MEDSI 2016

MECHANICAL ENGINEERING DESIGN OF SYNCHROTRON RADIATION EQUIPMENT AND INSTRUMENTATION

Ground motions measurements for synchrotron

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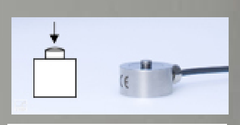
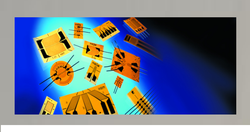
For more than two decades, ground vibration measurements were made by different teams for feasibility studies of linear accelerators. Recent measurements were performed in the SPS tunnel and at different CERN sites on the surface. The devices to measure vibrations of magnitude ranging in nanometres, the analysis techniques and the results are critically discussed and compared with the former measurements. The implication of the measured integrated R.M.S. displacements for the Crab cavities cavern are mentioned. The equipment used in this study consists of 2 state-of-the-art Guralp broadband triaxial seismometers. Models CMG-T60-0004 (Guralp Systems) performed measurements in three directions V, N/S and E/W. The first analysis was to evaluate the power spectral density for each direction of sensors and event. The power spectral density is calculated from the auto power spectrum: The power spectral density shows a typical curve for the geophones with the micro seismic peak between 0.2 and 0.4 [Hz]. It is important to point that ground vibrations should not be ignored in planning accelerator facility. Actually it is one of the limiting factor in the optimization of future accelerators.

Displacement Transducers

Vibration Sensors



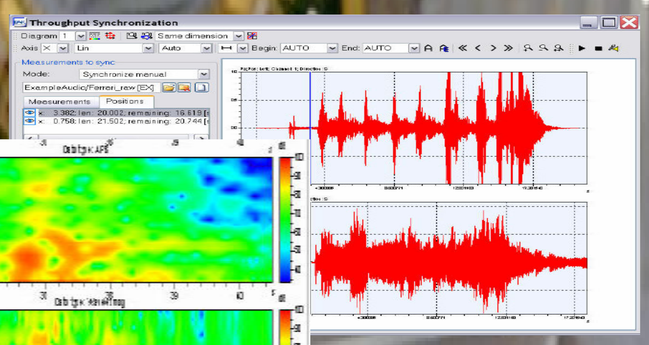
Load / Tensile Sensors



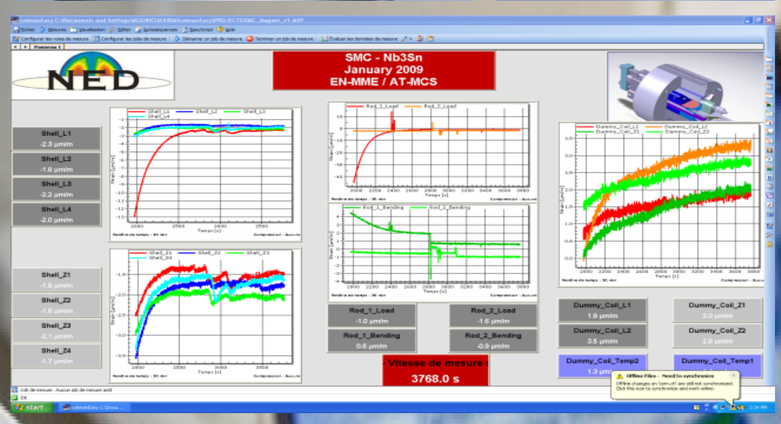
Optical / Electrical Strain Gauges

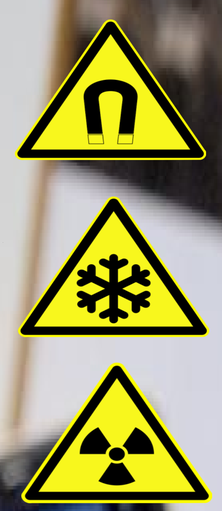
Calibration Tools

Static and Dynamic Acquisition System



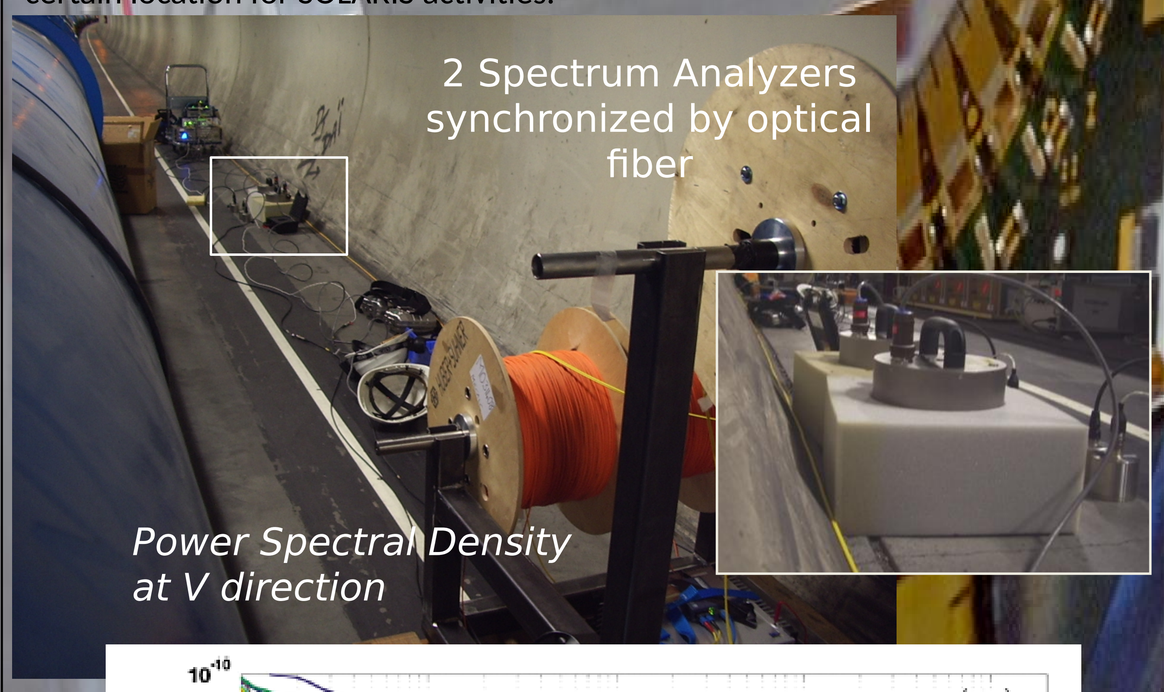
Post-Processing and Analysis

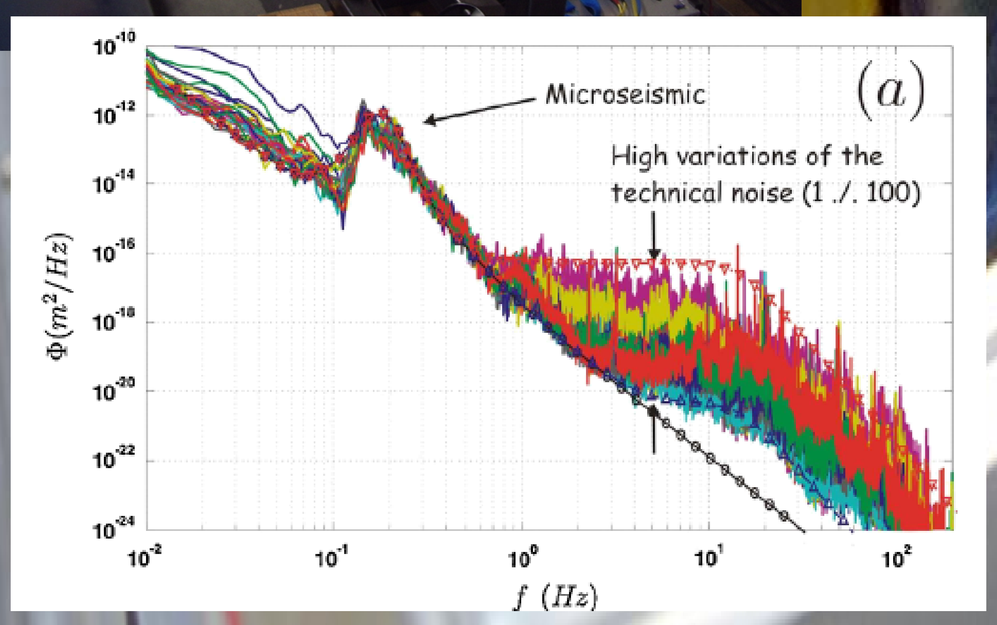




Ground motion

Ground motion measurements is a technique which allows to characterize the environmental vibrations. This technique allow to determine the suitability of a certain location for SOLARIS activities.



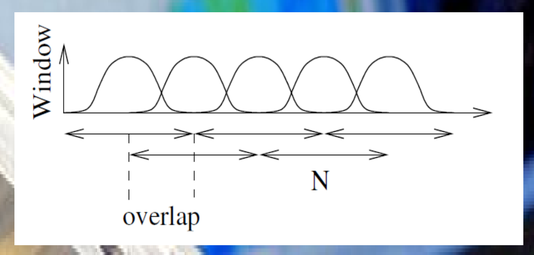


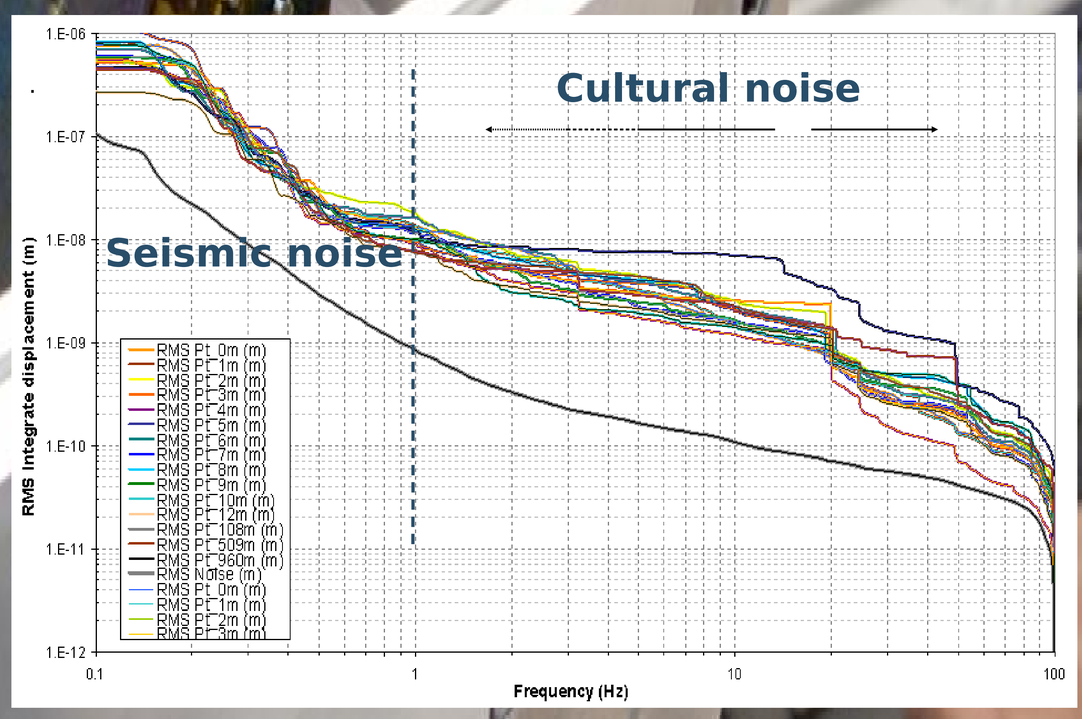
Integrated RMS displacement

Welch's method of averaging modied periodogramms
(Welch's overlapped segmented average)

Integrated RMS is used to sum up the total vibration in a spectrum. As the name indicates it give the RMS (Root Mean Square) value of the total vibration. The integrated RMS is defined by:

$$\sigma_w(\nu) = \sqrt{\sum_{k1}^{k2} \Phi_w(\nu) d\nu}$$





It is possible to see the total summation of vibrations from a frequency and down to every lower frequency.

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