Change log

Rel 2.5.0

- Improved FW file handling for Sensor Maintenance Tool 1.2.0
- GUI Example bug fix: the saved profiles length with different surface selections are corrected to be the same.

Rel 2.4.0

- Windows 10 driver updated for LCI401, LCI1600, LCI1200 and LCI1201 sensors.
- PARAM_AVERAGE_X_PIXEL_SIZE and PARAM_AVERAGE_Z_PIXEL_SIZE parameters are added to read average pixel sizes from the configured sensor's ROI.
- Z-compensation functionality is added to reduce artefacts caused by surface texture.
- Z-compensation calibration functions are added and an example usage is implemented to Field Calibration Tool.
- Z-compensation parameters are added to the recipe.
- Console example batch functionality is using Z-compensation if the calibration file is found.

Rel 2.3.0

- Groove height calculation improved especially for LCI401 sensors.
- Multisensor image acquisition issue fixed. Issue occurred in every 10 000th frame if triggered simultaneously.
- A new function added to clear the ongoing patch by a user command.

Rel 2.2.0

- FocalSpec SDK Demo application
  - A new example application with source codes
  - Multi-layer Line callback providing profile and intensity data
  - Load configurations from recipe
  - Multiple sensors, up to four supported
- Support for Intensity Calibration and Compensation
  - User can use any sample for the intensity calibration with Field Calibration Tool
  - Intensity compensation is done real-time in the SDK
  - See Intensity Calibration instruction document
- Support for short cluster removal
  - User can specify minimum length for connected segments
- Support for noise removal in Y-direction
  - The filter removes noise by using consecutive profiles
  - If the filter is enabled, the parallel processing is disabled, and the profile processing performance is decreased
- Batch Callback problems with batch timeout and freeing image data fixed
- Layer Sorting fixed when the middle layer is the brightest surface
- Performance Improvements: Support for parallel profile processing

Rel 2.1.0

- GuiExample: Support for creating, saving and loading recipes for ease of use and configuration management.
- Support for trim edges filter in LineCallback. Trim Edges filter is indented to remove artificial points detected at the end of the surfaces. The filter can be disabled/enabled at runtime in the line callback function and it takes effect on the next processed profiles.
- LabVIEW Example enhancement:
  - Support for Layer Specific Parameters
  - Support for Peak Detection Parameters
- Field Calibration Tool: Improved Groove Measurement
- The number of Dynamic Sensor Control points has been increased to 32 on LCI1220 and LCI1620 using FW 1.3.1 or newer.
- PARAM_MAX_POINT_COUNT support added to LCI1220 and LCI1620 using FW 1.3.1 or newer.

Rel 2.0.1

- Algorithm for interpolating missing measurement points is improved (parameter PARAM_FILL_GAP_X_MAX). The improvement adds a support for PARAM_LAYER_MIN_THICKNESS parameter which defines maximum Z difference for interpolated points. For opaque materials, a user can set parameter for the first layer.
- Improved image grabbing sequence to be more robust for continuous start and stop commands.
- Data corruption in line reordering fixed for LCI 401, LCI1200, LCI1201 and LCI1600 sensors.
- PARAM_MAX_POINT_COUNT parameter is used to reduce the amount of payload data in the Ethernet. Data limitation works with LCI401, LCI1200, LCI1201 and LCI1600 sensors using FW 4.9.0.

- Fixed connection issue on LCI1220 and LCI1620 startup when HDR is enabled.

Rel 2.0.0

- Thickness calculation and effective refractive index setting added for transparent layers.
- New filtering parameters replacing PARAM_PEAK_AVER_FIR_LENGTH parameter.
    - PARAM_PEAK_DETECTION_FILTER_LENGTH, Detection filter is used to average the signal to reduce noise before threshold (PARAM_PEAK_THRESHOLD). Low detection filter length is useful when the detected signal is rather faint.
    - PARAM_PEAK_AVERAGE_INTENSITY_FILTER_LENGTH, the filter is used for averaging intensity values of the detected peaks. With high average intensity filter length, the best possible intensity image is produced.
    - Parameters are supported from FSVevo FW 4.7.4 of LCI 401, LCI1200, LCI1201 and LCI1600 sensors and from FSMega FW 1.1.6 of LCI1220 and LCI1620 sensors
- _SetPeakDetectionParameters() function added to simplify peak detection configuration. Material type, detection sensitivity, minimum layer thickness is given as input parameter. The sets automatically PARAM_PEAK_FIR_LENGTH, PARAM_PEAK_AVERAGE_INTENSITY_FILTER_LENGTH, PARAM_SIGNAL_DETECTION_FILTER_LENGTH, PARAM_PEAK_AVER_FIR_LENGTH and PARAM_PEAK_THRESHOLD parameters.
- FROM_MAX_INTENSITY_TO_LOWER_AND_TOP_TO_BOTTOM sorting method added to line and batch callbacks. This method sorts points according to intensity values and after that from top to bottom. The method is useful when the number of layers is known before acquisition.
- Maximum layer thickness setting added. This is used to detect missing layer in materials having more than one layer. (PARAM_LAYER_MAX_THICKNESS)
- Option to select calculation method for intensity values per layer (PARAM_LAYER_INTENSITY_TYPE).
- Improved performance to process points in high frequency. This is needed especially when capturing multiple layers in high speed.
- Documentation improved. Data acquisition and deep dive for camera configuration chapters are added.
- Noise removal algorithm improved. An old version potentially removed points from a surface if there was a local dark area.
- Batch width fixed for LCI1220 and LCI1620 sensors.

Rel 1.51.0

- Number of expected cameras added to the Open-function. If expected camera count is not reached within given timeout, an additional timeout is waited until all expected cameras are found.
- Discover function is added. Function can be used to rediscover cameras if connection changes are expected.
- LabVIEW Example added to the SDK. See FocalSpec LabVIEW Example User Manual for further details.
- GuiExample performance improved to support high frequencies.
- Multilayer algorithm improved to detect small holes after the first layer.
- _AdjustRoiAndFps function is added. The function could be used to set or read maximum imaging parameters according to camera capabilities.
- Camera parameters are classified into groups in FSSDK's manual.
- Batch callback timing error fixed when processing multiple layers.
- PARAM_SENSOR_DATA_IN_FLASH parameter fixed when the FSSDK was not installed to the default folder.
- Visual Studio 2019 support added to example projects.

Rel 1.50.2

- Known Error: Hardware failure when AGC is used.
    - Error affecting all firmware versions prior to 4.7.4 in standard sensors and 1.1.6 in LCI1220 and LCI1620 sensors.
    - To prevent the failure this SDK version disables the AGC functionality until the firmware is fixed.

Rel 1.50.1

- Fix for LCI1220 and LCI1620 Sensors issue 'HSCAM-197, Interference in raw image after boot'.

Rel 1.50.0

- X-Filter parameter added to the SDK API and GuiExample Filter dialog box. For standard sensor firmware version 4.7.1 or later is required. For LCI1220 and LCI1620 sensors version 1.0.13 or later is required.
- Dynamic Sensor Control support added to the LCI1220 and LCI1620 Sensors. For LCI1220 and LCI1620 sensors version 1.0.14 or later is required. Supported parameters are encoder location, image height, image offset, pulse width and peak threshold.
    - Recommendation is to add the first set of parameters to the location 1. This way parameters are always written after received zero pulse.
- GetParameterSupport API function added. This function can be used to check whether the parameter is supported or unsupported in the connected sensor.

Rel 1.48.1

- Multiple camera tracing improved
    - Camera identifier is added to the Vevo log files
- Improved robustness for sensor connections
    - Timeout increased

Rel 1.48.0

- Logical sensor names added to the GuiExample.
- Default sensor calibration folder is changed from 'C:\Users\USER\Documents\Calibration' to 'C:\FocalSpec\Calibration\'.
- Improved robustness for sensor connections
  - Improves connectivity issues in Windows 7 when the configuration has multiple 10 Gbps ports and sensors connected.

Rel 1.47.2

- Z-Drift temperature compensation
- Camera Selection to the GuiExample

Rel 1.47.0

- Noise removal algorithm is added to the SDK. A new parameter is PARAM_NOISE_REMOVAL.
- GuiExample: Filtering parameters are added for the layer profiles. Available filters are noise removal, averaging, median and resampling.
- Multilayer algorithm improved for LCI401 and LCI1600.
- Default installation folder has been changed from Documents to C:\FocalSpec\FocalSpec Software Development Kit.
  In order to change the installation folder, the previously installed FSSDK should be uninstalled from the Documents folder by running Uninstall from 'Add and remove programs' system settings.
  If FocalSpec Software Development Kit is not uninstalled from the Documents, installation folder does not change and update will be installed into it replacing the previously installed version.

Rel 1.46.2

- Layer sorting algorithm improved. Improves situation especially when the distance between layers is large.
- Support for LCI1200 X-calibration.
- ConvertPixelsToMicrometers C# interface modified. Algorithm is not changed but parameters are given in different format.
- FieldCalibration functions robustness improved.
- PARAM_ILLUMINATOR_TEMPERATURE and PARAM_FRONT_PANEL_TEMPERATURE parameters are added for LCI1220 and LCI1620 Sensors.
- HDR settings added to GUIExample. LCI1220 and LCI1620 sensors are not supported.
- Lower value for the gain in LCI1220 and LCI1620 sensors is limited to 2.0.

Rel 1.45.0

- Support for LCI1220 and LCI1620 sensors
- Optimized performance for high imaging frequencies

Rel 1.31.0

- GuiExample: Support for Raw Image view
- GuiExample: Support for Intensity graph
- GuiExample: Surface selection, LineCallback: Top, Bottom, Brightest, layer index control added
- GuiExample: Menu action for selecting calibration files
- GuiExample: Support for configuring parameters
  - Peak Core Threshold
  - FIR Length
  - Averaging FIR Length
  - Height zero adjustment
- BatchCallback: modified running continuously. Support for timeout timer parameter "PARAM_BATCH_TIMEOUT".

Rel 1.30.0

- Support for dynamic sensor control parameters. Interface function: "DynamicSensorCtrlParameters()". Up to 10 predefined dynamic control sets are supported. Triggered by match of encoder location. Controlled sensor parameters are, sensor image height, sensor image offset and illuminator LED pulse width. Implementation examples inside comments both in "GuiExample" and "ConsoleExample".
- Support for calibration data saving to sensor. When calibration data is stored to the sensor, applications can automatically load and utilize the data. Dedicated tool required for writing.
- New function "ConvertPixelsToMicrometers()" added. Converts x and z pixel coordinates to micrometer units.

Rel 1.20.0

- Support for feature "Detect Missing First Layer". Adjusted by parameters "DetectMissingFirstLayer", "DetectMissingFirstLayerX" and "DetectMissingFirstLayerLength".
- Support for FIR average length filtering. New parameter "FirAverLength". Firmware version 4.6.1 or later is required.
- Support for LCI401 sensors.

Rel 1.19.2

- BatchCallback support with example implementation on ConsoleExample. Involved new parameter: "BatchLength"
- GuiExample: new configure attributes supported by "GuiExampleSettings.json" file "FirLength" and "Threshold".
- Support for read-only parameter "SensorTemperature"
- GuiExample: batch bitmap file format corrected from png to bmp.

Rel 1.19.0

- LineCallback support for median filtering, new parameters "MedianZFilterSize" and "MedianIntensityFilterSize" included.

Rel 1.18.1

- Support for multiple sensors improved in API.
- Parameter "FlipXEnabled" support extended to linear cameras.

Rel 1.18.0

- Support for LCI1201 sensors.
- Corrections for LCI1600 profile handling.

Rel 1.17.1

- Parameter "SensorType" returning unknown sensor type fixed.
- Support for command line arguments added to ConsoleExample project.

Rel 1.17.0

- LineCallback new parameters "AverageZFilterSize" and "AverageIntensityFilterSize" parameter added for profile averaging.
- LineCallback new parameter "ResampleLineXResolution" added to change the resolution.
- GuiExample new parameter " AgcMinPulseWidthLimit " added to define minimum limit for pulse width allow adjusted by AGC functionality.
- New parameter "ImageHeightZeroPosition" added. Returns image row z coordinate where height has been tuned crossing zero by calibration file on use.
- FieldCalibrationTool support for LCI400 and LCI1600 sensors.
- Halcon API driver included to the FSSDK.
- LineCallback max layers changed from 5 to 10.
- GuiExample vevolog new parameter: 'KEEP_LOGFILES_DAYS' Log files older than value in days are deleted automatically. Roll-outing log files based on file size.
- GuiExample batch mode setting reliability improved while switching between internal and external triggering.
- GuiExample Error preventing usage with LCI400 fixed.

Rel 1.16.0

- GuiExample support saving batch results in PCD file format.
- GuiExample configuration of 'PulseDivider' and 'TriggerSource' by 'GuiExampleSettings.json' file included.
- FieldCalibTool fixed for 1000 um groove
- GuiExample Start Batch delay reduced. Thread Sleep times reduced and unnecessary sensor parameter settings removed if no change was made.
- LineCallback support for parameter 'PARAM_FILL_GAP_X_MAX' added. Allows used configure in micrometers maximum no measurement point gap in profile to be filled by interpolation function.

Rel 1.15.0

- In GuiExample frequence value enabled on External triggering batch mode allow reducing z-range on higher frequencies.
- Function getting sensor type (LCI400, LCI1200 or LCI1600).
- FieldCalibrationTool fixed for 1000 um and 500 um grooves.
- Improved imaging reliability for the latest i7 processors.
- Parameters reordering span and reordering deviation added to adjust reordering functionality
- Support for new "OpaqueSurface" Interleaving filtering mode added for a single surface detection.
- Lower exposure time is used as default at startup. Needed if mirror/calibration plate is used. If not set selftest might fail due to too many points.

Rel 1.14.0

- FieldCalibrationTool example GUI added.
- Calibration functions added to the API.
- GuiExample batch file saving fixed to use correct index for position calculation.
- Discard profiles from the buffer of previous measurement when the program is started.
- SetLineCallback support for LCI1600 sensors.
- A new parameter frequency_calculation is added to select HW time_stamp or calculated frequency in the header.
- SaveToPointCloudFile fixed to use correct index for location

Rel 1.13.0

- A new driver installer where network card can be selected to the filter driver. Jumbo frames and received buffer sizes are also configured automatically by the installer.
- Improved reliability especially in high imaging frequency.
- Reordering option added to arrange received profiles according to the header->index parameter. Functionality is disabled by default and can be enabled by setting PARAM_REORDERING to 1.
- PARAM_SURFACE_MODE parameter is added to filter layers in the camera HW. Functionality is supported starting in firmware version 3.7. By default, functionality is disabled.
- GuiExample batch frequency setting is fixed. Previous version took the value from main window - not from dialog.

Rel 1.12.0

- A new interface to receive each line as a sorted array according to x-axis. Each layer (0-3) can be configured and received separately. Added functions are SetLineCallback and SetLineSortingOrder. Supported measurement heads are LCI1200 and LCI400. For LCI1600 use SetProfileCallback interface.
- GuiExample updated to use new interface when top/bottom/highest intensity surface is selected.
- ConsoleExample updated to use new interface and save images as height and intensity bitmaps. Command 4 in CLI.
- 2D Bitmap saving added to the GuiExample
- Micrometer unit option added to the GuiExample
- Windows 10 driver updated to support secure boot for installations starting with version 1607.
- Bug in peak enable and led duration setting is fixed. Bug prevented calibration setting if those were called before calibration call.

Rel 1.11.1

- Updates API/Changelog.pdf

Rel 1.11.0

- Fixed profile intensity scaling.
- Adds camera temperature parameter to read temperature with.
- FIR length is automatically fine-tuned when using exposure interleaving.
- Lost camera connection was not properly recognized.
- Performance optimization.
- VevoFirmwareUpdate tool performs firmware validity check.
- Fixed X [um] precision loss when camera sends profile in [um].
- GuiExample
  - Batch size can be set.
  - Surface (layer) selection is global affecting to live image, batch and profile export
  - Sensor ROI (height & offset) is automatically adjusts based on target sampling frequency.
  - AGC can be toggled on/off.
  - Camera is set to idle mode when changing parameters.
  - Fixed mismatch between batch index and frame index.

Rel 1.10.1

- Fixed batch collection buffer from the GuiExample application.

Rel 1.10

- Added parameter PARAM_MAX_POINT_COUNT to enable application to increase the max. number of points per profile.

Rel 1.9

- Added simple batch visualization in the GuiExample.
- Fixed FocalSpec driver installation issues.
- Fixed GuiExample installation issues regarding Visual C++ 2012 Redistributable.

Rel 1.8

- Added batch mode into the Graphical User Interface example (GuiExample). Batch mode can be used to collect profiles into a batch file. The batch file can be viewed and analyzed in 3rd party point cloud tools. Batch collection is done using either external or internal triggering.

Rel 1.7

- FSSDK including FocalSpec driver and other components is now installed with a single installer. Uninstall is provided via Windows standard tool as well.
- Added Graphical User Interface example application with visual feedback.
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Other minor fixes and improvements.

Rel 1.6.1

- Fixes handling of corrupted profile data. If the API detects that profile data was corrupted, it passes an empty profile to the application callback.
- Fixes handling of 4th order calibration polynomial data.
- Minor updates to performance.

Rel 1.6

24.05.2017

- Adds flip x and flip y parameters. A flip parameter can be used to flip the data with respect to a given zero point [um]. Adds support
- for auto IP. If PC is set to obtain an IP address automatically, application is not required to set an IP address to the sensor.
  Adds a header for each profile. The header groups existing parameters and provides additional information with selected devices.
- Adds interleaving filter routine, which selects the points of interest using the recipe application has set.
  Adds support for reading the X and Z calibration data from the sensor flash memory.
- Adds multiple new sensor parameters. Other
- minor fixes and improvements.
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Rel 1.5.2

- Fixed reception frequency parameter from the raw image callback. The value was not updated.

Rel 1.5.1

- Bug fixes for overly-saturated sensor.

Rel 1.5

- Support for FocalSpec LCI hardware V2. Other
- minor fixes and improvements.

Rel 1.4.2

- Bug fixes: Rel 1.4 and 1.4.1 were not backwards compatible with Rel 1.3

Rel 1.4.1

- Bug fixes: fixed reading sensor PARAM_IMAGE_HEIGHT

Rel 1.4

- Support for X scaling from sensor pixels to factory calibrated micrometers.
- Support for setting sensor gain, which, if needed, can be used to set sensor sensitivity.
- Support for setting sensor Region-Of-Interest (ROI) using sensor height and offset.
- Driver installation does not require Windows administrator privileges. Other
- minor fixes and improvements.

Rel 1.3

- An option to scale the Y coordinates from peaks to micrometers added.