

# *Vantage Release Notes*

Vantage Software Release 4.0.1-1903121200, 12 March 2019



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# 1 Introduction

This document summarizes the changes and new features included in the Vantage 4.0.1-1903121200 software release, and provides a summary of known issues to be addressed in future releases.

The 4.0.1 release includes a few incremental changes from 4.0.0, which was released in December 2018. This document covers all changes from both 4.0.0 and 4.0.1, under the headings "4.0.N". New items specific to 4.0.1 will have "(4.0.1)" included in their title.

For reference, the release notes from the previous Vantage software releases 3.4.0 (November 2017) through 3.4.4 (July 2018) and 3.3.0 (October 2017) are included at the end of this document.

## Matlab and Host Computer OS Compatibility

The Vantage 4.0.1-1903121200 Software release has been tested for compatibility and full functionality with the following versions of Matlab and host computer Operating Systems:

**MATLAB:** Release level 2017b. Verasonics recommends using the preferred Matlab version 2017b, but 2017a can also be used. The 4.0.N releases will not function on Matlab releases older than 2017a and will report a fault condition if a release older than that is detected. In addition, the 4.0.N releases are not compatible with the most recent Matlab releases 2018a and 2018b. Full compatibility with the most recent Matlab releases will be restored in a future Vantage software release. (issue 897)

**WINDOWS OS:** Windows 7 Ultimate 64 bit. (The Vantage Software can be used with Windows 10, but there are some anomalies to be aware of; see the Known Issues section of this document).

**MacOS:** Version 10.10 "Yosemite". The Vantage 4.0.1-1903121200 software can not be used with any MacOS release more recent than Yosemite.

**Linux:** Ubuntu Version 16.04 LTS. This is the same version supported by the earlier 3.4.N Vantage software releases. The 4.0.N releases are not compatible with the older Ubuntu Version 14.04 that was used with 3.3.0 and earlier Vantage releases.

# 2 New Features in the 4.0.N Releases

## (4.0.1) Deferred Features of the Verasonics Viewer

The 4.0.1 release adds some new features for the Verasonics Viewer that were not included in 4.0.0, including: image export in TIFF format, ability to draw graphic overlays on top of the image (such as a "region of interest" outline), and ability to do a mouse-click over the image and trigger a callback function with the image coordinates of the mouse cursor. For 4.0.0 and earlier releases, scripts that require any of these deferred features had to use the Matlab viewer. (issues 634, 866, 867)

## (4.0.1) HIFUPlex Pairing 5

New pairing with similar functionality to pairings 1, 2, 3, and 6 that were available with the 3.4.N releases, but with different therapy and imaging arrays. Refer to the HIFUPlex product literature for descriptions of these pairings. Pairing 4 will be added in a future release (issue 746)

## (4.0.1) High Image Quality Example Scripts for Vantage 64 LE

New example scripts have been added for the C5-2v, L11-4v, and L11-5v probes for use with the UTA 260-S adapter and Vantage 64LE system configuration. Refer to the "Examples\_Biomedical / Vantage 64 LE" subfolder in the 4.0.1 software for a listing of the individual scripts. (issue 977)

### (4.0.1) Automatic Execution of VSX from a SetUp script

This is a feature that has been present in all earlier Vantage software releases but has not been well documented: The "normal" execution sequence is that when you run a SetUp script, it creates the associated .mat file, saves it to the MatFiles folder, and then exits. To actually run the script you then have to start VSX from the Matlab command prompt, and then enter the name of the .mat file in response to a query from VSX. An alternative approach is to have the SetUp script automatically invoke VSX and run the script after it has saved the .mat file. To do this, you only need to add two lines in the SetUp script, immediately after the line with the "save" command to create the .mat file:

- First, create a string variable named "filename" and set it to the name of the script's .mat file that was just saved.
- Second, invoke VSX directly from within the SetUp script.

Note that these two lines can be concatenated on a single line in the SetUp script. For example,

```
filename = 'L11-5vFlash'; VSX;
```

When VSX starts up, it first looks to see if the variable 'filename' is present in the Matlab workspace and if so, VSX automatically loads and runs the .mat file that has been identified. If 'filename' does not exist VSX then proceeds with the query for the user to enter the desired .mat file to be run.

In Vantage 4.0.0 and other recent Vantage software releases, some of the example scripts included in the release were actually using this automatic scheme to run VSX from within the SetUp script while many others were not. The result was inconsistent behavior which could be very confusing to a new user of the system. For 4.0.1 we have made all SetUp scripts behave consistently by simply commenting out the lines to run VSX if they were present. If you prefer to have the script automatically run VSX you can simply uncomment those lines, or add them if they are not already there. The User Manual has also been updated for 4.0.1 to explain this feature and how to use it. (issue 744)

### (4.0.1) Identify .mat file to VSX using name of SetUp Script

This new capability applies to situations where you are using VSX in the "manual" fashion, where you must respond to its query at the Matlab command prompt with the name of the .Mat file to be loaded and executed. In all earlier Vantage software releases, the only acceptable response to this query was the actual name of the desired .mat file. Starting with 4.0.1, an alternative has been added: you can also respond with the name of the SetUp script that was used to create the .mat file. After you have entered a filename, VSX will first check to see if that name identifies a script (.m extension) or a .mat file (.mat extension). If it is a script, VSX will automatically open the file and find the name of the .mat file that was saved by the script and use that name. This new feature allows you to avoid the fairly common dilemma where you know the name of the script that created the .mat file you want to run, but you can't remember the exact spelling of the .mat file's name. Another way to use this feature is if you have just run a SetUp script and now you want to execute it with VSX, you can just enter "up-arrow" in response to the VSX filename prompt, and Matlab will provide the name of the script you just ran without your having to re-enter it. (issue 1047)

### (4.0.1) Simulate-Only and Software-Only Vantage Software Operation

New features have been added to support more flexibility in both "Simulate-only" and "Software-only" use of the system.

- **Simulate-only** refers to a user script that is intended for simulation use only and cannot be run on the hardware system because it goes beyond the hardware system's capabilities (such as using more than 256 channels). This operating state is specified in a SetUp script by setting *Resource.System.Product* = '*SimulateOnly*';. In this operating state the system will not attempt to communicate with the hardware system at all, even if one is present. None of the parameters needed to program the hardware system will be created.
- **Software-only** refers to running a script that is intended for use on a hardware system, but running it in simulate mode only. This operating state is specified in a SetUp script by setting *Resource.System.Product* = '*SoftwareOnly*';. In this operating state the system will not attempt to communicate with the hardware system at all, even if one is present. However, all of the parameters needed to program the hardware system

will be created and the software will check for any errors that would prevent the script from running on the hardware system. The intended hardware system configuration can be specified through the Resource.System structure, or will be set automatically based on the probe characteristics specified by the Trans structure in the user script.

The system will automatically switch into Software-Only operation when running a user script if the hardware system is not present, or if the hardware system that is present does not match the requirements of the script being run.

These capabilities are based on the new Resource.System structure added in 4.0.0. Refer to the User Manual for more information on Simulate-Only and Software-Only operation of the system. (issue 802)

#### **(4.0.0) Software-Only Vantage Software Installation**

With each purchase of a Vantage system, Verasonics provides the user with access to "stand-alone" software licenses to allow installation and use of the Vantage software on additional computers that will not be used with the hardware system. In earlier releases, installation of the Vantage software on a computer for stand-alone use still required installation of the driver for communication with the hardware system. Starting with the 4.0.N releases, you do not need to install the driver at all for creating a stand-alone software installation on a Windows-based computer; when the software recognizes the absence of the driver it automatically switches to Software-Only operation. This avoids the added complexity of installing the driver, and also eliminates the overhead when running a user script of having the software attempt to communicate with the hardware only to discover it is not there and then revert to Software-Only operation.

Note, however, that this "driver-free" capability is available only for the Windows OS when using the 4.0.N releases. For stand-alone software installation on a Linux or MacOS based computer you still need to install the driver before the software can be used. In a future Vantage software release the driver installation requirement will be removed for all three OS configurations. (issue 784)

#### **(4.0.0) New UTA Modules and Example Scripts**

Five new UTA modules are now available for use with Vantage systems, and are fully supported by the 4.0.N software including new example scripts to illustrate the user of each module, as listed below. Refer to the User Manual for a more detailed description of the features and system compatibility constraints of each module. (issue 738)

- UTA 160-SH/8 LEMO: This module supports the same 128 channel, 160 pin Hypertac connector interface as the existing UTA 160-DH/32 LEMO but allows access to more signals at the single connector than was possible with the dual connector adapter. (issue 862)
- UTA 128 LEMO and UTA 64 LEMO: This module is available in two versions, providing either 64 or 128 single-element coax connectors each directly connected to a channel of the Vantage system. (issue 858)
- UTA 156-U: Provides a single 128 channel, 156 pin connector that is compatible with probes for the Ultrasonix system. Example Scripts are included for two probes, the L14-5u linear array and SA4-2\_24u phased array.
- UTA 256-Direct: Provides the same "direct-connect" probe connector interface as the UTA 1024-MUX to allow semi-permanent connection of the probe cable to the adapter with mechanical cable strain relief, fully shielded enclosure, and small "paddle board" connector PCB's to allow termination of the micro-coax cables from the probe. This adapter is physically very similar to the UTA 1024-MUX, but provides no HVMux switching and instead allows direct connection of up to 256 probe element signals to Vantage system channels.

#### **(4.0.0) Vantage 32LE system configuration and example scripts**

The Vantage 32LE configuration provides 64 transmit channels and 32 receive channels but in all other aspects is identical to a Vantage 64 system (which has 64 transmit and receive channels). Example scripts for the 32LE have been added in the 4.0.N releases for use of the following probes through the UTA 260-MUX adapter: C5-2v, L11-4v, L11-5v, and P4-2v. (issue 815)

#### **(4.0.0) Dynamic HVMux Programming**

This new feature allows more flexibility in user script programming of the elements to be selected by the HVMux switches in each acquisition event, both for HVMux-based probes and also for the HVMux adapters UTA 260-MUX and UTA 1024-MUX. The "active aperture" HVMux programming scheme used in all earlier Vantage releases only allowed selection of a contiguous group of elements within the probe (typically in "tractor-tread" fashion across the elements of a linear array). With Dynamic Mux Programming you can select any arbitrary group of elements you want, within the constraints of the physical connections of the HVMux switches. If the HVMux design allows it, you can also select multiple elements in parallel routed to the system channel (for example, this would allow flash transmit across all elements of the transducer in a single transmit event). The Vantage software is fully compatible with both the new Dynamic Mux programming method and the legacy active aperture method used in earlier releases; in a user script you can select either method based on which one is most appropriate for the intended functionality of the script. (issue 852)

#### **(4.0.0) Resource.System Structure to Specify System Configuration**

With the growing number of Vantage system configurations, UTA modules, and probes supported by the system it can be confusing to determine which configuration a particular user script is intended for. The new structure "Resource.System" allows you to state explicitly at a very high level what is intended- for example, a script intended for use on a Vantage 32LE system with the UTA 260-MUX adapter module can now simply state that in the Resource.System structure; in earlier releases this had to be "implied" by the choices the script made in number of active channels, Apod array sizes, etc. This new structure makes it easier for anyone reading a script to determine what system configuration is intended, and also makes it easier to write a script by allowing the system software to automatically set low-level parameters that otherwise would have to be set manually in the script. (issue 802)

#### **(4.0.0) Transmit Waveform Definition using new TW.States Array**

The "PulseCode" waveform definition format used in all earlier Vantage software releases has been replaced by a new "States" format. The new format preserves full backward compatibility to any waveform defined with the PulseCode format and added additional features such as nested loops over waveform segments of arbitrary length. (issue 681)

#### **(4.0.0, 4.0.1) Event Analysis Tool Enhancements**

Extensive new features have been added to this utility, to perform much more thorough analysis of a user's SetUp script and identify errors. The best strategy when developing a new or extensively modified script is to first test it with EventAnalysisTool before attempting to run it on the system with VSX, and correct any errors that have been identified. Then set the flag "Resource.Parameters.InitializeOnly" to true in the script and run it with VSX; this will cause VSX to exit as soon as initialization is complete. Then run EventAnalysisTool again, on the fully initialized version of the script that has been left in the Matlab workspace and again correct any errors that are identified. After completing these tests, you can be much more confident the script will actually run successfully on the system. (The more extensive error checking performed by EventAnalysisTool is not included in VSX because we do not want to add excessive latency to VSX every time it initializes a known-good script.) (issue 534)

#### **(4.0.0) Enhanced Probe Connector Status Reporting**

A new utility function "ProbeConnectorStatus" has been added, to include reporting of whether each connector has disconnect sensing capability and probe ID sensing capability. This new utility replaces the "SHStatus" function that was provided in earlier Vantage releases. (issue 910)

### 3 Defects Corrected in the 4.0.N Releases

#### (4.0.1) Verasonics Verification Test error with incorrect FPGA code

In the 4.0.0 release, if you ran Verasonics Verification Test ("VVT") on a hardware system that did not have the correct FPGA code installed, VVT would report the problem but then exit with some confusing error messages without completing the tests. With 4.0.1 VVT will respond more appropriately in this situation.

As a general guideline, before attempting to run VVT you should first run "Version" to ensure the FPGA files have been updated or to complete the updates if needed. (issue 936)

#### (4.0.1) Potential Matlab Crash with Color Doppler Scripts

This issue was present in 4.0.0, but has been fixed in 4.0.1: A few situations had been found where an unusual operating state for a Color Doppler script could lead to a Matlab crash; in some cases the script would actually function as intended with the crash only occurring after exiting the script (when the cleanup functions are freeing allocated memory, etc.). One example is a "Doppler-only" acquisition script where there is no B-mode processing at all. Another situation that resulted in a crash was use of the "FIRHigh" wall filter along with an ensemble length greater than 75. (issues 966, 967)

#### (4.0.0) User Acquisition Script Errors Undetected by Vantage Software

Several situations have been identified in earlier Vantage releases where if a user makes an error in their SetUp script, the Vantage system software may not detect the error and thus the script will attempt to run but may result in a system crash, or a system fault condition with very misleading error messages that do not identify the underlying cause of the problem. These situations have been addressed in the 4.0.N releases through the enhancements to the EventAnalysisTool described in the "New Features" section of this document. If you are developing a new or extensively modified script, you should test it with EventAnalysisTool before attempting to run it on the system with VSX. The more extensive error checking performed by EventAnalysisTool is not included in VSX because we do not want to add excessive latency to VSX every time it initializes a known-good script. (issue 759)

#### (4.0.0) Receive data corruption at maximum LNA gain on High Frequency System

When the RcvProfile LnaGain field is set to its maximum level of 24 dB on a Vantage High Frequency system, objectionable artifacts could be introduced in some receive channels if the LnaZinSel field was set to a value less than 4. This is an expected result for the High Frequency configuration when using maximum LnaGain. To correct this problem the system software now detects this situation and automatically increases the LnaZinSel value to 4 with a warning message to the user. (issue 622)

### 4 Known Issues in the 4.0.1 Release

#### (4.0.1) Intermittent Failures with Linux OS

In both the 4.0.0 and 4.0.1 releases we have found that when running the hardware system with Linux, the driver for the hardware system will occasionally cease functioning, preventing the Vantage software from communicating with the hardware system. This failure can lead to very confusing error messages, such as that one of the CGD FPGA files is out of date and needs to be reprogrammed. This error message is incorrect, and is an artifact of the lost communication path. To recover when this failure occurs, you can simply close and restart Matlab- there is no need to run reprogramHardware or shut down and restart the entire system. Because of the rate at which this error occurs, Linux users are advised to avoid using 4.0.0 and 4.0.1. A new Vantage software release will be distributed as soon as a solution to this Linux-specific problem is found. (issue 1088)



## L22-14vX and L22-14vX-LF Probe Performance

These "vX" versions of the L22-14v were added in the 3.4.1 release, allowing the use of higher transmit voltage levels by applying a DC bias voltage to the transmit elements. Recently we have found that some of the L22-14vX probes generate spurious artifacts in the acquired RF data when operating at higher transmit voltages with the DC bias voltage applied. To avoid this problem, the allowed transmit voltage levels have been reduced in the 4.0.1 release. When the probe manufacturer has found and resolved the artifact problem, we will be able to restore operation at the higher transmit levels but for now the reduced levels will allow existing L22-14vX and L22-14vX-LF probes to be used reliably while avoiding the artifact problem. (issue 1049)

## Windows 10 Compatibility

If the Vantage HW system is turned off or disconnected while a host computer using Windows 10 is still running, Windows may disable the interface to the HW system and thus on the next power cycle the Vantage Software will report a "hardware not found" error. You can usually recover from this situation by shutting down the system and then disconnect or turn off the hardware system. Then restart the host computer and run the Vantage software in simulation mode, and then shut down the computer once more and reconnect the hardware system. After restarting with the hardware system reconnected and turned on, full driver functionality should be restored. If this is not the case, Contact Verasonics Technical Support ([support@verasonics.com](mailto:support@verasonics.com)) for additional assistance. Note that you may also encounter this same problem with windows 10 when using "reprogramHardware" or "Version" to update FPGA code in the hardware system, since these utilities will automatically disable the PCIe interface to the host computer as part of the FPGA update process.

Reminder: To minimize potential problems of this nature, always make sure AC power to the Vantage hardware system is connected and turned on before you start up the host computer. At shutdown, make sure you shut down the host computer first, and wait for it to complete the entire shutdown process to a full power-off state, before turning off or disconnecting the Vantage hardware system. (issue 417)

## Restart Matlab When Switching to a Different Vantage Software Version

In some situations (depending on the particular version of Operating System and Matlab you are using), the system can fail to select the correct library of low-level Hal software support functions when you switch from one Vantage software installation to another. The best way to avoid this is to quit Matlab and restart it and then navigate to the desired Vantage directory BEFORE you run activate. The malfunction can occur if you have run activate in a different directory, and then run it again after switching to the desired directory without restarting Matlab. Note that to conform to this guideline, if you are using a Matlab startup.m file to automatically select a default Vantage directory you should remove any activate call from the startup.m file to ensure activate will not be invoked until after you have selected a Vantage directory that is not the startup.m default. (issue 682)

## Software Installation Problems with Linux

There are some known but unresolved problems in the 4.0.N releases with the built-in utilities and instructions for installing the driver and setting up the system to run with the Linux OS. If you encounter problems installing 4.0.0 or 4.0.1 on a Linux-based system, contact Verasonics Technical Support ([support@verasonics.com](mailto:support@verasonics.com)) for assistance. (issues 935, 943, 949)

## Malfunction in Microvascular Imaging example script

There is a known problem in the 4.0.N releases with use of the capture button in this example script: it may result in putting Matlab in a "locked up" state where the only way to recover is to force quit Matlab. This will be corrected in a future release. (issue 959)

## Receive Data Interleave Processing Malfunction

This bug affects the Recon pre-processing function for combining interleaved RF data acquisitions to create a higher RF data sample rate. Very intermittently and on only a few channels at a time, the interleave processing may not actually have been

completed on all threads and thus the RF data near the end of the frame will still be in the interleaved format. This effect is more likely to occur on more complex acquisition sequences with a large number of acquisitions per frame. (issue 638)

## Wide Beam Doppler Example Script Bug

In the 3.4 and 4.0 releases we have found that the "Wide Beam Doppler" scripts will in some cases lead to a Matlab crash, but this bug is very difficult to reproduce. The underlying cause for this problem is under investigation and will be fixed as soon as possible in a future release. At present the best known workaround for this issue is to make sure you are using the recommended Matlab version 2017b; if a crash occurs restart the system and if the problem still exists contact Verasonics Technical Support ([support@verasonics.com](mailto:support@verasonics.com)) for assistance. (issue 712)

## MacOS Compatibility Restrictions

MacOS releases beyond 10.10 Yosemite have new driver requirements that will prevent them from functioning properly with the Vantage 4.0.1-1903121200 software. Driver updates will be included in an upcoming Vantage release to restore up-to-date MacOS compatibility. (issue 394)

## Receive A/D Sample Rate Initialization

The system's receive A/D sample rate is set by *VSX* during initialization, as defined by the *Receive* structures in the event sequence. The A/D sample rate clock signal is also used to control timing within hardware acquisition events, including synchronization to an external trigger input signal. In this and all earlier Vantage releases, the actual A/D sample rate being used by the hardware system is not initialized until the first *Receive* event in the event sequence is executed. Prior to that, the A/D sample rate will be indeterminate, typically remaining at the rate used by the last script that was executed. This means the execution time for that first *Receive* event will be longer than usual to complete the sample rate initialization, and any timing activity prior to that event (such as responding to a trigger input signal) may also be different than in subsequent events while the script is running. If these timing anomalies are unacceptable for the intended use of a script, a simple workaround is to place a dummy *Receive* event at the start of the script prior to any actual acquisition events or timing-related sequence control commands. This workaround may be particularly important to "single-shot" scripts that only execute once and do not repeat. (issue 117)

## Receive Mode 2 (accumulate from a reference acquisition)

The receive mode 2 accumulate feature is intended to allow you to acquire and save in HW memory a "reference acquisition" that can subsequently be combined with real-time acquisition events. This feature is not functional in 4.0.1-1903121200; it will be restored (in a more user-friendly implementation!) in a future release. (issue 202)

## Triple Mode Example Script Does Not Function Properly

The "TripleModeSimultaneous" example script from earlier Vantage releases does not function properly in the current software release. It has been removed and will be restored in a future release after it has been updated for full compatibility with the current system SW. (issue 144)

## Intermittent Matlab Crash in Simulation

In verification testing of the 4.0.1-1903121200 release, intermittent Matlab crashes were identified when running a very large number of scripts in simulation mode with no HW system present. This condition is very difficult to reproduce and does not always affect the same script or even similar types of scripts but does appear to be directly tied to use of the transmit-receive simulation function. Another situation that can lead to a Matlab crash while running in simulation mode is use of a TX.Apod array of all zeros. When one of these simulation-mode crashes occurs, it usually can be cleared by quitting the Matlab application, restarting it, and then running the same script again. (issue 412)

**Note**

The remaining sections of this document represent the release notes from previous releases within the past year. They are provided here for your convenience. If needed, copies of Release Notes from older releases can be requested from Verasonics Technical Support ([support@verasonics.com](mailto:support@verasonics.com)).

## 5 Release Notes History, from Releases 3.4.0 through 3.4.4

Vantage 3.4.0 SW was released in November 2017, followed by incremental releases 3.4.1 (March 2018), 3.4.2 (June 2018), 3.4.3 (July 2018), and 3.4.4 ("Beta" for new Vantage 32 LE customers, July 2018).

### New Features in the 3.4.N Releases

#### (3.4.4) Vantage 32LE system configuration

The Vantage 32LE configuration provides 64 transmit channels and 32 receive channels but in all other aspects is identical to a Vantage 64 system (which has 64 transmit and receive channels).

#### (3.4.4) P4-2v Example Scripts for Vantage 32LE

New example scripts have been added for the P4-2v probe, for use with the UTA 260-Mux adapter and Vantage 32LE system configuration.

#### (3.4.3) HIFUPlex Pairings 1, 2, 3 and 6

New pairings with similar functionality to pairing 2 in 3.4.1, but with different therapy arrays. Refer to HIFUPlex product literature for descriptions of these pairings. Several minor enhancements to HIFUPlex features have also been made in 3.4.3 that apply to all four pairings, including improvements to functionality of HIFUPlex GUI, software estimation and limit on HIFU transmit output power, and an improved HIFUProbeTest utility. (issues 769, 767, 788)

#### (3.4.2) Vantage Risk Analysis and User Manual updates

These documents have been updated to cover additional mitigations Verasonics has incorporated in recent releases, such as "Hardware-level enforcement of TPC profile maximum voltage limits" as described in the Release Notes for the 3.3.0 release. The documentation updates provide more information on the use of these features to minimize potential hazards when the system is used with human or animal subjects. (issue 753)

#### (3.4.1) HIFUPlex Pairing 2

HIFUPlex is a new licensed software option available with the 3.4.1 software, providing a customized user interface for managing ultrasound-guided Focused Ultrasound applications, supporting several "pairings" of imaging and HIFU transducers from Sonic Concepts. Contact Verasonics or visit our web site for a high-level overview of the HIFUPlex features. You can also review HIFUPlex documentation included with the Vantage software, at: Examples\_Biomedical / Specialty\_Applications / HIFUPlex / Documentation. The 3.4.1 release includes support for HIFUPlex pairing 2. Pairings 1, 3, 4, 5, and 6 will be added in subsequent software releases. (issue 723)

#### (3.4.1) Enhanced versions of L22-14v and L22-14vLF probes

New versions of these two probes are now available from Verasonics and fully supported through the 3.4.1 and later software releases. The new versions add a DC element bias voltage to the probe elements through new circuitry in the probe connector and a power supply provided by the Vantage system, allowing transmit at higher voltages than the earlier models and thus improving overall imaging sensitivity. In all other respects the new DC bias versions of the probes, named "L22-14vX" and "L22-14vX-LF", are identical to their earlier counterparts. Contact Verasonics for additional information on the new probes. (issue 721)

#### (3.4.1) UTA 260-D Module Compatible with all Vantage Systems

The UTA 260-D (dual HDI-format 260 pin, 128 channel connectors) could only be used on Vantage 256 systems in previous software releases. Starting with 3.4.1 it can be used with the Vantage 64, 64 LE, and 128 systems but with reduced channel count available at each connector depending on the system configuration. Refer to section 10 of the Vantage User Manual for a description of the UTA 260-D functionality available with each system type. (issue 723)

### (3.4.1) Support for Parallel Connection of Transmit Channels

For some HIFU applications using a probe with a relatively small number of elements, higher transmit power levels can be achieved by combining the output of several Vantage transmit channels to drive each element. This can be done either through some form of combining network, or by connecting up to four channels directly in parallel, or through a mix of both approaches. A critical requirement when taking advantage of this capability is to ensure all the channels being combined are producing the exact same transmit waveform with the exact same delay- any mismatch from channel to channel can be instantly destructive to the system transmitters. New features have been added in the 3.4.1 Vantage software to make it easier to write scripts for a probe that will be combining channels for each element, and to guarantee that all of the paralleled channels are indeed executing the same waveform and delay. Contact Verasonics Technical Support ([support@verasonics.com](mailto:support@verasonics.com)) to request an application note on how to use the new parallel-channel feature. (issue 694)

### (3.4.0) New Probes and Example Scripts

The following new probes and example scripts illustrating their use are now available from Verasonics and supported through the 3.4.N Vantage software releases. Refer to the Verasonics website for more information on these probes and sample images created with them.

- L35-16vX Single Crystal Linear array, 28 MHz 128 elements with example scripts for interleaved RF data acquisition, Wide Beam spatial compounding B-mode imaging and Flash Doppler imaging (issue 674)
- L38-22v CMUT Linear array, 30 MHz 256 elements with an imaging example script illustrating interleaved acquisition for RF sampling at 125 MHz sample rate, Wide Beam spatial compounding (issue 422)
- GE M5Sc-D "1.5 D" Phased array, 2.8 MHz 3 rows of 80 elements with example scripts illustrating "expanding aperture" utilization of the 3 elements in the elevation dimension. (issue 678)
- GE 9L-D Linear array, 5.3 MHz 192 elements with example scripts illustrating flash imaging, and high image quality Wide Beam scripts for spatial compounding and harmonic imaging. (issue 636)

### (3.4.0) UTA 260-S Module Compatible with Vantage 64 Systems

As an alternative to the UTA260-MUX adapter (which uses HV Mux switches to allow the Vantage 64 system to access all elements of a 128 element probe), the UTA 260-S adapter module can now also be used with a Vantage 64 system. The 260-S provides direct connections from the 64 channels of the Vantage 64 system to element signals 1:64 at the probe connector, but there is no access to element signals 65:128. As a result, the UTA 260-S on a Vantage 64 system can only be used with SetUp scripts that do not access elements 65:128. For example, any script for a 128 element probe using the HDI format connector could be modified so it only used the first 64 elements of the probe aperture; the modified script could then be used on a Vantage 64 system with the UTA 260-S adapter module. (issue 685)

### (3.4.0) New Linux OS and Driver

The Vantage 3.4.N releases have migrated to Ubuntu Version 16.04 LTS, from the older 14.04 Version that was used in 3.3.0 and earlier Vantage releases. The Driver for communication with the Vantage hardware system under Linux has also been upgraded to a newer version, resolving some functionality problems that existed with the older driver. Because of these changes, you will have to install the new 16.04 version of Linux and the new driver as part of installing a 3.4.N release; unfortunately to go back to using 3.3.0 or earlier releases you will have to revert back to the older Linux OS and driver. See the "Vantage Software Installation Instructions" document for more details. (issues 600, 639, 643)

## Defects Corrected in the 3.4.N Releases

### (3.4.2) Potential Matlab Crash when using multiple A/D sample rates

If a user script Event sequence includes interleaved receive data acquisitions at differing A/D sample rates, in some cases a Matlab crash may occur if the sample rate transitions occur in a particular order. This bug has been found and corrected in the 3.4.2 software. (issue 800)

### (3.4.2) Matlab Crash with unused ReconInfo

If ReconInfo structures have been defined in a script but are not being used by any Recon, their presence may cause a Matlab crash if a control is changed while the script is running that will cause the Recon look-up-tables to be regenerated. This bug has been found and corrected in the 3.4.2 software. (issue 798)

### (3.4.2) UTA 160-DH/32 LEMO Performance Improvement

In the earlier version of this UTA module, a hardware design flaw resulted in spurious error conditions from the system when transmitting at higher voltages with some commercial probes. This has been corrected in a new version of the UTA module that is supported with the 3.4.2 software. If you have a UTA 160-DH/32 LEMO module and are experiencing this problem, contact Verasonics Technical Support ([support@verasonics.com](mailto:support@verasonics.com)) to request an upgrade of your module. (issue 792)

### (3.4.1) Errors in Vantage 64 C5-2v Example Scripts

In the 3.4.0 release, errors were mistakenly included in some of the C5-2v example scripts for use with the UTA 260-MUX adapter on Vantage 64 systems. These errors have been corrected in 3.4.1; all of the Vantage 64 example scripts are now functioning properly. (issue 717)

### (3.4.1) Bugs in TW types 'function' and 'sampled'

These two TW waveform types are intended for use only in simulation-mode scripts; they do not generate a transmit waveform definition that can be used with the Vantage hardware system. System software bugs were found in the 3.4.0 software release that prevented these types from functioning properly, even in a simulate-only user script. Those issues have now been resolved so the 'function' and 'sampled' types are fully functional with simulate-only user scripts. Refer to the Sequence Programming manual for more information on these two waveform types. (issue 751)

### (3.4.1) Restrictions on computeTXPD Functionality

The computeTXPD and showTXPD utilities can now be used with all TW.Waveform types. In earlier Vantage software releases, the computeTXPD function could only be used with the 'parametric' TW Waveform type. (issue 116)

### (3.4.0) Verasonics Verification Test problems with Linux OS

In 3.3 and earlier Vantage releases, low-level hardware tests of the PCIe switch devices within the system could not be used with the Linux OS due to limitations of the device driver. With the migration to new versions of Linux and the device driver, these tests are now included in Verasonics Verification Test when running with Linux. (issues 578, 643)

### (3.4.0) Enhancements to 1024 Element Matrix Array Example Scripts

The example scripts for use with the UTA 1024-MUX adapter (located in the folder "Examples\_Biomedical / Specialty\_Applications / UTA\_1024Mux / Vermon") have several minor enhancements and bug fixes, including the ability to run in simulation mode. These scripts illustrate the use of a 1024 element, 32 X 32 matrix array transducer with the UTA 1024-MUX adapter for 3D volume data acquisition. (issues 683, 684, 688)

## Known Issues in the 3.4.N Releases

### Windows 10 Compatibility

If the Vantage HW system is turned off or disconnected while a host computer using Windows 10 is still running, Windows may disable the interface to the HW system and thus on the next power cycle the Vantage Software will report a "hardware not found" error. You can usually recover from this situation by shutting down the system and then disconnect or turn off the hardware system. Then restart the host computer and run the Vantage software in simulation mode, and then shut down the computer once more and reconnect the hardware system. After restarting with the hardware system reconnected and turned on, full driver functionality should be restored. If this is not the case, Contact Verasonics Technical Support ([support@verasonics.com](mailto:support@verasonics.com)) for additional assistance. Note that you may also encounter this same problem with windows 10 when using "reprogramHardware" or "Version" to update FPGA code in the hardware system, since these utilities will automatically disable the PCI interface to the host computer as part of the FPGA update process.

Reminder: To minimize potential problems of this nature, always make sure AC power to the Vantage hardware system is connected and turned on before you start up the host computer. At shutdown, make sure you shut down the host computer first, and wait for it to complete the entire shutdown process to a full power-off state, before turning off or disconnecting the Vantage hardware system. (issue 417)

### User Acquisition Script Errors Undetected by Vantage Software

Several situations have been identified where if a user makes an error in their SetUp script, the Vantage system software in current releases may not detect the error and thus the script will attempt to run but may result in a system crash, or a system fault condition with very misleading error messages that do not identify the underlying cause of the problem. Example scripting errors that can trigger this situation include:

- An event sequence with no return to Matlab: this results in the software acquisition sequence running in an endless loop but with no errors reported. The only way to exit the script is to force-quit Matlab.
- Re-use of a transferToHost Sequence Control command in more than one event in the event sequence. This violates the requirements explained in the Sequence Programming manual, but it is an easy mistake to make when creating a SetUp script. The system will not detect or report this as an error condition, but attempting to run the script may lead to a system lockup or Matlab crash, or in some cases the script may appear to be functioning normally but is not actually processing the correct acquisition frame of receive data.
- Inappropriate placement of transferToHost commands within the event sequence, that violate the requirement that all acquisition and DMA transfer(s) of a given RF data frame must be completed before any acquisition or DMA of any other frame or buffer. A script that makes this mistake may not trigger an error from the system, but the script may not function properly or may crash with very confusing error messages reported.

In future releases we will add error checking and reporting in the Vantage software for these easily overlooked scripting errors. The workaround for now is to carefully examine your script for the mistakes described above. You can also run the EventAnalysisTool on your script; it will detect and report many common scripting errors such as incorrect indexing into the various Sequence structures. (issue 759)

#### Restart Matlab When Switching to a Different Vantage Software Version

In some situations (depending on the particular version of Operating System and Matlab you are using), the system can fail to select the correct library of low-level Hal software support functions when you switch from one Vantage software installation to another. The best way to avoid this is to quit Matlab and restart it and then navigate to the desired Vantage directory BEFORE you run activate. The malfunction can occur if you have run activate in a different directory, and then run it again after switching to the desired directory without restarting Matlab. Note that to conform to this guideline, if you are using a Matlab startup.m file to automatically select a default Vantage directory you should remove any activate call from the startup.m file to ensure activate will not be invoked until after you have selected a Vantage directory that is not the startup.m default. (issue 682)

#### Receive Data Interleave Processing Malfunction

This bug affects the Recon pre-processing function for combining interleaved RF data acquisitions to create a higher RF data sample rate. Very intermittently and on only a few channels at a time, the interleave processing has not actually been completed on all threads and thus the RF data near the end of the frame is still in the interleaved format. This effect is more likely to occur on more complex acquisition sequences with a large number of acquisitions per frame. (issue 638)

#### Wide Beam Doppler Example Script Bug

In the 3.4.0 and 3.4.1 releases we have found that the "Wide Beam Doppler" scripts will in some cases lead to a Matlab crash, especially when running with Matlab version 2014a. The underlying cause for this problem is under investigation and will be fixed as soon as possible in a future release. At present the best known workaround for this issue is to use a more recent version of Matlab than 2014a. (issue 712)

#### Deferred Features of the Verasonics Viewer

Some features have been deferred for the new Verasonics Viewer that is included in the 4.0.1-1903121200 release (see the New Features section of this document). These missing features will be added in future releases, including: image export in TIFF format, ability to draw graphic overlays on top of the image (such as a "region of interest" outline), and ability to do a mouse-click over the image and trigger a callback function with the image coordinates of the mouse cursor. For 3.4.0 and 3.4.1, scripts that require any of these deferred features should use the Matlab viewer. (issues 620, 634, 642)

#### Receive data corruption at maximum LNA gain on High Frequency System

When the RcvProfile LnaGain field is set to its maximum level of 24 dB on a Vantage High Frequency system, objectionable artifacts may be introduced in some receive channels if the LnaZinSel field is set to a value less than 4. To avoid this problem the 4.0.1-1903121200 software will detect this situation and increase the LnaZinSel value to 4 with a warning message to the user. (issue 622)

#### MacOS Compatibility Restrictions

MacOS releases beyond 10.10 Yosemite have new driver requirements that will prevent them from functioning properly with the Vantage 4.0.1-1903121200 software. Driver updates will be included in an upcoming Vantage release to restore up-to-date MacOS compatibility. (issue 394)

#### Receive A/D Sample Rate Initialization

The system's receive A/D sample rate is set by *V SX* during initialization, as defined by the *Receive* structures in the event sequence. The A/D sample rate clock signal is also used to control timing within hardware acquisition events, including synchronization to an external trigger input signal. In this and all earlier Vantage releases, the actual A/D sample rate being used by the hardware system is not initialized until the first *Receive* event in the event sequence is executed. Prior to that, the A/D sample rate will be indeterminate, typically remaining at the rate used by the last script that was executed. This means the execution time for that first *Receive* event will be longer than usual to complete the sample rate initialization, and any timing activity prior to that event (such as responding to a trigger input signal) may also be different than in subsequent events while the script is running. If these timing anomalies are unacceptable for the intended use of a script, a simple workaround is to place a dummy "Receive" event at the start of the script prior to any actual acquisition events or timing-related sequence control commands. This workaround may be particularly important to "single-shot" scripts that only execute once and do not repeat. (issue 117)

#### Receive Mode 2 (accumulate from a reference acquisition)

The receive mode 2 accumulate feature is intended to allow you to acquire and save in HW memory a "reference acquisition" that can subsequently be combined with real-time acquisition events. This feature is not functional in 4.0.1-1903121200; it will be restored (in a more user-friendly implementation!) in a future release. (issue 202)

#### Triple Mode Example Script Does Not Function Properly

The "TripleModeSimultaneous" example script from earlier Vantage releases does not function properly in the current software release. It has been removed and will be restored in a future release after it has been updated for full compatibility with the current system SW. (issue 144)

#### Intermittent Matlab Crash in Simulation

In verification testing of the 4.0.1-1903121200 release, intermittent Matlab crashes were identified when running a very large number of scripts in simulation mode with no HW system present. This condition is very difficult to reproduce and does not always affect the same script or even similar types of scripts but does appear to be directly tied to use of the transmit-receive simulation function. Another situation that can lead to a Matlab crash while running in simulation mode is use of a TX.Apod array of all zeros. When one of these simulation-mode crashes occurs, it usually can be cleared by quitting the Matlab application, restarting it, and then running the same script again. (issues 338, 412)



## 6 Release Notes History, from Release 3.3.0

Vantage 3.3.0 SW was released in October 2017.

### New Features in the 3.3.0 Release

#### Verasonics Viewer for Image Display

The 4.0.1-1903121200 release features a Java based display window alternative for the Matlab display window. This addition was prompted by deficiencies in the Matlab display window for recent Matlab releases, which include an update limit of 20 frames per second and a noticeable lag between the time of update and the appearance of the image on the display. The Verasonics viewer resolves these issues with a visible frame rate limit of 60 frames per second and a minimal delay in rendering the image to the display. The default display window is still the Matlab window, but the Verasonics display window can be specified by setting the `Resource.DisplayWindow.Type` attribute to Verasonics. Setting it to 'Matlab' will select the original Matlab display window as used in all previous Vantage releases; the 3.3.0 release preserves full functionality of the Matlab display window. All other `Resource.DisplayWindow` attributes are interpreted similarly for both the Matlab and Verasonics Displays.

The performance benefit of the Verasonics display window is most noticeable for scripts that generate fairly high frame rates where the faster rendering and lack of display lag generate a much higher and smoother display update. For example, the L11-5vFlash example script, when run in simulate mode can generate frame rates over 200 fps, but the Matlab display window will throw away most of those frames and only update at around 20 fps. The Verasonics display window will also skip some frames by updating the display at 60 fps, but most computer displays only refresh at 60 fps, making it pointless to try and render all the frames at 200 fps. However, the 60 fps update will look much smoother to the eye than the 20 fps of the Matlab display window. The faster rendering will also result in a simulation frame rate increase, even with more frames being rendered and sent to the display.

The Verasonics display window currently supports the basic features of the Matlab display window including color bar display, intensity level cursor measurements and saving of single frames and movies. Some Doppler example scripts still require the Matlab display window for custom features such as graphic overlays, but most other example scripts have been modified to specify the Verasonics display window. Additional features will be added to the Verasonics display window in future releases, including features more relevant to ultrasound imaging such as spatial measurements. Eventually the Verasonics viewer will become the default image viewer for all example scripts. (issue 243)

#### Example Script Folder Restructuring

The example scripts provided with the Vantage software have been reorganized to make it easier for you to navigate through the multiple levels of sub-directories and find what you want. At the top level, the "Example Scripts" folder has been replaced by two new folders, "Examples\_Biomedical" and "Examples\_NDE\_NDT". Within "Examples\_Biomedical" you will find a new folder "Specialty\_Applications" containing the examples and documentation that were formerly in a lower level "MISC" folder. There is another new folder "Examples\_Biomedical / ArchiveScripts" containing the example script directories for probes that are no longer actively supported by Verasonics (primarily the ATL/Philips HDI-format probes that are becoming increasingly difficult to obtain from used probe suppliers). Example scripts located in the "ArchiveScripts" folder will be functional with the associated Vantage software release, but will not be optimized to take full advantage of performance enhancements that may be provided through that release. The example scripts themselves have not been modified as part of the folder restructuring—they have just been moved to new or renamed folders as summarized above. The "Example Script Matrix and Descriptions" document has also been updated to reflect these changes. (issue 354)

#### DC Bias for Probe Elements

A DC power supply that can be used as a bias voltage source for transducer elements is now provided by the system, through the UTA-260 adapter modules using the HDI-format connector (and also through the pre-UTA systems using the captive SHI module). In the 3.3 release this is done through the HVMux HV power supplies, and thus the element bias feature can only be used on probes that do not have HVMux chips. To enable this feature, a new field has been added to the Trans structure, "Trans.elBias". If this field does not exist or is set to zero, the element bias feature will be disabled. To enable it, set `Trans.elBias` to the desired bias voltage in Volts. The allowed voltage range is 10 to 100 Volts, either positive or negative. The probe must provide coupling of the bias voltage supply to the transducer elements and DC blocking of the bias voltage from the element signals presented to the system; the system only provides a source for the bias voltage at the probe connector. In future Vantage releases the element bias feature will be extended to other probe connector types, and a dedicated element bias power supply will be added to allow use independent of the probe HVMux power supply. (issue 598).



### Multi-System Synchronization with high speed data transfer

Earlier Vantage software releases included examples and documentation on the synchronization of multiple Vantage systems, to allow phase-accurate acquisition from very high element-count transducers. This capability has now been expanded to include high speed data transfer of RF data from the multiple host controllers associated with each Vantage system to a single computer for RF data processing and imaging. The data transfer requires installation of the Matlab Instrument Control Toolbox and high speed ethernet network adapters in the host computers. Refer to section 8 of the application note "PA\_Synch\_Multiple\_Vantage\_Systems" which can be found in the Vantage 4.0.1-1903121200 software installation at "Examples\_Biomedical / Specialty\_Applications / MultiSystemClockSynchronization / MultiSystemSyncModule". (issue 593)

### Arbwave Encoder Enhancement to the ArbWave Toolbox

A new encoder has been added to the Arbwave Toolbox that offers an 8 dB improvement in encoding accuracy compared to the encoding techniques used in the existing Arbwave GUI. The new encoder is provided as an independent stand-alone command line utility, not currently accessible through the Arbwave GUI. To use this new encoder, you must install the Matlab Communications System Toolbox. For more information on the new encoder and how to use it, refer to the folder "Tools / ArbWaveToolbox / Documentation ". (issue 564)

### System Support and Example Scripts for the GE 9LD Probe

The GE 9LD probe is now fully supported by the Vantage system, and a folder of example scripts is included in the 3.3.0 release (issue 636)

### New Example Scripts for the L11-5v probe

The L11-5v was introduced in the 3.2.2 with a basic set of example scripts. New scripts have been added for use of the L11-5v on Vantage 64 and Vantage 64 LE systems. In addition, many of the Specialty Application scripts that were originally written for the L7-4 or L11-4v have now been modified for use with the L11-5v. (issues 586, 587)

### UTA 1024-MUX Adapter Module and Example Scripts

A new "UTA 1024-MUX" adapter module is now available for use with Vantage-256 UTA systems, providing built-in 4:1 HVmux switching to allow use of the system with a 1024 element transducer. Example scripts are also provided for a 1024 element, 32 X 32 Matrix Array transducer (available from Vermon) demonstrating RF data acquisition and processing for a 2D array probe through the UTA 1024-MUX adapter. The scripts and an Application Note can be found in the 3.3.0 release at "Examples\_Biomedical / Specialty\_Applications / UTA\_1024Mux". (issue 296).

### User Script Initialization of Transmit Voltage

Starting with the 3.3.0 release, if you specify a value for the existing field "TPC(n).hv" for TPC profile n in your SetUp script, the system will automatically start up with that transmit voltage setting for that profile when the script is executed through VSX. If TPC(n).hv is not specified, the system will assign a default value of 1.6 Volts and thus the original system behavior of starting up at that minimum voltage setting will be preserved. If the initial voltage setting from TPC(n).hv exceeds the maximum allowed voltage as set by TPC(n).maxHighVoltage and TPC(n).highVoltageLimit, an error will be reported preventing the script from running. This new approach is much simpler than the scheme that was used in earlier releases to initialize the transmit voltage through "UI.Statement" commands, but the UI.Statement capability has been preserved for full backward compatibility with existing scripts using that feature. (issue 613)

### Improved Response Time for Freeze Control

Response time to the "Freeze" control in the VSX GUI window has been improved by eliminating the earlier practice of copying all data buffers out to the Matlab workspace every time the system goes into freeze. For scripts acquiring and processing either very large frames or a large number of frames, the added latency for the freeze command was excessive. The only side effect of this change is that if you want to do something with the data buffers in the Matlab workspace while the system is in freeze, you must first issue the "copyBuffers" command to runAcq. The "saveRF" examples included in the release are an example of this situation, and can be referred to as an example use of the copyBuffers command. (issue 644).

### Hardware-level enforcement of TPC profile maximum voltage limits

In previous Vantage software releases, the user can specify an independent maximum transmit voltage limit for each TPC Profile being used in a script through the field TPC(n).maxHighVoltage. The 3.3.0 SW adds a new level of enforcement to this existing limit, by programming the limit value into a register in the TPC module firmware. While a script is running, the TPC will trigger a hardware fault condition and immediately stop event sequence execution if it receives a command to set the transmit voltage above the pre-programmed limit for the associated profile. The intent of this new feature is to provide another layer of protection against user errors or software bugs in the utilities and controls used to set transmit voltage. This second

level of protection is intended to enhance the risk mitigation of potential hazards for a Vantage system being used on human subjects, in the context of an IRB or other regulatory/ safety review. Beyond the new mechanism for triggering a fault condition and system stop, this change has no effect on existing system functionality. (issue 497).

#### Settling Time parameter added to probe HVMux programming

A new parameter has been added to the Trans.HVMux structure used for programming the Vantage system to control HVMux element switching within a probe. After the programming of the HVMux chips has been completed and they have been toggled to their new settings, some settling time (typically a few microseconds) is required for the HVMux analog switches to actually transition to their new state. It is important that the transition be complete prior to attempting any transmit activity, but it is equally important to not burden transmit-receive events with additional overhead time between events that is not actually needed. The new field allows user control of the HVMux settling time, to match the actual requirements of a specific probe design using HVMux devices. The new field is named "Trans.HVMux.settlingTime", and should be set to the required analog settling time for the HVMux devices in microseconds, over a range of 0 to 15 usec. For backward compatibility, VSX will create this new field and assign a default value of 4 usec if it is not specified in a Trans structure using HVMux switching. (issue 398).

## Defects Corrected in the 3.3.0 Release

#### Image Display Performance with Matlab releases beyond 2014a

For all Matlab releases since 2014a we have found both a reduction in the achievable image display update rate and a severe increase in latency for the Matlab image display functions as used in all earlier Vantage software releases. This issue has been addressed in 4.0.1-1903121200 through the new Verasonics image display viewer, described in the new features section of this document. For applications where display frame rate and latency are important, we recommend use of the new Verasonics viewer. The 4.0.1-1903121200 software is still fully compatible with the Matlab viewer, for users who want to take advantage of other features it provides and are not concerned with frame rate or latency. With the availability of the new Verasonics viewer, we no longer recommend use of Matlab 2014a; users are encouraged to update to more recent Matlab releases. (issue 214).

"triggerOut" command with condition "syncADC\_CLK" did not work

Vantage software releases since 3.1.0 have allowed three different levels of synchronization of the output trigger pulse generated by the "triggerOut" Sequence Control command, as specified by the condition field. In the 3.1 and 3.2 releases, the "syncADC\_CLK" condition did not work properly; this has been corrected in 3.3.0. (issue 608)

#### Matlab Crash with complex HVMux probe scripts

A bug has been identified in Vantage software releases 3.1.0 through 3.2.2 that can cause unpredictable Matlab crashes when running scripts for probes using HVMux element switching. Crashes were more likely to occur on more complex scripts using a very large number of unique acquisition events. This bug has been found and fixed in the 3.3.0 Vantage software release.

## Known Issues in the 3.3.0 Release

#### Deferred Features of the Verasonics Viewer

Some features have been deferred for the new Verasonics Viewer that is included in the 4.0.1-1903121200 release (see the New Features section of this document). These missing features will be added in future releases, including: image export in TIFF format, ability to draw graphic overlays on top of the image (such as a "region of interest" outline), and ability to do a mouse-click over the image and trigger a callback function with the image coordinates of the mouse cursor. For 3.3.0, scripts that require any of these deferred features should use the Matlab viewer.

#### Receive data corruption at maximum LNA gain on High Frequency System

When the RcvProfile LnaGain field is set to its maximum level of 24 dB on a Vantage High Frequency system, objectionable artifacts may be introduced in some receive channels if the LnaZinSel field is set to a value less than 4. To avoid this problem the 4.0.1-1903121200 software will detect this situation and increase the LnaXinSel value to 4 with a warning message to the user. (issue 622)

#### MacOS Compatibility Restrictions

MacOS releases beyond 10.10 Yosemite have new driver requirements that will prevent them from functioning properly with the Vantage 4.0.1-1903121200 software. Driver updates will be included in an upcoming Vantage release to restore up-to-date MacOS compatibility.

#### Receive A/D Sample Rate Initialization

The system's receive A/D sample rate is set by *VSY* during initialization, as defined by the *Receive* structures in the event sequence. The A/D sample rate clock signal is also used to control timing within hardware acquisition events, including synchronization to an external trigger input signal. In this and all earlier Vantage releases, the actual A/D sample rate being used by the hardware system is not initialized until the first *Receive* event in the event sequence is executed. Prior to that, the A/D sample rate will be indeterminate, typically remaining at the rate used by the last script that was executed. This means the execution time for that first *Receive* event will be longer than usual to complete the sample rate initialization, and any timing activity prior to that event (such as responding to a trigger input signal) may also be different than in subsequent events while the script is running. If these timing anomalies are unacceptable for the intended use of a script, a simple workaround is to place a dummy *Receive* event at the start of the script prior to any actual acquisition events or timing-related sequence control commands. This workaround may be particularly important to "single-shot" scripts that only execute once and do not repeat. (issue 117)

#### Restrictions on computeTXPD Functionality

In this and all earlier Vantage software releases, the *computeTXPD* function can only be used with the parametric TW Waveform type. (issue 116)

#### Receive Mode 2 (accumulate from a reference acquisition)

The receive mode 2 accumulate feature is intended to allow you to acquire and save in HW memory a "reference acquisition" that can subsequently be combined with real-time acquisition events. This feature is not functional in 4.0.1-1903121200; it will be restored (in a more user-friendly implementation!) in a future release. (issue 202)

#### Triple Mode Example Script Does Not Function Properly

The "TripleModeSimultaneous" example script from earlier Vantage releases does not function properly in the current software release. It has been removed and will be restored in a future release after it has been updated for full compatibility with the current system SW. (issue 144)

#### Windows 10 Compatibility

If the Vantage HW system is turned off or disconnected while a host computer using Windows 10 is still running, Windows may disable the interface to the HW system and thus on the next power cycle the Vantage Software will report a "hardware not found" error. Contact Verasonics Technical Support ([support@verasonics.com](mailto:support@verasonics.com)) for assistance, if you encounter this issue. (issue 417)

#### Intermittent Matlab Crash in Simulation

In verification testing of the 4.0.1-1903121200 release, intermittent Matlab crashes were identified when running a very large number of scripts in simulation mode with no HW system present. This condition is very difficult to reproduce and does not always affect the same script or even similar types of scripts but does appear to be directly tied to use of the transmit-receive simulation function. When this crash occurs, it usually can be cleared by quitting the Matlab application, restarting it, and then running the same script again. (issue 412)