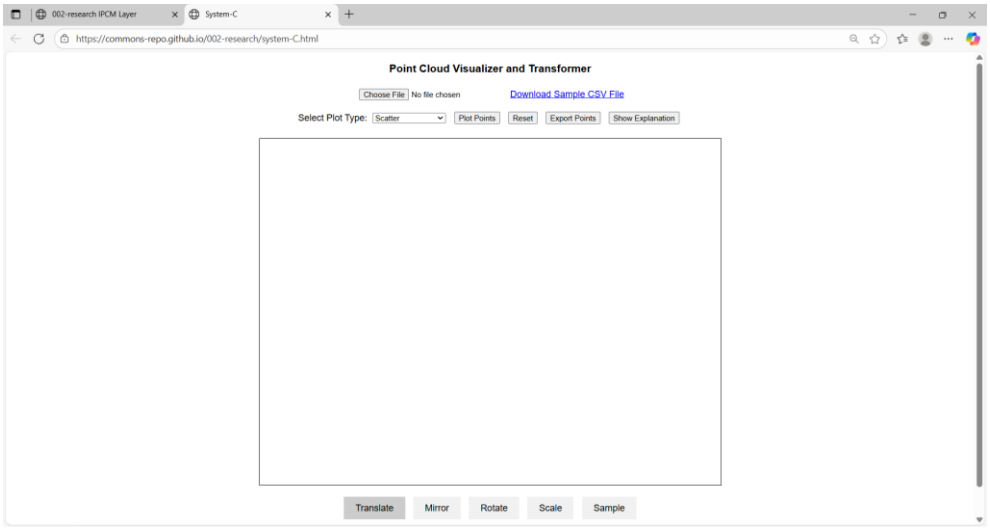
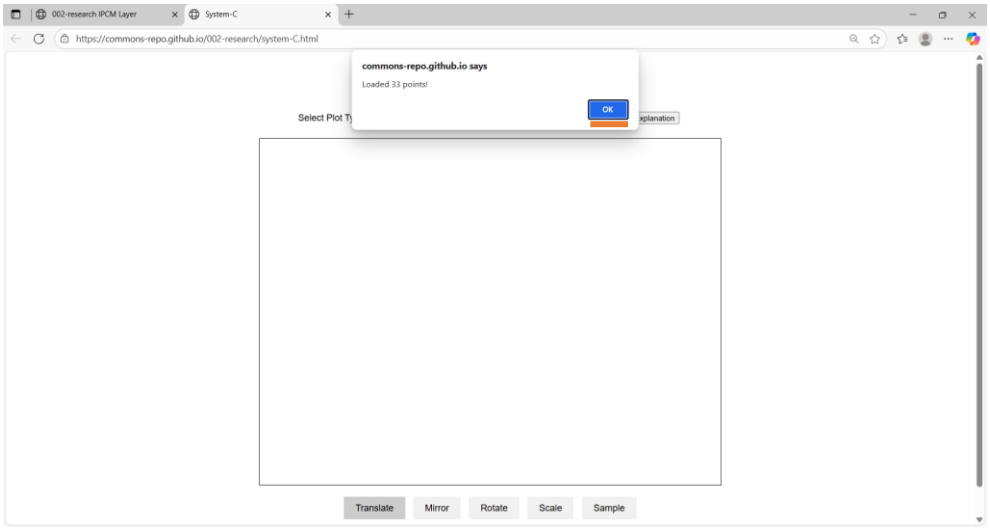
How to use System C

(Point Cloud Visualizer and Transformer)

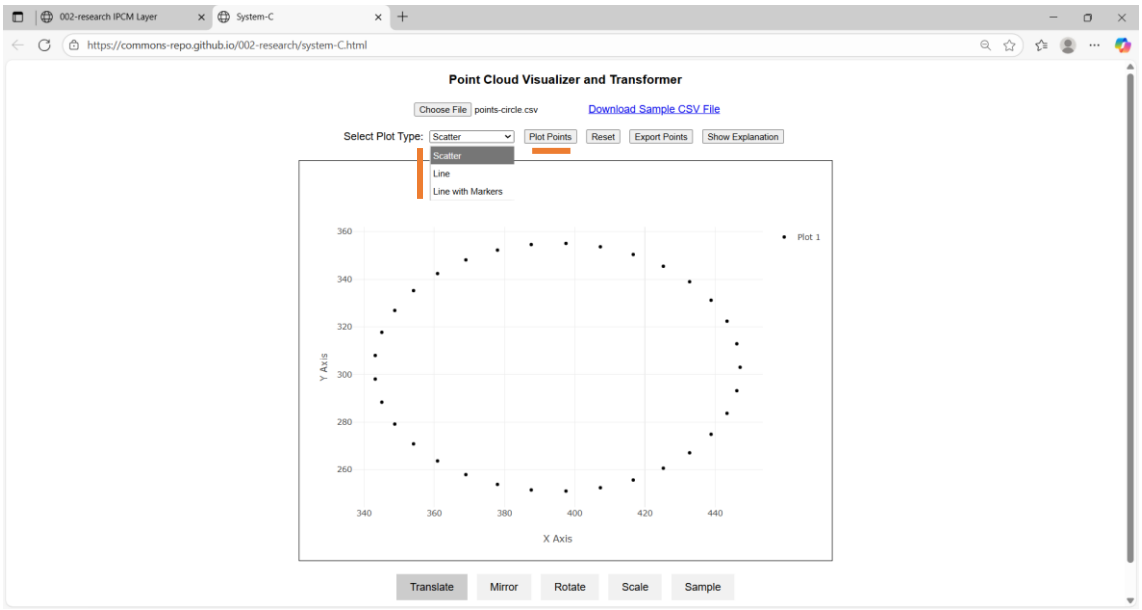
1. Open the system. An interface will be opened like below.



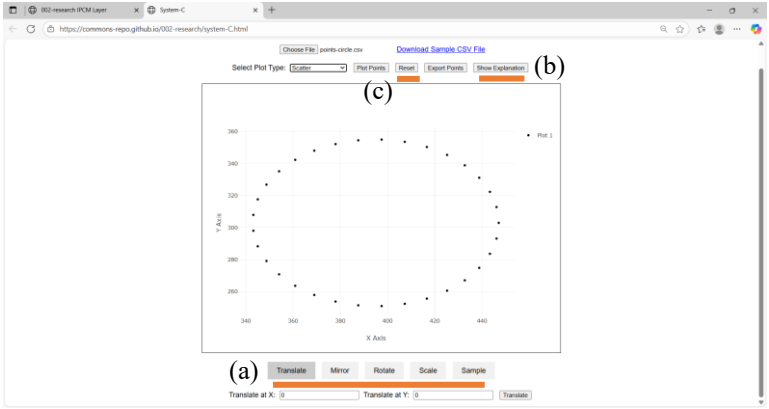
2. Load a CSV file containing the point cloud (X, Y coordinates) using the ‘Choose File’ button. A sample file may be downloaded via ‘Download Sample CSV File’ for reference. Ensure that the uploaded file follows the required structure demonstrated in the sample. In this example, the point set generated in the earlier systems (A1/A2 or B) is used to maintain continuity; refer to those guides if needed. After loading a file successfully, the interface will look like below. A pop-up appears indicating the number of points loaded from the CSV file. Select ‘OK’ to proceed.



3. Select a plot type from the dropdown menu (Scatter, Line, or Line with Markers). Then click the ‘Plot Points’ button to visualize the loaded point cloud accordingly. This example uses a scatter plot as shown below.



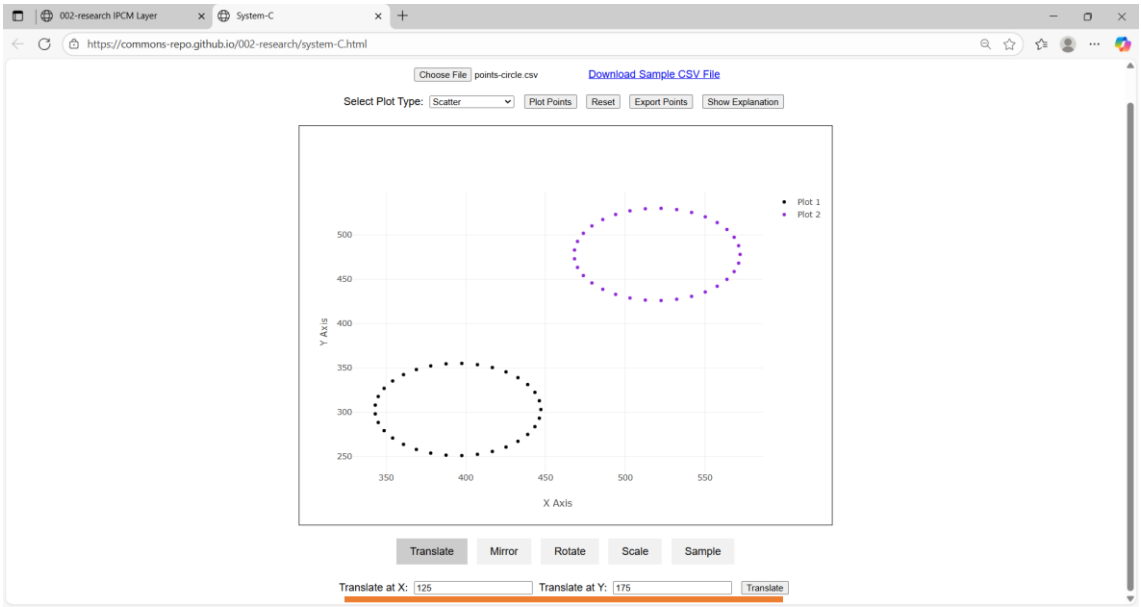
4. (a) Beneath the plot, a tabbed panel lists all available transformations: Translation, Mirror, Rotate, Scale, and Sample. Select any tab to switch between these operations and apply the corresponding transformation to the loaded points. (b) At the top, the ‘Show Explanation’ button opens a detailed pop-up window describing the formulations behind each transformation; use this when clarification is needed. (c) The ‘Reset’ button restores the original loaded dataset by clearing all applied transformations, allowing the user to restart at any time. From this point onward, this guide introduces each transformation in turn.



■ Translate

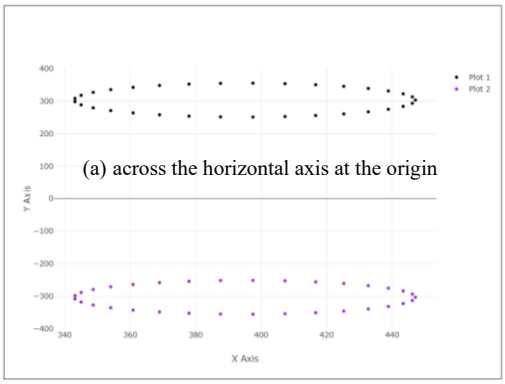
For translation, enter the offset values for the X- and Y-axes in the corresponding input fields and click the ‘Translate’ button. In the example shown below, the offsets 125 and 175 are used. The system applies the translation to the loaded points and displays the result as a new plot (Plot 2), while retaining the original plot (Plot 1) for comparison. Distinct colors and labels are used to clearly differentiate between the plots.

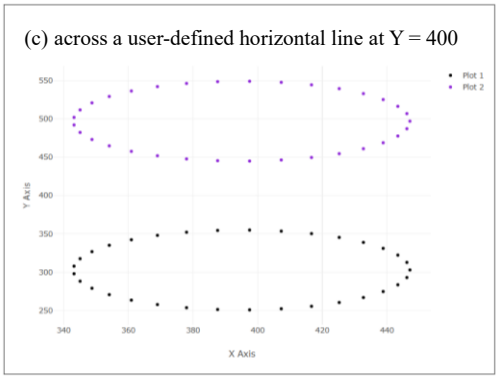
If new offset values are entered and the ‘Translate’ button is clicked again, the operation is applied to the most recently generated dataset, producing an additional plot (Plot 3). Please remember that each transformation is always applied to the latest available point set. If the user wishes to return to the original loaded points, the ‘Reset’ button should be used.

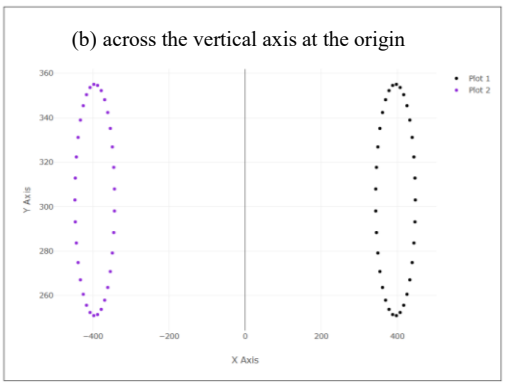


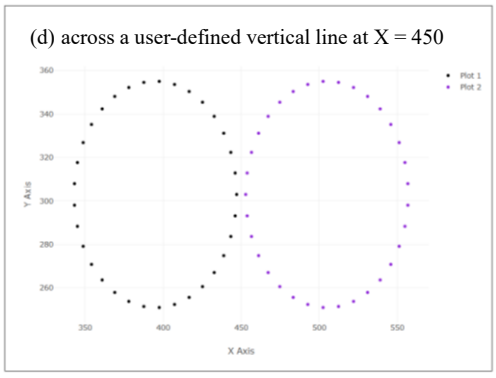
■ Mirror

For mirroring, the system offers four options that determine the axis about which the loaded points will be reflected. The user may choose to mirror (a) across the horizontal axis at the origin, (b) across the vertical axis at the origin, (c) across a user-defined horizontal line or (d) across a user-defined vertical line. After selecting the appropriate option, clicking the 'Mirror' button applies the reflection and produces a new plot, while retaining the earlier plots for comparison. The following image shows, collectively, the outcomes produced when each of these mirroring options is applied to the original loaded points.







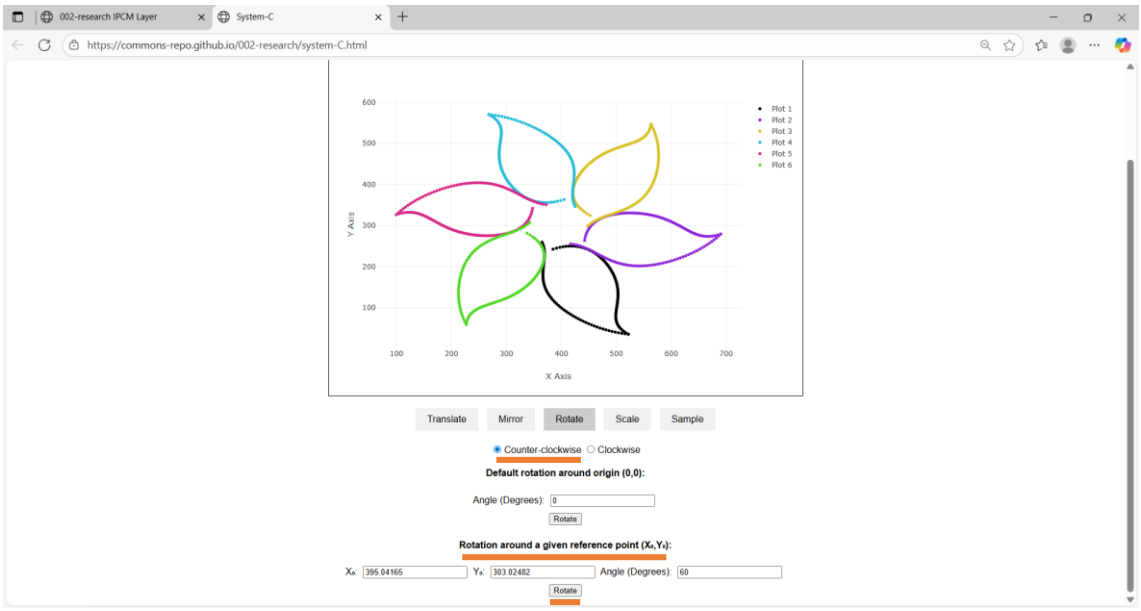


■ Rotate

For rotation, the system provides two options: rotating about the origin or rotating about a user-defined reference point, with the choice of clockwise or counter-clockwise direction.

In this example, the petal generated earlier is loaded as Plot 1. Because the circular arrangement of the full flower is already known, the center of that circle is entered as the custom rotation reference. Counter-clockwise rotation is selected, and an angle of 60 degrees is used—reflecting that six petals evenly distributed over 360 degrees require increments of 60. Applying the ‘Rotate’ button successively performs rotation on the latest available dataset, making it possible to generate all remaining petals by repeating the operation five times. The following image shows the resulting arrangement obtained through these consecutive rotations.

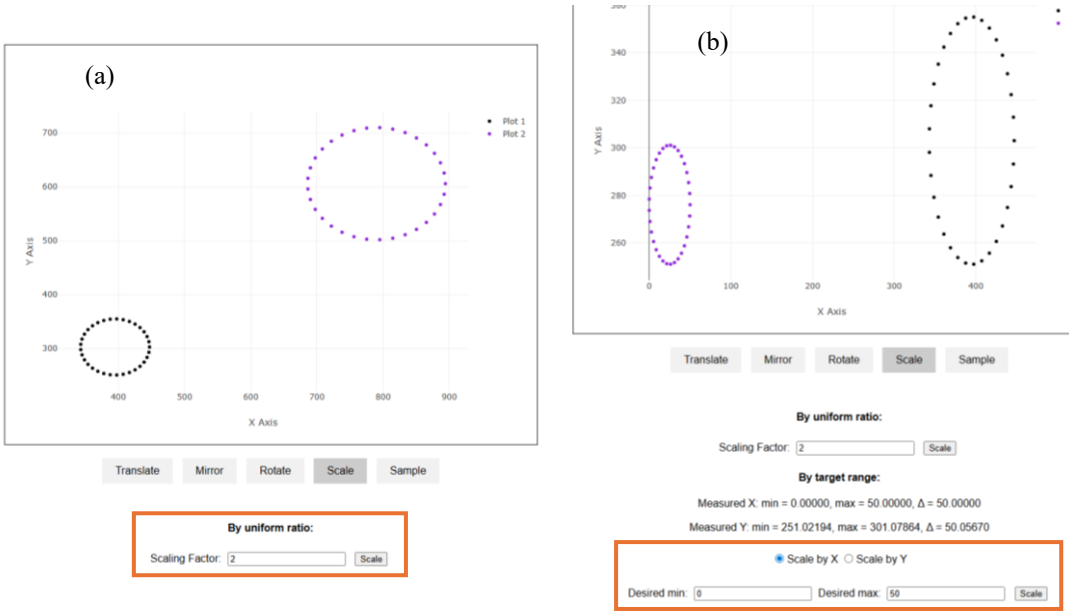
(Note: The petal geometry and circle-center properties used in this example were created earlier using Systems A1, A2, and B; please refer to their guides for details.)



■ Scale

For scaling, the system provides two options: scaling by a factor/ratio or scaling by fitting the point set into a specified target range. In the factor/ratio mode, the user enters a single scaling factor and selects ‘Scale’; the transformation is applied. In the range-based mode, the user selects whether scaling should be controlled along the X-axis or Y-axis, specifies the desired minimum and maximum values, and then clicks ‘Scale’. Before applying the transformation (scaling), the system displays a pop-up showing the internally computed scale factor for this. This allows the user to record the value if needed before confirming the operation.

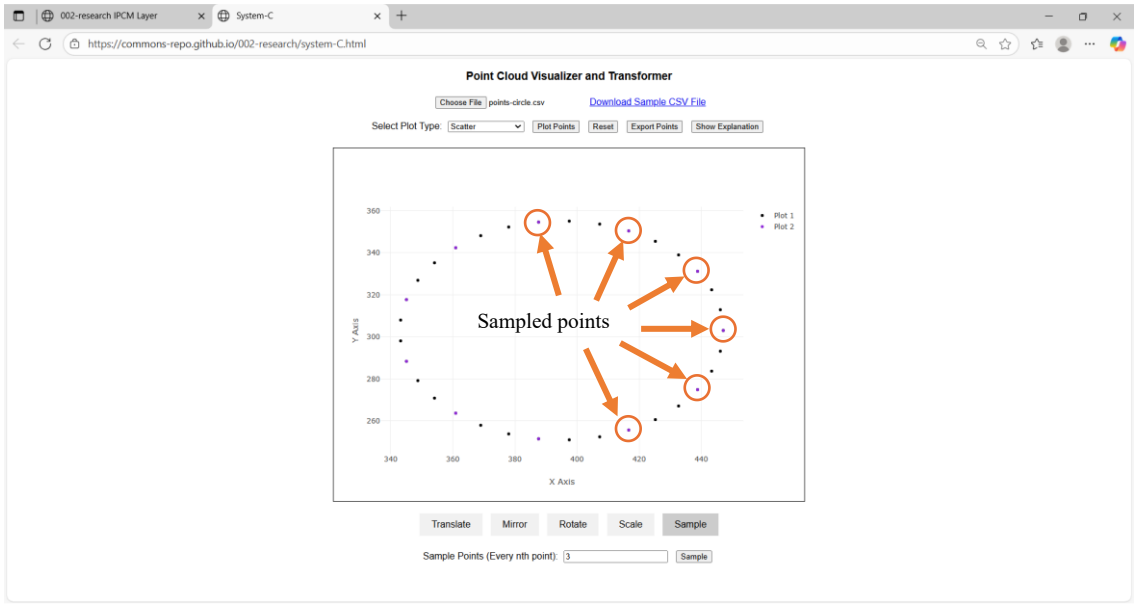
For the present example (see images below), (a) a uniform scaling factor of 2 is first applied, producing a scaled version of the original point set (Plot 2) alongside the loaded points (Plot 1). (b) Next, a range-based scaling is performed: since the goal is to constrain the geometry within the interval [0, 50] along the X-axis, the option ‘Scale by X’ is chosen and the desired minimum and maximum values (0 and 50) are entered. Upon clicking ‘Scale’, the pop-up reports the computed factor (0.48129). Selecting ‘OK’ applies the transformation, resulting in the scaled geometry shown in the image below.



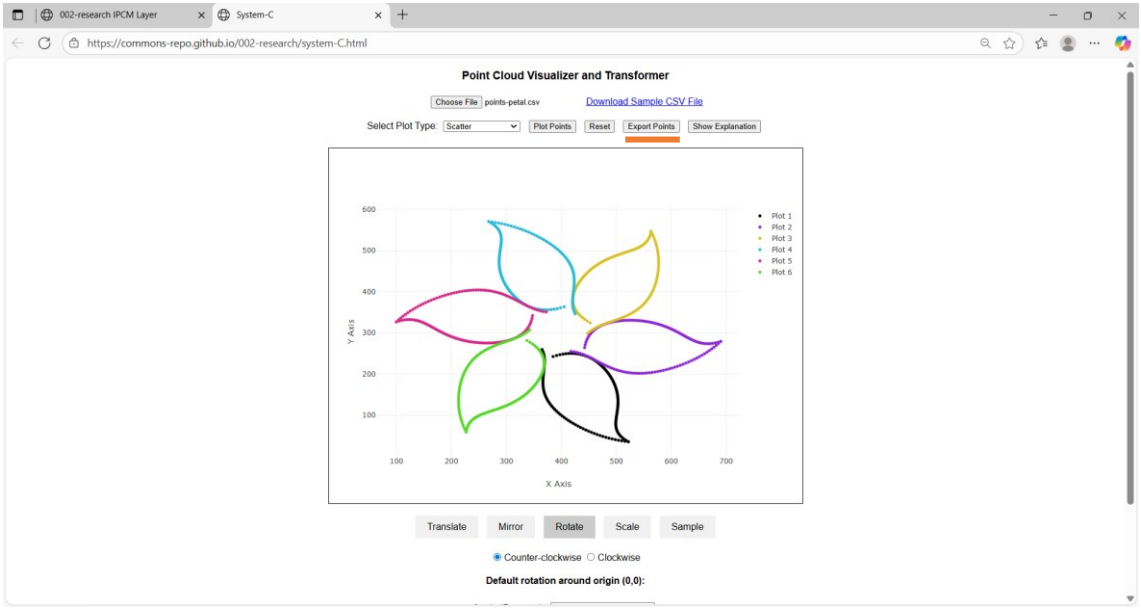
■ Sample

For sampling, the system extracts a reduced subset of points from the latest plotted dataset by selecting every *n*-th point. The user specifies the sampling interval in the input field and clicks ‘Sample’ to apply the operation. The output is plotted as a new dataset alongside the existing plots, allowing easy comparison between the original curve and the sampled version.

In this example, a sampling interval of 3 is used. After entering ‘3’ and selecting ‘Sample’, every third point from the loaded dataset is extracted and displayed on the plot (Plot 2), as highlighted in the illustration below. This functionality is helpful when a simplified or lower-resolution representation of the point cloud is desired—for example, for quick prototyping or for downstream applications that require fewer points.



5. To export the transformed datasets, click the ‘Export Points’ button (see below). The system compiles all generated plots—both the original and every transformation applied thereafter—into a single CSV file. In this file, each plotted dataset is stored in a pair of columns, labeled sequentially as plot1X, plot1Y, plot2X, plot2Y, …, allowing users to trace each transformation step clearly.



A sample excerpt from the exported file is shown below. In the present example, six sets are produced because the operation involved rotating the petal points to form all six petals; thus, the CSV contains twelve columns corresponding to the X–Y coordinates of all six plots.

```
plot1X,plot1Y,plot2X,plot2Y,plot3X,plot3Y,plot4X,plot4Y,plot5X,plot5Y,plot6X,plot6Y
365.00000,259.58334,417.64225,255.28725,447.68390,298.72873,425.08330,346.46630,372.44105,350.76239,342.39940,307.32091
366.76280,254.21130,423.17597,254.12786,451.45482,302.94138,423.32050,351.83834,366.90733,351.92178,338.62848,303.10826
368.03476,248.87691,428.43167,252.56221,455.43856,306.71012,422.04854,357.17273,361.65163,353.48743,334.64474,299.33952
368.88885,243.58284,433.44351,250.65484,459.59631,310.09682,421.19445,362.46680,356.63979,355.39480,330.48699,295.95282
369.39283,238.33127,438.24350,248.46552,463.89232,313.15907,420.69047,367.71837,351.83980,357.58412,326.19098,292.89057
369.60940,233.12394,442.86146,246.04941,468.29371,315.95029,420.47390,372.92570,347.22184,360.00023,321.78959,290.09935
369.59648,227.96215,447.32524,243.45732,472.77041,318.51999,420.48682,378.08749,342.75806,362.59232,317.31289,287.52965
369.40736,222.84689,451.66063,240.73591,477.29492,320.91384,420.67594,383.20275,338.42267,365.31373,312.78838,285.13580
369.09092,217.77878,455.89152,237.92781,481.84225,323.17385,420.99238,388.27086,334.19178,368.12183,308.24105,282.87579
368.69187,212.75821,460.03994,235.07194,486.38972,325.33855,421.39143,393.29143,330.04336,370.97770,303.69358,280.71109
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367.38675,197.98201,472.18394,226.55357,499.83884,331.59638,422.69655,408.06763,317.89936,379.49607,290.24446,274.45326
367.02666,193.15102,476.18766,223.82623,504.20265,333.70003,423.05664,412.89862,313.89564,382.22341,285.88065,272.34961
366.75096,188.36656,480.19327,221.19523,508.48396,335.85349,423.33234,417.68308,309.89003,384.85441,281.59934,270.19615
366.58308,183.62810,484.21296,218.68062,512.67153,338.07734,423.50022,422.42154,305.87034,387.36902,277.41177,267.97230
366.54351,178.93508,488.25745,216.29984,516.75559,340.38958,423.53979,427.11456,301.82585,389.74980,273.32771,265.66006
366.65000,174.28693,492.33611,214.06798,520.72776,342.80587,423.43330,431.76271,297.74719,391.98166,269.35554,263.24377
366.91772,169.68312,496.45698,211.99793,524.58091,345.33963,423.16558,436.36652,293.62632,394.05171,265.50239,260.71001
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