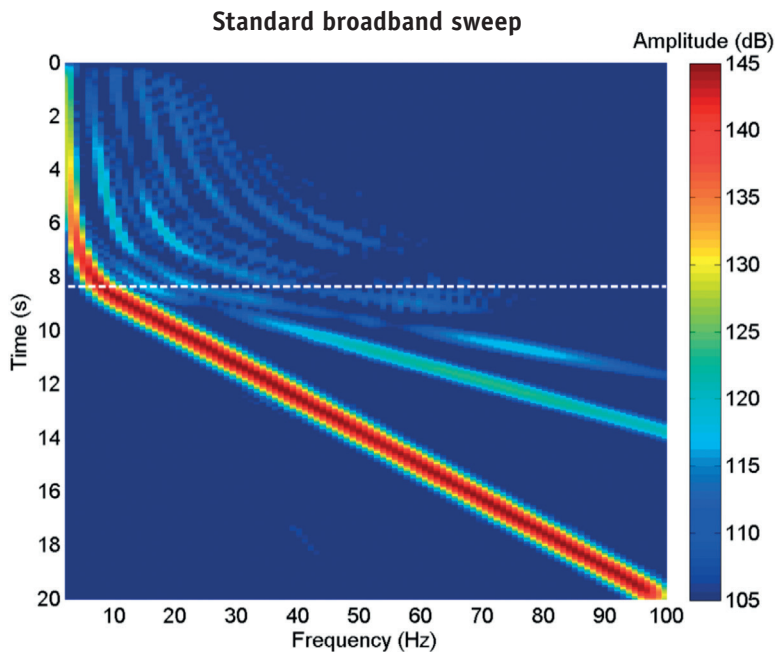




A game changer for onshore broadband seismic

CGG's **CleanSweep™** is a new technology which unlocks the full potential of broadband land seismic by delivering a sweep featuring high-fidelity low frequencies free of harmonic noise and exceptionally high signal-to-noise ratio over the whole bandwidth. **CleanSweep** enables you to leverage the broad frequency content of the data for more reliable inversion and interpretation.

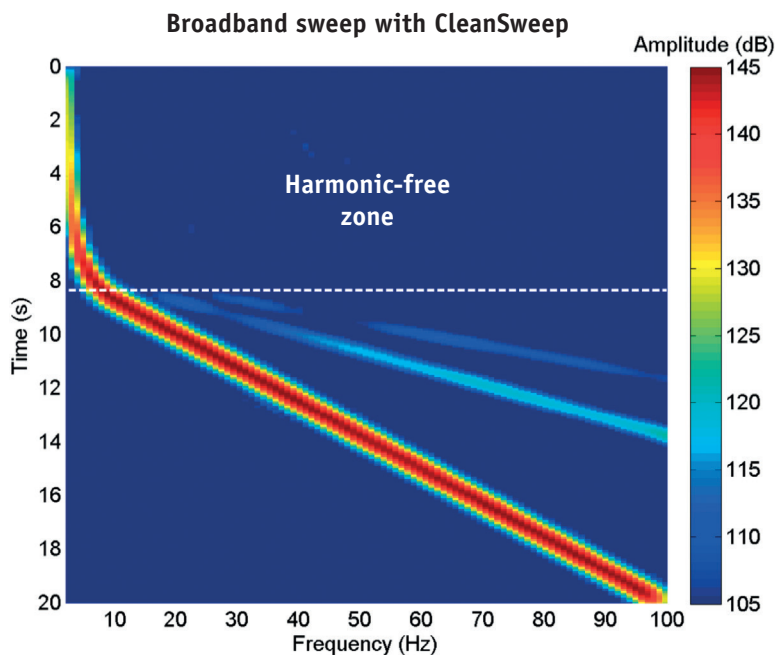


Getting the most out of your broadband sweep?

The advent of a new generation of sweeps tailored to extend the bandwidth at both low and high frequencies opened the door to onshore broadband acquisition. However, the full potential of these broadband sweeps remained, until now, obscured by the undesired harmonic distortion that was inevitably contaminating the whole bandwidth. To mitigate the effect of this broadband harmonic noise, specific acquisition strategies and post-acquisition processing techniques have been developed, without however addressing the problem at the source.

Innovative harmonic noise reduction during sweep generation

CGG's proprietary technology **CleanSweep** provides a signal free of harmonic noise over the first 4 octaves at the vibrator during sweep generation. It thus avoids subsequent broadband harmonic noise contamination. **CleanSweep** is a noise cancellation solution which consists of adding an anti-distortion signal extracted from field measurements to a standard pilot sweep. This is specifically designed to result in a ground force free of harmonics and which accurately fits the desired pilot.

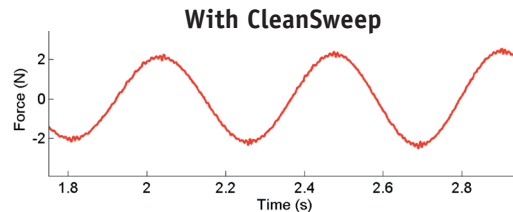
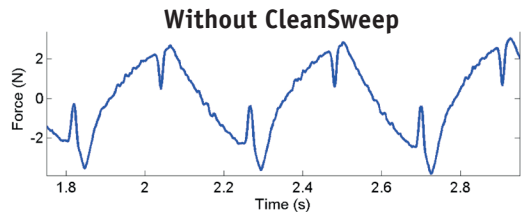


Average time-frequency amplitude spectra of the ground force for a low-dwell broadband sweep. With CleanSweep the harmonic noise is totally removed over the first 4 low-frequency octaves and is significantly reduced over the remaining bandwidth.

CleanSweep

4 octaves totally free of distortion

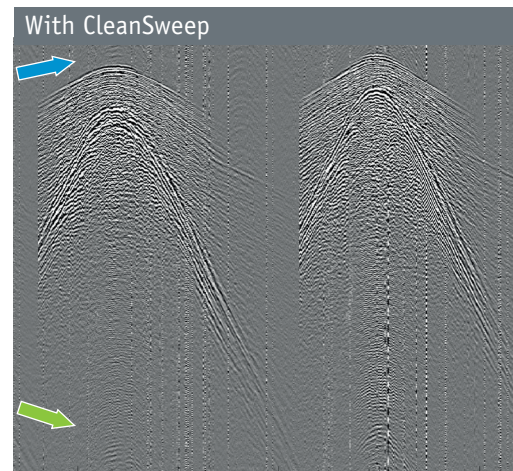
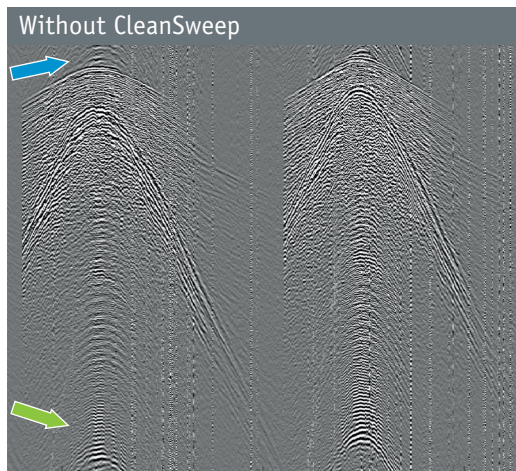
CleanSweep is effective on all sweep designs, particularly CGG's **EmphaSeis™** low-dwell sweep, delivering 4 low-frequency octaves free of distortion. This removes the requirement for the use of post-processing techniques to eliminate the high distortion energy commonly recorded at low frequencies and thus reduces the risk of impairing the signal.



Low frequency portion of a broadband sweep. CleanSweep is free from signal distortion, allowing the generation of mono-frequencies that accurately match the desired pilot sweep.

Best signal-to-noise ratio over the full bandwidth

Because of the broadband nature of harmonic noise it will contaminate the entire bandwidth if not handled properly. By canceling the distortion during sweep generation, **CleanSweep** provides a signal-to-noise ratio uplift over the full bandwidth. In flip-flop mode, it avoids the self-harmonic contamination such as the ground roll harmonic interference with the early arrivals. In slip sweep mode **CleanSweep** further improves the signal-to-noise ratio by reducing significantly the harmonic contamination from next shots. **CleanSweep** greatly benefits refraction waves which become clean and immediately usable for Tomography and Full Waveform Inversion applications.



Slip-sweep shot points. With CleanSweep the harmonic noise from current shot (blue arrow) and next shot (green arrow) is dramatically reduced.

Features

- Removes harmonic noise during sweep generation
- Addresses simultaneously intra and extra-shot harmonic noise contamination
- Delivers 4 low-frequency octaves free of distortion
- Ensures the best signal-to-ratio over the full bandwidth
- Particularly well-suited for broadband acquisition
- Leverages CGG's **UltraSeis™** solution
- Easy implementation on crews equipped with VE464

Benefits

- Raw gathers of exceptionally high quality
- Provides clean refraction arrivals immediately available for Tomography and Full Waveform Inversion
- Gives access to the lowest frequencies without impacting productivity
- Allows cost-effective generation of ultra-low frequencies with single vibrator

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