IN Cell Analyzer

Acquisition Software, Version 7.3

Release Notes

Introduction

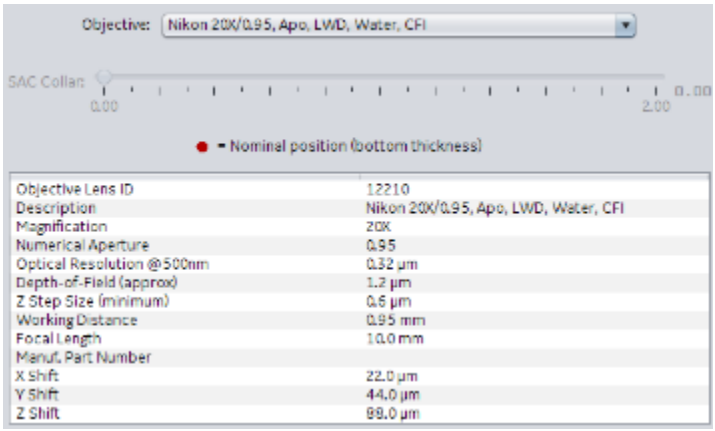
Version 7.3 of the INCell Analyzer software provides new features and bug fixes for instrument models 2500, 6500, 2200, and 6000.

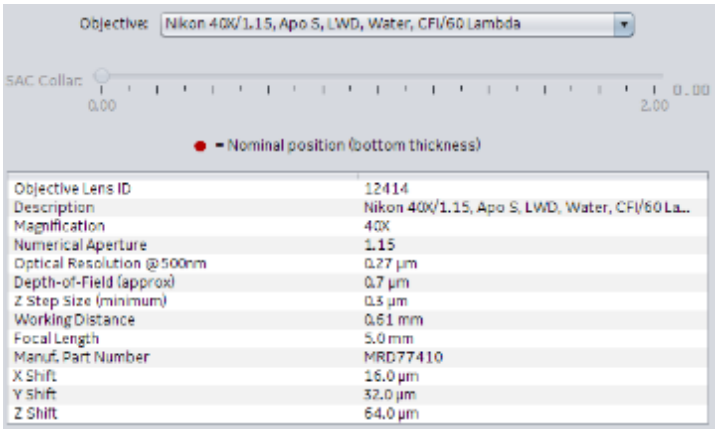
The release notes below describe the primary changes between versions 7.2 and 7.3. Many of the changes involve adding support for water immersion objective lenses. Additional information can be found in the release notes from previous versions of software, which are included within the installation packages and located in "C:\Program Files\GE Healthcare\IN Cell Analyzer XX00\manual".

New Features

Immersion Optics Support (2394)

Immersion optics can now be used within the INCell. A technical description of the supported lenses (2) is contained within the screenshots below.

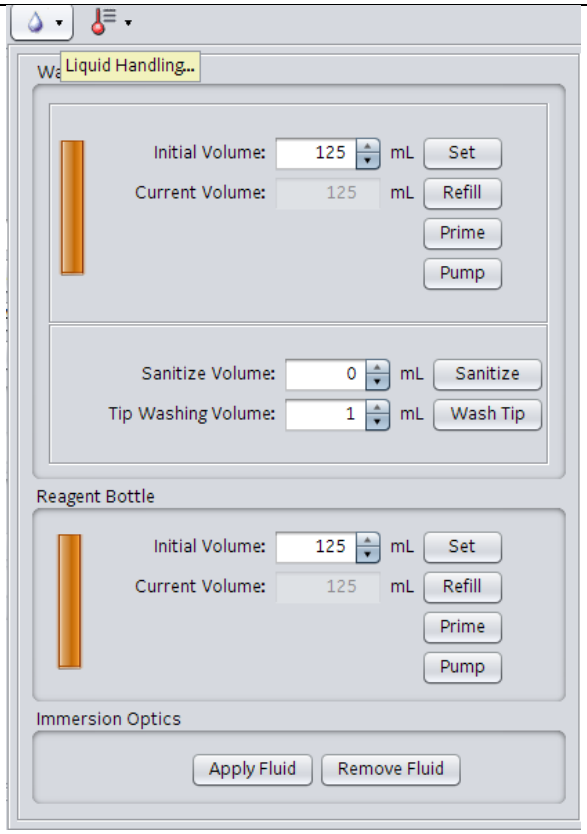




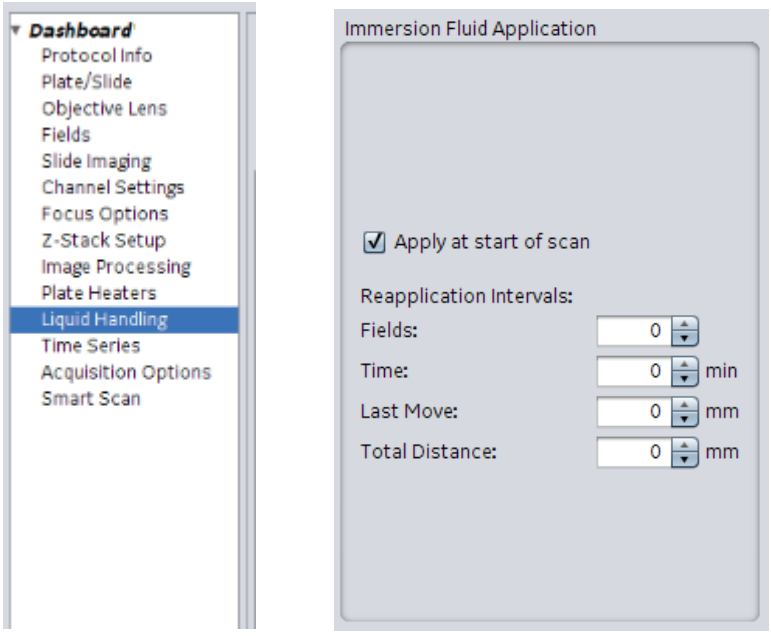
20X/0.95 Water Immersion Objective Lenses 40X/1.15

INCell's immersion optics system is based on the liquid handling (LH) sub-system, an optional feature of the INCell product line. Immersion fluid is applied to and removed from the tip of the objective lens using the LH needle, which can be located directly above the objective lens. Among the benefits of this approach is that the objective lens is not encumbered with extra tubing or water delivery mechanisms. The full working-distance is available for scanning plates. INCell's water immersion lenses can reach more wells than a lens that has complicated additions to tip. Another benefit of using the LH needle is that the possibility of leaks and complications near the scanning mechanism are reduced. The LH needle is only present during application and removal of fluid, and the fluid quantities are small.

The software provides two basic methods of controlling the immersion fluid: 1) interactive control using the liquid handling dialog, and 2) automated control during scanning using settings in the acquisition protocol. Screenshots of the controls are shown below. Look for tooltips that explain the buttons and provide important details.



Interactive Controls for Immersion Fluid



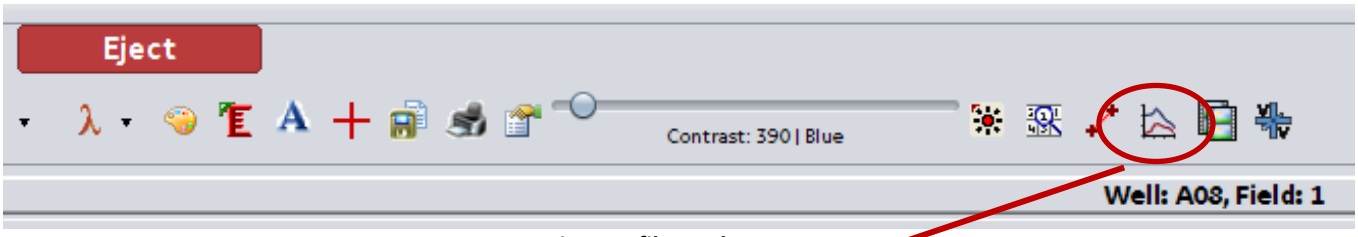
Acquisition Protocol Settings for Applying Immersion Fluid During Scanning

In addition to a software upgrade (i.e. V7.3) and new objective lenses, immersion optics require an updated LH sub-system and a modified plate carrier. Because liquid handling is an important element of the INCell immersion optics, many related improvements have been made to the LH sub-system. For example, the low-level firmware involved with controlling the LHZ and LHY axes is now more accurate, smoother, and more reliable (as described in 2452). Similarly, the installation procedures and LH coordinate system have also been improved. Note that the motion control electronics must be updated to firmware version 6.0031 in order to use liquid handling and immersion optics with V7.3.

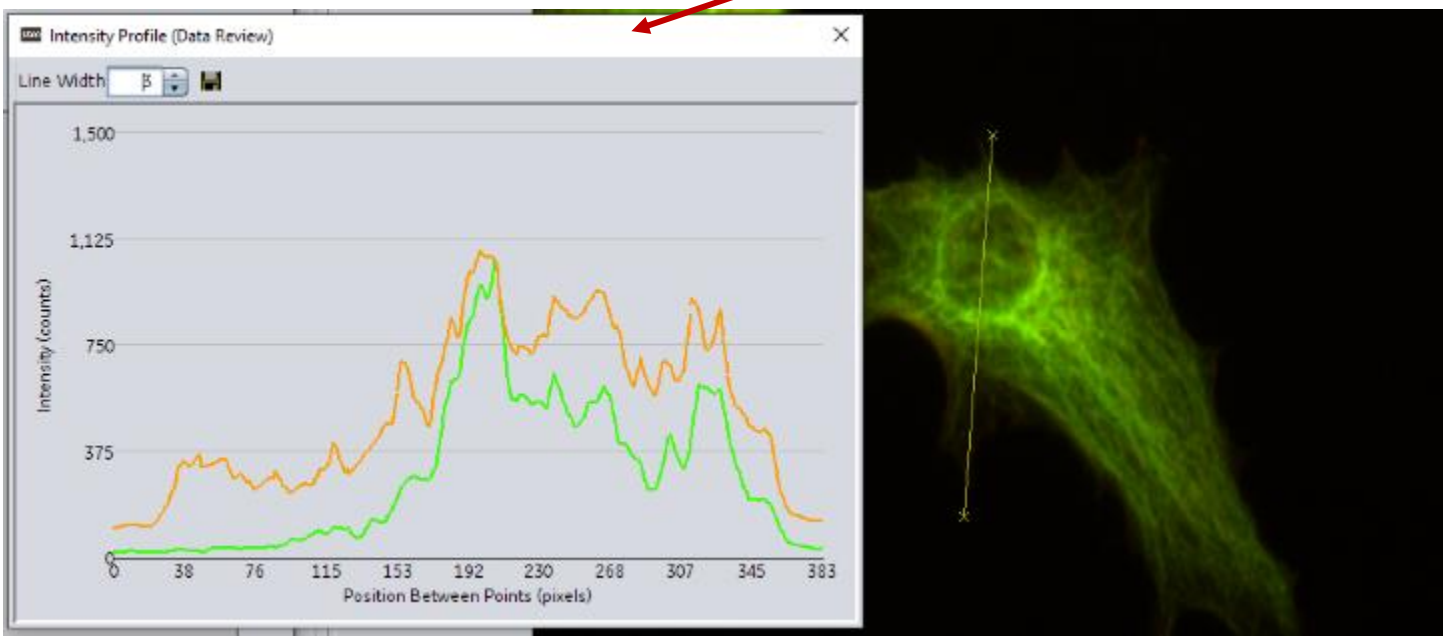
Contact GE sales for details about the immersion option for INCell.

Line Profile Tool (1599)

A line profile graphing tool has been added to both the *Setup* and the *Review* pages. Launch the tool with the button shown below. Select two points in the image to generate a new graph. The tool will remember all selected points until between the time of launch and the time of close. Press the disk icon to save the profile(s) to a CSV file. Line profiles created within *Setup* mode are limited to a single channel/wavelength. For multi-channel line profiles, acquire data with a scan and then generate line profiles within the *Review*.



Line Profile Tool Button



Line Profile Graphing Tool with Optional CSV File Output

Focus Improvements

Adjustable Threshold for Bottom Surface Detection (2615)

The laser autofocus procedure that finds the bottom surface relies on the presence of a large peak height at the air to glass/plastic interface. For almost all situations, the first surface peak is larger than 400 counts, even when the laser power is set below 10%. In the event that first peak is lower than 400 counts, use the LAF Trace tool to determine an appropriate setting and then modify the setting shown below. The INCell GUI software will need to be restarted before the setting will take effect.

```
<!-- peak height threshold used for finding the first surface in the LAF trace -->
<laser_autofocus_peak_height_min>400</laser_autofocus_peak_height_min>
```

Many different conditions will affect the peak height at the first/bottom surface. For example, the laser power, LAF pinhole optics, objective lens type, and optical aberration. Smaller peaks are to be expected when using water immersion between the tip of the objective lens and the plate bottom. The threshold may require adjustment at certain sites.

Configuration Setting to Adjust First/Second Surface LAF (2567)

A configuration setting has been added to help control whether the software uses the 1st or 2nd LAF peak.

To decide which peak to select, the software compares the following ratio

ratio = (optical bottom thickness) / (depth-of-field)

to the configuration setting shown below.

```
<laser_autofocus_peak_selection_ratio>34.0</laser_autofocus_peak_selection_ratio>
```

If the calculated ratio is above the threshold, then the software looks for the second peak. Conversely, if the calculated ratio is below the threshold, the software looks for the first peak. The default ratio threshold for V7.3 is 34.

Prior to V7.1, the decision logic was more complicated. In effect, though, the default ratio threshold was 15. Even though the threshold was somewhat configurable, the associated settings were difficult to use and contained significant flaws. For V7.1 and V7.2 the mechanism was reworked to the method described above. The threshold was initially set to 15, which was later determined to be too low for certain situations. Based on customer feedback, the threshold is now configurable and the optimum value has been increased to 34. The work done for 2567 was a follow-up to the changes for V7.1, item 2250.

3D Deconvolution Improvements

Upgraded Deconvolution Program (2156, 1609, 2551)

The program used to calculate 3D deconvolutions has been updated. INCell V7.3 now uses a version of the program that is based on the state-of-the-art version found in GE's *DeltaVision* microscope. The deconvolution algorithm uses a constrained, iterative approach to determining accurate, high-resolution images.

Improvements have been made in the following areas:

- better convergence to achieve lower residuals in fewer iterations
- faster single processor performance
- improved parallelization
- additional noise filtering to reduce artifacts
- tuned to work with the updated OTF files developed for V7.2
- dynamic memory allocation to enable large Z stacks. The XYZ image dimensions are not limited by the software.
- capable of handling long file names (> 256 characters, see 1609)
- various bug fixes

Note that digital saturation of 16-bit images is a common problem when deconvolving images. To systematically avoid this problem, the intensity scale of INCell's deconvolved results are always reduced by 0.25 X. Applying a consistent intensity reduction is especially important for INCell for the following reasons:

- the camera uses a 16-bit AD converter. The digitized intensity of the unprocessed images can potentially fill the entire dynamic range of the pixel data type prior to deconvolution.

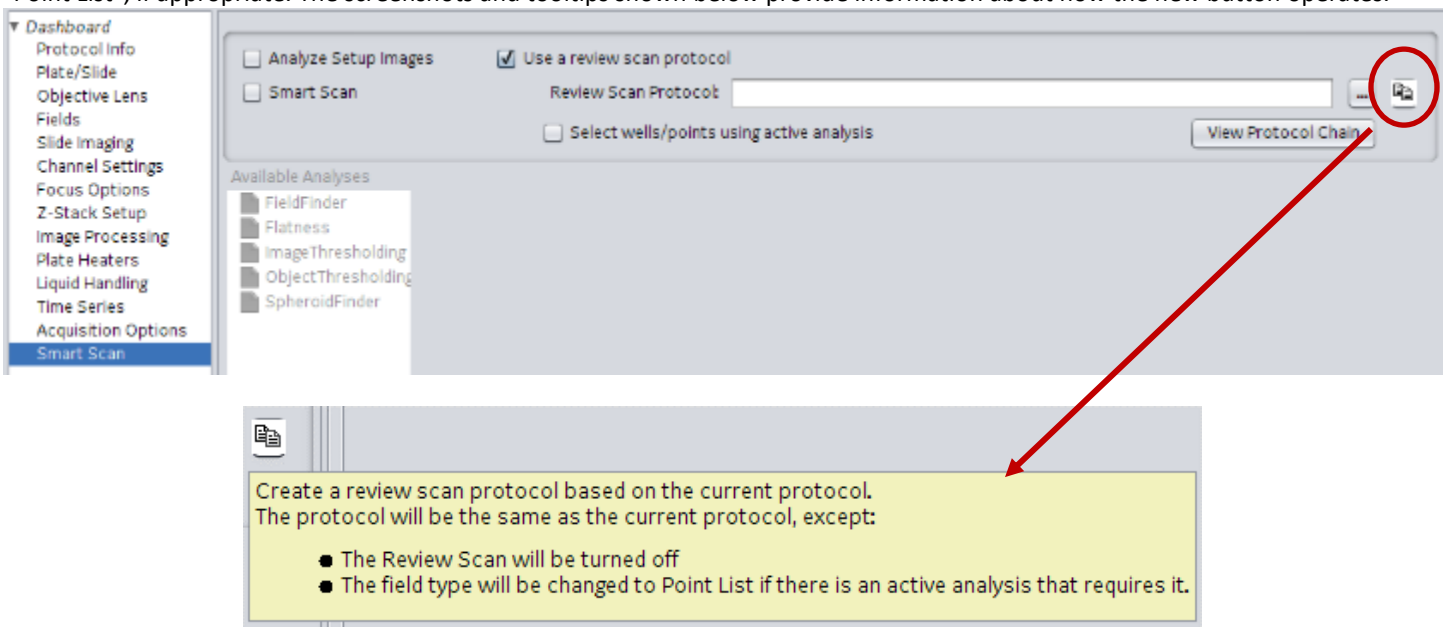
- optimizing the exposure conditions prior to automated scanning is rarely feasible. The fluorescence of images obtained during automated scanning is difficult to predict. High content screens often contain samples that have never been imaged before.
- dynamically adjusting the intensity scaling (the previous approach) makes it difficult to compare results from adjacent wells/fields. A single conversion factor between the original and deconvolved images is easier.

Basic Improvements

ReviewScan Setup Workflow. Minimize Reloading of 1st and 2nd Protocols (2535)

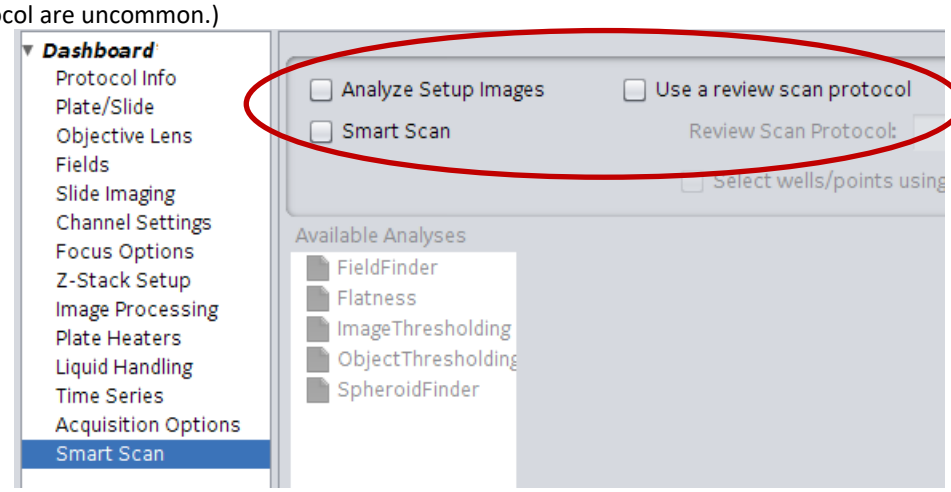
Preparing *ReviewScan* protocols can be tricky and time consuming. V7.3 contains two improvements that will reduce the amount of time required to set-up the protocols.

First, a button has been added to the *SmartScan* page that creates a copy of the current protocol. The copy will be mostly the same as the original, except for two important differences. First, *ReviewScan* will be turned off. Second, the field type will be changed to "Point List", if appropriate. The screenshots and tooltips shown below provide information about how the new button operates.

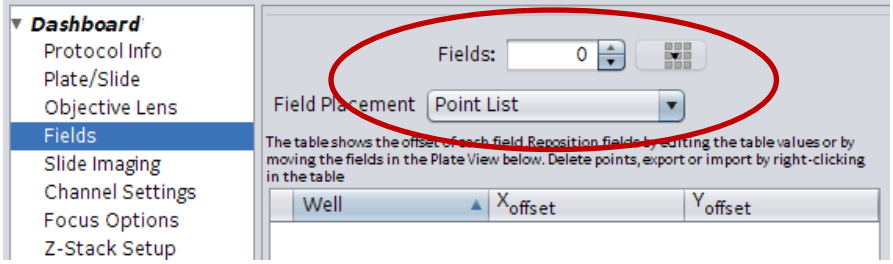


Details about the created protocol:

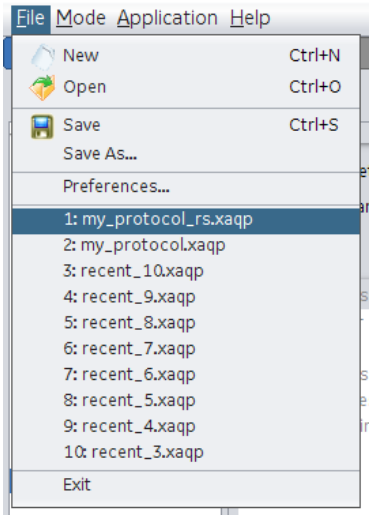
- the new name will be created from the original protocol's name with "_rs" appended
- *ReviewScan* settings will be disabled, because the new protocol follows the first protocol. (Sequences of more than one *ReviewScan* protocol are uncommon.)



- Field Setup will be set to an empty "Poin tList", in the case where the current protocol has an active analysis of a "wells-to-points" type. Otherwise, the field settings will be the same as those from the original protocol.



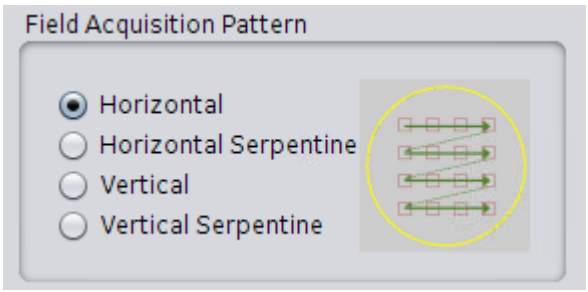
Once created according to the rules above, the new protocol will be automatically saved. The new protocol will also be added to the list of most recently used protocols for easy access.



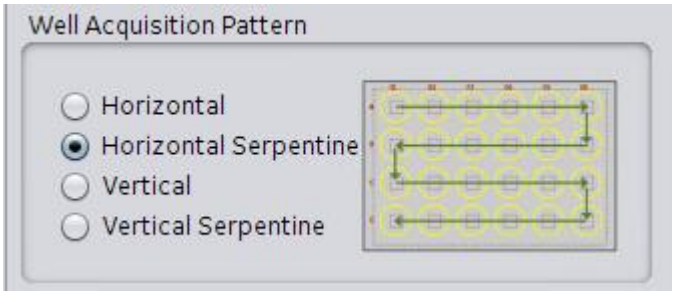
Recently Used Protocols with New *ReviewScan* Protocol

Field Acquisition Patterns Distinguishable from Well Acquisition Patterns (2581,2628)

Prior versions of software used the same graphics and terminology for both field and well acquisition patterns. The only way to distinguish the two was by context. To help identify the purpose of these control settings, the graphics and associated tooltips are now different, as shown below.



Fields



Acquisition Patterns **Wells**

Remote Control Improvements

The following changes relate to the INCell remote control interface. Refer to "*INCell_Remote_Control_Interface.pdf*" for details.

Monitor Remote Control Socket Buffer Contents (2549)
In the event that the remote control client does not actively receive communications from INCell, the TCPIP socket buffer can become full. Once the buffer is full, INCell will no longer be able to send messages to the remote control client and the automated run will be stopped soon thereafter. The operating system will block further progress until the buffer is cleared by the remote client. The information cannot simply be removed by INCell, because the buffer contents are owned by the operating system (i.e. Windows). The buffer can only be drained by the remote control client when it reads (or flushes) the contents. Reporting the buffer size to the log will help identify when this condition has occurred. Refer to the RC protocol document for additional details about this potential problem with the socket buffer.

Remote Control Mode Cannot Be Disabled if the Remote Client Fails (2565)
The paragraph below is intended for software developers and automation engineers. For everyone else, here's a brief explanation: if the remote control client stops listening to messages from INCell, then the operating system will eventually force INCell to freeze when it attempts to send another message.

In the event that the remote control client stops functioning, INCell will be blocked at the point where the socket write buffer fills up. See 2549 for more information about the buffer problem. When the condition described in 2549 occurs, then the INCell UI will stop when the operator presses "Disable" on the remote control dialog. Because there is no way to shut down the RC dialog, there is also no way to exit INCell without terminating the entire process. The root cause is that the socket write from INCell to the client is a synchronized, blocking method. That part of the code (an integral component of the Windows operating system) will be stopped from proceeding (by the operating system) if the buffer is full. When Socket.close() is called, INCell will hang because the close needs the lock held by the write.

StartScan Commands Should be Rejected if Not Waiting for StartScan (2582)
INCell should not accept the *StartScan* command unless the instrument is already in the appropriate state. The correct state number is 3, “Waiting for StartScan”. Prior to V7.3, INCell was not careful enough. Under certain conditions the *StartScan* command was accepted when it should not have been. A variety of failures, including a software stall, were possible. Starting with V7.3, INCell will only accept *StartScan* from the remote client when the instrument is in state 3, waiting for the *StartScan* command.

Clarifications to the PlateInserted Command (2643)
PlateInserted has always been a required message for advancing the state of the INCell while in remote control mode. This fact was not properly described in the protocol document. The essence of the change is provided in the updated version of the state machine diagram, as shown below. Additionally, a warning message will be recorded in the INCell log file if *PlateInserted* is used while INCell is in any other state. *PlateInserted* is only appropriate when INCell is presently in state 1.

V7.2 And Prior -> Diagram Clarification -> V7.3

Significant Fixes and Changes

Liquid Handling Motion Control (2452, 2694, 2681, 2646)
The firmware used to control the LHY and LHZ axes has been updated. The changes will improve the micro-positioning at the beginning and end of moves. For additional details, refer to the list of changes below.

Access Door Motion Control (2452)
Similar to the changes described above, the access door will move more smoothly. Fewer issues with the open and close positions are expected.

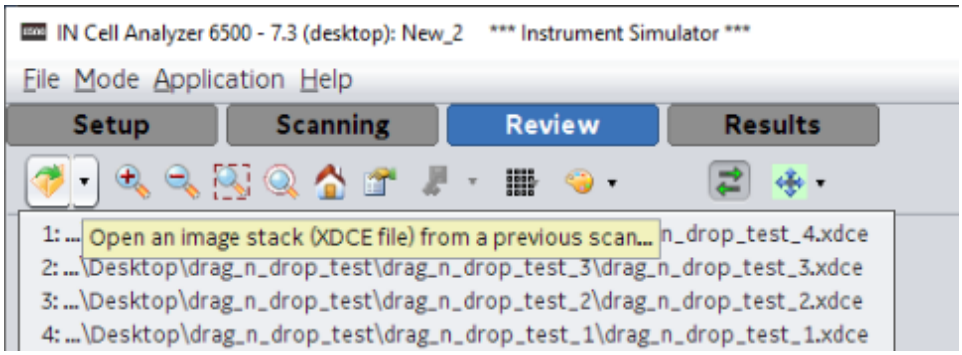
Long Exposure Times Can Cause a USB Read Error (2613)

Instrument communication errors were possible when using long exposure times (e.g. 4 seconds). The problem was caused by an unnecessary timeout within the USB sub-system. No actual failure occurred, other than the timeout. The problem is more serious with the 6500/2500, because the maximum allowed exposure time is 8 seconds. (The maximum allowed exposure time on the 6000/2200 is 3 seconds.)

Known Issues

Drag-and-Drop of XDCE Files into DataReview Doesn't Work with Window 10 (2688)

Drag-and-drop of XDCE files from the File Explorer to INCell *DataReview* window is somehow being disabled by Windows 10. To work around the problem, use the original method of opening XDCE files instead.



Original Method of Opening XDCE Files

Run Time Is Inaccurate when Using Water Immersion Lenses (2667)

The time run estimator does not account for the time required to apply immersion fluid during the scan. The actual scan time is longer than the time reported by INCell. Only water immersion lenses are affected by the problem.

List of Changes Between 7.2-16678 ("Patch 2") and 7.3-17026

Items listed in this table have been fixed in version 7.3, unless otherwise discussed in the comments.

ID	Brief Description	Comments
1599	Line profile tools in image display	Line profiles provide useful information about the pixels within the image.
1609	3D Deconvolution will fail when using files names longer than 256 characters.	Resolved by the changes described in 2156.
1927	Inadequate warnings when loading an acquisition protocol from a different instrument.	Similar to 2524.
2152	Handle the case where an acquisition protocol file requests and objective lens that is not available on the instrument.	INCell will now switch to the 10X or other available lens when loading an acquisition protocol that request an objective lens that is not available on the instrument. This can happen when transferring XAQP files between instruments. Previous versions of software did not respond well to undefined lenses. The problem did not affect the Simulator, because all lenses are supported by the Simulator. Similar to 1927 and 2524.
2156	Upgrade to the current version of the 3D Deconvolution program used in the *DeltaVision* product line.	Numerous enhancements have been made to the deconvolution program used for *DeltaVision* microscopes.
2160	Exposure time should not be adjustable during continuous acquisition.	Continuous acquisition should be stopped before the exposure time can be changed.
2271	Make *CaptureLog* work without a real instrument (i.e. with the Simulator)	Useful for debugging problems that can be recreated within the Simulator.
2278	Provide a warning if user attempts to quit INCell while temporary files are being copied to network storage	Failure to copy the files was a significant failure, in the case where users happened to exit the acquisition program while files were being copied.
2304	*DataReview* slows down with *AutoArrange* Montage	The *AutoArrange* code has been optimized.
2313	*CaptureLog* won't launch if scanner name is "ask"	*CaptureLog* will now work for R&D sites that use the scanner name “ask”. Most sites are not affected, because the standard scanner name is “scanner”.
2325	Review the code that checks "Annotation" strings.	Annotation strings entered by the operator were not always checked for invalid characters. A number of checks have been added. For example, the annotation field within the Run dialog.
2357	2D deconvolution optimization	Most of the improvement was realized by recompiling the existing, numerical calculations with the latest gcc compiler. No changes to the results are expected.
2363	Corrections and improvements needed for the RC protocol document.	Descriptions of the responses for the following commands have been updated: VersionNumber GetPlateHeaterStatus GetPlateStatus
2367	Look for Tecan log files when capturing INCell log files	Previous versions of the *CaptureLog* tool were able to find log files from Overlord (PAA) and Hudson remote control programs. V7.3 can also find log files from the Tecan Pegassus software. The expected location is: C:\ProgramData\Tecan\Pegasus\log*.log
2368	Point list viewing problem when adding locations to the list.	When adding locations to the point list, the columns within the table became misaligned. The point number did not match the coordinates. Prior to V7.3, the workaround was to scroll back and forth between the first point and the recently added point. Reported by David Pointu, October 2017
2398	Automatically acquire another image whenever a DIC or Phase parameter is changed.	Immediate acquisition provides rapid feedback about the adjustment.

2402	Offer to close the scanner's access door when closing the GUI	A dialog will now appear when the GUI is closed while the door is open.
2448	Image and thumbnail caching improvements.	Some of the memory caching mechanisms have been optimized for better performance with large data sets. The changes will also help with thumbnails.
2452	Holding current is incorrect on full step motors that use reduced current.	Affects the motors used for the liquid handling Z, and Y. Also affects the plate access door. Axis motion should be noticeably smoother and more accurate.
2479	Disallow mouse events within the *PlateView* area while in Scanning mode	Scanning and Setup modes originally shared the same *PlateView* controls. All the same mouse handlers for collecting and adjusting images were potentially active while in the Scanning part of the GUI. Especially during acquisition, mouse events should be inactive. V7.3 does not allow interactive control of the instrument while in the Scanning mode area of the GUI.
2490	Intensity contrast jumps when adjusting settings in plate view	The display contrast settings have been consolidated for better consistency. There are fewer places where the software might switch to a different set of min/max settings.
2503	GUI should return to Setup mode if a scan is cancelled with the "Stop" button.	Returning to Setup mode make more sense than remaining in the Scan mode. The operator often wants to change protocol settings, exchange plates, or interactively acquire images.
2510	Need wait cursors when processing thumbnails in *DataReview*	Wait cursors now appear when thumbnails are loading into the Thumbnail display and while *DataReview*. Applies to the situation where sync mode is enabled.
2511	Turn lid heater off if an electrical short is detected.	An electrical short will result in an impossible temperature reading. The SW will now shut off power if such a value is detected.
2519	Confocal aperture spinner - upper limit changes unexpectedly.	The upper limit is now properly controlled.
2532	Certain test scripts (e.g. rolloff.py) do not recognize the 2500 or 6500 scanners	The method used to determine the scanner name was unreliable. Scripts like rolloff.py and rolloff2.py have been simplified to look for the standard name “scanner”. Customer names for R&D and special sites can still be specified using the alternative source: scanner_name.txt.
2535	*SmartScan* setup workflow improvements needed. Minimize reloading of 1st and 2nd protocols.	See full description in the main section of the release notes.
2536	*CaptureLog* GUI contains a misspelled button "Add Addtional File"	A simple fix. Done.
2539	SAC slider in "Objective Lens" page does not refresh automatically.	The SAC slider will now update more reliably.
2540	Field positioning issue with certain XAQP files	When designing a protocol, if a user selects random or custom field spacing, the field placement needs to be modified if the device is changed. For example, if fields were originally positioned within a 6 well plate, then changing to a 96 well plate should cause appropriate adjustments to the field locations. A reasonable solution is to reposition the fields at the same relative place within the well. Prior to V7.3, the fields could have ended up outside the wells, which was not useful. There were actually two problems with the calculations: 1) the well ratio wasn't always being correctly calculated, and 2) an incorrect scaling factor (for the well size) was being used with the plate/slide type change that occurred while loading protocol.

2545	Log information about the remote control socket buffer size	Reporting the RC socket buffer size to the INCell log file will help diagnose cases where the remote client fails to read communications from INCell. 04/10/2018 08:25:44:565 RECO [Thread-20] com.api.applications.boxer.robotics.RoboticsClientSocket ? Remote control socket size: 8192
2547	Streamline IO during 3D deconvolution	Input/output between memory and disk can limit performance. V7.3 is more efficient. 3D deconvolution performance should be better than V7.2. A continuation of #2370.
2549	Add check for available space in the RC socket send buffer.	In the event that the remote control client does not read/drain the send buffer, automation runs could fail even though INCell is OK. The remote control client must continue to read information from INCell. Checking for available space in the send buffer will help diagnose situations where the remote control client has failed to read communication from INCell. Also see 2565.
2551	Always pre-scale 3DD image intensities to avoid inconsistent scaling in the final result.	Image intensities are typically elevated during deconvolution. IN Cell scanners contain 16-bit cameras that often create images that contain intensities up to the maximum possible value within a 16-bit data type (65535 counts). When combined with deconvolution, digital saturation is a common problem when attempting to save the final result. To avoid this problem, the deconvolution program will always scale the digital values by 0.25X while saving results to a file. Dynamic scaling is would create complications, because every result could be scaled differently. Images from adjacent fields/wells would be difficult to compare.
2554	Field position display problem after *PointList* scan	After you select points from the plate view and run the protocol and then go back to the setup tab, the selected field on the plate view has changed position (red box). The points list is still correct, but the corresponding red box is not which makes it hard to readjust fields if needed. Current workaround is to use the previewed image to reset the field of view in the list. Reported by Amy Jablonski, 18-Apr-2018
2560	On installation, "Automatically display review mode" check box is “Off”.	“On” is a better default for first time installation.
2562	Install problem while creating instrument controller drives during system integration.	The software installation procedure was checking the instrument type based on the serial number. The check did not work during early integration, prior to serial number assignment. Installation was prevented. The issue originated with V7.2 and did not affect previous versions. V7.3 will present a confirmation dialog, allowing the operator to continue or cancel.
2565	Can't Disable RC during a blocked write	If the remote control client stops functioning, INCell will block when the socket write buffer fills up. If you then try to Disable remote control on the remote control dialog the UI hangs. There is no way to shutdown the RC dialog so there's no way to exit INCell without terminating the entire process. The root cause is that the socket write is a synchronized method. The code is blocked in that method. When Socket.close() is called, INCell hangs because the close needs the lock held by the write. Also see 2549.

2566	Improve start up performance	The INCell GUI will now start more quickly.
2567	Enable the ability to use first surface for laser AF	New configuration setting. Restores certain capabilities that were dropped in V7.1.
2568	Mouse related events not working in plate view and field setup	The mouse did not always respond to click-and-drag types of activities within the plate view and within the field setup areas of the UI. The underlying issue was with the function that retrieved the mouse location.
2570	Batch AVI movie creation	Multiple AVI movies can now be created at the same time.
2571	Auto Color HDR of Brightfield should use Monochrome rather than Orange	Done.
2574	Connection problem during LH pump initialization when EC module is present	USB port identification can be a challenge. Ongoing maintenance is required to recognize devices that change signatures.
2579	RC Document error: "Method 2" vs. "Method 1"	The RC protocol document contained a simple error. The title “Method 2” was switched with “Method 1”.
2580	Clarify what RAM level is reported in the About page	The displayed amount of RAM corresponds to the Java VM used by INCell.
2581	Field Acquisition Pattern has misleading graphics.	Similar to 2628. The graphics are now appropriate.
2582	Remote control interface should not accept the *StartScan* unless in the correct state (Waiting for StartScan, 3)	INCell should not accept the *StartScan* command unless the instrument is in the correct state. The correct state is “Waiting for StartScan”. Prior to V7.3, INCell was not careful enough. A variety of failures, including a software stall, were possible.
2584	Prompt user to update firmware for LH	The latest firmware is needed for proper control of the liquid handling axes LHY and LYZ.
2586	Acquisition client freezes with Hudson robot	defect
2600	Improvements to the *AutoOffset* measurement procedure.	The Cancel button has been moved to the results dialog where the operator can choose to accept or cancel the measurement. Also, the AF offset values in the protocol settings part of the GUI are properly updated after the measurements. Also see 2614.
2602	Flatfield color map is always blue	The color of the FFC image display should now correspond to the wavelength of the FFC channel.
2603	Upgrade Java JVM from 1.8.92 to 1.8.162	Update the Java JVM to get the latest security updates and bug fixes.
2610	Add immersion fluid volume to GUI configuration files	The volume of fluid used for each objective lens is configurable. To adjust the volume, change the corresponding value (example shown below) in the GUI configuration file. immersion_vol="50"
2611	Laser Autofocus Tooltip not consistent with the actual behavior	The tooltip has been corrected, and details have been added.
2613	Long exposure times can cause a USB read error	Instrument communication errors can occur when using long exposure times (e.g. 4 seconds). The problem was caused by an unnecessary timeout. No actual failure occurred, other than the timeout. The problem is more serious with the 6500/2500, because the maximum allowed exposure time is 8 seconds. The maximum allowed exposure time on the 6000/2200 is 3 seconds.
2614	AF Offset measurements are not updated in the *DashBoard* channel settings.	Similar to 2600, but for the *DashBoard*.
2615	Adjustable threshold for the LAF first surface detection procedure.	The value is now adjustable. Look for the following value in the GUI configuration file. Valid settings are on a scale of 0-65535. “laser_autofocus_peak_height_min”

2616	Small optimization to LAF - turn on laser while moving to starting position	The laser should be slightly more ready for measurements. The improved power stabilization was not measured. In addition, the time required to turn on the laser is overlapped with movement of the Z axis.
2624	FFC measurement requirements checked for modelled but not measured maps	The logic was reversed. Measurement requirements were applied to the modelled calculations rather than the actual measurement. The fix was straightforward.
2628	Clarify whether the "Acquisition Pattern" UI applies to wells or fields.	The original UI was designed to represent wells. New graphics have been added to represent fields. Similar to 2581.
2631	"New" protocol button is silent if the protocol is already new.	A confirmation will now be displayed if the “New” button is pressed.
2636	Improved LHZ coordinate system	The improved coordinate system enables larger travel range and safer operation of the LH needle tip. The extra control is mainly needed for the water immersion option, however, other forms of LH experiments will also benefit. Instruments without the immersion option do not require coordinate modifications, however, the related firmware update is still recommended. Also see 2452.
2637	Update LH integration scripts	The scripts used for building and maintaining instruments with the LH sub-system have been improved. Some of the changes were needed for the water immersion option.
2642	Incorrect Text in Instrument Controller Software Update Required Message box	The instructions referred to “INCellICServerUpdater.exe”, but the correct name of the program is “INCellICServerInstaller.exe”
2643	Improve handling and documentation of RC command "PlateInserted".	The RC protocol document fails to describe how the "PlateInserted" command is needed for starting the load delay. The client must use "PlateInserted" in order to start the load delay and thereby prepare INCell for the ensuing "StartScan" message. At least two basic changes are needed: 1. the protocol document should clarify the need for PlateInserted 2. INCell should present a warning if PlateInserted is used improperly (INCell must be waiting for the next plate, otherwise PlateInserted doesn't make sense).
2646	Improved detection of LHZ obstructions	The low-level software is now better at detecting obstructions.
2651	LH dispense and aspirate procedures do not check for sufficient LHZ offsets	The LHZ offset is used to position the height of the LH needle tip relative to the plate carrier reference surface. The tip height must be sufficient to avoid collision with the bottom of the well. In order to work properly, the plate parameters (specifically the bottom height, bottom thickness, and plate height) must be accurate, because the LHZ offsets are determined from calculations.
2652	LH dispense procedure calculates the dispense height from the compound plate height rather than the sample plate height	The dispense height was calculated from the compound plate height rather than the sample plate height. If the compound and sample plate heights were different, then the dispense height would have been at the intended location.
2657	System test integration protocol uses the wrong polychroic mirror	The System Test protocols on the 2200 and 2500 use the wrong polychroic. For the 2200, the setting was correct until 7.0. For the 2500, however, the setting has always been incorrect. Both should be updated to use the 2nd polychroic, as indicated for the Red channel. The changes

		are helpful for GE manufacturing. No manufacturing defects were associated with this issue.
2669	Maximum LH dispense depth is always limited to 1mm above the bottom of the well.	The tolerance value for determining the maximum dispense depth should be adjustable. See #2387 from the V7.2 release notes for details.
2670	Reduce false reporting of modified protocols.	A continuation of previous efforts to reduce the number of situations where the protocol is falsely accused of having changed. The underlying problem involves insignificant changes in floating-point values that were being detected as changes.
2672	Liquid handling part of the XAQP file not created unless more than one LH operation is defined	Even though LH operations are necessary for a typical LH run, the <LiquidHandling> section of the XAQP file should still be created with whatever information is available. As of V7.3, the additional parameters are: 1. Compound plate name (if selected) 2. Reagent source: reagent bottle or compound plate Prior version of software quietly omitted these settings. The settings were then lost after saving and then reloading the protocol.
2681	LH dispense operation does not always wait long enough for the XY stage to stop moving.	In some situations, the LH needle could begin moving down into a well before the XY stage stopped moving laterally. LHZ did not always wait for XY. Collisions between the LH needle and the top of the plate were possible when dispensing into locations that were far apart.
2686	Recommended Z step size is not always updated with the objective lens is changed.	The Z step size remains at the previous lens' recommended step size. The actual step size is not changed either, although that is the desired behavior.
2687	Remove the warning overlay that appears when interactively acquiring snapshots while in 3D mode.	The warnings were confusing. Most users recognize that 3D settings will not take effect during interactive mode acquisition.
2694	LHY should move to a safe position after homing.	Always moving to a safe position after homing will help avoid collisions with the XY stage and other parts of the instrument.
2703	Plate view area no longer responds to mouse clicks after opening GE Service Mode	Fixed.
2732	User defined channels are removed from protocol	In some cases, channels are removed when loading an existing protocol due to inconsistencies when compared to the pre-defined channels. Changing the name of a channel or the list of allowed polychroics would cause this to happen. These consistency checks are not necessary and have been removed.

Notice to purchaser
IN Cell instruments are intended for research use only. The instruments are not for use in diagnostic procedures.

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