LOFAR, the Low Frequency Array [1], is a next-generation radio telescope in the Netherlands. It will initially operate at frequencies from 30 to 240 MHz (corresponding to wavelengths of 10 to 1.2 m). Its superb sensitivity, high angular resolution, large field of view and flexible spectroscopic capabilities will be a dramatic improvement over previous facilities at these wavelengths. As such, LOFAR will carry out a broad range of fundamental astrophysical studies.

The design, development and construction of the facility are being driven by four large key astrometric projects designed to pursue LOFAR science of fundamental importance:

- The Epoch of Reionisation
- Extragalactic Surveys and their exploitation to study the formation and evolution of clusters, galaxies and black holes
- Transient Sources and their association with high energy objects such as gamma ray bursts
- Cosmic Ray showers and their exploitation to study the origin of ultra-high energy cosmic rays

In November 2003 the Dutch Government allocated 524 Euro to fund the infrastructure of LOFAR under the Rijn programme. In accordance with Rijn guidelines, LOFAR was funded as a multidisciplinary sensor array that will facilitate research in geophysics, computer sciences and agriculture as well as astronomy. The infrastructure funding was allocated with the expectation that funding will be provided by the communities in each individual discipline to enable the relevant research to be carried out.

In December 2003 the Initial Test Station (ITS) for LOFAR became operational as an engineering array; it is located near the village Exloo, at the site of the future LOFAR compact core of the telescope array. Since its commission the ITS has been used for a variety of experiments - engineering, scientific and educational in nature. In April 2005 the core of the LOFAR Central Processor (CEP), an IBM BlueGene/L system, was commissioned in Europe, officially taken into operation at the Computer Centre of the Rijksuniversiteit Groningen.

In June 2005 the Samenwerkingsverband Noord-Nederland (SSN) allocated 22M Euro for the development of an ICT-infrastructure and the realization of a sensor-network within the scope of the LOFAR project. The construction of LOFAR is started at the beginning of 2007, with the compact core fully operational by 2008 (Phase 1). After that the remote stations will be added to the array (Phase 2), summing up to a total of 77 stations with 86 dipole each.

The extension of LOFAR to further European countries (Phase 3) would increase the baselines to several 1000 km and hence improve the resolution by another order of magnitude.

As initiated by a group of students from Amsterdam Univ., a parallel observation of Jupiter bursts was performed on 2005/03/14. Full waveforms were recorded on both sites for later correlation in a single-baseline VLBI setup, an off-line analysis had performed at Nijmegen (A. Nij).

As LOFAR will be operating in an environment well populated by man-made radio frequency interference (RFI), identification, classification and removal of this interference will be vital. In order to get an overview of the type of RFI signals and ways to identify them, we have set out to inspect the raw data recorded with ITS so far to gradually build up a catalog of (un-)identified phenomena. Depending on the observational context, these signals later either have to be removed (as interference) or selected (as target or calibrator).

Starting the analysis from the raw digitized waveform of the electric field at each dipole allows to exploit the potential of the “digital radio telescope” concept LOFAR will implement: exploration of multiple scales in the time-frequency domain and full 3D beamforming, to map the evolution of radio sources in time and space (tomographic movies).

Example: Lightning is a transient, high-current discharge whose path length is measured in kilometers. The total discharge is termed a flash, an event with a typical duration of about half a second. A flash has several components, the most significant being three or four high-current pulses called strokes. Each stroke lasts about a millisecond, and the separation between strokes is typically several tens of milliseconds [4].

Given its capabilities, the ITS is well suited to detect transient sources (such as electric discharges in thunderstorms) and study their characteristics, both in the time and the spatial domain, e.g. the substructure and evolution of individual strokes can be followed at a time resolution of 12.5 ms within a 3-dimensional volume (as a tomographic movie).