Landing Gear Model Plug-in

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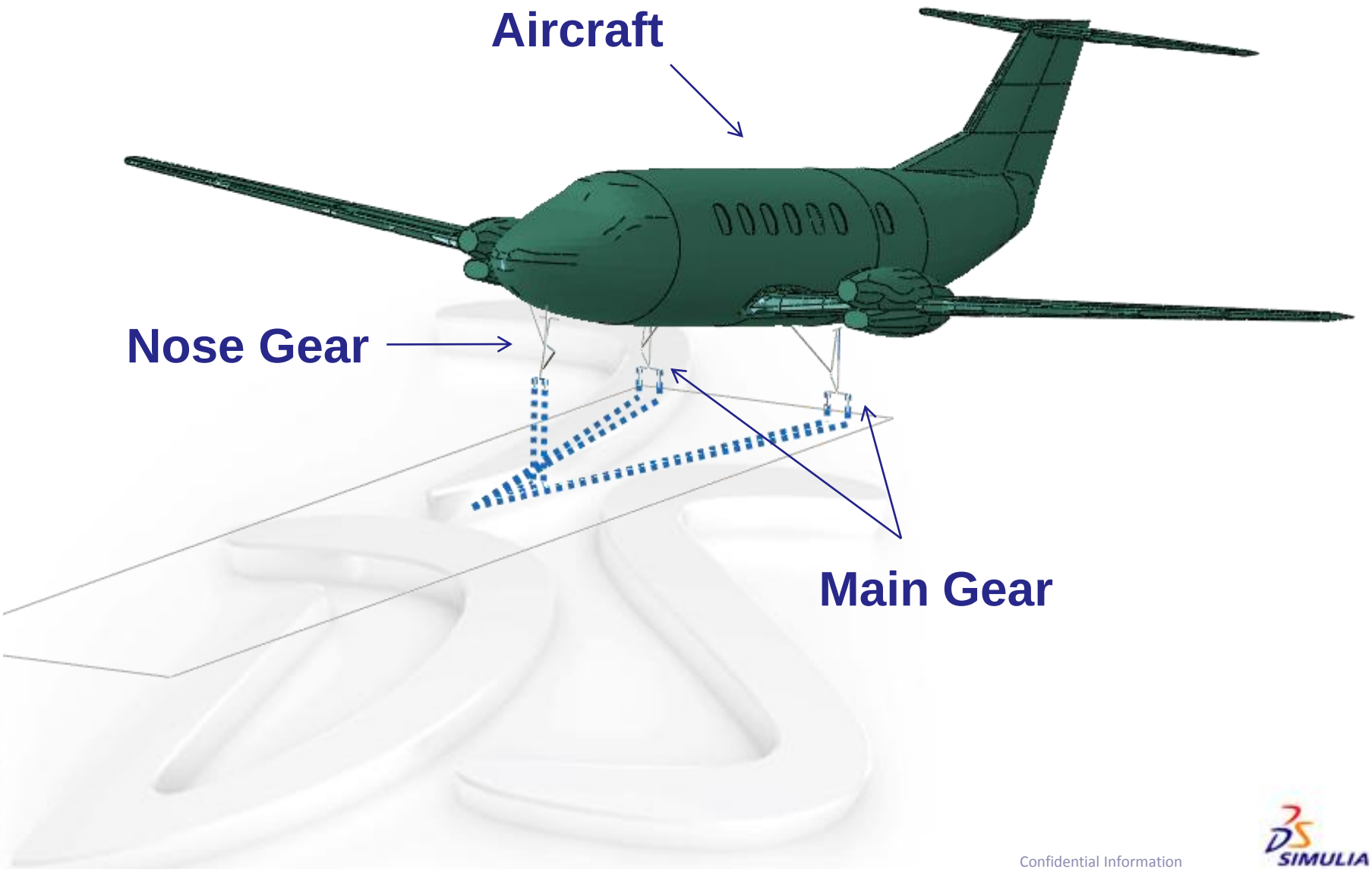
Landing Gear Model



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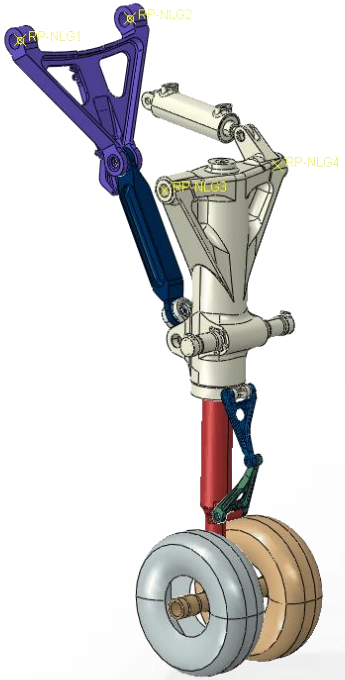
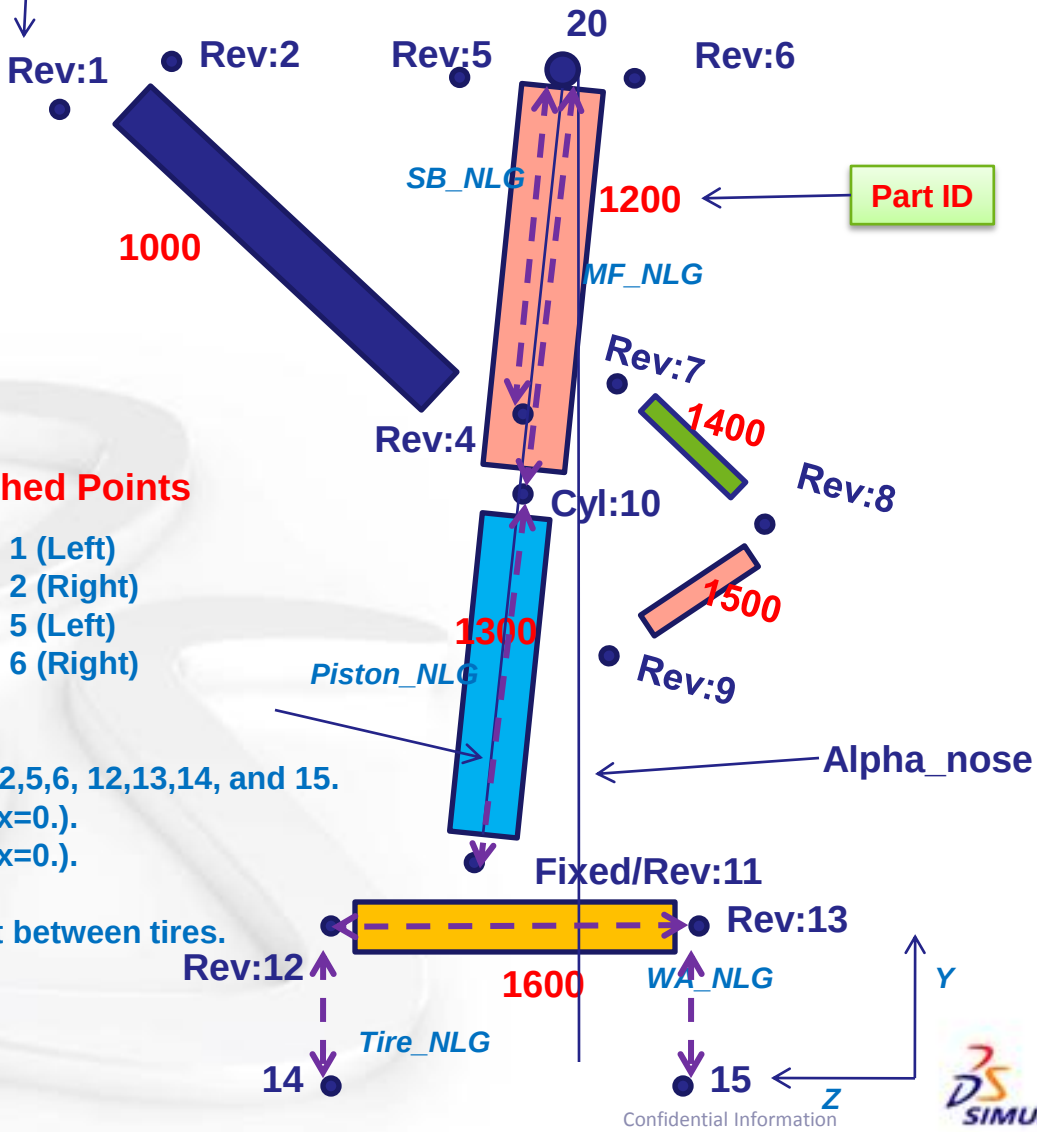
Schematic Model: Nose Gear

"Joint Type":"Last digit of reference point ID"





Aircraft Attached Points

RP-NLG1 => 1 (Left)
RP-NLG2 => 2 (Right)
RP-NLG3 => 5 (Left)
RP-NLG4 => 6 (Right)

Assumption:

- Every points lies in the YZ plane except for 1,2,5,6, 12,13,14, and 15.
- Points 1 and 2 are symmetric w.r.t. YZ plane (x=0.).
- Points 5 and 6 are symmetric w.r.t. YZ plane (x=0.).
- Points 20,4,10, and 11 are on the same line.
- The bottom point at shock is the middle point between tires.

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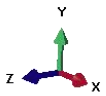
Schematic Model: Main Gear

"Joint Type":"Last Digit of Reference point ID"



Offset_MF_MLG
Offset_SA_MLG
Rev:1
Rev:3
Rev:5
Rev:6
Rev:8
1400
1200
SB_MLG
1000
SA_MLG
MF_MLG
Cyl:9
Rev:4
1300
Rev:7
TA_MLG
Alpha_shock
Alpha_mf
1500
Rev(1300&1500),
Fixed/Rev(1500,1600):11
Rev:12
WA_MLG
Rev:13
1600
Tire_MLG
14
15

Last Four Digits
of
Part ID
(e.g.:
left: 11200, right: 21200)

Aircraft Attached Points

RP-MLG_left1 => 5
RP-MLG_left2 => 6
RP-MLG_left3 => 1

Assumption:

- Points 5,3,8 and 6 are on the same line.
- Points 3, 4 and 7 are on the same line.
- The bottom point at shock is the middle point between tires.
- Left and right MLGs are symmetric w.r.t. YZ plane (x=0.).
- The axis of orientation of 1 is in the ZX plane.

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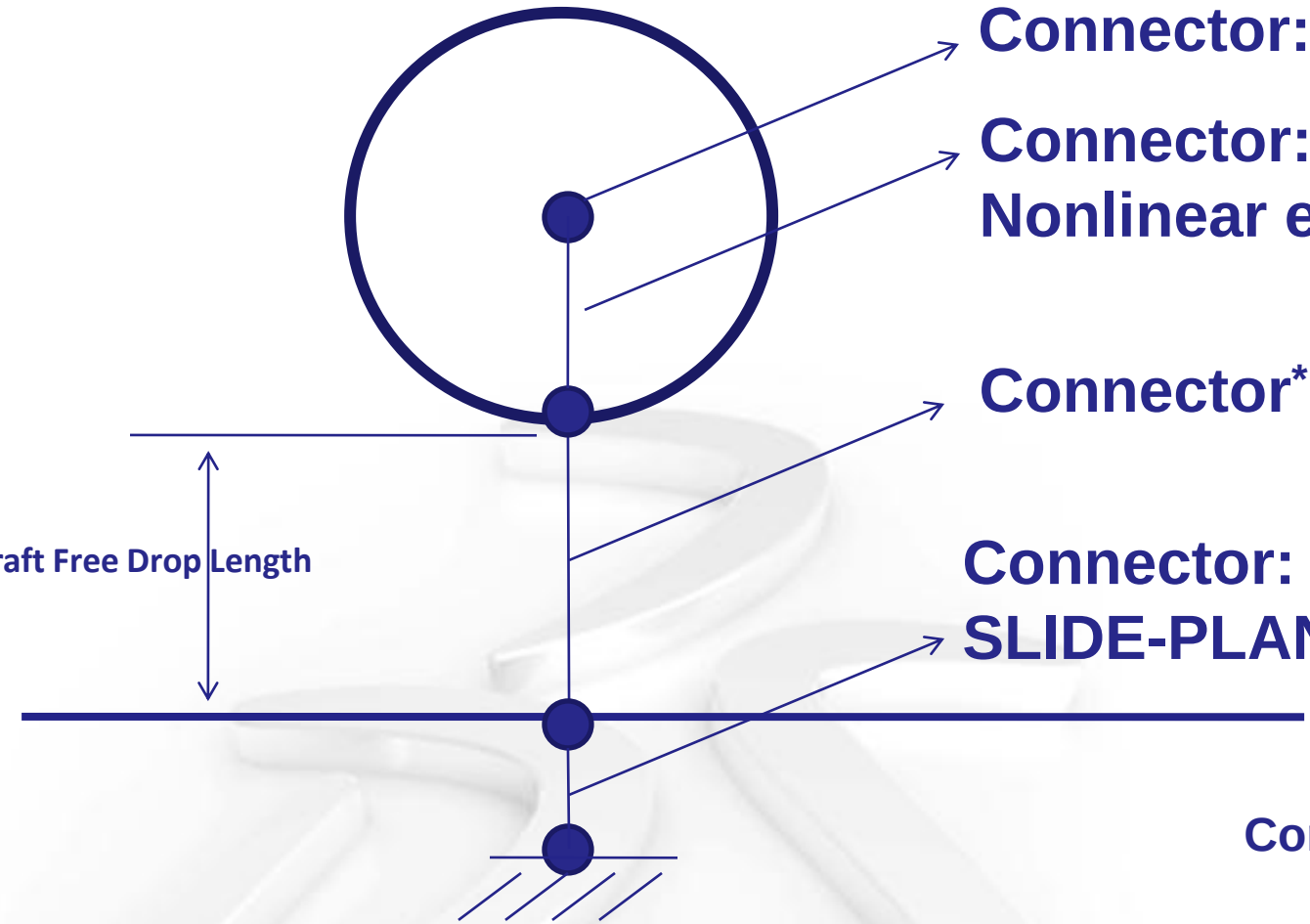
Schematic Model: Tire and Ground



* The working length is defined by "*Connector Stop".

** The working length of the tire is also defined by "*Connector Stop"

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Approximate Mass and Inertia of NLG

- **The total aircraft mass: 22.65 ton**

ton, mm

		Mass	Ixx	Iyy	Izz
NLG	Folding Braces	1.00E-03	1.00E+04	1.00E+04	2.00E+03
	MF	3.00E-03	6.00E+02	6.00E+02	80
	piston	3.00E-03	40	40	1.00E-01
	torque link Top	1.00E-03	0.1	0.1	1.00E-03
	torque link Bot	1.00E-03	0.1	0.1	1.00E-03
	WA	1.00E-03	2	2	2.00E-02
	Wheel	1.00E-01	3000	3000	1000
MLG	Folding Braces	6.00E-03	1000	1000	2
	MF	6.00E-03	5000	5000	100
	TA	5.00E-03	7	7	4.00E-02
	SA Top	1.00E-03	200	200	1
	SA Bot	1.00E-03	40	40	7.00E-02
	WA	1.00E-03	20	20	5.00E-02
	Wheel	1.00E-01	8.00E+04	8.00E+04	4.00E+04
Aircraft	Body	22	65.e6	100.e6	100.e6
Total Mass (considering 2 MLGs and a pair of tires)		22.65	N/A		

- **Every node in A/Explicit needs mass/inertia.**
  - We define relatively small mass/inertia for this.
    - Mass = 1.e-7, inertia = 1.e-7

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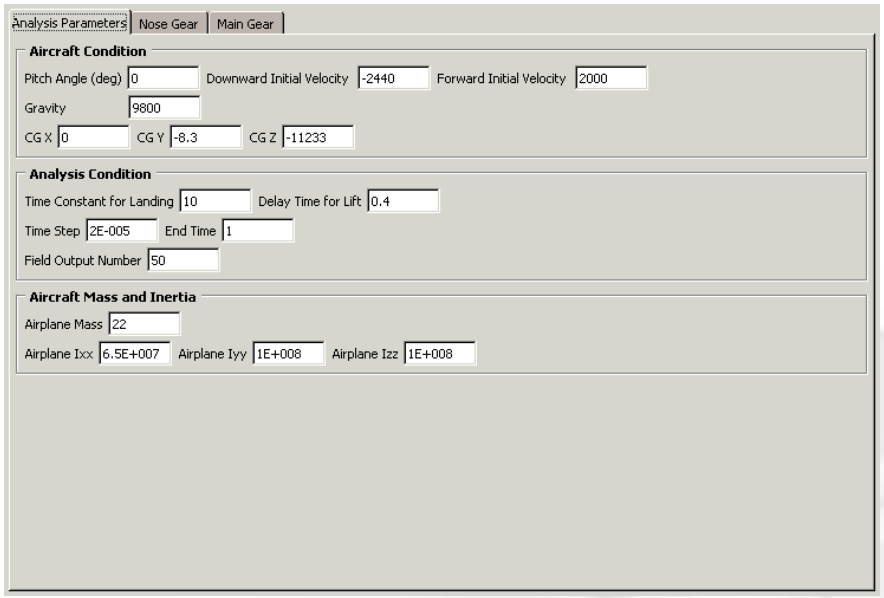
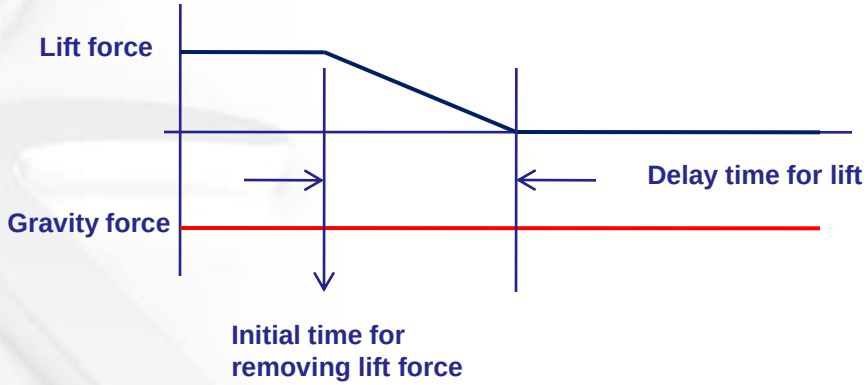
Analysis Parameter Tab



- Pitch Angle: pitch angle of the aircraft (deg)
- Downward Initial Velocity: initial velocity of the aircraft to the center of the earth
- Forward Initial Velocity: initial velocity of the aircraft in forward direction
- Gravity: the acceleration of the gravity (mm/s^2)
- CG X,Y,Z: the coordinate of CG of the aircraft
- Time constant for landing: Initial time for removing lift force= 1./ “time constant for landing”
- Delay time for lift:



- Time step, end time: time step and end time in A/explicit
- Field Output number: number of field output
- Airplane mass and inertia

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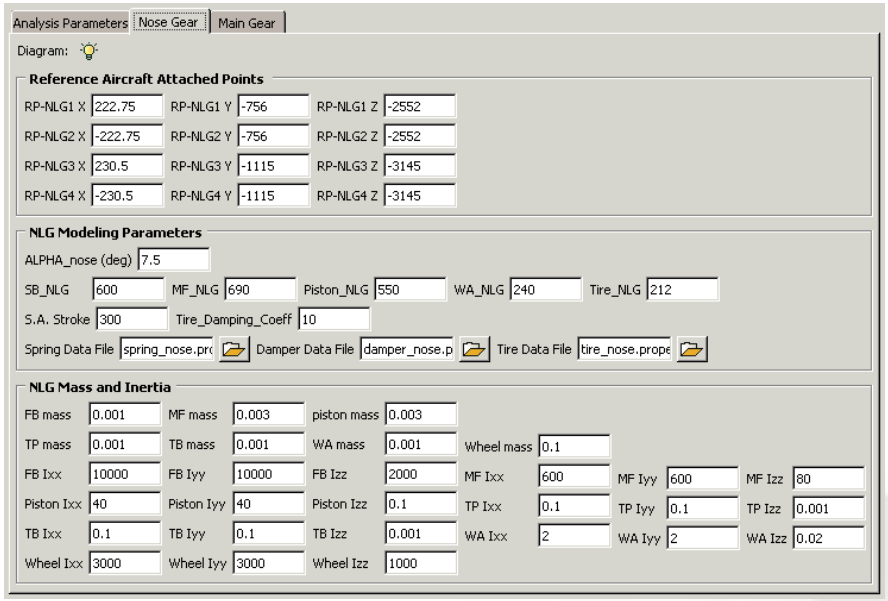
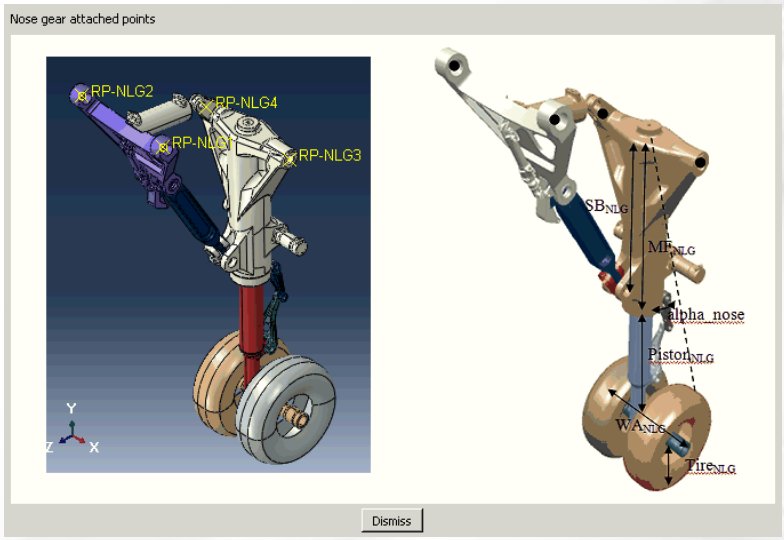
Nose Gear Tab





- **RP-NLG1, 2, 3, 4: The coordinate of the reference points in nose gear system. (please see the slide 3)**
- **NLG modeling parameter: relative length for nose gear system. (please see the slide 3)**
- **Spring data file, damper data file, tire data file: nonlinear spring (spring force is function of relative displacement(stroke), nonlinear damper (damping force is function of relative displacement(stroke) and relative velocity), and nonlinear tire stiffness (tire spring force is function of relative displacement (tire deflection))**
  - Spring data file format: force, relative displacement
  - Damper data file format: force, relative velocity, relative displacement
  - Tire data file format: force, relative displacement
- **NLG mass and inertia: please see the slide 3**
  - FB: folding brace: Part 1000
  - MF: main fitting: Part 1200
  - Piston: piston: Part 1300
  - TP: Part 1400
  - TB: Part 1500
  - WA: wheel axle: Part 1600
  - Wheel: wheel: Part 1700 and Part 1800 (these are not shown in slide 3)

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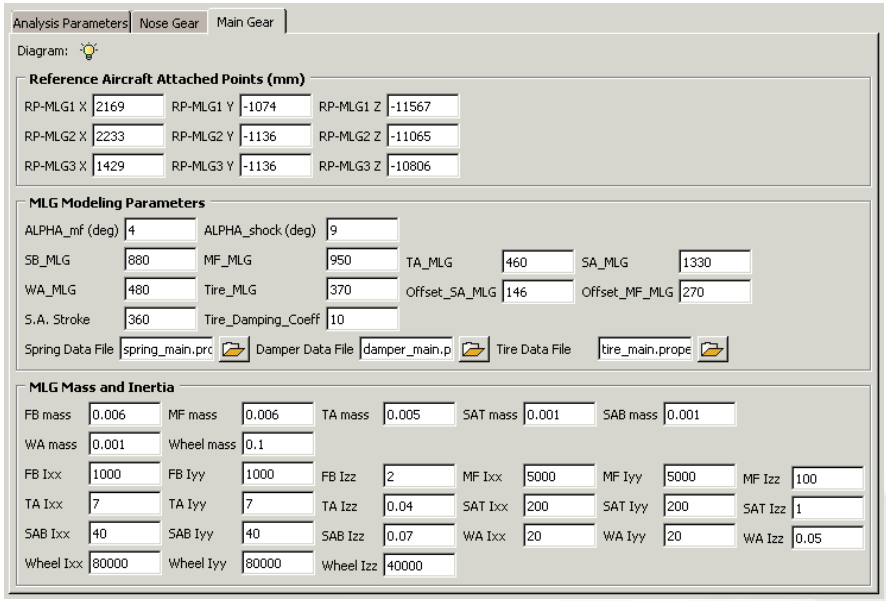
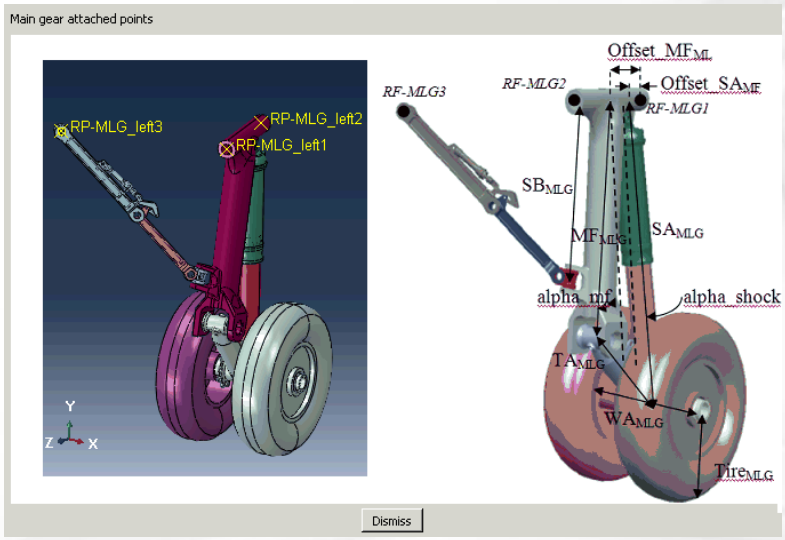
Main Gear Tab





- **RP-MLG1, 2, 3: The coordinate of the reference points in main gear system. (please see the slide 4)**
- **MLG modeling parameter: relative length for nose gear system. (please see the slide 4)**
- **Spring data file, damper data file, tire data file: nonlinear spring (spring force is function of relative displacement(stroke), nonlinear damper (damping force is function of relative displacement(stroke) and relative velocity), and nonlinear tire stiffness (tire spring force is function of relative displacement (tire deflection))**
  - Spring data file format: force, relative displacement
  - Damper data file format: force, relative velocity, relative displacement
  - Tire data file format: force, relative displacement
- **MLG mass and inertia: please see the slide 4**
  - FB: folding brace: Part 1000
  - MF: main fitting: Part 1400
  - TA: tailing arm: Part 1500
  - SAT: Upper Shock Absorber: Part 1200
  - SAB: Lower Shock Absorber: Part 1300
  - WA: wheel axle: Part 1600
  - Wheel: wheel: Part 1700 and Part 1800 (these are not shown in slide 4)

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