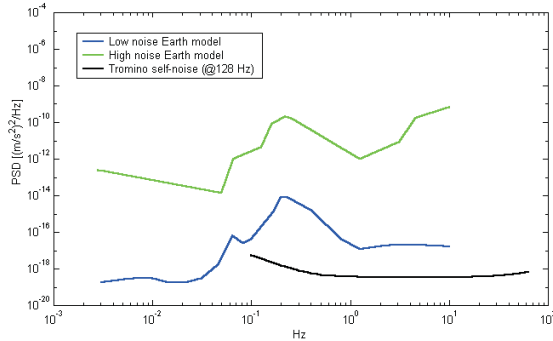


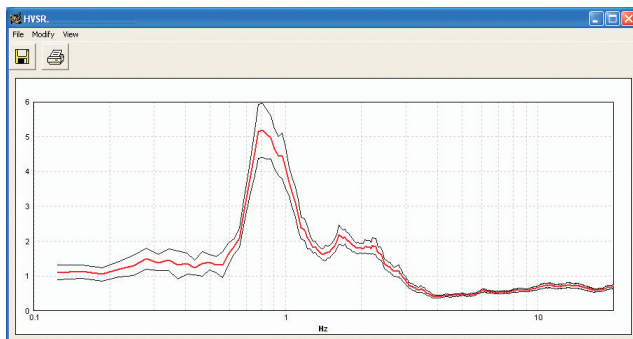
# TROMINO<sup>®</sup>: the New Generation of Seismic Noise Acquisition Systems

Site	Trace	Day	Start	End	Length	Freq. [Hz]	GPS
1	Florence Apennines	10/01/05	10:15:47	10:35:49	20' 0"	TRC 128	
2	Florence Giotto tower	10/01/05	15:36:30	15:42:31	6' 0"	TRC 128	
3	Florence Ponte Vecchio	12/29/12/04	11:34:16	11:54:18	20' 0"	TRC 128	
4	Venice Ducal Palace	11/01/05	12:52:07	13:12:06	19' 56"	TRC 128	
5	Venice Lido island	10/01/05	15:51:44	15:57:45	6' 0"	TRC 128	
6	Venice Murano island	15/01/05	20:15:19	20:45:20	30' 0"	TRC 128	
7	Venice Night recording	01/01/00	00:16:00	00:22:01	6' 0"	TRC 128	

Grilla analysis and administration software: the main window



Self-noise curve of TROMINO<sup>®</sup> compared to the standard seismic noise models of the Earth (vertical component of motion)



Example of spectrum of soil motion recorded at a site

**GRILLA is the software tool** created to access to, to store and to analyze the TROMINO<sup>®</sup> recordings. **GRILLA** is a Microsoft Windows<sup>®</sup> compatible software that consists of:

1. an interactive and very user-friendly database
2. graphical tools to visualize the recordings
3. a wide set of mathematical tools to perform spectral and HVSR ('time-dependent' and 'direction-dependent') analyses on the recordings.

TROMINO<sup>®</sup> is the reference instrument in the field of portable seismic noise acquisition systems.

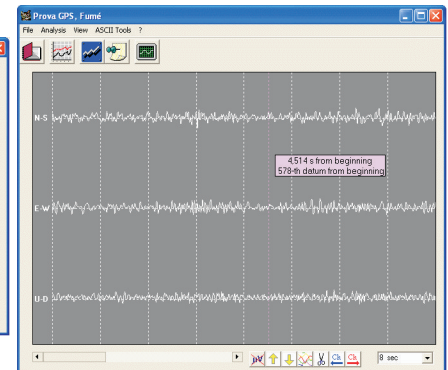
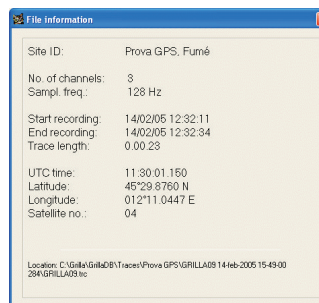
**History of an Italian tradition:** Italy has been pioneering the instrumental measurement of earth motions, and among them the measurement of tremors. It was around 1870 that Timoteo Bertelli designed and built in Bologna an accurate yet simple, light and comparatively inexpensive instrument to measure the tremors of the Earth. He named it micrometer from the name of the ancient Greek word for tremor. Today, Micromed - a company already acknowledged as a leader in the microelectronics applied to ultralow signals, such as those in neurophysiology - revives this Italian tradition and creates TROMINO<sup>®</sup>.

TROMINO<sup>®</sup> is the new generation of ultra-compact and ultra-light instruments for high resolution digital seismic noise measurement.

**Seismic noise exists everywhere** on the Earth surface and is mostly produced by wind and sea waves. Also industries and vehicle traffic locally generate seismic noise, although essentially at high frequencies (some Hz), which are quickly attenuated. Seismic ground noise acts as an excitation function for the specific resonances of both buildings and subsoil, much like a white light illuminates objects exciting the wavelength of their own color. Ground seismic noise can therefore be used to identify:

1. the resonance frequencies of buildings
  2. the resonance frequencies of subsoils
- in a passive, non-intrusive, fast and cheap way. In case of an earthquake, which can be thought as an episode of extremely high noise, if the soil resonance frequency is the same as that of a building on that soil, a coupled resonance will be induced. The latter, which greatly increases the amplitude of the stresses on the building, is called *seismic amplification*. Seismic amplification is the first cause of earthquake damage, more important than the size of the earthquake itself.

TROMINO<sup>®</sup> represents the ideal instrument for seismic noise measurements. The miniaturization and lightness, the ultra-low energy consumption, the total absence of external cables and the high-resolution digital electronics make TROMINO<sup>®</sup> an almost pocket-size instrument with a seismic noise resolution comparable or better than fixed state-of-the-art vault seismometers-digitizer chains.

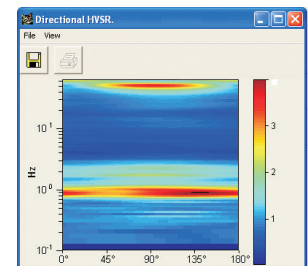
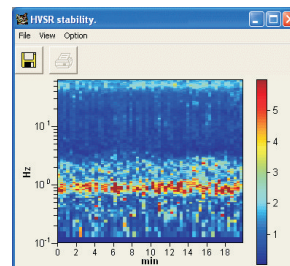


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Analysis software

**micromed micromed micromed micromed**

# TROMINO®

## The New Generation of Seismic Noise Acquisition Systems

- **New Generation** ultra-compact and ultra-light instrument for high resolution digital seismic noise measurement
- 3 orthogonal high resolution electrodynamic sensors
- **Truly portable:**
  - no external cables
  - only 10 x 14 x 8 cm
  - only 1.1 Kg
- Frequency range from 0.1 to 256 Hz



- **Ultra-low energy consumption:**
  - powered by 2 AA type (1.5 V) alkaline batteries
  - up to 80 hours of continuous measurement
- High resolution analog/digital conversion: 24 bit equivalent
- Very low electronic noise
- Oversampling frequency: 32x, 64x, 128x
- Internal memory storage up to 2 Gb
- Fast data output via USB
- Retroilluminated graphic display
- **Internal GPS:**
  - 12 channels
  - time-marker (precision 1  $\mu$ s)
- **Field-proof:**
  - shielded with a robust aluminium case
  - operating temperature range: from -10°C to +70°C
  - operating humidity range: from 0% to 90% without condensation
  - impermeability protection (IP) index: 65 (dust proof, splash proof)

TROMINO® is PATENT PENDING

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