

# A Tutorial for Gota4Airfoil 2025

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Gota4Airfoils 2025

Computational Fluid Dynamics Tool for Airfoils

CFD program for airfoils in two-dimensional pressureless air-mixed droplet flow

**Flight Conditions**

Mean Volume Diameter (meter):

Liquid Water Contents (g/m<sup>3</sup>):

**Numerical Modeling**

Alpha ( $1 \leq \alpha \leq 1.4$ , default:  $\alpha = 1.2$ ):

beta ( $0.6 \leq \beta \leq 1.0$ , default:  $\beta = 1.0$ ):

**Solver**

CFL ( $0 < CFL \leq 0.1$ ):

Convergence Criteria (Density):

Number of Iterations:

Reporting Interval (ex: 10,20,...):

Note: The files obtained by Vento4Airfoils 2025 must be moved to folders in Gota4Airfoils 2025.  
- See the manual for instructions -

**Technical Descriptions**

- Grid & inflow conditions imported from air solver

- HLLC solver

- 1st order accuracy

- Parameter  $\alpha$  for droplet impingement areas

- Parameter  $\beta$  for droplet non-impingement areas

- Local time marching (Steady state)

- 3rd stage Runge-Kutta explicit time step

- Tecplot style for visualization

- Non-dimensional chord length for collection efficiency

For more information, see our article published in AIAA Journal. DOI: 10.2514/1.J065693

**Developers & Contributors**

CFD Solver & Graphic User Interface: S.K. Jung

Validations: E.H. Tukairim

Generate input file

Run

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# 1 Introduction

This program is fully tested on Ubuntu 24.04.2. The technical descriptions for this program are briefly shown in the Graphic User Interface windows. To download this program, access url: <https://github.com/sungki-jung/CFD4Airfoils>, then download the following folders and files”

- folders: bin, \_internal, outputs
- files: GUI

# 2 Preparations

Once you downloaded the folders and files, put the files and folders into any place in your computer. Then, find out **GUI\_Drop\_2025** as shown in fig. 2.

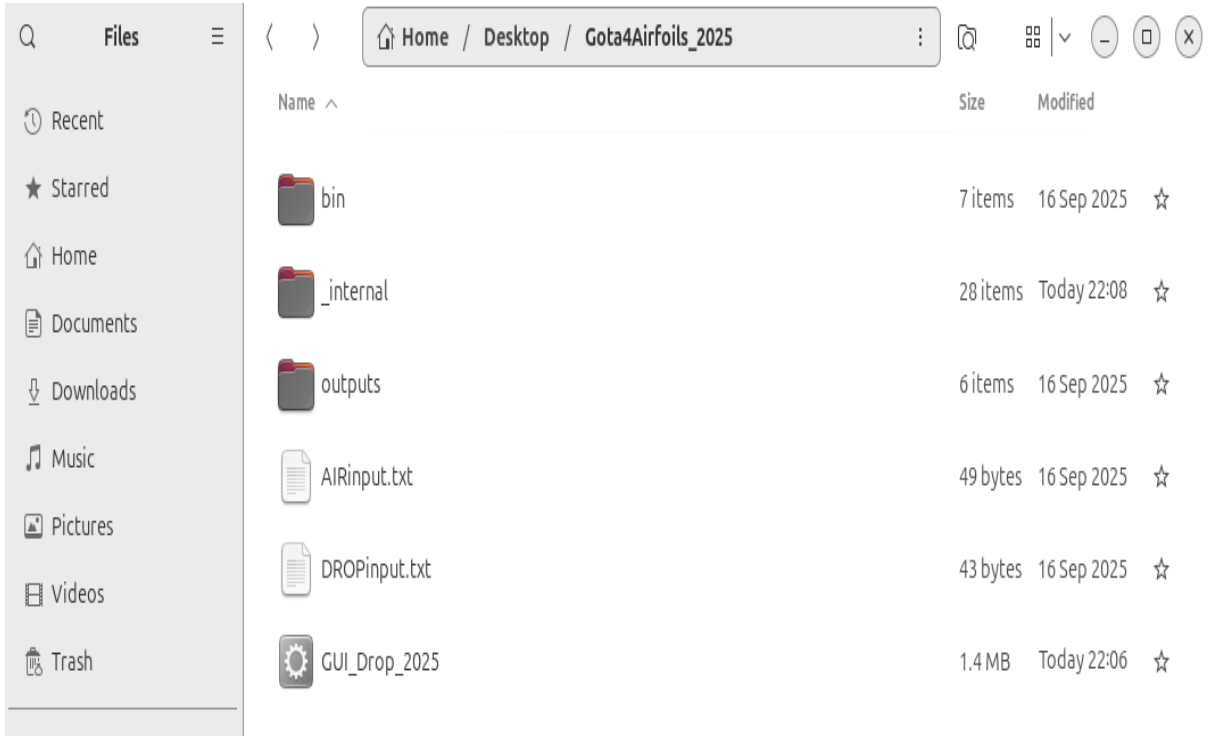


Figure 1: Program files and folders.

Firstly, the airflow solutions and grid files must be moved for droplet simulations. Thus, follow the instructions below,

- Move two files ('MESH\_INDEX.txt' and 'NSSOLVER.TXT') in **bin** folder of **Vento4Airfoils 2025** to **bin** folder of **Gota4Airfoils 2025**.
- As a same manner, move two files ('NACA4412.AIRSOL' and 'NACA4412.GRID') in **outputs** folder of **Vento4Airfoils 2025** to **outputs** folder of **Gota4Airfoils 2025**.
- Lastly, move one file ('AIRinput.txt') in **Vento4Airfoils 2025** folder to **Gota4Airfoils 2025** folder.

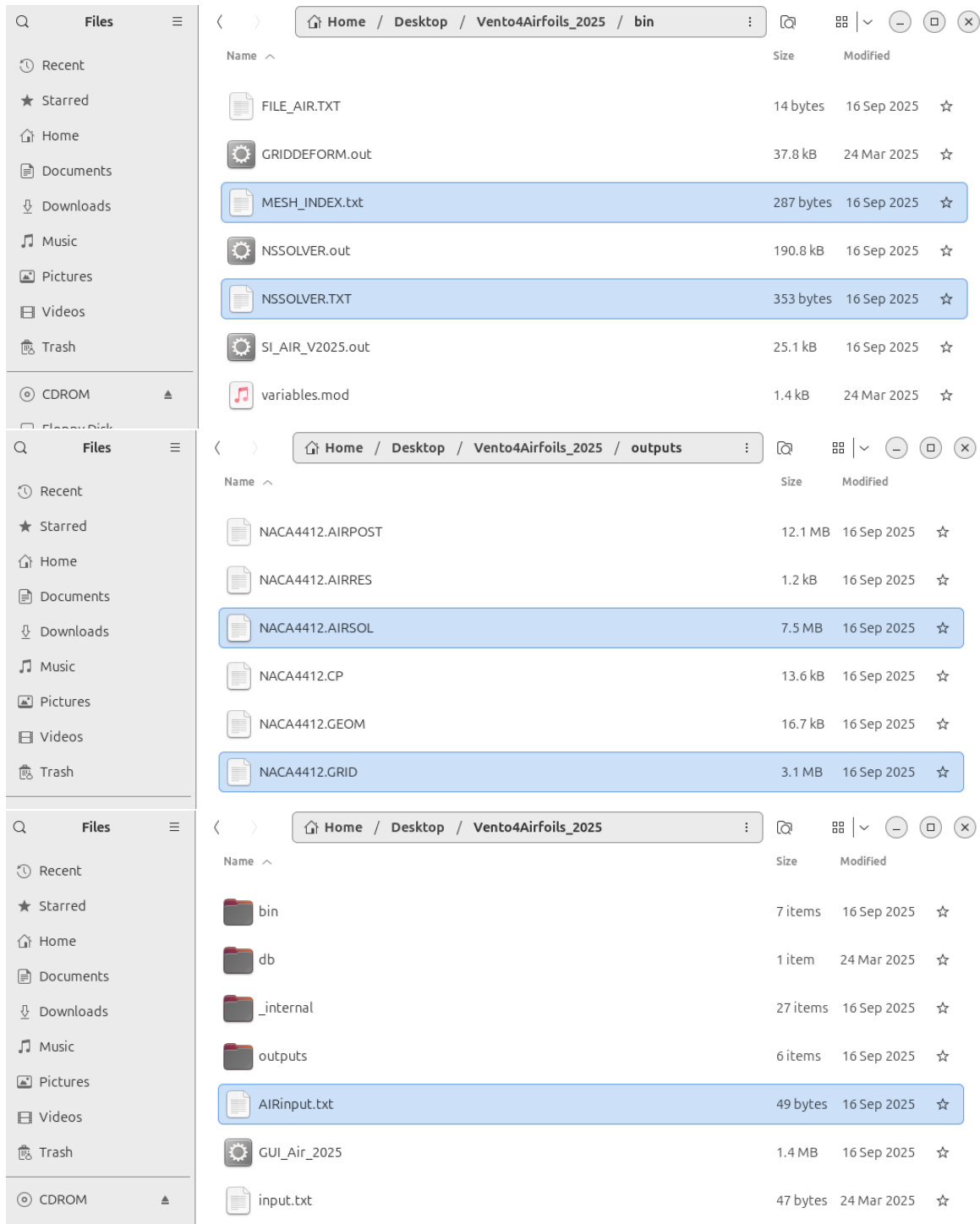


Figure 2: File movements.

### 3 GUI for Gota4Airfoil 2025

Open the terminal in **Gota4Airfoil2025** folder as shown in fig. 3. The terminal windows are shown in fig. 4. Execute the **GUI** file (type `./GUI.Drop_2025` on the terminal as shown in fig. 4 then hit "enter" on your keyboard).

Insert all parameters as shown in fig. 5. Click an icon, **Generate input file**, then, click an icon, **Run**. Residuals are shown in the terminal windows (fig. 5).

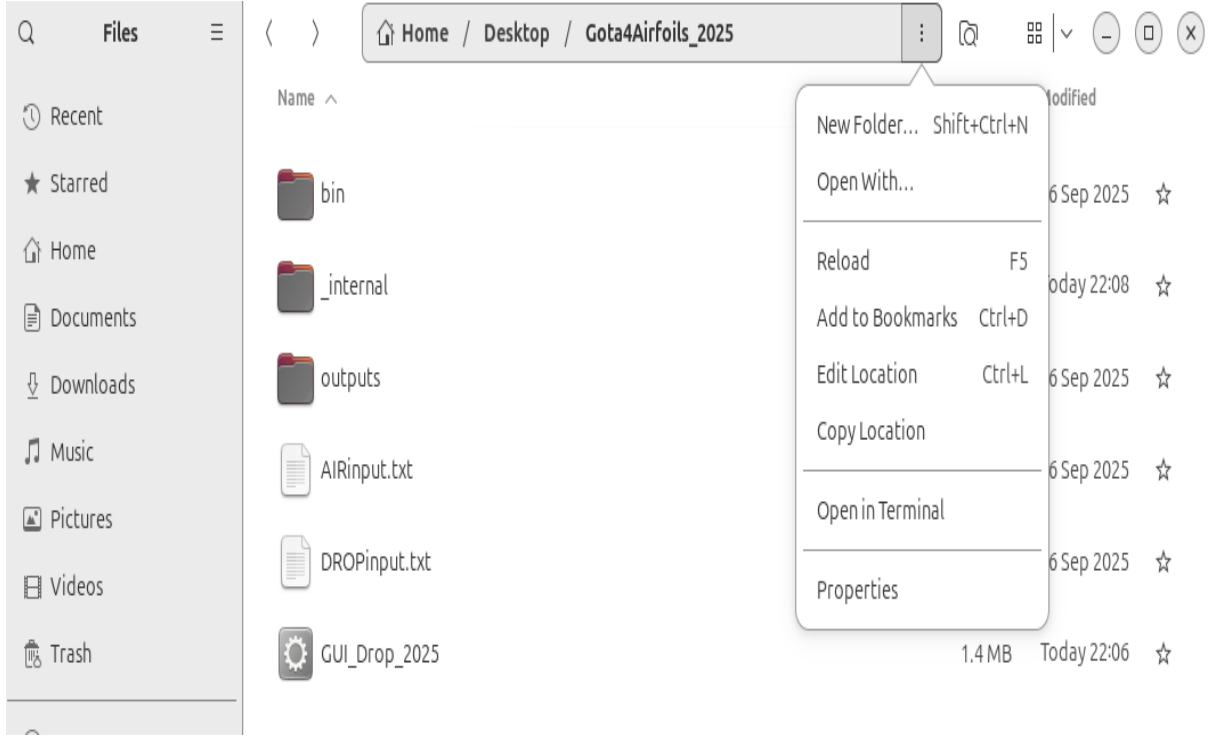


Figure 3: Terminal in **Gota4Airfoil2025** folder.

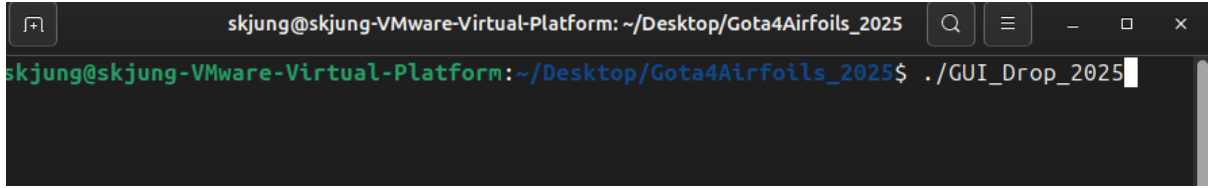


Figure 4: Terminal window.

## 4 Post-processing for Gota4Airfoil 2025

Once all calculations are completed, open **output** folder in **Vento4Airfoil2021** folder as shown in fig. 6. Extensions for each file in **output** folder denote the characteristics of outputs.

- .CE: Collection Efficiency
- .DROPRES: Residuals during CFD calculations
- .DROPPOST: Post-processing
- .DROPSOL: Primitive variables of droplet flow

### 4.1 Preparation for Visualization

For visualization of CFD simulations, install a visualization tool, **Paraview** that is a free open-source program, on your computer. To install **Paraview**, see url: <https://jungs-odds-and-ends.blogspot.com/2021/05/paraview-for-windows.html> or you can just type “sudo apt install paraview” on the terminal of Ubuntu to install the Paraview program.

### 4.2 Visualization Using Paraview

Once **Paraview** is installed, open **Paraview** program (type paraview on the terminal). Then follow figs. 7 to 9. Note that .DROPPOST file includes all information for CFD visualization. .DROPPOST

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```

skjung@skjung-VMware-Virtual-Platform: ~/Desktop/Gota4Airfoils_2025
skjung@skjung-VMware-Virtual-Platform: ~/Desktop/Gota4Airfoils_2025$ ./GUI_Drop_2025
ITERATIONS, DENSITY, U-VELOCITY, V-VELOCITY, RES, CE
10  2.7195029169591485E-007  5.6123558387189416E-002  4.9263051872313314E-002  7.5189299851728537E-010  0.31496277742835316
20  3.0478399674837023E-007  4.5137689500479814E-002  4.0670756294355861E-002  5.5951757534943511E-010  0.30001944043057893
30  3.2934058972140502E-007  3.8426223506925407E-002  3.5173525759788056E-002  4.4513205203871977E-010  0.29191097926078963
40  3.4970317270335179E-007  3.3774967341513522E-002  3.1166340079804650E-002  3.6811228850813923E-010  0.28748323954723048
50  3.6798133661135918E-007  3.0352225424749611E-002  2.8077765334442516E-002  3.1360203456758735E-010  0.28502191462649806
60  3.8479302203453237E-007  2.7728390418979159E-002  2.5611334337638118E-002  2.7326502720602974E-010  0.28358831410892238
70  4.0147309488841014E-007  2.5657117350504213E-002  2.3595573589190379E-002  2.4304956360901947E-010  0.2826606623067070
80  4.1776076000446038E-007  2.3984298406964921E-002  2.1915916534174459E-002  2.1959088107888123E-010  0.28196415122399077
90  4.3412722526794927E-007  2.2610008589719736E-002  2.0494339584998602E-002  2.0116465550861031E-010  0.28131136285537001
100 4.4879349902723314E-007  2.1502577057474211E-002  1.9274766905080117E-002  1.8600567932111855E-010  0.27680750757849532

```

Figure 5: Example for all parameters and Run.

file was written in Tecplot format.

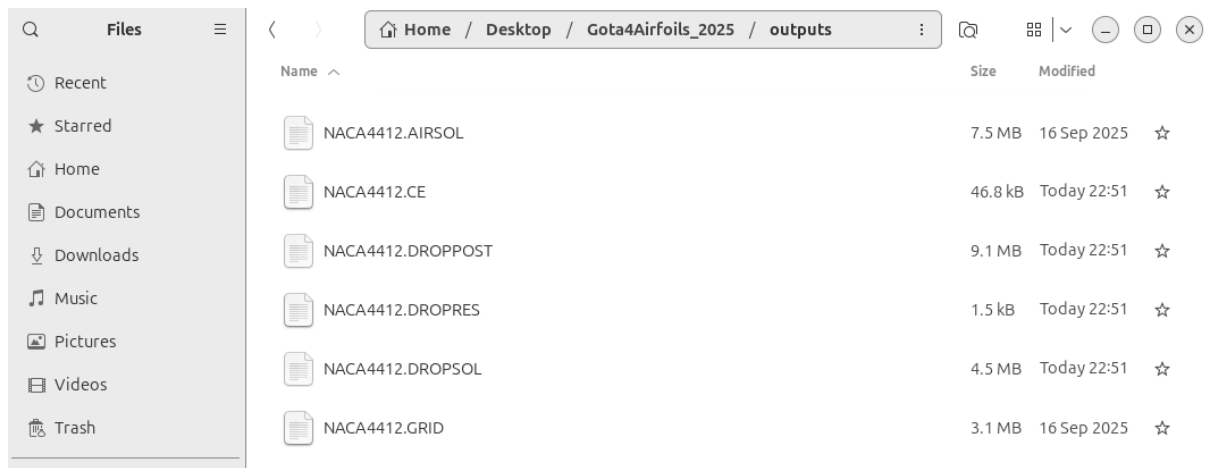


Figure 6: Outputs.

After you check the Tecplot format as shown in fig. 7, click **Apply** shown in fig. 8.

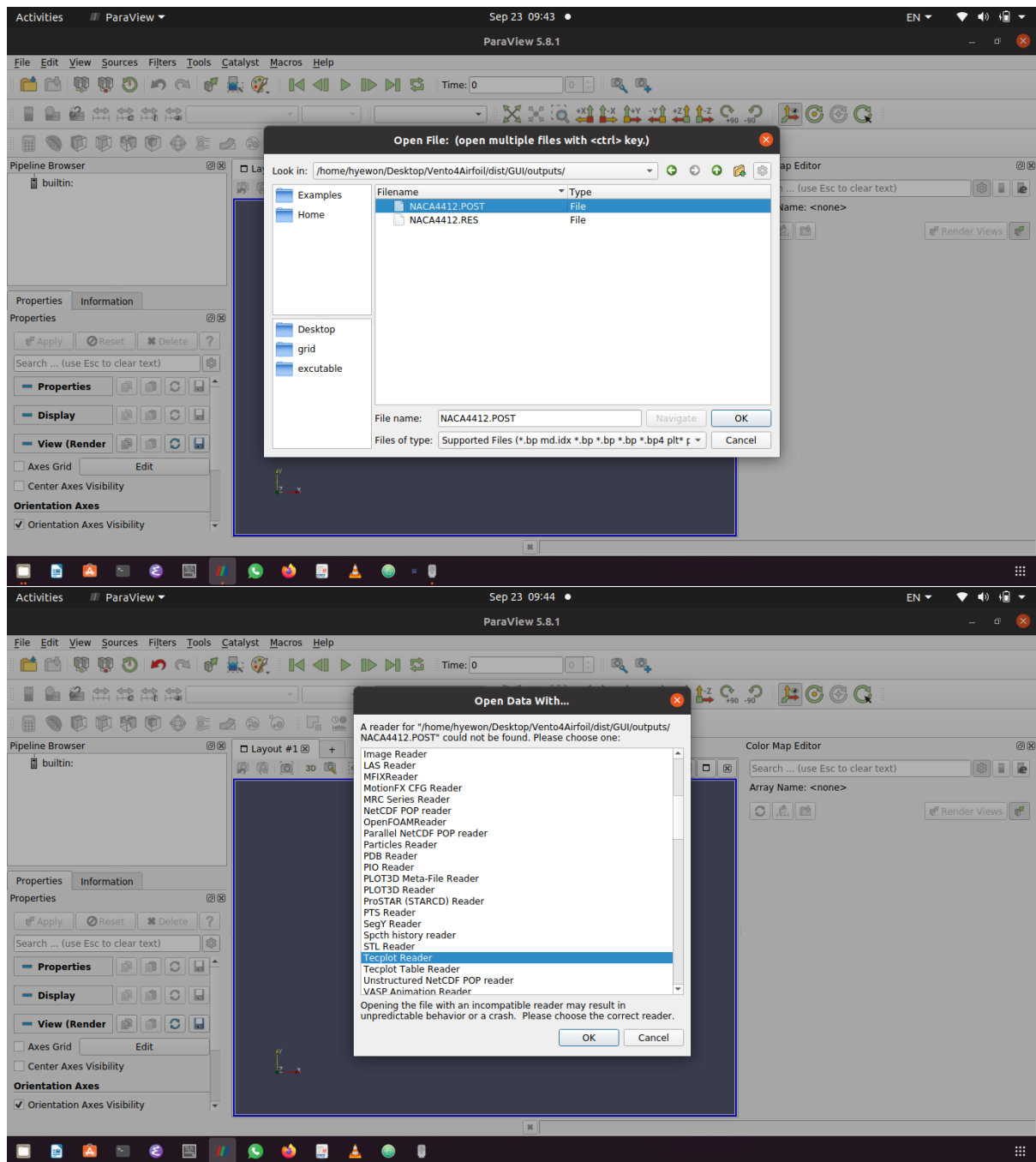


Figure 7: Select .POST file and choose Tecplot Reader in Paraview.

Lastly, change some options to visualize the simulation results.

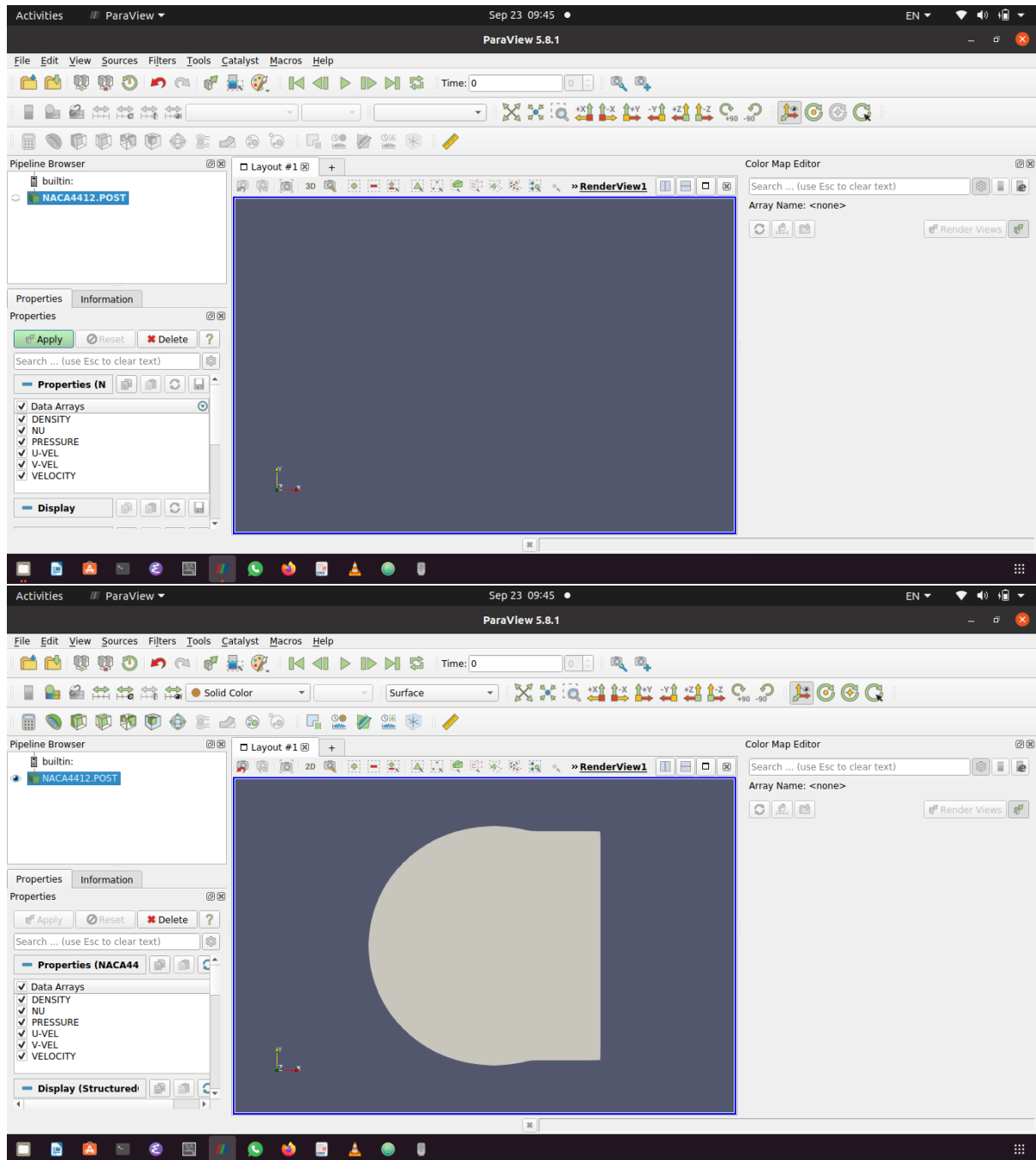


Figure 8: Apply and visualizations.



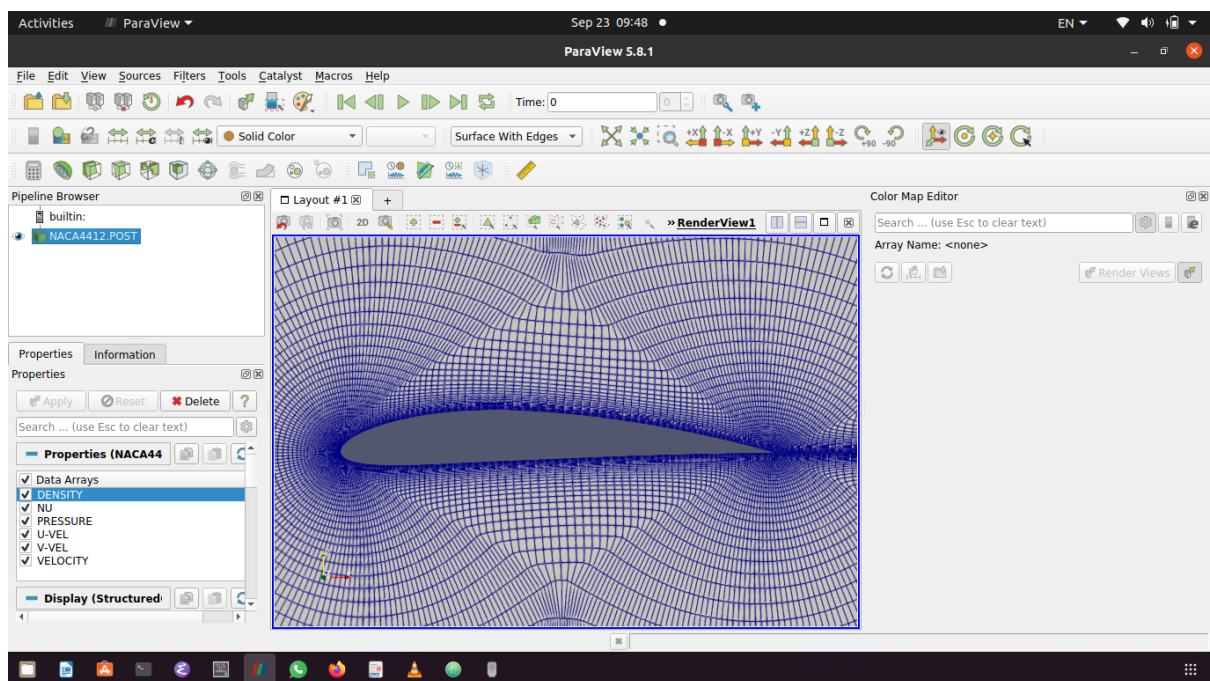


Figure 9: Options for visualizations.