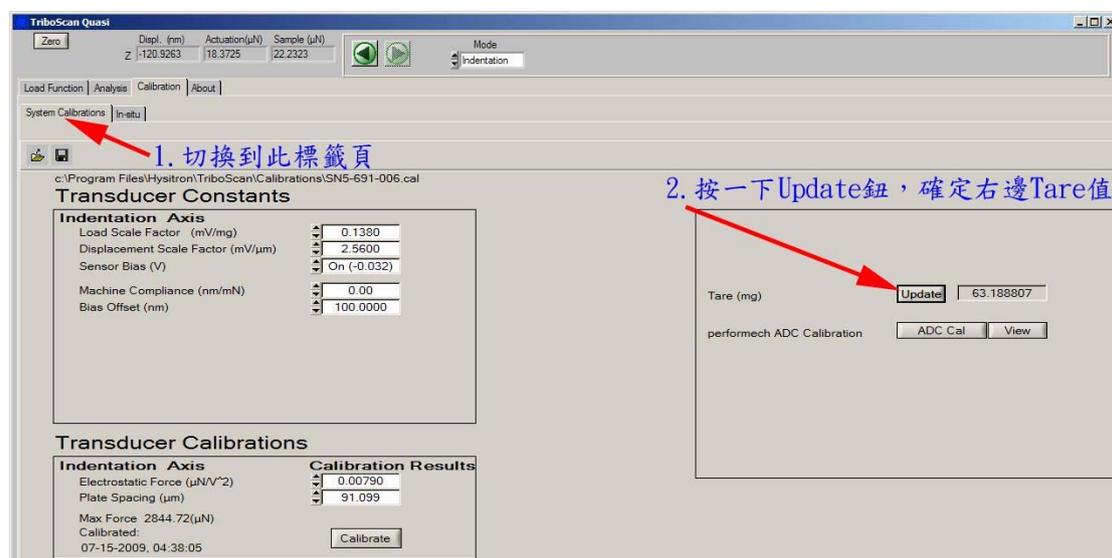
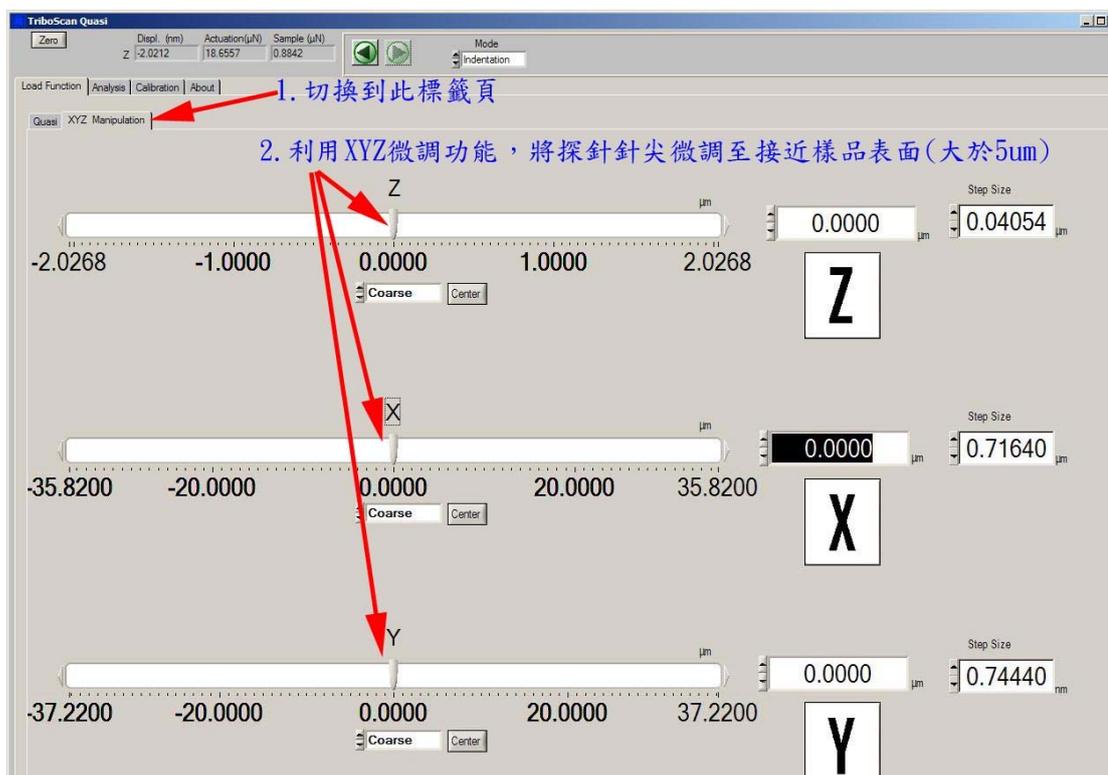


§ PicoIndenter 操作步驟

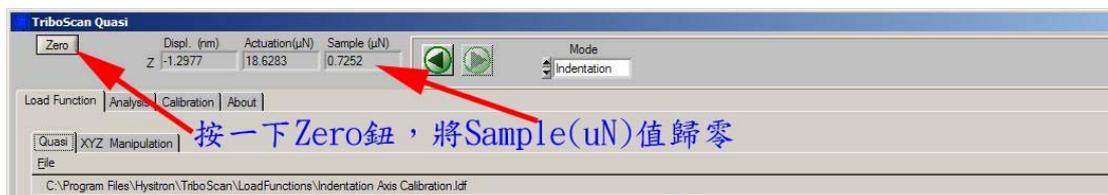
1. 開啟軟體後切換到 Calibration→System Calibration 標籤頁，然後按下 Tare(mg)右邊的 Update 鈕，此時 Update 鈕右邊的值會更新，可檢查一下此數值與出廠值是否接近，若相差太多表示 Transducer 可能有問題，或探針沒裝好。



2. 將軟體切換至 Load Function→XYZ Manipulation 標籤頁，再利用畫面中的 XYZ 微調功能，使探針針尖接近樣品表面(需大於 $5\mu\text{m}$)。(可先用 Pico Indenter 上之手動粗調旋鈕，先將探針調近至樣品表面再利用軟體之微調功能)。



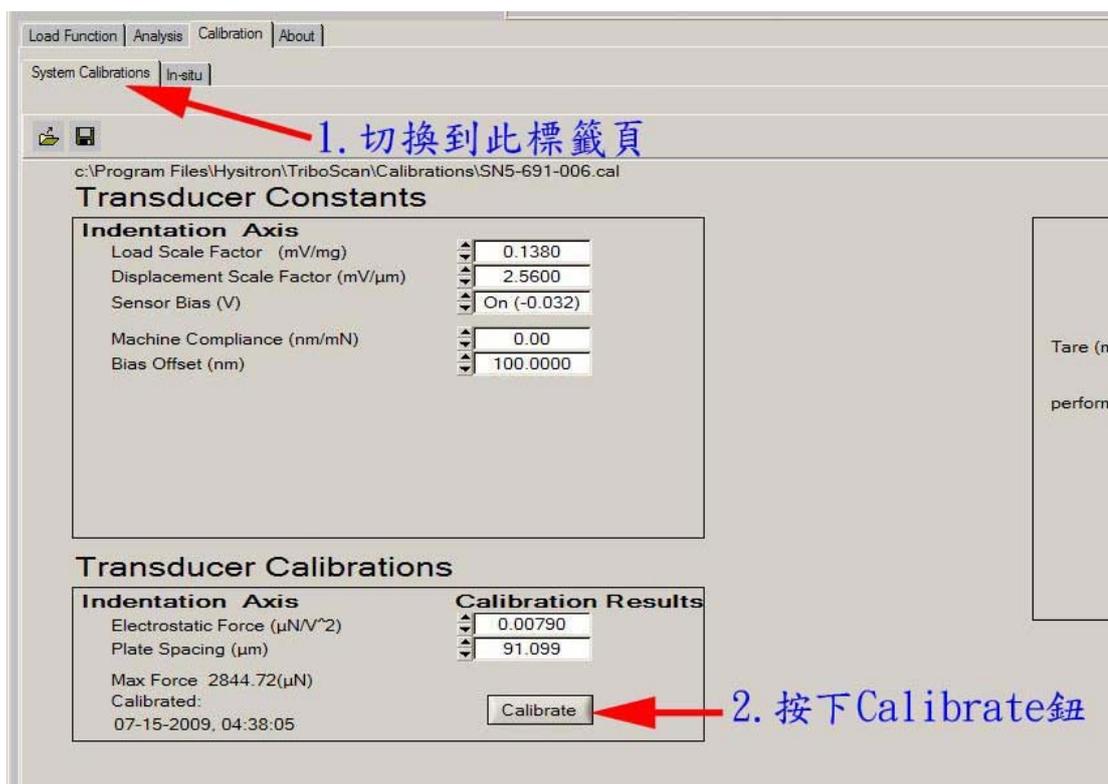
3. 按下畫面左上角之 Zero 鈕，使 Sample(μN)值大約接近 0(歸零後此數值約為零點多)。



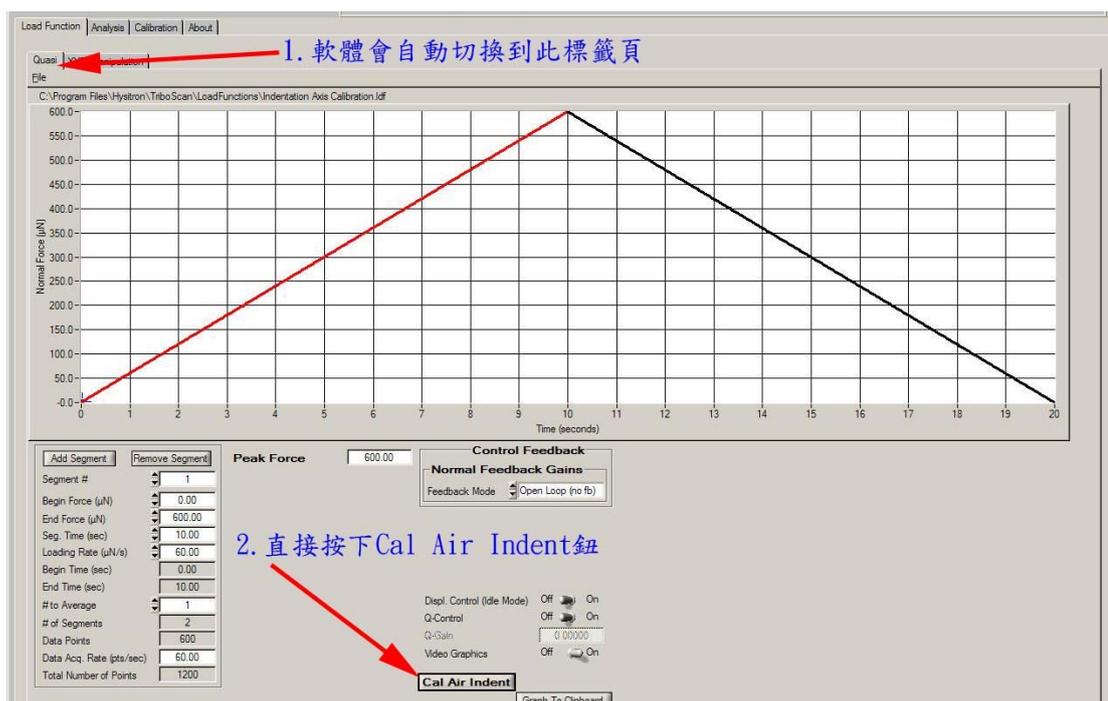
4. 按下 Zero 鈕後會出現下面畫面指示確認此時的探針是沒有接觸到樣品表面的，確定後按下 Yes 鈕。待上述歸零的動作完成後此 Sample(μN)的數值即可用來顯示探針接觸樣品的實際力量。



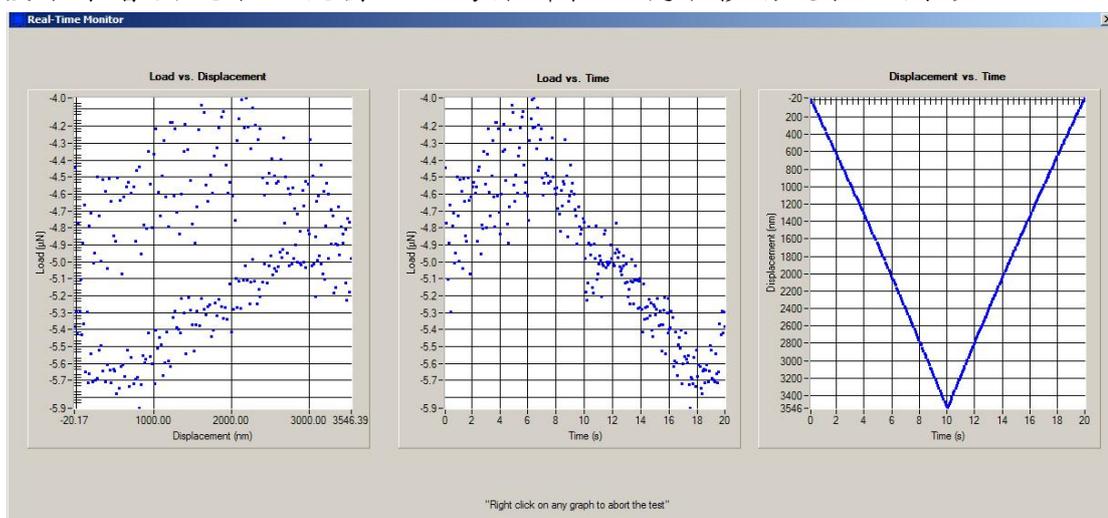
5. 接下來執行 Transducer 的校正。切換到 Calibration→System Calibrations 鈕，然後直接按下 Calibrate 鈕。



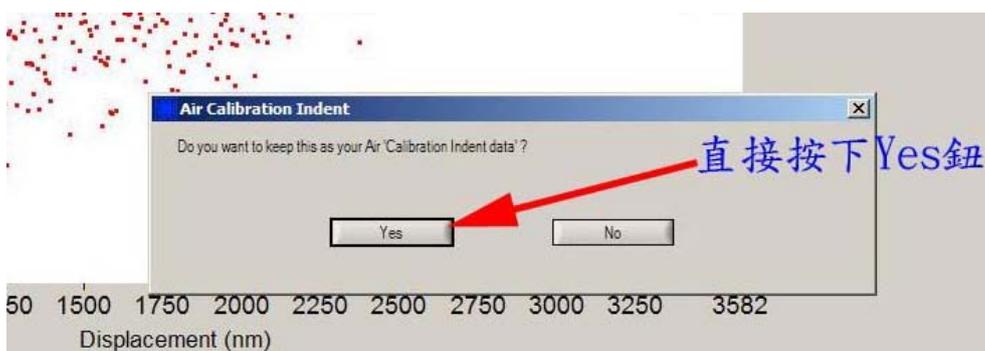
6. 此時軟體會自動切換到下面畫面，直接按下面的 Cal Air Indent 鈕。



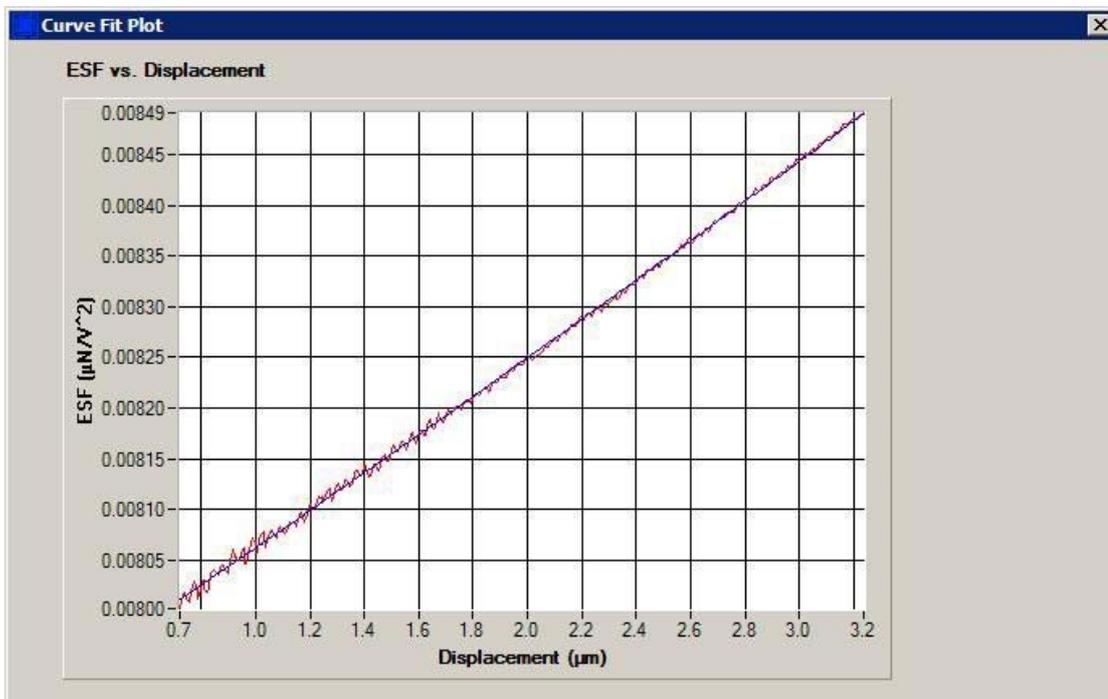
7. 接下來會出現下面視窗，此為探針在空氣中移動過程之圖形。



8. 接下來會出現下面視窗，直接按下 Yes 鈕。



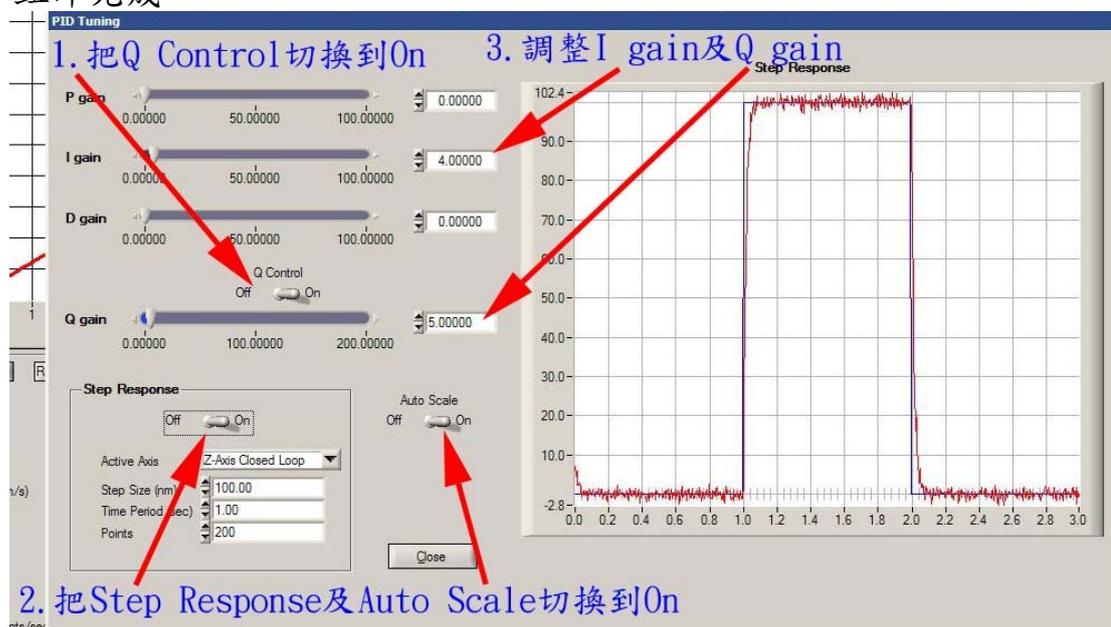
9. 出現下面視窗，由此可以看出 Transducer 在移動的過程是否正常（曲線上下抖動的程​​度代表雜訊大小），確認後將此視窗關閉。至此已完成 Transducer 的校正。



10. 接下來調整探針移動的靈敏度。將視窗切換到 Load Function → Quasi 標籤頁，按下 Tune Displ. PID 鈕。

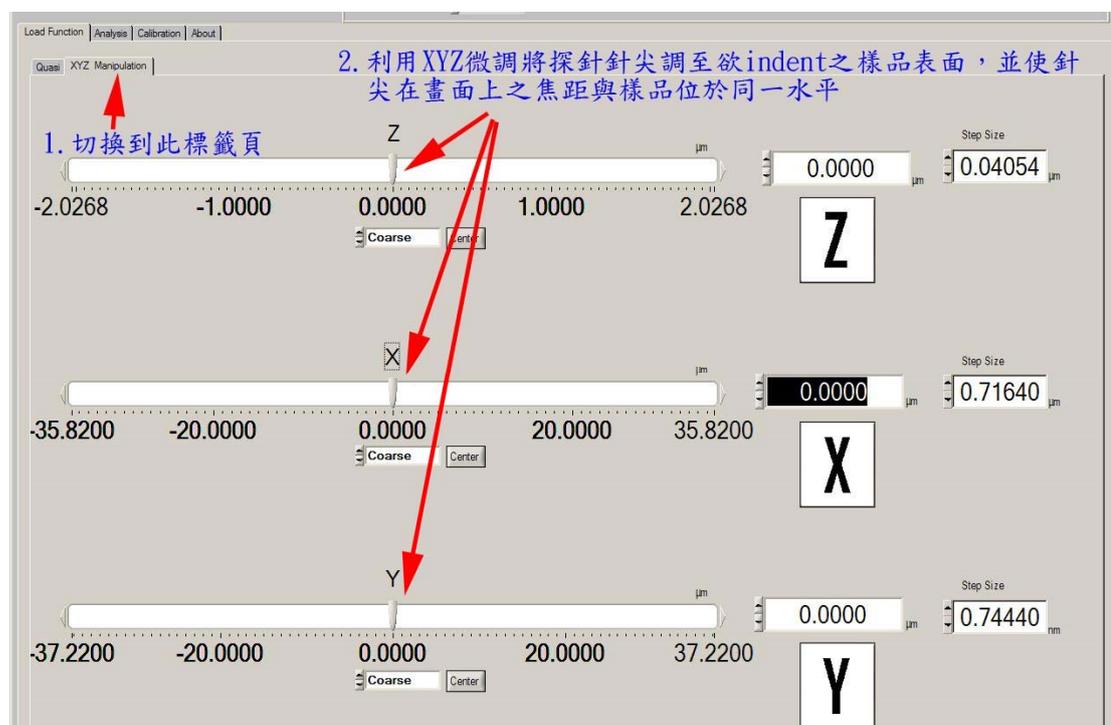
The figure shows the 'TriboScan Quasi' software interface. At the top, there are fields for 'Zero', 'Displ. (nm)', 'Actuation (μN)', and 'Sample (μN)', with values: Zero: z -523.8150, Displ. (nm): 18.6700, Actuation (μN): 95.0418. Below this is a 'Load Function' window with tabs for 'Quasi', 'Analysis', 'Calibration', and 'About'. The 'Quasi' tab is selected, and a red arrow points to it with the text '1. 切換到此標籤頁'. The main graph shows 'Displ (nm)' on the y-axis (ranging from -50.0 to 600.0) and 'Time (seconds)' on the x-axis (ranging from 0 to 20). The graph displays a red line that ramps up linearly from 0 to 600 nm at 10 seconds, then ramps down linearly back to 0 at 20 seconds. Below the graph is a 'Control Feedback' section with 'Normal Feedback Gains' (Proportional: 0.00000, Integral: 1.00000, Derivative: 0.00000, Adaptive: 0.00000) and checkboxes for 'Displ. Control (Idle Mode)', 'G-Control', and 'Video Graphics'. A red arrow points to the 'Tune Displ. PID' button with the text '2. 按下 Tune Displ. PID 鈕'. Other controls include 'Add Segment', 'Remove Segment', 'Peak Disp (nm): 600.00', and 'Perform Indent'.

- 11. 接下來會出現下面視窗，先把 Q Control 切換到 On，再把 Step Response 及 Auto Scale 切換到 On，然後調整 I gain 及 Q gain 值，使右邊紅色曲線接近藍色方波，且雜訊最小。完成後按下 Close 鈕即完成。



- 12. 至此步驟即完成所有的校正。接下來即可開始對樣品做 indent。

- 13. 將軟體切換到 Load Function → XYZ Manipulation 標籤頁，利用此處之 XYZ 微調將探針針尖調整至待 indent 的樣品表面，並且調整針尖之垂直位置，使針尖與樣品表面之焦距位於同一水平。



14. 切換到 Load function→Quasi 標籤頁，將 Feedback Mode 切換到 Displ. Control(位移控制)，再設定畫面中間探針要行走之行程及壓入深度，然後按下 Perform Indent 鈕，之後軟體會要求設定存檔路徑及檔名，即開始做 indent。

The screenshot displays the TriboScan Quasi software interface. At the top, there are status fields for Displ. (nm), Actuation (µN), and Sample (µN). The main window is titled 'Load Function' and contains a graph of Displ. (nm) vs. Time (seconds). The graph shows a red line increasing linearly from 0 to 600 nm over 10 seconds, followed by a black line decreasing linearly back to 0 nm over the next 10 seconds. Below the graph, there are several control panels:

- Segment # 1:** A table with parameters for the first segment, including Begin Disp (nm), End Disp (nm), Seg. Time (sec), Loading Rate (nm/s), Begin Time (sec), End Time (sec), # to Average, # of Segments, Data Points, Data Acq. Rate (pts/sec), and Total Number of Points.
- Peak Disp (nm):** A text box containing the value 600.00.
- Control Feedback:** A panel with 'Normal Feedback Gains' (Proportional, Integral, Derivative, Adaptive) and 'Feedback Mode' set to 'Displ. Control'. There are also checkboxes for 'Displ. Control (Idle Mode)', 'Control', 'G-Gain', and 'Video Graphics'.
- Buttons:** 'Perform Indent', 'Tune Displ. PID', and 'Graph To Clipboard'.

Four red arrows point to specific elements with blue text annotations:

1. 切換到此標籤頁 (Switch to this tab page) - points to the 'Quasi' tab.
2. 切換到 Displ. Control (Switch to Displ. Control) - points to the 'Displ. Control' radio button in the Feedback Mode section.
3. 設定好探針欲壓入樣品之行程及深度 (nm) (Set the travel and depth (nm) of the probe to be indented) - points to the 'Peak Disp (nm)' text box.
4. 按下 Perform Indent 鈕後會要求設定存檔路徑及檔名，即開始 indent (After clicking the Perform Indent button, you will be prompted to set the save path and filename, then start indent) - points to the 'Perform Indent' button.