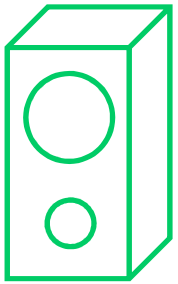
Stereo

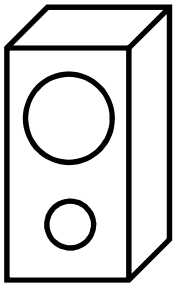
Helmut Wittek, 2013

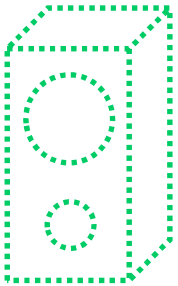
SCHOEPS Mikrofone

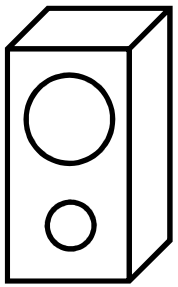
Real source vs. phantom source



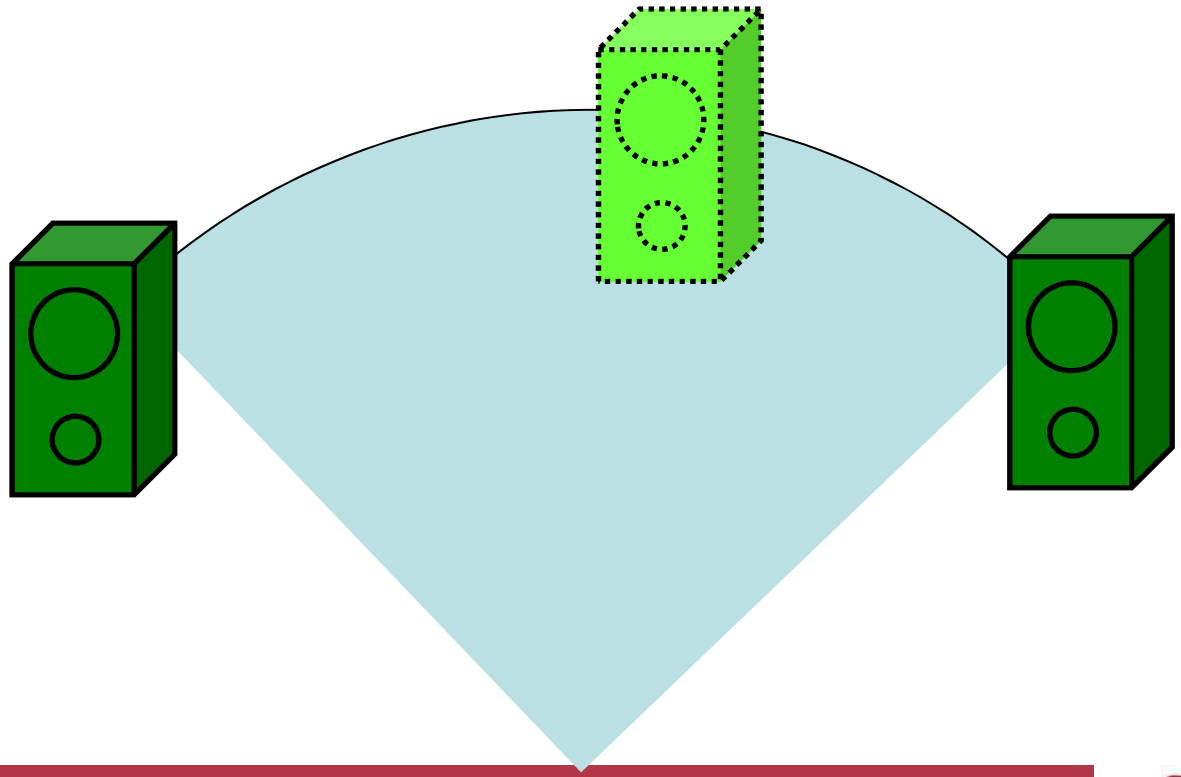
or





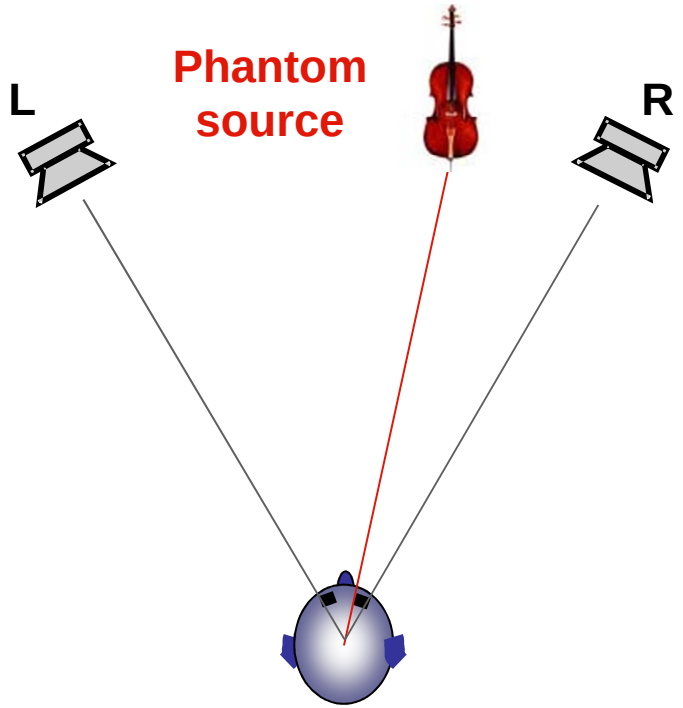


- A phantom source is a fictive sound source. It is perceived at a location where no actual sound source is.
- It is produced by min. two loudspeakers reproducing a coherent signal
- The phantom source is perceived between the loudspeakers. It is shifted towards the direction of one of the loudspeakers by level and/or time differences.



Sound source → Phantom source

Δt, ΔL
between microphones



Δt, ΔL
between loudspeakers

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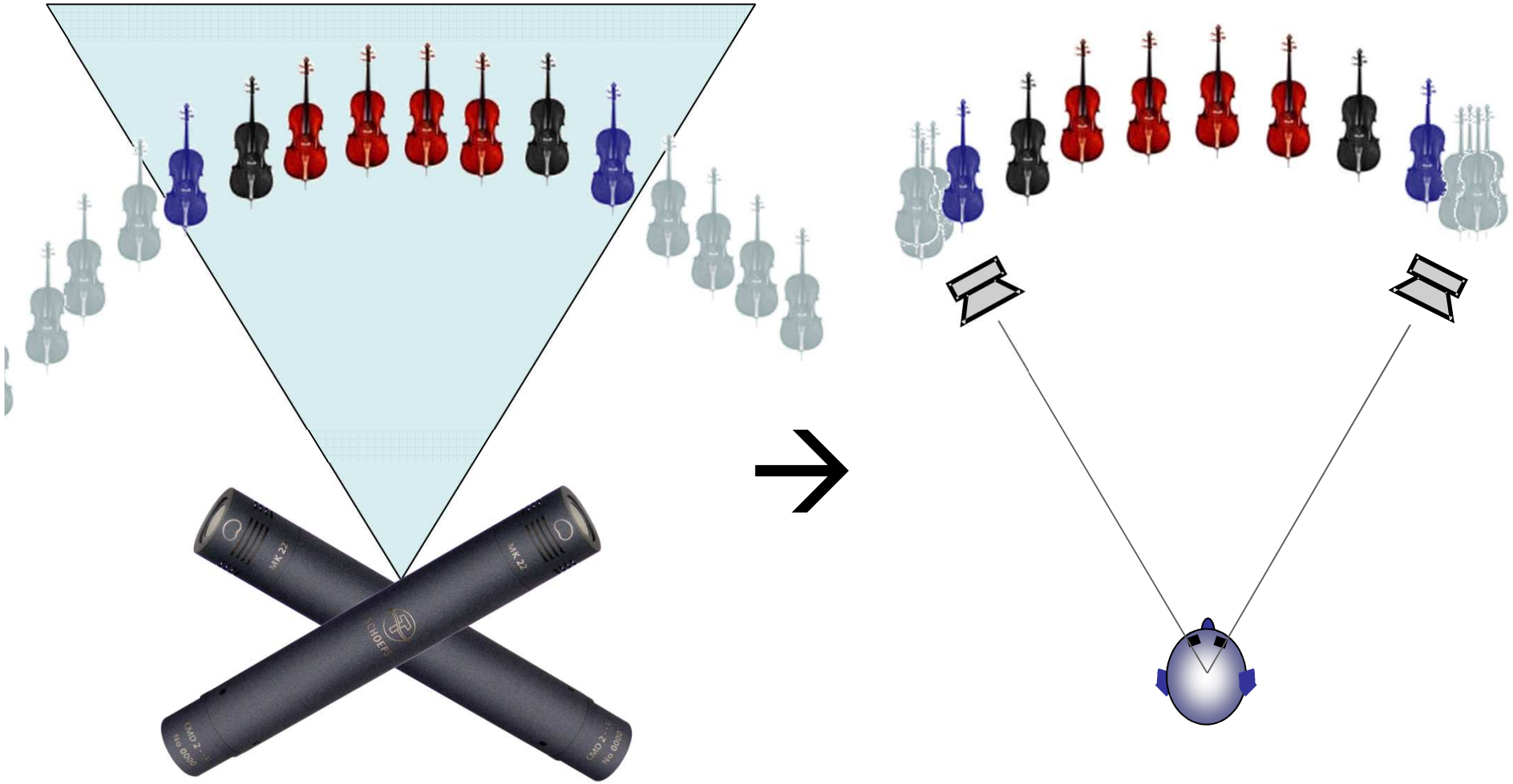
The Recording angle



Phantom Source

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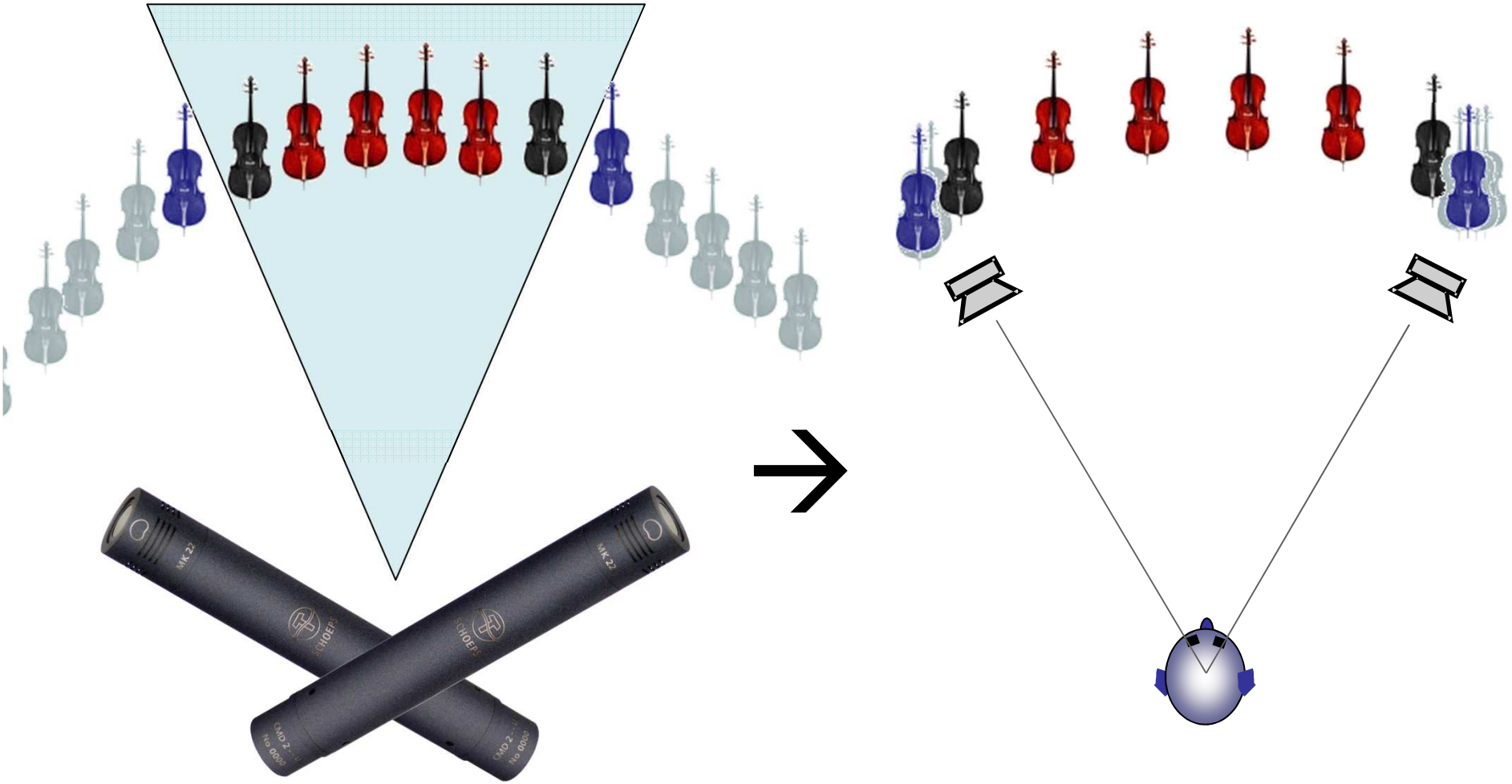
The Recording angle



Phantom Source

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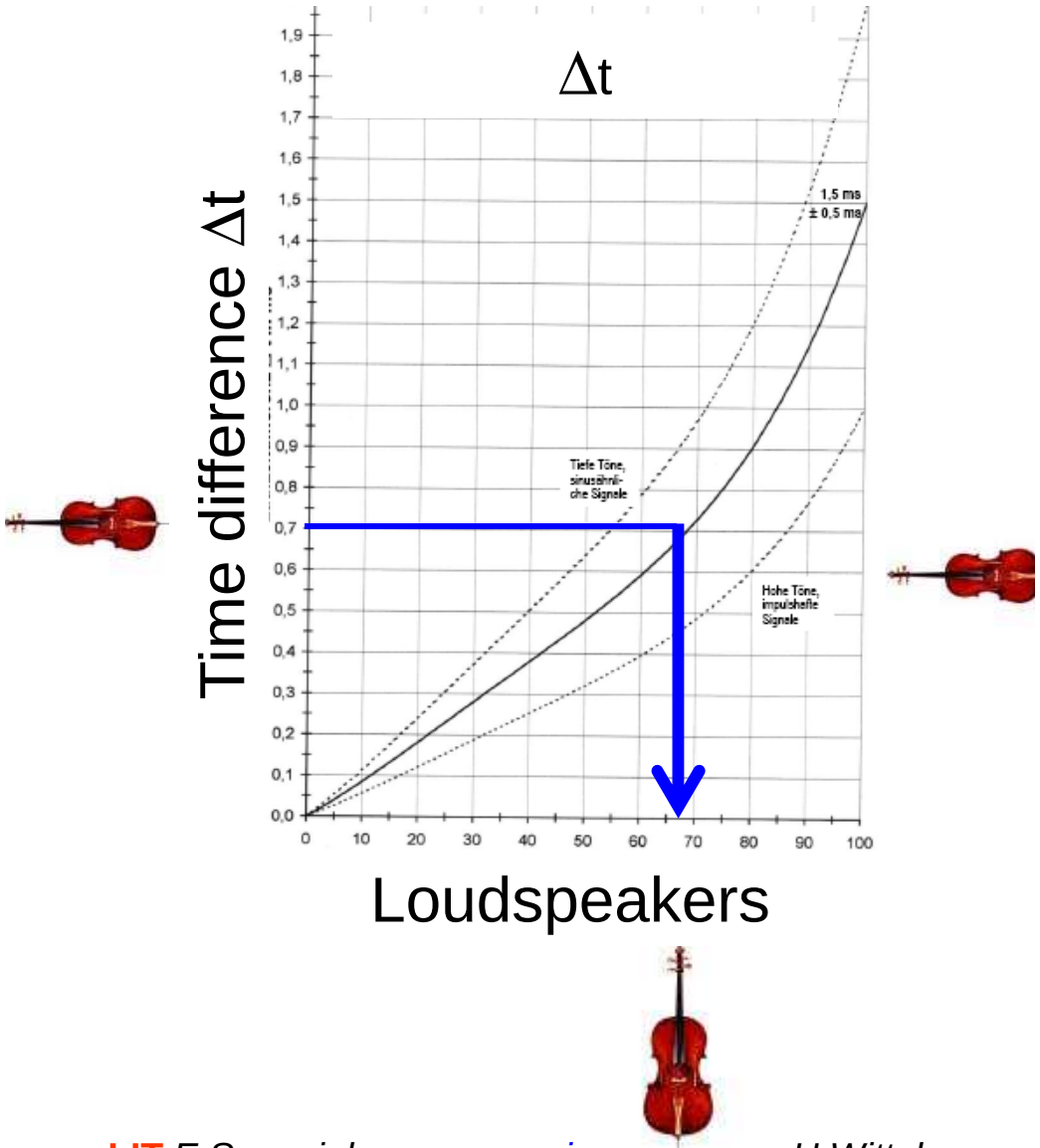
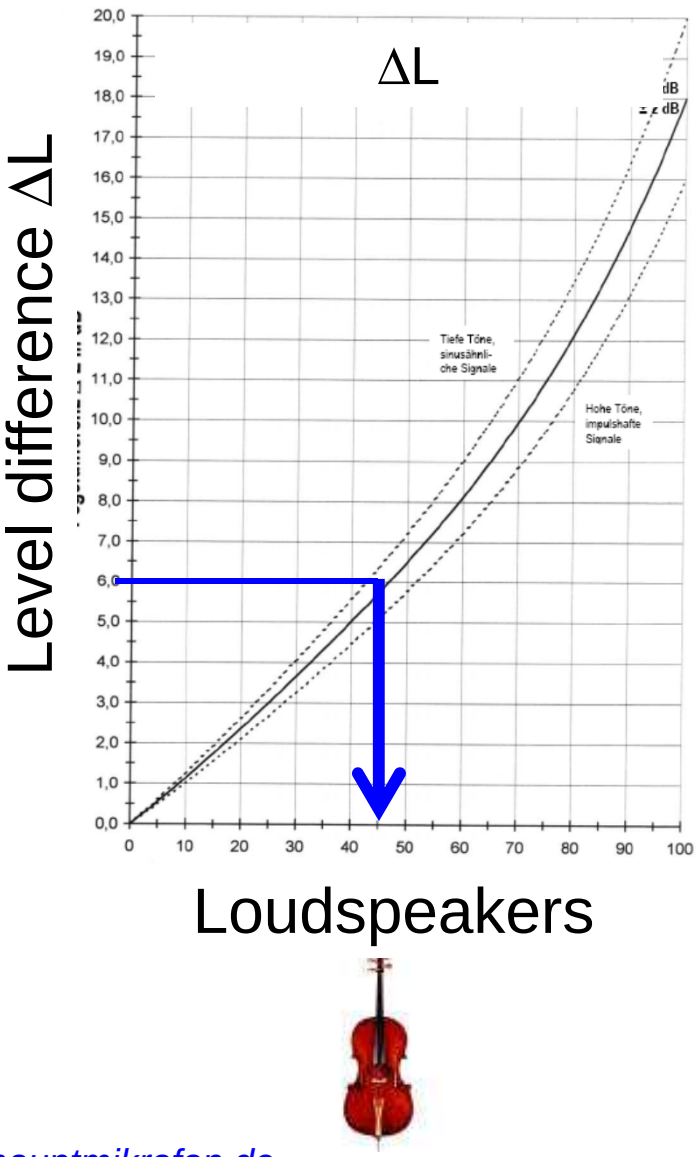
Phantom source shift by ΔL and Δt





LIT *E.Sengpiel: www.sengpielaudio.com, H.Wittek: www.hauptmikrofon.de*

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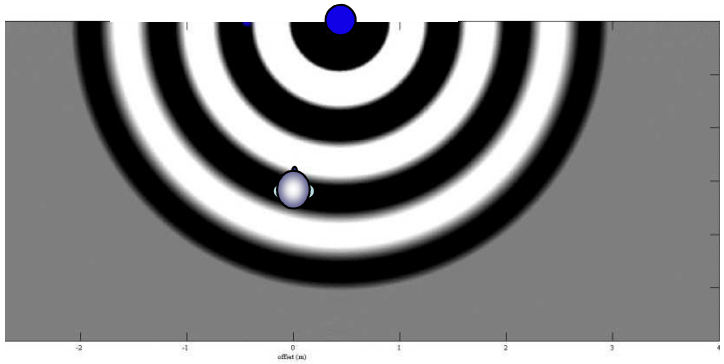
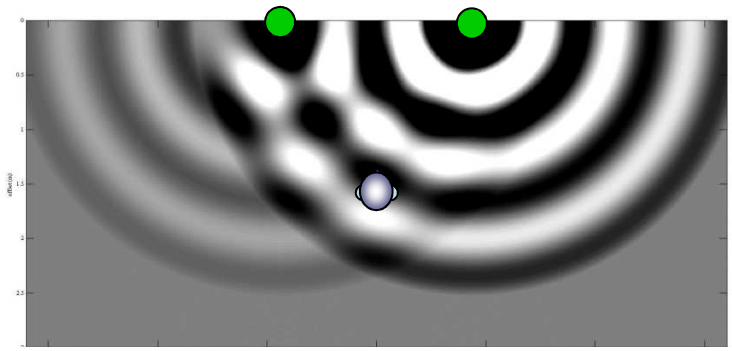
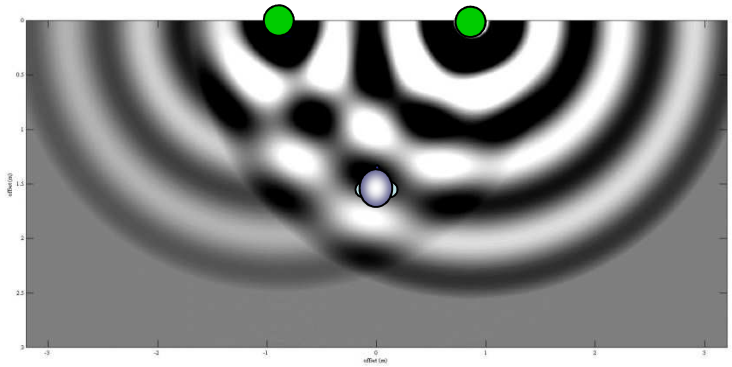




Real source, 15° right

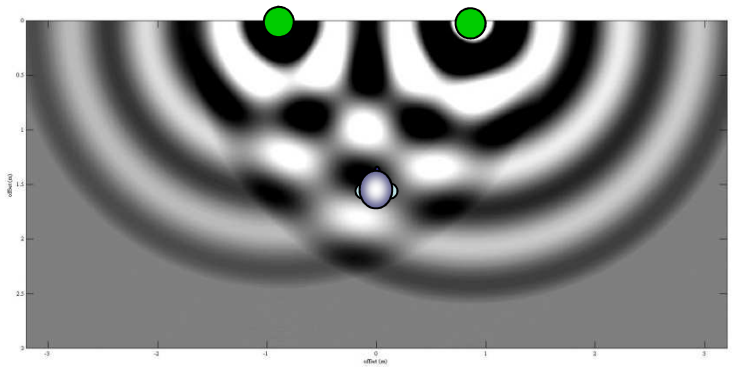
Phantom source, 15° right:

1: ΔL=7 dB, Δt=0 ms



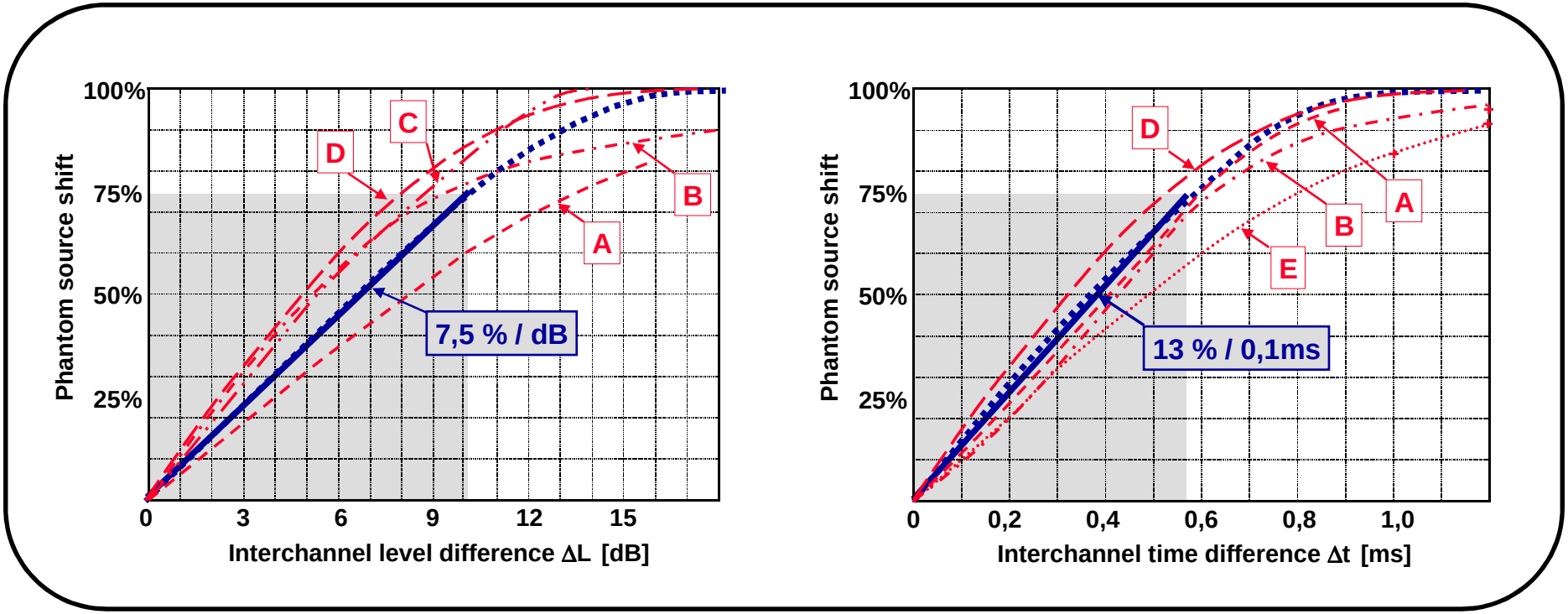
2: ΔL=3.5 dB, Δt=0.2ms

3: ΔL=0 dB, Δt=0.4 ms



Phantom source

Mikrofone



- A, B, C, D, E: different literature!

Phantom source shift by Δt/ΔL

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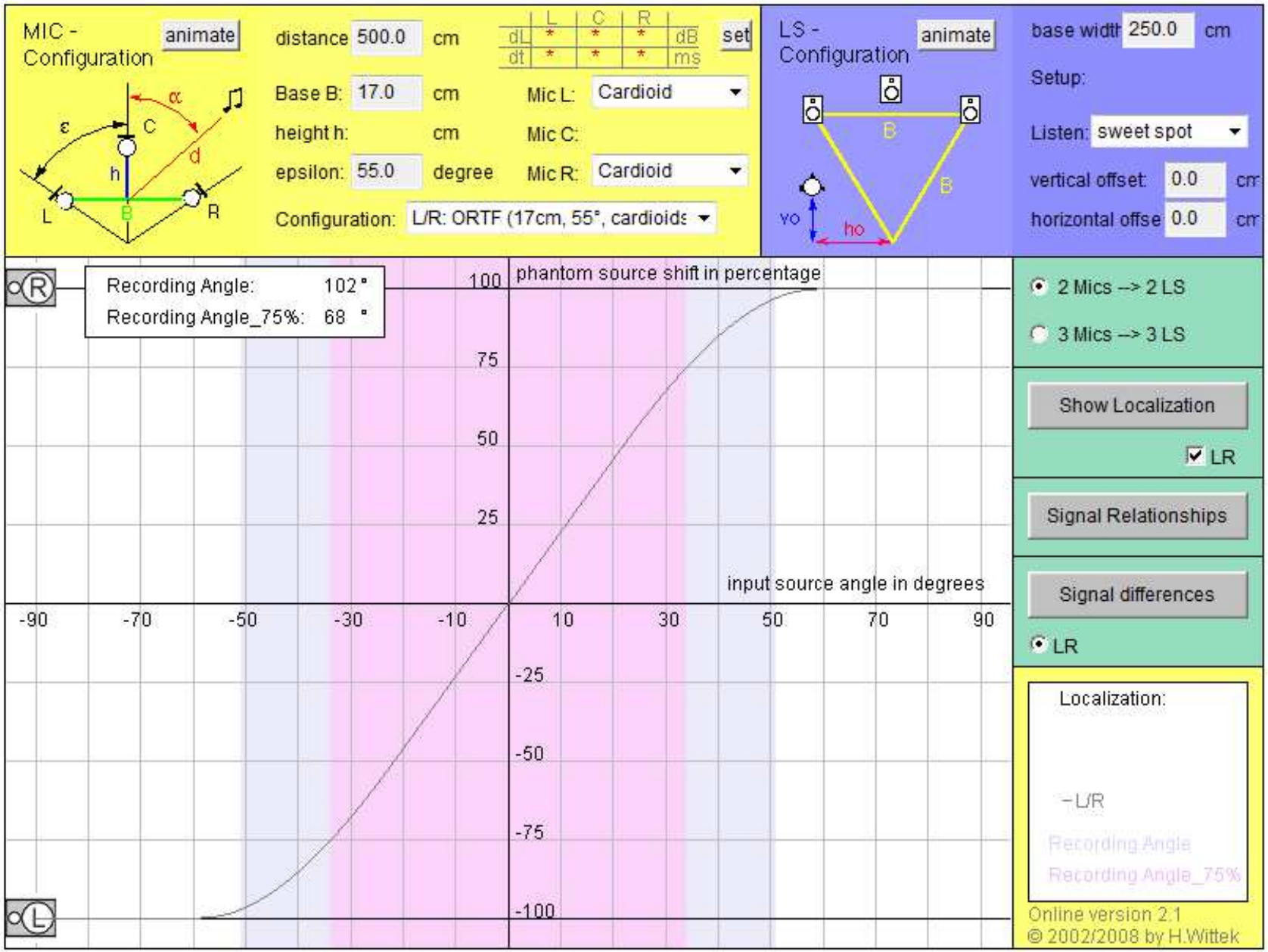

Image Assistant

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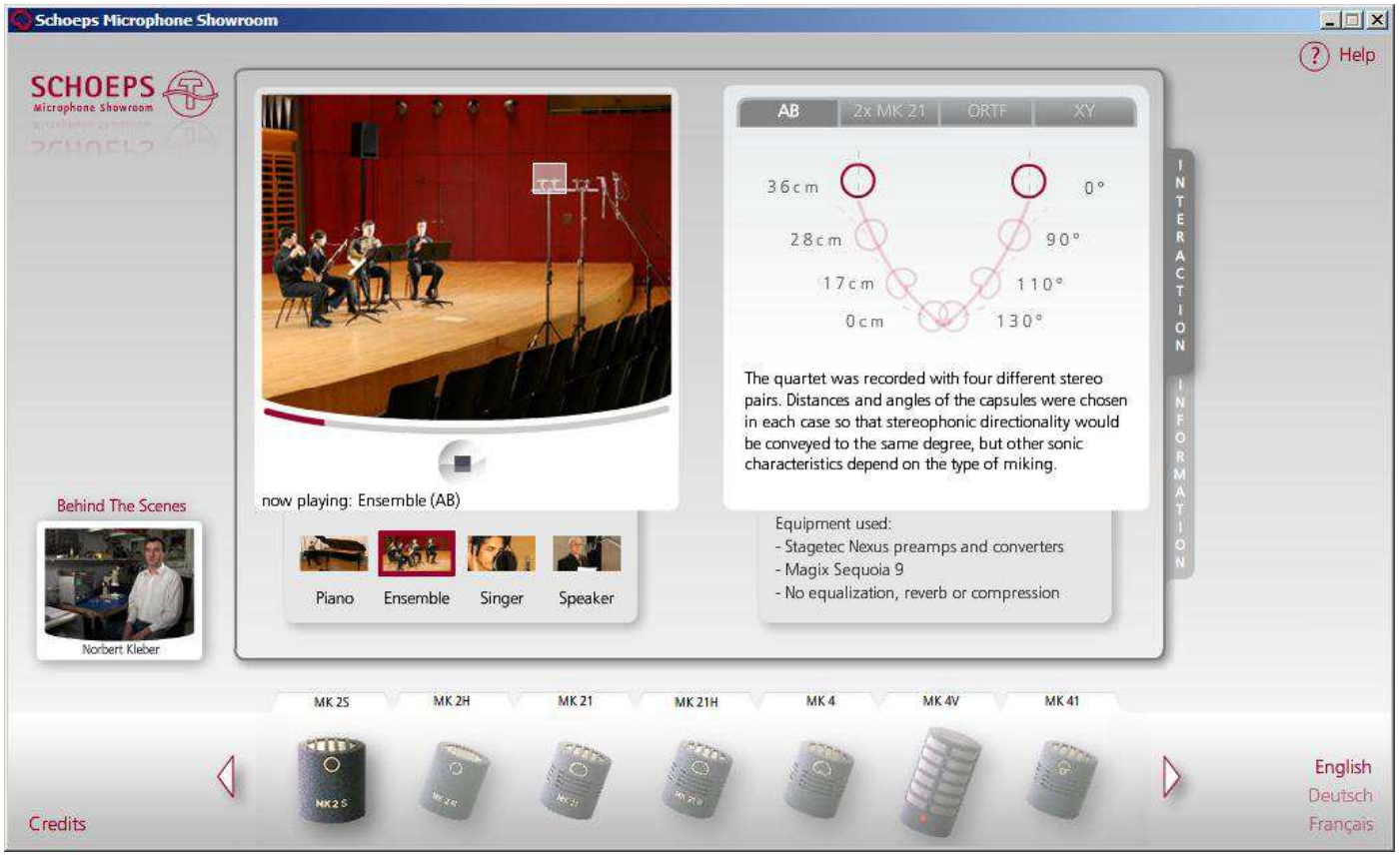
- *SCHOEPS Microphone Showroom:* www.schoeps.de/showroom

  offers an interactive comparison between various techniques and microphones…



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- *AB, Decca Tree*
  - 2-3 * Omni (LF pickup !)
  - Distance: 0.5 .. 2 m (decorr!)
  - Most popular for orchestra recording
  - Vague directional image, open spatial image

- *ORTF, quasi-ORTF setups*
  - 2 cardioids (or var.)
  - Distance: 0.17 m, Angle: 110 ° (or var.)
  - Most popular for ensemble recording
  - Good directional image, good spatial image
  - low DFC

- *XY, MS setups*
  - 2 directional pattern or M (variable) + S (fig-8)
  - Distance: 0 m, Angle ≥ 90°
  - Most popular for film, music, drama recording
  - Good directional image, clear spatial image
  - DFC often high, strongly depend on the setup

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UMS 20

UMS 20

M100C

CMXY

Stereo microphones: XY

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CCM 8 Lg oder
CCM 8 Ug

CMC 64 + CCM 8

CMIT MS

UMS 20

RCY

SGMSC (CCM4 + CCM8)

MS-BLM

WSR MS

Stereo microphones: M/S

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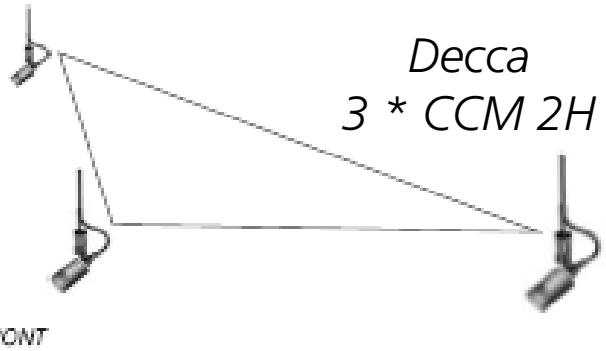

Decca
*3 * CCM 2H*

MSTC 64 U, STC

IMS 20

M100C

KFM 6

MAB1000

ORTF
Outdoor Set

Stereo microphones: spaced setups

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5.1 Surround

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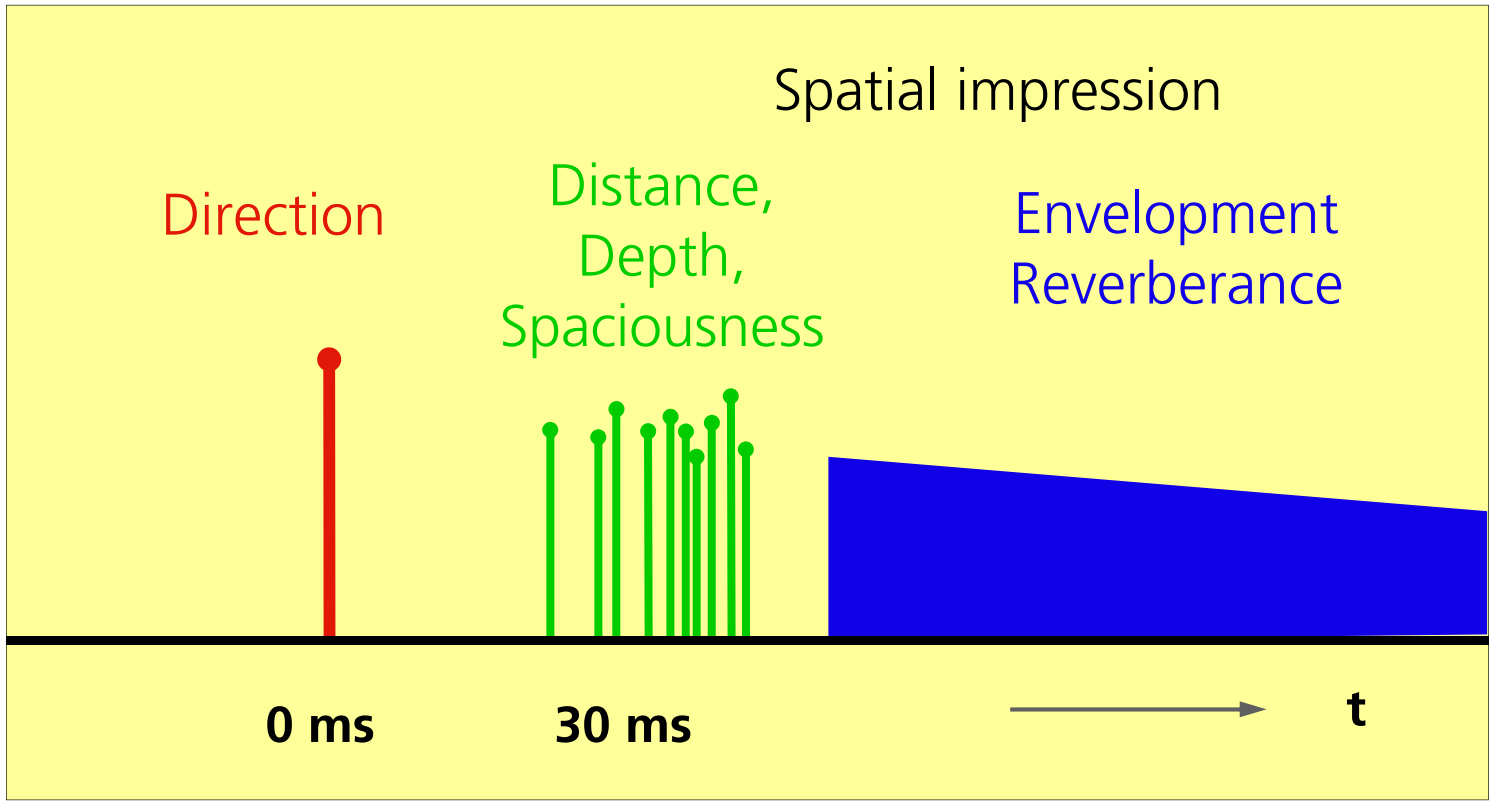
- **The reference: perception of a natural source**



© Theile

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Discrete Signals:

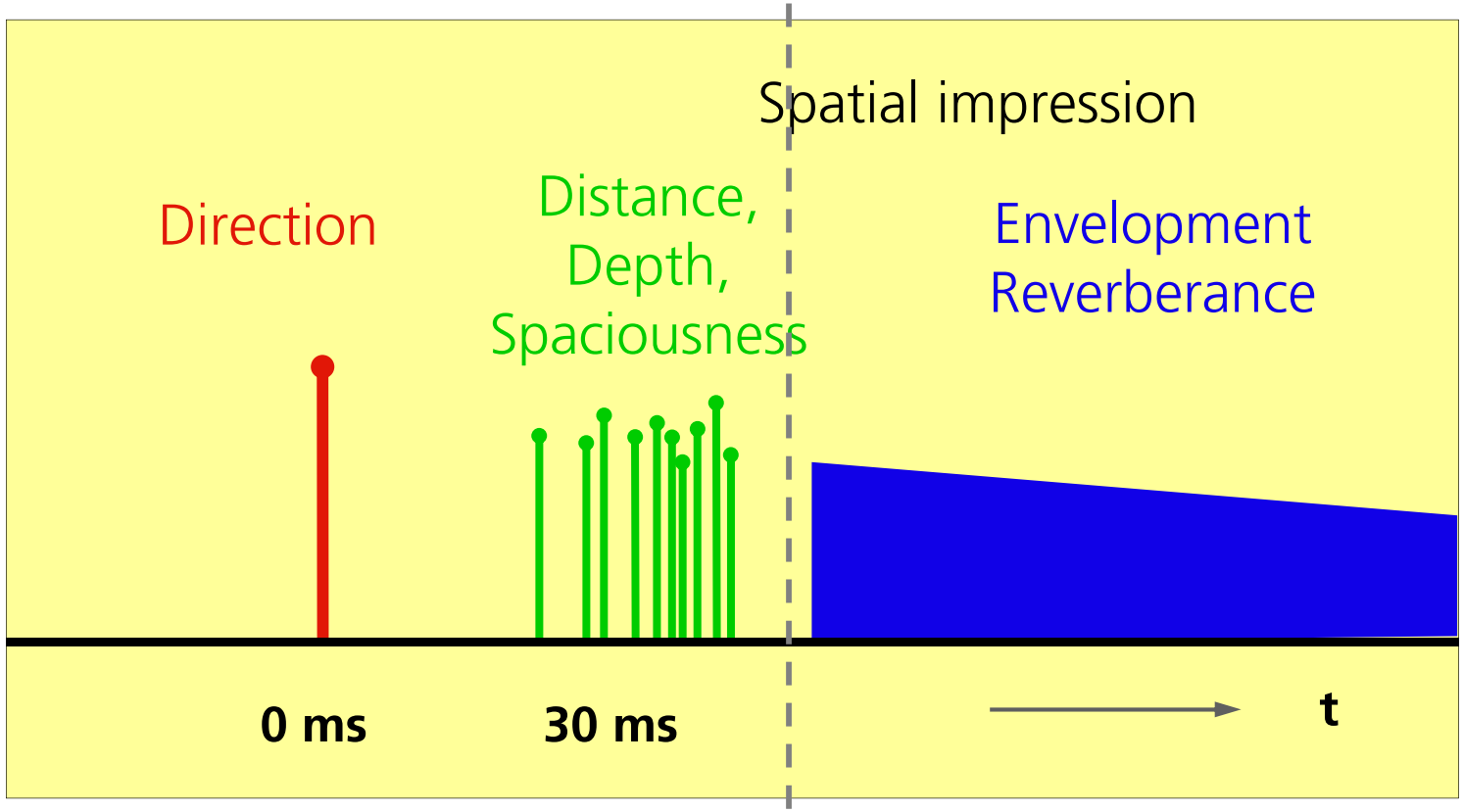
Correlated at both ears

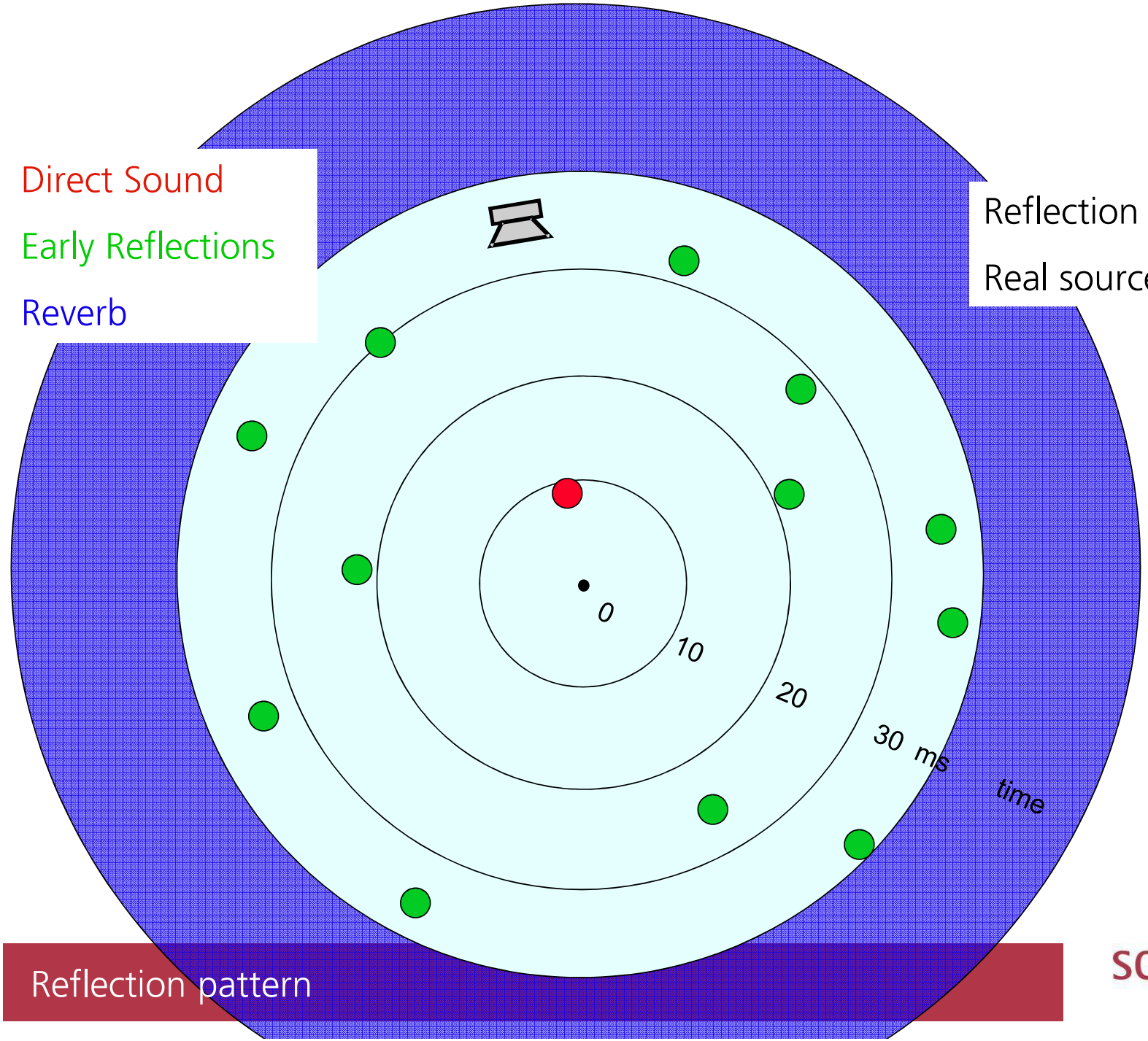
From discrete directions

Diffuse Signals:

Decorrelated at both ears

From all directions





Reflection pattern

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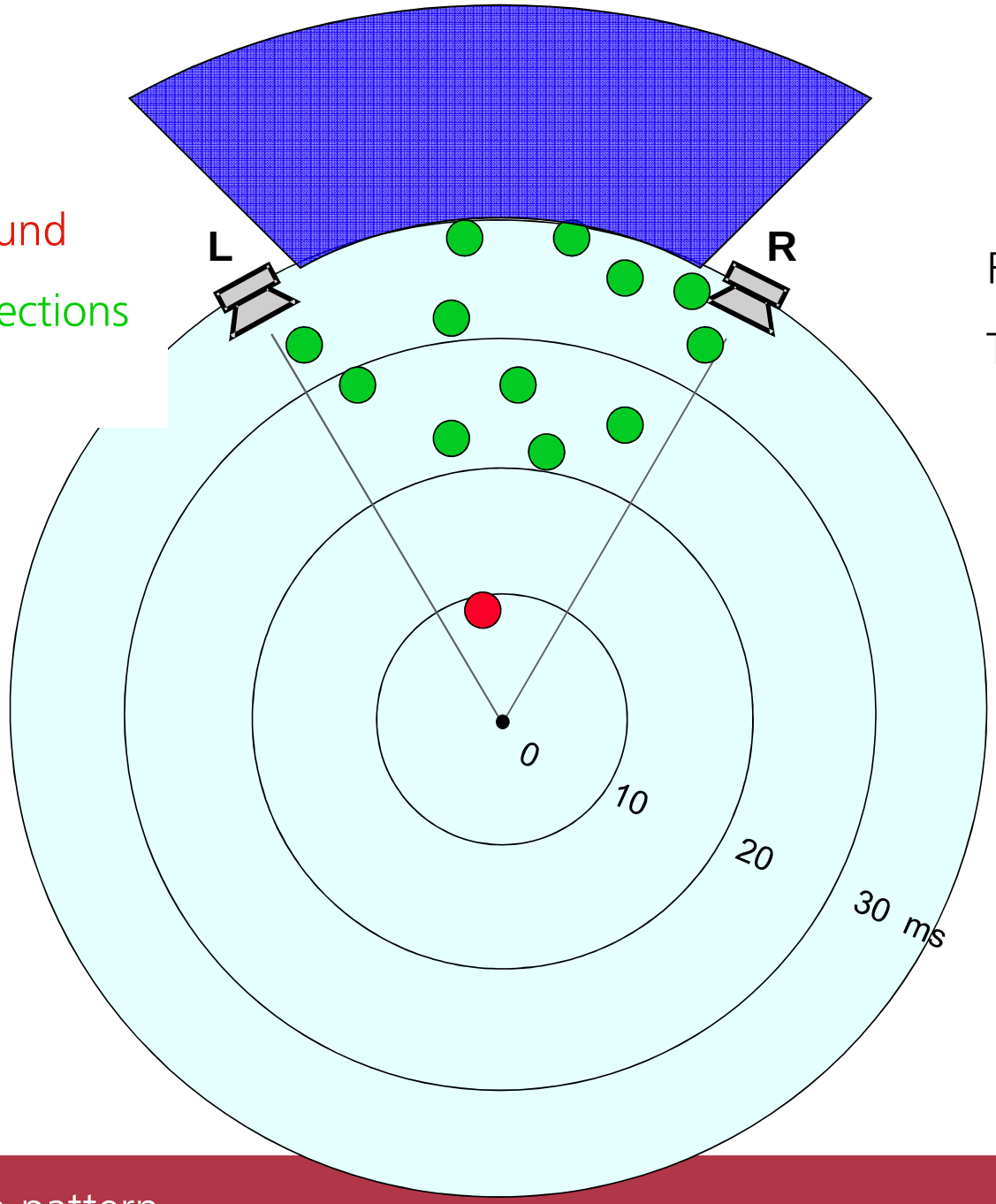
Direct Sound

Early Reflections

Reverb



Reflection pattern

Two-channel stereo

Reflection pattern

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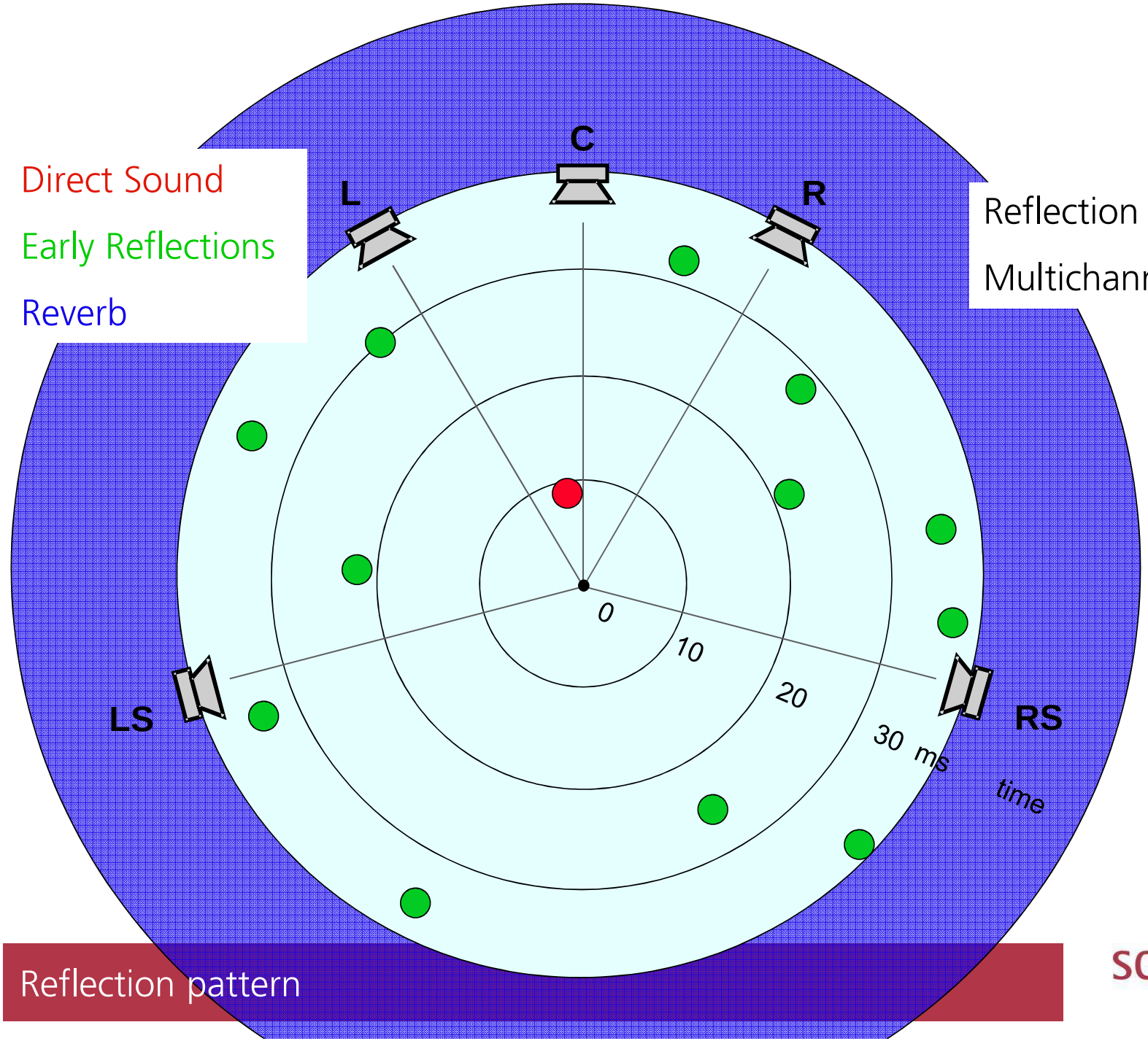

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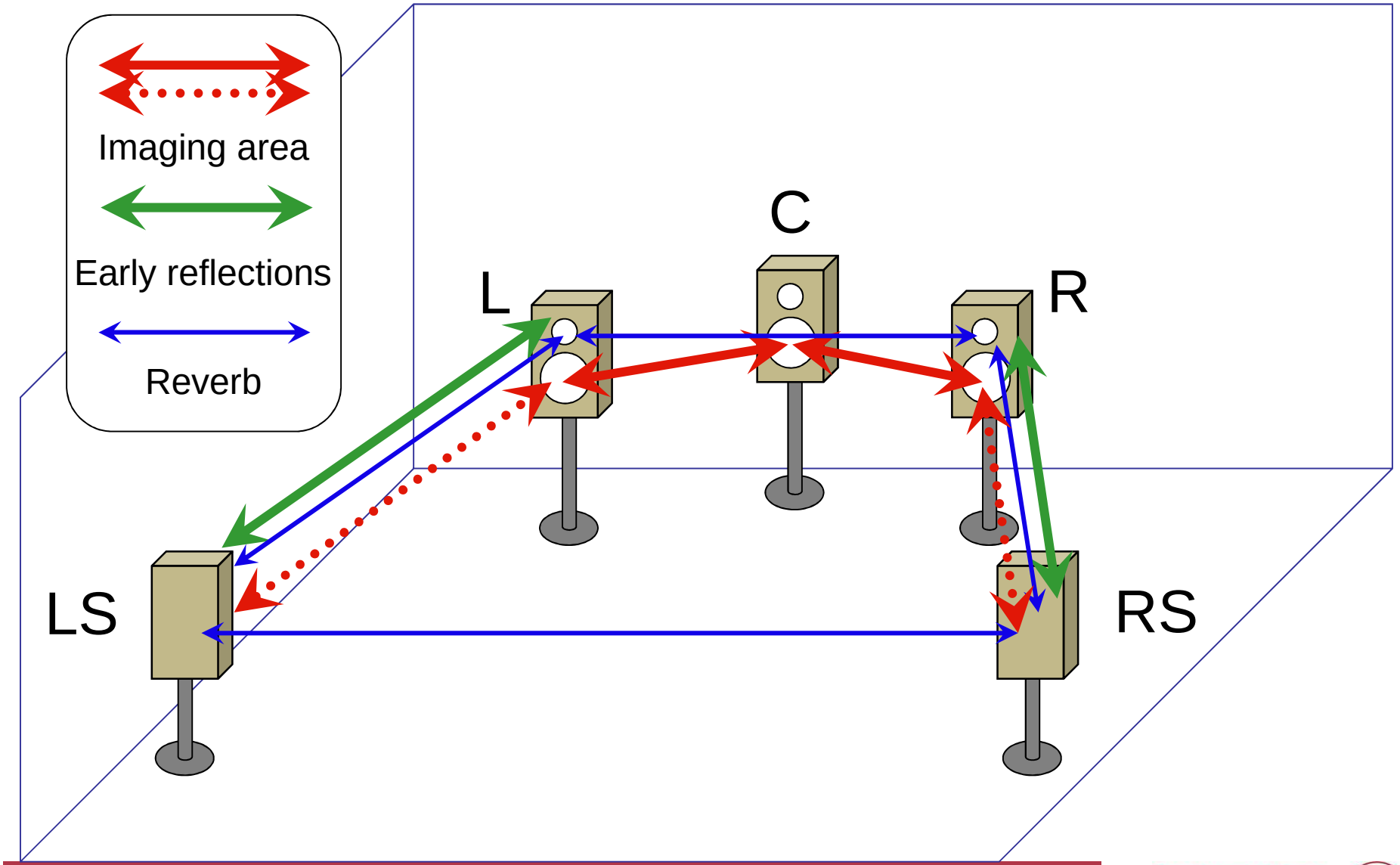

Spatial reproduction by multichannel stereophony

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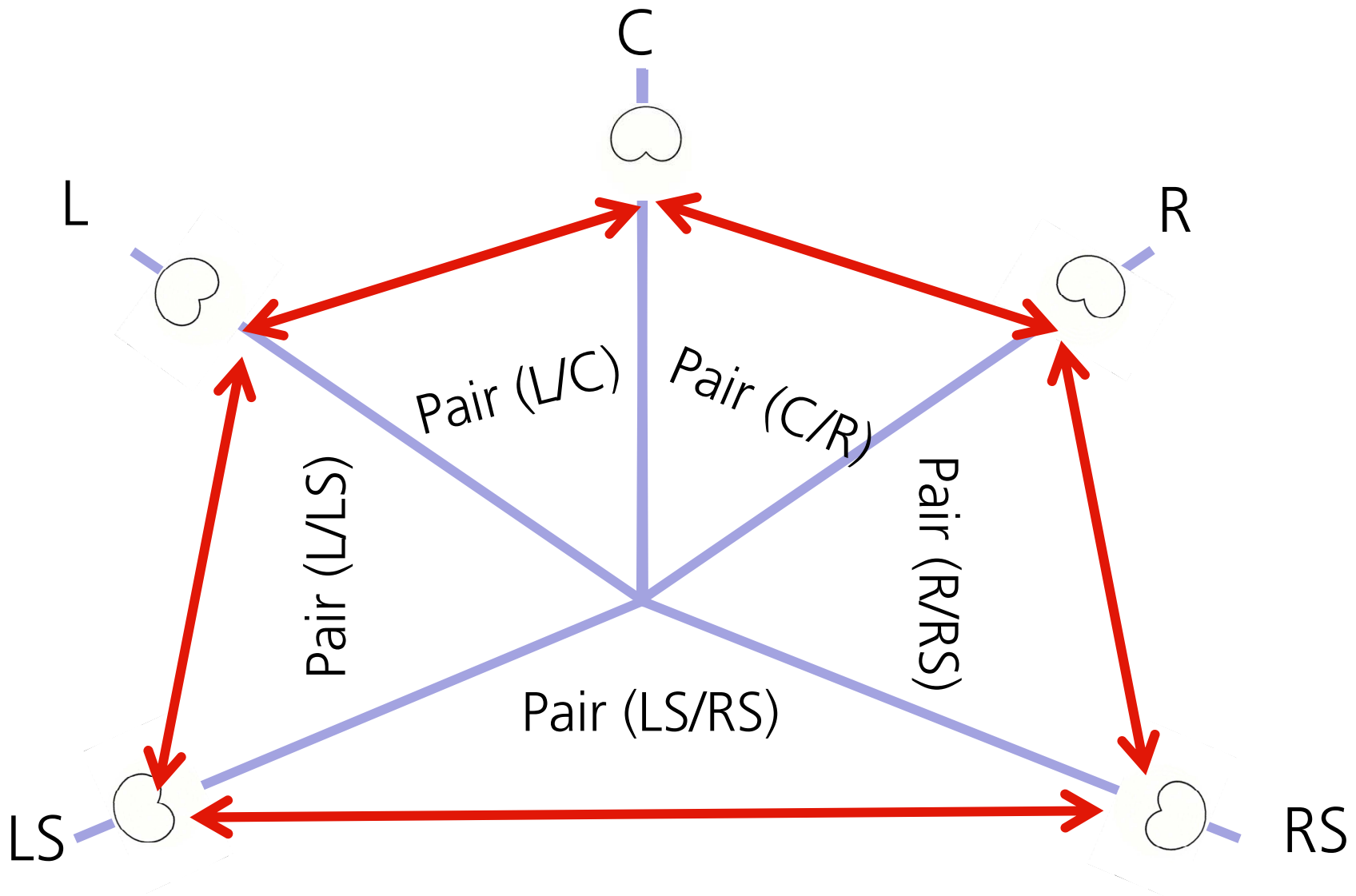

Developing a 5.1 Multichannel Microphone setup:

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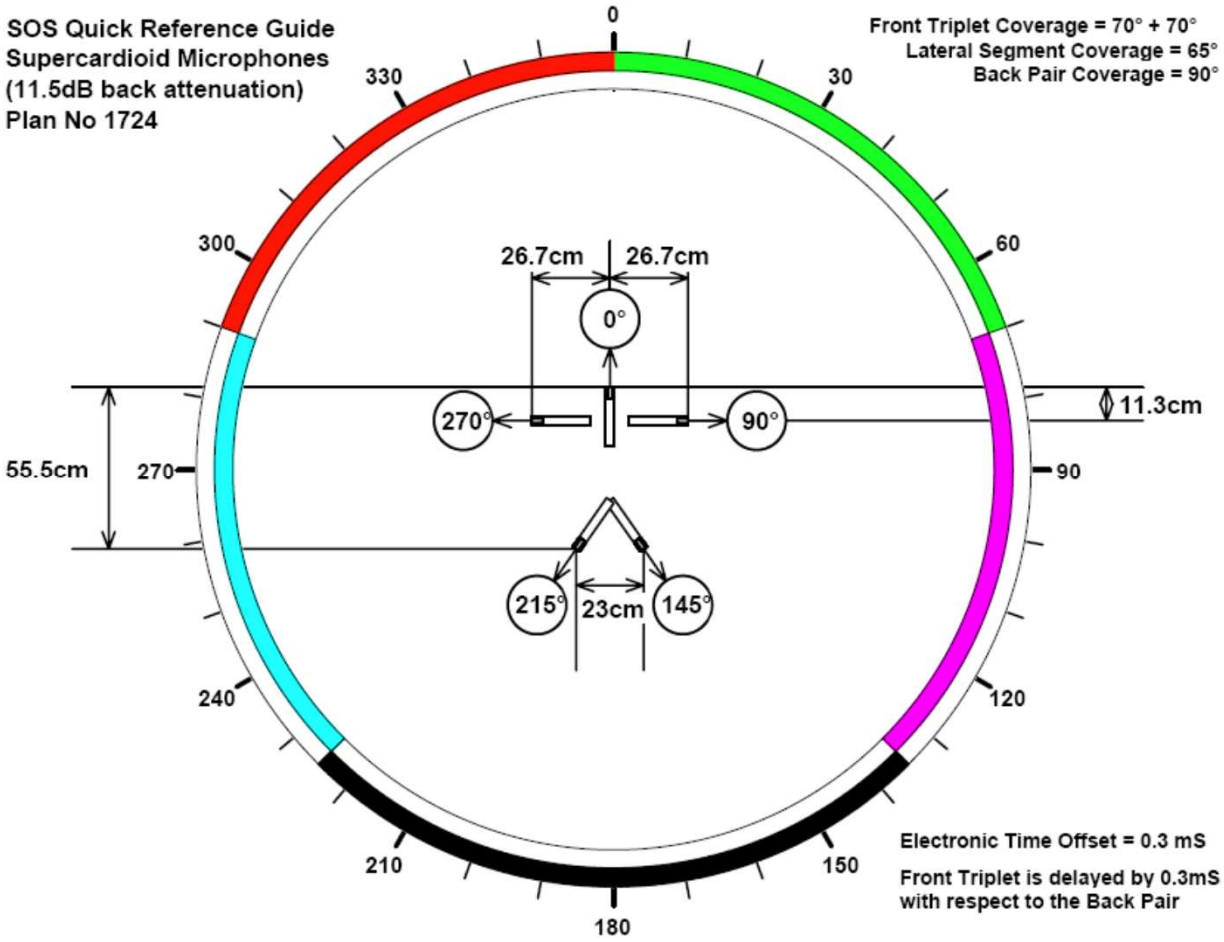
- Example: 5 cardioid (CCM 4) setup with windscreens:

- Calculation of Surround arrays:
- M.Williams: **MMAD**, MAGIC arrays, Critical Linking
  http://www.mmad.info



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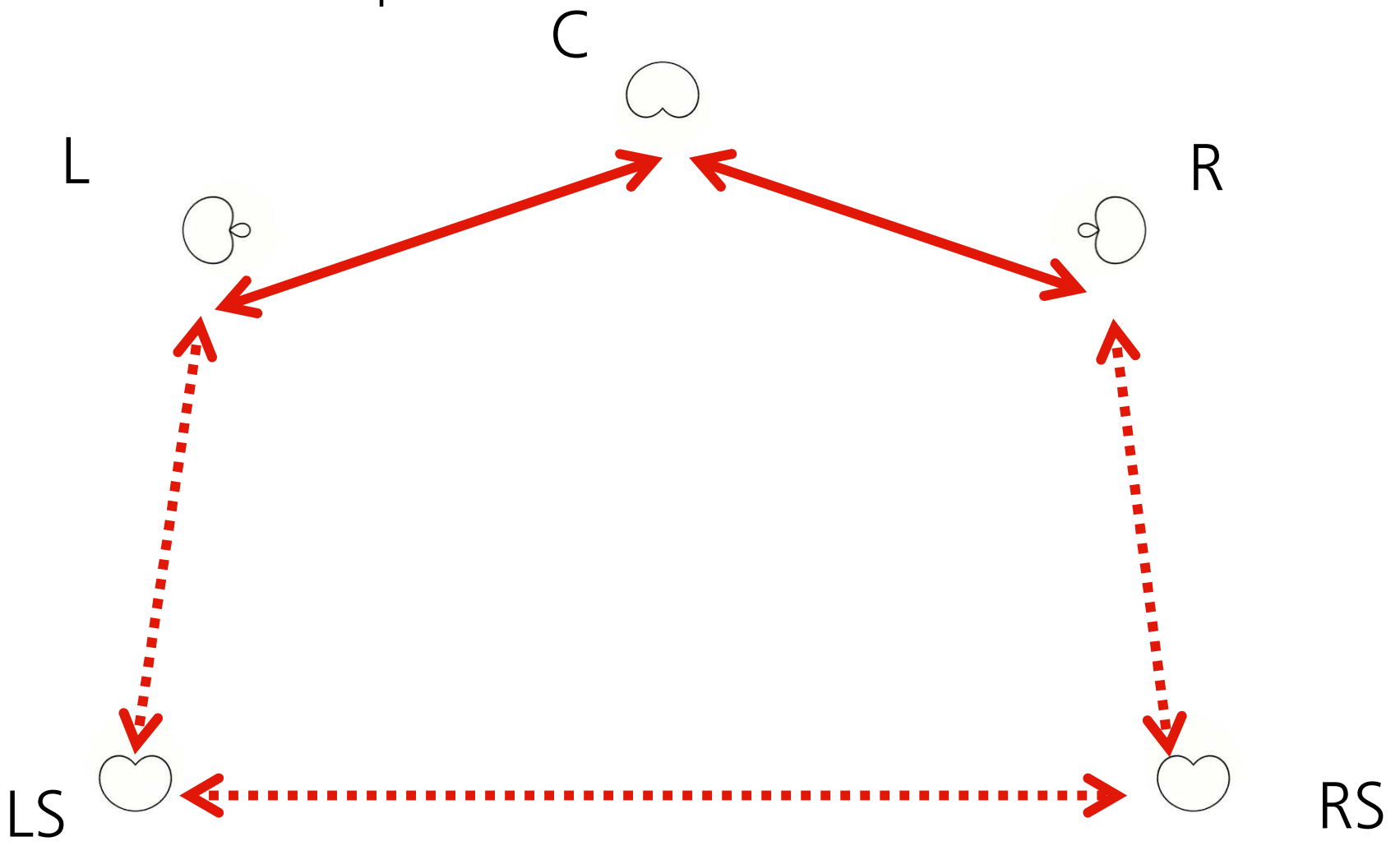
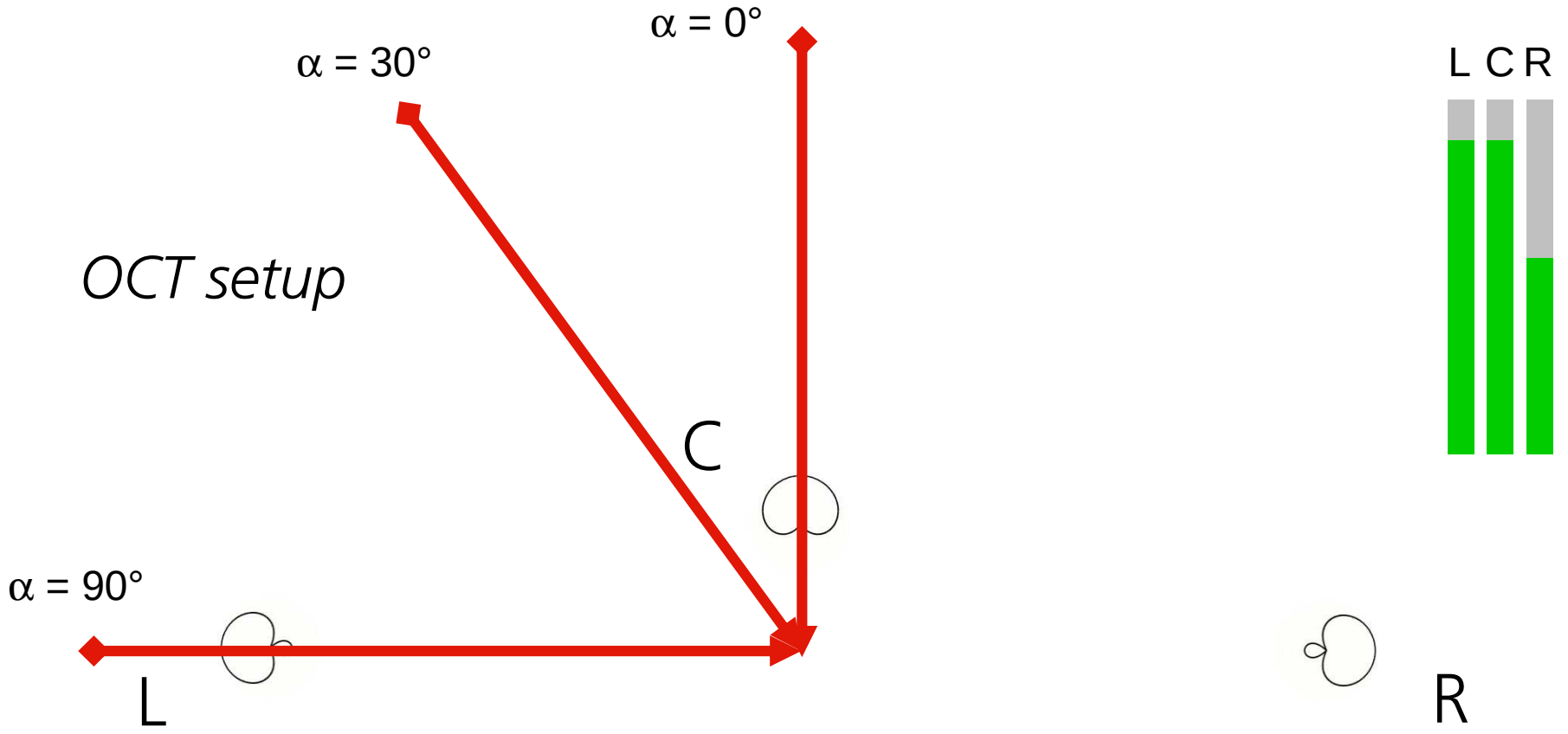
OCT Technique:



SCHOEPS Mikrofone



OCT: no Crosstalk

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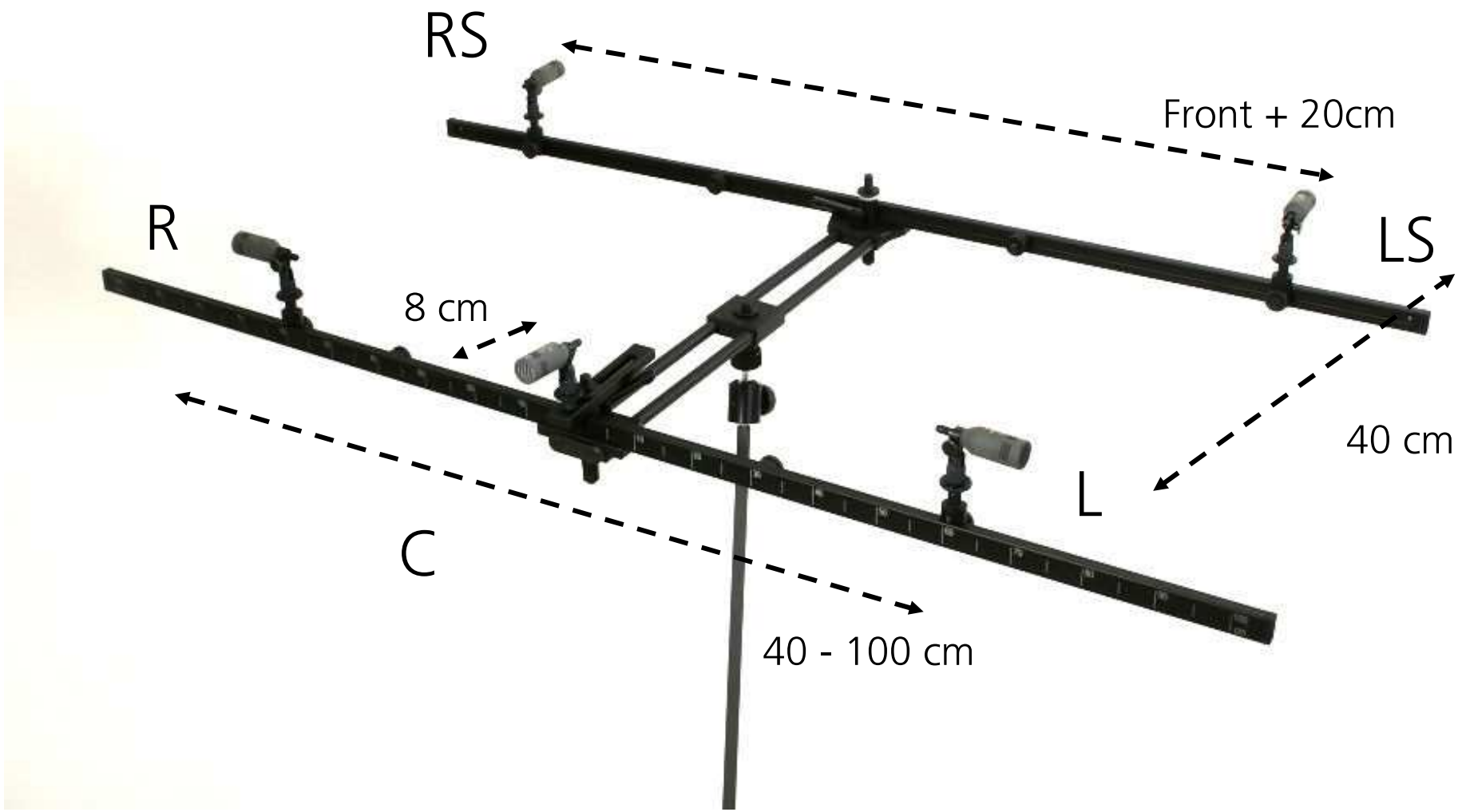
OCT Surround using 5 **SCHOEPS** CCM compact microphones and the stereo bar MAB1000



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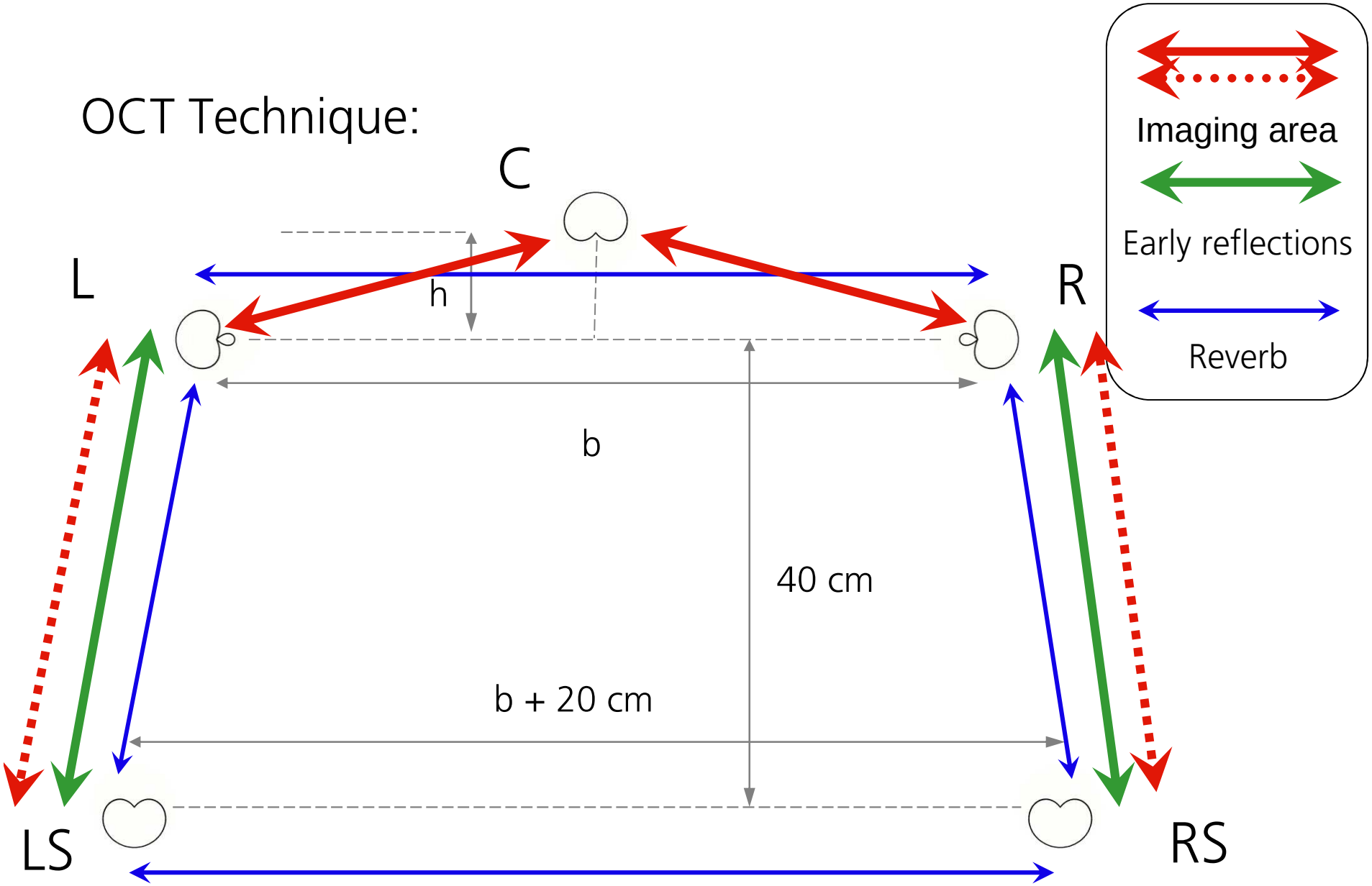
OCT Technique:



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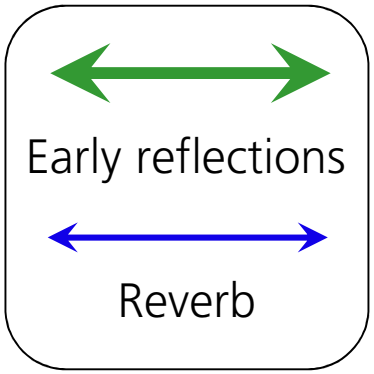
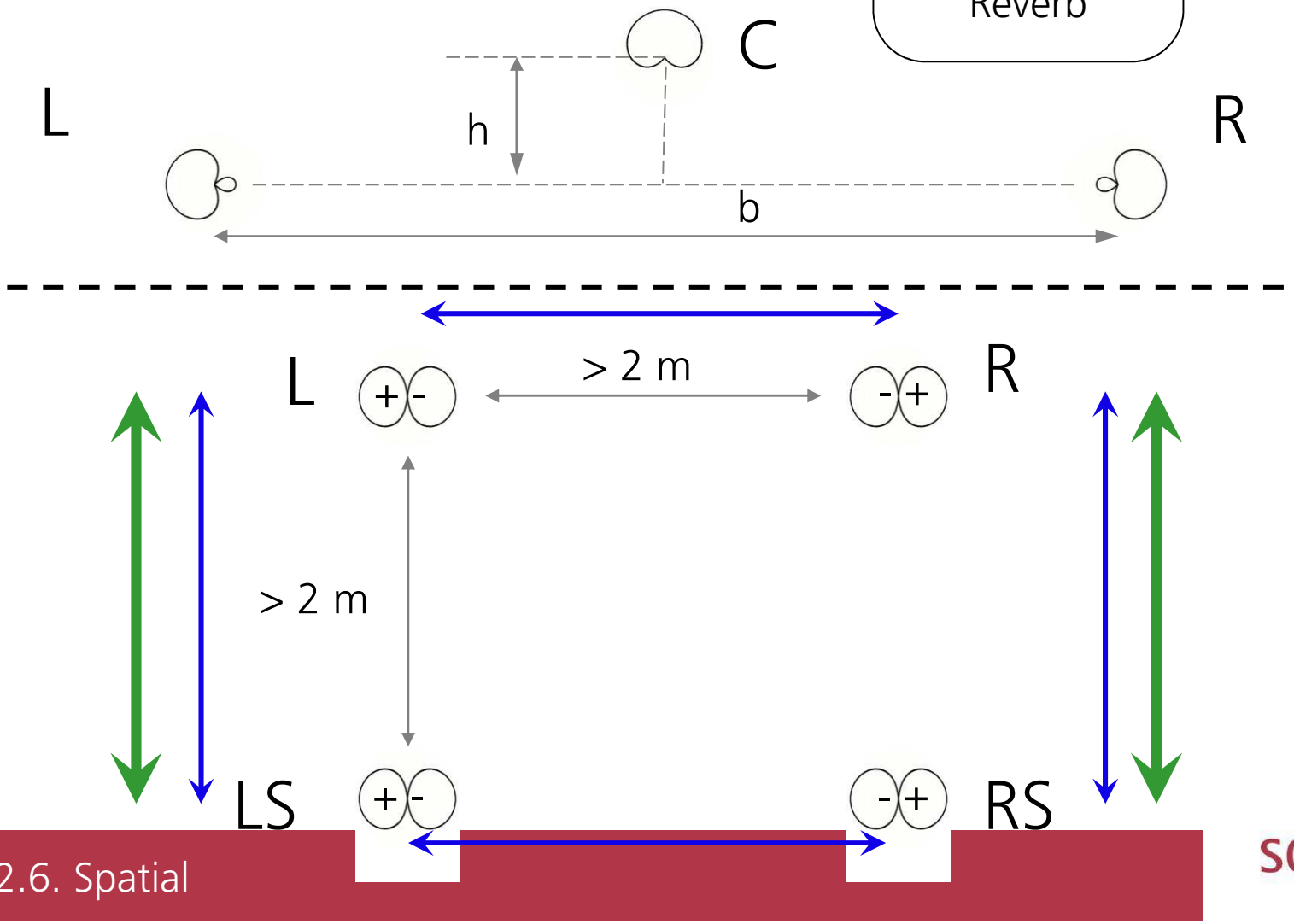
OCT + Hamasaki square

DEMO
Sound Sample #6
Lyon: OCT Surround-OCT+Hamasaki





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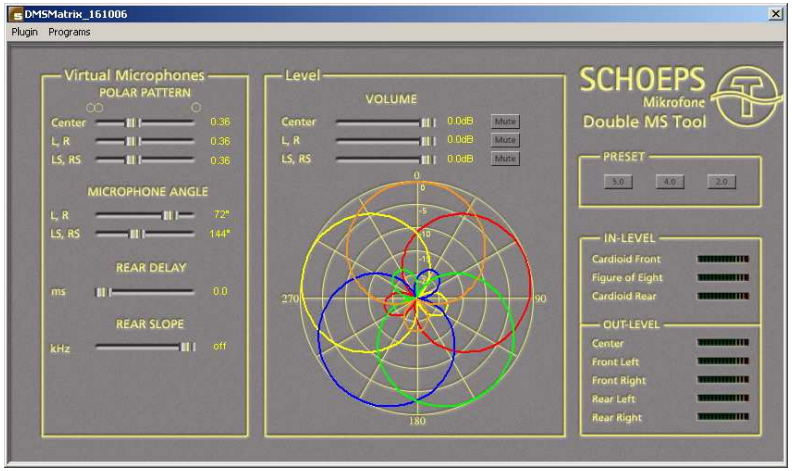
Double - M/S

free Plug-in and Audio Samples online:
www.schoeps.de/dmsplugin.htm



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Double MS: The M/S principle

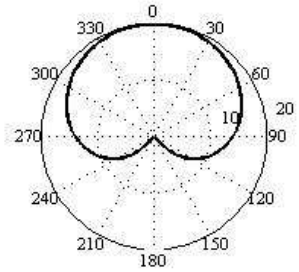
$$M = L + R$$

$$S = L - R$$

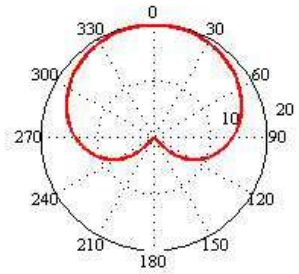
$$L = \frac{1}{2} * (M + S)$$

$$R = \frac{1}{2} * (M - S)$$

M
S



L
R



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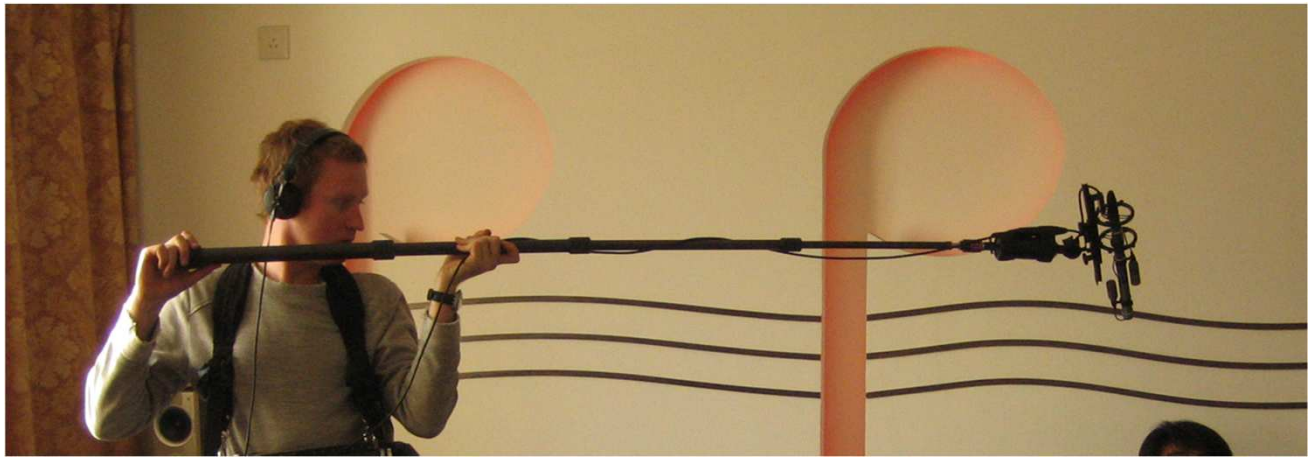
Double MS: The M/S principle

- Front M/S pair
- Rear M/S pair
- Combined
  Double M/S triplet

- Double M/S with shotgun



2.8. Surround main microphones: Double M/S

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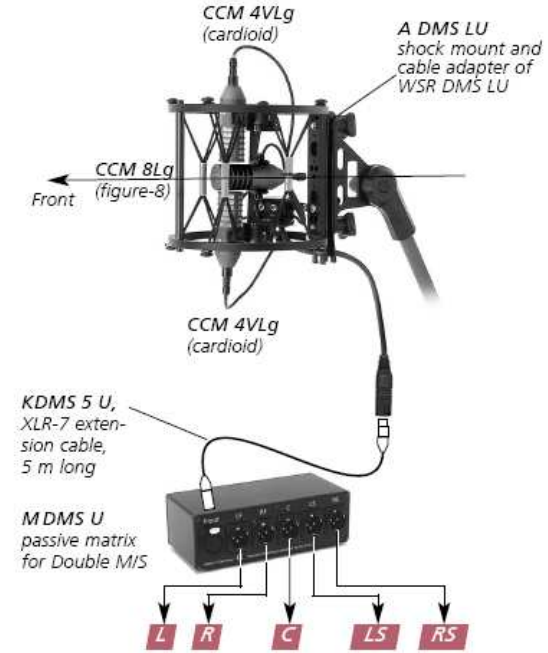
Decoding variants:

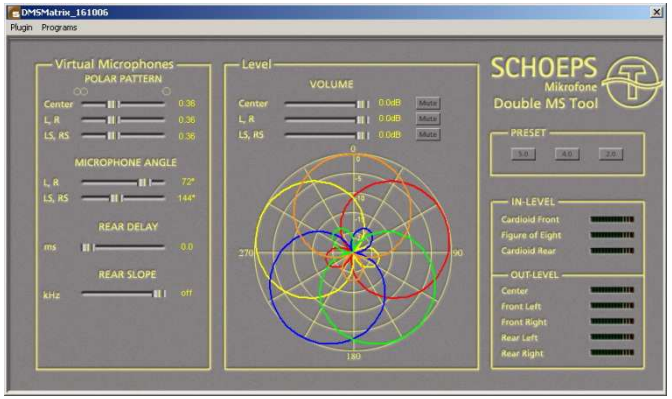
- 2 M/S Matrices
- Hardware (M DMS)

- Free Software (VST, RTAS)

  www.schoeps.de/dmsplugin.htm



Double M/S set



DEMO
Sound Sample #9
Schostakovitsch
Klavierkonzert
Rossini

DEMO
Sound Sample #10
Schalke
Volksmusik
Drums

2.8. Surround main microphones: Double M/S

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Ambience techniques for Stereo 2.0 and 5.1

Helmut Wittek, September 2013
www.hauptmikrofon.de

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- **Ambience**: how do you record it?
  - The 3 ambience layers
  - Microphone placement for the 3 ambience layers
  - Making decisions:
    Layer mix, tonmeister taste and practical requirements
  - Microphone techniques
    - M/S, X/Y, ORTF, A/B, Double M/S, Double M/S with Shotgun, IRT-Cross, ORTF Surround, Theile trapezoid, Hamasaki Square, 5 cardioids, Decca-Tree, …

Discrete Signals:

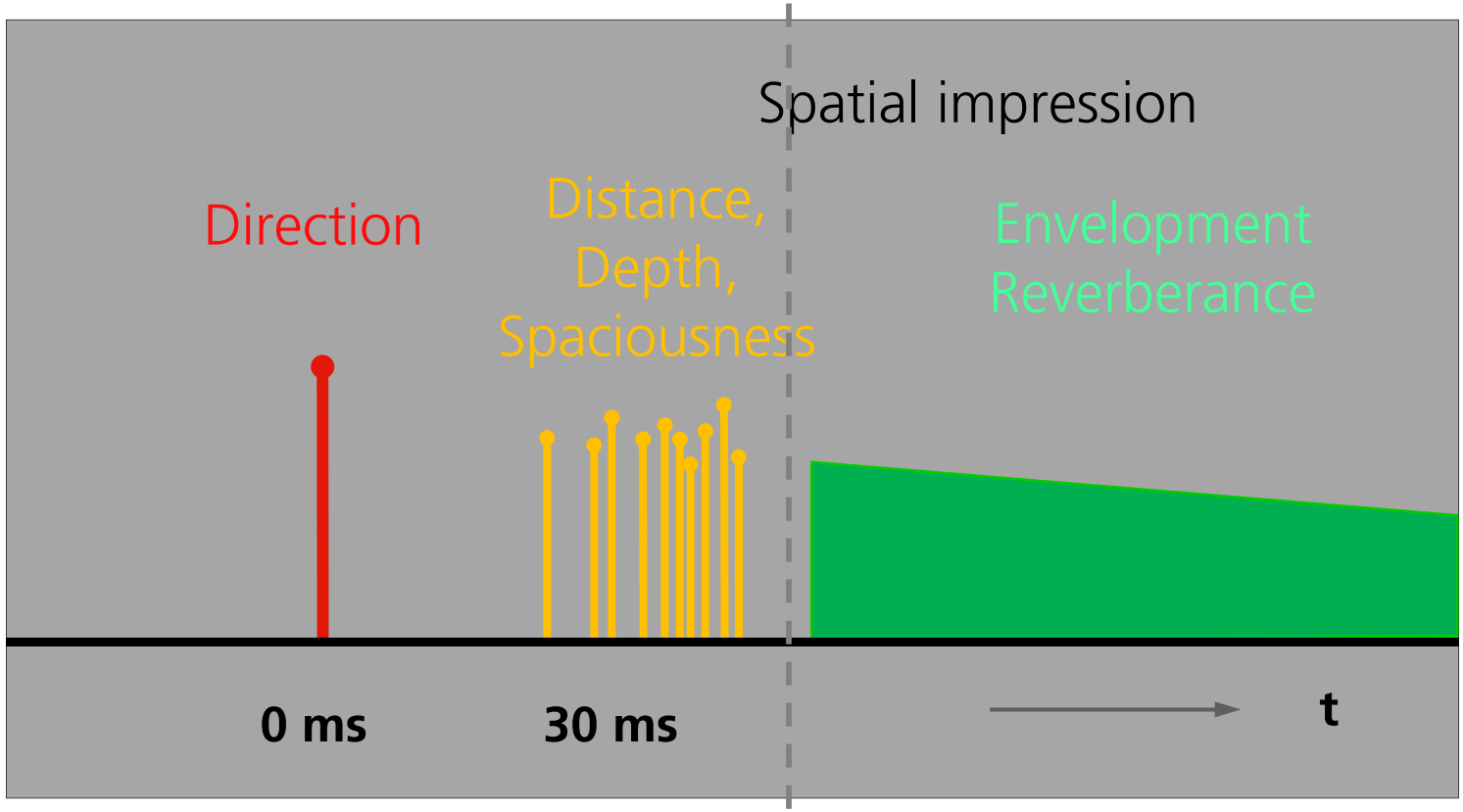
Correlated at both ears

From discrete directions

Diffuse Signals:

Decorrelated at both ears

From all directions



Spatial reproduction

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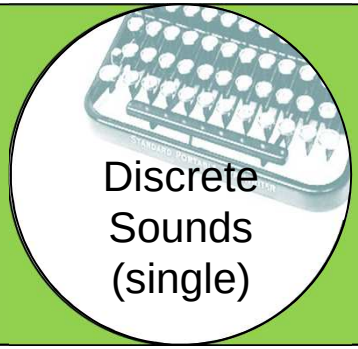
	Signal type		Room signal properties
1			• diffuse • location-independent • not localized • Room information
2			• discrete • location-independent • localized, but the location is arbitrary • Info on position of the source in the room
3			• discrete • location-dependent • localized • Source information

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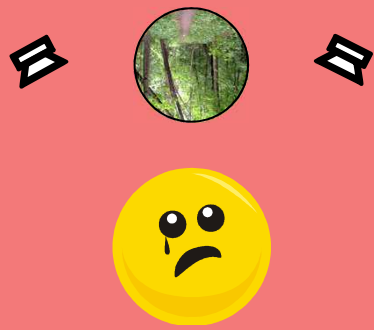
Microphone geometry for recording diffuse sound:

- Uncorrelated signals
- Balanced energy distribution

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



SCHOEPS Mikrofone

Microphone geometry for recording diffuse sound:

- Uncorrelated signals
- Balanced energy distribution

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

SCHOEPS Mikrofone

Microphone geometry for recording diffuse sound:

- Uncorrelated signals
- Balanced energy distribution

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

→ Each channel records a different diffuse signal

→ The channels are decorrelated regarding the the diffuse field

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Microphone geometry for recording diffuse sound:

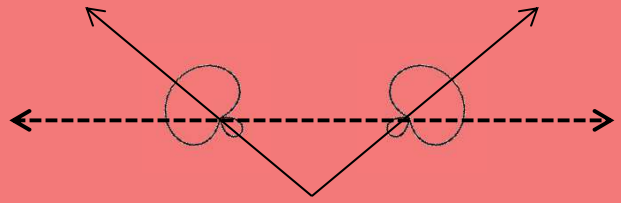
- The larger the distance, the more independent the signals

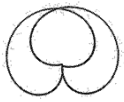
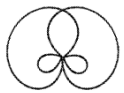
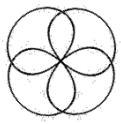
- The larger the directivity, the more independent the signals

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

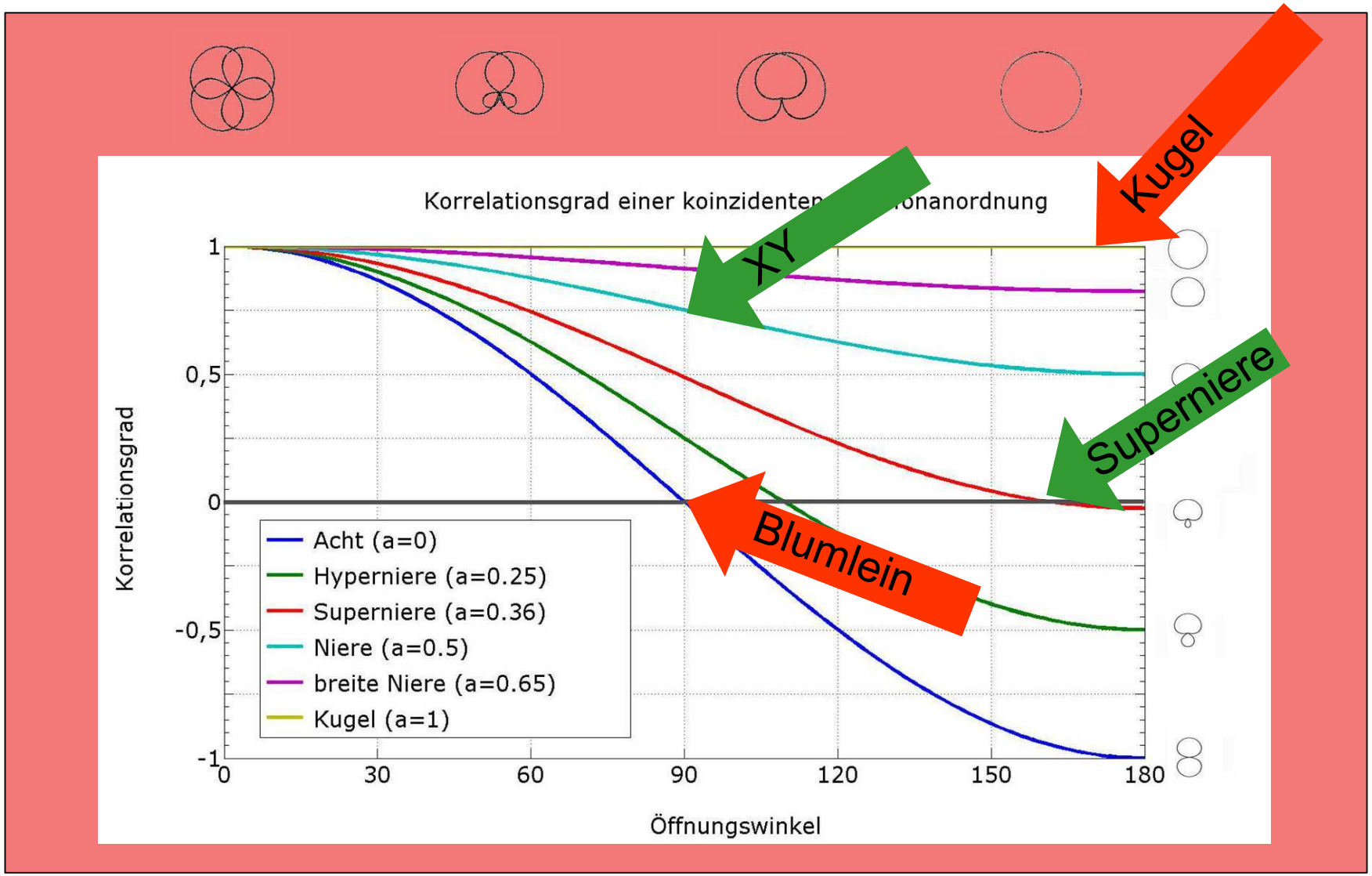
Diffuse field correlation (DFC)

- is dependent on the distance, angle and directivity
- is dependent on the frequency (wave length)



Setup	XY, 90°, Cardioids	XY, 120°, Super-cardioids	Blumlein, 90°, Figure-8
DFC	**0.75**	**0.23**	**0**
			

Diffuse field correlation (DFC): coincident setups



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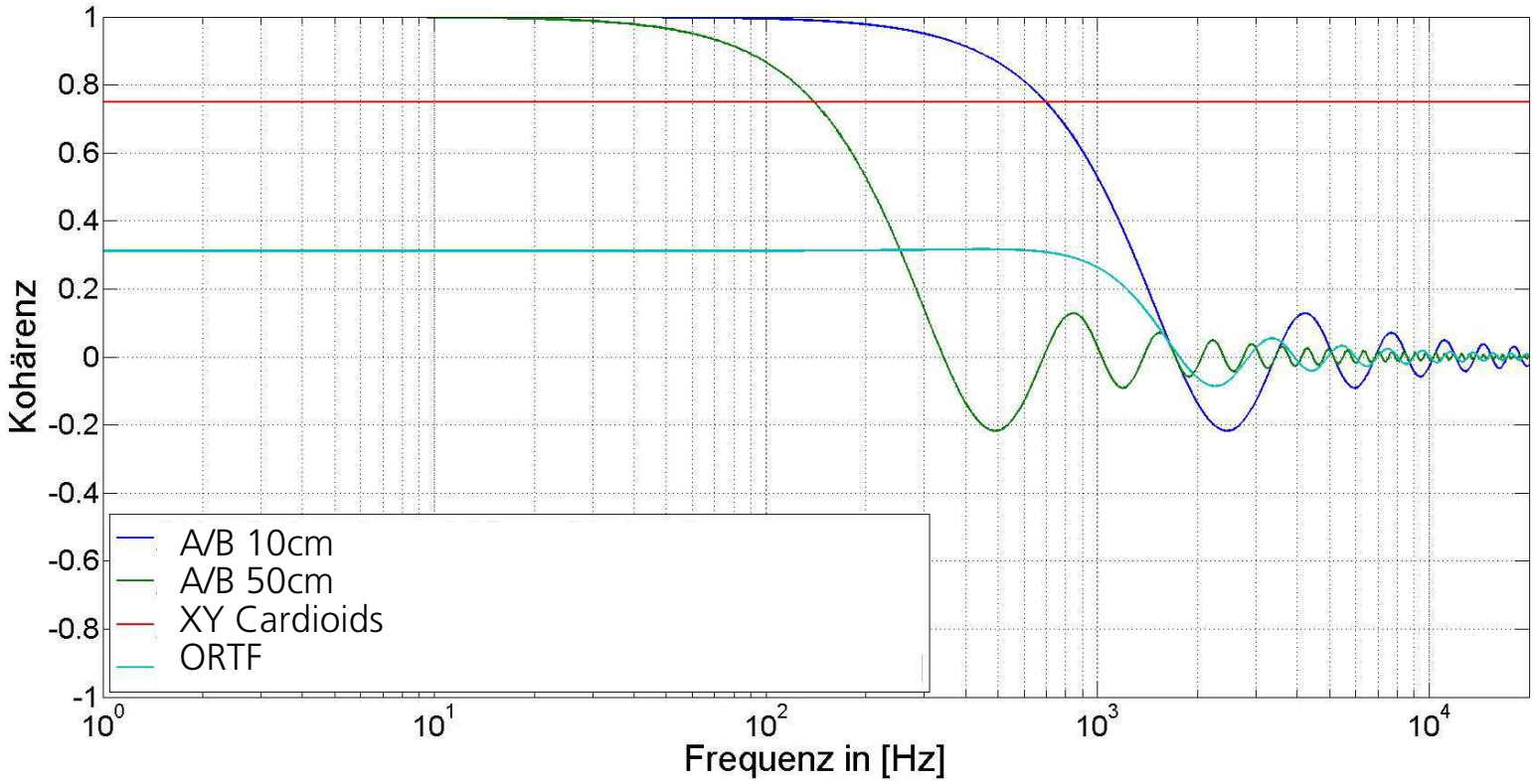
Diffuse field correlation (DFC)

DFC



from: [Riekehof et al., TMT 2010]

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Signal type

Microphone signal properties

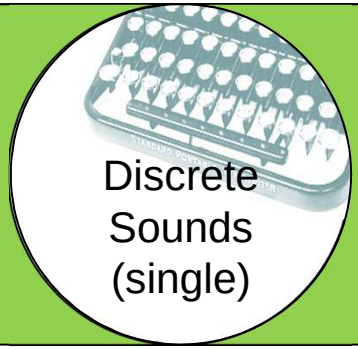
1

- Uncorrelated signals
- Balanced energy distribution

2

- Correlated signals
- Balanced directional distribution

3



- Correlated signals
- Balanced directional distribution
- Real or realistic directional imaging

What is ambience?

SCHOEPS Mikrofone

Choice of the setup: 3 Steps

Step 1. Ambience layer mix: what is my ambience composed of?

Diffuse Layer	Reflec-tion Layer	Direct sound layer	Example	Possible microphone setup for 5.1 Surround
X	X	- (with Center)	Film ambience without discrete noise	5 Omnis
X	X	- (without Center)	Conzert hall ambience	Hamasaki Square
X	X	X (without Center)	Stadium ambience for Sports	ORTF Surround
X	X	X (with Center)	Documentary ambience with discrete sources	5 wide cardioids
X	X	X (3 only in front)	Orchestra in the concert hall	OCT Surround, OCT + Hamasaki
	X	X	Dry outside ambience	Double M/S, ORTF Surround
		X	Dry radio drama recording in the studio	Double M/S

Choice of the setup: 3 Steps

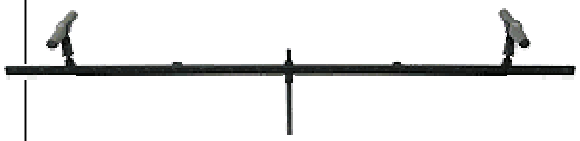
Step 2. The individual taste of the tonmeister and his priorities:

- Choise of the **directivity pattern** and the **microphone type**
- Relative weight of **sound colour, depth, immersion, room impression, directional imaging, naturalness, stability**, etc.

Step 3. Practical Aspects

- **Size, suspension, windshield, flexibility, ease of use, simplicity, price, postpro-options,** etc.

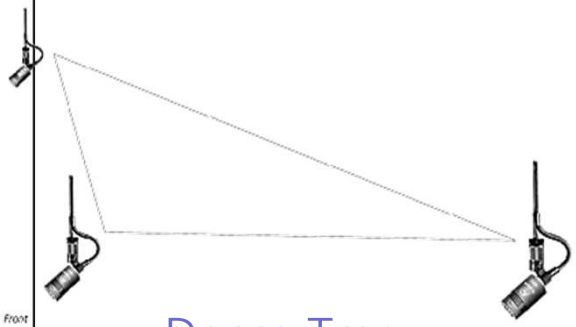
Ambience microphones for Stereo



A/B

ORTF

Coincident



Decca Tree

A/B/C

Ambience microphones for Stereo

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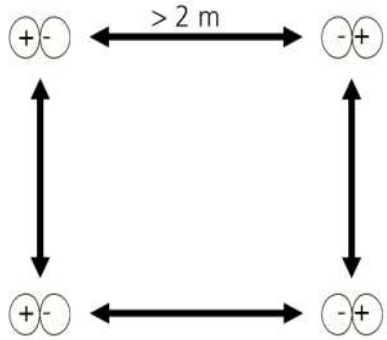
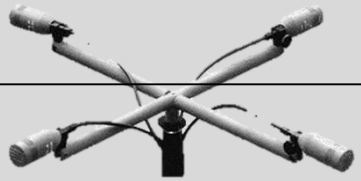
Ambience microphones for Surround



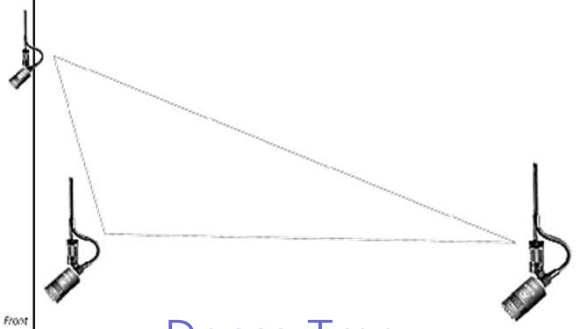
Hamasaki Square



IRT Cross

MMAD/INA/OCT/Equivalence

Coincident



Decca Tree

ORTF Surround

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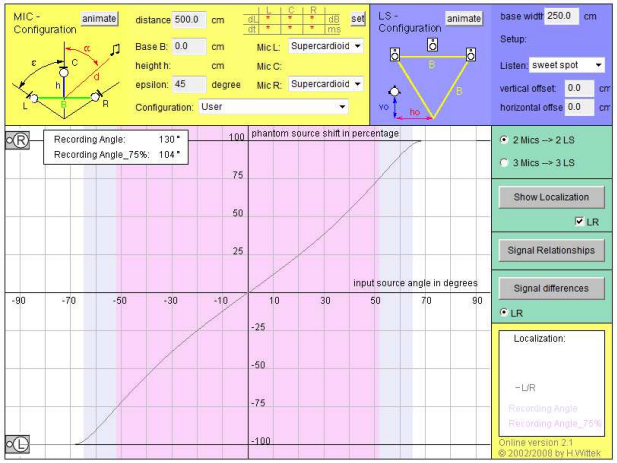
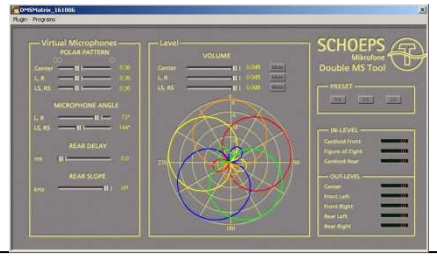
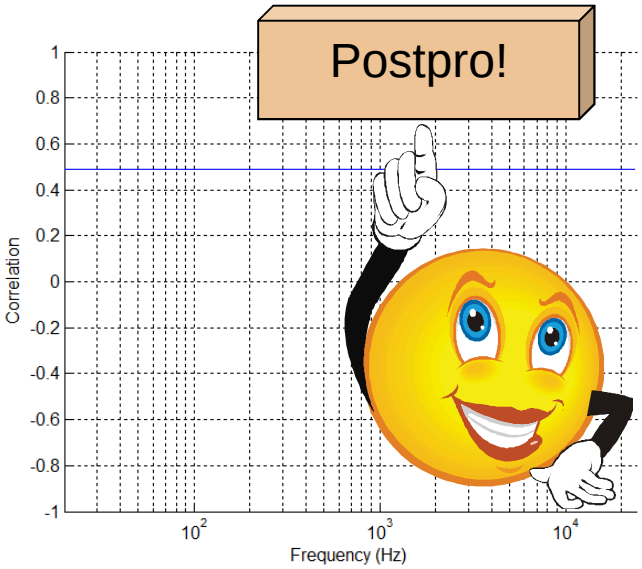
Double M/S

- Compact, flexible and practical
- Only 3 channels for Surround
- Decoding with 2 * M/S-Matrix, Hardware decoder or Plug-in
- High DFC if more than 3 output channels are used;
  maximum 4 Outputs are feasible
- If decoded properly:
  - Average room properties
  - Good sound colour;
    good imaging properties







Ambience microphones for Surround

SCHOEPS Mikrofone

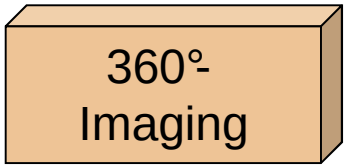
Double M/S with shotgun

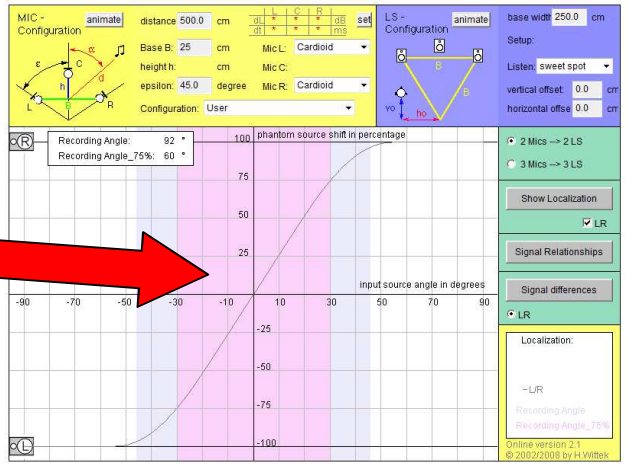
- Using a shotgun for the Centre channel: ideal setup for documentary
- Compact: Surround setup with windshield not larger than for Mono
- flexible und practical
- If decoded properly, good spatial properties
- Only 3 channels for Surround: shotgun, Fig-8, Cardioid
- Simple decoding with 2 normal M/S-Matrices

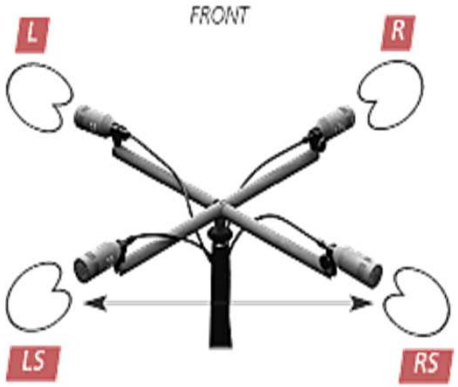
SCHOEPS Mikrofone

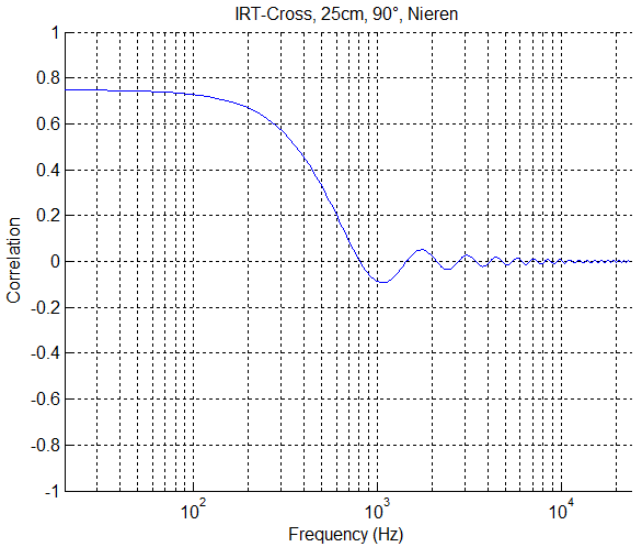
IRT Cross

- Open room sound, very good 360°-Imaging
- Basis spacing:
  - 4 cardioids: 25cm
  - 4 supercardioids: 18cm
  - 4 wide cardioids: 31cm





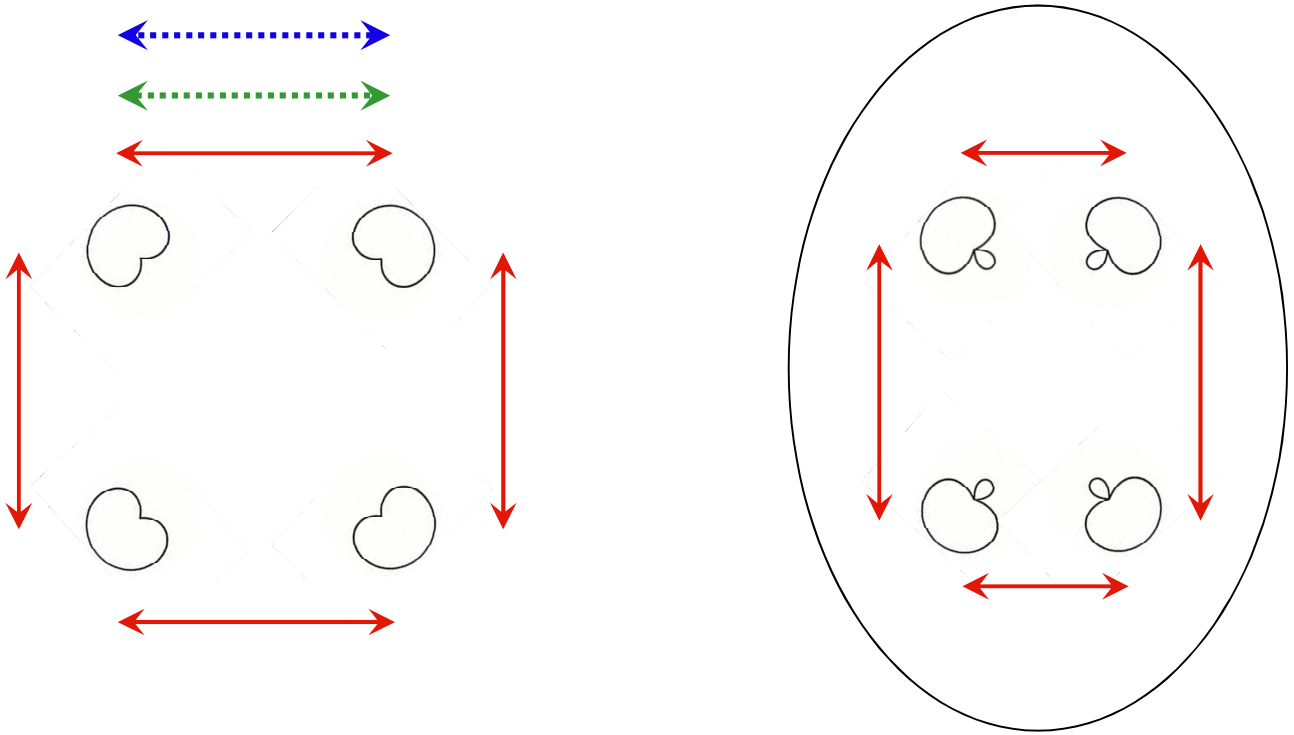




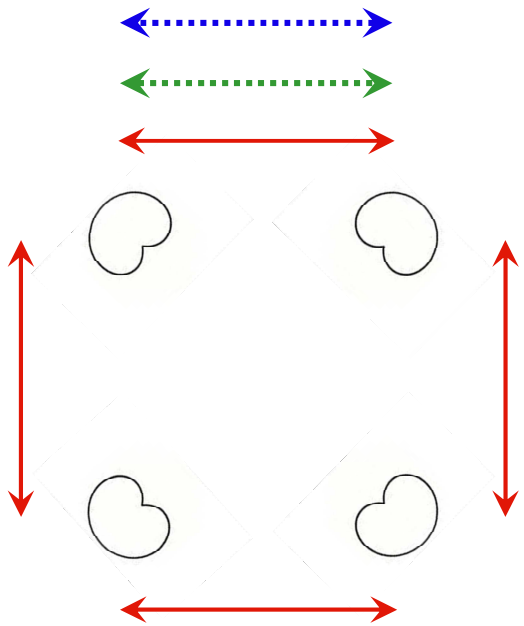
SCHOEPS Mikrofone

- IRT Cross: Application

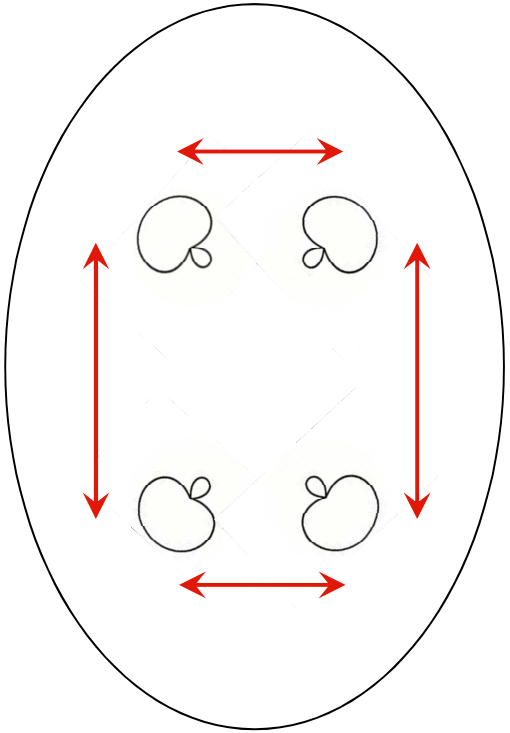
- IRT cross for Surround atmos:
  - 4 Cardioids at 20 cm - 90°
  - 4 Supercardioids at 14 cm - 90°
- "ORTF Surround" for Surround atmos:
  - 4 Supercardioids at 10/20 cm - 100°/80°



- IRT cross for Surround atmos
  - 4 Cardioids at 20 cm - 90°
  - 4 Supercardioids at 14 cm - 90°



- "ORTF Surround" for Surround atmos
  - 4 Supercardioids at 10/20 cm - 100°/80°



- IRT cross for Surround atmos
  - 4 Cardioids at 20 cm - 90°
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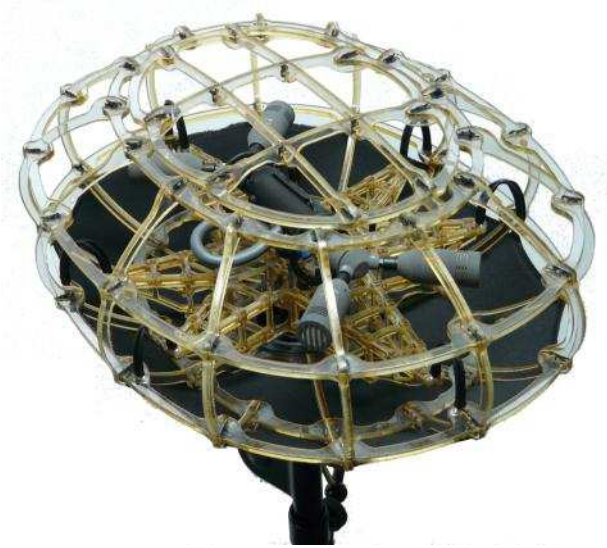
- "ORTF Surround" for Surround atmos
  - 4 Supercardioids at 10/20 cm - 100°/80°

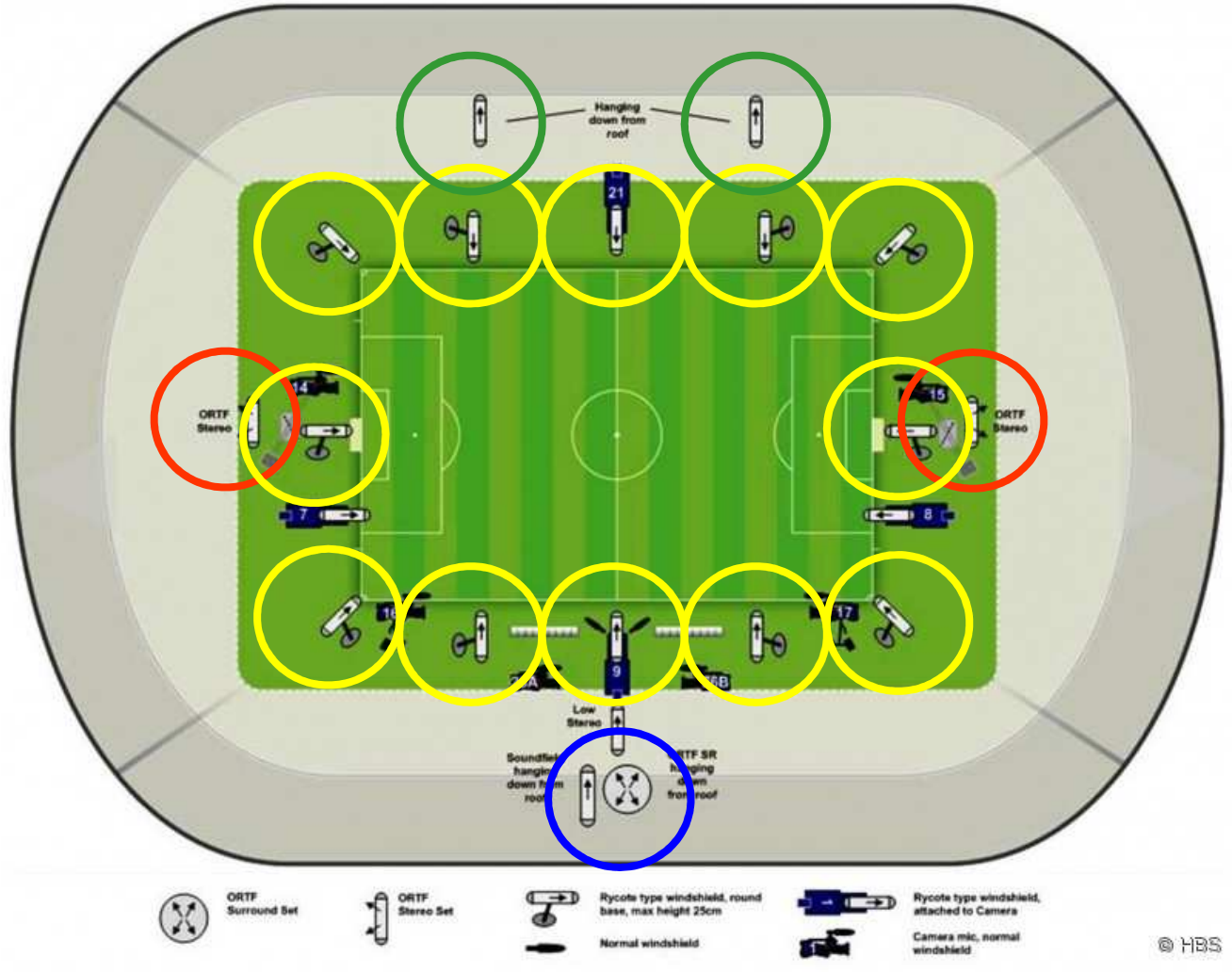


SCHOEPS Mikrofone

- ORTF Surround below the stadium roof

ORTF Surround: Football

SCHOEPS Mikrofone



The standard multilateral microphone plan

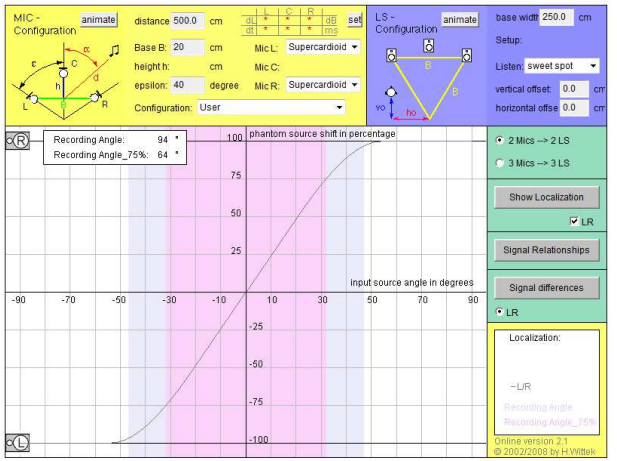
1. Main mic:
   ORTF Surround
2. Stereo spots:
   ORTF Stereo
3. „Close-Ball“:
   SuperCMIT
4. Mono spots:
   Single CCM

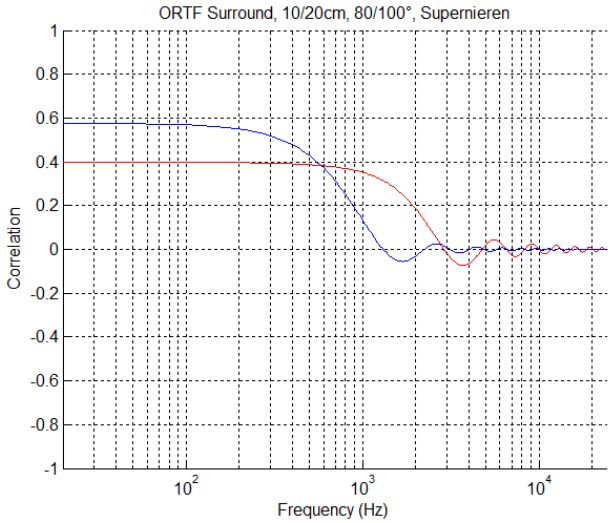
ORTF Surround: FIFA-WorldCup

SCHOEPS Mikrofone

ORTF Surround

- 4 Supercardioids, 10cm/100°+ 20cm/80°
- Compact and practical
- Open room sound + ideal 360°-Imaging (same as the IRT cross)
- ***Plug&Play:*** special windshield, suspension, Multicore mit Multipin-Plug

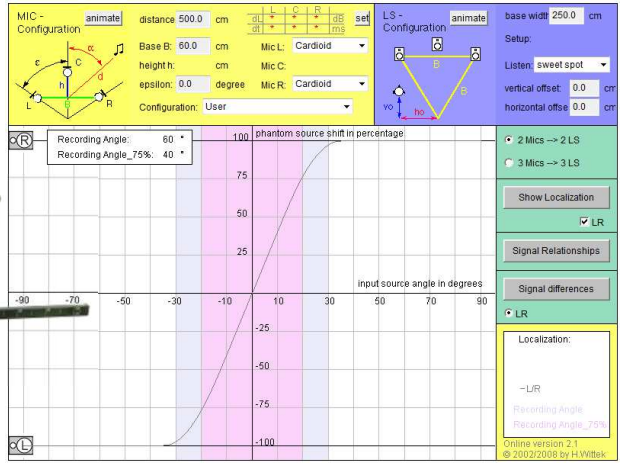




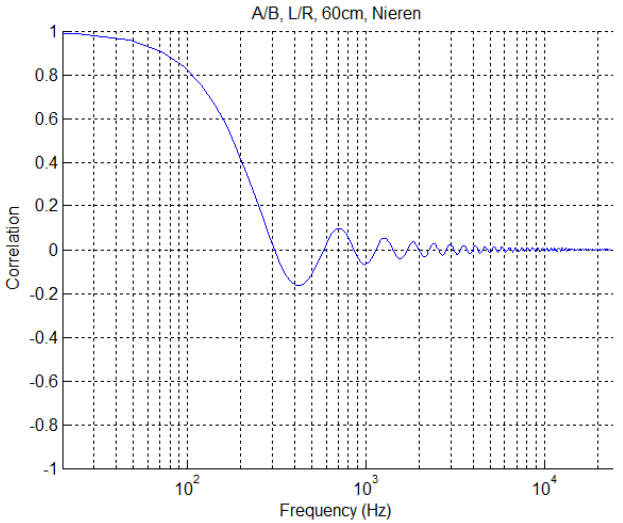
SCHOEPS Mikrofone

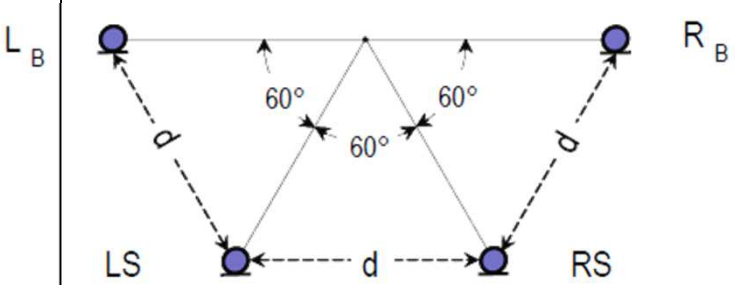
Theile trapezoid

- Room microphone for Front-Back-Scenario; not for Layer 3, ideal for layers 1 und 2
- 4 cardioids, facing backwards; d = 60 cm
- Optimal attenuation of direct sound from 0°



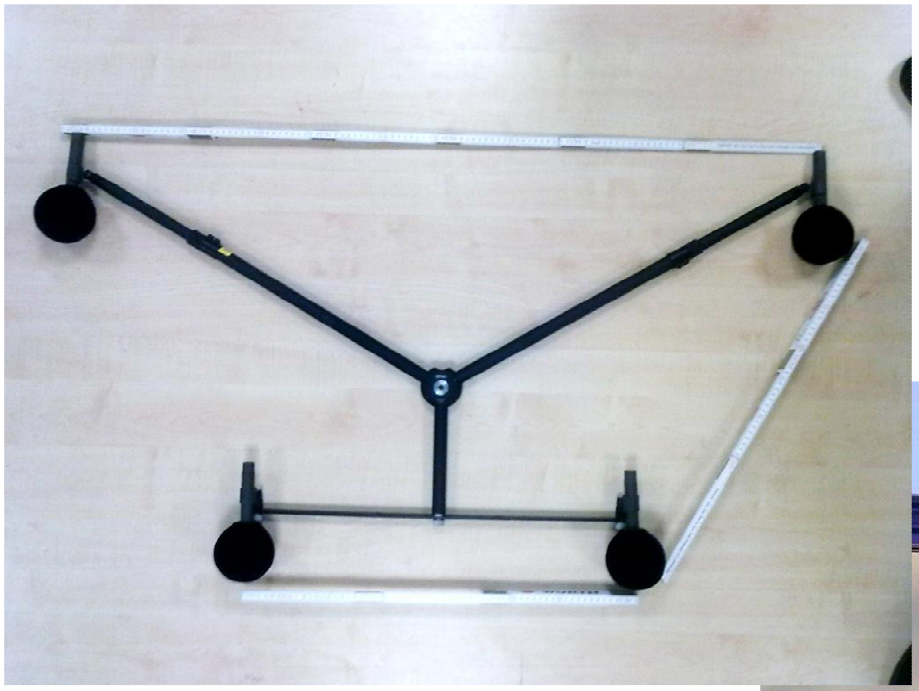
Audience microphone

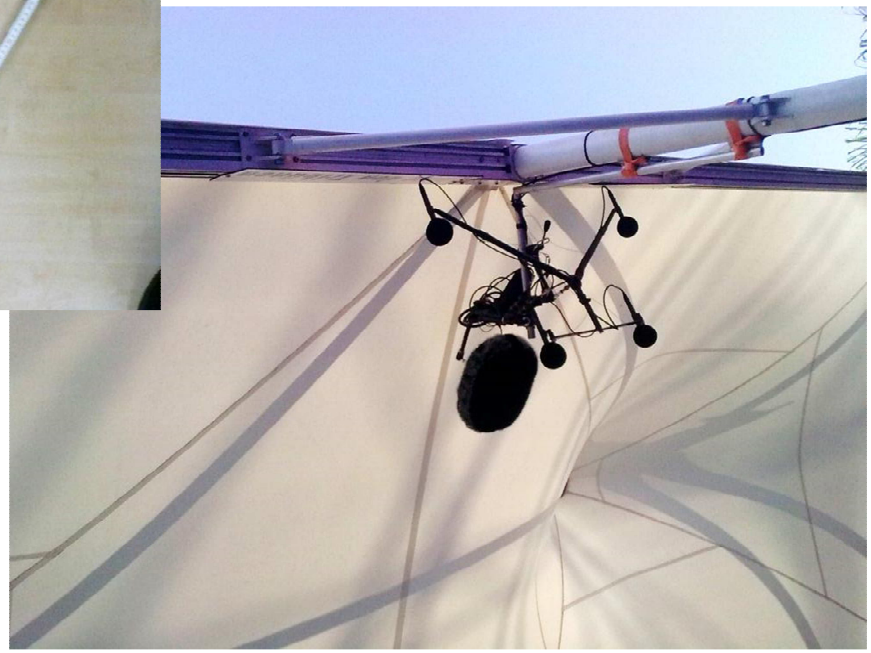




SCHOEPS Mikrofone

Theile trapezoid



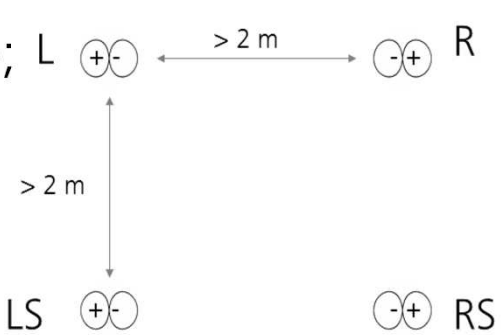


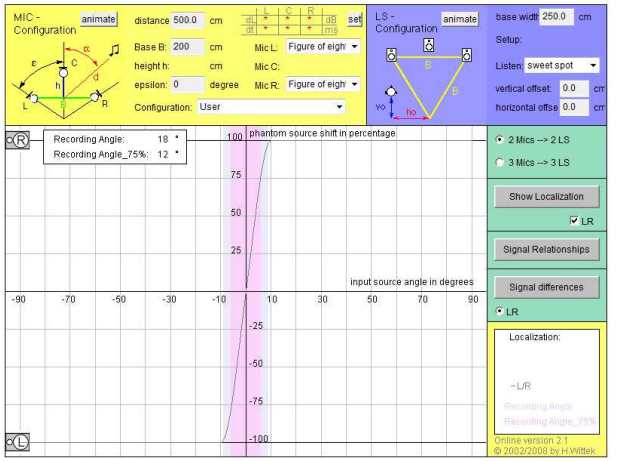
Photos: R. Bihler, SWR

SCHOEPS Mikrofone

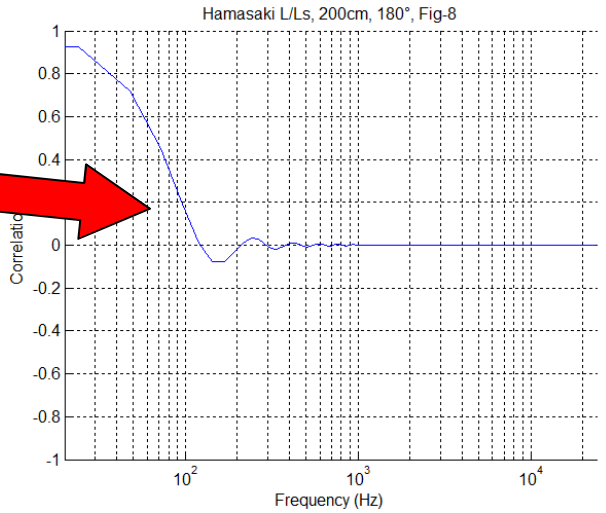
Hamasaki Square

- Room microphone; not suitable for Layer 3-Signals, ideal for Layer 1 and Layer 2
- Extremely large spacing, not handy
- Open room sound, extremely low DFC
- Large attenuation of direct sound from 0°!
- Optimal reproduction of early lateral reflections





DFC = 0!



Figures for the pair L/Ls; d=200 cm

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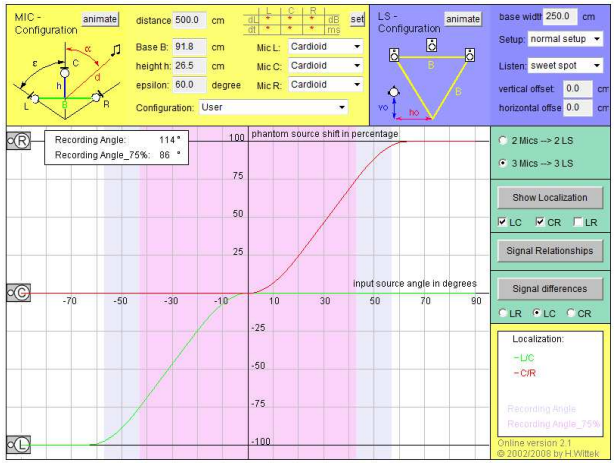
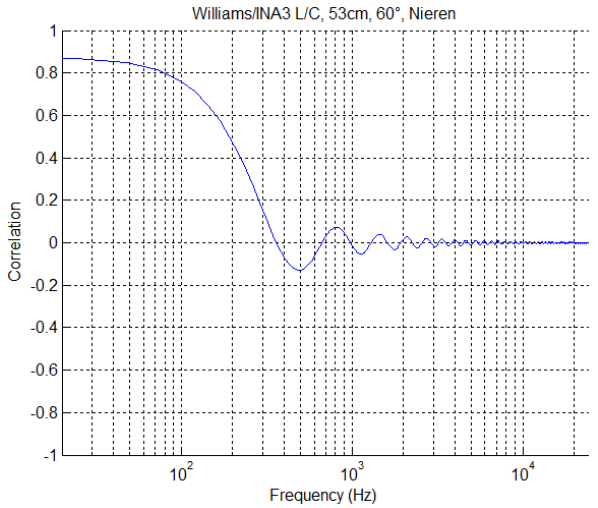
5ch – Equivalence setup after Williams/Theile/Wittek

- With Centre channel
- Geometry is calculated after e.g. Williams MMAD, INA or „Image Assistant“
- With normal, open or wide cardioids
- Very good sound colour
- Very good room and imaging properties
- Not compact; needs large spacings and single windshields

Stabile 360°-Abbildung, toller Klang



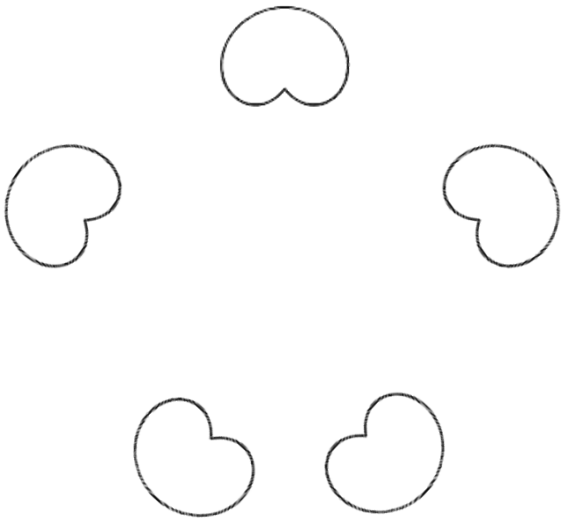


Figures for „INA 3“

SCHOEPS Mikrofone

5ch – Equivalence setup after Williams/Theile/Wittek

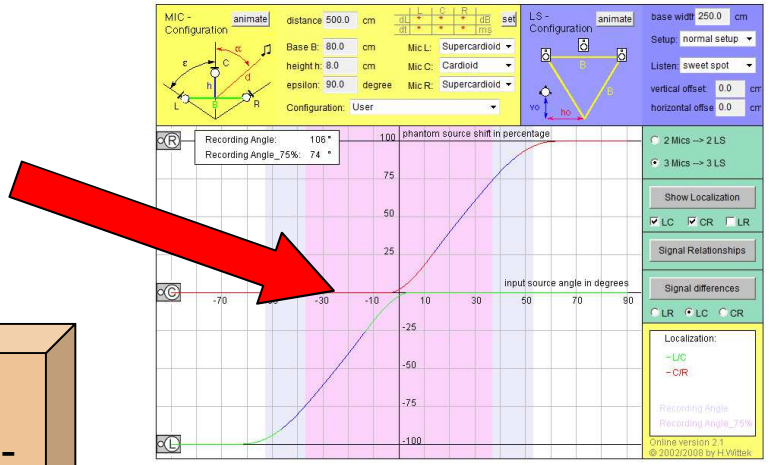
Williams „Umbrella“: flexible suspension

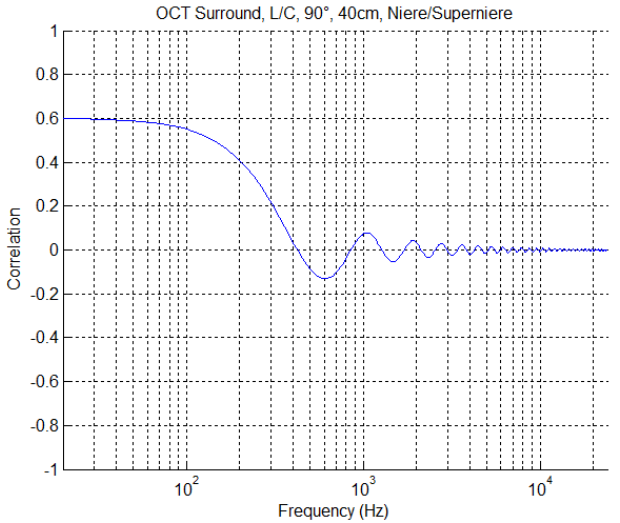


OCT Surround

- Ideal for Front-Back-Scene (Layer 3 only in front)
- Very natural room and imaging properties
- Not compact
- Good sound colour
- Optimal attenuation of Crosstalk → large stability of the image
- More Flexible: OCT + Hamasaki Square

Ideal for Front/Back-Scene

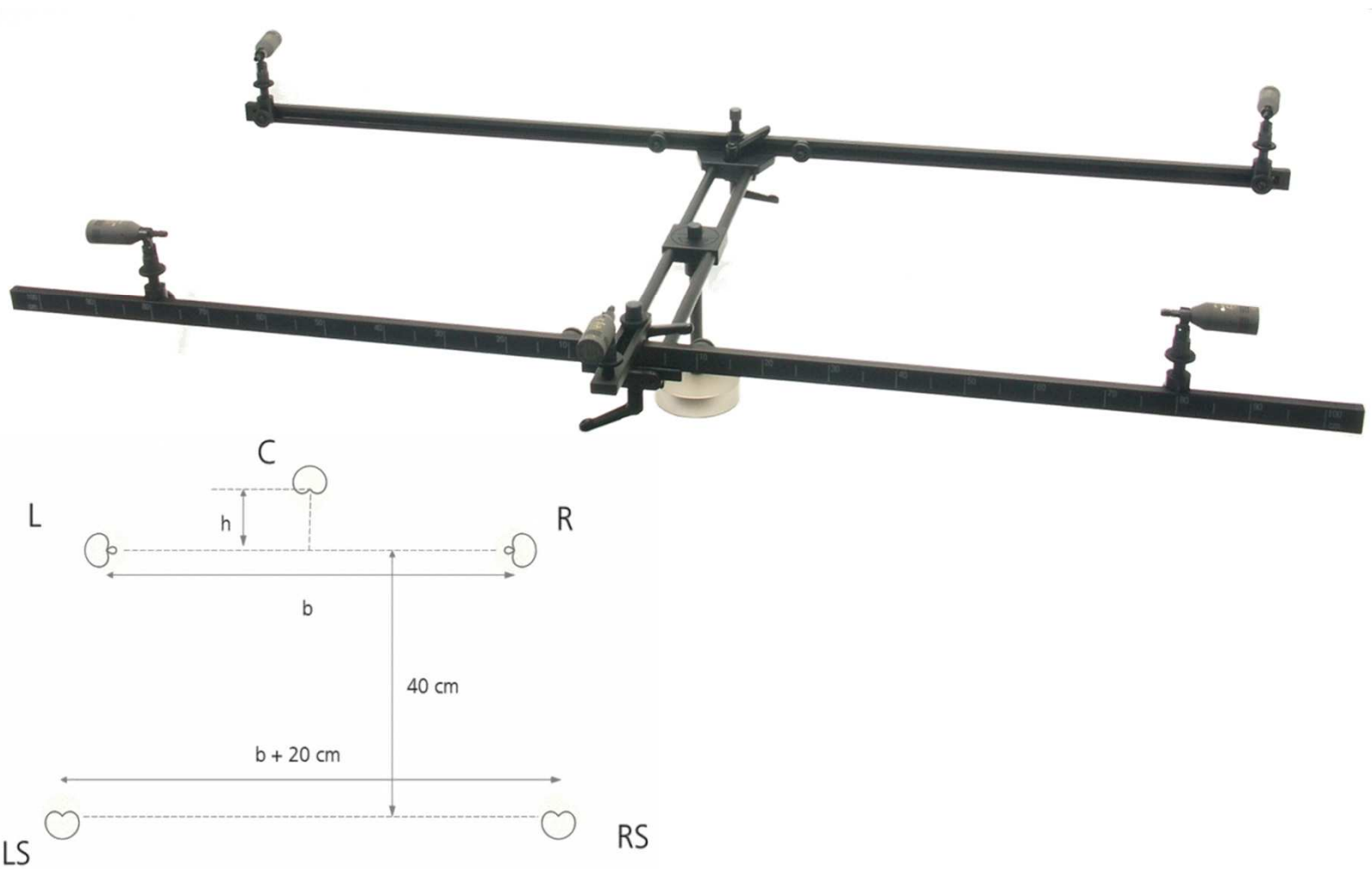




Figures for the pair L/C and C/R

SCHOEPS Mikrofone

OCT Surround



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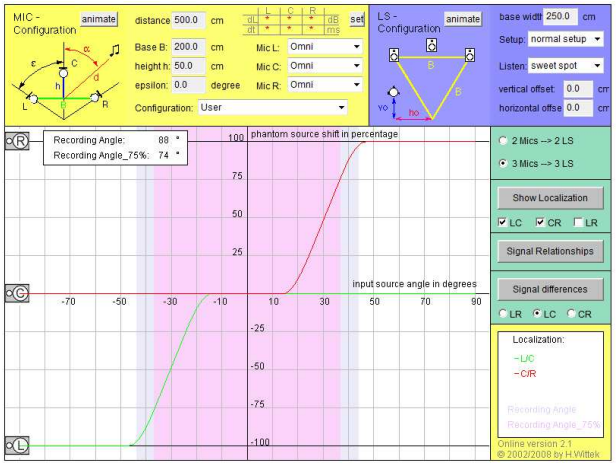
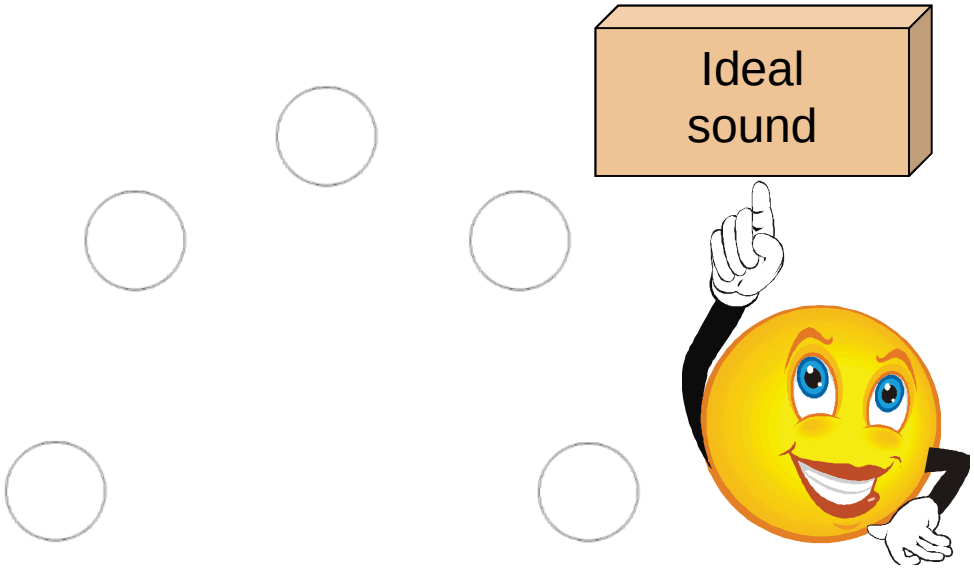
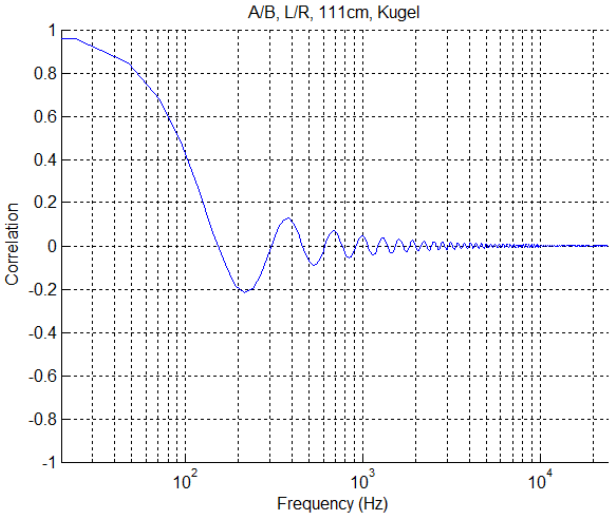
Omni setup

- Very large, not compact
- Uses Omnis → often preferred sound colour
- Very good room properties
- Average imaging properties, yet stable







Figures for L/C=111 cm

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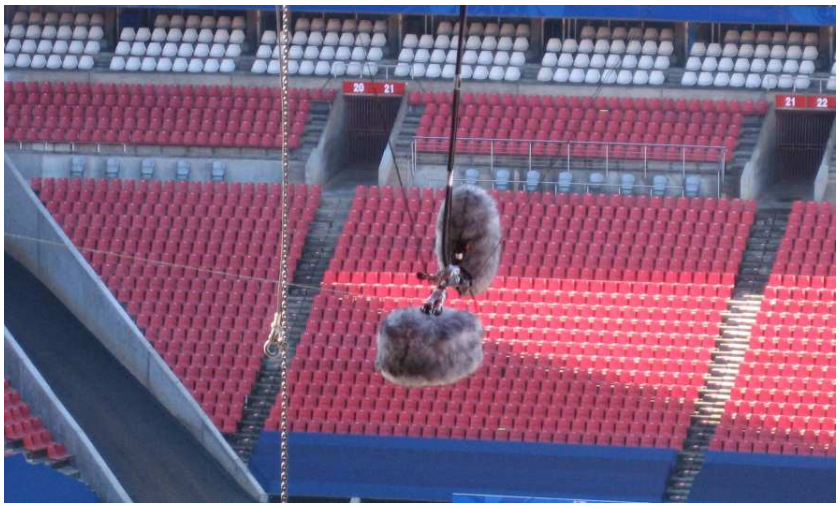
Practice: Sports

Soccer: ORTF in the curve

Soccer World Cup:
Double M/S and ORTF Surround



Ambience microphones for Surround: Examples

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Practice: Film

Double M/S with shotgun (A. Zacher)

IRT Cross

5 wide cardioids (F. Camerer)

„Sound only“ with M/S

Ambience microphones for Surround: Examples

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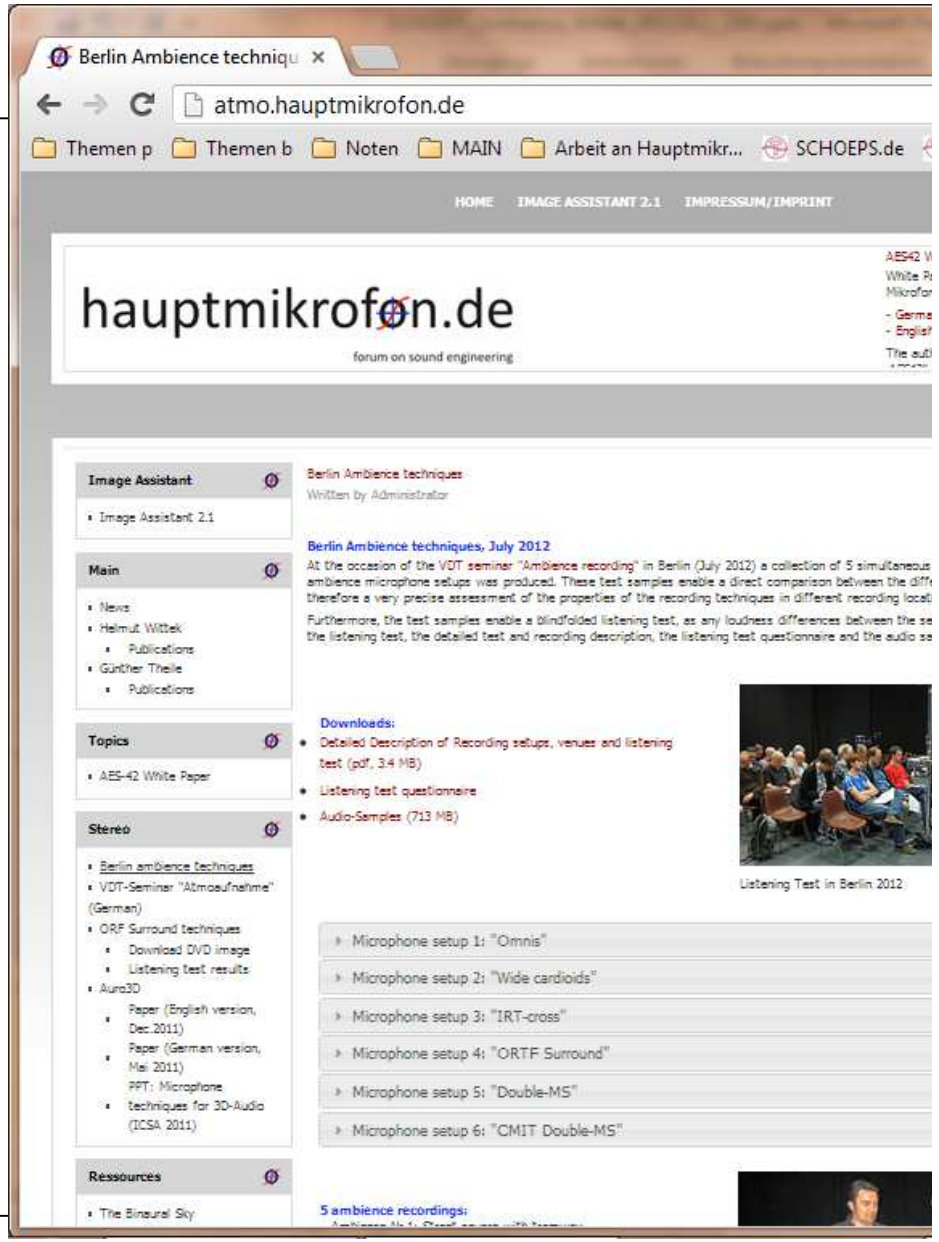
VDT Seminar ATMO(Ambience)

ambience.hauptmikrofon.de

- 5 * 6 Audio samples for Download
- Listening test can be performed
- Descriptions of the setups
- Download of all Seminar talks and videos

- **Thank you very much!**
- **wittek@schoeps.de**



SCHOEPS Mikrofone