



CurveCompare v1.0

INSTRUCTIONS

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INTRODUCTION

CurveCompare is non-commercial and is intended to help medical physicists analyze agreement between any pair of functions/curves, e.g. to study differences between a reference (analytical standard) DVH curve vs. a comparison (treatment planning system-generated) numerical DVH curve. It can also be used generally to compare any two functions/curves no matter what the data source. For example, you could explore the dose differences along extracted dose profiles.

CurveCompare is a research tool and is not intended for clinical use on specific-patient plans. It is meant to automate data analyses which might otherwise require specifically-designed Microsoft Excel spreadsheets, MatLab, or other code.

By using CurveCompare, you agree not to copy, distribute, or disassemble the software.

INSTALLATION

Platform

CurveCompare runs on Windows 7 or later. It can be installed locally, on a shared network drive, or on an application server, e.g. Citrix.

Verifying (or Installing) the Necessary .NET Framework

CurveCompare 1.0 requires the Microsoft .NET Framework version 4.5 or later. If the computer on which you wish to use CurveCompare does not have the required framework, you can download and install it free from Microsoft.

If you are unsure if you have the .NET Framework, or do not know the version(s) you have, below is a method to check the version. NOTE: You will need administrative privileges to verify the version and to download/install any new version, if required.

1. On the **Start** menu, choose **Run**.
2. In the **Open** box, enter **regedit.exe**.
3. In the **Registry Editor**, look for the subkey:
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\.NET Framework Setup\NDP\v4\Full.
4. If you see v4.0 but not v4, then you do not have .NET 4.5. You will need to download and install the latest framework from Microsoft.
5. If you see the v4 folder then click on its sub-folder called "Full" and inspect the panel to the right for the value named "Release." It will have a REG_DWORD value and if that value is 378389 (or higher) then you have the .NET Framework 4.5 or later. See Figure 1.

If you discover that do not have the necessary .NET Framework, simply google "install .NET Framework 4.5" and it will lead you to the appropriate Microsoft website for the free download.

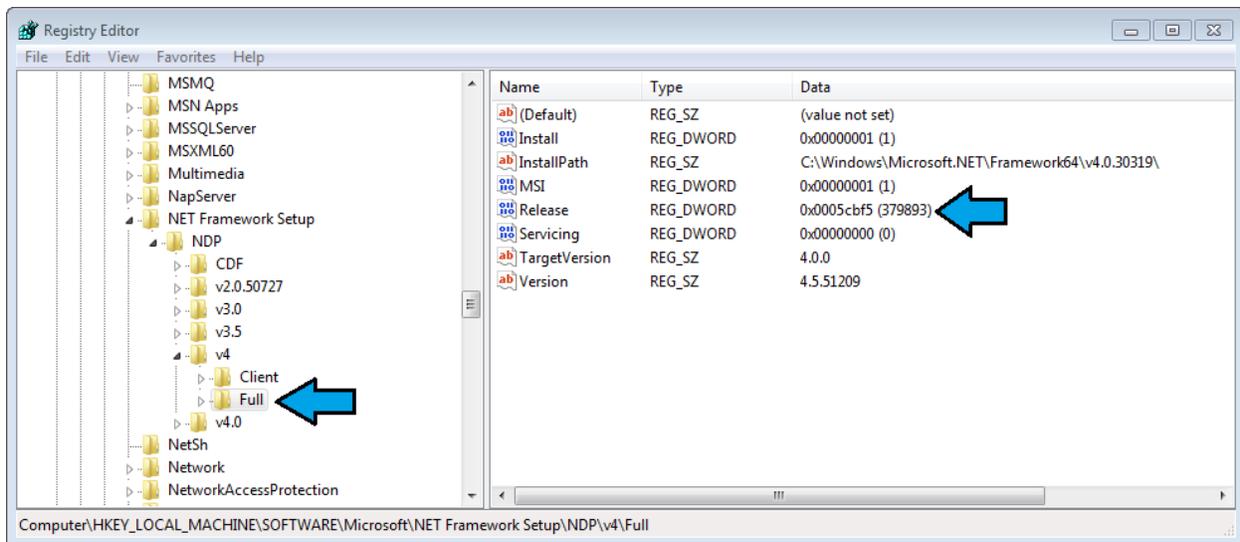


Figure 1. Example of what you will see when verifying the .NET Framework 4.5 (or later) on your computer.

Downloading and Storing the CurveCompare Executable(s)

If the user base and feature set of CurveCompare grows over time, i.e. beyond version 1.0, then these future versions will come with an installation package that you can click-and-run. However, for now, you will just download the executable and copy to your desired storage location.

Follow these steps to download the software:

1. Visit the website: <http://canislupusllc.com/portfolio-curvecompare/>
2. Find the "download" link for the CurveCompare software, and download the files.
3. If the files are in a *.zip file, then extract the contents of the zip file.
4. Create a storage folder in the desired location on your local or remote drive. If you want more than one computer to share the executable, then choose a shared network drive.
5. Move or copy the downloaded file(s) to the folder you just created.
6. If you would like a desktop shortcut, right-click the CurveCompare.exe file and select: "Send to -> Desktop (create shortcut)."
7. You can use the Windows OS tools to create shortcuts on your taskbar, if desired.

Running CurveCompare

Like any software, you can double-click (or click) the software icon to start the application. If you receive any errors on running the software, then please double-check the .NET Framework as described above.

USING CURVECOMPARE

Preamble

Some of the basic utilities of CurveCompare are summarized here. Not all of the features are explained, because they should be clear and easy to figure out when running the software.

Creating New Curve Data

You can create new data in two ways: 1) enter data manually in the reference or comparison spreadsheets, and/or 2) copy/paste from any Excel or delimited text file. For large curves with many data points, you will likely be copying and pasting.

Data stored in a text file

If you want to analyze data created by a treatment planning system (TPS) or other medical software, simply export the data as a delimited text file. Most, if not all, commercial TPS have the ability to extract DVH and dose profile data and save to a delimited text file.

Once the data are extracted to file, you can copy from that file to put the delimited text data on the clipboard. Then, simply highlight the upper left cell in the reference or comparison spreadsheet and select either: a) control-V or b) right-mouse in spreadsheet and "Paste Clipboard Data." The default assumed delimiting character is the tab character. However, if there is not at least one tab character per data line, i.e. row, in the clipboard text, then you will be prompted for an alternate delimiter, where you can enter the appropriate character, such as a "," or ";" character.

The copied/pasted data will likely have many more data rows than are shown in the software spreadsheet. Do not worry about this, because as many new rows as are needed will be added automatically during the copying/pasting.

Data stored in Excel (or other spreadsheet)

Similarly, you can highlight any data cells in Excel (or other spreadsheet application), copy to the clipboard, and paste into the reference or comparison curve data cells.

Editing Data and Axis Labels

Any data cells can be edited manually. You can also remove or add rows or clear cells by highlighting them and using the right-mouse menu items.

You may want to edit the labels of the x and y axes of the curves. This is easy to do, simply select from the main file menu "SETTINGS -> Change Abscissa Labels" or "SETTINGS -> Change Ordinate Labels." You will be prompted for the new label then, once accepted, both curves' axis labels will be updated.

Saving and Loading Curve Data

Once you have created a curve and set its labels, you can save it to a file for loading later so that you do not have to repeat any copying/pasting or relabeling. From the main file menu, select "FILE -> Save Reference Data to File" or "FILE -> Save Comparison Data to File" and enter the file name and location to save it.

To load a saved file, select "FILE -> Load Reference Data from File" or "FILE -> Load Comparison Data from File," then select a valid file, after which you will see the data and labels be populated automatically.

Clearing Data

The File menu has options to clear reference, comparison, or all data. If you only want to clear certain cells, just highlight those cells and select the delete or backspace key, or use the right-mouse menu to select what to clear.

Running Comparisons

Once reference and comparison data are loaded, you can run a comparison. From the main file menu, select "Compare -> Ordinate Differences" or "Compare -> Abscissa Differences." You will be prompted for the comparison interval and increment. The default range for analysis will be the range of the variable that is the overlap portion of the two curves, but this can be edited.

For example, if you want to compare volume differences from 0 to 60 Gy on a DVH plot in increments of 0.2 Gy, then you would select "Compare -> Ordinate Differences" (because volume, either cc or %, is the ordinate) then, when prompted, enter the range of 0 to 60 Gy and increment of 0.2 Gy.

There are several tabs with unique tools to analyze the differences:

- **Difference Curve.** This is a plot of the differences over the range of values and at the increment specified.
- **Difference Histogram.** This is a frequency plot of the differences, binned by difference level.
- **Difference Stats.** A summary of the difference stats (min, mean, median, max, and standard deviation) is shown here. Also, you can specify a difference range and the number of differences within that range (inclusive) will be shown as a % of the total difference values extracted. You can use this to analyze how many of the points in the two curves are "in agreement" where agreement is defined by the range of differences that you specify as the tolerance for agreement.

Example

Figures 2-5 illustrate one example of the analysis of a Pinnacle TPS DVH curve (loaded as comparison) compared to the reference, analytical DVH that was computed for the test purposes. In this example, we use absolute volume (cc) on the y-axis of the DVH, but you could use % volume. Just extract the data you wish to analyze and enter it into CurveCompare.

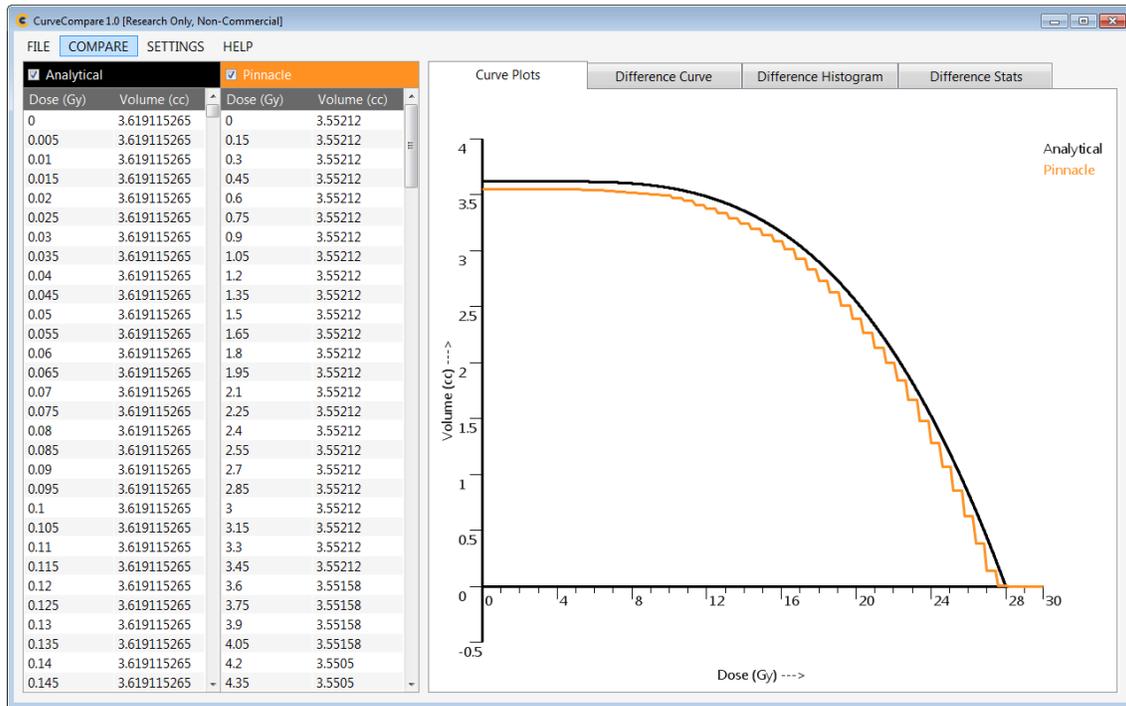


Figure 2. Curve data and plots after reference and comparison data are loaded.

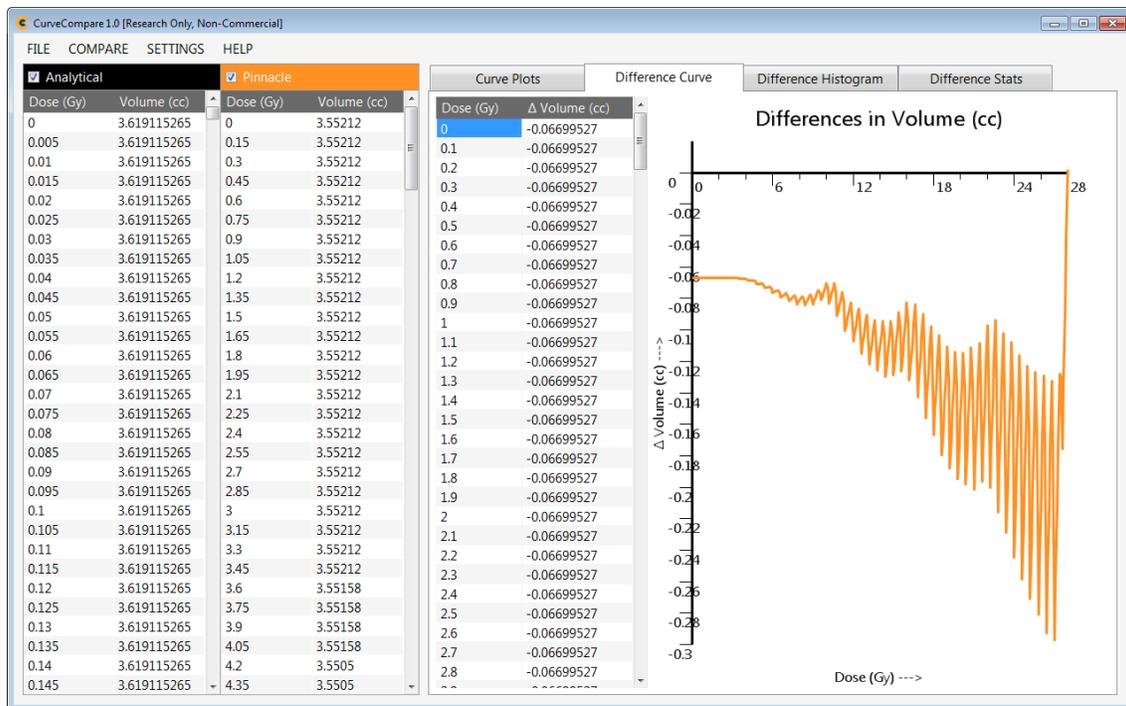


Figure 3. Difference data, raw data and plot. The points were those extracted based on the user-specified range and increment.

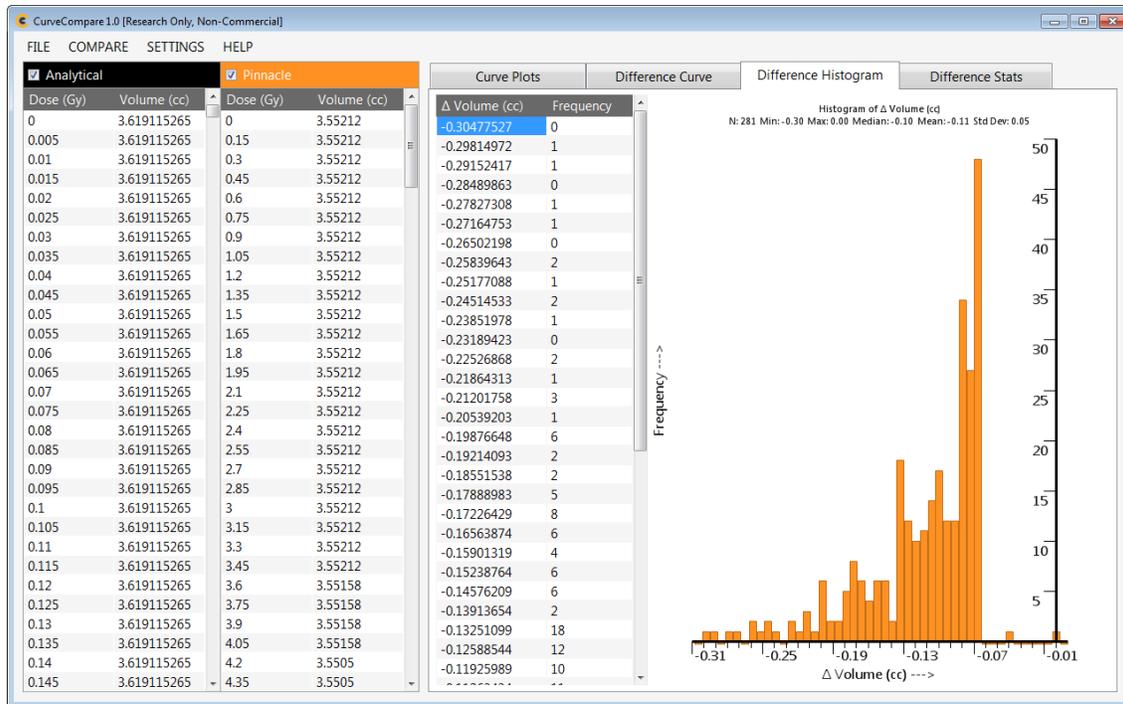


Figure 4. Difference histogram, raw data and plot.

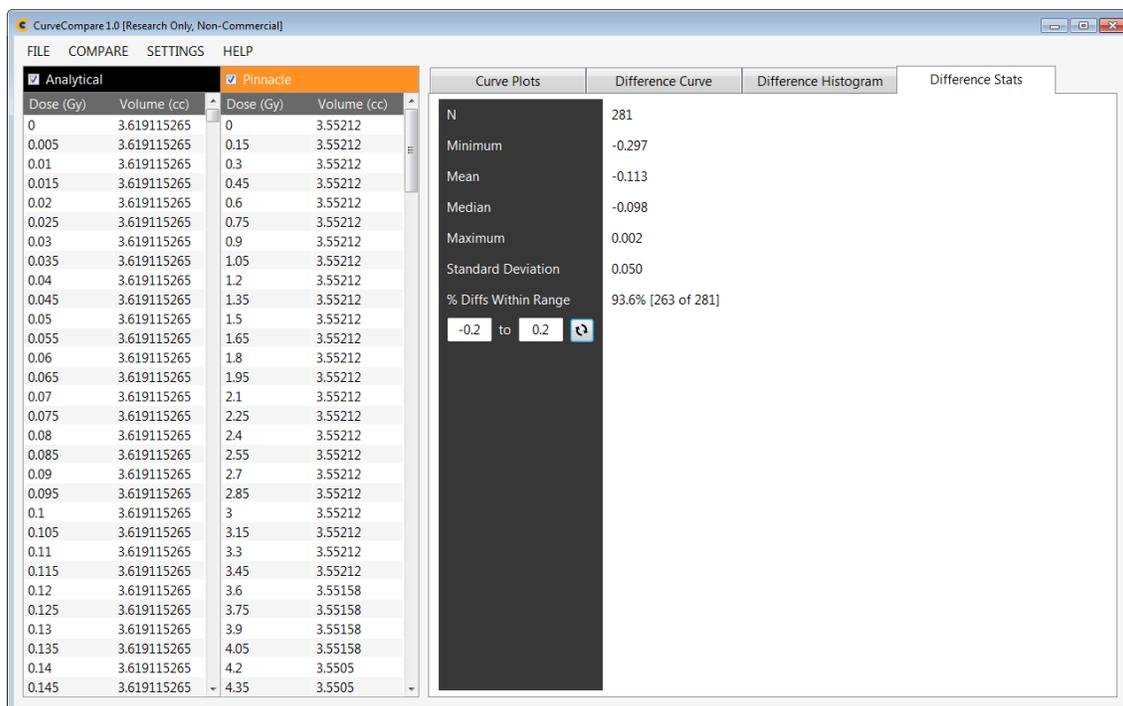


Figure 5. Statistical summary of the difference analysis, plus the % of points within a specified difference range of -0.2 to 0.2 cc.

Other Settings

Some preferences for plotting can be set, including:

- **SETTINGS -> Reference Curve Color.** Select the curve color for the reference data.
- **SETTINGS -> Comparison Curve Color.** Select the curve color for the comparison data.
- **SETTINGS -> Comparison Curve Line Type.** Select a line type (solid, dashed, dotted) for the comparison curves. NOTE: The reference curve will always be solid.