DLA Report 16

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1 Summary

After our meeting last week I set out to implement the ability to get the amplitude of the soliton edge. This requires using the existing soliton edge linear fit to find a suitable bounding box for reliable data, extracting the maximum and minimum values for each x-value in the bounding box, and averaging the difference in heights and distances. The idea is that this method will give us the soliton edge's amplitude without having to worry about the large-scale distortion we find in FSSS.

In this report I cover trial 2 at 13 seconds.

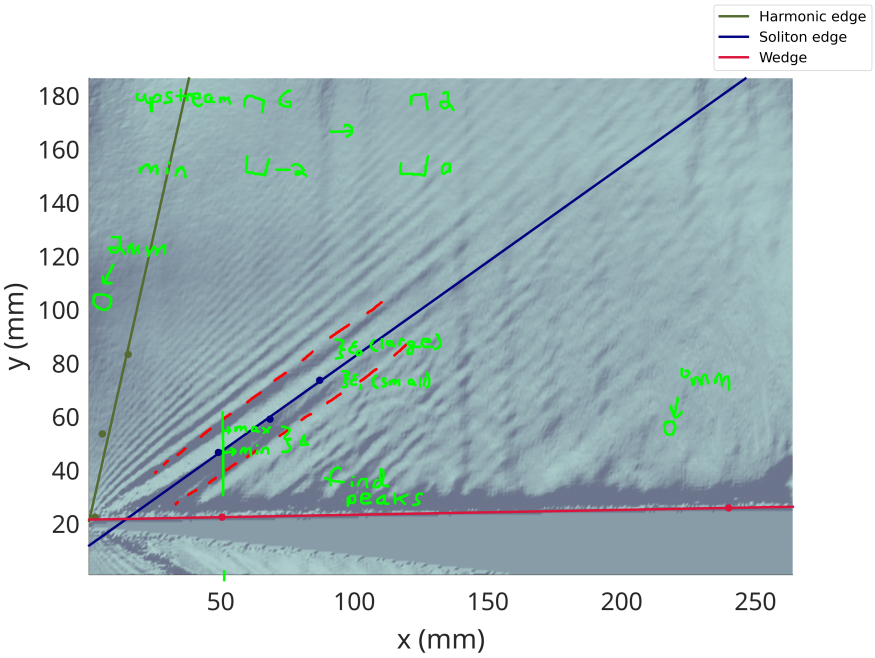

Figure 1: Notes I took during out meeting on June 3, 2022.

2 Description of what was done

The idea for extracting the soliton amplitude is simple. For a range of x-values, we want to get the maximum and minimum value of a "slice" of the FSSS

output. However, we can use the existing linear fit for the soliton edge to limit the data we are processing to ensure we are getting the maximum and minimum values of the soliton edge.

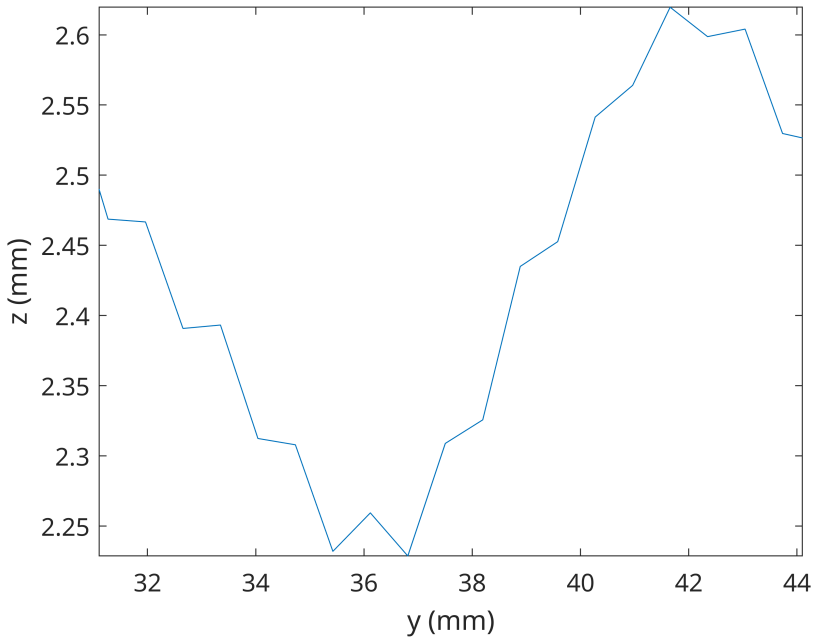

Figure 2: A slide of the FSSS output at $x = 32$mm and y between about 31mm and about 44mm. This range of y-values corresponds to 3mm below the value of the linear fit and 10mm above the value of the linear fit. Recall that the linear fit is fitted to the minimum of the soliton edge.

The above image shows such a slice with the help of our soliton edge linear fit. It is easy in MATLAB to then get the (x, y) coordinate of the global maximum and global minimum for this slice, along with the associated height (z-value) using `findpeaks`.

We want to obtain these maxima and minima for a range of x-values. To help determine this range we can use `matplotlib` as a visual aid in determining a suitable bounding box for data extraction.

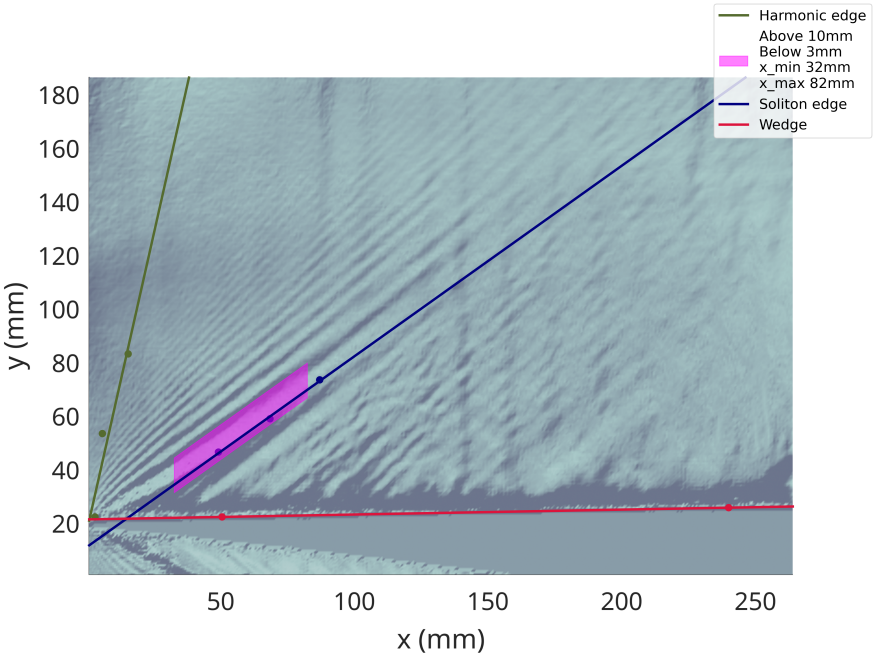

Figure 3: A bounding box 10mm above the soliton edge and 3mm below the soliton edge for x between 32mm and 82mm.

The bounding box is found by minimizing the space after the peak of the soliton and after the trough of the soliton by analyzing where the light and dark parts of the FSSS reconstruction meet.

Then, I can use these values in MATLAB to write to a file the (x, y, z) coordinates of the maxima and minima obtained from `findpeaks` over the range of x-values for the bounding box.

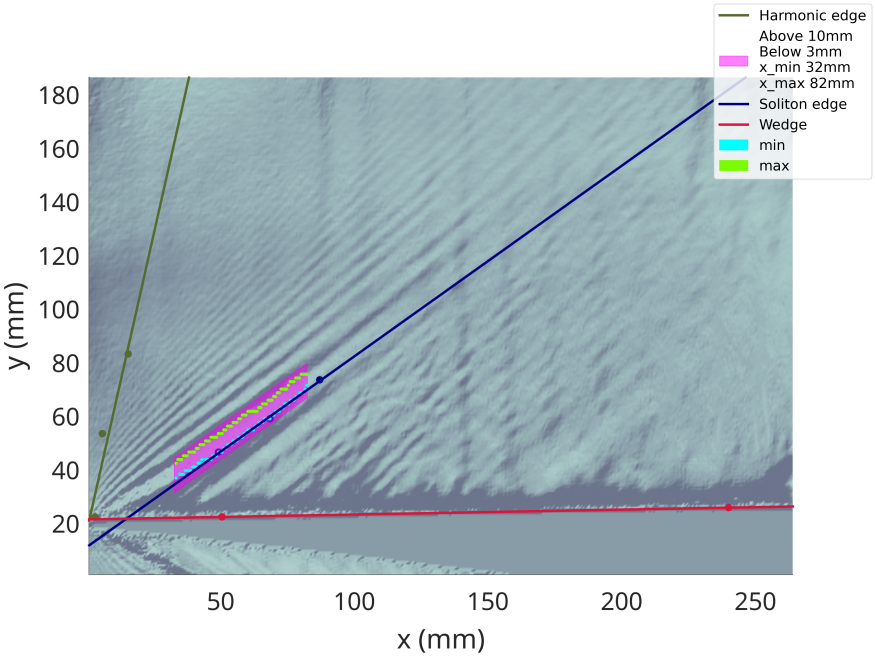

Figure 4: Maxima and minima for each x-value of the bounding box are plotted inside of the bounding box.

We can also use the same Python code to plot the maxima and minima to get the average difference between the maxima and minima and their distances. Note that "height" here is just the average difference in values for the maxima and minima and that the average amplitude is 1/2 the average height.

```
Sampled 72 pairs of values between 32 mm and 82 mm
Average Height (mm)    : 0.16924723611111114
Average Amplitude (mm) : 0.08462361805555557
Average Distance (mm)  : 6.423491666666665
```

3 Problems Encountered

Even when it seems like a good bounding box is chosen, there can be some strange data.

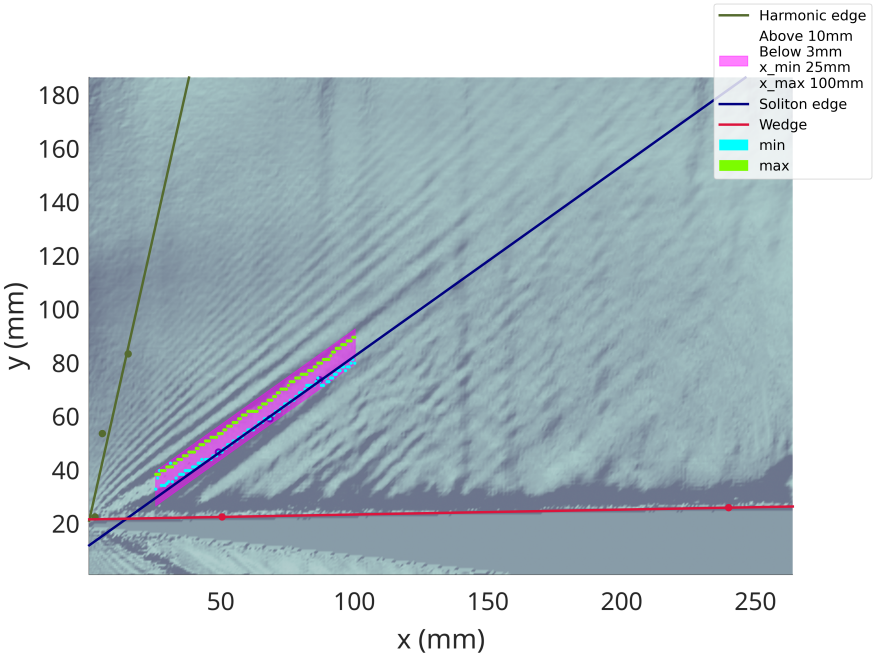

Figure 5: Maxima and minima for each x-value of the bounding box are plotted inside of the bounding box. Note the strange maximum and minimum values towards the left and right edges of the bounding box. In particular, the minimum is above the maximum for at least one x-value on the left side of the bounding box.

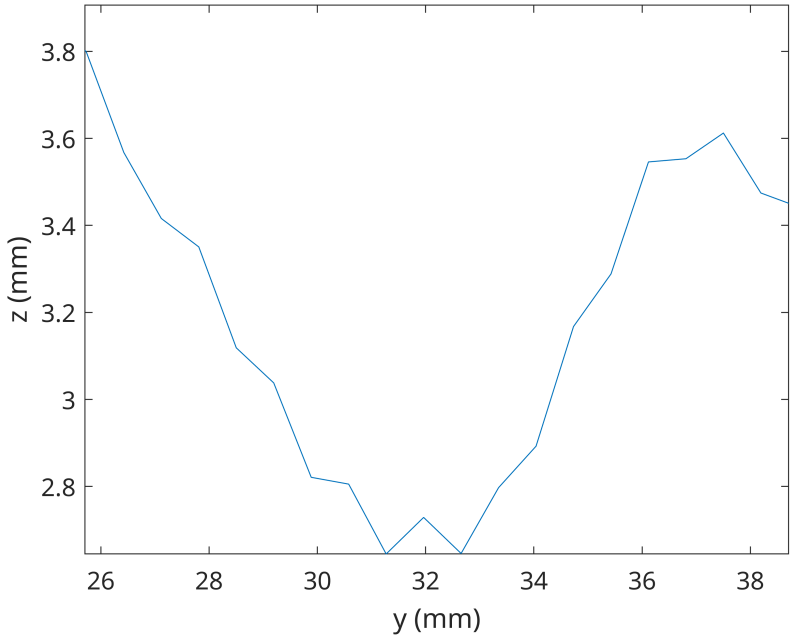

Figure 6: This is a slice at $x = 25$mm. Note that the global maximum is not where we expect it to be. We expect it on the right of the image but it is actually on the left.

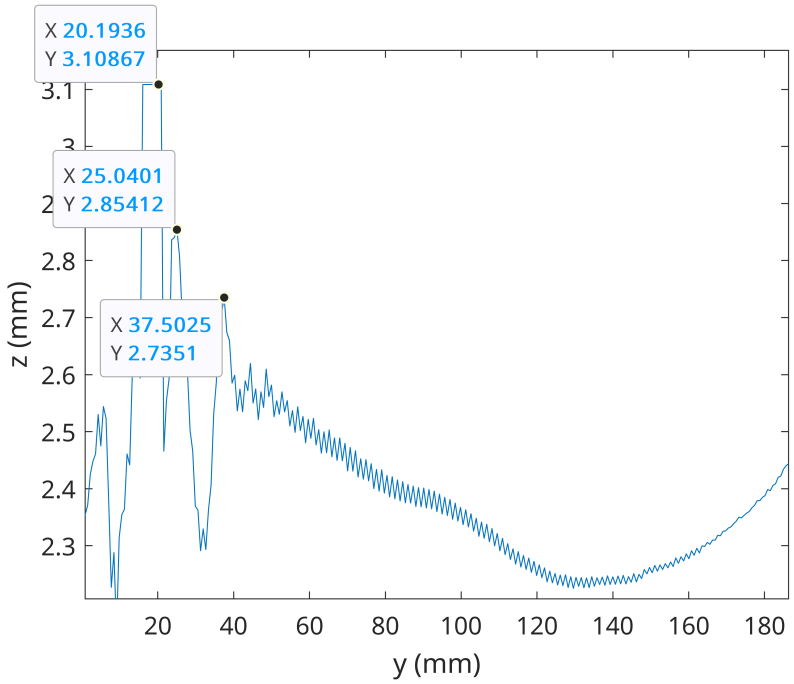

Figure 7: This is a slice at $x = 25$mm over the entire FSSS image. Note the selected points show (y, z) coordinates as (x, y) coordinates. Note that the global maximum ($y = 25.0$mm) in the previous figure appears to be from the water along the wedge, but it should be at y=37.5mm. The wedge is at $y = 20.2$mm with height $z = 3.1$mm.

The anomalous data is easily remedied by doing another pass of shrinking the bounding box to where we know there is better data.

4 Questions

- I remember Mark mentioned maybe we should've chosen a different location for the soliton edge. How would I go about choosing a different location and know that it's the correct one?
- Is this enough data to get the soliton amplitude?
- Any questions for me?