There're some important parameters that should be determined before the edge detection and thickness measurement:

Begin_frame & last_frame: the range of frames we want to cover in the analysis. last_frame must be smaller than the total number of frames in the video, and it must be larger or equal to begin_frame.

Frame_interval: interval between each processed frame, it's typically set to one to avoid detail losses.

Thickness_sample & pixel_interval: the former decides how many samples we want to collect in each frame to compute the mean thickness (the positions of the sample are symmetry about the middle-line of the tube). Pixel_interval decides the interval between each sample in terms of pixel.

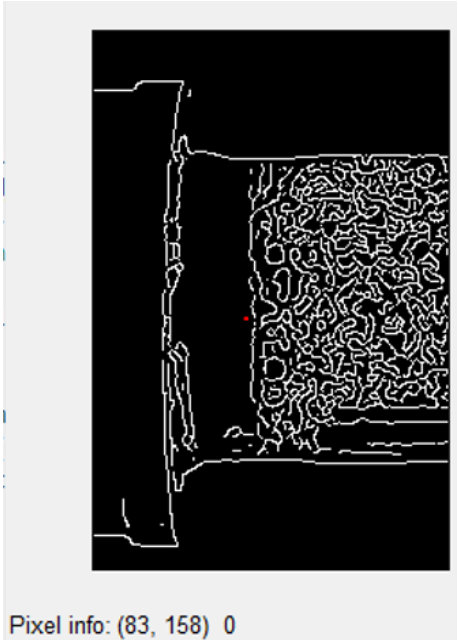
Noise_threshold: a median filter will be applied to a specific frame if the number of the detected noise is larger or equal to the threshold we set.

We can also make some adjustment about the output and input by changing the following parameters:

Show_image: the image of every step during the process will be presented when it is set to one. It's suggested to disable it when we're processing a clip with many frames for memory-saving, and turn it on when we're interested in a specific single frame.

Show_different_detectors: the result from different MATLBA built-in detectors will be presented when it is set to one. Similarly, It is suggested to disable it when we're processing a clip with many frames for memory-saving, and turn it on when we're interested in a specific single frame.

detecting_middle_point: the code will automatically select the middle point (symmetry line) of the tube if it is set to one, but we can also choose the point manually. For instance, the middle point we choose through observation is about 158(y-axis), and middle point approximated by the code is 160, which is close to the former



Cropping_image: it's set to zero if we've already finished choosing the detected region we need, but if we want to select a new region, this parameter should be set one, and then choose a new region we're interested in. It should be noticed that the middle point (symmetry line) need to be reselected for a new region, and it can be completed either manually or automatically as stated before.

Important output data:

Thickness_millimeter: this array includes the measured thickness of the frame region we specify in the first place, the unit is millimeter.

t: rescaled from the frame range we choose

frame_with_noise: this array indicates the frames where noises were detected, and a median filter was applied. It needs to be stressed that the result may differ if we choose a different noise threshold at the beginning.

**If we're interested in what happens at one specific frame, we can assign this frame number to both begin_frame and last_frame, and make sure that show_image is set to one

so that images of the whole process at this frame will be demonstrated. Also, we can check **detected_noise** to confirm the number of noises that is detected, and check **noise_locaiton** to locate the accurate locations of detected noise.