

# 2.0, 5.1 and 3D-Audio Main Microphone Techniques



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SCHOEPS GmbH

Demo: Paralympics Eröffnung

hauptmikrofon.de

## Contents:

- Stereophony Basics
  - 4 Spatial Sound reproduction principles
  - Psychoacoustics of Stereo
- Stereophonic Imaging
  - Direct/Diffuse Field
  - Directional Image
  - Room Image
- Array design methods and practical solutions for
  - Two-channel stereo
  - Multichannel stereo
  - 3D-Audio

Basics

Stereo Imaging

Array design

## Spatial sound reproduction techniques:

- Real source
- Stereophony
- Sound field reconstruction
- Binaural

## Basics

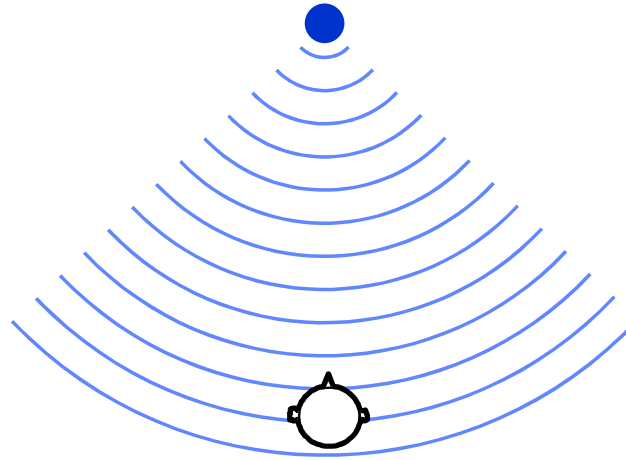
- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design

Spatial sound reproduction techniques:

- **Real source**
- Stereophony
- Sound field reconstruction
- Binaural



Basics

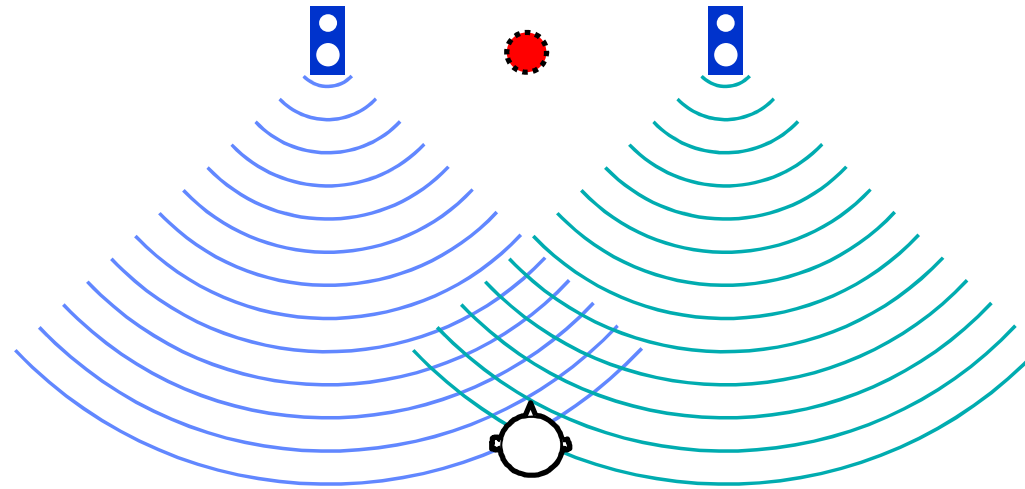
- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design

## Spatial sound reproduction techniques:

- Real source
- **Stereophony**
- Sound field reconstruction
- Binaural



## Basics

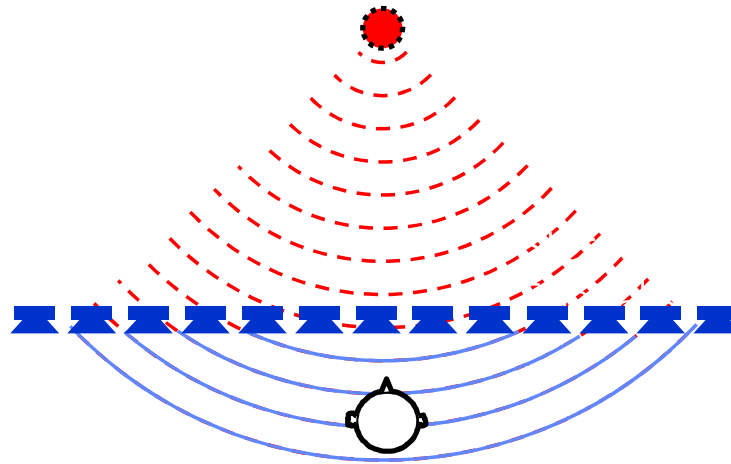
- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design

## Spatial sound reproduction techniques:

- Real source
- Stereophony
- **Sound field reconstruction\***
- Binaural



\* The term „Sound field reconstruction“ includes techniques like WFS or HOA

## Basics

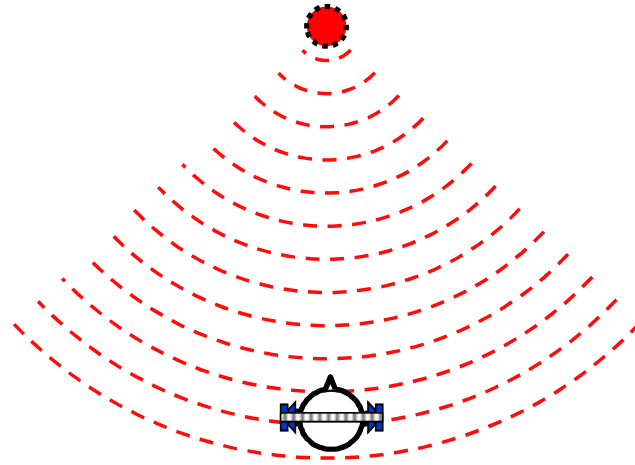
- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design

## Spatial sound reproduction techniques:

- Real source
- Stereophony
- Sound field reconstruction
- **Binaural**



## Basics

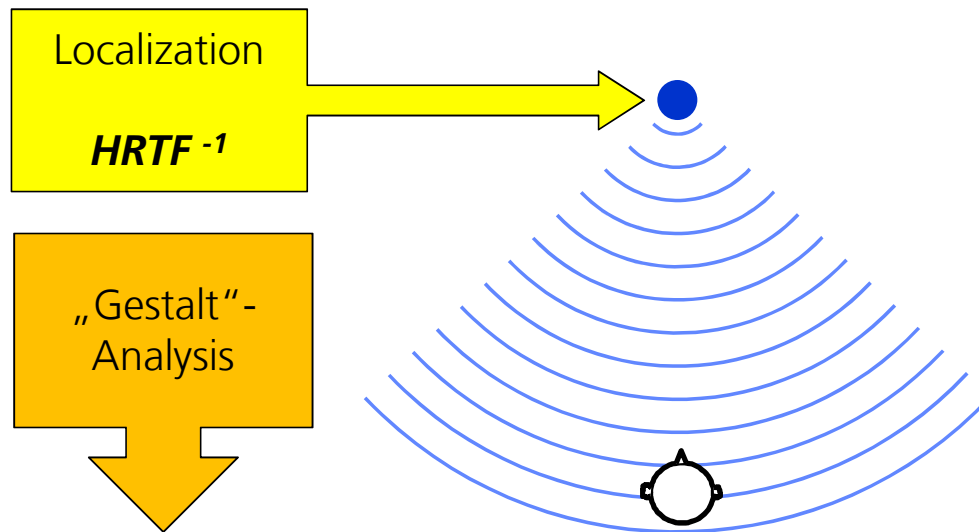
- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design

Localization and perception model:

- **Real source = Sound field reconstruction = Binaural**



Basics

- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

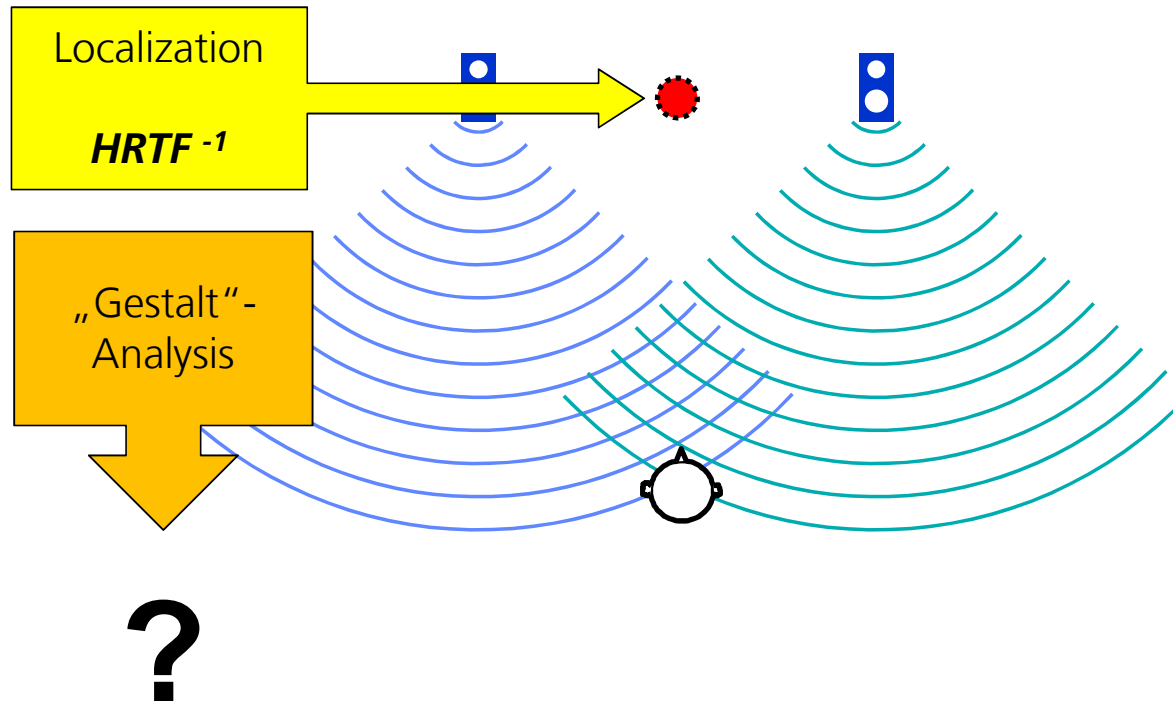
Stereo Imaging

Array design



Localization and perception model:

- **Stereophony unexplained!** Summing localization with strong comb filtering



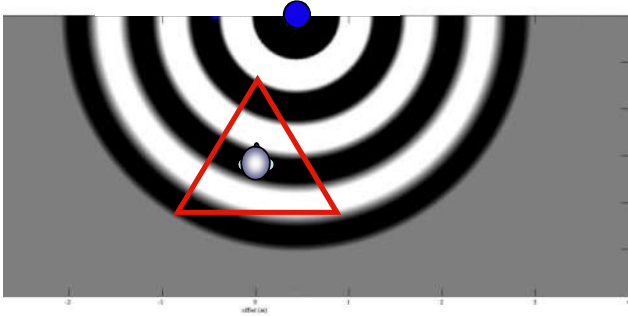
Basics

- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

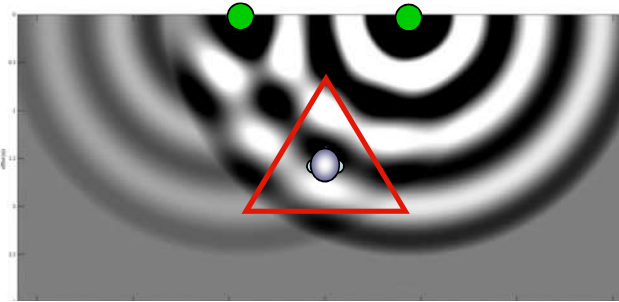
Array design

# Stereophony unexplained!

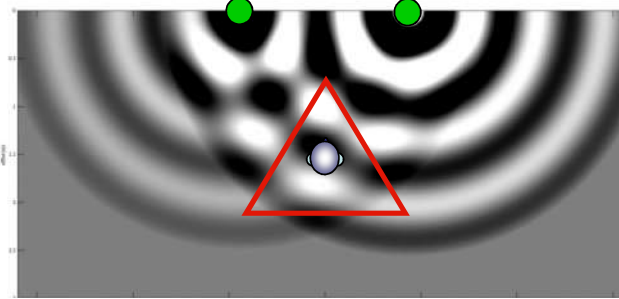


Real source, +15°

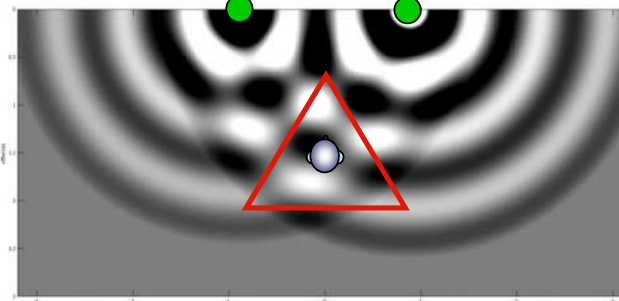
$\Delta L = 7\text{dB}$   
 $\Delta t = 0\text{ ms}$



$\Delta L = 3.5\text{dB}$   
 $\Delta t = 0.2\text{ms}$



$\Delta L = 0\text{dB}$   
 $\Delta t = 0.4\text{ ms}$



Phantom Source, perceived +15°

## Basics

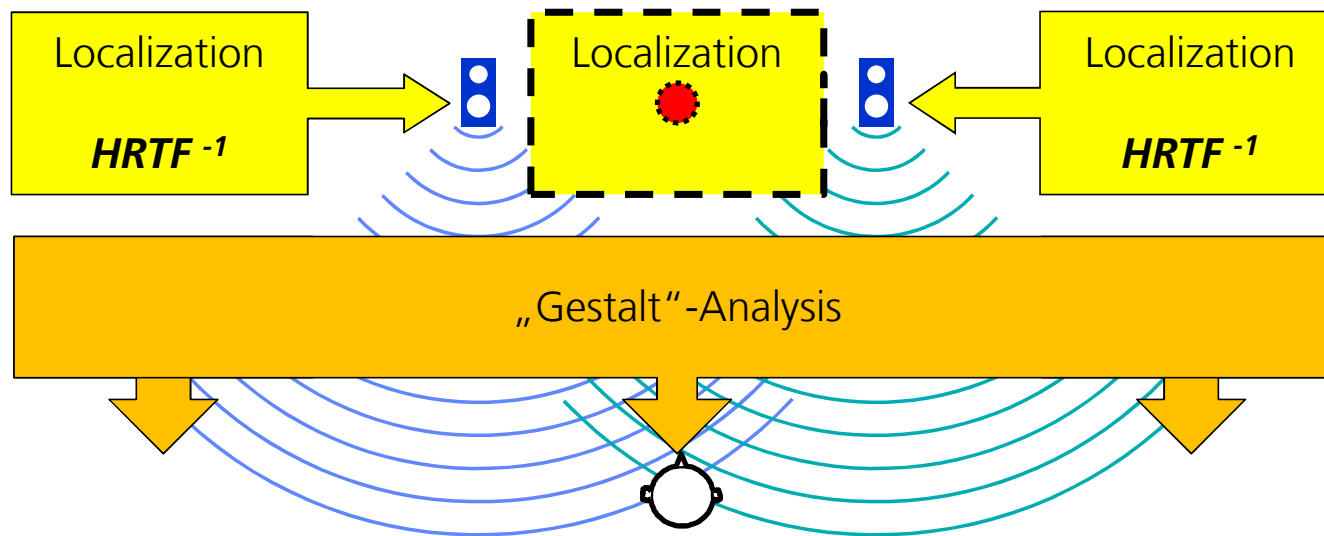
- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design

Localization and perception model:

- **Stereophony** after the „Association model“ of Theile



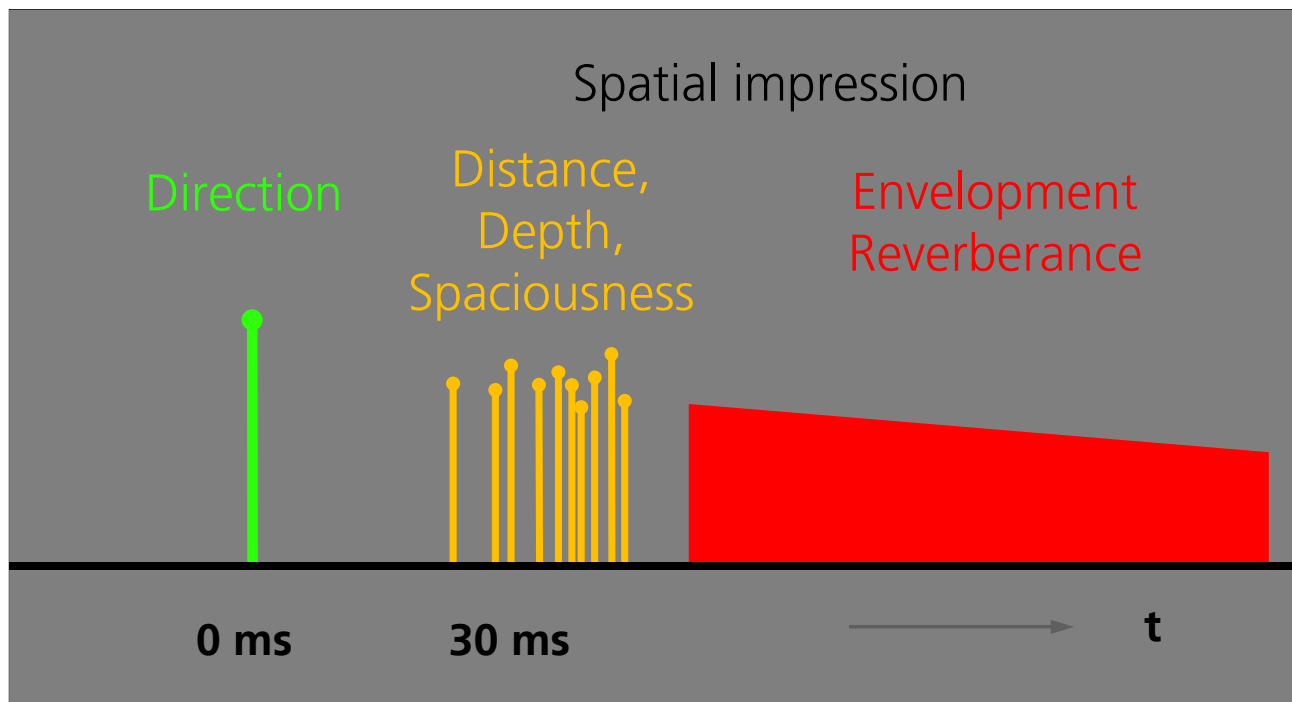
**REF** G.Theile: "On the Naturalness of Two-Channel Stereo Sound", JAES, Vol.39, 1991

Basics

- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design for 3D-Audio



© Theile

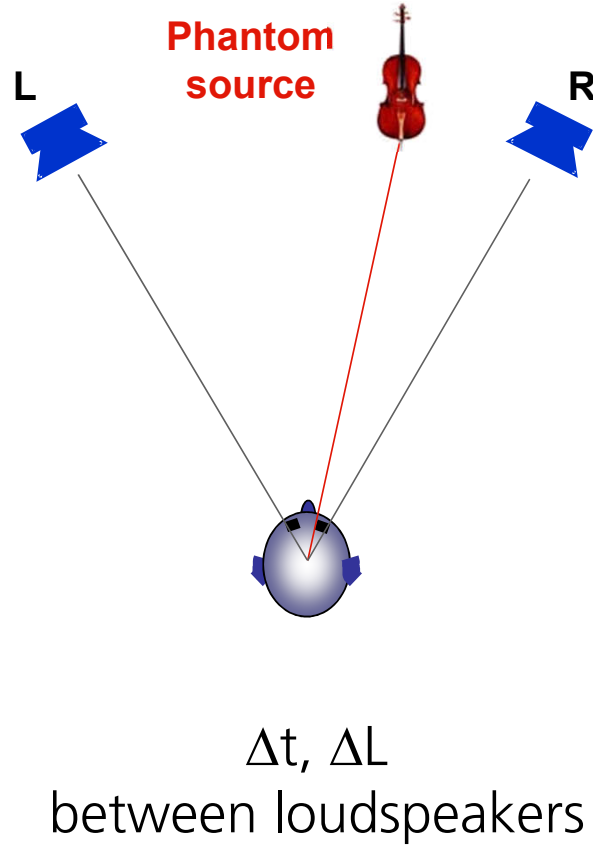
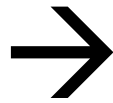
Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

- The Recording angle



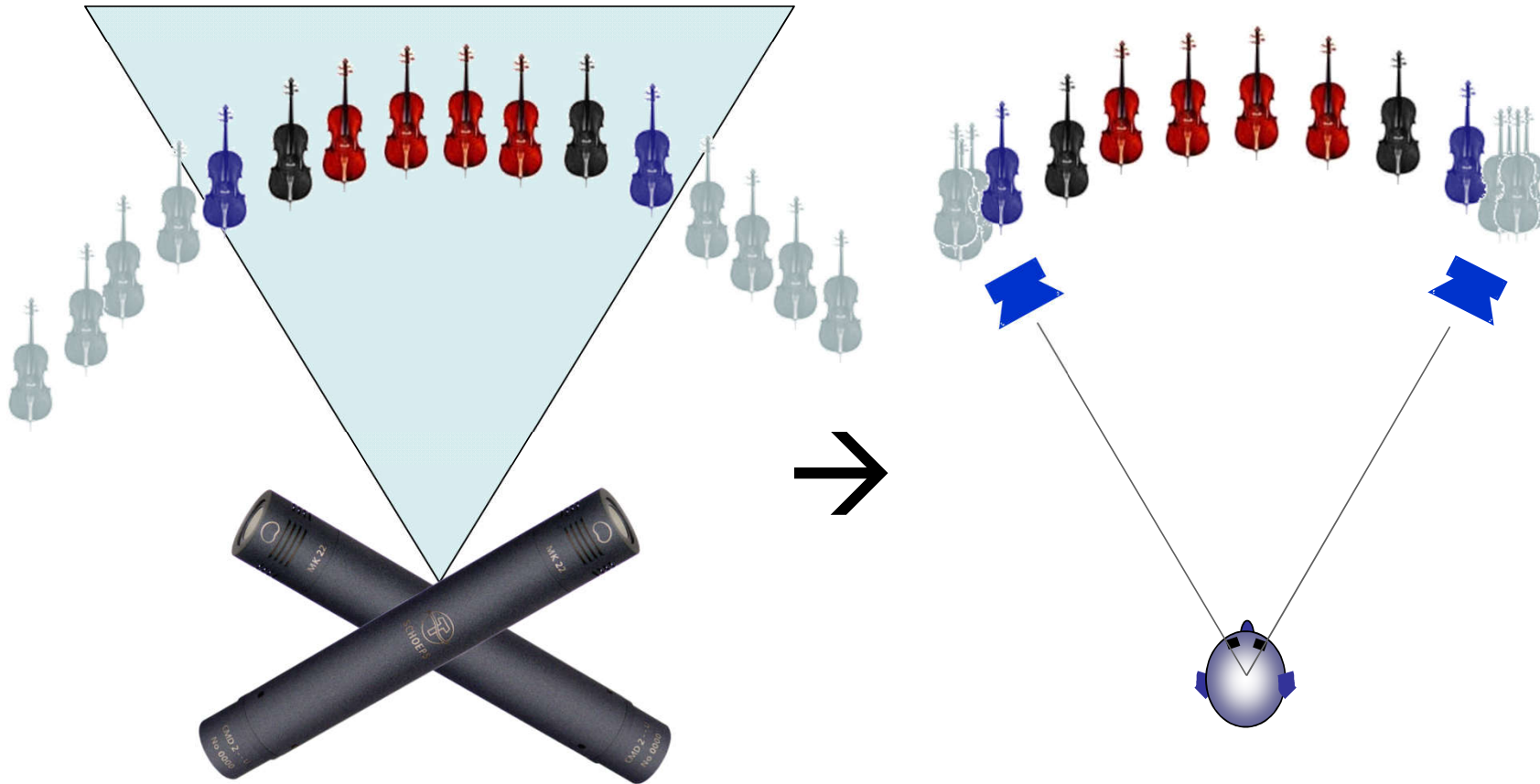
Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

- The Recording angle



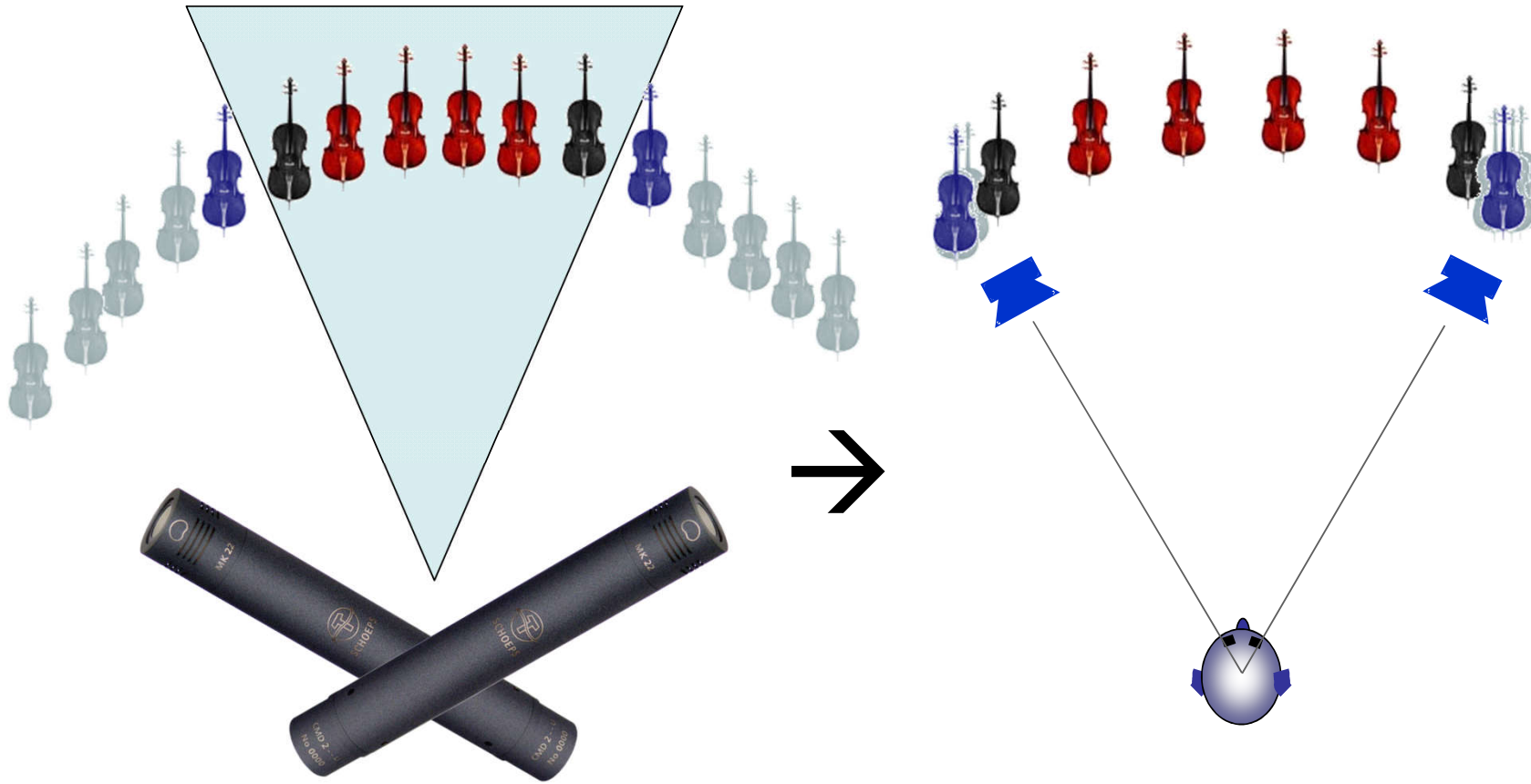
Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

- The Recording angle



Demo Recording Angle:  
Cedric 4 Stereophoniepaare "Schulhof" oder "Enten"

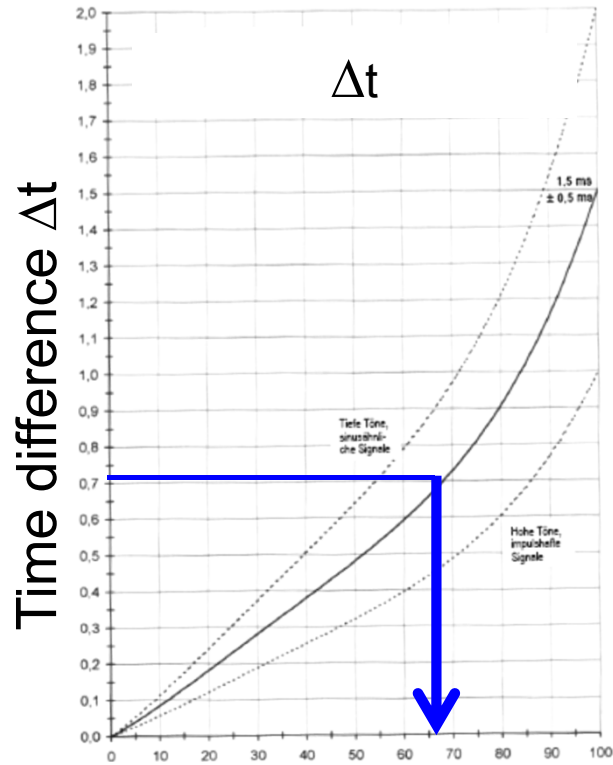
Basics

Stereo Imaging

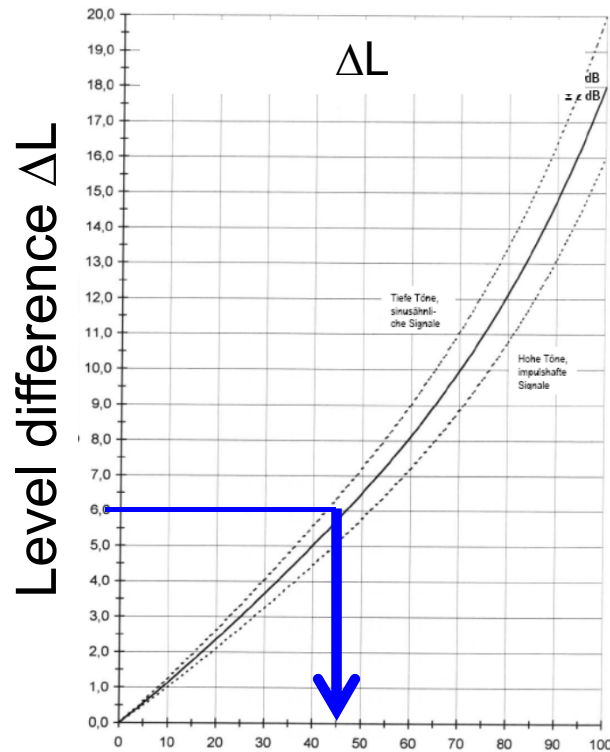
- Direct/Diffuse
- Directional Image
- Room Image

Array design

- The Recording angle



Loudspeakers



Loudspeakers



REF E.Sengpiel: [www.sengpielaudio.com](http://www.sengpielaudio.com)

Basics

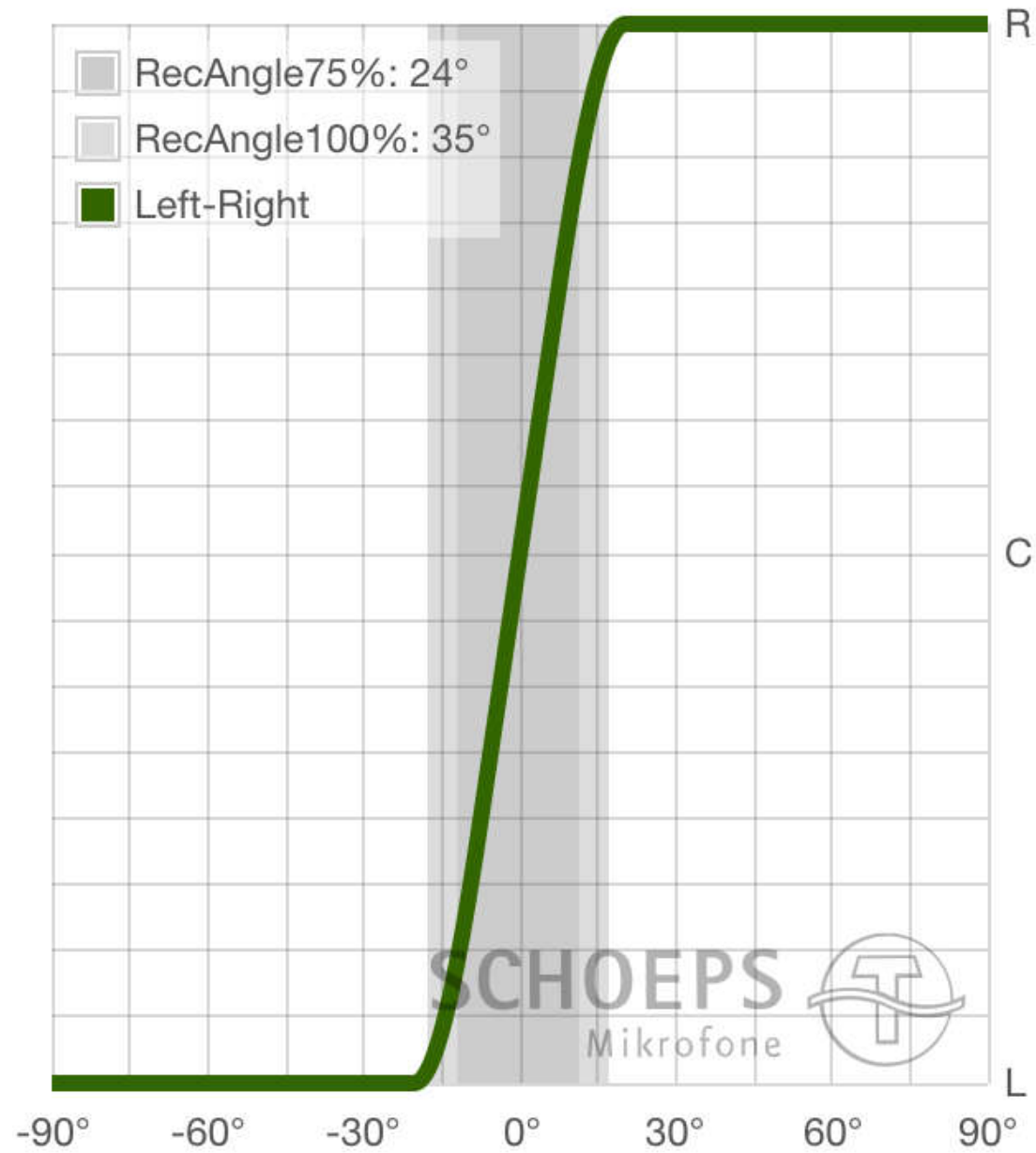
Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design



- Localisation Curve



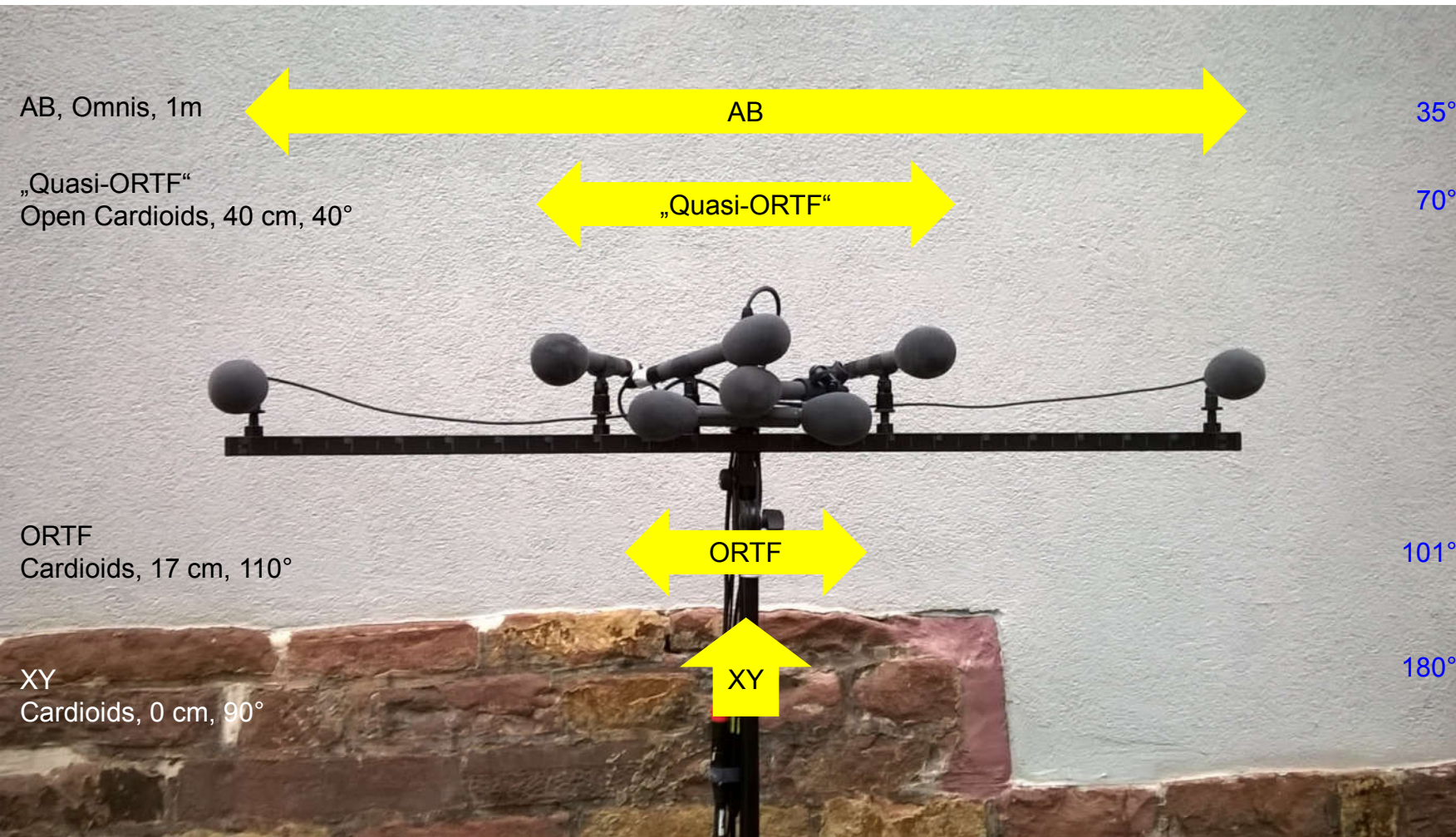
Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

## 2ch Ambience Recording: the effect of microphone spacing



Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

\*outdoor recordings on a 1 m Stereo bar MAB1000 with windshields B 5 D

## 2ch Ambience Recording: the effect of microphone spacing



Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image


Array design

- SCHOEPS-App "Image Assistant" [ima.schoeps.de](http://ima.schoeps.de)

## Image Assistant

By Schalltechnik Dr.-Ing. Schoeps GmbH

Open iTunes to buy and download apps.



**Description**

The Image Assistant is an App that calculates the localization curves of arbitrary 2- and 3-channel stereo microphone configurations.

[Image Assistant Support](#)

[View More by This Developer](#)

[...More](#)

[View in iTunes](#)

+ This app is designed for both iPhone and iPad

**Free**

Category: [Education](#)

Released: 29 October 2015

Version: 3.0.1

Size: 3.8 MB

Language: English

Developer: Schalltechnik Dr.-Ing. Schoeps GmbH

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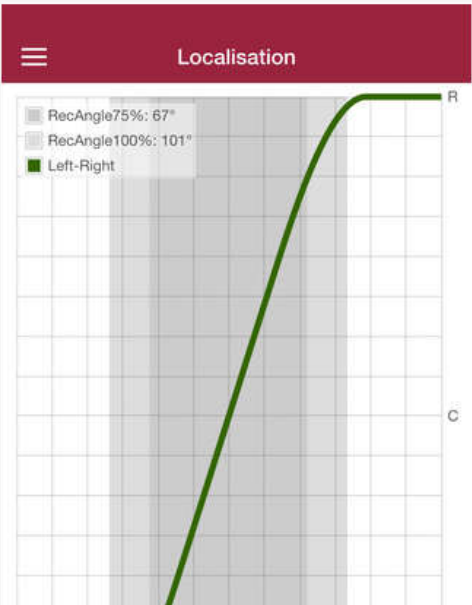
[Rated 4+](#)

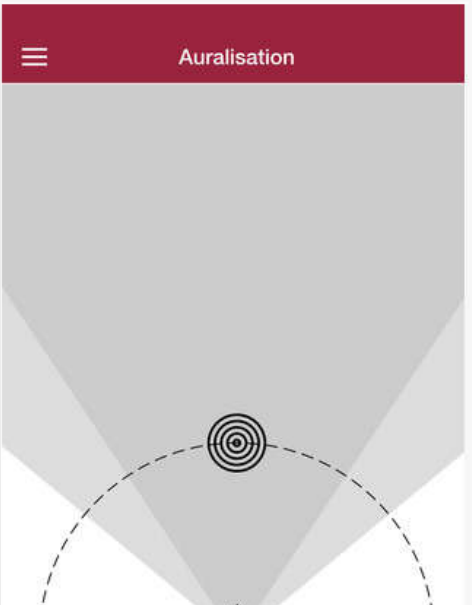
**Compatibility:** Requires iOS 7.0 or later. Compatible with iPhone, iPad, and iPod touch.

**Customer Ratings**

**Screenshots**

iPhone | iPad





Demo

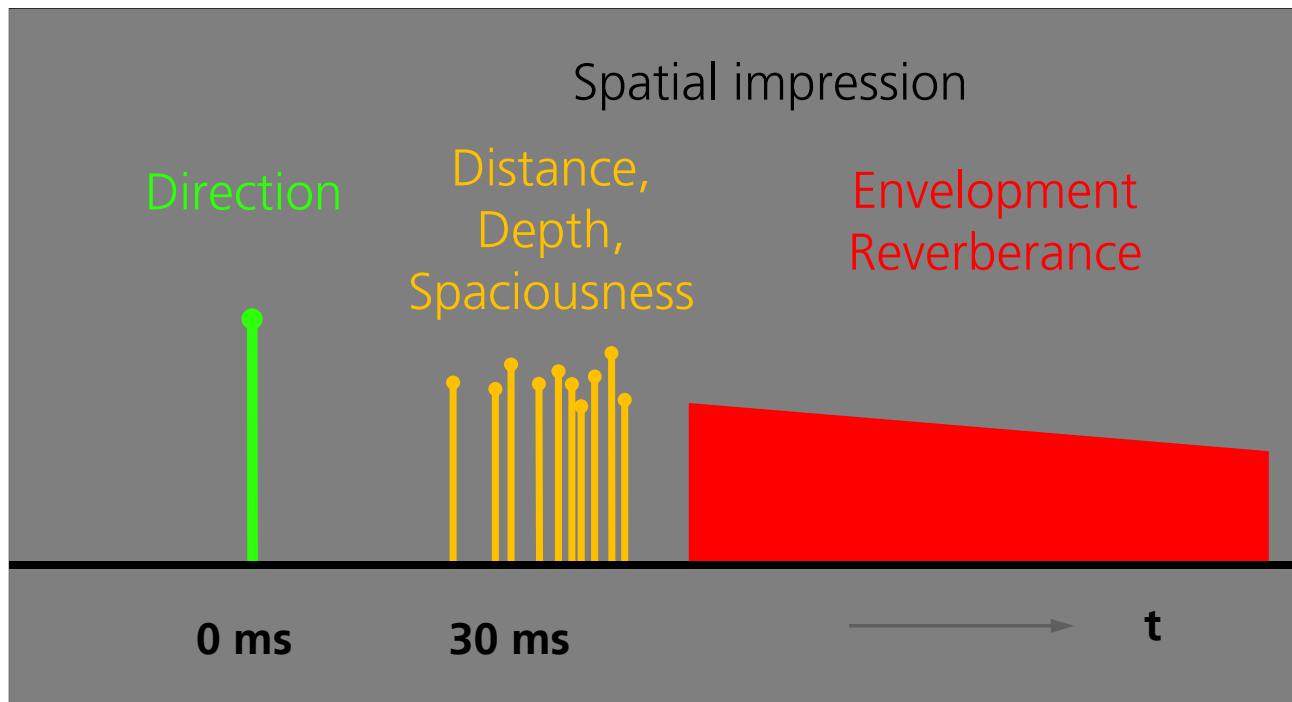
Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

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© Theile

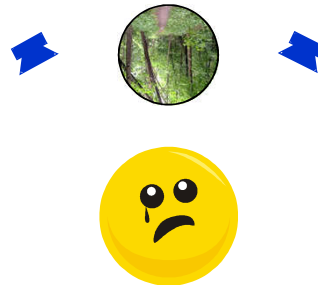
Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

Diffuse sound in the recording room → diffuse sound in the reproduction room



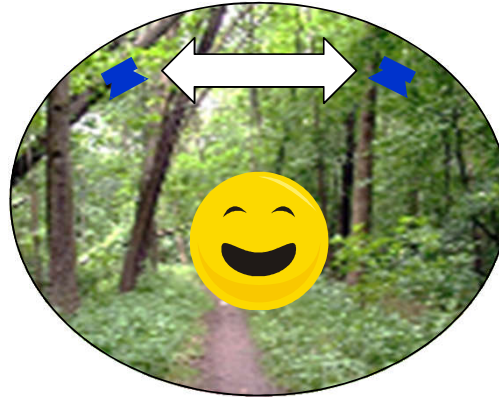
Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

Diffuse sound in the recording room → diffuse sound in the reproduction room



→ different diffuse signals  
= decorrelated in the diffuse field

Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design

- The larger the distance, the more independent the signals



- The larger the directivity, the more independent the signals



- The larger the opening angle, the more independent the signals



Basics

Stereo Imaging

- Direct/Diffuse
- Directional Image
- Room Image

Array design



- $\Delta L$  - Coincident microphones



Basics

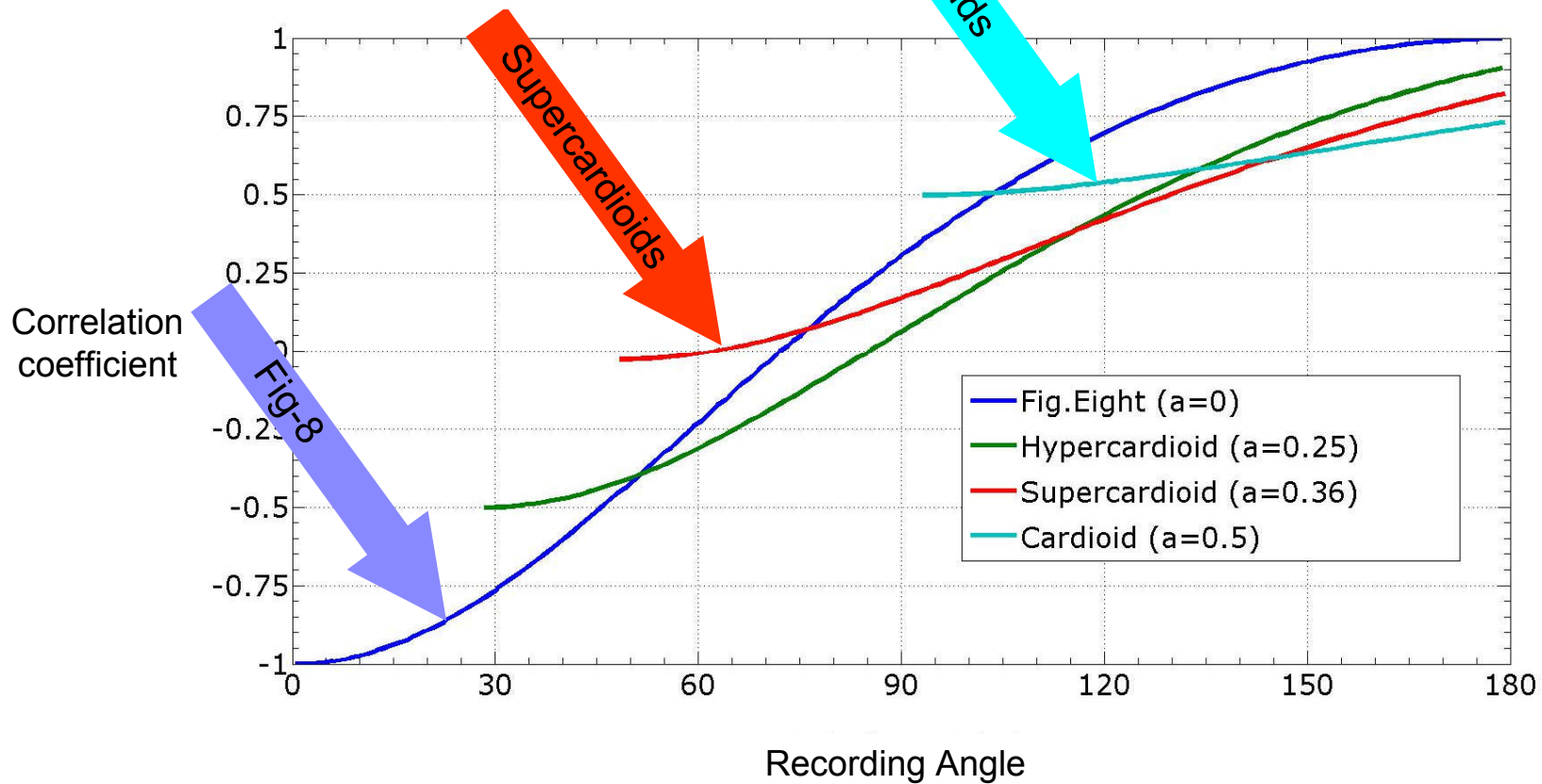
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- $\Delta L$  - Coincident microphones

Diffuse Field Correlation in a coincident setup



Basics

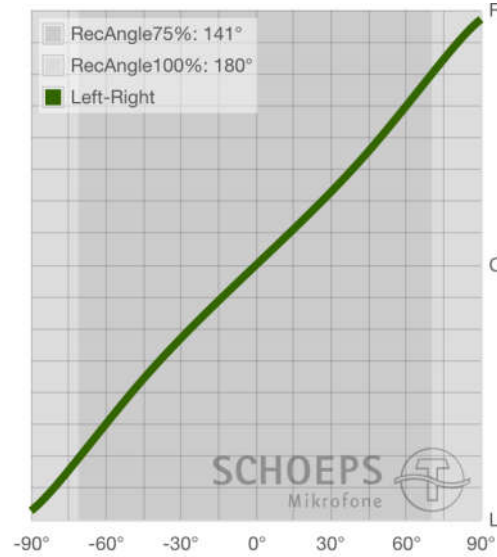
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## XY Cardioids, 90°

- compact
- small stereo width and a large DFC  
→ it can sound boring



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## XY Supercardioids, 60°

- compact
- good signal separation
- good stereo width
- low DFC



Better !



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## M/S

- compact
- flexible
- good room and imaging properties if decoded properly
- DFC can be 0
- Can be used on the boom with M = supercardioid or shotgun
- Good musical qualities with M = Omni or wide cardioid



Postpro!



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- $\Delta t + \Delta L$  – Stereo based on level and arrival time differences



Basics

Stereo Imaging

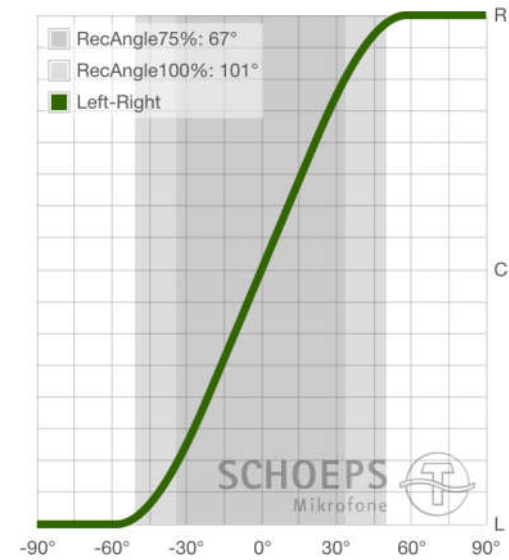
Array design

- Two-channel
- Multichannel
- 3D-Audio

## ORTF

- relatively compact
- very good imaging
- open and nice room sound

Room+Imaging



Basics

Stereo Imaging

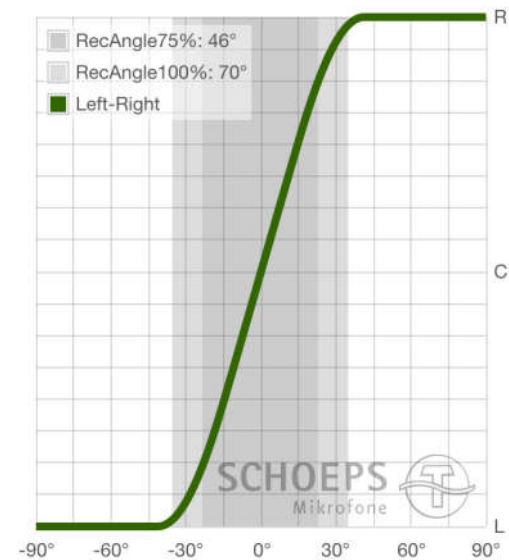
Array design

- Two-channel
- Multichannel
- 3D-Audio

## Quasi-ORTF

- Flexible recording angle
- good imaging
- open room sound

Room+Imaging



Basics

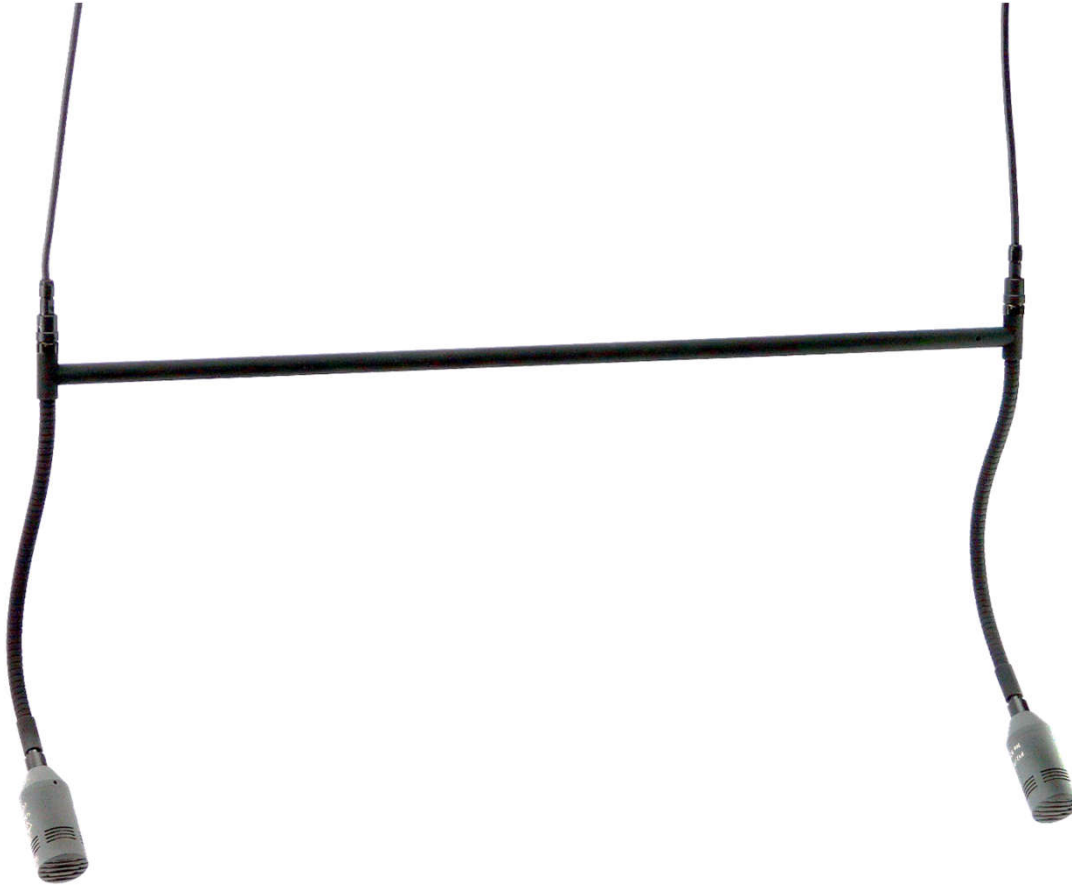
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio



- $\Delta t$  – Stereo based on arrival time differences



Basics

Stereo Imaging

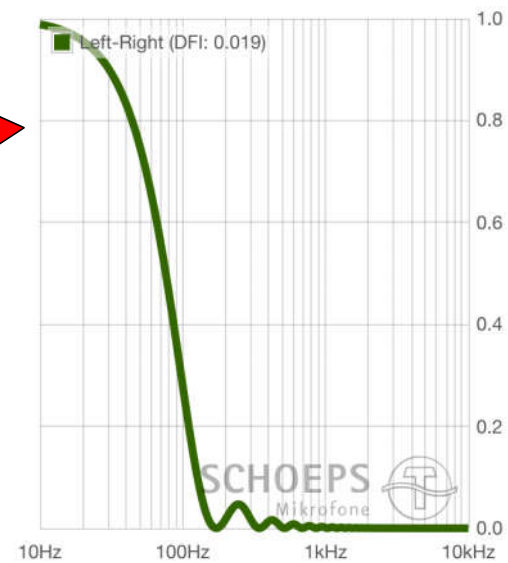
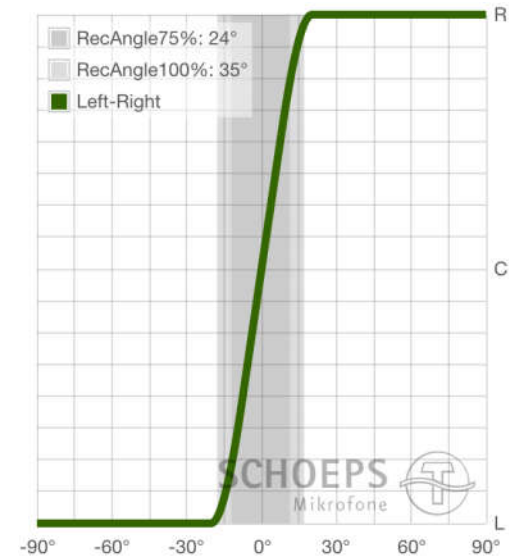
Array design

- Two-channel
- Multichannel
- 3D-Audio

A/B

- Not compact,  $d \geq 40$  cm
- Often preferred sound colour
- Open room sound
- Average imaging quality

Room !



Basics

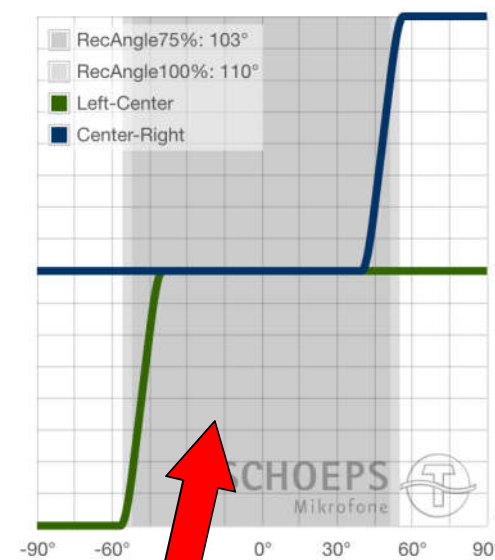
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## Decca-Tree

- Three stable phantom source locations (-30°, 0°, 30°)
- Robust image through large  $\Delta t$
- Robust image through  $\Delta L$  (1/r – law)
- Often preferred sound colour
- Open room sound



Stable A/B



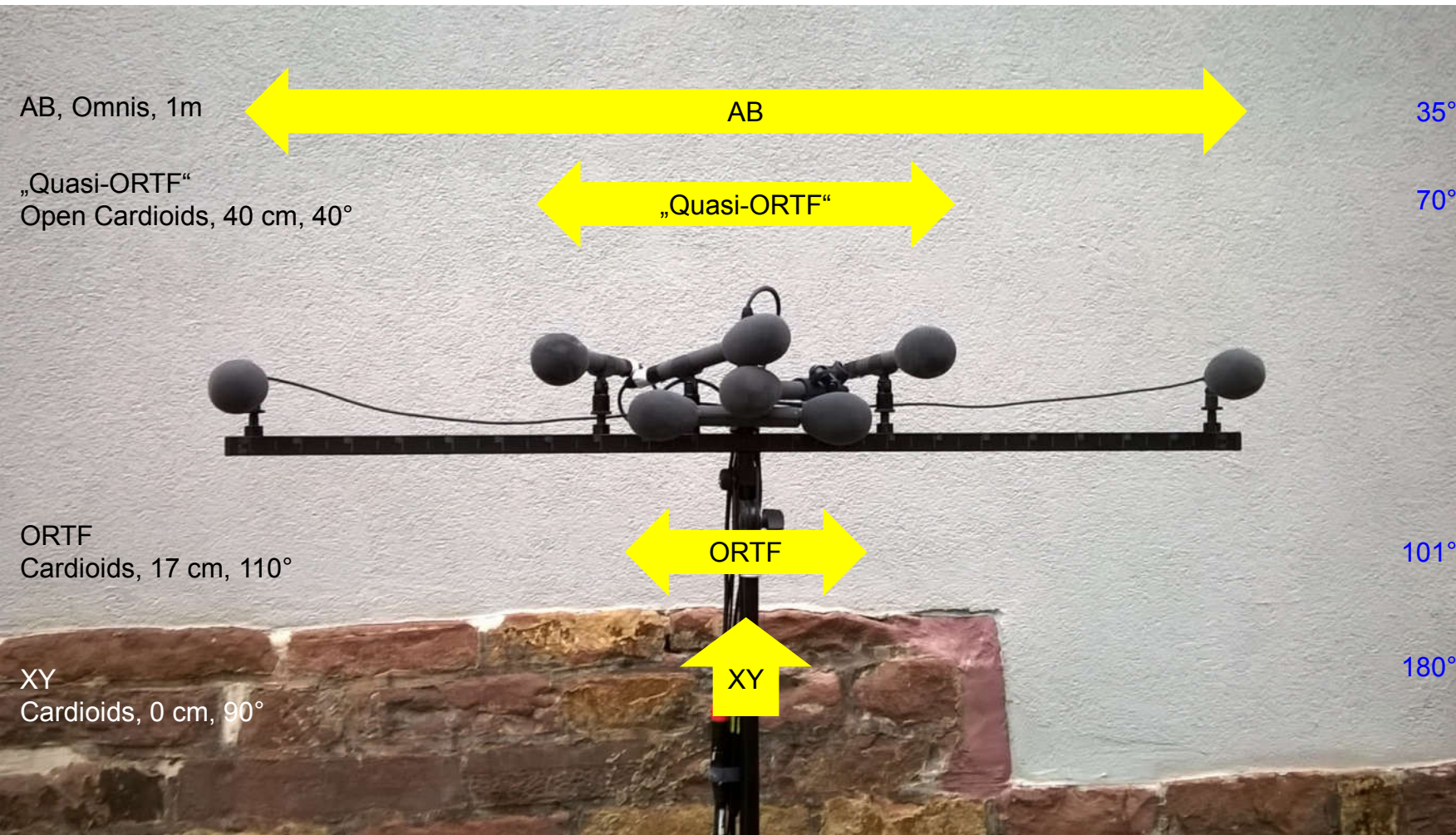
Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Comparison of four 2ch stereo setups (ambience)\* (Demo: Cedric, Bahnfahrt, Bahn+Motorroller)



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

\*outdoor recordings on a 1 m Stereo bar MAB1000 with windshields B 5 D

## 2ch Ambience Recording: the effect of microphone spacing



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Microphone Showroom: [www.schoeps.de/showroom](http://www.schoeps.de/showroom)

**SCHOEPS**  
Microphone Showroom

now playing: Ensemble (AB)

Equipment used:  
 - Stagetec Nexus preamps and converters  
 - Magix Sequoia 9  
 - No equalization, reverb or compression

INTERACTION  
INFORMATION

English  
Deutsch  
Français

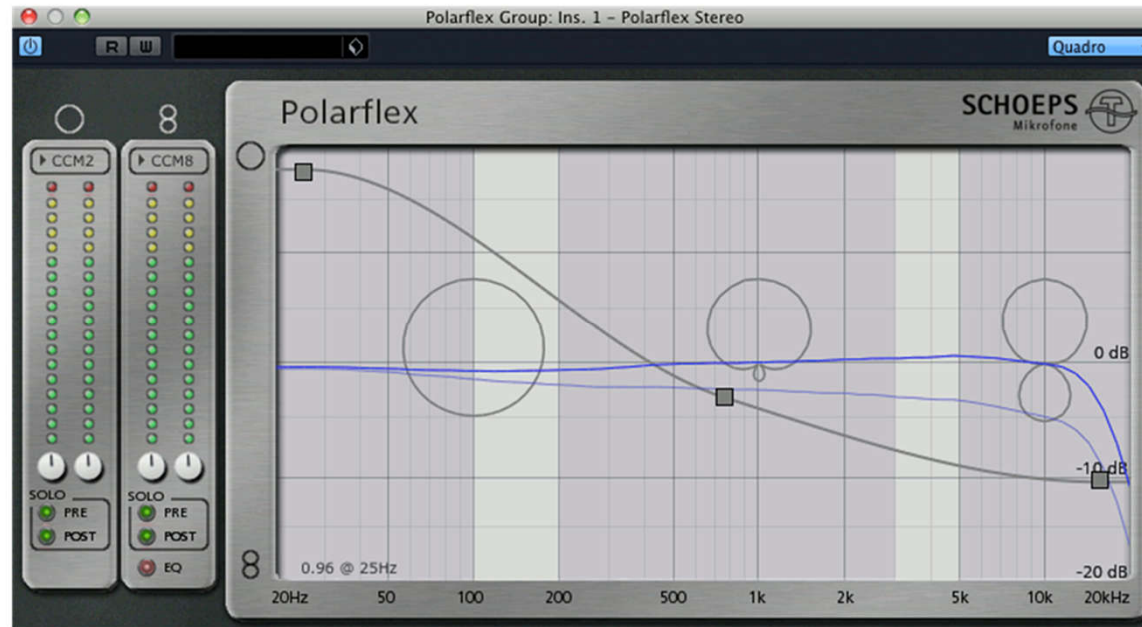
Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Polarflex technique
  - Mix Omni and Fig-8 in three frequency bands
  - Variation of the diffuse field response



## Directivity

Why?

Front to somewhere else ratios

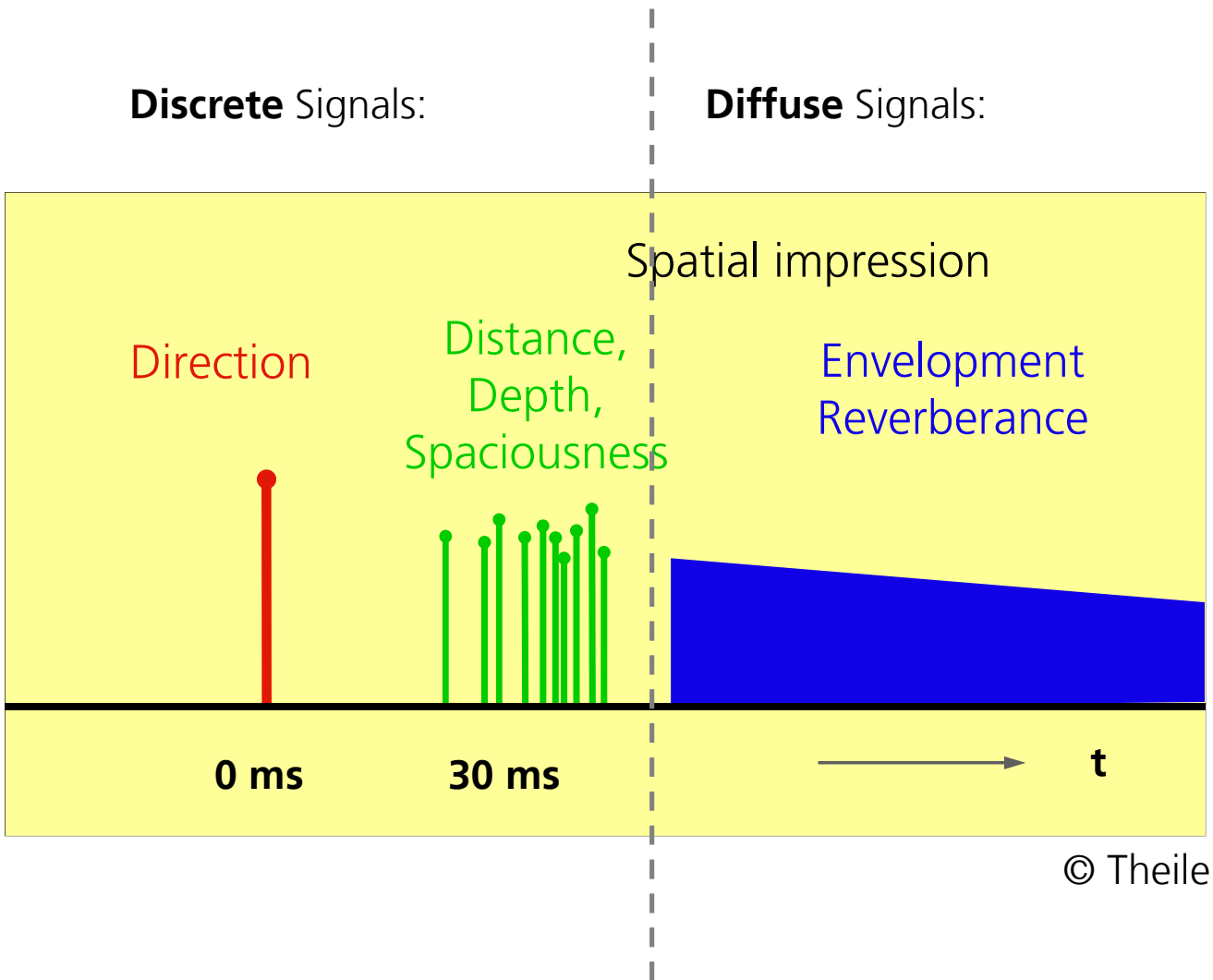
Distance factor

Polar diagram etc.

## Diffuse field

Interference tube

Higher order



Basics

Stereo Imaging

Array design

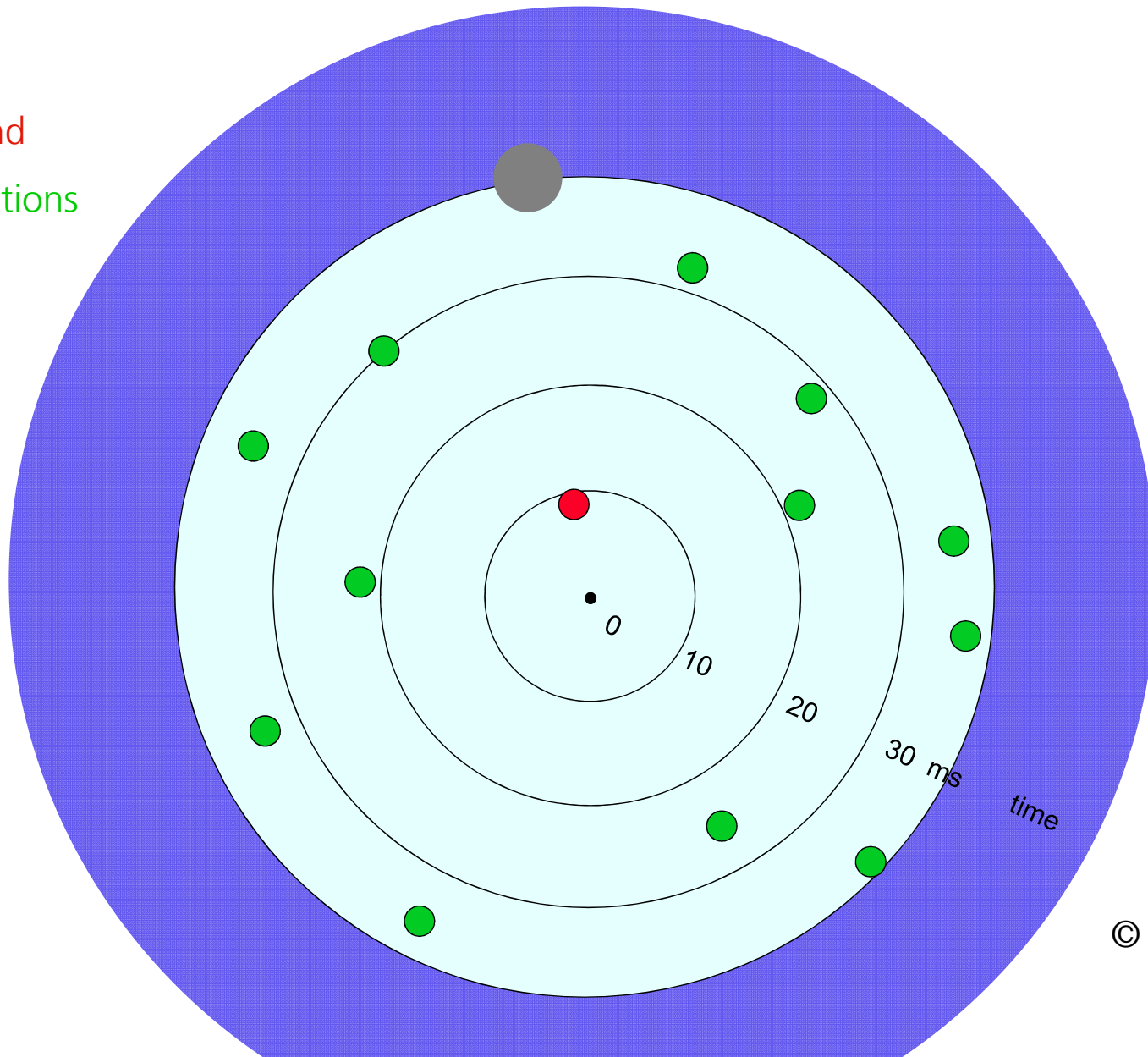
- Two-channel
- Multichannel
- 3D-Audio



Direct Sound

Early Reflections

Reverb



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

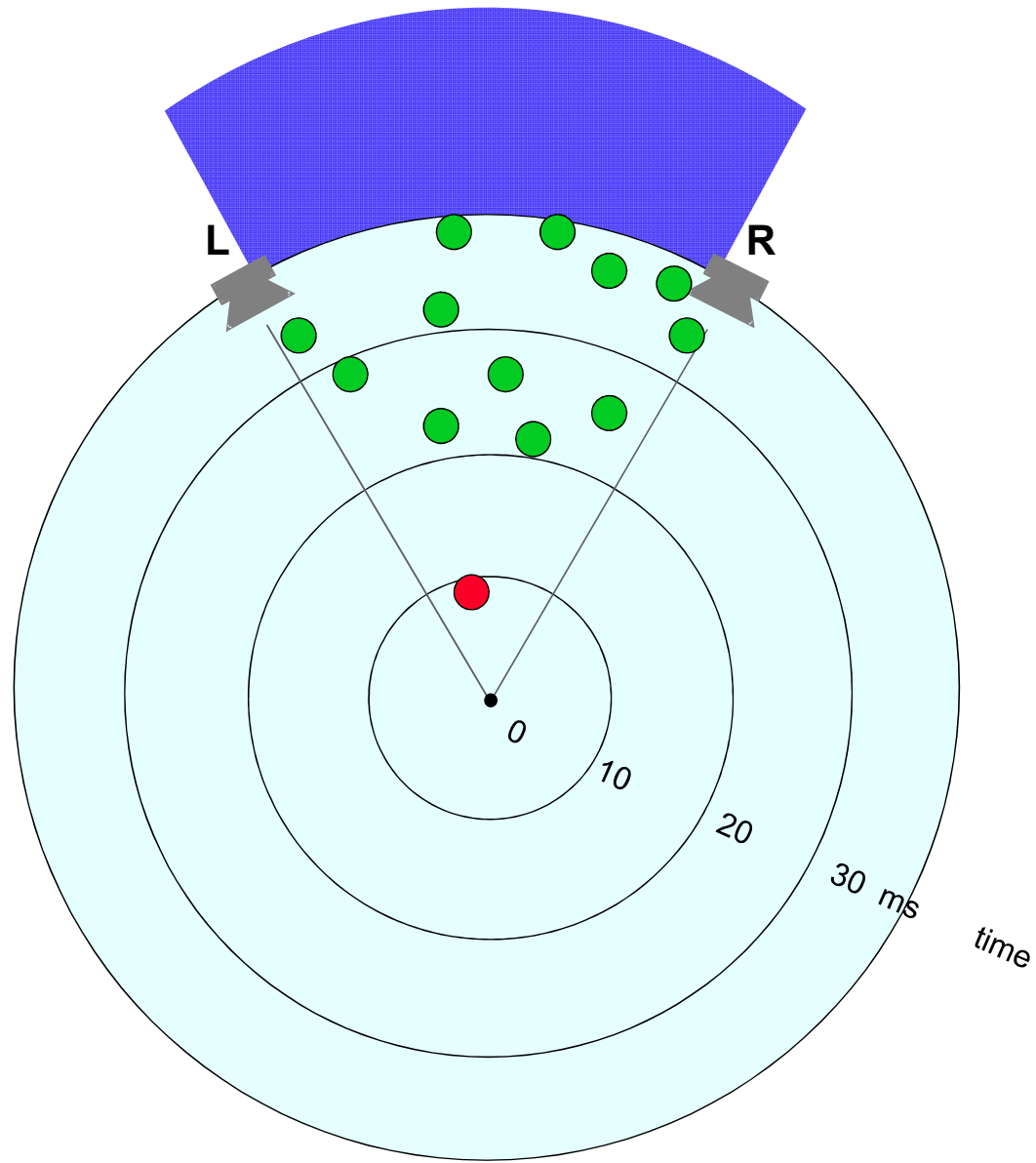
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Direct Sound

Early Reflections

Reverb



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

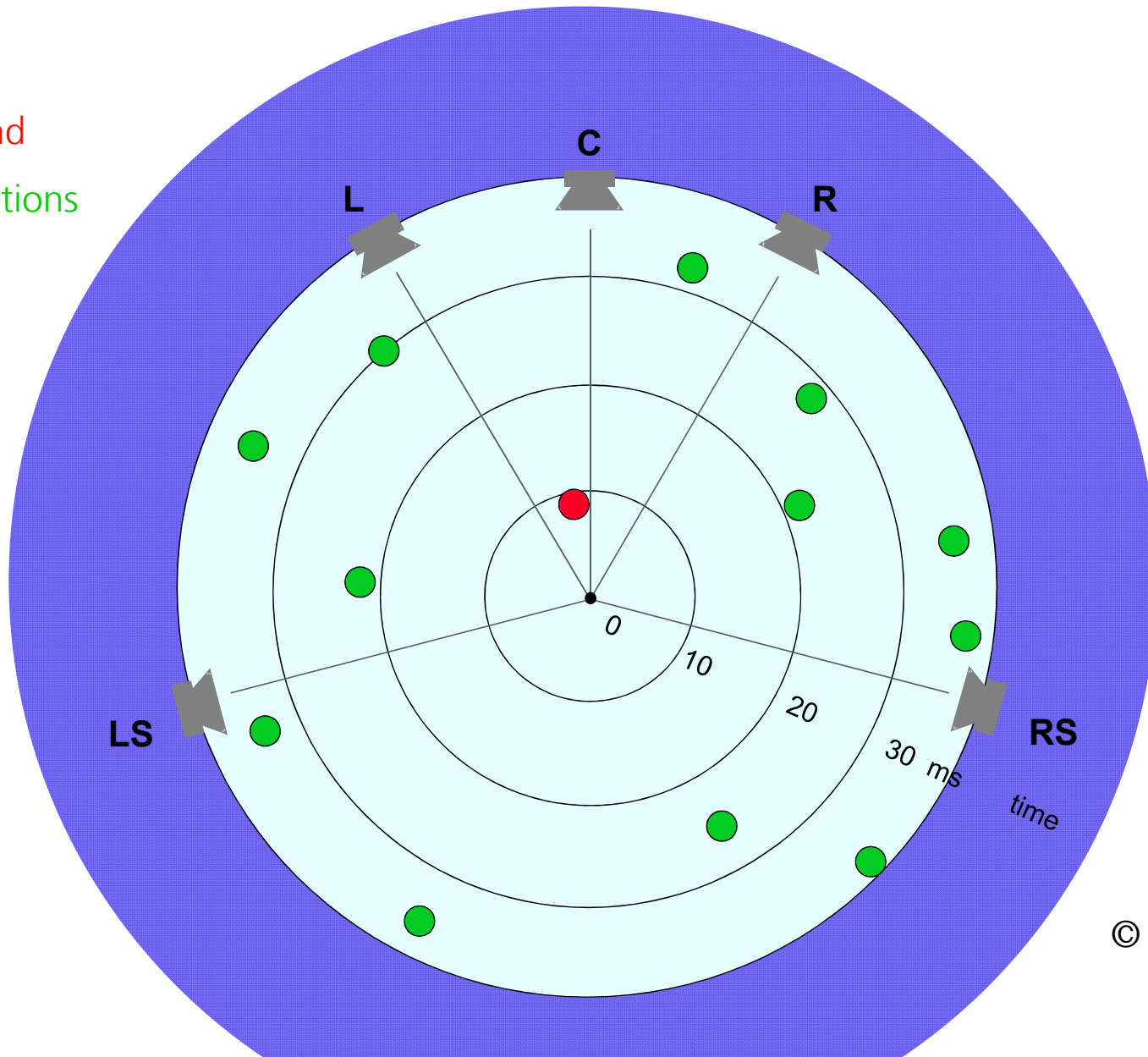
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Direct Sound

Early Reflections

Reverb



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

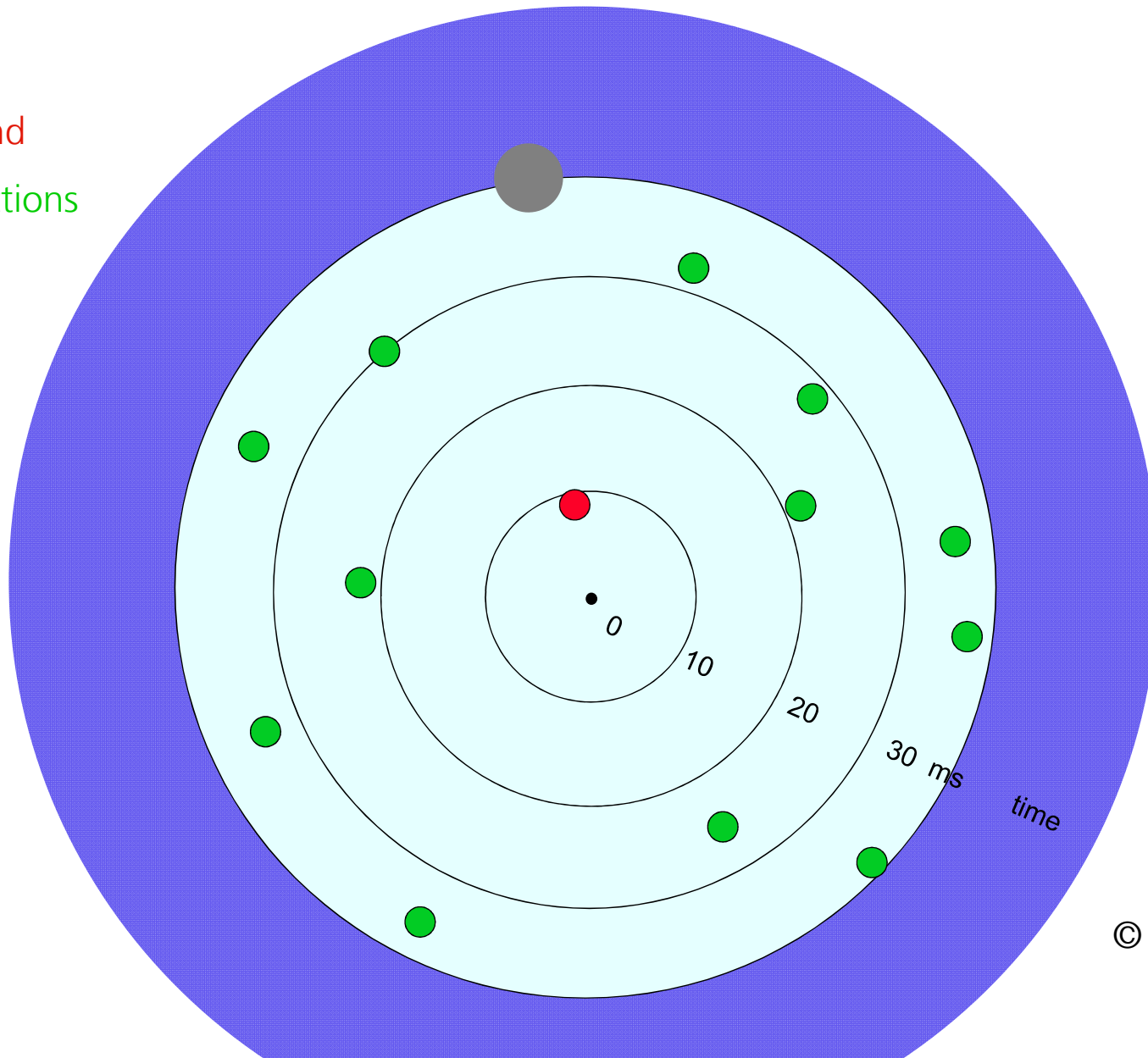
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Direct Sound

Early Reflections

Reverb



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

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- Demo Direktschall, Reflektionen/Tiefe, Diffusfeld zwischen Stereo und 5.1 (Auro3D-OCT9 Galaxy)

Basics

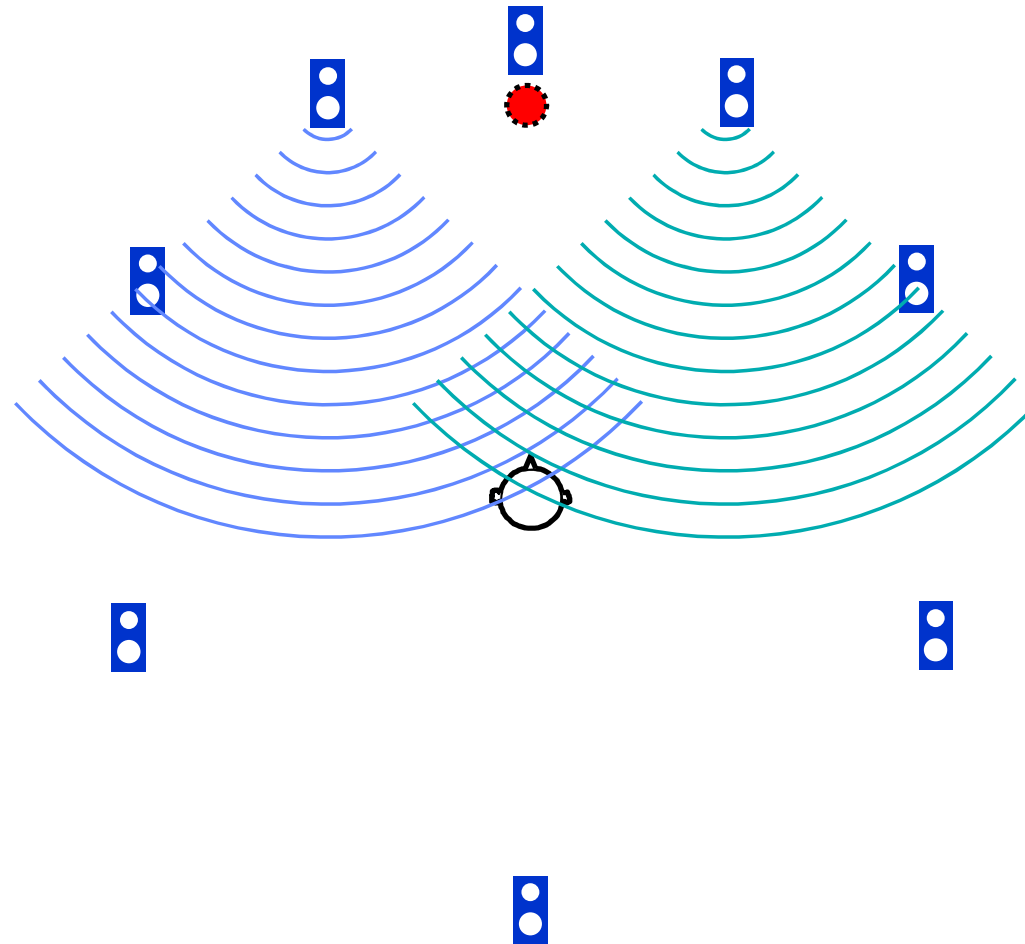
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

Spatial sound reproduction techniques:

- **Multichannel** Stereophony??



Basics

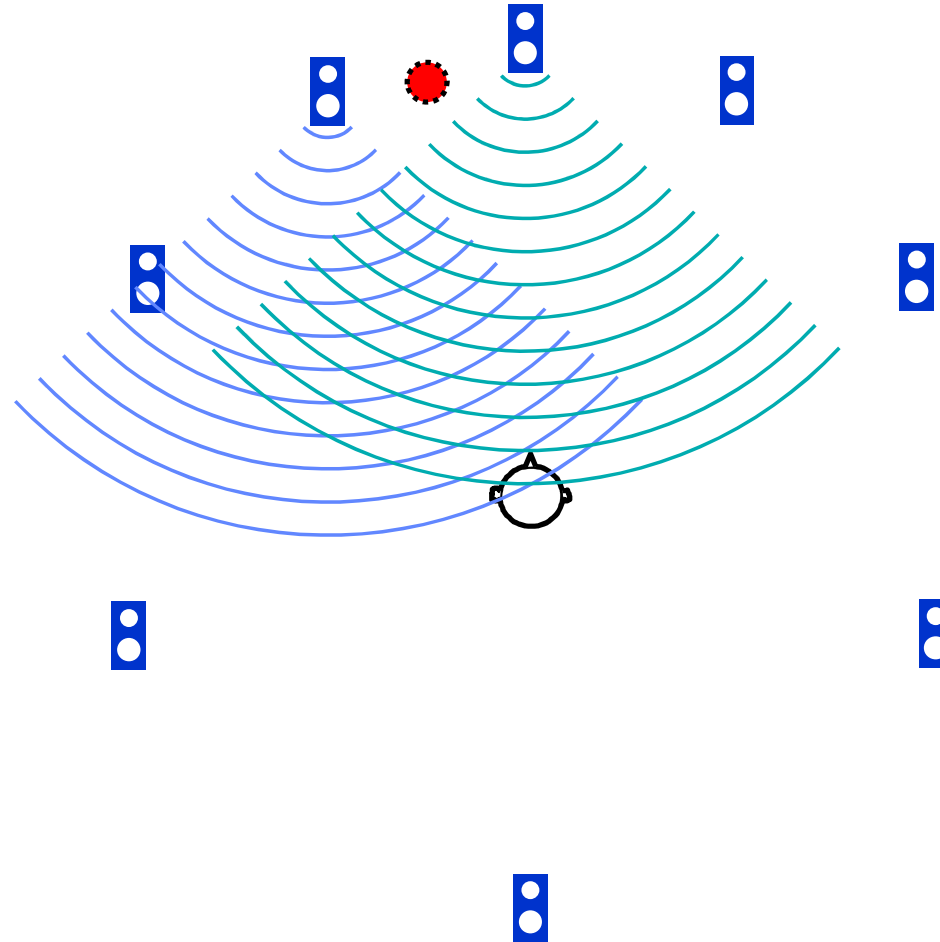
- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design for 3D-Audio

Spatial sound reproduction techniques:

- **Multichannel** Stereophony??



Basics

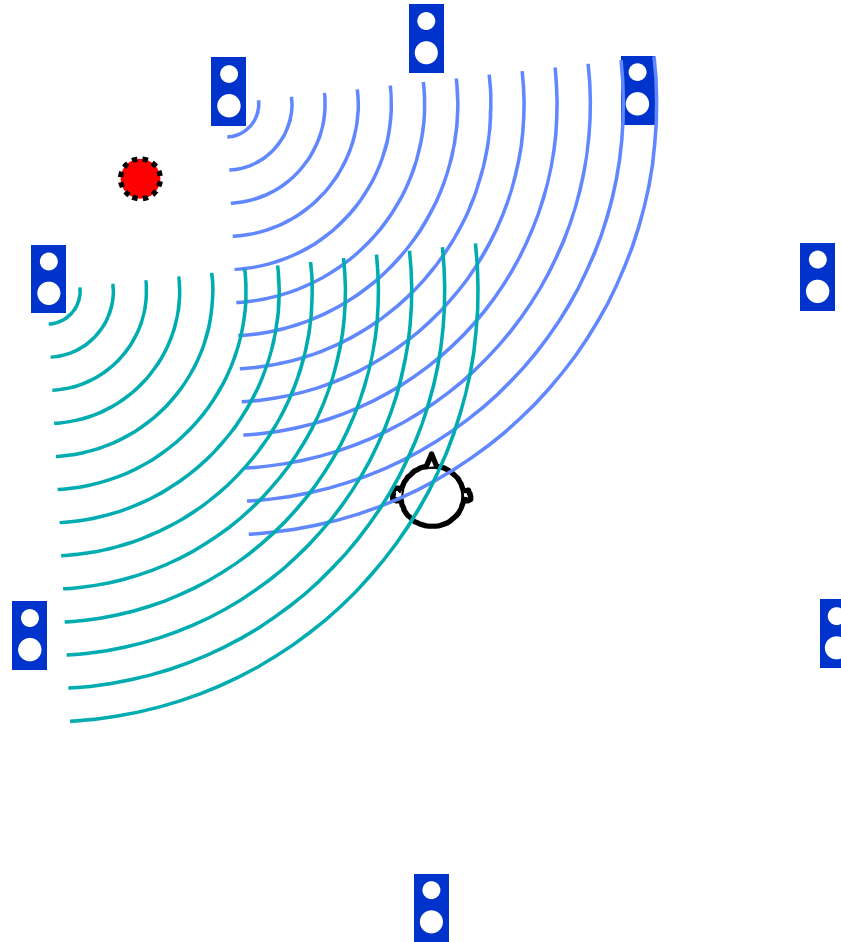
- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design for 3D-Audio

Spatial sound reproduction techniques:

- **Multichannel** Stereophony??



Basics

- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

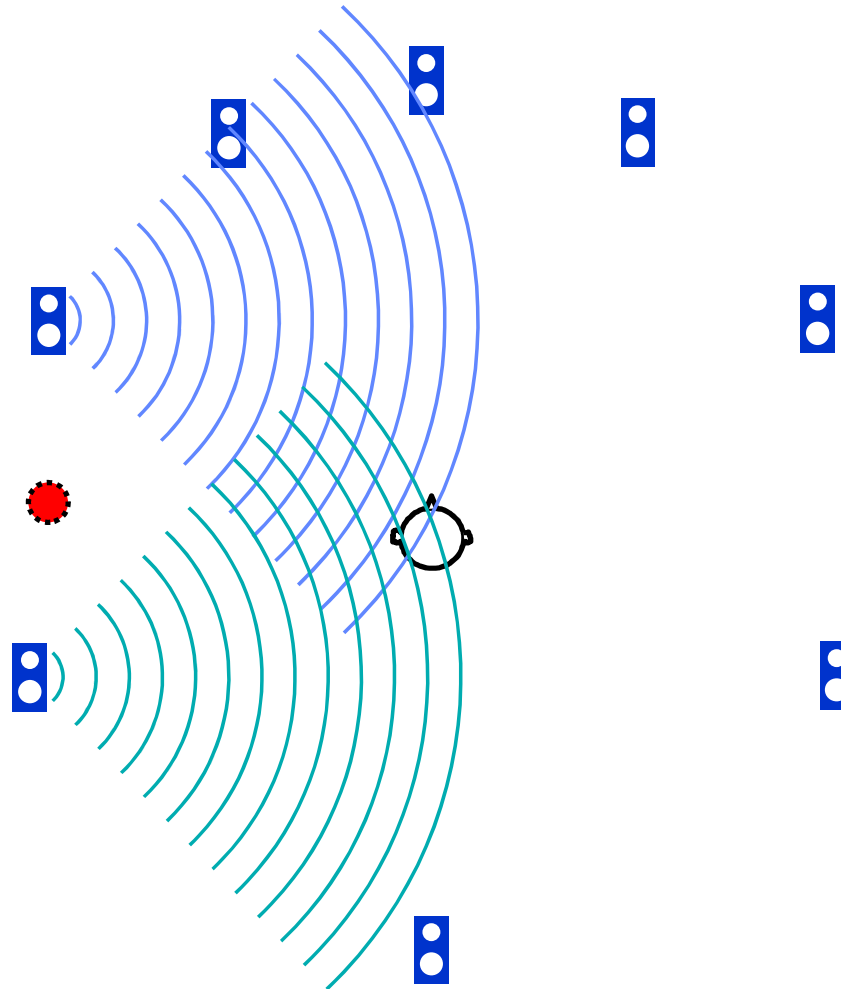
Stereo Imaging

Array design for 3D-Audio



Spatial sound reproduction techniques:

- **Multichannel** Stereophony??



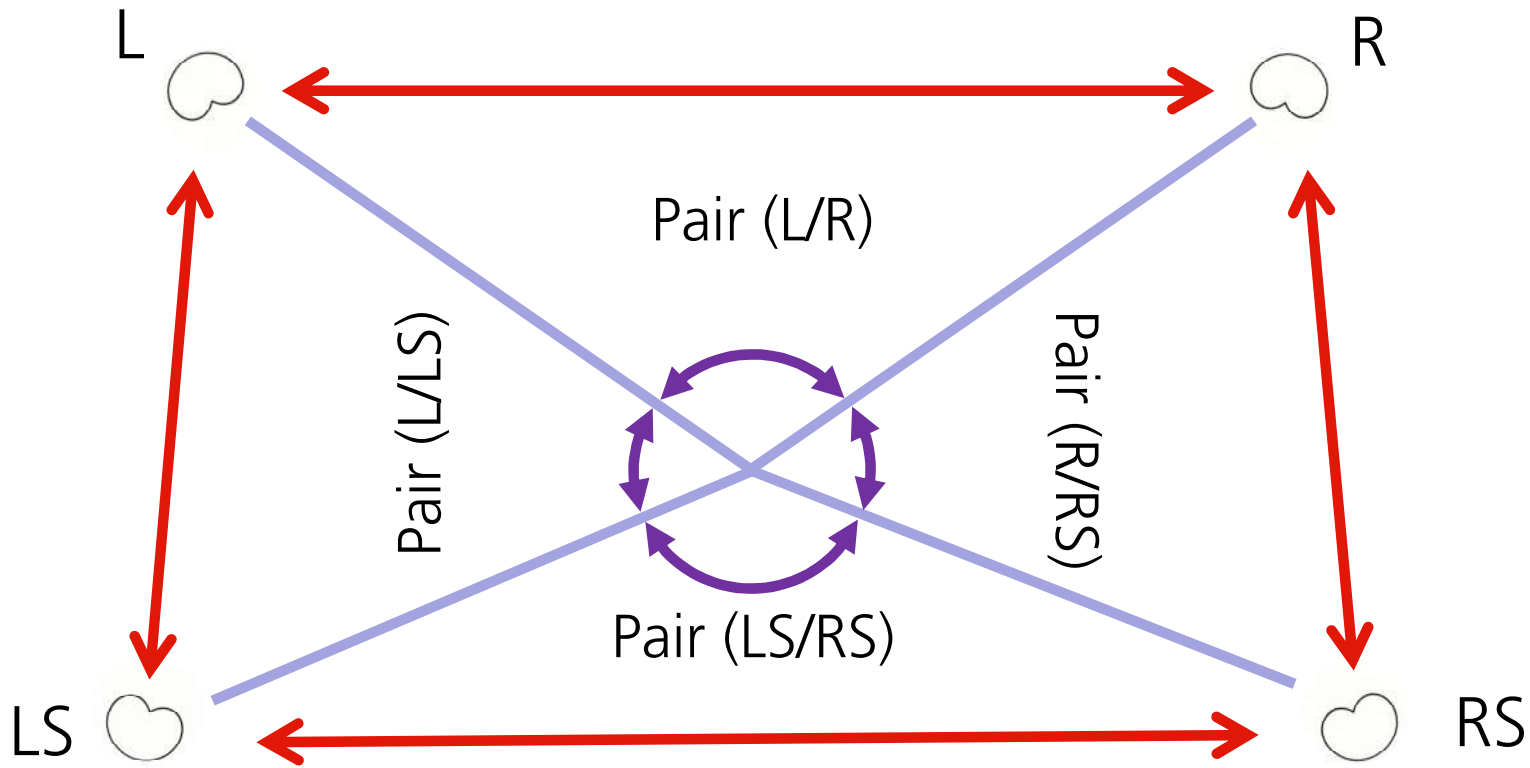
Basics

- 4 Spatial Sound reproduction principles
- Psychoacoustics of Stereo

Stereo Imaging

Array design for 3D-Audio

- 5.1 Array design for D/D scenes



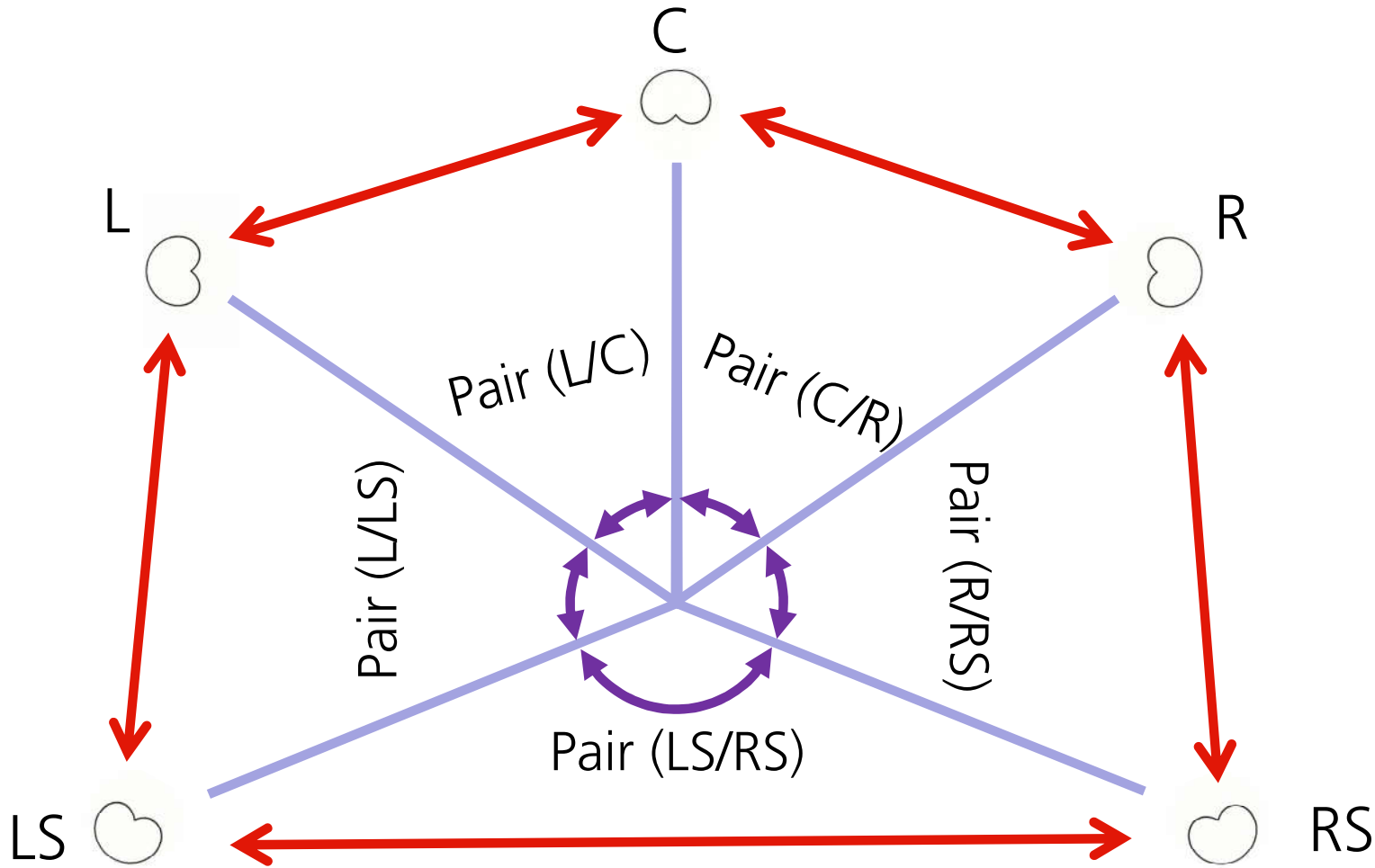
Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- 5.1 Array design for D/D scenes



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

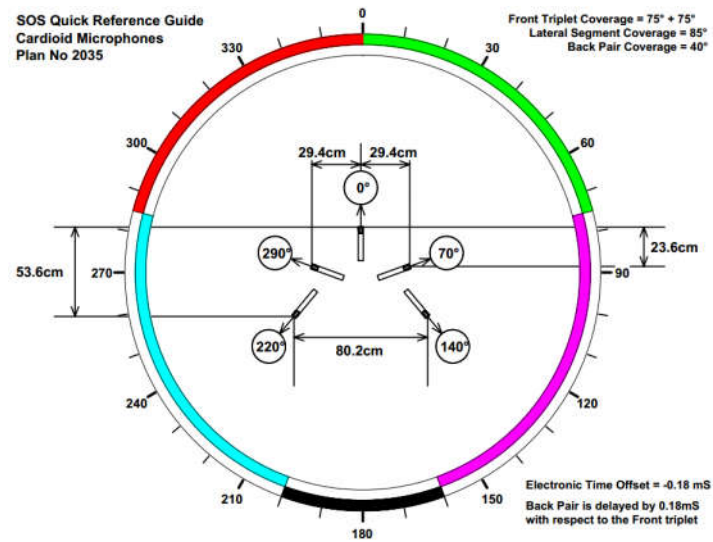
## Williams: MMAD

- Critical Linking of sectors
- <http://www.mmad.info>



Similar techniques based on this principle:

- INA 3/5 by Herrmann/Henkels
- Fukada-Tree
- etc.



REF M. Williams

Demo: Williams

hauptmikrofon.de

Basics

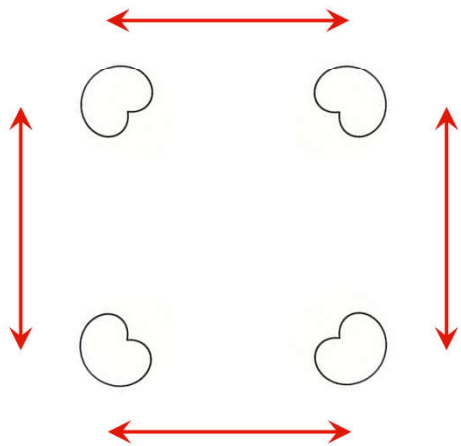
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

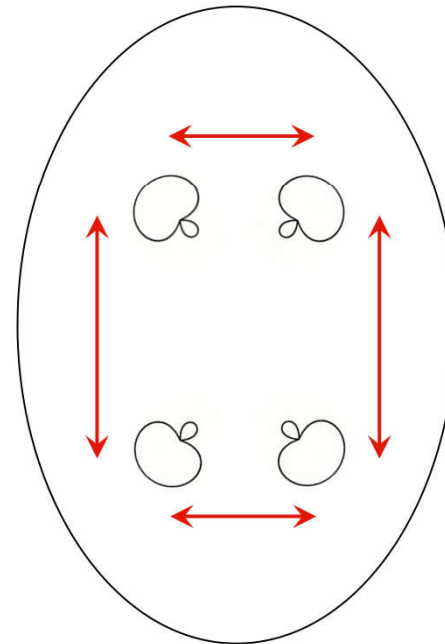
## IRT cross

- 4 Cardioids at 20 cm - 90°
- 4 Supercardioids at 14 cm - 90°



## “ORTF Surround”:

- 4 Supercardioids at 10cm/100°/80°



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## IRT cross

- 4 Cardioids at 20 cm - 90°
- 4 Supercardioids at 14 cm - 90°



## “ORTF Surround”:

- 4 Supercardioids at 10cm/100°/80°



Basics

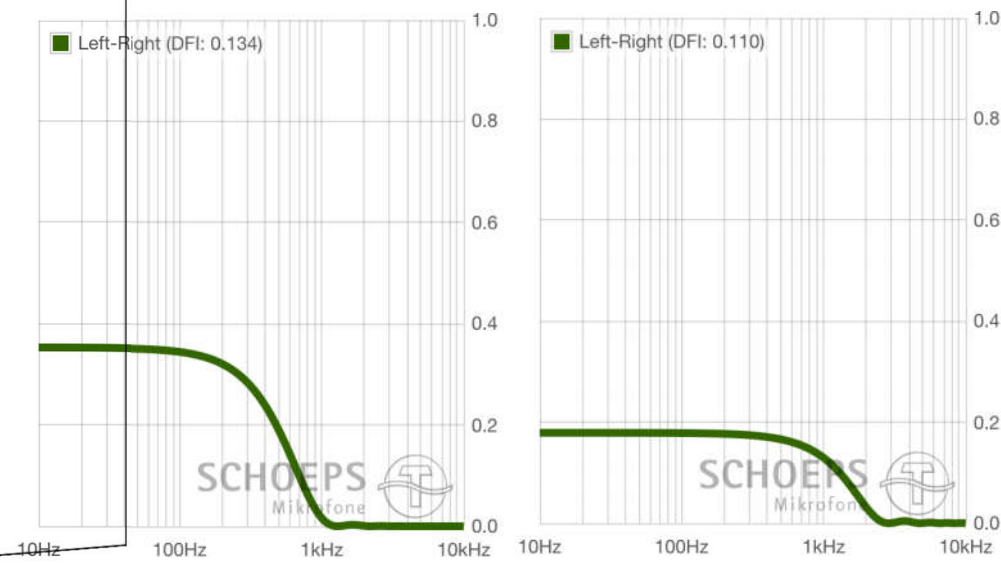
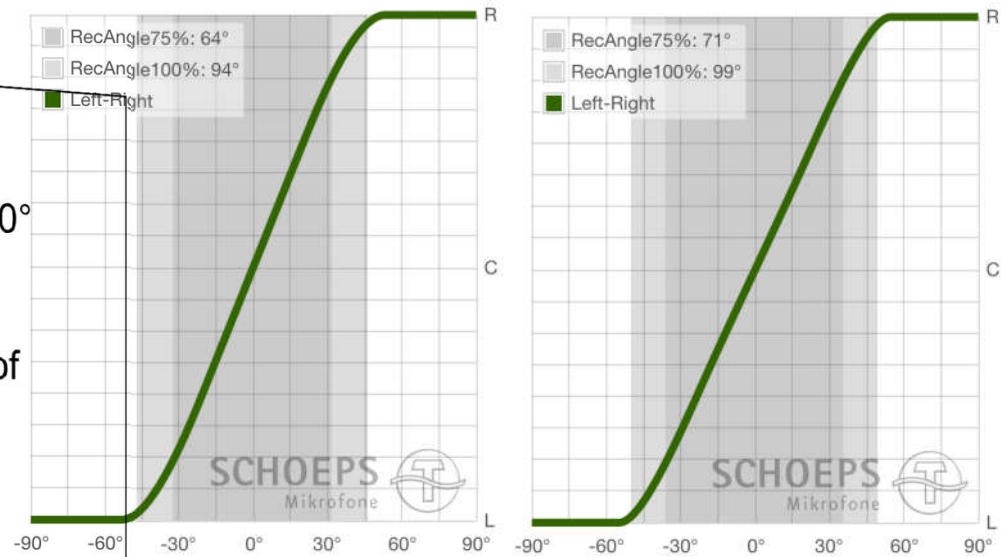
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## “ORTF Surround”:

- 4 Supercardioids at 10cm/100°/80°
- Minimum Crosstalk
- Optimal Directional Image
- Very good decorrelation in spite of the small dimensions



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Demo: ORTF Surround (Barbeau, Paralympics, WorldCup)



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio



- Additional Criteria for the Array design in 5.1
- Scene type: Which content is in the Front/Back? **D**irect or **A**mbience?
  - e.g. D/D: Direct sound in the Front and Back
- Use of Center channel

Example	Scene type	Special properties	Center channel	Suitable setup
<b>Documentary ambience with discrete sources</b>	D/D	Outdoor capability	X	5 wide cardioids
<b>Dry radio drama recording in the studio</b>	D/D	Post production, little diffuse sound	X/-	Double M/S
<b>Stadium ambience for Sports</b>	D/D	Small size, easy-to-use	-	ORTF Surround
<b>Ensemble in the concert hall</b>	D/A	Front Directional image	X	OCT Surround, OCT + Hamasaki
<b>Large Orchestra in the concert hall</b>	D/A	Uses spot microphones	X	5 omnis
<b>Concert hall ambience</b>	A/A	Direct sound suppression	-	Hamasaki Square

Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- 5.1 Array design for D/A scenes



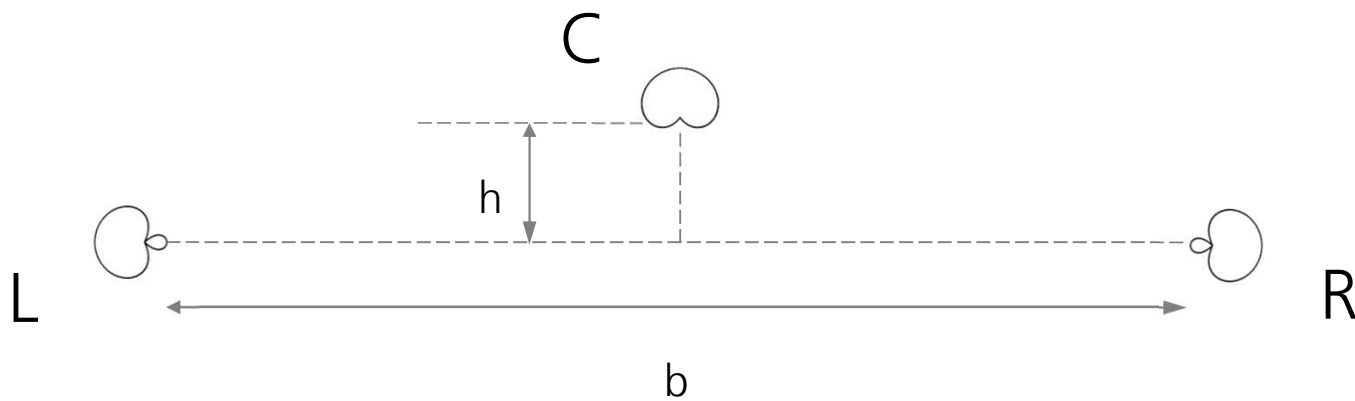
Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- 5.1 Array design for D/A scenes
- OCT:  $h = 8\text{cm}$ ;  $b = 40..100\text{cm}$



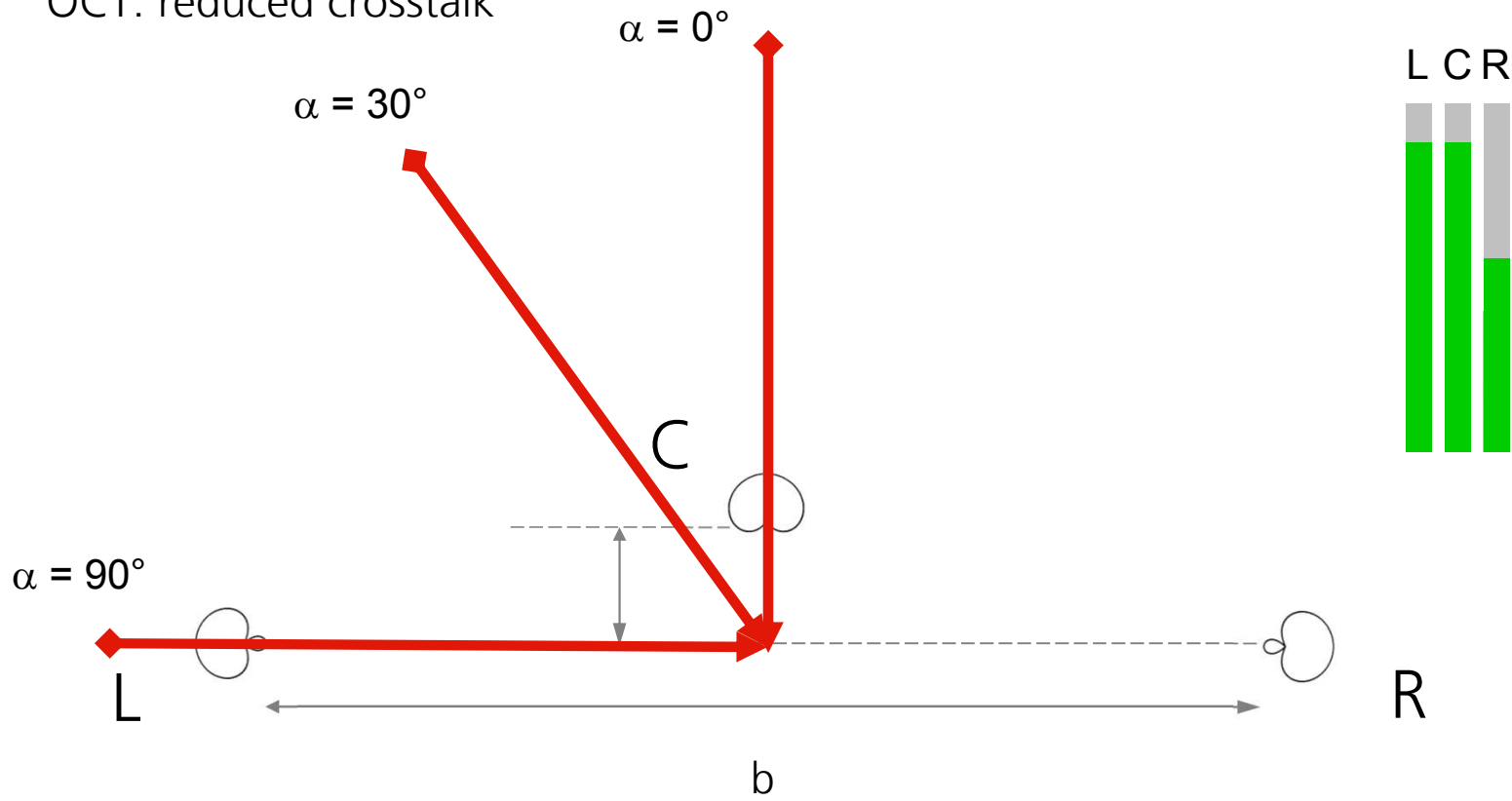
Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- 5.1 Array design for D/A scenes
- OCT: reduced crosstalk



Basics

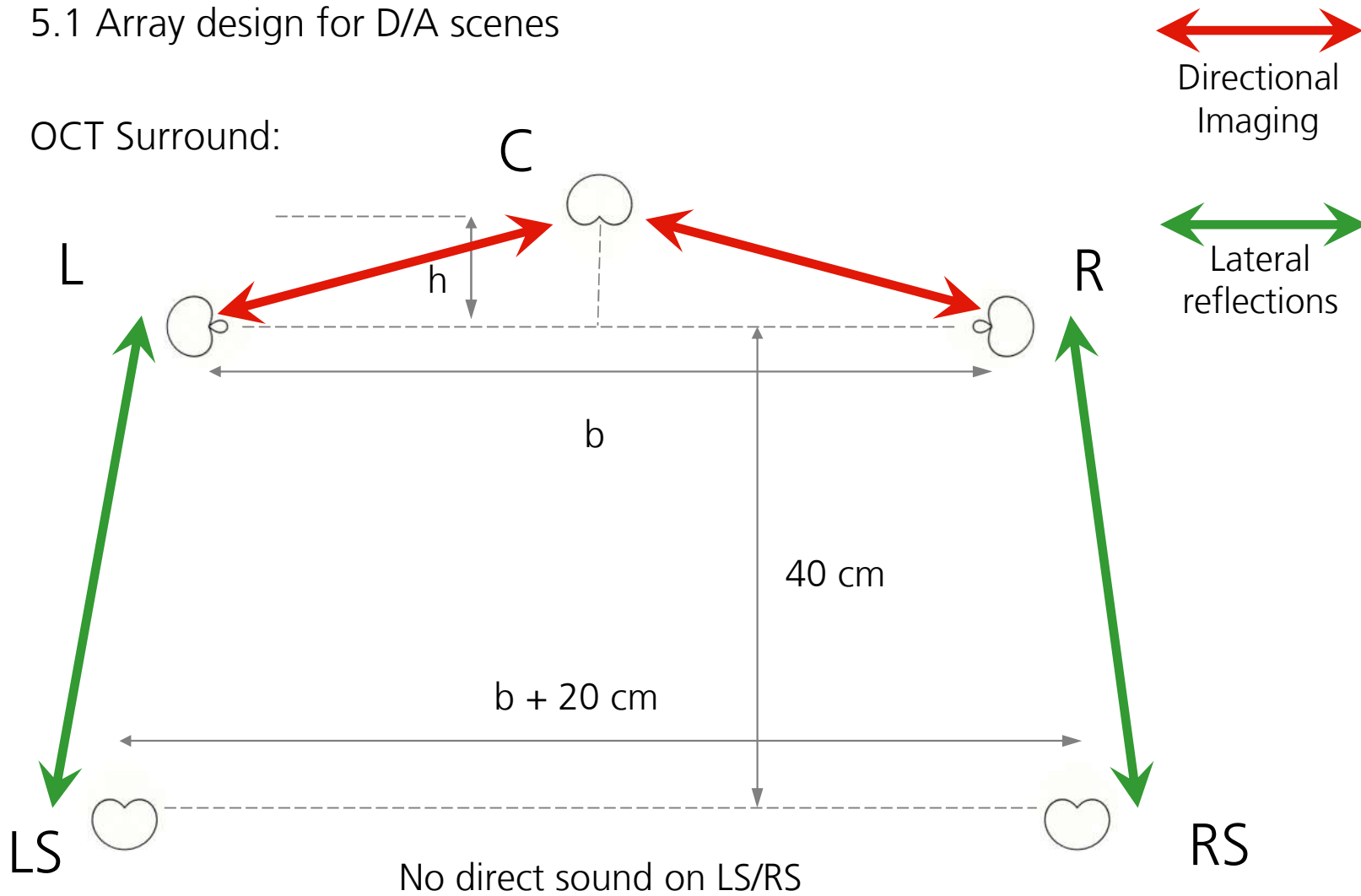
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- 5.1 Array design for D/A scenes

- OCT Surround:



Basics

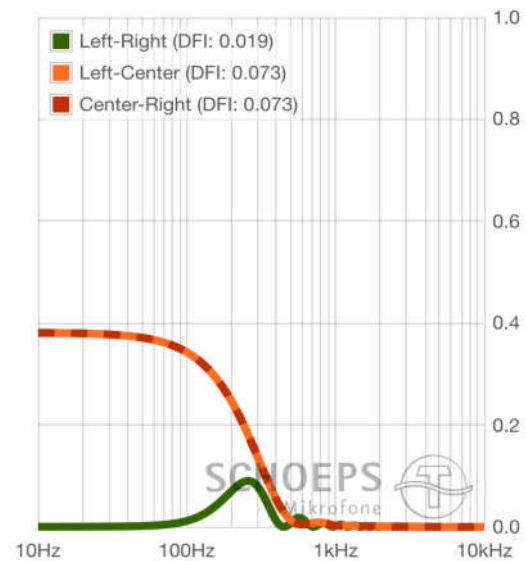
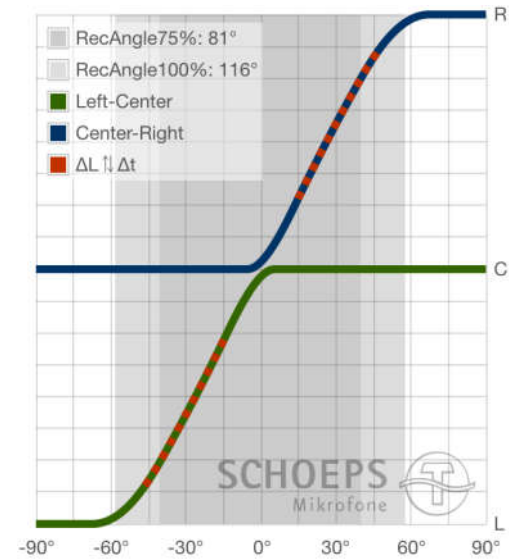
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## OCT

- ORTF-like Surround Array
- Minimum Crosstalk
- Optimal Directional Image
- Natural Depth



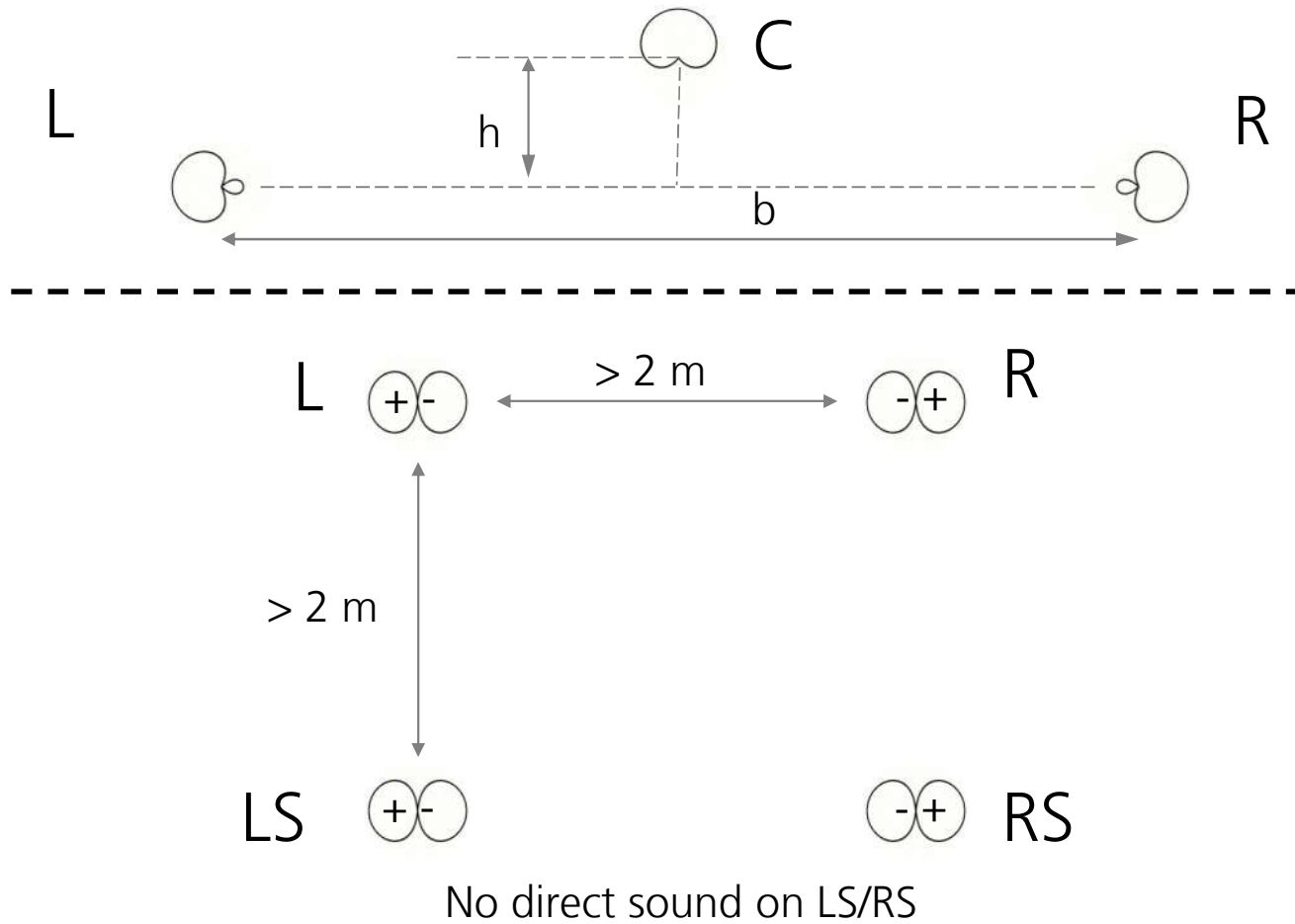
Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- 5.1 Array design for D/A scenes
- OCT + Hamasaki square



Basics

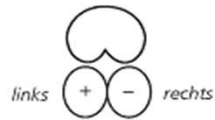
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## Double M/S

- Front M/S pair + Rear M/S pair =
- Combined Double M/S triplet
- Decoding like 2 \* M/S



Basics

Stereo Imaging

Array design

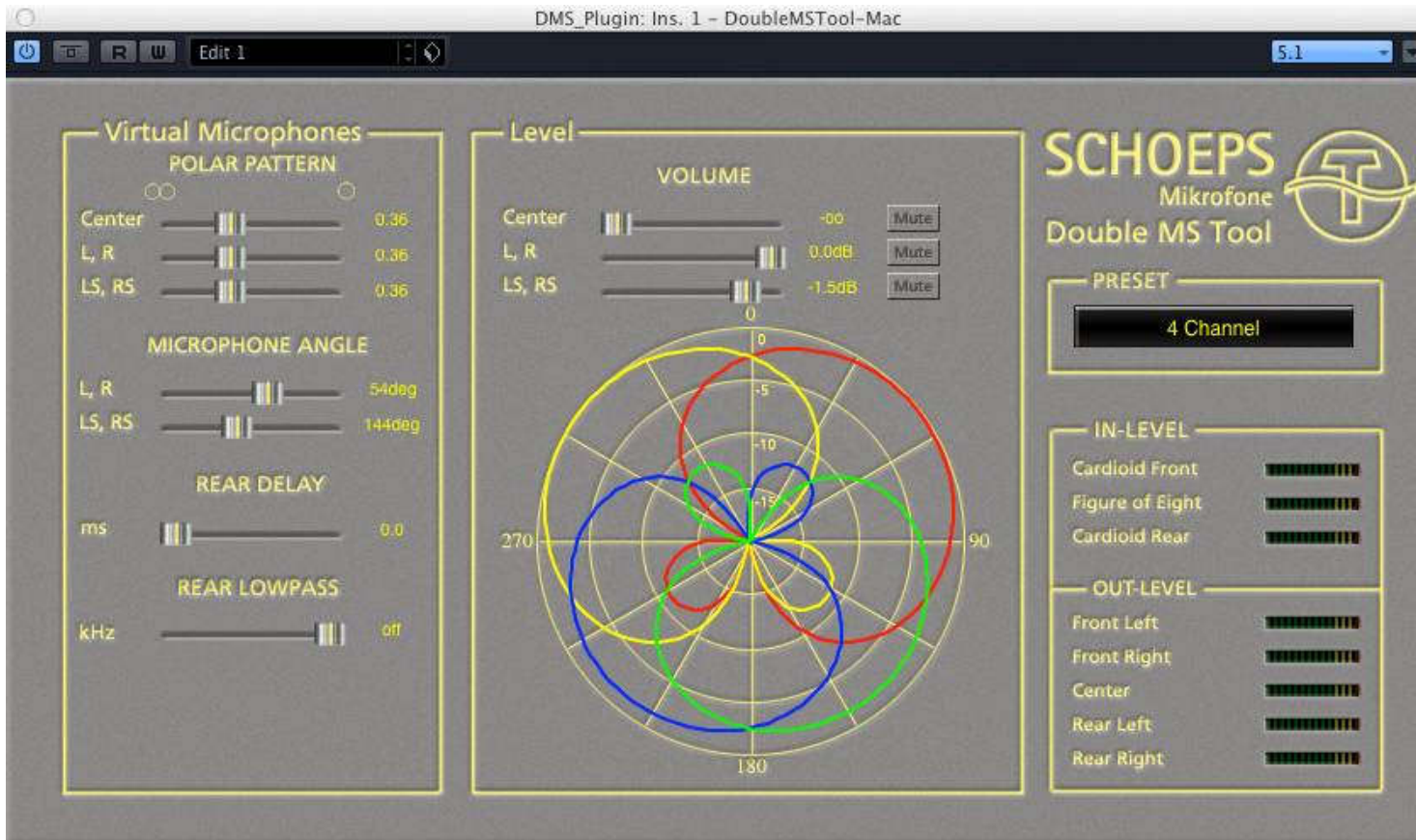
- Two-channel
- Multichannel
- 3D-Audio



- Double M/S

Demo DMS (Rossini, etc.)

Decoding with Plug-in



Double M/S Plug-in

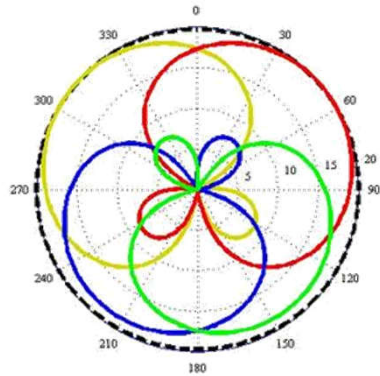
Basics

Stereo Imaging

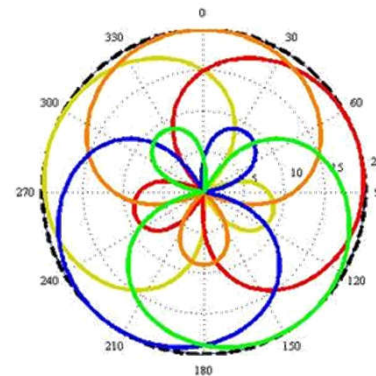
Array design

- Two-channel
- Multichannel
- 3D-Audio

- Double M/S



4ch decoding



5ch decoding

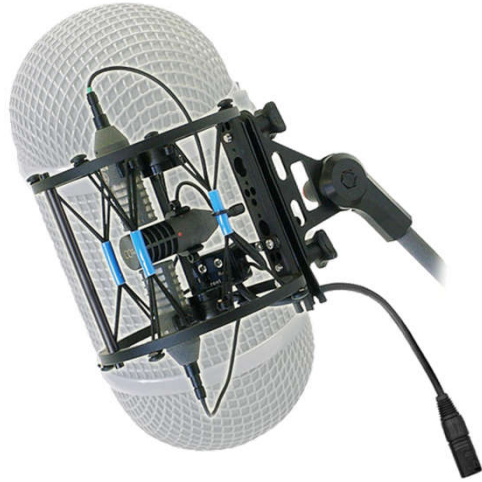
Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Various Double M/S setups



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- 5.1 Array design for D/A scenes
- Two recording principles with different priorities:

### **ORTF-like recording techniques**

- Closely spaced, directive microphones
- Typical properties:
  - proportional and clear directional imaging
  - natural spatial impression
- Application: chamber music, drama, sports, ambience

### **Wide a/b-like recording techniques**

- Widely spaced, omni-directional microphones
- Typical properties:
  - stable, but not proportional directional imaging
  - enhanced spatial impression
- Application: music, film music

Basics

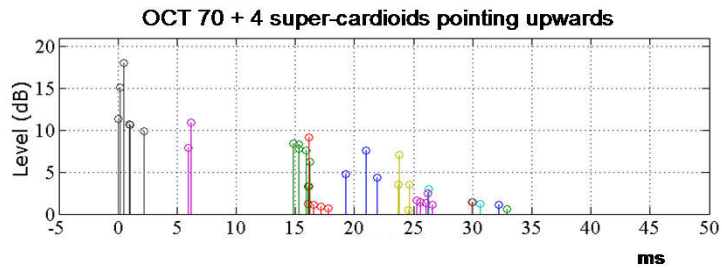
Stereo Imaging

Array design

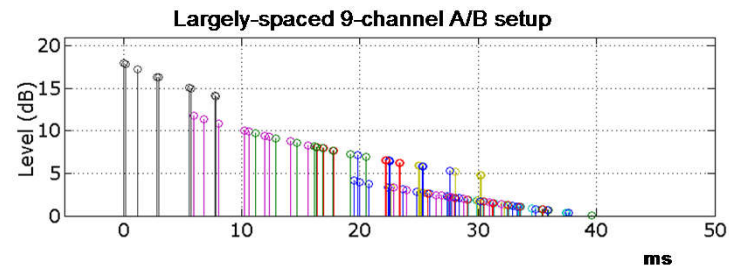
- Two-channel
- Multichannel
- 3D-Audio

- 5.1 Array design for D/A scenes
- Two recording principles with different priorities:

### ORTF-like recording techniques



### Wide a/b-like recording techniques



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

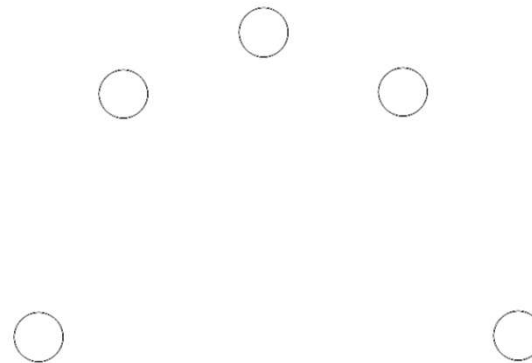
## OCT by Theile

- ORTF-like Surround Array
- Minimum Crosstalk
- Optimal Directional Image
- Natural Depth



## Omni Array

- 5 Omnis at large distances
- Good in reverberant rooms
- Open room sound



Demo Vergleich OCT-Decca (Galaxy)

Basics

Stereo Imaging

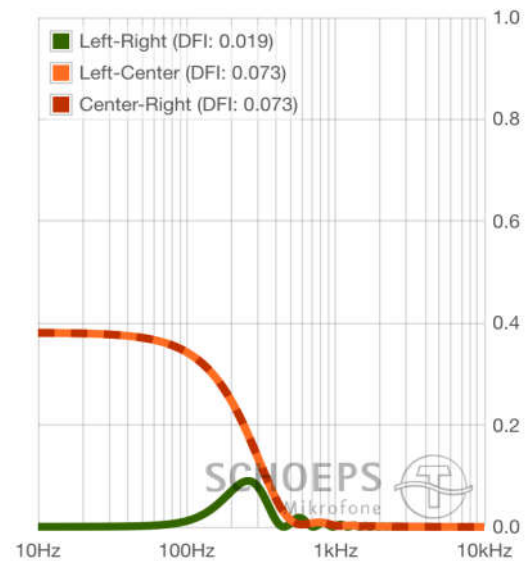
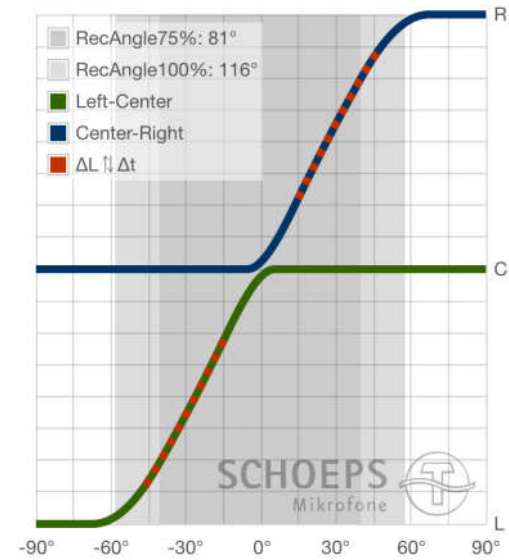
Array design

- Two-channel
- Multichannel
- 3D-Audio

hauptmikrofon.de

## OCT

- ORTF-like Surround Array
- Minimum Crosstalk
- Optimal Directional Image
- Natural Depth



Basics

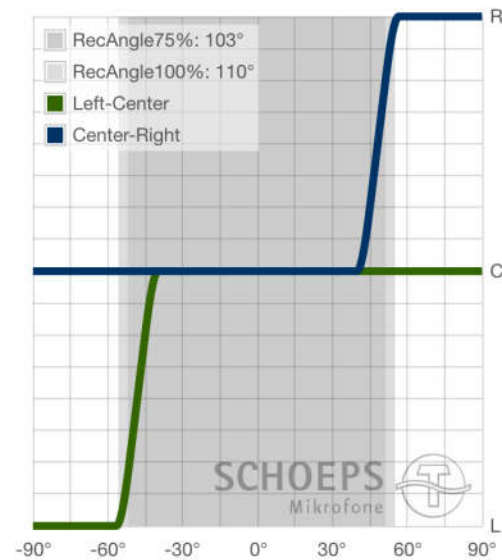
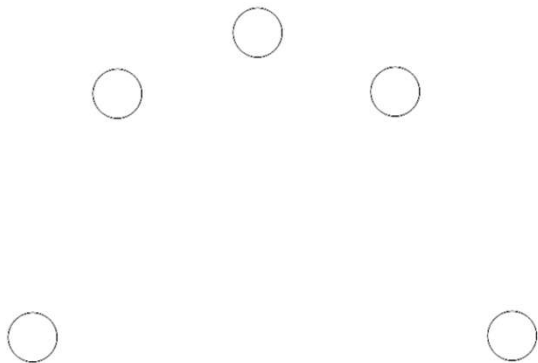
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## Omni Array

- 5 Omnis at large distances
- Good in reverberant rooms
- Open room sound



Basics

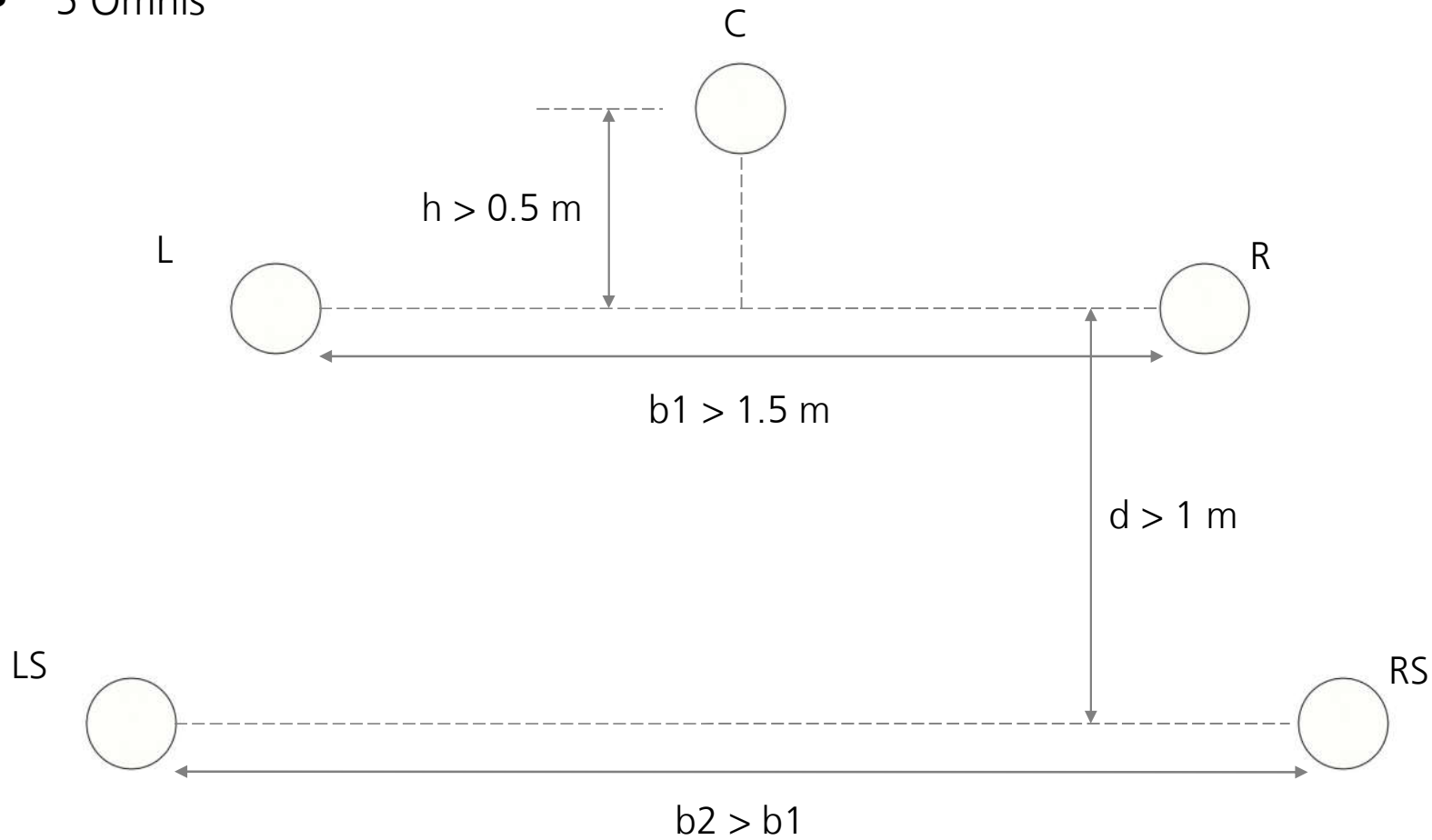
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio



- 5.1 Array design for D/A scenes
- 5 Omnis



Basics

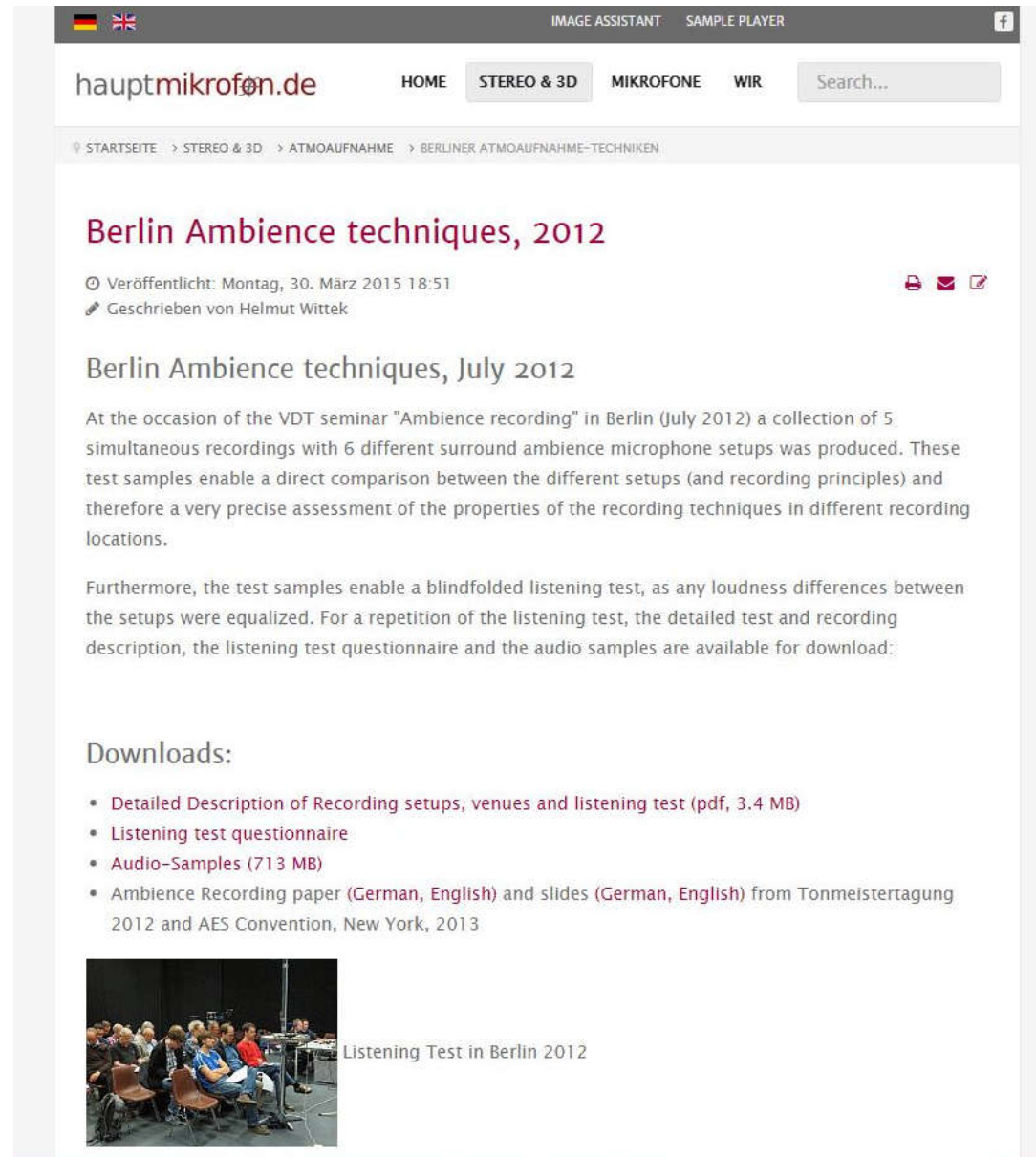
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

[ambience.hauptmikrofon.de](http://ambience.hauptmikrofon.de)

- 5 \* 6 Audio samples for Download
- Listening test can be performed
- Descriptions of the setups



The screenshot shows the website [hauptmikrofon.de](http://ambience.hauptmikrofon.de) with a navigation menu including HOME, STEREO & 3D, MIKROPHONE, and WIR. The main content area features a blog post titled "Berlin Ambience techniques, 2012" published on Monday, March 30, 2015, by Helmut Wittek. The post describes a collection of 5 simultaneous recordings with 6 different surround ambience microphone setups produced for a VDT seminar in Berlin (July 2012). It mentions that these samples allow for a direct comparison of recording techniques and a blindfolded listening test. A "Downloads:" section lists several resources: a detailed description of recording setups (3.4 MB), a listening test questionnaire, audio samples (713 MB), and an ambience recording paper from 2012 and 2013. At the bottom, there is a photo of a listening test session in Berlin 2012.

Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

hauptmikrofon.de

- Recordings with 6 different setups:
  - Omni-Setup
  - Setup with wide cardioids
  - IRT Cross
  - ORTF Surround
  - Double-M/S
  - Double-M/S with shotgun
- Ambience recordings at 5 different locations:
  - Nr.1: Street square with tramway
  - Nr.2: Supermarket
  - Nr.3: Workshop with machines
  - Nr.4: Applause in a room
  - Nr.5: People speaking in a room



Basics

aging

ign

channel

channel

dio



*Nr.1: Street square with tramway*



*Nr.2: Supermarket*

Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio



*Nr.3: Workshop with machines*

Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio



*All microphone setups at one place*

*Nr.4: Applause and people speaking  
in a room*

Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Array design for 3D-Audio  
(= Stereo + height)



Basics

Stereo Imaging

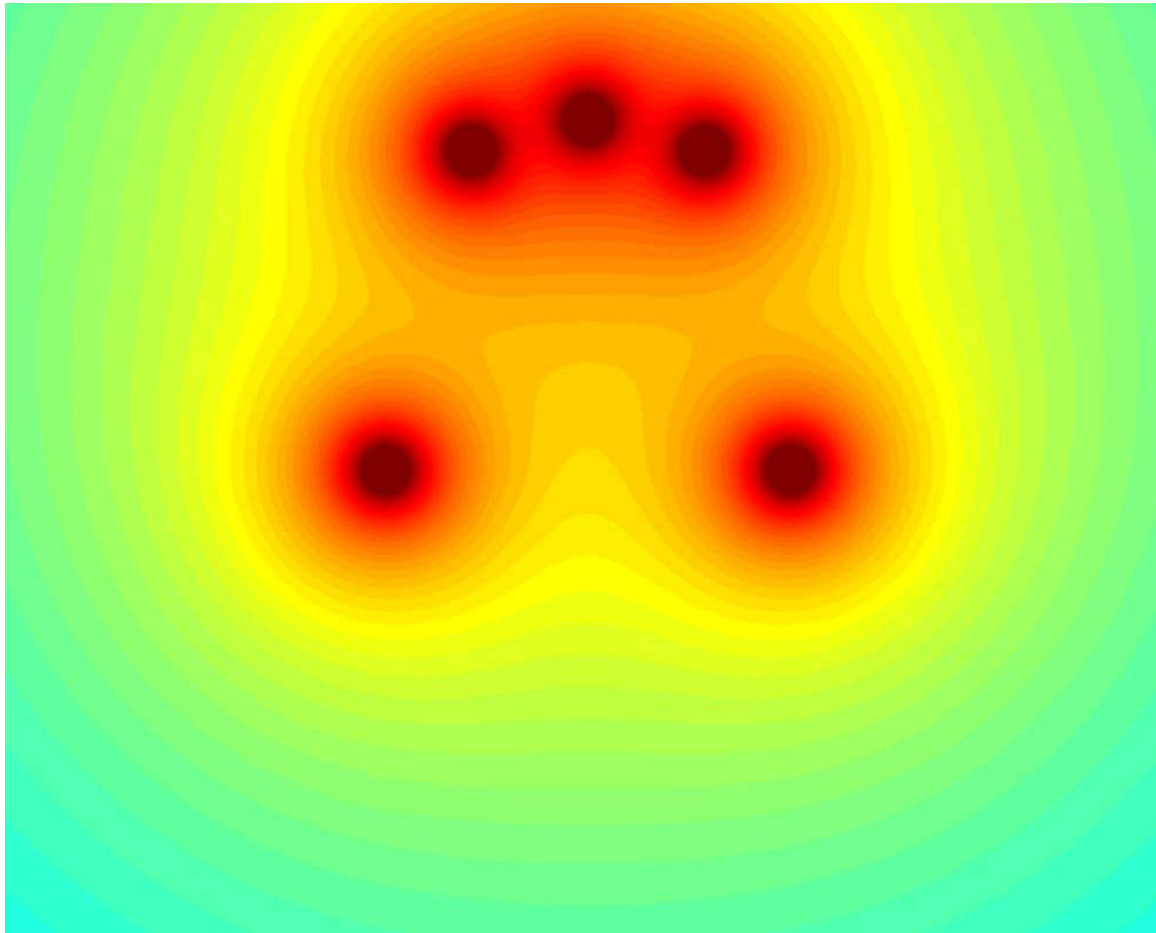
Array design

- Two-channel
- Multichannel
- 3D-Audio

hauptmikrofon.de

- „Diffuse Field Listening Area“

5ch Total power sum



Basics

Stereo Imaging

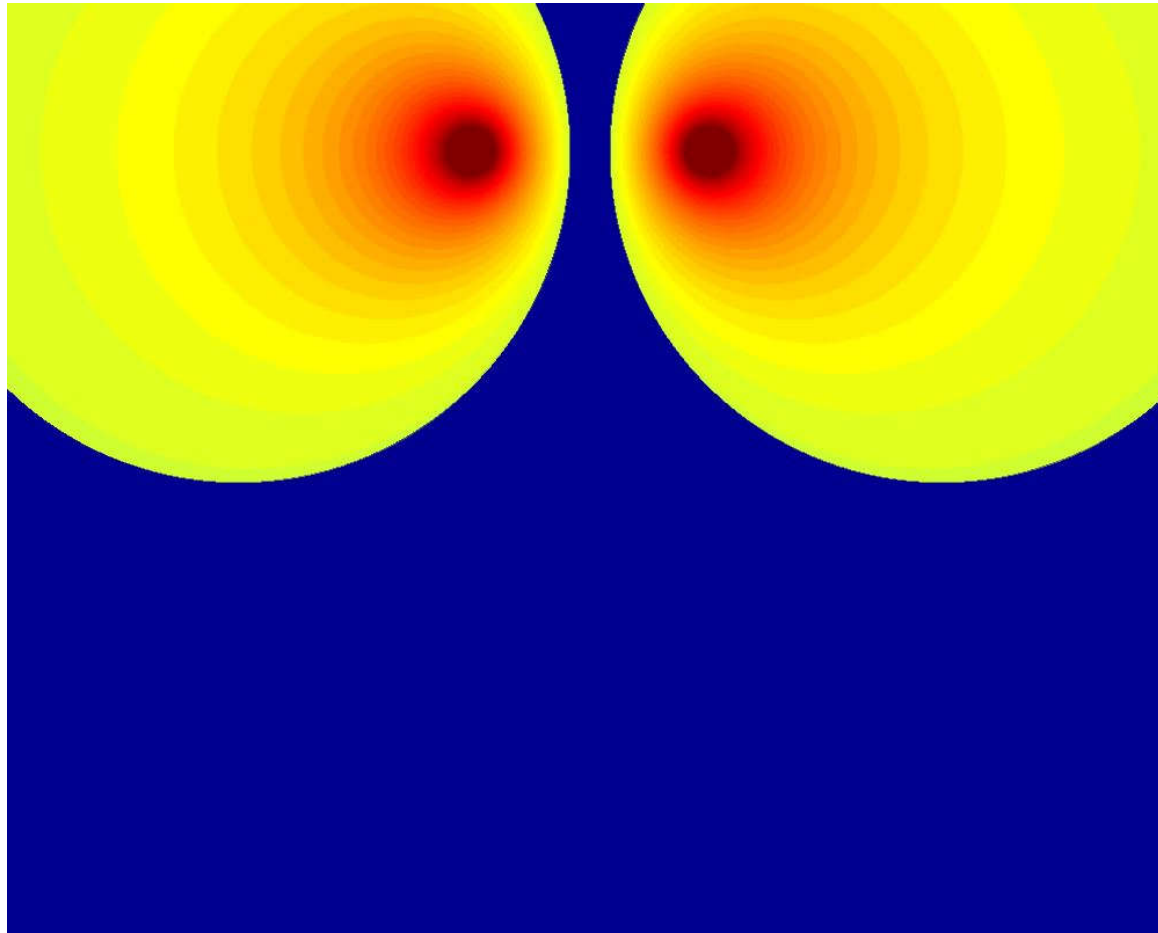
Array design

- Two-channel
- Multichannel
- 3D-Audio



- „Diffuse Field Listening Area“

2 ch Diffuse Field Listening Area



Blue Zone:

No individual  
loudspeaker is  
more than 3 dB  
louder than the  
sum of all other  
loudspeakers

Basics

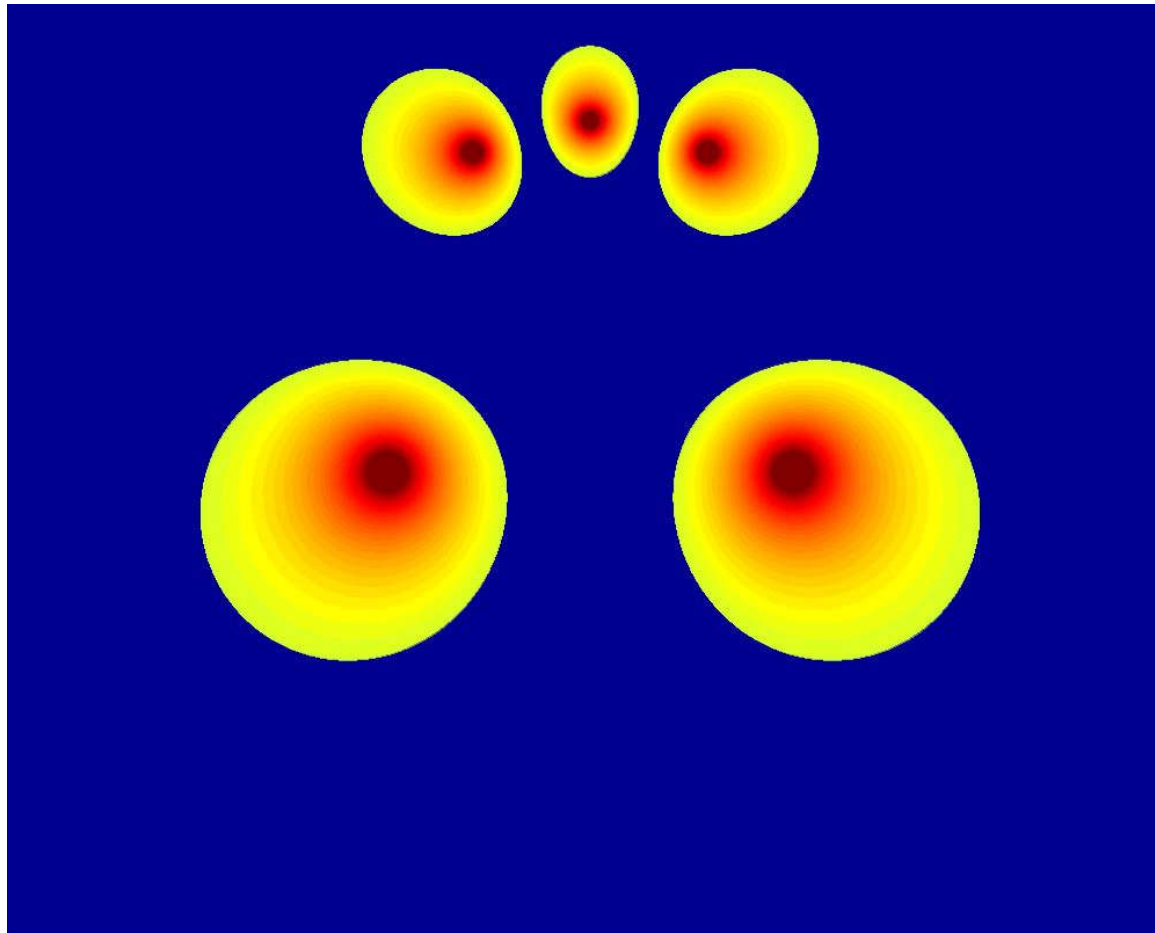
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- „Diffuse Field Listening Area“

5 ch Diffuse Field Listening Area



Blue Zone:

No individual loudspeaker is more than 3 dB louder than the sum of all other loudspeakers

Basics

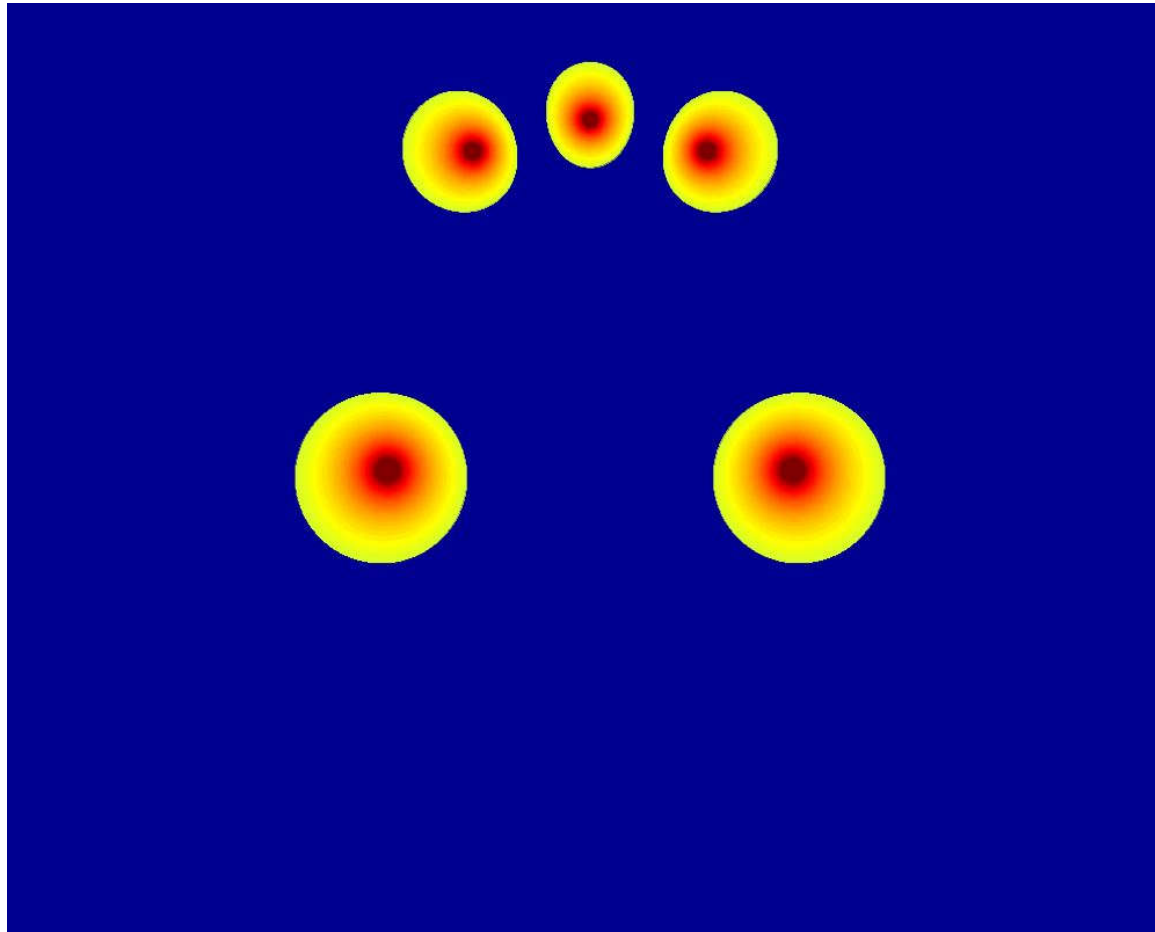
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- „Diffuse Field Listening Area“

9 ch Diffuse Field Listening Area



Blue Zone:

No individual loudspeaker is more than 3 dB louder than the sum of all other loudspeakers

Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Array design for 3D-Audio (= Stereo + height)
- Hypothesis: Less coloration and better perception of depth/distance through better source separation



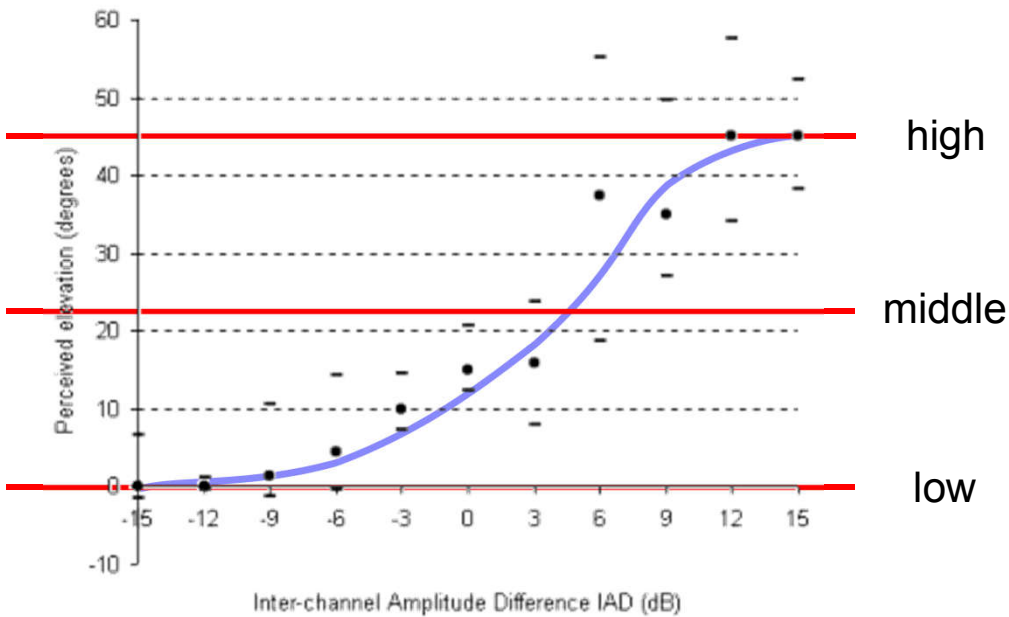
Basics

Stereo Imaging

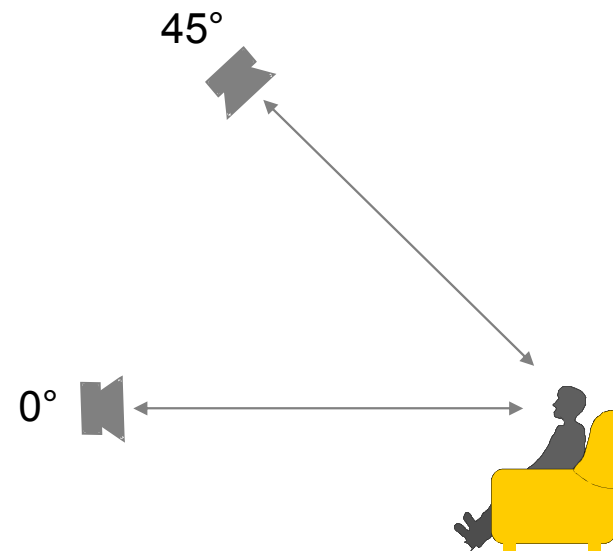
Array design

- Two-channel
- Multichannel
- 3D-Audio

- Panning/Stereophonic Imaging between vertical loudspeaker pairs (Demo Vertical Shaker)



REF Jim Barbour, AES



Demo Vertical Panning (3D Grundlagen)

Basics

Stereo Imaging

- Directional Image
- Room Image

Array design for 3D-Audio

- Array design for 3D-Audio (= Stereo + height)
- Typification of scenes: What is the content in Front/Back/Up?
  - D/D/D
  - D/D/A
  - D/A/A



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Array design for 3D-Audio (= Stereo + height)
- Two recording principles with different priorities:

### **ORTF-like recording techniques**

- Closely spaced, directive microphones
- Typical properties:
  - proportional and clear directional imaging
  - natural spatial impression
- Application: chamber music, drama, sports, ambience

### **Wide a/b-like recording techniques**

- Widely spaced, omni-directional microphones
- Typical properties:
  - stable, but not proportional directional imaging
  - enhanced spatial impression
- Application: music, film music

Basics

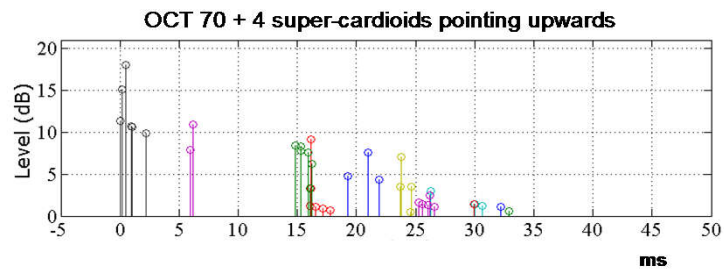
Stereo Imaging

Array design

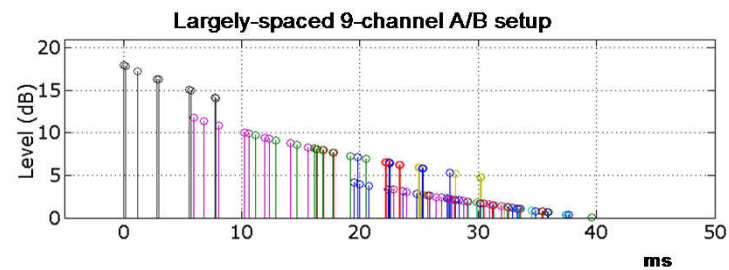
- Two-channel
- Multichannel
- 3D-Audio

- Array design for 3D-Audio (= Stereo + height)
- Two recording principles with different priorities:

### ORTF-like recording techniques



### Wide a/b-like recording techniques



Basics

Stereo Imaging

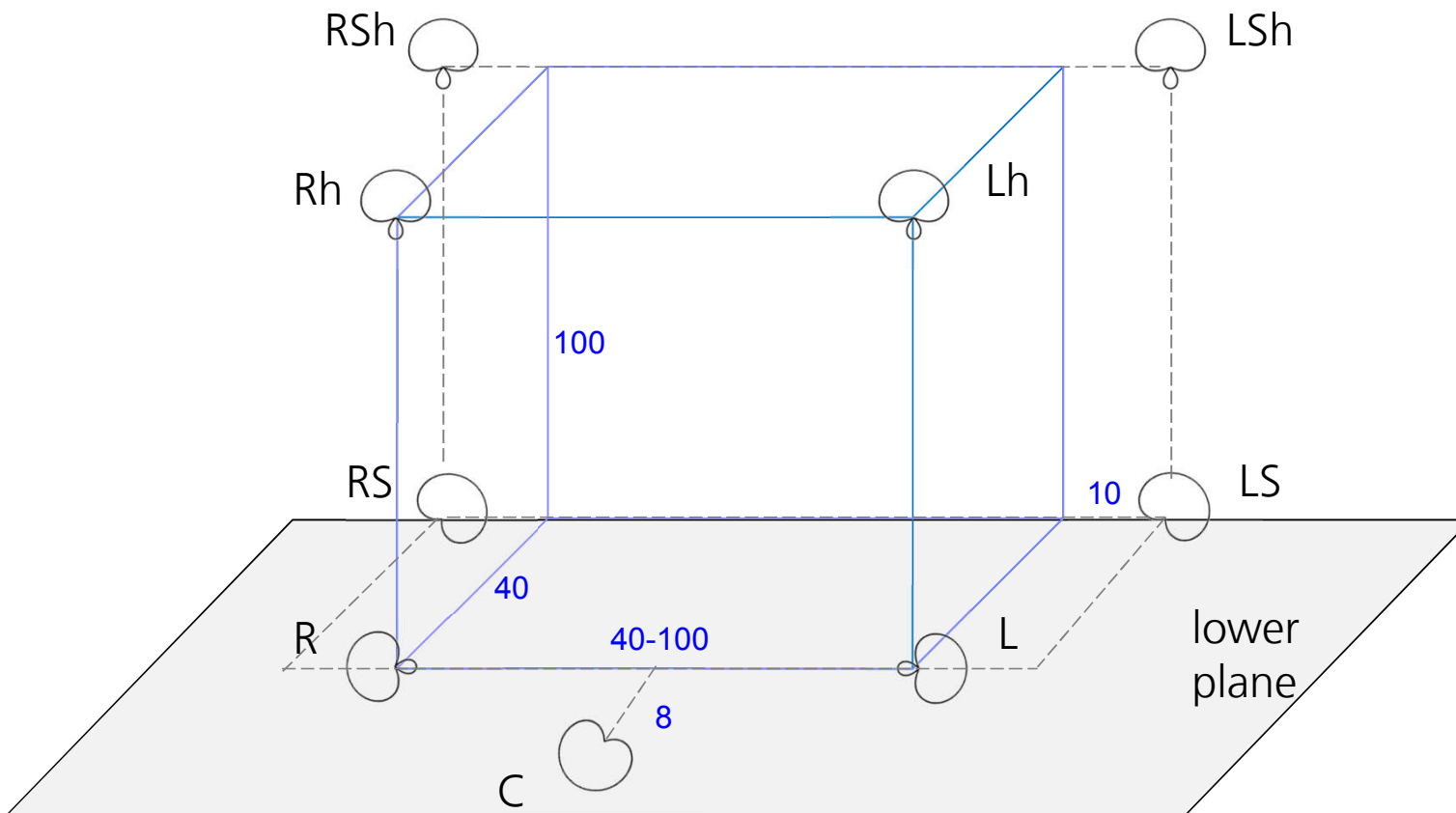
Array design

- Two-channel
- Multichannel
- 3D-Audio



„OCT 9“ for 9.1 Surround

- lower plane: OCT Surround
- upper plane: + **100cm (?)**, 4 supercardioids pointing upwards



Basics

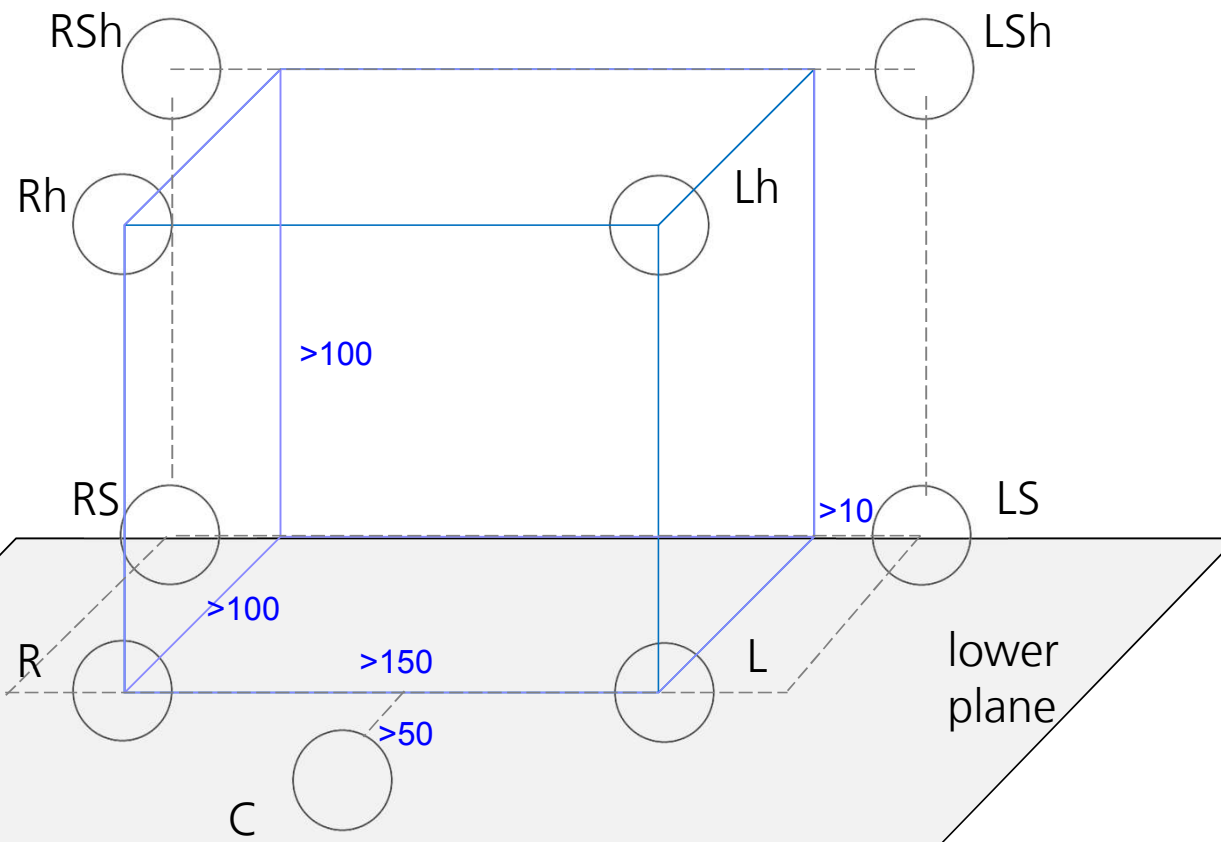
Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## „Omni Array“ for 9.1 Surround

- 9 Omnis



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

- Test recordings in the Galaxy Studios, Belgium
- OCT 9
- Omni array



Basics

Stereo Imaging

Array design

- Two-channel
- Multichannel
- 3D-Audio

## ORTF-3D regular

- 8 \* Supercardioid on the edges of a cube with  $d = 10\text{-}20\text{ cm}$



Basics

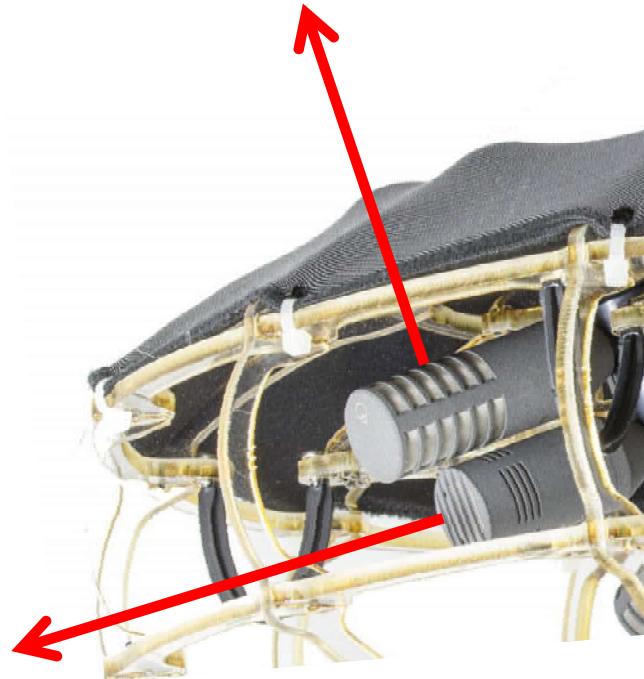
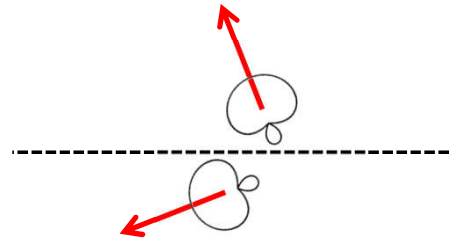
Stereo Imaging

Array design  
for 3D-Audio

- $\Delta t$  and/or  $\Delta L$
- ORTF-3D

## ORTF-3D „FLAT“ (NEW)

- 8 \* Supercardioid on the edges of a rectangle/square with  $d = 10\text{-}20\text{ cm}$
- Coincident X/Y microphone pairs for each vertical loudspeaker pair
- Orientation of the XY pair:  $+60^\circ$  (height layer) /  $-30^\circ$  (ground layer)



Demo Worldcup  
Demos ORFT-3D Ambience

Basics

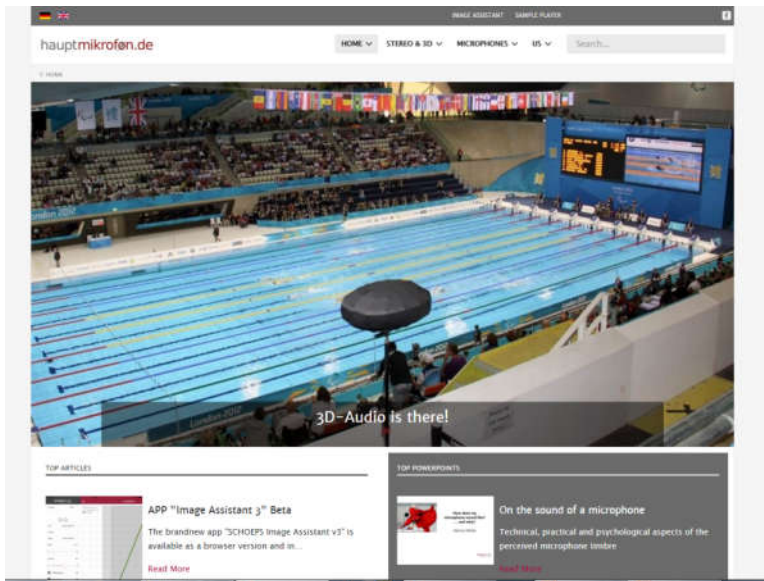
Stereo Imaging

Array design  
for 3D-Audio

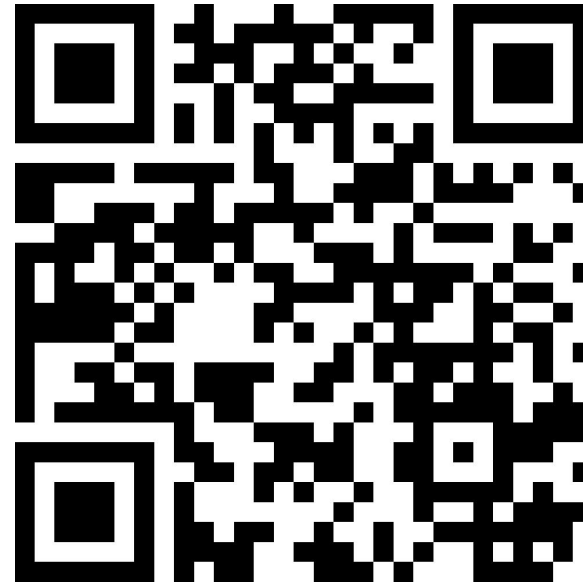
- $\Delta t$  and/or  $\Delta L$
- ORTF-3D

hauptmikrofon.de

- [www.hauptmikrofon.de](http://www.hauptmikrofon.de) (new launch today!)



- [www.facebook.com/hauptmikrofon](http://www.facebook.com/hauptmikrofon)
- [wittek@hauptmikrofon.de](mailto:wittek@hauptmikrofon.de)



Basics

Stereo Imaging

Array design  
for 3D-Audio