

Audiveris



FOSDEM 2012

Audiveris ***Optical Music Recognition***

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February 4, 2012

Agenda

- Music at stake
- Typical score processing
- Some OMR techniques
- Audiveris developments
- Pointers
- Q & A

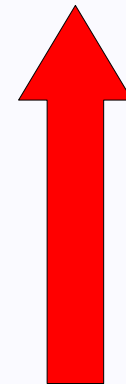
Music at stake

- Think of Google digitization campaigns
 - ✓ Currently performed on textual documents
- Millions of music scores on earth
 - ✓ Most of them available only on paper
 - ✓ Some available as scans or PDFs
- These scores are not really « usable »
 - ✓ At era of computer & Internet
 - ✓ How to play, edit, transpose, print, query?
- Key
 - ✓ Need to have all score data in symbolic notation

Music notation

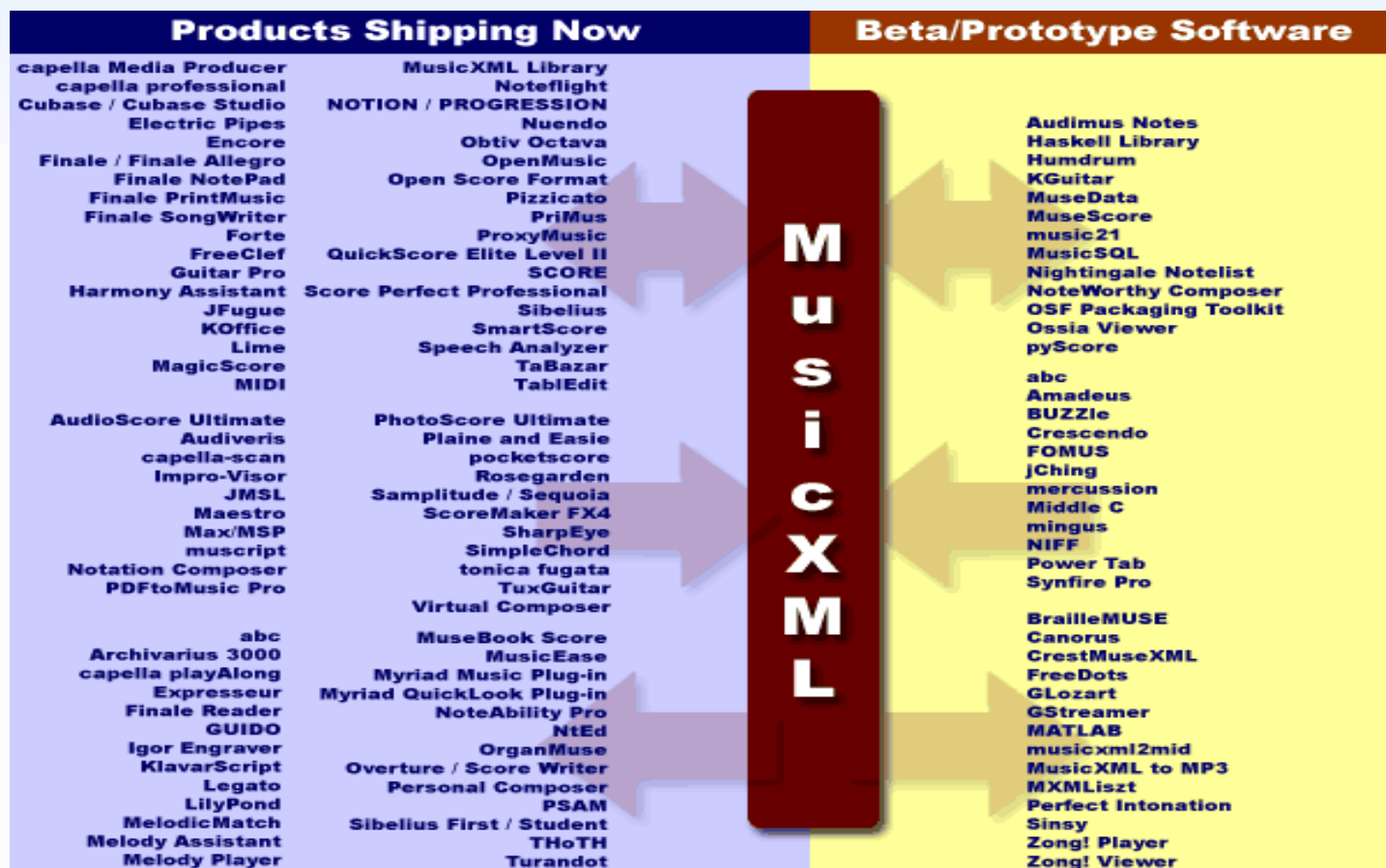
- **MusicXML**
 - ✓ Symbol level
 - ✓ Meant for score interchange
- **MIDI**
 - ✓ Note level
 - ✓ Meant for digital instruments
- **MP3**
 - ✓ Sound level
 - ✓ Meant for recorded music

High level



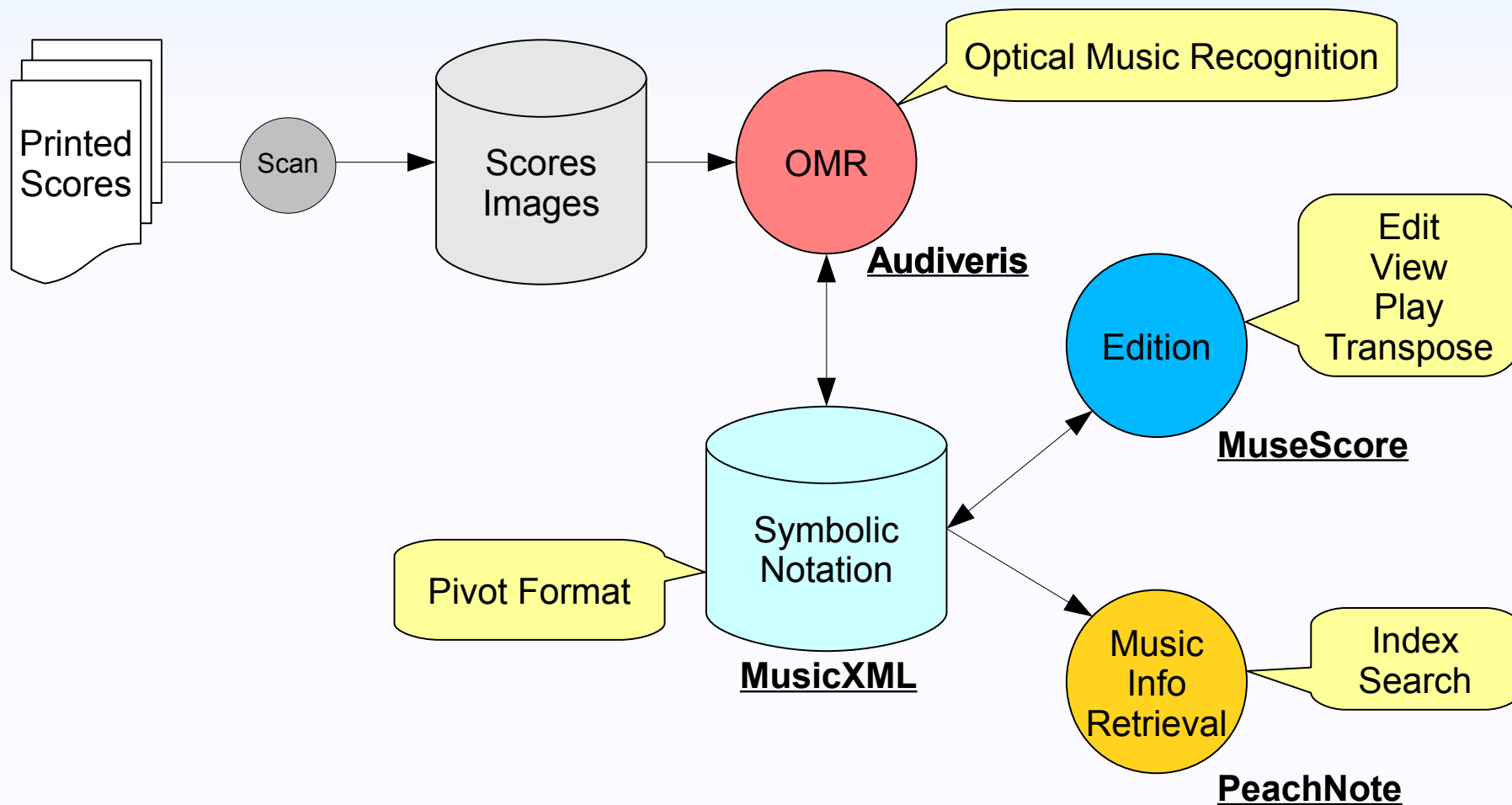
Low level

MusicXML used by 150+ products




[Picture out of date, see <http://www.recordare.com>]

Typical score processing




www.audiveris.org

OMR



[Home](#)
[Snapshots](#)
[Installation](#)
[Example](#)
[Operation](#)
[Releases](#)

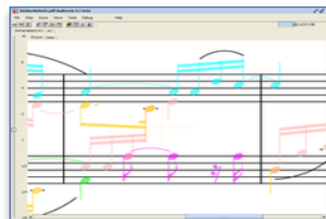
V4.1  **DOWNLOAD NOW**

Audiveris is an open-source **Optical Music Recognition** software which processes the image of a music sheet to automatically provide *symbolic* music information in **MusicXML** standard.

This opens the door to many tools (score editor, MIDI sequencer, ...) which can use this symbolic data for such tasks as edit, play, print, re-publish, transpose, query, etc.

Main features:

- Printed music as input (no handwritten music)
- Standard music notation (no tablatures yet)
- Input formats: PDF, JPG, PNG, TIFF, BMP, ...
- Output format: [MusicXML](#) version 2
- Any number of pages per score, of parts per system, of staves per part, of voices per measure
- Internal neural network trainable by end user
- Available on Windows and Linux platforms
- GNU GPL V2 license



News

Version 4.1 to be released
January ??, 2012

Audiveris at FOSDEM 2012
January 11, 2012

Development

Audiveris is developed in Java, and invokes Google Tesseract OCR (C++) for text recognition.

Project components (source code, binaries, issues tracking, forum) are available on [Kenai](#).

Help wanted for

- Upgrading from [Tesseract OCR](#) V2.04 to V3.x
- Coupling with [MuseScore](#) to edit, print, play, etc
- Use of cloud computing to provide "OMR as a service"
- Automated evaluation of transcription results
- Microedition features to enable crowd-sourcing approaches

[Logo](#) | [Slideshow](#)

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www.musescore.org

Edition

musescore
Free music composition & notation software



Free Download

Version 1.1

MuseScore is a free cross-platform WYSIWYG music notation program that offers a cost-effective alternative to commercial programs such as Sibelius and Finale.

You can print beautifully engraved sheet music or save it as PDF or MIDI file.

Some highlights:

- WYSIWYG, notes are entered on a "virtual note sheet"
- Unlimited number of staves
- Up to four voices per staff
- Easy and fast note entry with your keyboard, mouse, or MIDI keyboard
- Integrated sequencer and [FluidSynth](#) software synthesizer
- Import and export of [MusicXML](#) and Standard MIDI Files
- Available for Windows, Mac and Linux
- Translated in [43 languages](#)
- GNU GPL licensed



- Download
- Features
- Screenshots
- Handbook
- Forums
- Development
- Donate
- How to
- Plugins

Account

- Recent posts
- Recent changes
- ▷ Issue tracker
- My account
- Log out

www.peachnote.com

Query

Music Ngram Viewer



Please enter a melody or a sequence of [chords](#) (advanced use)

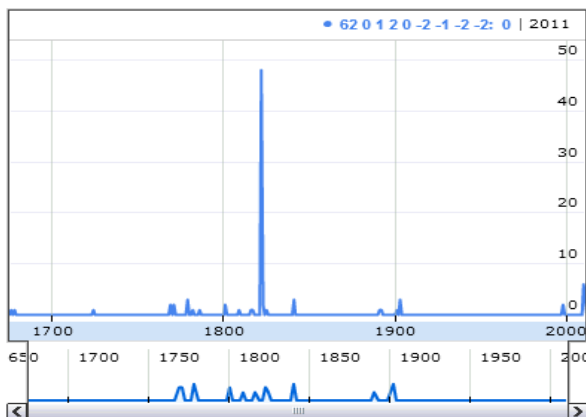


620120-2-1-2-2 chord Search

Petrucci Music Library Smoothing: 0 Normalized



Keyboard shortcuts



filter search results (e.g. Mozart, winds, or quartet)

Symphony No.9
Beethoven, Ludwig van (1822)

[YouTube](#) [\[score\]](#) pages 18, 19, 25
[\[score\]](#) pages 12, 14
[\[score\]](#) pages 12, 15, 28
[\[score\]](#) pages 12, 14

6 String Quartets, G. 165-170 (Op.8)
Boccherini, Luigi (1769)

[YouTube](#) [\[score\]](#) page 14

String Quartets, Op.17
Haydn, Joseph (1771)

[YouTube](#) [\[score\]](#) page 15

Symphony No.33
Mozart, Wolfgang Amadeus (1779)

[YouTube](#) [\[score\]](#) pages 12, 15

Violin Sonata No.6
Beethoven, Ludwig van (1801)

[YouTube](#) [\[score\]](#) page 4

[next](#)
you can also browse using the chart

Run your own experiment! Raw data is available for download [here](#).

Feedback

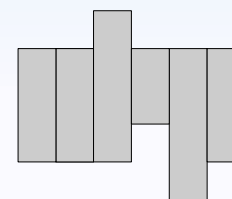
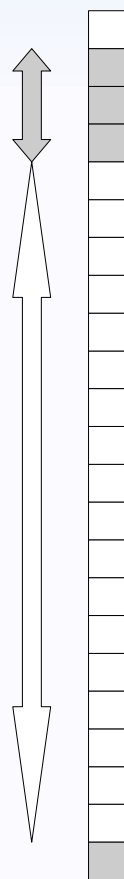
Music recognition techniques

	OCR (text)	OMR (music)
Complexity	Horizontal lines of characters	Combined horizontal & vertical directions
Technology	Rather mature	Several years behind OCR
Products	Many	Just a few. One FOSS: Audiveris

Basic definitions: Runs & Sections

Black run of 3 pixels

White run of 18 pixels



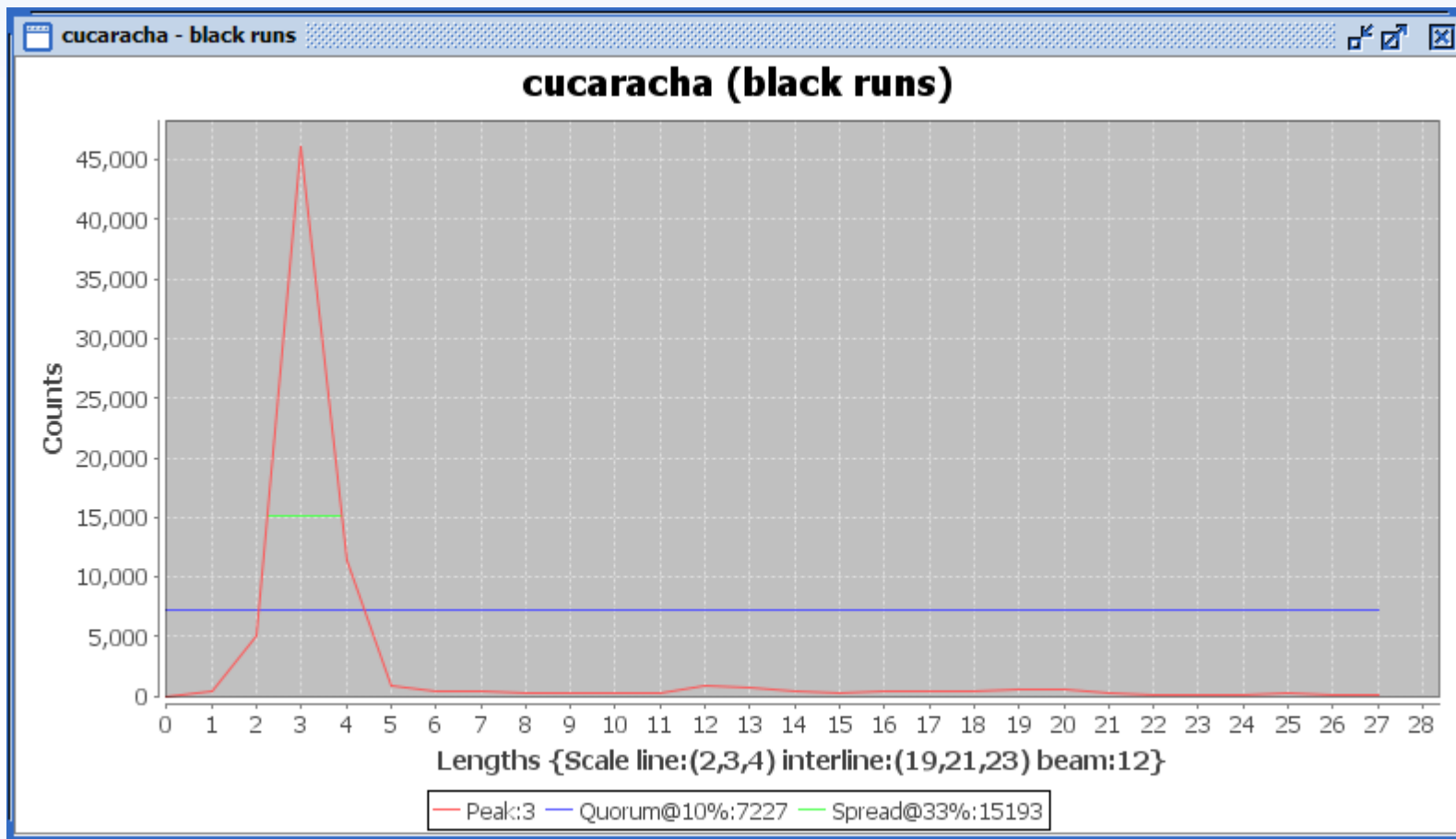
Section of 6 adjacent runs

Pixels: Staff Lines & other objects

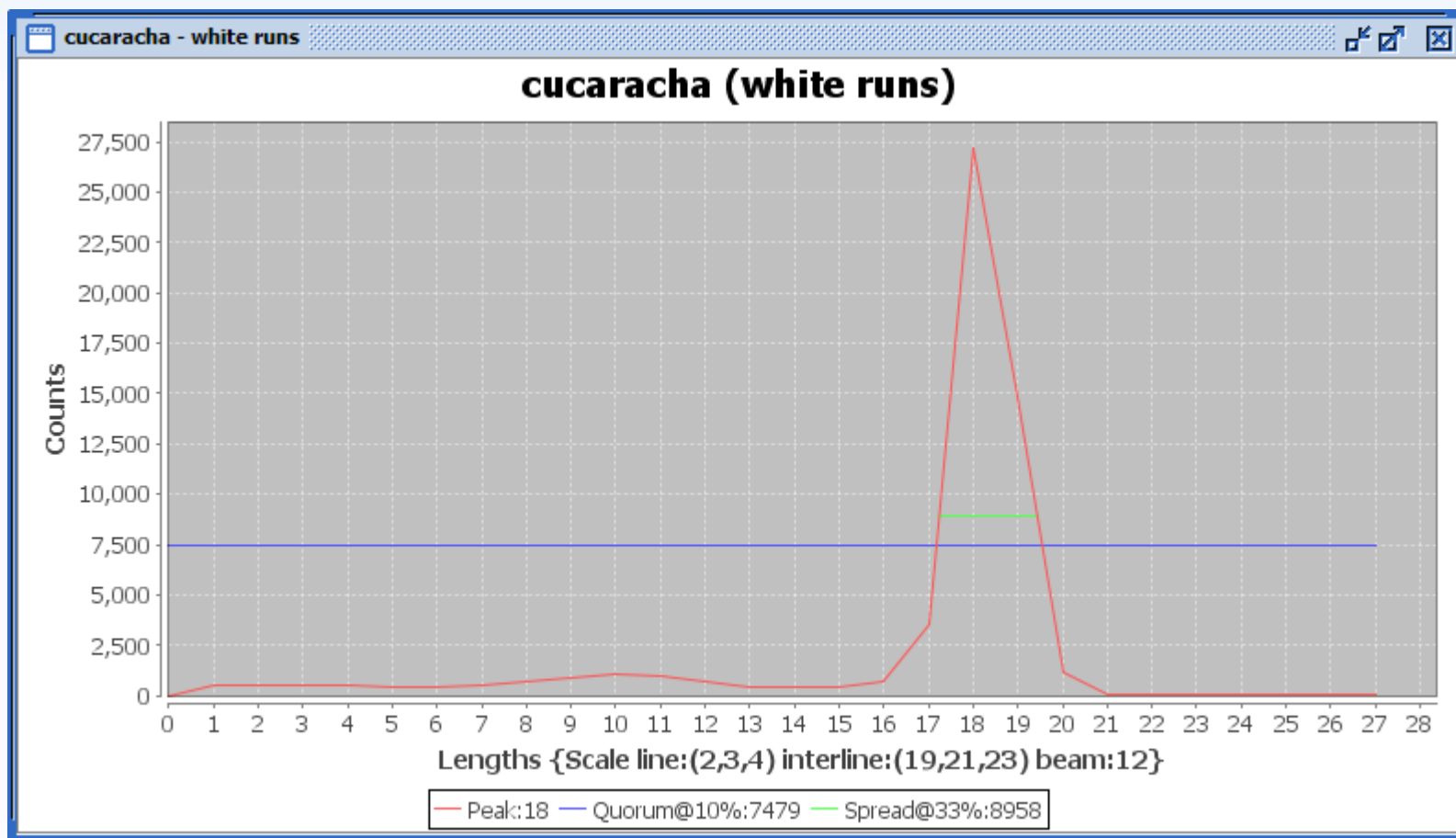
Rapide et joy

mf

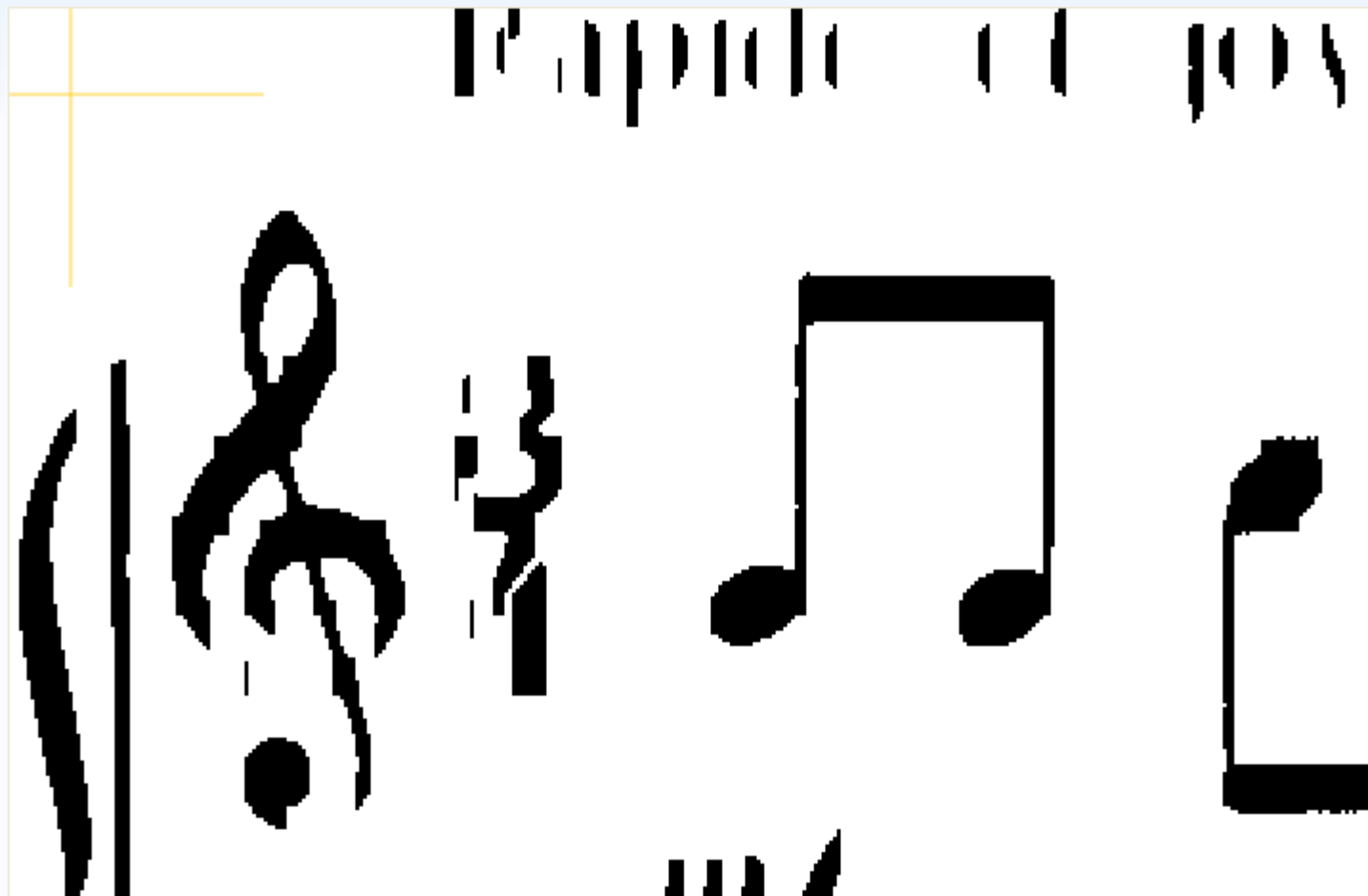
Black runs histo. → line thickness



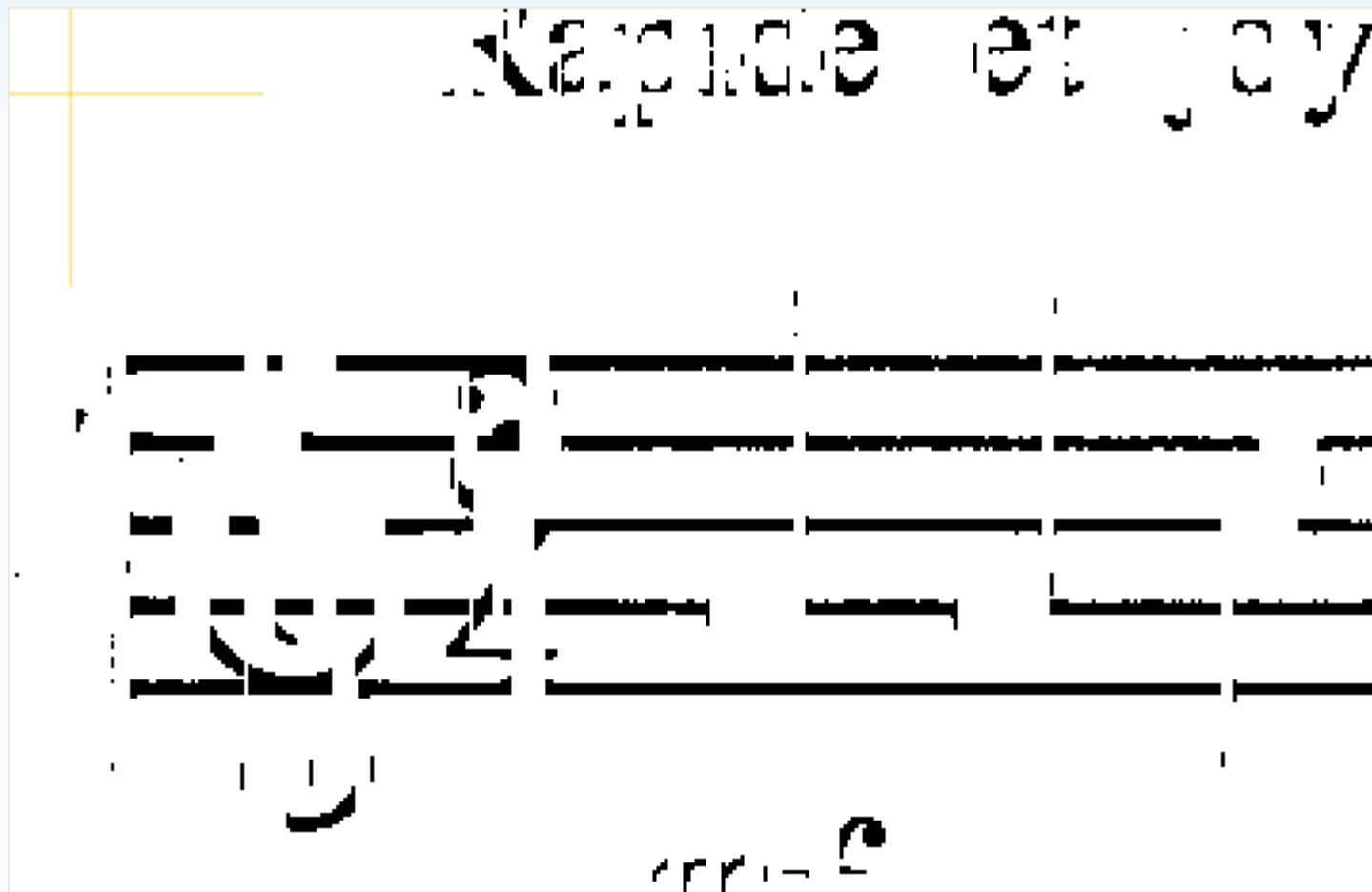
White runs histogram → interline



Vertical runs > line thickness



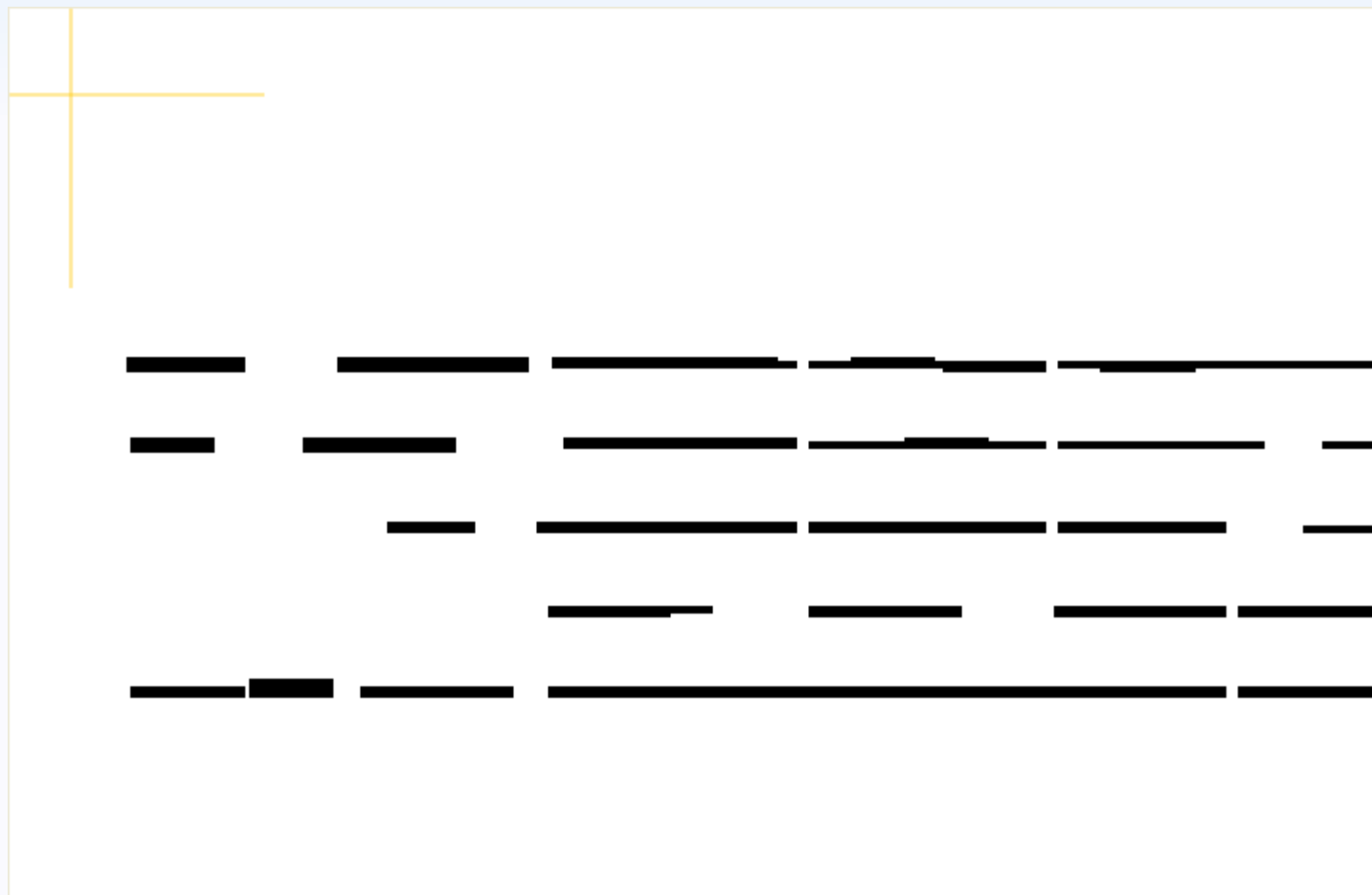
Vertical runs \leq line thickness



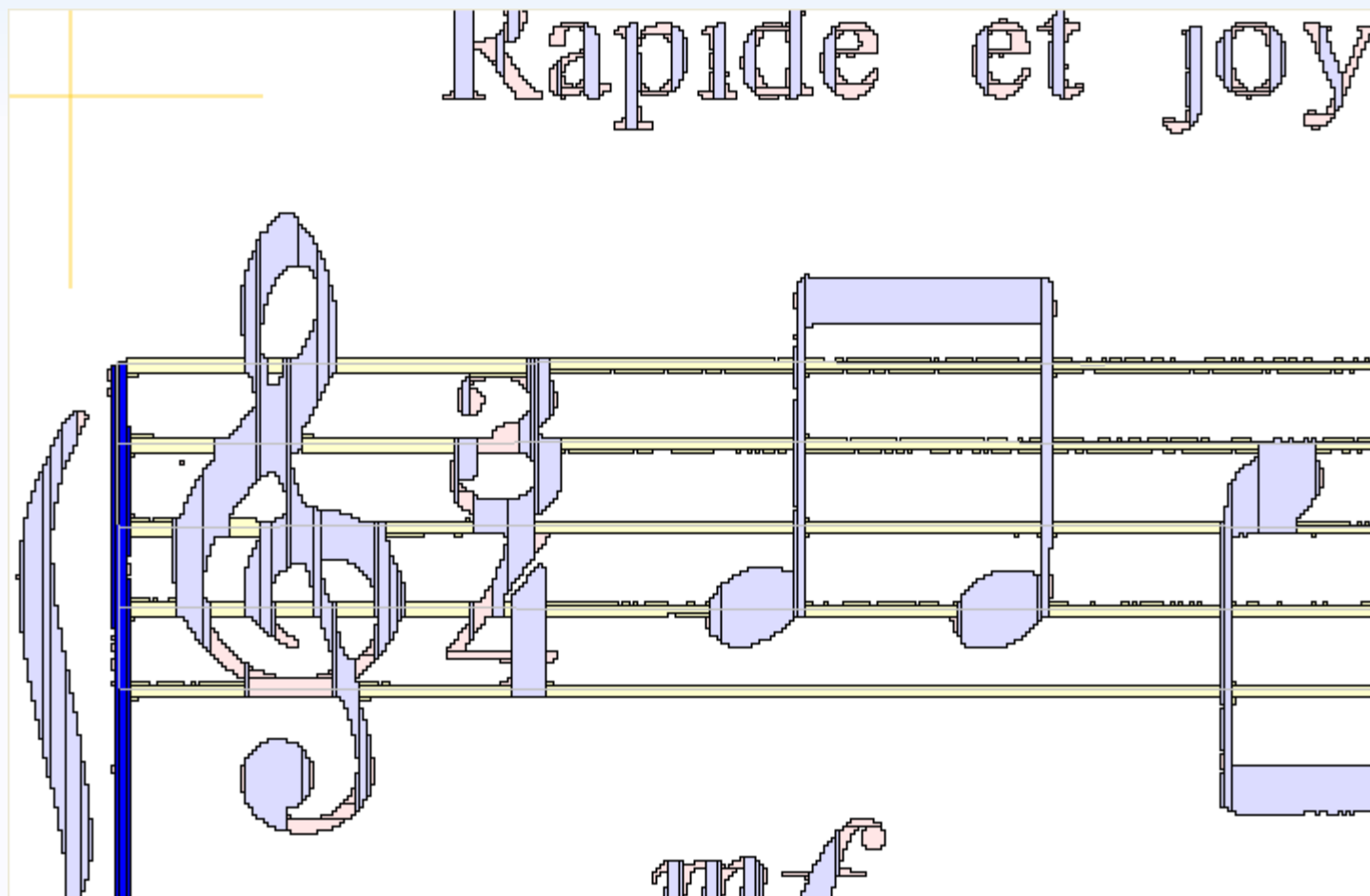
Short horizontal runs put aside



Long hori. runs → lines skeleton



Staff lines detected



Staff lines removed



Stems detected



Sections → Glyphs → Shapes



Generated score

Rapide et joy

The image shows a musical score for a piece titled "Rapide et joy". The score is written on a single staff with a treble clef. The time signature is 3/4. The music begins with a whole note chord on the first line (F4), followed by a quarter note on the second line (G4), and a quarter note on the third line (A4). The piece concludes with a whole note chord on the fourth line (C5). The dynamic marking is *mf* (mezzo-forte). The tempo and mood are indicated by the text "Rapide et joy".

Input with overlapping output

Rapide et joy

mf

The image shows a musical score for a piece titled "Rapide et joy". The notation is rendered in a vibrant green color. It features a treble clef, a 3/4 time signature, and a dynamic marking of *mf* (mezzo-forte). The melody consists of three quarter notes: the first is on the second line (G4), the second is on the second space (A4), and the third is on the second line (G4). The piece concludes with a double bar line and repeat dots.

4 Main Audiveris developments

- Upgrade to Tesseract OCR V3
- Switch to Symbol Interpretation Graph
- Smart coupling with MuseScore editor
- OMR as a service

This is a call for help!

Audiveris ↔ Tesseract OCR

- OCR
 - ✓ Needed for all textual glyphs (title, lyrics, ...)
 - ✓ Tesseract is Google open source OCR
- Audiveris ↔ Tesseract connection
 - ✓ Audiveris (Java) invokes Tesseract (C/C++)
 - ✓ Audiveris is stuck to old Tesseract 2.04
 - ✓ Connection to new Tesseract 3.x is totally different
 - Bits available for Linux
 - To be implemented for Windows

Sections → Glyphs → Shapes

- Old strategy: iterations

/ provides good results for good scans */*

1. Build glyphs (from poorly assigned sections)
2. Evaluate glyph shape in isolation (neural network)
3. Check with patterns (if !OK: forbid shape, goto 1.)

- New strategy: symbol interpretation graph

/ should provide better results for poor scans */*

- ✓ Build graph of possible glyphs w/ weighted shapes
- ✓ Annotate glyph with geometric relationships
- ✓ Annotate shape with conditional probabilities
- ✓ Pick up the best interpretations in the SIG

Audiveris ↔ MuseScore

- Model
 - ✓ Audiveris for batch OMR engine
 - ✓ MuseScore for GUI features (edit, play, print, ...)
- Beta connection available
 - ✓ One-way flow: AV → [MusicXML] → MS
- Improvements
 - ✓ AV → MS
 - Call user attention on annotated locations
 - ✓ AV ← MS
 - Feedback to propagate user corrections

OMR « *as a Service* »

- Goal
 - ✓ Light-weight OMR features
 - ✓ Accessed through the Web
- Various levels
 - ✓ Score, Page, System, Measure
- Context persistency
 - ✓ Incremental work
 - ✓ Shareable results
- Multi-user sessions
 - ✓ Building blocks for crowd-sourcing approach

Pointers

- AudiVeris
 - ✓ <http://www.audiveris.org>
- MuseScore
 - ✓ <http://www.musescore.org>
 - ✓ MuseScore stand here on K building, 1st level
- PeachNote
 - ✓ <http://www.peachnote.com>
- MusicXML
 - ✓ <http://www.recordare.com/musicxml>
- Tesseract
 - ✓ <http://code.google.com/p/tesseract-ocr/>

Audiveris



Thank you

Q & A

Audiveris [latin] := « you will have heard »

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