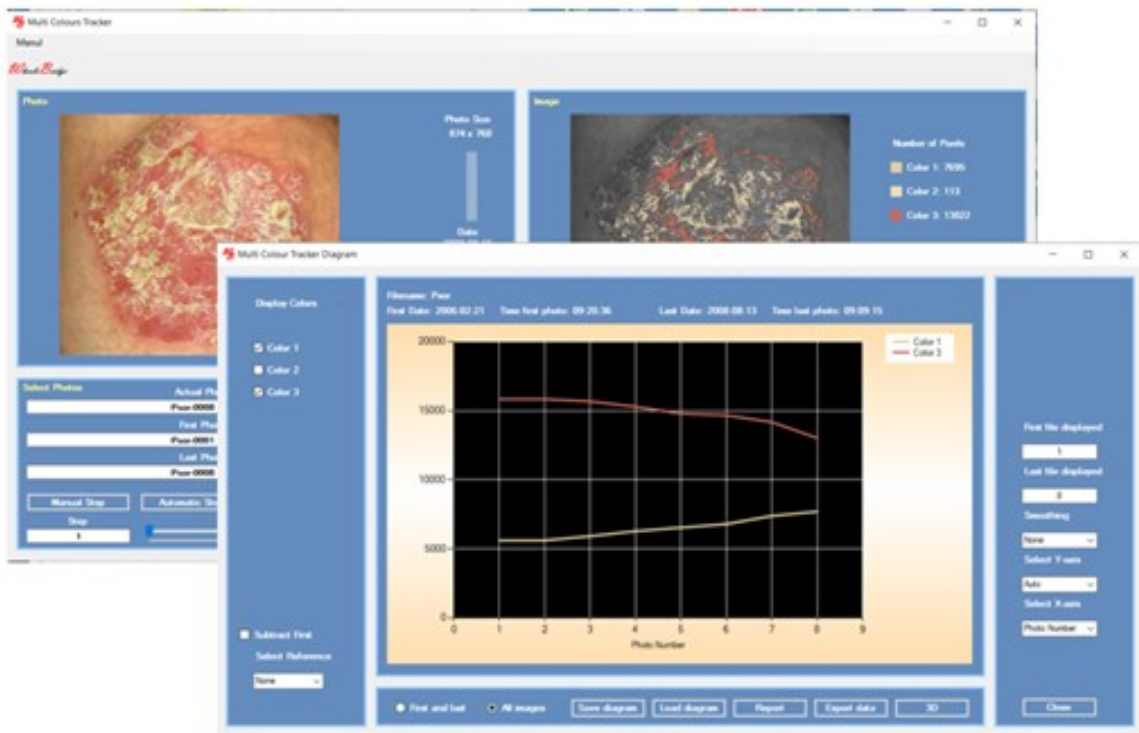




Wheels Bridge



Multi Colours Tracker TiVi201 User Manual

User Manual 1.0
Version 1.0
December 2021

PIONEERS IN TISSUE VIABILITY IMAGING

TiVi201 Multi Colours Tracker

Dear Valued Customer!

Welcome to the WheelsBridge TiVi201 Multi Colours Tracker intended for automatic analysis of the extent of tissues of different colours throughout a sequence of photos captured by the TiVi camera. The TiVi201 Multi Colours Tracker was designed for observer-independent analysis of changes in tissue colours of healing wounds and other tissue that may change colour for a variety of reasons.

The WheelsBridge TiVi201 Multi Colours Tracker utilizes a highly sensitive digital camera equipped with polarization filters making it possible to suppress surface reflections from the skin. The versatile system software allows for rapid and easy capturing and analysis of images. Among the many useful features of the TiVi201 Multi Colours Tracker software the following are of particular interest:

- Automatic capturing of photos.*
- Automatic tracking of tissues of specific colours.*
- Up to 6 different colour space layers can be employed.*
- Layers to be displayed are selected by the user.*
- The space of each colour can be reduced or expanded by the user.*
- Curves representing areas of different colours are automatically generated and displayed.*
- All data can be exported to ASCII-format spread sheets.*

We are convinced that the TiVi201 Multi Colours Tracker will be a productive tool in the assessment and follow-up of wound healing and tissue repair processes in medical research.

Thank you for choosing the WheelsBridge TiVi201 Multi Colours Tracker.

WheelsBridge AB

TiVi201Multi Colours Tracker

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1. INTRODUCTION

The healing process of a wound is reflected in changes of the colour of the tissue within the wound area. Red colour generally represents hyperemic areas while black and yellow colours represent necrotic tissue and pus respectively. By following the dynamic changes of areas of such colours over time the effect of the healing process from a treatment procedure can be quantified and displayed.

The *TiVi201 Multi Colours Tracker* makes it possible to automatically track the extension of tissue of different colours over time as defined by setting of separate colour space parameters in high resolution photos captured in cross-polarization mode.

The intended use of the *TiVi201 Multi Colours Tracker* is to analyse wounds of different shapes and colour in experimental and research applications. It is not yet approved for the diagnosis and treatment of disease.

2. OPERATING PRINCIPLE

When the user clicks at a point in the photo the colour of the point clicked on is registered. The colour representation of that point is a triplet (Red, Green and Blue value) on a scale from 0 to 255. The triplet [0, 0, 0] represents black colour while [255,255,255] represents white colour. Red colour is represented by the triplet [255, 0 0], while green and blue colours are represented by the triplets [0, 255, 0], and [0, 0, 255] respectively. Any colour of a “true colour image” can be represented by a specific triplet of values.

Certain shades of adjacent colours can be represented as a volume composed of close triplets in the RGB colour space. When a specific point in the photo is pointed at by the mouse, the average value of 125 triplets around this colour is registered as the centre colour. The colour space around this centre colour is then set by the position of the **Lower and Upper Delta Colour sliders** in the **Colour Settings** window, to define the colour space of the actual colour layer. This layer is displayed superimposed on the grayscale version of the photo in the **Image panel**. By changing the position of the **Lower and Upper Delta Colour sliders**, the area – and thus the number of triplets inside the defined colour space – changes to include more or less colours.

When a new colour space layer is created it is listed in the **Display Layer listbox**. Colour layers to be displayed in the **Image panel** photo are selected from this listbox.

To expand or shrink the colour space of a certain layer, the layer is first selected in the **Colour Settings window**. Moving the **Lower or Upper Delta Colour slider** then changes the colour space around the center colour of the selected layer. The changes are reflected in the image in the **Image panel**.

A specific colour layer can be deleted by selecting the layer from the **Delete Layer menu**. Layers of higher order are then re-numerated to form a uniform sequence of layers.

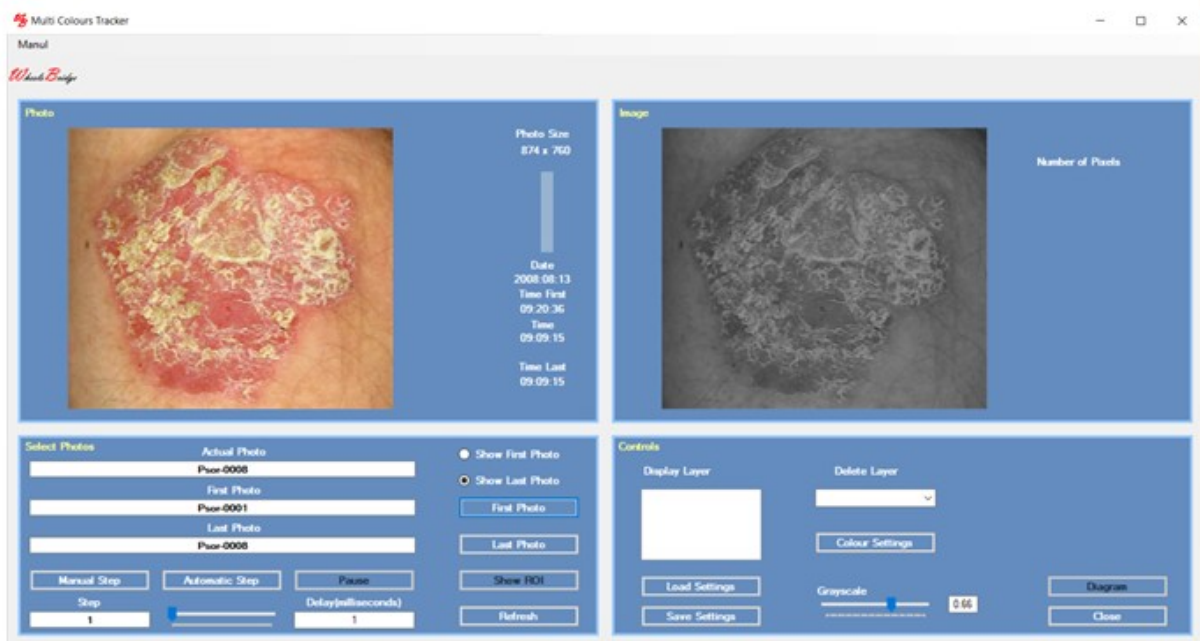
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The areas of the different layers can be dynamically displayed by clicking the **Automatic button**. After having scanned through and displayed all layers, the areas of different tissue colours in different photos in the sequence can be displayed as a curve in the **Diagram window**.

3. GETTING STARTED

The basic features of the *TiVi201 Multi Colours Tracker* are probably best explained by way of an example. In the following example it is assumed that the photos *Psor-0001.jpg* to *Psor-0007.jpg* have been captured by a TiVi camera system and stored in the *TiVi201 demonstration* folder. This photo displays a wound with tissue components of different colours.

1. Open the *Multi Colours Tracker* from the **Extension** pull-down menu in the *TiVi700 2.0* window.
2. Click the **First Photo** button and select *Psor-0001* from the *TiVi201demonstration* folder.

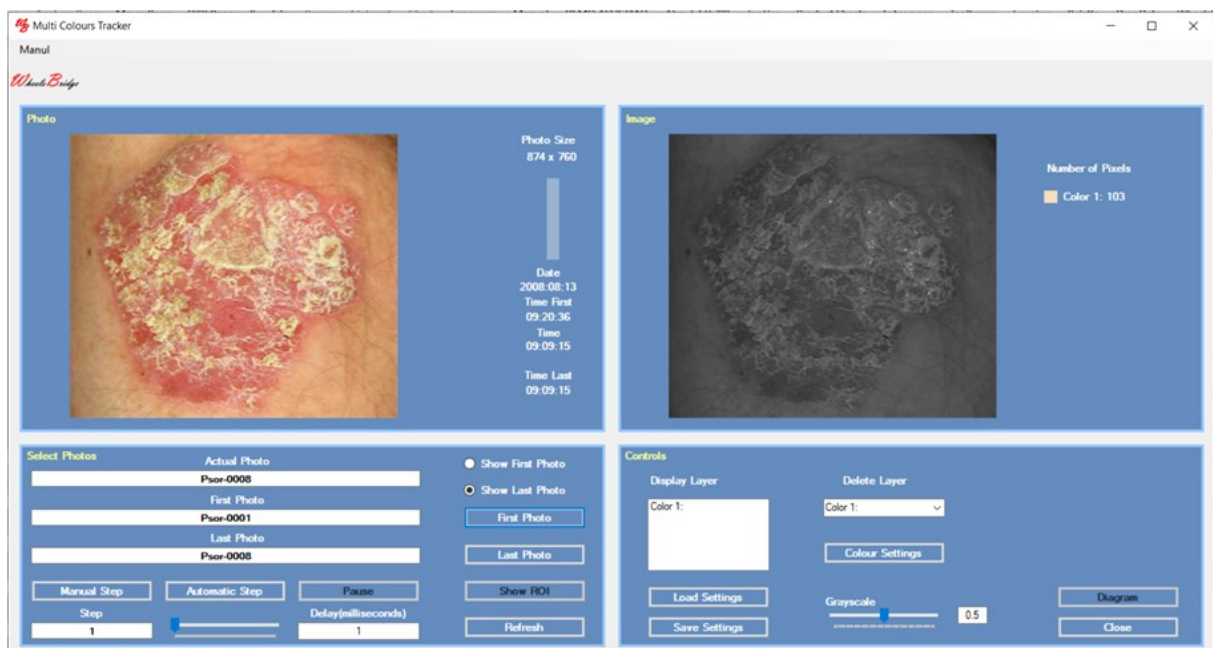


3. Click the **Last Photo** button and select *Psor-0007* from the same folder. The photo sequence *Psor-0001* to *Psor-0007* are now set for automatic analysis.

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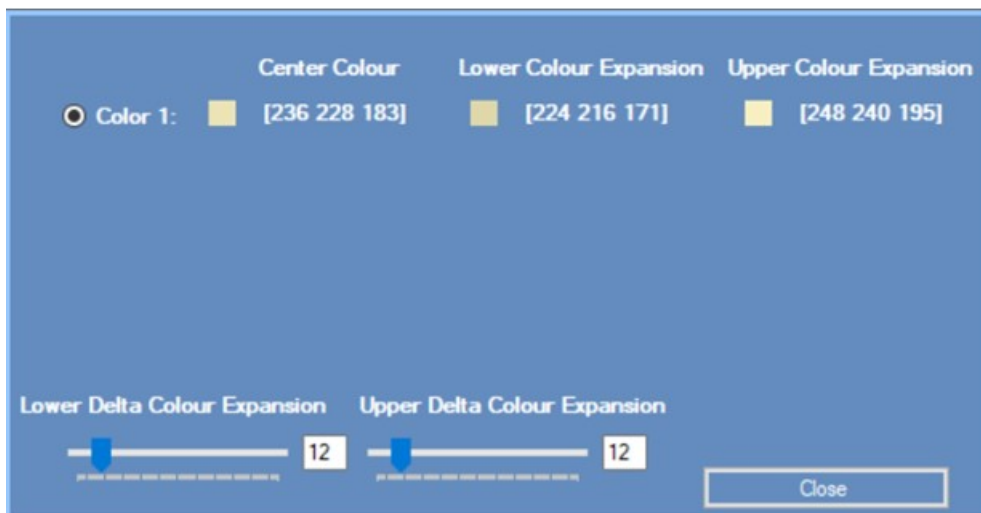


4. Click on a bright spot in the photo to pick up the colour of scaling tissue. Areas of this colour are now displayed superimposed on the gray image in the Image panel.

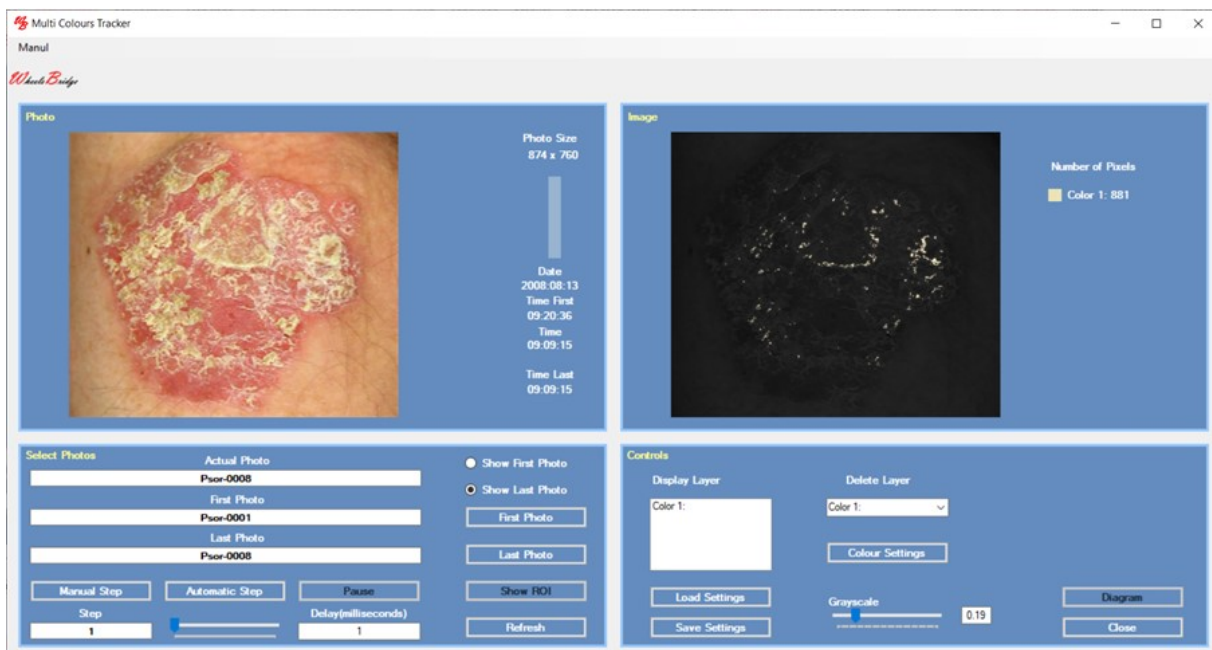


5. Click the **Colour Settings** button to open the **Colour Settings** window. Click the **Colour 1** radio-button and insert the value "12" in both the **Lower** and **Upper Colour Exansion** textboxes.

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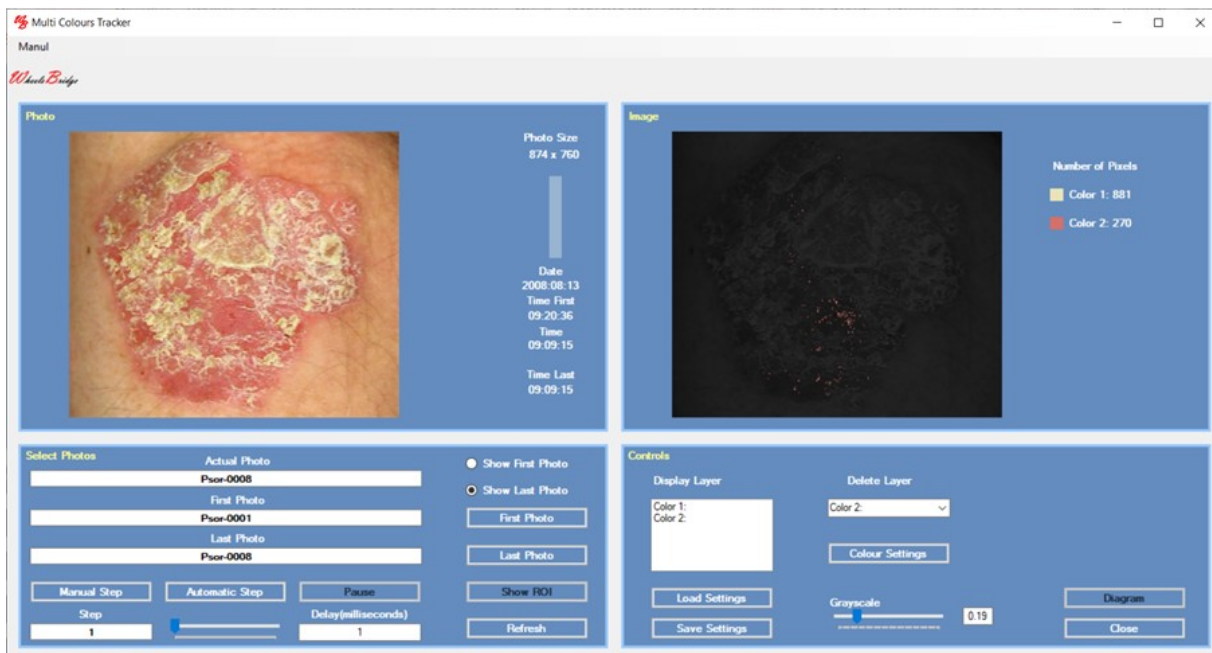


6. Close the **Colour Settings** window and drag the **Grayscale** slider to a lower value. The colours within the expanded colour space around the centre colour (the colour of the pixel pointed at in the photo) are now displayed in the image in the Image panel.



7. Click on a red spot in the photo to pick up this colour as centre colour of the next colour layer.

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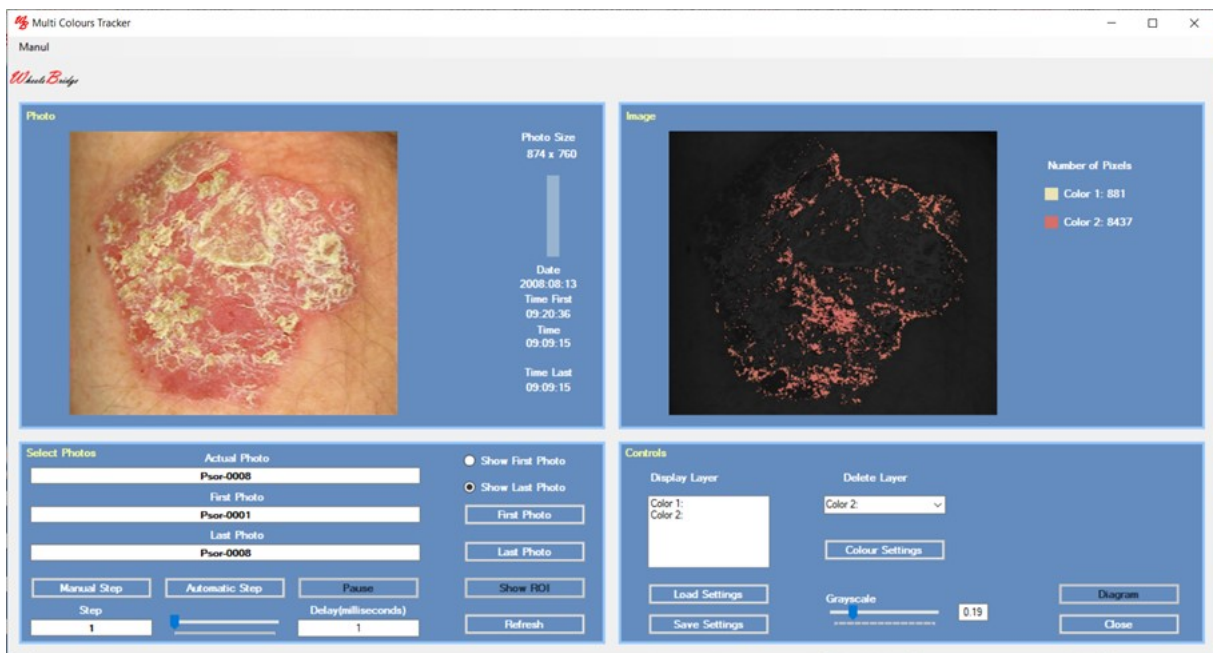


8. Click the **Colour Settings** button to open the **Colour Settings** window.

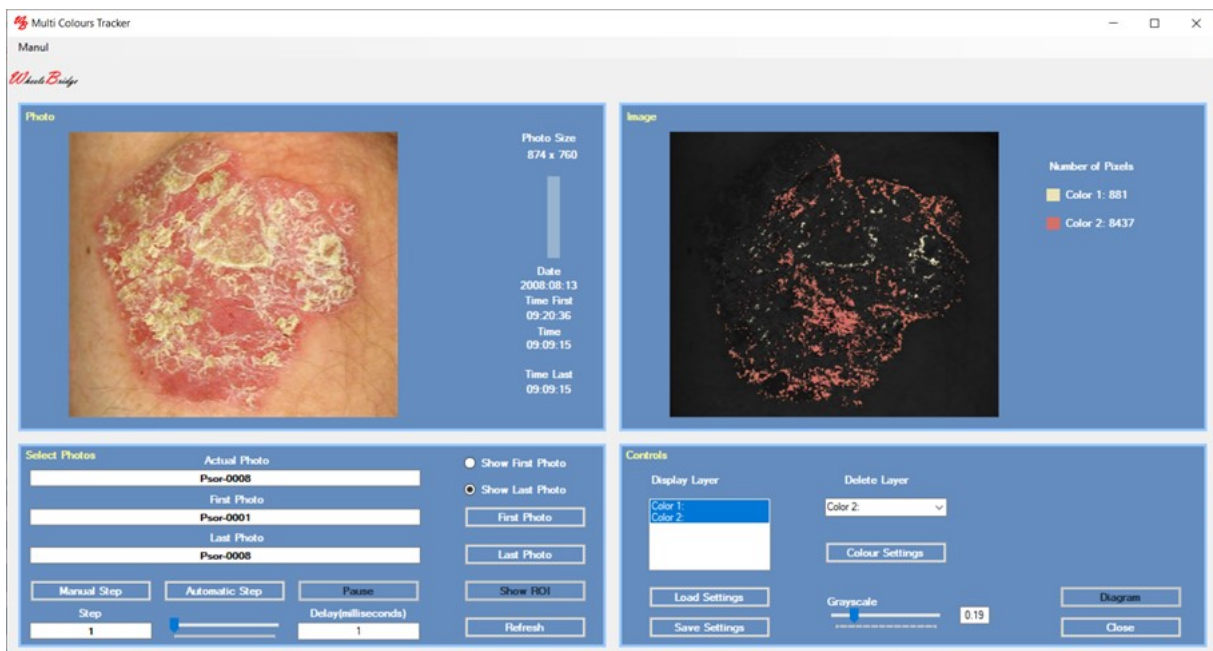


9. Select the **Color 2** radio-button and drag the **Lower** and **Upper Delta Colour Expansion** sliders to the right until the associated textboxes read “15”. Close this window. The main window should now look like:

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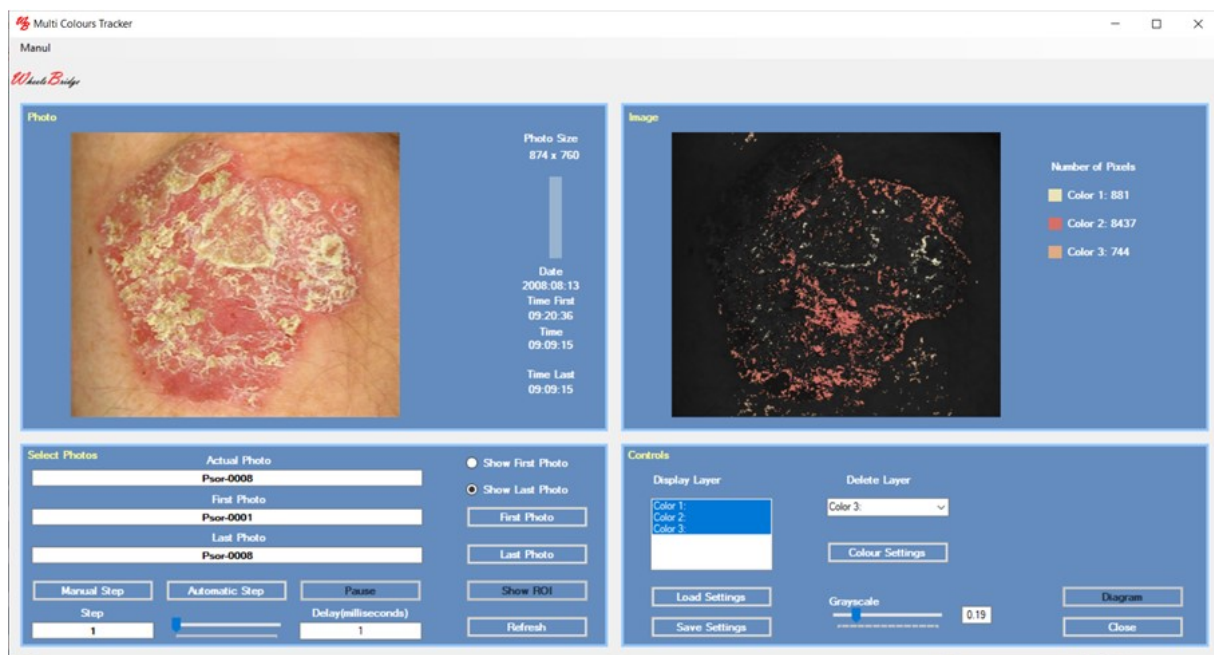


10. Check both **Color 1** and **Color 2** in the **Display Layer** textbox (by holding down the Ctr-key while selecting the two layers).

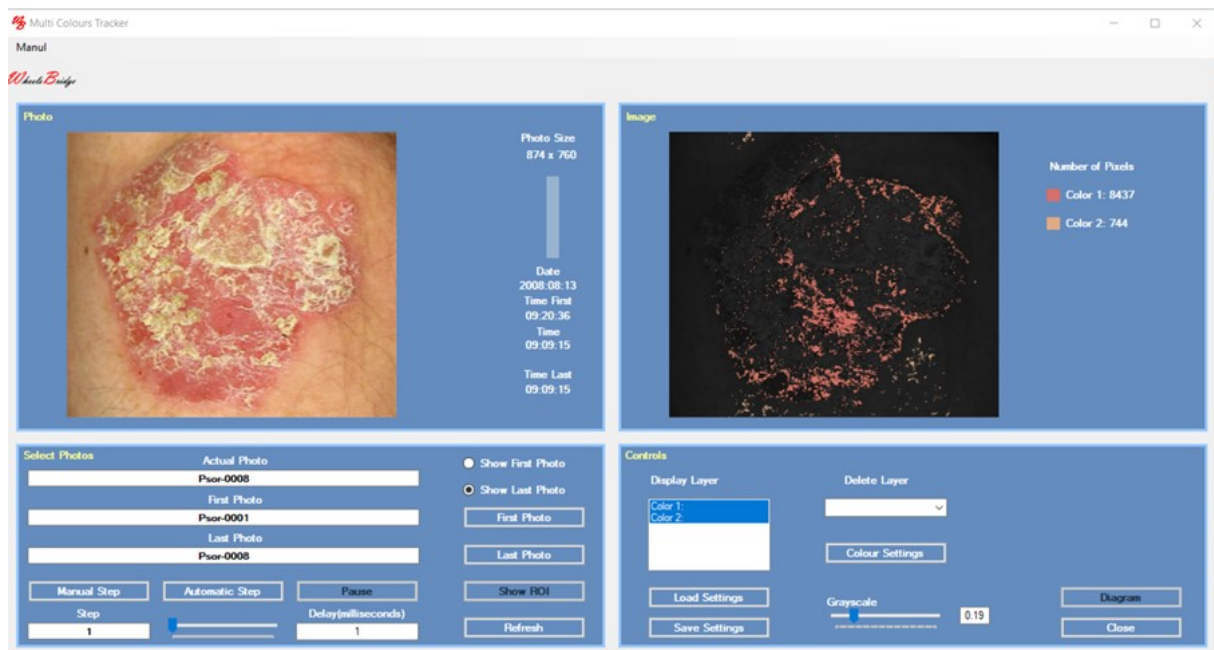


11. Insert yet another colour layer following the same procedure.

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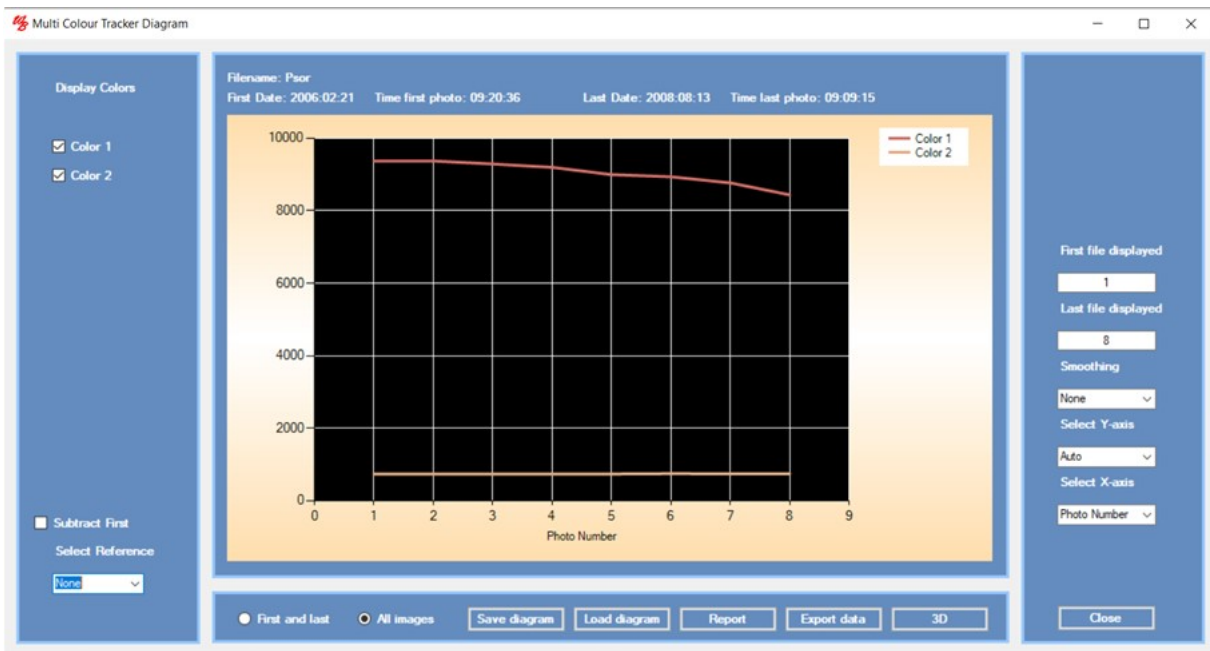


12. To delete **Layer 1**, select this layer in the **Delete Layer** combo-box. Check the remaining two layers in the Display Layers textbox to display these layers.



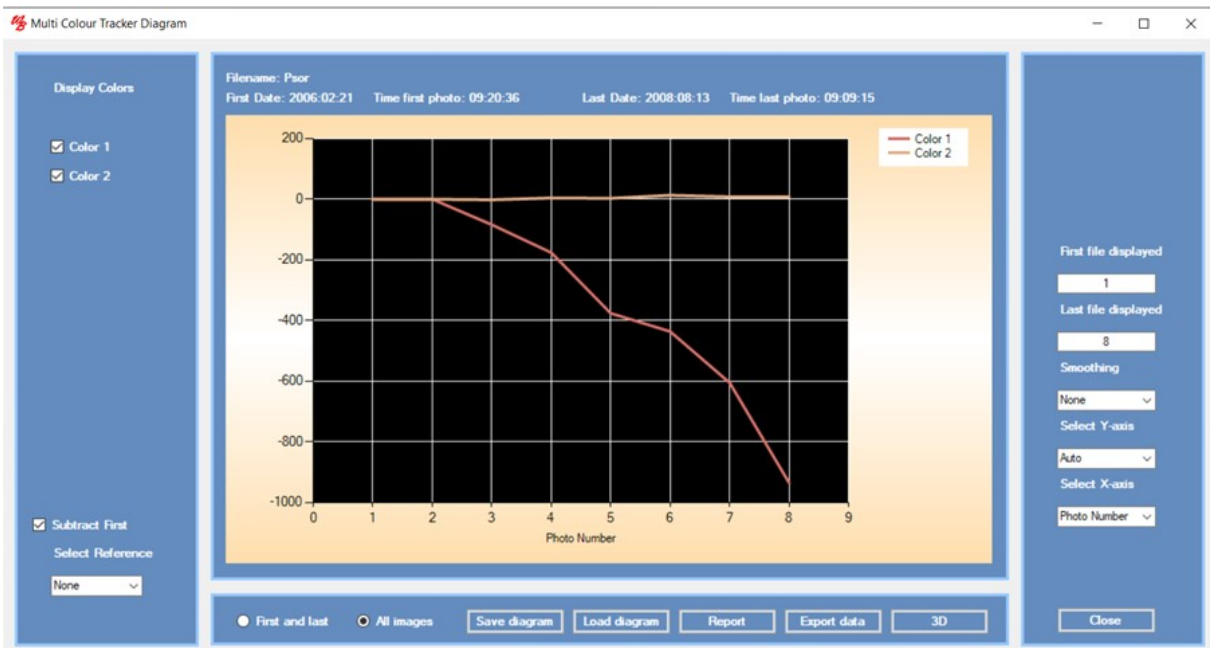
13. Click the **Automatic Step** button to scan through all the photos in the sequence. Then click the **Diagram** button to open the diagram window.

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14. This diagram displays the **Number of Pixels** within each colour space versus **Photo Number**.

15. Check the **Subtract First** checkbox to display just the deviations in pixels with the selected colour spaces from baseline.

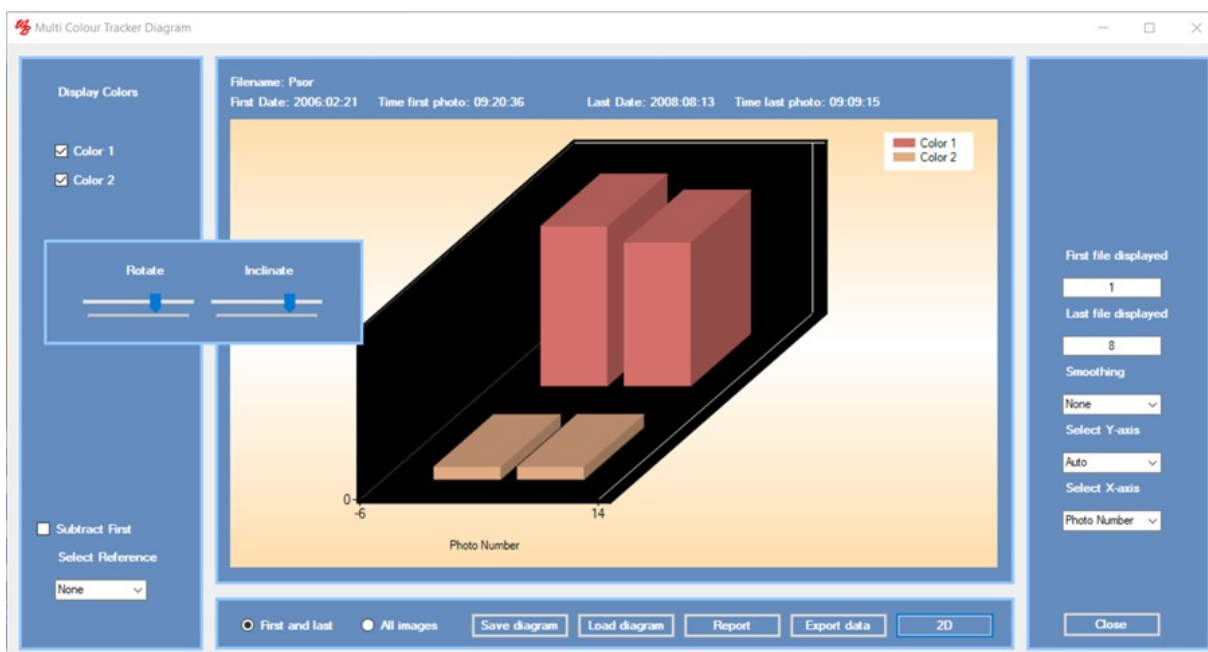


16. Uncheck the **Subtract First** checkbox and the check the **First and Last** radio-button.

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17. Click the 3D button to display the result as a 3D graph.



18. Move floating rotate / Incline window by pointing at it and move the mouse while keeping the left mouse button pressed. Drag the sliders to display the 3d graphs from different angles. Click the **2D** button to return to a 2D graph presentation. Click the **All Images** radio-button.

19. Click the **Report** button to generate a printable pdf report.

20. Click **Export Data** to export data to a spreadsheet.

21. This completes the **GETTING STARTED** section.

4. DETAILED DESCRIPTION

The TiVi201 Multi Colours Tracker window

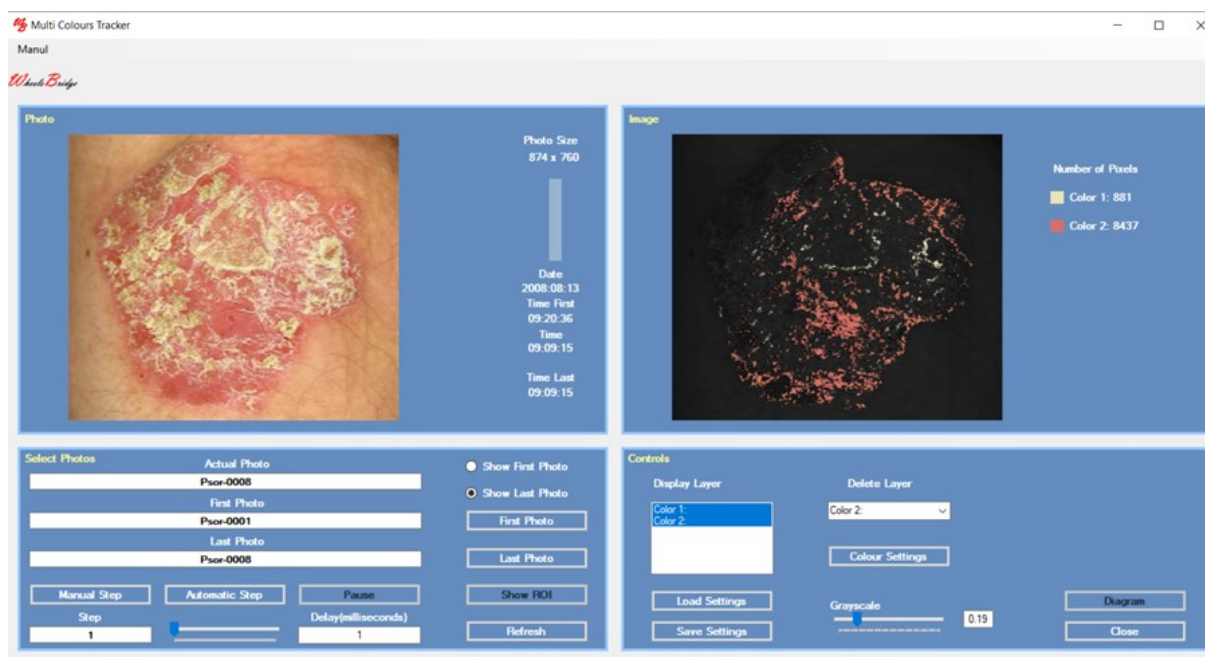


Photo Panel

1. **Photo size** – displays the size (in pixels) of the photo .
2. **Clicking in the photo** – placing the mouse pointer somewhere in the photo and clicking with the left mouse button at this point makes the system register the colour at the point and use this colour as the centre colour of the colour space displayed in the grayscale photo in the **Image panel**.
3. **Drawing a ROI in the photo** – use this option to draw a ROI in the photo. This ROI is used when the **Show ROI button** is clicked.
4. **The vertical bar** – to display the relative number of the photo displayed.
5. **Time & Date** – displays the time and date at which the displayed photo was captured

Image Panel

1. **Display photo** – displays a gray-scale photo with the selected layers superimposed.

2. **Colour Scale and Statistics** – displays the colour layers selected and the associated area (in pixels) covered by colours within the colour space of the actual layer.

Select Photos Panel

1. **Show First Photo button** – to display the first photo in a sequence.
2. **Show Last Photo button** – to display the last photo in a sequence.
3. **First Photo button** – to select the first photo to be displayed from file.
4. **Last Photo button** – to select the last photo to be displayed from file.
5. **Show ROI button** – click to display the ROI.
6. **Refresh button** – erases all colour layers and selected ROI coordinates.
7. **Step text box** – to select the step in the photo sequence to be displayed (default value = 1).
8. **Automatic Step button** – to step through the photos and generate the images.
9. **Pause button** – to temporarily halt the step through process .
10. **Actual Photo edit box** – displays the name of the actual photo. To select a specific photo in a sequence, insert its name and click the **Enter** button on the keyboard.
11. **First Photo edit box** – displays the name of the first photo in the sequence.
12. **Last Photo edit box** – displays the name of the last photo in the sequence.

Control Panel

1. **Display Layer textbox** – to display the layers generated.
2. **Delete Layer combobox** – to select the colour layer to be deleted.
3. **Load Settings** – to load parameters from disk.
4. **Save Settings** – to save parameters to disk.
5. **GrayScale slider** – to alter the grayscale of the background image.
6. **Grayscale textbox** - to alter the grayscale of the background image.

7. **Colour Settings button** – to open the **Colour Settings** window.
8. **Diagram button** – to open the *Diagram* window.
9. **Close** - to close this window.

Pull-down menus

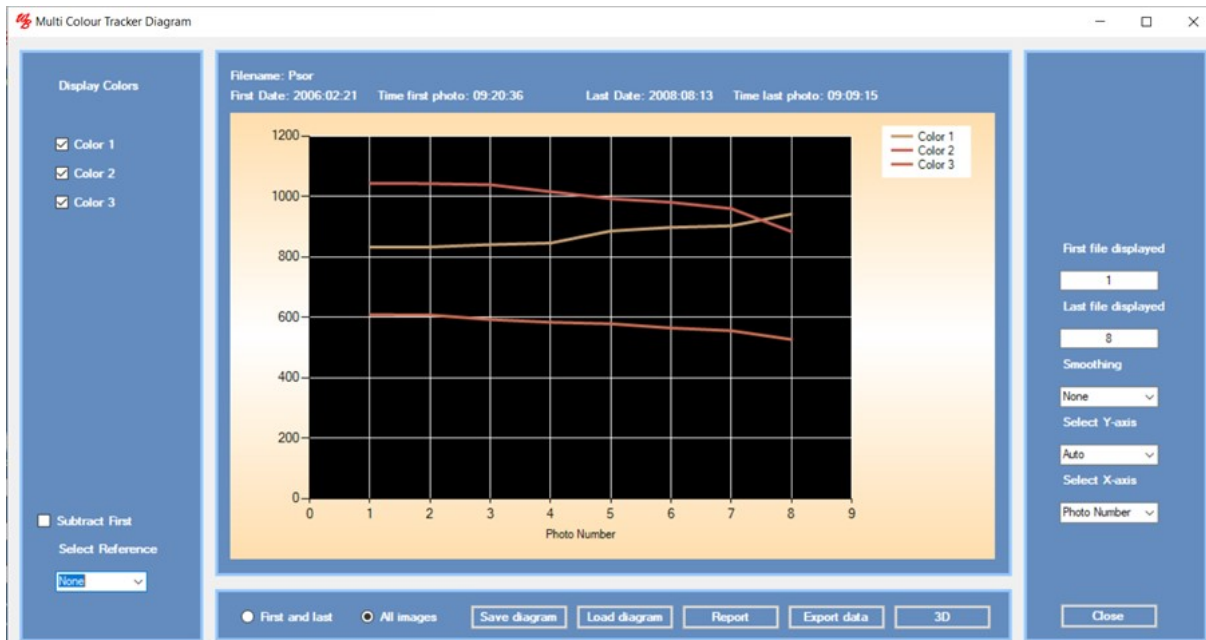
1. **Manual** – to open the on-line *TiVi201 Multi Colours Tracker* manual.
2. **About** – about the *TiVi201 Multi Colours Tracker* extension.

The TiVi201 Colour Settings window



1. This window can be moved by pointing at it with the left mouse button pressed and by dragging the mouse.
2. **Lower Delta Colour Expansion slider and textbox** - to set the colour space with colours below the centre colour selected by pointing at a pixel in the photo.
3. **Upper Delta Colour Expansion slider and textbox** - to set the colour space with colours above the centre colour selected by pointing at a pixel in the photo.
4. **Color X radio-button** – to select the color space to be expanded or reduced.
5. **Centre Colour** – displays the triplet centre colour.
6. **Lower Colour Expansion** – displays the lower boundary of the colour space.
7. **Upper Colour Expansion** – displays the upper boundary of the colour space.

The TiVi201 Diagram window



1. **Display Colours checkboxes** – check to display a selected colour trace.
2. **Subtract First checkbox** – check to display just deviations from baseline.
3. **Select Reference combobox** – to select reference curve subtracted from all other curves.
4. **First and last** – to display just the end-points of the curves.
5. **All Images** – to display the full curves.
6. **Save Diagram** – to save the current diagram to file.
7. **Load Diagram** – to load a diagram from file.
8. **Report** – to generate a printable pdf-report.
9. **Export Data** – to export data to a spreadsheet.
10. **3D button** – to present the curves as a 3D graph.

11. **First File displayed textbox** – insert the number of the first photo number to be displayed.
12. **Last File displayed textbox** – insert the number of the last photo number to be displayed.
13. **Smoothing combobox** – to smooth the curves to a Minor or Major degree.
14. **Select Y-axis** – to select the scale of the y axis.
15. **Select X-axis** – to select the scale of the x-axis as photonumber or elapsed time (in seconds).
16. **Close** – to close this window.