

Workshop 4, 14:15 - 15:45 (90min), July 24
AES 14th Regional Convention, Tokyo 2009

Introduction to Spatial Audio Conference, Tokyo 2010

What is 'Hibiki'?

「響き」とは何か？

Toshiki HANYU (Nihon Univ.), Akira OMOTO (Kyushu Univ.),
Toru KAMEKAWA (Tokyo Univ. of the Arts),
Kazutsugu UCHIMURA (NHK-MT)

羽入敏樹（日本大学），尾本章（九州大学），
亀川徹（東京藝術大学），内村和嗣（NHK-MT）

Chaired by Masataka NAKAHARA (SONA / ONFUTURE)
座 長：中原雅考（ソナ / オンフューチャー）

Panelists

H

Prof. Dr. Toshiki HANYU (Nihon University)
羽入敏樹 日本大学 短期大学部 建築学科 准教授

O

Prof. Dr. Akira OMOTO (Kyushu University)
尾本章 九州大学 芸術工学院 准教授

K

Prof. Toru KAMEKAWA (Tokyo University of the Arts)
亀川徹 東京藝術大学 音楽学部 音楽環境創造科 准教授

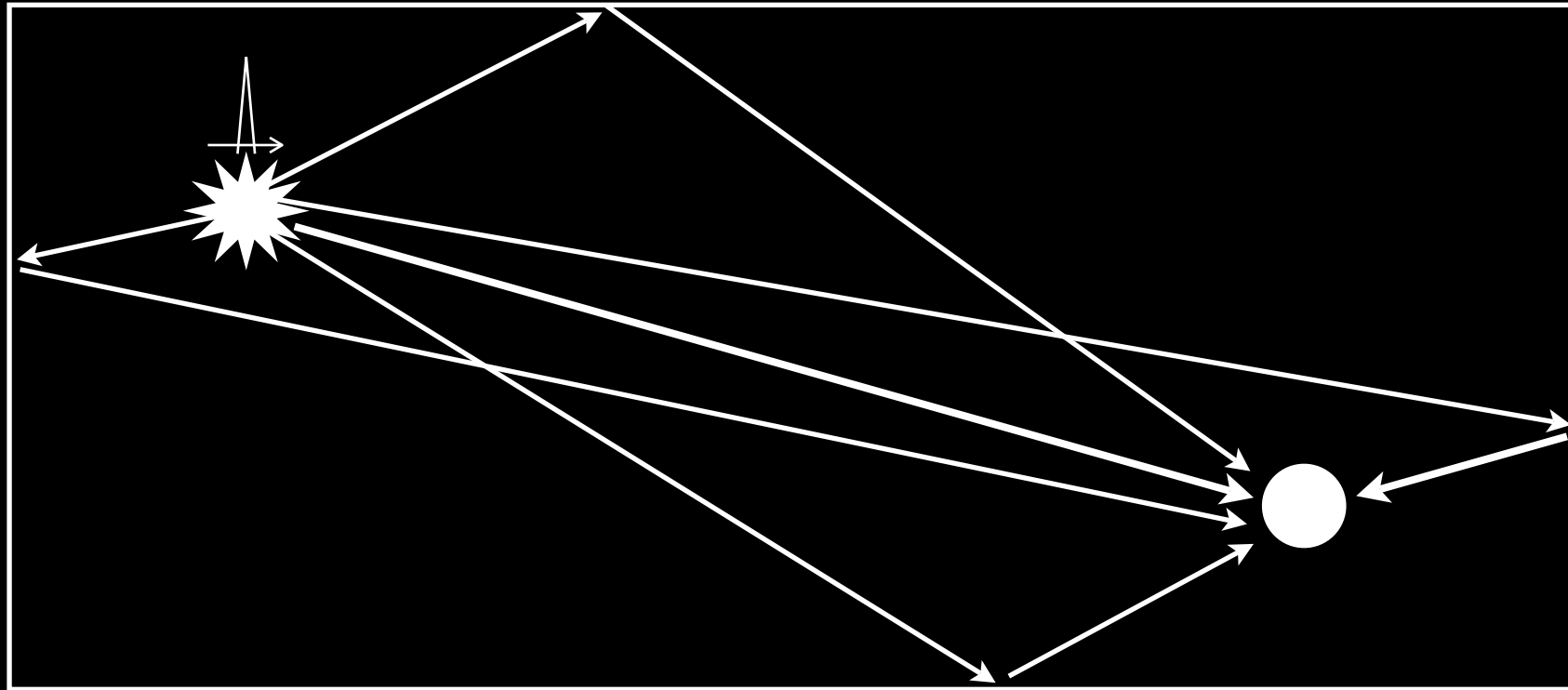
U

Kazutsugu UCHIMURA (Sound Designer/Mixer, NHK-MT)
内村和嗣 NHKメディアテクノロジー チーフ・エンジニア

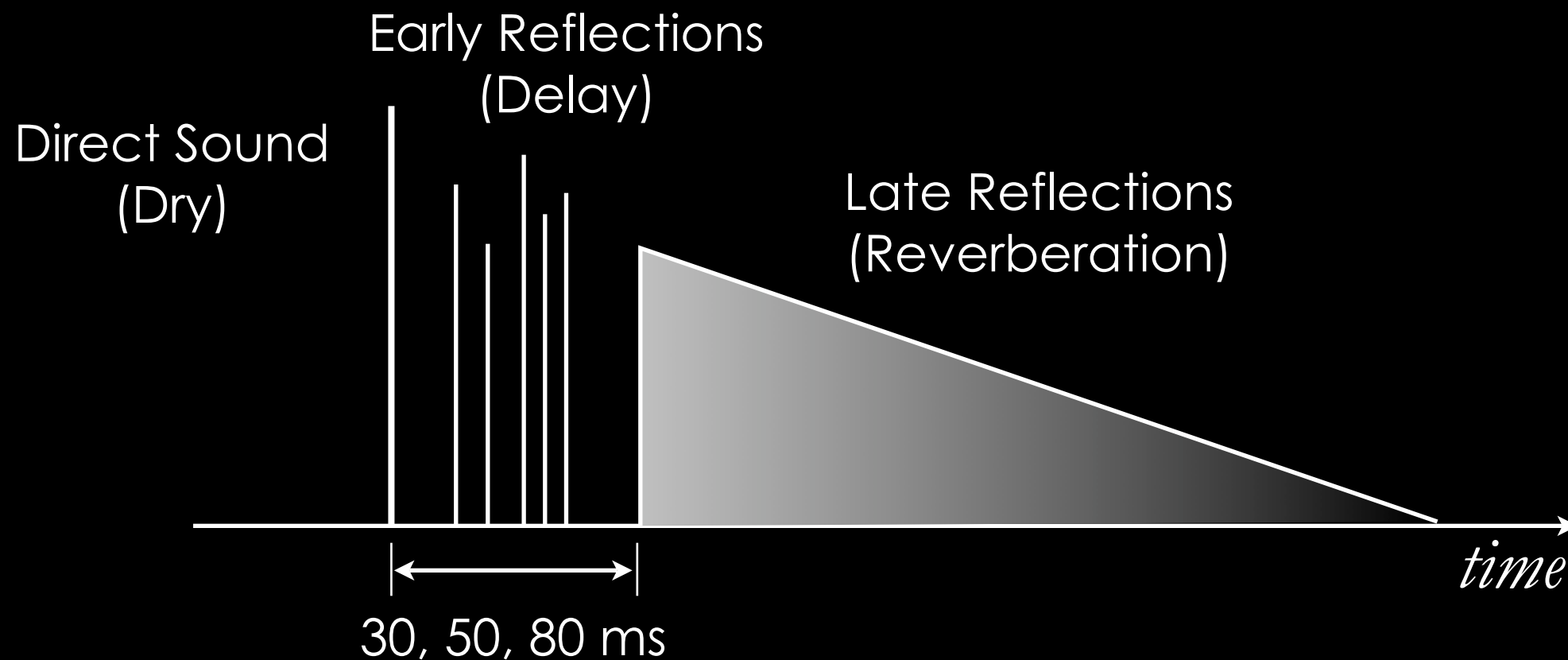
N

Chaired by Dr. Masataka NAKAHARA (SONA / ONFUTURE)
座 長 : 中原雅考 ソナ / オンフューチャー

What is 'Hibiki'? - Introduction -



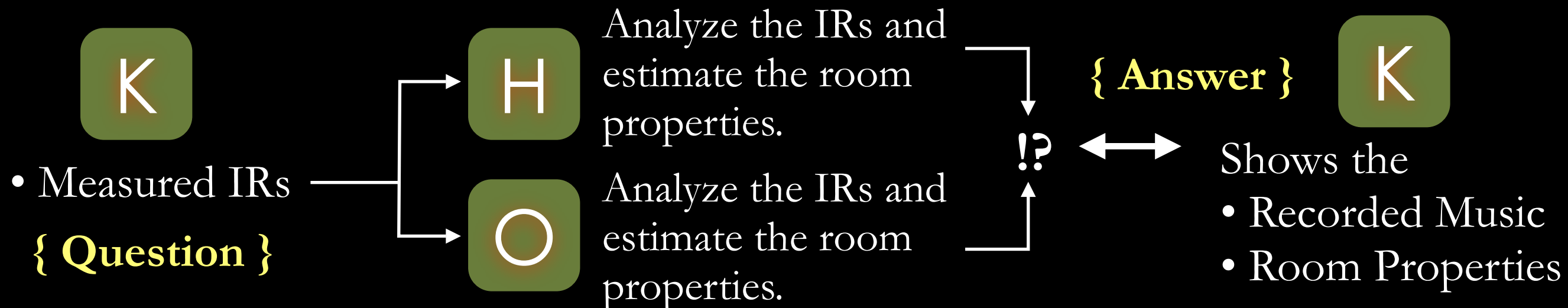
Reflections = Reverberation ?



1. What does IR tell us?

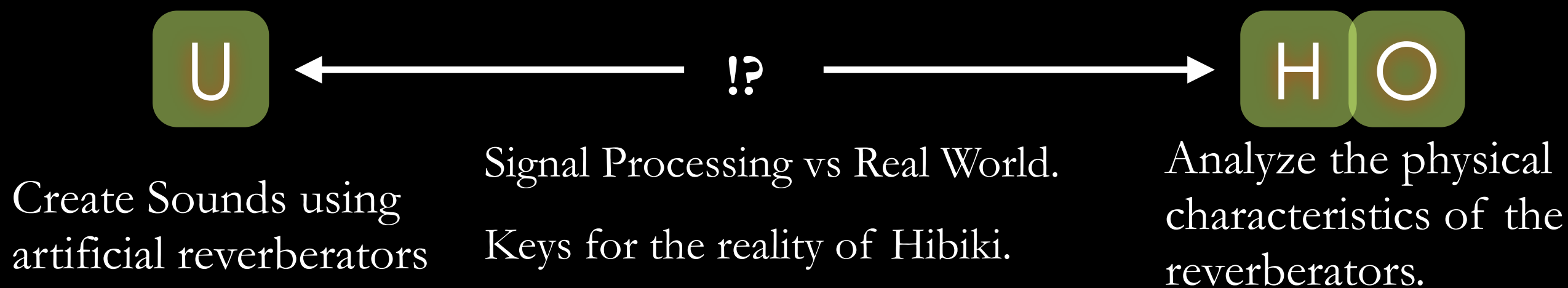
-Leading-edge technologies and their restrictions -

インパルスレスポンスから何が分かるか？ ～最新の科学と限界～



2. What is the key for spacial information?

何が空間らしさを創りだしているか？



3. Discussion



- Acoustical keys of Hibiki
- Reality vs Physical Data
- Directions and Channel Assign ...

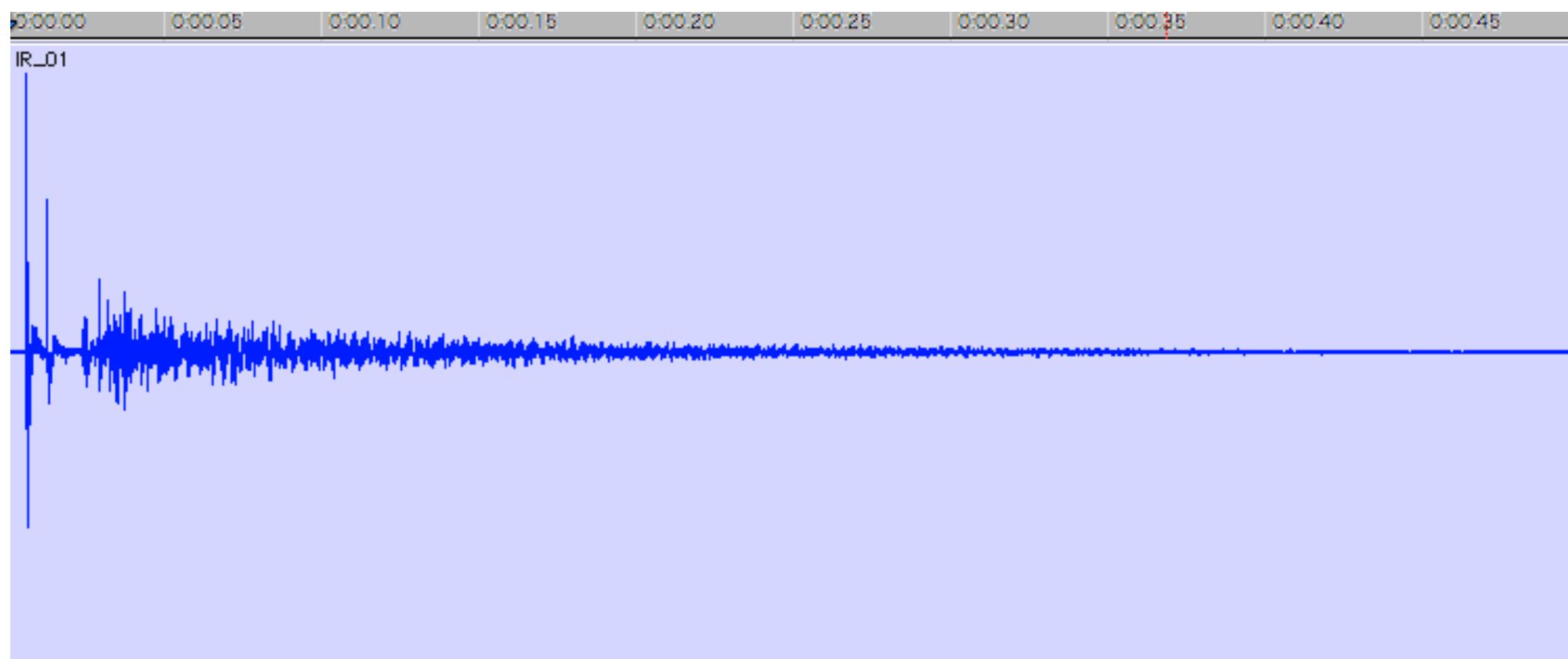
1. What does IR tell us?

[1] Question from Prof. Kamekawa.

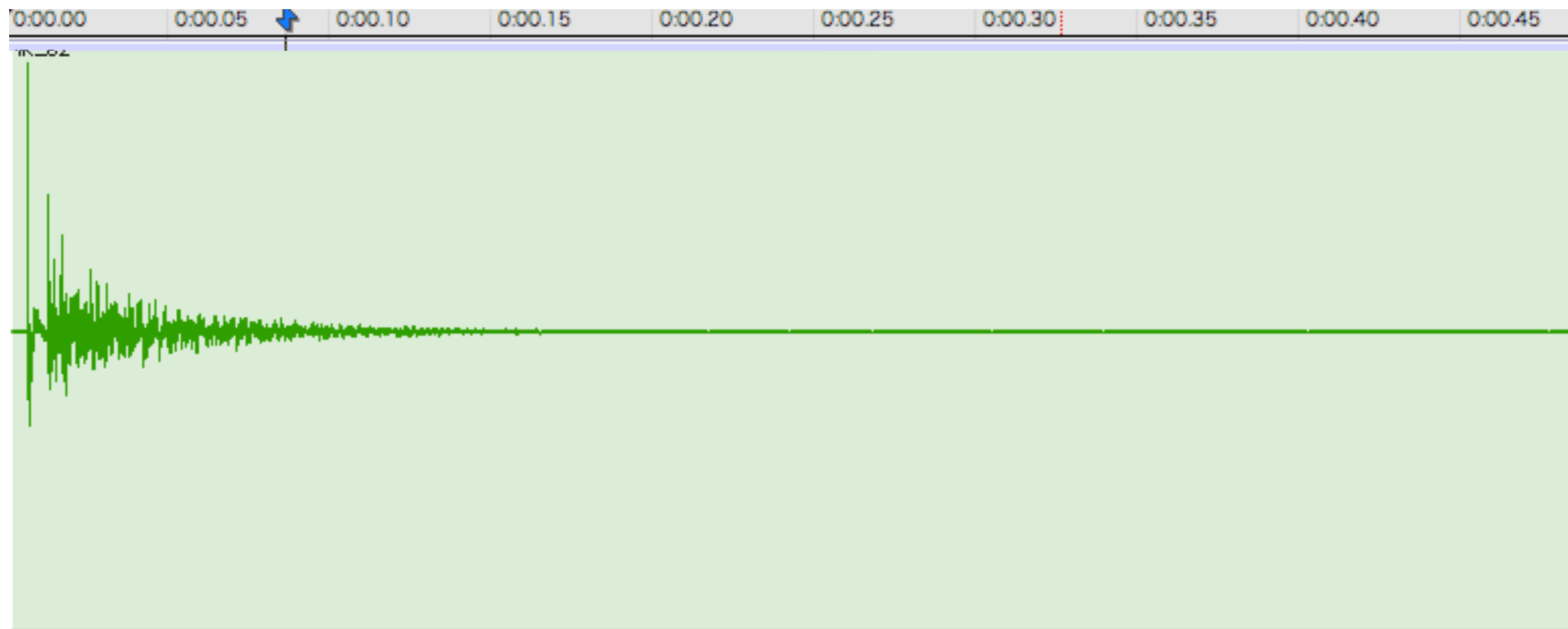
WS4 What is “Hibiki” ?

Toru Kamekawa
Tokyo University of the Arts

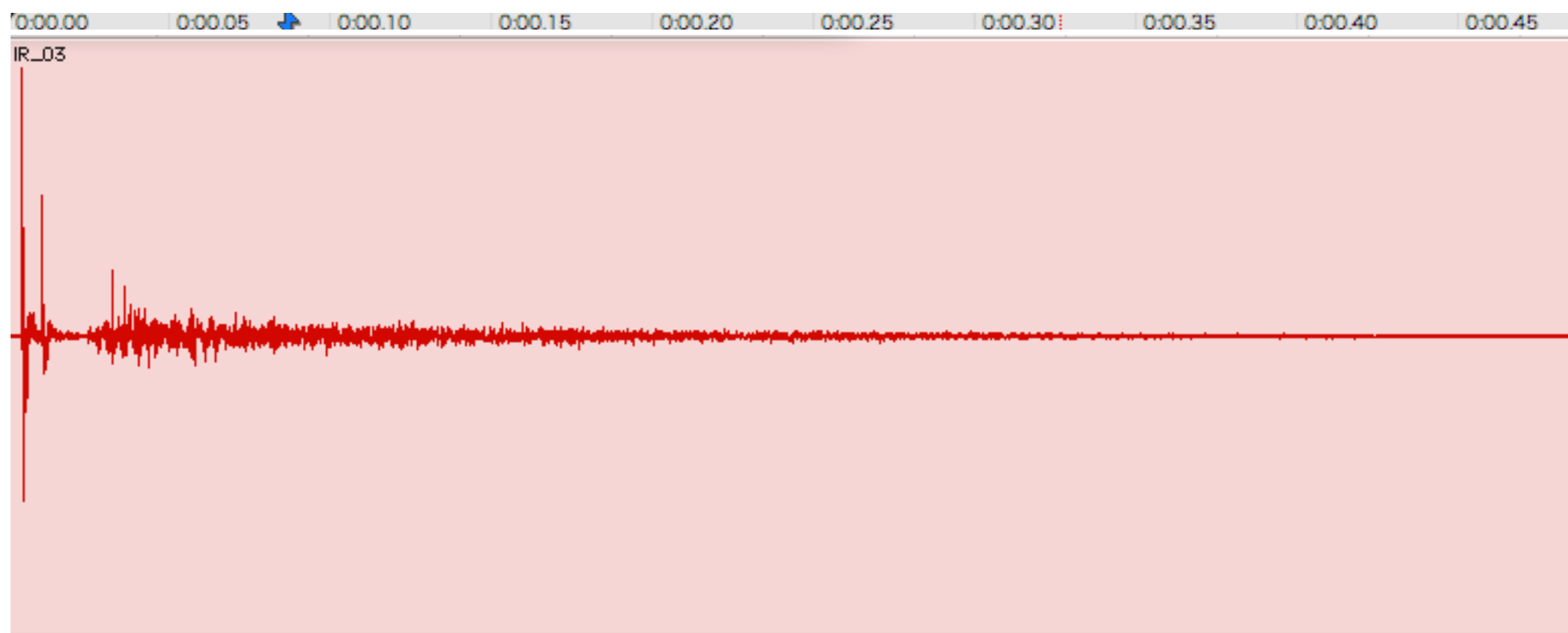
Sample 1



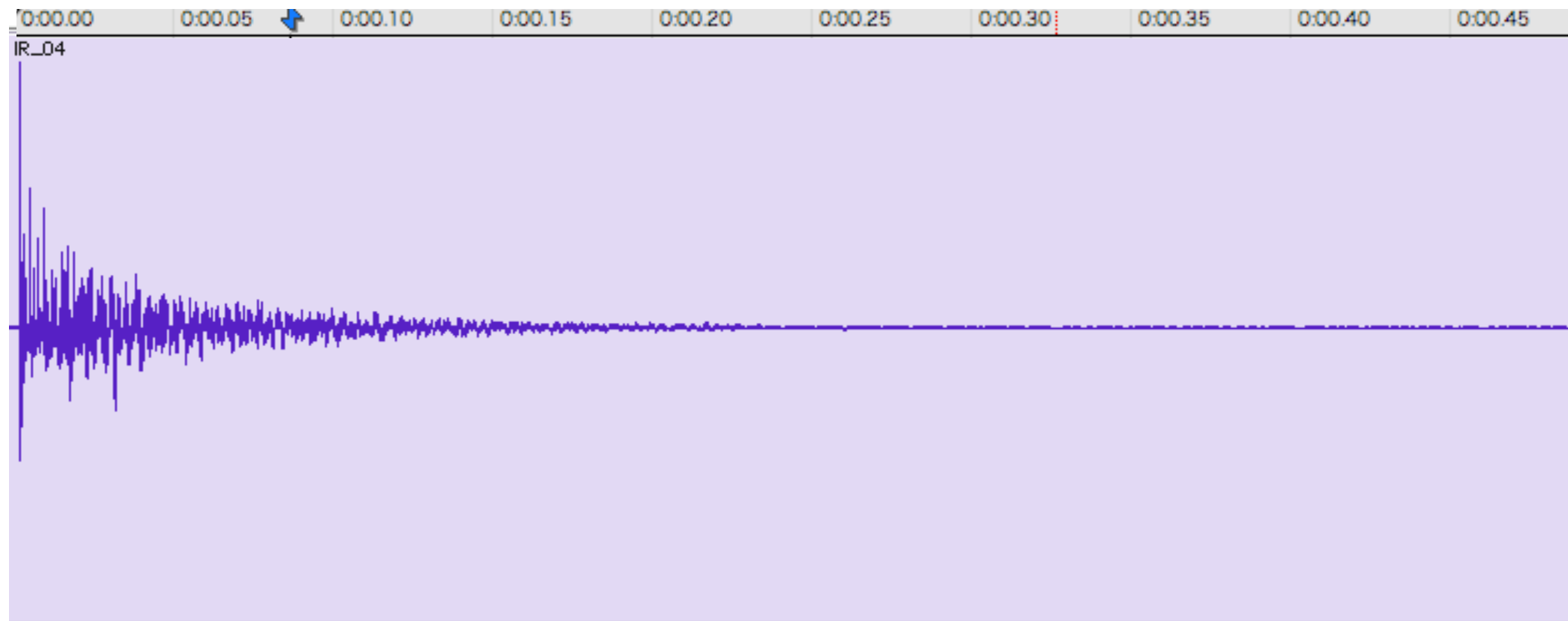
Sample 2



Sample 3



Sample 4



IR Samples

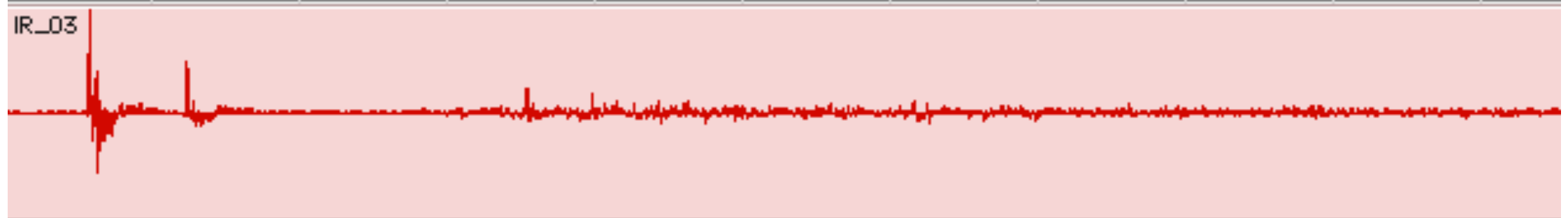
Sample 1



Sample 2



Sample 3



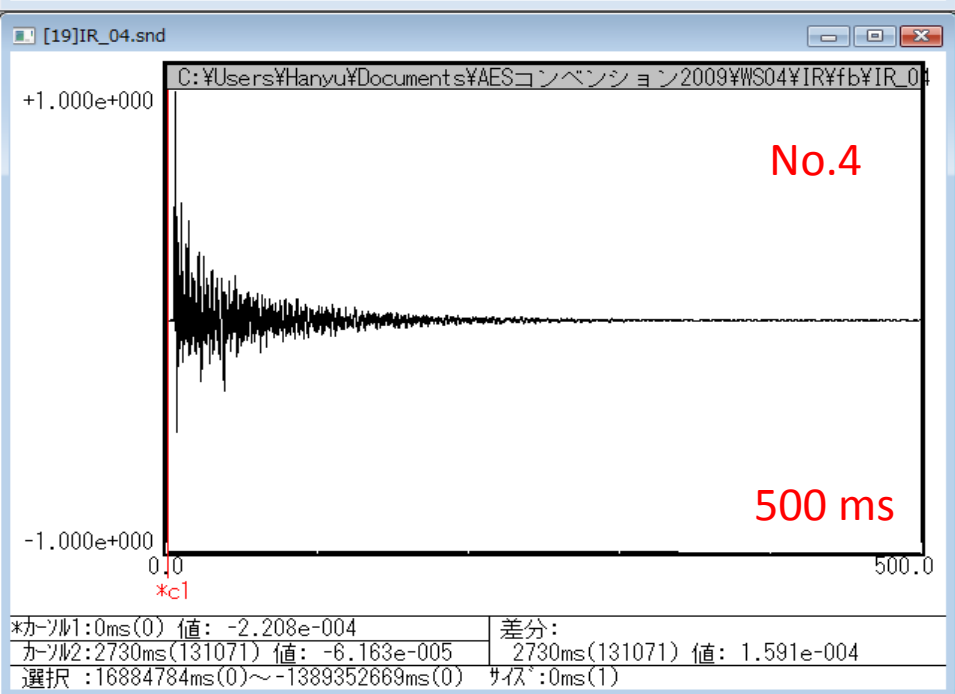
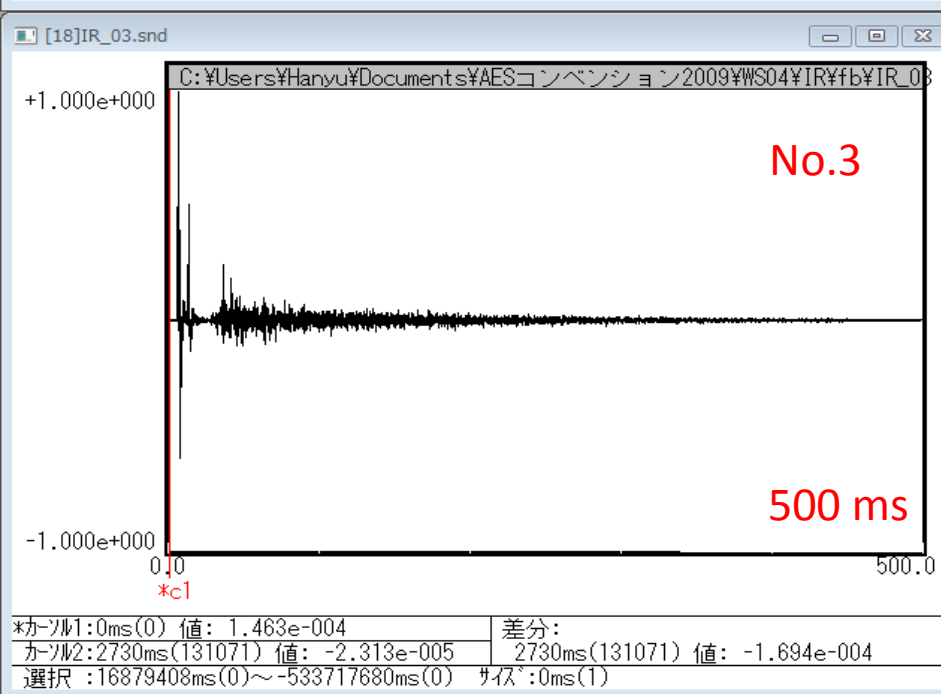
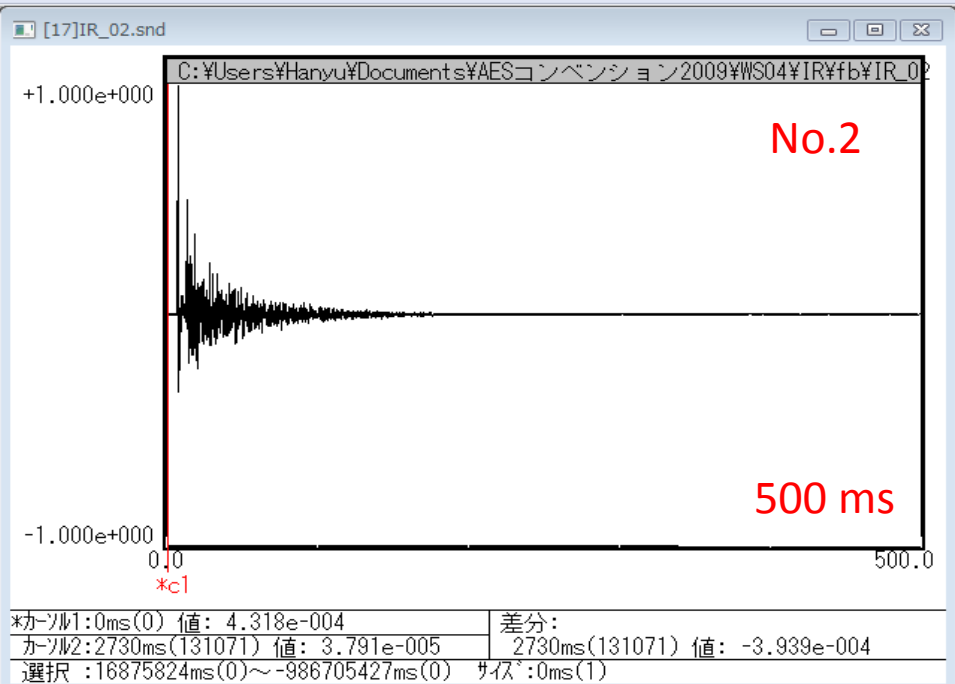
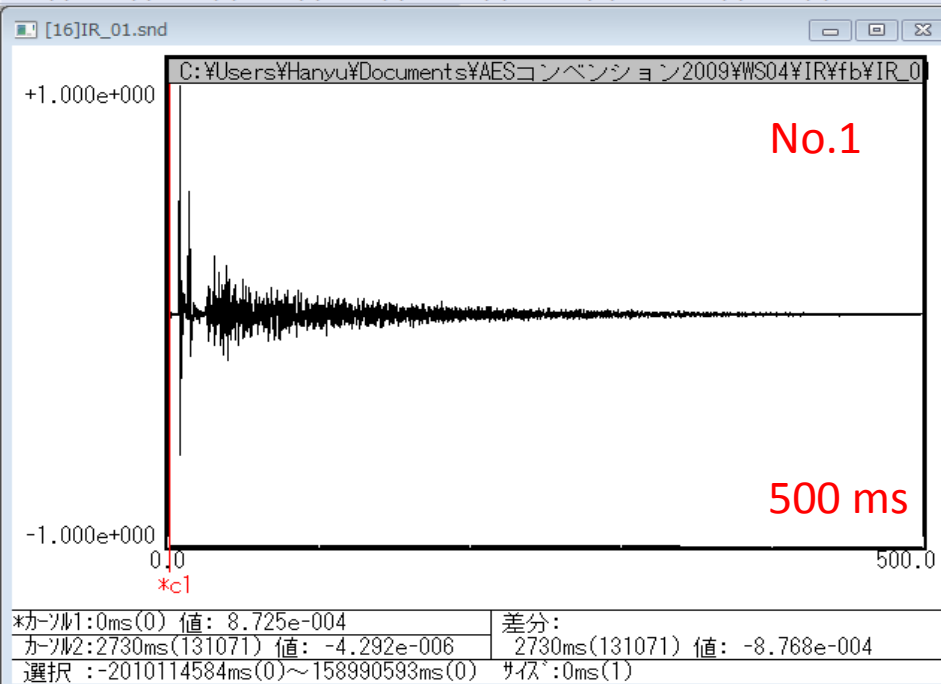
Sample 4



Can you imagine the space from the IR samples ?

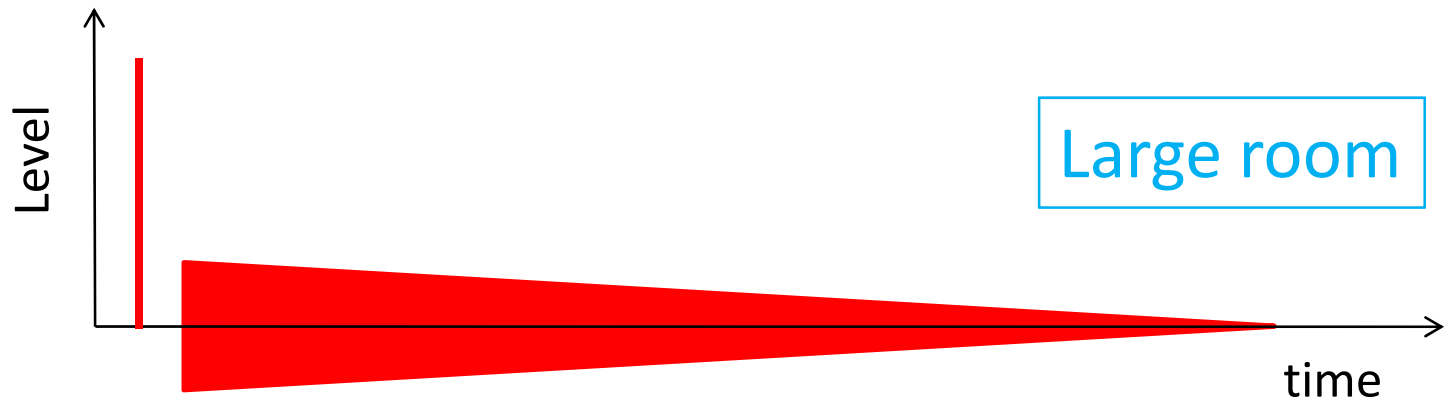
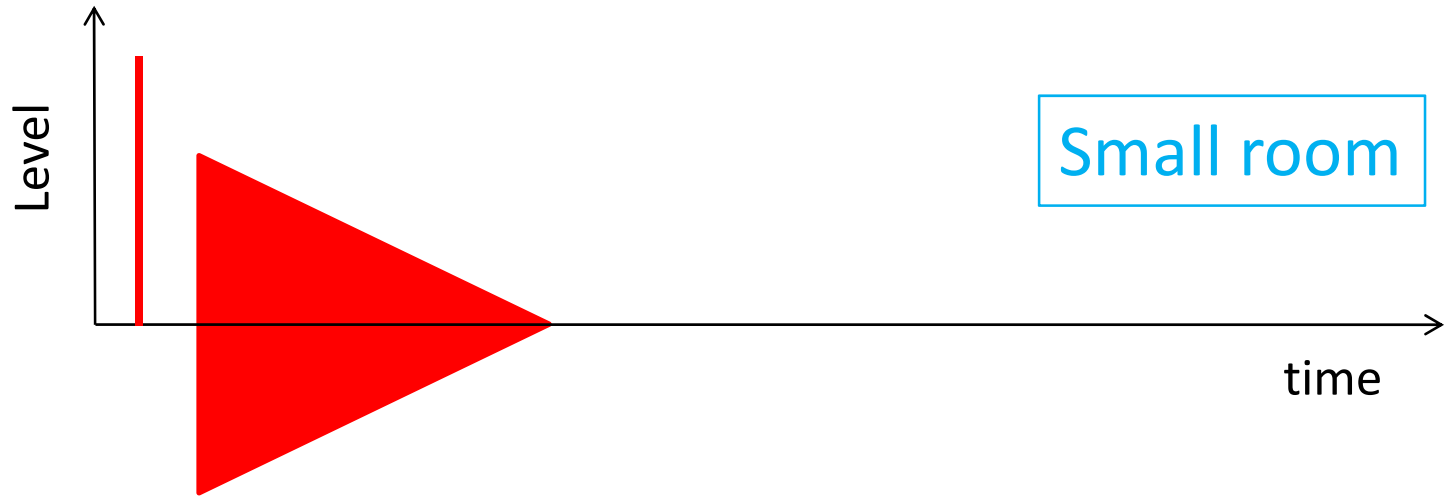
1. What does IR tell us?

[2] Answer from Prof. Hanyu.



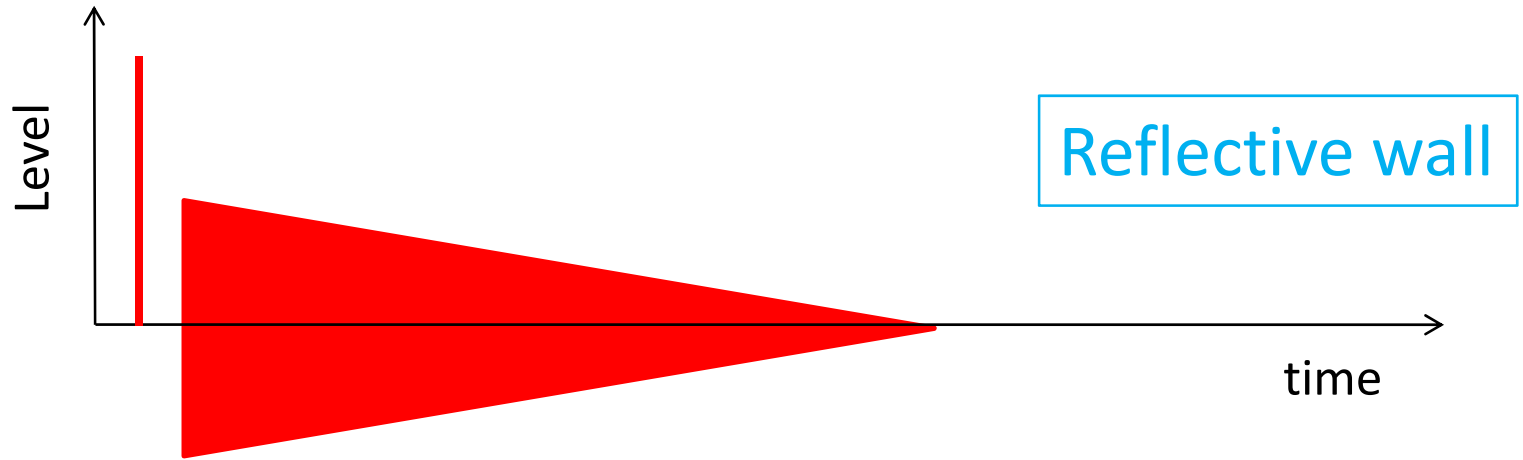
Outline of impulse response

<Influence of room size>



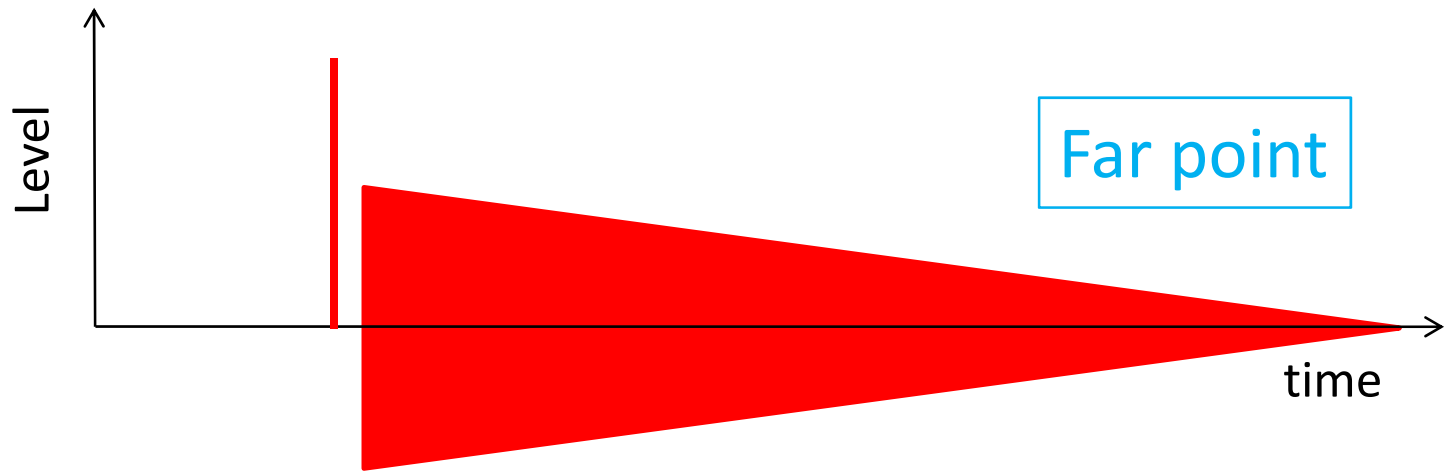
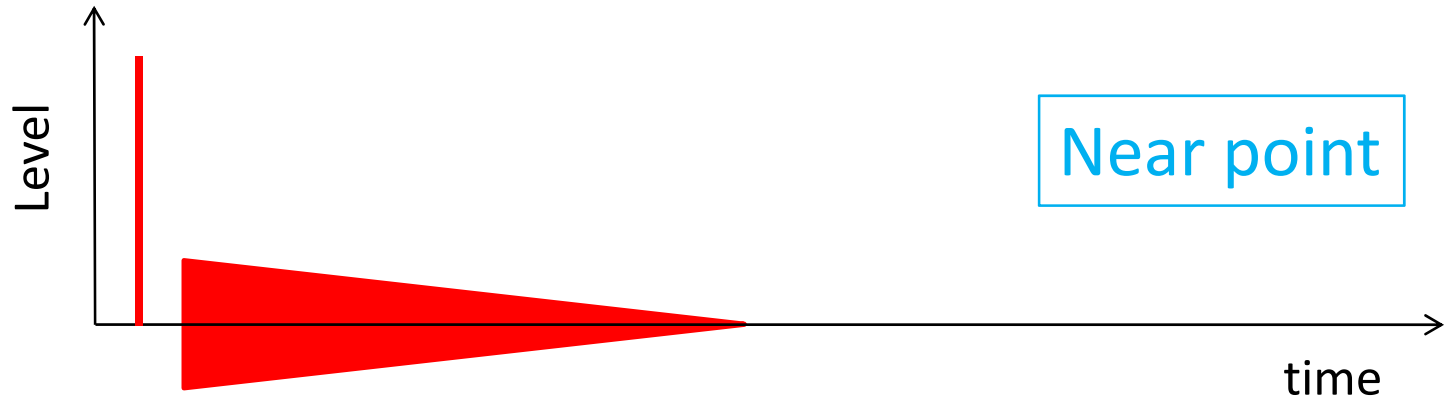
Outline of impulse response

<Influence of wall material>

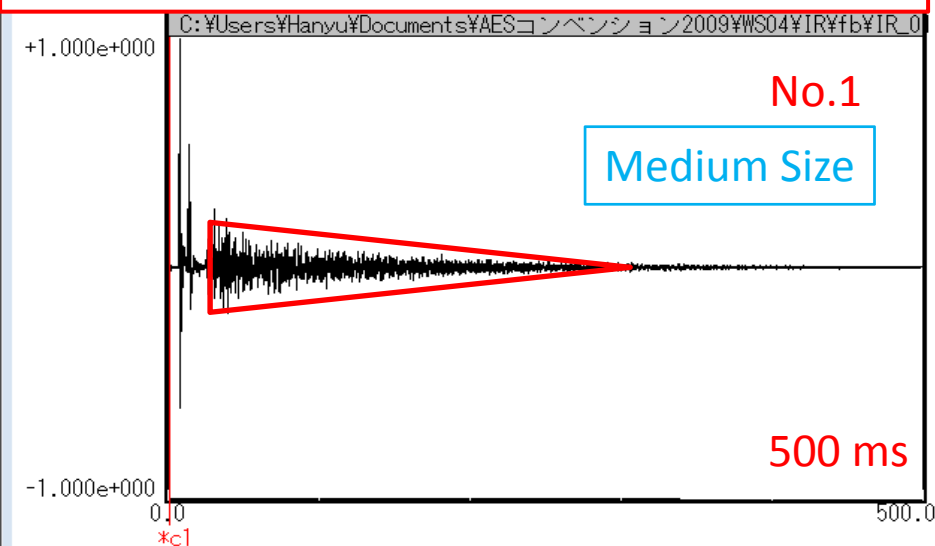


Outline of impulse response

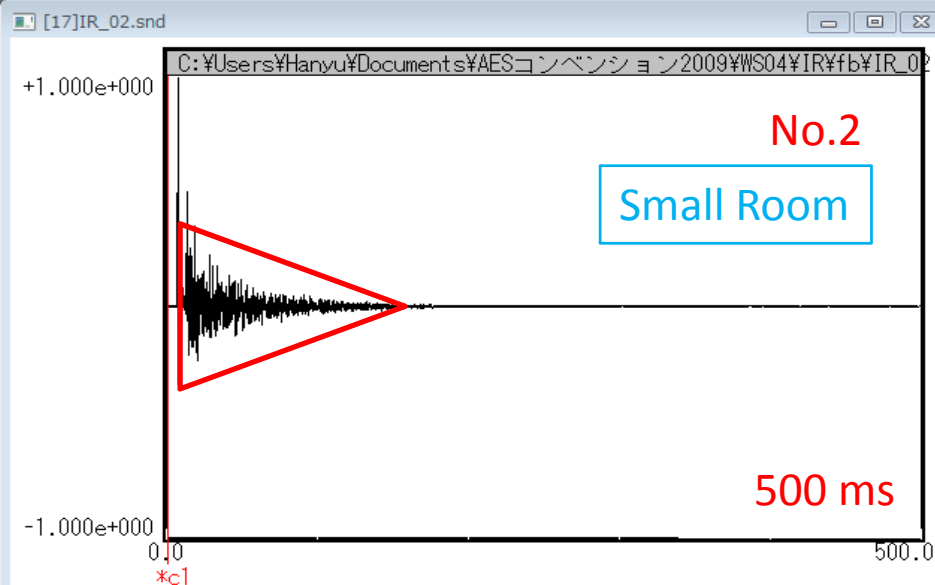
<Influence of receiver distance>



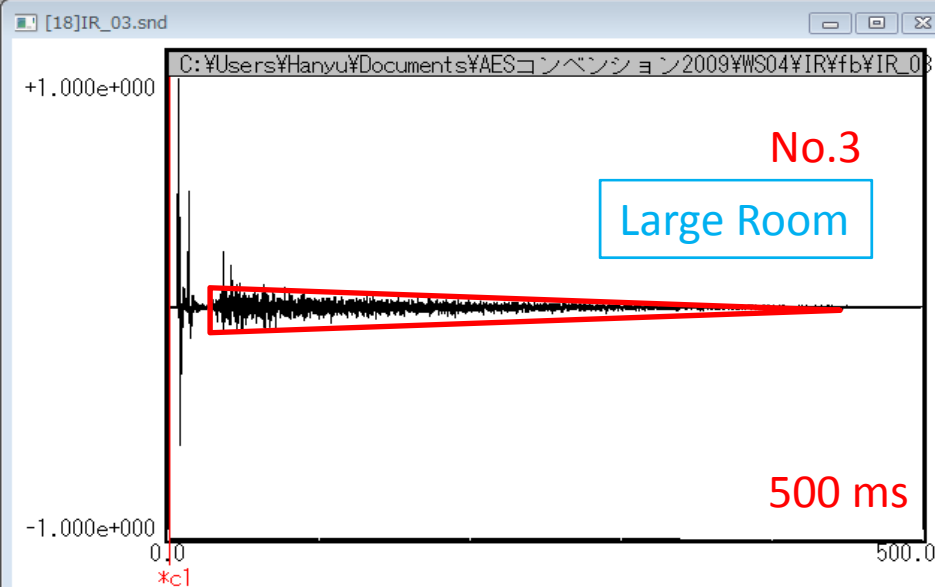
Outline of impulse responses



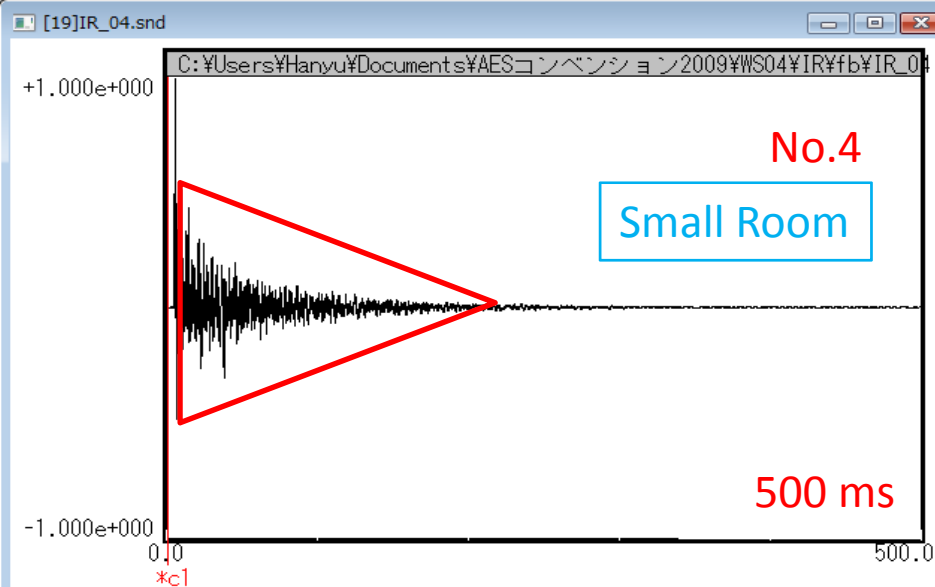
*カーソル1:0ms(0) 値: 8.725e-004
カーソル2:2730ms(131071) 値: -4.292e-006
差分: 2730ms(131071) 値: -8.768e-004
選択: -2010114584ms(0)~158990593ms(0) サイズ:0ms(1)



*カーソル1:0ms(0) 値: 4.318e-004
カーソル2:2730ms(131071) 値: 3.791e-005
差分: 2730ms(131071) 値: -3.939e-004
選択: 16875824ms(0)~-986705427ms(0) サイズ:0ms(1)

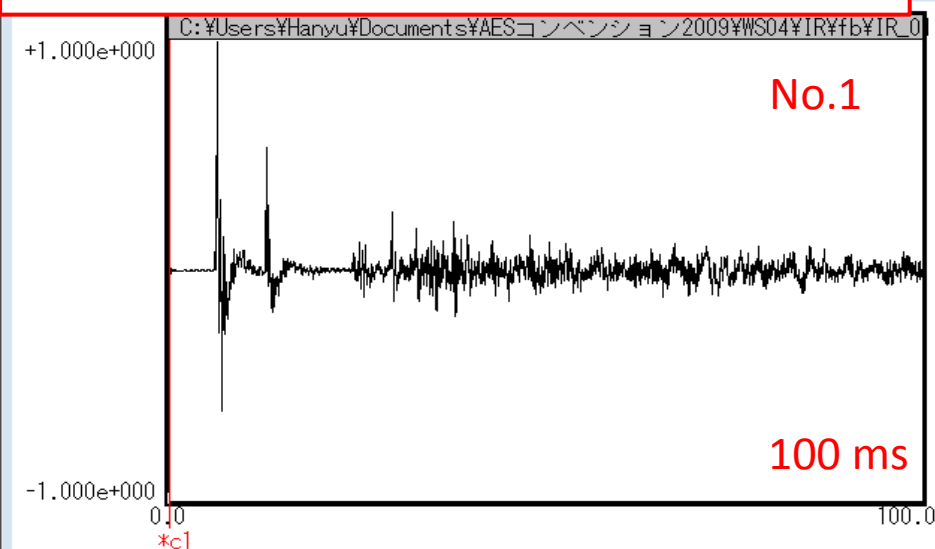


*カーソル1:0ms(0) 値: 1.463e-004
カーソル2:2730ms(131071) 値: -2.313e-005
差分: 2730ms(131071) 値: -1.694e-004
選択: 16879408ms(0)~-533717680ms(0) サイズ:0ms(1)

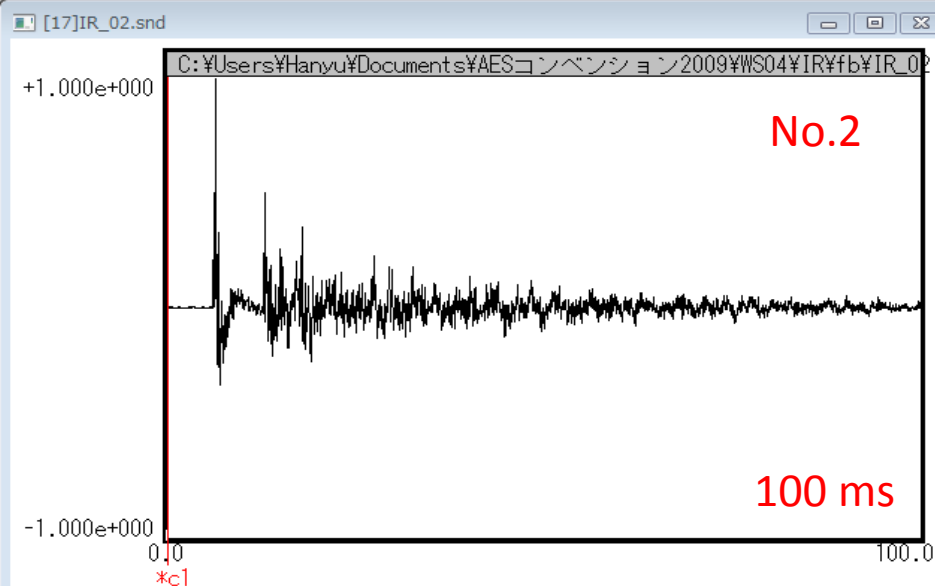


*カーソル1:0ms(0) 値: -2.208e-004
カーソル2:2730ms(131071) 値: -6.163e-005
差分: 2730ms(131071) 値: 1.591e-004
選択: 16884784ms(0)~-1389352669ms(0) サイズ:0ms(1)

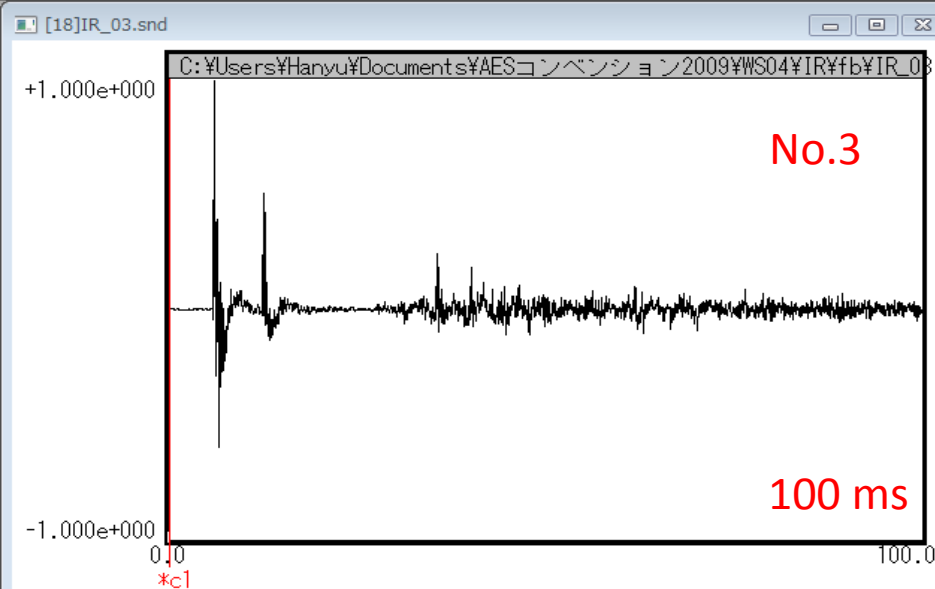
Details of impulse responses



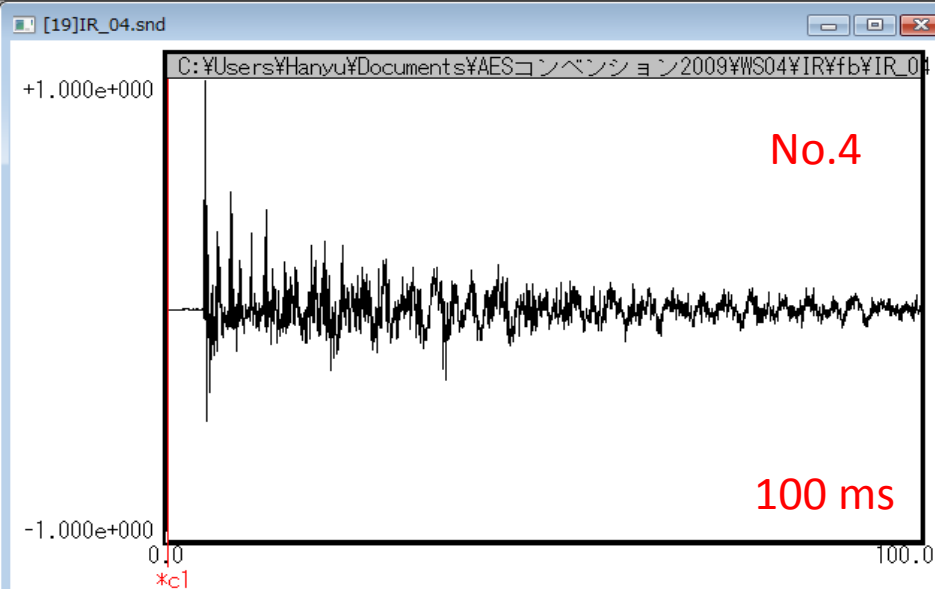
*カーソル1:0ms(0) 値: 8.725e-004	差分:
*カーソル2:2730ms(131071) 値: -4.292e-006	2730ms(131071) 値: -8.768e-004
選択: -2010114584ms(0)~158990593ms(0) サイズ: 0ms(1)	



*カーソル1:0ms(0) 値: 4.318e-004	差分:
*カーソル2:2730ms(131071) 値: 3.791e-005	2730ms(131071) 値: -3.939e-004
選択: 16875824ms(0)~986705427ms(0) サイズ: 0ms(1)	

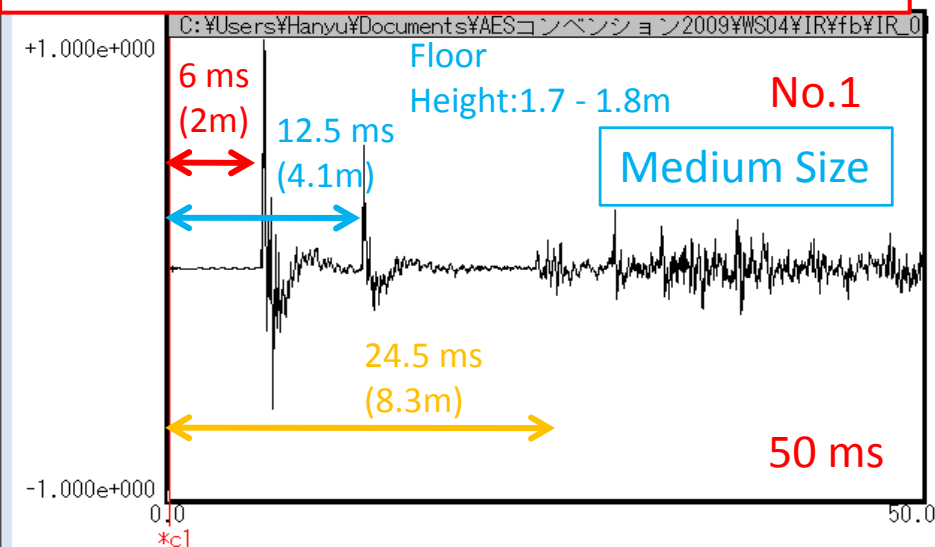


*カーソル1:0ms(0) 値: 1.463e-004	差分:
*カーソル2:2730ms(131071) 値: -2.313e-005	2730ms(131071) 値: -1.694e-004
選択: 16879408ms(0)~533717680ms(0) サイズ: 0ms(1)	

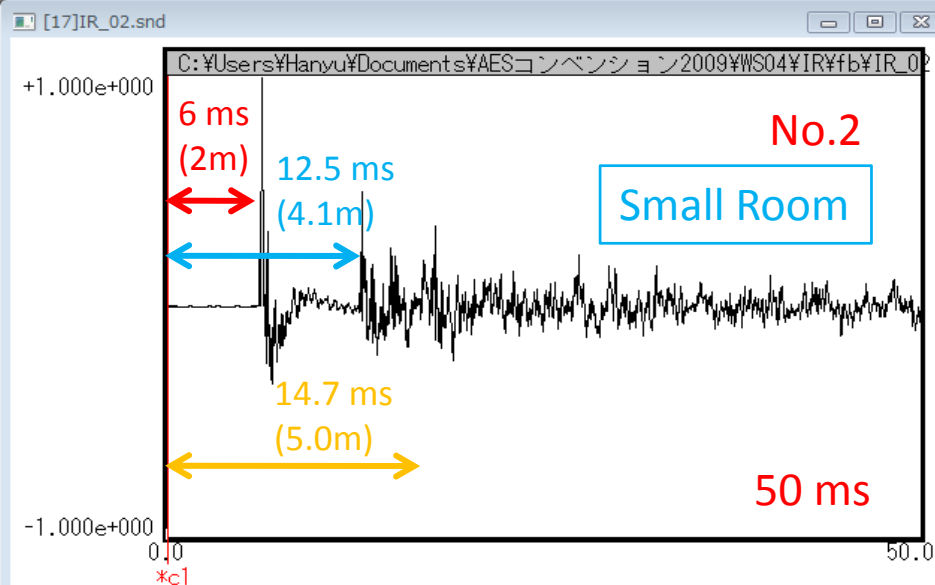


*カーソル1:0ms(0) 値: -2.208e-004	差分:
*カーソル2:2730ms(131071) 値: -6.163e-005	2730ms(131071) 値: 1.591e-004
選択: 16884784ms(0)~1389352669ms(0) サイズ: 0ms(1)	

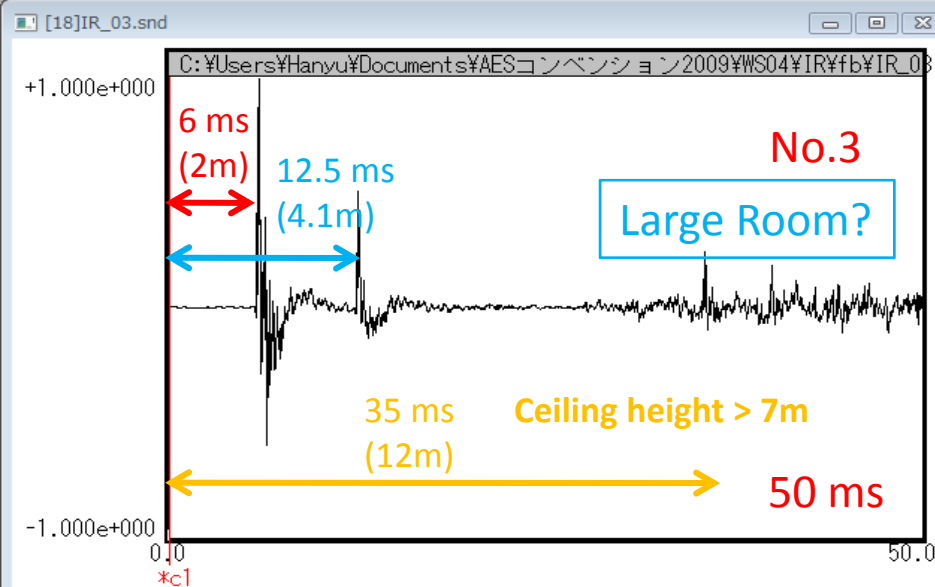
Details of impulse responses



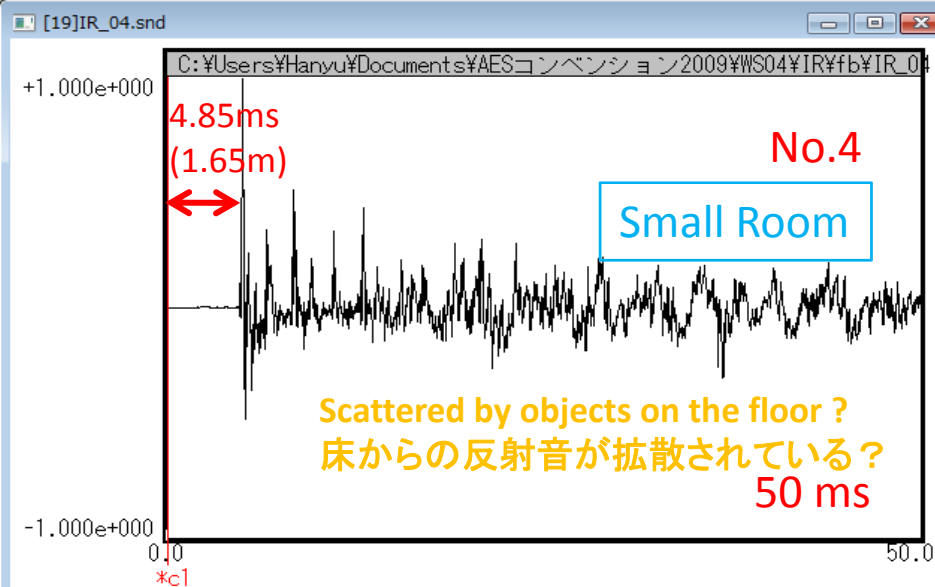
*カーソル1:0ms(0) 値: 8.725e-004	差分:
カーソル2:2730ms(131071) 値: -4.292e-006	2730ms(131071) 値: -8.768e-004
選択: -2010114584ms(0)~158990593ms(0) サイズ: 0ms(1)	



*カーソル1:0ms(0) 値: 4.318e-004	差分:
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選択: 16875824ms(0)~986705427ms(0) サイズ: 0ms(1)	

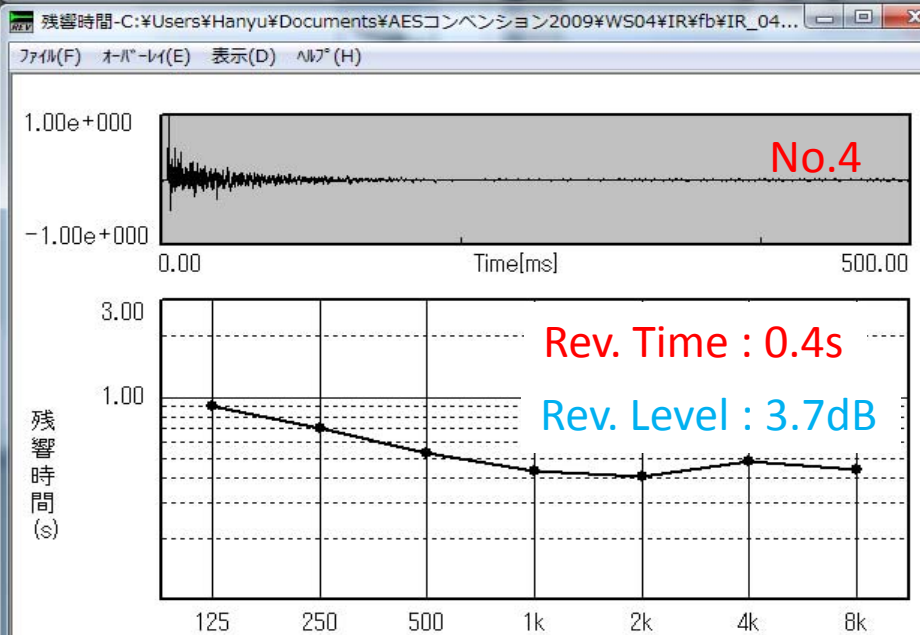
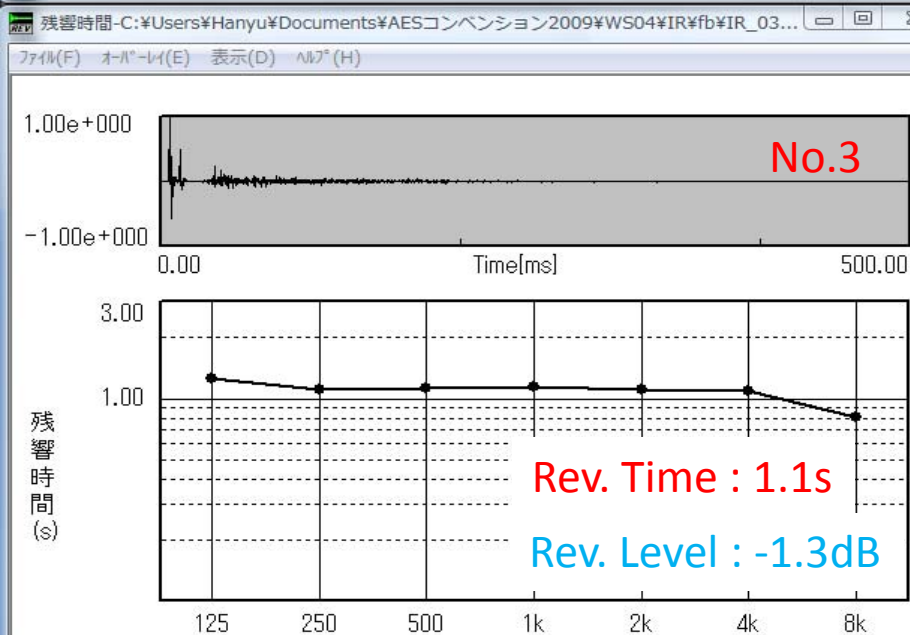
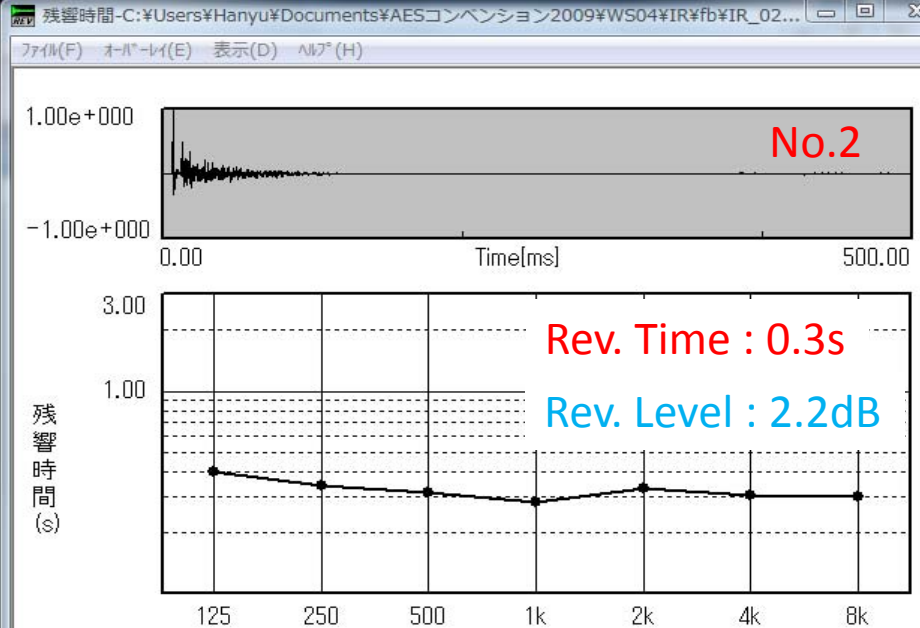
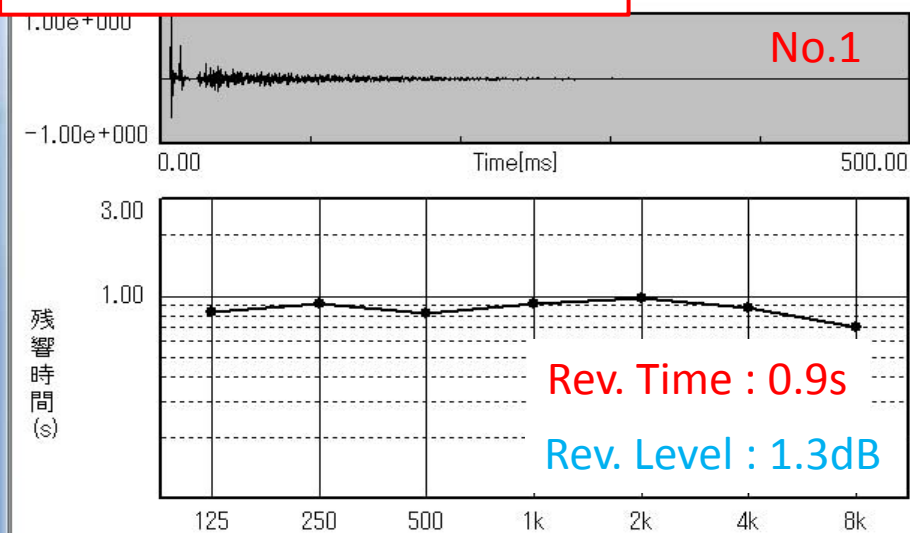


*カーソル1:0ms(0) 値: 1.463e-004	差分:
カーソル2:2730ms(131071) 値: -2.313e-005	2730ms(131071) 値: -1.694e-004
選択: 16879408ms(0)~533717680ms(0) サイズ: 0ms(1)	

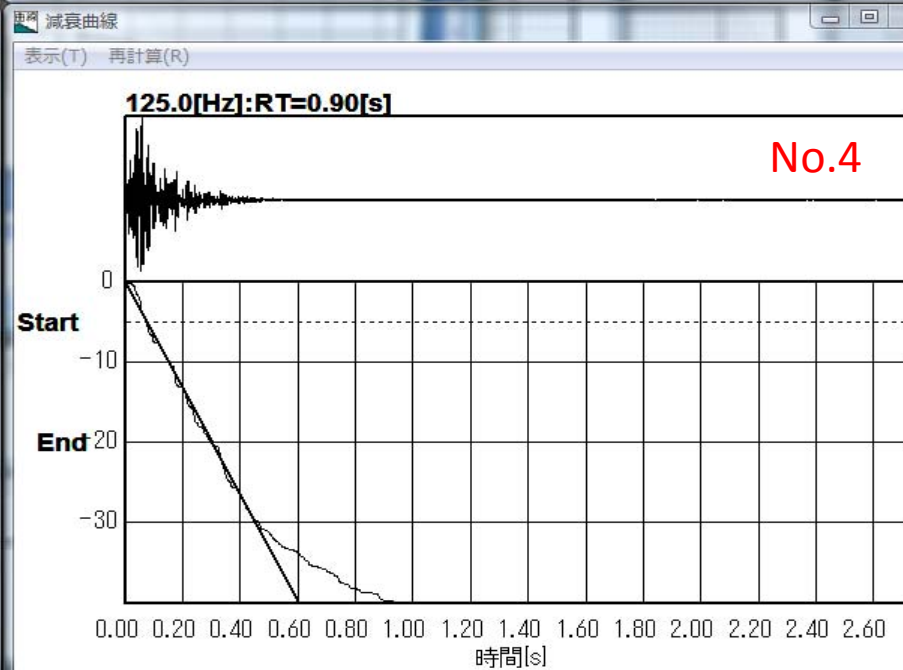
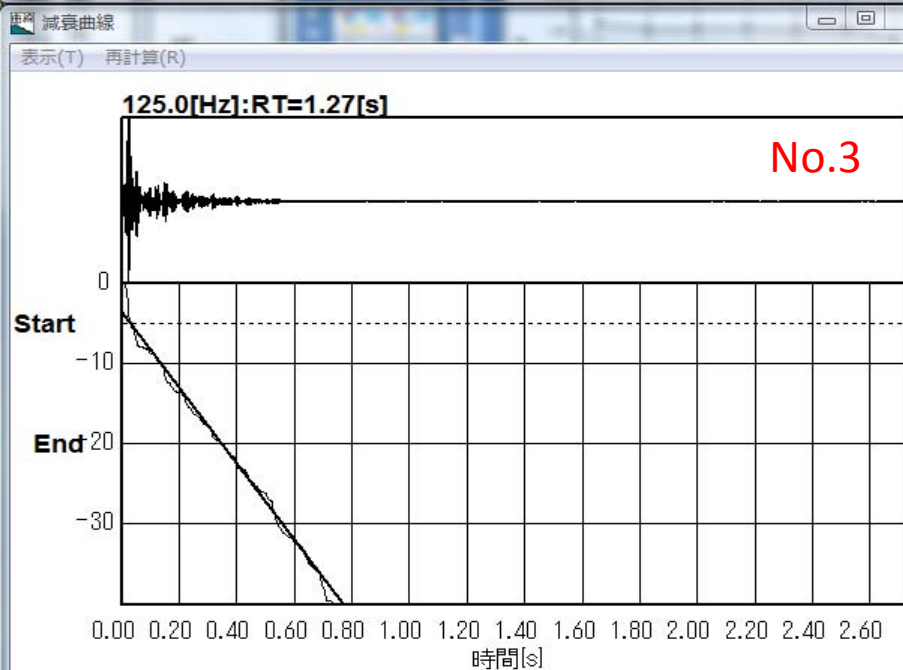
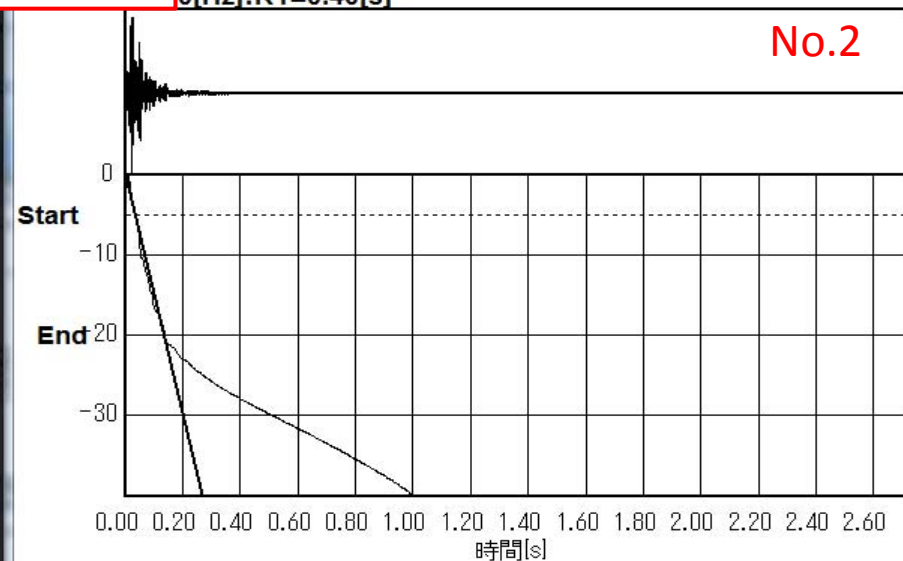
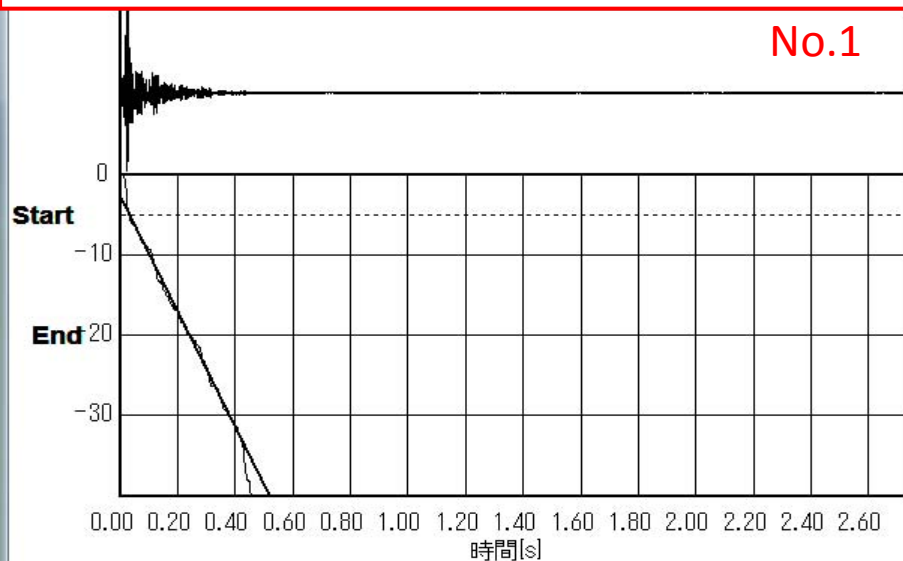


*カーソル1:0ms(0) 値: -2.208e-004	差分:
カーソル2:2730ms(131071) 値: -6.163e-005	2730ms(131071) 値: 1.591e-004
選択: 16884784ms(0)~1389352669ms(0) サイズ: 0ms(1)	

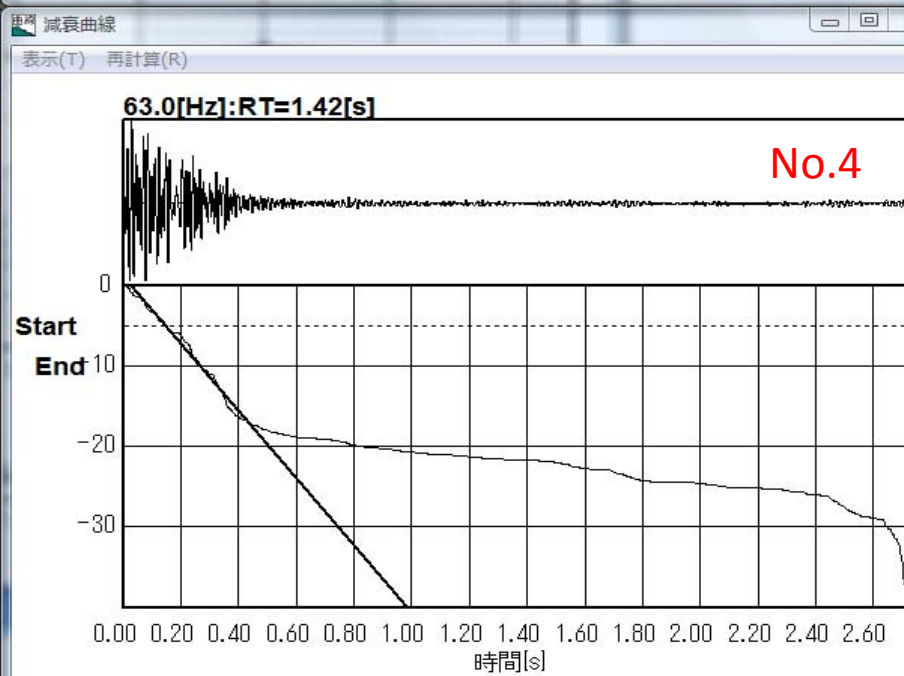
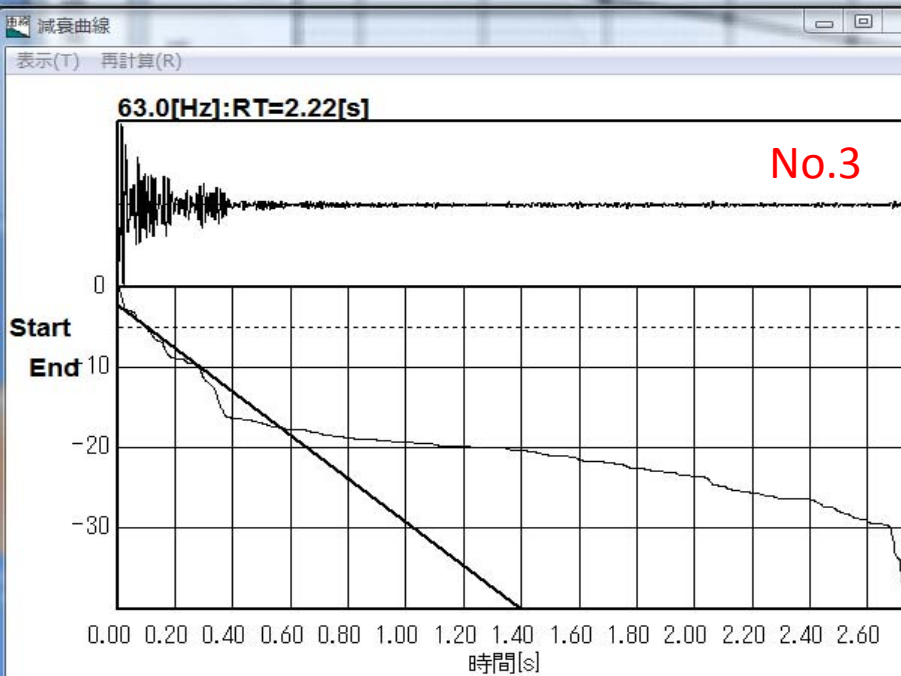
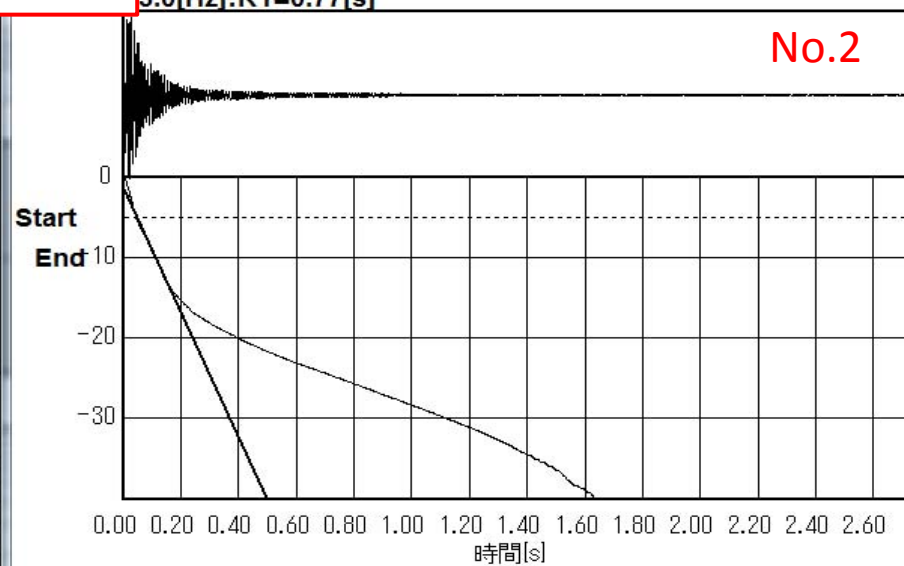
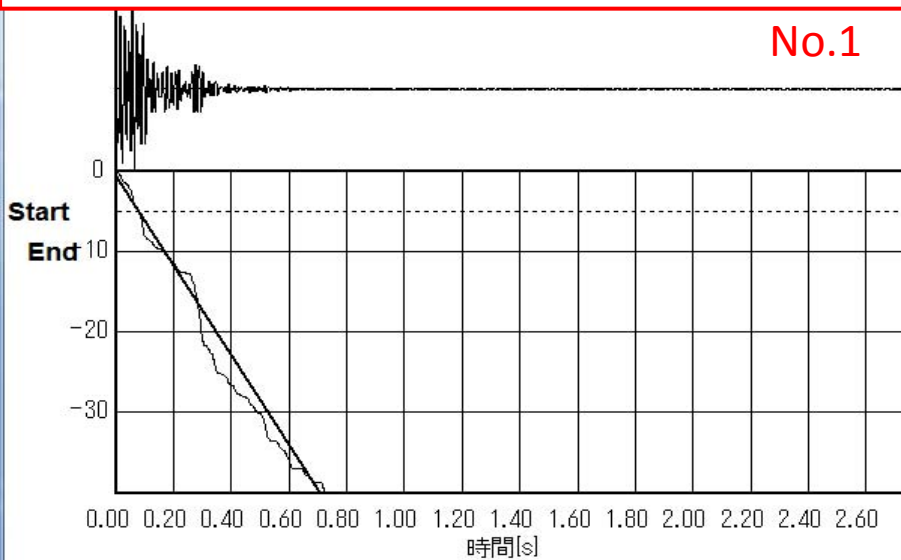
Reverberation time



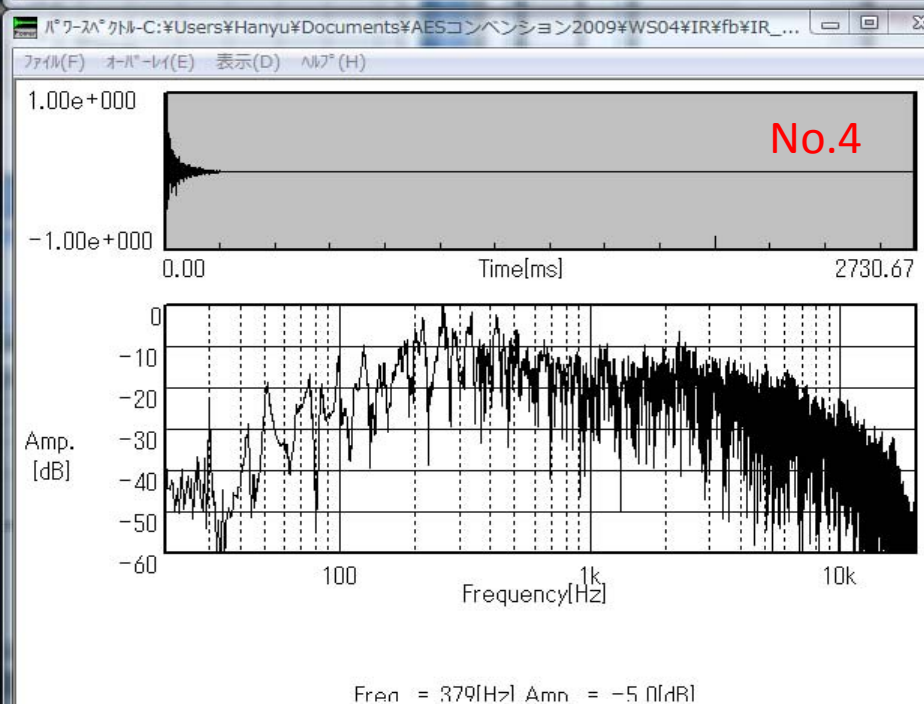
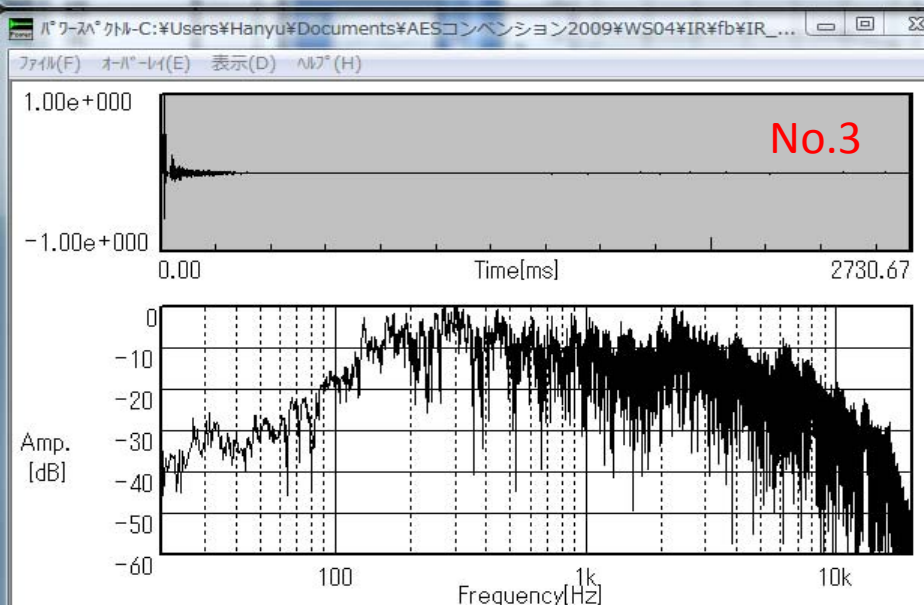
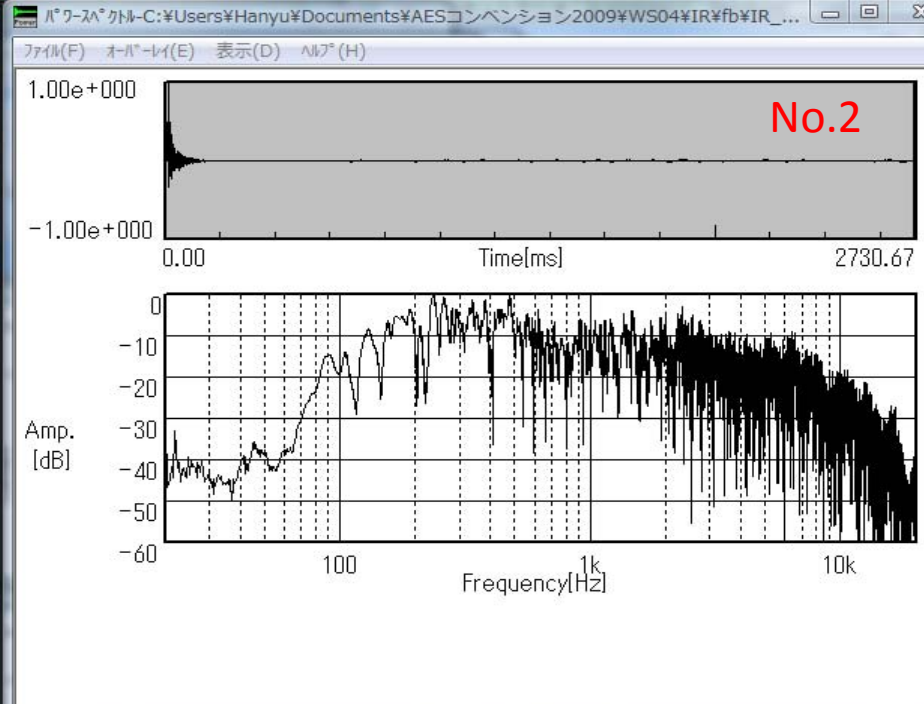
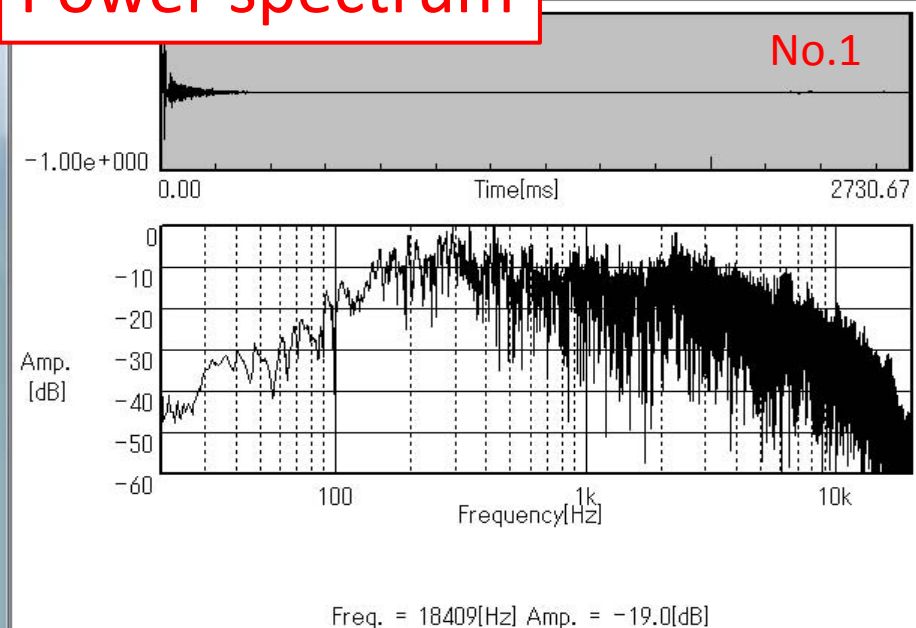
Decay curves at 125Hz octave band



Decay curves at 63Hz octave band



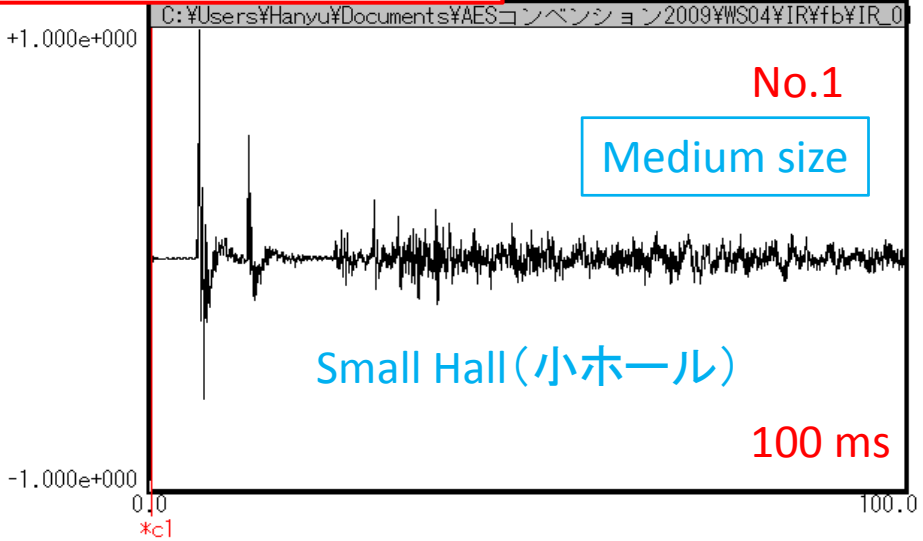
Power spectrum



My answers are

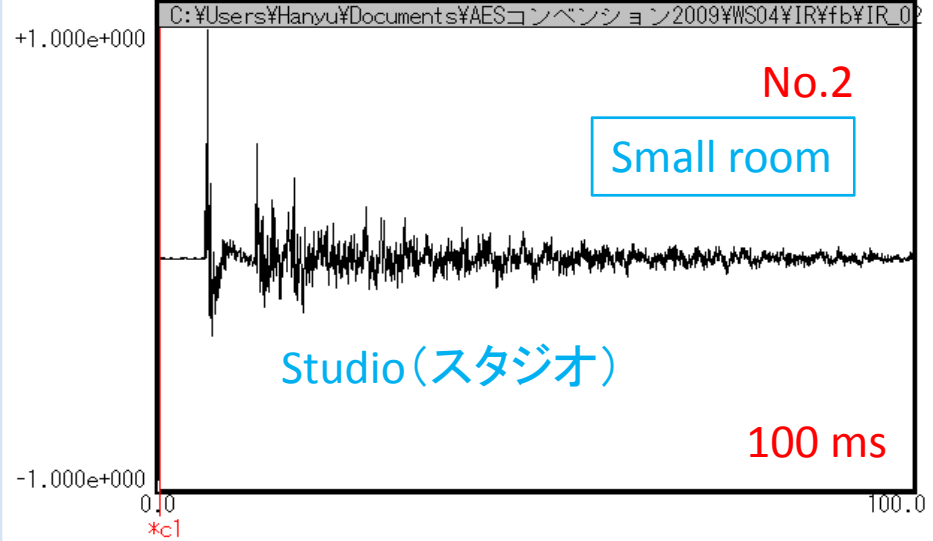
ファイル(F) 統合化ツール(T) ヘルプ(H)

[17]IR_02.snd



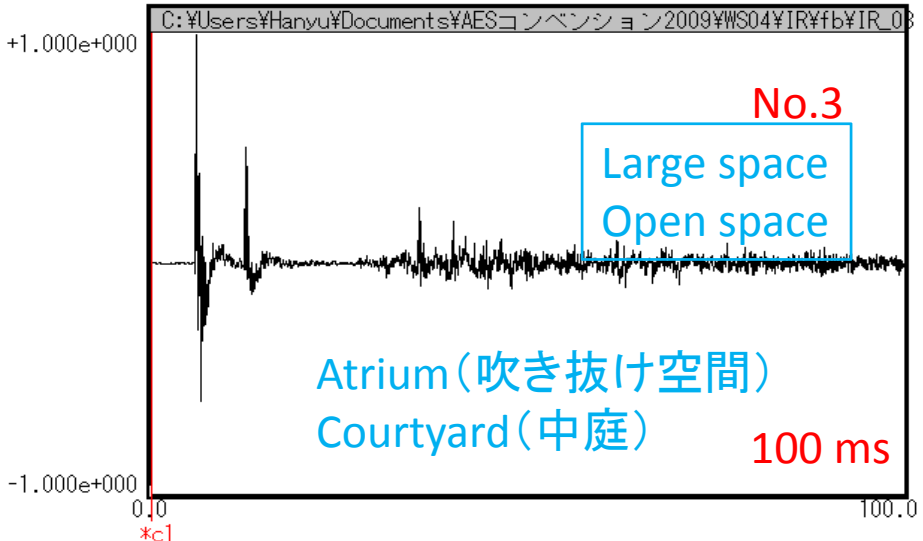
*カーソル1:0ms(0) 値: 8.725e-004	差分:
*カーソル2:2730ms(131071) 値: -4.292e-006	2730ms(131071) 値: -8.768e-004
選択: -2010114584ms(0)~158990593ms(0) サイズ:0ms(1)	

[17]IR_02.snd



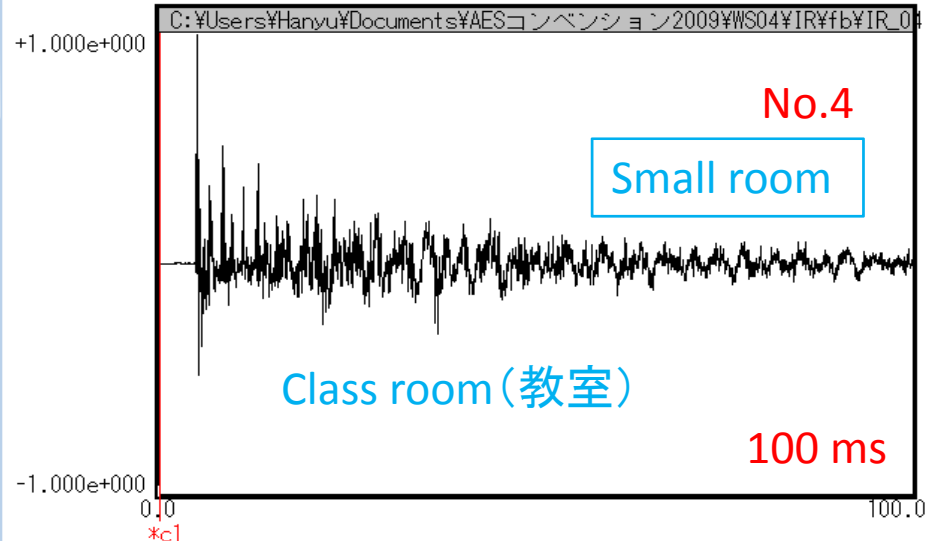
*カーソル1:0ms(0) 値: 4.318e-004	差分:
*カーソル2:2730ms(131071) 値: 3.791e-005	2730ms(131071) 値: -3.939e-004
選択: 16875824ms(0)~986705427ms(0) サイズ:0ms(1)	

[18]IR_03.snd



*カーソル1:0ms(0) 値: 1.463e-004	差分:
*カーソル2:2730ms(131071) 値: -2.313e-005	2730ms(131071) 値: -1.694e-004
選択: 16879408ms(0)~533717680ms(0) サイズ:0ms(1)	

[19]IR_04.snd



*カーソル1:0ms(0) 値: -2.208e-004	差分:
*カーソル2:2730ms(131071) 値: -6.163e-005	2730ms(131071) 値: 1.591e-004
選択: 16884784ms(0)~1389352669ms(0) サイズ:0ms(1)	

1. What does IR tell us?

[3] Answer from Prof. Omoto.



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AES 14th Regional Convention, Tokyo 2009

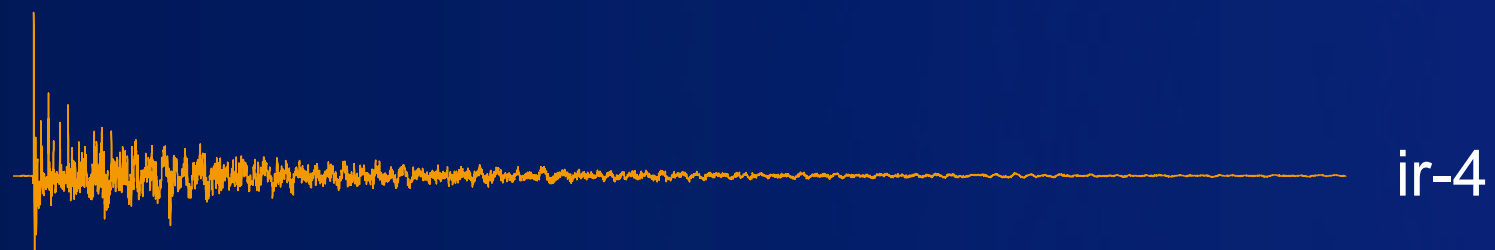
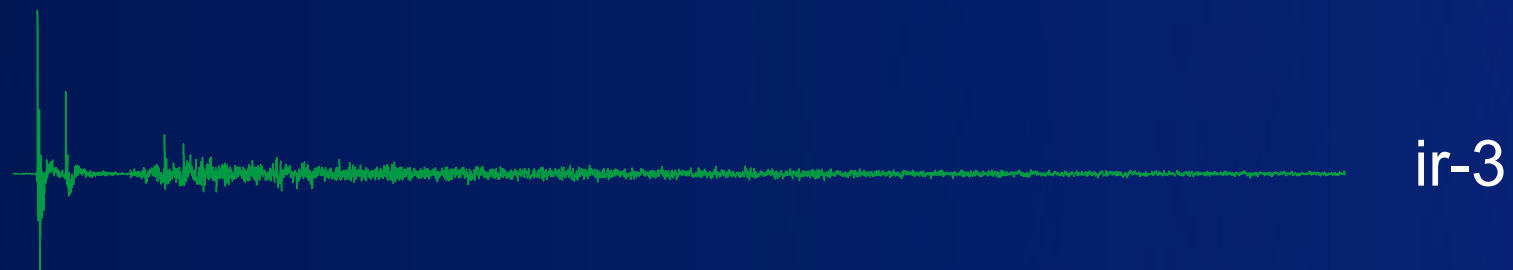
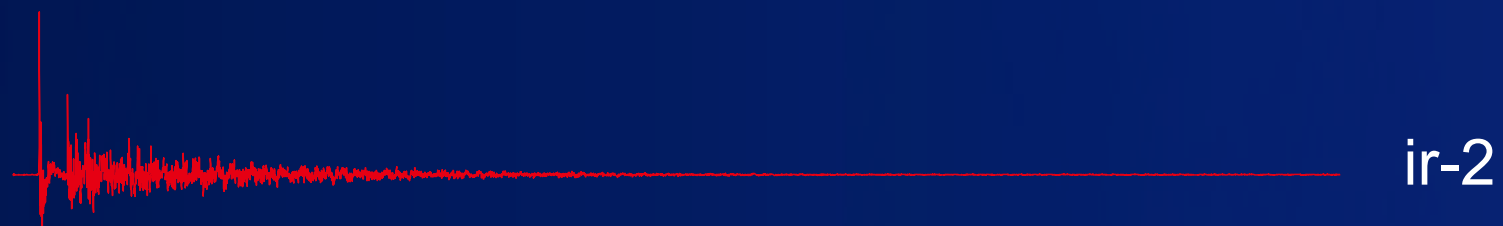
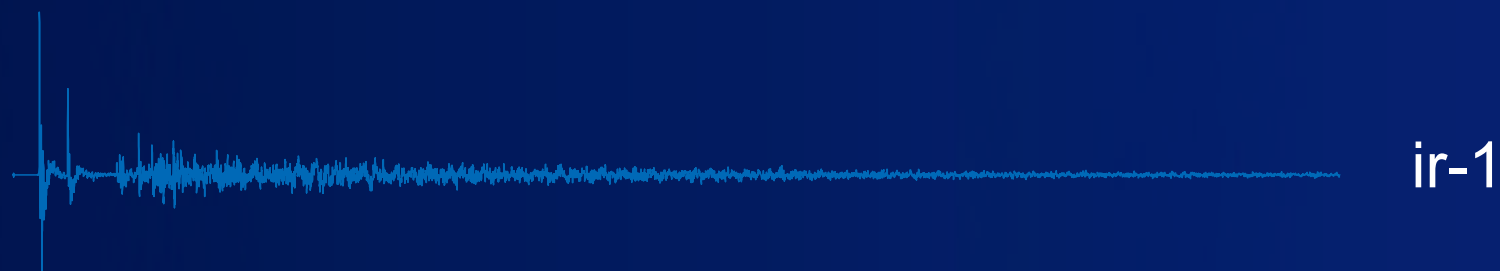
What is 'Hibiki'

- Room Profile Estimation by Impulse Responses
- Impulse Response Analysis of Reverb Effector

Akira Omoto
Faculty of Design
Kyushu University

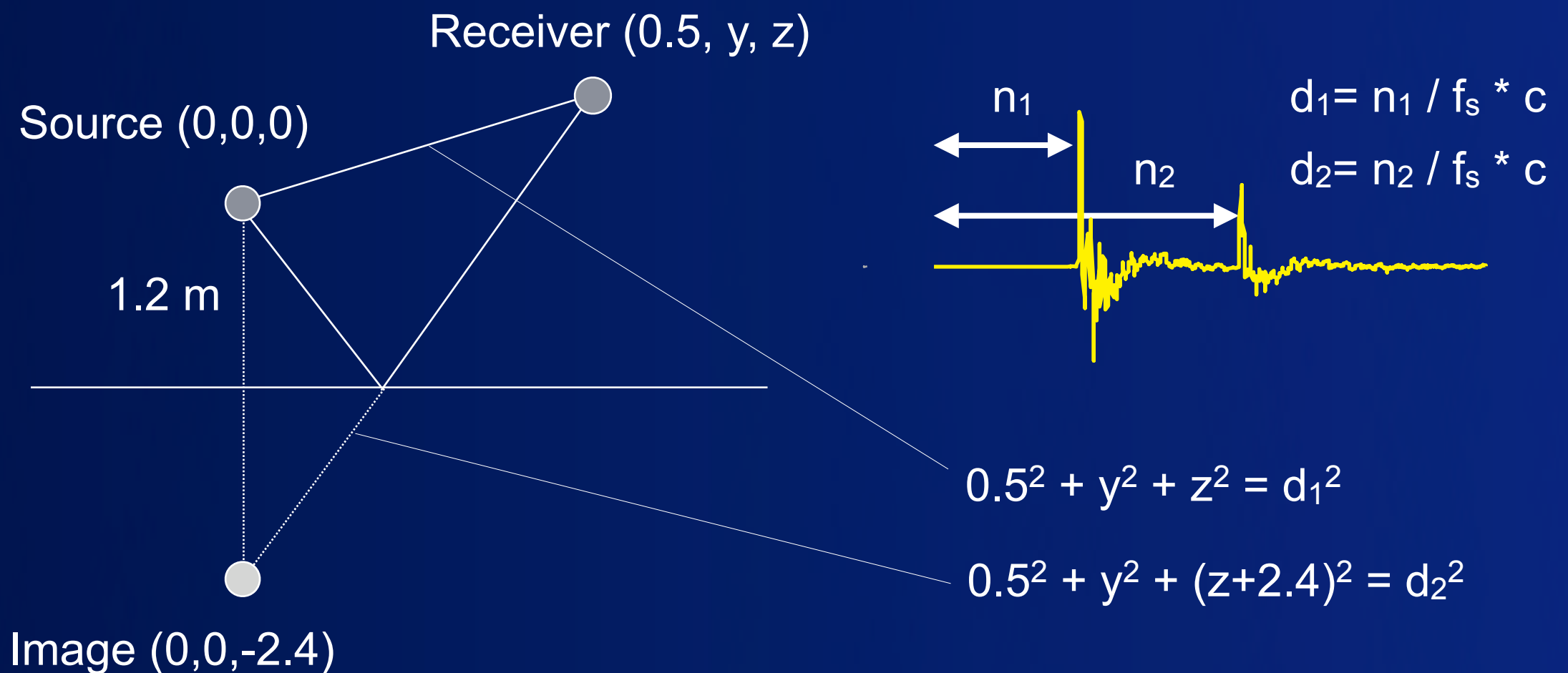
尾本 章
九州大学 芸術工学研究院

■ Impulse Responses Measured at Four Different Conditions



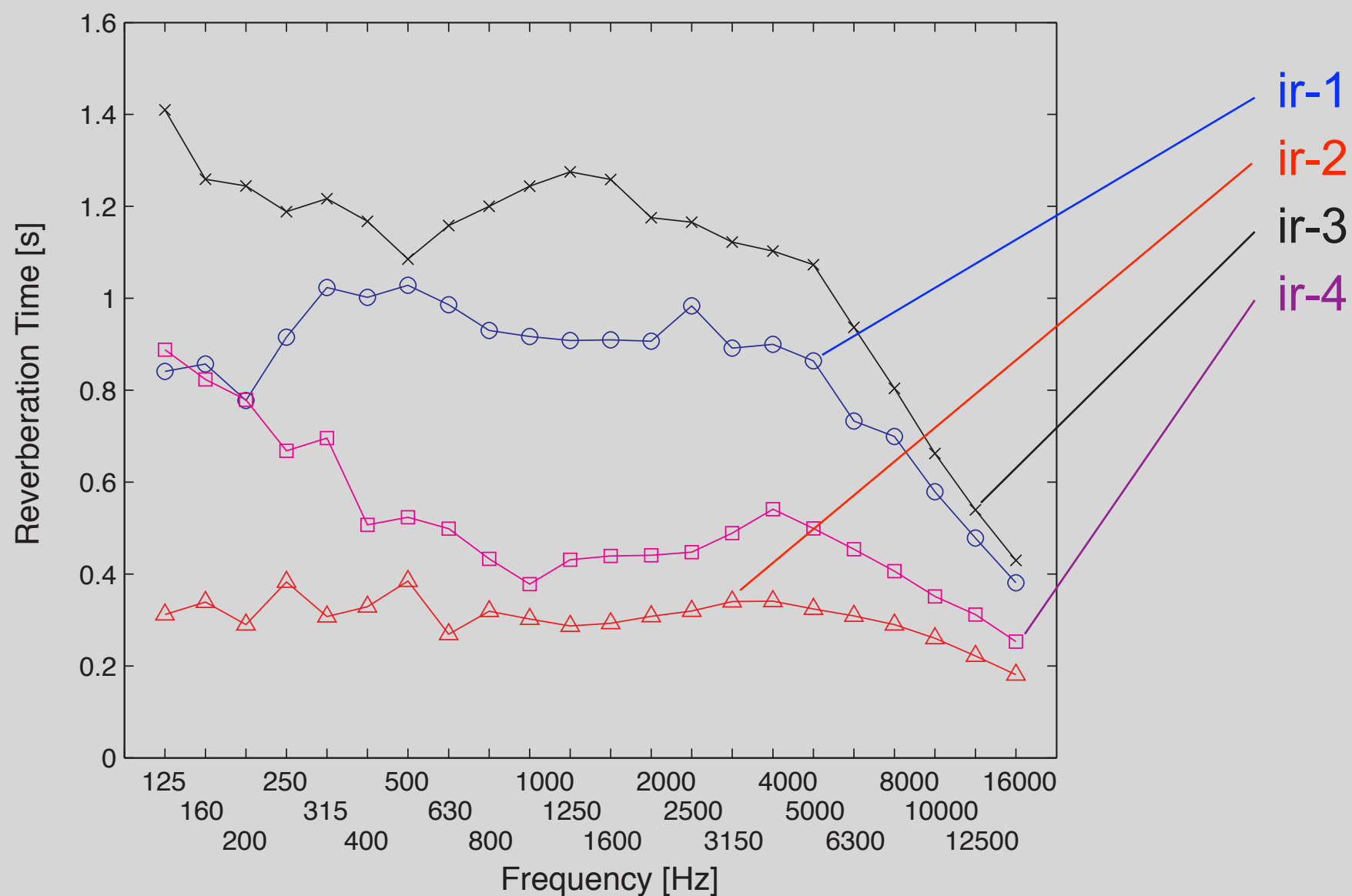
■ Analysis

■ Primitive Method based on Geometry



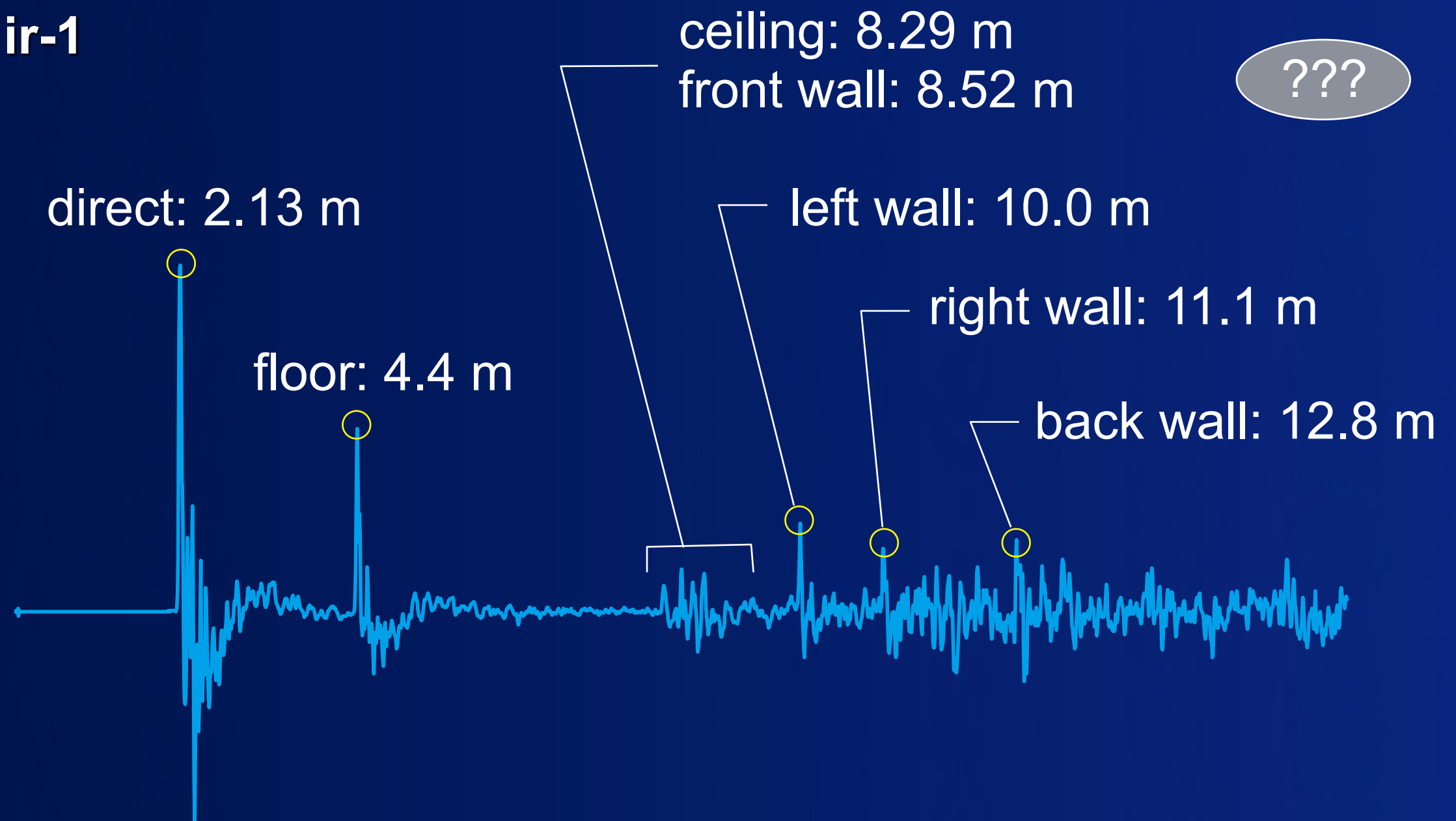
■ Analysis

■ Reverberation Time by Schroeder Integration



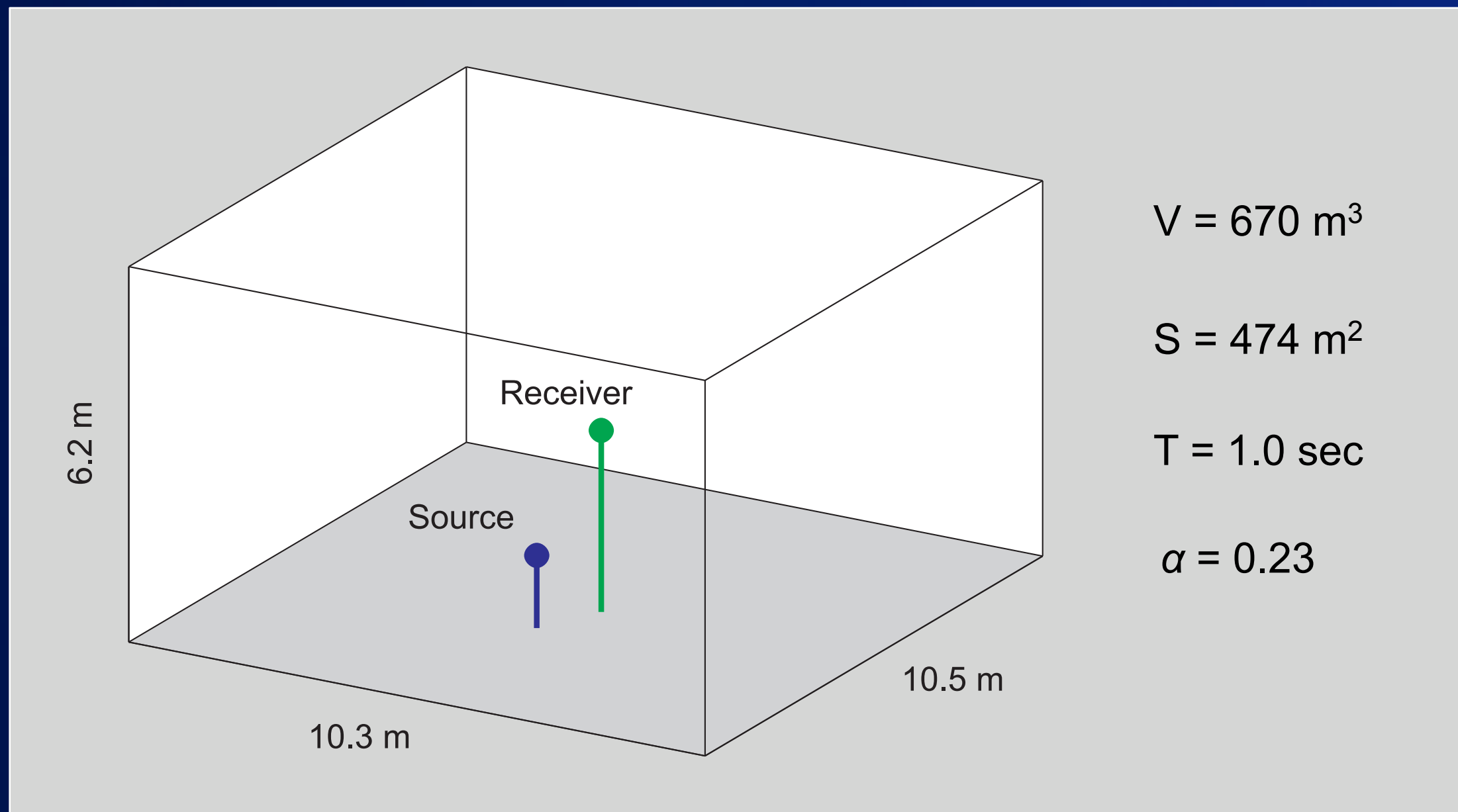
■ Results

■ ir-1



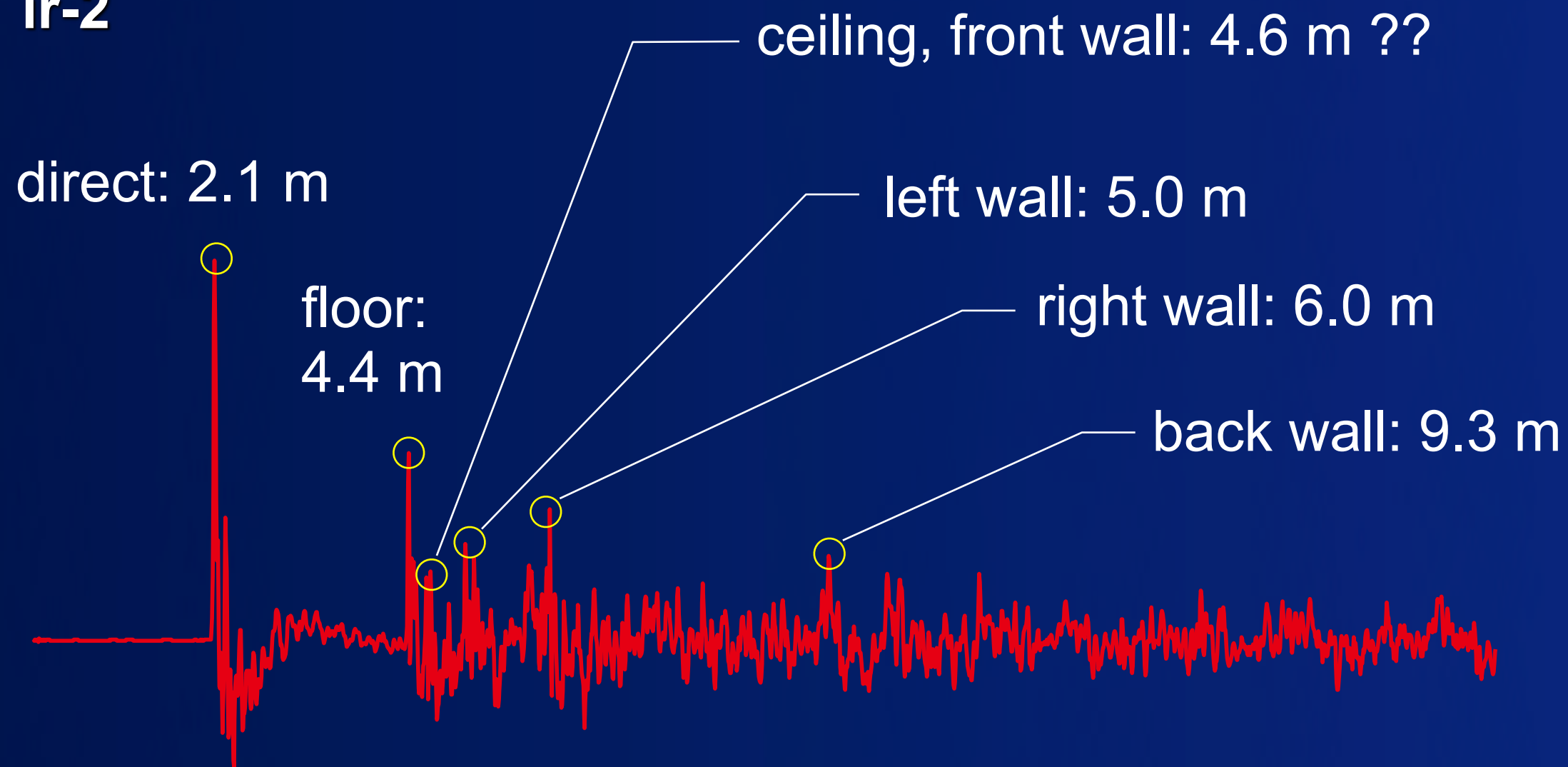
■ Results

■ ir-1



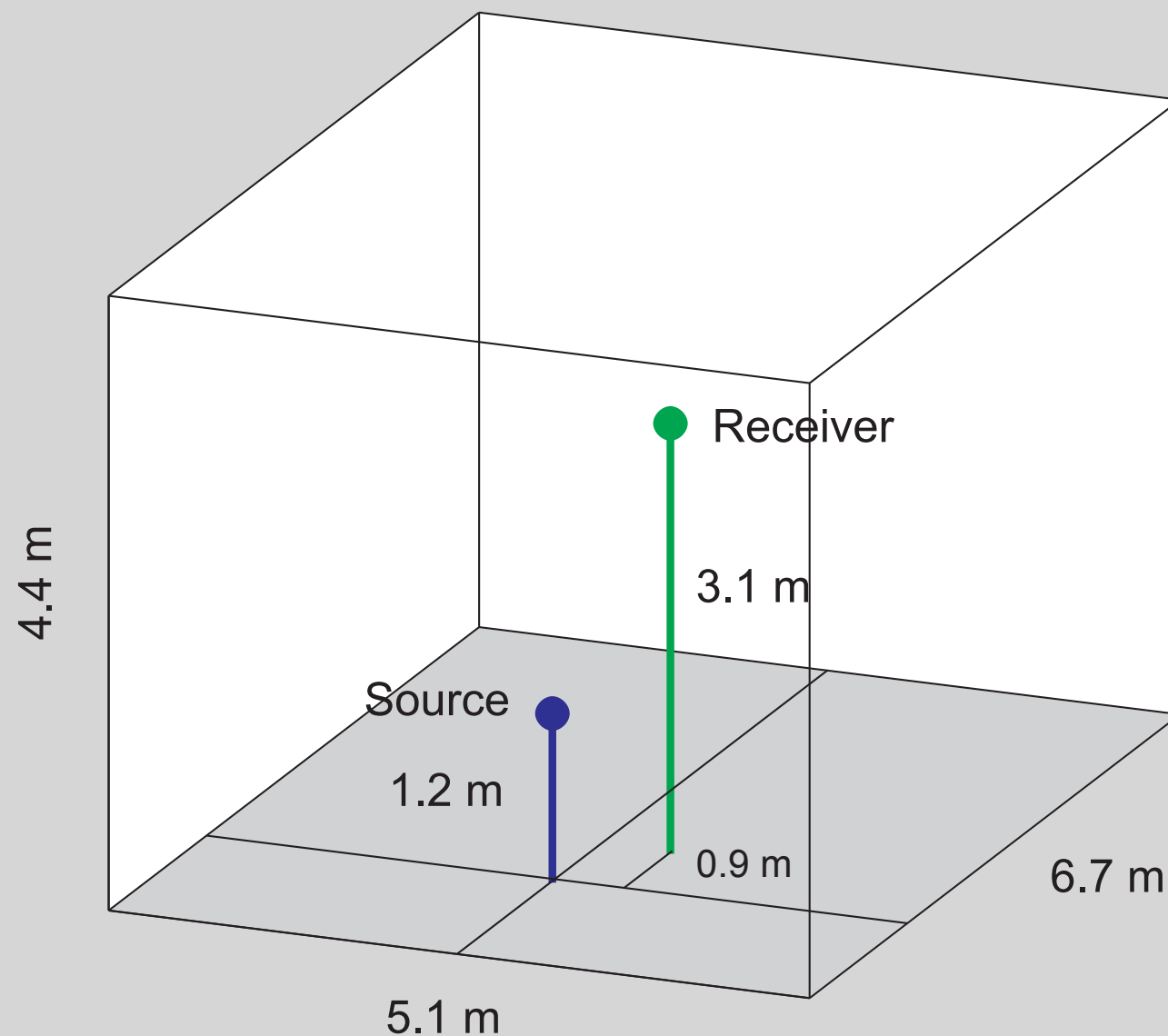
■ Results

■ ir-2



■ Results

■ ir-2



$$V = 154 \text{ m}^3$$

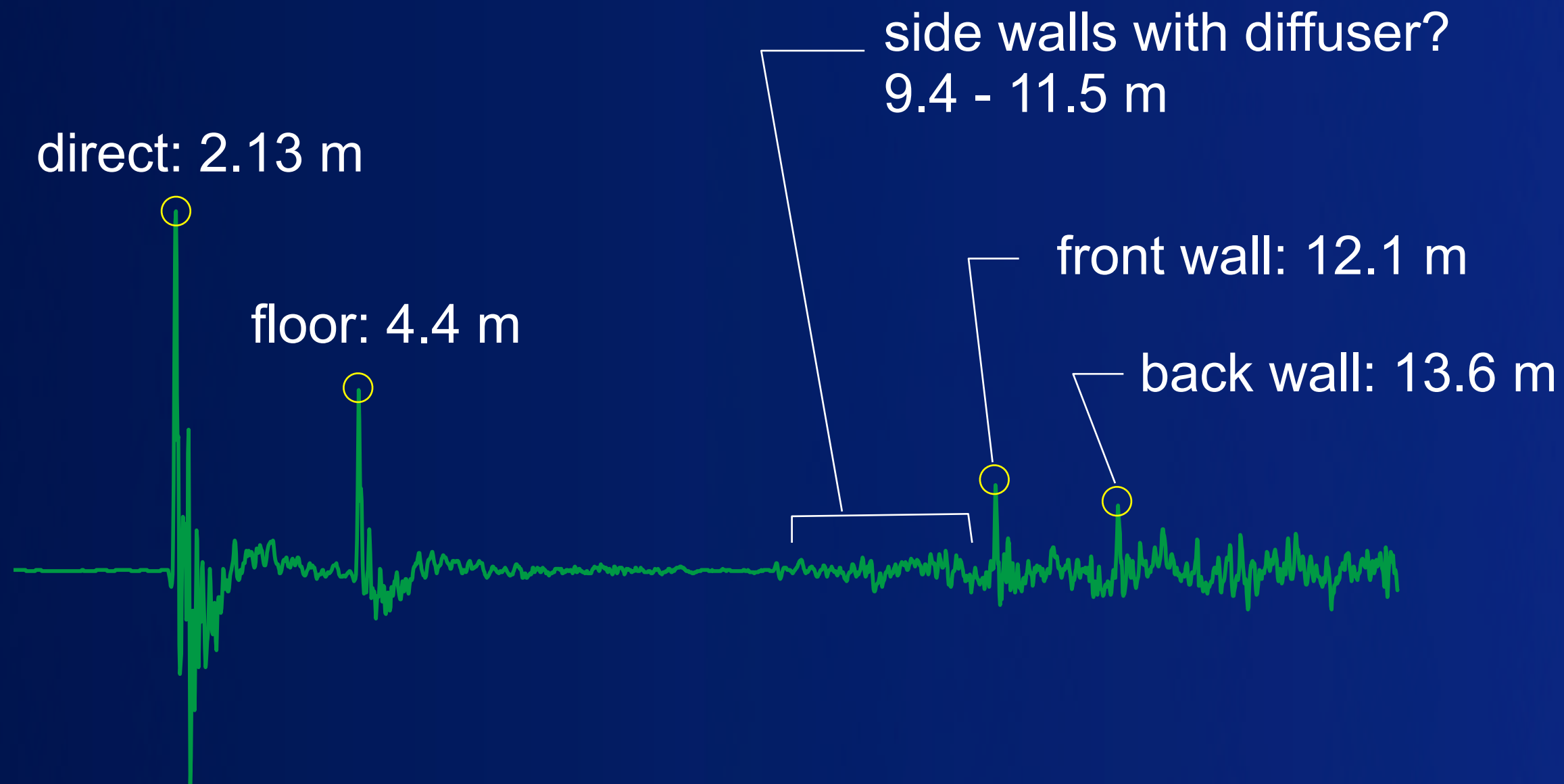
$$S = 175 \text{ m}^2$$

$$T = 0.3 \text{ sec}$$

$$\alpha = 0.47$$

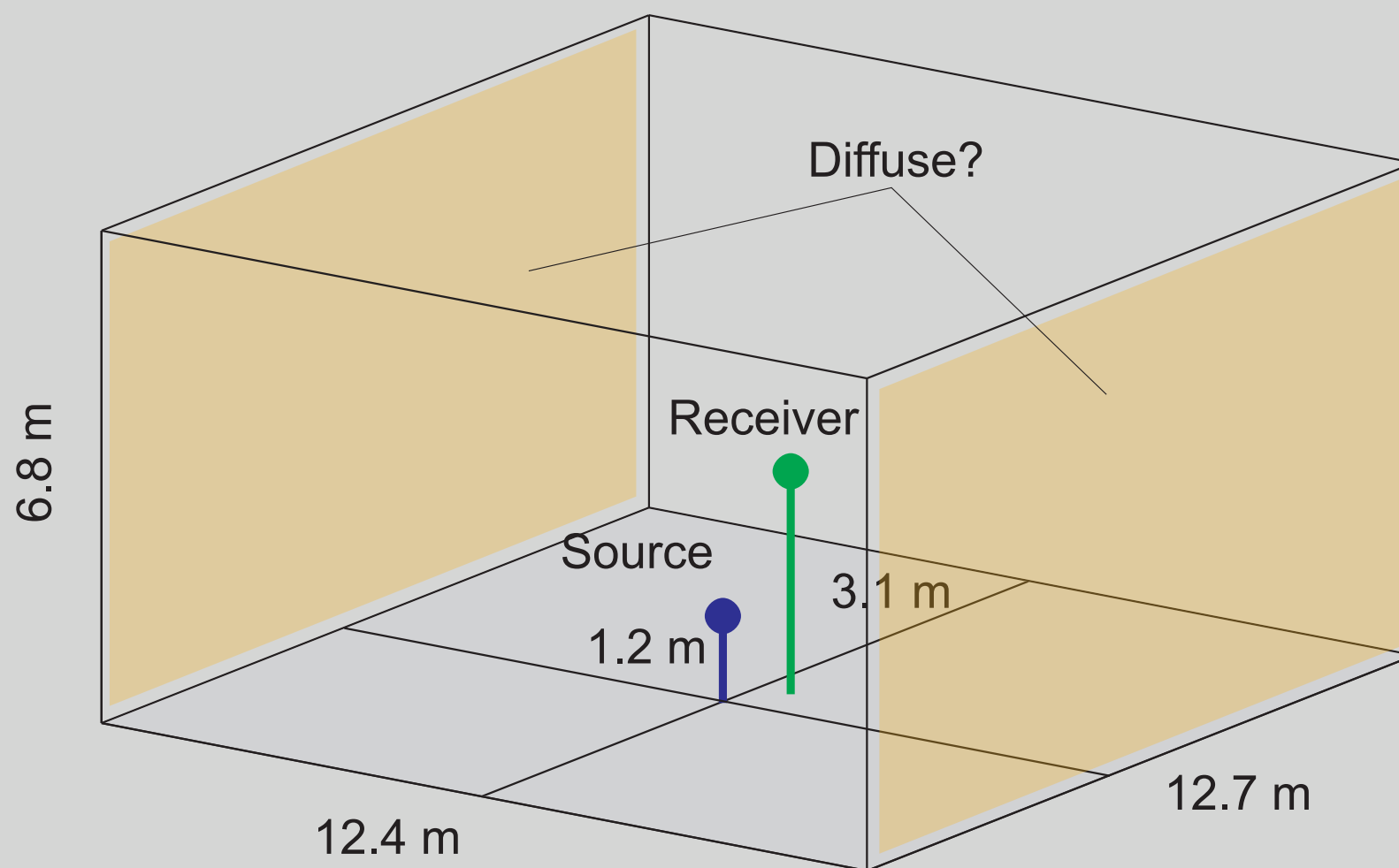
■ Results

■ ir-3



■ Results

■ ir-3



$$V = 840 \text{ m}^3$$

$$S = 548 \text{ m}^2$$

$$T = 1.2 \text{ sec}$$

$$\alpha = 0.20$$

■ Results

■ ir-4

direct: 2.13 m

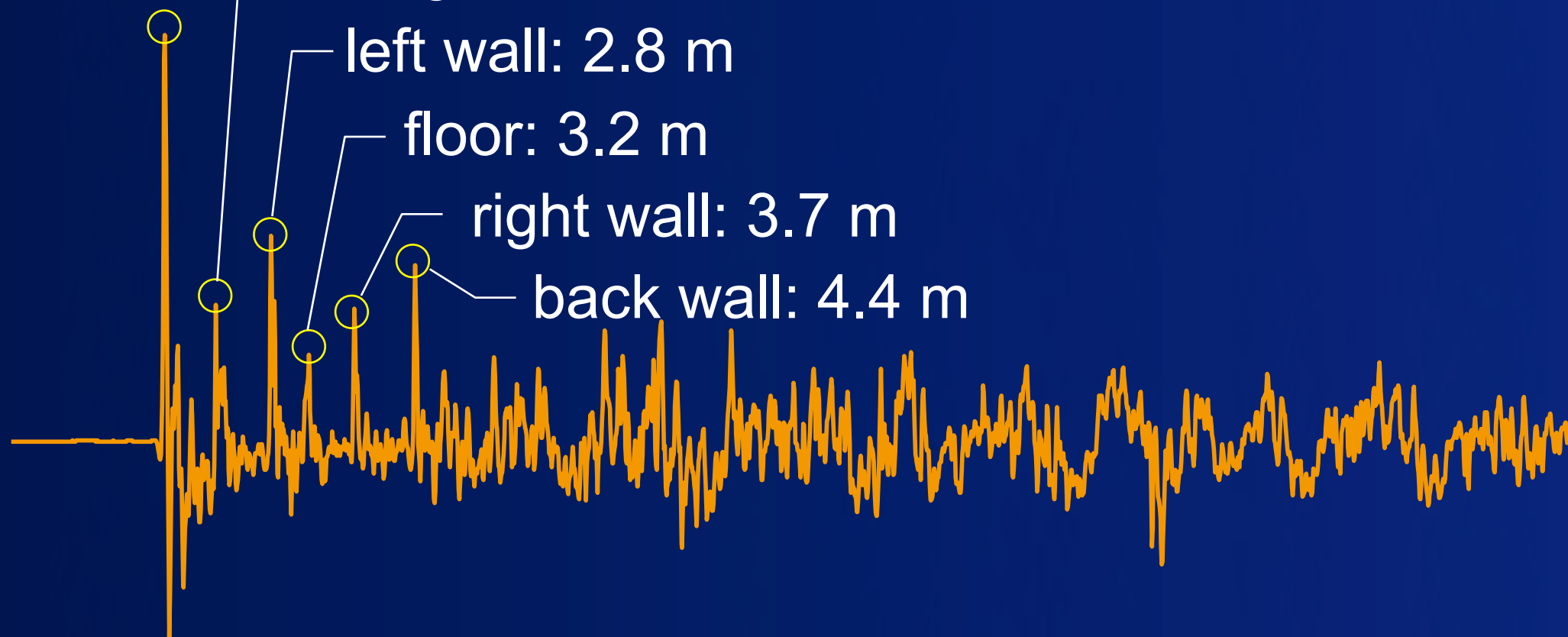
ceiling: 2.2 m

left wall: 2.8 m

floor: 3.2 m

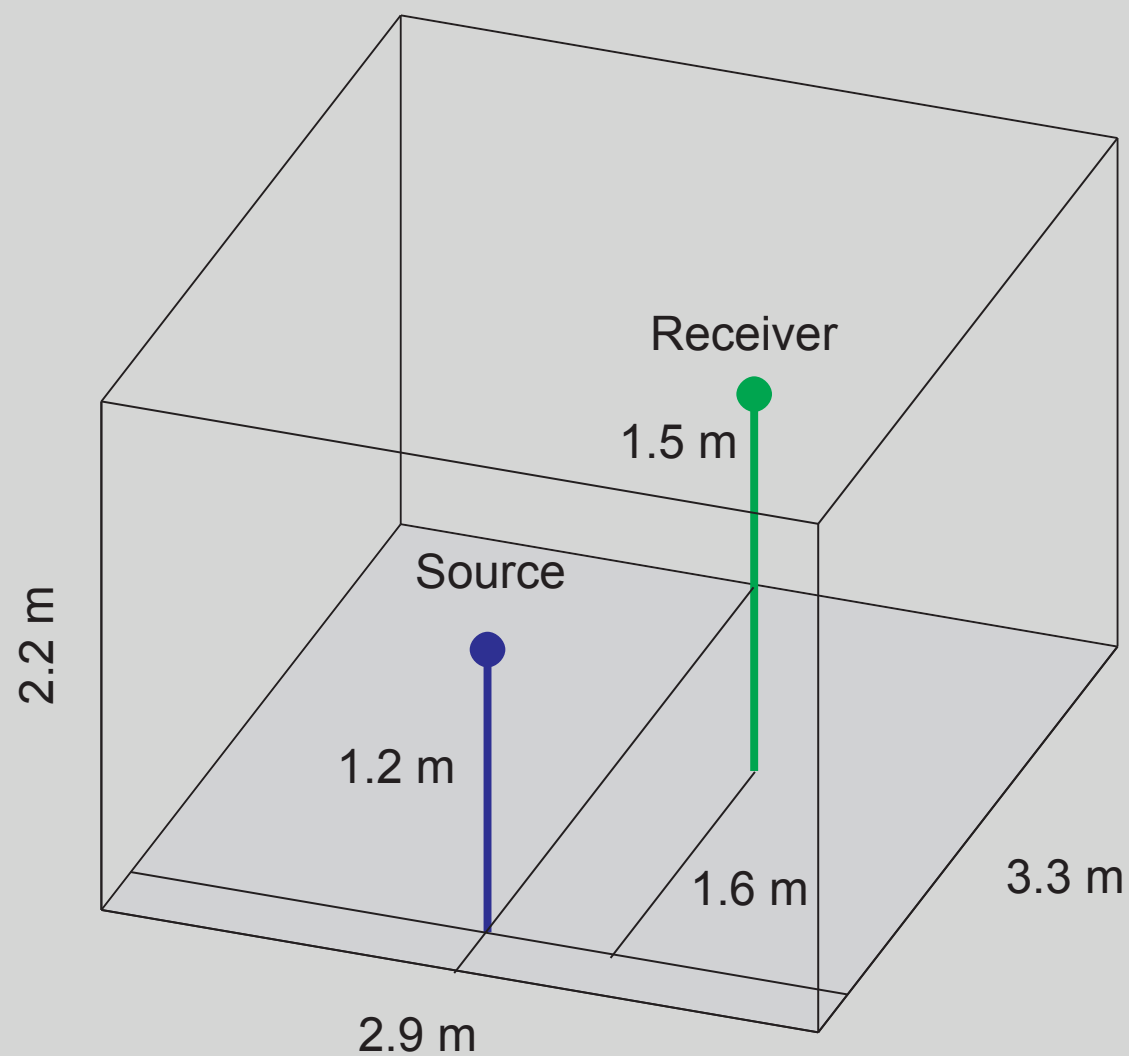
right wall: 3.7 m

back wall: 4.4 m



■ Results

■ ir-4



$$V = 20.4 \text{ m}^3$$

$$S = 45.7 \text{ m}^2$$

$$T = 0.4 \text{ sec}$$

$$\alpha = 0.18$$

1. What does IR tell us?

[4] True Answer from Prof. Kamekawa.

Recording Samples

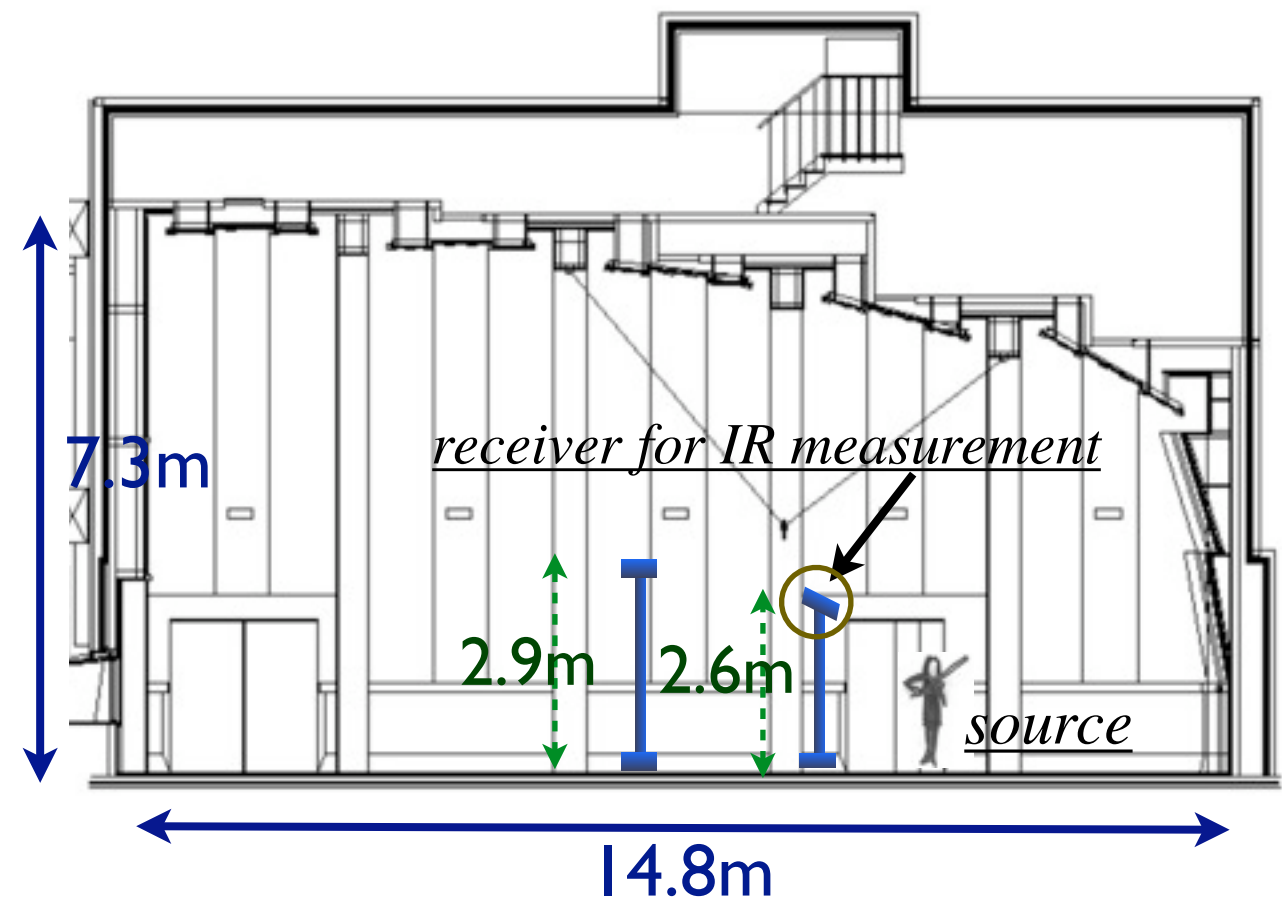
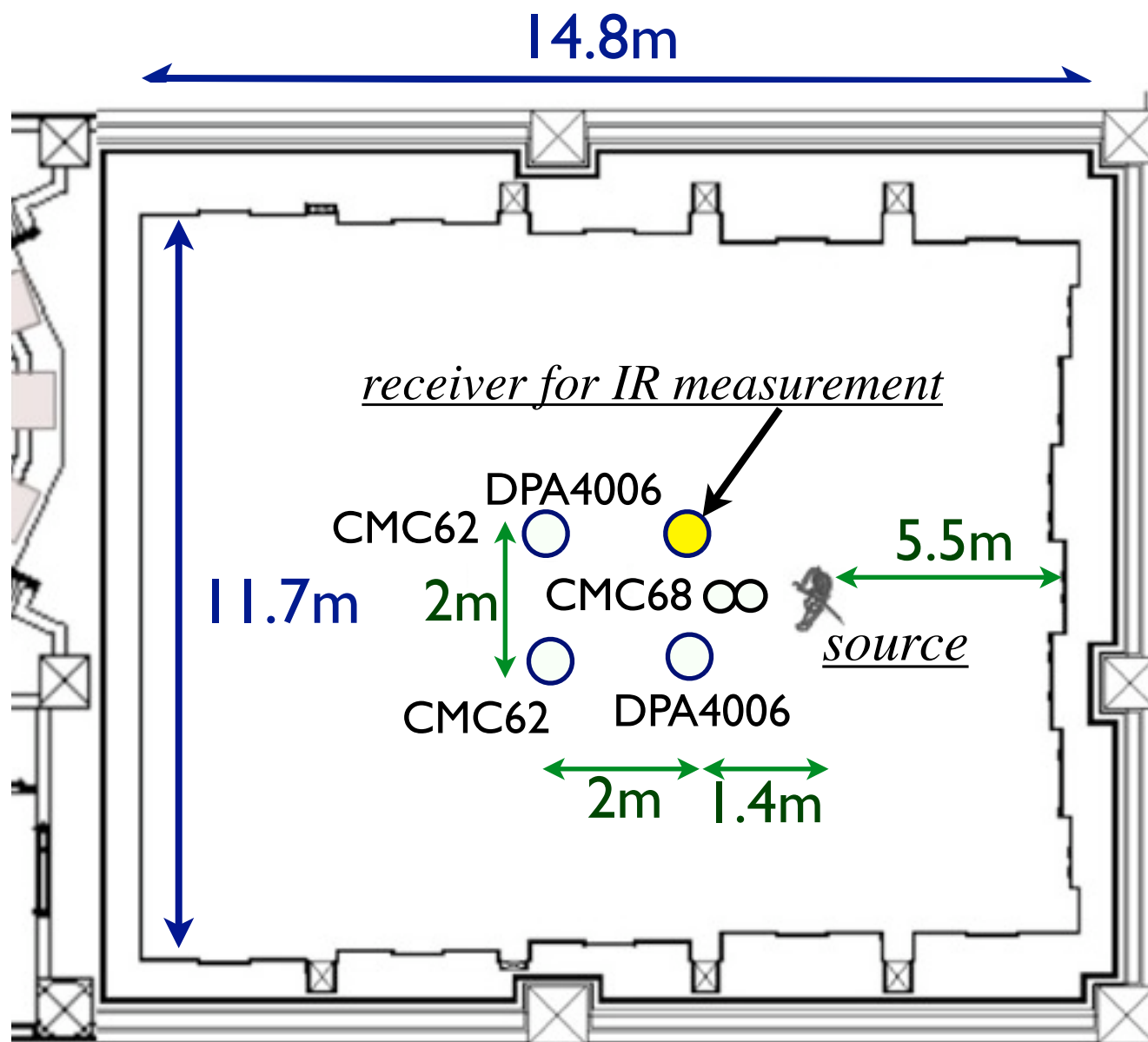
Performance

- エネスコ 幼き頃の印象
- バイオリン独奏 佐原 敦子

Violin Solo : Atsuko Sahara

Sample I

$$v = 1,060 m^3$$
$$S = 700 m^2$$
$$(S_{Floor} = 170 m^2)$$



Sample I

$$v=1,060m^3$$

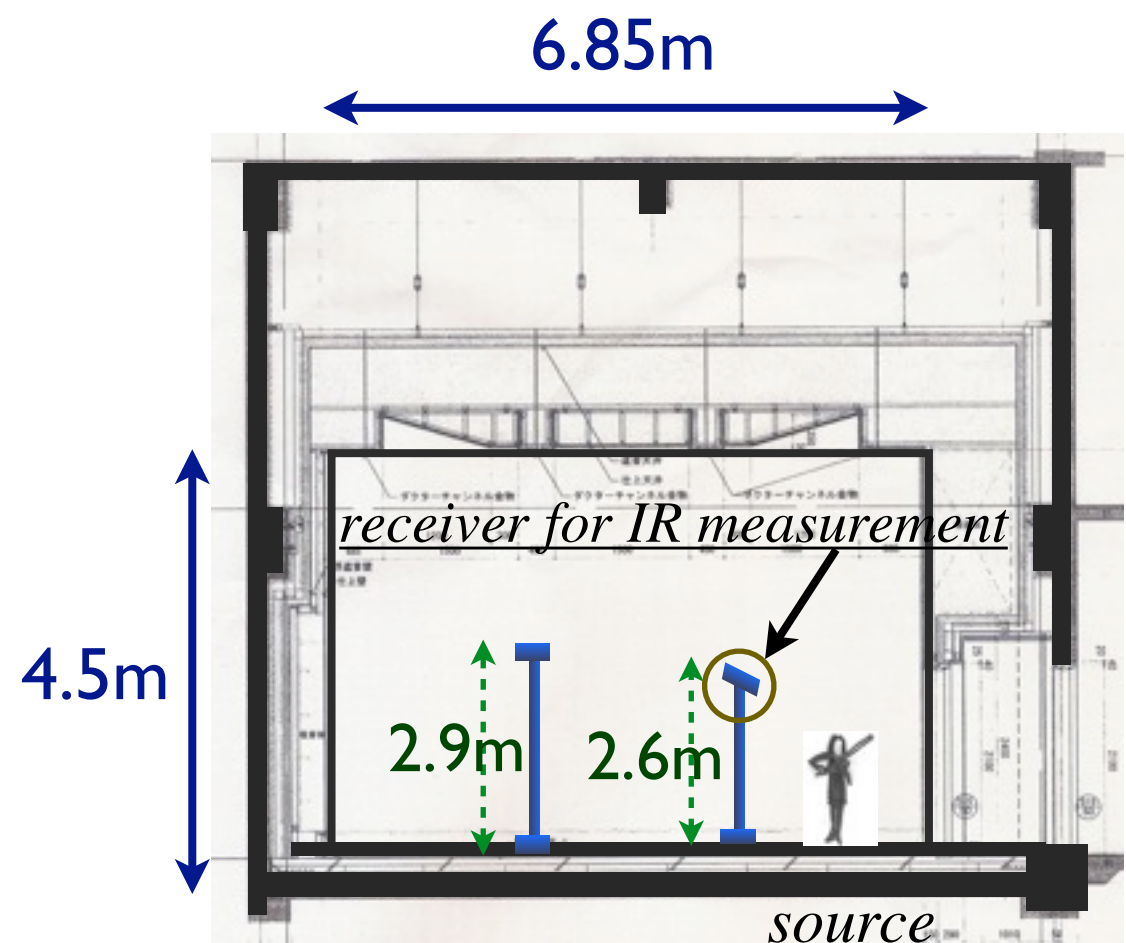
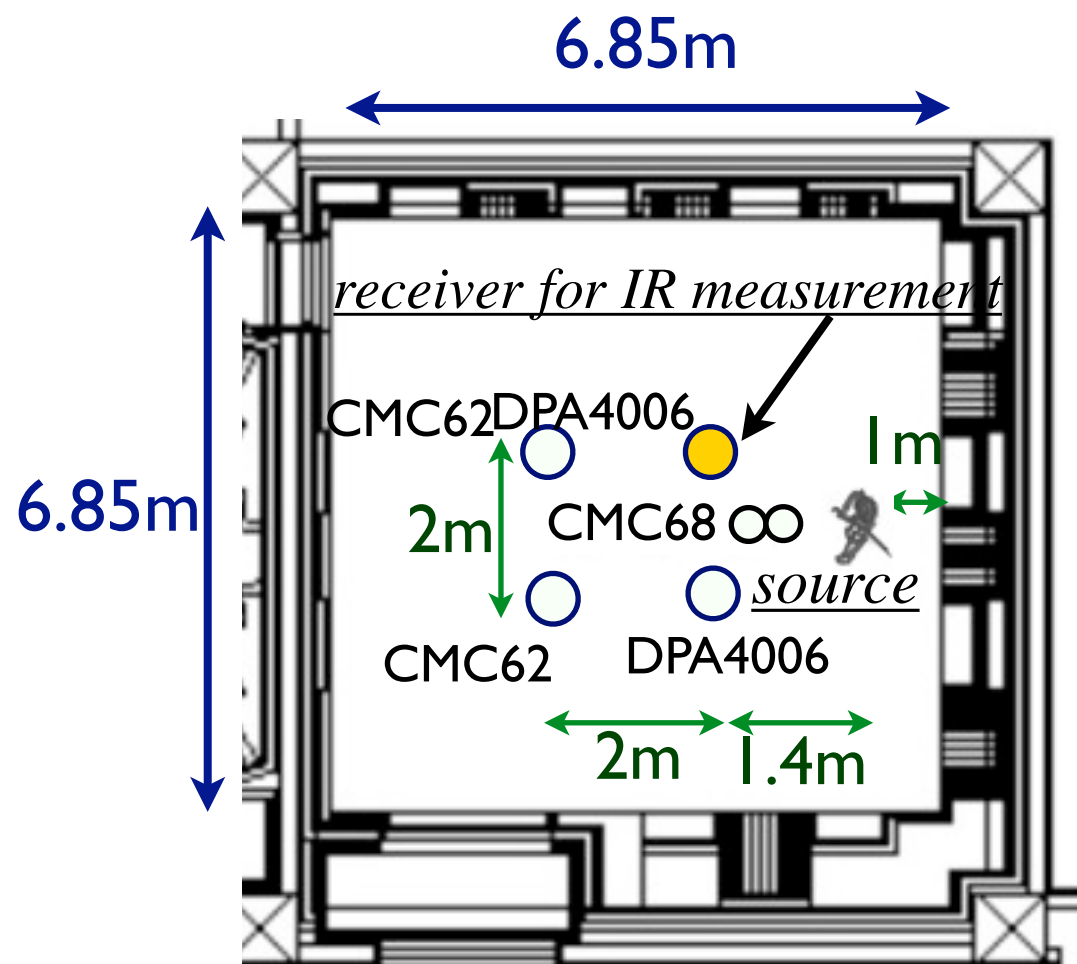
$$S=700m^2$$

$$(S_{Floor}=170m^2)$$



Sample 2

$$v = 1,060 m^3$$
$$S = 217 m^2$$
$$(S_{Floor} = 47 m^2)$$



Sample 2

$$v=1,060m^3$$

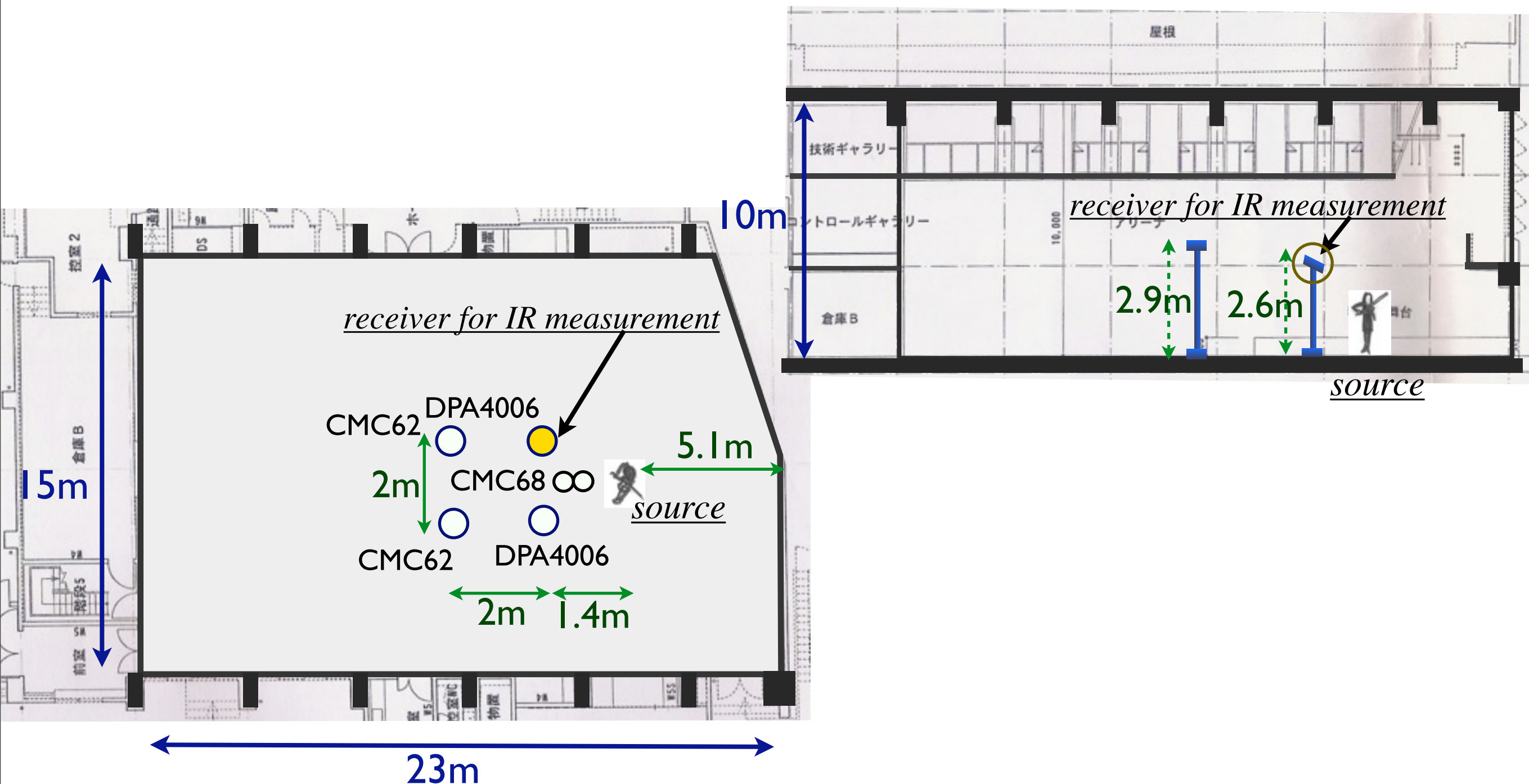
$$S=217m^2$$

$$(S_{Floor}=47m^2)$$



Sample 3

$$v=3,450m^3$$
$$S=1,440m^2$$
$$(S_{Floor}=340m^2)$$



Sample 3

$$v=3,450m^3$$

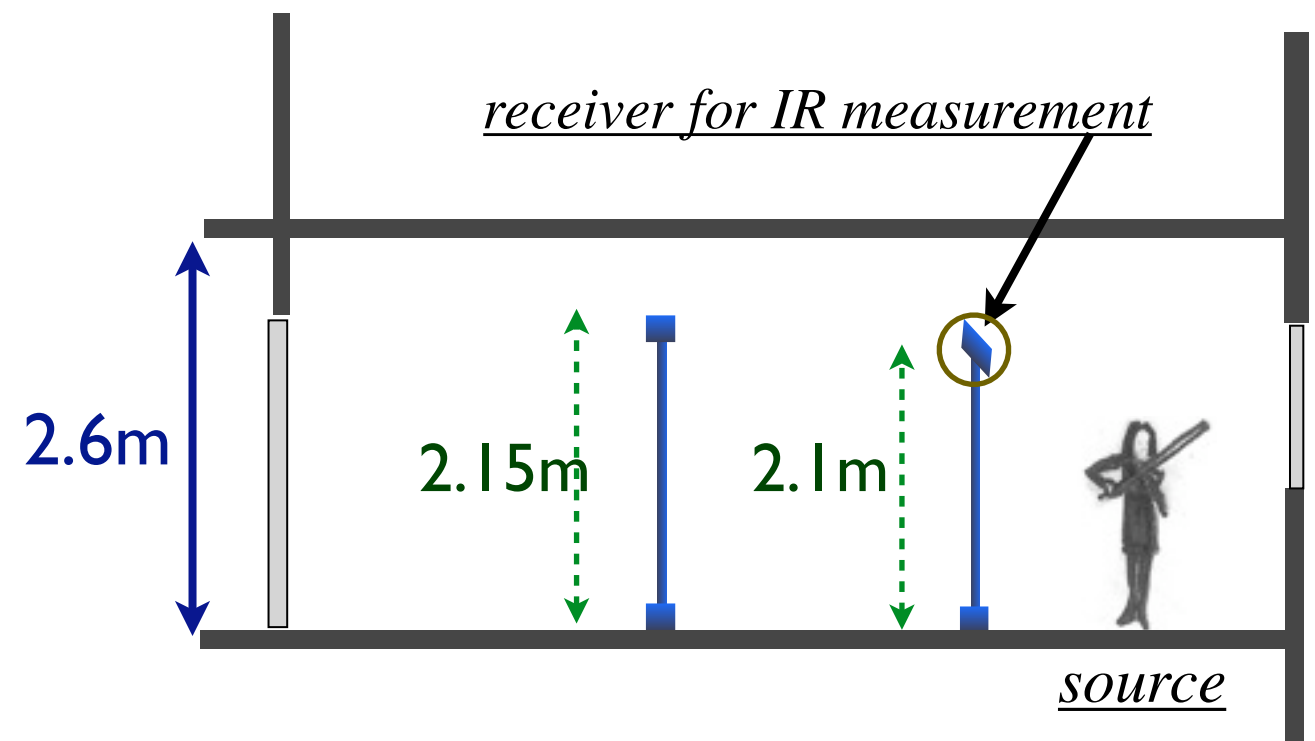
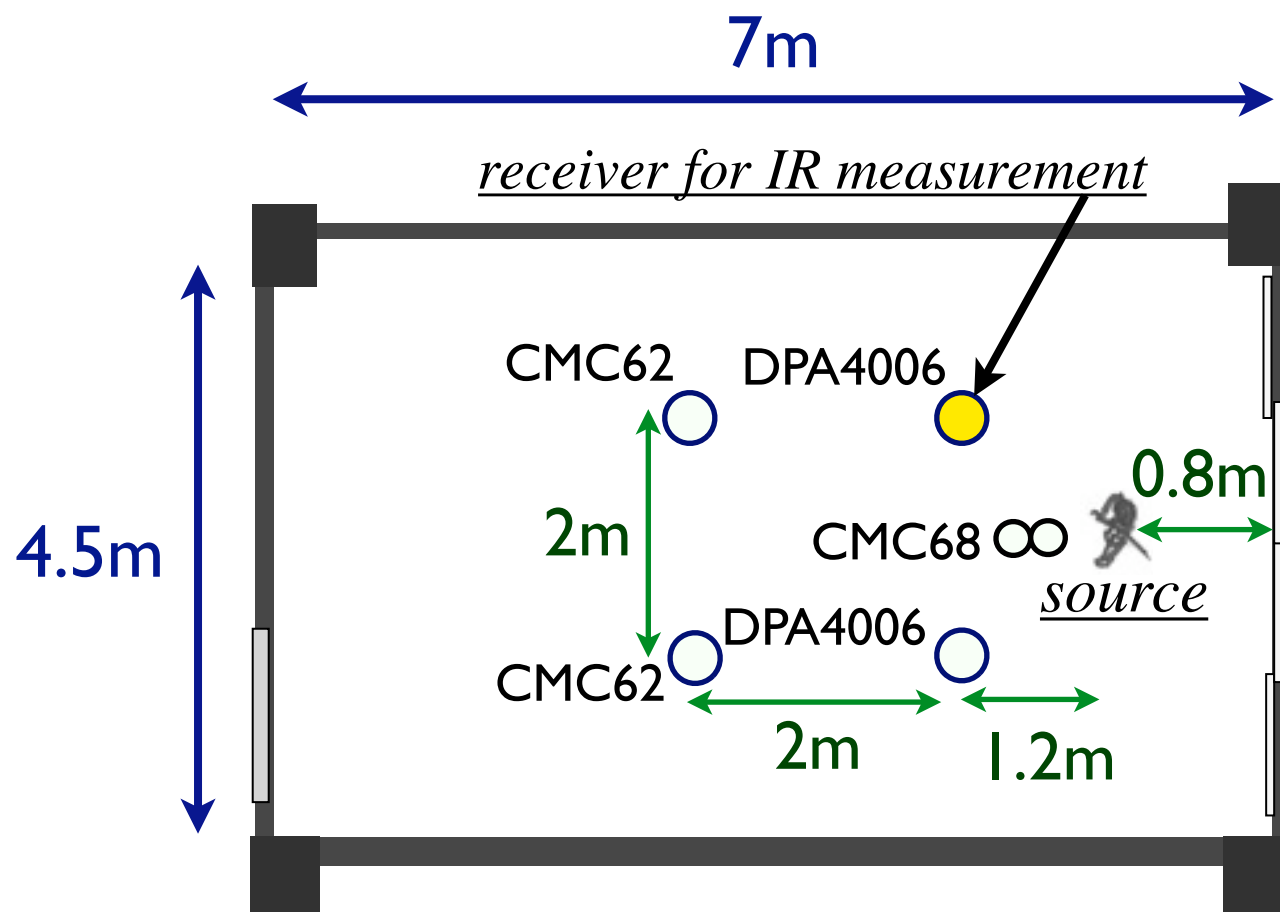
$$S=1,440m^2$$

$$(S_{Floor}=340m^2)$$



Sample 4

$$v=82m^3$$
$$S=123m^2$$
$$(S_{Floor}=31.5m^2)$$



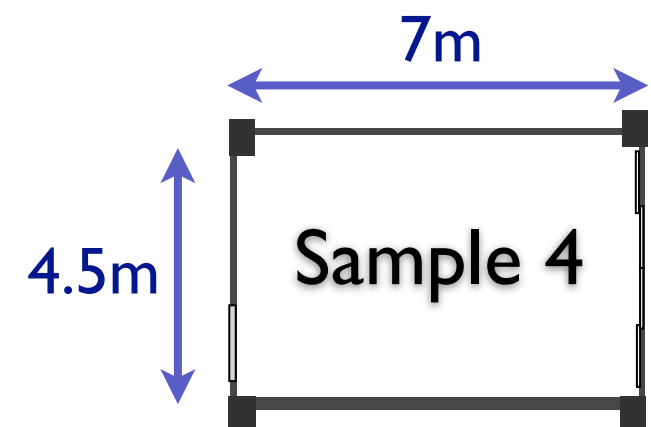
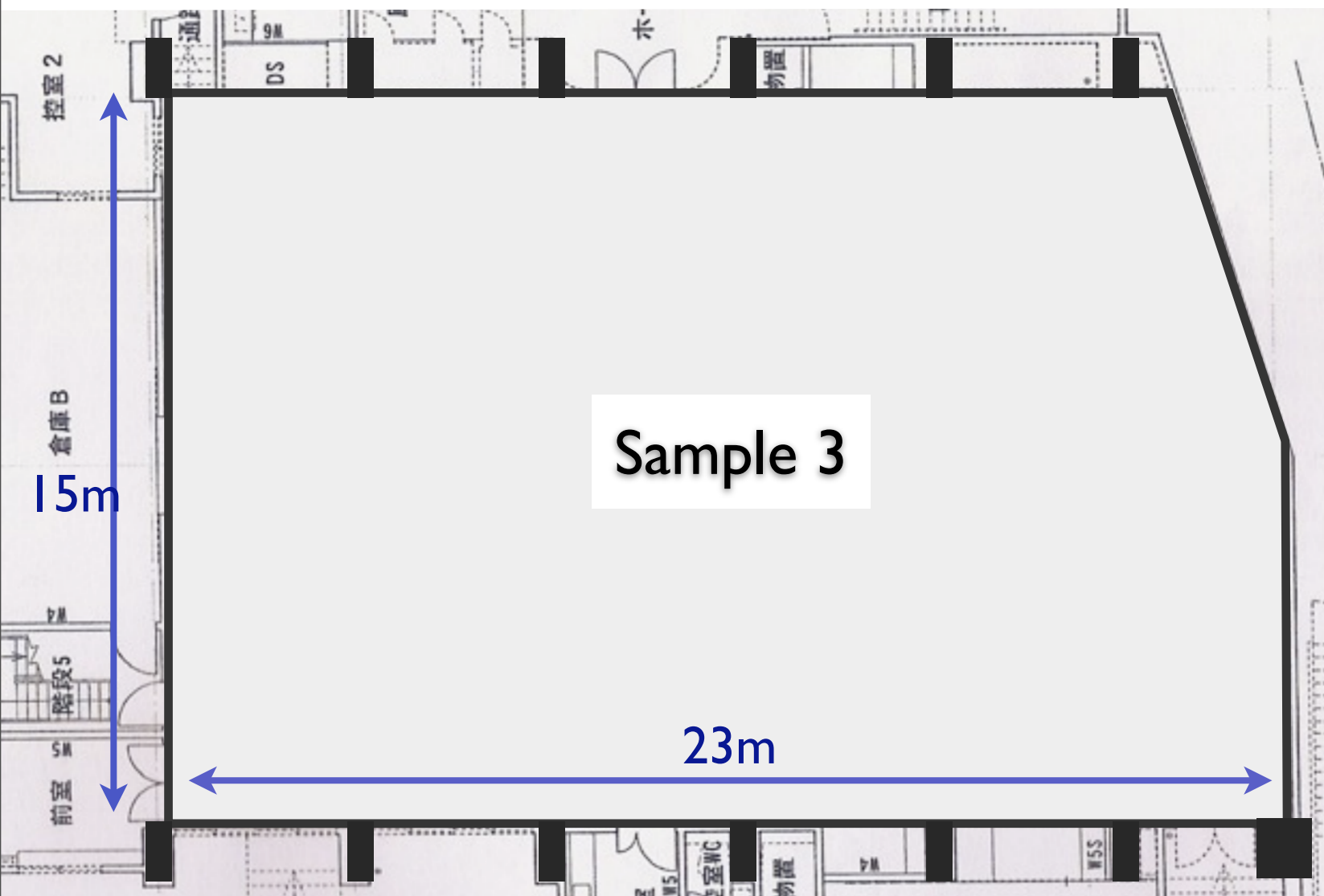
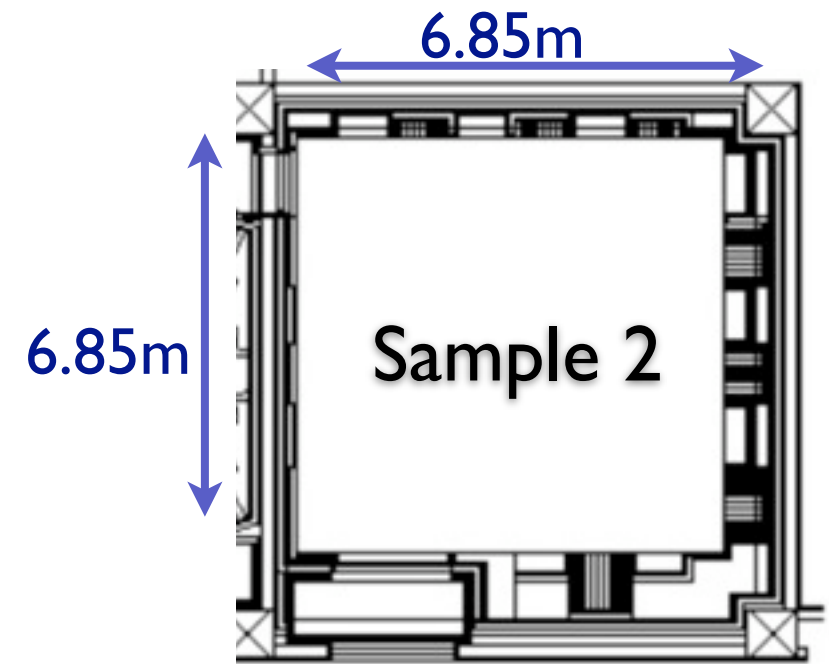
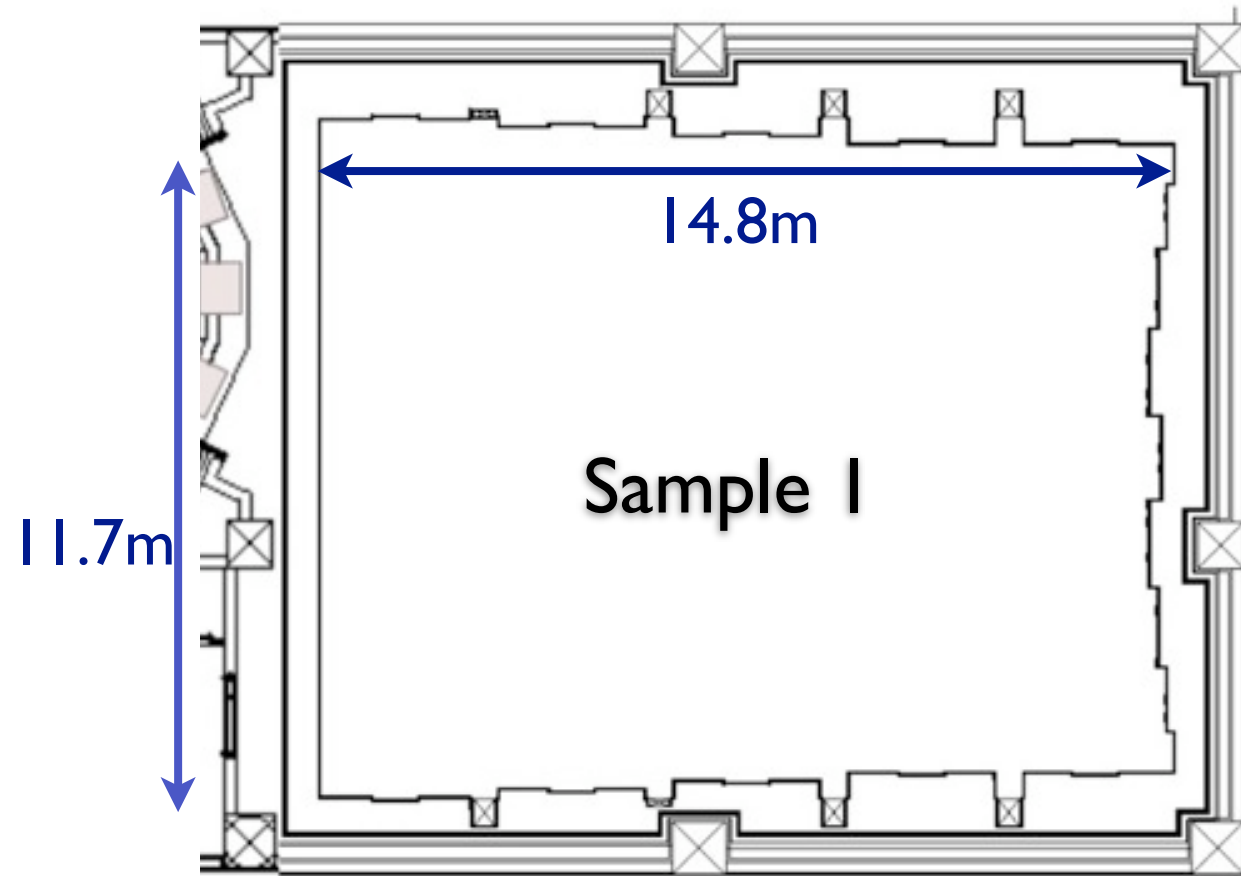
Sample 4

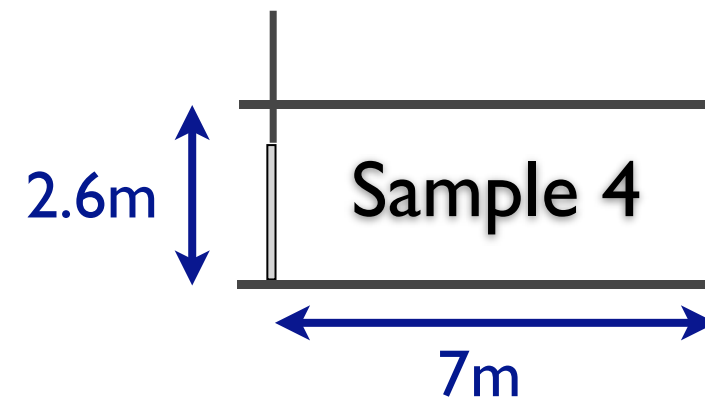
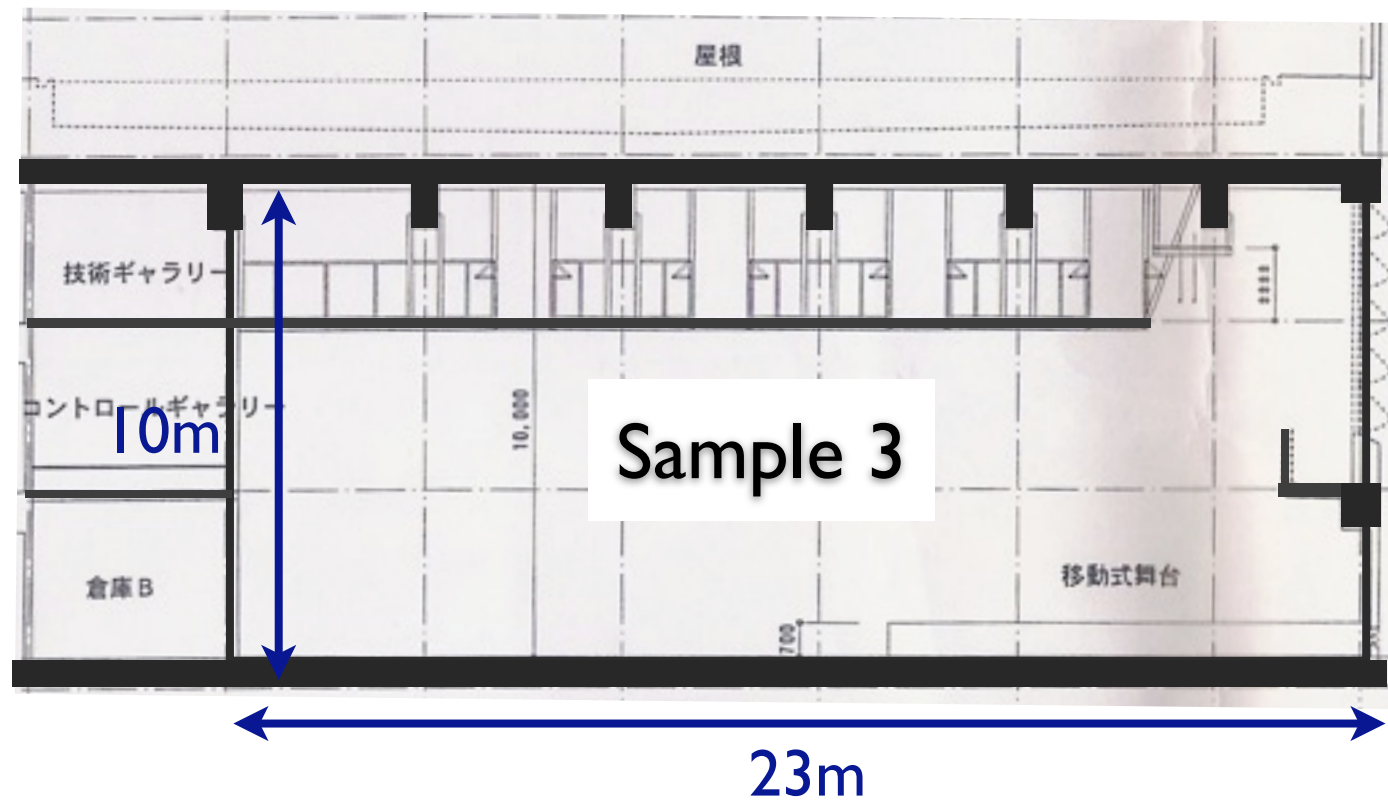
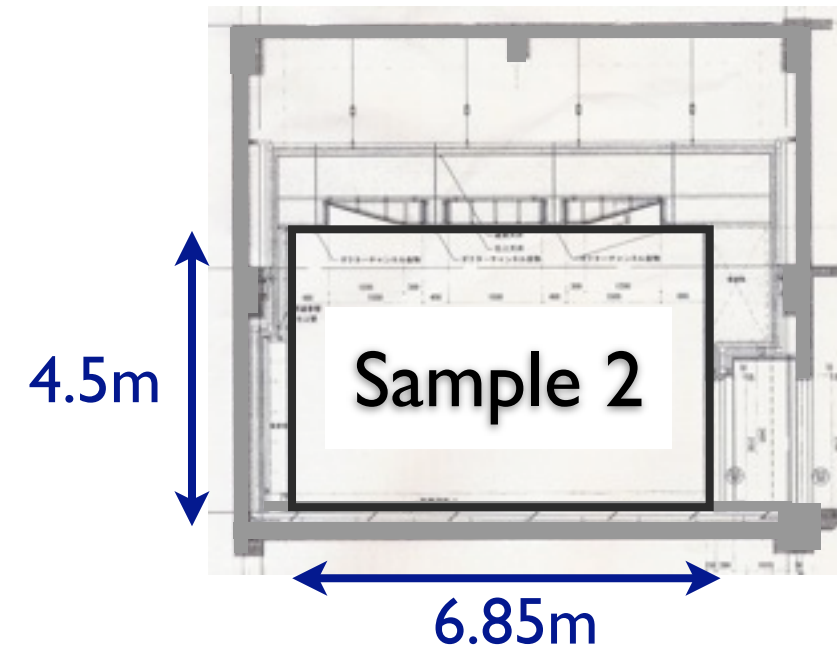
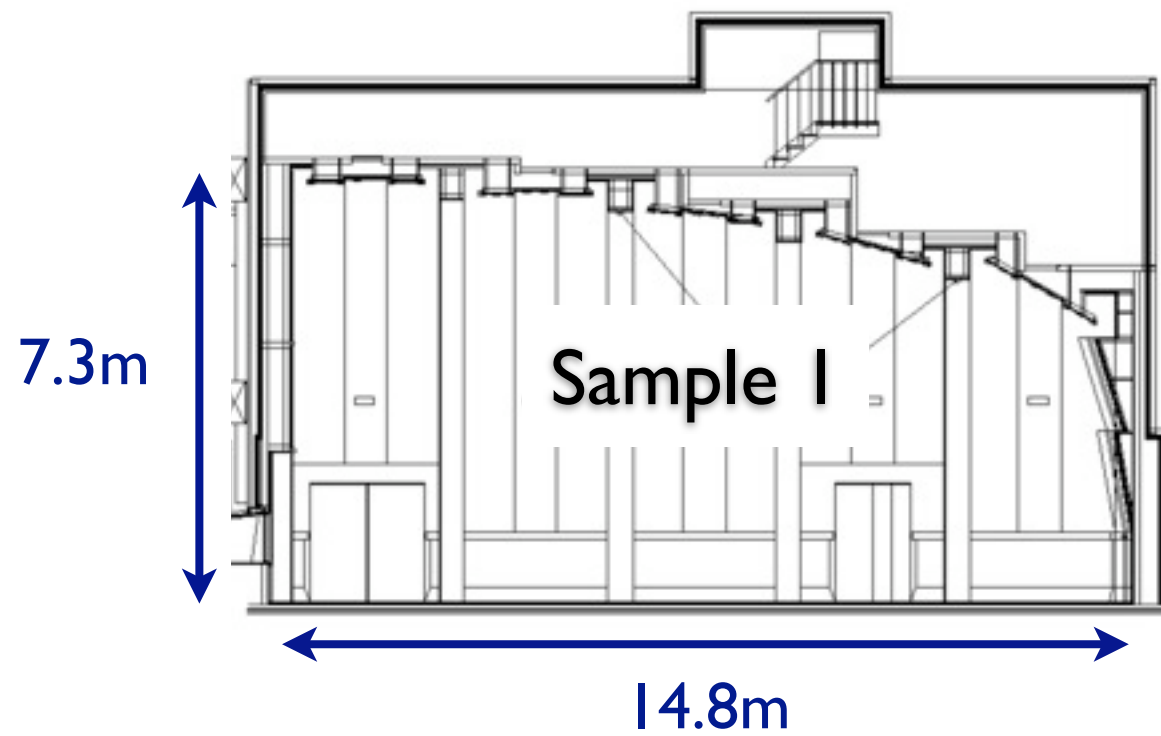
$$v=82m^3$$

$$S=123m^2$$

$$(S_{Floor}=31.5m^2)$$







2. What is the key for spacial information?

[1] Hibiki & Mixing Works.

Thought & Demo from Mr. Uchimura.

What is HIBIKI ?

for Sound Designer and Mixing Engineer
Introduction to Spatial Audio Conference Tokyo 2010

Kazutsugu UCHIMURA

Sound Designer / Mixer

NHK Media Technology

What is HIBIKI ?

- Reverberation 残響、反射
- Ringing 鳴り

What does HIBIKI express?

- Fixed place/scene 場所・場面の設定(確定)
- Ambiguous place/scene 場所・場面を曖昧に、物体をぼかす
- Character of material 物質(筐体)の特製
- Sense of distance 距離感
- Amount, Density 量・密度
- Focus 輪郭を変化させる(フォーカス変化)
- Attractively, Sexy 音色を魅力的に
- Undesirable 音色を曖昧に
- Linked a pitch change ピッチ変化を連続
- Linked a gain change レベル変化を連続
- Linked a position change 定位・方向感の移動を繋ぐ、尾引く
- Envelopment, Security 包まれ感、安心感
- Enhanced psychological meaning 心理的意味を深める
- Surprising, Amazing, Startling ドキッとさせる
- Dark image ダークな感じ

What is HIBIKI ?

- Digital Reverberator
 - Level
 - Frequency
 - Time

Equipment & Parameters of Demo Clip

SSL Avant Plus

PM L.R / Ls.Rs

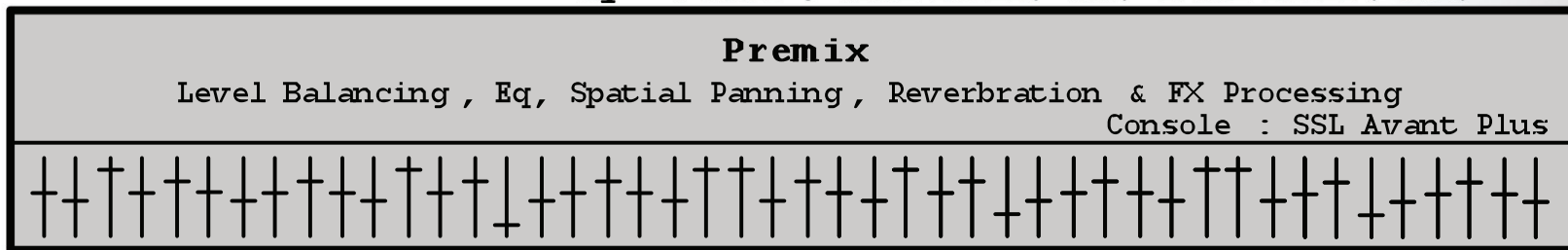
fader: -19 / -23 dB

eq : none / 5KHz shell(-6dB) 100Hz shell(+3dB)

Premix

Level Balancing , Eq, Spatial Panning , Reverbration & FX Processing

Console : SSL Avant Plus



ProTools HD
materials

Lexcon
480L

Bricasti
M7

Eventide
Orville

Lexcon 480L

Mode: Mono Split

PS: Small Wood Room

PM L.R / Ls.Rs

rt : 0.67 / 0.88 sec

shape : 45 / 45

size : 13m / 15m

hf c-off: 8.513k / 757Hz

pre dly : 0 / 80 msec

2. What is the key for spacial information?

[2] What does the reverberator create?

Examination from Prof. Omoto.



Workshop 4: What is 'Hibiki'?
Introduction to Spacial Audio Conference Tokyo 2010
AES 14th Regional Convention, Tokyo 2009

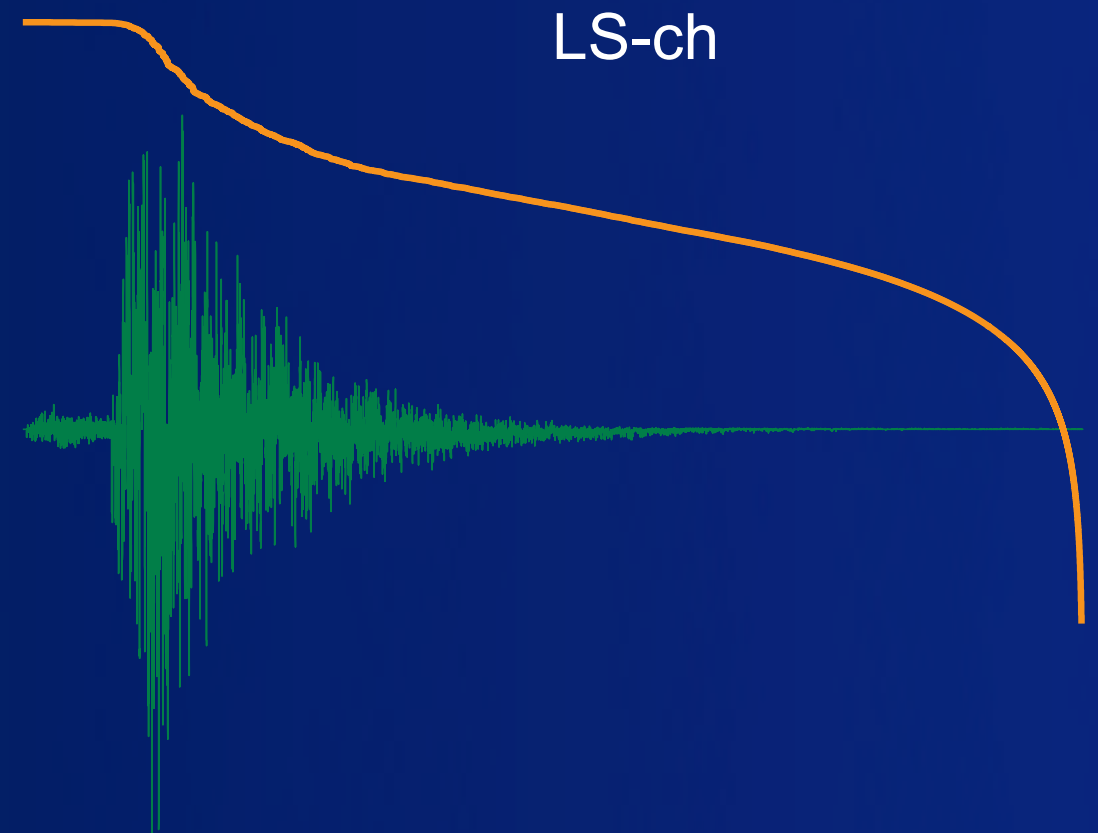
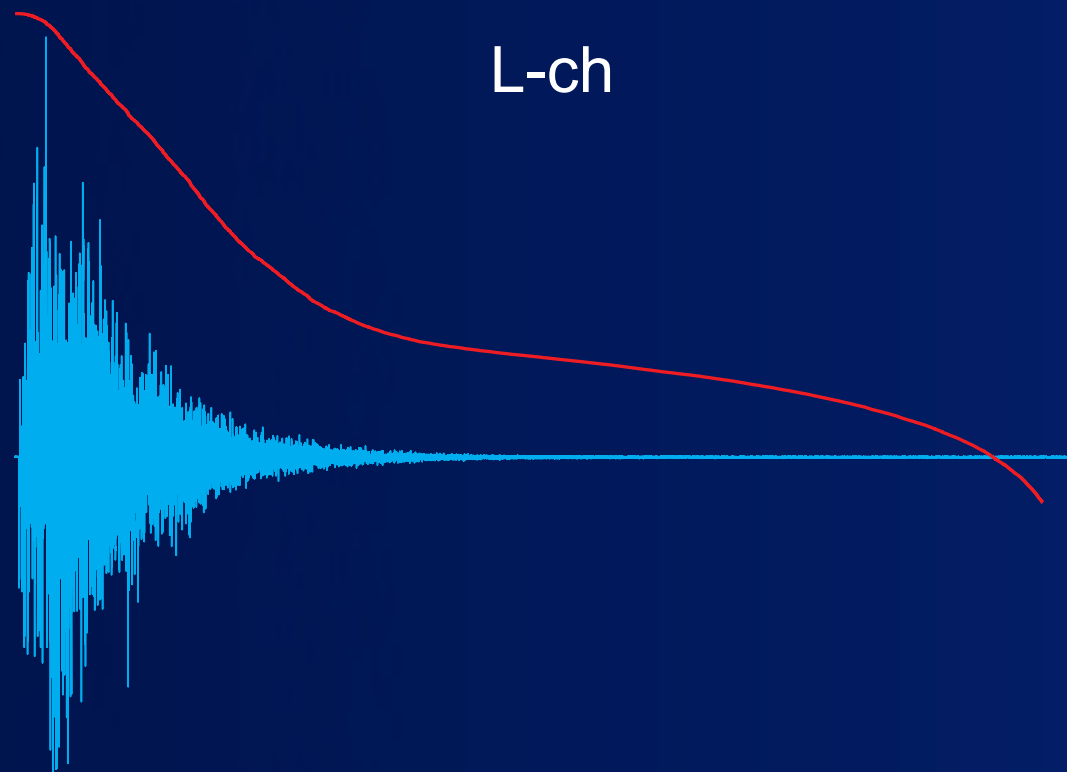
What is 'Hibiki'

- Room Profile Estimation by Impulse Responses
- Impulse Response Analysis of Reverb Effector

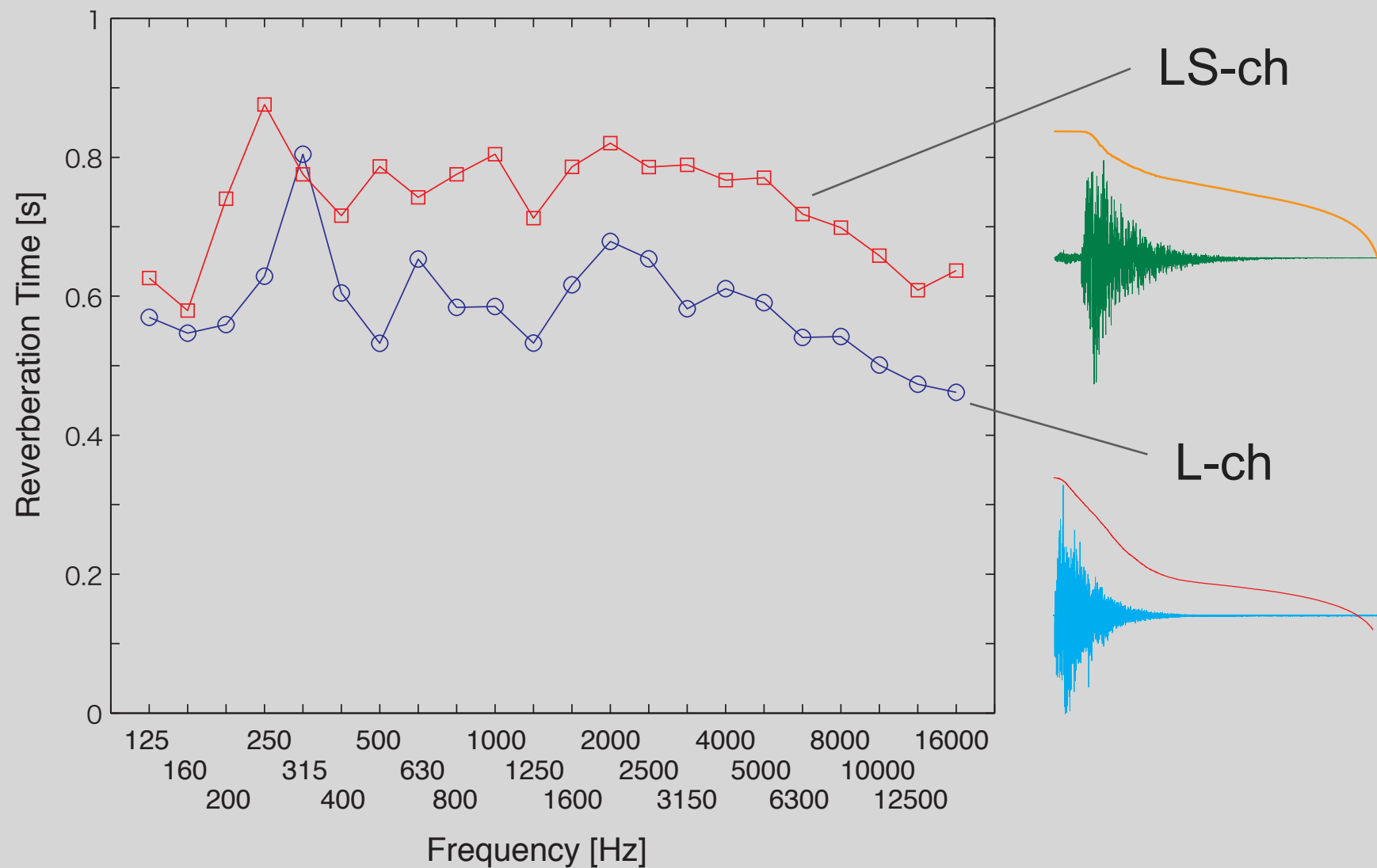
Akira Omoto
Faculty of Design
Kyushu University

尾本 章
九州大学 芸術工学研究院

■ Impulse Responses of Reverb-Effector



■ Impulse Responses of Reverb-Effector



2. What is the key for spacial information?

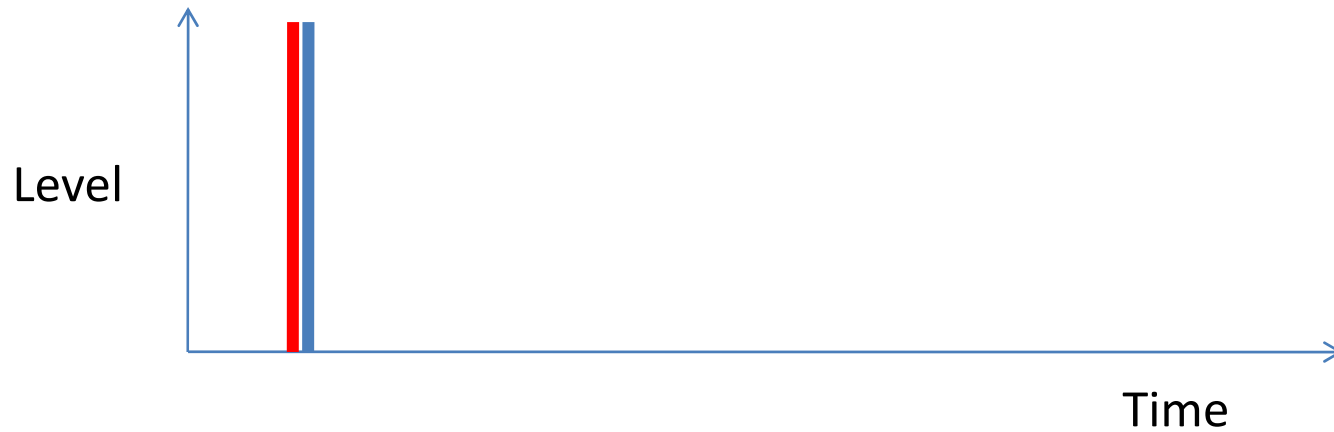
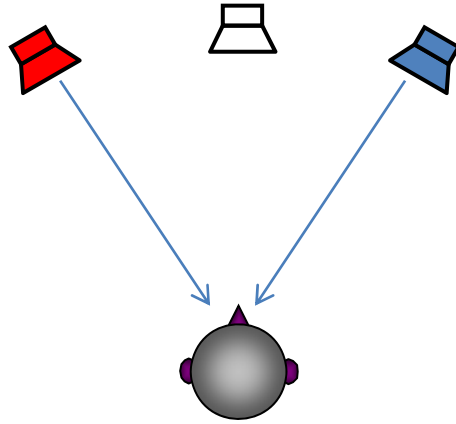
[3] What does the reverberator create?

Examination from Prof. Hanyu.

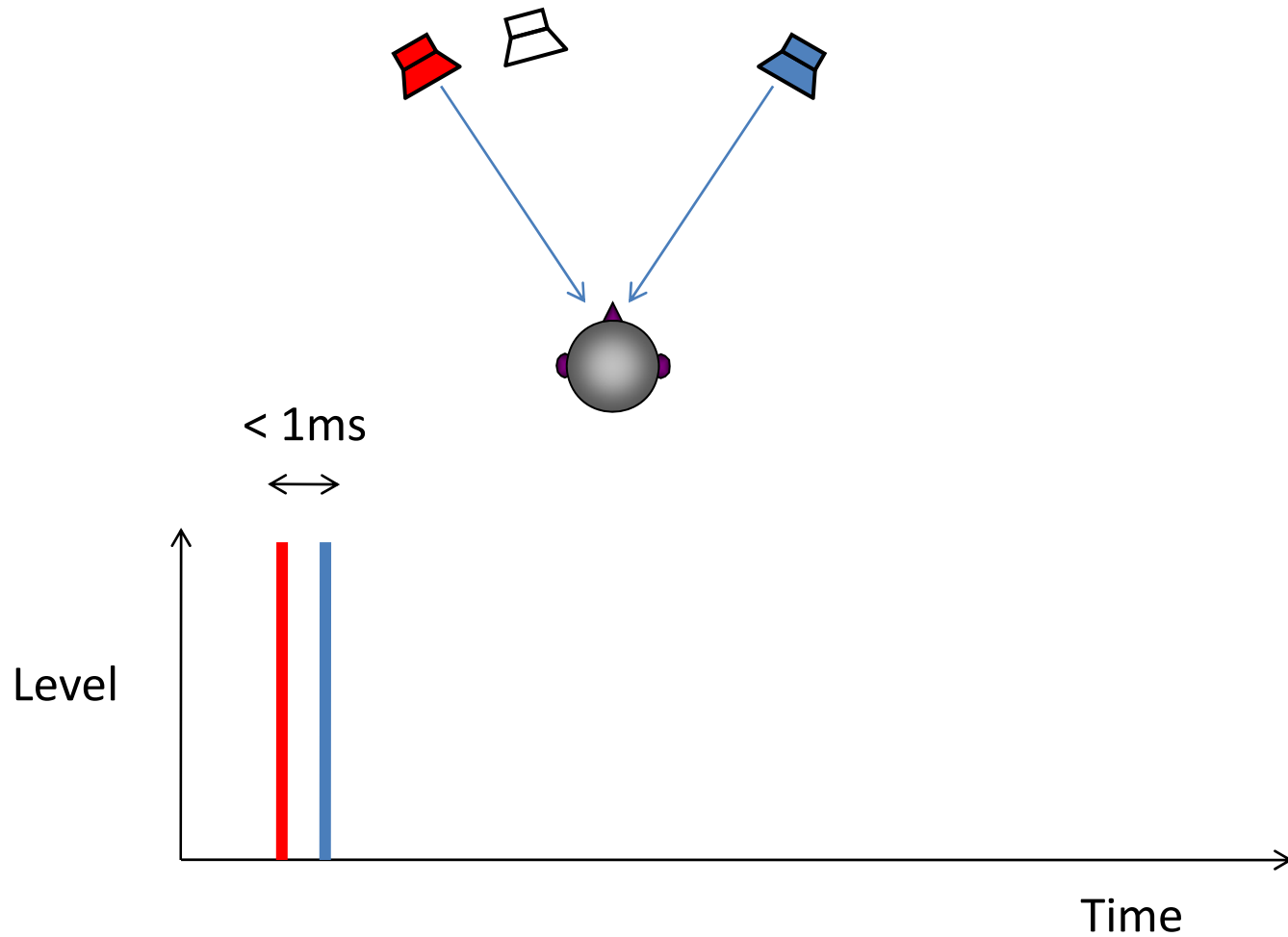
空間音響

Spatial Hearing

合成音像(Phantom image)

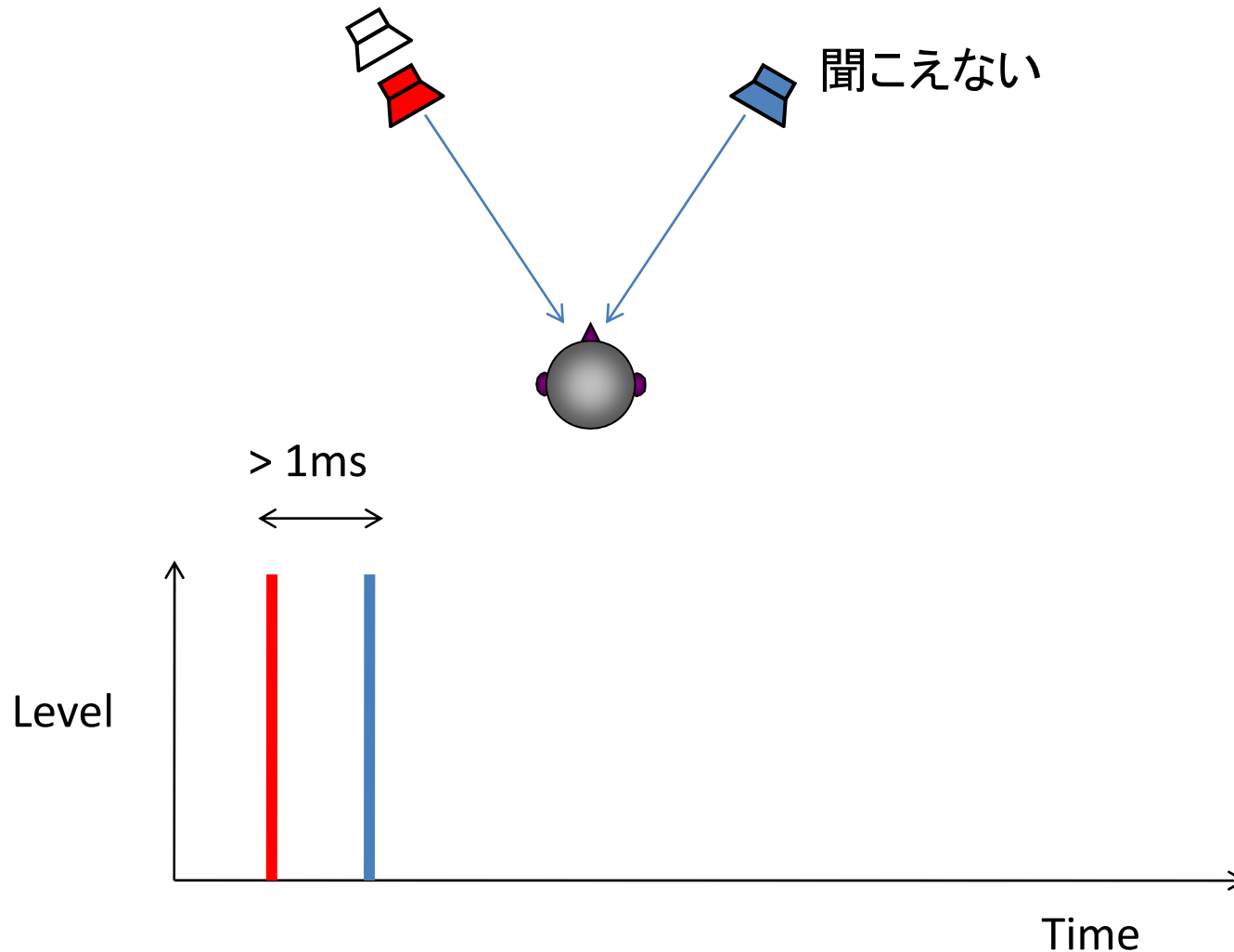


合成音像(Shifting phantom image)

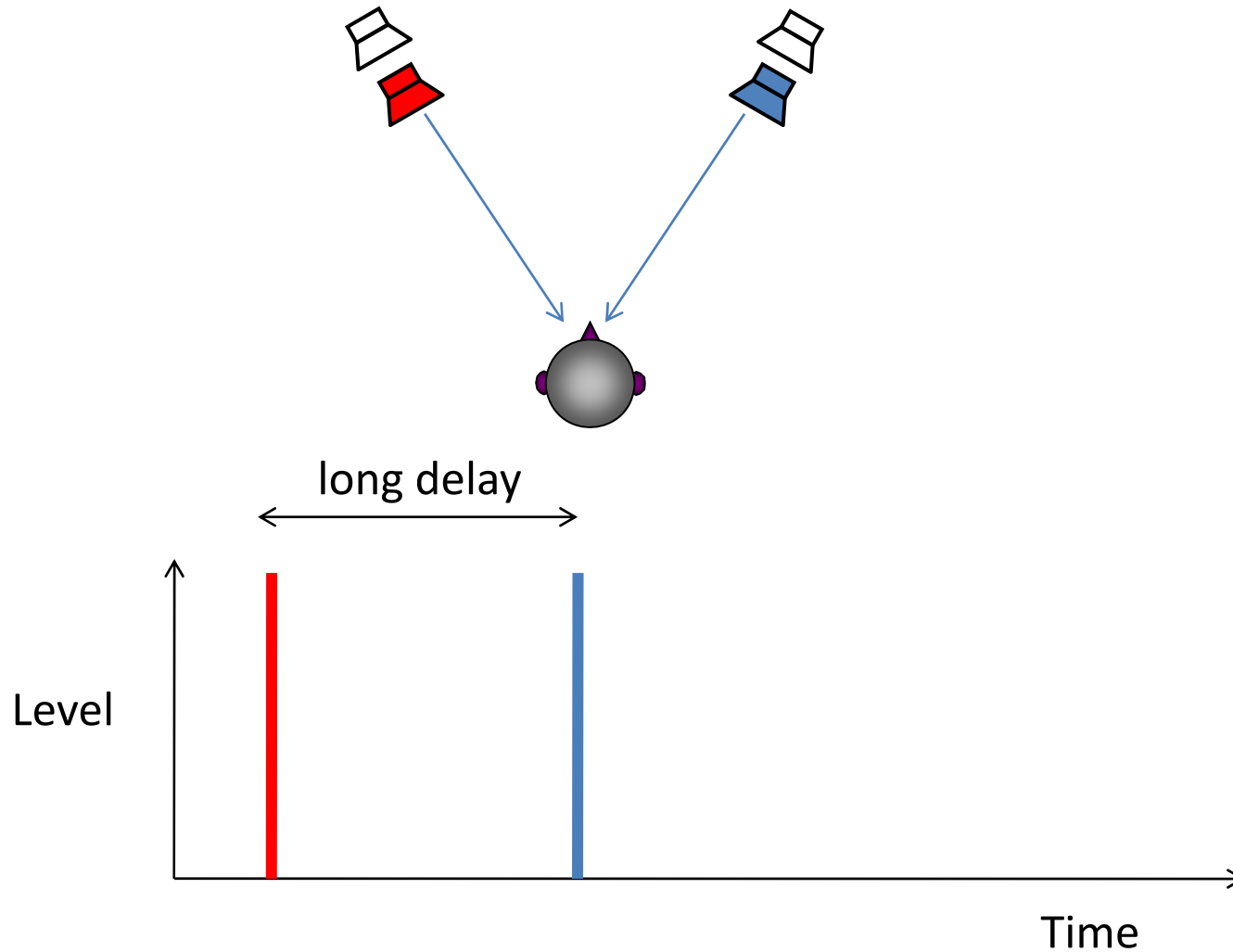


第一波面の法則（先行音効果）

Law of the first wave front (Precedence effect)

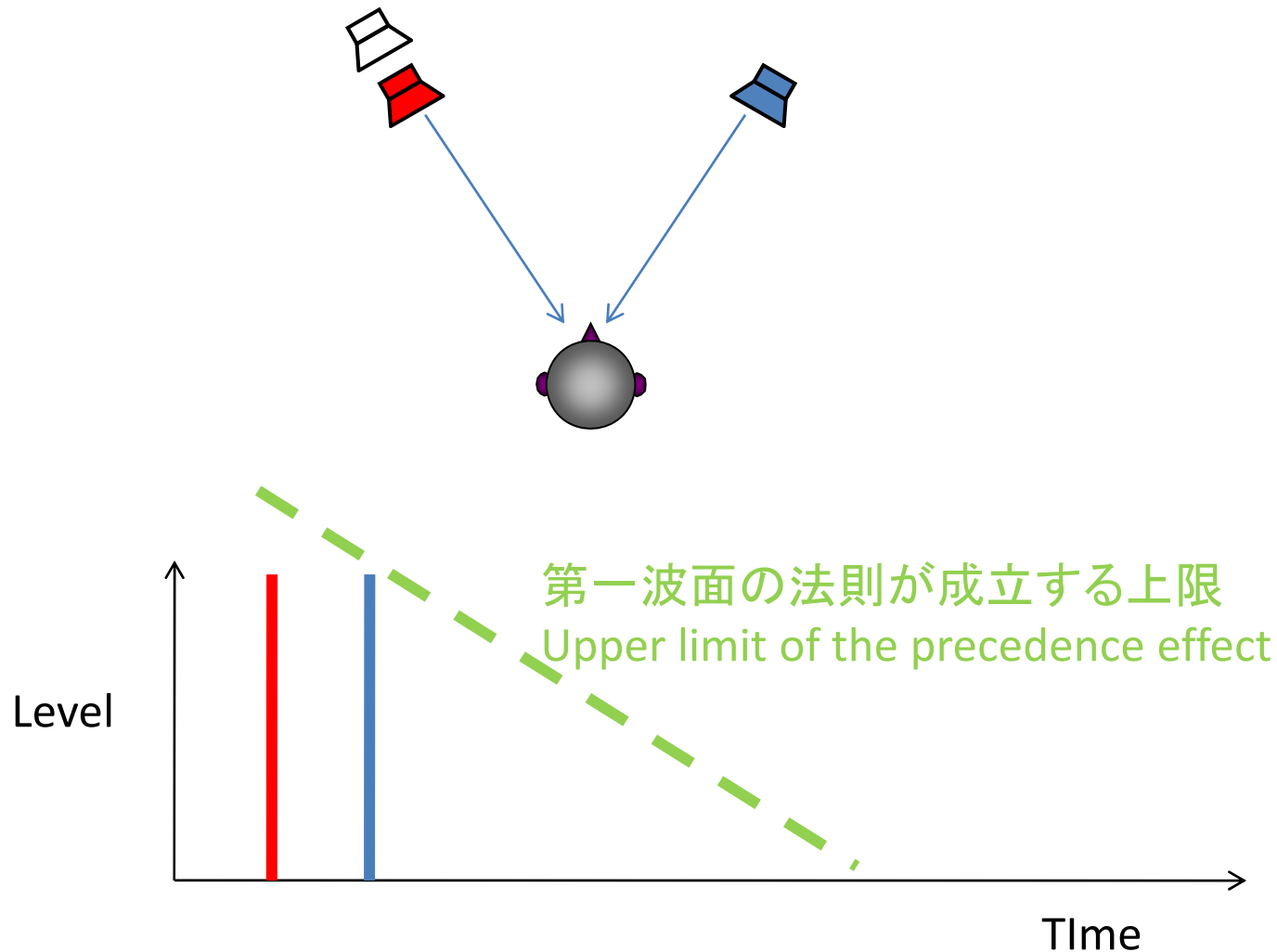


音像の分離(sound image split)



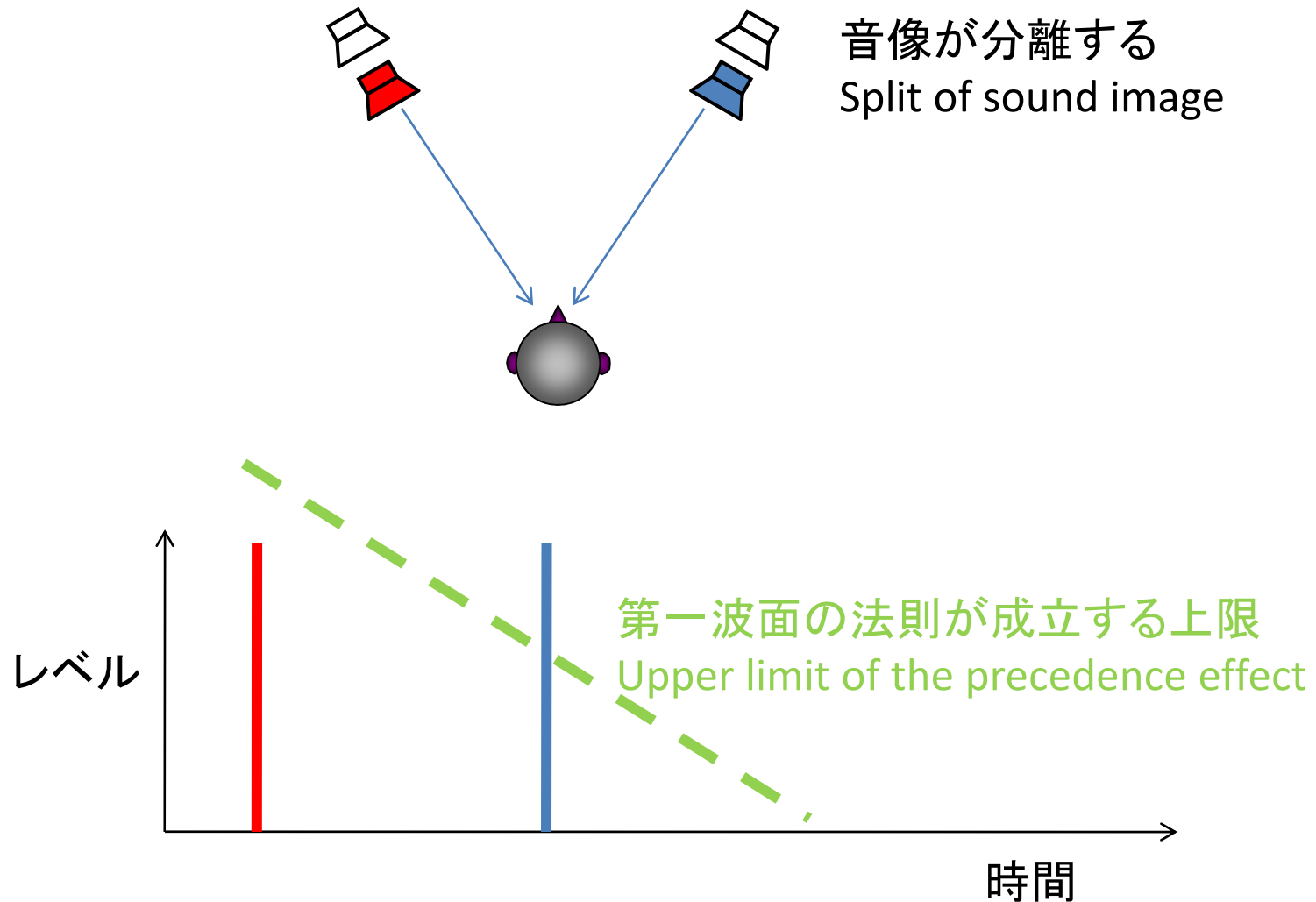
第一波面の法則の上限を超えない場合

Below the upper limit of the precedence effect



第一波面の法則の上限を超える場合

Over the upper limit of the precedence effect



第一波面の上限を超えない反射音の効果

Effects of reflected sound below the upper limit of the precedence effect

音像の幅が大きくなる

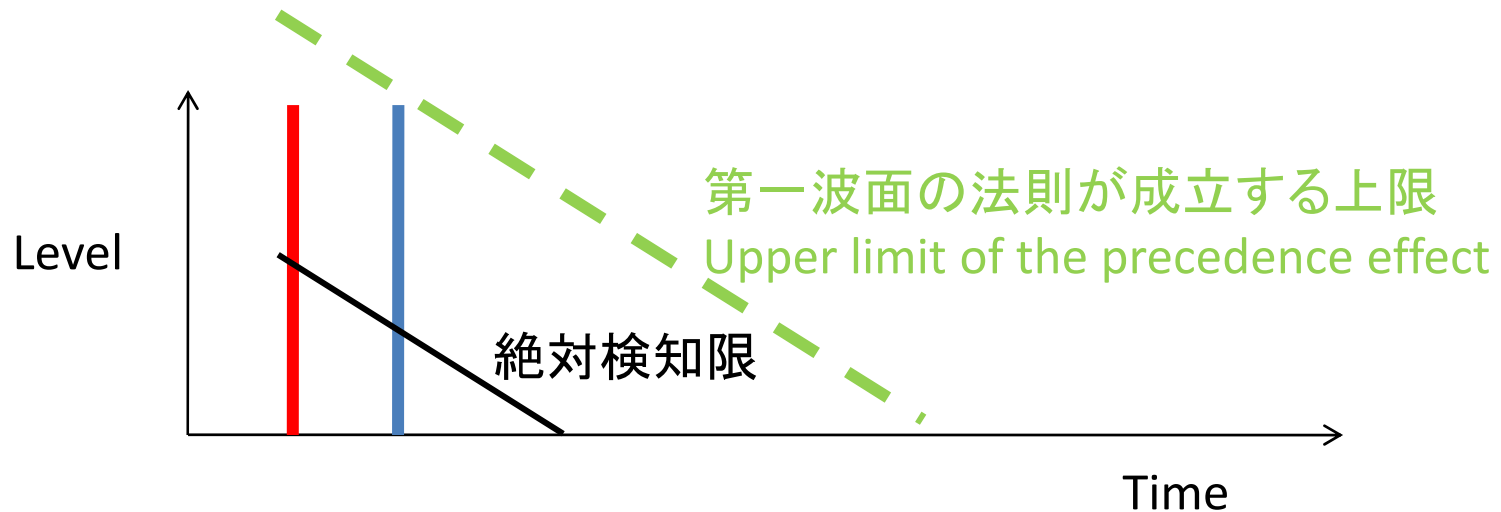
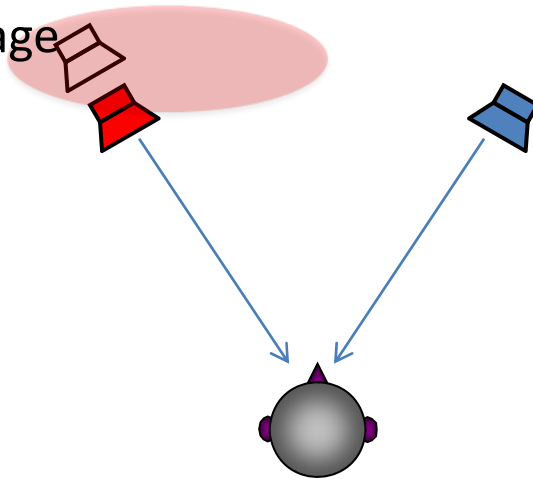
Broaden sound image

ラウドネスが増す

Increase loudness

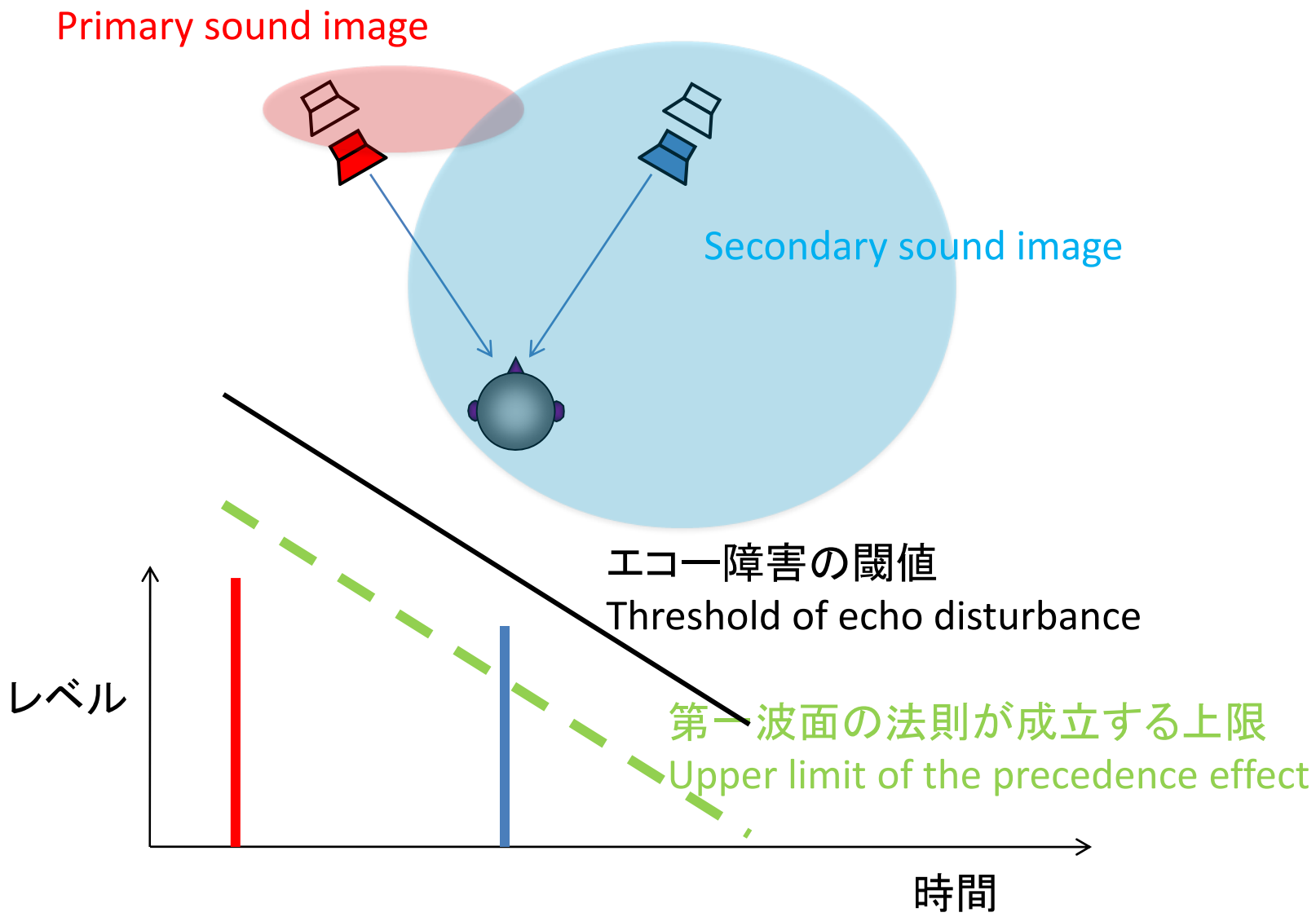
音色が変化する

Change tone

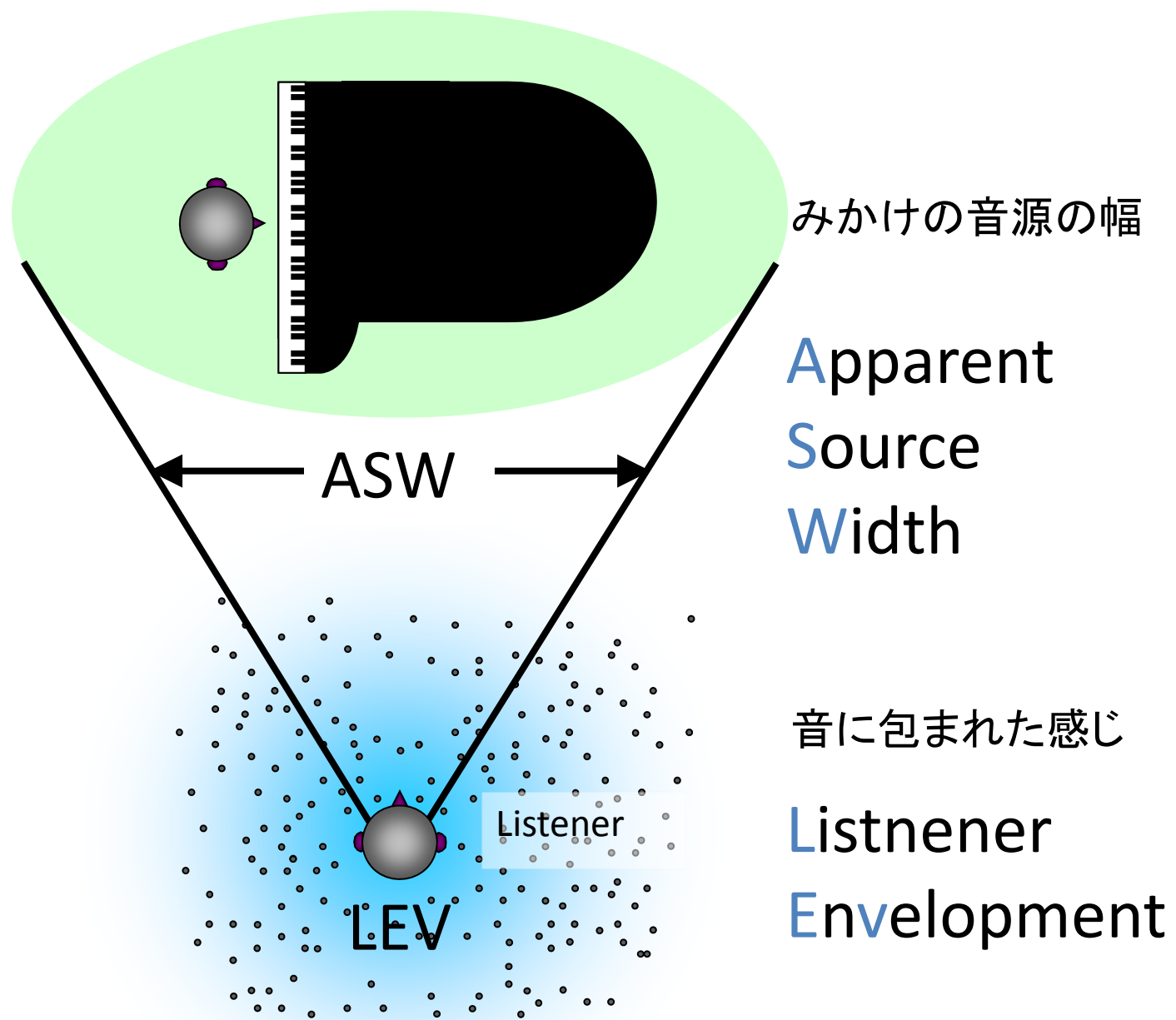


第一波面の法則を超える反射音の効果

Effects of reflected sound over the upper limit of the precedence effect

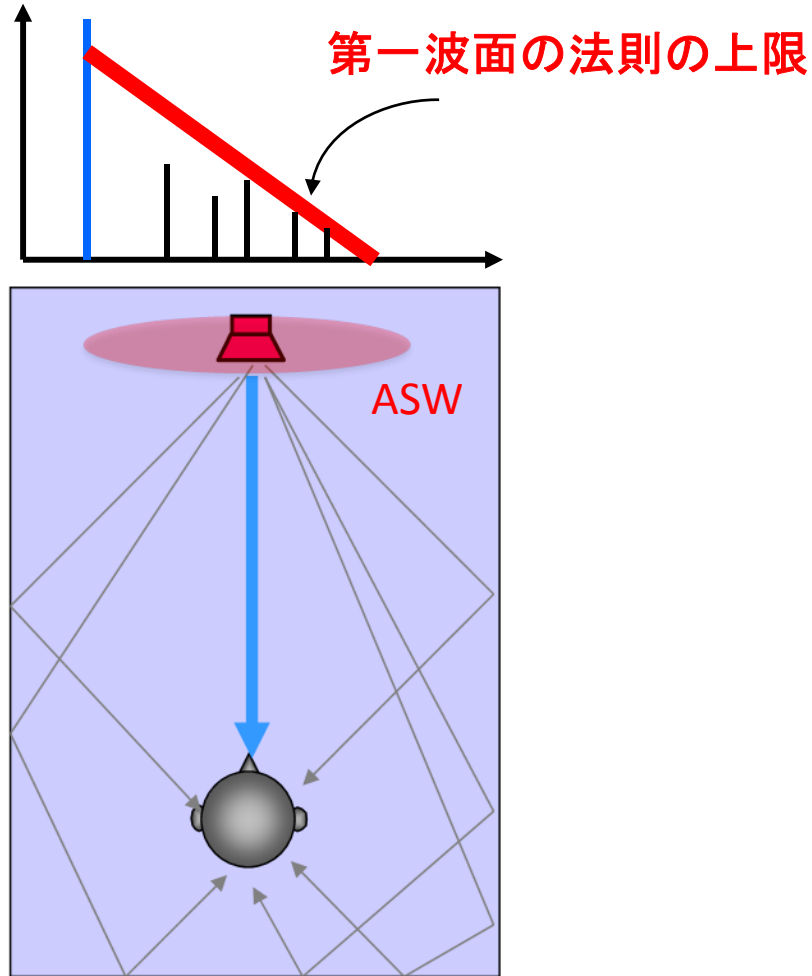


空間印象 (Spatial Impressions)



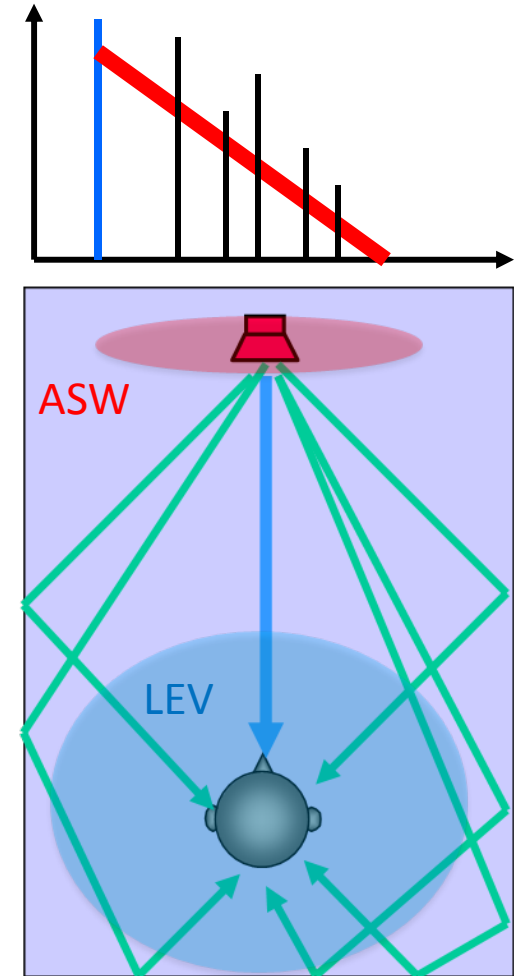
第一波面の法則と空間印象

反射音レベルが第一波面の法則
の上限を超えない場合



反射音を知覚出来ない

反射音レベルが第一波面の法則
の上限を超える場合



反射音を知覚できる

第一波面の法則と空間印象の関係

Relation between precedence effect and spatial impression

