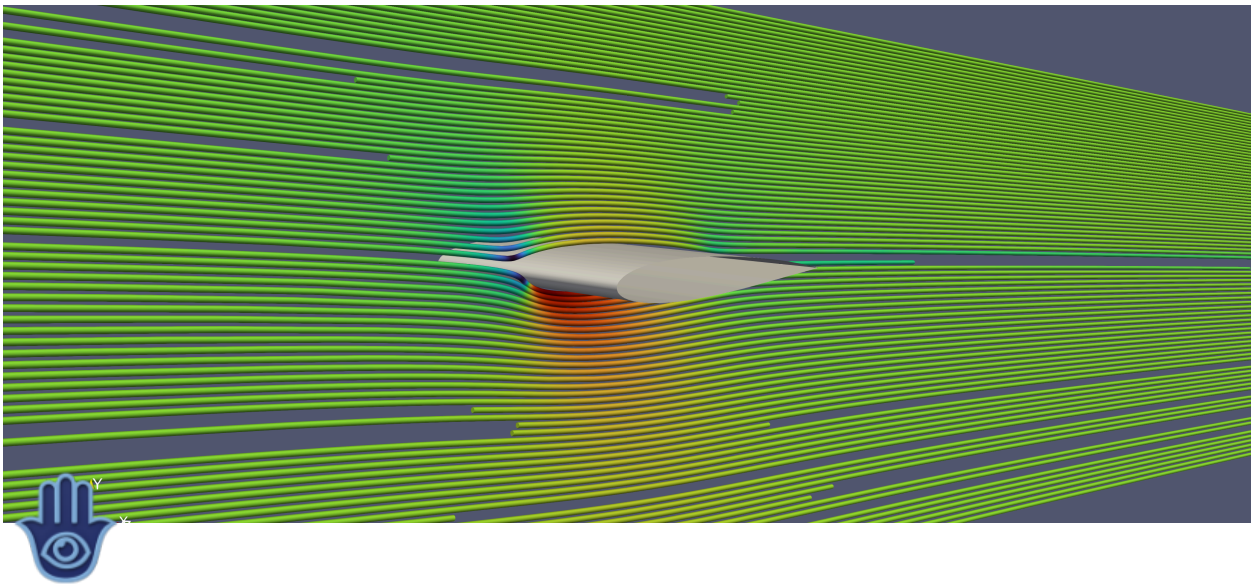


Work@Home Product Specialist

📝 Process

The goal of this case study is to understand your thought process and methods to find solutions, tools and capacity to script, as well as to get to discuss with you on your findings. We do not expect you to be a simulations or an AI expert (at least yet 😉), but we want to feel you capacity to grasp the different concepts in this project.

This is the opportunity for you to have a quick peek on the type of problem (data, technology, value) we are dealing with and a good introduction to the world of Deep Learning x Physics.

It's a two-part process:

1️⃣ AT HOME - max 2 days of production and thoughts

You may use the tools of your choice. The content quality is preferred to quantity.

Rest assured your work will solely be used for the interview process. 👍

2️⃣ WITH US (either on site or online) - < 1h30

Following the reception of your work, we will have a meeting with you to discuss your work further. It will be the opportunity to meet other people of the team !

Good luck and enjoy !

Context

You are a SimAI Product Specialist at Ansys.

A valuable customer is reaching out to you regarding some questions about the product.

The user is looking for some intel, some support and workflow feedback to test new ideas with the SimAI platform.

This customer is a company that is designing car.

Here is the email you receive from the user:

> Hi sir,
>
> I'm currently trying to use SimAI platform. The product seems really lean but I'm struggling importing my data into the platform. I've attached 2 of them. Can you help me figure out how to solve my problem ? Do you have any recommandation on how to look at the 3D data ?
>
> I'm working on an important topic, we are designing a new car and want to study the addition of a spoiler on the back of it, in order to decrease the drag.
>
> Globally speaking, I'm quite interesting about this Deep Learning for Physics. And my bosses would like to have a presentation on what is the technology under the hood of SimAI. Could you come up with some recommandations?

> And finally, I would like to use Deep Learning to optimise the spoiler we want to add on the car. I'm not sure how to do that with the platform, can you help me on this future workflow ?
>
> Thank a lot in advance, would you be available in 2 days to meet?
>
> This matter is quite urgent as my internal presentation is in 3 days.
>
> Best regards,

💡 SimAI is a platform that allows Ansys customers to create 3D AI (Deep learning) based on Physics simulation data. Once trained, the user can upload a new 3D design to have in a few seconds a 3D physics field prediction. The Platform is a SaaS Cloud solution accessible with a WebApp and an opensource Python library named PySimAI.

The SimAI platform is used in the context of *Computed Aided Engineering* (CAE).

Resources

▼ The 3D solution of the car

⚠️ Only the geometry and the cloud point of the volume simulation is available.

Volume file:

volume_car.vtp

Surface file:

surface_car.vtp

▼ The 3D solution of the spoiler

Volume file

volume_spoiler.vtu

Surface file

surface_spoiler.vtp

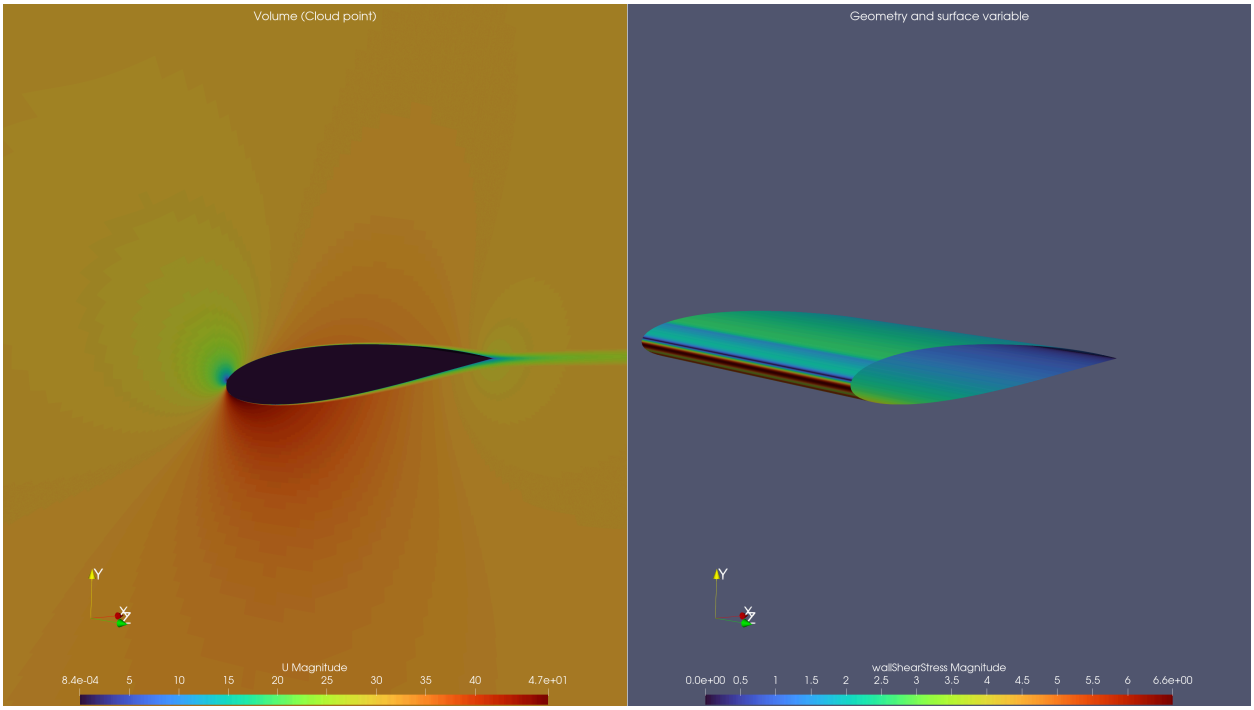
Problem 1

The user is asking for some advice to look at the 3D data.

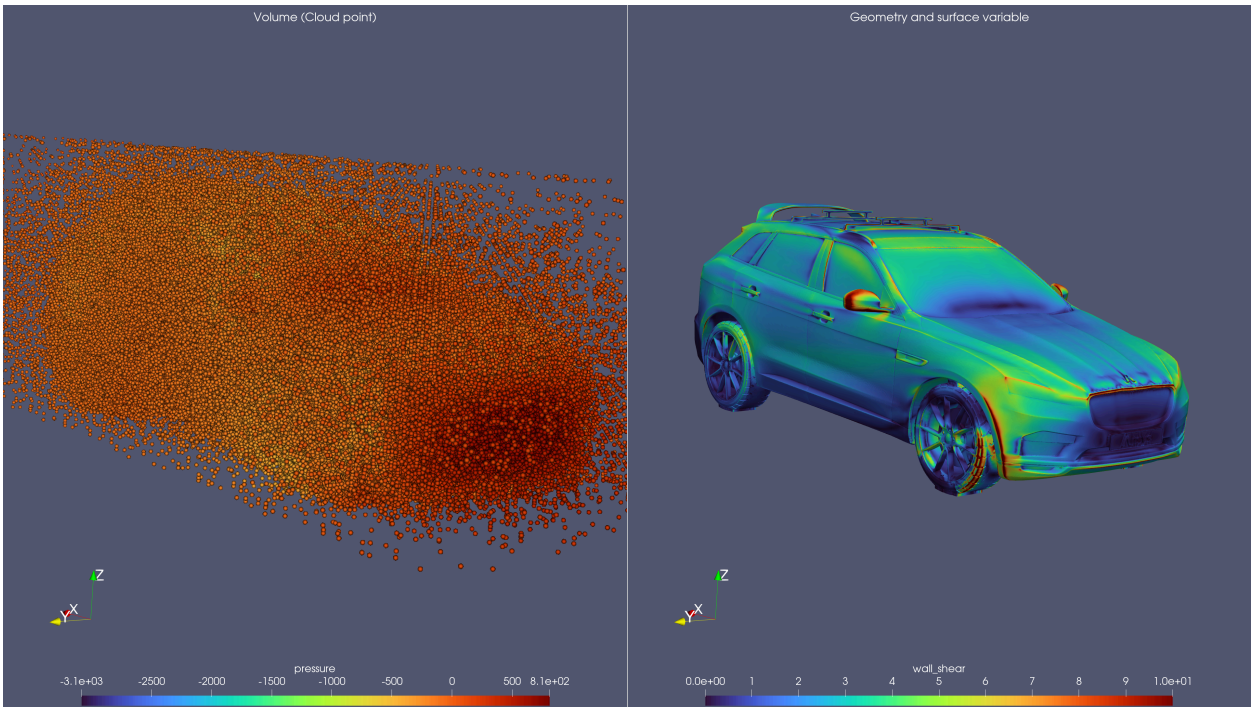
You will need to come with a 3D tools or libraries and quickly present your solution and 3D views of the data.

A 3D view can look like this.

For the spoiler:



For the car:



Expected delivery:

One summary tool/library introduction slide.

Problem 2

You understand that the user need to extract a value of interest from the surface file. This value is called `Drag` , it is directly a coefficient defining the car aerodynamic efficiency. The lower it is, the better.

The formula to compute this coefficient is the following:

$$Drag = \int_S (\text{pressure} + \text{wall\_shear}) \partial S$$

where the integral mean the integral on the whole surface of the geometry.

By looking at the data sample, you are able to see that on each case (spoiler and car) there is a variable missing in the surface file to compute this coefficient. But this variable is present in the volume file.

The user would need a script example and an explanation to project from the volume file the missing variable on the surface file.

Expected delivery:

A script allowing to showcase a solution to the users and one slide explaining the process and results.

The script should:

- read the volume file
- read the surface file
- project the closest point value of pressure of the volume on the surface node
- write back the surface file with the additional variable

> 💡 Have you ever hear about `PyVista` ?

Problem 3

In addition to the technical problem, the user will need to explain to his/her upper management the technology powering the SimAI platform.

This is and extraordinary opportunity to help pacing up the sale process at this important customer.

You understand that the company is familiar with traditional ML technology but lack of overview about Deep Learning, especially in the domain of the *CAE* and Physics.

The user is requesting some slides to base his/her presentation on.

Expected delivery:

A small slide deck describing Deep Learning solutions/algorithms and presenting the pros and cons of each for the type of problem at hand.

Select the one you think is the most appropriate and explain why it is the best to solve the CAE problem.

> 💡 For this, you can assume that the best one you've picked is the SimAI technology.

Problem 4: Bonus

In preparation of the meeting, the sales team had a feedback from the customer that they would like to have access to extended workflows in order to ease the engineering process.

As of today the user is struggling to understand how to use automatically the platform in order to optimise his/her problem.

It seems that the user want to optimise the position and shape of the spoiler on the car in order to decrease the `Drag`. He/She is doing that by manual trial-and-error as of today.

Sales team want to offer an automatic way to perform the optimisation.

Expected delivery:

A small slide deck describing optimisation process to reduce the drag with the actual technology. This deck should explain different approach of optimisation, select the most suitable one and offer a workflow slide.

> 💡 For this problem, you can assume any hypothesis, and request any tools/libraries for the customer to use and implement.