



Streams Rules Check: Overview

The Streams Rules Check functions allow you to define DFF and DRC Rules check schemes for reuse across multiple printed circuit board designs. The Streams Rules Check capability allows you to combine DFF rule checks, DRC rule checks, CAM350 macros and various utility operations to create batch schemes for verifying manufacturing rules for printed circuit boards. The Streams Rules check provides advanced human interface support for drag-and-drop rules setup, and results review.

For Streams Rules check, each DFF/DRC rules scheme is called a Stream. A Stream contains one or many groups of layer type checks. A layer type check contains multiple predefined checks that are relevant for that specific layer type. Layer type checks supported in Streams Rules Check include: Signal Layer, Positive Plane, Negative Plane, Solder Mask, Silkscreen, and NC Data Layer. In addition, special checks for Any Layer type and Netlist Comparison checks are supported. Design independent rules specification allows you to define consistent rules that will work independently of the number of layers and layer types in your design.

Command Sequence:

Create a new Stream from the main Streams Rule Check dialog using the **View > Streams Rules Check** command.

Use the Streams List dialog to add new Stream. You can manage existing Streams and global Streams options from the Streams List dialog. Setup the Stream in the Checks Tab of the Stream dialog that is docked to the bottom of the application window. Create the Stream definition by adding Layer type checks on the Checks Tab and then selected the detailed check parameters in the Details Tab. The Details Tab allows you to enable or disable check routines that are available for a layer type check.

Note: You can use the Areas Tab to specified named areas that can be reused for restricted rules checks in any Layer type check specified in your Stream.

Run the Stream in the Checks Tab of the Streams dialog by selecting one of the execution choices from the Run icon drop-down list.

You can run the Stream by:

- (1) Running the Stream definition per the Stream definition without parameter modification
- (2) Running the Stream on the area inside the printed circuit board border.
- (3) Running the Stream on the entire world (CAM350 workspace)

(4) Running the Stream on a user specified window to be interactively specified at runtime.

Analyze the results of the Stream execution using the Results Tab in Stream dialog. The Results Tab stores the error information for each execution that was run. The Results Tab organizes the Execution results in tree navigation style by date/time of execution, layer check type and check routine type. When selecting error(s), the graphics window zooms to the associated layout region and highlights the selected error(s). Use the Chart icon to display a histogram of the selected errors. On the chart, mouse over display and right mouse bottom commands support error analysis. Use the command Info > Report > Streams Results to display a report of execution results.

View > Streams Rules Check

View > Streams Rules Check opens the Streams List top level dialog. The Streams List dialog manages the Stream DFF/DRC rules schemes that are defined in the current database.

Note: The View > Streams Rules Check command toggles the visibility of the Streams List dialog on and off.

Command Sequence:

Select **View > Streams Rules Check**.

In the Streams List dialog, select an existing or add a new Stream Rules Check for DFF/DRC scheme, using the **Add Stream** icon.

Once selected, a Stream can be deleted using the **Delete Stream** icon.

Once selected, a Stream can be made visible in a Stream tab dialog using by clicking on the "Eye" visibility icon to the left of the Stream name.

To rename a Stream, double click on the system defined Stream name and type in the new desired name.

In the Streams List dialog, you can save all defined Streams to an external file, using the **Export Streams** icon. You can import Streams from an external file, using the **Import Streams** icon.

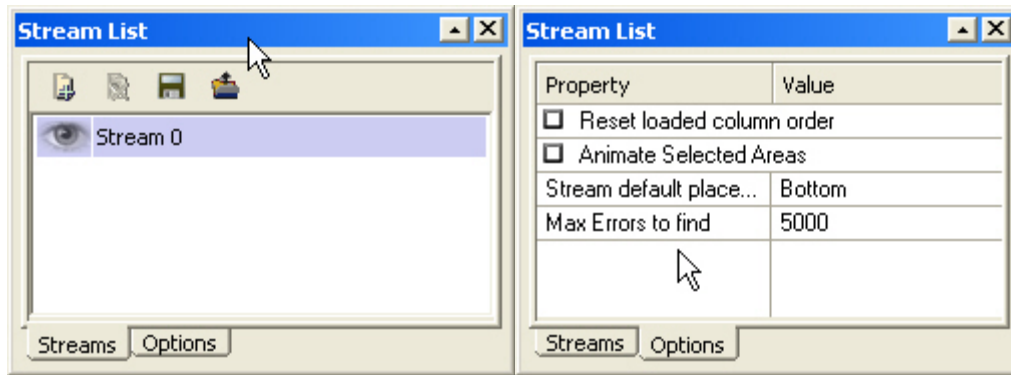
To set global Streams Rules Check options, click the **Options** tab at the bottom of the Streams List dialog.

To reset the column order for the **Stream Results** tab output, check the Reset Loaded Column Order checkbox. If unchecked, any customized column order will be retained for **Streams Results** tab output.

To animate selected regions during check area definition, check the **Animate Selected Areas** checkbox.

To set the default docking location of the Stream tabbed dialog, click in the "Value" column cell for the **Stream Default Placement** row. Then select the docking location from the drop-down list.

To set the maximum number of detected errors per Stream execution, click in the "Value" column of the **Max Errors to Find** row and type the desired maximum error limit.



Creating a Stream

A Stream is a set of layer type checks that test your design against manufacturing rules. Stream Rule checks can be specified in a design independent manner so that a Stream can be reused across many design files. Creating a Stream consists of two main steps. First, create and name a Stream in the top level **Streams List** dialog. Second, set up the layer type checks and technology specific manufacturing parameters for the desired check routines.

Command Sequence:

Create a new Stream from the main Streams Rule Check dialog using the **View > Streams Rules Check** command. Use the **Streams List** dialog to add new Stream. Make the Stream visible by selecting the "Eye" icon at the left of the new Stream row. The Stream tabbed dialog appears at the bottom of the application window.

Tip: You can manage existing Streams and global Streams options from the **Streams List** dialog.

Add Layer Type checks to your new Stream using the **Add New Check** icon in the **Checks Tab**. Layer types supported include: **Signal Layer**, **Positive Plane**, **Negative Plane**, **Solder Mask**, **Silkscreen**, and **NC Data Layer**. In addition, special checks for **Any Layer type** and **Netlist Comparison** checks are supported.



A Layer Type check groups check routines for DFF and DRC checks that are commonly used for that specific layer type.

Tip: Double click in the Name cell of the newly added Stream to rename the layer type check.

Tip: The sequence of check execution is based on the order of checks in the **Check Tab**. You can easily reorder the sequence by dragging and dropping existing layer type checks.

CAM350 macro scripts and Pause commands can be added to the Stream execution flow.

Save your Stream definition to an external file using the **Export Stream** icon in the **Checks Tab**. Use the **Import Stream** icon to import a preexisting Stream definition from an external file.

Tip: From the Stream Lists dialog (**View > Streams Rules Check**), all Streams in a design can be exported or imported from an external file.

Set up your Check routine parameters using the **Details Tab** in the Stream tabbed dialog. In the **Details Tab**, layer types are grouped in tree navigation style. Specify layer type check parameters by clicking on the Value column of the desired row.

Tip: Click the green arrow to toggle the enabled status for a layer type check or to toggle the enabled status for an individual Check routine.

Name - Click in the Value cell and enter a new name for the layer type check.

Layers - Click in the Value cell and click on the ellipsis ("...") at the right in the Value cell to open the layer selection dialog; specific design layers are listed first, followed by generic layer types that are useful for design independent Stream setup.

Drill Layers - Click in the Value cell and click on the ellipsis ("...") at the right in the Value cell to open the layer selection dialog; specific design layers are listed first, followed by generic layer types that are useful for design independent Stream setup.

DFF Checks - This is a non-editable summary of the enabled Check routines for this layer type check.

DCODE Filter - Click in the Value cell and click on the ellipsis ("...") at the right in the Value cell to open the DCODE filter dialog. Use the drop-down list to select the layers from which Dcodes are listed, and then select the desired DCODEs for this layer type check.

NC Tool Filter - Click in the Value cell and click on the ellipsis ("...") at the right in the Value cell to open the NC Tool filter dialog. Select the desired NC Tools for this layer type check.

Check Region - Click in the Value cell and click on the ellipsis ("...") at the right in the Value cell to open the Area Selection dialog. From predefined regions, select positive and negative regions to create the composite area for which check routines are run for this layer type check. See Stream Area Check Regions for more details.

Auto Fix Errors - Check the Auto Fix Errors checkbox to enable automatic fixing of DFF errors that can be programmatically fixed.

Details - This is a Tree Navigation style list of Check routines available for the layer type check. See Stream Rules Checks for details of available check

Stream 0 - DFF Stream	
Property	Value
▶ Signal Layer 0 - Signal Layer check	
Name	Signal Layer 0
Layers	[Outer Electrical]
Drill Layers	[All NC]
DFF Checks	TT, TP, PP, PD, MT, MP, UDC, DC, CB, RP, DWOP, PWOD, A, MG, MW, AT, CS, PH
DCODE Filter	
NC Tool Filter	
Check Region	Entire Area
<input type="checkbox"/> Auto Fix Errors	
Details	

Stream Check Routines

The following Check routines are available for Streams Rules Check layer type checks:

Signal Layer

Track to Track, Track to Pad, Pad to Pad, Pad to Drill, Minimum Track, Minimum Pad, Unplated Drills to Copper, Plated Drills to Copper, Copper to One-Up-Border, Redundant Pads, Plated Drills without Pads, Pads without Drills, Antennas, Minimum Gap, Minimum Width, Acid Traps, Copper Slivers, Pin Holes

Positive Plane

Plated Drills to Copper, Unplated Drills to Copper, Pads to Drills, Acid Traps, Copper Slivers, Pin Holes, Minimum Gap, Minimum Width

Negative Plane

Plated Drills to Copper, Unplated Drills to Copper, Pads to Drills, Copper to One-Up-Border, Isolated Thermal, Starved Thermal, Thermal Conflict, Tie Width

Soldermask

Pad to Mask, Drill to Mask, Mask Slivers, Soldermask Bridge, Pin Holes, Soldermask to Track, Missing Soldermask

Silkscreen

Silkscreen to Soldermask, Minimum Soldermask Width

NC Data Layer

Overlapping Hits, Coincidental Hits, Redundant Hits, Drill to Drill, Imploded Arcs, Imploded Path, Mill Tab Errors

Netlist Compare

Import External Netlist, Extract CAM Netlist, Run Netlist Compare

Check Descriptions:

SIGNAL LAYER AND POSITIVE PLANE CHECKS

Track to Track - The minimum distance required between adjacent traces.

Track to Pad - The minimum distance required between a trace and pad.

Pad to Pad - The minimum distance required between adjacent pads.

Pad to Drill - Annular Ring - Checks that the pad provides an annular ring around the drill hole size of the amount specified.

Minimum Track - The minimum width allowed for a trace.

Minimum Pad - The minimum size allowed for a pad.

Unplated Drills to Copper - Checks to see if any naked unplated drills come too close to any copper data (traces, planes, etc) on the selected copper layer(s).

Plated Drills to Copper - Checks to see if any naked plated drills come too close to any copper data (traces, planes, etc) on the selected copper layer(s).

Copper to One-Up-Border - The minimum distance between copper and the board outline.

Redundant Pads - Checks for superimposed pads.

Plated Drills without Pads - Checks to see if any naked plated drills exist on the layer(s) selected.

Pads without Drills - Checks to see if there are any through hole pads lacking drills on the selected drill layer(s).

Antennas - Checks that all trace end points are overlapping flashed pads.

Minimum Gap - Checks for minimum gaps between copper areas, including same polygon and voids areas.

Minimum Width - Checks for minimum width for all coppers areas, including traces and poured areas.

Acid Traps - Checks for locations where acid will be trapped causing over etching.

Copper Slivers - Checks for narrow copper areas that will likely flake off.

Pin Holes - Checks for tiny voids in copper areas that cause acid traps or photo resist flaking.

NEGATIVE PLANE CHECKS

Plated Drills to Copper - Checks to see if any naked plated drills come too close to any copper data (traces, planes, etc) on the selected negative plane layer(s).

Unplated Drills to Copper - Checks to see if any naked unplated drills come too close to any copper data (traces, planes, etc) on the selected negative plane layer(s).

Pads to Drills - Annular Ring - Checks that the pad provides an annular ring around the drill hole size of the amount specified.

Copper to One-Up-Border - The minimum distance between copper on the negative plane and the board outline.

Isolated Thermal - Checks that each plane connection to the copper plane is valid, or has been constricted by adjacent data so that it is isolated from the rest of the plane layer.

Starved Thermal - Checks that each thermal connection to the copper plane is valid, or has been constricted by adjacent data that is too close.

Thermal Conflict - Checks to determine if any padstack is tied to more than one negative plane.

Tie Width - Checks to determine if any thermal relief tie is too small.

SOLDERMASK CHECKS

Pad to Mask - Annular Ring - Checks that the mask layer provides an annular ring around the pad of the amount specified.

Drill to Mask - Annular Ring - Checks that the mask provides an annular ring around the drill hole size of the amount specified.

Mask Slivers - Checks for narrow soldermask layer areas that will likely flake off.

Soldermask Bridge - Checks for mask openings that uncover copper that is too close together that may cause bridging during soldering.

Pin Holes - Checks for tiny voids in copper areas that cause photo resist flaking.

Soldermask to Track - Checks solder masks against electrical layers to detect for areas where a mask opening may expose a trace if the stencil shifts.

Missing Soldermask - Checks that SMT pads on the selected layer(s) have soldermask openings.

SILKSCREEN CHECKS

Silkscreen to Soldermask - Checks that the silkscreen does not interfere with the opening of the solder mask layer.

Minimum Silkscreen Width - Checks for silkscreen features for too narrow line width.

NC DATA LAYER CHECKS

Overlapping Hits - Checks for two drill hits that touch (have no clearance between them).

Coincidental Hits - Checks for two or more drill hits (of the same size) in the same location, but made by different tools.

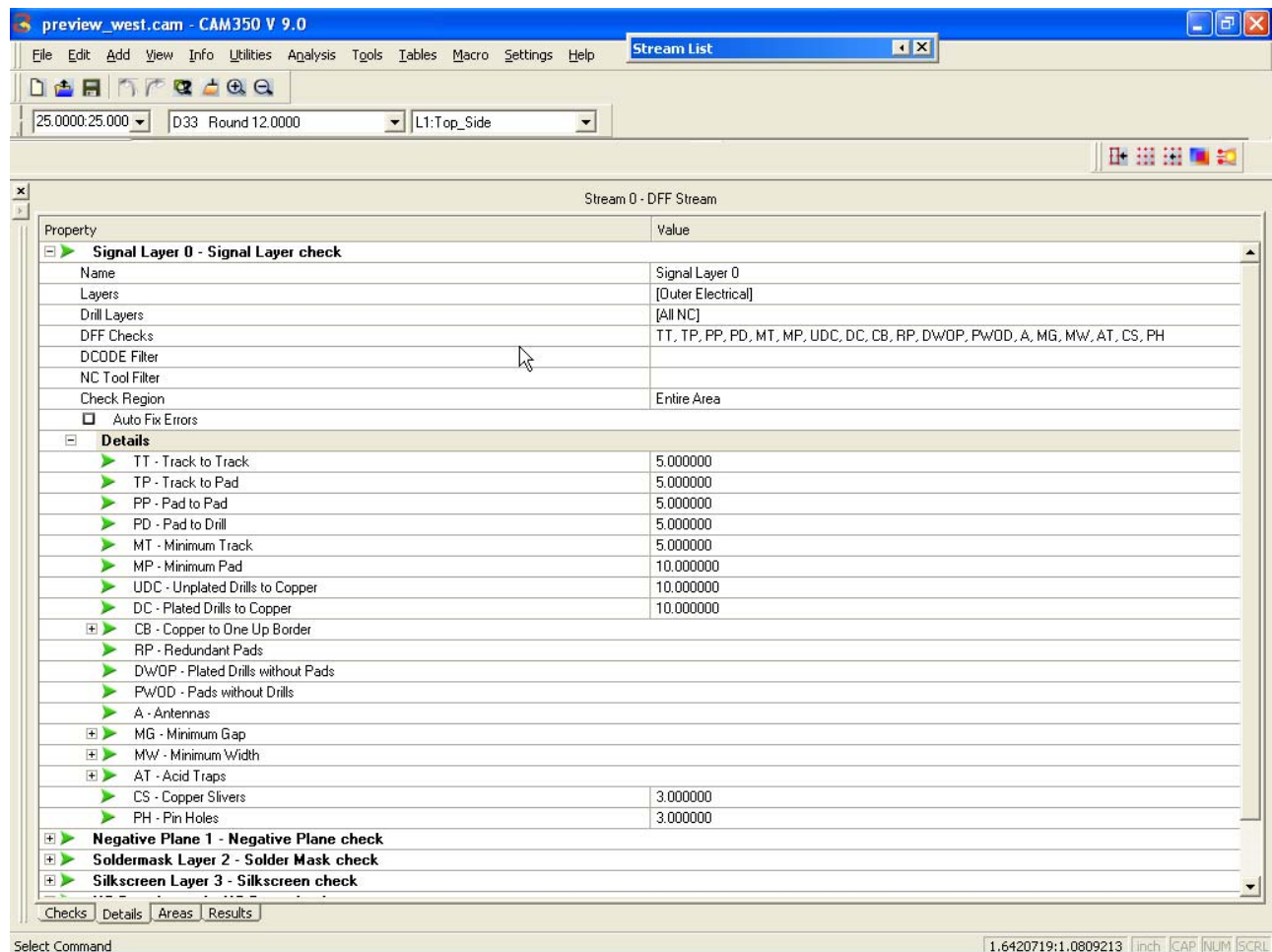
Redundant Hits - Checks for two or more drill hits in the same location, by the same tool.

Drill to Drill - Checks the minimum distance allowed between two drill hits. Any drill hits closer than this distance will be flagged.

Imploded Arcs - Checks for a radius in a mill path that is smaller than the mill tool is able to cut.

Imploded Path - Checks for a path that is too narrow for the tool, and crosses over itself.

Mill Tab Errors - Checks for segments that are shortened by compensation to the point where the mill tab will no longer fit.



Running a Stream

The **Checks Tab** has a Run icon (green icon) that displays a drop down list of the four available options to execute the Stream Rules check.

The **Run** option executes the Stream as defined using Check Region definitions in the Stream Details specification.

The **Run One-Up Border** option executes the Stream only with the region defined by the printed circuit board border, ignoring the Check Region definitions for the Stream.

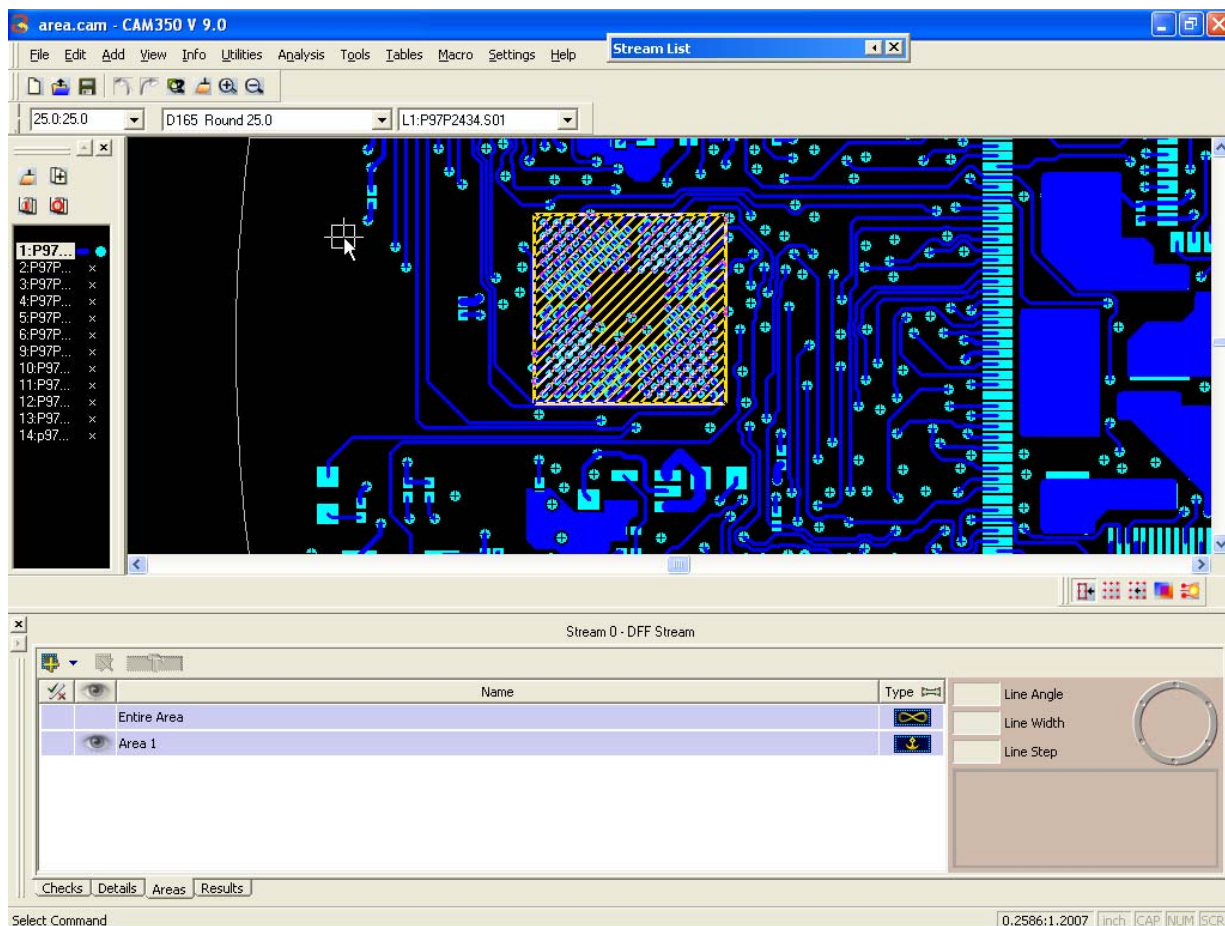
The **Run Entire** option executes the Stream on the entire CAM350 world space, ignoring the Check Region definitions for the Stream.

The **Select and Run** option executes the Stream on an interactively defined rectangular window, ignoring the Check Region definitions for the Stream.

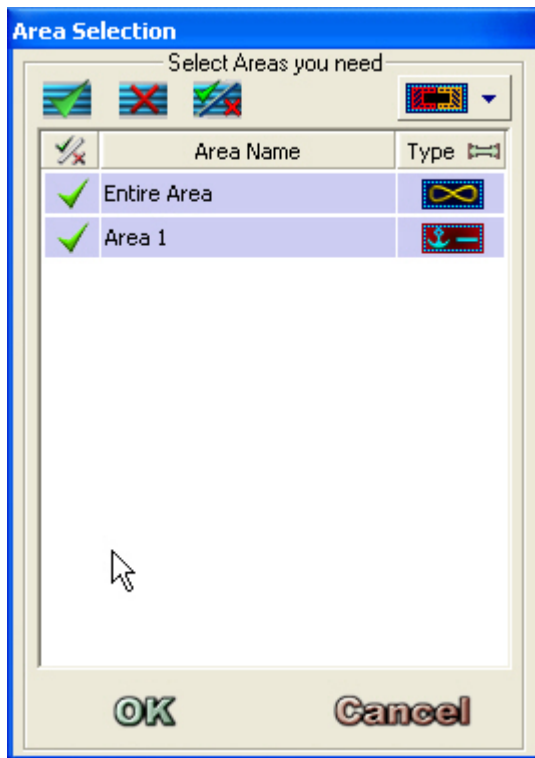
Area Check Regions

Area Check Regions can be defined and used for restricting regions where Stream Rules checks are tested. The **Areas Tab** on the Stream docked dialog allows users to create areas and name them for later identification and use in layer type checks. Check Regions are defined as rectangle regions or by the printed circuit board border.

In the Check Region row of a layer type check, you can combine defined areas in composites (positive or negative polarity) to create complex regions for which Stream Rules check are executed.

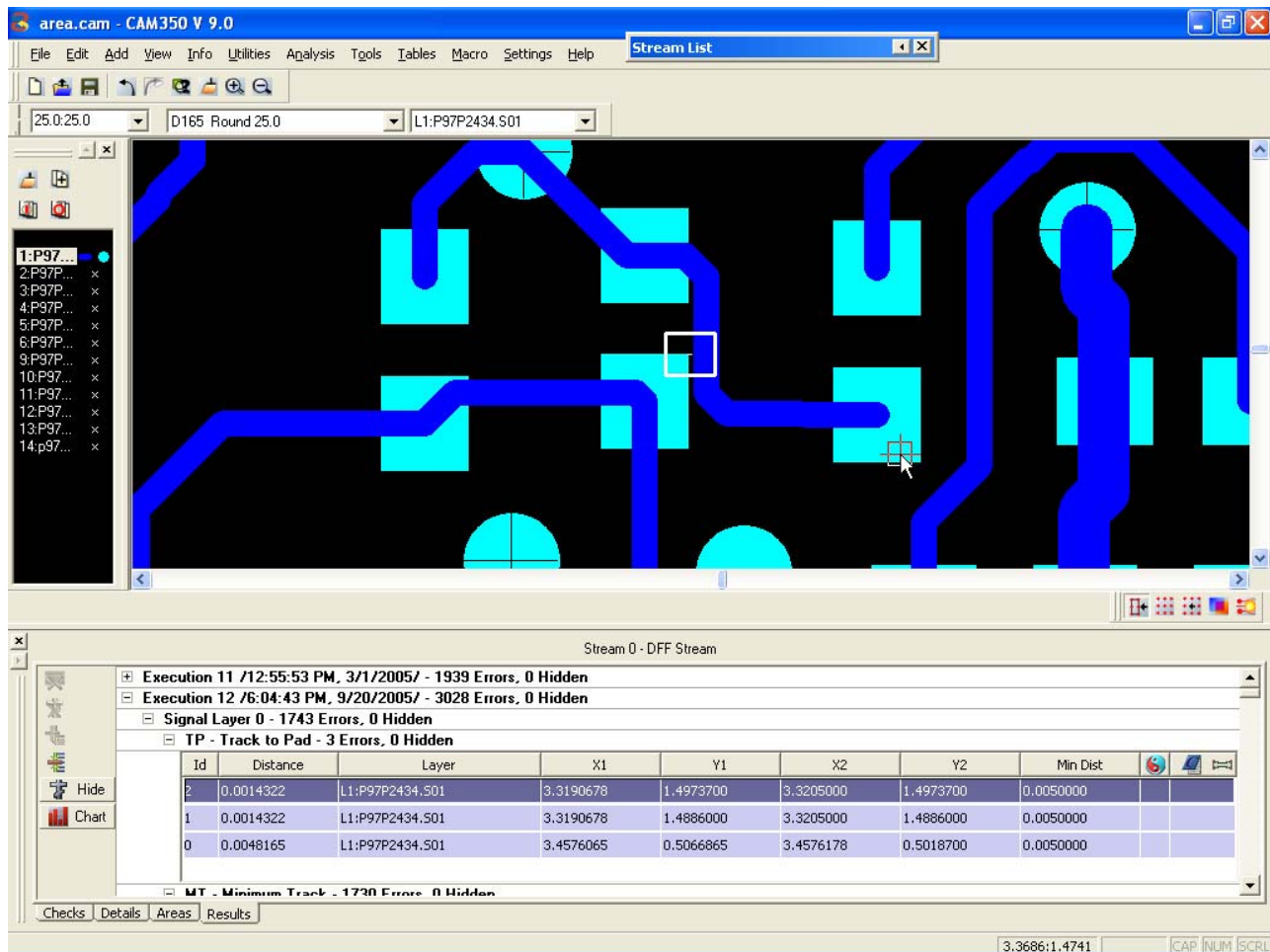


Property	Value
Signal Layer 0 - Signal Layer check	
Name	Signal Layer 0
Layers	[Outer Electrical]
Drill Layers	[All NC]
DFF Checks	TT, TP, PP, PD, MT, MP, UDC, DC, CB, RP, DWOP, A, AT, CS, PH
DCCODE Filter	
NC Tool Filter	
Check Region	Entire Area, -Area 1, -Area 2

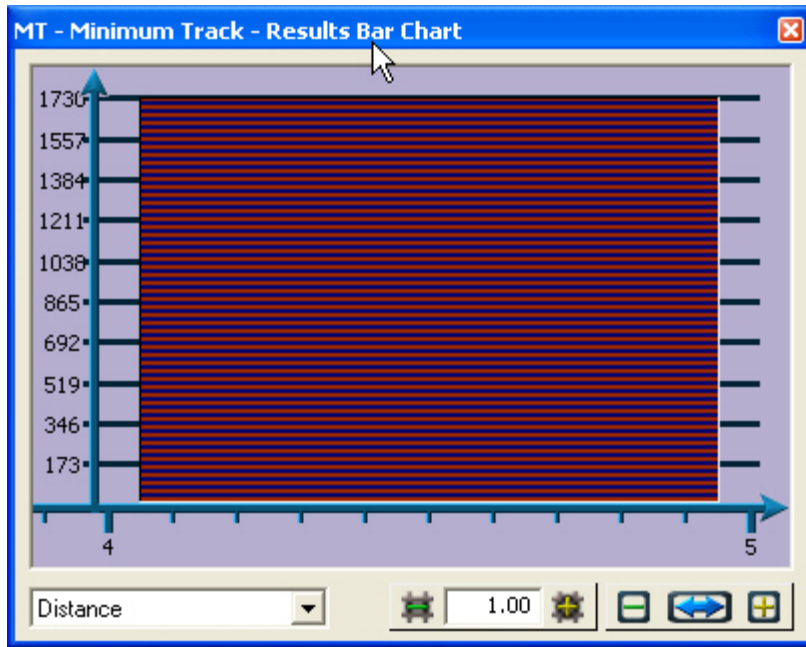


Analyzing Stream Results

The **Results** Tab in the Stream docked dialog display the detected errors for Stream execution. The results for multiple executions of a Stream are retained and labeled by date and time. The results are displayed in tree navigation style, grouped by execution time, layer check type and check routine type. You can select errors in the navigation tree by selecting one or multiple errors, or by selecting one or more of the grouping headers above the errors. The context menu is invoked with right mouse button and implements commands to delete, set ignore status, auto fix or comment errors. Deleted errors are hidden from list, display and report processing. Errors with ignore status are not detected in succeeding executions of the same Stream. Fixes can be made to some of the error types detected by the Stream. Comments can be added to errors for documentation of error processing.



The Histogram **Chart** invokes the histogram dialog for that displays a summary for the selected errors. The X axis shows groups errors based on the value of the error distance. The Y axis shows the number of errors in the groups. Mouse over dialogs display a summary of the error in each histogram bar, including error type, error distance and error count per distance. You can select errors by clicking on a histogram bar. The context menu invoked using the right mouse button implements commands on the selected errors of a histogram bar.



The **Stream Results** Report can be used to display, sort, save or print **Stream Rules** check results.

Id	Distance	Layer	X1	Y1	X2	Y2	Min Dist	Deleted	Comments
0	0.0048165	L1:P97P2434.S01	3.4576065	0.5066865	3.4576178	0.5018700	0.0050000		
1	0.0014322	L1:P97P2434.S01	3.3190678	1.4886000	3.3205000	1.4886000	0.0050000		
2	0.0014322	L1:P97P2434.S01	3.3190678	1.4973700	3.3205000	1.4973700	0.0050000		