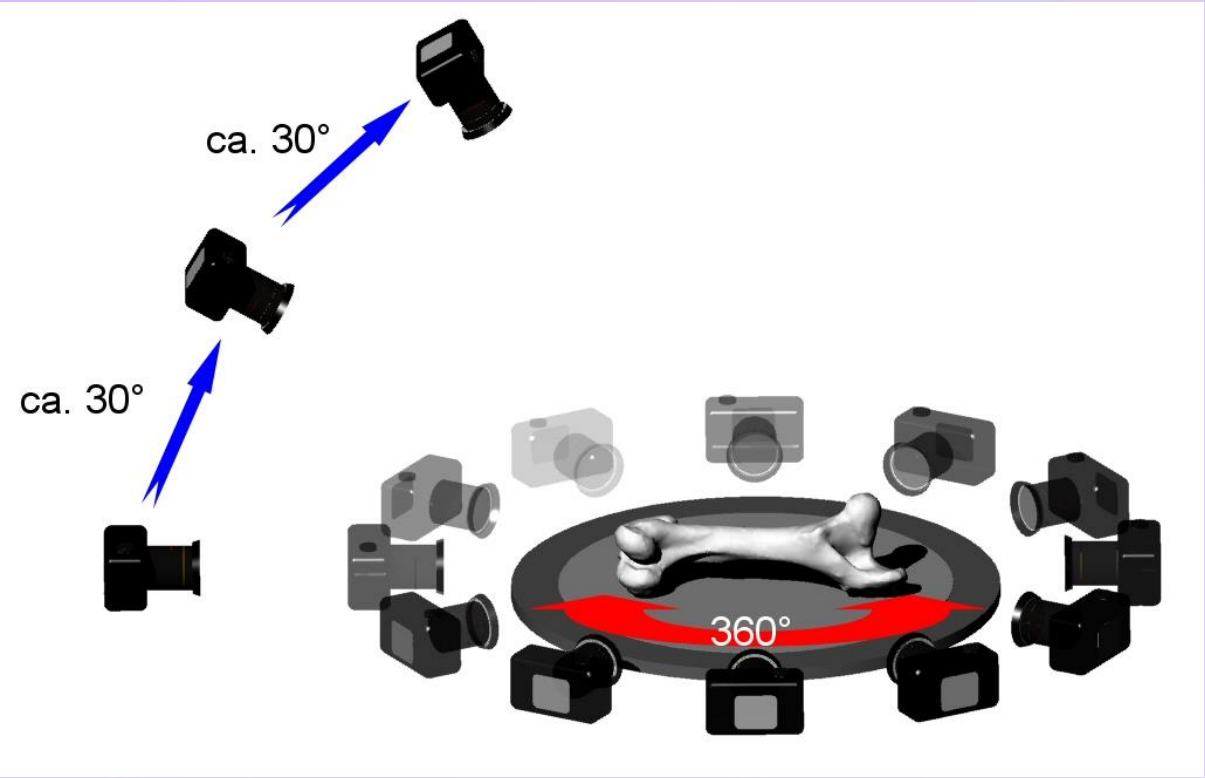
4. Research & Methodological approach

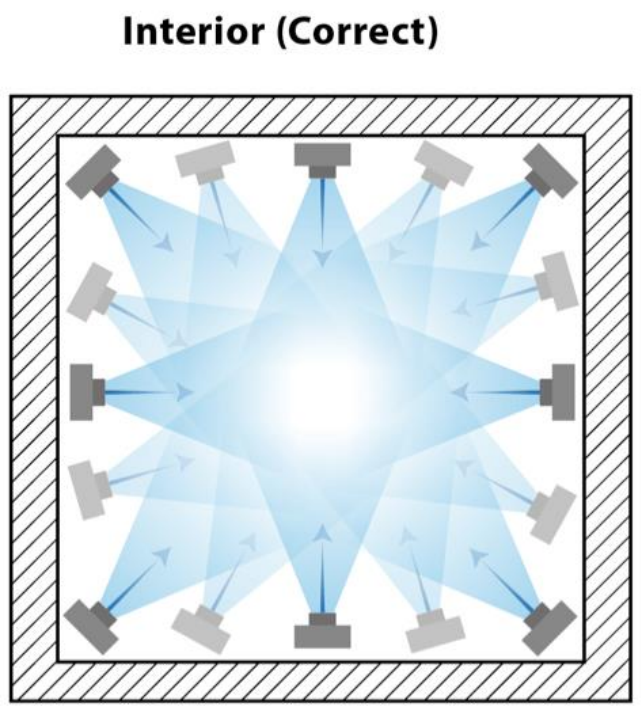
Intro

Since I had no idea how to do anything related to photogrammetry or Gaussian Splatting, not even how to take the pictures properly (no need to talk about software or how to use it), I had to investigate everything from scratch. It all started with photogrammetry and how to take pictures. I understood the concept of doing photos of objects: you just go around the object, capture it from multiple points, and process the results afterwards.



Some information I also got from one of my teammates was the “zigzag method,” like painting a wall, for capturing rooms. This didn’t really sit well with me, so I had to look into alternatives. That is how I found the orbital method. After researching different websites, I came across this method where you imagine a center point and then walk around the walls while keeping the camera pointed toward that center, taking multiple pictures with 70—80% overlap so the results would come out as good as possible. Then I started looking into camera settings: as low ISO as possible, fixed white balance (usually daylight), small aperture, and faster shutter speed (around 1/60 or more), keeping these settings the same across all pictures.

Orbital method: https://stichtingfontys.sharepoint.com/:w:/s/Sem-3Gang/IQCjosuC7sJfTKZrZV7hYDZSAYj0es7qCac3vFvdCassJdg?e=2yQXcM

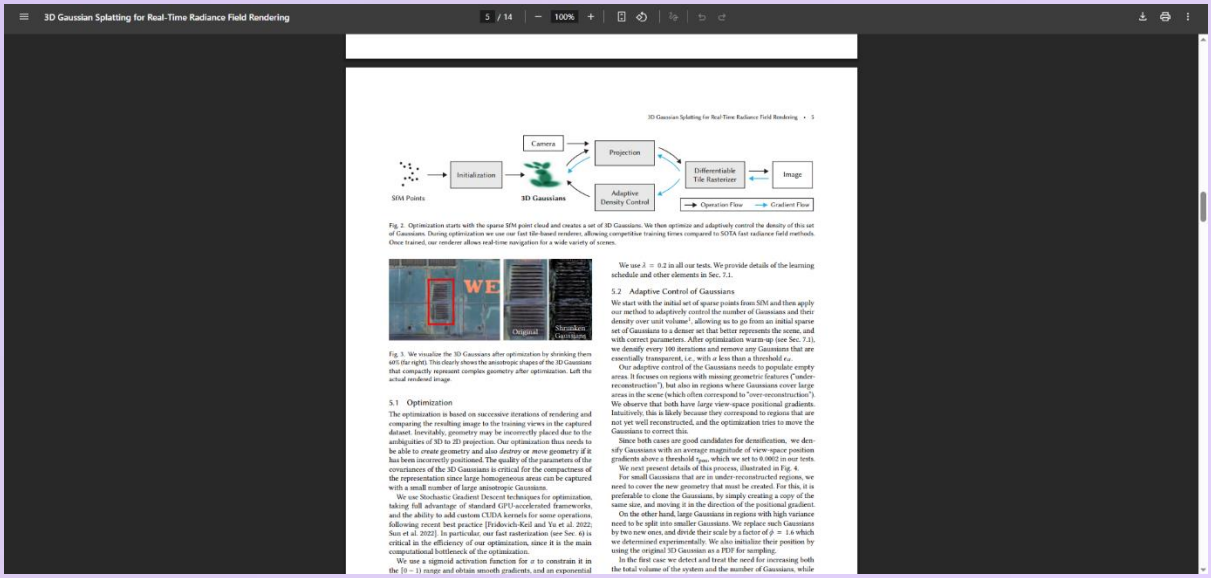


Process & Feedback

Once I had this information and was ready to start the scanning process, it was time to continue my research into how to work with Meshroom and what settings to put in so the scans would come out well.

After I was done trying different settings and documenting the process, I wanted to dive deeper into NeRF and Gaussian Splatting after our client meeting. I first started exploring what these technologies are, what they stand for, and what they can offer. So, I looked into the official paper “3D Gaussian Splatting for Real-Time Radiance Field Rendering” created by:

BERNHARD KERBL, Inria / Université Côte d’Azur
GEORGIOS KOPANAS, Inria / Université Côte d’Azur
THOMAS LEIMKÜHLER, Max-Planck-Institut für Informatik
GEORGE DRETTAKIS, Inria / Université Côte d’Azur



Gaussian Research: https://stichtingfontys.sharepoint.com/:w:/s/Sem-3Gang/IQCi5MiMqv91T4XG-pUfK-NHAZzfS3UUgFQymrgWZu5nz84?e=aMCUEZ

From this research I extracted the following conclusions:

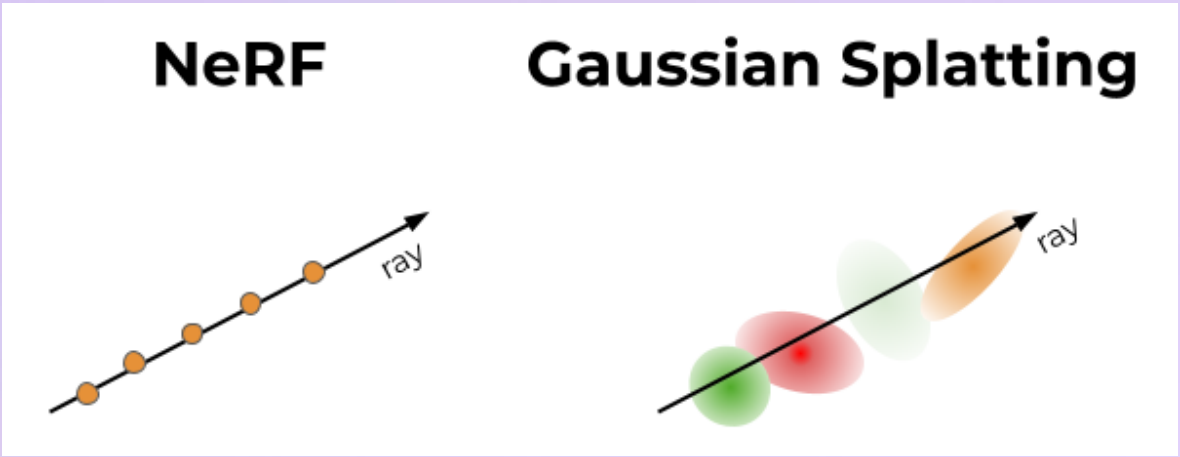
We can visualise a Gaussian in 3D as a blob.
At first, I thought they were just points, but:

- In 1D, a Gaussian is a bell-curve bump
- In 3D, the bump becomes a blob you can stretch, rotate, scale, and modify

Each Gaussian blob has a position, a size or shape, an orientation, and a color or appearance model.

Gaussian Splatting represents a scene as many of these blobs instead of polygons or voxels.

Why this works so well:
- It handles reflections
- It is much faster than NeRF
- NeRF is a neural model that reconstructs a scene from 2D images
- Gaussian Splatting is still a radiance field, but without the heavy neural rendering
- Surfaces realistically change color depending on viewing angle
- It supports editing
- It only needs a sparse point cloud to start
- Gradient descent adds more Gaussians where needed for detail



Once I understood the theory, it was time to test it. Nerf Studio was recommended by IRONFILMS, but because of my hardware limitations I could not use it to generate a Gaussian Splat. I also wanted to do everything myself, without using third-party cloud platforms. So, I switched to Linux Ubuntu, where I was finally able to render a Gaussian Splat.

At that point I wanted to understand the dataset better. I started researching new methods to take better pictures. From my experiments in Meshroom I already learned that the data set matters more than the software. This led me to other methods like “Swirl” or “Face-forward jigsaw,” and I started understanding the principles behind high-quality datasets:

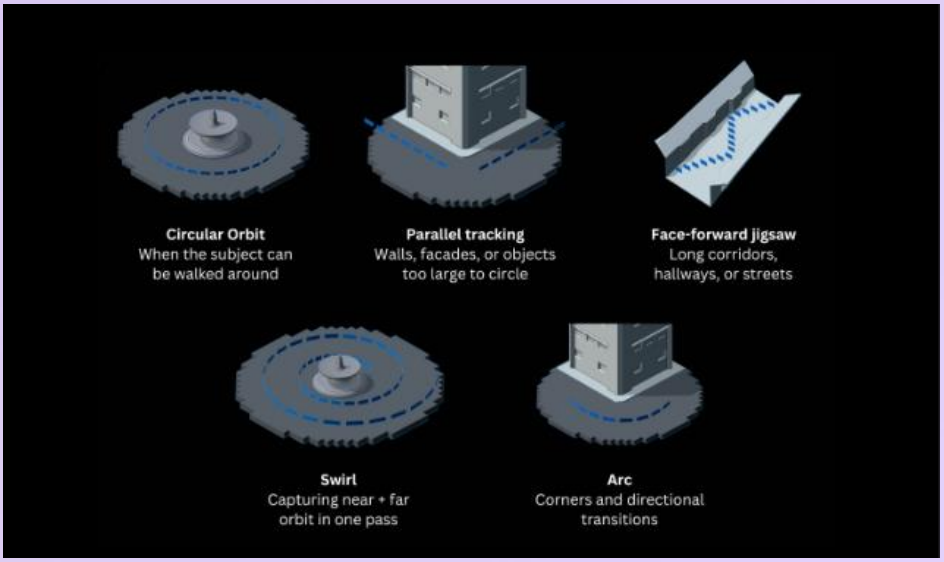
Consistency
- Fixed focal length
- Locked exposure, ISO, and white balance
- Manual focus

Clarity
- No motion blur
- Fast shutter (1/250 or more)
- Good depth of field (f/5.6—f/11)
- Avoid rolling shutter wobble.

Coverage and parallax
- Move the camera through space, not just rotate
- Capture overlapping views from different heights
- Include some background context.

Gaussian photo research:

https://stichtingfontys.sharepoint.com/:w:/s/Sem-3Gang/IQBAji9IW-eJRrr01moDQXoFASqRJTWdaXFwyHbtaIwceIw?e=snhbOQ



Reflection

All this research, from basic photogrammetry techniques to the academic paper on Gaussian Splatting, gave me a structured and professional way to approach the project. Instead of guessing or relying on trial and error, I built a method based on theory, testing and documentation. It helped me involve stakeholders correctly, justify decisions, and choose tools that made sense for the project requirements.

Choosing open-source tools also kept the workflow accessible and sustainable, and doing the computations locally avoided unnecessary cloud processing. Overall, this research phase gave me the foundation I needed to work professionally, make informed decisions, and support my team with reliable knowledge.

Official Paper for Gaussian Splatting:

https://repo-sam.inria.fr/fungraph/3d-gaussian-splatting/3d_gaussian_splatting_high.pdf