# Largest Scan Project Ever Collected: Versailles Case Study

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## SUMMARY

This abstract discusses when history and new technology meet up with a Google partnership. In order to open "La Galerie de l'histoire du Chateau de Versailles", AFT was in charge of acquiring virtual data needed to create Versailles in 3D. No less than 6 months and 100,000 scans stations were necessary to successfully create a digital copy of the biggest castle in Europe. Not only was the inner castle digitized, but all of the exterior fountains in the garden, the statues, the facades and the roof.
The result: It is now possible to take a virtual tour of Versailles or back in time and discover the castle at the age of "Le Roi Soleil!"

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Under an order of the Public Institution "Versailles" and Google as part of its project Google Art Project, we conducted all surveys 3D with the Laser Scan FARO Focus 3D 120 on: - The royal apartments and interior parts (king bedroom and apartments, the queen, the queen's office, the Royal Chapel, the “Galerie des Glaces”, Opera, the coronation hall, lounge and Malachite Grand Trianon) - All the statues of the castle walls - The set of bronze statues and fountains of the gardens of Versailles.

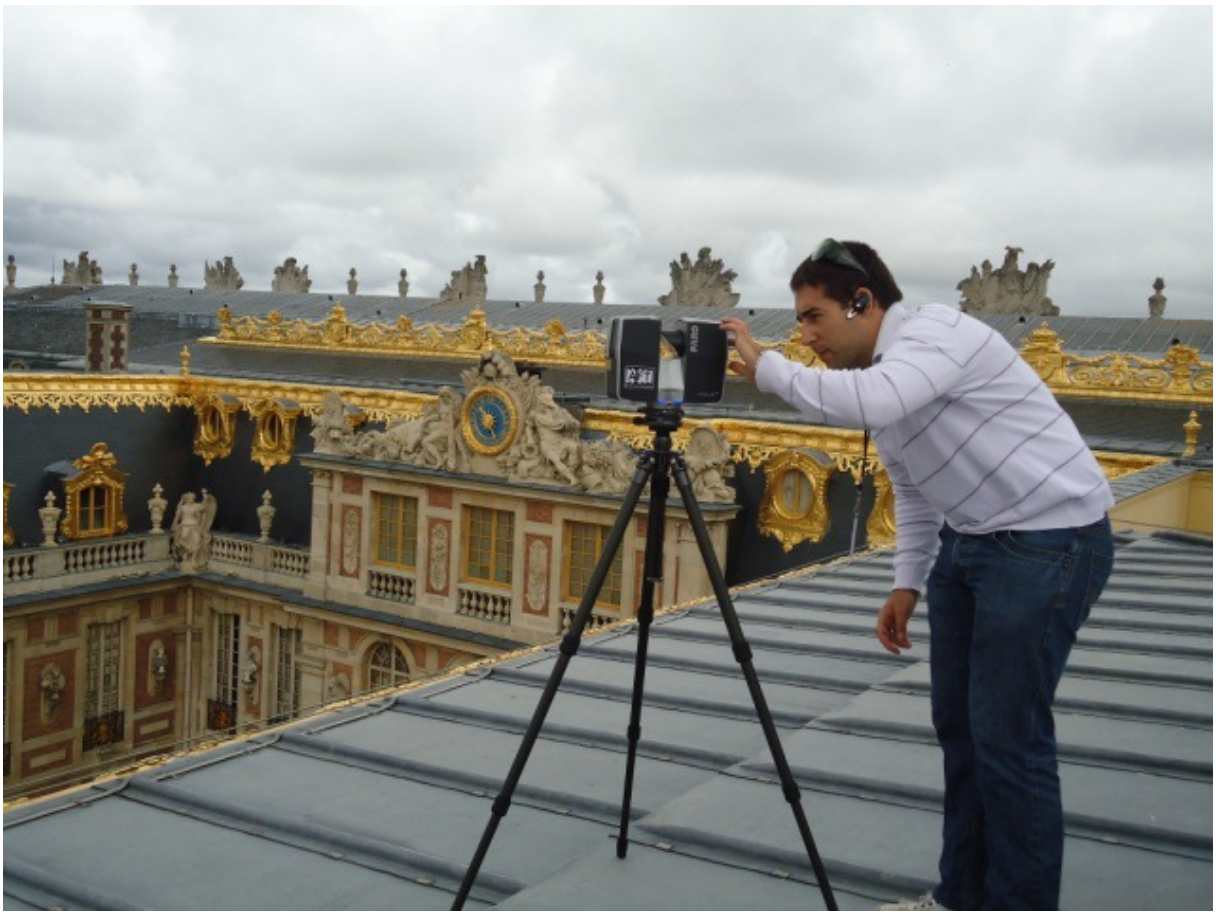

Figure 1. Acquisition of data on top of the Castle

The purpose of this project was to support virtual and interactive dissemination to the general public (via a comprehensive website) for a recovery operation of the castle and its dependencies (Figure 1).

AFT performed all scans and provide the raw data of the textured models who have been implemented in the interactive presentation of this. Due to the size of the site, the complexity

of the context of digitization and rendering issues, two months on land were needed to enable us to carry out all the surveys, then 4 months of data processing have been necessary to produce roughly textured of the 3D models.

From June 2011 to August 2011, the scanning surveys were conducted with 120 3D Focus LaserScan of the brand FARO. A photographic coverage in high definition was made with a Nikon D90 camera. 3D survey was carried out in two stages: first the scanning stations, then a time data processing and assembly of the 3D model.

Sometimes complex situations (including the Hall of Mirrors) led us to question the relevance of path stations scans and methods and setting the device to adopt.
For apartments and interior parts, the objective was to identify comprehensively and accurately reliefs, colors and textures of the inner cladding: inlaid ceilings, moldings, wall tapestry

For the statues of marble and bronze fountains, the objective was to properly inform the volume of sculptures with the complexity of the land and subtlety of their materials. On top of that, these elements were not easily accessible. They were neither in the coronation of the attic cornice nor intersecting hedges or in the middle pool of the tire tread.
100 000 laser scanning stations were necessary for a complete record of Versailles and its dependencies. In general, the process of tracking stations used was defined by interior space (room of the queen, gallery...) then a central station was established, and a station at each end. This process is the same on a facade. The lightweight Laser scanner was easy to handle in the most inaccessible places (e.g. narrow rows in the opera, for statues on the outer ledges of the second floor).

For interior parts, four or five stations by scanning were made, part because of the shadows that the presence of furniture entails. The device was set to acquire directly after colorized laser scanning textures. Each piece has about 20 million colored
points. Then the point cloud was converted to mesh model. The most telling example is the 3D modeling room of the queen.

For outside, most statues were relatively easy to scan as they are of modest size. Four stations at the four corners of each statue were taken each time. Depending on the size of the statue and special relief (arm position for example) shadows may result, so additional stations in the middle of all four sides were made. Some statues, especially along the great central aisle between the castle and the Grand Canal, are placed along fence, making it impossible to acquire data on the back of these statues. We had 3D models with a hole on the back. We had to deal with this problem by manually plugging the holes through our processing softwareure 2).

Difficulties encountered:
Sessions scanning requires a fairly strict and demanding environment. The laser scans any vegetation, fence, collapsed stone or any other items not belonging to the frame in place. By extension, it can hide and thus prevented the scan of some data. However, these error can

sometimes be corrected by clouds of additional points. The additional elements are in turn removed during the phase of data processing.

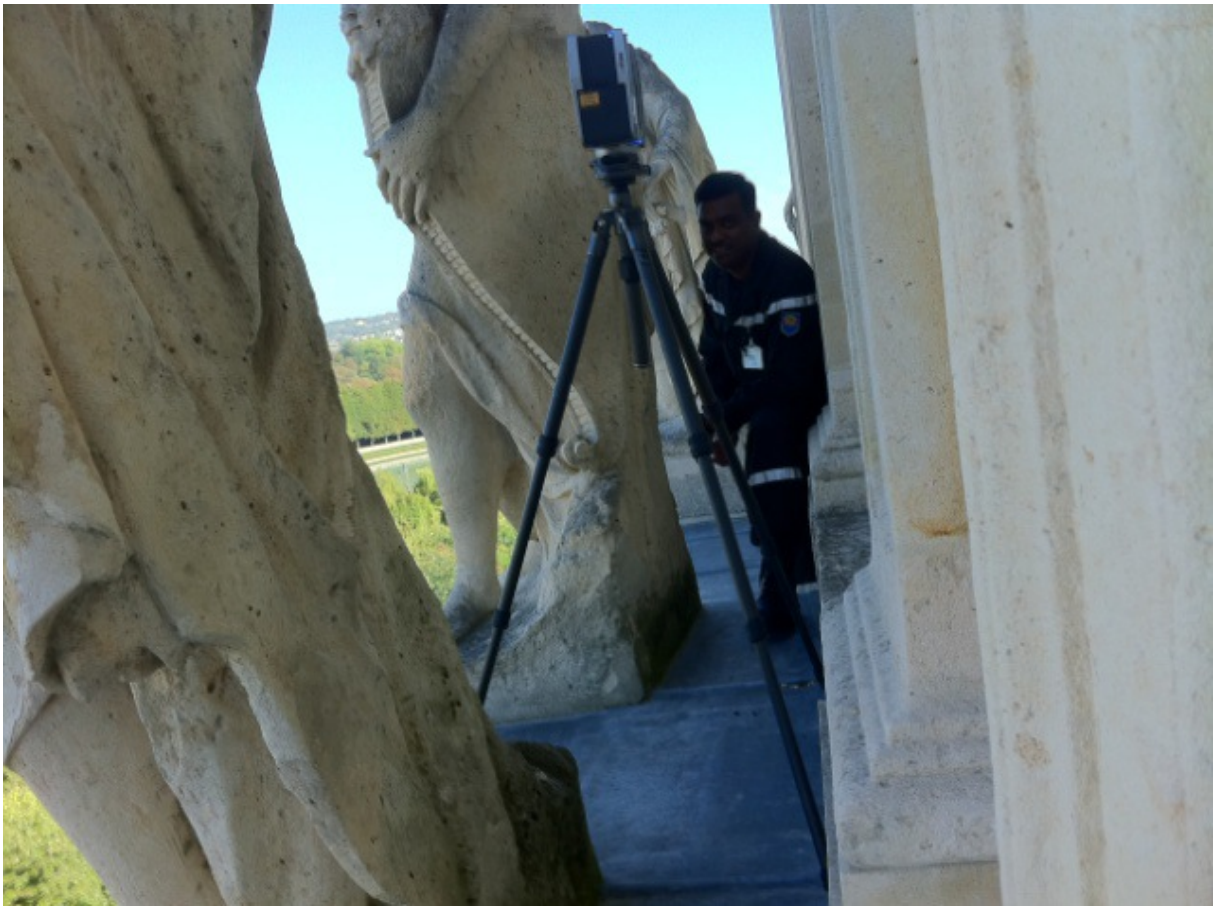

Figure 2. Technician in place

Public attendance was quite a significant barrier because when scanning should not be an absolute element starts between the camera and the subject scanner may distort decision point. Other issues related to this intervention outside there was the distance data acquisition for some bronze fountains and statues on the ledges of the castle above the second floor. Indeed, bronze fountains were sometimes surrounded by large areas (including watersheds of Neptune and Apollo) preventing as close bronzes. The same is true for the statues of the pediments and cornices (triumphs for example) far from the scanner since the height of the walls. Indeed, larger distances could be misleading. All these settings caused the acquisition to take much longer periods in the field.
The latest issue of two months of full-time readings outside was weather since this type of device, because of the mirror and the laser cannot possibly work in the rain, even moderate.

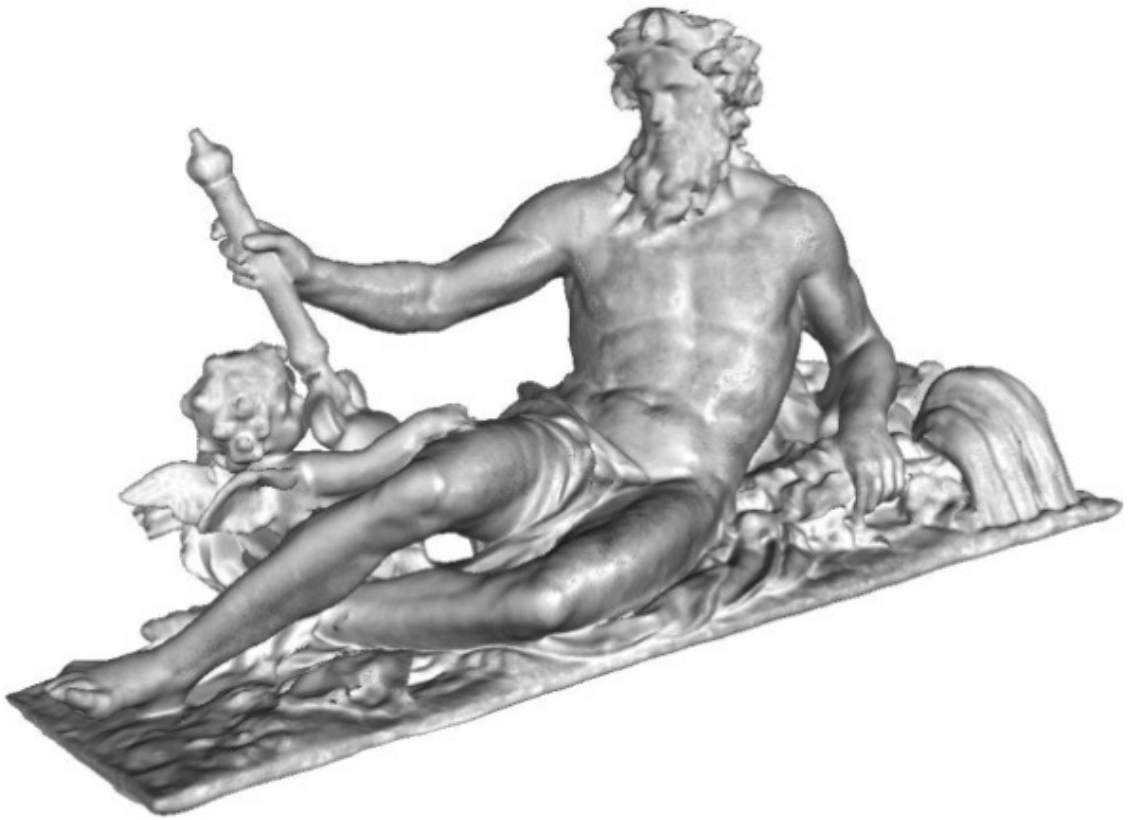

Figure 3. 3D model of a statue

Note that for the treatment of bronze statues and fountains, gardens, a technical constraint was imposed by Google. Indeed, our 3D models of statues should be legible on their Sketchup software to be integrated later on Streetview and Google Maps. The problem of opening the SketchUp 3D software models is that they must be converted into 3ds format. But this format only accepts models less than 65,000 polygons. This is binding as our 3D models of statues bronze fountains usually has 6 to 10 million polygons! So we were forced to optimize and degrade our templates to get to the bar 65 000 triangles. Fortunately, this constraint was not imposed for interior parts. (Figure 4)

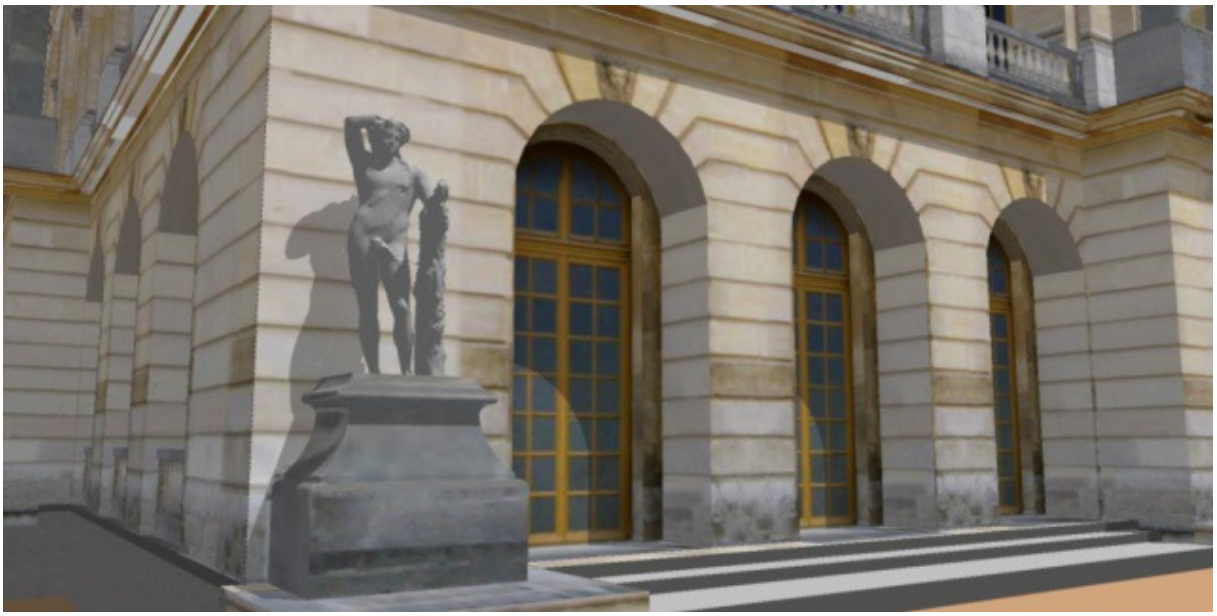
Figure 4. Publishing and development: provide the general public.

An accuracy of 0.005m has been achieved for all the statues of Versailles (bronzes and marbles) and 0.001m for all internal parts processed in true colors and textured. These models raw data were transmitted to computer graphics actors contracted by the public institution of the castle.
These 3D models were used by Versailles to offer interactive 3D presentations in twelve rooms "historic Versailles" at the entrance to the trail in the castle as well as their 3D Versailles internet site. As mentioned above, the 3D models of bronze statues and gardens are also directly visible on the Internet as well as Google Earth, Google Maps and Streetview. These models are shown on the website Versailles 3D.

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