OM Digital Solutions Corporation Freeware

HYRes IV
Resolution measurement tool software
Manual

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1   Introduction

HYRes IV (*pronunciation* [*haires aivi:*]) is a software tool designed for use in accurately gauging the resolution of a digital camera using resolution charts compliant with ISO 12233.

It is a freeware provided free of charge with goodwill by **OM Digital Solutions Corporation** (hereinafter referred to as "OM Digital Solutions" or "OMDS") which the creator (See the colophon in the last page) belongs, but in consider with its objectives, the distribution window is limited to download from the CIPA (Camera & Imaging Products Association)'s website <http://www.cipa.jp/index_e.html>. (The actual place is '**tool**' of the CIPA standard below in the corresponding page.)

HYRes software supports the measurement methods described in both ISO 12233 and CIPA standard DC-003 "Resolution Measurement Methods for Digital Cameras" (See <http://www.cipa.jp/std/std-sec_e.html>). Two versions of HYRes 3.1 (2004) and HYRes ACE (2006) have already been released by CIPA.

These are respective for different specifications of the resolution charts used for measurement (HYRes 3.1 is for the ISO 12233-2000 chart, HYRes ACE is for the ISO12233 compliant CIPA chart), and in recent years the cases they cannot run have been noticeably occurred by version-up of an OS (Microsoft Windows).

HYRes IV is the integration of the functions of these two softwares HYRes 3.1 and HYRes ACE, and has been renewed to run on the latest OS.IV is an abbreviation for the Integrated Version.

This book is a manual that describes how to use this software HYRes IV.

[Remarks/ Acknowledgement]

While HYRes 3.1 the first software of HYRes series was independently conceived and developed by the creator, the motivation of its development was stimulated by the discussions in the resolution sub working group of the former JCIA (Japan camera industries association: present CIPA), where the creator was acting the sub chief when DC-003 was under deliberation of standardization.

Also basic performance evaluation of the software was done in the sub working group especially by its voluntary study group, even in later improvements and debugging many valuable suggestions were made by respective deliberation members. Appreciation is expressed to the deliberation members from each company for their cooperation.

And for HYRes IV, appreciation is expressed to Mr. Toyoda, Mr. Furukawa and Mr. Kajimura from Olympus development division by writing down here that the development of this version has been acheaved by advices and implementation of the three people. (Actually the first draft of the functional explanation part in this manual was described by Mr. Kajimura who was the person in charge of implementation. However, all the responsibility for the software design and the manualis is owed by the creator.)

[Note (Mandatory to read)]

1) OM Digital Solutions is a company which the imaging business division of Olympus Corporation (hereinafter referred to as Olympus) was spun off from Olympus on January 1, 2021.

Since HYRes IV was developed before the independence and was released just after the independence, the description (including the link destination) related to the company name in the software itself remains "Olympus". As a transitional measure based on this circumstance, "Olympus" in all statements related to the use of this software (including licenses and oaths) shall be read as "OM Digital Solutions".

2) Anyone using this software is regarded as making the pledge described in "7. Pledge on use of this software" in this manual. Person not accepting this is prohibited to use. (Confirmation of this pledge will be done also at the first time of starting up this software.)

3) The originality (the status as its inventor and developer) of this software belongs to the creator, and all intellectual property rights related to this software are the property of OM Digital Solutions Corporation to which the creator belongs.

4) This software contains no help feature. Use it by reading the explanations of "3. Flow of the measurement" and "4. Method of operation" (and after also) in this manual.

5) This software displays in Japanese on a Japanese-language operating system otherwise in English on any other language operating system. But in case of English display mode there can be appears some garbled texts on some operation windows and others.

2   How to install

1) HYRes IV operates under the environment of Windows where Microsoft.NET Framework 4 is installed. In other words, it supports to Windows 8 and after generally, and even if NET Framework 4 is not installed it will be available by obtaining that from Microsoft download center in case of Windows XP SP3 or after. (It is downloadable with no charge in December 2020 at the present from https://www.microsoft.com/en-US/download/details.aspx?id=17851.)

However in any case no guarantees whatsoever are given on its operation.

2) When you extract the zip file for distribution, the folder [HYResIV 1.00] will appear. The contents of this folder are as shown in the figure. Each of the folders [x86] and [x64] is an execution program (the contents are both files <HYResIV.exe>, <HYResMain.dll> and subfolders [ja-JP]), and the one that matches the system architecture (PC processor) of the usage environment is to be used. You can delete the unused folder.
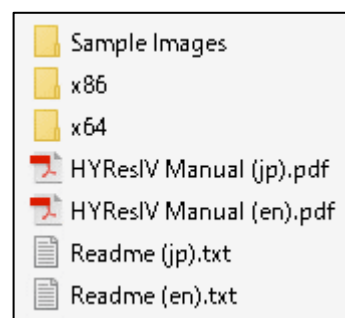
3) No special installation operation is required, put the folder of the execution program to be used in an appropriate place, and open the execution file <HYResIV.exe> to start it. It is convenient to create a shortcut to the execution file and put it on the desktop or other.

3   Flow of the measurement

All at first read the CIPA standard DC-003 'Resolution Measurement Methods for Digital Cameras' (especially the annexes) carefully then use this software.

However on DC-003-2020 (Revised 2nd edition), though the chart adopts CIPA resolution chart the

explanations in the annexes are written by using examples of the ISO12233-2000 chart and HYRes 3.1. Thus it is necessary to read the numerical values or others adequately with replacing in accordance with the chart and software actually used.

The whole measurement procedure is indicated as following flow:

(1) Recording the evaluation image using the camera under test → (2) Trimming the wedge part from the evaluation image → (3) Analyze the trimmed wedge and calculate the numerical value

(1) Recording the evaluation image

The evaluation image is let as a resolution chart taken at an adequate magnification using the camera under test. It is not necessary to use the standard magnification specified by ISO12233, and it may be taken at any magnification.

* Note that the measurement accuracy (minimum step of value) will decrease if the magnification is decreased. Since the detection is performed on a pixel-by-pixel basis, the effect is small for a camera with a large number of pixels, but in the end it is a trade-off with the required measurement accuracy.

(2) Trimming the wedge part image

Since this is a processing using this software, refer to "4. Method of operation" for the specific procedure. (In particular, pay attention to the conditions described in 4.5.1 .) The wedges to be measured in each chart are indicated below.

- ISO12233-2000 chart (HYRes 3.1 mode) targets the six wedges in the central area of the chart. (See also 4.5.2 .)

- CIPA chart (HYRes ACE mode) targets four wedges in the central area of the chart.

*In either chart, any of the wedges other than the above is not a subject and correct measurement values cannot be obtained.

(3) Measurement (numerical calculation)

Since this is a processing using this software, refer to 4. Method of operation" for the specific procedure.

TRASLATION NOTE only for the English version:

HYRes series software uses "Trim" as the word meaning to cut out the image of a partial area from an original whole image although "crop" is a well-known synonym for this case.
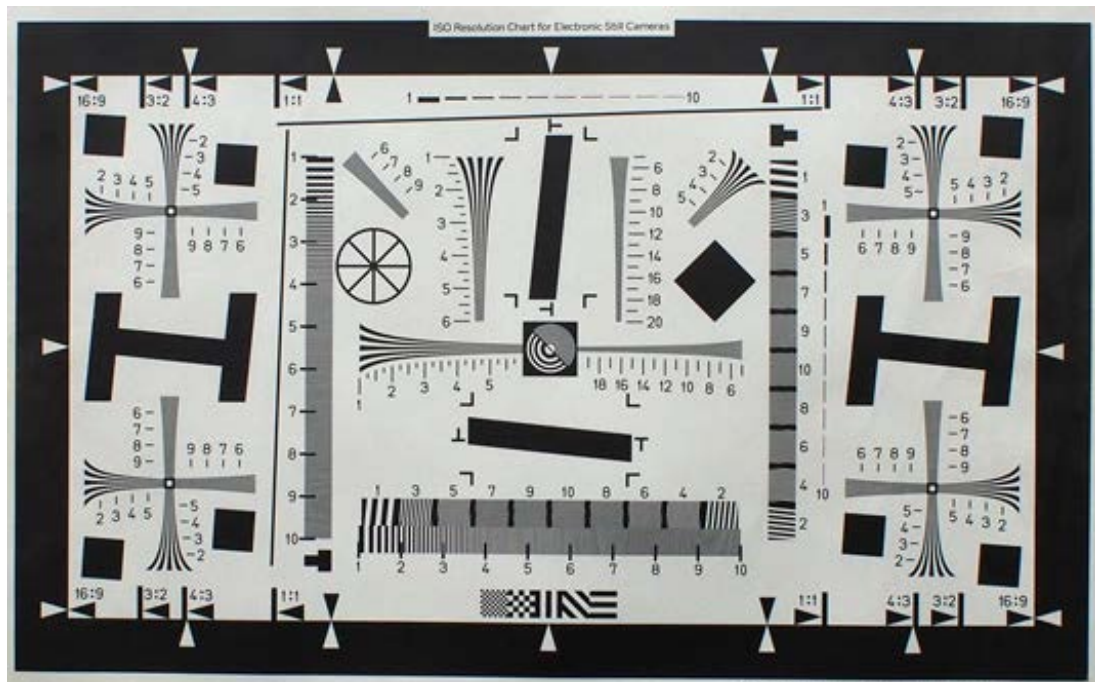
Sorry, figures showing the software windows in this manual are ones of operation under a Japanese OS.
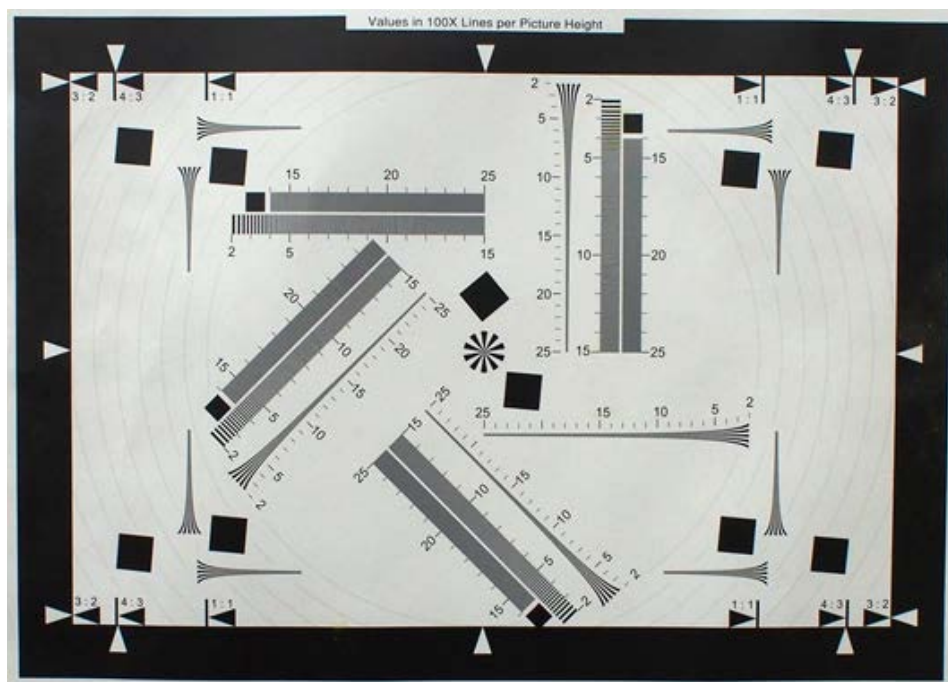
4   Method of operation

4.1   Measurement mode

HYRes IV has two modes which use different measurement target charts. The charts are shown below.

+ "HYRes 3.1" Mode (ISO12233-2000 chart)

+ "HYRes ACE" Mode (ISO12233 compliant CIPA resolution chart)

4.2   Overview of the window (tab) and explanations for respective parts
4.2.1 Main

+ Window when start-up.

4.2.2 Trim

+ Opening (reading) chart images, trimming the images for measure and setting measurement conditions.

(a) File menu: Open (read) an image.

(b) Zoom menu: An image can be displayed as either full (fit to) window, pixel equal size (actual pixels / one-to-one) or centred.

(c) (Information): Available to browse some information such as sample images of the charts.

(d)Mode：Select a measurement mode from two kinds.

(e)Various settings: Information such as read image file name and the picture height are displayed, also select and specify measuring direction, wedge type and trim area.

(f) Trim execute button: Transmit the image of selected trim area and the information of various settings to Measure tab.

(g) Display area of read image: By mouse operation move the image or select the trim area.

4.2.3 Measure
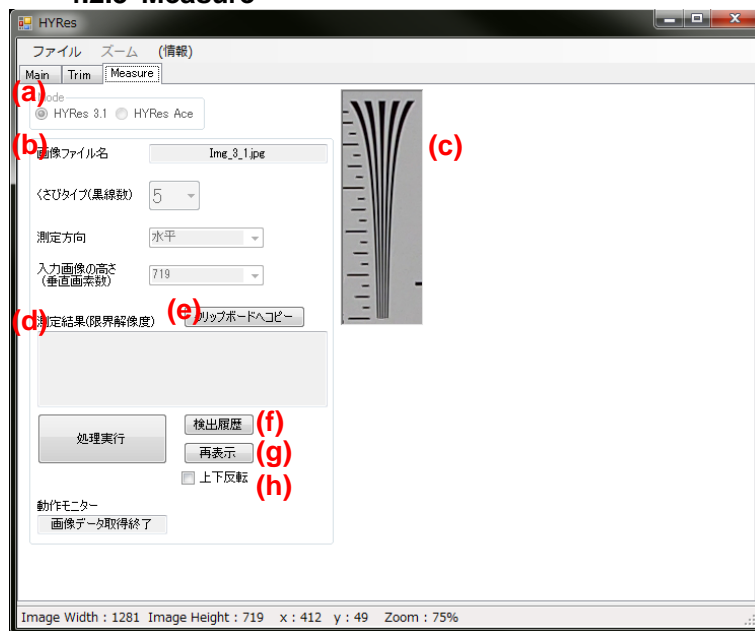
+ Measuring resolution on the wedge image cut out by Trim tab or read from a file.

(a) Mode: Measurement mode.

(b) Various settings: Information display such as read image file name, wedge type, measuring direction and the picture height.
(When the wedge image is read from a file, (a) and (b) above are selectable. If cut out by Trim tab, not selectable.)

(c) Display area of the wedge image.

(d) Result: When press the execute button, measurement result is displayed.

(e) "Copy to clipboard" button: Available to copy the measurement result to a clipboard.
(Simultaneously, record also a csv file by overwriting.)

(f) DetRcrd (detection record) button: Available to display the results of black line detection done to the wedge.

(g) Regenerat (regenerate) button: reset the drawing of (c), and reflect vertical invert.

(h) Vrt Invrt (vertical invert) check box: Flip the wedge image vertically.
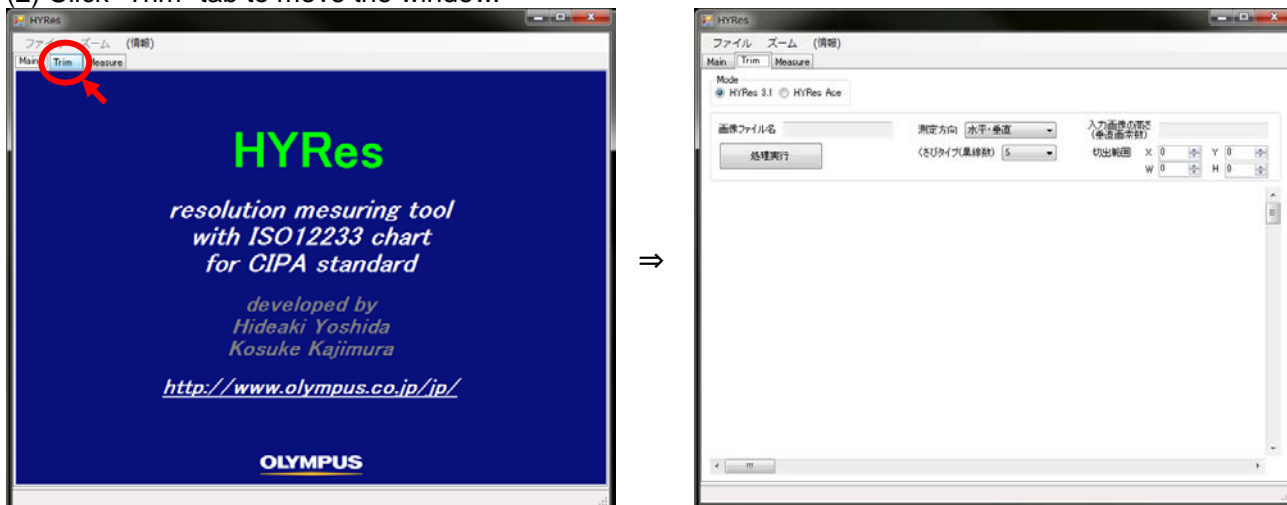
4.3   Method 1 (Reading a chart image, then using Trim of HYRes)
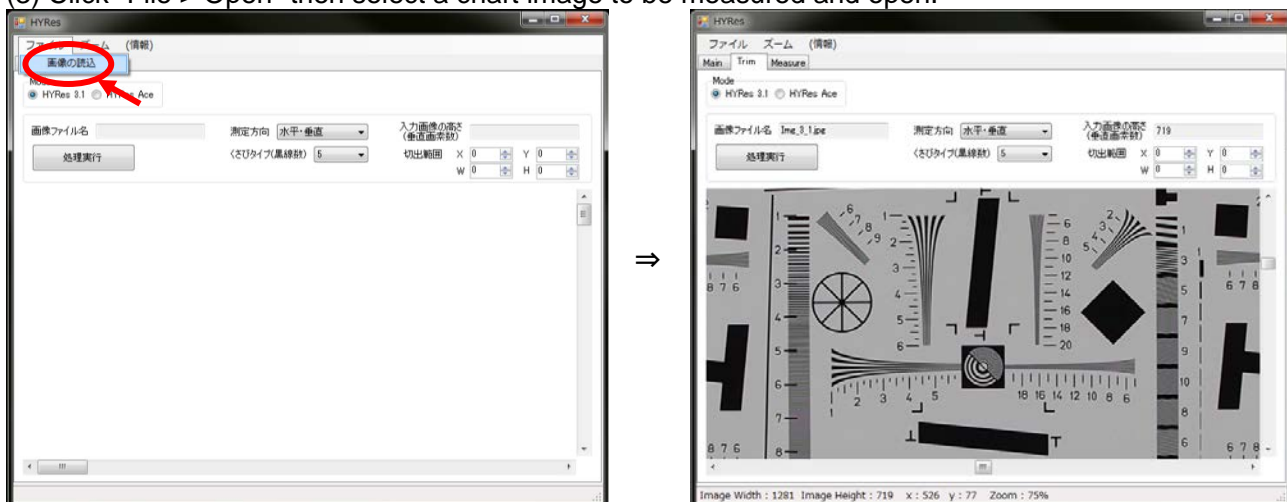
(1) Start up the software.
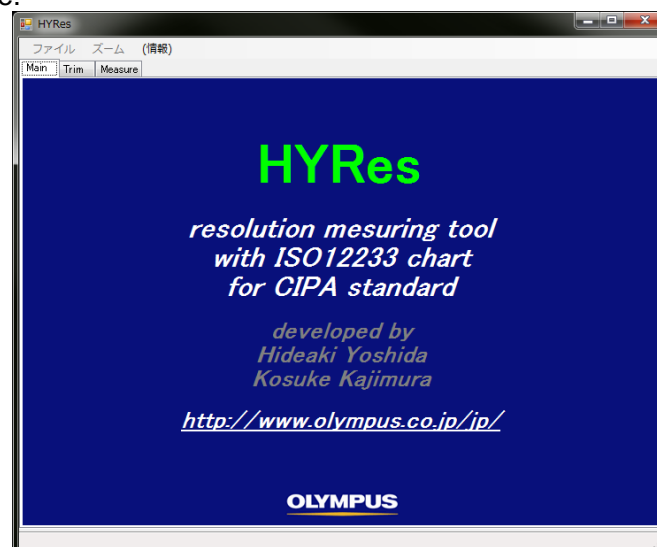
(2) Click "Trim" tab to move the window.

⇒

(3) Click "File > Open" then select a chart image to be measured and open.


⇒

(4) Select measurement mode, measuring direction and wedge type, or others. (Available to select or change still after (5).)

(5) Select the trim area by drag and drop of mouse so as to surround the wedge to be measured. (Also available to specify directly by numeric for selecting the trim area. (The blue bordered part in the figure below.))
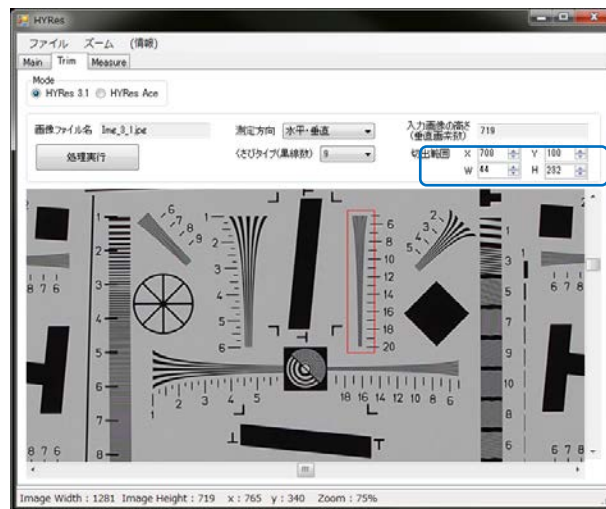
(6) Click "Trim execute" button. It is asked whether save the trimmed image thus select either. Then it automatically results to move on to Measure tab and be displayed the trimmed (and rotated if needed) image.
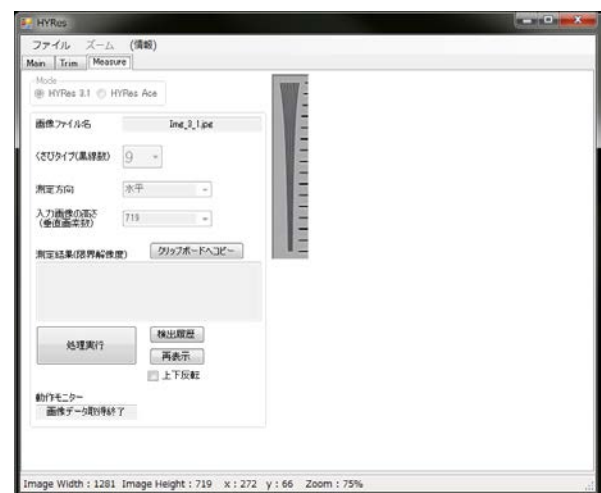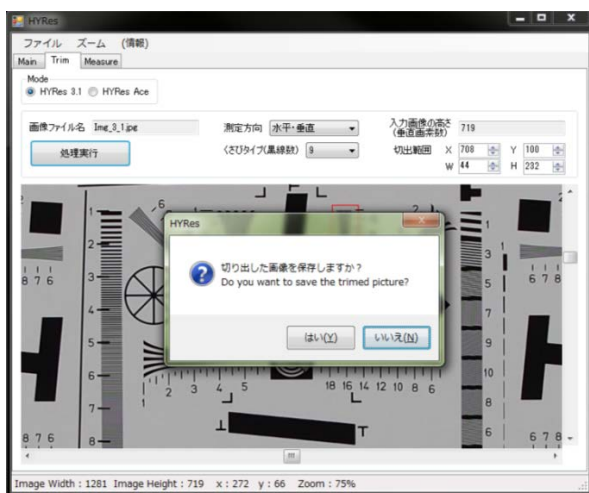
(7) Click "Execute" button to display measurement result.   + If click "Copy to clipboard" button the measurement result will be copied to a clipboard along with the various conditions. Simultaneously "result.csv" will be saved in the same folder as "HYResIV.exe" (by overwriting every time).
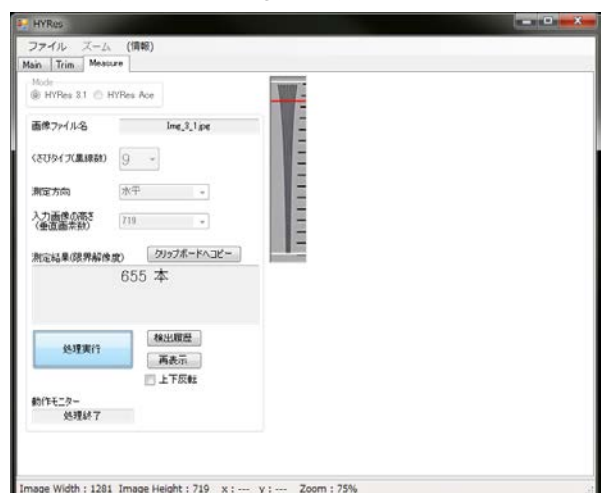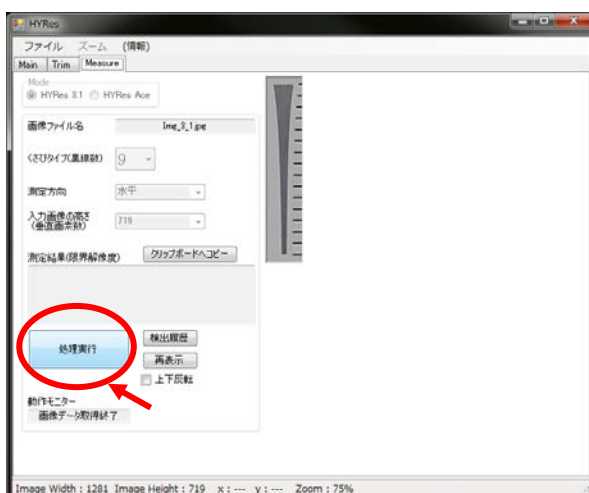
4.4   Method 2 (Reading the wedge image trimmed in advance)

(1) Start up the software.

(2) Click "Measure" tab to move the window.

⇒
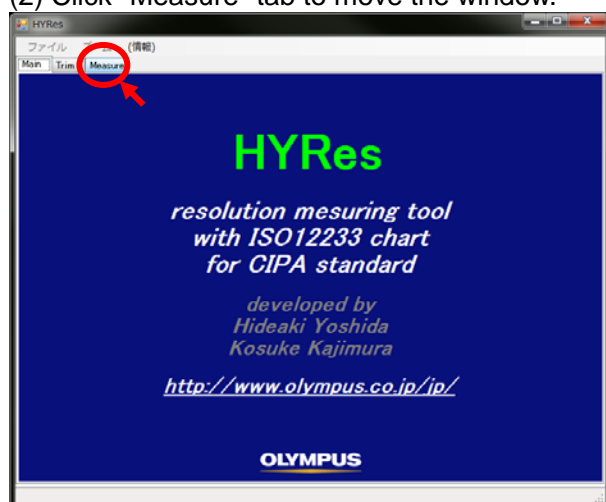
(3) Click "File > Open" then select a Wedge image to be measured and open.

⇒
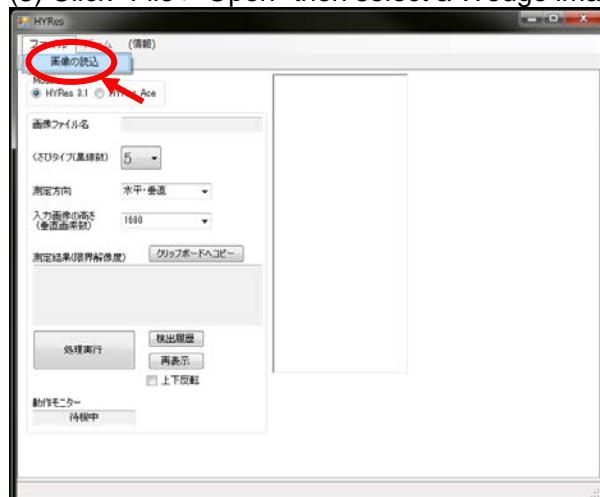
(4) Select or set measurement mode, measuring direction, wedge type and picture height or others in accordance with the wedge to be measured.
+ Note that picture height is <u>necessary to be specified that of the original image before trimming,</u> otherwise the right measurement result never come.
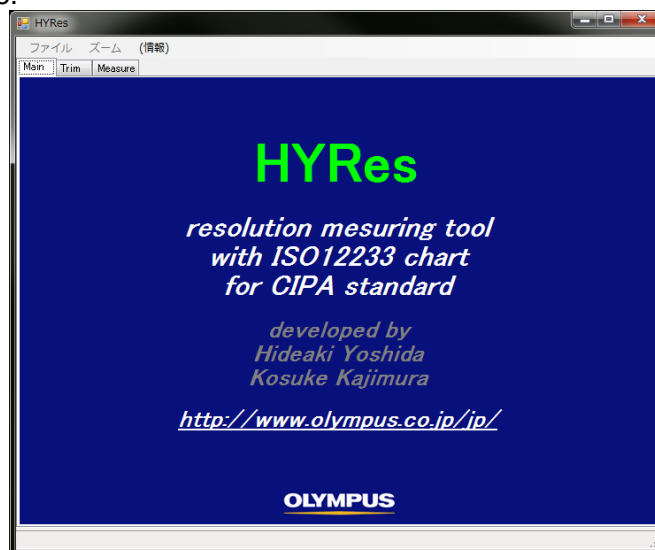

(5) Click "Execute" button to display measurement result.　　+ If click "Copy to clipboard" button the measurement result will be copied to a clipboard along with the various conditions. Simultaneously "result.csv" will be saved in the same folder as "HYResIV.exe" (by overwriting every time).
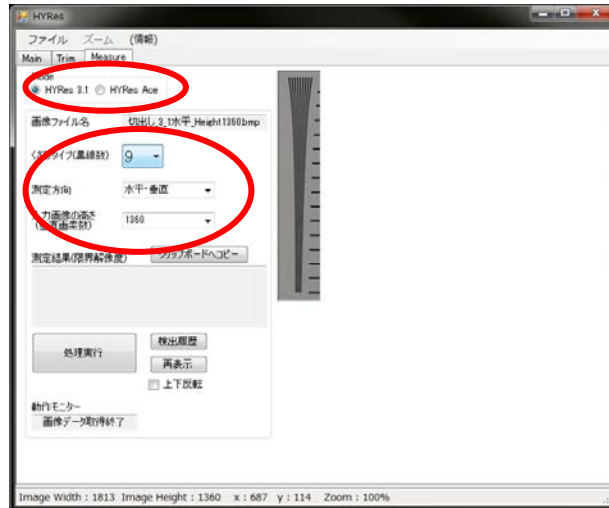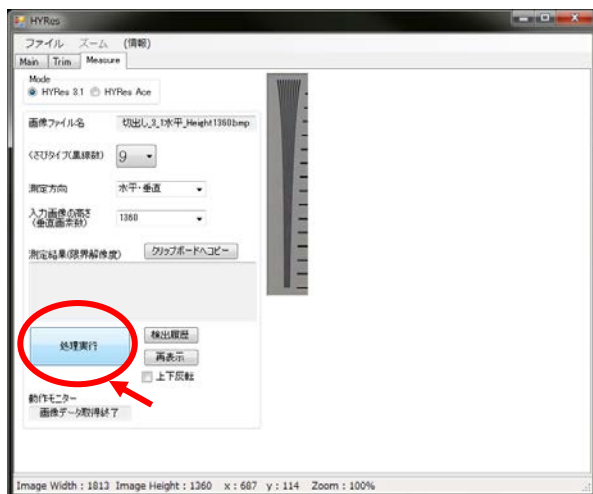

4.5　Note on measurement
4.5.1　About trimming for the wedge image
In either case of Method 1or Method 2, the trimmed wedge image must meet the following two conditions (Upper or lower means a direction relative to the rotated upright wedge, in other words in the Measure window):

++ The image must include the upper and lower blank areas. (Black blank, not white, is also accepted at the lower i.e. the highest frequency end.)

++ The image must be trimmed to exclude the uppermost line of the scale lines installed along the wedge. (No need to be care whether the other scale lines exist or not.)

If the measurement is incapable, at first check this trimming way once. Retrying sometimes makes it capable. Especially when using the "45 degree slanted 5 line wedge" in ISO 12233-2000 chart, since the lowest frequency end and the multi-burst portion in the neighbour are so close that the trimmed image sometimes include a tiny black part imperceptibly, which can　make the measurement incapable.

4.5.2 When rotate the chart at shooting

ISO12233-2000 chart is such that for diagonal 45 degree measurement 5 line wedges for low frequency and 9 line wedge for high frequency are arranged in two different directions (upper left to lower right and upper right to lower left). Thus in order to measure the two slanted directional resolutions individually and under the same conditions, it is necessary to measure the chart while rotating it by 90 degrees. At this time, if the Trim function of HYRes IV is used as it is, the wedge sent to the measurement window may sometimes be upside down (means the wedge at which the lower part is a low frequency and the upper part is a high frequency). Even in the case, if you use Vertical Invert function which is an option of Regenerate function of the measurement window, you can measure as is.

4.5.3 When not use Trim function of HYRes IV

Use an appropriate generic image processing software to trim a wedge part and save it as a bitmap image. (Jpeg is not acceptable.)

* Since the measurement in HYRes IV is performed by detecting from the top to the bottom of a wedge, it cannot measure anything other than upright wedges (oriented for measuring horizontal resolution). The wedge of any other orientation needs to be appropriately rotated using such as a generic image processing software.

However <u>for an angle of 45 degrees, it is mandatory to use the method described in CIPA resolution measurement method in order that the image interpolation processing performed during rotation has no effect on the resolution</u>. (The trimming and rotation of HYRes IV has no problem since it uses this method.)

4.5.4 Cases when abnormal results come out in spite of right usage

<Case 1>

Abnormal results can be brought out by scratches on the wedge image. If an image with a pattern slightly different from the original wedge figure is recorded due to dust adhering to the chart when shooting or deterioration of the chart (such as scratches), HYRes IV makes a judge such as "wrong wedge is used" or "Here is the resolution limit". Needless to say, shooting in the measurement has to be done without such an element.
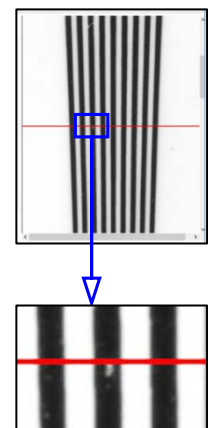

In the example image, it can be seen that there is a white island-like scratch by magnifying the point of the third black line from the left on the red line which indicates the resolution limit. Therefore HYRes IV made a judge such that a black line had increased into two lines at this point, it is not a wrong judge because aliasing (false resolution) of a camera may cause increase of black lines.

Example of case 1

When the points of scratches are limited it can be properly measured by local retouching on the corresponding points. However care should be taken of that if scratches are existing in the neighbourhood of the resolution limit it is too difficult to judge right or wrong. Moreover noise of large signal level can cause the same results such as scratches.
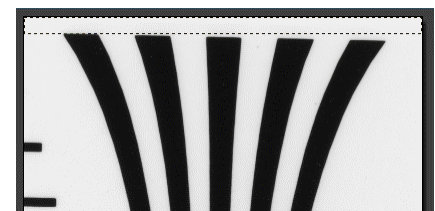

Copy the dotted line's area

<Case 2>

"In case that tilt of the camera to the chart (rotation around the optical axis) when shooting or geometric image distortion of the camera causes a situation that the upper end (the lowest frequency end) is not perfectly aligned in a horizontal line" or "In case that certain blur (bokeh) is appeared at the neighbourhood of that place by tilt of the optical axis when shooting", it can miss to detect the upper end of the wedge properly. (About a camera with large number of pixels, this phenomenon can occur even by slight misalignment almost unnoticeable at a glance.)
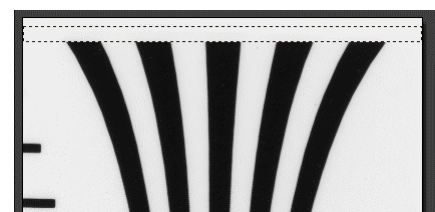
Rotation or blur should be excluded however it is unreal to make it zero perfectly, and since distortion is a part of camera

Then paste after sifting

Local retouching for case 2

characteristics it is impossible to avoid *.

For a practical alternative in these cases, align the upper end within a horizontal line (to the lowest upper end of black line) by local retouching on that place in the shot image and thereby measurement will be capable. In detail as shown in the figure, cut out (copy) the background area above the upper edge of the wedge with a rectangle, and paste it slightly lower (shifted). At that time, if you shift it too much, the measured value will be large due to the shortened wedge (inversely proportional to the wedge length), so keep it below the required accuracy.

* Except for the above-mentioned local retouching, it is strictly prohibited to perform image processing such as distortion correction and rotation on the image recorded by the camera, because it can have an unexpected effect on the result. (Regarding rotation, except 90 degree rotation under pixel equal size and 45 degree rotation of this software)

■ Note on retouching
In any case the resulted image where the evaluation image is locally retouched shall be saved as BMP that is uncompressed. Attention call is given here because it is important though would be obvious.

5　Extension

HYRes IV has extention not found in conventional HYRes 3.1 and HYRes ACE, and it can be used by launching with options at start-up. Multiple start-up options can be set at the same time. The details of each option are described below.

5.1　Contrast graph draw

Although referred to "contrast", it is not genuine contrast but a plot of the amount * corresponding to the output signal amplitude. And even as an amplitude characteristic, it is not a formal definition but just a substitute characteristic for reference.

* It is " [whole mean] - [mean of the 3 local minimums] in one line in the interested wedge area" called "black side half-amplitude" in the design of this software. An absolute value is one multiplied by a convenient constant (fixed value), and a relative value is one where the constant is so adjusted that the value near the starting point (low frequency end) of the wedge is about 0.7.

<Start-up procedure>
(1)In a command prompt mode, launch it with added the option as below

> HYResIV.exe /Contrast

(2) Instead of launching by a command prompt mode, it is convenient as following way. Create a shortcut to the execute file (HYResIV.exe) then save it by overwriting after adding the above option " /Contrast" to the end of the path to the execute file, which is located in "Target" (on the shortcut tab) in the property window of this shortcut. (See the right figure.)
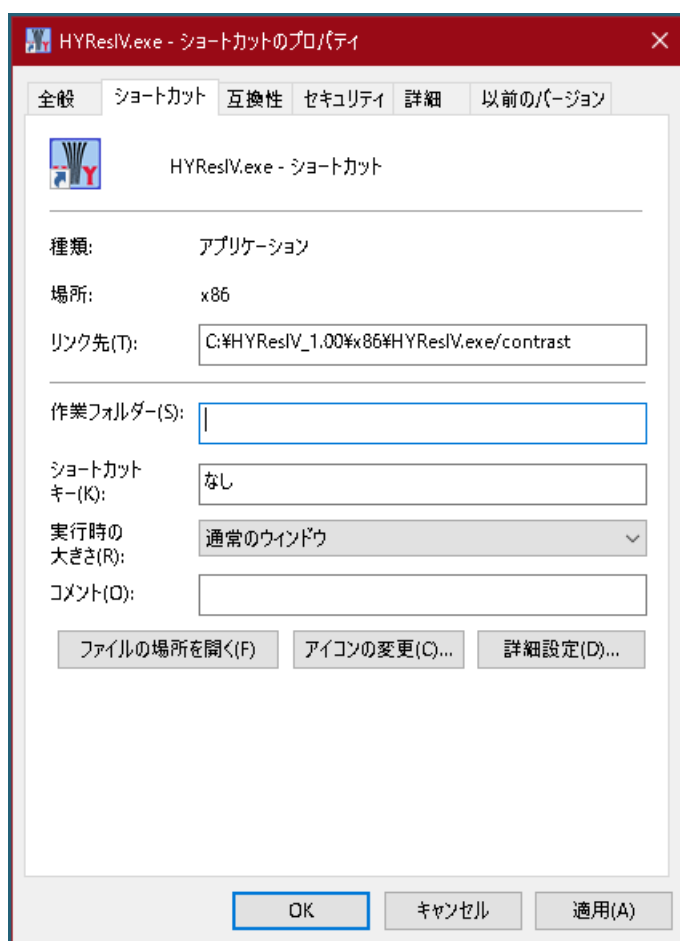
<Function>
+ When click the Execute button on the Measure tab to measure, with the measurement result the contrast calculated result will be drawn as a graph.
+ The vertical axis is the contrast value, the horizontal axis is spatial frequency (in unit [LW/PH])
       Note: The description [LP/mm] on the software is an error.
+ Drawing mode is changeable by selecting the radio button at the lower tier.
    All: Show both absolute value and relative one of contrast values
    Absolute: Show absolute value of contrast value (Blue)
    Relative: Show relative value of contrast value (Orange)
+ Vertical check box: When check it the graph will be rotated 90 degree to show along the wedge.
+"Copy to clipboard" button: Copy the listed data of the spatial frequency value and the corresponding contrast value to a clipboard (CSV format)
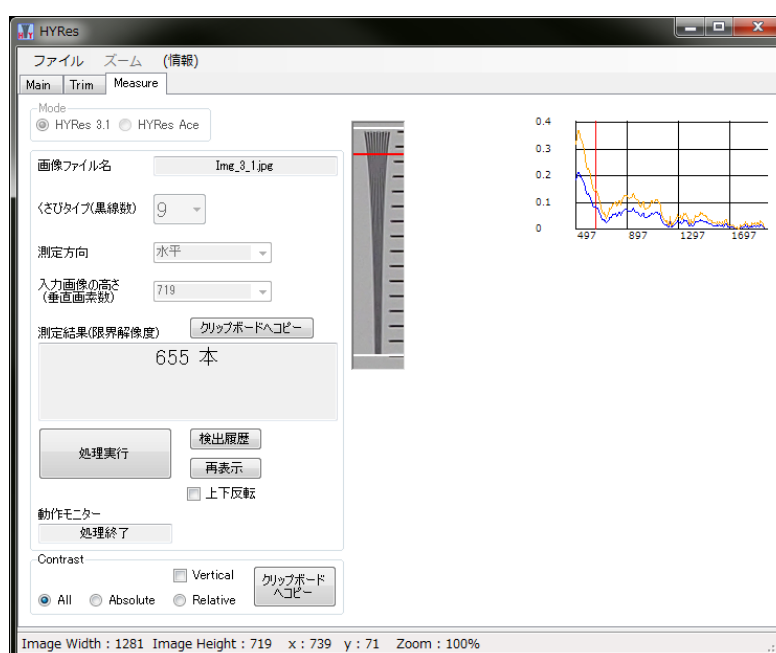
5.2   Batch processing

It is possible to measure a plurality of shot images together at once by trimming the same area.

<Start-up procedure>
(1)In a command prompt mode, launch it with added the option as below

> HYResIV.exe /Batch

(2) As well as 5.1 above, it is also available to add the option by using a shortcut.

<Function>
+ Collectively measure on the images in the same folder under the pre-set conditions (mode, wedge type, and measurement direction) and trim area then output the results as a CSV file.
+ Proper measurement result is obtained for only the images of the same of chart type, image size, measurement view angle and so on.
+ For those that could not be measured, the measurement failure is recorded in the CSV and the process continues.

<Operation procedure>
(1) Do the operations till (5) in 4.3 Method1 on one of the images wanted to be done batch processing.
(2) Move onto Batch tab.
(3) Input the path of the folder where the images wanted to be done batch processing are located to the "Input folder" column then click "Get filename list" button. Otherwise specify the folder from "…" button.
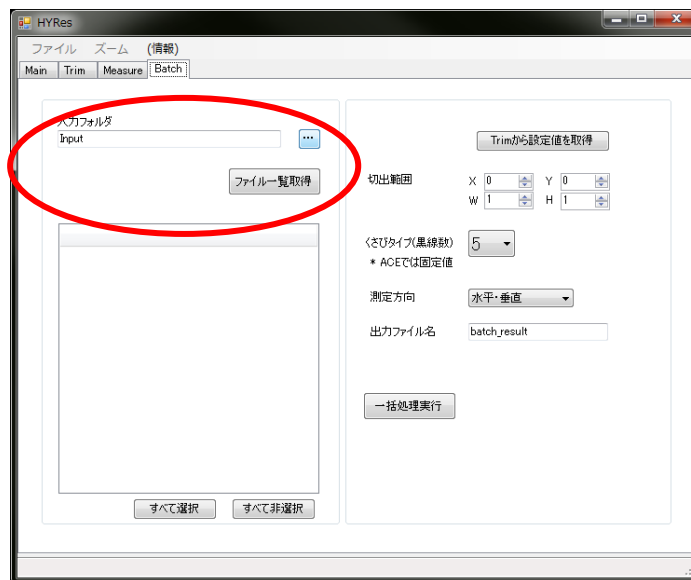

(4) Check the check boxes wanted to be processed from the shown file list.
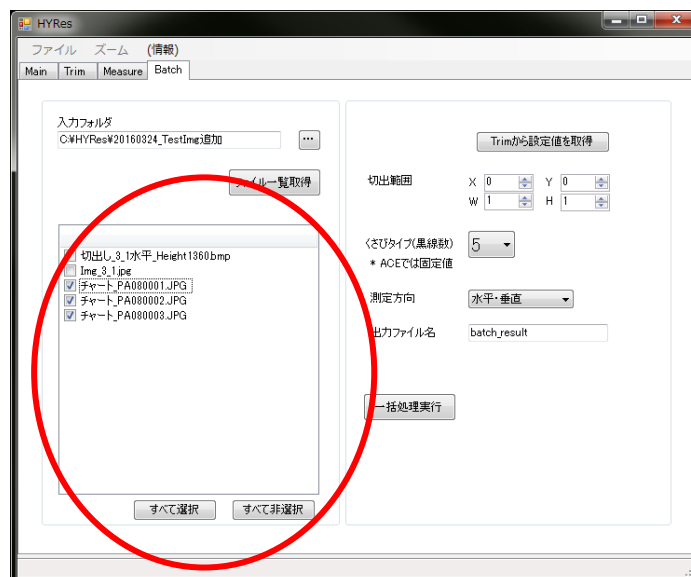
(5) Click "Get parameters from Trim" button to get the values set beforehand by Trim.
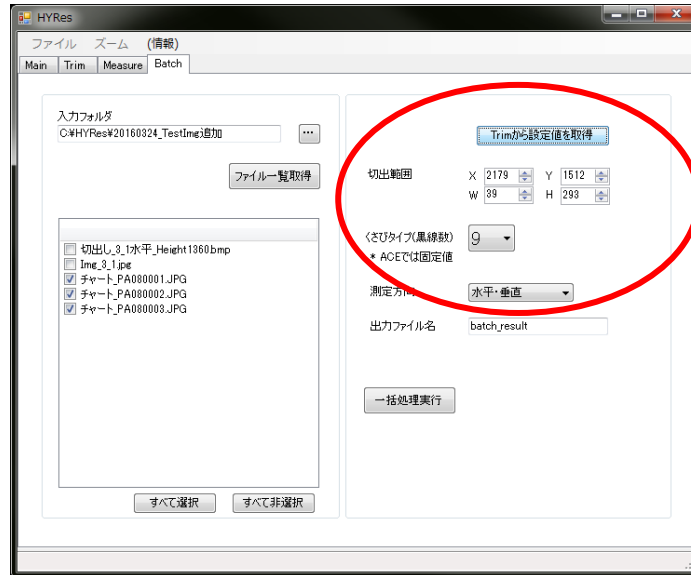
(5) Specify output file name if needed then Click "Execute batch" button. Thereby the CSV file of the processed result will be saved in the same folder as "Input folder". (Date and time are automatically added to the file name.)
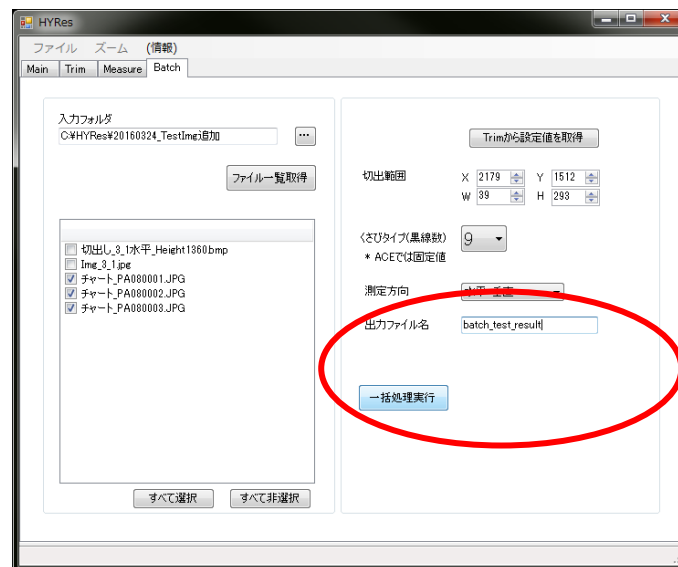
6   List of operation

Operation name	Mouse operation	Keyboard operation (Such as shortcut)
Change screen (tab)	Click a tab	← or →

6.1   Main tab

Operation name	Mouse operation	Keyboard operation (Such as shortcut)
Link to OLYMPUS's HP	Click the URL	-

6.2   Trim tab

Operation name	Mouse operation	Keyboard operation (Such as shortcut)
Read (Open) image	[Menu] File > Open	-
Display as full (fit to) window	[Menu] Zoom > Fit to Window	Ctrl + 0
Display as pixel equal size (actual pixels / one-to-one)	[Menu] Zoom > Actual Size	Ctrl + 1
Display as centred	[Menu] Zoom > Image to Center	Ctrl + 2
Select trimming area	+ Drag and drop on the image or + Click ▲ ▼ button of numeric input box	Input numeric
Zoom up displayed image	Operate mouse wheel forward with pressing Ctrl key	+ or ↑ (+ is a key in Numpad)
Zoom down displayed image	Operate mouse wheel reverse with pressing Ctrl key	– or ↓ (– is a key in Numpad)
Move displayed area of image	+ Drag and drop by right button click or + Operate scroll bar	Ctrl +arrow key: Move 50pix Ctrl + Shift +arrow key: Move 1pix
Move trim area	+ Drag and drop by right button click within trim area or + Click ▲ ▼ button of numeric input box	Input numeric

6.3   Measure tab

Operation name	Mouse operation	Keyboard operation (Such as shortcut)
Read an image	[Menu] File > Open	-
Specify height of input image	Select from list	Input numeric
Copy result to clipboard	Click "Copy to clipboard" button	-
Copy contrast graph data to clipboard as "Comma-separated values"	Click "Copy to clipboard" button inside Contrast frame	-
Copy contrast graph data to clipboard as "Tab-separated values"	Click "Copy to clipboard" button inside Contrast frame with pressing Shift key	-

7   Pledge on use of this software

Anyone using this software is automatically regarded as making the pledge below.

I pledge the following matters where using the resolution measurement software HYRes IV (hereinafter referred to as this Software).

1) All rights concerning this Software, including its copyrights, shall remain vested in OM Digital Solutions Corporation (hereinafter referred to as "OMDS"), to which the creator of this Software (hereinafter referred to as the "Creator") belongs, and except for as expressly granted under this pledge, no license or rights, in whole or in part, is granted, assigned or transferred to me by receiving and using this Software and its manual.
2) To the maximum extent permitted by applicable law, OMDS, Camera & Imaging Products Association (hereinafter referred to as "CIPA") and the Creator provide this Software AS IS AND WITH ALL FAULTS, and hereby disclaim all warranties and conditions, either express, implied or statutory, including, but not limited to, non-infringement of third party intellectual property rights, and its fitness for a particular purpose.
3) OMDS, CIPA, and the Creator shall not be liable for any claims or damages whatsoever due to any problems or damages, direct or indirect, arising from the use of this Software.
4) No questions pertaining to technical and other aspects of this Software, including its specifications, shall be directed to OMDS, the CIPA, or the Creator.
5) This Software shall be used solely for its intended usage and shall not be used, either in whole or in part, for any other usage such as sales.
*Said "intended usage" is to measure resolution properly and justifiably and to utilize its measurement results, also may include announcing the measured values if they are objective ones obtained properly and justifiably.
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HYRes IV resolution measurement tool software Manual

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Documentation and responsibility:
HIDEAKI YOSHIDA the creator of HRes IV
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