Testing the performance of the Metrozet STS1 Very Broadband sensor clone

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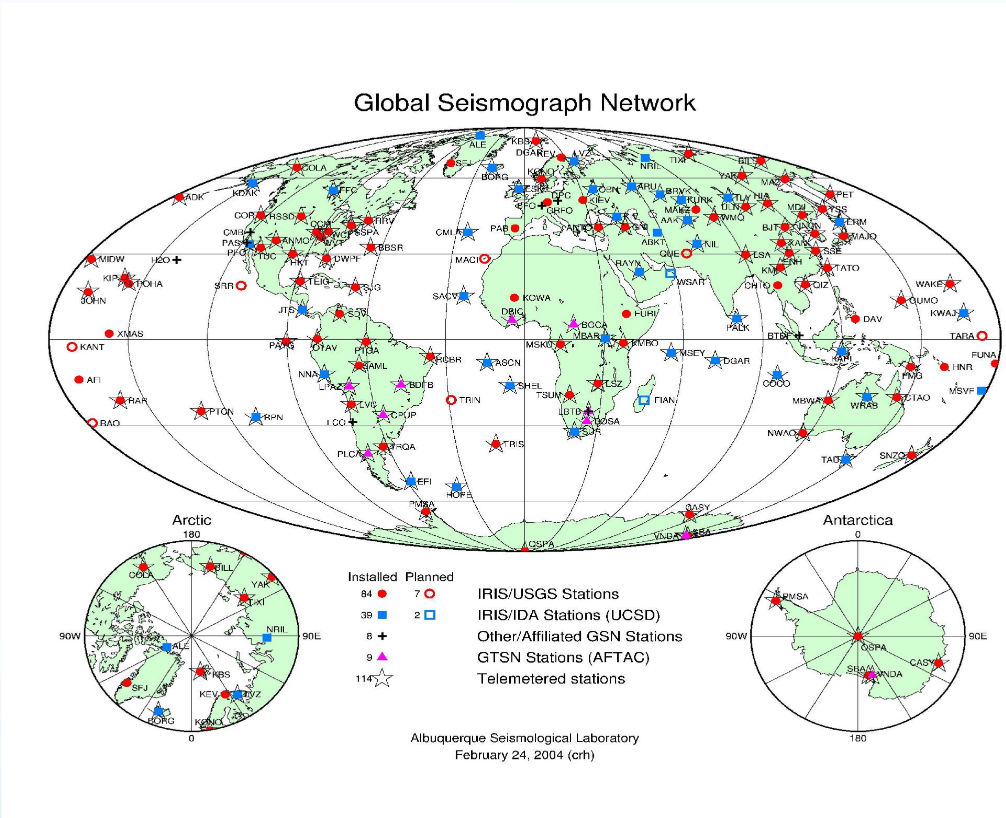
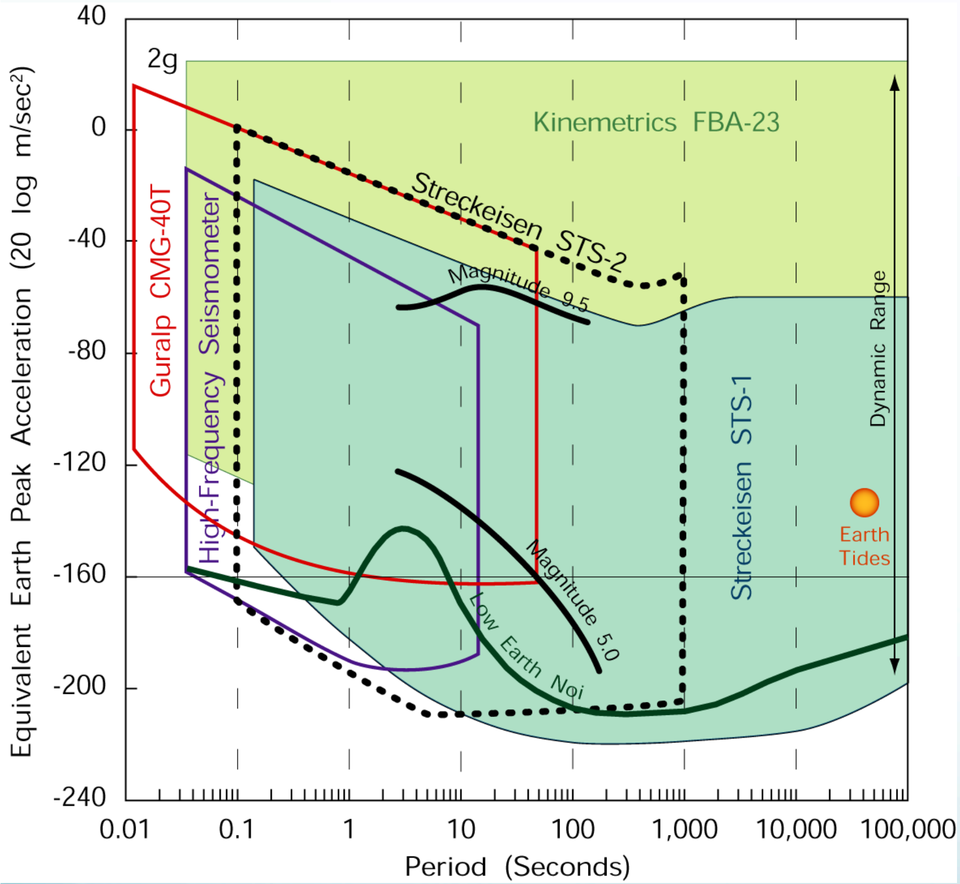
Motivation

- The STS-1 VBB seismometer is currently the principal seismometer used in most global networks and some regional networks and comprises approximately 250 stations.
- Many older sensors installed 20-25 years ago are starting to experience operation failures and age related degradation.
- Streckeisen is no longer supporting the instruments



Map from S. Ingate (IRIS) et al.
http://www.iris.edu/stations/seisWorkshop04/report.htm

Objectives



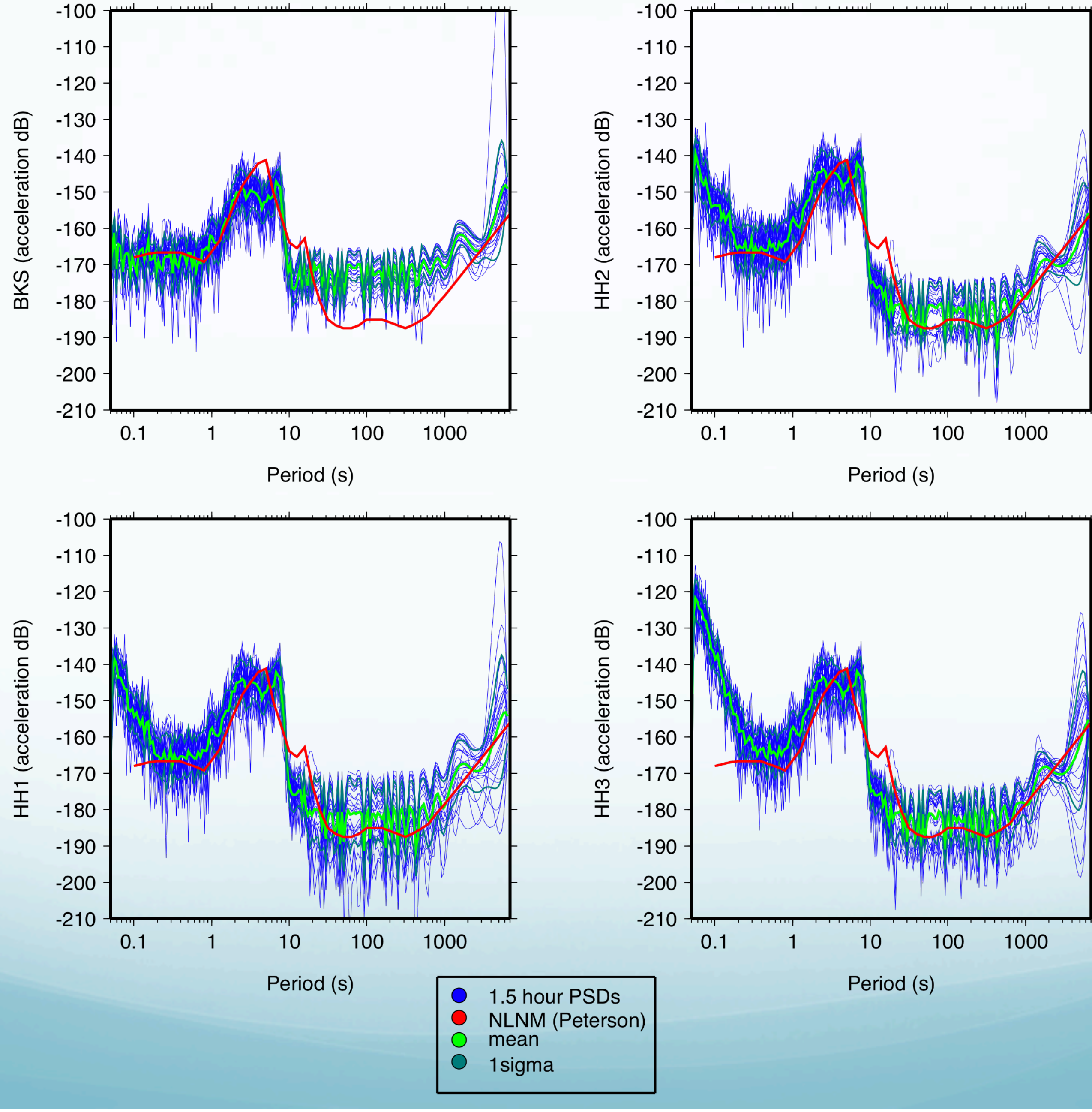
- Assess noise levels in the new Metrozet STS1-VBB sensor
- Compare the new sensor to the current STS1-VBB operating at station BKS since 1988
- Find potential problems in the new sensor and work with Metrozet to improve the noise floor of the sensors
- Assess the functionality of the new sensors to classical and new uses

Figure from S. Ingate (IRIS) et al.
http://www.iris.edu/stations/seisWorkshop04/report.htm

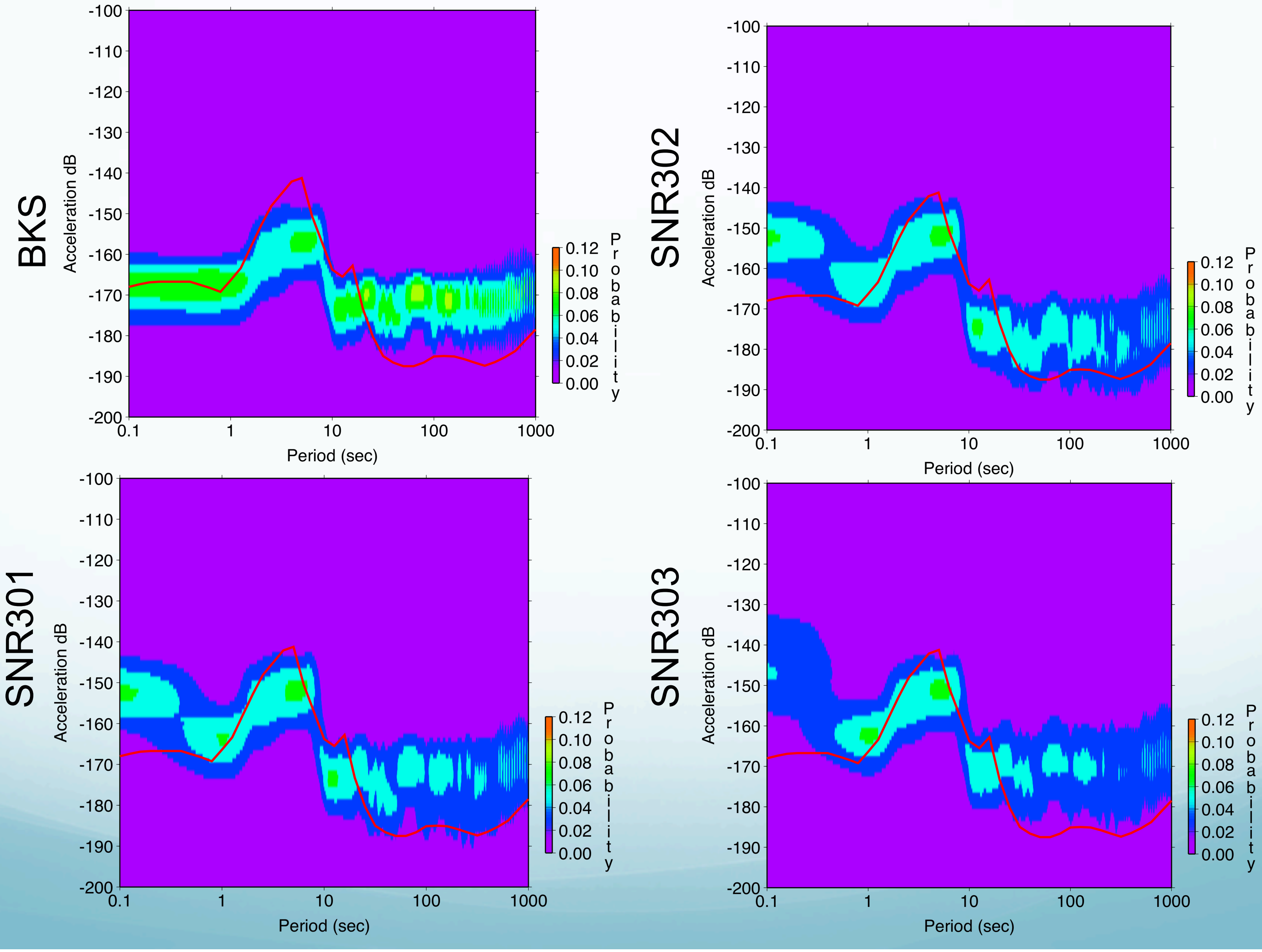
Methodology

- Noise floor – Acceleration Power Spectral Density as per McNamara and Buland 2004 and Peterson 1993
- Inter-sensor comparison – Coherence
- Probability Density Functions for variance

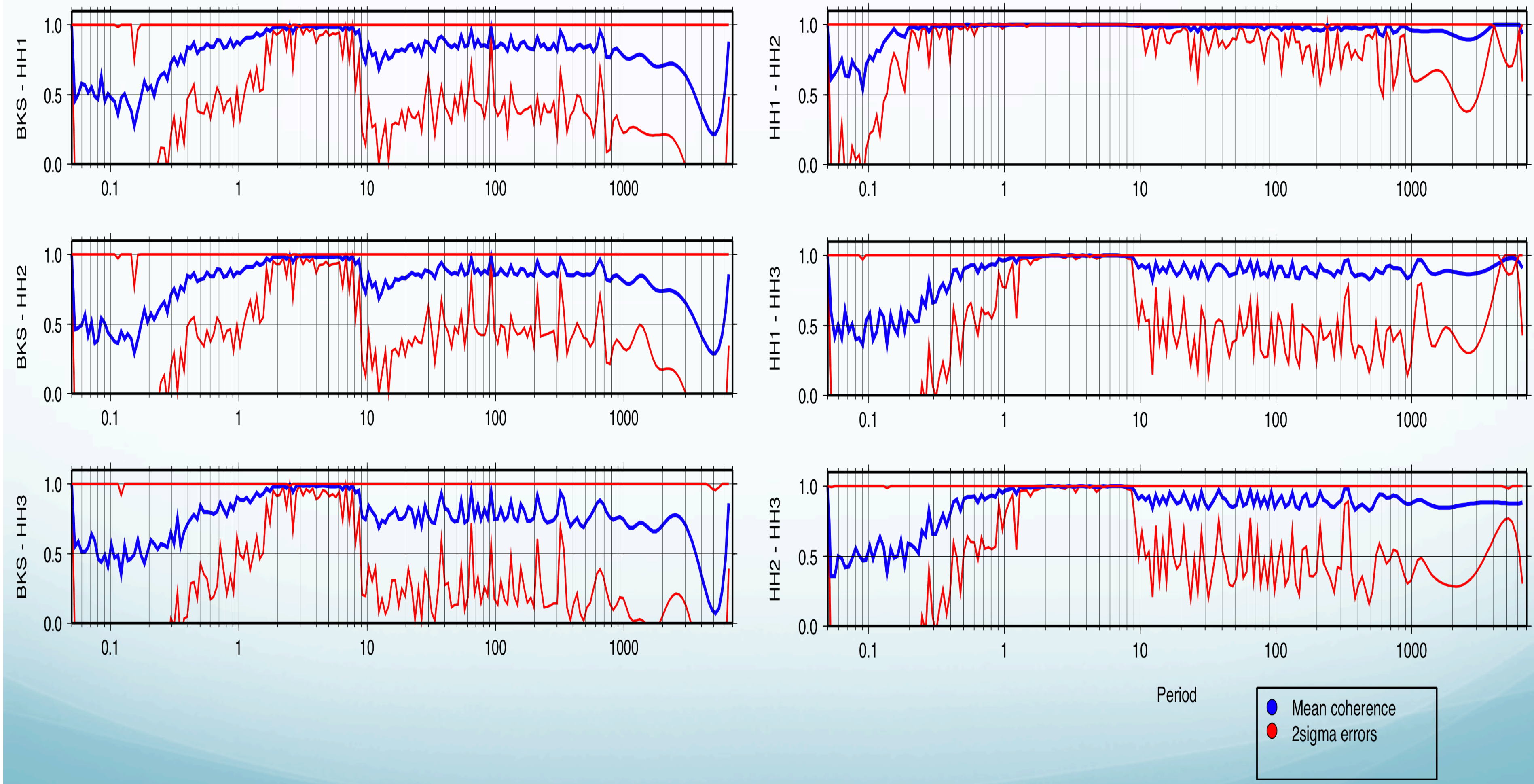
Initial Power Spectral Density



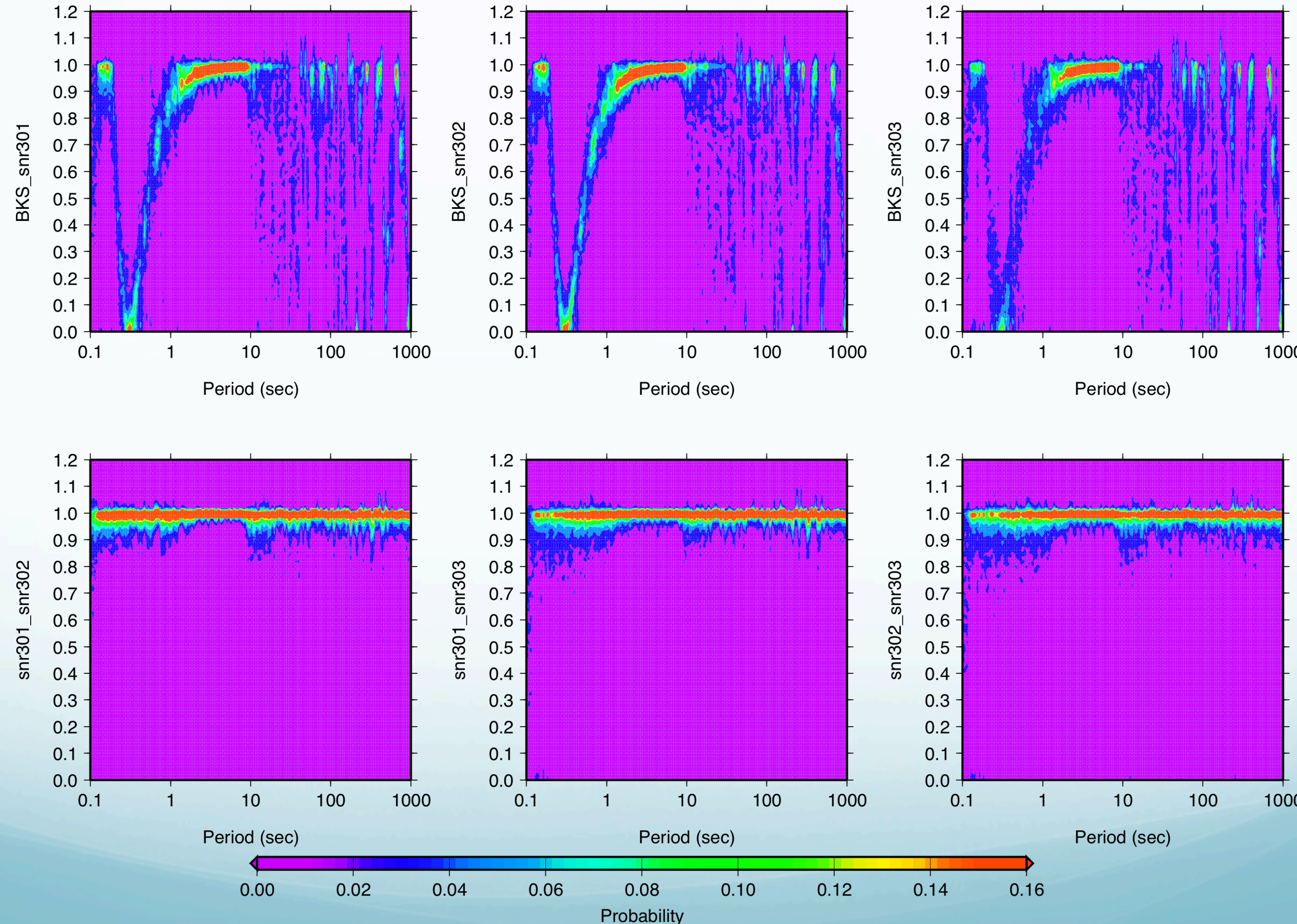
Initial Power Spectral Density PDF



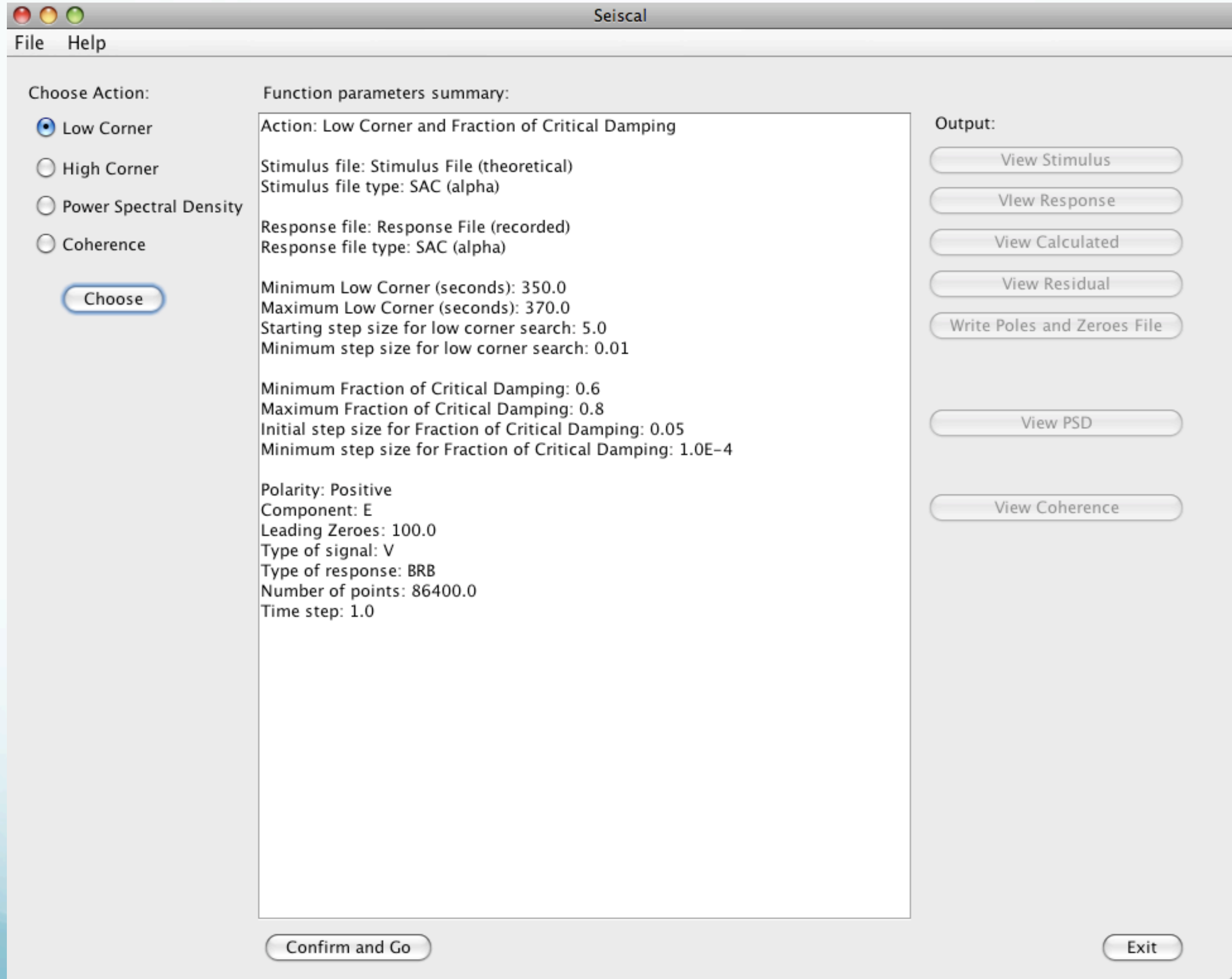
Initial Inter-sensor Coherence



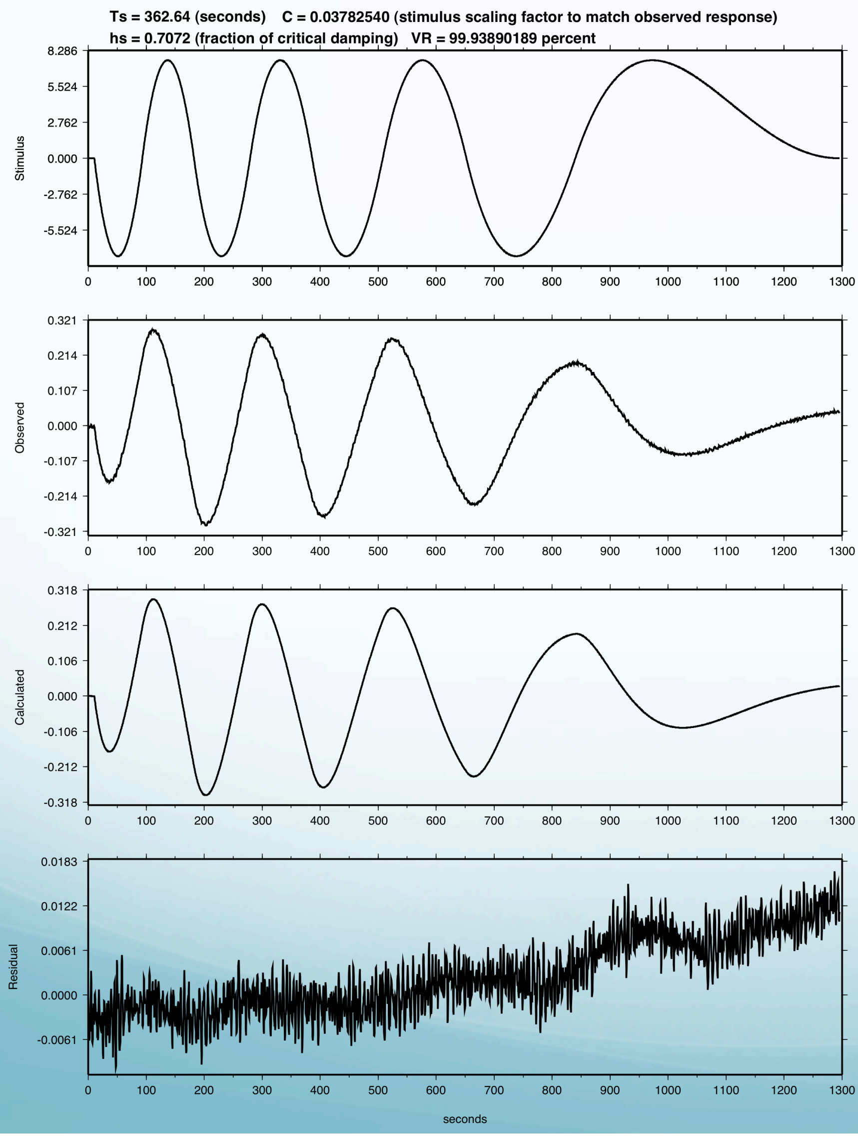
Inter-sensor coherence PDF



Calibration



Example of fitting the Low Corner



Stimulus input to the sensor

Observed response to stimulus

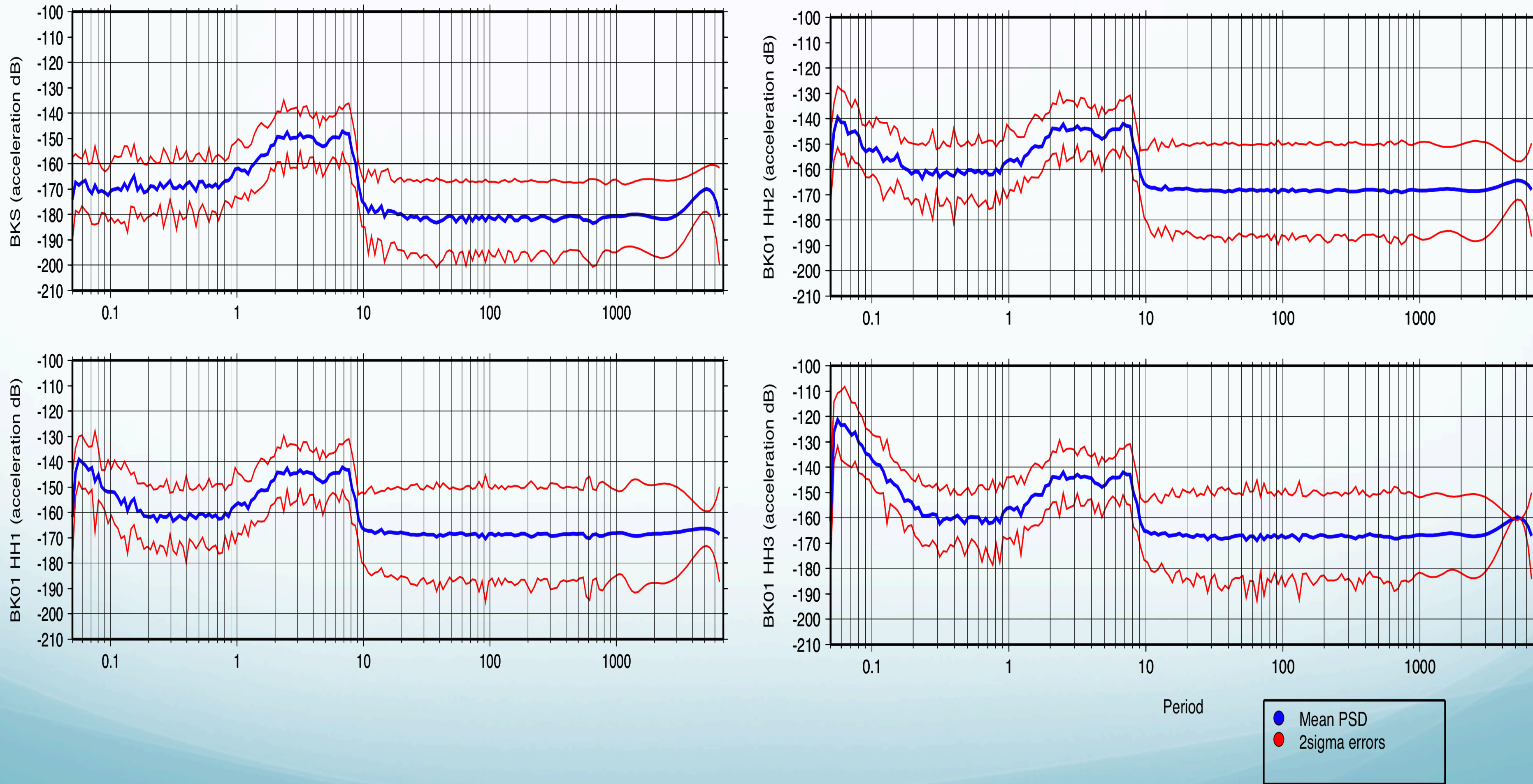
Response calculated if Ts ~ 362 seconds and hs ~ .7072

Residual between recorded and cacluated

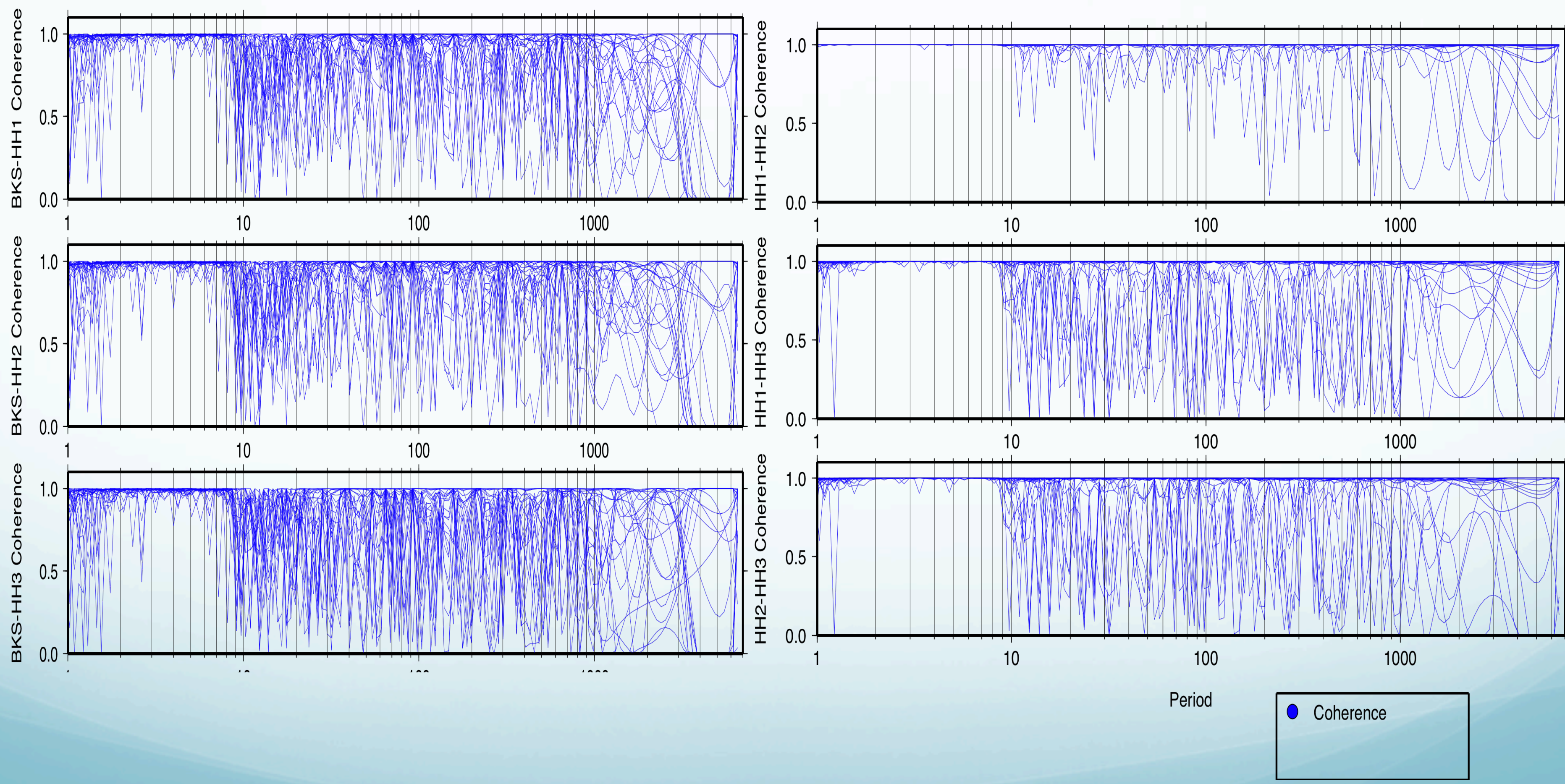
Proposal

- Assess the spectrum of replacement horizontal components
- Analyze temporal PSD and coherence variance
- Analyze sensor self-noise
- Monitor noise levels at the ASL in the stable US interior of the new physical package
- Distribute an easy to use cross-platform calibration tool to end users

Initial Power Spectral Density



Initial Coherence (scatter)

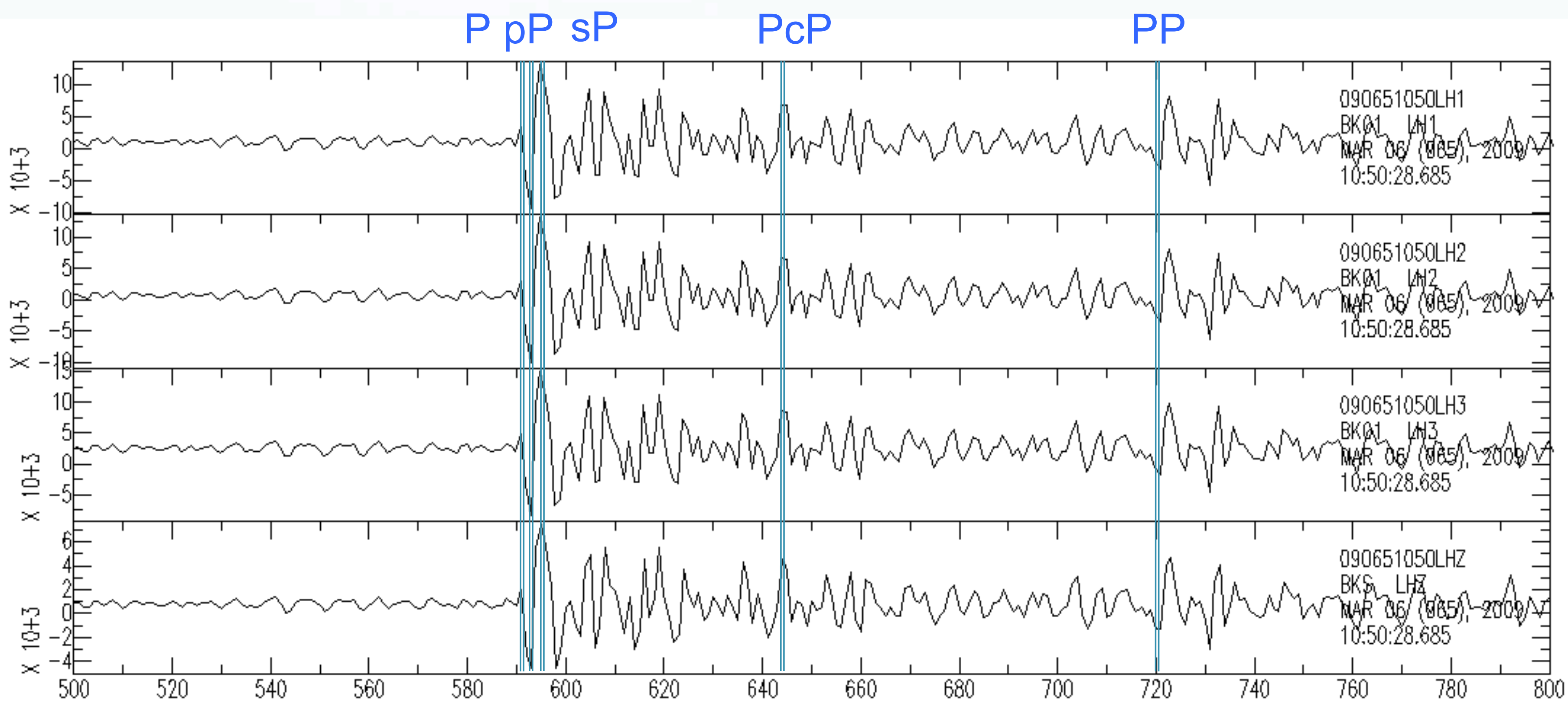


Testing reliability of sensors

- PDF?
- Control chart?
- Hypothesis tests?
- How to convey over the whole of the period band?

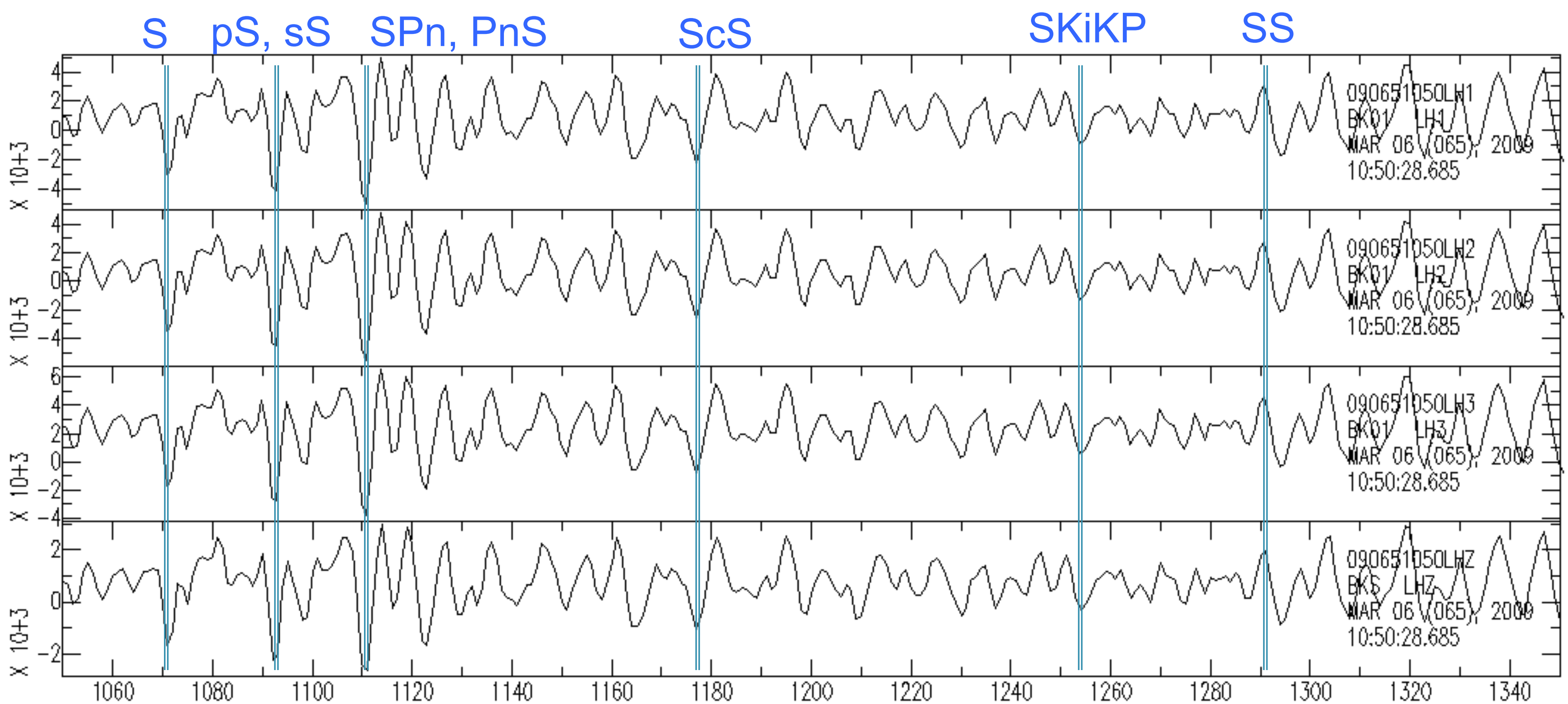
P - Phase Identification

- Mw6.5 Svalbard, March 6th, 2009



S – Phase Identifications

- Mw6.5 Svalbard, March 6th, 2009



Noise Correlation

Top to bottom:

3 month BKS-RAMR, 1 month BKS-RAMR, 1 month RAMR-LH1, 1 month RAMR-LH2, 1 month RAMR-LH3