Automatic Scoring up of Music in Mensural Notation

Martha E. Thomae, Julie E. Cumming, Ichiro Fujinaga

Centre for Interdisciplinary Research in Music Media and Technology (CIRMMT)

McGill University

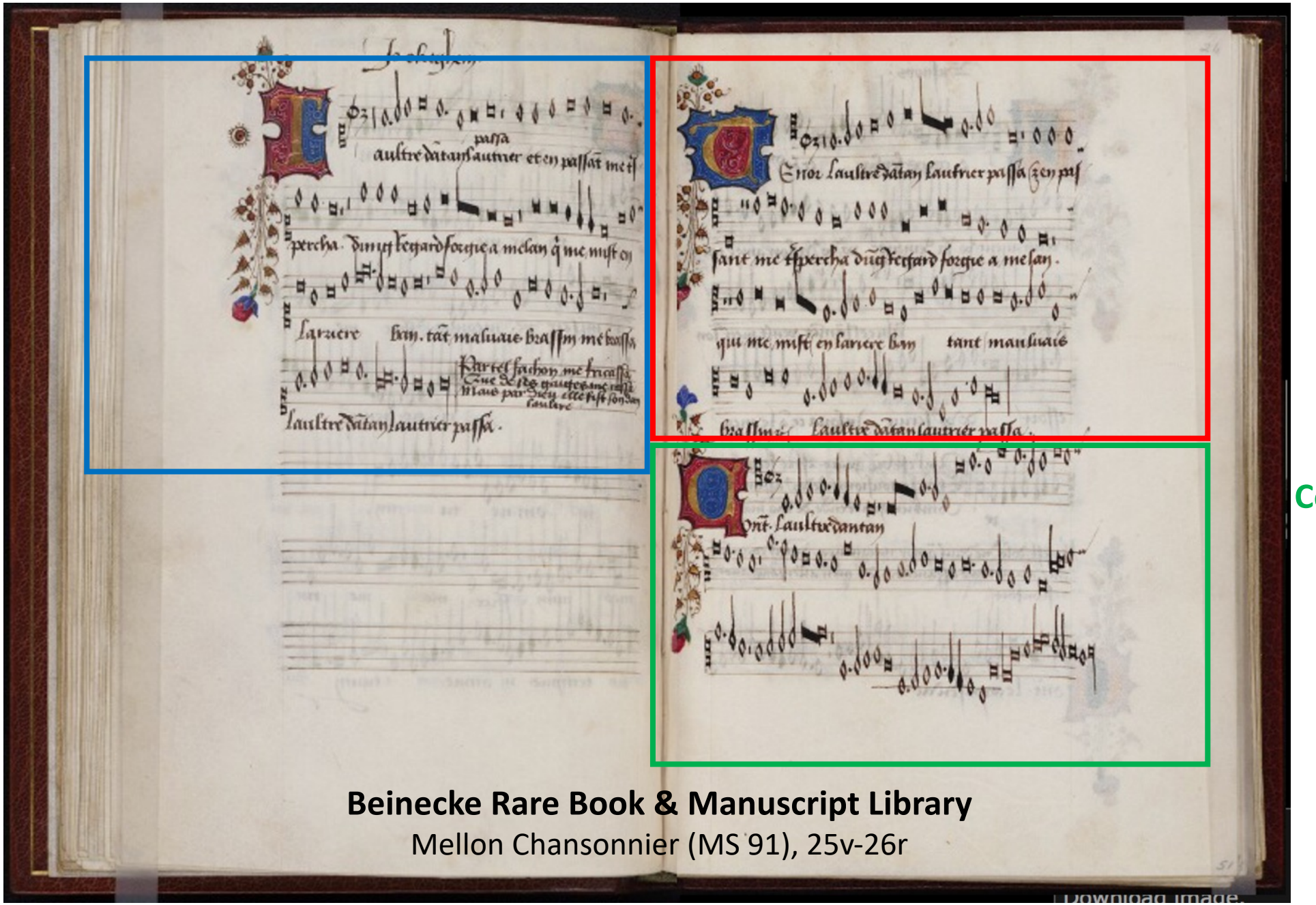
Music Encoding Conference

College Park, May 23rd, 2018

Superius

Tenor

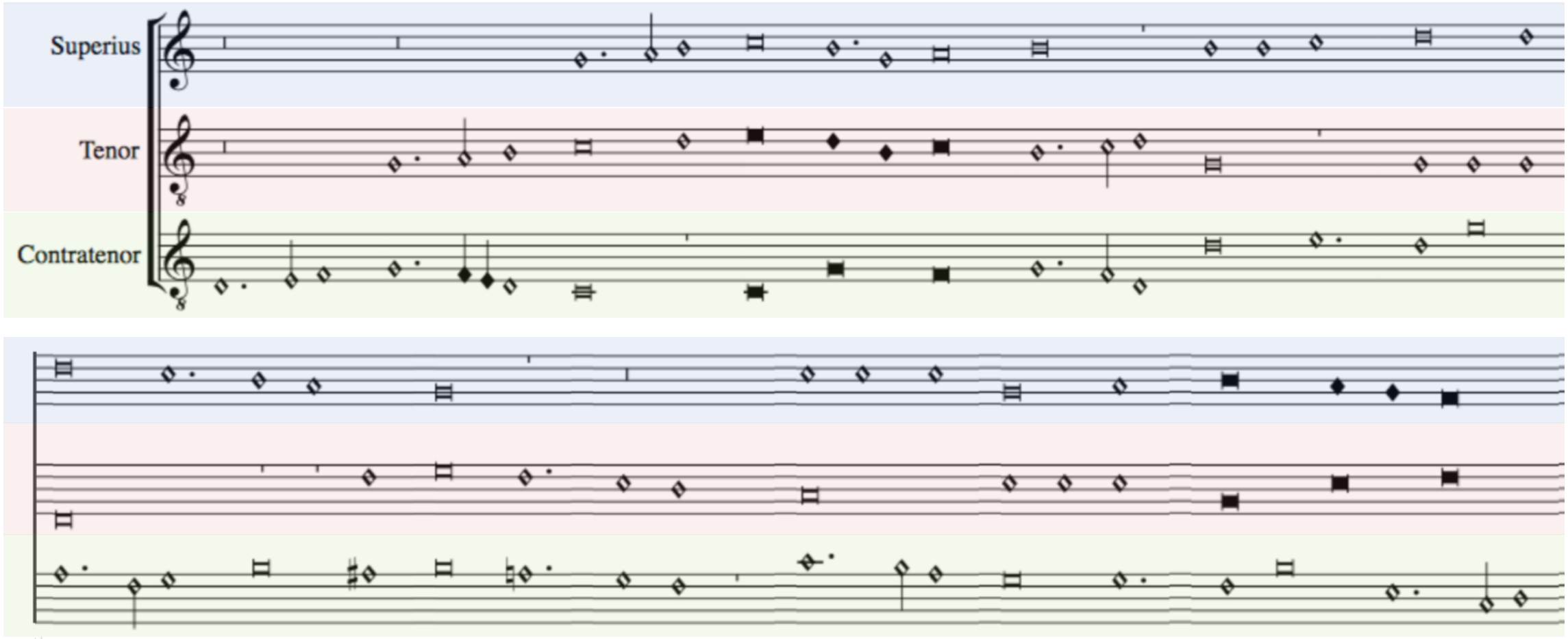
Contratenor



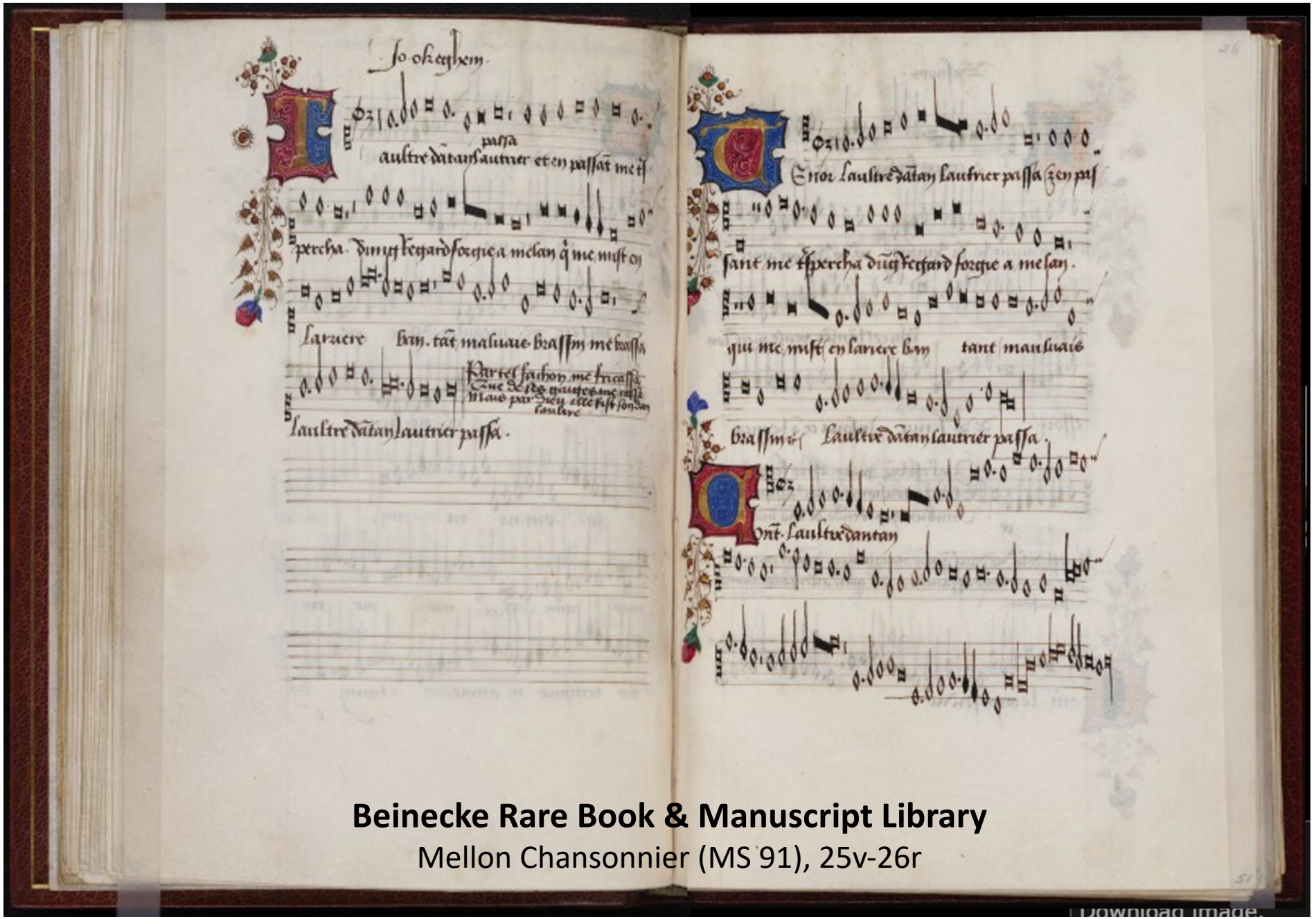
Beinecke Rare Book & Manuscript Library

Mellon Chansonnier (MS 91), 25v-26r

Scoring up



Mensural Notation
(An Introduction)



Beinecke Rare Book & Manuscript Library
Mellon Chansonnier (MS 91), 25v-26r

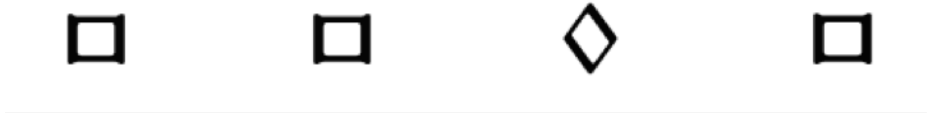
Mensural Notation

- There is a clear hierarchy in the note duration

longest

shortest

Notes		Values	
Name	Shape	Perfect	Imperfect
Maxima			
Long			
Breve			
Semibreve			



3 x ◊ 2 x ◊ 1 x ◊ 3 x ◊

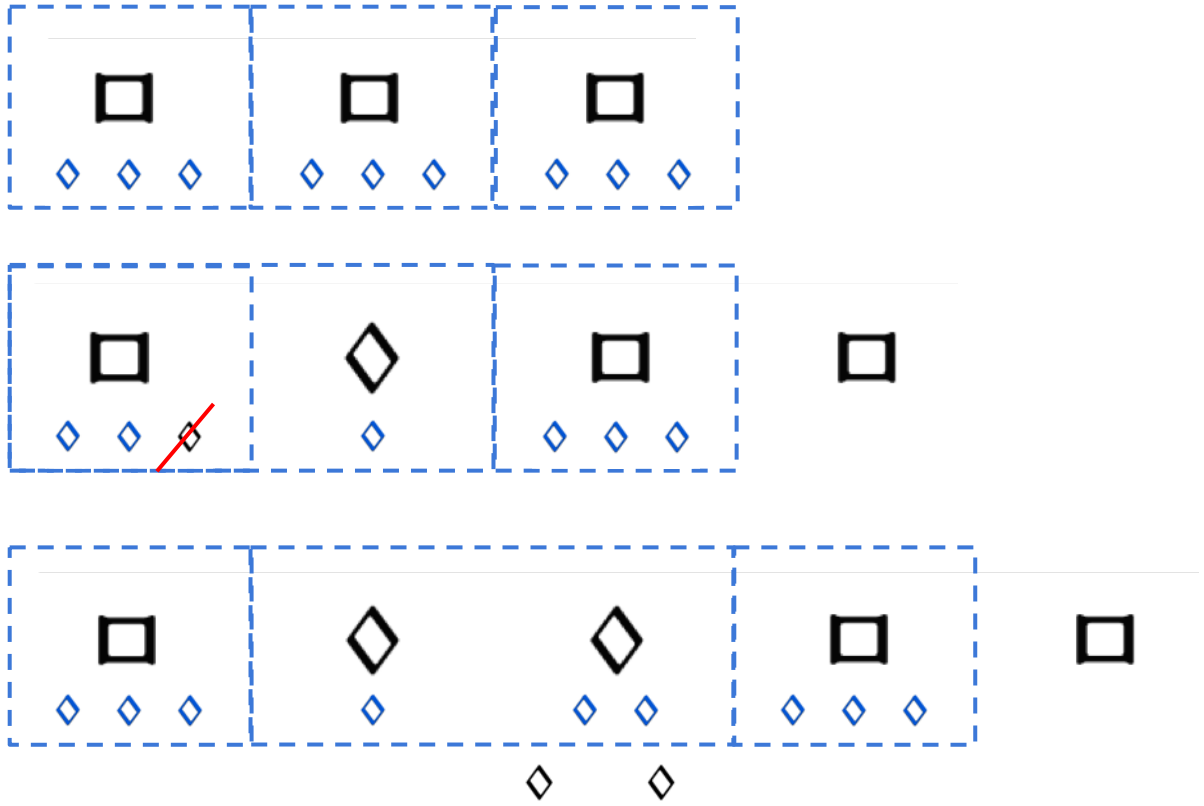
Mensuration

Establishes the relation between the note values (“perfect” or “imperfect”)

In **perfect mensurations**, the **duration** of the individual note symbols is not absolute, but rather depends on context

Examples of Context Changing the Note's Duration

Mensuration: Breve = 3 → Breves are perfect by default



Principles of Imperfection and Alteration

Imperfection
Perfect → Imperfect

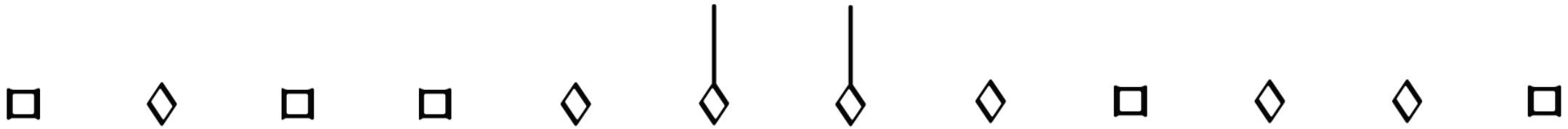
Alteration

Franco of Cologne
Ars Cantus Mensurabilis (ca. 1280)

The Scoring-up Tool

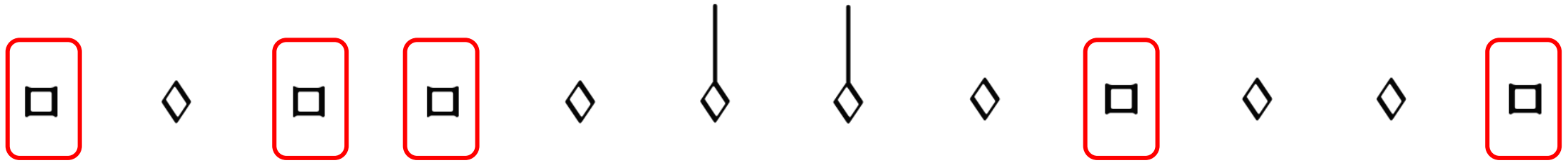
Algorithm

Mensuration: Breve = 3 → Breves are perfect by default



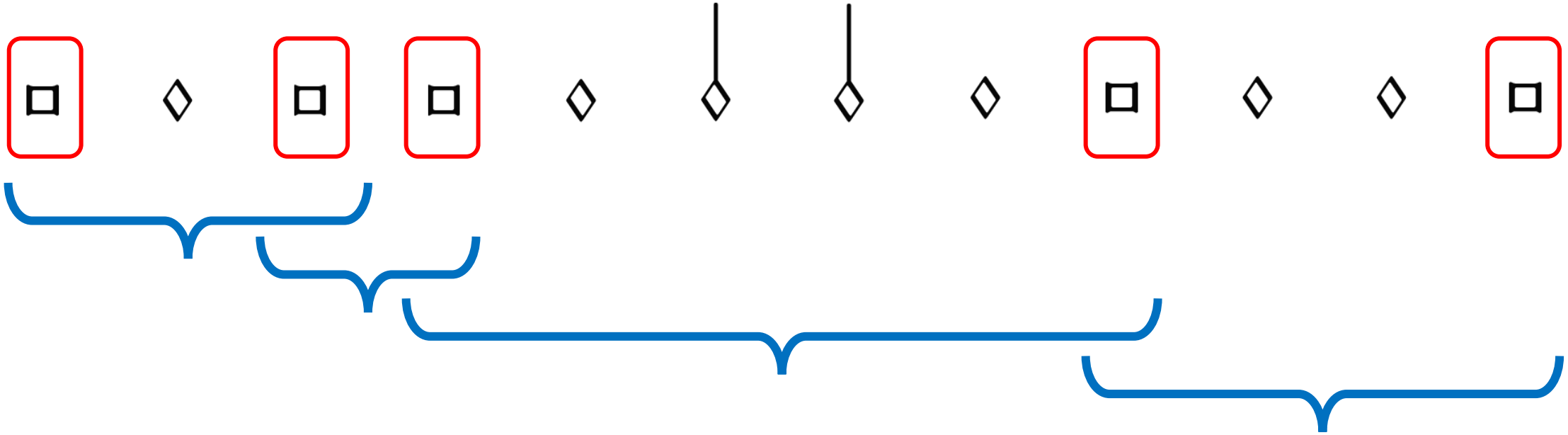
Algorithm

Mensuration: Breve = 3 → Breves are perfect by default

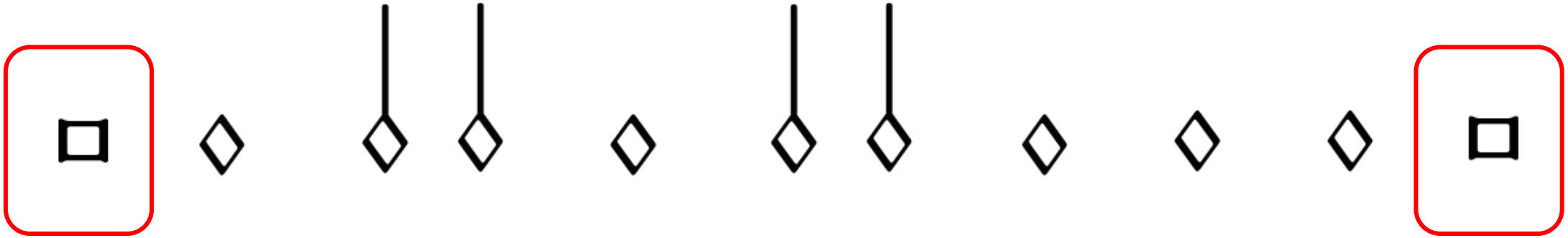


Algorithm

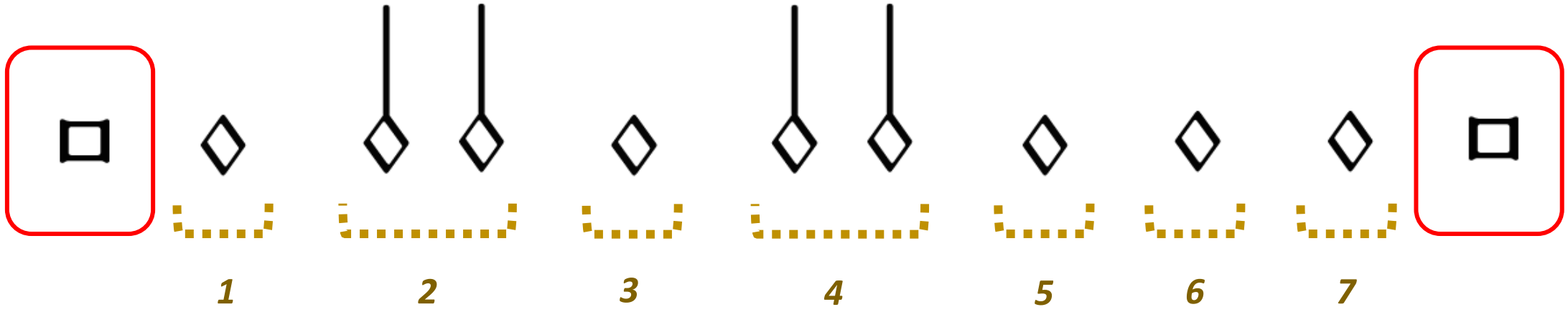
Mensuration: Breve = 3 → Breves are perfect by default



Example: (sequence bounded by breves)

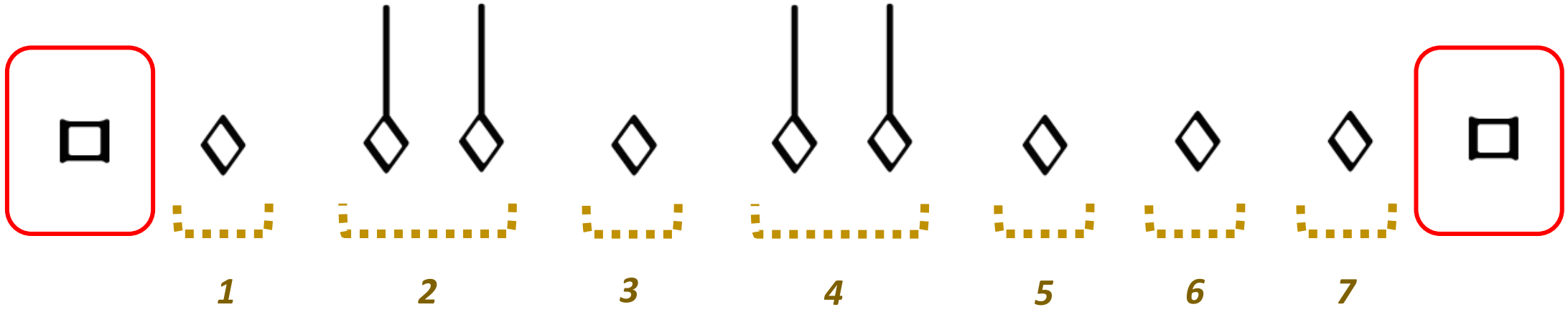


Example: (sequence bounded by breves)



7 semibreves

Example: (sequence bounded by breves)



7 semibreves = Two groups of 3 semibreves + 1

Number N of semibreves between the boundaries	Number P of perfect groups of semibreves	General Interpretation	Alternative Interpretation
N = 3P + 1	P >= 0	Imperfection (by following)	Imperfection (by preceding)
N = 3P + 2	P = 0	Alteration	Imperfection (by following) & Imperfection (by preceding)
	P > 0	Imperfection (by following) & Imperfection (by preceding)	Alteration
N = 3P	P = 0	-	-
	P = 1		Imperfection (by following) & Alteration
	P > 1	Imperfection (by following) & Alteration	-

Number N of semibreves between the boundaries	Number P of perfect groups of semibreves	General Interpretation	Alternative Interpretation
N = 3P + 1	P >= 0	Imperfection (by following)	Imperfection (by preceding)
N = 3P + 2	P = 0	Alteration	Imperfection (by following) & Imperfection (by preceding)
	P > 0	Imperfection (by following) & Imperfection (by preceding)	Alteration
N = 3P	P = 0	-	-
	P = 1		Imperfection (by following) & Alteration
	P > 1	Imperfection (by following) & Alteration	-

Number N of semibreves between the boundaries	Number P of perfect groups of semibreves	General Interpretation	Alternative Interpretation
N = 3P + 1	P >= 0	Imperfection (by following)	Imperfection (by preceding)
N = 3P + 2	P = 0	Alteration	Imperfection (by following) & Imperfection (by preceding)
	P > 0	Imperfection (by following) & Imperfection (by preceding)	Alteration
N = 3P	P = 0	-	-
	P = 1		Imperfection (by following) & Alteration
	P > 1	Imperfection (by following) & Alteration	-

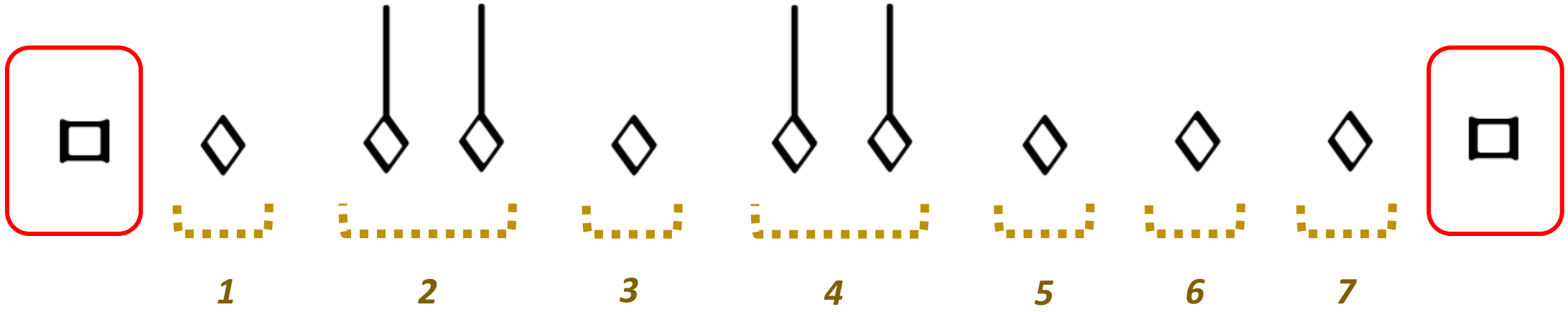
Number N of semibreves between the boundaries	Number P of perfect groups of semibreves	General Interpretation	Alternative Interpretation
N = 3P + 1	P >= 0	Imperfection (by following)	Imperfection (by preceding)
N = 3P + 2	P = 0	Alteration	Imperfection (by following) & Imperfection (by preceding)
	P > 0	Imperfection (by following) & Imperfection (by preceding)	Alteration
N = 3P	P = 0	-	-
	P = 1		Imperfection (by following) & Alteration
	P > 1	Imperfection (by following) & Alteration	-

Number N of semibreves between the boundaries	Number P of perfect groups of semibreves	General Interpretation	Alternative Interpretation
N = 3P + 1	P >= 0	Imperfection (by following)	Imperfection (by preceding)
N = 3P + 2	P = 0	Alteration	Imperfection (by following) & Imperfection (by preceding)
	P > 0	Imperfection (by following) & Imperfection (by preceding)	Alteration
N = 3P	P = 0	-	-
	P = 1		Imperfection (by following) & Alteration
	P > 1	Imperfection (by following) & Alteration	-

Number N of semibreves between the boundaries	Number P of perfect groups of semibreves	General Interpretation	Alternative Interpretation
N = 3P + 1	P >= 0	Imperfection (by following)	Imperfection (by preceding)
N = 3P + 2	P = 0	Alteration	Imperfection (by following) & Imperfection (by preceding)
	P > 0	Imperfection (by following) & Imperfection (by preceding)	Alteration
N = 3P	P = 0	-	-
	P = 1		Imperfection (by following) & Alteration
	P > 1	Imperfection (by following) & Alteration	-

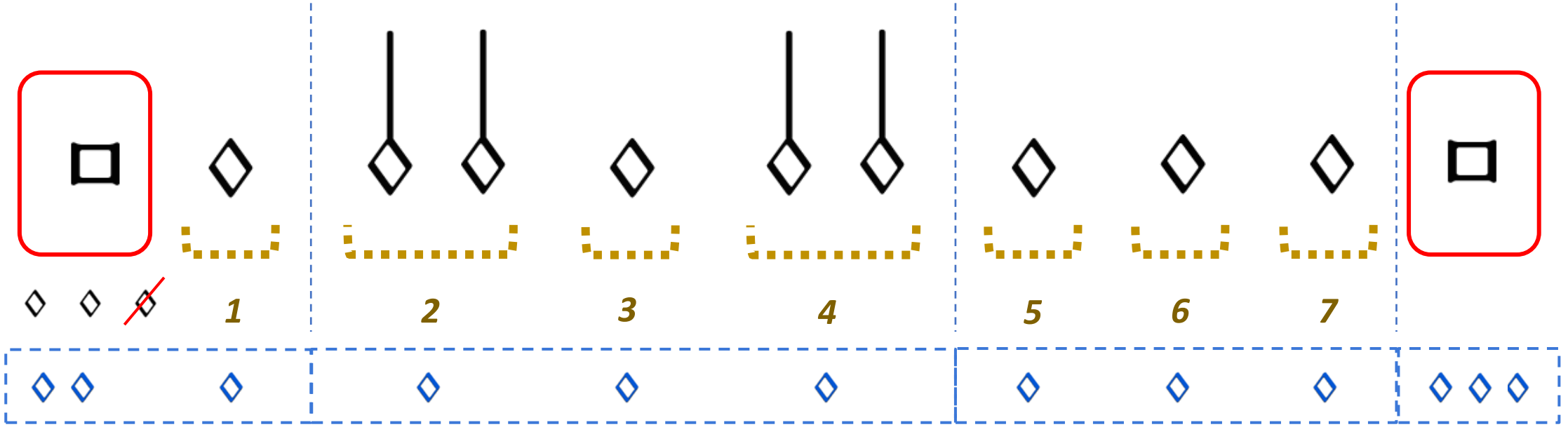
Number N of semibreves between the boundaries	Number P of perfect groups of semibreves	General Interpretation	Alternative Interpretation
N = 3P + 1	P >= 0	Imperfection (by following)	Imperfection (by preceding)
N = 3P + 2	P = 0	Alteration	Imperfection (by following) & Imperfection (by preceding)
	P > 0	Imperfection (by following) & Imperfection (by preceding)	Alteration
N = 3P	P = 0	-	-
	P = 1		Imperfection (by following) & Alteration
	P > 1	Imperfection (by following) & Alteration	-

Example: (sequence bounded by breves)



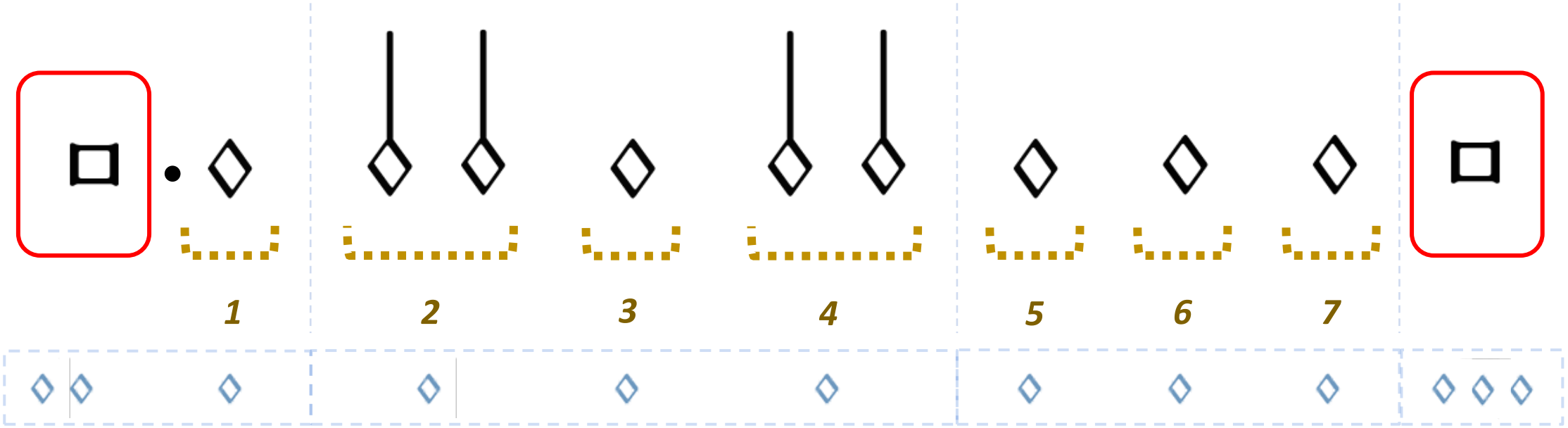
7 semibreves = Two groups of 3 semibreves + 1

Example: (sequence bounded by breves)



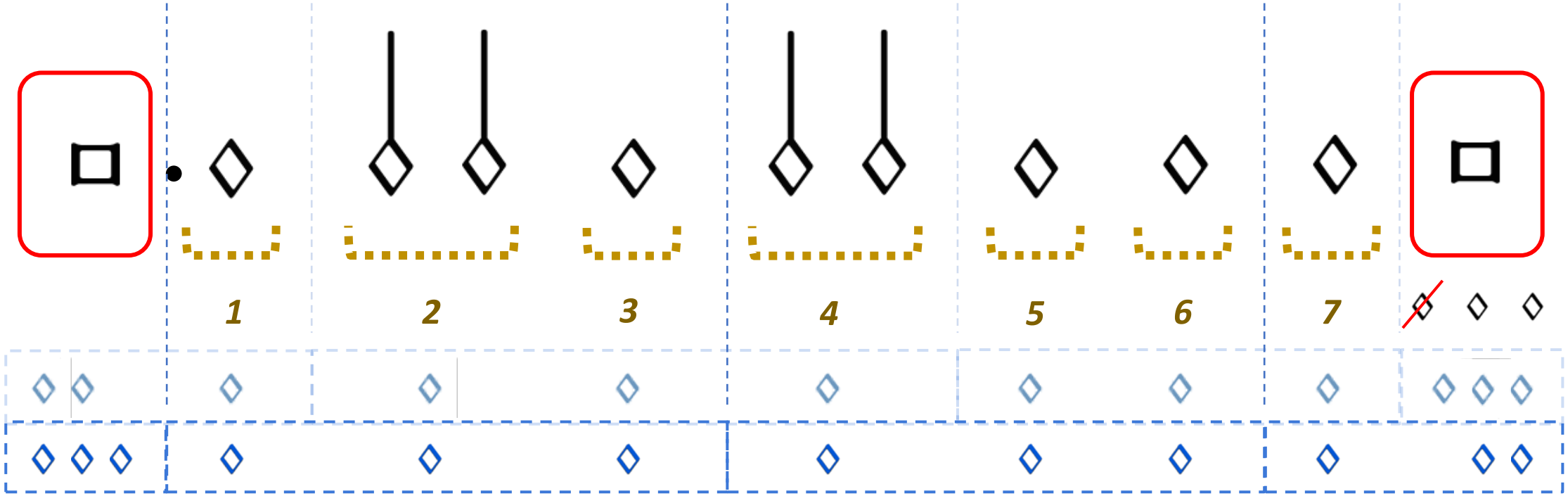
7 semibreves = Two groups of 3 semibreves + 1

Example: (sequence bounded by breves)



7 semibreves = Two groups of 3 semibreves + 1

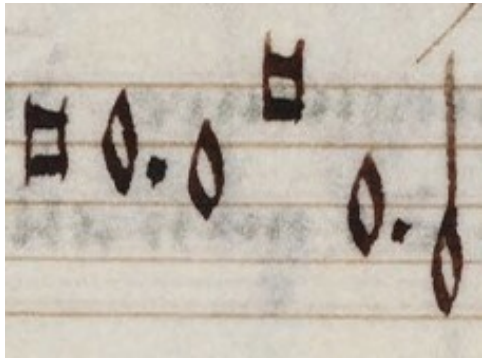
Example: (sequence bounded by breves)



7 semibreves = Two groups of 3 semibreves + 1

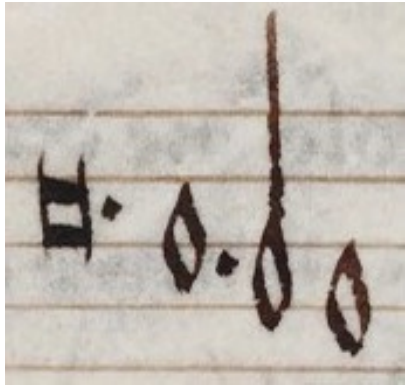
Scoring-up Tool

- Deals with the context-dependent nature of mensural notation
  - By implementing the “principles of imperfection and alteration”
- Deals with other non-context-related features:
  - Dots of augmentation → **When?** Distinguish between “dots of division” and “dots of augmentation”
  - Coloration



Scoring-up Tool

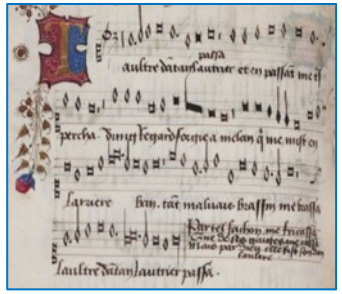
- Deals with the context-dependent nature of mensural notation
  - By implementing the “principles of imperfection and alteration”
- Deals with other non-context-related features:
  - Dots of augmentation → **When?** Distinguish between “dots of division” and “dots of augmentation”
  - Coloration



Scoring-up Tool

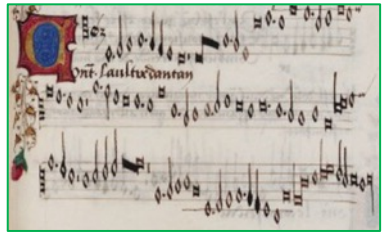
- Deals with the context-dependent nature of mensural notation
  - By implementing the “principles of imperfection and alteration”
- Deals with other non-context-related features:
  - Dots of augmentation → **When?** Distinguish between “dots of division” and “dots of augmentation”
  - Coloration → **When does coloration affect the note value?**

Scoring-up Tool



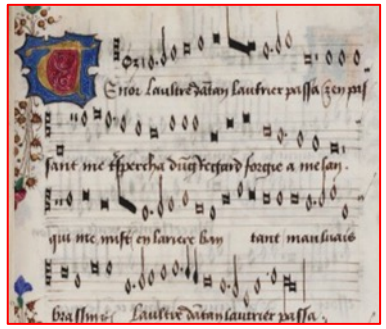
Mensural MEI file

Superius part



Mensural MEI file

Contratenor part



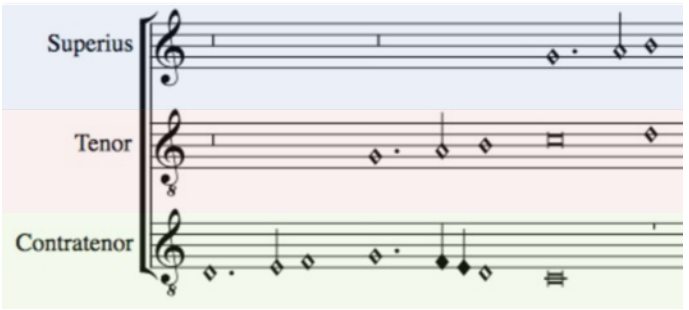
Mensural MEI file

Tenor part

Scoring-up Tool

Mensural MEI file

SCORE



Scoring-up Tool

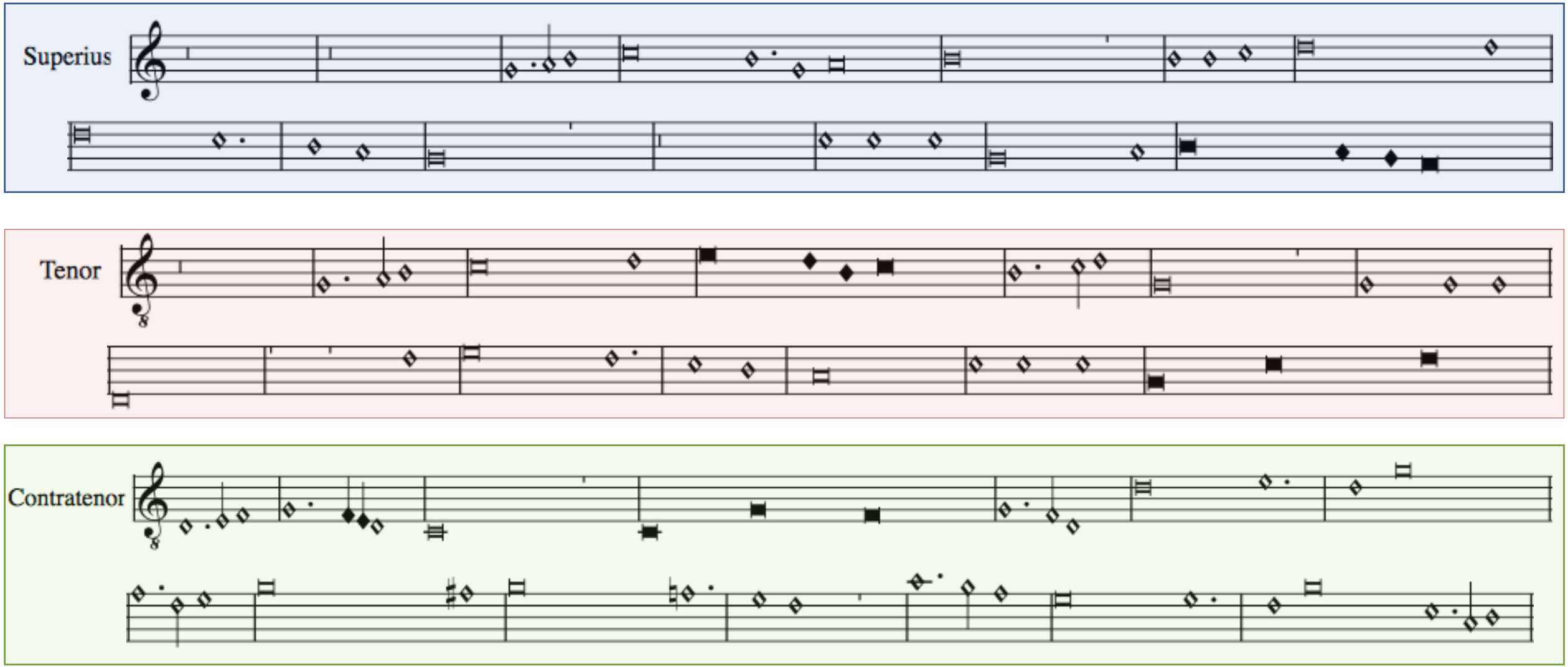
Modification	@num	@numbase
Imperfection	3	2
Alteration	1	2
Augmentation	2	3

Data used for the Experiment

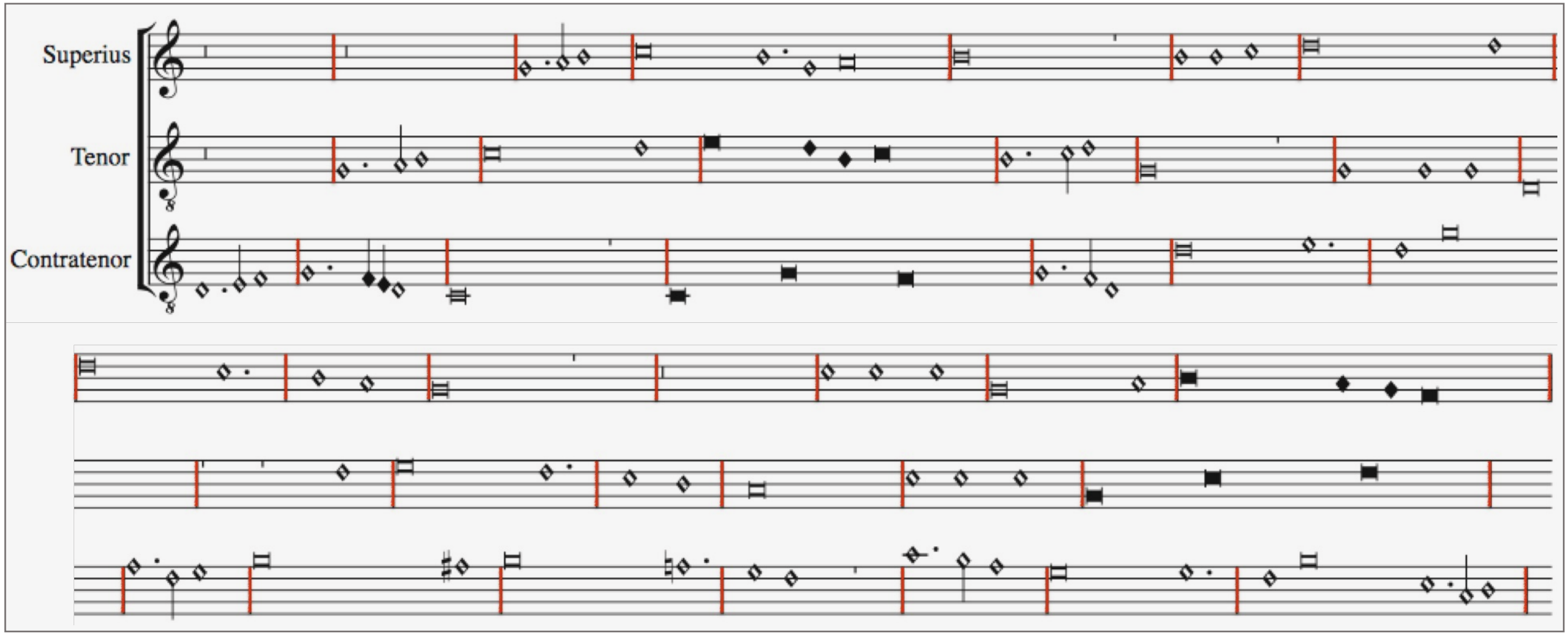
Pieces from the XIV and XV Centuries

Century	Project	Format	Composers and Sources	Number of Pieces
XIV	Measuring Polyphony Project (Karen Desmond)	Mensural MEI	Vitry, Machaut, Anonymous (Ivrea Codex)	8
XV	Josquin Research Project (Jesse Rodin, Craig Sapp, Clare Bokulich)	Modern transcriptions converted into Mensural MEI using: *SibMEI + Mensural MEI Translator*	Du Fay and Ockeghem (GB-Ob, Dijon, Mellon, Laborde, Wolfenbüttel)	Du Fay: 5 Ockeghem: 5

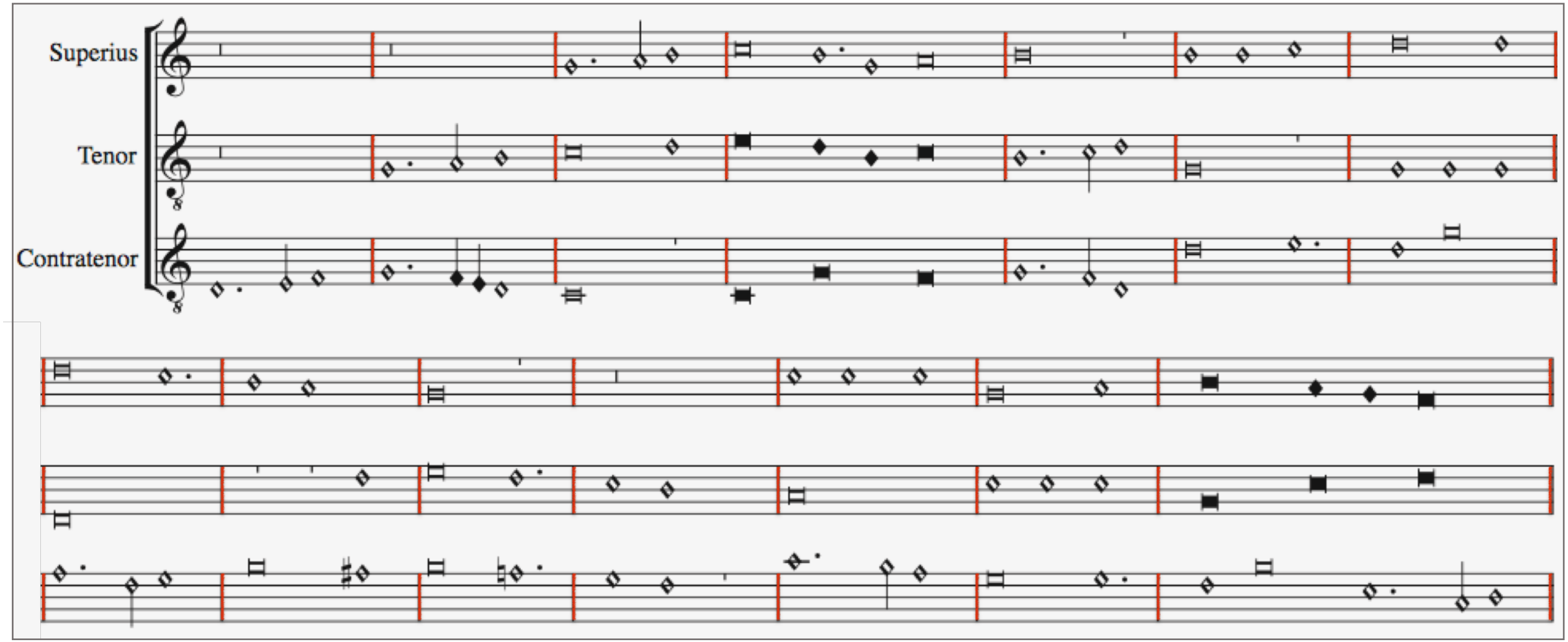
Example: Three Separate Parts



In Quasi-Score Format – Without Scoring-up Tool
(notes are not aligned)



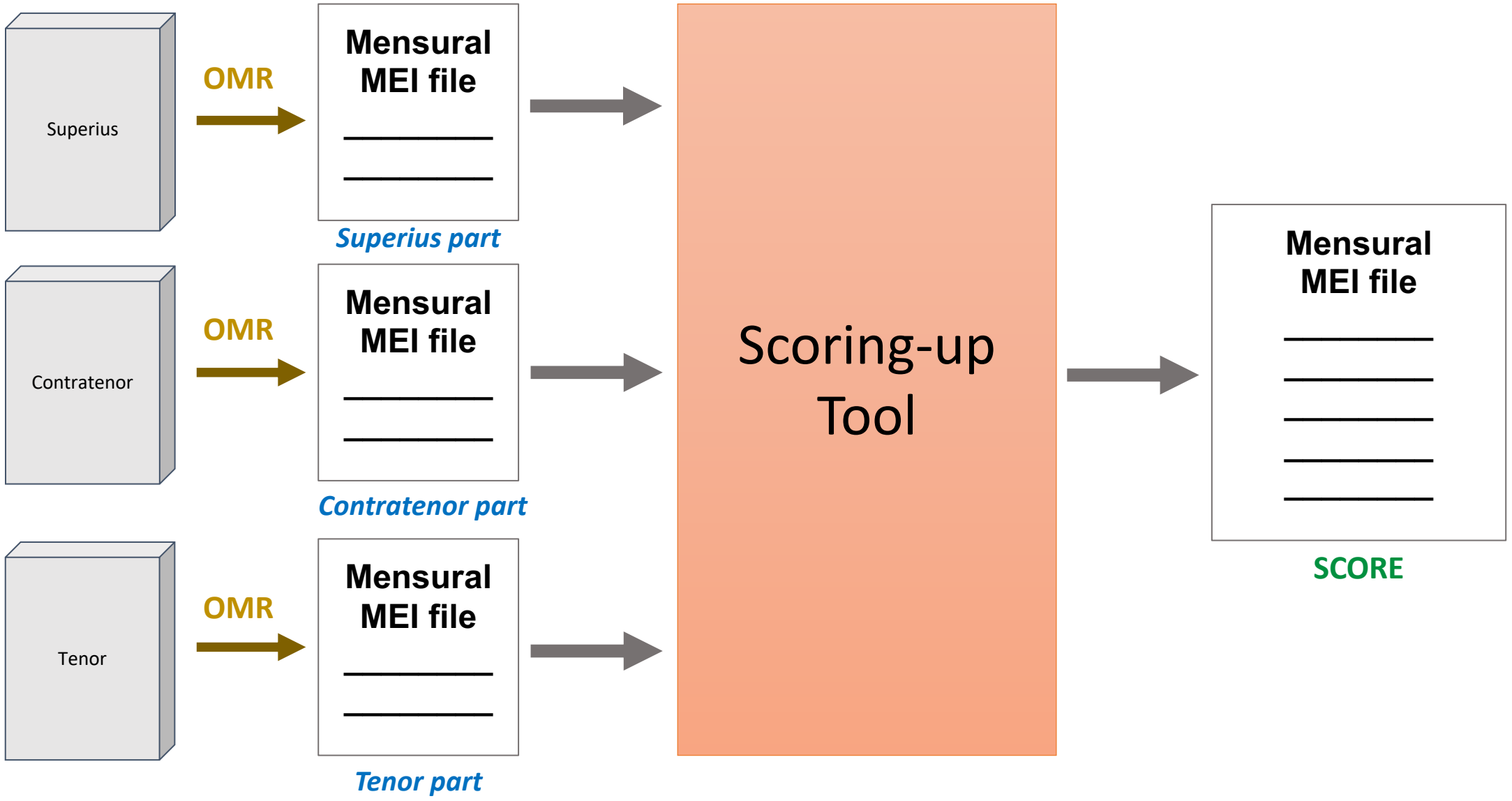
In Score Format – With Scoring-up Tool
(modification values encoded)



Conclusions

- Preserves the original note values
- The scoring-up tool presents the piece in score format
- Facilitates visualizing the vertical sonorities and studying the relation between the voices of a piece

- Future work…


Superius
OMR
Mensural MEI file
Superius part
Contratenor
OMR
Mensural MEI file
Contratenor part
Tenor
OMR
Mensural MEI file
Tenor part
Scoring-up Tool
Mensural MEI file
SCORE

Thank you!

https://github.com/elvis-project/scoring-up