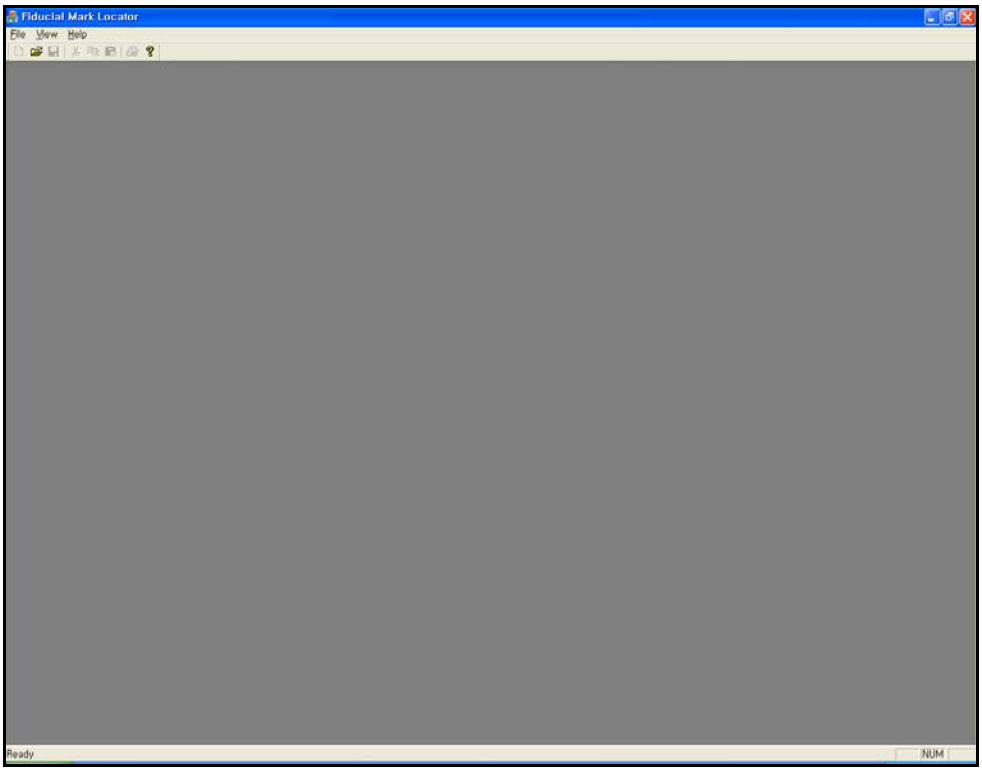
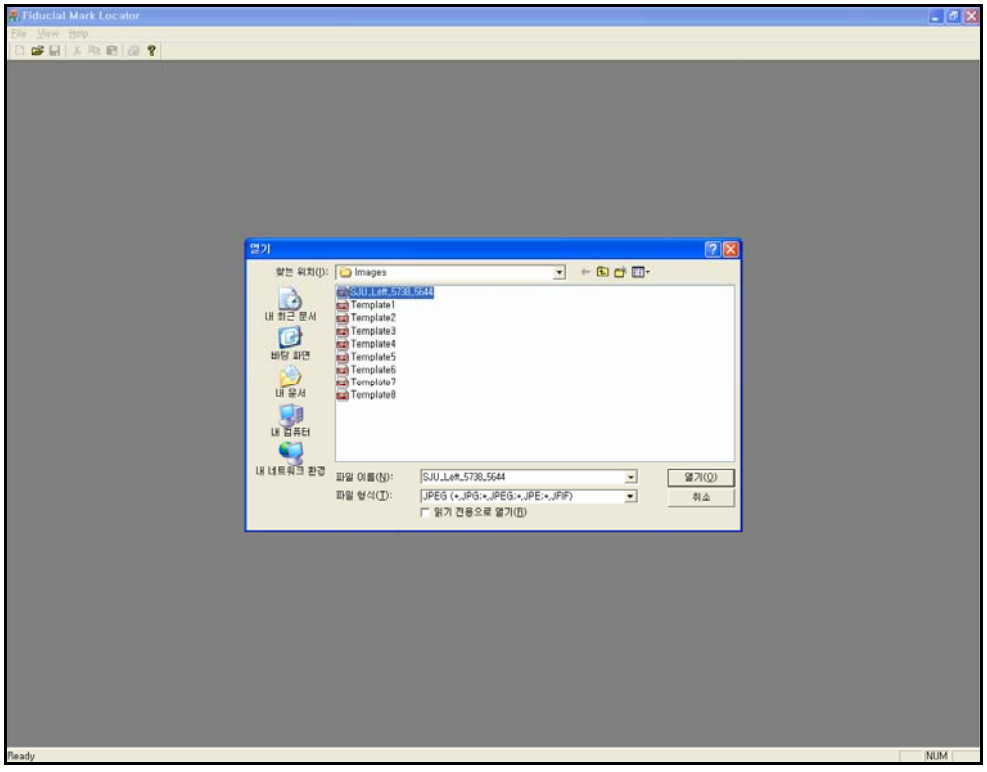
1. APPLICATION OVERVIEW

This section presents and explains the use of the application. The main screen of the application is presented as the figure below.



To perform the image matching for automatic interior orientation, navigate to the menu "File→Open…" and the dialog to open the image file will be opened.

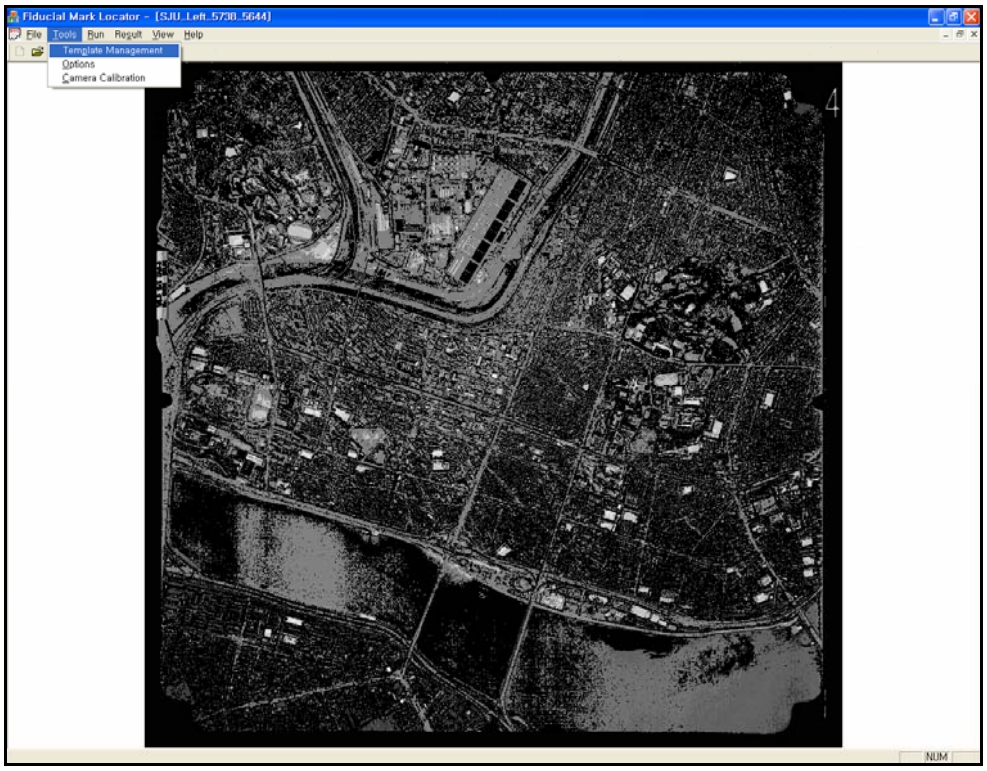


Once an image that contains fiducial marks to search for is selected, the application will show the image on the screen in the “Fit Screen” mode.

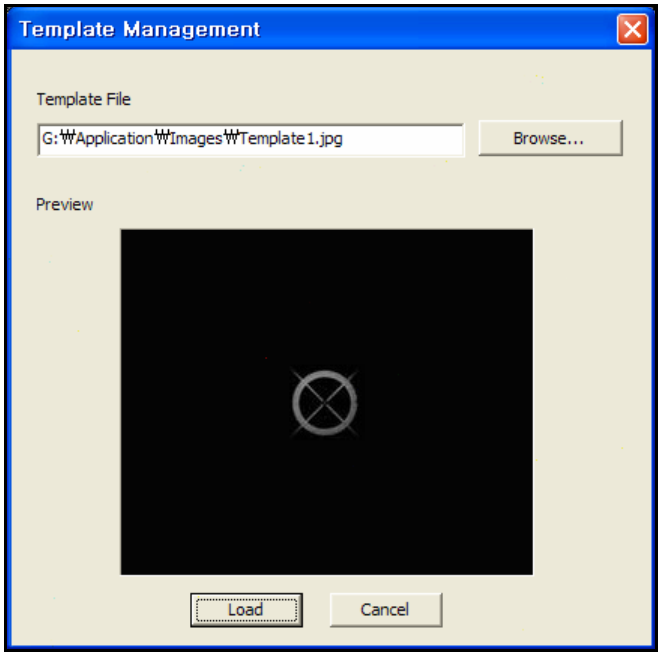
In order to view the actual size of image, navigate to the menu “View→Full Size”. The image will be displayed according to its actual dimension. In this view mode, the client can navigate through the image using the side and/or bottom scrollbar or right click in the image plane and freely pan to any direction.

Prior to perform image matching, it is a must to configure the system requirements. The

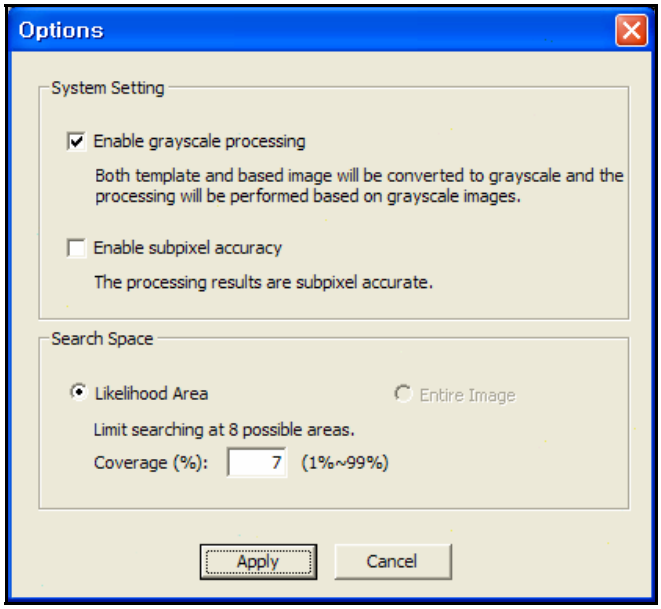
“Tools” menu holds all settings in the system.



The menu “Tools→Template management” provides an interface for the client to select the fiducial mark template. The selected template will be presented in the preview dialog and the client may reselect the template if any. The template will be used for the matching process if the “Load” button is clicked. Otherwise, the template used in the application is undefined and later the client will be asked to select the template during the image matching process is running.



The menu “Tools→Options” allows the client to optimize the system parameters to fit his/her requirement.



The available options divided into two sections as follows:

- System Setting
  - Enable grayscale processing

    This option will convert both template image and based image into grayscale in which only single channel is processed. Unselect this option will allow the system to process in three channels; blue, green and red.

    Note: In this implementation, only grayscale processing is applicable.
  - Enable subpixel accuracy

    This option allows the system to operate with subpixel accuracy.

    Note: In this implementation, the subpixel accuracy option is not available.
- Search Space
  - Likelihood Area

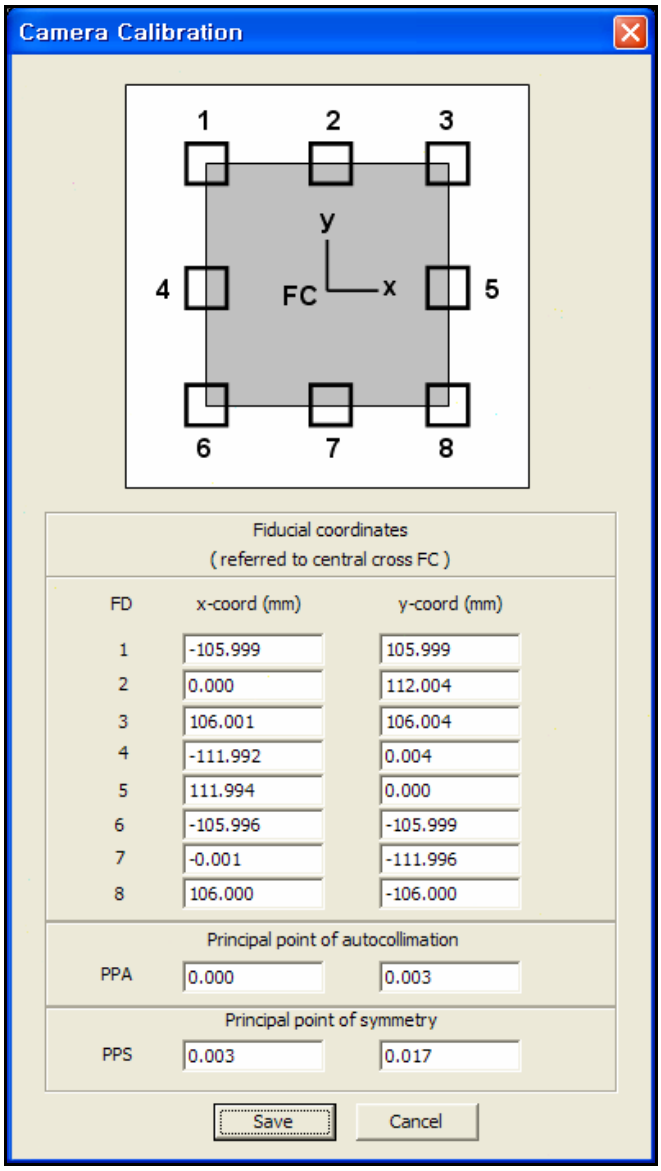
    Since the preliminary knowledge about the position locations of all fiducial marks exists, for example, four fiducial marks are close to the four corners of the image and the other four are at the middle position on the side of the images, the search area can be limited to speed up the operation.

    The search space for a fiducial mark can be specified to optimize the process. For example, the first fiducial mark is on the top-left corner. The client may have some knowledge that the position of the fiducial mark does not locate exactly at the corner but locate within a few hundred pixels from the left and top sides. Let say the fiducial mark is far from the left side and top side less than 300 pixels and the image size is 5738 x 5644 pixels. Therefore, 300/5738 is approximately 5.22%. The client may enter “6” into the “Coverage” editbox. Since this setting will be applied for all fiducial marks, care must be taken in specifying this number. Otherwise, the application may fail to search the correct fiducial marks and the application may malfunction. The default value for the coverage is 10%.

- Entire Image

  Note: Not available.

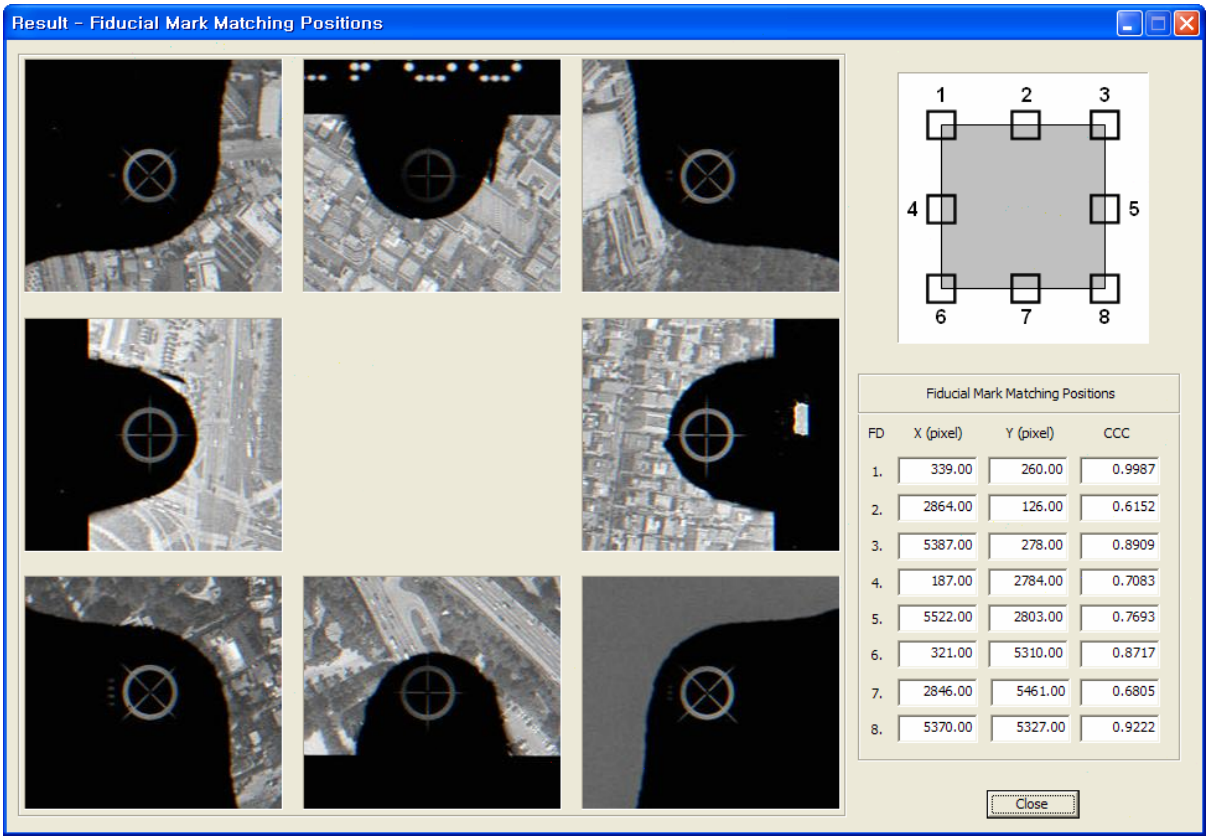
The menu “Tools→Camera Calibration” provide a dialog for client to enter the fiducial mark coordinate following the specification. This information will be required to calculate the affine transformation parameters in order to transform the pixel coordinates to the photo coordinates. Once the user edit the fiducial mark coordinates and click the “Save” button to apply the setting, the application will record the values into the “Data\Calibration.txt” file. If the application is reopened after closing or the dialog is reopen, the system will automatically load the setting data from file and display on the dialog.



After the preliminary settings are done, the application is now ready to operate. The image matching function will operated once the menu “Run→Image Matching→Cross Correlation” is clicked.

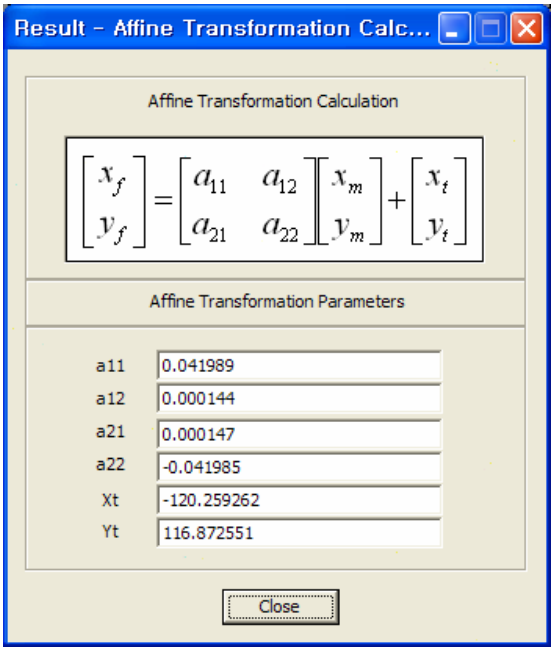
To view the results of the operations, navigate to the menu “Result” which will present all four possible results to present.

The menu “Result→Fiducial Mark Matching Positions” presents the possible matched fiducial marks and their positions in x and y coordinates as well as their cross correlation coefficient “CCC”. The CCC is theoretically expected to be “1.0” for any exact match. However, the application was developed without tolerant values and the raw coefficients without adjustments are presented. As a result, the CCC may be less than “1” for exact match.

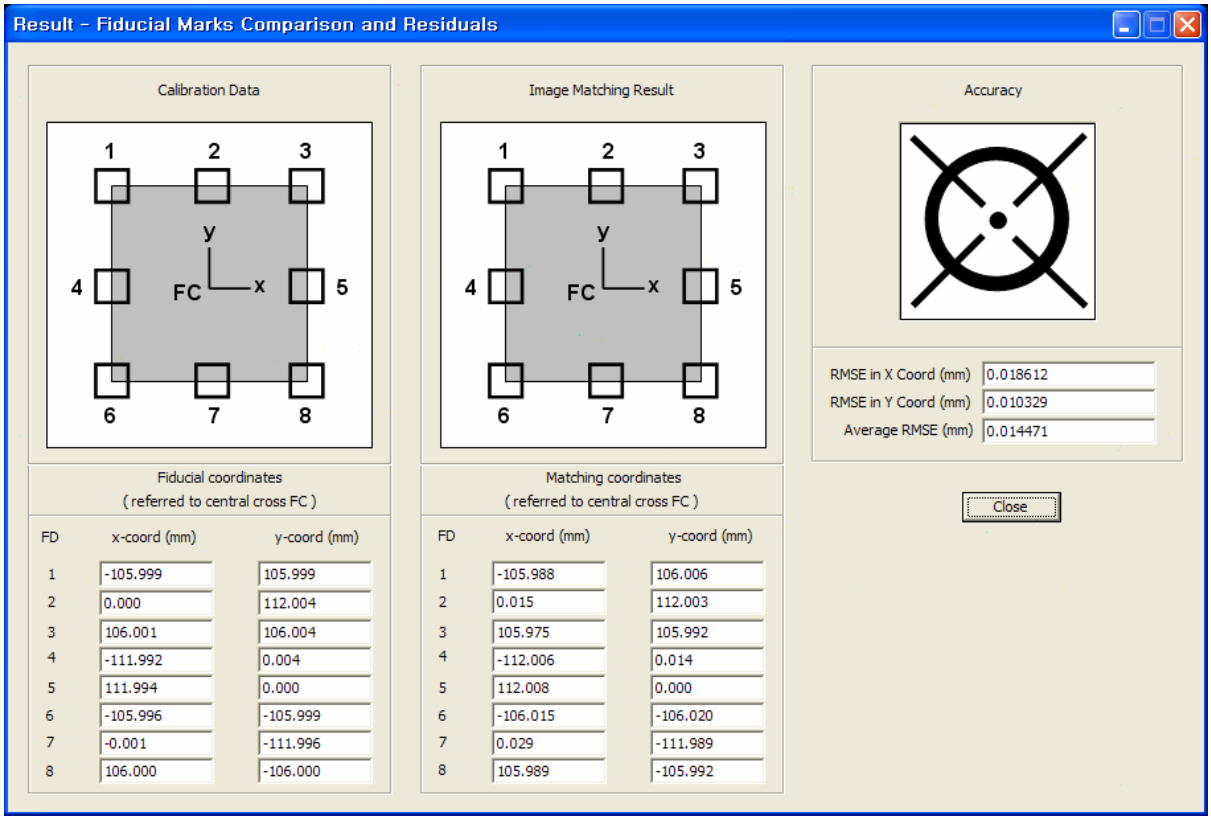


The menu “Result→Affine Transformation” displays the affine transformation parameters that define the relationship between the pixel coordinate system and the photo coordinate system. Using the coordinates of the matched fiducial marks and the fiducial coordinates from the calibration specification, the affine parameters are calculated based on the ordinary

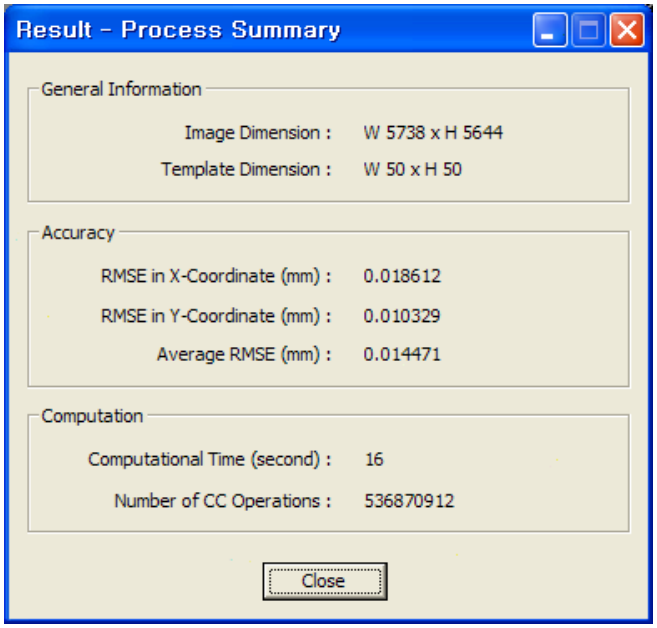
affine transformation formula as presented on the resulting dialog.



The menu "Result→RMSE" compares the fiducial coordinates from the calibration specification with the system calculated based on the affine transformation parameters. The accuracy of the system are determined by RMSE in x and y direction and average.



The menu "Result→Process Summary" gives the summary of the operations.


Result - Process Summary
General Information
Image Dimension : W 5738 x H 5644
Template Dimension : W 50 x H 50
Accuracy
RMSE in X-Coordinate (mm) : 0.018612
RMSE in Y-Coordinate (mm) : 0.010329
Average RMSE (mm) : 0.014471
Computation
Computational Time (second) : 16
Number of CC Operations : 536870912
Close