TROMINO® 3G

The first all-in-one instrument for the dynamic characterization of soils, structures and more...

Every few months a destructive earthquake occurs somewhere in the world. Despite it can be forecasted or not, the only way to limit the losses and damages is based on an adequate urban and territorial planning and on adequate construction rules. The application of the latter requires the knowledge of the dynamic response of subsoils (resonance frequencies, subsoil stiffness etc.) and structures (modal analysis).
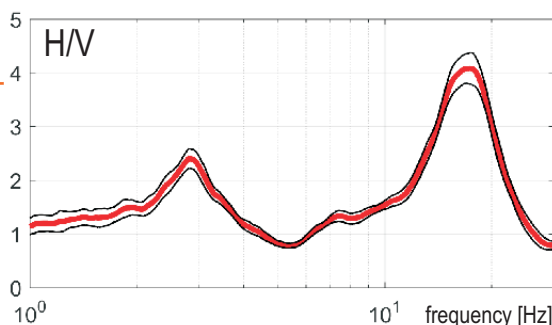
TROMINO® is the first brick for any wall

TROMINO® is the first 'all-in-one' instrument designed to achieve these goals. Very small in size and power consumption, it also works in array configuration through an exclusive radio communication system which makes it versatile and suited for many applications.

The new 3G version, with an augmented dynamics and sensitivity, allows to reach signal-to-noise ratios unusual for small size instruments, particularly at the low frequencies of seismological interest.
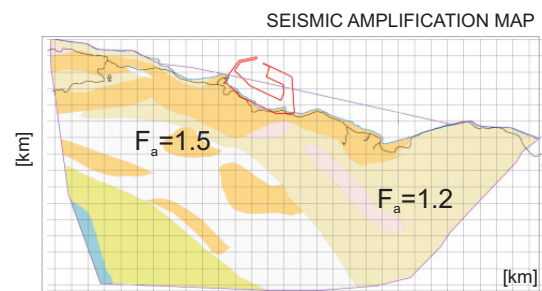
TROMINO® 3G is equipped with:

- 3 velocimetric channels with adjustable dynamic range and ultra-high sensitivity for sesmic ambient noise recordings (up to ±1.5 mm/s ~) and lower sensitivity but higher dynamics for strong anthropic vibrations (up to ± 5 cm/s)
- 3 accelerometric channels
- 1 analog channel (e.g., external trigger for MASW/refraction)
- built-in GPS receiver, internal and/or external antenna for positioning and absolute timing/synchronization among different units
- built-in radio transmitter/receiver module for indoor/outdoor synchronization among different units and alarm transmission (e.g., signal above threshold levels)
- Unique feature! Radio triggering tool for MASW / refraction surveys with a single-station, cableless system!
- built-in calibration and check-up system
- operating range [0.1, 1024] Hz on all channels with A/D conversion at 24 real bits

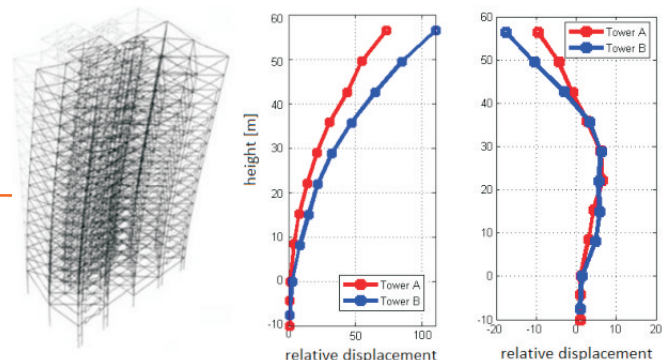## TROMINO® is the ideal solution for:

ENGINEERING GEOLOGY

- site effects and seismic microzonation (resonance frequencies, H/V)
- passive seismic stratigraphy
- Vs30 estimation from constrained H/V curve fitting
- active and passive seismic arrays (radio\GPS synchronization)
- small/mid scale seismic refraction for P and S waves, MASW, FTAN method (TROMINO® + trigger)

SEISMIC AMPLIFICATION MAP

$F_a=1.5$

$F_a=1.2$

TROMINO® is used worldwide. Example of seismic microzonation in Central Africa.

ENGINEERING

- modal analysis of structures (single station or synchronized multi-station approach)
- vibration monitoring
- alarm detection (e.g. signal above threshold)

TROMINO® is an international patent and a registered trademark.

TROMINO® is an ultra-portable package:

- no external cables
- very small size (10 x 14 x 8 cm)
- very light weight (~1 kg)

with very low consumption:

- powered by 2 standard AA batteries (1.5 V)
- works also on AC adapter for long monitoring

8 cm

TROMINO® can record in continuous mode without time-limits or for predefined time intervals. Starting is manual or on threshold. It can work in stand-alone mode or connected to and managed by a PC (or remotely, via web) through the software tool *Tromino Manager*. This allows to continuously view and save data acquired on remote stations and to send threshold-based alarms on-line or via e-mail. *Tromino Manager* allows remote control of networks of TROMINOs® connected via radio to a master TROMINO®.

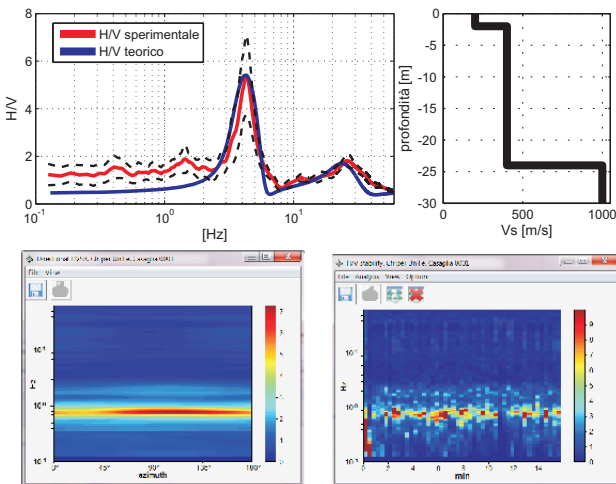**GRILLA** is the software to archive, organize, view and analyze the recordings of TROMINO®. Interactive, user-friendly, it produces automatic reports.

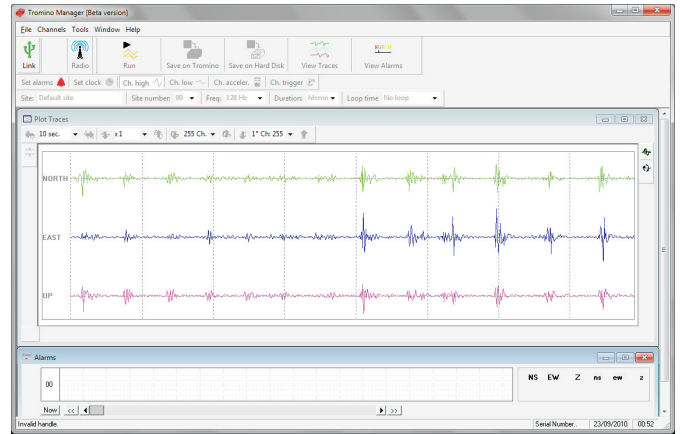
The **GRILLA** database: main window.

Some **GRILLA** capabilities:

EXTENDED H/V ANALYSIS. Full spectral analysis, H/V curves to estimate soil resonances, trace cleaning in the time- and frequency-domains, statistical testing of significance of the results based on the European guidelines, `reference site' method, comparison among different analyses and recordings, several other mathematical analysis tools. Automatic editable reports including tables and figures.

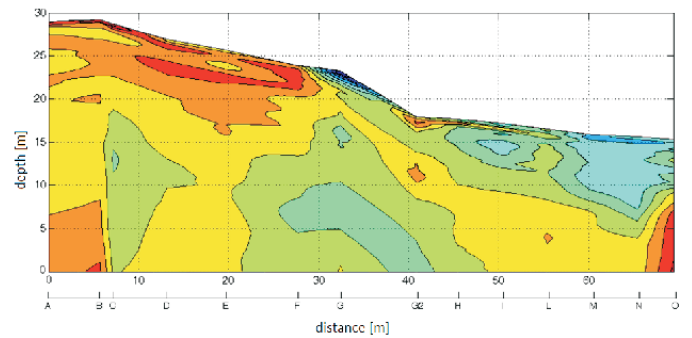Module for spectral and H/V analysis.

MODAL ANALYSIS OF STRUCTURES. Module for the calculation of the modal frequencies and shapes of structures.

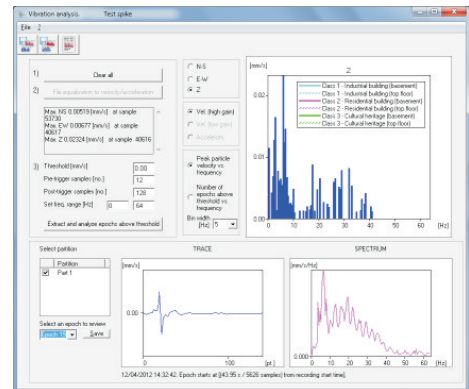

Interfaccia di *Tromino Manager*.

CONSTRAINED H/V CURVE FITTING FOR Vs30 ESTIMATES. H/V forward modeling and inversion tool based on surface waves (Rayleigh and Love). A constraint is needed to determine the model.

JOINT FITTING OF H/V AND DISPERSION CURVES. Subsoil velocity profile from joint fitting of H/V, active (MASW, etc.) and passive (ReMi™, ESAC, SPAC, passive MASW, etc.) array surveys. .

Contour map of the impedance contrasts in the subsoil.

VIBRATION ANALYSIS. Sorting and spectral analysis of signal sections above thresholds, according to the European regulations on strong vibrations in structures. Automatic editable reports including tables and figures.

Module for vibration analysis according to the European regulations.

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