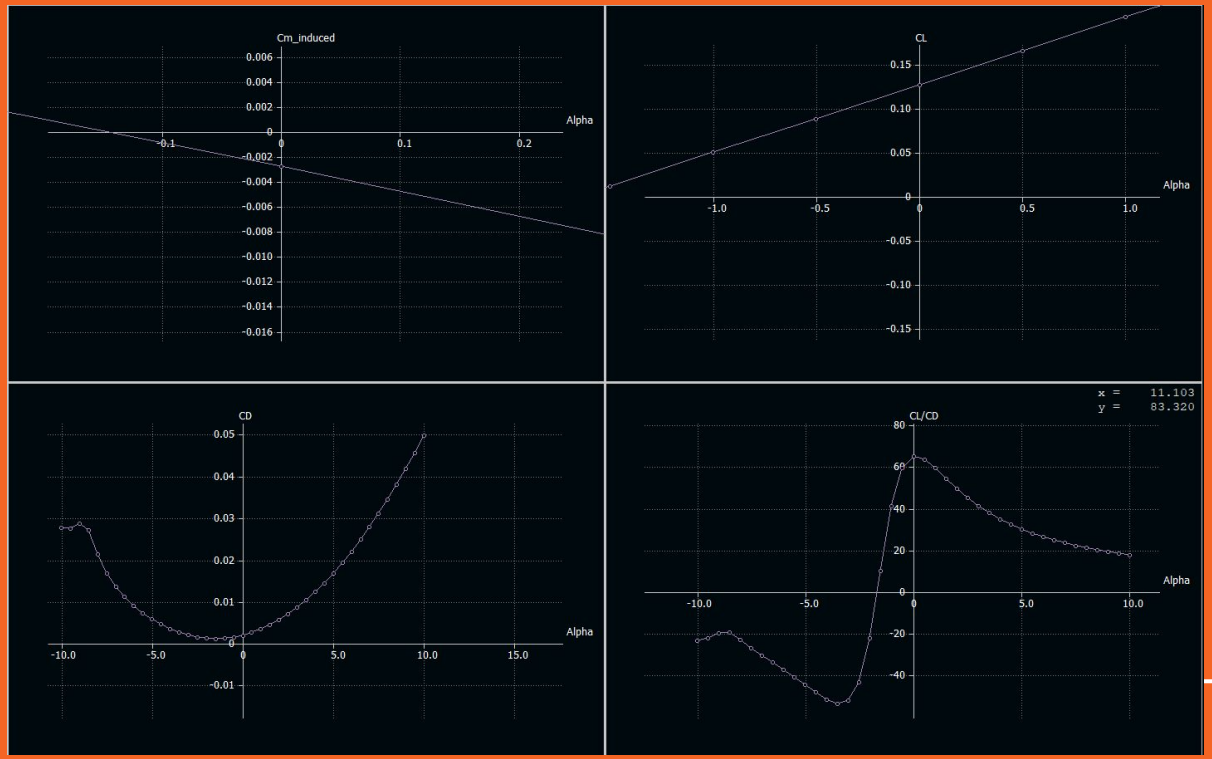
XFLR5 Sims!


Cm_induced
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.010
-0.012
-0.014
-0.016
-0.1
0
0.1
0.2
Alpha
CL
0.15
0.10
0.05
0
-0.05
-0.10
-0.15
-1.0
-0.5
0
0.5
1.0
Alpha
CD
0.05
0.04
0.03
0.02
0.01
0
-0.01
-10.0
-5.0
0
5.0
10.0
15.0
Alpha
x = 11.103
y = 83.320
CL/CD
80
60
40
20
0
-20
-40
-10.0
-5.0
0
5.0
10.0
Alpha

Getting Set Up

Getting the program

[Go to this site](#)

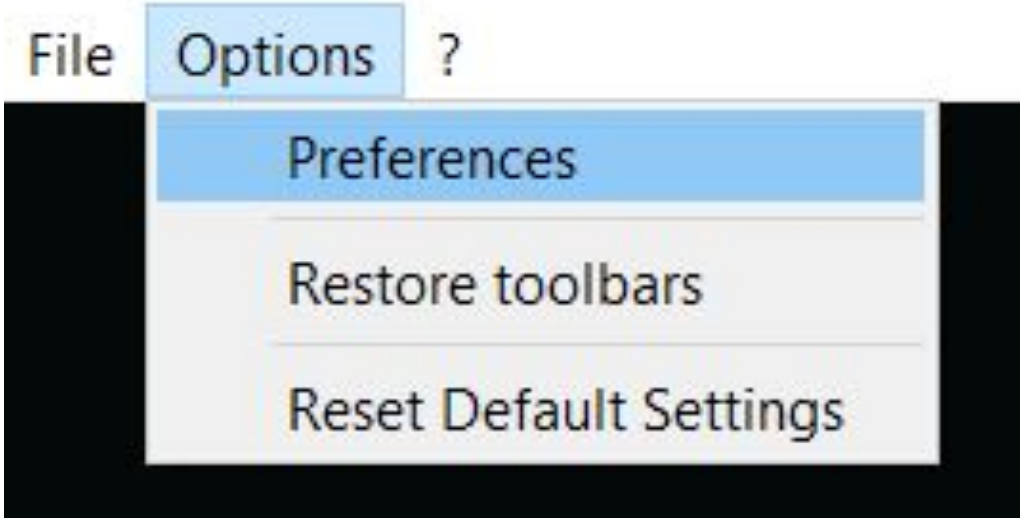
- Yes it's sketchy. Don't worry.

bearer	File folder					11/23/2020 1:26 PM
iconengines	File folder					11/23/2020 1:26 PM
imageformats	File folder					11/23/2020 1:26 PM
platforms	File folder					11/23/2020 1:26 PM
styles	File folder					11/23/2020 1:26 PM
translations	File folder					11/23/2020 1:26 PM
d3dcompiler_47.dll	Application extension	1,831 KB	No	4,245 KB	57%	4/20/2018 8:29 AM
Installation	Text Document	1 KB	No	1 KB	33%	11/23/2020 1:26 PM
libEGL.dll	Application extension	7 KB	No	18 KB	64%	3/7/2019 7:11 PM
libGLESV2.dll	Application extension	1,308 KB	No	3,487 KB	63%	3/7/2019 7:11 PM
opengl32sw.dll	Application extension	7,598 KB	No	20,433 KB	63%	6/14/2016 3:00 PM
Qt5Core.dll	Application extension	2,690 KB	No	5,891 KB	55%	9/3/2020 7:14 AM
Qt5Gui.dll	Application extension	2,579 KB	No	6,871 KB	63%	9/3/2020 7:14 AM
Qt5Network.dll	Application extension	564 KB	No	1,322 KB	58%	9/3/2020 7:14 AM
Qt5OpenGL.dll	Application extension	124 KB	No	313 KB	61%	9/3/2020 7:14 AM
Qt5Svg.dll	Application extension	134 KB	No	324 KB	59%	9/3/2020 2:50 PM
Qt5Widgets.dll	Application extension	2,441 KB	No	5,390 KB	55%	9/3/2020 7:14 AM
Qt5Xml.dll	Application extension	88 KB	No	209 KB	59%	9/3/2020 7:15 AM
vc_redist.x64	Application	14,461 KB	No	14,708 KB	2%	12/14/2019 12:05 PM
xflr5	Application	1,215 KB	No	2,930 KB	59%	11/23/2020 11:31 AM
xflr5-engine.dll	Application extension	310 KB	No	742 KB	59%	11/23/2020 11:31 AM
XFoil.dll	Application extension	129 KB	No	269 KB	53%	11/23/2020 11:30 AM

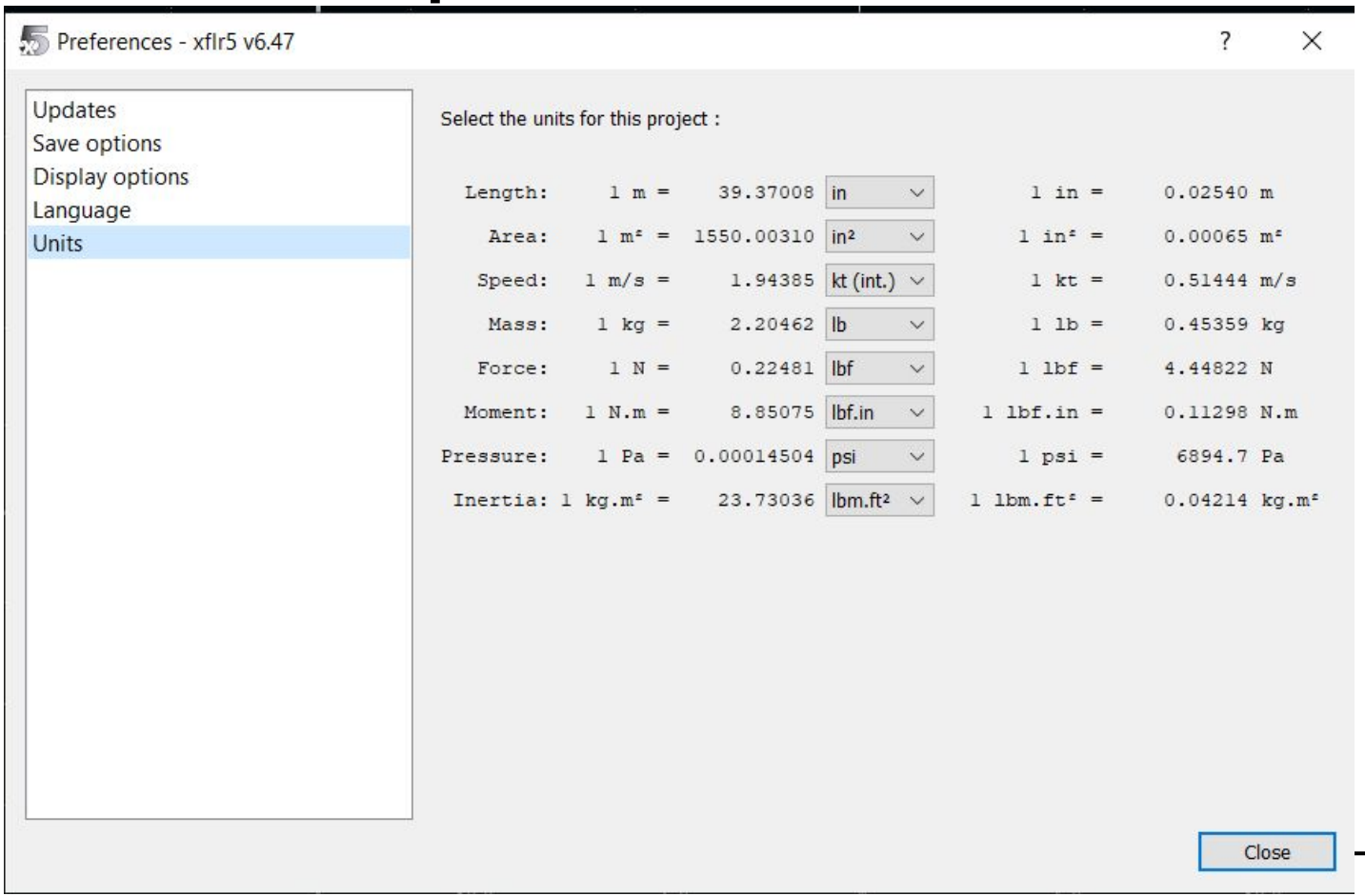
You should be here

Note: you'll have to turn off any anti-virus and the security on a mac

Units pt 1


File
Options
?
Preferences
Restore toolbars
Reset Default Settings

Units pt 2


Preferences - xflr5 v6.47
Updates
Save options
Display options
Language
Units
Select the units for this project :
Length: 1 m = 39.37008 in 1 in = 0.02540 m
Area: 1 m² = 1550.00310 in² 1 in² = 0.00065 m²
Speed: 1 m/s = 1.94385 kt (int.) 1 kt = 0.51444 m/s
Mass: 1 kg = 2.20462 lb 1 lb = 0.45359 kg
Force: 1 N = 0.22481 lbf 1 lbf = 4.44822 N
Moment: 1 N.m = 8.85075 lbf.in 1 lbf.in = 0.11298 N.m
Pressure: 1 Pa = 0.00014504 psi 1 psi = 6894.7 Pa
Inertia: 1 kg.m² = 23.73036 lbm.ft² 1 lbm.ft² = 0.04214 kg.m²
Close

Download 2 things:

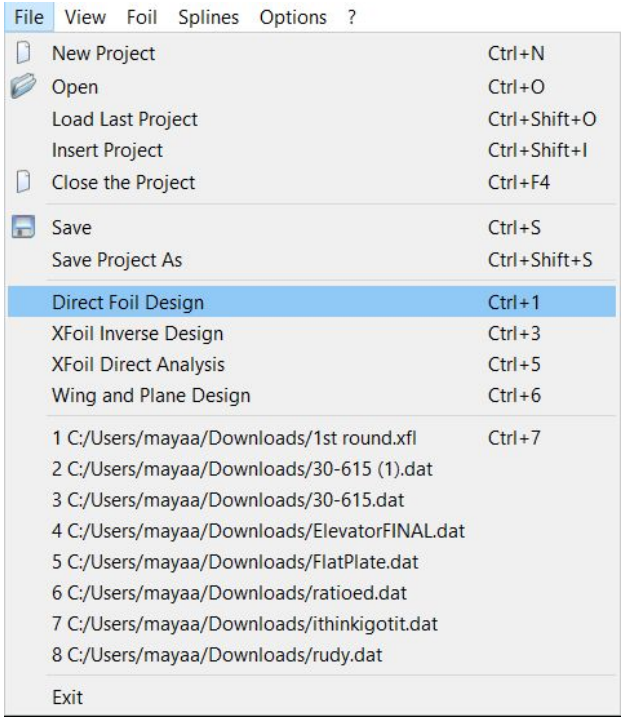
Clark Y .dat file

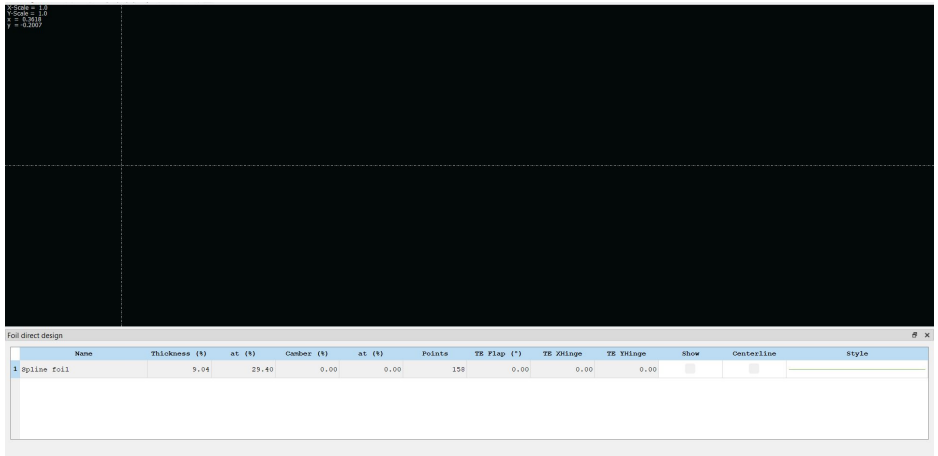
Flat plate .dat file

Note: make sure the file on your computer ends in “.dat” !!

- XFLR5 only recognizes .dat files with “.dat” in the name bc it’s quirky like that 🤪

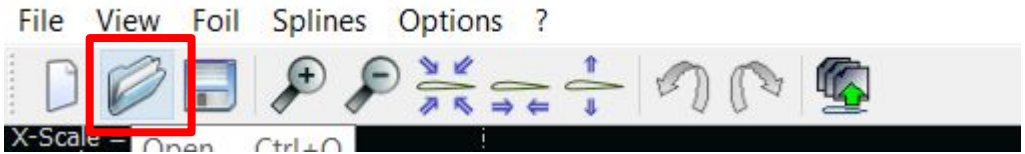
Input the foils you need



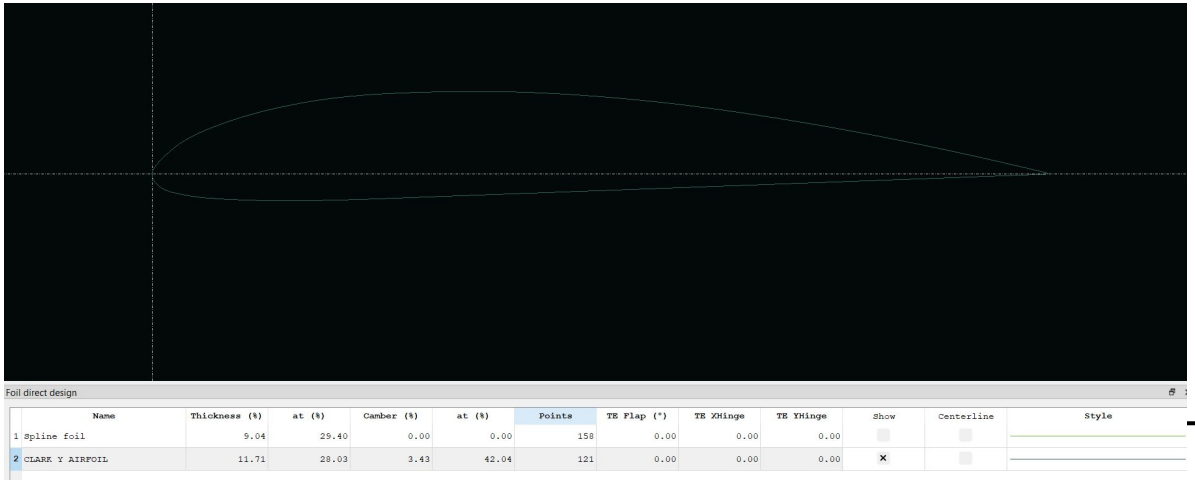


File > Direct Foil Design

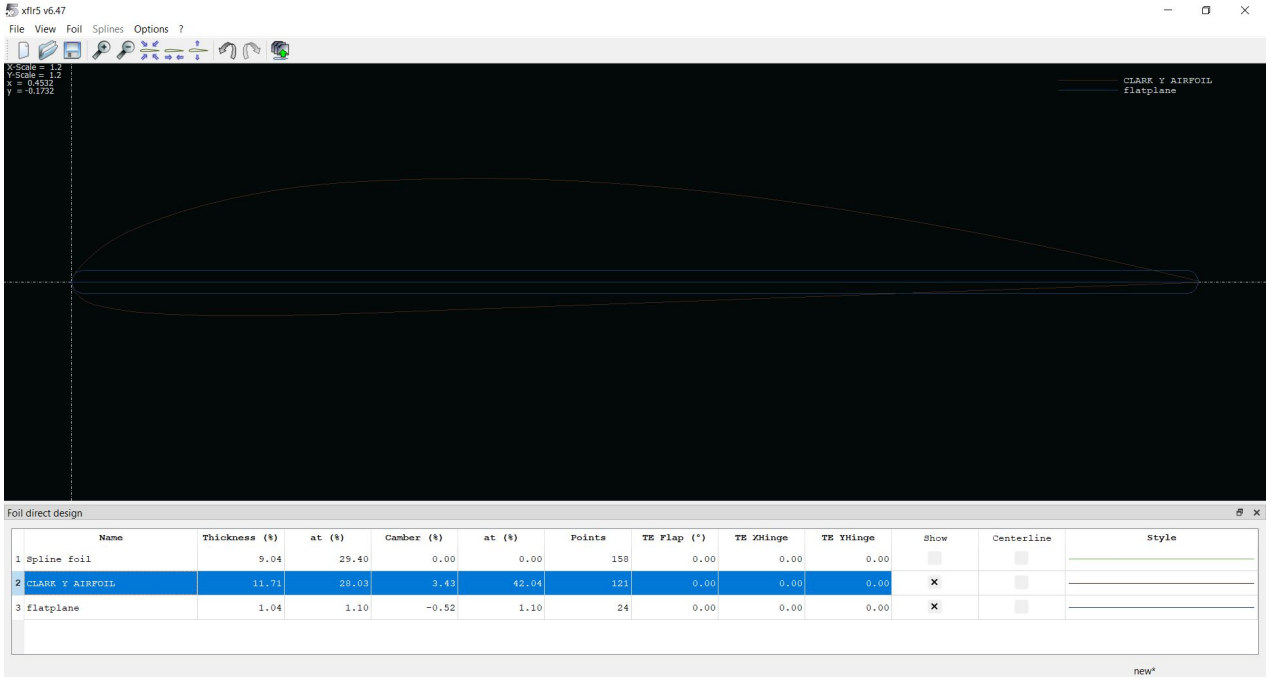
Input foil pt. 2



Then you'll open the .dat file and get this screen



Now do the same for the flatplate

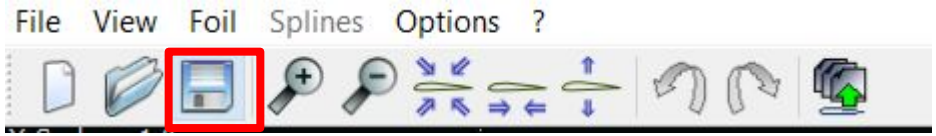


xflr5 is in permanent dark mode so sorry the pics are not showing up amazing

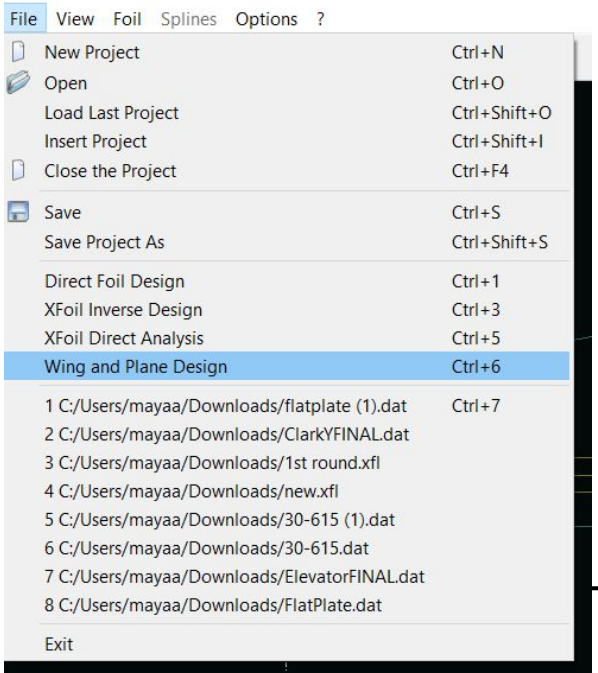
Pro tip: you can right click the foil to rename it

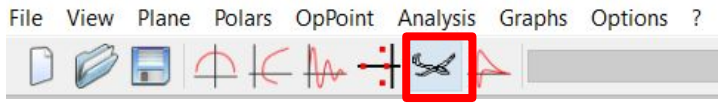
Starting your plane

First off, press save



Then:



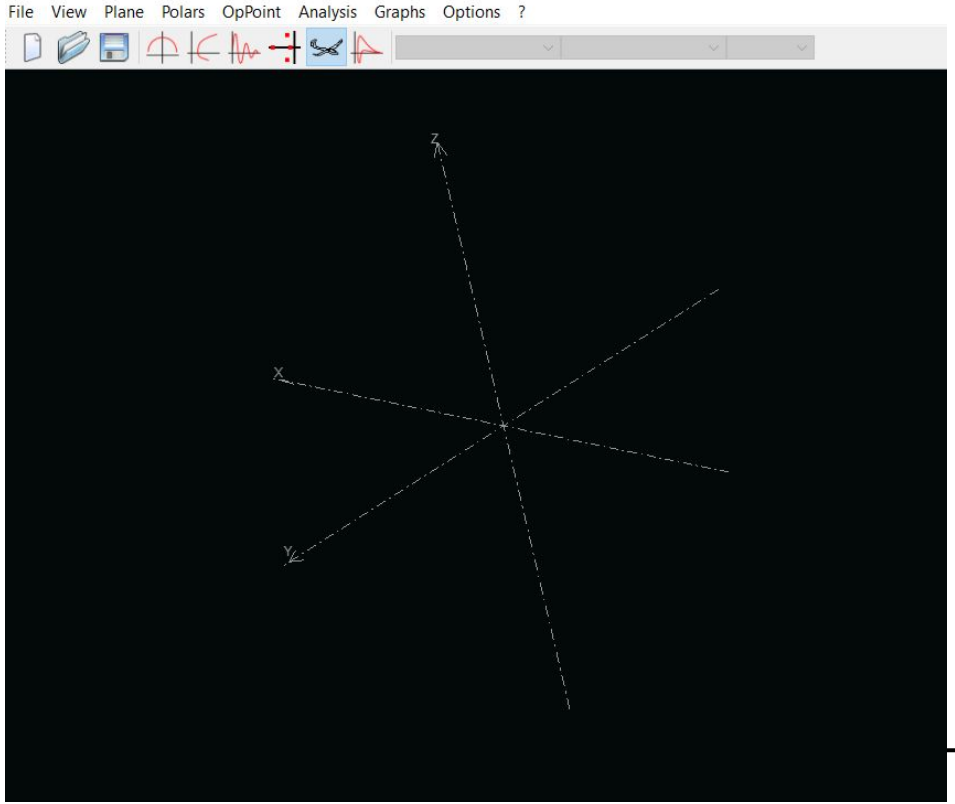


For a windows, it'll be at the top.

For mac, you'll have to right click first to get this (I think?)

Dimensions

You should be here:

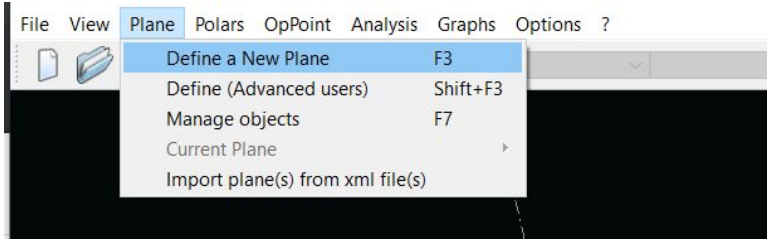


This is where you're gonna create your plane.

You'll be designing and adding mass to: rudder, elevator, wing

Everything else is going to be represented through a point mass

Creating your plane



Plane Editor - xflr5 v6.47

Plane Description

[Your Name] - FCA

Description:

Plane Inertia

Body

Warning:
Including the body in the analysis is not recommended.
Check the guidelines for explanations.

Body Actions...

x= 0.00 in

z= 0.00 in

Main Wing

Main wing

Define x= 0.000 in

Import z= 0.000 in

Tilt Angle= 0.000 °

Wing 2

Biplane

Define x= 0.000 in

Import z= 0.000 in

Tilt Angle= 0.000 °

Elevator

Elevator

Define x= 0.000 in

z= 0.000 in

Tilt Angle= 0.000 °

Fin

Fin

Define x= 0.000 in

Two-sided Fin y= 0.000 in

Double Fin z= 0.000 in

Tilt Angle= 0.000 °

Wing Area = 449.50 in²

Wing Span = 78.74 in

Elev. Area = 47.43 in²

Elev. Lever Arm = -0.79 in

Fin Area = 14.88 in²

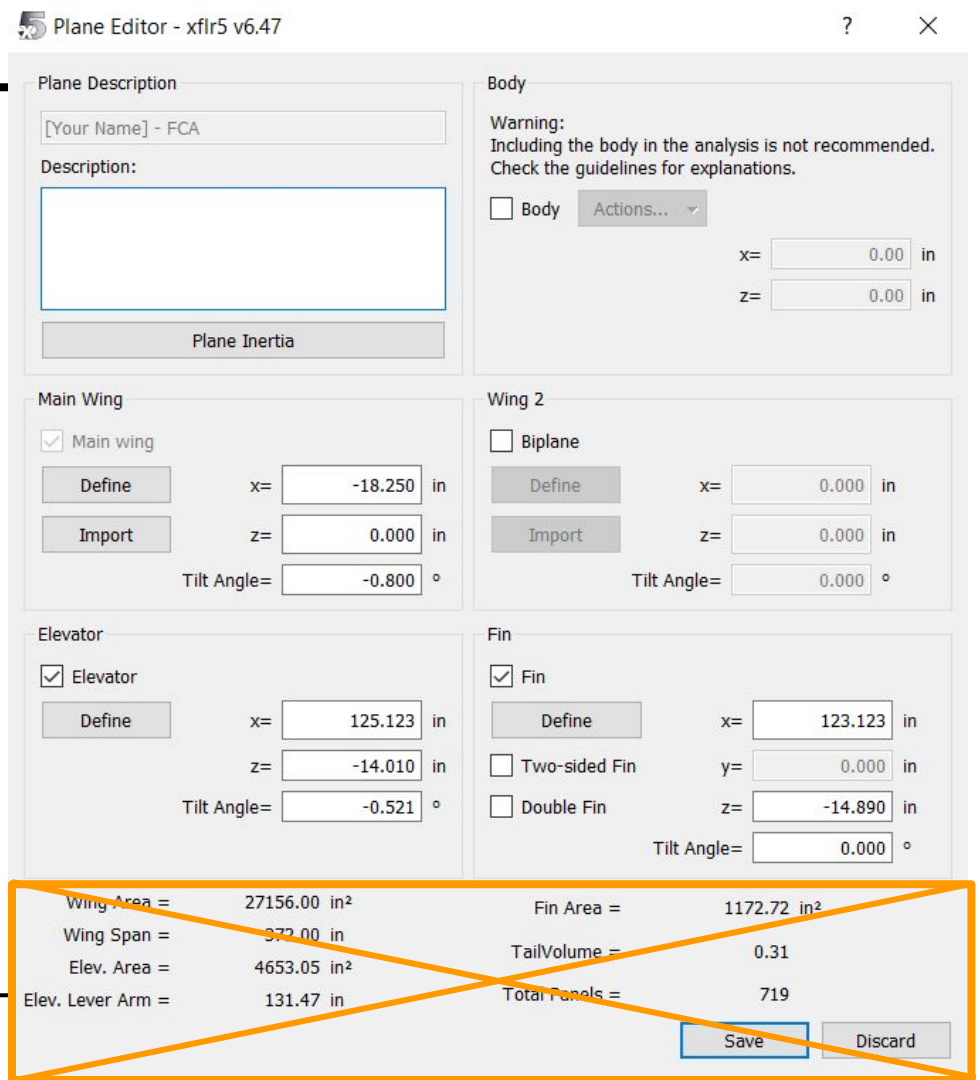
TailVolume = -0.01

Total Panels = 641

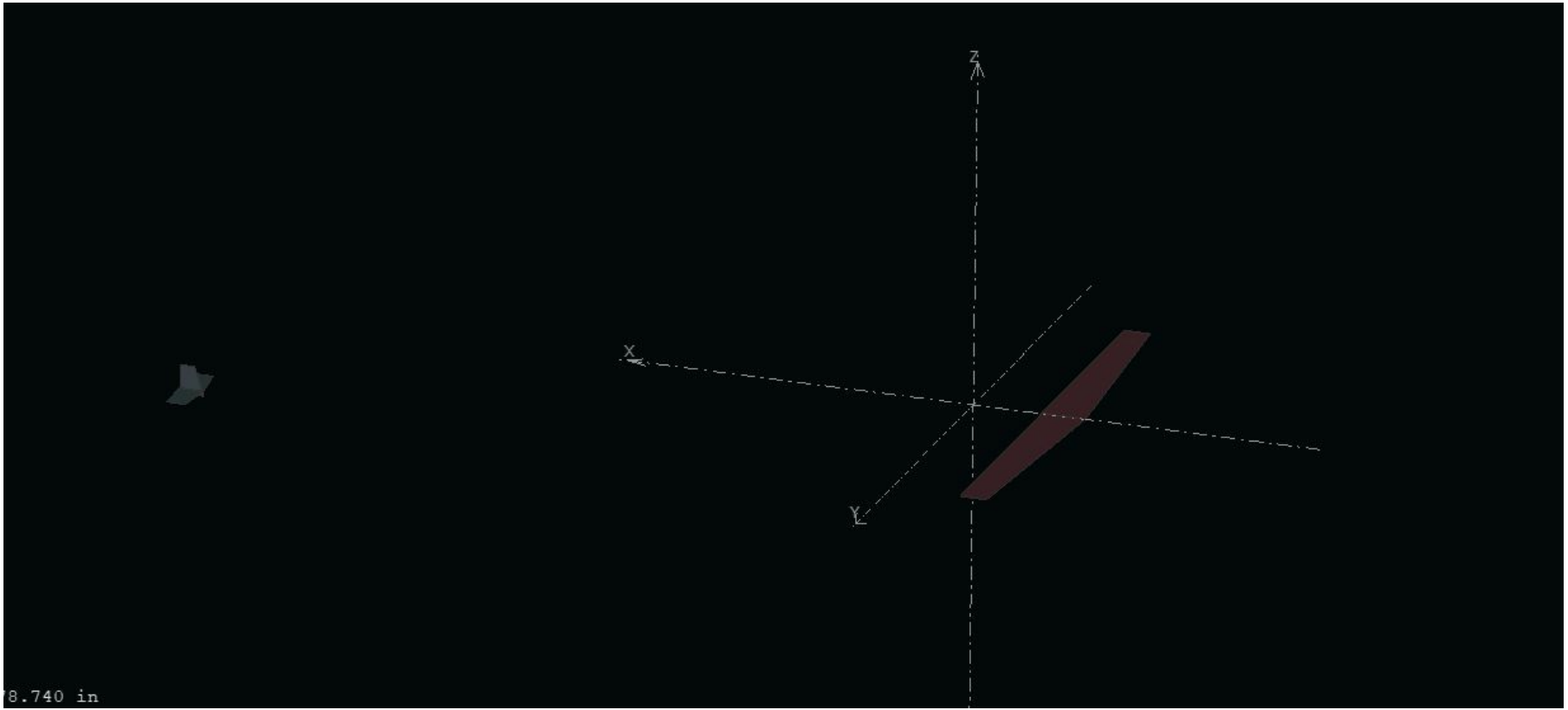
Save Discard

Edit your main editor so it looks like this

IGNORE the orange box for right now



You should be here:

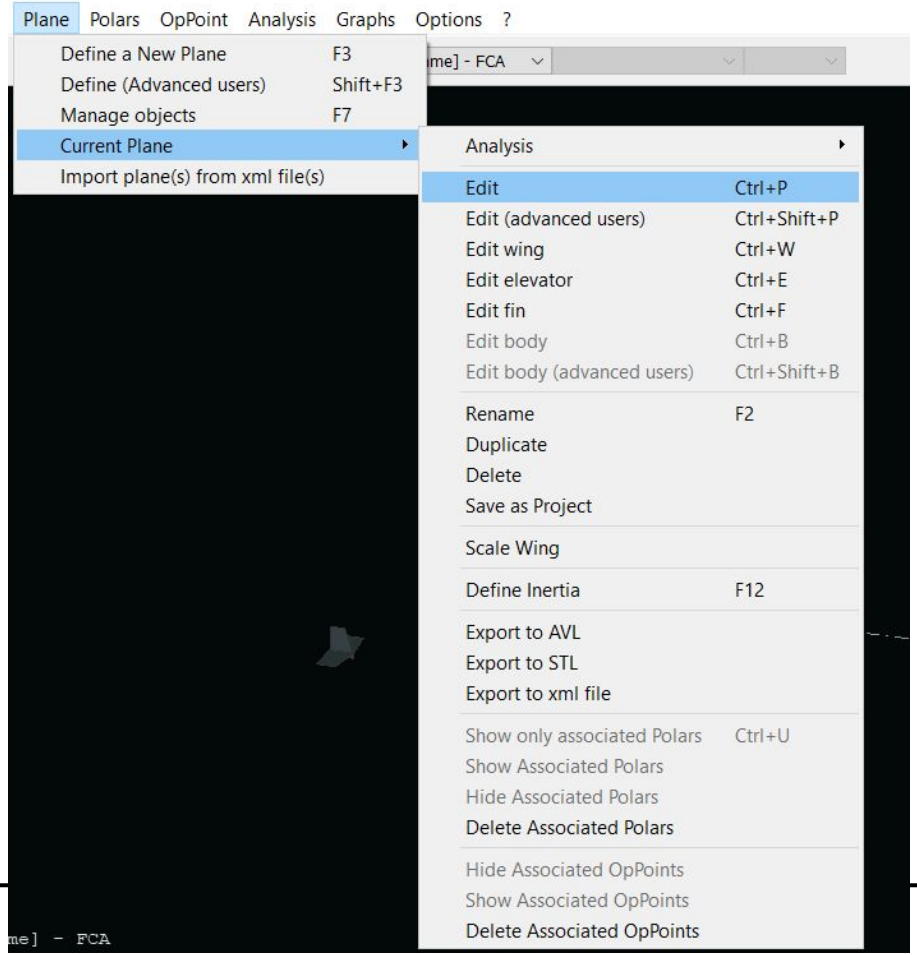


Note:

From now on you'll get to the dash by going

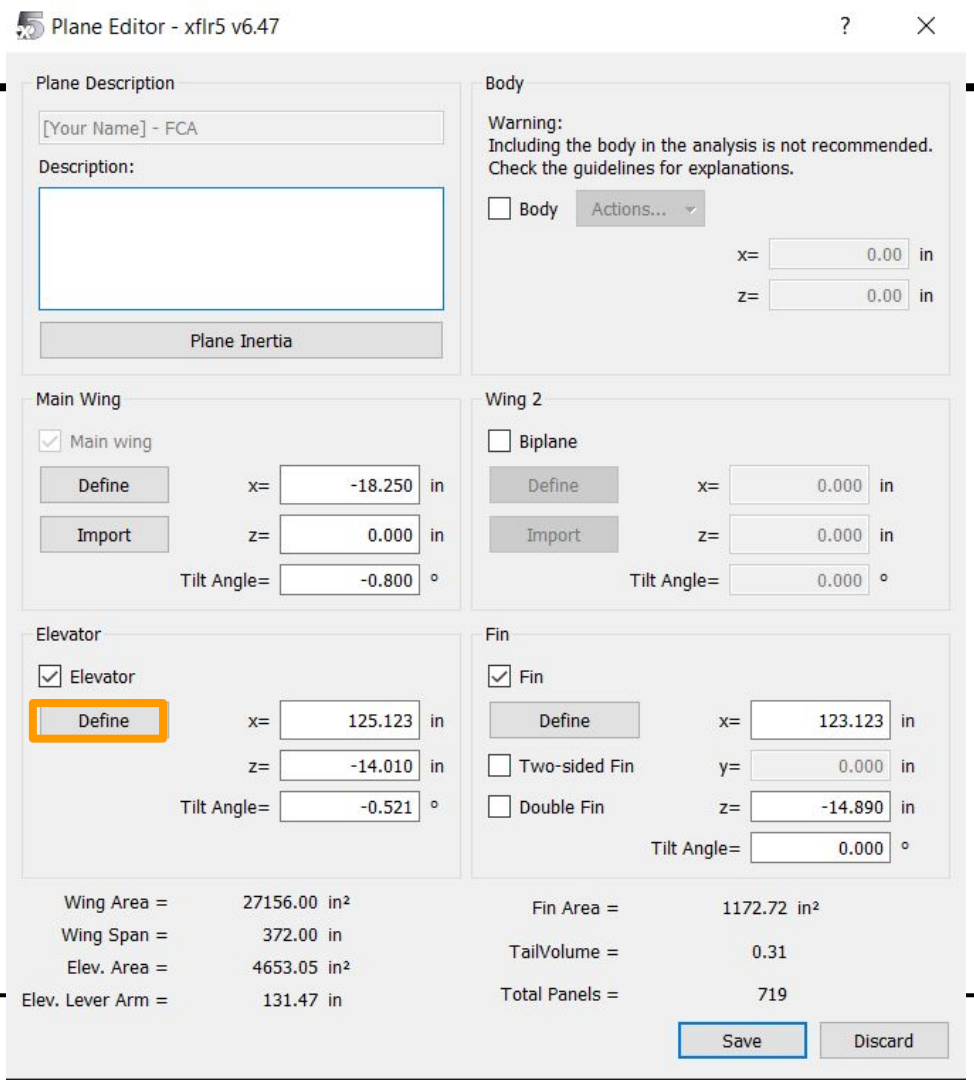
plane>current plane> edit

- Later you'll just go directly to the part you wanna edit

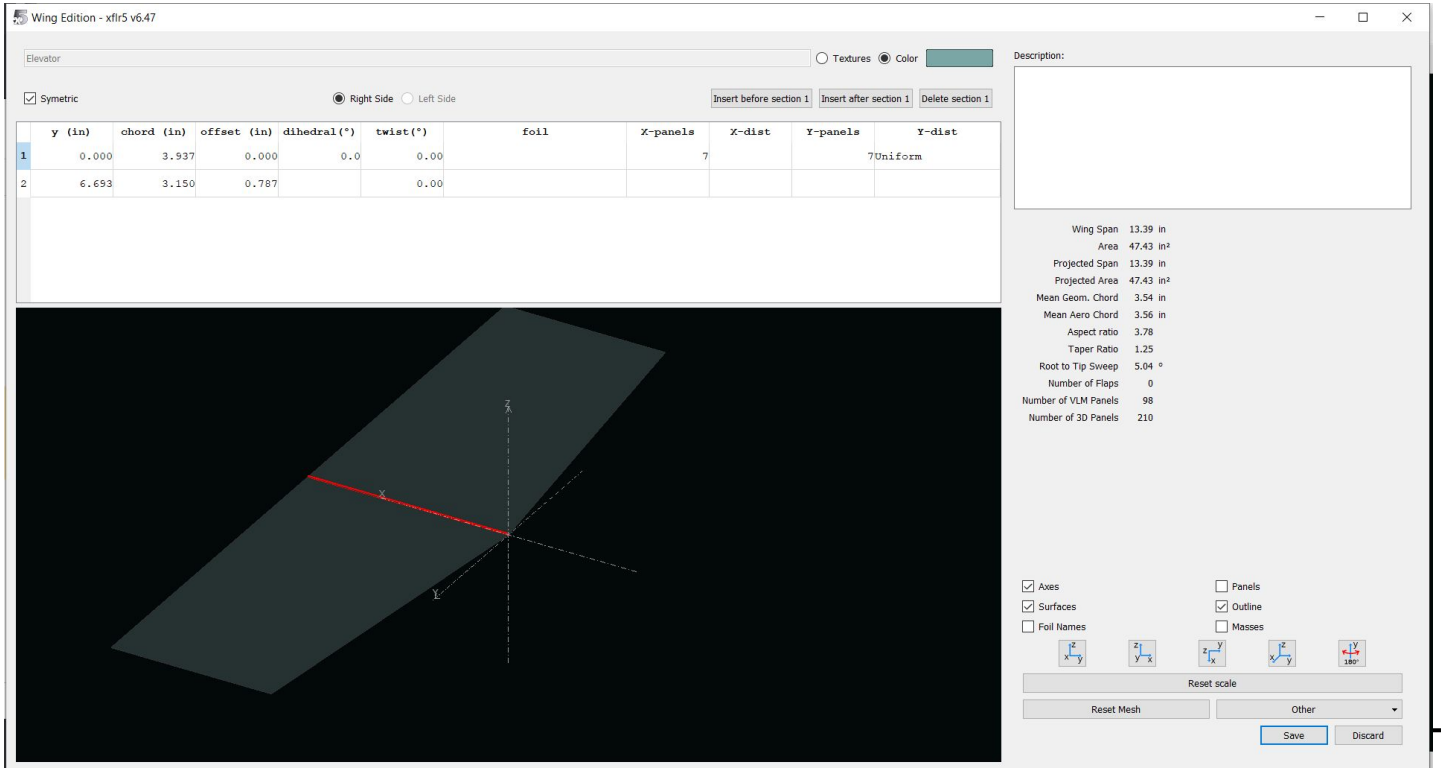


Designing Your Tail

To edit any of your surfaces, you're going to click "define" on the plane editor dash.

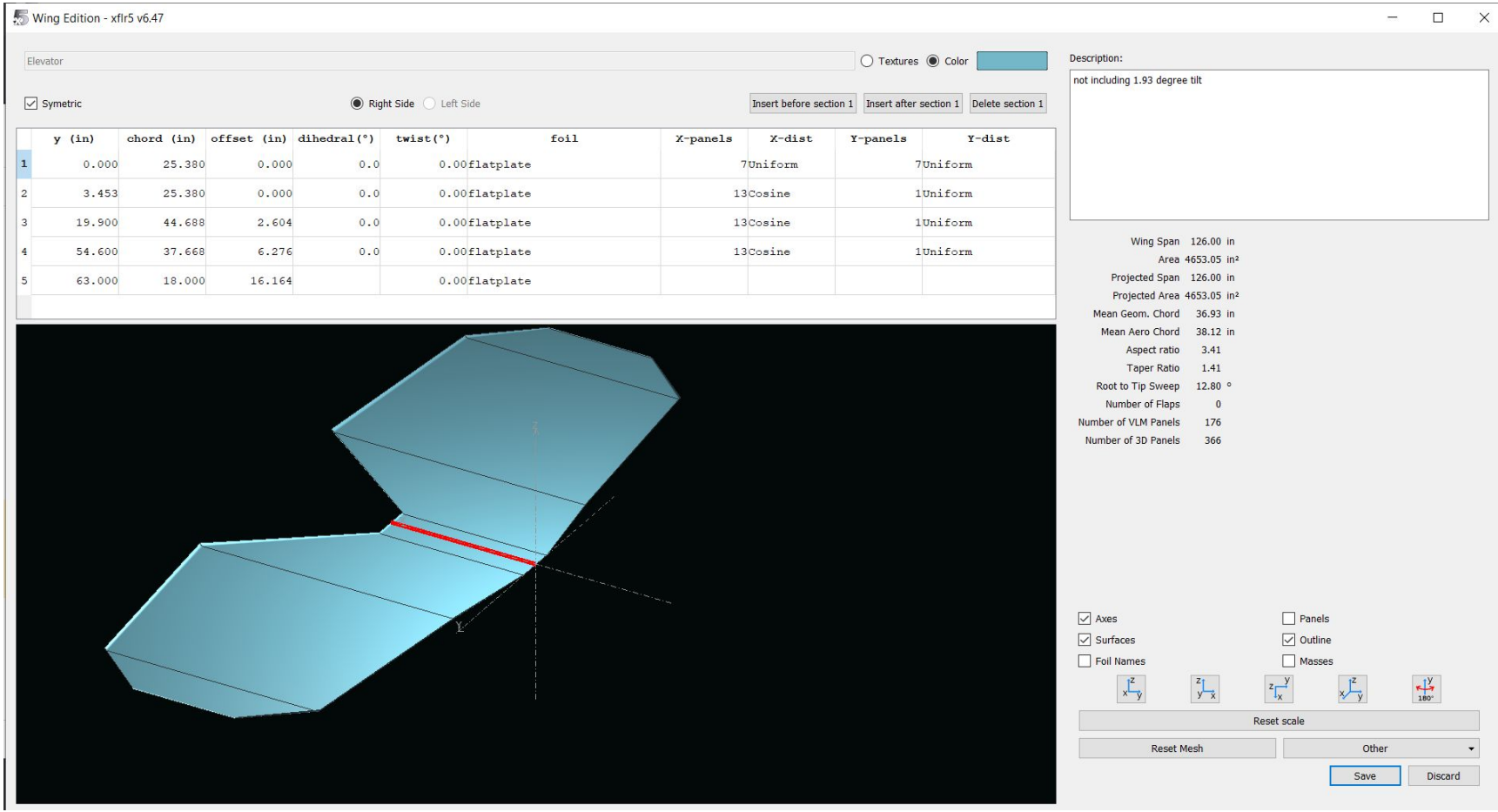


This is what it should look like



Okay now you're gonna input the values so it looks like this:

Link to screenshot



Elevator, Just the numbers:

	y (in)	chord (in)	offset (in)	dihedral(°)	twist(°)	foil
1	0.000	25.380	0.000	0.0	0.00	flatplate
2	3.453	25.380	0.000	0.0	0.00	flatplate
3	19.900	44.688	2.604	0.0	0.00	flatplate
4	54.600	37.668	6.276	0.0	0.00	flatplate
5	63.000	18.000	16.164		0.00	flatplate

Wing:

Link to Screenshot

Wing Edition - xflr5 v6.47

Main Wing

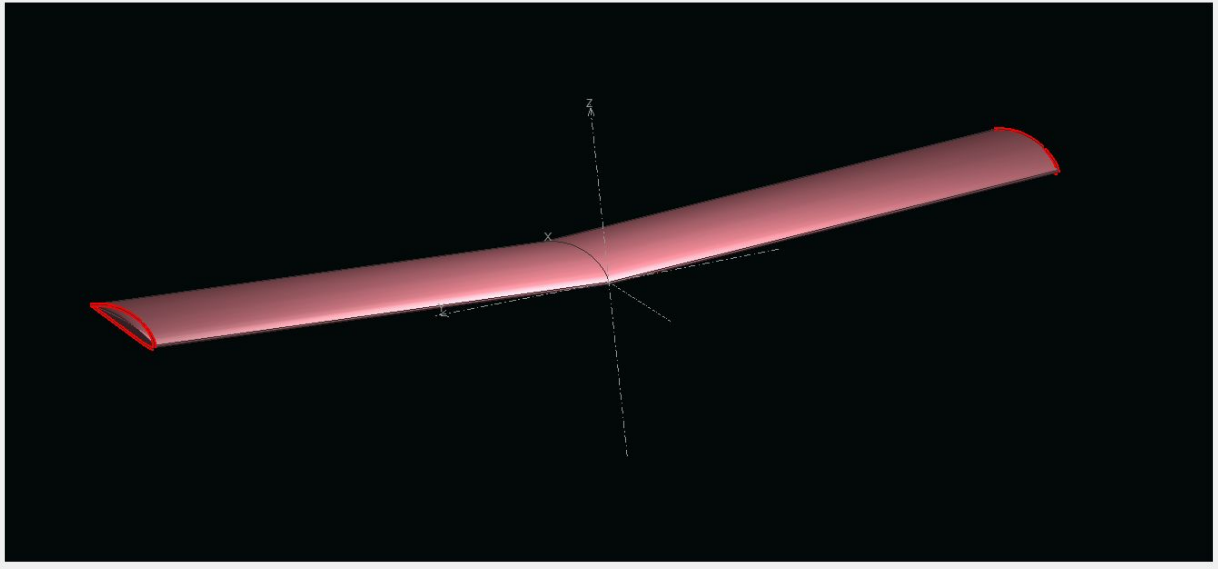
Textures Color

Symetric

Right Side Left Side

Insert before section 2 | Insert after section 2 | Delete section 2

	y (in)	chord (in)	offset (in)	dihedral(°)	twist(°)	foil	X-panels	X-dist	Y-panels	Y-dist
1	0.000	73.000	0.000	3.0	0.00	CLARK Y AIRFOIL	13	Cosine	19	Sine
2	186.000	73.000	0.000		0.00	CLARK Y AIRFOIL				



Description:

Wing Span	372.00	in
Area	27156.00	in²
Projected Span	371.49	in
Projected Area	27118.78	in²
Mean Geom. Chord	73.00	in
Mean Aero Chord	73.00	in
Aspect ratio	5.10	
Taper Ratio	1.00	
Root to Tip Sweep	0.00	°
Number of Flaps	0	
Number of VLM Panels	494	
Number of 3D Panels	1014	

Axes Panels

Surfaces Outline

Foil Names Masses

Reset scale

Reset Mesh Other

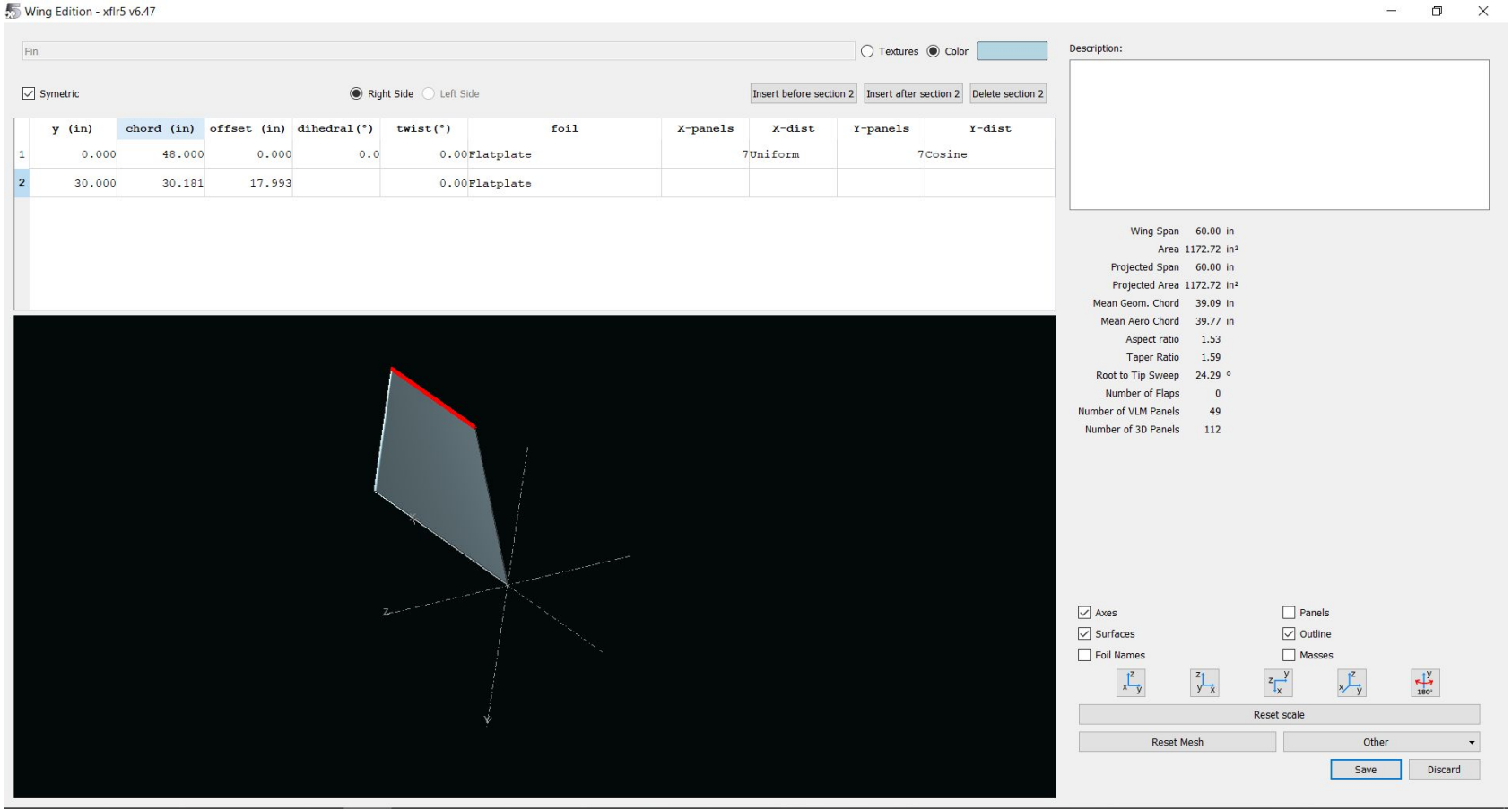
Save Discard

Wing, Just the Numbers:

	y (in)	chord (in)	offset (in)	dihedral(°)	twist(°)	foil
1	0.000	73.000	0.000	3.0	0.00	CLARK Y AIRFOIL
2	186.000	73.000	0.000		0.00	CLARK Y AIRFOIL

Rudder (their “Fin”)

Screenshot Link

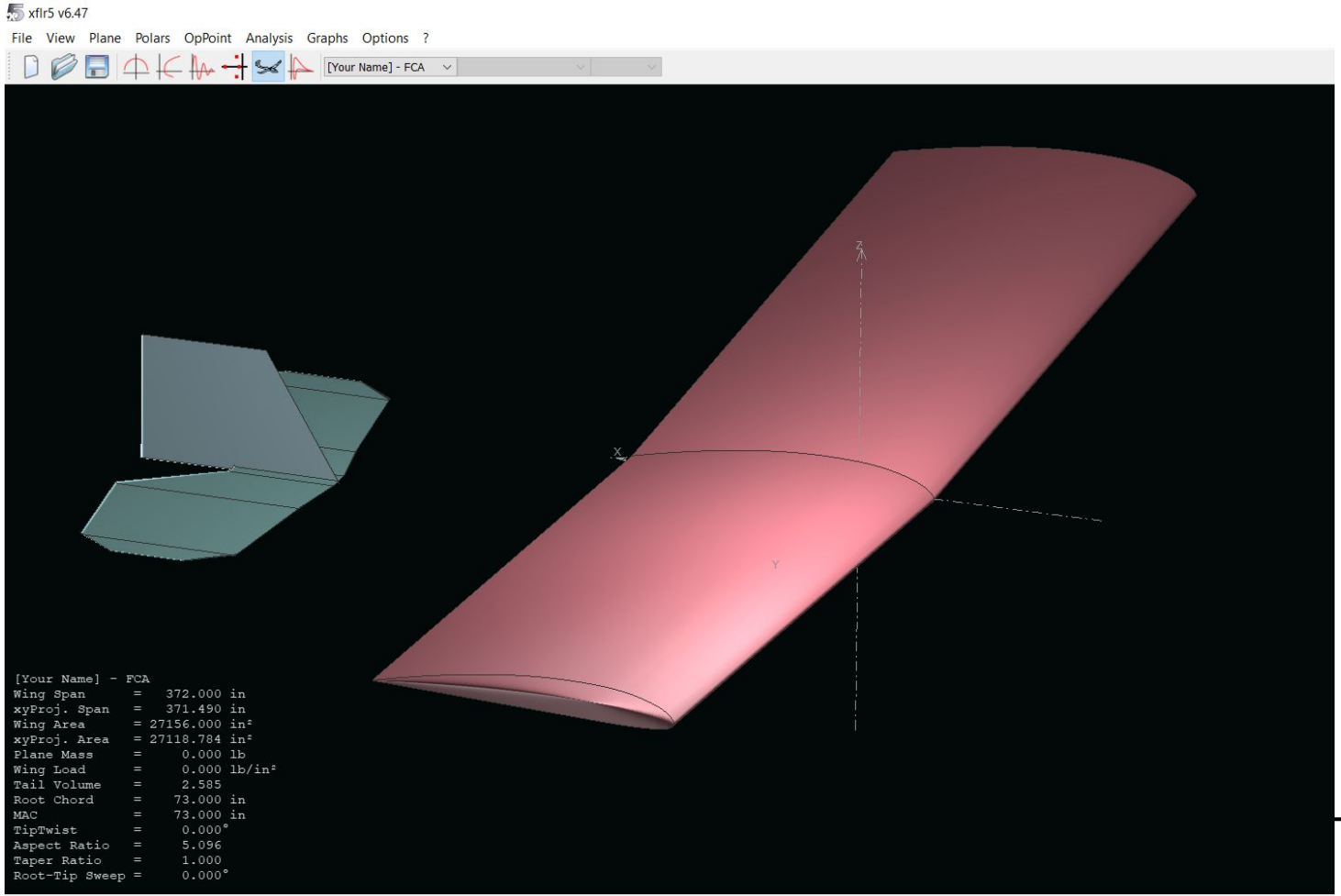


Rudder, Just Numbers

	y (in)	chord (in)	offset (in)	dihedral(°)	twist(°)	foil
1	0.000	48.000	0.000	0.0	0.00	Flatplate
2	30.000	30.181	17.993		0.00	Flatplate

Sweet! You should be here:

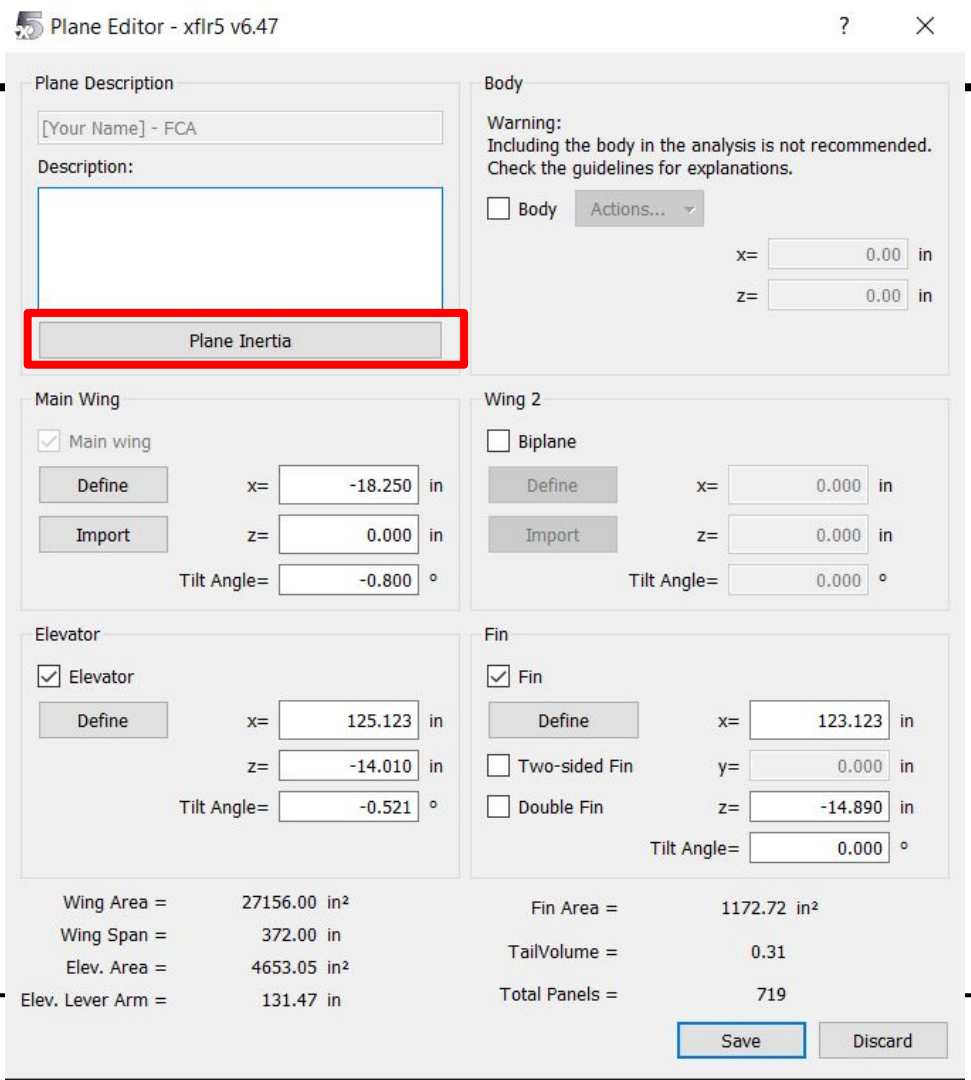
Ok hit save



Masses

We’re going to add masses to the plane so the analysis can function accurately

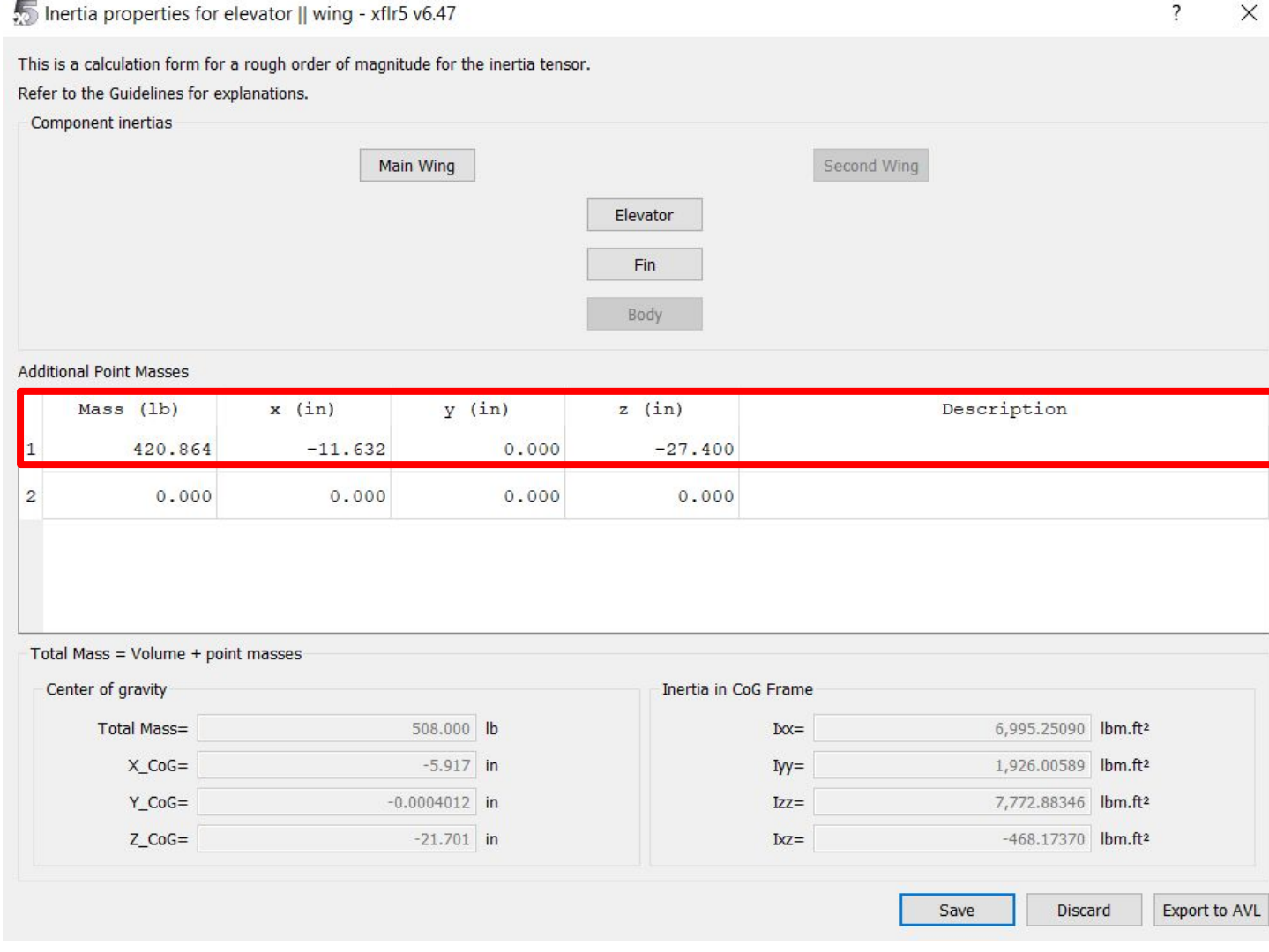
This “Plane Inertia” tab is going to take you to where you’re gonna put ALL your masses



First is to add the point mass

This mass represents everything except for the wing, elevator, and fin

Aka: fuselage, batteries, human, etc



Wing

Inertia properties for Main Wing - xflr5 v6.47

This is a calculation form for a rough order of magnitude for the inertia tensor.

Refer to the Guidelines for explanations.

Object Mass - Volume only, excluding point masses

Center of gravity

Wing Mass:	80.000	lb
X_CoG=	12.000	in
Y_CoG=	0.000	in
Z_CoG=	7.200	in

Inertia in CoG Frame

Ixx=	6,382.398	lbm.ft²
Iyy=	161.988	lbm.ft²
Izz=	6,535.189	lbm.ft²
Ixz=	-2.248	lbm.ft²

Additional Point Masses

	Mass (lb)	x (in)	y (in)	z (in)	Description
1	0.000	0.000	0.000	0.000	

Total Mass = Volume + point masses

Center of gravity

Total Mass=	80.000	lb
X_CoG=	12.000	in
Y_CoG=	0.000	in
Z_CoG=	7.200	in

Inertia in CoG Frame

Ixx=	6,382.39774	lbm.ft²
Iyy=	161.98758	lbm.ft²
Izz=	6,535.18870	lbm.ft²
Ixz=	-2.24827	lbm.ft²

Save | Discard | Export to AVL

Elevator

Inertia properties for Elevator - xflr5 v6.47

This is a calculation form for a rough order of magnitude for the inertia tensor.

Refer to the Guidelines for explanations.

Object Mass - Volume only, excluding point masses

Center of gravity

Wing Mass:	4.873	lb
X_CoG=	129.415	in
Y_CoG=	-0.000	in
Z_CoG=	-14.055	in

Inertia in CoG Frame

Ixx=	43.265	lbm.ft²
Iyy=	0.721	lbm.ft²
Izz=	43.986	lbm.ft²
Ixz=	-0.005	lbm.ft²

Additional Point Masses

	Mass (lb)	x (in)	y (in)	z (in)	Description
1	0.000	0.000	0.000	0.000	

Total Mass = Volume + point masses

Center of gravity

Total Mass=	4.873	lb
X_CoG=	129.415	in
Y_CoG=	-0.000	in
Z_CoG=	-14.055	in

Inertia in CoG Frame

Ixx=	43.26473	lbm.ft²
Iyy=	0.72097	lbm.ft²
Izz=	43.98559	lbm.ft²
Ixz=	-0.00546	lbm.ft²

Save | Discard | Export to AVL

Fin (Rudder)

Inertia properties for Fin - xflr5 v6.47

This is a calculation form for a rough order of magnitude for the inertia tensor.

Refer to the Guidelines for explanations.

Object Mass - Volume only, excluding point masses

Center of gravity

Wing Mass:	2.263	lb
X_CoG=	132.182	in
Y_CoG=	-0.090	in
Z_CoG=	0.110	in

Inertia in CoG Frame

Ixx=	1.178	lbm.ft²
Iyy=	1.601	lbm.ft²
Izz=	0.423	lbm.ft²
Ixz=	-0.705	lbm.ft²

Additional Point Masses

	Mass (lb)	x (in)	y (in)	z (in)	Description
1	0.000	0.000	0.000	0.000	

Total Mass = Volume + point masses

Center of gravity

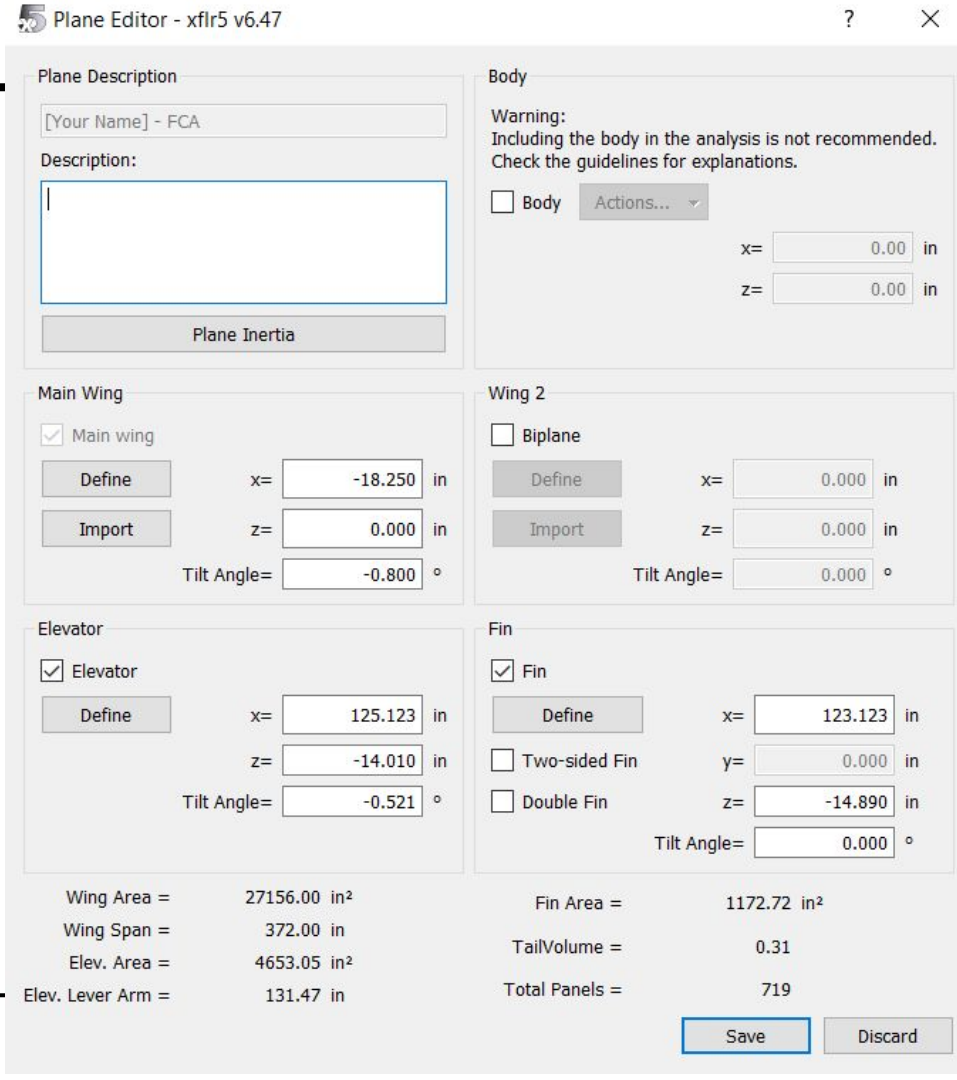
Total Mass=	2.263	lb
X_CoG=	132.182	in
Y_CoG=	-0.090	in
Z_CoG=	0.110	in

Inertia in CoG Frame

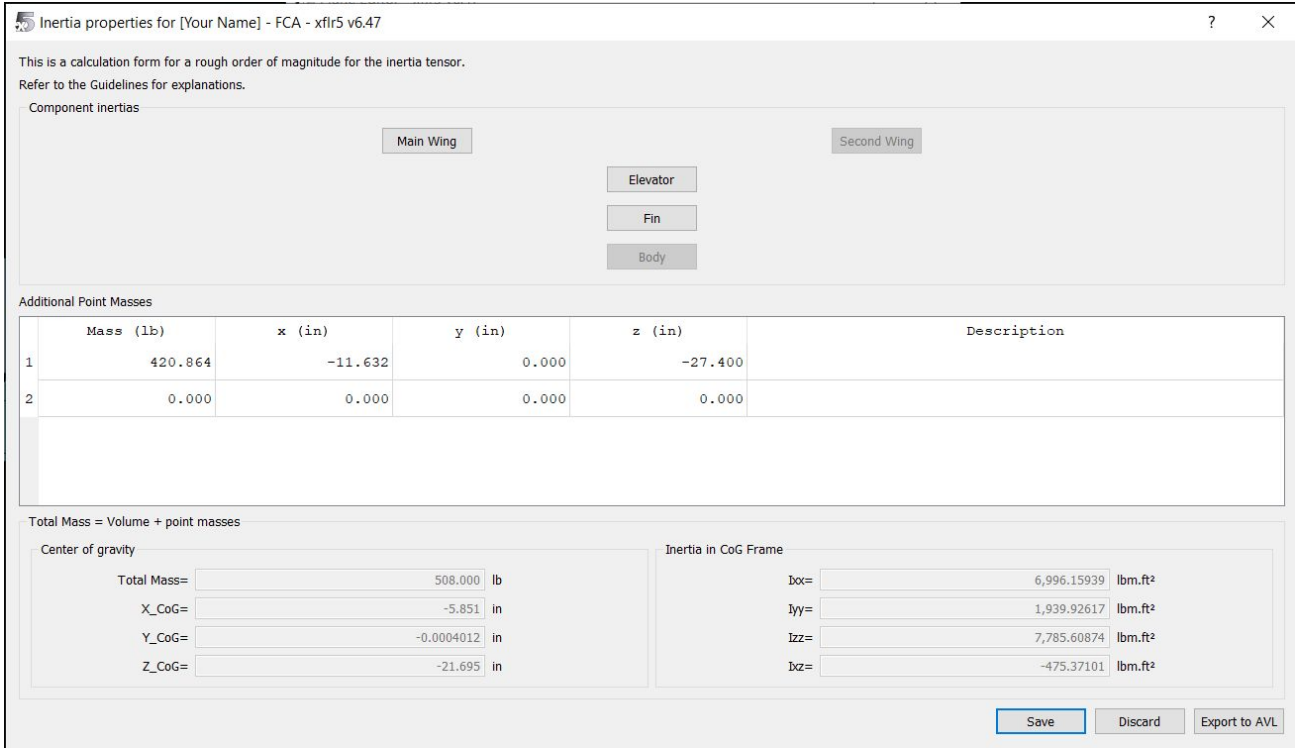
Ixx=	1.17791	lbm.ft²
Iyy=	1.60100	lbm.ft²
Izz=	0.42309	lbm.ft²
Ixz=	-0.70524	lbm.ft²

Save | Discard | Export to AVL

Now your main screen should exactly match this:



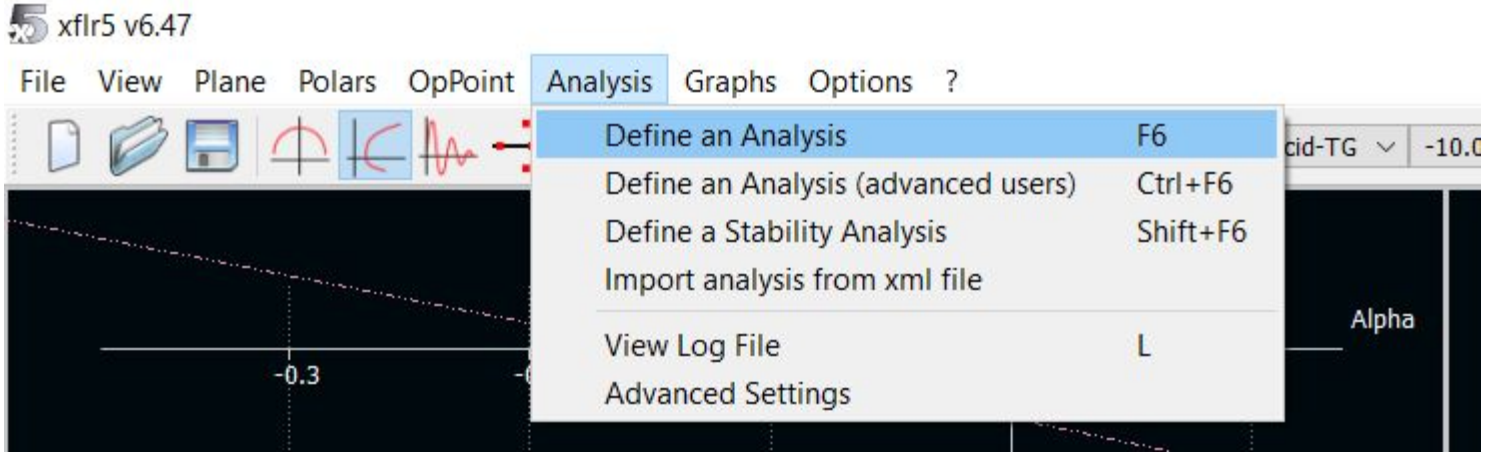
And your plane inertia home screen should also match:



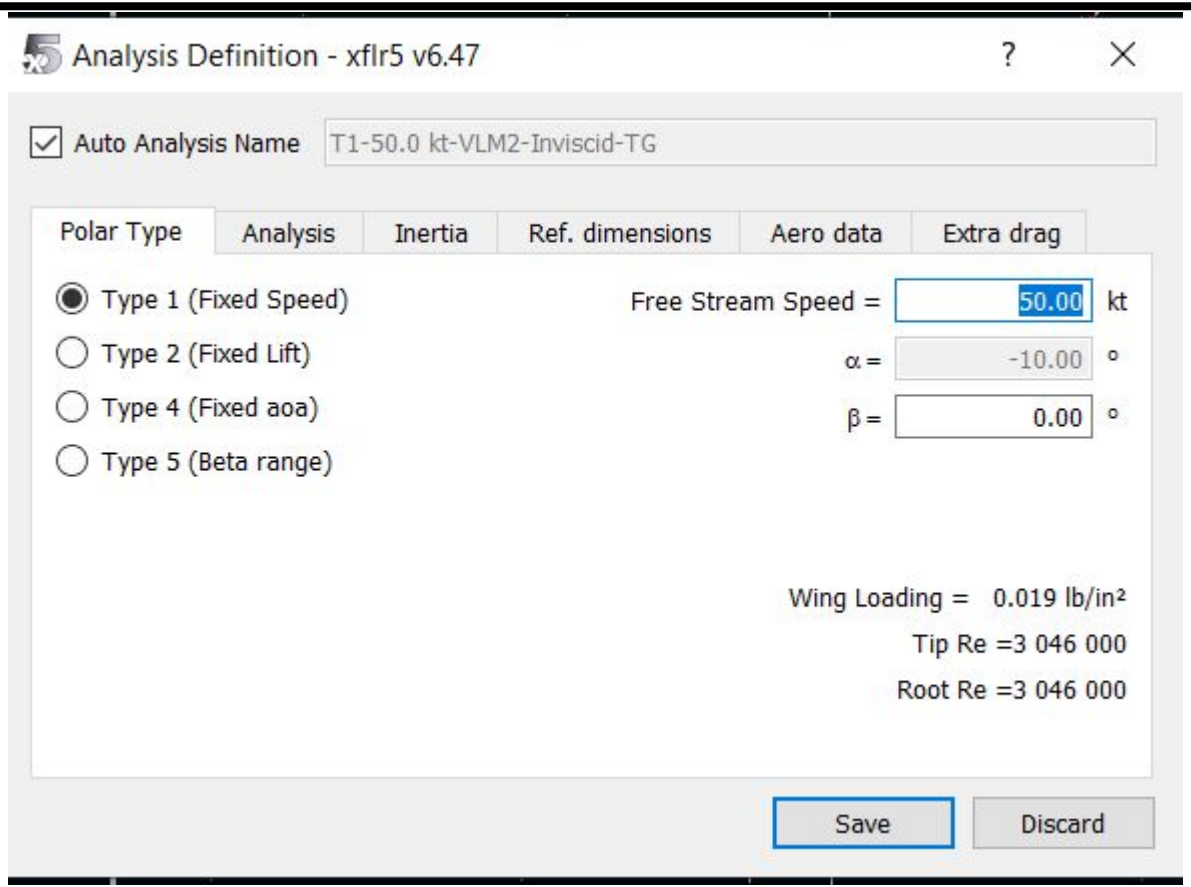
Analysis

This tells the computer what your environment looks like

Define an Analysis

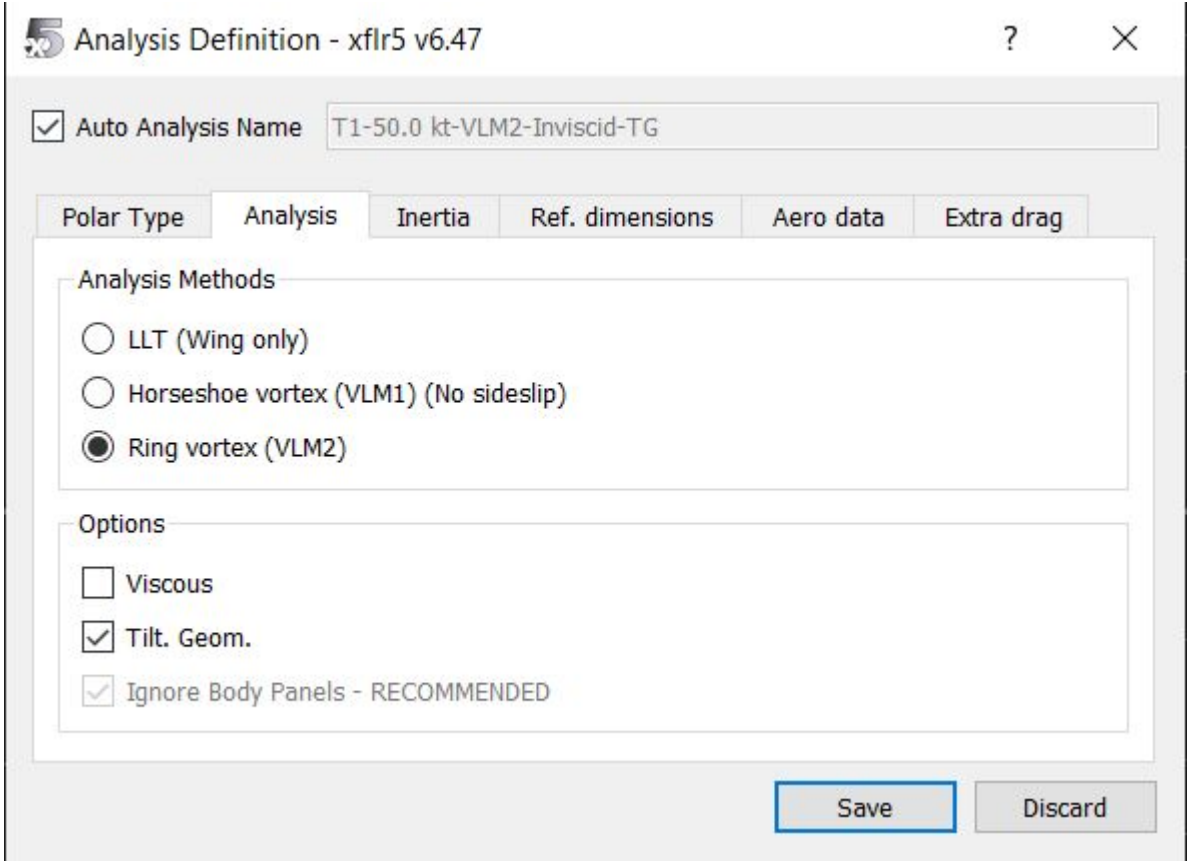


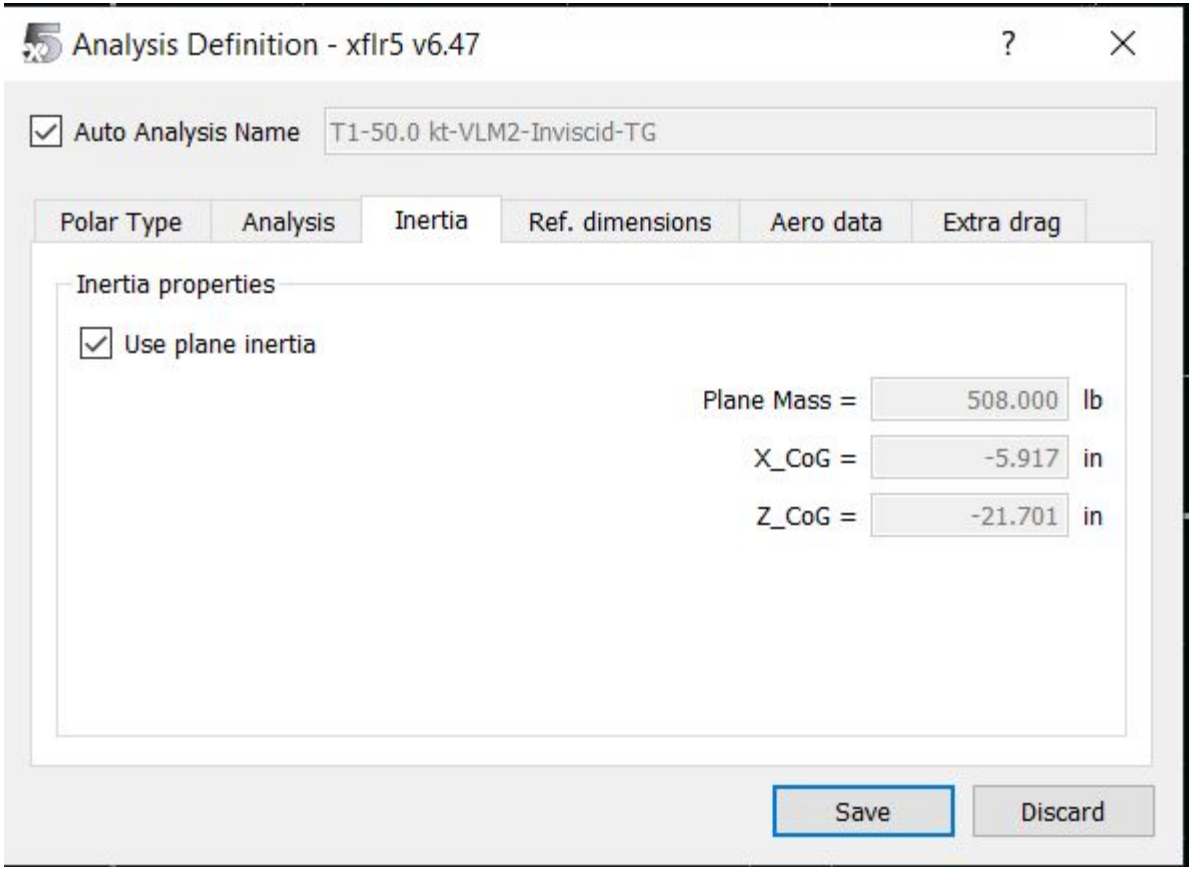
We care about the angle of attack - since the graph with the most information is the “coefficient of moment vs aoa” graph



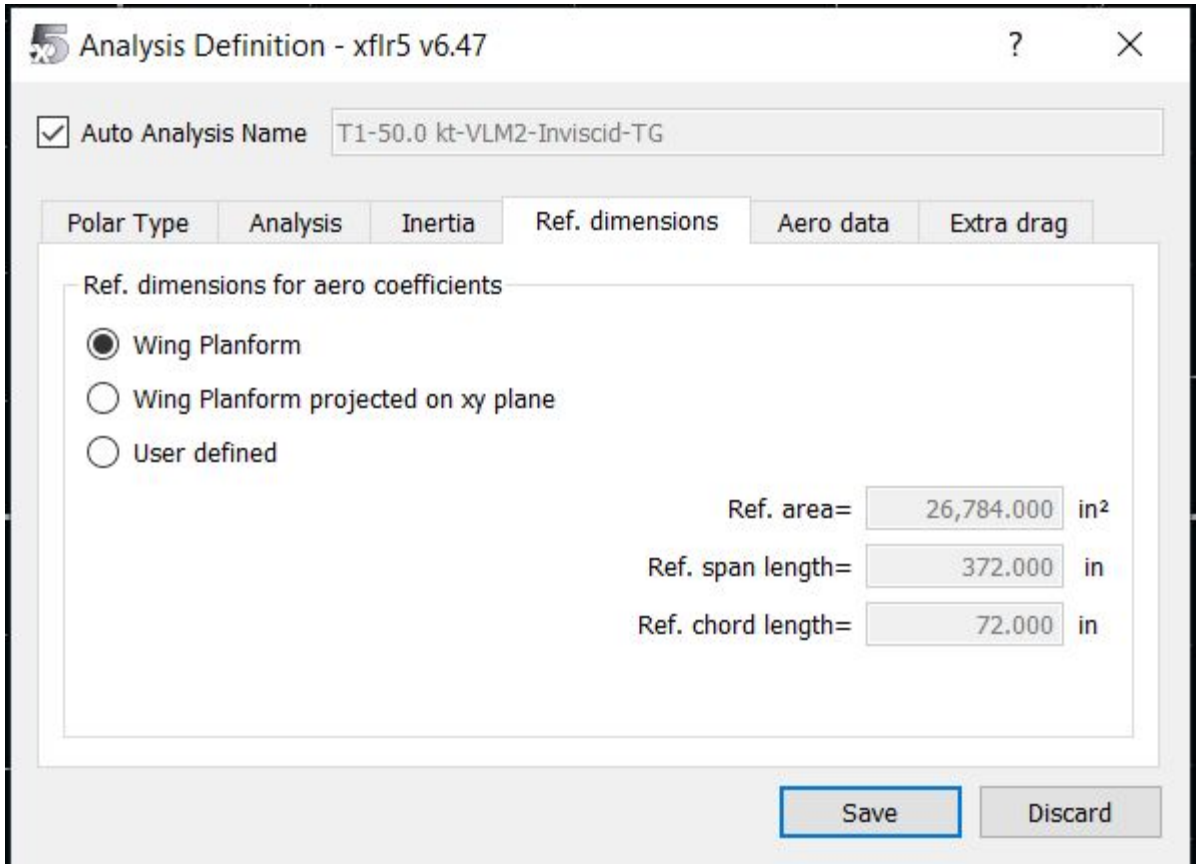
There will inevitably be sideslip, and we want it to take into account the tail section

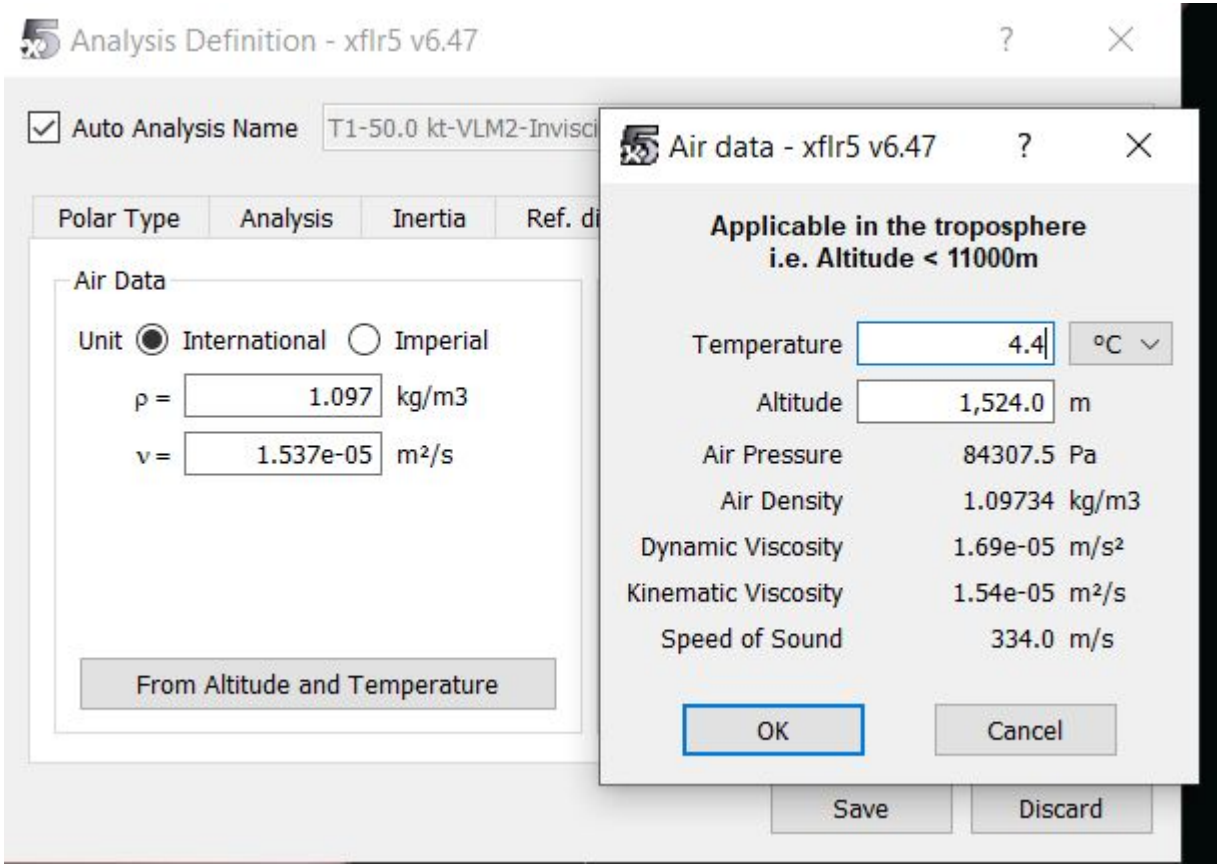
I'm actually not sure why no "viscous" but it keeps giving us errors if we do check the box

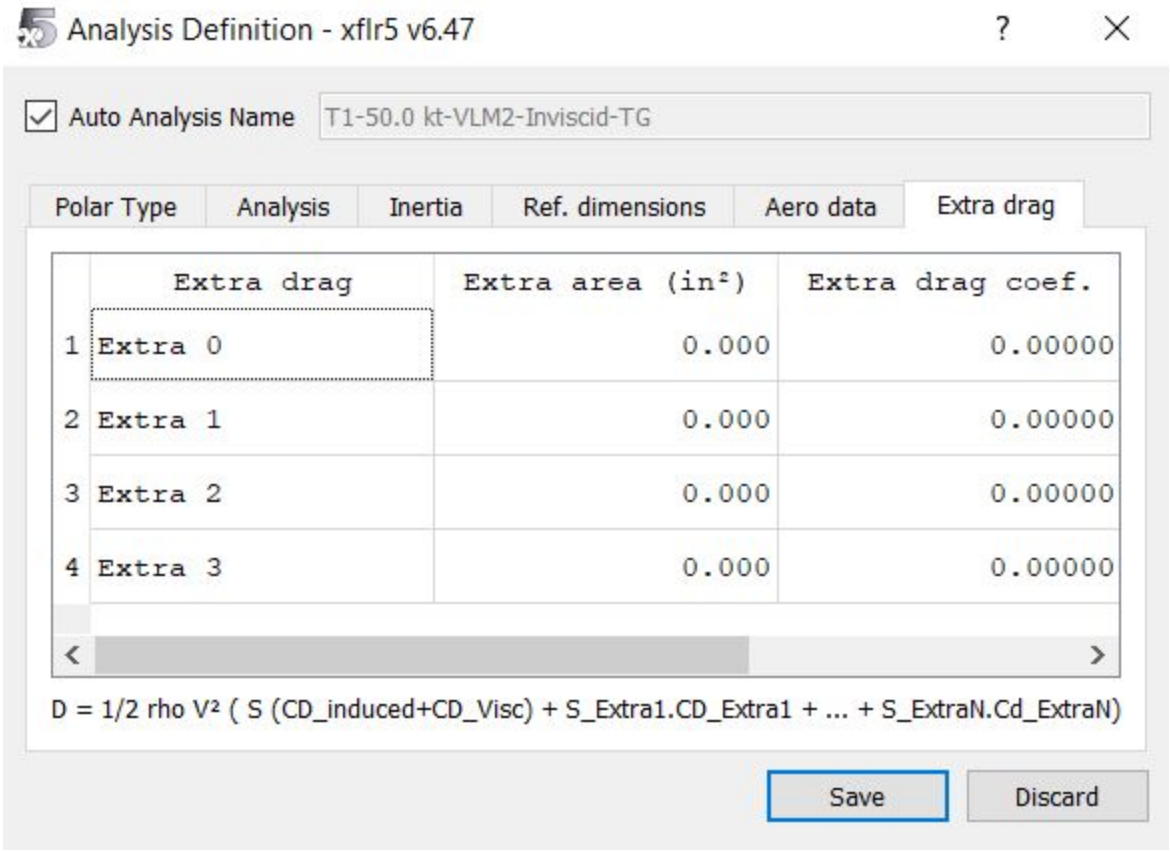


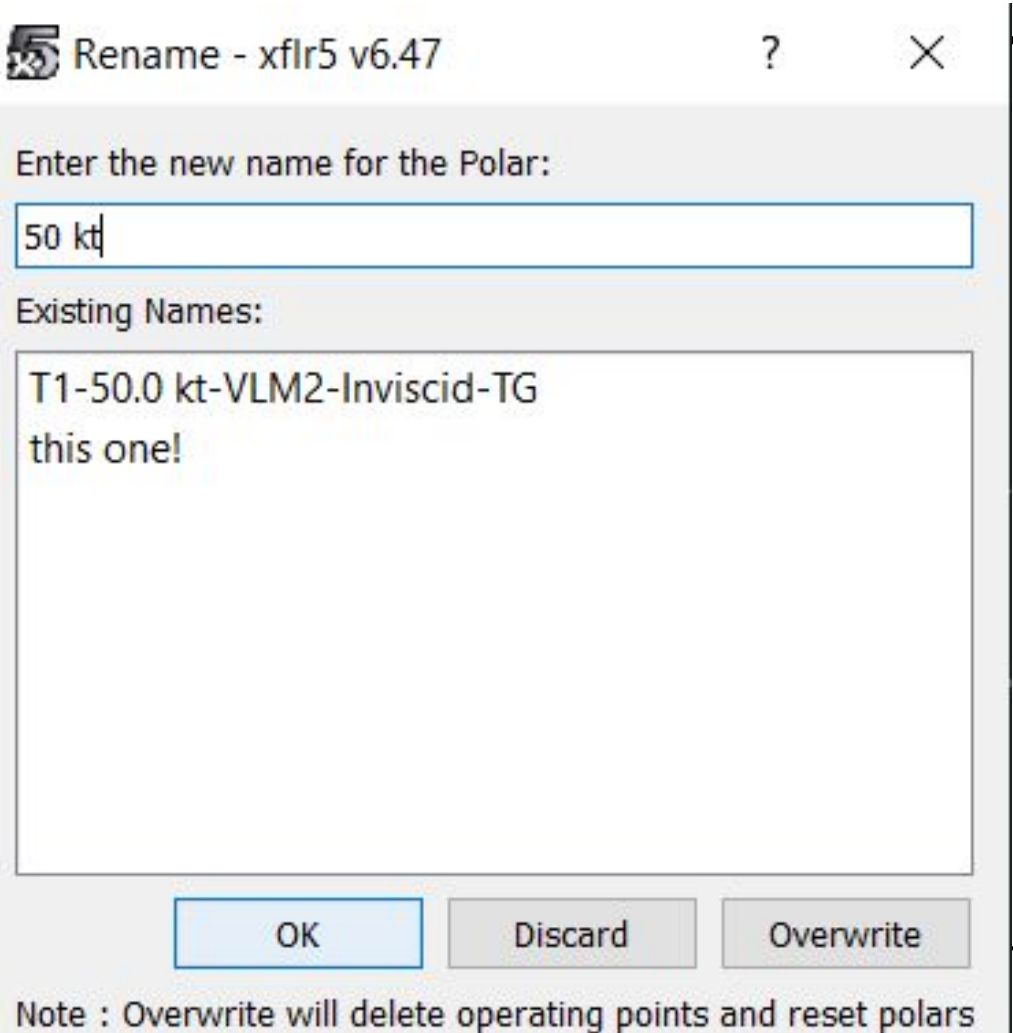

Analysis Definition - xflr5 v6.47
Auto Analysis Name
T1-50.0 kt-VLM2-Inviscid-TG
Polar Type
Analysis
Inertia
Ref. dimensions
Aero data
Extra drag
Inertia properties
Use plane inertia
Plane Mass = 508.000 lb
X_CoG = -5.917 in
Z_CoG = -21.701 in
Save
Discard

Basically saying the plane is 3D




Analysis Definition - xflr5 v6.47
Auto Analysis Name
T1-50.0 kt-VLM2-Inviscl
Polar Type
Analysis
Inertia
Ref. di
Air Data
Unit
International
Imperial
ρ =
1.097
kg/m3
ν =
1.537e-05
m²/s
From Altitude and Temperature
Save
Discard
Air data - xflr5 v6.47
Applicable in the troposphere
i.e. Altitude < 11000m
Temperature
4.4
°C
Altitude
1,524.0
m
Air Pressure
84307.5 Pa
Air Density
1.09734 kg/m3
Dynamic Viscosity
1.69e-05 m/s²
Kinematic Viscosity
1.54e-05 m²/s
Speed of Sound
334.0 m/s
OK
Cancel


Analysis Definition - xflr5 v6.47
Auto Analysis Name
T1-50.0 kt-VLM2-Inviscid-TG
Polar Type
Analysis
Inertia
Ref. dimensions
Aero data
Extra drag
Extra drag
Extra area (in²)
Extra drag coef.
1 Extra 0 0.000 0.00000
2 Extra 1 0.000 0.00000
3 Extra 2 0.000 0.00000
4 Extra 3 0.000 0.00000
D = 1/2 rho V² (S (CD_induced+CD_Visc) + S_Extra1.CD_Extra1 + ... + S_ExtraN.Cd_ExtraN)
Save
Discard

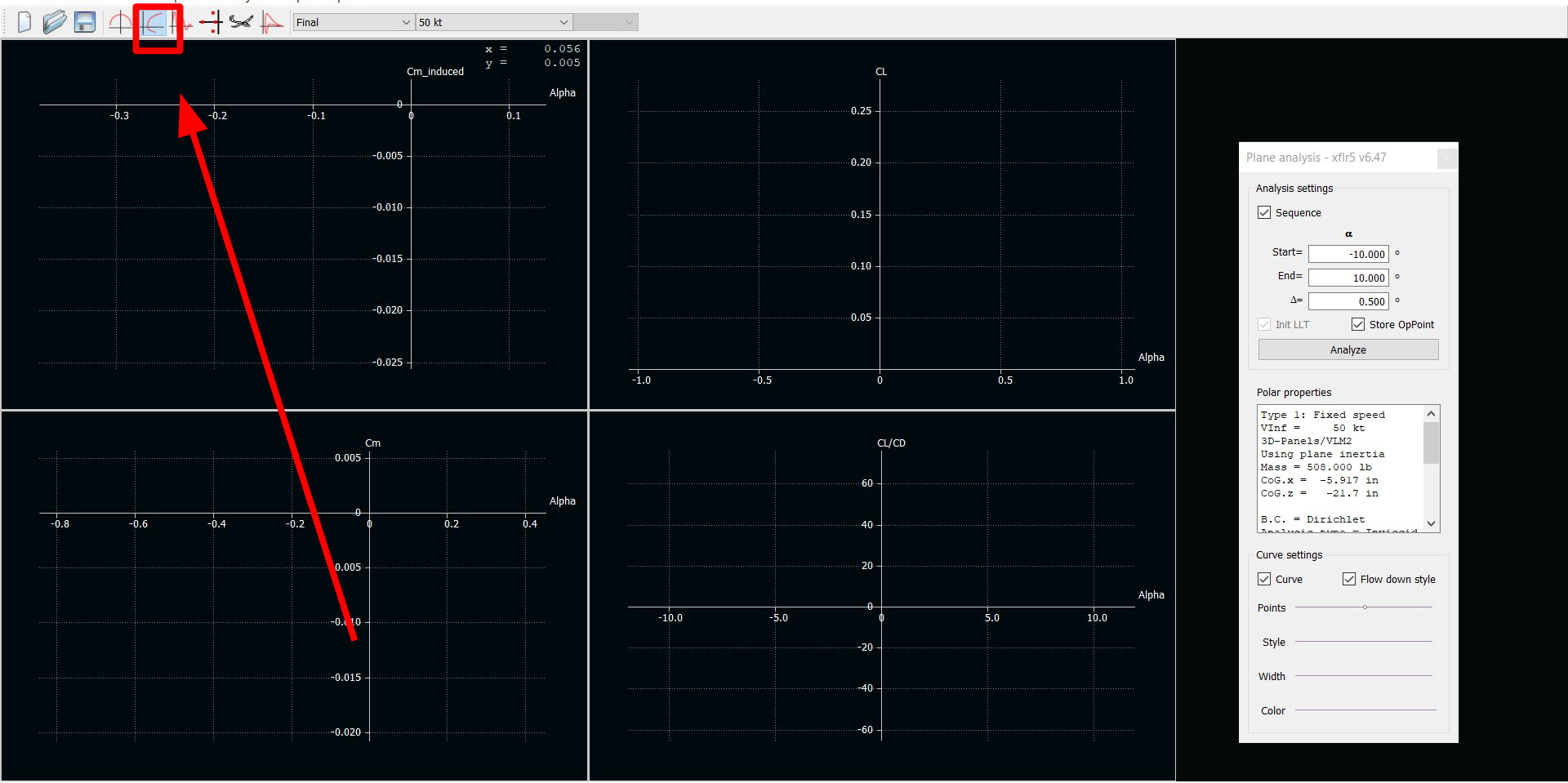


Hit “ok” then save!!!

Running an Analysis

xflr5 v6.47

File View Plane Polars OpPoint Analysis Graphs Options ?



Plane analysis - xflr5 v6.47

Analysis settings

Sequence

α

Start= -10.000 °

End= 10.000 °

Δ= 0.500 °

Init LLT Store OpPoint

Analyze

Polar properties

```
Type 1: Fixed speed
VInf =      50 kt
3D-Panels/VLM2
Using plane inertia
Mass = 508.000 lb
CoG.x =  -5.917 in
CoG.z =   -21.7 in

B.C. = Dirichlet
```

Curve settings

Curve Flow down style

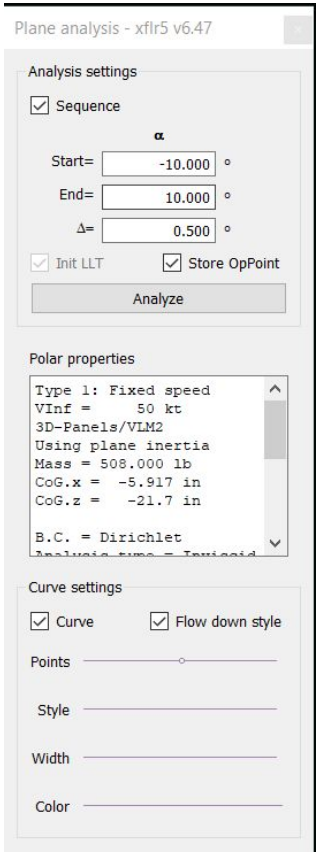
Points

Style

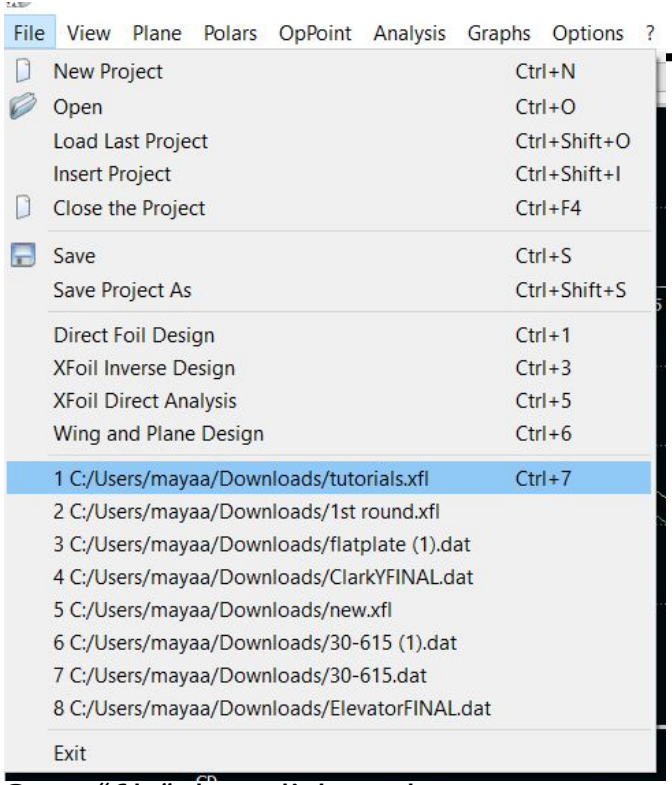
Width

Color

If you don't have this bar:

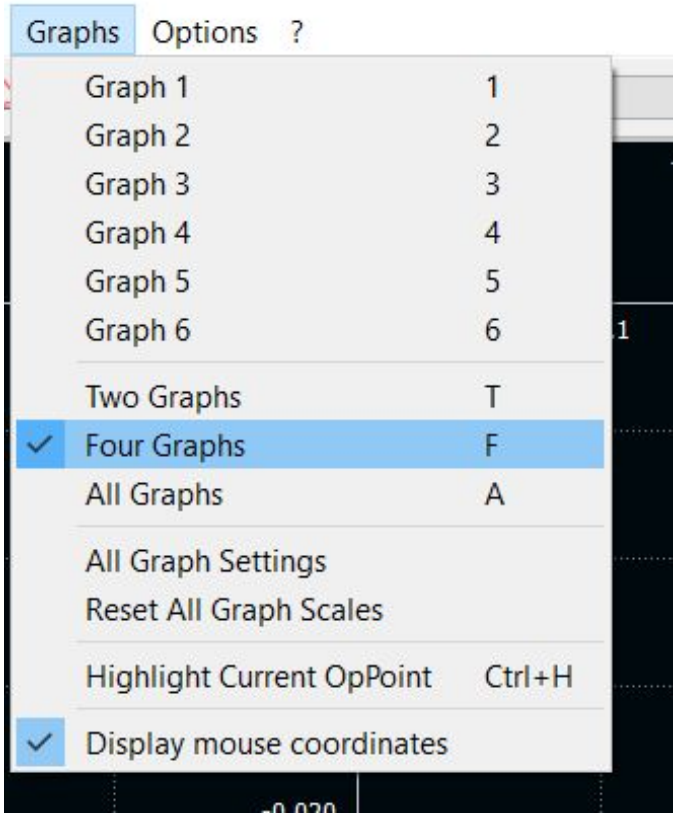


First: hit save!!!

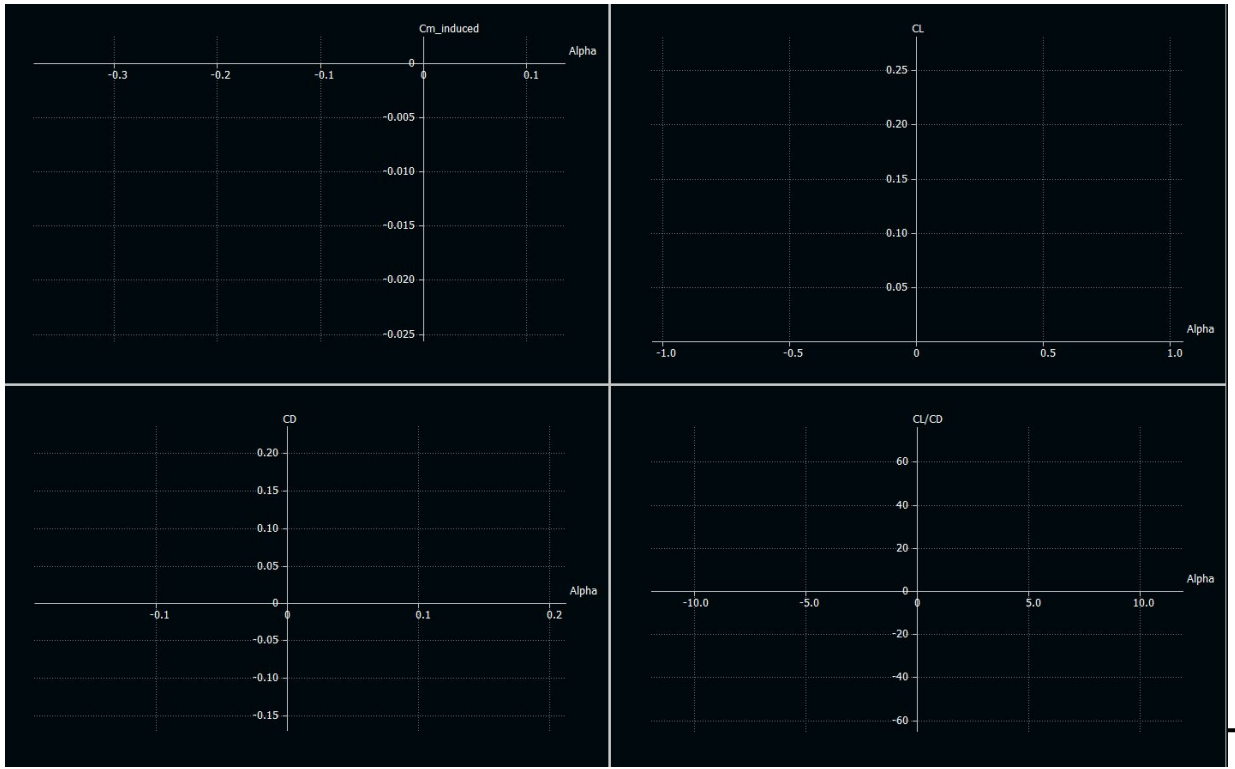


Go to "file" then click on the top one (which should be the one you're working on)

Graphs


Graphs
Options
?
Graph 1 1
Graph 2 2
Graph 3 3
Graph 4 4
Graph 5 5
Graph 6 6
Two Graphs T
Four Graphs F
All Graphs A
All Graph Settings
Reset All Graph Scales
Highlight Current OpPoint Ctrl+H
Display mouse coordinates

You’re gonna want these graphs



Alpha vs Cm_induced

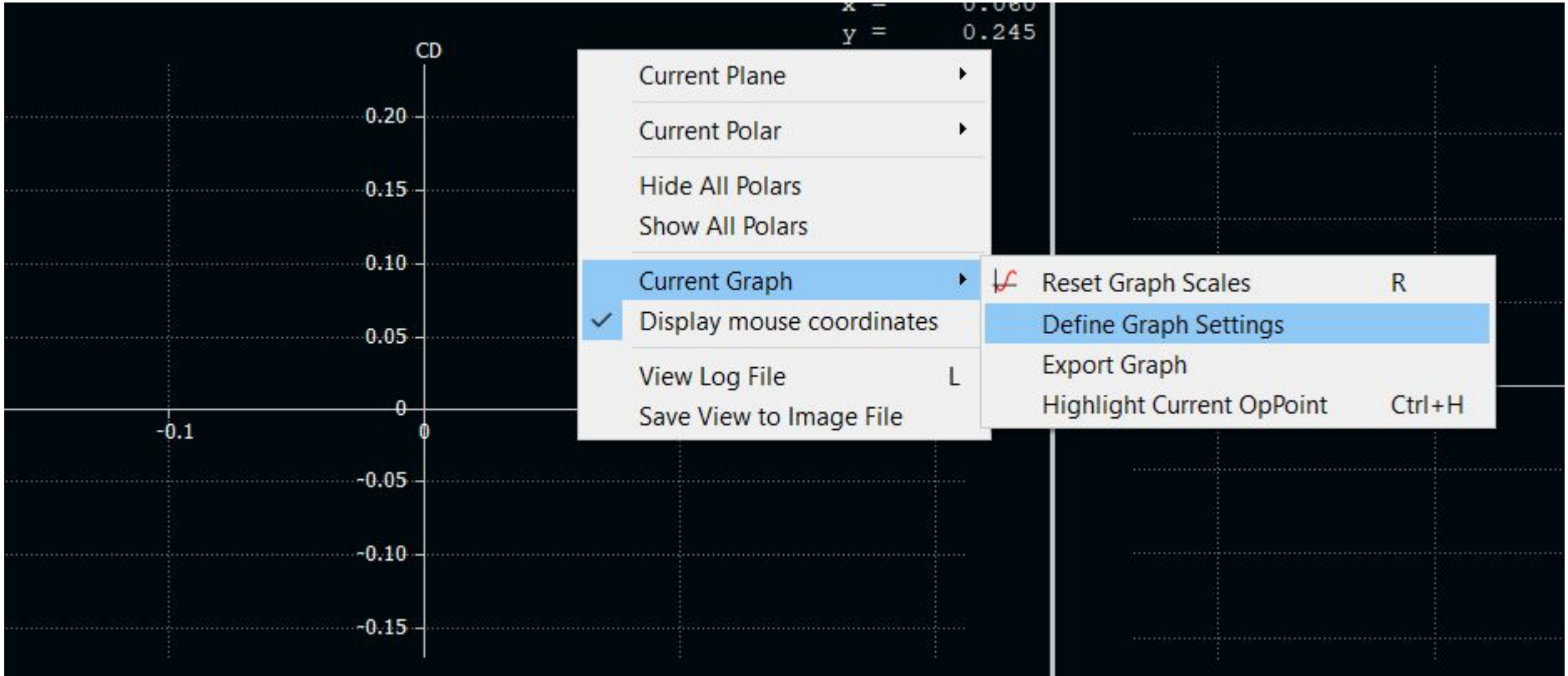
Alpha vs CD

Alpha vs CL

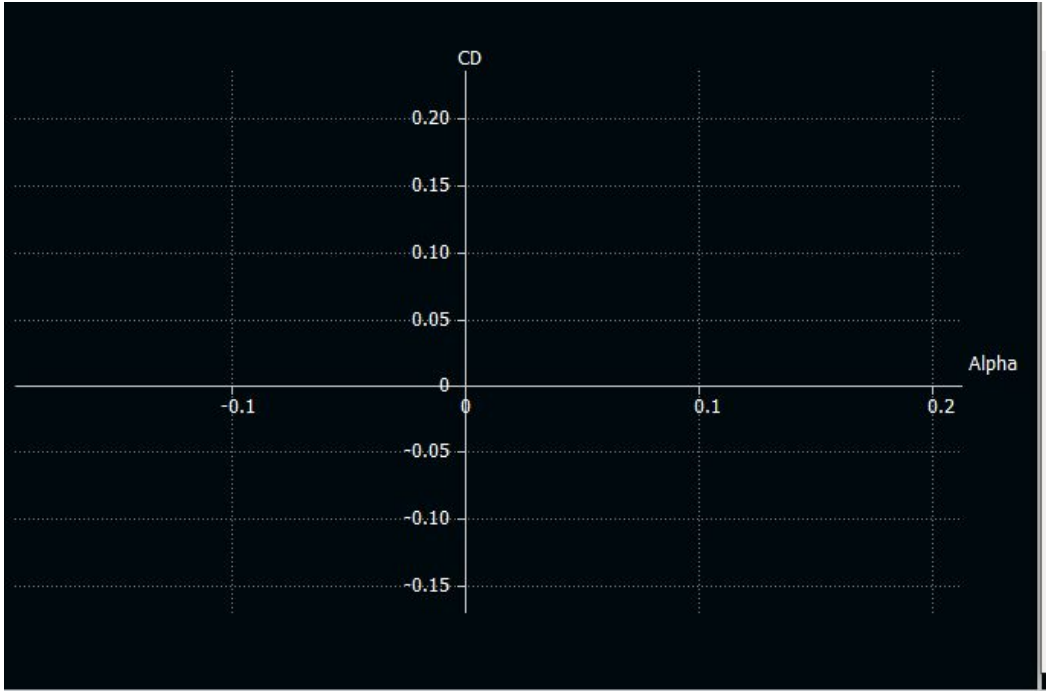
Alpha vs CL/CD

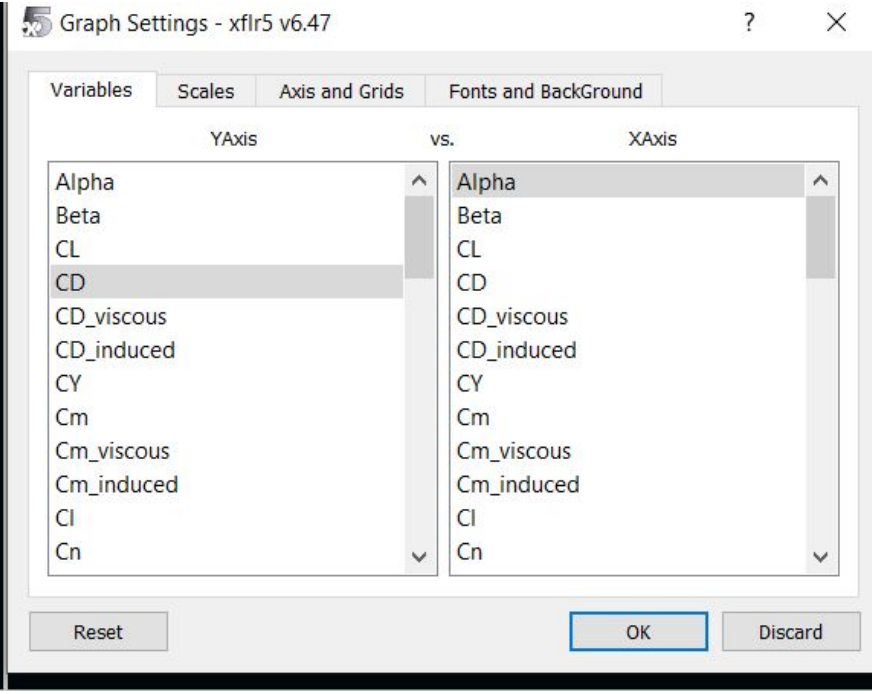
How to get them:

Right Click the graph you want changed

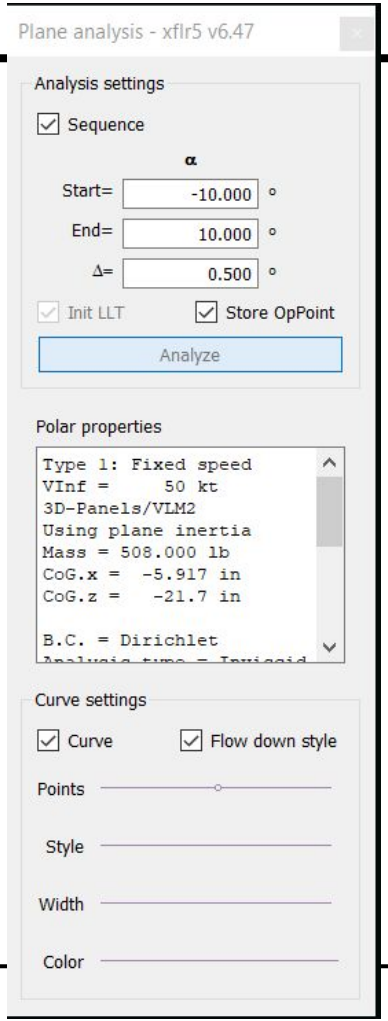


Then you'll get a list

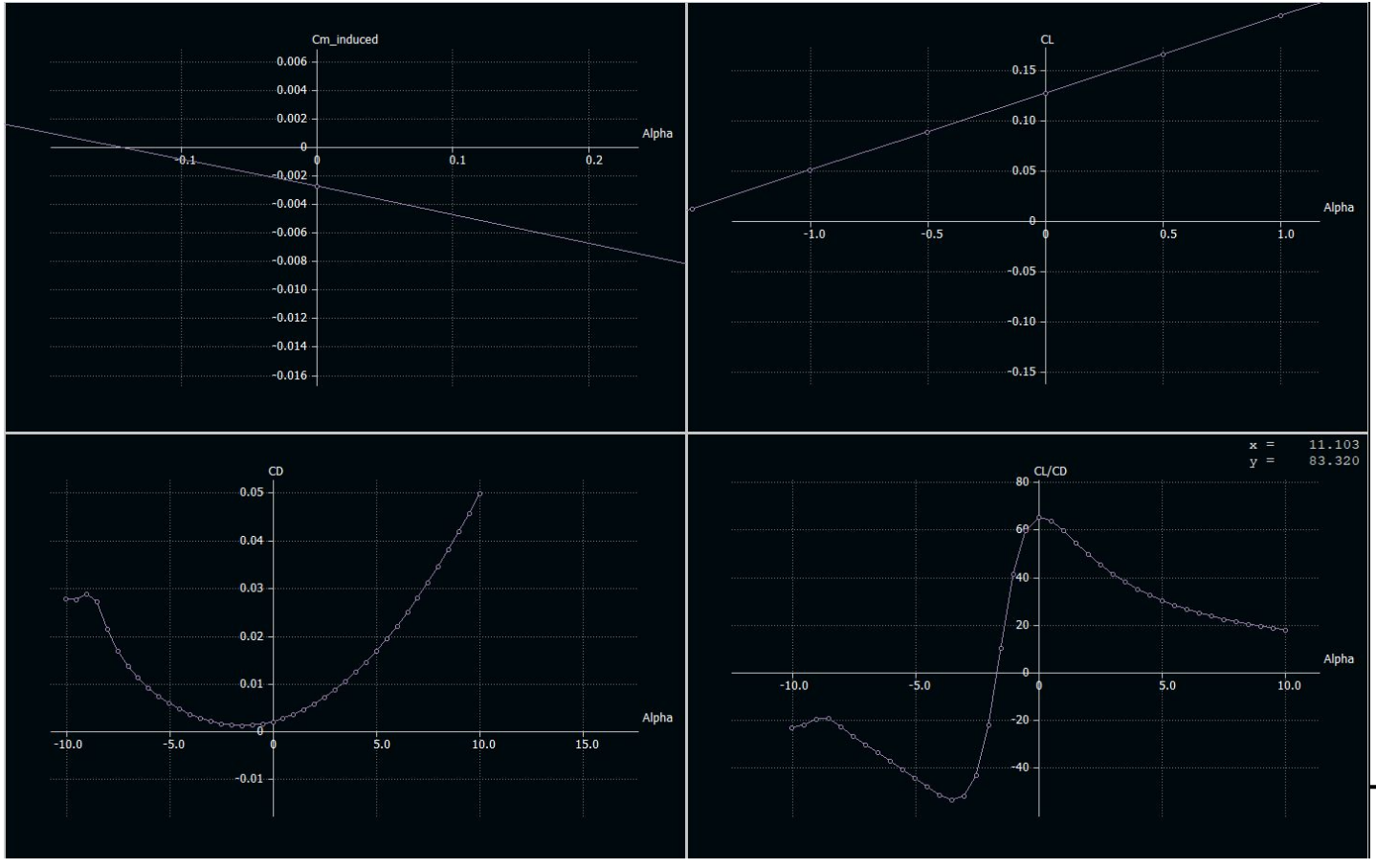




Coolio! Run a sim!

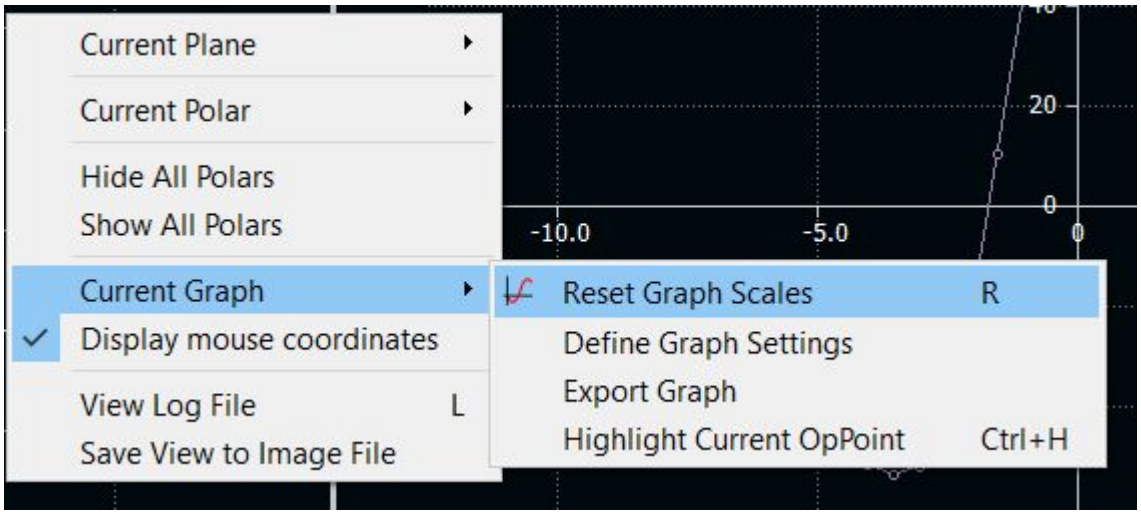


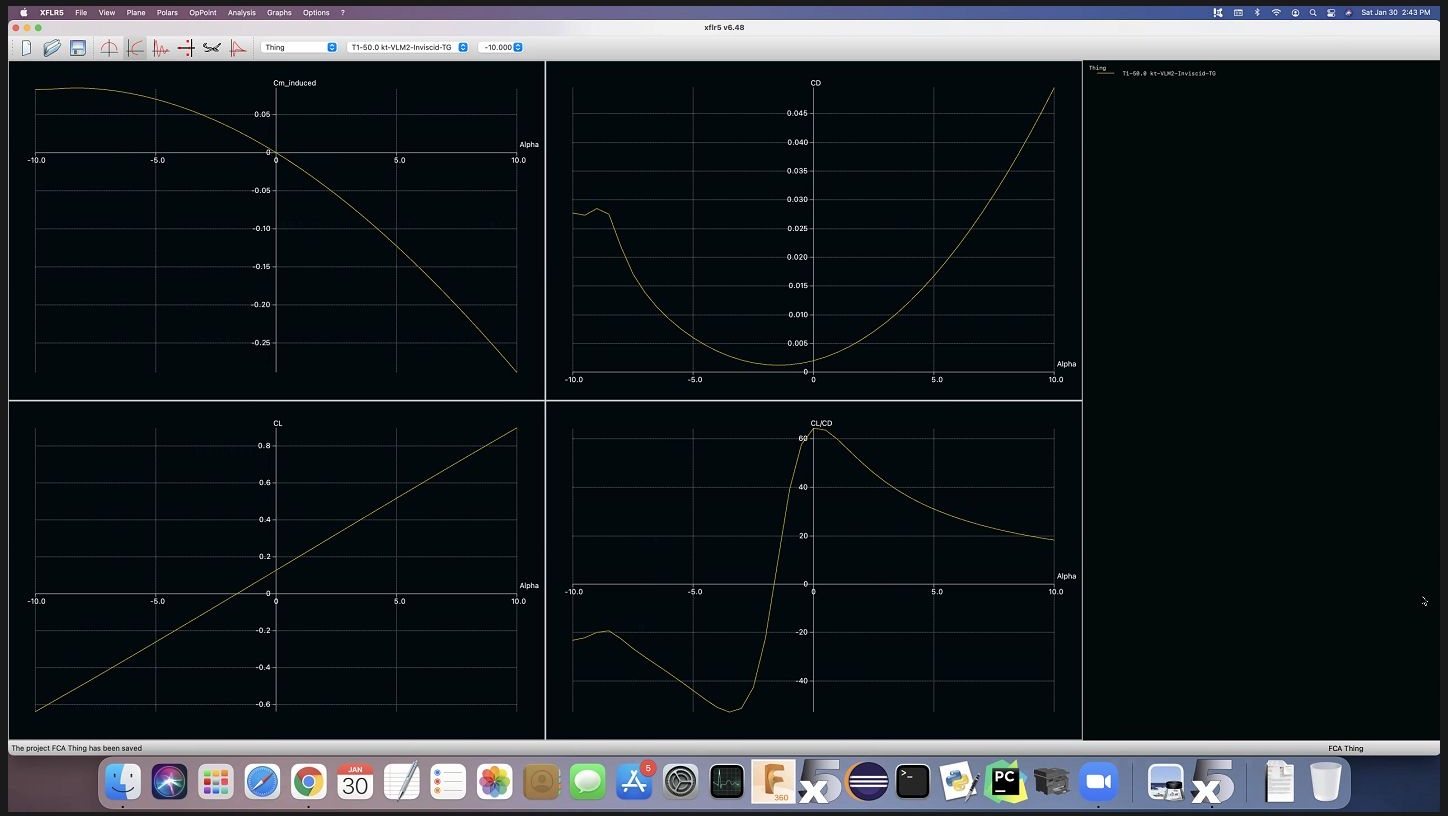
If you did everything correct:



Fixing Scales

Right click:



Thumbs up

Zoom Meeting