Altair HTC 2010

The new HyperMesh - Samcef interface.

Deployment and industrial applications at Eurocopter.

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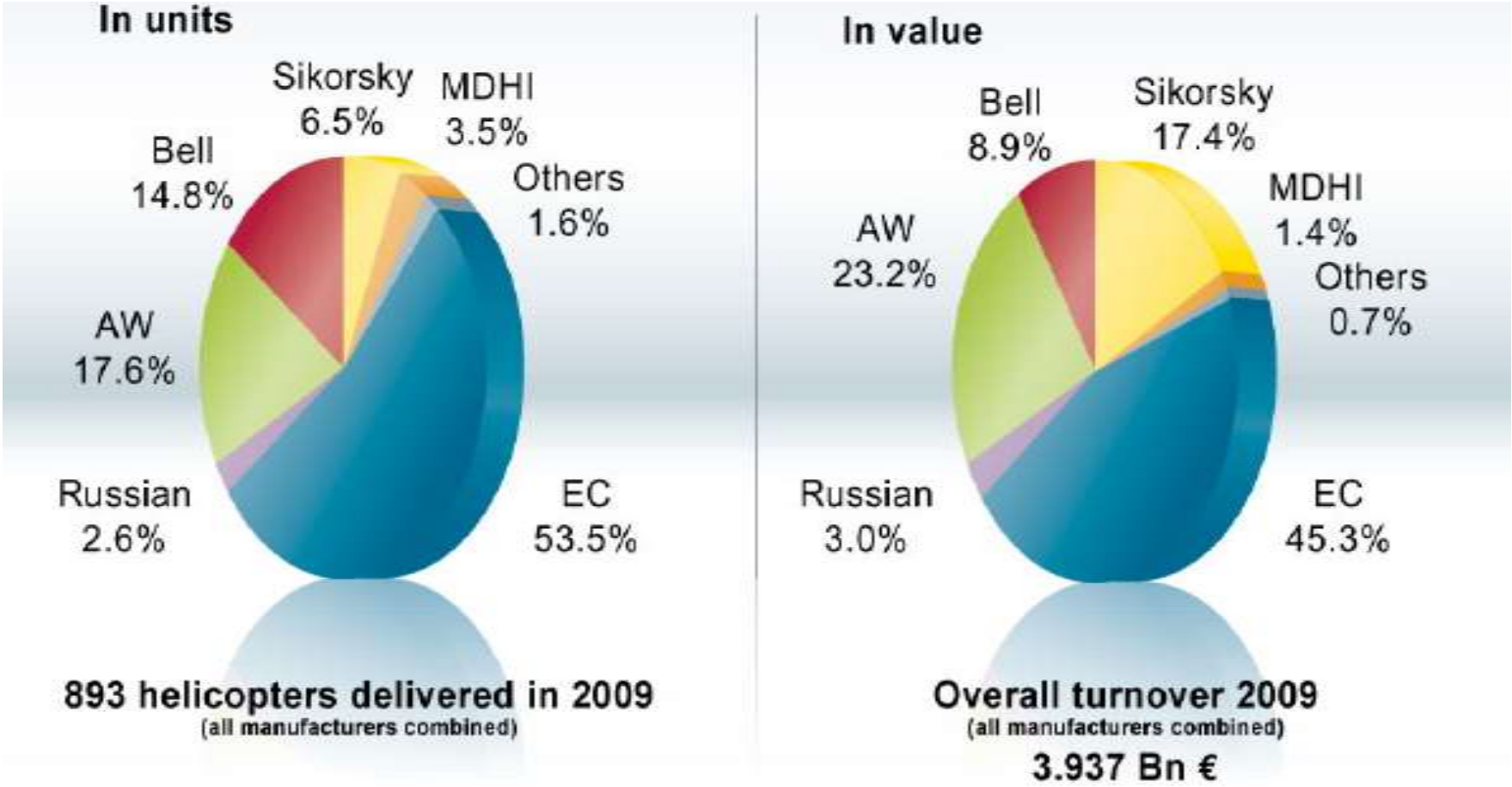
Presentation plan

- Eurocopter overview
- Stress computation performed in Eurocopter
- Samcef solver (strength and weakness)
- Development of Hypermesh / Samcef interface
- Development of Samcef / Hyperview interface
- Industrial cases performed and feedback
- Road map
- Conclusions

Eurocopter overview (1/3)

- LEADER IN THE CIVIL AND PARAPUBLIC MARKETS



Eurocopter overview (2/3)

→ THE CIVIL RANGE

Eurocopter overview (3/3)

→ THE MILITARY RANGE

Light

Medium

Medium/Heavy

Specialized

Finite elements computations in Eurocopter group

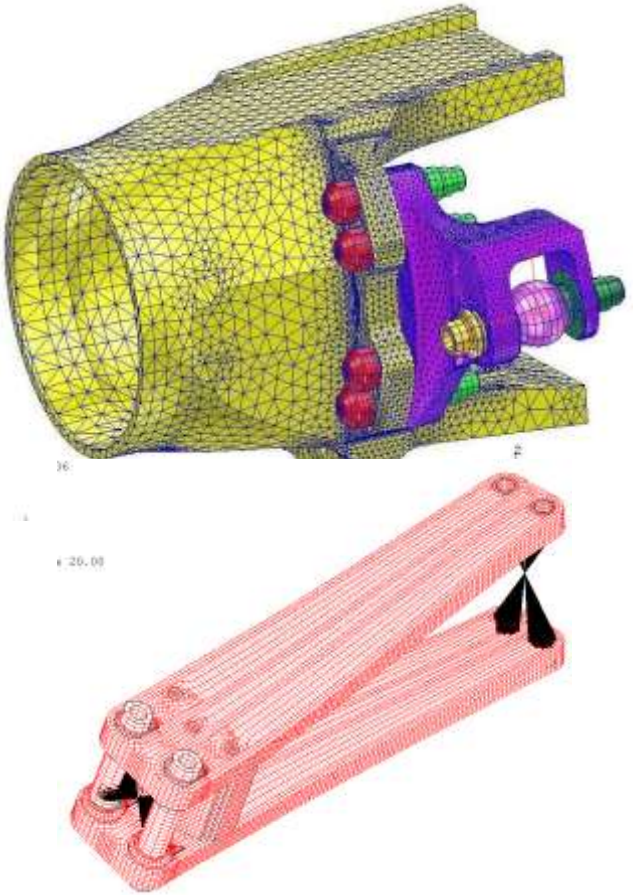
- Airframe static (Nastran, Samcef) and crash computation (Radioss)
- Blades computation (Samcef, Nastran, HWorks)
- **Dynamic systems** (Samcef, Nastran, HWorks) - Static and fatigue analysis
  - Rotors and suspensions
  - Power transmissions
  - Flight controls
- Others (Aerodynamics, thermal …)

Samcef solver (1/3)

- Historical solver of Eurocopter French stress office
- More than 20 years of helicopter FE model in Samcef
- Recognized in European aeronautic industry
- Mature solver (40 years old)
- European solver (Head Quarter in Belgium)

Samcef solver (2/3)

- Strengths :
  - Variety of element library
  - Macro command to make easier model definition
  - Contact definition either in linear or non linear analysis
  - Power of non linear solver (MECANO)
  - Composite definition including volumic composite
  - Fracture mechanics



Samcef solver (3/3)

A powerful solver but that suffers of a main weakness :

No modern pre and post processing tool for samcef can be found in the market !

Power of samcef is limited to what can be easily done and time compatible with industrial constraint.

Development of Hypermesh / Samcef interface

- Eurocopter has chosen Hypermesh / Hyperview has best solution for interfacing Samcef
- Eurocopter specification sheet in 2009 defining development priority
- Altair development started end of 2009 under responsibility of Richard Heslouin (Altair France)
- First official release delivered in March 2010 with basic functionalities
- Second official release delivered in June 2010 with bug fixes and additional functionalities

Development of Hypermesh / Samcef interface

Up to now (oct. 2010), Samcef interface allows to :

- Completely define standard linear calculation in HM
  - Standard elements supported (including pyramidal)
  - Isotropic and orthotropic material
  - Loads, pressure, displacements
  - Local frames and attribution to nodes or boundary conditions
  - Nodes, faces and elements groups
  - Export Samcef input file
- Define any kind of calculation
  - “Unsupported card” text windows is available in order to add any card. Recorded inside HM file and content written at the end of samcef input file.
  - Then contact, non linear analysis and specific kinematic function can be used even not yet implemented.

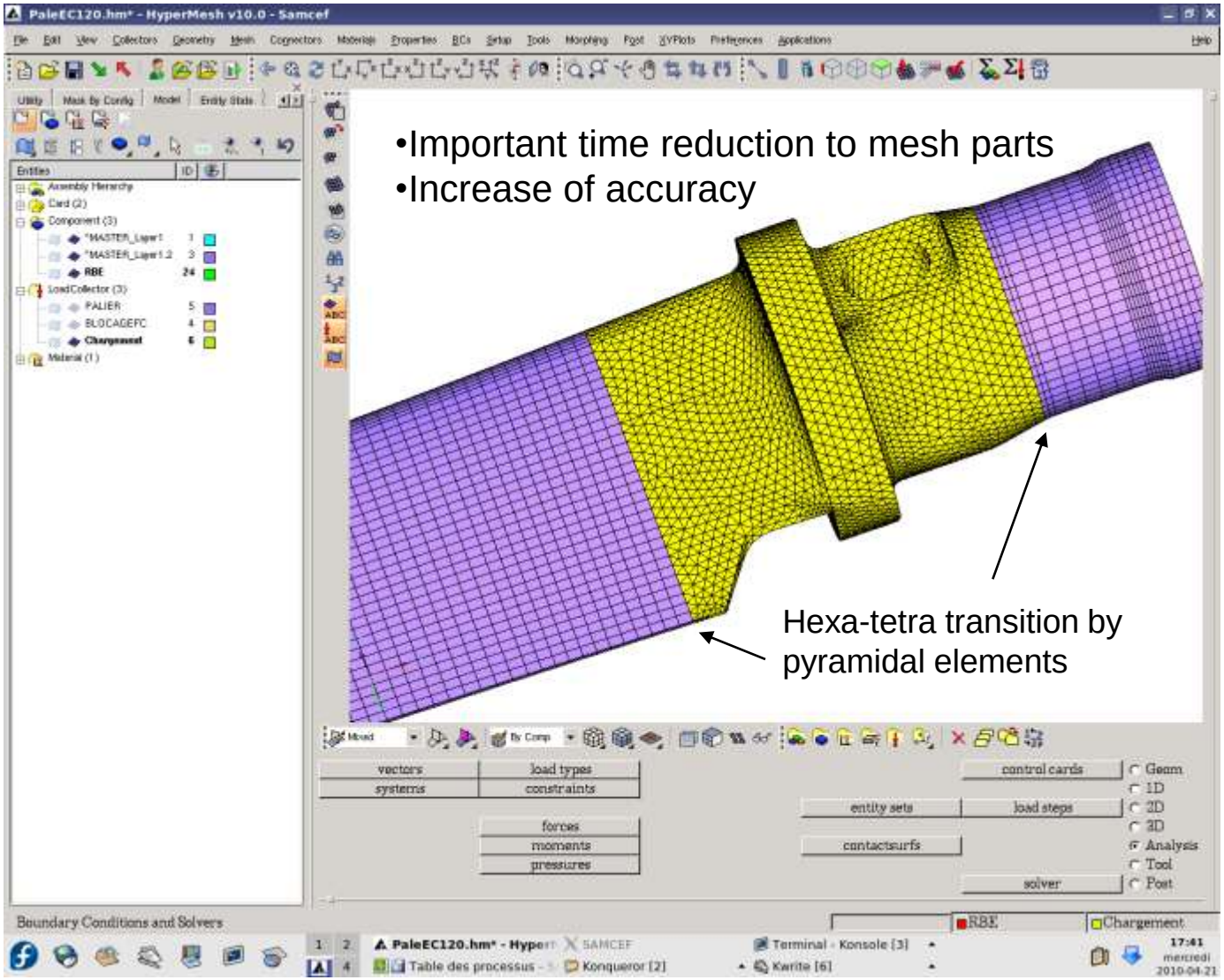
Development of Samcef / Hyperview interface

- Programming under Samtech responsibility
- SAM2H3D module convert Samcef results in Hyperview (*.h3d) format.

- Version 1 delivered (oct. 2010) : metallic linear analysis
- 2 others versions planned for end of 2010.

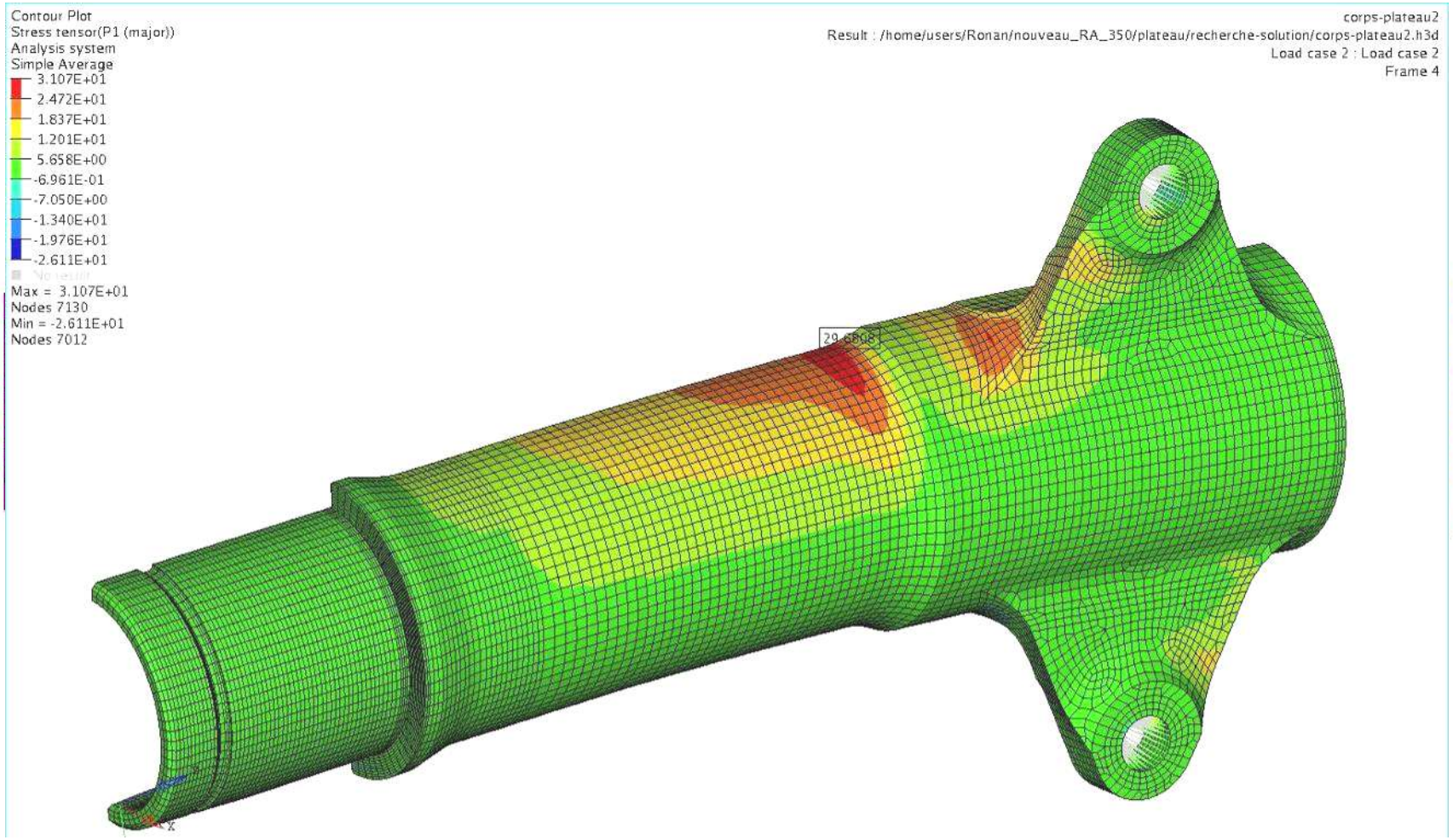
Industrial cases performed and feedback

- parts



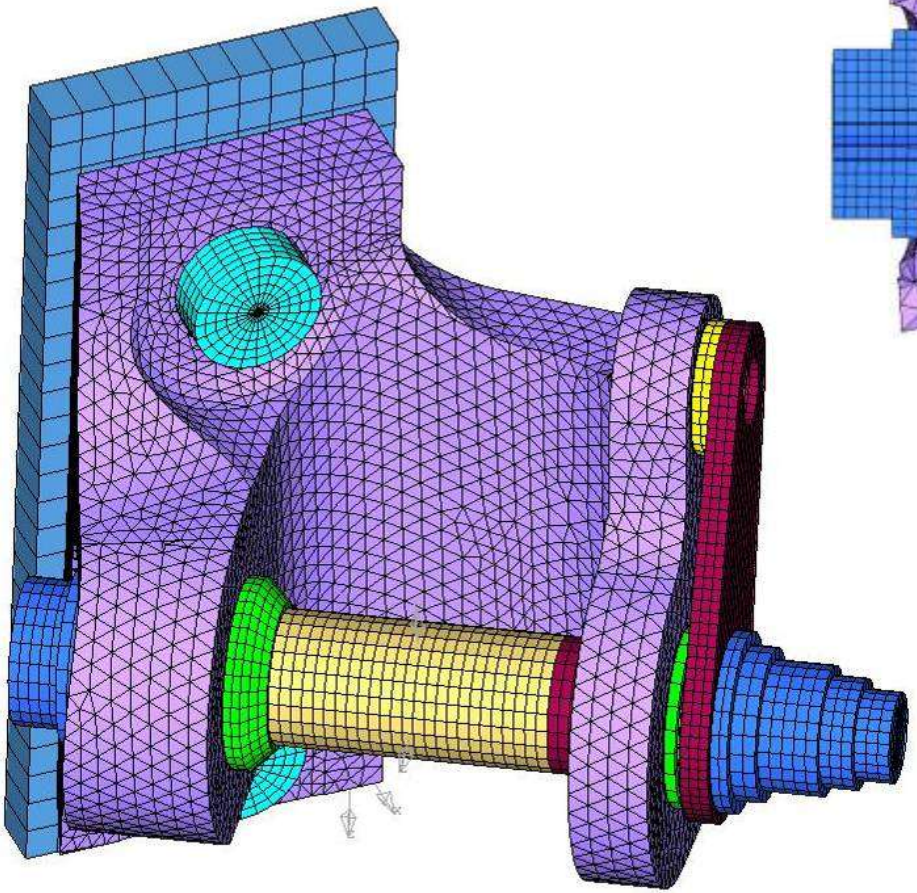
Industrial cases performed and feedback

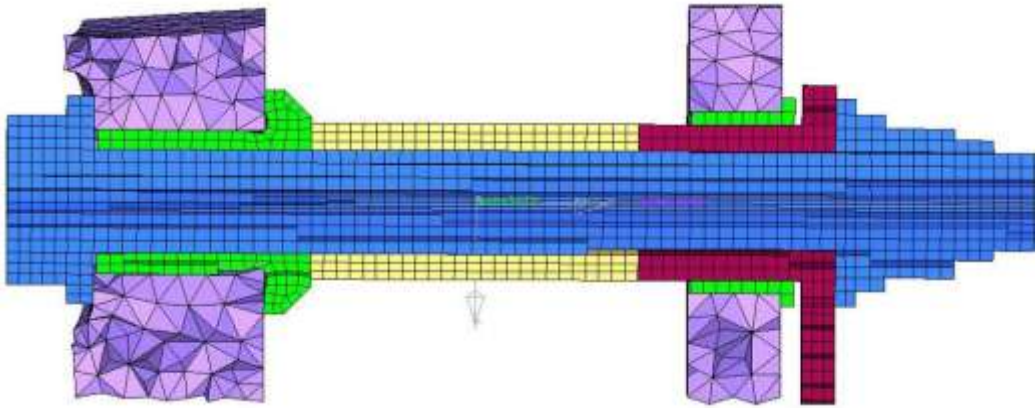
- Light assemblies (1/2)



Industrial cases performed and feedback

- Light assemblies (2/2)

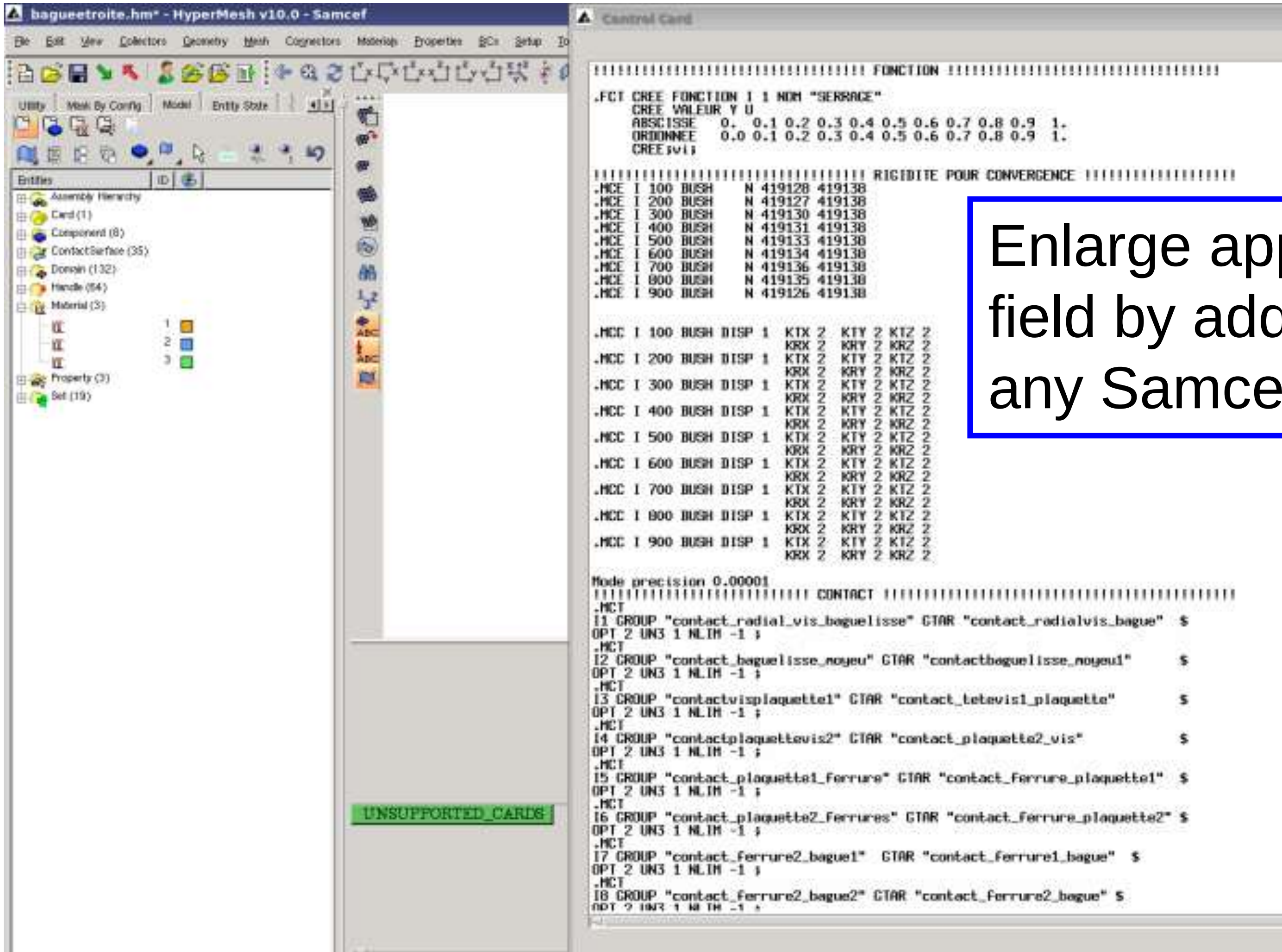




- Ease to manage elementary parts
- Ease to define and manage groups
- Visual comfort for model display

Industrial cases performed and feedback

- Additional text command “Unsupported cards”



Enlarge application field by addressing any Samcef card.

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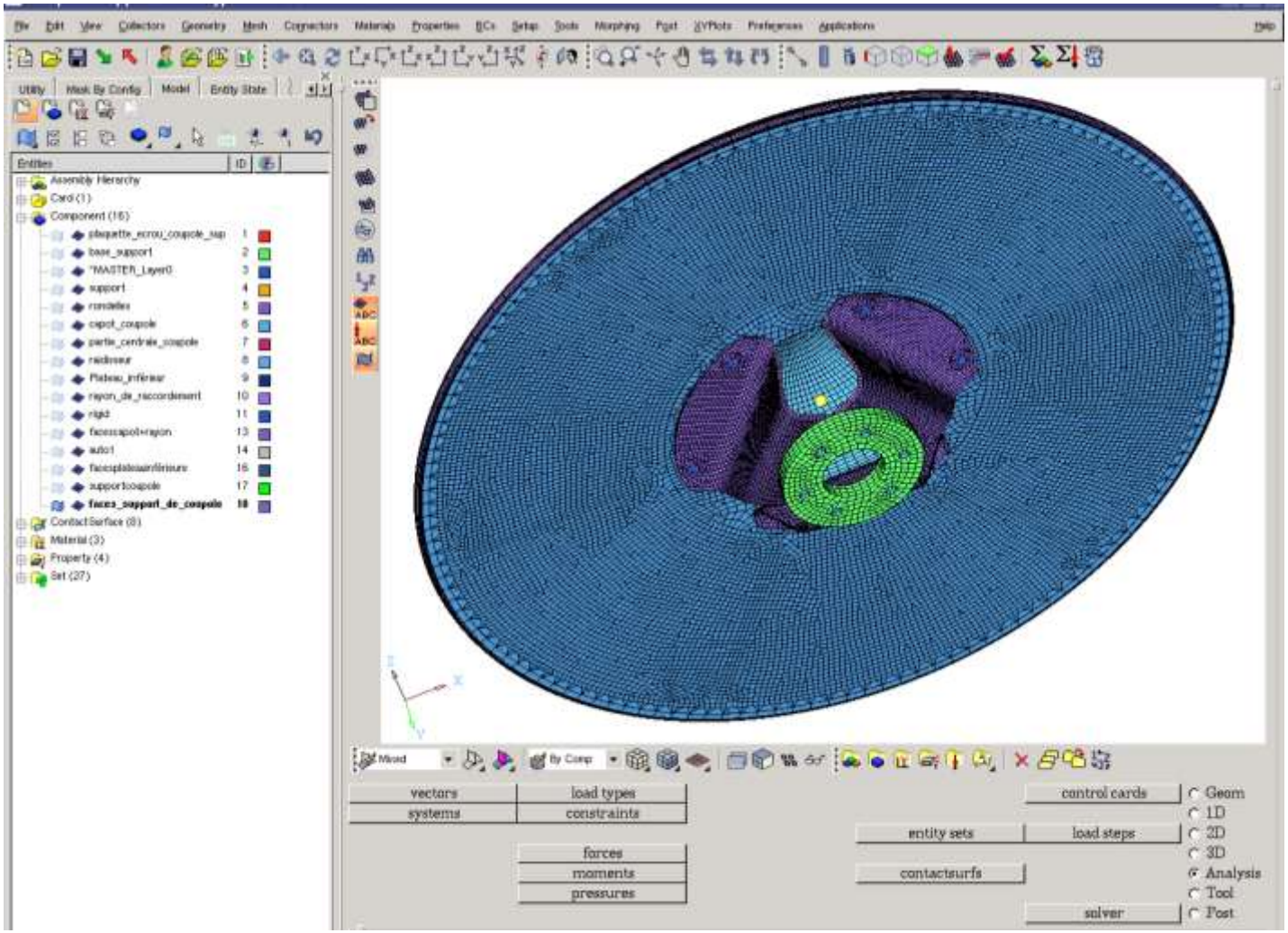
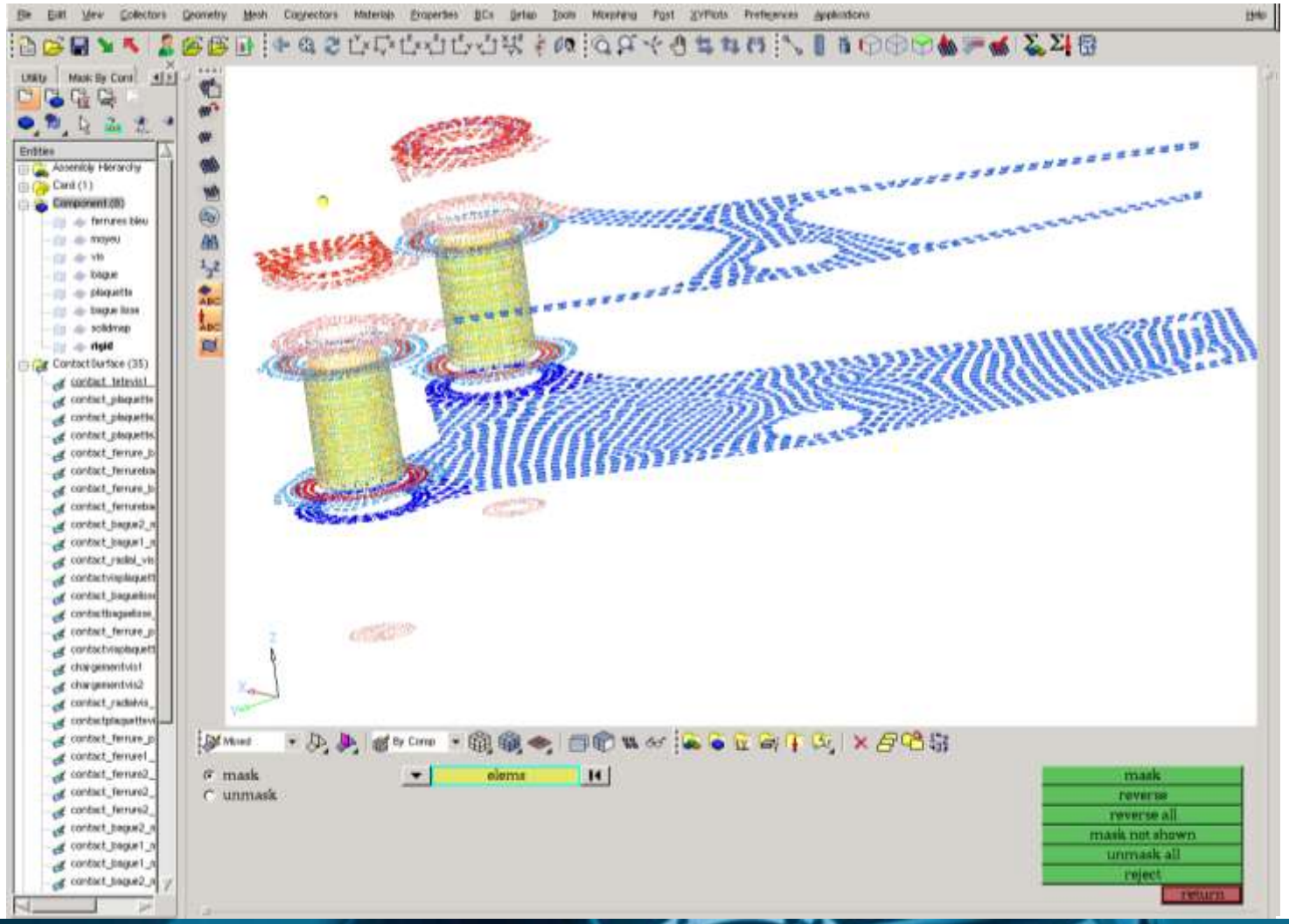
Industrial cases performed and feedback

- Complex assembly (1/4)



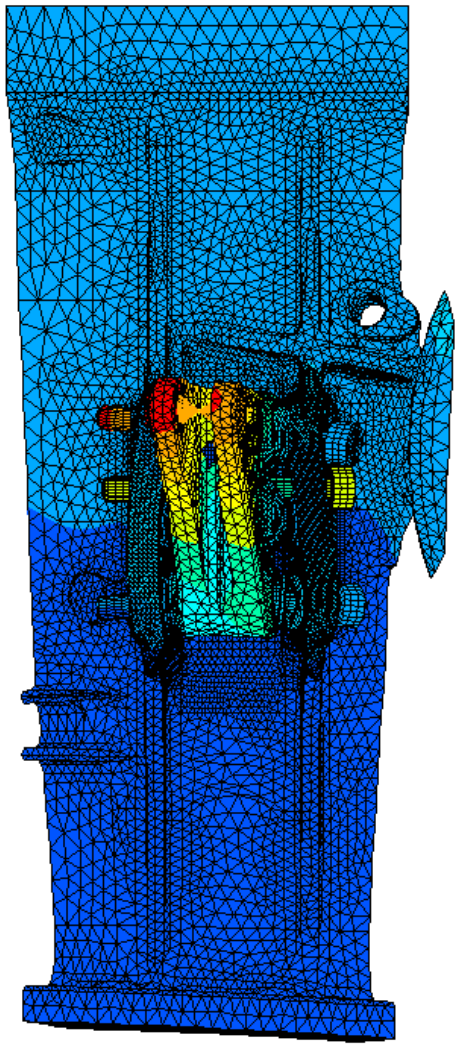
Industrial cases performed and feedback

- Complex assembly (2/4)

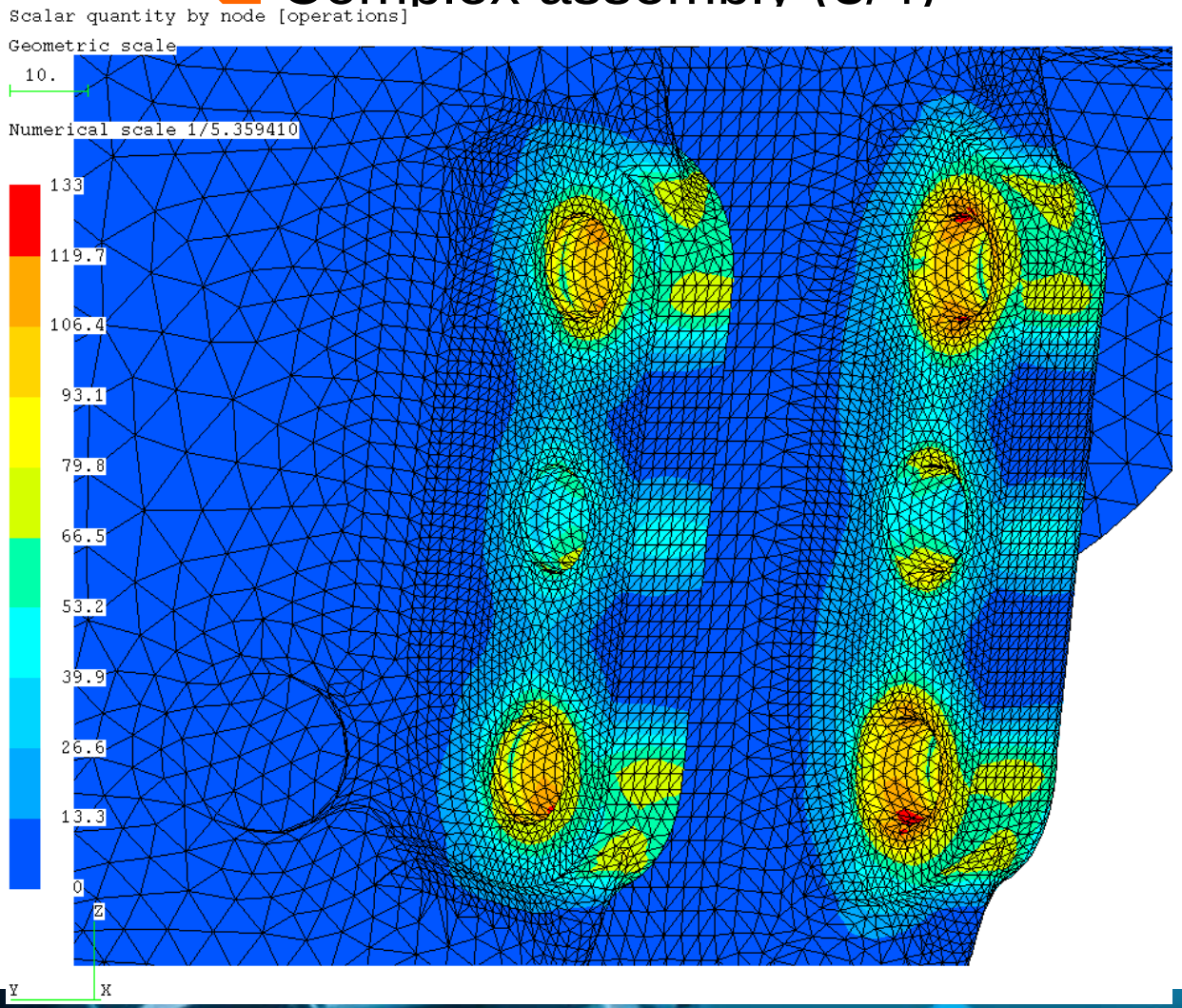


Ease to define, display and control faces groups for contact analysis

Industrial cases performed and feedback

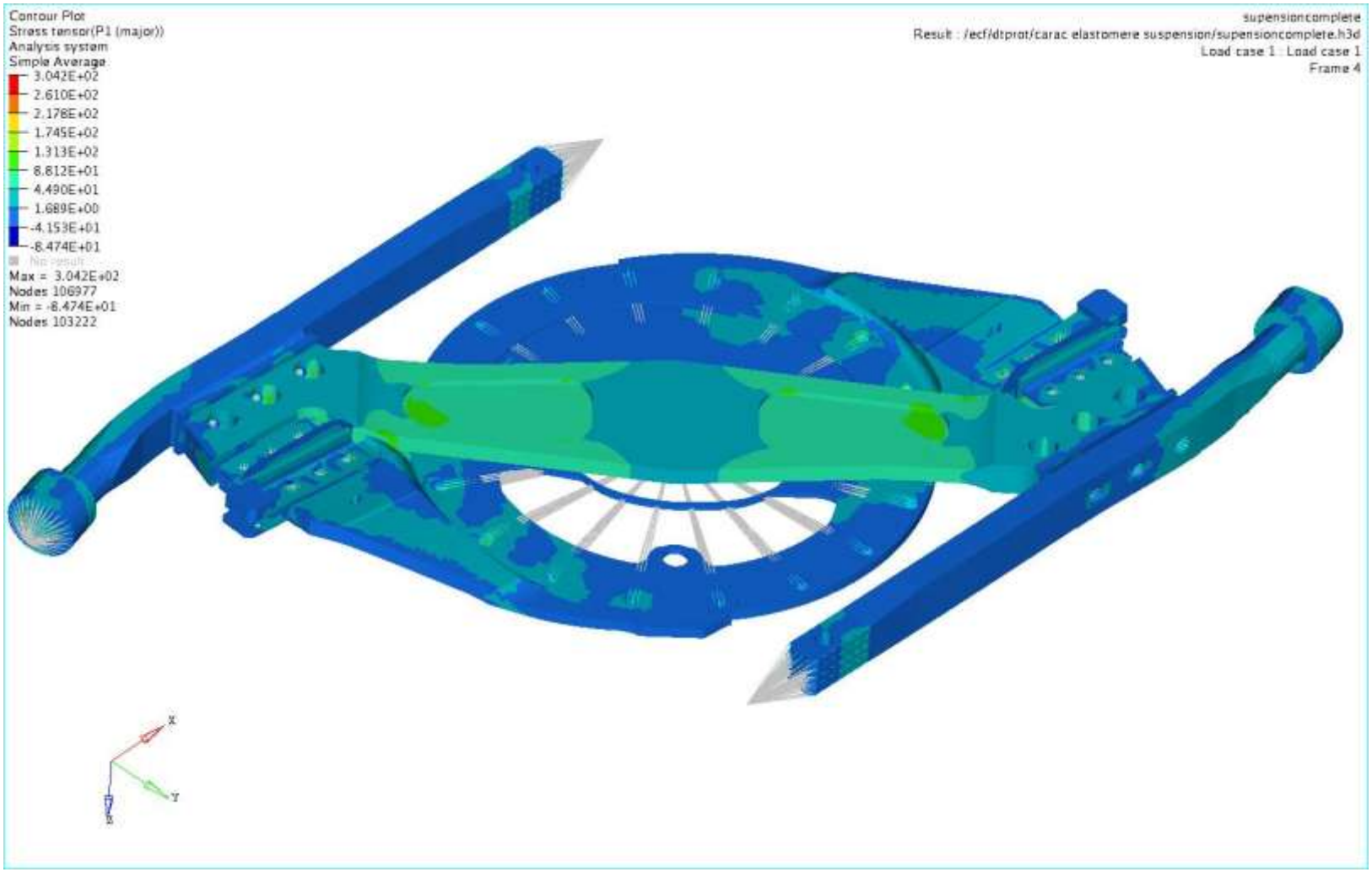


Complex assembly (3/4)



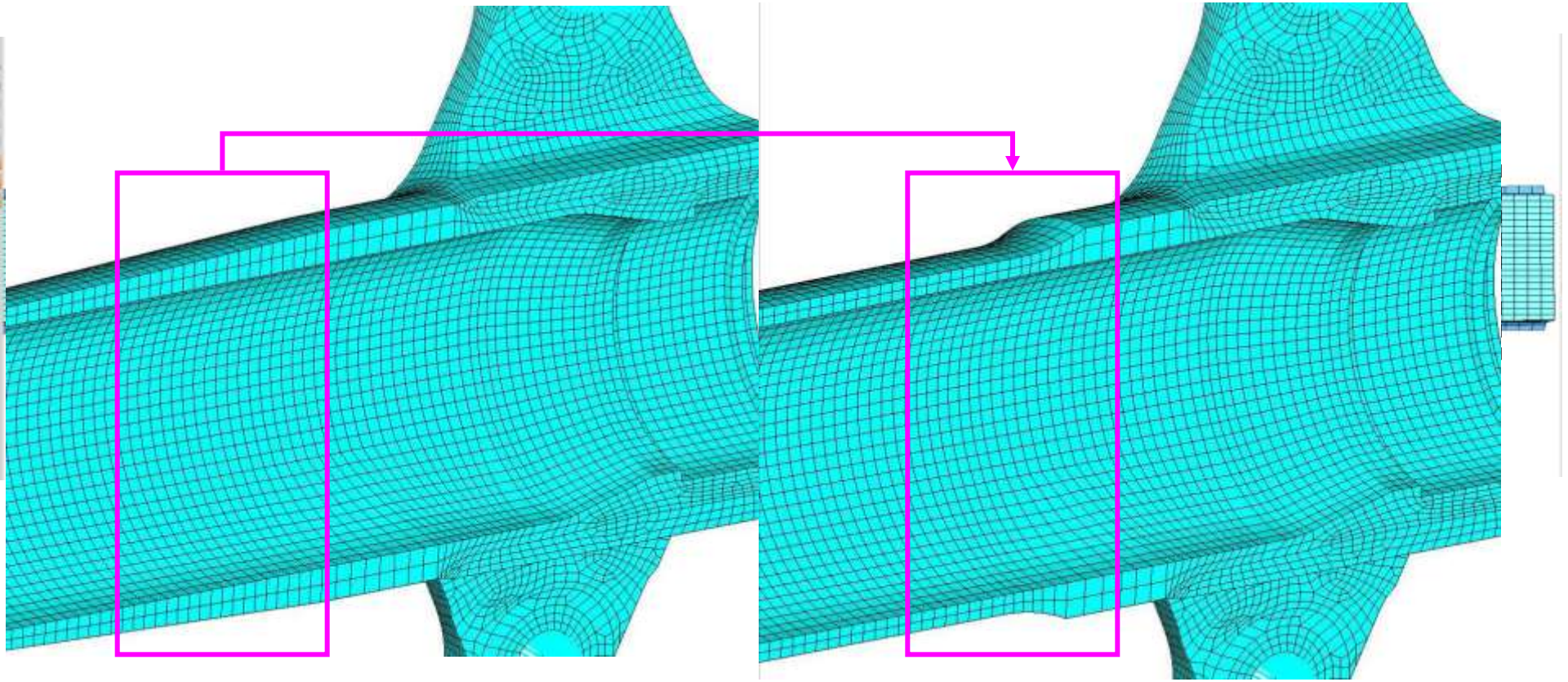
Industrial cases performed and feedback

- Complex assembly (4/4)



Industrial cases performed and feedback

- Geometric update managed by Morphing process



Shape modification in 5 minutes by projection on new geometry.

Automatic parametric optimization (coupling with Hyperstudy)

❑ Definition of shapes variables

Design variables

	On	Label	Variable Name	Model Parameter
▶	☑	Rayon_bas_1	m_1_Rayon_bas_1	m_1.Rayon_bas_1
	☑	Rayon_haut_1	m_1_Rayon_haut_1	m_1.Rayon_haut_1
	☑	Rayon_conge_haut_1	m_1_Rayon_conge_ha	m_1.Rayon_conge_
	☑	Rayon_conge_bas_1	m_1_Rayon_conge_ba	m_1.Rayon_conge_

Design variable properties

Type: Real

Mode: Discrete

Initial value: 0.0000000

Lower bound: -4.0000000

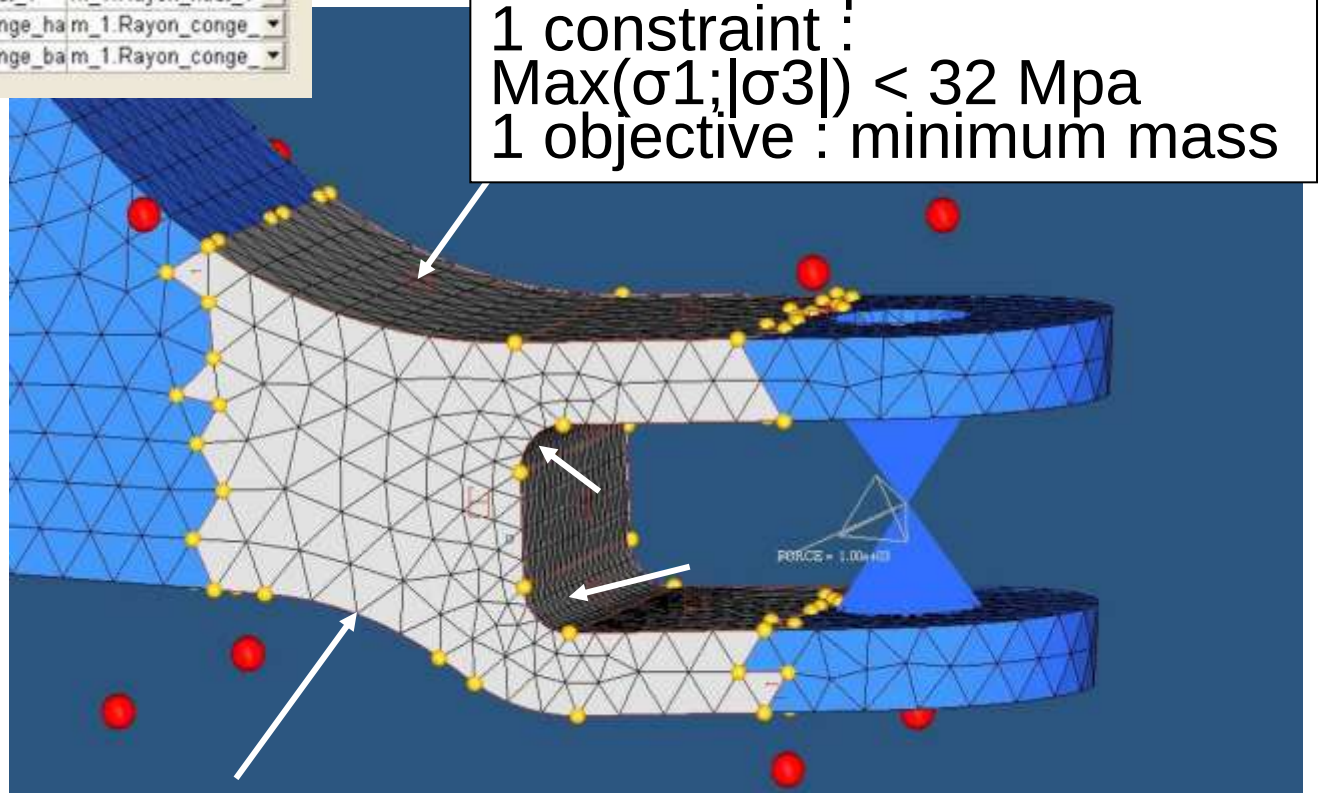
Upper bound: 2.0000000

No. of levels: 13

Value table

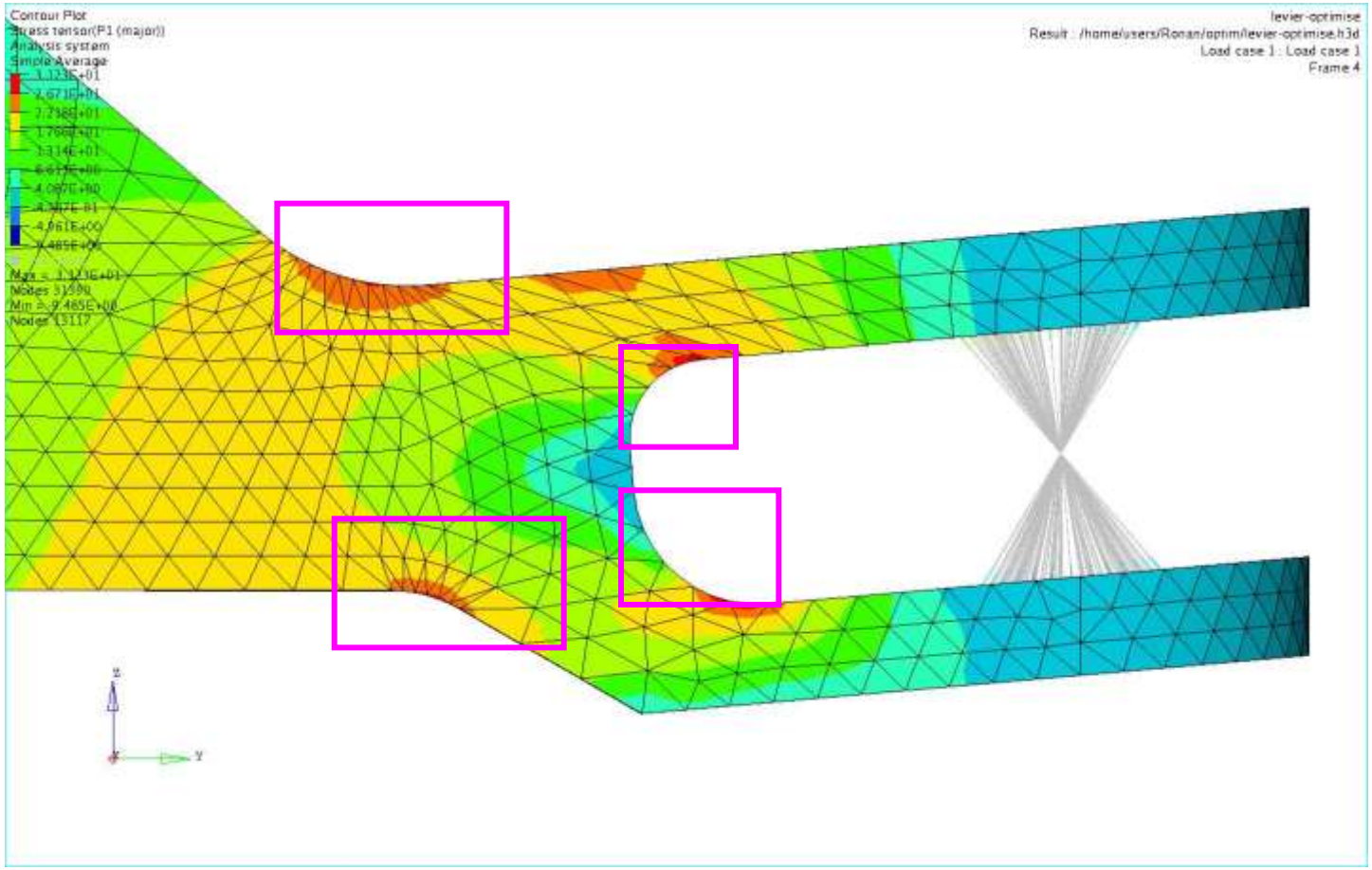
1	-4.000000
2	-3.500000
3	-3.000000
4	-2.500000
5	-2.000000
6	-1.500000
7	-1.000000
8	-0.500000
9	0.000000
10	0.500000
11	1.000000
12	1.500000
13	2.000000

4 radius to optimize
1 constraint :
Max(σ1;|σ3|) < 32 Mpa
1 objective : minimum mass



Automatic parametric optimization

- 3% mass saving. Optimum solution in 19 iterations



Road mad

- Hypermesh / Samcef (Responsibility Altair)
  - Contact and glue definition : v11.0
  - Composite materials (shell and volumic) : v11.0
  - Samcef file input reader : post v11.0 (patch)
  - Non linear analysis : post v11.0 (patch)

- Samcef / Hyperview (Responsibility Samtech)
  - Sam2H3d v2 : metallic non linear analysis (November 2010)
  - Sam2H3d v3 : Thermal and Composite (December 2010)

Conclusion (1/2)

- Development
  - Altair and Samtech did demonstrate their capability to develop in a short time an interface with good quality level,
  - Bugs are minors and fixes are fast : good reactivity of development team,
  - Eurocopter appreciate that Altair engaged its own funds do develop interface without asking Eurocopter finance contribution,
  - Eurocopter appreciate the partnership relation and technical comprehension of EC needs from Altair team.

Conclusion (2/2)

- Industrial deployment and feedback
  - About 50% of FE engineers have passed to HM/Samcef chain in 9 months,
  - HM/Samcef main contributions up to now are :
    - **Consider bigger and more accurate simulation**
    - **Significant reduction of model preparation time**
    - **Exploit more and more Samcef facilities**
    - **Fast design iteration by use of morphing**
  - Post treatment facility is new. First industrial cases show an ease of analysis.

- Global feeling : in a couple of months, HM/Samcef chain demonstrated a very satisfactory efficiency, time saving ratio and increased our simulation skills.

The end …

- Questions and Answers