



5 - S2d SEARCH Seam Triple SP V6

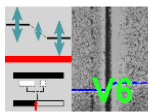
■ Description

Search seam borders left and right by first searching the seam center with "line width" algorithm and then check for correct seam border positions with the gradient algorithm.

For the Gradient algorithm the rectangle of the ROI (**R**egion **O**f **I**nterest) is cut in small horizontal stripes. In each stripe a left and right seam border position is searched. The average over all positions gives the final position for the left and for the right border position.

An additional check with a separate Gradient algorithm is used to check for a clear "gap", indicating that no correct welding is done. If such a gap is found it will overwrite the found seam and set this seam as NIO.

■ Icon



5 S2d SEARCH Seam Triple SP V6

Search seam borders left and right, considering the old seam positions and a 'Start position'

■ Parameters

Filter Groups of 5 S2d SEARCH Seam Triple SP V6

G00 Init

G11 Seam width

G20 Seam Gradient

G30 Seam Gradient FDS

G99 Prepositioning

G00 Init

Filters of
G00 Init

01.1 Expected SeamWidth

01.2 Start Position seam

01.3 Use LineWidth

01.4 Delta LineWidth center

Attributes of
01.1 Expected SeamWidth

Number
100.000

Parameter	Comment
Number	"Expected" width of the seam when searching the seam rims in the new image. [Pixel]

Attributes of
01.2 Start Position seam

Number
300.000

Parameter	Comment
Number	Expected seam center position in the first image of the seam. [Pixel]

Attributes of
01.3 Use LineWidth

Number
1.000

Parameter	Comment
Number	0 The "LineWidth search" is not used.
	1 The "LineWidth search" gives the expected seam center position if a valid position was found. That expected seam center position is used with the gradient search.



Attributes of
01.4 Delta LineWidth center

Number

Parameter	Comment
Number	Allowed distance of the found seam center from 'Line width' algorithm to the seam center in the before image. If the distance is bigger the found seam center is marked as invalid. [Pixel]

G11 Seam width

Filters of
G11 Seam width

05 LineWidth
 06 LineIntensity
 07 LineAdder
 09 LineWidthMinimum

Attributes of
05 LineWidth

Verboosity level

None

Threshold gray value

Height of the search area. Pixel


Dark Soot threshold

Light Soot threshold

Dark Soot Factor 1/10

Light Soot Factor 1/10

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Threshold	Minimum grey scale value for an image pixel that it's defined to belong to the laser line. [Greylevel]
Height of the search area	Upwards and downwards laser line search area (vertical). Height of the search area = 30 means: 30 pixel upwards and also 30 pixel downwards from a straight line between the laser line start points. [Pixel]
Dark Soot threshold	Limit value for dark grime. If the mean value for the brightness, measured in an area 20 - 70 pixel above, respectively 20 - 70 pixel below the straight line, and 50 pixel wide through the start points, does not exceed this value, there is dark grime lying on the steel sheet in this area. [Greylevel]
Light Soot threshold	Limit value for light grime. If the mean value for the brightness, measured in an area 20 - 70 pixel above, respectively 20 - 70 pixel below the straight line, and 50 pixel wide through the start points, does not exceed this value, but is higher than "Dark Soot threshold", there is light grime lying on the steel sheet in this area. [Greylevel]
Dark Soot Factor	Factor for widening up the found line width when having dark grime (in 1/10 th).
Light Soot Factor	Factor for widening up the found line width when having light grime (in 1/10 th).



Attributes of
06 LineIntensity

Verbosity level
 None

Height of the search area. Pixel
 10

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Height of the search area	Upwards and downwards laser line search area (vertical). Height of the search area = 10 means: 10 pixel upwards and also 10 pixel downwards from a straight line between the laser line start points. [Pixel]





**Attributes of
07 LineAdder**

Verbosity level
 None

Factor 1
 1

Factor 2
 0

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Factor 1	Weighting (multiplication factor) of the line width information from "05 LineWidth".
Factor 2	Weighting (multiplication factor) of the line intensity information from "06 LineIntensity".


**Attributes of
09 LineWidthMinimum**

Verbosity level
 None

Mode
 1

FilterLength Pixel
 30

MinYDistance Pixel
 10

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Mode	0 The minimum of the summed data from "07 LineAdder" is searched and sent as "Seam center" position. 1 The lowest and second lowest minimum of the summed data from "07 LineAdder" are searched. The lowest minimum is sent as "Seam center" position.
FilterLength	Filtering of the summed data from "07 LineAdder".
MinYDistance	Minimum (vertical) distance of the found minimum to the highest values that the minimum is sent as valid minimum.

G20 Seam Gradient

Filters of
G20 Seam Gradient

02 Intensity of stripes

02.1 Height of Stripe

03 Mean value of stripes

05 Gradient

06 Mean value of Gradient left

07 Mean value of Gradient right

08 Peaks of Gradients

09 Eliminate Outliers

10 Seam borders X

Attributes of
02 Intensity of stripes

Verbosity level

None

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.

Attributes of
02.1 Height of Stripe

Number

30,000

Parameter	Comment
Number	Number of lines in the image that are compressed to stripes for the seam detection. The higher the value the more lines are taken for the compressing. [Pixel]



**Attributes of
03 Mean value of stripes**

Verbosity level

None

Filter length N Pixel

3

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This smoothens the brightness in every stripe before further processing. [Pixel]

**Attributes of
05 Gradient**

Verbosity level

None

Filter radius off seam N pixel

5



Filter radius on seam N pixel

5

Gradient type N pixel

Dark seam

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter radius off seam	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This smoothens the brightness in every stripe before further processing. Value is for the stripe part outside the seam. [Pixel]
Filter radius on seam	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This smoothens the brightness in every stripe before further processing. Value is for the stripe part inside the seam. [Pixel]
Gradient type	How to check gradients at seam border: <ul style="list-style-type: none"> Absolute = don't care if the seam intensity is higher or smaller than the blanks intensity Dark seam = the intensity in the seam is expected to be smaller than the intensity outside on the blanks Bright seam = the intensity in the seam is expected to be bigger than the intensity outside on the blanks


Attributes of
06 Mean value of Gradient left




Verboesity level

None

Filter length N Pixel

1

Parameter	Comment
Verboesity level	Selection of verboesity level. Larger verboesity levels offer more overlay information.
Filter length	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This eliminates too small intensity changes. Value for the left seam rim. [Pixel]


Attributes of
07 Mean value of Gradient right


Verboesity level


None

Filter length N Pixel

1

Parameter	Comment
Verboesity level	Selection of verboesity level. Larger verboesity levels offer more overlay information.
Filter length	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This eliminates too small intensity changes. Value for the right seam rim. [Pixel]




**Attributes of
08 Peaks of Gradients**

Verbosity level
 None



Display Stripe
 0

Left gradient threshold
 10
 Intensity

Right gradient threshold
 10
 Intensity

Max. position distance
 10
 Pixel



Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Display stripe	Shows additional graphical information about the selected stripe. 0 no information ≥ 1 Information about that stripe
Left gradient threshold	Minimum brightness gradient in one stripe that is taken and, in order to detect the seam rim, must be surpassed. Separately for the left side. [Greylevel]
Right gradient threshold	Minimum brightness gradient in one stripe that is taken and, in order to detect the seam rim, must be surpassed. Separately for the right side. [Greylevel]
Max. position distance	Max. allowed distance of the new seam rim position to the position from the before image.


Attributes of
09 Eliminate Outliers


Verbosity level
 None

Variance factor
 1.000

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Variance factor	Allowed distance of the point's position that the position is used. Otherwise it's position is replaced through the 'mean position'.


Attributes of
10 Seam borders X


Verbosity level
 None

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.



G30 Seam Gradient FDS

Filters of
G30 Seam Gradient FDS

02 Intensity of stripes
 02.1 Height of Stripe
 03 Avg of stripes
 04 Gradient
 05 Avg Grad left
 06 Avg Grad right
 07 SeamWidth
 08 Peaks of Grad
 09 Checks for no seam

Attributes of
02 Intensity of stripes

Verbosity level
 None

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.

Attributes of
02.1 Height of Stripe

Number
 30.000

Parameter	Comment
Number	Number of lines in the image that are compressed to stripes for the seam detection. The higher the value the more lines are taken for the compressing. [Pixel]

Verbosity level
 None

Filter length N Pixel
 5

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This smoothens the brightness in every stripe before further processing. [Pixel]

Verbosity level
 None

Filter radius off seam N pixel
 5

Filter radius on seam N pixel
 5

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter radius off seam	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This smoothens the brightness in every stripe before further processing. Value is for the stripe part outside the seam. [Pixel]
Filter radius on seam	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This smoothens the brightness in every stripe before further processing. Value is for the stripe part inside the seam. [Pixel]



**Attributes of
05 Avg Grad left**

Verbosity level
 None

Filter length N Pixel
 5

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This eliminates too small intensity changes. Value for the left seam rim. [Pixel]

**Attributes of
06 Avg Grad right**

Verbosity level
 None

Filter length N Pixel
 5

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	The noisier the brightness is, the higher this parameter must be selected (1 - 100). This eliminates too small intensity changes. Value for the right seam rim. [Pixel]

**Attributes of
07 SeamWidth**

Number
 30.000

Parameter	Comment
Number	"Expected" width for a FDS (gap). [Pixel]

Verbosity level

None

Left gradient threshold Intensity

30

Right gradient threshold Intensity

30

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Left gradient threshold	Minimum brightness gradient in one stripe that is taken and, in order to detect the seam rim, must be surpassed. Separately for the left side. [Greylevel]
Right gradient threshold	Minimum brightness gradient in one stripe that is taken and, in order to detect the seam rim, must be surpassed. Separately for the right side. [Greylevel]

Verbosity level

None

Min. number of pairs with big gradients

3

Max. std. dev. of point distances Pixel

3.000

Max. dist. of pair's center positions Pixel

3

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Min. number of pairs with big gradients	Min. number of pairs (left/right) respectively stripes, whose intensity changes (gradients) are over the thresholds for a FDS.
Max. std. dev. of point distances	Max. allowed distance of the left/right seam rim points from a mean value in a stripe to be counted as FDS candidate. [Pixel]
Max. dist. of pair's center positions	Max. allowed distance of a pair's center position to a mean value to be counted as FDS candidate. [Pixel]



G99 Prepositioning

Filters of G99 Prepositioning	
	P01 rescale
	P03 offset Binarisierung Bauteilhelligkeit links
	P03 offset Binarisierung Bauteilhelligkeit rechts
	P04 BinarizeDynamicL
	P04 BinarizeDynamicR
	P05 EdgeDetectionL
	P05 EdgeDetectionR
	P06 linelowpass L
	P06 linelowpass R
	P07 lineGradientLowpass L
	P07 lineGradientLowpass R
	P08 Zuschnitt Linie L
	P08 Zuschnitt Linie R
	P09 Dummy Zpos Anzeige
	P10 LineExtractDynamic L
	P10 LineExtractDynamic R
	P11 LineSelectLocalExtremum L max2
	P11 LineSelectLocalExtremum L min2
	P11 LineSelectLocalExtremum R max2
	P11 LineSelectLocalExtremum R min2
	P12 offset Versuche L
	P12 offset Versuche R
	P13 PosDisplay L
	P13 PosDisplay R
	P14 TemporalLowPass L
	P14 TemporalLowPass R
	P20 linefit offset
	P21 LineFitPos L
	P21 LineFitPos R
	P21 konvexitätMaximum
	P22 maxDistanzVersucheZuKonvexität
	P23 AnzeigePosVersuche
	P23 minHöheKonvexität
	PosDisplay zeitlich L
	PosDisplay zeitlich R



**Attributes of
P01 rescale**


Verbosity level
 None


Rescale pixel intensities
☒ On/Off

Start image
 0

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Rescale pixel intensities	On The intensities of the image points are stretched that the brightest point has value 255 and the darkest point has value 0. Off The image is sent further without any changes.
Start image	Number of the image in a seam when the "rescaling" is started.




**Attributes of
P03 offset Binarisierung Bauteilhelligkeit links**


Value
 0.000




**Attributes of
P03 offset Binarisierung Bauteilhelligkeit rechts**


Value
 0.000

Parameter	Comment
Value	Sets the binarization level for the left resp. right blank. [Greylevel]


**Attributes of
P04 BinarizeDynamicL**


Verbosity level
 None


**Attributes of
P04 BinarizeDynamicR**


Verbosity level
 None

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.



Attributes of P05 EdgeDetectionL

Verbosity level

None

Attributes of P05 EdgeDetectionR

Verbosity level

None

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.

Attributes of P06 linelowpass L

Verbosity level

None

Filter length N Pixel

61

Attributes of P06 linelowpass R

Verbosity level

None

Filter length N Pixel

61

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	Filter to smoothen the left resp. right laserline part. That eliminates too small intensity changes. [Pixel]

Attributes of P07 lineGradientLowpass L

Verbosity level

Low

Filter length N Pixel

31

Attributes of P07 lineGradientLowpass R

Verbosity level


Low

Filter length N Pixel


31

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	Filter to smoothen the intensity changes in the left resp. right laserline part. [Pixel]

 Attributes of
P08 Zuschnitt Linie L

 Attributes of
P08 Zuschnitt Linie R

Parameter	Comment
Number	Width of the analysis area for the left resp. right laserline part. [Pixel]


 Attributes of
P09 Dummy Zpos Anzeige

Parameter	Comment
Number	Vertical position in the camera image to display the graphical information.

 Attributes of
P10 LineExtractDynamic L

Verbosity level

Low

 Attributes of
P10 LineExtractDynamic R

Verbosity level

Low

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.



Attributes of
P11 LineSelectLocalExtremum L max2

Verbosity level
Low

Distance Pixel
30

Difference
1.000

Attributes of
P11 LineSelectLocalExtremum R max2

Verbosity level
Low

Distance Pixel
30

Difference
1.000

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Distance	Min. horizontal distance between the biggest and the second biggest maximum. All maxima that are nearer to the biggest one are no real "new" maxima. [Pixel]
Difference	Min. vertical distance between the biggest and the second biggest maximum. All maxima that are nearer to the biggest one are no real "new" maxima. [Pixel]

Attributes of
P11 LineSelectLocalExtremum L min2

Verbosity level
Low

Distance Pixel
30

Difference
1.000

Attributes of
P11 LineSelectLocalExtremum R min2

Verbosity level
Low

Distance Pixel
30



Difference
1.000

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Distance	Min. horizontal distance between the biggest and the second biggest minimum. All minima that are nearer to the biggest one are no real "new" minima. [Pixel]
Difference	Min. vertical distance between the biggest and the second biggest minimum. All minima that are nearer to the biggest one are no real "new" minima. [Pixel]


**Attributes of
P12 offset Versuche L**


Value



0.000


**Attributes of
P12 offset Versuche R**


Value



0.000

Parameter	Comment
Value	Offset to shift the found left resp. right position because of the filtering, especially for the "optical" position display. [Pixel]


**Attributes of
P13 PosDisplay L**


Verbosity level



Low


**Attributes of
P13 PosDisplay R**


Verbosity level

Low

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.


**Attributes of
P14 TemporalLowPass L**


Kind of low pass

Median

Filter length N values



1

Start image

2

Maximal jump.

30.000


**Attributes of
P14 TemporalLowPass R**


Kind of low pass

Median

Filter length N values

1

Start image

2

Maximal jump.

30.000

Parameter	Comment
Kind of low pass	Mean Mean filter over "Filter length" images Median Median filter over "Filter length" images Separate for left and right side.
Filter length	Filtering over the given number of images to smoothen the changes of the positions. [Images]



Start image	The image number, when the filter becomes active. Separate for left and right side.
Maximal jump	Max. allowed distance of the new seam border position to the filtered position, that the new position is valid and passed over. [Pixel]

Attributes of P20 linefit offset

Number

Parameter	Comment
Number	Distance from the left resp. right ROI rim as start position for the 'lineFit' together with "P21". [Pixel]

Attributes of P21 LineFitPos L

Verbosity level
 Low

Length Pixel

Attributes of P21 LineFitPos R

Verbosity level
 Low

Length Pixel

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Length	Length to fit a straight line on the left resp. right laserline part. [Pixel]

Attributes of P21 konvexitatMaximum

Verbosity level
 Low

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.

Attributes of

P22 maxDistanzVorsucheZuKonvexitaet

Number

15.000

Parameter	Comment
Number	Max. horizontal distance between the position of the presearch and the convexity's maximum position that the position of the presearch is valid. [Pixel]

Attributes of

P23 AnzeigePosVorsuche

Verbosity level

Low

Rendering-mode

Cross, Medium

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Rendering-mode	Information how the positions of the presearch must graphically be displayed.

Attributes of

P23 minHoeheKonvexitaet

Number

3.000

Parameter	Comment
Number	Min. height of the convexity from the laserline that the position of the presearch is valid. [Pixel]



Attributes of PosDisplay zeitlich L

Verbosity level
 Low

Attributes of PosDisplay zeitlich R

Verbosity level
 Low

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Marks the left resp. right found and filtered seam rim position with a coloured cross.

■ Measured values for plotter

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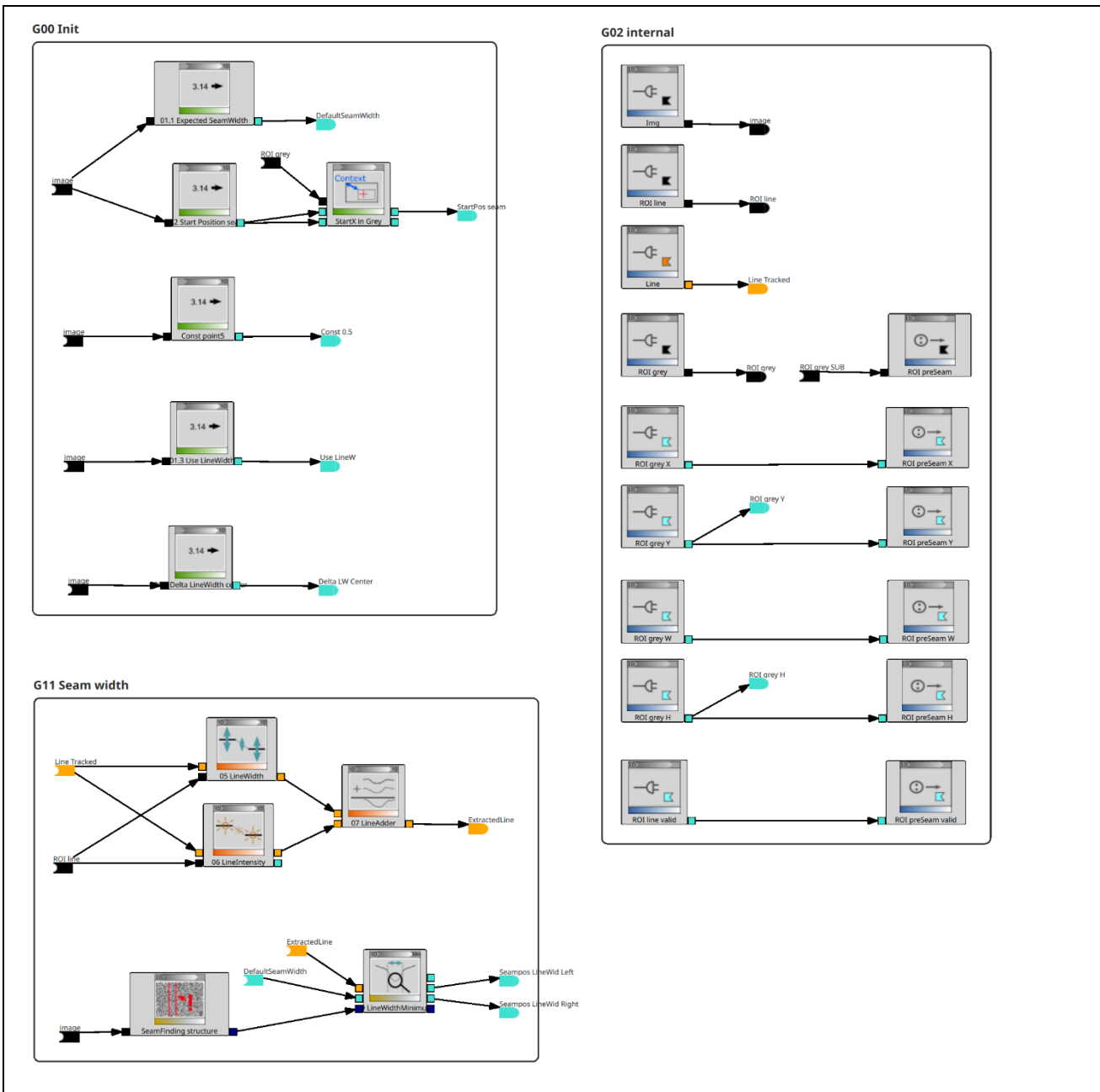
■ Subgraph interface

IN bridges

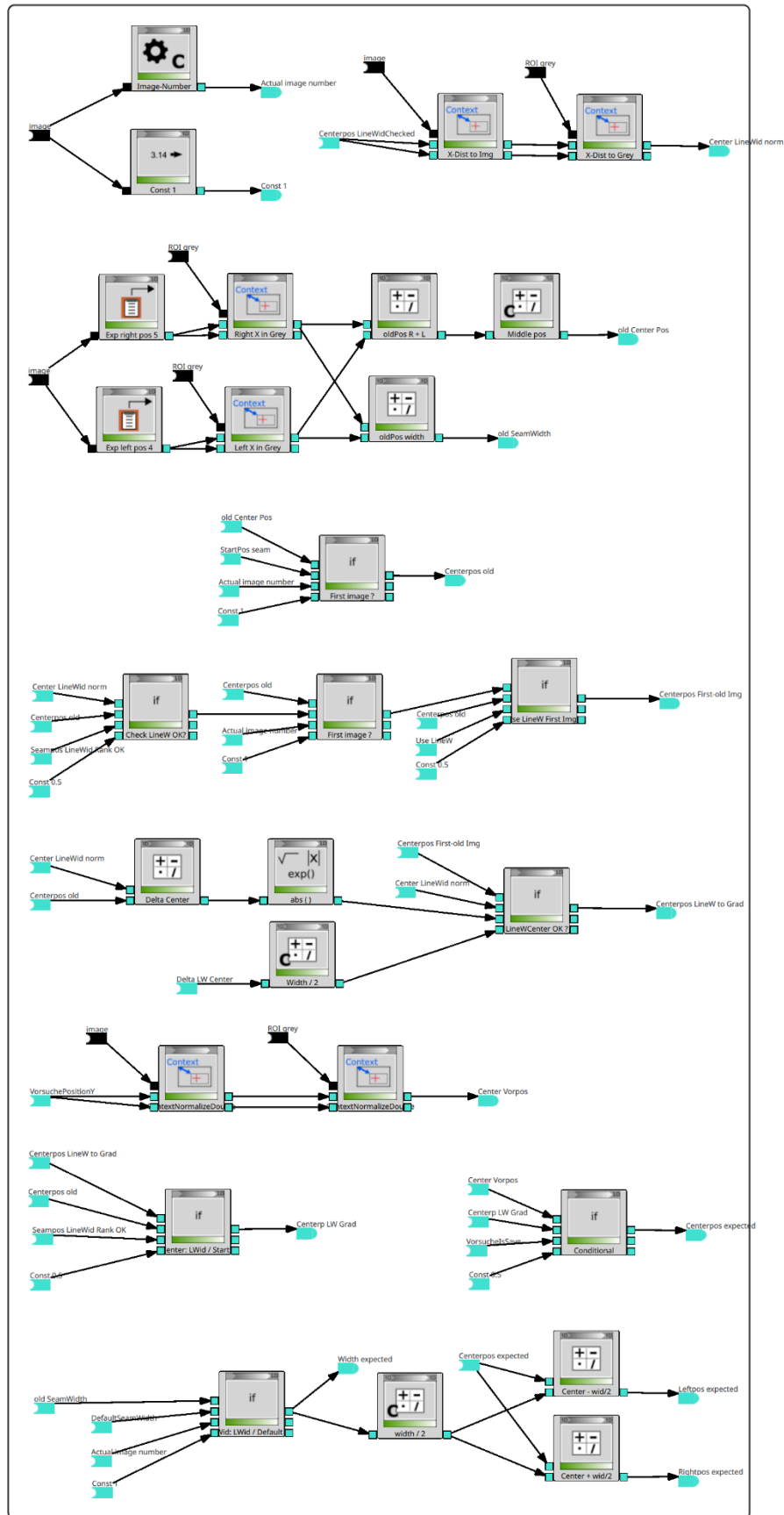
OUT bridges

image value	Img ROI grey ROI grey X ROI grey Y ROI grey W ROI grey H ROI grey valid	image value	ROI preSeam ROI preSeam X ROI preSeam Y ROI preSeam W ROI preSeam H ROI preSeam valid Seam pos left Seam pos right
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■ Graph block diagram

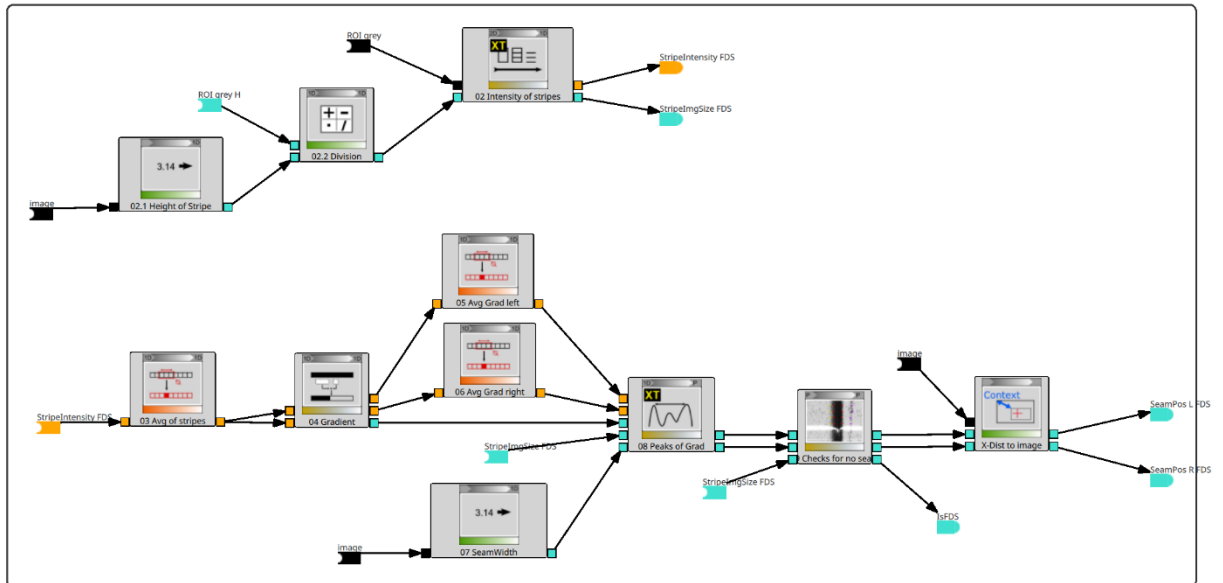


G13 Select center position





G30 Seam Gradient FDS



G50 Select SeamPos

