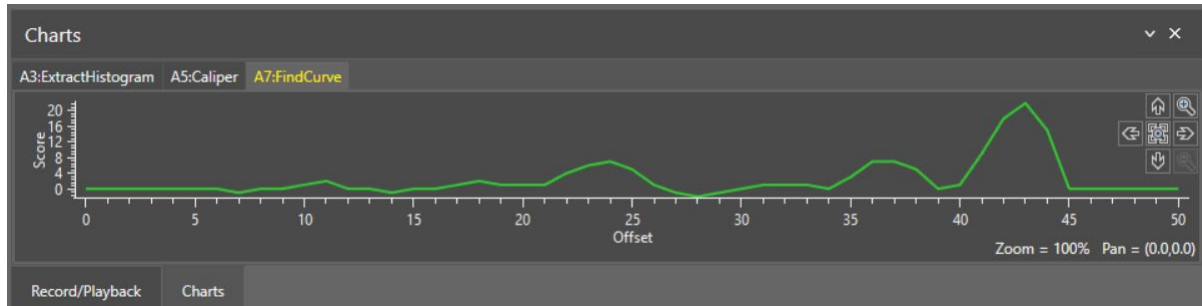


Contents

- 1. Charts..... 1
 - 1.1 Display 2
 - 1.2 Navigation and View 3
- 2. Explanation of Charted Data 6
 - 2.1 Charts as produced by the Extract Histogram tool..... 6
 - 2.2 Charts as produced by the FindLine tool 7
 - 2.3 Edge Width – Filtering Edges 9

1. Charts

Charts offer a visualization of the information relevant to the specific tools, enabling you to precisely configure tools and ensure repeat performance of a tool.



The functions that currently support charting:

1. Edge Based Tools

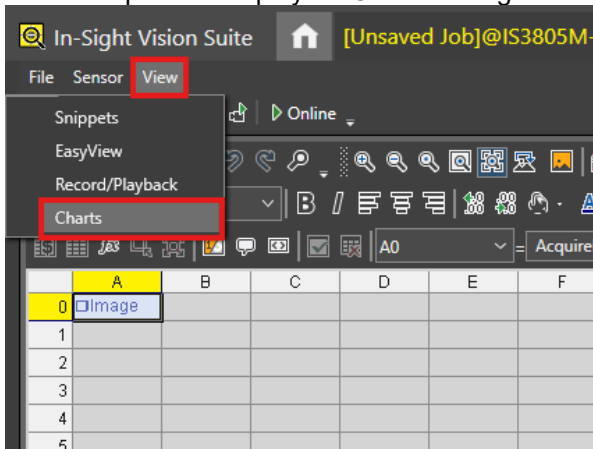
- Caliper
- FindCircle
- FindCurve
- FindLine
- FindMultiLine
- FindSegment
- InspectEdge
- InspectEdgeTrainBeadPath

2. Histogram Tools

- ExtractHistogram
- ExtractColorHistogram
- ExtractHistogram3D

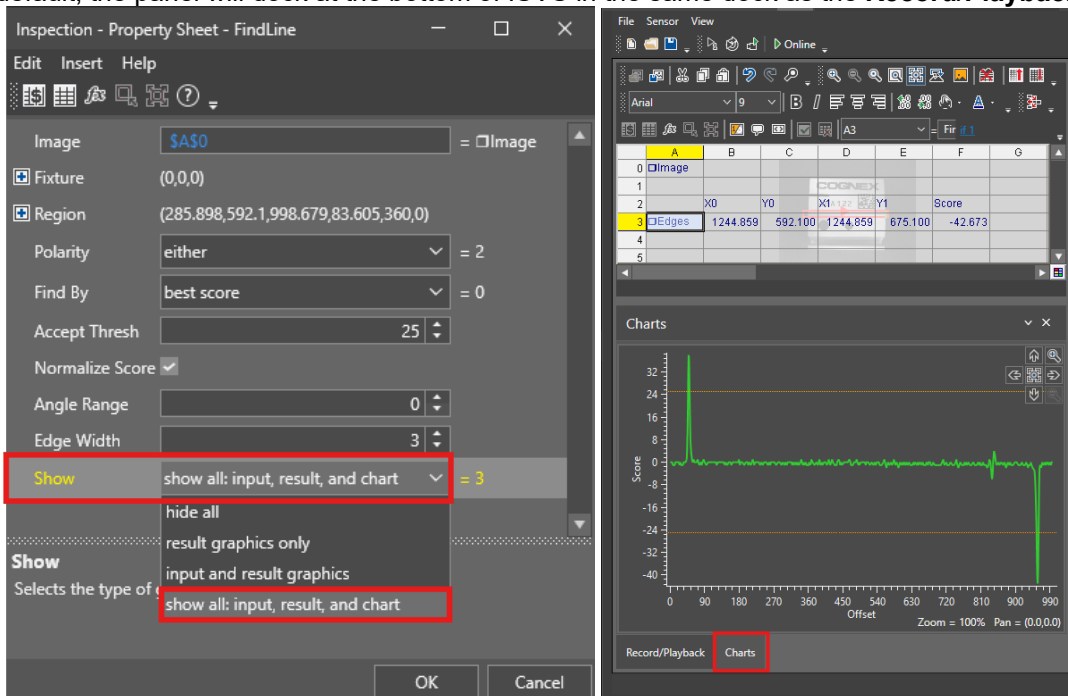
1.1 Display

You can open the display for Charts through the **View > Charts** menu.



Note: This contrasts with ISE where the charts would be overlaid as a graphic.

When the **Show** parameter is configured to display the chart, the chart opens in the **Charts** panel. By default, the panel will dock at the bottom of ISVS in the same dock as the **Record/Playback**.



The chart automatically syncs with the function. If you make changes to the function generating the chart, the chart automatically updates to reflect the change.



Note: When in the tool dialogue, updating a value requires that you leave the selected parameter before the change will be reflected in the graph.

When there are multiple functions that generate charts in a spreadsheet, the functions appear as new tabs. Selecting a function in the spreadsheet displays the chart in the **Charts** panel. Likewise, selecting the chart in the Charts panel shows the function tab generating the chart in the spreadsheet.

B19:Caliper	B20:Caliper	B21:Caliper	B22:Caliper	B23:Caliper	B24:Caliper	B25:Caliper	B26:Caliper	B27:Caliper	B28:Caliper	B29:Caliper
B6:Caliper	B8:Caliper	B9:Caliper	B10:Caliper	B11:Caliper	B12:Caliper	B13:Caliper	B14:Caliper	B15:Caliper	B16:Caliper	B17:Caliper

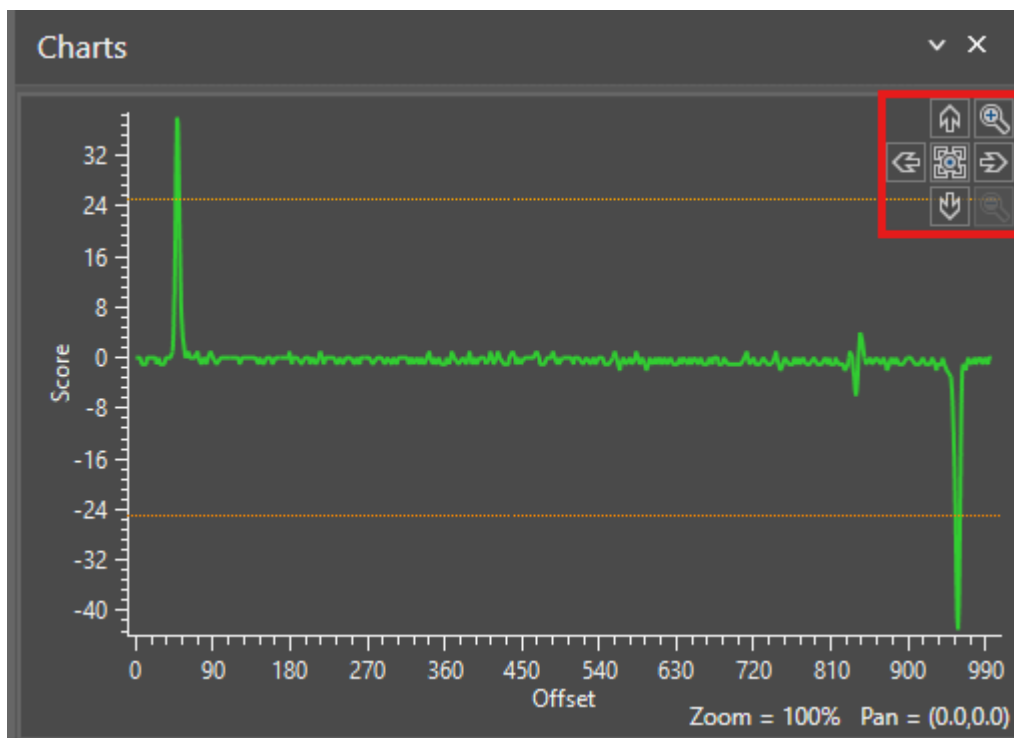


Note: The displayed tab name will always show the cell location and not the cell name if it has a Symbolic Tag.

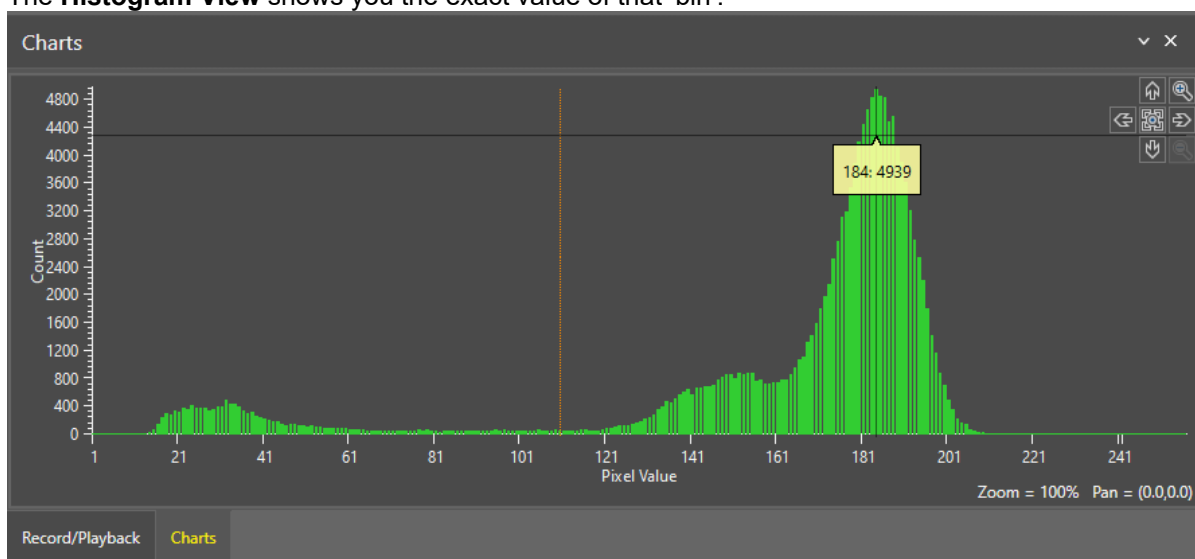
Navigation and View

You can zoom in on the chart with the navigation in the top right corner of the Chart. You can:

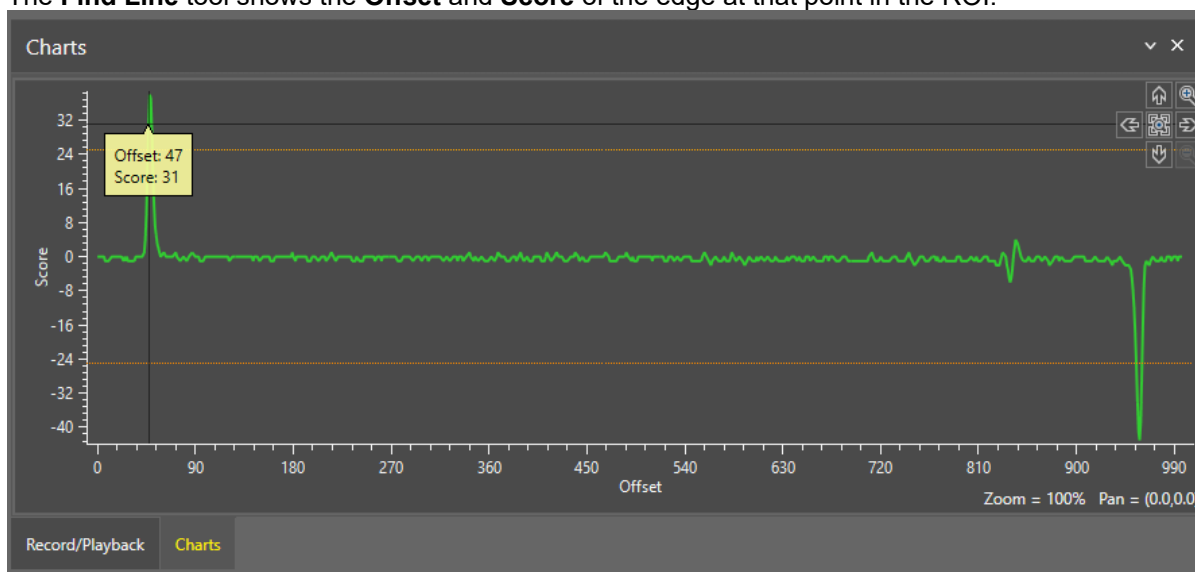
- Zoom in and out
- Use the arrows to navigate
- Reset the axes
- Click and hold at a point on the chart to get the data that is relevant to that point



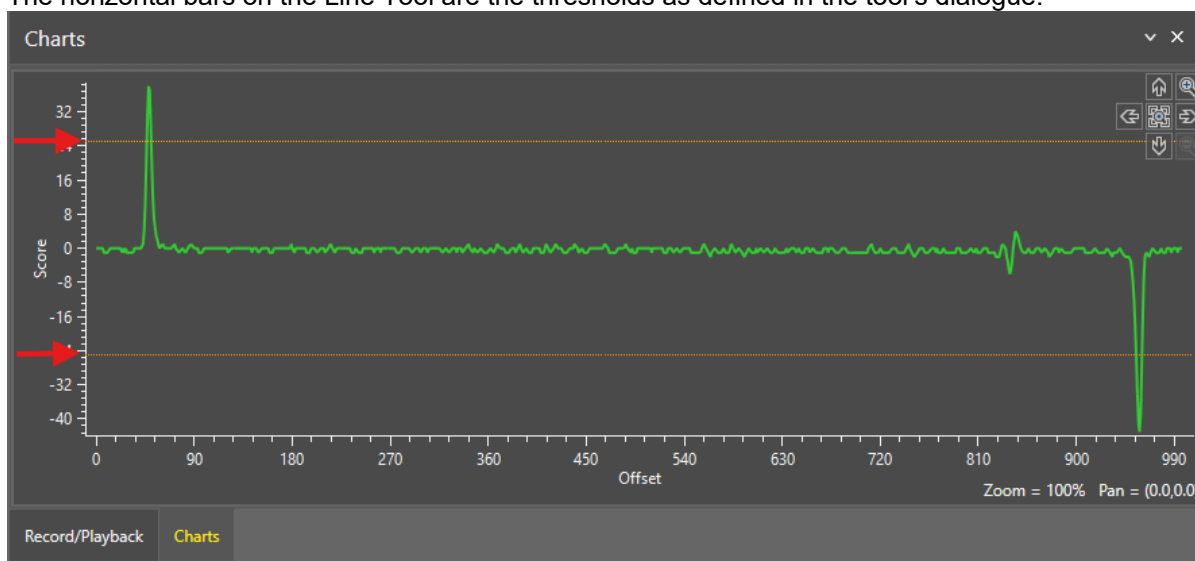
The **Histogram View** shows you the exact value of that 'bin'.



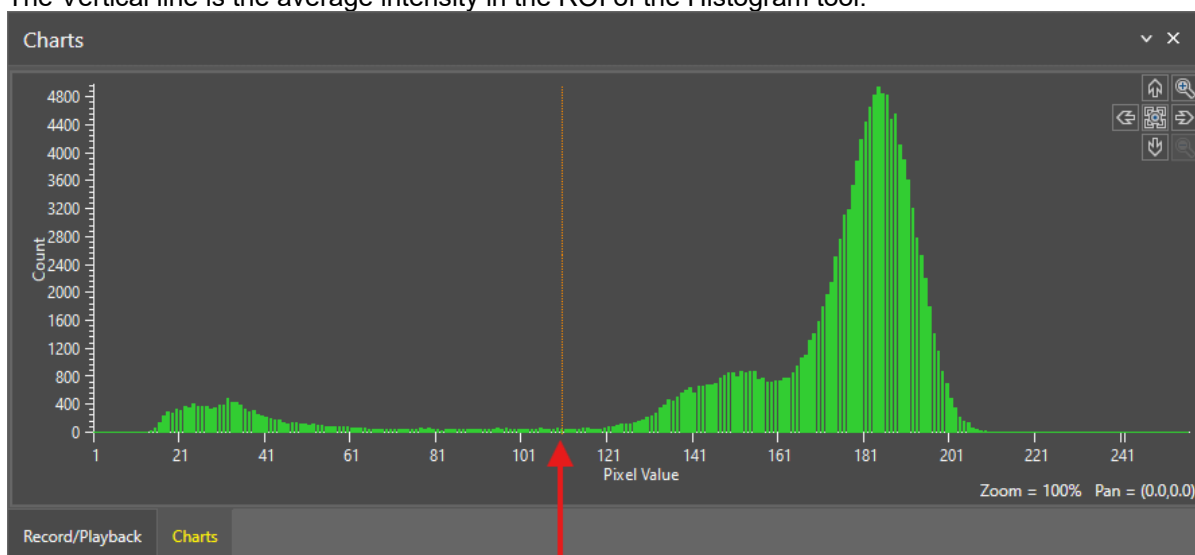
The **Find Line** tool shows the **Offset** and **Score** of the edge at that point in the ROI.



The horizontal bars on the Line Tool are the thresholds as defined in the tool's dialogue.



The Vertical line is the average intensity in the ROI of the Histogram tool.



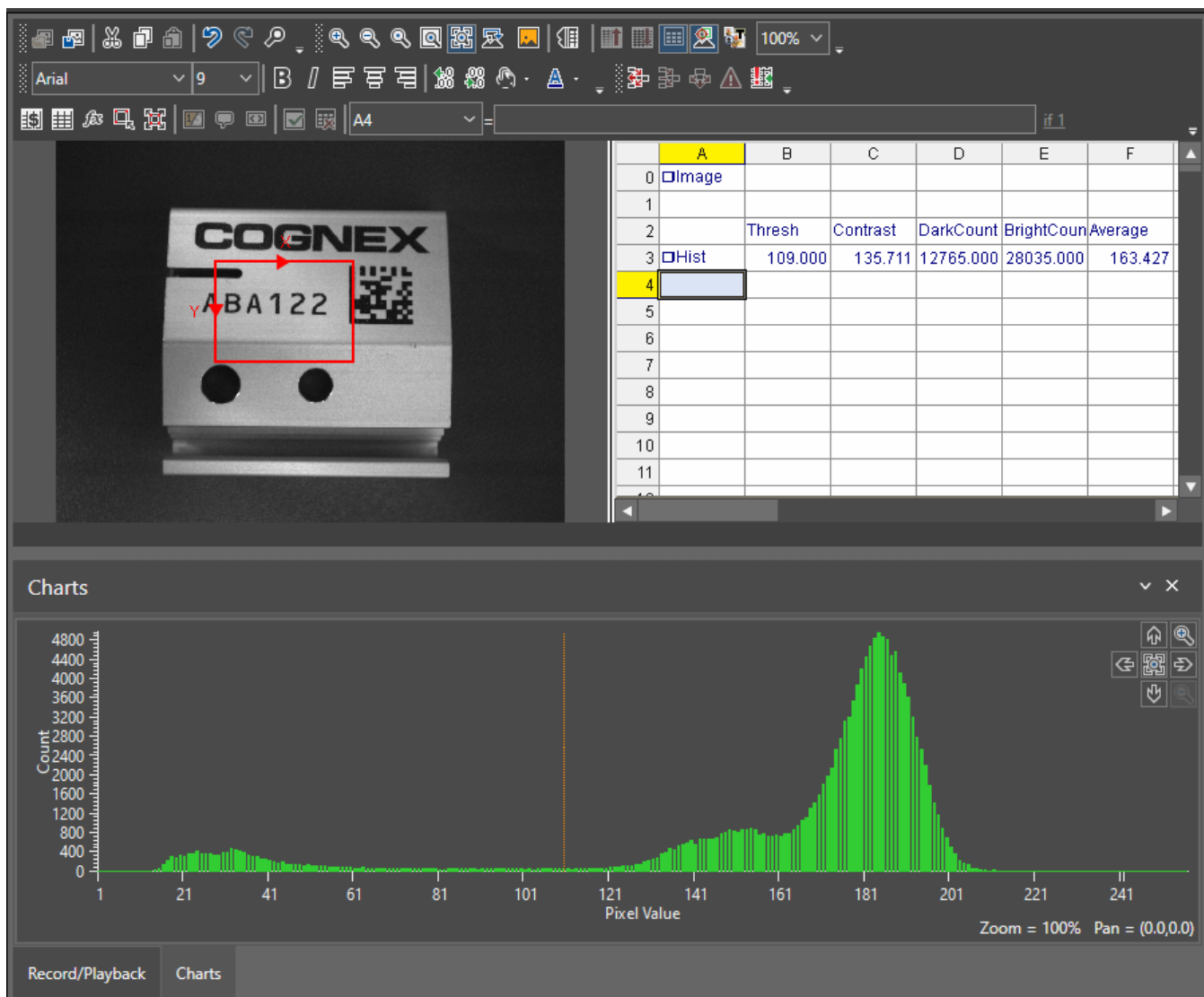
2. Explanation of Charted Data

2.1 Charts as produced by the Extract Histogram tool

The In-Sight Histogram tool performs histogram analysis by examining a ROI and classifying each individual pixel in it according to its greyscale value. It then places them in a "bin" according to the pixel's greyscale value. In an 8-bit greyscale image, there are 256 bins, based on possible greyscale values (0 to 255). Each bin contains a count of the number of pixels in it, with the bin being the index for the count.

For example, if an image were to contain 46 pixels with a greyscale value of 33, the 33rd bin of the histogram for that region would contain the value 46. Additionally, the sum of the bins in the histogram array is always equal to the area of the region from which it was extracted.

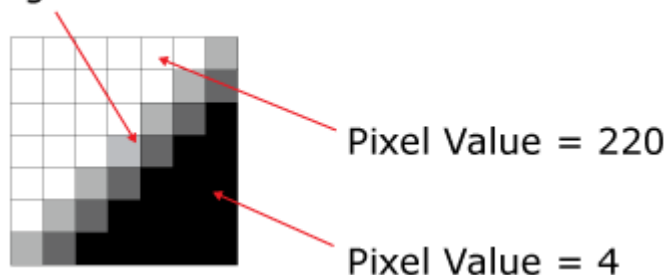
- The X-axis of the graph represents the total number of greyscale values (0 to 255).
- The Y-axis of the graph represents the number of pixels at a given greyscale value, and the scale is established by displaying the greyscale value with the greatest number of pixels.



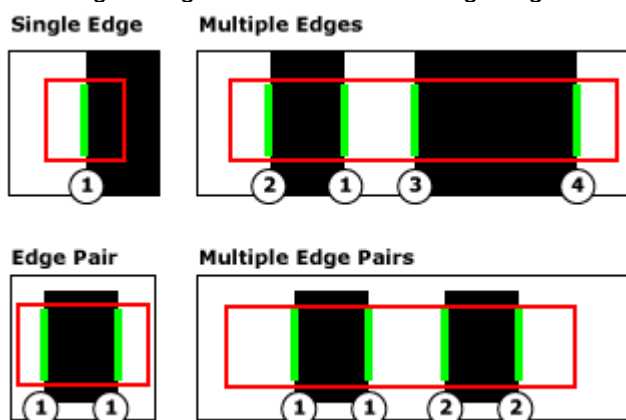
2.2 Charts as produced by the FindLine tool

The In-Sight Edge Tool functions detect edges by examining a region of interest (ROI) for discontinuities in pixel polarity (i.e., an area in the image where there is an abrupt change between light and dark (or vice versa) pixels). An edge might only span 2 or 3 pixels, or several.

Edge

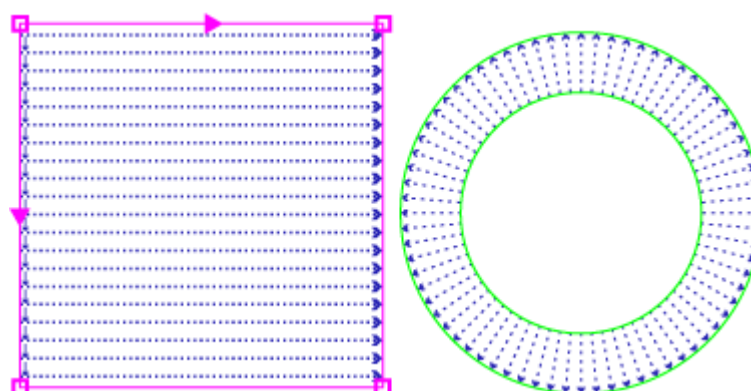


Edges can be comprised of a single edge or a pair of edges, which consists of two transitions from dark to light or light to dark. The following image shows the types of edges.



When an Edge Tool, such as a **Caliper**, **FindLine**, or **FindCircle** function, is inserted into the spreadsheet, the ROI is scanned for any pixel value discontinuities. The image below illustrates the direction in which rectangular and annular regions are scanned for edge features. In the rectangular region, the scan direction (the scan direction is indicated by the two directional arrows) starts from the uppermost left-hand corner and proceeds to the end of the right-hand side, and then continues the pattern until it reaches the bottom right-hand corner.

Scan Directions — Rectangular and Annular Regions



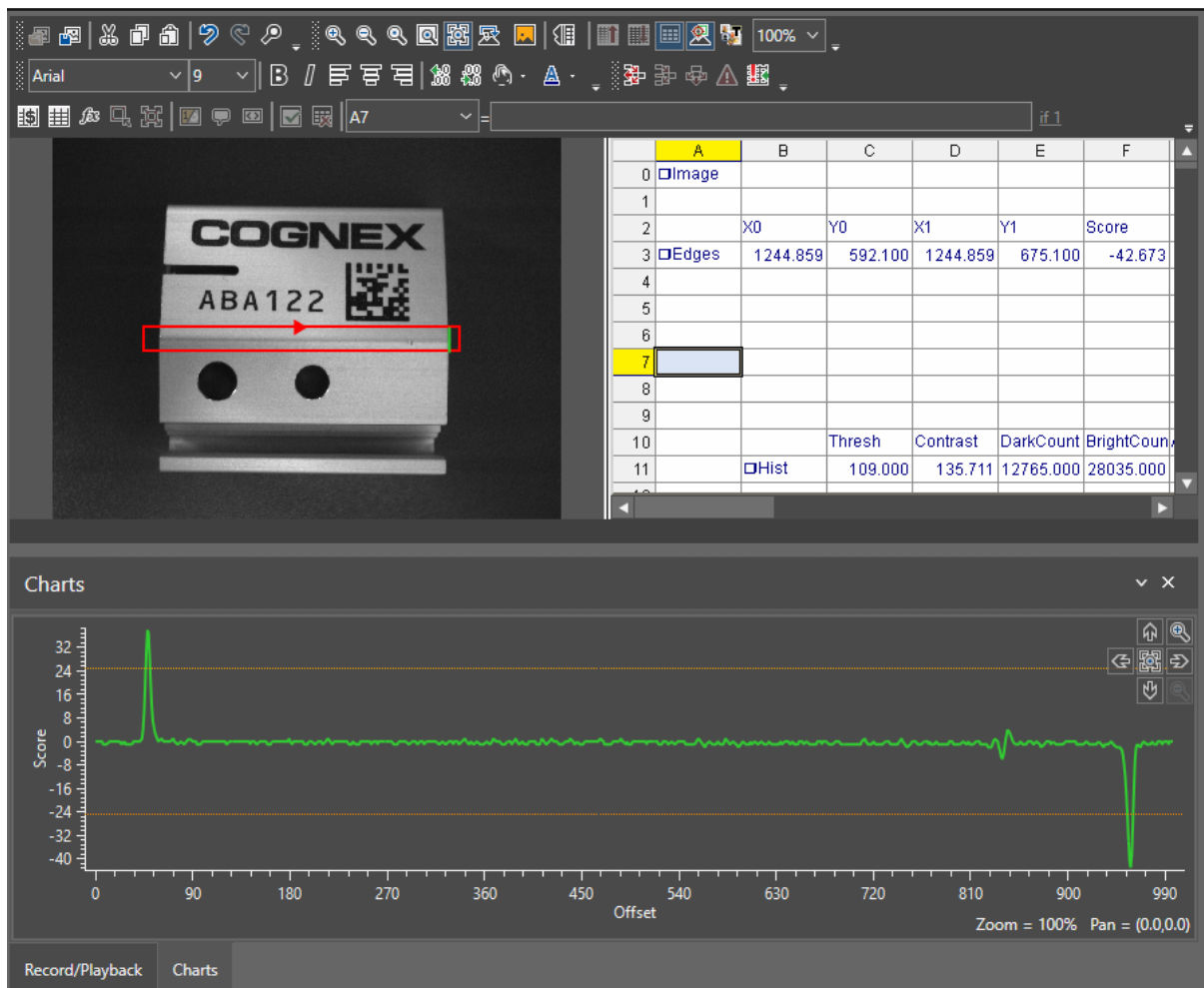
During this process, a greyscale histogram is computed of the ROI, and areas defined by high contrast (the difference between greyscale values found within the ROI) and meeting the other specified parameters, define an edge.

The **Edge Response** chart (displayed when the Show parameter is set to Show All: Input, Result, and Chart) displays the first derivative of the greyscale values found in the ROI with peaks and valleys representing the major edge transitions, as shown in the figure below.

The **Accept Threshold/Minimum Contrast** parameter is used to set a minimum peak height (contrast threshold). With this set, any peaks that are lower than the minimum peak height are excluded from the results. This allows the inspection analysis to be limited to edges in the image that are of a certain magnitude. Use the function's **Edge Response** chart to determine the correct contrast threshold.

- The X-Axis Offset axis refers to the ROI of detecting the edge feature, where 0 represents the beginning of the region and the right-hand value marks the maximum width (in pixels) of the region. The apex of the peaks or valleys along the Offset axis indicates the position of the found edge within the ROI.
- The Y-Axis Score axis is defined by the Score (100 and -100) and the Accept Threshold parameter set for the tool. **Peaks** (or positive scores) indicate that the edge transitions from **dark to light**, while **valleys** (or negative scores) indicate that the edge transitions from **light to dark** (a score of 0 indicates no edge was detected).

Edge Response Chart Example



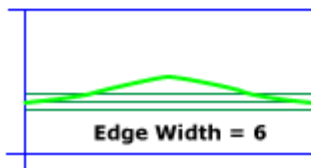
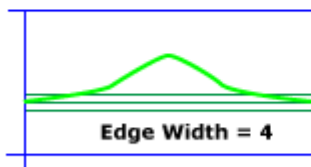
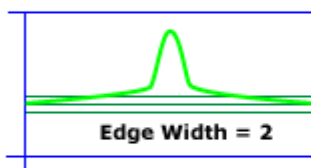
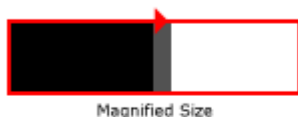
2.3 Edge Width – Filtering Edges

The **Edge Width** parameter is used to remove noise from the input image and accentuate the peaks of the edge profiles. The size of the **Edge Width** parameter should be specified such that:

- The size closely matches the size of the edges in the image, and
- The peak is sharp and steep, versus low and gradual.

The size of an edge is how many pixels wide the edge is. An edge can be sharp, spanning only a pixel or two, or edges can be dull, spanning several pixels. Specifying an Edge Width setting that is close to the edge size allows the function to produce stronger edge peaks in the image. Whereas specifying an Edge Width setting that is too large or too small will produce broad, low peaks in the image.

Sharp Edge
(1 Pixel Wide)



Dull Edge
(5 Pixels Wide)

