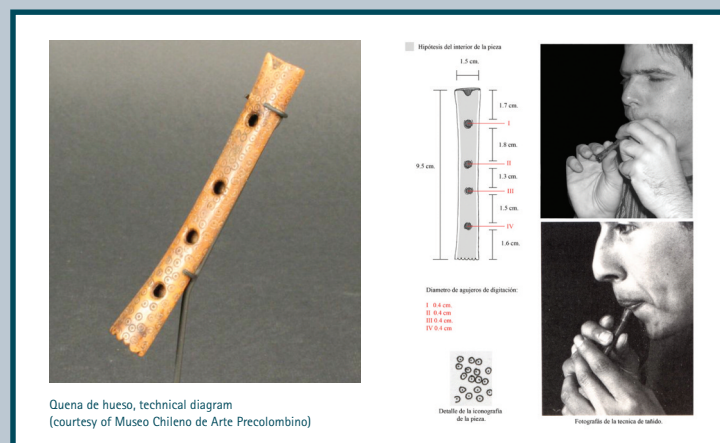


# Music Archaeology on GÉANT

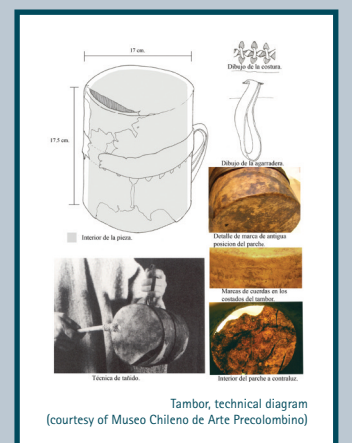
The reconstruction of two ancient musical instruments from Pre-Colombian Latin America through GÉANT and the ALICE2 transatlantic link

## 1 Two ancient instruments: Quena de Hueso and Tambor



The quena de hueso (literally bone flute) was a traditional flute of the Andes belonging to the Nasca culture (southern Peru). The reconstructed quena is a wonderful 9.5cm long instrument located at the Museo Chileno di Arte Precolombino (Chilean Museum of Pre-Colombian Arts) and it has four holes, dating back to 1000-700 B.C.

The tambór (drum) was a percussion instrument belonging to the Gentilar culture (northern Chile) and it is more ancient than the quena; we can date it to between 1200 and 1470 B.C. The reconstructed tambór is a relatively small instrument. The drum head had a diameter of 17cm and it was most probably played suspended by a small leather string.



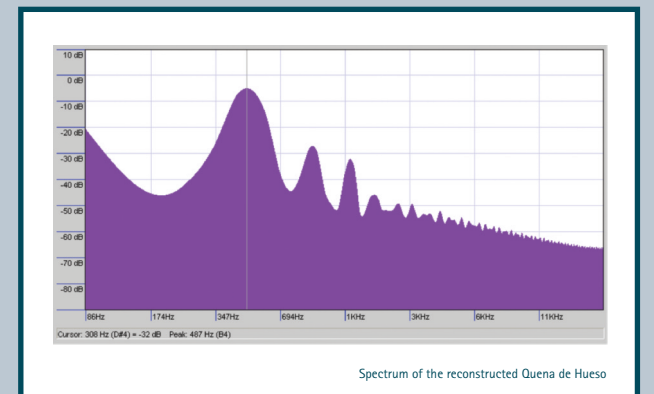
## 2 The reconstruction technique: physical modelling

The technique used to reconstruct the two instruments is called physical modelling synthesis and it has been extensively tested on the GÉANT and EUMEDCONNECT2 networks over the past few years by the ASTRA project. Equations and algorithms describe the physical structure of the instrument, while sounds are generated by modelling it as a mechanical system with different configurations for each note. Each instrument is defined by:

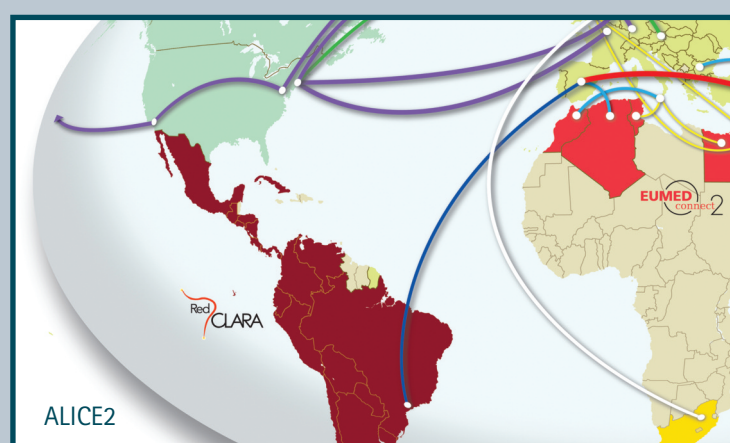
- an algorithm, describing the structure of the instrument
- a set of fixed constants, such as its dimensions and material properties

- a set of time-dependant functions, describing how the musician interacts with it.

For example, the frame drum is modelled by defining constants like the stiffness and mass density of its membrane, while a formula works out the energy injected into the system when it is struck with a particular force by the musician, producing a unique note.



## 3 ALICE2 transatlantic link enables collaboration



Data about the two instruments were transmitted across the ALICE2 transatlantic link between Europe and Latin America. Several GB of data were securely exchanged in almost real time by two teams of researchers in the two continents (historians and archaeologists in Latin America, archaeologists, musicians and engineers in Europe), enabling an effective collaboration at all levels. Software engineers in the UK and Italy created two models for the two ancient instruments based on the data from Latin America. Due to the complexity of the physical modelling process, the reconstruction algorithms were run simultaneously on hundreds of computers throughout Europe and the lower Mediterranean area using the GILDA

and EUMEDGRID infrastructures, which link computing resources through the GÉANT and EUMEDCONNECT2 research networks, using the EGI & NGI infrastructures.

Once the reconstruction phase was finished, the sounds were transferred back to Santiago in Chile, to be listened to by the researchers and used by the musicians.

The two reconstructed instruments were used for the first time in public on May 14th 2010, during the official launch of ALICE2 and the second generation of the RedCLARA network.

## 4 Acknowledgements

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