Introduction

SimplePCI **A**utomated **I**mage **C**apture-**C**amera **D**evices (**AIC-CD**) provides cost-effective image capture from a wide range of cameras, allowing image capture of monochrome or multiple channels and time sequence functions.

Expand the functionality of ***SimplePCI*** and **AIC-CD** by adding the following optional modules:

- **AIC-SD/AD/EP** for control of motorized devices
- **DIA**, dynamically measure intensity over time
- **IPA**, develops icon-driven work files for automatic image analysis and processing
- **IPA-MTA**, track and analyze moving objects
- **QFA-FRET**, accurate FRET measurements and cross talk correction
- **VIS-MD**, provides rapid 3D visualization of multi-dimensional data sets
- **DNN**, Remove or Restore blur in images using fast algorithms
- **DNN-2D**, a Point Spread Function is derived and used in restoration

Getting Started

This **Quick Start Guide** contains examples of how to utilize **AIC-CD**. For further assistance, refer to the online help, manual, or visit support at http://www.cimaging.net, for access to the latest **How to's** and frequently asked questions. Additional support is available at e-mail: support@cimaging.net, or Tel: 412-741-7920.

Example guides:

Add Camera to a New Profile

To accommodate multiple users on one system, it is possible to set up a profile for each user. Profile information is stored in the User Registry; therefore, the user must have Administrator or Standard User (Power user) access. Restricted user accounts will not allow storage of profile settings in the registry.

1. At File Menu, select **Manage Profiles**.
2. Click Add (**fig.1.A**), and enter a name for the new profile.
3. Click **Properties** to add device and define file paths and settings (**fig.1.B**).
4. Assign Default File Paths by clicking on category (**fig.2.A**).
5. Default file path by clicking on Browse (**fig.2.B**).
6. Click on **Device Control** to add capture device (**fig.2.C**).
7. Add a Camera by clicking on **Image Capture Devices** (**fig.3.A**).
8. **AIC-CD** supports cameras; other devices are not allowed and trying to add other devices will prompt the message (**fig.3.B**).
9. To add other devices, please upgrade to **AIC-SD**, **AD** or **EP.**
10. **AIC-CD** supports cameras from several manufacturers. Select a Camera by clicking on appropriate device (**fig.4**), which includes:
    - **D_CAM** supports Hamamatsu cameras
    - **PVCAM32** supports Photometric cameras
    - **SPOT32** supports Diagnostic Instruments cameras
    - **Q_CAM** supports QImaging Cameras
    - **DXM-1200** supports Nikon DXM 1200 camera
    - **Pixera** support for Pixera cameras
    - **TWAIN** generic driver for general use
11. Save Profiles by clicking on the **Save** icon (**fig.1.C**).

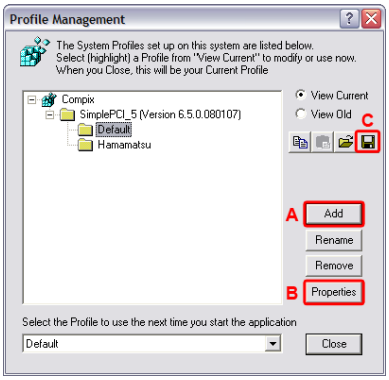


fig.1

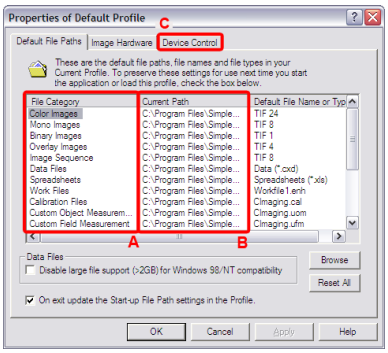


fig.2

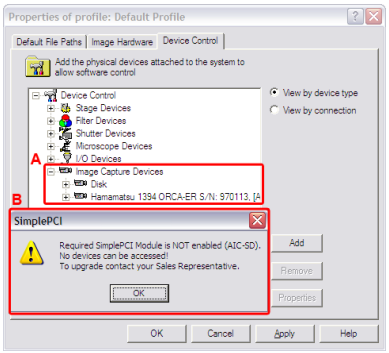


fig.3

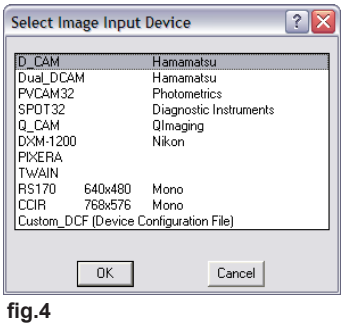
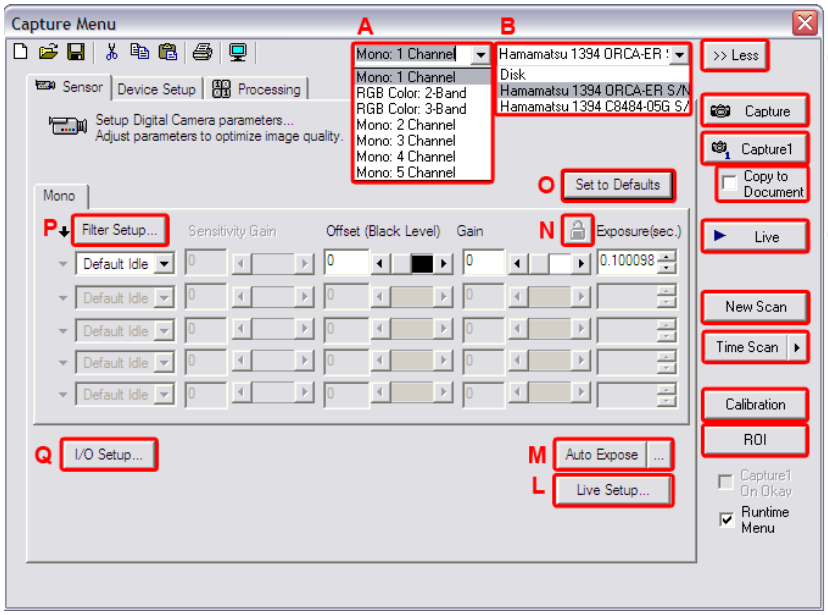


fig.4

Understanding the Capture Window

The **Sensor Tab** functions include sensor exposure, gain and black level adjustment settings. May include digitizer controls: digitizer gain and pre-digitization reference offsets. Controls vary depending on the selected camera's capabilities. Includes setup of the Filter/Shutter/Wavelength combinations to customize the illumination of the sensor.



A Select number of channels to capture.

B Select Capture device from a list of available cameras.

C **Less**: Minimize the Capture Window.

D **Capture**: Will initiate Image Capture using the Active Camera, and the settings of each channel.

E **Capture1**: Capture an image with current settings.

F **Copy to Document**: If checked, Capture1 will copy each captured image to an image document.

G **Live**: Displays a Live Image of the selected channel.

H **New Scan**: Start a new image sequence. The sequence can be based on Time Lapse, X,Y, or Z movement or wavelength scanning.*

I **Time Scan**: Shortcut to initialize the selected scan. Also, allows to load previously saved scan settings.

J **Calibration**: Images can be calibrated with Spatial Calibration for accurate measurement of distances or Intensity Calibration for correcting non-linear image intensities.

K **ROI**: Create a Region of Interest for intensity measurement.

L **Live Setup**: Define Live preferences.

M **Auto Exposure**: An iterative process of adjustment, capture, and analysis is used to determine the exposure settings that optimize the dynamic range of intensities in the image.

N **Lock Exposures**: Locks current exposure ratio.

O **Set to Defaults**: Sets all camera settings to camera defaults.

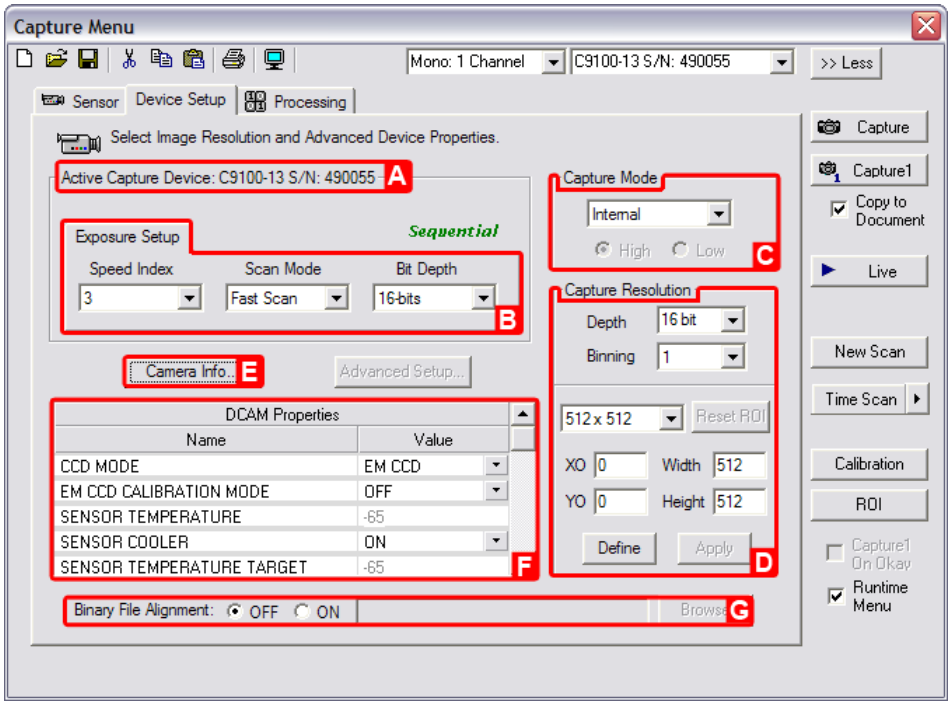
P **Filter Setup**: The Automatic Filter and Shutter Control Setup dialog allows customizing a list of positions for each of the computer-controlled filters and shutters installed in the Current Profile.*

Q **I/O**: Setup capture triggers and output signals.

*Must have AIC-SD module and equipment installed in the Current System Profile.

Understanding the Capture Window - continued

Device Setup - Change device settings of Image Capture Device (shown below). The **Device Setup Tab** manages the settings of the Active Capture Device. The Device Setup allows the user to control the acquisition mode, capture resolution including binning, triggering, subregion, bit depth and other special camera functions.



A **Active Capture Device**: Displays current Capture Device.

B **Exposure Setup**: ***Speed Index*** - Select readout speed for cameras with selectable readout speeds, e.g. Hamamatsu 9100-13 has Speed 1 = 0.69 MHz, Speed 2 = 2.75 MHz, Speed 3 = 11 MHz.

Scan Mode - Select digitizer to use for cameras with multiple digitizers, e.g. Hamamatsu Orca II has a High Speed Digitizer or a High Precision Digitizer.

Bit Depth - Change the format of data from the camera, 8 bit or 16 bit. Use 16 bit data format for 10, 12, 14, and 16 bit digital CCD cameras.

C **Capture Mode**: External Triggering can be set to Edge or Level. The trigger polarity can be set to High or Low.

D **Capture Resolution**: Allows the user to adjust Capture Depth (8 bit or 16 bit) as well as Binning and Resolution (as determined by the camera).

E **Camera Info**: Provides camera details including model, driver and firmware version.

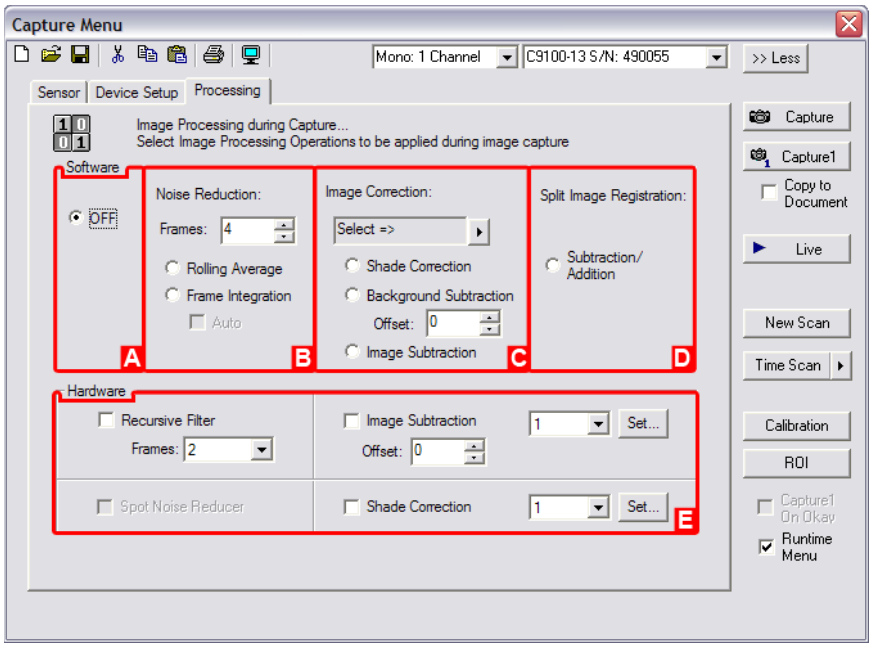
F **DCAM Properties**: Lists all of the properties associated with the DCAM* supported Active Capture Device. Some of the properties have drop-down menus which allow the user to control specific aspects of the functionality of the camera.

***This functionality is only available with DCAM supported Hamamatsu cameras. Not all Hamamatsu cameras will display properties in this window.**

G **Binary File Alignment**: Allows the user to load a Binary Image from disk to use as a registration overlay when capturing images.

Understanding the Capture Window - continued

Processing Tab - Controls how images are enhanced during Live and acquisition by incorporating image processing operations during or immediately after capture. The operations may be at frame rate for some Capture Devices or may be applied as a sequential step for others. Some operations require multiple images to be acquired and combined before the result is displayed.



Software Processing

A **OFF**: Disable image processing within the capture setup.

B **Noise Reduction**: Remove unwanted random noise from incoming image.

Rolling Average - The effect of this is to create a rolling average of the image from the Capture Device over time.

Frame Integrate - A selected number of images are acquired and the accumulated image intensities are displayed. The number of images used may be changed in the Frames field, or Auto may be selected.

C **Image Correction**: Remove artifacts from incoming image.

Shade Correction - The algorithm calculates a correction image in which each pixel's value is a positive integer which, when added to the corresponding pixel in the shaded image increases intensity value of darker pixels (presumably more shaded) by a greater amount than the intensities of lighter pixels (which are presumed to have been more strongly illuminated).

Corrected Image = (Original Image)/(Arithmetic Image) * (mean value of all pixels in the arithmetic image)

Original Image = image needing shade correction
Arithmetic Image = the background image (such as that which results from the procedure outlined below) selected in shade correction step
Note: For color images the shade correction is performed separately on each color channel (RGB).

Background Subtraction - An image of the illumination deformity is stored in the memory and subsequent live images from the Captive Device are corrected by using simple subtraction and the resultant image is displayed in the Image Display.

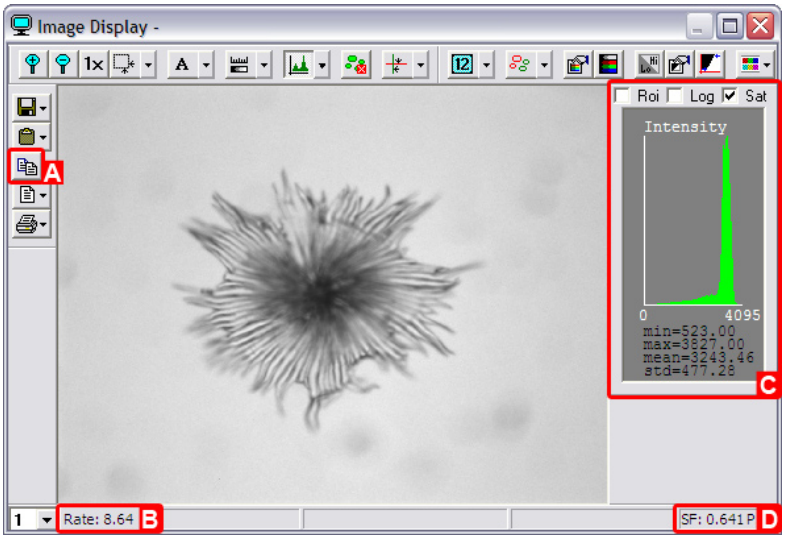
Image Subtraction - If it is necessary to measure the difference between two images from two different time intervals or an experiment versus a control, we may need to generate an image showing intensity loss or gain. Using Image Subtraction, an image of the first instant is stored in memory and subsequent live images from the Capture Device are subtracted from it before the result is stored in the display. This technique can be used for full grey scale image alignment between images.

D **Split Image Registration**: Used in conjunction with the Optical Insights Dual View. The processed image in the display is split in two parts A & B. The left side displays (A - B) and the right side displays (A + B).

E **Hardware Processing**: Some cameras also support hardware processing. The Hamamatsu 9100-13 is shown above.

Understanding the Image Display

The Image Display is used to show the Image being acquired, processed and measured. The Image Display can be moved independently of the main application window. This allows a dual monitor display configuration that can maximize the Image Display area on a secondary monitor while the user interface is displayed on the primary monitor. The Image Display can be shown and hidden using the Toggle Image Display icon in the Main Toolbar. The Display Image selection drop-down determines the image to be displayed during Capture. Up to five images can be defined in the Capture Dialog's Sensor Tab. This selection can be changed during Capture for immediate visual feedback.

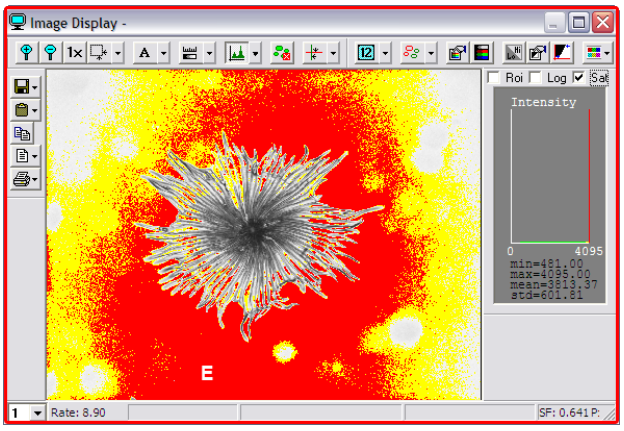


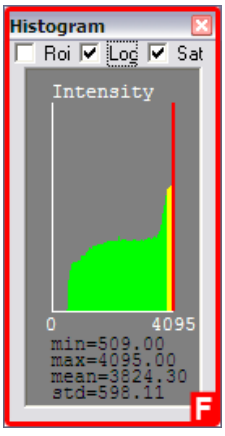
A **Copy Original Image**: Copies the current Original Image to an Image Document.

B **Frame Rate**: The current frame rate that the camera is capturing images.

C **Intensity Histogram**: A live display of the image intensity in a histogram. The Sat (saturation) layer is checked and will display points of top (red) and bottom (blue) saturation.

D **Calibration**: Displays the calibration factor for the current selected calibration.





E **Saturation Layer**: The red areas of the mask where the image intensity has become saturated. Notice the change in the Intensity Histogram due to the increased intensity. Yellow indicates area getting close to saturation.

F **Intensity Histogram**: When the Log function is checked the Intensity Histogram graphically displays the Log of the image intensity.

Capture an Image

1. Click on the **Camera** Icon  to activate the Capture window.
2. Select Camera (**fig.1.B**) and choose number of Channels for image capture, one channel for single wavelength and two, three, four or five for multi-color images (**fig.1.A**).
3. Set camera binning, capture resolution in the **Device Setup** tab.
4. Click **Calibration** (**fig.1.F**) to select the calibration factor for your current objective.
5. Select a filter configuration setup from the Filter Setup drop-down menu (**fig.1.I**).
6. Click **Live** (**fig.1.E**) for a live image.
7. Adjust Exposure manually (**fig.1.H**) or automatically by clicking **Auto Expose** (**fig.1.G**). View intensity distribution in histogram (**fig.2**). Check **Sat**. in the histogram to guard against saturation.
8. Click **Capture** (**fig.1.C**) for continuous display of images, with image processing, update of histogram and intensity profiles. Click **Capture1** (**fig.1.D**) to take a picture.
9. Save the captured image by clicking on the **Save** icon.

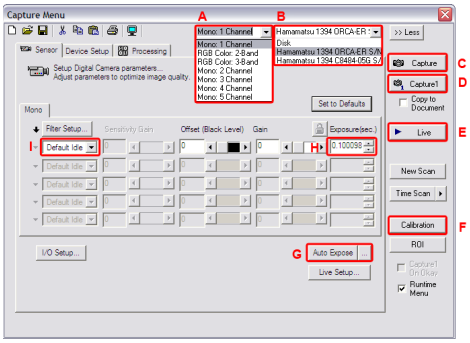


fig.1

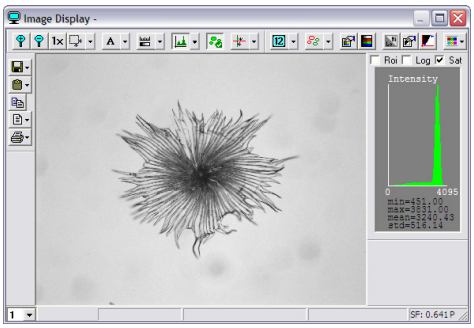


fig.2

Calibrate an Image from Pixels to Microns

1. Capture an image of a micrometer or reticle of a known distance.
2. Click **Calibration** in the Capture Menu, the Calibration window open (**fig.1**).
3. Enter a Title for the calibration file, e.g., 10X. Select the Units and symbol from the drop-down menu, and customize if required (**fig.1**).
4. Click **Calibrate** in the Calibration window (**fig.1**). Move the Calibration window to the side so you can see the image. Move the cursor to the start of a known distance; click and drag a line to span the distance you wish to measure, as shown in (**fig.2**).
5. Enter the known distance of the line you have drawn and click **OK** (**fig.3**). The Calibration Factor in the **Spatial Calibration Menu** will be updated.
6. Save the Calibration file. Click **Save** in the Calibration window and click **OK**.

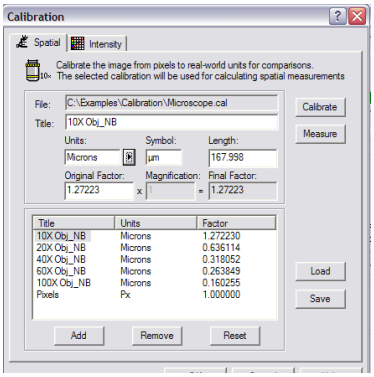


fig.1

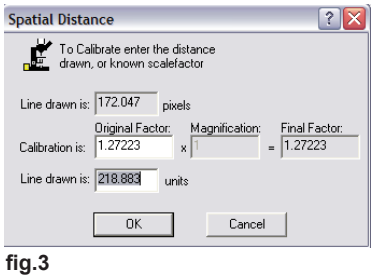


fig.3

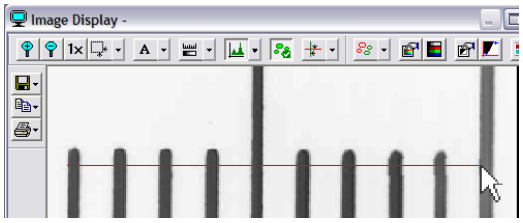


fig.2

Run a Time-Lapse Image Sequence

1. Click on **Camera** Icon  to activate the **Capture** window.
2. Select a Camera (**fig.1.B**), and select the number of channels to be captured (**fig.1.A**).
3. Select a filter configuration setup from the **Filter Setup** drop-down menu (**fig.1.F**).
4. Click **Live** (**fig.1.C**) for a live image.
5. Adjust Exposure manually, or automatically by clicking **Auto Expose** (**fig.1.E**).
6. In the Image Display window check **Sat**. in the histogram to guard against image saturation. Adjust camera settings as necessary before starting a sequence.
7. Click on **Time Scan** (**fig.1.D**), > Assign a file name and path > **Save.**
8. Enter time scan settings in the **Sequence Capture** window (**fig.2**).
9. Check **Maximum** for high-speed transfer into memory, as well as user defined time intervals, in Field Delay 1, 2 and 3 (**fig.2.A**).
10. Define time-lapse duration by **Time**, **Field Number** or **No Auto Stop** to run continuously (**fig.2.B**).
11. Save current scan settings by clicking on **Save Scan** (**fig.2.C**).
12. Click **Start** to begin image capture time lapse (**fig.2.D**).
13. Click on **Pause** to pause sequence.
14. Click **Live Preview** (**fig.2.E**) to get a Live image and adjust capture settings.
15. Check **Review Images** (**fig.2.F**) to activate the playback toolbar in the image display (**fig.3**). Use the slider to review the captured images.

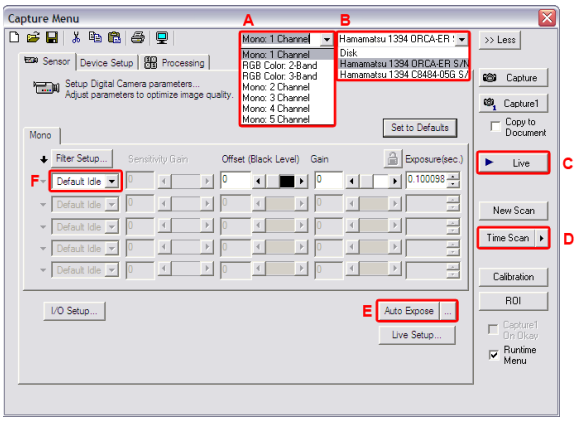


fig.1

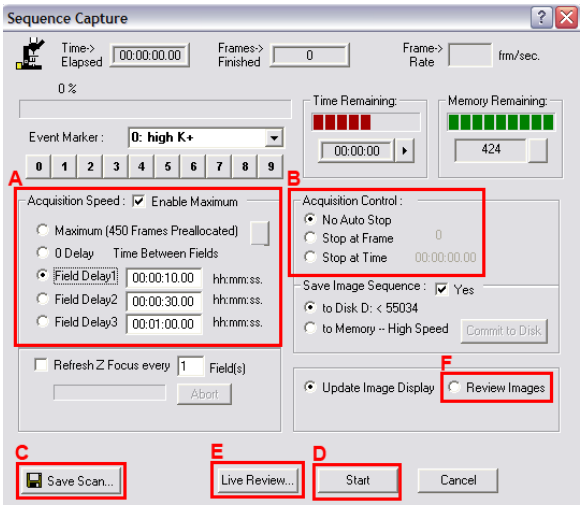


fig.2

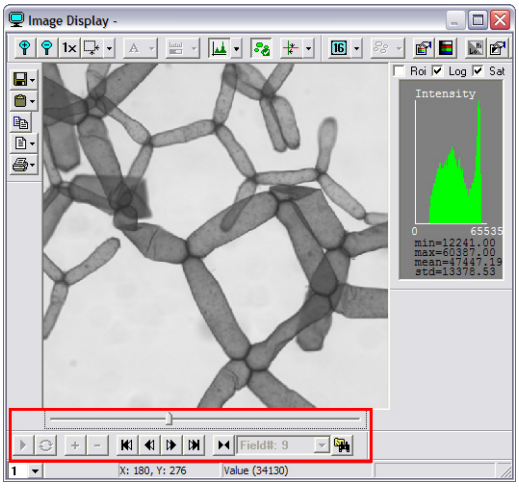


fig.3

Run a Time-Lapse Sequence Using the Scheduler

1. Click on **Camera** Icon  to activate the **Capture** window.

2. Select a Camera (**fig.1.B**), and select the number of channels to be captured (**fig.1.A**).

3. Select a filter configuration setup from the **Filter Setup** drop-down menu (**fig.1.F**).

4. Click **Live** (**fig.1.C**) for a live image.

5. Adjust Exposure manually, or automatically by clicking **Auto Expose** (**fig.1.E**).

6. In the Image Display window check **Sat**. in the histogram to guard against image saturation. Adjust camera settings as necessary before starting a sequence.

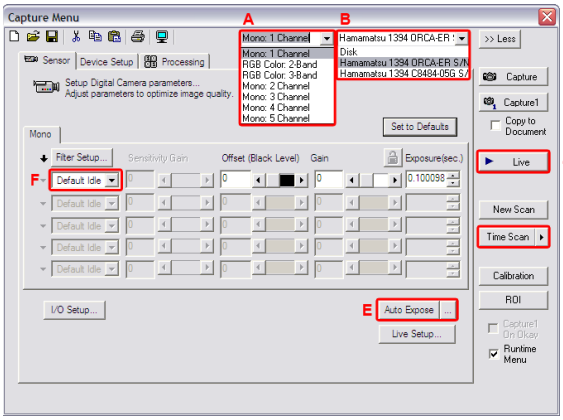


fig.1

7. Click on **New Scan** (**fig.1.D**), > Check **Use Scheduler** (**fig.2**) > **Finish** > **Save.**

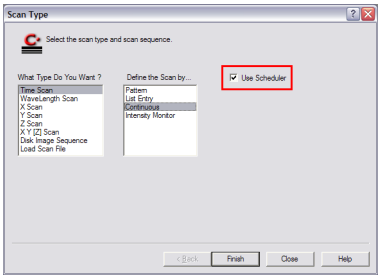


fig.2

8. Add multiple scans by right-clicking the scan field and selecting **Add SubScan**.

9. Select **Type of Scan**. **Capture** uses the active camera in the **Capture** menu. **TTL** initializes an **I/O** device by sending a **TTL** pulse to a single device configure via the **I/O Setup** in the **Capture** menu.

10. Click on each Scan and set its capture parameters. Define time-lapse duration by **Time**, or **Number of Frames**. **Field Delay,** or **Pulse Duration** for **TTL**(**fig.3**).

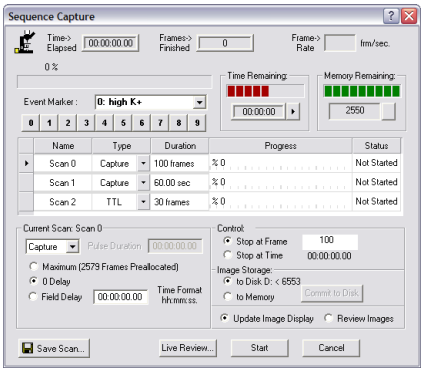


fig.3

11. Save current scan settings by clicking on **Save Scan.**

12. Click **Start** to begin the time-lapse.

13. Click on **Pause** to pause the sequence.

14. Click **Live Preview** to get a Live image and adjust capture settings.

15. Check **Review Images** to activate the playback toolbar in the image display. Use the slider to review the captured images.