



## ACOUSTIC RESEARCH INSTITUTE VIENNA

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### COMPACT 3D AUDIO RESEARCH LAB

The renowned Acoustic Research Institute in Vienna relies on **four high-class, MADI equipped sonible d:24** power amplifiers and a tailor made **91-channel hemispherical loudspeaker array** to recreate auditory scenarios for psychoacoustic research.

# PROJECT INFORMATION

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Location: **Vienna, Austria**

Venue: **Acoustic Research Institute (ARI),  
Austrian Academy of Sciences (ÖAW)**

Participants: **sonible, ARI**

Date: **06/2017**

In June 2017 a 3D audio system, including four **d:24 MADI amplifiers** and a tailor made **hemispherical rig equipped with 91 loudspeakers**, was installed at the **Acoustic Research Institute (ARI)** in Vienna.

ARI is part of the Austrian Academy of Science (ÖAW) – a non-university research and science institution. The institute conducts application-oriented fundamental research. According to **Piotr Majdak**, Vice Director of ARI, “Everything we’re researching here needs ten to twenty years before it arrives at the consumer.” The team of researchers currently focuses on topics such as the localization of sound sources with cochlea implants, noise attenuation for traffic, phonetic acoustics of regional dialects and the improvement of audio perceptual coding strategies.





# CONCEPT

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## Challenge

One of the purposes of the 3D audio system is the **research of human spatial and directional hearing**. With the ambition to explore the perceptual limits of auditory perception, the system has to produce unambiguous acoustic stimuli with a very high directional resolution. Due to the spatial restrictions of the laboratory room, the speaker array itself has to be **very compact** and easy to install. As the system is used for different research applications inside and outside the lab, it also needs to be **mobile and scalable**.

Throughout the system, a **high signal to noise ratio (SNR)** and a **low total harmonic distortion (THD)** are also crucial requirements. At the same time, high sound pressure levels (SPL) are needed for experimental setups involving hearing impaired listeners. Considering the large number of speakers directed at one single test subject within the array, safety is also an important issue.

## Solution

To meet the ARI's demanding specifications, sonible designed a tailored **hemispherical rig** accommodating **91 coaxial speakers**. Optimal loudspeaker mounting positions were determined based on acoustical simulations and CAD modelling.

Despite the power of **250W per channel**, an exceptionally **high SNR**, and **low THD**, all four amps together only occupy 12 RU within a standard rack. Given these specifications, all the requirements defined by ARI were not only met but surpassed.



The amplifier solutions  
by sonible are  
really unique and  
a perfect match  
for our requirements.

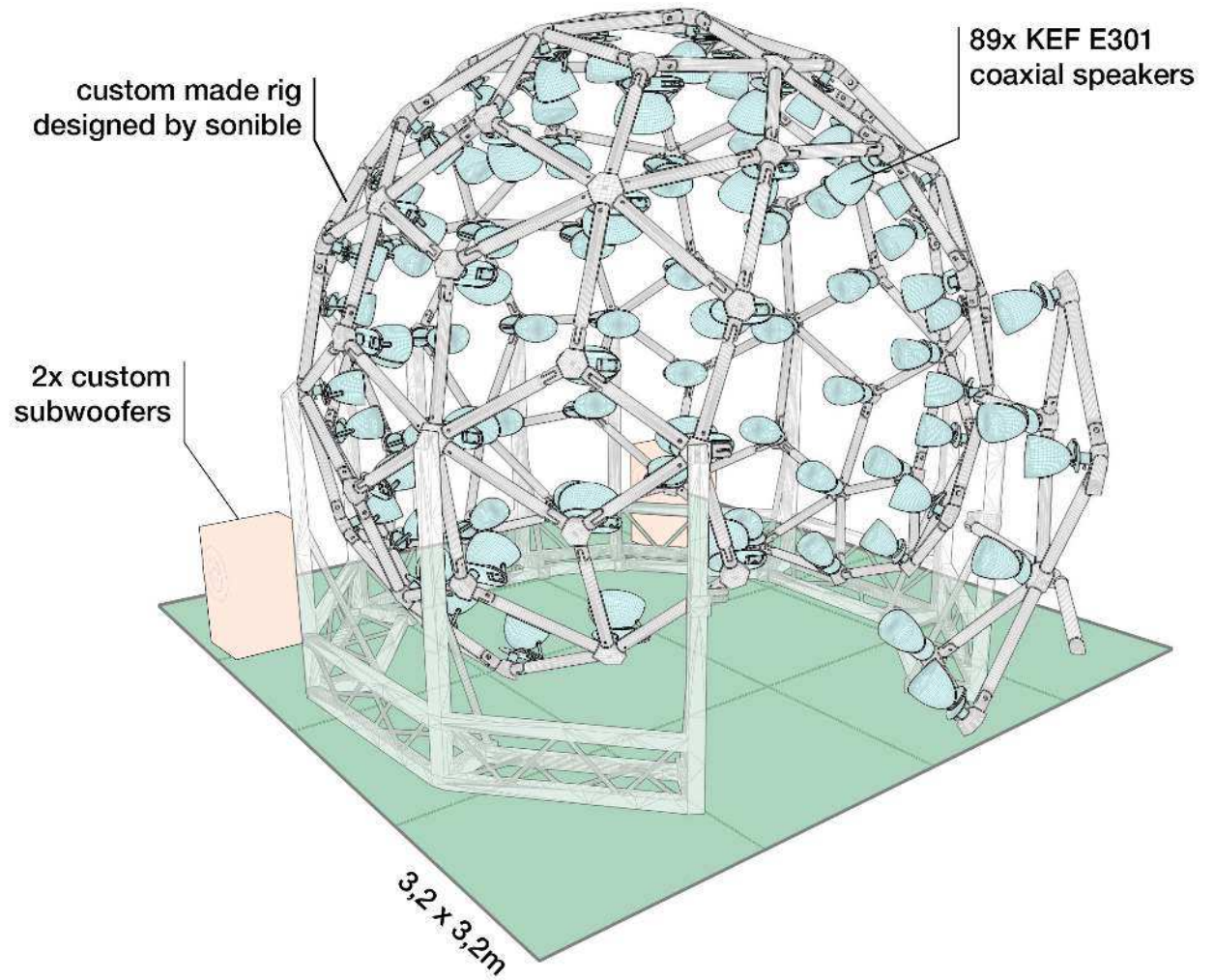
Dr. Piotr Majdak,  
Vice Director of the Acoustic Research Institute



# SYSTEM DESIGN

## Specifications

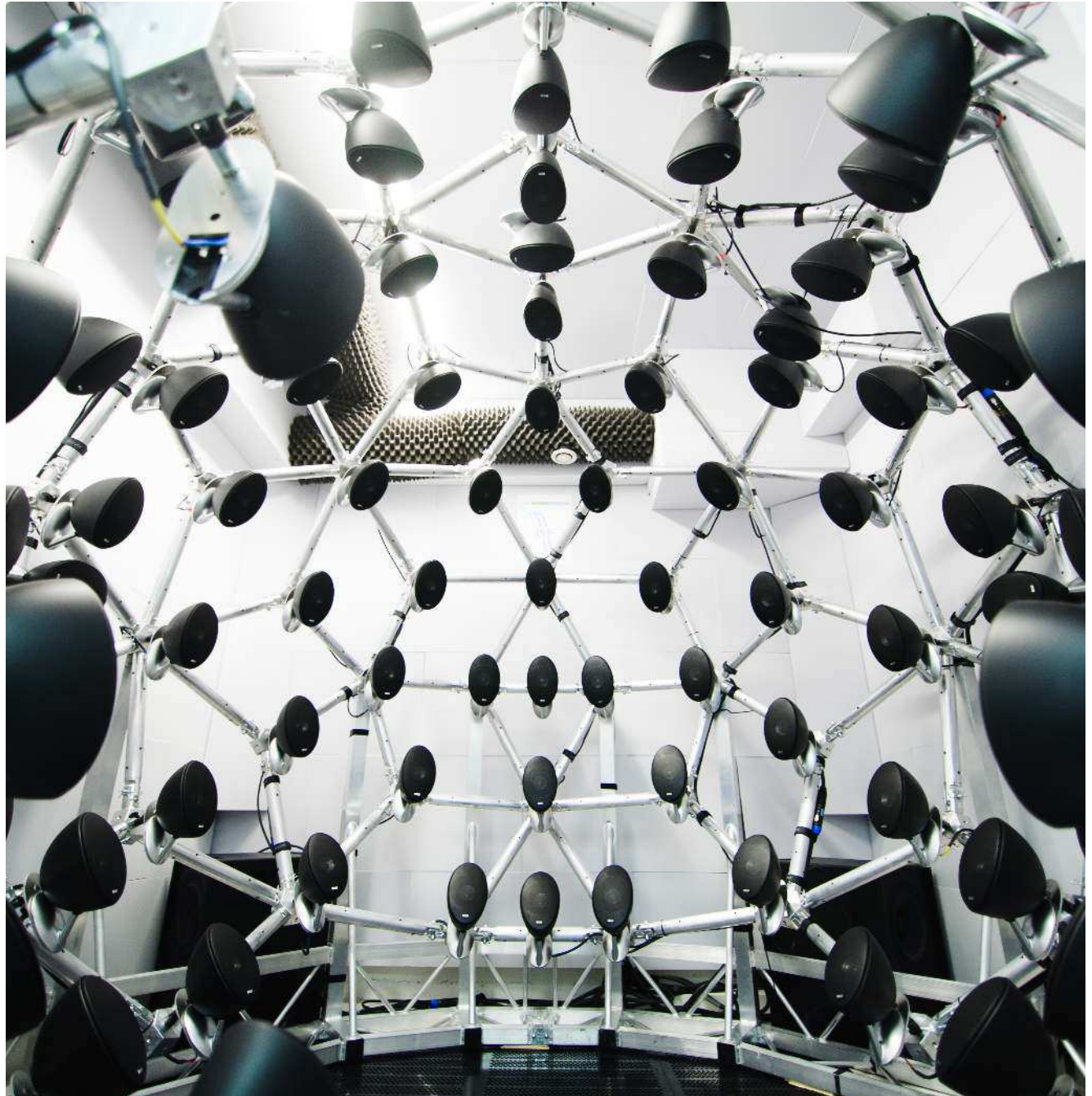
- Room: 3,2 m by 3,2 m
- 4x sonible d:24mio MADI amplifiers
- 2x custom made subwoofers by sonible
- custom hemispherical rig by sonible
- 89x coaxial speakers by KEF



The 3D Audio system at ARI Vienna consists of a three-quarter hemispherical speaker array with an approximate radius of 1.4 m located inside a 3.2 m by 3.2 m room.

KEF E301 speakers were selected for the main speaker system, as coaxial technology can approximate point sources as closely as possible. This is not only ideal for working with **Higher Order Ambisonics** (HOA) and **Vector Based Amplitude Panning** (VBAP), but also guarantees a large sweet spot at the centre of the system where the test subject is placed.

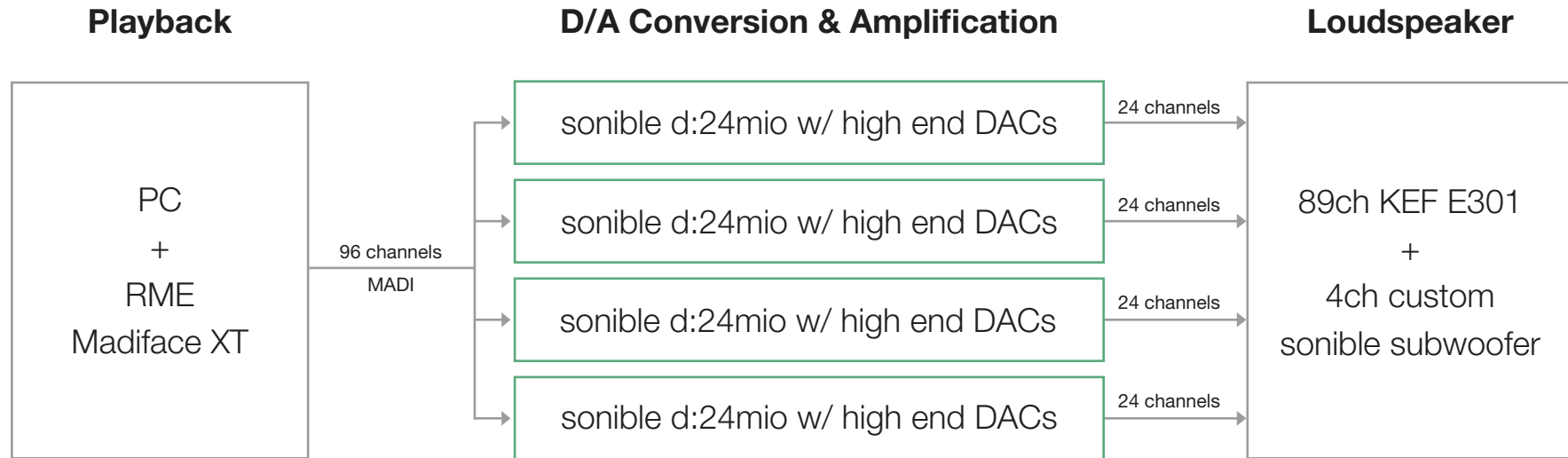
The compact and flexible design of the system allows two engineers to install the entire system within 8 to 10 hours.



The four d:24 MADI amps powering the system are not only used to drive all 91 speakers installed on the hemispherical rig, but also operate two custom made subwoofers by sonible.

Features like the **remote control** of the amps and the **integrated emergency shut down** helped to ensure highest safety standards for the 3D audio system.

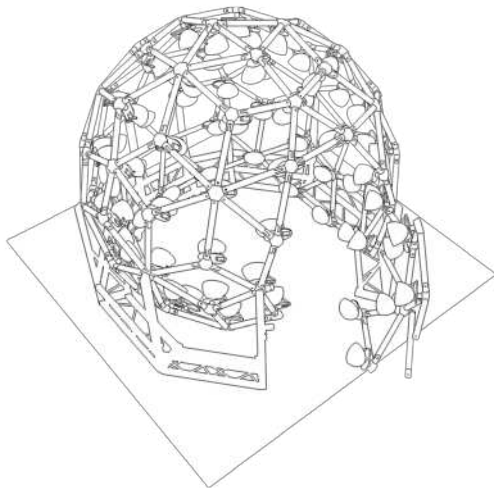
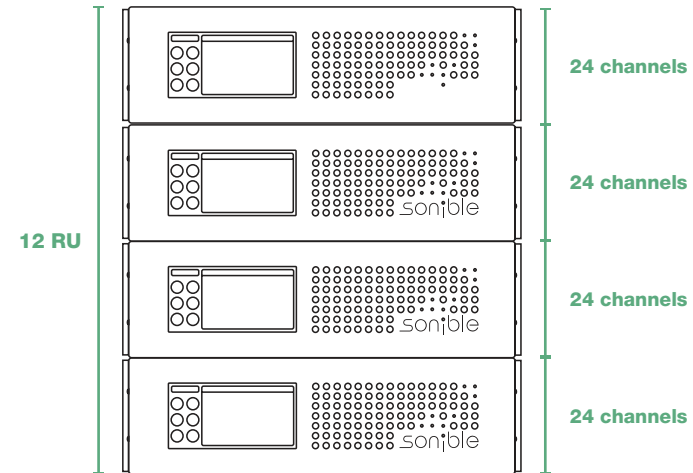
### SIGNAL FLOW CHART





# BENEFITS

- ✔ 96 channels each providing 250W covering only 12 RU of rack space
- ✔ high-end amplification with SNR > 110 dB per channel
- ✔ hardware based emergency shut down to ensure highest safety standards



- ✔ custom made hemispherical rig with flexible mounting positions for speakers
- ✔ system layout optimized to offer perfect sound field synthesis using HOA or VBAP
- ✔ high mobility – the installation of the entire system requires less than 20 man hours



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