#### NEW TECHNOLOGIES FOR PASSIVE LOW-FREQUENCY ABSORPTION AND CASE STUDIES IN SOUND REINFORCEMENT APPLICATIONS

Niels W. Adelman- Larsen Musician, acoustician, inventor, author Flex Acoustics Part 1: room-acoustics The sound fields' 2 components: \* direct sound \* reflected sound



# Reflections multiply into tenth/ hundreds of thousands over time, - if NOT absorbed!



#### Definition of reverberation time, T30



#### Different venues have various RT



# Recommended RT for pop/rock



#### Best venues have short RT at low frequencies



#### Masking. Reverberant LF sound masks even higher pitched direct sound



# Musical instruments' fundamental frequencies: 63 Hz- 1k Hz



# Why? 1. Absorption of audience



Why? 2. Lower directivity at LF
the distance at which the diffuse sound is just as loud as the direct sound

$$r, cr = \sqrt{\frac{Q V}{100 \pi T (1 - \alpha') N}}$$

Bass frequencies have a low Q

# Acceptable T30 tolerances divided into 3 ranges



Part 2 Solving the problem

# -curtains do not absorb much low frequency sound



#### New sound absortion technology Weighs nothing – takes up little space when deflated Patented



aQflex: ON/OFF low-mid absorption product aQtube: mobile low-mid absorption product

Absorps bass and mid

Absorp only little high frequency sound

Close to no absorption when deflated



# aQtube Cse 1: Eurovision 2014 venue



#### 7000 m2 mobile aQtubes for ESC



# Horizontally mounted in ceiling, 50 m long Tubes



# Vertically mounted, 35 m



# RT before/after; ESC 2014



#### **CASE 2: AMSTERDAM ARENA**



# Lowering RT<sub>(80-1250 Hz)</sub> by 25%



#### **CASE 3: Kraftwerk in Berlin**



#### Neue National Gallerie



#### 500 m2 aQtubes; RT: 4,5s -> 2,5s



Frequenz f in Hz

Part 3 aQflex (Patented) **Permanently installed** on/off absorption for preparing a venue for different types of music

# Traditional variable acoustics use porous absortion



# curtains do not absorb much low frequency sound compared to hi



# aQflex: on/off: inflated /deflated



#### Case : on/of aQflex in music school



# 125 cm between baffles=> alpha = 0,37 80 cm between baffles => alpha = 0,50



" "I have worked for several halls with the challenge of achieving favorable acoustics for different types of music.

This is the first time I have witnessed that challenge being solved. We use the AqFlex system every day - never seen or heard anything like it!" Director Allan Gardersø Absorption must work equally well in the range 63-1000 Hz = fundamental frequencies of musical instruments



#### **Concert hall Korea**



# aQflex mounted above suspended, open ceiling



# New book on Springer Verlag about the topic

2

Niels Werner Adelman-Larsen	
Rock and	
Pop Venues	
Acoustic and Architectural Design	
Free	>
Preview	
2 Springer	

#### Rock and Pop Venues

Acoustic and Architectural Design **Adelman-Larsen**, Niels Werner

2014, XIII, 162 p. 120 illus.

**Available Formats:** 

≑ eBook i

🚡 Hardcover i

(gross) price for Denmark

106,99€

🐨 Get it now

# Flex Acoustics

