

Dear Summer Students Recruitment Team,

I am writing to express my strong interest in working at CERN this summer.

Through programming a fluid simulation on my own, I learned how crucial theoretical and mathematical foundations are. Indeed, I started the project, years ago, without caring about physics. I programmed a particle-based fluid simulation out of pure intuition and no matter how hard I tried to heuristically change the rules of the simulation, I couldn't get anything satisfying. So, I then spent months learning about fluid simulations, learning how to discretize Navier-Stokes equations, how I needed to use Taylor's formula to keep the uncertainty small and prevent the simulation from blowing up. It's hard to explain. I thought that trying to come up with rules intuitively was more fun but, at some point, I found myself mesmerized by the theory and its implacable pragmatism. I devoted countless hours gaining knowledge and successfully creating a functional simulation.

I then learned how using hardware at its maximum efficiency was crucial. In fact, after getting my first simulation to run I only had one thing in mind: make it run faster. I first recoded the simulation using libraries for matrix operations that resulted in a 30 times faster simulation. But it still wasn't enough for me, because I knew that I was using my CPU to do all those calculations when it was way more appropriate to use my GPU. I had to rethink all my code and learned a new programming language, but in the end I did it: the simulation got another 50 times faster. The satisfaction was unspeakable.

I could also talk about how I spent over 120 hours during the last two weeks (while still having classes during one of them) writing down and illustrating all the knowledge I had acquired. I could also speak about my informatics projects: 3D printing a RC car. That taught me how using the right tools, fusion 360, instead of the first at hand, blender, was crucial for efficiency. I spent countless hours modeling version after version of the car's gearing.

This drive to learn and push boundaries is exactly what I hope to bring to CERN's Summer Student Program. I'm eager to dive into new challenges, apply theoretical insights immediately to hands-on work, and collaborate with others who share a passion for scientific discovery.

Kind regards,

Marco Costa