

2007 Chevrolet Silverado Finite Element Model Validation Detail Mesh



doi: 10.13021/G8F312

Vehicle Description

2007 Chevy Silverado 1500 2WD

- VIN 2GCEC13C771511793
- 4 door crew cab short box pick-up truck
- Engine 4.8L V8
- M30 Transmission 4 speed Automatic
- Curb weight – 2337 kg



Specifications

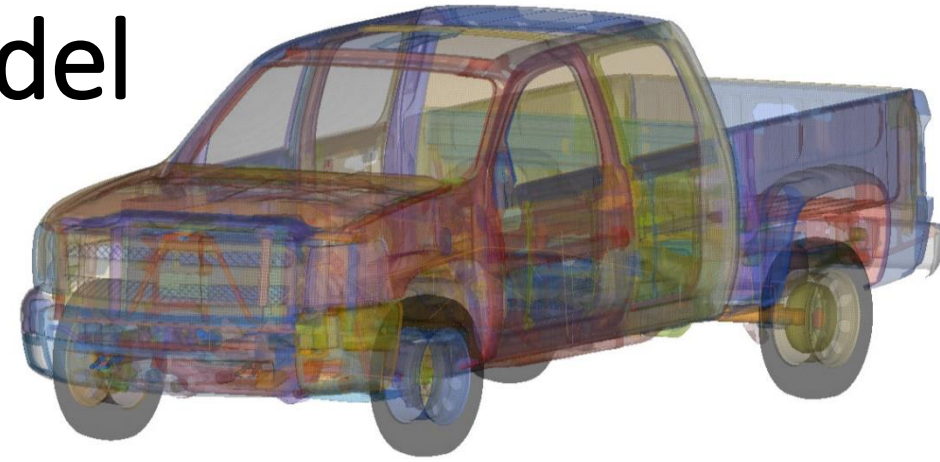
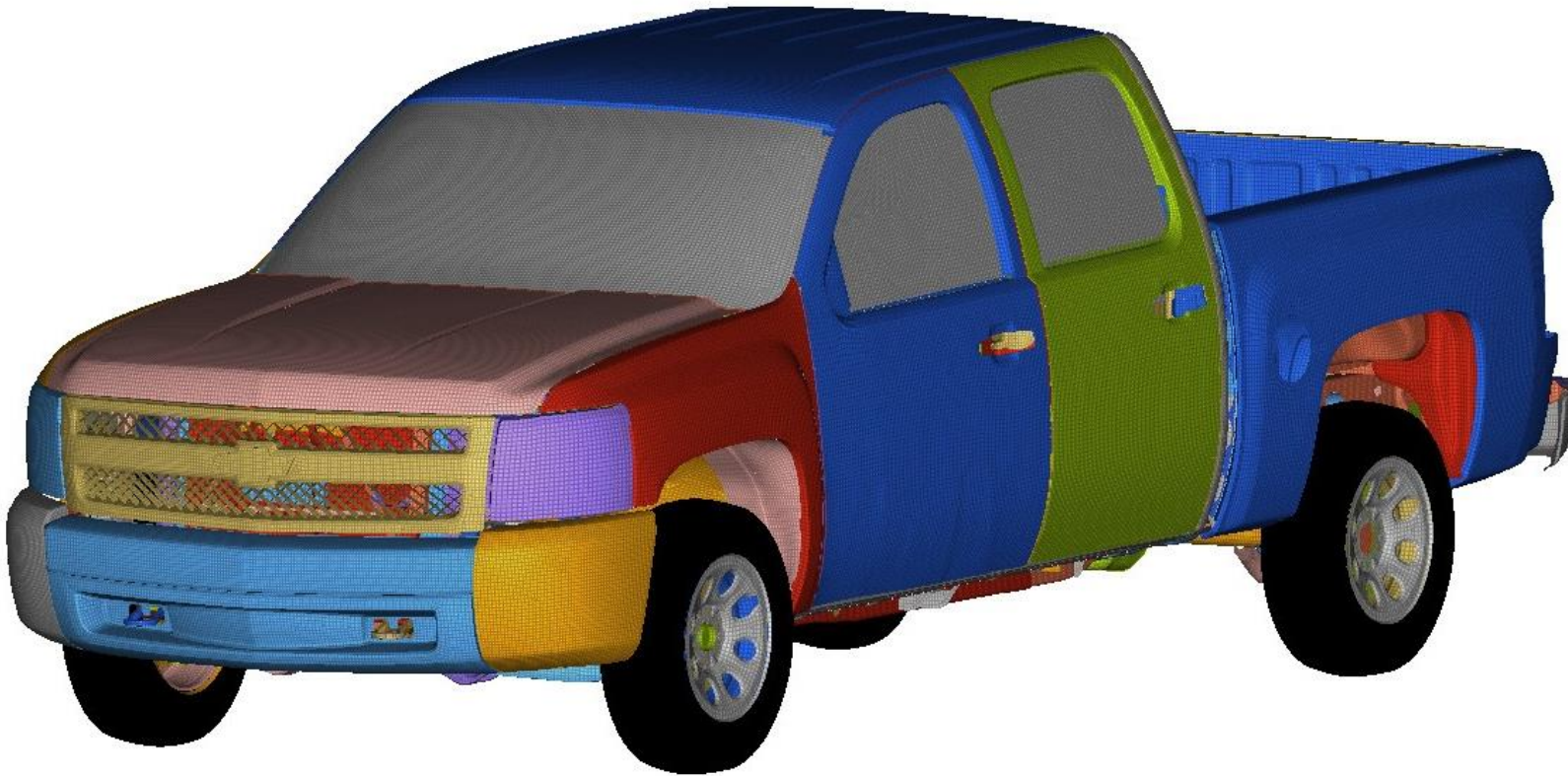
Model Year: 2007
Make: Chevrolet
Model: CC10543 - Silverado: 1500 2WD Crew Cab Short Box

Color1: 10U Summit White Exterior Color
Color2: N/A
Trim: 88V Dark Titanium Vinyl Interior Trim
Package: 1WT Work Truck
Engine: LY2 Engine: 4.8L, V-8
Trans: M30 Transmission: 4-Speed Automatic

Event Code: 5000 Vehicle delivered to dealer
VIN: 2GCEC13C771511793

1SZ Option Package Discount
AE7 Seat: 40/20/40/ Split Front Bench
AJ1 Glass: Deep Tinted
AU3 Power Door Locks
C5U GVW Rating 6800 Lbs
C67 Air Conditioning, Manual
DE2 Mirrors, O/S: Black Foldaway
E63 Body, Fleetside
FE9 Federal Emissions
G80 Locking Differential, Rear
GU5 Rear Axle 3.23 Ratio
JL4 Stabilitrak - Stability Control
K34 Cruise Control
K47 Air Cleaner, High Capacity
KNP Transmission Cooling System
NX7 Wheels: 17" Steel
PCY Trailing Package
QPR Tires: P245/70R17-108S BW ALS
R9Z Sold Order Expedite
SAF Spare Tire Lock
UE1 OnStar Communication System
UM7 ETR AM/FM Stereo w/Seek-Scan and Digital Clock
VK3 License Plate Front Mounting Pkg
Z82 Trailing Package
Z85 Handling/Trailing Suspension

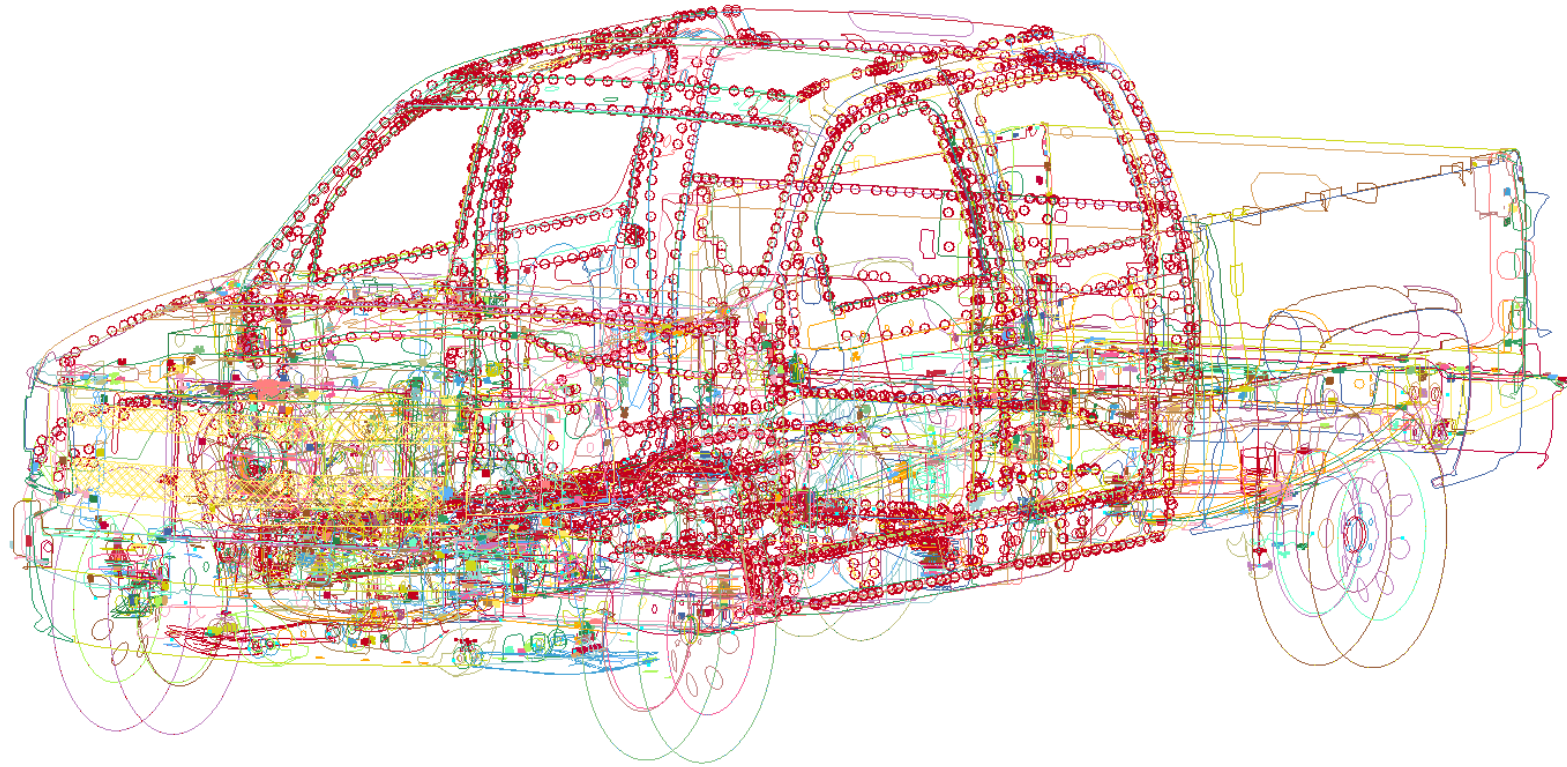
Model Information – Detailed Model



Number of parts	721
Number of nodes	979,598
Number of solid elements	53,294
Number of shell elements	907,067
Number of beam elements	3113
Number of elements	963,474

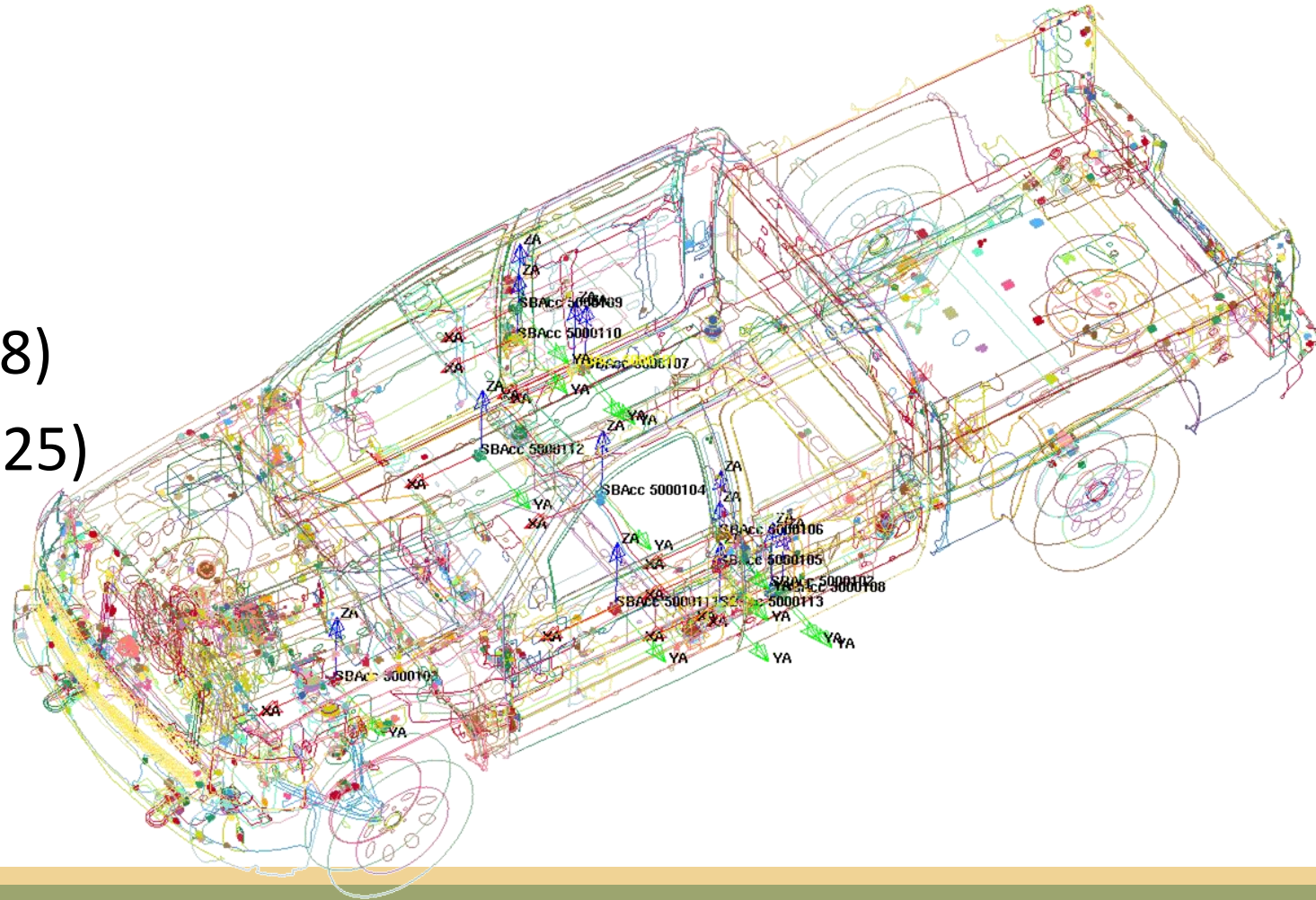
Connections – Detailed Model

● BEAM CONNECTIONS	2825
● NODAL_RIGID_BODY	709
● EXTRA_NODES_SET	46
● JOINTS	40
● RIGID_BODIES	4
● SPOTWELD	7136

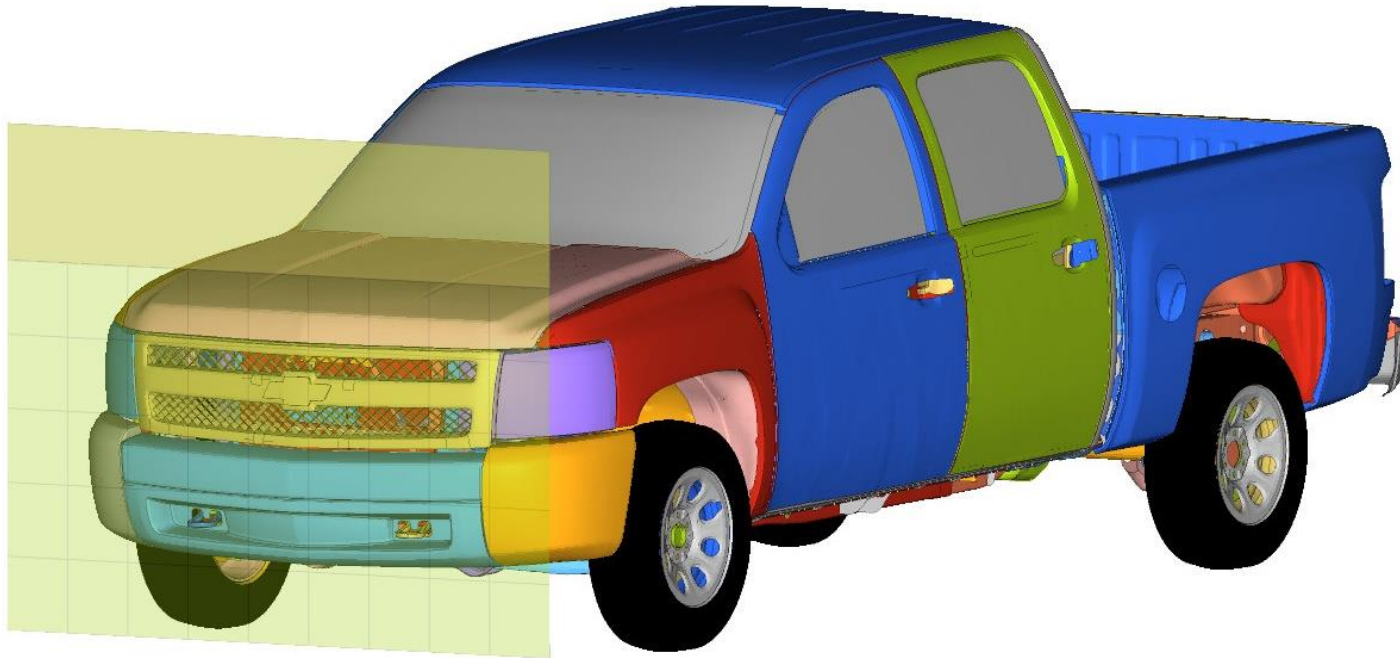


Accelerometers – Detailed Model

- Left Rear Seat (Node 5000016)
- Right Rear Seat (Node 5000008)
- Engine Bottom (Node 5000020)
- Vehicle C.G. Local (Node 5000028)
- Vehicle C.G. Global (Node 5000025)



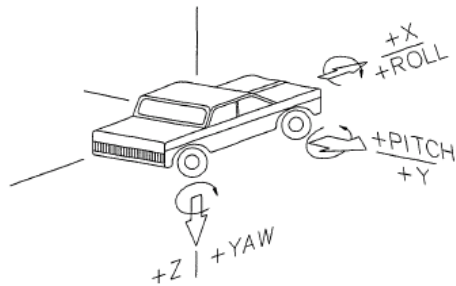
Simulation Benchmark – Detailed Model



LS-DYNA	
Platform	Linux RHEL 5.4
Version	mpp s R6.1.2
Revision	85139
Precision	Single precision (I4R4)
Time to simulate 200 ms	4 hour 33 min.
Number of processors	16

Inertia Comparisons – Detailed Model

- 2337 kg for the physical vehicle includes a full tank of gasoline
- Fuel mass removed to create a 2270 kg FE model



	<i>Actual Vehicle</i>	<i>FE Model</i>
Weight, kg	2337	2271.7
Pitch inertia, kg-m ²	6155	6059
Yaw inertia, kg-m ²	6453	6537
Roll inertia, kg-m ²	1051	1049
Vehicle CG Z, mm	710.1	730.3

Full-Scale & Component Crash Tests

● Non-destructive testing

- Inertia tests
- Speed bump tests
- Sloped terrain trajectory tests

● Quasi-static testing

- Front coil spring
- Rear leaf spring
- Rear bump stop

● Component level suspension tests

- Front suspension – vertical loading
- Rear suspension – vertical loading
- Rear suspension – lateral loading

● Full Scale Crash Tests

- NHTSA NCAP
- New Jersey Concrete Median Barrier
- G4(2W) Guardrail
- G9 Thrie Beam Barrier
- PennDOT Transition
- G4(1S) Median Barrier
- G2 Weak Post W-beam Guardrail
- G3 Box Beam Barrier

Full-Scale Crash Tests

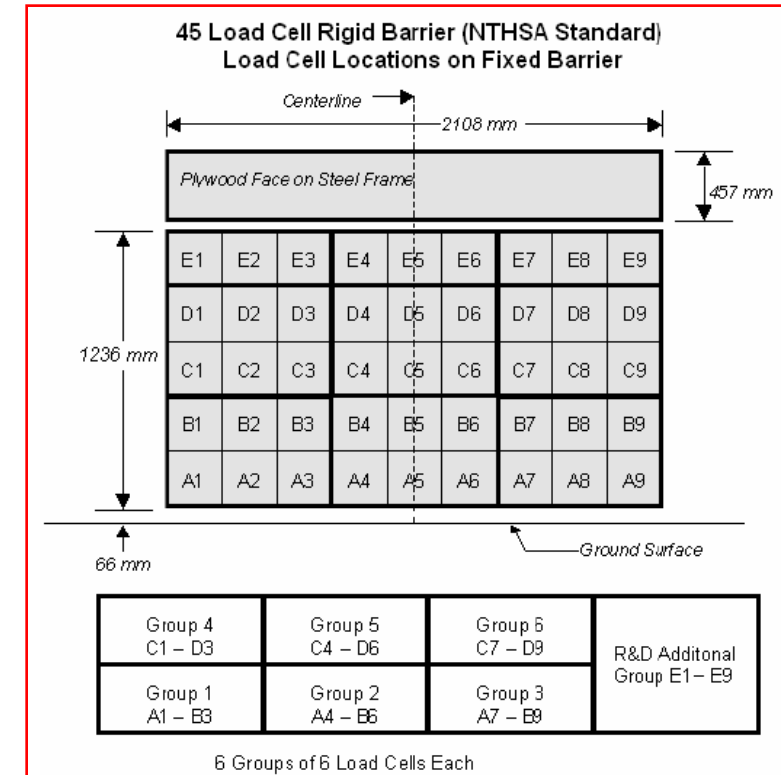
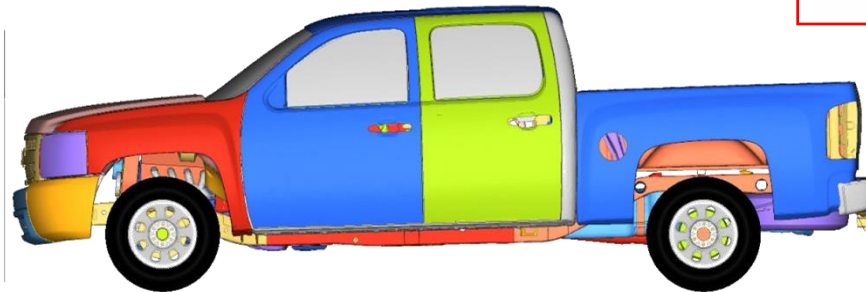
● Chevy Silverado (2007-2013)

Test Type	Test Number
Frontal Full Wall	NHTSA 5877 (56.3 km/hr), NHTSA 5907 (56.3 km/hr), NHTSA 6108, NHTSA 6371, NHTSA 6678 (39.8 km/hr),
Frontal Offset	IIHS CEF0825 (64.7 km/hr), NHTSA 6277 (64.4 km/hr)
Side Impact NHTSA	NHTSA 06171 (61.8 km/hr), 6174 (61.1 km/hr), 6185 (61.8 km/h),
Side Impact IIHS	IIHS CES0903 (49.9 km/hr),
Roadside Hardware Test	TTI 476460-1-4, TTI 476460-1-3, TTI 476460-1-8, TTI 476460-1-6, TTI 476460-1-7, TTI 476460-1-9, TTI 476460-1-5 (25 deg, 100 km/hr)
Vehicle to Vehicle	NHTSA 6372 (0 deg, 104 km/hr, 40 % overlap),
Roof Strength	IIHS SWR1125
Speed Bump	FOIL 07009 (6 tests: varied speed bump configurations)
Sloped Terrain	FOIL 07010 (6 tests: 6H:1V slopes, 25 deg - 16, 32 and 50 km/hr)
Suspension	FOIL 08011 (Rear Suspension System Bottom Out with damper), FOIL 08012 (Front Suspension System Bottom Out), FOIL 08013 (Rear Side Suspension System Characterization)

Frontal Full Wall – 56 km/hr

● NHTSA Test 5877 (56.3 km/hr) – Frontal NCAP

- 2007 Chevy Silverado NCAP test
- 45 load cell fixed wall
- 56 km/hr



Full-scale Crash Testing – Front NCAP – Detailed Model

Left Side View



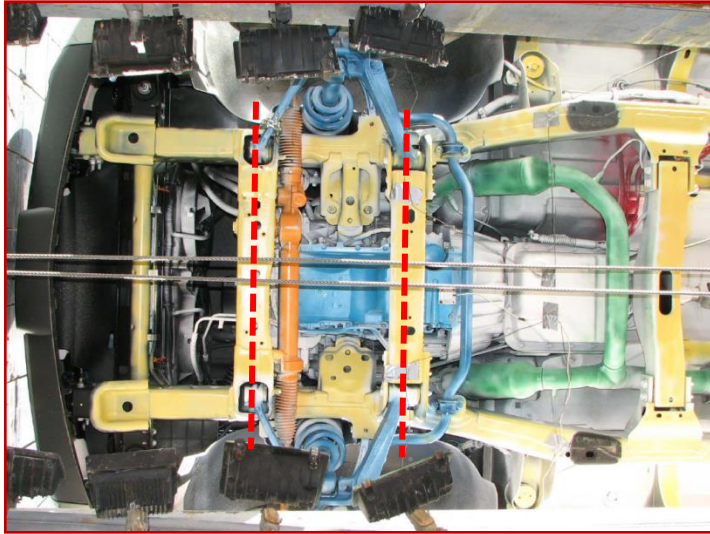
Right Side View



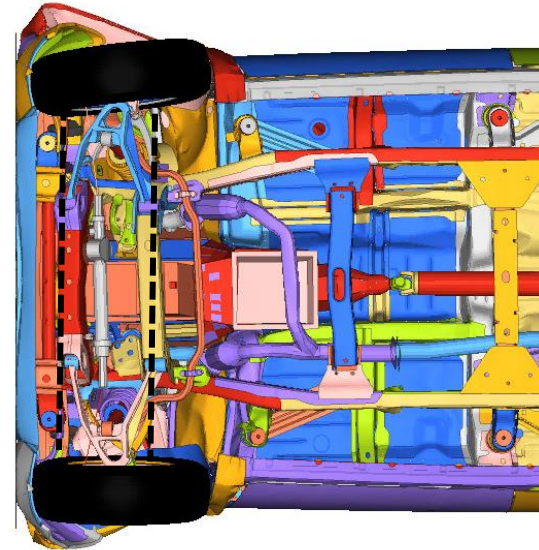
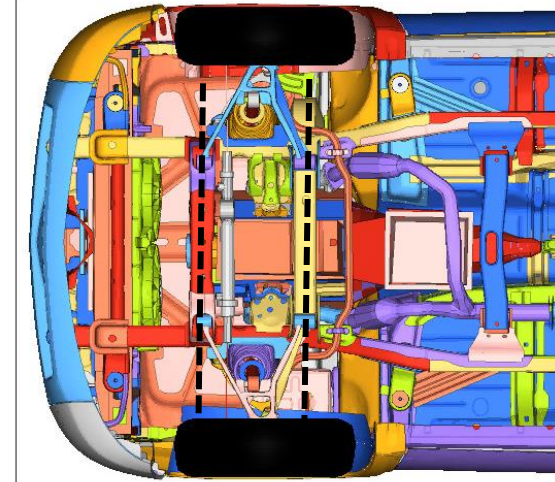
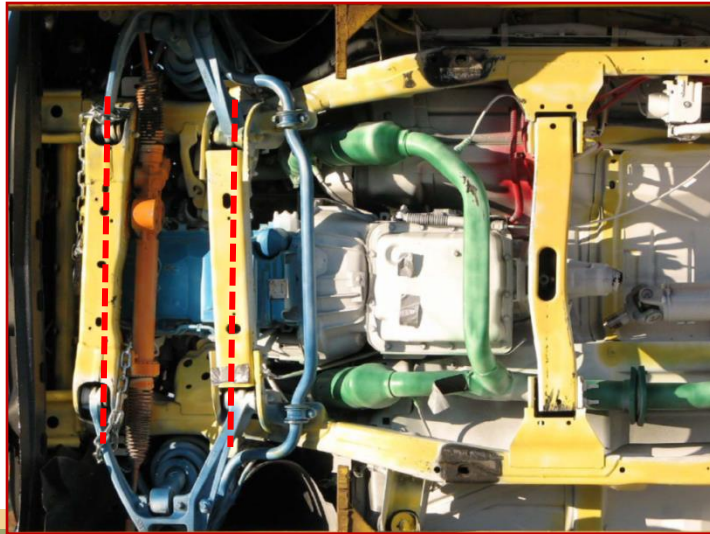
	FE Model	NCAP Test 5877
Weight (kg)	2622	2625
Engine Type	4.8 L V8	4.8 L V8
Tire size	P245/70R17	P245/70R17
Attitude (mm)	F – 1016	F – 929
As delivered	R – 1043	R – 1002
Wheelbase (mm)	3660	3664
CG (mm) Rearward of front wheel C/L	1670	1664
Body Style	4-door crew cab	4-door crew cab

Full-scale Crash Testing – Front NCAP – Crush Mode

Pre-Test

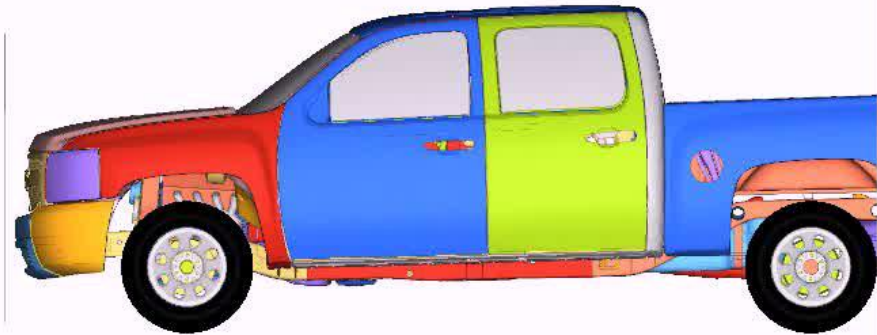


Post-Test



Frontal Full Wall – 56 km/h – Video – Detailed Model

1: Silverado (CCSA V3)
Loadcase 1: Time = 0.000000 : Frame 1



Time: 50.0

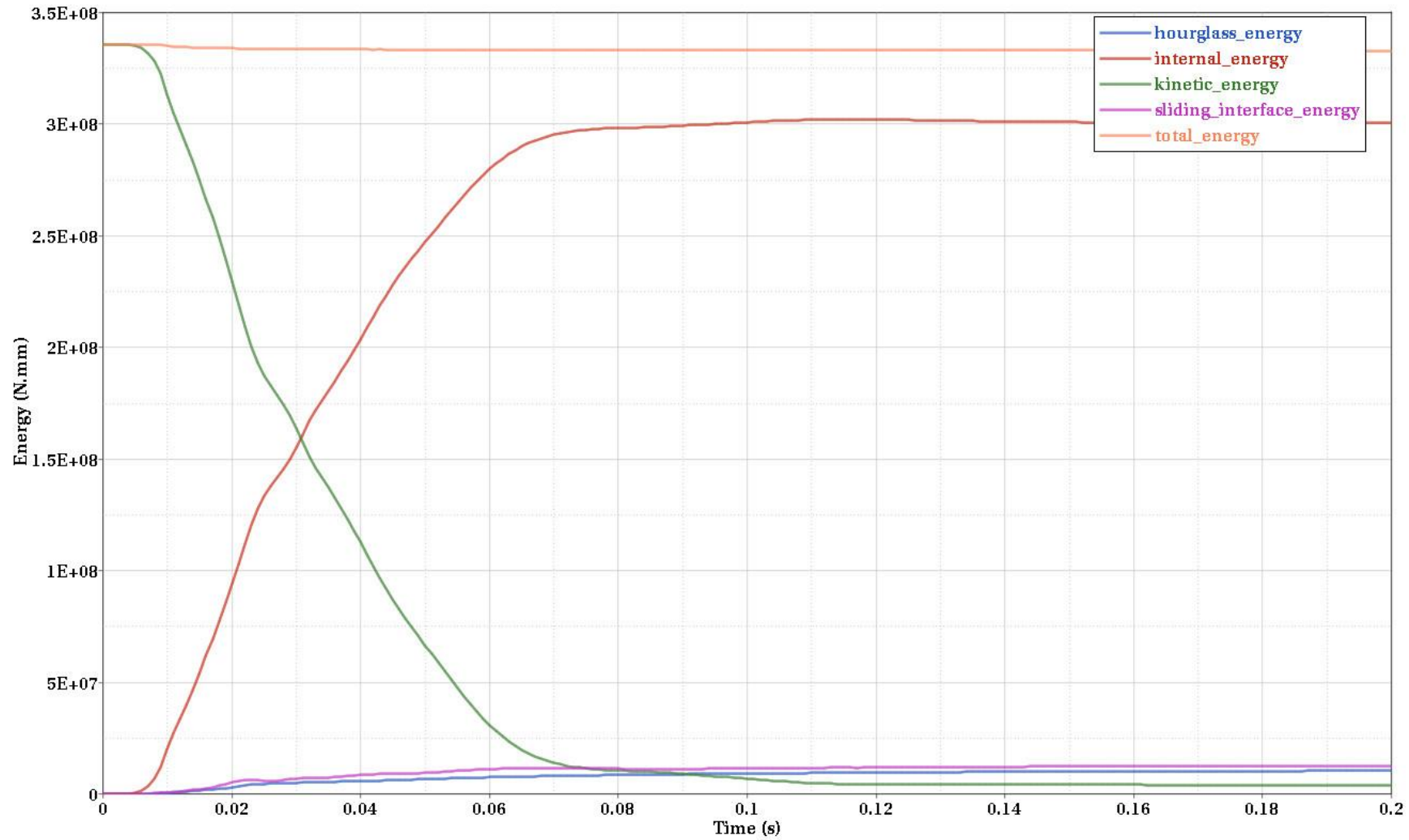
Camera
View # 02

Frame #
0

Time
0.0000

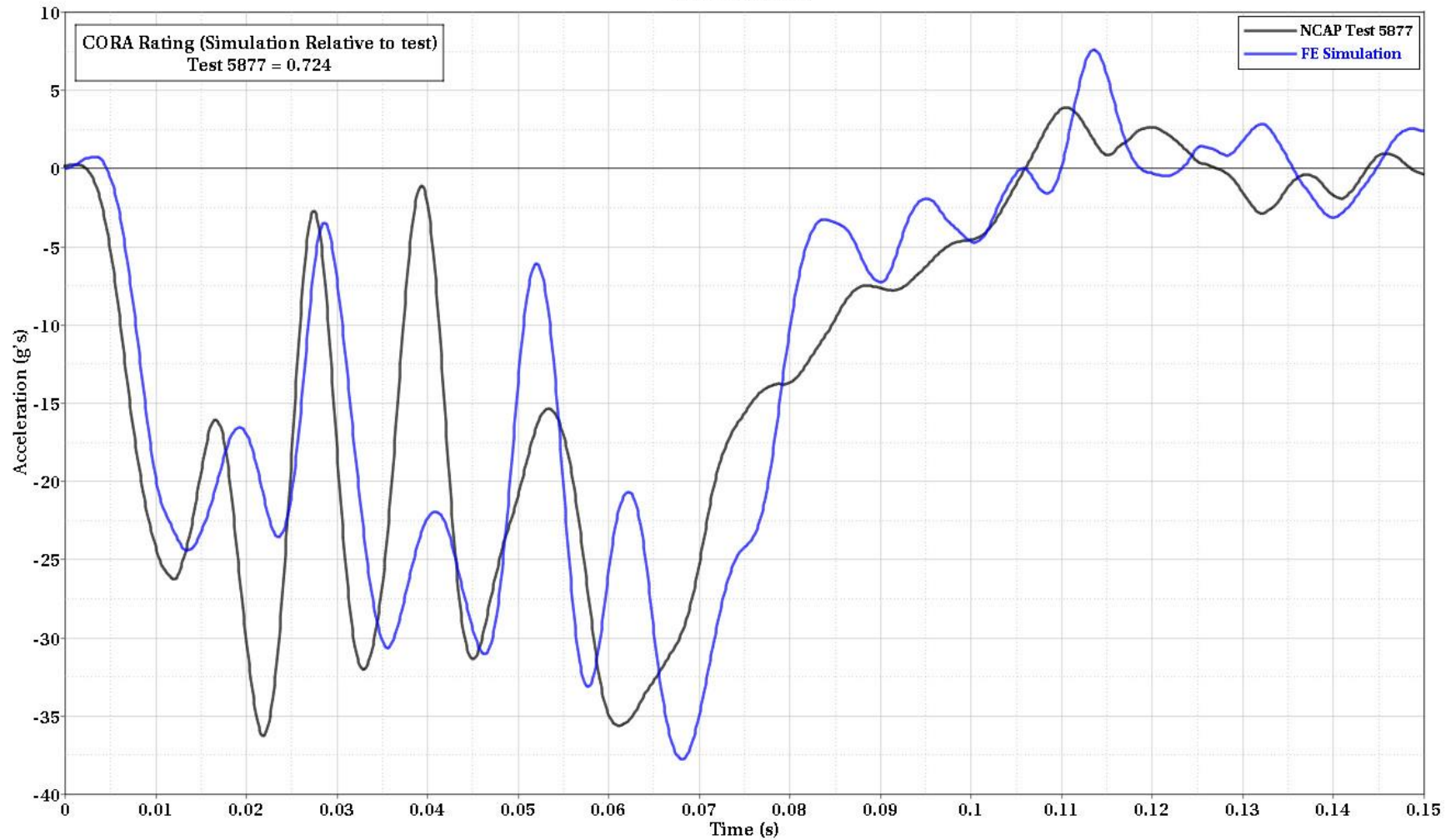


Frontal Full Wall – 56 km/hr – Energy Summary – Detailed Model



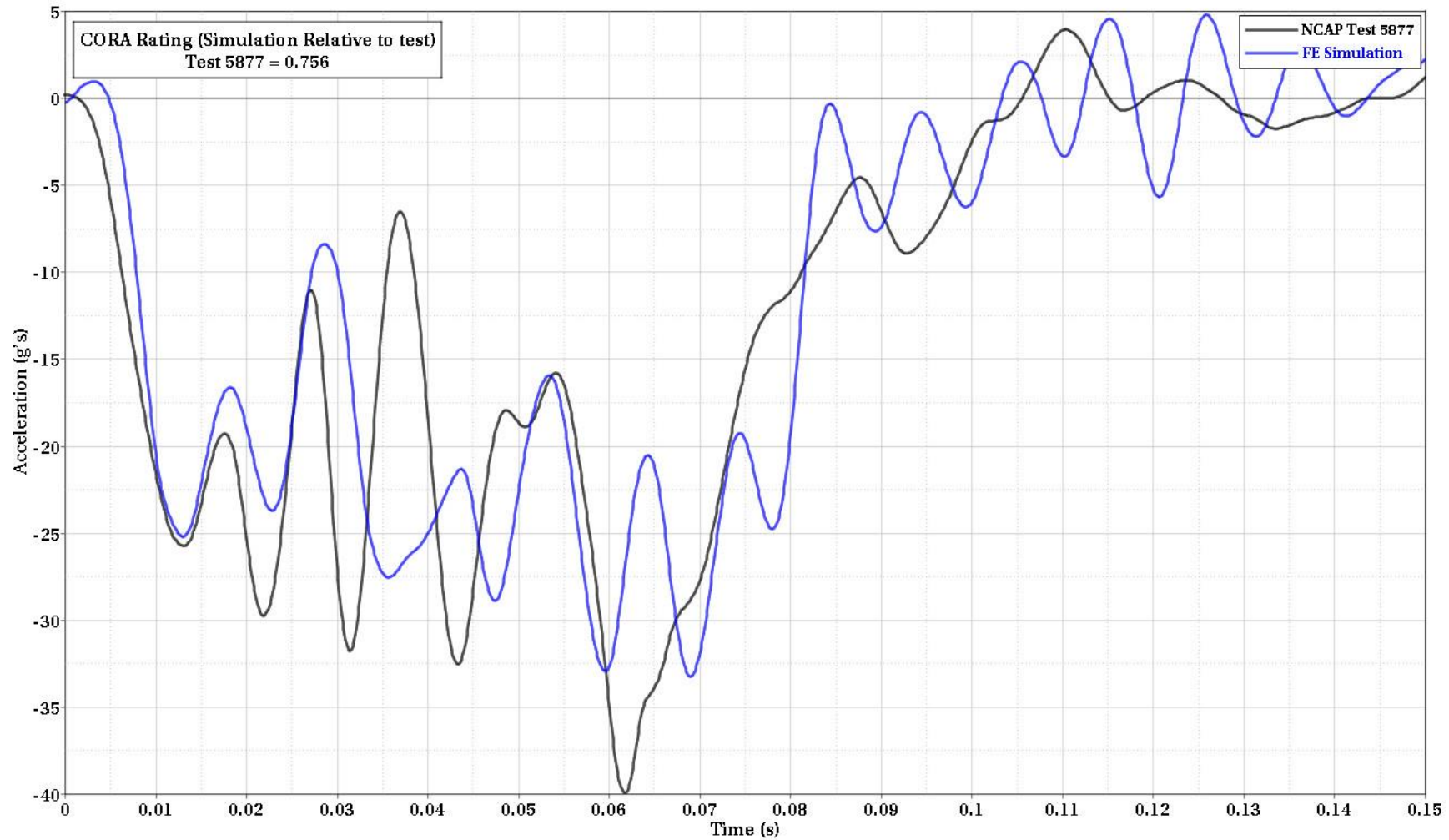
Frontal Full Wall – 56 km/hr – Acceleration – Detailed Model

Left Rear Seat



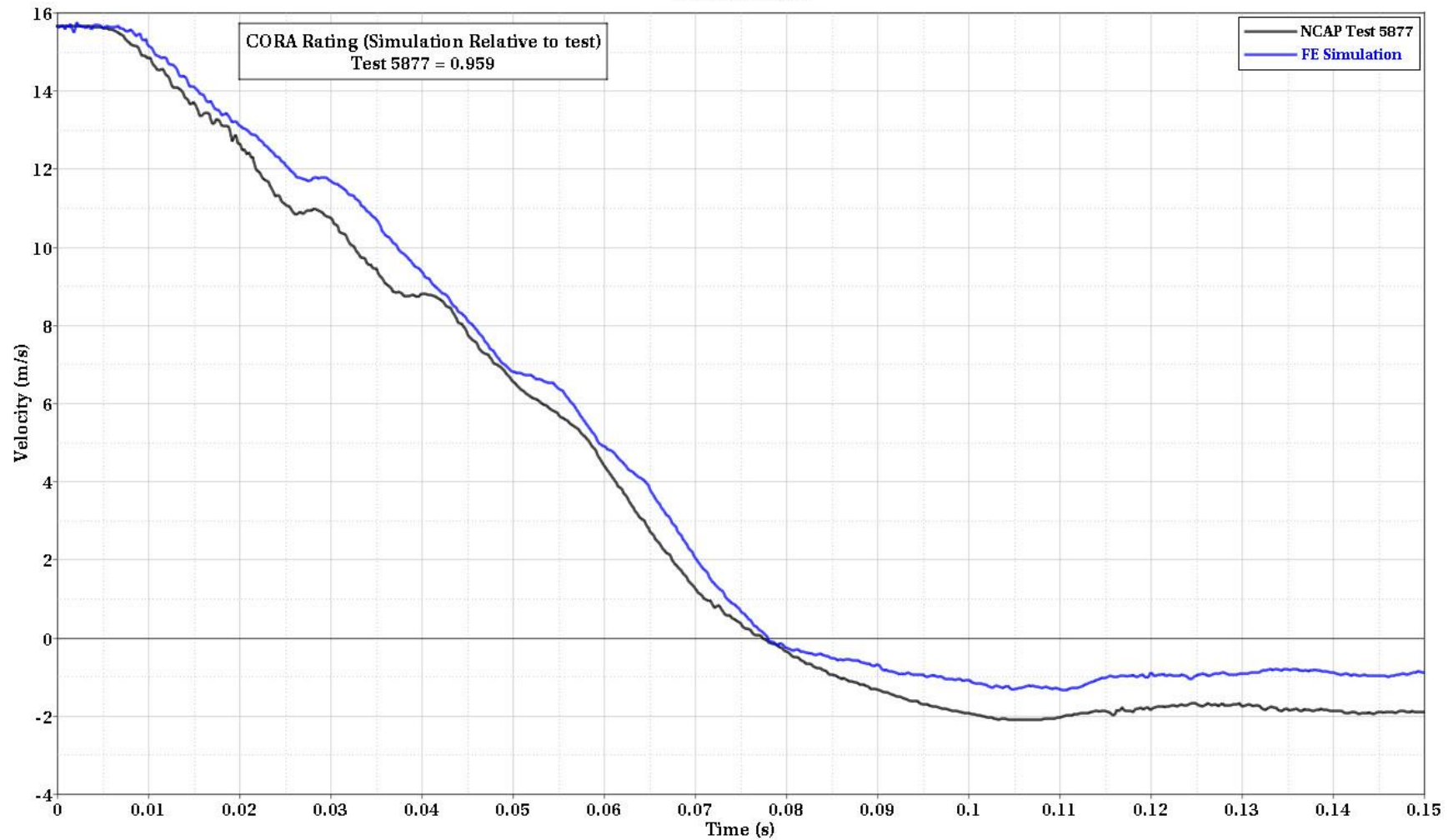
Frontal Full Wall – 56 km/hr – Acceleration – Detailed Model

Right Rear Seat



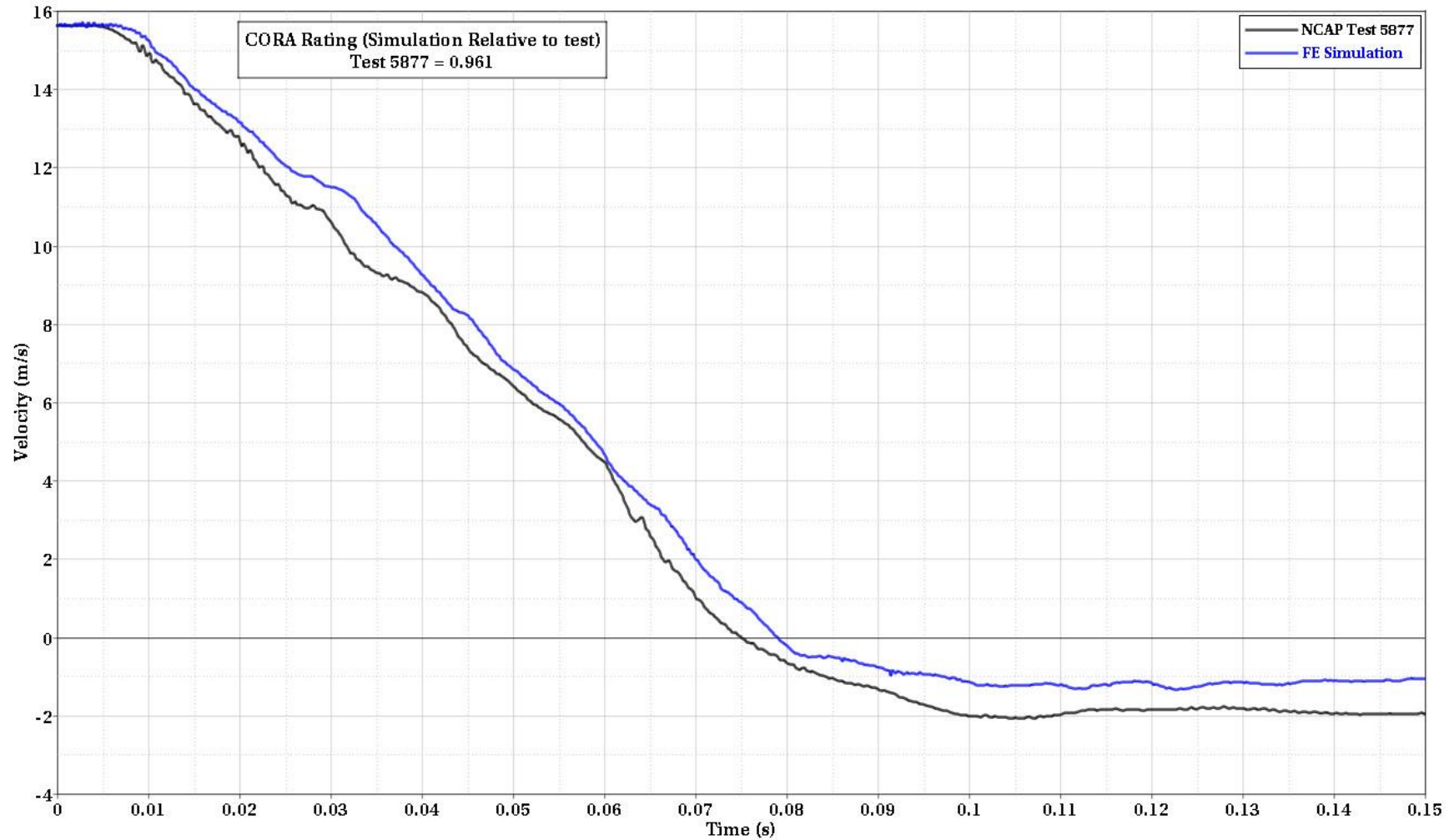
Frontal Full Wall – 56 km/hr – Velocity – Detailed Model

Left Rear Seat

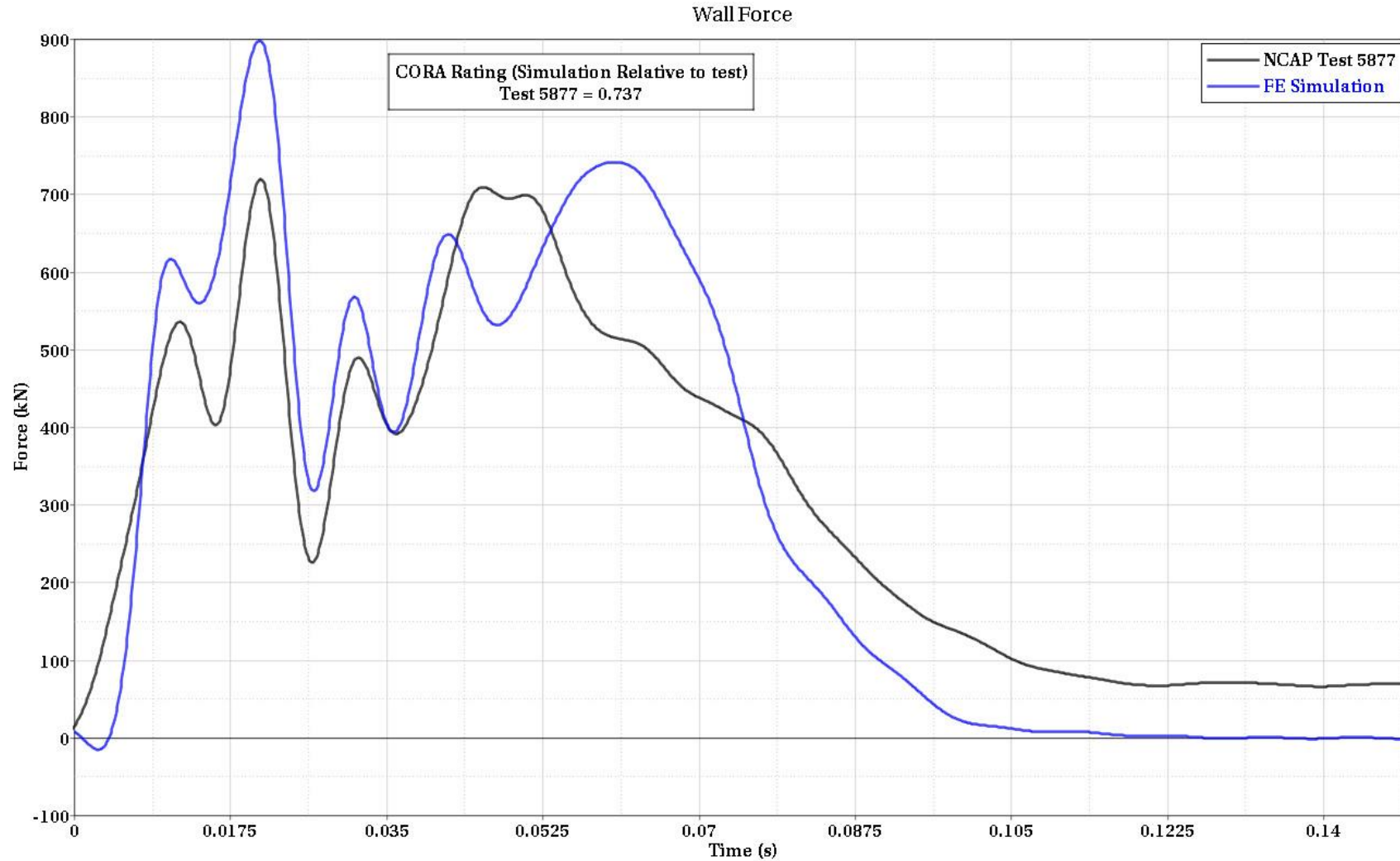


Frontal Full Wall – 56 km/hr – Velocity – Detailed Model

Right Rear Seat



Frontal Full Wall – 56 km/hr – Wall Force – Detailed Model



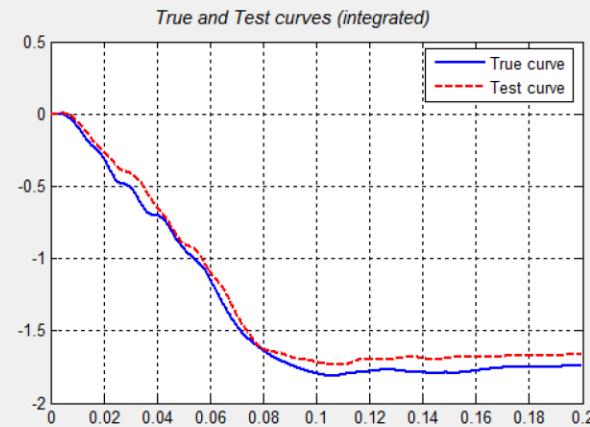
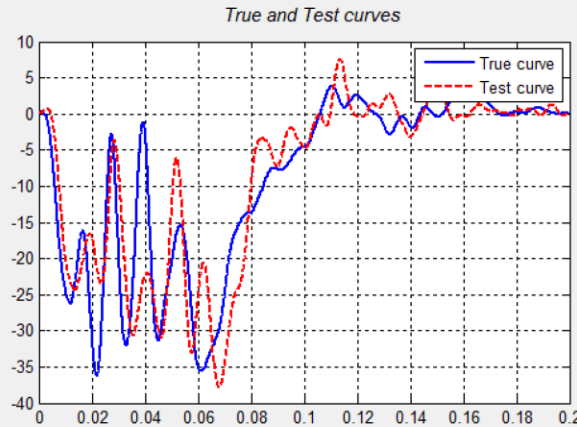
Frontal Full Wall – 56 km/hr – Wall Force – Detailed Model



Frontal Full Wall – 56 km/hr – Acceleration – Left Seat

Comparison Metric values

Whole time interval [0,0.1999]



MPC Metrics

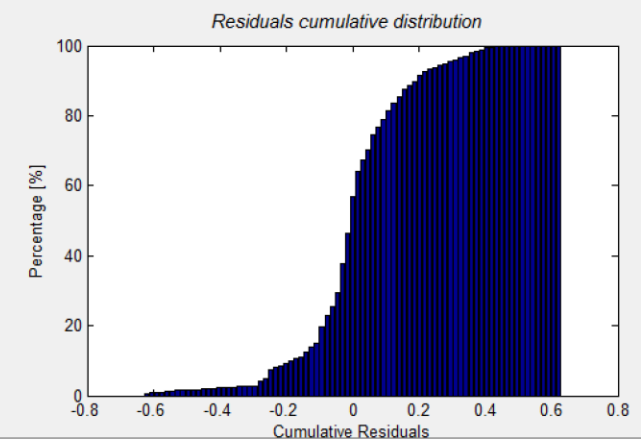
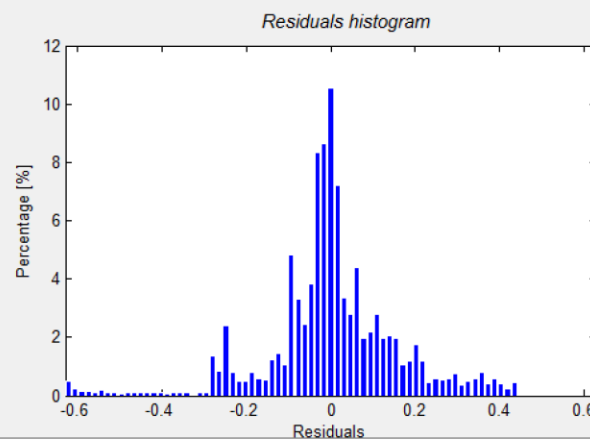
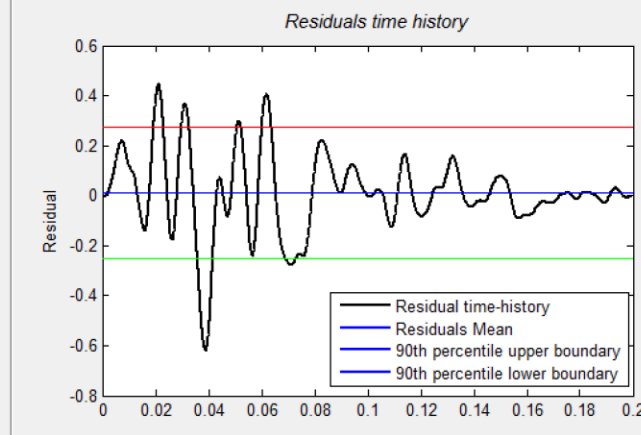
	Value [%]	
Sprague-Geers Magnitude	-1.8	Pass
Sprague-Geers Phase	12.8	Pass
Sprague-Geers Comprehensive	12.9	Pass

ANOVA Metrics

	Value [%]	
Average	1.1	Pass
Standard deviation	16	Pass

(Values normalized to peak of True curve)

Acceleration Residuals

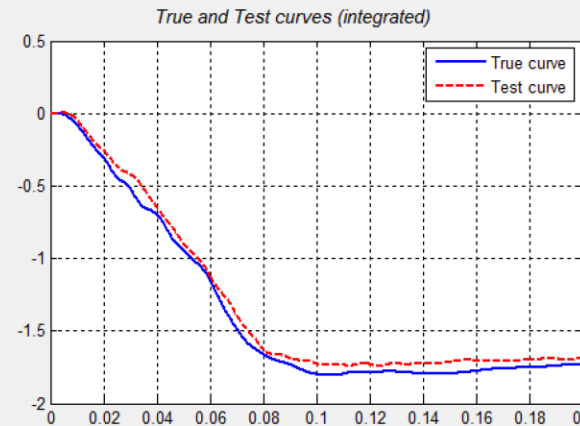
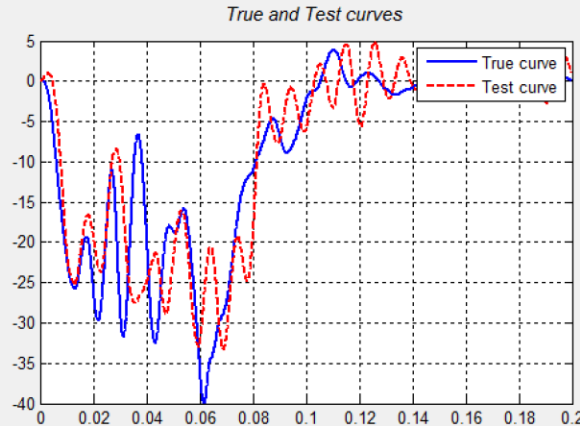


Evaluate on a new interval

Save results and Exit

Frontal Full Wall – 56 km/hr – Acceleration – Right Seat

Comparison Metric values
Whole time interval [0,0.1999]



MPC Metrics

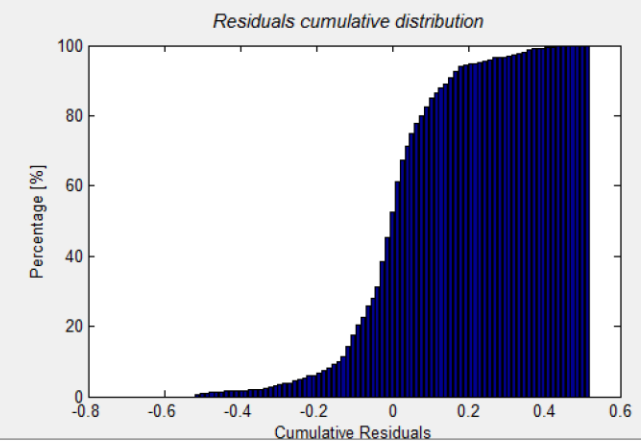
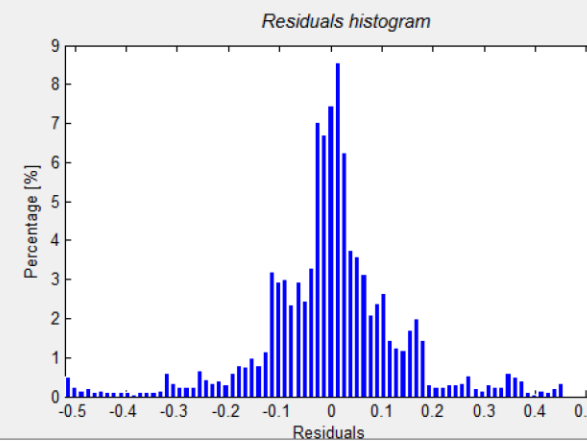
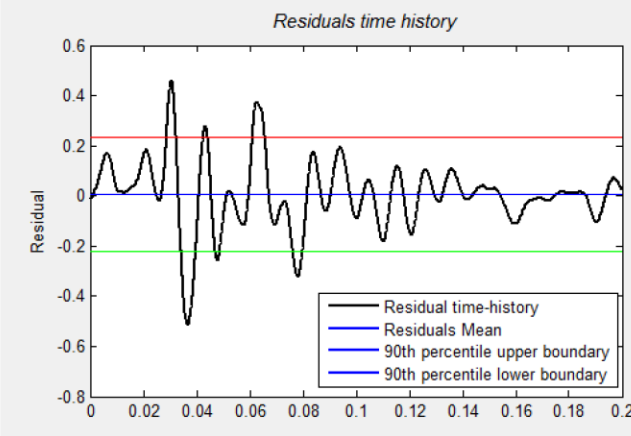
	Value [%]	
Sprague-Geers Magnitude	-3	Pass
Sprague-Geers Phase	12.3	Pass
Sprague-Geers Comprehensive	12.7	Pass

ANOVA Metrics

	Value [%]	
Average	0.6	Pass
Standard deviation	13.8	Pass

(Values normalized to peak of True curve)

Acceleration Residuals



Evaluate on a new interval

Save results and Exit