A CONCERT HALL WITHOUT ARTISTIC LIMITS – THE BERGSON APPROACH

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1 INTRODUCTION

With the Bergson Kunstkraftwerk, a new, multifaceted arts and culture venue covering an area of approx. 20,000 m^2 has emerged in Munich for which a heritage-listed industrial ruin was revitalized and expanded with new buildings. This in itself is certainly not unusual. What is special is that it is a purely privately funded project, that the arts and cultural centre is located in a rather unattractive commercial area on the outskirts of Munich, and even more so that the types of events and possibilities offered there are anything but conventional and proven concepts, with new things being constantly experienced and discovered. As the first year since its completion in October 2024 has shown, Bergson's motto "Cultural Gravity," attracts many visitors of all ages and interests, and this unconventional and refreshing approach to culture is gaining attention not only in Munich and the surrounding area, but throughout Germany. Initiating and continually developing such a project requires visionaries and creative minds, but it also requires the physical space and technology to provide space and sound for limitless ideas. In Bergson Kunstkraftwerk there are several such spaces, but the highlight, besides the enormous atrium, is a concert hall with a capacity of almost 500 people, which the operators promote as "the most intelligent concert hall in Europe."

This paper does not only address the acoustical concept of the space and the implementation of the electronic audio and room enhancement devices. It also emphasizes how acoustic design and digital features influence the artistic possibilities and how the overall concept of the venue, which also contains a huge atrium in a former industrial hall, an arts' gallery, a cozy jazz club, a restaurant, and a beer garden, attracts new audiences.

2 THE STORY

Part of the Bergson Kunstkraftwerk is a former industrial hall, designed in the 1920s, whose construction began in 1937 but which was not completed until the 1950s. It was used as a heating plant by the German Federal Railway until the 1980s, after which it stood empty or was used for illegal techno raves and similar subcultural events. In 2005, Michael and Christian Amberger, owners of the family-run Munich-based mineral oil company Allguth, discovered and purchased the former heating plant. Over the years, several ideas for the use of the building, which was listed as a historical monument in 2007, emerged. In 2019, plans for a new arts and culture centre, based on a design by Stenger2 Architekten, took concrete shape. This centre was initially intended to house a classical concert hall as the central performance venue. But when, after a planning break due to the coronavirus pandemic, a new artistic director, Roman Sladek, bandleader of the worldwide performing Jazzrausch Bigband, took the stage in March 2022, a programmatically and acoustically exciting journey began for the client, the users, and the entire planning team.

Figure 1. Bergson Kunstkraftwerk in the suburbs of Munich. In the foreground, the former boiler hall of the heating plant; in the background, the new building with gallery spaces and event halls. © Bergson, Simon Haseneder.

The idea of a traditional classical chamber concert hall, which, while sounding great for well-known classical formats, can only ever be a compromise for jazz, rock, pop, and techno, was no longer convincing, and so the owners were persuaded to rethink the concept, especially the main hall, from scratch. This paved the way for the transition from a classical concert hall in oak veneer to a concert studio in matte black.

Starting with the partial opening of the restaurant and the atrium in the old boiler hall, a veritable opening marathon of the various areas – from the beer garden to the exhibition spaces of an arts' gallery – began in April 2024, culminating in the resounding inauguration of the new Elektra Tonquartier in October.

The Bergson Kunstkraftwerk is located on Bergsonstreet, named after the French philosopher and Nobel Prize winner Henri Bergson. Construction costs are not public but have been reported in the press as approx. 80 million €. Today, almost a year after its opening, the Bergson employs about 200 people.

3 THE VENUE

The aim and artistic specification for the usage concept was to make almost every corner of the building culturally usable – be it for gastronomy, music, or an exhibition – and so (almost) every room in the complex was acoustically planned in detail according to its purpose and further developed with architects and specialist planners. Some of them are addressed in the following.

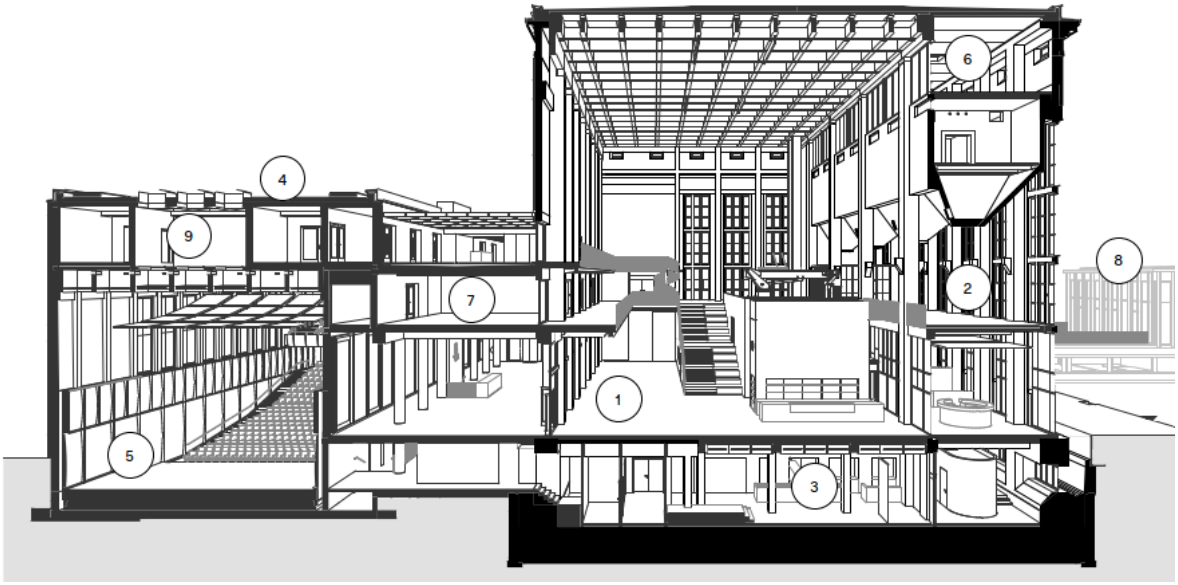

Figure 2. (1) Atrium in the former boiler hall with bel étage (2), max. 600 people
(3) Live-Club Barbastelle, 90 seated, 200 standing
(5) Elektra Tonquartier concert hall, 470 seats
(6) Salon
(4, 7 – 9) Further event rooms in the new building for 80 – 300 people
© Bergson.

3.1 Atrium

The former boiler hall with its impressive 25 m ceiling height received a new roof and new windows that meet historic preservation as well as sound and thermal insulation requirements. A fine-dining restaurant and a kitchen and service block were built in the hall, and a daytime bar was created in the atrium. Above, the Beletage was introduced as an additional, multifunctional area within the atrium.

Figure 3. The new atrium in the former boiler hall. © Bergson, Sebastian Reiter.

The acoustic concept was to maintain the authentic hall character in the atrium while simultaneously allowing the space to accommodate a variety of uses. With a net volume of 23,000 m³, a reverberation time of around 2 seconds was targeted. To achieve this, the entire ceiling between the coffered reinforced concrete structure was clad with broadband absorbers and the ceiling panels below the balcony were acoustically activated. Furthermore, the old masonry with mortar joints contributes to high-frequency absorption.

3.2 Live-Club Barbastelle

The Barbastelle Live-Club is located in the basement of the former boiler hall. In this room for 90 people seated (200 people standing) the goal was to achieve a rather dry acoustic environment without excessive bass and without high-energy early ceiling reflections with respect to amplified events. This was achieved through appropriate absorber structures in the ceiling and rear wall areas leading to broadband reverberation times of less than 0.7 seconds. The name of the Barbastelle Live-Club derives from the barbastelle bat which had its winter quarters in the basement of the boiler hall. During the renovation, a 70 m² refuge was created for the bats near the live-club, including a light-controlled flight path.

Figure 4. Live-Club Barbastelle. © Bergson.

3.3 Elektra Tonquartier

Despite the versatility of the entire building, the Elektra Tonquartier with its 470 seats forms the musical and technical heart of the Bergson. It is located in an elongated new building, which is connected to the former boiler room (atrium) via a spacious foyer area.

The original planning envisioned a shoebox-shaped chamber concert hall. The proportions of 30 m max. in length, up to 12.3 m in height, and 14.5 m in width were due to the limited width of the new building. With convexly curved and segmented wood panelling, a sound-reflecting coffered ceiling, inclined high-upholstered seating, and a room volume of almost 10 m³ per person, the initial goal was to create a transparent and engaging sound with a beautiful, homogeneous reverberation of around 1.7 seconds.

But later the room acoustics were to be designed so that the PA would provide a full sound for the orchestra in residence. Yet, classical music should also be able to take place in "perfect" acoustics, and the desire for 3D audio and immersive sound applications was soon apparent. However, unlike it was and still is common practice in so many other halls, the space should not be optimized for classical concerts and adapted to the requirements of sound reinforcement by means of curtains (retractable banners) or folding elements. The clearly formulated goal quickly emerged: to realize a concert studio with natural acoustics optimally tailored to the "techno-jazz" genre, and to introduce an electronic room acoustic system that electronically generates all other desired room acoustics.

Figure 5. Originally planned chamber music hall and finally realized concert studio Elektra Tonquartier. Visualizations © Stenger2 Architekten.

One might think that natural acoustics and its planning only play a minor role due to the existence of an electronic room acoustic system – the opposite is the case.

The objective was to achieve a sufficiently low reverberation time particularly in the bass range. At the same time, high-energy, sound-colouring early reflections had to be avoided. While sound-controlled events rely on electronic monitoring, a certain degree of natural spatial feedback for acoustic instruments was to be ensured for mutual hearing.

The room proportions were already set, the inclined fixed seating as well, this could not be adjusted anymore. Therefore, the above-mentioned objectives had to be achieved through the cladding design and materials. Thus, the wooden panelling in the lower area was tilted backwards and largely designed as broadband sound-absorbing (micro-perforated). The edges of the individual panels are unperforated and, in conjunction with the vertical and horizontal fins, ensure diffuse, low-energy early reflections. In the upper wall area, textile-covered wooden panels were subsequently installed, backed with insulation, and perforated in some areas. The high-upholstered seating with displacement air outlets is mounted on a raised hollow floor.

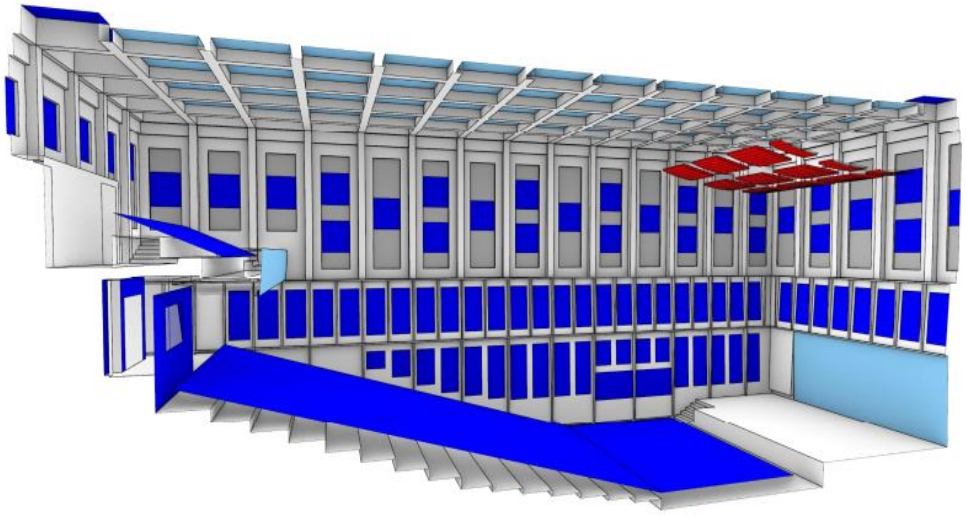

Figure 6. Acoustic model of the Elektra Tonquartier. The illustration shows the room acoustics' concept after the redesign. The dark blue surfaces are micro-perforated or perforated panel cladding, the latter with textile covering. The reflectors above the podium are planned to facilitate mutual hearing for acoustic instrumentation.

Broadband and low-frequency absorbers were suspended between the 1.2 m high ceiling joists. The absorption was estimated by a 1:5-scale model test.

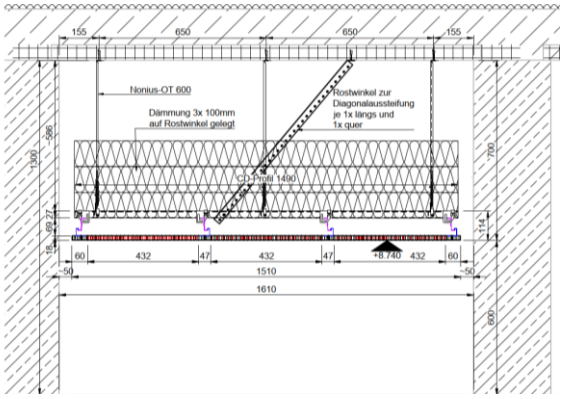

Figure 7. Left: Section through suspended ceiling panels with 300 mm insulation layer and textile-covered perforated or non-perforated panels and joints to the joists (chop drawing © Lindner SE). Right: Model structure of the ceiling, scale of 1:5.

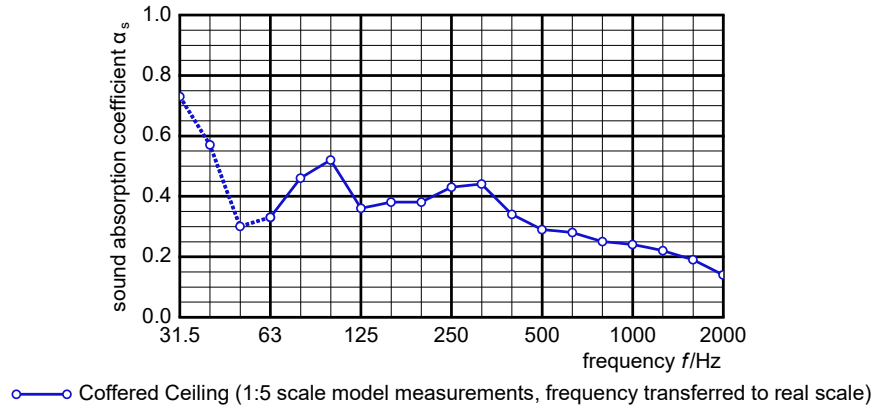

Figure 8. Sound absorption coefficient for the 1:5-scale ceiling model. Frequency transferred to real scale.

Right at the first sound check of the sound system, the Jazzrausch Bigband's sound engineers were impressed by the clear sound with rich bass. Acoustic measurements, with reverberation times of less than 0.9 seconds across the broadband spectrum, objectively underline this (see following diagram).

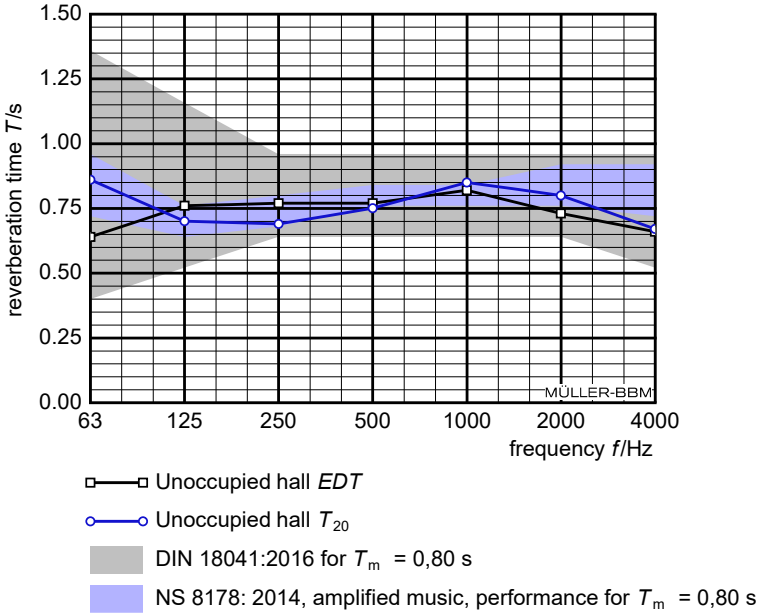

Figure 9. Reverberation time, measured in the unoccupied hall, tolerance range according to DIN 18041 and NS 8178.

4 INTEGRATION AND APPLICATION OF THE ACOUSTIC SYSTEM

With the decision to design the natural acoustics of the hall for very dry studio acoustics and to generate all other room acoustic conditions via an electronic room acoustic system which was also to provide full functionality in terms of 3D audio and immersive sound, the active sound system became most important. Despite more than 20 years of experience in dealing with and developing active acoustic systems, such a central role was a novelty for the authors. In most cases, such as in

theatres, opera houses or smaller multi-purpose halls, electronic room acoustic systems are used to expand the range of uses by extending the reverberation time or to compensate for or “repair” acoustic deficits. Often the existence and use of an electronic room enhancement system is kept secret from the audience.

In Bergson's case, however, the system forms the basis for the event-specific design of almost all acoustic target parameters and is therefore responsible for the room acoustic quality in certainly more than 90 % of events. For this reason, no compromises were made in the selection of system components and their integration into the hall. The latter particularly concerned the positioning of the loudspeakers and microphones which is essential for the optimal functioning of the system. At the client's request, the technically advantageous, openly visible installation of all 84 loudspeakers was intended to emphasize the already technical character of the concert studio.

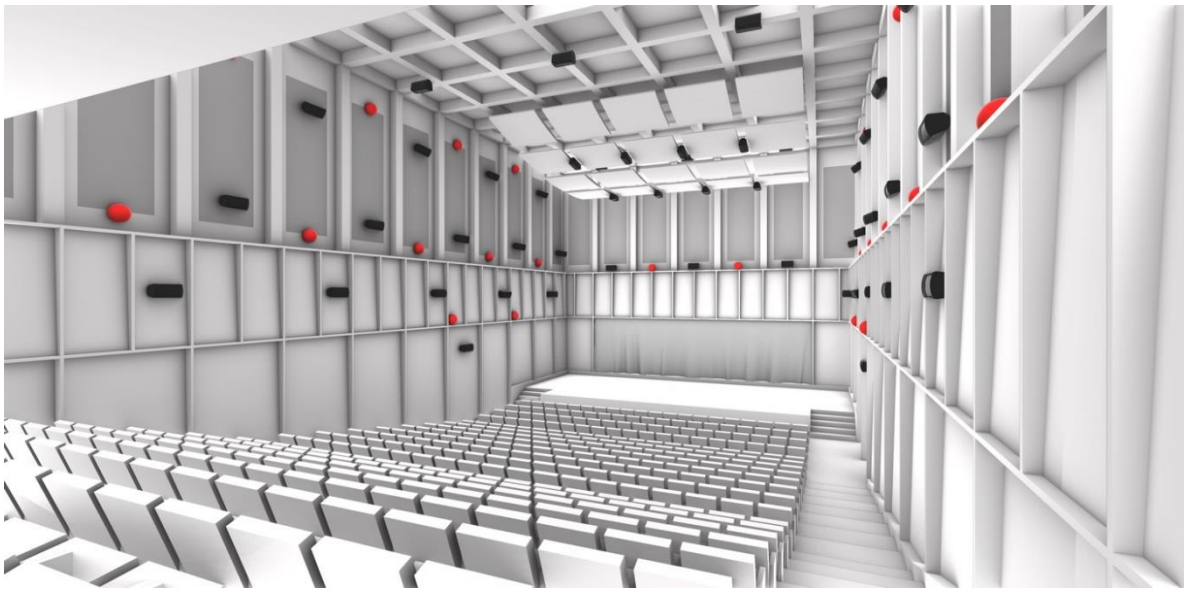

Figure 10. Interior view of the acoustic model showing the distribution of loudspeakers and microphones of the active acoustic system.

After careful consideration, the Vivace system was chosen, which in its current configuration can be described as a classic hybrid system. In Elektra Tonquartier, the room acoustics section of Vivace works with a total of 24 input microphones (red dots in the illustration above), which are evenly distributed throughout the hall, thus ensuring a balanced delay and level structure especially for the generation of the subsequent reverberation components. Additional microphones and, in some cases, shotgun-microphones are used in the immediate vicinity of the stage to generate the early reflections that influence the sound character. In the Vivace processor itself, which is integrated into a DANTE network structure in the Bergson, the input signals are processed and played back into the hall via a total of 84 loudspeakers. Early signal components are distributed discretely to the individual loudspeakers via a multi-layer matrix, depending on the room acoustic requirements, and can be varied individually in terms of level and delay for each of the more than 4,000 nodes in the Elektra Tonquartier. The later signal components in the Vivace system have always been generated using patented convolution algorithms that work with individually synthesized impulse responses which can be adapted to the acoustic requirements of the hall and the wishes of the users via a wide range of processing options.

In conjunction with the controlled, system-inherent recursive signal components, individual reflection structures and reverberation spectra can be generated with a complexity and acoustic quality that is

indistinguishable from “natural” acoustics, both in terms of measurement technology and, to a considerable extent, subjectively.

For the opening of the hall in October 2024, a wide variety of acoustic scenarios, rooms and environments were created during the calibration process, leaving nothing to be desired, from small chamber music halls to voluminous concert hall acoustics to Gothic cathedrals.

The acoustic properties created in this way and changed at the touch of a button open up previously unimagined artistic freedoms and possibilities for Bergson. For example, a Steinway Prize-winning pianist was once inspired during a classical piano recital to perform a Chopin Impromptu in a different acoustic setting than the preceding Bach partita. Not a “must”, but artistically interesting – and in any case unthinkable in a classical concert hall until now.

The design of concert repertoires can also take on new forms thanks to the possibilities offered by variable acoustics. One example of this is the “Vivace” concert, named after the system itself, which was commissioned by the Bergson Phil’, an ensemble comprising musicians from renowned orchestras in Munich and the surrounding area, and which has a regular place in the Bergson concert calendar. The concert features stylistic references to Gregorian chant, Baroque, classical literature, and the swing of the 1920s, transporting the astonished audience through the diverse acoustic possibilities of the hall.

The variability of the hall offers interesting possibilities, especially for organ music – the first organ concerts are planned for November this year as part of the Munich Bach Festival – and choral literature, so one can look forward to performances by the recently founded Bergson Voices.

In addition to the in-house ensembles, Bergson and Elektra Tonquartier feature a wide variety of mostly young and up-and-coming artists who are not afraid to embrace the technical and sonic possibilities of the 21st century but rather use them with curiosity and experimentation.

Vivace's capabilities in the field of 3D audio and immersive sound further expand the musical and artistic spectrum of the hall, e.g. when the Jazzrausch Bigband uses Vivace as a 3D reverb engine, for static directional sound reinforcement, or for dynamic, spatial positioning of solo sources in the hall. For this purpose, the effects section of the Vivace system in the Bergson is linked to the FOH mixing console via appropriate interfaces (OSC, DANTE/MADI) and integrated into the main sound system. In this way, natural acoustics, electronic room acoustics as well as immersive possibilities merge into a holistic acoustic environment with the aim of conveying the stage action to the audience in the most emotional way possible. Purism and classic frontal sound reinforcement are no longer what the audience expects here.

Figure 11. 2D map and 3D reverb engine of the Vivace GUI.

The production “Oddly Satisfying” goes one step further as an immersive audio play and “cinema for the ears” that fills the concert hall without a single live sound. This avant-garde, completely pre-produced one-hour work makes full use of the functions and qualities of the Vivace system's 3D audio engine. The ADM files, which were created in the studio and comprise up to 128 dynamic objects, are played back and rendered to the given speaker set-up via the cue player of the Vivace Control. This process runs independently and in parallel with the electronic room acoustics part. This allows Vivace to deliver an immersive one-button show, and the new technology in Bergson and other concert halls opens up programmatic possibilities that were previously reserved for cinemas or specially configured installations.

5 CONCLUSION

How does a paper that deals in the broadest sense with art, architecture, technology, and the diversity of concert programs make it to an international acoustics conference? Well, the acoustician's work contributes to the creation of venues that open up aural and artistic possibilities. The versatility of the venue, the architecture and also the acoustics – whether natural or enhanced – inspire the Bergson to create an extremely diverse and exciting program. The term "Cultural Gravity" is not just an empty phrase, it is intensely lived here where people of all ages and social classes meet in the mutual interest to experience new things, technology, approaches and great music. The project can and should motivate acousticians to rethink acoustic planning, question stereotypes and confidently utilise today's technical acoustic possibilities. At least if the project brief and intended program call for it.

6 REFERENCES

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