

# The Cathedral of Palermo

## From survey to historic interpretation

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**Abstract—** The Norman kings built the Cathedral of Palermo at the end of the XII century, in the same place where an older Christian church and then a mosque were sited. Many features of the Cathedral echo the Norman churches in northern France and in England, whilst some others belong to the peculiar mixing of Norman, Muslim and Byzantine culture that characterizes the art and architecture of medieval Sicily. At the end of the XVIII century the church underwent huge and extensive transformations, that deeply altered its original shape. The historic sources that document the Medieval church are some XVIII century perspective drawings, and a textual description.

The Cathedral has been surveyed with topographic and laser scanning devices; some decorative elements have been surveyed with a structured light scanner.

In this study survey, 3D modelling and historic sources have been integrated for the purpose to detect the elements that survived the transformations and propose a virtual reconstruction of the state of the Cathedral before the end of the XVIII century.

**Keywords—** Laser scanning survey; Historic analysis; Virtual reconstruction.

### I. INTRODUCTION

The Cathedral of Palermo is sited at the western end of the ancient town center of Palermo; it was built at the end of the XII century, during the reign of the Norman king William II. Soon after the beginning of the works at the Cathedral, William II, maybe in opposition to the Archbishop Walter, promoted the erection of a great cathedral in Monreale, a small town sited a short distance from Palermo. This is presumably the reason why the Cathedral of Palermo suffered from lack of funds and the church was not decorated with mosaics. Most of the Norman churches of Sicily preserved their original state; the cathedral of Palermo underwent instead several transformations along the time. Up to the XVII century many elements were added to the original medieval building, both to complete unfinished parts and to update the church according to the changes of taste: the bell towers at the corner of the building were raised with additional storeys in the XIV century; a 'portico' was added to the southern front in the XVI century; a magnificent marble apparatus, named 'Tribuna', was built inside the main apse by A. Gagini in the XVI century. At the end of the XVIII century the cathedral was deeply modified; the heavy transformation project, named 'Riforma', determined the state of the cathedral as we see it today. The remains of the medieval church are today

concealed, disconnected and fragmentary. The subject of this study is the reconstruction of the nave and the transept of the cathedral 'ante-Riforma'; digital representation and laser scanning surveys have been used both to point out the relations between disconnected elements and to verify and visualize reconstructive hypotheses.

### II. SOURCE I: SURVEYING

The first phase of the surveying process was the set-up of a topographic polygonal, made of vertexes placed around and inside the church; topographic nails were used to fix for the external station points; peculiarities, such as the joints in the marble pavement, were used to detect the station points in the interior. The topographic polygonal is an effective tool for the survey of complex monuments, since it allows the integration of parts that are disconnected; it allows also the registration of data that are acquired along the time, as an integration or for monitoring. Laser scans were performed with TOF laser scanners (Trimble GS200, Leica Scanstation2, Leica HDS7000); the scans of the external fronts were performed stationing the device on the ground and on the buildings facing the church. A huge number of scans was acquired in the interior so as to get an almost detailed documentation of the present state of the church and of the parts that survived the 'Riforma'. The topographic coordinate system has been rotated so to orient the 'x' axis parallel to the longitudinal axis of the church. Coded targets were acquired on each scan and at the same time were measured with total stations. Registered point clouds allowed us an effective control on the relations between the parts of the cathedral and supported the geometric and dimensional analysis. Point cloud processing was performed with Cyclone and Rapidform XOS. Processed point clouds were converted into the POD file format and imported in Rhinoceros (fig. 1). The plug-in 'Pointools4Rhino' allowed us to use the point clouds as a source for the extraction of drawings (plans, sections, fronts) and also for 3D modeling. Further surveys focused the documentation of some specific elements that were used in the reconstruction process. For the reconstruction of the 'Tribuna' we surveyed the statues that are placed on the pillars of the nave with TOF laser scanners; a wooden model of the 'Tribuna', made by the students of the School of Fine Arts of Palermo, and residual parts of the 'Tribuna' in the Museum of the cathedral, were surveyed with the structured light scanner 'Mephisto'. For the reconstruction of the 'tetrastyle' pillars we surveyed the pillars of the church 'San Giorgio dei Genovesi', built at the end of the XVI century in Palermo by the architect G. di Faccio; historic

sources state that the architect drew the pillars using the 'tetrastyle' of the cathedral as a model.

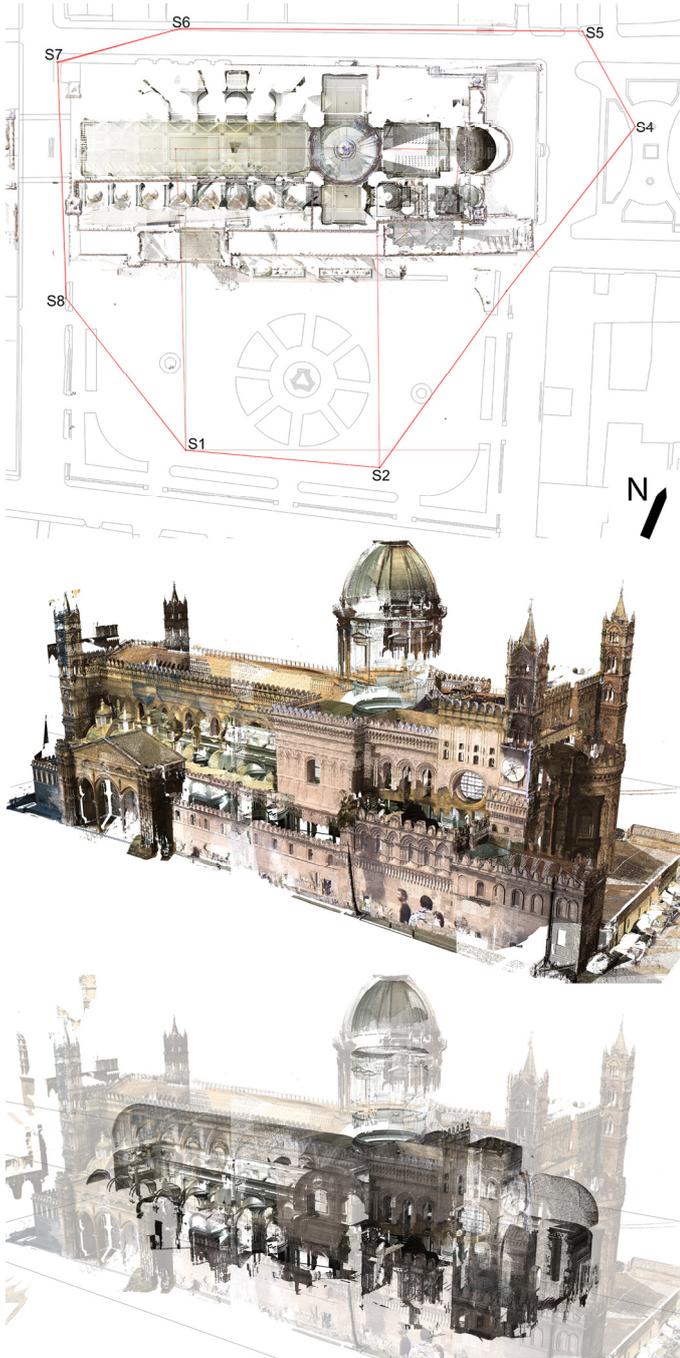


Fig. 1. Topographic polygonal and perspective views of the registered point clouds.

### III. SOURCE II: HISTORIC DOCUMENTATION

A relevant source for the documentation of the cathedral 'ante-Riforma' is the book 'De Principe Templo panormitano' (The main church of Palermo) [1], written in 1728 by Giovanni Maria Amato. The author, a Jesuit priest, records a detailed description of the Cathedral, based on an accurate survey of the previous studies. A synthesis of the records from

the book of Amato, with regards to the nave and the transept, can be proposed as follows: (1) 22 pillars and 20 pointed arches were placed at the sides of the nave; (2) each pillar, named 'tetrastyle', was made of 4 columns placed over a pedestal; (3) the nave was covered by a wooden decorated roof with 19 trusses; (4) at the eastern end of the nave were two rectangular areas north-south oriented, namely the 'Titulo' and the 'Antititulo' opening into the apses; (5) the central part of the 'Titulo', named choir, was encompassed by four pillars decorated with columns; (6) inside the main apse was the 'Tribuna'. Amato also reports the size of the church and of many architectural elements; such dimensions are reported in the section that focuses the reconstruction process. The document that best represents the description reported by Amato is the plan of the Cathedral 'ante-Riforma' (fig. 2) that was published by G. Di Marzo [2]; unfortunately no details about the drawer and the dating are available today.

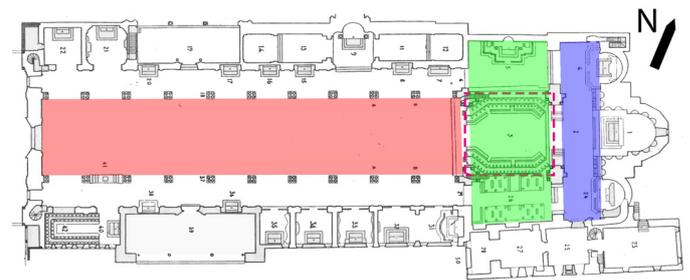


Fig. 2. Plan of the cathedral 'ante-Riforma'. Highlights on the nave (red), the 'Titulo' (green) and the 'Antititulo' (blue). The choir in the 'Titulo' is framed.

Further historic sources for the reconstruction project are the paintings and drawings dated XVII and XVIII century; the eldest one, recently published [3], is a perspective drawing of the nave decorated for the funeral of the Spanish viceroy Emanuele Filiberto di Savoia in 1624 (fig. 3). The nave is seen from the 'Antititulo'; in the foreground we see the central area of the 'Titulo' (the choir), encompassed by pillars. The nave, with columns at its sides, is covered by the wooden roof with trusses.



Fig. 3. Funeral of the Viceroy Emanuele Filiberto in the Cathedral of Palermo, 1624. It is the only ancient drawing showing the nave from the choir.

The southern front of the cathedral, facing a wide square connected to the main street of the ancient town, is the subject of an engraving by A. Bova (fig. 4), dated 1751. The drawing illustrates the state of the southern face of the cathedral in detail: the church is encompassed by four towers at the corners; the walls of the nave and aisles are partially covered by the 'portico'; the 'Titulo' and the emerging choir are placed at the eastern end of the nave; the front of the 'Antititulo' is pierced by small openings and by a wide circular window.

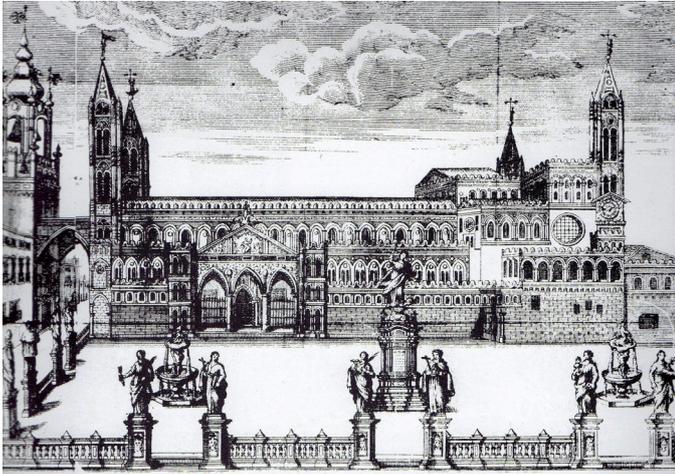


Fig. 4. The southern front of the Cathedral in the engraving by A. Bova, 1761.

The 'Riforma' started in 1782; twenty years later, the cathedral, as we see it today, was built. The fronts were left almost unchanged while the interior was fully neglected. The external wall of the southern aisle was destroyed and then rebuilt few meters outwards; new wider chapels were built and covered with small domes; the 'tetrastyle' pillars of the nave were removed and the columns were resized and placed at the sides of the new pillars; the pointed arches were substituted with rounded ones; a barrel vault covering the nave occluded the old wooden roof (fig. 5).



Fig. 5. The nave from the choir. Columns and statues attached to the pillars are remains of the previous setup of the church.

The sanctuary area was fully reshaped as well: the erection of the new transept with a dome caused the destruction of the eastern end of the nave and of the 'Titulo'; the 'Antititulo' was cut by the elongation of the main apse; the 'Tribuna' was disassembled and its statues were attached to the sides of the pillars facing the nave. The southern front, though remarkably modified, preserved its medieval taste and most of its decorations; the front of the new transept was decorated so as to match the general arrangement of the front.

#### IV. THE RECONSTRUCTION

The reconstruction process started with the comparison of the data from survey with the dimensions reported by Amato. It has been assumed that the width of the nave and the distance between the windows opening into the nave were left unchanged under the 'Riforma'. The longitudinal extension of the nave and the whole width of the church could not be used, since they were strongly altered. The dimensions reported in the description by Amato are given in 'palmo', the unit of measurement of the time; Amato states that 1 'palmo' (palm) is made of 12 'dita' (fingers); the 'piede' (foot) is made of 16 'dita', that is 4/3 'palmi'. We know that 1 "palmo" is equal to 0.258m; we can then argue that 1 'dito' is 0.0215m and that 1 'piede' is 0.344m. The distance between the axis of the pillars exactly matches the distance between the axis of the windows; such distance has irrelevant variations along the nave and has a medium value equal to 6.59m. Amato states that the base of the pillar is wide 5 "palmi" and 8 "dita" and that the distance between the pillars is 20 "palmi". The distance between the axis of two pillars is therefore 25 "palmi" and 8 "dita", that is 6.62m.; it matches almost perfectly the surveyed dimension. The tetrastyle pillars have been reconstructed by scaling the pillars of San Giorgio dei Genovesi according to the dimensions reported by Amato; the reconstructed pillars have been positioned on the middle point of the existing pillars; the cross dimension of the nave has then been measured; the length, 13.46m, is only 4cm longer than the dimension reported by Amato (52 "palmi"=13.42m). Such correspondences state that the dimensions reported by Amato are to be considered trustworthy and that they can support the reconstruction of the eastern end of the nave, of the 'Titulo' and 'Antititulo'. The reconstruction of the 'Titulo' started from the analysis of the remaining portion of its southern front; we noticed three windows and a portion of a fourth one, while the drawing by Bova reports four windows; by positioning the fourth window on the plan of the church we could argue what the position of the western wall of the 'Titulo' could be. A wall, wide as the existing eastern wall of the 'Titulo', has been placed on the plan. The resulting whole width of the "Titulo", 16.67m is slightly different by the report of Amato (65 'palmi'=16.77m). The surveyed width of the 'Antititulo' (22 'palmi'=5.68m in Amato) is 5.63m. The second step in the reconstruction process of the transept has been focused on the gallery at the top of the walls bordering the 'Antititulo'; the remains of such gallery have been surveyed and compared with historic drawings. What results is a complex system of paths developing all around the 'Antititulo' and the choir.

Recent studies [4] have supported the reconstruction of the precious marble ornament in the main apse, the ‘Tribuna’; its statues, today placed on the pillars of the nave, have been surveyed and virtually placed in their original location.

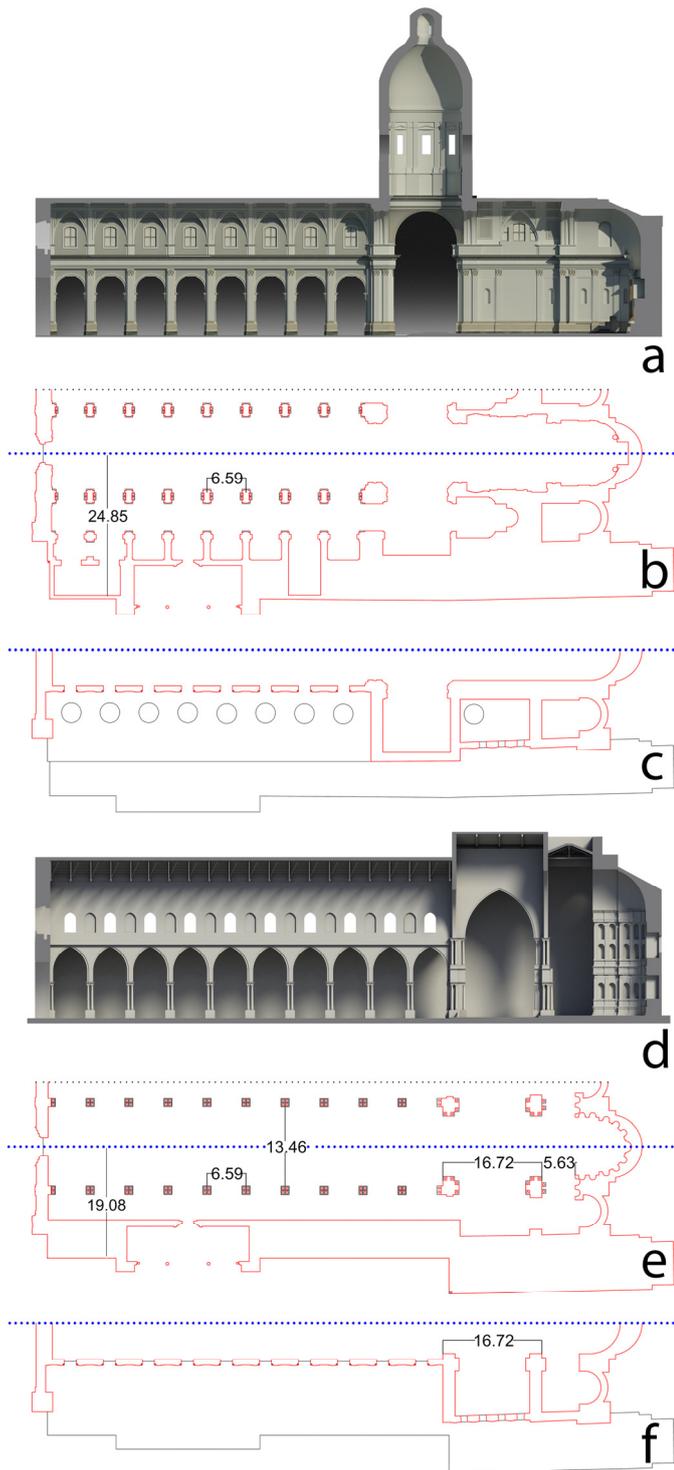


Fig. 6. Longitudinal section, Plan of the pillars, Plan of the windows of the nave. (a, b, c) The cathedral today; (d, e, f) Reconstruction of the cathedral ‘ante-Riforma’.

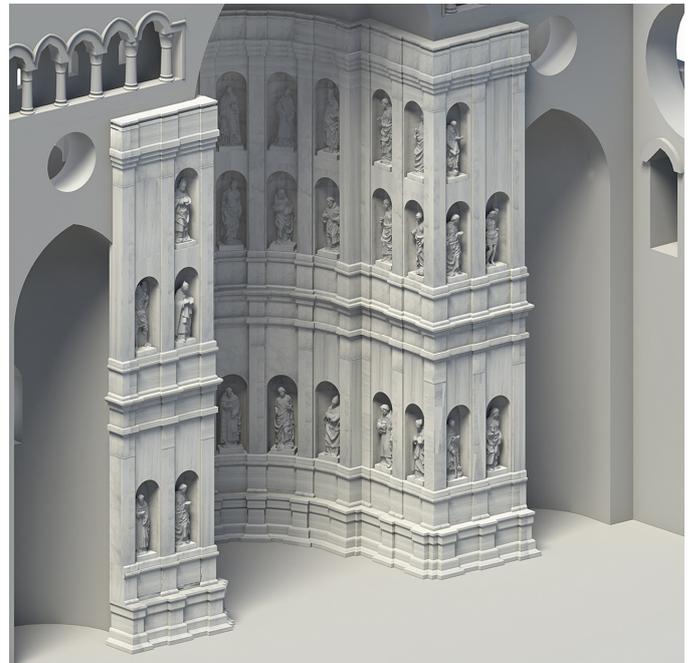


Fig. 7. The ‘Tribuna’ in the main apse.

## V. CONCLUSIONS

The study focuses the interpretation of a complex and overlaid historic monument, the cathedral of Palermo. The sources used in the reconstruction process are: laser scanning survey, historic documentation and ancient drawings. Metric data were used to detect and reconnect the physical remains of the old cathedral and to test the reliability of ancient dimensional reports. A reconstruction of the ancient set-up of the cathedral has finally been proposed.

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