

Integrated CAE Driven Development Within a HyperWorks Framework

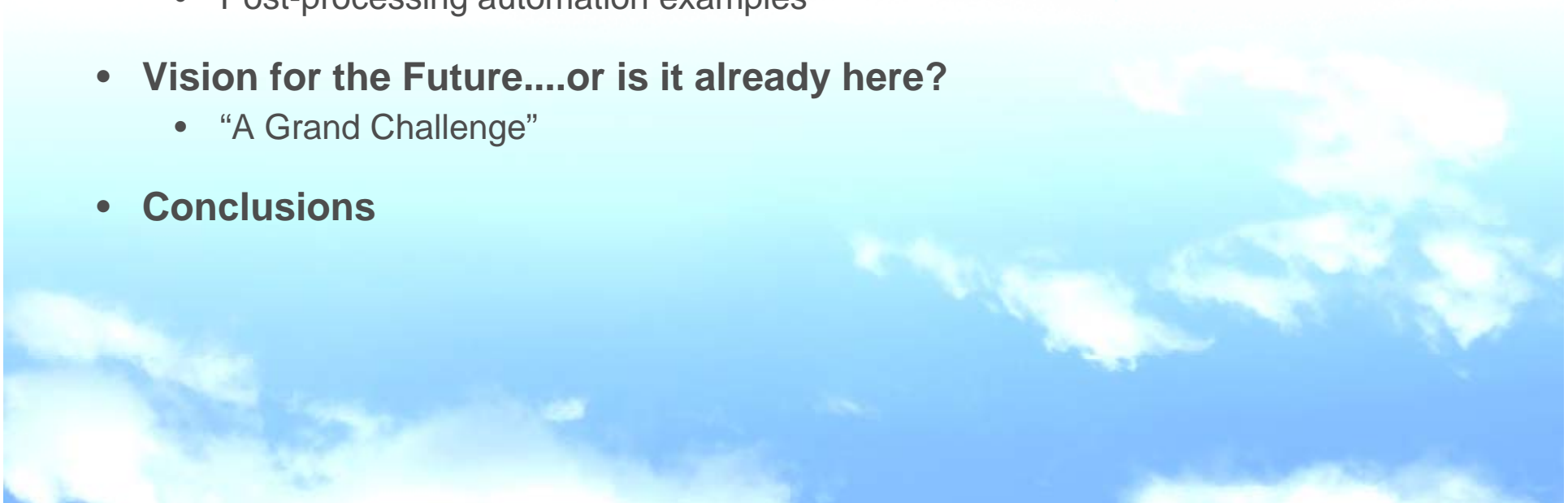
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24th November 2010

Presentation Contents

- **Altair ProductDesign Introduction**
- **The Design Process Today**
 - Historic bottlenecks in the design process
 - “Simulation Driven Design”
- **What Processes are at our Disposal?**
 - Pre-processing automation examples
 - Post-processing automation examples
- **Vision for the Future....or is it already here?**
 - “A Grand Challenge”
- **Conclusions**



Company Overview



A multi-disciplinary global product development partner that delivers innovative, end-to-end solutions.

We use our experience, methods and technology leadership to turn concepts into realities.



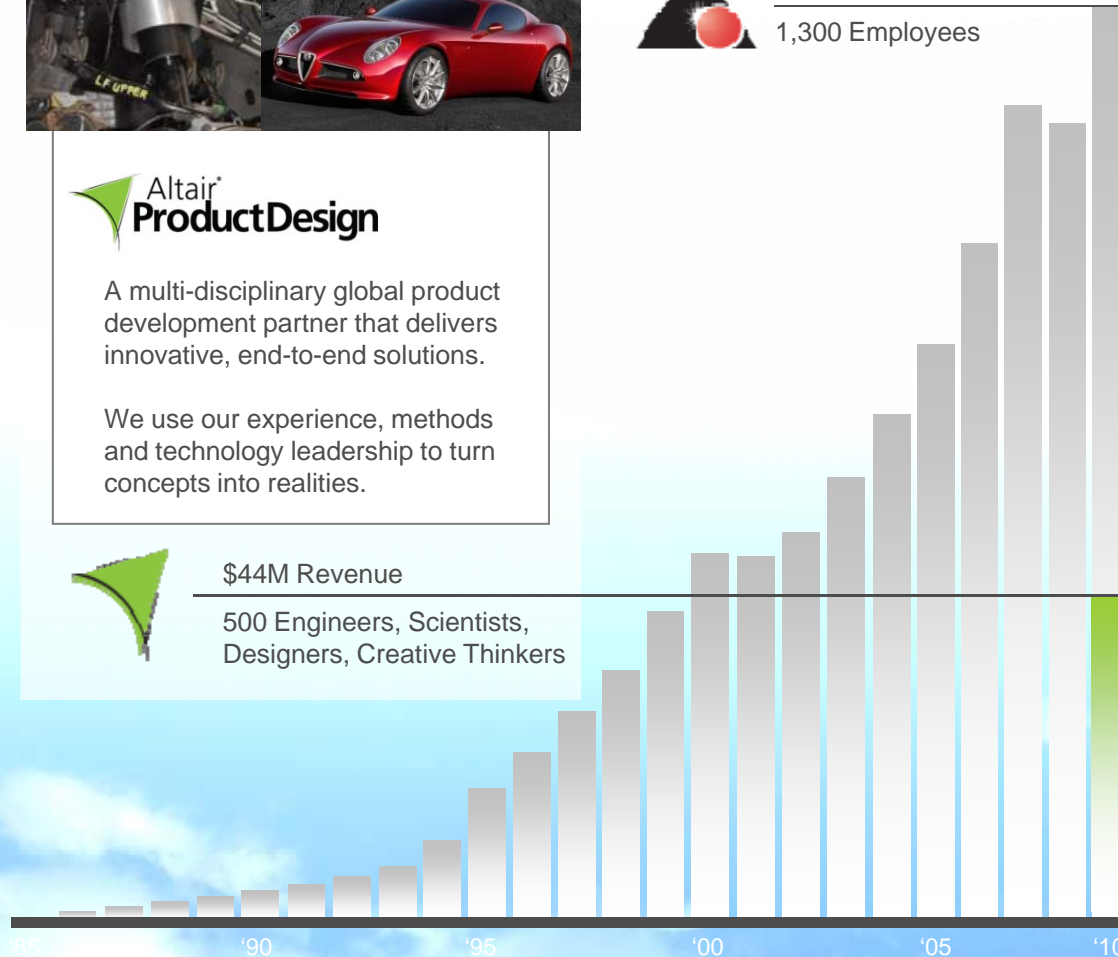
\$44M Revenue

500 Engineers, Scientists, Designers, Creative Thinkers



Projected \$170M Revenue

1,300 Employees



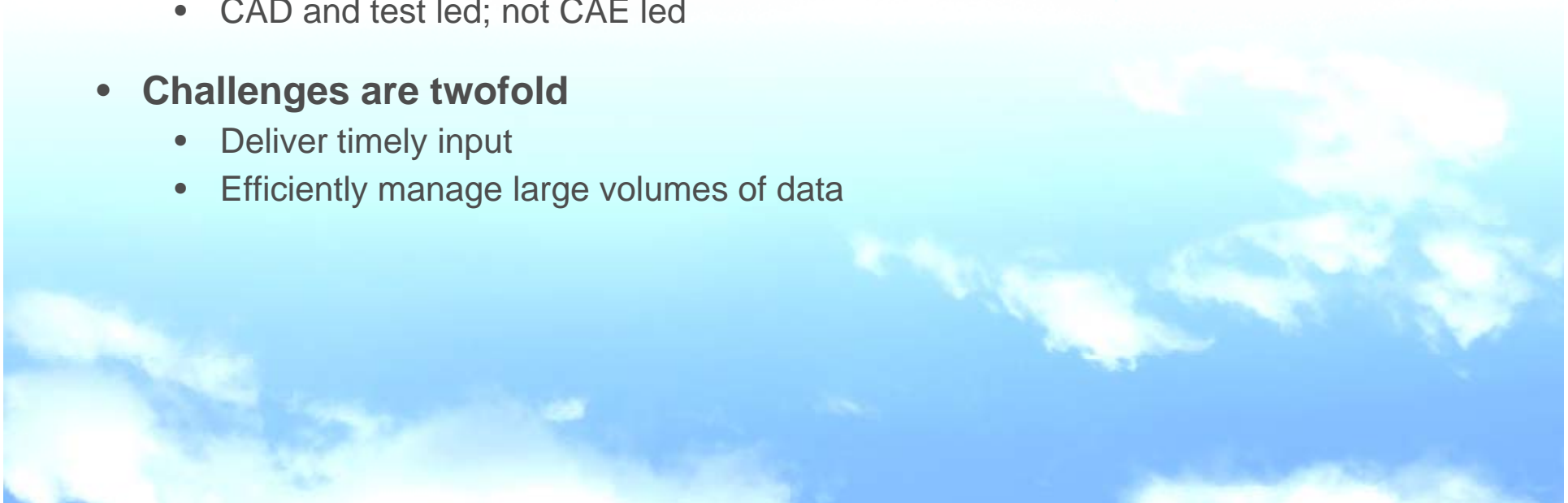
Founded ... In 1985 as a product design consulting company

Today ... A global software and technology company focused on enterprise analytics, product development and advanced computing



Design Process Today

- **OEMs use CAE as core process**
 - Well defined processes within vehicle development
 - Ever more sophisticated modelling techniques
 - Reliant on CAE to deliver performance objectives
 - Strong feedback into development process
- **From simply a validation tool to ‘Simulation Driven Design’**
 - Historically lag in the CAE process
 - CAD and test led; not CAE led
- **Challenges are twofold**
 - Deliver timely input
 - Efficiently manage large volumes of data



Modern Approach to Design

The Traditional Design Process...

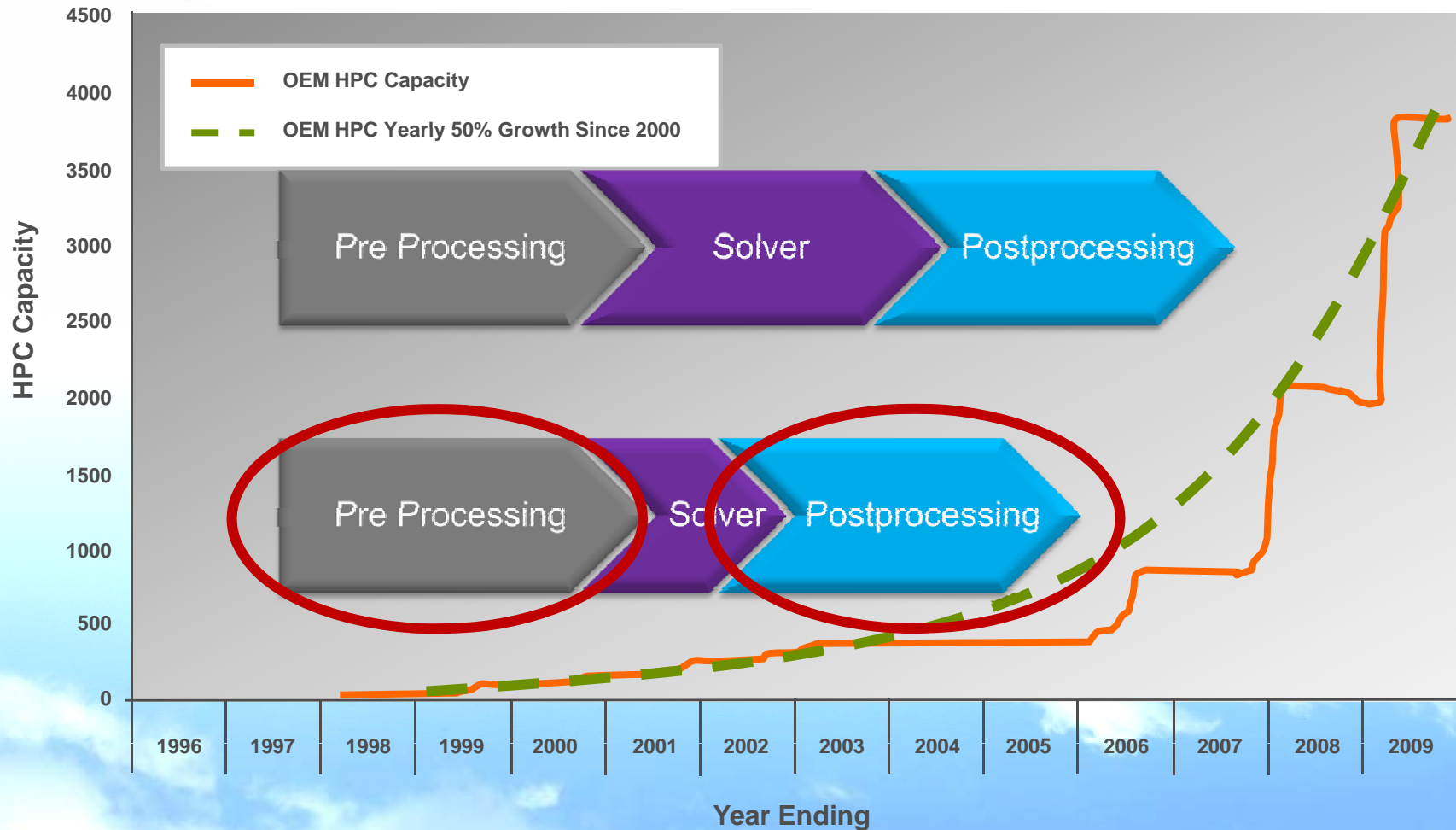


The Simulation Driven Design Approach...



CAE Process Today

Automotive OEM HPC Capacity Growth

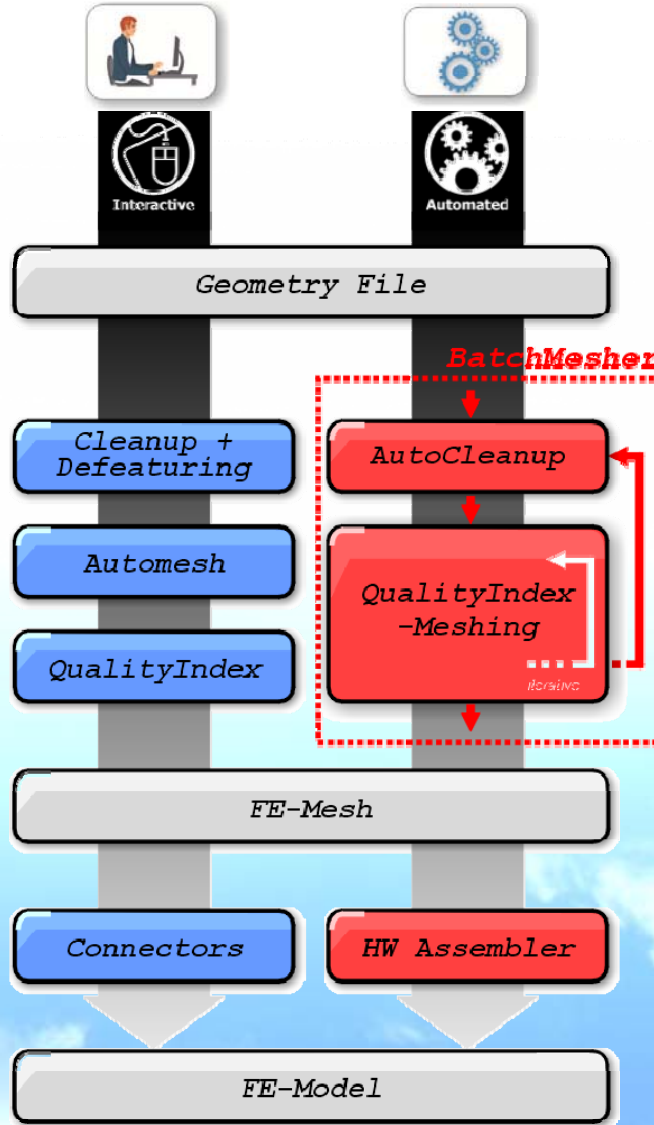


Pre-Processing – Batch Meshing

Interactive Modeling

Example:
Automotive BIW modeling

1 Month



Batch CAE Process

- Automatic quality criteria based geometry preparation and meshing
- Automatic template based model assembly
- Easy part reuse when combined with data management

Days

smart fortwo Development CAE Partner



Altair ProductDesign Germany formed team for CAE development

Project support 2003-2007

European and *new US market*

- Legislative requirements
- Consumer requirements
- Internal requirements

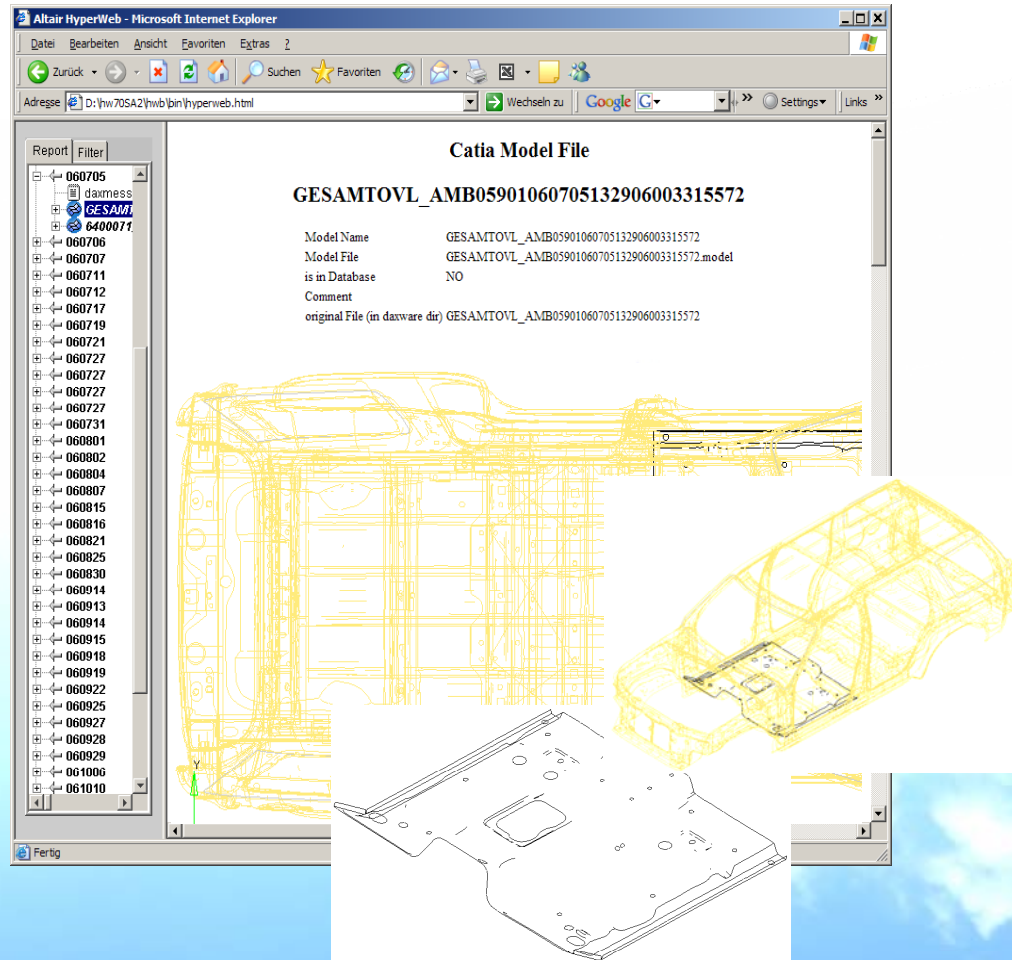
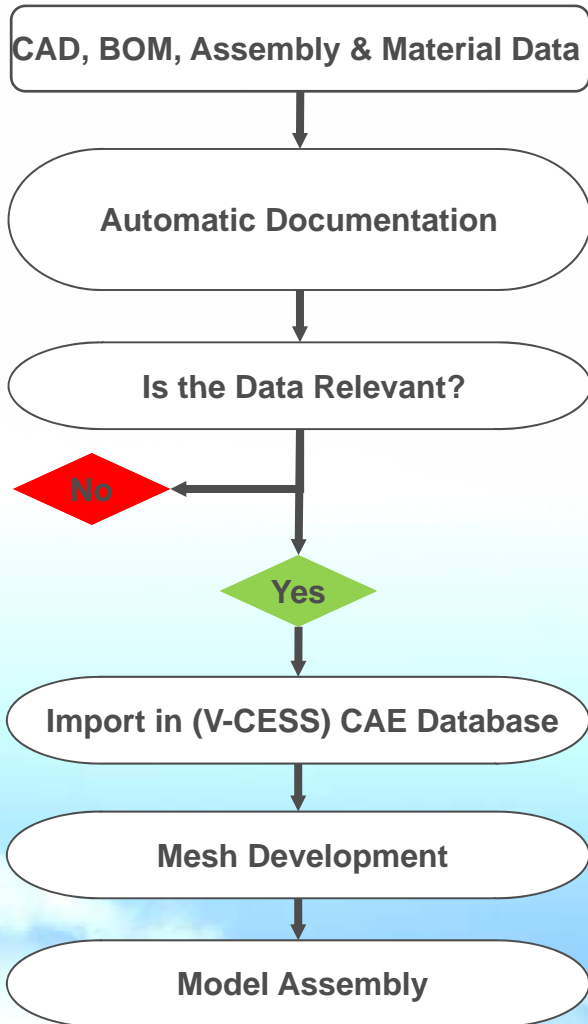
Coupe and Convertible versions with a team of 15 Engineers

First Crash Tests of smart fortwo: "DIMINUTIVE TWO-SEATER EARNS TOP RATINGS FOR PROTECTING PEOPLE IN FRONT & SIDE CRASHES" (Source IIHS)

Process automation essential

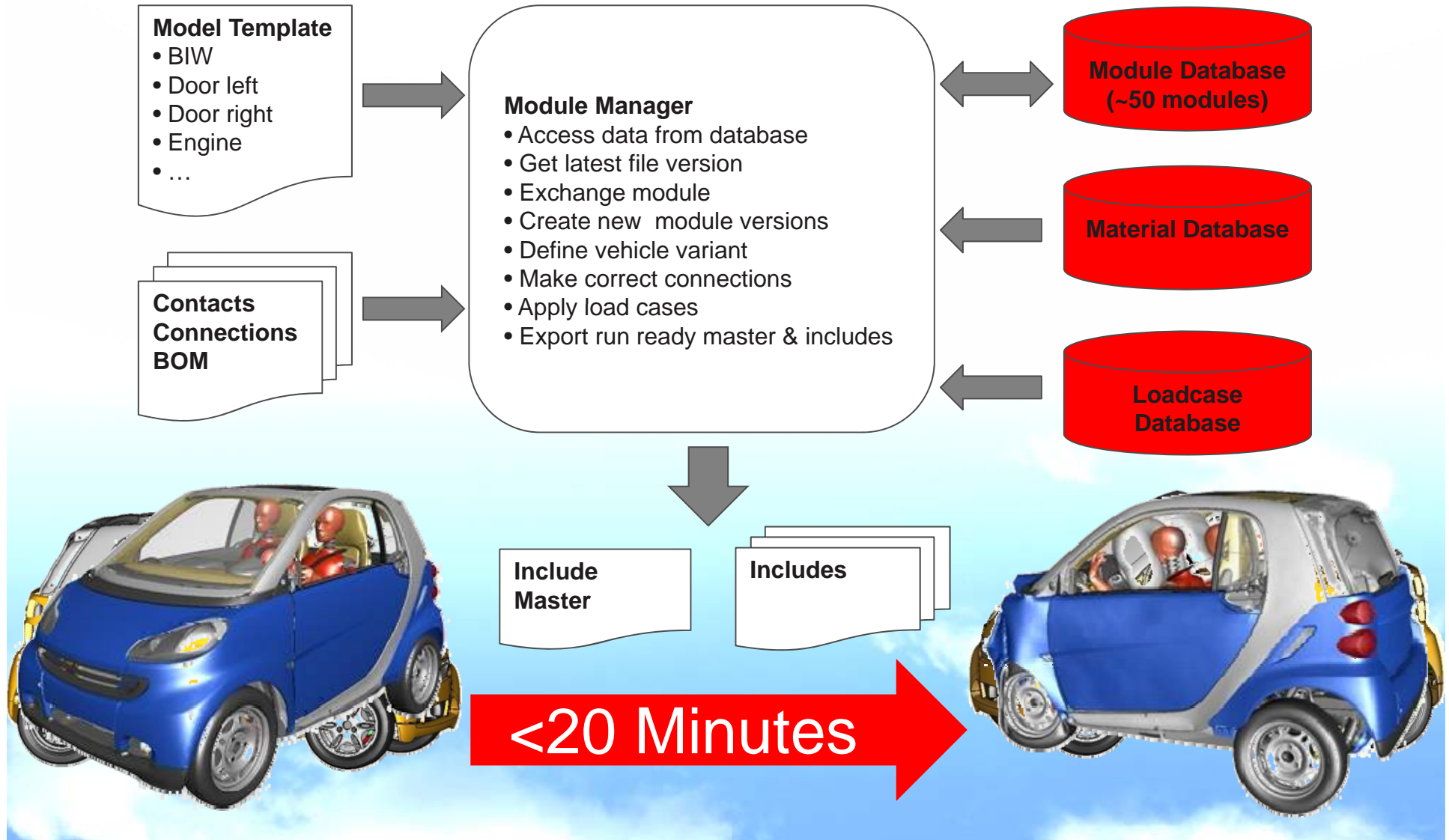


Model Development – Aspects of Data Receipt

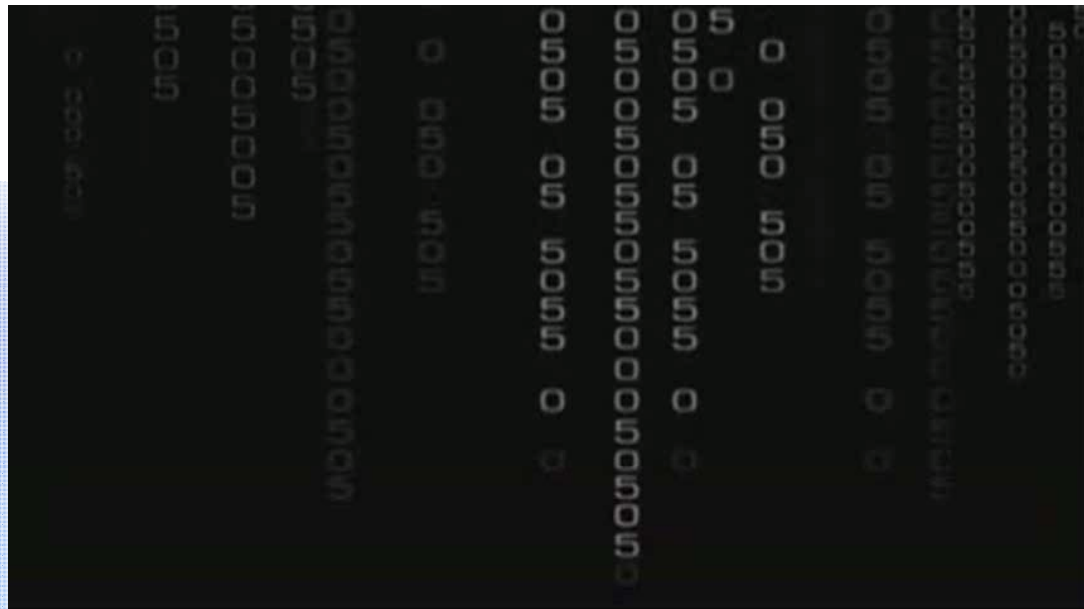


- ~50% time saving through automation

Model Development – Assembly for Crash



Roewe 550 Development CAE Partner



SAIC MOTOR 上海汽车

Altair ProductDesign UK formed core team for structural development

**Responsible for:
Structural crash performance
Body & Closures Durability
NVH & Stiffness**

Small core team of 12 Engineers

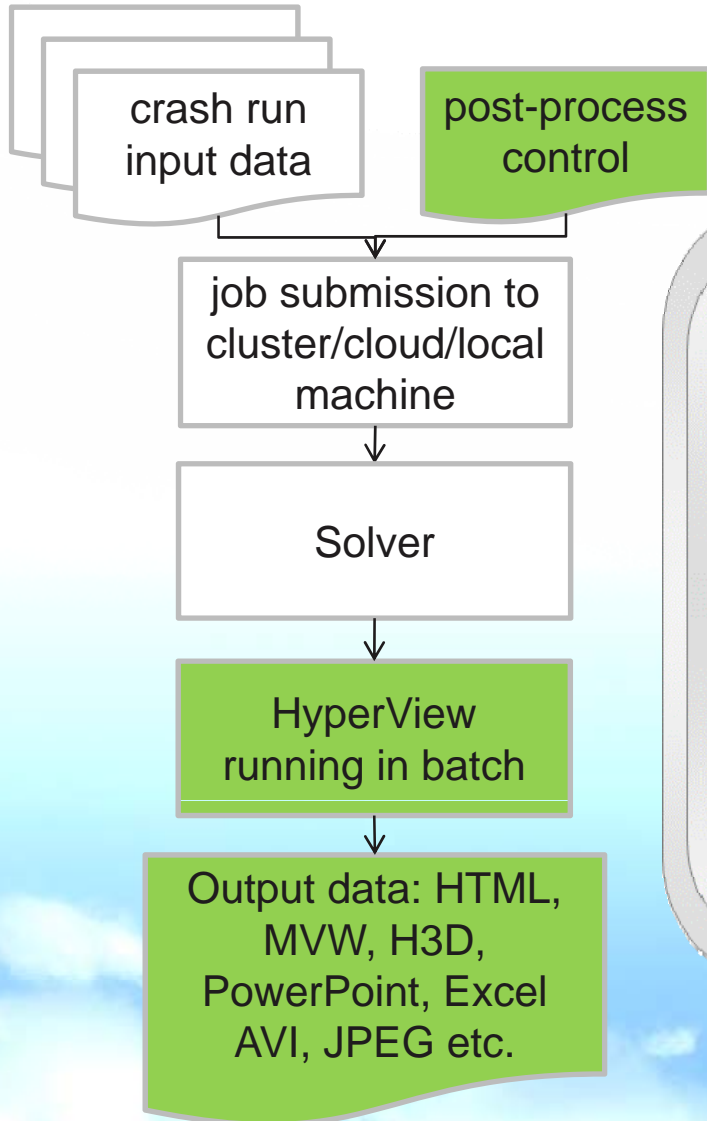
Tight timescales and modest budget

**Achieved through:
HyperWorks based toolset
Process Automation
Massive deployment of optimisation
Unconstrained by OEM process**

Simulation Driven Design



Automated Post Processing



Views / Section Cuts **Diagrams / XY-Plots**

Automatic evaluation is done directly after simulations and result summaries are stored

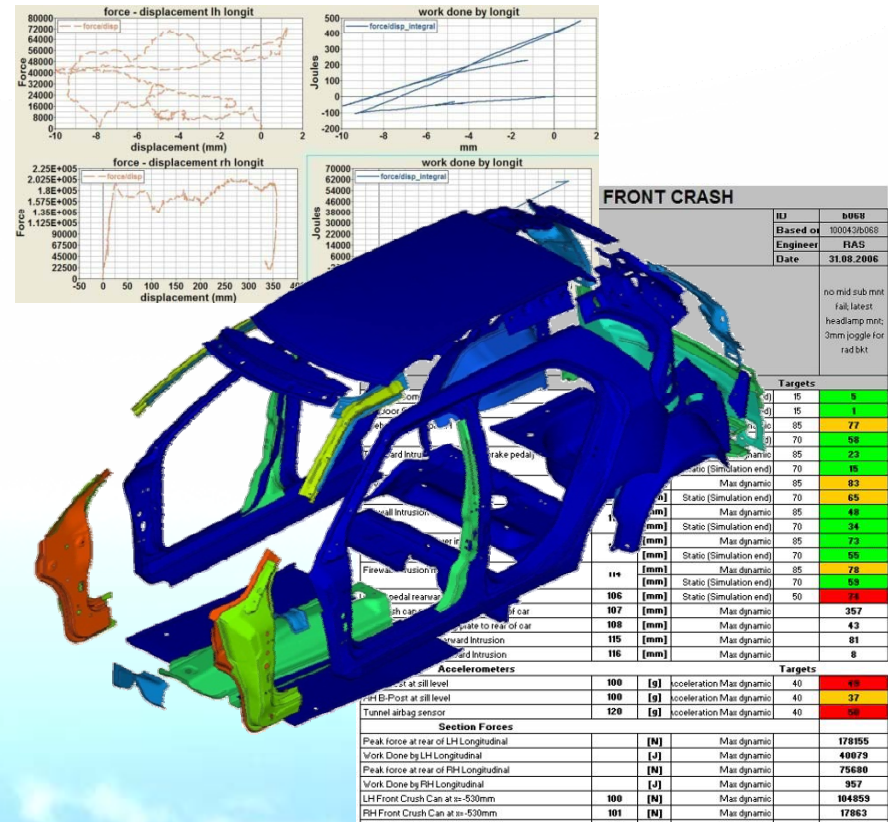
Lists / Tables **Comparison**

Complete evaluation for every load case **Complete documentation for all load cases**

The central image displays several screenshots from the Altair HyperView software. On the left, a 'Report' window shows a tree view of analysis results for 'AT1_1M14Dv_1.html', including categories like 'Global_Deformation', 'Distort', 'Stress', 'Displacement', and 'XY Plots'. In the center, there are two windows: 'Views / Section Cuts' showing a 3D model of a car chassis with a color-coded stress distribution, and 'Diagrams / XY-Plots' showing a line graph of stress versus time. Below these are 'Lists / Tables' showing a 'CRASH STATUS REPORT' with columns for load cases and their status (e.g., 'Pass', 'Fail'), and 'Comparison' showing multiple line graphs side-by-side for comparison. On the right, another 'Report' window shows a detailed list of results for 'crash_10_001_205.html', including various load cases like 'EO (40kph Unlabeled +30°)', 'EN (40kph Unlabeled -30°)', 'FC (40kph Offset)', and 'CT1' series.

Significant Benefits to Automation

- **Significant time for manual reporting**
 - High risk of inconsistency
 - Multiple data sets required
 - Accelerometer outputs
 - Intrusions
 - Energies
 - Still Images, animations, H3D
 - Dummy metrics....
 - Comparison to target or existing data
- **Benefits of Automation:**
 - Reduced time and cost overhead
 - 100% consistency – quality
 - Reporting format is defined by template
 - Summary reporting in seconds
 - Estimated to save 1-3hrs/run
 - Applies to physical & simulation data



**“Automated post processing saved (SAIC) several hundred man hours”,
John Johnston, Vice Director Body & Trim, SAIC Motors**

Automated Post Processing ROI



€70 per hour



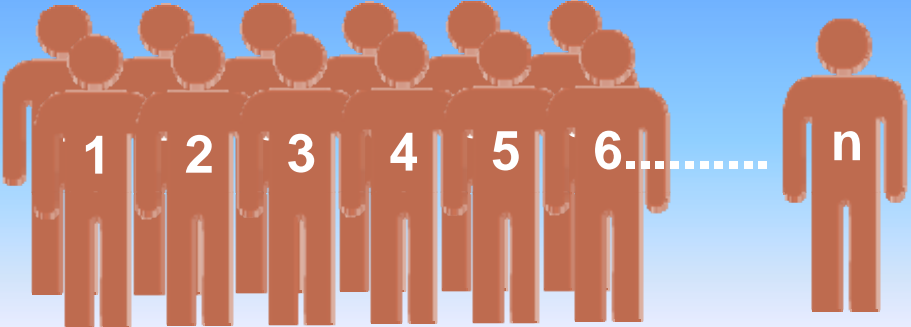
1 hour per run



Minimum 224 per year

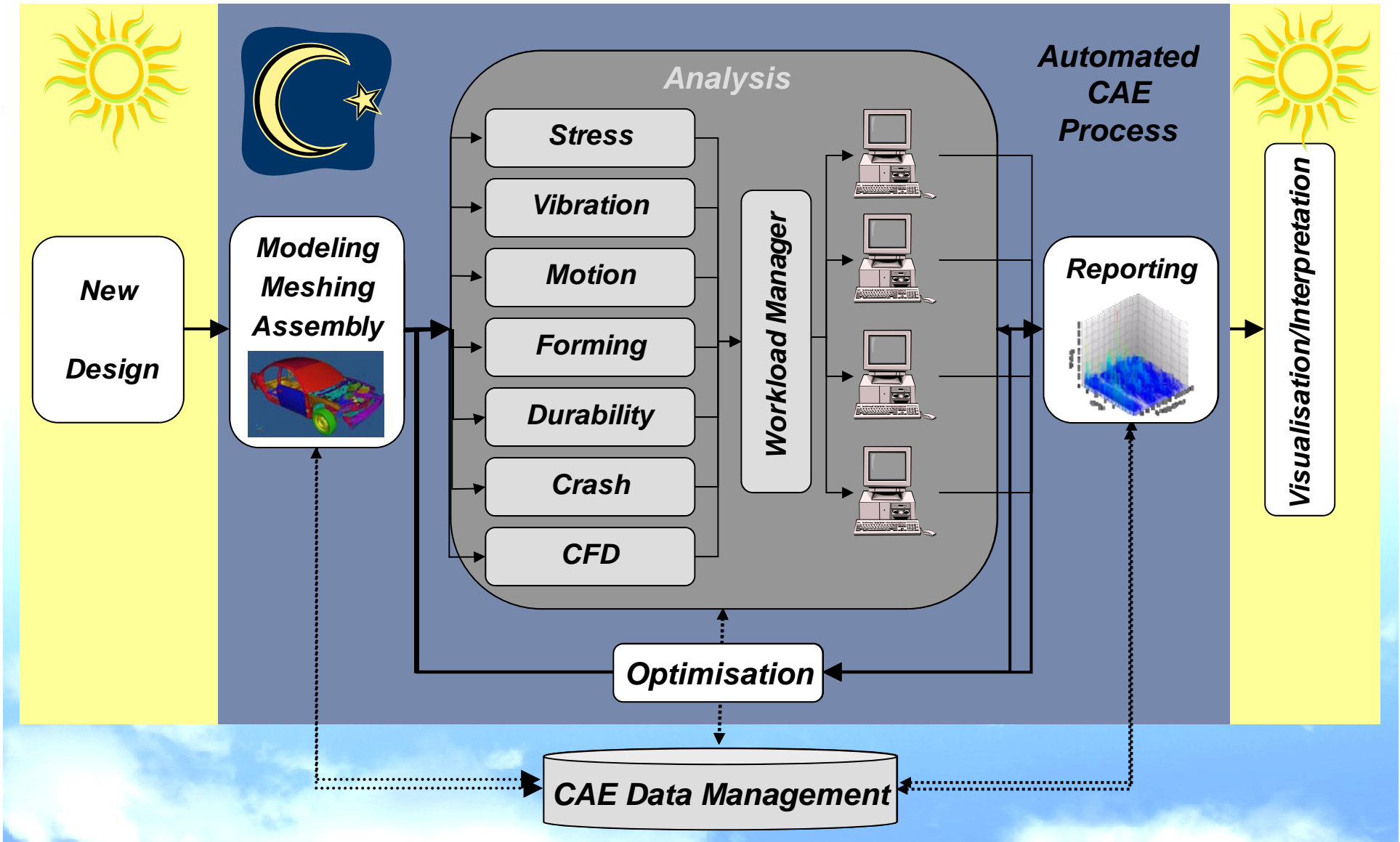


Costs €15,680 per year



Savings of €780,000 per team of 50 Crash Engineers!

Virtual Vehicle Development - Vision





Engineering Simulation Platform



On-demand Computing Technology



Product Innovation Consulting



Enterprise Analytics Solutions



Solid State Lighting Products



Industrial Design Technology

CAD2Crash24

A Grand Challenge

Models courtesy of



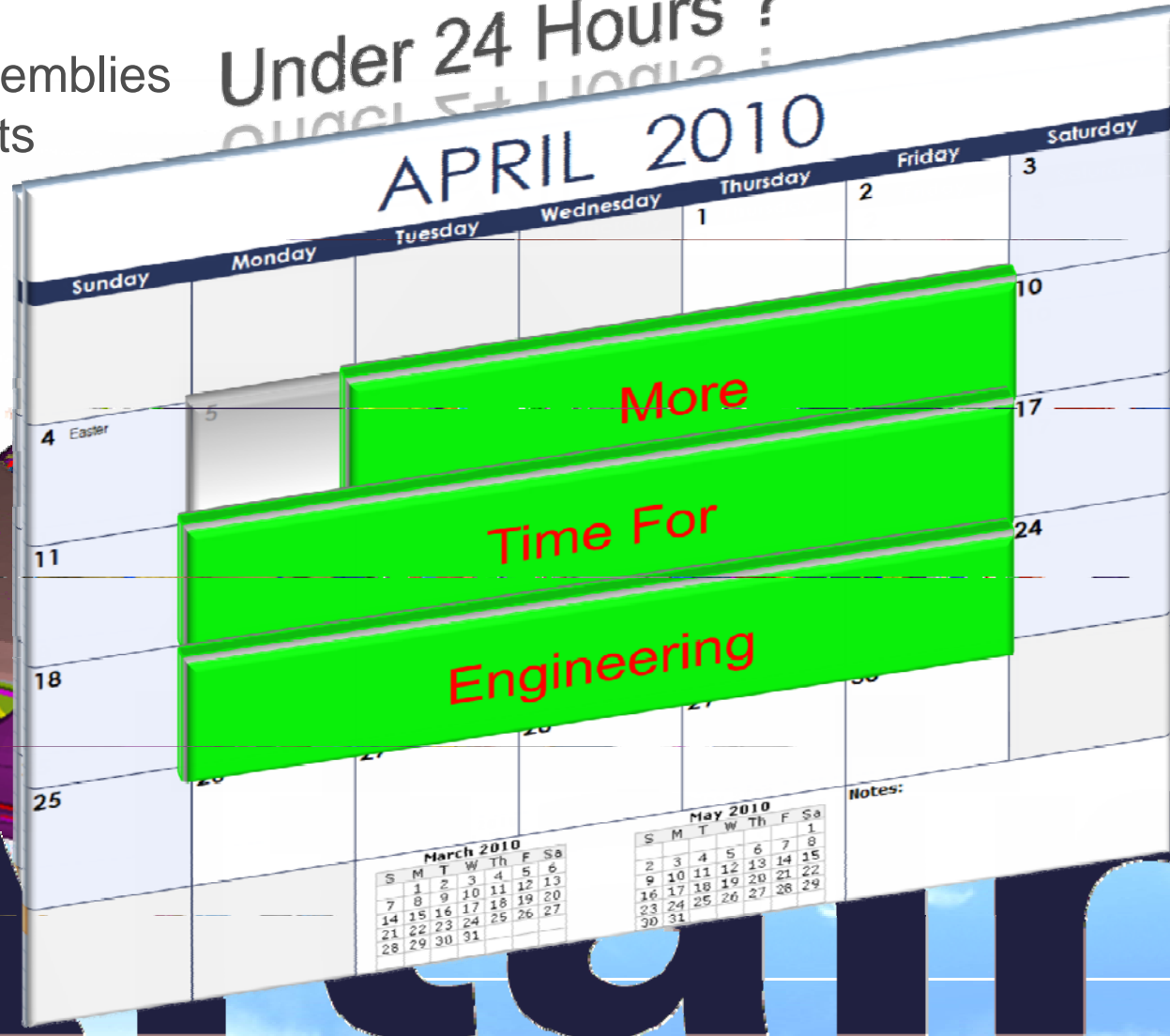
Mar. 2010

CAD2Crash24: A Grand Challenge

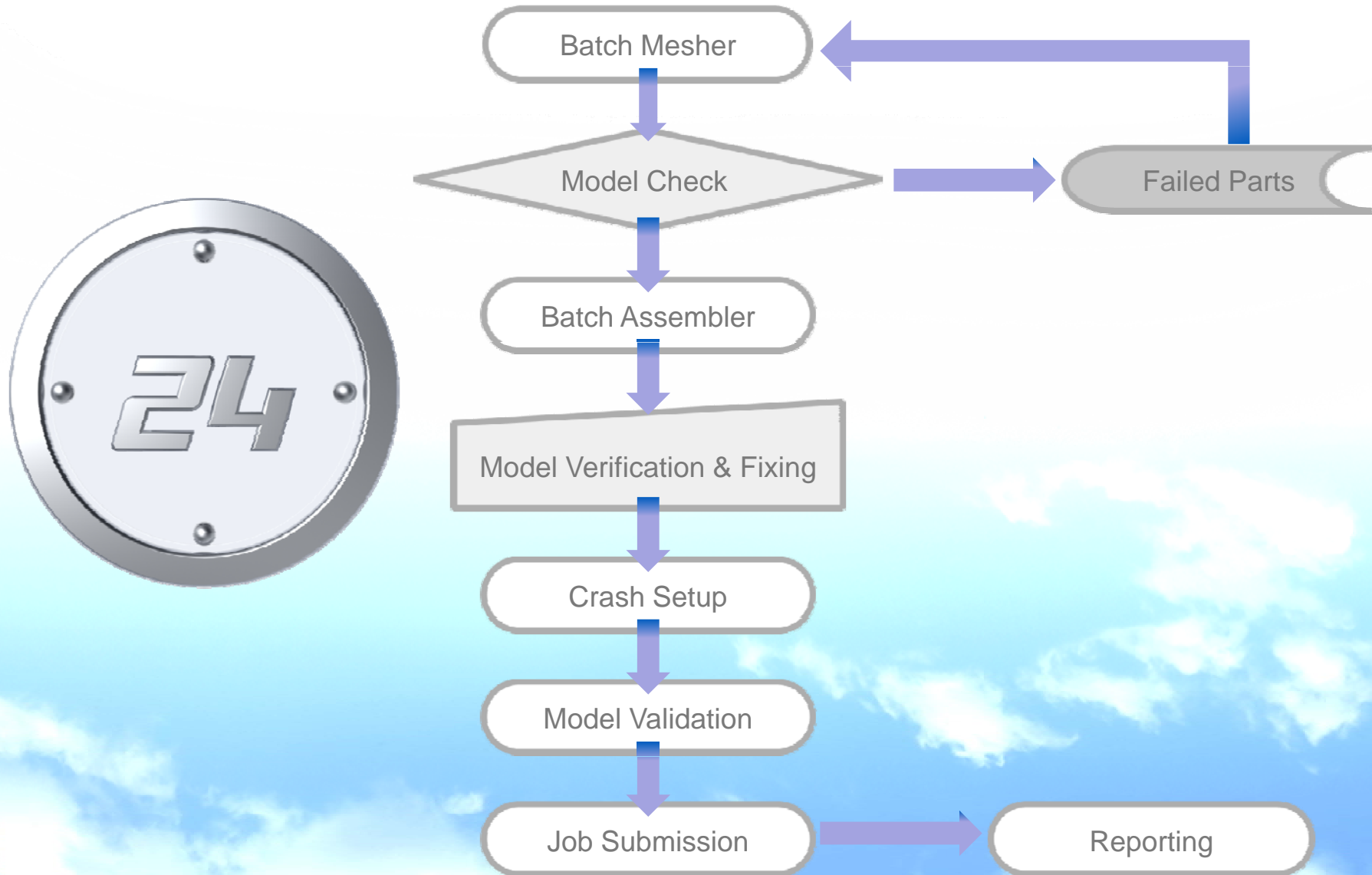
Full Car

- Over 1000 Assemblies
- Over 2000 Parts
- Over 3 Weeks

Under 24 Hours ?



Process Overview



Model Details

- **BIW meshed from CAD data for a generic sedan provided by Ford**
- **IP, Powertrain, Front bumper, Seat assemblies, Tires, Suspension components were meshes from a NHTSA model morphed to be assembled in the generic model provided by Ford**
- **Final Model : ~1M elements (990 K)**



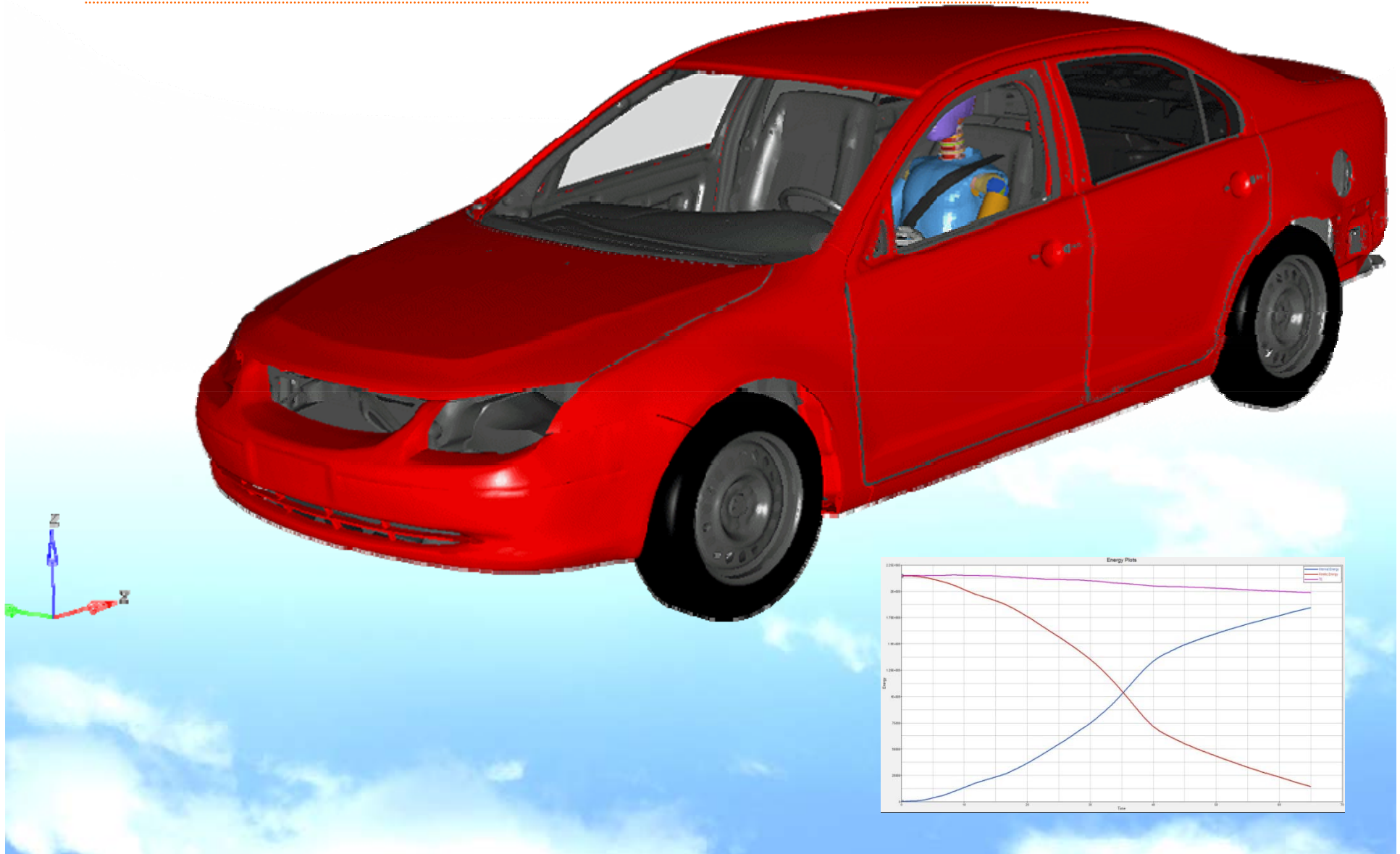
Technical Details

- Loadcase
- NCAP Frontal crash simulated for 65 ms
- FTSS 50th percentile Hybrid III dummy used
- Airbag used
- Materials
- Ford materials used for the BIW and sub assemblies since the parts were supplied by Ford
- Generic materials used for parts that were created by Altair
- Connections
- BIW, Closures were connected using spotwelds
- Bolts were connected with rigid spiders

Taking the Grand Challenge



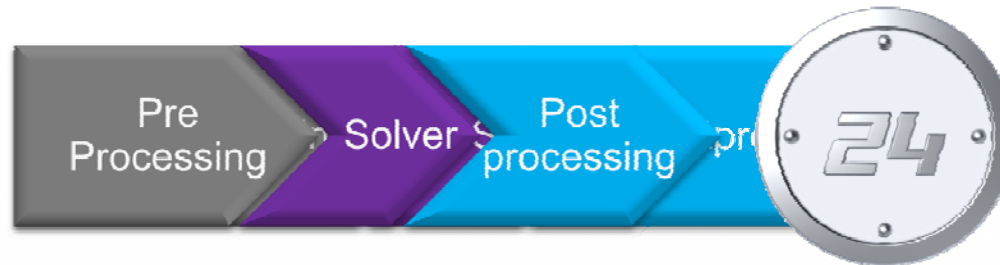
Animations



Timing Report

Task	Budget (Hours)	Actual (Hours)
BIW BatchMesh	2	1.5
Sub Assembly BatchMesh	2	1
Assembly – BIW (Welding)	2	1.5
Assembly – Sub-Assembly (Bolts, Welds, Glues)	4	2
Mass Trimming	2	2.75
Crash Set up	2	3.25
Model Validation	2	1.5
Solution (64 CPUS) (Final Iteration)	6	6.5
Reporting	2	1
Total	24	21

Conclusions



- **Enablers to Simulation Driven Design are already here!**
 - Massive compute is widely available
 - HyperWorks Framework to minimise pre and post processing
- **Brings significant savings**
 - Strong ROI calculation through reduced time
 - Greater value delivered by CAE – “Simulation Driven Design”
 - Improvements to quality and data management
 - Engineers have greater freedom to Engineer