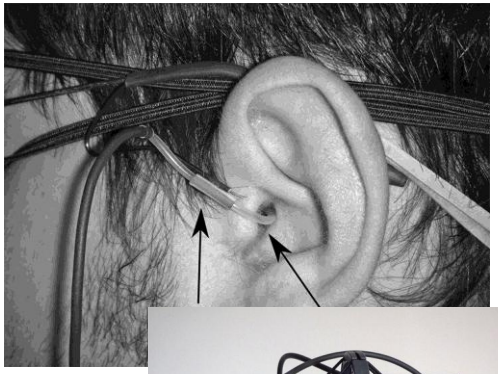
STEREO

From Live to Recorded and Reproduced

What does it take?

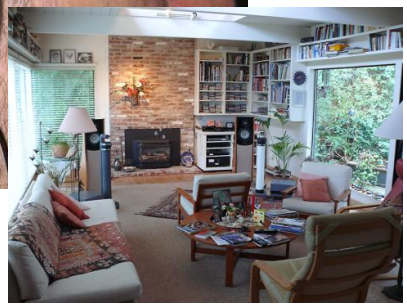
Binaural recording & playback

- From ear drum to ear drum
- Very low spatial distortion
- The Auditory Scene does not follow head movement cues

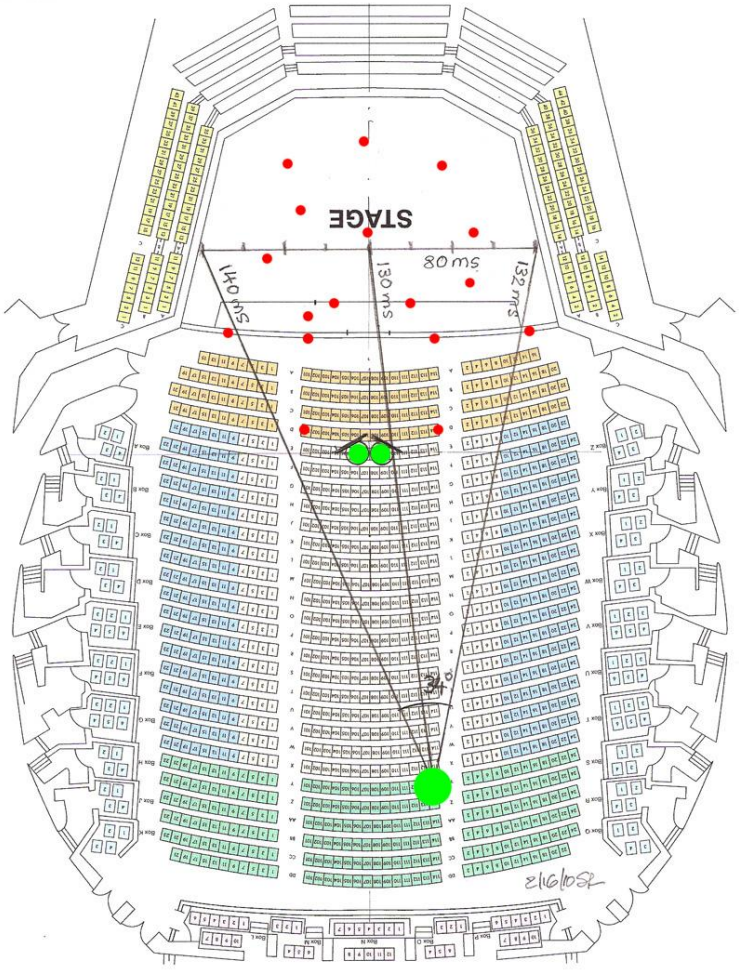


Conventional recording & playback

- From microphones to loudspeakers & room
- Generally very high spatial distortion
- The Auditory Scene is formed using head movement cues



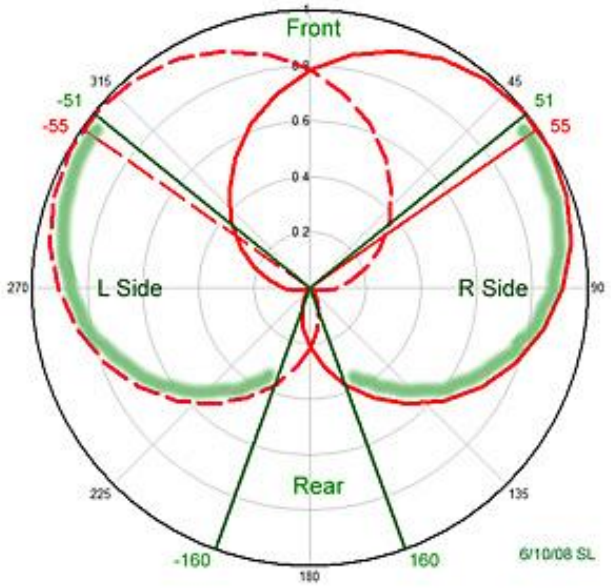
What do I hear?
What do the microphones hear?

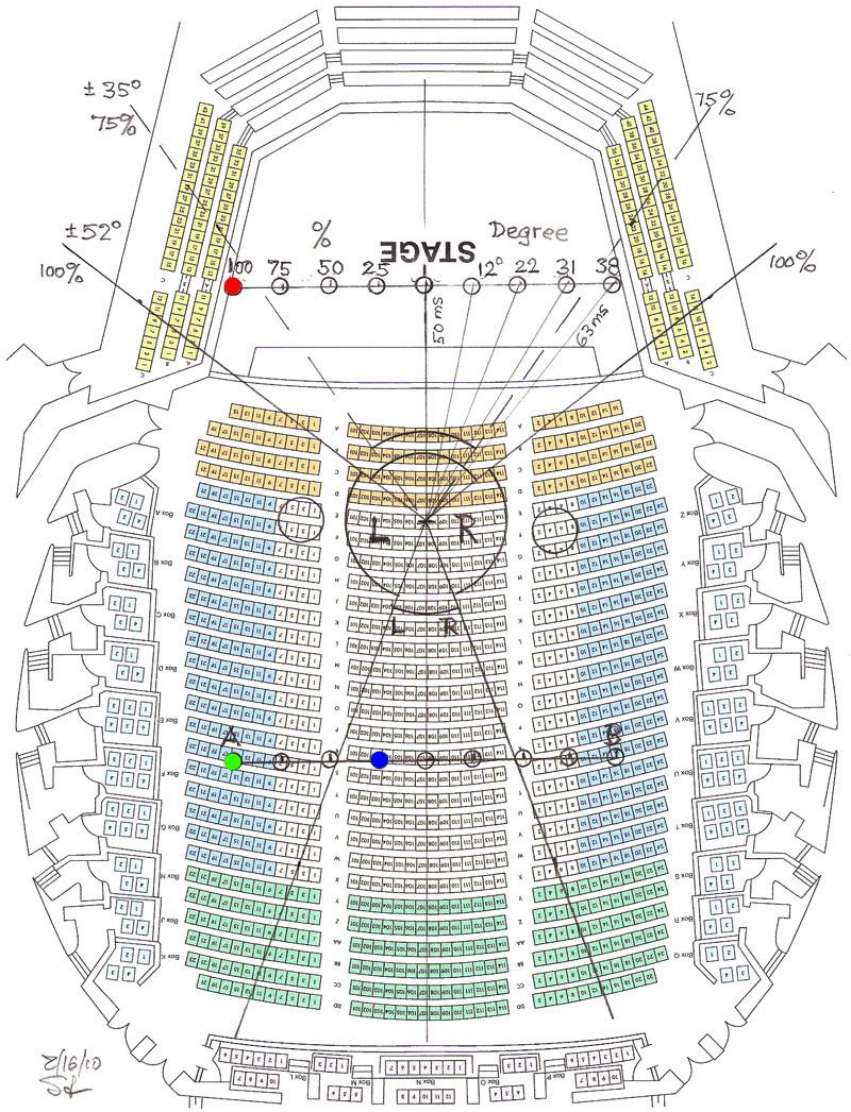


- Direct sound streams
- Multitudes of reflected sound streams

Sound sampling
from an audience perspective

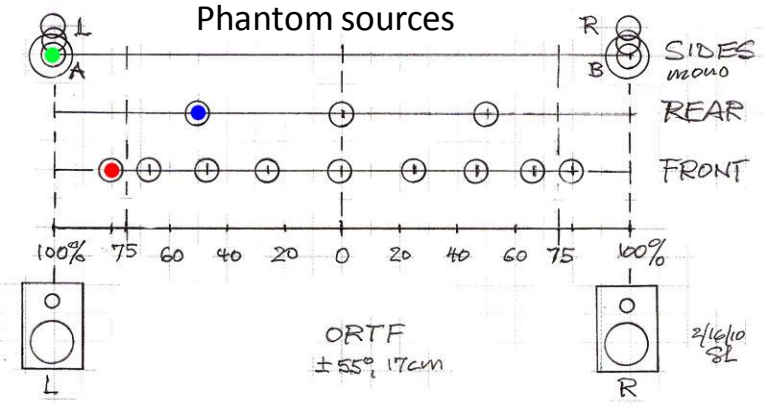
Pick up of
sound streams
from the Orchestra
and of reflected streams
from the Hall



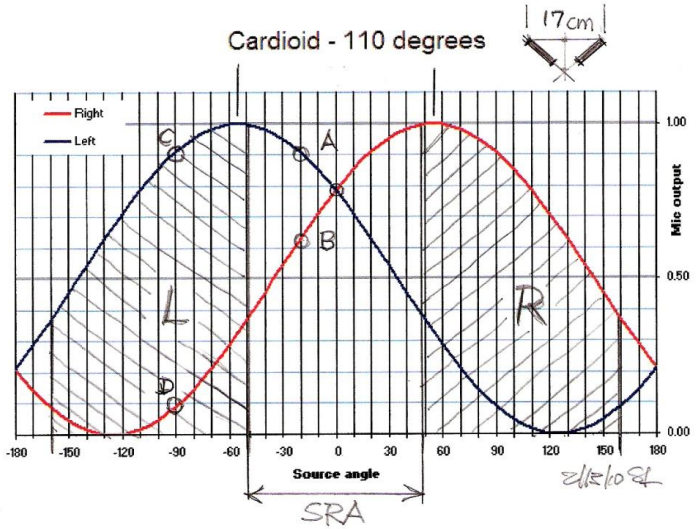


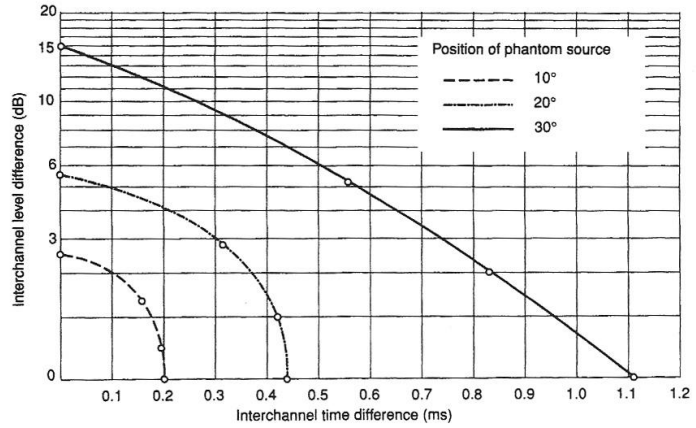
Physically, the microphone signals are reproduced by left and right loudspeakers

Perceptually, the microphone signals are mapped as phantom sources to the space between the two loudspeakers and as mono signals into each loudspeaker



Level and arrival time difference between the two microphones determine the position of the phantom source





The perceptual mapping procedure

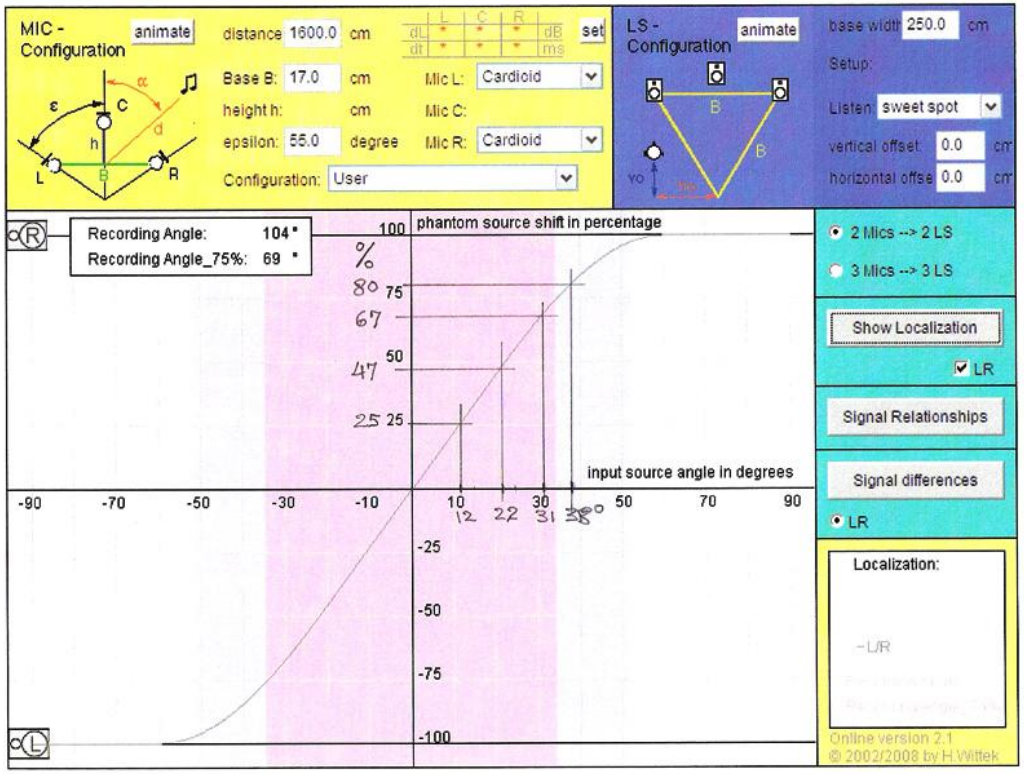
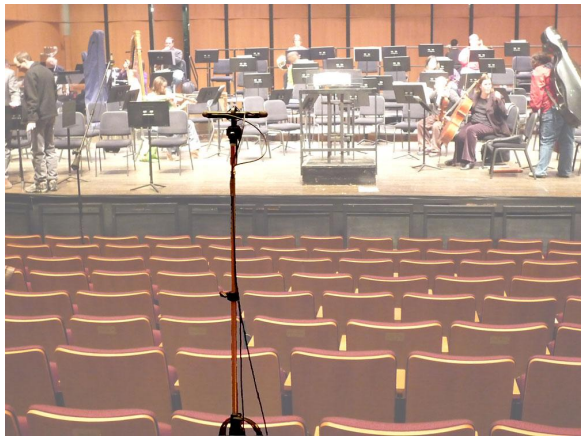


Image Assistant 2.1 (Theile & Wittig)
www.hauptmikrofon.de

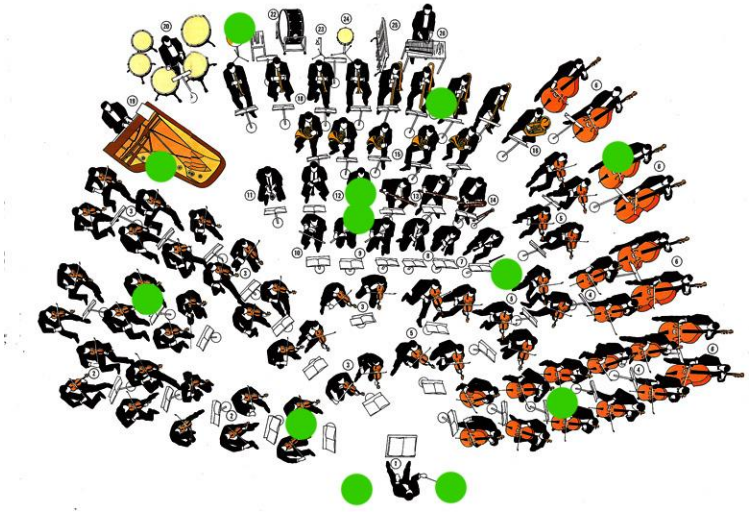
Potential problems with recording from an audience perspective



Loss of clarity
Too much reverberation
Too distant sounding

- We de-reverberate the hall sound in a live situation
- We have difficulty to de-reverberate the recorded hall sound upon playback

Potential problems with not recording from an audience perspective



Ever greater Spatial Distortion of the Acoustic Scene

- Outputs from multiple microphones close to the performers and in their own sub-spaces are down-mixed to 2 tracks
- Phantom sources are placed between L & R loudspeakers
- Artificial reverberation is added to the mix

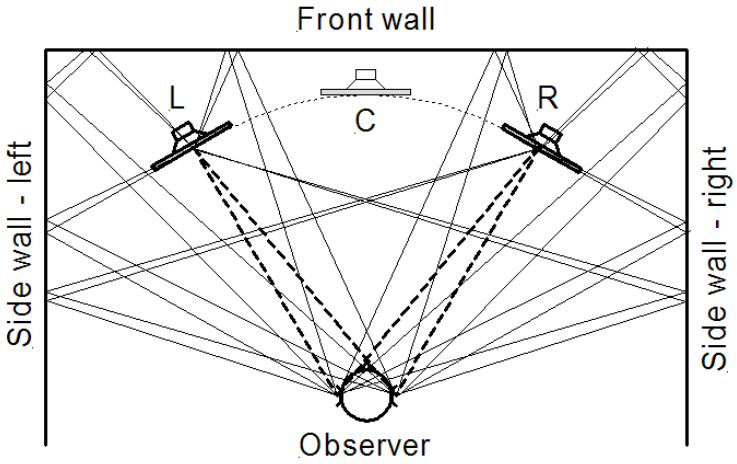
Recording - What does it take?

The microphones must capture a believable spatial perspective

or

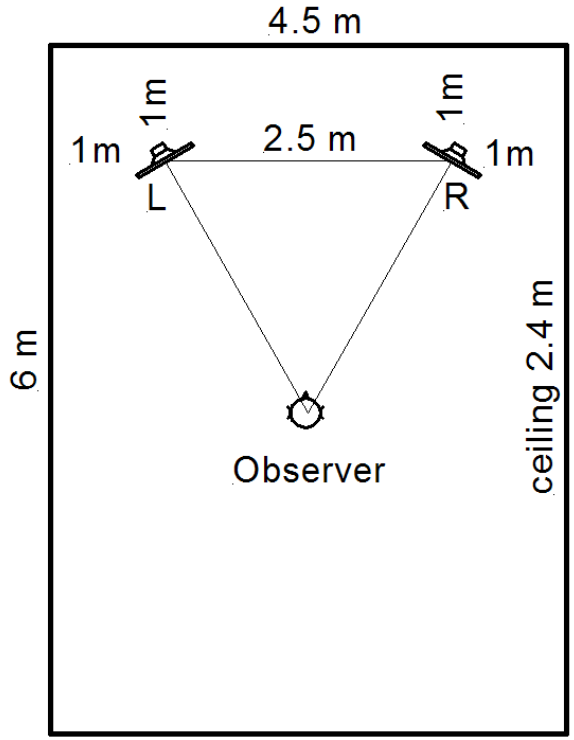
A believable spatial perspective must be obtained
in the mixing process

What happens to the recorded microphone signals when they are reproduced over two loudspeaker in a room?



- We hear real and phantom sound streams
- The direct sound streams are governed by the loudspeakers' on-axis response in Frequency & Time & Amplitude
- L&R streams interfere at the listener's ears
- Room reflections depend upon the loudspeakers' polar response and the absorptive/diffusive properties of the room surfaces

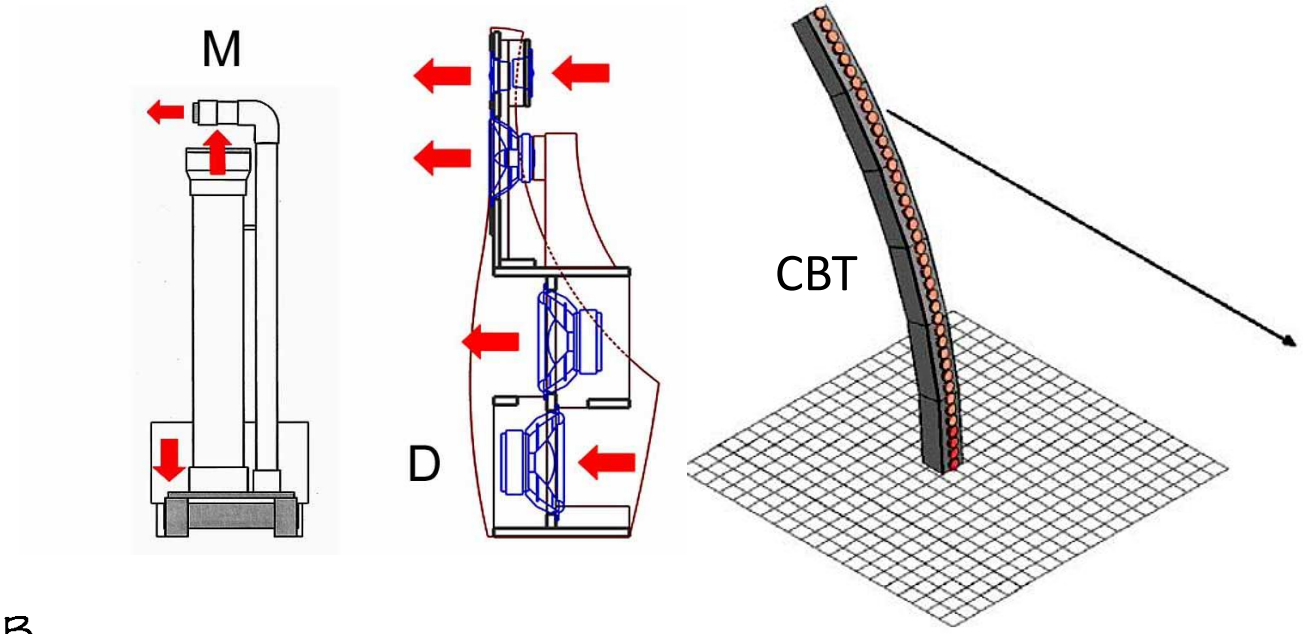
Reproduction - What does it take?



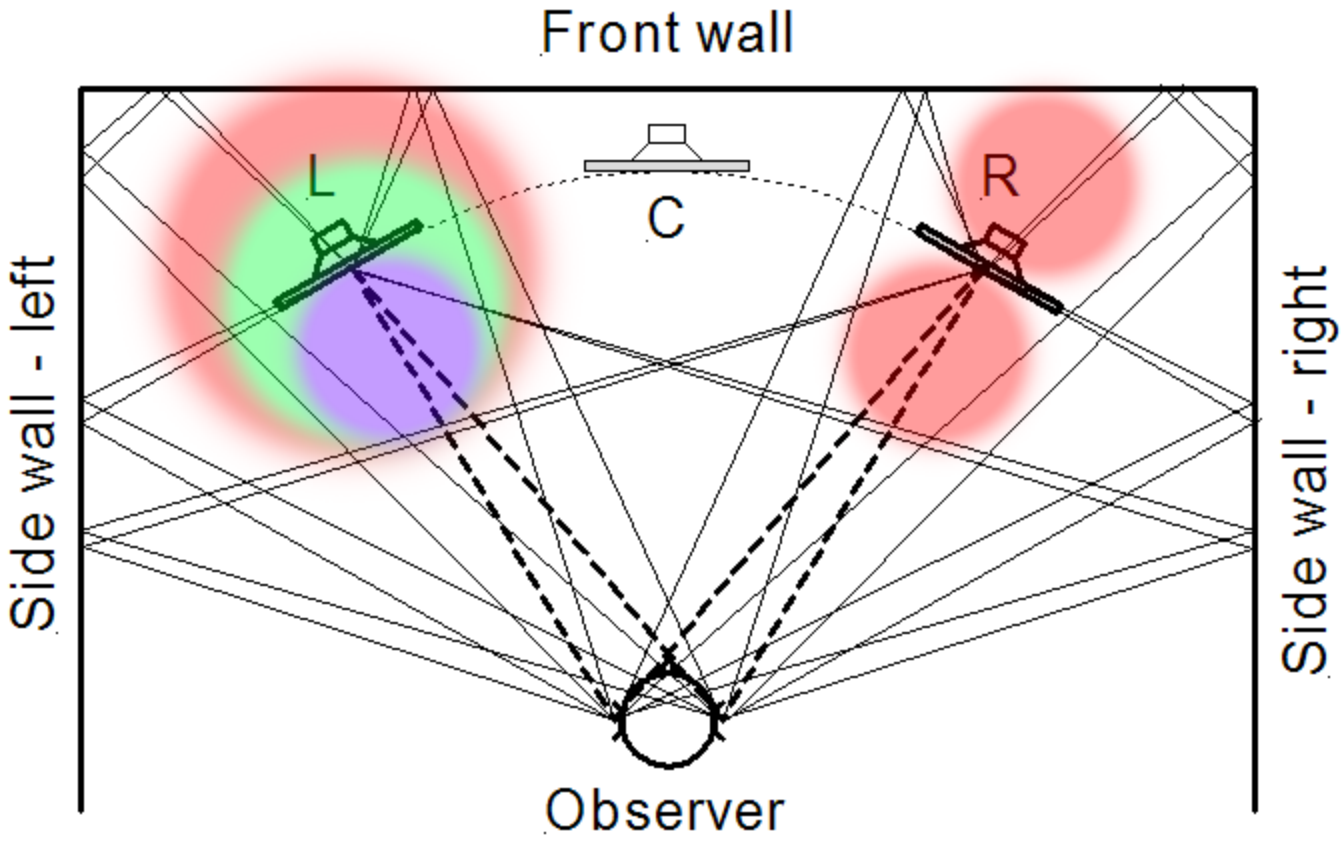
1. Normally live room acoustics
2. Symmetrical loudspeaker & listener setup
3. Reflections >6 ms delayed
4. Neutral spectrum of reflections

Loudspeakers - What does it take?

1. Controlled directivity
2. Sufficient volume displacement
3. Low stored energy
4. Low non-linear distortion



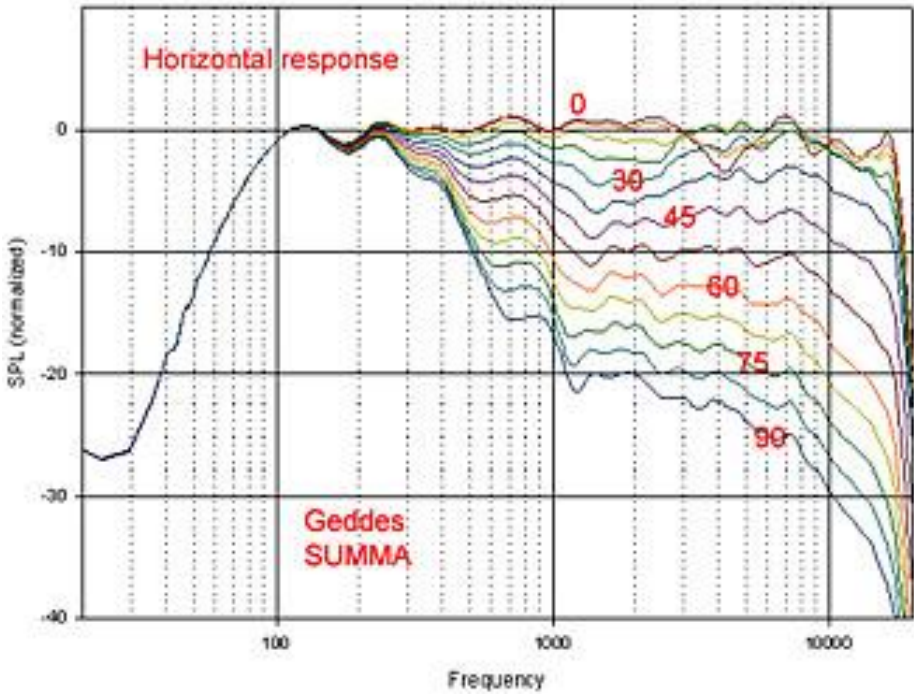
1 – Controlled directivity

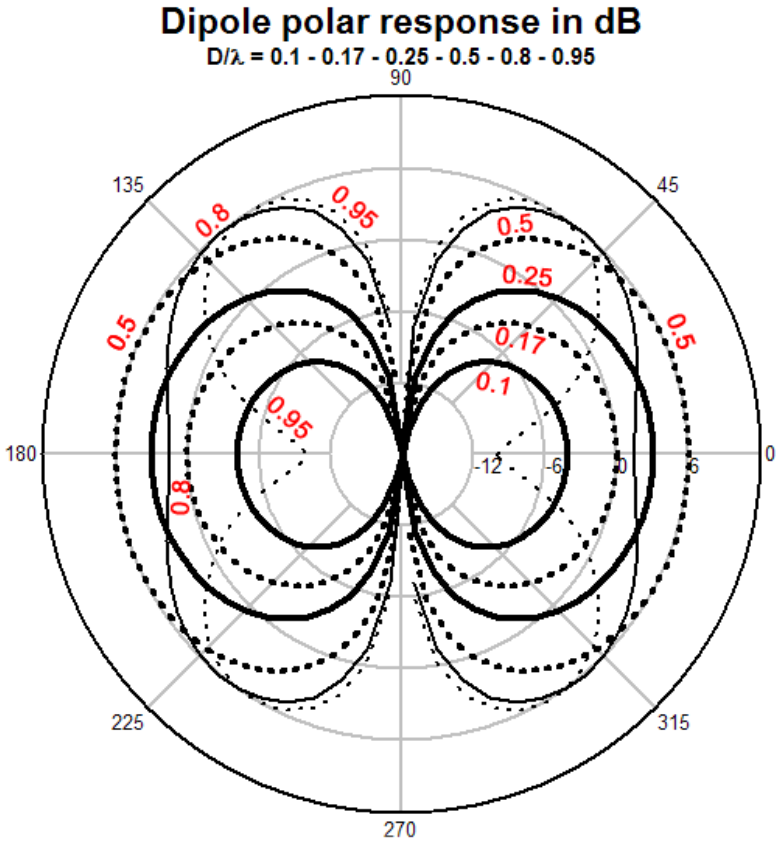


We auditorially process the room via its reflections

1 – Controlled directivity

Omni and waveguide

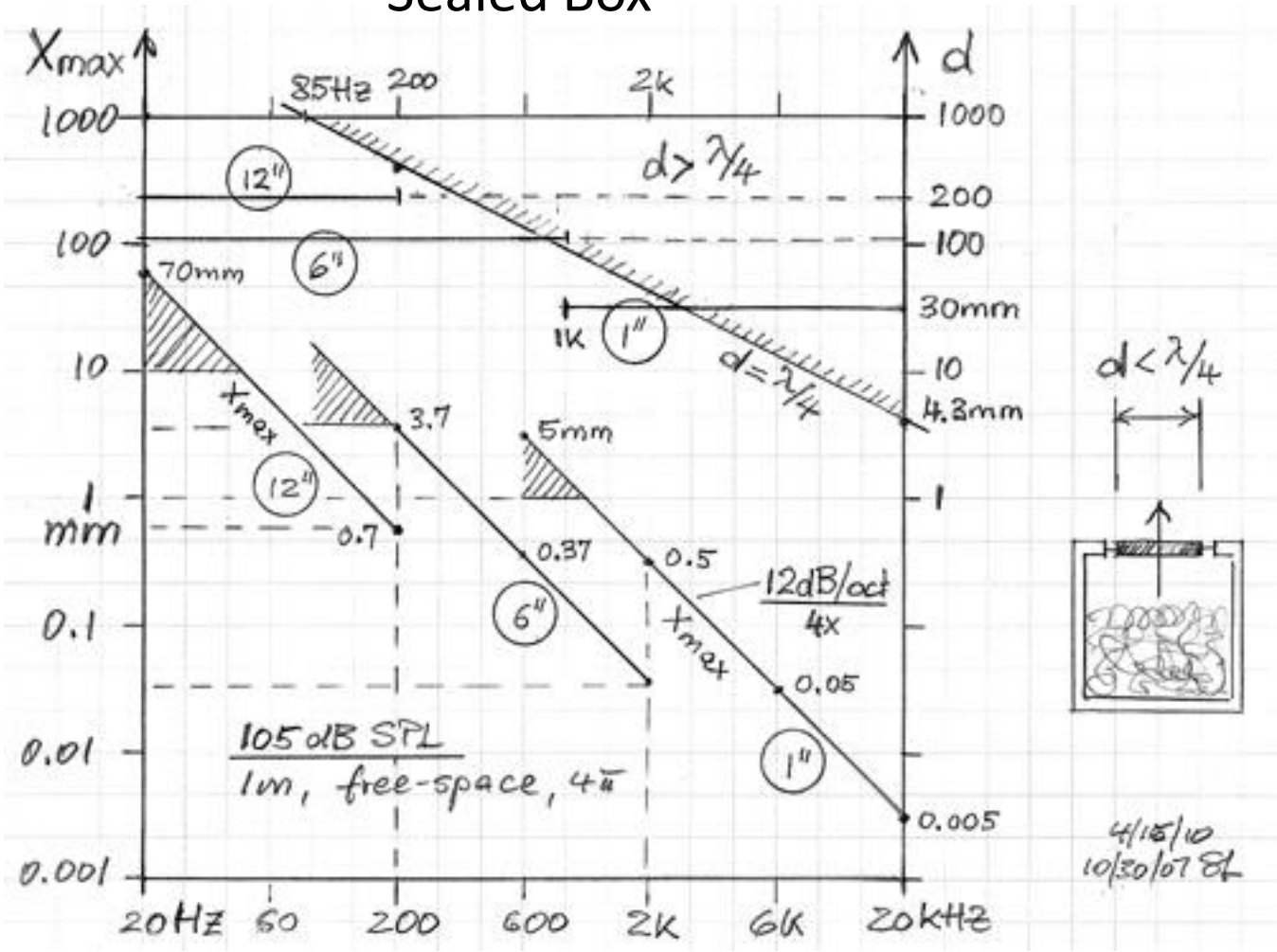




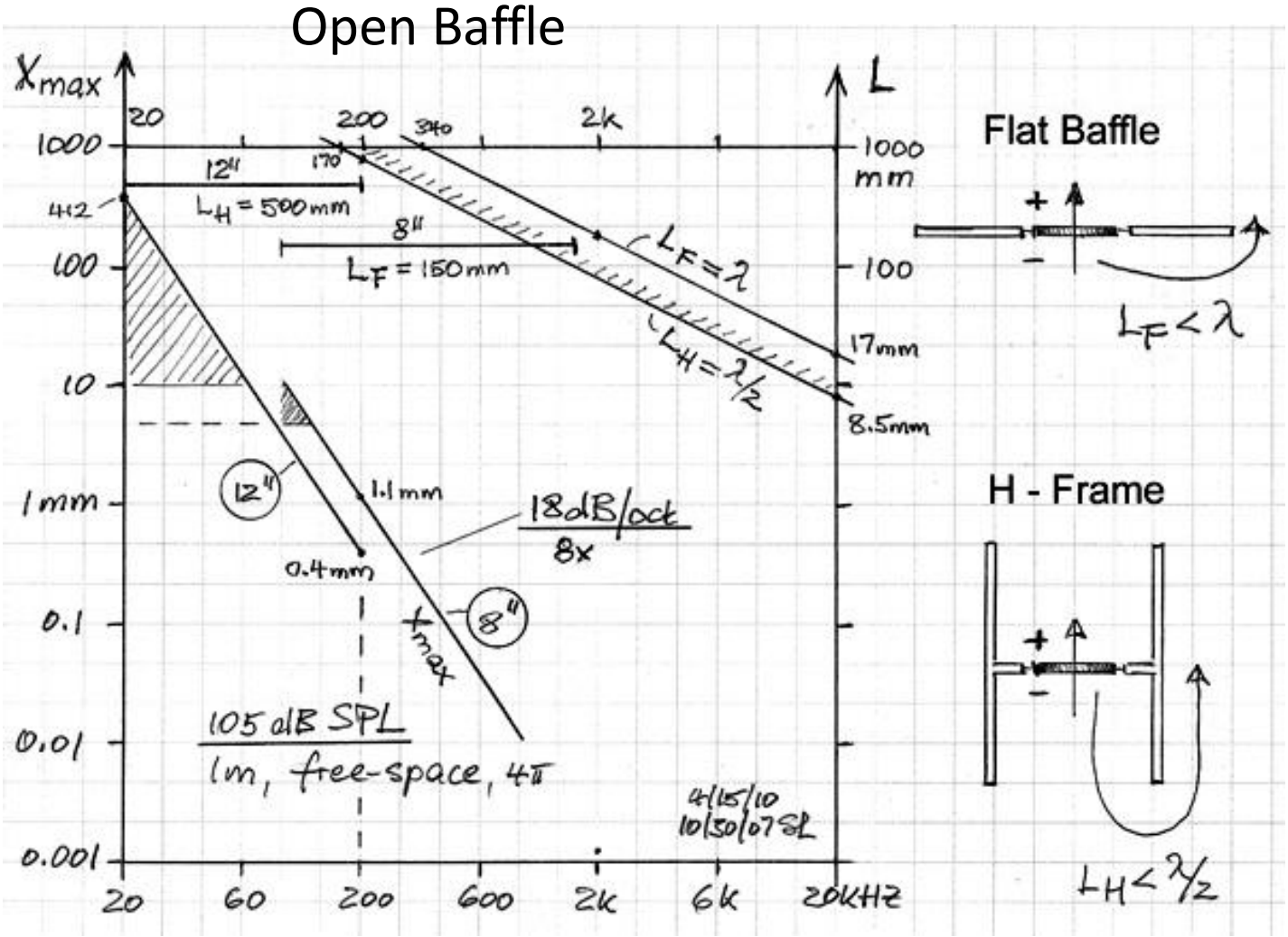
What is the optimum radiation pattern for a believable Auditory Scene?

2 – Sufficient volume displacement

Sealed Box

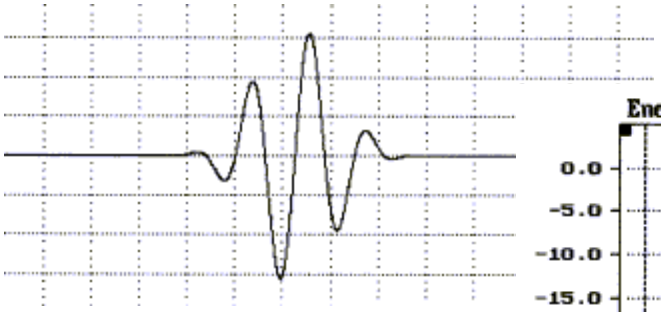


2 – Sufficient volume displacement

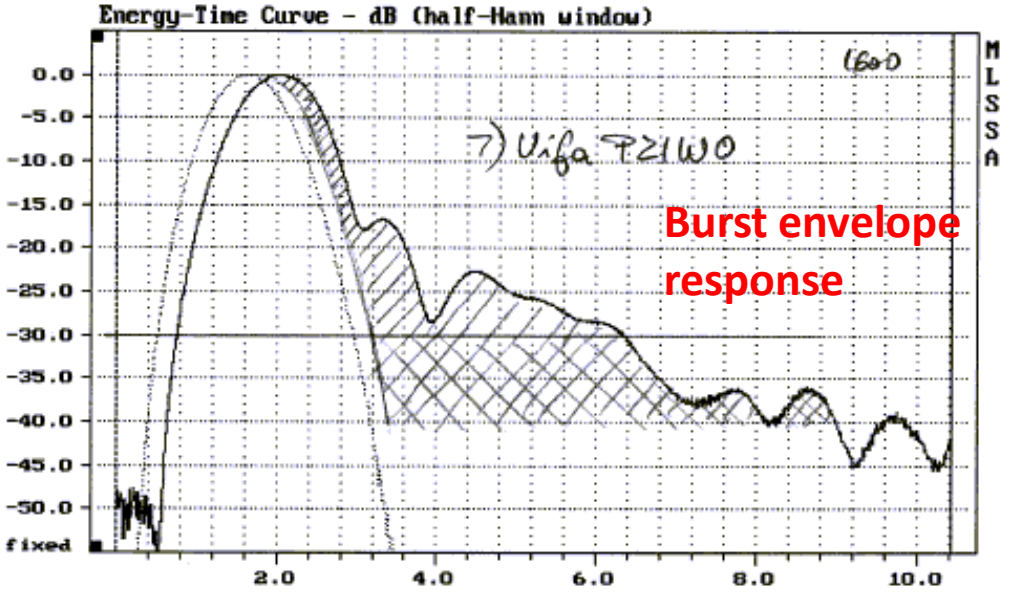


3 – Low stored energy

- Cabinet panel resonance modes
- Air cavity resonances inside the box
- Driver membrane break-up modes
- Driver frame + magnet resonance
- Vented system roll-off response

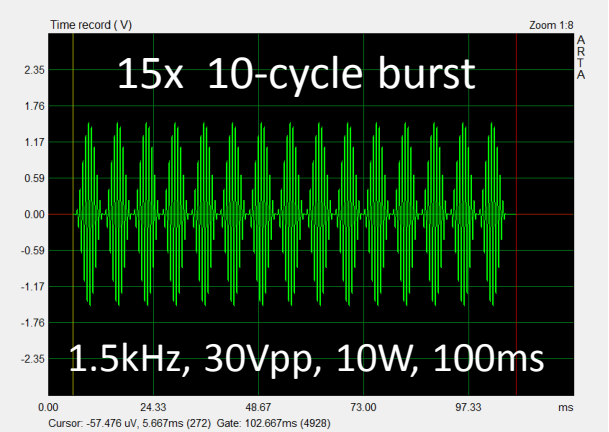


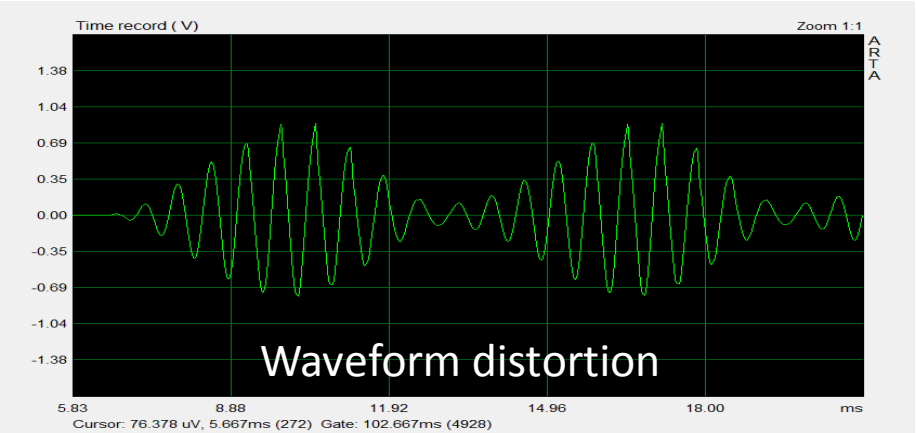
Stimulus:
4-cycle burst,
Blackman windowed

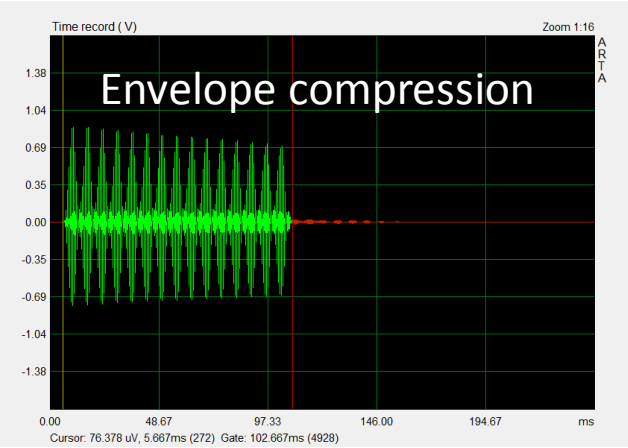


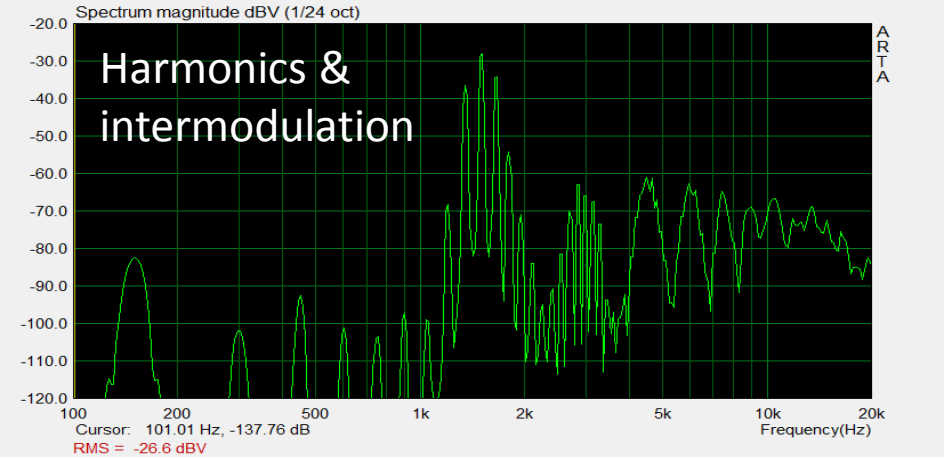
4 – Low nonlinear distortion

- Harmonic & intermodulation distortion
- Thermal gain compression









STEREO
From Live to Recorded and Reproduced
What does it take?

A system design approach at every stage

A - Microphone setup & mix

B - Room & loudspeaker setup

C – Loudspeakers having

1. Controlled directivity
2. Volume displacement
3. Low stored energy
4. Low nonlinear distortion

The reduction of Spatial Distortion in the Auditory Scene is the final frontier

STEREO

We know what it takes, but do not pay sufficient attention to the reduction of Spatial Distortion in the Auditory Scene

i.e.

Microphone setup & Mix

Polar response of Loudspeakers

Thank You

www.linkwitzlab.com

Accurate Reproduction and Recording of Auditory Scenes