Diamond Image Tracking App Tutorial

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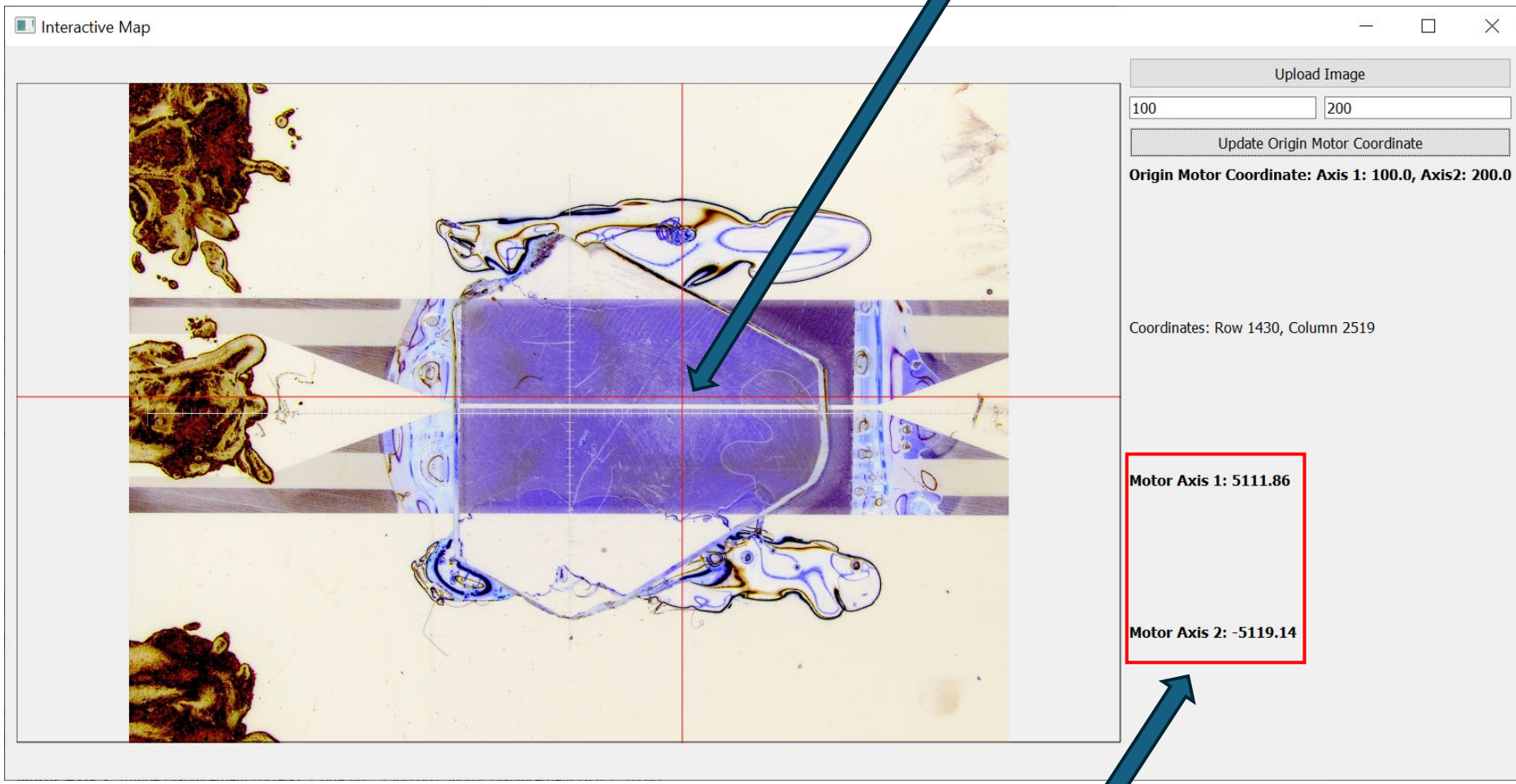
Example use

- The diamond tracking app allows you to click anywhere on an image of the whole diamond/hBN sample and tell you how much to move the piezo stages

1. Select a location on the diamond



2. Tells you what motor/piezo values you should set to to go there in the white light/confocal image

Prerequisite

Equipment:

- An optical microscope capable of capturing a full-sample image.
- A 2D movable sample stage with precise control in two perpendicular directions (e.g., piezo stack or motorized stage with positional feedback).

Images:

- A **full-sample image** taken under the optical microscope, showing an overview of the sample.
- The ability to take one or both of the following highly zoomed-in images:
  - **White light image**: Captured using the microscope at a high magnification.
  - **Confocal scanned image**: Acquired via a confocal scanning setup.

Image Setup

1. Capture the Full-Sample Image:

- **Position the Sample**: Place the sample under the optical microscope and ensure it is properly aligned and stable.
- **Acquire the Full-Sample Image**: Capture a clear and well-focused image of the entire sample using the optical microscope. Make sure key features of interest are visible in the image.
- **Define an Origin Feature**:
  - Identify a distinct and recognizable feature in the full-sample image to serve as the **origin feature**.
  - Ensure this feature is clearly visible in both the full-sample image and the zoomed-in white light/confocal image.
  - Ideally, this origin feature should allow you to consistently define a coordinate system, including an origin point and two perpendicular axes, for precise navigation

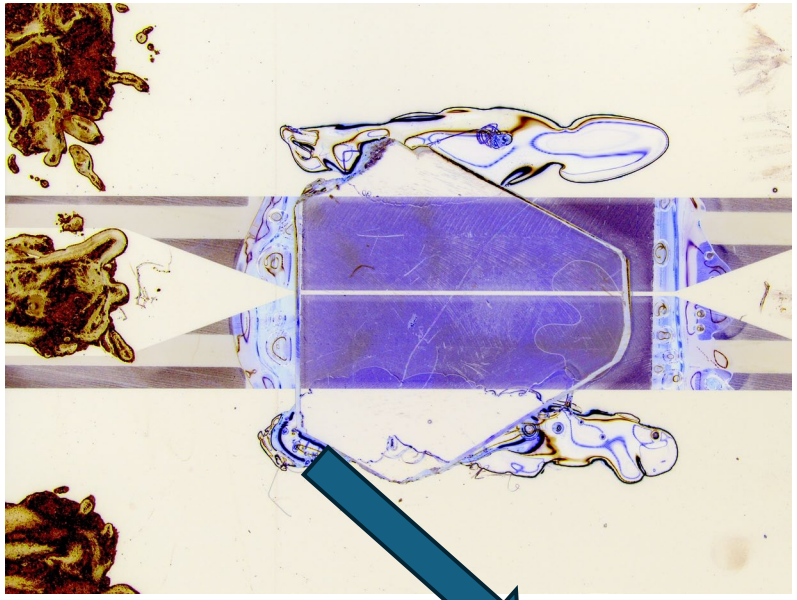


Fig. 1. Microscope image of a diamond (False color)

Fig. 3. Same feature under white light

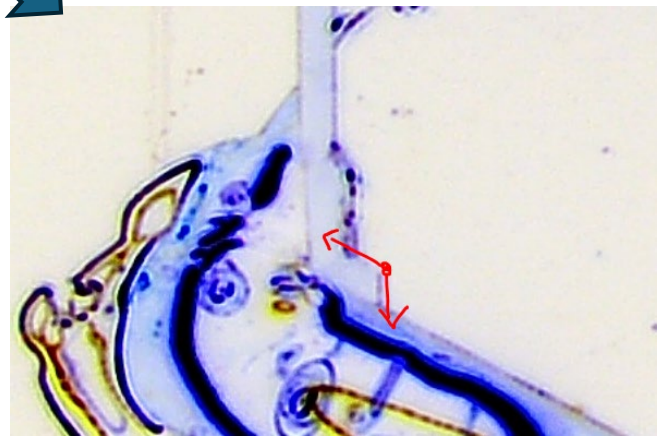


Fig. 2. Zoomed into Fig. 1, identify a distinct feature (a cut) as the origin and two axis.

Image Setup (CONTINUED)

2. Capture the Zoomed-In Image(s):

1. Using a higher magnification, acquire either a white light image or a confocal scanned image of a small region of the sample. You need to take the following three images

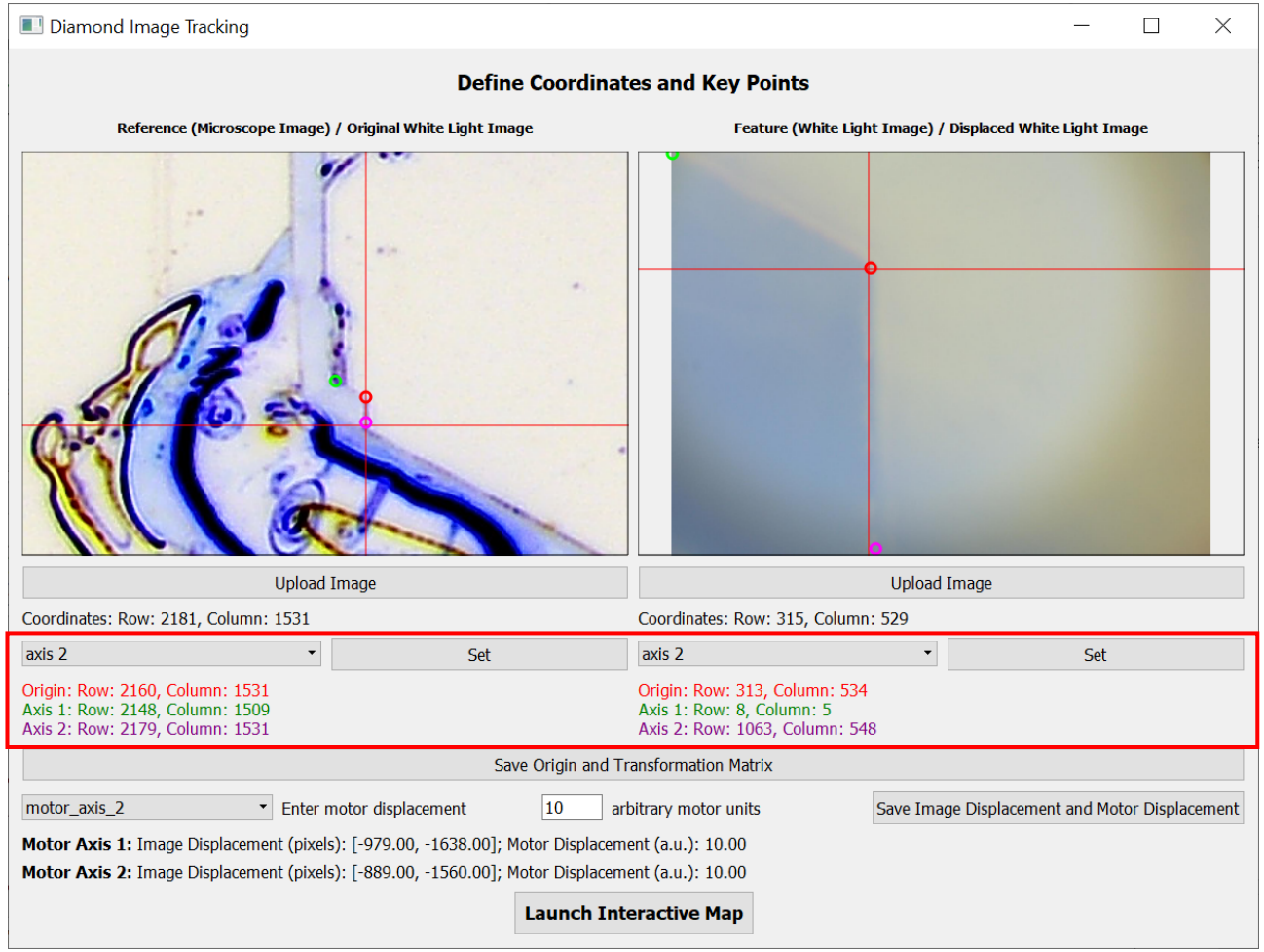
Fig. 1. Initial position (call it **motor original position image**) (record the motor readings for future use)

Fig. 2. motor/piezo stack moved along axis 1 for -20 microns (call it **motor axis 1 displaced image)**

Fig. 3. motor/piezo stack moved along axis 2 for -20 microns (call it **motor axis 2 displaced image**)

Calculate Transformation Matrix

- In the APP, upload the microscope image to the **left** panel, the motor origin position image to the **right** panel
- Using left mouse button to select a location, right mouse button to drag, and wheel to zoom, find the origin feature in both the left and the right images
- In each image, click on the location where you want to set as origin, axis 1, and axis 2. Choose in the dropdown menu in the red box, and click set. Once set, the location you selected will have a circle of the respective color
- Click save origin and transformation matrix button to record the 2X2 matrix mapping from the coordinate system in the left image to the right image.



Calculate Displacement Vectors

- Reupload the **motor origin position** image to the left panel, the **motor axis 1 displaced** image to the right.
- Choose three points in each image using the buttons in the red box. DO NOT PRESS SAVE ORIGIN AND TRANSFORMATION MATRIX
- Select a motor axis in the blue box, enter the displaced amount as read by the motor sensor or piezo reading. (e.g. if the right image is obtained by displacing the motor by -20 microns, then enter -20 in the text box). Click save image Displacement and Motor Displacement to record the values.
- Upload the **motor axis 2 displaced** image to the right panel and repeat the above steps (you should choose motor_axis_2 in the dropdown menu in the blue box this time)

Launch Interactive Map

- Click Launch Interactive Map button
- Upload the microscope image to this window again (i.e. the image you uploaded to the left image panel on slide 6.
- On slide 5, you have recorded the motor/piezo readings for **motor origin position** image. Enter the readings of the two axis into the text box on the right (e.g. 100, 200), click Update Origin Motor Coordinate.
- Now, you can left click on anywhere of the image and know what value to set for the motor axis 1 and axis 2 to read that location in the white light/confocal image!