CATIA for Composites
Design & Manufacturing Preparation

Design and produce: better, stronger and lighter

domenico.berardi@3ds.com

Cell +39 3464002722

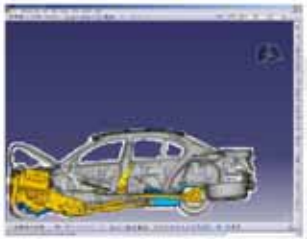
DASSAULT SYSTEMES

Gruppo Dassault Systèmes

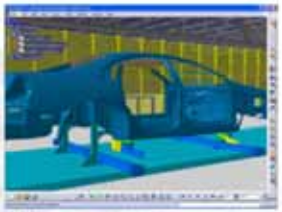
3D MCAD	Virtual Product	Virtual Testing	Virtual Production	PLM Collaboration	Life Experience

CATIA

SIMULIA

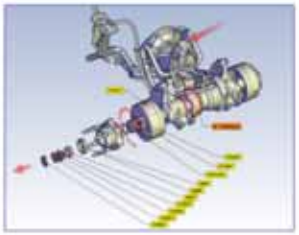


DELMIA

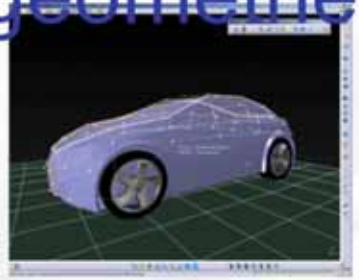


ENOVIA

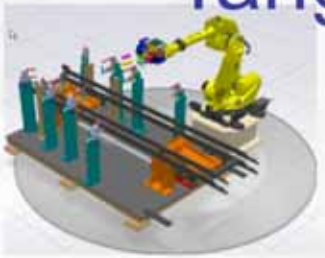
3dvia



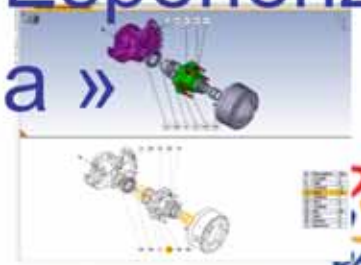
«Creazione forme & geometrie »



« Realtà Tangibile »



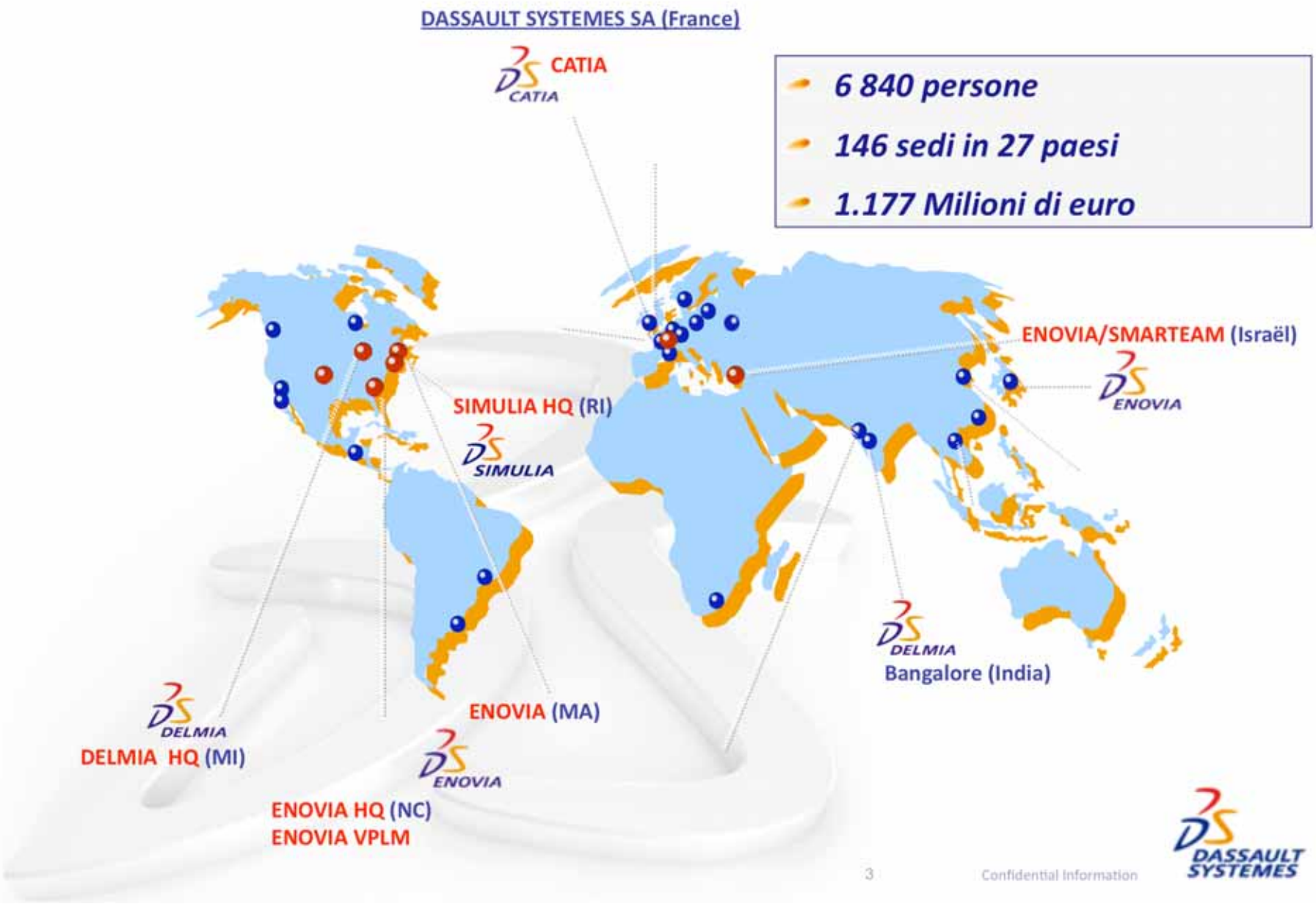
« Esperienza »



DASSAULT SYSTEMES

Dassault Systèmes nel mondo

Una societa', soluzioni di eccellenza



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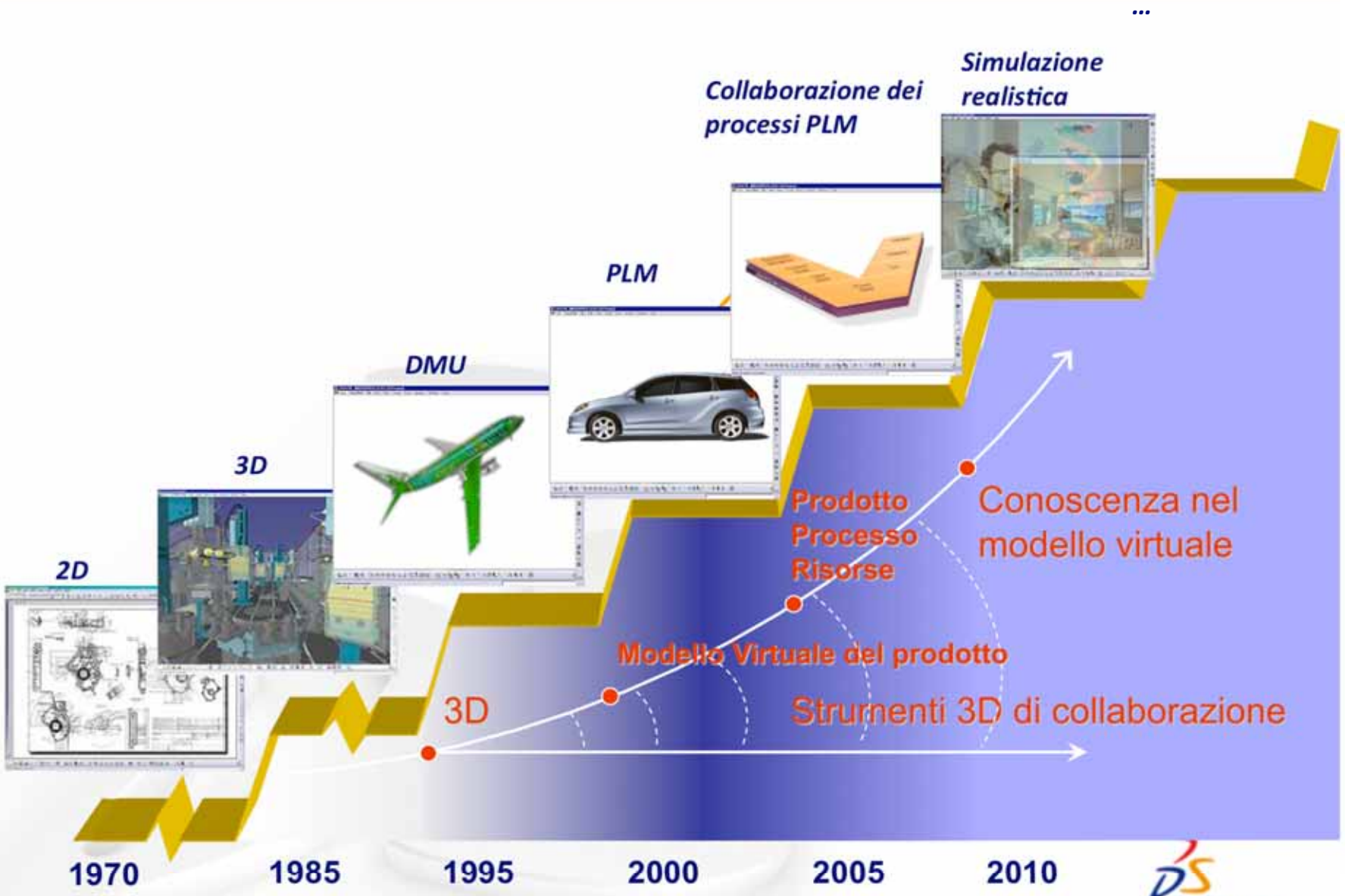
“Aumentate la competitivita’ dei clienti”



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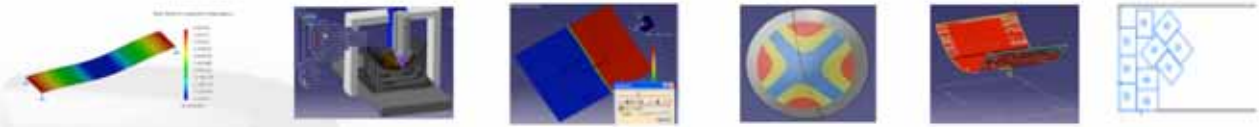
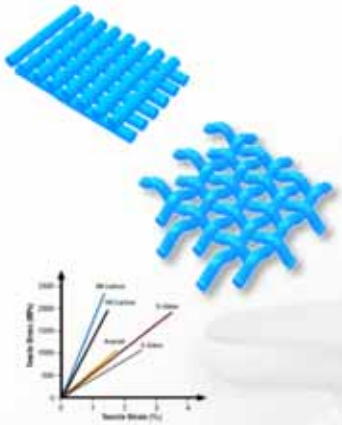
Typical needs of the composites industry

Reduce the **costs** of:
- non quality: produce as designed, tailorability
- trials, mock-up: virtual performance tests, manufacturing processes simulation
- raw materials: material use from design mock up





Optimize weight and performances:
- Drive the design choices
- Design in context

Be **efficient:**
- Work as a global team with an integrated solution

Be **productive:**
- Work with the best in class solution

Innovate:
- Industrialize the processes

DASSAULT SYSTEMES

DS fulfills your needs and help innovation

CATIA, SIMULIA, DELMIA and DS Partners for an integrated end-to-end composites process from design & simulation to manufacturing & simulation

- *Full process coverage and First closed loop between analysis/design/manufacturing*
  ->Eliminates error risks and drastically reduces cost

- *Unique design capabilities*
  - *"in manufacturing Context"*
  - *« in assembly context »*

-> designs right the first time

- *Strong collaboration capabilities enabling concurrent design and manufacturing synchronisation*
  -> Reduces lead-time from Design to Production

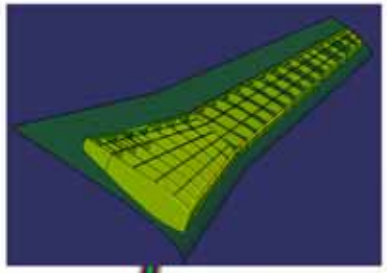
- Nesting
- Laser Projection
- Tape laying
- Fiber Placement
- Resin Transfer Molding

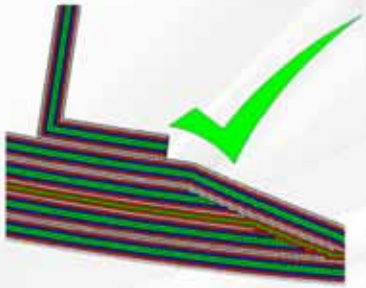
Physical world

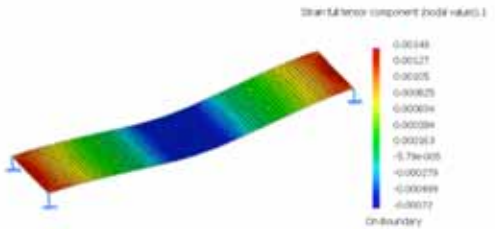
Expected gain : ~ 30% overall

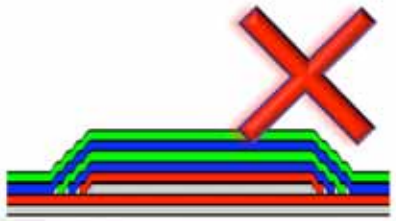
Design intent & Design context

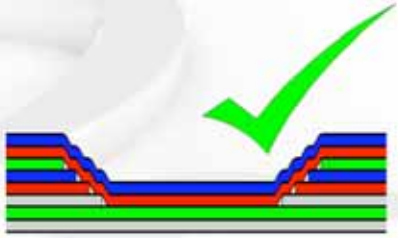
Define the right part configurations by designing in the **context of assembly**





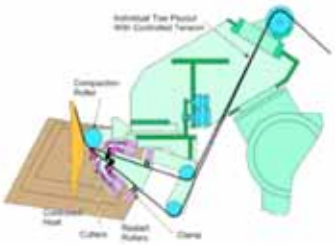


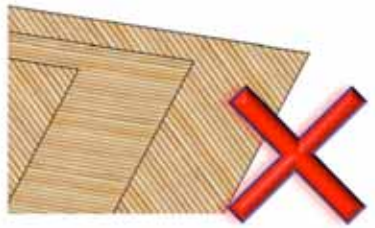




Optimize the performances and weight by designing in the **context of analysis**

Produce better and cheaper by designing in the **context of manufacturing**





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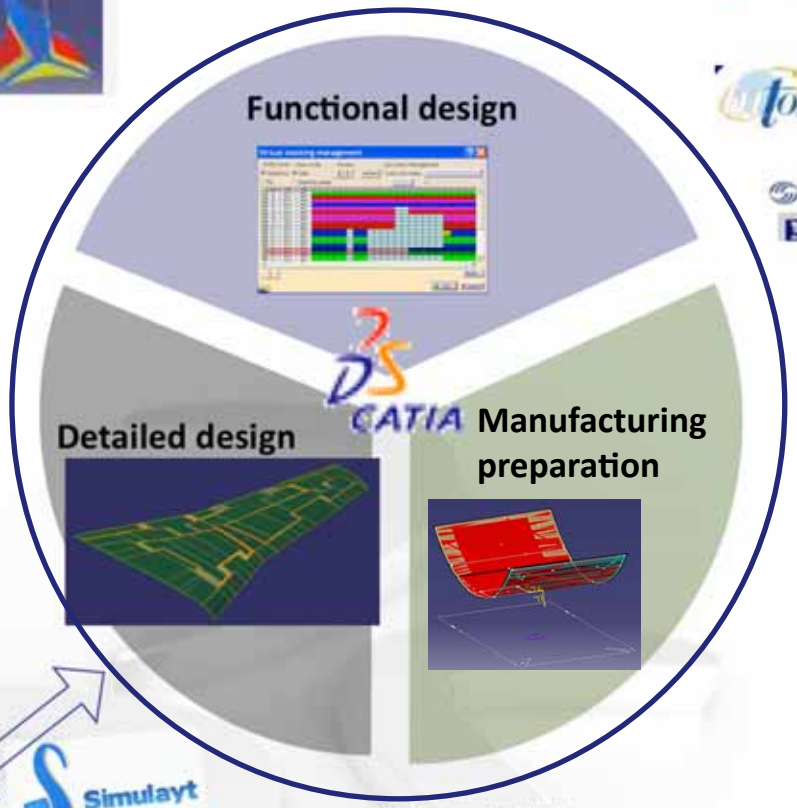
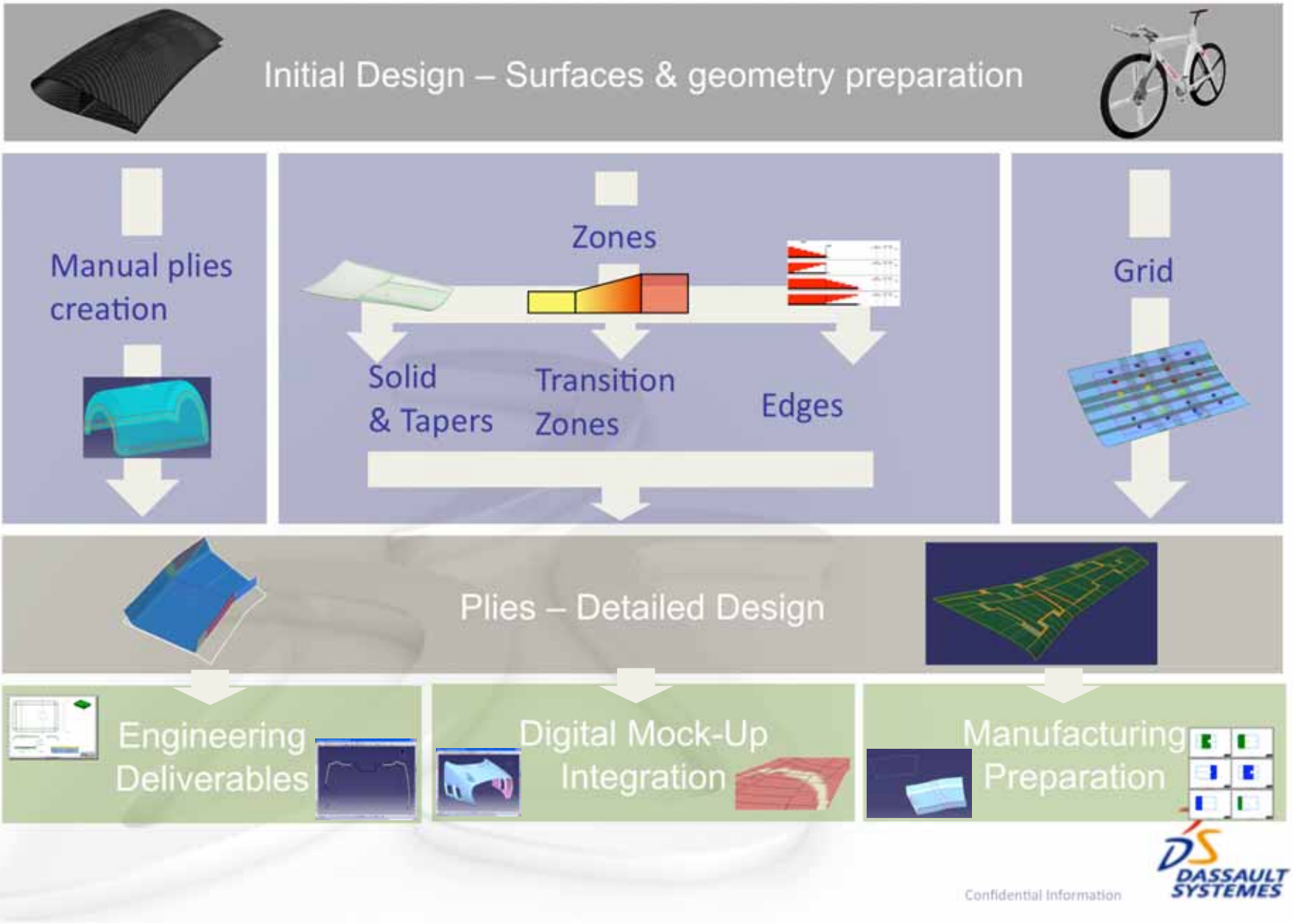
CATIA for Composites:
The backbone of an extended solution



ESI GROUP
Simulayt
Adv. Draping processes
Nesting
Cutting
AIRBUS CIMPA
MAGESTIC SYSTEMS
Laser Projection System
MAGESTIC SYSTEMS
CINCINNATI LAMB
INGERSOLL
FiberPlacement
TORRES
CAAV5 BASED
AIRBUS CIMPA
FOREST-LINE
CORIOLIS composites
CINCINNATI LAMB
FOREST-LINE
Tape Laying
AIRBUS CIMPA
CAAV5 BASED
TORRES
INGERSOLL
NEW
DELMIA
3dvia
Manufacturing Planning And documentation
ESI GROUP
RTM
CAAV5 BASED
Simulayt
ABAQUS
SIMULIA
CATIA
DASSAULT SYSTEMES
+ other solvers

CATIA Composites: From shapes to Laminates



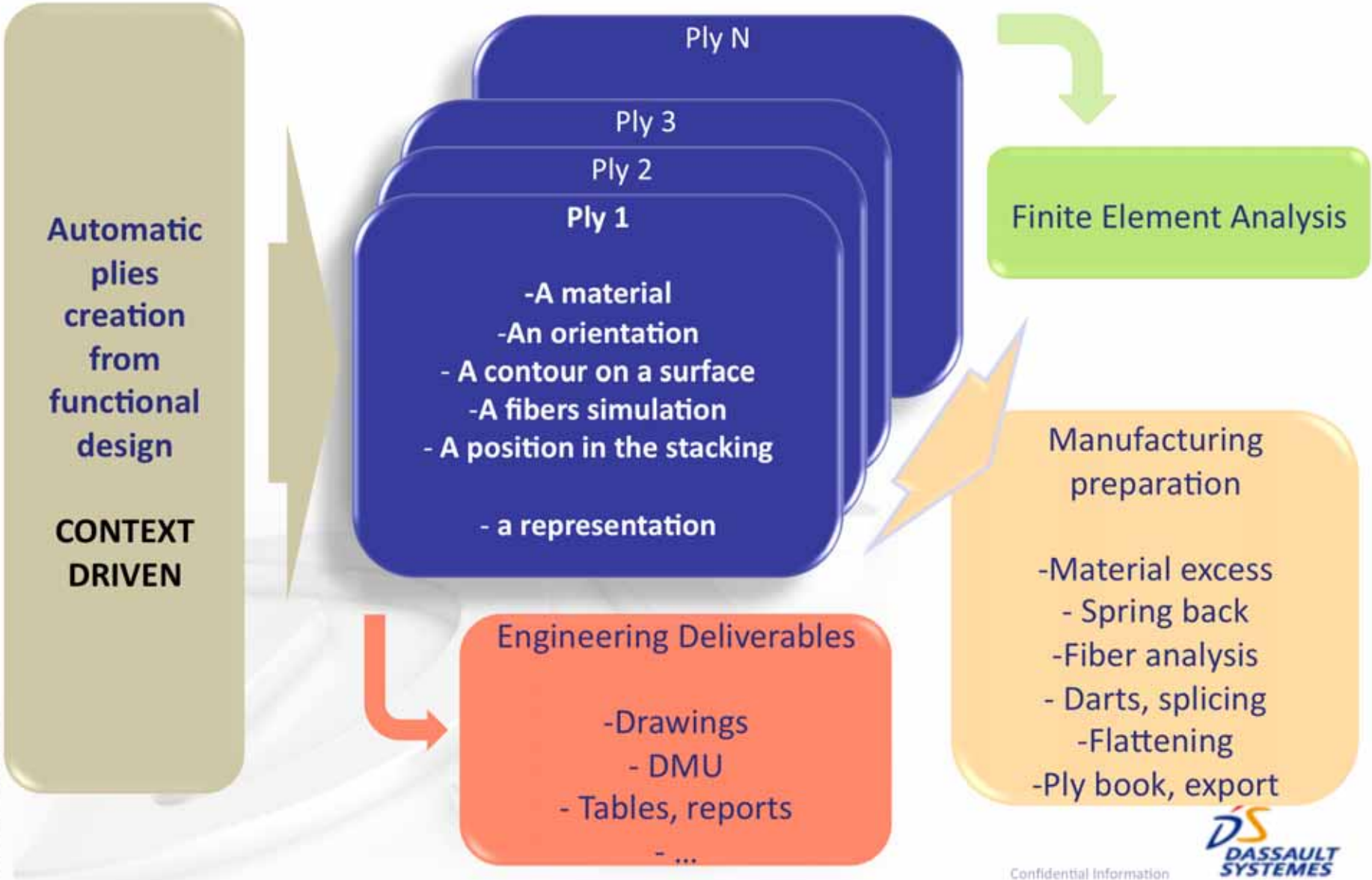
What is a ply in CATIA ?

What is a ply in CATIA?

-A material
-An orientation
- A contour on a surface
-A fibers simulation (draping process)
- A position in the stacking

- a representation

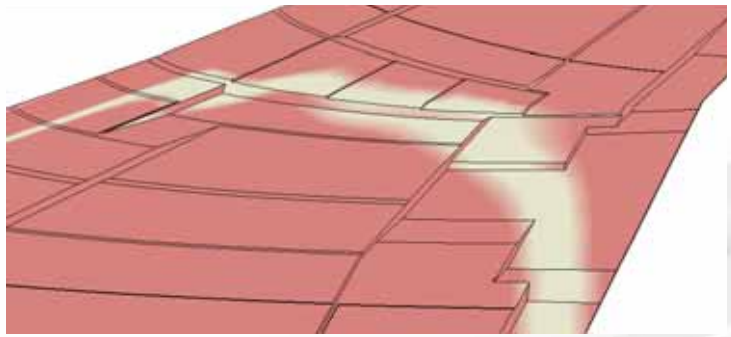
The « Ply Lifecycle management » in CATIA

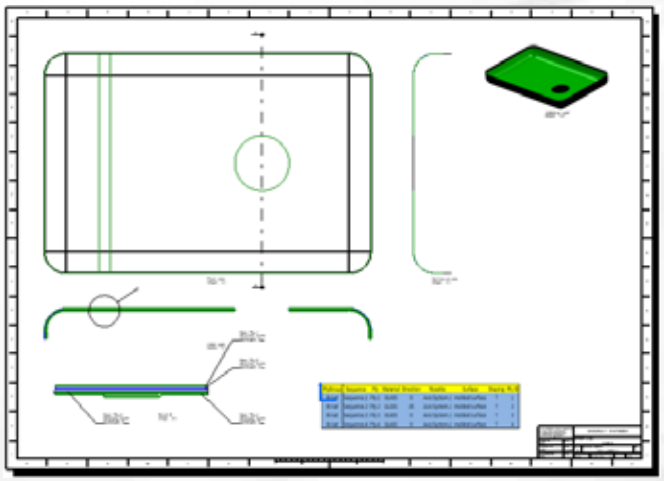


Engineering deliverables…

-Drawings
- DMU
- Tables, reports
- …

PlyGroup	Sequence	Ply	Material	Direction	Rosette	Surface	Draping	Ply ID
ilk kat	Sequence.1	Ply.1	GLASS	0	Axis System.1	molded surface	T	1
ilk kat	Sequence.2	Ply.2	GLASS	45	Axis System.1	molded surface	T	2
ilk kat	Sequence.3	Ply.3	GLASS	0	Axis System.1	molded surface	T	3
ilk kat	Sequence.4	Ply.4	GLASS	0	Axis System.1	molded surface	T	4



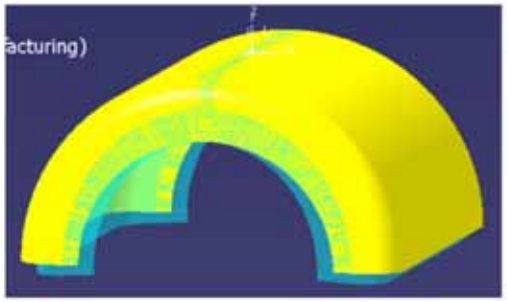


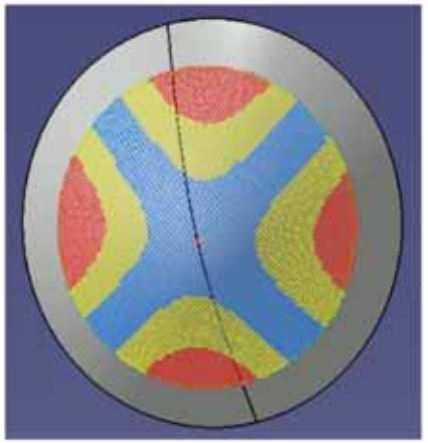
- Solid/Top surface from plies
- IML (Inner Mold Line)
- Analysis, Core Sample
- Ply table
- Drawings with Generative view style
- Drawing with Annotation templates

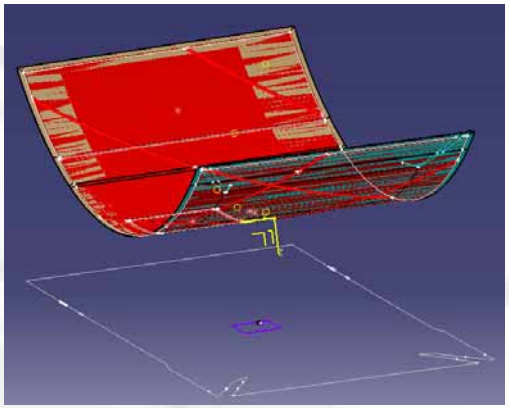
Manufacturing Preparation

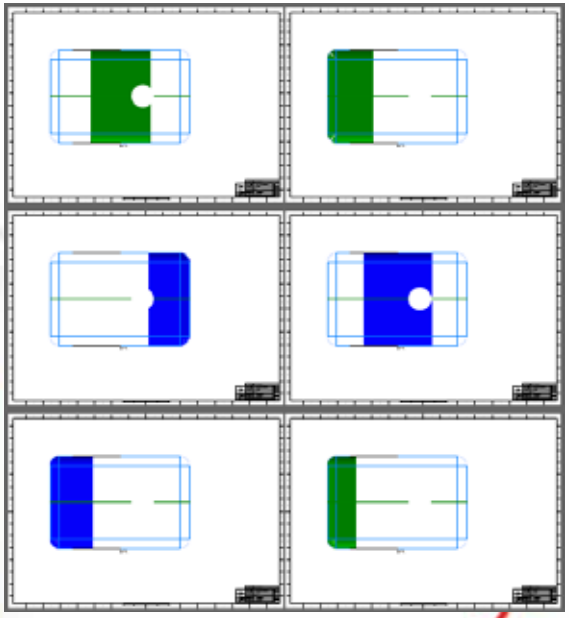
Manufacturing preparation

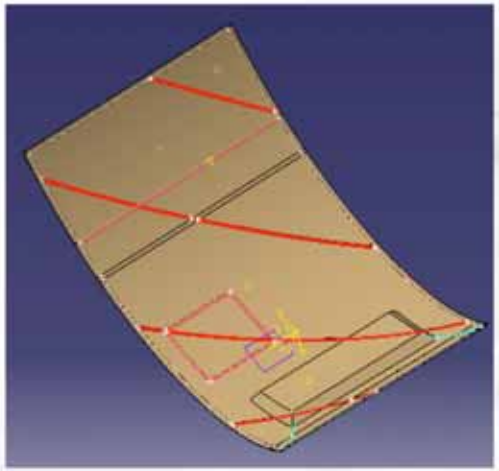
-Material excess
- Spring back
-Fiber analysis
- Darts, splicing
-Flattening
-Ply book, export

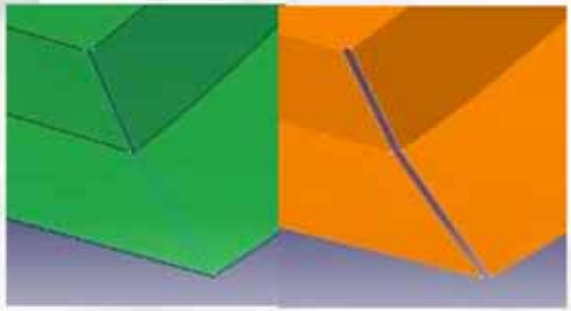








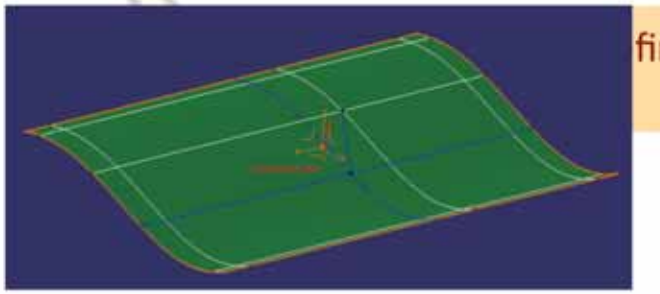




DASSAULT SYSTEMES

Solid and tapers approach

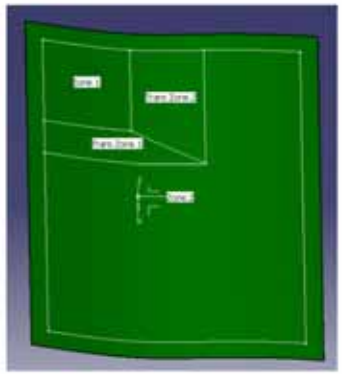
1 fining Group of Zones



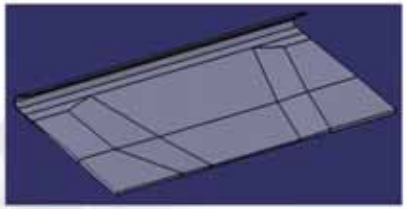
2 Defining Zones

ZONES	MATERIAL	0	45	-45	90
Zone.1	Carbon 0.27	10	5	5	0
Zone.2	Carbon 0.27	2	0	0	0

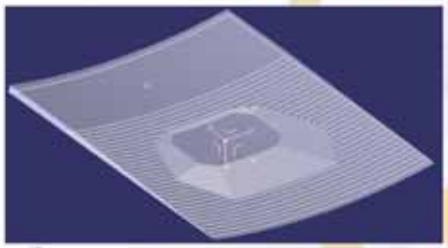
3 Defining Tapers



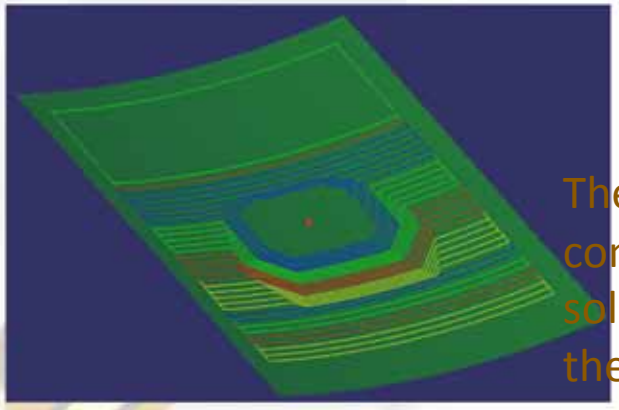
4 Defining Solid Or Using Solid



5 Defining Slicing



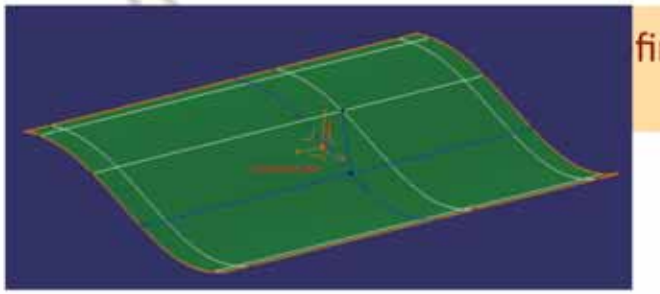
6 Defining Plies and ordering



The creation of the plies contours computed on the solid ensure the respect of the geometric tolerance

Zones and transition zones approach

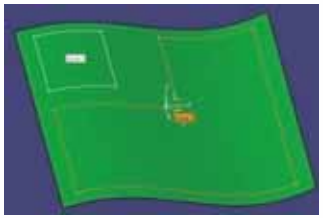
1



fining Group of Zones

2

Defining Zones

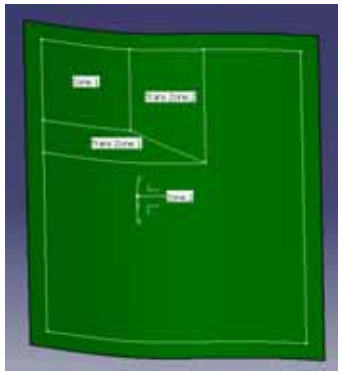


ZONES	MATERIAL	0	45	-45	90
Zone.1	Carbon 0.27	10	5	5	0
Zone.2	Carbon 0.27	2	0	0	0

Material	Orientation	Z1-1	Z2-1	Z3-1	Z4-1	Z5-1	Z6-1
Carbon 0.24	0	2	2	2	2	2	2
Carbon 0.24	30	1		1	1	2	1
Carbon 0.24	45					2	1
Carbon 0.24	-45	1		1		2	1
Carbon 0.24	60			1		2	1
Carbon 0.24	90	1		1	1	1	1
Glass 0.1	0	1	1	1	1	1	1

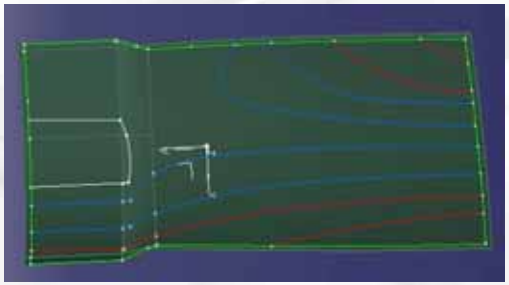
3

Defining Tapers



4

Editing the stack Up file



5

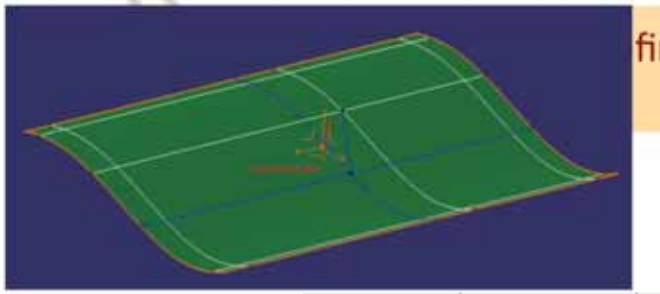
Defining plies

Zones and transition zones approach allows to dedicate areas to assembly interfaces, and manage the drop off on dedicated areas

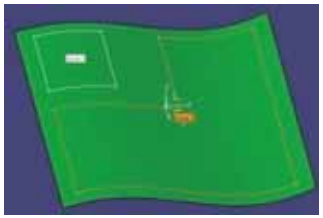
DASSAULT SYSTEMES

Zones and Staggering edges approach

1 fining Group of Zones



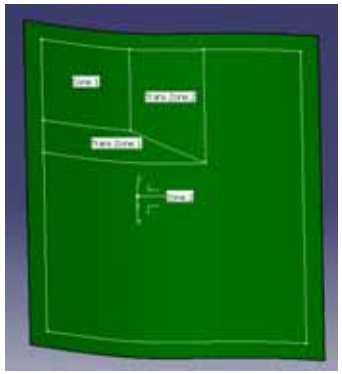
2 Defining Zones



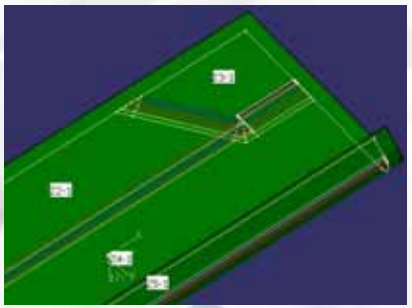
ZONES	MATERIAL	0	45	-45	90
Zone.1	Carbon 0.27	10	5	5	0
Zone.2	Carbon 0.27	2	0	0	0

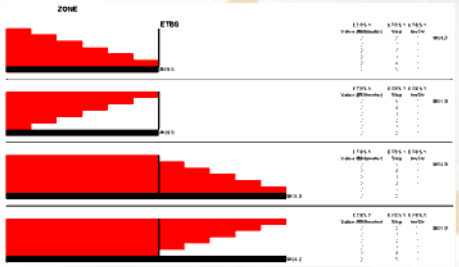
Material	Orientation	Z1-1	Z2-1	Z3-1	Z4-1	Z5-1	Z6-1
Carbon 0.24	0	2	2	2	2	2	2
Carbon 0.24	30	1		1	1	2	1
Carbon 0.24	45					2	1
Carbon 0.24	-45	1		1		2	1
Carbon 0.24	60			1		2	1
Carbon 0.24	90	1		1	1	1	1
Glass 0.1	0	1	1	1	1	1	1

4 Editing the stack Up file



4 Editing the staggering file



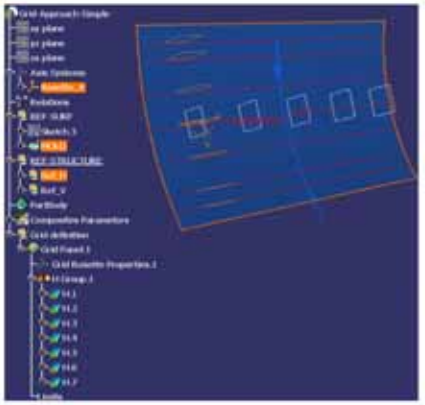


5 Defining plies

The zones and staggering approach allows a perfect tuning on the plies limits contours at the transition between two zoneh

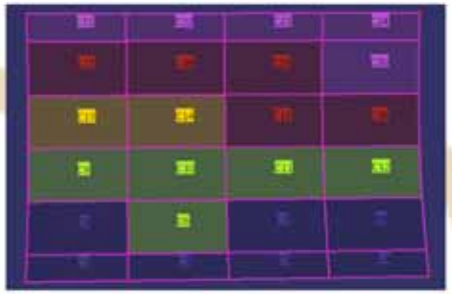
DASSAULT SYSTEMES

Grid approach



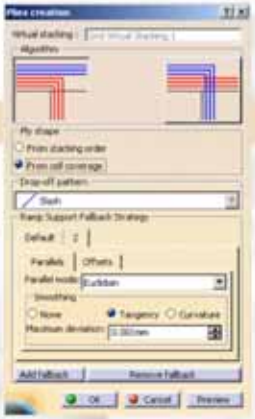
1

Defining Grid panel



2

Defining Grid

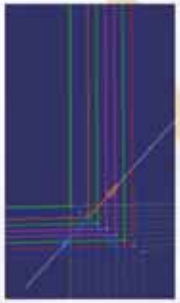


3

Defining Virtual Stacking

4

Defining Plies



5

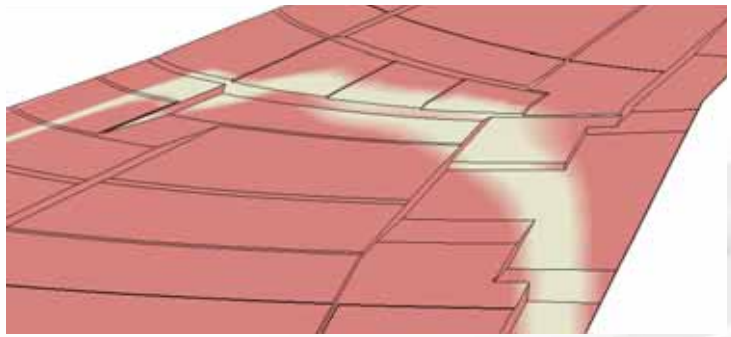
Optimize plies

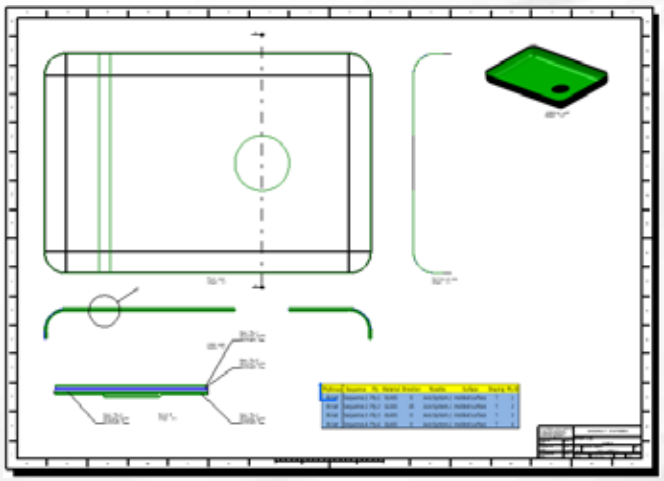
Based on geometries coming from the assembly context, driven by analysis specifications, and compliant with manufacturing challenges.

Engineering deliverables, DMU integration…

-Drawings
- DMU
- Tables, reports
- …

PlyGroup	Sequence	Ply	Material	Direction	Rosette	Surface	Draping	Ply ID
ilk kat	Sequence.1	Ply.1	GLASS	0	Axis System.1	molded surface	T	1
ilk kat	Sequence.2	Ply.2	GLASS	45	Axis System.1	molded surface	T	2
ilk kat	Sequence.3	Ply.3	GLASS	0	Axis System.1	molded surface	T	3
ilk kat	Sequence.4	Ply.4	GLASS	0	Axis System.1	molded surface	T	4

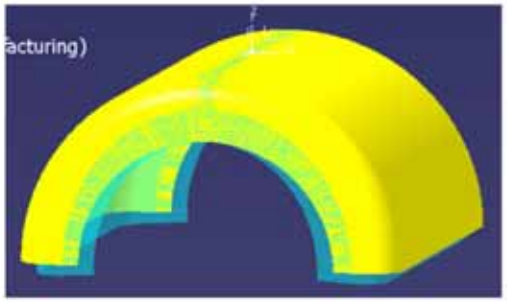


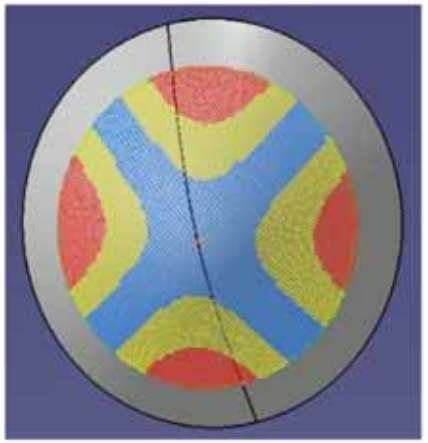


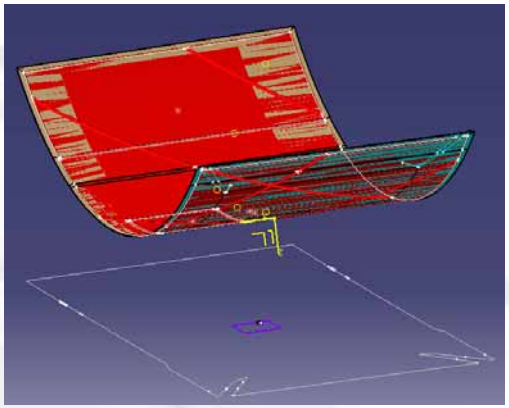
- Solid/Top surface from plies
- IML (Inner Mold Line)
- Analysis, Core Sample
- Ply table
- Drawings with Generative view style
- Drawing with Annotation templates

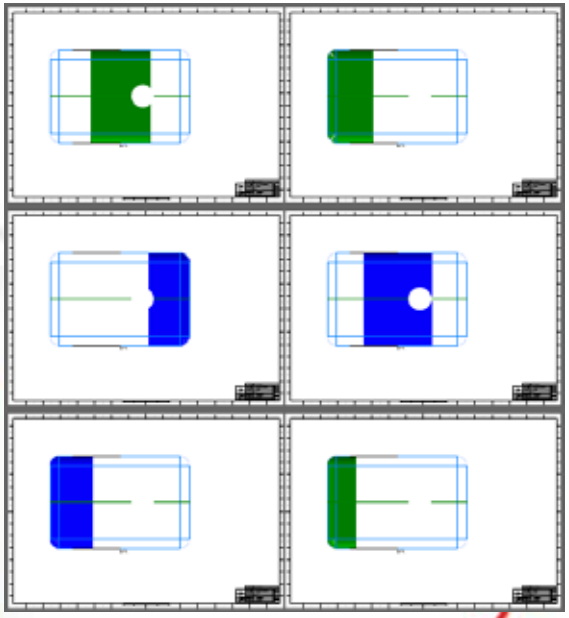
Manufacturing Preparation

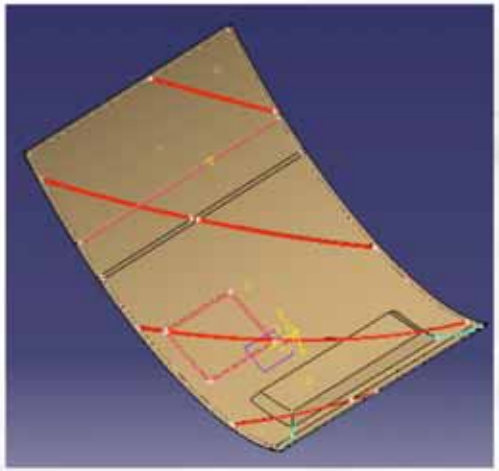
Manufacturing preparation
-Material excess
- Spring back
-Fiber analysis
- Darts, splicing
-Flattening
-Ply book, export

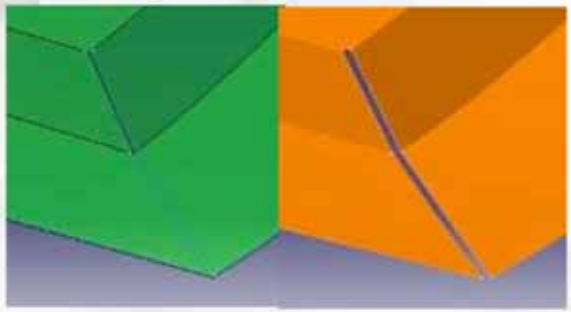






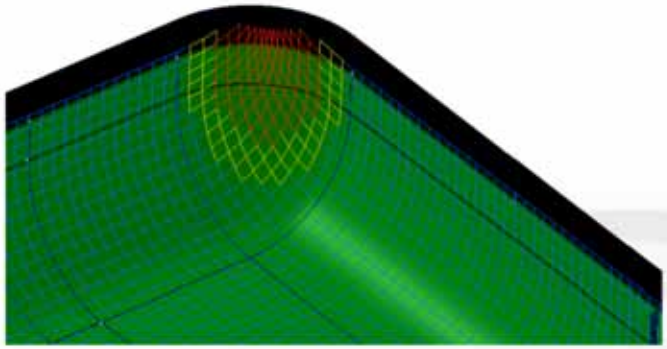


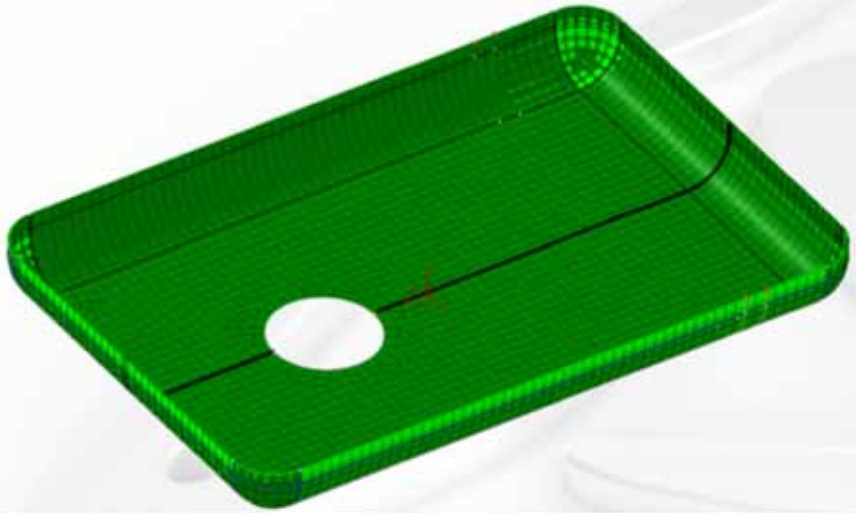




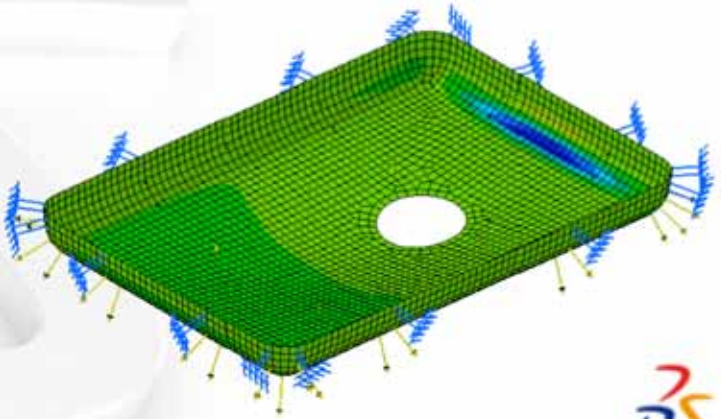
Integrated composite structural analysis

Finite Element Analysis





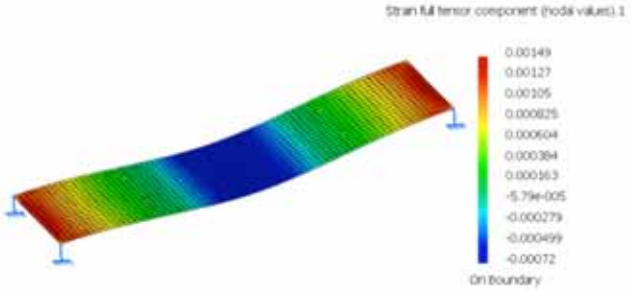
- Fiber deviations
- Mesh
- Composite properties
- Load case
- Solving
- Postprocesing

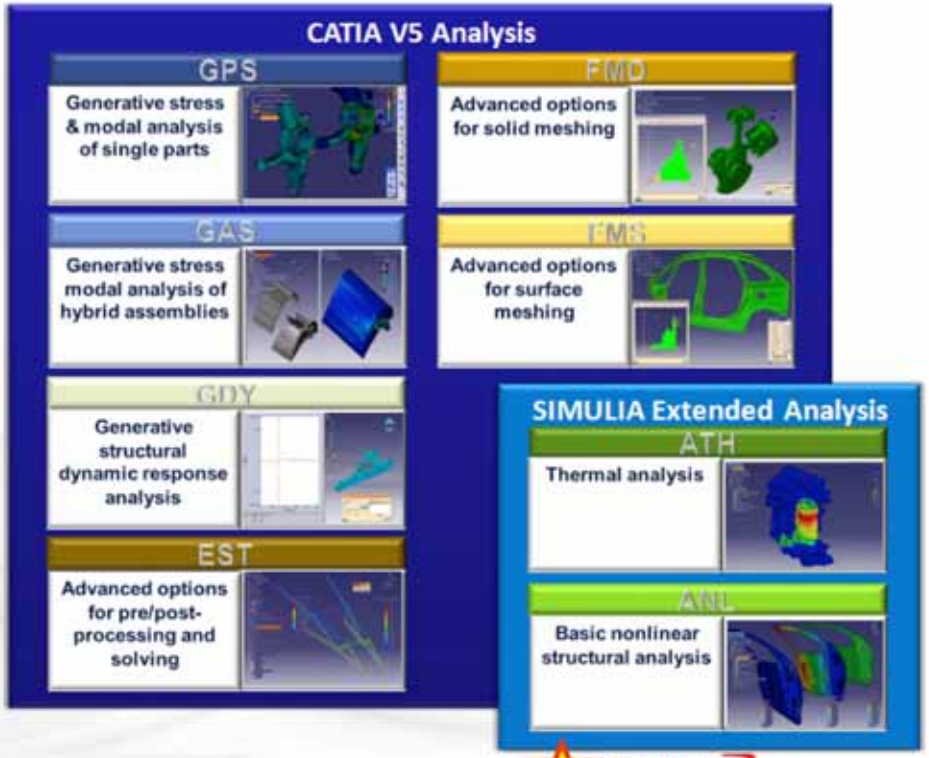


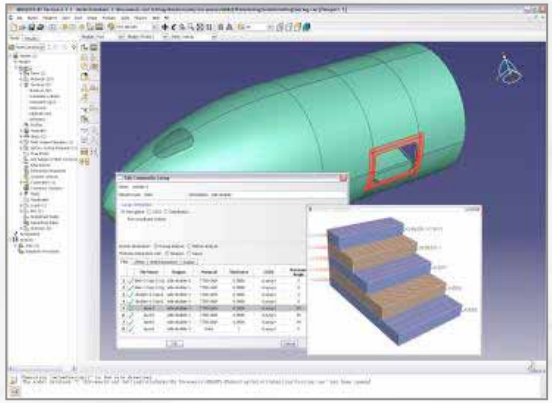
DASSAULT SYSTEMES

SIMULIA for composites structures performances

Scalable Solutions





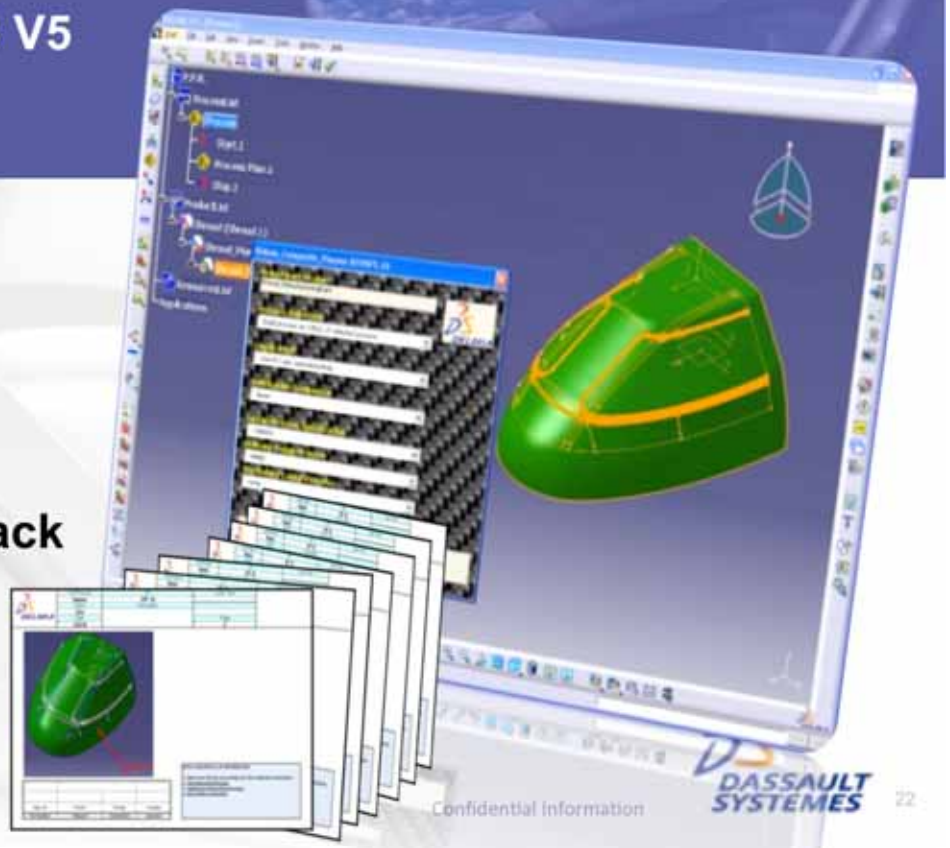


NEW

DELMIA composites production planning & documentation

Solution

- Rules based automatic process planning of composite plies
- Reuse engineering ply data in planning
- Deliver accurate as-planned and as-designed information to the shop floor
- End to end process coverage with DS V5 Partner solutions



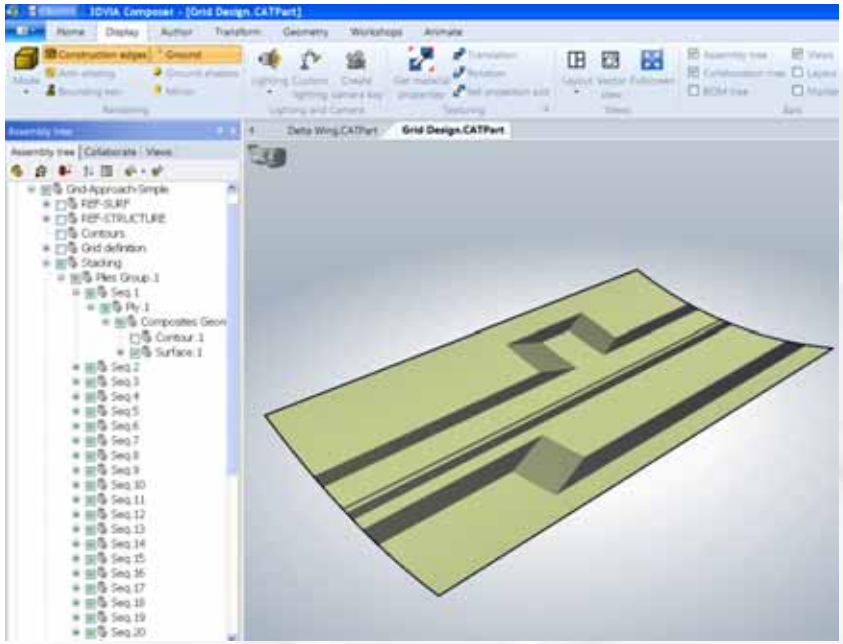
Results

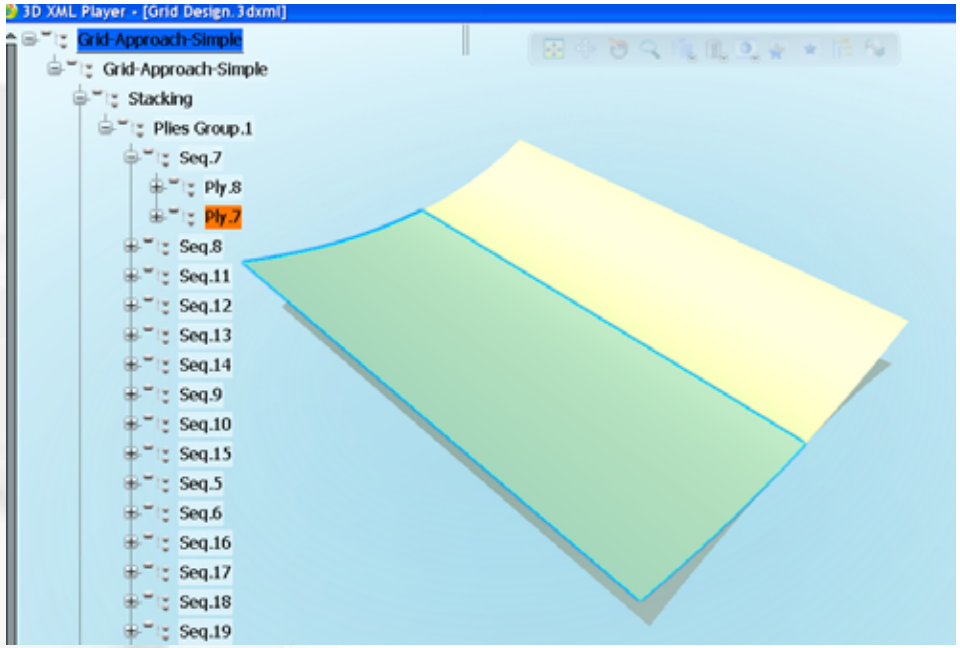
- Reduce Planning time up to 90%
- Avoid re-work with error free communication
- Minimize design changes with feedback

3D VIA for e-ply book

NEW

- **3D Via Composer reads natively CATIA Composites entities. It allows the diffusion of electronic ply book and training manuals to the shopfloor.**

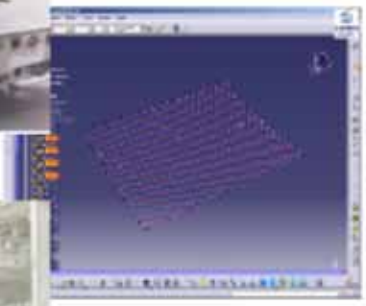




Mature Ecosystem of Manufacturing Solutions

Automated Tape Laying

- TORRES LAYUP V5
- TAPE GENERATION+TAPE MANUFACTURING
- Tape Laying Advanced CPS Interface
- ACE V2 Tape Laying and Fiber Placement Composite CAA V5 Interface

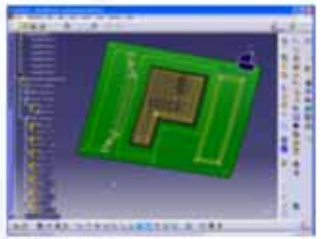




Automated Fiber Placement

- iCPS for Designer + iCPS for NC Programmer
- ACE V2 Tape Laying and Fiber Placement Composite CAA V5 Interface
- TORFIBERDES +TORFIBERMAN
- CATFiber Export CAA V5 Interface
- FP Standard Composites Design + FP Virtual Production
- Composites Strategy CAA V5 based + FiberLay + NC Composites Machine Simulation

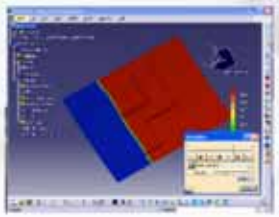
Hand Lay-Up

- TruLASER View Composite + TLV Light View Composite
- TruNEST Composite CAA V5 Interface
- PANOGEN Nesting Solution for Composites Part Programing

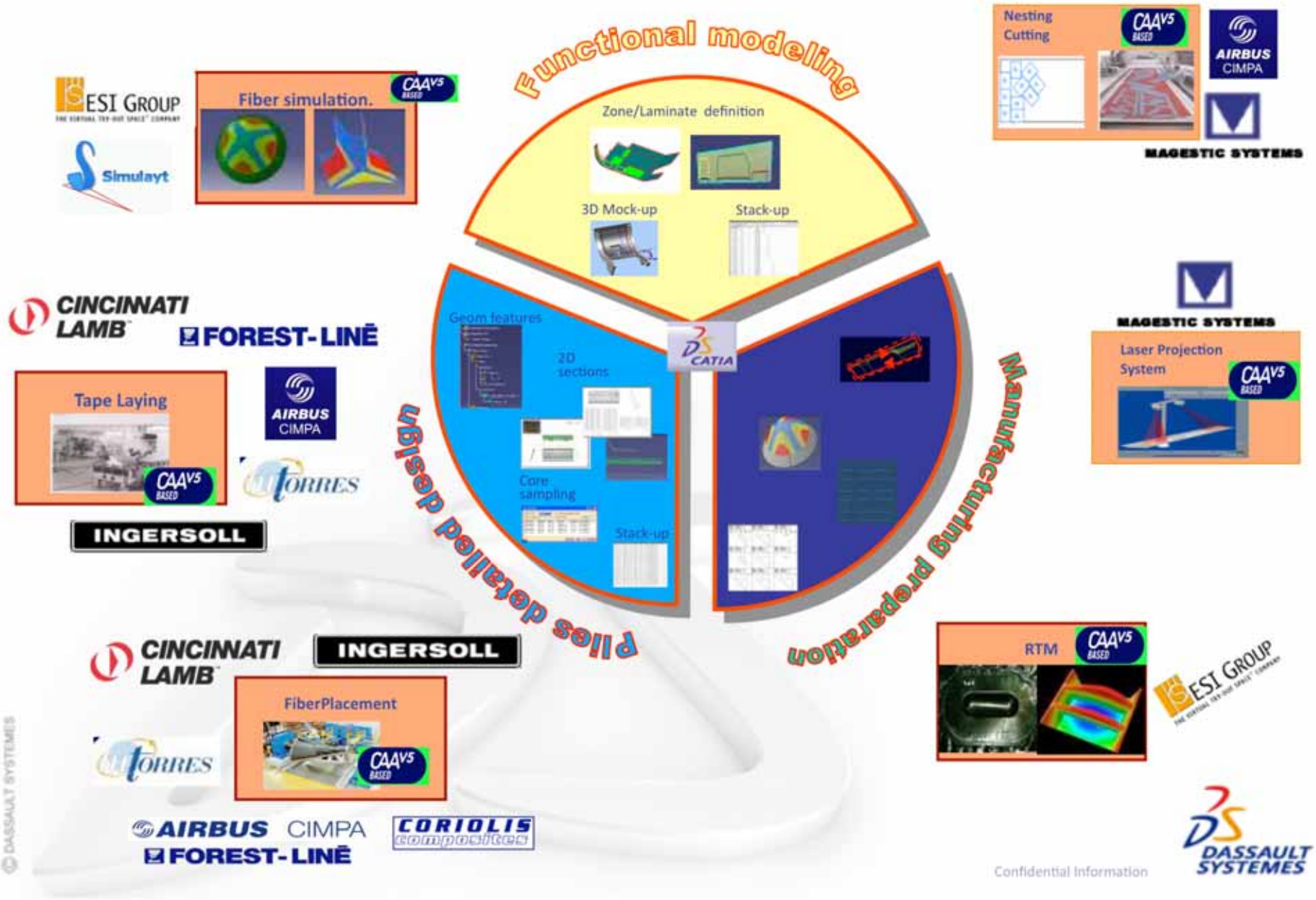



RTM / VARTM, RFI

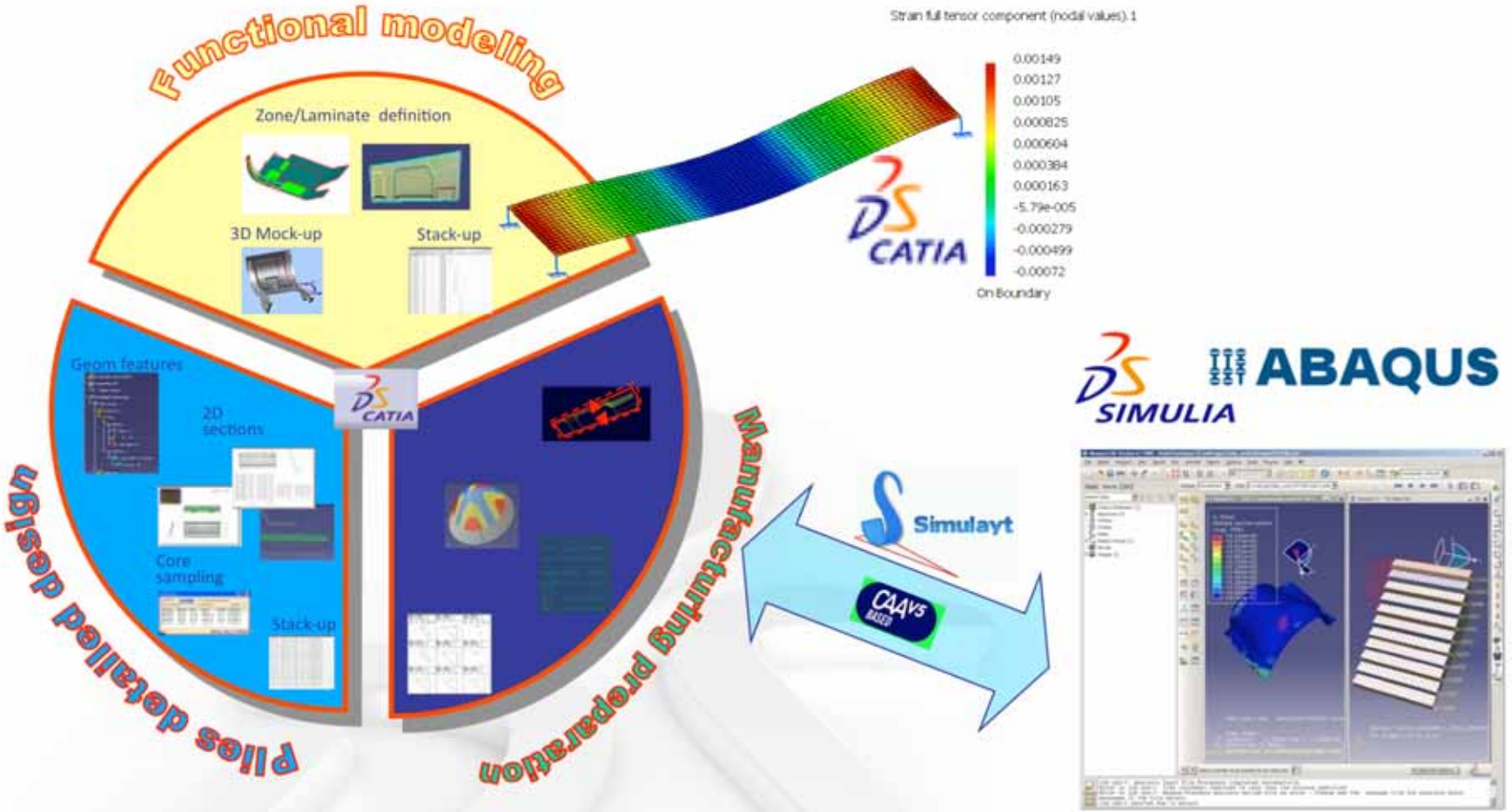
- PAM-RTM for CATIA V5




Solution architecture (1 of 2)



Solution architecture (2 of 2)



DASSAULT SYSTEMES