Microphone techniques for Ambience recording in 2.0 and 5.1

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Contents

- What is ambience and 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
- How do the techniques differ in practice?
  - 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, …
- These findings do not only apply to Ambience!

Signal type

Room signal properties

1

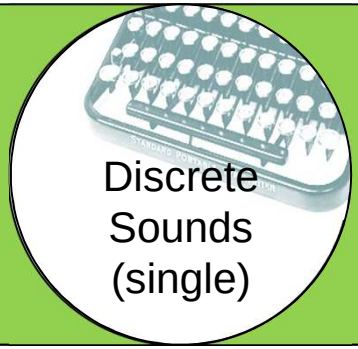
- diffuse
- location-independent
- not localized

- 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

What is ambience?

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Signal type

Microphone signal properties

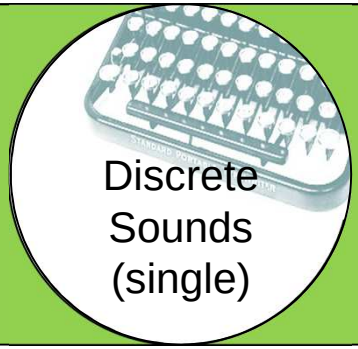
1

- 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?

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Possible microphone setup:

Microphone signal properties

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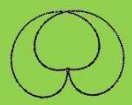
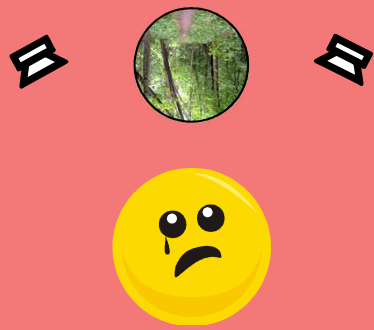


- Correlated signals
- Balanced directional distribution
- Real or realistic directional imaging

Microphone geometry for recording diffuse sound:

- Uncorrelated signals
- Balanced energy distribution

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



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Microphone geometry for recording diffuse sound:

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

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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

→ 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

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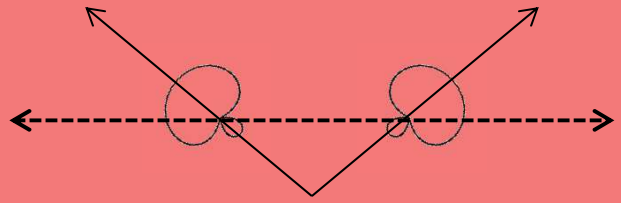
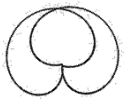
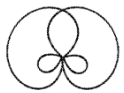
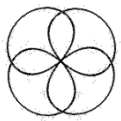
Diffuse field correlation (DFC)

- 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**
			

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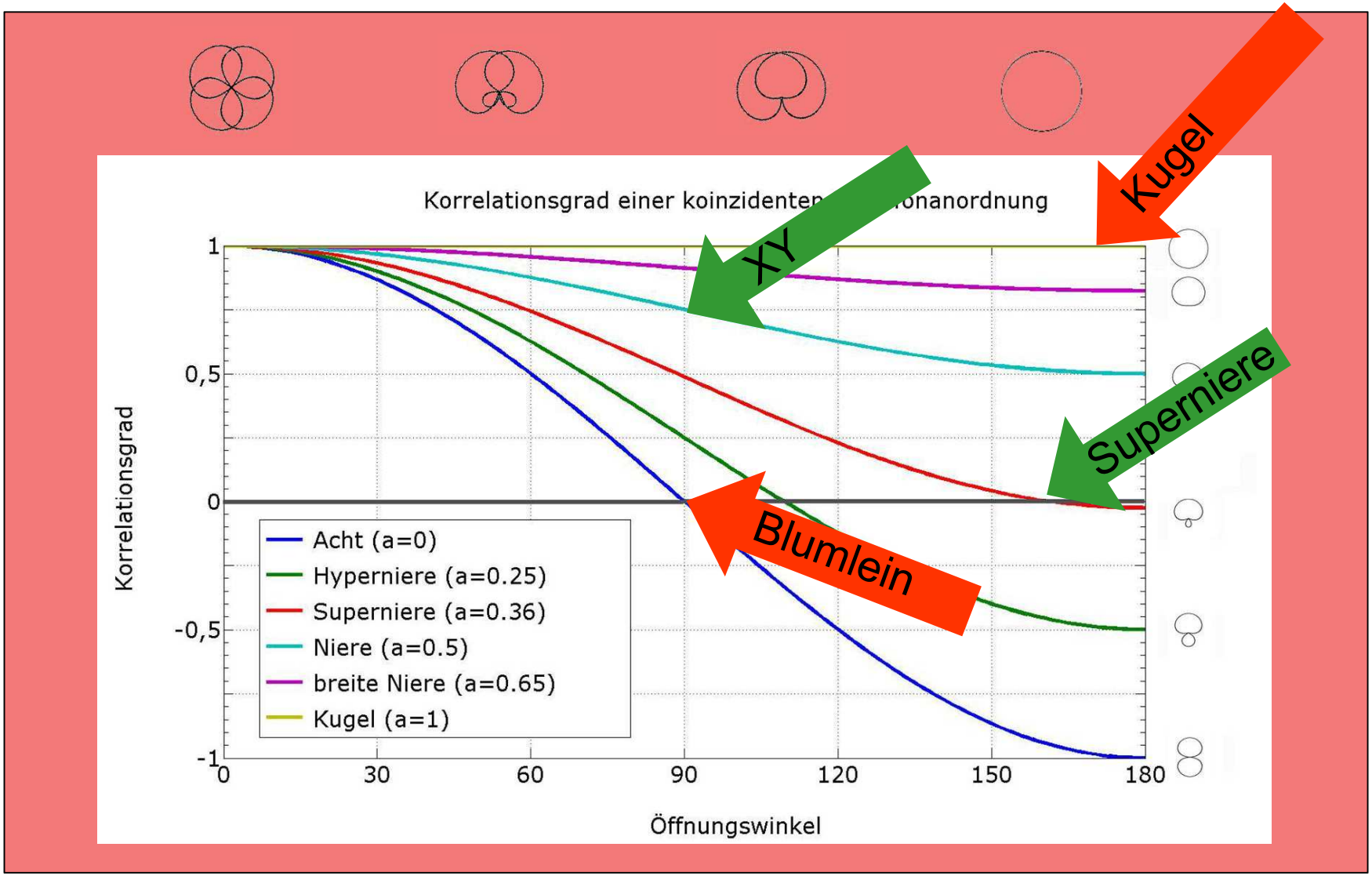
Diffuse field correlation (DFC): coincident setups



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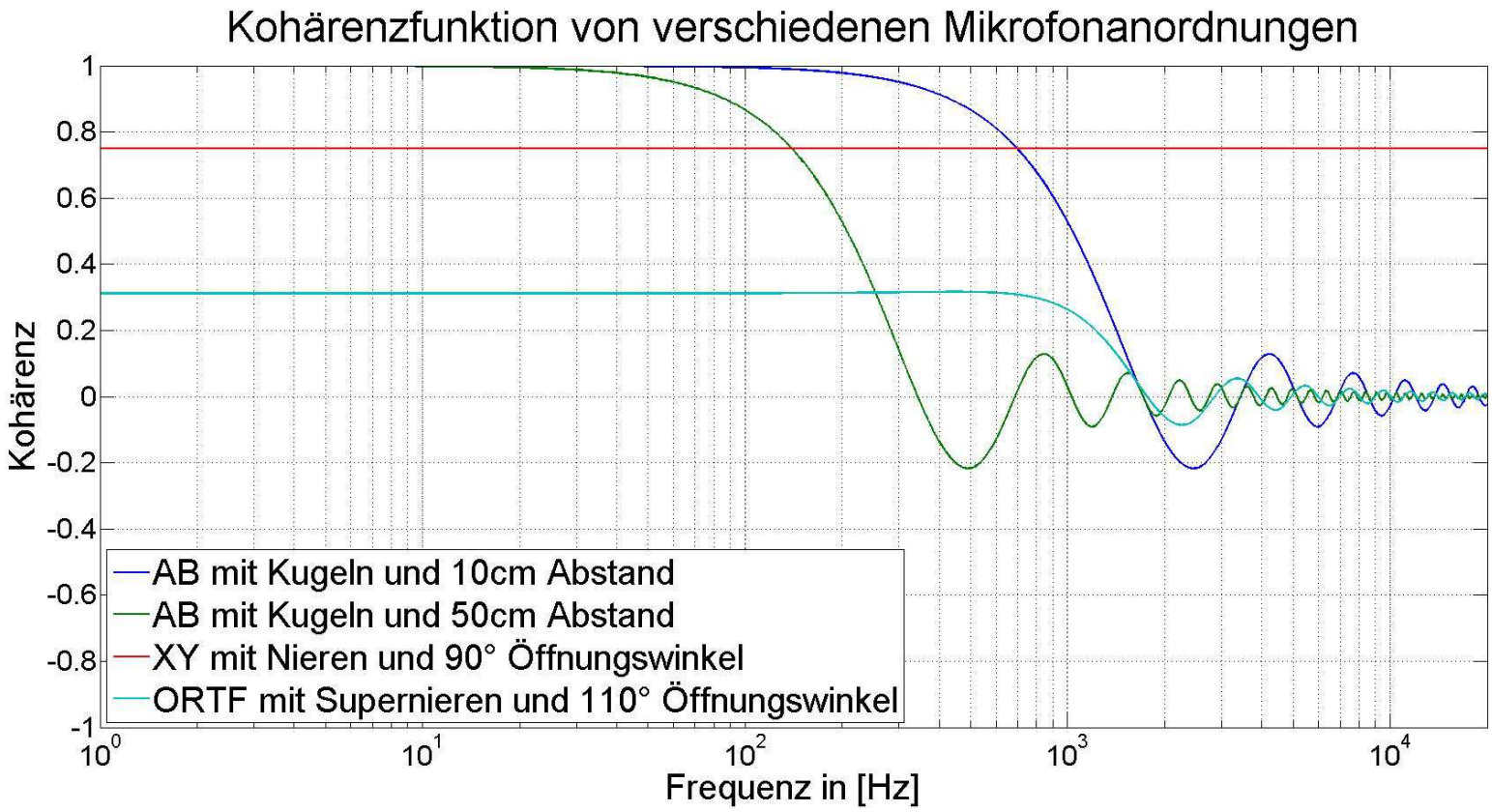
Diffuse field correlation (DFC): non-coincident setups



from: [Riekehof et al., TMT 2010]

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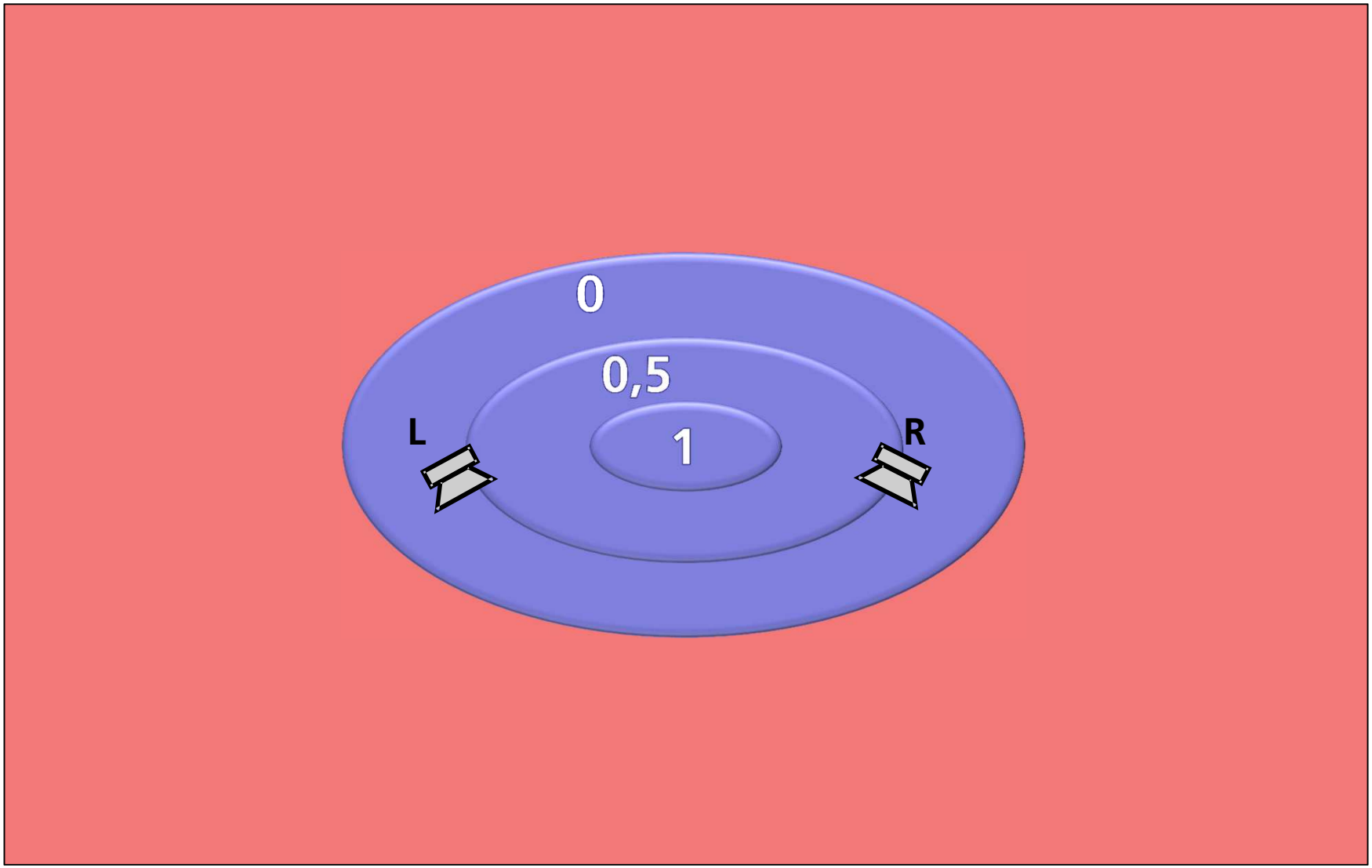
Diffuse field correlation (DFC): determines the perceived width



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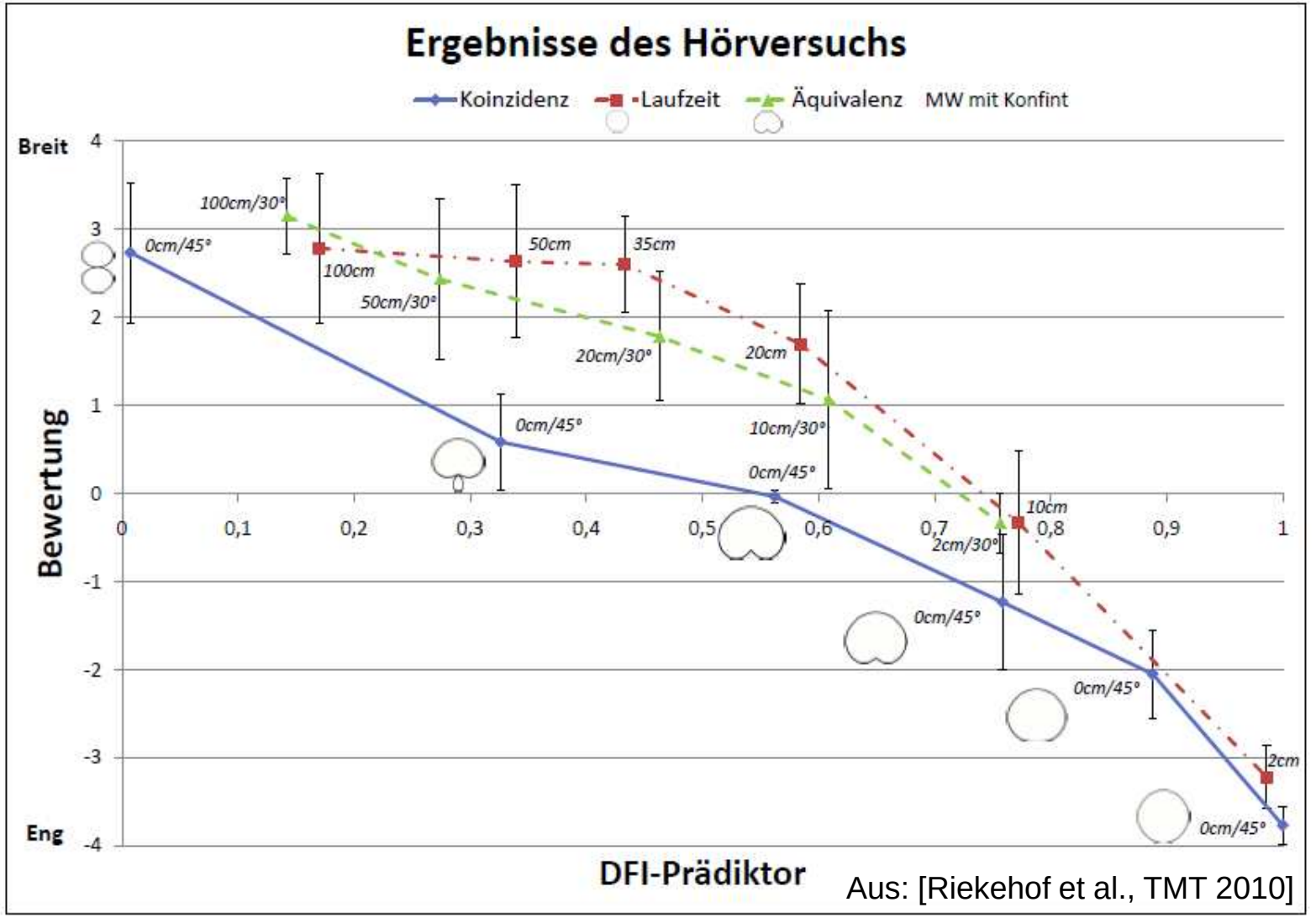
DFI-Predictor: Prediction of the perceived width



Aus: [Riekehof et al., TMT 2010]

Ambience components: diffuse sound

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Signal type

Microphone signal properties

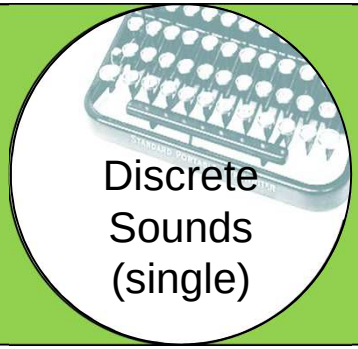
1

- 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?

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Early Reflections, Discrete Sounds (spread)

- Correlated signals
- Balanced directional distribution

- A discrete early reflection or a certain sound should be reproduced as a phantom source
- The sources should be distributed homogenieously
- The localisation curve doesn‘t have to be linear:
  This means that e.g. channel swapping, large A/B or non-symmetrical setups are an option

Possible microphone setup:

Microphone signal properties

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- Uncorrelated signals
- Balanced energy distribution

2

- Correlated signals
- Balanced directional distribution

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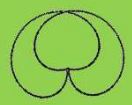

- Correlated signals
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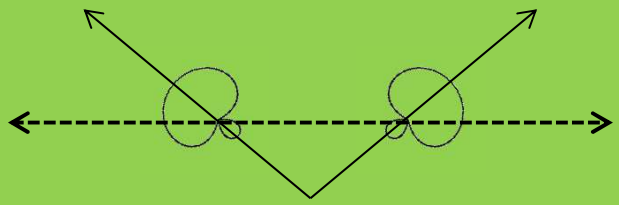
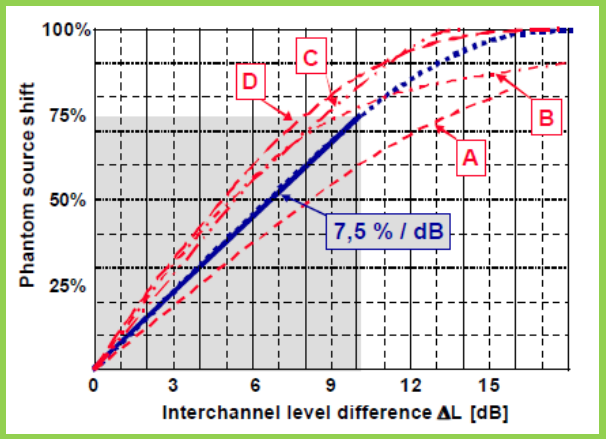
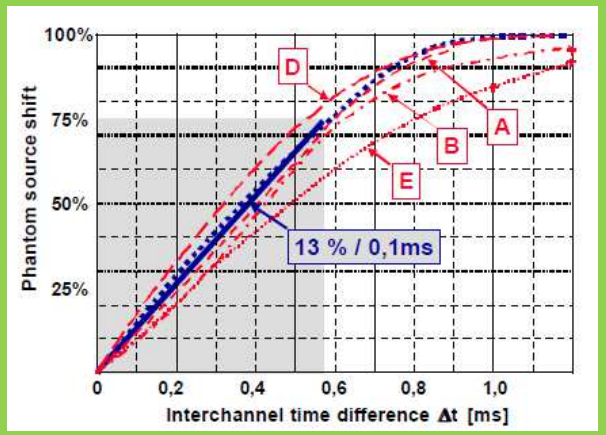
Directional Imaging



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

- Directional Imaging
  - is dependent on the spacing, angle and directivity patterns





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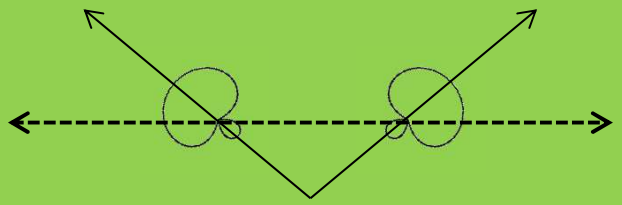
Directional Imaging



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

- Directional Imaging
  - is dependent on the spacing, angle and directivity patterns
  - Image Assistant (www.hauptmikrofon.de)

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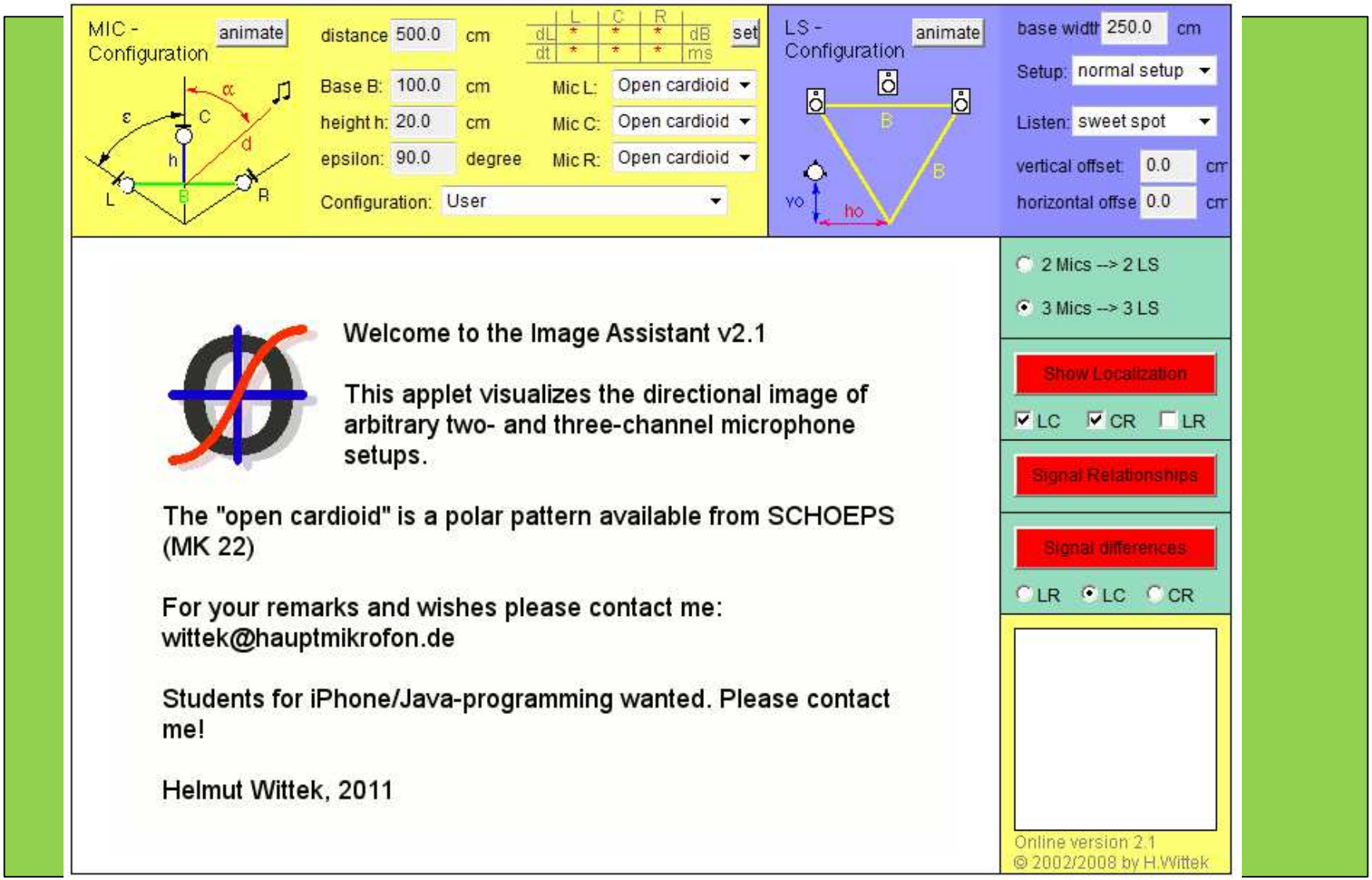
Image Assistant (www.hauptmikrofon.de)



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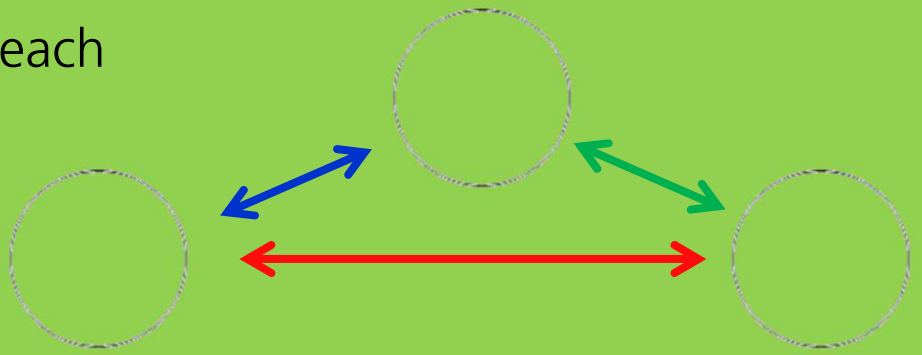
… more than 2 signals

- The correlation between each channel pair is important



- Crosstalk =
  the same signal on more than 2 channels leads to blur and comb filtering

Bei mehr als 2 Signalen

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Signal type

Microphone signal properties

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2

- Correlated signals
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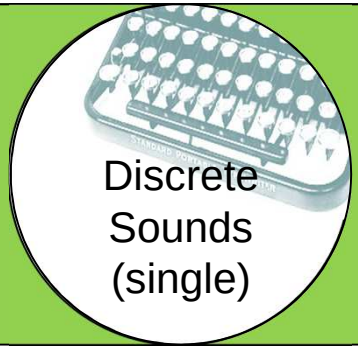
3



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

What is ambience?

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Choice of the setup: 3 Steps

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

Ambience layer mix	Example	Possible microphone setup for 5.1 Surround
1 + 2 (with Center)	Film ambience without discrete noise	5 Omnis
1 + 2 (without Center)	Conzert hall ambience	Hamasaki Square
1 + 2 + 3 (without Center)	Stadium ambience for Sports	ORTF Surround
1 + 2 + 3 (with Center)	Documentary ambience with discrete sources	5 wide cardioids
1 + 2 + 3 (3 only in front)	Orchestra in the concert hall	OCT Surround, OCT + Hamasaki
2 + 3	Dry outside ambience	Double M/S, ORTF Surround
3	Dry radio drama recording in the studio	Double M/S

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Choice of the setup: 3 Steps

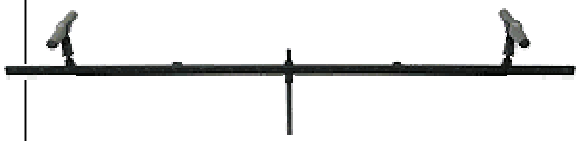
Step 2. The individual taste of the tonmeister and his priorities:

- 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.

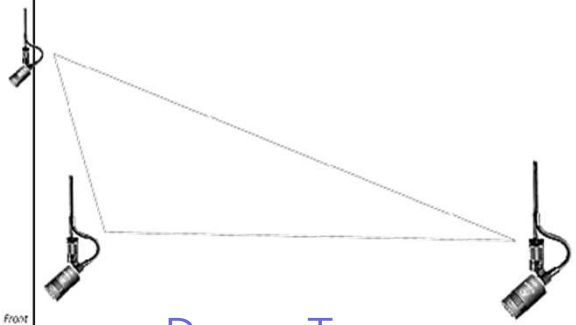
Ambience microphones for Stereo



A/B

ORTF

Coincident



Decca Tree

A/B/C

Ambience microphones for Stereo

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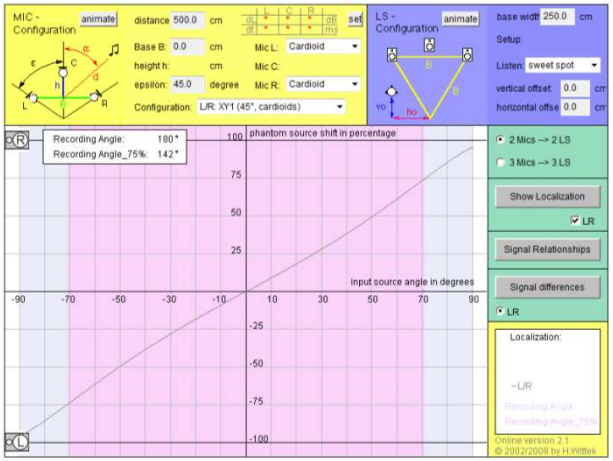
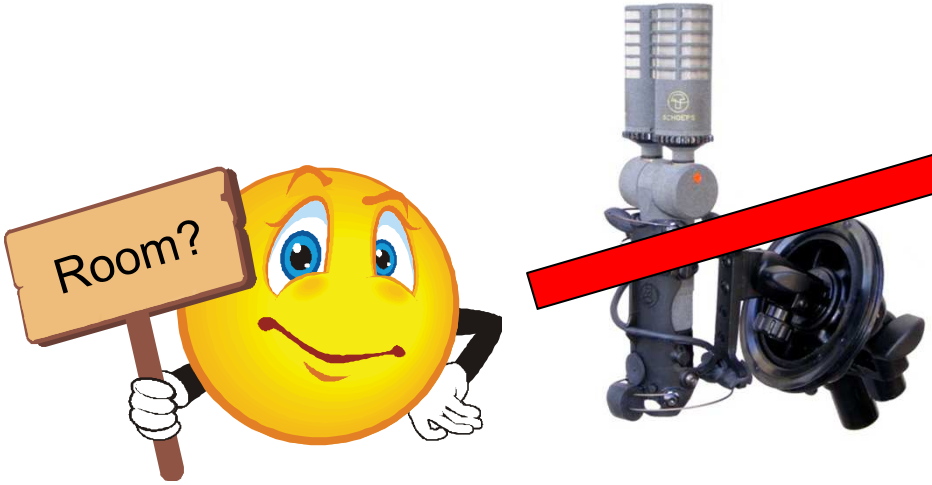
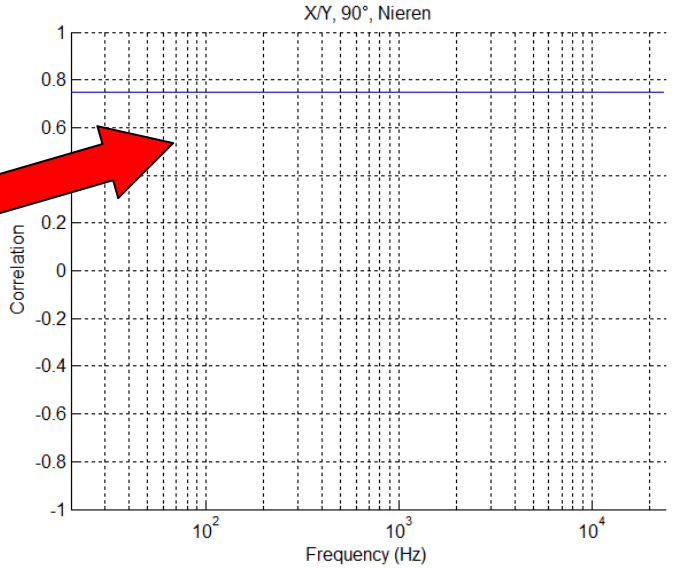
XY

- compact
- Cardioid XY has a large recording angle (180°), but a large DFC = 0.75
  → Room sounds boring
- Can be better with supercardioids







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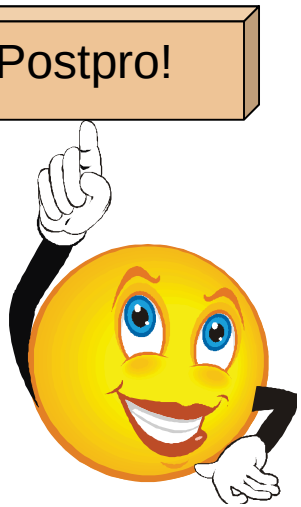
M/S

- 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
- With M = Omni or wide cardioid a „full“ sound is possible



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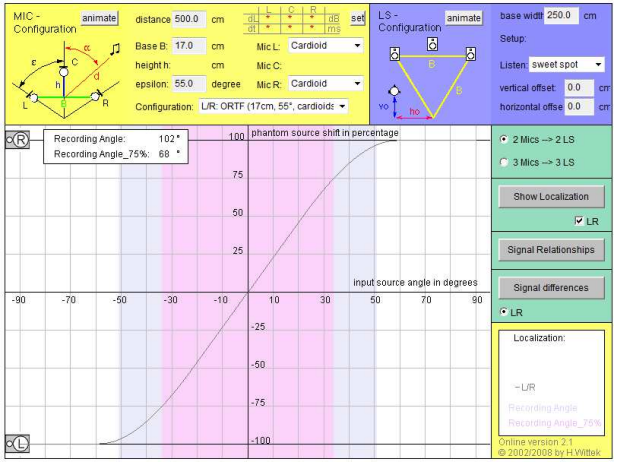
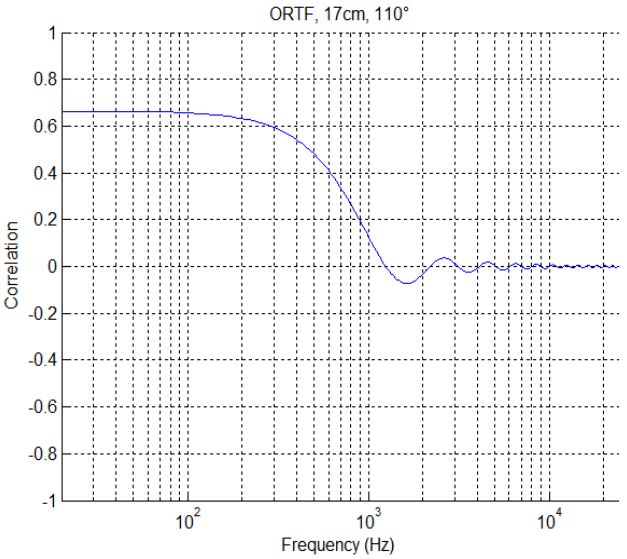
ORTF

- relatively compact
- Very good imaging
- Open and nice room sound





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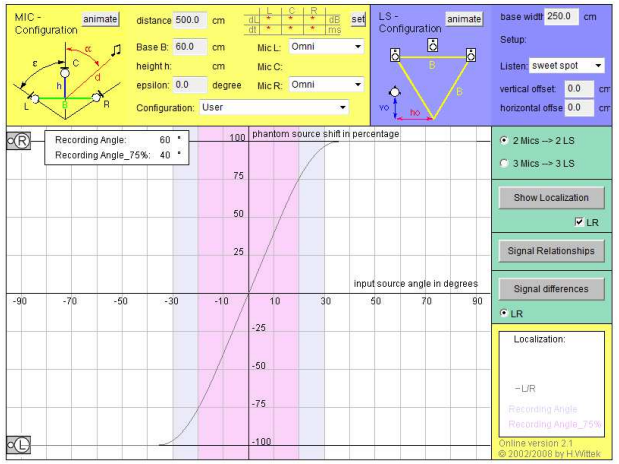
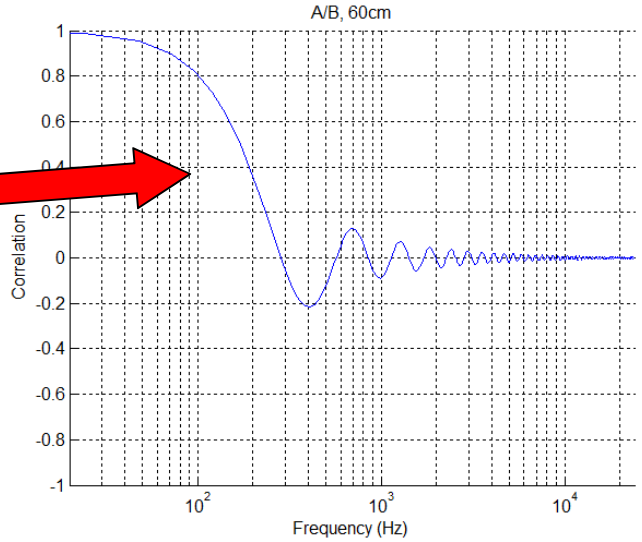
A/B

- Not compact, d ≥ 40 cm
- Often prefered sound colour
- Open and very nice room sound
- Average imaging quality
- Low wind sensitivity of the omnis, a foam windshield is often sufficient





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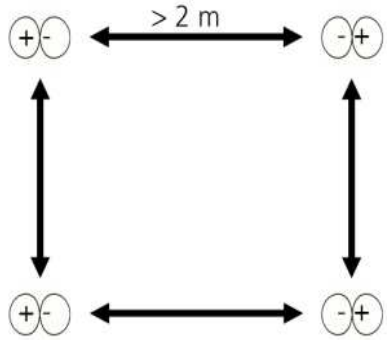
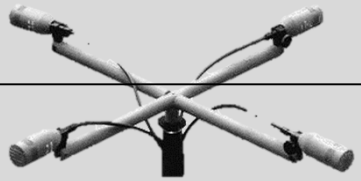
Ambience microphones for Surround



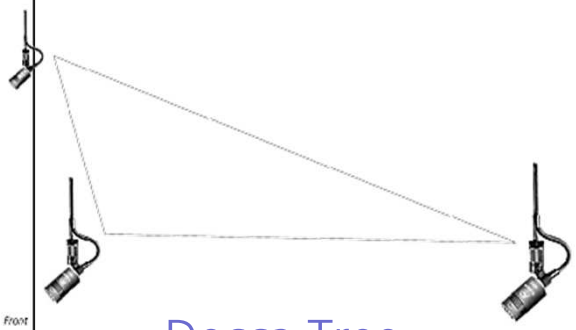
Hamasaki Square



IRT Cross

MMAD/INA/OCT/Equivalence

Coincident



Decca Tree

ORTF Surround

Ambience microphones for Surround

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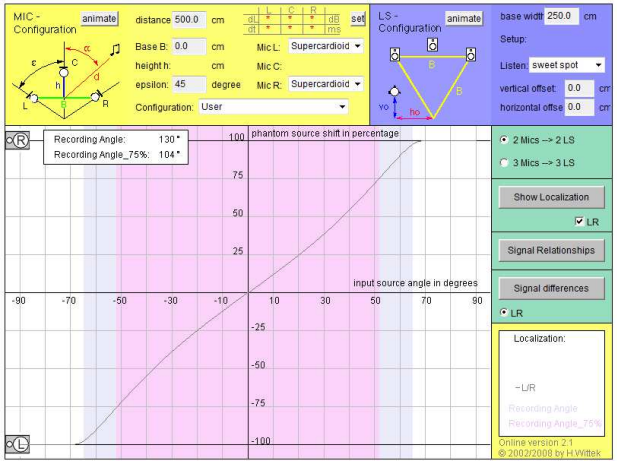
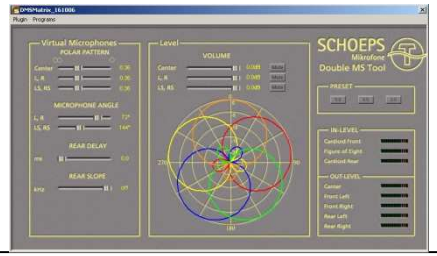
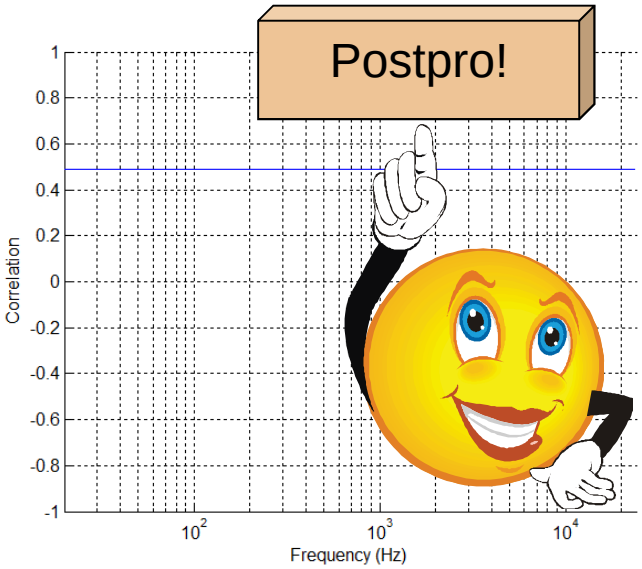
Double M/S

- 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

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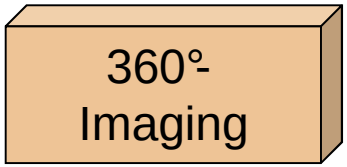
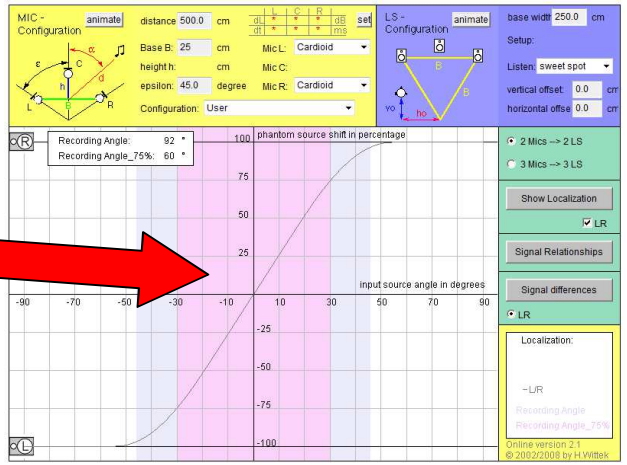
Double M/S with shotgun

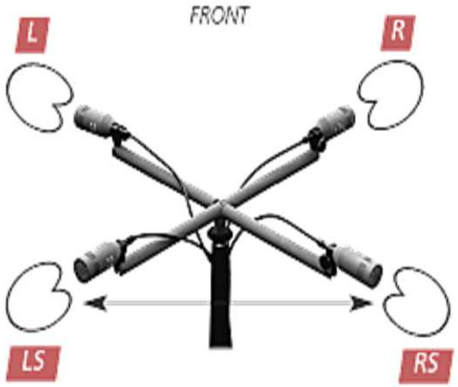
- Using a shotgun for the Centre channel: ideal setup for documentary
- Compact: Surround setup with windshield not larger than for Mono
- flexible und practical
- If decoded properly, good spatial properties
- Only 3 channels for Surround: shotgun, Fig-8, Cardioid
- Simple decoding with 2 normal M/S-Matrices

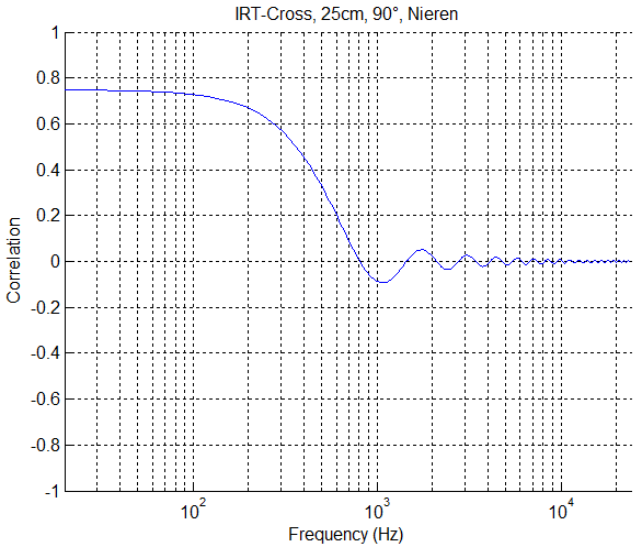
IRT Cross

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





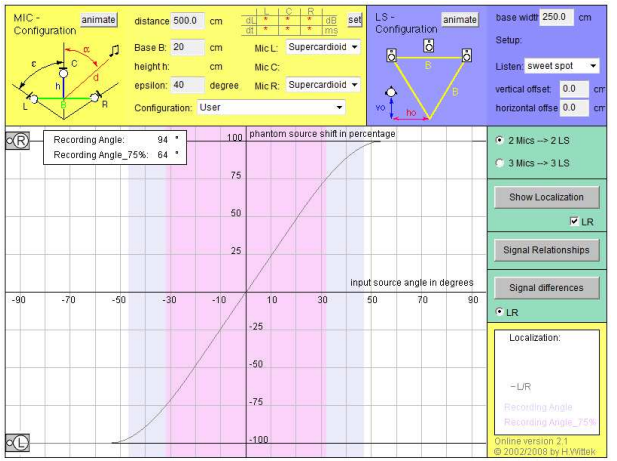


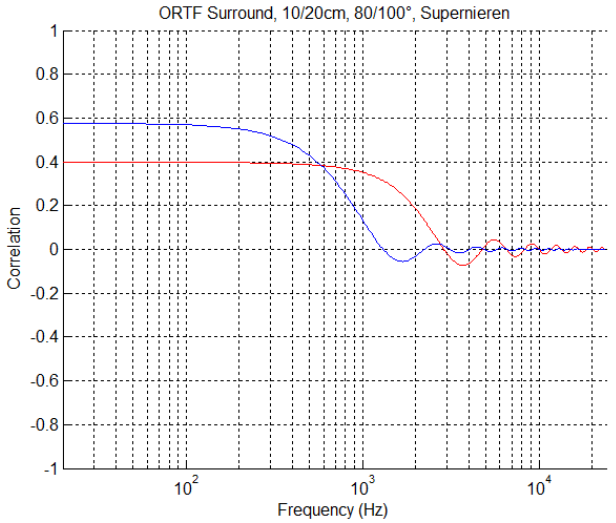


SCHOEPS Mikrofone

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



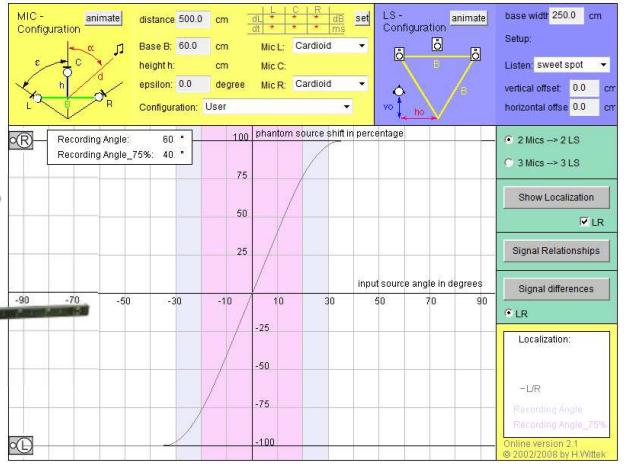


Ambience microphones for Surround

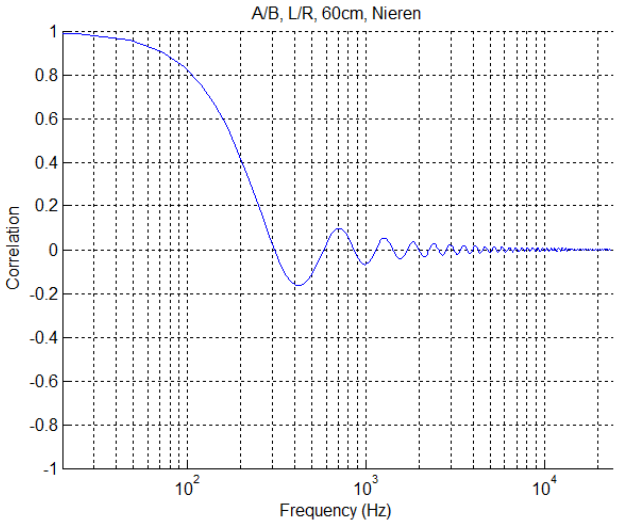
SCHOEPS Mikrofone

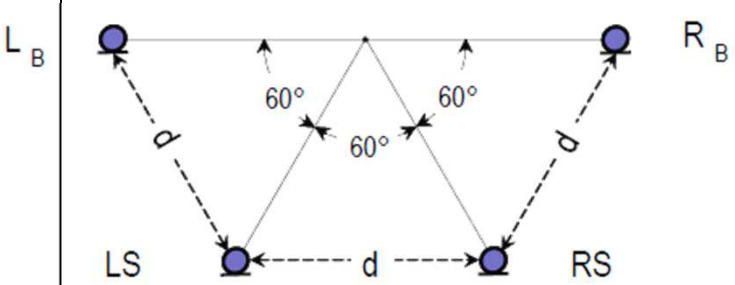
Theile trapezoid

- 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°



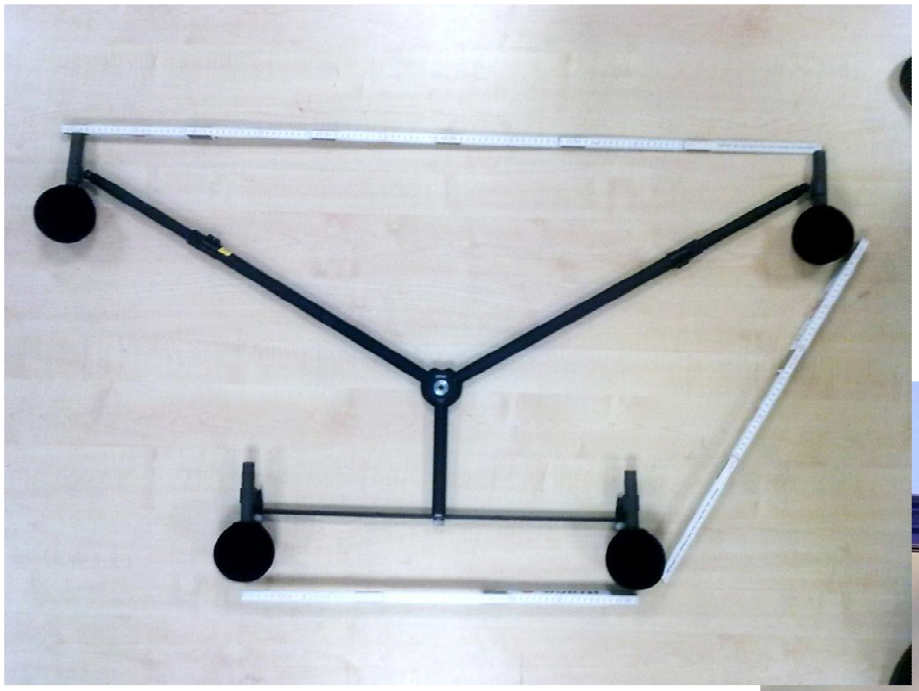
Audience microphone

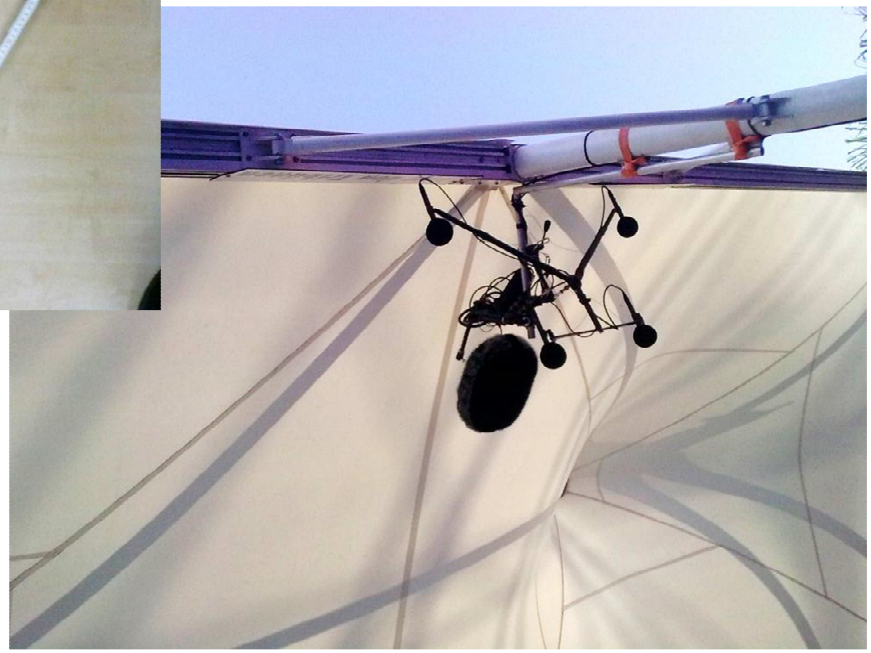




SCHOEPS Mikrofone

Theile trapezoid



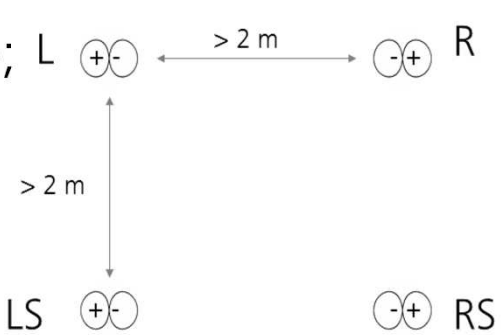


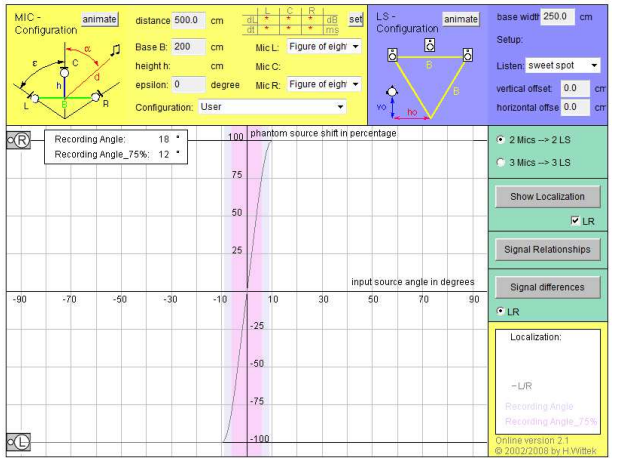
Photos: R. Bihler, SWR

SCHOEPS Mikrofone

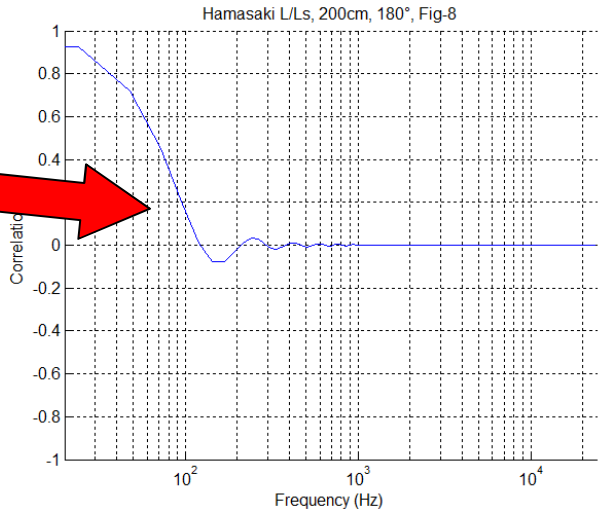
Hamasaki Square

- 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!



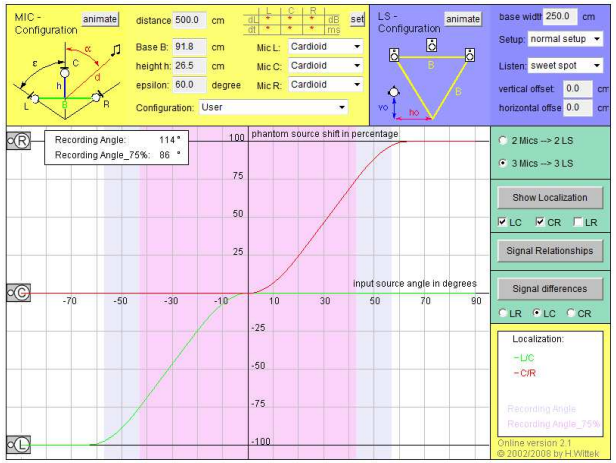
Figures for the pair L/Ls; d=200 cm

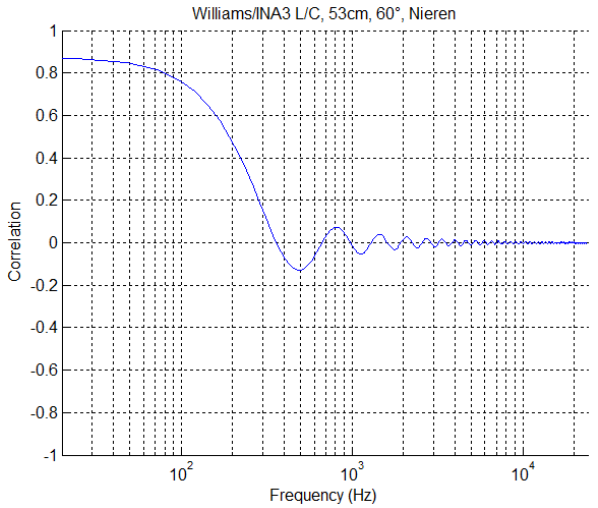
SCHOEPS Mikrofone

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



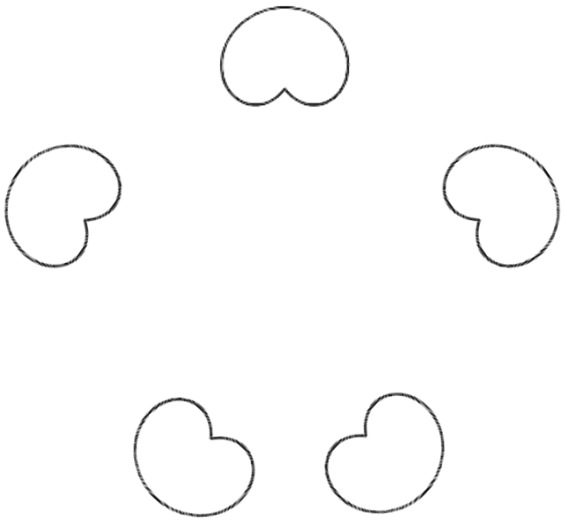


Figures for „INA 3“

SCHOEPS Mikrofone

5ch – Equivalence setup after Williams/Theile/Wittek

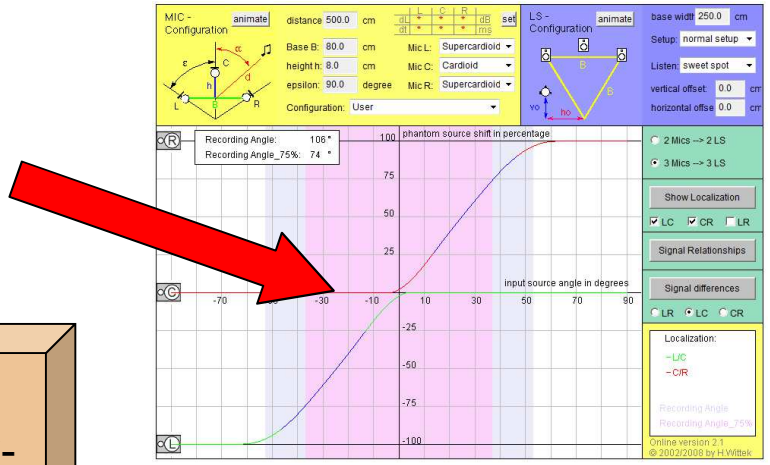
Williams „Umbrella“: flexible Suspension

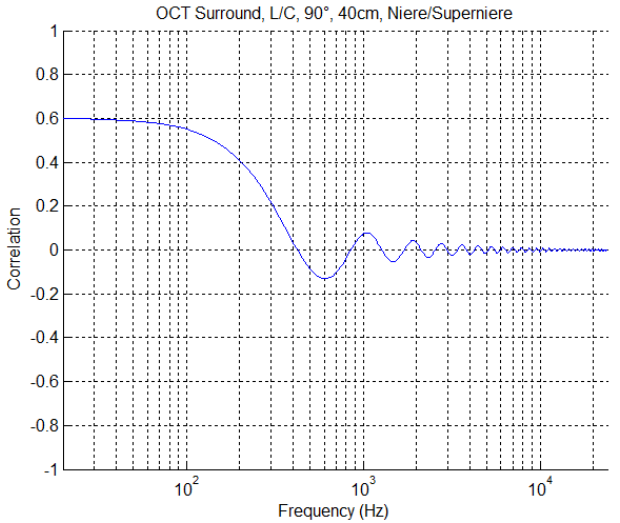


OCT Surround

- 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

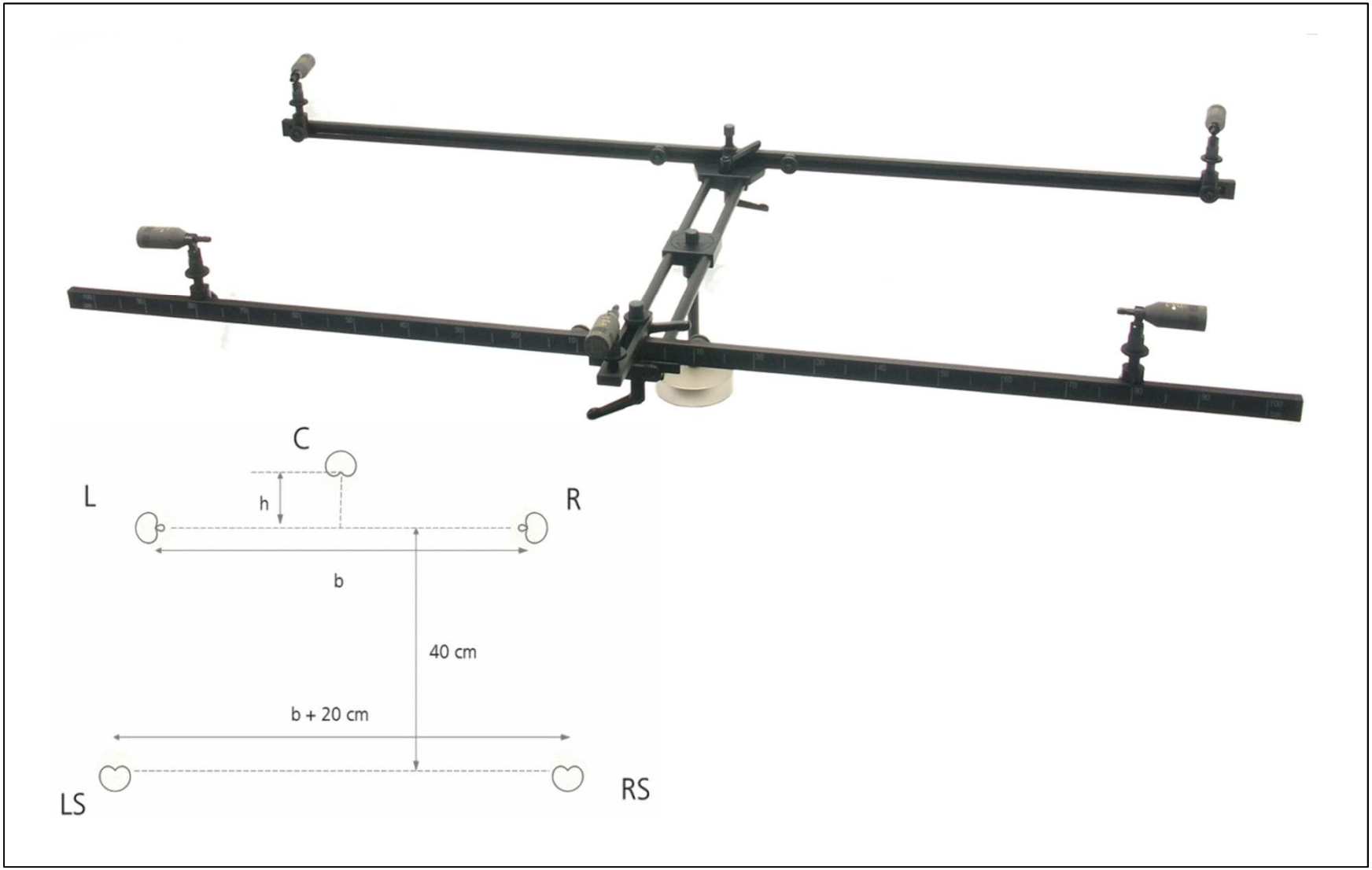




Figures for the pair L/C and C/R

SCHOEPS Mikrofone

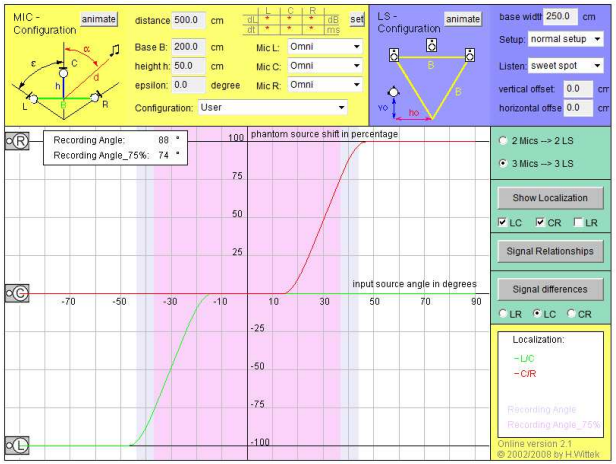
OCT Surround

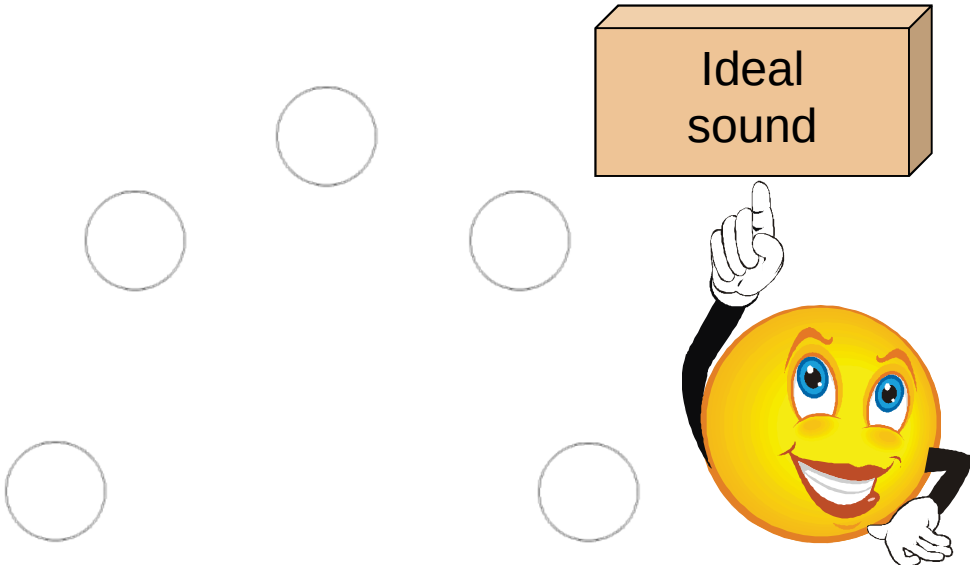


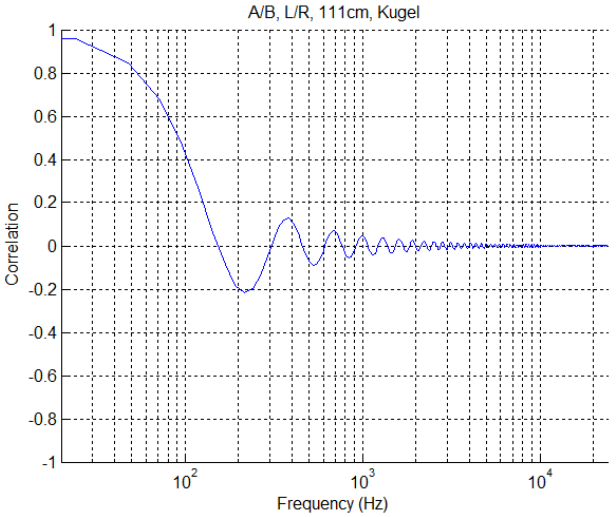
SCHOEPS Mikrofone

Omni setup

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







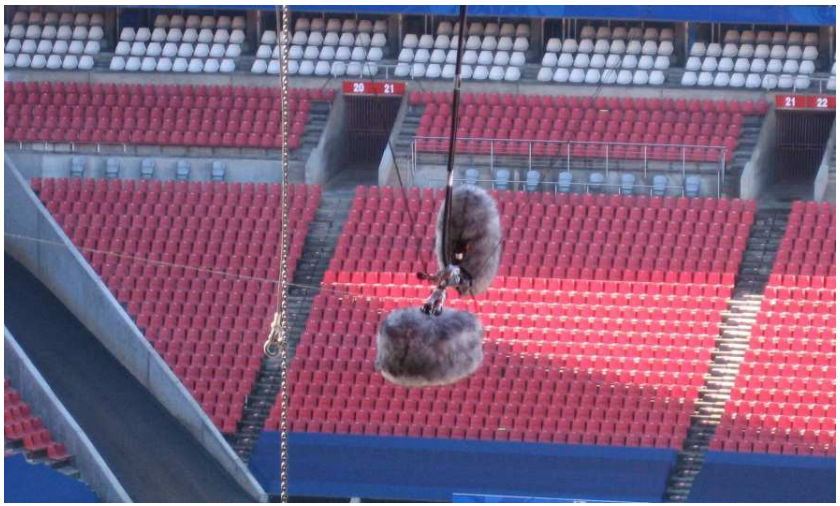
Figures for L/C=111 cm

SCHOEPS Mikrofone

Practice: Sports

Soccer: ORTF in the curve

Soccer World Cup:
Double M/S and ORTF Surround



Practice: Film

Double M/S with shotgun (A. Zacher)

IRT Cross

5 wide cardioids (F. Camerer)

„Sound only“ with M/S

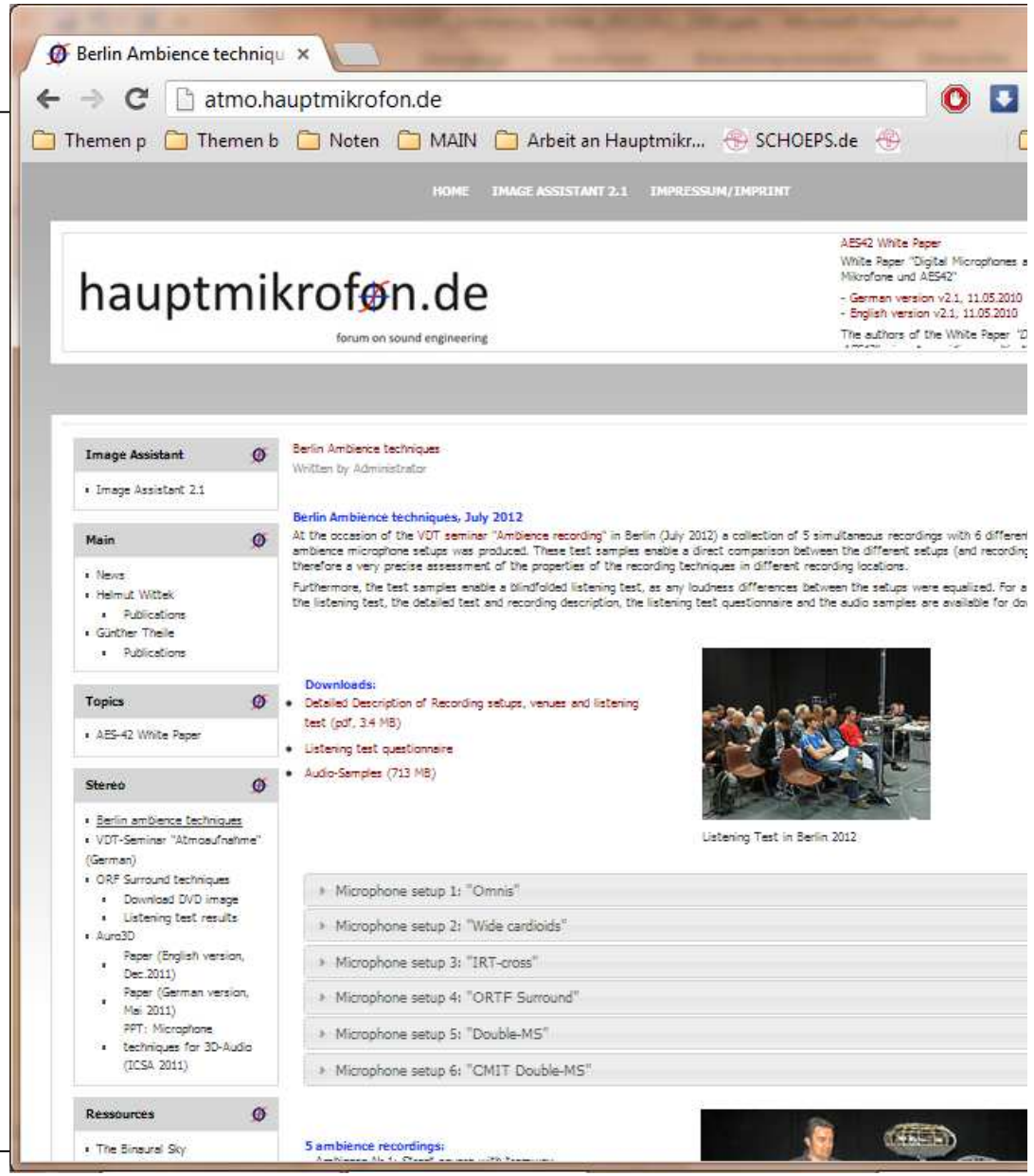
Ambience microphones for Surround: Examples

SCHOEPS Mikrofone

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



SCHOEPS Mikrofone