Vibration Investigations at PETRA III

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Abstract and Motivation

One of the most challenging problems for experimental setups at third-generation and especially fourth-generation synchrotrons are vibrations. In order to keep vibrations on a as low as possible level one must not only take extremely care in the design of all components but also have a profound knowledge of the sources of vibrations. We started a project to map the vibrations at PETRA III both locally and timely in order to get a better understanding of the influencing factors and possible consequences for the ongoing PETRA IV project.

We are still in the commisioning phase of our sensorsystem and evaluatiin software.

Software

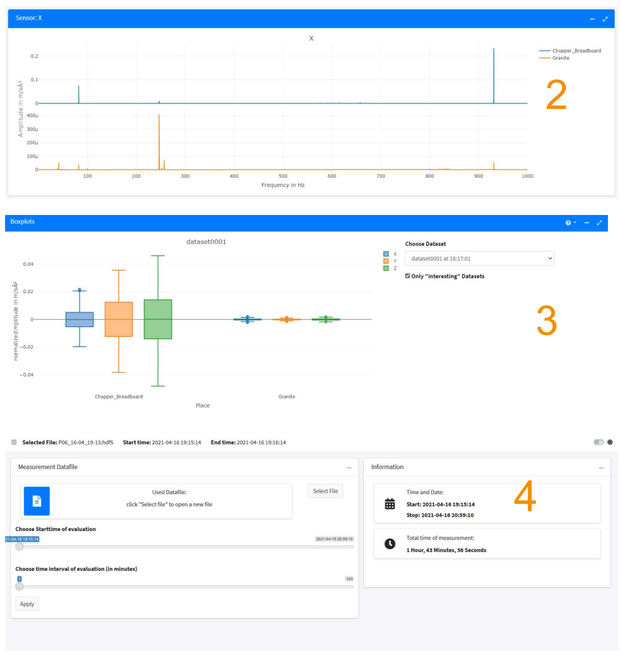
Data evaluation

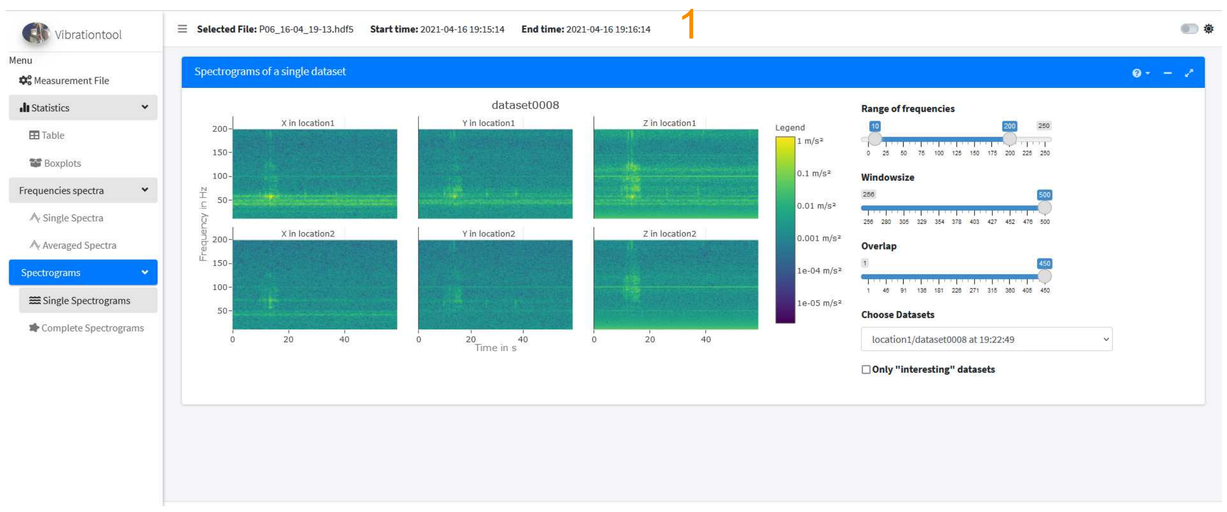
- Written in R

- Web based using Shiny and bs4dash

- Features:
  * Spectrograms (1)
  * FFT's (2)
  * Boxplots (3)
  * Informatiin about datafile (4)

- Supports:
  * our Accelerometers (custom hdf5)
  * Attocube Interferometer (CSV format)
  * SmarAct PicoScale Interferometers (custom hdf5)





Hardware

Controler

Source: https://micromega-dynamics.com

Manufacturer: Micromega DYNAMICS
Type: Recovib Monitor-4
Channels: 4

Accelerometers

Source: https://micromega-dynamics.com

Manufacturer: Micromega DYNAMICS
Type: IAC-UHRS-Ud-01-Z-3G-5m
Range: +/- 3 g
Noise: 1 µg/√Hz
Freq.-Range: 0.0 - 500 Hz

Example: Measurements Vibrotruck

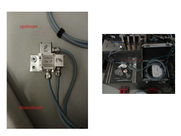
What has been done:

- exitation of the ground
- near DESY campus (~200m)
- several sweeps from 3 to 130 Hz
- we used differnt sensors to monitor vibrations at P06

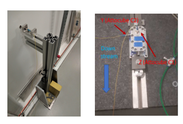
Result:

- exitation can be seen at:
  - floor and walls
  - sample position
  - sample granite
  - floor

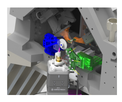
Accelerometers
Floor and Sample Granite

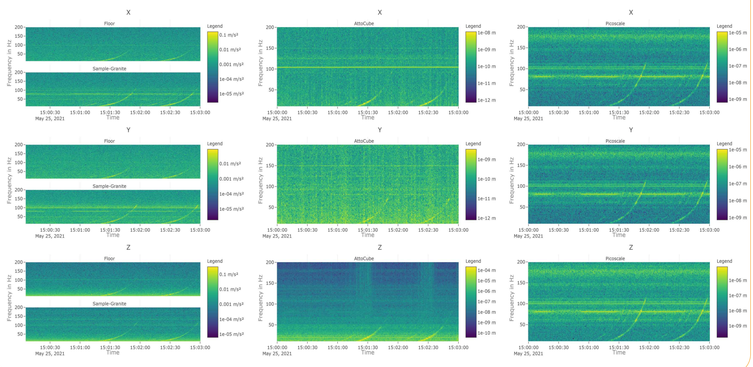


Interferometers
Wall and Sample Granite



Interferometers
Sample Position





Future Plans

Define measurement points

We want to define different interesting points in the experiental halls where we will repeatedly perform vibration measurements to get an idea of the seasonal changes of our vibrations

Define a reference point

One of the measurement points should be taken as reference point. The plan would be to monitor this point everytime we do a measurement elsewhere

Do vibration measurements for beamlines

If requested we will do the measurement of vibrations at special setups or parts of the Petra III beamlines in order to find places for improvement.

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