Meeting the challenging performance requirements of Global Seismic Observatory Networks with the new Trillium 360 GSN

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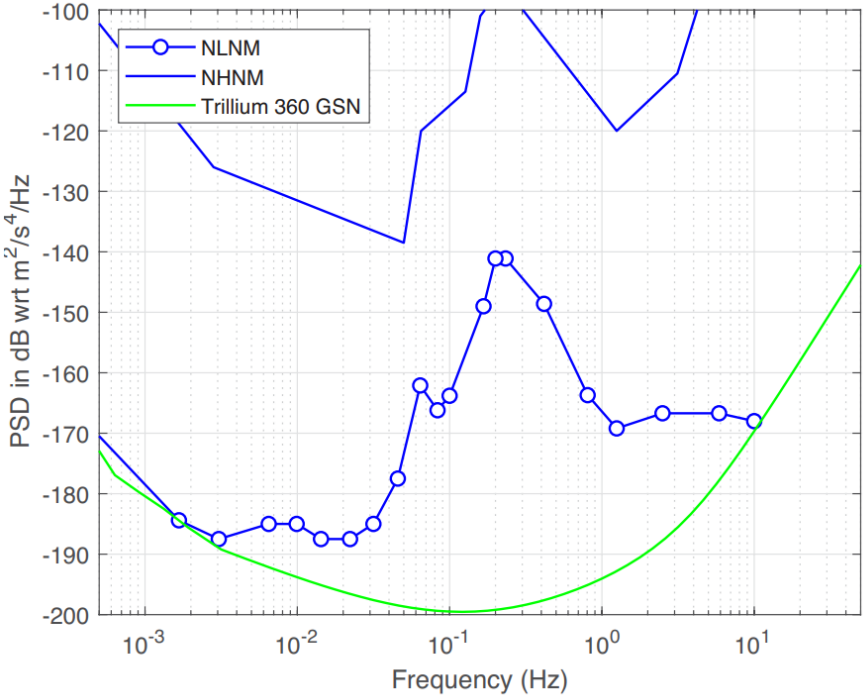
Objective: Lowest possible instrument self-noise

- Needed to replace STS-1 and KS-54000 instruments for global seismology (Earth normal modes etc.) in networks such as GEOSCOPE and GSN
- Achieved through several years of development and testing in cooperation with US Geological Survey, Scripps IGPP, and Black Forest Observatory



Trillium 360 GSN Self-Noise Specification

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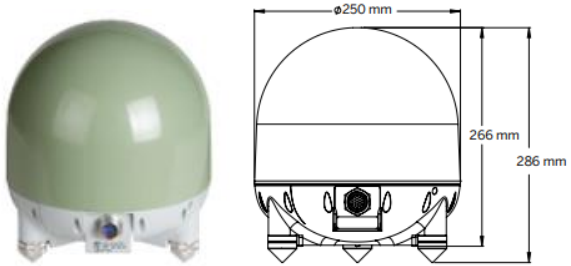
Instrument Overview

Same sensor technology available in vault, posthole, and borehole form factors

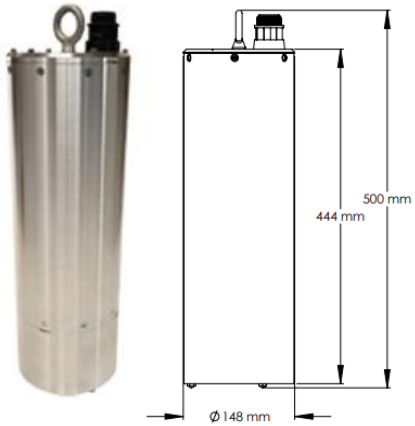
Key specifications

- Self-Noise below NLNM at all frequencies
- Bandwidth: 360 seconds to 79 Hz
- Magnetic sensitivity: <0.03 (m/s^2)/T
- Power consumption: 820 mW quiescent

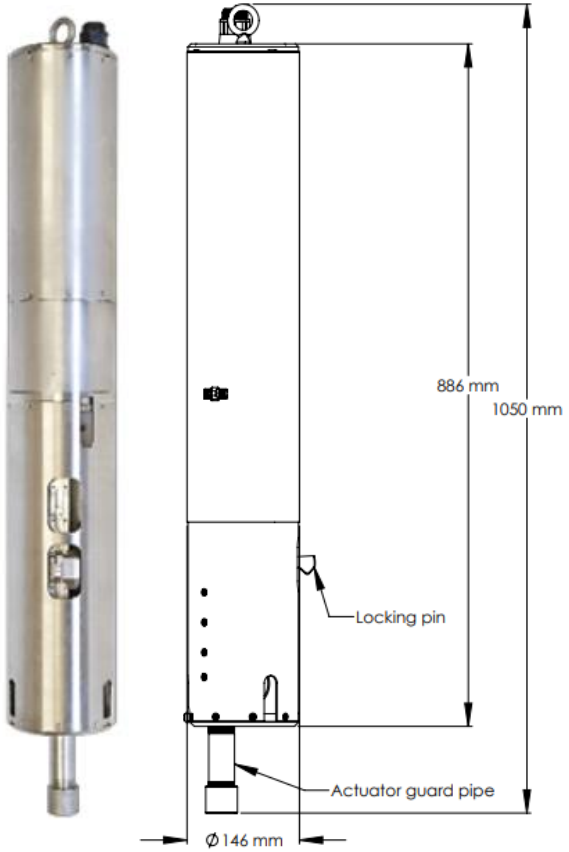
Trillium 360 GSN Vault



Trillium 360 GSN Posthole



Trillium 360 GSN Borehole



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Test Results at BFO

T360 GSN Vault seismometer installed in August 2019

Self-noise PSD calculated by Sleeman coherence for 2 days continuous data, 3 months after installation:

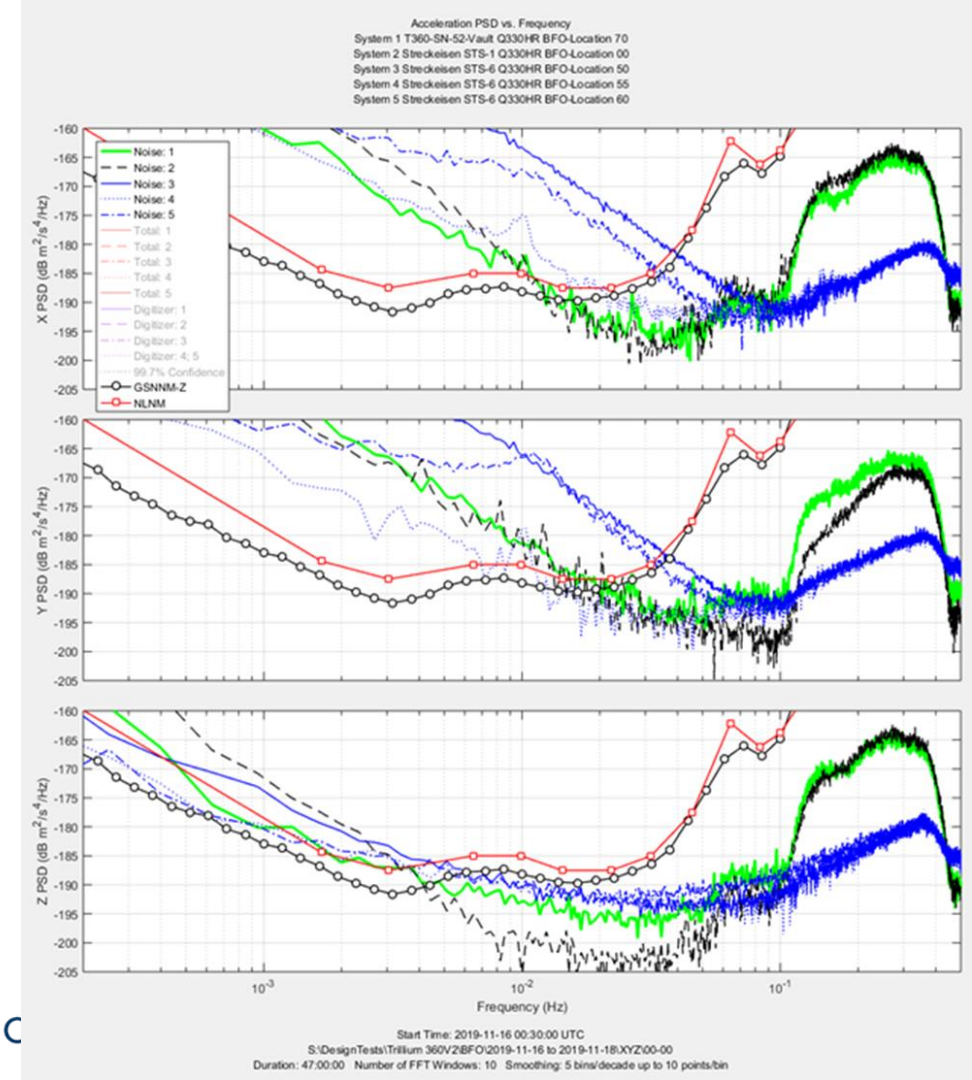
- STS-1 (dashed black)
- T360 GSN Vault (green line) – on pier with STS-1
- 3 STS-6 (blue) – in shallow cored holes in tunnel vault
- NLNM (red circles)
- GSNNM-Z (black circles)

On X (East): T360 has the lowest overall noise level

On Y (North): T360 noise is similar to the STS-1 on the pier. Noise of STS-6 units in postholes is quite variable.

On vertical:

- T360 is at or below NLNM (red line) and is the only sensor reaching NLNM at 0.003 Hz where earth background signal is at a minimum.
- STS-1 is quieter at 0.01 Hz, and 2 of the 3 STS-6s are quieter at 0.0002 Hz.



Conclusion

Noise performance at or below the NLNM was demonstrated in testing T360 GSN Vault and Borehole seismometers at BFO and ASL. The design was accepted by GSN as a replacement for STS-1 and KS-54000 seismometers and is currently being ordered and deployed.

Since the obsolescence announcement of the STS-6 in March 2021, Trillium 360 GSN is the only seismometer qualified to this level of performance.

Questions? email geoffreybainbridge@nanometrics.ca

References:

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