Imaging Codec Pack

Release Notes

RDDMS-6-5903

Version 3.12.0

Contents

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1   Releases

1.1 What's new in this release?

This release contains the following bug fixes:

- **Fixed decoding bug for MRC2014 Mode 101 files**

  The non-standard mode 101 represents 4-bit unsigned integer data and is typically used for 'counted' data from the Gatan K2 and K3 cameras. The values of two pixels is packed into one single byte. The first byte in the MRC file contains the values for the two bottom left pixels.

  Bytes in MRC file (as seen with hex editor):

F0	8A		

  Pixels on the screen (as seen in DigitalMicrograph):

0	F	A	8		

  Previous versions of the Imaging Codec Pack displayed this data wrongly, see the example below:

 | | | | | | |
  |--|--|--|--|--|--|
  | | | | | | |
  | | | | | | |
  | | | | | | |
  | F | 0 | 8 | A | | |

  This bug is solved in Imaging Codec Pack 3.12.0 which displays MRC2014 mode 101 files in exact the same way as DigitalMicrograph.

- **Disabled signed/unsigned detection for MRC2014 Mode 0 files**
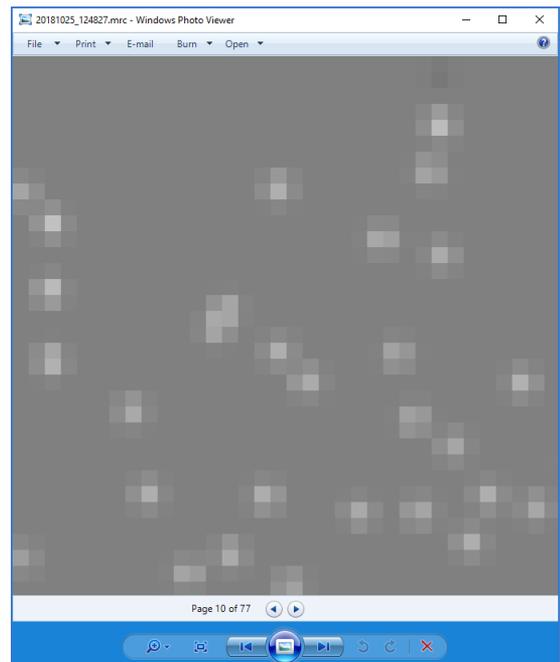
  The original MRC format specification did not clearly specify whether mode 0 should be used for 8-bit signed or unsigned integer data. Most people assume signed, but also a lot of unsigned data is labelled as mode 0. The MRC2014 format specification clarified mode 0 as 8-bit signed integer data.

  MRC Readers had to deal with this confusion for some time and often applied tricks to detect whether signed or unsigned integer data was written. The Imaging Codec Pack also contains an algorithm which can detect that mode 0 is wrongly used for 8-bit unsigned integer data. This algorithm works well for natural images but can fail on artificial images and counted data from direct detection cameras.

  These tricks are not needed for MRC2014 files since that format specification is clear about mode 0. Previous versions of the Imaging Codec Pack also applied this automatic signed/unsigned detection on MRC2014 files with as result that sometimes 'counted' data was displayed incorrectly (see the left screenshot below). This new version of the Imaging Codec Pack handles mode 0 as 8-bit signed integer data for MRC2014 files, with as result that 'counted' data always is displayed correctly (see the right screenshot below). The automatic signed/unsigned detection is still used for MRC files that are written according to the original MRC format specification.
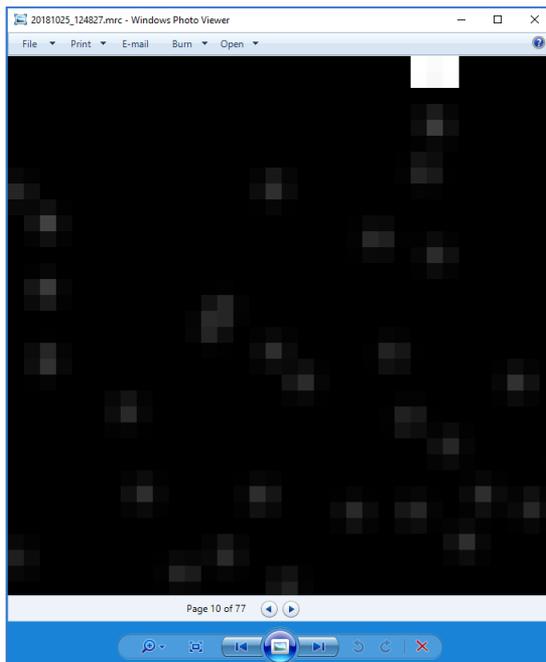
Imaging Codec Pack 3.11.0   *Imaging Codec Pack 3.12.0*

1.2 Release History

3.11.0 – April 13, 2018

Small service update with the following new features and fixes:

- **Rebranding**

  This is the first release of the Imaging Codec Pack with Thermo Scientific branding. The full product name is now "Thermo Scientific Imaging Codec Pack". This will be shortened to "Imaging Codec Pack" in this document and the accompanying User Guide.

- **Added support for embedded experiment thumbnails in Velox EMD files**

Velox 2.4.0 and newer versions will store a preview of the experiment in EMD files. This version of the Imaging Codec Pack will use the embedded experiment preview in Velox EMD files as thumbnail for Windows Explorer. One of the stored images in the EMD file is used as Windows Explorer thumbnail in case no embedded experiment thumbnail is present (which is the case for older EMD files or when Velox cannot generate and store the experiment preview).

## 3.10.0 – October 9, 2017

Small service update with the following new features and fixes:

- **Fixed displaying issues with Enhanced Metafiles in Microsoft Office 2016 documents**

  Pictures can be embedded as Enhanced Metafile (EMF) in Microsoft Office 2016 documents. It turns out that this data format can sometimes have the same bit pattern in the header as MRC files. In that case Office will use the Imaging Codec Pack (when installed) for displaying these images. The Imaging Codec Pack will read the EMF data as MRC file with a striped grayscale image as result (see the left screenshot below).
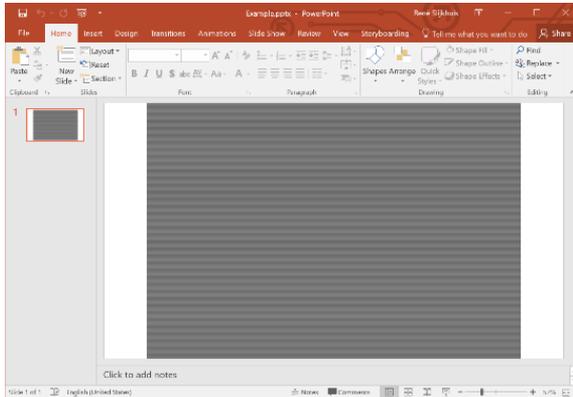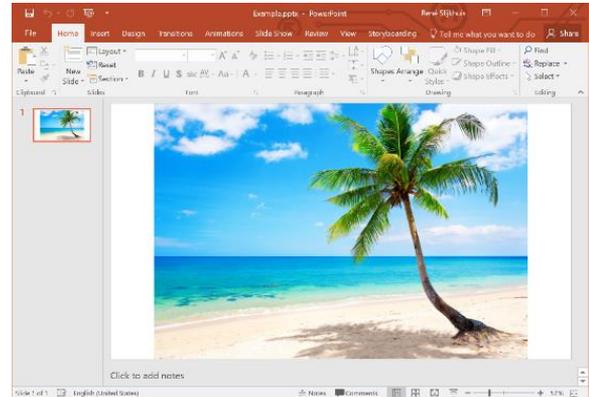

Office 2016 and Imaging Codec Pack 3.9.0   *Office 2016 and Imaging Codec Pack 3.10.0*

| Note	**This issue occurs when Microsoft Office 2016 (a.k.a. Office 365) is used in combination with Imaging Codec Pack 3.9.0 or earlier.**

- **Improved auto brightness/contrast algorithm**

  The large variety of supported pixel formats has to be converted to 8-bit grayscale for displaying on standard monitors. Some images even have a dynamic range of more than 16-bit. The Imaging Codec Pack tries to do this conversion with preserving the details in the light and dark areas. However, the used algorithm is not perfect. On a test set of thousands of images are always a few displayed with bad brightness and/or contrast settings. This new release of the Imaging Codec Pack comes with an improved algorithm which has a very high success rate on the used test set. The left screenshot is done with previous version of the Imaging Codec Pack and the right one is done with this new release.
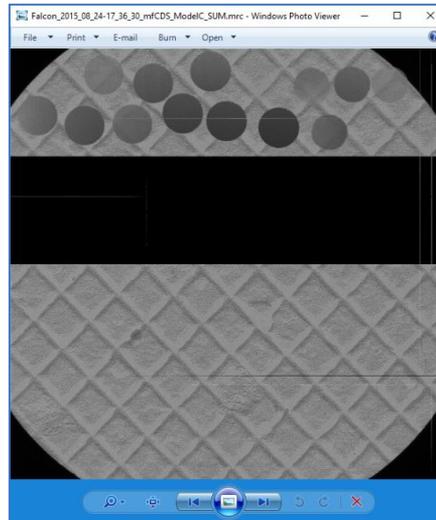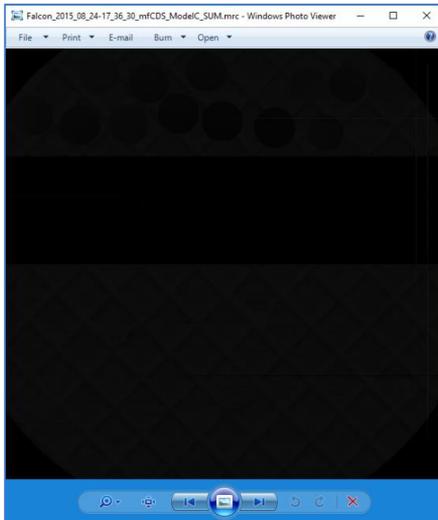
- **Improved support for Amira and Avizo files**

  This release of the Imaging Codec Pack supports a wider number of Amira and Avizo files than previous version. Compressed image data is still not supported. The left screenshot shows an Avizo file with previous version of the Imaging Codec Pack. The right one shows the same file with this release.
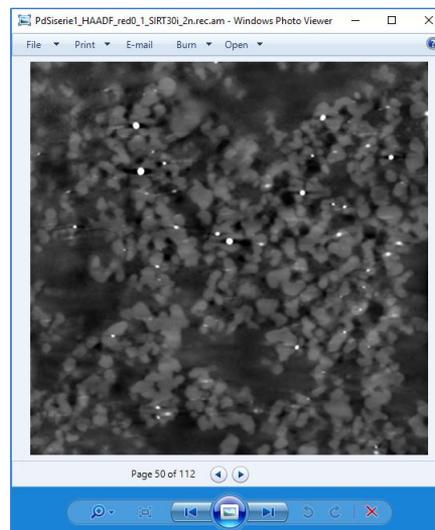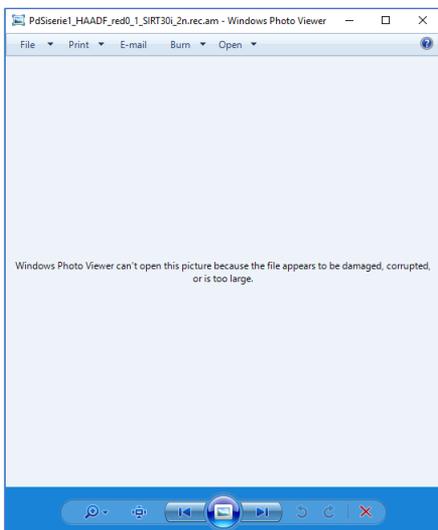
3.9.0 – July 10, 2017

Small service update with the following new features and fixes:

- **Added support for viewing complete image series in Velox EMD files**

  Velox EMD files can contain multiple images and image stacks. Previous versions of the Imaging Codec Pack supported only the first frame of image stacks. This new version of the Imaging Codec Pack provides access to all frames of the image stacks that are present in the file. This functionality is currently limited to 250 frames per file for performance reasons. The screenshots below show the same Velox EMD file with one image stack of 99 frames. The left screenshot is done with previous version of the Imaging Codec Pack and the right one is done with this new release.
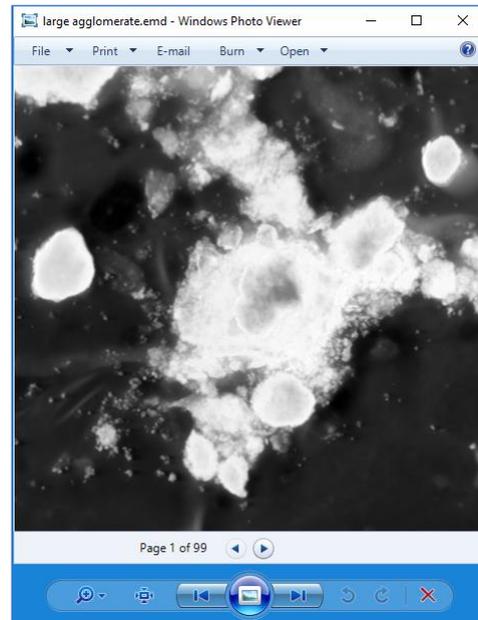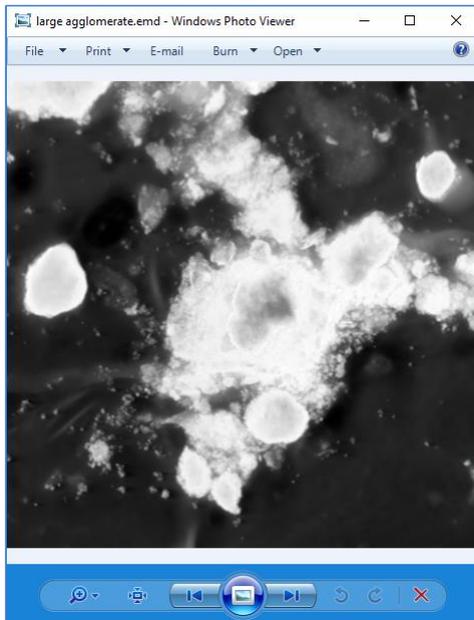
- **Added support for new TIA EMI format**

  The EMI data format of TIA is changed since TIA version 4.15.0 Build 2311 (which is part of the TEM 6.7 release). This means that EMI files that are generated with this (or later) TIA version cannot be opened in earlier versions of TIA. Also, earlier versions of the Imaging Codec Pack cannot be used for viewing these files (see the left screenshot below). This new release of the Imaging Codec Pack has full support for this new TIA EMI format (see the right screenshot below) and still supports the previous version of the TIA EMI format.
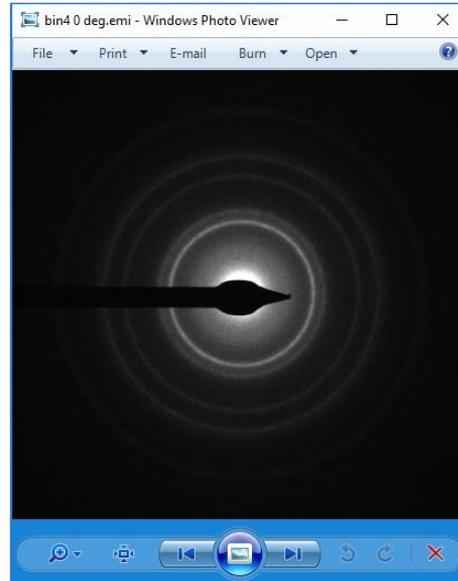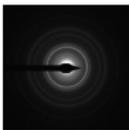

  We understand that this compatibility break is not convenient for everybody who has to deal with TIA EMI files. A comment is added to the file properties in Windows Explorer to make identification of incompatible new EMI files easier (see the screenshot in next item).

- **Added the used TIA version to the file properties of EMI files in Windows Explorer**

  Earlier versions of the Imaging Codec Pack mentioned "FEI TIA" as creator of EMI files. This new release also mentions the used version of TIA (see the screenshot below).

- **Added support for viewing complete image series in Python NumPy files**

  Python NumPy files can contain a stack of images. In previous versions of the Imaging Codec Pack were only files with one image supported. This new release offers support for three-dimensional structures according to the description in appendix C. The screenshots below show the same NumPy file with 5 frames. The left screenshot is done with previous version of the Imaging Codec Pack and the right one is done with this new release.
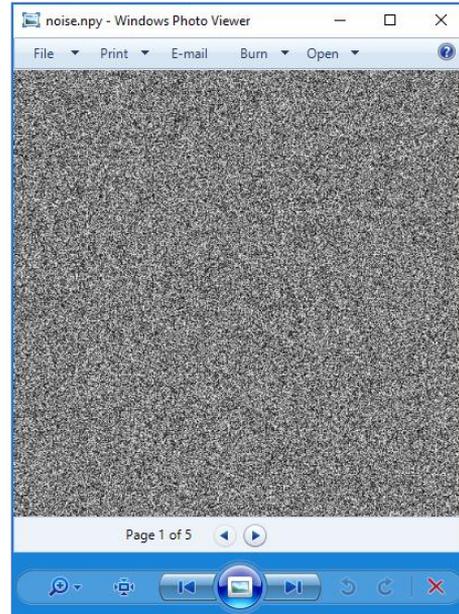
- **Added support for 16-bit Int images in Velox EMD files**

  The Velox EMD format is extended (in data version 4) with support for the 16-bit Int pixel format. Previous versions of the Imaging Codec Pack didn't support this pixel format in Velox EMD files (see the left screenshot below). This new version of the Imaging Codec Pack has full support for it (see the right screenshot below).
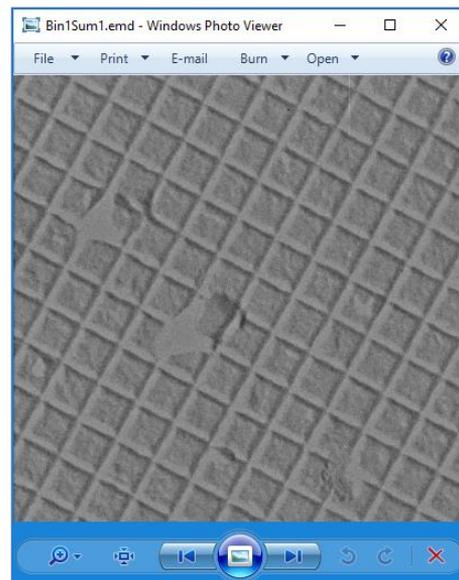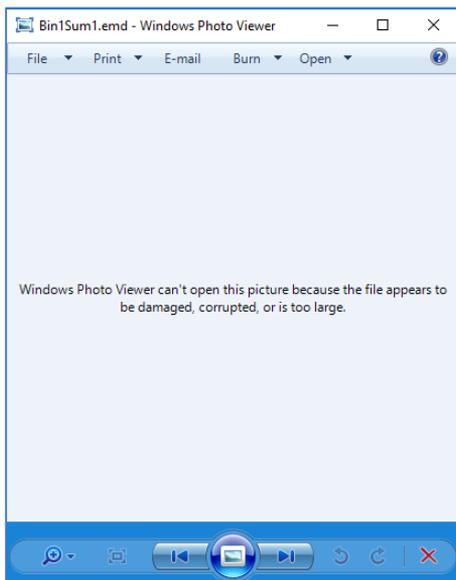
- **Added support for 32-bit UInt images in Velox EMD files**

  The Velox EMD format is extended (in data version 4) with support for the 32-bit UInt pixel format. Previous versions of the Imaging Codec Pack didn't support this pixel format in Velox EMD files. This new version of the Imaging Codec Pack has full support for it.

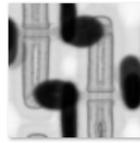- **Improved support for TIA EMI files that contain multiple images**

  TIA EMI files can contain multiple images. In previous versions of the Imaging Codec Pack was often only the first image accessible (see the left screenshot below). This new release provides access to all images in TIA EMI files (see the right screenshot below).
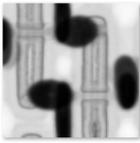
	11.00.00 Scanning Acquire.emi EM Image		11.00.00 Scanning Acquire.emi EM Image
Width:	1024 pixels	Width:	1024 pixels
Height:	1024 pixels	Height:	1024 pixels
Frame count:	1	Frame count:	3
Bit depth:	16	Bit depth:	16
Encoding settings:	UInt16	Encoding settings:	UInt16
Size:	6,02 MB	Size:	6,02 MB
Tool name:	FEI TIA	Tool name:	FEI TIA
Date modified:	13-5-2016 11:04	Date modified:	13-5-2016 11:04
Date created:	13-5-2016 13:39	Date created:	13-5-2016 13:39

- **Added support for 24-bit RGB RAW images**

  The RAW format that is used for the Falcon and Ceta cameras supports storing of color information for each pixel (which can be useful for saving annotated images). A few different color spaces are supported (RGB, RGBA, BGR, BGRA, YUV and HSV). Previous versions of the Imaging Codec Pack didn't support RAW files with color information (see the left screenshot below). This new release supports the usage of the 24-bit RGB pixel format (see the right screenshot below).

|	FoilHole_FFT.raw EM Image		FoilHole_FFT.raw EM Image
		Width:	1264 pixels
		Height:	843 pixels
		Frame count:	1
		Bit depth:	24
Encoding settings:	Add text	Encoding settings:	RGB24
Size:	3,04 MB	Size:	3,04 MB
Date modified:	27-11-2015 10:17	Date modified:	27-11-2015 10:17
Date created:	31-1-2017 15:11	Date created:	31-1-2017 15:11

- **Added the Velox EMD data version to the file properties in Windows Explorer**

  The data version of Velox EMD files is displayed in the comments field of the file properties since this new release of the Imaging Codec Pack (see the screenshot of the Windows Explorer Details pane below).


- **Added the MRC version and mode to the file properties in Windows Explorer**

  The used MRC version and mode (pixel format) are displayed in the comments field of the file properties since this new release of the Imaging Codec Pack. The left screenshot below shows the properties of a file that is written according to the original MRC format specification. The right screenshot below shows the properties of a file that is written according to the new MRC2014 format specification (which also contains information about the writer of the file).
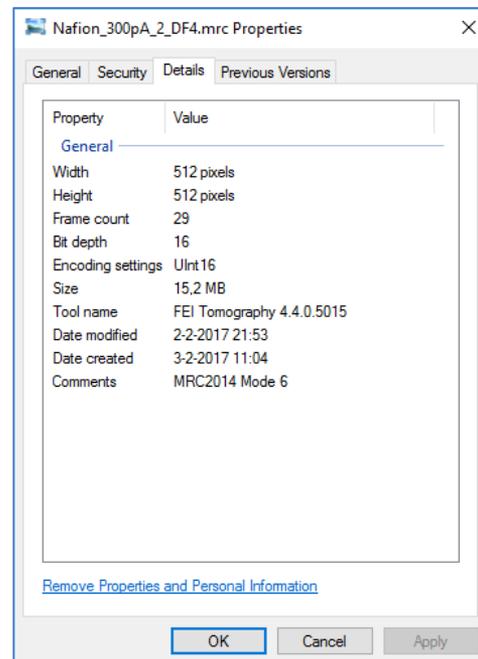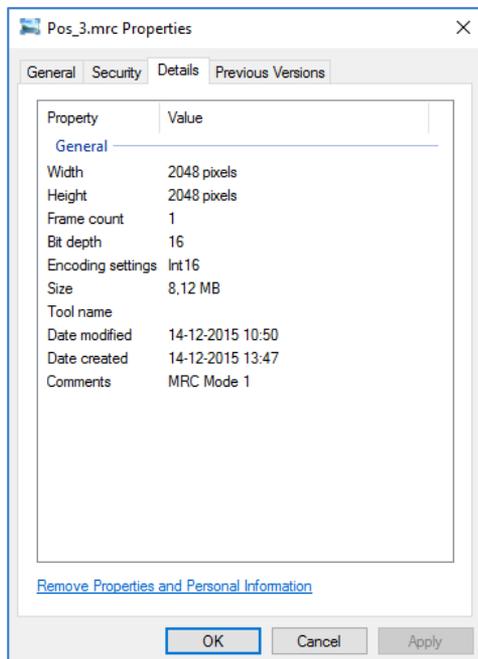
- **Fixed wrong RAW format implementation**

  The implementation of the RAW format that is used for the Falcon and Ceta cameras contained an error in previous versions of the Imaging Codec Pack. This was visible in the bottom line of some images when viewing them in actual size (see the left screenshot below). Some effort has been put in getting the format specification clear. This release of the Imaging Codec Pack should give a correct representation of the image (see the right screenshot below).
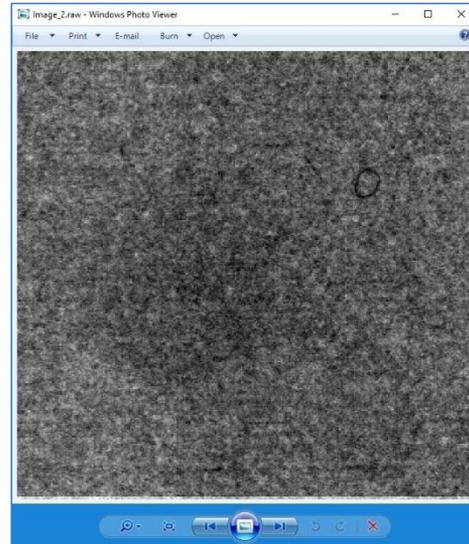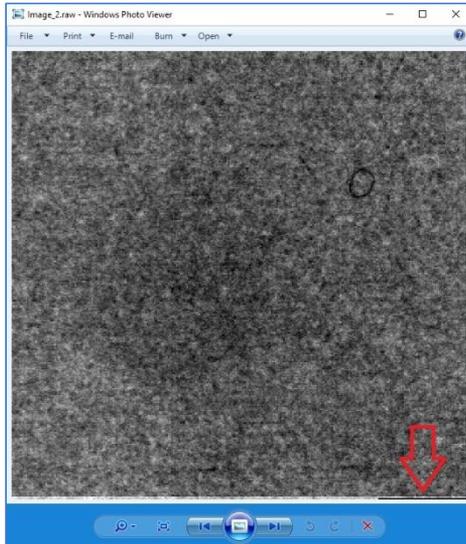
- **Solved a Windows shell integration conflict with Gatan Microscopy Suite**

  The Gatan Microscopy Suite integrates in the Windows shell in a similar way as the Imaging Codec Pack. However, different technologies are used, so some Windows shell functionality of the Gatan Microscopy Suite will behave differently when the Imaging Codec Pack is installed. For example; the Gatan Microscopy Suite allows direct pasting of DM3 and DM4 images in Microsoft Office documents. The Imaging Codec Pack also allows that but only via the option "Insert → Pictures". The direct way of pasting DM3 and DM4 images doesn't work anymore when the Imaging Codec Pack is installed together with the Gatan Microscopy Suite. This is fixed by <u>not</u> associating the Imaging Codec Pack with DM3 and DM4 files anymore when the Gatan Microscopy Suite is installed.

- **Improved performance when viewing directories with many Velox EMD files**

  The Imaging Codec Pack uses a third-party software library (HDF5) for reading Velox EMD files. Unfortunately, this library has some shortcomings which makes the thumbnail generation slower than for the other supported electron microscopy image formats. The most important limitations are the bad support for parallel accessing the library and the inability to directly read from a byte stream.
  Some users noticed that it can take a long time before thumbnails are visible when viewing a directory with many Velox EMD files. This issue is registered as #60286 in Velox. The root cause of this issue are the mentioned shortcomings of the used library which cannot easily be tackled. However, some attempt is made to improve the user experience in this use case. The following changes are made:

  o Velox EMD files larger than 512 MB are <u>not</u> supported anymore.

  o Thumbnail generation is <u>not</u> done when the Velox EMD file cannot be accessed within 1 second.

- **Improved support for Amira and Avizo files**

  A wider number of Amira and Avizo files is supported now. Compressed image data is still not supported.

3.8.0 – February 6, 2017

Small service update with the following new features and fixes:

- **Added support for the TIA EBN format**

  The TIA application can export images in the EBN format (extended header binary file for the TrueImage application). This new version of the Imaging Codec Pack has built-in support for these files. The screenshot below shows that Windows Explorer can now be transformed into a powerful EBN image viewer.
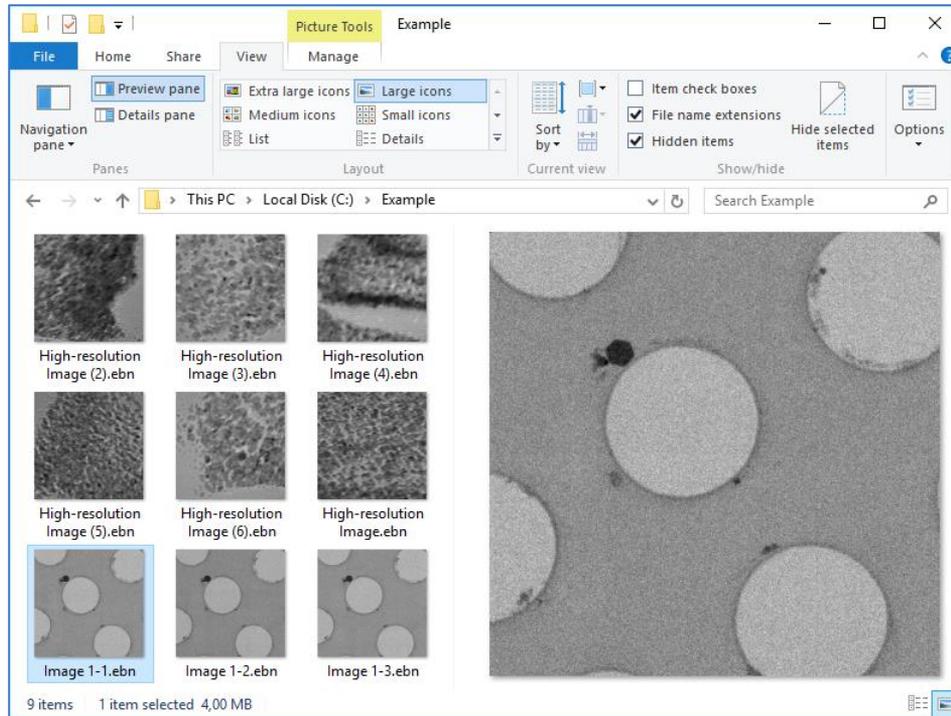

- **Fixed an exceptional issue that can shortly cause a large memory allocation**

  Previous version of the Imaging Codec Pack can try to allocate a huge amount of memory in very exceptional circumstances. Windows will quickly terminate the codec when this happens and users will not be able to view that specific file. This bug is thoroughly fixed in this new release of the Imaging Codec Pack.

- **Added support for the TIA BIN format**

  The TIA application can export images in the BIN format (small header binary file). This new version of the Imaging Codec Pack has built-in support for these files. However, this support has to be <u>manually</u> enabled after installation, since the extension ".bin" is often used for other binary data. Regular users of TIA BIN files can check Appendix J about how to enable this support. The TIA BIN files can also have the extension ".sbn". That extension is automatically supported after installation since it is not commonly used by other software.
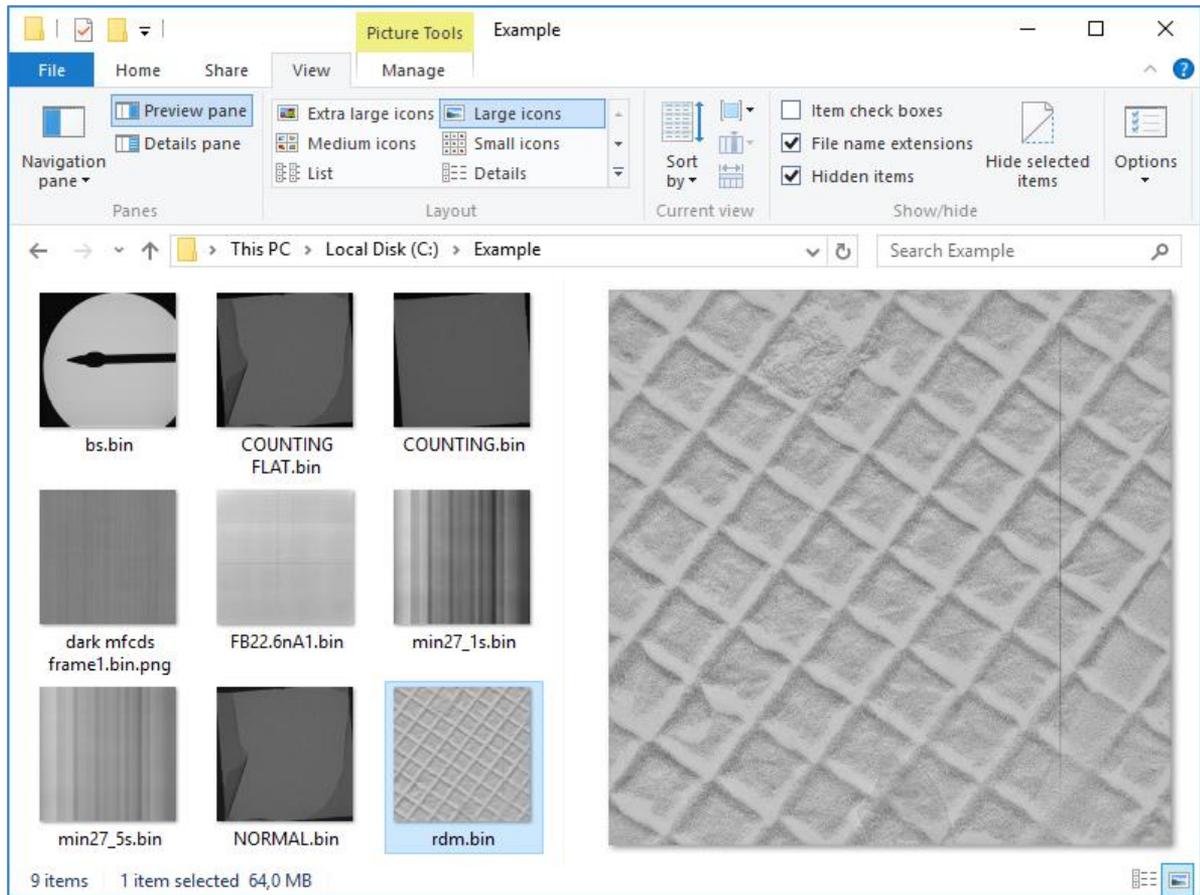
- **Added support for image stacks in Gatan Digital Micrograph files**

  Gatan Digital Micrograph files can contain multiple images and image stacks. Previous versions of the Imaging Codec Pack supported only the first frame of image stacks. This new version of the Imaging Codec Pack provides access to all frames of the image stacks that are present in the file. The screenshots below show the Windows Explorer details pane of a file with one thumbnail image and an image stack with 200 frames. The left screenshot is done with previous version of the Imaging Codec Pack and the right one is done with this new release.
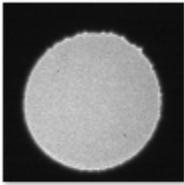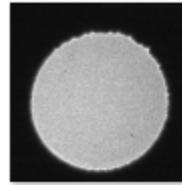

stack.dm4		stack.dm4	
EM Image		EM Image	
Width:	512 pixels	Width:	512 pixels
Height:	512 pixels	Height:	512 pixels
Frame count:	2	Frame count:	201
Bit depth:	32	Bit depth:	32
Encoding settings:	Int32	Encoding settings:	Int32
Size:	200 MB	Size:	200 MB
Tool name:	Gatan Digital Micrograph	Tool name:	Gatan Digital Micrograph
Date modified:	3-12-2016 18:18	Date modified:	3-12-2016 18:18
Date created:	2-1-2017 20:07	Date created:	2-1-2017 20:07

- **Fixed that images could not be displayed by some .NET client applications**

The Imaging Codec Pack can be used by application developers who want to support the electron microscopy image formats that are listed in the User Guide. Some functionality for getting the electron microscopy image as bitmap was not properly working for particular .NET code constructions. Windows Imaging Component clients written in C++ didn't experience this issue. This new release of the Imaging Codec Pack contains a C# / WPF example application that proves that this issue is fixed and that it's possible to make an electron microscopy image viewer within a few lines of code! See appendix 8 of the User Guide for more information. The left screenshot below shows the included example image viewer while the right screenshot below shows the amount of used C# code.
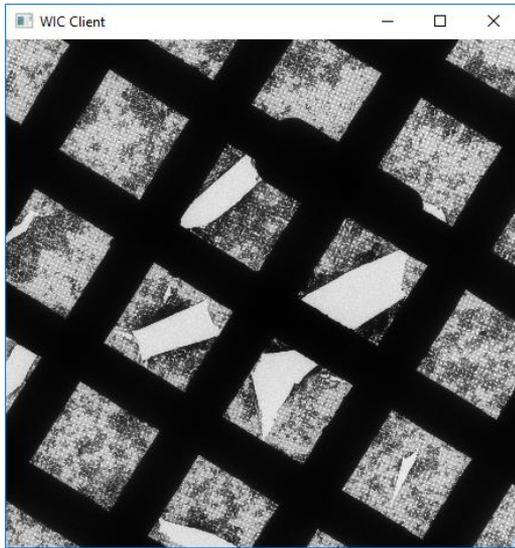

```csharp
using System.IO;
using System.Windows;
using System.Windows.Media.Imaging;

namespace WicClient
{
    public partial class MainWindow : Window
    {
        public MainWindow()
        {
            InitializeComponent();

            image.Source = LoadImage(@"<filename>");
        }

        private BitmapSource LoadImage(string filename, int frameIndex = 0)
        {
            using (var inFile = File.OpenRead(filename))
            {
                var decoder = BitmapDecoder.Create(inFile,
                    BitmapCreateOptions.None, BitmapCacheOption.None);
                return Convert(decoder.Frames[frameIndex]);
            }
        }

        private BitmapSource Convert(BitmapFrame frame)
        {
            int stride = frame.PixelWidth * (frame.Format.BitsPerPixel / 8);
            byte[] pixels = new byte[frame.PixelHeight * stride];

            frame.CopyPixels(pixels, stride, 0);

            var bmpSource = BitmapSource.Create(frame.PixelWidth, frame.PixelHeight,
                frame.DpiX, frame.DpiY, frame.Format, null, pixels, stride);

            return bmpSource;
        }
    }
}
```

- **Added basic metadata support for Windows Imaging Component clients**

The Windows Imaging Component (WIC) supports reading and writing of arbitrary metadata in image files, with the ability to preserve unrecognized metadata during editing. This new release of the Imaging Codec Pack offers basic support for reading metadata from the supported electron microscopy images. A simple C++ client example is included (See appendix 8 of the User Guide for more information). The C++ code fragment below gives a quick impression about how C++ WIC clients can read metadata.

```cpp
CComPtr<IWICBitmapFrameDecode> pFrame;
CComPtr<IWICMetadataQueryReader> pMetadataReader;

// Get the interface of the frame here...

pFrame->GetMetadataQueryReader( &pMetadataReader );

PROPVARIANT variant;
PropVariantInit( &variant );

pMetadataReader->GetMetadataByName( L"System.Image.BitDepth", &variant );
```

3.7.0 – December 5, 2016

Small service update with the following new features and fixes:

- **Performance improvements for Velox EMD files**

  This new version of the Imaging Codec Pack offers shorter loading times for Velox EMD files. There is also no longer data temporarily cached on disk when Velox EMD files are viewed. The maximum supported file size is increased from 1 GB to 4 GB. These improvements are also applicable for generic HDF5 files with images.

- **Added full support for .NET Windows Imaging Component (WIC) clients**

  Some functionality was already working in previous releases, but now can all WIC codec interfaces be used from .NET clients. Two C# example projects are part of this release (see appendix D).

  Reading electron microscopy images from .NET code has never been so easy!

```csharp
static void Main(string[] args)
{
    ConvertToPng("<filename of electron microscopy image>");
}

private static void ConvertToPng(string filename)
{
    using (var inFile = File.OpenRead(filename))
    {
        var decoder = BitmapDecoder.Create(inFile, BitmapCreateOptions.None,
            BitmapCacheOption.None);

        for (int i = 0; i < decoder.Frames.Count; i++)
        {
            var encoder = new PngBitmapEncoder();

            var frame = decoder.Frames[i];
            encoder.Frames.Add(frame);

            using (var outFile = File.OpenWrite(filename + "_" + i + ".png"))
            {
                encoder.Save(outFile);
            }
        }
    }
}
```

- **Added support for 32-bit Int images in Velox EMD files**

  The Velox EMD format is recently extended with support for the 32-bit Int pixel format. This pixel format is added for the new Ceta 2 camera. Previous versions of the FEI Imaging Codec Pack didn't support this pixel format in Velox EMD files (see the left screenshot below). This new version of the FEI Imaging Codec Pack has full support for it (see the right screenshot below).

- **Fixed an auto brightness/contrast issue with a small number of annotated Digital Micrograph images**

  The second frame in a small number of Digital Micrograph files looked heavily overexposed in previous version of the Imaging Codec Pack. Theoretically this issue can occur with every supported image format that use pixel formats of 32-bit and greater. However, in practice this bug was only seen with a few Gatan Digital Micrograph images. The left screenshot below shows the second frame with previous version of the Imaging Codec Pack. The right screenshot below shows the second frame with this new version of the Imaging Codec Pack.
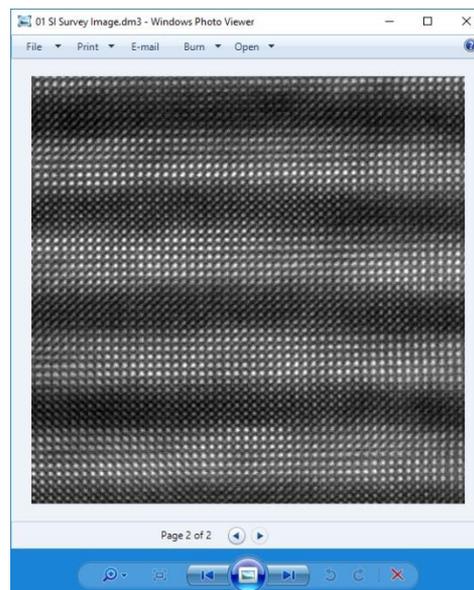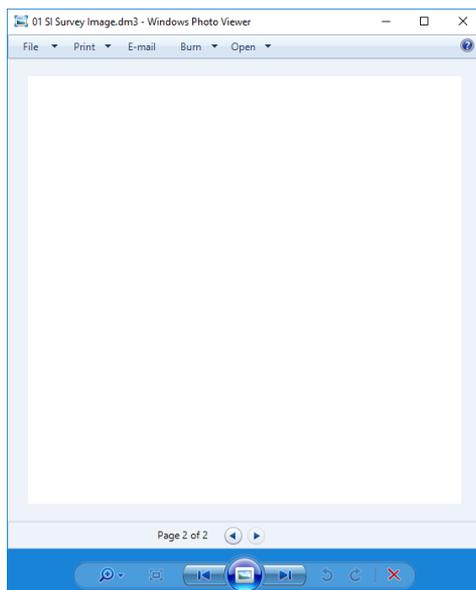
- **Improved support for Amira and Avizo files**

  A wider number of Amira and Avizo files is supported now. Compressed image data is still not supported.
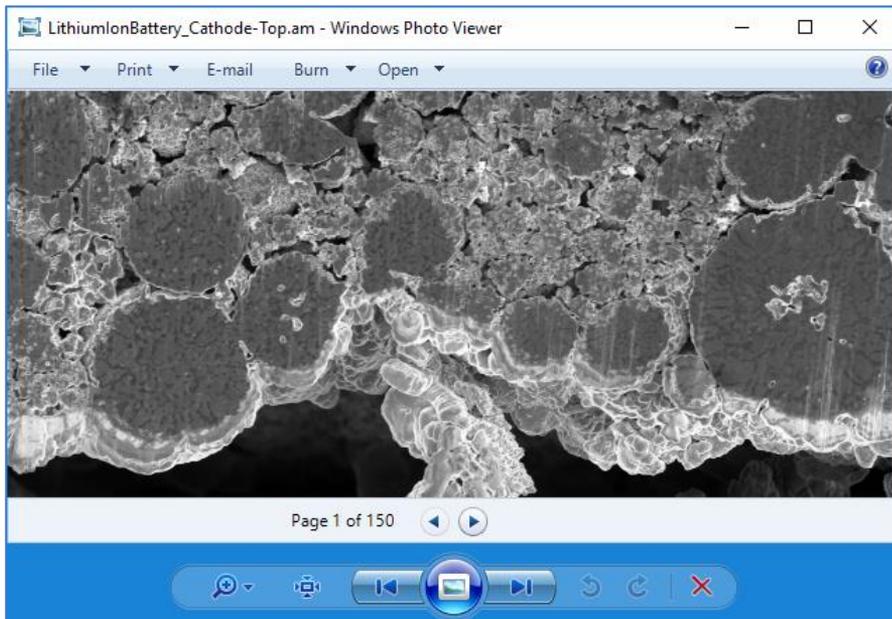
- **Fixed that the 'Save As' functionality did not work for some images**

  The used Microsoft Windows infrastructure expects that bitmap lines are aligned to 4-byte boundaries. For most of the electron microscopy images is that the case (since the image width is often a multiple of four). However, in other situations did the 'Save As' functionality produce a corrupted file (see the left image below). This new version of the Imaging Codec Pack will save all image sizes correctly (see the right image below).

- **Added support for Windows Server 2016**

  The Imaging Codec Pack can also be used on the just released Windows Server 2016. For example, to generate thumbnails for web services. See appendix 2 of the User Guide for more information.

- **Added support for corrupted MRC image stacks with zero frames defined in the header**

    Some applications write first the frames to an MRC file and update later the number of frames in the header (because they don't always know on forehand how many frames will be written). It can happen that the application crashes before the MRC header is updated with the number of frames that is actually written to the file. Previous versions of the Imaging Codec Pack could not open MRC files with a frame count of zero in the header. This new version of the Imaging Codec Pack will check how many frames are actually present in the MRC file, so even this kind of MRC files can be viewed.

- **Added support for the non-standard MRC mode 101**

    SerialEM has introduced the non-standard MRC mode 101 for 4-bit counted data of the Gatan K2 camera. This new release of the Imaging Codec Pack has full support for this unofficial extension to the MRC format specification. This new mode is proposed as official extension on August 2015:

    http://www.ccpem.ac.uk/mrc_format/mrc_proposals.php

    Please note that earlier versions of the Imaging Codec Pack already supported 4-bit MRC files from SerialEM which were saved as mode 0 (8-bit) with half of the image width.

    SerialEM_mode_101.mrc
    EM Image
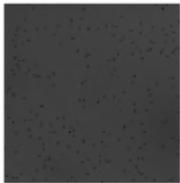
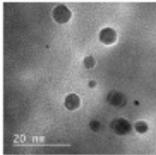 | | |
    |---|---|
    | Width: | 3710 pixels |
    | Height: | 3838 pixels |
    | Frame count: | 1 |
    | Bit depth: | 4 |
    | Encoding settings: | UInt4 |
    | Size: | 6,79 MB |
    | Tool name: | SerialEM |
    | Date modified: | 12-11-2016 10:26 |
    | Date created: | 12-11-2016 11:51 |

- **Improved image property displaying in Windows Explorer for Digital Micrograph files**

  The image properties that are shown in Windows Explorer are always the properties of the first image in the file (that is also used as thumbnail image). Gatan Digital Micrograph files contain usually a small colored thumbnail image that is also used by the Imaging Codec Pack as default thumbnail image.
  Previous versions of the Imaging Codec Pack always show the image properties of the colored thumbnail image in Windows Explorer (see the left screenshot below of the Windows Explorer details pane). However, most users are more interested in the properties of the image on which this thumbnail is generated. This new version of the Imaging Codec Pack shows the image properties of the first normal image in Digital Micrograph files (see the right screenshot below).

PtSalt_30degO2N2__0005.dm4		PtSalt_30degO2N2__0005.dm4	
EM Image		EM Image	
Width:	384 pixels	Width:	2048 pixels
Height:	384 pixels	Height:	2048 pixels
Frame count:	2	Frame count:	2
Bit depth:	32	Bit depth:	32
Encoding settings:	RGBA32	Encoding settings:	Int32
Size:	16,5 MB	Size:	16,5 MB
Tool name:	Gatan Digital Micrograph	Tool name:	Gatan Digital Micrograph
Date modified:	20-9-2016 17:33	Date modified:	20-9-2016 17:33
Date created:	31-10-2016 17:49	Date created:	31-10-2016 17:41
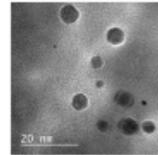
3.6.0 – September 19, 2016

Small service update with the following new features and fixes:

- **Added support for the Amira format**

  This version of the Imaging Codec Pack has experimental support for Amira output files with the extension ".am". Currently only non-compressed image data is supported. See section 1.1 of the User Guide for the supported pixel formats.
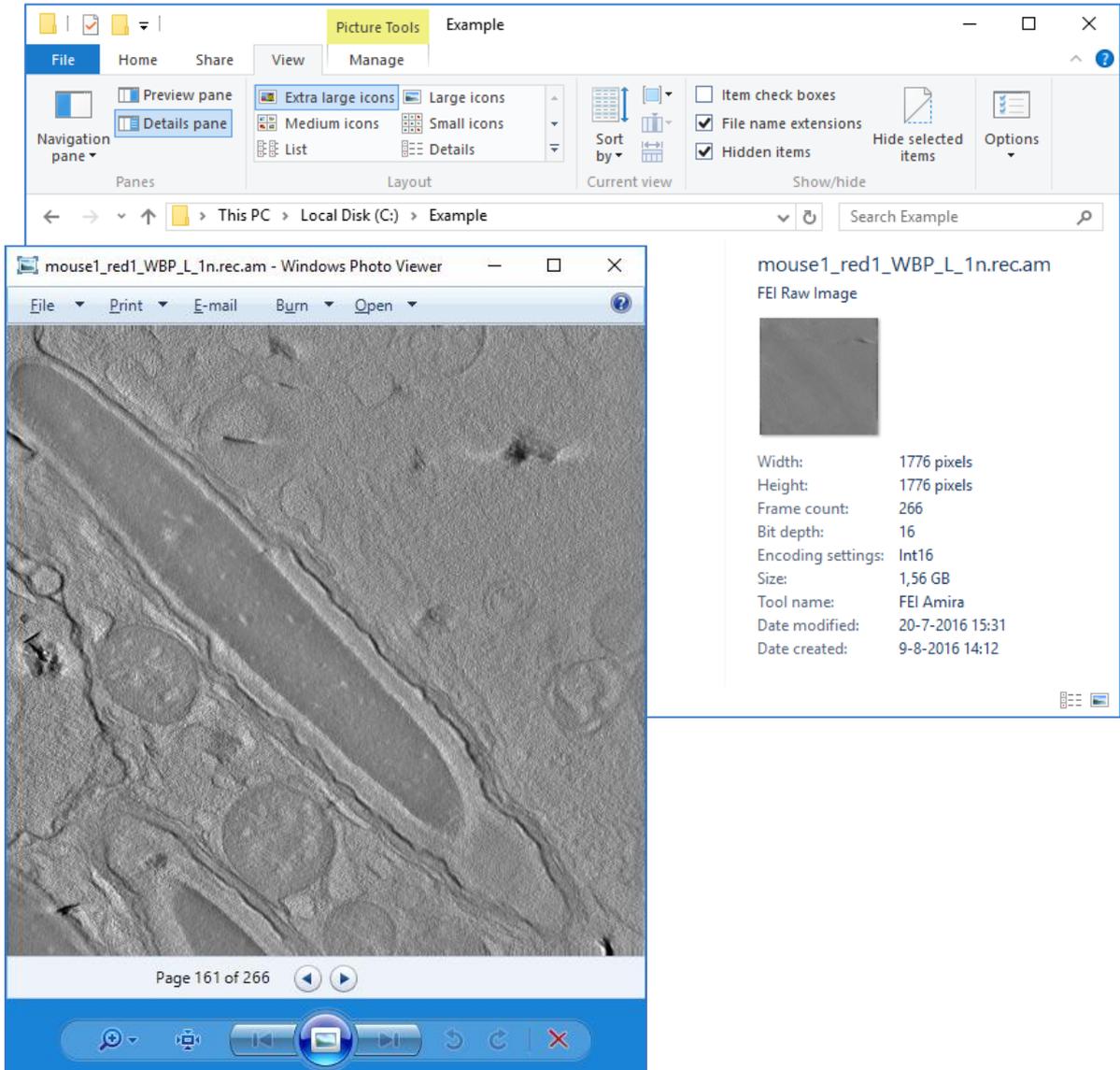
- **Added support for the Avizo format**

  This version of the Imaging Codec Pack has experimental support for Avizo output files with the extension ".rec". Currently only non-compressed image data is supported. See section 1.1 of the User Guide for the supported pixel formats.
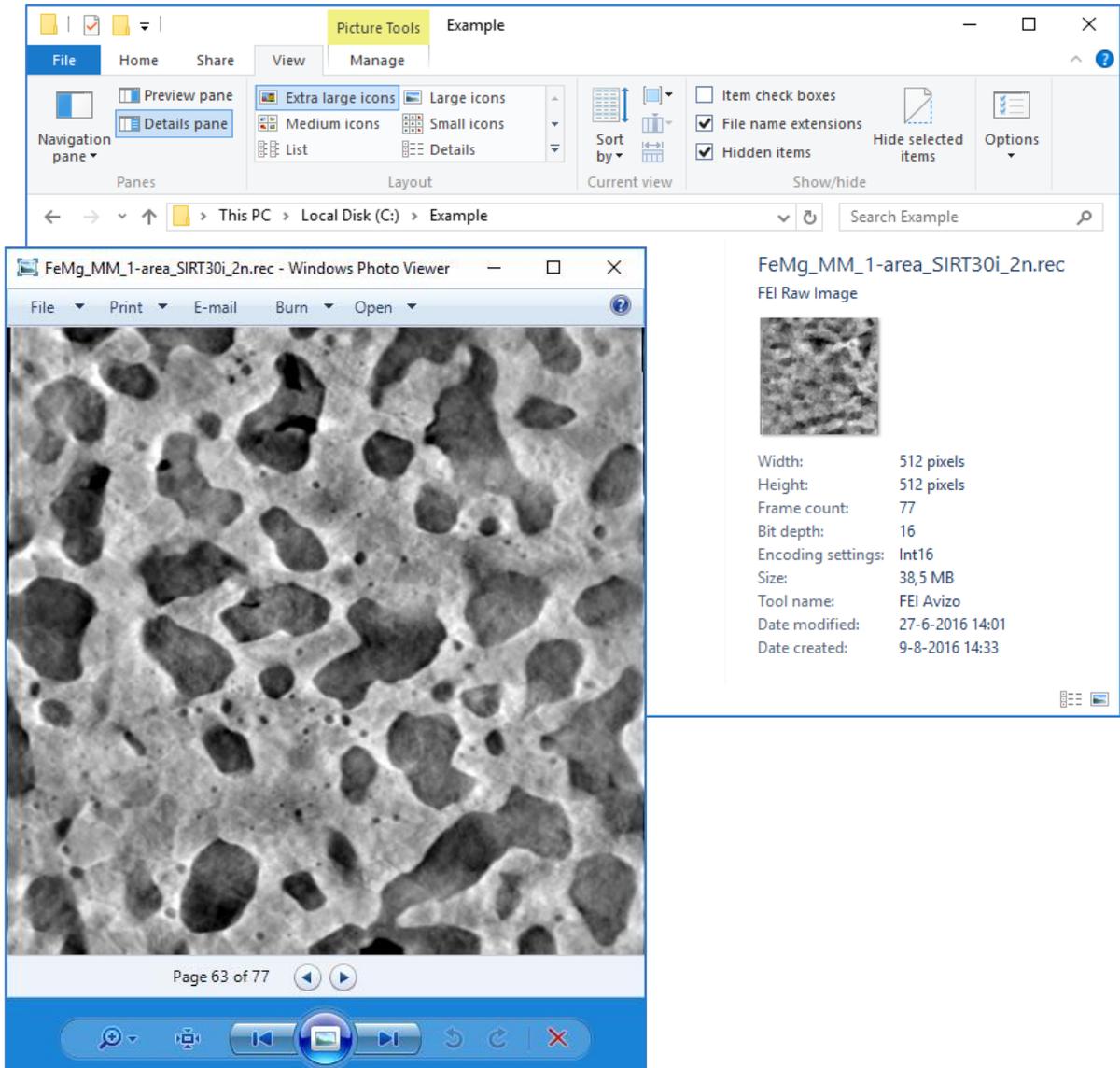
- **Reduced installer size**

  The installer size of previous version of the Imaging Codec Pack was 14.9 MB. Till version 3.3.0, the installer size was below the 10 MB which is commonly used as maximum size for e-mail attachments. It was possible to bring the installer size back to 8.8 MB for this new release of the Imaging Codec Pack (without losing functionality).

- **Some performance optimizations**

  This version of the Imaging Codec Pack has reduced loading times for some image format – pixel format combinations. Images that use the Int32 pixel format will have the most noticeable improvement.

- **Name change**

  The original name of this software solution (Camera Image Preview Pack) is changed into Imaging Codec Pack. The new name hopefully better reflects that this software comes in the form of an imaging codec and that the format support is not limited to raw camera images only (also the most important data formats from our applications are supported).

- **Windows 10: The Windows Photo Viewer is restored as available image viewer for all image formats**

  The Windows Photo Viewer is still present in Windows 10. The Imaging Codec Pack sets it for example as default viewer for electron microscopy specific raw image formats during installation. However, Microsoft tries to hide it as available viewer for standard image formats (like; bmp, jpeg, png) on clean Windows 10 installations. This new version of the Imaging Codec Pack makes the Windows Photo Viewer available again in the Windows 10 operating system.

Note	**This is not applicable to Windows 7 or systems that are upgraded to Windows 10.**

  The left screenshot on the top of next page shows that on a clean Windows 10 installation the Windows Photo Viewer cannot be set as default viewer for bitmap files. The right screenshot on the top of next page shows that this functionality is back after installing the Imaging Codec Pack.
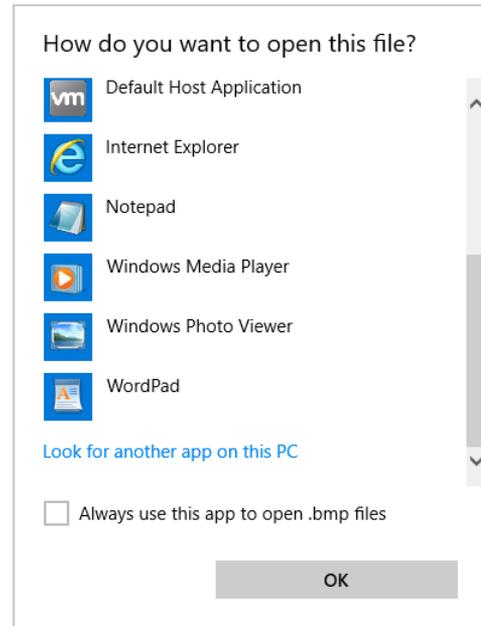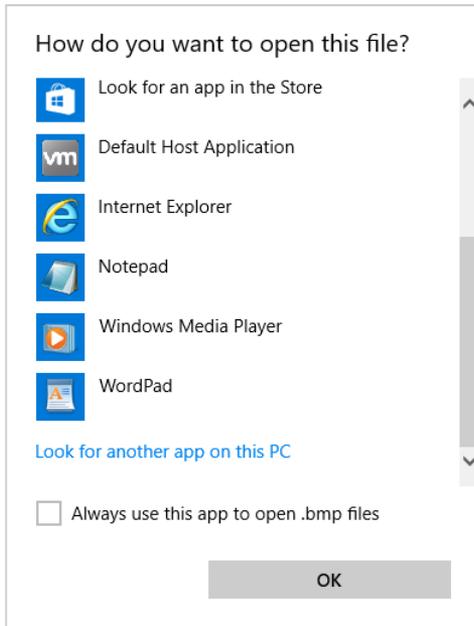
- **Added bookmarks and thumbnails to the Release Notes / User Manual document**

    The combined release notes / user manual document is getting quite comprehensive. This updated version supports bookmarks and thumbnails for easier navigation.
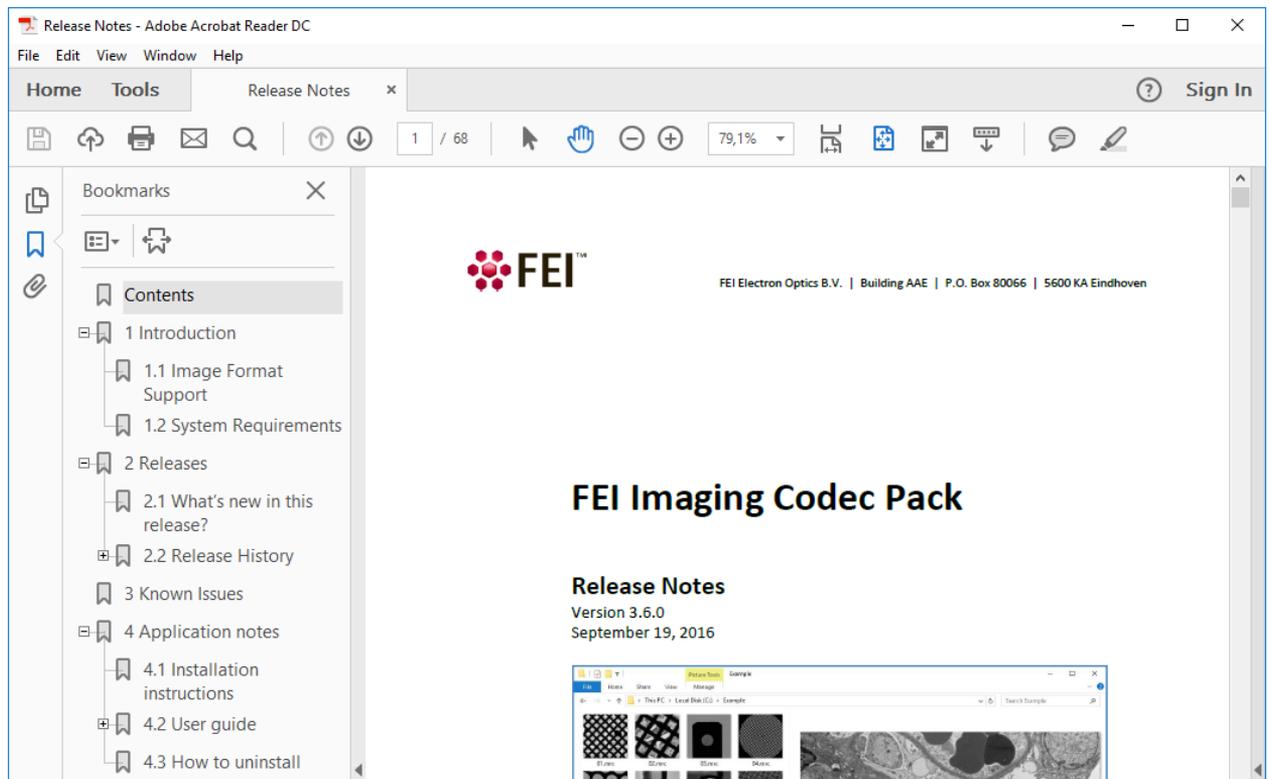
3.5.0 – July 4, 2016

Small service update with the following new features and fixes:

- **The creator application (including version number) is now shown as file property in Windows Explorer**

The Camera Image Preview Pack will now fill-in the creator application file property for the supported raw image formats. The version number of the creator application is also included when that one is available. This new feature will only work for new file formats that support this functionality, like: MRC2014 (EPU and Tomography) and the latest Velox EMD data format.

Note	**This property is known as "System.Media.CreatorApplication" in the Windows Property System. Windows Explorer displays it as "Tool name".**
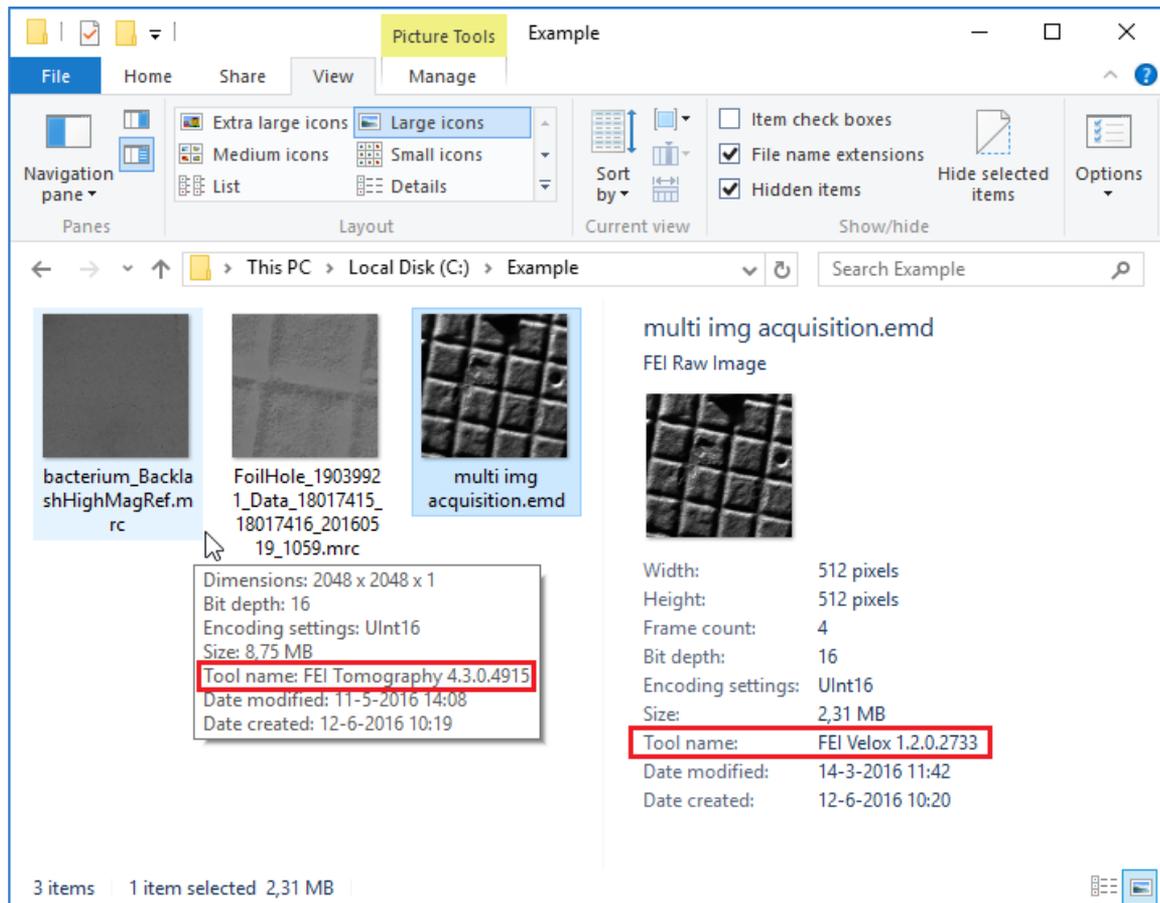
- **The pixel format is now shown as file property in Windows Explorer**

  The Camera Image Preview Pack will now fill-in the pixel format file property for the supported raw image formats. If big endian byte ordering is used, then it will also be displayed.

Note	**This property is known as "System.Media.EncodingSettings" in the Windows Property System. Windows Explorer displays it as "Encoding settings".**
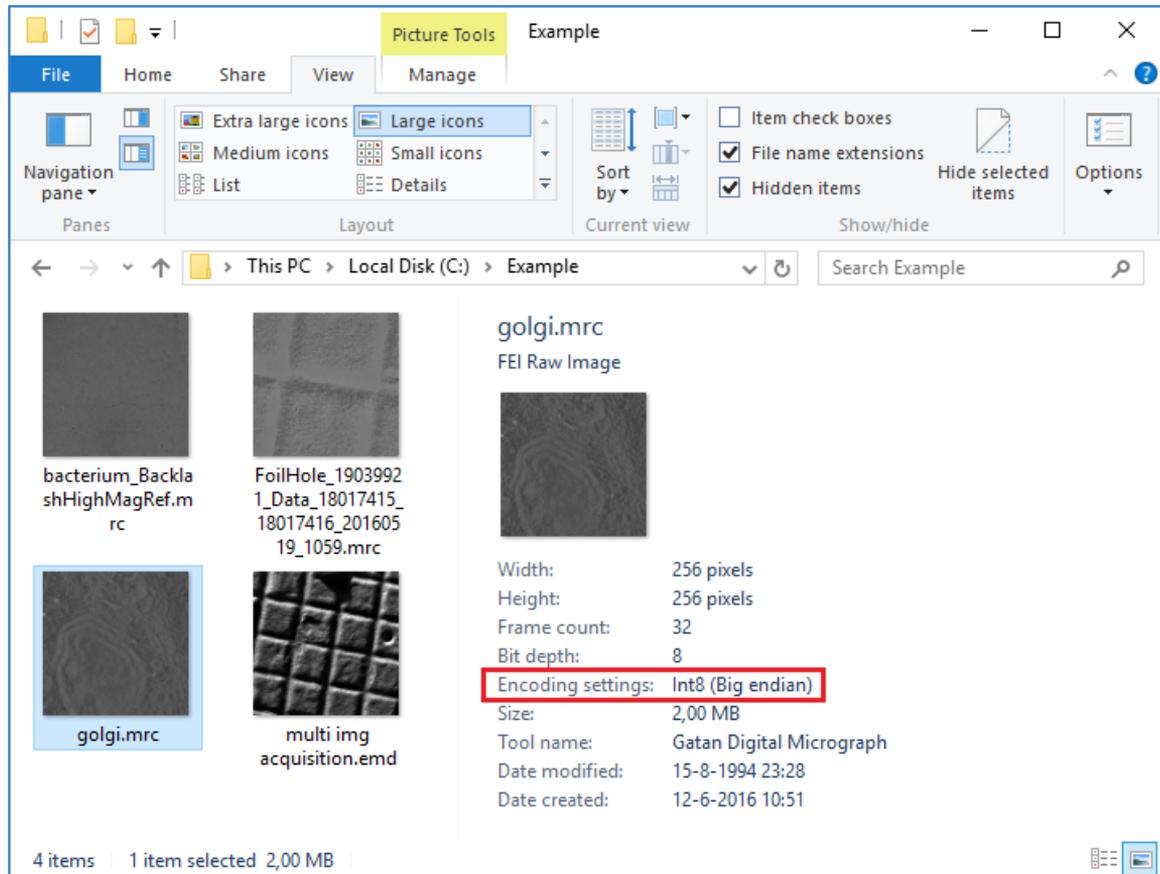
- **Fixed issue with "Save As" to TIFF and PNG**

  The Camera Image Preview Pack can convert the supported raw image formats into bitmap, jpeg, png and tiff images. This can be done by right-clicking on a supported raw image file and by choosing the "Save As…" option in the context menu (see section 2.3.1 of the User Guide). In previous versions of the Camera Image Preview Pack were images always saved as tiff with the extension png when tiff or png was chosen as export file format. The "Save As…" option worked properly for the bitmap and jpeg formats. This problem is fixed in this new version of the Camera Image Preview Pack.

3.4.0 – May 11, 2016

Small service update with the following new features and fixes:

- **Added support for directly inserting raw images into Microsoft Office documents**

  The supported raw image formats (see section 1.1 of the User Guide) can directly be inserted into Microsoft Office documents when the Camera Image Preview Pack is installed. See section 2.3.3 of the User Guide for more information.
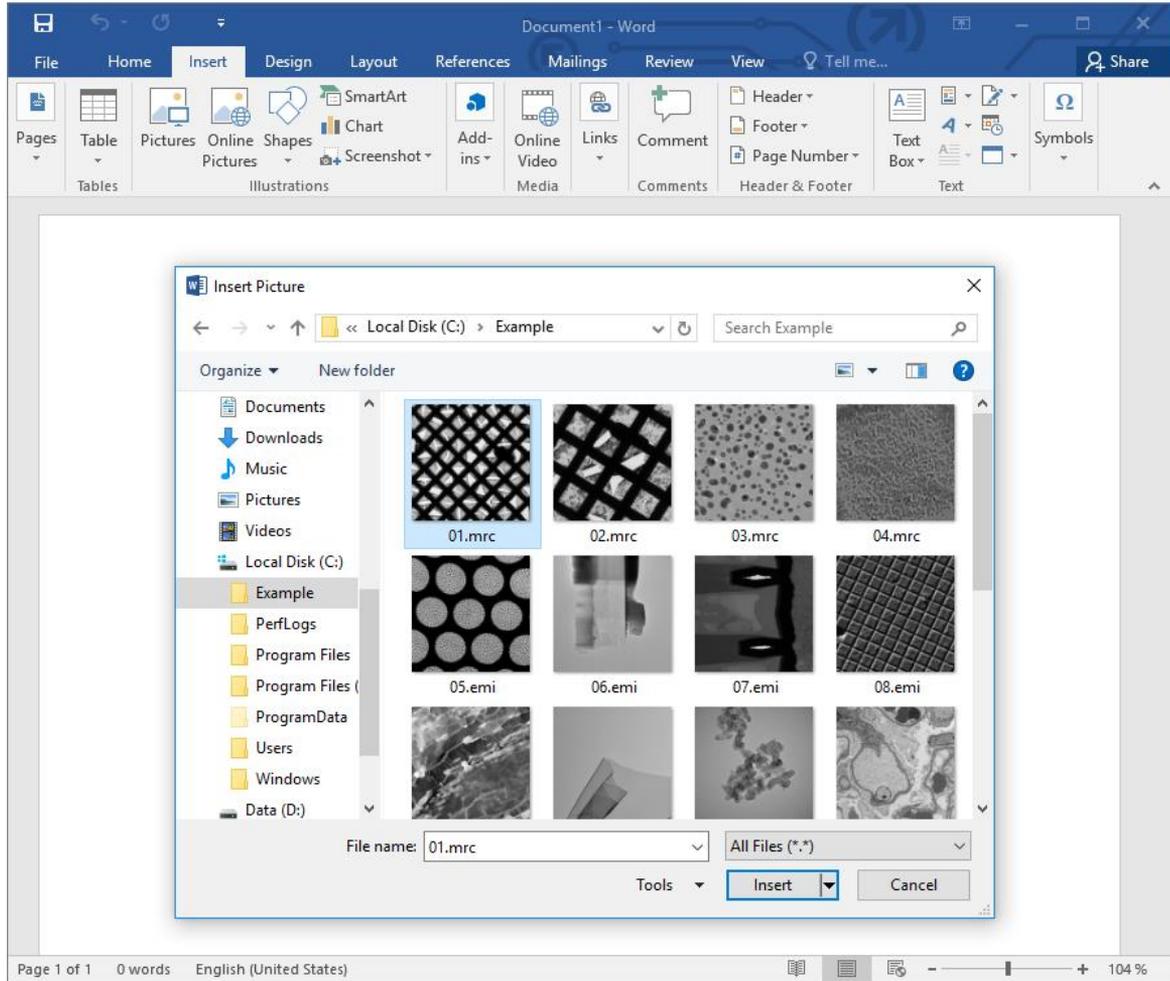
- **Added support for 4-bits UInt 'counted' MRC files**

  Counted images from the Gatan K2 Direct Detection camera can be saved by some software as non-standard 4-bit UInt MRC files. MRC Viewers like Fiji/ImageJ and previous versions of the Camera Image Preview Pack can display these files but the images will look deformed (see the left screenshot below). This new version of the Camera Image Preview Pack supports these files in a proper way (see the right screenshot below).
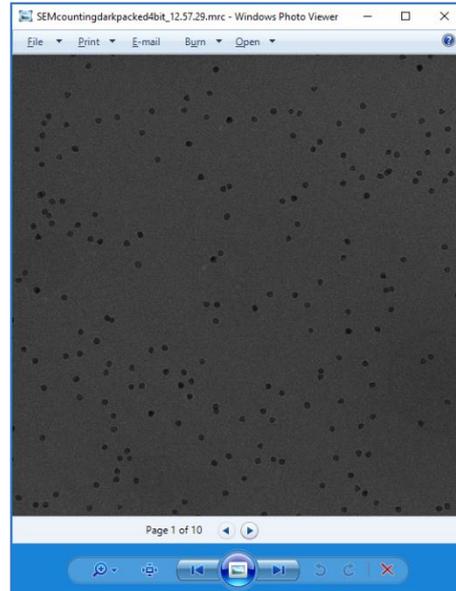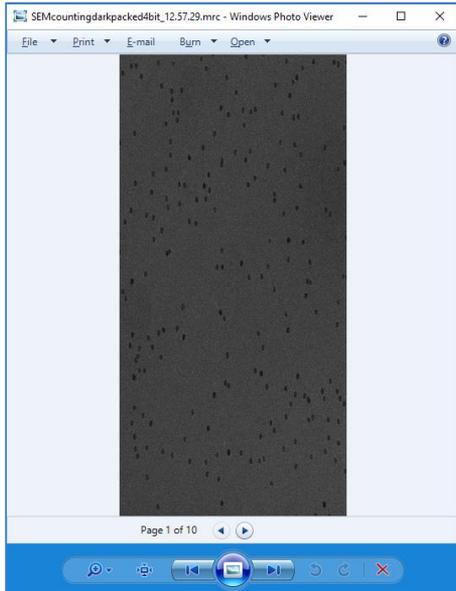

- **Improved auto brightness/contrast algorithm**

  The auto brightness/contrast algorithm didn't work well on a very small number of images (see the left screenshot below). This new release of the Camera Image Preview Pack has an improved algorithm which solves this issue (see the right screenshot below).
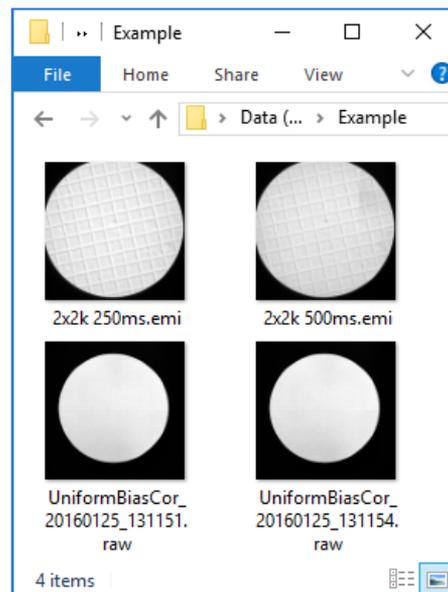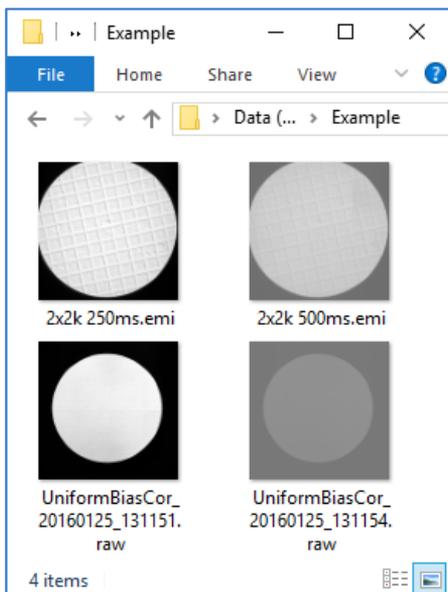
- **Added support for 24-bit RGB (type 16) MRC files**

  Some applications (like IMOD) can save color images as nonstandard (type 16) MRC files. This new release of the Camera Image Preview Pack supports these files.
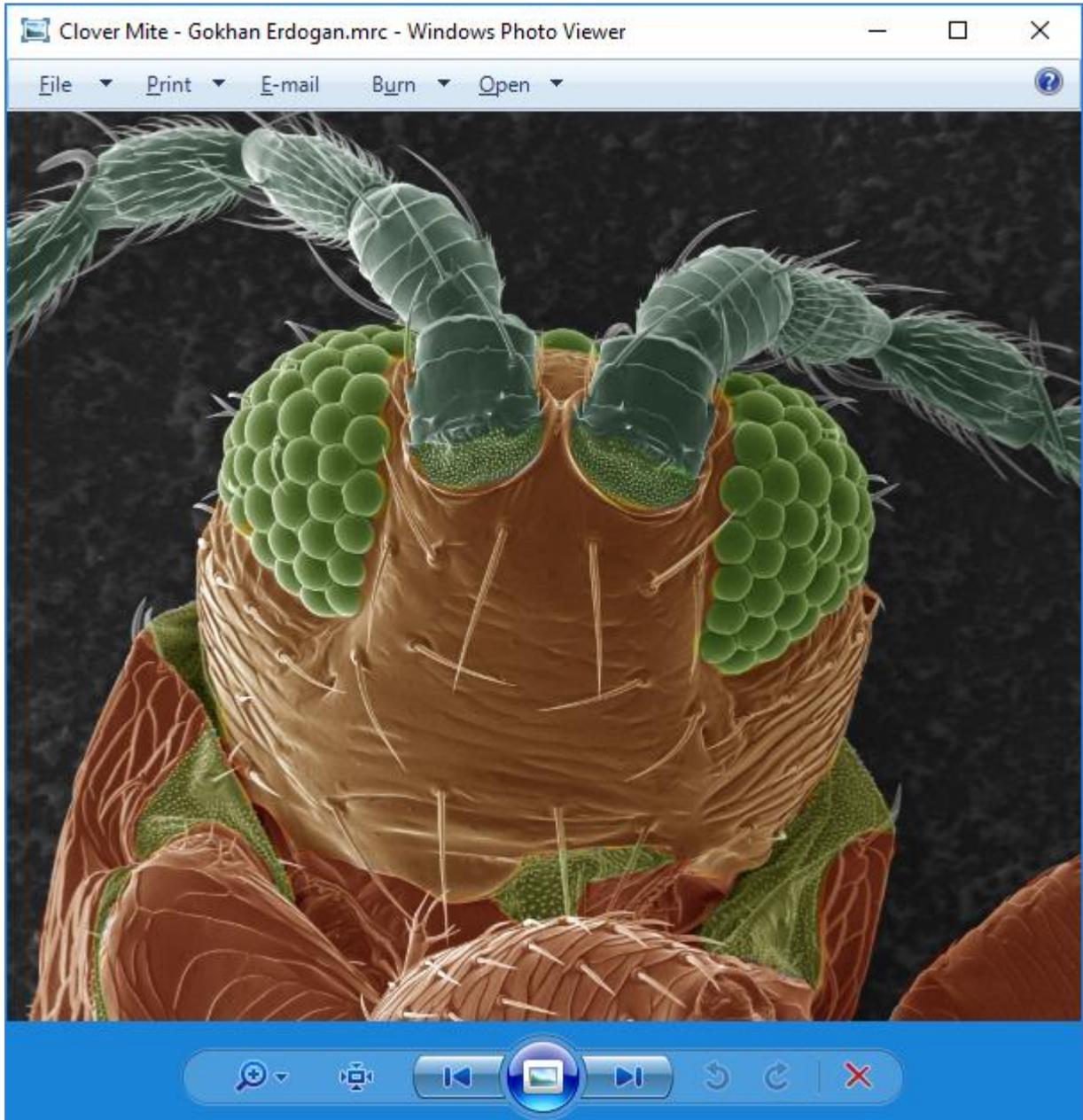
- **Added support for 8-bit Int (type 1) RAW images**

 This variant is not in use yet, but support is added for completeness.

- **Added support for all TIA SER pixel formats that were not supported yet**

  Support for the following TIA series data (SER) pixel formats has been added to this new version of the Camera Image Preview Pack:

  - 8-bit UInt (type 1)

  - 32-bit UInt (type 3)

  - 8-bit Int (type 4)

  - 64-bit Float (type 8)

  - 64-bit Complex (type 9)

  - 128-bit Complex (type 10)

- **Fixed displaying issues with some 16-bit Int (type 1) RAW images**

  Some 16-bit Int RAW images are not correctly displayed with earlier version of the Camera Image Preview Pack (see the left screenshot below). The right screenshot below shows that this issue is fixed in this new release of the Camera Image Preview Pack.
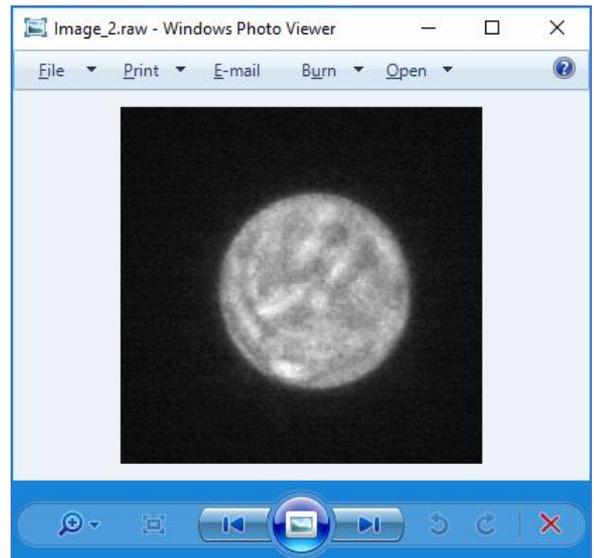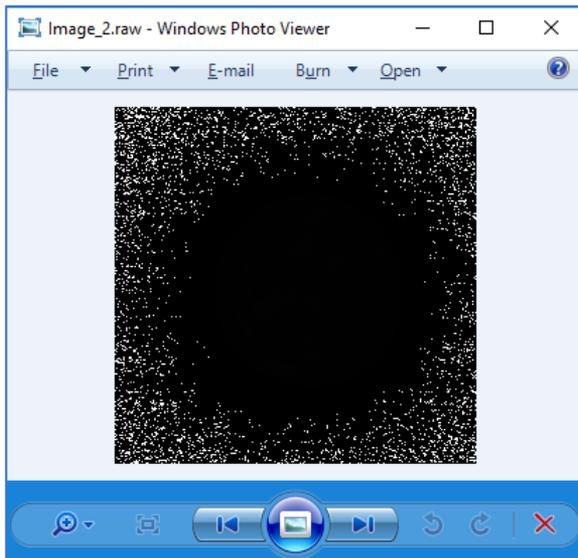
- **Fixed the support for viewing the first frame of image series in Velox EMD files**

  The last release of the Camera Image Preview Pack contained a new feature for viewing the first frame of image series in Velox EMD files. However, the format of the Velox EMD files changed just after that release, so it was in practice still not possible to get a proper preview (see the left screenshot below). This new version of the Camera Image Preview Pack supports the latest Velox data format, so this feature works again (see the right screenshot below).
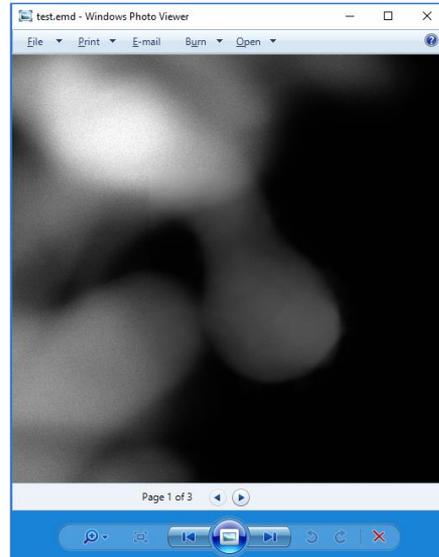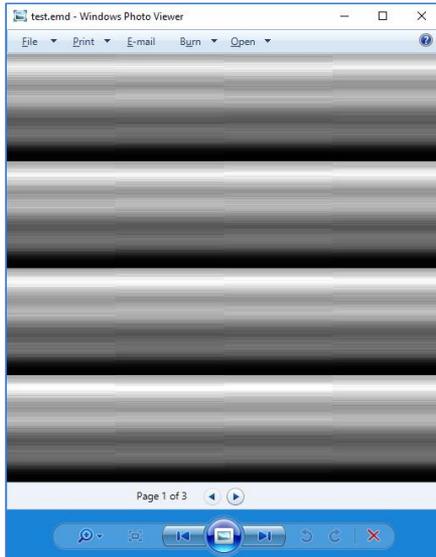

- **Added support for 8-bit UInt (type 6) Gatan Digital Micrograph images**

  The 8-bit UInt pixel format is rarely used for Gatan Digital Micrograph images. Support is added because some real life examples popped up on the grid. The left screenshot below shows the lack of support in previous versions of the Camera Image Preview Pack. The right screenshot below shows that these files are now properly supported.
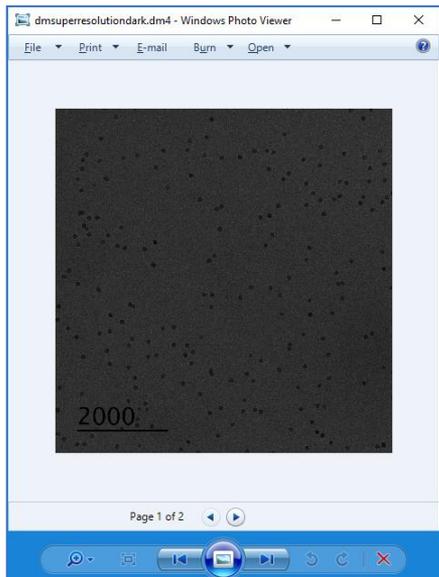
- **Added support for RAW files with wrong bits per pixel in the header**

  A small number of RAW files has a wrong number of bits per pixel in their header. Typically, 10 bits per pixel is specified while the file is actually written with 16 bits per pixel. Previous versions of the Camera Image Preview Pack could not detect this and displayed these images in a wrong way (see the left screenshot below). This new release of the Camera Image Preview Pack can detect this wrong information in the header and displays the images in a correct way (see the right screenshot below).
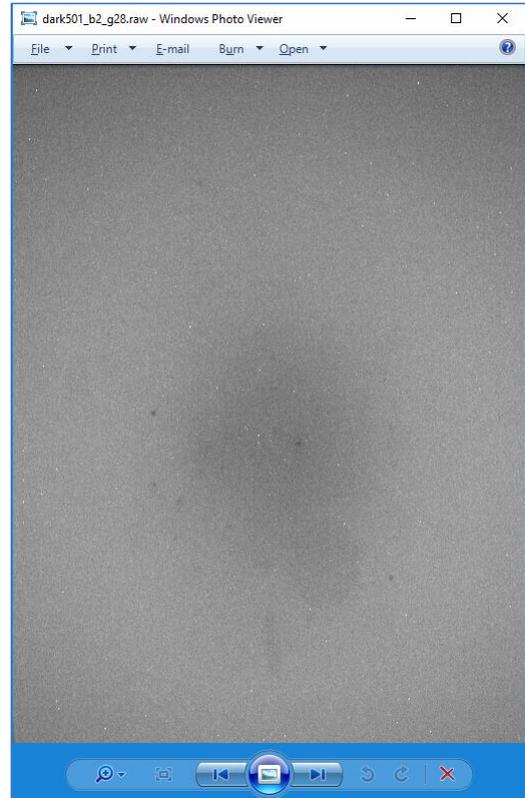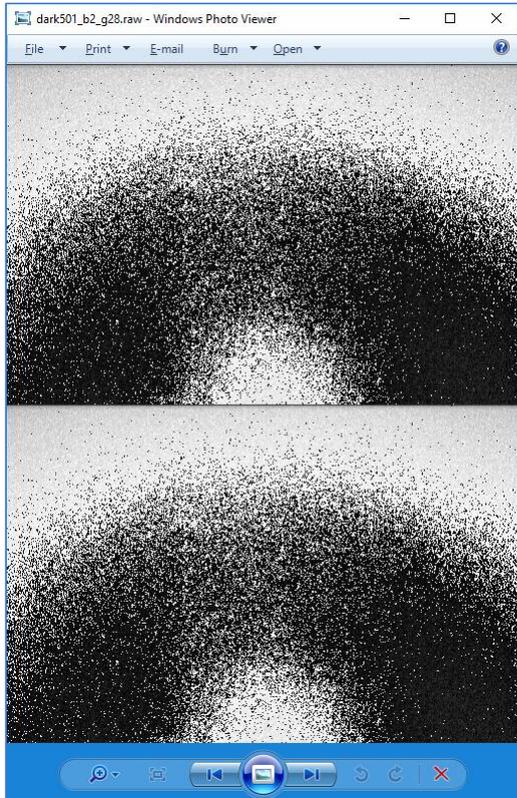
3.3.0 – March 7, 2016

Small service update with the following new features and fixes:

- **Added support for the thumbnail image in Gatan Digital Micrograph files**

Gatan Digital Micrograph files (*.DM3 and *.DM4) often contain a colored thumbnail image. This new version of the Camera Image Preview Pack can read these images and uses them as Windows thumbnail image. The resolution of these thumbnail images is quite low, but they give some impression about what is in the file.
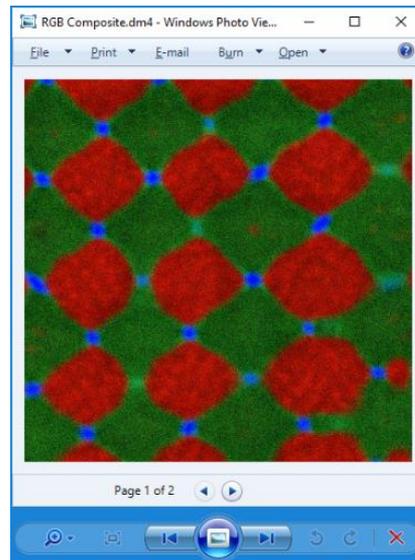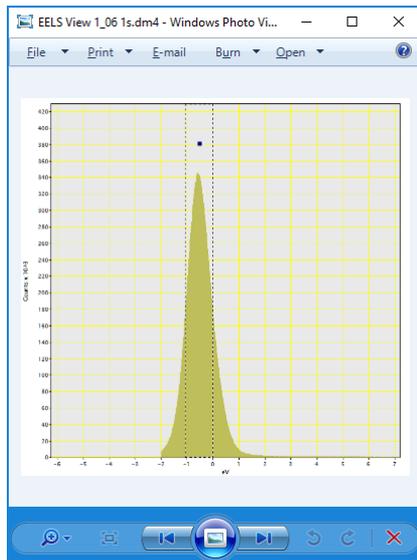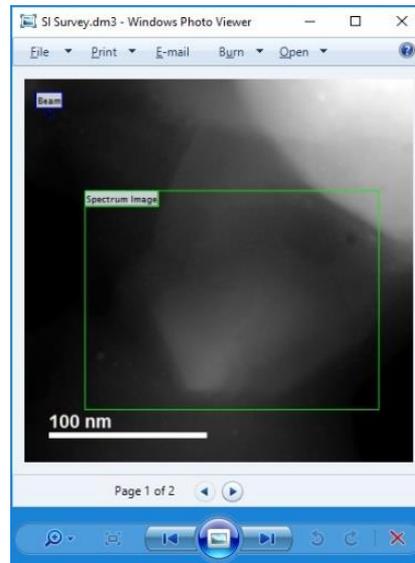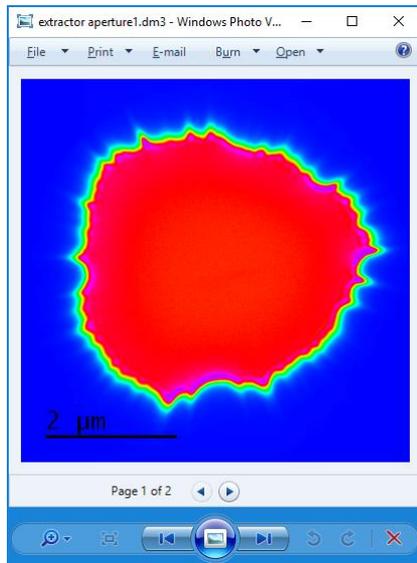
- **Added support for viewing the first frame of image series in Velox EMD files**

 Velox EMD files can contain image series (see the screenshot below).
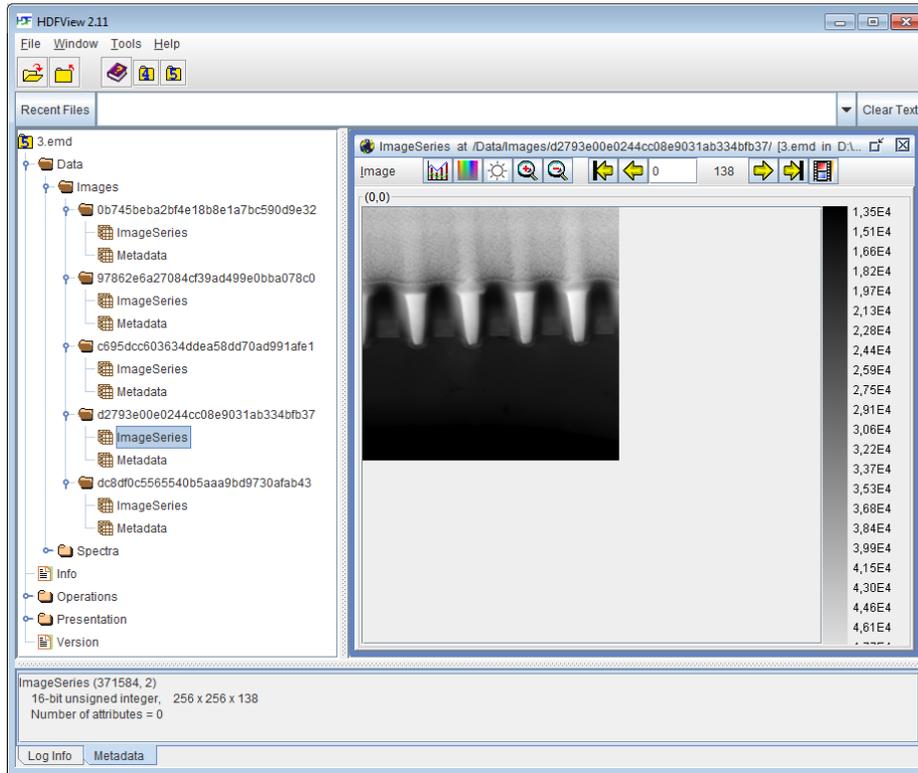
  These image series were skipped in previous versions of the Camera Image Preview Pack (see the number of frames in the left image below). This new release supports viewing the first frame of image series (see the number of frames in the right image below).

- **Added support for 16-bit Int (type 5) TIA SER images**

  The 16-bit Int pixel format is rarely used for TIA SER images. Support is added because some real-life examples popped up on the grid. The left image below shows the lack of support in previous versions of the Camera Image Preview Pack. The right image below shows that these files are now properly supported.
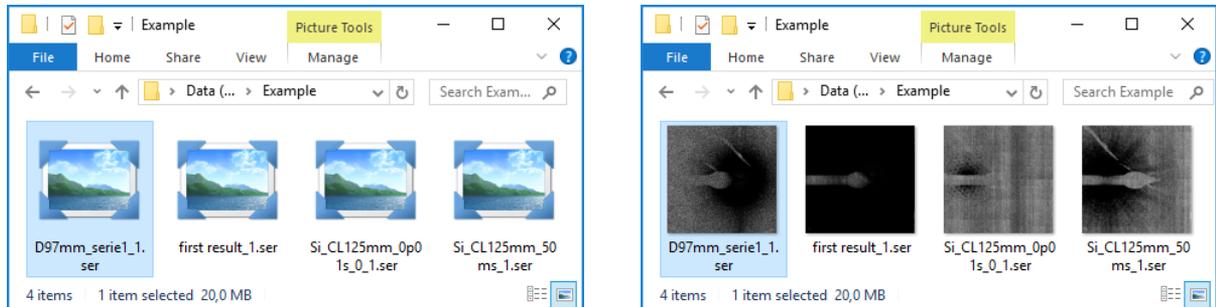
- **Added support for all Python NumPy pixel formats that were not supported yet**

  Support for the following Python NumPy pixel formats has been added to this new version of the Camera Image Preview Pack:

    o 8-bit Int

    o 16-bit Int

    o 32-bit UInt

    o 64-bit complex numbers

  See appendix 6 of the User Guide for more information.

- **Added support for Windows Server 2012 R2**

  The Camera Image Preview Pack supports now officially the 64-bits version of Microsoft Windows Server 2012 R2. See appendix 1 of the User Guide for instructions on how to set up Windows Server for the Camera Image Preview Pack.

3.2.0 – January 11, 2016

Small service update with the following new features and fixes:

- **Significantly reduced loading times for Velox EMD files with many images**

  Some refactoring was done to speed up the loading time of Velox EMD files in Windows Photo Viewer. The performance gain is especially impressive for EMD files that contain tens of images (see the table below).

Resolution (pixels)	Number of images in file	Version 3.1.0 (relative loading time)	Version 3.2.0 (relative loading time)
256	1494	100	24
512	31	100	3
1k	4	100	60
2k	2	100	76
2k	4	100	68
4k	4	100	52

- **Added support for generic HDF5 files**

  Velox EMD files are based on HDF5 technology. Until last release, the Camera Image Preview Pack did only support Velox specific HDF5 data structures. Some refactoring was done to support all file formats based on HDF5 technology. This means that the Camera Image Preview Pack can now be used outside the electron microscopy domain (for example by organizations as NASA and CERN who also use HDF5 as storage technology). The support for different pixel formats is still limited (see section 1.1 of the User Guide), but this can easily be extended when more real-life examples become available.

- **Added file associations for *.h5 and *.hdf files**

  The Camera Image Preview Pack supports now generic HDF5 files (see previous item). It already had a file association with the Velox *.emd extension. This new release also makes file associations with the standard HDF5 extensions *.h5 and *.hdf.

- **Added support for 24-bit RGB images in HDF5 files**

  This new release of the Camera Image Preview Pack has support for colored images in HDF5 files. Currently only 24-bit RGB images that use pixel interlacing or scan-plane interlacing are supported. Scan-line interlacing and the usage of color palettes are not supported, but this can easily be added in the future. The screenshots below show an example HDF5 file from the HDF5 SDK. This development is done to support future extensions of the Velox EMD format, like the storage of screenshots in Velox EMD files.
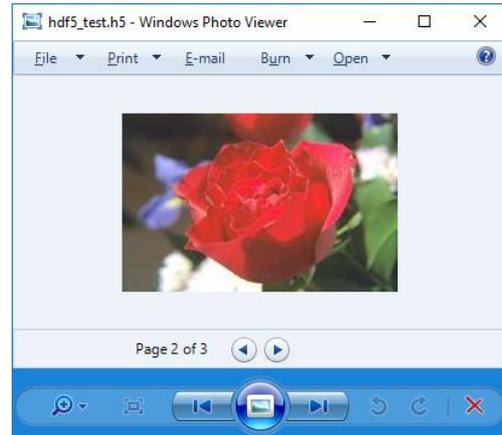

- **Improved robustness for corrupted Velox EMD files**

  The previous version of the Camera Image Preview Pack could crash when a single image in a Velox EMD file could not be read. This issue is solved in this new release. The screenshot below shows the structure of such file in HDFView.
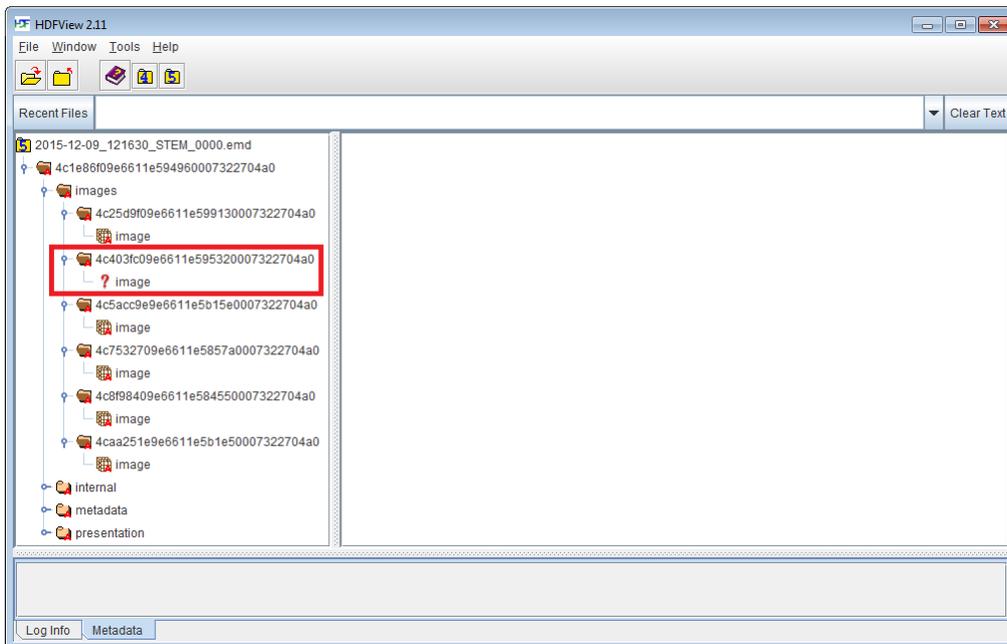
- **Fixed that some RAW images were not (correctly) viewable**

  Previous versions of the Camera Image Preview Pack did not support the 'stride' property in RAW images in a correct way. Also, support for a shifted zero position was not implemented well. The result was that some RAW images from Falcon and Ceta cameras could not be displayed or were displayed in a wrong way (for example; with incorrect orientation or image shift). The implementation of the RAW image format is now in line with other implementations. The screenshot below shows an image from the Falcon 3 EC camera that was not viewable with earlier versions of the Camera Image Preview Pack.
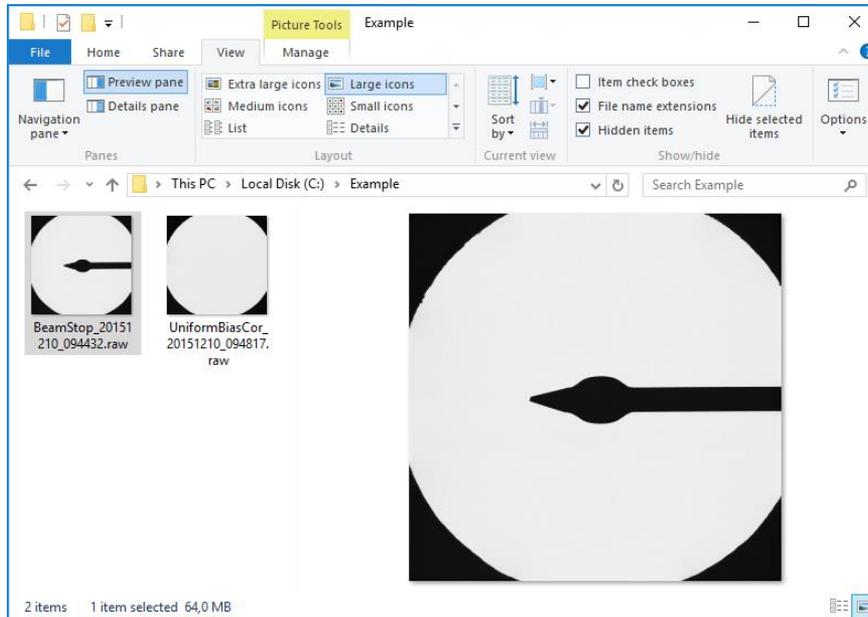

- **Added support for 32-bit UInt (type 0) RAW images**

  The 32-bit UInt pixel format is rarely used in combination with Falcon and Ceta RAW images. Support is added because one real life example popped up on the grid (see the screenshot below).
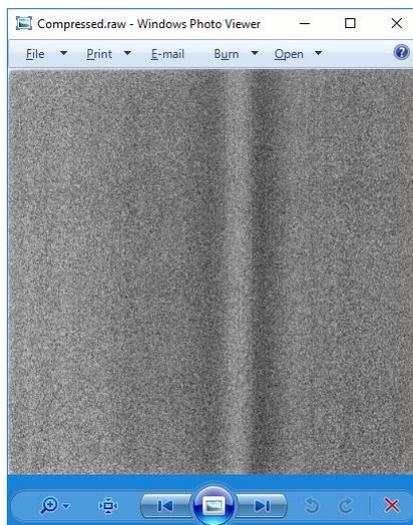
- **Added support for 24-bit RGB Python NumPy images**

  This new release of the Camera Image Preview Pack has support for colored Python NumPy images. Currently only 24-bit RGB images are supported. See appendix 6 of the User Guide for more information. The screenshot below shows a few color images that are part of the Python NumPy SDK.
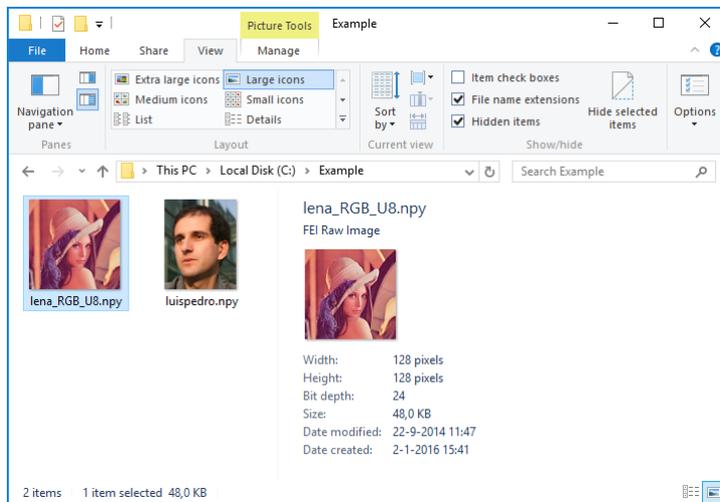
- **Fixed displaying issues with some 8-bit Int MRC files**

  The MRC file format supports the 8-bit signed integer pixel format (known as MRC type 0). Some software writes this pixel format by using 8-bit unsigned integers. The left image below shows how such images typically look like when this error is not detected and corrected by the viewer application. In the previous release of the Camera Image Preview Pack was a similar issue fixed for the 16-bit signed integer pixel format (MRC type 1). This release contains a fix for the 8-bits variant, which is more obscure since the 8-bit unsigned integer pixel format is not supported by the MRC format specification. The right image below shows that these files are now correctly displayed.
  Note: this particular example file cannot be viewed with the popular Fiji/ImageJ application since also big-endian byte ordering is used. The Camera Image Preview Pack has no problem with handling two MRC format errors simultaneously.
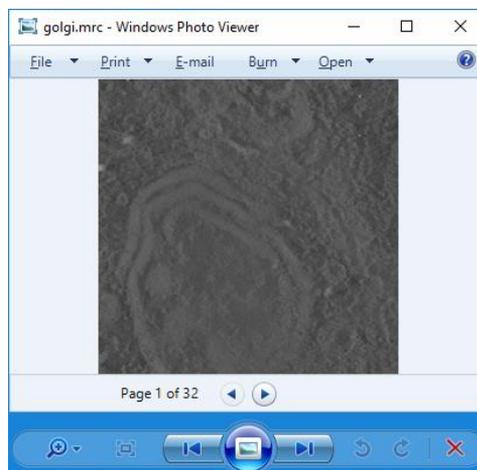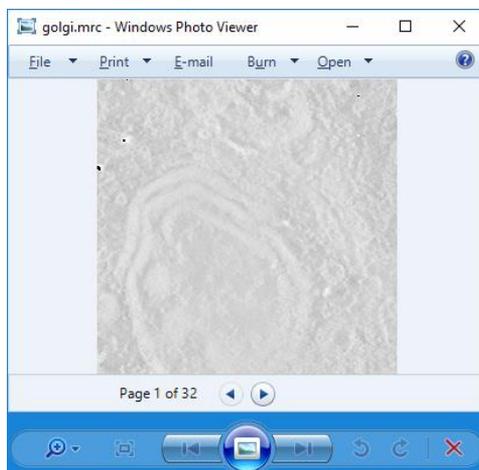
- **Fixed displaying issues for some images with a very small dynamic range**

  The automatic brightness and contrast did not work well for a few images with a very small dynamic range. The left image below shows this issue with the previous version of the Camera Image Preview Pack. The screenshot on the right shows that this image is now correctly displayed.
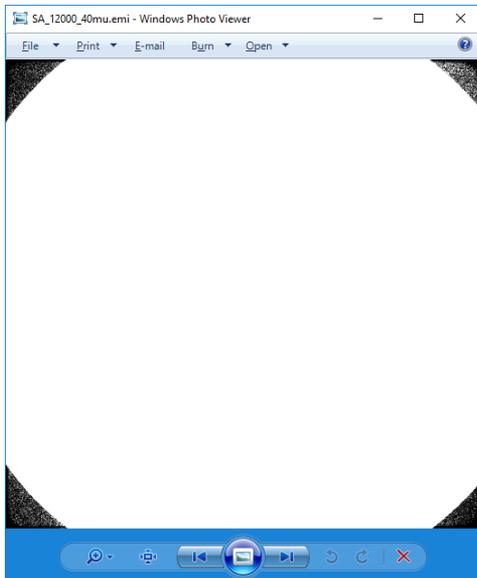
- **Fixed that some MRC tilt series with more than 1024 frames could not be opened in Windows Photo Viewer**

  The MRC file header can have a different size when the file contains a tilt series with more than 1024 frames. The previous version of the Camera Image Preview Pack could not handle all MRC header variants (see the left image below). The latest release of the Camera Image Preview Pack supports all commonly used header constructions (see the right image below).
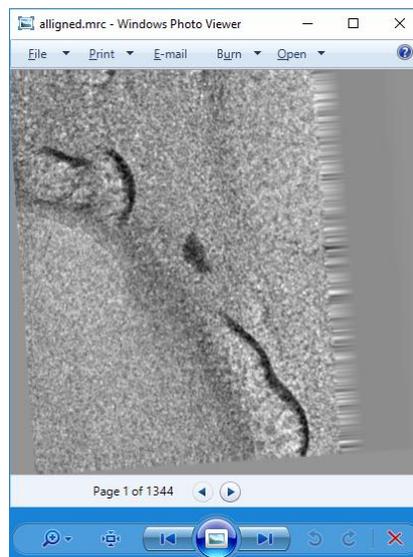
3.1.0 – November 3, 2015

Small service update with the following new features and fixes:

- **Added support for files larger than 4 GB**

  Files that contain image stacks, like tomography tilt series, can be very large. Image sizes of 4k x 4k x 32 bpp (64 MB) are quite common nowadays. An image stack with 100 of these images will be 6 GB. Until this release of the Camera Image Preview Pack were 32-bit integers used for file positions. This was not a problem until the previous release (3.0.0), since it was only possible to view the first frame of an image stack. With the previous release, it became possible to view image stacks unto 4 GB. This new version of the Camera Image Preview Pack removes this limitation by using 64-bit integers. Although the huge theoretical improvement, is in real-life the maximum usable file size much smaller. The Windows Photo Viewer needs a lot of memory and time to load files over 4 GB. It is recommended to use a powerful system with at least an Intel Core i7 processor, 16 GB RAM and a large SSD for viewing these images. There is still some patience required on such systems when loading an image stack of 15 GB, but it is possible to view it in Windows Photo Viewer (see the screenshots below).
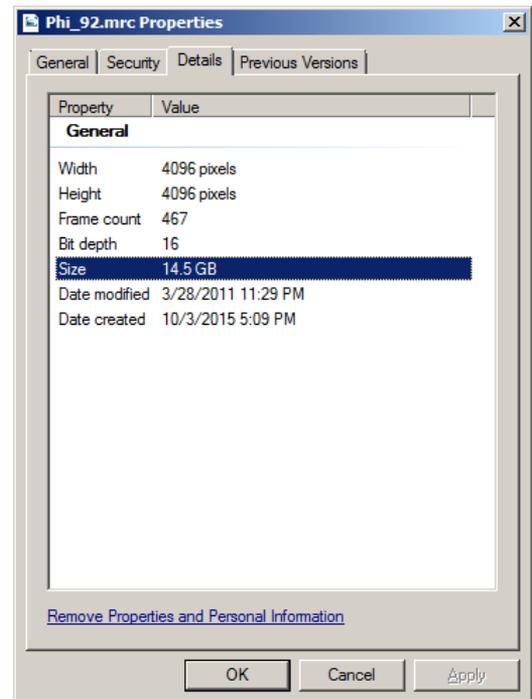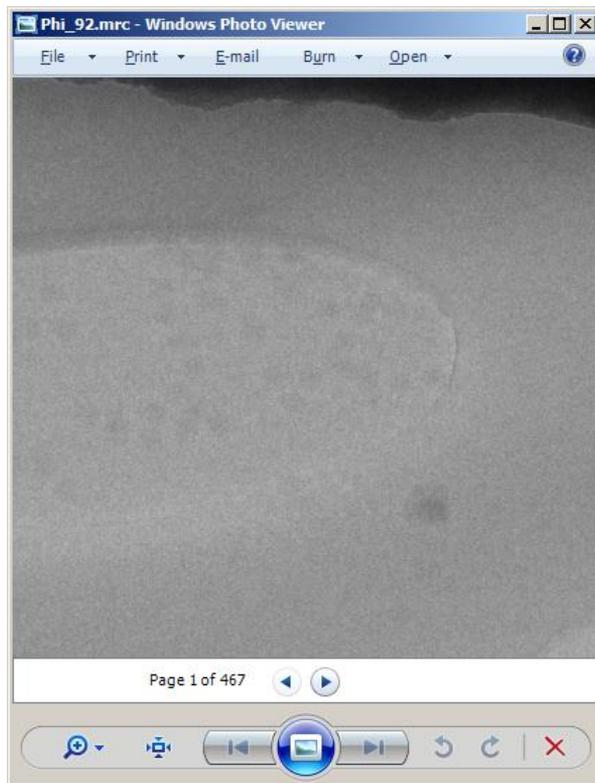
- **Fixed displaying issues with MRC files produced by the Tomography application**

For many years, the Tomography application writes the wrong pixel format in MRC headers. The image data is marked as 16-bits signed integer (MRC type 1) while actual 16-bits unsigned integers (MRC type 6) are used. Unfortunately, there is no way to detect this while reading the MRC header. Some other applications can handle these files correctly because they assume that all their MRC input images are coming from the Tomography application. Having displaying issues with MRC files from other sources is an accepted drawback when using this strategy. The Camera Image Preview Pack should support MRC files from all sources, so it took some time to develop a reliable detection mechanism for this violation of the MRC specification.

A large representative test set of MRC files from different applications is used to verify this improvement. When possible is the Camera Image Preview Pack compared with the application that has produced the specific MRC file. In other situations is the Fiji/ImageJ application used as benchmark. There are still a few MRC files left in the test set that are not properly displayed, but the Camera Image Preview Pack performs currently better than the popular Fiji/ImageJ application.

Note: the extensions ".ali" and ".rec" are also used for MRC files that contain tomography tilt series. This improvement is in particular useful for files with these extensions.

The left image below shows a tomography tilt series that is displayed by the previous version of the Camera Image Preview Pack. The right image below shows that it is correctly displayed now.
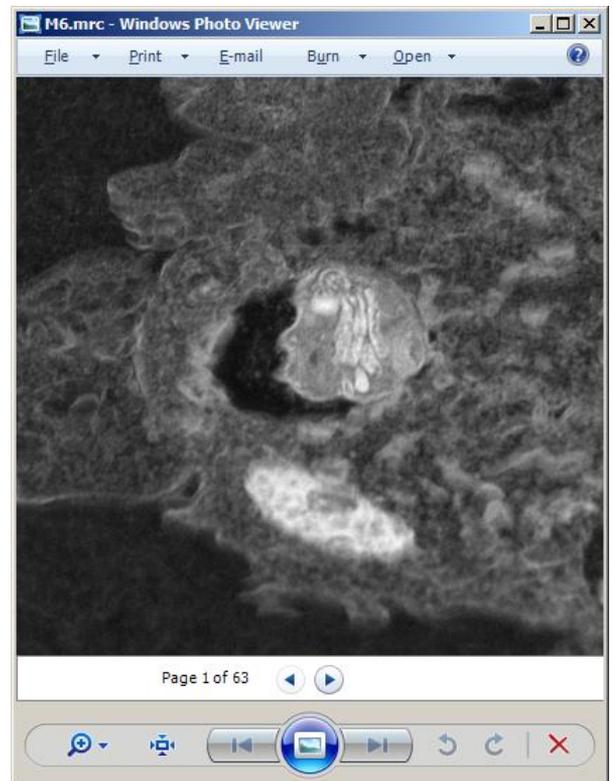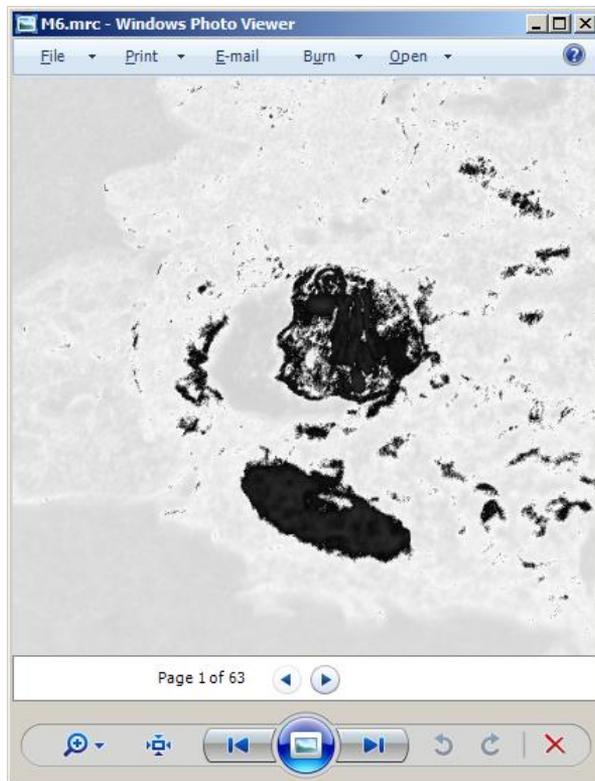
The left image below shows frame number 33 of the same tilt series in the Fiji/ImageJ application. The right image below shows the same frame in this new version of the Camera Image Preview Pack.
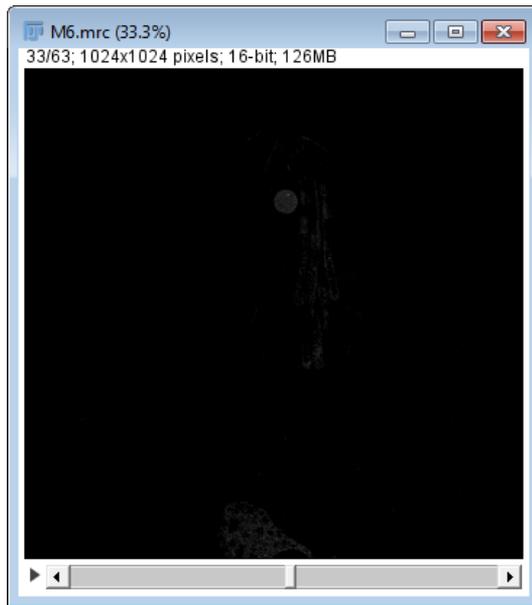

- **Added support for MRC images with big endian byte ordering**

  Images from the Gatan BioQuantum Direct Detection camera are saved as MRC files with big-endian byte ordering. Except of Gatan Digital Micrograph is no software available that supports this variant of the MRC format. The Camera Image Preview Pack offers now experimental support for viewing these files. Support for saving them as bitmap, jpeg, png or tiff is not available yet.
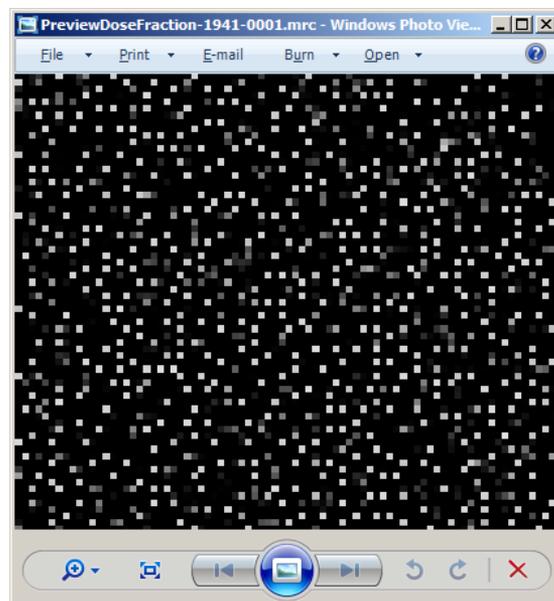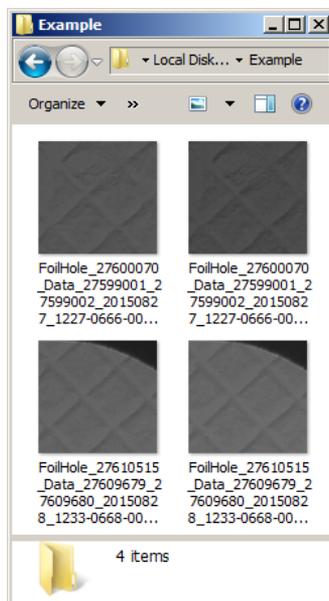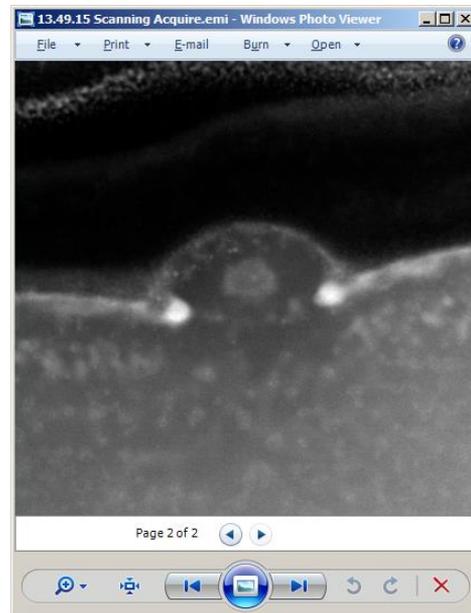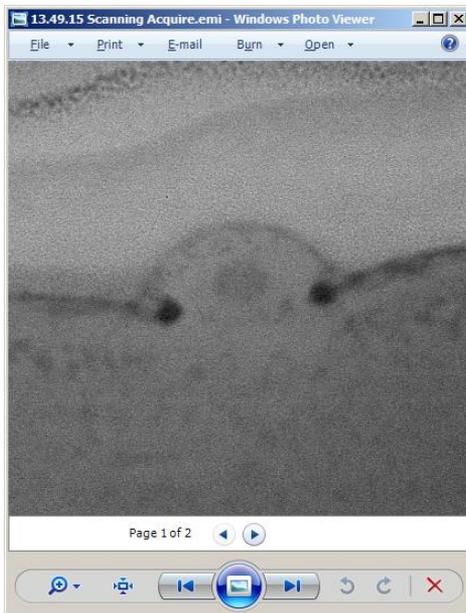
- **Added support for displaying FFT images in EMI files**

  TIA EMI files can contain FFT images. This version of the Camera Image Preview Pack can display most of them in Windows Photo Viewer (see the screenshots below). This feature is implemented by means of adding support for the 64-bit Complex pixel format (see section 1.1 of the User Guide).
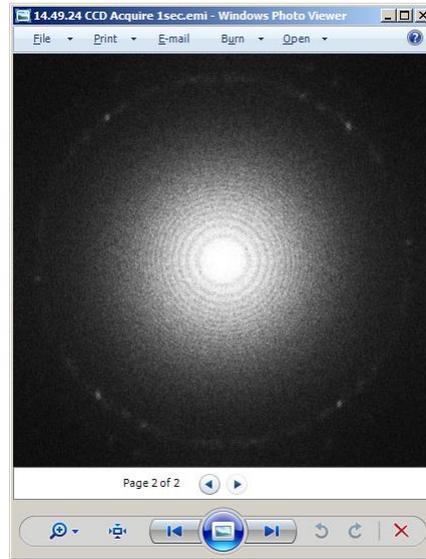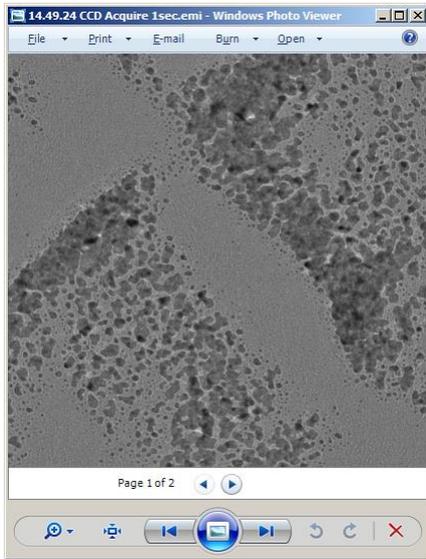

- **Added support for displaying image series in TIA EMI files**

  TIA EMI files can contain multiple images. Until this release of the Camera Image Preview Pack, it was only possible to view the first image in the file. This version of the Camera Image Preview Pack can display all images in Windows Photo Viewer (see the screenshots below).
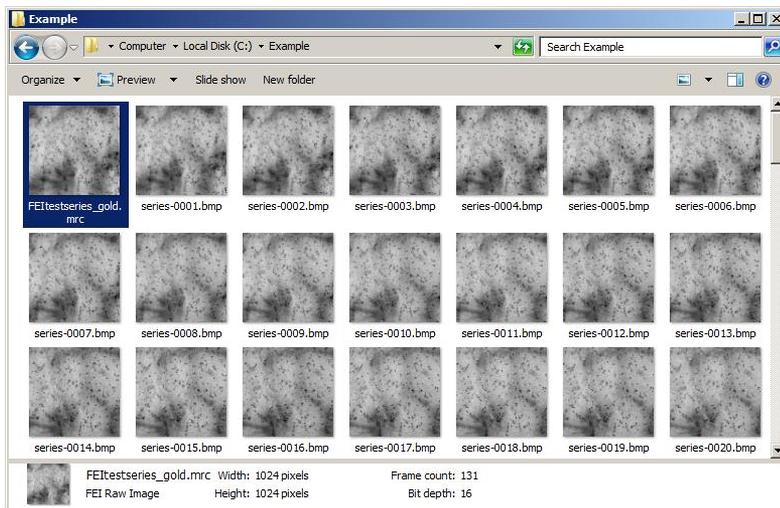
- **Added support for displaying image series in TIA SER files**

  The TIA SER files contain typically a series of images and/or spectra. Until this release of the Camera Image Preview Pack, it was only possible to view the first image of a series. With this new version of the Camera Image Preview Pack, it is possible to view the complete image stack in Windows Photo Viewer (see the screenshot below).
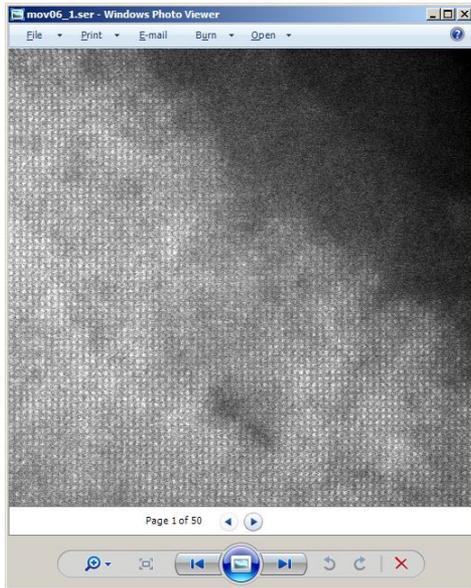

- **Added support for saving the complete image stack as separate and numbered files**

  Since last release of the Camera Image Preview Pack it is possible to view complete image stacks in Windows Photo Viewer. Although this support, the "Save As" option did only save the first frame. In this version can complete image stacks be saved as separate and numbered files (in the bitmap, jpeg, png and tiff file format). Movie making software can use these files as input. Appendix 7 of the User Guide describes how an image stack can be converted into a video file. This functionality is especially useful when the image stack contains a tomography tilt series (like in the screenshot below).

- **Fixed displaying issues with 32-bit Int RAW images**

  Some RAW images showed white noise in dark areas (see the bottom-right corner of the left image below). This issue is fixed in this release (see the right image below).
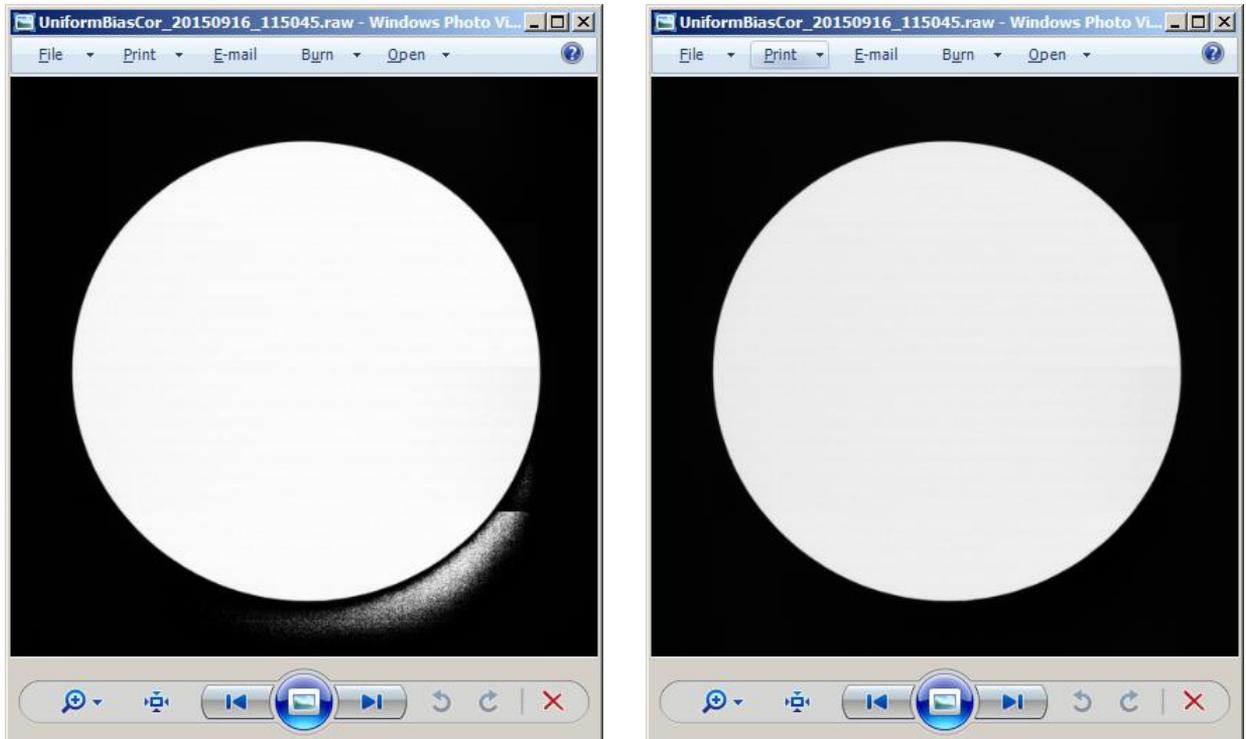
- **Added support for 32-bit Float Python NumPy images**

  See appendix 6 of the User Guide for more information. The used test images are confidential and cannot be shown here.

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Major new version with the following new features and fixes:

- **Added support for Windows 10**
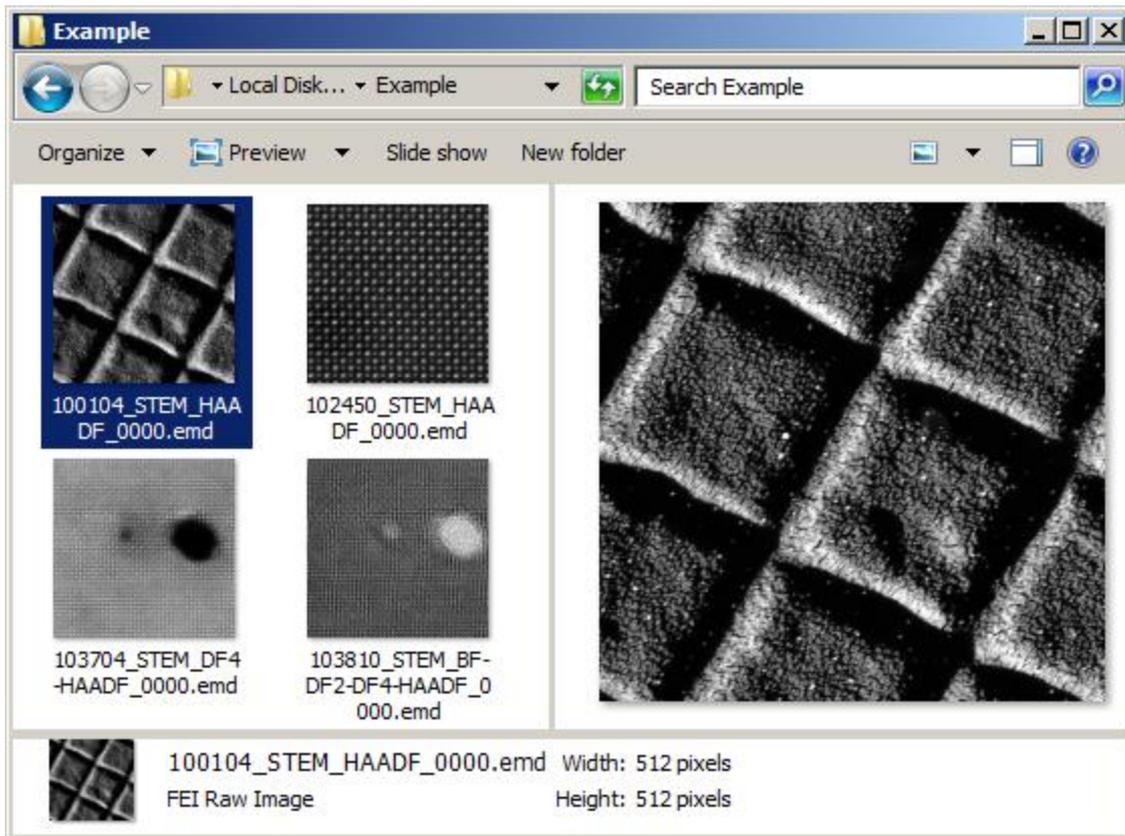
  The Camera Image Preview Pack supports now officially the 64-bits version of Microsoft Windows 10.

- **Added support for the Velox EMD format**

  The Velox software uses the open source HDF5 file format for data storage. The used extension for Velox files is ".emd" and not all the files contain images. This version of the Camera Image Preview Pack offers support for EMD files.

- **Added Windows Photo Viewer support for viewing all images in a file**

  The supported raw image formats can contain a single image or an image stack. Until this release of the Camera Image Preview Pack, it was only possible to view the first image of an image stack in Windows Photo Viewer. With this release of the Camera Image Preview Pack it is possible to browse through the complete image stack of a file. The Windows Photo Viewer will show extra controls for navigating in the image stack when multiple images are present in the file (see the screenshot below). With the 'Page Up' and 'Page Down' buttons can be scrolled fast through the image stack. You can get a movie-like experience when the image stack represents a complete tilt series (as in the example below).


  There is also a disadvantage of this new functionality. Opening raw image files with large series of images will take considerably more time than with the previous release of the Camera Image Preview Pack. The Camera Image Preview Pack only loads images from a file on request, but the Windows Photo Viewer asks for the complete image stack on startup.

  Currently there are displaying issues with many image stacks in the MRC file format (which also includes the extensions ALI and REC). The reason for this is that the specific files are not written according to the MRC format specification. An attempt will be done to improve the support for these files in the next versions of the Camera Image Preview Pack.

- **Added support for the Gatan DM4 format**

  The Camera Image Preview Pack already had support for the Gatan DM3 format. In this release is also support for the newer DM4 format of the Gatan Digital Micrograph software added.
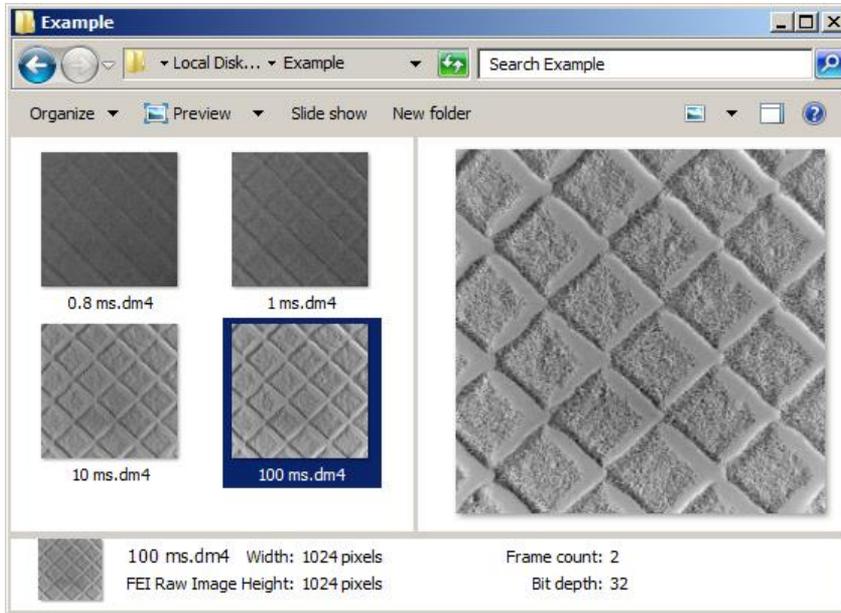

- **Added support for 32-bit Float EMI images**

  EMI images that uses the 32-bit float pixel format are not a curiosity, but support for them was not present in earlier releases. The left image below shows that these files were unsupported in the previous release of the Camera Image Preview Pack. The right image below shows that this gap is closed now.
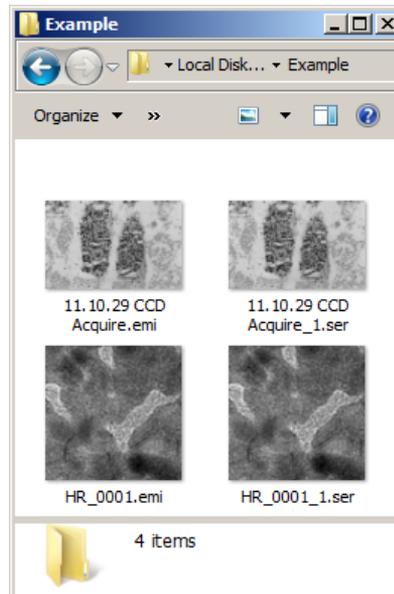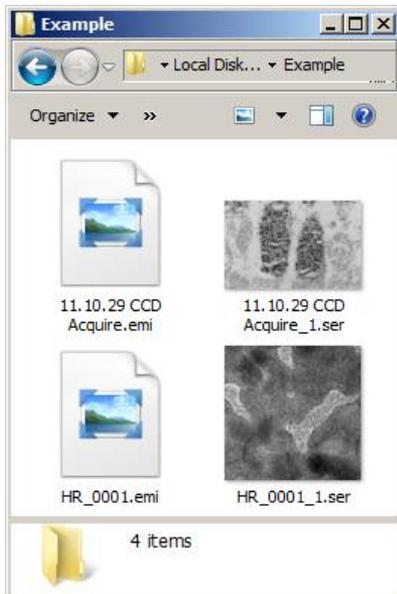
- **Fixed displaying issues with 32-bit Int EMI images**

  Some EMI images showed white noise in dark areas (see the top-right corner of the left image below). This issue is fixed in this release (see the right image below).
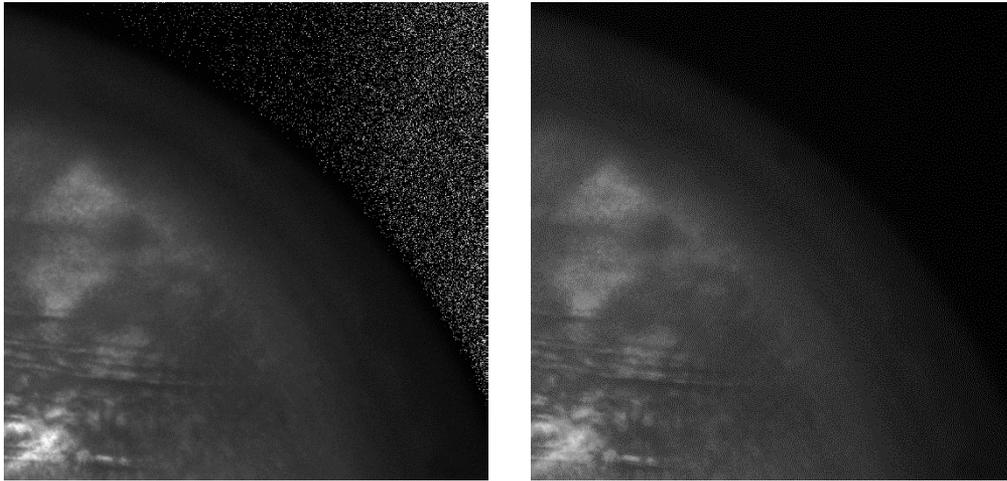
- **Fixed displaying issues with 32-bit Int SER images**

  Some SER images showed white noise in dark areas (see the beam stop in the left image below). This issue is fixed in this release (see the right image below).
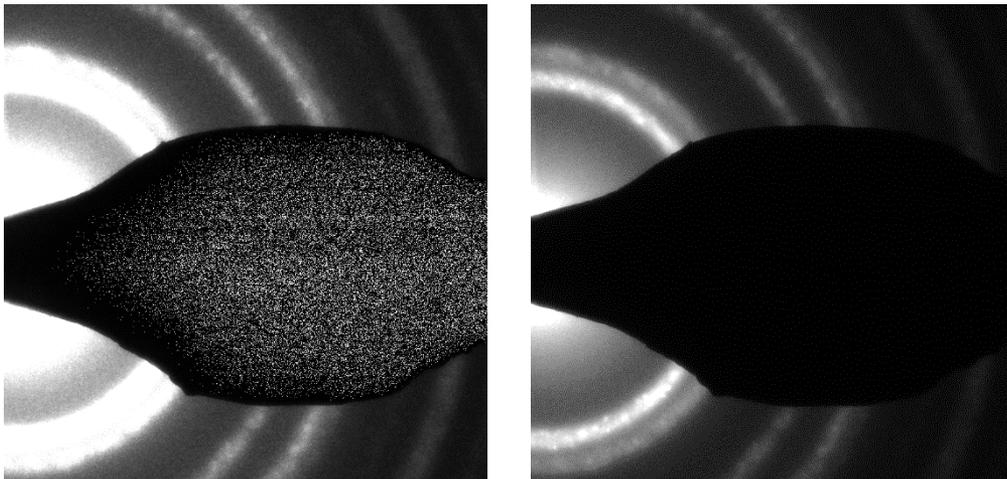
- **Removed the 64 MB file size limitation for Gatan DM3 images**

  This limitation was not built-in on purpose, but it was a result of implementation choices. Some refactoring was done to get rid of this restriction.

- **Added support for 16-bit UInt Python NumPy images**

  See appendix 6 of the User Guide for more information. The used test images are confidential and cannot be shown here.

- **Added support for 16-bit Int (type 1) DM3 images**

  The DM4 format is also supported since this release and the same pixel formats are supported for that related image format (see section 1.1 of the User Guide for a comprehensive overview of supported pixel formats).
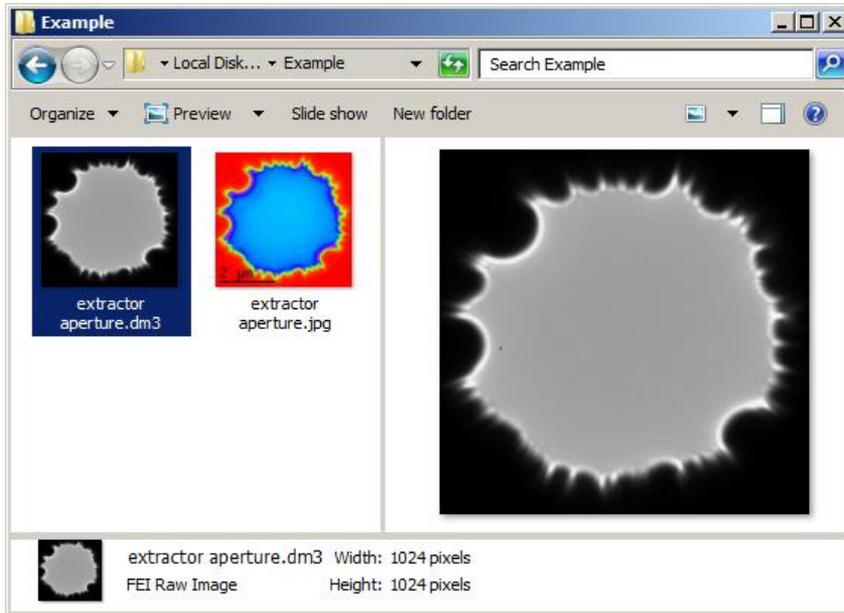
- **Added support for 128-bit Complex Python NumPy images**

  This pixel format is especially used for storing FFT images (see the screenshot below). Appendix 6 of the User Guide provides more information about the Python NumPy format.
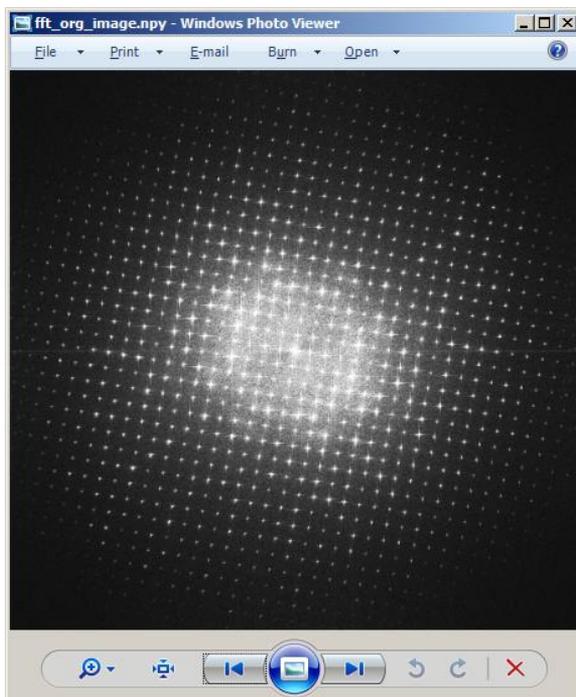
- **Added support for MRC images with big endian byte ordering**

 Some UNIX, Linux and Apple Macintosh systems use big endian byte ordering. MRC image files that are produced on such systems can have this byte ordering. Gatan software uses this byte ordering also on the little-endian Windows/Intel architecture. The added support for big endian MRC files is experimental and currently limited to the Int8 pixel format. The support will probably be extended in next versions of the Camera Image Preview Pack.
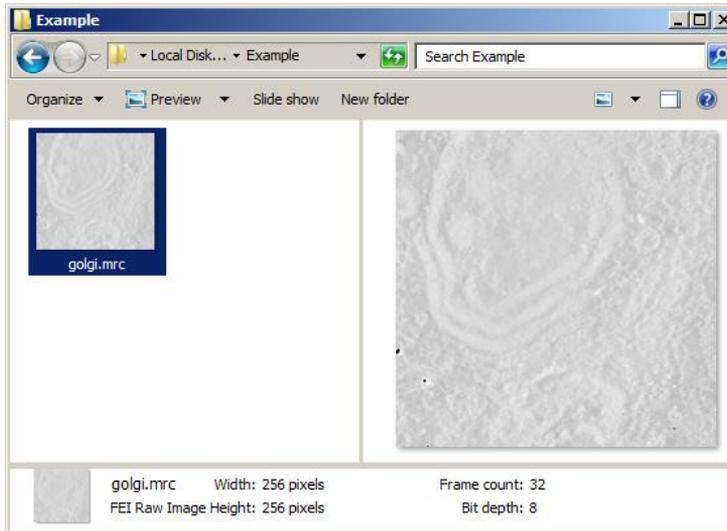
- **Extended the "Save As…" option with the PNG file format**

  In addition to the bitmap, jpeg and tiff file formats can the supported raw image formats now also be saved as png (Portable Network Graphics) file. The number of grayscale levels will be reduced to 256 (8 bpp), which makes them unusable for scientific image processing.
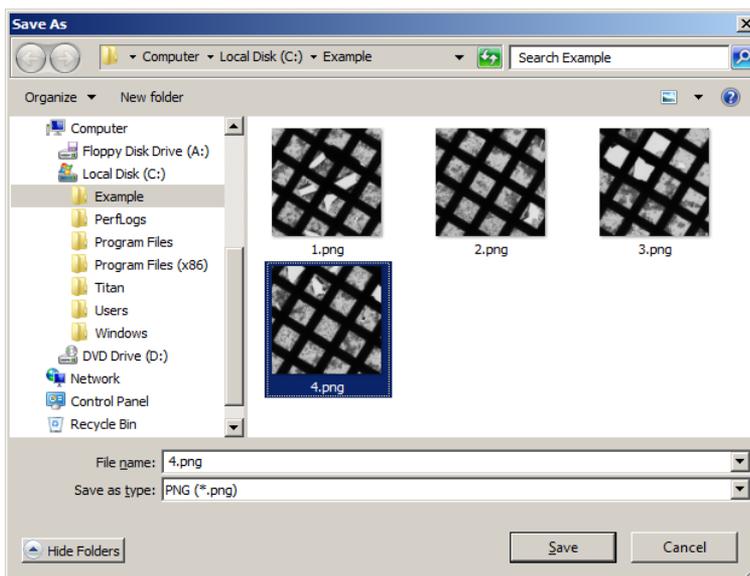
Older releases

The release notes of Imaging Codec Pack versions before 3.0.0 are no longer included in this document. The full release history is described in the Release Notes till version 3.10.0 of the Imaging Codec Pack. The releases excluded from this document are:

Version	Release date
2.2.0	2015-07-06
2.1.0	2015-06-29
2.0.0	2015-06-11
1.3.0	2015-05-28
1.2.0	2015-05-26
1.1.0	2015-05-21
1.0.0	2015-05-18
0.9.1	2015-05-11

Note   **It's strongly recommended to upgrade to the latest release if you are still running one of these Imaging Codec Pack versions.**

2   Known Issues

The following known issues are present in the latest release:

1. **The electron microscopy specific image properties are not shown in the Windows Explorer details pane when another default viewer is chosen than Windows Photo Viewer.**

   Workaround: Set the default viewer back to the Windows Photo Viewer and use "Open with" in the context menu when another viewer is desired (uncheck "Always use the selected program to open this kind of file" when an alternative viewer is chosen).

2. **The "Save As…" option in the context menu of supported electron microscopy images is not present when another default viewer is chosen than Windows Photo Viewer.**

   Workaround: Set the default viewer back to the Windows Photo Viewer and use "Open with" in the context menu when another viewer is desired (uncheck "Always use the selected program to open this kind of file" when an alternative viewer is chosen).

3. **Electron microscopy images that are attached to email cannot be opened directly (by double-clicking).**

   Workaround: Save the attached image and open the saved version.

4. **The TIA Folder Export option does not work when EMI files are associated with another viewer than TIA.**

Note	**This issue (with TeamTrack number 531407) is fixed in TIA 4.17 which is part of the TEM 6.9 release (Talos 1.9 / Titan 2.9).**

   Workaround: Restore TIA as default viewer for EMI files:
   - Right-click on an EMI-file in Windows Explorer
   - Click "Open with" → "Choose default program…"
   - Select "ES Vision Application"
   - Check "Always use the selected program to open this kind of file"
   - Click OK
   - The TIA Folder Export option will work again

5. **Opening a large image stack on the microscope PC can consume so much system resources that the TEM server crashes and the FEG is shut-down.**

Note	**This issue is registered with Redmine number 112687.**
Note	**This is a generic problem that applies to all resource demanding software that runs on the microscope PC.**

Workaround: Try to avoid opening large image files on the microscope PC when limited system resources are available. Uninstall the Imaging Codec Pack when this is a structural problem.