BROADBAND SEISMOMETER TESTING AND CALIBRATION

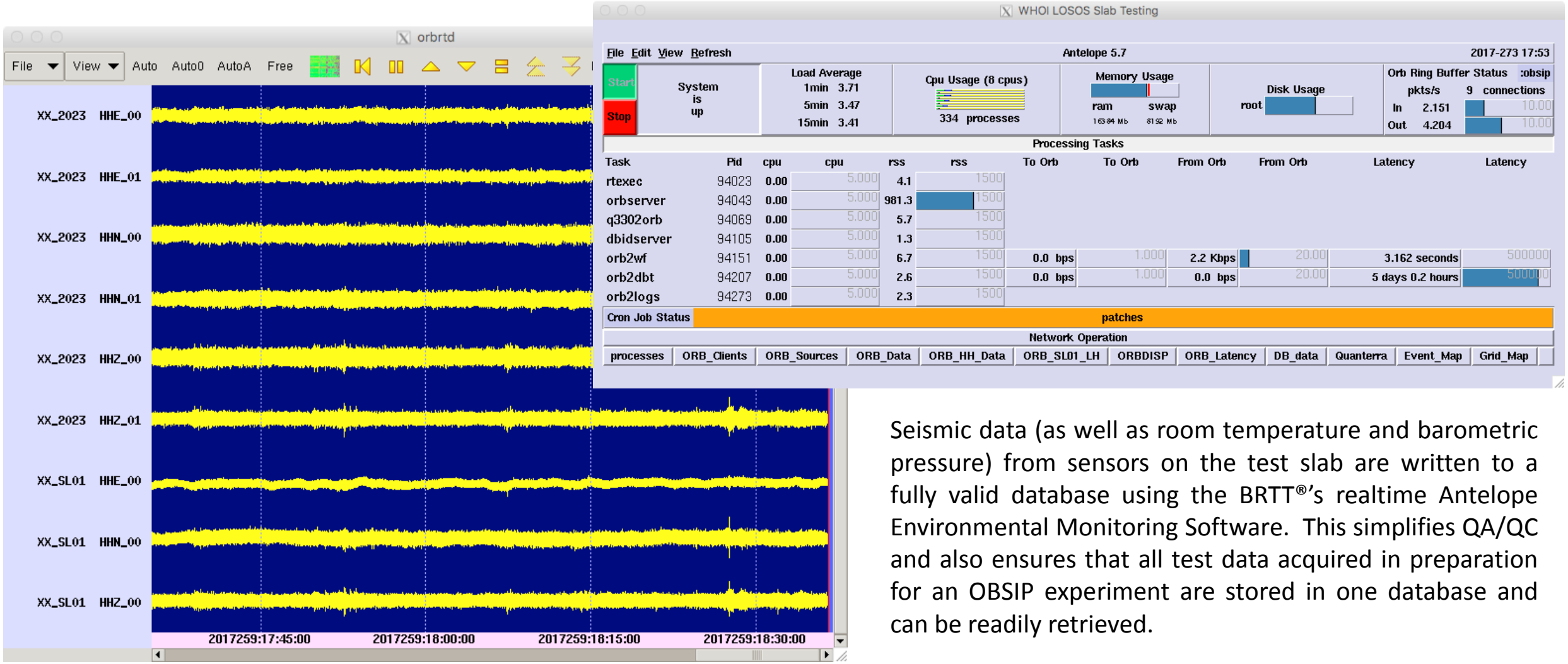
WHOI Ocean Bottom Seismograph Laboratory

Broadband Seismometer Testing and Calibration

The WHOI OBS Lab has a concrete floor slab dedicated for seismometer testing. The slab is detached from the building walls and from the room floor. A series of north-south lines oriented with an Octans® gyroscopic compass are scribed on the slab surface. Four 6-channel Quanterra® Q330 data-loggers and associated Balers allow simultaneous recording of eight 3-component sensors. The tall green-colored sensor at the rear is a Nanometrics® Trillium 240 broadband seismometer (temporarily without its insulating cover) that acts as a reference sensor.

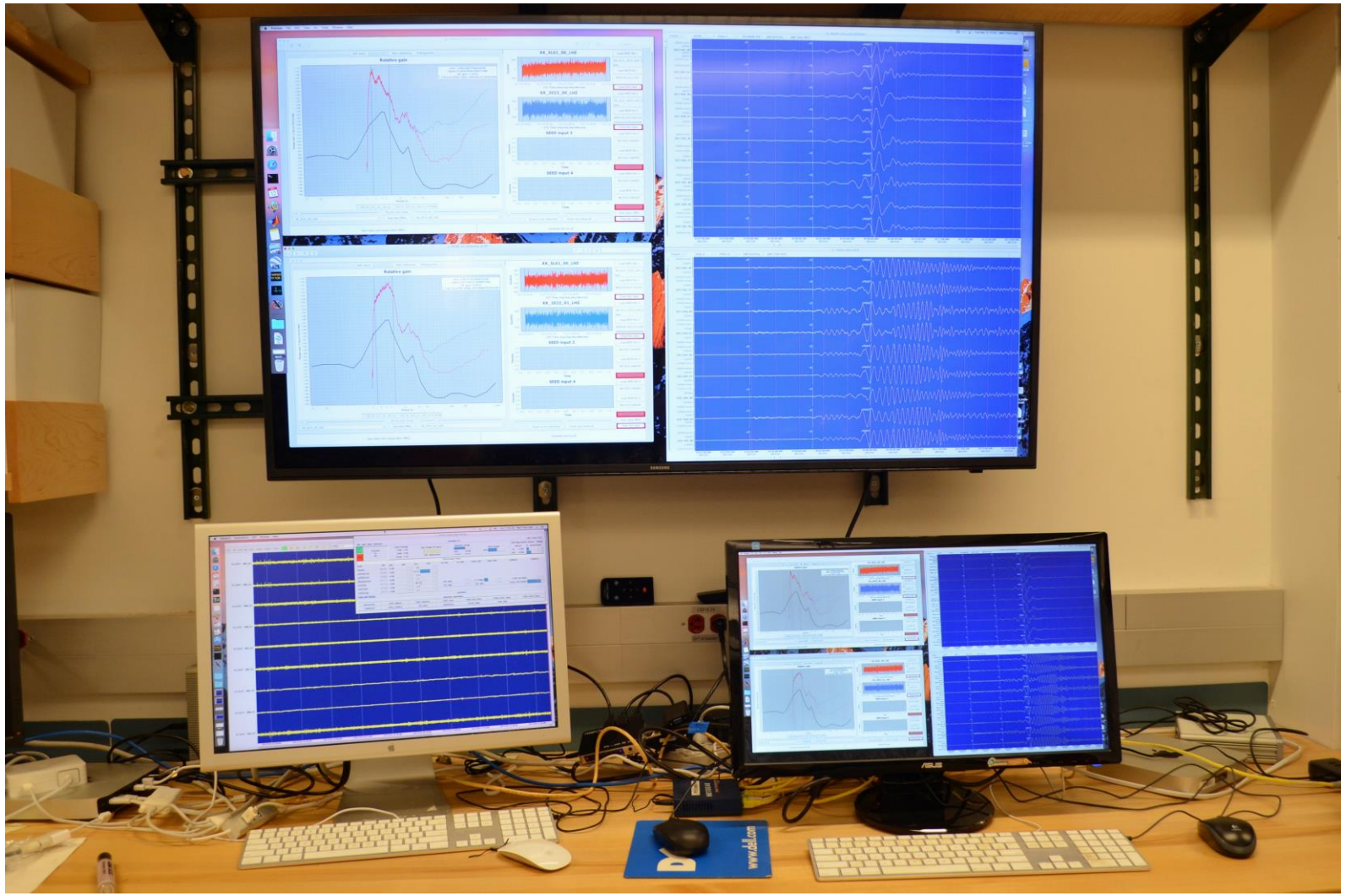
The picture shows 5 Guralp CMG-3T broadband seismometers sitting in their gimbaled leveling systems in the lower hemispheres of their pressure housings. The pressure housings sit in bins of glass beads to ensure adequate coupling to the ground. Other sensors on the slab include a Nanometrics Trillium Compact seismometer (at rear), a Nanometrics Trillium Compact OBS seismometer (in foreground), and a WHOI 3-component geophone package (right foreground)

Antelope Environmental Monitoring Software



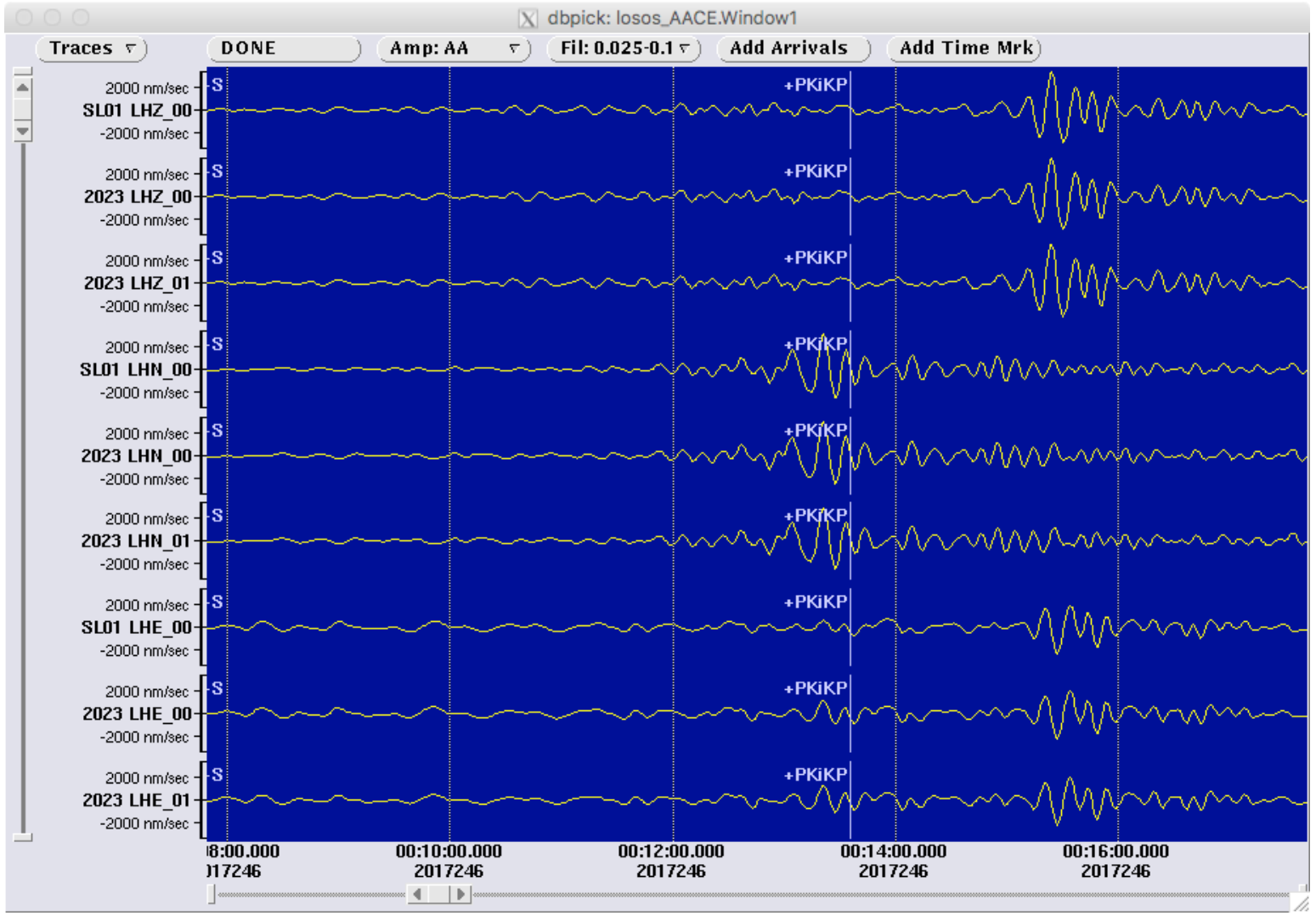
Seismic data (as well as room temperature and barometric pressure) from sensors on the test slab are written to a fully valid database using the BRTT®'s realtime Antelope Environmental Monitoring Software. This simplifies QA/QC and also ensures that all test data acquired in preparation for an OBSIP experiment are stored in one database and can be readily retrieved.

Data Display



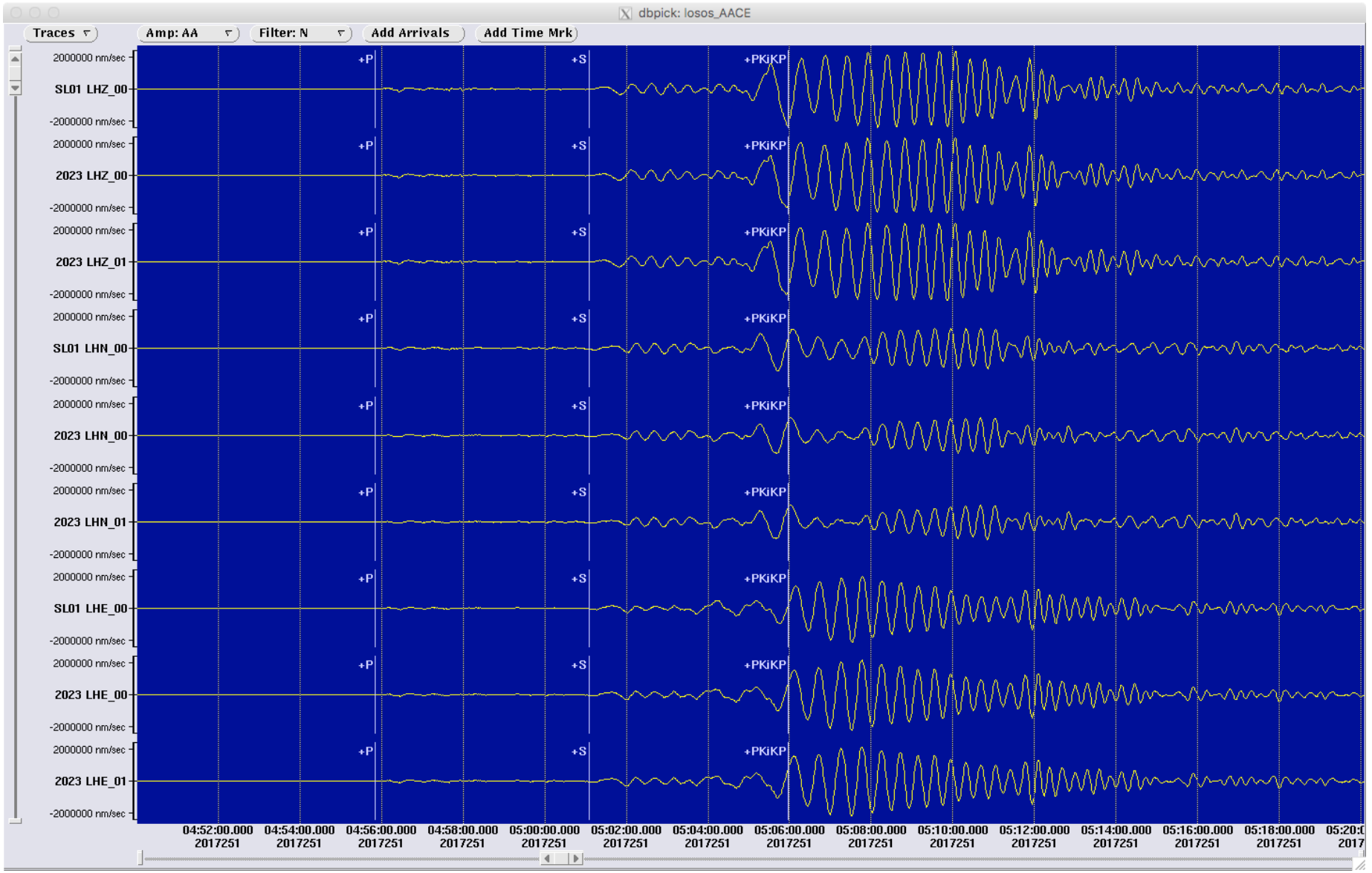
A dedicated Apple Mac mini in the OBS Lab runs the Antelope software.
Another Mac mini handles data processing and display.

Instrument Quality Assessment



Ground motion from the September 02, 2017 Mw 5.3 Eastern Idaho earthquake recorded by our reference sensor (station SL01), and 2 Guralp stations (2023_00, and 2023_01). Epicentral distance is ~30°, and the back-azimuth is 286°, so the the E-W and N-S components are approximately radial and transverse, respectively. The three stations show good coherence for Love and Rayleigh waves arrivals in the frequency band (0.025–0.1 Hz).

Instrument Quality Assessment continued

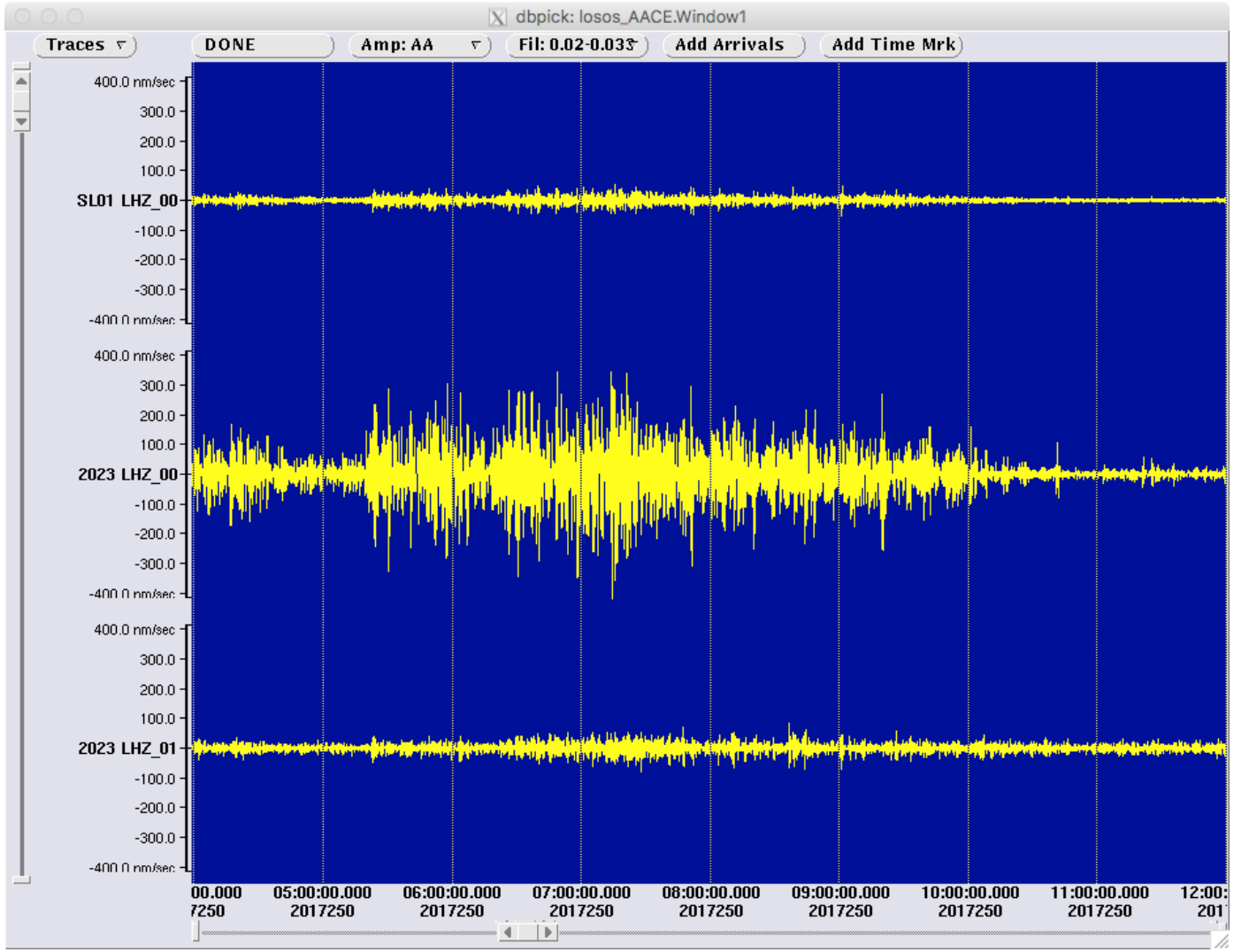


Ground motion from the September 08, 2017 Mw 8.2 Mexico earthquake recorded by our reference sensor (station SL01), and 2 Guralp stations (2023_00, and 2023_01). Epicentral distance is 33°. Data are unfiltered.

Instrument Quality Assessment continued

Vertical-component background noise in the period band 30–50 seconds recorded by our reference sensor (station SL01), and 2 Guralp stations (2023_00, and 2023_01). Amplitude scale is identical for all three seismograms.

The data from station 2013, location code 00 are substantially noisier than on the other two stations, implying that this seismometer is a candidate for repair.



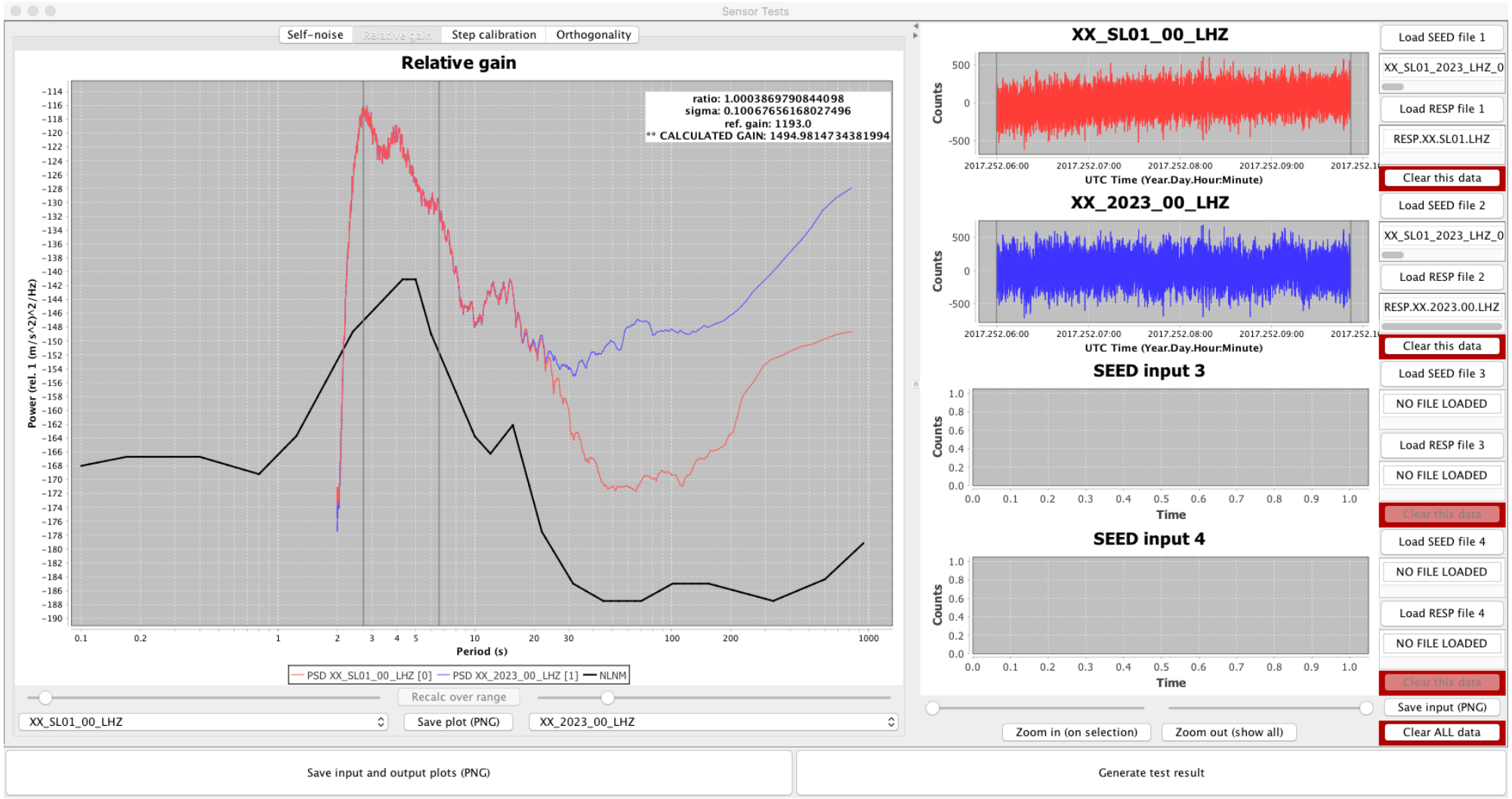
Instrument Inspection

Tim Kane inspects a Guralp CMg-3T seismometer and gimbal levelling system that he has removed from its pressure housing. The electronics controller on top of the seismometer carries a Persistor computer , tilt sensor, and flux-gate compass. The controller is programmed to re-level the seismometer, if necessary, on a user-defined schedule.

Instrument Repairs

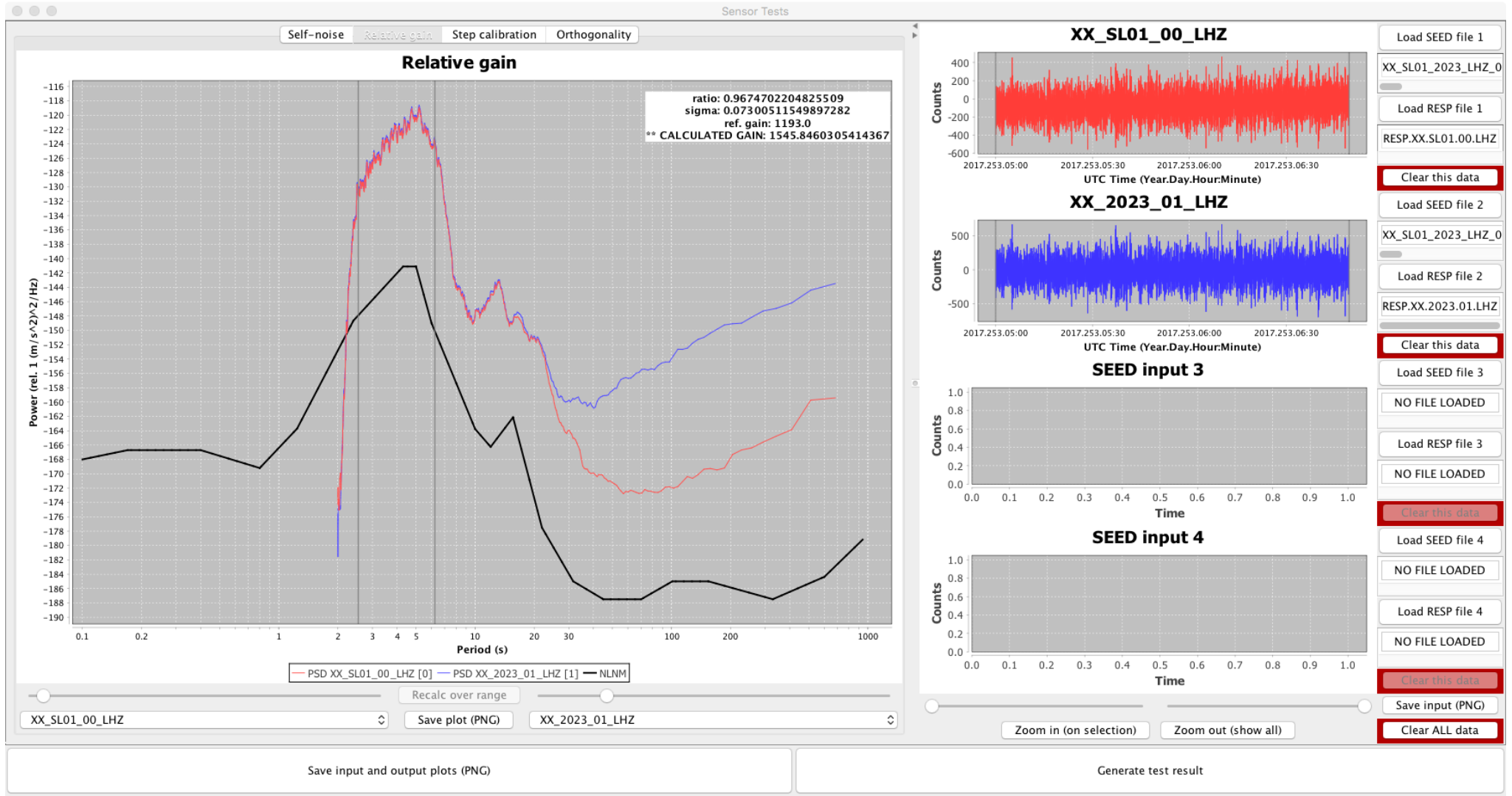
Tim Kane repairs a Guralp CMG-3T in a laminar-flow clean hood. The clean environment reduces the risk of contamination by dust and dirt.

Calibration



Calibration of Guralp CMG-3T seismometer S/N T3G92 relative to WHOI's Nanometrics Trillium 240 reference sensor. The calibration procedure, from USGS Albuquerque, compares power spectral density levels in the microseismic band. This particular Guralp sensor shows a calculated sensitivity of 1495 V/m/s. The factory-specified sensitivity for this channel was 1494 V/m/s.

Calibration continued



Calibration of Guralp CMG-3T seismometer S/N T3G38 relative to WHOI's Nanometrics Trillium 240 reference sensor. The calibration procedure, from USGS Albuquerque, compares power spectral density levels in the microseismic band. This particular Guralp sensor shows a calculated sensitivity of 1546 V/m/s. The factory-specified sensitivity for this channel was 1490 V/m/s, an ~4% change.