MANTIS VISION
3D that works for you

Mantis – Vision

Projector Beam Centering Algorithm concepts.

Mar 2018

1 Scope.

This document Describes the principal of method for projector beam placement alg'. This is conceptual description recommended to be used for the module assembly station. The performance accuracy is not guaranteed and it depends on the implementation and tuning by the designer.

2 Revision History.

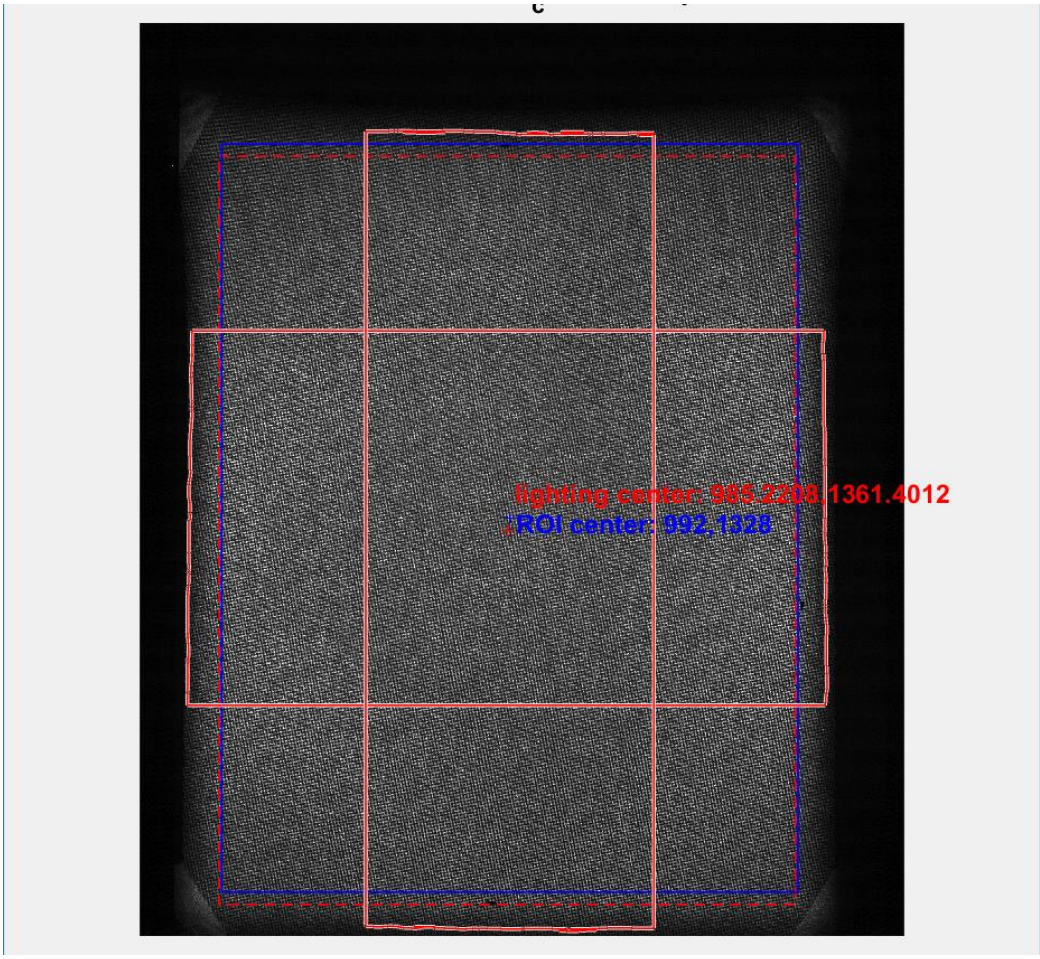
Ver	Date	Owner	Description
0.1	Mar 2018	Yelena	Initial

3 Overview.

For the sake of detecting center of lightness in VCSELs the next steps are implemented.

1. Input image of VCSEL is undergone some filtering with gaussian filter in two directions: vertical and horizontal. This is done separately for each direction, so at the input there is a source gray-level image, while at the output we get two images with horizontal and vertical edges accented respectively. (Fig.1)

Input Image:



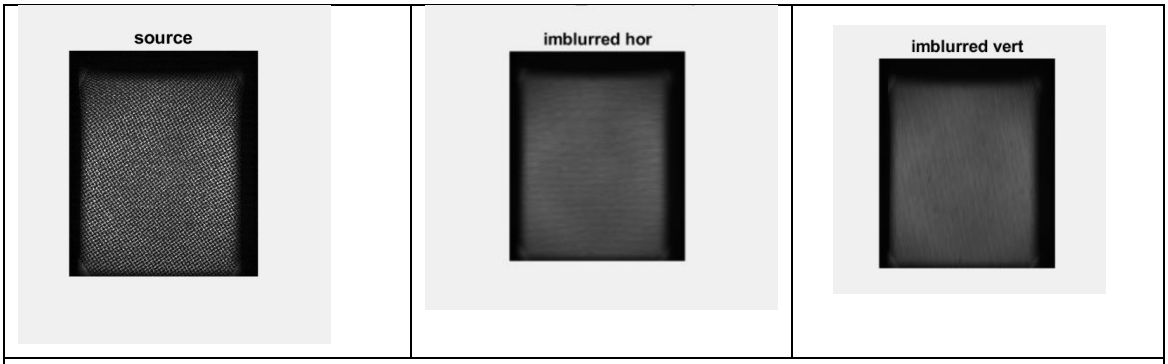


Fig.1

Blurred images are analyzed along their center part as shown above. For the horizontal centering we take the vertically blurred image cross section and vice versa.

Analyzed part should be taken with reference to the tool ROI definition of the target placement with external frames, for example ROI + 200pix width/ height.

2. Next step – finding the special threshold for binarization so, that most enlightened area, including inflection point[1] of blurred edge. Here Otsu's algorithm for edge detection is employed for the case of edge that have ramp-like profile rather than step-like edge, which corresponds to the physical nature of image as PSF of light source. Fig.2 shows the essence of this for the horizontal intensity profile of image intensity. The same view has the vertical one.

   We get to binary images as a result of such binarizing (Fig.3):

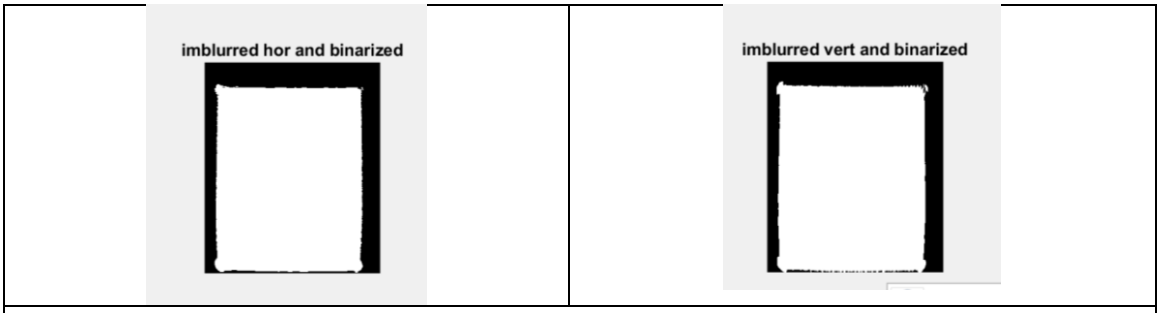


Fig.3

[1] Inflection point – point on function graph, where function derivative changes it's sign. For example, point (0,0) for function y = x^3

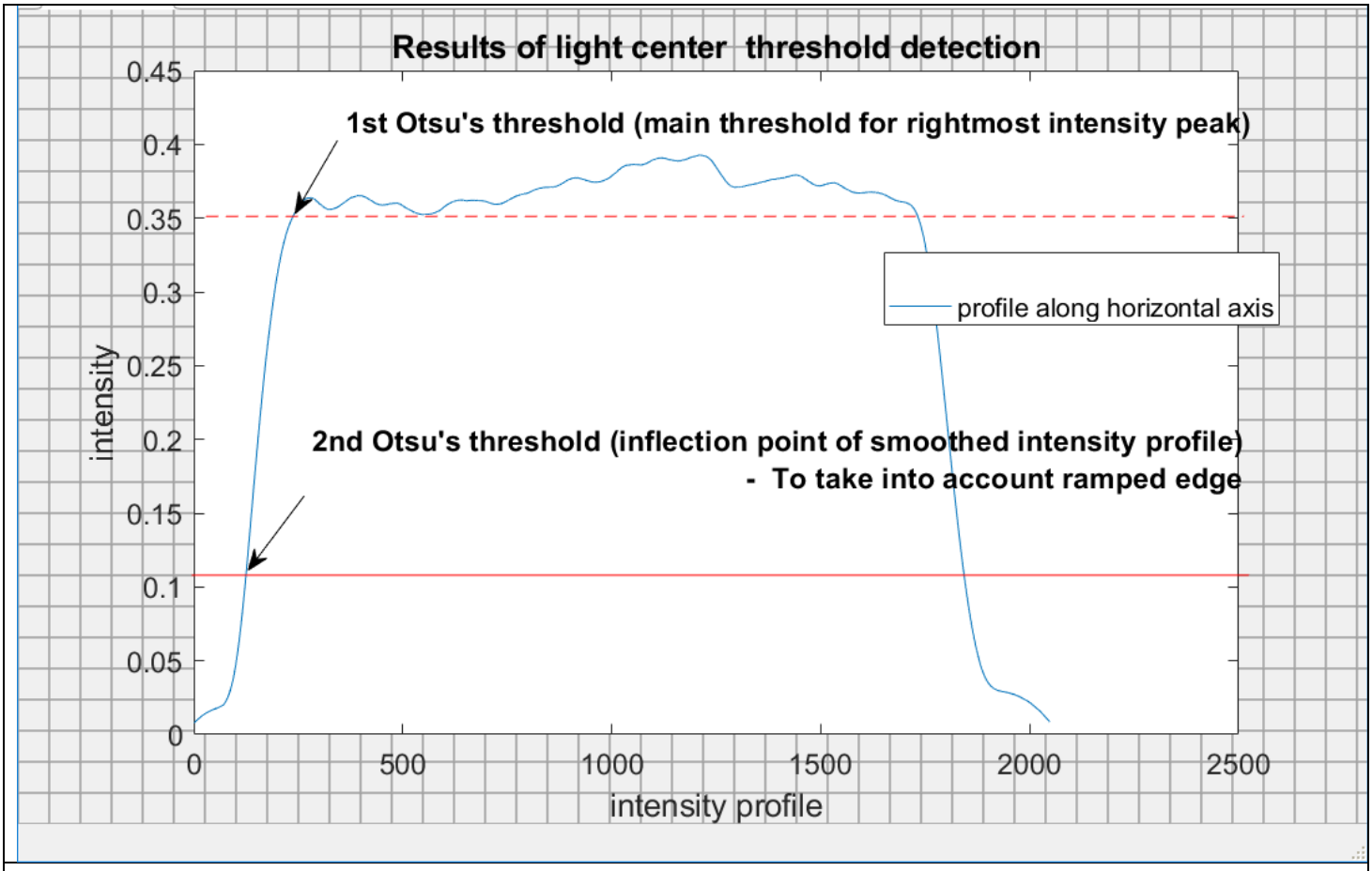
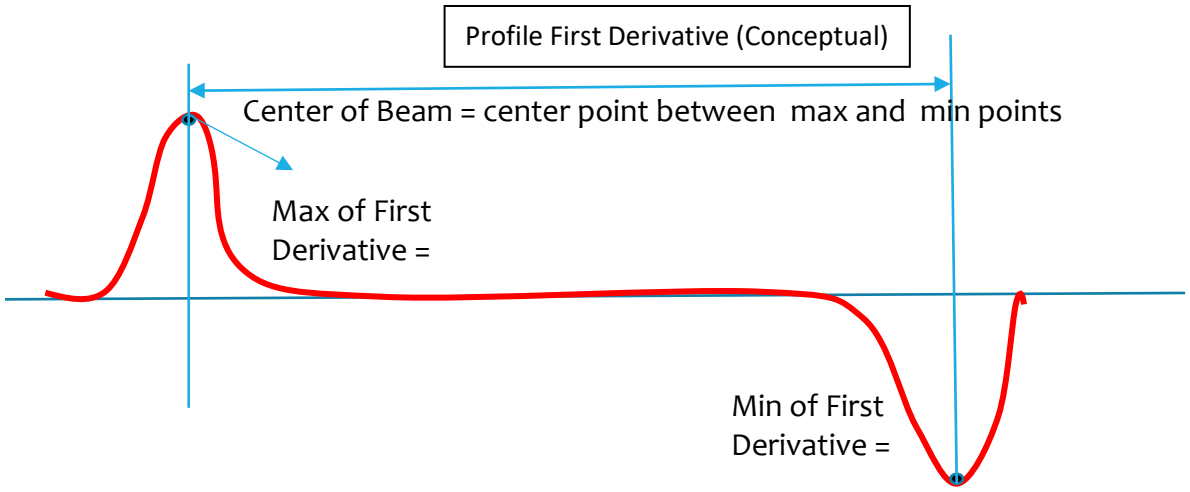

Results of light center threshold detection
1st Otsu's threshold (main threshold for rightmost intensity peak)
profile along horizontal axis
2nd Otsu's threshold (inflection point of smoothed intensity profile)
- To take into account ramped edge
intensity
intensity profile
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
500
1000
1500
2000
2500

Fig. 2


Profile First Derivative (Conceptual)
Center of Beam = center point between max and min points
Max of First Derivative =
Min of First Derivative =

3. We calculate the centroids of parts of white object on both binarized images , falling into horizontal and vertical strips of certain width/height about the predefined center (horizontal strip is gotten from horizontally filtered image, vertical is from vertical one respectively), and compose from them the one centroid while taking vertical coordinate (y) from vertical image, and horizontal coordinate (x) – from horizontal image respectively:

Center = (Xhor,Yvert);

Reported Center – Relative to the Given ROI Center in pixels

4. Resulting image with plotted nominal and detected centers and delineated contours of cross-shaped region of interest can be seen on Fig.4:

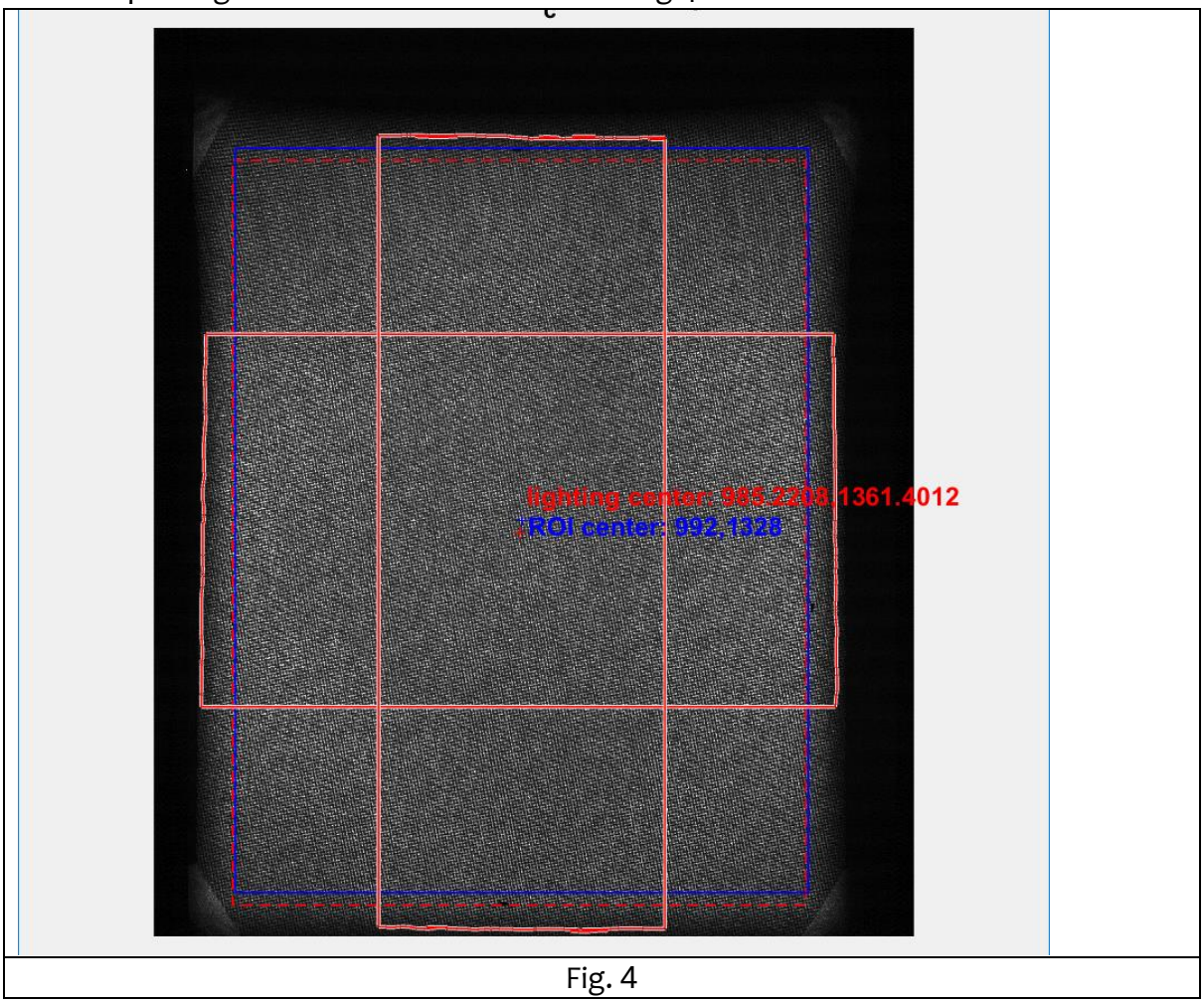


Fig. 4