Spring Wiz v1.1 B Updates:

The v1.1B has several new enhancements, which include:

Standard and Plus Version new features:

You can now print different types of Reports from the Main Screen. Fig 1,2.

You can now print “More” types of Reports from the Cam Harmonics/Analysis screen under File. Fig 15.

The Spring ODs turn Red if the clearance between the larger spring’s ID does not fall within certain limits of this particular Spring’s OD. These limits can be set in Preferences, either a negative clearance (spring interference) or positive (a gap between the springs). Fig 3, 5A.

There is a new Calculation Utility for Spring O.D. for the 2nd and 3rd springs. Hold the Shift Key down when you click on Spring O.D. to see this option. Fig 5B, 7.

There is a new output on the main screen of Net Valve Lift, which is the same as the existing Gross Valve Lift, but with the lash subtracted out. Gross Valve Lift is what cam grinders will show in their catalog. Net Valve Lift is what the valve will actually do. These 2 lifts are based on cam inputs in the Cam/Valve Train Analysis screen. If the cam is hydraulic, the “lash” is assumed to be .006”. Fig 3.

If the Difference between Installed Height and Open Height is not equal to the Net Valve Lift, the Open Height will change to Red. Fig 3, 4.

There is a new Calculation Utility for Open Height. Hold the Shift Key down when you click on Open Height to see this option. Fig 5B, 6.

You can turn Off the introductory “Warning” screen by clicking on the “Don’t Show This Again” check box.

Reports now include the estimated Spring Mass for each spring. Fig 2.

This new version has adjusted the calculation for Bind Height for the number of coils for better accuracy.

Features which access the internet now work better to use your default internet browser.

Plus Version new features (not in Basic version):

Fatigue and Stress Analysis reports have been added, to estimate the life of the springs. Fig 8, 9.

Beehive and Tapered springs have been added as Spring Types. Fig 3, 10, 11.

The Calculation utility for Valve Mass now has an adjustment for standard Cylindrical, Tapered or Beehive springs. Fig 12.

Detailed, High Resolution Graphs for the Frequency Analysis screen have been added. Fig 13 - 25.

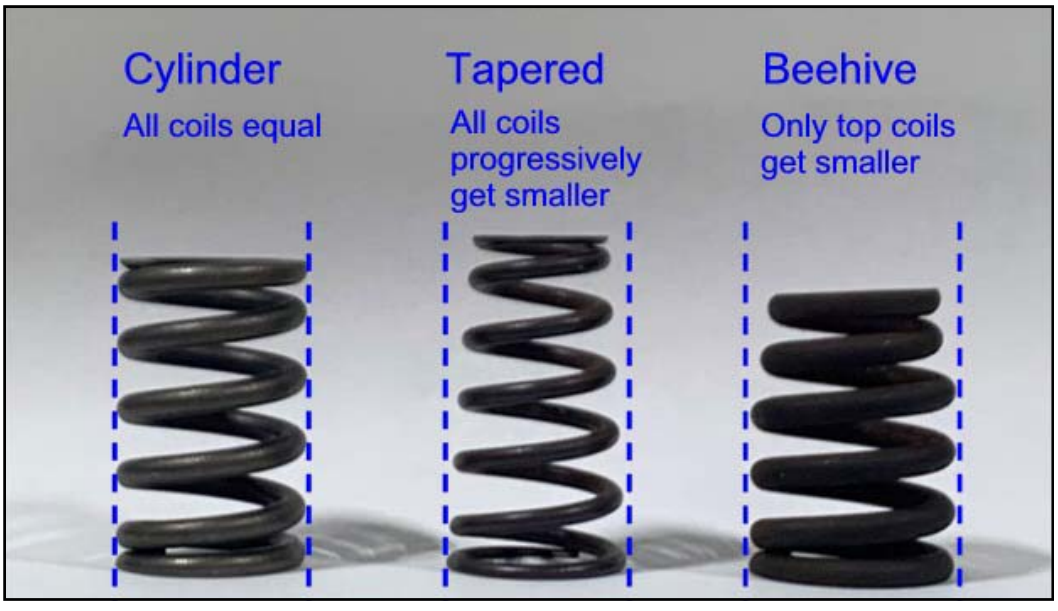
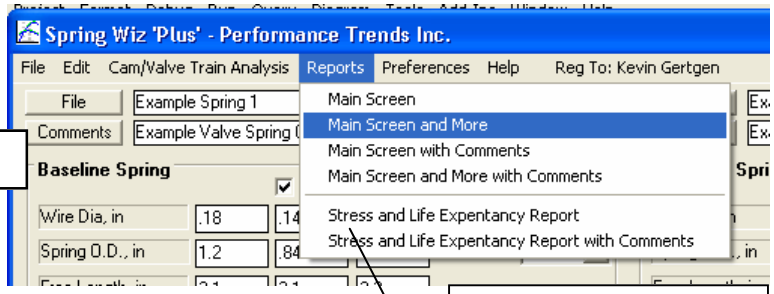


Fig 1



Stress Reports are in the Plus Version only

Fig 2

Main-Report.txt - Notepad

File Edit Format View Help

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---------------------------------- Kevin Gertgen ----------------------------------
------------------------ This Title 1 is contained in Preferences ------------------------
------------------------ This Title 2 is contained in Preferences ------------------------

Date: 10/17/24    Time: 10:35 am

Spring:             Baseline                          Proposed
File:               Example Spring 1                  Example Spring 2

                    Base     2nd      3rd      Rev Kit  Base     2nd      3rd      Rev Kit

Wire Dia, in         .18      .14      .07               .18      .18      .18      .18
Spring O.D., in     1.2       .84      .56              1.21      .98      .5      1.01
Free Length, in     2.1      2.1      2.2               2.1      2.1      2.2      4
# Total Coils       6        8        9                 6        10.5     8        11
# Active Coils      4.       6.       7.7               4.       8.5      6.7      9.
# Inactive Coils    2        2        1.3               2        2        1.3      2
Type                Cylinder Cylinder Cylinder          Cylinder Cylinder Cylinder Cylinder
Small End O.D. in
Std Spring Steel    Yes      Yes      Yes               Yes      Yes      Yes      Yes
Youngs Mod. psi E6
Poissons Ratio
Density lb/cu in
Aspect Ratio        1        1        1                 1        1        1        1
Installed Ht, in    1.8      1.690    1.680             1.8      1.700    1.680    2.3
Retainer Step, in             .11      .12                        .1       .12
Open Ht, in         1.43     1.320    1.310             1.3      1.200    1.180    1.780
Spring Rate, lb/in  356.62   269.15   38.21             346.33   347.81   6892.62  294.14
Installed Force, lb 107.0    110.3    19.9              103.9    139.1    3584.2   505.9
Open Force, lb      238.9    209.9    34.0              277.1    313.0    7030.5   658.9
Bind Ht, in          .963    1.029     .634              .963    1.773    1.449    1.863
Nat Freq            551.2    606.8    482.5             540.6    421.7    3343.1   370.0
Nat Freq, CPM       33074    36411    28949             32435    25301    200583   22199
Bind Stress, psi    229185   245373   264075            224235   53871    1670738  305471

Total (or limit)
Spring Rate, lb/in  663.98                             7880.90
Installed Force, lb 237.2                              4333.1
Open Force, lb      482.8                              8279.5
Bind Ht, in         1.029                              1.773
Nat Freq            482.5                              370.0
Nat Freq, CPM       28949                              22199
Bind Stress, psi    264075                             1670738

Cam Specs
Installed on        Intake                             Exhaust
R.A.R.              1.3                                1
Lash                 .020                               .02
Gross Valve Lift     .39                                .6
Valve Lift Bind Lim  .661                              -.073

Additional Info
Installed Stress    60471    93933    87660             59165    65897    1156836  243004
Open Stress         135052   178703   150033            157773   148269   2269178  317335
Spring Mass, gms    50.1     29.1     6.1               50.6     74.7     23.1     81.6
Coil OD             1.200     .840     .560             1.210     .980     .500
Coil ID              .840     .560     .420              .850     .620     .140
Coil Clearance                .000     .000                       -.130     .120

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Ln 1, Col 1

2 Extra Title lines are in the Plus Version only

Estimated spring mass is shown here, in all versions.

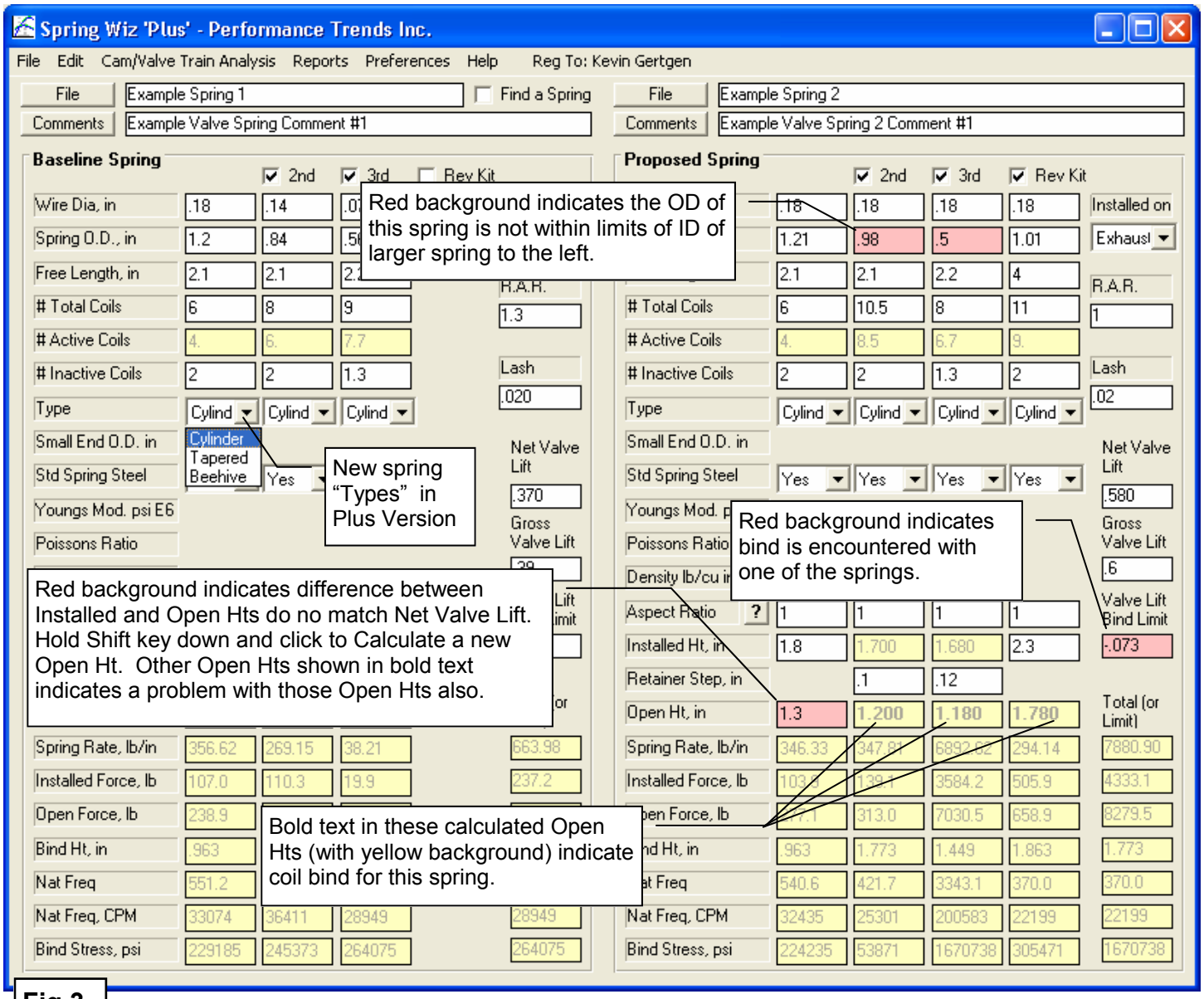
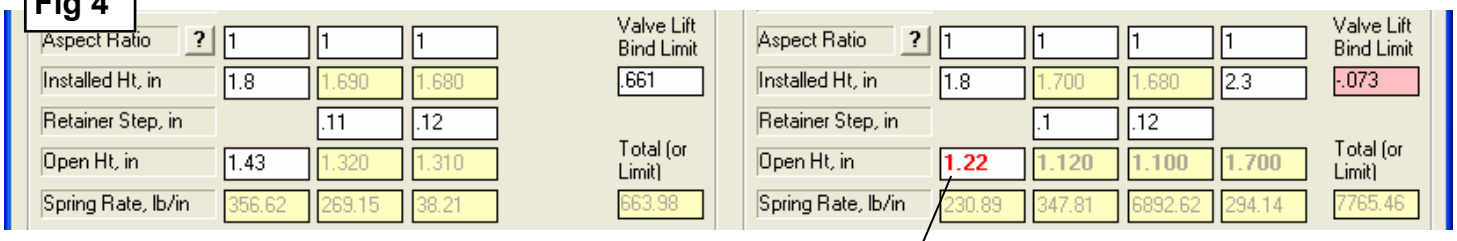


Fig 3

Fig 4



Red text indicates Coil Bind encountered for the Primary spring. The other springs which also have Coil Bind with yellow background are shown in bold text. The white background indicates the height difference between Installed Ht and Open Ht (1.8 inches and 1.22 inches) matches the Net Valve Lift of .580. The Net Valve Lift is determined from inputs in the Cam/Valve Train Analysis screen.

Click on Preferences at the top of the Main Screen

Hold down the Shift Key while clicking on the in input (in this case the red Spring O.D.) and you are presented with a menu of options. Choose the "Calculate from Other Measurements" to be presented with a Calculation utility for this input.

Hold down the Shift Key while clicking on the in input (in this case the red Spring O.D.) and you are presented with a menu of options. Choose the "Calculate from Other Measurements" to be presented with a Calculation utility for this input.

Fig 5A

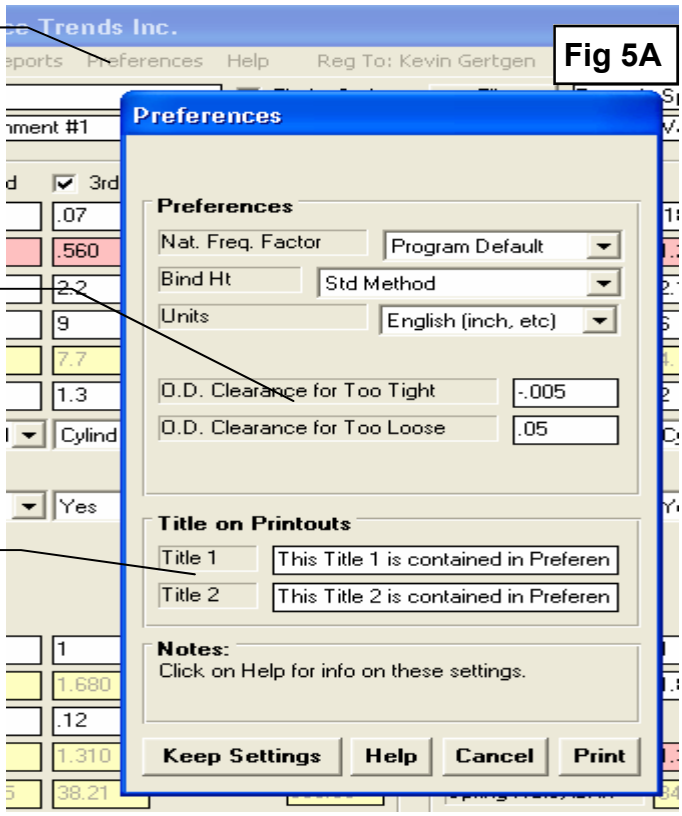
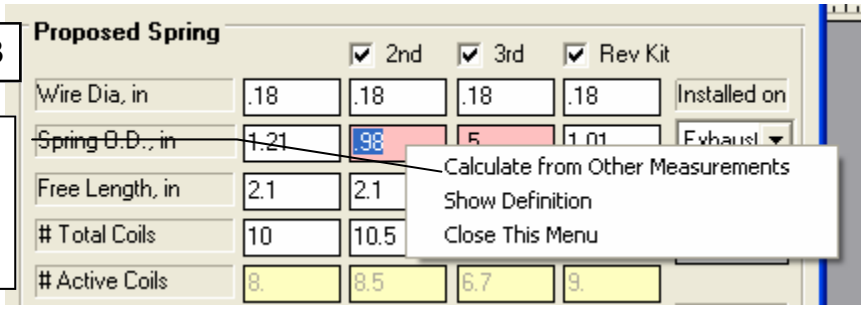


Fig 5B

Hold down the Shift Key while clicking on the in input (in this case the red Spring O.D.) and you are presented with a menu of options. Choose the "Calculate from Other Measurements" to be presented with a Calculation utility for this input.



Screen to calculate Spring OD from the larger spring's OD and Wire Diameter, and the Desired Clearance.

Fig 7

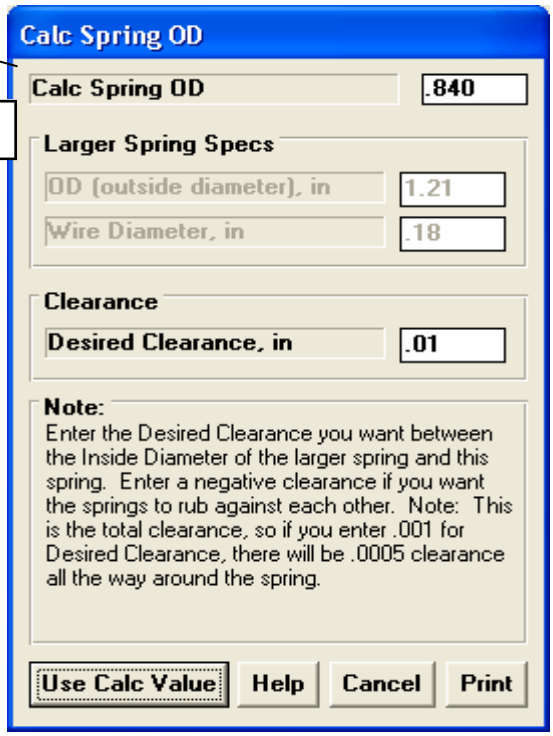
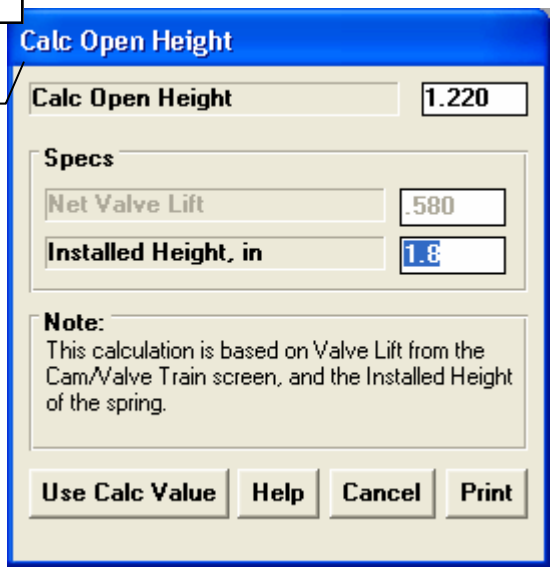


Fig 6

Screen to calculate Open Ht from Installed Height, and Net Valve Lift.



Plus Version, Stress and Fatigue Analysis:

The Plus version estimates the Stress and Fatigue life of the valve spring you have designed to work with the valve lift of the cam. Think of bending a piece of wire like a paper clip back and forth. If you don't bend it very far, it may take a long time before it breaks, or it may never break. Bend it a lot and it could fail with only 5-10 cycles.

This example illustrates the engineering principle called fatigue. It is the science of calculating the stress level of a component (like the spring wire) and how the stress is oscillating, and how many cycles it will take before the component will break. The higher the change in this stress level, the fewer

Fig 8

Stress-Report.txt - Notepad

File Edit Format View Help

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---------------------------------- Kevin Gertgen ----------------------------------
------------------------- This Title 1 is contained in Preferences -------------------------
------------------------- This Title 2 is contained in Preferences -------------------------

Baseline File:     Example Spring 1
Baseline Comment:  Example Valve Spring Comment #1
Example Valve Spring Comment #2
Example Valve Spring Comment #3
Example Valve Spring Comment #4


Proposed File:     Example Spring 2
Proposed Comment:  Example Valve Spring 2 Comment #1
Example Valve Spring 2 Comment #2
Example Valve Spring 2 Comment #3
Example Valve Spring 2 Comment #4


Date: 10/17/24    Time: 02:37 pm

Valve Spring Life Expectancy Report for Continuous   7000  RPM
Based on Stress at Open and Installed Heights


Spring:             Baseline                              Proposed

                    Base      2nd       3rd       Rev Kit  Base      2nd       3rd       Rev Kit

Installed Height    1.800     1.690     1.680               1.800     1.700     1.680     2.300
Installed Stress    128303    93933     87660               39443     65897     1156836   243004
Open Height         1.430     1.320     1.310               1.220     1.120     1.100     1.700
Open Stress         286544    178703    150033              115700    161448    2447153   328770

Best Case
Number Cycles       > 10^8    > 10^8    > 10^8              > 10^8    > 10^8    0         > 10^8
Number Hours        938.3     > 10^8    > 10^8              > 10^8    > 10^8    0.0       765.0

Good Case
Number Cycles       1691555   > 10^8    > 10^8              > 10^8    > 10^8    0         16913
Number Hours        8.1       > 10^8    > 10^8              > 10^8    > 10^8    0.0       0.1

Typical Case
Number Cycles       0         0         26                  > 10^8    0         0         0
Number Hours        0.0       0.0       0.0                 440903    0.0       0.0       0.0

IMPORTANT:  These durability limits can NOT be used to estimate
the actual life of valve springs.  This information can ONLY be
used to give a comparison of a very APPROXIMATE life expectancy
between different springs and different operating conditions.

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Ln 1, Col 1

Fig 9

cycles it will take until the spring wire will fail.

The same is true for valve spring wire. Depending on these spring specs, material properties of the wire and Installed and Open heights, the valve spring could break very quickly. If this is a valve spring for a nitro blown dragster, an estimated life of 0.1 hours is good enough. These springs are typically changed every 5 second run. If this is a valve spring for a street vehicle, it should have a very long or infinite life.

The report on the previous page gives an estimate of the Number of Cycles a valve spring can run before it is likely to break. The Number of Hours is also calculated based on the Max RPM you have entered in the Valve Train specs screen. If the number is reported as "10^E8" it means it is expected to last more than 100,000,000 (100 million) cycles or hours. This means it should have infinite life and be good for production or street vehicles.

There are several methods for calculating Spring Fatigue Life, and the Spring Wiz shows 3 different estimates.

- Best Case: This calculation assumes the very best materials and surface finish (like shot peening), very best manufacturing technology, etc.
- Good Case: This calculation assumes very good materials and surface finish (like shot peening), very good manufacturing technology, etc.
- Typical Case: This calculation will closely match what you will see in typical engineering text books, Machinist Handbook, etc.

What you will typically see for racing springs is that for the Typical Case, they may last only 0 cycles. That means they should break the first time the engine turns over. But obviously that is not the case in the real world, and that is why we have added the Good Case and Best Case estimates.

Plus Version, Tapered and Beehive Springs:

A recent advancement in valve spring design is the use of tapered or beehive springs. The idea is that they will use a smaller retainer and have less spring mass by the retainer. This mass by the retainer moves much like the valve itself, and anything you can do to reduce this mass will allow the engine to rev higher before valve toss is encountered.

Fig 10

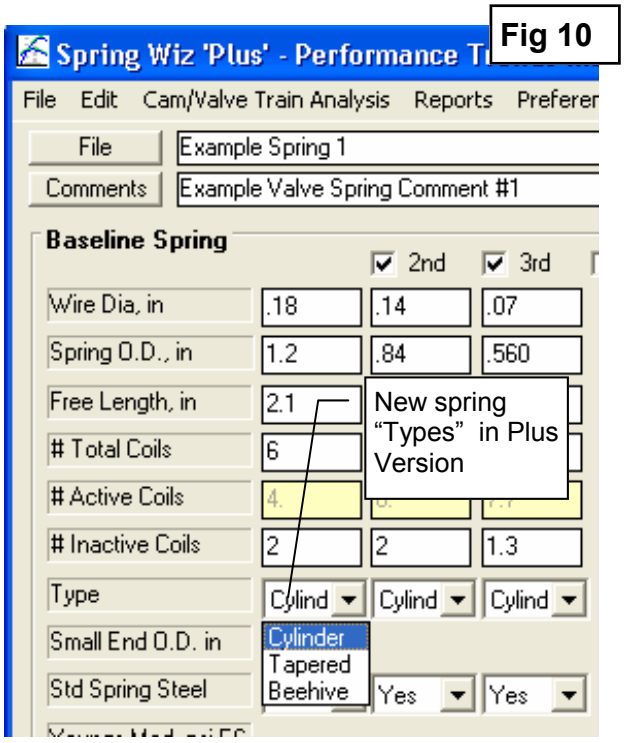
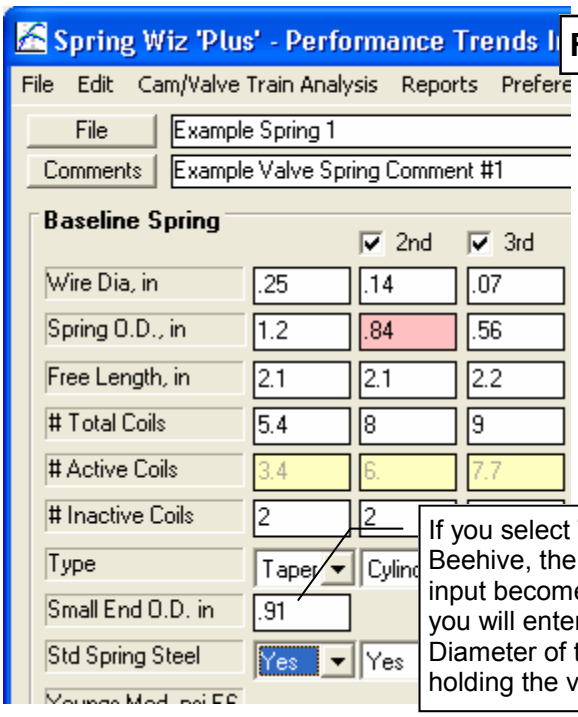
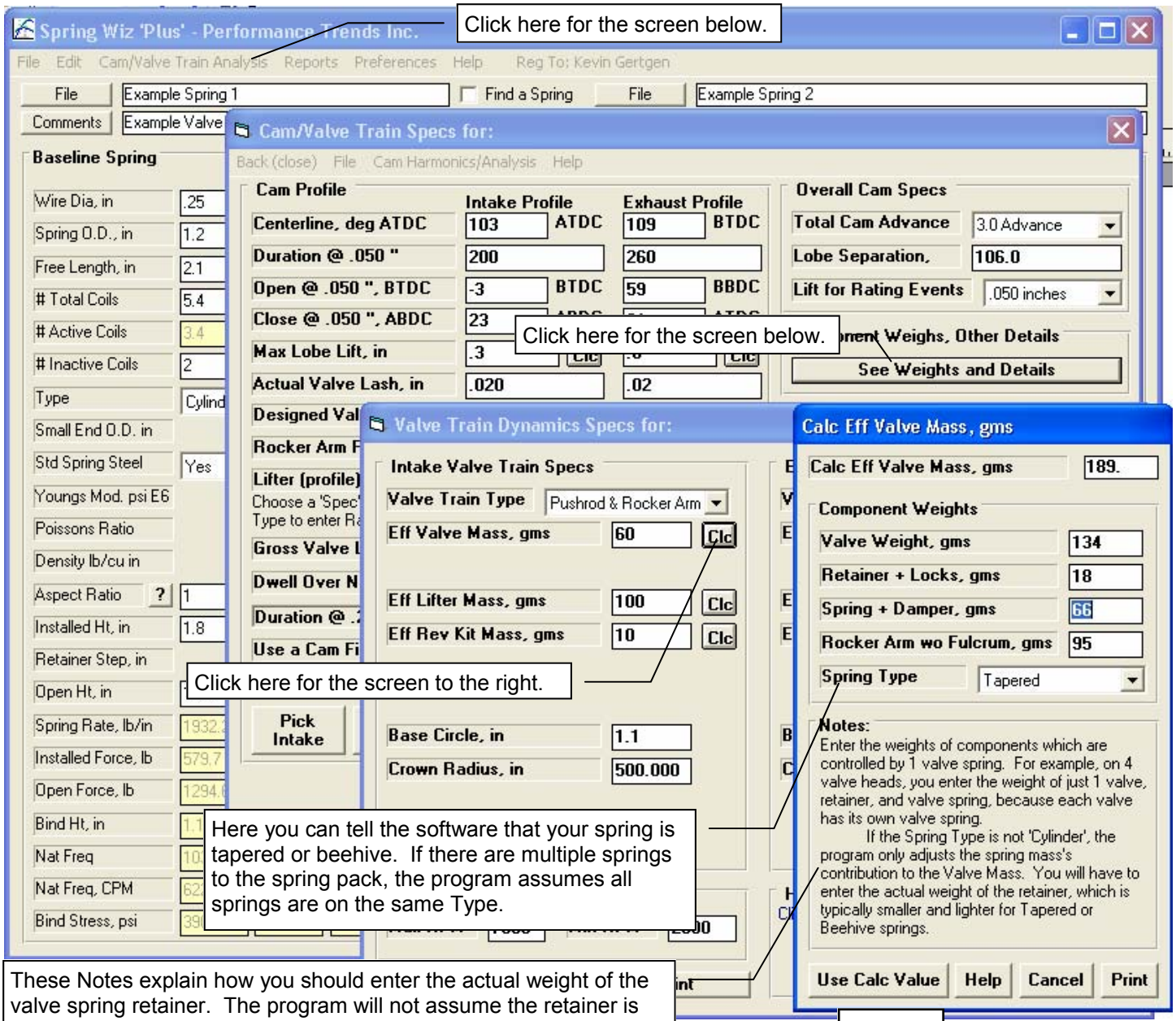


Fig 11





These Notes explain how you should enter the actual weight of the valve spring retainer. The program will not assume the retainer is smaller that the weight you enter. So to simulate a tapered spring you must both choose Tapered as the Spring Type, and enter the actual Retainer + Locks weight, which is typically smaller.

Fig 12

Plus Version, Detailed Graphs:

If you do a Cam Hamonics/Analysis, the Plus version lets you do more detailed graphs. See the screen sections below and on the next screen to see how to get to these more Detailed Graphs.

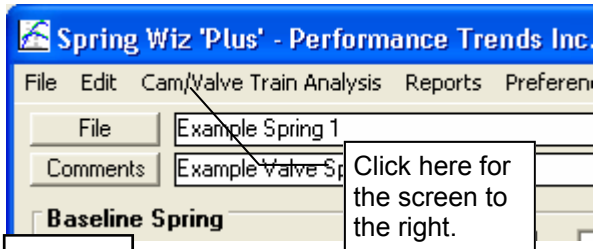


Fig 13

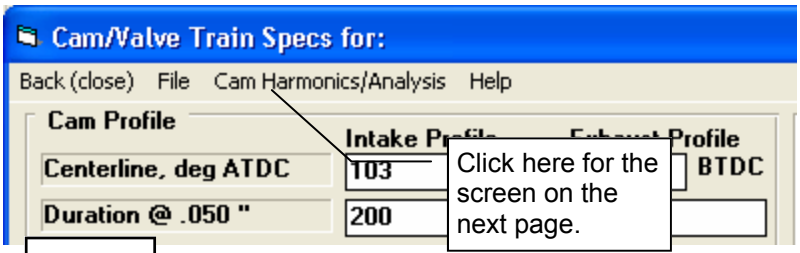


Fig 14

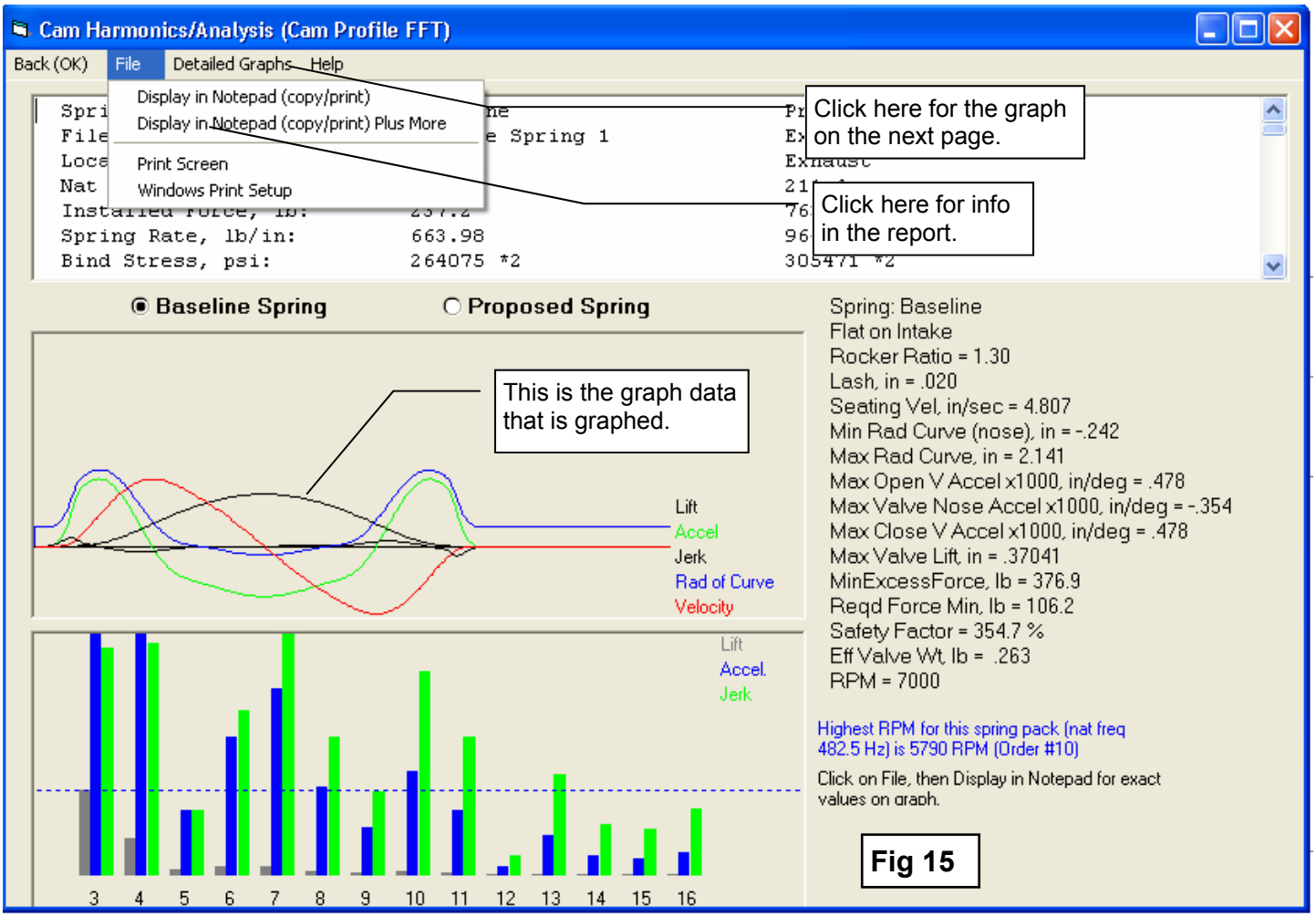


Fig 15

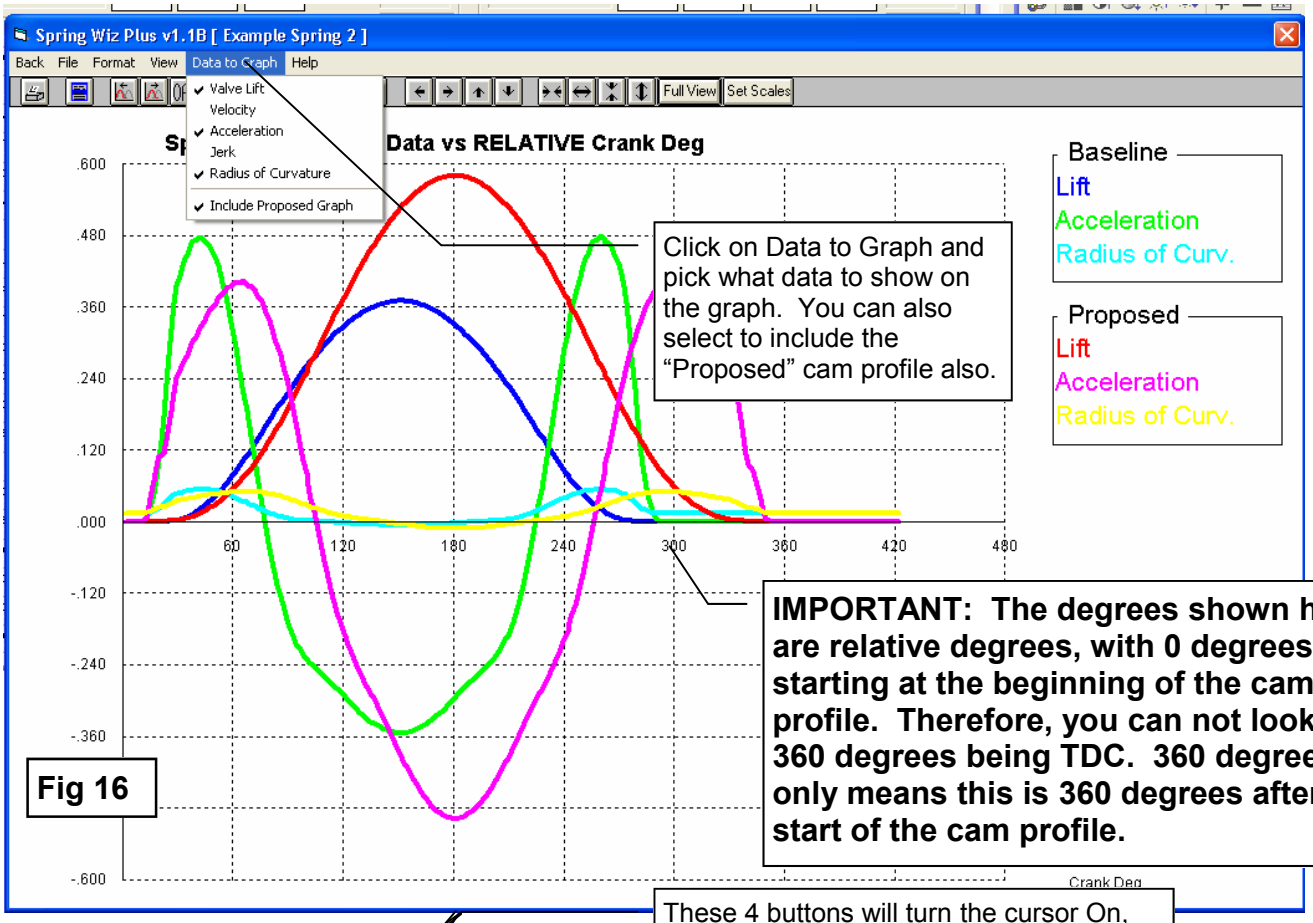


Fig 16

These 4 buttons will turn the cursor On, Off, or move it 1 Crank Deg left or right.

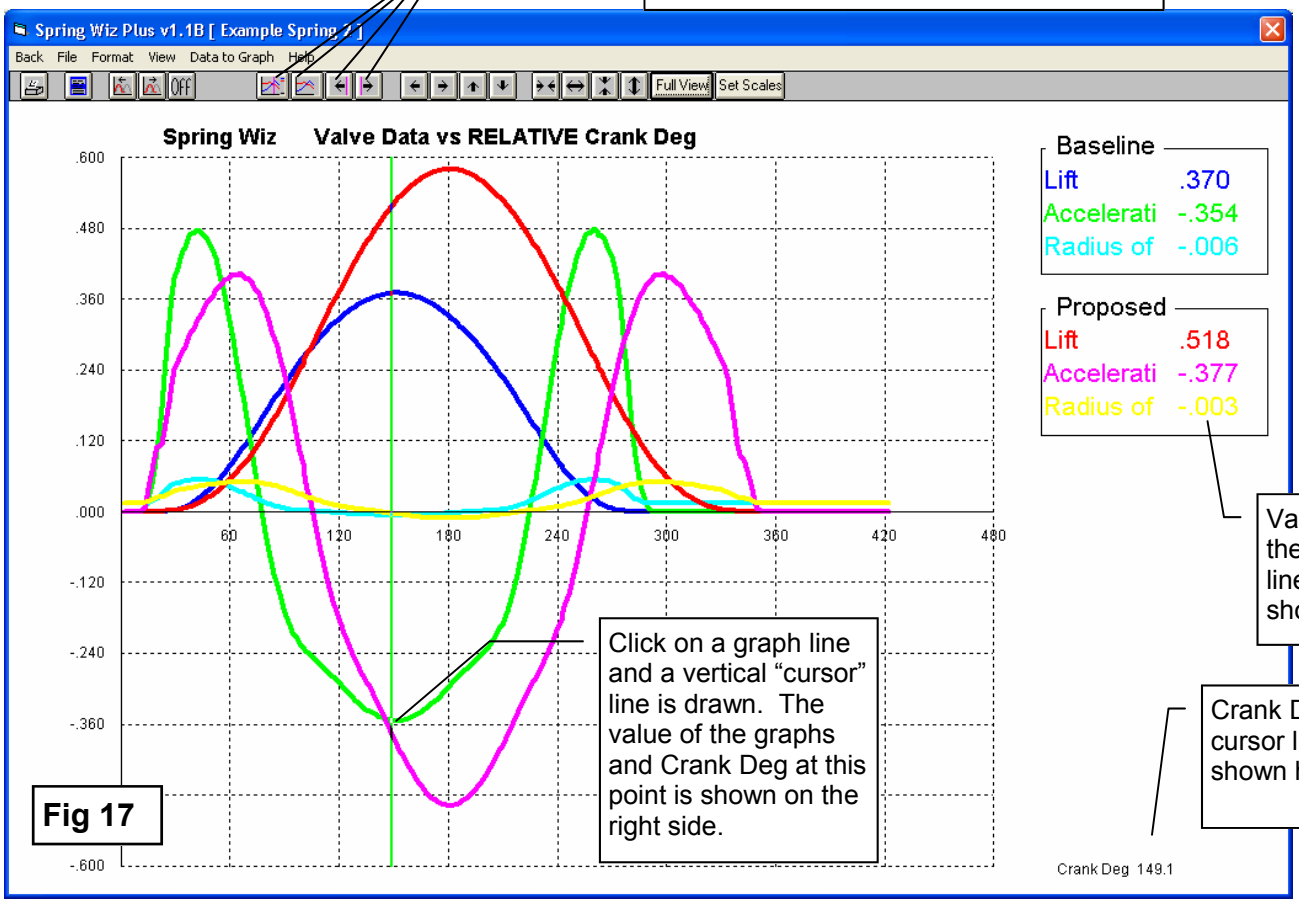


Fig 17

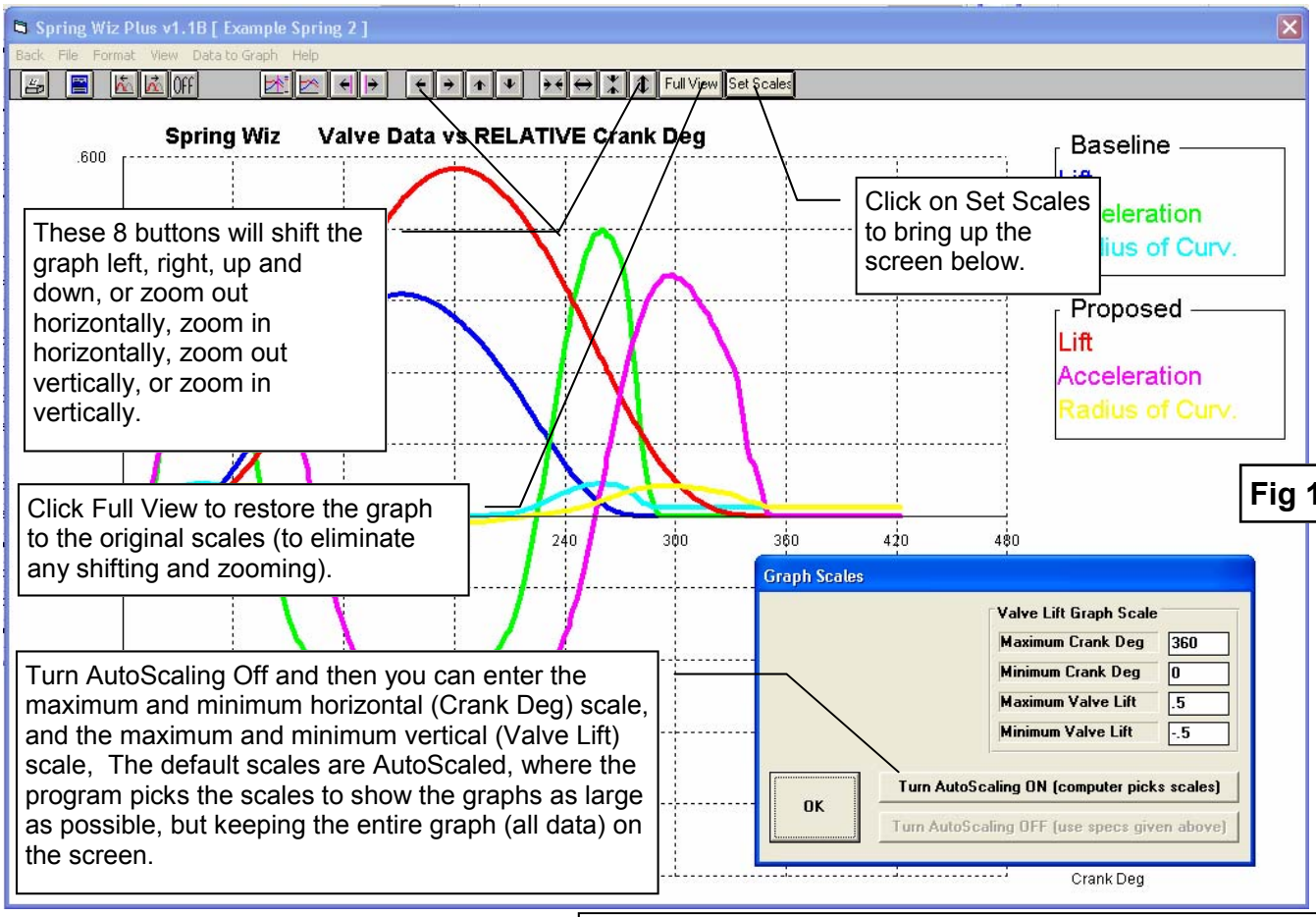

Spring Wiz Plus v1.1B [Example Spring 2]
Back File Format View Data to Graph Help
Full View
Set Scales
Spring Wiz Valve Data vs RELATIVE Crank Deg
Baseline
Lift
Acceleration
Radius of Curv.
Proposed
Lift
Acceleration
Radius of Curv.
These 8 buttons will shift the graph left, right, up and down, or zoom out horizontally, zoom in horizontally, zoom out vertically, or zoom in vertically.
Click on Set Scales to bring up the screen below.
Click Full View to restore the graph to the original scales (to eliminate any shifting and zooming).
Turn AutoScaling Off and then you can enter the maximum and minimum horizontal (Crank Deg) scale, and the maximum and minimum vertical (Valve Lift) scale, The default scales are AutoScaled, where the program picks the scales to show the graphs as large as possible, but keeping the entire graph (all data) on the screen.
Graph Scales
Valve Lift Graph Scale
Maximum Crank Deg 360
Minimum Crank Deg 0
Maximum Valve Lift .5
Minimum Valve Lift -.5
OK
Turn AutoScaling ON (computer picks scales)
Turn AutoScaling OFF (use specs given above)
Crank Deg

Fig 18

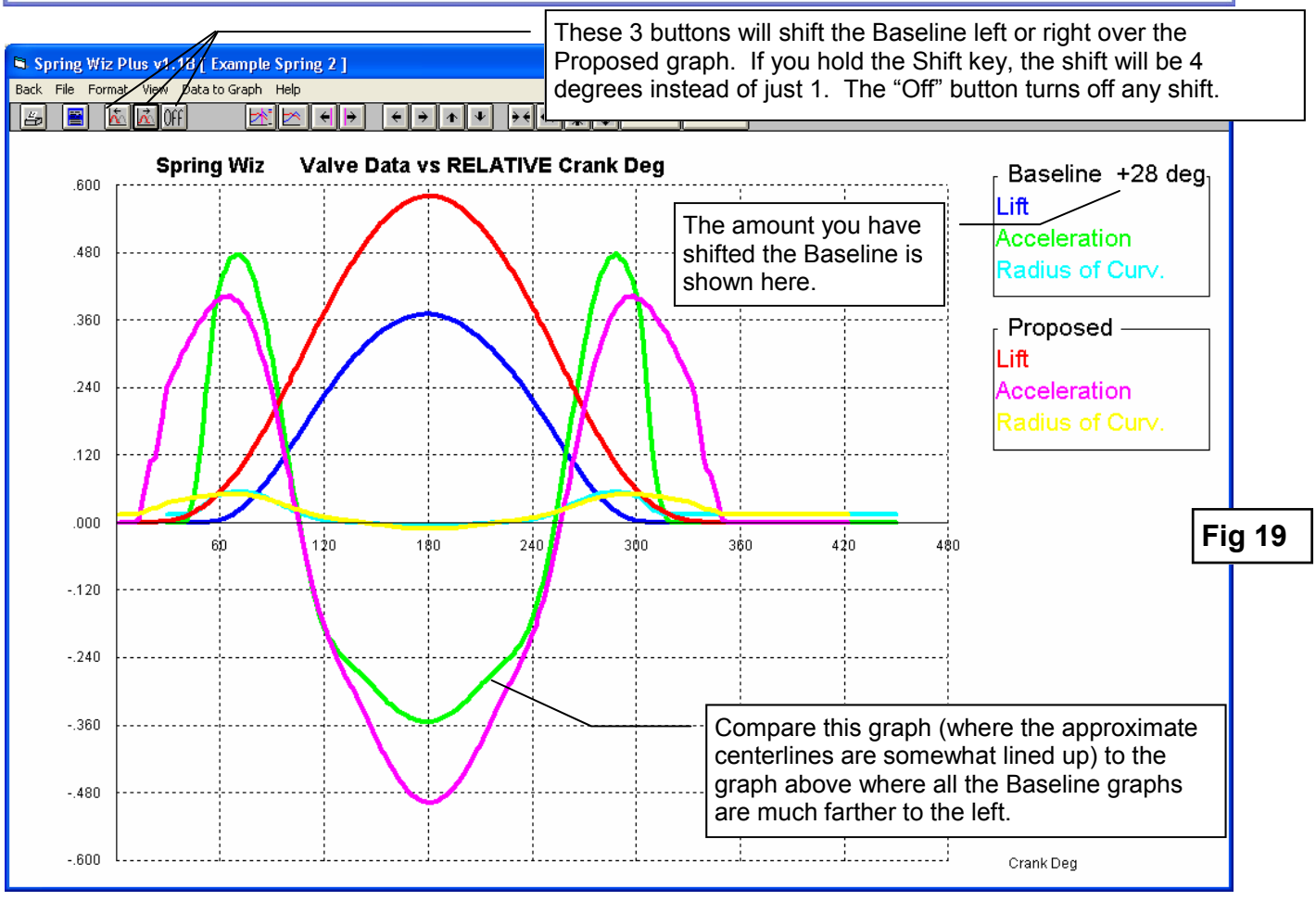
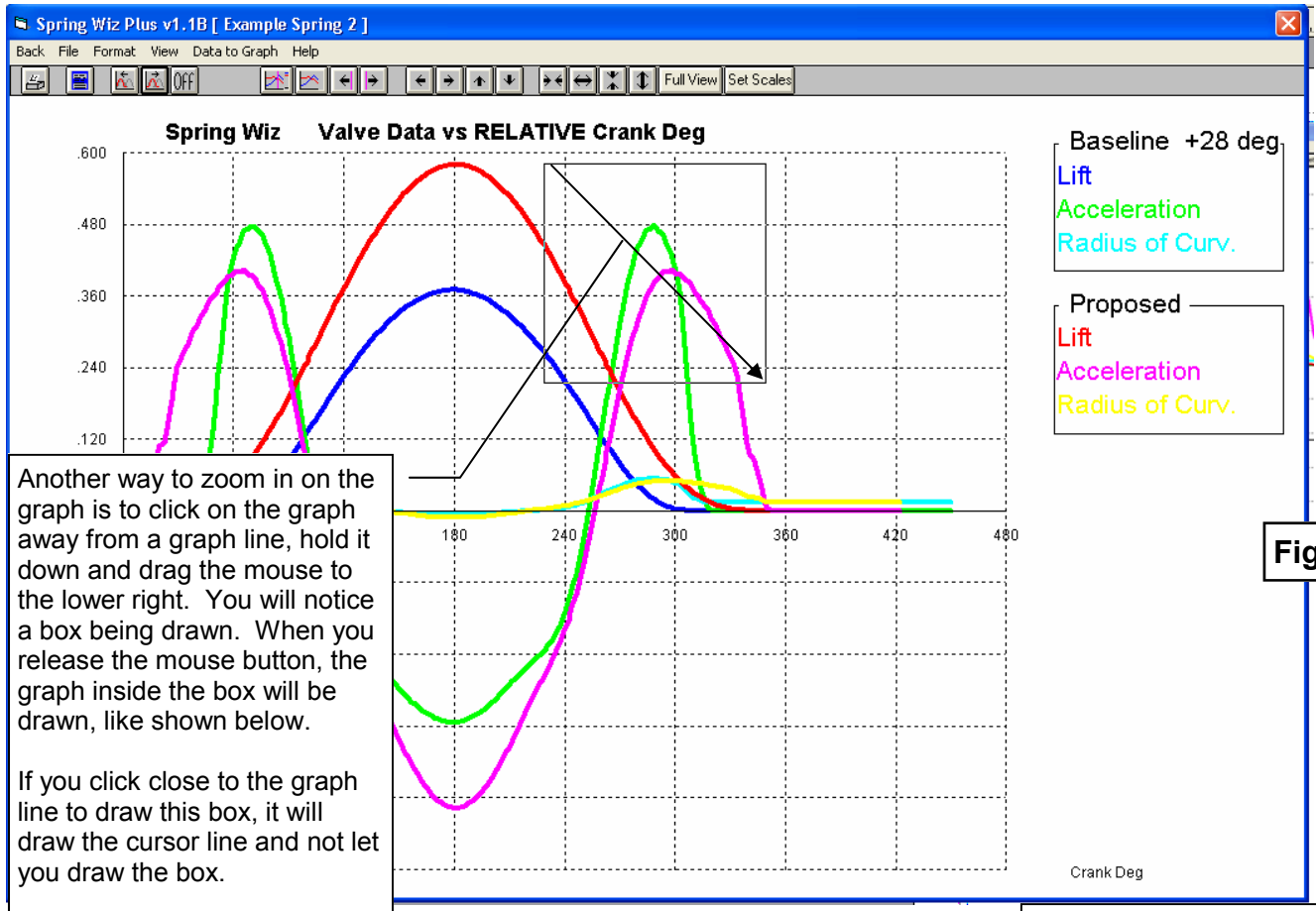

These 3 buttons will shift the Baseline left or right over the Proposed graph. If you hold the Shift key, the shift will be 4 degrees instead of just 1. The "Off" button turns off any shift.
Spring Wiz Plus v1.1B [Example Spring 2]
Back File Format View Data to Graph Help
Spring Wiz Valve Data vs RELATIVE Crank Deg
Baseline +28 deg
Lift
Acceleration
Radius of Curv.
Proposed
Lift
Acceleration
Radius of Curv.
The amount you have shifted the Baseline is shown here.
Compare this graph (where the approximate centerlines are somewhat lined up) to the graph above where all the Baseline graphs are much farther to the left.
Crank Deg

Fig 19



Another way to zoom in on the graph is to click on the graph away from a graph line, hold it down and drag the mouse to the lower right. You will notice a box being drawn. When you release the mouse button, the graph inside the box will be drawn, like shown below.

If you click close to the graph line to draw this box, it will draw the cursor line and not let you draw the box.

Fig 20

This is the result of drawing the box on the graph above.

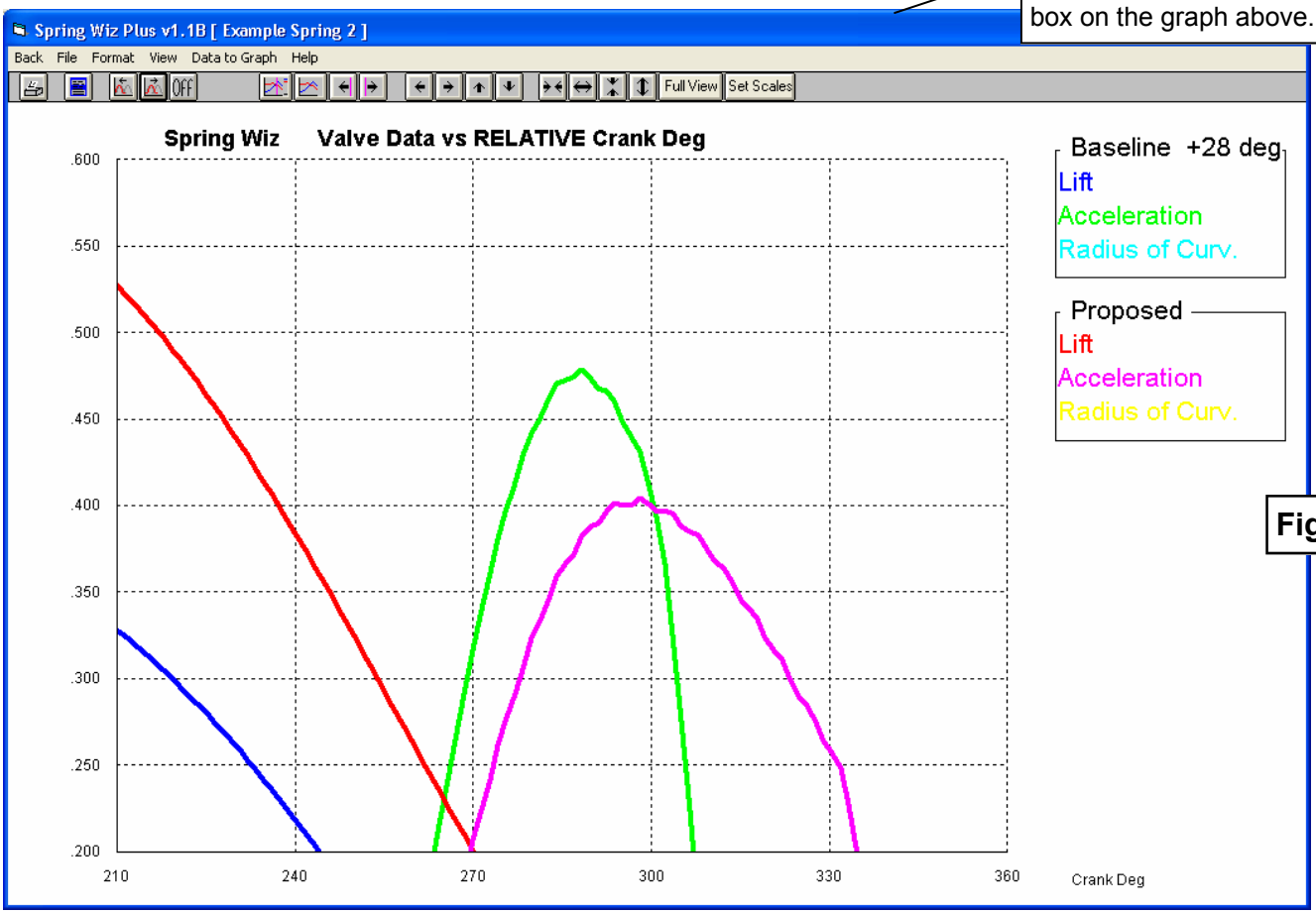


Fig 21

Shown to the right are additional menu options to adjust the graph.

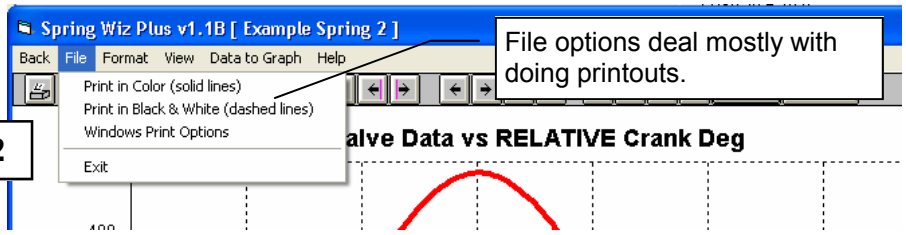


Fig 22

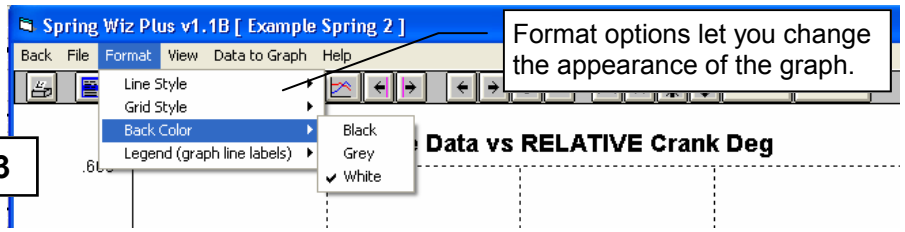


Fig 23

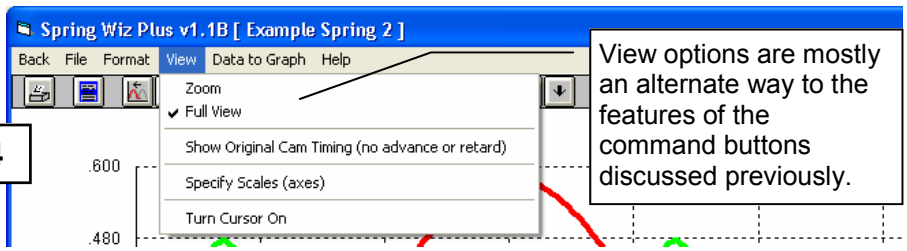


Fig 24

Below is a printout of a detailed graph.

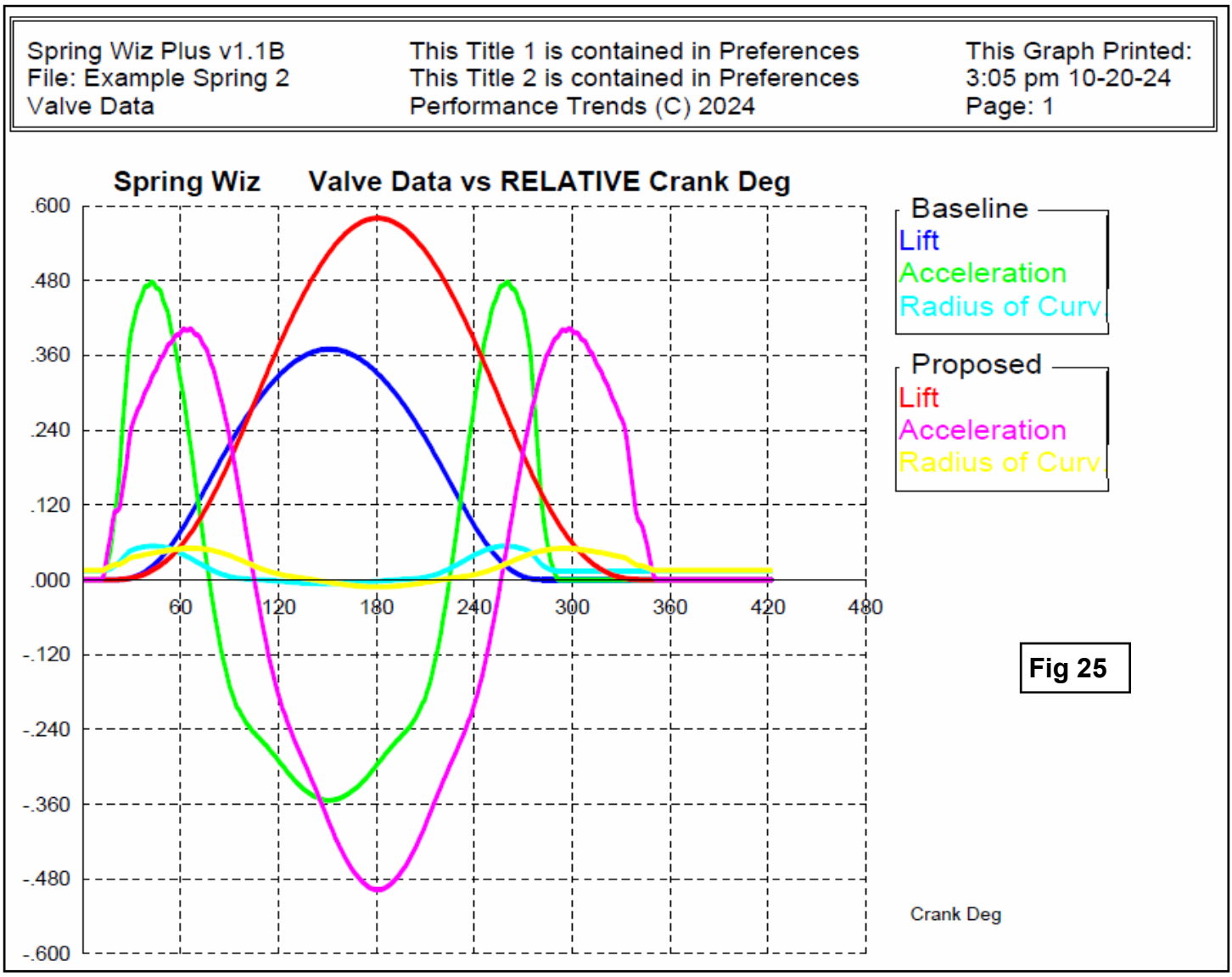


Fig 25