

## Project Description

The installation *Spatial Sonification of the Higgs Boson Decay* is conceived as an interactive 3D sound experience embedded in a virtual space linked to the physical space of the Large Hadron Collider (LHC) particle accelerator built in the European Organization for Nuclear Research (CERN) facilities.

The installation is conceived as an immersive trip through which the user explores in an auditory way the deepness of the elements that shape the origin and constitution of the universe. Through this sound set up we put into play a different sensorperceptive way which through humans try to grasp some knowledge of reality.

Mainly two topics are entangled within the auditory experience: a reconstruction of sounds taken from sonification models created in the LHCSound project, and a mixed reality sound spatialization device connected to SPASM 4 Live software developed at V2\_ Institute for the Unstable Media.

Firstly, sonification is the presentation of data using sound. The idea behind it is to render an acoustic data presentation that enables humans to draw conclusions on data properties such as trends, clustering, or other distributional patterns by listening to the sound.

In our installation, we present six sound samples that are generated via real data from the ATLAS detector. In particular, this data collection of the proton-proton collisions contains the recent event of production of the Higgs boson particle, also referred as God's particle in main media.

For each track different sonification techniques are used. Depending on the sonification technique and on the particular data under scrutiny, different sounds are created, ranging from harmonic marimba like tones to the most abstract noises.

Secondly, in the spatialization of sound device the virtual position of the player is connected with the real one through a tracking of his coordinates and orientation in the installation room via an Arduino and a Xbee device. This position is sent to the SPASM program and determines whether various sounds will be heard. Therefore, as one walks through the room, one passes and hears the various virtual sound sources.

In the middle of a room there are placed a pair of wireless headphones with the Xbee transmitter. When the player puts them on, is at once surrounded by the six tracks forming the spatial composition. The first sound he hears, in the center of the room, is an ambient sound that recreates the environment of the LHC laboratory facilities (i.e. human voices taken from chats and discussions of scientists and engineers of the center). The other five sounds correspond to different sonification data taken from the particle collisions in the detector. These ones are distributed virtually in equidistant spots over the archs of a circle that is circumscribed in the room (see figure 1).

In this way, the virtual sound spatial composition in the room mirrors the 27km particle accelerator ring shape. When the user is in the center, he feels that he is inside the facilities, as he moves circularly toward the walls he experiences the sound that is generated inside the beamlines, where particles circulate and collide nearly at the speed of light.

Figure 1: Left, location of CERN facilities in a map. Right, virtual sounds in SPASM

