

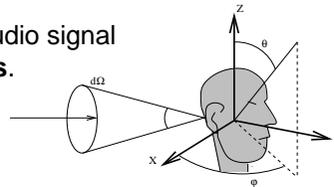
## Research activities in 3D sound and Auralization

### What is AURALIZATION?

The technique of creating audible sound files from simulated acoustical spaces. The auralization gives the user **the impression of being inside the simulated room**.

A room acoustics model is created to compute the *directional room impulse responses* (DRIRs) at several locations in the room.

These DRIRs are then convolved with an anechoic audio signal (speech, music, ...) to generate the **auralized signals**.



The auralized signals are reproduced by **headphones** or in an **immersion studio** by an array of loudspeakers surrounding the listener.

### Contributions of INTELSIG

INTELSIG is active in auralization through its audio and acoustics team.

Created in the early 80s, the sound ray-tracing program *SALREV* is continuously updated. It is presently able to compute the classical room acoustics parameters, the echograms and the directional RIRs.

An auralization module has been created and operated during the research project AURALIAS (2007-2010), including an immersion studio for the sound reproduction.



# The research project AURALIAS



A research project to develop an interactive tool for room acoustics studies, mixing real-time 3D auralization and 2D visualization of the virtual room.

Three research teams:

- INTELSIG (ULg): audio, applied acoustics, signal and image processing,
- LISA (ULB): image synthesis and analysis,
- LUCID (ULg): architecture, human-machine interaction.

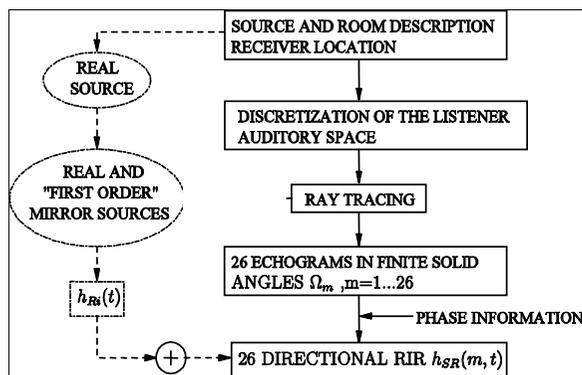
Funded by the Region of Wallonia (program Wist2)



## Directional Room Impulse Responses

The AURALIAS auralization system is based on the concept of directional RIRs.

DRIRs allow for **better localization cues**, since not only the direct sound and the first-orders specular reflections are precisely reproduced (in amplitude, delay and direction), but also the complete directional reverberation.



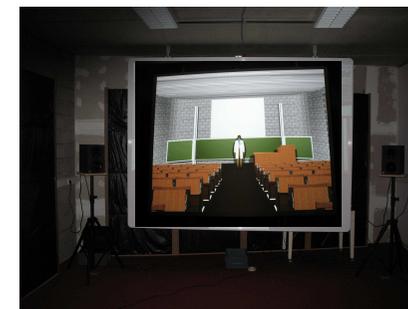
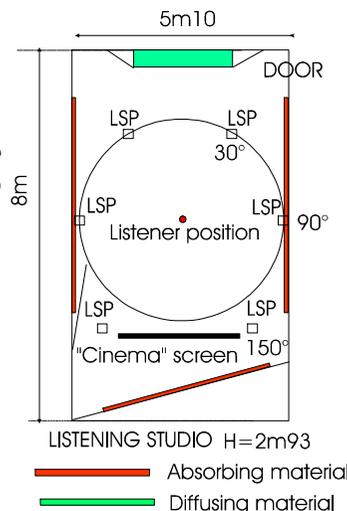
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## The immersion studio

The auralized signals are reproduced in AURALIAS with six loudspeakers surrounding the listener in the horizontal plane and (presently) two frontal loudspeakers at an elevation angle of 45°.

Spatial audio is provided by the Vector Base Amplitude Panning (VBAP) method.

Plane view of the immersion studio with the six loudspeakers (LSP)



The « Cinema » screen in the immersion studio

## The audio signal processing system

**Real time 3D Auralization** is an objective of AURALIAS.

The signal processing include a real-time frequency block segmented convolution allowing the following **real-time applications**:

- Displacement and head's rotation of the listener in the virtual room <=
- Control of the source volume and audio message <=
- Several sound sources playing simultaneously <=
- Displacement of the source in the virtual room <=
- Switching between two acoustical configurations of the same room <=
- Tracking system to adapt the auralization filter to the real user's position <=