IN Cell Analyzer

Acquisition Software, Version 5.1

Release Notes

28 April 2015

Introduction

Version 5.1 of the IN Cell Analyzer software contains improvements, optimizations, and fixes over version 5.0.

Upgrading from version 5.0 to version 5.1 requires minimal training. The new features and interface changes should be intuitive for experienced users.

The following release notes describe the primary changes between release 5.0-13098 and 5.1-13722 of the IN Cell Analyzer software. Additional information can be found in the release notes from previous versions of software (e.g. 4.6 and 5.0).

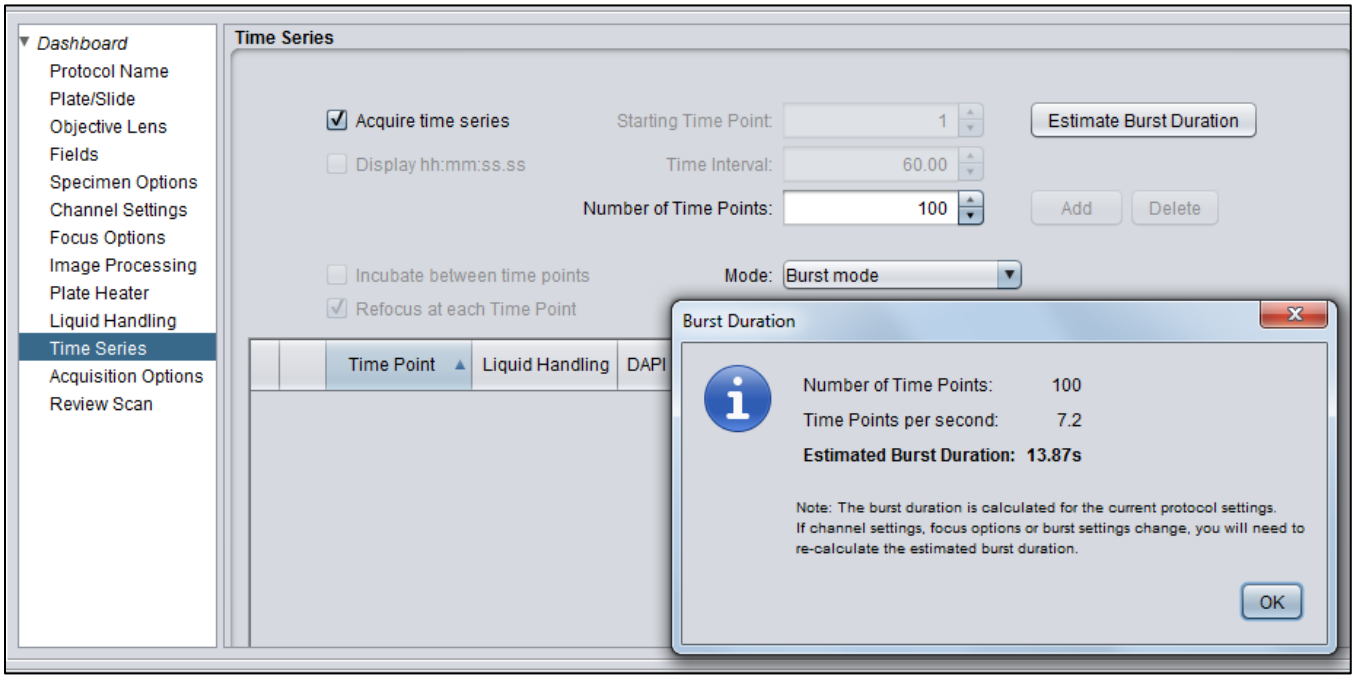
New Features

Optimized Acquisition for the 6000

The laser scan control software used within the 6000 has been optimized to increase frame rates, especially for small images sizes. A table of performance results is provided later this in document. To benefit from the improvements, both the instrument control software (ICS) and the IO Board firmware must be upgraded. The necessary software components are included within the 6000 installation package. Upgrading the firmware is straightforward. Refer to the section title "Instrument Compatibility Checked During Installation" for further information.

Burst Mode Time-Series Acquisition

"Burst Mode" is now an official, time-series acquisition method within IN Cell. Prior to V5.1, Burst Mode was only possible when using Z stacks with a Z step size of 0 um. The new Burst Mode will be listed as a time-series method, as shown in the following screenshot. Also shown is a dialog box that presents results from the button titled "Estimate Burst Duration".



The new Burst Mode acquisition has the following capabilities:

- tool for quickly measuring the actual frame rate (see "Estimate Burst Duration" in the screen shot)
- estimated burst duration for each field, based on the number of images and the approximate frame rate
- support for many acquisition protocol settings, such as channel changes and software autofocus. (The original burst mode could only be used to acquire a single channel.)

The original method of acquiring short bursts of images (by setting the Z step size equal to 0 um) is still supported, although the resulting image stacks are not fully compatible with *Investigator*. Use Burst Mode instead.

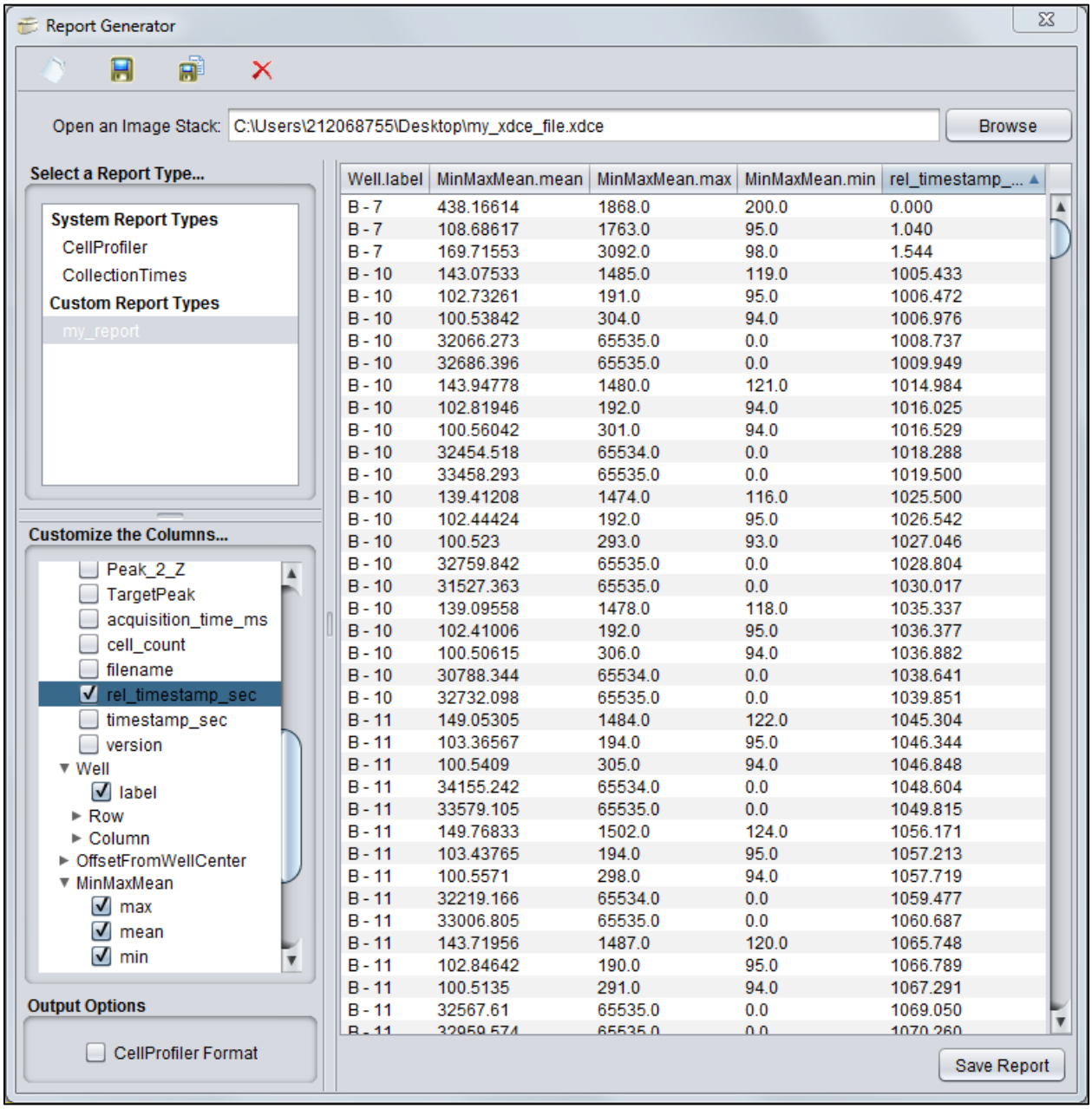
Report Generation

The Data Export tool has been fully incorporated into the acquisition process and a number of new features have been added. The name of this feature has been changed from "Data Export" to "Report Generator" on account of its expanded role within the

IN Cell acquisition workflow. Reports can now be generated in either of two ways: from existing XDCE files or automatically during acquisition. Standard report types are included with the software, and users can create custom report types.

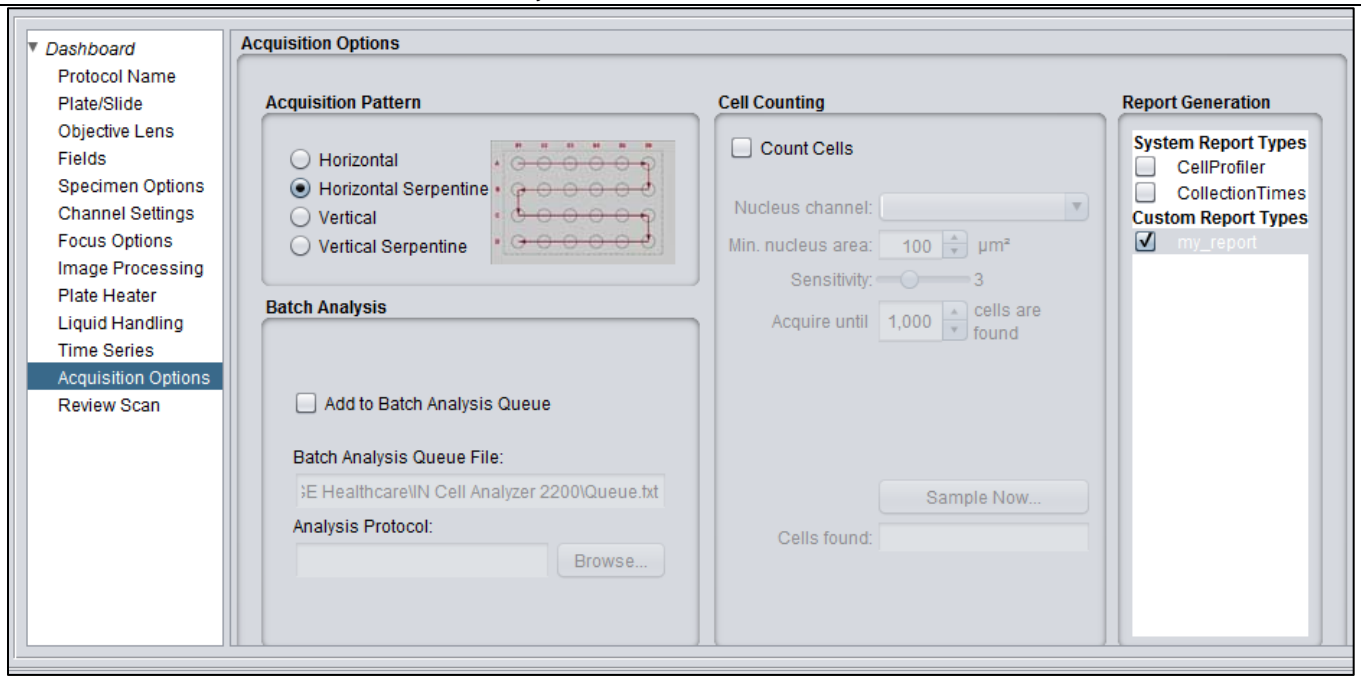
The report generator can be started in three different ways:

1. the Windows "Start Menu", under "GE Healthcare" | "IN Cell Analyzer XXXX" | "Report Generator"
2. "Show image properties" within Data Review
3. the IN Cell program's "Application" menu.



Report Generator for Saving Reports and Creating Report Types

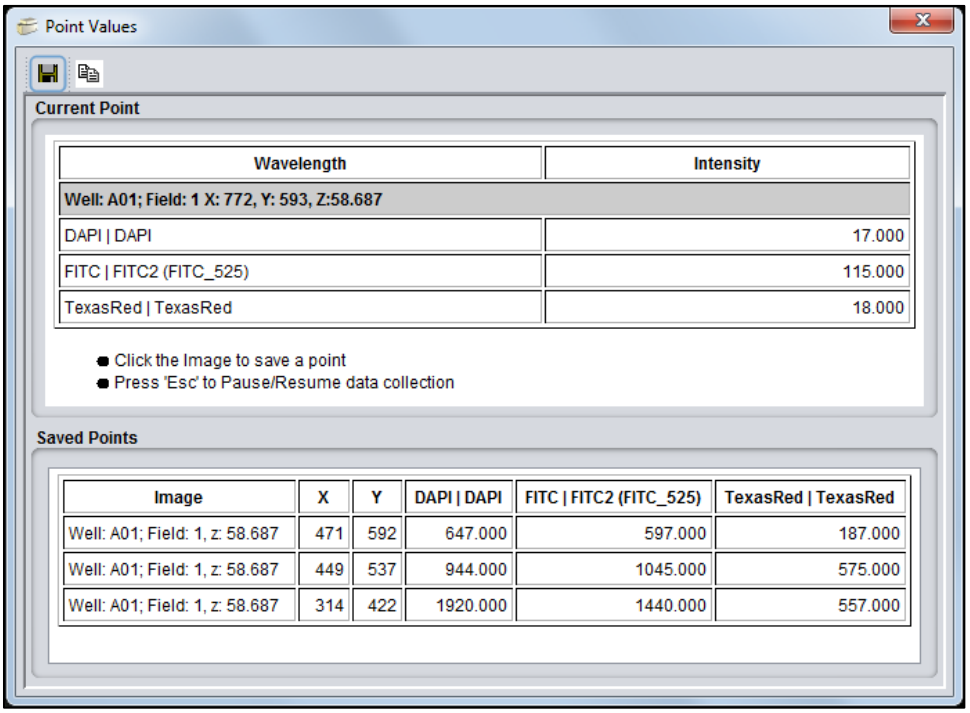
In addition, acquisition protocols can be configured to automatically save reports, by selecting from the list of available reports presented in the "Acquisition Options" page of the protocol designer. For example, the acquisition protocol represented in the following screenshot will generate a report with type "my_report" whenever a scan has finished.



Acquisition Option for Automatic Report Generation

Data Review Tools - Point Values and Distance Measurement

New capabilities have been added to some of the key tools within Data Review. The following screenshots provide examples of the Point Values and Distance measurement tools.



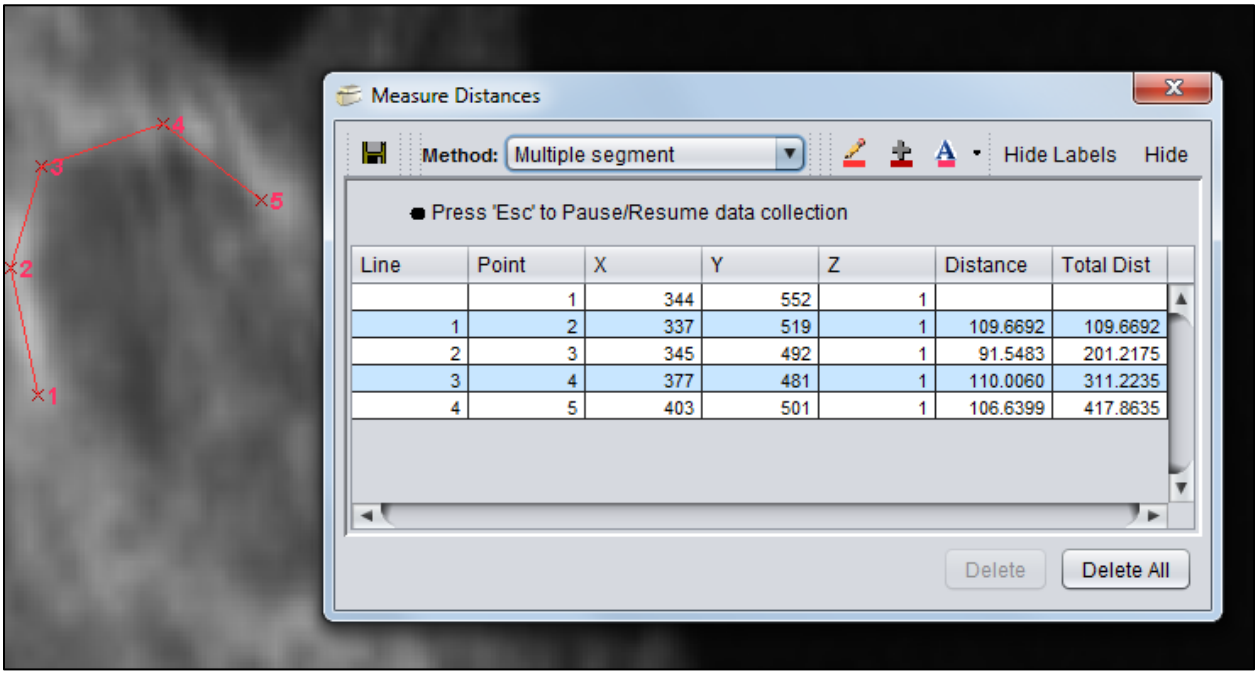


Image Size / Region-of-Interest Control

Support for 2048x1024, 1024x512, 512x256, 256x128, and 128x128 images has been added to the list of standard sizes. Small images are useful when speed is more important than field-of-view. Rectangular images have been added because sCMOS cameras are optimized for digitizing columns of pixels. All of the pixels in a row are digitized simultaneously. The acquisition performance of a 256x128 image is almost as good as the acquisition performance of a 128x128 image.

Improvements

Acquisition Speed

The following table compares version 5.1 with previous versions. Also shown are the acquisition rates at various image sizes. The most significant performance changes since version 5.0 involve the 6000.

Acquisition Benchmarks (frames/second)*:

	Software	Image	2200		6000		2000
	Version	Size	Edge1	Edge2	Edge1	Edge2	K4
"As Fast As Possible"	4.0	2048x2048	4.0	NA	1.7	NA	1.2
Time series	4.6	2048x2048	11.0	NA	4.5	NA	2.8
100 time-points	5.0	2048x2048	11.2	12.6	4.2	4.4	2.8
1 channel	5.0	1024x1024	22.0	22.7	4.3	4.6	4.6
	5.0	512x512	22.0	23.3	4.4	4.7	6.8
	5.0	256x256	27.0	30.6	4.5	4.8	8.3
	5.1	2048x2048	10.9	12.4	9.4	10.8	2.8
	5.1	1024x1024	24.5	33.5	15.8	19.6	4.6
	5.1	512x512	34.1	57.7	22.3	25.9	6.8
	5.1	256x256	43.0	70.4	28.8	33.6	8.3
	5.1	128x128	54.9	87.3	30.2	35.0	NA
"Burst Mode"	5.1	2048x2048	16.9	19.3	11.4	13.6	2.8
Time-series	5.1	1024x1024	28.1	37.8	22.9	26.1	4.8
100 time-points	5.1	512x512	47.3	63.9	38.5	47.7	6.8
1 channel	5.1	256x256	66.3	91.8	58.0	81.2	8.4
	5.1	128x128	76.4	112.2	78.0	124.8	NA

*Benchmarks are approximate. Actual performance will depend on the workstation and site configuration. Refer to the list of known issues and workarounds for information about achieving top speed acquisition.

Rectangular images sizes may provide the best combination of acquisition performance and field-of-view size, as previously described. In the case of the 6000, the IO board firmware and instrument control software must be updated in order to run V5.1.

Exposure times:

2200	0.001 seconds
6000	0.070 seconds, pre version V5.1
6000	0.060 seconds, V5.1
2000	0.012 seconds

To enable 0.06 second exposures on the 6000 it may be necessary to remove old configuration settings from the site specific configuration file. GE recommends deleting (rather than editing) the following lines from site specific configuration files:

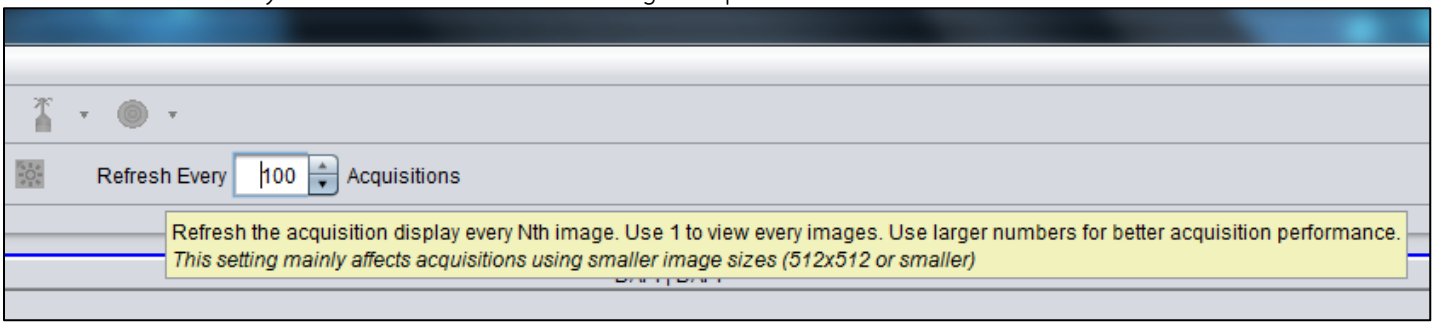
```
<!-- Exposure time in milliseconds (ms) -->
<min_exposure_time>70</min_exposure_time>
<max_exposure_time>3000</max_exposure_time>
<step_exposure_time>100</step_exposure_time>

<!-- Min Exposure time for autofocus in milliseconds (ms) -->
<min_autofocus_exposure_time>70</min_autofocus_exposure_time>

Site specific       "IN Cell Analyzer 6000.xml"
Factory defaults    "IN Cell Analyzer 6000.xml_default"
```

The "factory defaults" configuration file contains the approved configuration settings.

For best performance, increase the refresh interval to a large number of images, as shown in the following screenshot. The option is available in the acquisition mode panel of the user interface. Using a large interval will also hide the plate map overview. To restore the plate map display, drag the vertical separator to the right. This feature is new for version 5.1. Future versions of software may use a different method of limiting GUI updates.



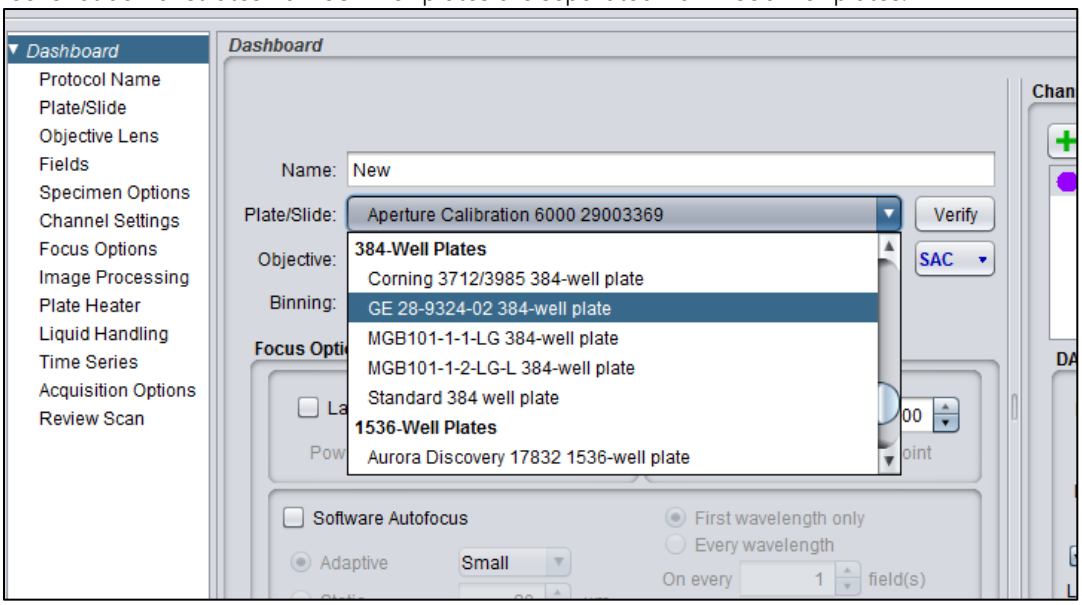
Refresh interval - A new option in the Acquisition Mode part of the GUI.

DataReview Image Stack Loading

The time required to load image stacks (XDCE files) has been reduced. For example, in the case of a stack consisting of 5800 images, the time was reduced from ~120 to ~15 seconds.

Plate List Menu Sorted According to Plate Type

The following screenshot demonstrates how 384 well plates are separated from 1536 well plates.

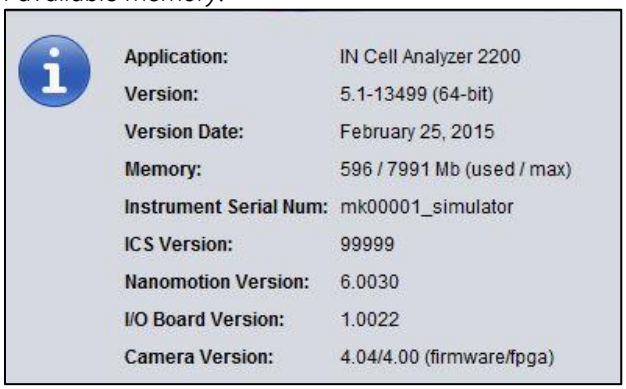


Support for New Aperture Calibration Plates (PN 29144664)

An improved aperture calibration plate (PN 29144664) is now available for the 6000. The original plate (PN 29003369) is still supported by the software, but the part is being discontinued by GE. The aperture calibration wizard provides a pull-down selection for the plate type.

Additional Information in the "About" Dialog

The V5.1 "About" dialog displays information about the Java memory status. Acquisition performance and certain *DataReview* features are related to the amount of available memory.

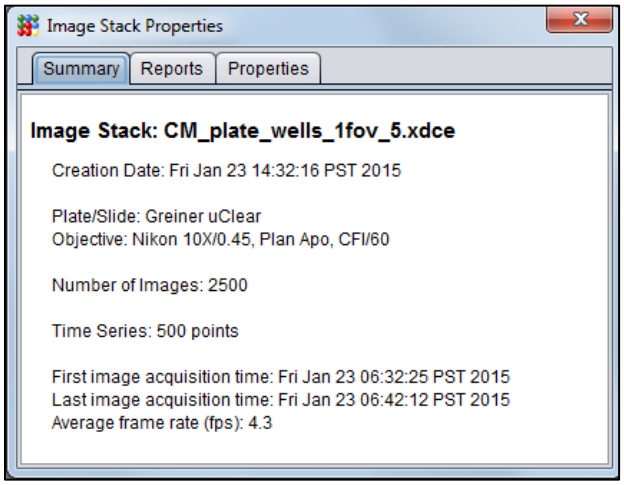


"Objective Lens" Page Moved to Before "Fields"

The sequence of pages in the protocol designer has been changed, because objective lenses should be selected before positioning imaging fields. The field-of-view size is dependent on magnification.

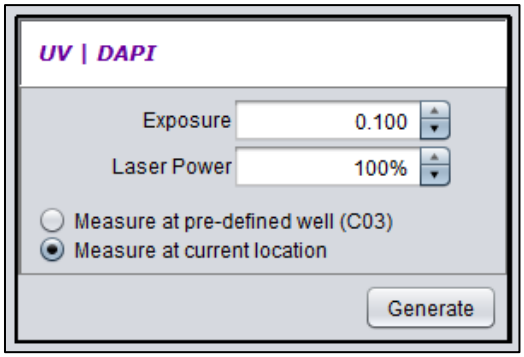
Data Review "Image Stack Properties"

The dialog box that presents image stack properties now consists of three tabs. A "Summary" page has been added on the left side. General information about the time and date of acquisition is presented in the summary. The "Reports" page (middle tab) contains the *ReportGenerator*, as described in the New Features section. The "Properties" page (right tab) provides access to the full list of XDCE tags.



Improved Flat-Field Calibration Measurement

Version 5.1 enables the use of custom flat-field calibration plates. The measurement workflow in V5.1 is similar to previous versions, but with a new option labelled "Measure at current location". When measuring at the current location, the software assumes that the calibration target has already been positioned (in X, Y, and Z). The following screenshot corresponds to the "Refresh" dialog on a 6000.



Instrument Compatibility Checked During Initialization

The GUI initialization procedure now includes a series of instrument compatibility checks. Information about the following items will be requested from the instrument and then compared against known version numbers.

- instrument type
  - The prefix of the serial number should match the acquisition GUI type.
  - Known prefixes/instrument types: "bx"/2000, "bk"/6000, "mk"/2200.
- IO board firmware version
  - 1.0020 is OK for the 2200 and 2000.
  - 1.0023 (or higher) is required for the 6000
- Nanomotion firmware version
  - 6.0030 is preferred over 6.0028
- Instrument control software version
  - 23540 (or higher) is required for V5.1

Most of the checks are intended to determine whether an upgrade is available and recommended. Certain types of incompatibilities, however, will prevent operation. When appropriate, the IN Cell software will offer to launch the appropriate firmware upgrade program, as shown in the following example.

In the event that additional upgrades are required, launch the IO board firmware update program by double-clicking on:

"C:\Program Files\GE Healthcare\IN Cell Analyzer 2200\IOBoardFirmwareUpdater.exe"

Select the appropriate version of firmware (usually the largest number), and then following the simple instructions. It is important that the power to the instrument is not shutoff during the upgrade.

For assistance with firmware upgrades, contact GE support.

Z Motor Configuration Settings Changed to Improve Reliability

The configuration settings on the Z motor have been changed in order to increase torque and to reduce the chances of an unexplained encoder error.

Multi-well Time Series Scanning

There are now two methods of multi-well time series scanning: "original" and "new".

The original method uses a timing model to divide the plate scan into groups of wells. Each group is then scanned as a separate time-lapse scan. The purpose of using sub-groups is to enable shorter time-lapses between measurements than would be possible if all wells were scanned before starting the next time point. The reliance on a timing model leads to some undesirable behaviors, which is the motivation behind the new, alternative approach. Rather than dividing the plate into sub-groups, the new method simply scans all of the wells for every time-point. A timing model is not needed, because the software will only wait at the start of each time-point.

By default, the software is configured to use the NEW method of multi-well scanning. Only one mode will appear in the list of time series options. To use the original algorithm, set the configuration variable "use_original_multi_well_scan_method" to "true" and then restart the GUI software. (Refer to the release notes from version 4.6 for information about modifying the GUI configuration file.)

When configured to run with the new method, the GUI will append "*" to the name listed in the time series mode.

A number of status messages and GUI changes have been added to help make the multi-well scanning algorithm more transparent. Most importantly, the status messages that get presented during a time-lapse wait will include:

- time point number
- scheduled acquisition time (nominal number of seconds since time 0)
- well position
- scan group (if using the original method of multi-well scanning)
- count down timer to the start of the next acquisition

In addition, when the instrument moves to the incubation (i.e. standby) position, the plate view region of the GUI will be updated accordingly.

In the case of the original, multi-well scanning method, some of the acquisition timing restrictions imposed by the timing model have been removed. Rather than relying on a timing model to avoid missing planned time points, increase the time separation between points and then run the experiment again. Trial and error is an essential part of achieving top speed for a given set of experimental conditions. Developing and maintaining a timing model for the purpose of accurately predicting the minimum scan time on all instrument types and all acquisition protocols is not possible.

Previous versions of software contained an imprecise countdown timer with a range of time-lapses between 0 and +1.5% of the intended wait time. For example, in the case of a "100" second countdown, the actual wait time could have been anywhere between 100 and 101.5 seconds. Even larger differences were possible when the workstation was busy with extra tasks. For longer wait times, the potential lag was many seconds, leading to low precision time-lapse acquisition. Because the difference was always positive, the chances of missing/skipping time points increased with long time-lapses. (See item #1294 in the list of changes.)

The behavior of "Incubate between time points" has been changed to reduce scan times and to better match the capabilities of the hardware.

- the instrument will only move to the incubation position if the time until the next acquisition is longer than the time required to move to-and-from the standby position (i.e. 20 seconds).
- the time required to move to-and-from the standby position will no longer be counted within the scan timing model. The minimum allowed time between time-points will shrink by 20 seconds, relative to previous versions of software.

It should be noted that the actual benefit of moving to the standby position between time-points is difficult to quantify. The entire XY stage is heated, except for the hole around the objective lens. The temperature difference between the standby position and other imaging locations cannot be predicted.

The logic used to determine the next well location has been improved. For details, see #1377.

Time Point Reference

IN Cell records timing information about when images were collected. The *ReportGenerator* allows the time values to be easily viewed and exported. The values of interest in the *ReportGenerator* are typically:

timestamp_sec

An absolute, POSIX-style (i.e. number of seconds since 1/1/1970) timestamp assigned to the image when it was collected by the instrument. The value is measured before the start of the exposure.

rel_timestamp_sec

The imaging time (in seconds) relative to a reference event ("time zero").

Refer to the following summary for a description of when the reference time is recorded for each type of time series acquisition:

Single Well Mode
The reference time is defined to be the time immediately after the initial XY stage move and the positioning of the liquid handling needle (if any). For the first well, the value of *rel_timestamp_sec* from the *ReportGenerator* for the first image in the well (FIW) will correspond closely to the first scheduled time point. (Although there is a slight lag corresponding to the time being the command being sent by the GUI and the command processing on the instrument). For other wells, the difference between the FIW of the *Nth* time point and the FIW of the first time point should correspond to the scheduled time (assuming the schedule can be satisfied). Note that if liquid handling occurs at a planned time point, the liquid handling will start at the scheduled time such that the image timestamps will lag the scheduled time.

As Fast As Possible
The reference time occurs after the plate is loaded, but before any initial stage move or liquid handling positioning. The *rel_timestamp_sec* of the FIW should lag the time embedded in the image filename. The lag represents the difference between the start of the time point and the actual acquisition of the FIW.

Burst Mode
The reference time is the same as it is with Single Well Mode. No other general relationships can be inferred.

Multi-Well Mode (new)
The reference time occurs immediately after the initial XY stage move, liquid handling positioning (if any) and the first large range autofocus. For the first well, *rel_timestamp_sec* from the *ReportGenerator* for the FIW will correspond closely to the scheduled time points (if the schedule can be met). No general relationship can be inferred for other wells. Note that if liquid handling occurs at a time point, the liquid handling starts at the scheduled time so the image timestamps lags the scheduled time.

Multi-Well Mode (original)
The reference time occurs immediately after the initial XY stage move. For the first well, *rel_timestamp_sec* from the *ReportGenerator* for the FIW will correspond closely to the scheduled time points. Otherwise, for the first well of each scan group, the difference between the FIW of the *Nth* time point and the FIW of the first time point should correspond to the scheduled time (assuming the schedule can be satisfied). Note that if liquid handling occurs at a time point, the liquid handling starts at the scheduled time so the image timestamps will lag the scheduled time.

Discontinued Development for Windows XP and 32-Bit Windows 7

GE has discontinued development of IN Cell Analyzer software for workstations running Windows XP. Microsoft no longer supports this operating system and the company has stopped providing security updates. It is not possible to purchase the installation disks, and many IT departments will not allow XP computers on their network.

GE has also discontinued development of software for 32-bit Windows 7. In this case, the reason is that 32-bit operating systems cannot access enough memory to support the new features within the IN Cell software. Features like 3D acquisition, extended time series (with lots of points), deconvolution, thumbnails, animation, and *DataReview* all require large amounts of memory to operate smoothly. Even though 32-bit workstations typically have 4Gb of RAM installed, the actual amount of usable memory limit is closer to 3Gb. Increasing the amount of memory beyond 3Gb (in a 32-bit workstation) is not possible without upgrading the operating system.

GE recommends 64-bit Windows 7 with at least 8Gb of RAM for all IN Cell instruments. For information about setting up a workstation for use with an IN Cell instrument, refer to the IN Cell workstation setup guide. A copy of the guide is provided within the standard installation packages at

"C:\Program Files\GE Healthcare\IN Cell Analyzer XXXX\manual\INCell_Workstation_Setup_V5.1.pdf".

The setup guide also summarizes the minimum workstation requirements.

For sites that want a GE approved computer, preconfigured 64-bit workstations are available from GE Service. The part numbers are:

2000	Inquire
2200	29033559
6000	29044907

Software Licensing

Certain aspects of the software licensing mechanism were changed between versions 4.5 and 4.6. Information about the changes is provided in the release notes from version 4.6.

Software Configuration

For information about the files used to configure the IN Cell user interface, refer to the release notes from version 4.6.

Known Issues and Usage Notes

Information about previously reported topics can be found in previous versions of the release notes, which are located in "C:\Program Files\GE Healthcare\IN Cell Analyzer XX00\manual". Only new or updated items are described here.

Windows System Clock Timer Can Affect Acquisition Performance

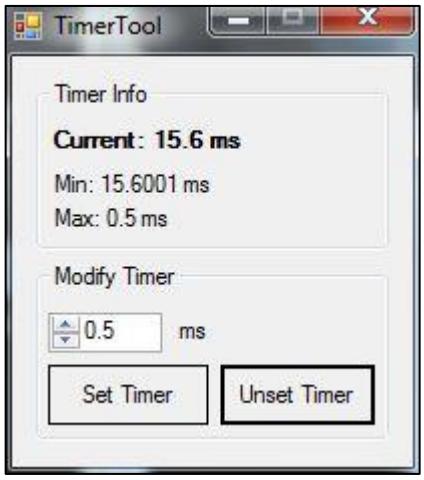
The Windows system clock timer has adjustable resolution. Certain programs (like SQL Server and Internet Explorer) use low-level methods to dynamically adjust the timer resolution. To view the current clock timer resolution, download and run a clock timer utility program on the workstation. Two such programs can be found at the following web-sites:

http://vvvv.org/contribution/windows-system-timer-tool

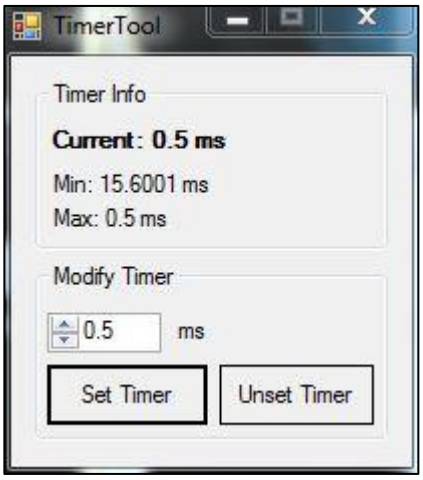
https://technet.microsoft.com/en-us/sysinternals/bb897568.aspx

For best acquisition performance, the timer resolution should be set to a low value (like 0.5 msecs) during acquisition.

Under most conditions, Windows sets the timer value to 15.6 msecs, as shown in the left panel of following screen shot. Setting the value to 0.5 msecs (panel on right) will increase acquisition performance consistency and frame rate. Performance data for a sample scan ("As Fast As Possible", 256x256, 100 images, 0.001 sec exposures) are reported underneath the screen shots.



28.3 +/- 2.7 frames/sec, n=8



35.1 +/- 0.7 frames/sec, n=8

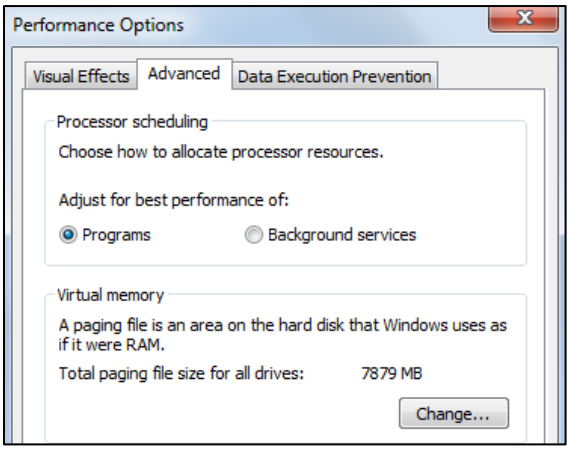
It is important to state that there is no "best setting" for all situations. For example, larger values can improve multi-processor performance and reduce energy consumption.

Windows Performance Settings - Processor Scheduling Allocation

To help ensure optimum acquisition performance, processor scheduling should be optimized for "Programs" rather than "Background services". The underlying issue is related to the clock timer resolution, as previously described.

Use the following steps to adjust this performance setting:

Start the Windows Control Panel
Set the view setting (upper left corner) to "View by: Large icons" or "View by: Small icons"
Select "Performance Information and Tools"
Select "Advanced tools" from the list on the left side
Select "Adjust the appearance and performance of Windows" and choose the "Advanced" tab
Set the toggle button to "Adjust for best performance of: Programs" (not "Background services")



IO Board Firmware Compatibility

Version 5.1 includes a new version ("BlinkIO_1.0023") of the IO board firmware that is required for proper operation of the 6000 with the V5.1 software. The following table summarizes the IO board firmware compatibility with the GUI software and instrument type.

Firmware Version	Supported Instruments	GUI Software Versions
BlinkIO_1.0023	6000	All
BlinkIO_1.0020	2200	All
BlinkIO_1.0020	6000	5.0 and earlier
BoxerIO_2.0006	2000	All

In the case where the GUI software is switched from running V5.1 to an earlier version, the instrument must be power cycled in order to reset the state of the IO board.

Extremely Long Time Series Will Eventually Consume All Available Memory

The IN Cell acquisition software records meta-data in memory during the entire scan. After about 280,000 images, the meta-data will occupy all of the memory available to the Java Virtual Machine (JVM) on workstations that have 8Gb of RAM.

Adding memory to the workstation will increase the maximum number of time points that can be acquired. When configured normally, IN Cell's JVM will automatically attempt to use 1/2 of the available RAM on the workstation.

The memory limitation described here also affects previous versions of the software. It should be mentioned that the limitation would be especially problematic on 32-bit workstations. See the section titled "*Discontinued Development for Windows XP and 32-Bit Windows 7*".

SAC Collar Disabled Due to an Empty Turret Position

SAC collars will be disabled by the GUI if there are preceding empty turret positions. For example, the SAC collar of lens 12604 will be disabled in the following turret configuration

[Lens Changer]
Lens IDs = 12111 12206 **0** 12604

The GUI's configuration logic incorrectly assumes that the SAC controls for turret position (3) are "too large".

To work around the problem, add a fake lens to the list of available lenses in the IC's INI file. For example:

[Lens Changer]
Lens IDs = 12111 12206 **12110** 12604

The bug was introduced in version 5.0.

Significant Bug Fixes

Only the most significant items are described in this section. See the table in the next section for a full list of changes and fixes.

Image Size Changes on the 2200 (1383)

The instrument control software ("ICS") will crash if the first image after initialization is not full sized. 2200's (not 6000's or 2000's) running V5.0 were affected. To avoid the crash, acquire a full sized image immediately after restarting the instrument controller. Once the memory is allocated to full size, the software is OK. If the crash occurs, the instrument will need to be restarted.

Movie / Animation Flicker (1282)

The "Start" movie creation button remained active while movies were being created. It was possible for more than one movie creation procedure to run at the same time, causing extra frames to get inserted into the movie. The extra frames may have been responsible for flicker.

User Defined Channels Names Don't Always Work (1314)

Under certain conditions, user defined channel names prevented proper operation of the software. The bug was introduced in the last version of software.

Instrument Operation is Sensitive to the Workstation's Locale (1385)

The communication protocol between the GUI and the instrument was only designed to work with periods for decimal points rather than commas. European style numbers with commas did not work. Prior to V5.0, the formatting issue did not cause major issues, and was therefore difficult to detect. Starting with V5.0, however, the formatting problem affected some of the critical instrument control commands. The issue has been addressed in V5.1.

List of Changes Between 5.0-13098 and 5.1-13722

Release 5.1-13722, 15 April 2015:

Items listed in this table have been fixed in version 5.1, unless otherwise discussed in the comments.

ID	Brief Description	Additional Comments
559	*PointValues* tool improvements	Many improvements have been made to the *PointValues* tool within *DataReview*.
560	*MeasureDistance* tool improvements	Many improvements have been made to the *MeasureDistances* tool within *DataReview*.
781	XDCE file left in temp folder when using spooling	Certain types of temporary files are only deleted during software initialization.
885	FFC setup and configuration improvements	A new option has been added for measuring FFC maps at the present location. Enables users to measure FFC maps from custom plates.
1057	Group plate types together in *DashBoard* and *ProtocolDesigner* lists	Plates are now grouped according to the number of wells.
1085	Improvement requests for dialog box used to open XAQP files	The dialog box used to open XAQP files can now sort on the usual file parameters like, date, size, and name.
1095	Automatically enable "Refocus at each time point"	By default, time-series scans will now "Refocus at each time point". In previous versions of software, the default condition was the opposite.
1122	Evaluate ability to use a 2560x1440 monitor	2560x1440 monitors have been confirmed to work well with the IN Cell software. A dual monitor configuration (1920x1200 and 2560x1440) mostly works, however, do not use microscopy mode and the *DashBoard* at the same time.
1124	Add predefined reports for the XDCE exporter.	Two predefined report types are included with the standard installation. Users can also add new report types.
1126	Difficult to de-select Preview Scan.	A button for explicitly disabling Preview Scan has been added.
1140	Occasional missing image at Z=1 with multiple 3D channels (only when using Simulator).	The problem was only observed with the Simulator.
1188	High performance ROI control on the 6000.	Representative benchmarks are reported in the release notes. Requires IO board firmware 1.0022, or higher.
1195	Strange behavior when attempting to move the scale bar.	Fixed
1219	IC command GALVO_GET_AGS_COORDS is used more often than necessary (6000).	The unnecessary commands have been removed, leading to GUI performance improvement for the 6000. Mainly affects the *FocusFinder* and continuous acquisition.
1224	Focus finder should display a box indicating the current image size.	The Focus Finder always uses the full image size, which can cause confusion when the acquisition protocol is configured to use a smaller image size. A red box representing the ROI will now be overlaid on the *FocusFinder* images.
1233	Need access to algorithm selection when using Adv 2D deconvolution.	It is now possible to choose the deconvolution method when processing images with Advanced 2D deconvolution. A 3D deconvolution license is no longer required to gain access to the options "Enhanced Ratio, "Ratio", etc.
1234	Incorrect title displayed on image window.	In certain situations, the wrong channel information was being displayed along the top of the preview image.
1237	Add support for the Prior H224WPX2 slide holder.	A new slide type has been added.
1247	Report the situation where the remote control client disappears/disconnects.	If the remote control client (e.g. PAA Overlord) disappears or disconnects, IN Cell will now present a warning message to alert the operator. The warning message will be suppressed if the IN Cell is "idle" (state 0) or "waiting for next plate" (state 1).
1248	The order of protocol designer pages "fields" and "objective lens" should be reversed.	Selecting the objective lens before defining field locations is important, because the field size changes with magnification.
1250	*DataReview* slows down when loading large image stacks.	The performance has been greatly improved.
1251	Unexpected behavior when cell counting is enabled for time-lapse acquisition.	Cell counting and time-lapse don't really work together. The software will now present a warning if both options are enabled.
1254	Panning doesn't work right at high zoom levels.	Fixed.
1258	*MeasureDistances* tool is not functioning well in *DataReview* Grid view.	A variety of limitations have been addressed. Supporting distance measurement within multiple display windows is tricky.
1263	Report basic scan timing information.	A "Summary" page has been added to the image stack properties dialog within *DataReview* mode.
1267	Add latest Overlord/INCell driver (1.0.3.20) to installation packages.	Version 1.0.3.20 contains small improvements over the previous driver. For further details, contact PAA.

1270	Verify LAF needs a better method of checking whether the lens can image through the bottom.	The logic used to determine whether an objective lens can image through the plate bottom will now work more reliably. The previous logic did not properly analyze the case where a high NA lens would be unable to image through a thick bottom plate.
1271	Strange "wavelength_manager.xml/Temp" directory created during initialization.	The directory (never actually used) was inadvertently created by the installer.
1274	Implement "Burst Mode" as a regular timing method.	Prior to V5.1, burst mode was only available as a form of 3D imaging (Z step size equal to 0). The acquisition loop could only acquire images in a single channel at a time. Starting with V5.1 the burst mode loop includes all channels listed in the acquisition protocol. The original method can still be used, but the new method is preferred.
1275	Add an option to export CSV files with all channels listed on a single row.	The report generator has an option for generating CSV files that are compatible with analysis programs that need to have all channel information listed on a single row. *CellProfiler* is an example of such a program.
1276	sCMOS camera firmware updater GUI doesn't update final status message.	The camera firmware update takes about 10 minutes to complete. At the end of the upgrade, the dialog box does not update all of the status messages presented to the operator. Conflicting status information is presented to the operator. The message "Update in progress..." remains in the dialog, even though the upgrade is complete.
1277	Issues with the heatmap in *DataReview* during acquisition.	The *DataReview* heatmap switches to the same mode after every image acquisition.
1281	Add scan name to log messages at start and end of scans.	Adding the scan name to the instrument controller's log file will help diagnose failures.
1282	AVI movie/animation flicker - extra frames out of sequence.	The "Start" movie creation button remained active while movies were being created. It was possible for more than one movie creation procedure to run at the same time, causing extra frames to get inserted into the movie.
1284	Remove obsolete instructions for the Simulator/Emulator.	Instructions aren't needed anymore, because the Simulator is automatically installed and launched when needed. Also, the instructions were out-of-date.
1286	sCMOS camera firmware updater reports the wrong firmware version.	The sCMOS camera version consists of both the "firmware" and the "FPGA" versions. V5.0 only reported the FPGA version, which does not always match the firmware version (for example "4.04" and "4.00"). V5.1 reports both versions. Also see #1268.
1288	*FocusFinder* graph points are inconsistent.	The location of the graph points has been improved. The graph profile should now be smoother and easier to interpret.
1289	Z Stacks with DZ=0 are incompatible with *Investigator*.	XDCE files generated by the original burst mode (Z Stacks with dz=0) were not recognized by *Investigator*. Modifications have been made to improve backwards compatibility, however Investigator is not able to handle a Z slice thickness of zero. Use the official Burst Mode instead.
1292	Scan logic needs better method of checking whether laser autofocus can work through the plate bottom.	The logic used to check whether the high NA objectives can view objects through the current bottom thickness has been improved. A warning message will be displayed if the objective lens cannot image through the substrate. Either the objective lens or the bottom thickness must be changed to use LAF.
1293	Report the situation where the main configuration file is not found.	If the main, GUI configuration is absent, a warning message will now be displayed during GUI initialization. Proper operation of the IN Cell GUI requires the presence of the factory defaults contained within: "C:\Program Files\GE Healthcare\IN Cell Analyzer XX00\config\IN Cell Analyzer XX00.xml_default".
1294	Time-lapse wait method is imprecise. Wait times are always longer than requested.	The wait times were longer than requested, which may cause time-lapse scheduling problems. The new method is more precise.
1296	Base folder (for image output) validation method needs improvement.	The logic used to check the base folder will now look for more potential issues.
1297	Installer page for choosing installation location needs to be removed.	The standard installation location cannot be changed. It was never really possible to choose an alternative installation location. This option has been removed.
1299	Create desktop installers for use at special sites.	Under special circumstances, the software can be provided in the form of "Desktop" installers. Desktop installers are totally self-contained. All IN Cell files are stored within a folder called "GE Healthcare" on the User's desktop.
1305	Zoom to well bug in assay development mode.	Fixed.
1306	Add JVM memory information to the "About" dialog.	The "About" dialog now includes information about the current and maximum allowed amount of memory used by the Java Virtual Machine (JVM). The information is useful for monitoring the IN Cell's software environment.
1311	Add standard disclaimers to the end of the release notes.	GE's standard disclaimers have been added to the end of the release notes.
1312	Hot pixels affect the FFC gain map.	Hot pixels on the camera sensor can affect the scaling within the gain map. V5.1 filters out hot pixels before generating the FFC gain map.

1313	Greiner uClear 96 well plate bottom thickness in XPLT file is incorrect.	The default plate bottom thickness was incorrectly set to 150 um. According to Greiner, the actual, nominal value is 190 um.
1314	Cannot create user defined channel name in Channel section.	This bug was introduced in V5.0.
1317	Objective loading script doesn't fully load the 20X/0.45 (12206).	The bug was introduced at V5.0. The bug has minimal effect on normal installations, because the bug only causes problems under the following conditions: 1. the 20X is de-installed from the instrument using the loadobj.py script 2. the 20X is reinstalled using the V5.0 loadobj.py script Sites that are affected by the bug and still using V5.0 should contact GE for support.
1318	Controller RPM naming method needs improvement.	The instrument controller software packages ("RPMs") names now include the version numbers that match the GUI software version numbers. For example "5.1".
1319	Add a plate type for the new, 6000 aperture calibration plate.	The new aperture calibration plate can be found in the plate selection list. The name is "Aperture Calibration 6000 29144664". (The original plate is called "Aperture Calibration 6000 29003369".)
1321	FFC measurement uses incorrect ROI when run after the *FocusFinder*.	The *FocusFinder* left the camera in a state that was incompatible with the FFC measurement procedure. To work-around this issue with previous versions of software, simply acquire an image from the *DashBoard* before attempting to calibrate the apertures. Similar to #1326.
1322	FFC measurement improvement.	The FFC measurement procedure has been improved. FFC maps are now less sensitive to artifacts in the calibration plates. Also see #1312.
1323	Add a plate type for the new Flat-field calibration plate type.	The new FFC measurement plate can be found in the plate selection list. The name is "Flat-field Calibration 29144664".
1325	LAF setup tool uses the incorrect bottom thickness for slides.	When using the LAF tool to autofocus on slides, the incorrect substrate thickness was used to find the 2nd peak.
1326	Aperture calibration fails after using *FocusFinder*.	The *FocusFinder* left the camera in a state that was incompatible with the aperture calibration procedure. To work-around this issue with previous versions of software, simply acquire an image from the *DashBoard* before attempting to calibrate the apertures. Similar to #1321.
1327	Can't interact with Instrument Shutdown and Log File capture dialogs.	An unneeded dialog box was interfering with the desired operation.
1328	Add the remote control state to the dialog box's title bar.	The name of the button used to enable and disable remote control is the opposite of the current state, causing confusion. To help reduce confusion, the title bar of the remote control dialog box will now report either "Enabled" or "Disabled".
1329	LAF Verify applies calculated thickness to slide rather than coverslip.	Similar to #1325. When using the LAF tool to calculate the bottom thickness of a slide, the resulting value was applied to the opposite of the correct substrate. In cases where the coverslip was mounted on the "bottom", the calculated bottom thickness was incorrectly applied to the "top", and vice versa.
1331	GUI/dashboard is active during FFC measurement.	*DashBoard* acquisition controls were active during FFC measurements. To avoid this issue on earlier versions of software, wait for the FFC measurement to finish before pressing control buttons.
1332	Aperture calibration plate type (presented in the *DashBoard*) momentarily reverts to default type.	While stepping through the aperture calibration wizard, the *DashBoard* and *PlateView* momentarily switched to the "PE ViewPlate".
1333	Add 128x128 to the list of image sizes.	128x128 is potentially useful when high speed acquisition is more important than field-of-view.
1334	Image will not display when 3DD is used for the first channel.	Display images acquired with different acquisition settings can be tricky. Improvements have been made to the way *DataReview* handles mixtures of 3DD and 2D images.
1335	Plate/slide editor doesn't allow well sizes larger than 50x50mm.	The plate/slide editor contained an internal size limit of 50mm. Attempting to plate types with sizes larger than 50mm caused the program to exit immediately and without notification.
1336	Improve frame rate on the 6000 by reducing galvo rewind delays.	Representative benchmarks are reported in the release notes.
1337	Aperture calibration return codes need to be translated somehow.	When possible, aperture calibration failure codes will be explained to the operator.
1338	Aperture calibration parameter control issues.	The exposure and laser power controls did not behave reliably, making it difficult to adjust the laser line intensity.
1339	*FocusFinder* for the 6000 should use open aperture.	The *FocusFinder* will work better on the 6000 when out-of-focus objects are more visible.

1340	FFC map compatibility with *Investigator*.	FFC maps from images below full size are not recognized by *Investigator*. This issue only affects the situation where FFC is applied by *Investigator* after acquisition. Also, only small images are affected. To work-around the situation the small image FFC can be renamed.
1341	Add rectangular image sizes for the 6000 and 2200.	Rectangular image size such as 2048x1024 and 1024x512 work well on sCMOS sensors.
1343	Single slide Cover Slip Position is set up wrong.	The cover slip position within the default plate type "Single Slide" was incorrect.
1344	Software autofocus options for skipping fields & wells does not work properly.	A number of problems existed with the previous skipping algorithm. The options should now behave as expected.
1348	Remove obsolete "ic601" prefix on ICS version number.	The ICS version number reported on the "About" page will only contain the unique build number.
1349	Check instrument firmware, software, and type during initialization.	Additional information is provided in a previous section of this document.
1353	Handle UTC timezone and timestamp issues.	The image timestamps need to be adjusted according to the workstation's timezone. XDCE files from earlier versions of software may contain timestamps in the PDT timezone rather than the workstation's timezone. In most situations, this is not a problem, because the absolute time of day is unimportant compared to the time since the start of the scan. To work-around the problem, shift the time stamps by the appropriate time difference.
1354	Add the system serial number to the XDCE file.	The XML tag is called "serial_number".
1355	Remove "IN Cell Miner HCM" from the "Applications" menu.	The menu selection will no longer be visible unless the "support_incell_miner" configuration setting is "true".
1362	XAQP wavelength index is zero after editing a channel.	Editing channels can lead to a situation where the XDCE file contains a wavelength index equal to 0, which can cause problems for *Investigator*. (The acquisition software does not use the index.) To work-around this problem with earlier versions of software, reload the XAQP file, resave the XAQP file, and then regenerate the XDCE file.
1363	Multi-well time-lapse scan method needs to be more predictable to enable routine use.	Waiting between wells and dividing the scan into sub-groups of wells are common sources of problems. The multi-well time-lapse algorithm has been simplified. To use the original algorithm, enable the configuration setting "use_original_multi_well_scan_method" by setting the value to "true".
1366	Channel naming inconsistency if channels added on Microscopy page.	Fixed.
1368	"Scan Time Remaining" status bar doesn't work properly with multi-well time series.	Improved.
1369	Setting the field skipping value and/or well skip value to zero causes strange behavior.	A skipping value of zero is invalid and should not be allowed by the GUI.
1372	Change the default Z motor velocity and acceleration.	The default settings of the Z axis motor have been changed to improve reliability and to correct an initialization problem that has been observed at certain sites. Original settings: Velocity Table=600 2500 2800 0 Acceleration Table=250000 450000 250000 0 New settings: Velocity Table=600 1950 0 0 Acceleration Table=250000 450000 0 0 Underlying Changes: 1. template INI file 2. RPM will modify the active INI file during installation
1374	Improve performance by providing an option for limiting image display during acquisition.	There is now an option for adjusting the frequency of display updates within the Acquisition Mode part of the GUI.
1377	Multi-well scanning uses flawed logic when determining the "next well" location.	The logic sometimes went to the current well rather than the next well.
1378	Multi-well time series moves to incubate/standby position even when time-lapse is short.	Moving to the incubate/standby position only makes sense if the time-lapse is longer than the time required to move to-and-from the standby position.
1379	GUI doesn't update the stage position when moving to the incubate/standby position.	The plate view did not update the box position that's used to indicate the current stage position.
1381	LAF without a slide/plate causes an unrecoverable error report.	Running the LAF tool without a slide/plate could potentially cause the GUI to become stuck while reporting that the LAF did not find any peaks.
1382	Firmware updater GUIs take a long time to start.	The workstation based firmware update programs provide no indication that they have actually started. About 10 seconds elapse before anything is presented to the operator.
1383	The instrument control software can crash when switching from a small image size to a large image size.	Only occurs when the very first image is smaller than full sized. To avoid the problem, always acquire at least one full sized image after the instrument has been initialized.

1384	Record POSIX time zero for the image acquisition time stamps.	Although every image includes a POSIX/Epoch time-stamp, the POSIX time at the start of the experiment ("time zero") is currently not recorded within the XDCE file. Recording time zero will enable third party analysis software to accurately calculate the relative time since the start of the experiment.
1385	Instrument control protocol is sensitive to the workstation's locale.	Older versions of software (especially V5.0) were sensitive to the workstation's locale setting. The communication protocol between the GUI and the instrument was only designed to work with periods for decimal points rather than commas. European style numbers with commas did not work. Prior to V5.0, the formatting issue did not cause major issues, and was therefore difficult to detect. Starting with V5.0, however, the formatting problem affected some of the critical instrument control commands.
1386	Change the 6000's minimum allowed exposure time from 0.07 to 0.06 seconds.	The minimum exposure time of the 6000's line scanning mechanism is actually 0.06 seconds. To enable the use of 0.06 second exposures it may be necessary to remove old configuration settings from the site specific configuration file.
1392	Animation and movie tool Stop button is unresponsive.	The Stop button can become unresponsive when viewing full size images at high frame rates (for example 20 frames/sec). Fixed.
1395	Can't remove liquid handling operations from the protocol editor.	Once a liquid handling operation is added to a time point using the protocol editor it cannot be removed. The "blank" selection in the pull-down list doesn't work.
1396	Add the GUI version label to the top of XDCE files.	XDCE files will now contain a tag called "software_label" to record the nominal version of software that was used to acquire the image stack. The existing tag ("software_version") will still be present. Note that "software_version" is a unique number that represents the actual version of software. The new tag serves as a label (e.g. "software_label=5.1") to identify the overall feature set.
1403	Logic error can lead to stall during acquisition (very rare).	A logic error in the GUI's acquisition control software could (on very rare occasions) cause a scan to stall. The bug affects V4.5, V4.6 and V5.0. The circumstances that expose the issue appear to be very rare. Only one known case has been observed since the bug was created in V4.5. If the problem occurs (with previous versions of software), the GUI program must be restarted. The logic error is unrelated to remote control/robotics mode operation. The bug is fixed in V5.1.
1404	Data Folder Naming options are no long exclusive radio button in Acquisition Session Dialog	On the Acquisition Session Dialog, the Data Folder Naming method options ("Current Date & Time", "Unique Plate Identifier", "Scratch Folder") are no longer mutually exclusive. You can select more than one which is confusing. The bug was introduced at version 5.0.
1405	Firmware updater programs for the IO Board and Nanomotion electronics on the 2200 and 6000 do not accept firmware updates on the first attempt.	A plug-and-play feature of the instrument controller's operating system can interfere with the firmware download process. The first upgrade attempt can fail as a result of simultaneous activity from the operating system. The second upgrade attempt (without power cycling in between) succeeds, because the operating system's activity only occurs when new port is created. The problem is not related to the firmware itself, and is not actually caused by the download program either. V5.1 contains an alternative approach to the downloading the firmware and thereby avoids interference from the computer's plug-and-play activities.
1409	Workstation based firmware updaters should check for confirmation of success.	If the necessary confirmation is available, the workstation based firmware update programs should report whether the update is successful.

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

For local office contact information, visit:
www.gelifesciences.com/contact

GE Healthcare UK Limited
Amersham Place, Little Chalfont
Buckinghamshire, HP7 9NA, UK
www.gelifesciences.com

GE Healthcare Bio-Science AB
Björkgatan 30
751 84 Uppsala, Sweden

GE Healthcare Europe, GmbH
Munzinger Strasse 5
D79111 Freiburg, Germany

GE Healthcare Japan Corporation
Sanken Building, 3-25-1
Hyokunincho, Shinjuku-ku, Tokyo 169-0073, Japan