Fin Cover Ansys Investigation

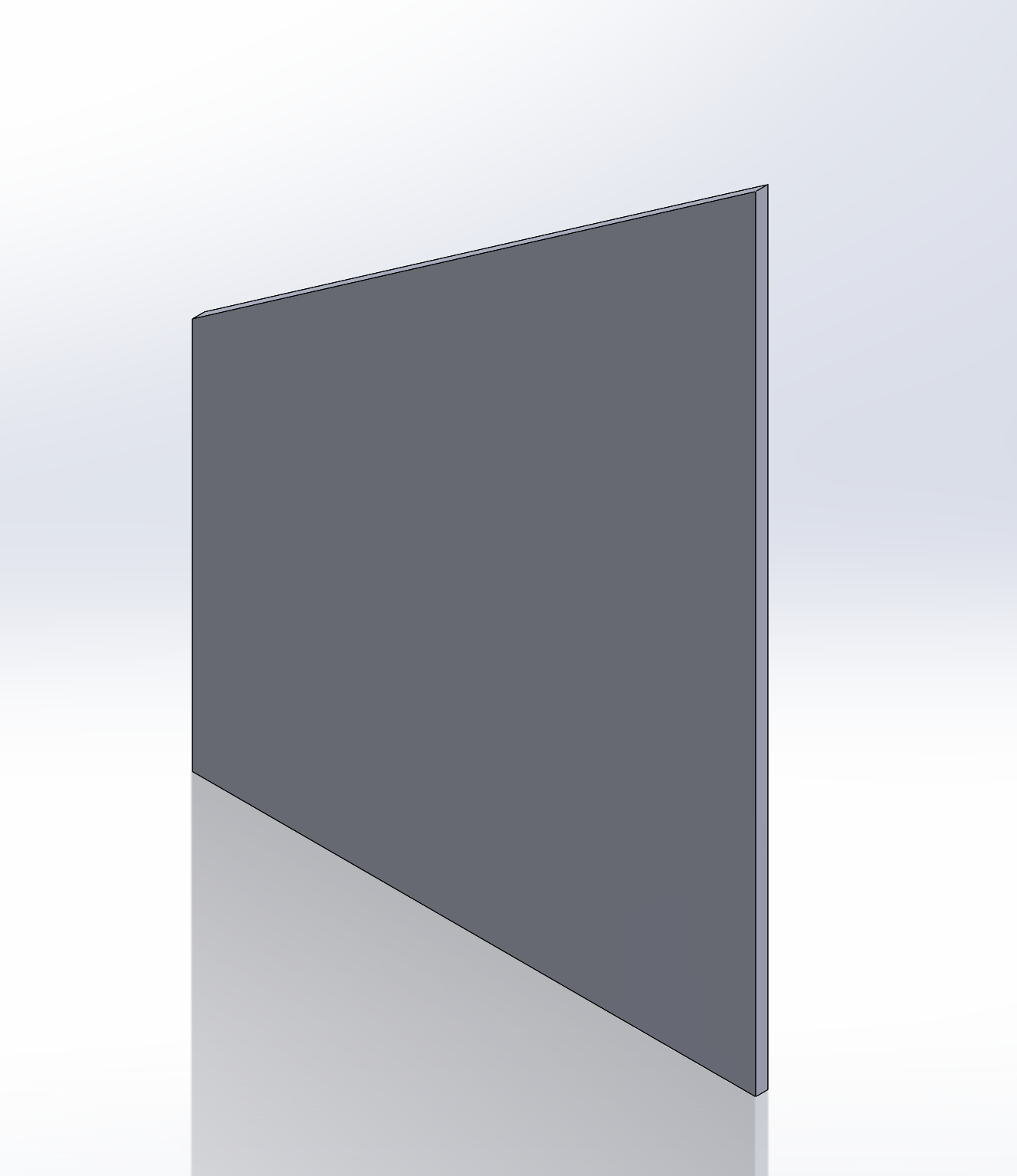
1. Set-up

Different fin covers were tested using ansys fluent density based solver. Domain was constructed such that it extended 300 mm behind the back edge of the fin, 200 mm in front of the fin, and 125 mm from the other edges. The bottom of the domain wall lines up with the bottom edge of the fin. First to higher order blending was used to attempt to damp out oscillations in the continuity residuals. Automatic refinement was used to refine high pressure gradient cells every 100 iterations. Solutions are converged when continuity residual reach 1 x 10-6.

Shapes tested:

* Bare Fin
* Current Airfoil
* Current Airfoil with some cut off the trailing edge
* Current Airfoil with most cut off the trailing edge
* Current Airfoil with almost all of trailing edge cut off
* Smaller Airfoil that does not cover the entire fin

1. Bare Fin Results



Geometry

Volume: 0 in3

A blue and orange square

Description automatically generated

A blue rectangular object with a dark background

Description automatically generated

Velocity Contour Plot

Drag Force: 5.8805059 N

1. Current Airfoil Results

A grey rectangular object with a white background

Description automatically generated

Geometry

Volume: 7.41 in3

A rainbow colored rectangular object

Description automatically generated with medium confidence

A red box with a grey stripe

Description automatically generated with medium confidence

Velocity Contour Plot

Drag Force: 4.1975856 N

1. Current Airfoil Some Cut

A grey rectangular object with a shadow

Description automatically generated

Geometry

Volume: 7.08 in3

Badly behaved for some reason: A graph of colorful lines

Description automatically generated

Residuals Plot

A colorful object with a black line

Description automatically generated with medium confidence

A blue and yellow rectangle with a grey strip

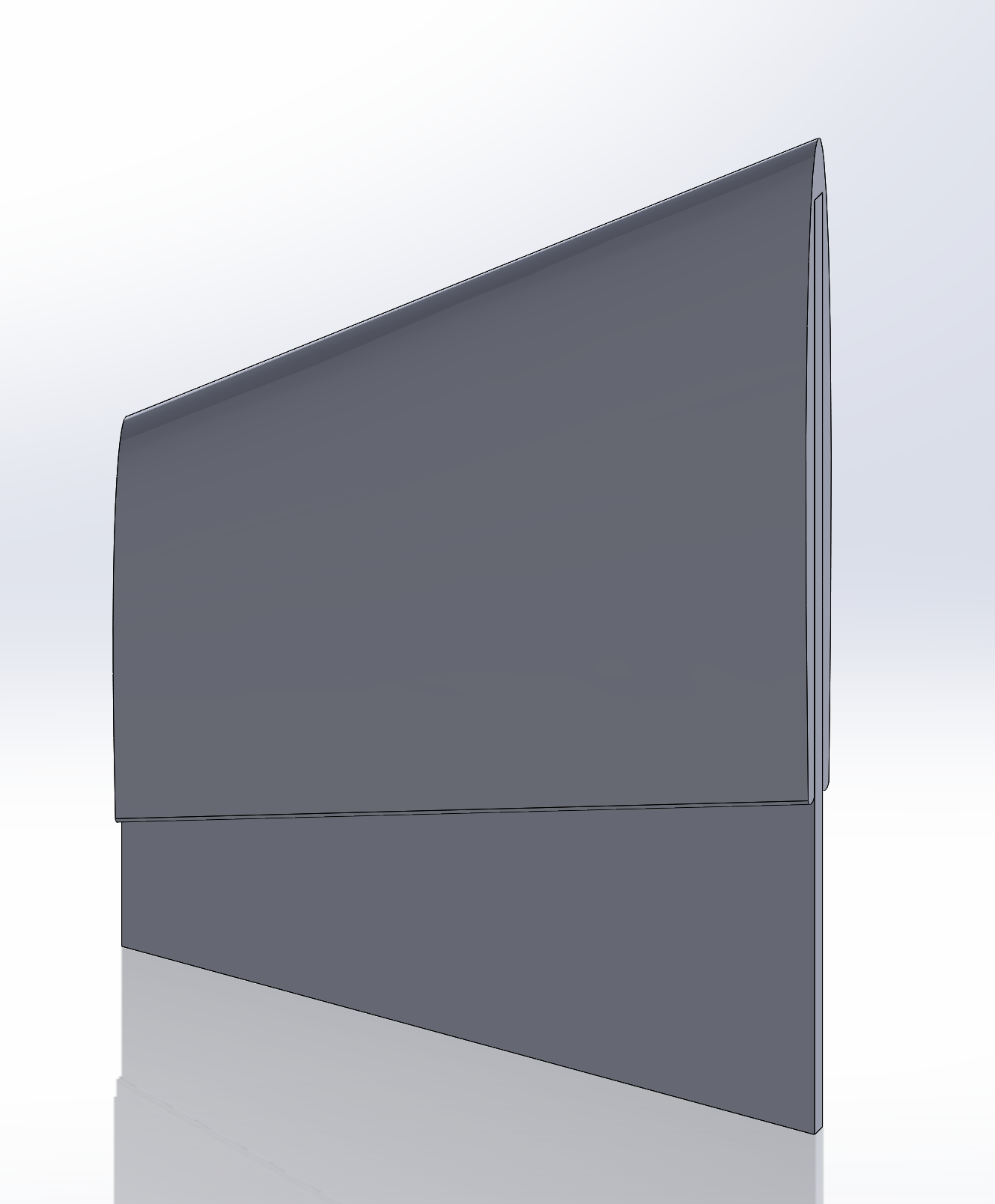
Description automatically generated

Velocity Contour Plot

Drag Force: 4.2432439 N

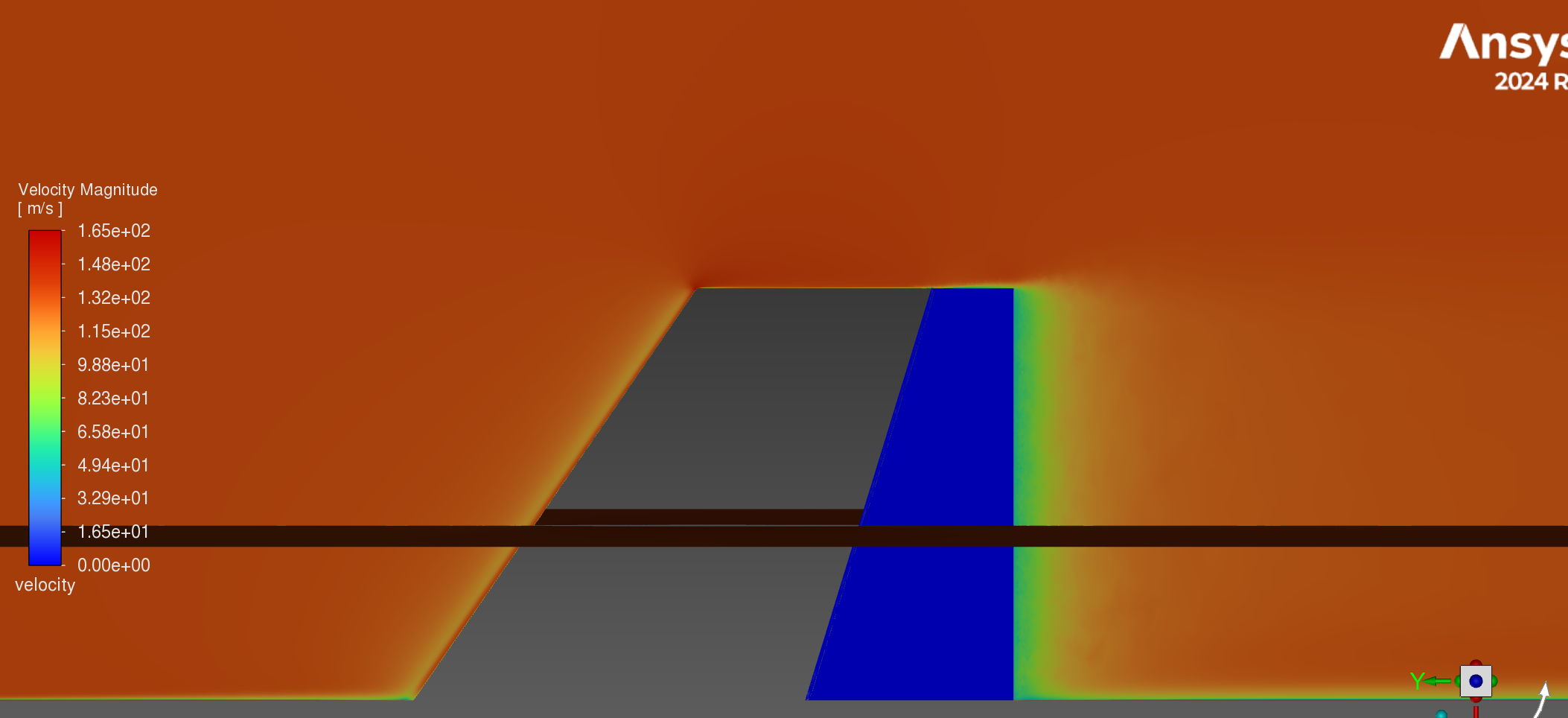
Even though this did not converge like the others, the result makes sense.

1. Current Airfoil Most Cut



Geometry

Volume: 6.09 in3



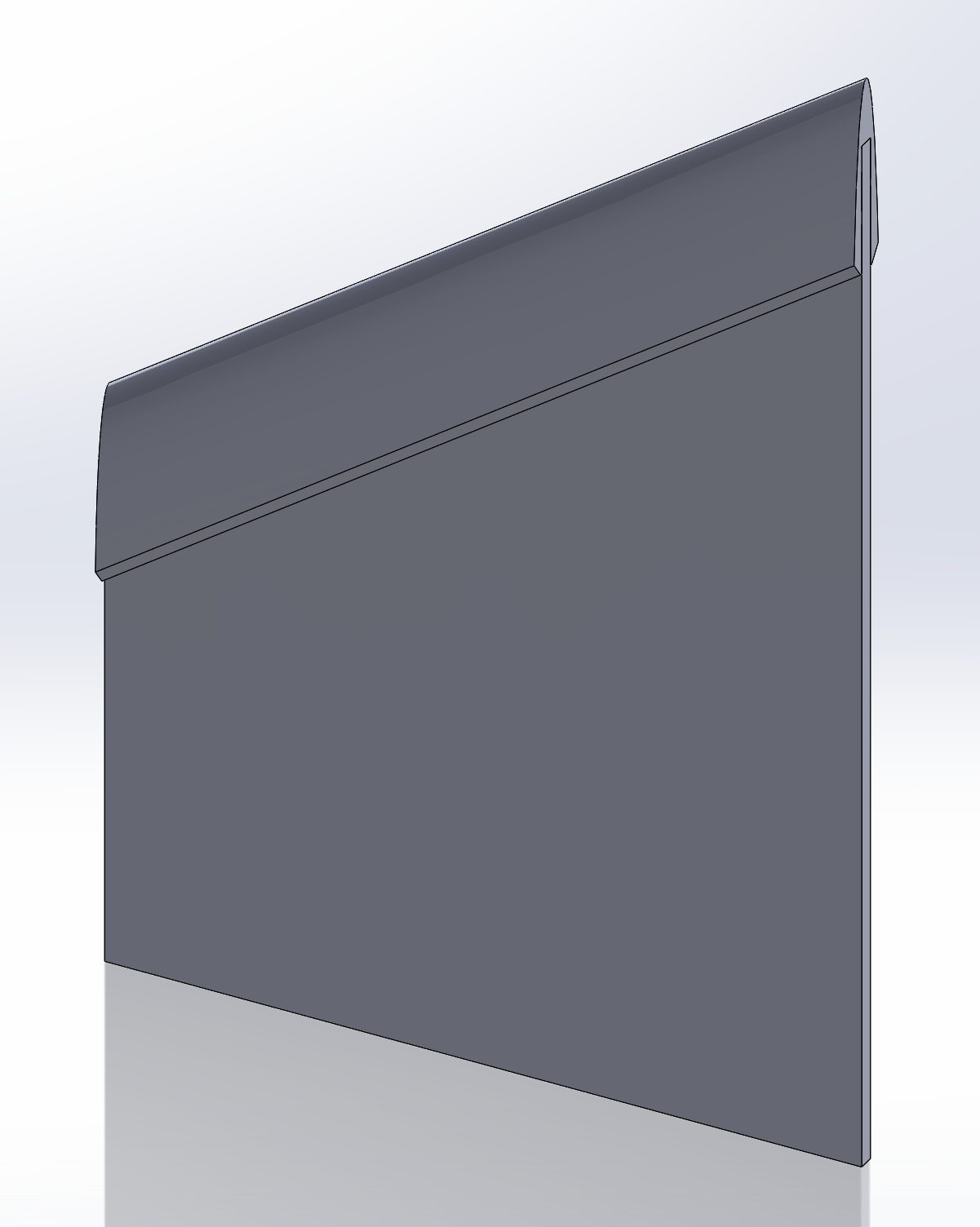
A blue and orange rectangle

Description automatically generated

Velocity Contour Plot

Drag Force: 4.8751383 N

1. Current Airfoil All Cut



Geometry

Volume: 1.64 in3

A blue and orange square

Description automatically generatedA blue rectangle with green and blue squares

Description automatically generated

Velocity Contour Plot

Drag Force: 6.0303478 N

1. Smaller Airfoil

A grey rectangular object with a shadow

Description automatically generated

Geometry

Volume: 4.81 in3

A blue and grey rectangular object with a black line

Description automatically generated

A blue and orange rectangle

Description automatically generated

Velocity Contour Plot

Drag Force: 4.2829938 N

1. Compiled Results

|  |  |  |
| --- | --- | --- |
| Shape | Drag Force (N) | Additional Volume (in3) |
| No Airfoil | 5.8805059 | 0.00 |
| Current Airfoil | 4.1975856 | 7.41 |
| Current Airfoil with Some Cut | 4.2432439 | 7.08 |
| Current Airfoil with Most Cut | 4.8751383 | 6.09 |
| Current Airfoil with All Cut | 6.0303478 | 1.64 |
| Smaller Airfoil | 4.2829938 | 4.81 |

Notes: Results potentially highly dependent on value used for first-to-higher-order blending. Changing from 90% second-order to 80% second-order changed drag on certain fin by 0.5 N. All results are from 90% blending, so should be comparable.