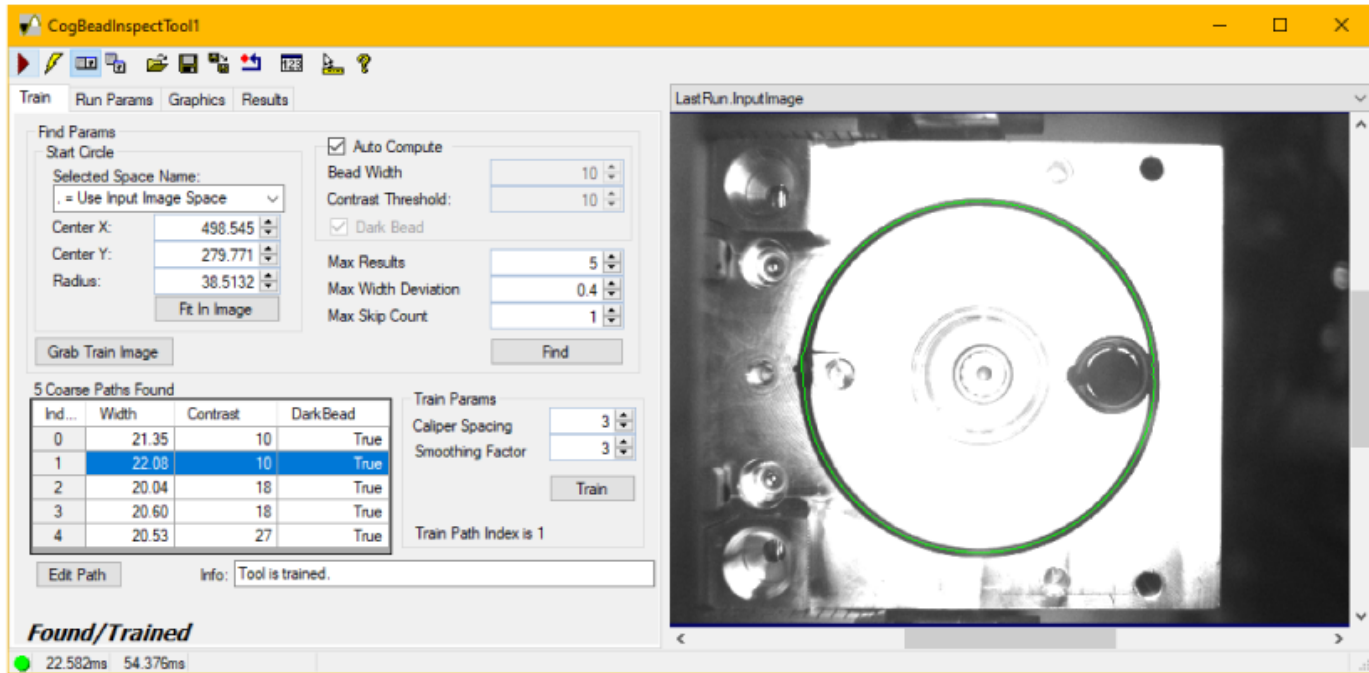


Bead Inspect Edit Control

Use a Bead Inspect tool to examine the path of a bead and find defects in images where the bead suffers gaps, over-filling, or other flaws. See the topic [Using a Bead Inspect Tool](#) for more information on using a Bead Inspect tool.

QuickBuild offers a Bead Inspect tool edit control for training and testing a Bead Inspect tool:



The edit control offers the following features:

- A row of control buttons at the top provide access to the most common operations.
- A set of function tabs allow you to train the path of a bead, provide runtime parameters and view tool results.
- An image display window displays acquired images and graphical results of the Bead Inspect tool.

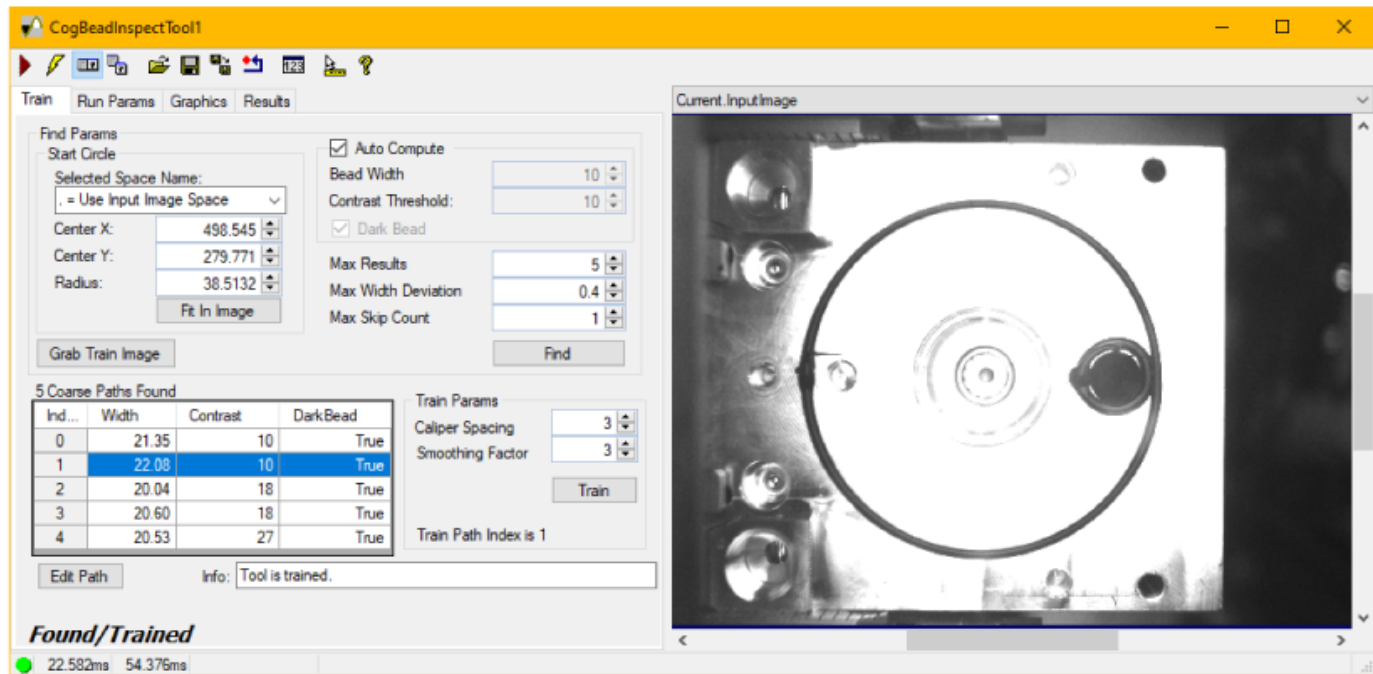
To include the edit control in your Visual Studio vision application, you must first add it to your .NET development environment. See the topic [Adding Edit Controls to Visual Studio](#) for more information.

Use the following features to configure the tool:

- [Train Tab](#)
- [Run Params Tab](#)
- [Graphics Tab](#)
- [Results Tab](#)
- [Button Bar](#)

Train Tab

Use the **Train** tab to locate the bead path in a sample image and then train the tool to find it in your runtime images:

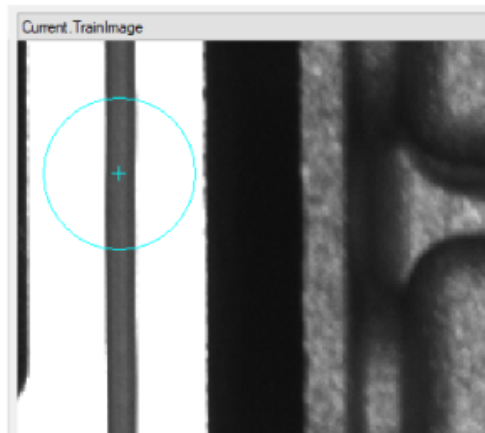


You must perform the following steps to train the tool with the path of a bead:

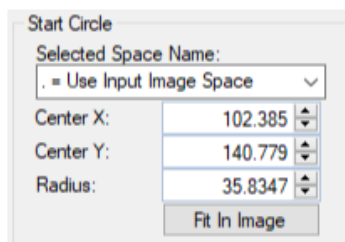
1. Acquire a good sample image of the bead you want to analyze in runtime images and Run this CogJob to pass the image to the Bead Inspect edit control.

The Current.InputImage

2. Click **Grab Train Image** to copy the Current.InputImage buffer to the Current.TrainImage buffer.
3. Switch to the Current.TrainImage buffer and adjust the Start Circle graphic so the center of the circle is as close to the middle of the bead as possible:



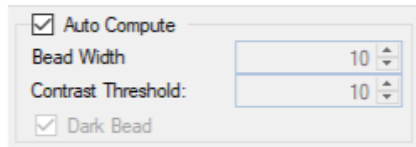
Adjust the Start Circle using the graphics on the Current.TrainImage or use the **Start Circle** parameters in the tab, which reflect the settings in the Current.TrainImage buffer:



Selected Space Name	Coordinate space in which this shape is to be interpreted.

Center X	X coordinate of the center of the Start Circle
Center Y	Y coordinate of the center of the Start Circle
Radius	Radius of the Start Circle

4. Allow the tool to determine the best settings for the following parameters with the **Auto Compute checkbox**, or set these parameters manually:



Bead Width	The expected width of the bead path to search for, based on the current coordinate system
Contrast Threshold	The contrast threshold used to detect the edges of the bead
Dark Bead	Indicates if the bead path is darker than the background pixels

5. Click **Find** to have the tool detect the features in the image corresponding to the bead path.

The Bead Inspect tool analyzes the sample image with different search parameters and attempts to generate one or more coarse paths that accurately track the bead path in your sample image. Depending on the features in your image, some coarse paths might accurately reflect the bead path while others will not.

The **Train** tab supports a grid that shows the bead width and contrast of each coarse path and indicates if the found path consists of a dark bead:

Ind...	Width	Contrast	DarkBead
0	13.15	17	True
1	13.04	35	True
2	13.04	35	True
3	13.08	17	True
4	14.98	52	True

Select any of the coarse paths in the grid to display it in the Current.TrainImage buffer. Before you can train a Bead Inspect tool you must choose which coarse path is the closest to the actual bead path.

Click **Edit Path** to open a graphical user interface to edit the coarse path. See the section [Choosing a Coarse Path](#) for details on how to choose and modify a coarse path before training the tool. Save the changes you make to the desired coarse path.

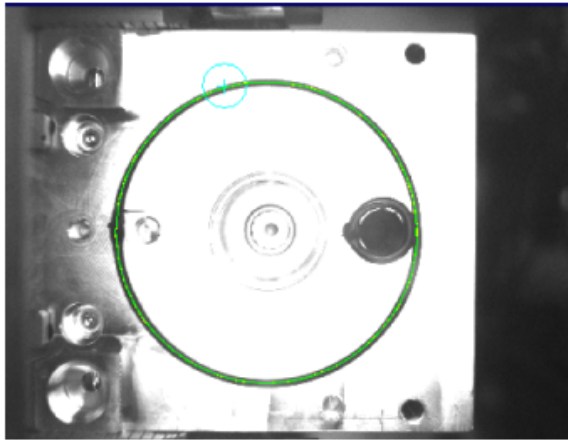
Based on the coarse paths found, you can adjust the following parameters and perform another **Find** operation to search the image again for coarse paths:



Max Results	By default the tool finds a maximum of five coarse bead paths but you can lower that value to have the find operation execute faster.
Max Width Deviation	The maximum allowable change in the width of the bead path, specified as a fraction of the bead width.
Max Skip Count	The find algorithm searches along one direction to find the bead path in your sample image. The algorithm can ignore, or jump, over gaps in the expected location of the bead path. The width of the found bead path determines the size of each jump. Set the maximum allowable jumps the algorithm can continue searching along its current direction.

6. Click **Train** once you have a coarse path that matches the actual bead path in your sample image.

After a successful training the Current.TrainImage buffer highlights the found bead path that the tool will use in your runtime images:



The **Train** tab also supports the following parameters that offer additional control over the calipers the tool uses to locate the path of the bead:

Caliper Spacing	Set the spacing between caliper center-points along the chosen coarse bead path. Larger values result in fewer calipers along the bead path while a smaller values result in more calipers. Smaller values can increase accuracy at the cost of execution time.
Smoothing Factor	A higher smoothing factor allows the tool an increased tolerance for change in features along the bead path in your runtime images. You might increase this value when variation in the bead path in your runtime images is expected and acceptable.

Run Params Tab

This section contains the following subsections.

- [Setting Run Parameters](#)
- [Copy Suggested Run Parameters](#)
- [Setting Mask and Fill Edge Ranges](#)

The **Run Params** tab supports a set of parameters to locate the bead path in your runtime images and allows you to specify masking and fill edge pixels. See the section [Masking and Filling Edges](#) for more information on masking and edge filling.

CogBeadInspectTool

Train Run Params Graphics Results

Contrast Threshold: 10
 Absolute Distance Threshold: 0.33
 Consecutive Failing Calipers: 2
 Coverage: Min: 0.8
 Width: Min: 0.8
 Step Threshold: 0.37

Copy Suggested Run Parameters

Max: 1.4
 Max: 1.49

Mask and Fill Edge Index Ranges:

Mask Left Fill Edges Right Fill Edges

ID	First Index	Last Index	Value
0	0	100	True
1	101	855	False

Set Index Range

First: 0
 Last: 0
 Value: True

Set Index Range

Edit Mask or Fill Edges

Found/Trained

29.511ms 29.654ms

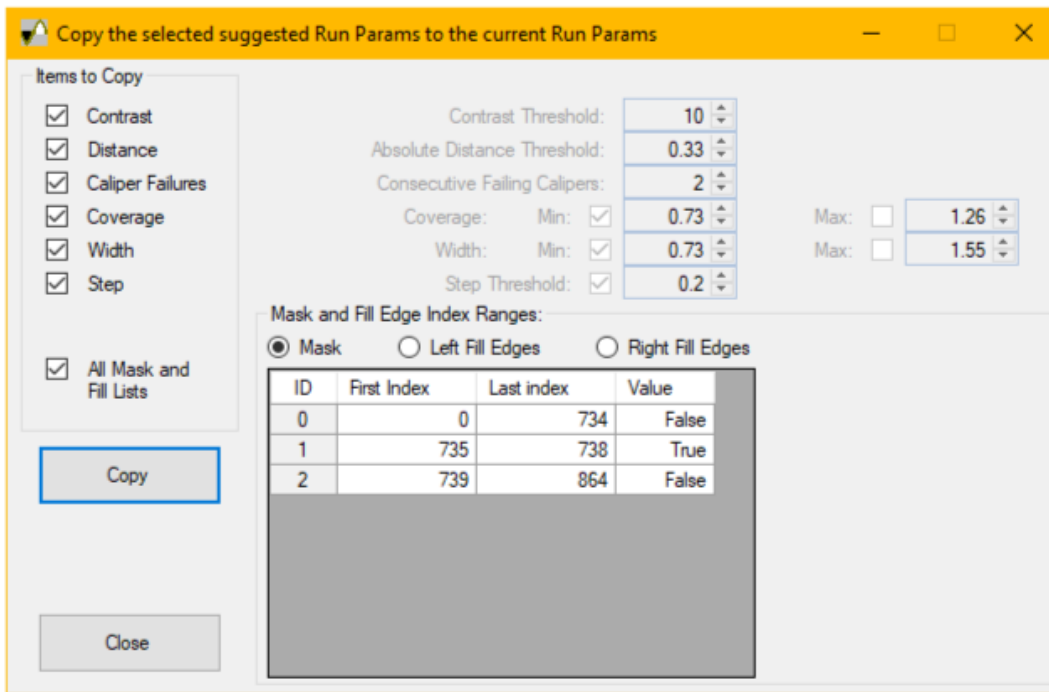
Setting Run Parameters

The tool supports the following run parameters:

Contrast Threshold	Set the absolute minimum difference in average pixel values to indicate the edge of the bead.
Absolute Distance Threshold	<p>Set the maximum amount an edge position of the bead can deviate in location from the trained bead position, based on a fraction of the average bead width. The default value of 0.5 indicates a bead edge can deviate position as much as half the average width of the bead.</p> <p>Use a low value when the edges of the bead in a runtime image must appear very close to where they were found in the training image, or a higher value when the edges of the bead can drift and the bead can still be considered valid.</p>
Consecutive Failing Calipers	<p>Set the minimum number of consecutive failing calipers for a defect to be reported.</p> <p>Use a low value to have the tool report small defects in the bead path, or use a higher value if your bead path can contain small defects and still be considered valid.</p>
Coverage Max and Coverage Min	<p>The tool compares the number of bead pixels found in your runtime image to the number of bead pixels found in the training image.</p> <p>Set a minimum and maximum percentage of acceptable coverage, with the tool returning a defect if the bead path in your runtime image is outside of this range.</p> <p>For example, the default value of 0.5 (Coverage Max) allows your runtime image to contain half as many pixels as the bead path in the training image, and the default value of 1.5 (Coverage Min) allow your runtime image to contain 150% more pixels than the bead path in the training image.</p>
Width Min and Width Max	<p>The tool compares the width of the bead path in your runtime image to the width of the bead path in the training image.</p> <p>Set a minimum and maximum width ratio, with the tool returning a defect if the bead path in your runtime image is outside of this range.</p>
Step Threshold	<p>Set the maximum relative amount an edge position along the bead path can deviate from neighboring edges, specified as a fraction of the average bead width at that location.</p> <p>A higher value allows the edges of the bead path to deviate with more tolerance.</p>

Copy Suggested Run Parameters

When you train a Bead Inspect tool it generates a set of candidate run parameters to find the bead path in your training image. Click **Copy Suggested Run Parameters** to select which of the suggested run parameters you want to use in the edit control:



The interface allows you to select some or all the run parameters suggested by the training image, as well as any masking or edge filling index ranges the tool determines you can use to avoid finding any defects in the image you used for training.

Setting Mask and Fill Edge Ranges

Click **Edit Mask or Fill Edges** to open an interface that allows you to ignore or modify imprecise areas of a bead path which could otherwise result in false defects:

Bead path represented as a range of caliper results

Choose to create a range of mask caliper results or a range of calipers where the right or left edge will not be marked as defects

Mask and Fill Edge Index Ranges:

Mask Left Fill Edges Right Fill Edges

ID	First Index	Last Index	Value
0	0	855	False

Set Index Range

First: 0
Last: 0
Value: False

Set Index Range

Space: (924,966, 132,606) | Zoom: 61.08% | Value: 206

Mask Left Fill Edges Right Fill Edges

Create

Erase

Graphic Options

Show Caliper Centers

Show Caliper Rectangles

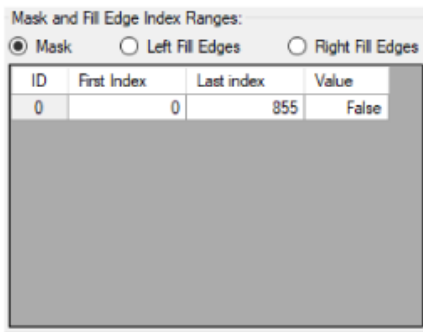
Clear All

Cancel

Confirm Selection

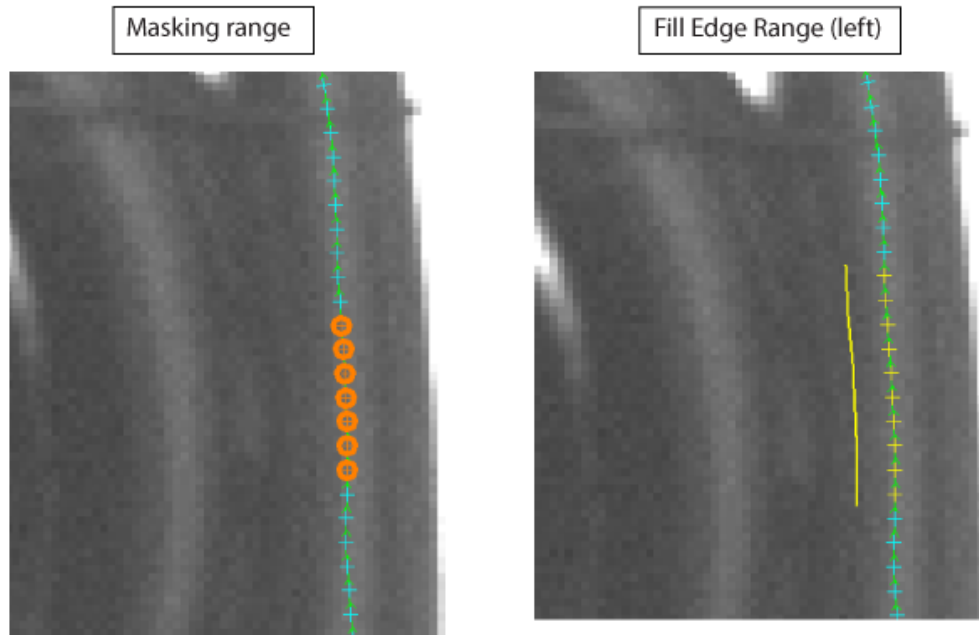
Perform the following steps to use the interface:

1. Select **Mask**, **Left Fill Edges**, or **Right Fill Edges** to choose which type of range you want to create:



2. Zoom in on the image and double-click the caliper results that become part of the range.

The caliper results in the bead path change appearance depending on the type of range you are creating:



The interface also offers a control that lets you specify the first and last caliper result of the range:

Set Index Range

First:

Last:

Value:

3. The interface also offers options for creating or erasing links from the desired ranges:

	<u>M</u> ask	<u>L</u> eft Fill Edges	<u>R</u> ight Fill Edges
<u>C</u> reate	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
<u>E</u> rase	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Graphic Options

Show Caliper Centers

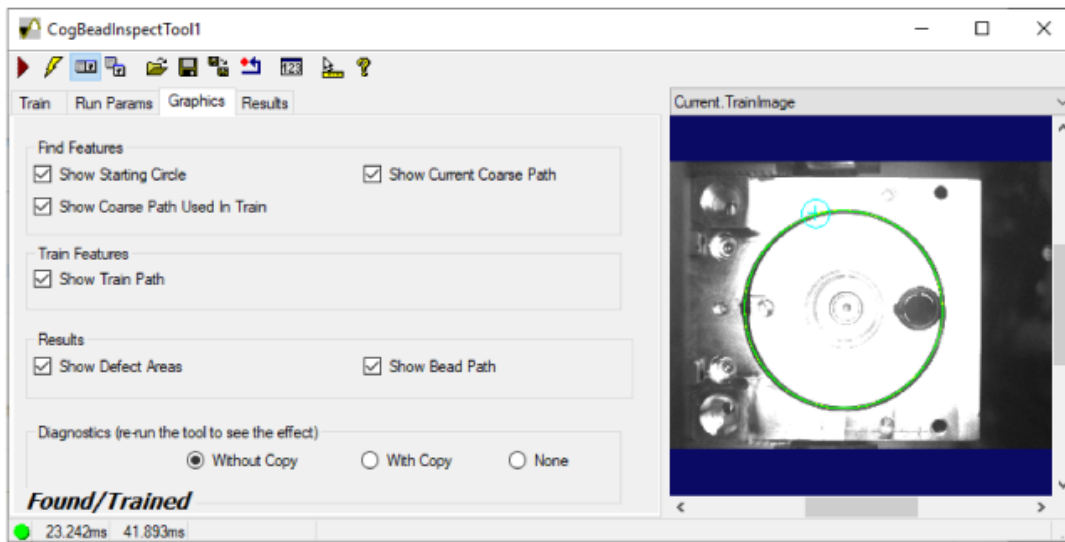
Show Caliper Rectangles

4. Click **Confirm Selection** when you are done creating the desired ranges.

5. Test your mask or fill ranges on run-time images to see that they generate the expected results.

Graphics Tab

Use the **Graphics** tab to enable or disable various graphics over the Current.TrainingImage and LastRun.InputImage:



Find Features

Enable or disable the following graphics over the training image:

Show Starting Circle	Show the graphic for the Start Circle property the tool uses to find the bead path in the training image.
Show Current Coarse Path	Show the coarse path currently selected on the Train tab.
Show Coarse Path Used in Train	Show the coarse path used to train the tool with the location of the bead path.

Train Features

Enable or disable the trained path the tool will use to locate the path in runtime images.

Results

Enable or disable the following graphics over the current input image:

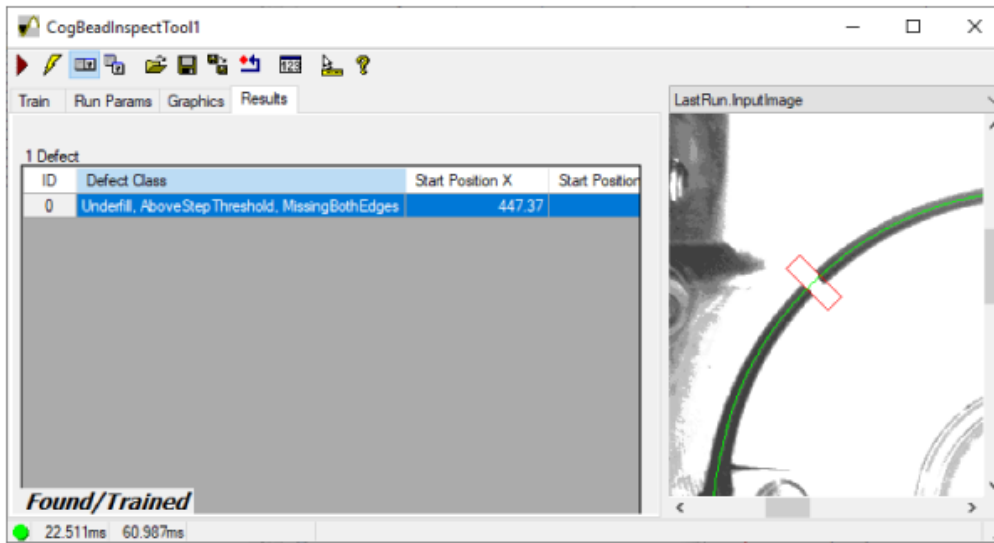
Show Defect Areas	Highlight the areas the tool determines are defects.
Show Bead Path	Highlight the bead path.

Diagnostics

The **Without Copy**, **With Copy**, and **None** options determine whether or not the input image is recorded as part of the diagnostic record; and whether the image is copied to the record or saved in the record as a reference.

Results Tab

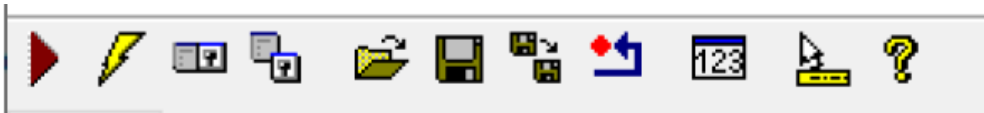
Use the **Results** tab to view any **defects** found in the last runtime image:









See the section [Finding Defects](#) for a list of defects the tool can detect.






Button Bar

The edit control supports a button bar across the top:



The following table describes the function of each button:

Button	Description	Function
	Run	Run the Bead Inspect tool and examine the current input image for the trained features of a bead path. To run the tool you must have a trained path, an input image and specified run parameters.
	Electric mode	Toggle electric mode, where the tool executes automatically when you change the value of certain parameters. In electric mode, a lightning bolt appears next to every electric property.
	Local image display	Open or close the local image display window. A Bead Inspect tool supports the following image buffers: <ul style="list-style-type: none"> The Current.InputImage buffer contains the latest acquired image. The Current.TrainImage buffer contains an image for training the features of a bead path you want to examine in runtime images. The LastRun.InputImage buffer contains the last image the tool analyzed for the trained features of a bead path. The image might contain graphics you enable or disable on the Graphics tab.
	Floating image display	Open one or more floating image windows, which support the same image buffers as the local image display window.
	Open	Open a VisionPro persistence (.vpp) file that contains a set of saved properties for this vision tool object type. VisionPro reports an error if you try to open a .vpp file for another object type.
	Save	Save the current properties of the vision tool to a VisionPro persistence (.vpp) file. The edit control allows you to choose between saving the vision tool with or without its image buffers and tool results.
	Save As	Save the current properties of the vision tool to a new VisionPro persistence (.vpp) file.

		
	Reset	Reset the tool to its default state. The tool gives you a choice between resetting to the default-constructed state, which is appropriate when you are using it in a Visual Studio .NET application, or its template-initialized state, which is appropriate for QuickBuild applications.
	Show Floating Results	Open a separate results window with the same contents as seen in the Results tab.
	Show ToolTips	Enable or disable the display of tooltips for individual items in the edit control.
	Help	Open this VisionPro online help file.

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