Step-by-Step Workflow

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1. Launch SanjVIEW and Prepare for Imaging (Project Manager)

1. Launch SanjVIEW and Prepare for Imaging (Project Manager)

1. Launch SanjVIEW from the Windows Start screen shortcut.
2. Wait for the software license to be verified — the **Project Manager** window opens. [diagram/image in source — not reproduced here: Figure 1, Project Manager Window]
3. Place the device under test (DUT) on the probe station.
4. In Project Manager, confirm all system-status indicator lights are green (unless the NIR camera is unavailable — an unconnected/uncommunicating instrument shows a white/off indicator).
5. Select the desired illumination option and the Channel Number.
6. Focus the microscope. A live image of the DUT appears on the right side of the screen.
7. Check the **"Auto"** box under LED Brightness to let the software self-adjust image brightness for optimum results. This option is only available when using the Visible Camera for TR imaging.

> **Note:** When imaging with infrared light (IR), the Transient Thermoreflectance options are unavailable, and LED illumination is disabled for the duration of the IR session.

Supporting reference (Project Manager window):

- **Camera Selection** — switch between the turret-mounted IR camera and the Visible/Near-IR camera; the **F1** hotkey toggles between them.
- **Workspace Path Selection** — set via File > Options > Software; this path is passed to SanjVIEW's other modules to keep files organized.
- **Image Intensity Graphs** — shows average image intensity plus a histogram option; keep pixel values below saturation.

2. View Temperature Response in DC Mode

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1. While Project Manager is running, use the rectangle tool to draw a Region of Interest (ROI) on the sample in the image display window. (If no ROI is drawn, the entire image is averaged.) The approximate temperature for the ROI scrolls in the camera measurement window. [diagram/image in source — not reproduced here: Figure 2, Microsanj test sample in DC mode]
2. Using the **DUT Bias Controls**, select the desired output (device, TC-100 stage, or Relay) and set the output voltage while the camera acquires images. The TC-100 stage output is approximately 100 mA/V; the Relay output can be selected from its pulldown menu. [diagram/image in source — not reproduced here: Figure 3, DC mode with heater under bias conditions]
3. To read the thermocouple: select the **TC-100** tab and press **"TC-100 State"** on. This displays the TC-100 stage value, which can be used to set the IR camera gain accordingly.
4. Right-click the image window to directly save the acquired image and its color palette.

3. Acquire a Transient Thermoreflectance (TR) Measurement

3. Acquire a Transient Thermoreflectance (TR) Measurement

The Transient Thermoreflectance module acquires thermal imaging data for pulses between 50 µs and 5 ms; it is only available with the Visible Camera. Worked example (values as given in the source):

1. Turn off the **"Int Vo 20mA Range"** button in Project Manager.
2. Set the **"DUT Pulse"** control to the desired pulse width (500 µs in the source example).
3. Set **"Voltage to Device"** (6.0 V in the example) and select **"Update Values."**
   - Switch to "Thermal Imaging" mode.
   - Confirm the device is heating as expected for the 500 µs delay.
4. Set **"Image Delay(s)"** to 0 to initialize the delay to 0 µs. (A transient measurement can be started at any initial delay time.)
5. Go to **File > Setup Sweep**. [diagram/image in source — not reproduced here: Figure 6, Setup Sweep]
6. Enter **"Number Delay Images"** (51 in the example).
7. Enter **"Delay Steps(s)"** (10.0 µs in the example) — the software will take 51 images in 10 µs steps starting at 0 s (covering 0–500 µs).
8. Enter **"Ave time per frame(s)"** (5 s in the example) — the software averages for 5 s at each image.
9. Enter the **Base File Name** to save data under.
10. Select an ROI with the **"Draw ROI"** tool to monitor the temperature response of a region.
11. Press **"Start."** The software automatically steps through the thermal transient and shuts the device voltage off when finished; a thermal image is averaged and saved every 5 s in

this example (255 s total for 51 data points ≈ 4 minutes 15 seconds).

12. Once the measurement finishes, exit and open the saved data in **SanjANALYZER**.

The transient response of an ROI can be monitored live in the lower-left **"Region Mean Graph"** tab by selecting a region with the Draw ROI tool. In the source's worked example, a small 5 µm Gold heater responds very quickly, reaching thermal equilibrium within a few microseconds due to its small thermal mass.

Reference — Timing Control: DUT pulse width, LED width, and acquisition period are set in this column. Acquisition period should be longer than DUT pulse width, which should be longer than LED width. Click **"Update Timing"** after changing any of these values.

4. Obtain a Movie Mode Image

4. Obtain a Movie Mode Image

The Movie Mode module acquires thermal imaging data for pulses longer than 5 ms (quasi steady state); it is IR-only. [diagram/image in source — not reproduced here: Figure 7, Movie Mode Window]

Optional configuration (before running):

- Go to **Options > Software** and use the **"Movie Mode Length"** drop-down to set the averaging time window, 3–30 seconds. [diagram/image in source — not reproduced here: Figure 8, time-window control]

Worked example:

1. Connect the Device Under Test (DUT) to **Voltage Out** (the AUX Output is optional).
2. Select the biasing conditions for the DUT via the **"Device Control"** panel and click **"Update Values."**
3. While the image is averaging, use the ROI tool, the scale bars, and the Thermal Image Display tool to optimize the image.
4. Once the desired thermal image is achieved through averaging, save a data file for further analysis and output.

Reference: Voltage Out (Output 1) is the primary, camera-synced output always used for thermal imaging; Output 2 is a constant secondary source that can power other parts of the circuit. Neither output changes until **"Update Values"** is clicked.

5. Verify Calibration Using TCAT-100 in Pulsed Mode

5. Verify Calibration Using TCAT-100 in Pulsed Mode

To verify calibration coefficients obtained from the Calibration module:

1. Set up a test sample the same way as for a standard calibration run.
2. Launch the Pulsed Mode software and select the **TCAT-100** as the output device.
3. Select to read back the thermocouple. This lets the software simultaneously display the thermocouple signal alongside the Thermoreflectance or Infrared measurement data.
4. Compare results: the calibrated IR camera results should closely overlap the thermocouple results. [diagram/image in source — not reproduced here: Figure 13, pulsed-mode operation on the Microsanj test sample; Figure 14, final calibrated measurement in Pulsed Imaging mode]

> **Note:** The thermocouple used with the TCAT module has a response time of approximately 0.5 seconds, so it may be necessary to lengthen the time scale to view an accurate response.

6. Analyze a Transient Thermoreflectance Image in SanjANALYZER

6. Analyze a Transient Thermoreflectance Image in SanjANALYZER

SanjANALYZER opens `.fdi` (Low Frequency) or `.tti` (Transient) data files. Load a thermal image by double-clicking the file of interest in the file selection control; the CCD and thermal images then appear in the display windows.

Worked example — image series analysis:

1. Select the first image of the transient series.
2. Enter the **"number of images in the series"** (51 in the example).
3. Select an ROI box on the area of interest (on top of the 5 µm Gold heater in the source example).
4. Select **"Process Series."**

The software steps through the image series and plots the data in the **"ROI Mean Series"** graph, lower left. Right-click the y-axis to auto-scale the graph.

Reference: Under the **Cross-Section** tab, select the correct **"Objective"** used during imaging to get the correct pixel-to-distance scale before saving a cross-section (ASCII, tab-delimited).

7. SanjANALYZER Plus — Calibration Image and ΔT Measurement

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7.1 Open Calibration Image

1. Open the file where all test images are saved.
2. Open the Calibration Image file.
3. Click **"Correct XY"** to correct for thermal expansion.

7.2 Save Calibration Image

4. Click **"Save Images/Data."**
5. Change **Image Save Format** to **TTI**.
6. Click **"Save Image (Current VIEW)"** to capture an image.
7. If TTI is already selected, click **"Quick save"** instead.

7.3 Open Measurement (SS) Image

8. Click **"Open File."**
9. Select **"Refresh"** to update the file list with the corrected Calibration Image.
10. Open the Transient Image file (double-click).
11. Select **"Point by Point"** — the **"Load Cth Map"** window opens.
12. Select the corrected Calibration Image file from the file browser and click **"LOAD."**

> **Note:** Increasing the Alignment % value and decreasing the Vibration Filter improves alignment accuracy.

7.4 Measuring ΔT

13. Drag the ROI box across the length of the specimen with the rectangle tool to measure temperatures across that range. Up to 5 ROI boxes can be drawn to measure and compare temperatures at different locations on the specimen.
14. Select **"Thermal Cross-Section."**
15. Click **"Rectangular Profile"** to see the rectangular temperature profile within the ROI box.

In the source's example image, a **green** ROI box marks ΔT along the length of the specimen line, and a **yellow** ROI box marks the peak temperature. [diagram/image in source — not reproduced here]

Alignment accuracy vs. ΔT accuracy (this guidance appears twice in the source, under near-duplicate headings "2. Measuring ΔT" and "3. Measuring ΔT" — consolidated here):

- If an accurate ΔT is needed on smaller features, increase the Alignment % during calibration. This increases measurement time but yields more accurate, smoother results ("GOOD CAL" in the source's example figure).
- A lower-accuracy measurement shows red lines and unevenness in the image, caused by the device not being properly aligned and/or device movement ("BAD CAL" in the source's example figure). [diagram/image in source — not reproduced here]

8. Visible Camera Operating Modes (Reference Screens)

8. Visible Camera Operating Modes (Reference Screens)

Source section 9 walks through the same acquisition modules described above, screen-by-screen, using the Visible Camera. The source provides screenshots for each mode with little or no additional body text; each is noted here for completeness. [diagram/image in source — not reproduced here, for all items below]

1. **Single Image**
2. **Transient Thermoreflectance Series**
3. **Movie Mode** — acquires new transient thermal imaging (`.tti`) data from samples for pulses longer than 5 ms (quasi steady state).
4. **FA Mode** — simplified differential imaging for quick fault localization.
5. **SanjANALYZER** — perform advanced analysis on previously acquired data; opened via "Open SanjANALYZER."
6. **Calibration** — calculates the thermoreflectance coefficient (TR) or emissivity (IR) of specific surfaces on a device; accurate temperature readings require this calibration coefficient.
7. **Steady State** — creates transient thermal image files containing raw data for low-frequency thermal images.

9. Infrared (IR) Camera Workflow

9. Infrared (IR) Camera Workflow

9.1 System Status and Initial Setup

Open SanjVIEW v7.0 from the desktop, then center the sample in the Project Manager to focus on the desired device.

1. Ensure all indicator lights are green for the connected system.
2. Select the camera to use. Available cameras: **Infrared (IR)**, **Visible – Thermoreflectance (TR)**, **Near Infrared (NIR)**. (Press **F1** to switch between camera selections.)
3. Click the **"Temp Control"** tab; turn ON/OFF and view readings for Stage, Thermal Coupler (TC), and ROI. Set **Set Point** to 75, then click **"Stage State"** to turn on the stage.
4. Click the **"Auto Focus"** tab (Piezo system control) and select the objective magnification (5X in the source example).
5. Click **"Enable Motion"** ON and click **"Center Stage"** ON to center the Piezo controller. (The microscope may need refocusing after centering the stage.)
6. Click the file browser icon, choose the folder to save your file to, then click **"Current Folder."**
7. Select the desired imaging operation.

> **Note:** Transient Thermoreflectance is not available when using an INFRARED camera.

9.2 Steady State Measurement

In the main Project Manager, select **"Steady State"** to open a new window.

Hardware:

1. Enter the desired **Base Temp (C)** — 75 in the example — and click **"SET"** next to Set Base Temp.
2. Turn **Stage State** "ON."
3. Set **"Vo ON Voltage"** to 7V.

Timing/Illumination: 4. Set **Device On Time** to 10. 5. Set **Image Averages (#cycle)** to 10.

3D Alignment — Focus ROI: 6. Select a region on the CCD image with the rectangle tool. Choose a unique feature on the sample, such as edges or scratch marks. 7. Press **"Focus ROI"** to set the selected region as the ROI. 8. Wait a few seconds until the region is focused and the Focus ROI light turns green. (The selected ROI region displays in green. Use the magnifying glass with Shift held to zoom out, Shift+Click to zoom in.) 9. Confirm **"Enable 3D NanoAlign"** is checked; check it if not.

3D Alignment — Capture Reference: 10. After selecting the ROI and waiting for focus, press **"Capture Reference"** to set the selected region as the reference region. 11. Wait for the **"Capture Ref"** light to turn green — **"Enable Digital Anti-vibration"** turns on automatically. 12. Set initial values for Focus Tolerance, Alignment %, and Vibration Filter; the lights turn green when the image is in range. (Increasing Alignment % and decreasing Vibration Filter improves alignment accuracy. Alternatively, load a prior reference for easier alignment.)

Start Measurement: 13. Click **"START Measurement"** to begin. 14. The System Status bar shows progress and displays "Turn OFF" after each cycle, with the cycle count under **"Loop Iterations."** (For TR, 9–11 Loop Iterations is sufficient.) 15. Under **Save Path**, verify the directory and Save Path name are correct. 16. Click the **"Save Every Cycle"** box; click **"Save Data"** when ready to save. (Save the image before stopping the measurement.) 17. Click **"STOP MEASUREMENT"** to stop. 18. Click **"Return to Project Manager,"** or click **File > Quit**, to exit the current measurement.

9.3 Calibration Measurement

In the main Project Manager, select **"Calibration"** to open a new window.

Hardware:

1. Set **"Magnification"** to match the objective (5x in the example).
2. Set **"High Temp"** to 120 C and **"Base Temp"** to 75 C.
3. Turn **"Stage State"** ON.

4. Click **"Set Low Temp"** to initialize the chuck temperature to the base temperature.
5. Click **"Use Chuck Sensor"** to use the embedded chuck thermal sensor for calibration, or leave it off to use an external thermal probe.

Timing/Illumination: 6. Set **Stage Heating Time** to 40. 7. Set **Image Averages** to 50.

3D Alignment — Focus ROI: 8. Select a region on the CCD image with the rectangle tool (a unique feature such as edges or scratch marks). 9. Press **"Focus ROI."** 10. Wait a few seconds until the region is focused and the Focus ROI light turns green. 11. Confirm **"Enable 3D Nano Align"** is checked; check it if not.

3D Alignment — Capture Reference: 12. Press **"Capture Reference"** to set the selected region as the reference region. 13. Wait for the **"Capture Ref"** light to turn green — **"Enable Digital Anti-vibration"** turns on automatically. 14. Set initial Focus Tolerance, Alignment %, and Vibration Filter values; lights turn green when the image is in range.

> **Notes:** (1) Increasing Alignment % and decreasing Vibration Filter improves alignment accuracy. (2) As an alternative to Focus ROI/Capture Reference, load a prior reference: click **"Load Reference,"** select the saved file, and wait until the "Load Reference" light turns green.

Start Measurement: 15. Click **"START Measurement"** to begin. 16. The calibration cycles through; the System Status bar shows progress and displays "Calibration Done" after each cycle, with the cycle count under "Loop Iterations." 17. Select a region on Thermal Image View to view the Calibration Factor of the sample while the measurement runs (shown in the "Mean CTR" bar). 18. Under Save Path, verify the directory/name are correct (example in source: `C:\Data\Qualification\Training`). 19. Under Save Image, click **"Save Every Cycle"**; click **"Save Data"** when ready. (Save the image before stopping the measurement.) 20. Click **"STOP MEASUREMENT,"** then **"Return to Project Manager,"** or click **File > Quit**, to exit the current measurement.

9.4 Failure Analysis (FA) Mode

Frame Rate Selection:

1. In Project Manager, change **"Cam Selection (F1)"** to **"INFRARED."**
2. Uncheck the **"INT Vo 20mA Range"** box (green = checked, grey = unchecked).
3. Click **File > Options** to open a new window.
4. Go to the **"Software"** tab; set **"FA Mode Pulse Width"** to **Long (15 Frames)**.
5. Return to the main Project Manager and click **"FA Mode"** to open the FA Mode window.

Process (confirms the device is biased and has current flowing before using Movie Mode): 6. Go to the **"Biasing"** tab. 7. Change **Vo(V)** to 7.000. 8. Click **"Update Values"** to apply the voltage. 9. Check that **"Peak Voltage (V)"** and **"Peak Current (I)"** show values near 7V and 70mA for device 2 (Center Diode).

> **Note:** If the current is much lower than expected, return to Project Manager and confirm **"INT VO 20mA Range"** is unchecked.

Save Data: 10. **File > Save Data.** 11. Click the File Browser, select the folder to save data in, and click **"Current Folder."** (Source example path: `C:\Data\Qualification\Training`.) 12. Enter the desired file name (source example: "FA-file"). 13. Click **"Save"** to save the data. 14. Click **"Return"** to exit the Save Microsanj Data pop-up window.

> **Note:** Remember to change the "Microsanj Data Save Path" before saving a new data set, to avoid overwriting previous data.

9.5 Movie Mode

In the main Project Manager, select **"Movie Mode"** to open a new window.

Control Settings:

1. Set **"Voltage to Device (V)"** to 7V.
2. Click **"Update V"** to apply the voltage.
3. Set the **"DUT Pulse (s)"** (1 s in the example); click **"Update Timing."**
4. Confirm **"Save Whole Series"** is on (default); click it if not selected.
5. Click the **"File Path"** icon, or type the desired path, and select a name.
6. Click **"Start Movie"** on **"Movie Mode Acquisition."**
7. Click **"Save Image."**

> **Note:** Movie Mode saves a series of 105 files per cycle when "Save Image" is clicked.

9.6 SanjANALYZER — Process Data

System Status:

1. Confirm the Camera is set to **INFRARED.**
2. Click **"SanjANALYZER"** to open the "SanjVIEW Image Analyzer" window.

Process Data: 3. Select the **"Calibration"** tab. 4. Select **"Point to Point"** under the **"Method"** drop-down (a "Load CTR Map" window appears). 5. Click the Browse icon and select the calibration image. 6. Click **"LOAD"** to overlay the calibration image onto the selected test image. 7. In the file window (top left), click the Browse icon and double-click the file to analyze. (If the file isn't listed, click **"UP Dir"** to update the directory.) 8. Drag the ROI box across the length of the specimen with the rectangle tool to measure temperatures in that range. Up to 5 ROI boxes can be drawn to measure and compare temperatures at different locations — hold **Ctrl** while selecting. 9. Adjust the temperature scale and image-averaging factors as desired (optional). 10. Select the **"Settings"** tab, choose a file save path via the Browse icon, and save the processed image by clicking **"Save Image Current View."** 11. To process a series of images, enter the number of files into **"Number of Images in Series"** and click **"Process Series."** The ROI Mean graph plots the mean temperature of the selected ROIs over time.

> **Note:** Export the graph data to a table via right-click on the graph → Export → Export Data to Clipboard.

10. Device Biasing, Trigger Function, and Timing Reference

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SanjCONTROLLER PLUS™ I/O (for TR imaging):

Label	Description
A. VI EXT	Input for fixed DC voltage up to +60V
B. VO EXT	Pulsed output of DC voltage input to VI EXT
C. AUX INT	Up to ±10V DC for secondary DUT bias
D. VO INT	Up to ±10V pulse for DUT pulsed bias
E. TRIG	Internal mode output; 5V TTL pulse to sync an external DUT bias supply

[diagram/image in source — not reproduced here: SanjCONTROLLER PLUS diagram for TR imaging]

The remaining topics in this source chapter are presented only as diagrams/screenshots, with no accompanying procedural text: Relation to Timing Sequence for Transient Analysis; Internal Biasing; External DC Supply; Triggering an External Source; Slave Mode (TRIG IN) in Movie Mode only; Transient Timing Signal; Transient Software with Light Emission. [diagram/image in source — not reproduced here, for all of the above]