



Line Tracking Featureless Objects

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Abstract

This project showcases the ability of ProAnalyst to analyze fuel combustion in an engine. Combustion has no distinct features that can be tracked, however, we can use the unique **1-D Line Tool** to track the leading edge of a flame front that is expanding out from the center.

Topics Covered in This Tutorial

1. 1-D (Line) Tracking

Files Needed for This Tutorial

1. *flame.avi*

1•D (Line) Tracking

The **1•D Tracking** module is capable of detecting peaks or derivatives of intensity along a line. **1•D Tracking** is also able to detect points of transition that exceed a configurable threshold value for intensity or derivative of intensity. These transition points can then be used to calculate a best-fit circle. We will use this capability to track the leading edge of the flame front by analyzing the black-to-white threshold derivative along three lines, while a circle fit is used to estimate the radius of the flame front as it expands.

1. Create a new ProAnalyst project and add the *flame.avi* movie file.
2. Open the **Line Tracking** control panel by clicking the **1•D** icon on the **Analysis Modules/Tools** palette.
3. Click the **“Enable”** button. A track line will appear in the center of the video window (Figure 1).

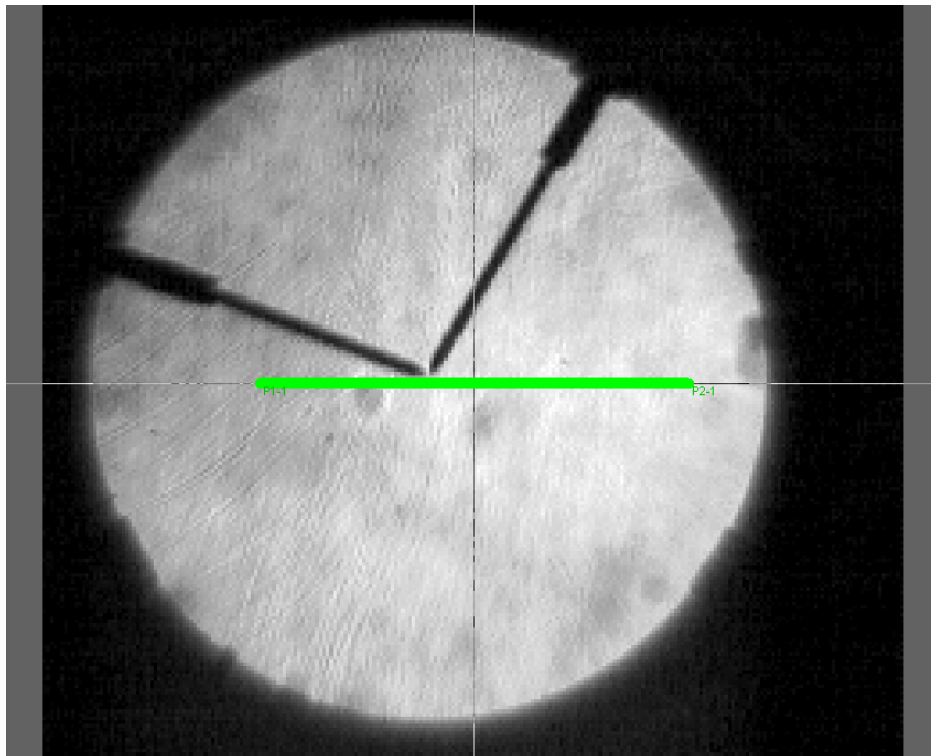


Figure 1

4. Click the **“Modify Line”** button.

5. Click and hold down the left mouse button over the position where you want the line to begin. Without releasing the button, drag the mouse along the video image to the position where you want the line to end. You should see the line redraw along the path you followed (Figure 2).

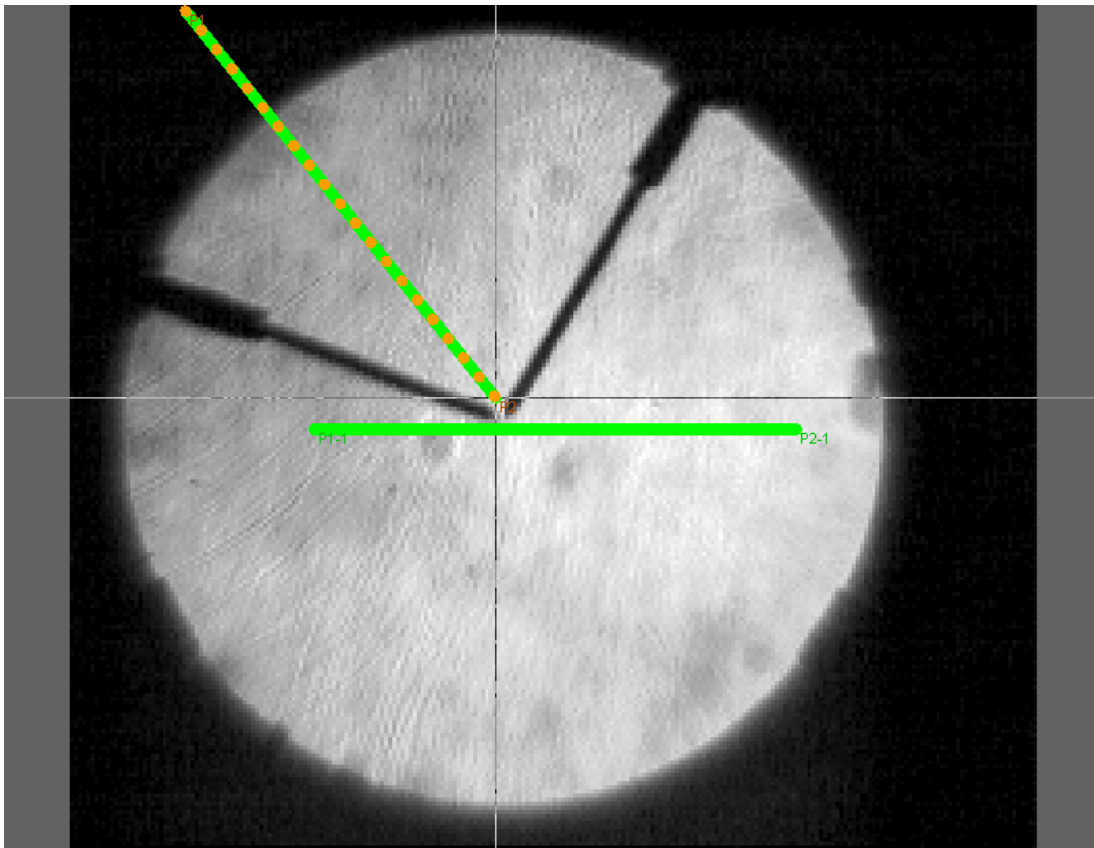


Figure 2

6. Release the mouse and click the **“Set Line”** button.

It is possible to modify only one end of a line while leaving the other end in place. To do this, click and hold down the left mouse button on the end point you wish to move, drag the mouse to the desired position, and release the button. Likewise, the line can be moved as a unit by clicking and dragging the center of the line to the desired position.

7. Additional lines can be placed by clicking the **“Add”** button. Add two more lines to the image and repeat steps 3-6 for each one. Your video image should resemble Figure 3.

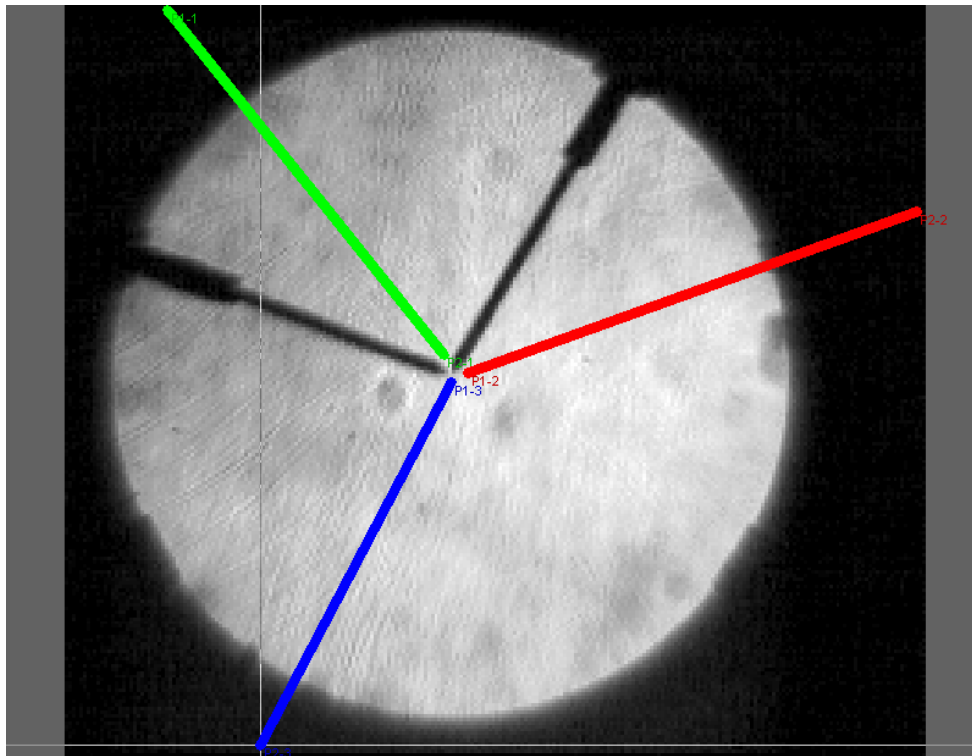


Figure 3

8. Click the **“Track Forward”** button to begin the line tracking.
9. As the video tracks forward, it will be obvious that the default settings for the line track are not adequate for the analysis and must be modified. Figure 4 shows frame 10 of the line track.

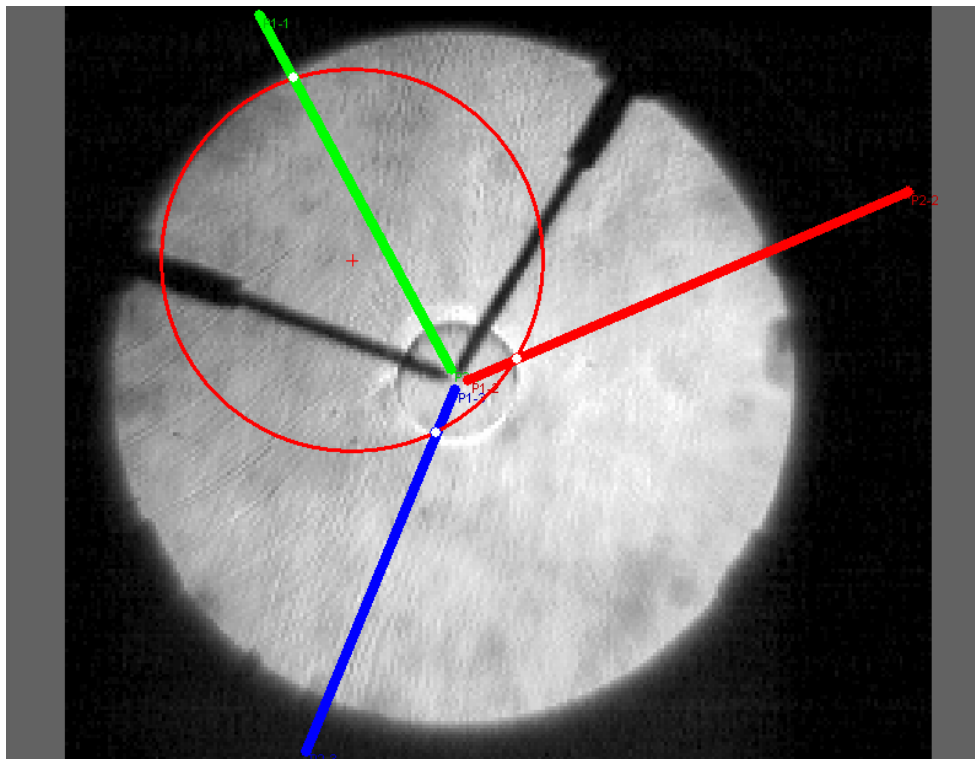


Figure 4

10. Click on Line 1 in the properties frame to make it active.

11. Click the  icon to open the Line Settings dialog.

12. Change the Transition Type from “Black to White” to “White to Black” by selecting it from the dropdown menu (Figure 5).

13. Click the Apply button, followed by the Close button.

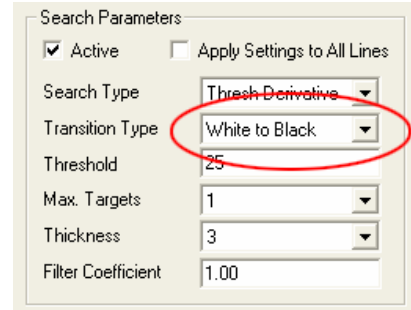


Figure 5

14. Repeat steps 11 – 14 for Line 2, but do not change the Transition Type option. Instead, set the Threshold value to “40”. Line 3 can remain with its default values.

15. Click the “Track Forward” button. You should now see a more accurate track of the flame leading edge. Figure 6 shows frame 30. Note how accurately the circle fits the radius of the expanding flame.

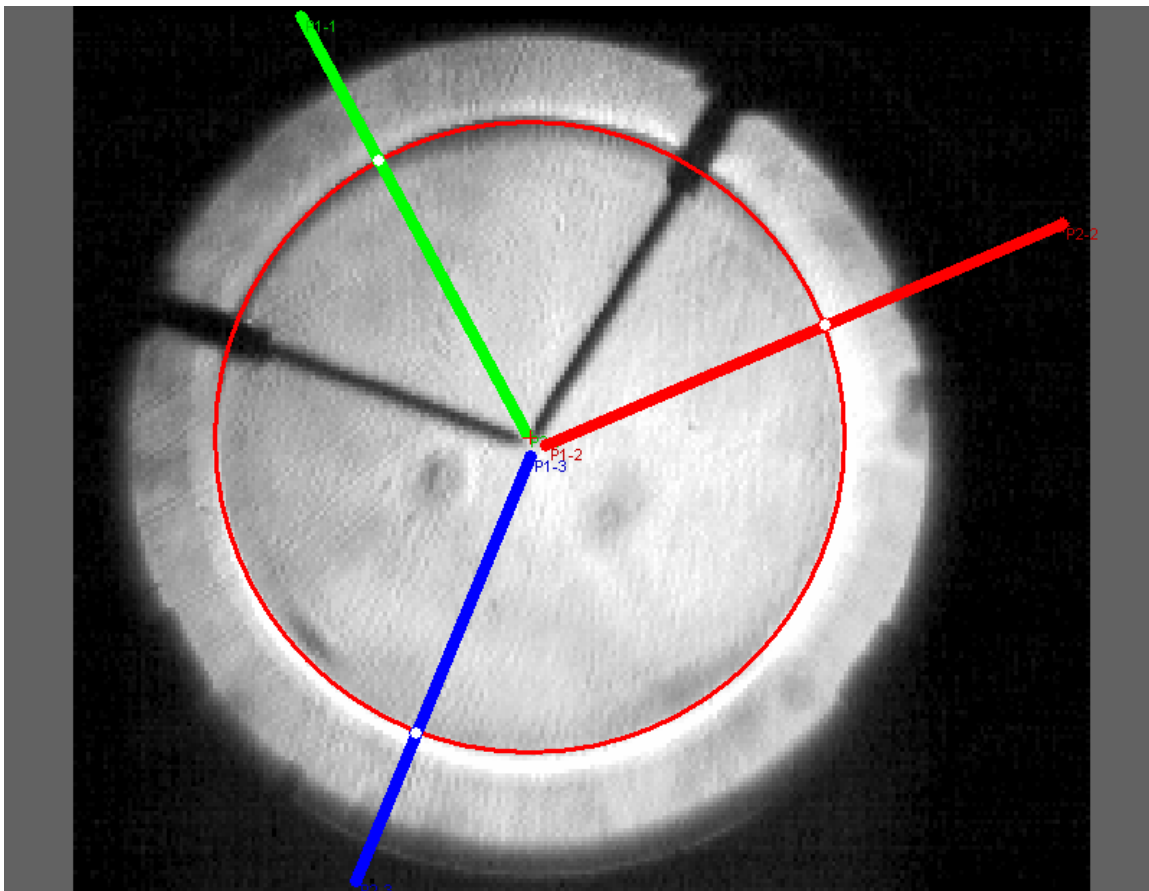


Figure 6