

# MONTREUX JAZZ DIGITAL PROJECT

Activity report Q4-2015

## Executive Summary

After launching many valorization actions in 2014, and approaching the end of digitization tasks, 2015 was the year for the **archive consolidation**. The MMC team prepared the structures required to:

- Offer a clean database in the perspective of public access to the archives in the Under One Roof building of EPFL in 2016,
- Build tools to better manage, access, and process archive files on the storage server,
- Store the archive in an efficient, secure, and flexible way for the next decade, making use of the most advanced hard-drive based object-storage technologies.

### Digitization

90% of the digitization work is done. The following tasks progressed well, they will be completed in 2016:

- Acquisition of HDCAM video tapes (performed at EPFL by the Metamedia Center)
- Acquisition of DAT audio tapes (performed by our new partner in Paris, the *Studio D.E.S.*)
- Digitization of the old analog Philips VCR tapes (performed in Paris by *Vectracom*)
- Inventory of the last “non master” tapes in Caux, in the perspective of their future digitization
- Digitization of the pictures from the photographer Georges Braunschweig (performed by MMC)

### Innovation, Valorization, and Events

The Metamedia Center was present again at the Montreux Jazz Festival in 2015, presenting the archives to the public on their way to the entrance of the Auditorium Stravinsky, at level B5 of the 2M2C building. The re-designed Archive Discovery iPad Application was available there, next to the posters, and with the “Montreux Jazz Video Jukebox” proposing a gestural-based navigation in 49 years of festival. At the Montreux-Palace, prototype elements of the new “Montreux Jazz Heritage Lab” in development at the *EPFL+ECAL-Lab* were presented to guests and specialists, with great success. Coordinated by the Metamedia Center, several EPFL workshops were presented during this edition of the festival, for example to explain the new project “Remix-The-Archive” defined with our partner *Future-Instruments*, to valorize the multi-tracks of the archive. Members and partners of MMC also participated to *Babylone* and *Magma*, two radio programs on RTS. The Montreux Jazz Digital Project was also presented by the MMC at the EBU Production Technology Seminar in Geneva (January 2015), and at the SMPTE annual conference in Hollywood (November 2015).

### The new HGST Storage System

From the Amplidata hard-drive storage (2.5Pb), a move to the brand new 3-GEOSite “Active Archive” solution from HGST (a sub-company of Western Digital) is planned for Spring 2016, thanks to a new partnership signed in September 2015 between the MMC and HGST for a 2.5 M\$-equivalent equipment sponsoring deal. Three 4.7PB units (corresponding to a 6.8PB exploitable storage size) will be installed at EPFL and in the Montreux Music Convention Center (2M2C), and linked through a 10Gb/s optical link allowing secure storage and redundancy of archive media files. The system capacity is large enough to integrate data for coming editions of the festival during many years, including possible increase in data resolution (such as Ultra-HD, high-definition audio).



## Partnerships

Very important international partnerships were initiated by the MMC in 2015. Next to the HGST storage sponsorship agreement, a first project was launched with IRCAM, the archive being shared in the frame of an ANR project with INRIA. As a counterpart, use of the IRCAM descriptors to enrich the Montreux Jazz archive with musical metadata is planned. Promising discussions were started as well with the French institution INA regarding archiving technologies and standards. Strong links appeared recently with the Berklee College of Music in Boston, whose students should soon re-master the audio of the MJF archive. Finally, projects linked to the archives of the Swiss Television (RTS / SwissTXT) are in discussions, preliminary actions were started with EPFL students. Several funding requests are under evaluation or definition in the frame of future MMC actions in partnerships with IDIAP, IVRL Lab, DIAS Lab, or the Swiss Musicians Association.

## Future Work

The MMC activity will continue in 2016 with the goal to finalize digitization of the master formats and prepare the database and medias for the Montreux Jazz Café @ EPFL navigation platforms. Installation, setup and tests of the new Active Archive storage will be an important step as well in April 2016. A robot to yearly check the tape supports of the reference digital archive (LTO) will be installed and set in production in 2017. In parallel, more valorization projects in partnerships with EPFL Labs are on the way, for example regarding metadata extraction (beautiful song thumbnails, creation of video summaries, solo detection, artist's face or instrument tracking, emotion, ...). Actions regarding the 50<sup>th</sup> edition of the **Montreux Jazz Festival** will require some workload as well. In partnership with Audioborn, an audio/video 360-degrees concert capture is planned to propose an immersive concert discovery experience to the public.

Additional digitization actions will be scheduled for 2016 and 2017, regarding the "rests". More and more are being discovered, in particular non-master tapes (sometimes of better quality compared to the master), newly identified collections (RTS, Philippe Dahinden), interviews and TV emissions, recordings of the secondary concert venues in Montreux (Montreux Jazz Café, Platinum, Q's, or Le Club for example). Most of those operations should be performed in-house at EPFL in collaboration with Montreux Sounds Studio.

In 2017, numerous projects for music information retrieval, automatic metadata extraction, or media editing and enhancement should start in collaboration with partners (IRCAM, INA, Berklee College of Music). The development of a sister metadata database is planned at the MMC, in order to store the massive amounts of metadata associated to signal processing actions on the medias (like short-term feature extraction in the audio/video signals). This new development will serve the numerous projects planned with the signal processing labs or the future Digital Humanities Institute.

## Sustain

With the progressive end of the digitization actions, 2016 and 2017 will see the Sustain mode of the Montreux Jazz Digital Project start, in overlap with the opening of the Montreux Jazz Café @ EPFL, the final phases of the archiving project, and together with the increasing number of partners interested to launch valorization actions. Definition of new funding structures are on the way, and brainstorming has started at EPFL to position the Metamedia Center at best in the perspective of its operational competences in archiving, considering the research and valorization actions it brings to EPFL labs and the VPIV, its role in the emerging digital humanities institute, and thinking about the arrival of RTS on campus and all the other archive-related actions in view. Structures should be defined by the end of 2016.



## Highlights: The Montreux Jazz Digital Project in 2015

This report depicts the activities conducted until 2015 at the Metamedia Center of EPFL (MMC), which oversees the project. This first section summarizes the work performed during the past year, while the following parts of the document describe the project globally, and in more detail.

After launching many valorization actions in 2014, and approaching the end of digitization tasks, 2015 was the year for **archive consolidation**. The MMC team prepared the structures required to:

- **Offer a clean database in the perspective of a public access to the archives in the Under One Roof building of EPFL for 2016.**

Efforts were dedicated to many clean-up tasks, optimizing the database structures (adapting to new kinds of data such as artist's rights, pictures, song indexing information and advanced song metadata), fixing incorrect concert information, identifying missing recordings, setting up the processes and tools to complete and clean the metadata, or to control and track the status of the digital archive tapes. Proper care was dedicated to model and categorize the concerts' rights, and identify the associated modes of authorized playback for the "Montreux Jazz Café @ EPFL".

- **Build the tools to better manage, access, and process the archive files on the storage server.**

An important step was reached for efficient and automated batch-based transfer and creation of the various file sub-formats needed by researchers and partners or for the new valorization platforms (Heritage Lab, iPad application, ...). Exploiting the results of the concert indexing work, transcoding tools were designed to automatically process the media files, cut the concerts in songs and convert them to the suitable formats, sometimes adding text-metadata information to the produced media according to the needs of the use-cases. As a result, more than 1000 songs were made available to the public on the Montreux Jazz Festival archive portal, which is now the main archive valorization tool, providing large-scale diffusion of the EPFL Metamedia Center work (<http://montreuxjazz.com>).

- **Store the archive in an efficient, secure, and flexible way for the next decade, making use of the most advanced hard-drive based object-storage technologies.**

From the Amplidata hard-drive storage (2.5PB), a move to the brand new 3-GEOsite "Active Archive" solution from HGST (a sub-company of Western Digital) is programmed for March 2016, thanks to a new partnership signed in September 2015 between the MMC and HGST for a 2.5M\$-equivalent equipment sponsoring. Three 4.7PB units (corresponding to a 6.8PB exploitable storage size) will be installed at EPFL and in the Montreux Music Convention Center (2M2C), and linked through a 10Gb/s optical link allowing secure storage and redundancy of the archive media files. The system capacity is large enough to integrate data for coming editions of the festival during many years, including possible increase in data resolution (such as Ultra-HD, high-definition audio).

### Digitization

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- Digitization of the pictures from the photographer Georges Braunschweig (performed by MMC)

## Innovation, Valorization, and Events

The Metamedia Center was present again at the Montreux Jazz Festival in 2015, presenting the archives to the public on their way to the entrance of the Auditorium Stravinsky, at level B5 of the 2M2C building. The re-designed **Archive Discovery Application**, an iPad with all the digitized and indexed concerts (including the ones from the evening before!), was available there, next to the posters and the collaborators explaining the projects. The iPad was equipped with an interface for users to give their feedback on the emotion induced by the songs playing, building a reference database for the **“Emotion Detection”** project on-going at the *IVRG* lab of EPFL.

In the same area, the **“Montreux Jazz Video Jukebox”** offered an experience prepared in collaboration with our partner *Artanim Interactive*. A “sound box”, capable of hosting 10 people in a very good acoustical environment, proposed a gestural-based navigation in 49 years of festival. This project was organized in partnership with the Swiss companies *PSI-Audio* (for speakers) and *Illusonic* (an EPFL start-up specialized in spatial audio).

At the Montreux-Palace, prototype elements of the new **“Montreux Jazz Heritage Lab”** in development at the *EPFL+ECAL-Lab* in partnership with *ALICE*, were presented to guests and specialists, in order to show and validate the innovation solutions for video display, 3D audio rendering, and database navigation interfaces. A 1:4 scaled version of the future platform gave a good idea of this immersive experience to be proposed in 2016 at EPFL. In particular, the quality of the audio reproduction met great success. Designed by the newly created start-up *Audioborn*, as an evolution of the **Casino Kursaal Revival** project launched by MMC and the *LCAV Lab* in 2014, this sound installation will offer the possibility of selecting the acoustics of the desired festival venue, for playing any concert from the archive. After discovering this experience, the Al Jarreau team was amazingly impressed. They declared they would never hear music in the same way anymore! Since that time, they support the new Audioborn product called “Auratorium”.

Coordinated by the Metamedia Center, several EPFL workshops were presented in Montreux during this edition of the festival. Next to the one proposed by the team to describe the Montreux Jazz Digital Project in more details, Dr. Hervé Lissek proposed **“All About That Bass”**, studying the evolution of the bass throughout the 49 years of festival. This talk was derived from the recent audio analysis projects defined between MMC and the *LTS2 Lab* of EPFL, to extract musical information from the archive media (such as genres for example) and store this as metadata.

Another workshop described the new project defined in 2015 with our partner *Future-Instruments* from the EPFL Innovation Park. Named **“Remix-The-Archive”**, this project aims to valorize the audio multi-track archives of the festival, and allows people to remix the concerts in a simple way using a touch interface to individually control the volume of each instrument. More generally and in a creative way, the system offers the option to easily mix pre-processed audio loops available from any existing library. In collaboration with *Audioborn*, the platform will soon integrate a 3D sound interface to place and move the instruments in space, assuming a 3D sound system similar to the one in design for the Montreux Jazz Café @ EPFL.

During the Montreux Jazz Festival, lots of press publications appeared regarding the archives. Members and partners of MMC also participated to **Babylone** and **Magma**, two radio emissions on RTS:

- <https://www.rts.ch/espace-2/programmes/babylone/6865991-babylone-du-29-06-2015.html>
- <https://www.rts.ch/espace-2/programmes/magma/6867268-magma-du-14-07-2015.html>

The Montreux Jazz Digital Project was also presented by the MMC at the **EBU Production Technology Seminar** in Geneva (January 2015), and at the **SMPTE annual conference** in Hollywood (November 2015).

## Partnerships

Very important international partnerships were initiated by the MMC in 2015. Next to the HGST storage sponsorship agreement, a first project was launched with **IRCAM** (Institution de Recherche et Coordination Acoustique/Musique), the archive being shared in the frame of an ANR project with **INRIA** (Institut National de Recherche en Informatique et Automatique) . As a counterpart, use of the IRCAM descriptors to enrich the Montreux Jazz archive with musical metadata is planned. Promising discussions were started as well with the French institution **INA** (Institut National Audiovisuel) regarding archiving technologies and standards. A first trainee will come to EPFL for 6 months in 2016 for an INA master work. Strong links appeared recently with the **Berklee College of Music** in Boston, whose students should soon re-master the audio of the MJF archive. Projects definition is on the way. Finally, projects linked to the archives of the Swiss Television (**RTS / SwissTXT**) are in discussions, preliminary actions were started with EPFL students.

The following requests are under FNS evaluation or definition in the frame of future MMC partnerships:

- “*Swiss Big Data Infrastructure for Reproducible Research in Open Science*”, FNS-Big data funded project, in collaboration with **IDIAP**, for the development of a secured computing platform for the archive.
- “*Old Videos, New Looks*”, FNS funded project, in collaboration with **EPFL IVRL Lab**, for video super-resolution and enhancement
- FNS funded project in collaboration with the **ASM (Association Suisse des Musiciens)**, to rebuild their database with novel database approaches (possibly in collaboration with the **EPFL DIAS Lab**).

Let’s also mention the partnership with the **Digital Humanities Lab** from Basel University, for an additional FNS Big data request cautioned by MMC, and named “*Integrated Digital Collections, Big Data in the Humanities - Methods and Tools*”. The team has been in contact with MMC for a long time. Part of the MJF pictures archive (color negatives from Georges Braunschweig’s collection) will be digitized in Basel in 2016.

Still in the frame of Digital Humanities, let’s mention the link between MMC and the team of Prof. Dominique Vinck from the “**Culture et Humanités Digitales**” lab at UNIL. While valorization platforms for the archives are being studied by a Ph.D. from the lab, the MMC participates intensively to the lectures of Prof. Vinck “Numérisation des Cultures” and “Dynamique de l’Innovation”, where the MMC innovation actions are the object of students’ SHS works in the EPFL College of Humanities program.

## Future Work

The MMC activity will continue in 2016 with the objective to finalize digitization of the master formats (VCR, DAT, HDCAM, D5, pictures), keep on cleaning the archive metadata (a never-ending action ...), and prepare the database and medias for the Montreux Jazz Café @ EPFL platforms (iPad app, Montreux Jazz Heritage Lab, consultation cabins). Installation, setup and tests of the new Active Archive storage will be an important step as well in March 2016. In parallel, more valorization projects in partnerships with the EPFL Labs are on the way, like video defect detection and correction (in partnership with **MMSPG**), or regarding metadata extraction (beautiful song thumbnails, creation of video summaries, solo detection, artist’s face or instrument tracking, emotion, ...). A manual tagging project for the existing 140’000 digitized pictures is planned in collaboration with a Swiss partner **Specialisterne**, which employs autistic collaborators. The result will be available as a reference database for researchers in image analysis.

Actions regarding the 50<sup>th</sup> edition of the **Montreux Jazz Festival** will require some workload as well in 2016, in particular the yearly audio/video media capture, control, ingestion, indexing and transcoding, including generation and updates of the medias for the on-site or on-line platforms. In partnership with MMC and Audioborn, an audio/video 360-degrees concert capture is planned to propose an immersive 360-degrees concert discovery experience to the public. Actions for a performance created in collaboration with the local musical schools (**HEMU – EJMA**) are planned too.

Additional digitization actions will be planned for 2016 and 2017, regarding the “rests”. More and more are being discovered, in particular non-master tapes (sometimes of better quality compared to the master), newly identified collections (RTS, Philippe Dahinden), interviews and TV programs, recordings of the secondary concert venues in Montreux (Montreux Jazz Café, Platinum, Q’s, or Le Club for example). Most of those operations should be performed in-house at EPFL or in the Montreux Sounds Studio.

In 2017, numerous projects for music information retrieval, automatic metadata extraction, or media editing and enhancement should start in collaboration with partners (IRCAM, INA, Berklee College of Music). Consequently, the development of a sister metadata database is planned at the MMC, in order to store the massive amounts of metadata associated to signal processing actions on the media (like short-term feature extraction in the audio/video signals). This new development will serve the numerous projects planned with the signal processing labs or the future Digital Humanities Institute.

Finally, the tape supports of the digital archive (LTO) will need to be yearly checked and controlled in the future. A robot will be acquired for this goal, installed, and set in production at the beginning of 2017.

## **Sustain**

With the progressive end of the digitization actions, 2016 and 2017 will see the Sustain mode of the Montreux Jazz Digital Project start, in overlap with the opening of the Montreux Jazz Café @ EPFL, the final phases of the archiving project, and together with the increasing number of partners interested to launch valorization actions. Definition of new funding structures are on the way, and a brainstorming is started at EPFL to position the Metamedia Center at best in the perspective of its operational competences in archiving, the research and valorization actions it brings to EPFL labs and VPIV, its role in the emerging digital humanities institute, and thinking about the RTS arriving on campus and all the other archive-related actions in view. Structures should be defined by the end of 2016.

## **Figures**

The MMC team is lead by Adrienne Corboud (director). As part of VPIV, it employs 12 other persons, an operation and development director, one IT+media specialist, one audio/video technician (70%), two programmers, one documentalist (70%), two operators for video acquisition and indexing tasks (60%), two archivists students (80%), one IT trainee, and an administrative assistant (20%). This represents the equivalent of 8 full-time employees. To this must be added collaboration with 10 EPFL students working 20% each (indexing and quality control), partnerships with about 10 EPFL labs, two external partners for innovation projects, three partners for digitization and storage and the help from the Claude Nobs Foundation.



*Presence of EPFL at the Montreux Jazz Festival in 2015, posters and Montreux Jazz Video Jukebox*

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# Introduction

## The Audio-visual Archive of the Montreux Jazz Festival

“It’s the most important testimonial to the history of music covering Jazz, Blues and Rock.”

These are the words that Quincy Jones uttered to the press from his New York studio during the presentation of the preservation project for one the world’s most important audio-visual patrimony of 20th century music. The collection created throughout the 49 years of the Montreux Jazz Festival (MJF) by its founder Claude Nobs, brings together the greatest artists of that period. The archive was officially recognized in 2013 and is now inscribed in the 2013 UNESCO memory of the world register. From Ella Fitzgerald, Miles Davis, Phil Collins to David Bowie and Prince, over 5,000 hours of ‘live’ concerts were recorded in video and audio (of which a large part as multi-tracks) which were also visually depicted by tens of thousands of photos.



*The archive bunker at the chalet of Claude Nobs “Le Picotin” in Caux*

## The Montreux Jazz Digital Project

All the media collection is currently being digitized at EPFL as part of the "Montreux Jazz Digital Project", a collaboration between the engineering school in Lausanne, the company "Montreux Sounds" and the newly born "Claude Nobs Foundation" responsible for overseeing the preservation of the Montreux Jazz Festival audio-visual archive. The Montreux Jazz Digital Project aims to preserve and transform this heritage into a unique archive of "raw material" for researchers to innovate in the field of music technology, acoustics, multimedia and even architecture. Innovative user-interaction tools are being developed and will be placed at the archive's disposal to transform the MJF archive into a living collection easily accessible by the general public. A substantial annotation and metadata enrichment program will be devised for schools, musicians and musicologists in particular.



*After digitization, all the media is reunited on a hard-disk storage server*

For this purpose, the "Under One Roof" building is under construction at the EPFL campus. One of its pavilions will include a "Montreux Jazz Café", an innovative space where the public will be able to discover the recordings of Montreux in an interactive, creative and innovative way.



*Renderings of the Under One Roof building, for which works have started and will open end of 2016 at EPFL.*



## The Metamedia Center (MMC)

The mission of the Montreux Jazz Digital Project is to save the archives, to valorize them through the development of visualization and consultation tools and to also ensure its survival for several decades at least. The project is led by the Metamedia Centre (MMC), an EPFL competence center launched in 2010 by the Vice-Presidency for Innovation and Valorisation (VPIV) under the guidance of Adrienne Corboud-Fumagalli. More generally, the Metamedia Centre aims to accelerate and enhance research and innovation in the field of media at EPFL. In a multi-disciplinary framework, it supports and stimulates the development of new technologies from the laboratories of the school as well as startups based at EPFL's Innovation Park. It provides financial assistance, managerial advice (management, business cases) for promising technological projects, with the aim to build prototypes and tools that will generate the credibility and visibility needed to capture the interest of potential investors.

If one of the goals of the MMC in the framework of the Montreux Jazz Digital Project is to revive the famous heritage for which the Montreux Jazz Festival archive is known for, to valorise and sustain it, it also considers this archive to be a wonderful tool for the University, a valorization platform at the service of laboratories but also at the service of all types of actions aimed at promoting innovation and technology transfer at EPFL.



*Metamedia Center's presence is felt during the Montreux Jazz Festival in 2014 thanks to new sound diffusion technologies which aid the discovery of the festival archives with an iPad application.*

# Montreux Jazz Digital Project

## Digitization

After a long and fastidious inventory process performed between 2007 and 2010, the actual digitization process began in 2010. On a format by format basis, the tapes are transported to the company performing digitization, professionals who possess the necessary skills and equipment to run multiple encoding chains in parallel. MMC oversees the entire project and ensures that a quality assessment is performed on all digitized media supplied as IT files.



*Quality Control workstations to check media content received after digitization*

The first batches of tapes to be digitized were video tapes in U-matic format (whose condition was the most critical) and 2" (for which playback equipment was becoming obsolete). Following on were the 1" videotapes, Betacam SP tapes, Digital Betacam and D2. In parallel, digitization of audio tapes started with ¼", U-matic audio and multi-track audio (2" and ½").

Most of the analogue tapes have now been digitized, only the Philips VCR format remains, it should be processed during Q1-Q2 2016. In parallel, EPFL has started acquiring the digital part of the collection, covering recordings from the middle of the 90s. The formats in question are DAT (Digital Audio Tapes) and HDCAM (HD video tapes) mainly. The acquisition of all HD video formats used since 1991 at the MJF takes place at EPFL on the premises of the MMC. The work is performed under the supervision of the MMC team, with the help of several trained collaborators and students. At the rate of 8 concerts per day (2 acquisition chains working in parallel), it will be completed by the middle of 2016.

Digitized files are generated in an uncompressed format to ensure the lossless conversion of media to future file formats. The digitized archive is stored on digital LTO tapes which is traditionally used as a mass storage medium for computer data. A set of two LTO tapes are generated for redundancy purposes, one of them is kept at EPFL and the other in Montreux.





*The HDCAM acquisition Setup at EPFL.*

90% of the master tapes were digitized by December 2015, they should all be processed by the end of 2016. Additional tape lots recently discovered will be processed afterwards, the non-master tapes or recordings covering secondary festival venues, interviews and TV emissions, or collections belonging to private persons or public institutions (Swiss TV and Radio for example).

## Hard-drive based Storage

A hard disk-based storage system is used since 2012 by the MMC to provide immediate and flexible access to EPFL teams working on the archive. This novative object-storage device reached a capacity of several petabytes (2.5PB at the beginning of 2015). It is based on a bit-spreading technology from the company Amplidata, which brought two generations of their “AmpliStor” (then “Himalaya”) “products to the benefit of the MMC, and became a sponsor of the Montreux Jazz Digital Project.

The storage system can be accessed using Amazon's S3 REST API. All file transfers are initiated and monitored using a web platform specially created by the developer's team of the Metamedia Center. This transfer platform is based on the “Play” framework, which interacts with a set of distributed software agents running on the MMC workstations where the files are downloaded and uploaded. The agents have been developed in Scala, a language created at EPFL by Prof. Martin Odersky from the Programming Language Laboratory (LAMP). Designed and properly tuned to provide the highest speed performance, the agents use “Akka”, an opened library for building concurrent, distributed, and fault tolerant applications.

In Spring 2015, Amplidata was acquired by HGST, a sub-company of Western Digital. HGST rapidly became interested in participating to the Montreux Jazz Digital Project and a new sponsoring agreement was signed in September with the Metamedia Center. As a result of this agreement, a brand new 3-geosite “Active Archive” installation of 6.8PB exploitable size will soon be installed at EPFL to replace the Amplidata setup. Made of 3 units holding each 4.7PB, the system will be split on three different locations to ensure proper security and redundancy of the data. After a test phase in Spring 2016, it will be in production for the 50<sup>th</sup> edition of the festival in 2016.



*Five racks of hard-drives from Amplidata storing the MJF Archive in the datacenter of EPFL in 2015 (above), and two of the new 4.7PB Active Archive units from HGST, just arrived at EPFL in February 2016 (below).*





metamedia center

Grégory Marti

Transfer

Tasks

Cleanup

MJF Database

Admin

+ Connect to Agent + Connect to AmpliStor

Agent SRV01

/MEDIAS/MEDIAS

Name	Size	Last Modified
..		
Audio Heritage		
Montreux Jazz Video Juckbox		
Selection		
Supplément ECAL		
4 Directories		

Agent WRKS14

Agent WRKS06

Agent WRKS01

AmpliStor admin@AS3

/non-archive-video/ipadmp4/

Name	Size	Storage Date
..		
2015		
03MDHA5011BD.mp4	3.00 GB	03.07.2015
04CASI01A11BD.mp4	1.07 GB	02.07.2015
04CASI01I11BD.mp4	3.04 GB	03.07.2015
04CASI02A11BD.mp4	2.67 GB	03.07.2015
04CASI02I11BD.mp4	2.58 GB	03.07.2015
04CASI03A11BD.mp4	1.70 GB	03.07.2015
04CASI04A11BD.mp4	2.34 GB	02.07.2015
04CASI05A11BD.mp4	1.38 GB	03.07.2015
223 Files 1 Directories		

AmpliStor epffproduction@AS3

AmpliStor cmm@AS3

metamedia center

Grégory Marti

Transfer

Tasks

In Progress

History

Cleanup

MJF Database

Admin

Tasks in progress

#	Name	Size	Files	User	Done	Speed		
16 65 6	DIGITIZATION_A/... → AS3/...	742.60 GB	0/1	MJF_WO RKER_DI GITIZATI ON	<div></div>	259.11 MB/s		

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Grégory Marti

Transfer

Tasks

In Progress

History

Cleanup

MJF Database

Admin

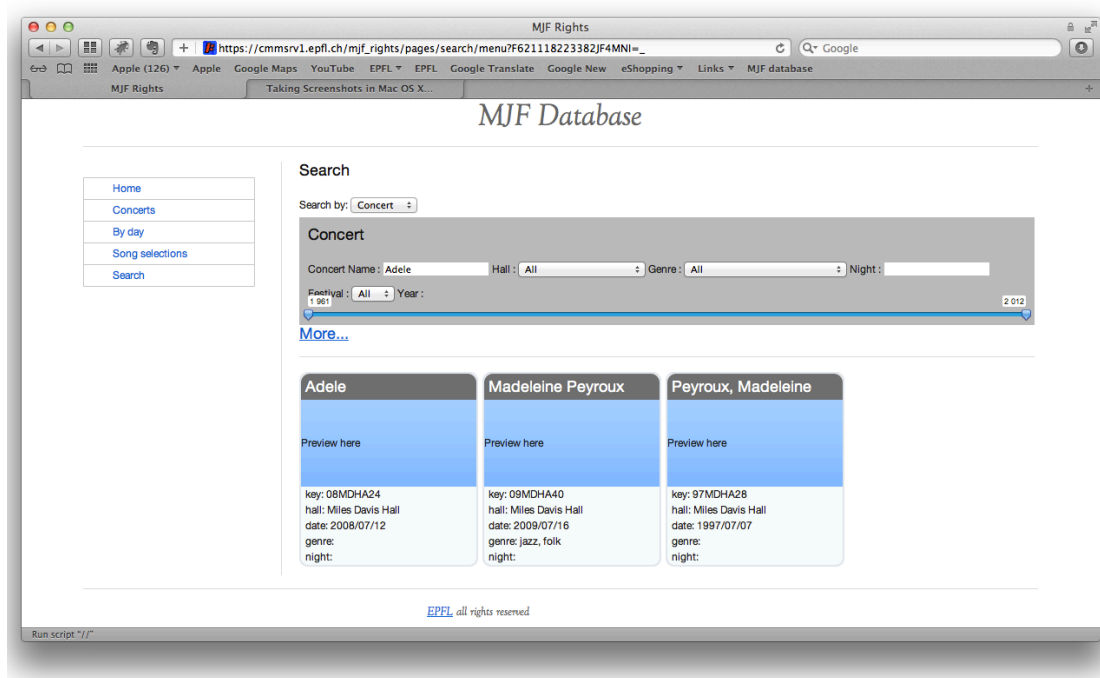
Tasks History

#	Name	User	Files	Size	Duration	End	Status	
16 65 5	AS3/non-archive-video/hdtv/2005/05MDHA03A11HD.v0-fndtv.mkv → SRV01/INDEXATION/STUDENTS/curtelin/CHECKING/05MDHA03	sartacho	1	5.81 GB	00:16:59	23.02.2016 10:03	Success	
16 65 4	AS3/... → SRV01/...	MJF_WO RKER_IN DEXATIO N	1	308.51 MB	00:00:02	23.02.2016 09:40	Success	
16 65 3	DIGITIZATION_B/... → AS3/...	MJF_WO RKER_DI GITIZATI ON_WAV	1	308.51 MB	00:00:01	23.02.2016 09:40	Success	
16 65 2	DIGITIZATION_B/... → AS3/...	MJF_WO RKER_DI GITIZATI ON	1	145.23 GB	00:08:47	23.02.2016 09:39	Success	
16 65 1	AS3/mjf-archive-high-video-quality/2003/03STRA16A11HD.v0.mov → SRV12/03STRA16A11HD.v0	DOWNL OAD_JO B_03STR A16A11H D.v0	1	669.46 GB	01:24:30	23.02.2016 04:18	Success	
16 64 9	AS3/mjf-archive-high-video-quality/2003/03STRA18A11HD.v0.mov → SRV12/03STRA18A11HD.v0	DOWNL OAD_JO B_03STR A18A11H D.v0	1	946.48 GB	02:01:34	23.02.2016 04:07	Success	
16 64 7	AS3/... → WRKS13/...	qc_files_t ransfer	6	4.04 TB	03:41:13	23.02.2016 03:41	Success	

Screenshots of the web platform developed by the Metamedia center, for file transfers to the storage:  
Transfer view (above), tasks view (middle), and history view (below).

## Database

The unified Montreux Jazz database is a single point of reference for all partners involved in the Montreux Jazz Digital Project. All information relating to concerts, musicians, tunes and songs (with their duration, order, authors and composers), the media, their properties, quality and possible defects, as well as with the broadcasting rights and artists' contracts with the festival are centrally contained in a relational database developed by the database team of the Metamedia Center. This database regroups various generations of databases created over time at the Montreux Jazz Festival including many paper documents. It has been used since 2012 by the Montreux Jazz Festival team, in live to input data during the festival. It meets both the requirements of the digitization process, media inspection quality, indexing of various format settings (audio, video, etc.), but also MJF users and soon a larger public. It is programmed in Scala, the EPFL innovative language by Professor Odersky (used by social media networks like Twitter), and uses the Lift web framework. The data is stored in a MySQL database, although other database technologies have been used in the past (Cassandra and Neo4j), and is queried/accessed via the Lift Mapper and Slick libraries.



*A screenshot of the MMC database interface, with search results*

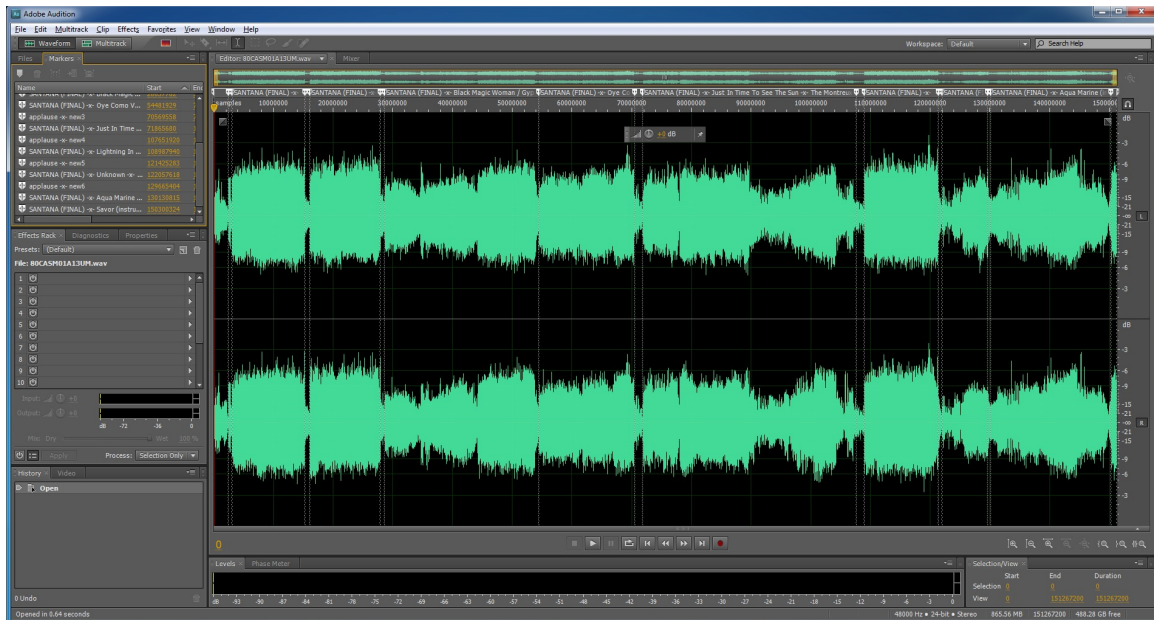
This database is the heart of future developments of the MJF collection. It will give users the opportunity to discover, analyze, understand and work with 50 years of Jazz music. In 2016, MMC started to enrich it with other media such as photographs, testimonials and other archival documents to be discovered. A more “user-friendly” portal aimed at the general public will be developed for the opening of the Under One Roof Pavilion in 2016. Meanwhile, with the collaboration of a team of students, MMC will embark on the substantial task of cleaning up data as many errors in the database still need to be corrected.

## Songs & Events Indexing

In Spring 2013 a major indexing project was launched by the MMC with the aim to cut events and songs occurring throughout the recording of a concert (introduction, song, clapping, speech, call back, etc). The indexing project is also a way to check and correct the songs and setlists information, and operate a first important clean-up pass of the metadata, adding comments and information to the concerts.



To date, more than sixty students have participated on this project, which will go on in the future, as long as new concerts are added to the archive. The precise cutting point of each event, its location in the time code and the information related to these events in the MJF archive database will enable immediate access to all of the songs ever played at Montreux (50 '000 approximately up to now), or for example, to listen to a nice playlist of songs in crossfade mode recreating an old concert indefinitely!



*The audio waveform is used as the basis for event indexing tasks, showing the global song structure.*



*Students at EPFL indexing the concerts in the Metamedia Center lab.*

## Picture Digitization

In association with Georges Braunschweig, one of the official Montreux Jazz Festival photographers, a first collection of more than 50'000 photos will be progressively digitized and added to the Montreux Jazz Festival digital archive. With the help of the Digital Humanities Lab of the Basel University, a digitization setup was installed at EPFL in March 2014, to process the negatives and dispositive supports.



*The picture digitization setup, in the premises of the Metamedia Center*

Two archivist students following the “Information Studies” program at the HEG in Geneva are running the operational work, which takes up to two years to complete. Together with already-digitized material, 140'000 pictures should be available in the archive by the end of 2016. All those digitized photos will be tagged and added to the collection. Tagging operations are planned to start in Spring 2016 with the help of the partner Specialisterne. This company is based in the Bern area and employs autistic collaborators with particular concentration capabilities.

## Valorization Projects

Many valorization projects have been launched since summer 2010 by the Metamedia Centre, mostly realized in conjunction with research laboratories. The following paragraphs present some examples (as a non-exhaustive list!). All these projects are designed around the archive of the Montreux Jazz Festival which have resulted in the creation of experiences for the general public.

### Montreux Jazz Heritage Lab (v1.0)

The first innovative platform developed at EPFL to showcase content from the Montreux Jazz Festival was the "Cocoon" or "Montreux Jazz Heritage Lab" created in 2010. It is a small module of 3 x 4 x 5 meters in size for 2 to 4 people with a unique audio-visual environment at their disposal containing technologies such as spatial sound and a curved video screen. This installation enables the audience to try out an immersive experience of Montreux Jazz digital media to discover the best moments of the 2009 and 2010 Festivals (already available at the time). This module is based on the technologies and skills developed at EPFL in the fields of design, ergonomics, acoustics, computer science, architecture and signal processing. In particular,



the expertise of EPFL + ECAL Lab in design resulted in the proposal of a tactile interface to navigate concerts with music recommendation functionalities (based on the similarities of songs established by the LTS2 Signal Processing Lab of EPFL).



*Version 1.0 of the Montreux Jazz Heritage Lab*

Turning the Montreux Jazz archive into a user experience is a key challenge. The project was organized in collaboration with several other EPFL Labs, including the Space conception Laboratory (ALICE) for architectural approach and the LEMA for acoustic issues. In this first prototype, specific aspects about the perception of the image were considered. One of the main goals was to provide the users a new relation to the cultural content (1). The prototype achieved this following 3 specific principles:

1. Replace the user in a normal situation.
2. Create a feeling of immersion with simple concepts (audio, curved geometry, simple projection).
3. Set a specific status of digital content

Trying to mimic the original concert would lead to the perception of a bad copy. Rather to fake a situation, the prototype set a new one, involving specific features linked to digital content, like exchange between users, relation between browsing and watching, views of the concert.

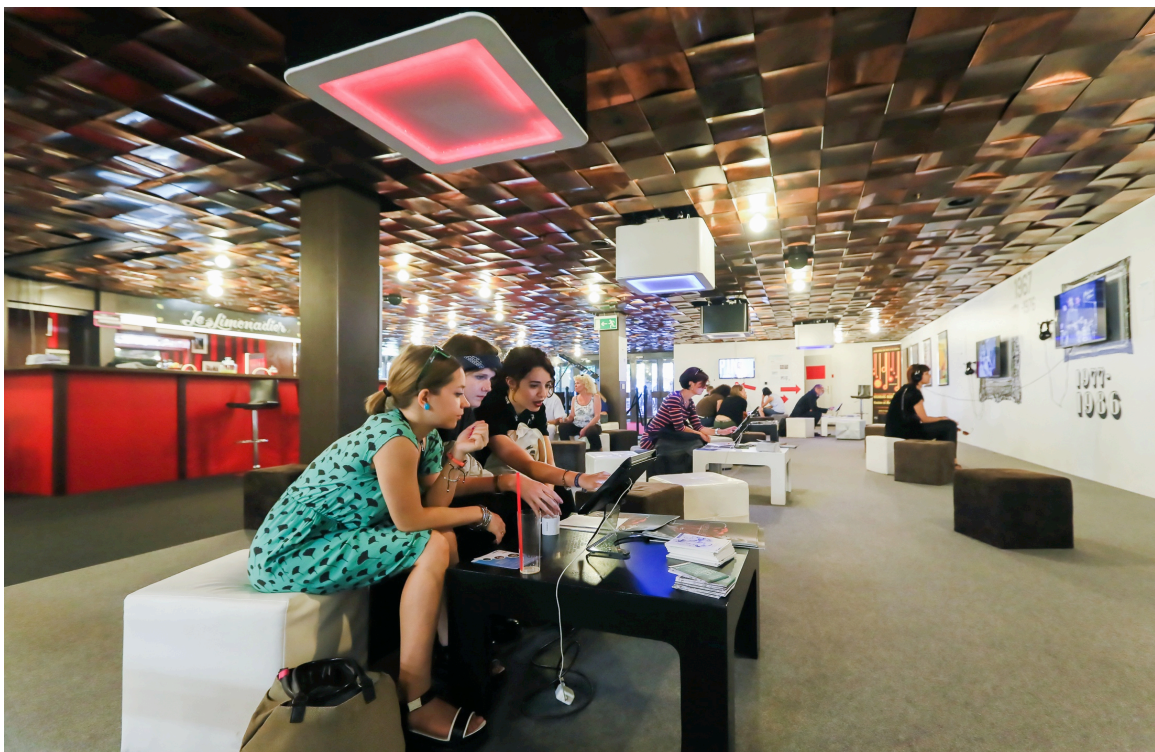
### **The iPad Archive Discovery App**

During the 2014 and 2015 editions of the Montreux Jazz Festival, and as a result of the indexing work described above, the public could discover the complete collection of MJF concerts digitized up till now – a world exclusive! An iPad application was proposed with an interface designed for search and navigation purposes, to discover the myriad of recordings and photos available, to swipe through the concerts of a

specific year, witness the evolution of an artist during their many performances at Montreux, or embark on a journey of discovery, jumping from one song to another throughout the many editions of the Festival.



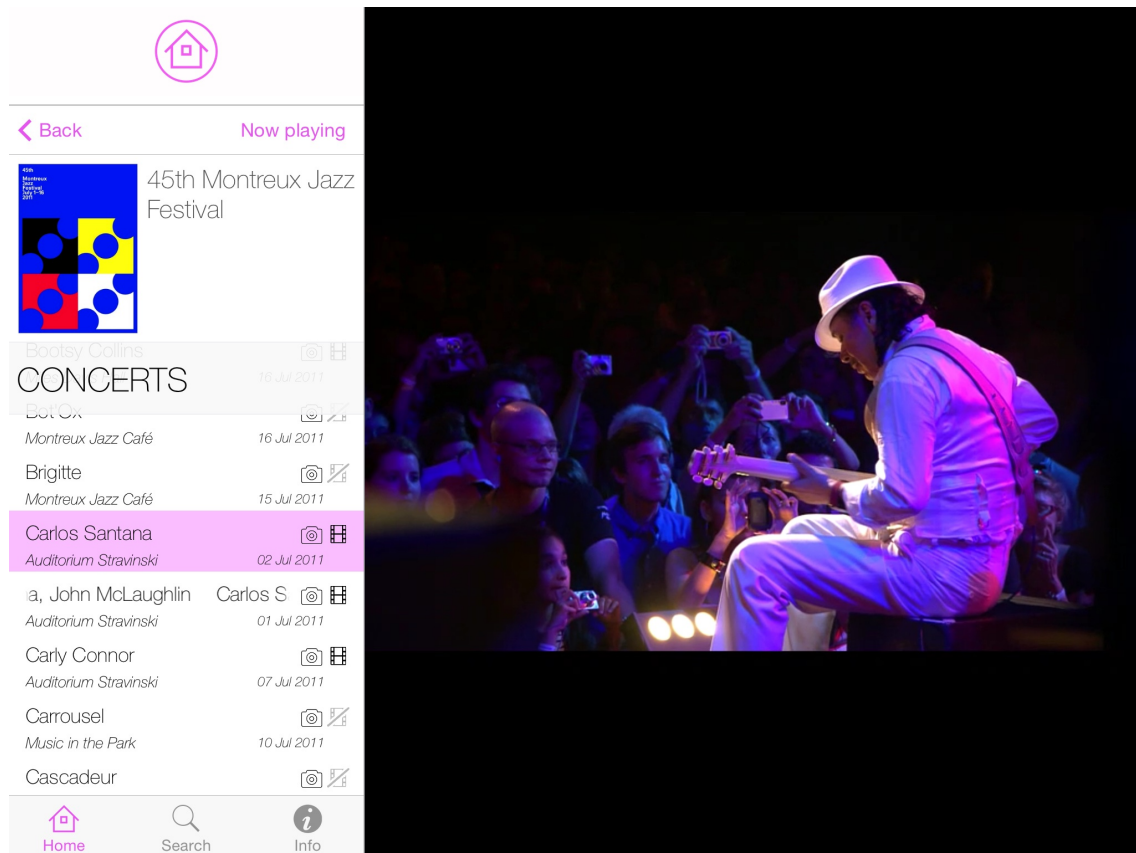
*Watching a concert on the iPad Archive Discovery app at Montreux during the 2014 MJF edition.*



*People discovering the archives and the iPad Application in the “Chalet d’en Bas” area (below).*



This application was an enormous success. In 2015, the iPad was re-designed and equipped with a participative interface for the users to give their feeling about the emotion induced by the songs playing. This built a reference database for the “Emotion Detection” project on-going in partnership with the Image Visualization and Representation Lab of EPFL (IVRL).



*iPad Application: navigation screen for browsing the festival by year with concert descriptions*

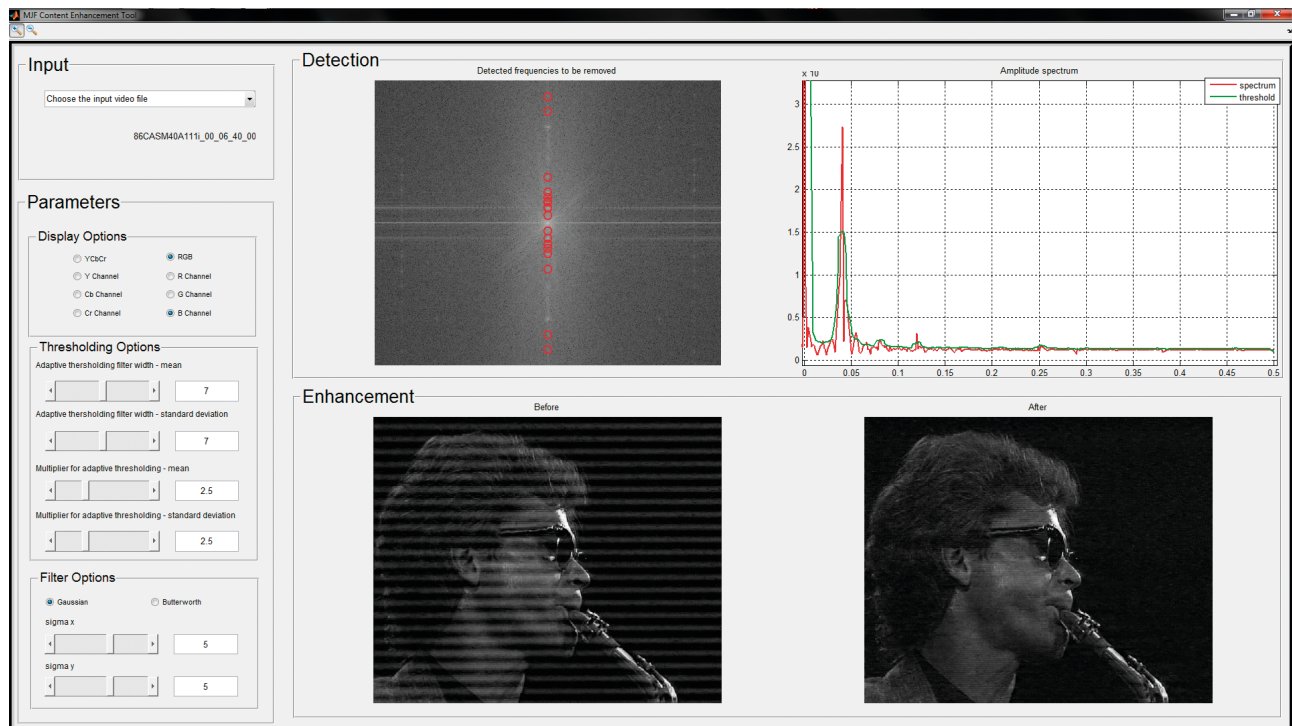
The app will become one of the pillars of archive consultation tools in the future Montreux Jazz Café @ EPFL. The backend of the application will be re-designed in 2016 to properly secure the access to the media, and offer the flexibility required to present the app in future external events.

### « Tapeless » HD Video Acquisition

Since 2013, the Metamedia Center is installed in the Montreux Jazz datacenter during the festival, and captures the concerts in live, using direct recording onto hard disks. In 2014, the MMC team completed the acquisition of the festival concerts in a non-compressed format (1.5 Gbit/s). Thanks to a high-speed fiber optic cable installed specially between Montreux and EPFL, the uncompressed HD video files could be immediately transferred and stored on the AmpliStor servers in the archive at EPFL. After proper transcoding to lighter formats, an expert team of students performed the song indexing of concerts, for immediate availability on the iPad application the night after the concert. A very nice surprise which the public greatly appreciated! This experience will be tuned in the coming years, with the objective of moving to “tapeless-only” recording in 2018, eliminating the need for the festival to invest in expensive HDCAM tapes.

## Video / Audio Defect Detection & Enhancement

The Multimedia Signal Processing Group of EPFL (MMSPG) and the Signal Processing Laboratory (LTS2) are involved in several actions regarding automatic defects detection and enhancement, for video and audio respectively. In video, defects like periodic lines or dropouts (points or lines dropouts) were already addressed with good results. Applied to frequency domain representations of the image spectra, the algorithms were tuned to the particular situation of standard definition images from the Montreux Jazz Festival archive. An interface for automatic and semi-automatic correction of the defects was being designed, detailed description can be found in a paper by Hanhard & al. (2).



*Interface for video defect enhancement*

In audio, detection of the cuts was studied, a wider action about “audio in-painting” is currently in the start phase for short mutes that can be observed on U-matic audio tape recordings.

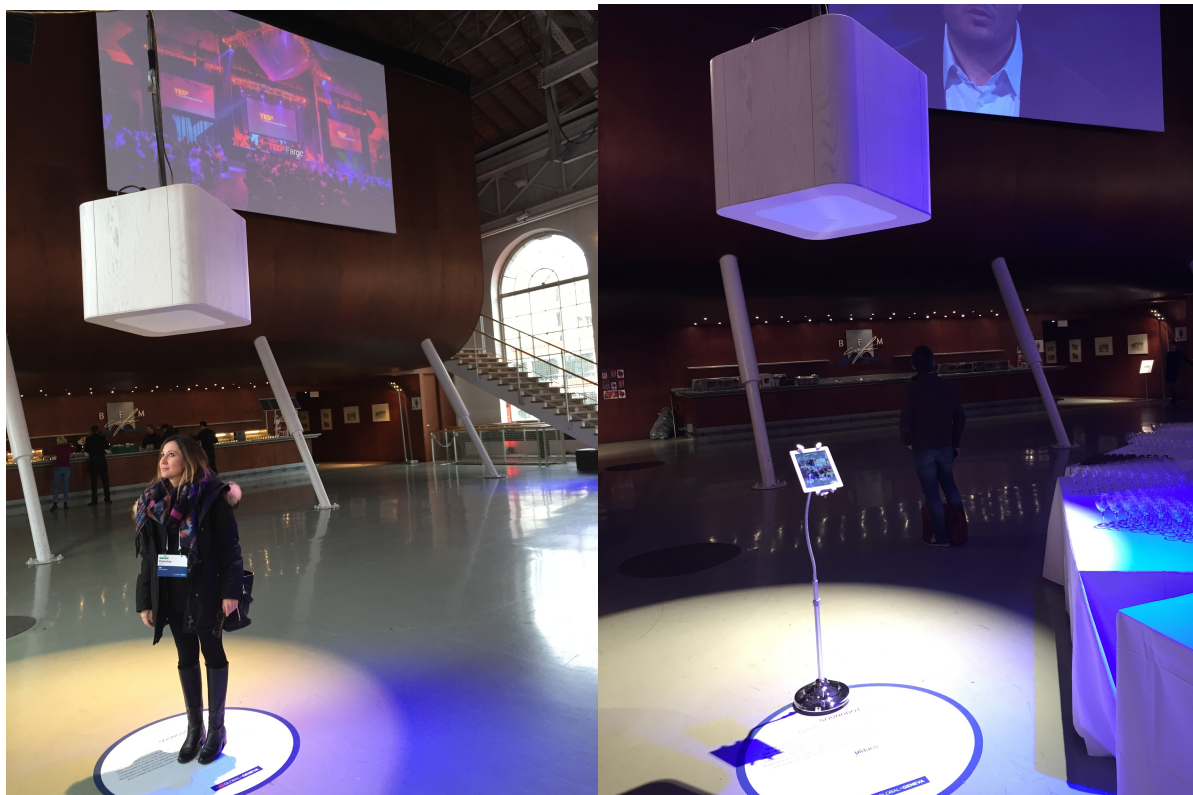
## Sound Dots

With the objective of enabling discovery of the archive between friends in the lively space of the Festival, without the need for headphones and whilst maintaining the quality of social interactions, the MMC set up several spots each equipped with a coffee table, an iPad, and one of the demonstrators of the "Sonic Umbrella". Sonic umbrellas were the subject of several projects initiated by the Metamedia Center since 2012. This is an innovative concept developed by the acoustics group at EPFL, and recently developed into a new start-up Hidacs ("SoundDots" technology). Sonic umbrellas are devices resembling chandeliers equipped with speakers and designed to play sound directionally e.g. over a coffee table. They thus allow several groups of people to enjoy different music programs without disturbing their neighbors. This is a typical example of the MMC's role, showing what the MJF archive represents in terms of innovation and technology transfer. In 2015, the very new Hidacs' loudspeaker, named Opéra, was launched. The innovation is based on a unique arrangement and casing of multiple regular loudspeakers and a fine grain tuning signal distribution to each of them. The main applications interest museums, restaurants, conference center or stands on tradeshow. Opéra comes with a unique wood-based aesthetic and many smart features like automatic volume control, presence detectors, LED-lighting etc.

A newly designed version of the device will be installed in the Montreux Jazz café @ EPFL, and recently, a brand new project funded by the Artlab Initiatives team was launched between MMC, LTS2, and Hidacs, to try and prevent incoming sounds to enter the bubble below the sound dots. A challenge!



*A Sonic Umbrella and its admirers in Montreux during the 2014 MJF edition*



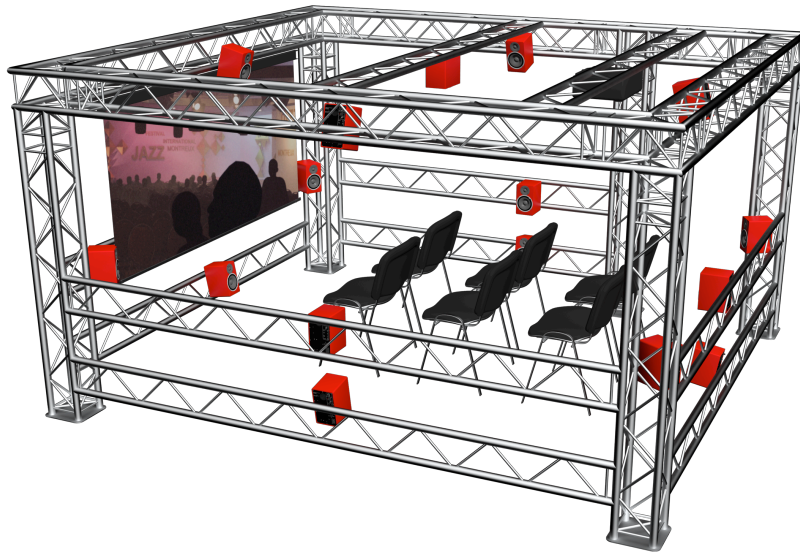
*A new design with wood shown by Hidacs at the TED Global conference in Geneva in December 2015*

### 3D Audio Experiences

3D sound systems enable virtual sound fields to be created in a space thus allowing for the accurate placement of sound elements in desired locations of a listening room. Since the apparition of stereo sound, these systems appear to be the next major evolution in sound reproduction technology. They can create for example, a spatial reproduction of recordings, immersing the listener in a virtual concert hall, or even place a listener center stage at a concert. Based on the number of available speakers, they no longer force the listener to remain at a fixed point in the listening space.



A first experiment involving 3D sound and multi-track audio from the archive was made available to the public at the Montreux Jazz Festival in the summer of 2014 (3). Based on a geometric reconstruction of the legendary Montreux Kursaal Casino hall which burned down in 1971, a 3D visual and acoustic model of the room was rebuilt by the Audio-Visual Communications Laboratory team at EPFL (LCAV) in collaboration with the Atelier Feuerroth. Working in conjunction, these two models enabled the rendering of a video in which it is possible to travel virtually through a concert hall, starting for example from the back of the room, then through to the “lounge” area, flying over the audience, the famous hourglass, then to the musicians and end up next to the drummer, the guitarist, all whilst enjoying the sound impressions associated with the journey “as if you were there.” This reconstructive technology for room acoustics, along with the broadcast of an early concert from the MJF archive actually results in “the resurrection of the Casino Kursaal.” The installation featured George Benson’s award-winning hit “Give me the night” and Woodkid’s “Iron”, both recorded at the Montreux Jazz Festival 2013, but played back as a 3D audiovisual performance in the virtually reconstructed Montreux Casino of 1971, shortly before the whole complex burnt down to the ground during a concert by Frank Zappa and the Mothers of Invention /cite Acoustics Australia.



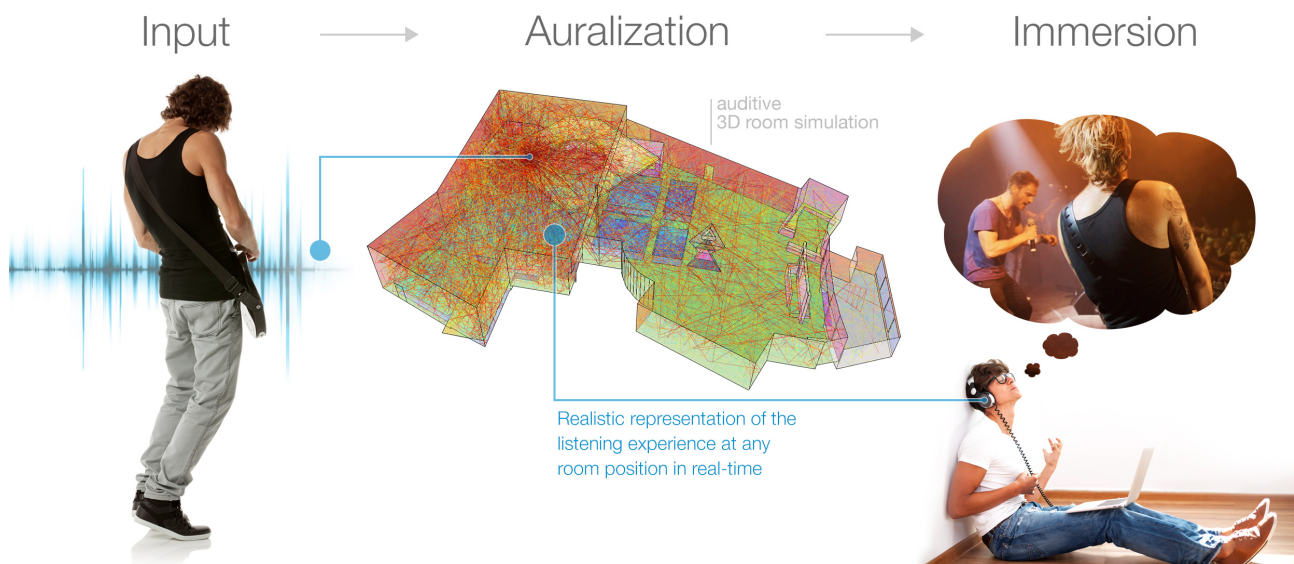
*Sketch-up for the 3D sound installation*



*Immersive experience presented at the MJF 2014 edition:  
Public attending the 3D Sound experience, discovering a concert from the backstage*



The technology is now further developed by the new company “audioborn”. With its software “Auratorium” the German company has developed a cutting edge real-time 3D audio processor for Real-time Room Acoustics Simulation, Music Production & Sound Engineering and Virtual Reality Applications. Originally designed as a high-performance and top-accurate simulation engine in serious applications such as the room acoustical design of concert halls, Auratorium features – as the only one in its class – a physics-based ray tracing simulation without any simplifications. In particular, the real-time simulation core supports all relevant wave effects including interference, absorption, diffraction, scattering and sound transmission thereby reconstructing a physically accurate and naturally sounding room acoustics. As depicted in the figure below, the result is a realistic and immersive auralization of virtual environments, finally opening up a multitude of new applications such as the authentic audio production for VR movies and 360° videos and the creation of spatial audio mixes including 3D reverberation.



*Principle of auralization: audio signals are fed to the simulation core, which computes in real-time the sound propagation inside the current room design. The result is an authentic 3D audio auralization of the initial audio input, which sounds like being played back in the virtual room.*

The technology behind Auratorium provides true 3D sound over standard headphones or renders the same mix for arbitrary loudspeaker layouts up to 64 Channels, including standard 5.1, 7.1 up to 22.2 layouts. Real-time rendering can be set to Vector-Base Amplitude Panning and Higher-Order Ambisonics seamlessly.

By enhancing typical CAD programs with real 3D sound including the accurate sound reflections inside the building, architects are now - for the first time - able to listen to and account for the acoustics of their room construction during the modeling process. This way, it is easy to identify frequently encountered room acoustics design failures and re-balance the focus between visual and acoustic appearance - both known to be of equal importance in human perception. In addition, sound designers and sound engineers can use Auratorium directly within their audio workstation and add authentic room acoustics to their mixes. With the recently emerging field of Virtual Reality applications and immersive audio in general, a high demand raises for realistic sound generation and reproduction. Here, a physics-based room simulation is the only way to deliver the most realistic auditive stimuli for the audience, and now, with the interactive real-time technology inside Auratorium, this is finally being available for many applications.

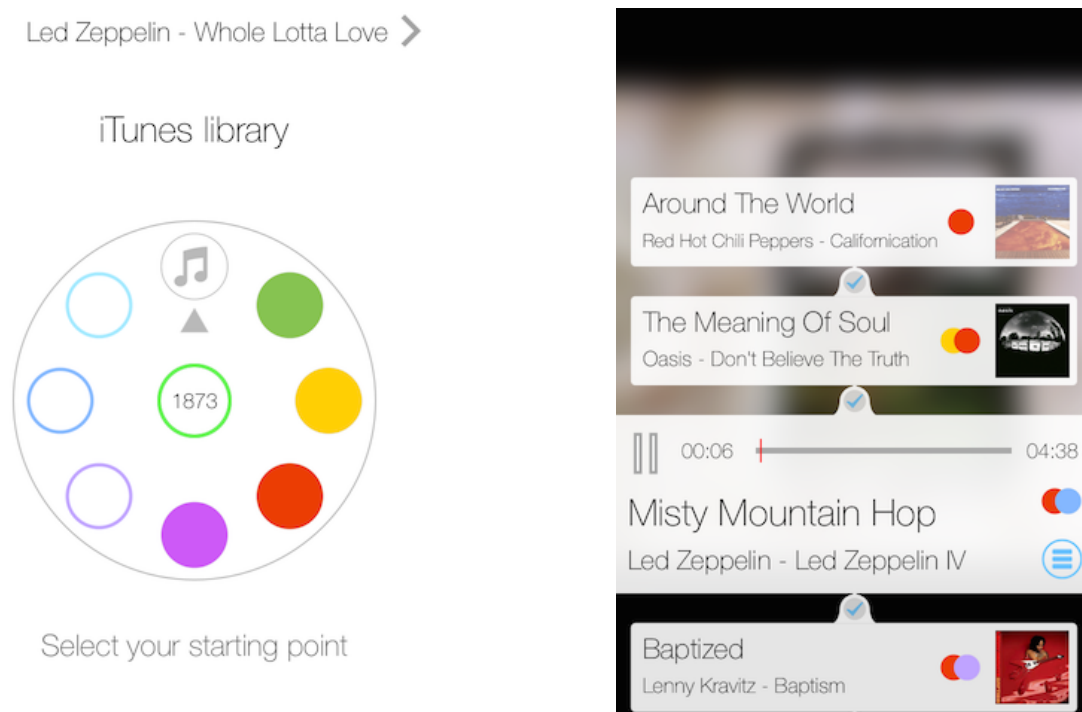
For the future of the "Montreux Jazz Digital Project", Auratorium will be used for creating interactive acoustic spaces that offer a unique, personalized and immersive content experience of the archive. The virtual reconstruction of the different Montreux Halls (Kursaal Casino, Auditorium Stravinski, Montreux Jazz Club for example), that will be presented at EPFL in the second version of the Montreux Jazz Heritage Lab, is a good example to demonstrate how the technique of physics-based auralization has become mature enough to turn over traditional workflows in architectural design and 3D audio production.

Physics-based auralization techniques are expected to find frequent use in future, especially in immersive applications such as Virtual Reality. This new approach allows to exclude most technical sound engineering tasks such that more focus can be given on the artistic component of the room model. At the same time an outstanding sound quality is provided through the realistic reconstruction of the virtual sound field.

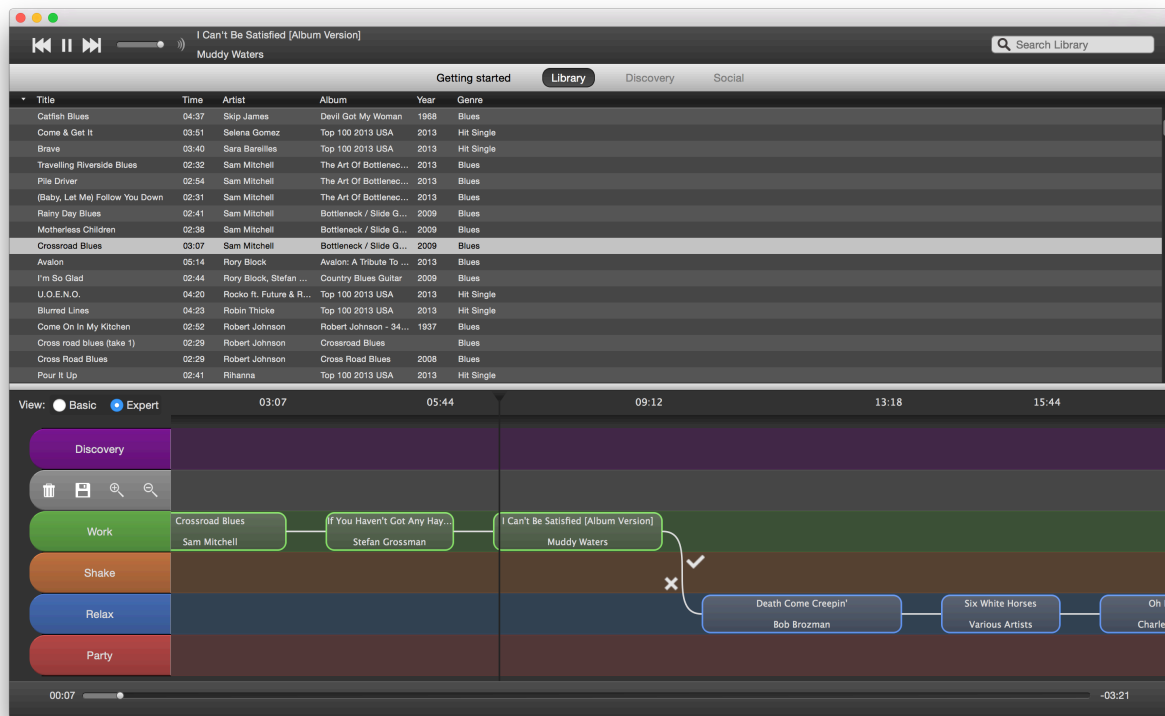
## Genezik

Genezik is a music recommendation engine and automatic generator of smart playlists for "musical journeys".

It is able to extract a large number of significant parameters from the audio signal and thus establish a measure of similarity between songs. Similarity graphs can then be used to build playlists for which the following songs are similar to each other in terms of psychoacoustic perception. The user can choose the general atmospheres (moods) or specific ones (jogging, relax, work, etc.) and improve the playlist generator by rating the software recommendations (I like/I do not like). The graph being common to all users, recommendations can be made, giving the user the opportunity to discover new music in their genre of choice.



*Screenshost of Genezik application for the iPhone*



*Screenshot of Genezik application for the Mac*

The development of Genezik was financed by the MMC and started in 2012 at EPFL's Signal Processing Laboratory (LTS2). The application was released in 2015 on the appstore and is compatible with Mac platforms and the iPhone. Genezik was built into the iPad discovery application for the MJF archive, which enables the automatic creation of playlists reuniting all artists from the Montreux Jazz Festival.

Other projects are being now defined to try and automatically identify musical styles from the audio signal, and develop new data visualization schemes to better analyze or navigate into the musical data.

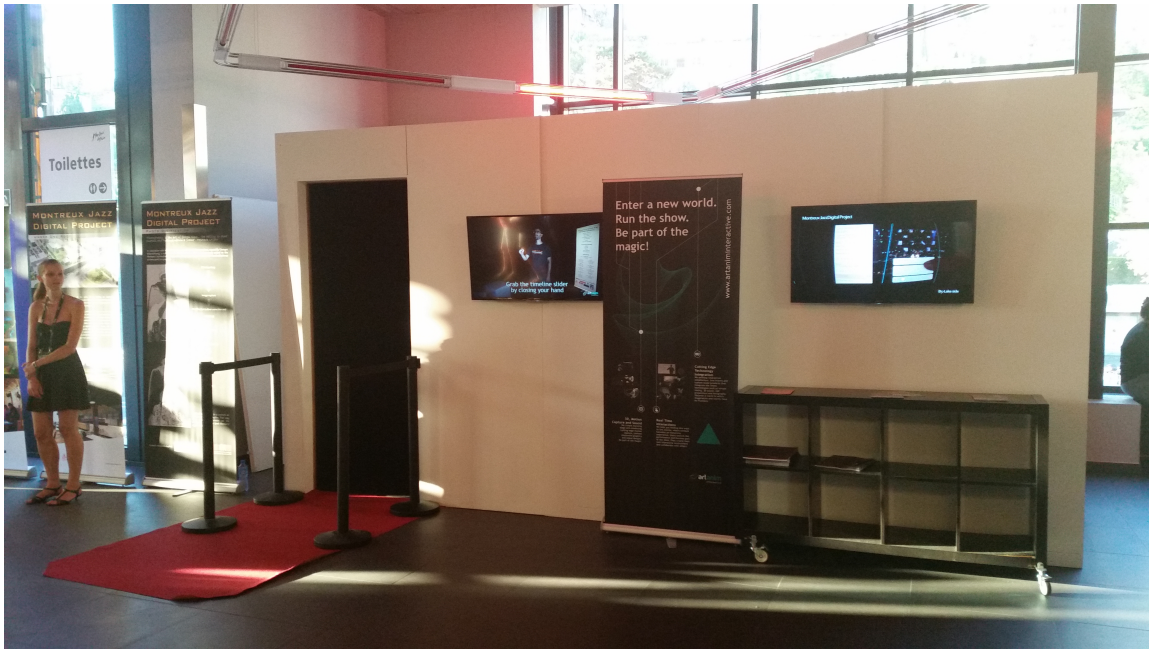
A project dedicated to more advanced song analysis is targeted in the coming times, trying to automatically identify and index detailed structures into concerts and pieces of music.

## The Montreux Jazz Video Jukebox

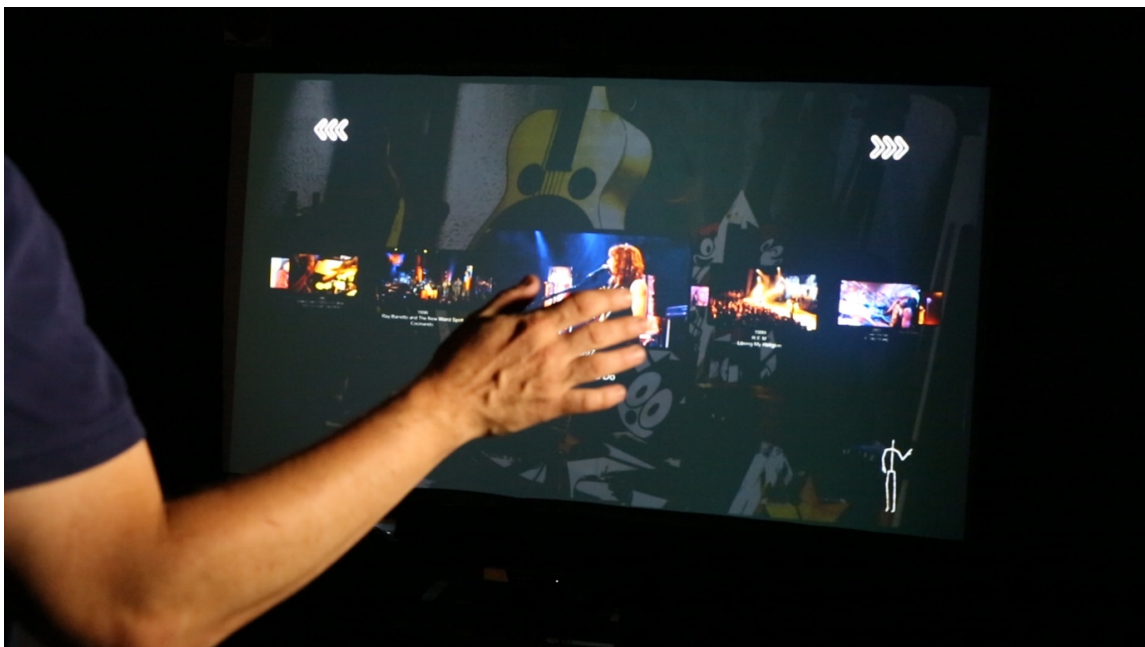
The "Montreux Jazz Video Jukebox" was purposely developed by Artanim Interactive (AI) for exhibition during the 49<sup>th</sup> edition of the Montreux Jazz Festival in 2015. The aim of the technology was to provide a touchless innovative way to navigate through a collection of video footage from the archive. The technology underlying the video jukebox was developed with two goals in mind:

- Firstly, the ease of use and "in the air" navigation of an interface by users without any hardware controller. A motion capture technology using a Microsoft Kinect 2 camera was purposely developed for the interface, allowing users to scroll through the video catalogue, navigate videos and other features using motion capture and gesture recognition.
- Secondly, a special focus was given to the sound quality for both sound designs and the audio part of the video footage. The audio signal was up-mixed in real time using Illusonic Audio Processors (IAPs) and broadcast on a 5.1 system provided by PSI Audio.

The system used AI's Motion Controlled Interactive Display (MCID) developed for products such as interactive installations, showcases and audiovisual archive navigation. MCID innovative approach combines motion capture and gesture recognition to naturally navigate through complex content layers. Users don't need to touch screens or other devices to access and manipulate content; everything is done in the air. The technology can be installed anywhere and is also multi-user. A distinct advantage of MCID is that it can be deployed very quickly and reliably.



*The entrance of the Montreux Jazz Video Jukebox in the Montreux Jazz Festival venue in 2015*



*Jukebox in use during the 49th edition of the Montreux Jazz Festival*

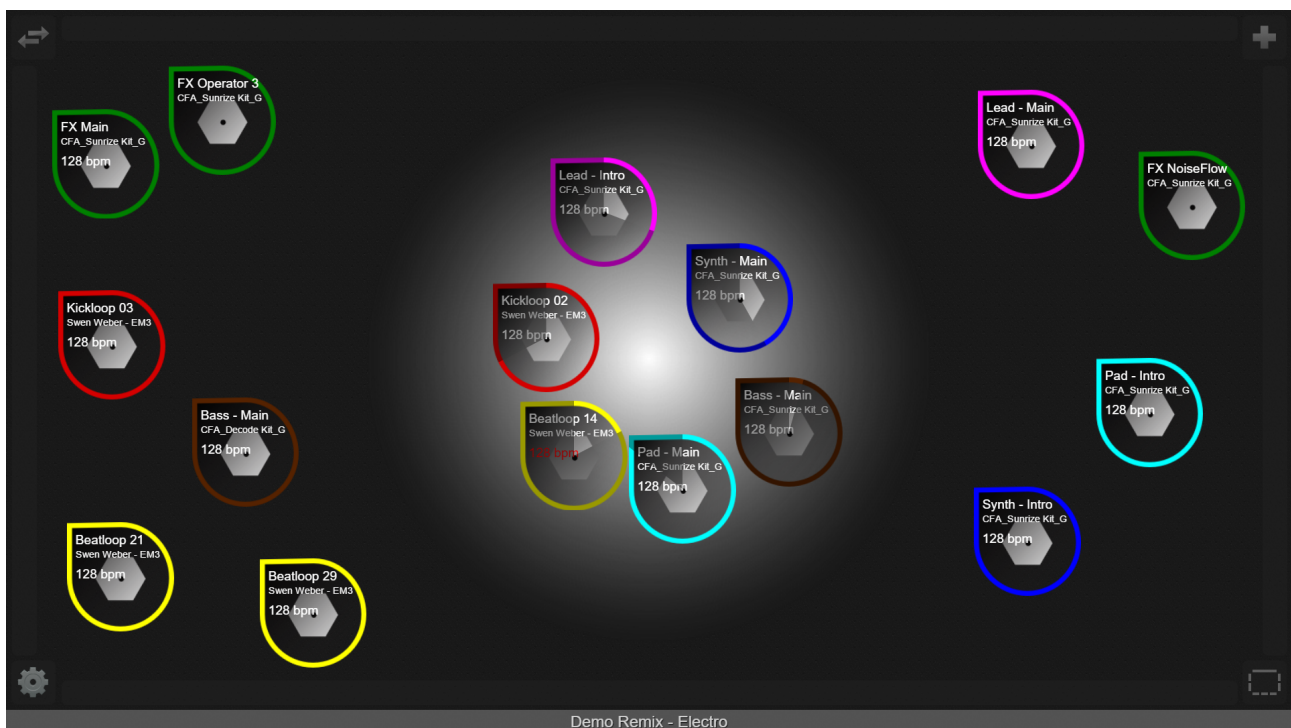
## **Remix The Archive**

In order to try and valorize the multi-track recordings of the archive, the Metamedia Center works in partnership with the company Future-Instruments, which is installed in the Innovation Park of EPFL. Future



Instruments has created a visual, collaborative, and interactive web-based environment which allows representing any kind of information (notes, documents, images, videos) as a virtual object that can be moved intuitively on a tactile screen, just like physical objects. Kinaps, this multi-platform environment, is compatible with mobile devices or fixed installations equipped with tactile screens. In the collaborative context, the objects can be exchanged from one device to another by a simple dragging movement, giving the feeling of continuous trajectories between screens. In another mode, participants can collaborate around a shared tactile surface, everyone's interactions being synchronized in real-time on all connected devices.

By defining new audio objects with special parameters, this project provides a funny way to visually mix the instruments of a concert, each instrument becoming an object in the interface, which volume (or other figures) can be changed in a tactile way. In addition, and when working with series of prepared audio loops or "bricks", the environment becomes a creative interface to compose new versions of music pieces. The tool can be made available to non-musicians thanks to the automatic synchronization capabilities programmed across the audio objects.



*The collaborative environment of the Remix-The-Archive project: each instrument is represented as an object on the touch interface, that can be dragged on the surface, increasing level when getting near to the center of the screen.*

In the future, new parameters can be associated to the audio objects, for example to control 3D positioning of the instruments in the volume of a listening room equipped with Ambisonics or Wave Field Synthesis sound reproduction (3D audio). Experiences like re-creation of a particular concert stage configuration can be imagined, or even moving the instruments in space in real-time to provide an instrument mixing tool in 3D !

The first phase of the project was performed in 2015, the 3D extension is planned for Q1-Q2 in 2016.

## Montreux Jazz Heritage Lab, V2.0

The new version of the Montreux Jazz Heritage Lab to be opened in Fall 2016 in the Montreux Jazz Café @ EPFL is in development at the EPFL+ECAL Lab. As a partnership between EPFL+ECAL Lab (design), ALICE (architecture) and MMC (sound, database and media), it also integrates the companies Audioborn for the (acoustics and 3D audio design), PSI-Audio (for the speakers), and Illusonic (for channel upmix processes).

During the 49<sup>th</sup> edition of the Montreux Jazz Festival, after one year of work, the prototype elements were presented to invited people and specialists in Montreux, in order to show and validate the innovation solutions for video display, 3D audio rendering, and database navigation interfaces. A 1:4 scaled version of the future platform gave a good idea of this immersive experience to be proposed in 2016 at EPFL.

In particular, and considering the contribution of the Metamedia Center, the quality of the audio reproduction met great success. Designed by our partner Audioborn as an evolution of the **Casino Kursaal Revival** project launched by MMC and LCAV Lab in 2014, the sound installation will offer the possibility of selecting the acoustics of the desired festival venue, for playing any concert from the archive!



*Views of the 1:4 scaled prototype for the Montreux Jazz Heritage Lab, as shown to a selected public in the Rotary room of the Montreux-Palace during the Montreux Jazz Festival in 2015.*

Lots of activities will be performed in Q1-Q2 2016, in order to complete the work for the opening in Fall. Next to the design and construction tasks progressing at the EPFL+ECAL Lab, the Metamedia Center is working hard to transcode the media of the archive to the proper Heritage formats, to clean and update the database with new musical metadata (styles or danceability for example, including lots of visualizations developed at the LTS2). All this information will result in better search and navigation possibilities.



In particular, several students were hired to identify text and pictures information, with the objective of adding geographical or historical elements to the archive experience and gather all the stories and souvenirs around the festival, from its creation to the recent years.



*Views of the prototype database navigation tool, as disposed in the 3D sound system space in the Palace*

## Future Projects

The Metamedia Centre oversees the following projects for 2016-2017 and the following years:

1. End of the digitization work for the master tapes of the Montreux Jazz Festival archive (DAT, HD video, Philips VCR), beginning for newly identified tapes (non-masters, secondary venues, private collections, RTS tapes, interviews and TV programs).
2. End of the digitization of Georges Braunschweig's pictures, tagging for 140'000 digitized pictures. Possibly, inclusion of other photographers' collections.
3. Continued development and enrichment of tools for archive consultation: database, metadata clean-up, infrastructure for media transcoding and streaming, web portal and iPad app for archive navigation, new version of the Montreux Jazz Heritage Lab, all this in the perspective of the public archive access in the Montreux Jazz Café @ EPFL.
4. Capture, ingestion, and storage (including the whole data analysis and enrichment process) for the new festival archives, use of new technologies from EPFL and partners (like 4k, uncompressed, 3D, or 360-degrees recording).
5. Innovation projects for valorization of both the archive and the EPFL innovation technologies (remix-the-archive with 3D audio rendering, audio or video defect detection and corrections (in-painting), super-resolution for SD to HD or SD to 4k format conversion, ...).
6. Analysis and indexing of the concert files via a metadata enrichment program (music and content) to provide improved search tools and data visualizations.
7. Development of a second database storing the massive amounts of data associated to signal processing actions on the medias (like short-term feature extraction in the audio/video signals). This new development planned in 2017 will serve the numerous projects planned with the signal processing labs or the future Digital Humanities Institute of EPFL.
8. Development of the collaborations presently under definition with IRCAM, Berklee College of Music, INA, IDIAP and many other institutions, for archive enrichment or valorization through participative and creative musical experiences (see section below)
9. Setup and development of the infrastructures required to sustain the archive and guarantee its access on the long-term. In particular, the tape supports of the digital archive (LTO) will need to be annually checked and controlled in the future. A robot will be acquired in this goal, to be installed and set in production at the beginning of 2017.
10. Documentation and quality assessment of the digitization work. A trainee from INA will be welcomed in March 2016 in this goal. Assess
11. ment will be based on ISO archiving standards.

## Innovation Projects for Valorization of the Archive And New Technologies

New ideas for interactive media-related user experiences have appeared after the development of the Remix-The-Archive platform presented at the Montreux Jazz Festival in 2015. They will take the form of operational or research projects in collaboration with partners such as the IRCAM or the Berklee College of Music in Boston, and could be organized as special events occurring in the Montreux Jazz Café @ EPFL:

- Project "Steal The Show" (brand MJF created by the Montreux Jazz Artists Foundation in 2014 !). This is the idea of a musical karaoke, which aims to give new musicians the opportunity to play their favorite instrument and superimpose it onto the original recording (audio + video) by integrating it with all the other musicians in the concert. This experience requires the preparation



of media for isolation, the removal and even regrouping of certain instruments in the concert. Such an event was presented at the Jazz day in the Swiss Culture Center in Paris in 2014, it will happen again in 2016.

- Project “3D Steal The Show” an immersive version with 3D sound and video (ISO cams): same experience as the one proposed above but set up within a 3D sound environment. The idea is that the musician can actually “feel” the presence of other instruments playing on stage. In the context of an event, a concert in the archive could be re-created with the ISO cameras to include images from the side of the original concert hall to make the event more immersive.
- Project “Mix Your own track”: This installation is for 10-20 people standing in a 3D sound system with each person given the opportunity to control an instrument from a concert with their smartphone to regulate the diffusion of that sound (location, volume, effects) within the space. In discussion with IRCAM, the project would require the development of an application for smartphone or tablet.
- “OMAX” (brand IRCAM): The OMAX system developed at IRCAM offers an artist the chance to communicate musically with sounds from a computer. This is a new type of jam session in which the computer gradually builds a model of the musician’s improvisation over time and is continuously updated to form a fluid dialogue between computer and musician. It can also include in the dialogue models from other sessions with different musicians to bring a richness and originality much appreciated by musicians, and which works especially well with Jazz. The MMC will soon collaborate with IRCAM as part of a French research project and discussions are under way to participate in a European project. A demonstration of OMAX technologies to enhance archive technology is in progress for the 2015 MJF edition.

## Metadata Enrichment Program

Annotation is essential when it comes to create a living archive. It brings efficient possibilities to search and access specific parts of the media collection, in particular if advanced specific studies are required.

For the Montreux Jazz digital archive, public access to the recordings, valorization through new immersive platforms and tools, studies by engineers, sociologists, musicians or musicologists, future editing, mastering or enhancement need an important effort to annotate or automatically enrich the collection in advanced metadata. This represents a long and intensive work, which will bring larger value and visibility to the archive, in particular in research and education institutions. This section briefly presents the main articulations of the identified program, which started in 2015 and should go on within the coming years for the main components:

Priority Program:

- Automatic creation of song thumbnails
- Instrument solo detection (bass, drums, piano, ...)
- Automatic recognition of instruments resulting in start/end markers into the concert timeline
- Automatic lyrics recognition and import in the database
- Detailed indexing of the song structures (intro, repetitions, ...)
- Automatic mood, genre, or emotion detection

- Automatic music information retrieval (rhythm, harmony, ...)
- Audio event detection (applause, speech, cut, feedback, ...)
- Automatic generation of notes
- Automatic instrument separation from stereo tracks (karaoke)
- Automatic tracking, recognition, and indexing of the singer or musicians faces from the video
- Automatic tracking, recognition, and indexing of instruments viewed in the video (guitar, sax, drums, ...)
- Video tagging (manual and automated)
- ...

## Archive Sustainability

An archive must be able to evolve with changes in technology in order to avoid obsolescence. The storage system on digital LTO tapes has a lifespan of over 30 years, this period is much lower for hard-disk storage. Unfortunately, there is no eternal solution and the longer a technology migration is put on hold, the higher the cost and risk of losing valuable information. In addition, when equipment reaches its expiration date and is no longer supported by its manufacturers, finding spare parts and knowledgeable technicians that can repair the technology is a challenge. Precautionary measures must be put in place so this problem does not occur in ten years, when the size of the archive will become even more significant.

By creating a hybrid archival system with both digital tapes and hard-disk drives, EPFL has already taken a step forward to establish an optimal and scalable video storage infrastructure. Over the next two years, the MMC will address sustainability issues to carefully assess the following challenges for the preservation of the archive on the long-term:

- Regular integrity checks of LTO tapes
- Migration of LTO media to new generations (LTO4 are transferred to LTO6 in 2016 / 2017)
- Study of audio/video formats for modern use
- Minimized operating costs and technology costs
- Storage of new content and increased storage capacity of hard-disks
- Rapid adaptation to archive technology shifts

A fundraising effort dedicated to sustaining the archive is on-going.

## Human Resources

The MMC team is lead by Adrienne Corboud (director). As part of VPIV, it employs 12 other persons:

- one operation and development director (100%)
- one project coordinator for digitization and IT equipments (100%)
- one database programmer (100%)
- one software developer (100%)
- one audio/video technician (70%)
- one documentalist (70%)
- two operators for video acquisition, quality control, and indexing tasks (2x 60%)
- two archivist students for picture acquisition and tagging (2x 40%),
- one IT trainee (100%)
- two administrative assistants (20%).

This represents the equivalent of about 9 full-time employees. To this must be added collaboration with 5 EPFL students working 20% each (indexing and quality control), partnerships with about 10 EPFL labs, two external partners for innovation projects, three partners for digitization and storage and the help from the Claude Nobs Foundation.

## Metamedia Center – Perspectives

With the progressive end of the digitization actions, 2016 and 2017 will see the sustain mode of the Montreux Jazz Digital Project start, in overlap with the opening of the Montreux Jazz Café @ EPFL, the final phases of the archiving project, and the increasing number of valorization actions launched by interested partners. A brainstorming was started at EPFL, to position the Metamedia Center at best in the perspective of:

- its operational competences in archiving technologies (processes and tools, databases, storage),
- the research and valorization actions it brings to EPFL labs and VPIV (for innovation and technology transfer),
- its role in the emerging digital humanities institute,
- and thinking about the RTS arriving on campus, involving setup of many archive-related projects.

Using audio-visual archives to valorize research from EPFL labs, or in the other way, exploiting the competences of EPFL labs to valorize those archives, it appears in both cases that the idea of positioning the Metamedia Center as a tool to fill the gap between research results and ready-for-use prototypes or large-scale exploitable solutions is working well. From the Montreux Jazz Digital Project, the Metamedia Center has acquired adequate and specific competences in archiving operations, databases or software development, which appears of great value in the perspective of valorizing new digital humanities actions, or to turn research projects linked to archives (such as the RTS one) into exploitable solutions.

Lots of new innovation projects are in definition at EPFL in the frame of the Montreux Jazz Digital Project. Valorization actions are on the way with our new partners IRCAM, Berklee, and INA. Several funding requests in big data were written, to develop a new type of secure IT media processing platform (with IDIAP), or to build a novel database structure and valorization platform for the Swiss Musicians Association.

New structures should be defined as soon as possible in 2016, in order to keep the Metamedia Center team in a safe environment and not lose the competences acquired for the next sustain steps. From the MMC experience, and also taking into account the criteria that ensure a good funding success in archiving projects, it is very important to keep the operational and valorization actions in a same view. Addressing topics in a transversal and practical way from a competence center like the MMC helps to efficiently drive and exploit the outcomes of the valorization projects defined in collaborations with EPFL labs or academic partners, for the benefit of the archive itself, the developed valorization platforms, and also for the subsequent technology transfers.

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We are at your disposal for further information. THANK YOU for your support, trust and confidence!

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