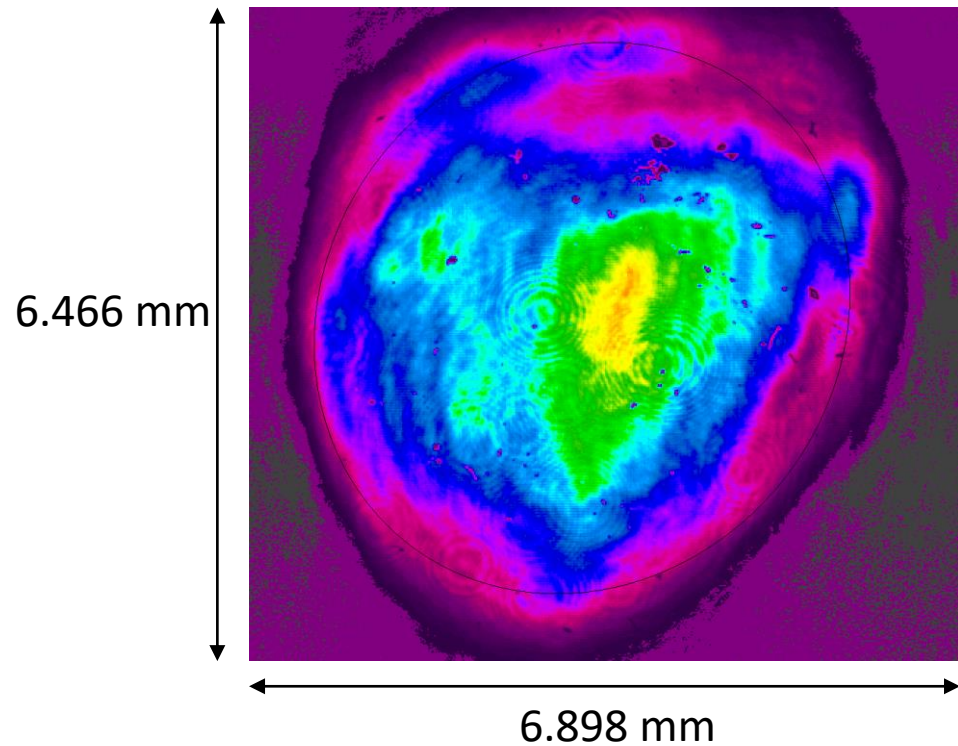


Implement the laser profile \* QE scan profile as  
a one image into GPT

Sajini Wijethunga

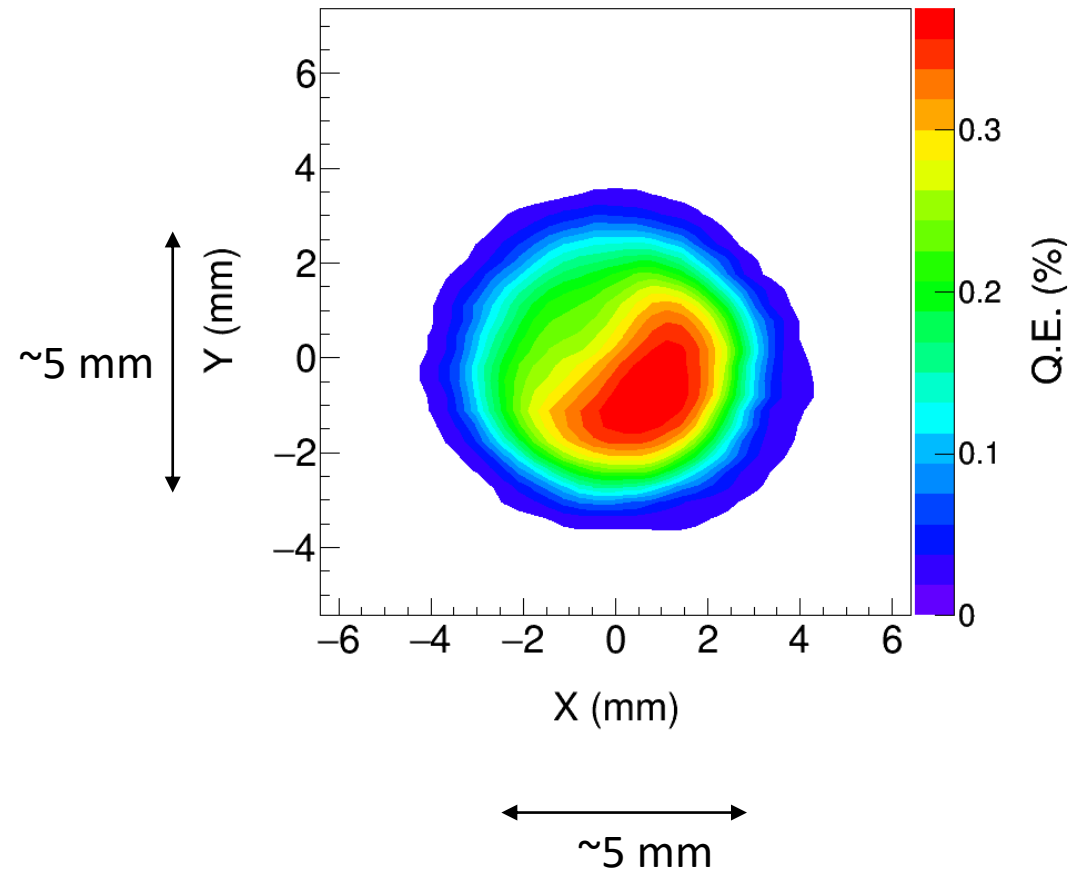
07/24/2019

Laser profile for  $\sigma = 1.64$  mm

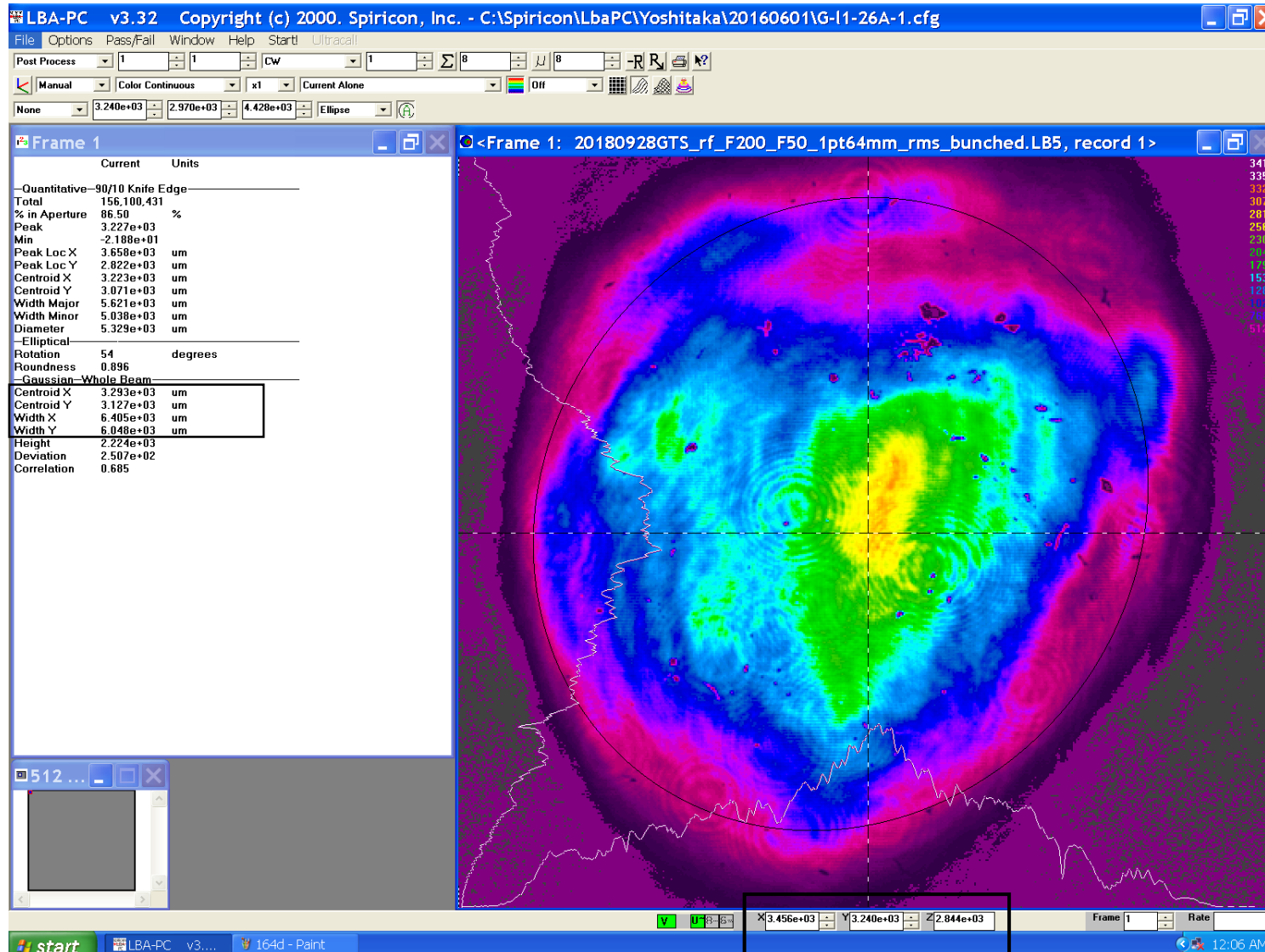


1 px=0.01347 mm

QE scan of the 90 min Sb photocathode  
(Full active area)

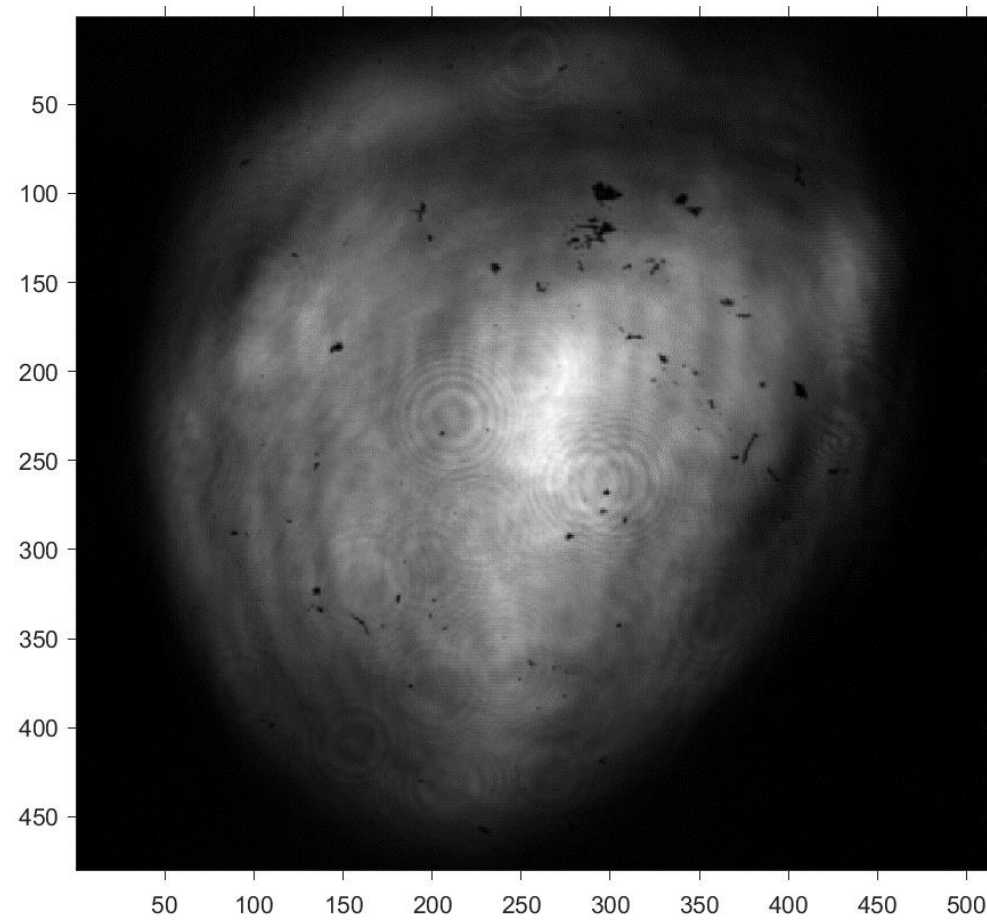


- In order to use an image as the initial particle distribution in GPT it has to be grayscale, 8-bit per pixel .bmp file.
- Image details shows in the Spiricon software:



## Steps

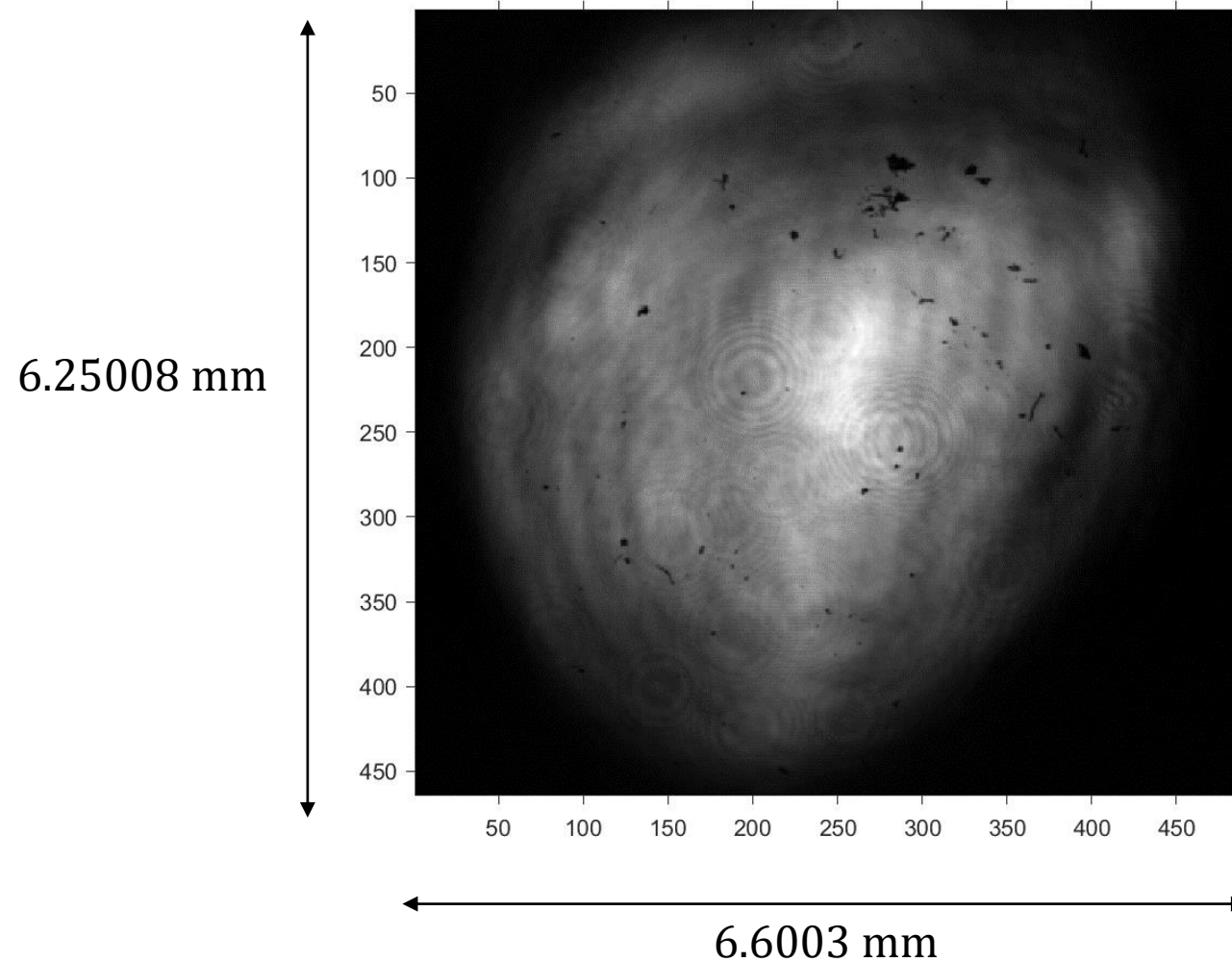
- Get the .cma file from Spiricon software, which is a 480\*512 matrix.
- Convert it into a grayscale image (converts the matrix to an intensity image that contains values in the range 0 (black) to 1 (white)).



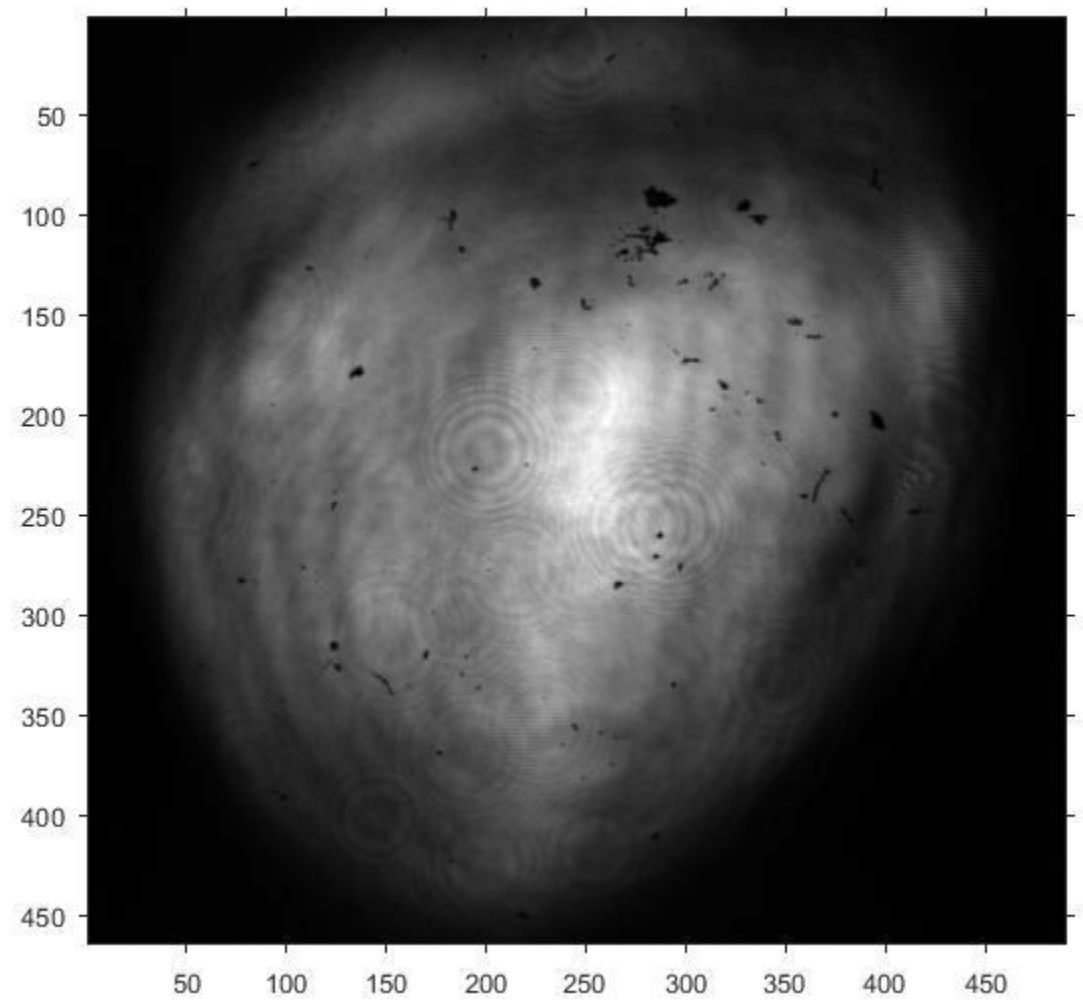
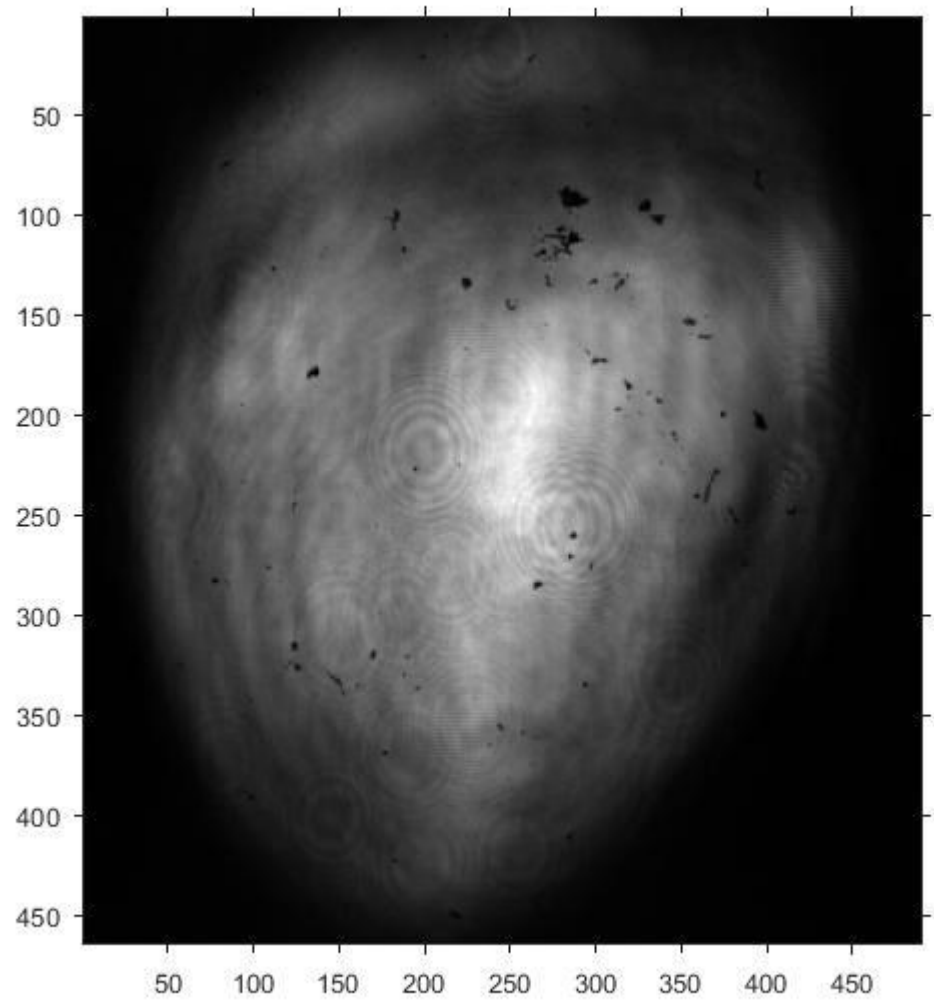
- Crop the image such that the center of the image is the center of the laser spot.

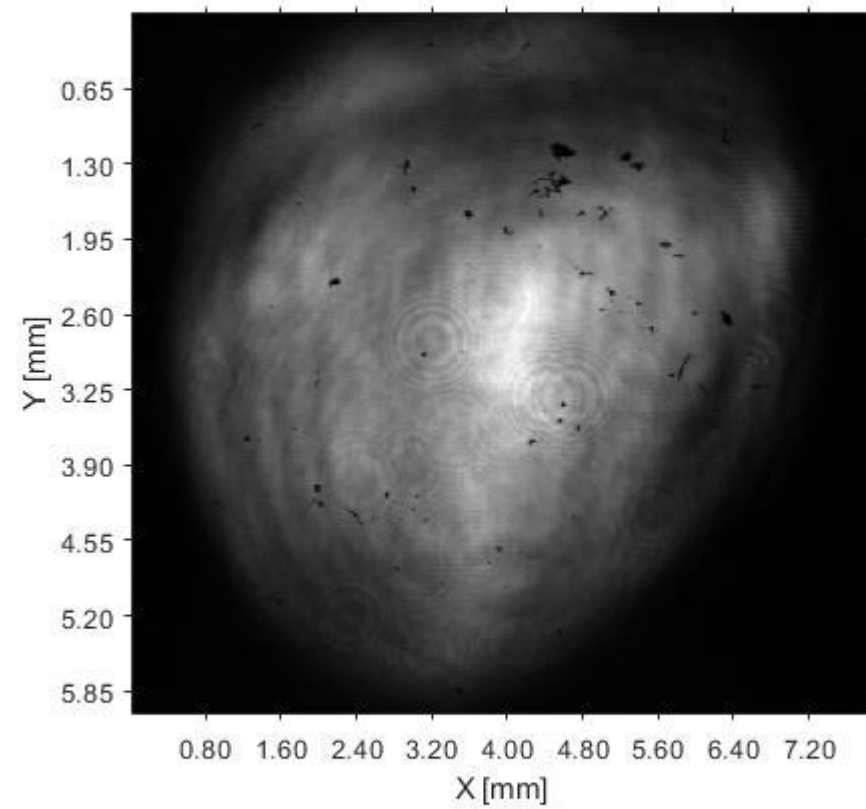
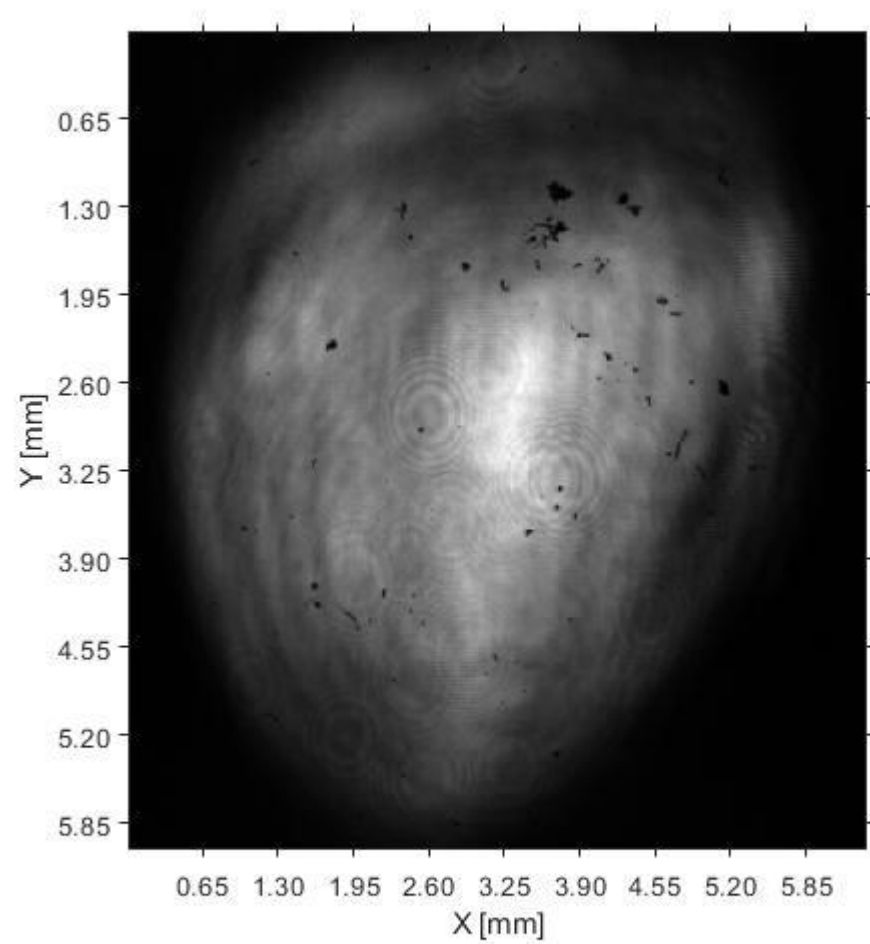
Centroid coordinates X= 3.293 mm, Y=3.127 mm

$\frac{1}{e^2}$  X = 6.405 mm, Y = 6.048 mm



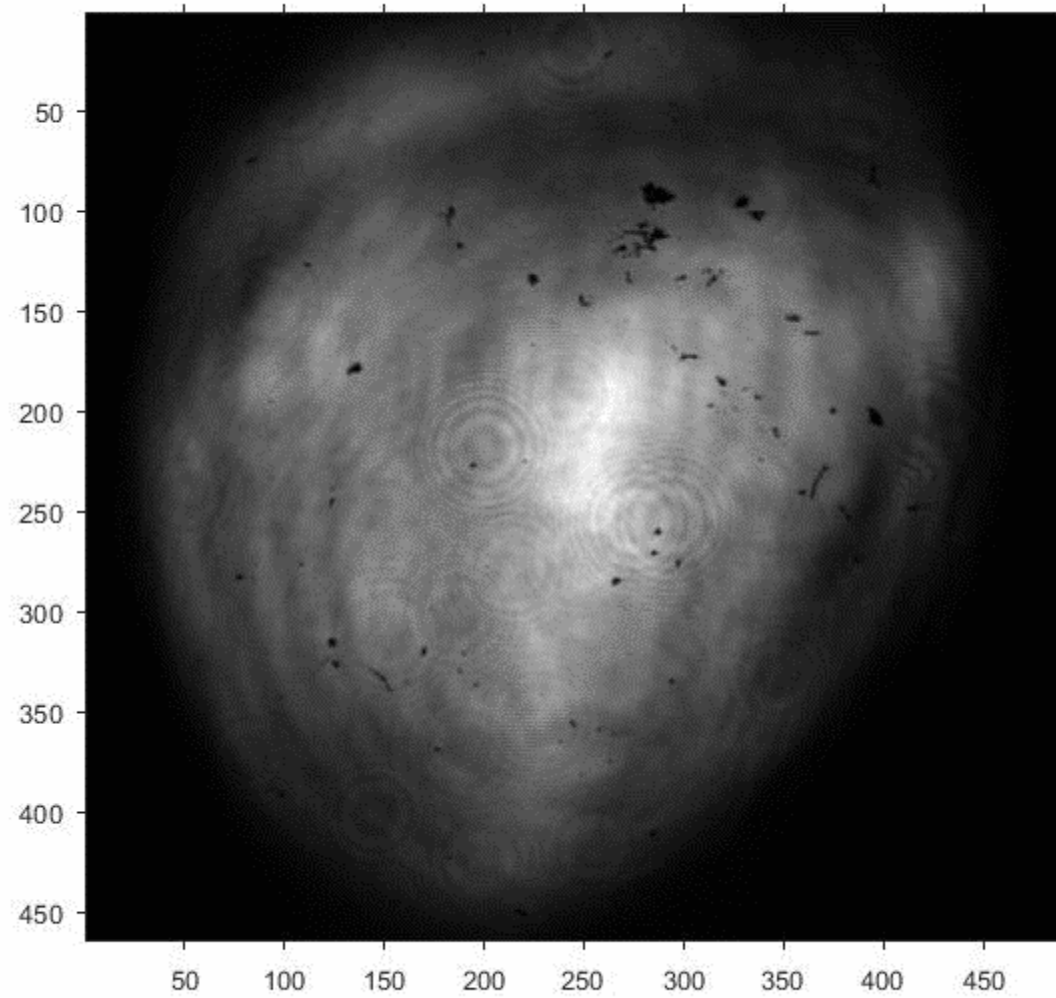
- Since the laser hit the cathode at 25 degree angle, updated the aspect ratio of the image.  $\frac{x}{y} = 1.1690$







- Convert the 24 bit image to 8 bit image.

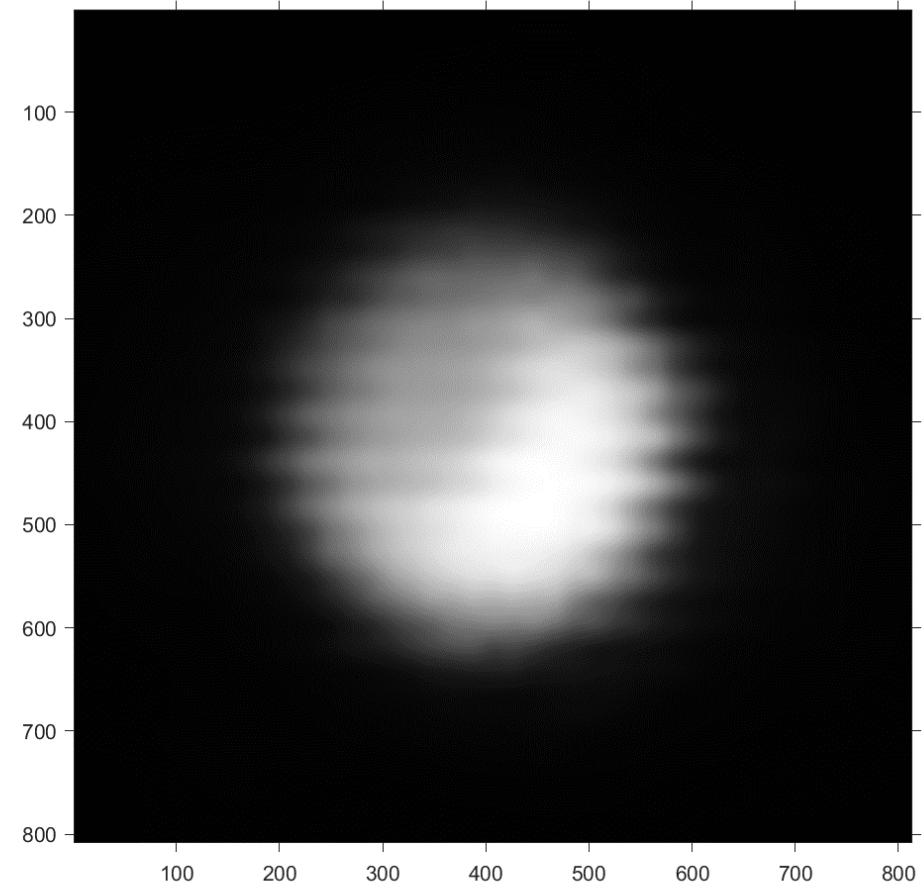
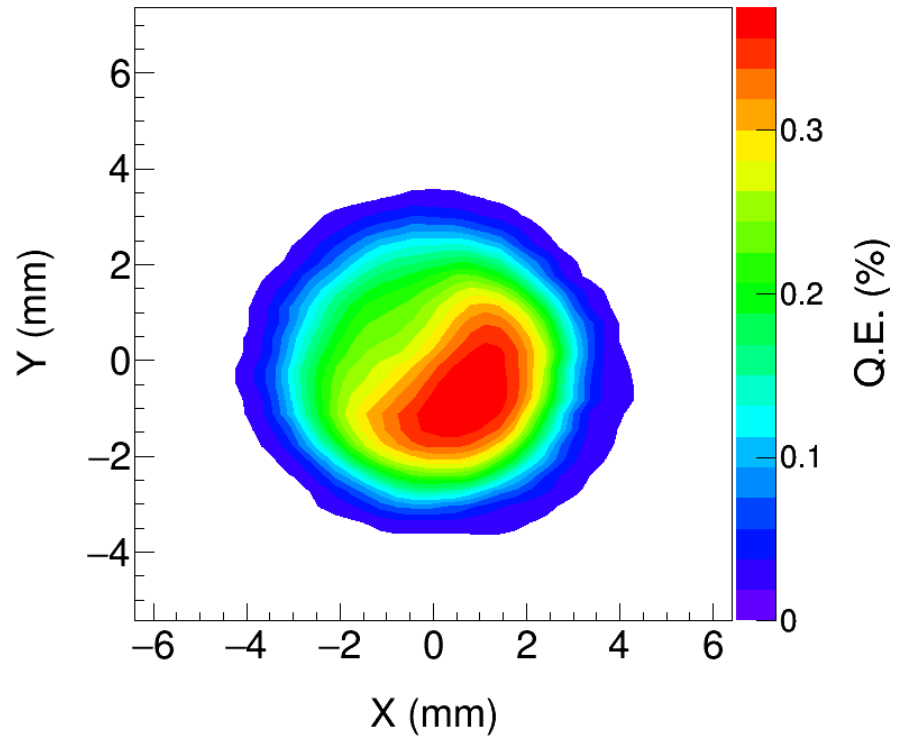




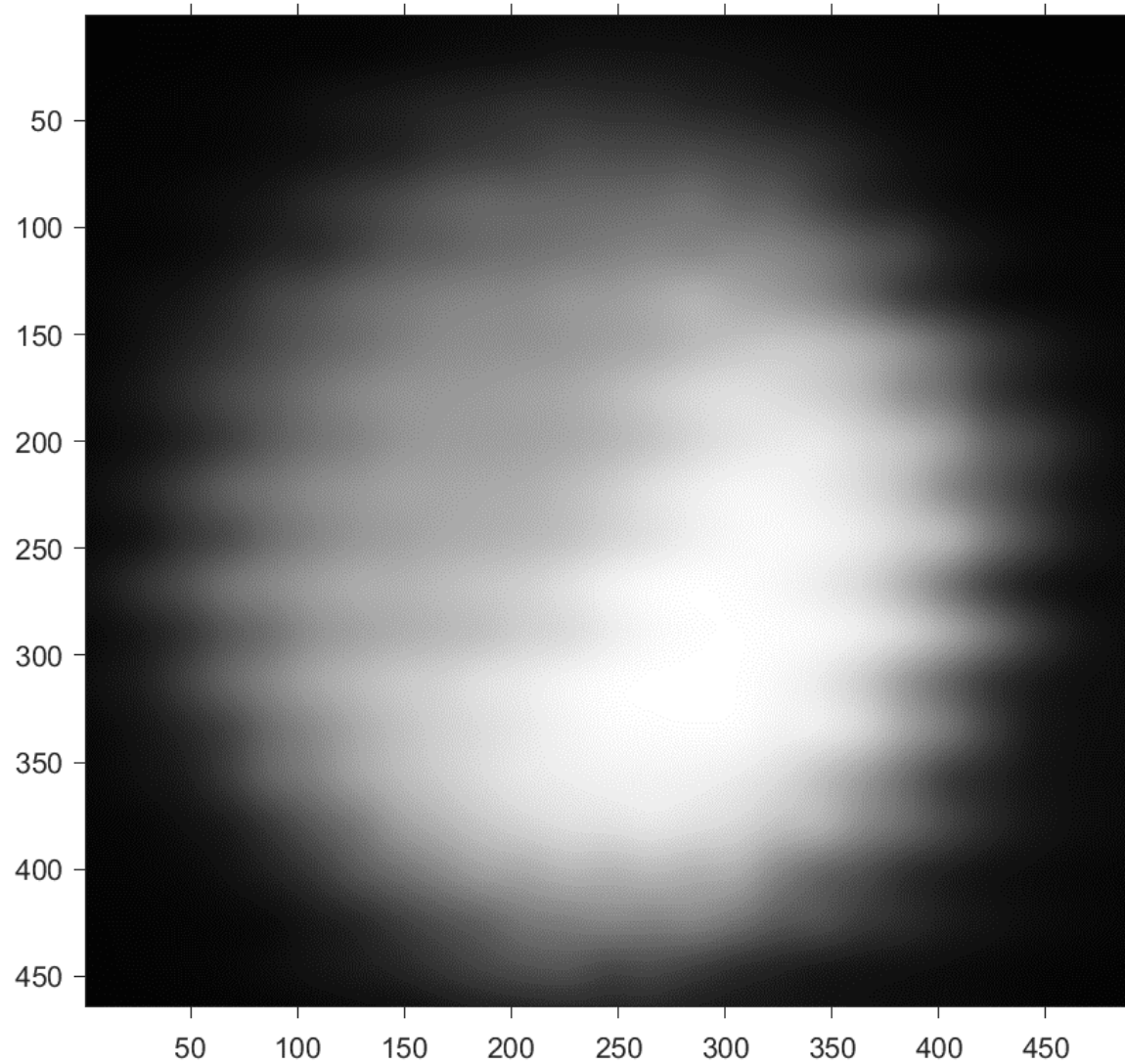
## QE scan image

### Steps

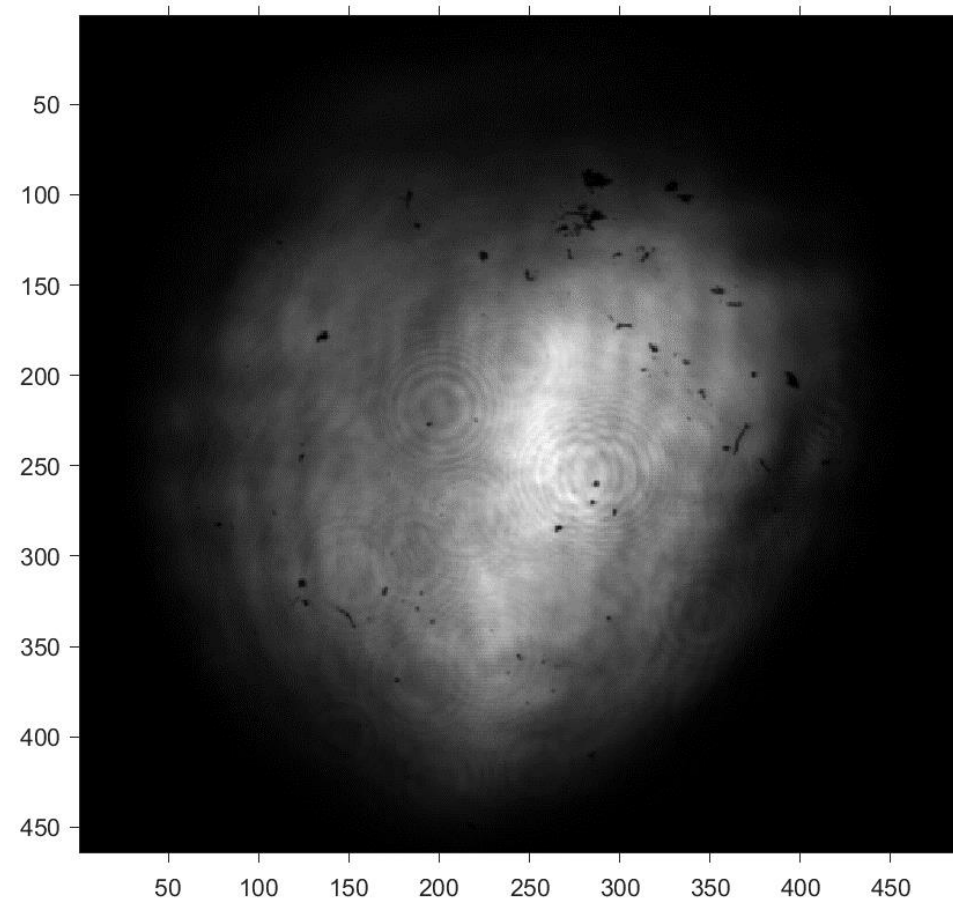
- Get the matrix of the QE profile and make the center of the active area the center of the QE image.
- Normalized to 1.



- Scale it to match the px/m ratio of the laser image.
- Crop the QE image to the size of the laser image.



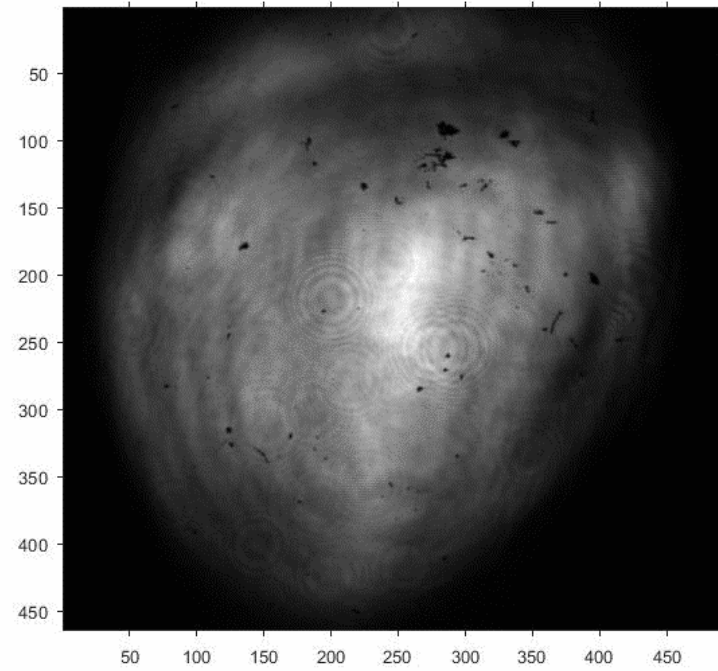
- Multiply the two matrixes (laser image\*QE).
- Normalized to 1.



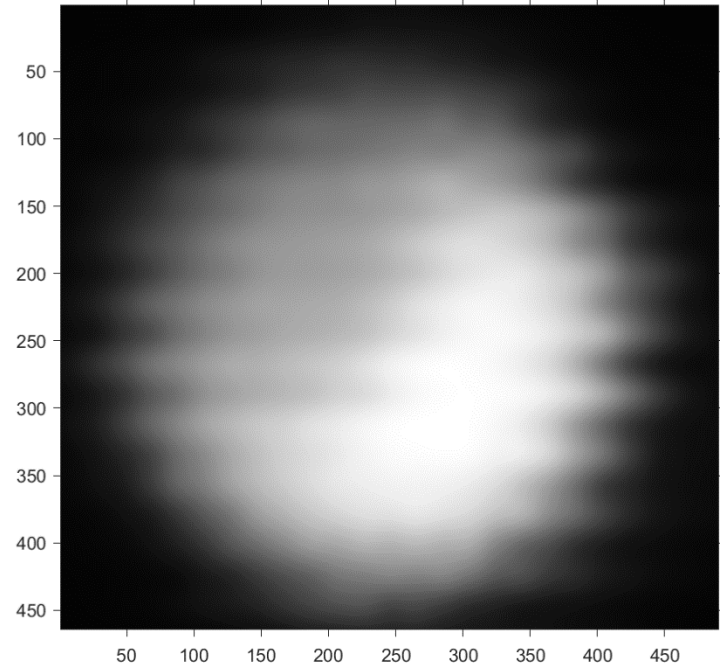
- Convert the 24 bit image to 8 bit image.

# Summary

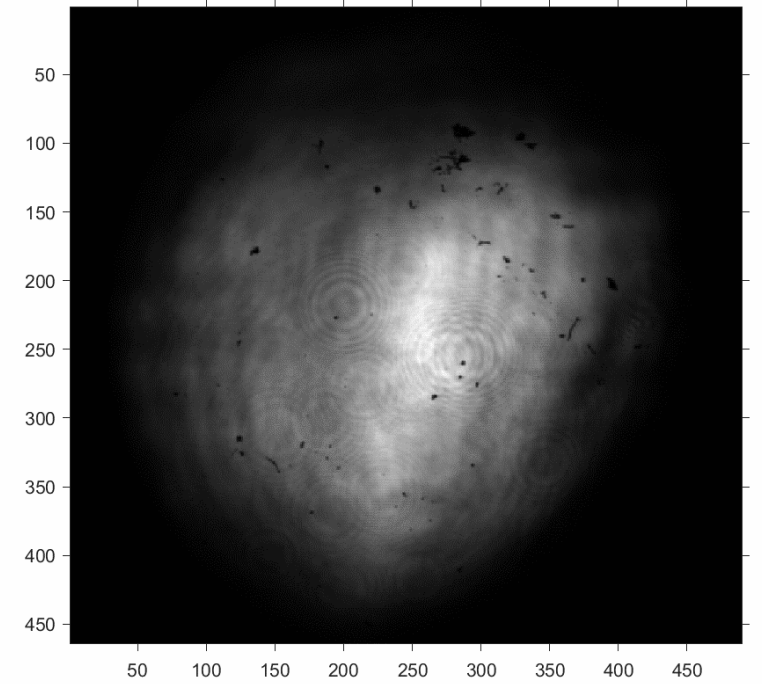
Laser profile



QE scan

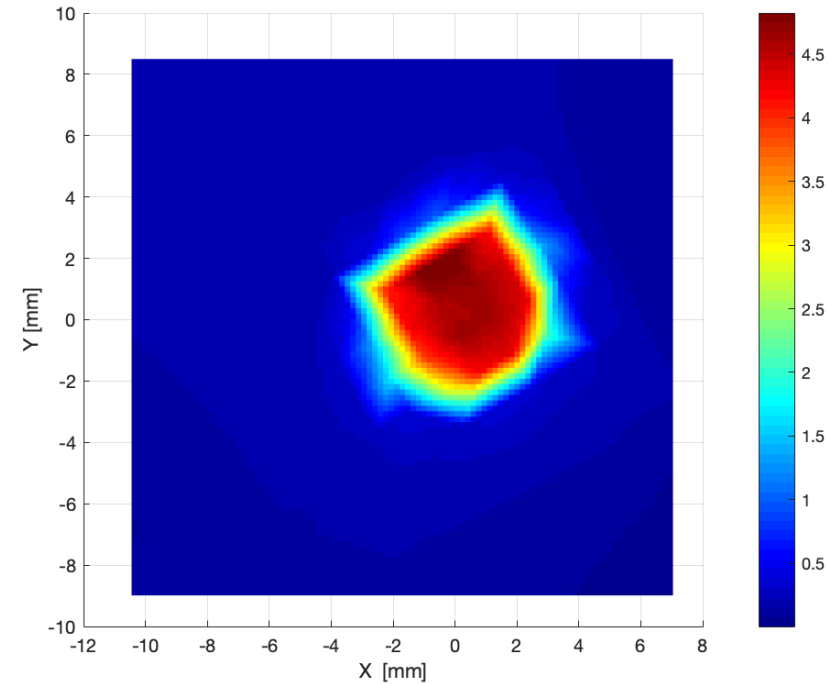
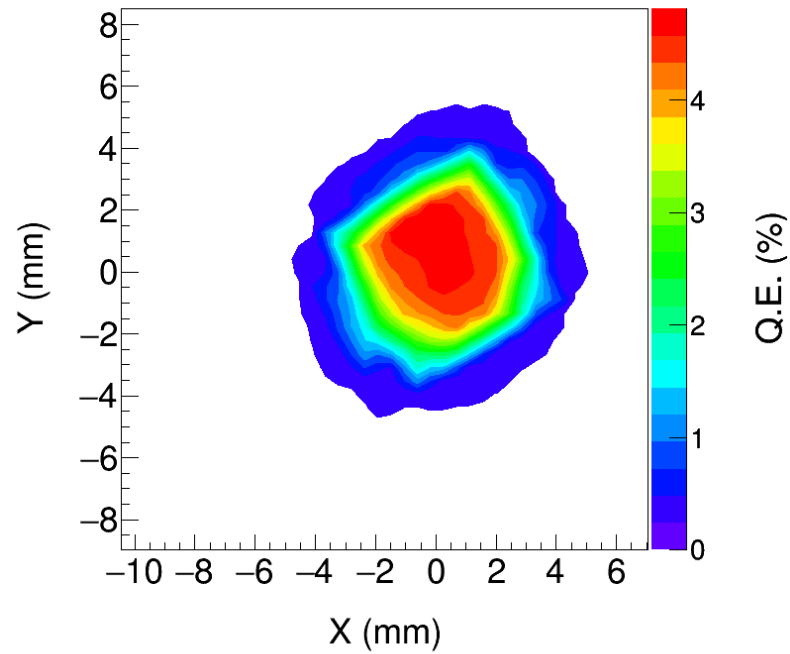


Laser\*QE



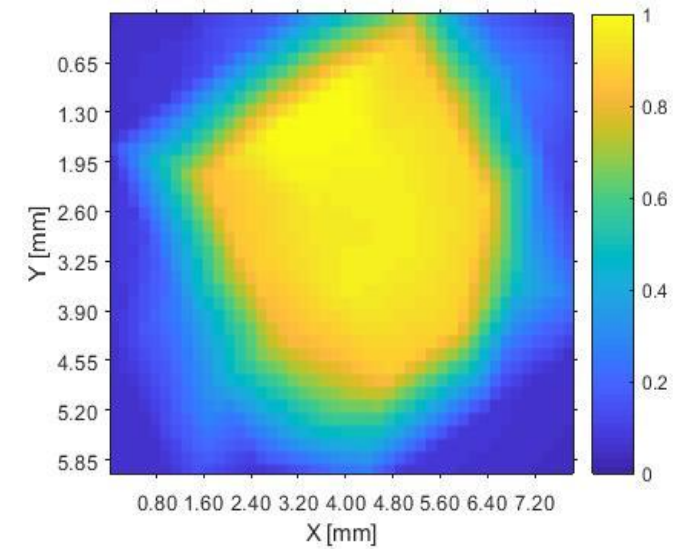
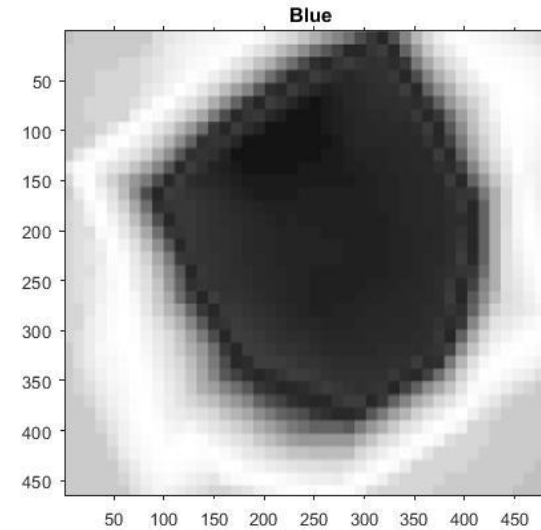
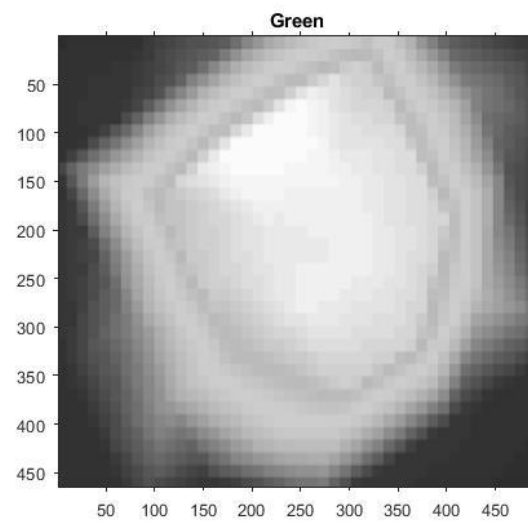
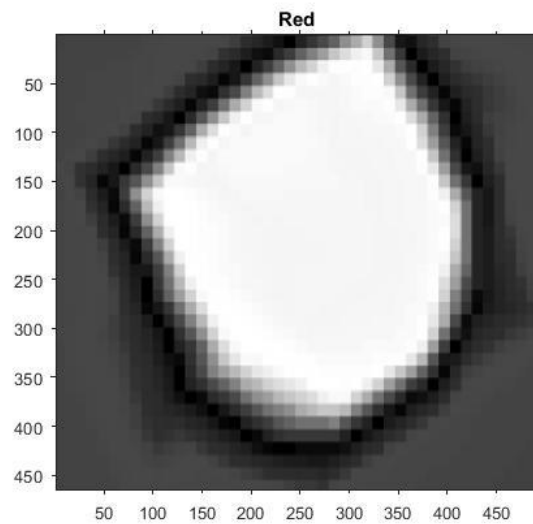
## QE scan did in June'18 for 90 min Sb photocathode

- Plot the original scan data from the .sdds file in X Y coordinates by making the center (0,0) and save that data file in .txt format.
- Make a surface plot from the .txt file (if the step size of the rotated data is large and not constant, have to do interpolation)
- Save that surface plot as image and convert it to a matrix.

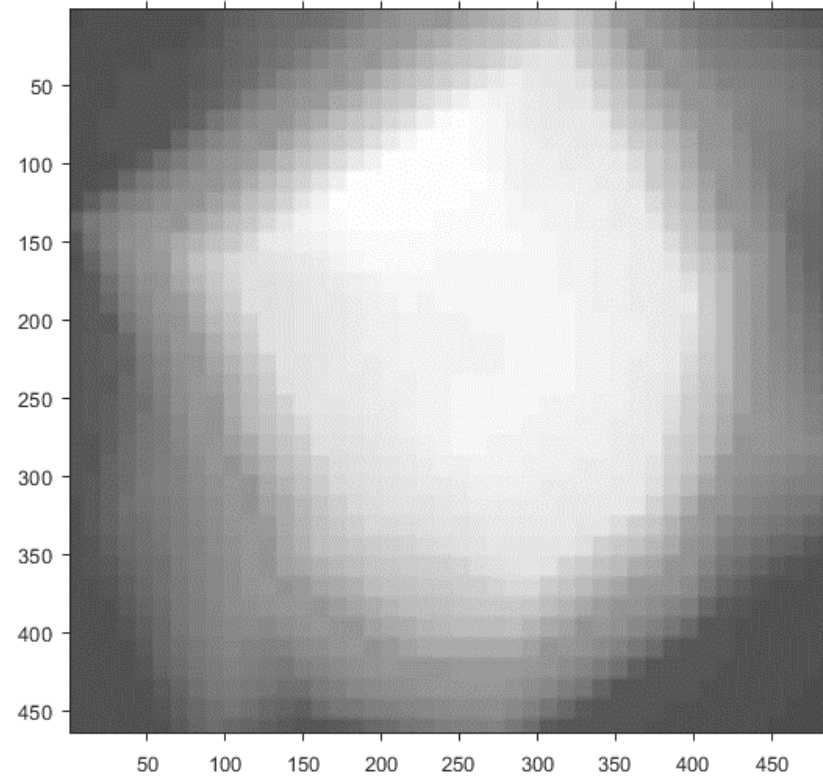


- Matrix comes out as a RGB matrixes (3 separate matrixes) which by concatenating the 3 gives the original image.
- Thus, have to do further calculations separately for the 3 matrixes and finally concatenate them.

- Cropped the image such that the center of the image is the center of the QE scan.
- Scale it to match the px/m ratio of the laser image.
- Crop the QE image to the size of the laser image.



- Convert to a gray scale image.
- Normalize.

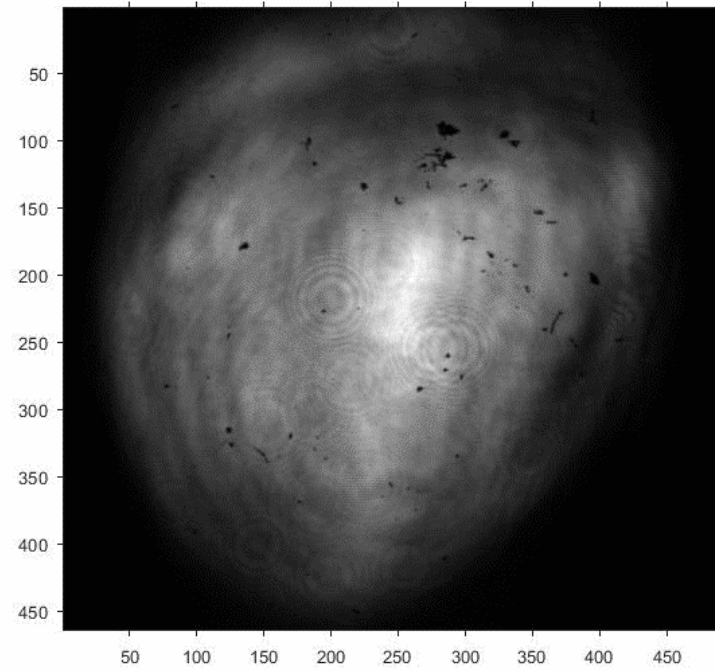


- Multiply the two matrices (Laser \* QE)
- Normalize.
- Convert 24 bit to 8 bit image.

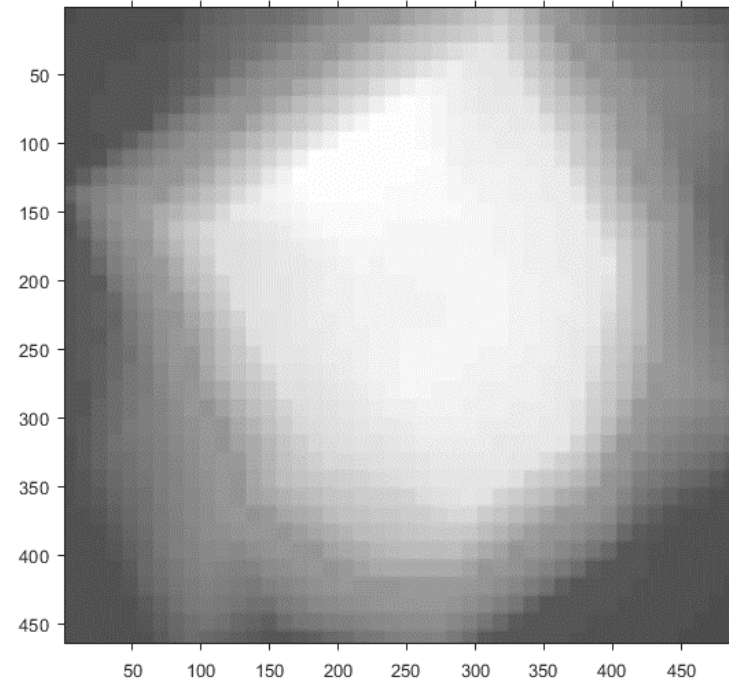


# Summary

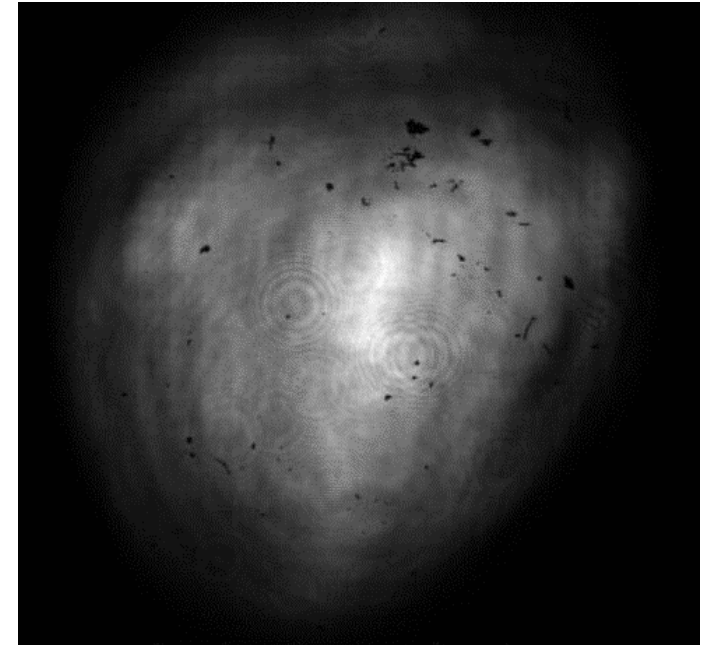
Laser profile



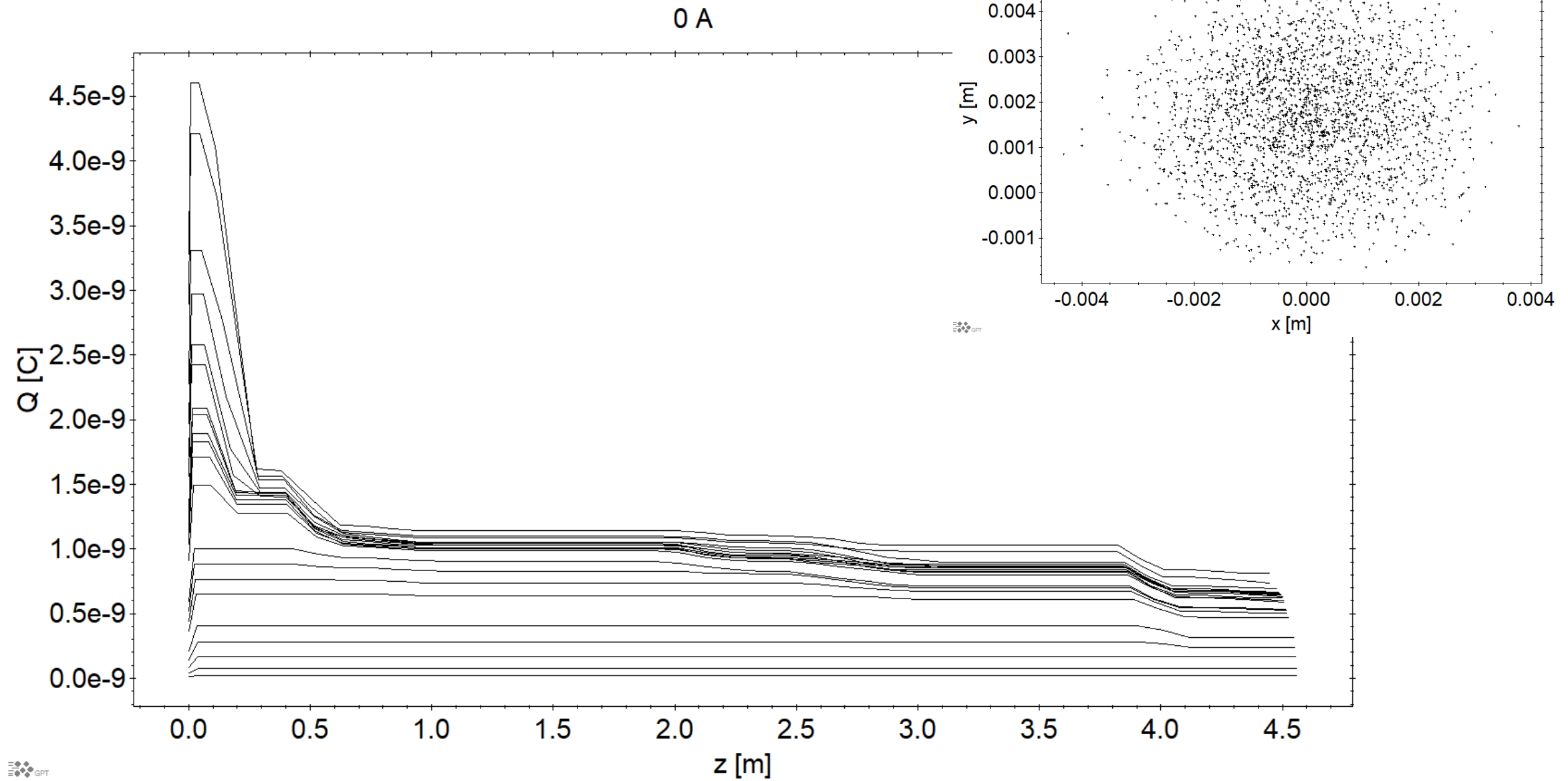
QE scan



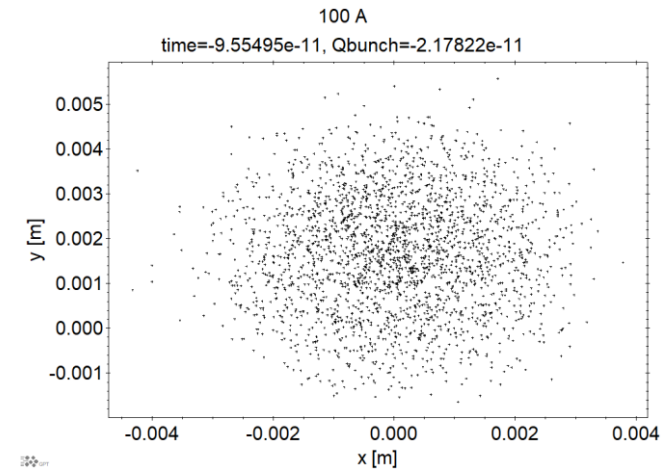
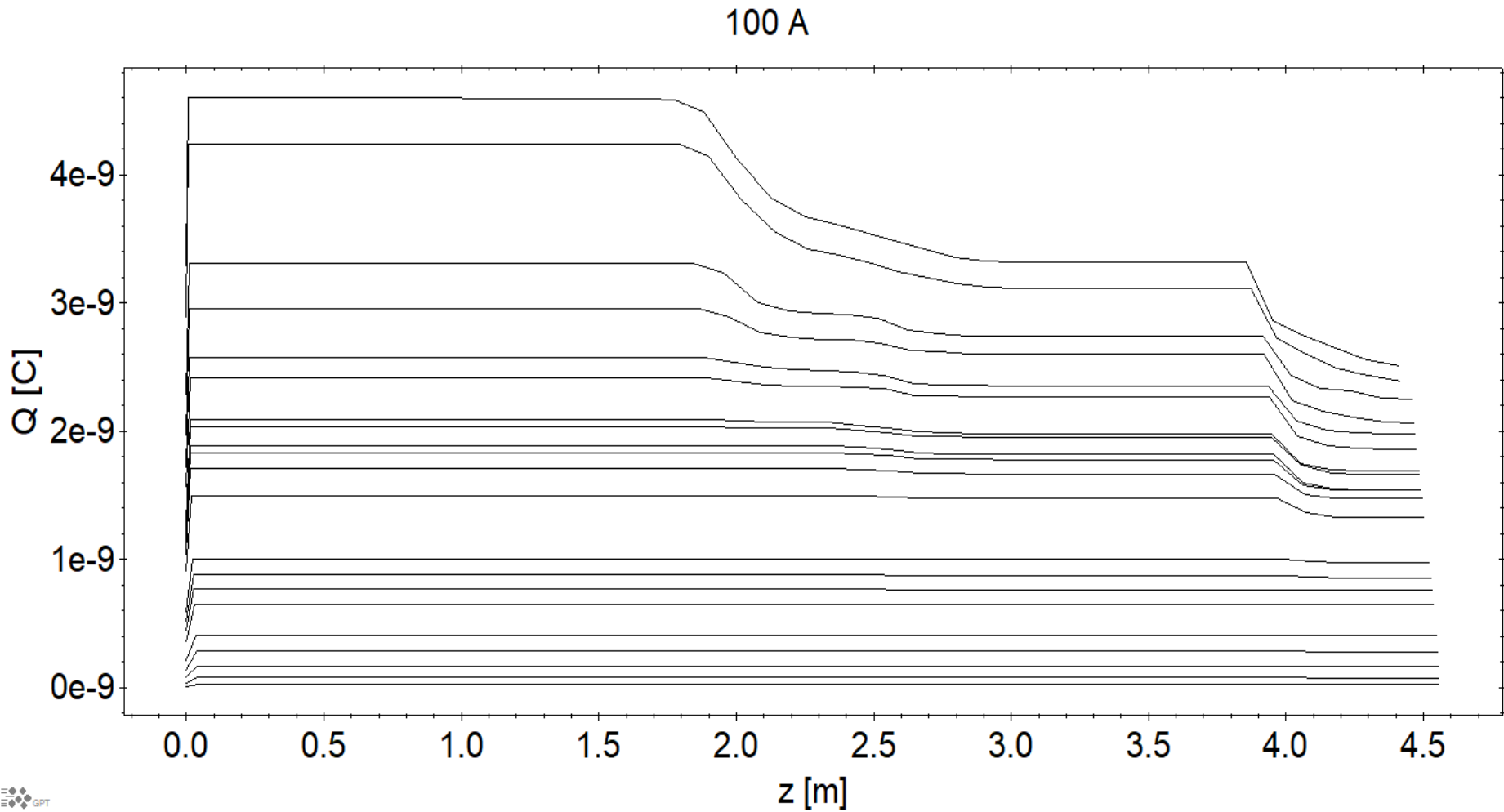
Laser\*QE



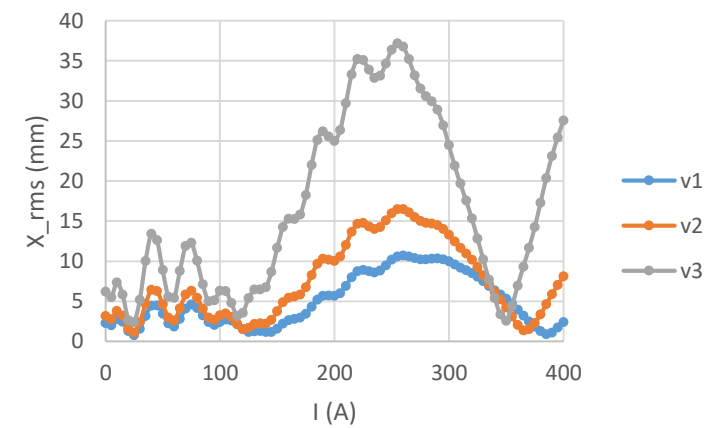
0 A



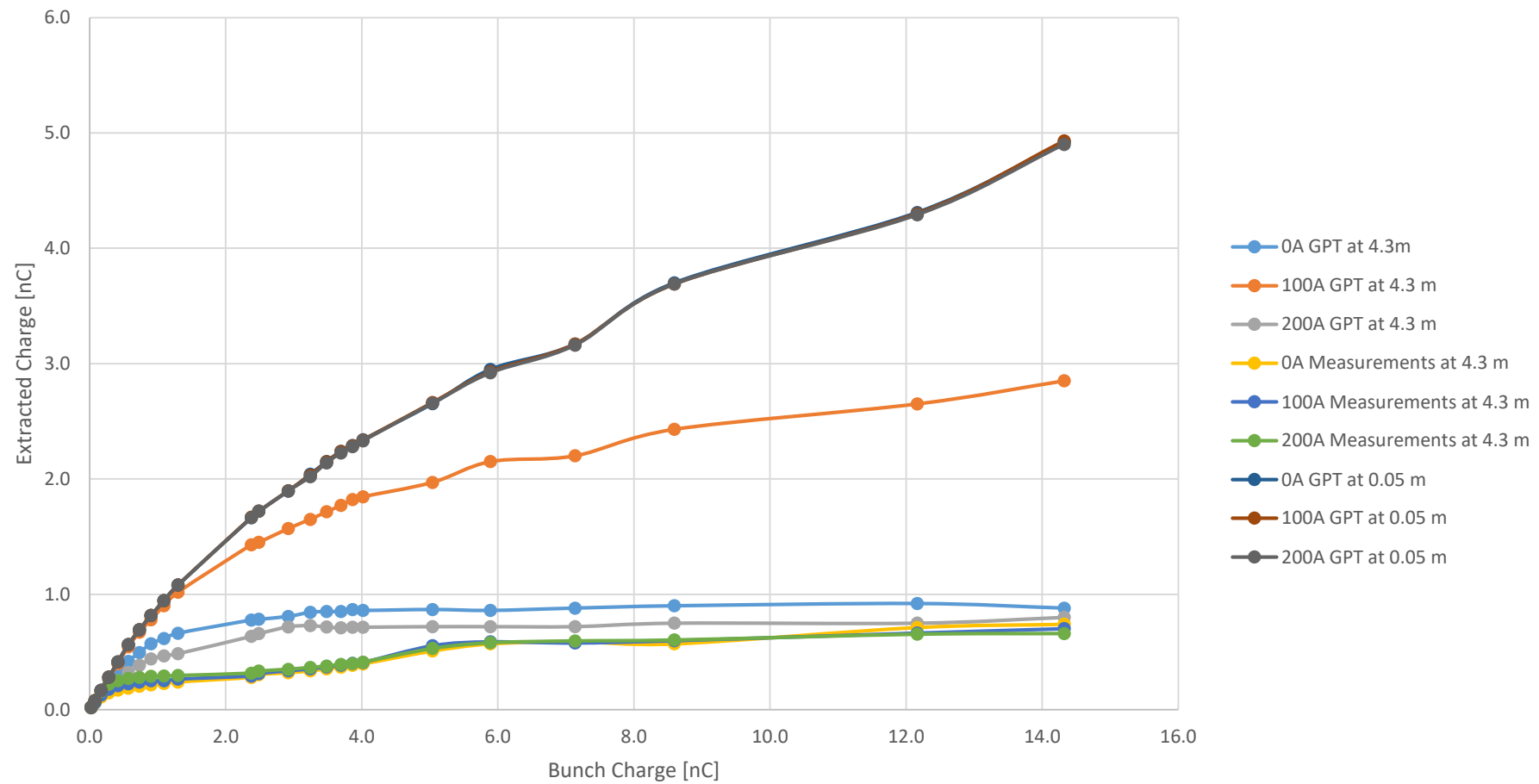
# 100 A



Beam Size vs Solenoid Current 200 kV



Extracted Charge vs input charge for 0 A, 100 A, 200 A  
225 kV, 50 kHz, 1.64 mm rms, 75 ps (FWHM)



Extracted Charge vs input charge for 0 A, 100 A, 200 A  
225 kV, 50 kHz, 1.64 mm rms, 75 ps (FWHM)

