

## **RAMMSES**

AR for medieval music in Siena and Senese

Irene Volpi

Università degli Studi di Siena

[irene.volpi@unisi.it](mailto:irene.volpi@unisi.it)

### **Abstract**

RAMMSES (Augmented Reality for Medieval Music in Siena and Senese) is a project funded in 2020-22 by Regione Toscana. Manuscripts and musical fragments from the Senese area, dating from the 11<sup>th</sup> to 13<sup>th</sup> centuries, have been digitized, transcribed (both texts and melodies) and accompanied by a series of metadata, regarding genre, book, and liturgical occasions. On the website (<https://rammses.unisi.it/>), each manuscript is accompanied by a paleographic description, images uploaded using IIIF technology, an explanation of its origins – enriched by analysis of the feasts and songs contained within, as well as a comparison with similar manuscripts and repertoires – and a notice on peculiarities in the formulary. The records of the chants specific or, otherwise, representative of the Senese area were performed by the Siena Cathedral Choir, led by Maestro Donati. The content of the AR experience, created from these chants, also allows to view the pages of the codex containing the piece in question, along with information designed for a non-specialist audience. You can reach this experience through the website, or via QR-codes in the places where these pieces were performed centuries ago, or, finally, through a specially created virtual exhibition. All the data contained in the database can be accessed via a search interface that allows for more complex or narrow searches.

**Keywords:** Medieval Music; Augmented Reality; Accessibility; Siena; Manuscripts.

*RAMMSES (Realtà aumentata per il medioevo musicale a Siena e nel senese) è un progetto di ambito culturale finanziato negli anni 2020-22 dalla Regione Toscana. Grazie a esso, i manoscritti e i frammenti musicati dei secoli XI-XIII provenienti dall'area senese sono stati digitalizzati, trascritti, sia nei testi che nelle relative melodie, e corredati da una serie di metadata relativi al genere, al libro e alle occasioni liturgiche di appartenenza. Nel sito (<https://rammses.unisi.it/>), ciascun codice è corredato dalla descrizione paleografica, dalle immagini caricate con tecnologia IIIF, dall'escussione – arricchita dall'analisi delle feste e dei brani contenuti, nonché dal confronto con manoscritti e repertori analoghi – sulla loro origine-provenienza, la segnalazione di peculiarità nel formulario. I canti propri dell'area senese o comunque rappresentativi sono stati eseguiti dal Coro della Cattedrale di Siena, guidato dal maestro Donati. A partire da essi è stato creato il contenuto dell'esperienza in realtà aumentata, che permette, inoltre, sia nei luoghi dove queste musiche furono eseguite secoli fa tramite QR-code, sia dal sito web, sia tramite una mostra virtuale create ad hoc, di visualizzare le pagine del codice con il brano in questione, corredato da alcune informazioni pensate anche per un pubblico non specialistico. Tutti i dati contenuti nel DB sono raggiungibili tramite un'interfaccia di ricerca che permette ricerche complesse e articolate.*

**Parole chiave:** Musica medievale; Realtà Aumentata; Accessibilità; Siena; Manoscritti.

## 1. Introduction

The earliest music found in Sieneſe manuscripts has remained unexplored and virtually unknown, as well as the institutions that transcribed and preserved it or their location and importance in the history of the town. No tool existed for understanding the musical fragments of the Siena State Archives, apart from the index of musical pieces compiled by G. Baroffio<sup>1</sup>. Italy is terribly behind in making this material available, while various international projects, among which we mention *Cantus Database*<sup>2</sup> for its affinity with our own, are currently integrated into the large *Cantus Index*<sup>3</sup> through a single index (*Cantus ID number*).

*RAMMSES (Augmented reality for medieval music in Siena and Sieneſe)*<sup>4</sup> focuses on the digitalization and meta dating of the liturgical manuscripts with notation, from the tenth to thirteenth century, now preserved in the Municipal Library and the State Archive of Siena.

The project, directed by Stella for the University of Siena, was implemented during the 2020-22 academic year, starting with the Tuscany Region’s call for cultural research grants and co-funded by several organizations, including SISMEL (International Society for the Study of Medieval Latin). Its implementation involved the collaboration of two research fellows: Irene Volpi for the philological-musical aspects and Matteo Passarelli for those relating to digitization and the use of augmented reality.

## 2. Tool description

All the research findings are freely available online in a website developed in *WordPress* CMS (integrated by the Toolset plugin) and independent DB MySQL, with relational structure (via the PhpMyAdmin DBMS). The website contains all the images of manuscripts uploaded via the IIIF technology (Mirador plugin) and a DB with data and metadata easy to implement even by collaborators non-experts in DH and the transcriptions of texts and notations of the chants. The search interface integrates multiple data and allows cross-referencing and melody research.

There you can also find the description of all manuscripts or fragments used in the project, the history of the churches or monasteries which used them and a selection of ten songs performed by the Guido Chigi Saracini cathedral choir conducted by the choirmaster Lorenzo Donati and recorded with 4 microphones in A-B configuration with omnidirectional capsules at about 2.5 meters from the sources and a pair of microphones in Mid/Side configuration. The open-source software Reaper was used for post-production.

You can reach the AI service:

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<sup>1</sup> <https://liturgicum.irht.cnrs.fr/fr/>.

<sup>2</sup> [cantusdatabase.org](https://cantusdatabase.org).

<sup>3</sup> [cantusindex.org](https://cantusindex.org).

<sup>4</sup> <https://rammses.unisi.it/>.

1) via a web-app with Instagram audio/video filter that allows to virtually browse the manuscript on site, listen to the songs, access the descriptions of books and songs, and learn about the history of the home institution.



Fig. 1 – AR at the church of Abbadia a Isola.

2) with the virtual exhibition<sup>5</sup> through the adoption of the Spatial metaverse with 10 videos presenting the manuscripts and the vocal recordings of the songs.

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<sup>5</sup> R*AMM*SES virtual exhibition: <https://www.spatial.io/s/Rammstes-62d963d4080854000170c8dc?share+=2604768479444212144&share=2604768479444212144>.



Fig. 2 – Virtual exhibition

The sources for this work are four manuscripts (and seven fragments) held in the Siena Municipal Library (two missals, a gradual, and an antiphony) and 44 fragments from the Siena State Archives.

This collection comprises over 7,500 pieces, along with related information and links to high-definition digital reproductions.

The database contains a series of metadata for each piece: liturgical book, liturgical occurrence and action, the feast code (a unique code assigned by *Cantus Index* to each feast), the folio, the standardized incipit, the semi-diplomatic transcription of the piece, and the transcription of the melody using the Volpiano method when it differs significantly from the known melody or is unknown. There are also fields for notes on the text and melody, and references to similar manuscripts and repertoires, including *Cantus Index*. The reference to the ‘Cantus ID number’, along with the database structure, which adopts *Cantus*’s nomenclature and metadata, makes the project exportable and reproducible in other similar contexts.

To the descriptions of the manuscripts, whose images are loaded using IIIF technology, and the reconstruction of their origins, as well as a comparison of the different liturgical calendars used by these sources, a page of the website is dedicated. Particular attention has been paid to the description of the codex and its origins; in addition to strictly paleographic data, with a link to the *Codex*<sup>6</sup> project’s descriptive page (when available) and musical notation, the contents of each manuscript are reported, including mention of specific feasts or pieces, and the formularly (i.e., a list of all feasts with the reference folio and a note on particular series, such as the Alleluia after Pentecost or the sequences).

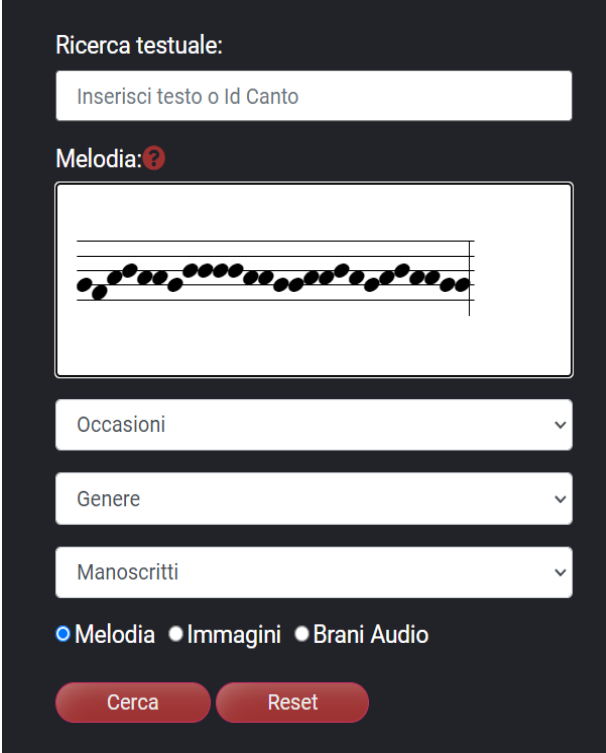
Moreover, analysis of the contents of these liturgical books has, in several cases, made it possible to advance or refute existing hypotheses regarding their origin. This was the case for the previous

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<sup>6</sup> *Nuovo\_Codex*, consultabile all’interno di *MIRABILE* (Archivio digitale della cultura medievale): <<https://www.mirabileweb.it/home>>.

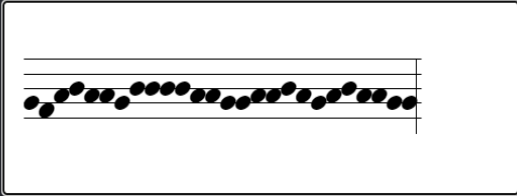
incorrect attribution of the codex F.VI.9, from the second half of the 12th century, to the Certosa di Pontignano (founded in 1343), based on the dedication to a church of San Pietro, which instead turned out to have belonged to the ancient Church of San Pietro alle Scale in Siena, or the attribution of the beautiful codex F.VI.15 to the Abbey of Abbadia Isola, whose library merged in 1446 with the one of the Abbey of Sant'Eugenio in Siena before arriving at the Biblioteca degli Intronati. For the fragments of the State Archives, however, given their small number, it was not possible to infer their origin but working on the pieces they contain has sometimes allowed us to reunite some units or to recognize their provenance from the same codex. Furthermore, inventorying, cataloguing, and reproduction by photographs of the musical fragments preserved at the Siena State Archives, achieved thanks to this project, enabled the sharing of data and metadata with both the Archives and ICAR, the central institute for archives, whose digital platform we directly implemented. For each codicological unit, even those different from the ones concerned by the *RAMMSES* project, a paleographic description was provided along with a brief overview of the content and related images. The collaboration with the Siena State Archives and the central institute seems to be a good example of shared best practices and, consequently, shared data and metadata, for greater dissemination and use of sources and knowledge. The ICAR platform offers greater usability and breadth of material than that of the project, but it cannot grant searchability within the pieces and melodies present as the *RAMMSES* website does.

The need to find as much information as possible and to intersect it in complex searches was considered essential and made it necessary to design a complex search interface.



Ricerca testuale:

Melodia: ?



Occasioni

Genere

Manoscritti

Melodia  Immagini  Brani Audio

Cerca Reset

Fig. 3 – Research interface

We offer two practical examples of targeted searches.

1) ‘Search by liturgical occasion’. Selecting the feast of st. Agatha (*Agathae*) from the menu yields several well-known pieces (as evidenced by the ‘Cantus ID number’ found in each piece’s entry) for both the Mass Proper and the Liturgy of the Hours. However, if we select ‘*In sancte Agathe ad processionem*’ from the same menu, we find, in addition to the antiphon *Mentem sanctam*, three responsories present in the codex F.VI.9, which lack the ‘Cantus ID number’ because they are otherwise unknown. These are pieces composed specifically for the procession that passed from the church of San Pietro alle Scale, to which the manuscript belonged, to the Castellaccia di Sant’Agata, located not far from it. Since these are unpublished pieces, one of them, *Agatha laetissima*, has been recorded by the Cathedral Choir and is therefore freely available.

**F.VI.9**

IN S. AGATHAE AD PROCESSIONEM  
150v

*Responsorio*

R.

A - ga - tha le - tis - si - ma et glo - ri - an - ter i - bat ad car - ce - rem  
et qua - si ad e - pu - las in - vi - ta - ta a - go - nem su - um Do - mi - no  
pre - ci - bus co - men - da - bat

V.

No - bi - lis - si - mis or - ta na - ta - li - bus ab i - gno - bi - li gau - dens  
tra - he - ba - tur ad car - ce - rem

Fig. 4 – Transcription of text and song of the Responsory *Agatha laetissima*

2) ‘Search by melody’. By entering the series of notes Sol, Si, La-La (1-gjh-h, the initial number one tells the interface that the search must occur at the beginning of the melody), we obtain three results, namely three graduals, one of which, the *Salvator mundi*, is otherwise unknown but shares the same melody with the previous ones. This is a well-known phenomenon in Gregorian chant: combining new texts with pre-existing melodies, usually drawn from the pool of pieces belonging to the same liturgical genre. In this case, for the anniversary of the *Exaltatio Crucis*, the monks of Abbadia a Isola have woven a new praise, dedicating it to the Savior of the world, to whom the Abbey church was also dedicated at the time.

These types of research therefore allow not only for targeted results, which can be further refined with the combination of multiple filters, but also to introduce the modalities of the genesis of these compositions. The hope is that it will be a useful research tool for scholars of various historical-philological-musical disciplines.