

Vibration measurements of the PETRA III slab

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Our homepage: <http://vibration.desy.de>



Equipment used

$x(t), y(t)$	time series of length T, N points each
$X(v_i), Y(v_i)$	FFT
$\langle XX^* \rangle, \langle YY^* \rangle$	Estimated displacement power spectral density (PSD)
$\frac{ \langle XY^* \rangle ^2}{\langle XX^* \rangle \langle YY^* \rangle}$	Coherence
$\sqrt{\frac{ \langle XY^* \rangle }{\langle XX^* \rangle}}$	Transfer function amplitude
$\sqrt{\frac{1}{T} \sum_{i=k}^{N/2} \langle XX^* \rangle (v_i)}$	Integrated RMS amplitude at frequency v_k



❖ Broadband Seismometers, GÜRALP CMG

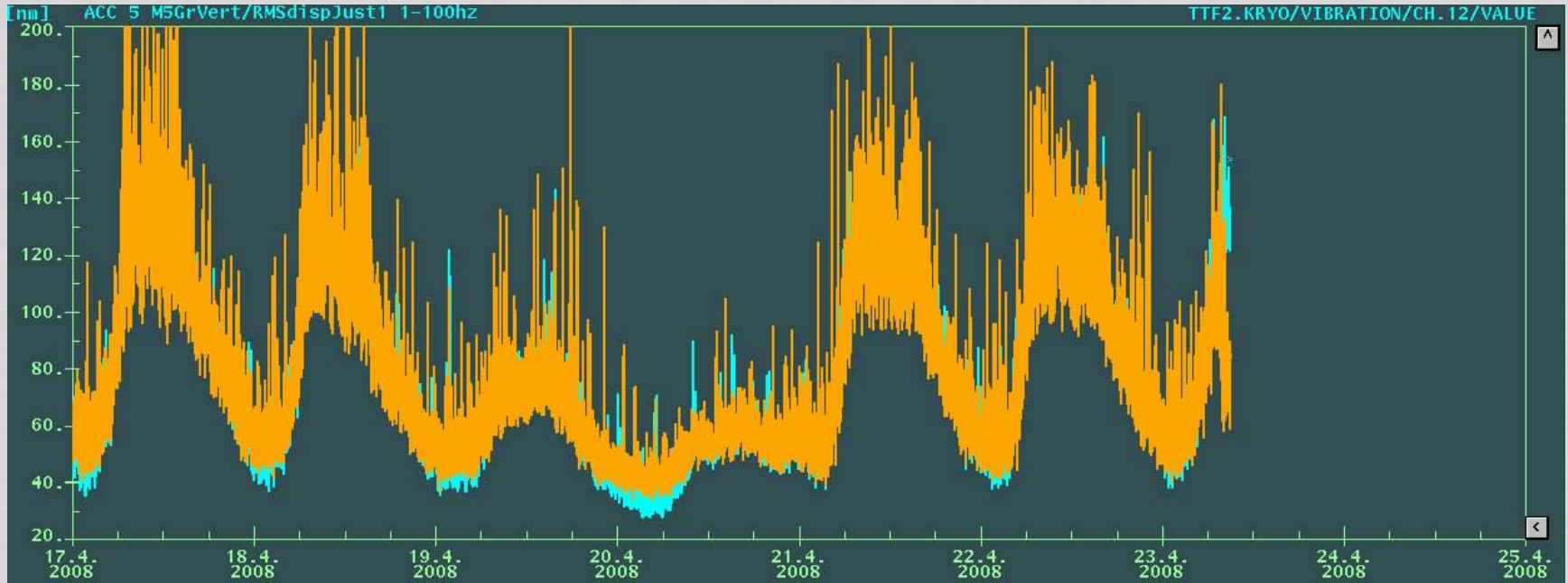
- ❖ Measurement of acceleration, output signal: velocity
- ❖ Three components: vertical, 2x horizontal
- ❖ Integrated 24bit ADC, 200Hz sampling rate
- ❖ Frequency range:
 - 360s – 80Hz CMG-3T (old)
 - 120s – 80Hz CMG-3T (new)
 - 60s – 80Hz CMG-6T, used for the PETRA III measurement

Measurements

- 1) Slab & crossing between pillars 4 & 5
- 2) Floor & slab
- 3) Floor & crossing between pillars 4 & 5

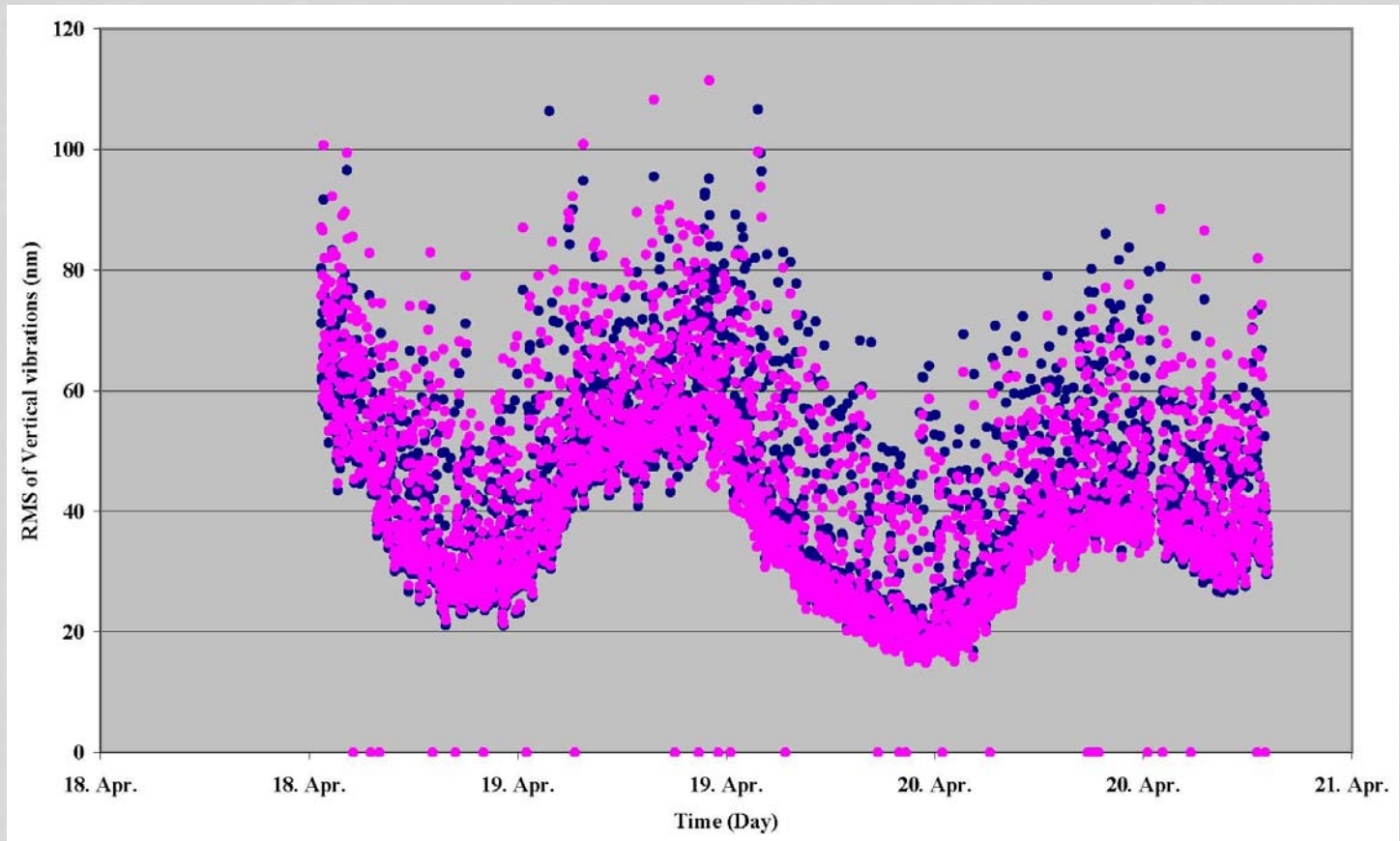


Ground motion measured in FLASH



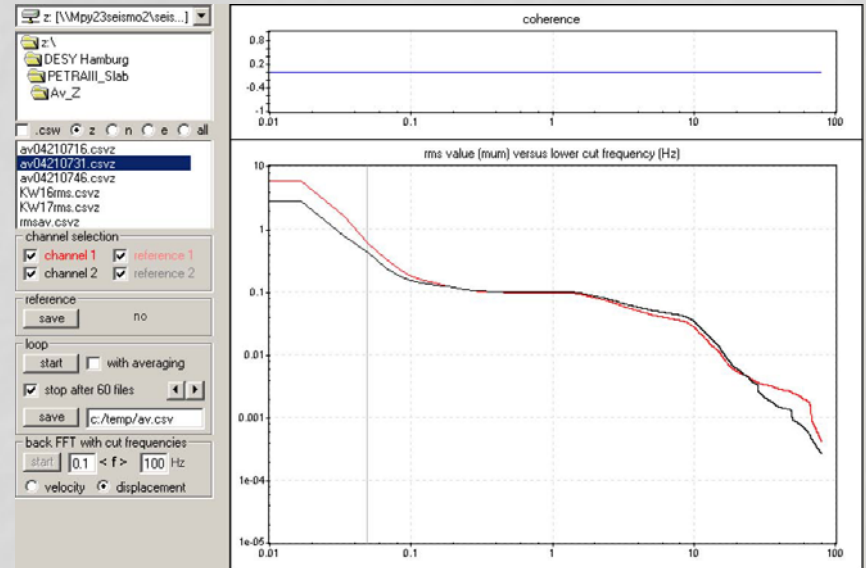
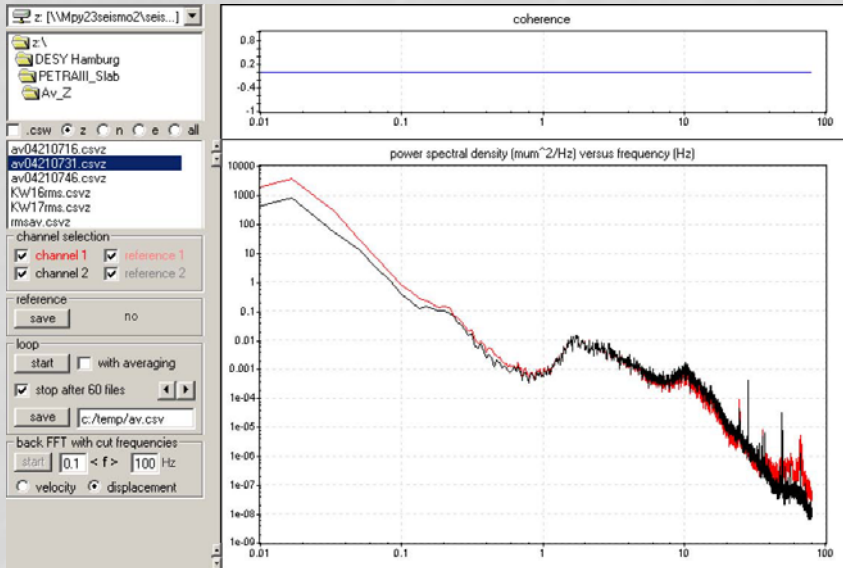
Vertical vibrations (nm) vs. time (day)
17-23 April

Tracking vertical vibrations in the PETRA III hall



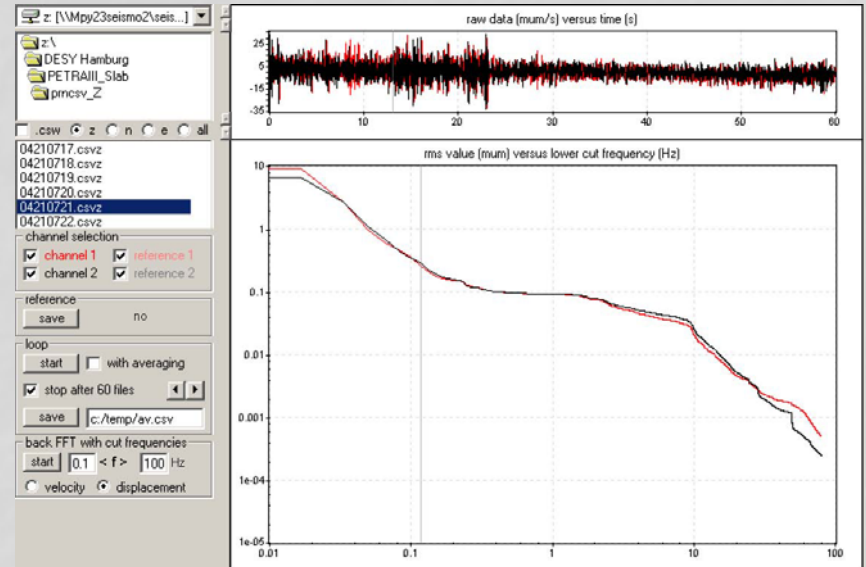
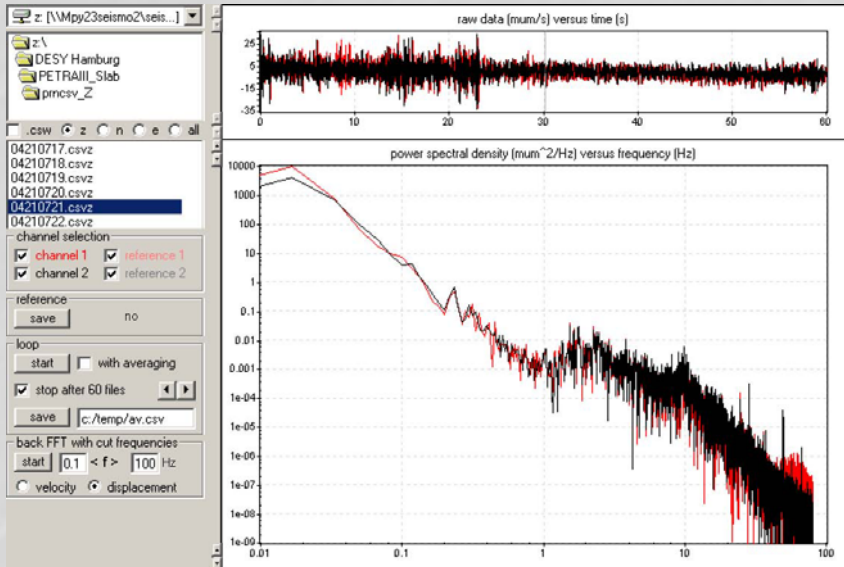
Comparable with the FLASH tunnel data

Slab vs. crossing on Monday, 21st of April between 7:15-7:30 (15 minute average)



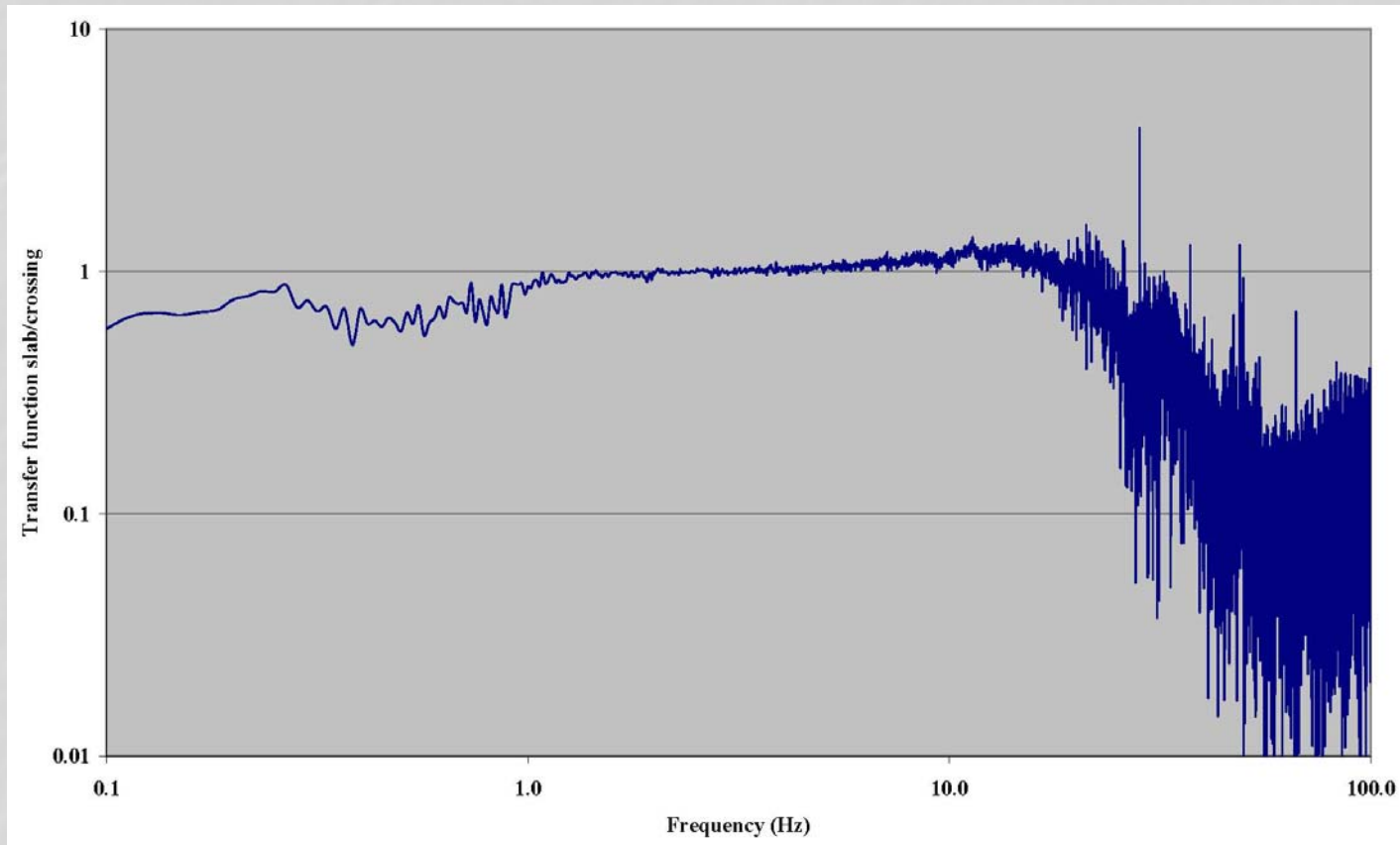
15 minute average files: @ 1 Hz rms of vertical vibration of the slab (black line) is 100 nm and the crossing area (red line), 96 nm. High frequency noise ~28 Hz is attenuated by the slab.

Slab vs. crossing on Monday, 21st of April instantaneous (1 minute file) at 7:21



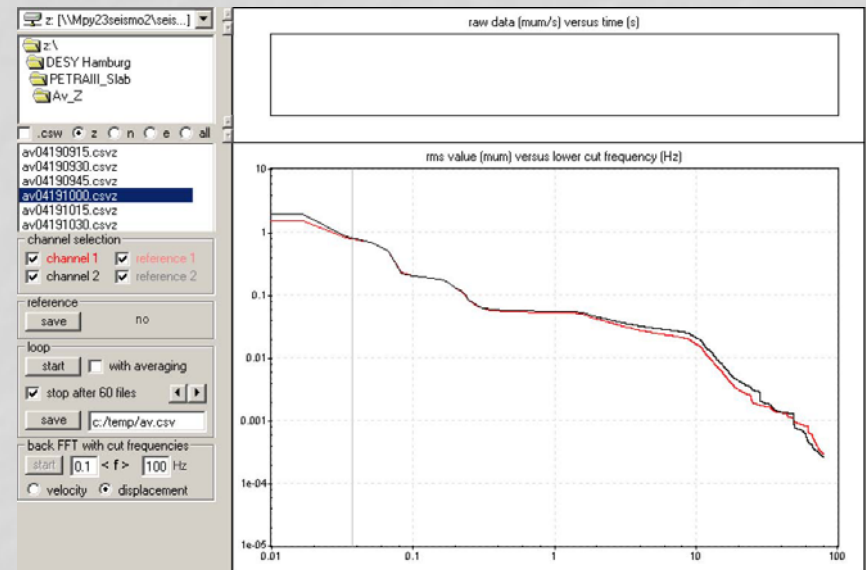
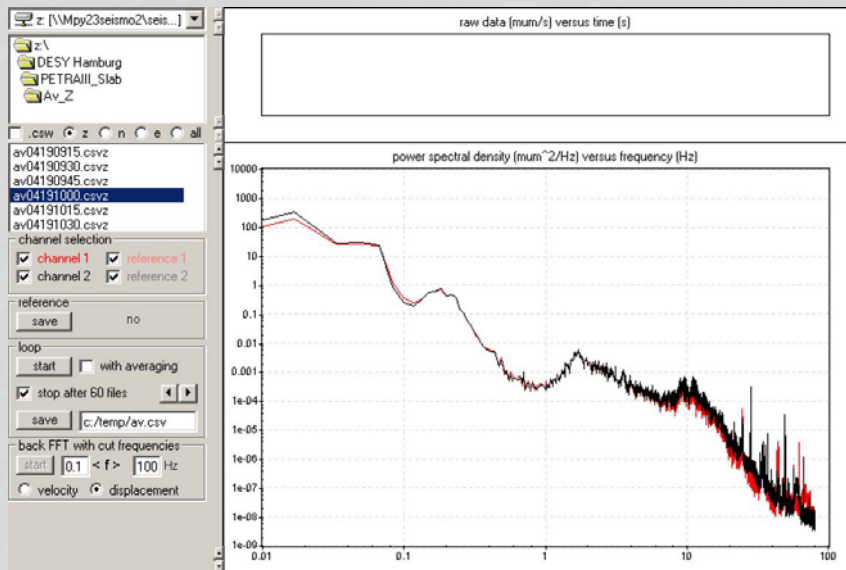
1 minute file: @ 1 Hz rms of vertical vibration of the slab (black line) is 92 nm and the crossing area (red line), 91 nm. High frequency noise (drilling in the hall) ~28 Hz is attenuated by the slab.

Transfer function between the slab and the crossing in the vertical direction



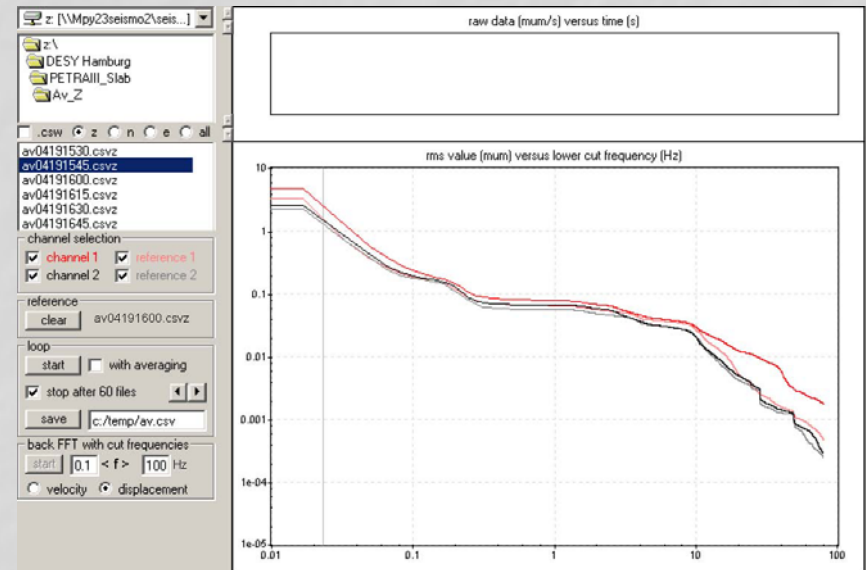
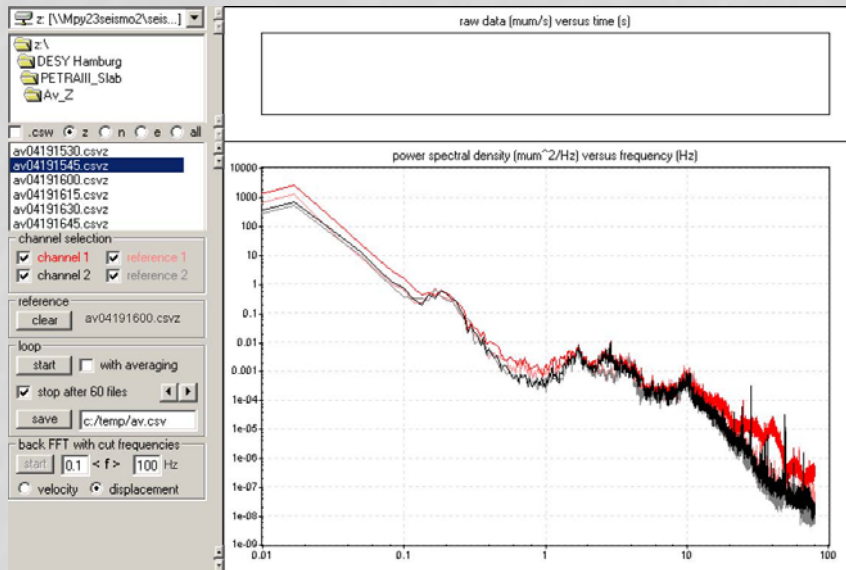
Slab is effective from ~ 30 Hz in the vertical direction

Slab vs. crossing on Saturday, 19 April at 10:00 a.m., wind speed ~ 30 km/h



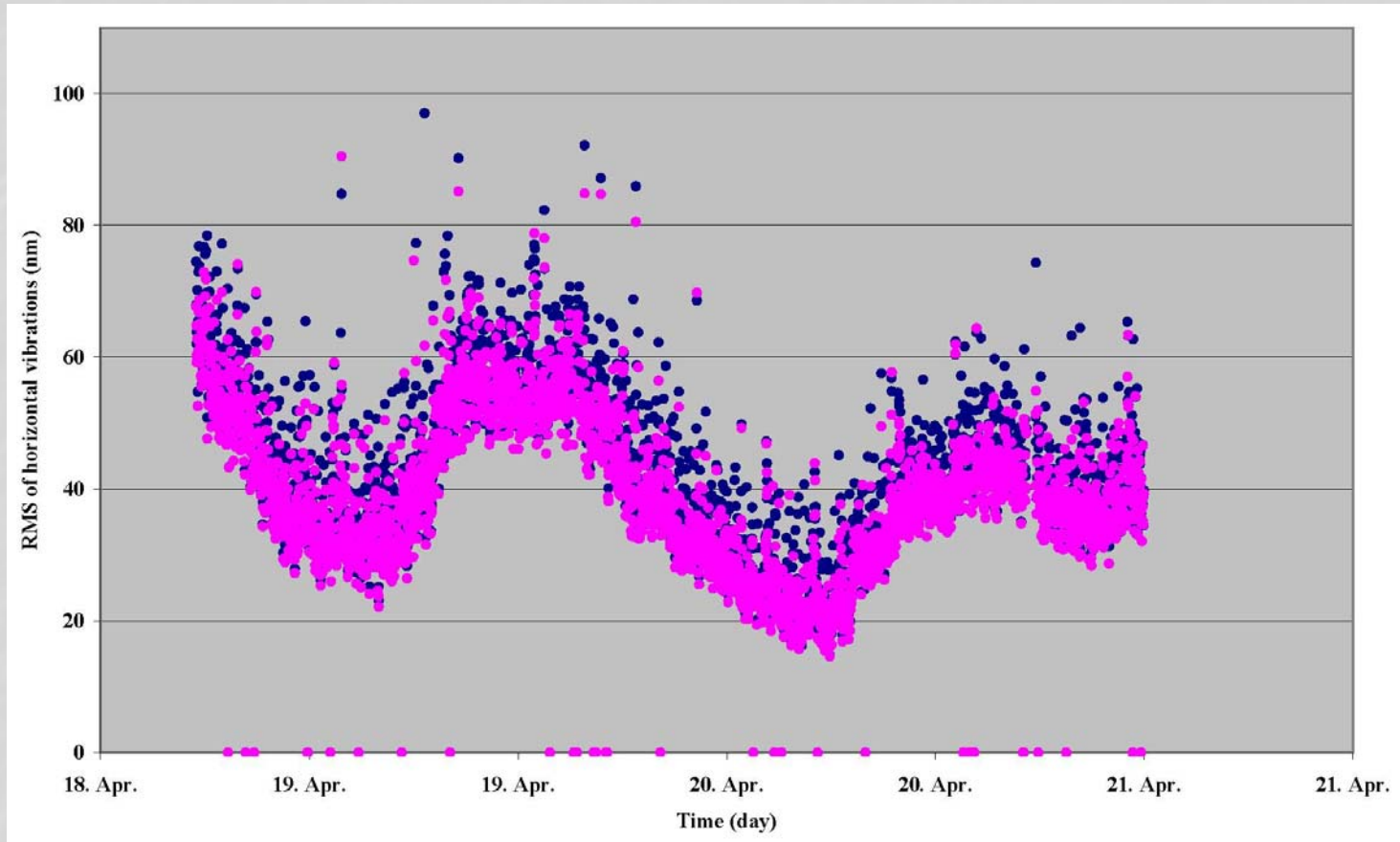
15 minute average files: @ 1 Hz rms of vertical vibration of the slab (black line) is 55 nm and the crossing area (red line), 52 nm.

Slab vs. room floor on Saturday, 19 April between 15:45-16:00



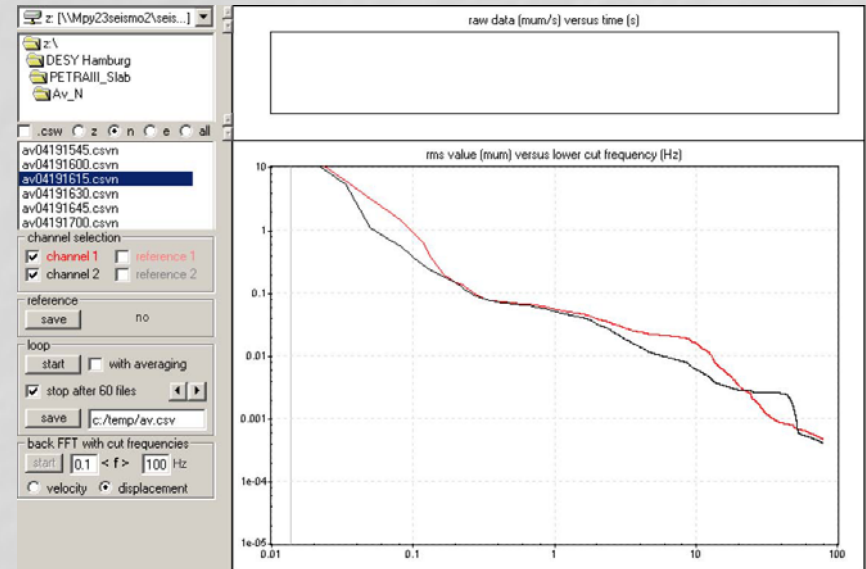
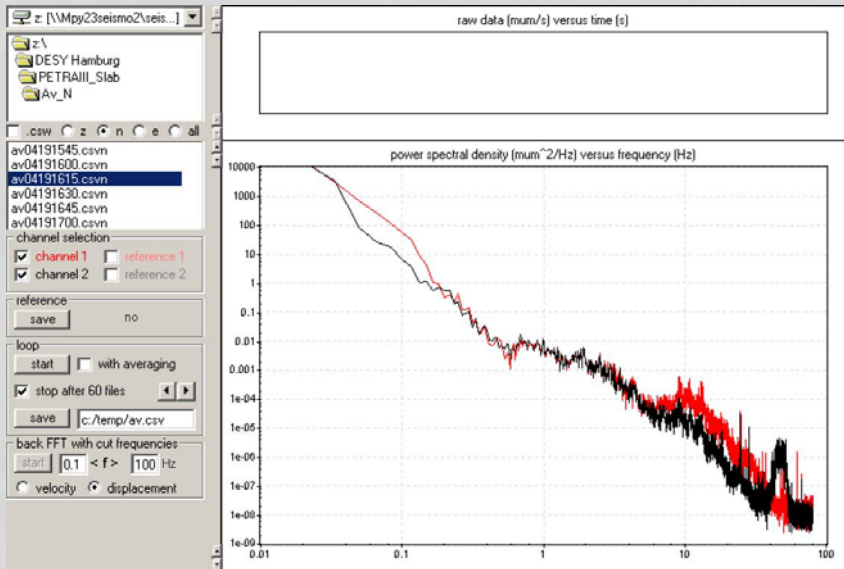
The slab is not affected by noise (black line), the floor (red line) shows the difference between noisy floor at 15:45 and quiet floor at 16:00.

Tracking horizontal vibrations in the PETRA III hall



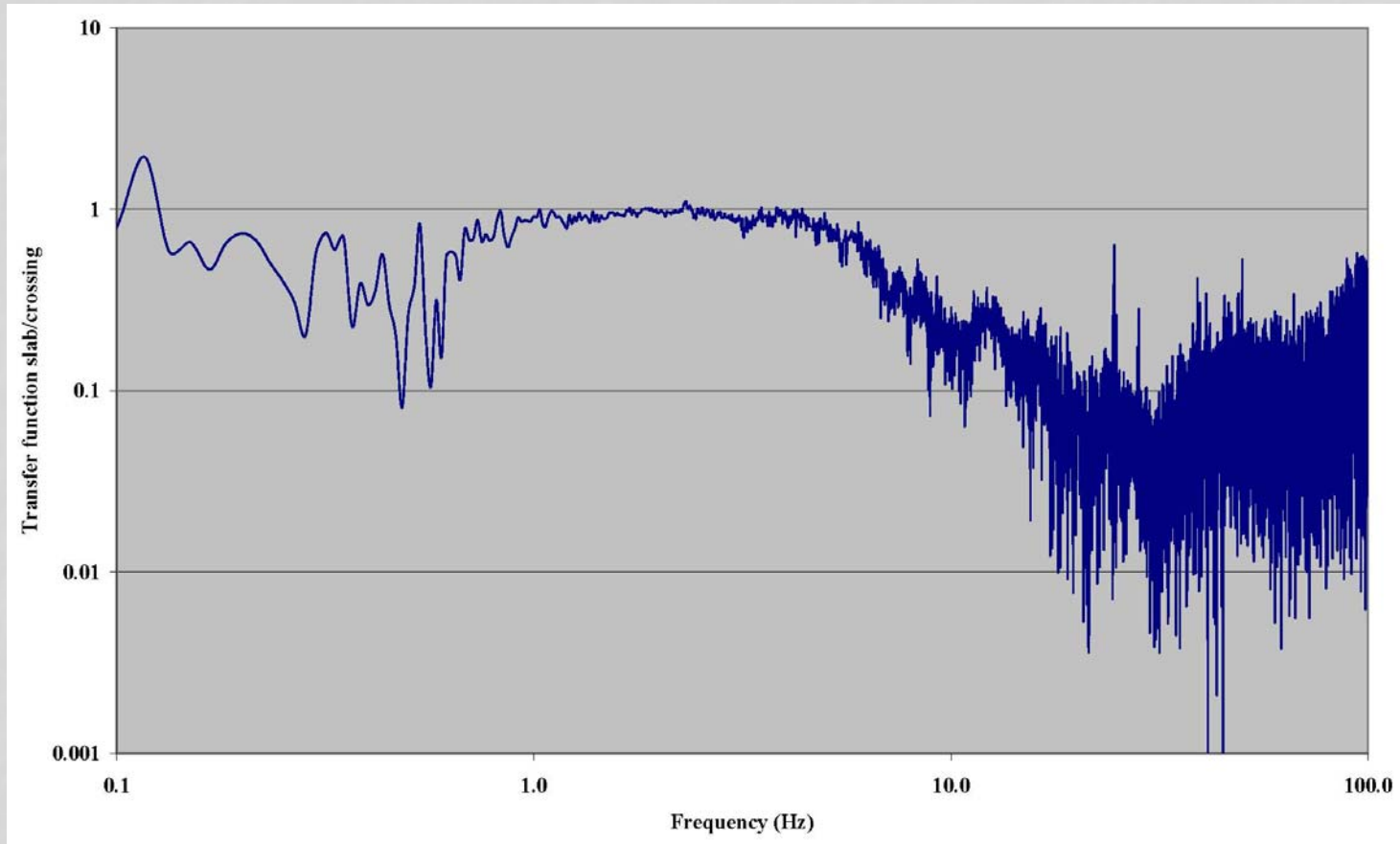
Comparable with the vertical data

Slab vs. room floor (horizontal direction) on Saturday, April the 19th between 16:00-16:15



15 minute average files: @ 1 Hz rms of horizontal vibration of the slab (black line) is 56 nm and the room floor (red line), 52 nm.

Transfer function between the slab and the crossing in the horizontal direction



Slab is effective from ~ 10 Hz in the horizontal direction

