

Photoluminescence Analysis of Unknown Materials with the Photon Systems Mini PL

The MiniPL system configured with Motorized XY stage for PL Mapping.

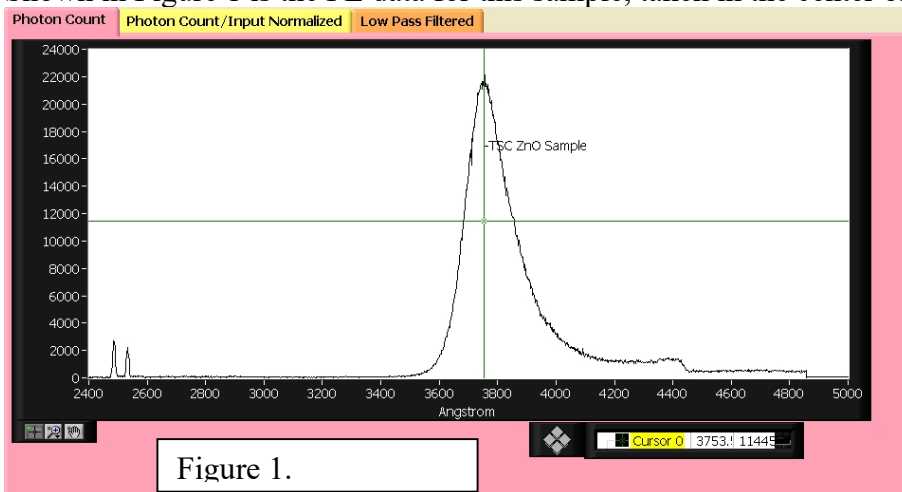
Samples

Eight samples of unknown materials were provided. Each roughly a 5mm square. A custom mapping configuration of 121 points was used for these samples. We were unable to get adequate PL data from sample

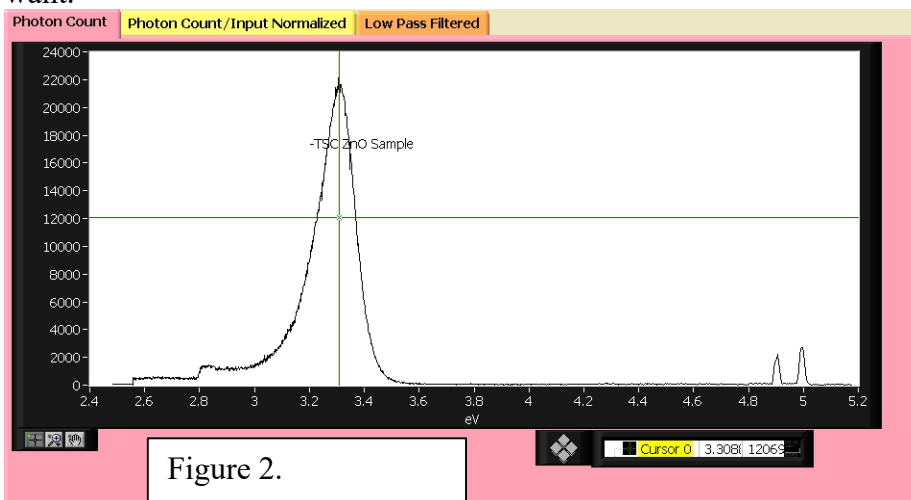
For each sample we ran a PL scan from 260nm to ~500nm in the center of the sample. We then peaked the sample focus to spectral peak. At that point a XY scan based on the 121 point data set including the 3D PL intensity was taken.

Sample 5, Labeled ZnO

Shown in Figure 1 is the PL data for this sample, taken in the center of the sample.



You can see the center wavelength is 375.3nm, this can also be displayed in eV if you want.

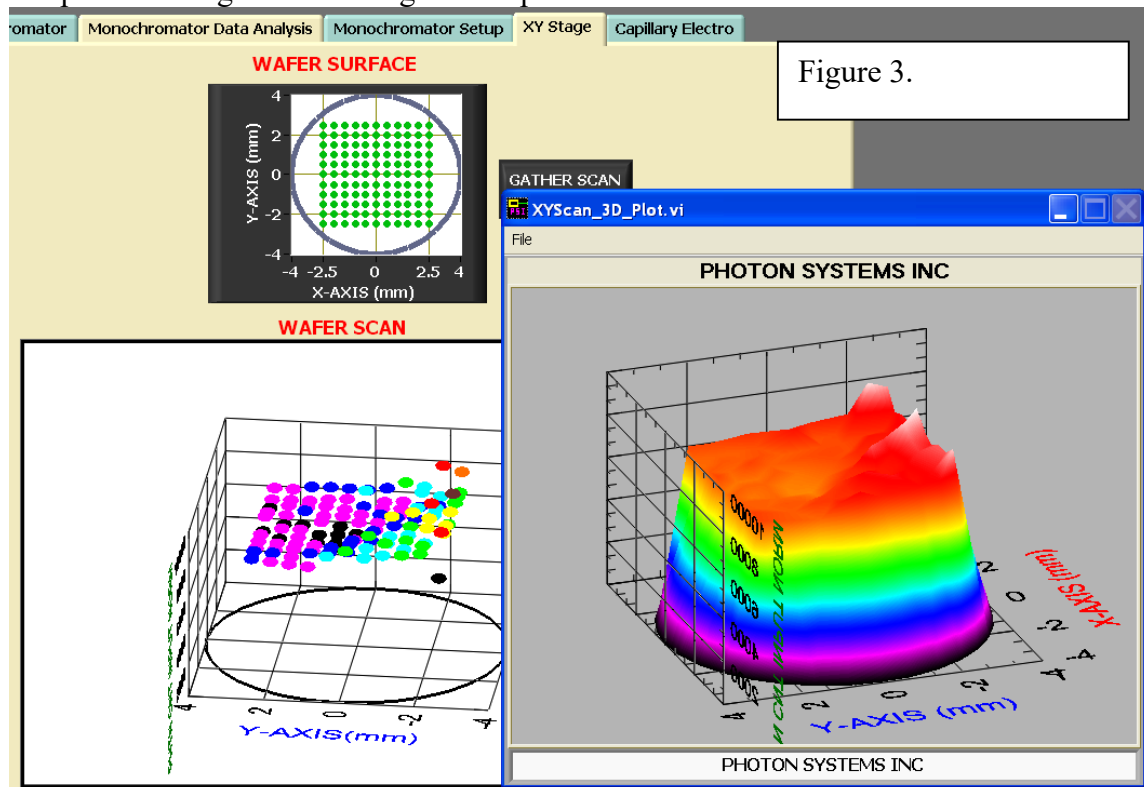


Shown here is the center energy is 3.308eV, note the excitation energy is NeCu laser at 248nm or ~5eV.



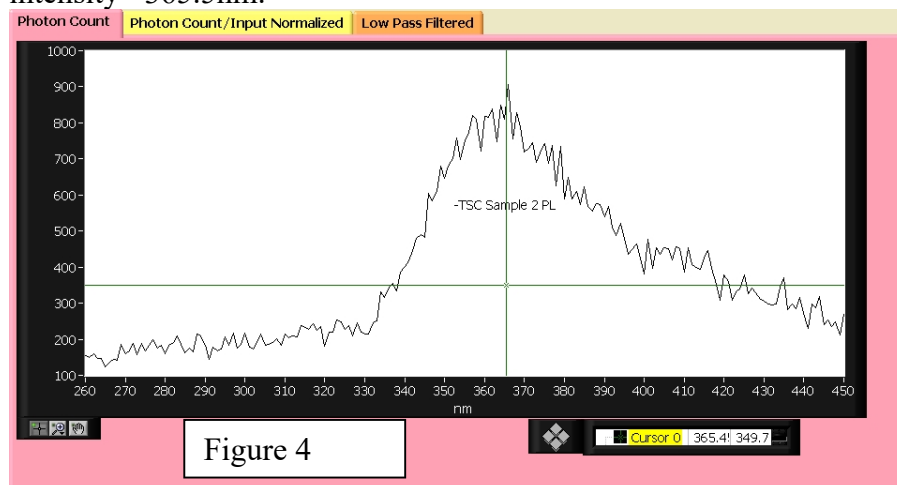
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In Figure 3 we show the XY scan and PL Map taken at the center wavelength of 375.3nm or 3.308ev. Note the map is a square that matches the sample. The intensity across the sample shows significant changes in output PL.



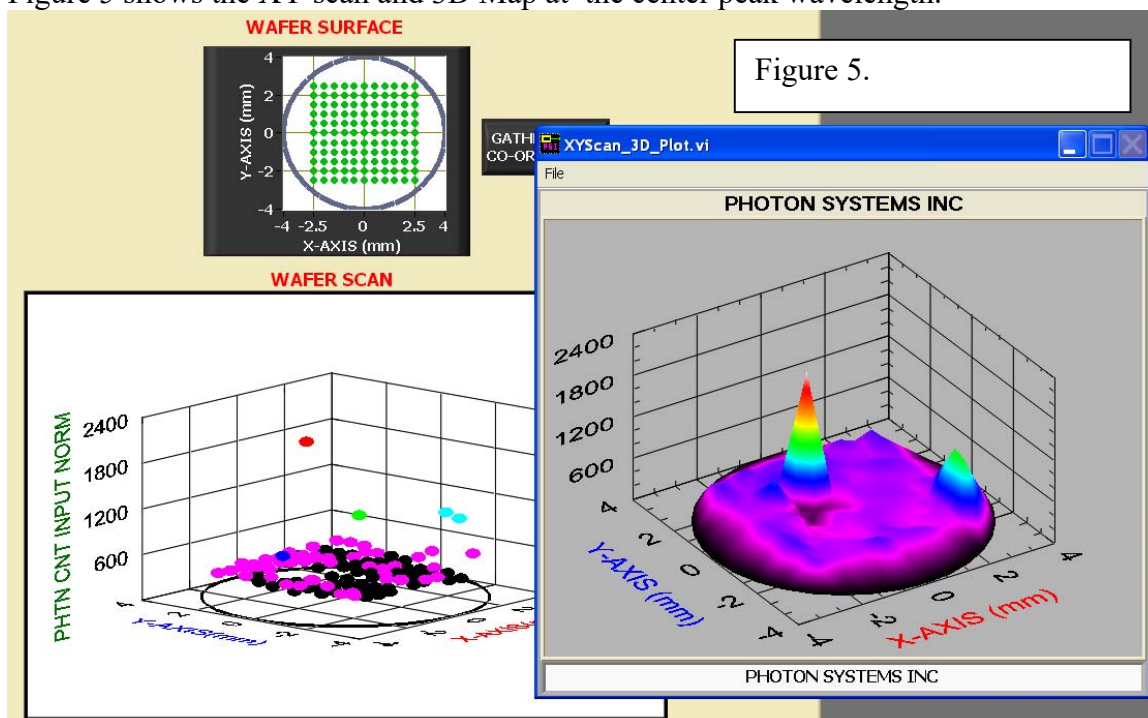
Sample 2 see Figure 4.

The PL data indicates that this sample produces very little PL intensity. Even then the High NA optics of the MiniPL were able to capture the PL spectrum with the Peak intensity ~365.5nm.



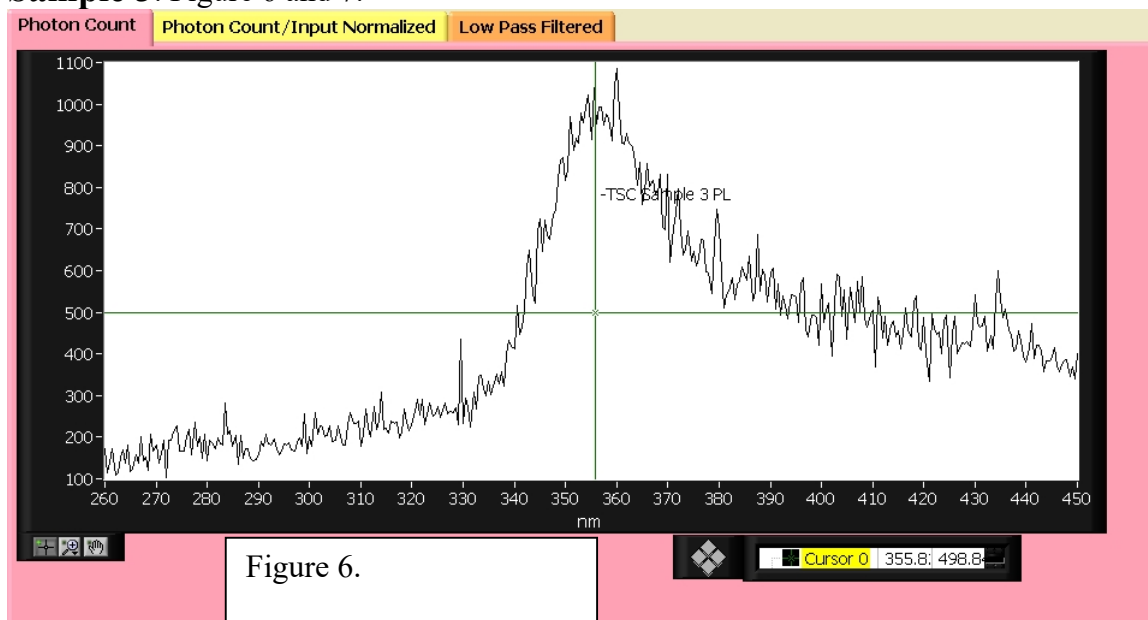
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Figure 5 shows the XY scan and 3D Map at the center peak wavelength.



Note that there are a couple significant peaks on this sample as well as several locations that have no output (around X=-2, Y=0.5). In this configuration the Spot size of the laser was ~20um.

Sample 3. Figure 6 and 7.



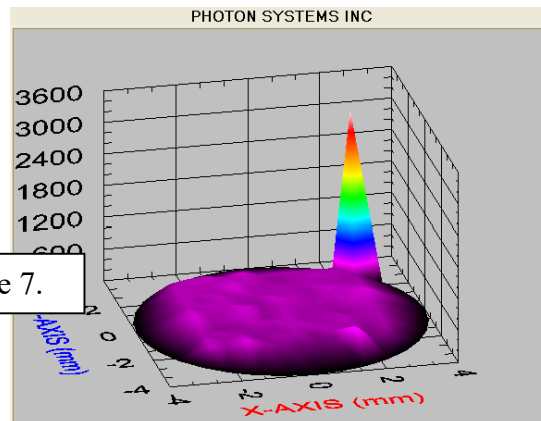
Significant PL spectra with the center wavelength ~355.8nm. Note the Red extended level. Again as in sample 2 the PL was not as intense as some of the samples.



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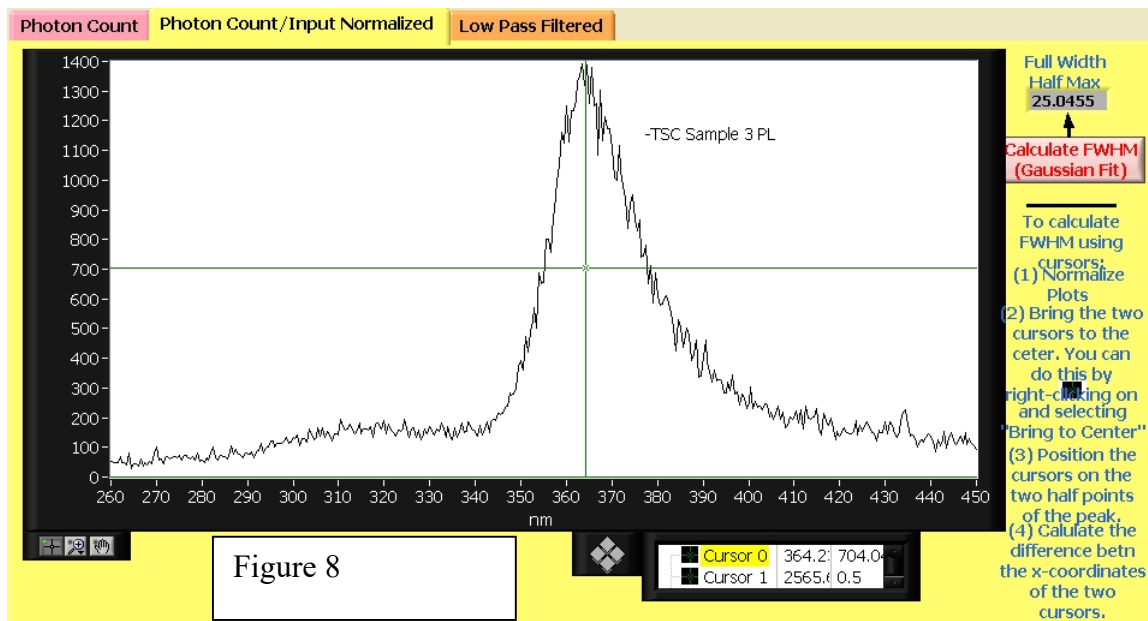
Figure 7. shows the 3D map of the sample 3. Note again a significant peak. We checked this level several times and it did appear as a very intense peak at the Center wavelength of the PL Spectra.

Figure 7.



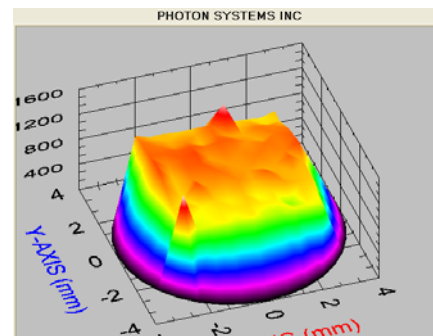
Sample 4, Figure 8 and 9

Figure 8 shows the PL data for this sample we have used the MiniD feature of calculating the FWHM. This is an automatic Gaussian fit.



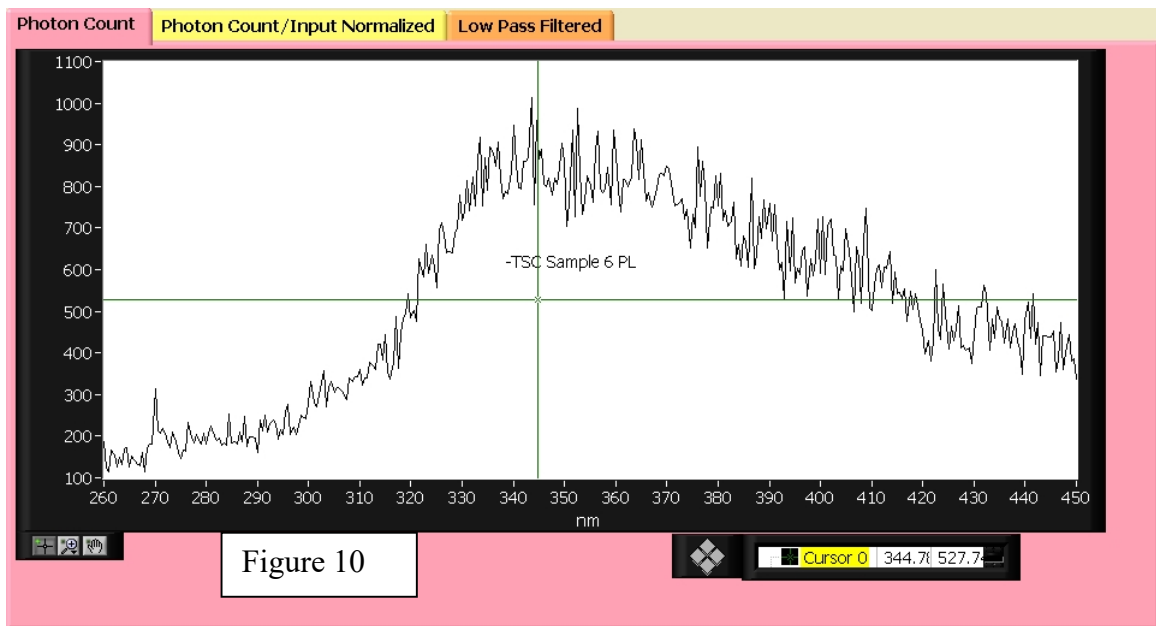
Note center wavelength of 364.2nm. Also note the small broad peak around 310nm. This is most likely an organic contaminant on the wafer piece. Further evaluation shows it is most likely finger print containing Tryptaphane.

Figure 9 shows the Mapping feature. Note the surface is very non uniform. The peaks vary between 1700 and ~1000 photon counts. The analysis program can also take the XY scan back to the peak point on the wafer.



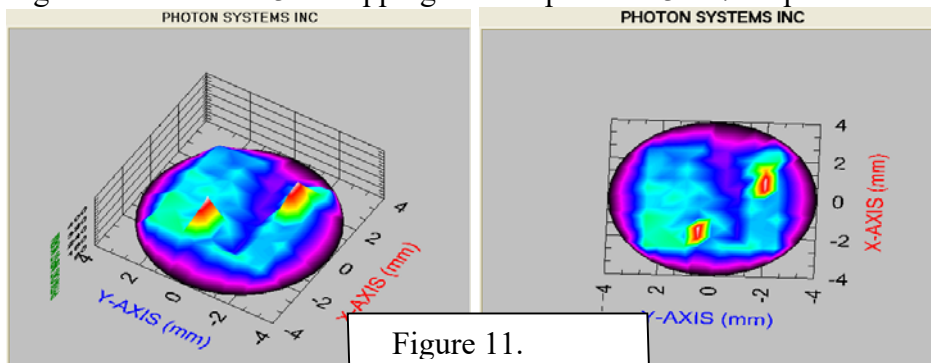
Sample 5. ZnO shown at top.

Sample 6 shown in figures 10 and 11.



Note that again the PL is not as intense as in other runs. There is also a large and slow decaying tail toward the Red side of the spectra. Note there is also a Raman Peak at the 3200cm⁻¹ area of the spectra. Most likely this is bound water in the wafer. I do not know why this sample has so much water, maybe it is Hydroscopic in nature.

Figure 11 shows the 3D Mapping of this spectra at 344.7nm peak.

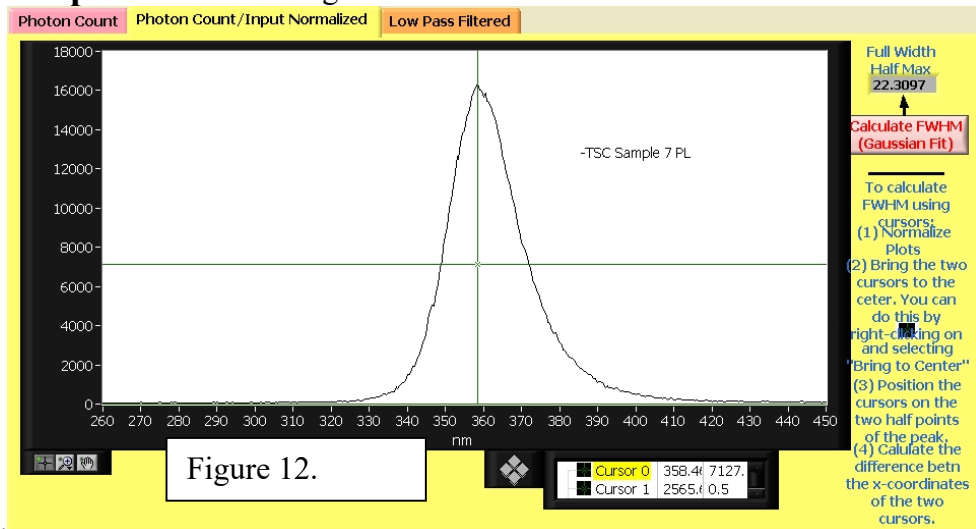


Note this sample has the most varied Map profile of all the samples. Note two prominent peak area with a relatively low output region in the middle.

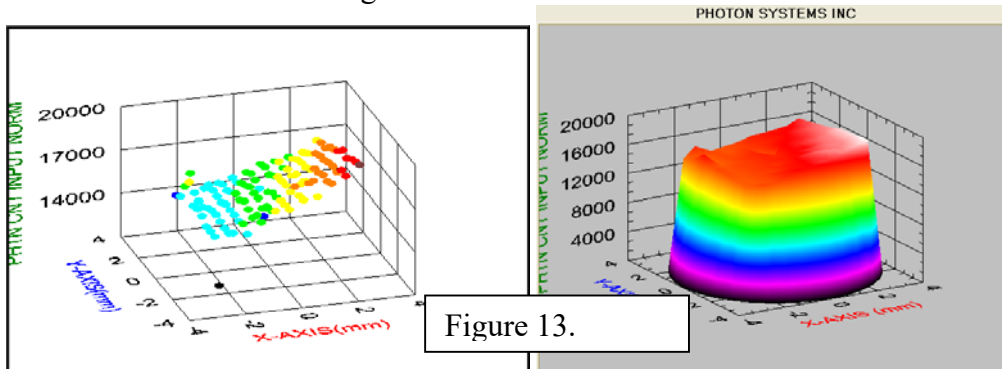


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Sample 7 shown in Figures 12 and 13



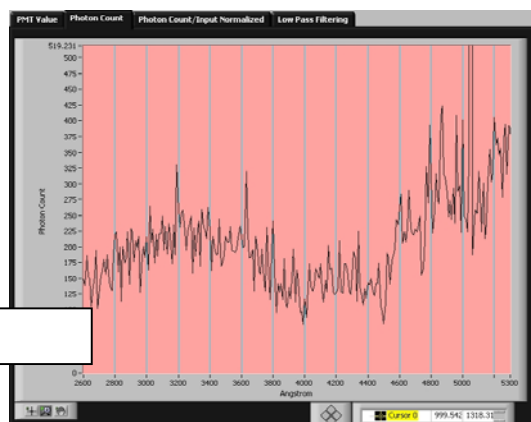
Note this sample has the highest PL output and a very crisp peak with a FWHM ~ 22.3 nm. The center wavelength is ~ 358.4 nm. The PL Scan is shown in Figure 13.



Note in this figure you can see that the intensity is quite high but there is greater than 30% variation in the peak PL across the surface of the sample.

Sample 8, Figure 14 show a very weak PL spectra for this sample. Also note we increased the scan range as there is some fluorescence occurring at the higher wavelengths. We again suspect that the spectrum around 310nm is due to organic contamination in the form of a fingerprint.

Figure 14



Summary of data.

Figure 15 show the PL spectra of all of the samples with relative intensities.

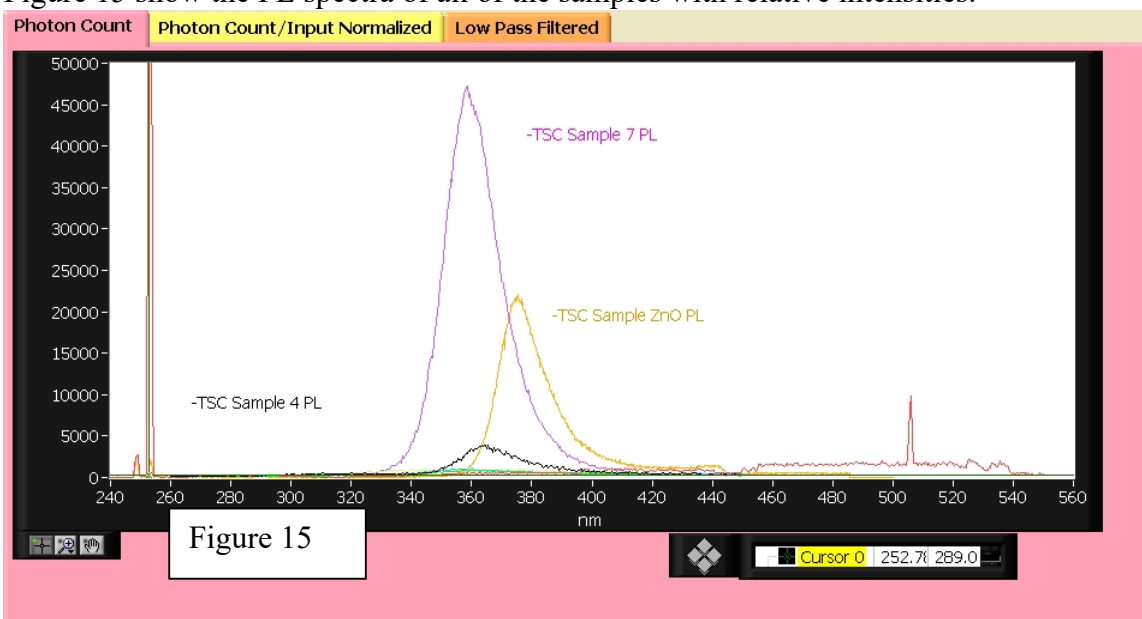
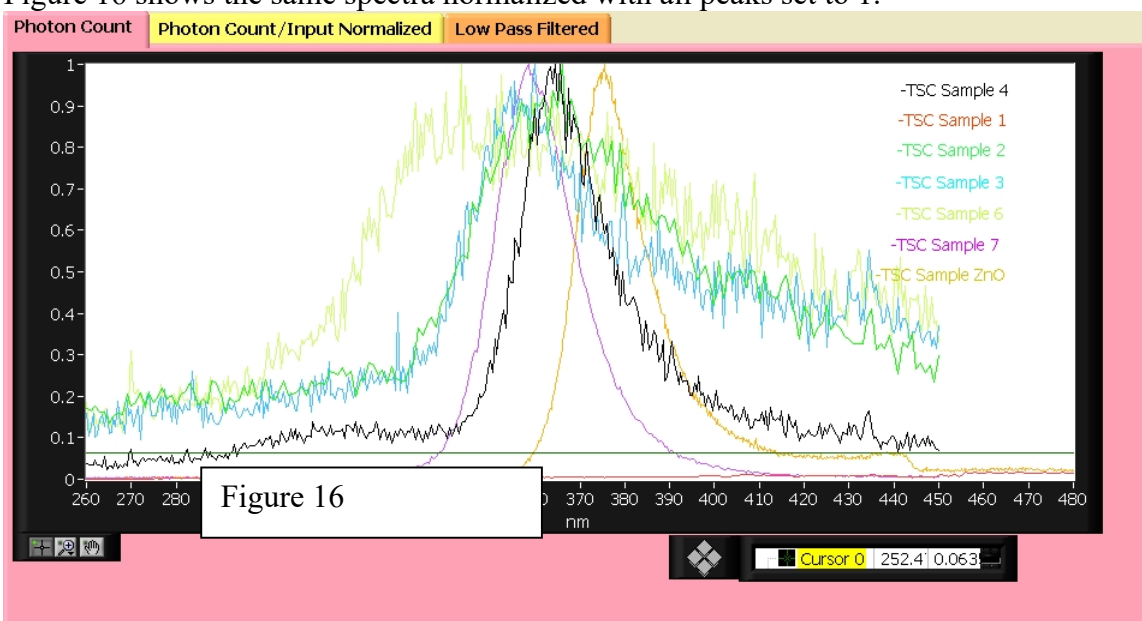


Figure 16 shows the same spectra normalized with all peaks set to 1.



This figure show the relative peaks of the PL. Sorry the colors are as bright or as easy to read as in the operating program.

Summary table of samples

Sample	Center Wavelength	Peak Intensity at CW
2	365.9nm	890
3	355.8nm	1076
4	364.2nm	3872
5	375.1nm	22057
6	344.7	1010
7	358.4	47254



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