Structurally sound is the way to go. (Sport (Sport Utility Vehicle Chassis)

Grant Atkinson

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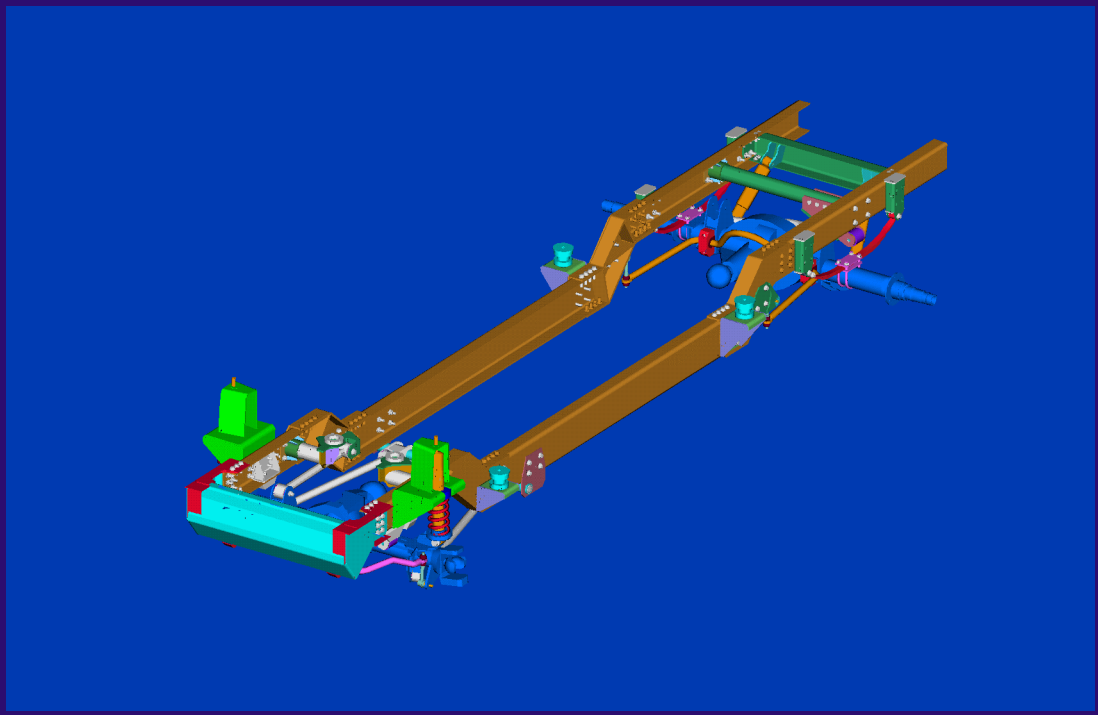
Advantages of Interfacing With Complimentary Engineering Packages to Achieve a Complete and Robust Robust Design.

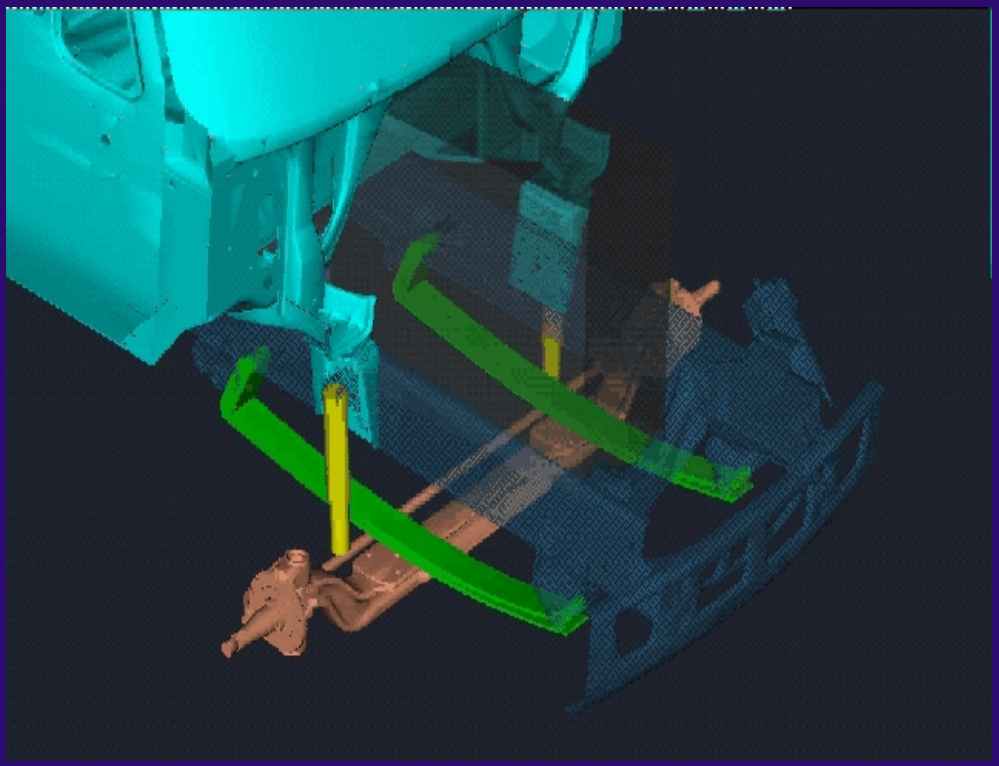


ADAMS Simulation

- Virtual Prototyping software
- Allows vehicle performance to be evaluated before building a physical prototype
- Models are built using high fidelity component models (tires, bushings, non-linear springs, bump stops, shocks, etc.)

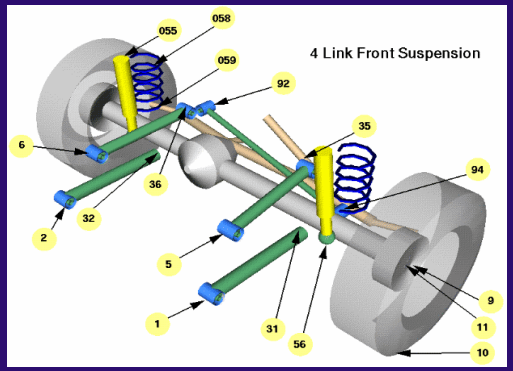
Front Suspension Simulation

- Front suspension simulates full jounce and full rebound
- Geometry data is exported to Datum Point File
- Datum Point File is imported in Pro/E to create Front Axle point data geometry



Typical Example of a 4 Link Front Suspension

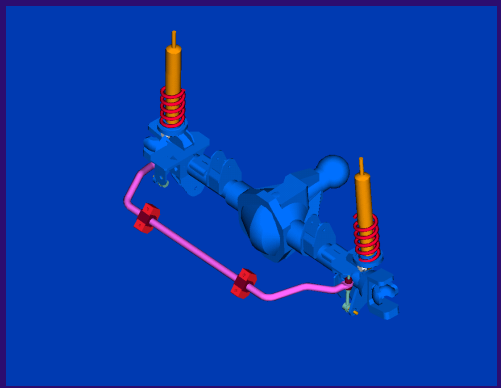
GEOMETRY	Point #	LEFT (mm)			RIGHT (mm)		
		X	Y	Z	X	Y	Z
Lower Link to body	1-2	950.00	-308.00	-235.00	(mirror)		
Lower Link to axle	31-32	0.00	-500.00	-280.00	(mirror)		
Upper Link to body	5-6	560.00	-308.00	-40.00	(mirror)		
Upper Link to Axle	35-36	0.00	-308.00	-48.80	(mirror)		
Wheel Center	9	0.00	-876.00	-169.00	(mirror)		
Hub Compliance at Axle	9h	0.00	-776.00	-169.00	(mirror)		
Tire Patch	10	0.00	-876.00	-593.18	(mirror)		
Ball Joint Center	11	0.00	-730.00	-169.00	(mirror)		
UBJ	19	3.00	-711.10	-43.40	(mirror)		
Stab. Bar to Axle	61-62	100.00	-550.00	-110.00	(mirror)		
Stab. Bar to Link	63-64	100.00	-550.00	-190.00	(mirror)		
Stab. Link to Frame	65-66	550.00	-320.00	-200.00	(mirror)		
Tie Rod L_R Spindle	12	-196.00	-749.00	-123.50	(mirror)		



DATUM POINT ARRAY WITH DIMENSIONS REFERENCE COORDINATE SYSTEM = CS0

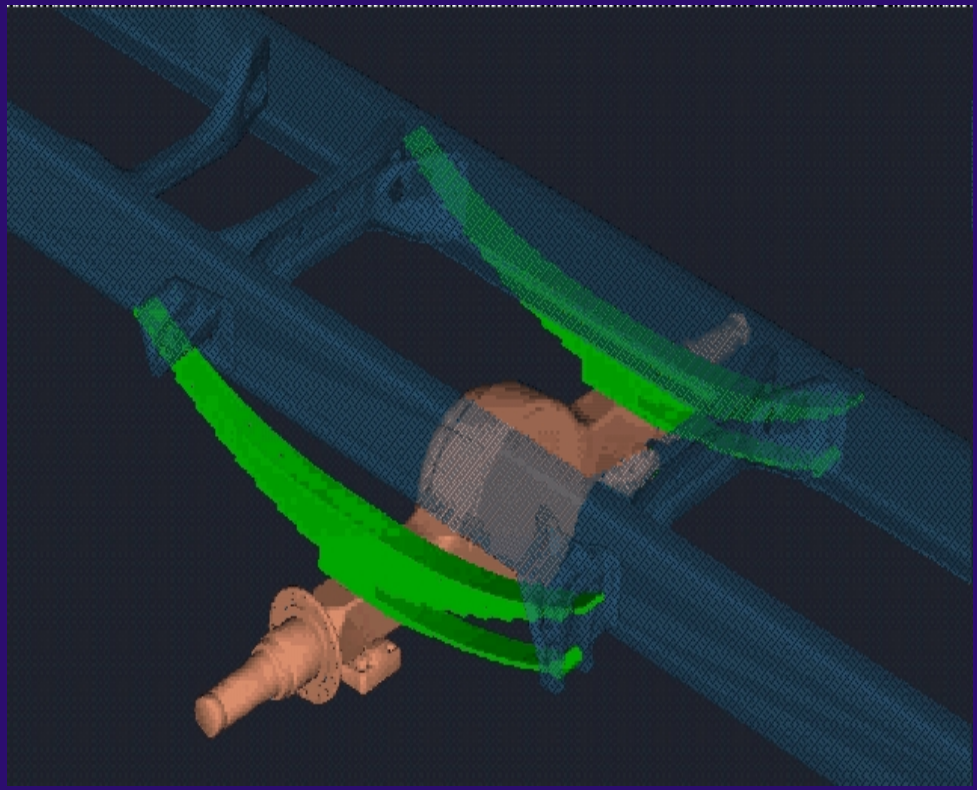
DIMENSIONS RELATIVE TO COORDINATE SYSTEM

X	Y	Z	NAME
d505=950.00	d506=-250.00	d507=-235.00	F1
d508= 0.00	d509=-500.00	d510=-280.00	F31
d511=560.00	d512=-308.00	d513=-40.00	F5
d514= 0.00	d515=-308.00	d516=-48.80	F35
d517= 0.00	d518=-876.00	d519=-170.00	F9



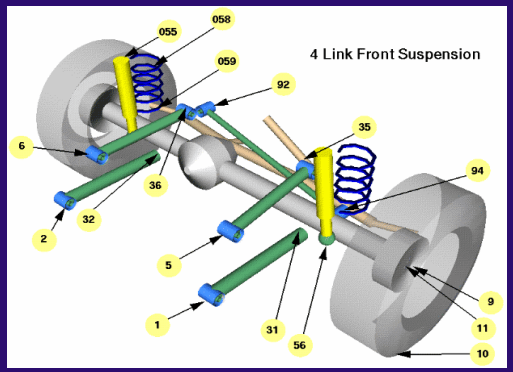
Rear Suspension Simulation

- Rear suspension simulates full jounce and full rebound
- Geometry data is exported to Datum Point File
- Datum Point File is imported in Pro/E to create Rear Axle point data geometry



Typical Example of a 4 Link Rear Suspension

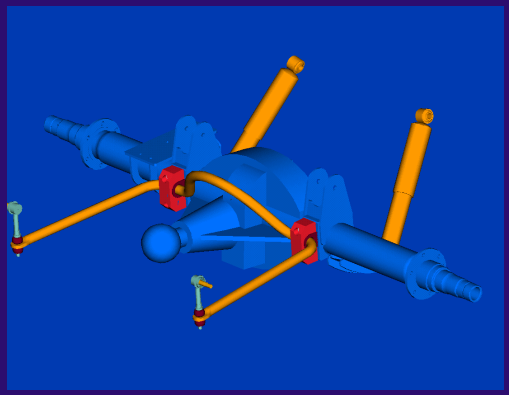
GEOMETRY	LEFT (mm)			RIGHT (mm)		
	X	Y	Z	X	Y	Z
Lower Link to body 1-2	600.00	-400.00	-210.00			
Lower Link @ Body Orientation 3-4						
Lower Link to axle 31-32	80.00	-470.00	-250.00			
Lower Link @ axle Orient 33-34						
Upper Link to body 5-6	560.00	-308.00	-30.00			
Upper Link @ Body Orientation 7-8						
Upper Link to Axle 35-36	80.00	-308.00	-30.00			
Upper Link @ Axle Orientation 37-38						
Wheel Center 9	0.00	-876.00	-169.00			
Tire Patch 10						
Wheel Alignment Point 11	0.00	-800.00	-169.00			
Stab. Bar to Axle 61-62	100.00	-550.00	-110.00			
Stab. Bar to Link 63-64	100.00	-550.00	-190.00			
Stab. Link to Frame 65-66	550.00	-320.00	-200.00			
Tie Rod L_R Spindle 12	-196.00	-749.00	-123.50			
Drag Link 14	-240.00	630.00	-129.00	-283.30	-307.20	-112.60



DATUM POINT ARRAY WITH DIMENSIONSREFERENCE COORDINATE SYSTEM = CS0

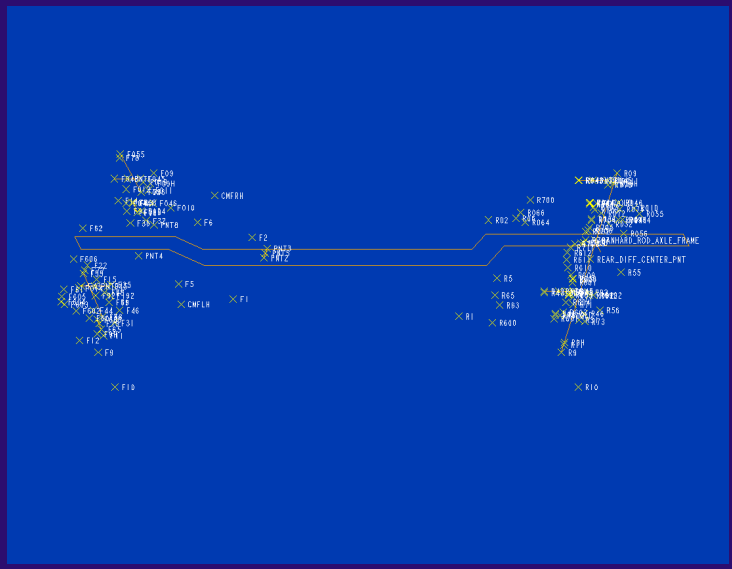
DIMENSIONS RELATIVE TO COORDINATE SYSTEM

X	Y	Z	NAME
d874=2867.70	d875=-470.10	d876=-235.00	R1
d877=3850.00	d878=-500.00	d879=-280.00	R31
d880=3290.00	d881=-293.00	d882= 10.00	R5
d883=3850.00	d884=-308.00	d885= 2.20	R35
d886=3850.00	d887=-876.00	d888=-170.00	R9



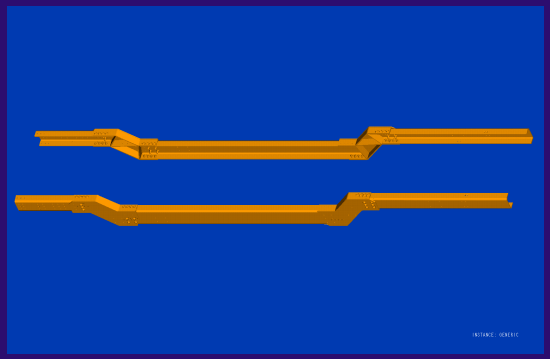
Front and Rear Suspension Points Files Are Imported From Adams Geometry Data

- This is the only file containing original geometry from ADAMS
- Front geometry is independent from rear geometry
- Datum curves are control by chassis layout
- Geometry can be updated by just re-reading new data from ADAMS



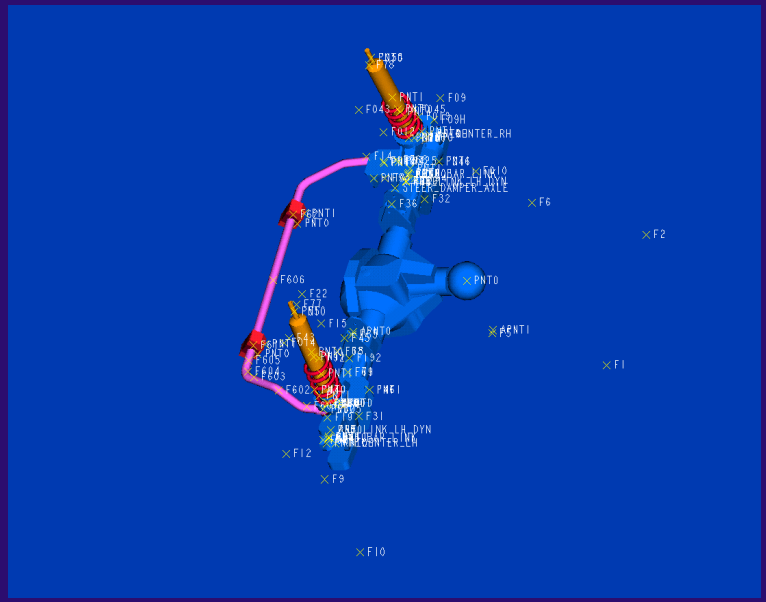
Chassis Controlled by Independent Layout to Define the Envelope Around ADAMS Geometry (Front and Rear Point Data)

- Beam cross-sections of front, middle and rear
- Length of front and rear drop sections
- Length of front and rear splice sections
- Height above front axle from front ACSO
- Height above rear axle from front ACSO
- Overall width of chassis



Front Axle Use Copy Geometry From Skeleton With ACSO As Default Position

- Sub-assemblies and parts are placed using copy geometry from ADAMS original data in skeleton
- Front shocks placed by datum curves connecting 2 points (skeleton). Shocks will follow geometry from ADAMS

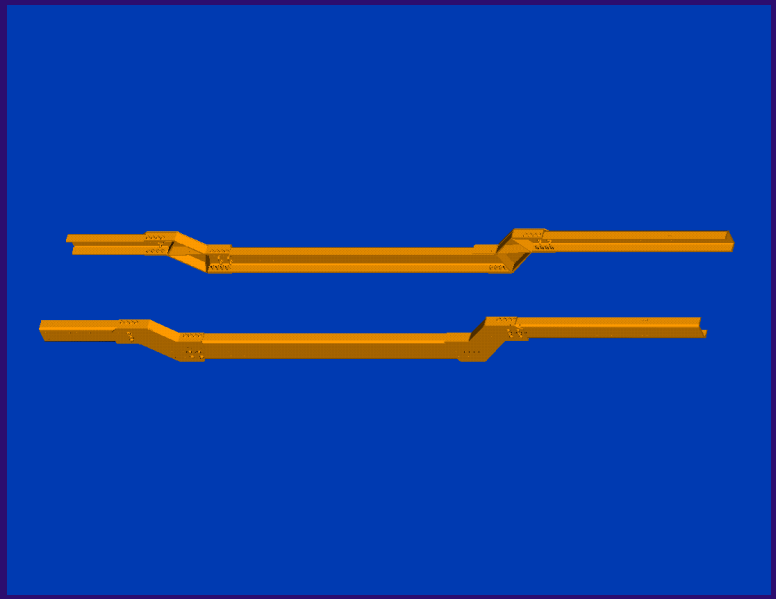


Rear Axle Use Copy Geometry From Skeleton With ACSO As Default Position

- Sub-assemblies and parts are placed using copy geometry from ADAMS original data in skeleton
- Rear sway BAR is developed thru a group of points (skeleton). Rear sway bar will follow geometry from ADAMS

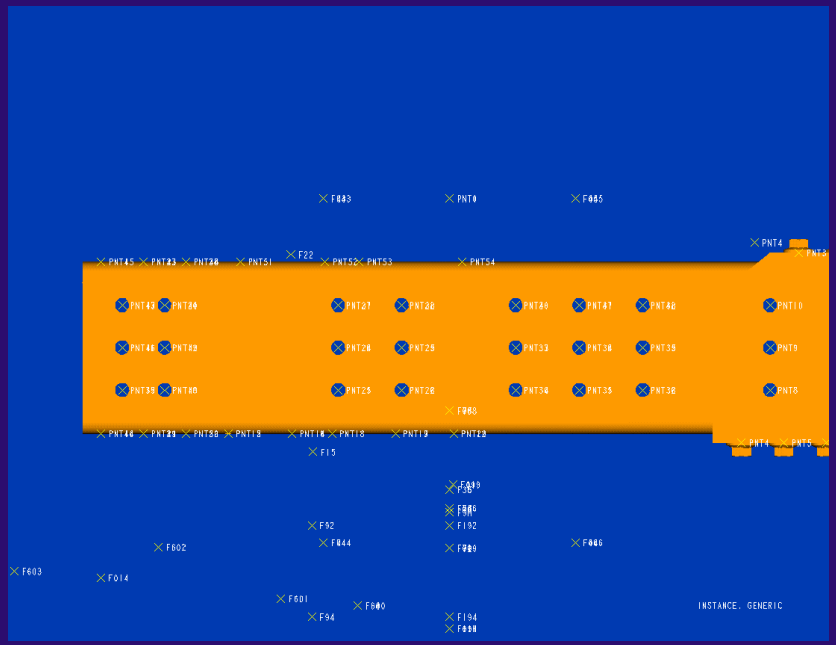
Structurally Analyzing Chassis by Using Datum Points and Also Collapsing to Mid-planes for Sub-assemblies

- Pro/program is created in top assembly and flows down to parts by the execute command
- “Mesh” parameter drives the suspension of all holes and all hardware
- Weldments also use this parameter to collapse the parts to mid-planes for successful meshing



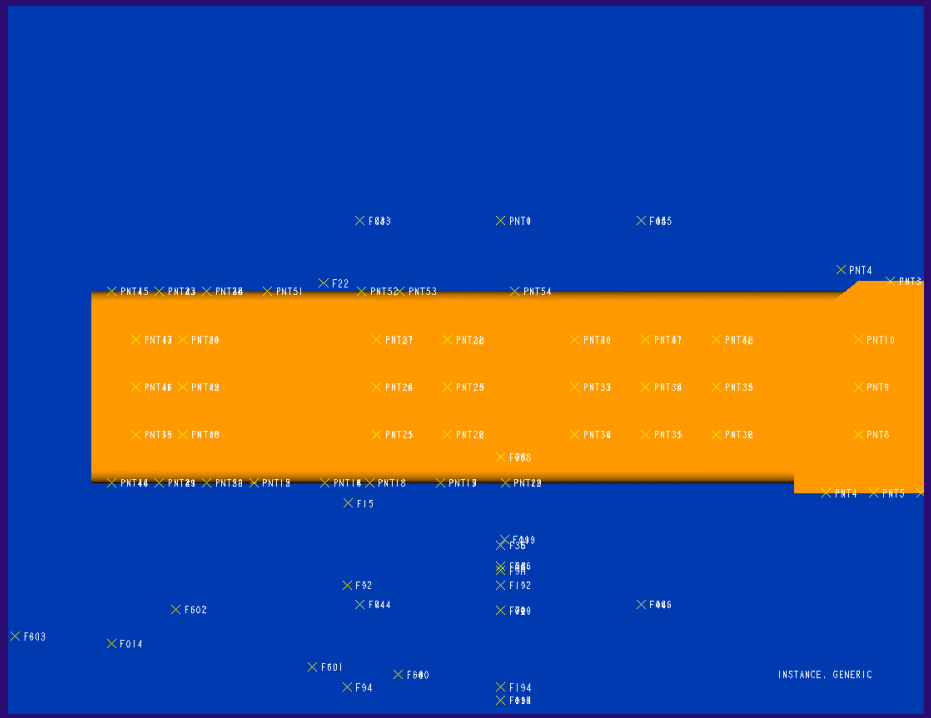
Creating an Input Statement “Mesh Yes/no”

- Datum points are created to show bolting positions
- Bolt holes are placed using datum points
- “Mesh” parameter is added to the bolt holes and also added to all associated hardware (bolts, washers and nuts)



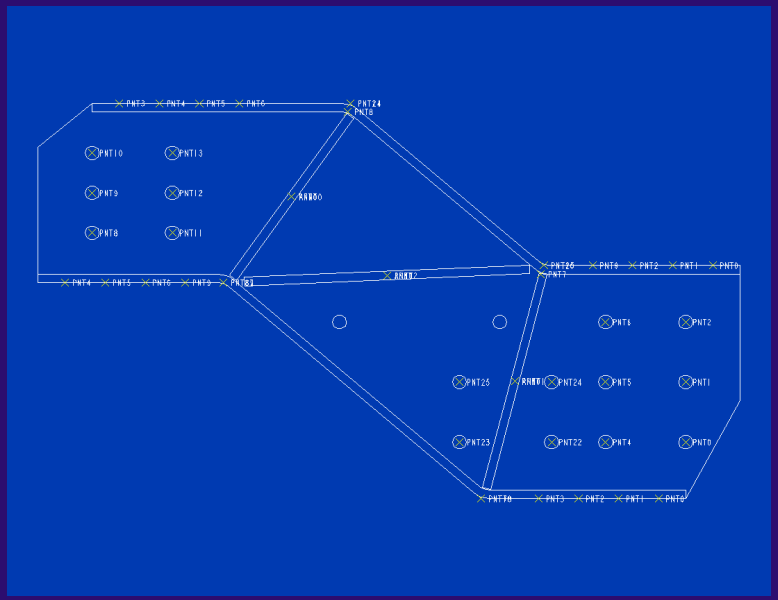
Pro/program Can Be a Powerful Ally When Interfacing With a FEA Solver

- When “mesh=yes” all the holes in all the parts will be suppressed and only the point geometry will be visible
- Now this assembly can be meshed and analyzed using any solver in this case we used Ansys



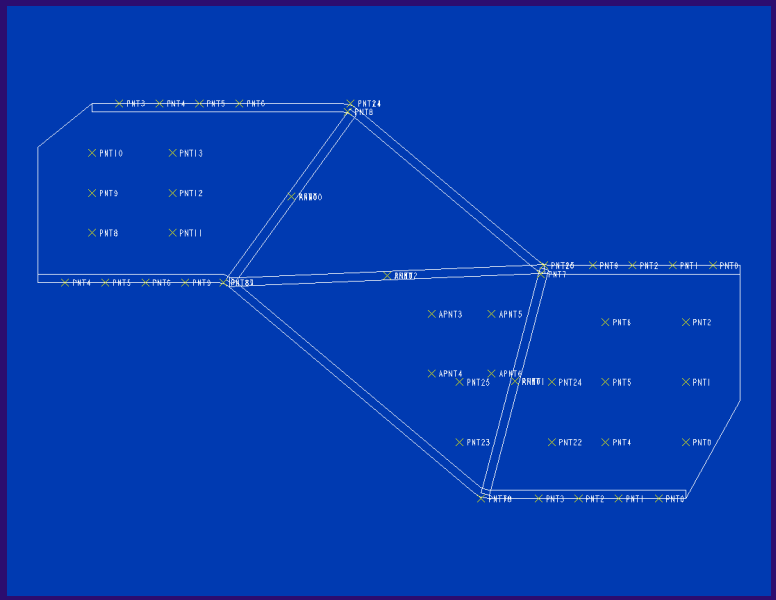
Weldments Using Pro/program

- Right front splice Weldment is shown with gaps for correct weld penetration
- Datum points and bolt holes are shown when “mesh=no”
- Datum curves drive the three internal splice parts



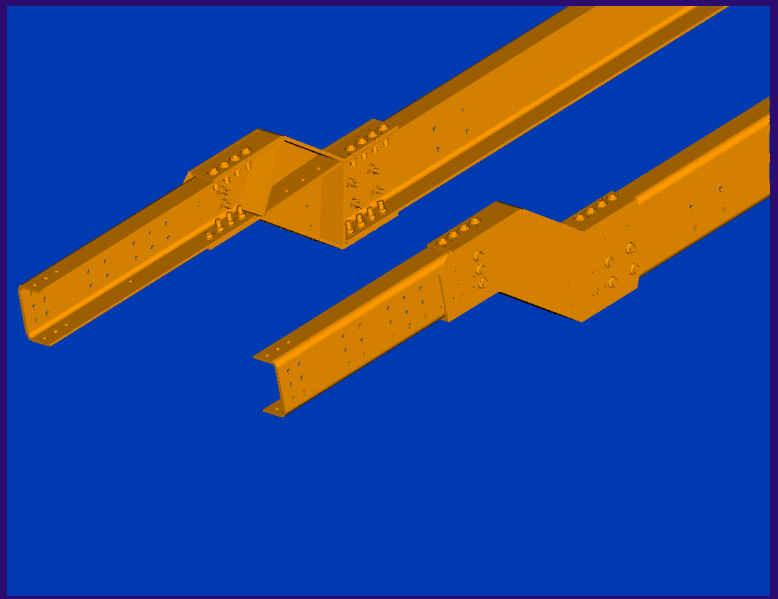
Weldments Using Pro/program

- Right front splice Weldment shown splice parts collapsing to the mid-plane
- Datum points and bolt holes are not shown when “mesh=yes”
- Datum curves drive the three internal splice parts



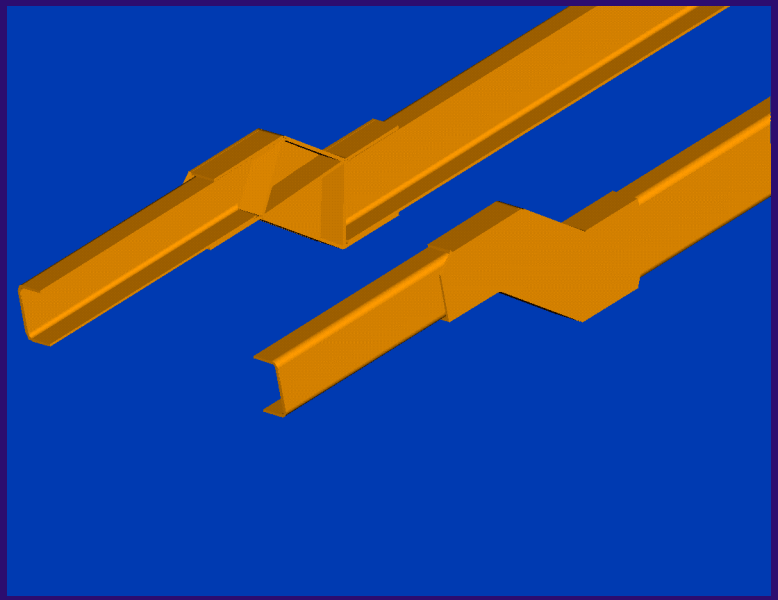
Chassis Assembly

- “Mesh==no”
- All holes and bolts are shown
- Splice sub-assembly Weldment sections are shown with appropriate weld penetration gaps



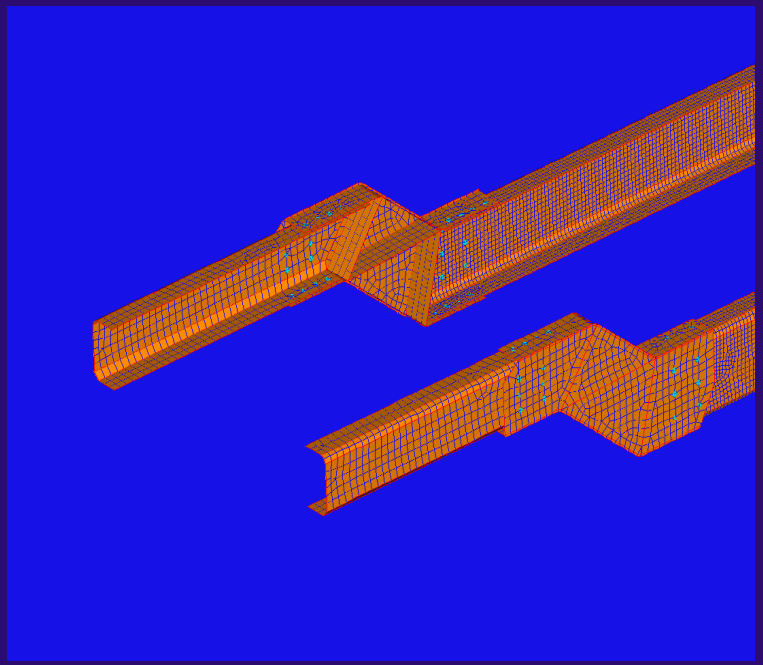
Chassis Assembly

- “Mesh=yes”
- All holes and bolts are not shown
- Splice sub-assembly Weldment sections are shown with splice parts collapsing to mid-planes for a complete mesh



Chassis Assembly

- Pro/mesh used to create mesh
- Beams elements are used for all bolted connections
- Practically any solver can be used now to analyze the structural integrity of this sub-assembly (Ansys was used in this case)



Summation

- ADAMS software controls all suspension geometry
- Using 2 separate point files (front axle and rear axle)
- Geometry can be re-read at any point in time using a common ACSO
- Layout controls basic envelope of chassis also from a common ACSO