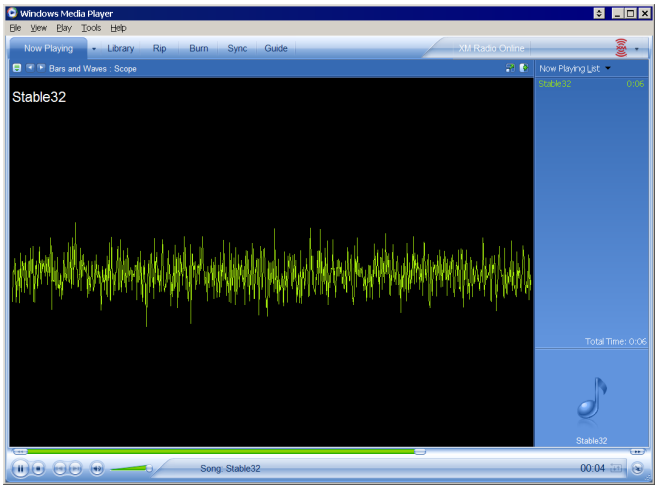
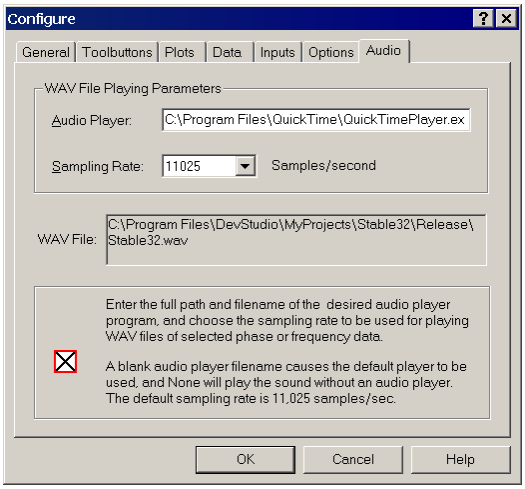
Stable32 Version 1.53 User Manual Addendum

• Audio Function

Stable32 Version 1.53 includes an Audio function that allows listening to phase and frequency noise data as a .WAV file on the computer sound system.. This sound file may be played on the default audio player (e.g., Windows Media Player), another specified audio player (e.g. Quick Time Player), or directly without a separate audio player program. The sampling rate of the WAV file may be set to one of five standard values between 8 kHz and 44.1 kHz, and has no relationship to the sampling period (tau) of the phase or frequency data. The data is stored with 16-bit CD quality having a nominal 96 dB dynamic range. The audio player and sampling rate are set on the Audio page of the Configure property sheet.



White FM frequency noise data displayed in Windows Media Player



Audio page of the Configure property sheet

While of little analytical use, this does provide another way to experience various noise types. It works best with long data files (several tens of thousands of points), and with headphones or a sound system having good bass response. The more divergent noise types are best observed at the highest sampling rate. White PM frequency noise, at the "blue" end of the audio spectrum, sounds like frying bacon. White FM frequency noise sounds like the "white" noise from a radio. Random walk FM frequency noise, toward the "red" end, has a low rumbling sound. And random walk FM phase noise, in the "infrared" region, cannot be heard at these sampling rates. Some media players have oscilloscope, spectrum analyzer, and other visualizations that can add another dimension to noise observations.

• Function Keys

Additional function key commands were added to the Stable32 user interface. Besides the standard F1 Help command, the F2-F12 function keys now provide another way to execute common commands, and the Shift F1 key provides immediate access to the Stable32 User Manual.

Key	F1	F2	F3	F4		F5	F6	F7	F8		F9	F10	F11	F12
Normal	Help	File #1	File #2	File #3		Conv	Edit	Plot	Stats		Run	Power	ACF	Select
Shift	Manual													

The F2-F4 keys reopen previous phase or frequency data. The F5 key performs a phase-frequency conversion from the current data type, which can be selected with the F12 key. The F6 and F8 keys open the Edit or Statistics dialogs. The F7, F9, F10, and F11 keys execute the Plot, Run, Power and Autocorrelation functions, producing their respective plots with a single keystroke.

• Polynomial and Function Fits

Polynomial (up to 9^{th} order) and general non-linear function fits were added to the phase and frequency data plot options.

• Autoregressive Fit and Removal

An option for a first-order AR(1) autoregressive fit and removal was added to the Frequency Drift function. This may be used to prewhiten divergent data before frequency jump detection.

• Data Reversal

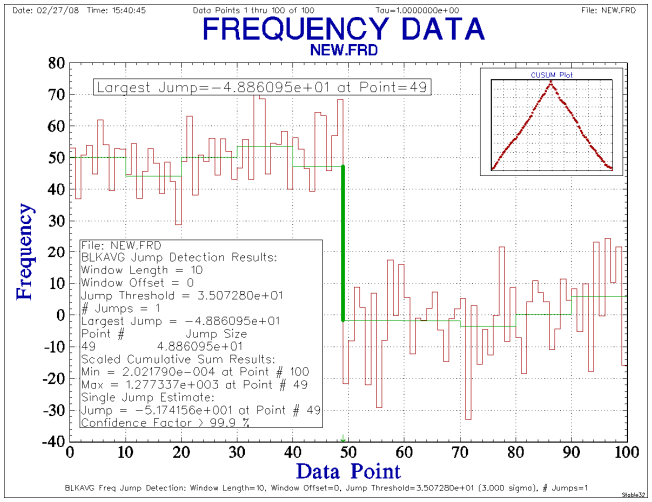
An option for reversing the phase or frequency data was added to the Scale function.

• Frequency Timetag Types

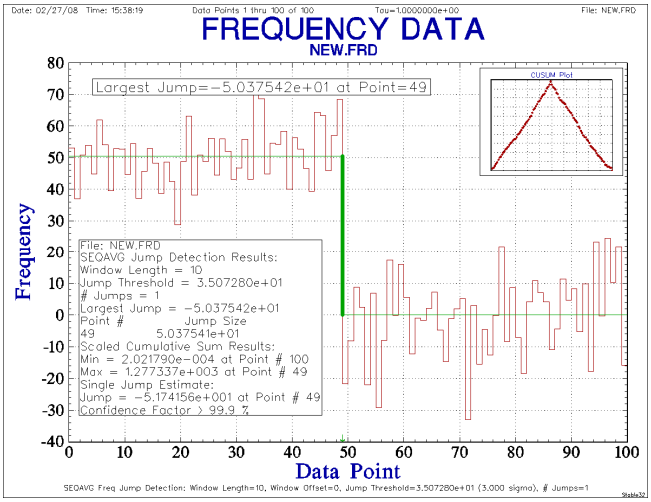
Options were added to select the type of frequency timetag based on the corresponding first, second or average phase timetag.

• Frequency Jump Detection

Options for detecting frequency jumps were added to the Frequency Data Plot function. Examples of frequency jump plots are shown below:



BLKAVG Frequency Jump Detection Plot



SEQAVG Frequency Jump Detection Plot

This plot is an example of the Stable32 Version 1.53 Block Average (BLKAVG) frequency jump detection method that can be invoked from the Fit Type list box of the Frequency Plot Options function. It shows the results of a simulated frequency jump analysis for a relatively short frequency record. The red points on the main plot are the frequency data values, shown as boxes that denote the measurement interval. The light green horizontal lines are the frequency averages over the default moving average jump analysis windows of length 10, one-tenth of the record. The heavy vertical line at the center denotes the detected jump whose value of about -48.9 at point 49 exceeds the default 3-sigma jump threshold of 35.1. The cumulative sum (CUSUM) for these data is shown in the inset plot, whose sharp slope change is associated with the frequency jump. The inverted-V CUSUM plot is used to calculate another estimate of the frequency jump, about -51.7 at point 49. The actual value of the simulated frequency jump was 50. 1000 randomly-shuffled CUSUM ranges are used to obtain the > 99.9 % confidence factor for the frequency jump. The plot annotation at the bottom shows the analysis parameters.

This plot is an example of the Stable32 Version 1.53 Sequential Average (SEQAVG) frequency jump detection method for the same frequency record. The red points on the main plot are the frequency data values, shown as boxes that denote the measurement interval. The light green horizontal lines are the frequency averages over the two jump regimes. The heavy vertical line at the center denotes the detected jump whose value of about -50.4 at point 49 exceeds the default 3-sigma jump threshold of 35.1. The same CUSUM results are shown in the inset plot. Data files `Jump.dat` and `Cusum.dat` are automatically written for the frequency averages and CUSUM values respectively, with frequency jumps indicated by zero values in the former. The note inset, copied from the Windows clipboard, shows the jump analysis results. The plot also contains the usual date, time, data points, tau, filename and organization markings, as well as a green arrow denoting the location of the largest jump. The jump detection options include the use of an alternate color for the frequency data to make the jump analysis lines more visible.

- **Miscellaneous Changes**

1. An edit control was added to the General page of the Configure property sheet to allow setting the printer font point size.
2. A much faster method was implemented for the ThêoBR bias calculation.
3. Several improvements were made to the Power function, including normalization of the data before PSD calculations, optional zero padding via a checkbox on the Options page of the Configure property sheet, and display of the effective noise bandwidth.
4. Improvements were made to the Database file reading function, including reading the last data point, a Stop on Gap feature, access to PostgreSQL help and updating to PostgreSQL version 8.3.
5. Copy to clipboard button added to Print function.
6. Several minor user interface changes were made.

- **Help File**

See the Stable32 Help file for more information about these new features that are not included in the Stable32 Version 1.50 User Manual.