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DE QUATTUOR PARTIBUS MUNDI MEDIEVAL SACRED BUILDINGS ON THE VIA FRANCIGENA IN NORTHERN AND MIDDLE ITALY: SOLSTICE ALIGNMENTS AND ORIENTATIONS

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ABSTRACT

This paper discusses different aspects of sun light linked to a religious rite and combined with ecclesiastical architecture. Our focus is on the four points of the solstices which form two sectors, one towards the sunrise and the other to the sunset. This examination is mainly based on the study of the ancient thought of scholars and Fathers of the Church. Despite the deep significance of the solstices (the Births of Jesus Christ and John the Baptist, His forerunner), only few of the over two hundreds medieval churches, situated in the North of Italy and long the old pilgrimage route, the Via Francigena, are oriented towards the solstice and equinox rise/set points on the horizon.

Georeferenced surveys on field with astronomical calculations were carried out on these sacred buildings by the author and the results were strengthened with primary and secondary written sources.

Throughout medieval times on path of faith a lot of hostels and sacred buildings were founded for pilgrims and travellers and a great deal of diaries written by the pilgrims survived so far. These travel reports record important building descriptions and knowledge of that time. In detail we will discuss a medieval drawing, one of the few we can admire and which represents the Holy Sepulchre of Jerusalem. It is particularly interesting to note, in this accurate drawing, the position of the doors of the building which appear oriented to the eight Winds Rose and the summer/winter solstices; the niches which show the cardinal points; and the *Sepulchri* that incorporates an Easter alignment. Finally, we discuss solstitial alignments of medieval church axes and of the position of sunlight inside sacred buildings among the summer solstice, when the sun is at its highest and simultaneously begins to appear lower.

KEYWORDS: sacred medieval buildings, orientation, light incidence, solstices, objective and written evidence, georeferenced surveys, the Via Francigena.

1. INTRODUCTION

For the last ten years the author has studied over 200 medieval sacred buildings regarding their orientation and their references, thus revealing an ancient building tradition. For each church she made a georeferenced survey with astronomical calculations and then cross-checked the results with primary and secondary sources. The analysed churches are situated in northern and central Italy and in the Swiss Alps. One third of them are along the old pilgrimage route, the Via Francigena (Spinazzè, 2016a). This was an important route for economic and religious reasons which facilitated cultural exchange between Northern Europe and Italy, just as the pilgrimage route to Santiago de Compostela that connected central Europe to the Atlantic coast. Along these paths of faith, numerous sacred buildings and structures, providing hospitality to travellers and pilgrims, were built about a day's walk one from another. Thanks to many medieval travel diaries written by pilgrims (Donner, 2002, *Peregrinatio Egeriae; Itinerarium Burdigalense. Breviarium de Hierosolyma; Adamnani de locis sanctis libri tres. The Epitome of S. Eucherius about certain Holy Places*, 1890. Procopius, 1896. *Citez de Jherusalem*, 1896. Hodoeporicon S. Willibaldi, 1880/1881. Eusebius of Caesarea, *Life of Constantine*), scholars have primary evidence that construction knowledge travelled from one place to another. Furthermore, the beginning of every single stage of the journey began on a special day, e.g. with the sunrise on a saint's feast or on a holy day, sometimes illustrated with a drawing. In this section, we are going to discuss a medieval drawing (9th c.) which represents the *Sancti Sepulchri* of Jerusalem, one of the oldest surviving architectural drawings (Adamnanus, *De locis sanctis*, Ms. Rh. 73).

Cultural knowledge is essential for interpretation. In medieval times the horizon was divided into four parts, delimited by the four solstice sunrise/set points, as we learn from the many treatises written by the Fathers of the Church and the medieval scholars. The solstices were related to significant religious feasts: the summer solstice with John the Baptist and the winter solstice with Jesus Christ. Moreover, the orientation of most medieval churches are delimited between these two points, formed by the solstices, with the highest and lowest light, and almost all of them show an alignment laid down by its history and dedication (Spinazzè, 2007/2008; 2015a; 2016a; 2016c; 2017).

2. LITURGICAL ASPECTS THAT DETERMINED THE ORIENTATION

In the Christian World the solar theological concept for orientation was surely the most used (Podossinov, 1991). This theory reflects in:

- *the orientation – direction of the prayer* (Figure 1): at first pagans, and then Christians turned to the risen Sun and lifted up their hands to greet and pray the

brightest star, seen as their divinity or God (Dölger, 1925. Vogel, 1964. De Blaauw, 2010, 2008, 1994. Piva 2010. Wallraff, 2001. Plato, *Symposium*, 220d. Cicero, *De natura deorum*, I.28.79. Virgil, *Aeneid*, XII.172-176);



Figure 1. Celebration of the mass, in *Décrétales de Grégoire IX*, Ms. 105, f. 133r, 13th c., Archives du Chapitre de Sion (CH).

- *the orientation of the sacred building*: thus, the medieval church took that orientation, especially looking to the point on the horizon where the Sun rose or set on a special day, an important day for the constructor. The orientation could be determined during the foundation ceremony of the church (empirical method) or by astronomical calculations, as it is indicated in treatises for an equinox and solstice alignment (Vitruvius, *De Architecture*, IX.7. References in: Spinazzè, 2016a; 2016b, 2-3);
- *the orientation of the baptistery*: The catechesis of the Fathers of the Church describes the baptismal rite in detail (Cyril of Jerusalem, *Mystagogic Catechesis*, c.313-387. John Chrysostom, *Homilies*, c.349-407. Theodore of Mopsuestia, *Baptismal Homilies*, c.350-428. Narsai c.399-502. Tertullian, *On Baptism*, c.160-c.220. St. Ambrose, *On the Mysteries*, c.339-397. Chromatius bishop of Aquileia, *Sermons*, c.335-408). The catechumen had to turn first to the West to renounce Satan, then he/she entered into the piscina where he/she turned to the rising Sun to obtain salvation. This turning from the West to the East, towards the region of light, symbolized the conversion to the Christian religion and a new re-birth. So, the architectural components of the baptistery and its church have a precise direction in correspondence with the symbolic path of the catechumen, performed inside the sacred building during the rite of baptism; e.g. the basilica of Saint Mary of the Assumption in Aquileia, Italy (Spinazzè, 2016c);

- *the orientation of the sepulture / burial*: archaeological excavation shows that often Early Christian burials goes along the church axes and the head of the dead faces the rising Sun waiting the Final Judgment (*Matthew* 25:31-46); e.g. the Romanesque church of St. Maurice d' Agaune, Switzerland (Spinazzè, 2015b; 2016a);
- *The light incidence inside the sacred building*: in some churches the light which passes the openings of the façade and/or the apse illuminates the altar or frescos on holy days thereby engendering a religious sentiment among believers (Incerti, 1999. Spinazzè, 2016a).

The orientation of a sacred building therefore emphasizes a deep symbolic meaning of its space.

3. THE FOUR SECTORS DEFINED BY THE SOLSTICES

We have the written evidence of numerous scholars and Fathers of the Church describing the path of the Sun and the Moon in their treatises and homilies. Such evidence provides us with a vision of the geographic, astronomical and liturgical concepts existing during the Middle Ages. These various descriptions divide the year into 8 moments and 4 sectors defined by the solstices. One indication can be found in the book *Etymologiae* (III. 51; V.34) by Bishop Isidoro of Seville (c. 560-636). The Bishop states the Sun stations like this: the sunrise and sunset on the winter solstice, 25th December; the sunrise and sunset on the equinoxes, 25th March and 24th September; the sunrise and sunset on the summer solstice, 24th June. He also associates the winter and summer solstices with the births of Jesus Christ and John the Baptist. We find the same information, also in the Roman calendar of the 5th century, which is the official Christian calendar, elaborated by Polemic Silvio, where the summer solstice (*solstitium*) occurs on June 24th and December 25th is memorized with these words *natalis domini corporalis* (Mortem, 1893, 279). Moreover, in the *martyrologium hieronymianum* (4th/5th century) on this day is written *nativitas Salvatoris Domini Nostri Jesu Christi*, and on June 24th appears the name of *sancti Iohannis baptis*, and on March 25th is recorded *Dominis nostris Iesus Christus crucifixus est et est conceptio sanctae Mariae et passio* (Mortem, 1893, 266-267. *Martyrologium Hieronymianum* 1894, II.1, 82, 36).

Also Bede, the Anglo-Saxon monk and scholar (c. 672-735), recommended in his work *De temporum ratione* (*caput XXX, De aequinoctiis et solstitiis*) to observe the equinoxes on the 8th *calendas* of April (25 March) and the 8th *calendas* of October (24 September) and the solstices on the 8th *calendas* of July (24 June) and the 8th *calendas* of January (25 December). In another passage of this work (*caput XXX*), Bede states that Christ was conceived and then died on 25th March (on this day the world was created; it is the day of the spring equinox) and Jesus was born on the winter solstice, December 25th (see also Tertullian, *De adversus Iudaeos*, VIII. St. Augustine of Hippo,

De civitate Dei, XVIII.54). Conversely, his forerunner, John the Baptist, was conceived in the autumn equinox, 24th September and was born on the summer solstice the 24th June. Bede explained, as the Creator was seen as the eternal light, the Sun of Righteousness, that's why He was born with the rising of the light, that is 25th December. Instead John the Baptist, the Messenger of Penance, had to diminish and so he was born when the light went shortening, 24th June, leaving his place to Christ.

Bede refers to the lines in the Gospel of John (3:28-30), when Saint John the Baptist exalts Christ: "You yourselves bear me witness, that I said, 'I am not the Christ, but I have been sent before him.' The one who has the bride is the bridegroom. The friend of the bridegroom, who stands and hears him, rejoices greatly at the bridegroom's voice. Therefore this joy of mine is now complete. He (Christ) must increase, but I must decrease."

It is important to distinguish the "liturgical equinox" fixed on March 25th from the astronomical equinox on March 21st ¹. This fundamental aspect has to be recognized, because most medieval churches are not aligned with the Sun on the astronomical equinox, but with the Julian calendar Equinox of March 25th, as the author demonstrated by her scientific studies (Spinazzè, 2016a, c). In the days following the Vernal Equinox, the darkness is completely defeated by the light, relating to the Bible (*Psalms* 18.29); it was believed that the world was created on March 25th, it is the remembrance of the Annunciation to the Holy Mary and the day of the Incarnation, feasts that had already been fixed in the 4th/5th century (Duchesne, 1903, 271-273. Strozzi, 1766, XIV. Brubaker, 2011, 19-22); it is a date with a deep religious meaning.

Throughout the whole Middle Ages these four solstitial points have been connected to the four fundamental dates: the summer solstice reveals the day of John the Baptist (June 24th), the winter solstice of Christ's Birth (December 25th) and the two close feasts saints' days, i.e., protomartyr Saint Stephen (December 26th) and Saint John the Evangelist (December 27th); while Vernal Equinox marks the Annunciation to Mary (March 25th); while the Autumnal Equinox commemorates her Assumption (September 25th); and the conception of John the Baptist (September 24th), with the close feast of the Archangel Saint Michael (September 29th) (Hrabanus Maurus, *Liber de computo*, Ms I-27, I, 9th c.). The above four days are the memorials of the feasts of Christ, the Virgin and John the Baptist to whom some of the main saints were set beside.

Great importance was given to the winter solstice when the Sun, in the constellation of Capricorn, rises at its most southern point on the horizon and moves slowly over the horizon describing its lowest course in the sky. Then the Sun begins to move the ever-increasing

¹ As the Julian calendar bears an error, the astronomical equinox during the Middle Ages happened some days earlier (1 day approx. every 128 years).

orbit and goes further northward until it reaches its northern most point at the summer solstice. The increase of the hours of light are perceived by naked eye a few days after the solstice, exactly at Christmas, the day when the Renewed Sun, Jesus Christ is reborn. Roman Emperor Aurelian (r.d. 270-275), as it is said, set the birth of Christ on December 25th, on the same day of the pagans' feast when they worshipped their Sun god Mithra (*Sol Invictus*). His reform was intended to bring peace religious unity to the Roman Empire (Usener, 1905. Hijmans, 2003. Berrens, 2004). The patriarch of Jerusalem Sophronius (6th-7th century) in his *Homilies* praised Christ's Christmas, seen as the only Sun of Righteousness. He invited the Christians to bring lit candles during the Lord's presentation to the Temple (40 days after His birth), associating their light with the divine light of Christ, in front of Him everything shines and darkness vanishes: "Everyone should be eager to join the procession and to carry a light. Our lighted candles are a sign of the divine splendor of the one who comes to expel the dark shadows of evil and to make the whole universe radiant with the brilliance of his eternal light. Our candles also show how bright our souls should be when we go to meet Christ... So let us all hasten together to meet our God" (Sophronius, *Homilies*, I. Luke 2.32).

The image of Christ seen as the Sun of Righteousness and bearer of victory was also based on a passage of the prophet Malachi (3.20 or 4.2): "But for you who revere my name, the Sun of Righteousness will rise with healing in its rays". Furthermore, one of the seven Antiphons which was sung on the vesper before Christmas, it exalts Jesus Christ as the true Sun of Righteousness and seen as the glory of eternal light:

"O Oriens, splendor lucis aeternae, et sol justitiae: veni, et illumina sedentes in tenebris, et umbra mortis" (Gauthier, Valentano, 1786, 185-227. Guillois, 1856, IV, 436-438).

"O Morning Star, splendor of light eternal and sun of Righteousness: Come and enlighten those who dwell in darkness and the shadow of death".

4. DE QUATTUOR PARTIBUS MUNDI

The heaven was also seen with "gates" of the Sun, so called *Solis portas*. Macrobius Ambrosius Theodosius (5th c.), in his treaty *Commentary upon Scipio's Dream* (I.12.1-3) said that there are two gates of heaven. He has an allegorical view of these *portas*: one is called the "gate of men", which is the Cancer from where the souls descend. The other is called the "gate of the gods", which is the Capricornus from where the souls ascend and become immortal. Through these gates it is believed that deserving souls / human beings reach and stay in heaven and are blessed with eternal happiness:

"Per has portas animae de caelo in terras meare et de terris in caelum remeare creduntur. Ideo hominum una, altera deorum vocatur: hominum, Cancer, quia per hunc in inferiora descensus

est; Capricornus, deorum, quia per illum animae in propriae immortalitatis sedem et in deorum numerum revertuntur".

The ancient scholars described the travel of the Sun in this way: after sunset, it is reborn in the morning at sunrise. It is believed that "the sun goes to the west and plunges into the Ocean, and it travels unknown paths under the earth, and once again runs back to the east" (Isidore, *The Etymologies*, III.52). So, Christ, seen as the Sun, descends in the evening through the "western gate" (seen also as the Passion) and reappears in his rising every morning from the "eastern gate" (seen as the Resurrection). Entering the church is a sacred gesture, one passes from this world to the world of God, which leads to eternal life.

We can find some other similar evidences in another treaties about astronomical topics (Anonymous author *Interrogationes et responsa varie*, Ms. I-27, IV, 9th c., Antonian Library of Padua). In a dialogue between a disciple and a magister, the disciple asks: "How many are the gates of heaven?" and the magister answers: "They are two, rising and setting, in fact, a door opens to the sun, the other closes to it" (Isidore, *The Etymologies*, XIII.1.7).

The summer-solstice-oriented architecture represents the descending phase of the solar cycle, whereas the one oriented to the winter solstice represents the ascending phase, called the door of the gods, of the Sun, of Heaven. Indeed, since that day in the northern hemisphere, the days are becoming increasingly longer and this moment is considered "the rebirth of the Sun", so it is written in the *Scriptures*: "This is the house of God and this is the gate of heaven" (*Genesis* 28:17).

This ancient thought represents the astronomical and liturgical concept of medieval scholars and shows that heaven is symbolically seen with two doors - *Solis portas* - which are facing the Sun: one door towards the sunset and the other one towards the sunrise. In this way, these two gates divide the heaven into four parts, formed by the solstices. In the *Munich computes* we have a clear understanding and explanation of it: "The Eastern sector is so called because the sun rises there every day between the extreme points of the solstices, where the Sun rises on June 24th and on December 25th. The South is measured from the place where the sun rises on December 25th to the place where it sets on the same day. The West is so called because it ends the day and is measured in relation to the space between the two extreme points of the solstices, where the Sun sets on December 25th and on June 24th. The North is measured from the place where the Sun sets on June 24th to the place where it rises on the same day" (*Computus*, Clm 14456, Bayerische Staatsbibliothek, 8th/9th c., ff. 25v, 26r. Warntjes 2010. Isidore, *The Etymologies*, III.42. Spinazzè 2016a).

This theory combined with the deep theological significance of the divine light associated with Christ and the Virgin, is not at all astonishing to get this kind of pattern (Figure 2. Spinazzè 2016a, 2017): most part of the medieval sacred buildings analysed, fall inside these two

sectors defined by the solstices (182 of 203: 89,7%), (and nearly all of them if we consider also the lunistic arc, 197 of 203: 97,1%); plus most of them indicate a deliberate and proper alignment according to their history. Allegorically these churches are protected by the Sun which starts to decrease (John the Baptist) and the Sun which starts to increase (Jesus Christ), but also by the Moon which represents the Virgin Mary (*Apocalypse of John*, 12.1. *Song of Songs* 6.10. Liguori, 1836, II, 316.) who symbolizes the Church too (Gaudentius of Brescia, *Sermons*, III.1. Pope Innocent, *Sermon* II. Liguori, *The glories of Mary* (lived in 17th-18th c.) Briffault 1931), while Christ represents the newly risen light, the Sun of Justice (*Malachi* 3:20. Clement of Alexandria, *Christ the Educator*, IX.88. Gaudentius of Brescia, *Sermons*, I. Sophronius, *Homilies*, I. Bernard of Clairvaux, *Sermons on the song of songs*, XXI.4, XXVIII.13, XXXI.2).

The buildings themselves provide evidence of their orientation and the existence of the link between the church and the heaven.

Moreover, cardinal points and solstices were associated with the winds, so the rose of winds was born. Aristotle in his work *Meteorologica* (II.5-6. See also: Pliny, *Historia Naturalis*, II.45-46), mentioned and described eight principal winds which fell together with the astronomical main points: Zephyrus blows from the equinoxial West; Apeliotes, meaning Sun, comes from the Equinox Orient; Aparctias, also called Borea, is the Northern Wind; Notos blows from the South; Caecias (Volturna) blows on the Sunrise on the summer solstice; while Euros blows on the Sunrise on the winter solstice; Argestes, Olimpia or Scirone, blows on the Sunset on the Summer solstice and the wind Lips blows on the Sunset on the winter solstice.

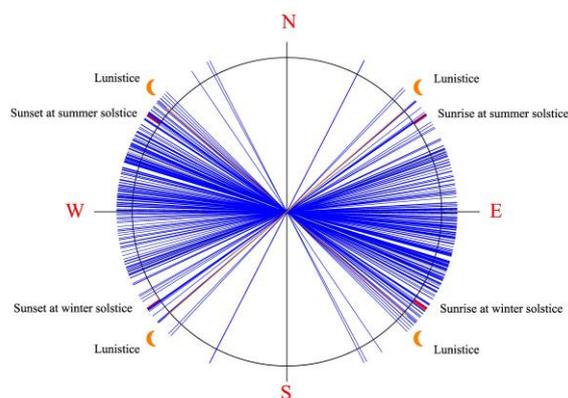


Figure 2. The above diagram shows the 203 alignments of the medieval sacred buildings' axis analysed. E. Spinazzè.

Objective testimonies are for example marble discs of Roman times, also called "wind tables" or anemoscopes, on which the directions of the winds are engraved (Rome, the Pio Clementino Museum, *Vestibulum*).

Coming back to medieval travel diaries it is significant to focus on the work *De locis sanctis* written by Adamnan (Adamnanus Hiensis), an Irish monk,

who lived in the 7th century. He wrote down the journey of the Gaulish monk and bishop Arculf who visited the Holy Land. He described in particular the church of the Holy Sepulchre in Jerusalem. In a version dating back to 9th century, a drawing of the Sepulchre is also included beside the text. It is one of the few oldest drawings of buildings that has reached us, giving remarkable information about this sacred building. The Holy Sepulchre has eight doors, four facing the wind Volturno (summer solstice) and four facing the wind Euro (winter solstice), creating a real representation of the solstice section designed and planned for this church (Adamnanus, *De locis sanctis*, Ms. Rh.73, II.1-14):

"De ecclesia rotundae formulae super sepulchrum domini aedificata et de ipsius sepulchri figura et eius tegorioli. "Haec bis quaternales portas habet, ... ex quibus iiii ad ultimum spectant, qui et caecias dicitur ventus, ali vero iiii ad eorum respiciunt".

According to the Venerable Bede's description, Adamnano gave his book to King Aldfrith of Northumbria in 698 to be widely spread all over the Western Europe and therefore it had to be written in such a way that everyone could read and understand it (BEDE, *Ecclesiastical History of the English People*, V.15).

Observing this drawing (Figure 3), we can recognize sectors and lines like the ones termed by the medieval scholars who divided the heaven into four parts. The cardinal points (North, South. Isidore, *Etymologies* XIII.1.7: "*Cardines autem mundi due, Septentrio et Meridies; in ipsis enim voluitur caelum*") and the West point correspond to the directions in the drawing on the manuscript. Furthermore, we can notice an Easter sector which is similar to the solstice sector. If we calculate the solstitial arc for the city of Jerusalem (latitude 31°46' North), the azimuth between the astronomical North and the point where the Sun rises on the summer solstice is about 62° and on the winter solstice it is about 118°, so the solstice arc corresponds to 56°. If we include these values in this medieval drawing, we note that the sector beginning of the doors corresponds, roughly, to the solstice arc for the city of Jerusalem, and the *sepulchrum domini*, which shows another orientation, (4th century. Azimuth of the *Sancti Sepulchri* approx. 104°-284°) to the sunset on the local horizon around 20th April, which could be Easter, highlighting the Passion of Christ (*Psalms* 104 (103). Isidore, *Etymolo-*

² Geographic coordinates: lat. 31°46' N and long. 35°13' E. Approx. azimuth of the *Sancti Sepulchri* in the direction of the risen Sun 104°, in the direction of the setting Sun approx. 284°. Astronomical horizon = local horizon. Altitude of Jerusalem approx. 750 m. Declination of the celestial body on the mountainous profile on the rising: -12°12' and on the setting: 11°33'. Corresponding days on the sunrise on the mountainous profile for the first half of 4th century: 17th February, 25th October; on the sunset: 20th April, 23rd August.

gie, VI, cap. XVII, XIX. Saint Augustine, *Enarrationes in psalmos*, XXVI. 54). Eusebius of Caesarea (c. 260-c. 340), a Christian theologian, in his work of the *Life of Constantine* (III.31) states that the construction of the *Sancti Sepulchri* was ordered by the Emperor Constantine in the year 325 (in this year Easter fell on 18th April). Also in the *Itinerarium burdigalense* (Donner, 2002, n. 594), dating back to 333, written by an anonymous pilgrim, it is recorded that this basilica was built by Constantine. This church is the place where Christ was buried and it was called the church of Resurrection. Furthermore, the *Sancti Sepulchri*, "enclosed" by the two solstices, between the feast of John the Baptist when the light starts to diminish and the feast of Jesus Christ when the Sun starts to rise again, incorporates an Easter alignment, underlining His birth, death and Resurrection.

This church conveys a deep message to the Christians: the doors oriented towards the summer and winter solstice highlight the passage expressed by John the Baptist in the Gospel of John (3:28-30). The designation *Sepulchri* underlines Easter, emphasizing the death and Resurrection of Christ, eternally memorialized by the Paschal orientation of the sacred building³.

5. SOLSTICIAL LIGHT INSIDE SACRED BUILDINGS

It was astonishing to observe that only 14 of 203 (7%) medieval churches were oriented towards the solstice points, either on local or astronomical horizons (Figure 4). Even if the summer solstice is seen as the highest light (Kreuser, 1851, I, 38-48), compared with the magnificence of Christ, and the winter solstice seen as the "new" Sun and the Nativity of Christ since ancient times, medieval builders chose in most cases another orientation for a sacred building: on one of the four Mary feasts commemorated during the Medieval age (Annunciation, March 25th; Assumption, August 15th/January 18th; Nativity, September 8th; Purification, February 2nd) or on the patron saint's day (Spinazzè, 2016a, c).

We wonder why there are so few alignments towards the summer solstice and the winter solstice even their deep symbolic significance. One reason for the first case could be represented by the symbolism of light, which begins to decrease after the summer solstice. In the second case, one might think of a practical reason linked to climate, for the difficulty of tracing the foundations during the winter especially in a mountainous setting.

On the other hand, we could notice in many more medieval churches an interior summer solstice alignment:

- Light which passes through the original openings (sometimes rebuilt on the original position) such as a rose window on the façade, crosses the whole church and goes out from the windows of the apsis with the setting Sun around the summer solstice. As we can see in the churches: St. Mary, Piacenza; St. Peter in ciel d'oro, Pavia. In the church of Piacenza, around the summer solstice the "highest light" on its setting passes through the large rose on the façade going through the whole nave and out the apsis window showing even today this fundamental moment, the magnificence of Christ. On this particular morning, this "highest light" brightens also the altar. A similar case: church of St. Martin, Siccomario, Pavia (Spinazzè, 2016a, n. 35, 24, 22; 2016b).
- Or the summer solstice light signs the length of the whole church touching the apsis area with the sunset. As we can see in the medieval churches in Italy: St. Mary, Gambassi Terme, Chianni; St. Stefan, Sorano, Filatiera; St. Theodor, Pavia; Chiaravalle Milanese, Milan; Chiaravalle della Colomba, Alseno (Spinazzè, 2016a, n. 56, 43, 27, 20, 38. Incerti, 1999).
- Also frescos sometimes had a special place in the church and were illuminated on most significant days and hours of the year. In the Cistercian church of Saint Mary near Milan the fresco over the top of the lantern, which depicts the Marriage of the Virgin, is illuminated on the summer solstice when the Sun reaches its highest light and at the same time it starts to diminish (Spinazzè, 2016a, n. 20).

6. CONCLUSION

In medieval times the horizon was divided into four parts, delimited by the four points of the solstices. In this way two sectors were formed facing the Sun, one sector in direction of the sunrise and the other in direction of the sunset. The orientation of most medieval churches up to the Romanesque age are enclosed between these two liturgically and astronomically important days when the Sun begins to diminish (summer solstice), the feast of John the Baptist and when the Sun begins to rise again (winter solstice), the birthday of Jesus Christ. This representation recalls a deep message written in the line of the Gospel of John the Apostle (3:28-30) when John Baptist says: "I have to diminish and He (Jesus Christ) has to increase".

But there are only few medieval churches with major axes oriented to the solstitial light. On the other hand, the medieval builders preferred to align a sacred building between the solstice points of minimum and maximum sunlight: viz. mostly towards the Sun on the Virgin's feast (Annunciation, Assumption, Nativity, Purification) or on the patron saint's day. However, the solstitial light often strikes significant architectural feature inside the church. Either the length of the entire church or the altar is fully illuminated among the summer solstice, or a significant image, fresco is illuminated around these days. Or we can

³ Another sacred building in the Middle East, which contains an orientation with the solstitial light: the church of St. Sophia, Constantinople, built in 6th c. In this church the axis has a perfect winter solstice alignment (Schibille 2009).

observe how the solstitial light passes through the openings on the façade and goes out from the apsis window.

One significant medieval drawing, dating back to the 9th c. of a sacred building which reached us through the work *De locis sanctis* of Adamnano (7th c.), represents the *Sancti Sepulchri* of Jerusalem. In this drawing the doors were aligned in the direction of the wind Volturno (summer solstice) and the

wind Euro (winter solstice). It shows us a real representation of the solstitial arc, with the cardinal points through the niches and with a Pasqual alignment of the *Sancti Sepulchri* on the sunset recalling with its dedication the birth, death and Resurrection of Jesus Christ.

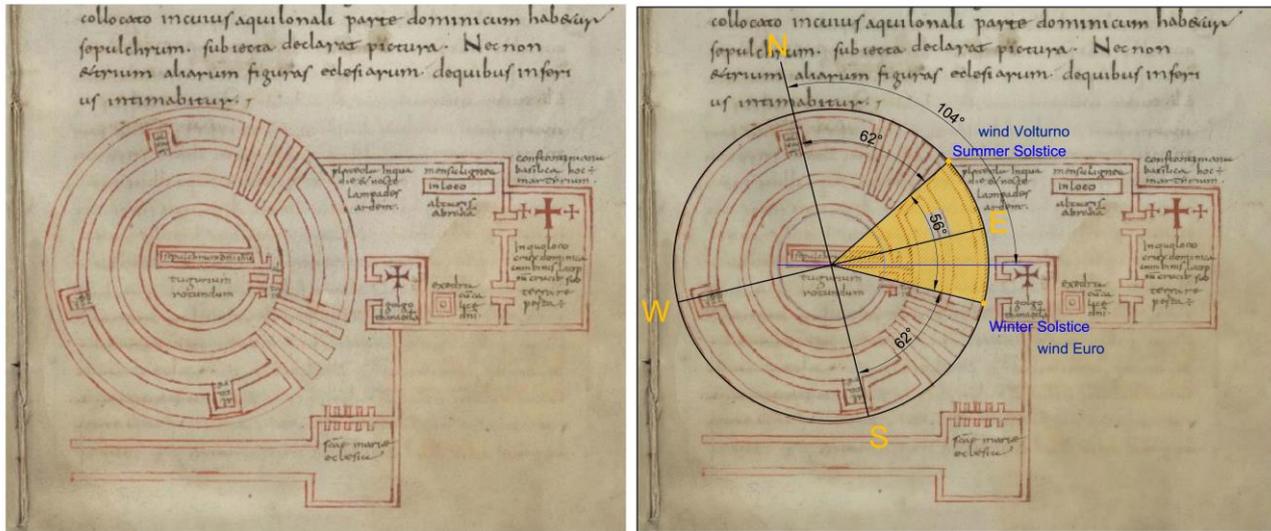


Figure 3. Left: Drawing of the Ecclesia Sancti Sepulchri in Jerusalem, Church of the Resurrection, in Adamnanus of Iona (lived in 7th c.), *De locis sanctis*, Zurich, Zentralbibliothek, Ms. Rh. 73, 9th c., ff. 2r-28r, drawing f 5r. Right: Reconstruction by E. Spinazzè.

Sacred building Place in Italy	Century of con- struction	Geographic coordinates Lat. N. Long. E.	Azimuth true rising setting	Decl. on a.h. rising setting	Error of azimuth <	Days corresp. to foundation age rising setting	Horizon Altitude rising setting	Decl. on l.h. rising setting	Days corresp. to foundation age rising setting	Link with the history of the sacred building interpretation
San Giacomo di Rialto Venice	5th	45°26'18'' 12°20'06''	123°31'38'' 303°31'38''	-23°15' 22°21'	0,4°	10 Dec - 29 Dec 10 July - 1 June	--- ---	-23°15' 22°21'	10 Dec - 29 Dec 10 July - 1 June	Christmas, winter solstice
San Fermo e Rustico Verona	8th	45°26'23'' 11°00'01''	55°45'03'' 235°45'03''	23°28' -23°42'	1,2°	summer solstice winter solstice	7°58' ---	28°34' -23°42'	lunistice winter solstice	lunistice winter solstice
San Pietro Camaiole (Lucca)	8th	43°56'18'' 10°18'36''	123°18'16'' 303°18'26''	-23°44' 22°51'	0,6°	winter solstice 5 June - 4 July	4°44' 6°43'	-20°07' 27°33'	18 Jan - 18 Nov ---	winter solstice on a.h. St Peter, 18 January, on l.h.
San Marziale Venice	9th	45°26'37'' 12°19'57''	124°43'59'' 304°43'59''	-24°00' 23°06'	0,4°	winter solstice 6 June - 1 July	---	-24°00' 23°06'	winter solstice 6 June - 1 July	St Marziale, Limoges, 30 June
Santa Maria Follina (Treviso)	10th	45°57'16'' 12°07'05''	60°06'50'' 240°06'50''	19°49' -20°42'	0,4°	15 May - 21 July 13 Jan - 19 Nov	4°48' 5°51'	23°29' -15°37'	11 June - 21 June 1 Feb - 1 Nov	summer solstice Purification of Mary, 2 Feb
Abbadia Isola Monteriggioni (Siena)	10th	43°23'15'' 11°11'41''	127°01'47'' 307°01'47''	-26°23' 25°30'	0,6°	---	3°51' ---	-23°25' 25°30'	10 Dec - 23 Dec ---	Christmas, winter solstice
San Stae (Eustachio) ribuilt 17th c., Venice	10th	45°26'29'' 12°19'50''	124°35'25'' 304°35'25''	-23°55' 23°01'	0,4°	winter solstice 4 June - 28 June	---	-23°55' 23°01'	winter solstice 4 June - 28 June	winter solstice
San Simeone Profeta (grande) Venice	10th	45°26'26'' 12°19'27''	54°08'01'' 234°08'01''	23°49' -24°43'	0,4°	summer solstice ---	---	23°49' -24°43'	summer solstice ---	summer solstice
Sant'Aponal Venice	11th	45°26'16'' 12°19'56''	55°02'26'' 235°02'26''	23°15' -24°09'	0,4°	7 June - 26 June winter solstice	---	23°15' -24°09'	7 June - 26 June winter solstice	approx. summer solstice winter solstice
San Martino Arnad (Aosta)	11th	45°38'42'' 7°43'09''	126°00'32'' 306°00'32''	-24°43' 23°48'	0,5°	approx. winter solstice summer solstice	15°32' 9°57'	-12°16' 31°27'	12 Feb - 17 Oct ---	winter solstice summer solstice on a.h.
Eremo di Sant'Alberto Butrio (Pavia)	11th	44°51'18'' 9°08'59''	124°51'22'' 304°51'22''	-24°20' 23°27'	0,9°	approx. winter solstice summer solstice	10°39' ---	-15°59' 23°27'	31 Jan - 30 Oct summer solstice	Purification of Mary, 2 Feb summer solstice
Santa Maria Carità Acc. Venice	12th	45°25'53'' 12°19'41''	123°21'13'' 303°21'13''	-23°08' 22°14'	0,4°	5 Dec - 25 Dec 27 May - 5 July	---	-23°08' 22°14'	5 Dec - 25 Dec 27 May - 5 July	Christmas, approx. winter solstice
Santo Stefano Venice	13th	45°26'01'' 12°19'50''	125°19'56'' 305°19'56''	-24°23' 23°29'	0,4°	summer solstice	---	-24°23' 23°29'	summer solstice	summer solstice
Sant'Andrea Apostolo Venice	13th-14th	45°26'18'' 12°18'57''	125°53'32'' 305°53'32''	-24°44' 23°50'	0,4°	summer solstice	---	-24°44' 23°50'	summer solstice	summer solstice

Figure 4. Alignments on the solstices. 14 medieval sacred buildings (in Italy) of 203 (6,9%).
a.h. = astronomical horizon; l.h. = local horizon. For each sacred building an accurate georeferenced survey together with astronomical and trigonometrical calculations was carried out. (For detailed information see the publications of the author, with the diagrams, drawings, surveys and calculations).

REFERENCES

- Adamnanus of Iona (9th c.) *De locis sanctis*. Ms. Rh. 73, manuscript originally from Reichenau, Zentralbibliothek, Zurich.
- Anonymous author (9th c.) *Interrogationes et responsa varia*. Ms. I-27 – Miscellanea, Biblioteca Antoniana, Padova, part IV.
- Aristotele (2003) *Meteorologia*, by Lucio Pepe, Bompiani, Milano.
- Berrens, S. (2004) *Sonnenkult und Kaisertum von den Severern bis zu Constantin I*. F. Steiner, Stuttgart.
- Briffault, R. (1931) *The Mothers*. New York.
- Brubaker, L.; Cunningham, M. B. (2011) *The Cult of the Mother of God in Byzantium*. Ashgate, Surrey GB.
- Cicerone (2000) *La natura divina*, by Cesare Marco Calcante, Bur, Milano.
- Citez de Jherusalem* (1896) by C.R. Conder, *City of Jerusalem*. Palestine Pilgrims' Text Society, Adelphi, London.
- Computus* (8th/9th c.) Clm 14456. Bayerische Staatsbibliothek. Manuscript transcribed and translated in English by Immo Warntjes (2010) *The Munich Computus: Text and Translation, Irish computistics between Isidore of Seville and the Venerable Bede and its reception in Carolingian times*. Franz Steiner Verlag, Stuttgart.
- De Blaauw, S. (2010) In vista della luce. Un principio dimenticato nell'orientamento dell'edificio di culto paleocristiano. In Paolo Piva, *Arte medievale, le vie dello spazio liturgico*. Jaca Book, Milano, pp. 15-45.
- De Blaauw, S. (2008) Orientierung. Architektonische Ausrichtung. *Reallexikon für Antike und Christentum*. A. Hiersemann, Stuttgart, Vol. XXII, pp. 278-282.
- De Blaauw, S. (1994) *Cultus et decor, liturgia e architettura nella Roma tardoantica e medievale*. Biblioteca Apostolica Vaticana, Città del Vaticano, Vol. I e II.
- Dölger, F.J. (1925) *Sol Salutis, Gebet und Gesang im christlichen Altertum*. Aschendorff Verlagsbuchh., Münster in Westfalen.
- Donner, H. (2002) *Pilgerfahrt ins Heilige Land, die ältesten Berichte christlicher Palästinapilger (4.-7. Jahrhundert)*. Verlag Katholisches Bibelwerk, Stuttgart: *Peregrinatio Egeriae*, pp. 68-133; *Itinerarium Burdigalense. Breviarius de Hierosolyma*, pp. 214-225; *Adamnani de locis sanctis libri tres*, pp. 296-394.
- Duchesne, L. (1903) *Origines du culte chrétien*, ed. Albert Fontemoing, Paris.
- Gauthier, F.L. and Valentano, N. (1786) *Riflessioni sopra gli O, le antifone dell'Avvento, in forma di omilie*, ed. S. Occhi, Venezia.
- Guillois, A. (1856) *Explication historique, dogmatique, morale, liturgique, canonique du catéchisme*, ed. C. Monnoyer, Paris, tome IV.
- Hijmans, S. (2003) Sol Invictus. The Winter Solstice and the origins of Christmas. *Mouseion*, Series III, Vol. 3, pp. 377-398.
- Hodoeporicon, S. Willibaldi (1880/1881) *S. Willibalds Pilgerreise, geschrieben von der Heidenheimer Nonne*, by J. Brückl, Druck Däntler, Eichstätt.
- Hrabanus Maurus (9th c.) *Liber de computo*. Ms. I-27 – Miscellanea, Biblioteca Antoniana, Padova, part I.
- Incerti, M. (1999) *Il disegno della luce nell'architettura cistercense*. Certosa Cultura, Firenze.
- Kreuser, J.P.B. (1851) *Der christliche Kirchenbau, seine Geschichte, Symbolik, Bildnerie*. Bonn.
- Liguori, Alphonsus (1888) *The glories of Mary*. Kenedy & Sons, New York.
- Macrobio (2007) *Commento al sogno di Scipione*, by M. Neri, Bompiani, Milano.
- Martyrologium Hieronymianum* (1894) by G. B. de Rossi, L. Duchesne, *Acta Sanctorum Novembris*. Société de Librairie, Bruxelles.
- Mortem, Caesaris (1893) *Inscriptiones Latinae Antiquissimae*, ed. Reimerum, Berlin.
- Piva, P. (2010) Le vie dello spazio liturgico. In Paolo Piva, *Arte medievale, le vie dello spazio liturgico*, Jaca Book, Milano, pp. 7-13.
- Platone (1992) *Il Simposio*, by Carlo Diano, Marsilio, Venezia.
- Plinio Gaio Secondo (1982) *Historia Naturalis*, by Alessandro Barchiesi, Roberto Centi, Einaudi, Torino.
- Podossinov, A. (1991) Himmelsrichtung. *Reallexikon für Antike und Christentum*. Anton Hiersemann, Stuttgart, Vol. XV, pp. 233-286.
- Pope Innocent (2006) *I Sermoni*, by Stanislao Fioramonti, Libreria editrice Vaticana, Città del Vaticano.
- Procopius (1896) *Buildings of Justinian*, by Aubrey Stewart, Palestine Pilgrims' Text Society, Adelphi, London.
- Publio Virgilio Marone (2012) *Eneide*, by Alessandro Fo, Einaudi, Torino.
- Schibille, N. (2009) Astronomical and Optical Principles in the Architecture of Hagia Sophia in Constantinople. *Science in Context*, March, n. 22, pp. 27-46.

- Spinazzè, E. (2007/2008, 2015a) *Luce ed Orientazione nelle Abbazie Benedettine Altomedioevali e Medioevali nel Veneto*. Università Ca' Foscari Venezia, Magister Thesis in Medieval Archaeology, year 2007/2008; published in 2015, title: *Luce e canto incisi nelle pietre. Allineamenti astronomici delle chiese monastiche benedettine medioevali nel Veneto*, Cleup, Padova.
- Spinazzè, E. (2015b) Un santo, una Pasqua e un lunistizio a Saint-Maurice d'Agaune. *Atti del XIV Convegno nazionale annuale S.I.A. Padova, 17-18 ottobre 2014*, Padova University Press, pp. 307-314.
- Spinazzè, E. (2016a) *La luce nell'architettura sacra: spazio e orientazione nelle chiese del X-XII secolo tra Romandie e Toscana*. Mediaevistik, Peter Lang Verlag, Frankfurt am Main (Ph.D. Thesis, 2013/2014, Department of Philosophy and Cultural Heritage, Ca' Foscari University of Venice, IUAV Venice in joint supervision program with University of Zurich).
- Spinazzè, E. (2016b) The alignments of sacred medieval buildings and the path of light inside the church on the Patron Saint's day. *SEAC-proceedings, Société Européenne pour l'Astronomie dans la Culture, International Conference, Rome, 9-13 November 2015, Astronomy in Past and Present Cultures, Mediterranean Archaeology and Archaeometry*, Vol. 16, no. 4, 455-463.
- Spinazzè, E. (2016c) Il battistero e il fonte: un'interpretazione sull'orientazione degli edifici battesimali medioevali nel medio-basso Friuli. Il percorso 'simbolico' del catecumeno da Occidente verso Oriente. *Atti dell'Accademia 'San Marco' di Pordenone*, Pordenone, Vol. n. 18, pp. 491-550, 967.
- Spinazzè, E. (2017) Gli allineamenti negli edifici sacri medioevali situati nel Nord e Centro Italia. Risultati e interpretazioni. *Atti dell'Accademia 'San Marco' di Pordenone*, Pordenone, Vol. n. 19, pp. 379-436.
- Strozzi, Pier Filippo (1766) *L'assunzione al cielo della Madre di Dio*. Stamperia Generoso Salomoni, Roma.
- The Epitome of S. Eucherius about certain Holy Places* (1890) by A. Stewart, Palestine Pilgrims' Text Society, Adelphi, London.
- Usener, H. (1905) Sol invictus. *Rheinisches Museum für Philologie*, n. 60, pp. 465-491.
- Vitruvio Pollione Marco (1990) *De Architectura*, by di Luciano Migotto, Edizioni Studio Tesi, Padova.
- Vogel, C. (1964) L'orientation vers l'est du célébrant et des fidèles pendant la célébration eucharistique. *L'orient Syrien*, Vernon, IX, pp. 3-37.
- Wallraff, M. (2001) *Christus verus sol: Sonnenverehrung und Christentum in der Spätantike*. Jahrbuch für Antike und Christentum, Aschendorff Verlagsbuchhandlung, Münster in Westfalen, Ergänzungsband XXXII.
- Works by the Fathers of the Church are cited in the text *supra*.