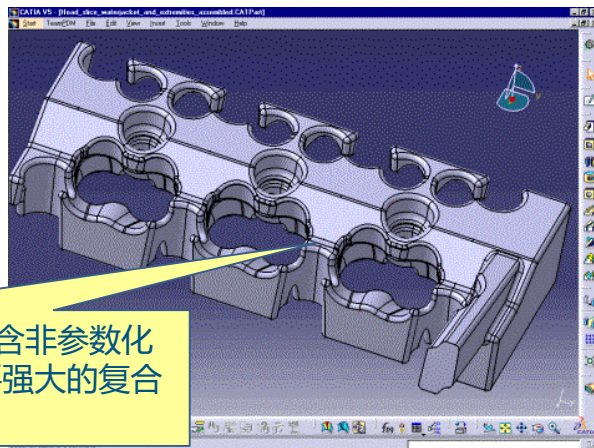


各个层级的Spec和骨架模型一层层地控制着各个详细设计环节和层级。

设计复杂产品的关键：各种强大的建模能力



水套，气道都是曲面模型，通过CAE分析和实验得到的曲面还是不可编辑的非参数曲面。

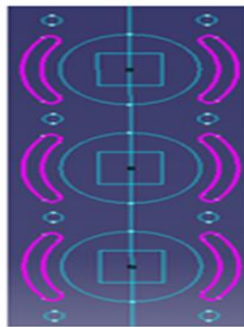
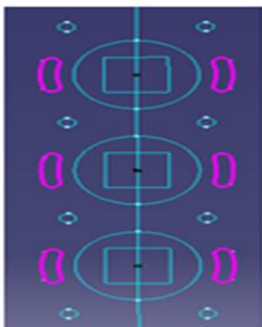
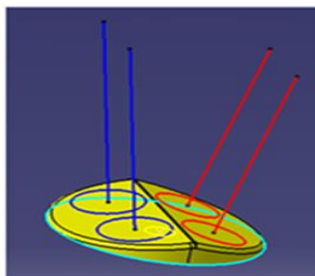
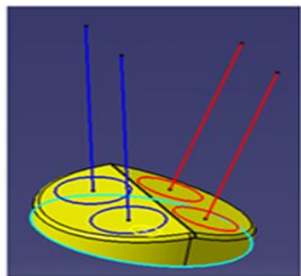


一个复杂零件既包含参数化特征，又包含非参数化特征，而且参数化程度还可以提高，这需要强大的复合建模能力。

曲线，曲面作为参数容差性建模草图的Profile定义等等

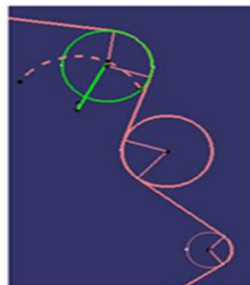


快速更改，多方案优化：优异的Publication



对于整个产品而言，常常需要做多个设计方案的评估和优化。CATIA的Publication功能帮助工程师们在多个方案中，针对参数特征和非参数特征，都可以进行快速和稳定的更改。

CATIA关联设计最核心的功能，没有之一。



行业的领导者 - CATIA的先进性介绍



样机(Mock-Up)



► 样机的三大作用

- ▷ 相对于传统的平面的二维工程图而言，样机使工程技术人员对产品的了解更为形象和直观。
- ▷ 样机使工程技术人员可以进行一些产品的功能性分析
- ▷ 研讨和验证设计方案

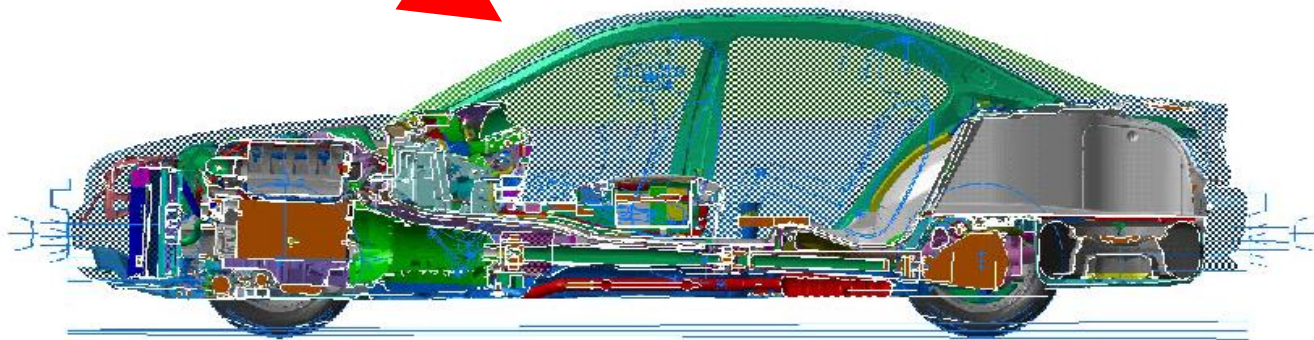
► 制造样机的目的

- ▷ 给工程技术人员提供了一个分析产品，验证方案，进行技术决策(Decision Making)的平台。

数字样机 (Digital Mock-Up)



二十世纪九十年代以来，随着各种产品的更新换代越来越快，样机的制造周期和制造成本变得难以适应产品开发的需求，同时，计算机三维辅助设计技术却出现了飞速地发展，所以，通过计算机三维设计技术建立数字样机(Digital Mock-Up，以下简称DMU)成为工程技术人员新的设计手段。



数字样机的三个层次

► 物理样机的三大作用

- ▷ 形象
- ▷ 功能性分析
- ▷ 多方案研讨

► 数字样机应用的三个层次

- ▷ 可视化 (Visualization)
- ▷ 数字化预装配 (Digital Pre-Assembly)
- ▷ 关联设计 (Relation design)

可视化 (Visualization)



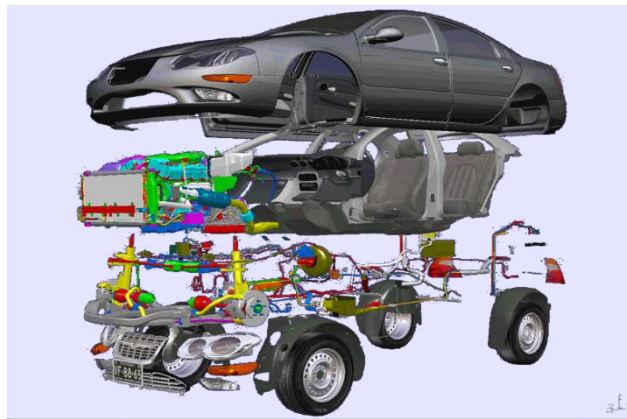
可视化的目标是尽可能在数字化环境中看到真实世界中相同的效果

DMU可视化的价值

- 低成本
- 快速可视化的实现

DMU可视化的超越价值

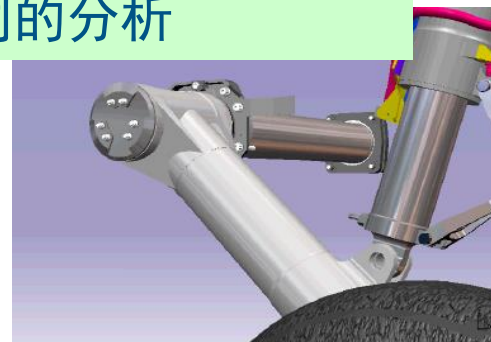
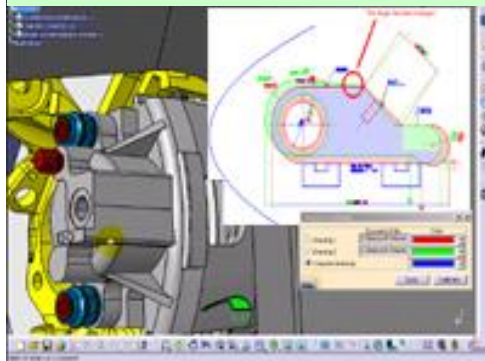
- 可视化和产品结构的统一
- 复杂区域的可视化
- 可视化应用范围的扩展



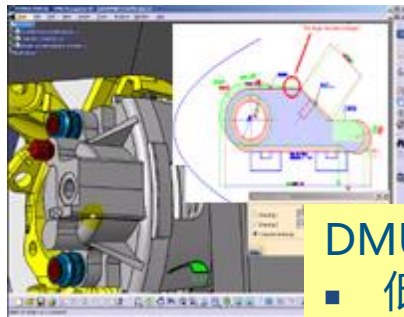
数字化预装配 (Digital Pre-Assembly)



数字化预装配的目标是尽可能在数字化环境中进行真实世界中相同的分析



数字化预装配 (Digital Pre-Assembly)



干涉检查

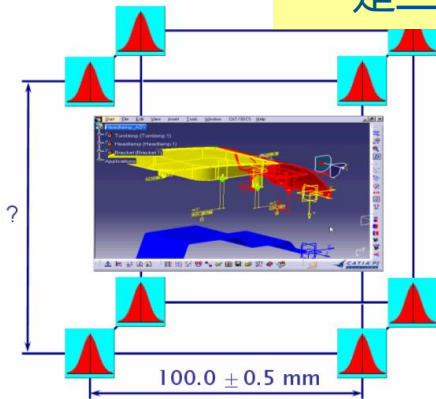


DMU DPA的价值

- 低成本进行产品功能性研讨
- 使设计人员更多地考虑产品的功能设计，而不是三维建模



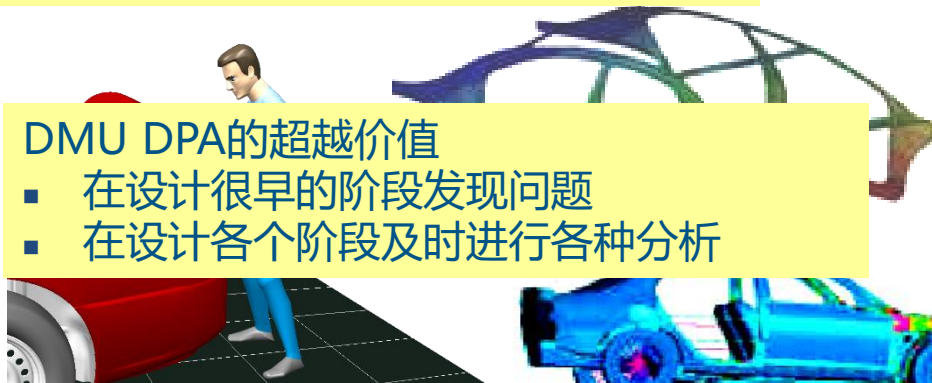
人机工程分析



公差分析

DMU DPA的超越价值

- 在设计很早的阶段发现问题
- 在设计各个阶段及时进行各种分析



可制造性分析

性能分析



关联设计 (Relation design)

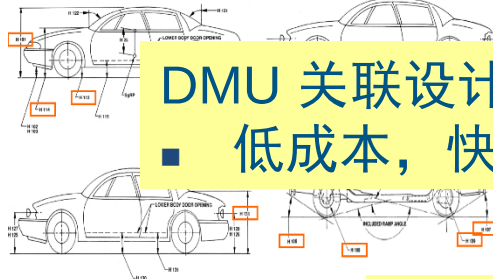
- 自顶向下的设计方式
- 总体参数的驱动与控制
- 端到端的相关性

DMU 关联设计的目标是多个what-if方案的研讨，从而完成最优的技术决策

No.	h136 (mm)	h101 (mm)	h112 (mm)	h114 (mm)	h138 (mm)	h147 (deg)	h151 (deg)	h156 (deg)	h168 (mm)	h169 (mm)
1	26	14.14	52	220	135	34.3	60	195	222.6	522.5
2	26	14.14	52	140	134	34.3	60	195	222.5	522.5
3	26	14.14	52	150	133	34.3	60	195	222.5	522.5
4	25	1399	70	150	133	34.1	740	185	35	37.1
5	25	14.14	58	220	135	34.3	60	195	222.6	522.5



Select a simulation object

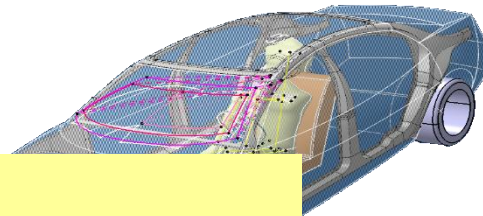


DMU 关联设计的价值

- 低成本，快速进行多方案研讨

DMU 关联设计的超越价值

- 通过定义总体控制参数和各个阶段的局部控制参数对整个研发过程实行控制



行业的领导者 - CATIA的先进性介绍



CATIA V6的特点

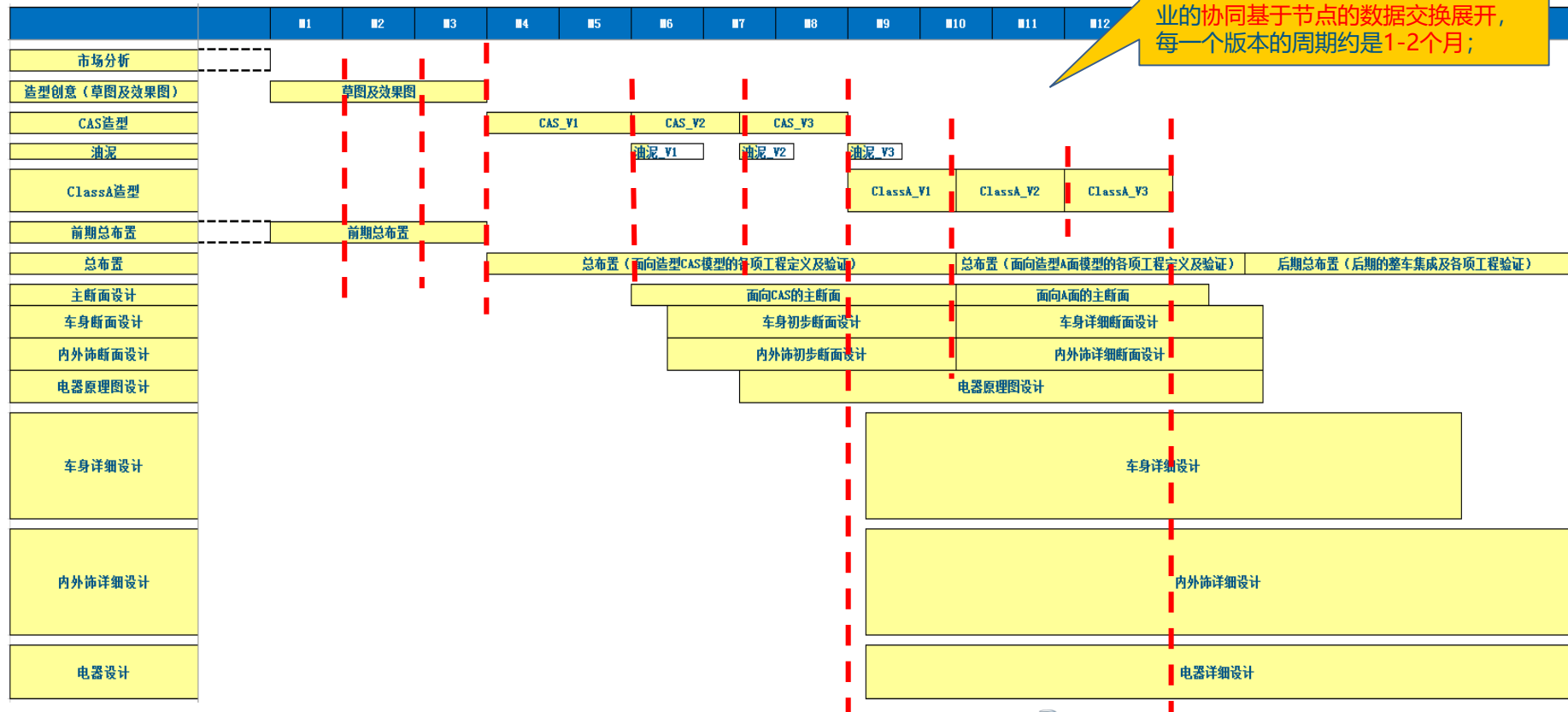
相对于过去的基于文件的CATIA V5应用，集成在“3DEXperience平台”中的CATIA V6应用有三大技术特点

- ▶ CATIA V6数据存储在**统一的数据库**中
- ▶ CATIA V5的文件变成了一个个更细颗粒度的**CATIA V6数据对象**
- ▶ “CAD软件的三维模型数据” 和 “PDM软件的Meta Data” 的**融合**

协同设计流程

图示为一个较传统的换代车型的
造型-总布置流程。

红色虚线表示一个个节点，各专
业的协同基于节点的数据交换展开，
每一个版本的周期约是1-2个月；



协同设计流程

序号	工作任务	部门	负责人
1.0	前期总布置	总布置	总布置工程师01
2.0	概念CAS建模	造型	造型设计师01
3.0	概念CAS工程校核	总布置	总布置工程师01

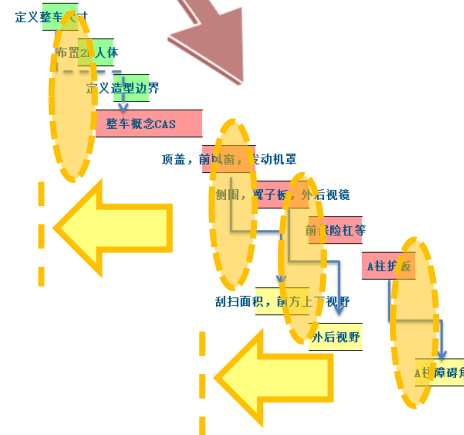
60-70个概念总布置要素 (子流程)

40-50个先行CAS要素 (子流程)

若干前期CAS的工程校核要素 (子流程)

序号	工作任务	部门	负责人
1.2	前期总布置-侧围总布置 (10+项关键点示例)	总布置	总布置工程师01
1.3	前期总布置-车顶总布置	总布置	总布置工程师01
2.2	概念CAS建模-前风窗, 发动机罩	造型	造型设计师01
2.3	概念CAS建模-侧围, 翼子板, 外后视镜	造型	造型设计师01
2.4	概念CAS建模-前保险杠等其它分片	造型	造型设计师01
2.5	概念CAS建模-A柱护板	造型	造型设计师02
3.1	概念CAS校核_前风窗, 前风窗, 发动机罩	总布置	总布置工程师02
3.2	概念CAS校核_侧围, 翼子板, 外后视镜	总布置	总布置工程师02
3.3	A柱护板	总布置	总布置工程师02
3.4			

转化为更细颗粒度的子流程协同



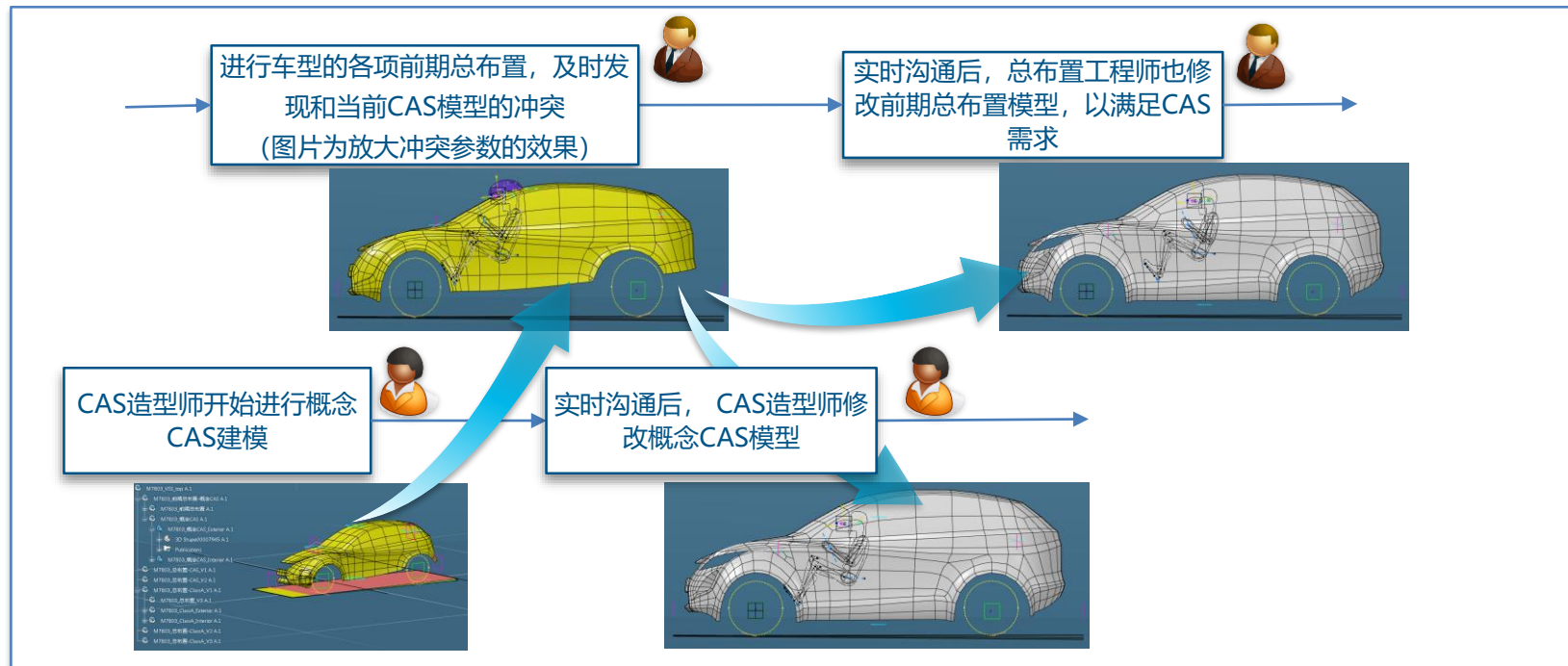
协同设计流程



总布置工程师

CAS造型师

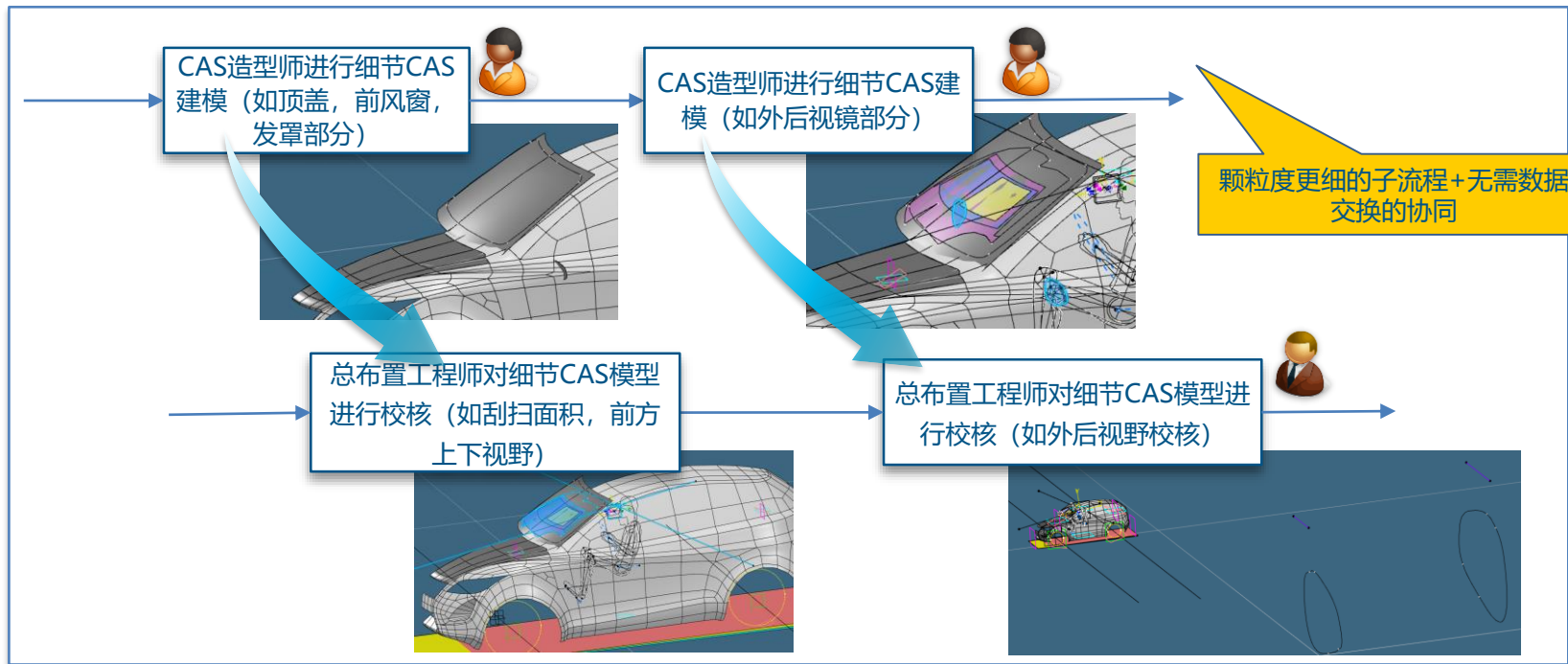
协同设计流程



总布置工程师

CAS造型师

协同设计流程



总布置工程师 

CAS造型师 

协同设计流程

序号	工作任务	部门	负责人
1.0	前期总布置	总布置	总布置工程师01
2.0	概念CAS建模	造型	造型设计师01
3.0	概念CAS工程校核	总布置	总布置工程师01

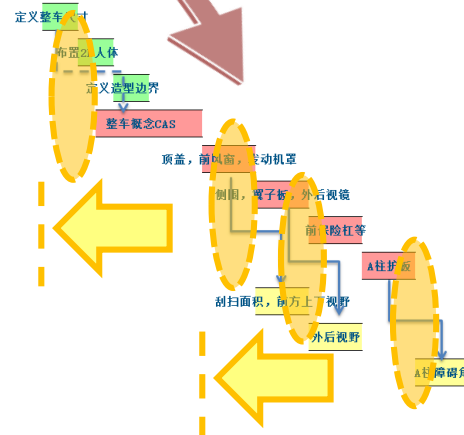
60-70个概念总布置要素 (子流程)

40-50个先行CAS要素 (子流程)

若干前期CAS的工程校核要素 (子流程)

协同设计只是手段，最终目标是缩短周期，提前减少专业间的冲突

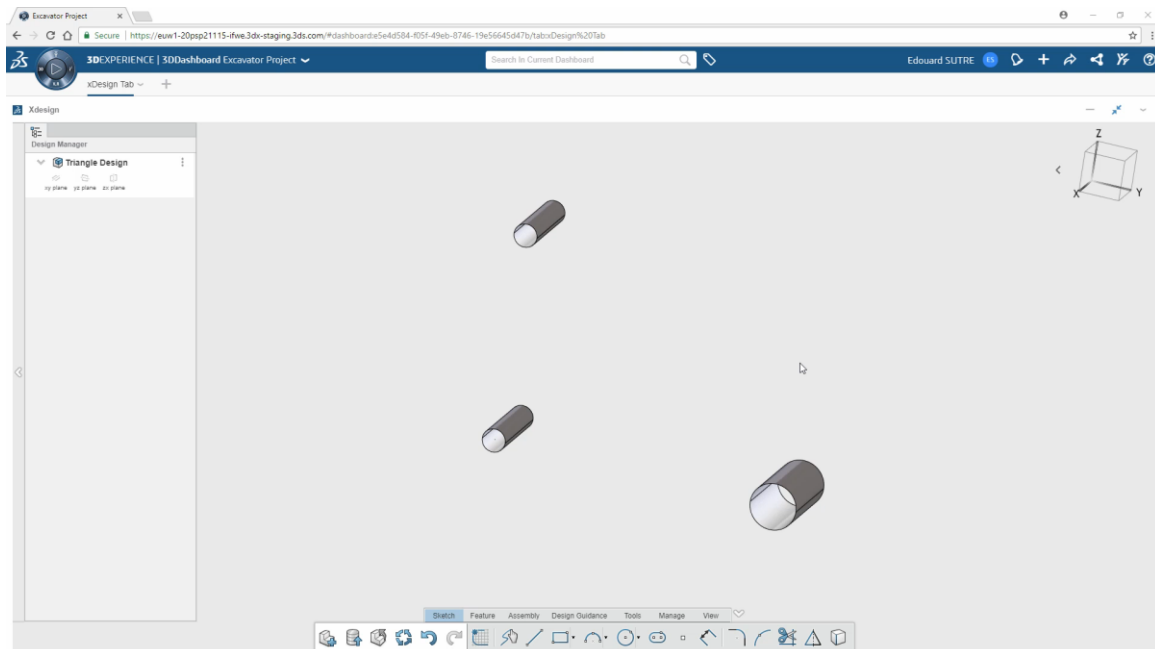
序号	工作任务	部门	负责人
1.2	前期总布置-侧围总布置 (10+项关键点示例)	总布置	总布置工程师01
1.3	前期总布置-车顶总布置	总布置	总布置工程师01
2.2	概念CAS建模-前风窗，发动机罩	造型	造型设计师01
2.3	概念CAS建模-侧围，翼子板，外后视镜	造型	造型设计师01
2.4	概念CAS建模-前保险杠及其它分片	造型	造型设计师01
2.5	概念CAS建模-A柱护板	造型	造型设计师02
3.1	概念CAS校核-前风窗，前风窗，发动机罩	总布置	总布置工程师02
3.2	概念CAS校核-侧围，翼子板，外后视镜	总布置	总布置工程师02
3.3	A柱护板	总布置	总布置工程师02
3.4			



转化为更细颗粒度的子流程协同

行业的领跑者 - CATIA的未来发展

Web浏览器上的三维设计：CATIA Xdesign



在当今互联网高速发展的时代，常常会有工程师憧憬在互联网上进行CAD设计，无需在电脑上安装数十G的CAD软件，像其它互联网应用一样，仅仅是打开浏览器网页就可以进行CAD设计。

CATIA xDesign正是应这种需求而生的CATIA新模块。在达索系统公司的公有云平台上，通过浏览器网页，就可以完成实体设计，曲面设计，装配设计，以及基本的CAE分析及优化。

结语

新一代平台带来的价值

