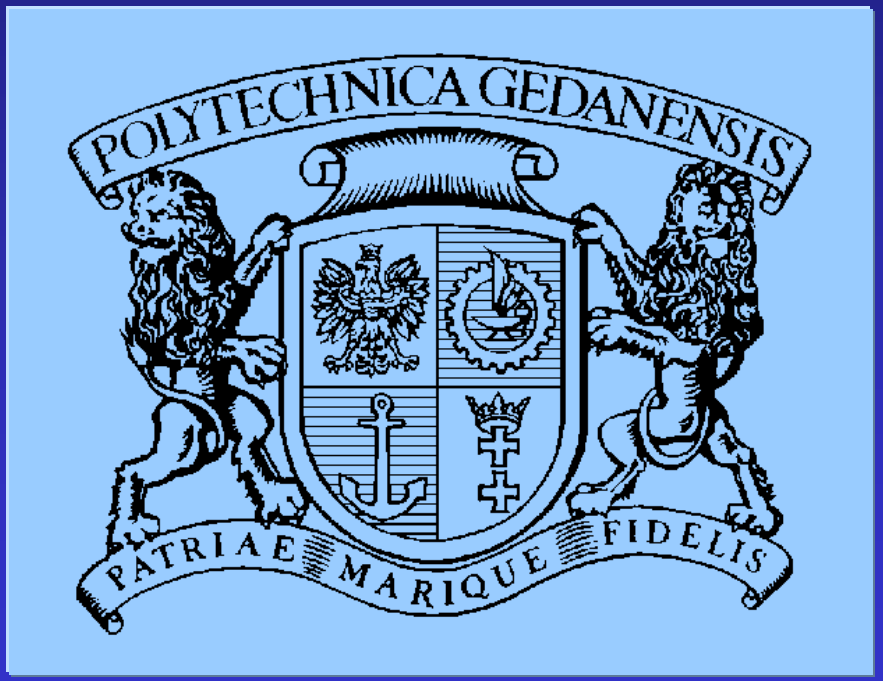
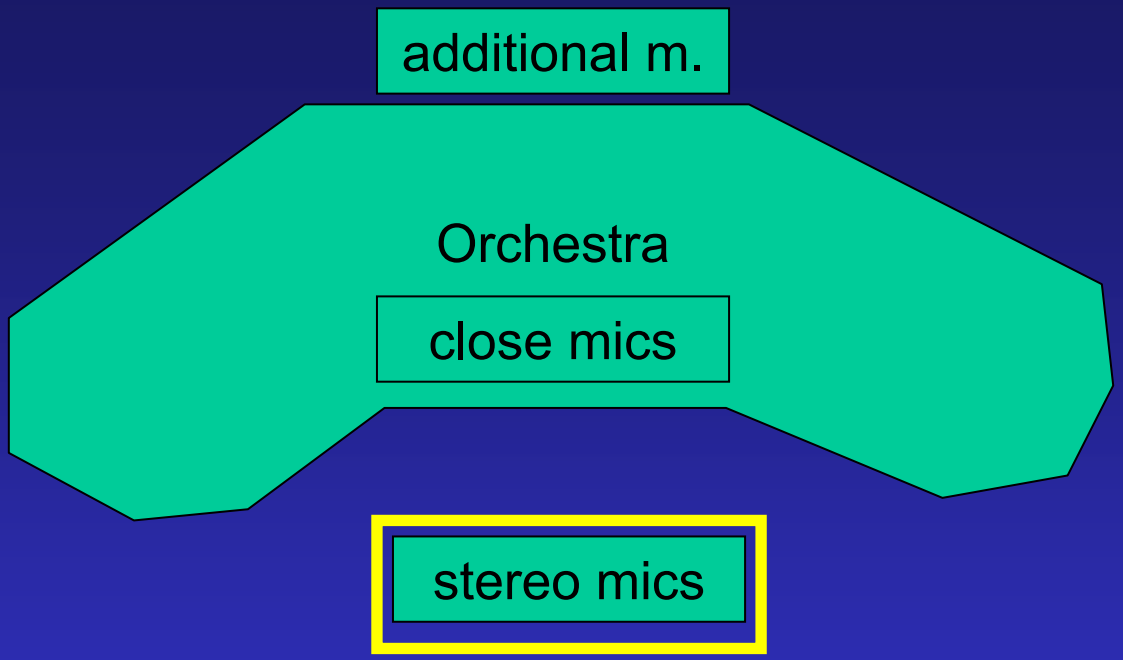
Techniki mikrofonowe
Zebrała Prof. B. Kostek

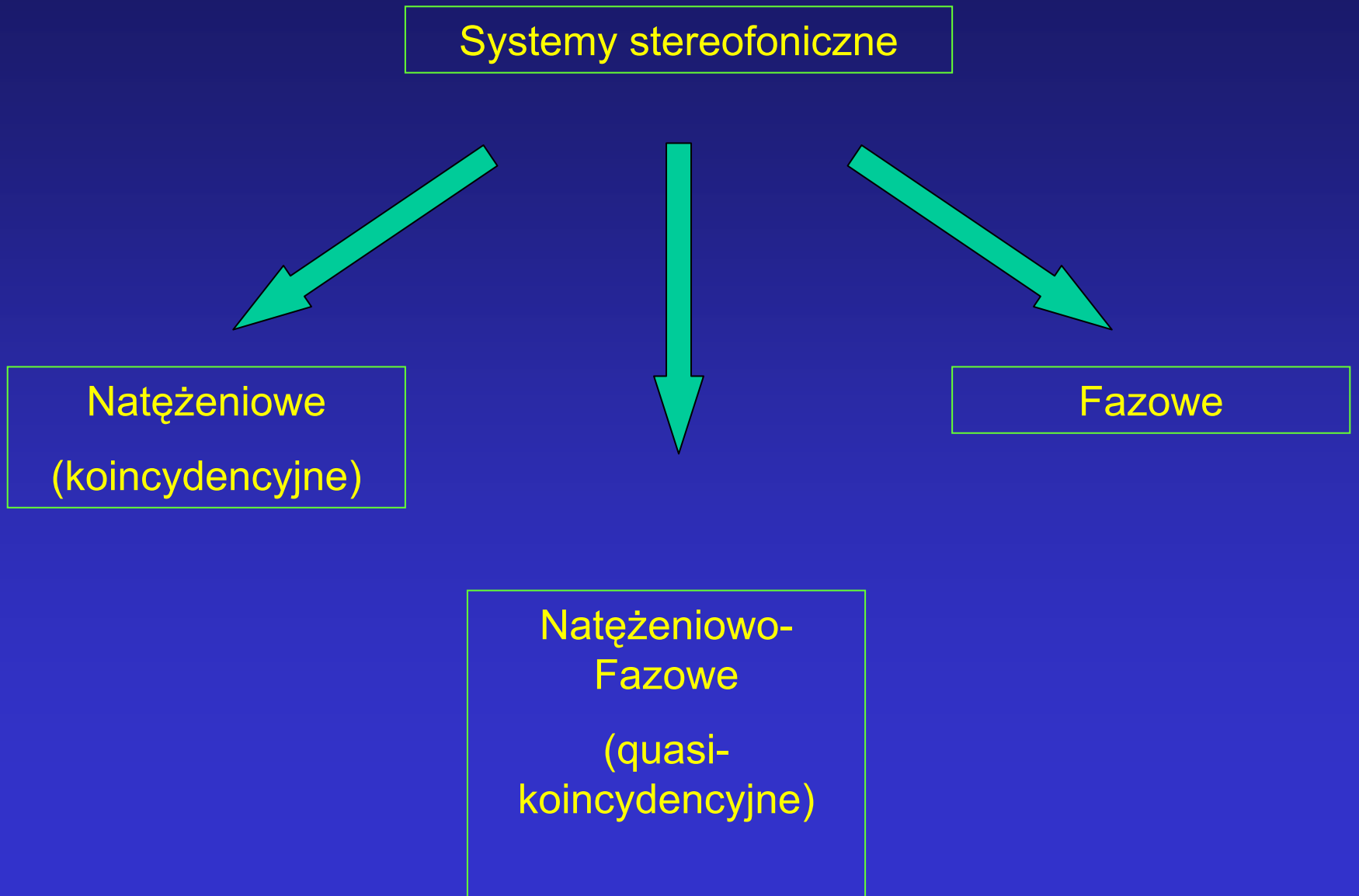


Recording the orchestra

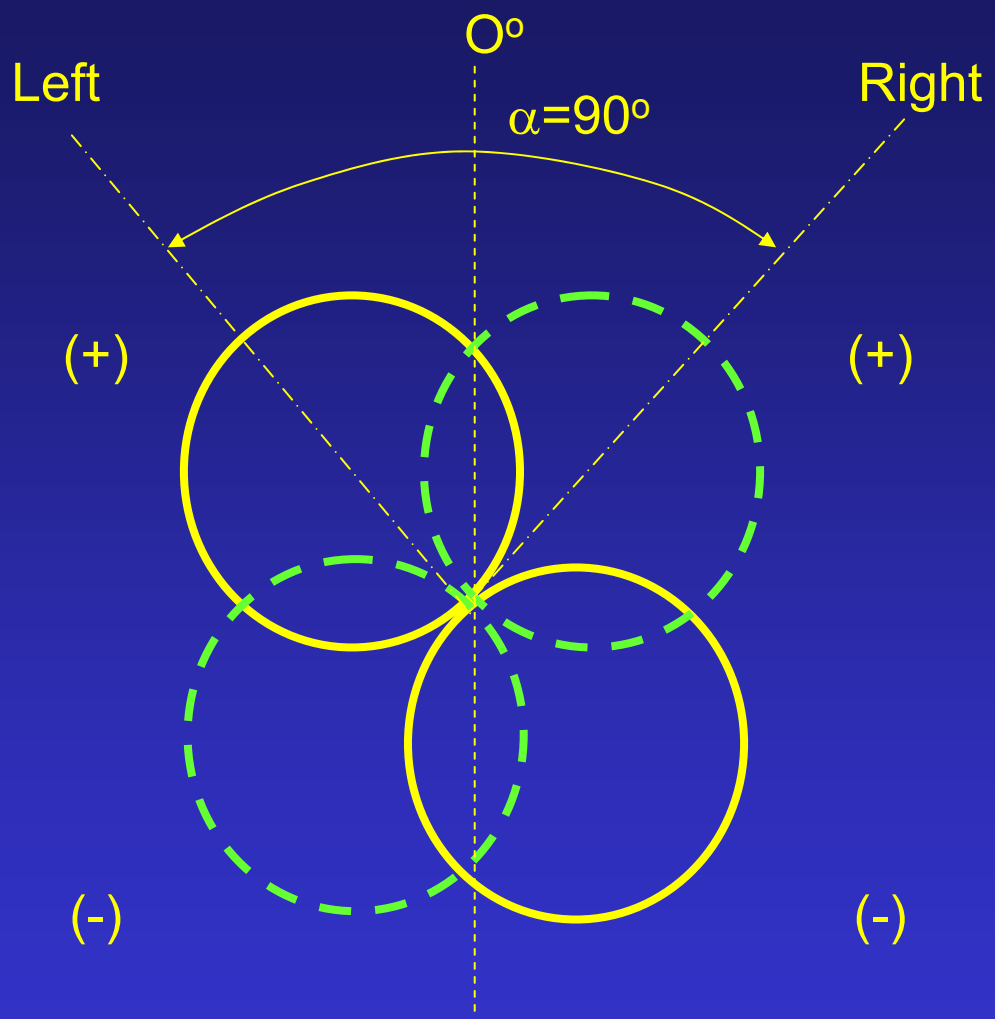


ambient mics

Stereophonic systems



Stereosonic, Blumlein Array

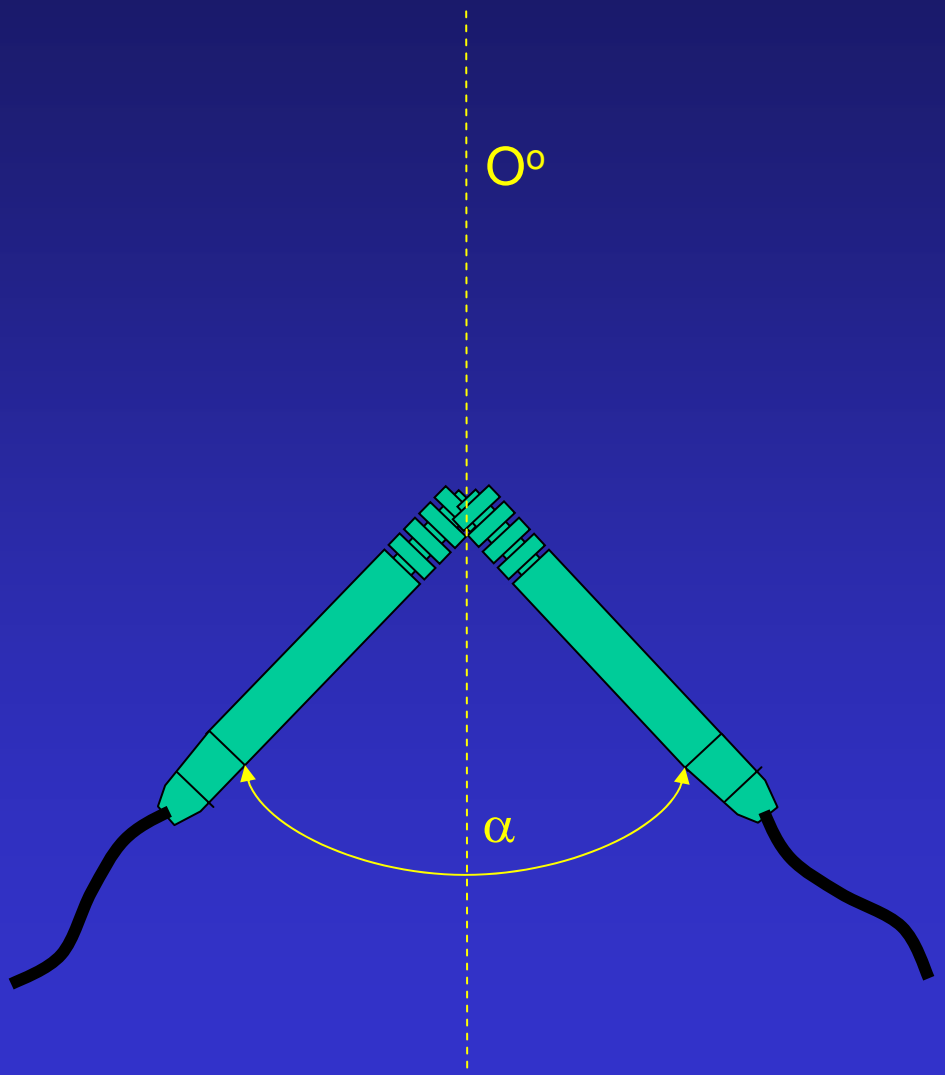


Stereosonic, Blumlein Array

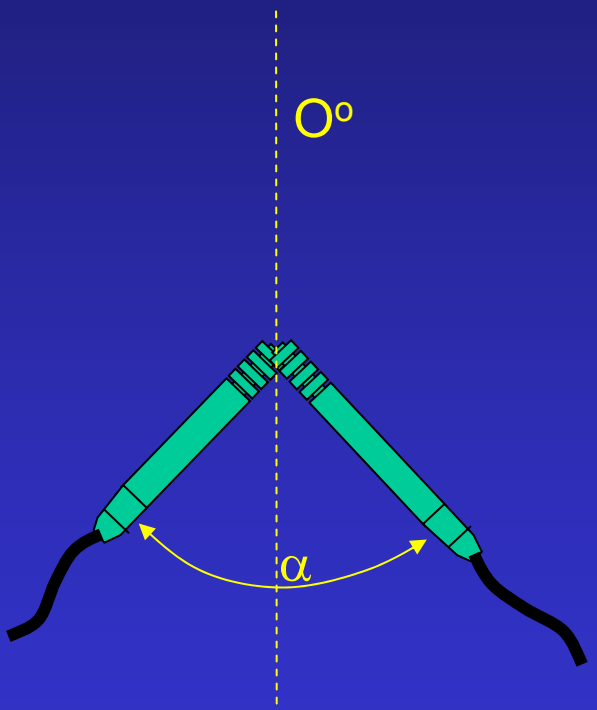
- ILD (coincidence microphones)
- Accurate front imaging
- Out-of-phase side quadrant pickup (ambigous side imaging)
- Good reverberation pickup (it benefits from both the out-of-phase side pickup and in-phase pickup in the back quadrant)
- Sensitive to positioning (direct-to-reverberant relationship)
- Elaborated in England (excellent imaging)

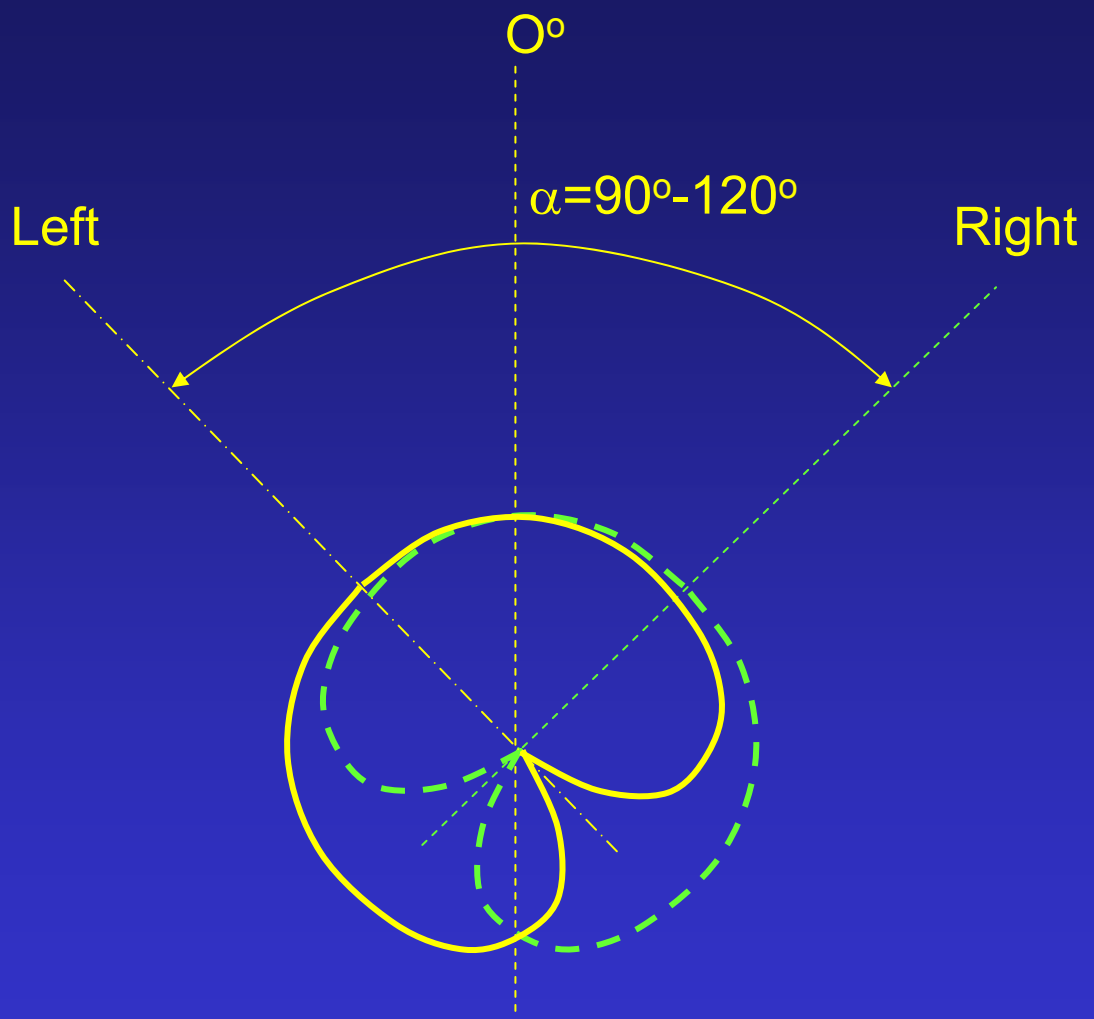
Coincidence microphones

- Accurate angular imaging
- Imaging independent from the distance between the source and the array
- No time differences (f < 4 kHz)
- Flat image (no depth)
- Popular in England

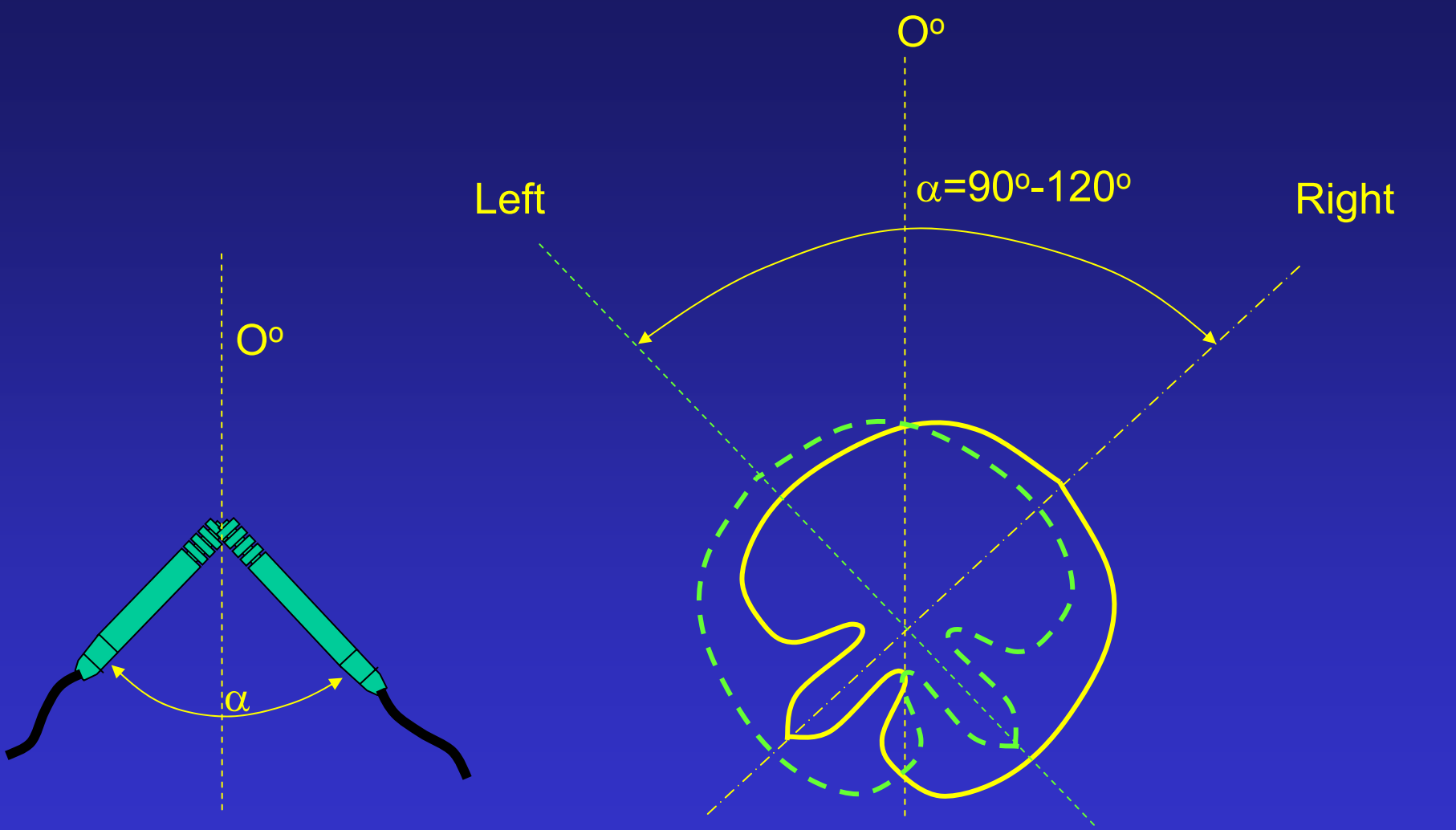


XY – (cardioidal patterns)





XY – (hipercardioidal patterns)

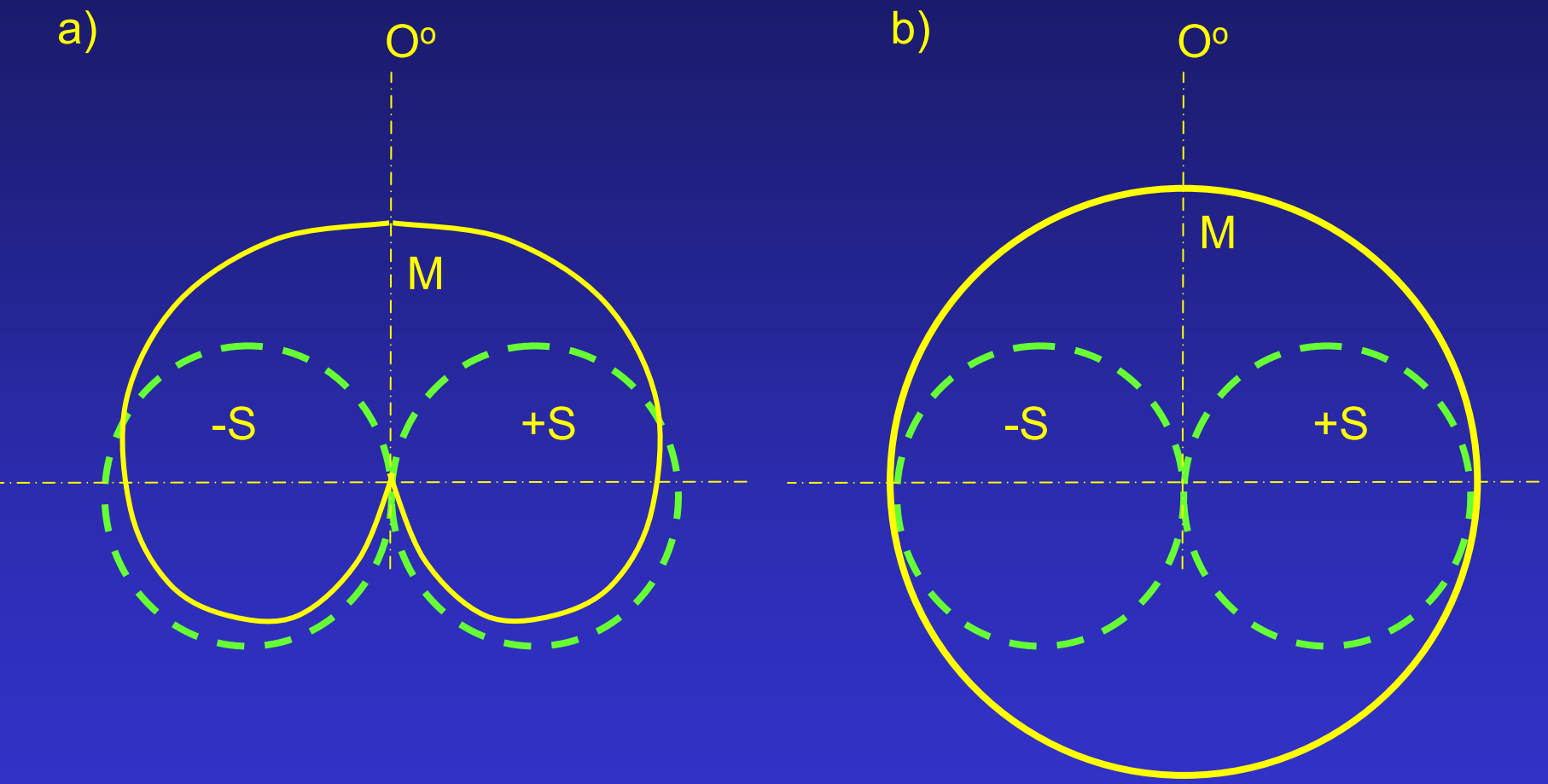


XY

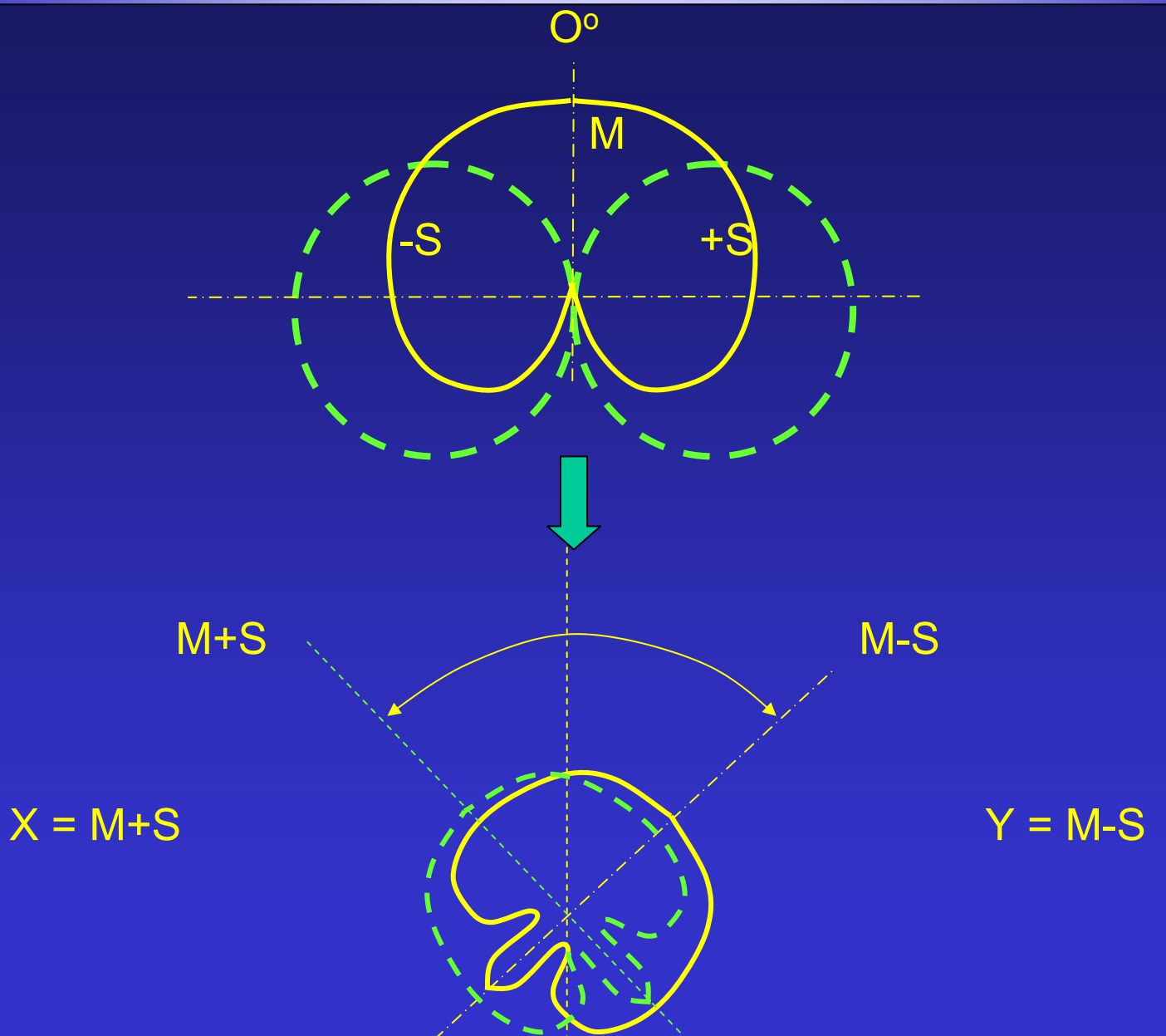
- ILD (coincidence microphones)
- Accurate front imaging
- Angle greater than 90º (to avoid too much pickup from the central axis)
- Hipercardioid and supercardioid patterns can be used in ”too live” rooms for the Blumlein array (this allows the recording engineer to move away from the ensemble)
- Off-axis coloration
- Patterns should overlap at –3 dB point, relative to on-axis

attern	Total angle between the microphones for –3 dB overlap
idirectional	90º
ardioid	131º
ypercardioid	105º
upercardioid	115º

MS Array

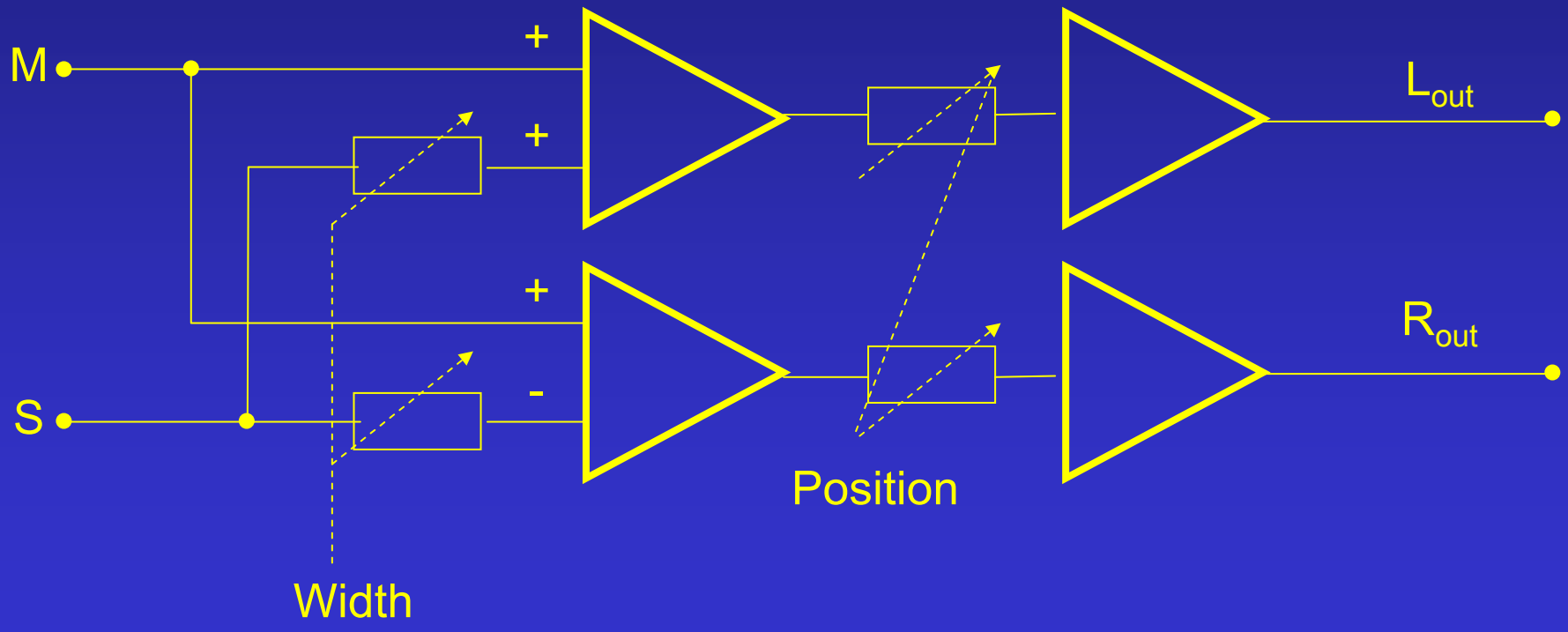


MS Pickup



MS Pickup

- Middle-Side Pickup
- Not listened to directly in stereo; processing through sum and difference circuits necessary
- Flexible control (width, position, direct-to-rev. ratio)

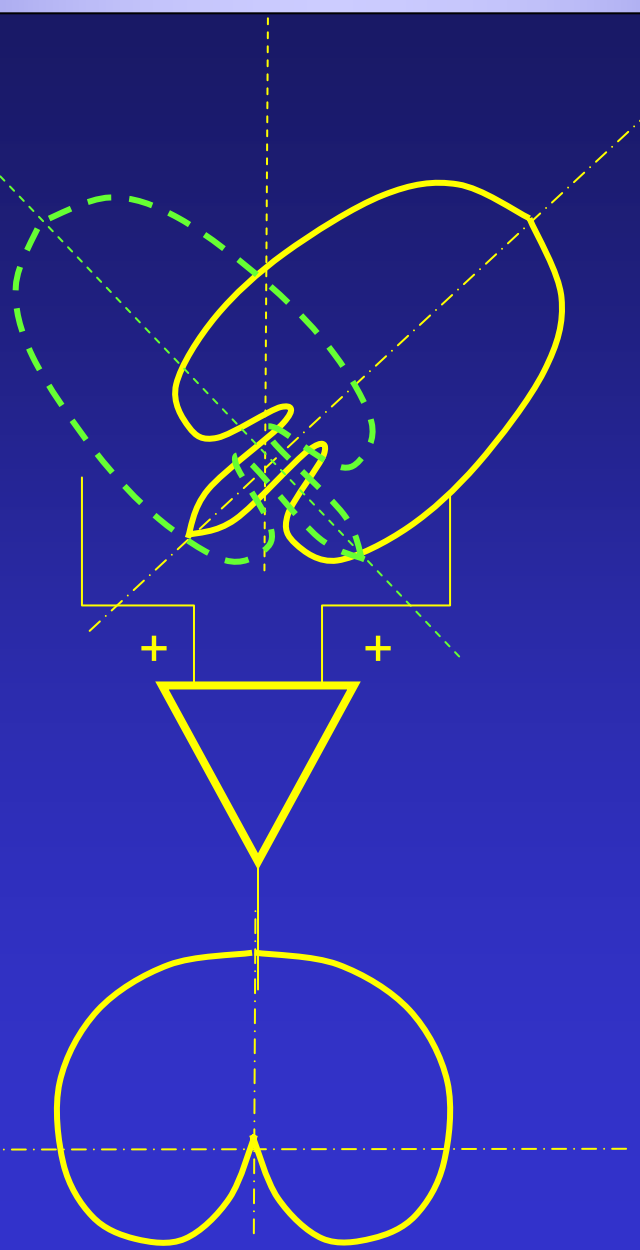


MS Pickup - Monophonic compatibility of the MS technique

Left and Right Patterns

Summation of Left and Right Channels

Resultant Forward-Oriented Cardioid



MS Pickup - Flexibility

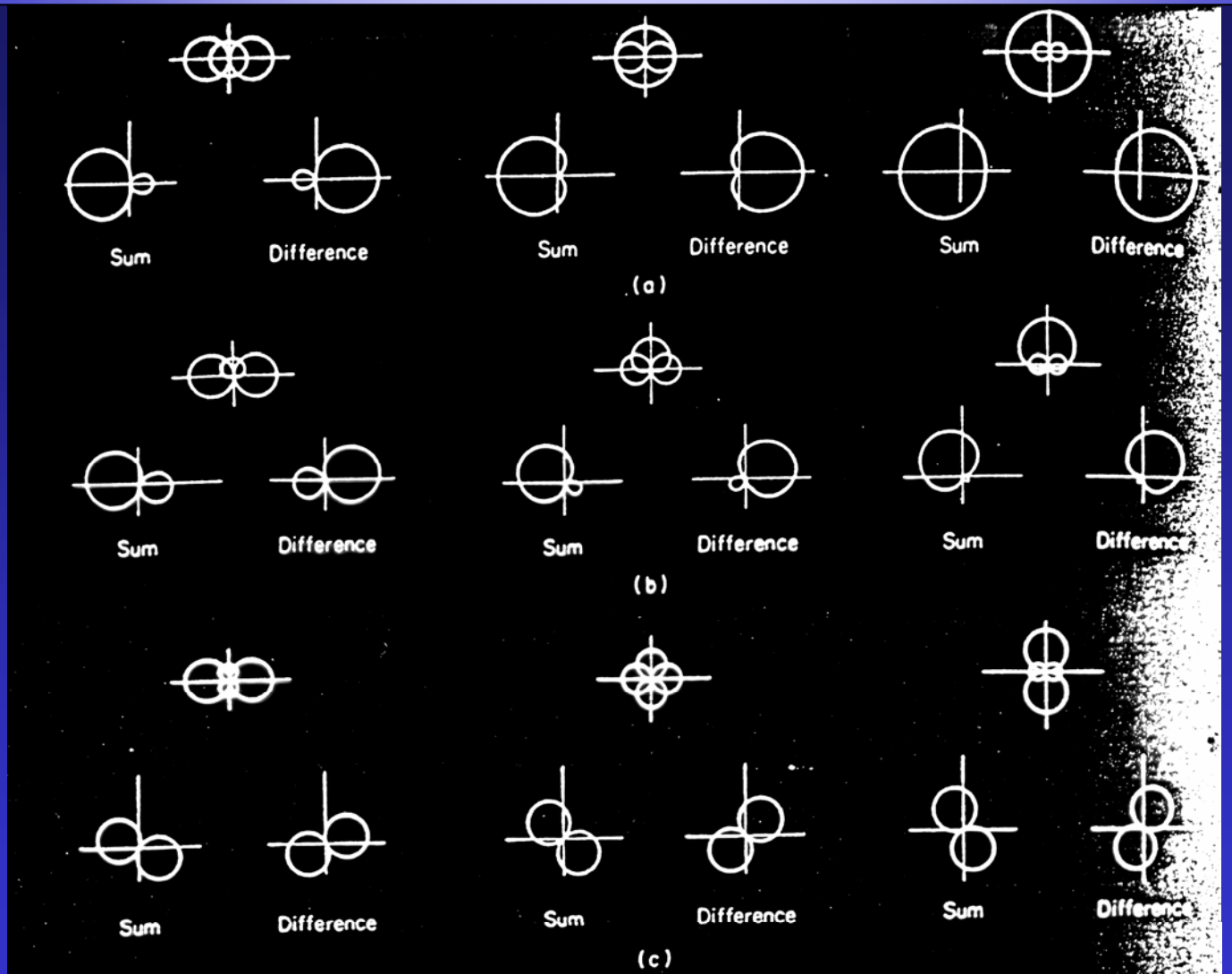
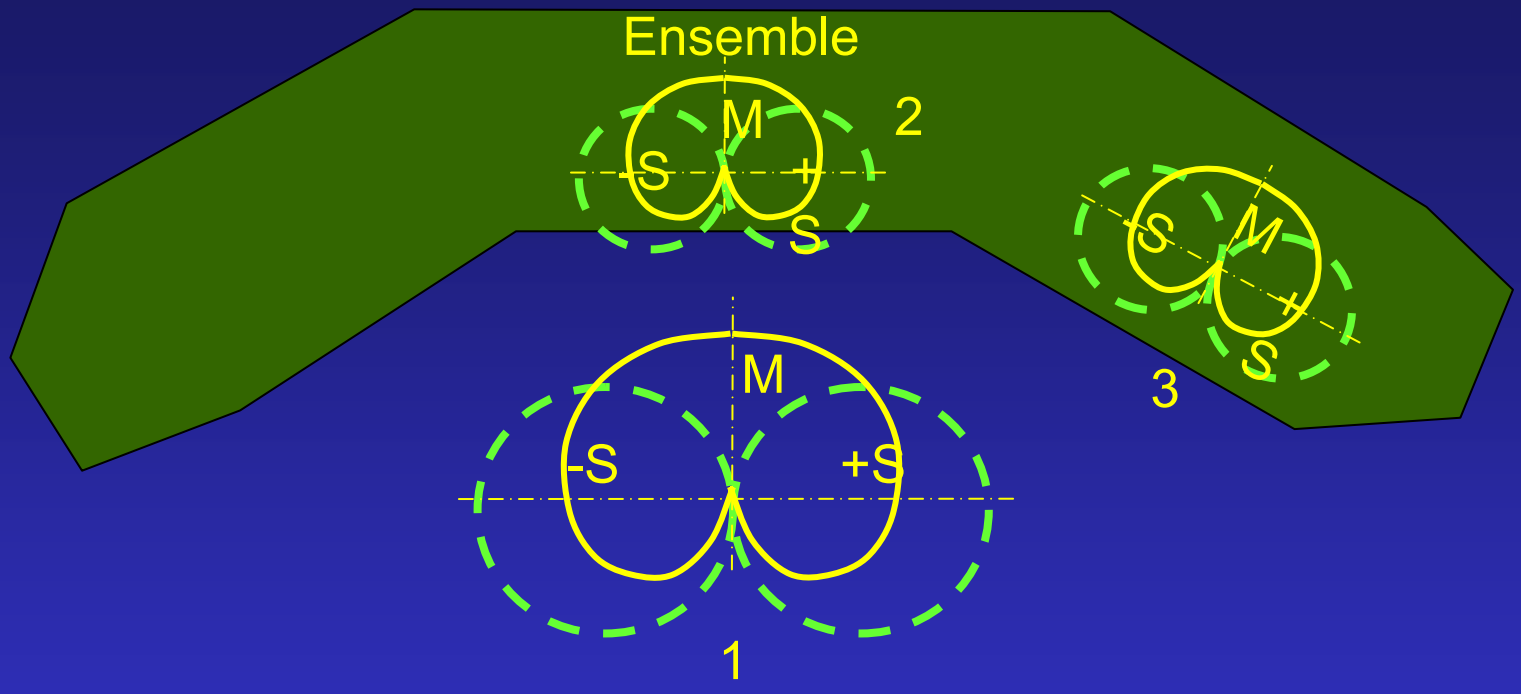


FIG. 6.43 MS to equivalent *XY* transformations for M/S ratios of 30:70, 50:50, and 70:30. (*a*) Omnidirectional M component. (*b*) Cardioid M. component. (*c*) Bidirectional M component. [*From W. L. Dooley and R. D. Streicher, "M-S Stereo: A Powerful Technique for Working [in] Stereo," J. Audio Eng. Soc., 30, 707–718 (October 1982).*]

MS Pickup

- ILD (coincidence microphones)
- Accurate front imaging (depends on M-S ration)
- Remote control
- Flexibility
- Coincident arrays popular in England (excellent front imaging)

MS Pickup - Application



Pair 1 – overall pickup (panorama centered, wide width)

Pair 2 – highlighting soloists (centered, narrower presentation)

Pair 3 – highlighting soloists (located to the right, narrower presentation)

Spaced Microphone Arrays – The Multichannel Approach

ell Telephone Laboratories (USA)

Accurate sound field synthesis

Independence from listening location

Need of many channels (simplification – 3 channels)

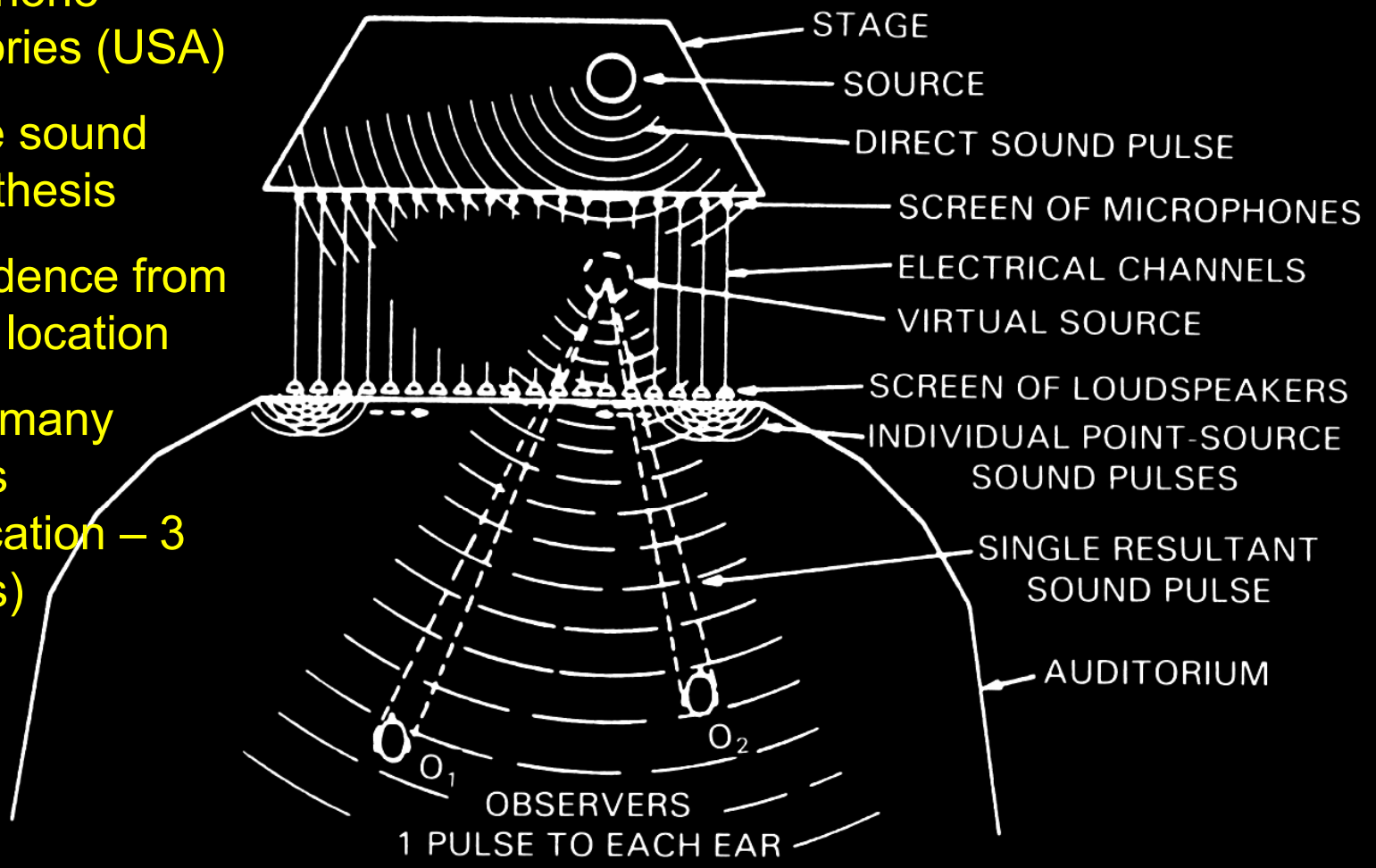


Figure 3-16. Multi-channel stereo recording with wavefront reconstruction. (W. Snow, ''Basic Principles of Stereophonic Sound,'' J. SMPTE, vol. 61 (Nov. 1953))

Spaced Microphone Arrays – Panned Arrays

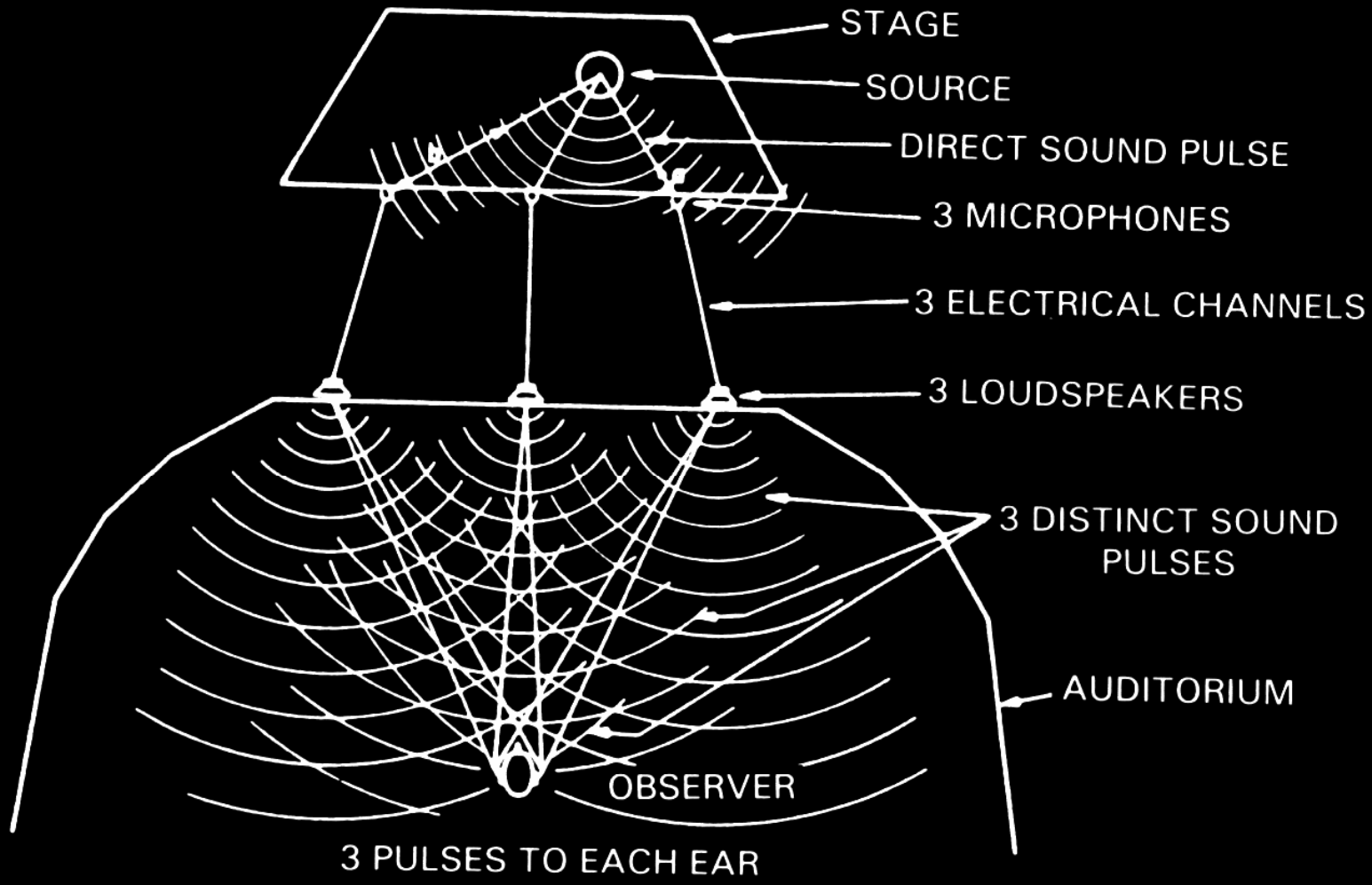
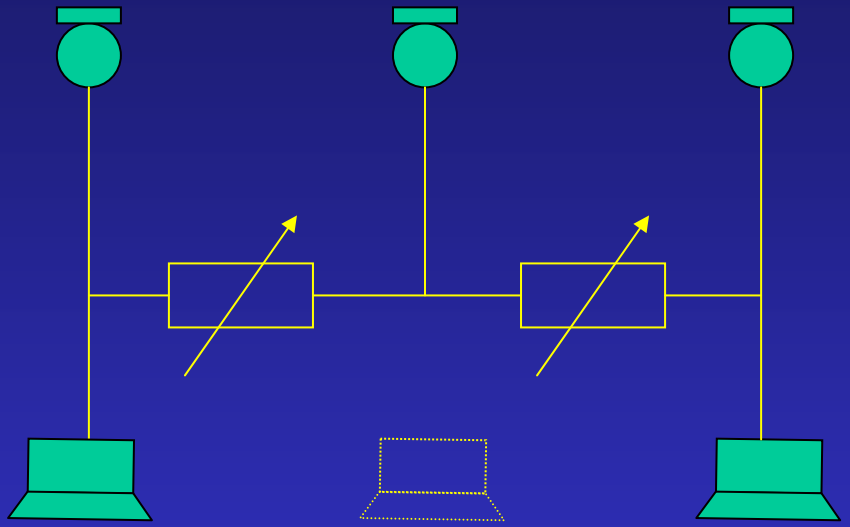
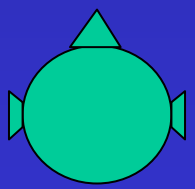


Figure 3-17. Three-channel wavefront reconstruction. (*Data after Snow*, SMPTE Journal)

Accurate localization for listeners located over a broad seating area

Spaced Microphone Arrays – Panned Arrays



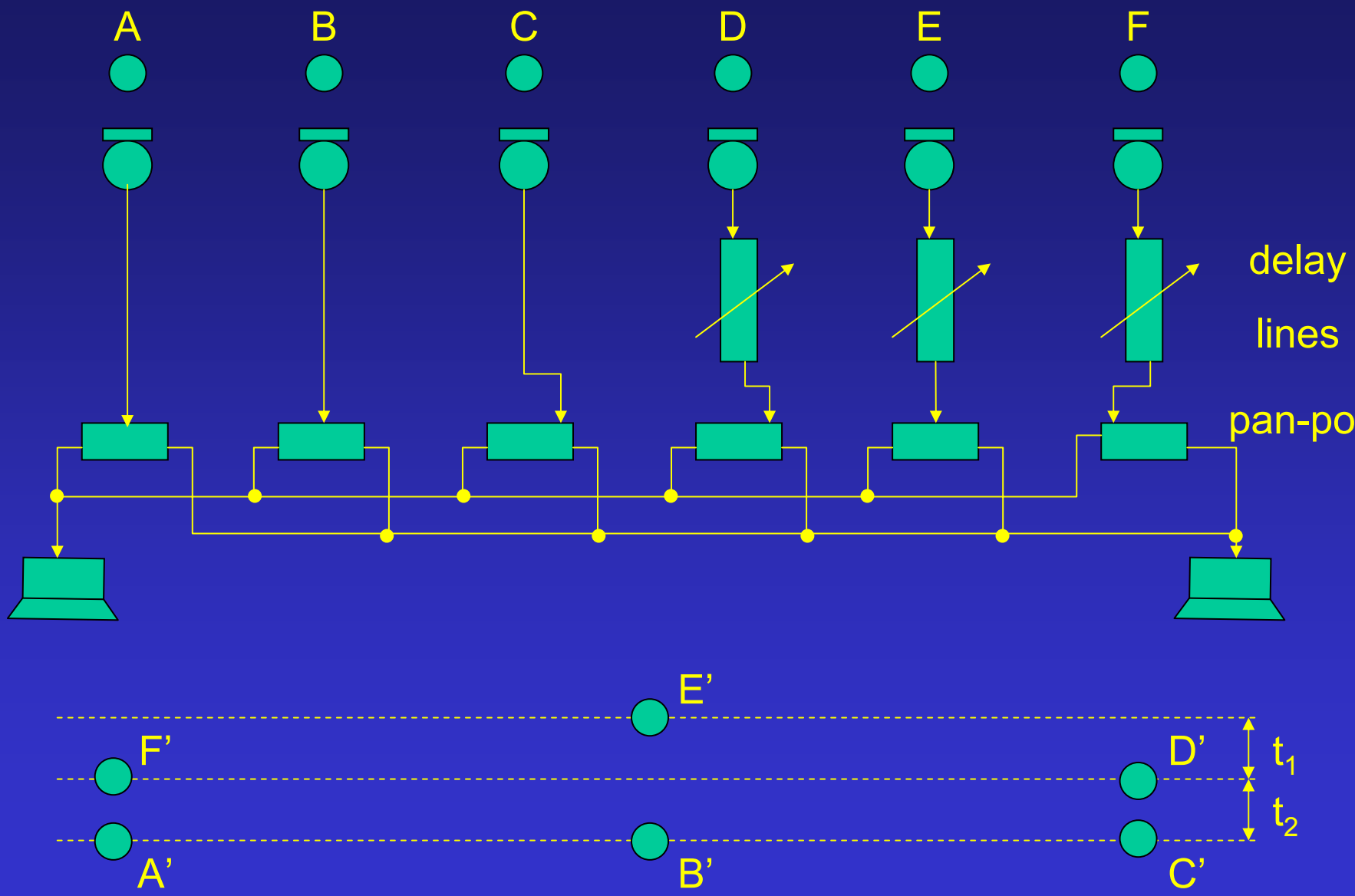


Listener

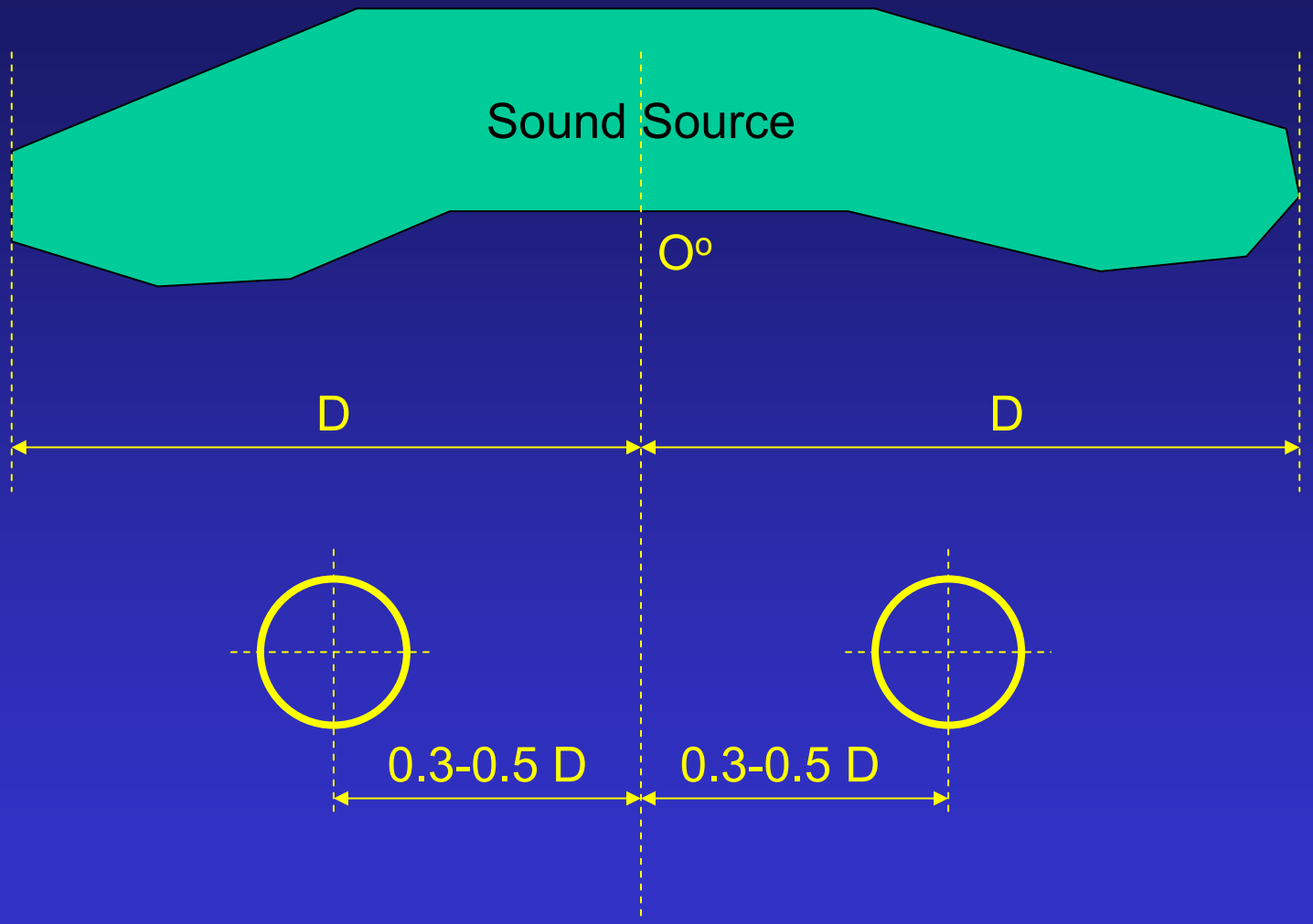
Spaced Microphone Arrays – Panned Arrays

- Popular in USA
- Center microphone – panned centrally (a phantom center image)
- The total distance (left-center-right) = 3…4 m (depends on the size of the ensemble)
- The level of the center microphone = -6 dB (about)
- ITD
- Good reproduction of early reflections through loudspeakers
- Engineer can control time delays between loudspeakers by microphone placement (advantage)
- Give sense of the environment (ambience)

Spaced Microphone Arrays – PAN-POT



AB Array



AB Array

- Located about 3 m apart
- Patterns, distance from the source – variables
- Not accurate center phantom image
- Problem – mono compatibility (low frequency comb filtering of signal coming from sides)

Omnidirectional patterns:

- Spaced 1/4 to 1/6 of sound source width (about 0.6 to 3 m, see previous Figure)
- Sensitive to positioning (direct-to-rev. signal ratio)
- Accurate recording of low frequencies (street noise, air conditioning)

AB Array

Cardioidal patterns:

- “Highlighting” of sounds coming at 0^{o} angle
- Of-axis coloration
- Sensitive to positioning

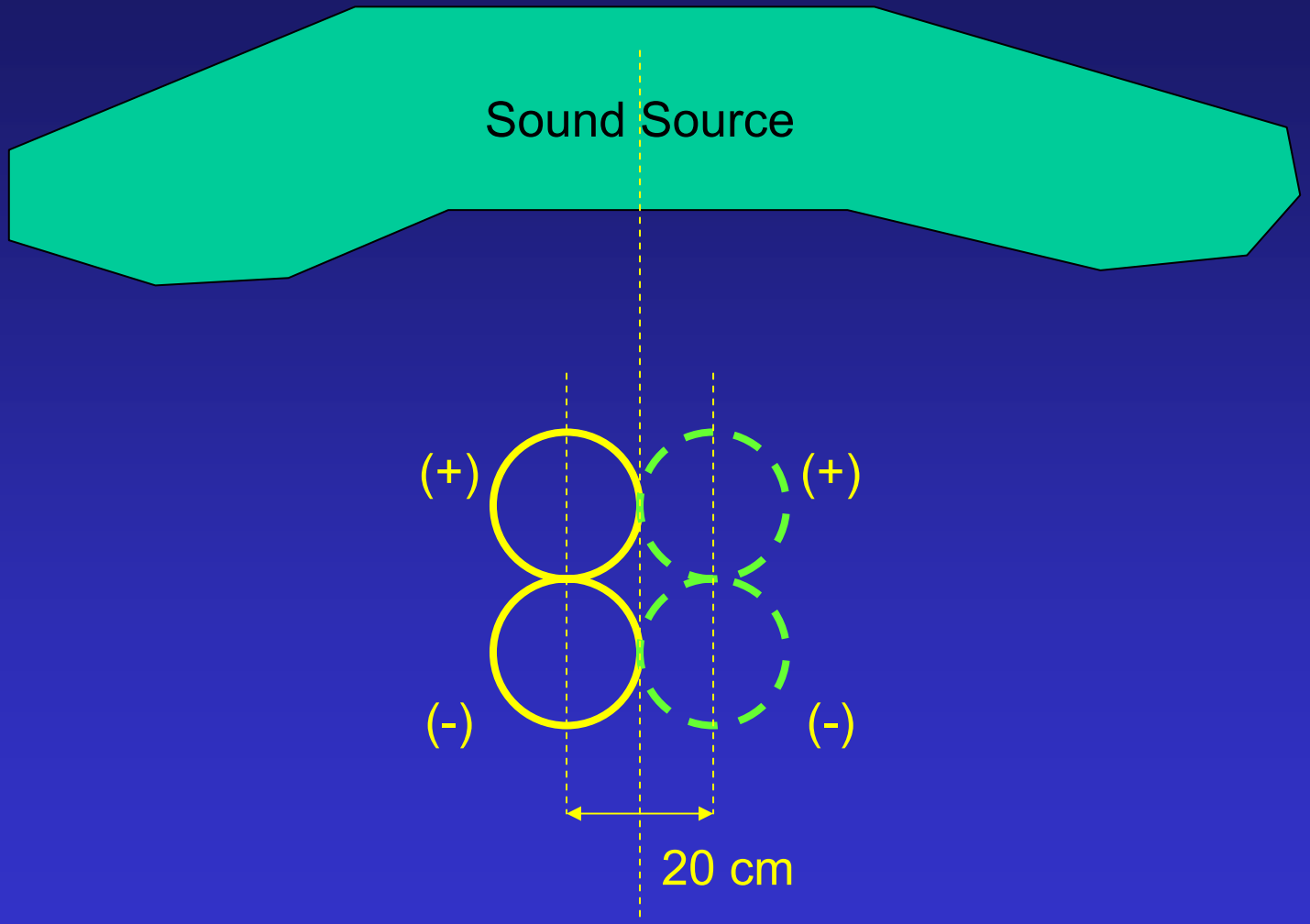
Hipercardioidal patterns:

- “Highlighting” of sounds coming at 0^{o} angle
- Of-axis coloration
- Sensitive to positioning

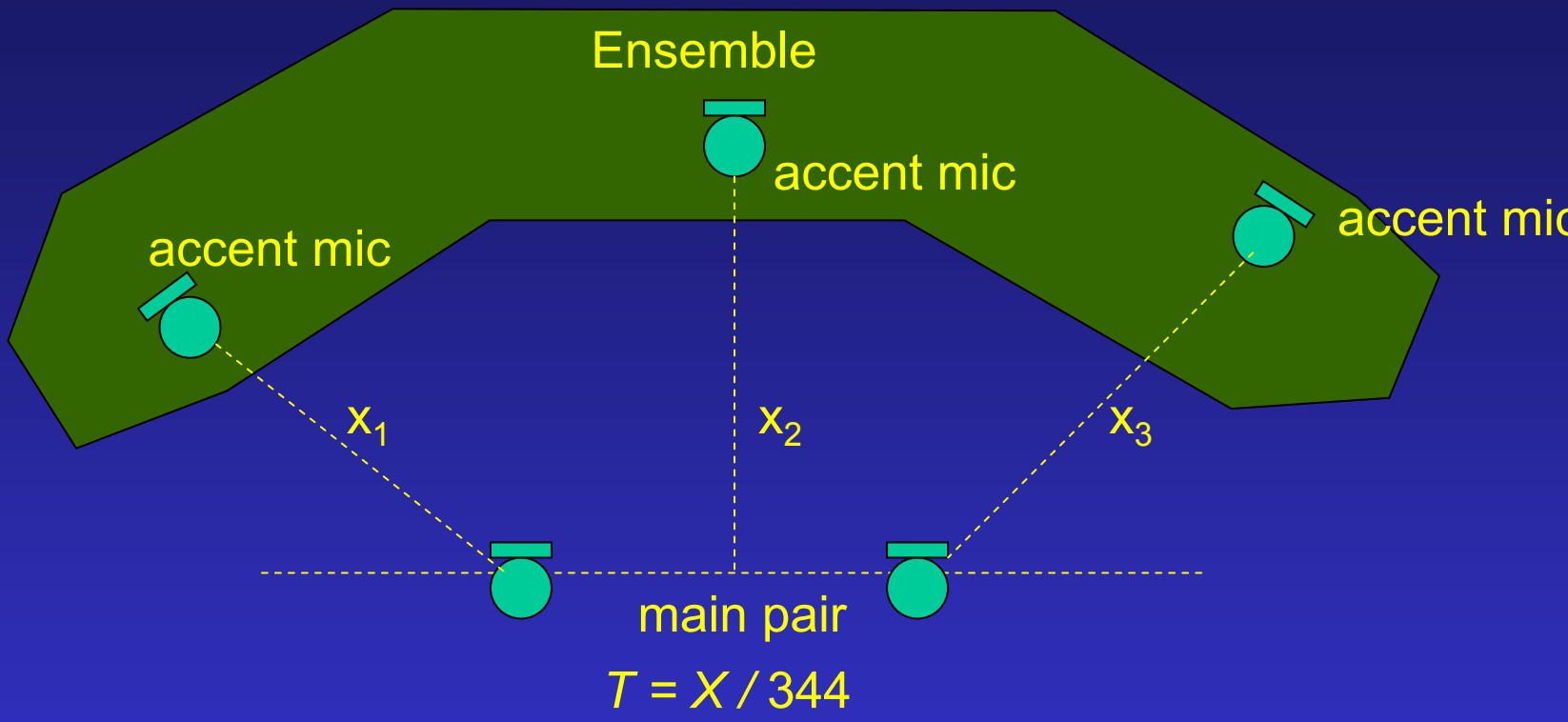
Figure of eight patterns:

- “Highlighting” of sounds coming at 0^{o} angle
- Sensitive to positioning
- Insensitive to sounds coming at 90^{o} and 270^{o}

Faulkner Array



Use of Accent (Close) Microphones



- Usually employed with the spaced-apart technique
- “Highlights” or adds presence to some instruments
- Mix: Should be properly placed in panorama, not too loudly
- Should be delayed (about 2- to 10-milliseconds after the signal from the main pair)

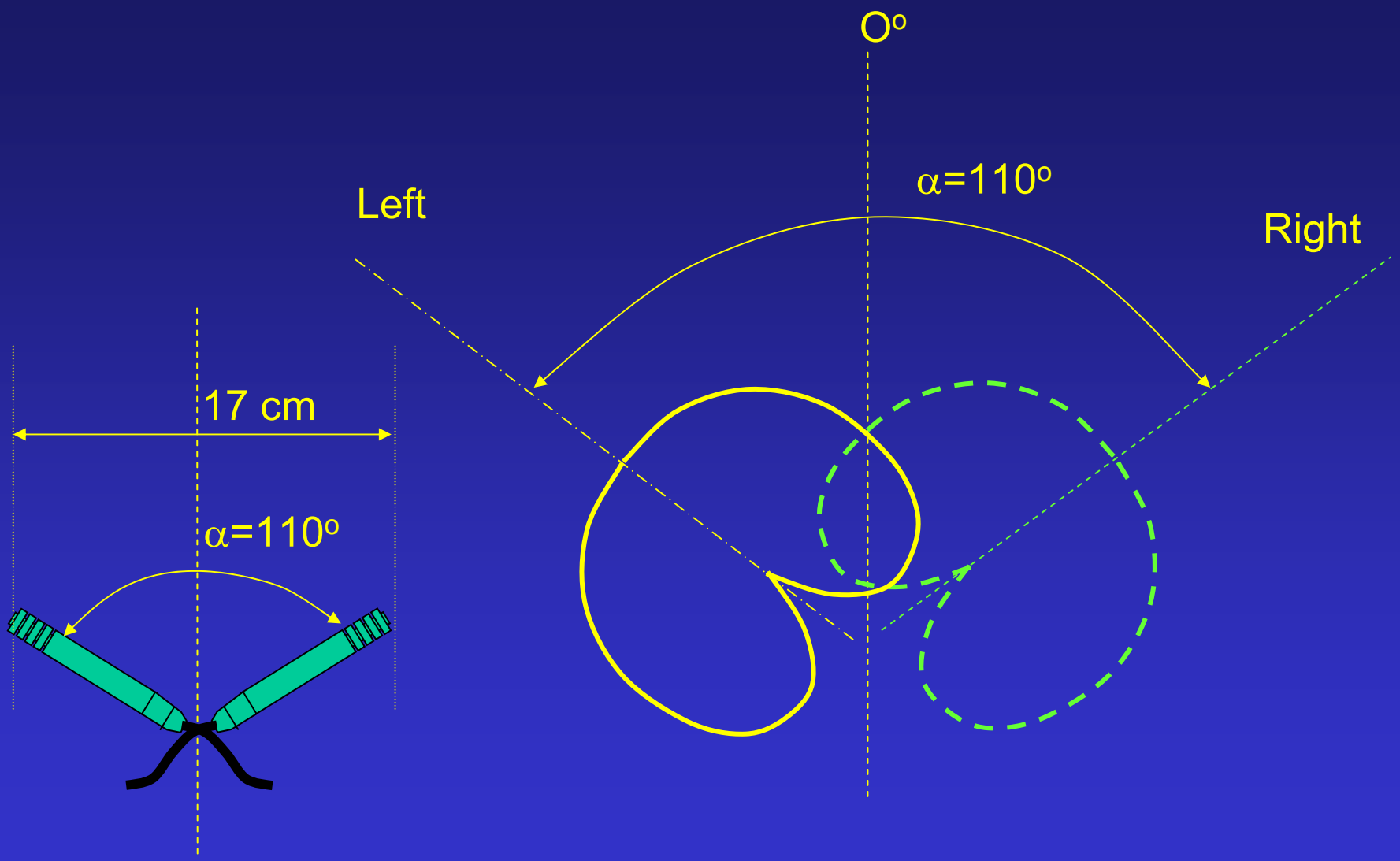
Quasi-Coincident Microphone Arrays

- Pair of directional microphones spaced no more than about 30 cm
- The intent: Combine excellent imaging of the coincident arrays and the added sense of space or ambience

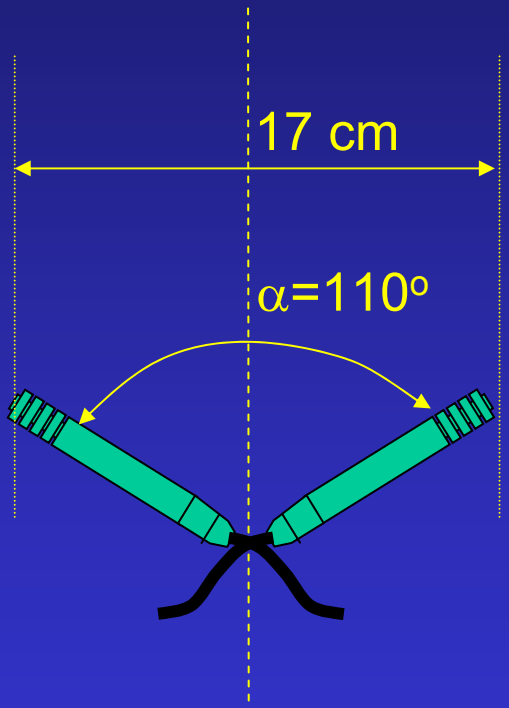
Examples:

- ORTF
- NOS
- Stereo-180 Array
- Bidirectional Microphones with Baffle

ORTF Array

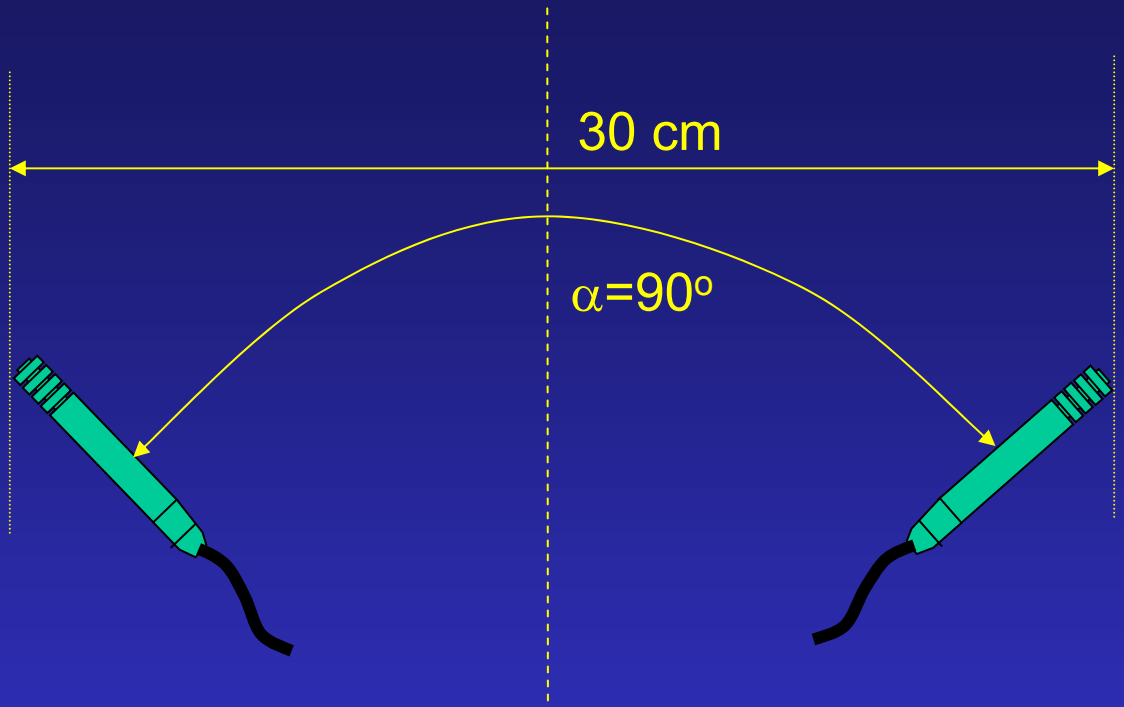


ORTF Array



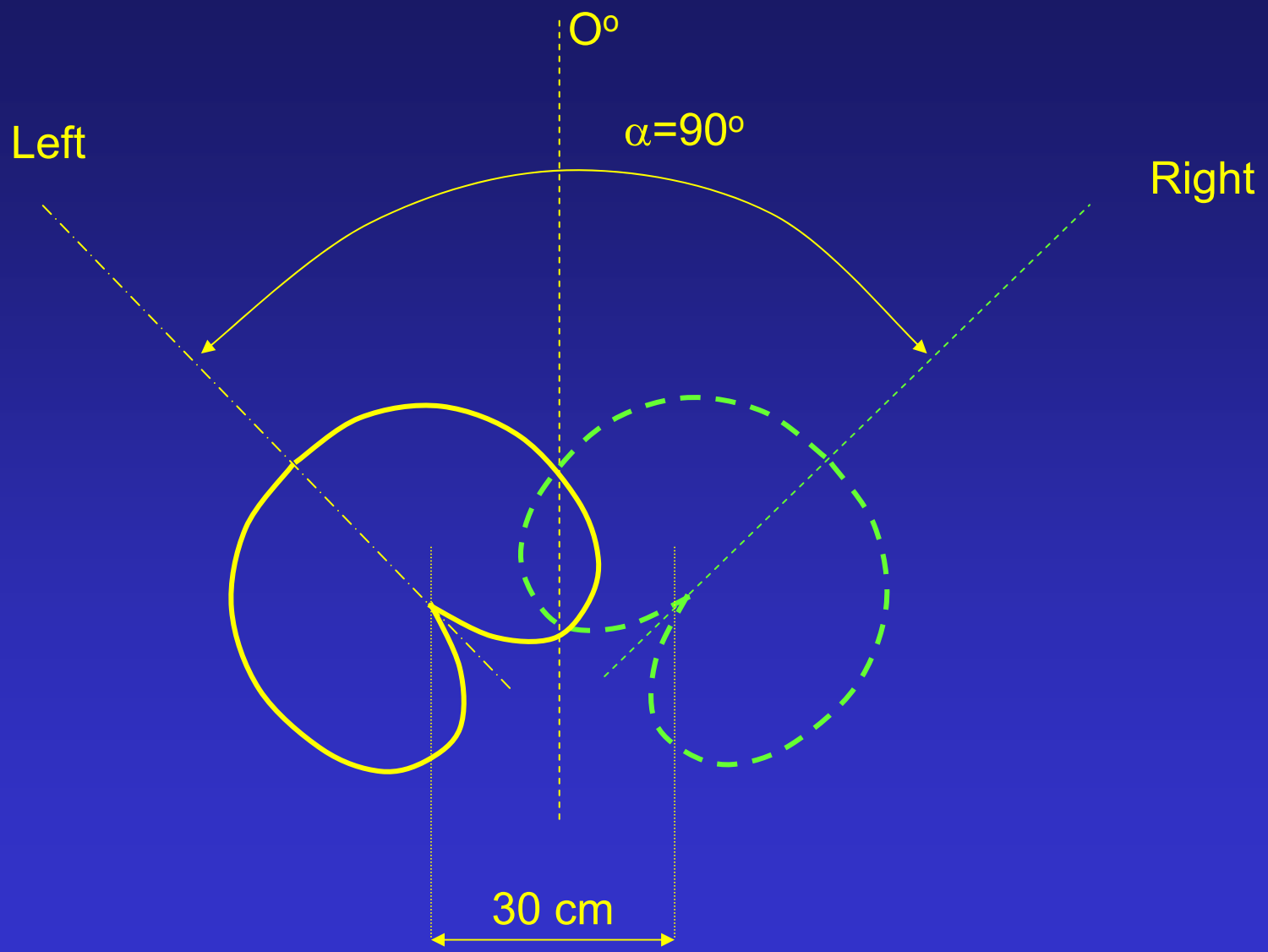
- Developed by the French Broadcasting Group (*Office de Radiodiffusion-Television Francaise*)
- Quasi-coincidence array

NOS Array

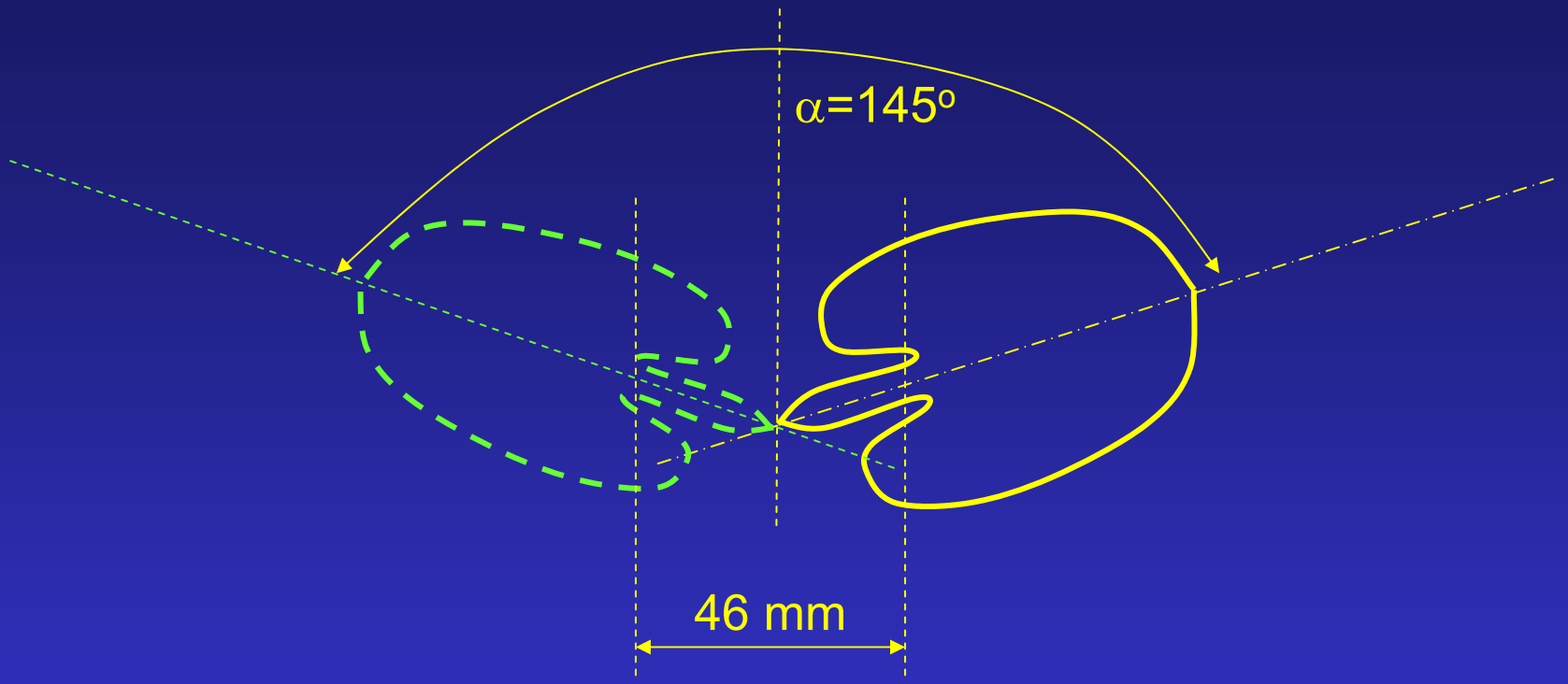


Developed by the Dutch Broadcasting Group
(*Nederlandsche Omroep Stichting* – hol.)

NOS Array

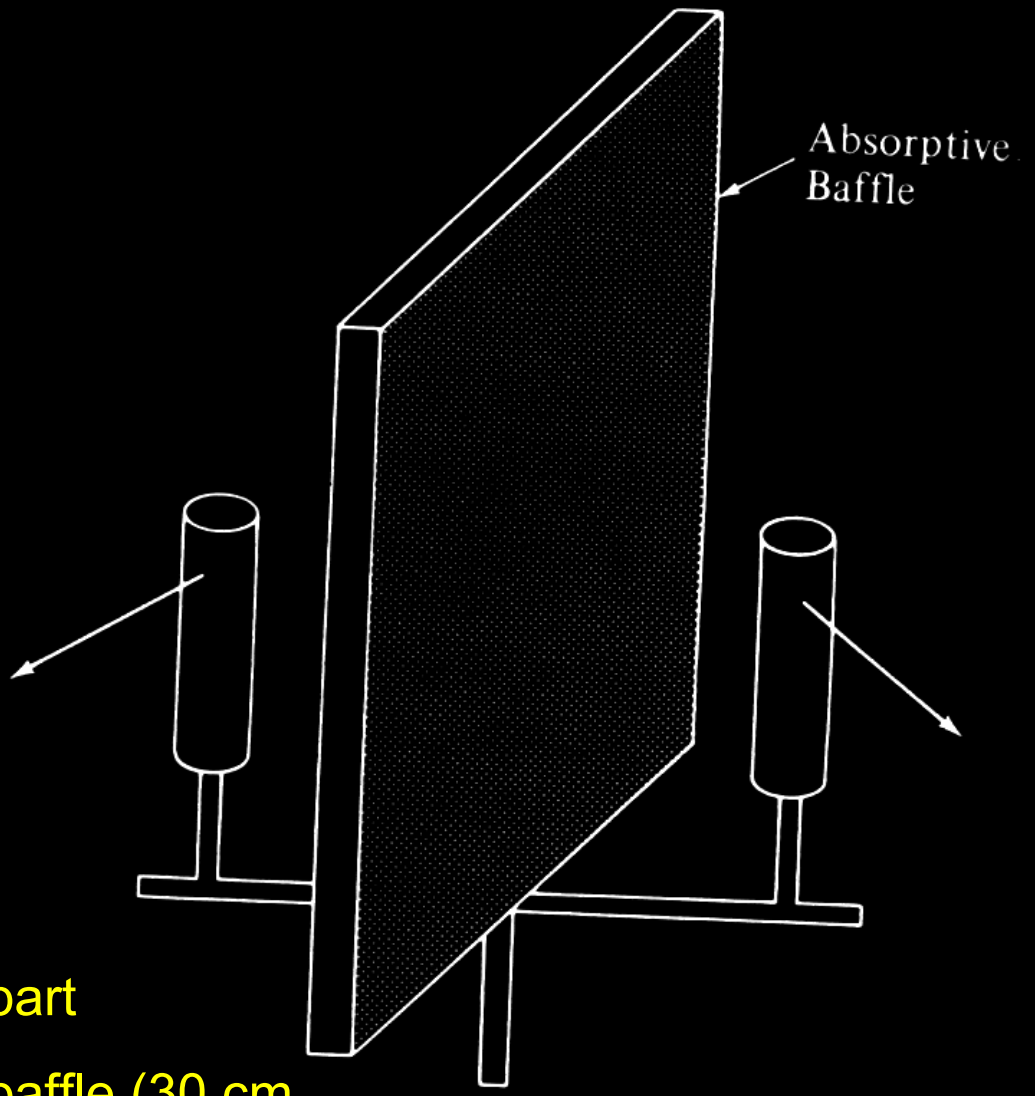


Stereo-180 Array



- Hypercardioid patterns
- Spaced 46 mm apart
- Angle of 135°
- The array picks up sound over a very wide frontal angle with accuracy

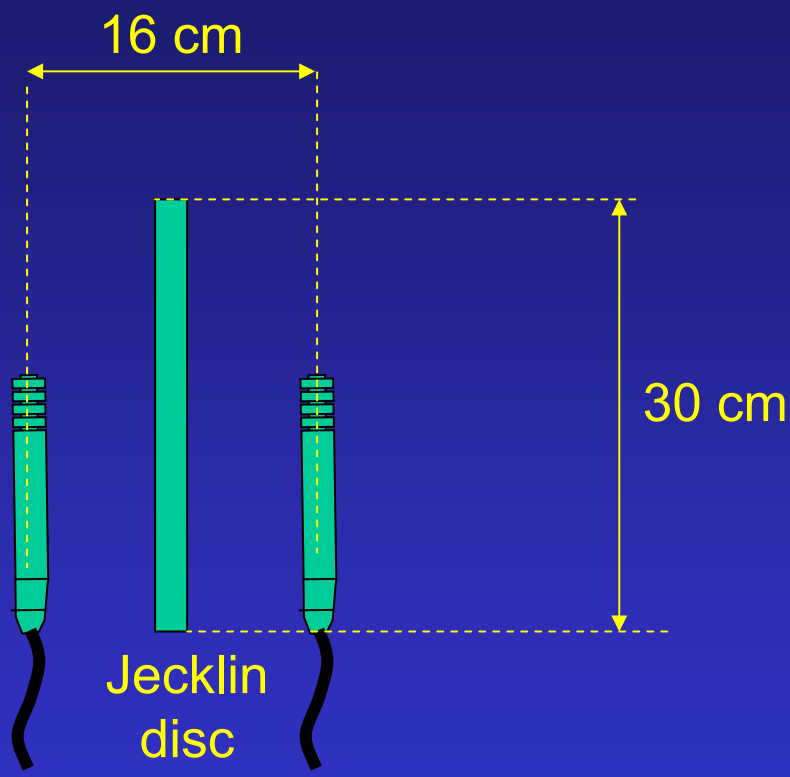
Bidirectional Microphones with Baffle



- Bidirectional microphones
- Angle = 90^{o} (aprox.)
- Spaced about 20 to 30 cm apart
- Separated by an absorptive baffle (30 cm square, effective above 1 kHz)

OSS Array

- OSS – Optimum Stereo Signal
- Omnidirectional patterns
- Spaced 16 cm apart
- Disc (30 cm diameter)
- f < 200 Hz phase differences (imperceptible)
- 200 Hz < f < 1500 Hz phase and intensity differences
- f > 1500 Hz intensity differences
- natural stereo imaging
- Distance from the sound source should be less than the critical one

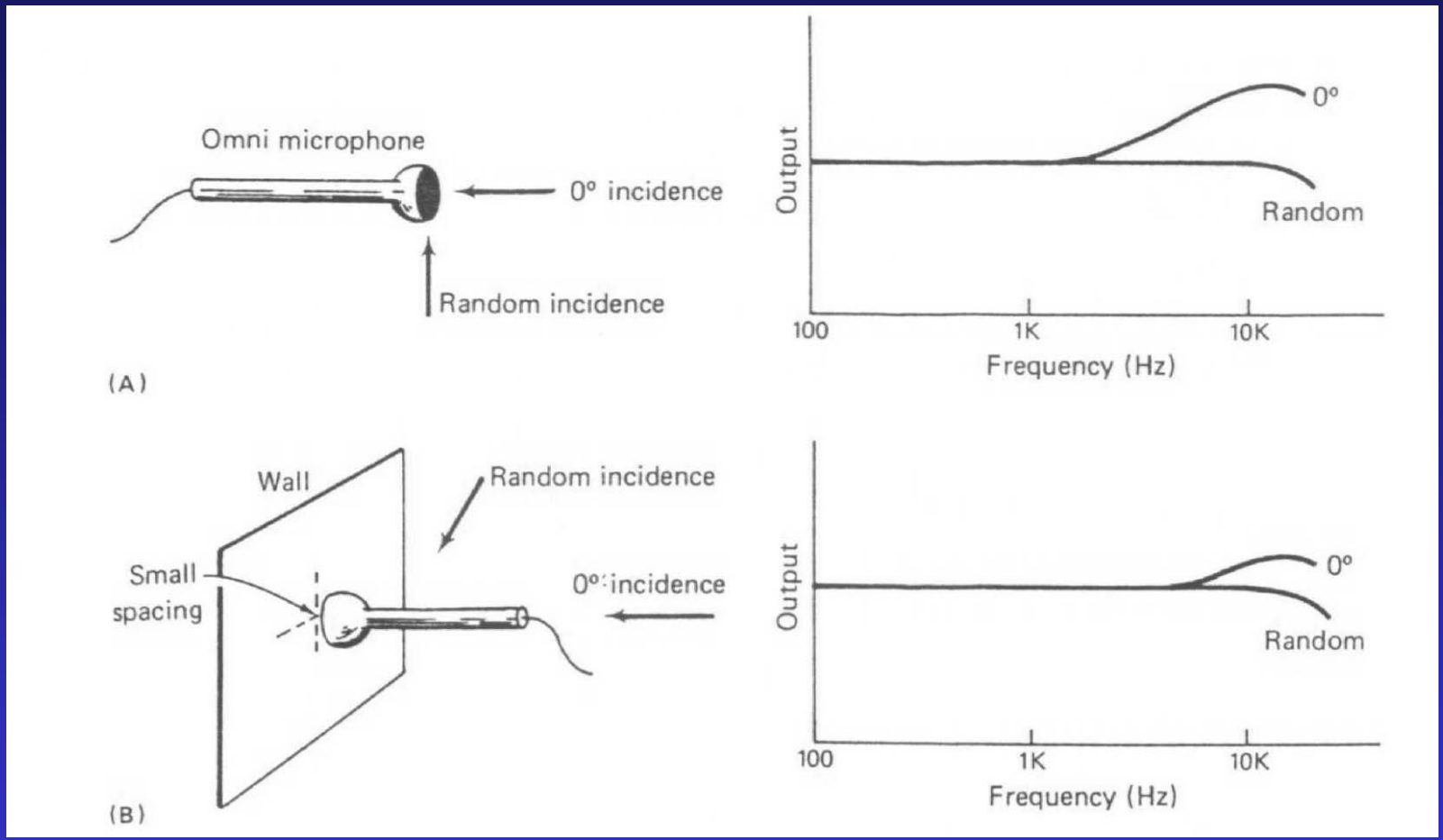


PZM

Mikrofon PZM na biurku lektora

Skierowanie mikrofonu osią główną w kierunku powierzchni przegrody zmniejsza typowe dla mikrofonów dookólnych podbicie wysokich tonów (jakie występuje właśnie na osi głównej mikrofonu) Umieszczenie mikrofonów na naturalnej powierzchni granicznej, jaką jest ściana może być o tyle problematyczne, że odległość mikrofonów od muzyków w typowym studio będzie zbyt duża, co może niekorzystnie wpłynąć na różne cechy nagrania. Rozwiązaniem tego problemu jest umieszczenie mikrofonów na sztucznej powierzchni (specjalna płyta z umieszczonym na niej mikrofonem), którą można ustawiać w dowolnej odległości od nagrywanego zespołu.

PZM

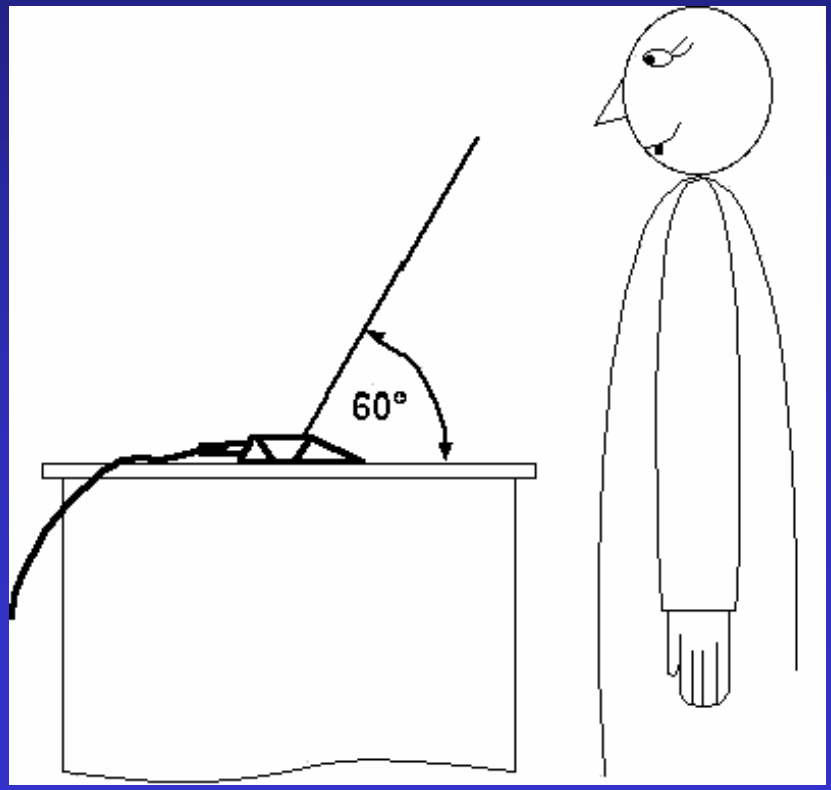


Mikrofon wszechkierunkowy; (A) pracujący normalnie; (B) pracujący w strefie ciśnień. Ustawienie mikrofonu na równi z powierzchnią graniczą, powoduje brak wyjścia fali odbitej od tej powierzchni do mikrofonu, zbiera on zatem tylko dźwięk bezpośredni. Przykład zastosowania pokazuje powyższy rysunek, gdzie wykorzystano mikrofon PZM jako mikrofon lektora, redukując w ten sposób odbicia od powierzchni

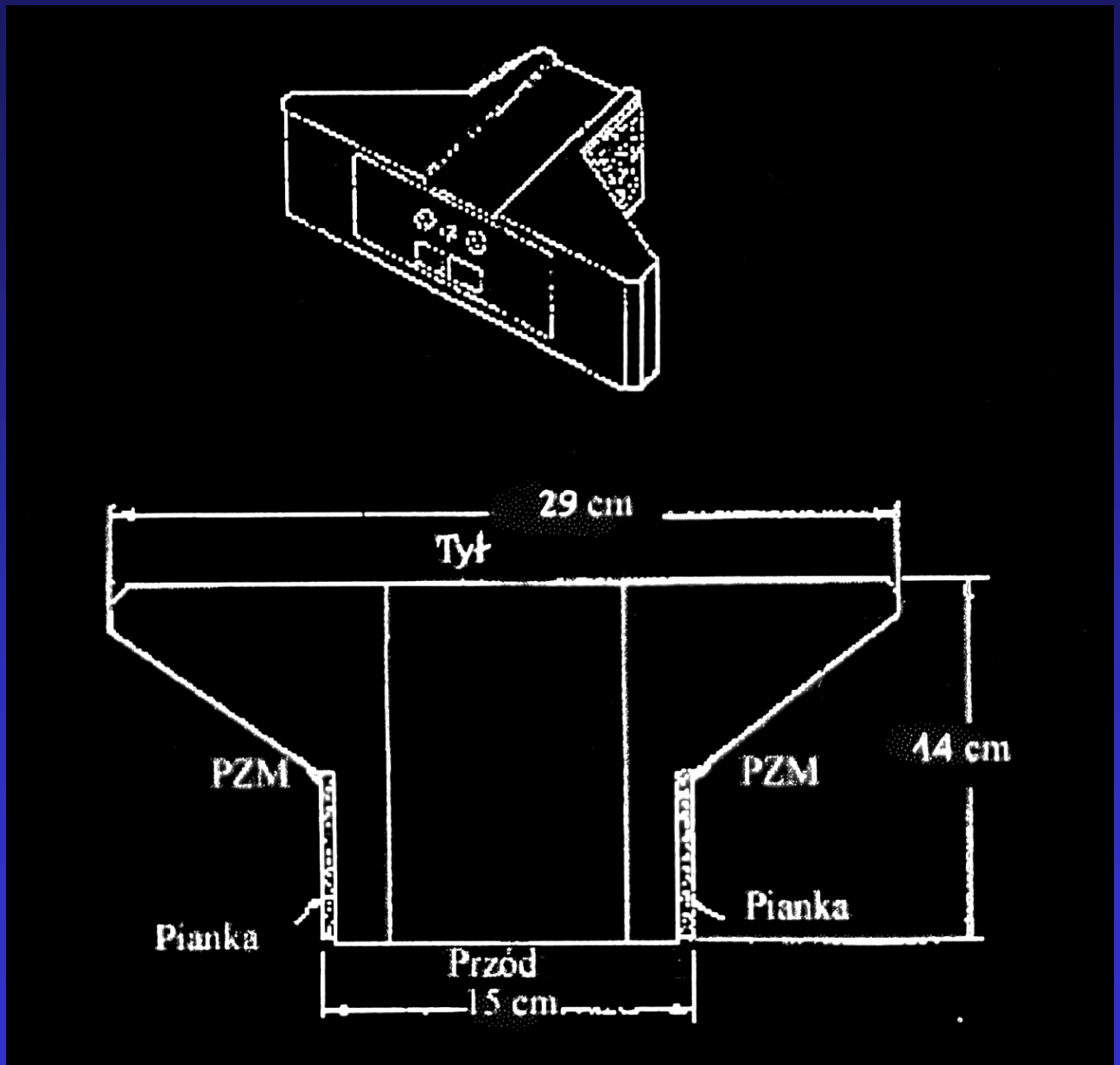
PZM

„PZM” (ang. *Pressure Zone Microphones*) to ogólna nazwa dla systemów, które opierają się na zjawisku występującym dokładnie na powierzchni płaskiej przegrody tj. np. podłogi lub ściany. Termin wywodzi się stąd, że mikrofon umieszczony jest bardzo blisko ściany lub płaszczyzny granicznej, gdzie sens ma jedynie ciśnienie dźwięku (cząsteczki powietrza mają prędkość równą zeru na granicy powierzchni). Jako mikrofony PZM najczęściej używane są mikrofony dookólne specjalnie projektowane do tego celu z membraną znajdującą się równo z powierzchnią przegrody, w strefa ciśnienia. Jako mikrofon PZM, również dobrze będzie pracował zwykły mikrofon wszechkierunkowy jeśli zostanie przyklejony do podłogi lub bezpośrednio do ściany [10]. Na rysunku 4.22 przedstawiona jest przykładowa pozycja mikrofonu wszechkierunkowego znajdującego się bardzo blisko powierzchni granicznej, a jego oś główna skierowana jest prostopadle do ściany [14].

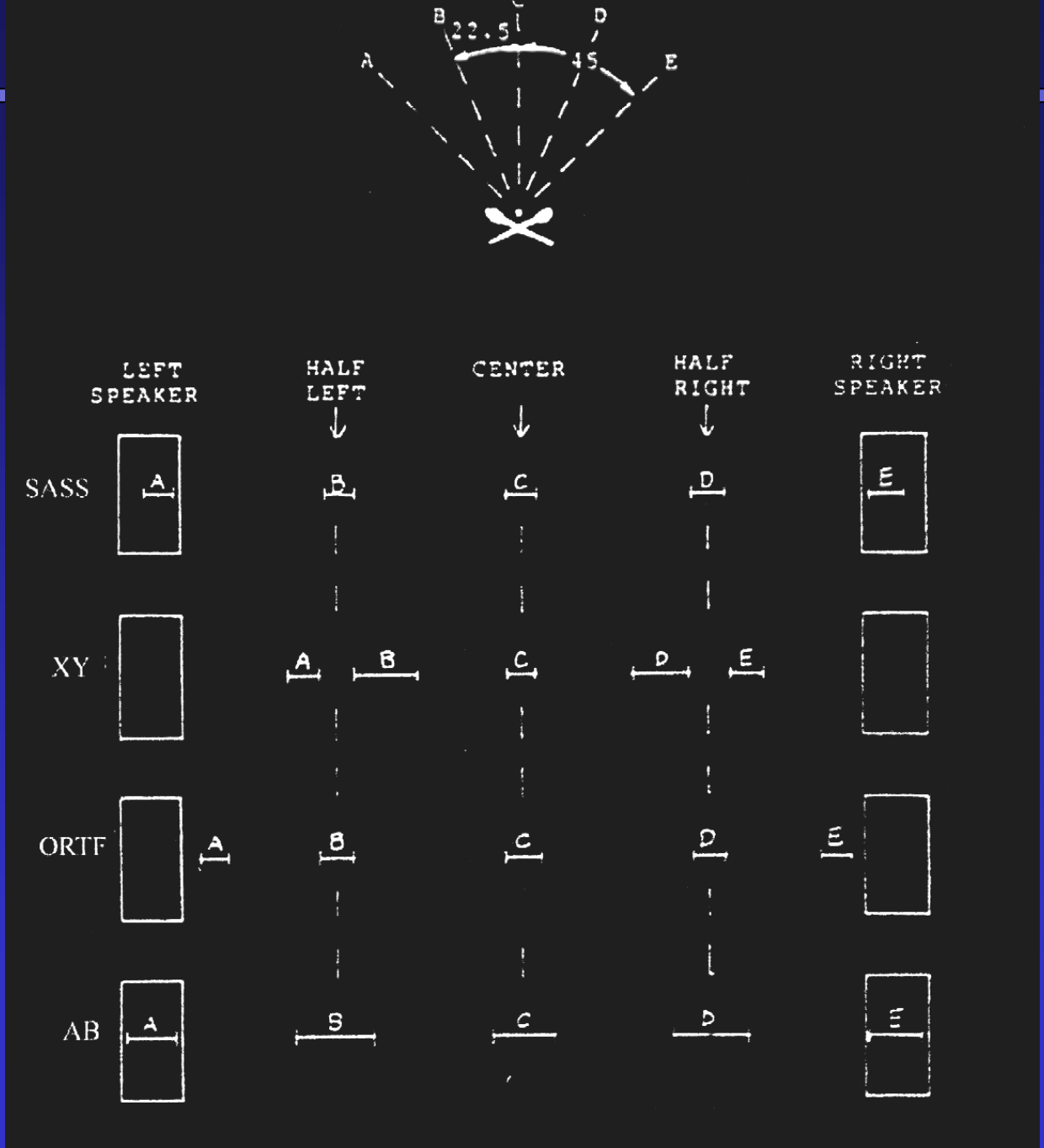
PZM



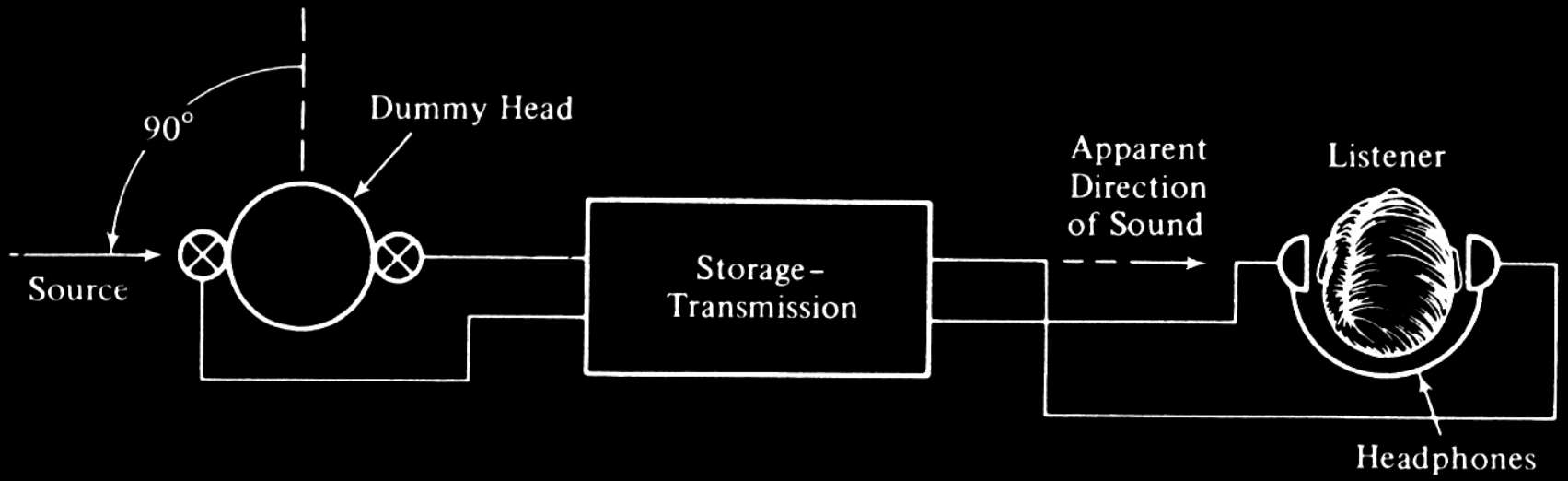
SASS



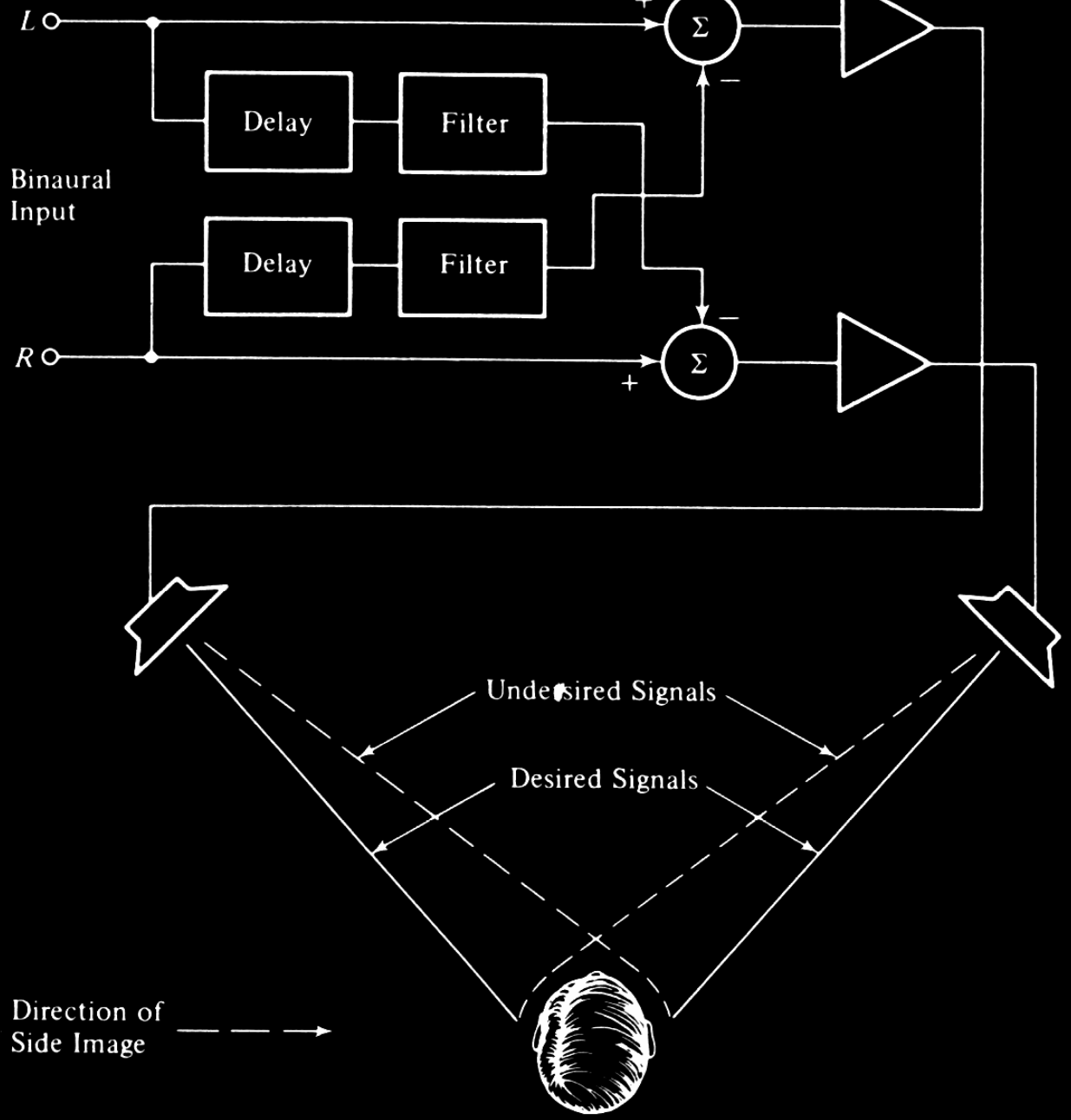
SASS


B
C
D
22.5
A
45
E
LEFT SPEAKER
HALF LEFT
CENTER
HALF RIGHT
RIGHT SPEAKER
SASS
XY
ORTF
AB
A
B
C
D
E

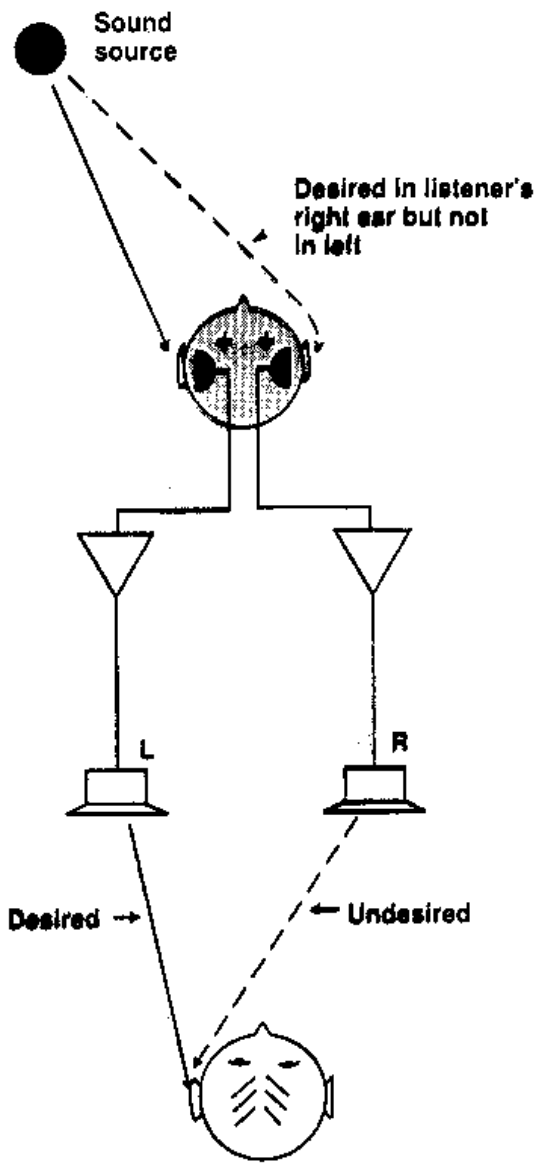
Dummy Head


90°
Dummy Head
Source
Storage–
Transmission
Apparent
Direction
of Sound
Listener
Headphones

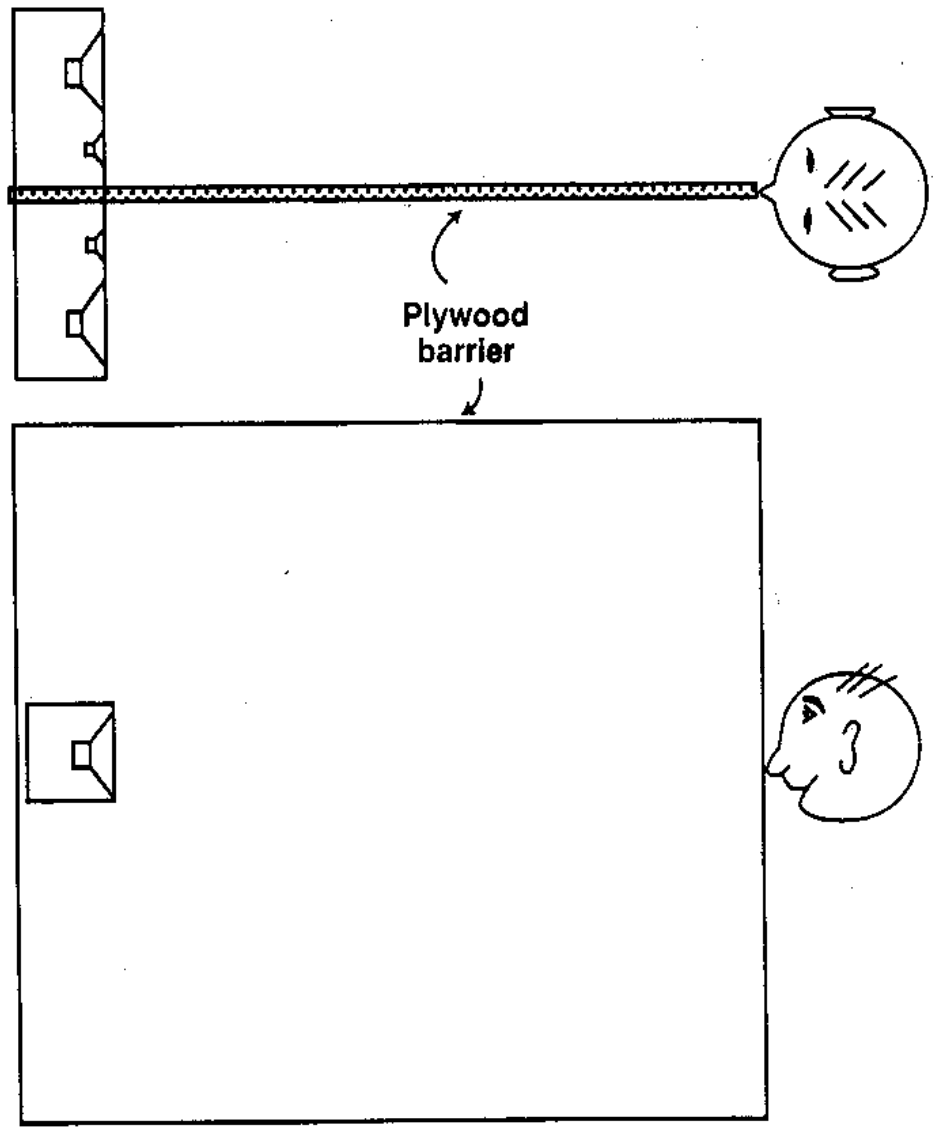
(a)


L
R
Binaural Input
Delay
Filter
Delay
Filter
Σ
Σ
+
−
−
+
Undesired Signals
Desired Signals
Direction of Side Image

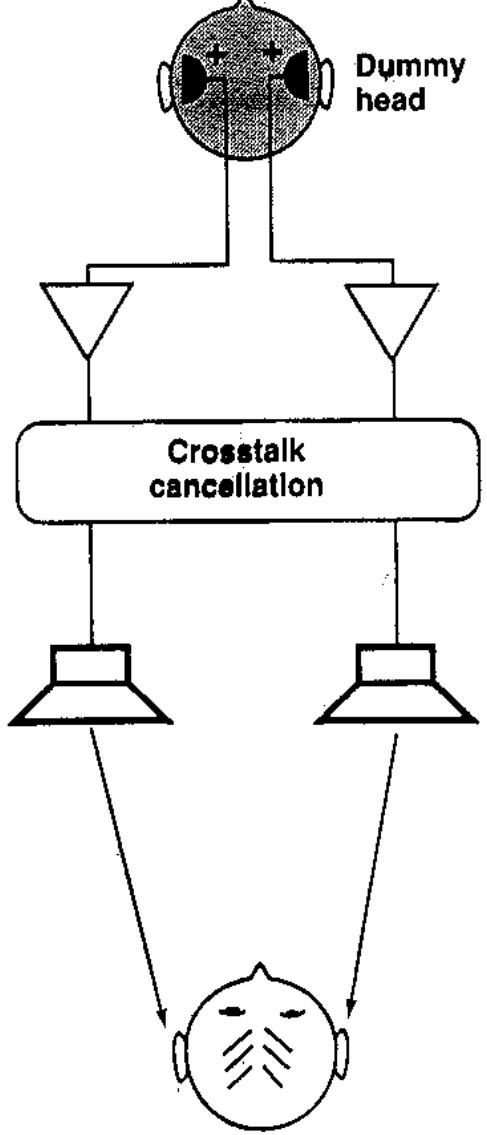
(b)



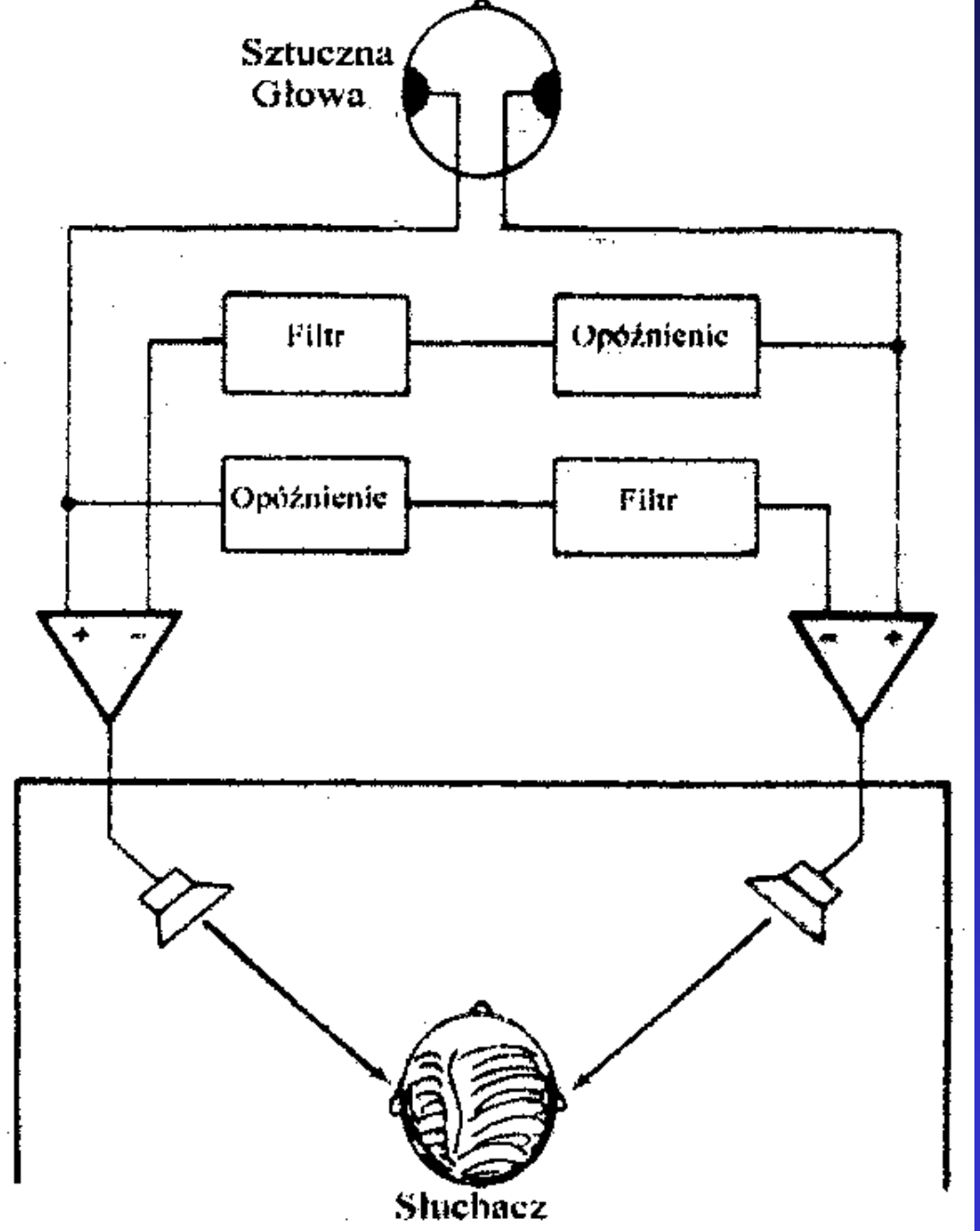
6-4 Binaural signals reproduced by loudspeakers are distorted by crosstalk. An example of crosstalk is the undesired signal arriving at the left ear from the right loudspeaker. The effects of this crosstalk can be electronically canceled.

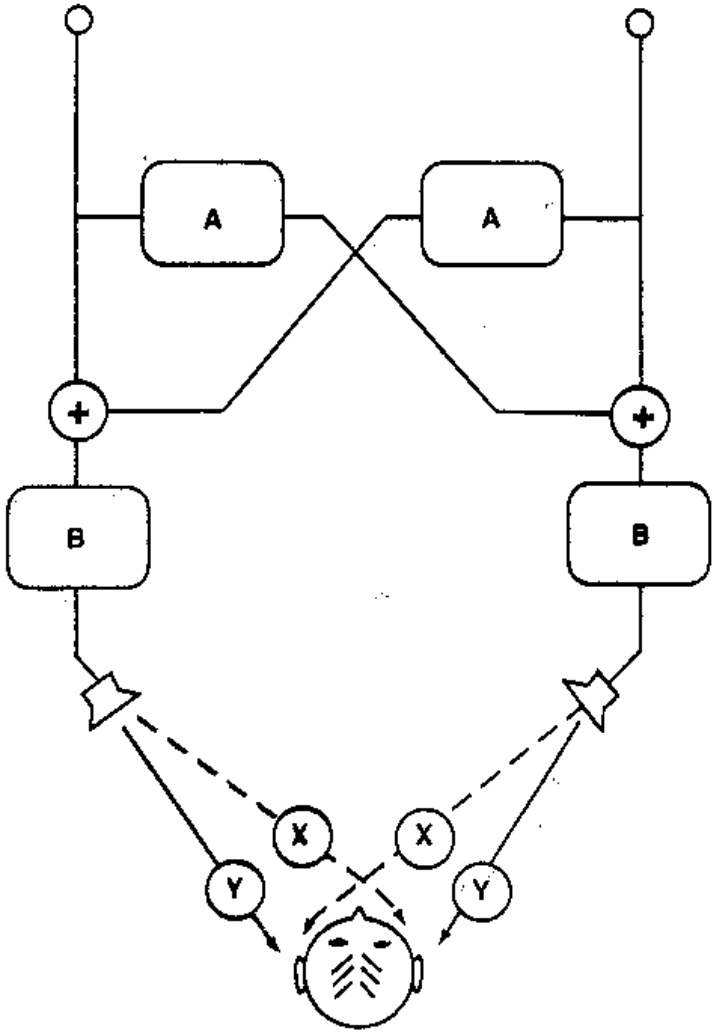


6-6 One effective, albeit impractical way to eliminate crosstalk in listening to binaural signals with loudspeakers is the use of a plywood isolation barrier.



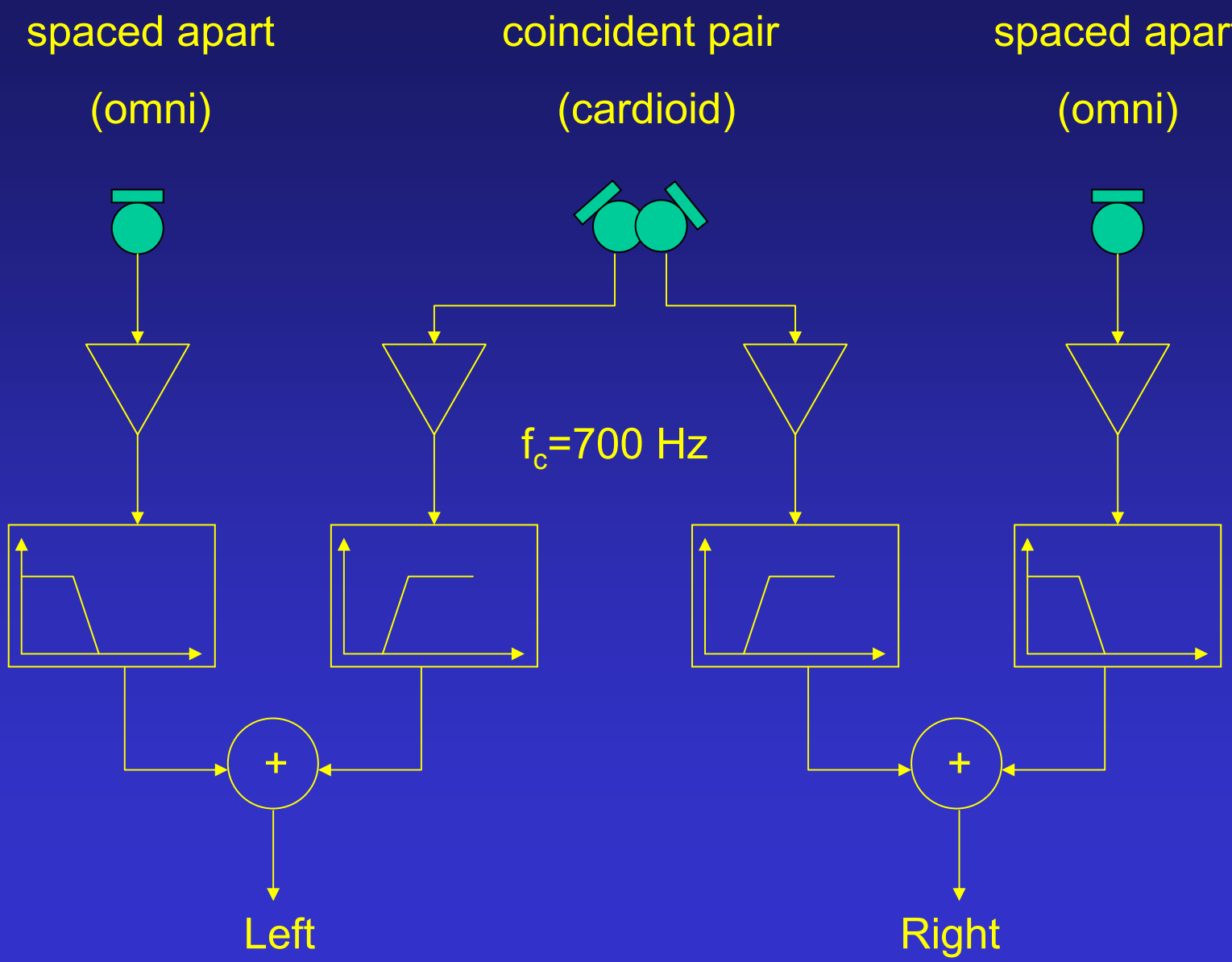
6-7 The cancellation of crosstalk with simple electronic circuits has been only partially successful.


Sztuczna
Głowa
Filtr
Opóźnienie
Opóźnienie
Filtr
+
-
-
+
Słuchacz

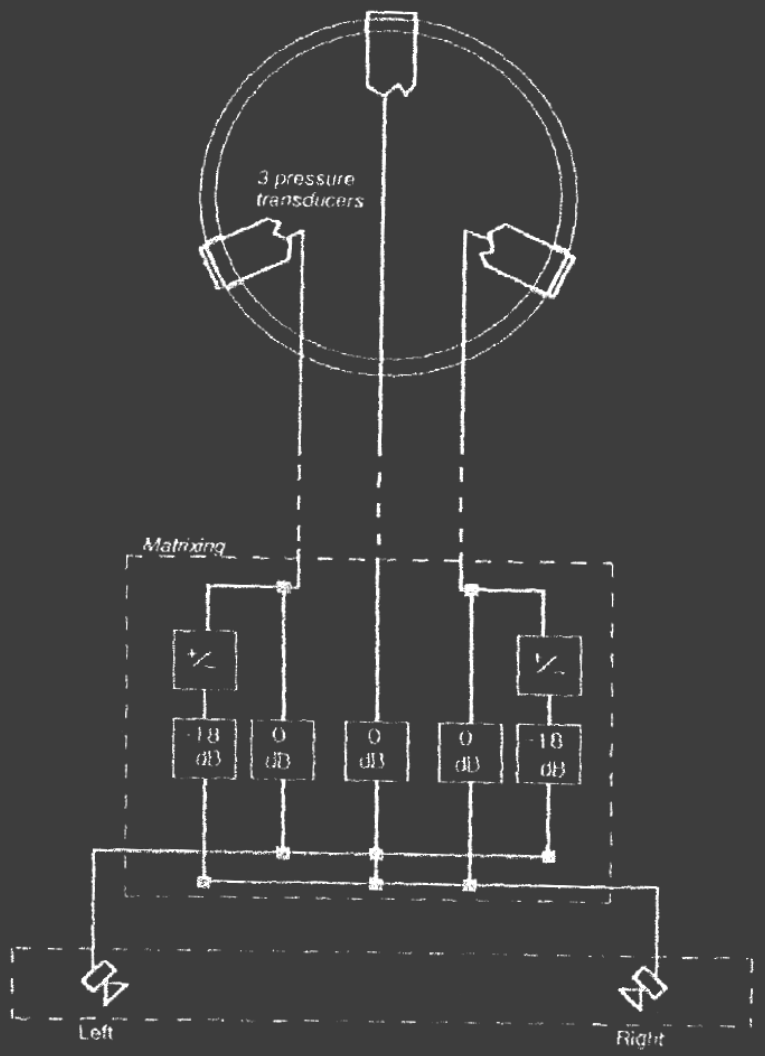


6-8 Faithful reproduction of binaural head signals by loudspeakers has been mathematically defined by Atal and Schroeder. The A and B components of their circuit can be obtained from complex transfer functions X and Y as measured between the loudspeaker and the listener's ear in an anechoic chamber.

HFDMA (Hybrid Frequency Dependent Microphone Array)

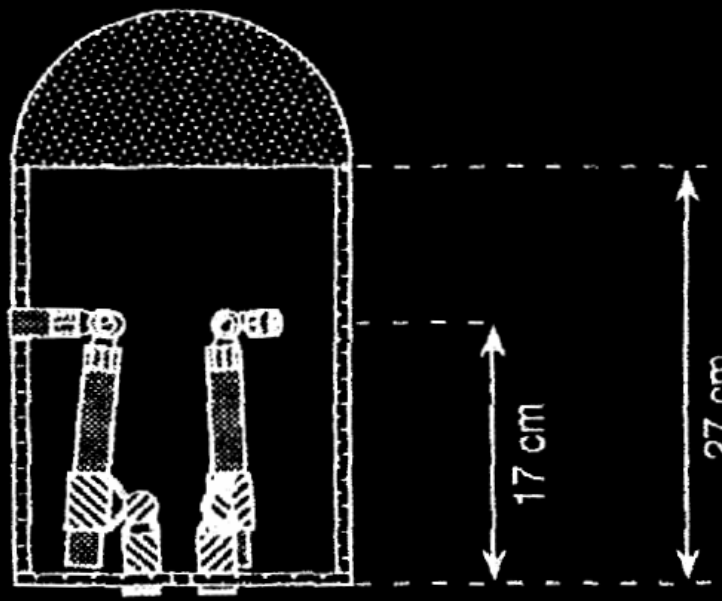


MPT (Matrixed Pressure Triplet)



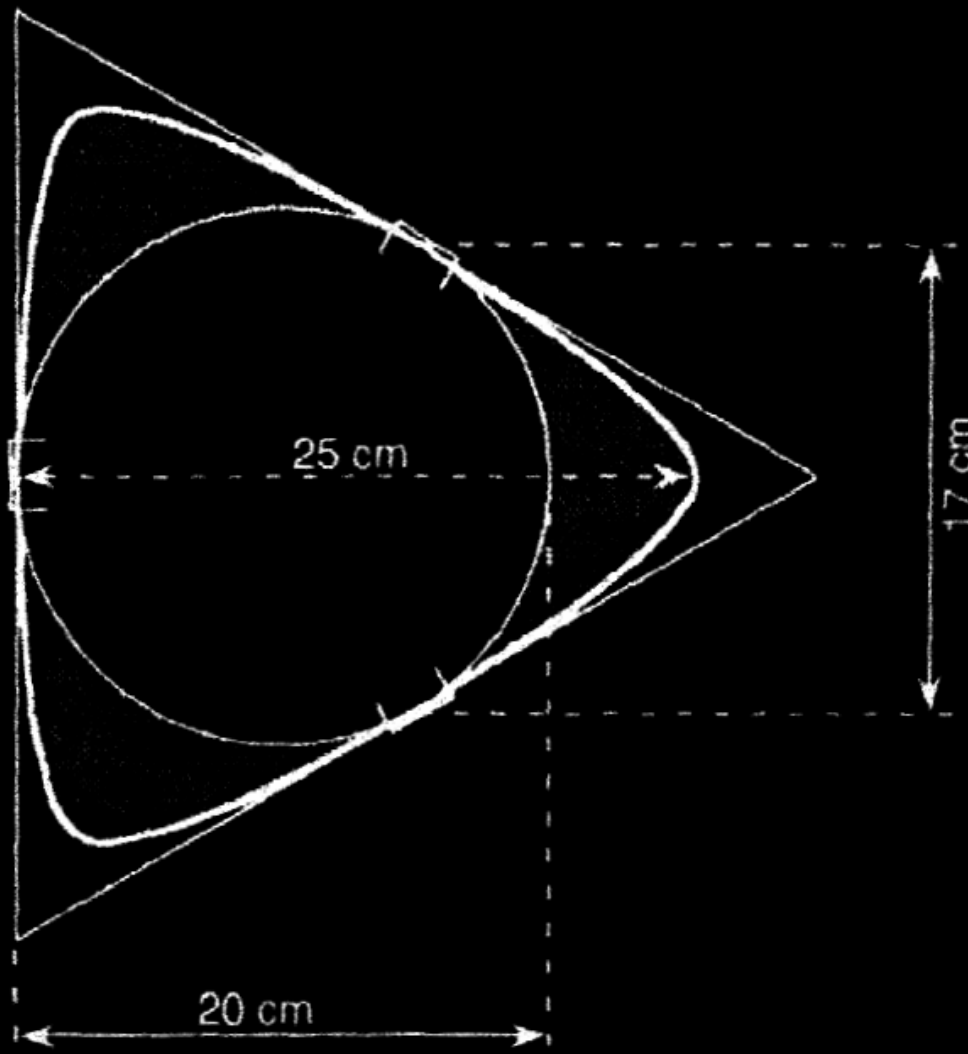
Rys. 4.2. Schemat systemu MPT [8]

MPT (Matrixed Pressure Triplet)

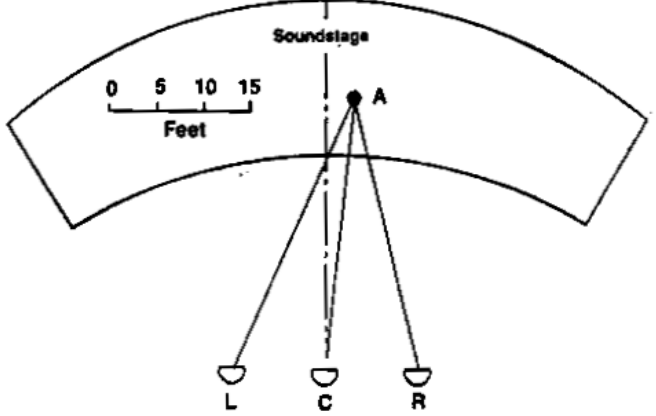


Rys. 4.3. System MPT z drugą wersją obudowy [8]

MPT (Matrixed Pressure Triplet)



Rys. 4.4. Schemat systemu MPT z trzecią wersją obudowy [8]



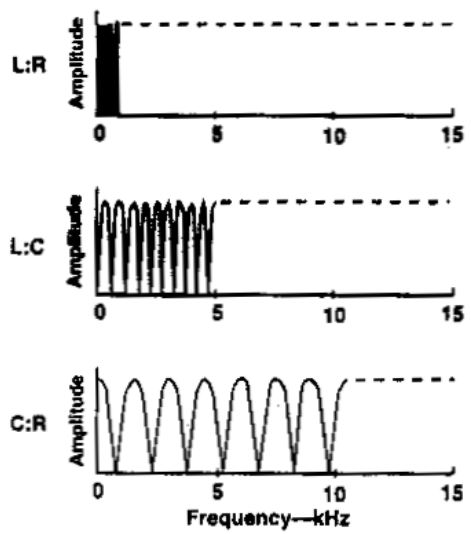
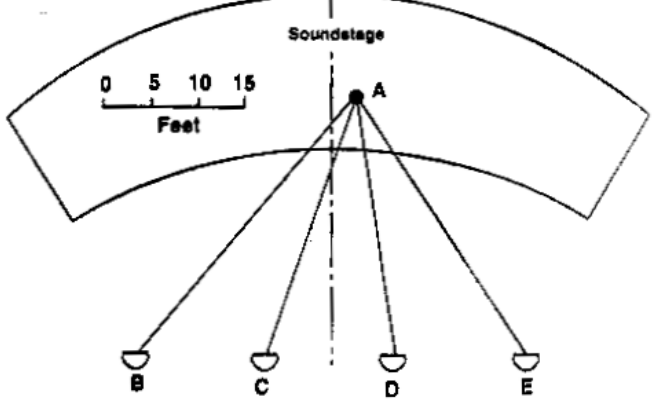


Fig. 9-11



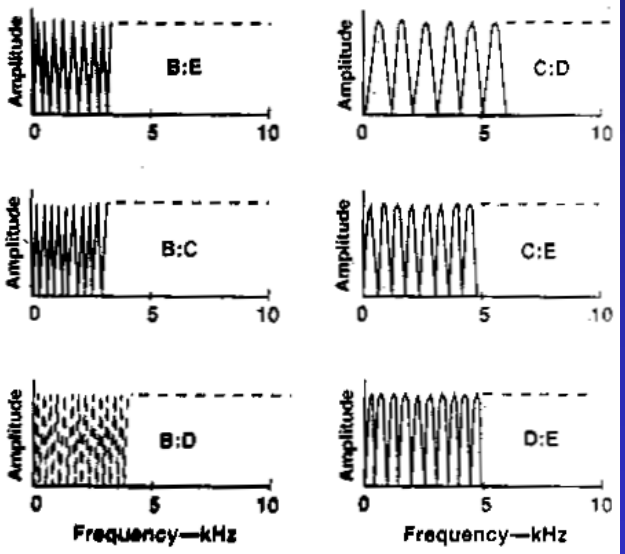


Fig. 9-12

9-11 Comb filter effects occur between any two microphones in a three-microphone spaced array. The three response curves shown will combine into a complex comb filtered response.

9-12 When four spaced microphones are used, six comb filter response curves are generated. These will combine to produce a highly colored frequency response, which can seriously affect the stereo signal. These effects are even more