



Special – NGS1_B_nn

■ Description

Here in the "Line ROI" of subgraph NGS1_A a rough but stable prepositioning is made, where later (in the subgraph NGS1_C) the correct gap position is searched.

The detection is done by the following steps:

- With a line tracking from left and from right side the laser line is extracted ('two lines').
- If there is a gap (break) the position is found.
- If there is no break (line ends are overlapping), the program switches to a second detection version.

The second detection version searches with a new line tracking ('one line') one of the following criterias (selectable):

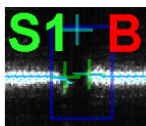
- Position in % between the lowest and the highest vertical laser line position.
- Darkest/smallest intensity position (position in % between Min and Max).
- K-curvature (position in % between Min and Max).

In this way a "*Preposition ROI*" for subgraph NGS1_C gets available.

Also a dynamic ROI ("*Dark gap ROI*") for a gap detection in the grey image is positioned, together with a dynamic ROI ("*Light gap ROI*") for a bright gap detection in the grey image. The detections are done in subgraph NGS1_C.

nn: declaration of the actual subgraph version (here: version 22).

■ Icon



NGS1_B_22

Comment for the new graph

■ Parameters

Filter Groups of NGS1_B_22

G01 INIT

G05 doubleline

G10 pre search line left and right

G15 second search

G25 ROI detection

G27 ROI greydark

G30 ROI gap light

G01 INIT

Filters of
G01 INIT

P01 ImageArithmetic

P02 BinarizeDynamic

P03 OffsetBinarization

P04 choose second saerch type 0 to 2

P05 DrawPositions

Attributes of
P01 ImageArithmetic

Verbosity level

None

TimeWindow

1

frames

Rescale pixel intensities


☒ On/Off

Operation

Mean




Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
TimeWindow	Number of single camera images that are "laid over each other" for the analysis. Not suited for curved weldings!
Rescale pixel intensities	Recalculation of the image for 'TimeWindow' > 1.
Operation	Filter function for the image overlaying: SUM Sum over "TimeWindow" images Mean Mean filter over "TimeWindow" images Median Median filter over "TimeWindow" images


Attributes of
P02 BinarizeDynamic


Verbosity level
 None


Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information Display of the binarized area in the "Line ROI" of subgraph NGS1_A.


Attributes of
P03 OffsetBinarization

Value
 50.000


Parameter	Comment
Value	Used for detection of greylevel values for the gap. The higher the value, the darker the gap must be compared with the blank intensity. [Greylevel]


Attributes of
P04 choose second saerch type 0 to 2



Number

Parameter	Comment
Number	0 Line profile (e.g. Minimum or Maximum)
	1 K-Curvation
	2 Combination of darkest/smallest position

Attributes of
P05 DrawPositions





Number


Parameter	Comment
Number	0 No marking
	1 Marks the found gap position with a cross


G05 doubleline
Laser line tracking for "one line"

Filters of
G05 doubleline





P01 LineTracking double

P02 CloseGaps

P03 line low pass




Attributes of
P01 LineTracking double


Verbosity level
 None

Tracking Threshold
 100

mean x pixel
 2

search area y upper pixel
 31



mean area y pixel
 5

Maximum Gap Width
 15

Maximum Number of Gaps
 15

Maximum height jump
 21

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Tracking threshold	Minimum grey scale value for an image pixel that it's defined to belong to the laser line. [Greylevel]
mean x	Number of pixels in X direction, used for averaging the brightness in order to define the next point of the laser line. [Pixel]
search area y	This parameter defines the maximum limits for the search area in Y direction, used for searching the next tracking point. [Pixel]
mean area y	Number of pixels in Y direction, over which the "Average brightness in X direction" is averaged, in order to define the next laser line point. [Pixel]
Maximum Gap Width	Maximum allowed width of a laser line interruption: If the number of side by side laying pixels, having a lower grey scale value than the search threshold, exceeds this parameter figure, the line interrupts counter figure is raised by 1. [Pixel]
Maximum Number of Gaps	Maximum number of laser line interrupts: If the number of line interrupts per laser line becomes higher than this parameter, the line search is stopped and a line interrupt warning is released.
Maximum height jump	Maximum interrupt in Y direction: If the height jump of the laser line exceeds this parameter, the line search is stopped. [Pixel]


Attributes of P02 CloseGaps




Verbosity level
 None

Minimal segment length in X direction. NPixel
 5

Max. jump Y NPixel
 15

Maximal interpolation length NPixel
 50

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Minimal segment length in X direction	Minimal length of a line piece before a break that the break may be closed. [Pixel]
Max. jump Y	A break in the laser line may be closed by a direct line if the vertical distance between the end ponts of the break is smaller than 'Max. jump Y'. [Pixel]
Maximal interpolation length	A break in the laser line may be closed by a direct line if the horizontal distance between the end ponts of the break is smaller than 'Max. interpolation length'. [Pixel]


Attributes of P03 line low pass


Verbosity level
 None

Filter length N Pixel
 5

Kind of low pass
 Mean

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	Filtering over the given number of pixel to smoothen the changes of the vertical positions of the laser line points. [Images]
Kind of low pass	Mean Mean filter over "Filter length" points Median Median filter over "Filter length" points



G10 pre search line left and right

Laser line tracking for "two line"

Filters of
G10 pre search line left and right

P01 LineTracking left
 P02 LineTracking right
 P03 GapPositionBreak left
 P04 GapPositionBreak right
 P05 RegelPosition

Attributes of
P01 LineTracking left

Verbosity level
None

Tracking Threshold
100

mean x
1

search area y upper
3

mean area y
5

Maximum Gap Width
1

Maximum Number of Gaps
1

Maximum height jump
3

Attributes of
P02 LineTracking right

Verbosity level
None

Tracking Threshold
100

mean x
1

search area y upper
3

mean area y
5


Maximum Gap Width
1

Maximum Number of Gaps
1

Maximum height jump
3

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Tracking threshold	Image pixel with an intensity of "Tracking threshold" or higher are treated as "laserline points" [Greylevel]
mean x	Number of pixels in X direction, used for averaging the brightness in order to define the next point of the laser line. [Pixel]

search area y upper	This parameter defines the maximum limits for the search area in Y direction, used for searching the next tracking point. [Pixel]
mean area y	Number of pixels in Y direction, over which the "Average brightness in X direction" is averaged, in order to define the next laser line point. [Pixel]
Maximum Gap Width	Maximum allowed width of a laser line interruption: If the number of side by side laying pixels, having a lower grey scale value than the search threshold, exceeds this parameter figure, the line interrupts counter figure is raised by 1. [Pixel]
Maximum Number of Gaps	Maximum number of laser line interrupts: If the number of line interrupts per laser line becomes higher than this parameter, the line search is stopped and a line interrupt warning is released.
Maximum height jump	Maximum interrupt in Y direction: If the height jump of the laser line exceeds this parameter, the line search is stopped. [Pixel]


 Attributes of
P03 GapPositionBreak left

Verbosity level
 None

 Attributes of
P04 GapPositionBreak right

Verbosity level
 None

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

 Attributes of
P05 RegelPosition

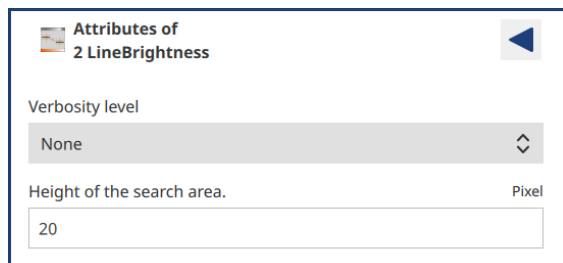
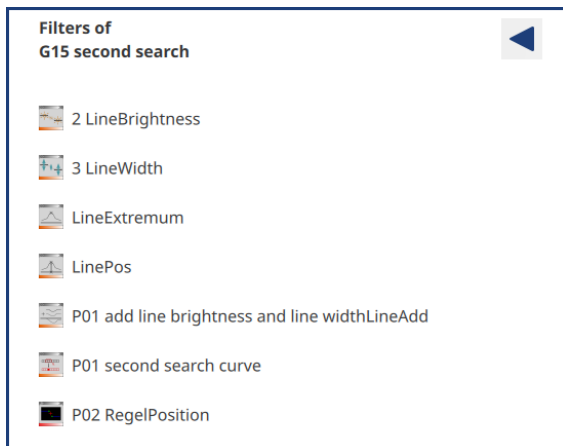
Verbosity level
 None

Weighting Percent
 50



Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Weighting	Position (in %) between Minimum and Maximum.



G15 second search



Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Displays the intensity values of the found laser line, scaled inside the "Line ROI", with orange points.
Height of the search area	Total vertical range above and below each found laser line point to calculate the mean intensity for this point. '20' means: 10 pixel upwards and 10 pixel downwards around the actual laser line point. [Pixel]


**Attributes of
3 LineWidth**


Verbosity level
 None

Threshold gray value
 255

Height of the search area. Pixel
 20

Dark Soot threshold
 40



Light Soot threshold
 60

Dark Soot Factor 1/10
 30

Light Soot Factor 1/10
 20

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Displays the width values of the found laser line, scaled inside the "Line ROI", with orange points.
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 LineExtremum


Verbosity level
 Low

Extremum type
 Maximum



Search direction
 From right

Parameter	Comment	
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Marks the found position with a lightblue cross.	
Extremum type	Minimum	Searches the (vertical) lowest point of the laser line
	Maximum	Searches the (vertical) highest point of the laser line
Search direction	From left	Check the vertical positions of the laser line from the left to the right side
	From right	Check the vertical positions of the laser line from the right to the left side


Attributes of LinePos


Verbosity level
 None

Parameter	Comment	
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Marks the found position with a red cross.	




Attributes of
P01 add line brightness and line widthLineAdd


Verbosity level
 None

Factor 1
 1

Factor 2
 1

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Displays the summed values of the found laser line, scaled inside the "Line ROI", with yellow points.
Factor 1	Weighting (multiplication factor) of the width information from "3 LineWidth".
Factor 2	Weighting (multiplication factor) of the intensity information from "2 LineBrightness".


Attributes of
P01 second search curve


Verbosity level
 Low

Filter length N Pixel
 1

Kind of low pass
 Mean

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Filter length	Filtering of the summed data from "P01 add line brightness and line widthLineAdd".
Kind of low pass	<div> Mean Mean filter of the summed data from "P01 add line brightness and line widthLineAdd" </div> <div> Median Median filter of the summed data from "P01 add line brightness and line widthLineAdd" </div>



**Attributes of
P02 RegelPosition**

Verbosity level
 None

Weighting Percent
 50

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information.
Weighting	Position (in %) between Minimum and Maximum.

G25 ROI detection

Sets the ROI for the "Preposition".

**Filters of
G25 ROI detection**



P01 dY
 P02 dZ
 P03 W
 P04 H
 P05 low pass ROI detection y

**Attributes of
P01 dY**


Operation
 Addition

Value
 -35,000

Parameter	Comment
Operation	Div. arithmetic operations.
Value	Distance of the "expected horizontal gap position" to the left rim of the "Preposition ROI". [Pixel]


Attributes of P02 dZ


Operation

Addition
 

Value

Parameter	Comment
Operation	Div. arithmetic operations.
Value	Distance of the "expected vertical gap position" to the upper rim of the "Preposition ROI". [Pixel]


Attributes of P03 W


Number

Parameter	Comment
Number	Width of the "Preposition ROI". [Pixel]


Attributes of P04 H


Number

Parameter	Comment
Number	Height of the "Preposition ROI". [Pixel]



Attributes of
P05 low pass ROI detection y

Kind of low pass

Median

Filter length

N values

11

Parameter	Comment
Kind of low pass	Mean Mean filter over "Filter length" images Median Median filter over "Filter length" images Minimum Minimum filter over "Filter length" images Maximum Maximum filter over "Filter length" images
Filter length	Filtering of the y positions over "Filter length" images.

G27 ROI greydark

Sets the "Dark gap ROI" to detect a dark gap.

Filters of
G27 ROI greydark

P01 dy
 P02 dz
 P03 W
 P04 H
 P05 temporalLowPass ROI gap darkY
 ROI grey dark

Attributes of
P01 dy

Value

-15,000

Parameter	Comment
Value	Distance of the "expected horizontal gap position" to the left side rim of the "Dark gap ROI". [Pixel]

 Attributes of
P02 dz 

Value

Parameter	Comment
Value	Distance of the "expected vertical gap position" to the upper rim of the "Dark gap ROI". [Pixel]

 Attributes of
P03 W 

Number

Parameter	Comment
Number	Width of the "Dark gap ROI". [Pixel]

 Attributes of
P04 H 

Number

Parameter	Comment
Number	Height of the "Dark gap ROI". [Pixel]



Attributes of
P05 temporalLowPass ROI gap darkY

Kind of low pass
 Median

Filter length N values
 11

Start image
 1

Maximal jump.
 100,000,000

Parameter	Comment
Kind of low pass	Mean Mean filter over "Filter length" images Median Median filter over "Filter length" images
Filter length	Filtering over the given number of images to smoothen the position changes. [Images]
Start image	The image number, where the filter becomes active.
Maximal jump	Max. allowed distance of the new position to the filtered position, that the new position is valid and passed over. [Pixel]

Attributes of
ROI grey dark


Verbosity level
 Low


Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Marks the area of the "Dark gap ROI" with a lightblue rectangle.


G30 ROI gap light


Sets the "Light gap ROI" to detect an illuminated gap.


Filters of
G30 ROI gap light


DynamicRoi

P01 dY

P02 dZ

P03 W

P04 H

P05 temporalLowPass ROI gap light Y

Attributes of
DynamicRoi

Verbosity level

Low

Parameter	Comment
Verbosity level	Selection of verbosity level. Larger verbosity levels offer more overlay information. Marks the area of the "Light gap ROI" with a yellow rectangle.

Attributes of
P01 dY

Value

-5.000

Parameter	Comment
Value	Distance of the "expected horizontal gap position" to the left side rim of the "Light gap ROI". [Pixel]




Attributes of P02 dZ


Value

-100.000

Parameter	Comment
Value	Distance of the "expected vertical gap position" to the upper rim of the "Light gap ROI". [Pixel]


Attributes of P03 W


Number

25.000



Parameter	Comment
Number	Width of the "Light gap ROI". [Pixel]


Attributes of P04 H


Number

100.000

Parameter	Comment
Number	Height of the "Light gap ROI". [Pixel]


Attributes of
P05 temporalLowPass ROI gap light Y


Kind of low pass

Median

Filter length N values

11

Maximal jump.

100,000.000

Parameter	Comment
Kind of low pass	Mean Mean filter over "Filter length" images
	Median Median filter over "Filter length" images
Filter length	Filtering over the given number of images to smoothen the position changes. [Images]
Maximal jump	Max. allowed distance of the new position to the filtered position, that the new position is valid and passed over. [Pixel]



■ Measured values for plotter

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■ Subgraphs interface

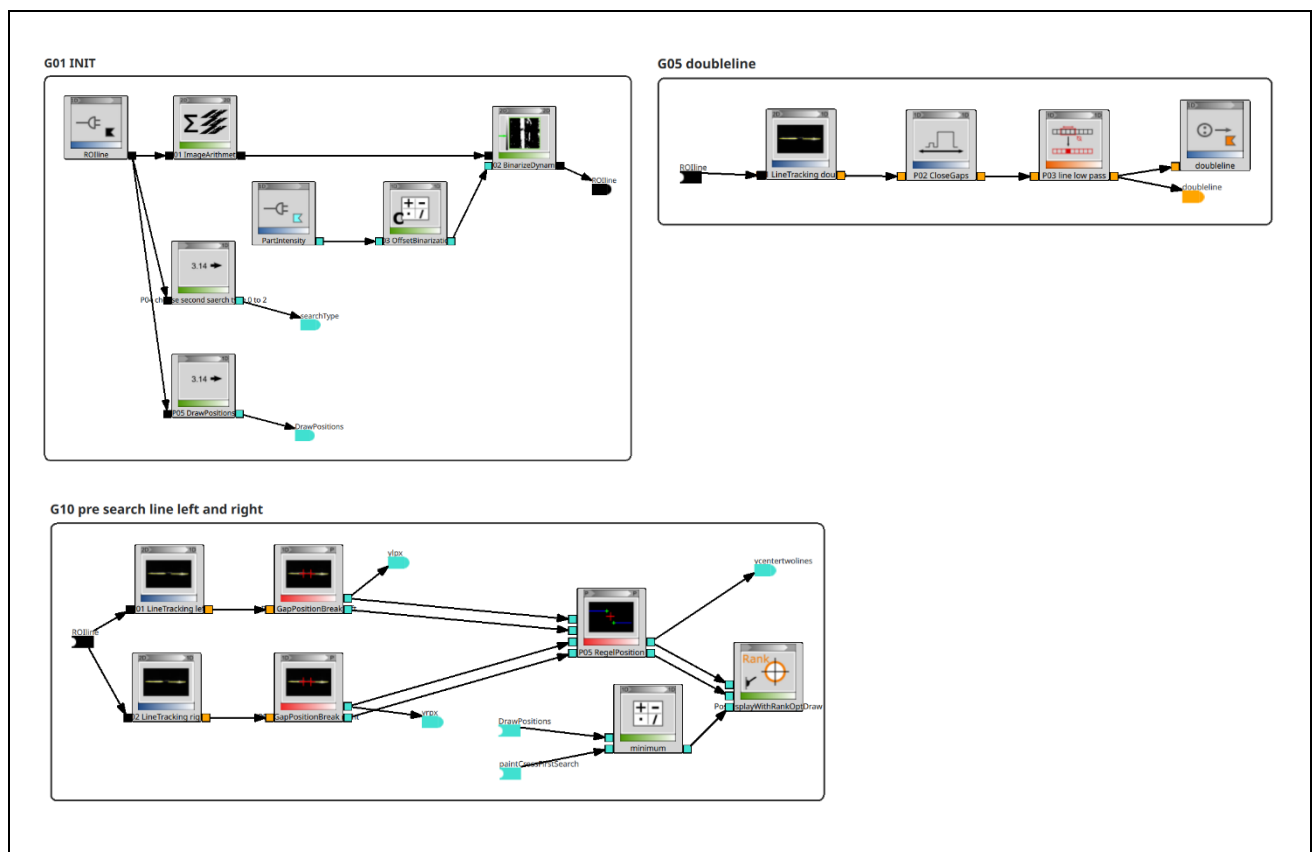
IN bridges

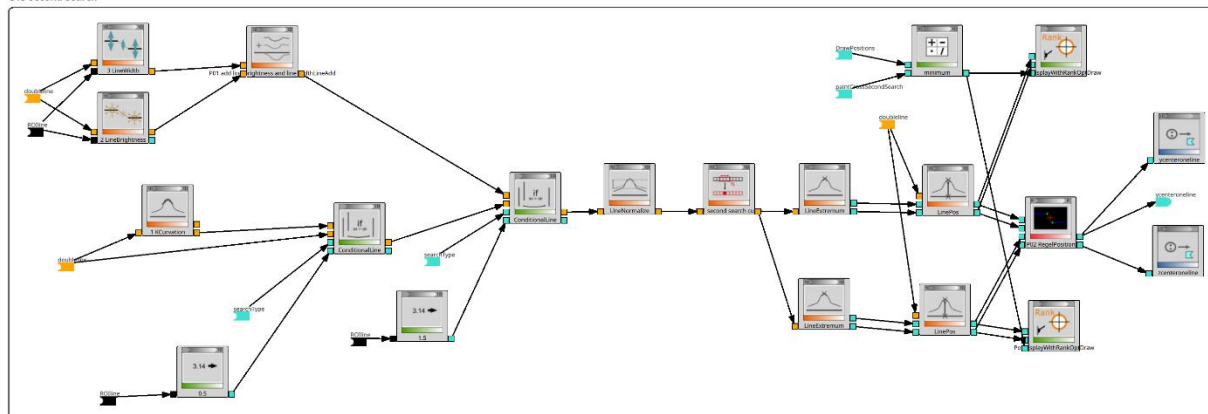
image	IMG ROLine
value	PartIntensity Zpx upper

OUT bridges

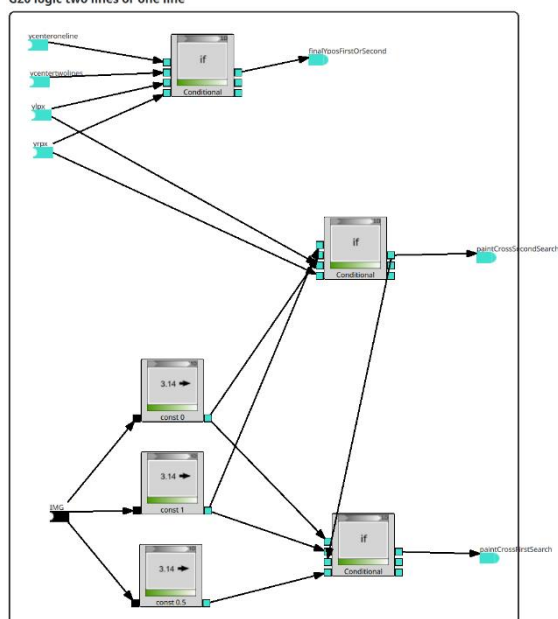
image	ROI grey ROIDetection ROI greydark ROI gaplight
line	doubleline
value	ycenteronline zcenteronline

■ Graph block diagram

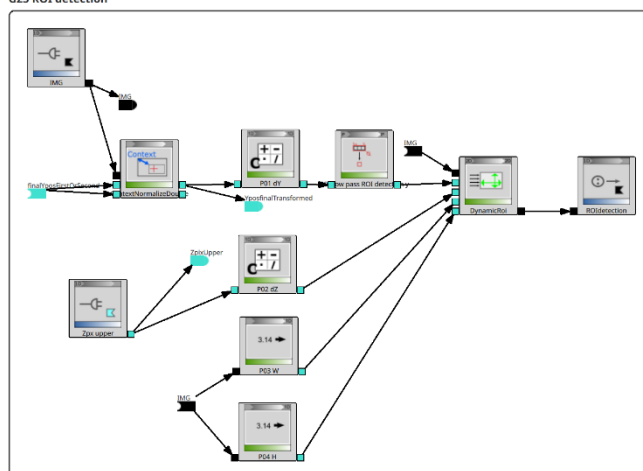




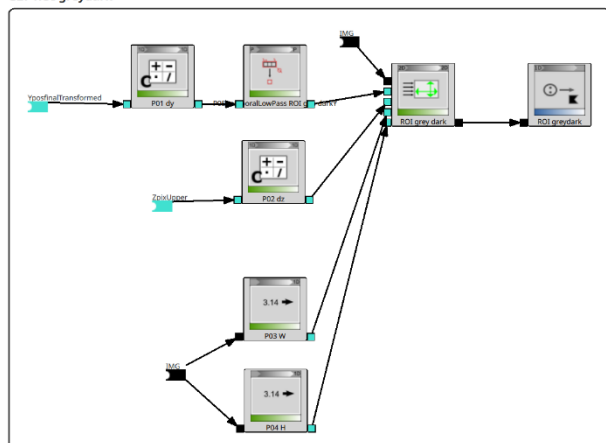
G20 logic two lines or one line



G25 ROI detection



G27 ROI greydark



G30 ROI gap light

