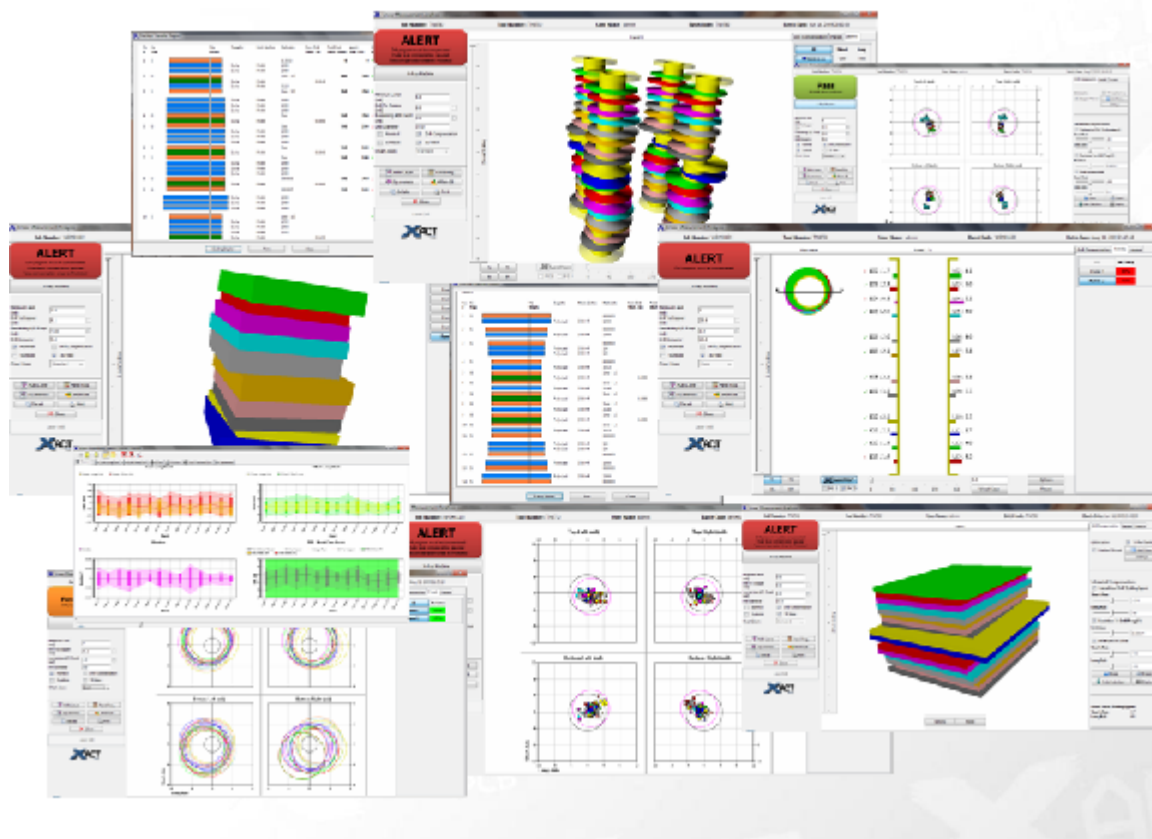




Gemini-X Linear+



XACT Gemini X Linear+

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There may be some loss of data due to reformatting into a pdf document.

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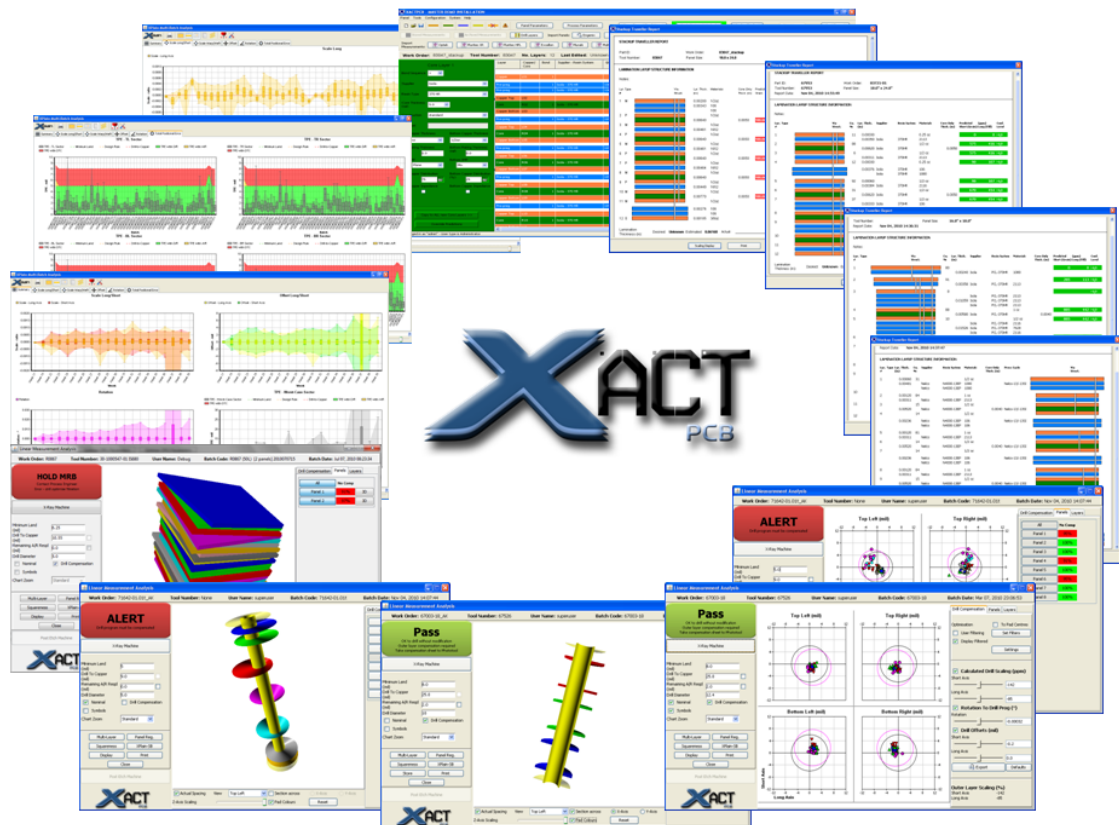
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1: Gemini-X Linear+

Gemini-X Linear+

Registration Control & Prediction System



Software Revision: 2.52
User Manual

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1.1 Complete Registration Control

Gemini-X Linear+ is a complete registration control system that enables PCB fabricators to understand and compensate for the fundamental causes of registration errors in the manufacturing process. The software utilises measurement data captured from industry standard production machines to provide both graphical and numerical analysis of the data. The data is used to provide accurate inner layer scale factor compensation and drill program compensation.

The Linear+ module has at its core a powerful self-learning model constantly

analysing design and measurement information. As a result, Linear+ is able to predict the material scaling that will occur in any new PCB design according to the combination of materials and processing parameters used - even if that exact combination of materials has not been used before - provided that the core materials have measurements associated previously.

An intuitive and automated engineering stack-up model offers a fast and easy-to-use method of entering design information, running design rule checks and interrogating the self-learning model to determine accurate inner layer scale factors. The stack-up model can be automatically populated from industry standard software packages using XML and text files to transfer the data. Once all data has been entered, the prediction model will calculate the scaling factors to apply to each of the inner layer cores.

After the product is laminated (bonded), measurement data captured by an x-ray drill machine (or similar) can be viewed graphically with the measurement analysis module. In addition to the data visualisation, this module calculates scaling errors for each internal layer and generates tooling compensations that can be exported electronically to improve the registration of subsequent processes.

The measurement data is then combined with design information from the stack-up module and automatically fed back to the database for adaptive tuning of the model.

The continuous learning capability of the system ensures that the scale factor values always reflect the current status of the manufacturing processes.

XACT PCB Linear+ allows build information, process information, and measurement data to be combined and used by a complex self-learning model. The model determines the influence of the different materials and processes on the amount of material movement taking place. The stack-up interface allows accurate scale factors to be predicted for each layer of new designs using the data from the constantly updated model.

1.2 What's New In the Current Release

The Current Release version of the Gemini X product is version 2.52

[Version 2.52 Changes and Improvements](#)

[Version 2.51 Changes and Improvements](#)

1.2.1 Version 2.51 Changes and Improvements

The major additions and changes since the last documented release are shown below:

General:

- A major change in this version enables scale values to be displayed and edited per layer instead of per core.
- Panel Offset Scaling function implemented to allow control and prediction of products not required to be at nominal at the drill process
- Reference Scaling function added to allow display of stored drill scale during measurement analysis

- New buttons added to allow export of Stored scale values and Remake scale values
- Range & Deviation displays added to measurement analysis
- Additional XML data merge function to allow import of additional data not provided by standard import functions including sub-assembly structures, press cycles, measurement target nominal positions and individual layer/drill annular ring/drill to copper data.
- Interactive Help manual - the web browser based help manual has been introduced with access from the Help menu and throughout the application.

Traveller Report:

- Traveller Report extended to allow multiple report formats to be configured
- Traveller Report notes section modified to prevent truncation of long entries in the Notes section.

Measurement Import:

- Measurement import modified to allow correct data interpretation where targets exist on outer layers, blank side of single sided cores and on filler cores
- Additional Multiline CLT data import module created to allow analysis of products using centre line target system
- Custom Optek import formats have been developed
- New import format developed for Fein Focus X-ray systems

Measurement Analysis:

- The Measurement Analysis module has been updated to provide a more interactive usage.
- Squareness plots are now available for each panel measured

Database Upload:

- A new administrative function has been created under the System menu to allow a backed up database or other file to be directly uploaded to the customer's FTP account at XACT, allowing easy transfer for review by the XACT technical teams.

Stack-up Import: (Licensed Options)

- Direct Logix import modified to provide a warning for missing panel size or grain direction and allow the user to enter the correct values
- Procim import has been extended to allow scale data and grain direction to be imported
- Procim import has been extended to allow import of process specific information
- Procim import can be configured to define sub-assemblies using the drill layers view

- An alternative Procim (Procim2) import format has been developed
- Procim2 allows work order and lot number to be entered in a single lookup field to find the relevant data.
- Inplan import modified to allow alternative fields to be used to define inner layer scale values
- Inplan import modified to use alternative data to define sub-assemblies instead of the drill layers
- Inplan import extended to read copper types and identify different cores accordingly
- Inplan import extended to read additional custom fields related to press cycle parameters (pressure & stack height)

E-mail Alerts (License Option)

- E-mail alert from measurement analysis for out of tolerance products

SBU Module (License Option)

- Prediction algorithms extended to include multiple levels of dynamic variables
- Individual confidence thresholds for each optimisation variable set

Xplain Module (License Option)

New modules available to those customers that purchased the Xplain reporting module

- Graphical display of position offset error, rotation error, scale error and total positional error available by layer or panel for each batch
- View error trends and scaling trends by month, week, day, batch
- Select data by date, product, technology, processes and materials

Command Line/API module (License Option)

- Additional functionality provided

1.2.2 Version 2.52 Changes and Improvements

The major additions and changes since the last documented release are shown below:

General:

- A major change in this version changes the way in which sub-assembly data is defined and modified using the stack-up editor
- Language switching is enabled via the Configuration menu option [Settings Manager](#)

SBU Module (License Option)

- Automated naming of sub-assemblies extended to include option for naming

- in line with Paradigm naming conventions
- Sub-assembly names may be manually modified using the sub-assembly definition GUI and maintain the link to the parent record
- Sub-assembly structure at the same bond sequence may have different press cycles defined
- Sub-assembly definition extended to allow non-copper layers to be identified as the start and end layers of sub-assemblies.

Stack-up Import: (Licensed Options)

- Inplan import extended to read plating thickness for internal copper layers
- Gemini X XML format extended to include additional material types used in flexible/rigid-flex products
- Gemini X XML format extended to allow sub-assemblies to be defined using non-copper materials
- Gemini X CSV format extended to allow sub-assemblies to be defined using non-copper materials

Measurement Import (Licensed Option):

- [Multiline CLT](#) format extended to include legacy formats from older machines

Measurement Analysis:

- Additional data checks implemented to prevent import and analysis of erroneous data
- Verification required before data that appears incorrect can be stored
- Logging of settings introduced to allow traceability of deviations from standard configuration

Drill Compensation:

- Extended algorithms to calculate optimum drill compensation according to individual layer design criteria (minimum land)
- Export of drill compensations for individual panels and batch in XML or Fastec format
- Ability to store and recall user determined drill compensation used for the batch

X-Section: (Licensed Option)

- New module allowing interactive 3D viewing of measurement data
- Virtual cross sections showing minimum land at each corner in any orientation.

2 2: Installation

*XACT personnel will provide a **secure backup copy** of the configured installation.*

Hardware and Network requirements

XACTPCB Gemini-X software is a Microsoft Windows application written using Java component libraries and a secure database infrastructure. The installation provided by XACTPCB support personnel will be installed on the customer's own hardware and network infrastructure.

The software is able to run as either a standalone application running on a high specification PC, or in a Client-Server installation where a central networked Server will control multi-client access to the database.

[Standalone Configuration](#)

[Server Configuration](#)

Backups

The customer is responsible for backing up databases and all files used by the software. This should ideally be run as part of a regular (daily) Network Backup.

2.1 2.1: Standalone Configuration

Standalone Configuration

In this configuration a single PC, running a Gemini-X Licence, will run the Gemini-X software. The executables and local configuration files will run from the PC.

The location of the database and other file storage is configurable to either (a) reside on the same PC, or (b) - as is our recommendation – on a backed up network location.

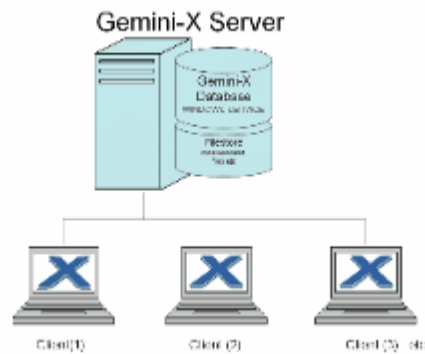
Gemini-X requires a PC running Microsoft Windows XP (Pro and Home) or Windows 2003 Server Edition.

A PC with at least a 1GHz processor and 1GB of Memory is recommended to ensure optimal performance.

Up to 500Mb of disk will be required for the installation and initial database. As data accumulates more disk space will be required. A drive allocation of at least 10Gb is recommended.

Please note that although GeminiX will run under Vista & Windows 7 – these are not currently supported.

2.2 2.2: Server Configuration



Server:

Gemini-X Server Installation requires Microsoft Windows XP Pro or ideally Windows 2003 Server Edition.

A dedicated hardware server is not required; however, sufficient processor overhead must be available to the Gemini-X program.

The server should have at least a 1GHz processor and >1GB of Memory is recommended to ensure optimal performance.

10Gb of disk space s recommended

Database :

The database application used by Gemini-X utilizes Java protocols. In a server-client installation, access to the Server database is maintained by running the database server as (a) a Windows Service called **XACTDATASTORE** or (b) as a server application that is constantly running under a logged in profile.

If network security policy prohibits permanent log on to the server then the Windows Service option must be used.

Configuration files for installing the Gemini-X Database as a Windows Service are included in the installation.

Please note that although GeminiX will run under Vista & Windows 7 – these are not currently supported.

3 3: Operation of Gemini-X Linear+

A simplified flowchart for the operation of Linear+ is shown below. The key to understanding the operation of Gemini-X products is to understand the cycle of PREDICT-MEASURE-OPTIMISE.

PREDICT – uses the **Linear+ Stack-up Module** to provide the CAM department with a scale factor for each layer of the PCB based on the Gemini-X prediction engine.

MEASURE – uses the **Measurement Analysis** functions to read in and analyse the actual distortion on the manufactured PCB panel and batch/lot. In the event that each layer's Scale Factors are not at optimum scale, this module will allow the user to edit the drill scale, rotation and offset to improve

yields. Any difference in scale will be fed back into the predictive engine.

OPTIMISE – The Optimiser function is the mathematical engine at the heart of the predictive module. It runs through all data that has been collected to date – coupled with all the stackups entered for those measurement points, and calculates optimal predictions for scale factors.

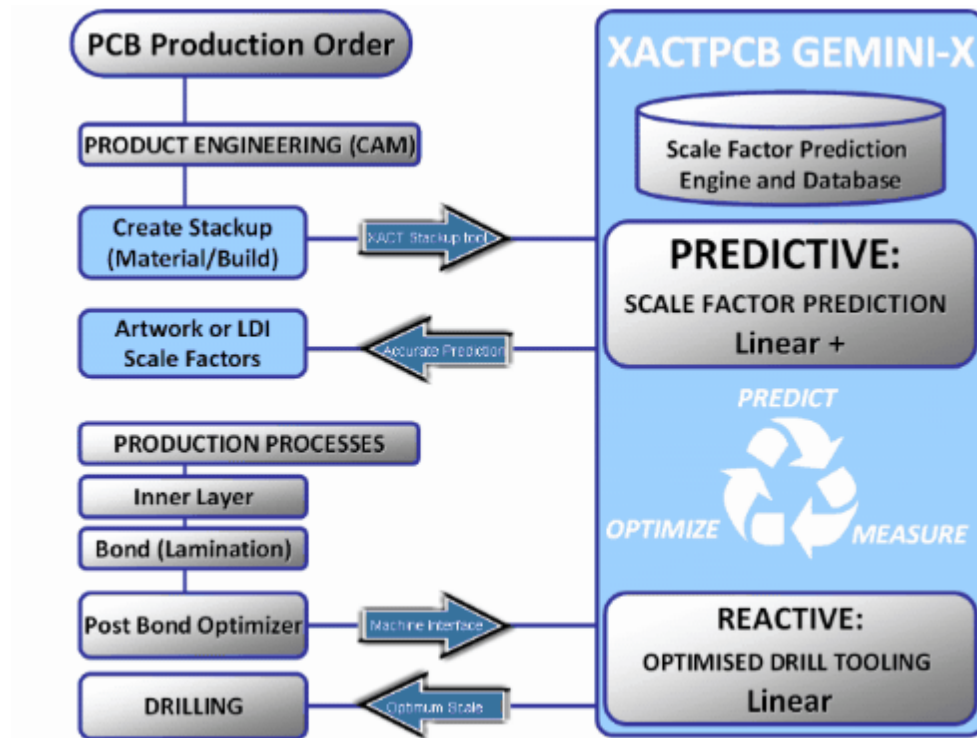


Figure 3:1 - Flowchart of operation and integration within PCB manufacturing process

A note about customisation

All of the text fields used in the Gemini-X software are configurable to allow for local language and terminology changes. For example – throughout this document the (European) terms “WARP and WEFT” are used for the linear and cross ply glass cloth directions. In other regions the terms “GRAIN and FILL”, or “WARP and FILL” are predominant

Similarly the default name for a PCB Panel Design is “Panel Code” – this can be changed to any name desired as can Panel ID (numeric) and Panel Name (alphanumeric).

Upon installation, XACT personnel will set up the terminology required by an individual customer.

4 4: Getting Started

A quick tour of the main menus

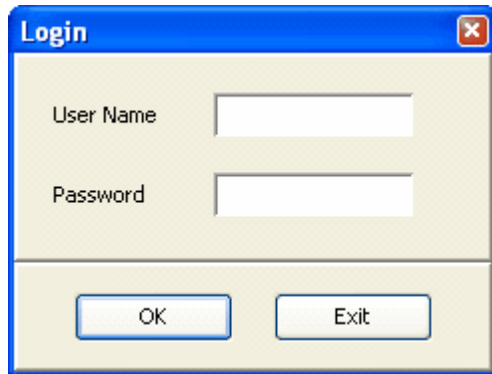
This section describes the main functions and options that are immediately accessible from the main menu. Detailed descriptions follow in later sections.

4.1 4.1: Log-In

When the Gemini X software is initially started, the user will be required to log in to access the features of the software.

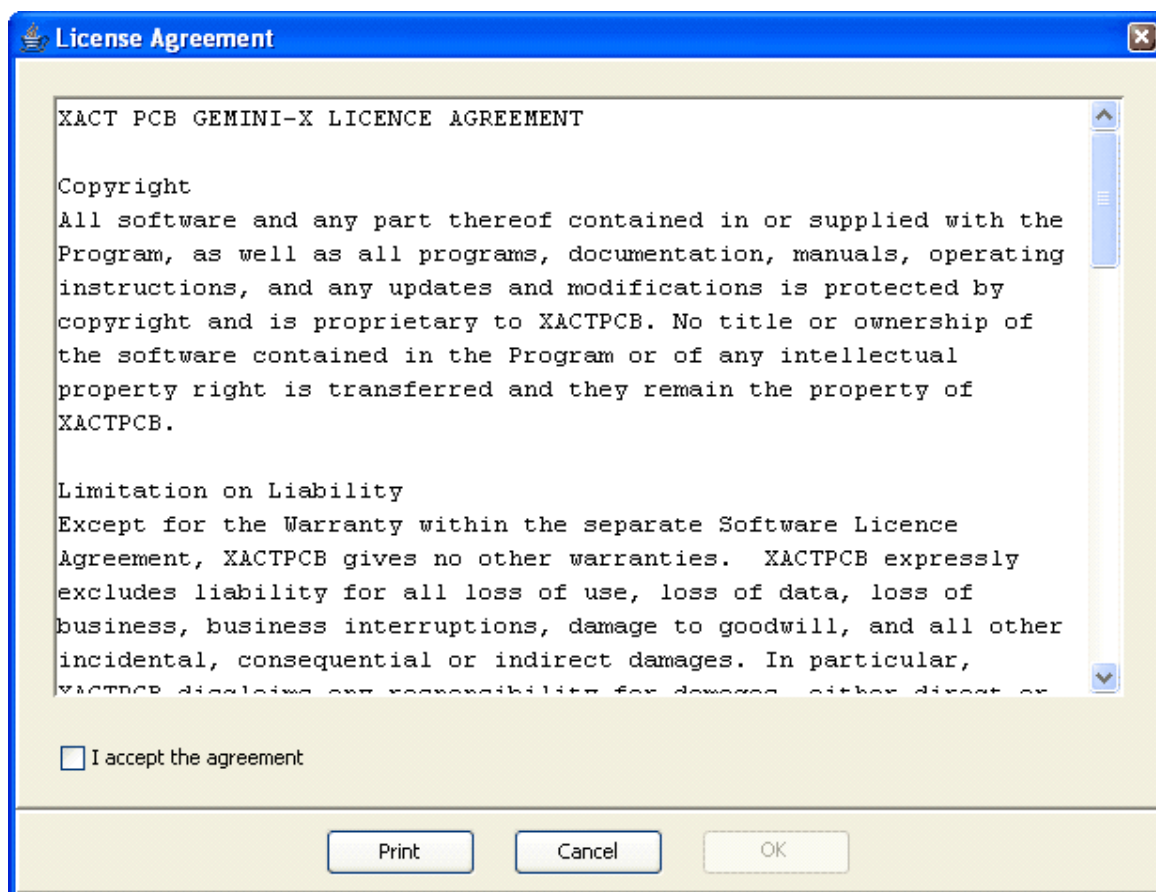
Enter the user name and password provided by your administrator or XACT PCB support and click **OK**.

Assigned User Names will allow access to specific functions and areas of the software.



4.1.1 4.1.1: License Agreement

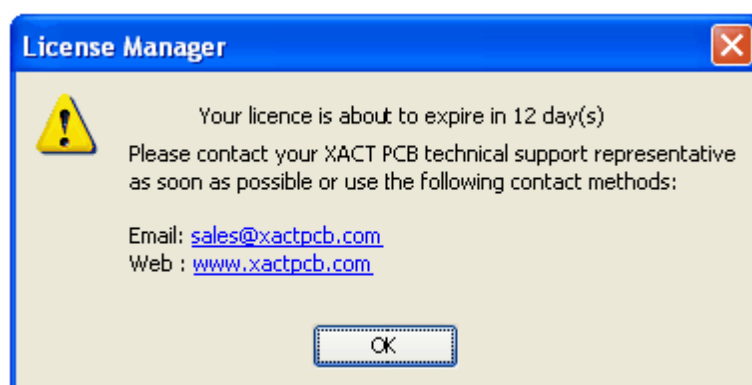
When logging into the system for the first time after a licence change the following **License Agreement** is shown.



Check the “I accept the agreement” box and click “OK”..

4.1.2 4.1.2: License Expiry Warning

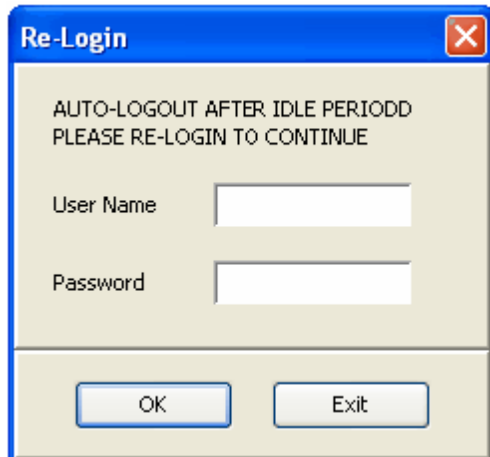
In the event that the current licence will soon expire, a dialog may be seen at login. This allows the user to update the licence key by contacting XACT personnel.



4.1.3 4.1.3: Auto Logout

If this option is enabled in the main configuration the system can auto logout the user for security.

After a user defined period of idle-time (defined as no mouse movement, mouse button clicks or keyboard activity inside the application GUI), the current user will be logged out and a re-login dialog displayed.



4.2 4.2: Main Menu & Toolbars

After log in, the button configuration and view is dependent on the licence and modules that have been purchased.

Standard button tool bars include Import Panel, Import Measurements and Reports.

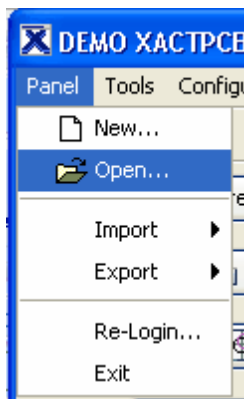
The menu bar across the top of the screen gives easy access to the most often used functions of the software.

To get maximum visual information at all times from the software, it is strongly advised to use a widescreen monitor of 1400x900 resolution or higher.



4.2.1 4.2.1: Panel Menu

This menu links to the STACKUP module of Gemini-X and allows the user to create a new PCB Stackup or Open and edit an existing stackup.



The stack-up module is entered by selecting **Panel** from the main menu. To begin entering a new stack-up select **New**, to review or modify an existing stack-up select **Open**.

Refer to the stack-up section for further details of using the stack-up module.

In addition, this menu option can be used to **Import** a new stack-up using files from InPlan, Engenix, Direct Logix, Softwires, Polar Speedstack, ProCIM and other ERP/CAM system formats. (Import formats are license specific)

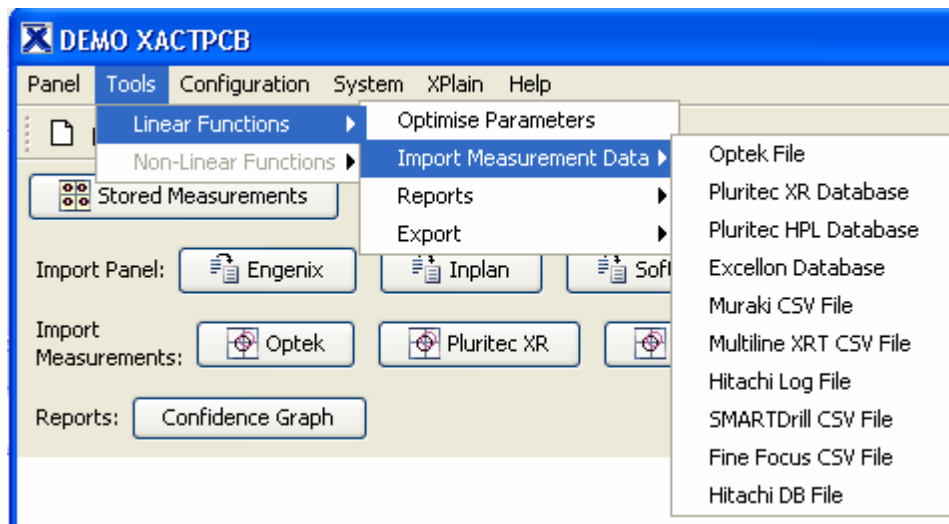
The **Export** function is used to output a set of report files that will give an overview of the measured and stored parts in the database.

Once a stack-up is open for editing, additional functions will appear on the Panel drop down list - these are detailed in the Stack-up editor section.

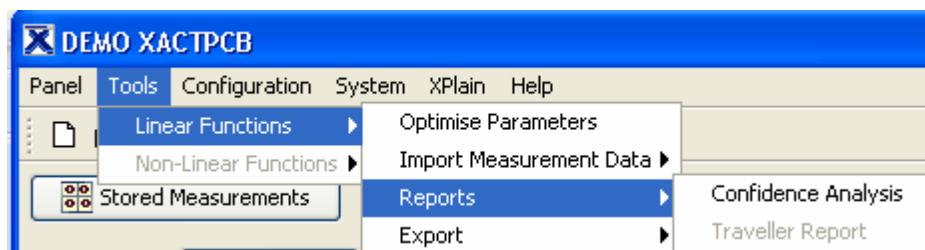
4.2.2 4.2.2: Tools Menu

The TOOLS menu provides access to

- (a) the Database [Optimisation](#) function
- (b) the Gemini-X **Measurement Import** functions



- (c) the **Reports** functions allowing access to the prediction Confidence Analysis and when a stack-up is open, the Traveler Report



- (d) the **Export** function to export the Library Report containing details of the data that is currently held in the prediction engine.

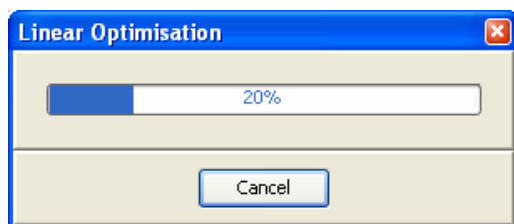
4.2.2.1 4.2.2.1: Optimise Parameters

Parameter Optimisation is the process by which the mathematical engine at the heart of the XACT Gemini-X software runs through all data that has been collected to date – coupled with all the stackups entered for those measurement points, and calculates optimal predictions for scale factors.

This is an administrator level function and is intended to be run on a daily or weekly schedule – often at the end of the working day.

The parameter optimisation functions are found under the **Tools** option on the main menu.

To access Optimisation – click on the OPTIMISE PARAMETERS menu item. The following progress bar will be displayed

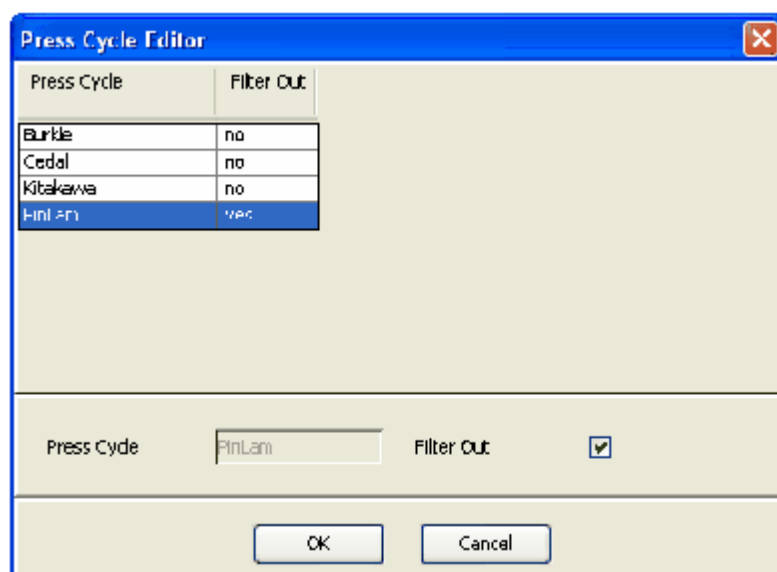


4.2.2.1.1 Advanced Press-Cycle Optimisation Filtering

For advanced users running multiple process systems (press cycles) who wish to completely segregate the influences of each process, a function has been added to the optimisation engine.

When the optimiser is run in this mode the user will be given the option to ignore data collected from certain press cycles within the database. In this way, a user can get predictions based upon:

- (a) all press cycles (i.e. no cycles filtered out), or
- (b) select a subset of press cycles – such as only masslam, or only pinlam cycles.



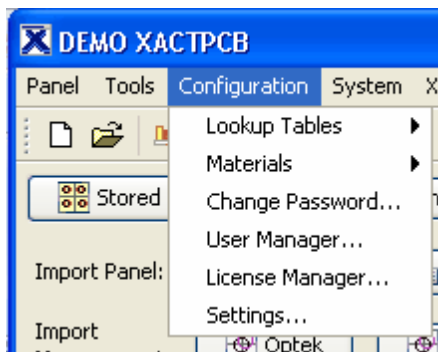
The standard method (a) is recommended for most customers – and is the default configuration. (The standard mode)

Note: In the advanced mode, the optimiser **MUST** be run each time a prediction is required.

4.2.3 4.2.3: Configuration Menu

The CONFIGURATION menu is where the user can edit and add new material types to the database (through the Lookup Table submenu), change the user passwords, access the user and licence manager features, and set measurement units.

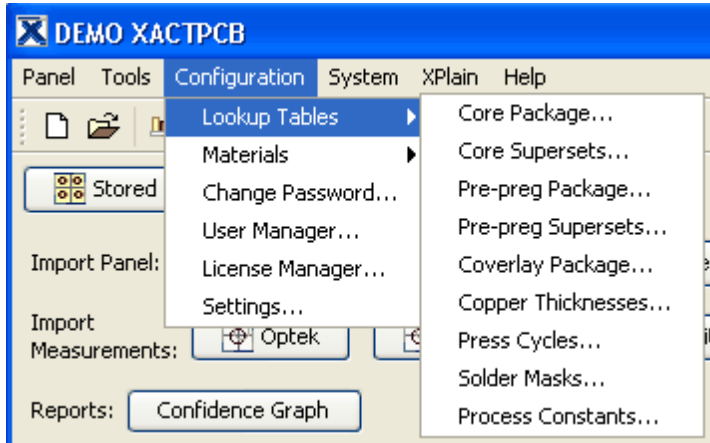
Detailed explanations of the Lookup Tables and other settings can be found in the [Configuration Menu](#) section.



4.2.3.1 4.2.3.1: Look-up Tables

These tables store all the key material characteristics

In many cases the data in the Lookup Tables will be added by automated import functions



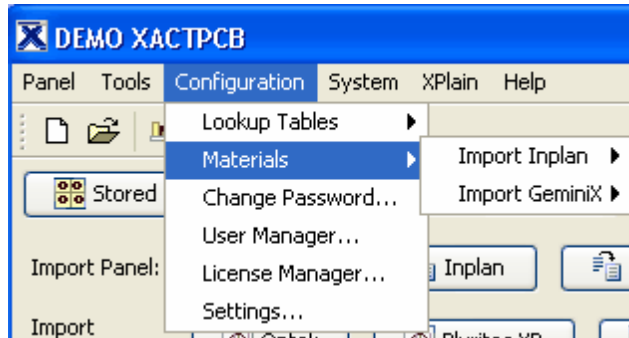
Detailed explanations of each of the Lookup Tables can be found in the following sections:

4.2.3.2 4.2.3.2: Materials

The Materials option allows material libraries to be imported from external files.

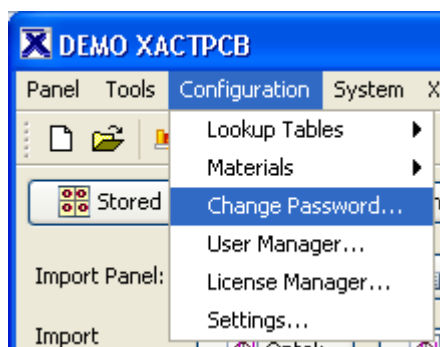
This prevents the user having to set-up and edit each material individually.

The formats currently supported are Inplan and GeminiX.



4.2.3.3 4.2.3.3: Change Password

This function allows a user to set the password for the login



When selected, a pop-up window will ask for the current (Old) password and the New password.

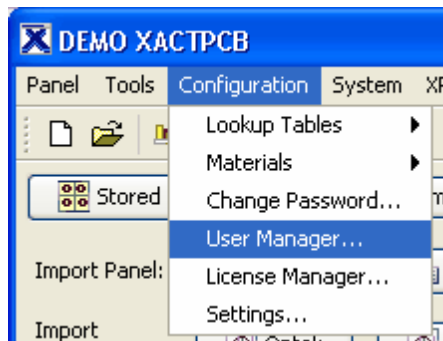
Re-enter the new password in the Confirm Password box and then press OK.

Next time the user logs in, the new password will be required.



4.2.3.4 4.2.3.4: User Manager

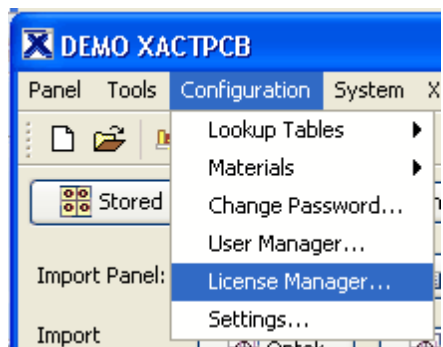
This function allows an administrator to set up new users and their access privileges.



More Details: [8.2.1: Add New User](#)
[8.2.2: User Types](#)

4.2.3.5 4.2.3.5: License Manager

This function is used to enable/activate a new licence key code.

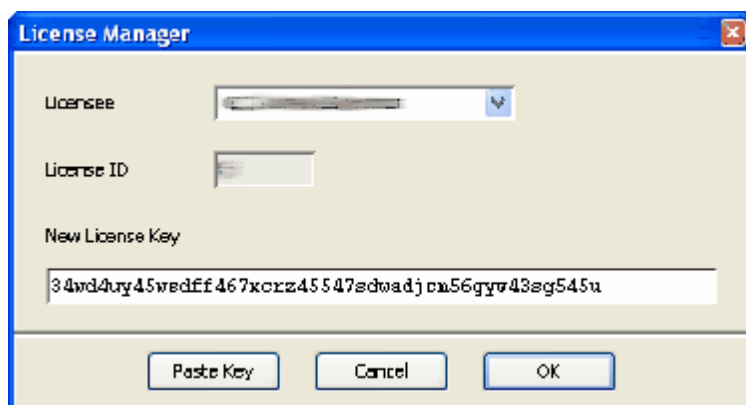


The **active licence** is issued solely by XACT PCB and is locked to an installation through secure licence held within the installation.

The **active licence** controls the number of active users, the interfaces and other program settings.

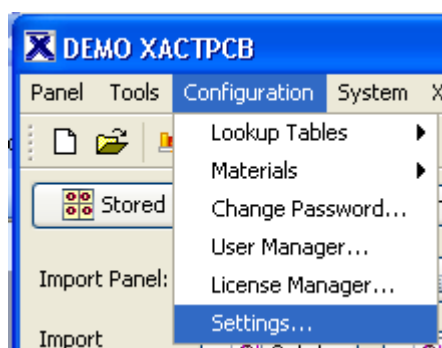
In many installations, a licence key may expire at a set time and a new key will be issued by XACT. This licence will be issued by email.

To activate a licence the provided key should be pasted into the box shown below and press OK.



4.2.3.6 4.2.3.6: Settings Manager

From the main menu, select **Configuration** and **Settings**.

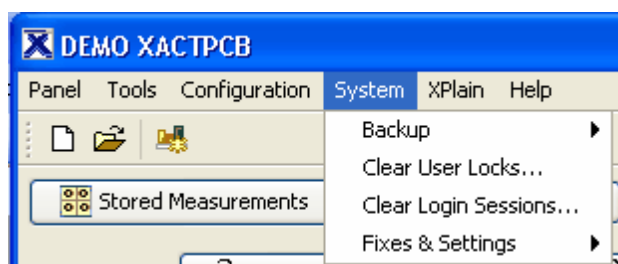


More Details: [Units Selection](#), [Stackup Layout](#) and [Measurement Analysis Colours](#)

4.2.4 4.2.4: Systems Menu

The **System** menu options enable an administrator or other user with sufficient privilege to carry out administrative tasks on the software.

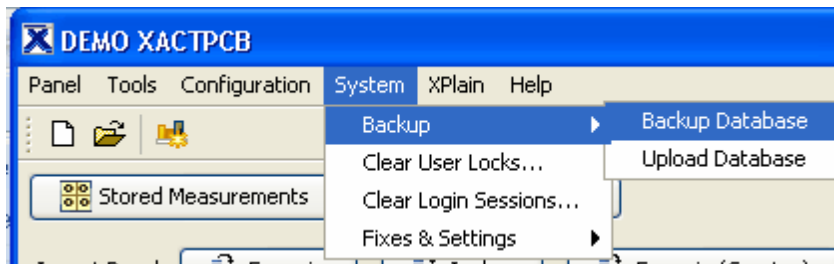
These options include database back-up, removal of user locks on stack-up records, log off other users and activate special database functions when required.



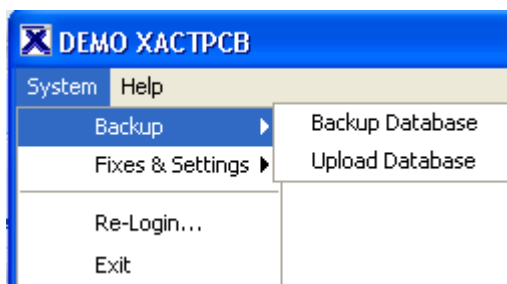
4.2.4.1 4.2.4.1: Database Back-up

As an administrator, the database back-up function is activated by the **Backup**

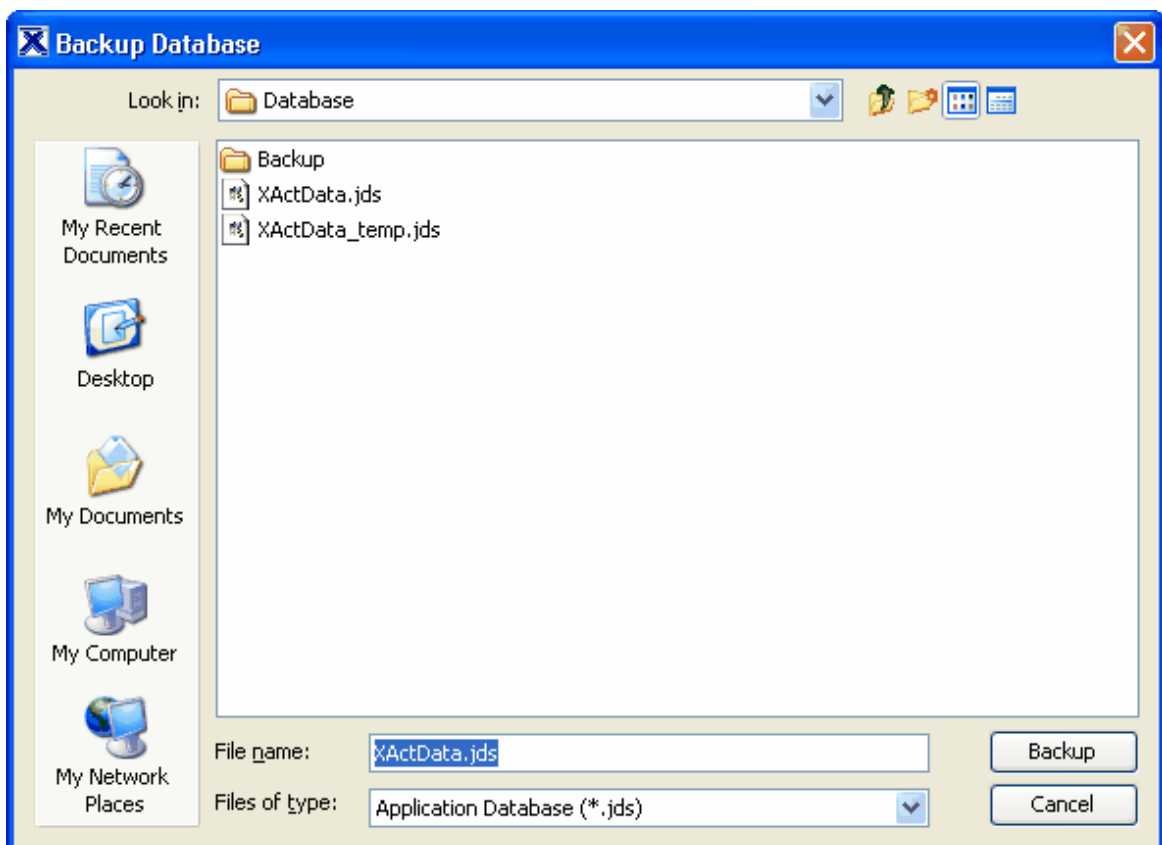
option under the **System** menu.



When logged in as **Maintenance**, the database back-up function is also available under the **System** menu.



When the option is selected, a pop-up will ask for a name for the database back-up file.



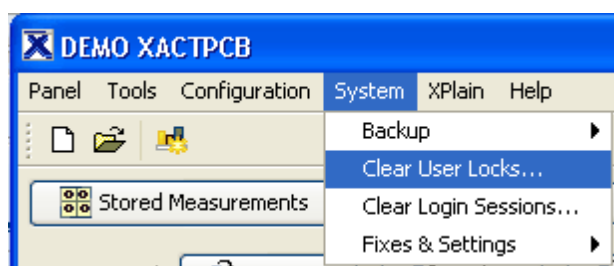
Automatic back-ups created during software updates will all be saved in the .\Database\Backup directory and will use the naming format **XActData-yyyy-mm-dd.jds** where yyyy is the year, mm is the month and dd is the date.

4.2.4.1.1 Database Upload

Enter topic text here.

4.2.4.2 4.2.4.2: Clear User Locks

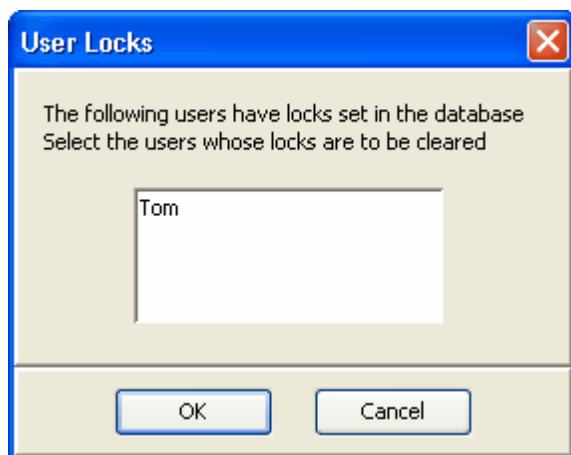
The **Clear User Locks** function is accessed from the **System** option in the main menu.



In a server based multi-user environment, stack-up records must be locked when opened for editing. This prevents other users from making changes at the same time, though they can still open the records to view them.

If the lock is not released when editing is finished (e.g. due to PC shutdown or network fault) other users would not be able to edit the record in future. This function will display which users have records locked and if necessary allow the records to be unlocked.

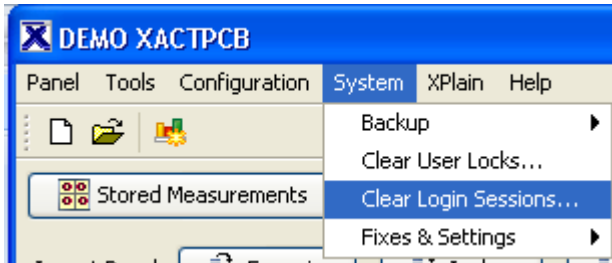
Note: Always check that the user displayed is not currently editing a record as unlocking in this way would lose any changes made.



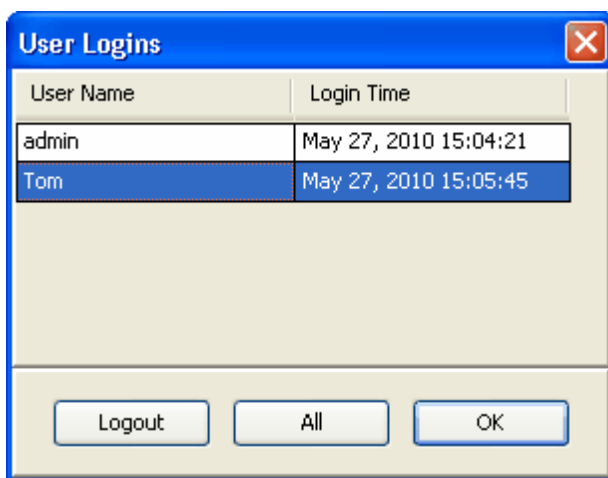
4.2.4.3 4.2.4.3: Clear Login Sessions

For Administrators and those users with sufficient privilege, the clear log-in sessions can be used to log off other users to free up a license.

Note: This function will only log off a user and return them to the log-in screen; it does not close down the application.



To log-off another user, select the user from the list and click the **Logout** button



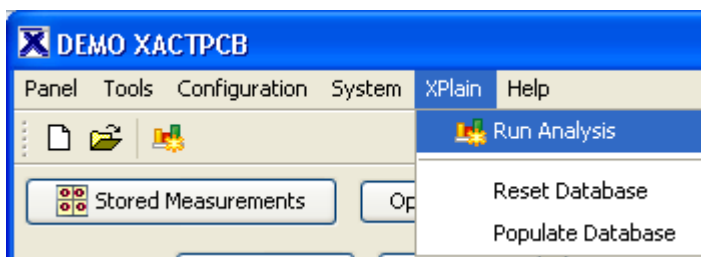
4.2.4.4 4.2.4.4: Fixes and Settings

The Fixes and Settings menu option allows access to one off functions that can be run on a database.

All items on this list require a run code which will be provided by XACT personnel if required.

4.2.5 4.2.5: Xplain

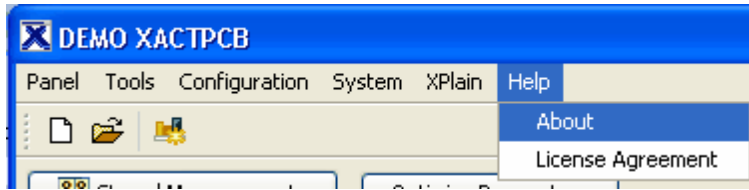
The Xplain menu option will only appear if the xplain modules' license option has been purchased.



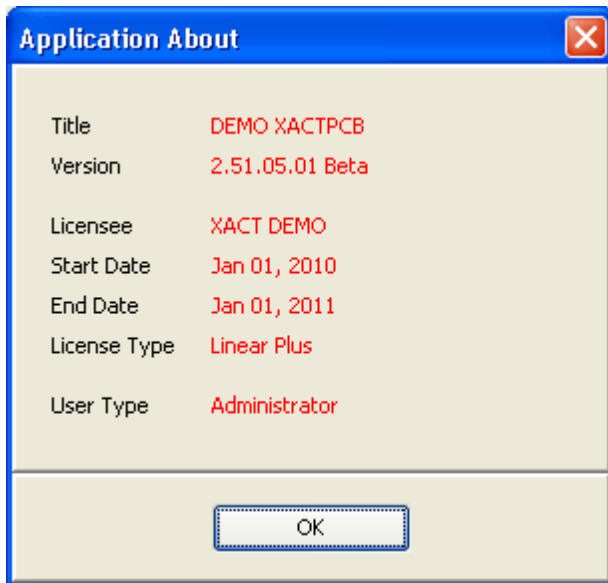
From the Xplain menu, it is possible to launch the reporting module,

4.2.6 4.2.6: Help Menu

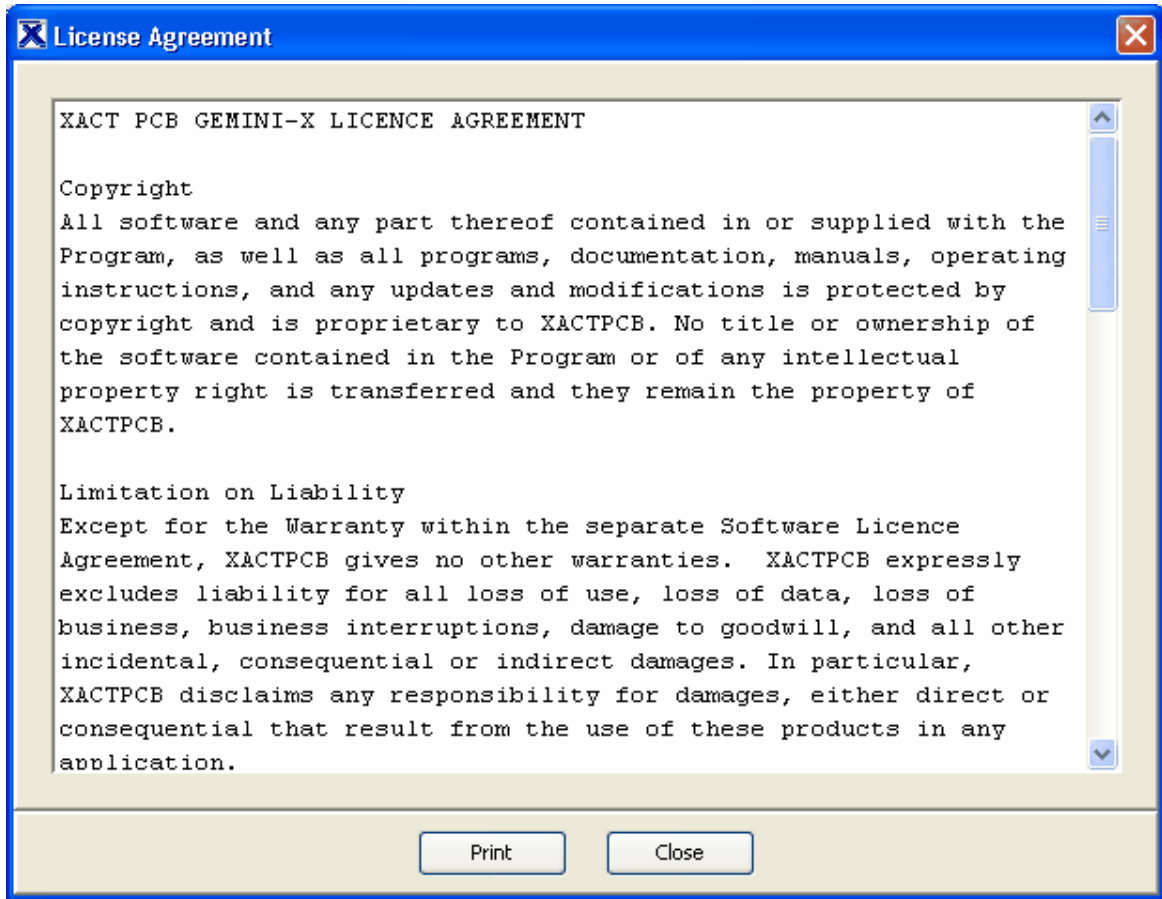
The **Help** menu provides access to the **About** function and the License Agreement



The About option displays a dialogue window that shows the name of the Licensee and the expiry date of the active License key.



The License Agreement option displays a copy of the license agreement which has been agreed to when a license key is issued or an upgrade has been installed.



5 5: Stackup Module

As we have already noted – there are key process steps to using the Gemini-X software. It may be instructive to add a little detail to the process flow:

- (1) **“Predict” – use the XACT stackup module to import/build/define a stackup get scale factors**
- (2) **“Build the board”** - using the scale factors predicted
- (3) **“Measurement Analysis”** – use an X Ray Drill or similar to determine how the layers have scaled in manufacture
- (4) **“Store” or “Link”** – this locks the actual measurement (3) to the actual stackup (1) – lot by lot if necessary.
- (5) **“Optimise”** – Use the intelligent optimiser engine in Gemini-X to figure out what material and process factors have the influence on scale factor.

This section deals with the first step – Prediction using the stackup module

5.1 5.1: Create a New Stackup

Users can only access the stack-up module options if they have been granted

“**designer**” privilege in their log-on settings.

A new stack up can be generated by selecting the **New** option from the **File** menu, or clicking the new stack-up icon.



When the new stackup is selected, a dialogue window will appear.

The field names that appear on the dialogue screen are often customised to match the standard nomenclature used at the installation site, these names are configured in the XactMain.properties file.

The default names are Work Order, Tool Number and Part ID - these names will be used throughout this manual.

Enter a unique alphanumeric identifier for the **Work Order**. **This field is mandatory and must be a unique name.**

If multiple lots are issued against the same work order, append the name of each lot to the work order name when creating the records.

E.g. work order Q1234, lot number 1 could be entered as Q1234-001 as shown above.

If using master tool number records which reflect the current engineering status of a product, enter the tool number with the prefix **TN** in the Work Order field.

E.g. Tool number 12345 should be entered as TN12345 in the work order field (the tool number field will be just the tool number)

Using this nomenclature allows the Xact system to correctly identify work order records and master tool records and link them where necessary.

The **Tool Number** allows alphanumeric text entries and can be searched within the

database. .

The **Panel ID** allows additional alpha-numerical information to be saved. This is an optional field and can be left blank.

Enter the required **Number of Layers** or select from the drop down box and choose either **Foil** or **Capped** construction – this will be used to define the initial stack-up model to be used. Additional layers can be added from the main application interface.

Enter the **Panel Size** details ensuring that the correct dimensions are allocated to the **warp** and **weft** (**grain** and **fill**) direction of the materials. This is critical as the material movement in the warp and weft directions are different for almost all materials.

By default the Circuit size is set to be equal to the panel size and need not be filled in unless specifically required:

The **Circuit Size** refers to the unit used to obtain the copper distribution information – if the CAM system is providing data for a circuit which is repeated around the panel, set the dimensions to the circuit size and the **No. up** to match the number of circuits on the panel.

The **Datum Short and Long** co-ordinates refer to the position of the datum used in the measurement analysis relative to the origin position (0,0) of the CAM system.

This is of importance within the Non Linear modules only and by default is greyed out in Linear+

Although the New Panel dialog enables simple creation of through-hole multilayer PCBs, in cases where more complex builds are used, it is advisable to set up a number of product type templates that can be copied and modified.

5.2 5.2: Import Stackup

Integration with customers' CAM and Pre-CAM systems is recognised by XACT as being very important to its customers and although the XACT stackup generator is a very powerful tool, if a customer already has a Panel Stackup generated in a CAM/ERP system such as Cimnet Engenix, Frontline InPlan, Genesis2000, Direct Logix, Polar SpeedStack, Procim or one of our supported custom options then the XACT software can import it using an XML, SQL or other interface.

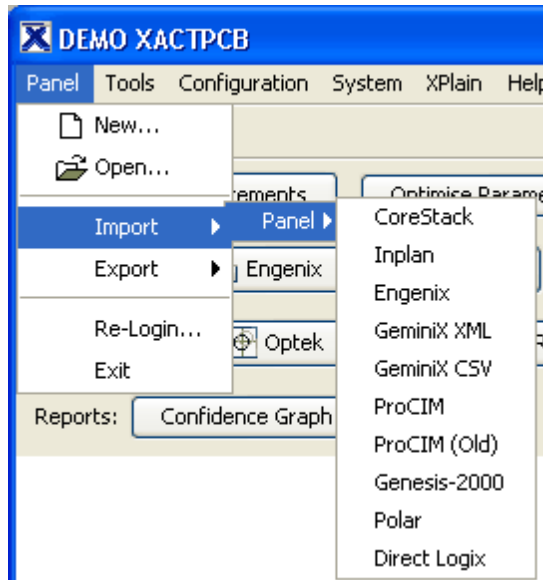
This ensures that the engineers entering this data electronically only have to do it in their existing systems and therefore the data entry occurs once.

The procedure for importing a stackup using files is as follows:

- Where using files to transfer the data, a stackup in the external software system is **output** as a standard format file.
- It is important that the file output format follows the expected standards. Contact XACT if more details are required.
- The XACT software Panel>Import>Panel function is used to locate the file

and read in the contained data to XACT's stackup editor.

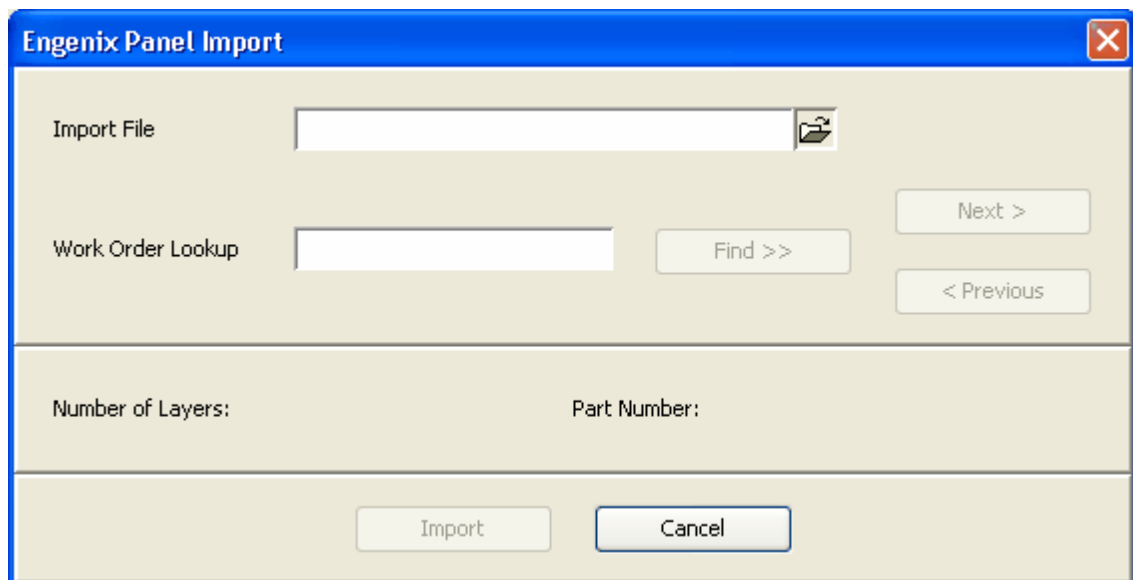
An alternative method currently used with Procim only is to import the required data using an SQL link directly to the external system's database.



5.2.1 5.2.1: Engenix

To import a new stackup:

- select the file using the file open button
- Press the **Find>>** button to locate and select the data within the XML file (the software is compatible with multiple stackups in the same XML file)
- The number of layers and part number will be displayed
- Press Import to complete and the Log file dialog will be displayed.



5.2.2 5.2.2: Inplan

To import a new stackup:

- select the file using the file open button
- Press the **Find>>** button to locate and select the data within the XML file (the software is compatible with multiple stackups in the same XML file)
- The number of layers and panel size will be displayed
- If additional information is to be read from a separate file, select the correct file in the update field
- Press Import to complete and the Log file dialog will be displayed.

The screenshot shows the 'Inplan Panel Import' dialog box. It has a blue title bar with a close button. The main area is divided into several sections. At the top, there's an 'Import File' section with a text box and a file selection icon. To the right of this is a 'Settings' button. Below that is a 'Work Order Lookup' section with a text box and a 'Find >>' button. To the right of this are 'Next >' and '< Previous' buttons. Below that is an 'Update XML File' section with a text box and a file selection icon. The bottom section contains four labels: 'Panel Part:', 'Tool Number:', 'Number of Layers:', and 'Grain Size (inches):'. Below these are two more labels: 'Fill Size (inches):'. At the very bottom are 'Import' and 'Cancel' buttons.

5.2.3 5.2.3: Procim

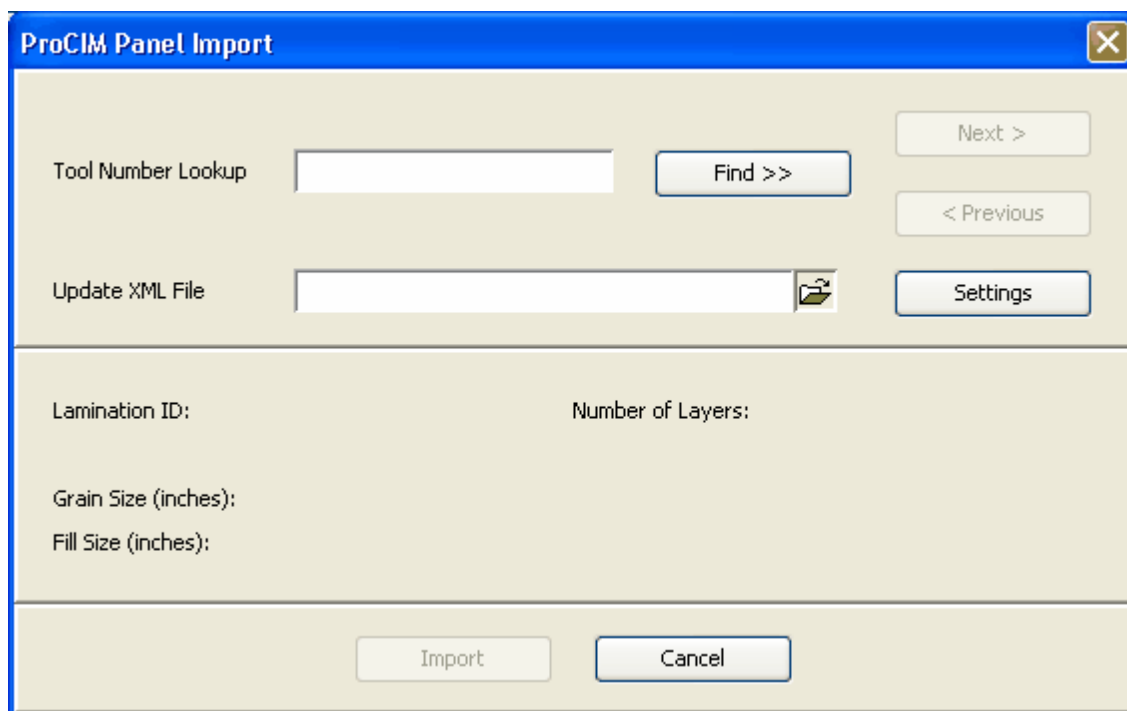
Enter the tool number to lookup in the tool number field and press the **Find>>** button.

Use the Next and Previous buttons to navigate through the displayed records matching the selected tool number.

For each record, the Lamination ID, number of layers and panel size will be shown.

If additional information is to be read from a separate file, select the correct file in the update field

Press Import to complete and the Log file dialog will be displayed.

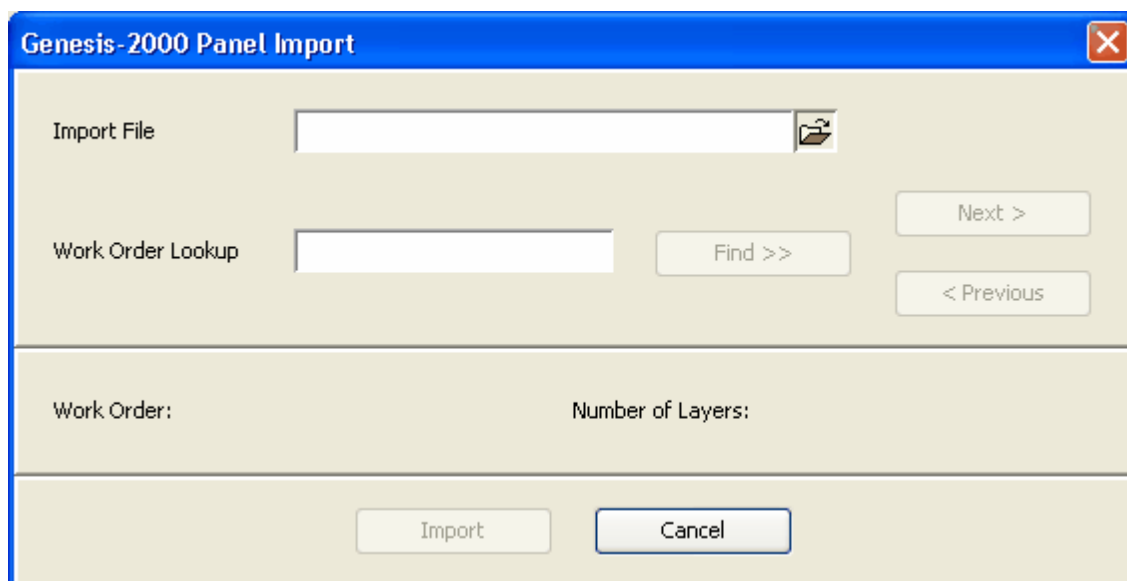


The ProCIM Panel Import dialog box features a blue title bar with a close button. It contains two input fields: 'Tool Number Lookup' and 'Update XML File'. The 'Tool Number Lookup' field has a 'Find >>' button to its right. The 'Update XML File' field has a file icon button to its right. To the right of these fields are three buttons: 'Next >', '< Previous', and 'Settings'. Below these fields, there are four labels: 'Lamination ID:', 'Number of Layers:', 'Grain Size (inches):', and 'Fill Size (inches):'. At the bottom are 'Import' and 'Cancel' buttons.

5.2.4 5.2.4: Genesis 2000

To import a new stackup:

- select the file using the file open button
- Press the **Find>>** button to locate and select the data within the XML file (the software is compatible with multiple stackups in the same XML file)
- The number of layers and panel size will be displayed
- Press Import to complete and the Log file dialog will be displayed.

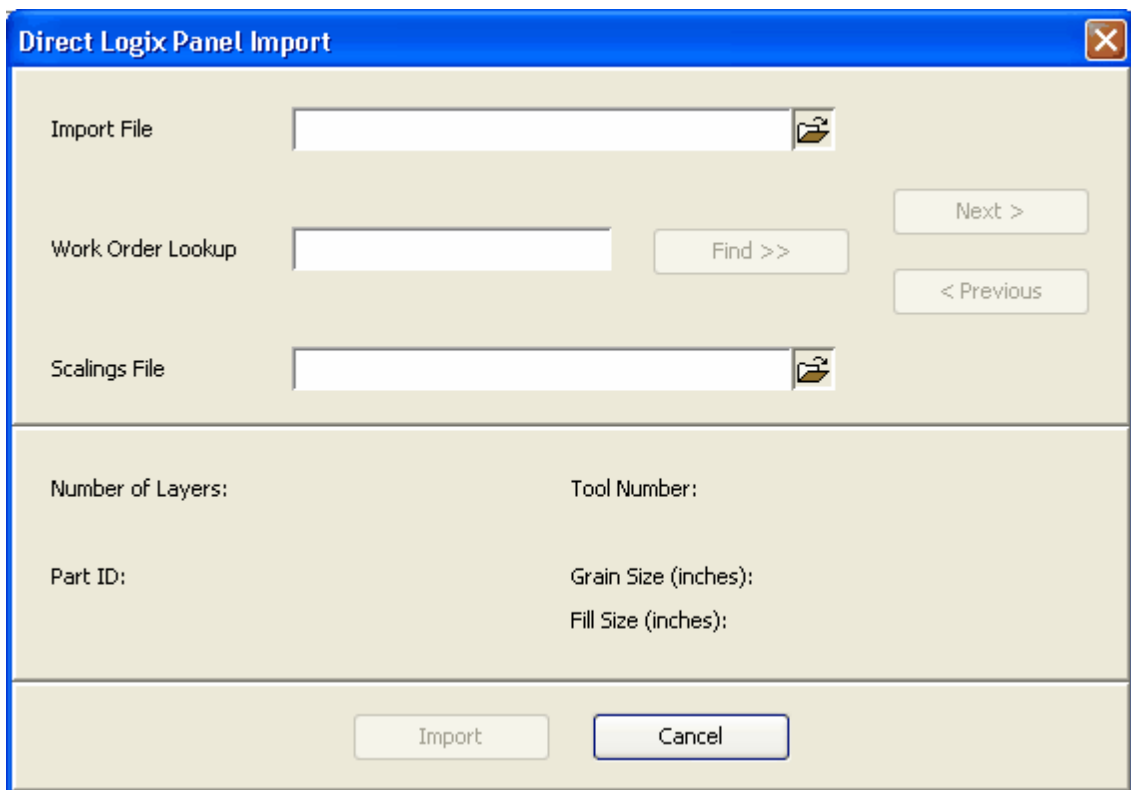


The Genesis-2000 Panel Import dialog box has a blue title bar with a close button. It includes an 'Import File' field with a file icon button to its right. Below this is a 'Work Order Lookup' field with a 'Find >>' button to its right. To the right of these fields are 'Next >' and '< Previous' buttons. The bottom section contains 'Work Order:' and 'Number of Layers:' labels, and 'Import' and 'Cancel' buttons at the very bottom.

5.2.5 5.2.5: Direct Logix

To import a new stackup:

- select the file using the file open button
- Press the **Find>>** button to locate and select the data within the XML file (the software is compatible with multiple stackups in the same XML file)
- The number of layers and panel size will be displayed
- If additional scale information is to be read from a separate file, select the correct file in the scalings file field
- Press Import to complete and the Log file dialog will be displayed.

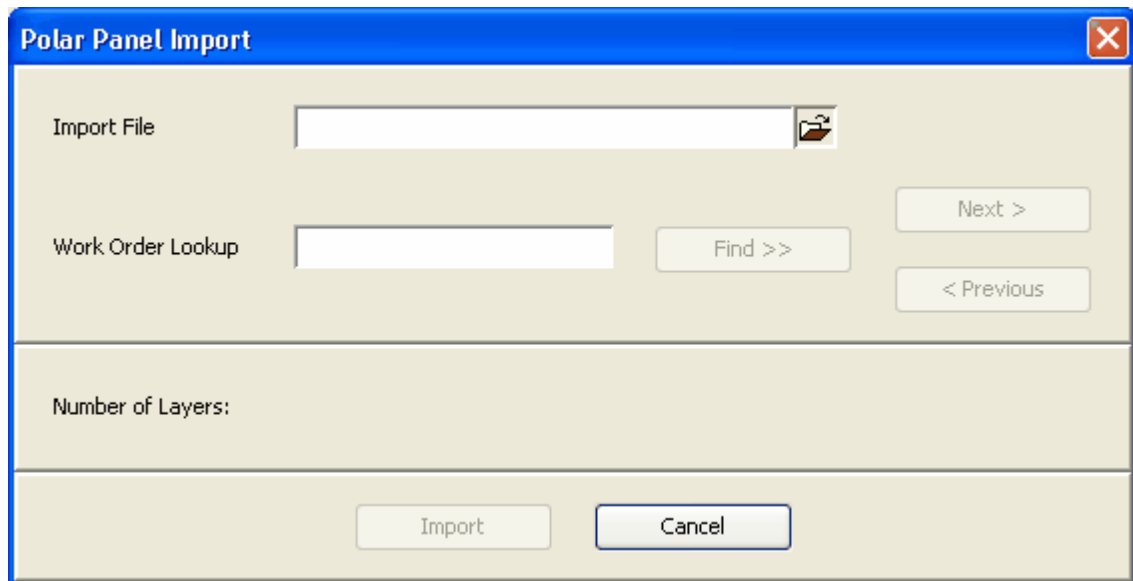


The image shows a software dialog box titled "Direct Logix Panel Import". It has a blue title bar with a close button (X) in the top right corner. The dialog is divided into several sections. The top section contains three input fields: "Import File", "Work Order Lookup", and "Scalings File". Each field has a file selection icon (a folder with a document) to its right. To the right of the "Work Order Lookup" field is a button labeled "Find >>". To the right of the "Scalings File" field is a button labeled "< Previous". Below these fields are two rows of labels: "Number of Layers:" and "Tool Number:" in the first row, and "Part ID:" and "Grain Size (inches):" in the second row. Below these are two more labels: "Fill Size (inches):". At the bottom of the dialog are two buttons: "Import" and "Cancel".

5.2.6 5.2.6: Polar

To import a new stackup:

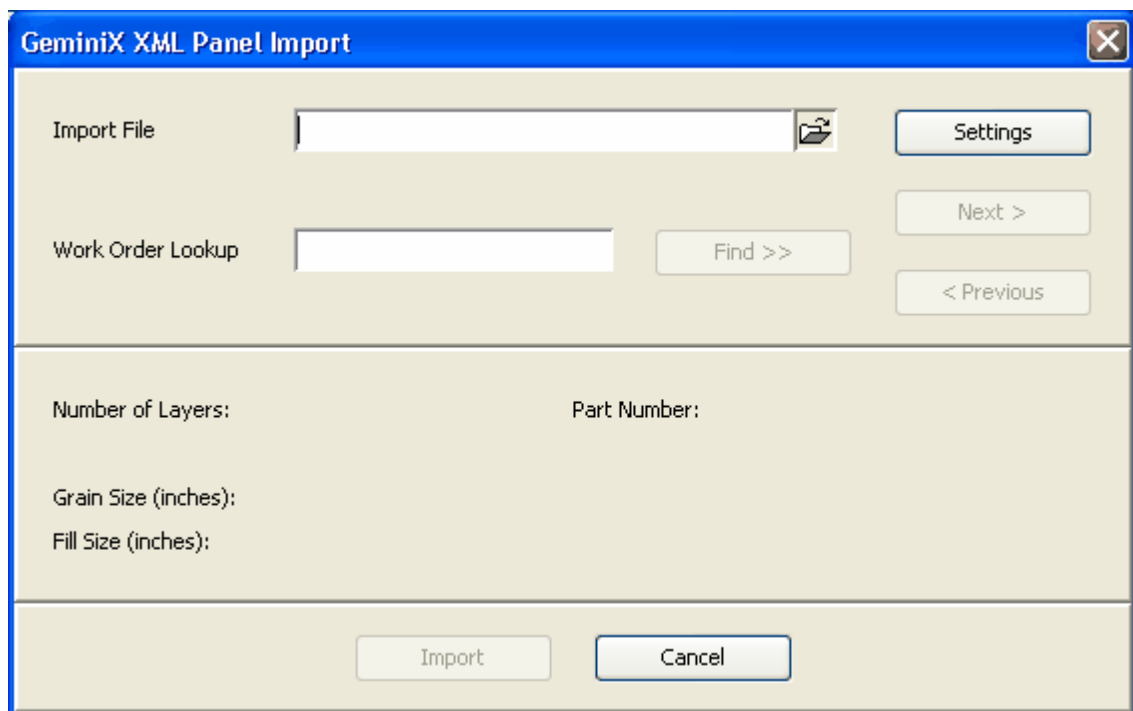
- select the file using the file open button
- Press the **Find>>** button to locate and select the data within the XML file (the software is compatible with multiple stackups in the same XML file)
- The number of layers will be displayed
- Press Import to complete and the Log file dialog will be displayed.



5.2.7 5.2.7: GeminiX XML

To import a new stackup:

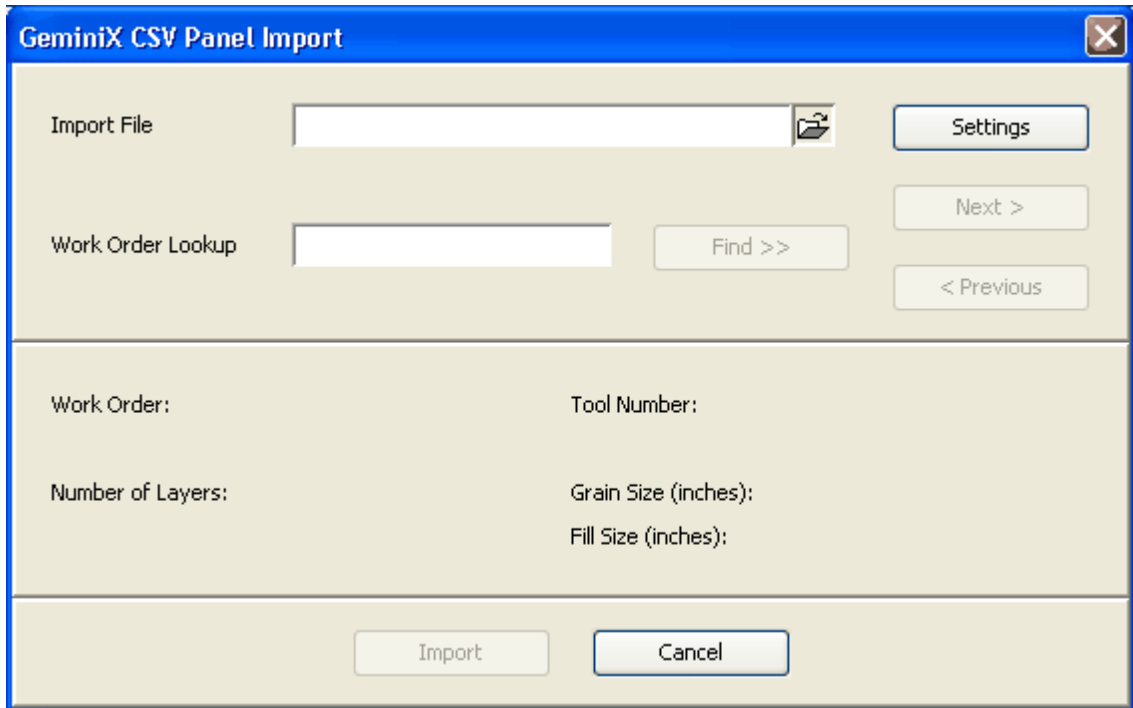
- select the file using the file open button
- Press the **Find>>** button to locate and select the data within the XML file (the software is compatible with multiple stackups in the same XML file)
- The number of layers and panel size will be displayed
- Press Import to complete and the Log file dialog will be displayed.



5.2.8 5.2.7: GeminiX CSV

To import a new stackup:

- select the file using the file open button
- Press the **Find>>** button to locate and select the data within the XML file (the software is compatible with multiple stackups in the same XML file)
- The number of layers and panel size will be displayed
- Press Import to complete and the Log file dialog will be displayed.



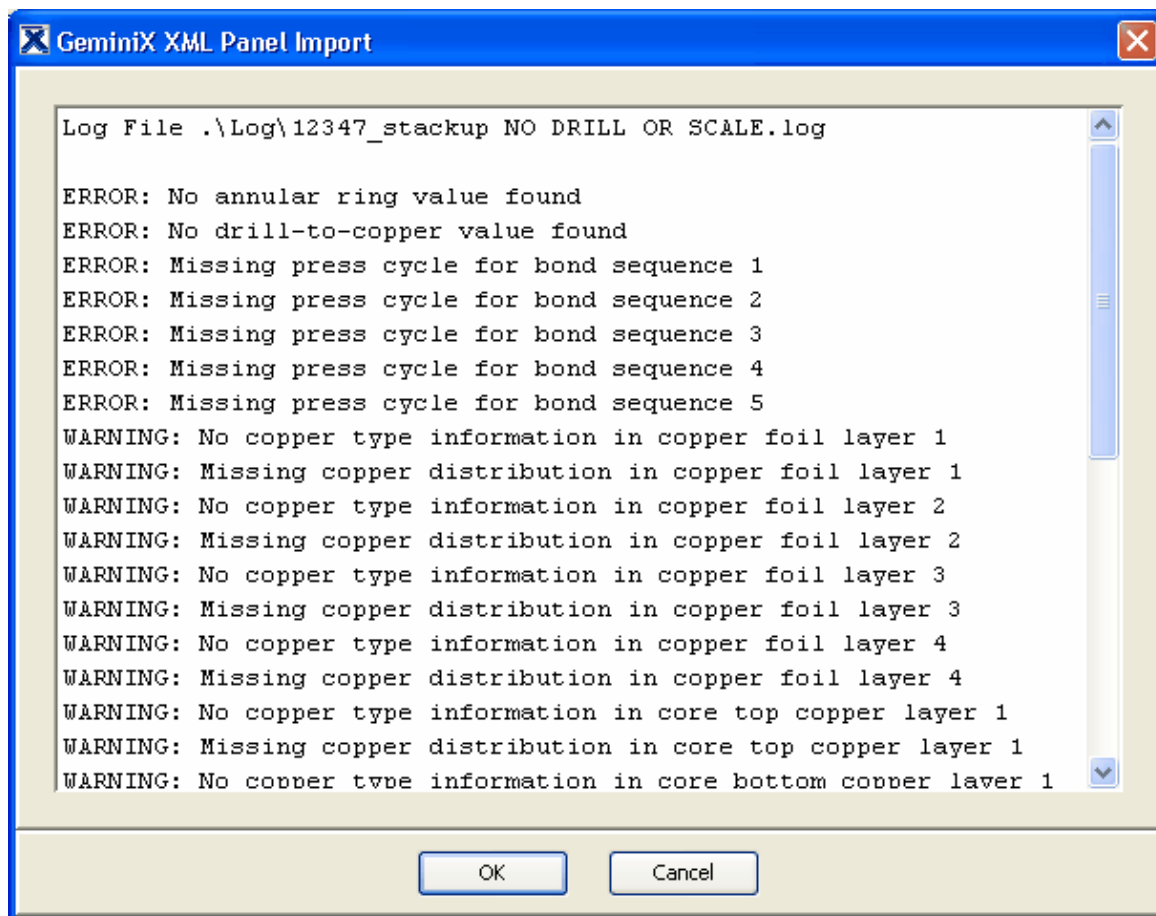
5.2.9 5.2.8: Panel Import Log & Errors

In the event that the new stackup contains cores, prepregs and Cu weights that are not in the master material library the log file will either display a message indicating new materials have been added to the database or if the automatic material addition function is disabled, it will display an error message.

If any error messages appear in the log, the stackup will still import but additional information will need to be manually entered in the XACT stackup before the job can be saved.

This error should be rare and usually indicates that data is missing from the imported file.

In addition to the error messages, warning messages may also appear - these indicate issues which are not critical to the scale factor prediction process.



5.3 5.3: Open, Copy and Edit Stackup

To open an existing stack-up either click on the open stack-up icon or select the option from the File menu.

The Open Panel window will be displayed.

The find buttons allow quick searching or instant access to particular stack-ups. Enter the **Work Order**, **Tool Number** or the **Panel ID** in the look-up boxes and click the find button.

Partial names with a * wild card can be used for multiple selection – use the **next/previous** buttons to navigate to the desired stack-up.

Press **Open** to enter the selected stack-up.

To access the extended search options, click the **Advanced** button.

5.3.1 5.3.1: Advanced Selection

The Open Panel window will now extend to show the extended search options.

The user can search by:

1. Date last edited
2. Last Editor names
3. Number of layers
4. Number of lamination stages
5. If a product has sub-components*
6. Panel Status:
 - i. Incomplete
 - ii. Awaiting Measurements
 - iii. Measurements Stored

Only one of the options 2, 3, 4 and 5 can be selected at the same time.

The user can select whether to include sub-component records in the search results by clicking on the “Include Sub-Component Panels” check box.*

* Licensed sub-component (SBU) options

The user can toggle through the matching records using the Next/Previous buttons.

Press **Open** to enter the selected stack-up.

5.3.2 5.3.2: Copy Stackup

This same **Open** dialog box is used to **COPY** an existing stackup record to a new stackup – for example when making a clone stackup for another lot of the same part.

Clicking on **Copy** brings up the following dialog box.

The new record to be created must have a unique name for the database to be able to create this. Enter the unique name for the new record in the first text box (Work Order).

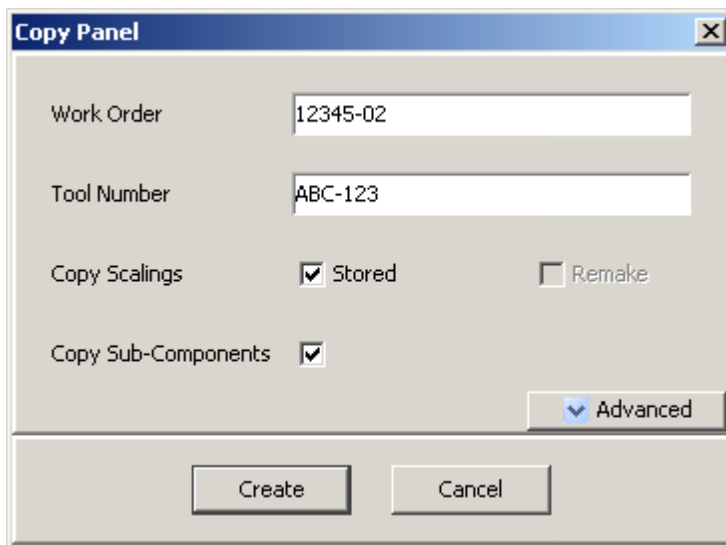
If the existing stackup has measurements **stored** then the user may want to copy across one of the following:

- (a) the same original stored scale factors
- (b) the Remake scale factors based on the measurement
- (c) no stored values to the new stackup.

These options are all made available here.

If the user has a license for the sub-component module, it is also possible to create a copy of all child sub-components for the selected record by clicking the Copy Sub-components check box.

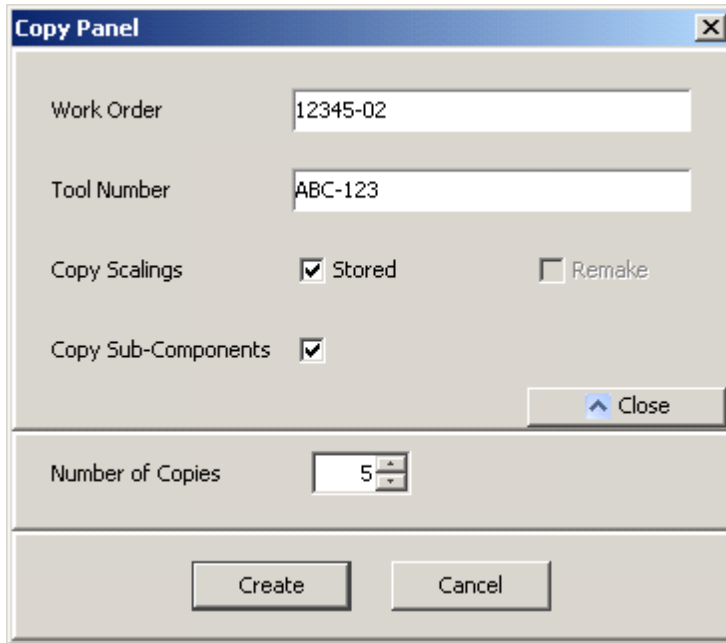
When the **Create** button is clicked, the new record will be created and the stack-up will be displayed.



To create multiple copies of the same record, click on the **Advanced** button and the dialogue will extend to show the number of copies to be created. This option prevents the user from having to keep navigating the Panel Open dialogue to make multiple copies of the same record.

Enter the number of records to be created and enter the new name of the first record as with the single record copy function. Each time the Create button is clicked, a new record will be created and the number of copies will decrement. Remember to enter a new name for each record to be created.

When the final record has been created, the dialogue will disappear and the last record will be shown in the stack-up editor.



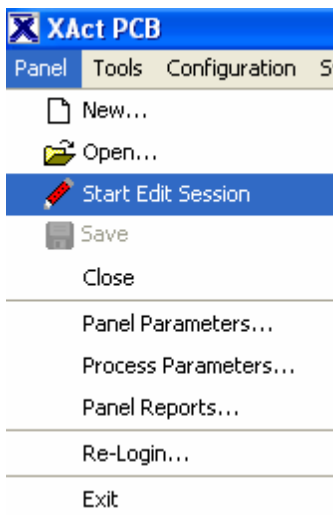
The 'Copy Panel' dialog box contains the following fields and controls:

- Work Order:** Text field containing '12345-02'.
- Tool Number:** Text field containing 'ABC-123'.
- Copy Scalings:** Two checkboxes: 'Stored' (checked) and 'Remake' (unchecked).
- Copy Sub-Components:** One checkbox: 'Copy Sub-Components' (checked).
- Close:** A button with an upward arrow icon and the text 'Close'.
- Number of Copies:** A numeric spinner box set to '5'.
- Create:** A button at the bottom left.
- Cancel:** A button at the bottom right.

5.3.3 5.3.3: Panel Locks

Panel Edit – User Locks

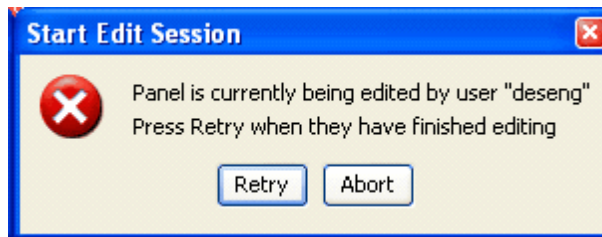
In a multi-user installation (Server-Client mode) it is possible for two users to open the same Panel Code. In order to ensure that the database correctly controls the most recent edits, there is an additional function button (shown as a Red Pencil) and an associated function in the menu.



By default, in a multi-user installation, when a panel is opened the edit functions are disabled and the feature dialog boxes are greyed out. This is because in a multi-user environment *any* editor can open *any* panel as READ-ONLY.

To start an edit session – that is to enable the job for editing, click on the Pencil icon.

In the event that another user already has the job open, the following dialog box is shown. No edits are allowed until the other user closes their edit session.



5.3.4: Templates

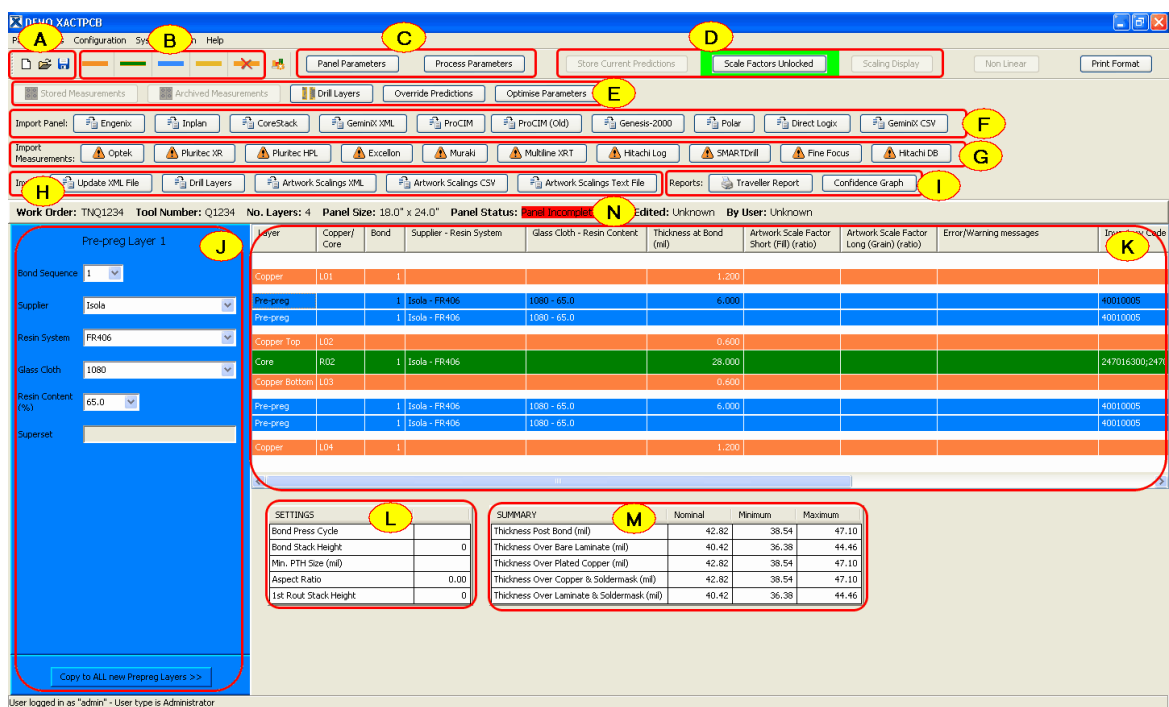
With a little planning, the COPY function can be used to create a very useful set of Templates that share key characteristics. During the installation and training process, XACT personnel will create some example TEMPLATES which can be used as the basis of real product Stack-Ups.

Typically a set of Template Stack-Ups will consist of:

- (i) Through Hole PCBs of various layers using single prepreg constructions
- (ii) Through Hole PCBs of various layers using multiple prepreg constructions
- (iii) Blind via and buried via common configurations
- (iv) Common SBU configurations
- (v) Stack-Ups using advanced material configurations etc.

Once the TEMPLATES are set up the user will simply have to select the template closest to the actual PCB stackup to be created and edit the necessary parts. This can be a much quicker process than creating the stackup from first principles.

5.3.4: Stackup Editor Layout



A: New Stack-up, Open Stack-up, Save Stack-up

- B: Insert & delete material options
- C: Panel parameters & Process parameters access
- D: Scale Factor store and control
- E: Additional Function Toolbar
- F: Import Stackup from external sources using quick import features
- G: Import Measurements using quick import features
- H: Import additional data from external sources
- I: Traveller Report and Confidence Graph
- J: Material definition panel
- K: Stack-up Display Pane
- L: Process settings display
- M: Panel thickness summary
- N: Panel Status

5.3.5.1 Panel Parameters

The details shown on the Panel Parameters dialogue should be entered when creating a new stackup, but when importing data from an external source it is possible that some details will be missed and need to be added later.

Pressing the Panel Parameters button will bring up the dialogue shown below.

When entering the Panel Size details, ensure that the correct values are put against the Grain (Warp) and Fill (Weft) directions.

Panel Parameters

Work Order: TN0447

Tool Number: TN0447

Part ID: 1

Panel Size Grain (inches): 18.0 Panel Size Fill (inches): 24.0

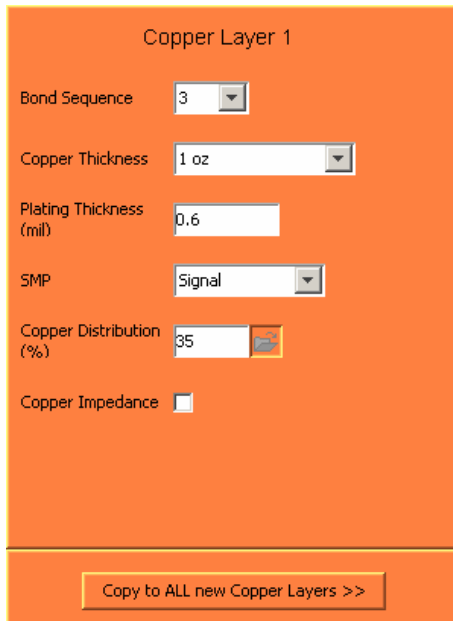
Circuit Length (inches): 18.0 Circuit Width (inches): 24.0 ☐ Override

Ccts/Panel [default=1]: 1

Datum Long (inches): 0.0 Datum Short (inches): 0.0 ☐ Override

OK Cancel

5.3.5.2 Copper Layers



The **copper layers** refer to layers of copper foil used in the stack-up. In a standard build there will be two copper layers – one each at the top and bottom of the stack. Capped builds and sequential build-ups may have different numbers of copper layers – these can be inserted or deleted in the stack-up module.

Bond sequence refers to the stage at which this copper foil layer is initially laminated into the stack-up. For standard builds, this would be set to bond sequence 1, but for a sequential build-up design, there may be copper foil layers laminated in stage 1 and stage 2 – each layer should be identified accordingly.

Select the **Copper Thickness** of the copper foil from the defined list shown in the drop down menu and enter the **Plating Thickness** in the text box below.

The **SMP** drop down box allows the user to select whether the layer is a Signal, Mixed or Plane (Ground) layer. If no copper distribution has yet been entered, selecting these values will enter default copper distribution values in the Copper Distribution text box.

Enter the **Copper Distribution** of the layer as it will be at the final lamination stage.

The **Copper Impedance** checkbox allows the user to define those copper layers with Impedance requirements – this is not used in any impedance calculations, but allows the **Traveller Report** to show those layers where Impedance has been designated as a requirement.

Press the **Copy to ALL Copper Layers** button to set the same values to all other copper layers in the stack-up which are currently not defined.

5.3.5.3 Prepreg Layers

Pre-preg Layer 1

Bond Sequence

Supplier

Resin Type

Glass Cloth

Resin Content (%)

Superset

[Copy to ALL new Prepreg Layers >>](#)

Each prepreg layer used in the stack-up is defined individually, but the calculated thickness and press-out loss are displayed for each prepreg based dielectric separation.

To define a prepreg layer, click on the relevant layer from the stack-up view and the active layer display will show the prepreg details.

Bond sequence is defined according to the stage at which the prepreg layer is first laminated into the product.

For each prepreg:

Select the prepreg **Supplier** from the drop down menu.

Select the **Resin type** from the available list.

Select the **Glass cloth** from the available list.

Finally if a glass cloth is supplied in more than one **Resin content**, select the correct percentage resin content for the prepreg from the available list.

If the user is using the Superset function, the name of the superset group for the selected prepreg will be shown in the **Superset** text box.

The **Copy to ALL new Prepreg Layers** button will copy the prepreg details to all other prepreg layers that have not yet been defined.

5.3.5.4 Core Layers

Core Layer 1

Bond Sequence: 1

Supplier: Isola

Resin Type: 370HR

Core Thickness (mil): 6.0

Construction: standard

Superset:

Top Copper Thickness: .50 oz

Bottom Copper Thickness: .50 oz

Top Plating Thickness (mil): 0.0

Bottom Plating Thickness (mil): 0.0

Top SMP: Mix

Bottom SMP: Mix

Top Copper Distribution (%): 60

Bottom Copper Distribution (%): 58

Top Copper Impedance:

Bottom Copper Impedance:

Copy to ALL new Core Layers >>

Override Predictions

Core layers define both the substrate material and the attached copper layers – referred to as top copper and bottom copper.

Select the correct **bond sequence** according to the stage at which the core will initially be laminated into the product.

Select the material **Supplier**.

Select the **Resin type** from the drop down list.

Select the **Core thickness** from the list – this is the thickness of the dielectric substrate between the copper layers and does not include the copper thickness.

If the core thickness is available in more than one **Construction**, select the correct construction from the list of available options.

If the user is using the Superset function, the name of the superset group for the selected core will be shown in the **Superset** text box.

Select the correct **copper thickness** for the copper layers above (top) and below (bottom) the core as it is orientated in the stack-up.

If the core has been copper plated, enter the **plating thickness** for the each side of the core.

The SMP drop down box allows the user to select whether the layer is a Signal, Mixed or Plane layer. If no copper distribution has yet been entered, selecting these values will enter default copper distribution values in the **Copper Distribution** text box.

Enter the percentage **copper distribution** at the final lamination stage for each of the copper layers. If using non-linear modules, copper distribution files must be read in using the file open icon.

Copper distribution can be IMPORTED directly from a CAM-generated file (e.g. UCAM or Genesis)

The **Copper Impedance** checkboxes allow the user to define those copper layers with Impedance requirements – this is not used in any impedance calculations, but allows the **Traveller Report** to identify layers where Impedance has been designated as a requirement.

The **Copy to ALL Core Layers** button will copy the core details (excluding the copper distribution) to all other core layers that have not yet been defined.

The **Override Predictions** button will allow the user to manually enter the scale factors for this layer.

5.3.5.5 Add/Remove Layers

The initial stack-up model created for any new design will be based on a standard model with one prepreg layer between each copper/core layer. If any additional prepreg, copper or core layers are required in the stack-up, these can be inserted by using the relevant layer insertion buttons.



Insert copper layer



Insert core layer



Insert prepreg layer



Insert coverlay material (*only with licensed Flex materials option*)

To **insert** a layer click on the relevant button and move the cursor over the stack-up view – the cursor will show the relevant layer type. Click on the stack-up view at the point the layer is to be inserted. Repeat the process for each additional layer required.



To **delete** a layer, click on the delete icon and move the cursor over the layer to be deleted in the stack-up view. Click on the layer to delete.

As with the layer entry buttons, double clicking will allow multiple deletions.

5.3.5.6 Summary Details

At the bottom of the stack-up view and on the report page are three summary tables. These tables show the process parameters that have been entered, the calculated thickness of the panel at various stages and other processing details.

SUMMARY	Nominal	Minimum	Maximum
Thickness Post Bond (mm)	2.5240	2.2716	2.7764
Thickness Over Bare Laminate (mm)	2.4880	2.2392	2.7368
Thickness Over Plated Copper (mm)	2.5940	2.3346	2.8534
Thickness Over Copper & LPISM (mm)	2.6780	2.4102	2.9458
Thickness Over Laminate & LPISM (mm)	2.5720	2.3148	2.8292

The **thickness summary** shows the calculated thickness of the panel incorporating the press out loss of the prepregs. This allows for comparison against customer specifications which can be quoted for any of these options

The **thickness post bond** is the calculated thickness of the product when removed from the press at the final lamination stage.

The **thickness over bare laminate** is the thickness between the outer copper layers at the final lamination stage.

The **thickness over plated copper** is the post bond thickness plus any plated copper thickness.

The **thickness over copper & Soldermask** is the total thickness of the product including plated copper and solder mask thickness.

The **thickness over laminate & Soldermask** is the total thickness of the product including solder mask thickness, but excluding all surface copper thickness.

The minimum and maximum values displayed are based upon a tolerance of +/- 10%.

The settings summary displays the user entered press cycle and minimum plated through hole diameter along with additional process settings based upon the product thickness calculations.

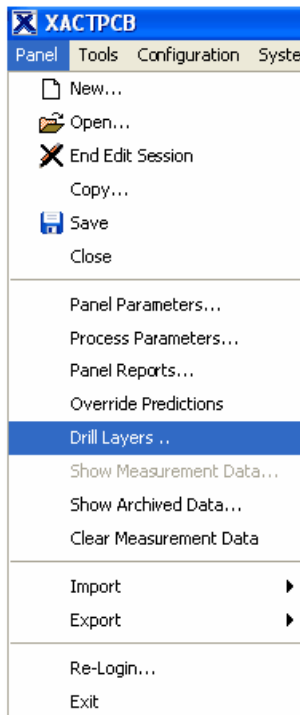
SETTINGS	
Bond Press Cycle	Low Tg
Bond Stack Height	10
Min. PTH Size	0.45
Aspect Ratio	3.40
1st Rout Stack Height	5

The **bond stack height** shows the quantity of panels that could be laminated in a single daylight, based upon the available daylight thickness and separator thickness values set in the configuration menu.

The **aspect ratio** for plating is shown based upon the ratio of panel thickness at the plating process to the minimum hole diameter.

The **1st rout stack height** shows the quantity of panels that can be processed in a single stack at a post lamination trimming operation.

5.4 5.4: Drill Layers



This should be done AFTER the stack up materials are fully specified, but before the stored scale factors are set (or imported).

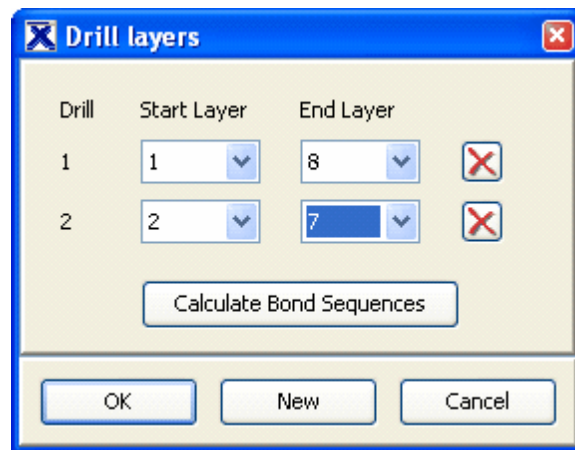
To define the drill layers in a PCB stack use the option shown on main panel menu or click on the drill layers button in the menu bar.



This will bring up a popup where the drilled layers can be defined

Select the start and end layers of each drilled hole in the job.

Click on NEW to add a further drilled hole



If using the drill layers to calculate the sub-assembly layers, click on Calculate Bond Sequences – GeminiX will use a smart algorithm to determine the bond sequence. It is the responsibility of the user to check that the calculated bond sequence is correctly set. (If defining sub-assemblies using the sub-assembly start and end layers, do not use the drill layers to create bond sequences.)

Always check that the bond sequences set after clicking the calculate button are correct - some drill configurations can be manufactured by more than one method and the results could be incorrect.

Note: For supported stack-up modules, the drill layers may be imported automatically from an external file.

5.5 5.5: Process Parameters

When all materials within the entire stack-up have been defined using the above steps the Panel Code should be saved and the user must now enter the **Process Parameters** for the PCB.

To display the parameter window, click on the Process Parameters button below the

main menu.

The Process Parameters window is used to define the [Press Cycle](#) that will affect the material movement and the [Plating](#) and [Solder Mask](#) details that will affect the final thickness of the current stack-up.

In addition, [Drill Parameters](#) such as the **Annular Ring** and **Drill to Copper** are specific to a given PCB design are entered here – the minimum layer values are usually applied.

Process Parameters

Press Cycle Bond 1	370HR	Press Cycle Bond 6	
Press Cycle Bond 2	370HR	Press Cycle Bond 7	
Press Cycle Bond 3	370HR	Press Cycle Bond 8	
Press Cycle Bond 4		Press Cycle Bond 9	
Press Cycle Bond 5		Press Cycle Bond 10	

Desired Lamination Thickness (inches)

Min. PTH Size (mil) Min. Annular Ring (mil)

Drill To Copper (mil) IPC Annul. Ring (mil) ☒ Applied

Panel Plating ☐ Pattern Plating ☐

Solder Mask

Notes

Offset Grain Scaling (ratio)	<input type="text" value="1.000100"/>	Offset Fill Scaling (ratio)	<input type="text" value="1.000000"/>
Reference Drill Grain Scaling (ratio)	<input type="text" value="1.000100"/>	Reference Drill Fill Scaling (ratio)	<input type="text" value="0.999950"/>

5.5.1 Press Cycle

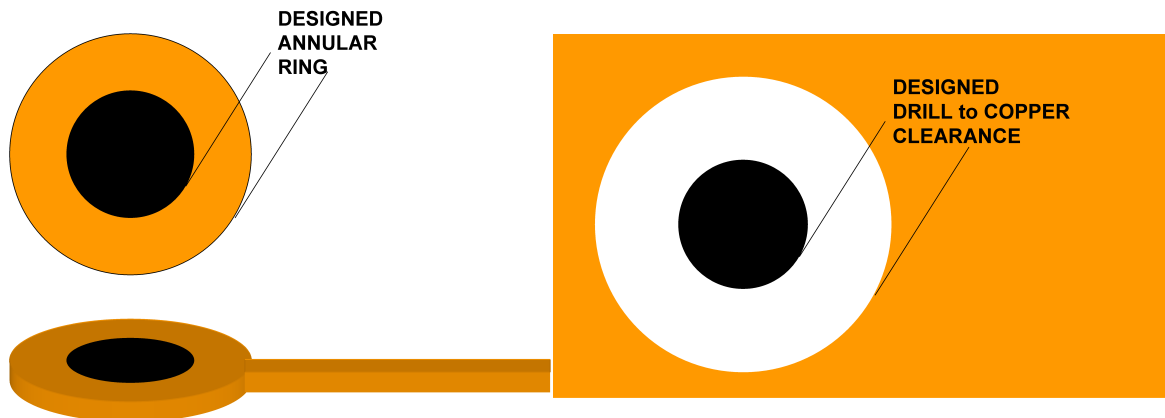
Select the press cycle(s) that will be used to laminate the product. You must enter a press cycle for each bonded lamination stage (Bond Sequence).

The press cycle selected should match that used to laminate the materials with that bond sequence into the panel - for sequential lamination PCBs a different press cycle may be used on the inner buried via compared to the outer lamination layers.

This information is required to predict the material movement that will take place and predicted scale factors will not be displayed until this information has been entered.

Process Parameters			
Press Cycle Bond 1	370HR	Press Cycle Bond 6	
Press Cycle Bond 2	370HR	Press Cycle Bond 7	
Press Cycle Bond 3	370HR	Press Cycle Bond 8	
Press Cycle Bond 4		Press Cycle Bond 9	
Press Cycle Bond 5		Press Cycle Bond 10	
Desired Lamination Thickness (inches)			
Min. PTH Size (mil)	10	Min. Annular Ring (mil)	8
Drill To Copper (mil)	13	IPC Annul. Ring (mil)	1 <input checked="" type="checkbox"/> Applied
Panel Plating	<input type="checkbox"/>	Pattern Plating	<input type="checkbox"/>
Solder Mask	LPISM		
Notes			
Offset Grain Scaling (ratio)	1.000100	Offset Fill Scaling (ratio)	1.000000
Reference Drill Grain Scaling (ratio)	1.000100	Reference Drill Fill Scaling (ratio)	0.999950
OK		Cancel	

5.5.2 Drill Parameters



Left - Designed Annular Ring (signal layer) = "MINIMUM LAND"

Right - Designed Drill to Copper clearance (power/plane layer). = "DRILL TO COPPER"

IPC Class Compensations

NOTE – the MINIMUM LAND and DRILL TO COPPER values entered should be as designed and not take into account any etch compensation and should not be adjusted according to any remaining annular ring requirements required to match IPC standards.

If a design specification requires that a minimum annular ring must remain after drilling (e.g. IPC Class 3 requires 1 mil (25 microns) remaining on inner layers), this should be defined in the IPC A/R Req'd field.

For example:

For a hole size of diameter 10 mil (0.25 mm) in a pad of diameter 20 mil (0.5 mm) and a minimum clearance diameter of 32 mil (0.8 mm) manufactured to IPC class 3...

Min PTH size	= 10 mil	
Minimum Land	= 5 mil	i.e. $(20 - 12) / 2$
Drill to Copper	= 12 mil	i.e. $(32 - 12) / 2$
IPC A/R Req'd	= 1 mil	

Enter the diameter of the minimum drill (PTH) size – once the panel thickness has been calculated, this will be used only to calculate the aspect ratio of the panel. This is an optional field.

The minimum land (annular ring) and minimum drill to copper for the design must be entered before measurement analysis can be performed.

Minimum Land (Annular Ring) and Drill to Copper (ie the ground plane clearances) are used in the measurement analysis module to determine if the product is within specification and to calculate the optimum drill compensations.

If the customer requires a minimum annular ring remaining after drill e.g. 1 mil on inner layers as per IPC Class 3, this can be defined in the IPC Annul. Ring field.

If the product is not required to be at 1:1 scaling at the final drill process, it is possible to enter the required scale under the **Offset Scaling** section. (This

functionality is optional and must be enabled through configuration)

If the drill program for this product is already scaled, it is possible to enter the current drill scale for reference in the measurement analysis - the drill scale should be entered in the **Reference Drill Scaling** section. (This functionality is optional and must be enabled through configuration)

Process Parameters			
Press Cycle Bond 1	370HR	Press Cycle Bond 6	
Press Cycle Bond 2	370HR	Press Cycle Bond 7	
Press Cycle Bond 3	370HR	Press Cycle Bond 8	
Press Cycle Bond 4		Press Cycle Bond 9	
Press Cycle Bond 5		Press Cycle Bond 10	
Desired Lamination Thickness (inches)			
Min. PTH Size (mil)	10	Min. Annular Ring (mil)	8
Drill To Copper (mil)	13	IPC Annul. Ring (mil)	1 <input checked="" type="checkbox"/> Applied
Panel Plating	<input type="checkbox"/>	Pattern Plating	<input type="checkbox"/>
Solder Mask	LPISM		
Notes			
Offset Grain Scaling (ratio)	1.000100	Offset Fill Scaling (ratio)	1.000000
Reference Drill Grain Scaling (ratio)	1.000100	Reference Drill Fill Scaling (ratio)	0.999950
OK		Cancel	

5.5.3 Outer Layer Plating

Select the panel plating or pattern plating options according to the processes that will be used.

These will be used to calculate the thickness over plated copper shown in the thickness summary at the bottom of the stack-up editor.

This is an optional field and not required if plating thicknesses have been entered on the individual copper layers.

Note: The thickness associated with panel plating and pattern plating is defined in the **Process Constants** table under the Configuration, Lookup Tables menu option.

Process Parameters			
Press Cycle Bond 1	370HR	Press Cycle Bond 6	
Press Cycle Bond 2	370HR	Press Cycle Bond 7	
Press Cycle Bond 3	370HR	Press Cycle Bond 8	
Press Cycle Bond 4		Press Cycle Bond 9	
Press Cycle Bond 5		Press Cycle Bond 10	
Desired Lamination Thickness (inches)			
Min. PTH Size (mil)	10	Min. Annular Ring (mil)	8
Drill To Copper (mil)	13	IPC Annul. Ring (mil)	1 <input checked="" type="checkbox"/> Applied
Panel Plating	<input type="checkbox"/>	Pattern Plating	<input type="checkbox"/>
Solder Mask	LPISM		
Notes			
Offset Grain Scaling (ratio)	1.000100	Offset Fill Scaling (ratio)	1.000000
Reference Drill Grain Scaling (ratio)	1.000100	Reference Drill Fill Scaling (ratio)	0.999950
OK		Cancel	

5.5.4 Solder Mask

From the drop down list, select the solder mask thickness that will be used.

This is used to calculate the final board thickness shown in the thickness summary at the bottom of the stack-up editor screen.

This is an optional field and is not used in the scale factor calculations.

Note: The thickness associated with each solder mask option is defined in the **Process Constants** table under the Configuration, Lookup Tables menu option.

5.6 5.6: Prediction of Linear Scale Factors

The ability to accurately predict scale factors for a wide variety of stack-ups is at the heart of the Gemini X system.

The primary role of the Gemini-X Stack Up viewer is of course to display the ACCURATE PREDICTED SCALE FACTOR for warp and weft (grain and fill) of each core in the stackup. However, the powerful XACT software is also able to toggle its display between other scale factor calculations:

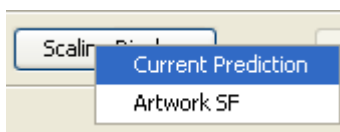
To toggle the display, the user should click on the PREDICTION DISPLAY button on the main toolbar.

If insufficient data has been entered into the stack-up to be able to provide accurate predictions, the Prediction Display button will not be accessible. The Panel Status display will show **Panel Incomplete** when this is the case – the red background indicating that scale factors can not be calculated.

When enough data to provide predicted scale factors is available, the Panel Status will change to either **Panel Incomplete** or **Awaiting Measurements** and the Prediction Display button will be accessible.

While no measurement data has been stored for a stackup there are two options shown:

- a) Show the Current Prediction Scale Factors
I.e. those calculated from the data currently entered and based upon the last optimisation of self-learning model.
- b) Show the Artwork Scale Factors (Stored Scale Factors)
I.e. the scale factors that have been chosen/imported by the user and will be used to manufacture the product.



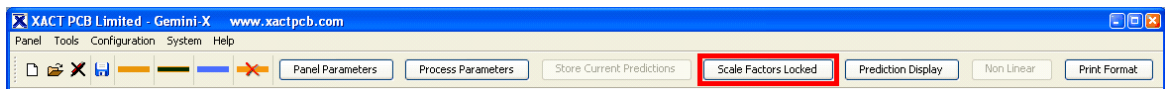
The displayed values are toggled between the stored values and the current predictions using the **Prediction Display** button at the top of the screen. The reason for the differentiation between Current Prediction and Stored Value is that the user can choose to override the predicted scale factor in certain cases.

Current Prediction linear scale factors are calculated automatically as the stack-up data is being entered, but can not be displayed until all required information has been entered.

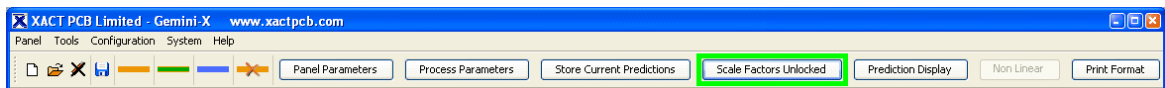
Once displayed, changing an element of the build will recalculate and update the predicted scale factors.

The normal mode of operation is that once the user has built the stack-up, the predicted values will be displayed and the user will choose to copy these values to the Stored Values in the database. The values are stored only when the **Store Current Predictions** button is pressed and the panel is saved.

When the **Store Current Predictions** button is pressed, the database will lock to prevent any accidental change to the stored values. In the event that the user wishes to change scale factors once more, then to unlock the database press the **Scale Factors Locked** button. The button will change from red (locked) to green (unlocked).



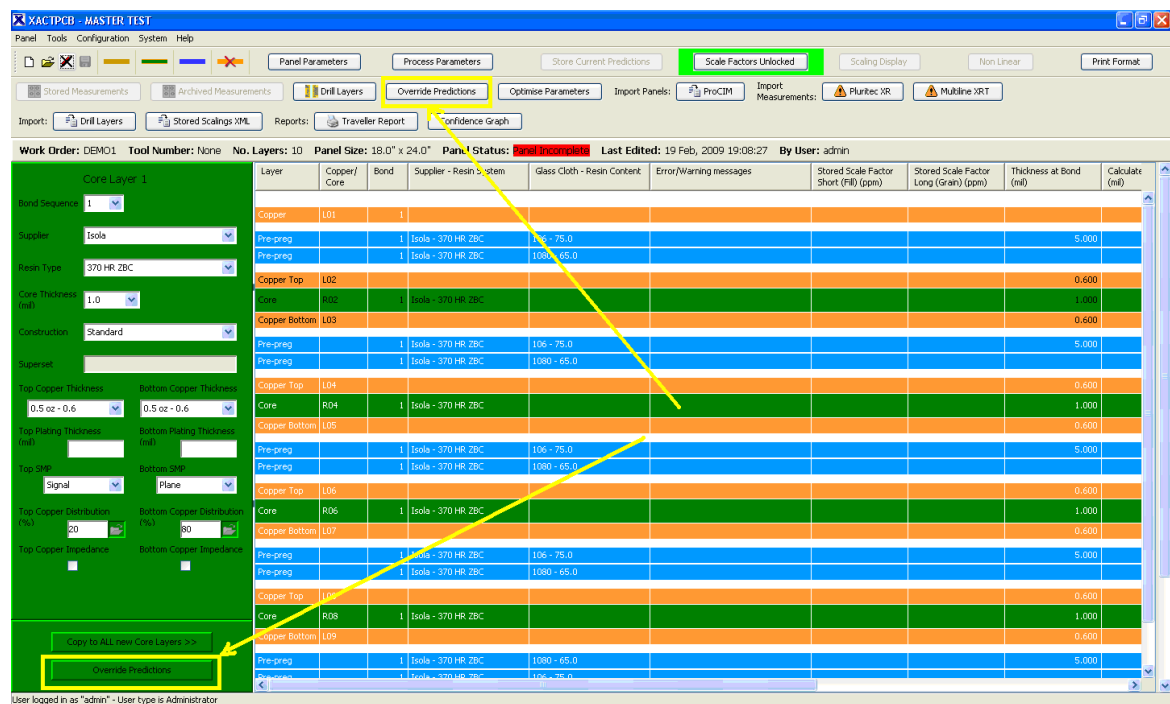
Scale factors locked



Scale factors unlocked

The user can manually enter values for each core by selecting the core in the stack-up window and pressing the **Override Predictions** button in the current layer display.

A pop-up will display the currently stored scale factors and allow the user to enter new values.



Override predictions buttons

Layer	Short (Grain) Scale Factor		Long (Fill) Scale Factor	
	Artwork (ratio)	Predicted (ratio)	Artwork (ratio)	Predicted (ratio)
All		Set Short		Set Long
		<- Swap ->		
L02/L03	1.00046	<< 1.000657	0.99993	<< 0.999746
L04/L05	1.00096	<< 1.000833	0.99977	<< 0.999748
L06/L07	1.00093	<< 1.000783	0.99998	<< 0.999853
L08/L09	1.00096	<< 1.000790	0.99995	<< 0.999854
L10/L11	1.00101	<< 1.000854	0.99981	<< 0.999754
L12/L13	1.00095	<< 1.000852	0.9999	<< 0.999811
L14/L15	1.00049	<< 1.000689	0.99987	<< 1.000028
L16/L17	1.00049	<< 1.000689	0.99988	<< 1.000028
L18/L19	1.00102	<< 1.000852	0.9999	<< 0.999811
L20/L21	1.00098	<< 1.000854	0.99974	<< 0.999754
L22/L23	1.00095	<< 1.000790	0.99994	<< 0.999854
L24/L25	1.001	<< 1.000790	1.00011	<< 0.999854
L26/L27	1.00097	<< 1.000848	0.99979	<< 0.999751
L28/L29	1.00048	<< 1.000657	0.99991	<< 0.999746

The values for short axis and long axis can be set for all layers by entering values in the **All** fields and then pressing the Set Short or Set Long buttons.

Individual predicted values can be copied using the << buttons located next to each entry field.

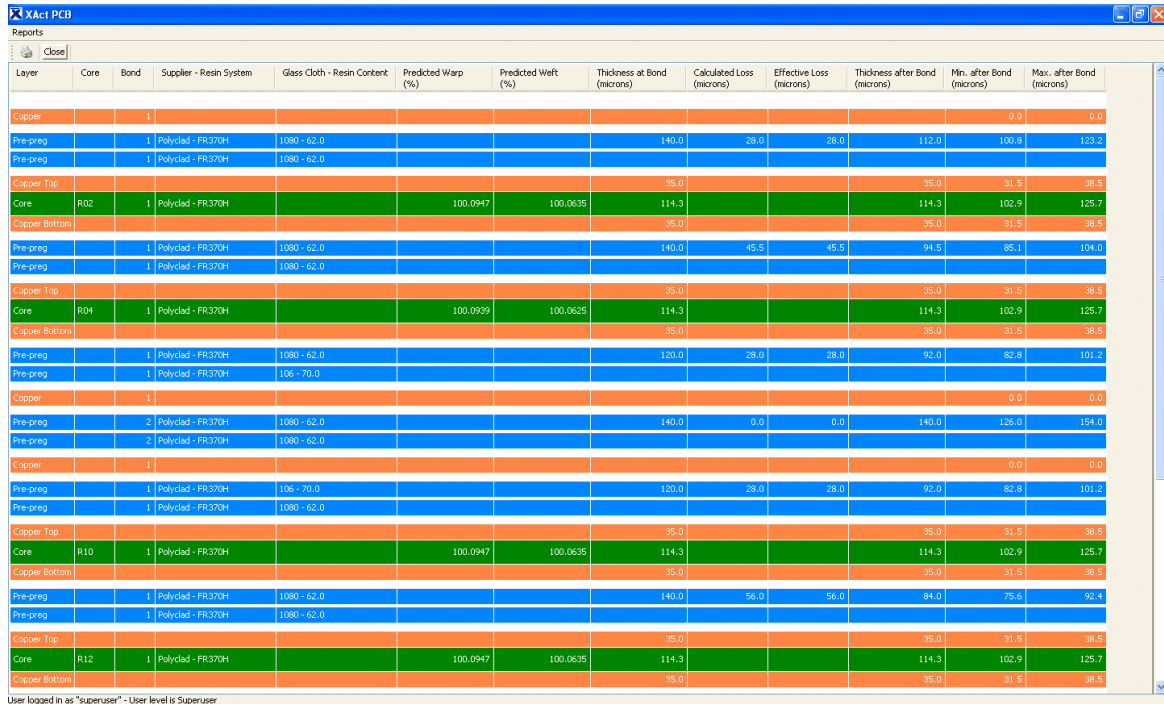
When the correct values have been entered, click the OK button. When values are entered using the override function, the scale factors will be automatically locked when updated.

Note: If the **Store Current Predictions** button is pressed after using the override function, the stored values will be replaced with the current predictions and the overridden values will be lost.

The values stored **MUST BE** the **TRUE and ACCURATE** scale factors that are used to manufacture the product as they will be recalled and combined with measurement data in the **Measurement Analysis** module.

5.6.1 Reporting Linear Scale Factors

The linear scale factors for each of the cores are displayed on the main stack-up screen and can also be printed using the Print Preview button below the main menu. In the print preview screen, press the Print button to print the report.



Layer	Core	Bond	Supplier - Resin System	Glass Cloth - Resin Content	Predicted Warp (%)	Predicted Welf (%)	Thickness at Bond (microns)	Calculated Loss (microns)	Effective Loss (microns)	Thickness after Bond (microns)	Min. after Bond (microns)	Max. after Bond (microns)
Copper		1									0.0	0.0
Pre-preg		1	Polyd - FR370H	1080 - 62.0			140.0	28.0	28.0	112.0	100.8	123.2
Pre-preg		1	Polyd - FR370H	1080 - 62.0								
Copper Top							35.0			35.0	31.5	38.5
Core	R02	1	Polyd - FR370H		100.0947	100.0635	114.3			114.3	102.9	125.7
Copper Bottom							35.0			35.0	31.5	38.5
Pre-preg		1	Polyd - FR370H	1080 - 62.0			140.0	45.5	45.5	94.5	85.1	104.0
Pre-preg		1	Polyd - FR370H	1080 - 62.0								
Copper Top							35.0			35.0	31.5	38.5
Core	R04	1	Polyd - FR370H		100.0939	100.0625	114.3			114.3	102.9	125.7
Copper Bottom							35.0			35.0	31.5	38.5
Pre-preg		1	Polyd - FR370H	1080 - 62.0			120.0	28.0	28.0	92.0	82.8	101.2
Pre-preg		1	Polyd - FR370H	106 - 70.0								
Copper		1									0.0	0.0
Pre-preg		2	Polyd - FR370H	1080 - 62.0			140.0	0.0	0.0	140.0	126.0	154.0
Pre-preg		2	Polyd - FR370H	1080 - 62.0								
Copper		1									0.0	0.0
Pre-preg		1	Polyd - FR370H	106 - 70.0			120.0	28.0	28.0	92.0	82.8	101.2
Pre-preg		1	Polyd - FR370H	1080 - 62.0								
Copper Top							35.0			35.0	31.5	38.5
Core	R10	1	Polyd - FR370H		100.0947	100.0635	114.3			114.3	102.9	125.7
Copper Bottom							35.0			35.0	31.5	38.5
Pre-preg		1	Polyd - FR370H	1080 - 62.0			140.0	56.0	56.0	84.0	75.6	92.4
Pre-preg		1	Polyd - FR370H	1080 - 62.0								
Copper Top							35.0			35.0	31.5	38.5
Core	R12	1	Polyd - FR370H		100.0947	100.0635	114.3			114.3	102.9	125.7
Copper Bottom							35.0			35.0	31.5	38.5

User logged in as "Superuser" - User level is Superuser

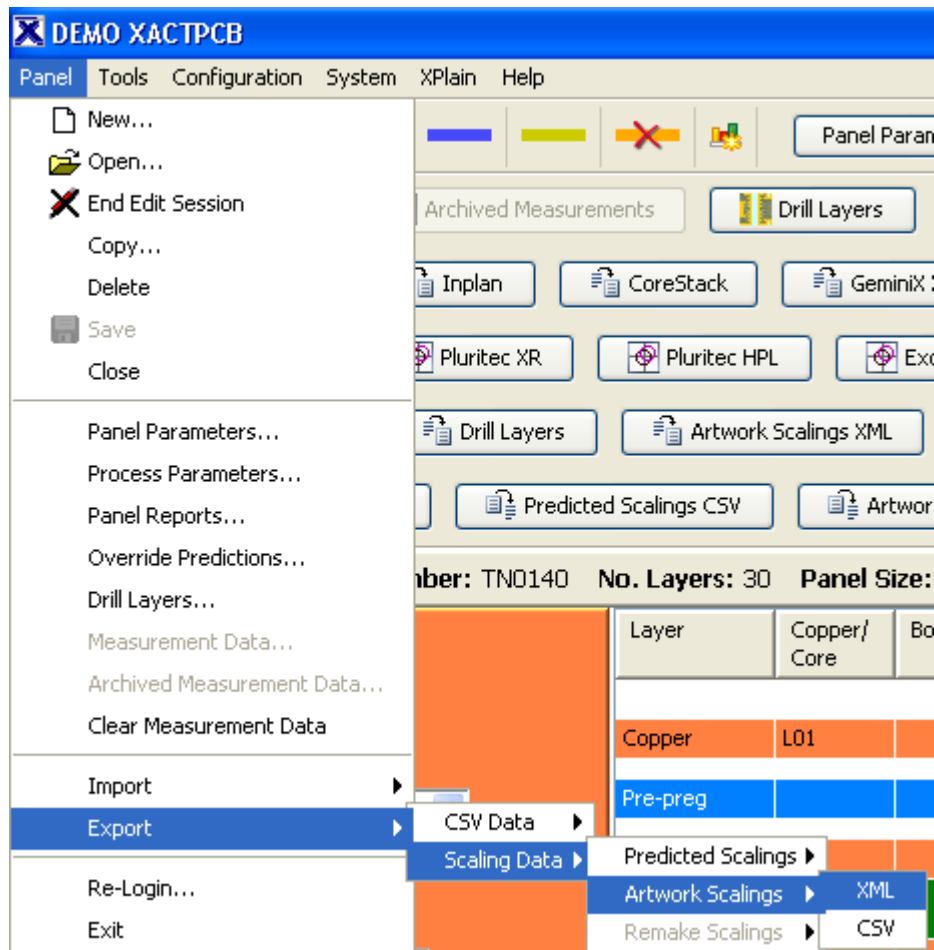
To return to the stack-up view, click the Close button located below the main menu.

5.6.2 Export and Import Linear Scale Factors

Once the scale factors to be used have been determined, the values of the **stored scale factors** (artwork scale factors) for a given job can be **output** in XML or CSV format for reading into a CAM system.

This function is accessed by selecting the menu shown in the left image.

In addition – the scale factors can be imported from an identically structured XML or CSV file that has been output from CAM.



5.6.3 Scale Factor Confidence Levels

In order to explain the concept of the calculated confidence levels one has to firstly explain a little about how the optimiser (the maths engine at the core of the software) works. As indicated in Figure 2 - Flowchart of operation and integration within PCB manufacturing process – the optimiser relies upon (a) stackup information and (b) the accompanying post-bond measurement information for that stackup.

The Gemini-X software uses a patent protected methodology for identifying the key characteristics of the stackup that affect scale factors and links these using a complex multi-dimensional error minimisation algorithm.

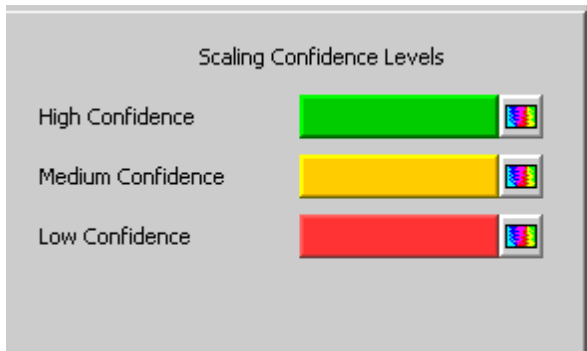
Naturally, one of the key characteristics of a given stackup is the type of core material that is specified within the stack. There are many other characteristics that are taken into account by the XACT software, but let us focus now on just one – the core:

If the optimiser has been fed with little or no actual measurement information for a material type then the optimiser cannot predict accurately the scale factor for that core. The same principle applies to the process characteristics (such as press cycle) and to the pre-pregs used in the build.

While the Gemini-X system is in a “learning phase” it is important to know how much measurement information is driving the displayed prediction. Too little information in the database about those materials or processes can lead to a prediction that may

not be accurate.

Therefore, the Gemini-X software includes a **traffic light system** for indicating the amount of active measurement data in the database related to the given stackup. The colours for the traffic light system are set on the Settings Manager under the Configuration option of the main menu. (see below)



These control the colours that are displayed in the background of the predicted scale factors shown in the stack up viewer .

In the below examples the SFC is shown – note that the predicted warp and weft element will change colour dependent on SFC but the stored Scale Factor text area (when toggled) will not change colour.

Layer	Copper/ Core	Bond	Supplier - Resin System	Glass Cloth - Resin Content	Thickness at Bond (mil)	Current Short (G
Copper	L01	1			1.300	
Pre-preg		1	Isola - FR406	3070 - 49.0	0.000	
Copper Top	L02				1.300	
Core	R02	1	Isola - FR406		2.000	
Copper Bottom	L03				1.300	
Pre-preg		1	Isola - FR406	3070 - 54.0	4.400	
Copper Top	L04				0.650	
Core	R04	1	Isola - FR408		24.000	
Copper Bottom	L05				0.650	
Pre-preg		1	Isola - FR406	3313 - 54.0	4.000	
Copper Top	L06				0.650	
Core	R06	1	Isola - FR408		31.000	
Copper Bottom	L07				0.650	

Core R02 has high confidence and shows the predicted scale factors with a green background.

Core R04 has medium confidence and shows the predicted scale factors with an amber/yellow background.

Core R06 has low confidence and shows the predicted scale factors with a red background.

In order to obtain more detail about the SFC level the user can RIGHT-CLICK upon any displayed core and some additional dialogs will be visible. The individual SFC levels for the core type, the prepreg packages, the copper layers and the process (ie press cycle, process parameters etc) will be displayed.

If some of the advanced optimisation algorithms have been selected then additional information will also be shown.

Layer	Copper/ Core	Bond	Supplier - Resin System	Glass Cloth - Resin Content	Thickness at Bond (mil)	Current Predicted Short (Grain) (ratio)	Current Predicted Long (Fill) (ratio)	Et
Copper	L01	1			1.300			
Pre-preg		1			0.000			
Copper Top	L02				1.300			
Core	R02	1			2.000	1.000433	0.999778	
Copper Bottom	L03				1.300			
Pre-preg		1			4.400			
Copper Top	L04				0.650			
Core	R04	1	Isola - FR408		24.000	1.000821	0.999808	
Copper Bottom	L05							
Pre-preg		1	Isola - FR406	3313 - 54.0				
Copper Top	L06							
Core	R06	1	Isola - FR408			1.000429	0.999980	
Copper Bottom	L07							
Pre-preg		1	Isola - FR406	2116 - 56.0				ER

NOTE – the SFC level shown in the coloured “traffic light” format will be the MINIMUM of the individual SFC levels.

i.e. if the SFC level for the core is low but all others are high, the colour shown will still be red (low confidence).

5.7 5.7: Job Traveller Report

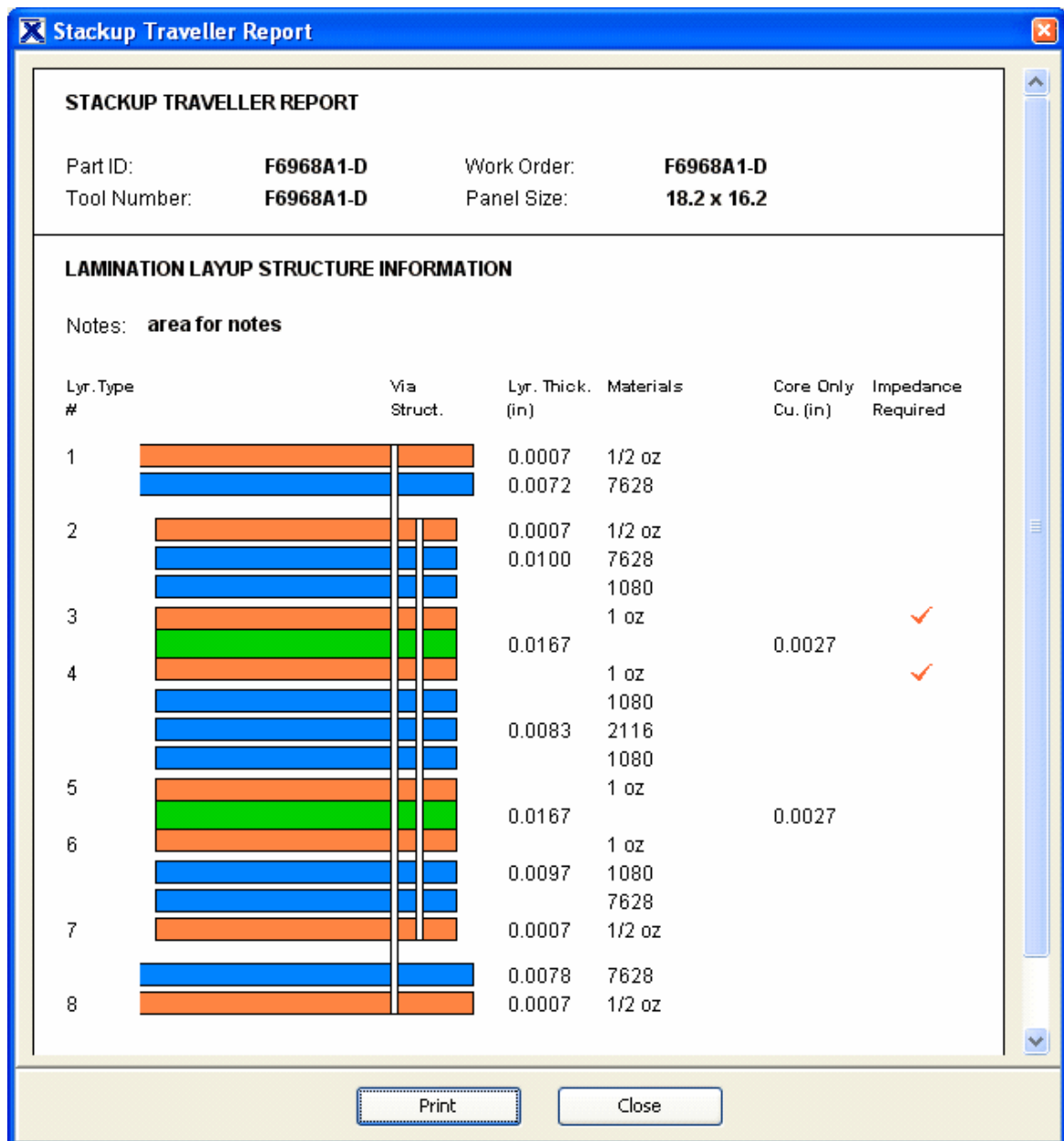
The Job Traveller Report is a simple printable report designed to show the stackup and associated drill layers and lamination sequences.

The Job Traveller Report for any job can be seen by clicking the button indicated below

Reports:  Traveller Report

The Report will appear similar to that shown below.

The indented areas show the calculated bond sequences



Note that the Impedance Required tick boxes are set by similar boxes on the stackup (see below). There is no calculation performed – it is shown purely for information.

Core Layer 1

Bond Sequence

Supplier

Resin Type

Core Thickness (mil)

Construction

Superset

Top Copper Thickness Bottom Copper Thickness

Top Plating Thickness (mil) Bottom Plating Thickness (mil)

Top SMP Bottom SMP

Top Copper Distribution (%) Bottom Copper Distribution (%)

Top Copper Impedance Bottom Copper Impedance

[Copy to ALL new Core Layers >>](#)

[Override Predictions](#)

5.8 5.8: Sequential Build Up (SBU) Module

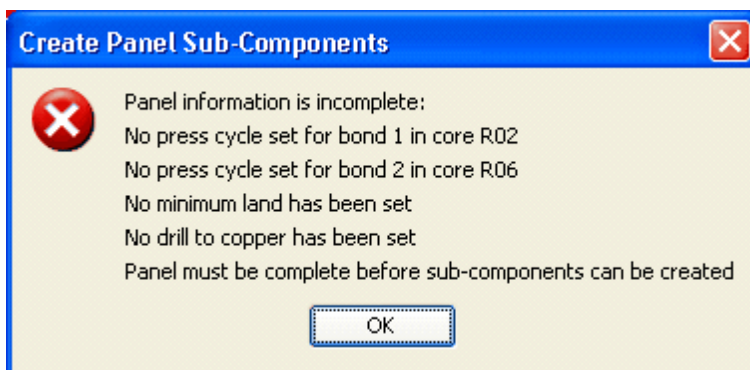
The Sequential Build Up module is a licensed option designed specifically for complex build up technologies. With this option installed, it is possible to automatically create stack-up records for the sub-components and navigate between final and intermediate stages. Additional benefits of the SBU module are described in the measurement analysis section.

Create Sub-components

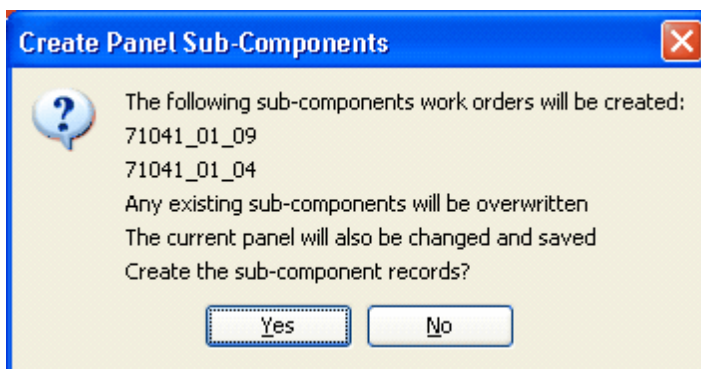
If a stack-up file imported contains the details of sub-component constructions, the additional records for sub-assemblies can be automatically created provided all required information is present.

The records for sub-components can be manually created by pressing the **Create Sub-Components** button in the menu bar or selecting the menu option Tools – Sub-components – Create Sub-components.

If more information to complete this is required, a warning message will appear detailing the additional information required.



Once all data is present a message box will appear detailing the sub-component records that will be created. The standard naming convention used is {Parent Name}_{Start Layer}_{End Layer}. Click the Yes button to accept and generate the additional records.



Delete Sub-components

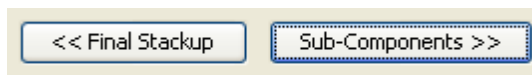
The sub-component records can be removed without removing the final stage record, by clicking the Delete Sub-components button or selecting the menu option Tools – Sub-components – Delete Sub-components

If measurement data has been stored against any of the intermediate records, this must be removed also.

Navigating Through Sub-components

From the final stage stack-up it is possible to navigate directly to any intermediate stage stack-up and from an intermediate stage it is possible to navigate to the final stack-up or a sub-component of the current assembly stage.

This is achieved by pressing the <<Final Stackup or Sub-Components>> buttons.



Predicted Scale Factors for SBU Products

With the SBU module installed, the stack-up and traveller report views will display the expected scale for each copper layer that forms the outer layer of a sub-component.

Where a scale factor is shown against a core and a copper layer of the core – the core scale factor is the predicted scale factor to be applied to the internal side of the core – i.e. at it's first production stage.

The scale factor shown against the copper layer is the anticipated size of the image required for that copper layer before it is laminated into the next stage.

Lyr. Type #	Via Struct.	Lyr. Thick. (in)	Materials	Core Only Thick. (in)	Predicted Short (Fill)	(ratio) Long (Grain)	Conf. Level	Inventory Code	Impedance Required
1		0.00060	14.17475					30010002	
		0.00462	1080					N4000-13EP 1080(65) 12...	
			1080					N4000-13EP 1080(65) 12...	
2		0.00120	28.3495		1.000103	1.000509		30010008	
		0.00311	2113					N4000-13EP 2113(58) 12...	
3			14.17475					30010002	
		0.00520		0.0040	1.000628	1.001011	High	N4000-13EP 4.0 CA F1/F1 ...	
4			14.17475		1.000103	1.000509		30010002	
		0.00236	106					N4000-13EP 106(75) 12X...	
			106					N4000-13EP 106(75) 12X...	
5		0.00120	28.3495		1.000086	1.000510		30010008	
		0.00311	2113					N4000-13EP 2113(58) 12...	
6			14.17475					30010002	
		0.00520		0.0040	1.000619	1.001009	High	N4000-13EP 4.0 CA F1/F1 ...	
7			14.17475		1.000086	1.000510		30010002	
		0.00236	106					N4000-13EP 106(75) 12X...	
			106					N4000-13EP 106(75) 12X...	
8		0.00120	28.3495		1.000129	1.000510		30010008	
		0.00311	2113					N4000-13EP 2113(58) 12...	
9			14.17475					30010002	
		0.00520		0.0040	1.000628	1.001011	High	N4000-13EP 4.0 CA F1/F1 ...	
10			14.17475		1.000129	1.000510		30010002	
		0.00236	106					N4000-13EP 106(75) 12X...	
			106					N4000-13EP 106(75) 12X...	
11		0.00120	28.3495		1.000016	1.000504		30010008	
		0.00311	2113					N4000-13EP 2113(58) 12...	
12			14.17475					30010002	
		0.00520		0.0040	1.000628	1.001011	High	N4000-13EP 4.0 CA F1/F1 ...	
13			14.17475		1.000016	1.000504		30010002	
		0.00236	106					N4000-13EP 106(75) 12X...	
			106					N4000-13EP 106(75) 12X...	
14		0.00120	28.3495		0.999990	1.000339		30010008	
		0.00460	1080					N4000-13EP 1080(65) 12...	
			1080					N4000-13EP 1080(65) 12...	
15		0.00060	14.17475					30010002	

On the subcomponent stages – only the scale factors of the outer layers are shown in the stack-up view and traveller report.

The final stage is the only place that the predicted starting scale factors are displayed. These scale factors are the values expected to compensate for all stages of manufacture and provide nominally dimensioned product after the final lamination stage.

6: Measurement Analysis

The key process steps to using the Gemini-X software are:

- (1) “Predict” – use the XACT stackup module to import/build/define a stackup get scale factors
- (2) “Build the board” - using the scale factors predicted
- (3) **“Measurement Analysis” – use an X Ray Drill or similar to determine how the layers have scaled in manufacture**
- (4) “Store” or “Link” – this locks the actual measurement (3) to the actual stackup (1) – lot by lot if necessary.
- (5) “Optimise” – Use the intelligent optimiser engine in Gemini-X to figure out what material and process factors have the influence on scale factor.

This section deals with the Measurement Analysis module used in stage 3.

What is “Measurement Analysis”

This feature opens, converts and quickly DISPLAYS measurement data from various Post Bond Optimisers (e.g. Muraki, Excellon, Pluritec, Optek, Multiline, Schmoll etc) The visualisation of real measurement data is powerful, intuitive and is standardised – such that in a facility with multiple measurement machines, the Gemini-X system can be used to display any information in a common format.

The final function of Measurement Analysis is to LINK the stackup to the actual data and so provide the database optimisation function with Scale Factor feedback.

Measurement Analysis: with or without a stackup ?

The Measurement Analysis (MA) module is designed to be used either:

- (a) As a purely reactive module to determine the layer distortions and scale for ANY bonded PCB panel equipped with suitable measurement targets. In this case it is NOT necessary to have a stackup defined in the database.
- (b) As above - but linked to a defined stackup for feeding data into the intelligent model (see section 7 below)

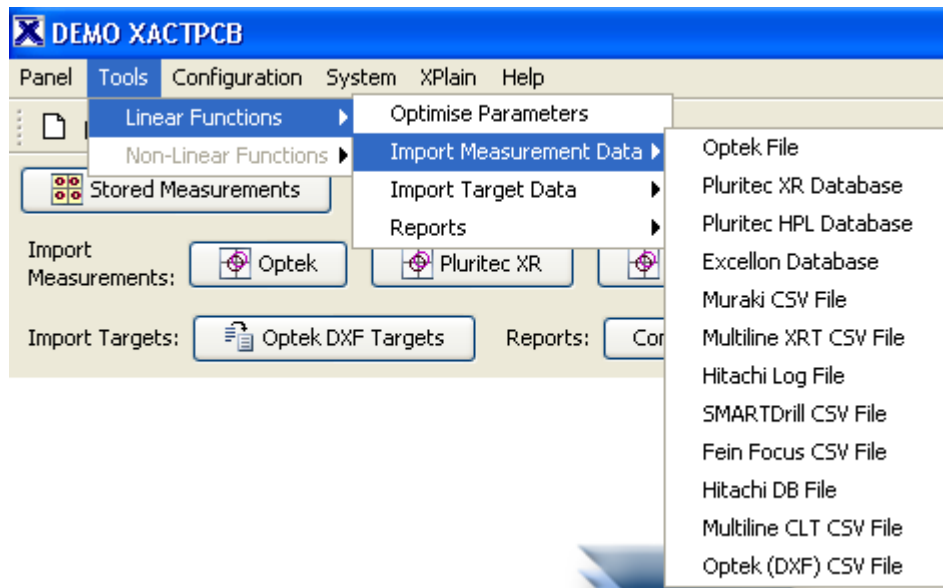
It may be thought that most users would use the software in mode (b) only – however, there is significant value in using the “simpler” method (a) for matching drill scale to sequential lamination sub components and stackups where reactive analysis alone is sufficient.

6.1 6.1: Importing Measurement Data

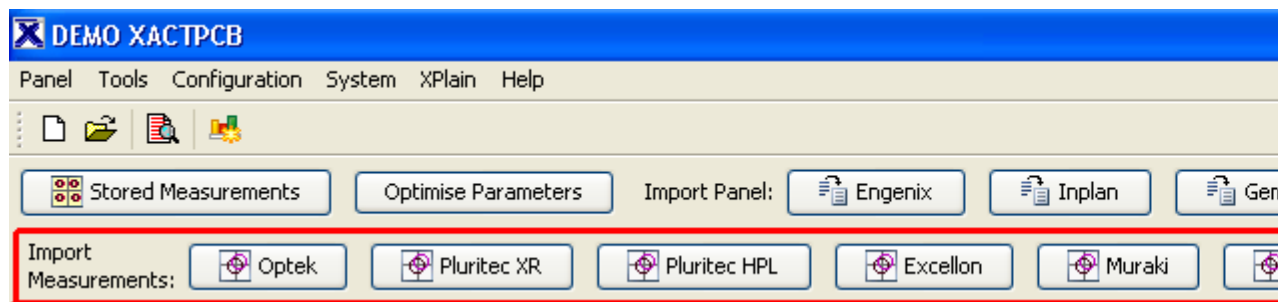
The Measurement Analysis module is compatible with all leading X Ray drill, Intelligent Drill and X Ray CMM systems.

The linear analysis module is activated by the following methods:

- (a) Select **Tools, Linear Functions, Import Measurement Data** from the menu bar



(b) By clicking one of the Import Measurement buttons displayed on the main Toolbar.



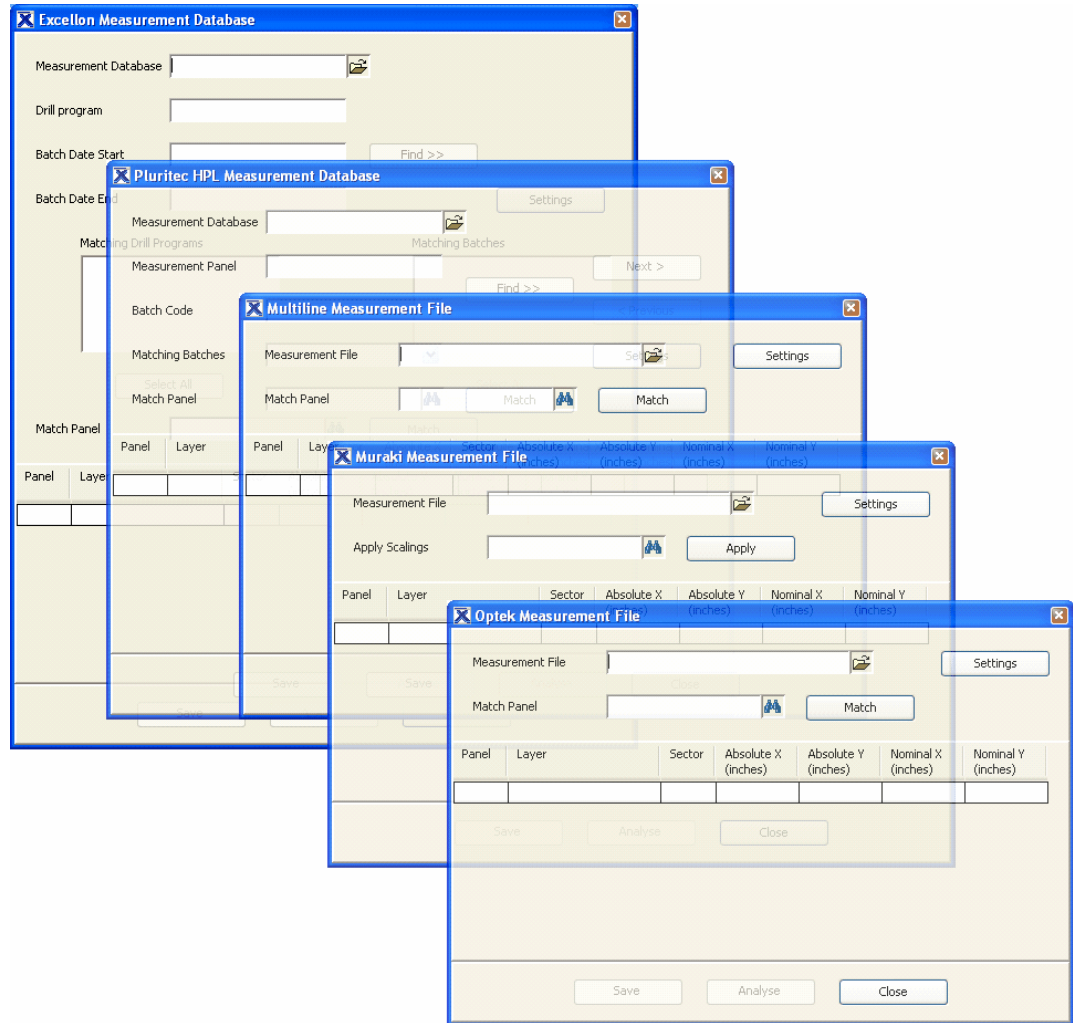
Note: Before selecting the linear measurement analysis function, it is important to ensure that the unit selection matches the measurement units of the measurement files to be read in. I.e. if the measurement files are metric, ensure the unit selection is set to metric. Contact XACT PCB technical support to discuss custom configuration.

Process Flow

The process flow for MA – independent of the machine - is as follows:

With or without a stackup open...


(1) Open the machine interface



A dialog box such as those shown above will appear.
(Only one box will appear – this is a montage showing a selection of available formats.)

See the detailed section for each machine format for further details.

- (2) Select the Measurement File from the network or file directory.

To select the file click on the  button and choose the relevant file from the list displayed and click the Open button.

- (3) Click on the Find button if applicable (for a search within a database or file containing multiple records).

When the correct file name is displayed in the main window, the required data within the file must be selected.

As a rule, partial names can be entered with a * wildcard – use the next/previous buttons to navigated through the matching panel codes.

All measurement machines save the data in a unique way and the method of

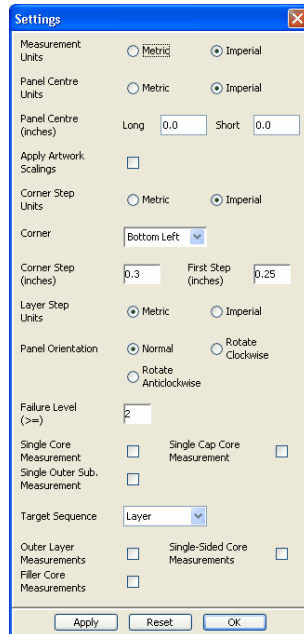
importing may vary slightly from machine to machine - select the help chapter for the relevant machine type to see more details.

Once the relevant data is selected, the user will then be able to see the raw data displayed for quick verification. You do not need to consider this information in any detail, but it is easy to see whether the import units are set correctly etc. The settings should be set-up in the system configuration files, but occasionally it may be necessary to modify the settings using the **Settings** button.

Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-11.62782	8.02990	-11.63000	8.03000
1		TR	11.62766	8.02983	11.63000	8.03000
1		BR	11.62850	-8.02987	11.63000	-8.03000
1		BL	-11.62847	-8.02981	-11.63000	-8.03000
1	Measurement Layer 1	TL	-11.68003	7.93170	-11.68000	7.93000
1		TR	11.67932	7.93042	11.68000	7.93000
1		BR	11.67794	-7.93044	11.68000	-7.93000
1		BL	-11.67982	-7.92787	-11.68000	-7.93000

Measurement Database Open (Pluritec Format Shown)

- (4) If necessary, click on Settings and modify the set-up for the data import. The settings dialogue controls the native measurement units for the data files, panel rotation, panel datum etc, refer to the specific machine sections for full details.



There are some parameters which are standard to all import formats, and these are described below:

- Measurement Units – Metric or Imperial (this overrides the default configuration in the .properties file)
- Panel Centre indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated.
- Apply Artwork scalings is used if the targets measured have not been scaled with the inner layer features. I.e. they were originally imaged at nominal positions and therefore are not expected to be at nominal when measured.
- Panel Rotation – determines the orientation of the panel on the machine (portrait/landscape etc)
- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. Single Core Measurement - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. Single Cap Core Measurement - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. Single Outer Sub. Measurement - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are

measured individually, this should remain unchecked. It is unusual for this to be checked.

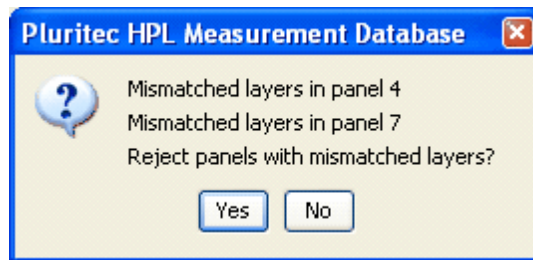
- Target Sequence - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. Outer Layer Measurements - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. Single-Sided Core Measurements - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. Filler Core Measurements - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.

Click the apply button to see the impact of the settings changes and click OK when finished.

- (5) If no stack-up record is open and the results are to be compared and saved against the stack-up layers the Match Panel section should be completed. This is where the program is attempting to match the measurement data to a saved stackup.

Click the record selection icon next to the field and choose the relevant stack-up record.


Note that in some cases, the data from the measurement machines may contain errors (i.e. there may be a missed layer or panel measurement) in this Gemini-X will indicate the presence of such errors and give the user the option to reject these panels from the measurement.



(6) When all data is correctly selected, click on the Analyse button and the Measurement Analysis Console will be displayed.

6.1.1 6.1.1: Optek

Press the Optek import button to bring up the file selection window.


To select the file click on the  button - this will bring up a standard windows file navigation dialogue.


Navigate to the correct directory if necessary and choose the relevant file from the list displayed.

Click the Open button to close the dialogue and return to the Optek dialogue screen.

If the selected file is a valid format file, the details of the measurement co-ordinates will be displayed on screen.

Optek Measurement File

Measurement File: 

Match Panel: 

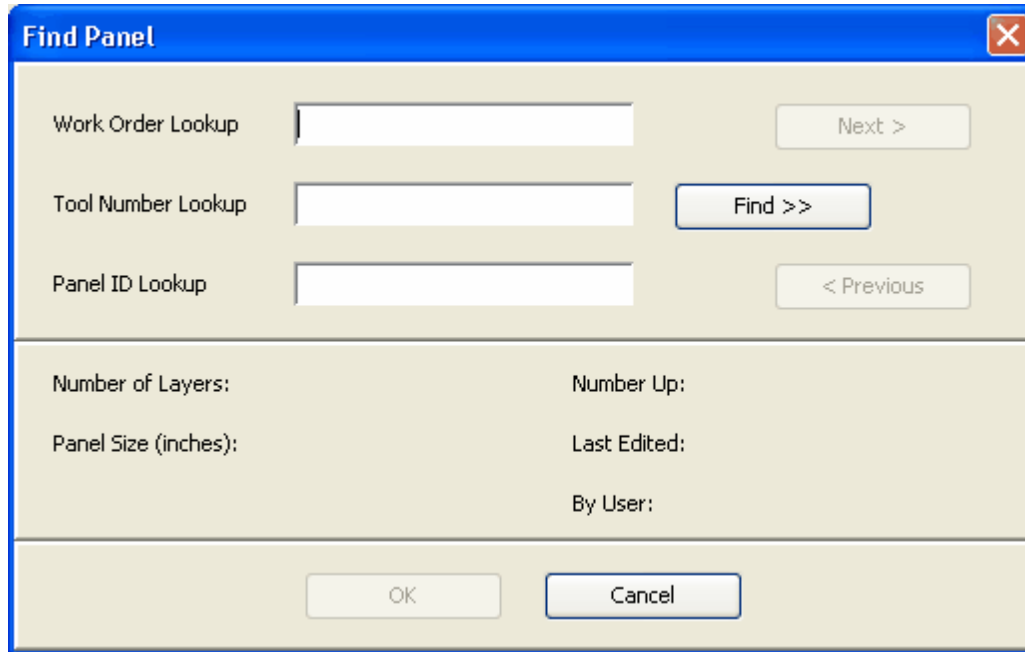
Panel Size (inches) X: Y:

Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-11.29850	7.87860	-11.30000	7.88000
1		TR	11.29990	7.87990	11.30000	7.88000
1		BR	11.29870	-7.87890	11.30000	-7.88000
1		BL	-11.30000	-7.57950	-11.30000	-7.58000
1	L02	TL	-11.29500	7.63100	-11.30000	7.63000
1		TR	11.30100	7.62600	11.30000	7.63000
1		BR	11.29700	-7.63100	11.30000	-7.63000
1		BL	-11.30100	-7.32600	-11.30000	-7.33000

If there was a stack-up record open when the Optek button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box has a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of the first field is a 'Next >' button, and to the right of the second field is a 'Find >>' button. To the right of the third field is a '< Previous' button. Below these fields are five labels: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', 'Last Edited:', and 'By User:'. At the bottom are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Optek file and may not correspond to the actual layer names of the product measured.

Press the **Analyse** button to view the analysis of this measurement data.

6.1.1.1 Optek Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjust by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.

- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc)
- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both

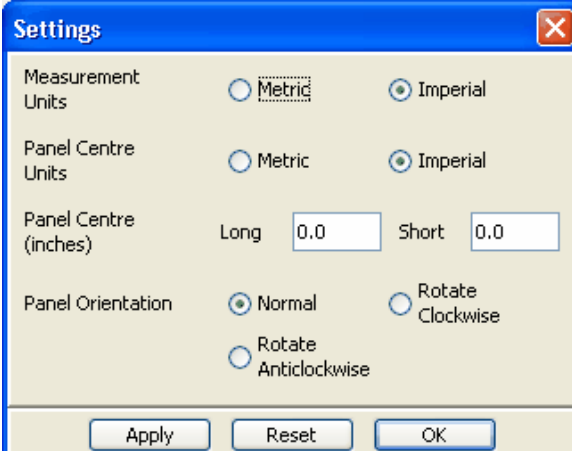
sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.

- c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers and an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
 - d. **Single Panel Measurement** - this should only be checked when measuring HDI build up boards where a single target position is assumed to be representative of the position of all inner layers. Note this is a licensed option.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
 - **Additional targets** - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.

NOTE: If the measurement file is selected first and contains details of the layer numbers, then a reduced number of options will be displayed as the layer mapping functions are not required.

Full Options:

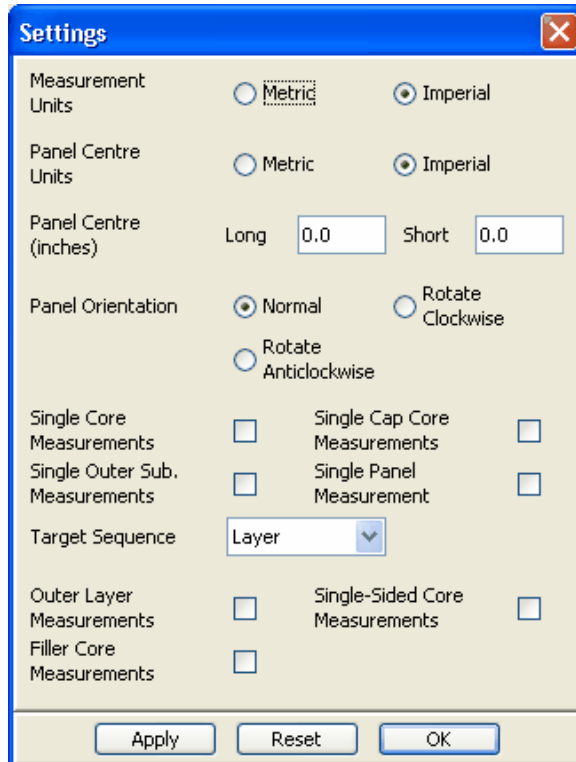
Reduced Options:



The screenshot shows a 'Settings' dialog box with the following options:

- Measurement Units:** Radio buttons for Metric (unchecked) and Imperial (checked).
- Panel Centre Units:** Radio buttons for Metric (unchecked) and Imperial (checked).
- Panel Centre (inches):** Two input fields labeled 'Long' and 'Short', both containing the value '0.0'.
- Panel Orientation:** Three radio buttons: Normal (checked), Rotate Clockwise (unchecked), and Rotate Anticlockwise (unchecked).


At the bottom of the dialog are three buttons: 'Apply', 'Reset', and 'OK'.



6.1.2 6.1.2: Excellon ID

Press the Excellon import button to bring up the file selection window.

If all measurements are saved to a single access mdb file, the name of the file should be displayed in the Measurement Database field.

To select a different file click on the  button - this will bring up a standard windows file navigation dialogue.

Navigate to the correct directory if necessary and choose the relevant mdb file from the list displayed.

Click the Open button to close the dialogue and return to the Excellon dialogue screen.


To find the relevant data in the mdb file, either enter details into the **Drill Program** field or enter a start and end date then press find.

All matching records will be displayed in the **Matching Drill Programs** window.

Select the required records (use shift/control for multiple selections) or press the select all button.

When selected, the details of the measurement co-ordinates will be displayed on screen.

Excellon Measurement Database

Measurement Database:  Settings

Drill program:

Batch Date Start: Find >>

Batch Date End:

Matching Drill Programs


- 76359.vis-1
- 76359.vis-2
- 76359.vis-3
- 76359.vis-4

Select All

Matching Batches


- 02/09/07 10:06:51

Select All

Panel: 

Panel Size (inches) X Y

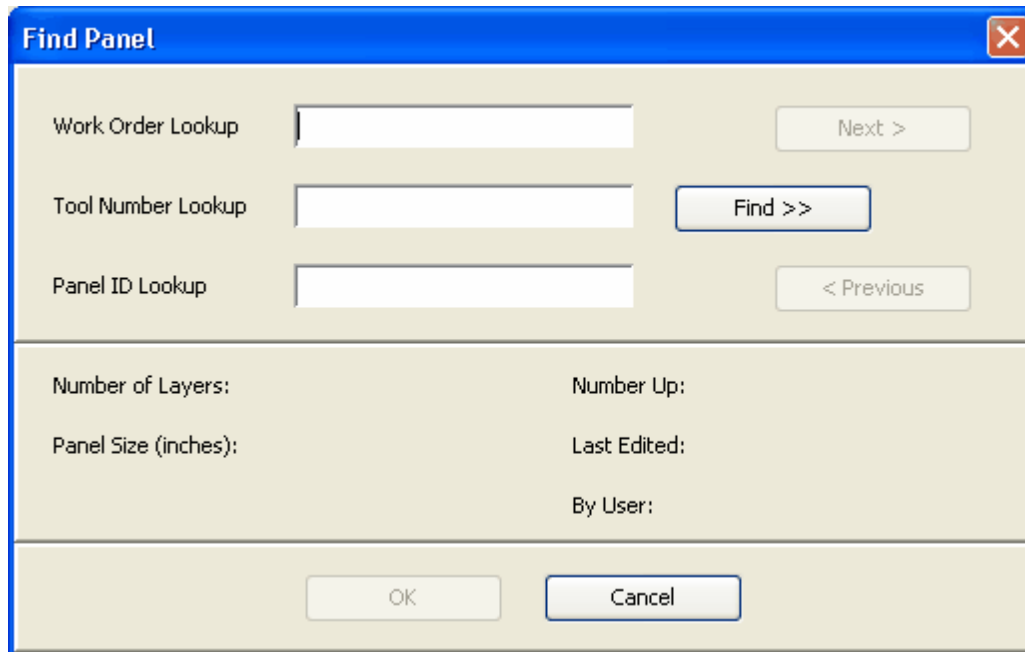
Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-5.24628	8.59383	-5.25000	8.60000
1		TR	4.64264	8.59953	4.65000	8.60000
1		BR	4.64596	-8.39377	4.65000	-8.40000
1		BL	-5.24599	-8.39418	-5.25000	-8.40000
1	Measurement Layer 1	TL	-5.24795	8.59699	-5.25000	8.60000
1		TR	4.64261	8.59812	4.65000	8.60000
1		BR	4.64559	-8.39295	4.65000	-8.40000
1		BL	-5.24708	-8.39458	-5.25000	-8.40000

Export Analyse Close 

If there was a stack-up record open when the Excellon button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box is a standard Windows-style window with a blue title bar and a close button (X) in the top right corner. It contains three text input fields on the left, each with a label: 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of these fields are three buttons: 'Next >' (top right), 'Find >>' (middle right, highlighted with a blue border), and '< Previous' (bottom right). Below these fields is a section with five labels arranged in two columns: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', 'Last Edited:', and 'By User:'. At the bottom of the dialog are two buttons: 'OK' and 'Cancel'.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Excellon file and may not correspond to the actual layer names of the product measured.

Press the **Analyse** button to view the analysis of this measurement data.

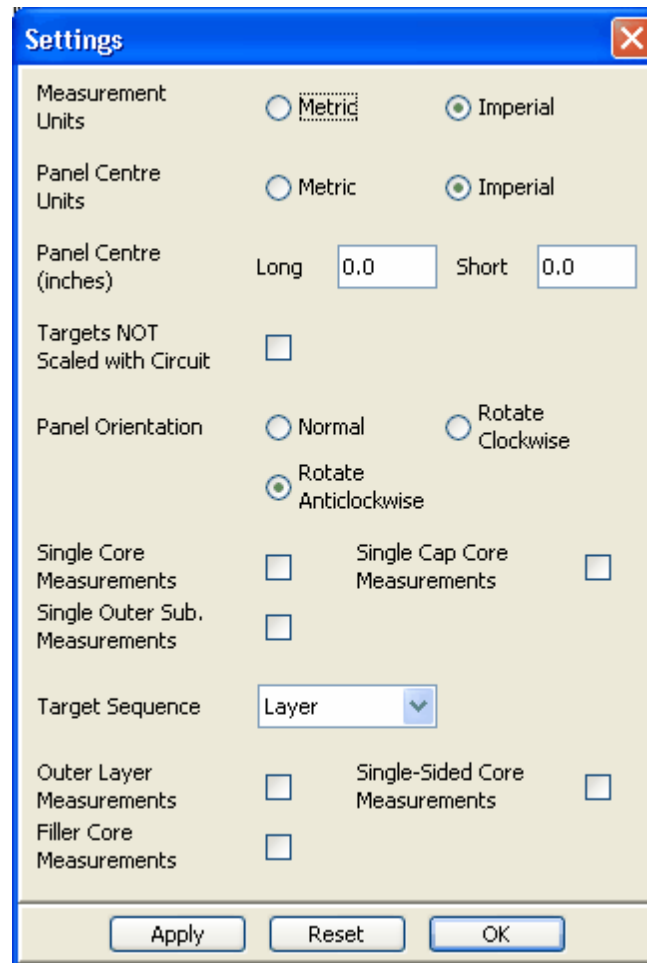
6.1.2.1 Excellon Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjusted by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.

- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the Excellon measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Panel Orientation** – determines the orientation of the panel on the machine

(portrait/landscape etc). Normal will assume the panel is measured in a "portrait" orientation on the Excellon machine with the long axis in the Y direction.

- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.



6.1.3 6.1.3: Pluritec XR

Press the Pluritec XR import button to bring up the file selection window.

If all measurements are saved to a single access mdb file, the name of the file should be displayed in the Measurement Database field.

To select a different file click on the  button - this will bring up a standard windows file navigation dialogue.

Navigate to the correct directory if necessary and choose the relevant mdb file from the list displayed.


Click the Open button to close the dialogue and return to the Pluritec XR dialogue screen.

To find the relevant data in the mdb file, either enter details into the **Batch Code** field or enter a start and end date then press find.

The first matching record will be displayed in the **Matching Batches** field - additional records can be viewed and selected by clicking the arrow at the end of the field. .


When selected, the details of the measurement co-ordinates will be displayed on screen.


Pluritec XR Measurement Database

Measurement Database:  Settings


Measurement Panel: Find >> Next >

Batch Code: < Previous

Matching Batches: 

Panel: 

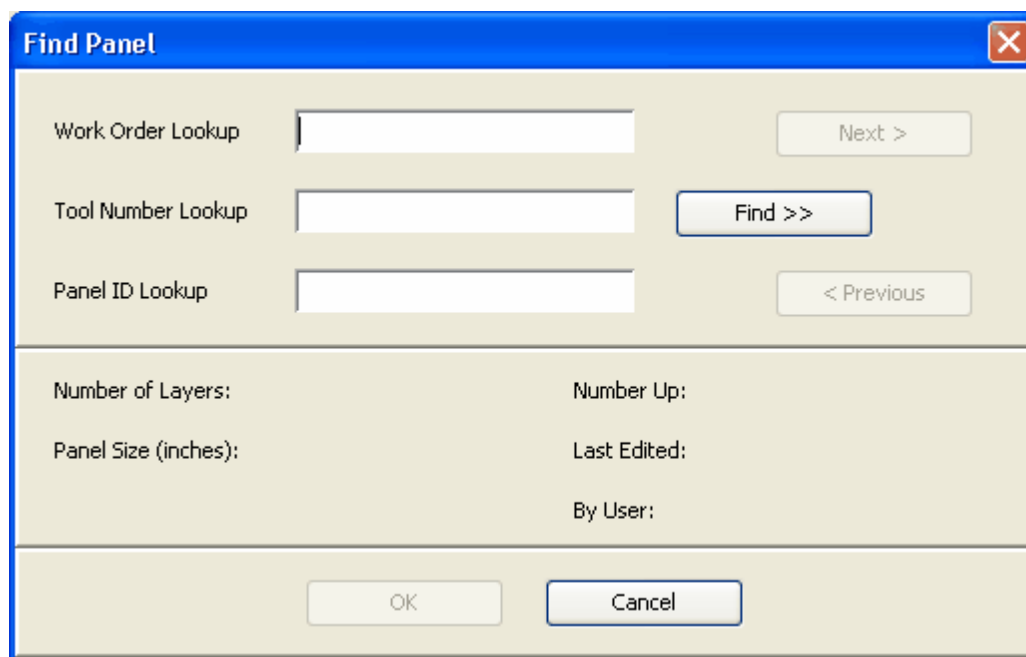
Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-11.69820	8.35040	-11.70000	8.35000
1		TR	11.69810	8.35020	11.70000	8.35000
1		BR	11.69760	-8.35020	11.70000	-8.35000
1		BL	-11.69750	-8.35040	-11.70000	-8.35000
1	Measurement Layer 1	TL	-11.69820	8.35040	-11.70000	8.35000
1		TR	11.69810	8.35020	11.70000	8.35000
1		BR	11.69760	-8.35020	11.70000	-8.35000
1		BL	-11.69750	-8.35040	-11.70000	-8.35000

Export Analyse Close 

If there was a stack-up record open when the Pluritec XR button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box has a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of the first field is a 'Next >' button. To the right of the second field is a 'Find >>' button. To the right of the third field is a '< Previous' button. Below these fields are four labels: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', and 'Last Edited:'. Below these labels are two more labels: 'By User:' and an empty input field. At the bottom are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Pluritec file and may not correspond to the actual layer names of the product measured.

Press the **Analyse** button to view the analysis of this measurement data.

6.1.3.1 Pluritec XR Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjust by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.

- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the Pluritec measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Corner Step Units** - Metric or Imperial (this overrides the default configuration in the .properties file) - this allows the system to import data where the units of an offset corner do not match the measurement units.

- **Corner** - selects which corner has an offset (for anti-rotation). Options are None, Top Left, Top Right, Bottom Left or Bottom Right.
- **Corner Step** - Sets the distance that the corner is offset. A positive value will indicate an offset towards the centre of the panel and a negative value will indicate an offset towards the edge of the panel.
- **First Step** - Sets the distance between the stacked (common) pad and the first staggered (layer) pad. As this is not defined in the mdb file, it must be set in configuration or via this setting dialogue. It is unusual to need to change the first step value.
- **Layer Step Units** - Metric or Imperial (this overrides the default configuration in the .properties file) - this allows the system to import data where the units of the layer step defined in the mdb file do not match the measurement units.
- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc). Normal will assume the panel is measured in a "landscape" orientation on the Pluritec XR machine with the long axis in the X direction.
- **Failure Level** – when errors are encountered during measurement, the Pluritec sets a value for the failure level according to the problems encountered. This option defines which failure levels should be ignored. Any value greater than or equal to the value defined will be ignored - the default setting is 2 which will only allow failure level 1 (out of tolerance) data to be imported.
- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.

- b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
- c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.

The screenshot shows a 'Settings' dialog box with a blue title bar and a close button (X) in the top right corner. The dialog contains various configuration options for measurements:

- Measurement Units:** Radio buttons for Metric (dotted outline) and Imperial (selected).
- Panel Centre Units:** Radio buttons for Metric and Imperial (selected).
- Panel Centre (inches):** Two input fields labeled 'Long' (0.0) and 'Short' (0.0).
- Targets NOT Scaled with Circuit:** An unchecked checkbox.
- Corner Step Units:** Radio buttons for Metric and Imperial (selected).
- Corner:** A dropdown menu showing 'Bottom Left'.
- Corner Step (inches):** An input field with '0.0'.
- First Step (inches):** An input field with '0.1181'.
- Layer Step Units:** Radio buttons for Metric and Imperial (selected).
- Panel Orientation:** Three radio buttons: Normal (selected), Rotate Clockwise, and Rotate Anticlockwise.
- Failure Level (>=):** An input field with '2'.
- Single Core Measurements:** A checked checkbox.
- Single Cap Core Measurements:** An unchecked checkbox.
- Single Outer Sub. Measurements:** An unchecked checkbox.
- Target Sequence:** A dropdown menu showing 'Layer'.
- Outer Layer Measurements:** An unchecked checkbox.
- Single-Sided Core Measurements:** An unchecked checkbox.
- Filler Core Measurements:** An unchecked checkbox.


At the bottom of the dialog are three buttons: 'Apply', 'Reset', and 'OK'.

6.1.4 6.1.4: Pluritec HPL

Press the Pluritec HPL import button to bring up the file selection window.

If all measurements are saved to a single access mdb file, the name of the file should

be displayed in the Measurement Database field.

To select a different file click on the  button - this will bring up a standard windows file navigation dialogue.

Navigate to the correct directory if necessary and choose the relevant mdb file from the list displayed.


Click the Open button to close the dialogue and return to the Pluritec HPL dialogue screen.

To find the relevant data in the mdb file, either enter details into the **Batch Code** field or enter a start and end date then press find.

The first matching record will be displayed in the **Matching Batches** field - additional records can be viewed and selected by clicking the arrow at the end of the field. .


When selected, the details of the measurement co-ordinates will be displayed on screen.


Pluritec HPL Measurement Database

Measurement Database: 

Measurement Panel:


Batch Code:

Matching Batches: 

Panel: 

Panel Size (inches) X Y

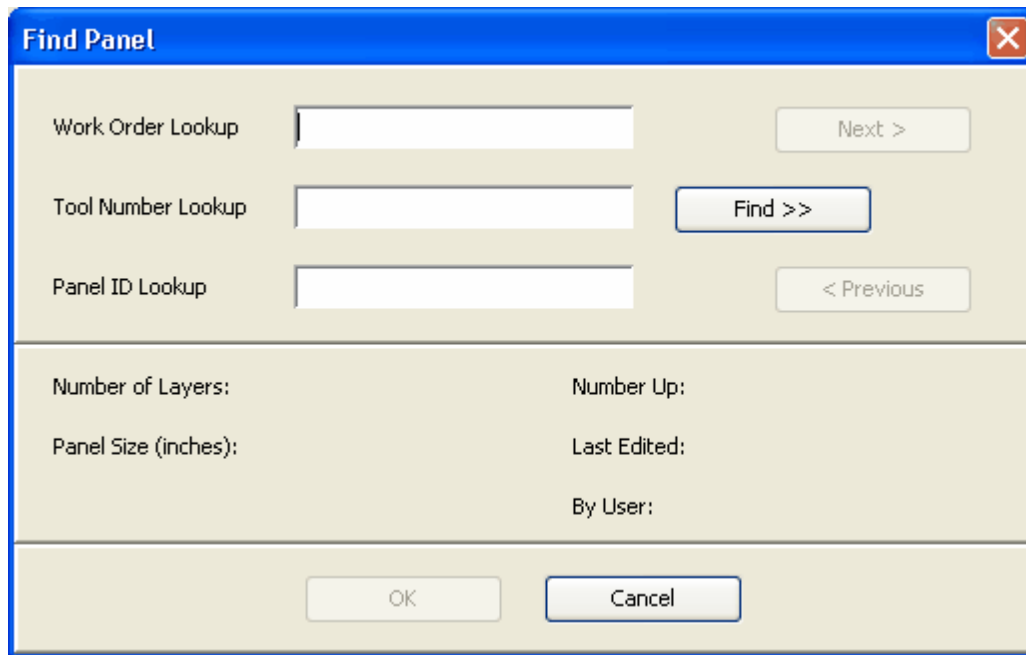
Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-11.44338	7.48418	-11.44090	7.48430
1		TR	11.44306	7.48423	11.44090	7.48430
1		BR	11.44309	-7.48542	11.44090	-7.48430
1		BL	-11.44335	-7.48547	-11.44090	-7.48430
1	Measurement Layer 1	TL	-11.44347	7.36507	-11.44090	7.36610
1		TR	11.44262	7.36512	11.44090	7.36610
1		BR	11.44265	-7.36899	11.44090	-7.36610
1		BL	-11.44343	-7.36904	-11.44090	-7.36610



If there was a stack-up record open when the Pluritec HPL button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box has a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of the first field is a 'Next >' button, and to the right of the second field is a 'Find >>' button. To the right of the third field is a '< Previous' button. Below these fields are four labels: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', and 'Last Edited:'. Below these labels are two more labels: 'By User:'. At the bottom of the dialog are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Pluritec file and may not correspond to the actual layer names of the product measured.

Press the **Analyse** button to view the analysis of this measurement data.

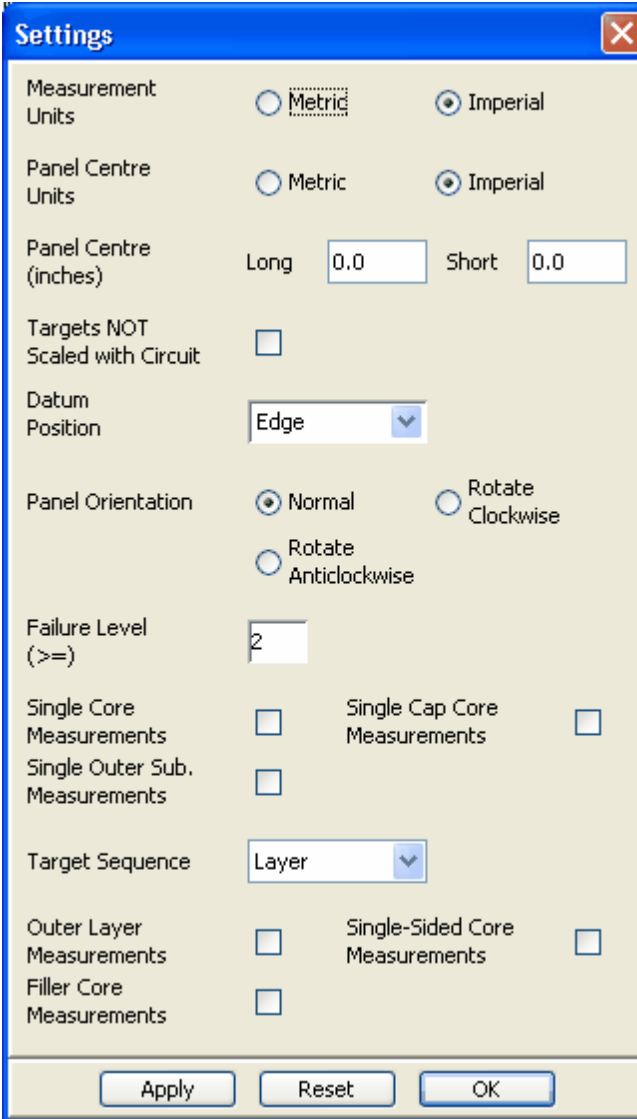
6.1.4.1 Pluritec HPL Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjust by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.

- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the Pluritec measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Datum Position** - This defines whether the datum is set from the edge of the panel or the centre of the panel. If set to "Centre", a positive offset value in X or Y would indicate an offset away from the centre of the panel i.e. further to the left on the left side of the board and further to the right on the right side of the board. Set

to "Edge" would use a standard Cartesian axis system with a positive value indicating a shift to right or up and a negative value indicating a shift to left or down. This setting should not need to be changed once configured.

- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc). Normal will assume the panel is measured in a "landscape" orientation on the Pluritec HPL machine with the long axis in the X direction.
- **Failure Level** – when errors are encountered during measurement, the Pluritec sets a value for the failure level according to the problems encountered. This option defines which failure levels should be ignored. Any value greater than or equal to the value defined will be ignored - the default setting is 2 which will only allow failure level 1 (out of tolerance) data to be imported.
- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.




The Settings dialog box contains the following options:

- Measurement Units:** Radio buttons for Metric and Imperial. Imperial is selected.
- Panel Centre Units:** Radio buttons for Metric and Imperial. Imperial is selected.
- Panel Centre (inches):** Long and Short input fields, both set to 0.0.
- Targets NOT Scaled with Circuit:** An unchecked checkbox.
- Datum Position:** A dropdown menu set to Edge.
- Panel Orientation:** Radio buttons for Normal, Rotate Clockwise, and Rotate Anticlockwise. Normal is selected.
- Failure Level (>=):** An input field set to 2.
- Single Core Measurements:** An unchecked checkbox.
- Single Cap Core Measurements:** An unchecked checkbox.
- Single Outer Sub. Measurements:** An unchecked checkbox.
- Target Sequence:** A dropdown menu set to Layer.
- Outer Layer Measurements:** An unchecked checkbox.
- Single-Sided Core Measurements:** An unchecked checkbox.
- Filler Core Measurements:** An unchecked checkbox.

Buttons at the bottom: Apply, Reset, OK.

6.1.5 6.1.5: Multiline XRT

Press the Multiline XRT import button to bring up the file selection window. (The Multiline XRT option is for 4 corner target measurement)

To select a measurement file click on the  button - this will bring up a standard windows file navigation dialogue.

Navigate to the correct directory if necessary and choose the relevant data file from the list displayed.

Click the Open button to close the dialogue and return to the Multiline XRT dialogue screen.

To find the relevant data in the file enter details into the **Work Order** field and then press find.

(If Work Order details are not stored, then this field can be left blank)

The matching records will be displayed in the **Run List** field - select the required

entries from the list (use shift/control for multiple selection).

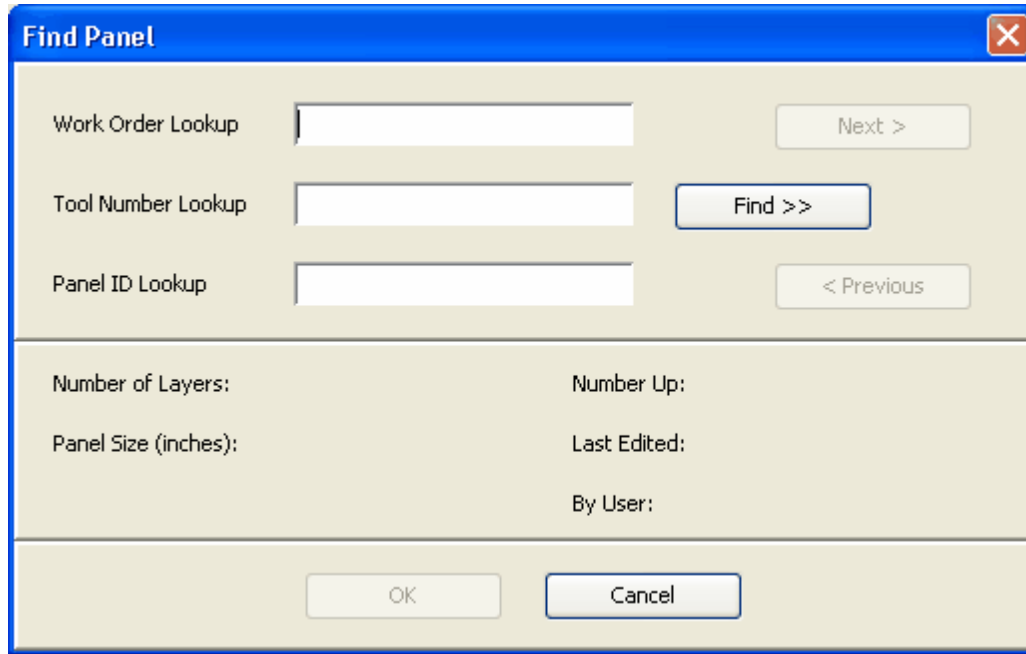
When selected, the details of the measurement co-ordinates will be displayed on screen.

Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-11.00276	7.69779	-11.00000	7.70000
1		TR	11.00005	7.69623	11.00000	7.70000
1		BR	11.00219	-7.69740	11.00000	-7.70000
1		BL	-10.99971	-7.69836	-11.00000	-7.70000
1	Measurement Layer 1	TL	-11.05697	7.34309	-11.05000	7.35000
1		TR	10.95418	7.34303	10.95000	7.35000
1		BR	10.95618	-7.34239	10.95000	-7.35000
1		BL	-11.05387	-7.34328	-11.05000	-7.35000

If there was a stack-up record open when the Multiline XRT button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box features a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of these fields are three buttons: 'Next >', 'Find >>', and '< Previous'. Below the input fields, there are five labels: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', 'Last Edited:', and 'By User:'. At the bottom of the dialog are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Multiline file and may not correspond to the actual layer names of the product measured.

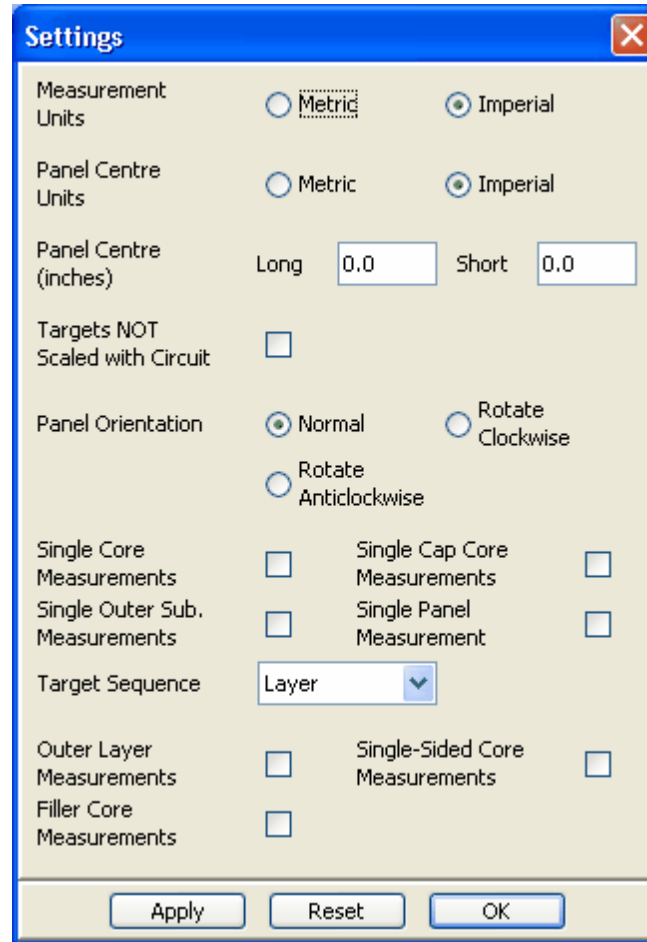
Press the **Analyse** button to view the analysis of this measurement data.

6.1.5.1 Multiline XRT Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjusted by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.


- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the Multiline measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc). Normal will assume the panel is measured in a "landscape" orientation on the Multiline XRT machine with the long axis in the X direction.

- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
 - d. **Single Panel Measurement** - this should only be checked when measuring HDI build up boards where a single target position is assumed to be representative of the position of all inner layers. Note this is a licensed option.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.



6.1.6 6.1.6: Multiline CLT

Press the Multiline CLT import button to bring up the file selection window. (The Multiline CLT option is for centre line target measurement)

To select a measurement file click on the  button - this will bring up a standard windows file navigation dialogue.

Navigate to the correct directory if necessary and choose the relevant data file from the list displayed.

Click the Open button to close the dialogue and return to the Multiline CLT dialogue screen.


To find the relevant data in the file enter details into the **Work Order** field and then press find.

(If Work Order details are not stored, then this field can be left blank)

The matching records will be displayed in the **Run List** field - select the required entries from the list (use shift/control for multiple selection).

When selected, the details of the measurement co-ordinates will be displayed on screen.

Multiline CLT Measurement File


Measurement File: 

Work Order:

Run No.:

Run List:

Panel 1 Run 1
Panel 1 Run 2

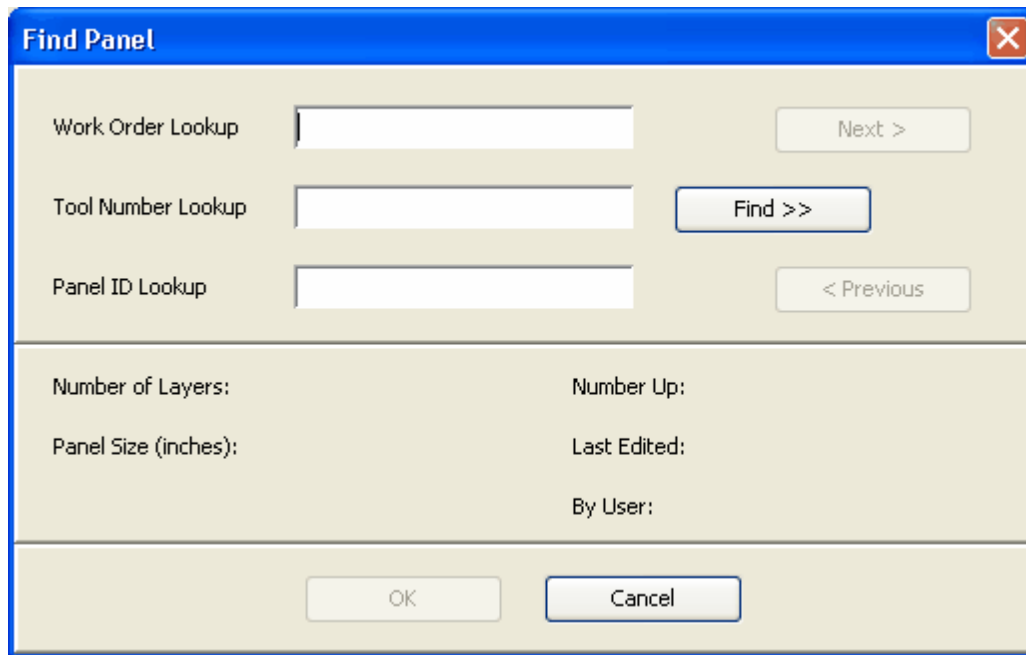
Match Panel: 

Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-11.62305	8.39800	-11.62500	8.40000
1		TR	11.62235	8.39800	11.62500	8.40000
1		BR	11.62235	-8.39678	11.62500	-8.40000
1		BL	-11.62305	-8.39678	-11.62500	-8.40000
1	Measurement Layer 1	TL	-11.67242	8.34596	-11.67500	8.35000
1		TR	11.57178	8.34596	11.57500	8.35000
1		BR	11.57178	-8.44696	11.57500	-8.45000
1		BL	-11.67242	-8.44696	-11.67500	-8.45000

If there was a stack-up record open when the Multiline CLT button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box has a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of the first field is a 'Next >' button, and to the right of the second field is a 'Find >>' button. Below the third field is a '< Previous' button. The bottom section of the dialog contains labels for 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', 'Last Edited:', and 'By User:'. At the very bottom are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Multiline file and may not correspond to the actual layer names of the product measured.

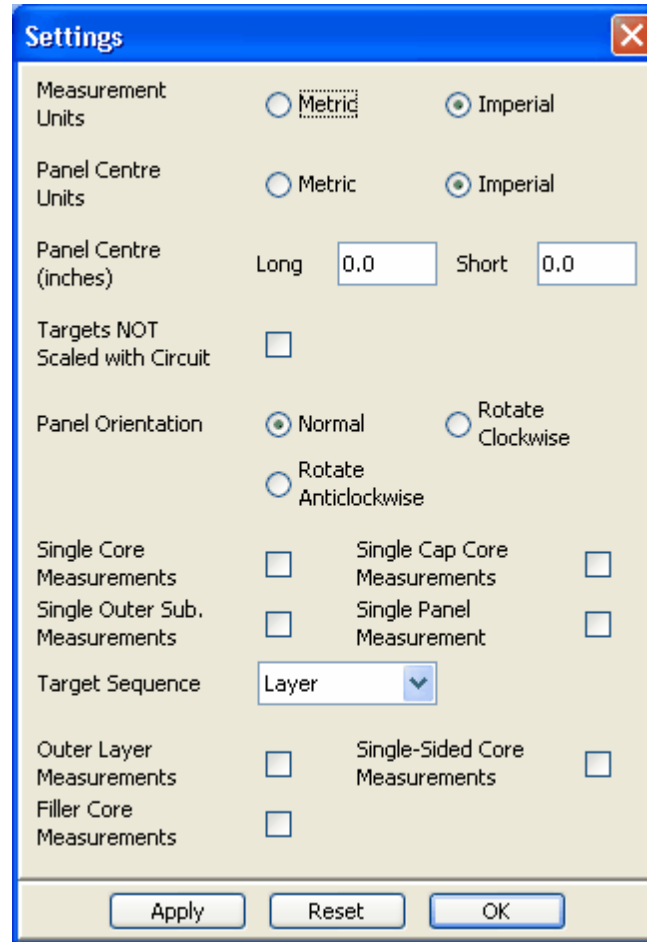
Press the **Analyse** button to view the analysis of this measurement data.

6.1.6.1 Multiline CLT Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjust by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.


- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the Multiline measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc). Normal will assume the panel on the Multiline CLT machine is measured first in the "landscape" orientation with the long axis in the X direction and then in the "portrait" direction.

- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
 - d. **Single Panel Measurement** - this should only be checked when measuring HDI build up boards where a single target position is assumed to be representative of the position of all inner layers. Note this is a licensed option.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.



6.1.7 6.1.6: SmartDrill

Press the SmartDrill import button to bring up the file selection window.

To select a measurement file click on the  button - this will bring up a standard windows file navigation dialogue.

Navigate to the correct directory if necessary and choose the relevant data file from the list displayed.


Click the Open button to close the dialogue and return to the SmartDrill dialogue screen.


To find the relevant data click the arrow at the side of the **Order** field and select the relevant work order.

The matching records will be displayed in the **Date** field - select the required entries from the list (use shift/control for multiple selection).


When selected, the details of the measurement co-ordinates will be displayed on screen.

SMARTDrill Measurement File


Measurement File: 

Order: 

Date:




2007/10/18 04:26
2007/10/18 04:31
2007/10/18 04:36

Panel: 

Panel Size (inches) X: Y: ☐ Reverse Axes

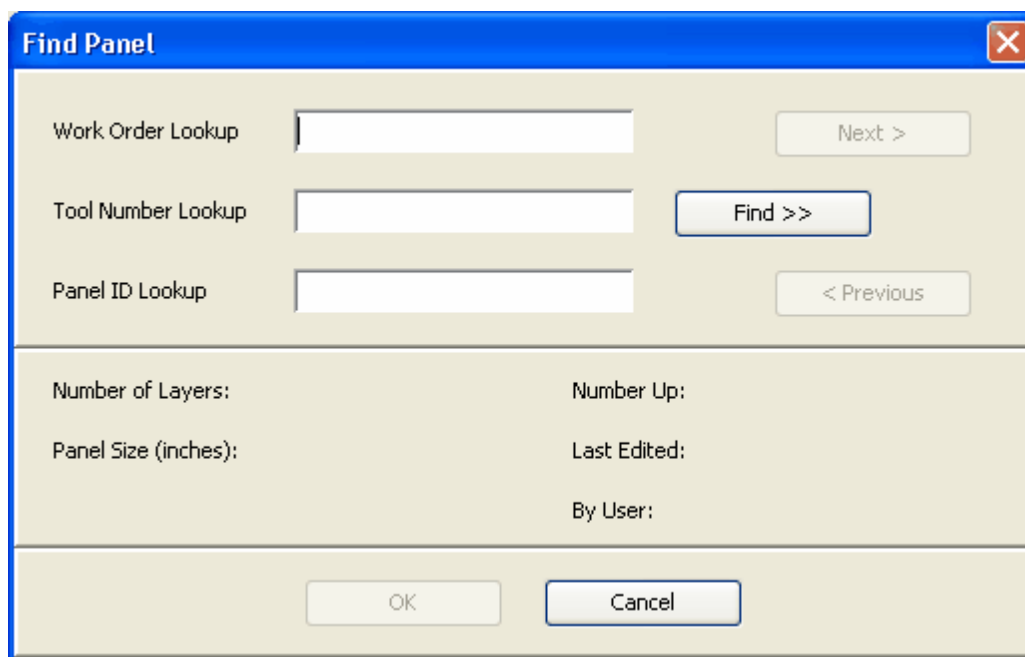
Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-11.00084	7.99800	-11.00000	8.00000
1		TR	11.00084	7.99800	11.00000	8.00000
1		BR	11.00084	-7.99800	11.00000	-8.00000
1		BL	-11.00084	-7.99800	-11.00000	-8.00000
1	L02 Copper Foil	TL	-11.00180	7.99831	-11.00000	8.00000
1		TR	11.00238	7.99749	11.00000	8.00000
1		BR	11.00178	-7.99835	11.00000	-8.00000
1		BL	-11.00240	-7.99753	-11.00000	-8.00000



If there was a stack-up record open when the SmartDrill button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box has a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of the first field is a 'Next >' button, and to the right of the second field is a 'Find >>' button. To the right of the third field is a '< Previous' button. Below these fields are four labels: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', and 'Last Edited:'. Below these labels are two more labels: 'By User:' and 'By User:'. At the bottom are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the smartDrill file and may not correspond to the actual layer names of the product measured.

Press the **Analyse** button to view the analysis of this measurement data.

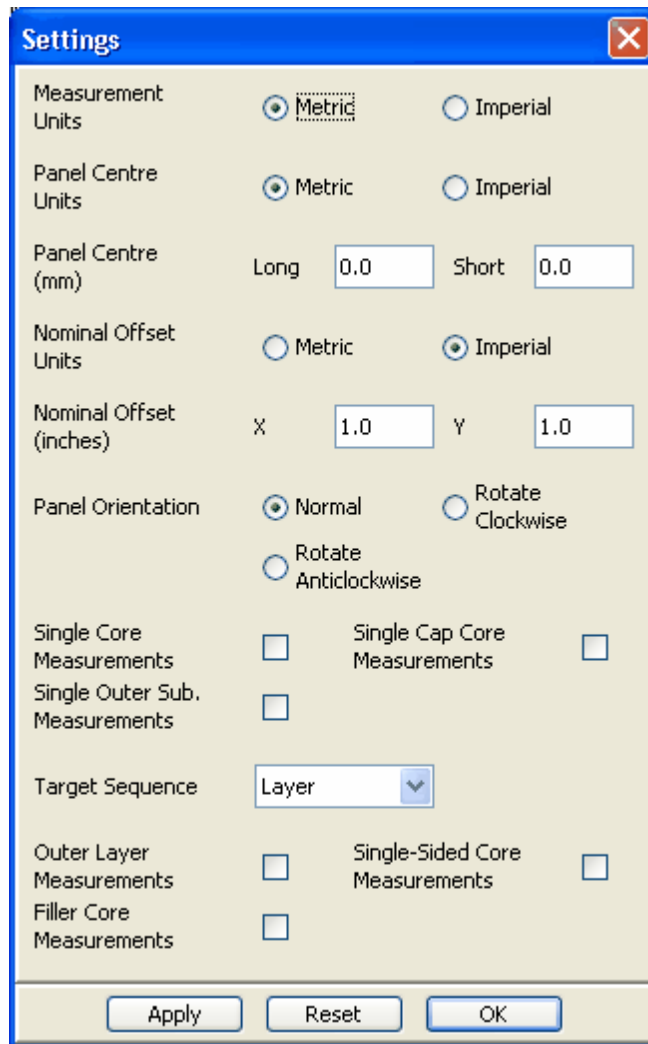
6.1.7.1 SmartDrill Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjust by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.

- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the SmartDrill measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc). Normal will assume the panel on the SmartDrill machine is measured in the "portrait" orientation with the long axis in the Y direction.
- **Nominal Offset Units** – Metric or Imperial - sets the units used in the Nominal

Offset fields.

- **Nominal Offset** – As the SmartDrill only provides post processed scale, offset and rotation data and not actual coordinate data, the target positions need to be recreated. The nominal offset indicates the distance from the corner of the panel in X and Y to use as the modelled position.
- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.




The Settings dialog box contains the following controls:

- Measurement Units:** Radio buttons for Metric (selected) and Imperial.
- Panel Centre Units:** Radio buttons for Metric (selected) and Imperial.
- Panel Centre (mm):** Input fields for Long (0.0) and Short (0.0).
- Nominal Offset Units:** Radio buttons for Metric and Imperial (selected).
- Nominal Offset (inches):** Input fields for X (1.0) and Y (1.0).
- Panel Orientation:** Radio buttons for Normal (selected), Rotate Clockwise, and Rotate Anticlockwise.
- Single Core Measurements:** Check box (unchecked).
- Single Cap Core Measurements:** Check box (unchecked).
- Single Outer Sub. Measurements:** Check box (unchecked).
- Target Sequence:** A dropdown menu currently showing 'Layer'.
- Outer Layer Measurements:** Check box (unchecked).
- Single-Sided Core Measurements:** Check box (unchecked).
- Filler Core Measurements:** Check box (unchecked).

At the bottom are three buttons: Apply, Reset, and OK.

6.1.8 6.1.7: Muraki

Press the Muraki import button to bring up the file selection window.


To select a measurement file click on the  button - this will bring up a standard windows file navigation dialogue.


Navigate to the correct directory if necessary and choose the relevant data file from the list displayed.

Click the Open button to close the dialogue and return to the Muraki dialogue screen.

When selected, the details of the measurement co-ordinates will be displayed on screen.


Muraki Measurement File

Measurement File 

Panel 

Panel Size (inches) X Y

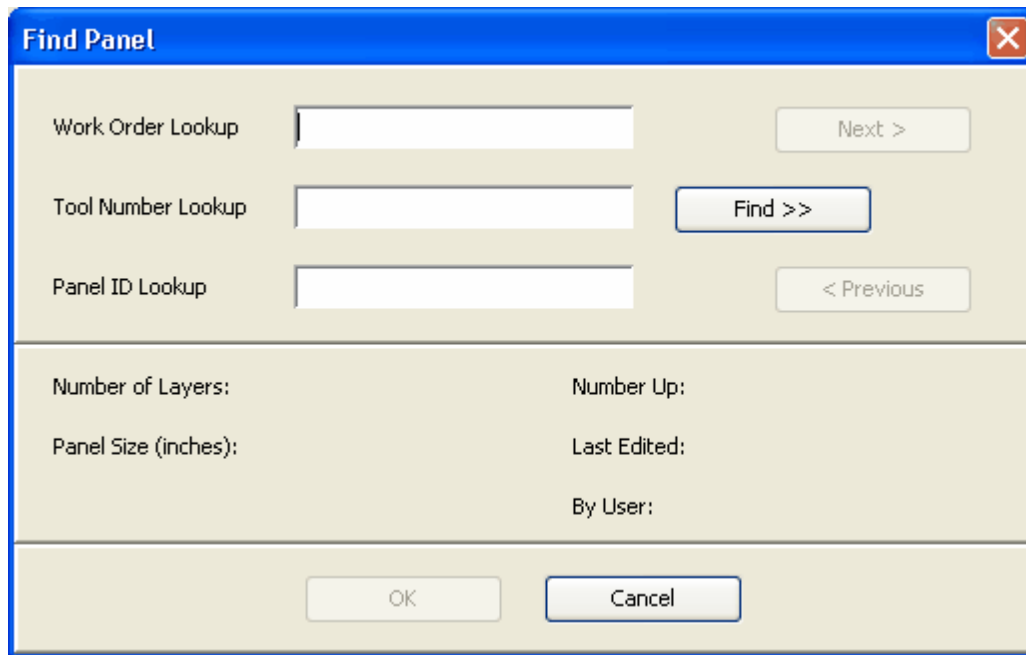
Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)



If there was a stack-up record open when the Muraki button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box has a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of the first field is a 'Next >' button, and to the right of the second field is a 'Find >>' button. To the right of the third field is a '< Previous' button. Below these fields are four labels: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', and 'Last Edited:'. Below these labels are two more labels: 'By User:' and 'By User:'. At the bottom are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Muraki file and may not correspond to the actual layer names of the product measured.

Press the **Analyse** button to view the analysis of this measurement data.

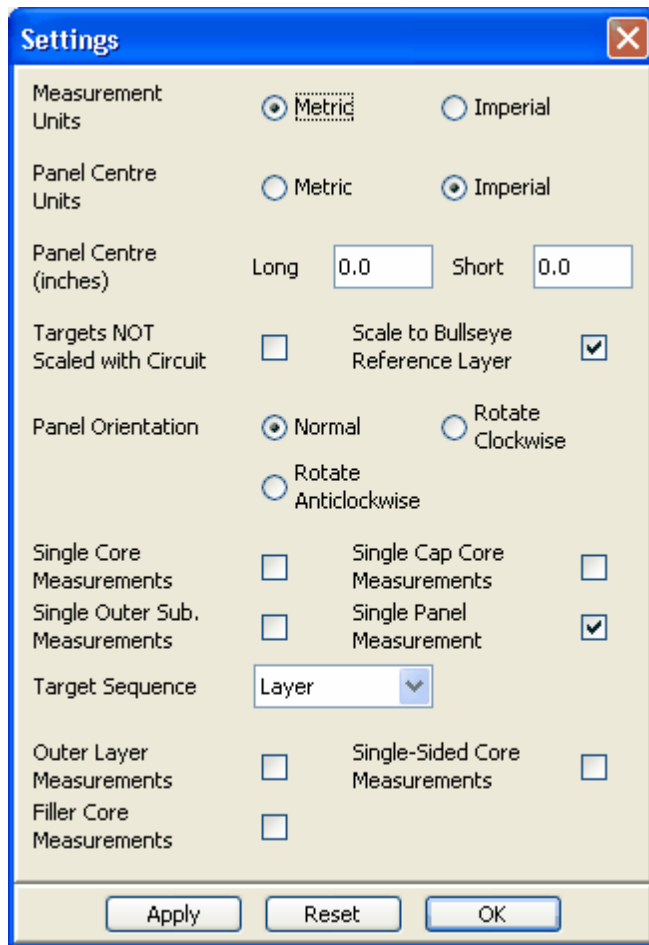
6.1.8.1 Muraki Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjust by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.

- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the Muraki measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Scale to Bullseye Reference Layer** - This option should be checked if the bullseye (concentric circle) targets are used.
- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc). Normal will assume the panel on the Muraki machine is


measured first in the "landscape" orientation with the long axis in the X direction and then in the "portrait" direction.

- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
 - d. **Single Panel Measurement** - this should only be checked when measuring HDI build up boards where a single target position is assumed to be representative of the position of all inner layers. Note this is a licensed option.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.



6.1.9 6.1.8: Hitachi Log

Press the Hitachi Log import button to bring up the file selection window.

To select a log file click on the  button - this will bring up a standard windows file navigation dialogue.

Navigate to the correct directory if necessary and choose the relevant log file from the list displayed.

Click the Open button to close the dialogue and return to the Hitachi dialogue screen.


To find the relevant data in the mdb file, either enter details into the **Drill Program** field or enter a start and end date then press find.

All matching records will be displayed in the **Matching Drill Programs** window.

Select the required records (use shift/control for multiple selections) or press the select all button.

When selected, the details of the measurement co-ordinates will be displayed on screen.

Hitachi Log Measurement File

Measurement File: 20081020-1._PC.txt  Settings

Drill Program: G494-D Find >>


Batch Code:

Matching Drill Programs: G494-D

Matching Batches:

- Prgc849 2008/10/20 13:31:56
- Prgc849 2008/10/20 13:38:23
- Prgc849 2008/10/20 13:39:11
- Prgc849 2008/10/20 13:40:07
- Prgc849 2008/10/20 13:42:35

Select All Select All

Match Panel:  Match

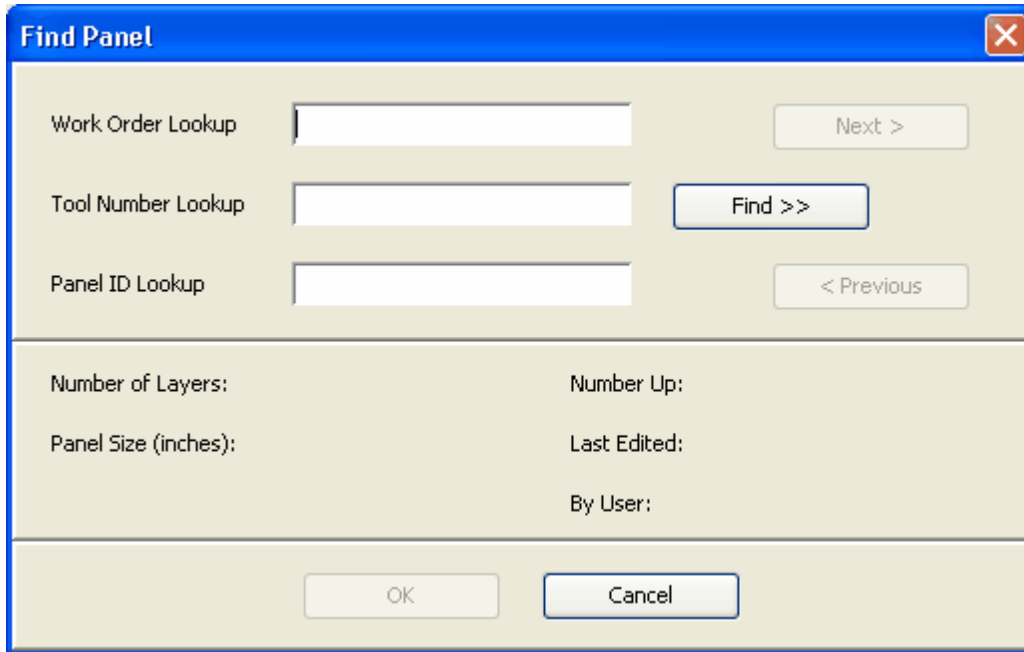
Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-10.06475	8.24925	-10.06500	8.25000
1		TR	10.38025	8.24925	10.38000	8.25000
1		BR	10.38025	-8.25075	10.38000	-8.25000
1		BL	-10.06475	-8.25075	-10.06500	-8.25000
1	Measurement Layer 1	TL	-10.06500	8.25000	-10.06500	8.25000
1		TR	10.38000	8.25000	10.38000	8.25000
1		BR	10.38000	-8.25000	10.38000	-8.25000
1		BL	-10.06500	-8.25000	-10.06500	-8.25000

Export Analyse Close

If there was a stack-up record open when the Hitachi Log button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box has a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of the first field is a 'Next >' button. To the right of the second field is a 'Find >>' button. To the right of the third field is a '< Previous' button. Below these fields are five labels: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', 'Last Edited:', and 'By User:'. At the bottom are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Hitachi log file and may not correspond to the actual layer names of the product measured.

Press the **Analyse** button to view the analysis of this measurement data.

6.1.9.1 Hitachi Log Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjust by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.

- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the Muraki measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc). Normal will assume the panel on the Muraki machine is measured first in the "landscape" orientation with the long axis in the X direction and then in the "portrait" direction.

- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
 - d. **Single Panel Measurement** - this should only be checked when measuring HDI build up boards where a single target position is assumed to be representative of the position of all inner layers. Note this is a licensed option.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.

Settings

Measurement Units: ☐ Metric ☒ Imperial

Panel Centre Units: ☐ Metric ☒ Imperial

Panel Centre (inches): Long Short

Targets NOT Scaled with Circuit: ☐

Panel Orientation: ☐ Normal ☒ Rotate Clockwise ☐ Rotate Anticlockwise

Single Core Measurements: ☐ Single Cap Core Measurements: ☐

Single Outer Sub. Measurements: ☐ Single Panel Measurement: ☐


Target Sequence:

Outer Layer Measurements: ☐ Single-Sided Core Measurements: ☐

Filler Core Measurements: ☐

6.1.10 6.1.8: Hitachi DB

Press the Hitachi DB import button to bring up the file selection window.

To select a log file click on the  button - this will bring up a standard windows file navigation dialogue.

Navigate to the correct directory if necessary and choose the relevant log file from the list displayed.

Click the Open button to close the dialogue and return to the Hitachi dialogue screen.


To find the relevant data in the mdb file, either enter details into the **Drill Program** field or enter a start and end date then press find.

All matching records will be displayed in the **Matching Drill Programs** window.

Select the required records (use shift/control for multiple selections) or press the select all button.

When selected, the details of the measurement co-ordinates will be displayed on screen.

Hitachi Log Measurement File

Measurement File: 

Drill Program:


Batch Code:

Matching Drill Programs:

G494-D

Matching Batches:

Prgc849 2008/10/20 13:31:56
Prgc849 2008/10/20 13:38:23
Prgc849 2008/10/20 13:39:11
Prgc849 2008/10/20 13:40:07
Prgc849 2008/10/20 13:42:35

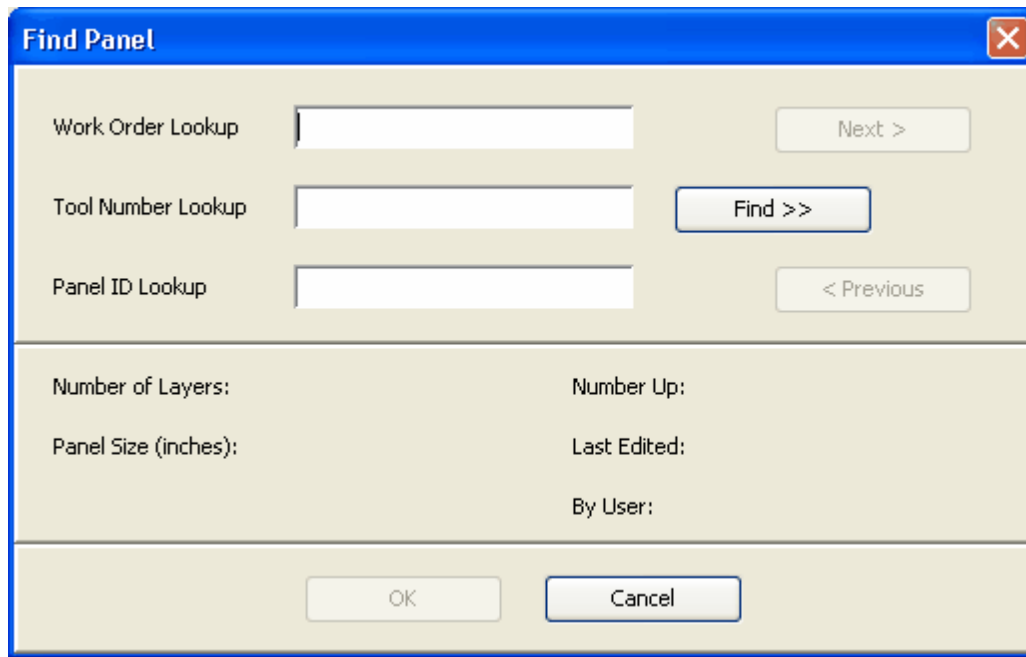
Match Panel: 

Panel	Layer	Sector	Absolute X (inches)	Absolute Y (inches)	Nominal X (inches)	Nominal Y (inches)
1	Common	TL	-10.06475	8.24925	-10.06500	8.25000
1		TR	10.38025	8.24925	10.38000	8.25000
1		BR	10.38025	-8.25075	10.38000	-8.25000
1		BL	-10.06475	-8.25075	-10.06500	-8.25000
1	Measurement Layer 1	TL	-10.06500	8.25000	-10.06500	8.25000
1		TR	10.38000	8.25000	10.38000	8.25000
1		BR	10.38000	-8.25000	10.38000	-8.25000
1		BL	-10.06500	-8.25000	-10.06500	-8.25000

If there was a stack-up record open when the Hitachi DB button was pressed, the Match Panel field will already show the name of the open record.

If no record was open, then a stack-up must be selected to be able to store the measurement results - to do this, click the binocular icon next to the match panel field. This will open a record selection screen - enter a value in any of the three search fields and click the Find button.

If more than one result is returned, click the Next and Previous buttons to navigate to the correct record and then press OK.



The 'Find Panel' dialog box has a blue title bar with a close button. It contains three input fields for 'Work Order Lookup', 'Tool Number Lookup', and 'Panel ID Lookup'. To the right of the first field is a 'Next >' button. To the right of the second field is a 'Find >>' button. To the right of the third field is a '< Previous' button. Below these fields are four labels: 'Number of Layers:', 'Number Up:', 'Panel Size (inches):', and 'Last Edited:'. Below these labels are two more labels: 'By User:' and an empty text field. At the bottom are 'OK' and 'Cancel' buttons.

If the results are not going to be saved, then there is no need to select a stack-up record - however in this case, the layer names shown in the measurement analysis screens will reflect the names shown in the Hitachi mdb file and may not correspond to the actual layer names of the product measured.

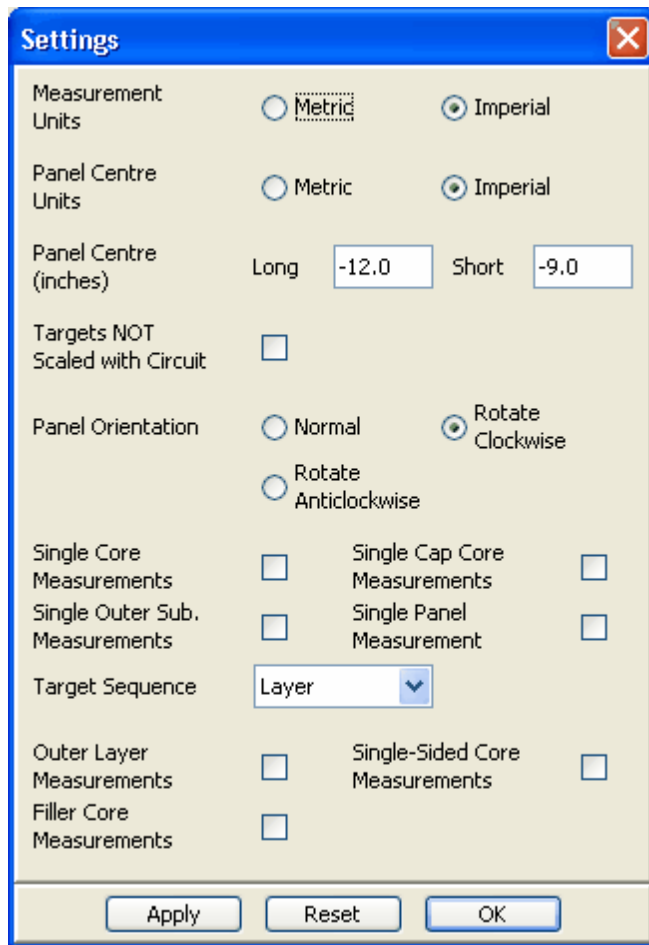
Press the **Analyse** button to view the analysis of this measurement data.

6.1.10.1 Hitachi DB Settings

For a standard configuration, there should be no need to adjust any of the settings that can be adjust by pressing the Settings button - all relevant settings should be correctly configured when the system is installed by Xact personnel. However, if the nature of the products and measurement process allow changes in the way the data should be analysed, these changes can be made from the Settings menu.

- **Measurement Units** – Metric or Imperial (this overrides the default configuration in the .properties file)
- **Panel Centre** indicates the distance from the 0,0 datum within the measurement data to the centre of the panel about which all scaling, offsets and rotation will be calculated. The units can be set to either metric or imperial.
- **Targets NOT scaled with circuit** - This should only be checked if the panelisation script does not apply scaling to the Muraki measurement targets i.e. they are imaged at nominal on the inner layers. This is not normally checked.
- **Panel Orientation** – determines the orientation of the panel on the machine (portrait/landscape etc). Normal will assume the panel on the Muraki machine is measured first in the "landscape" orientation with the long axis in the X direction and then in the "portrait" direction.

- Core measurement type - this cross references layers in the measurement data to the stackup to ensure the correct layer names are displayed and that the data is stored against the correct layers in the stack-up.
 - a. **Single Core Measurement** - this should be checked if there is only target position on a core. If the top and bottom of a standard inner layer core have separate target positions, leave this unchecked.
 - b. **Single Cap Core Measurement** - this should only be checked if both sides of a capped core have the same target position, even though they are imaged at different times. It is unusual for this to be checked.
 - c. **Single Outer Sub. Measurement** - this should only be checked if both outer layers an internal sub-assembly use the same target position. If the top and bottom sides of the sub-assembly are measured individually, this should remain unchecked. It is unusual for this to be checked.
 - d. **Single Panel Measurement** - this should only be checked when measuring HDI build up boards where a single target position is assumed to be representative of the position of all inner layers. Note this is a licensed option.
- **Target Sequence** - the standard setting here is "Layer" meaning that the order of the targets matches the order of the layers from the top of the stack downwards. the alternative setting "Build" allows for targets that are ordered according to the sequence that the layers are added (i.e. in sequentially laminated products only)
- Additional targets - this enables the system to cope with targets that do not relate to functional inner layers.
 - a. **Outer Layer Measurements** - If the measurement data includes measurements from the external copper layers, this should be checked. Leave unchecked if the data refers to inner layers only.
 - b. **Single-Sided Core Measurements** - If a core is blank on one side i.e. there is no functional circuitry, but still has a measurement target then this box should be checked.
 - c. **Filler Core Measurements** - If a core is blank on both sides i.e. there is no functional circuitry on either side, but there are still targets on the core, then this box should be checked.



6.1.11 6.1.9: Fein Focus

Enter topic text here.

6.2 6.2: Measurement Analysis Console

Once the Measurement Analysis (MA) Console appears, all machine specific configuration and import is complete - from this point on, the application is generic to all formats.

If a stack-up is open or "matched", the details will appear at the top of the console dialogue.

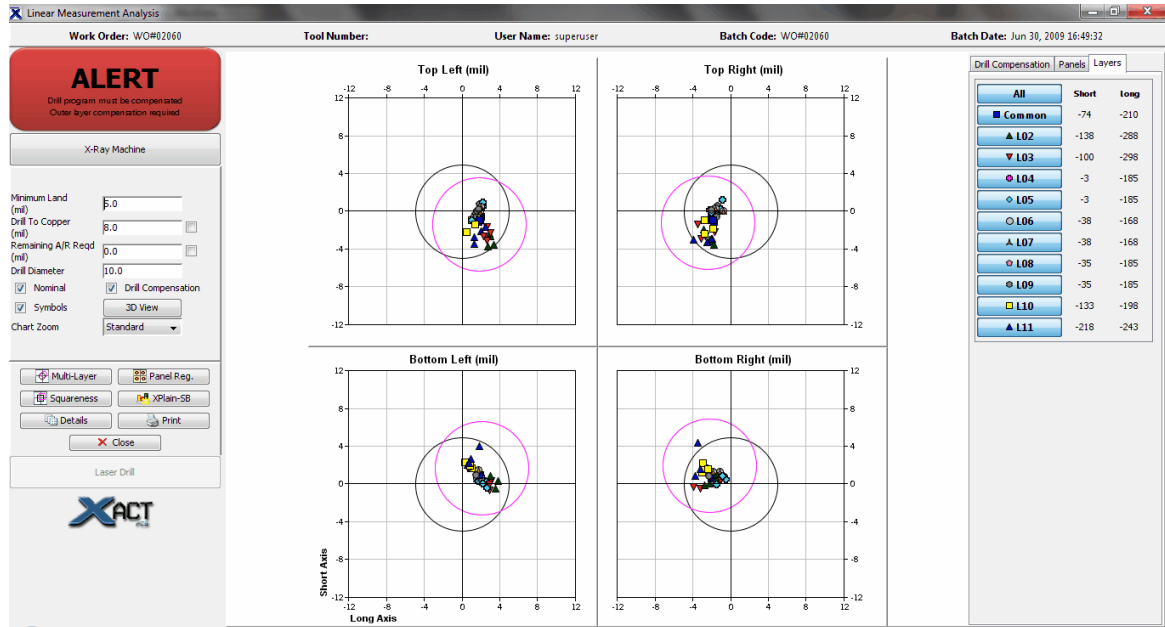
There are 3 panes in the measurement analysis window:

Left Pane = Specification and View Control

Centre Pane = Graphical Data Display

Right Pane = Interactive Functions

Click the panes below to see more details.



6.2.1 6.2.1: Left Hand Pane

The left hand pane has 3 main functions:

- 1 - To display measurement status of the batch - Pass / Alert / Hold MRB etc.
- 2 - To allow the user to interact with the analysis by modifying the design rule parameters for minimum land / drill to copper / minimum drill size etc
- 3 - To allow the user to switch between the different measurement display options.

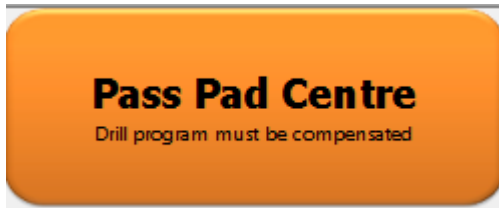
Batch Status:

There are 4 different batch statuses which may be displayed:

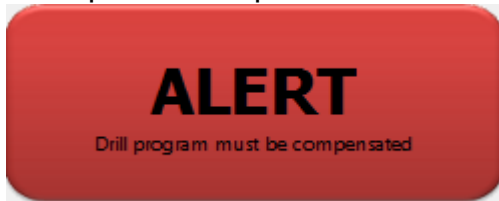
1. PASS - the required amount of measurement data is within the required annular ring.



2. PASS PAD CENTRE - the required amount of data is within the required annular ring but the user has selected the compensate to pad centre option. I.e. whilst the data is within specification, the registration can be improved by applying a compensation to the drill program.



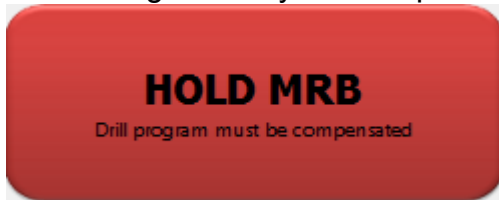
3. ALERT - with no drill compensation, there are points which will not be within the specified minimum land. Applying the recommended drill compensation will bring these points into specification.



4. HOLD MRB - there are a number of reasons that this message will appear.
 - too many panels/layers have been filtered out of the drill compensation calculations (either manually or automatically)



- the system is unable to find a drill compensation that can achieve the required annular ring for all layers of all panels.



Design Rule Parameters:

There are 4 fields that can be modified by users with engineer or higher privilege.

1. Minimum Land - The minimum distance between the edge of the drilled hole and the edge of the inner layer pad in the design data.

2. Drill to Copper - The minimum distance between the edge of the drilled hole and the nearest non-connected inner layer copper feature in the design data.

The check box alongside this field will display a circle on the "Multilayer" display representing this distance.

3. Remaining A/R Required - The customer requirement for the minimum distance between the edge of the drilled hole and the edge of a drilled pad in the delivered PCB.

The value entered in this field is subtracted from the minimum land value to determine the "design rule" i.e. the tolerance that is allowed on the measured panels.

The check box alongside this field will show the edge of the pad as well as the

design rule area on the "Multilayer" display.

4. Drill diameter - The diameter of drill to be used in the "Panel Reg" display

Minimum Land (mil)	5.0
Drill To Copper (mil)	8.0 <input type="checkbox"/>
Remaining A/R Reqd (mil)	0.0 <input type="checkbox"/>
Drill Diameter	10.0

In addition to being used in the display, these parameters can also affect the drill compensation algorithm used to find the best fit for the measurement data.

Display Options:

The following options interact with the currently selected display.

<input checked="" type="checkbox"/> Nominal	<input checked="" type="checkbox"/> Drill Compensation
<input checked="" type="checkbox"/> Symbols	3D View
Chart Zoom	Standard
<input type="button" value="↶"/>	<input type="button" value="Reset Rotation"/>
	<input type="button" value="↷"/>

The Nominal Check Box toggles the display of the nominal drill position on and off.

The Drill Compensation Check Box toggles the display of the compensated drill position on and off.

The Symbols Check Box toggles on and off the measurement points symbols in the "Multilayer" view

The Chart Zoom drop down box allows the resolution of the charts to be adjusted - the settings for each zoom level are controlled in the configuration file "XActMA.properties". There are 5 options Very Wide/Wide/Standard/Zoom/Max Zoom

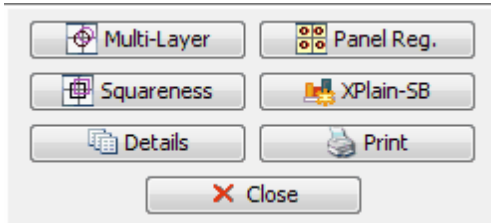
Standard
VeryWide
Wide
Standard
Zoom
MaxZoom

The Rotation buttons allow the displayed data to be rotated either clockwise (right button) or anti-clockwise (left button). The Reset Rotation button will return to the orientation set by the system configuration.

In addition to this is a licensed option which will be displayed if purchased - 3D View. This allows access to the 3D display of the measurement data and virtual cross section (X-Section) modules.

Display Selection:

There are a number of buttons that allow the display to be changed and to access the data used. Clicking these buttons will either change the display in the centre pane or open another dialogue box.



The "Multilayer" button is the default view showing each measured point as an individual symbol.

The "Panel Reg" view displays the measured data as pads with the nominal and compensated drill positions shown using the drill size - this view is also available in 3D with the X-section module license activated.

The "Squareness" view shows the outline of each layer formed by connecting the measured points - this view is also available in 3D with the X-section module license activated.

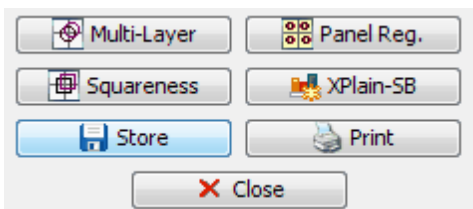
"Xplain-SB" is the single batch version of the Xplain module - clicking this will open a new window displaying the Xplain data analysis.

The "Details" button allows the user to view the co-ordinate data used to produce the charts.

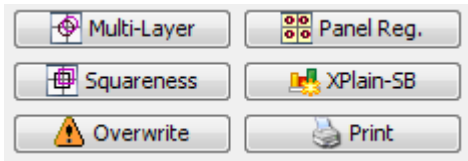
The "Print" button allows access to multiple report/printing options.

The "Close" button will close the measurement analysis window.

When new measurement data has been imported with an associated stack-up record, the Details button will be replaced with a "Store" button to allow the data to be saved back to the main database.



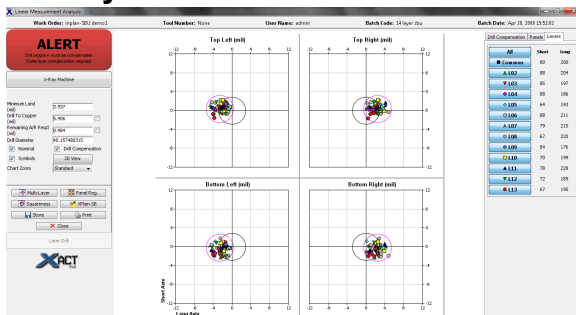
When reviewing stored measurements, it is possible to reject measurement data - if this has happened, the Details button will be replaced with an "Overwrite" button allowing the stored data to be overwritten with the modified data.



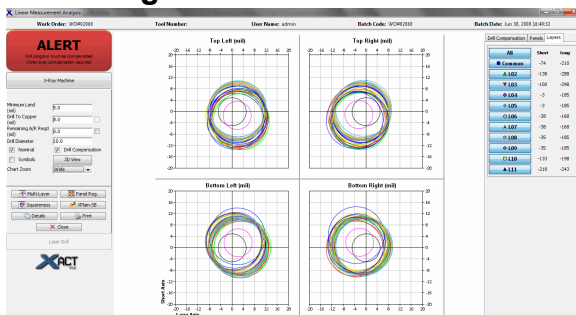
6.2.2 6.2.2: Centre Pane

The Centre Pane displays the measurement data being analysed - click on the image to see further details of the display.

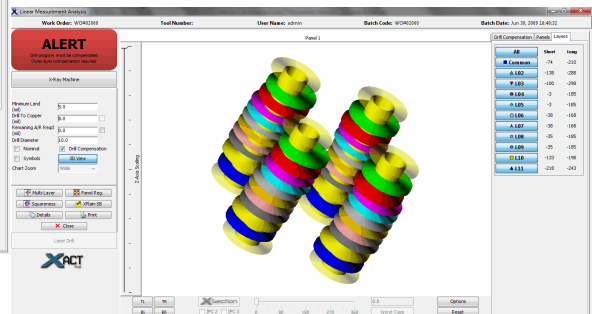
Multilayer View:



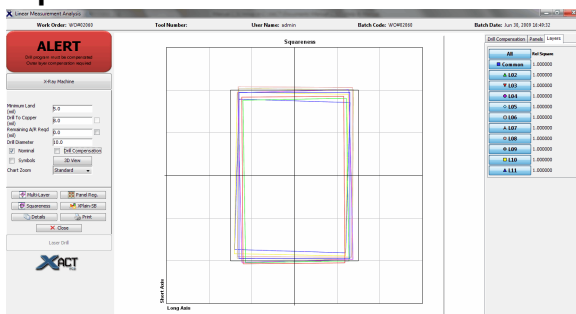
Panel Registration View:



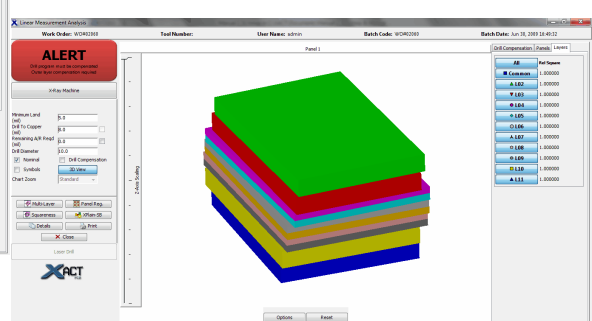
3D Panel Registration View (Licensed Option):



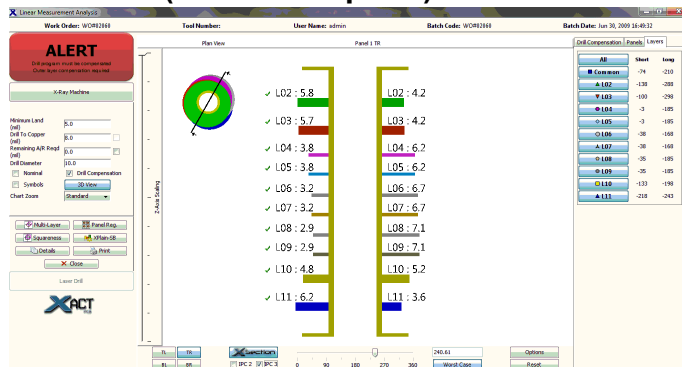
Squareness View:



3D Squareness View (Licensed Option):



X-Section (Licensed Option):



6.2.3 6.2.3: Right Hand Pane

The right hand pane allows access to three tabs with interactive controls.

Click on the tabs below for more details.

Drill Compensation: Panels:

Layers (Scale Errors): Layers (Relative Squareness):

Drill Compensation	Panels	Drill Compensation	Panels	Drill Compensation	Panels
All	No Co	All	Sho	All	Rel Squ
Panel 1	100%	Common	-74	Common	1.0000
Panel 2	97%	L02	-138	L02	1.0000
Panel 3	100%	L03	-100	L03	1.0000
Panel 4	100%	L04	-3	L04	1.0000
		L05	-3	L05	1.0000
		L06	-38	L06	1.0000
		L07	-38	L07	1.0000
		L08	-35	L08	1.0000
		L09	-35	L09	1.0000
		L10	-138	L10	1.0000
		L11	-218	L11	1.0000

6.2.3.1 6.2.3.1: Drill Compensation

The screenshot shows the 'Drill Compensation' tab with the following settings:

- Optimisation:** ☒ To Pad Centres, ☒ Display Filtered,
- Calculated Compensations:** ☒ Calculated Drill Scaling (ppm)
 - Short Axis:** Slider at -128
 - Long Axis:** Slider at -238
 - ☒ Rotation To Drill Prog (°)
 - Rotation:** Slider at 0.00062
 - ☒ Drill Offsets (mil)
 - Short Axis:** Slider at -0.3
 - Long Axis:** Slider at -0.2
- Buttons:**
- Reference Drill Scaling (ppm):**
 - Long Axis:** 200
 - Short Axis:** -200
- Outer Layer Scaling (ppm):**
 - Short Axis:** -128
 - Long Axis:** -238

The drill compensation information is accessed from the Drill Compensation tab in the left hand pane of the measurement analysis window. The drill compensation tab can be accessed at any time by users with engineer/administrator level permissions but an operator level and some other users can not access the drill compensation screen in some circumstances:

- If the compensation algorithm determines that too many layers need to be filtered i.e. the data is scattered so much that the system identifies too many points as erroneous data.
- If the compensation algorithm can not determine a suitable drill compensation to fit the measured data.

In addition, an Operator level user is not able to modify any of the fields/settings of this tab

The top section allows modifications that will affect the calculation of drill compensations.

The Pad Centres check box toggles on/off optimisation to pad centre - see [Drill Optimisation Options](#) for further details.

The Set Filters button will bring up a new dialogue allowing the user to select which panels/layers should be included in the drill optimisation calculation. If the Display Filtered checkbox is left unchecked, the points optimised will not be displayed in the centre pane views. See [Drill Optimisation Filter](#)

The settings button if configured allows the user to modify parameters used in the drill compensation calculations - consult your XACT support team before modifying these values.

The drill compensations consist of:

- Scale factors for each axis
- An offset for each axis
- Rotation angle

The checkboxes next to each of these compensations allow the compensation to be toggled on or off (i.e. used or not used).

Sliders allow the user to manually override the calculated values.

NOTE: the rotation compensation is indicated as +ve for counter clockwise and -ve clockwise.

The **Store** button allows the user to store the drill compensation values that will be used for this product.

The **Export** button allows the user to export a drill compensation file which can be used with third party software to apply the compensations to the drill program.

The **Scale Calculator** button allows the user to review the effect of applying the displayed drill compensation over a user entered pitch to ensure that the customer hole to hole specification is not compromised.

The **Display** button allows the user to switch between the recommended drill compensations, stored drill compensations and user filtered compensations. If the system configuration is storing reference drill scaling information, this is shown in the lower section of the dialogue.

By default - if scaling of greater than 100ppm is required, the compensation display will recommend that the outer layer images be scaled to match.

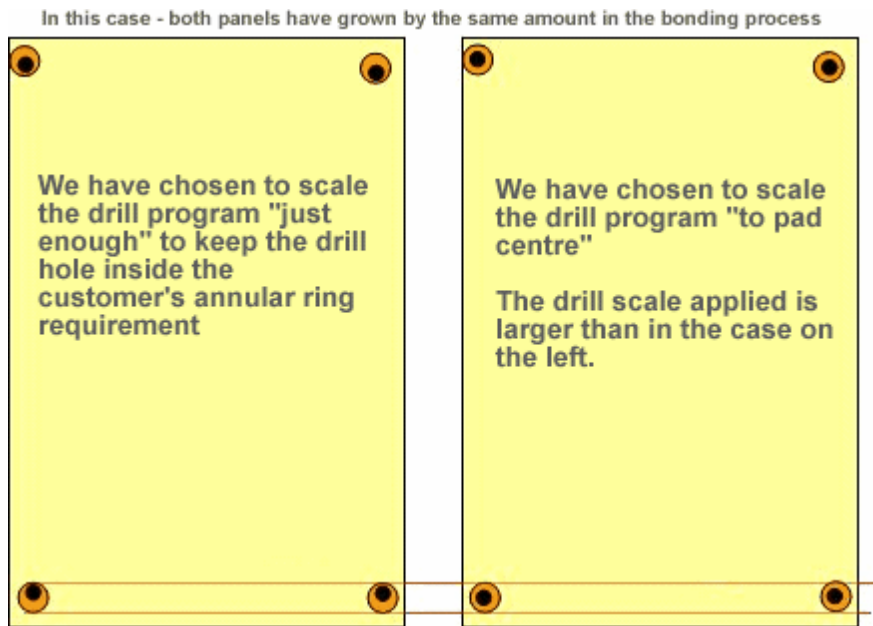
The displayed units for all fields are set in the Settings Menu from the main screen. The drill scale units are set by the Drill Scaling option and the Outer Layer scaling units are set by the Stackup Scaling option. (See [Units Selection](#))

6.2.3.1.1 Drill Optimisation Options

By default, the Measurement Analysis module is set to provide optimised drill scale, rotation and offset using as “**small an applied change as possible**”. This ensures that the drills will be constrained within the available annular ring – but it does not force the holes to be in the dead-centre of the pads. The reason for this is clear, we do not want to force a larger than necessary drill scale, which in turn would force a larger adjustment to outer layer (or next lamination) scaling.

Console Option - Optimise to Drill Centre

If the product requires maximum possible annular ring, or is a plated core blind via component (i.e. will be through holed drilled and then laminated again into the final product), it is likely that the holes and pads should be optimised to pad centre. In this case select the **Optimise to Drill Centre** option. This will force the drill compensation algorithm to optimise to the centre of the measured pads increasing the scale factors from the standard algorithm which ensures no breakout.



Console Option - Compensation Options

In a linear system, there are three possible ways that a drill program can be compensated: By applying a shift (offset) in one or both of the machine axes, by applying a rotation or by applying a scale factor in one or both axes.

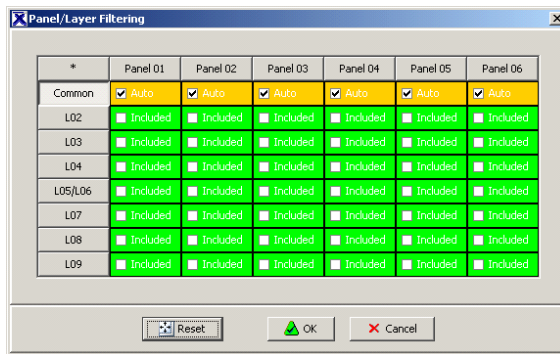
The measurement analysis console gives access to switch on or off each of these compensation types individually - the default settings are stored in the configuration files.

As an operator level, it is not possible to override the default settings, however as an engineer level user it can be useful for analysis of the registration issues.

6.2.3.1.2 Drill Optimisation Filter

Console Option – User Filtering (Layer and Panel Filtration)

The point filtration controls can be accessed by clicking the **Filter** button in the **console** screen. The filter button is only accessible to users with engineer level log-in permission.



When opened, the filtration control shows the layers that are currently filtered out. By default, the common layer is filtered out, but the software is intelligent and additional points may be filtered if there are spurious measurement points.

To override the automatic filtration, click the **User Filtering** option. It is then possible to switch on or off whole panels using the top row of buttons, whole layers using the left column of buttons or an individual layer on an individual panel using the corresponding button.

The checkboxes with an amber background have automatically been filtered out. By default, the Common layer is not included in the drill compensation calculations and is therefore automatically filtered out.

To calculate the result of the selected filtering press the **OK** button and return to either the panel registration plot or the multilayer plot to view the newly compensated drill positions.

If there is excessive variation or scatter of the measured points, the automatic filtration logic may try to remove more points than is desirable. In these instances, the software is configured to prevent **operator** level users from accessing the drill compensation data.

6.2.3.1.3 Exporting Drill Compensation/Scale Error Data

On the Drill Compensation tab there is an EXPORT button which will allow you to produce a file with the recommended drill scale, rotation and offset together with the actual scale errors (deviation of scale factor from nominal) for each of the layers in the stack.

The OUTPUT format can be in

(a) XACT XML format

or

(b) FASTEC format

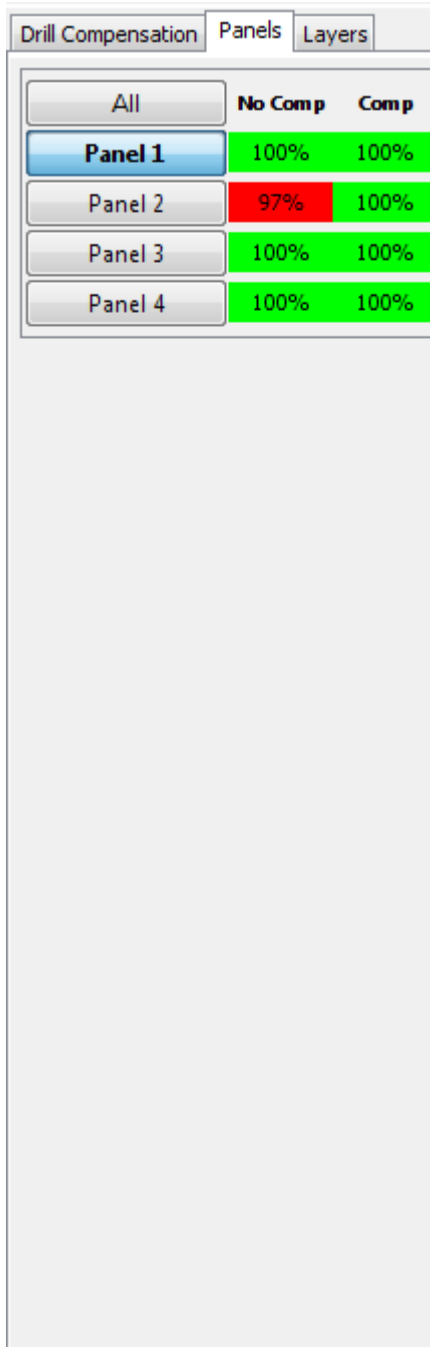
In addition it is possible to export compensation data for individual panels by right clicking on the panel buttons in the Panels tab

The XACT and FASTEC outputs allow a user to automate the creation of scaled drill programs specific to each set of measured panels.

If configured, the Fastec output can be extended to include compensation values for

each individual panel as well as the best fit compensation for all panels.

6.2.3.2 6.2.3.2: Panels Tab

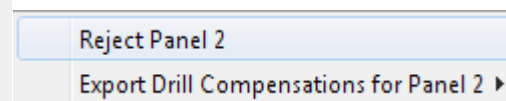


The **Panels** tab allows the user to toggle panel data on or off in the centre pane display by clicking the individual panel buttons or the All button.

Note: Toggling panels on and off in this way does not affect which data is used for drill compensation. See [Drill Optimisation Filter](#) for details of this.

Alongside the buttons are two columns showing how many measured points are within specification for each panel with no drill compensation and with drill compensation.

In addition to changing the display, right clicking on any of the panel buttons allows access to some additional functionality.



1. The panel can be rejected i.e. removed from the measurement data and therefore drill compensation calculations. (Note: unless the data is stored/overwritten after this operation, the panel will re-appear next time the measurement data is viewed).

2. Individual drill compensations can be exported for the selected panel.

6.2.3.3 6.2.3.3: Layers Tab

Drill Compensation	Panels	Layers	Drill Compensation	Panels	Layers
All	Short	Long	All	Rel Square	
Common	-74	-210	Common	1.000000	
L02	-138	-288	L02	1.000000	
L03	-100	-298	L03	1.000000	
L04	-3	-185	L04	1.000000	
L05	-3	-185	L05	1.000000	
L06	-38	-168	L06	1.000000	
L07	-38	-168	L07	1.000000	
L08	-35	-185	L08	1.000000	
L09	-35	-185	L09	1.000000	
L10	-133	-198	L10	1.000000	
L11	-218	-243	L11	1.000000	

The **Layers** tab allows the user to toggle layer data on or off in the centre pane display by clicking the individual layer buttons or the All button.

Note: Toggling layers on and off in this way does not affect which data is used for drill compensation. See [Drill Optimisation Filter](#) for details of this.

Depending on the display in the centre pane, a longside the buttons are one or two columns showing measurement data for each layer.

If the centre pane is Multilayer or Panel Reg view, two columns will be displayed showing the scale errors for each layer in the short and long axes.

If the centre pane is the Squareness view, a single column of data will display the relative squareness of each layer.

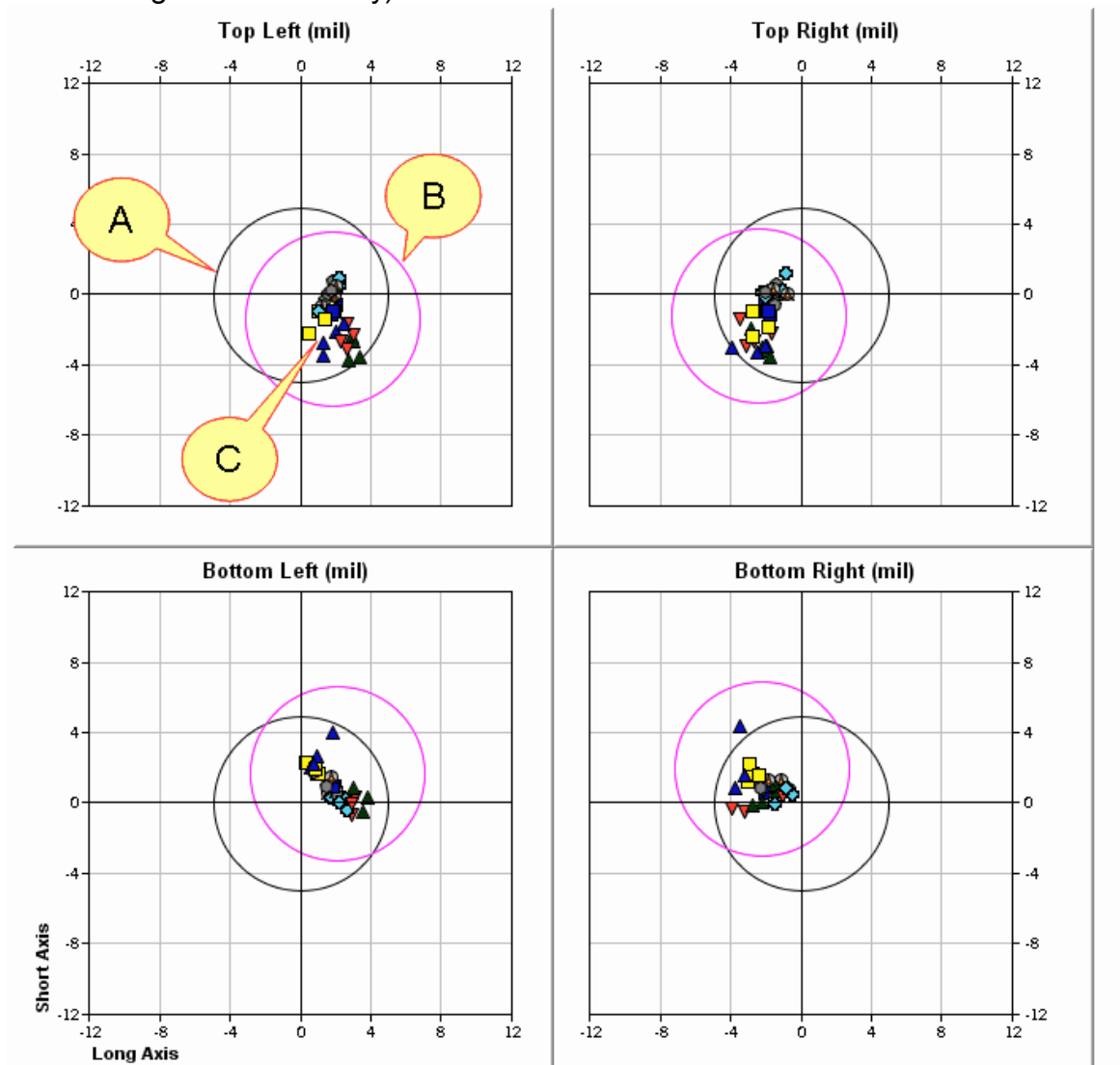
6.3 6.3: Multilayer View

The Multilayer View (Scatter Plot) is the default view of measurement analysis but can be accessed by pressing the **Multilayer** button on the left hand pane of the Measurement Analysis Window.

When pressed, the Multilayer analysis screen will appear in the centre pane.

The display is divided into 4 quadrants representing the top left, top right, bottom left and bottom right of the panel.

(The orientation of the panel data can be configured - by default the orientation is set with the long axis horizontally)



A - Represents the nominal location. The radius of the circle is defined by the Minimum Land and Remaining A/R requirement as follows:

$$\text{Radius} = [\text{Minimum Land}] - [\text{A/R Remaining}]$$

If the points measured are inside this circle then the product meets the required specification.

B - Represents the compensated drill location. The radius is defined the same as the nominal location.

If the points measured are inside this circle, then the product will meet specification if the displayed drill compensation is used.

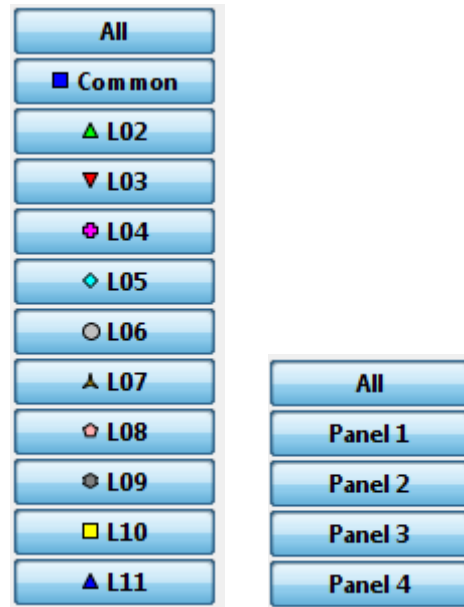
(Note: applying drill compensation may improve the pad to hole registration but can compromise the hole to hole tolerance)

C - Each symbol represents a target that has been measured.

Different symbols represent different layers - the key for which symbol represents each layer can be seen in the right hand pane on the Layers tab. Each button shows a symbol and the associated layer. Clicking the buttons will toggle the layer on or off in the display - this functionality affects all views in the centre pane.

Multiple points with the same symbol show the same layer on different panels.

In addition to the layer toggle buttons, the buttons on the Panels tab allow each panel to be toggled on or off.



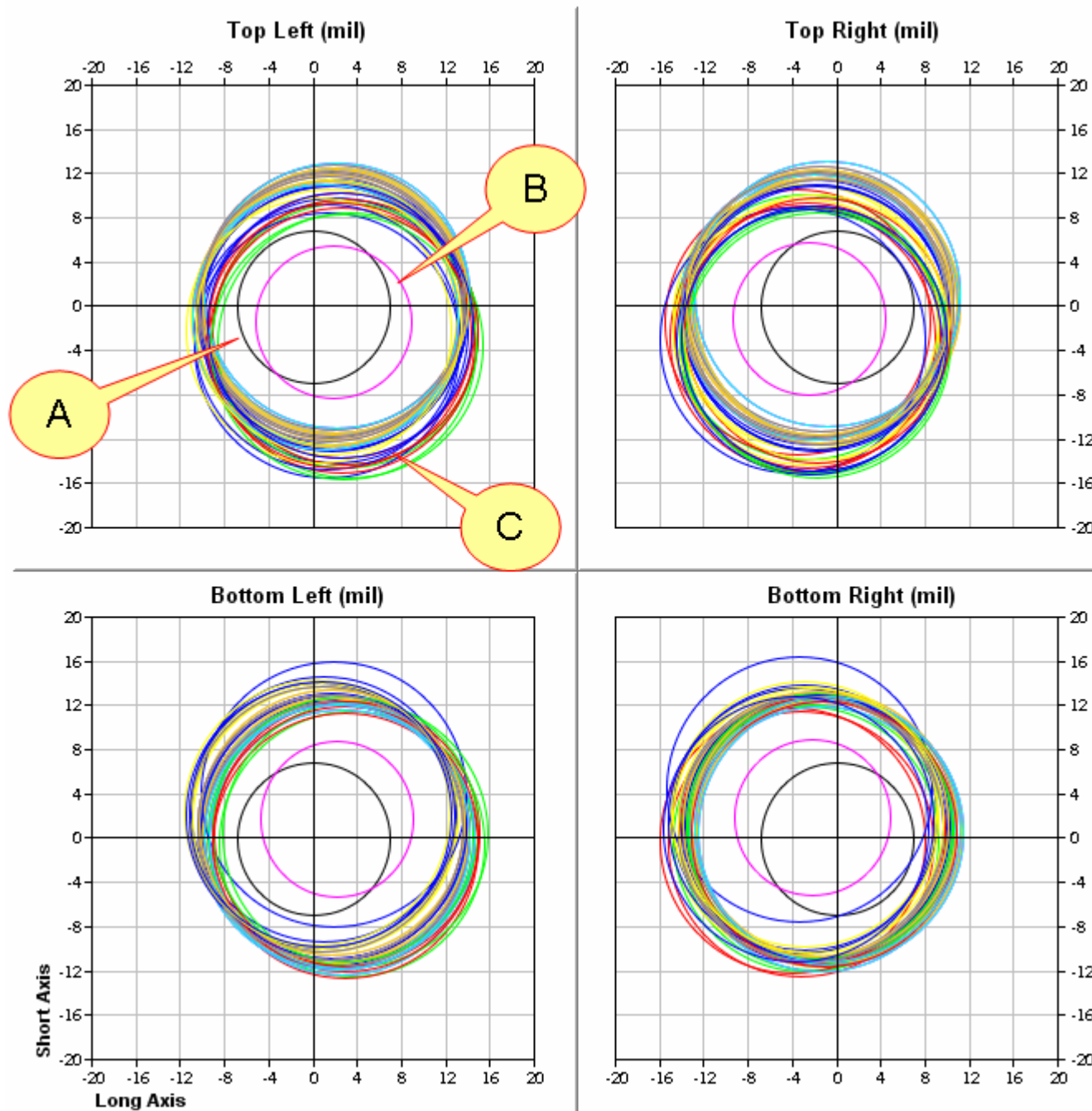
6.3.1 6.3.1: SBU Measurement Analysis

The Sequential Build Up module is a licensed option designed specifically for complex build up technologies. With this option installed, it is possible to save data against sub-component stack-up records automatically linked to the final construction. This enables the “expected” location of the sub-component layers to be shown in the measurement analysis stage.

6.4 6.4: Panel Registration View

The Panel Registration View is accessed by pressing the **Panel Reg** button on the left pane of the Measurement Analysis window.

The panel registration view is an alternative representation of the analysis information. The measured points and drill positions are both represented as circles. The difference in size between the drill circles and the measured positions is based upon the minimum land criteria. The plot effectively shows an overhead view of a stack of pads at each of the four corners of the panel and the relative position of a compensated and non-compensated (nominal) drill hole.



A: Position of non-compensated (nominal) drill hole - The size of the hole is set by the Drill Diameter field on the left pane.

B: Position of compensated drill hole - size again set by the Drill Diameter field.

C: Measured layers - the diameter is defined by the minimum land, A/R requirement and drill diameter as follows:

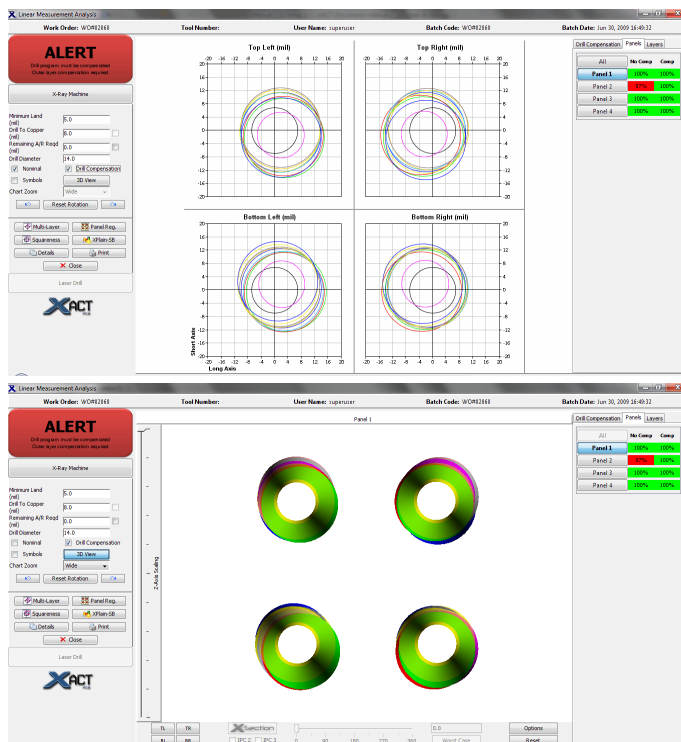
$$\text{Pad diameter} = [\text{drill diameter}] + \{ 2 \times ([\text{Minimum Land}] - [\text{A/R Requirement}]) \}$$

In this view it is possible to toggle on/off different panels and layers using the buttons in the Panels and Layers tabs on the right hand pane.

6.4.1 6.4.1: 3D Panel Registration

The 3D Panel Registration Plot is a licensed option and can be accessed from the standard **Panel Reg** view by clicking the **3D View** button on the left pane of the Measurement Analysis window.

The initial view shown will be an overhead view of the first panel - by default the drill holes will be shown in the compensated position.

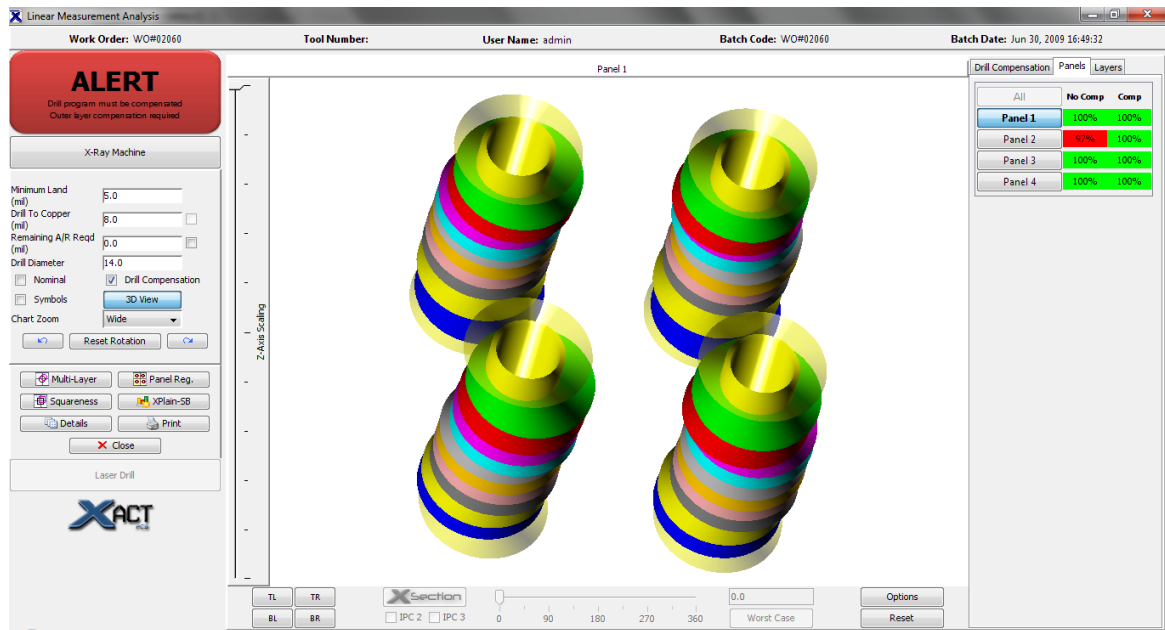


The image can be rotated by clicking the left mouse button anywhere in the centre pane and dragging the mouse with the button held down.

Zoom in and out with a mouse wheel or hold down the Alt key and left mouse button whilst moving the mouse up (zoom out) or down (zoom in)

The thickness and spacing of the layers are displayed as they are defined by the associated stack-up. (If no stack-up record is selected, default values will be used).

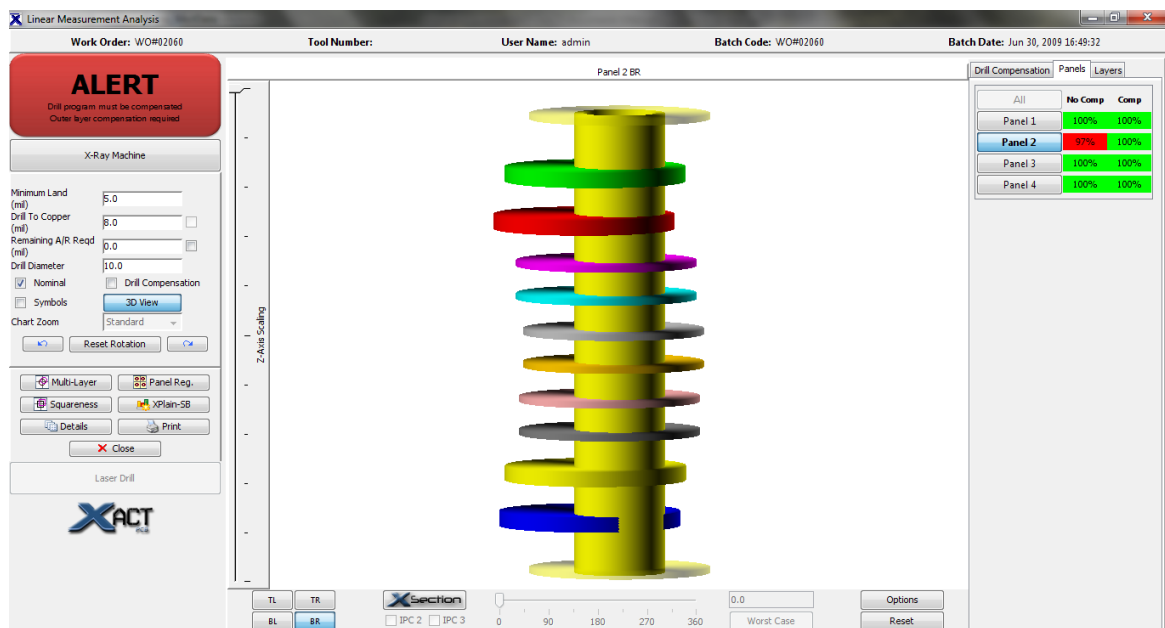
The Z axis scaling can be adjusted by the slider at the left edge of the centre pane - this will reduce the space between layers whilst maintaining the thickness of the layers.



The 3D display is interactive just like the other displays and will adjust when settings are modified in the left pane.

The panel and layer controls in the right pane allow different panels/layers to be displayed, however in the 3D view, only a single panel can be displayed at any time.

At the bottom of the window are 4 buttons allowing selection of individual corners. TL = Top Left, TR = Top Right, BL = Bottom Left, BR = Bottom Right



From this view it is then possible to access the X-section virtual cross section

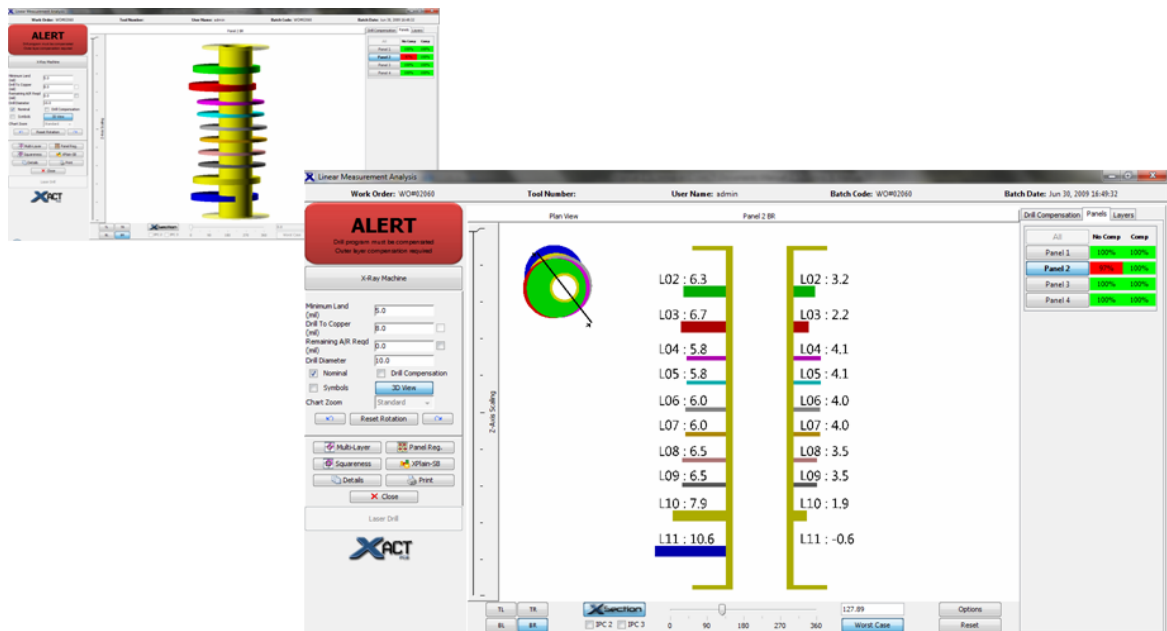
functions.

6.4.2 6.4.2: X-Section

X-Section is XACT's new module for displaying virtual cross sections based upon the measured position of inner layer pads and drill position.

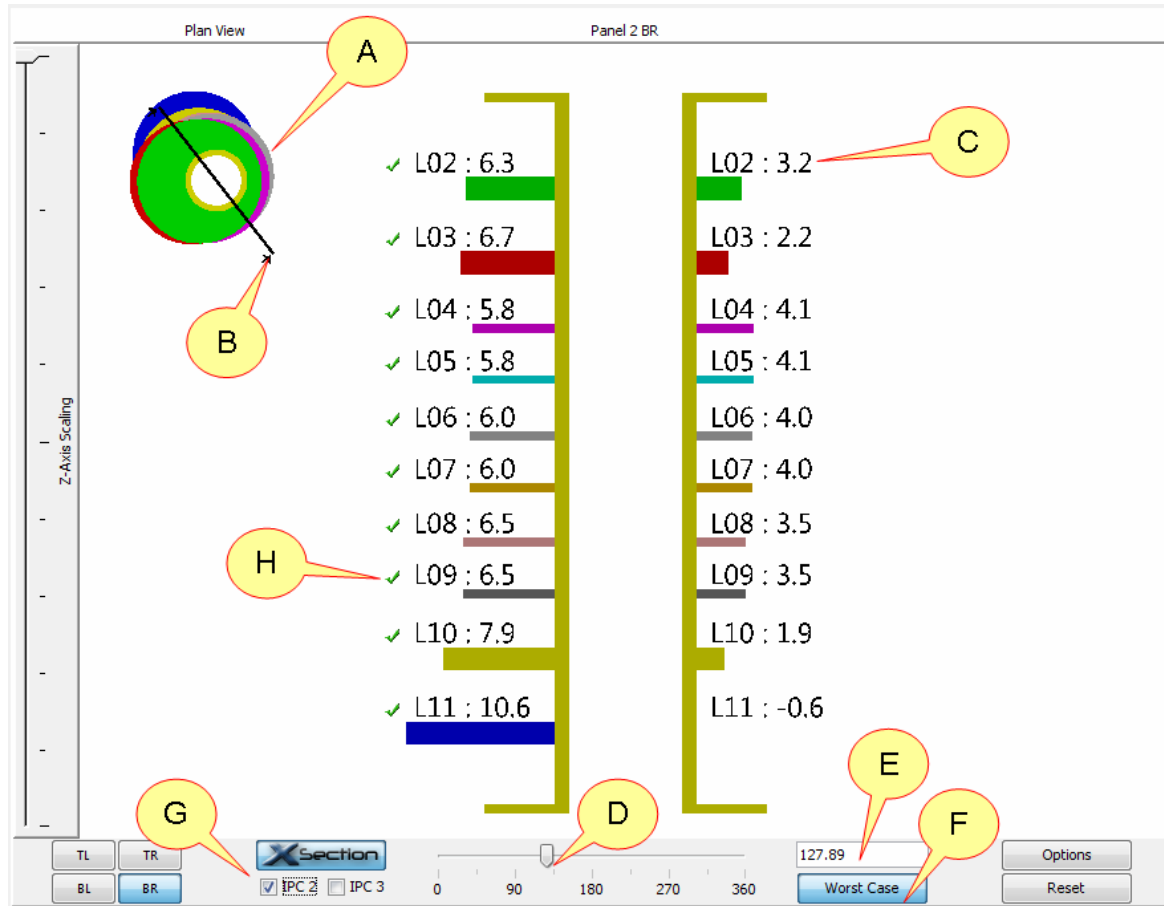
The module is a licensed option and will only be active once the license is purchased.

Access to the virtual X-Sections is via the Panel Registration view within the Measurement analysis window. Click the 3D view and select the corner of the panel that is of interest. Click the X-Section button to show the virtual X-Section.



For each panel, the display shows the remaining annular ring at either side of the drilled hole.

The Nominal/ Drill Compensation check boxes allow the display to switch between the compensated and non-compensated drill positions.



A: Plan View of pad stack and drilled hole

B: Line showing angle of section and direction of view

C: Remaining annular ring

D: Slider for adjustment of section angle

E: Current section angle - this can be edited by the user

F: Worst Case toggle - when depressed the view will automatically jump to the angle of greatest misregistration for the selected panel/corner.

If left depressed when changing corner/panel the view will jump to the worst angle for the new data.

G: IPC Class Selection - select which class to against.

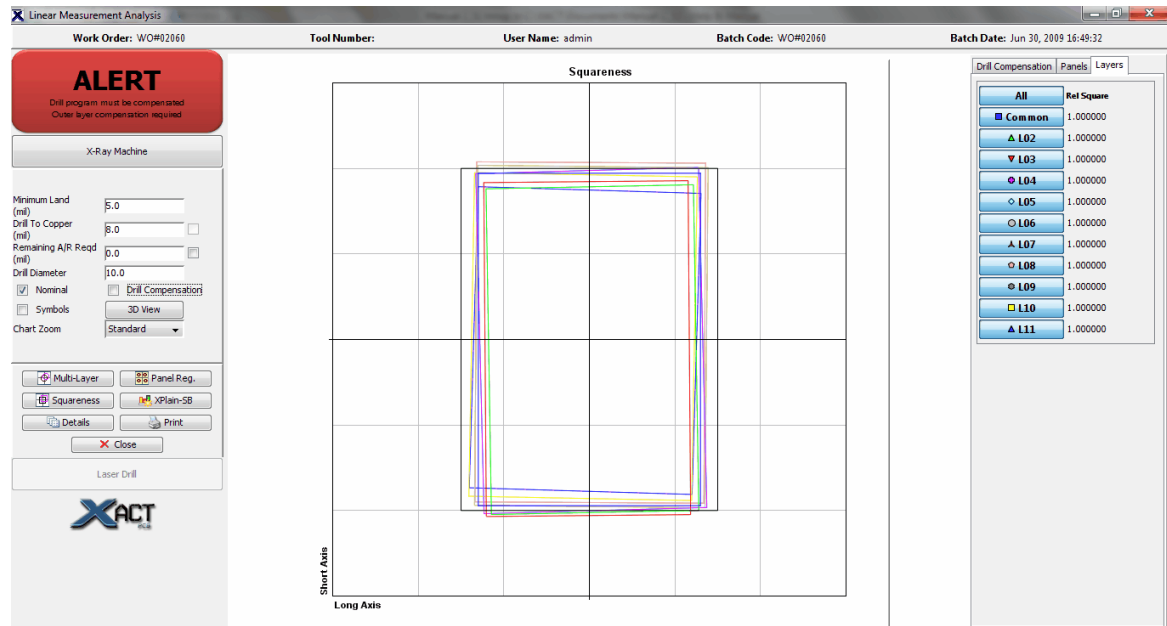
H: Check marks - display when the layer meets the requirements of the currently selected IPC class.

6.5 6.5: Squareness View

The Squareness View is accessed by pressing the **Squareness** button on the left pane of the Measurement Analysis window.

The Squareness view shows the outline of each layer formed by connecting the measured points - this view is also available in 3D when the X-section module license activated.

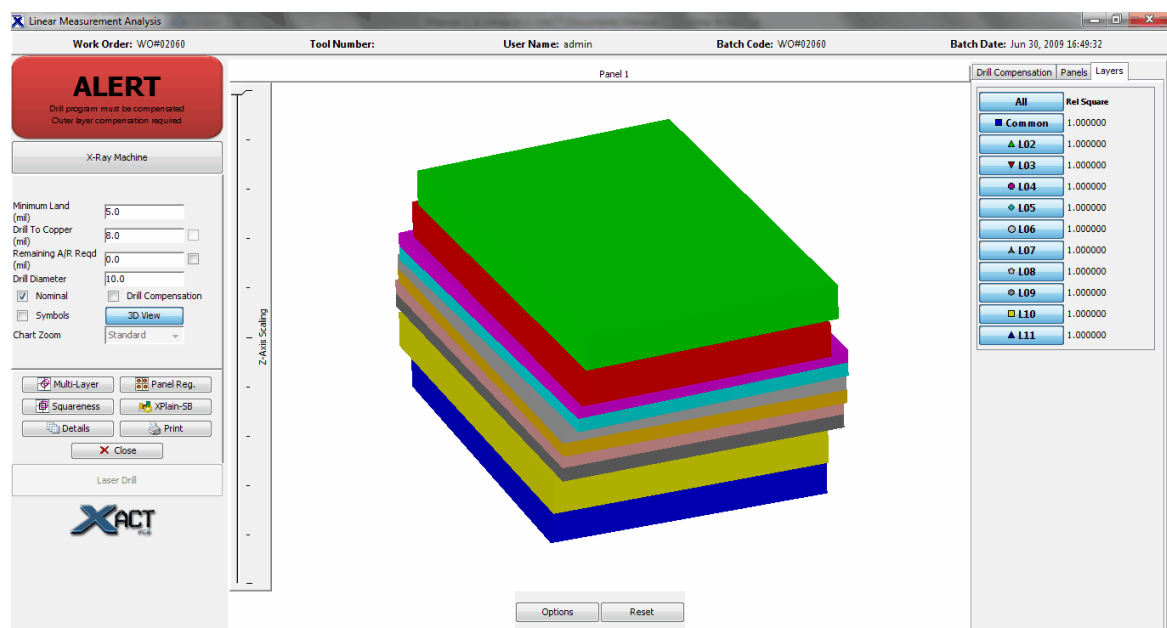
The Panel and Layer tabs allow interaction to toggle features on and off in the display - on the Layers tab, the relative squareness of each layer is shown (1.000 = Square i.e. no non-linearity).



6.5.1 6.5.1: 3D Squareness

The **3D Squareness View** is accessed by pressing the 3D View button when the squareness view is displayed in the centre pane of the Measurement Analysis window.

The 3D view is only available when the X-Section license is active.



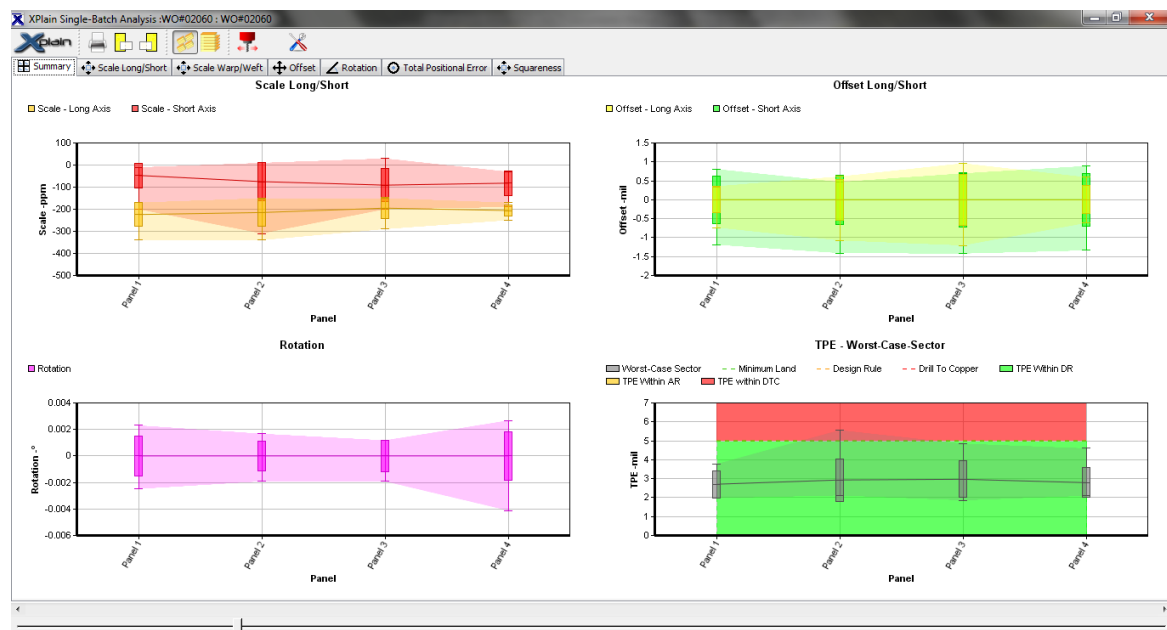
6.6 6.6: Xplain Single Batch Analysis

The Xplain module is a licensed option but the Xplain single batch option is available from the measurement analysis window.

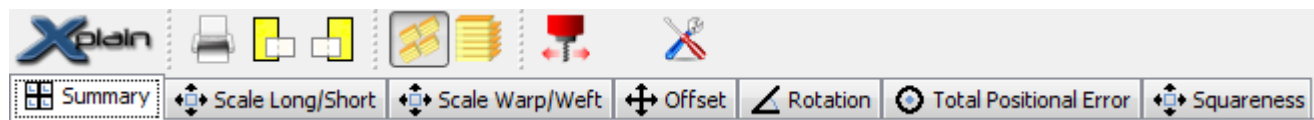
The summary tab shows charts for the following:

- Scale Errors (Long & Short Axes)
- Offset Errors (Long & Short Axes)
- Rotation Errors
- TPE - Worst case positional error

More detail can be seen by clicking the individual tabs.



6.6.1 6.6.1: Toolbar



The tool bar is displayed at the top of the Xplain SB window above the data display tabs.



The Print Icon allows the charts in the current display to be printed.



The left and right pane icons will move the Xplain window to fill the left or right half of the screen.



The panels icon switches the display to show the data aggregated by panel.



The layers icon switches the display to show the data aggregated by layer.



The drill compensation icon toggles the drill compensation data on or off the display. In the scale, offset and rotation error charts this data is shown as a dashed line. In the TPE charts, the data displayed is adjusted to show the positional error after applying the drill compensation.

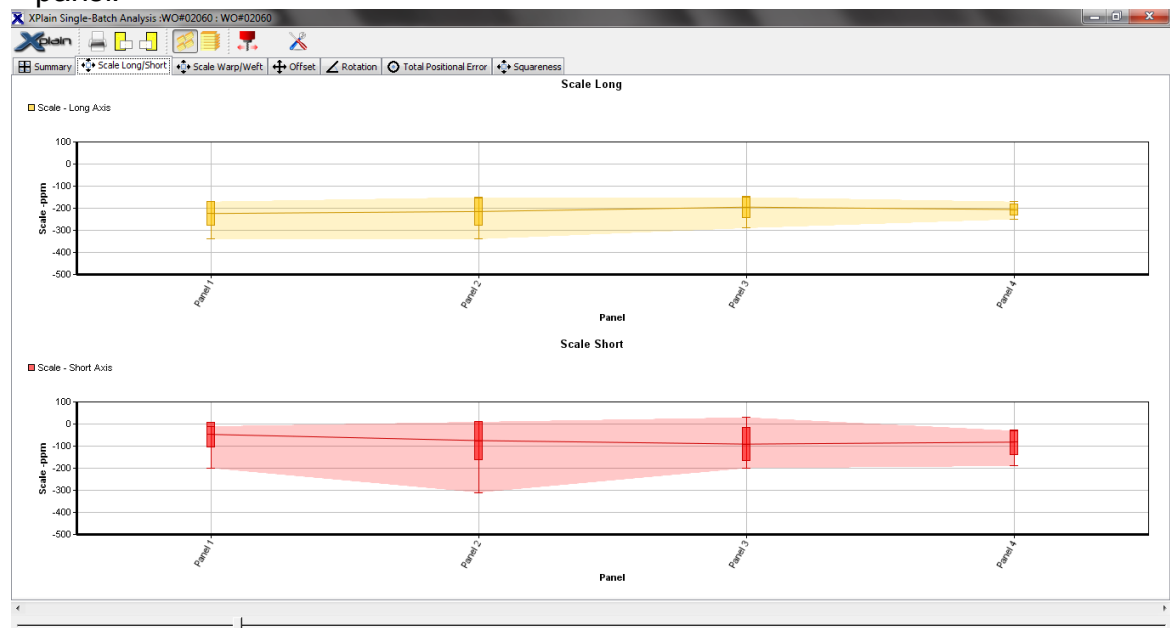


The settings icon allows access to a separate GUI that changes the details displayed on the charts.

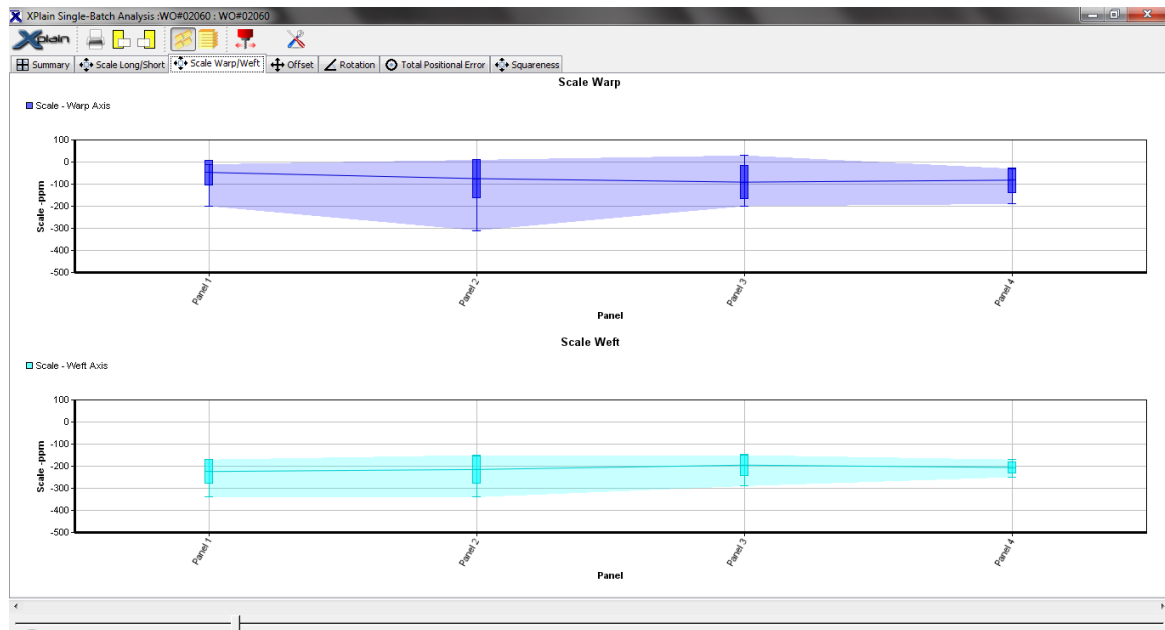
6.6.2 6.6.2: Scale Errors

There are two tabs for displaying the scale errors.

- **Scale Long/Short** displays the errors relative to the physical dimensions of the panel.

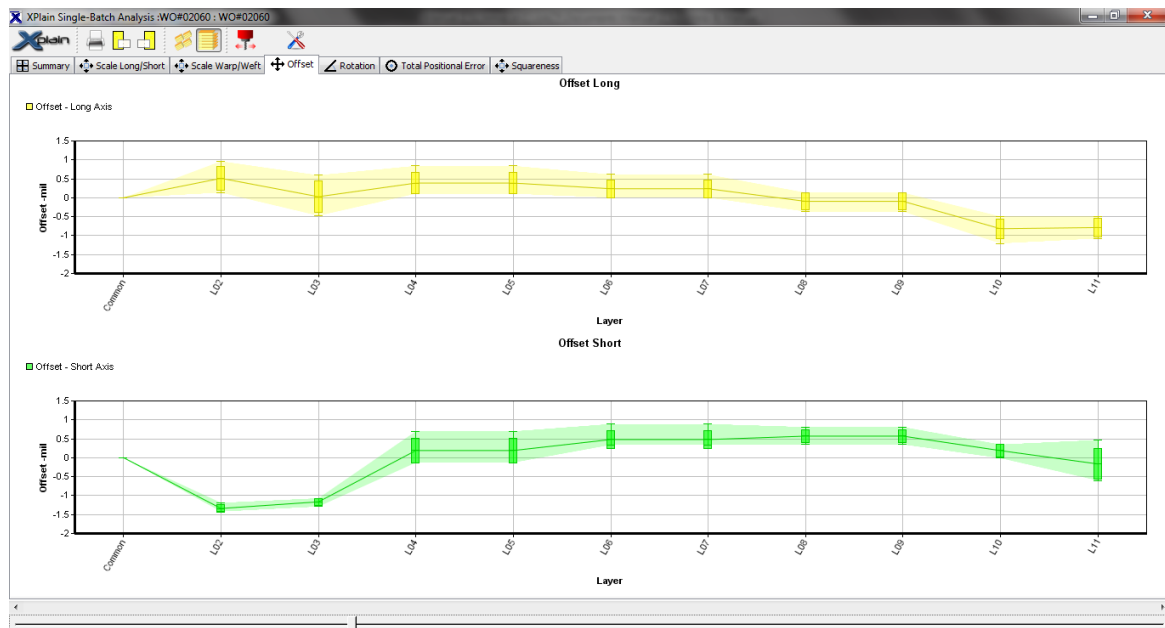


- **Scale Warp/Weft** displays the errors relative to the weave (warp/grain direction) of the materials used to manufacture the panel. This tab is only available if a stack-up is associated with the measurement data.



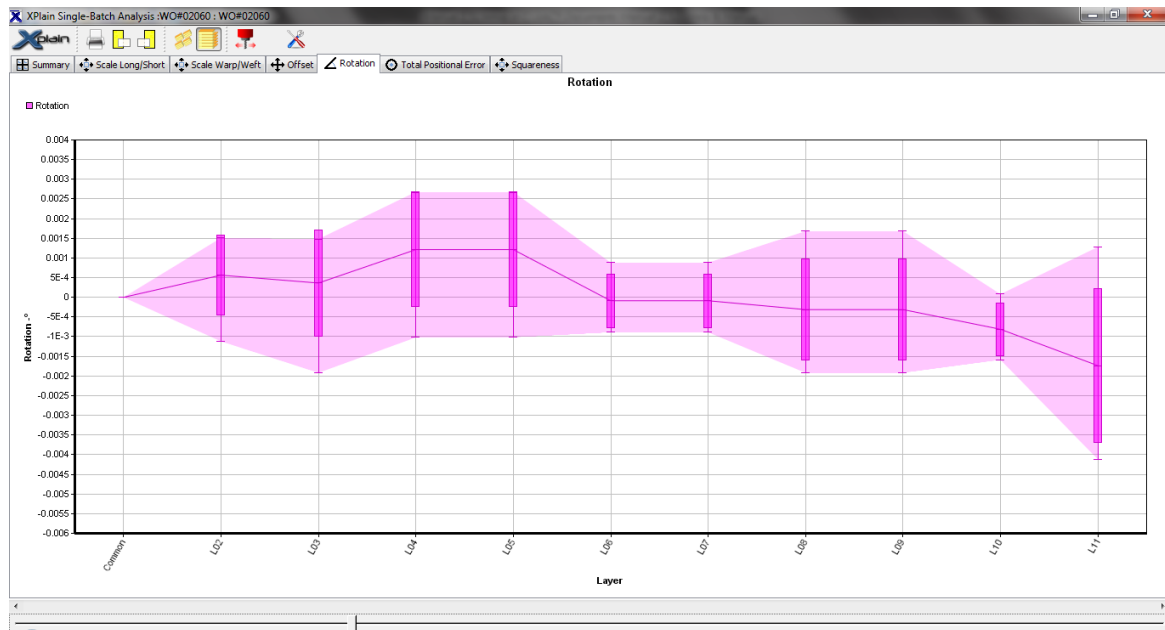
6.6.3 6.6.3: Offset Errors

The Offset errors are displayed relative to the panel dimensions. e.g. An error shown on the long axis indicates a shift parallel to the long axis of the measured panel.



6.6.4 6.6.4: Rotation Errors

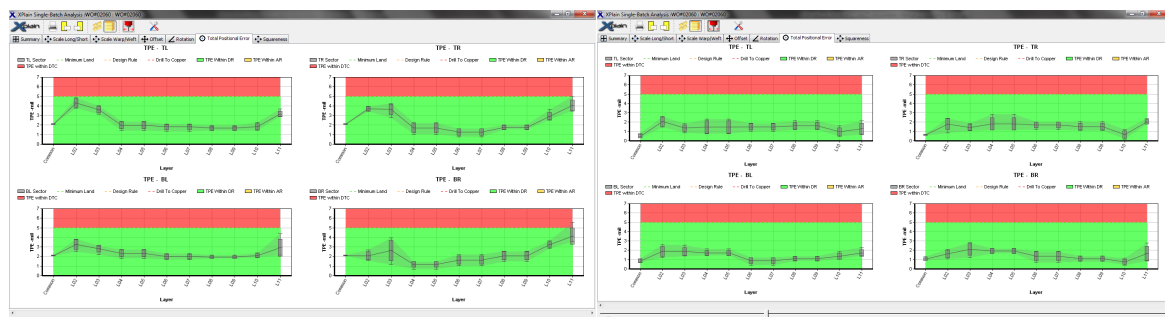
The Rotation errors are displayed in a single chart where a positive rotation indicates a rotation in the anticlockwise direction and a negative rotation indicates a rotation in the clockwise direction.



6.6.5 6.6.5: Total Positional Error

The Total Positional Errors are displayed in a separate charts for each corner of the panels measured i.e. top left/top right/bottom left/bottom right.

Clicking the drill compensation icon in the tool bar changes the graphs to show the positional errors with or without drill compensation.



TPE Charts Without Drill Compensation

TPE Charts With Drill Compensation

The green area displayed on the charts represents the design rule tolerance on the measured product calculated as:

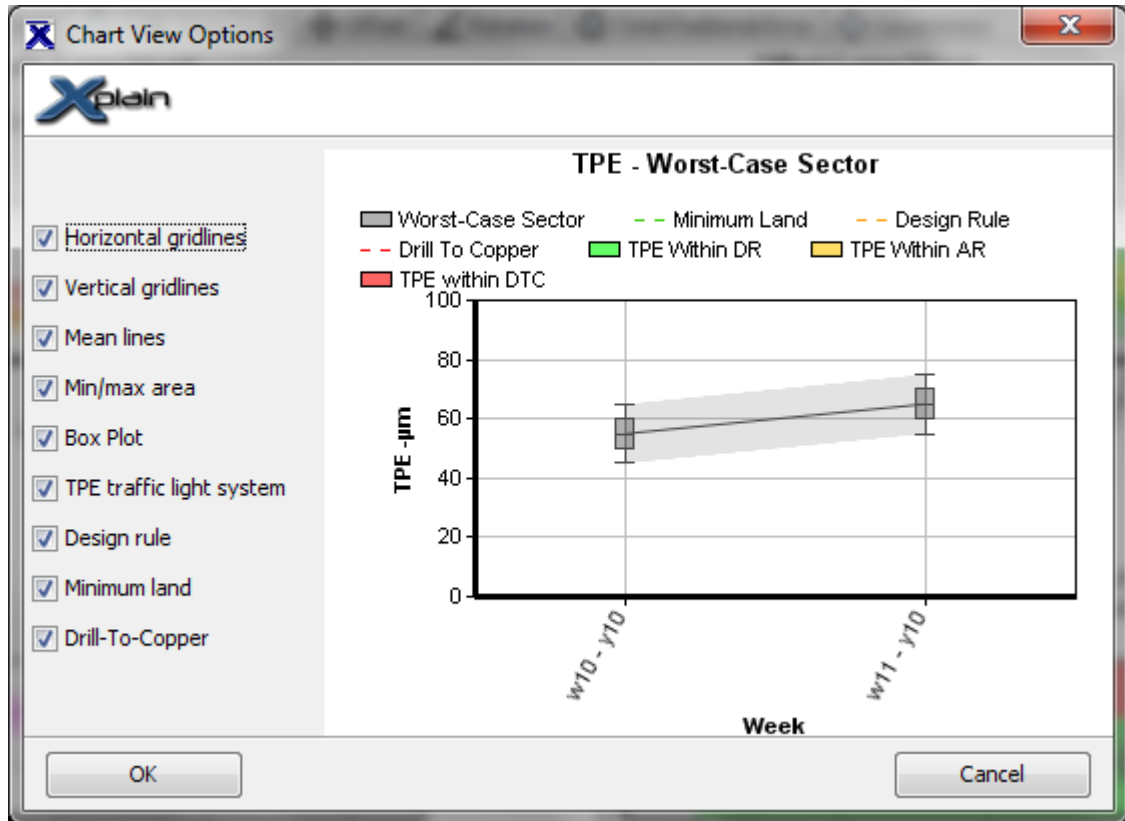
[minimum land] - [A/R requirement]

Any remaining annular ring requirement specified is displayed as an amber area above the green area. Any measured points in this amber area do not meet the annular ring requirements, but do not break out of the pad.

The red area represents the distance from the edge of the pad to the closest copper feature. Any measured point in the red area will have breakout. Any measured point above the red area will short circuit to an adjacent copper feature.

6.6.6 6.6.6: Settings

The settings dialogue is activated by clicking the settings icon in the Xplain toolbar.



In addition to this settings dialogue, it is possible to modify the Y axis scales on the charts by double clicking on the axis. This will bring up a dialogue allowing the scales to be manually configured.

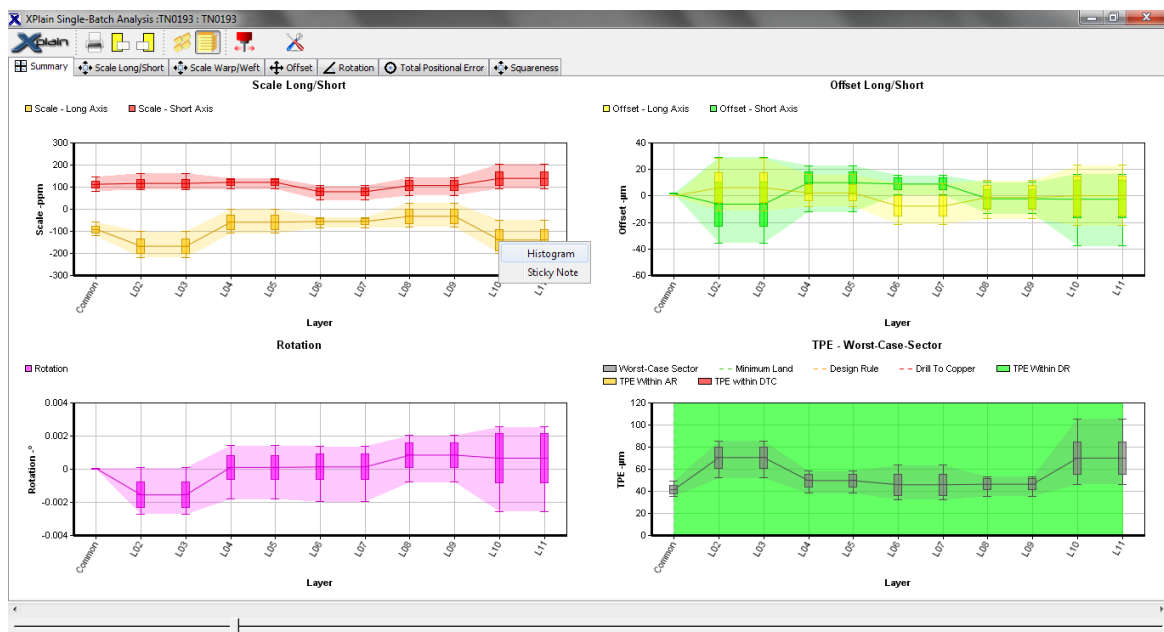
The 'Set Y-Axis' dialog box allows manual configuration of the Y-axis. It contains four sections: 'Y-Axis Scale' (Min: -450, Max: 80), 'Y-Axis Offset' (Min: -45, Max: 35), 'Y-Axis Rotation' (Min: -0.006, Max: 0.004), and 'Y-Axis TPE' (Min: 0, Max: 200). Each section has an 'Auto Scale Y-Axis' checkbox. The 'OK' and 'Cancel' buttons are at the bottom.

The check boxes down the left side allow the user to select which data is displayed in the charts - the example chart on the right side will update as these are selected.

When finished click the OK button to save the changes.

6.6.7 6.6.7: Histograms

Right clicking on any of the data points in the charts will bring up a small dialogue allowing the user to select a histogram of the aggregated data. Click the Histogram option to display the data.



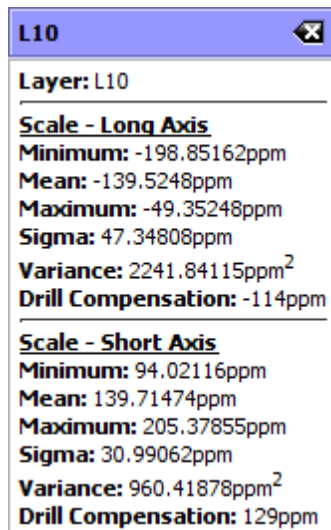
Where the graph shows data for two axes (as in the summary charts), two histograms will be shown, one for each axis.



6.6.8 6.6.8: Sticky Notes

Right clicking on any of the data points in the charts will bring up a small dialogue allowing the user to select a summary of the aggregated data displayed as a "Sticky Note".

Click the Sticky Note option to display the data.



7 7: Linking Measurement Data to Stackups

The key process steps to using the Gemini-X software are:

- (1) "Predict" – use the XACT stackup module to import/build/define a stackup get scale factors
- (2) "Build the board" - using the scale factors predicted
- (3) "Measurement Analysis" – use an X Ray Drill or similar to determine how the layers have scaled in manufacture
- (4) **"Store" or "Link" – this locks the actual measurement (3) to the actual stackup (1) – lot by lot if necessary.**
- (5) **"Optimise" – Use the intelligent optimiser engine in Gemini-X to figure out what material and process factors have the influence on scale factor.**

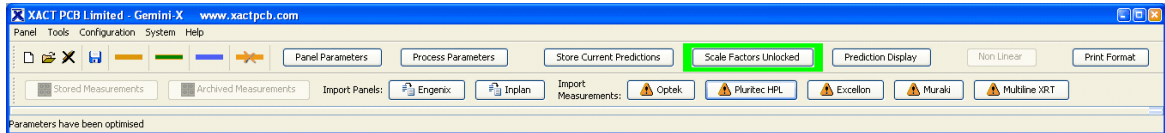
This section covers stages 4-5.

This step is the key step in getting data into the intelligent self-learning model. It is here that we link the defined stackup with the measurement results for that stackup.

The process steps are as follows:

- (1) Open the Panel (part number) for which you have measurement data available.
- (2) Ensure that all necessary data is entered about the panel
e.g. panel size, design annular ring, drill to copper, etc

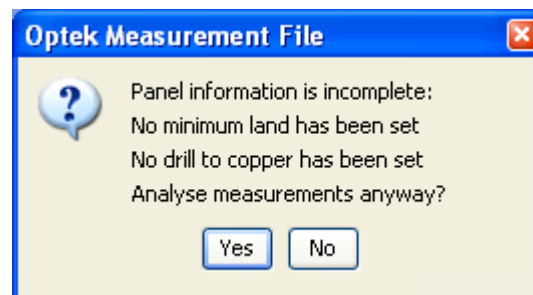
Note that the Gemini-X software will provide a visual indicator when the system is missing necessary information about a stackup. This is shown below:



The Measurement Analysis buttons will show a small yellow alert symbol.

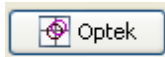


Clicking on the alert button will display a dialogue telling the user which data is missing:

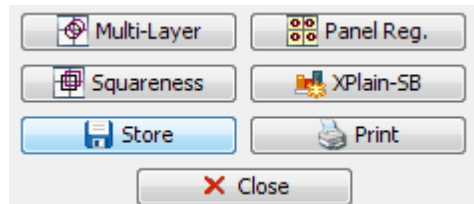


The user will be given the choice to analyse the data anyway but the data will not be able to be linked to the stackup until all data is in place.

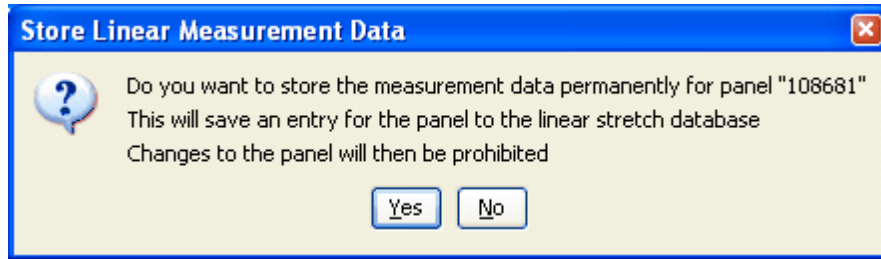
Once all essential stackup data is in place the symbol changes to...



- (3) Select Measurement Analysis as described in the previous section.
- (4) Run through all the MA module's reactive analysis *as needed* (drill scale etc)
- (5) At the point that we choose to return to the MA console, the user will be able to click on the **Store** button as shown below:



- (6) When the module closes, a message box will ask if the results should be saved to the linear library. This will allow the results to be used for parameter optimisation.



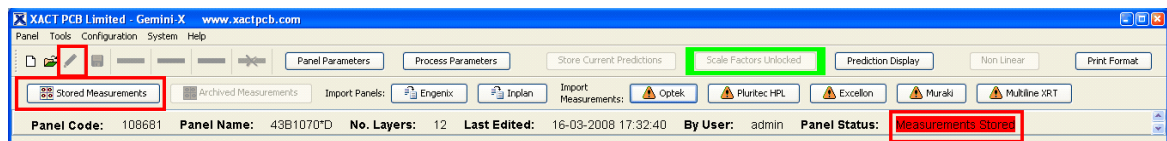
(7) Click the Yes button only if the stored compensations saved in the database were used to manufacture this product.

7.1 7.1: Locks

Gemini-X uses a secure lock to control if and when existing Panels Stack-Ups are allowed to be edited.

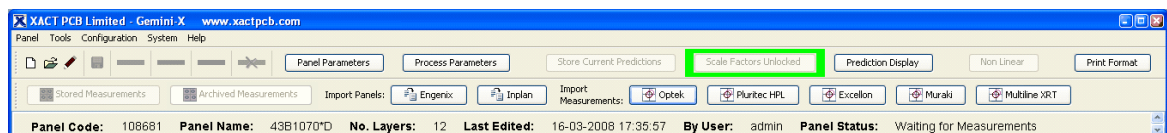
A Stack-Up will no longer be allowed to be edited once a batch measurement has been associated with the Stack-Up (through the Measurement Analysis functions).

In this case the software shows the **Measurements Stored** flag at the top of the screen, the edit record button will be disabled and the Stored Measurement button will be active.



You will also note that the MA “Import Measurements” buttons will show an alert symbol – this indicates that we cannot save data against the same part again – unless we use archive data functions.

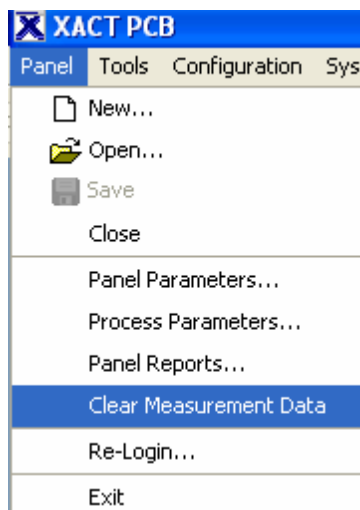
When Measurement Analysis has locked the Stack-Up in question it can be viewed but not edited. This is to ensure that measurements are fixed to the associated material types.



In the example above, measurements are not yet stored and the panel may still be edited.

7.2 7.2: Clear Measurement Data

In the rare event that a linked measurement file is known to be incorrect and the panel is required to be associated with a new measurement then there is an option to remove the measurement file from the panel code – this is accessed by the menu option shown below.

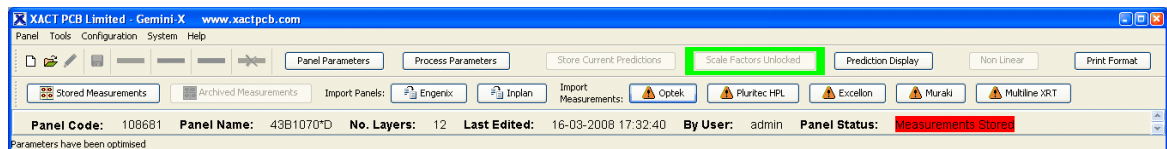


7.3 7.3: Archived Measurements

If the primary identifier for a stackup relates to a part at the product level (e.g. Part Number/Catalogue Number) and not a batch or lot level, it is likely that there will be multiple lots of this part made – and that each lot may have measurements from an X Ray optimiser or equivalent.

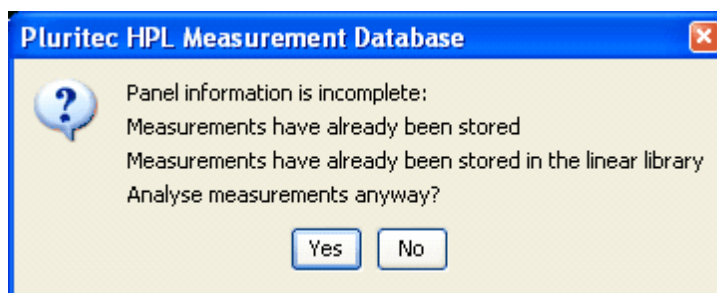
The method employed by Gemini-X to store multiple lot measurements is “Archived Data”

It is important to note that the FIRST set of measurement data linked to a stackup will be the stored as shown and this will be used by the prediction engine and for remake scale factors.



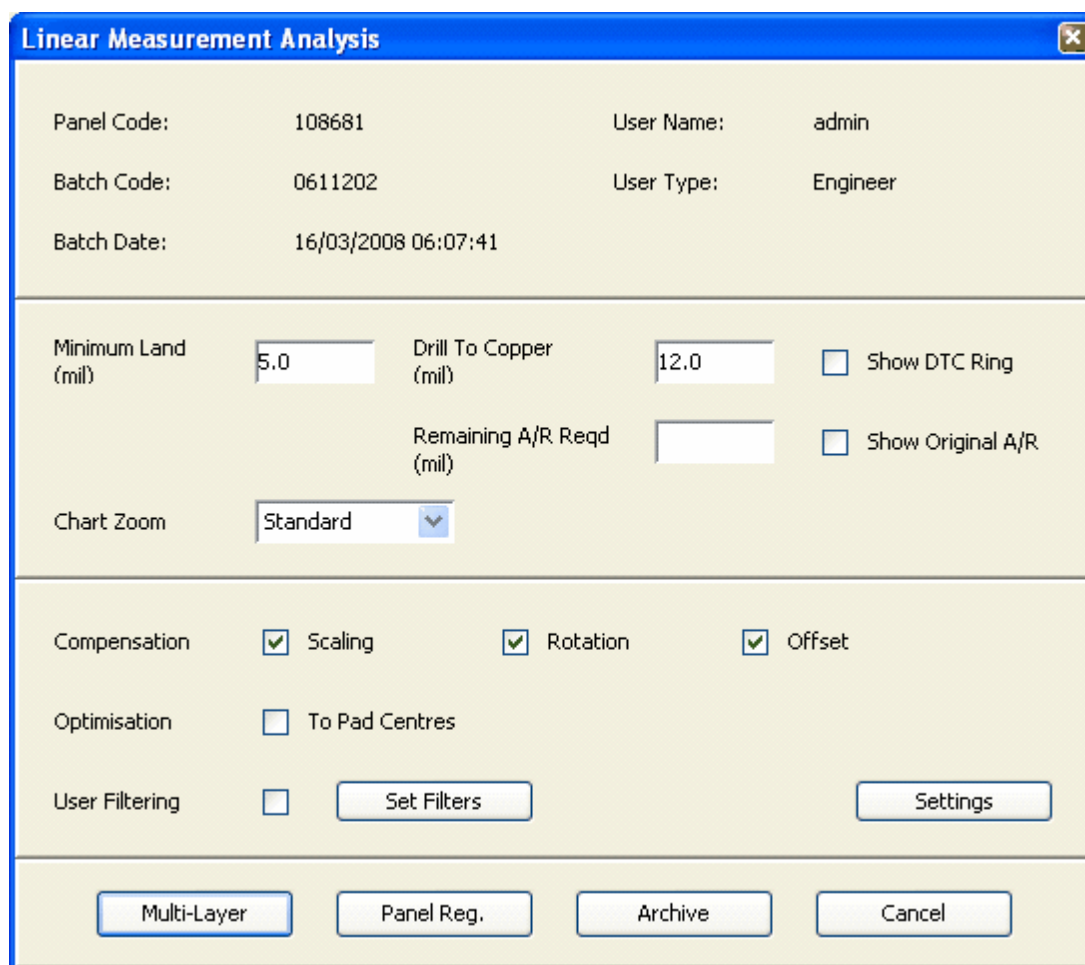
However, other lots of the same part can be measured and stored against this part number by repeating the Measurement Analysis process.

Note that the alert dialog will show a warning indicating that there are already measurements stored against this stack-up.



On the Measurement Analysis Console, there will no longer be a **Store** button - this

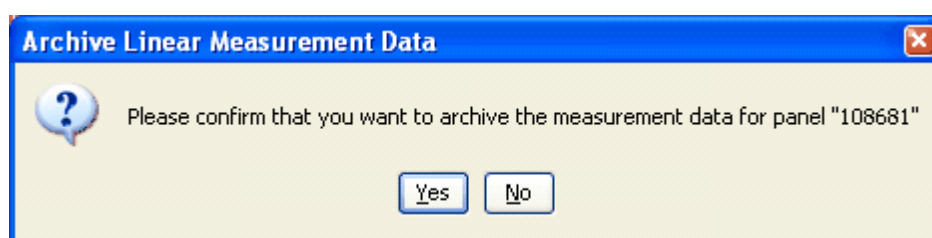
will be replaced with a button labelled **Archive** as shown below.



The 'Linear Measurement Analysis' dialog box contains the following fields and controls:

- Panel Code:** 108681
- User Name:** admin
- Batch Code:** 0611202
- User Type:** Engineer
- Batch Date:** 16/03/2008 06:07:41
- Minimum Land (mil):** 5.0
- Drill To Copper (mil):** 12.0
- ☐ Show DTC Ring
- Remaining A/R Req'd (mil):** [empty field]
- ☐ Show Original A/R
- Chart Zoom:** Standard (dropdown menu)
- Compensation:** ☒ Scaling, ☒ Rotation, ☒ Offset
- Optimisation:** ☐ To Pad Centres
- User Filtering:** ☐ [Set Filters button]
- [Settings button]
- [Multi-Layer button]
- [Panel Reg. button]
- [Archive button]
- [Cancel button]

Click on Archive and the following dialog will be displayed-

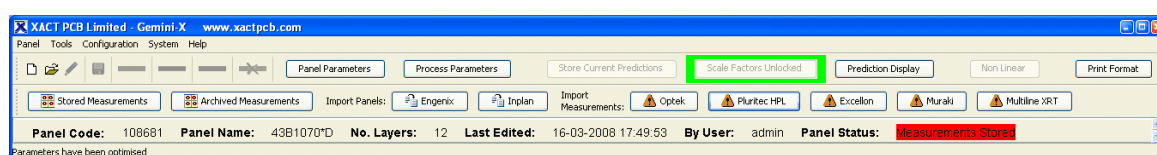


The 'Archive Linear Measurement Data' dialog box displays a confirmation message:

Please confirm that you want to archive the measurement data for panel "108681"

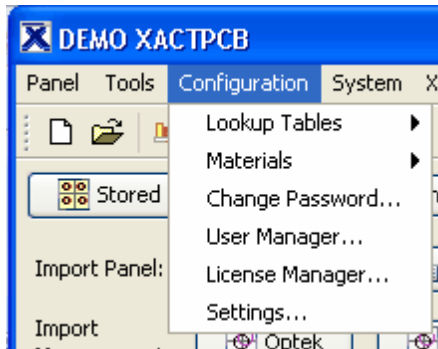
Buttons: Yes, No

Once a lot has been added in this way, the Archived Measurements button will become active on the main toolbar.



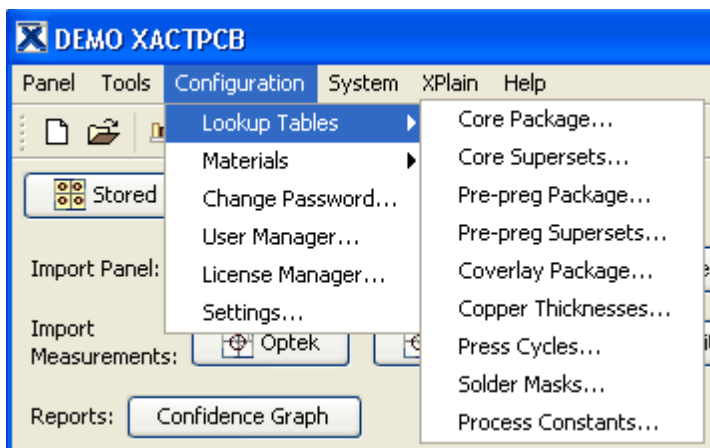
8 8: Configuration Menus

The CONFIGURATION menu is where the user can edit and add new material types to the database (through the Lookup Table submenu), change the user passwords, access the user and licence manager features, and set measurement units.



8.1 8.1: Lookup Tables

The lookup tables can be modified via the *Configuration* option on the main tool bar.



Select the required lookup table from the list to begin modification or to add new details

8.1.1 8.1.1: Core Lookup Tables

The screenshot shows the 'Core Package Editor' window. It is divided into several sections. At the top, there are two tables: 'Supplier Name' and 'Resin System'. The 'Supplier Name' table lists 'Isola', 'Kingboard', 'Hisco', 'None', and 'Polyclad'. The 'Resin System' table lists 'FR406' and 'FR408'. Below these tables are input fields for 'Supplier Name' (Isola) and 'Supplier Details' (None). To the right, there are input fields for 'Resin System' (FR406) and 'Resin Density (g/cm³)' (1.2). Below these are 'New', 'Save', and 'Remove' buttons. The main section of the window contains a table with the following data:

Core Thickness (mil)	Construction	Inventory Code	Core Tolerance (mil)	Min. Thickness Post Bond (mil)	Max. Thickness Post Bond (mil)
14.000	2-7628	DT-014-HH-2421-406	1.400	12.600	15.400

Below the table are input fields for 'Core Thickness (mil)' (14.0), 'Construction' (2-7628), 'Inventory Code' (T-014-HH-2421-406), 'Core Tolerance (mil)' (1.4), 'Min. Thickness Post Bond (mil)' (12.6), and 'Max. Thickness Post Bond (mil)' (15.4). At the bottom are 'New', 'Save', 'Remove', and 'OK' buttons.

The core editor allows new suppliers and resin systems to be added to the database as well as new core type details.

To enter a new core type, select a relevant supplier from the list. The system list will update to show the systems available for that supplier. The required resin system from the lowest section of the screen will be selected. Click the **New** button to enter the thickness and construction details. Click **Save** to save the database.

To enter a new resin system, first select a supplier then click the New button in the resin system list. Enter the details and press Save.

New suppliers can be entered by clicking the new button below the supplier list. Any new suppliers and resin systems entered in this screen will also be available to use in the prepreg editor section.

8.1.2 8.1.2: Core Superset Tables

Supersets are a means of linking multiple material vendors' core and prepreg products through a common "heading". For example, a user of Gemini-X may have 5 or more material vendors, each of which sells FR4 4mil core.

Over time the XACT database will acquire a great deal of information about these vendors material. In the event that a new material vendor is added to the supply list, it will be a little time before Gemini-X has time to acquire the same level of information.

Supersets are a means of linking the collected data to the new material type to augment the data collection process.

The definition of supersets is usually done by XACT personnel at installation or upgrade.

The Core Superset editor allows the user to define the material types (Resin System Supersets) under which the core materials will be grouped. Under each resin system superset sub-groups can be defined to select the thickness of materials that should be grouped together.

Core Superset Editor

Resin System Superset	Core Superset Thickness	Minimum Core Thickness (mil)	Maximum Core Thickness (mil)
BT	Ultra Thin	1.000	1.900
FR4	Thin	2.000	4.000
High Tg FR4	Med	4.000	8.000
PTFE	Thick	8.100	20.000
Polyimide			

Resin System Superset	FR4	Core Superset Thickness	Ultra Thin	Minimum Core Thickness (mil)	1.0
		Maximum Core Thickness (mil)	1.9		

8.1.3 8.1.3: Prepreg Lookup Tables

Pre-preg Package Editor

Supplier Name	Supplier Details	Resin System	Resin Density (g/cm ³)
Isola		N4000-13	1.2
Nelco		N4000-2	1.2
Polyclad		N4000-6FC	1.2
		N4000-7	1.2
		N7000-2HT	1.2
		N7000-2VD	1.2

Supplier Name	Nelco	Supplier Details		Resin System	N4000-13	Resin Density (g/cm ³)	1.2
---------------	-------	------------------	--	--------------	----------	------------------------------------	-----

Glass Cloth	Glass Density (g/cm ²)	Glass Weight (g/m ²)	Glass Thickness (mil)	Resin Content (%)	Inventory Code	Resin Tolerance (%)	Thickness at Bond (mil)
2113	2.600	78.000	3.543	58.0	PREPRG-2113-2421-N13	1.2	5.314
2116	2.600	103.800	3.937				

Glass Cloth	2113	Glass Density (g/cm ²)	2.6	Resin Content (%)	58.0	Inventory Code	RG-2113-2421-N13
Glass Weight (g/m ²)	78.0	Glass Thickness (mil)	3.543	Resin Tolerance (%)	1.2	Thickness at Bond (mil)	5.314

The prepreg editor works much the core editor. New supplier systems can be entered here available to the core editor.

To enter a new prepreg, select supplier and resin system - available glass cloth styles will be shown. If the required glass cloth is not available, click the **New** button in the **Glass Cloth** section, enter the name and thickness, then press **Save**.

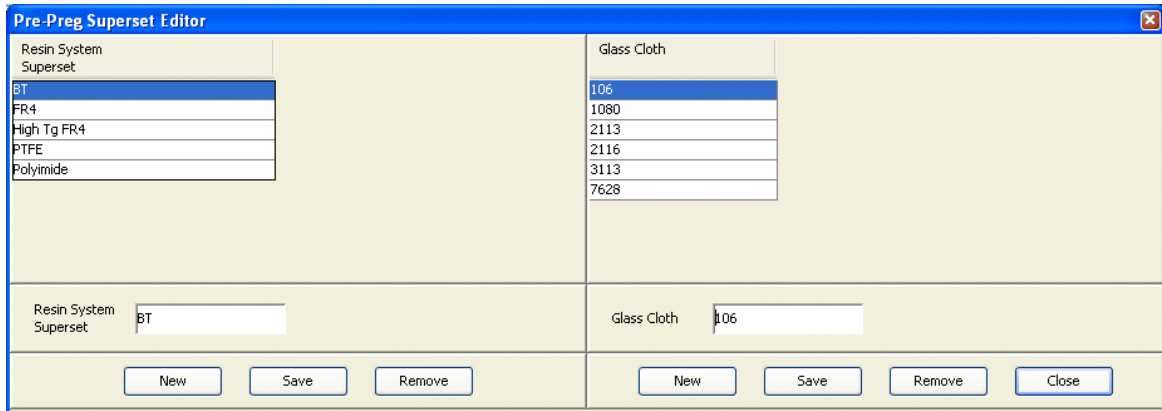
To enter a new resin content for a glass cloth, select the required resin system and glass cloth details, then click the **New** button in the **Resin Content** section. Enter the percentage resin content and thickness details then **Save**.

8.1.4 8.1.4: Prepreg Superset Tables

The Prepreg Superset editor allows the user to set up "headings" under which the prepreg materials in the data list above will sit.

In addition one can set glass families.

Definition of supersets is usually done by XACT personnel at installation or upgrade.



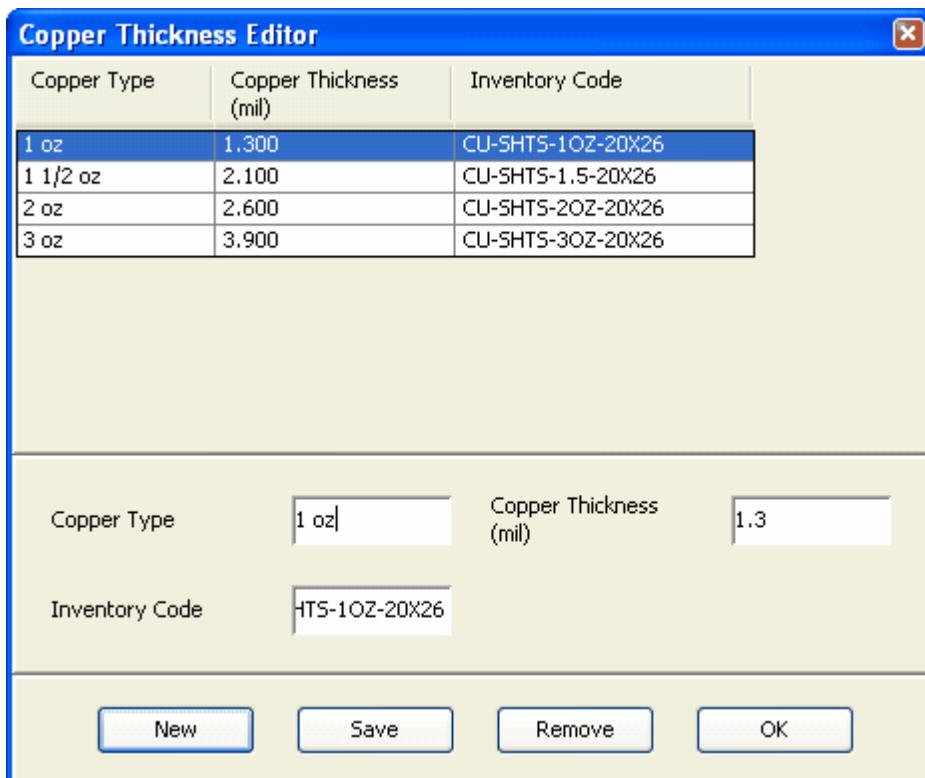
The Pre-Preg Superset Editor dialog box is divided into two main sections. The left section, titled 'Resin System Superset', contains a list box with the following items: BT, FR4, High Tg FR4, PTFE, and Polyimide. Below this list is a text input field containing 'BT'. The right section, titled 'Glass Cloth', contains a list box with the following items: 106, 1080, 2113, 2116, 3113, and 7628. Below this list is a text input field containing '106'. At the bottom of the dialog, there are two rows of buttons. The first row has 'New', 'Save', and 'Remove' buttons. The second row has 'New', 'Save', 'Remove', and 'Close' buttons.

8.1.5 8.1.5: Copper Thickness

The copper thickness editor allows the user to enter the available copper thickness for use in the copper foil and core layer sections of the stack-up module.

In this menu we assign a “characteristic name” such as “Half Ounce”, “18 Micron”, or “0.6mil” to the actual thickness of 18 μ m (0.006”). It is the real thickness that is important for the prediction engine, not the characteristic.

Add new details using the New and Save buttons as for the other editors.



The Copper Thickness Editor dialog box features a table with three columns: Copper Type, Copper Thickness (mil), and Inventory Code. The table contains the following data:

Copper Type	Copper Thickness (mil)	Inventory Code
1 oz	1.300	CU-SHT5-1OZ-20X26
1 1/2 oz	2.100	CU-SHT5-1.5-20X26
2 oz	2.600	CU-SHT5-2OZ-20X26
3 oz	3.900	CU-SHT5-3OZ-20X26

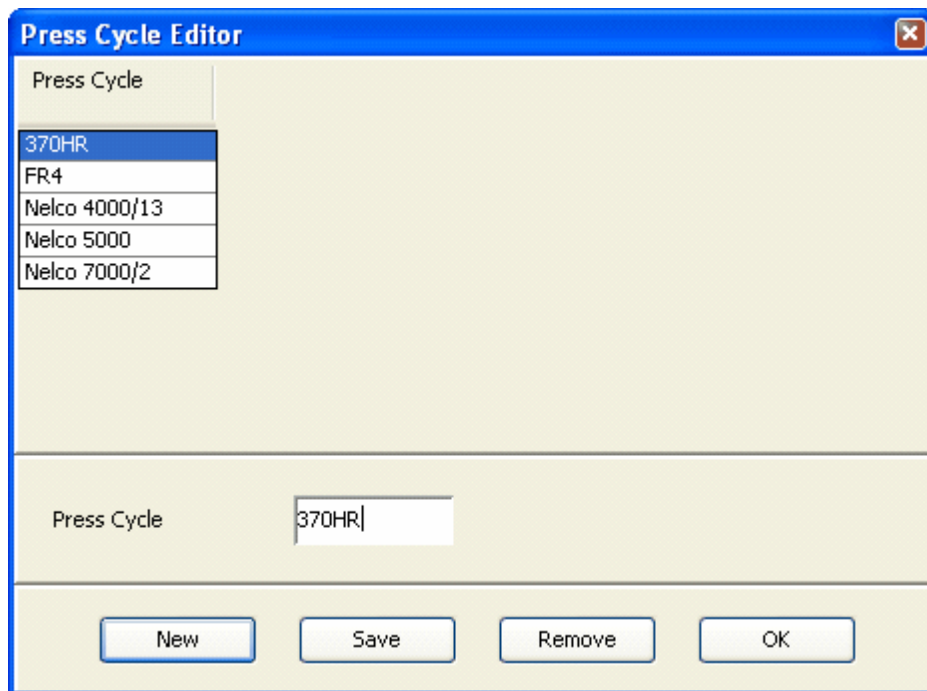
Below the table, there are three input fields: 'Copper Type' with the value '1 oz', 'Copper Thickness (mil)' with the value '1.3', and 'Inventory Code' with the value 'HTS-1OZ-20X26'. At the bottom of the dialog, there are four buttons: 'New', 'Save', 'Remove', and 'OK'.

8.1.6 8.1.6: Press Cycles

The press cycle editor allows the press cycle names to be added to the list for use in the stack-up module.

For clarity it is recommended that press cycles are given both a meaningful name to

identify them - if the press system simply uses a numerical name, include the number with a description. E.g. "7 - Standard FR4"

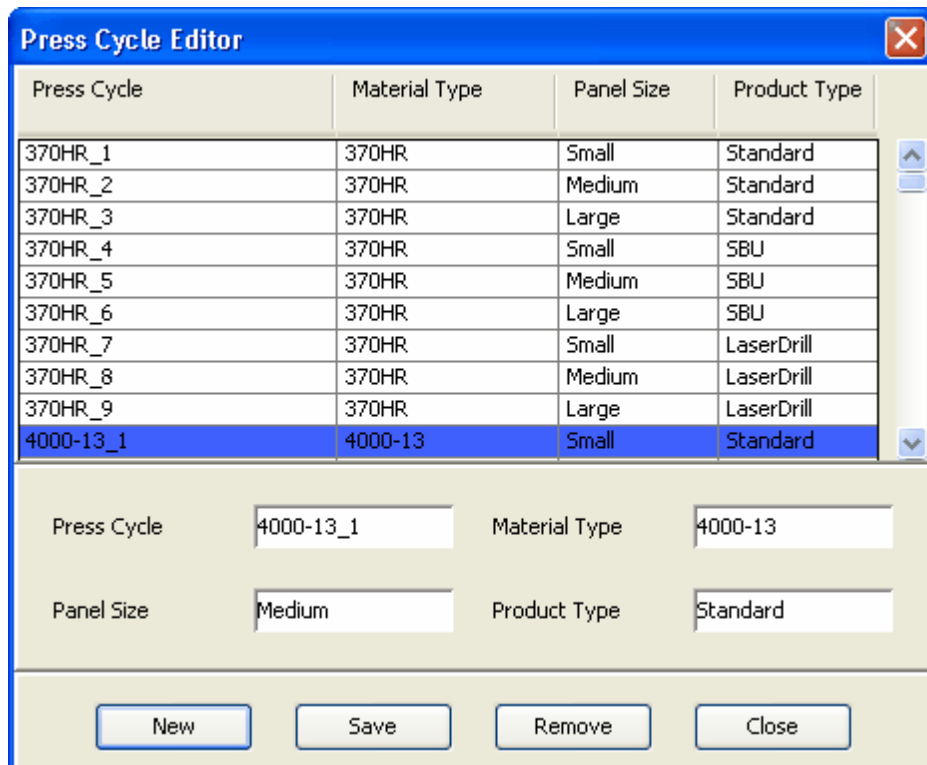


8.1.6.1 Extended Press Cycles

Where it is possible to have variations on a press cycle, for example due to the panel size or the product type it is possible to create extended press cycles which will allow the user to select a number of parameters to define the press cycle.

The names of the parameters can be configured in the press cycle configuration file "XactPressCycle.properties" - in the example below, the options are called "Material Type", "Panel Size" and "Product Type".

To define an extended press cycle, enter a unique name in the Press Cycle field and then enter the details to appear in each of the other fields.



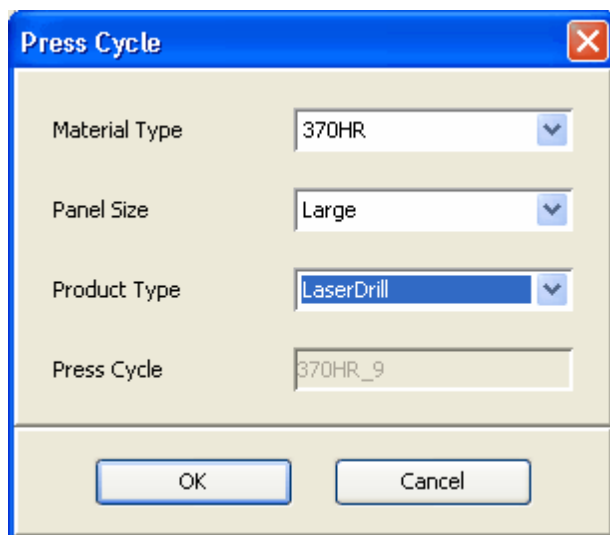
The Press Cycle Editor dialog box features a table with four columns: Press Cycle, Material Type, Panel Size, and Product Type. The table contains ten rows of data. The row with Press Cycle '4000-13_1' is selected. Below the table, there are four input fields corresponding to the columns: Press Cycle (4000-13_1), Material Type (4000-13), Panel Size (Medium), and Product Type (Standard). At the bottom, there are four buttons: New, Save, Remove, and Close.

Press Cycle	Material Type	Panel Size	Product Type
370HR_1	370HR	Small	Standard
370HR_2	370HR	Medium	Standard
370HR_3	370HR	Large	Standard
370HR_4	370HR	Small	SBU
370HR_5	370HR	Medium	SBU
370HR_6	370HR	Large	SBU
370HR_7	370HR	Small	LaserDrill
370HR_8	370HR	Medium	LaserDrill
370HR_9	370HR	Large	LaserDrill
4000-13_1	4000-13	Small	Standard

Press Cycle: 4000-13_1 Material Type: 4000-13
 Panel Size: Medium Product Type: Standard

New Save Remove Close

When extended press cycles are used, the stackup process parameters page dialogue will give access to a separate press cycle definition dialogue for each bond sequence.



The Press Cycle dialog box contains four dropdown menus: Material Type (370HR), Panel Size (Large), Product Type (LaserDrill), and Press Cycle (370HR_9). At the bottom, there are two buttons: OK and Cancel.

Material Type: 370HR
 Panel Size: Large
 Product Type: LaserDrill
 Press Cycle: 370HR_9

OK Cancel

8.1.7 8.1.7: Solder Masks

The solder mask editor allows standard solder mask specifications to be added for use in the stack-up module process parameters.

Each entry is given a characteristic name and a thickness. This thickness value only will be used in the calculations of final board thickness shown in the stack-up module.

Solder Mask Editor

Mask Name	Mask Thickness (mil)
Gloss	0.79
HFX	0.80
Matte	0.80
NoMask	0.00

Mask Name: Mask Thickness (mil):

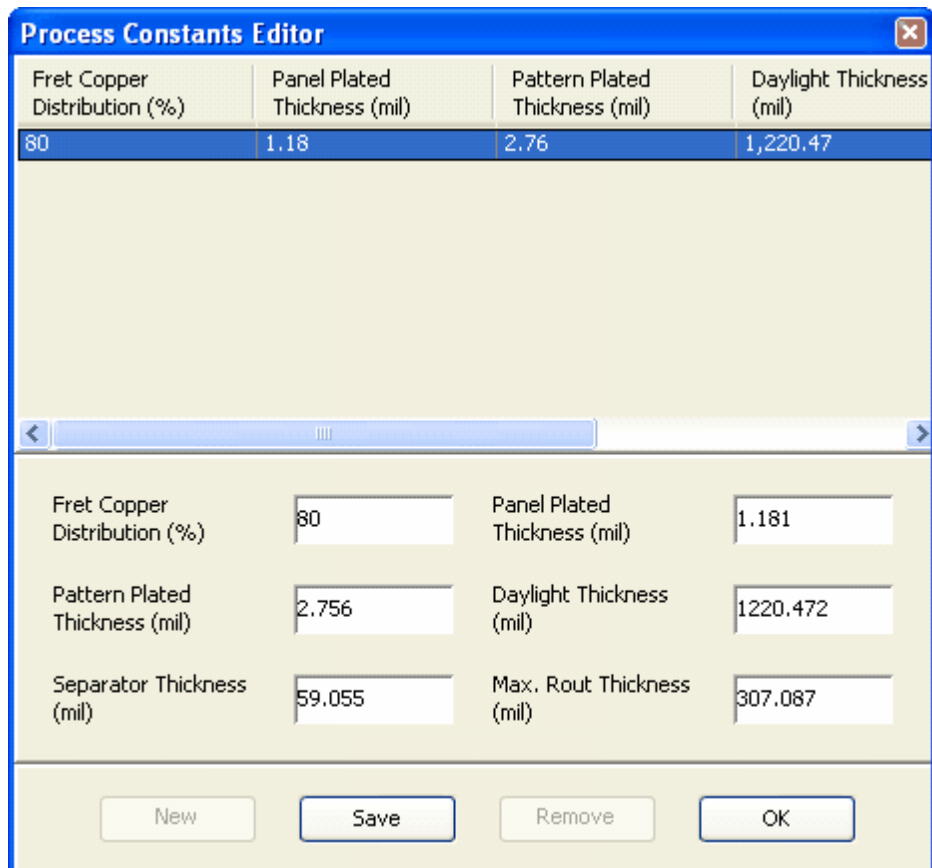
8.1.8 8.1.8: Process Constants

Process Constants is the name given to the section where

- (a) The copper distribution on the fret (robber/thieving/waste area around the panel) is defined
- (b) Copper plating thicknesses are defined,
- (c) Bond Stack height parameters are entered,
- (d) Rout stack height parameters are entered.

The fret constant editor controls the entry of global factors used by the stack-up module.

Copper distribution allows the average percentage copper distribution of the panel fret area to be set. This will be used to determine the total copper distribution where the panel sizes and unit sizes differ.



The **Process Constants Editor** dialog box is used to configure various process parameters. It features a table at the top for quick viewing and a set of input fields below for editing. The table contains the following data:

Fret Copper Distribution (%)	Panel Plated Thickness (mil)	Pattern Plated Thickness (mil)	Daylight Thickness (mil)
80	1.18	2.76	1,220.47

Below the table, there are input fields for the following parameters:

- Fret Copper Distribution (%): 80
- Panel Plated Thickness (mil): 1.181
- Pattern Plated Thickness (mil): 2.756
- Daylight Thickness (mil): 1220.472
- Separator Thickness (mil): 59.055
- Max. Rout Thickness (mil): 307.087

At the bottom of the dialog, there are four buttons: **New**, **Save**, **Remove**, and **OK**.

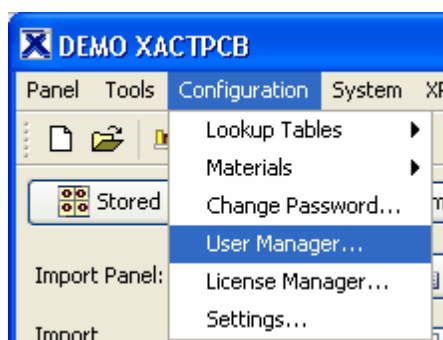
The panel plated thickness and pattern plated thickness allow standard plating thickness to be entered. These values should be the total thickness of copper plated on both sides i.e. the thickness the panel will increase by during these processes.

Daylight thickness is the available stack thickness for lamination – this will be used to determine the number of panels and separators that will fit in the press opening. The separator thickness is used in the stack height calculations detailed above.

The maximum rout thickness is the maximum thickness of product that can be routed at the post lamination trim stage. This is used to calculate the stack height for this process.

8.2 8.2: User Manager

This function allows an administrator to set up new users and their access privileges.



8.2.1 8.2.1: Add New User

To set up a new user, click the New button and enter the user name.

Select the user type from the drop down menu, then enter a password and confirm the password.

When all data is complete, press the Save button.

The screenshot shows a 'User Manager' dialog box with a table of existing users and a form for adding a new user. The table lists users with their names, types, and passwords (masked with asterisks). The form below the table has fields for 'User Name' (containing 'Tom'), 'User Type' (a dropdown menu currently showing 'Operator'), 'Password', and 'Confirm'. At the bottom are three buttons: 'New', 'Save', and 'Remove'.

User Name	User Type	Password
Bob	Operator	*****
Delilah	Administrator	*****
Fred	Designer	*****
Jane	Supervisor	*****
Bill	Reviewer	*****
Jim	Operator	*****
Reg	Designer/Engineer	*****
Samson	Engineer	*****
admin	Administrator	*****
maint	Maintenance	*****

User Name: User Type:
 Password: Confirm:
 Buttons:

8.2.2 8.2.2: User Types

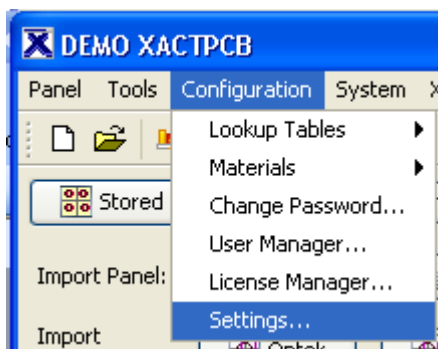
There are multiple levels of USER and the operations available to each user type are fully configurable, but the standard functionality available to each user type as default is described here.

- (1) **Administrator** – sets up database functions and has full control of users' access rights. Can use all parts of the software.
There must be at least ONE admin user.
- (2) **Designer/Engineer** – this allows full access to both stack-up functions and measurement analysis functions.
- (3) **Designer** - this allows full access to the stack-up functions include editing and importing external data.
- (4) **Supervisor** – access to view stackup and perform full measurement analysis.

- (5) **Engineer** – access to measurement analysis functions.
- (6) **Operator** – an account suited to day to day use – but does not allow access to stackup functions.
- (7) **Reviewer** - a user with reviewer permissions can only access the review queue.
- (8) **Maint** - the maintenance log-in allows access to database administration tasks including back-up and upload to the Xact server.
When a new software revision is installed, the first log-in must be a maintenance log-in to allow any required database configuration changes to be carried out.

8.3 8.3: Settings Manager

From the main menu, select **Configuration** and **Settings**.



The Settings Manager allows the user to change the look and feel of the system by changing units used to display scale factors and measurements. This section also allows the user to configure the colours used in the various GUI modules.

8.3.1 8.3.1: Units Selection

The software can be configured to display in imperial units or metric units.

In the pop-up window that appears after selecting Settings from the Configuration menu, click on the Calculations tab and select either metric or imperial units.

In addition the Calculations window provides the ability to change the format of scale factor [Stackup Layout](#) s displayed in various parts of the software.

Stackup Scaling

Refers to all scale values related to CAM/artworks that are displayed against internal/external layers in the stack-up editor and the outer layer scale compensation values displayed in Measurement Analysis

Drill Scaling

Refers to the drill compensation scale values displayed after pressing the Drill Compensation button in Measurement Analysis

Layer Movement Scaling

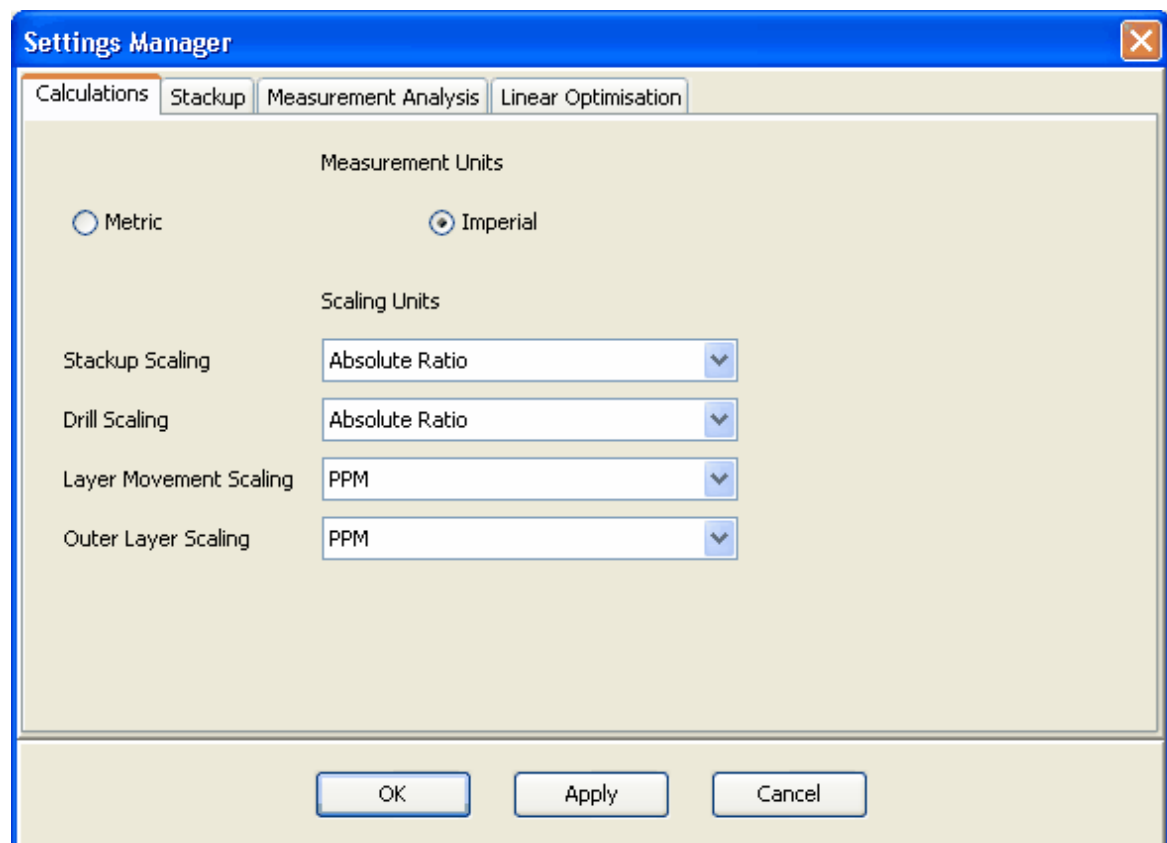
Refers to all scale error values displayed against internal/external layers in the measurement analysis windows and in the Xplain reports

Outer Layer Scaling

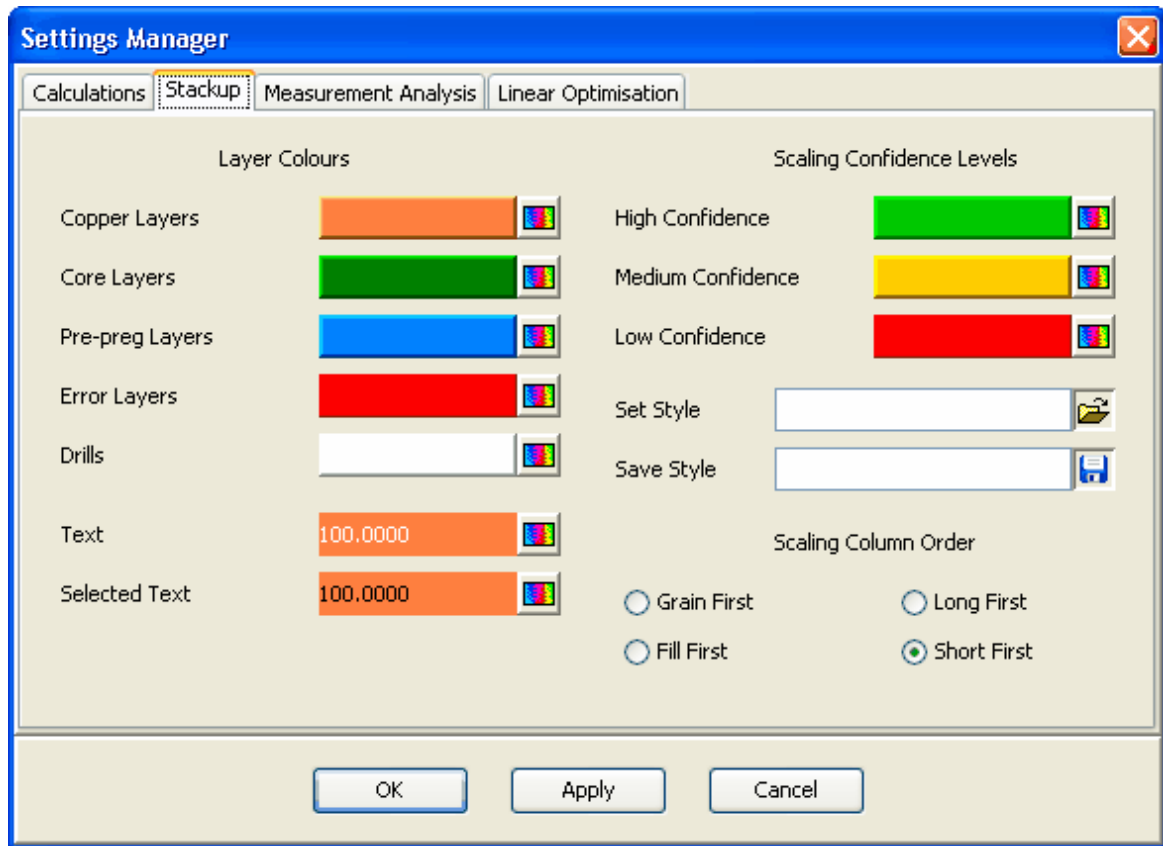
Refers to the required outer layer scaling (Panel offset scaling) to be used instead of no scale at the outer layer processes (starting with drill) - these values are entered via the Process parameters window.

The available scale unit settings are

- Absolute % (e.g. 100.0123)
- Relative % (e.g. 0.0123)
- PPM “parts per million” (e.g. 123ppm)
- Relative length (mil/inch or microns/mm) (e.g. 0.123)
- Absolute ratio (e.g. 1.000123)
- Relative ratio (e.g. 0.000123)
- Panel Scale (mil or microns) – calculated from panel dimensions and Relative Length setting (note panel size must be defined for this to be available)
- PPTT “parts per ten thousand” (e.g. 1.23)
- PPHT “parts per hundred thousand” (e.g. 12.3)



8.3.2 8.3.2: Stackup Layout



Colours:

The **Stackup** tab of the **Settings** screen allows the user to change displayed colours in the stackup display and traveller report.

The colours may be changed in the stackup module for the materials Copper, Core, Prepreg and Coverlays.

The Error highlight colour can be modified as well as the colours used to indicate high, medium and low prediction confidence.

The colour of the Drill displayed in the traveller report can also be configured from here.

This screen also allows the colour of text and selected (highlighted) text to be set.

Column Order:

This interface also allows the order of the scaling columns in the stack-up screens to be set.

“Grain first” would ensure that the scale factors for the grain direction are always shown in the first column irrespective of whether the grain direction is in the long or short axis.

“Long First” would set the first column to always display the scale for the Long axis, irrespective of the axis is the grain direction.

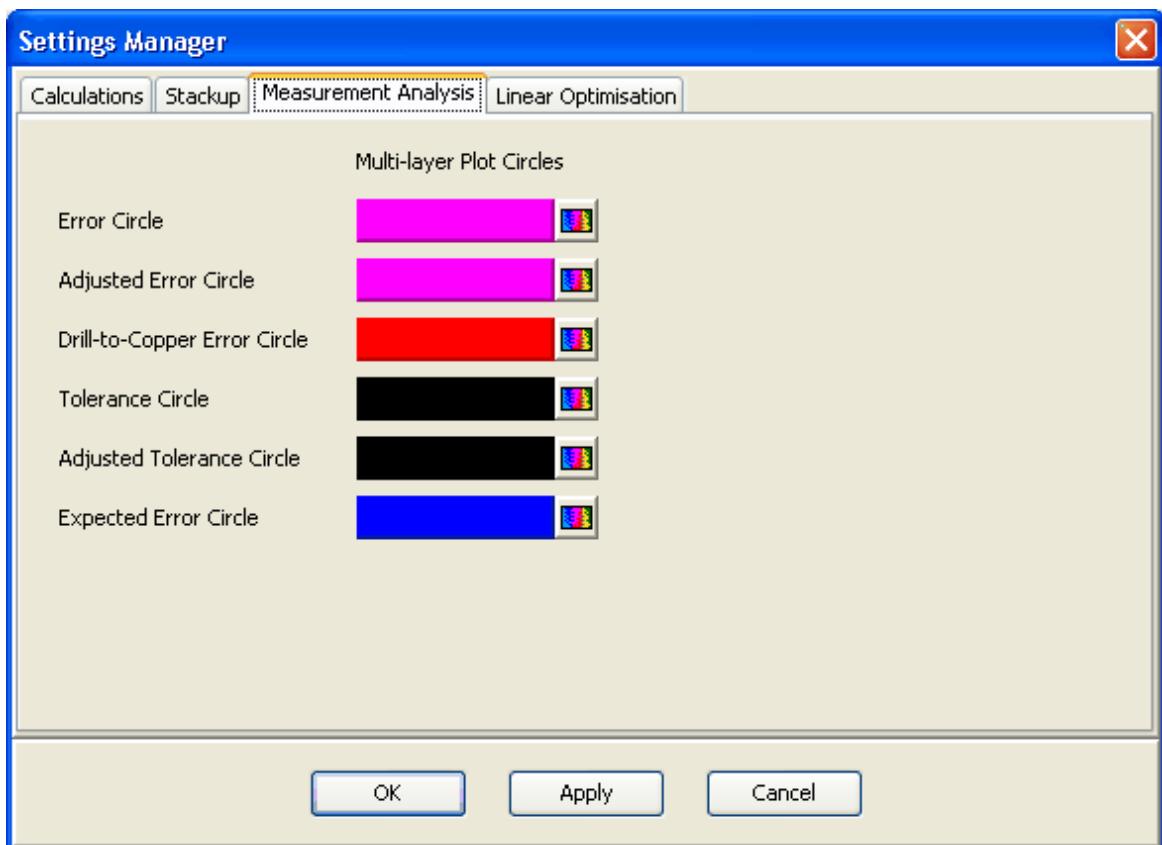
(The default setting for scaling column order can be set in the *xact.cfg* configuration file)

8.3.3 Measurement Analysis Colours

The **Measurement Analysis** tab of the **Settings** screen allows the user to change displayed colours in the stackup display.

The colours may be changed in the measurement analysis module for minimum land, design rule and drill to copper circles for the drill compensated (adjusted) positions and nominal positions.

For measurements of subcomponents before the final lamination of sequentially laminated product, the colour of the design rule circle for the expected position can also be set.



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