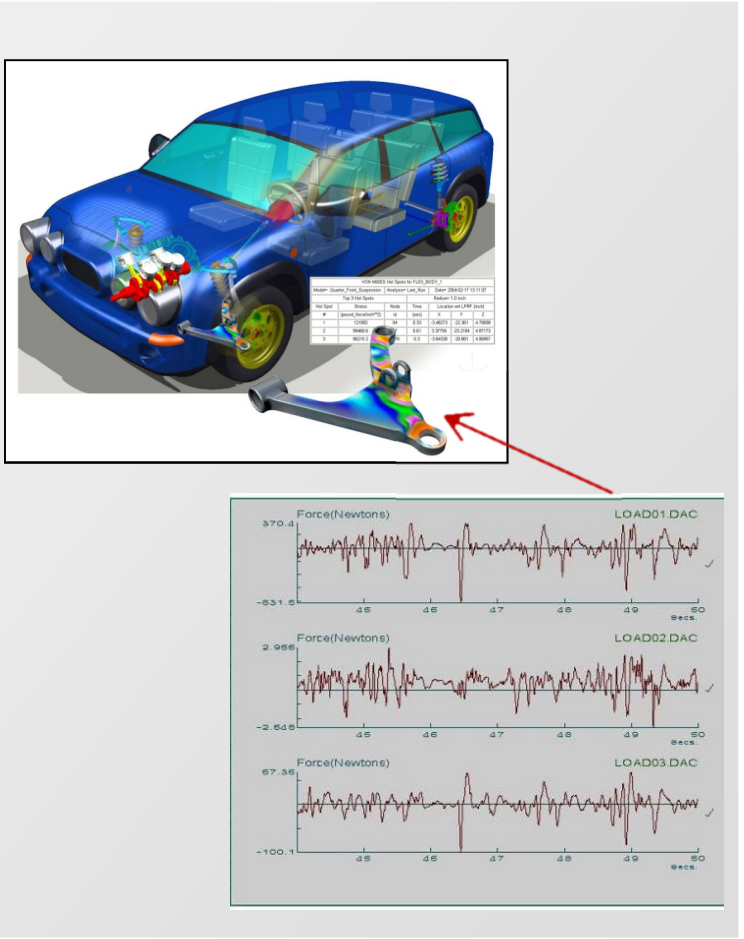
Durability Analysis

Adams/Durability

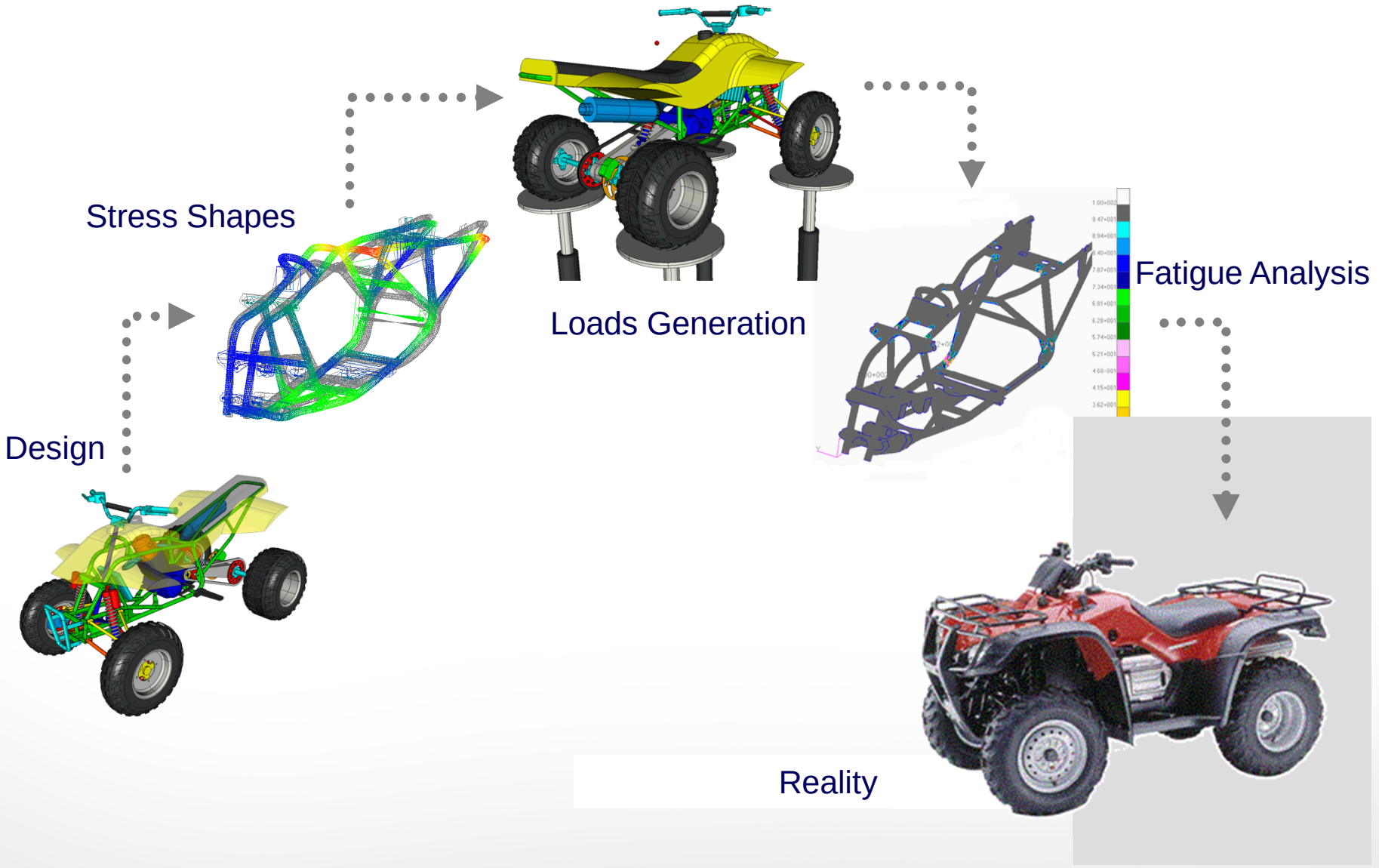
- **Create virtual test inputs**
  - Extend the traditional test-based durability design process into the virtual world
  - Import test data & simulate duty cycles
  - Data exchange with FE or fatigue programs
  - Modal stress recovery in Adams/PPT
  - Virtual measurements like strain gauges
- **Benefits**
  - Critical results automatically extracted
  - Help predict life of the system
  - Gain more insight into system performance and failures
  - Avoid surprises in field usage



By developing a virtual durability test based on their laboratory process, we were able to analyze durability before the hardware test. We have reduced the number of physical prototypes from three or four previously, down to one on our two most recent designs

*- **Product Engineer, John Deere Welland***

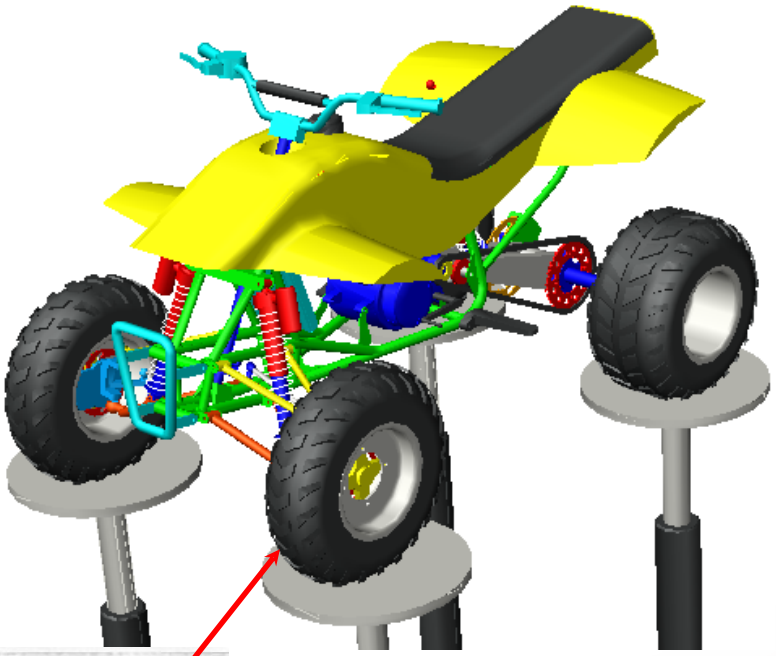
Durability Simulation

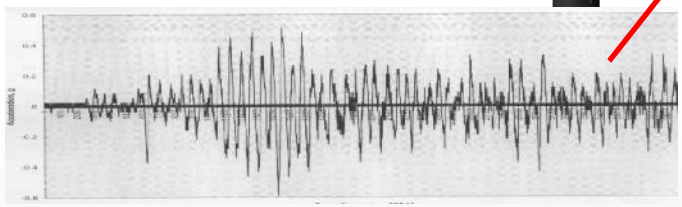


ADAMS/Durability

Construct virtual test lab inputs and outputs

- Import physical test data
  - MTS Systems RPC® III file
  - nCode International DAC file
- Efficient spline interpolation
- Add virtual measurements like strain gauges



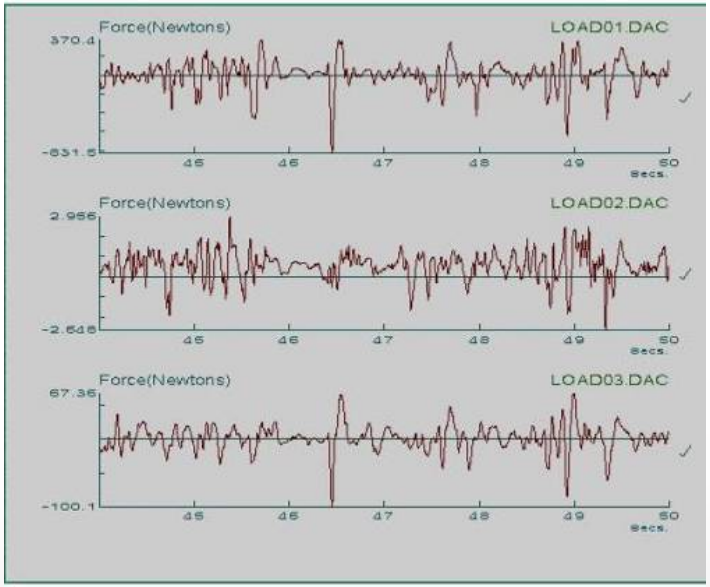


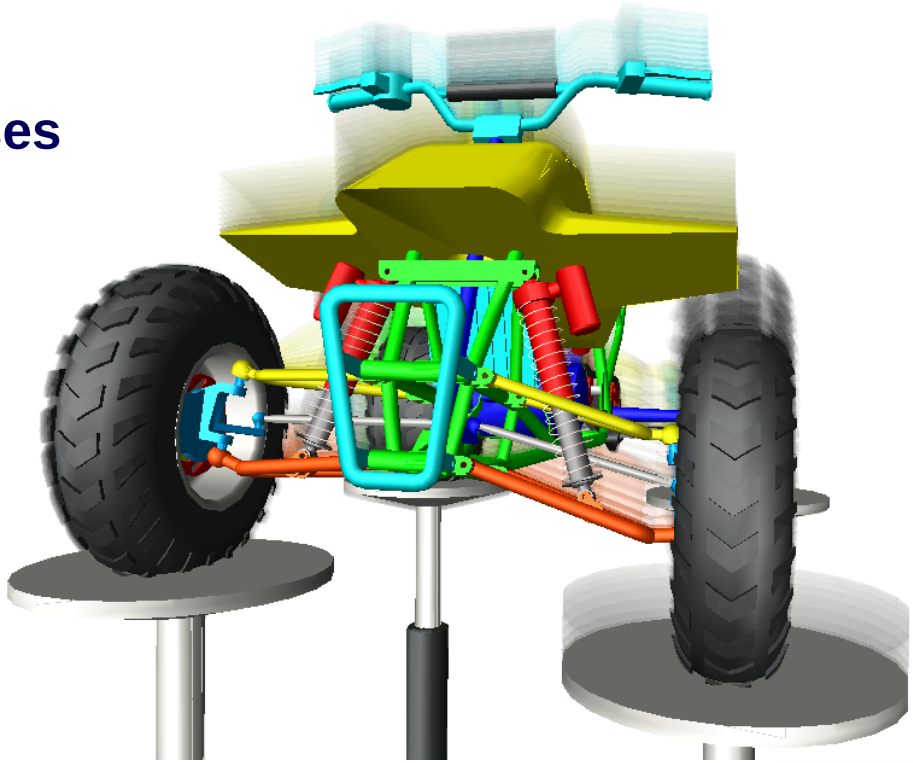
ADAMS/Durability

Test

Simulate duty cycles

- Static and quasi-state analyses
- Transient and dynamic
- Critical results automatically extracted



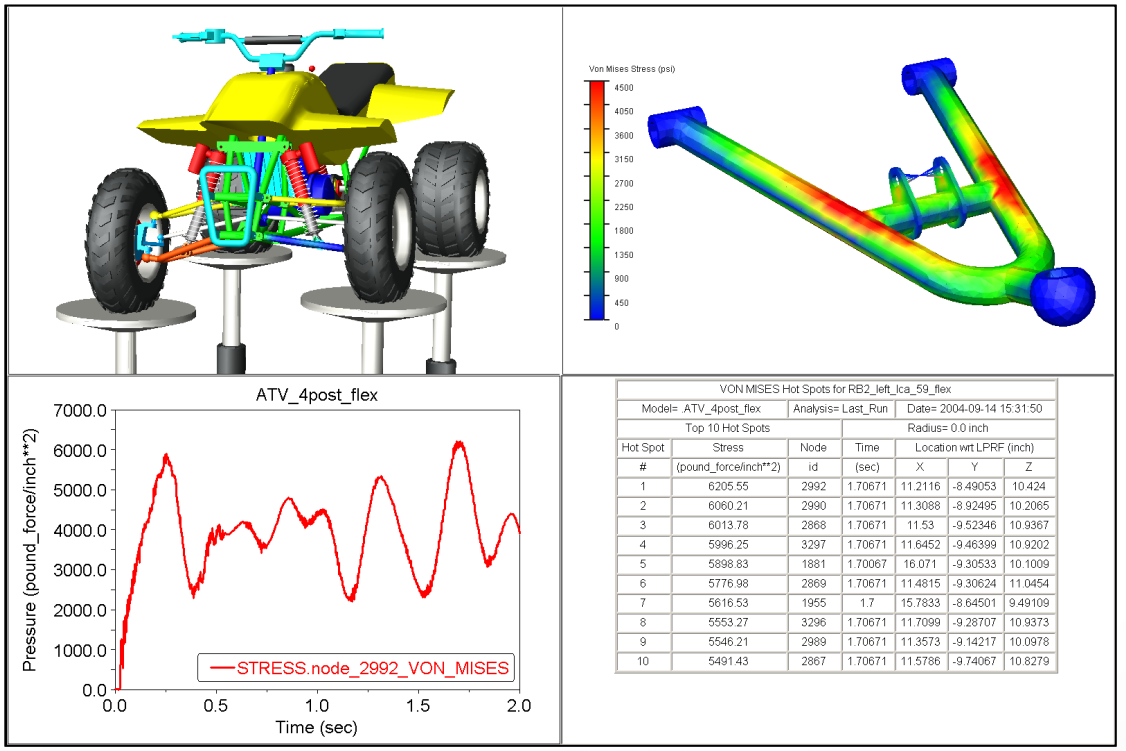


ADAMS/Durability

Review

Assess the design

- Test data correlation
- Color contour plots
- Powerful plotting capabilities
- Hot spot tables
- Data exchange with FE or fatigue programs for life prediction



VON MISES Hot Spots for RB2_left_lca_59_flex

Model= .ATV_4post_flex		Analysis= Last_Run		Date= 2004-09-14 15:31:50		
Top 10 Hot Spots			Radius= 0.0 inch			
Hot Spot	Stress	Node	Time	Location wrt LPRF (inch)		
#	(pound_force/inch**2)	id	(sec)	X	Y	Z
1	6205.55	2992	1.70671	11.2116	-8.49053	10.424
2	6060.21	2990	1.70671	11.3088	-8.92495	10.2065
3	6013.78	2868	1.70671	11.53	-9.52346	10.9367
4	5996.25	3297	1.70671	11.6452	-9.46399	10.9202
5	5898.83	1881	1.70067	16.071	-9.30533	10.1009
6	5776.98	2869	1.70671	11.4815	-9.30624	11.0454
7	5616.53	1955	1.7	15.7833	-8.64501	9.49109
8	5553.27	3296	1.70671	11.7099	-9.28707	10.9373
9	5546.21	2989	1.70671	11.3573	-9.14217	10.0978
10	5491.43	2867	1.70671	11.5786	-9.74067	10.8279

Case Study: John Deere

- **Business:**

  Agriculture equipment manufacturer
- **Challenge:**

  Shorten the durability design process
- **Solution:**

  Replicate the durability testing in a virtual lab
- **Value:**

  Identify critical locations before the first hardware prototype is built

"Using the new method, we have reduced the number of physical prototypes from three or four previously, down to one on our two most recent designs."
– Terry Ewanochko
Product Engineer, John Deere Welland Works