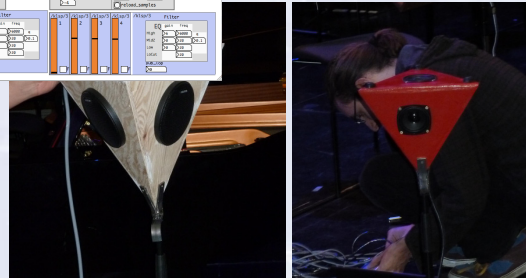
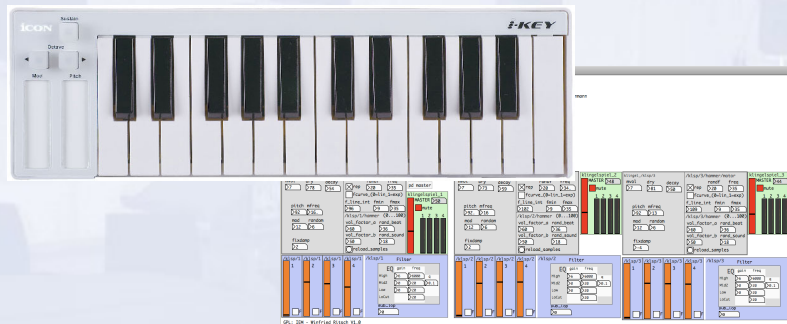


Designing Simulacra or the electronic replication of a mechanical instrument



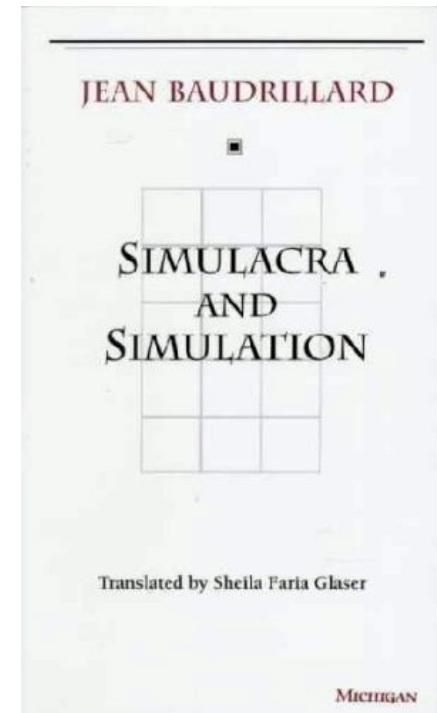
Fabio Kaiser
Marian Weger
Winfried Ritsch

Unconventional instruments

- Specific instruments for a composer's demands
- Challenges
 - No longer available
 - Damaged
 - Unhandy
 - Insufficient documentation
- James Tenney – „Overtone Organ“
- Scelsi - Pranam II
- Lachenmann – Mouvement (- vor der Erstarrung)

Simulacra

- Mechanical / Identical replication
- Software Simulation/Emulation
- We want:
 - Functional replication
 - Qualitative replication
 - Holistic replacement
- Simulacra
 - Simulacrum (pl.: simulacra), according to Jean Baudrillard:
„The essential characteristics are being recreated but not the form of appearance“



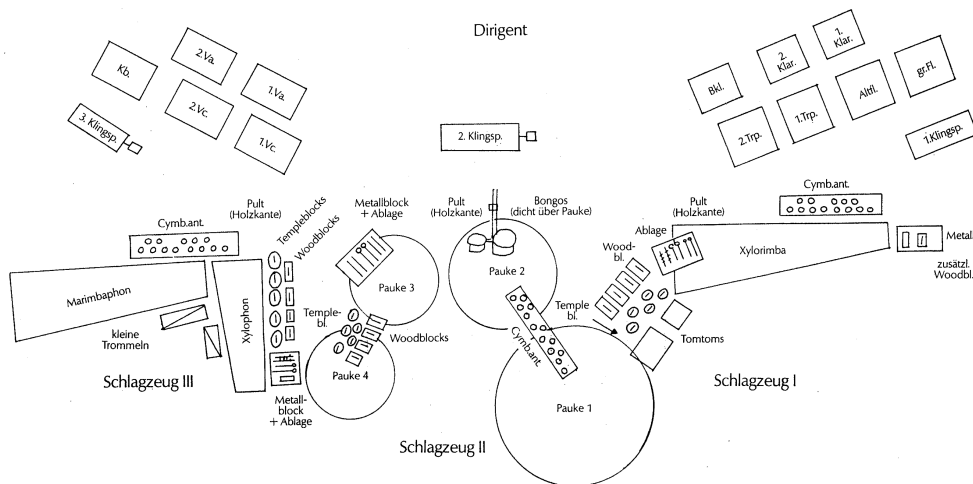
This work

- Performance of „Mouvement – Vor der Erstarrung“ (Helmut Lachenmann)
- Klingelspiel (Bell keyboard)
 - Modified toy piano
 - Not working properly
 - Not reliable
- Task was to find a solution...
 - Design a simulacrum

Mouvement – vor der Erstarrung (Helmut Lachenmann)

- 3 bell pianos
- Played polyphonically
- Range: $g' - g''$
- 8 keys diatonic
(G-Major)

The musical score shows three staves for bell pianos. The first staff (I L.) is marked 'Klingelspiel' and has dynamics p , ff , fff , ff , and fff . The second staff (II M.) is marked 'Bongo 2.' and 'Klingelspiel', with a note '(osia siehe T.103/4)' and dynamics p , ff , and f . The third staff (III Ra) is marked 'Klingelspiel' and has dynamics p , ff , ff , ff , and ff .



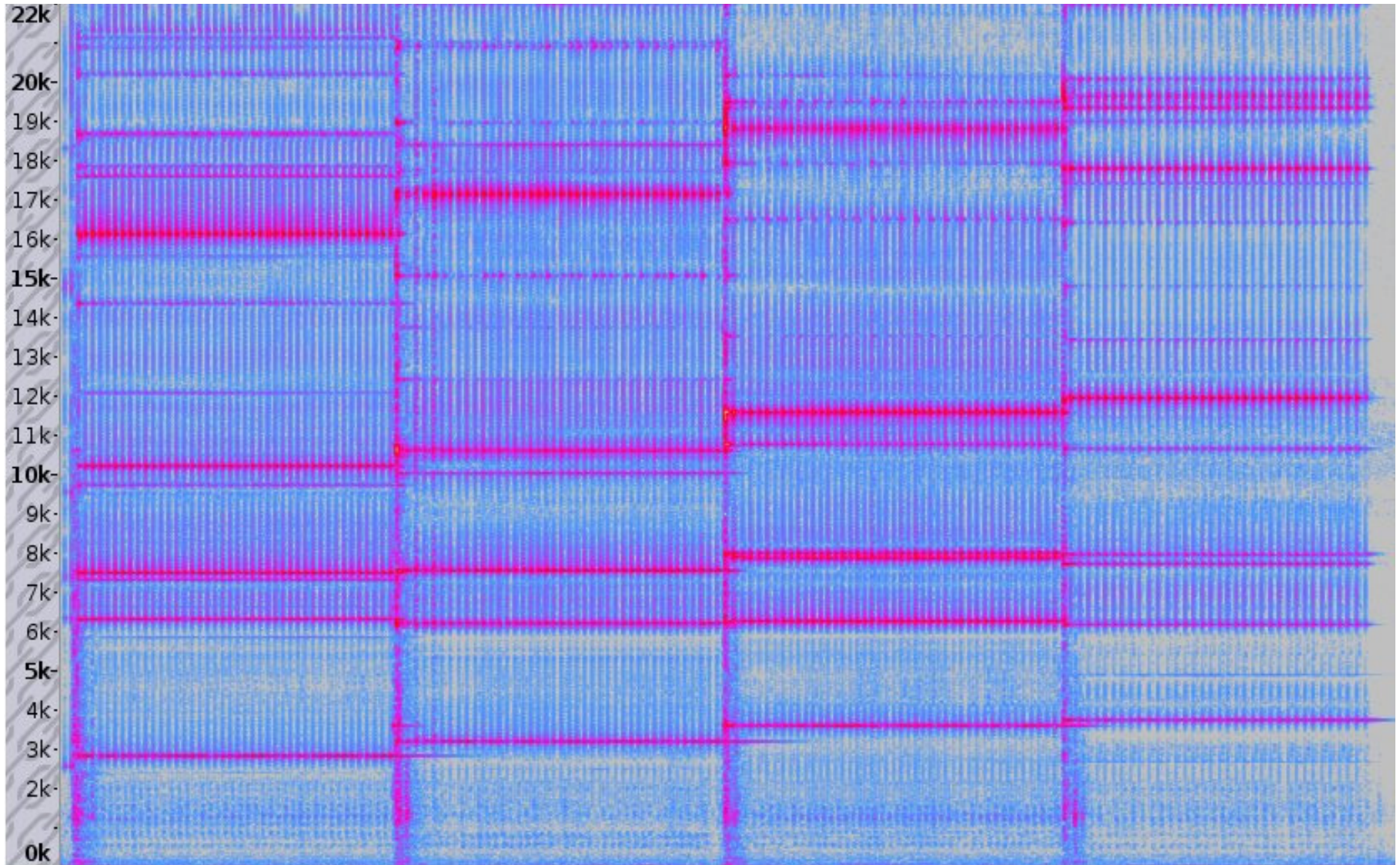
Introducing... the Klingelspiel



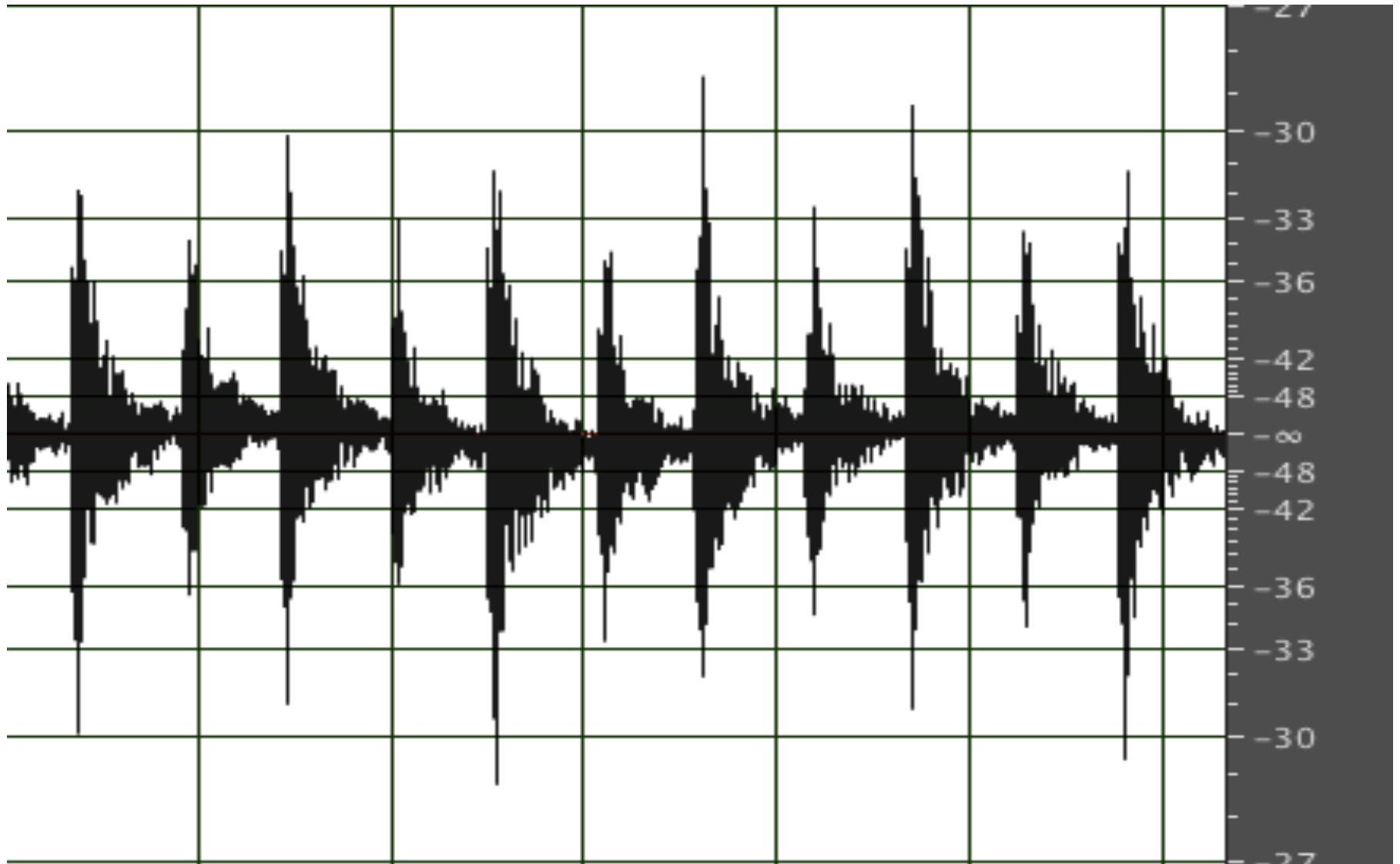
Under the hood



Spectral analysis



Temporal analysis



What the composer has in mind

- Rattling & chattering
- Fluttering movement
- Irregularities
- Engine noise not desired
 - also noted in the score
- Sound should have some tonal quality but does not have to be precise
- Integration into the ensemble
 - Good mix with the ensemble
- Spatial perception of Klingelspiel for the audience

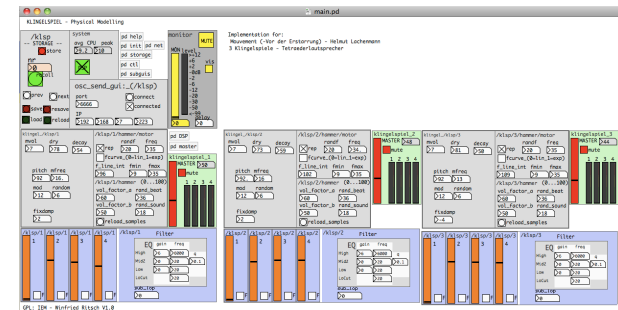


Our design criteria

- Sound quality
- Playability
- Robustness
- Acceptance
- Sustainability

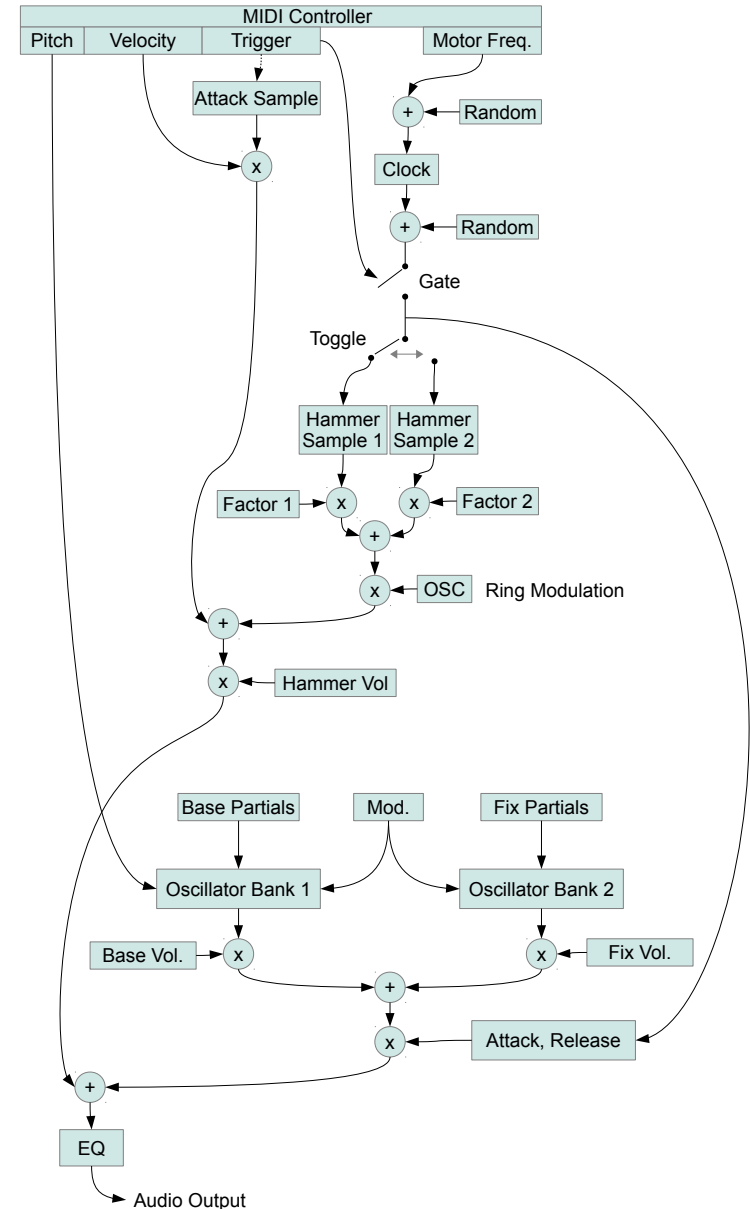
The simulacrum

- Interface
 - MIDI Keyboard
- Sound Synthesis
 - Software modeling
 - Free software: PureData, Linux
- Sound Reproduction
 - Loudspeaker



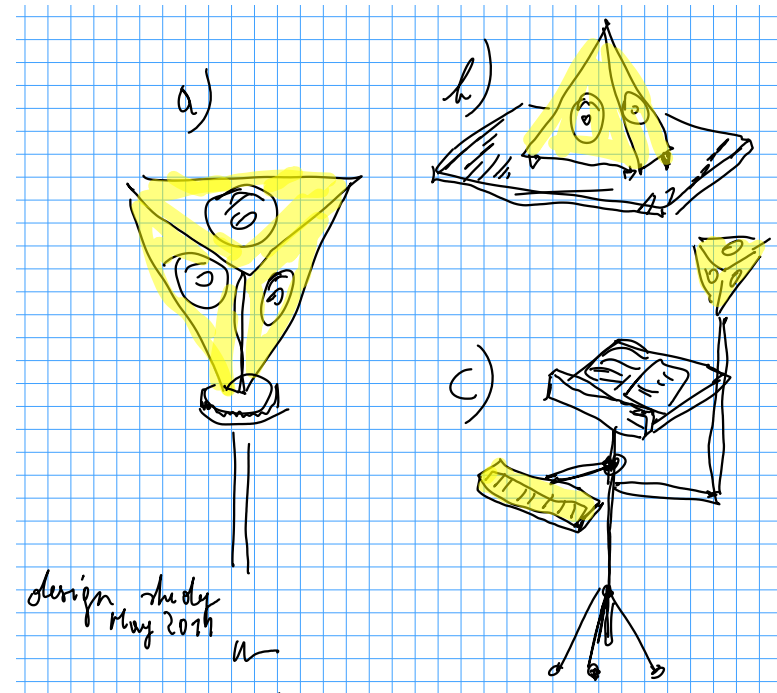
Software Simulation

- Trigger: irregular clock
- Noise: Sampling
 - 3 Samples per Note:
 - Attack, Hammer 1, Hammer 2
 - Tonal elements removed
 - Ring modulation
- Harmonics: 2 Oscillator banks
 - Base partials
 - Fixed partials
- Output stage
 - EQ
 - Spatialisation



Loudspeaker System

- Criteria
 - Localisation
 - Mix with the Ensemble
 - Monitoring
- PA System
- Studio Loudspeakers
- Omnidirectional Loudspeakers
 - Simplest design: Tetrahedron
 - Excitation of Concert Hall
 - Spatial Reproduction
 - Directivity Control



Loudspeaker System



The final Simulacra on stage



Conclusions

- Concerts with „Klangforum Wien“
 - 2011/06/28 Mumuth Graz
 - 2011/09/29 Vienna Konzerthaus (Mozartsaal)
- 2nd concert without authors present
 - Musicians were able to tune sound by themselves
- Publisher of the piece has shown interest in the system

