

Of the master's dispersed leaves on the fabric of instruments: the drawing and the reasoning are his, in the mirror hand; the measures were reduced by a later student to the Cremonese B form of 1710, and noted in millimetres. Form and harmony are drawn from the body itself.

The Cello Maker's Manuscript

OFFICINA CREMONENSIS · ARCHIVUM LUTHERIAE

TABULA I · CORPUS

Plate the First · the body, its woods and its proportions

MENSURA INTEGRA Principal measures

Corpus body	755
Chorda string	690
Collum neck	280
Pondus weight, kg	3.5–4.5

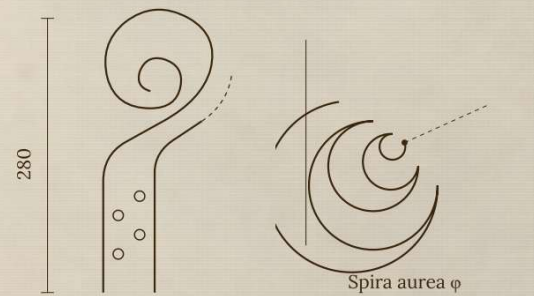
I. LIGNUM SONORUM

Woods of Sound · materials & density

	A. Picea Abies Norway spruce Top plate, bass bar and blocks. Straight even grain of 1.2–3.0 mm. 0.35–0.45 g/cm ³
	B. Acer Pseudoplatanus Sycamore maple Back, ribs and neck. Oblique flame; quartered or radial cut. 0.55–0.65 g/cm ³
	C. Diospyros Ebenum Ceylon ebony Fingerboard, pegs and saddle. Purfling of pear and dyed poplar. 1.05–1.20 g/cm ³

II. VOLUTA & CAPUT

Scroll & Head · the upper architecture

	
Pyxis verticillorum pegbox length	175
Latitudo faucium throat width	34
Altitudo capitis head height	78
Conus verticilli peg taper	1:30
Foramen peg hole	12.0
Gyri volutae turns of the volute	2½

III. FORMA & LATERA

Mould & Ribs · the garland and its blocks

Forma interior inner mould	22.0
Trunci blocks	6
Latera, crassitudo rib thickness	1.6–2.0
Altitudo ad collum rib height, neck	118.0
Altitudo ad caudam rib height, tail	125.0
Taeniae linings	2.5 × 12
Filum purpuræ purfling width	1.8

The ribs are bent on the hot iron and set upon the inner mould; the corner blocks are cut to their curves only after the garland will stand free of it.

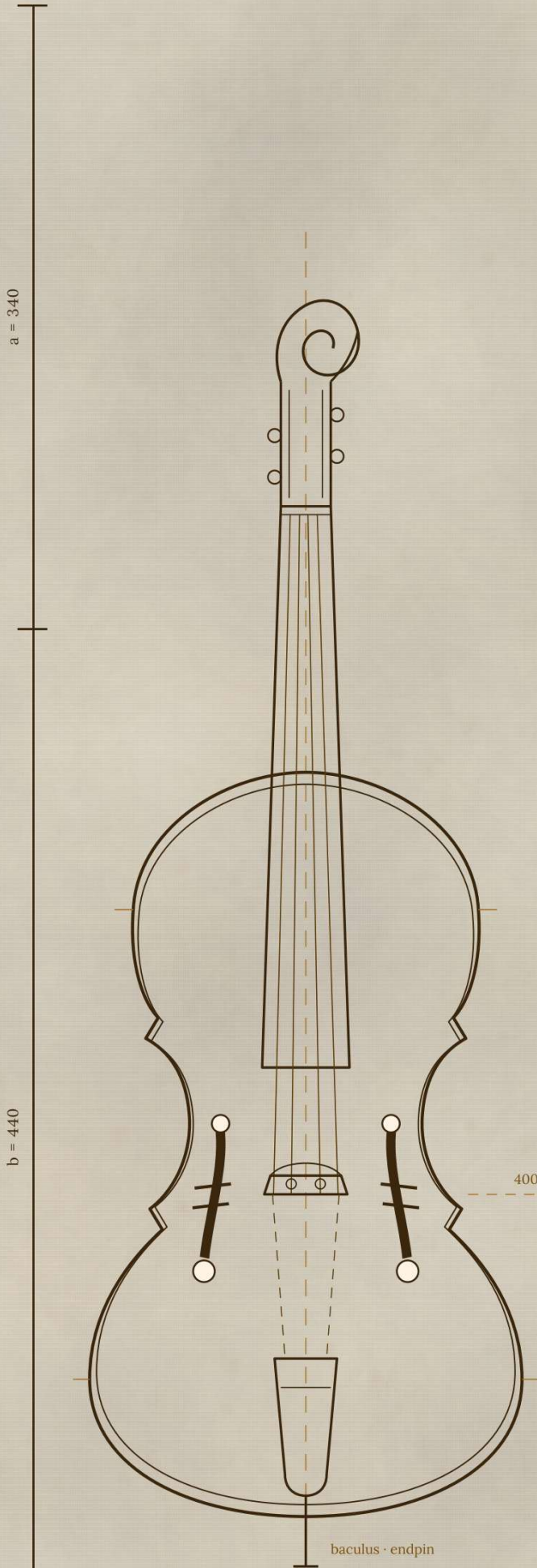
DE MODULO

Of the Mould

The Cremonese did not draw the cello and then build it; they built the mould and let the mould draw the cello. The garland of ribs, standing free of its form, already fixes the outline, the corners and the height of the box. Every later decision — the arching, the graduation, the setting of the post — is taken against a shape that is by then no longer negotiable. Hence the maker's first labour is in pear wood and pencil, not in spruce.

IV. STRUCTURA VIOLONCELLI

The Structure of the Cello · proportion & architecture



a : b = 1 : 1.294	φ = 1.6180339887	400 mm
b : L = 1 : 1.716	neck : stop = 7 : 10	f-holes on the stop line

V. MENSURAE CORPORIS

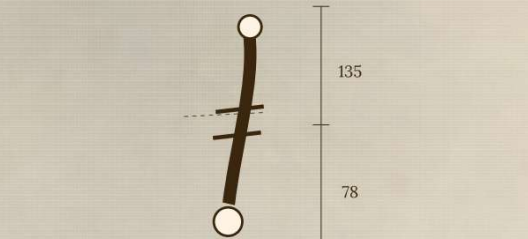
Measures of the Body · in millimetres

Longitudo corporis body length	755.0
Latitudo superior upper bout	340.0
Latitudo media waist	240.0
Latitudo inferior lower bout	440.0
Altitudo laterum ribs, upper	118.0
Altitudo laterum ribs, lower	125.0
Arcus tabulae top arching	25.0
Arcus fundi back arching	26.0
Mensura ad pontem stop length	400.0
Longitudo colli neck length	280.0
Chorda vibrans vibrating string	690.0
Crassitudo tabulae top thickness	4.0–5.5
Crassitudo fundi back thickness	3.0–6.0

The neck stands to the stop as seven to ten — 280 : 400. The corners of the middle bouts fall at one third of the length.

VI. RATIO HARMONICA

Harmonic Ratio · the f-holes & the golden section

	
Longitudo foraminis f-hole length	135.0
Inter crenas between notches	78.0
Latitudo incisurae width of cut	8.0
Oculus superior upper eye	12.0
Oculus inferior lower eye	16.0
Angulus ad axem angle to axis	8°

The upper notches touch the stop line; the eyes fall at the golden section of the length.

VII. ANGULUS & ELEVATIO

Neck Angle & Projection · the line of the fingerboard

Angulus colli neck angle	84°
Elevatio ad pontem projection at the bridge	81.0
Longitudo tabulae fingerboard length	580
Curvatura camber radius	60
Latitudo ad nucem width at the nut	32.0
Latitudo ad finem width at the end	90.0
Altitudo chordarum string height at the end	5.5–9.0

The plane of the fingerboard, produced, meets the bridge at eighty-one millimetres above the top; every other measure of the set-up follows from that one line.

DE MENSURA

Of Measurement

The figures on this sheet are nominal. They are the measures of surviving instruments of the classical period, taken with the caliper at the points named, and they vary between one instrument and the next by more than the third decimal place suggests. Where a figure and the ear disagree, the ear is the older authority. Read them as the bounds within which the work is known to succeed, not as a specification to be met. The caliper settles nothing that the plane has not already decided: a tenth of a millimetre on the graduation of a back is worth more than a whole millimetre in the outline, and no table of figures will tell a maker which of the two he is looking at.

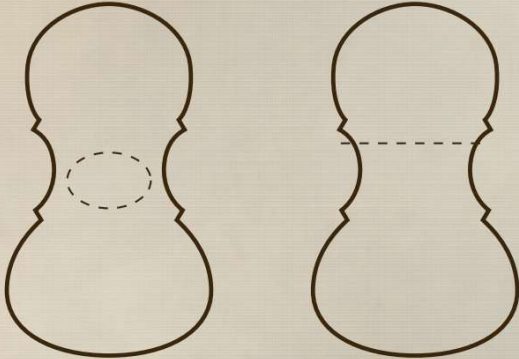
Tabula II · The Sounding Parts

Plate the Second · resonance, tension, the inner organs, the bridge and the bow

OFFICINA CREMONENSIS

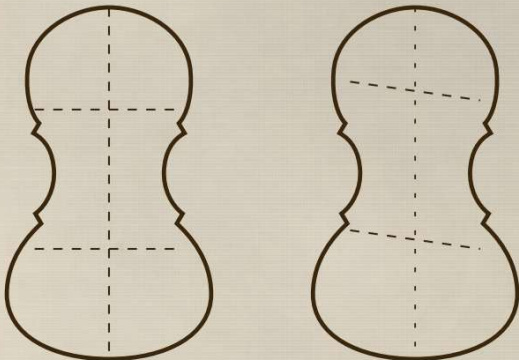
VIII. ARCHITECTURA ACUSTICA

Acoustic Architecture · the resonant modes of the body



AO · 100 Hz
Helmholtz air mode

CBR · 150 Hz
centre-bout rotation



BI- · 175 Hz
first corpus bending

BI+ · 210 Hz
second corpus bending

Free plates are tuned to the fifth mode: the top near 150 Hz, the back near 165 Hz. The bridge hill lies between one and two thousand.

IX. TENSIO CHORDARUM

String Tension · equal temperament, A = 440

Chorda	Hz	kg	Ø mm	Anima
A 3	220.0	15.5	0.72	Steel
D 3	146.8	13.8	1.05	Steel
G 2	98.0	13.0	1.25	Rope
C 2	65.4	12.5	1.45	Rope

Total tension ≈ 55 kg · downforce on the bridge ≈ 22 kg

X. GRADATIO TABULARUM

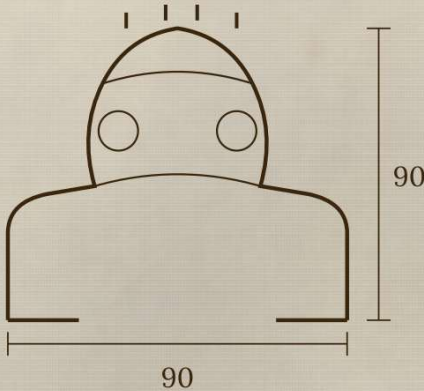
Graduation · the thicknesses of the plates

Tabula, centrum top, at the centre	4.5
Tabula, ad flexus top, at the bouts	3.8
Fundus, centrum back, at the centre	6.0
Fundus, ad marginem back, at the edge	3.5
Margo, crassitudo edge thickness	6.5
Margo, prominentia edge overhang	3.5
Canalis, altitudo fluting depth	2.0

The back is graduated from a full centre outward; the top is left the more even of the two. Tap tone is judged with the plate held light at one corner.

XI. PONS SONORUS

The Bridge · maple, section & measures



Altitudo height	90.0
Inter pedes foot span	90.0
Crassitudo basis at the base	12.0
Crassitudo apicis at the crown	3.0
Spatium chordarum string spacing	47.0
Arcus superior crown radius	90.0

XII. CLAVUS & CAUDA

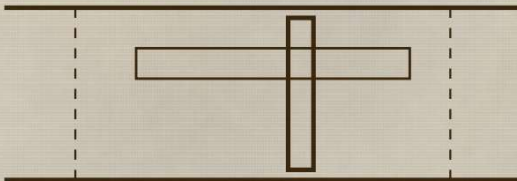
Tailpiece & Afterlength · what stands behind the bridge

Longitudo caudæ tailpiece length	230
Post pontem afterlength	115
Chorda caudæ tailgut	1 : 6
Nux, altitudo nut height	0.8
Nux, spatium string spacing at the nut	33.0
Sella saddle height	5.0
Clavus, diameter endpin	22.0

The afterlength stands to the vibrating string as one to six. Shorten it and the instrument tightens; lengthen it and the voice goes slack.

XIII. ANIMA & CATENA

Soundpost & Bass Bar · the inner organs



Sectio transversa · cross-section

Catena, longitudo bar length	620
Catena, latitudo bar width	12.0
Catena, altitudo bar height	22.0
Anima, diameter post diameter	11.5
Post pedem acutum behind treble foot	3.0

XIV. NOTA CURATORIS

Curator's Note · varnish & colour

Oleum lini coctum boiled linseed oil	4
Colophonium pini pine rosin	3
Mastiche mastic gum	1
Lacca rubiae madder lake	to colour

A mineral ground is laid first, then eight to twelve coats dried in the sun. Colour is built in glazes, never in a single heavy application.

XV. CURA & CONSERVATIO

Care of the Instrument · air, hair and felt

Humiditas relative humidity	45–55%
Temperatura temperature	18–22°C
Chordæ renovandæ strings renewed	200–300 hor.
Crines arcus bow rehaired	1–2 anni
Anima inspicienda soundpost checked	singulis annis

Wood answers the air before it answers the player. Keep the case shut, the room steady, and the post will keep its place.

XVI. CATALOGUS MAGISTRORUM

Catalogue of Masters · the Cremonese & Venetian schools

Nicolò Amati, Cremona	1596–1684
G. Grancino, Milan	1637–1709
Matteo Goffriller, Venice	1659–1742
Antonio Stradivari, Cremona	1644–1737
D. Montagnana, Venice	1686–1750
G. B. Guadagnini, Piacenza	1711–1786

Tensio intemperata, crossæ fissuræ: cave. — Beware uneven tension and cracks at the crossings.



DE OFFICINA

Of the Workshop

Hide glue at sixty degrees, thin enough to run from the brush, and a joint rubbed rather than clamped. Gouges kept sharp enough to cut end grain across the arching without tearing. Benches at the window, north light, and the work turned constantly to the light so the eye reads the curve rather than the drawing of it. The tools of this trade have not changed in three hundred years because they were right at the start.

XVII. ARCUS

The Bow · Paubrasilia echinata, pernambuco



Longitudo length	725	Pondus weight	80 ± 3 g
Crines hair ribbon	600	Numerus hairs	180–200
Aequilibrium balance point	175	Nasus ebony frog	14.0

ARS LONGA · VITA BREVIS · MUSICA AETERNA

Art is long · life is short · music is eternal · ex codicibus deperditis Leonardi · Tabula II de II