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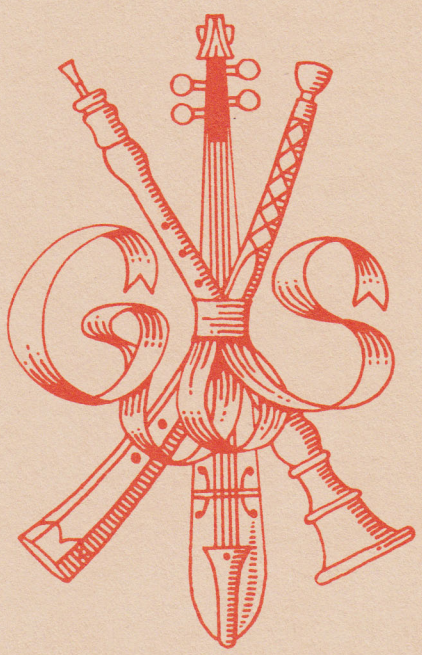

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An Inside Look at Four Historical Violins by Brussels Makers

During the second half of the seventeenth and first half of the eighteenth century violin making in Brussels flourished, and instruments made during this era, both by court employees and independent makers, can still be enjoyed in various museum collections, concert performances and recordings. This article explores four of those instruments, all violins, by Jan de Maseneer, Gaspar Borbon, Egidius Snoeck and Benoit-Joseph Boussu, currently part of the collection of the Musical Instruments Museum (MIM) in Brussels. In the past, instruments by the above and other Brussels makers from the same period have been examined, and their constructional features identified, most notably by Lutgart Moens,[1] Karel Moens[2] and Mia Awouters.[3] By using the present-day techniques of digital endoscopy and CT-scanning, however, we can now provide revealing and comprehensive insights into the architecture and material selection of these instruments. The results of those investigations enable us to elaborate on the way the violins were constructed and further, to discern developments in the way successive Brussels violin makers have worked. It also becomes possible to identify modifications and to determine the authenticity of various often-replaced parts of the instruments, such as the neck, the upper block and the bass bar.

HISTORICAL BACKGROUND[4]

The religious struggles in the Low Countries in the second half of the sixteenth century, when part of the local population revolted against the Catholic Spanish rulers, ultimately resulted in the division of the region into the northern and the southern Netherlands. The seven Protestant northern provinces united into a republic from 1579, which would grow into a strong political and cultural force in the seventeenth century. The southern territories

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[1] Lutgart Moens, *De familie Snoeck, vioolbouwers aan het hof te Brussel in de 18de eeuw*, unpublished licentiate thesis, University of Leuven (1976).

[2] Karel Moens, 'Vioolbouw in de Oostenrijkse Nederlanden', *Arca Lovaniensis* 10/b Jaarboek 1981 (Leuven: Depret, 1983), pp.135–56.

[3] Mia Awouters, 'X-raying musical instruments: a method in organological study', *Revue belge de musicologie / Belgisch tijdschrift voor muziekwetenschap* 36–38 (1982–1984), p.213.

[4] Unless otherwise stated, the historical context is based on J. Blom and E. Lamberts, eds., *Geschiedenis van de Nederlanden* (Amersfoort: ThiemeMeulenhoff, 2012).

returned to be within the Spanish sphere of influence, with, from 1598, the archduke Albrecht and his wife archduchess Isabella (daughter of Spanish king Philip II) as sovereigns. At the beginning of the seventeenth century, Brussels functioned as the capital of the southern Netherlands and under the regime of the archdukes, Catholicism was consolidated.

During Albrecht's and Isabella's regency, the orchestra of the court's private, liturgical chapel became the most important musical ensemble in the southern Low Countries. According to Awouters,[5] this stable situation ensured that from the middle of the seventeenth to the end of the eighteenth century, various families of musicians (instrumentalists as well as singers) and instrument makers would be employed by the court chapel for several generations. One such early chapel employee was Laureys vander Linden, recorded as musician or instrument maker in court documents during the period 1611–1653.[6] Subsequently, archival evidence demonstrates that successive members of the Borbon family worked at the chapel as musicians and/or stringed instrument makers from the 1640s until 1710.[7] Awouters distinguishes Peeter (i), Peeter (ii) and Gaspar, presumably grandfather, father and son.[8] They were succeeded by descendants of the Snoeck family – Egidius, Marcus and Henri-Augustin – who would serve in the chapel as instrument makers and repairers between 1710 and 1764.[9]

Besides the chapel, another musical entity at the court during the seventeenth century was the chamber ensemble. Whereas the chapel musicians provided the music for the religious services at the court, the chamber orchestra, with a different music master, performed worldly repertoire for diversion of the nobility. Chapel players sometimes also worked for the chamber ensemble.[10] In Figure 1 in the colour section, a painting by the Flemish artist Hieronymus Janssens (*b* Antwerp 1624–*d* Antwerp 1693) is shown, depicting a court scene with a dancing nobleman and -woman, accompanied musically by a small group of stringed instrument players. This painting may give an impression of how musicians were deployed in seventeenth-century court life in the southern Low Countries, and of the instruments they used.

A third major factor in musical life in Brussels was formed by the churches. In the seventeenth century, church music was given new colour due to the introduction of basso continuo and violins.[11] At times there was a strong musical connection between the ducal court and the St Gudula collegiate church: Jan Tichon, for example, functioned as director of both their ensembles between 1658 and 1666.[12] In the course of the century, the Flemish musical tradition, initially still prevailing at the court chapel, would be gradually influenced and replaced by the more contemporary Italian styles.[13] In 1703 or 1706,[14] Venice-born Pietro-Antonio Fiocco became the chapel master, and a new Italianate approach was introduced by him and his successors.[15]

Following the deaths of the archdukes Albrecht

[5] Mia Awouters, 'De hofkapel en haar instrumentenbouwers ten tijde van Karel van Lotharingen', *Het tijdschrift van de Dexia Bank* 54/212 (Brussels: Dexia, 2000), p.63.

[6] Moens (1983), p.144; and Mia Awouters, 'VANDER LINDEN, Laureys', in Malou Haine and Nicolas Meeùs, eds., *Dictionnaire des facteurs d'instruments de musique en Wallonie et à Bruxelles du 9e siècle à nos jours* (Liège/Brussels: Mardaga, 1986), pp.427–8.

[7] Moens (1976), pp.34–8; Paul Raspé, 'La lutherie', in Robert Wangermée and Philippe Mercier, eds., *La musique en Wallonie et à Bruxelles* (Brussels: La renaissance du livre, 1980), vol.1, p.276; and Moens (1983), pp.137–8 and 142–5.

[8] Mia Awouters, 'BORBON', in Haine and Meeùs (1986), pp.60–1.

[9] Moens (1976), pp.79–86, 95–103 and 117–23; Raspé (1980), pp.276–8; Moens (1983), pp.142–5; and Mia Awouters, 'SNOECK', in Haine and Meeùs (1986), pp.385–8.

[10] Robert Wangermée, 'La musique à la chapelle royale des Pays-Bas', in Wangermée and Mercier (1980), p.202.

[11] José Quitin, 'La musique dans les églises urbaines', in Wangermée and Mercier (1980), pp.219–22.

[12] D. Coekelberghs and A. Vanrie, 'Brussel en de kunsten', in Jean Stengers *et al*. eds., *Brussel. Groei van een hoofdstad* (Antwerpen: Mercatorfonds, 1979), p.345.

[13] Wangermée (1980), p.204.

[14] Moens, Awouters, and Weytjens state 1703 as the year of Fiocco's appointment as chapel master; see Moens (1976), p.14; Awouters (2000), p.64; and Renate Weytjens, 'De Fiocco's: een Italiaanse muzikantenfamilie in de Zuidelijke Nederlanden', in Louis Peter Grijp, ed., *Een muziekgeschiedenis der Nederlanden* (Amsterdam: Amsterdam University Press-Salomé, 2001), p.330. On the other hand, Coekelberghs and Vanrie, and Sadie, state the year of appointment as 1706; see Coekelberghs and Vanrie (1979), p.345; and Julie Anne Sadie, 'Biographical dictionary. The Low Countries', in Julie Anne Sadie, ed., *Companion to baroque music* (Berkeley/Los Angeles: University of California Press, 1998), p.323.

[15] Coekelberghs and Vanrie (1979), p.345.

and Isabella in 1621 and 1633 respectively, a series of Spanish governors ruled the southern Netherlands throughout the seventeenth century. As a result of the War of the Spanish Succession in the early eighteenth century, the region, including Brussels, had come under Austrian government in 1715. A big fire in 1731 destroyed the ducal palace at the Coudenberg, including musical treasures which were kept there.[16] During the middle of the eighteenth century, under the regime of Charles of Lorraine (Governor-General of the Austrian Low Countries), who took a keen interest in science and art, music making at the court prospered. The direction was now in the hands of chapel master Jean-Joseph Fiocco and his successor Henri-Jacques de Croes, and the chapel included players like violinist and composer Pieter van Maldere, harpsichordist, organist and composer Josse Boutmy and members of the Rottenburgh family.[17] Typically, the ensemble consisted of six to ten adult male singers and a number of choir boys, around ten players of bowed stringed instruments of various sizes and an organ player, completed by one or two oboists and a bassoonist.[18] By this time, the chamber orchestra was no longer a separate unit, since the chapel musicians provided music for religious as well as secular purposes.[19] Concurrently, Brussels opera theatre 'La Monnaie', founded in 1700, followed the fashion of other European capitals, especially that of Paris with French and Italian repertoire. Under the direction of D'Hannetaire (Jean-Nicolas Servandoni) and later Ignaz Vitzthumb, the theatre became renowned by the second half of the eighteenth century.[20]

Returning to the court's instrument makers, after the decease of Marcus Snoeck in 1762 and a short tenure of his son and successor Henri-Augustin (1762–1764), the position of court instrument maker was abolished and replaced by that of repairer, wages being reduced from 300 to 50 florins.[21] The new role was filled by Egidius Michiels (appointed in 1764, *d*1783) and Joannes Nuemans (appointed in 1758, *d*1784).[22] While Michiels was in charge of the violin family division, Nuemans appears to have tuned and maintained the harpsichords; few instruments are known by either of these two men, so it is likely that new instruments were bought from local independent makers or from abroad.[23] The last court maker was Henri-Joseph de Lannoy, who was employed from 1785 until 1794.[24] At the time of his appointment, de Lannoy had already spent 50 years as an independent violin maker in various cities (starting in Brussels in 1730),[25] and he is mentioned in chapel payrolls as instrument maker rather than repairer.[26] Only one instrument from his time as court maker is known, however, a violin from 1791,[27] although its authenticity has been questioned.[28] In 1794, the court chapel was disbanded, due to the annexation of the Austrian Low Countries by France.[29] This event ended the long tradition of Brussels court instrument making.

In parallel with the activity of these court makers, Brussels also harboured several independent violin makers.[30] One of the earliest amongst them was Jan de Maseneer, who is believed to have worked around the same time as Gaspar Borbon. Other independent violin makers – Benoit-Joseph Boussu, Jean-

[16] Coekelberghs and Vanrie (1979), p.345.

[17] Koen Buyens, *Musici aan het hof. De Brusselse hofkapel onder Henry-Jacques De Croes (1749-1786): een sociaal-historische studie* (Brussels: VUBPRESS, 2001).

[18] Moens (1976), pp.15–8; and Buyens (2001), pp.79 and 119–21.

[19] Wangermée (1980), p.209.

[20] Coekelberghs and Vanrie (1979), p.345.

[21] Moens (1976), pp.119–21; and Moens (1983), p.144.

[22] Moens (1976), pp.124–6; Moens (1983), p.144; Mia Awouters, 'MICHIELS, Egidius', in Haine and Meeùs (1986), pp.300–1; and Mia Awouters, 'NUMANS (Nuemans, Neumans), Joannes Baptista', in Haine and Meeùs (1986), pp.312–3.

[23] Moens (1983), p.144.

[24] Moens (1976), pp.129–30; and Moens (1983), p.144.

[25] Paul Raspé, '(1) Henri-Joseph DE LANNOY', in Haine and Meeùs (1986), p.114.

[26] Moens (1976), p.130; and Moens (1983), p.144.

[27] The Musical Instruments Museum, Brussels, Belgium, MIM inv. no. 2810.

[28] Moens (1983), p.144.

[29] Buyens (2001), p.232.

[30] Moens (1983), pp.146–52.

Hyacinthe Rottenburgh[31] and Petrus Boom[32] – were active in the second half of the eighteenth century and must have taken advantage of the declining instrument building activities at the court. Perhaps, the autonomous makers built instruments for use in the court chapel on occasions, but it is known that at least Boussu made bowed stringed instruments for churches,[33] self-employed musicians[34] and amateurs.[35]

SELECTION OF THE FOUR VIOLINS

The violins selected for this study are all part of the collection of the Musical Instruments Museum (MIM) in Brussels and are introduced in Table 1. None of the investigated instruments is presently in playing condition.

All four selected violins were included in the catalogue by Mahillon[36] of the 'Musée instrumental du Conservatoire royal de musique de Bruxelles'. They were acquired by that museum (the precursor of the MIM) in 1908 from the estate of collector César Snoeck (*b*1834–*d*1898), who gathered, amongst many other instruments, around 140 violin and viola da gamba family instruments by makers from the Low Countries of the seventeenth through the nineteenth centuries. The collector himself incorporated the four violins in his catalogue of Flemish and Dutch instruments, posthumously published in 1903.[37] Moreover, vander Straeten[38] writes in 1880 that the collection of César Snoeck includes 'pochette et violons sans date' by 'Jean De Maseneer' and 'violons et violoncelle, vers 1760' by 'Benoit-Joseph Boussu', and that Victor Mahillon possesses a violin labelled 'EGIDIUS SNOECK A BRUXELLES, 1727'. Although vander Straeten further describes various violin family instruments by Gaspar Borbon owned by private collectors, no mention is made of a violin that can be identified as the instrument with the current MIM inventory number 2774.

The makers de Maseneer, Gaspar Borbon, Egidius Snoeck and Boussu were selected in the current study because they represent, both from a stylistic and a constructional point of view, the various decennia within the 'golden period' of Brussels violin making. In the case of Borbon, Snoeck and Boussu, several violins per maker are held in the MIM collection, and for each maker we selected the instrument that is most relevant regarding original construction and/or authenticity.

While the MIM collection includes two violins by Gaspar Borbon, only the selected instrument

[31] The MIM collection includes a cello (MIM inv. no. 1369) bearing the handwritten label reading 'Jean Hijacint Rottenbûrgh / maior fecit a bruxelles 1753', as well as a viola (MIM inv. no. 2835) attributed by the nineteenth-century collector César Snoeck to 'J.H. Rottenburgh'.

[32] The MIM collection includes two instruments by this maker: a violin from 1779 (MIM inv. no. 2787) and a viola from 1776 (MIM inv. no. 2837).

[33] Lewis Reece Baratz, 'Les œuvres de Joseph Hector Fiocco (1703–1741) dans la bibliothèque du chanoine Vanden Boom (1688–1769)', in Roland Mortier and Hervé Hasquin, eds., *Etudes sur le XVIII^e siècle. Musiques et spectacles à Bruxelles au XVIII^e siècle* (Brussels: Editions de l'Université de Bruxelles, 1992), vol.XIX, pp.48 and 58. Baratz cites a document from the archive of the St Gudula church (State Archive of Belgium, location Anderlecht, Oud archief van de kapittelkerk van Sint Michiel en Sint Goedele te Brussel, inv. no. 10125), stating that canon Vanden Boom (*d*1769) had donated to the church '[…] seven Violen waer van een van Bossù, vier Violoncellen waer van een van Bossù, twee alto violen, twee dobbel Bassen waer van eenen van Bossù […]'.

[34] Marie Cornaz, 'La vie musicale à Bruxelles entre 1741 et 1780 vue par le biais de la Gazette de Bruxelles et de la Gazette des Pays-Bas', in Mortier and Hasquin (1992), pp.41–2. Cornaz reports that the Brussels music publisher and dancing master Joseph-Claude Rousselet (*d*1760) owned a 'basse de Bossu', since his widow advertised it for sale in 1765.

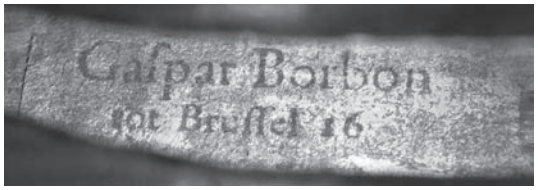
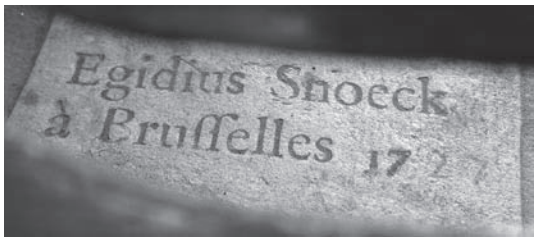
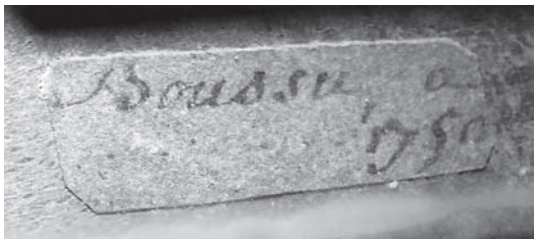
[35] Jean-Philippe van Aelbrouck, 'Annonces concernant la musique dans les gazettes et périodiques bruxellois au XVIII^e siècle (1741–1780)', *Tradition wallonne* 4 (Brussels: Ministère de la communauté française de Belgique, 1987), p.799. During a public auction announced in the *Gazette des Pays-Bas* of 17 July 1780, wine seller Jean-Baptiste van Dievoet offered for sale 'un violon fait en 1752 par B.J. Bossu'. Thanks to Fañch Thoraval for bringing this information to our attention.

[36] Victor-Charles Mahillon, *Catalogue descriptif et analytique du Musée instrumental (historique et technique) du Conservatoire royal de musique de Bruxelles* (Ghent: Ad. Hoste, 1912), vol.4, pp.402–4.

[37] César Charles Snoeck, *Catalogue de la collection d'instruments de musique flamands et néerlandais* (Ghent: I. Vanderpoorten, 1903), pp.7–9.

[38] Edmond vander Straeten, *La Musique aux Pays-Bas avant le XIX^e siècle* (Brussels: G.-A. van Trigt, 1880), vol.5, pp.146–7, 184 and 405–6.

Table 1. Overview of the four instruments selected for the current study.

Instrument	Maker / location / year	Label
violin, MIM inv. no. 2786	Jan de Maseneer, Brussels	
violin, MIM inv. no. 2774	Gaspar Borbon, Brussels, 16[…]	
violin, MIM inv. no. 2779	Egidius Snoeck, Brussels, 1727	
violin, MIM inv. no. 2781	Benoit-Joseph Boussu, 1750	

(MIM inv. no. 2774) is complete, the other (MIM inv. no. 2776) lacking the top plate, fingerboard and original scroll. Two violins by Egidius Snoeck are also available in the MIM collection. In this case, violin MIM inv. no. 2779 was selected due to the well preserved state of its inner construction, especially the back plate, which is the least modified. In addition, the other Snoeck violin (MIM inv. no. 2778) bears an untrustworthy label with a date of 1764 (by which year Egidius Snoeck would have been about 100 years old). For Boussu, there were no less than six reliable violins from which to select: we chose the one in near original state (MIM inv. no. 2781). This instrument carries the label 'Boussu, a / . . . . . 1750', and it is therefore not certain where the instrument was made. While we know that Boussu worked briefly in Liège until at least November 1749,[39] and then in Etterbeek (near Brussels) from at least February 1751,[40] the date of violin MIM inv. no. 2781 implies that it could have been made in either location. It should be stressed, however, that this instrument is very similar, both in style and construction, to the other five violins of this maker in the MIM collection (which are known to have been made in or near Brussels) and thus a good example of Boussu's work from this period.

[39] Geerten Verberkmoes, 'Benoît Joseph Boussu: la carrière singulière d'un notaire hainuyer devenu luthier', in: Brigitte Van Wymeersch and Fañch Thoraval, eds., *Hainaut, terre musicale - XVII^e–XVIII^e siècles* (tentative title), in press, expected year of publication: 2016.

[40] Geerten Verberkmoes, 'Benoit Joseph Boussu (1703–1773): violin maker and notary', *The Galpin Society Journal* LXVI (2013), p.129.

Figure 2. *A Gaspar Borbon viola from 1692, MIM inv. no. 2836: (a) front view (Photo: Musical Instruments Museum, Brussels, © MIM); (b) conventional X-ray photographs (Photos: © KIK-IRPA, Brussels).*

SHORT MAKER BIOGRAPHIES

The earliest of the four makers is probably Jan de Maseneer. Although biographical details remain obscure, most of the available sources suggest he was active in the second half of the seventeenth century.[41] Only two instruments are known from this maker: in addition to the violin in the current study, the MIM also holds a pochette bearing the label 'Jan de Maseneer / tot Brussel'.[42] Our preliminary research has identified a marriage record from 1642 of a certain 'Jean Maseneer'[43] and a burial record from 1727 concerning 'Jean Baptiste de Maseneer'.[44] Further research is necessary to verify whether these archive entries indeed relate to the violin maker de

[41] Raspé (1980), p.276; Moens (1983), p.147; and Mia Awouters, 'DE MASENEER (De Maeseneer), Jan', in Haine and Meeùs (1986), p.127.

[42] The Musical Instruments Museum, Brussels, Belgium, MIM inv. no. 2761.

[43] St Nicolas parish, Brussels, marriage register, 25 November 1642.

[44] St Géry parish, Brussels, burial register, 1 October 1727.

Maseneer. Since his name does not appear in the registers of the court chapel, it can be assumed that he was self-employed.

Somewhat more is known about the life of Gaspar Borbon (*b c*1635–*d*1710)[45] who was the son of Peeter (ii) Borbon, a musician and instrument maker at the Brussels court chapel. Gaspar Borbon is listed as instrument repairer for the chapel for the first time in 1664, and the earliest known instrument – a bass viol[46] – dates from the following year. Various other instruments from his hand have survived, 12 of which at the MIM in Brussels. These include a cello from 1707,[47] and a large-size viola from 1692[48] (see Figure 2[49]): an instrument that, although seriously damaged by woodworm, survives in its original composition. It is interesting to note that this viola, especially its long plate corners, fingerboard and tailpiece, shows a considerable similarity to the instruments depicted in the painting by Hieronymus Janssens (see Figure 1 in the colour section). Borbon married twice (in 1661 and 1674) and was buried in Brussels on 25 November 1710.

Egidius Snoeck (*b c*1660–*d* post 1734)[50] succeeded Gaspar Borbon as instrument maker of the court chapel, a position he held until about 1720 when he resigned in favour of his son Marcus. It is noteworthy that Gaspar Borbon was a witness at Snoeck's marriage (1688) and was godfather to his first child. The apparent close relationship between these two makers, as well as the strong similarities between their instruments, has led some to suggest that Snoeck learned the craft from Borbon.[51] Rather than instrument maker, Snoeck was probably better known in his lifetime as musician and actor at the court's theatre and as an occasional composer.[52] The MIM collection includes only four instruments by Egidius Snoeck, the earliest, a type of violoncello da spalla, being built in 1714.[53] The moment of his death is unknown, but he must have lived beyond 1734, the date of his last known instrument, a bass violin.[54]

Of the four makers discussed here, the biography of Benoit-Joseph Boussu (*b*1703–*d*1773) has been elucidated most fully.[55] Born in 1703 in Fourmies, a small town in the north of France, he worked as a notary in his native area until 1748, only to make his first known instrument, a cello, in the next year in Liège. Between at least early 1751 and late 1762, he worked in the Brussels area, first in the suburb of Etterbeek and subsequently within the city walls. In Brussels, Boussu worked as an independent maker, not employed by the court chapel. During the relatively short period in Etterbeek and Brussels, he produced a substantial number of instruments of the violin family, nine of which are now part of the MIM collection, while various others are still in use by musicians. In the mid-1760s, Boussu seems to have temporarily ceased making instruments, but between 1767 and 1773 he was again active as 'marchand luthier' in Amsterdam. Based on the limited number of known instruments made during his Dutch period, it is plausible that he focused more on buying and selling instruments by other makers and possibly on the sale of accessories and on undertaking repairs. In 1773 he returned to his birth area in France, where he died in Avesnes-sur-Helpe that same year.

STYLISTIC CHARACTERISTICS

Front views of the four selected violins are shown in Figure 3 (colour section). The violin by de Maseneer (MIM inv. no. 2786), as depicted in Figure 3(a), is finely built and clearly demonstrates the skills of the maker. The outline of the sound box and the plate archings show similarities to the work of makers such as Nicolò Amati and Jacob Stainer. Figure 4 shows the scroll, which is smoothly and rather symmetrically cut, while some slight tool marks can

[45] Moens (1976), pp.37–8; Raspé (1980), p.276; and Mia Awouters, '(3) Gaspar (Jaspar) BORBON', in Haine and Meeùs (1986), p.61.

[46] Museum Vleeshuis, Antwerp, Belgium, inv. no. 60.37.1.

[47] The Musical Instruments Museum, Brussels, Belgium, MIM inv. no. 2005.023.

[48] The Musical Instruments Museum, Brussels, Belgium, MIM inv. no. 2836.

[49] The X-ray images in Figure 2(b) were first published by Awouters; see Awouters (1982–1984), pp.207–15, Figure I11.IV.

[50] Moens (1976), pp.81–6; Raspé (1980), pp.276–7; and Mia Awouters, '(4) Egidius SNOECK', in Haine and Meeùs (1986), p.386.

[51] Moens (1976), p.82; and Moens (1983), p.145.

[52] Moens (1976), pp.82–4; and Awouters (2000), p.63.

[53] The Musical Instruments Museum, Brussels, Belgium, MIM inv. no. 2853.

[54] The Musical Instruments Museum, Brussels, Belgium, MIM inv. no. 2875.

[55] Verberkmoes (2013), pp.125–34; and Verberkmoes, in press, expected year of publication: 2016.

Figure 4. *Side view of the scroll on the violin by Jan de Maseneer, MIM inv. no. 2786. (Photo: Musical Instruments Museum, Brussels, © MIM).*

be seen where the volute is scooped out. The corner points of the plates are delicately long and thin, a feature especially visible at the back plate, where least wear of the corners has occurred. Narrow purfling is carefully inserted close to the outer edge of the plates. On the well-defined plate archings, an elongated central region is accentuated by a broad fluting channel around the perimeter of the plates. The f-holes, featuring wide openings and relatively small lower circular holes, are in contrast with the overall appearance of the instrument and look not dissimilar to Brescian examples. For the top plate, finely grown spruce is used, while the one piece back is made from maple with an interesting converging figure pattern. A thin, yellow-brown varnish, with a white-yellowish UV fluorescence, is still present on large areas of the instrument.

On the whole, the violin by Gaspar Borbon (MIM inv. no. 2774) is representative of instruments by members of the Borbon and Snoeck families. The scroll, shown in Figure 5(a), is somewhat boldly carved and has the distinctive slightly oval shape characteristic of Gaspar Borbon and his court colleagues. For comparative purposes Figures 5(b) and 5(c) show two further scrolls by Borbon. As can be seen in Figure 5, the three scrolls are similar in style and workmanship. A considerable degree of asymmetry is noticeable when the scroll of the violin (MIM inv. no. 2774) is viewed from the front: the ear on the treble side sits several millimetres higher compared to the bass side ear. Perhaps this is confirmation that Borbon carved the scrolls freehand. The belly, in particular the shape of the f-holes, is in complete contrast with the coherent style of the rest of the instrument (see Figure 3(b) in the colour section). When comparing an f-hole of this violin with those of a viola and bass violin by Gaspar Borbon (see Figure 6), it is clear that the violin f-hole (Figure 6(a)) is atypical of Borbon and more in keeping with eighteenth-century Cremonese making. On the other hand, Borbon's f-holes displayed in Figures 6(b) and 6(c) appear to be inspired by late sixteenth- or early seventeenth-century precedents, for example those of the Amati brothers.[56] We strongly believe, therefore, that the violin's top plate is a replacement,[57] made either as a substitute for a damaged original or to 'upgrade' the instrument's appearance. The arching of the (original) back plate is smoothly executed and extends closely towards the plate's perimeter, leaving room for a narrow but rather pronounced fluting channel. Plate corners are long, which is most noticeable on the back plate. The varnish is of a yellow-brown colour, shows fine craquelure and lights up yellow-orange under UV light, except for the top plate varnish, which displays a somewhat brighter orange UV fluorescence. At the places where the original varnish has disappeared, especially at the centre and lower part of the back plate, a ground layer seems to protect the wood.

[56] The presence of Italian musicians in the Brussels court's chamber ensemble, from the second half of the seventeenth century onwards (Moens (1976), p.11; and Coekelberghs and Vanrie (1979), p.345) could explain the influence of Italian violin makers, such as the Amati brothers, on early Brussels violin making. The instruments brought along by the Italians may have served as examples for the court makers. Moreover, there is evidence that an Amati violin was in fact part of the instrument collection of the court chapel. In 1783, music master de Croes reported this instrument as stolen from the chapel's inventory; see Moens (1976), p.23; and Buyens (2001), p.166.

[57] Violin maker Gert Schrijvers holds this opinion too. Personal communication with Mr Schrijvers.

Figure 5. *Side views of scrolls on three instruments by Gaspar Borbon: (a) side view of the scroll of the violin with MIM inv. no. 2774; (b) side view of the scroll of the viola with MIM inv. no. 2836; (c) side view of the scroll of the bass violin with MIM inv. no. 2879. (Photos: Musical Instruments Museum, Brussels, © MIM).*

Figure 6. *Bass side f-holes on three instruments by Gaspar Borbon: (a) bass side f-hole of the violin with MIM inv. no. 2774; (b) bass side f-hole of the viola with MIM inv. no. 2836; (c) bass side f-hole of the bass violin with MIM inv. no. 2879. Note that the f-hole shape on the violin MIM inv. no. 2774 is atypical, indicating that the top plate of this instrument is presumably not original. (Photos: Musical Instruments Museum, Brussels, © MIM).*

Violin MIM inv. no. 2779 by Egidius Snoeck clearly shows the influence of Gaspar Borbon, although the workmanship reveals a rougher and more hurried approach. Further, the contour of the sound box differs, in a way that the upper bout is narrower and the lower bout is wider than in case of Borbon, which results in an outline with the emphasis on the lower bout (see Figure 3(c) in the colour section). Compared to his predecessor, Snoeck's archings are clearly less smooth and more angular. His purfling is inserted less precisely, with even some slight gaps along the strips resulting from a too widely cut channel. The sound holes are placed very low into the belly, the bass side f-hole standing more upright than the treble f-hole. The style of Snoeck's sound holes is coherent with that found on other Brussels

Figure 7. *Side views of scrolls on three instruments by Egidius Snoeck: (a) side view of the scroll of the violin with MIM inv. no. 2779; (b) side view of the scroll of the violin with MIM inv. no. 2778; (c) side view of the scroll of the bass violin with MIM inv. no. 2875. (Photos: Musical Instruments Museum, Brussels, © MIM).*

court instruments, as is apparent from a comparison with the Gaspar Borbon f-holes in Figures 6(b) and 6(c). However, Snoeck's execution lacks refinement in comparison to the work of Borbon. Edgework must have been finished quickly, as is witnessed by the moderate and irregular rounding of the plate borders. As can be seen in Figure 7(a), the design and manufacture of the scroll of this particular violin represents the biggest departure from Borbon's ideas. The volute has half a turn less and is rather hastily carved. The side profile of the peg box and its throat under the scroll look almost unfinished. When compared to other examples by Egidius Snoeck, which resemble more closely the scrolls of Gaspar Borbon (see Figures 7(b) and 7(c)), it must be concluded that this particular violin scroll is either an exceptional specimen by Snoeck himself, or a later replacement by someone trying to emulate the style of the Brussels court makers. We are, however, inclined to believe the former, because the scrolls of the Brussels court makers show a considerable degree of artistic freedom. The varnish on violin MIM inv. no 2779 has a slightly more reddish-brown appearance compared to the yellow-brown varnish of Borbon. The texture is also smoother, without visible craquelure. Under UV light, this varnish lights up yellow, with some orange areas resulting from later retouches.

Figure 8. *Side view of the scroll on the violin by Benoit-Joseph Boussu, MIM inv. no. 2781. (Photo: Musical Instruments Museum, Brussels, © MIM).*

From the four instruments discussed here, the violin by Boussu, MIM inv. no. 2781, is the most meticulously built (Figure 3(d) in the colour section). Although influences from several directions can be distinguished, the violin as a whole appears to have a consistent design. The upright f-holes are carefully cut and seem to be modelled after Stainer, whereas the deeply carved scroll (see Figure 8), with its extra half turn and large, flat central eye, possesses a regular, almost geometric quality. This scroll shape is exemplary for Boussu, and can be seen on his other instruments too. For both top and back plate, the arching is rather high and full, resolving into a distinct edge fluting. The violin's body is relatively long, providing the instrument with a slender appearance, and regular purfling is accurately inserted. The instrument is finished with a yellow-brown varnish, probably based on shellac, given its orange coloured UV fluorescence.

MEASUREMENTS

The four instruments were measured using traditional tools, such as rulers and callipers. For internal parts (such as the bass bar) and for external measurements where a calliper of a sufficiently large size was not available, dimensions were obtained from the CT-scans.[58] Basic measurements of the violins are summarized in Table 2.

VISUAL EXAMINATION AND ENDOSCOPY

By performing visual inspections of the outside of the four instruments and conducting digital endoscopy on the interiors, we have tried to identify the original construction features as well as any modifications. A Discovery (Microtex, Italy) digital violin endoscope was used for the endoscopy and images were captured with the Debut video capture program (NCH Software, Australia). While the original endoscopy images are in colour, they are reproduced here in greyscale. Results of the visual examinations and endoscopy are summarized in Table 3.

The original neck of the violin by Jan de Maseneer was replaced by a new one, which was fitted into a mortise cut into the upper block, while the original scroll was grafted onto the new neck. In that way, a modern neck configuration was achieved. When looking at the internally applied upper block (see Figure 9(a)), it is clear that the present block is also a replacement. On the inner side of the back plate, in front of the upper block, the extending part of the platform on which the original upper block was seated is still visible. Moreover, the current replacement block is too wide for the original platform and it protrudes over the platform edges. This implies that the original upper block must have been longer and narrower. Presumably, the original upper block and neck were integral, made from the same piece of wood, with the upper block having an extending foot on the back plate. Figure 9(b) shows the lower bout area with the original lower block. Linings of a European hardwood are applied at the belly side, but are lacking at the back plate side (see Figure 9(a)–(c)), since the ribs are secured in a channel just inside the back's perimeter. De Maseneer reinforced this connection by gluing in linen strips, which are still partly present. The joint at the rib corners is executed by means of a mitre joint, with a central seam instead of an overlap utilized in classical making, strengthened internally by tiny corner blocks (see Figure 9(c)). Some repairs have been performed on both the belly and the lower ribs, as evidenced by a number of internal reinforcement studs. A rosewood dowel with a diameter of *c*4mm has been applied through the peg box between the pegs for the d^1-string and e^2-string, see Figure 4. Probably, this dowel serves to raise the a^1-string, in order to prevent it from touching the d^1-string peg. We believe this dowel to be a later addition.

In the violin by Borbon, we see a similar manner of connecting the ribs in a channel in the back plate, without the use of linings at the back plate side. The presence of this channel is best observable from the exterior of the instrument, at places where Borbon

Figure 9. *Endoscopic photos of the interior of the violin by Jan de Maseneer, MIM inv. no. 2786: (a) upper block.*

[58] From comparing measurements taken with ruler and calliper against measurements taken from the CT-scans using a measurement function in the viewer software, we have not observed a significant difference in results between the two methods.

Table 2. Basic measurements in mm of the four selected violins.

	MIM inv. no. 2786	MIM inv. no. 2774	MIM inv. no. 2779	MIM inv. no. 2781
maker	Jan de Maseneer	Gaspar Borbon	Egidius Snoeck	Benoit-Joseph Boussu
body length back	354	354	357	362
body stop length (top plate upper edge to inner notches of f-holes)	195	198 (top plate likely not original)	205	196
width back at upper bout	159	164	159	168
width back at C-bout	103	110	109	108
width back at lower bout	196	202	207	205
rib height at upper block	29.0	29.0	28.5	32.0
rib height at C-bout	28.0	29.5	28.5	32.0
rib height at lower block	29.0	30.0	30.0	32.5
scroll width	original scroll 36.5	original scroll 35.5	possibly original scroll 35.5	original scroll 36.5
neck length (top nut to plate edge)	127 (new modern type neck, original scroll grafted on)	119 (original neck, length increased by *c*3.0mm)	134 (neck modified at neck root, most likely elongated)	130 (original, unaltered neck)
neck angle (degrees)	82° (new modern type neck)	83° (reduced from *c*90° by wedge under upper block)	85.5° (probably modified)	86°* (original angle)
overstand of neck above upper edge of top plate	5	0	0	1
fingerboard	solid ebony, modern length: 260 projection: 28	solid ebony, wedge-shaped length: 236 projection: 29.5	solid ebony, wedge-shaped length: 259 projection: 26.5	veneered, most likely original length: 240* radius: *c*40 projection: 22*
distance between upper eyes of f-holes	46	41.5 (top plate likely not original)	44	44
distance between f-holes at height of notches	69	73 (top plate likely not original)	79.5	76.5*
bass bar	glued in length: 244 width: 5.5 height: 8.0	carved from the (likely non-original) top plate length: 256 width: 5.0 height: 6.0	glued in, growth rings parallel to top plate length: 262 width: 4.5 height: 8.5	original, glued in length: 234* width: 5.0* height: 7.0
purfling b/w/b	*c*0.35/0.3/0.35	at back plate: *c*0.5/0.5/0.5	*c*0.5/0.5/0.5	*c*0.5/0.5/0.5
distance purfling to edge	*c*2.8	at back plate: *c*3.0	*c*3.0	*c*3.2

* Measurement values for these dimensions have been published previously (Verberkmoes, 2013). However, in the current study, these dimensions were determined more accurately.

Table 3. Constructional characteristics and modifications in the four selected violins.

	MIM inv. no. 2786	MIM inv. no. 2774	MIM inv. no. 2779	MIM inv. no. 2781
maker	Jan de Maseneer	Gaspar Borbon	Egidius Snoeck	Benoit-Joseph Boussu
connection between ribs and back plate	ribs glued into channel in back, no wooden linings, reinforced with linen strips which are still partly present	ribs glued into channel in back, no linings	ribs glued into channel in back, reinforced by (later?) spruce linings	ribs glued onto the back, reinforced by very small beech linings
connection between ribs and top plate	reinforced by European hardwood linings	reinforced by spruce linings	reinforced by spruce linings	reinforced by very small beech linings
lower bout	one piece	one piece	one piece	two pieces
neck	new modern type neck, original scroll grafted on	original neck, elongated by *c*3.0mm, angle modified	neck most likely significantly elongated, angle modified	original, unaltered neck
upper block	not original, remains of platform at back plate	original upper block, integral with neck	not original, neck attached by nail, remains of platform at back plate	original upper block, integral with neck
lower block	original	original, bell-shape cross section	original	original
corner blocks	yes, small	yes, small	yes, possibly added later	yes
joint at rib corners	mitre, with central seam	mitre, with central seam	mitre, with central seam	mitre, with central seam
bass bar	glued in	carved from the (likely non-original) top plate	glued in, growth rings parallel to top plate	original, glued in
wood top plate	spruce, fine grained, two pieces	spruce, medium grained, two pieces (top plate likely not original)	spruce, medium grained, two pieces bookmatched; deviation from quarter cut at the plate edges	spruce, fine to medium grained, two pieces bookmatched
wood back plate	maple, one piece	maple, medium figured	maple, medium figured	maple, lightly figured
wood ribs	maple, possibly same tree as back	maple, lightly to medium figured	maple, lightly figured	maple, lightly figured
wood neck/scroll	scroll: unfigured maple; neck (not original): lightly figured maple	maple, lightly figured, neck and scroll still integral	maple, lightly figured, neck and scroll still integral	maple, unfigured, neck and scroll still integral

cut the groove irregularly, resulting in a slight gap along the ribs. The original neck, with its integral upper block, is still present (see Figure 10(a)), although the neck angle has been altered from *c*90° to 83° by placing a wedge of *c*7° under the upper block. Fortunately, the original neck construction, including the unity between neck and upper block, and the original foot-like extension of the upper block, was preserved during this modification. At the same time, as a result of the change in neck inclination, the neck length must have been increased by *c*3.0mm. The profile of the neck seems to be mostly original, if not slightly thinned. The lower block, depicted in Figure 10(b), has a peculiar

Figure 9. *Endoscopic photos of the interior of the violin by Jan de Maseneer, MIM inv. no. 2786: (b) lower bout area with lower block; (c) C-bout area with corner block.*

bell-shape (coronal) cross section.[59] As in the case of the de Maseneer violin, the Borbon violin also exhibits long rib corners, strengthened internally by corner blocks of minimal dimensions, while a mitre is formed at the four corner joints of the rib parts.

The f-holes of the violin by Egidius Snoeck are placed very low into the top plate. Nowadays, a violin's bridge is generally placed between the inner notches of the f-holes. For the Snoeck violin, this bridge position would yield a body stop length of 205mm, which is uncommonly large for modern standards. However, in the seventeenth and eighteenth centuries, the bridge position was more flexible. Iconographical evidence suggests that the bridge was often placed at positions below the inner f-hole notches, thus resulting in a longer body stop length and scale length.[60] So, for the Snoeck violin discussed here, the given stop length is not unusual for eighteenth-century standards. As in the case of the violins by de Maseneer and Borbon, the ribs of the Snoeck instrument are glued into a groove in the back plate. In the Snoeck violin, however, linings are also applied at the back plate side, but these may be later additions to reinforce the construction. The neck angle has probably been modified to its current 85.5º, and the neck lengthened significantly since external wooden inserts are visible at each side of the neck root. This latter modification will be discussed in more detail in the following sections on CT-scanning. The neck length of violin MIM inv. no.

Figure 10. *Endoscopic photos of the interior of the violin by Gaspar Borbon, MIM inv. no. 2774: (a) upper block; (b) lower block.*

[59] A similarly shaped lower block is present in a violin attributed to Marcus Snoeck (MIM inv. no. 2780).

[60] Dmitry Badiarov, 'On the early violin bridge position', *Historical violin newsletter* 2/1 (Brussels: Badiarov, 2004), pp.9–14.

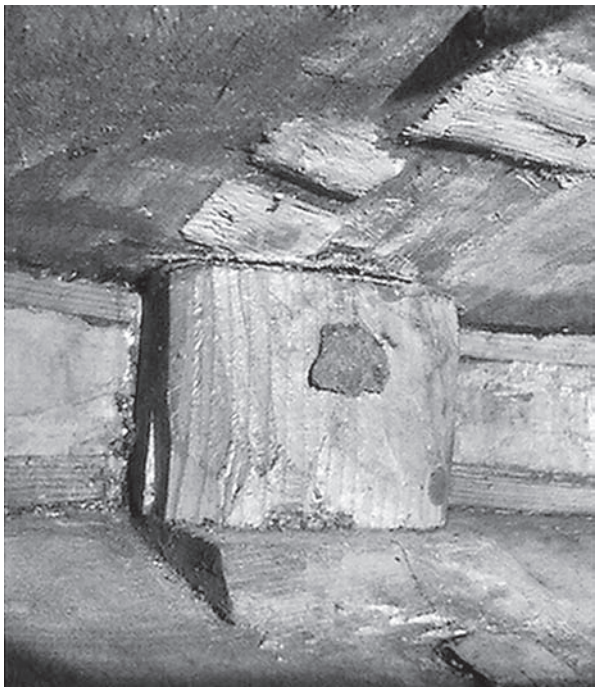


Figure 11. *Endoscopic photo of the upper block of the violin by Egidius Snoeck, MIM inv. no. 2779.*

2779 is certainly much greater than that of another violin with original neck attributed to Egidius Snoeck (MIM inv. no. 2778): 134mm versus 125mm. Moreover, the neck appears to be fairly thinned: its current profile resembles that of a modern neck. Internally, the original upper block, which must have been integral with the neck, has been separated and discarded; the current replacement block is pierced by a nail that now secures the neck (see Figure 11). As can be seen, the platform on the back plate, that once supported the extending foot of the original neck block, is still untouched. Corner blocks are present, but we believe that these could well be later additions. The lower block remains unchanged, whereas the top plate must have had many past repairs, considering the presence of a large internal doubling patch in the central area and numerous reinforcement studs. It is not clear whether the bass bar is original. Given the current condition of the inner surface of the belly, it is not unthinkable that the bass bar has been replaced at a certain moment.

Of the four violins, the Boussu instrument has been modified the least. It retains its original, unaltered neck, including the integral upper block with its (relatively small) extending foot (see Figure 12(a)). This foot has a square shape, a feature also seen on some other early Boussu instruments.[61] From around

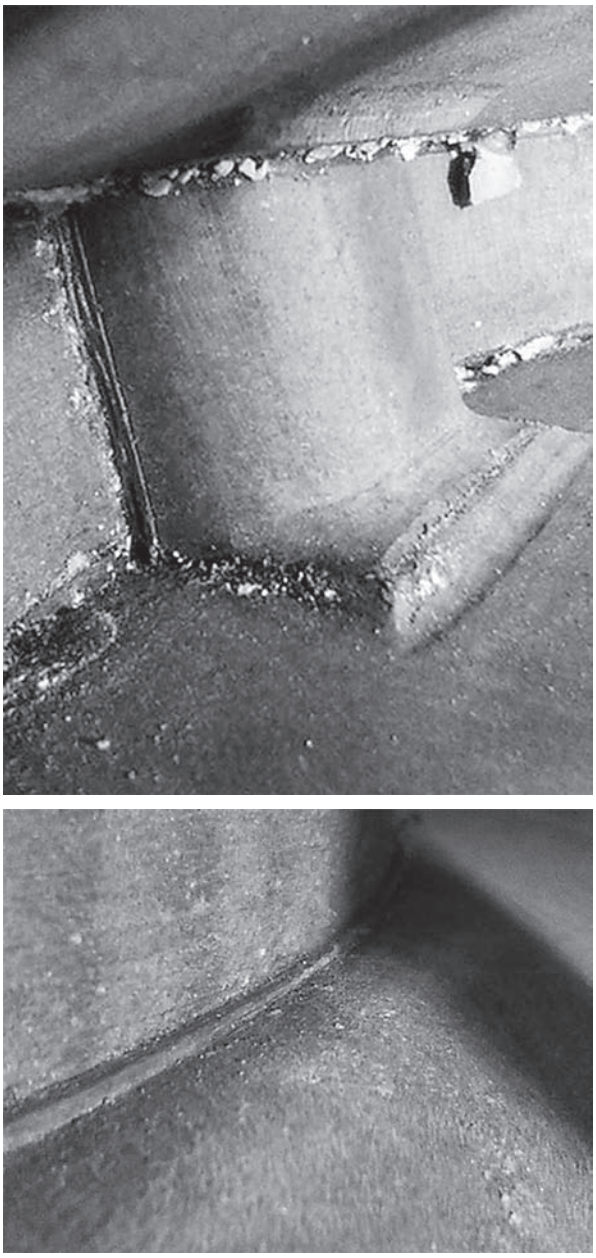


Figure 12. *Endoscopic photos of the interior of the violin by Benoit-Joseph Boussu, MIM inv. no. 2781: (a) upper block; (b) detail of lining.*

1752, Boussu started to give the entire upper block a more rounded profile,[62] perhaps to reduce weight or for acoustic improvement. On the left in Figure 12(a), between the bass side upper rib and the upper block, a wedge that secures the rib into the neck root can be seen. Also visible in the picture are the white, flake-like particles that are stuck to areas where glue is exposed from internal joints. We have not yet been able to identify this substance, but analysis

[61] Such a square-shaped neck block foot was identified on the original (but extracted) neck of Boussu's first known instrument, a cello built in 1749 in Liège (private collection), as well as on a violin from 1751 (MIM inv. no. 2785).

[62] Verberkmoes (2013), p.264. Two examples of this type of rounded neck block are depicted.

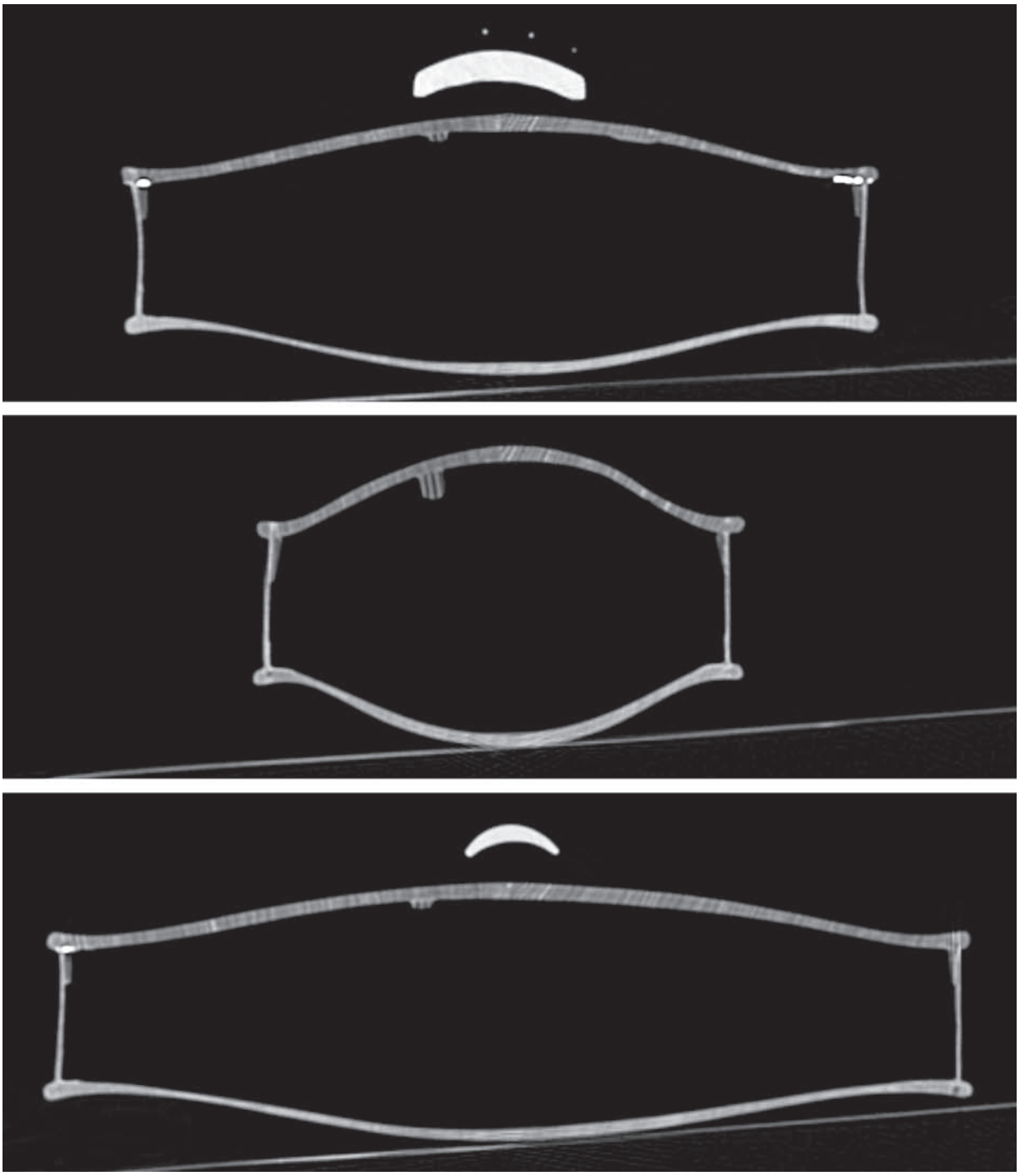


Figure 13. *Axial plane cross sections of the sound box of the violin by Jan de Maseneer, MIM inv. no. 2786: (a) upper bout at widest part; (b) C-bout at narrowest part; (c) lower bout at widest part.*

of these particles will be required in the future to rule out any harmful effect for the instrument. In this violin, very small beech linings are employed with cross-sectional dimensions of maximum *c*1.5×1.5mm (see Figure 12(b)). These small linings seem to be an experiment by Boussu, since he later used beech strips of larger dimensions.[63] In any case, besides being applied on the top plate side, linings are present on the back plate side as well. From the four makers discussed, Boussu is the only

[63] Verberkmoes (2013), p.136. Several other Boussu violins from the MIM collection, made between 1752 and 1760, have beech linings with dimensions of around 2×5mm.

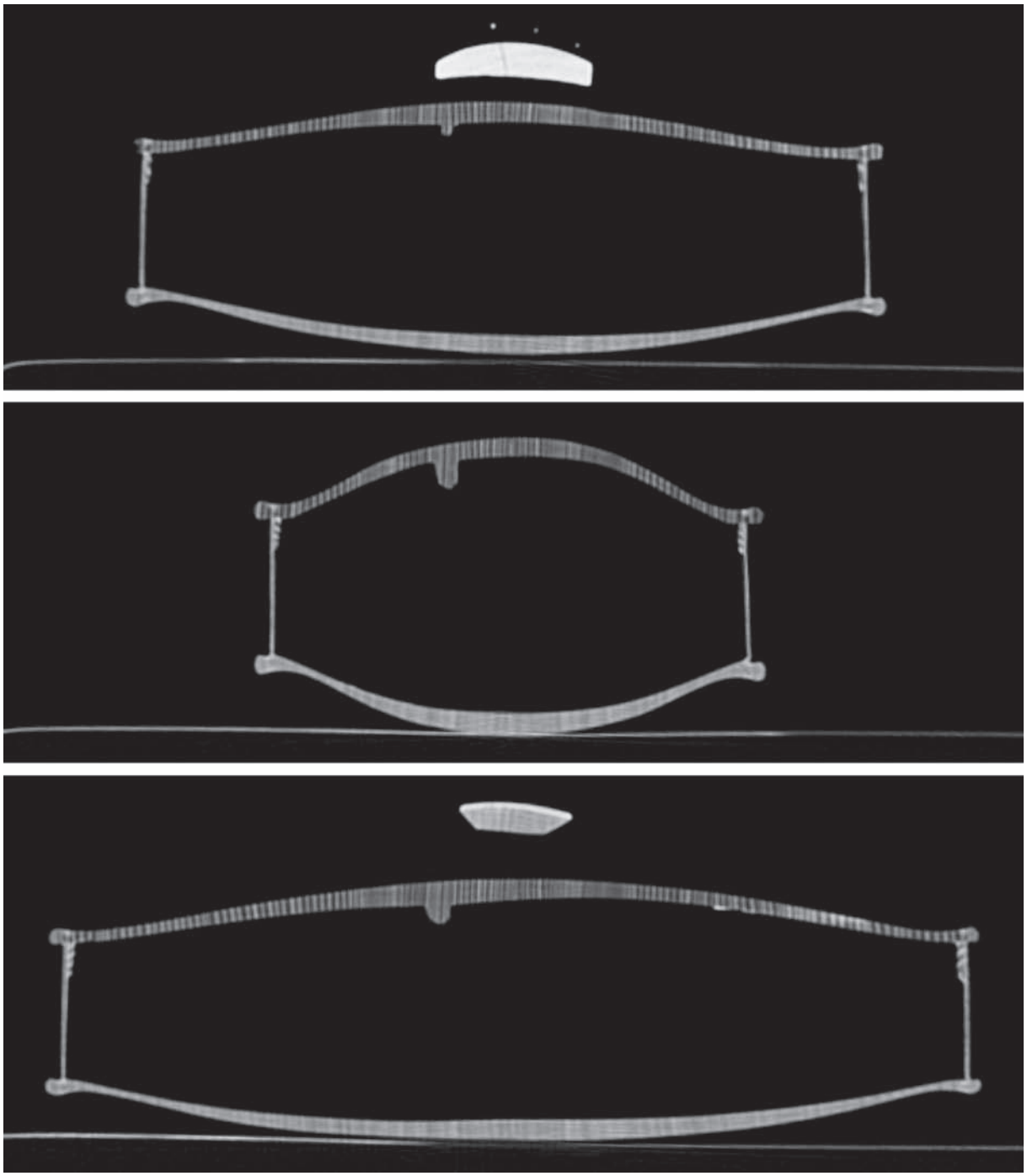


Figure 14. *Axial plane cross sections of the sound box of the violin by Gaspar Borbon, MIM inv. no. 2774: (a) upper bout at widest part; (b) C-bout at narrowest part; (c) lower bout at widest part.*

one who did not secure the ribs into a channel in the back plate, but rather glued them *onto* the back, thereby making the use of linings on the back plate side indispensible.[64] In general, the interior of the instrument is conscientiously finished. The violin still retains its original bass bar (dimensions are given in Table 2). The veneered fingerboard, with a length of 240mm, is also believed to be original, especially since we found a fingerboard with the same length on a Boussu pochette.[65]

[64] After studying more than 20 of Boussu's instruments, we have not yet encountered a Boussu instrument where the ribs are inserted into a channel in the back plate.

[65] Musée de la Musique, Paris, France, inv. no. D.E.Cl.2045.

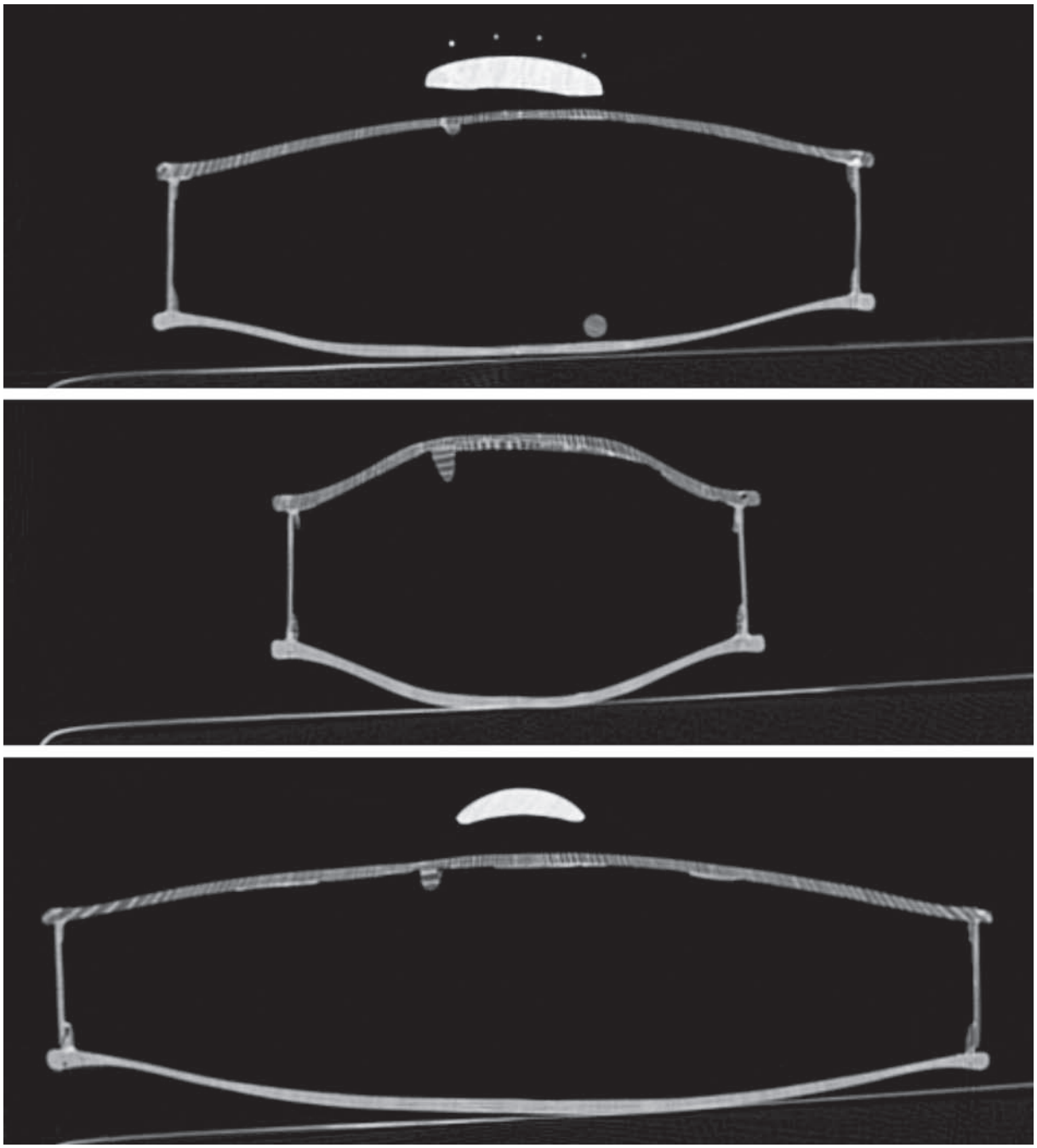


Figure 15. *Axial plane cross sections of the sound box of the violin by Egidius Snoeck, MIM inv. no. 2779: (a) upper bout at widest part; (b) C-bout at narrowest part; (c) lower bout at widest part.*

CT-SCANNING: 2D AND 3D VISUALISATIONS

X-ray computed tomography (CT), also named computer assisted tomography (CAT), was introduced in medicine in 1971. The technique was developed by Godfrey Hounsfield and Allan Cormack, who shared the 1979 Nobel Prize in Physiology or Medicine for their work in this field. Computed tomography is a visualisation technique using X-ray imaging principles, replacing the conventional film by a computer assisted reconstruction of the amount of X-ray absorbed by the structure under examination. Resulting from this computation are digital imaging 'slices', made of 'voxels' (opacity value data points on a regularly spaced, three-dimensional grid), which provide cross-sectional views of the scanned object. A stack of multiple successive slices documents the object in the three perpendicular (xyz) directions. In post-processing, many different views can be generated from the initial data. Since the 1980s, CT-scanning has been used to explore the

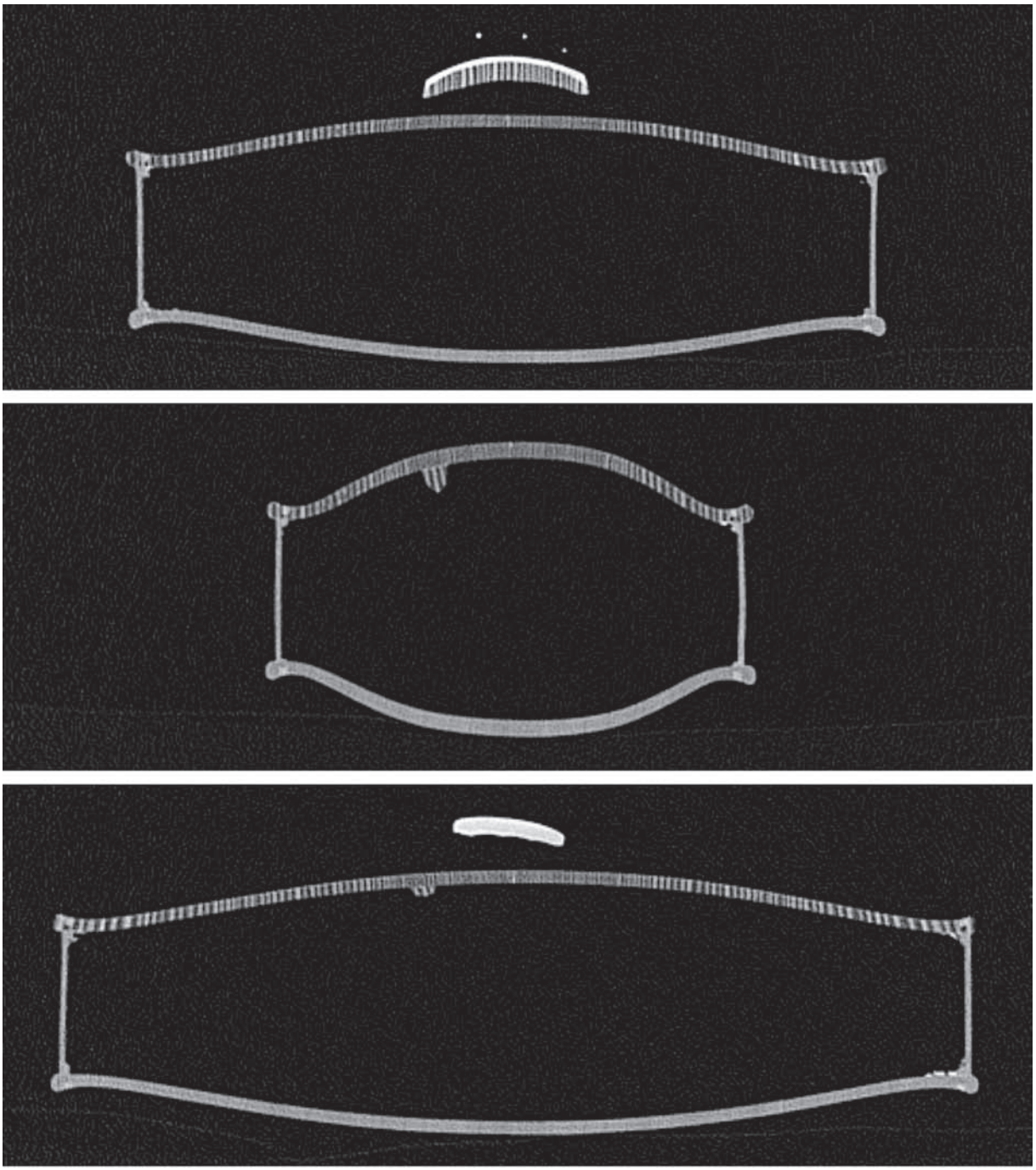


Figure 16. *Axial plane cross sections of the sound box of the violin by Benoit-Joseph Boussu, MIM inv. no. 2781: (a) upper bout at widest part; (b) C-bout at narrowest part; (c) lower bout at widest part.*

internal structures of violin family instruments.[66]

The violins by de Maseneer, Borbon, Snoeck and Boussu were CT-scanned at the Brussels Erasmus Hospital under the guidance of co-author Danielle Balériaux. The Boussu violin, along with another violin by the same maker (MIM inv. no. 2784), was scanned on 28 November 2012. During this session, a Sensation 64 CT-scanner (Siemens, Germany)

[66] Ian Fairbairn, 'X-ray scanning of violins', *The Strad* 91/1092 (April 1981), pp.889–91; Steven Sirr and John Waddle, 'CT scan of a Montagnana cello built in 1730 (interlude)', *Radiology* 173 (1989), p.446; Steven Sirr and John Waddle, 'CT analysis of bowed stringed instruments', *Radiology* 203 (1997), pp.801–5; and Terry Borman and Berend Stoel, 'Review of the uses of computed tomography for analyzing instruments of the violin family with a focus on the future', *J. Violin Soc. Am.: VSA Papers* XXII/1 (2009), pp.239–50.

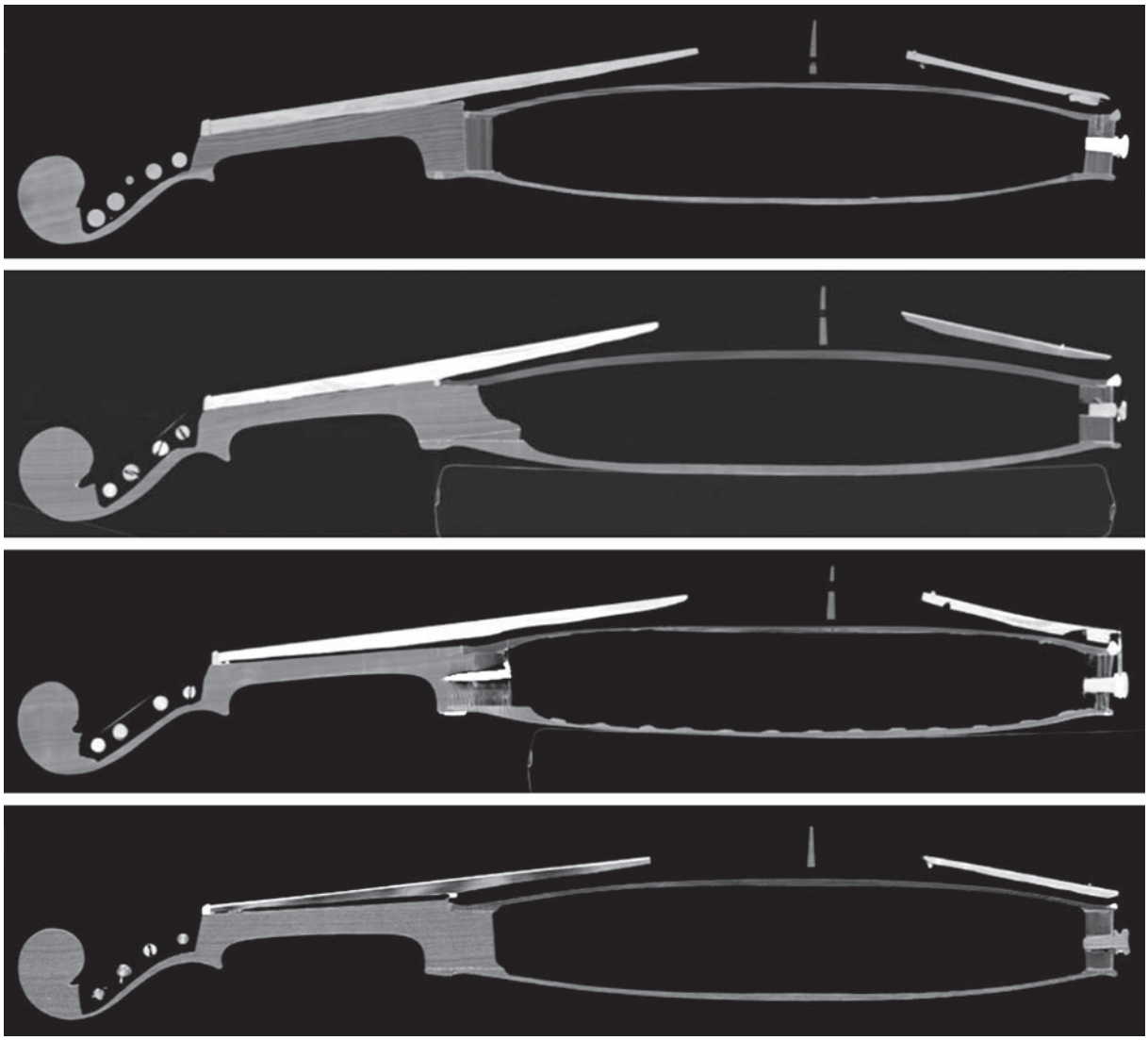


Figure 17. *Sagittal plane cross sections (along the instrument's centre line) of the four instruments: (a) violin by Jan de Maseneer, MIM inv. no. 2786; (b) violin by Gaspar Borbon, MIM inv. no. 2774; (c) violin by Egidius Snoeck, MIM inv. no. 2779; (d) violin by Benoit-Joseph Boussu, MIM inv. no. 2781.*

was used.[67] The other three violins, along with an additional violin attributed to Egidius Snoeck (MIM inv. no. 2778), were scanned on 29 May 2013. On this occasion, a Sensation 16 CT-scanner (Siemens, Germany) was employed.[68] The scans produced three-dimensional data sets (composed of voxels) for each violin. From this raw data, two-dimensional (2D) and three-dimensional (3D) visualisations were created by using Carestream Vue software (Carestream Health, Inc., USA), available at the Erasmus Hospital. Additional image viewing and processing was performed with the Osirix Lite DICOM Viewer program (Pixmeo, Switzerland).

Axial plane cross sections of the sound boxes of the four violins are shown in Figures 13 to 16.[69] The shape of the top and back plate transverse arching profiles, as well as the position of the bass bar, can be clearly seen in these slices.

From Figures 13 and 14, it can be observed that wooden linings were not applied at the back plate side in the instruments by de Maseneer and Borbon. Due to the resolution limits of the CT-scans, it is

[67] Settings: 120kVp, exposure: 90mAs, pixel size: 0.47mm, slice thickness: 0.6mm (increment: 0.4mm), kernel: H70h.

[68] Settings: 120kVp, exposure: 260mAs, pixel size: between 0.45 and 0.47mm, slice thickness: 0.75mm (increment: 0.5mm), kernel: B60f.

[69] The thin line visible below the back plate in Figures 13 through 15 is caused by the cover of the cushion supporting the instrument.

not possible to distinguish, in the Figures 13, 14 and 15, the channel in the back plate receiving the ribs, even under magnification. It should be noted, in this respect, that this channel is not more than approximately 0.5mm deep, a dimension probably close to the resolution limits of the CT-scans. The similar intensity induced by the ribs and back plate in the CT-images makes it even more difficult to discern the channel. As is evident from the respective cross sections, the back plates of the violins by de Maseneer and Snoeck appear to be thinly made.

As already discussed above, the belly of the Borbon violin is in all probability a replacement. The CT-images reveal that the bass bar is an integral part of this substitute top plate (see Figure 14): the growth rings in the plate continue uninterrupted into the bar. Carving the bass bar from the mass of the plate is a technique associated with archaic making habits, whereas in later and more advanced traditions, the bar is made from a separate piece of wood that is glued in against the inner surface of the plate. The presence of an integral bass bar suggests that the replacement top plate of this violin was produced during the early lifetime of the instrument, perhaps by a local maker.

From Figure 15 we can see that the plate archings of the Snoeck violin are rather 'angular', a property already noticed while examining the instrument visually. It can also be seen that the bass bar of this instrument has the growth rings in parallel with the top plate, while in the other three violins the bass bar's growth rings are perpendicular to the top. In Figure 15(b), a doubling patch at the inside of the belly is visible, and Figure 15(c) indicates that the spruce wood of the top plate strongly deviates from quarter-sawn orientation near the plate's edges.

In the axial plane cross sections of the sound box of the Boussu violin (Figure 16), the minuscule linings as well as the veneered fingerboard (ebony over a spruce core) can be distinguished. The top of the bass bar has a triangular shape in the central (highest) section. Also striking is the regular and identical thickness pattern of top and back plate.

The sagittal plane cross sections in Figure 17 show the longitudinal archings of the top and back plates and also provide information regarding the necks. The violin by de Maseneer (see Figure 17(a)) has a replacement neck, which is attached to the sound box by a mortise joint into the renewed upper block. The original scroll has been grafted onto the new neck; a difference in greyscale intensity in the CT-image is visible between the two jointed parts. The instrument by Borbon has retained its original neck, although this neck was slightly elongated and placed under an angle by insertion of a wedge under the upper block (see Figure 17(b)). In the Snoeck violin, the neck was separated from the original integral upper block and then most likely elongated and re-angled, before being re-attached to a new upper block by means of gluing and insertion of a metal nail, as shown in Figure 17(c). During the neck alterations on the violins by Borbon and Snoeck, no overstand of the neck at the upper edge of the top plate was created, requiring the currently present, wedge-shaped fingerboards on both violins to achieve the desired fingerboard projection at the bridge. This observation, in combination with the short neck and fingerboard length in the case of the Borbon violin and the moderate neck inclination and use of the nail in the case of the Snoeck violin, leads us to believe that the discussed alterations were performed in the late eighteenth or early nineteenth century, and that the two instruments have thus largely retained a 'post-baroque', yet 'pre-modern' neck configuration. Figure 17(d) once again demonstrates the original state of the Boussu instrument, with its completely untouched neck. This neck is tilted slightly backwards, resulting in a neck angle of 86°, which indicates that Boussu's design was already moving towards a 'classical' setup. Given a neck overstand at the upper edge of the top plate of only 1mm, a wedge-shaped fingerboard was installed to obtain an appropriate projection. The foot-like extension on the upper block in this violin is rather small compared to the overall size of the block, especially in comparison to the neck block feet currently or previously present (as evidenced by the shape of the remaining platform) in the Borbon and Snoeck instruments. In the case of the Boussu violin, the foot almost appears to be a 'vestigial remnant' rather than a fully functioning constructional feature. The careful working habits of Boussu are exemplified by the smooth way the peg box cavity is chiselled out, especially in comparison to the other three studied instruments. A central, lengthwise channel in the underside of the fingerboards on the violins by Snoeck and Boussu is visible in Figures 17(c) and 17(d) as a dark line between the neck and the fingerboard.

Figure 18 shows the lengthwise cross sections of the bass bars. It has to be remembered that the top plate of the Borbon violin, with its integral bass bar (see Figure 18(b)), is presumably not original. Dimensions for the bass bars, as measured from the CT-scans, are given in Table 2. From comparing the dimensions of the bass bar of the Boussu violin with those of original bass bars from other eighteenth-

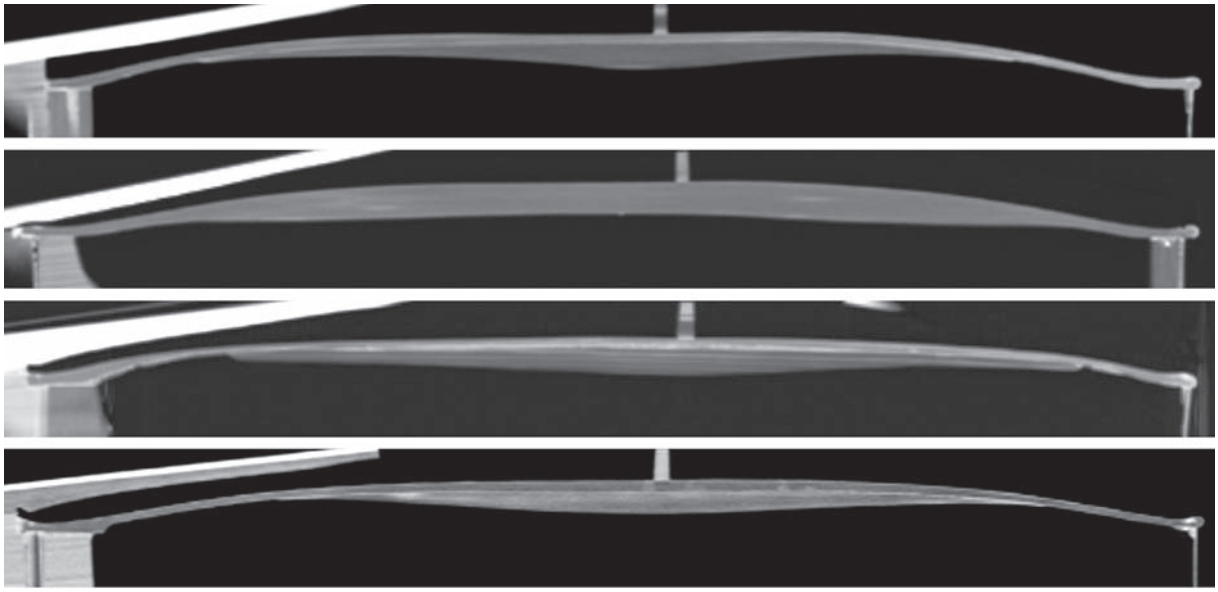


Figure 18. *Longitudinal cross sections of the bass bars of the four instruments: (a) violin by Jan de Maseneer, MIM inv. no. 2786; (b) violin by Gaspar Borbon, MIM inv. no. 2774; (c) violin by Egidius Snoeck, MIM inv. no. 2779; (d) violin by Benoit-Joseph Boussu, MIM inv. no. 2781.*

century violins,[70] as well as from its shape and condition, we conclude that the bass bar in the Boussu violin is original. Regarding the de Maseneer and the Snoeck violins, we are not certain about the authenticity of their bass bars, although these bars do not have the usual modern dimensions, such as a height of around 12mm.

In the violins by Borbon, Snoeck and Boussu, all with original necks, it is interesting to note the placement of the top nut in relation to the extremity of the peg box chin. In all three instruments, the nut is placed several millimetres out of alignment with the extremity of the chin (orientated towards the scroll, see Figures 19(b)–(d)). The de Maseneer violin, on the other hand, has a modern neck configuration, where the nut is typically placed in

Figure 19. *Nut placement in the four instruments: (a) violin by Jan de Maseneer, MIM inv. no. 2786; (b) violin by Gaspar Borbon, MIM inv. no. 2774; (c) violin by Egidius Snoeck, MIM inv. no. 2779; (d) violin by Benoit-Joseph Boussu, MIM inv. no. 2781.*

[70] Fred Lindeman, *The rebirth of the baroque violin* (Amsterdam: Gopher, 2011), pp.121–2. Lindeman lists the dimensions (length, width, height) for 21 original eighteenth-century violin bass bars. The length of the bass bar in the Boussu instrument appears to be relatively short, compared to several mid-eighteenth-century examples specified by Lindeman.

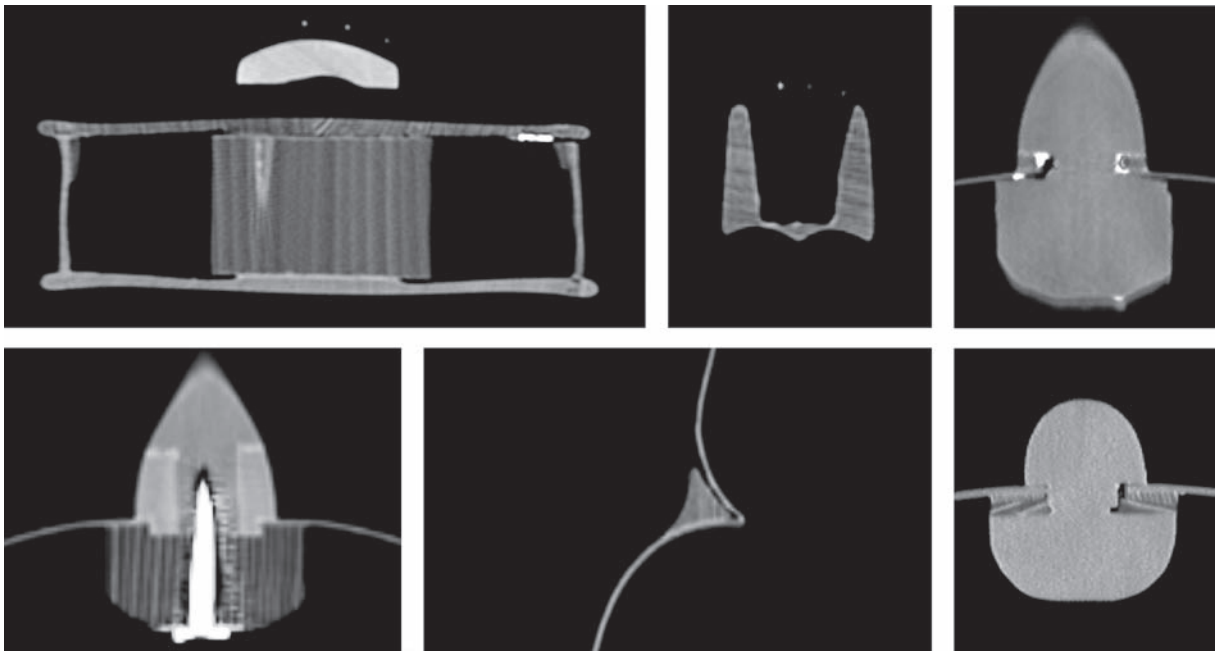


Figure 20. *Various additional 2D cross sections (top row: (a)–(c); bottom row: (d)–(f)): (a) axial cross section of the upper block in the violin by Jan de Maseneer, MIM inv. no. 2786; (b) axial cross section of the peg box of the violin by Gaspar Borbon, MIM inv. no. 2774; (c) coronal cross section of the upper block and neck root of the violin by Gaspar Borbon, MIM inv. no. 2774; (d) coronal cross section of the upper block and neck root of the violin by Egidius Snoeck, MIM inv. no. 2779; (e) coronal cross section of a corner block in the violin by Egidius Snoeck, MIM inv. no. 2779; (f) coronal cross section of the upper block and neck root of the violin by Benoit-Joseph Boussu, MIM inv. no. 2781.*

alignment with the peg box chin (see Figure 19(a)). The nut placement, as present in the three violins with original necks, allows for an increase in string length by several millimetres. Furthermore, while discussing this feature with a professional baroque violinist,[71] the idea arose that this configuration (coupled with a thicker neck) would have an effect on the player's hand position, facilitating the thumb to act as a pivot and perhaps also lending an orientation to just intonation. These preliminary assumptions, however, need to be clarified by future research, both by studying extant historical instruments to identify further examples of this particular nut placement, as well as by playing experiments, both using original instruments and accurate copies having this feature.

In Figure 20 several final 2D reconstructions are shown to further illustrate some particularities of the four violins. In Figure 20(a), an axial cross section across the upper block of the violin by de Maseneer, it can clearly be seen that the replacement upper block is too wide for the original platform on the back plate. Figures 20(b) and 20(c) both relate to the violin by Borbon. Figure 20(b) illustrates how this maker chiselled out the peg box cavity deeply, leaving only very little wood at the cavity floor. Figure 20(c) demonstrates that external wedges have been applied by a repairer to fill the enlarged rib-slots in the neck root. To allow the neck to make the shift in angle, these slots must have been widened when the neck inclination was modified. From Figure 20(d) it is evident that the neck of the Snoeck violin has been elongated by some 10mm, thereby necessitating the use of a wooden insert in each side of the neck root. The metal nail, applied during that neck alteration to secure the modified neck to the new upper block, is visible as well. Figure 20(e), also from the Snoeck violin, shows that the depicted corner block does not completely fit into the rib corner (this appears to be the case for all four corner blocks), indicating that either Snoeck added the blocks himself after the rib structure was already completed, without caring too much about a perfect fit, or that the blocks are later additions. Finally, Figure 20(f) demonstrates the way Boussu secured the upper rib parts into the neck root: by applying two complementary wedge-shaped spruce inserts in each slot. Furthermore, the width of the upper block is 36.5mm, measured from the coronal cross section. This dimension is equal to the width of the scroll, which implies that Boussu, in the initial stage of making the neck, prepared a maple

[71] Personal communication with Stephen Freeman.

Figure 21. *Inside views of the top plate in the four instruments: (a) violin by Jan de Maseneer, MIM inv. no. 2786; (b) violin by Gaspar Borbon, MIM inv. no. 2774; (c) violin by Egidius Snoeck, MIM inv. no. 2779; (d) violin by Benoit-Joseph Boussu, MIM inv. no. 2781. Images obtained from 3D volume rendering of CT-scan data.*

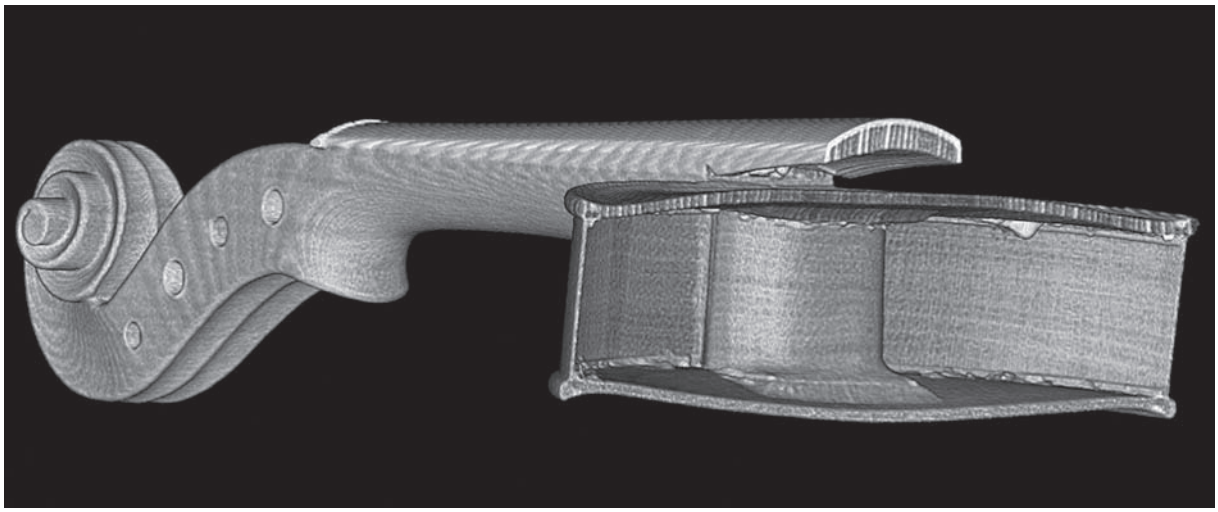


Figure 22. *Inside view of the upper block area of the violin by Benoit-Joseph Boussu, MIM inv. no. 2781. Image obtained from 3D volume rendering of CT-scan data. The usual striping artefacts, especially visible on neck, scroll and fingerboard are the result of the limited resolution of the CT-scanner.*

block with a uniform width of 36.5mm.

By combining the voxel data in three dimensions, it becomes possible to create 3D views of the scanned violins. The possibilities of this way of visualisation are extensive, resulting in elucidative (and sometimes rather eye-pleasing) depictions of the interior of the scanned instrument. By performing spatial rotation of a 3D reconstruction with the imaging software, combined with the application of cut-offs, it is possible to view the inside of the violin from every angle and to handle the reconstruction as if a real object, giving this method an obvious advantage over optical endoscopy. Moreover, by applying filtering based on the density of the composing materials, 'erasing' of certain components from the reconstruction can be achieved.

Due to the many possibilities and the limited space available for illustrations in the present publication, we restrict ourselves to some illustrative 'still images' of 3D reconstruction. In Figure 21, views of the inside of the top plates are displayed, where the shape and position of the bass bar can easily be seen. Moreover, other internal components, like the upper, lower and corner blocks, can be studied from these images. In Figure 21(c), the many internal reinforcing patches on the top plate can be clearly distinguished. Figure 21(d) shows that the Boussu violin has woodworm damage in the lower treble side section of the top plate, near the edge, and above the bass side f-hole. Figure 22 shows a final example, this time for the upper bout area of the Boussu violin.

CT-SCANNING: DENSITY, THICKNESS AND ELEVATION MAPS

A dedicated MATLAB (The MathWorks, Inc., USA) based computer program, developed by co-author Berend Stoel,[72] was used to automatically detect the superior and inferior surface of the top and back plates from CT-data. Using these surfaces, the local density, plate thickness and plate elevation were computed. From the calculated values, map-like images were constructed in which various colours represent the numerical value ranges. In that way, maps for each violin were created for density (in kg/m^3), thickness[73] (in mm) and elevation (in mm). Figures 23 to 26 in the colour section display the maps for the four violins. Bass and treble side of the plates are indicated by the respective letters 'B' and 'T', while the accompanying scales correlate the colours to numerical values. Besides being useful sources of plate thicknesses and elevations for present-day makers, who wish to make a copy of the original instrument, these maps provide information on the construction, material selection and condition of the violins. The thickness map of the top plate also learns us about the bass bar position, since the bar appears as a yellow ribbon-shape in the map.

From Figure 23, the density map of the back plate, it can be seen that the wood of the back plate of the violin by de Maseneer has a relatively high density; the interesting converging pattern of the figured maple is visible as well. The top plate's annual growth ring lines are not parallel, especially on the

[72] Borman and Stoel (2009), pp.239–50.

[73] The striping artefacts in the thickness maps are caused by quantization errors due to the limited resolution of the CT-scanner.

treble side part of the plate, as can be observed from the plate's density map. From the thickness map of the back plate, it appears that de Maseneer made the back plate thinly on the whole and especially in some outer areas of the upper and lower bouts.[74] Also visible in this map is the platform that used to support the original (but now replaced) upper block. De Maseneer created an elongated, 'tube-like' central section in the archings of the top and back plate, a feature that can be noticed in the elevation maps in Figure 23.

It is evident from Figure 24 that the violin by Gaspar Borbon has few repairs in its top and back plate, although the top plate is thought to be a replacement. As can be seen in its thickness map, this plate shows a thick central area located around the integrally carved bass bar. The thickness map of the back plate illustrates that Borbon created a deep, albeit narrow fluting channel around the perimeter of the back, leaving the plate fairly thin in these areas,[75] perhaps to counterbalance the ample graduations of the central region of the back. The platform on the back plate for the upper block can also be observed from the same thickness map. A noticeable difference in elevation pattern between top and back plate could be a further indication for the non-authenticity of the top plate.

The many repairs in the violin by Egidius Snoeck are visible when looking at the thickness maps in Figure 25. We can see numerous small (internal) reinforcement plates, especially in the lower part of the top plate, as well as a large doubling patch that is visible in the central section of the top plate's density map. For the central area of the back plate, depicted as a transparent whitish shaded region on the map, it was not possible to calculate the thickness correctly due to contact of the outer surface of the back plate with the cover of the supporting cushion during the CT-scan. However, thickness determination of the peripheral areas of the back plate proved possible, and it can be seen that Snoeck made these sections rather thin.[76] Again, the remaining rectangular upper block platform on the back plate is clearly discernible. The elevation maps display a fair amount of asymmetry in the archings, either caused by inaccurate workmanship of Snoeck during the shaping of the archings, or by deformations that took place throughout time.

The density map of the back plate in Figure 26 illustrates that Boussu used maple wood of low density, whereas the density map of the top plate reveals some places where woodworm damage has occurred, most notably above the bass side f-hole and in the lower section of the treble side half. In this latter area, a filler material appears to have been applied. The thickness maps display a very identical and regular thickness pattern for both plates, with a similarly shaped upper block platform on the belly as well as the back. The archings for both plates are made in a corresponding similar manner, as is evident from the elevation maps in Figure 26.

CONCLUSIONS

The combined application of present-day investigation and imaging techniques has allowed us to thoroughly study and visualize four important instruments by historical Brussels makers from the MIM collection. Since then, scans of violins have been reported using even more advanced techniques, such as micro-CT-scanning[77] and synchrotron radiation microtomography (SRM),[78] which allow for voxels spacings in the micrometre range. These newer methods yield images of much higher resolution, while the dimensional measurement values derived from the scan data have a significantly higher accuracy. At the time of our study, we only had clinical CT-scanning equipment at our disposal; moreover, at the time of writing very few institutions have the above mentioned micro-CT-equipment of a sufficient dimension available. Furthermore, we decided to perform the scans at a Brussels hospital, where only clinical CT-scanners were in use, to

[74] By using a magnetic thickness gauge (Hacklinger, type B, Germany), we confirmed that these thin areas have local minimum thicknesses between 1.1 and 1.4mm. In Figure 23, the area with measured thickness of 1.1mm is indicated by symbol ○, and the areas with measured thickness of 1.4mm are indicated by symbol □.

[75] By using a magnetic thickness gauge (Hacklinger, type B, Germany), we confirmed that the local minimum thickness in this channel is around 1.7mm. In Figure 24, the areas with measured thickness of 1.7mm are indicated by symbol △.

[76] By using a magnetic thickness gauge (Hacklinger, type B, Germany), we confirmed that these thin peripheral areas have local minimum thicknesses between 1.2 and 1.5mm. In Figure 25, the area with measured thickness of 1.2mm is indicated by symbol ☆, and the areas with measured thickness of 1.5mm are indicated by symbol +.

[77] Andrea Zanrè and Rudolf Hopfner, 'New light on an uncut diamond', *The Strad* 125/1494 (October 2014), pp.36–43.

[78] Franco Zanini, 'Learning the finer points', *The Strad* 123/1461 (January 2012), pp.36–41.

avoid long transportation times for the instruments. Despite the above considerations, we feel our results are representative and reliable and we are confident that our investigations provide new understanding of the studied violins.

The visualisations, obtained from CT-scanning and digital endoscopy, allow us to identify original constructional elements within the four instruments, as well as modifications and repairs that have been carried out over the centuries. The modernized neck in the violin by de Maseneer can easily be recognized from the outside, but the renewed upper block and remaining original neck block platform on the back could only be fully visualized by the acquired endoscopy and CT-scanning images. Similarly, for the violins by Borbon and Snoeck, our investigations made it possible to construct complete representations of the current neck and upper block configurations and thus to get a clear idea of the alterations that had been performed to these parts throughout time in order to modify the instruments according to progressing musical demands. Furthermore, our findings suggest that the entire top plate of the Borbon violin is in all probability a later replacement. A future dendrochronological analysis should be performed to clarify this presumption. The scanning and endoscopy examinations on the Boussu violin confirm that this instrument survived in near original condition.

The presented results also permit us to comment on the construction techniques used by the four makers. More specifically, we have identified authentic necks with integral upper blocks in two of the instruments and remaining extended upper block platforms on the back plates of the two other violins. Thus, all four violins were originally built with the neck and upper block made from a single piece of maple, where the upper rib parts were secured in side-slots in the neck root, although this structure is only preserved in the Borbon and Boussu instruments. Furthermore, with the exception of the Boussu violin, the ribs are fitted in a groove in the back plate. From these observations, we confirm that all four studied instruments were assembled from the back plate without the aid of a mould. It is thus interesting to note that this kind of construction system, normally associated with early building traditions,[79] was still in use by both court and independent makers in Brussels until well into the eighteenth century. We do not, however, want to classify these working methods as solely 'Flemish' or typical of the southern Low Countries. After all, extant seventeenth- and early eighteenth-century violin family instruments from other northern European regions, such as England (William Prior from Newcastle and William Baker from Oxford)[80] and the southern Black Forest and Switzerland[81] show similar constructional features. Lindeman[82] states that Paris makers from the first half of the eighteenth century, Jacques Bocquay and Claude Pierray, still employed the 'through neck' method as well. This makes it legitimate to argue that during the seventeenth and eighteenth centuries, such kind of practice was customary rather than an exception in northern parts of Europe. Nevertheless, when looking at the internal construction of Boussu, a hybrid making system can be distinguished, in which local habits were mixed with imported techniques, as practised for example in northern Italy. Whereas Boussu had started to diverge from the local traditions, by abandoning the insertion of the ribs into a channel in the back plate, instruments of some of his contemporaries, such as Jean-Hyacinthe Rottenburgh,[83] already fully display the classical ('Italian') constructional features, including a separate upper block and ribs glued onto the back plate reinforced by the aid of wooden lining strips. So, during the course of the eighteenth century, local making techniques were gradually ignored by the Brussels makers in favour of a making system with a mould.

From an aesthetic perspective, the court makers consistently employed a uniform style, apparently modelled after foreign, mostly Italian, examples

[79] Karel Moens, 'De viool in de 16de en 17de eeuw. Oorsprong en ontwikkeling van haar vorm- en bouwkenmerken. Deel III: Reminiscenties aan de speelmanneninstrumentenbouw in de 17de-eeuwse vioolbouw', *Musica Antiqua* 2 (1985), p.85.

[80] John Milnes, Tim Baker, John Dilworth and Andrew Fairfax, *The British violin. The catalogue of the 1998 exhibition '400 years of violin & bow making in the British Isles'* (Oxford: British Violin Making Association, 2000), pp.398–9.

[81] Olga Adelmann and Annette Otterstedt, *Die Alemannische Schule. Geigenbau des 17. Jahrhunderts im südlichen Schwarzwald und in der Schweiz* (Berlin: Staatliches Institut für Musikforschung, 1997), pp.45–8.

[82] Lindeman (2011), p.36.

[83] Moens (1983), p.152. We could confirm the observations of Moens by performing endoscopic investigations on a viola from *c*1750, attributed to Jean-Hyacinthe Rottenburgh (MIM inv. no. 2835), and a cello from 1753 by the same maker (MIM inv. no. 1369).

from the late sixteenth and early seventeenth century. A representative instrument in this respect is the Gaspar Borbon viola from 1692 (MIM inv. no. 2836), depicted in Figure 2. Thus, it appears that makers attached to the Brussels court held on to aesthetic ideals that already had been internally established since the initial violin making attempts within the court chapel. Only in the work of Marcus Snoeck (active *c*1718–1762), the last court employee to build a substantial number of instruments, some contemporary stylistic influences become noticeable, although he still employed the local construction methods.[84] On the other hand, the autonomous makers seem to have had a more adapting attitude towards external stylistic guides, embracing influences from their foreign contemporaries, as can be seen in the instruments of de Maseneer and Boussu. Yet, this still could result in an individual style, as is especially evident in the work of Boussu. Eventually, these aesthetical reflections must lead once again to the rejection of the idea of a 'Brussels' or 'Flemish' school. After all, the court makers held on to an 'old-fashioned' style, shaped after early foreign precedents, while the self-employed makers incorporated contemporary influences from abroad.

Moens has argued that the independent makers were more open to incorporate new constructional and stylistic elements into their instruments: as specialized craftsmen with advanced making skills they worked at a higher technical level and were not averse to innovation. On the contrary, in case of the court makers, since most of them were musicians as well, they probably preferred to maintain the employ of uncomplicated and proven techniques instead of the ever-evolving and more advanced methods adopted by the specialized independent makers.[85] Moreover, Awouters has argued that the persistence in clinging to the outdated construction methods and aesthetics by the court makers is largely due to the fact that these men worked in relative isolation within the protected environments of chapel and guild, where knowledge was primarily passed on from father to son (or master to pupil) instead of being actualised from outside examples.[86]

Our investigations confirm the views of these two previous authors. In addition, for the first time we have made available detailed measurements and images of the internal structures of the four violins under study. This approach has yielded new insights, beneficial for both researchers and violin makers alike. Furthermore, the measurement data and images obtained will reduce the need for handling of these instruments in the future. Researchers can now also consult our visualisations of the four scanned violins, generate their own 2D and 3D reconstructions from the data and perform measurements on them. We therefore would like to recommend and encourage a more widespread use of this approach in documentation for other instruments in museum collections.

AUTHOR CONTRIBUTIONS

Verberkmoes: research design and instrument selection, stylistic analysis, measurement of dimensions, visual examination and endoscopy, CT-data analysis (2D and 3D reconstructions), writing article text.
Ceulemans: instrument selection and curatorship, visual examination and endoscopy, coordination of instrument photography and transportation.
Balériaux: coordination and performance of CT-scans, initial CT-data analysis.
Stoel: CT-data analysis (density, thickness and elevation maps; additional 2D reconstructions), advice on CT-data interpretation.
All co-authors commented on the article manuscript.

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[84] Mia Awouters, '(5) Marcus (Marc) SNOECK', in Haine and Meeùs (1986), pp.386–7.

[85] Moens (1983), pp.137–40 and 146–7.

[86] Awouters (2000), p.63.

GEERTEN VERBERKMOES *et al*
An Inside Look at Four Historical Violins by Brussels Makers

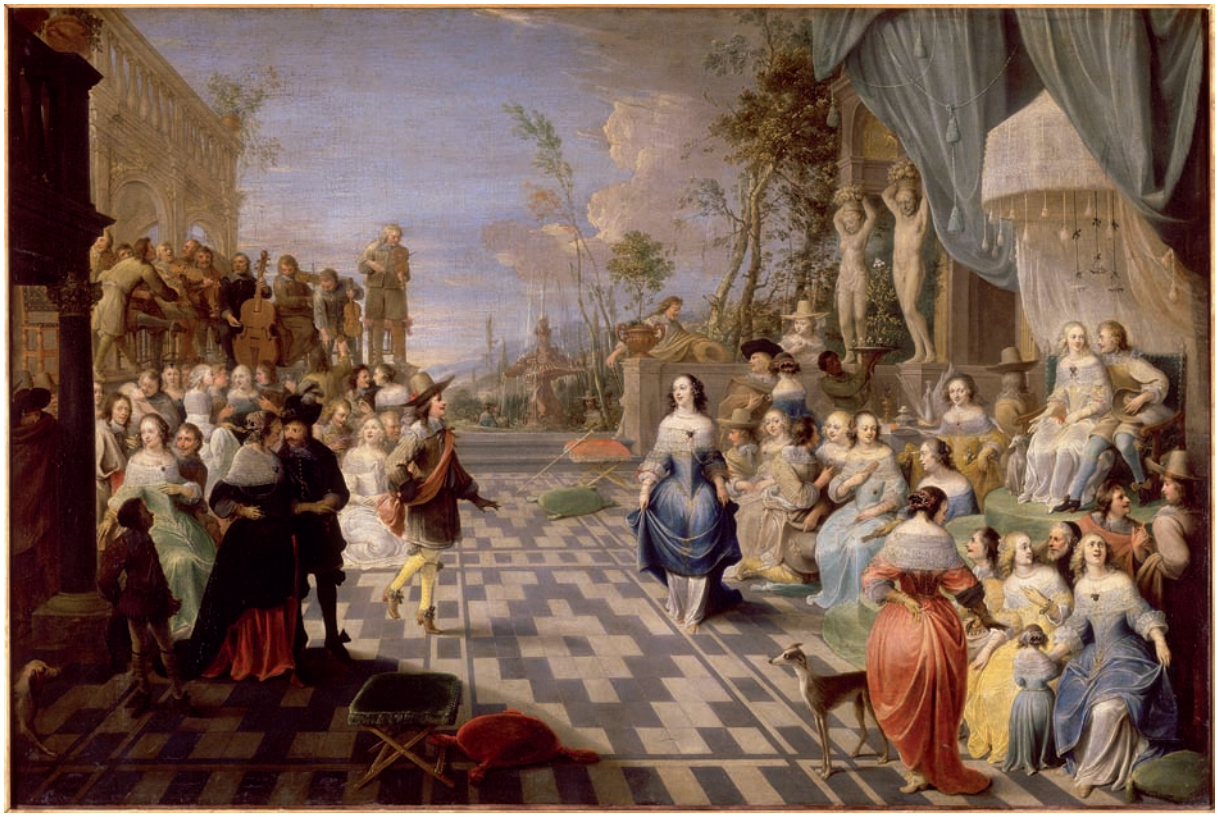

Figure 1. *Painting by Hieronymus Janssens from 1658, titled 'Ball on the terrace of a palace': (above) entire painting; (below) detail. The Museum of Fine Arts, Lille, France, inv. no. P186. (Photo: © RMN-Grand Palais / René-Gabriel Ojéda).*

Figure 3. *Front views of the four instruments: (a) violin by Jan de Maseneer, MIM inv. no. 2786; (b) violin by Gaspar Borbon, MIM inv. no. 2774. (Photos: Musical Instruments Museum, Brussels, © MIM).*

Figure 3. *Front views of the four instruments: (c) violin by Egidius Snoeck, MIM inv. no. 2779; (d) violin by Benoit-Joseph Boussu, MIM inv. no. 2781. (Photos: Musical Instruments Museum, Brussels, © MIM).*

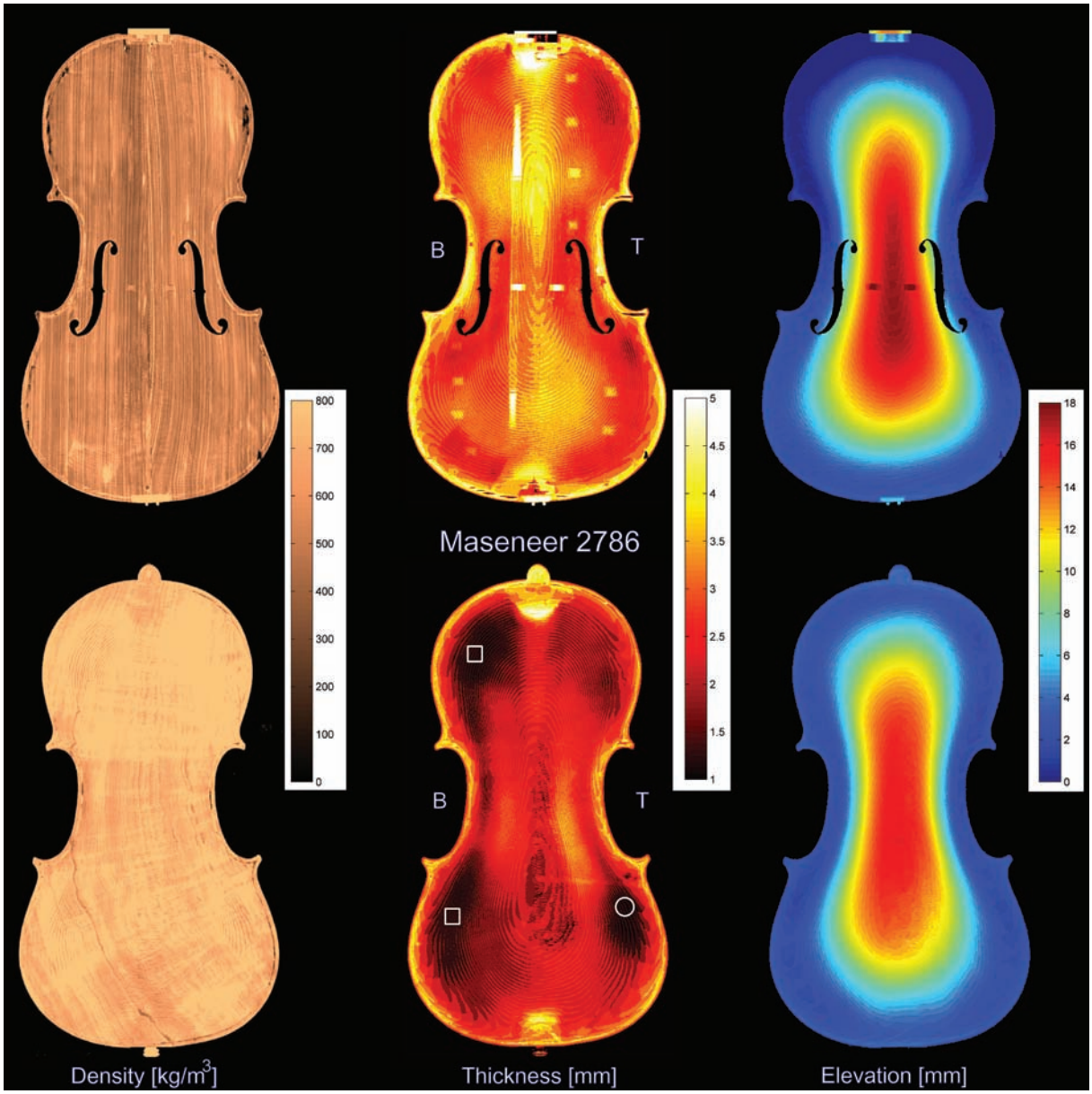

Figure 23. *Density, thickness and elevation maps for the violin by Jan de Maseneer, MIM inv. no. 2786. The symbols ○ and □ in the thickness map of the back indicate the places where confirmation measurements were performed with a magnetic thickness gauge (Hacklinger, type B, Germany) at areas of local minimum thickness. At the location indicated by symbol ○, a thickness of 1.1mm was measured and at the locations indicated by symbol □, a thickness of 1.4mm was measured.*

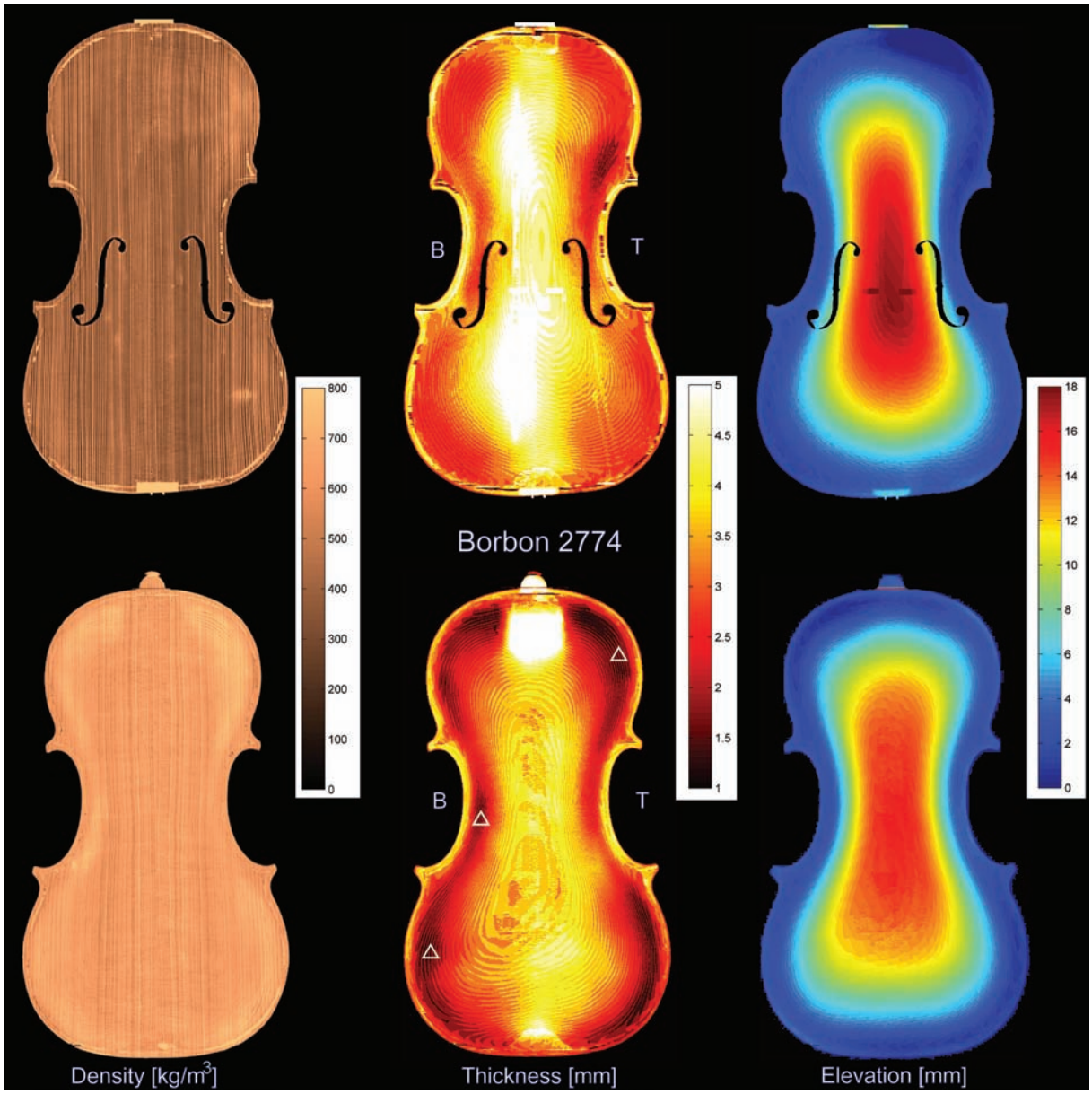

Figure 24. *Density, thickness and elevation maps for the violin by Gaspar Borbon, MIM inv. no. 2774. The symbol △ in the thickness map of the back indicates the places where confirmation measurements were performed with a magnetic thickness gauge (Hacklinger, type B, Germany) at areas of local minimum thickness. At the locations indicated by symbol △, a thickness of 1.7mm was measured.*

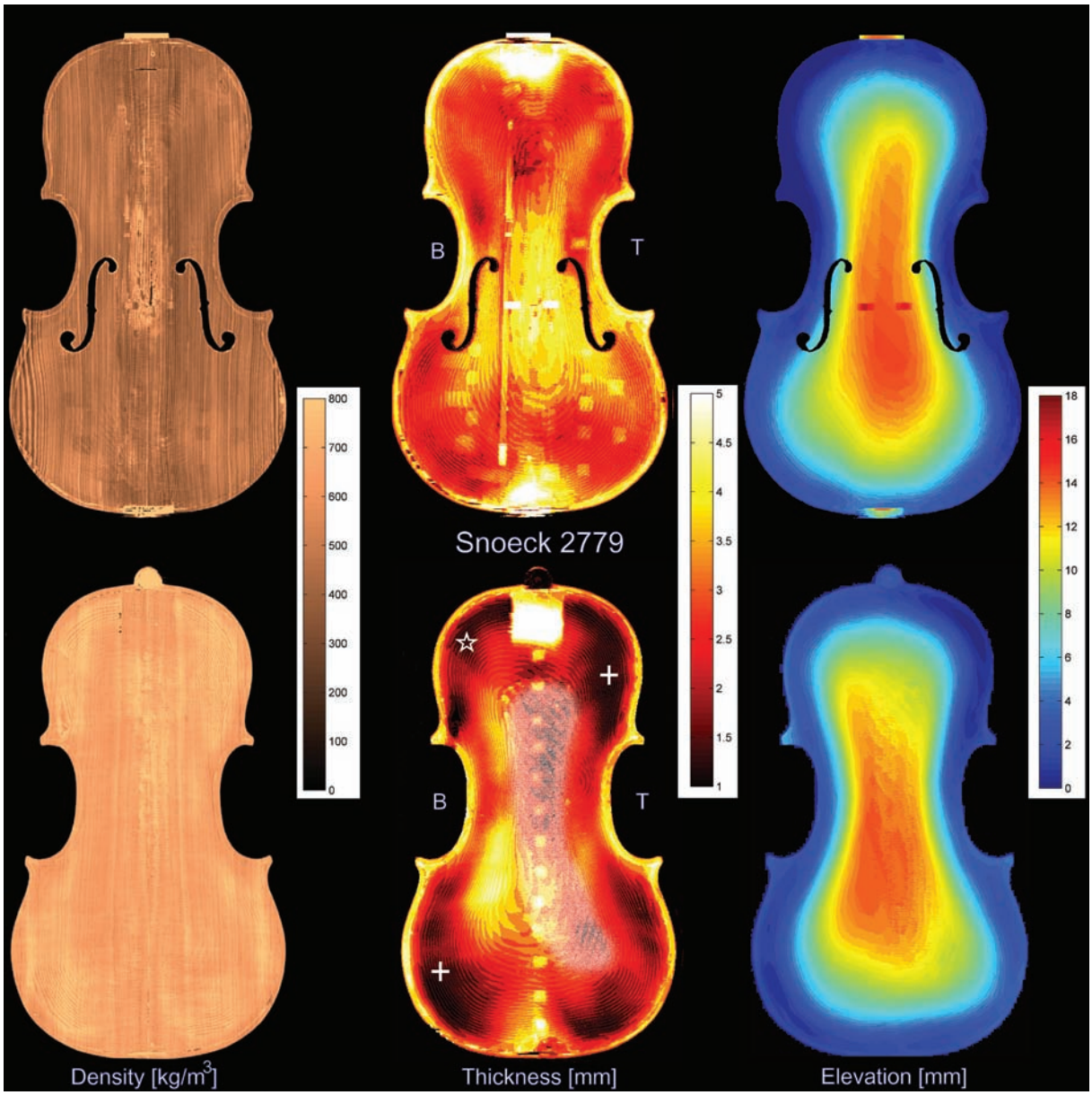

Figure 25. *Density, thickness and elevation maps for the violin by Egidius Snoeck, MIM inv. no. 2779. The transparently whitish shaded region in the thickness map of the back plate indicates a section where the thickness could not be determined accurately, due to contact with the cover of the supporting cushion during the CT-scan. The symbols ☆ and + in the thickness map of the back indicate the places where confirmation measurements were performed with a magnetic thickness gauge (Hacklinger, type B, Germany) at areas of local minimum thickness. At the location indicated by symbol ☆, a thickness of 1.2mm was measured and at the locations indicated by symbol +, a thickness of 1.5mm was measured.*

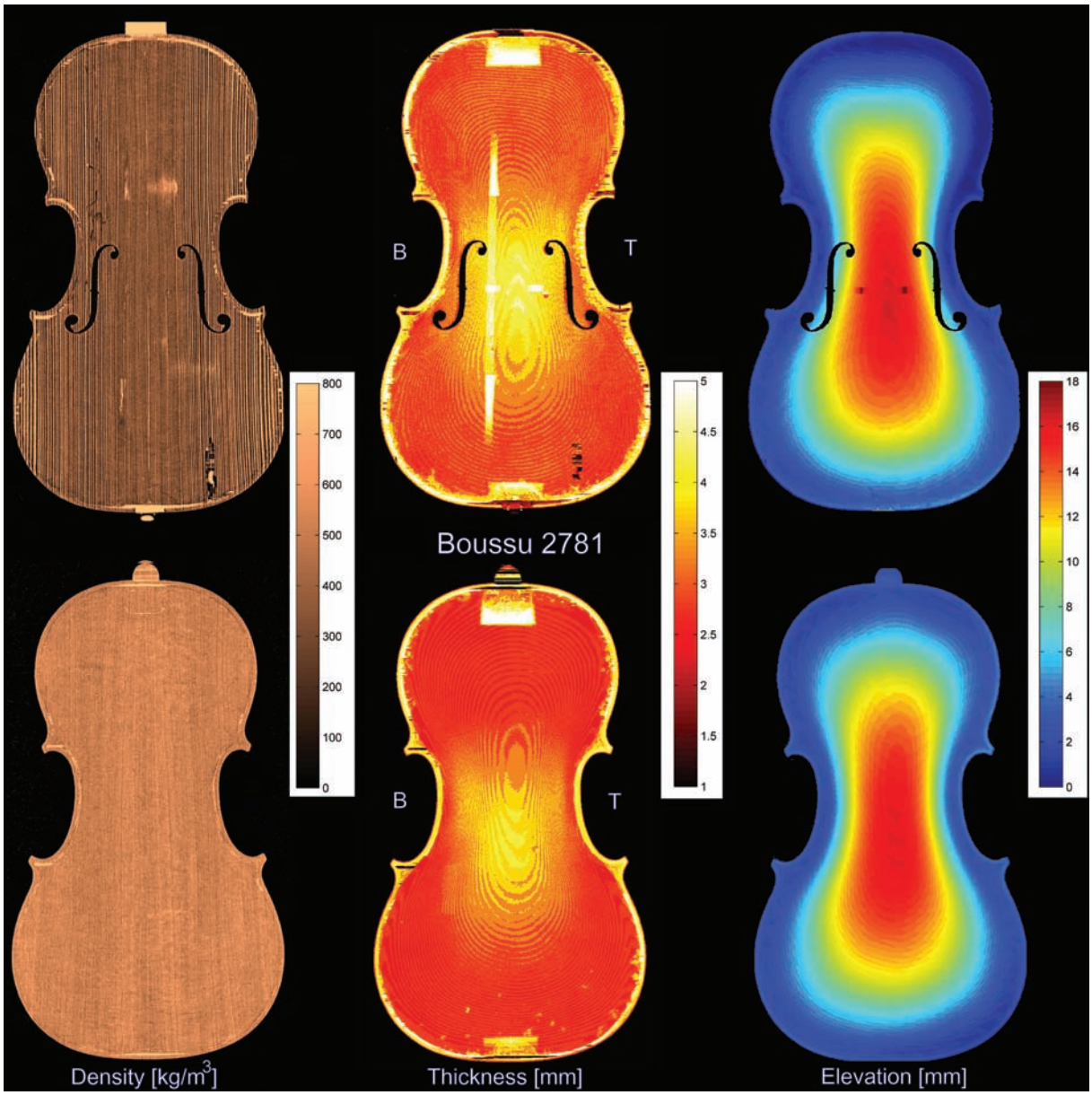

Figure 26. *Density, thickness and elevation maps for the violin by Benoit-Joseph Boussu, MIM inv. no. 2781.*