

STEP 1: Planning the stackup construction

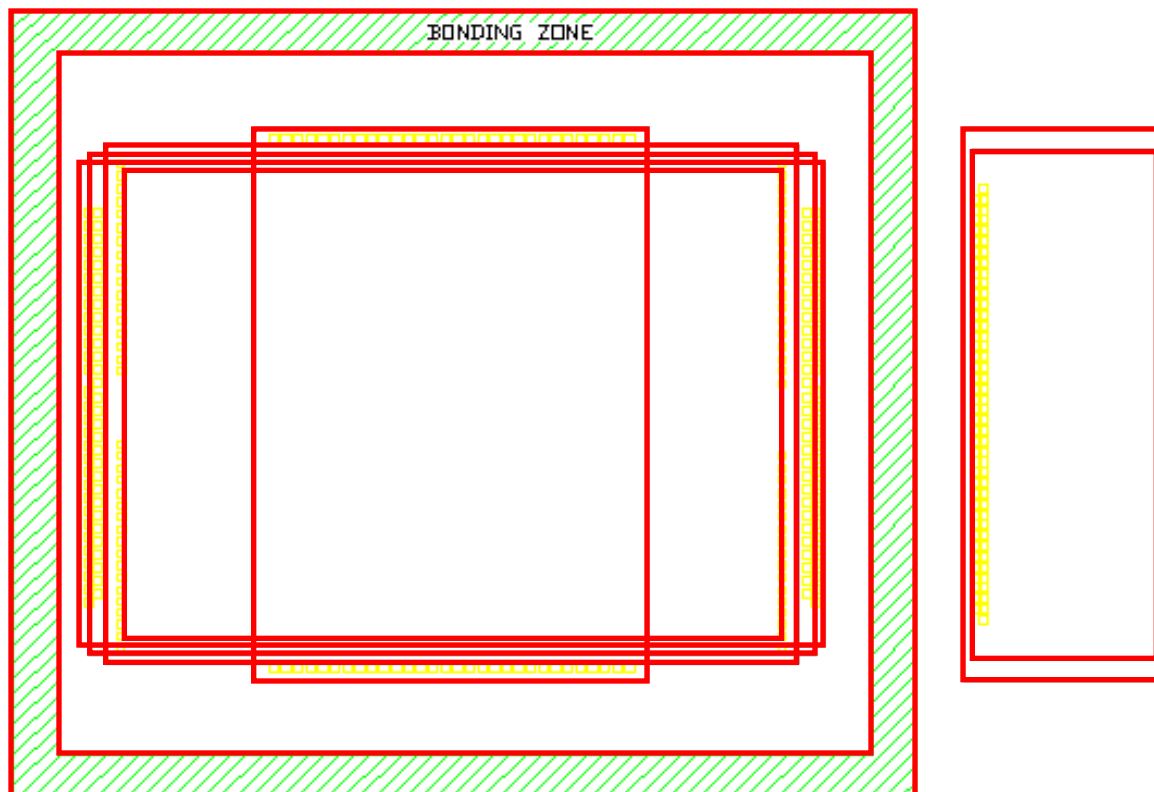
Plan

First, the package size and die configuration is determined.

Then, the layout and stackup conditions are decided:

On the bottom level, two similar dies will be used

This is followed by a spacer on level 2... Another die on level 3... And another die on level 4.



Two similar dies will be used on the right side on level 1.

A common bonding area will be used.

STEP 2: Input the die information

Die Input
Parameters

Dies can be created parametrically,...

Die Input
Diewiz/LIQ

Regular Dies

Dummy Dies

Die Input
Analyze

Spacer Dies

Create Components

General Component Properties:

Block Name	Component Name	Type	Length (X)	Width (Y)	Height (Z)
			0	0	0

Visible

General Properties CBP Properties

General Component Bond Pads Orientation:

CBP Group	# of CBPs	CBP Pitch	CBP Center to Component Edge Distance	CBP Group Offset From Component Center	Stagger	Staggered CBP Rows Center to Center Distance	Inner Staggered Group First CBP
Left XY, Top Z	0				<input type="checkbox"/>		
Bottom XY, Top Z	0				<input type="checkbox"/>		
Right XY, Top Z	0				<input type="checkbox"/>		
Top XY, Top Z	0				<input type="checkbox"/>		
Left XY, Bottom Z	0				<input type="checkbox"/>		
Bottom XY, Bottom Z	0				<input type="checkbox"/>		
Right XY, Bottom Z	0				<input type="checkbox"/>		
Top XY, Bottom Z	0				<input type="checkbox"/>		

STEP 2: Input the die information

Die Input Parameters

Die Input Diewiz/LIQ

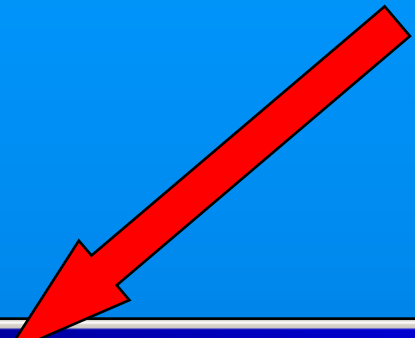
Die Input Analyze

By using X,Y coordinates,...

Excel/TXT data (through DieWizard)

LIQ format

MCM format



```

flash1 a.liq - Notepad
File Edit Format View Help
UNIT MM
COMPL 8.3000
COMPW 5.7000
CBP 1 -4.0500 2.1850 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 2 -4.0500 2.0350 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 3 -4.0500 1.8850 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 4 -4.0500 1.7350 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 5 -4.0500 1.5850 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 6 -4.0500 1.4350 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 7 -4.0500 1.2850 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 8 -4.0500 1.1350 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 9 -4.0500 0.9850 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 10 -4.0500 0.8350 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 11 -4.0500 0.6850 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 12 -4.0500 0.5350 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 13 -4.0500 0.3850 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 14 -4.0500 0.2350 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 15 -4.0500 0.0850 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT
CBP 16 -4.0500 -0.0650 CBP-NS 0.1000 0.1000 RECTANGLE *LEFT

```



STEP 2: Input the die information

Die Input Parameters

Die Input Diewiz/LIQ

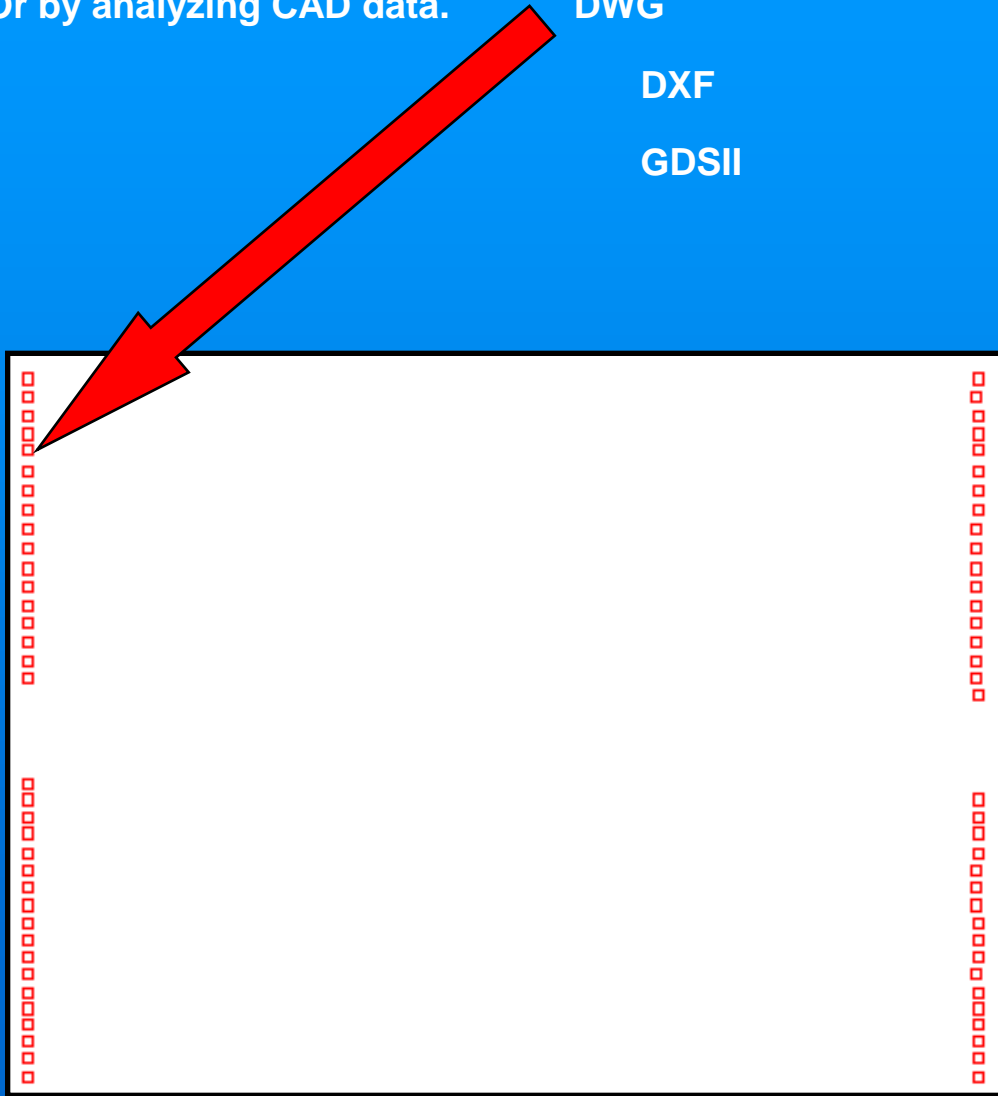
Die Input Analyze

Or by analyzing CAD data.

DWG

DXF

GDSII



STEP 3: Save the die data

Die Input Parameters

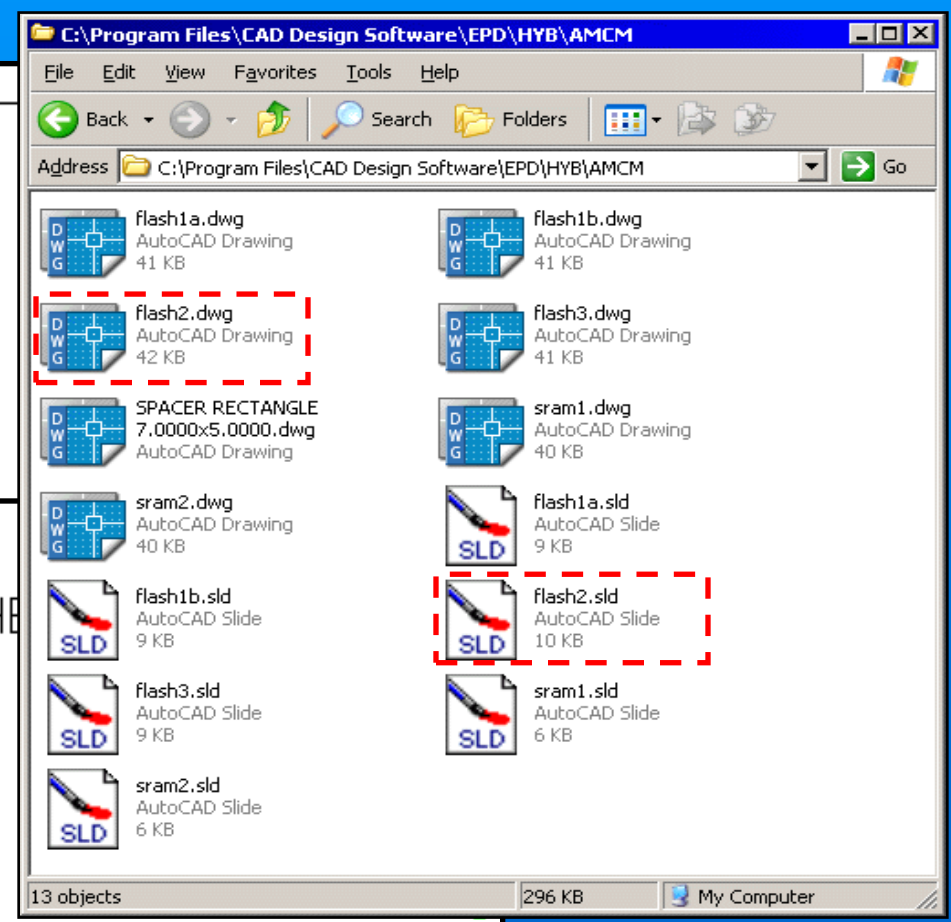
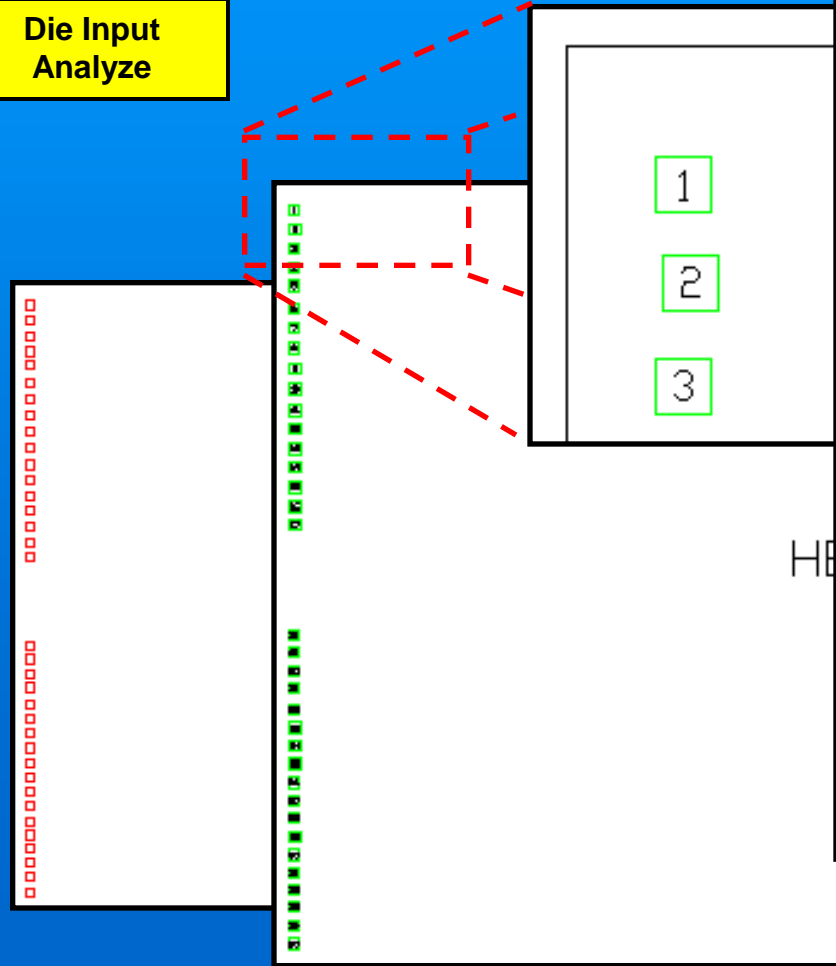
Die Input Diewiz/LIQ

Die Input Analyze

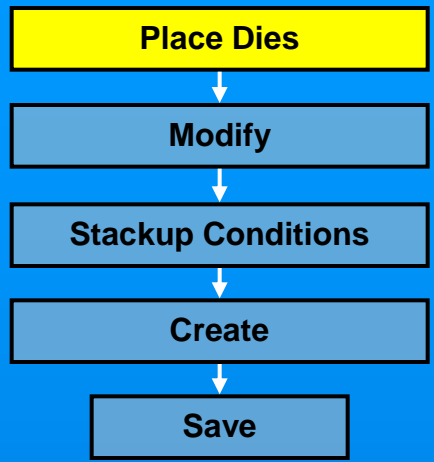
Once all data has been processed,...

It becomes intelligent, with pin numbers, netnames, etc.,...

And it is saved in a standard die library, ready for Advanced MCM.



STEP 4: MCM-Start the command



In AMCM, first a fanout name is specified,...
 A designator is assigned,...
 The total number of die levels is selected,...
 And the netlist is read into the design.

```

Netlist.net - Notepad
File Edit Format View Help
( )
NETC1 F1A,1 F1B,1 F2,1 F3,30
NETC2 F1A,2 F1B,2 F2,2 F3,29
NETC3 F1A,3 F1B,3 F2,3 F3,28
NETC4 F1A,4 F1B,4 F2,4
NETC5 F1A,5 F1B,5 F2,5 F3,27
NETC6 F1A,6 F1B,6
NETC7 F2,7
NETC8 F1A,7 F1B,7 F2,8
.
.
.
NETC89 S1A,28 S1B,28
NETC90 S1A,27 S1B,27
NETC91 S1A,26 S1B,26
NETC92 S1A,25 S1B,24 F1A,44 F1B,44 CBP_CBP=YES
NETC93 S1A,24 S1B,22
NETC94 S1A,23 S1B,21
NETC97 S1A,21 S1B,20
  
```

Multiple Component Module

Name of Attach Pattern: MCM1

Reference Designator: U1

Number of Stacked Components: 4

Display Interactive Toolbar

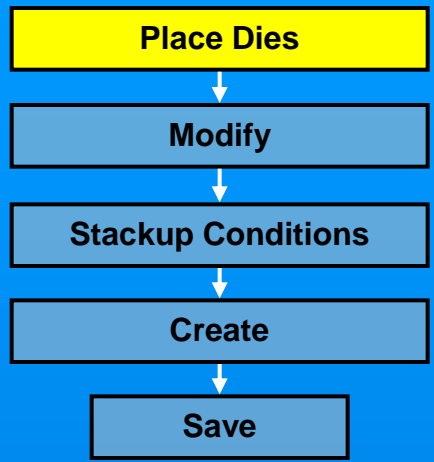
Buttons: Create Components..., Place Components..., Remove Components..., Replace Components..., Configure Components..., Conditions Control..., Attach to Substrate..., Read / Write Properties..., Save, OK, Cancel

Update Everything from Drawing

Select Blocked Pattern to Edit

Netread

STEP 4: MCM-Place the dies in the stackup



In AMCM, the dies are selected from the die library,...
 Then, some basic information is entered,...
 And the initial stackup is created.

Place Components

Library Path: C:\Program Files\CAD Design Software\EPD 7.5\h

Select Library: AMCM

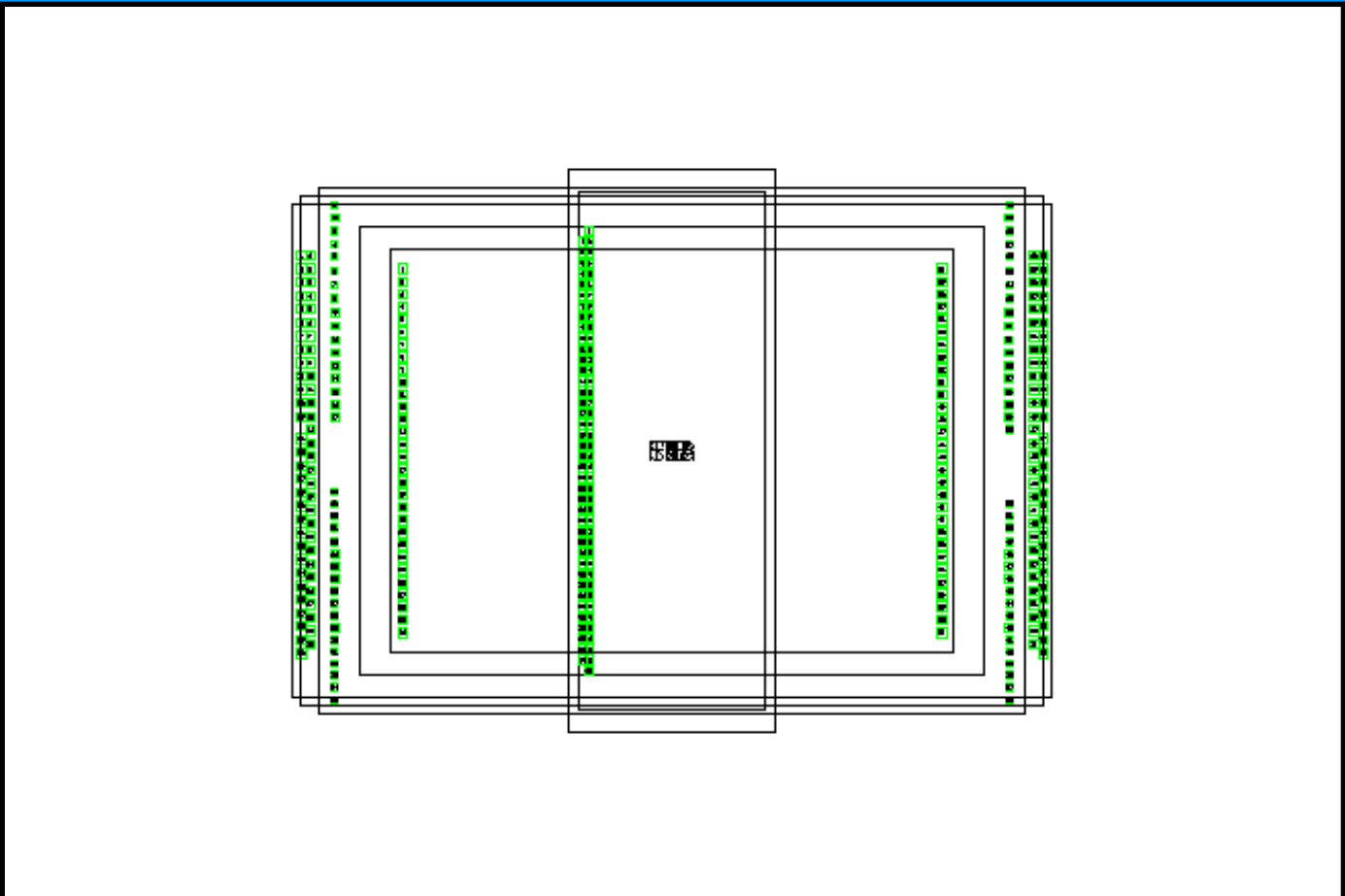
Components in Library: Expand

#	Block Name	#
1	SPACER RECTANGLE 7...	1
2	flash1a	2
3	flash1b	3
4	flash2	4
5	flash3	5
6	sram1	6
7	sram2	7

Total # of Components in Library: 7

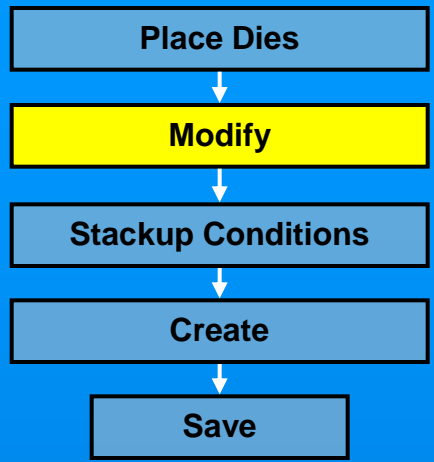
Prompt for Center Coordinate and Rotation

Place OK Cancel



Next, some details about the dies are specified,...

STEP 5: MCM-Modify the stackup (fix location/rotation of the dies)



Two separate die stackups, with Flash3 rotated 90 degrees,...

And the stackup is ready.

Configure Components

Components in Drawing:

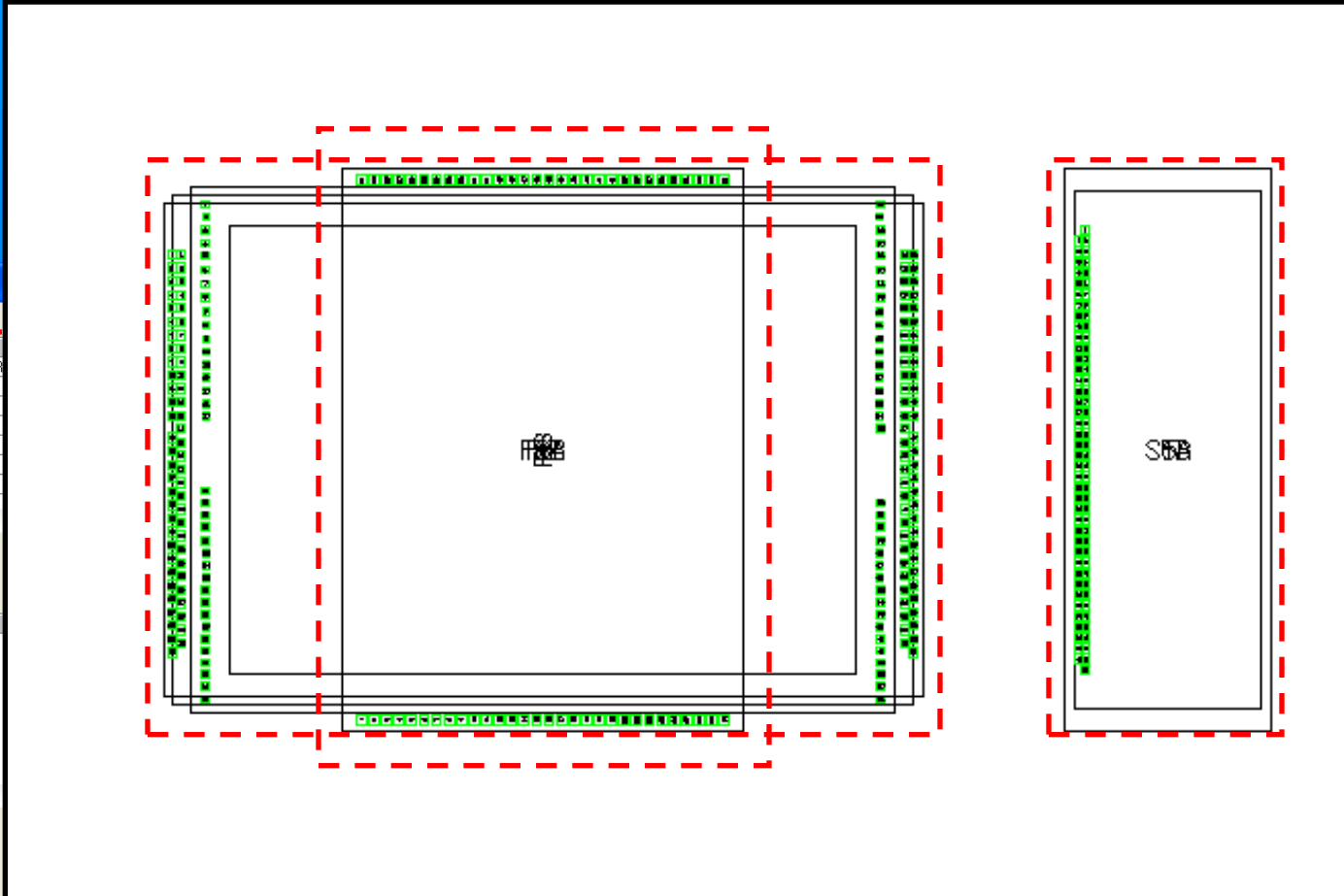
#	Component #	Block Name	Component Name	Type
1	1	SPACER		SPACER
2	2	flash1a		FLASH
3	3	flash1b		FLASH
4	4	flash2		FLASH
5	5	flash3		FLASH
6	6	sram1		SRAM
7	7	sram2		SRAM

Total # of Components in Drawing: 7

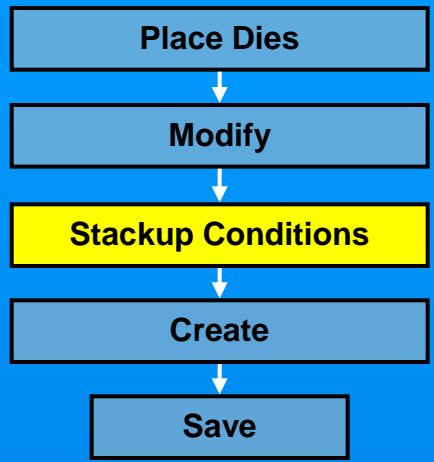
Present in Conditions:

#	Condition #	Condition Name	Level

Total # of Conditions Defined:



STEP 6: Specify the Stackup Conditions



In this case, two separate FLASH dies are used in the main stackup,...
 And two separate SRAM dies are used as stand-alone die,...
 Therefore, 4 separate conditions are possible.
 The conditions are specified, and saved in the database.
 The user can also specify the exact bonding points for each level.

Conditions Control

Conditions Definition Table:

#	Component #	Block Name	Component Name	Ref Des	Typ
1	1	SPACER		Z1	SPACE
2	2	flash1a		F1A	FLASH
3	3	flash1b		F1B	FLASH
4	4	flash2		F2	FLASH
5	5	flash3		F3	FLASH
Total		7			

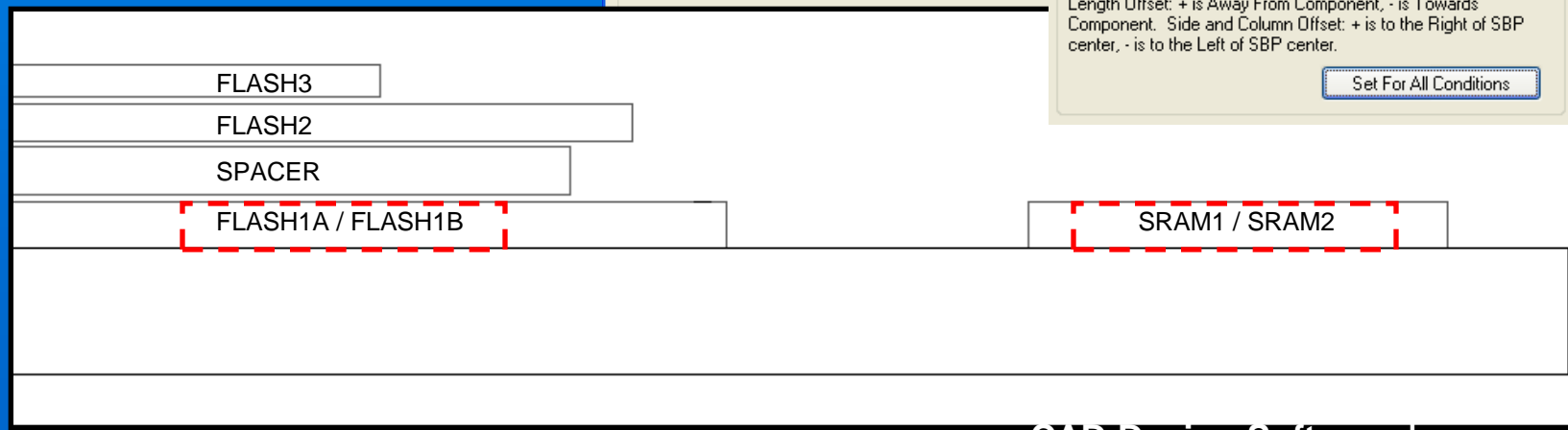
Condition Properties (Show Column Selected in Upper Right)

Bond Wire Offsets for the Selected Condition

Total # of Levels: 4

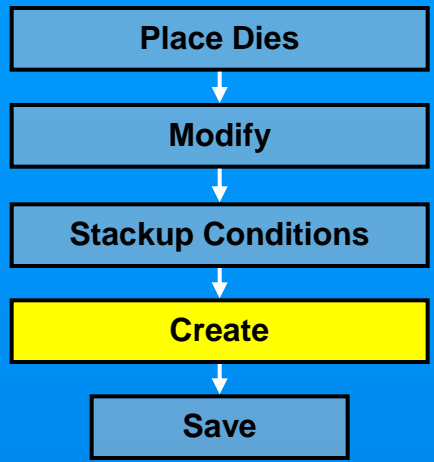
Level	Relative to SBP Center	Length Offset	Side Offset	Relative to Inner Wire
1	<==	-0.075	0	
2		0	0	
3		0.05	0	
4		0	0	

Length Offset: + is Away From Component, - is Towards Component. Side and Column Offset: + is to the Right of SBP center, - is to the Left of SBP center.





STEP 7: Setup the global Fanout Pattern settings



First, the die information is confirmed (no die bond pad for this sample)

Next, the design rules and fanout preferences are specified

Next, the dies are connected according to the reference netlist,...

Which contains die pad sharing information,...

Including direct die-to-die bonding.

SBP Groups (Step 2) Expand

#	Group #	Name	Side	Side Of	Fanout Type	Lock
Common	Common		varies	varies	Straight = P Angled Aligned	<input type="checkbox"/>

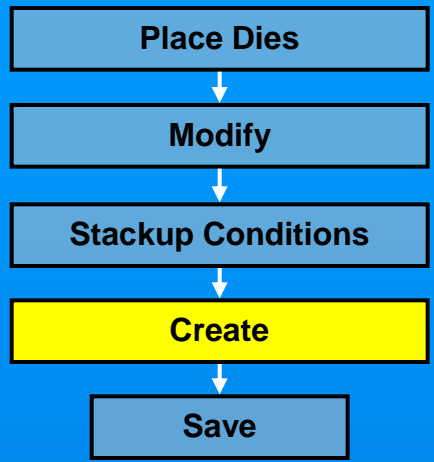
Components In Drawing (Step 1): Expand

#	Component #	Block Name	Component Name	Type	Ref Des	DBP	DBP #	DBP X Offset	DBI	led Aligned	Lock
1	1	SPACER		SPACER	z1	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
2	2	flash1a		FLASH	F1A	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
3	3	flash1b		FLASH	F1B	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
4	4	flash2		FLASH	F2	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>

#	Component #	Block Name	Component Name	Type	Ref Des	DBP	DBP #	DBP X Offset	DBI	led Aligned	Lock
2	2										
3	3										
4	4										

NETC89 S1A, 28 S1B, 28
 NETC90 S1A, 27 S1B, 27
~~NETC91 S1A, 26 S1B, 26~~
 NETC92 S1A, 25 S1B, 24 F1A, 44 F1B, 44 CBP_CBP=YES
 NETC93 S1A, 24 S1B, 22
 NETC94 S1A, 23 S1B, 21
 NETC97 S1A, 21 S1B, 20

STEP 7: Create the initial Fanout Pattern



Next, the pad locations, angles, wires, etc. are calculated,...

And the pads are placed in the design for the initial fanout pattern.

Very good start, but there is still work to be done:
Some wires are crossing,...

And the SRAM wires need their own bonding location.

Dwg. Maint. (Step 4)

Calculate

Place

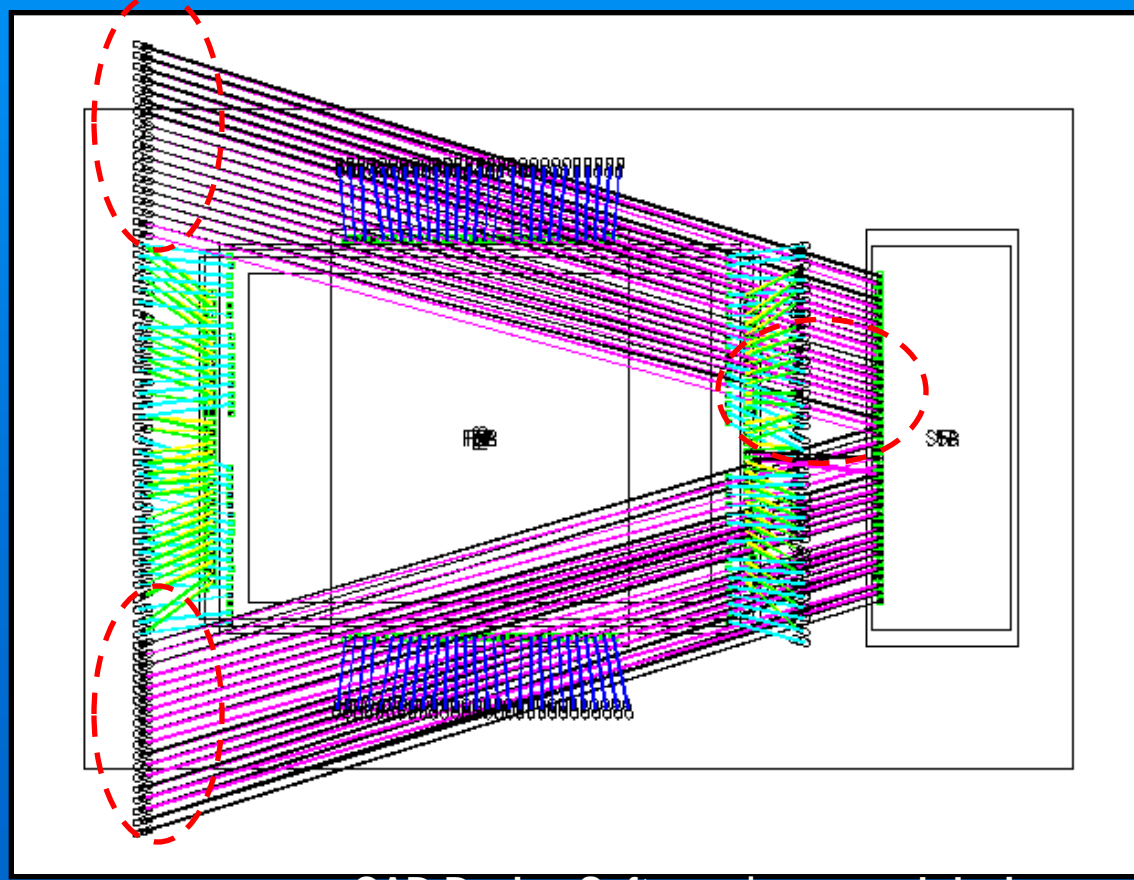
Delete

SBPs

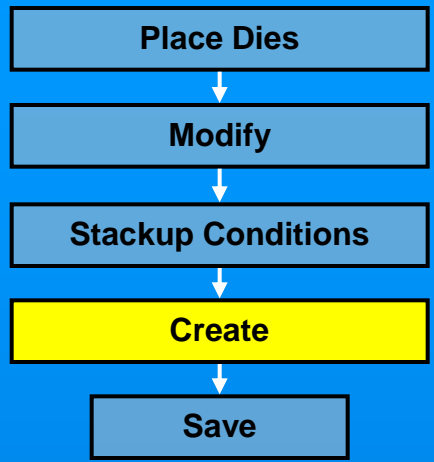
DBPs

Wires

Zoom Out After Placing



STEP 7: Adjust the Fanout Pattern



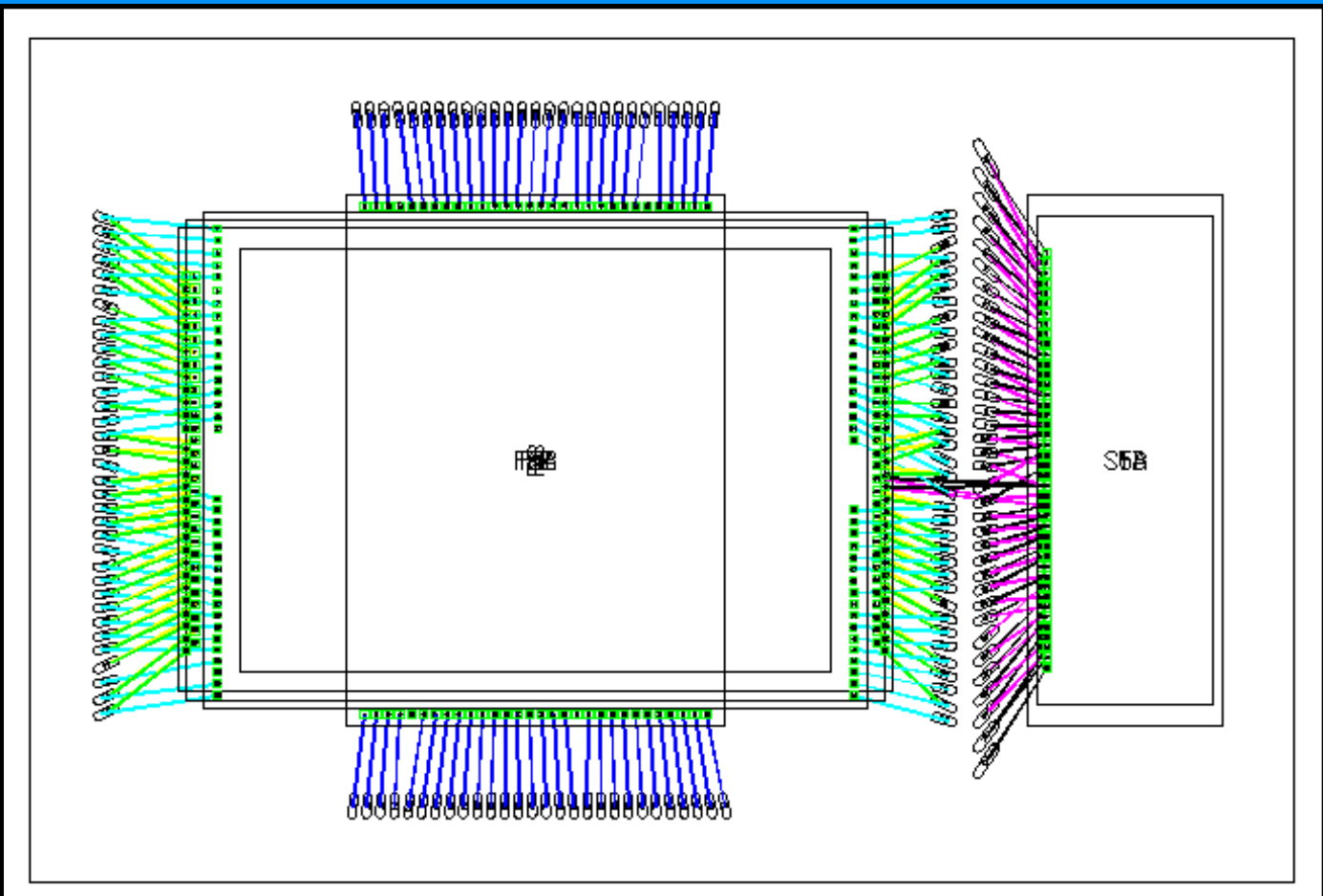
First, a new group is defined (left2),...
 Then, new parameters are specified for the new group.
 Now, the pads for the SRAM are selected,...
 And changed to the new group.
 After a new Calculate pass, the pads are placed once again.

SBP Groups (Step 2)

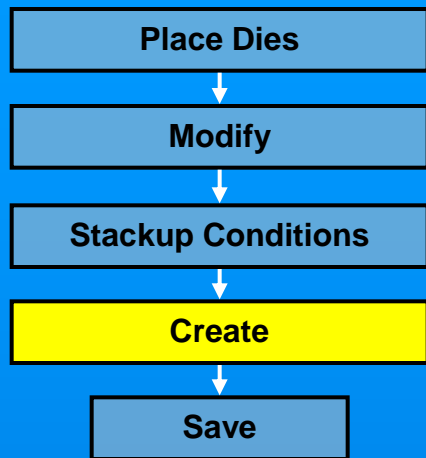
#	Group	Component
1	1	
2	2	
3	3	
4	4	
5	5	

General Substrate Bond

#	SBP	Pin #	Net
1	64	21	NET0
2	65	20	NET0
3	66	19	NET0
4	67	18	NET0
5	68	17	NET0
6	69	16	NET0
7	70	15	NET0
8	71	14	NET0



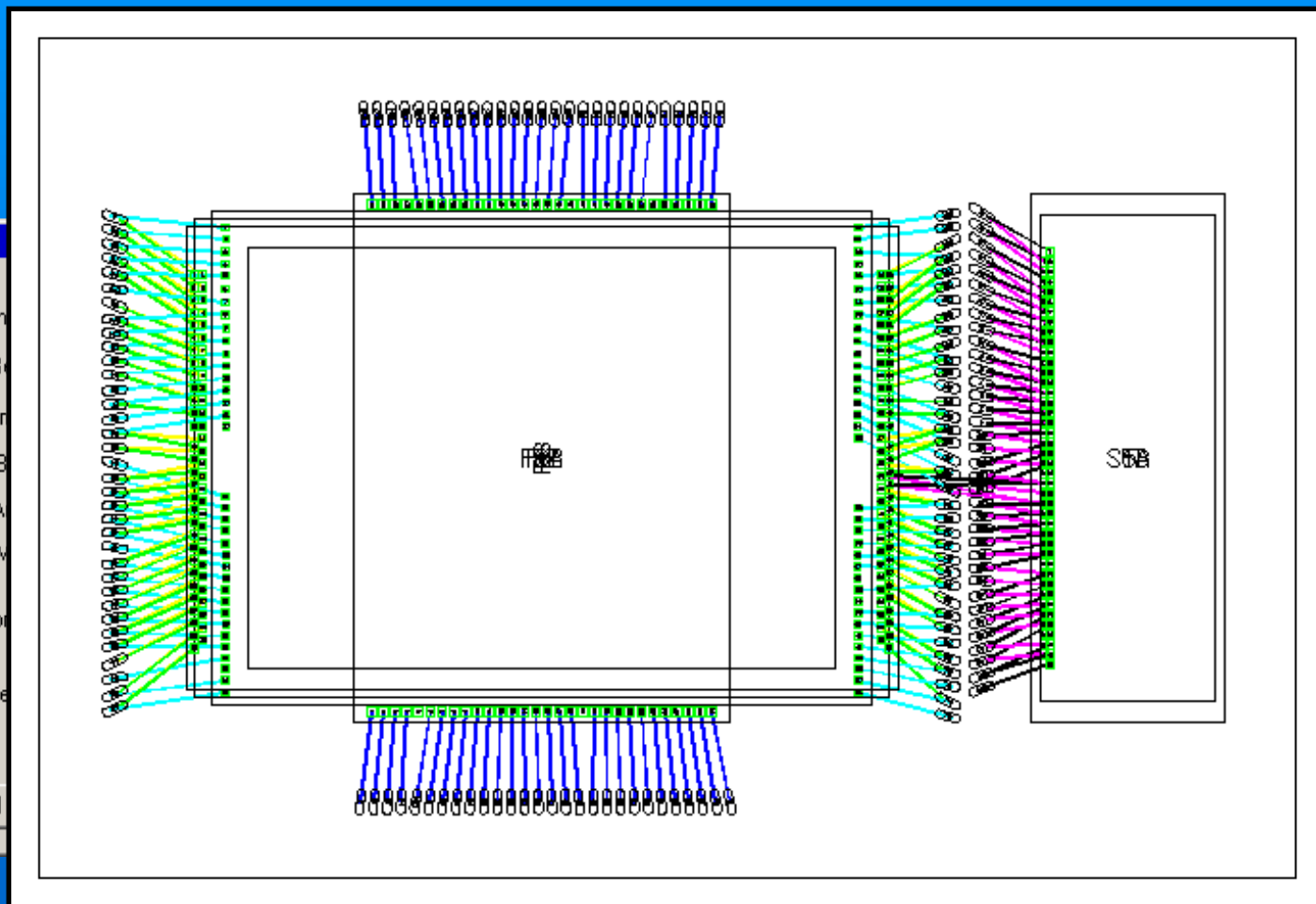
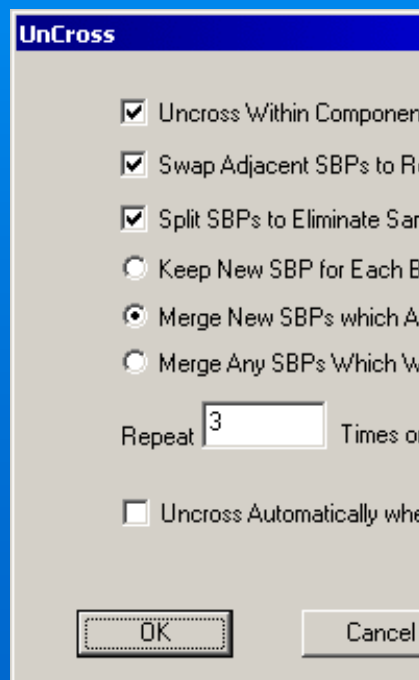
STEP 7: Optimize the Pattern (remove crossovers)



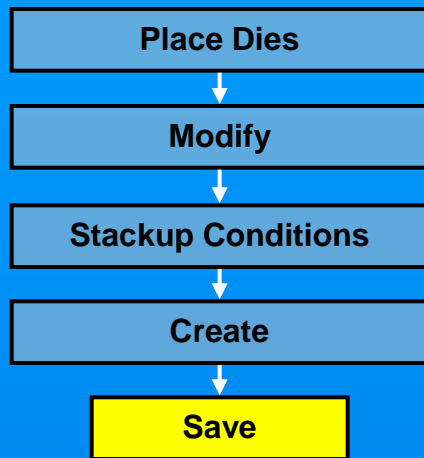
But there are still some crossover problems,...

The Uncross function is used,...

And the system automatically sorts and uncrosses the wires.



STEP 8: Save the MCM pattern

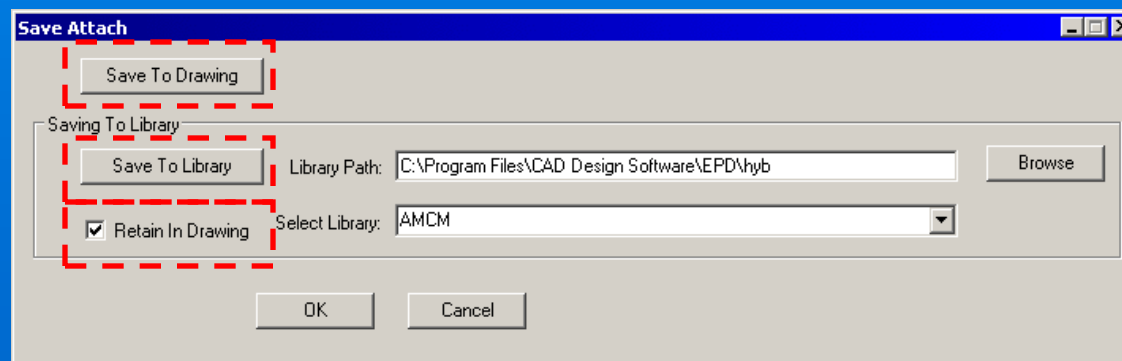


Now that the pattern is complete, it is saved,...

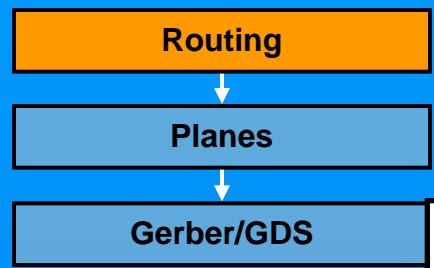
Either to the current drawing,...

To the die library,...

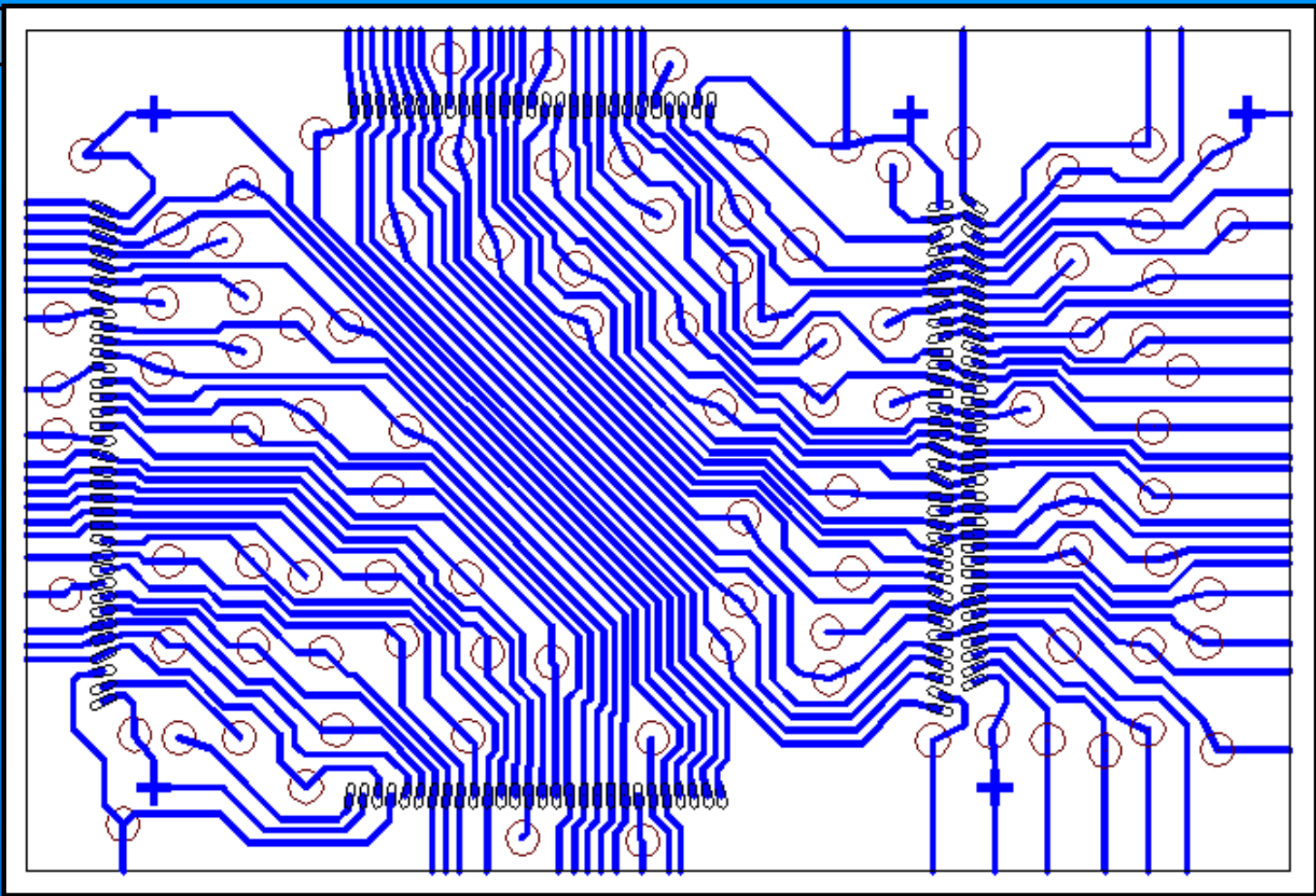
Or to both.



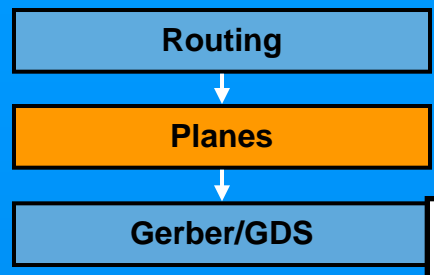
STEP 9: Substrate Design



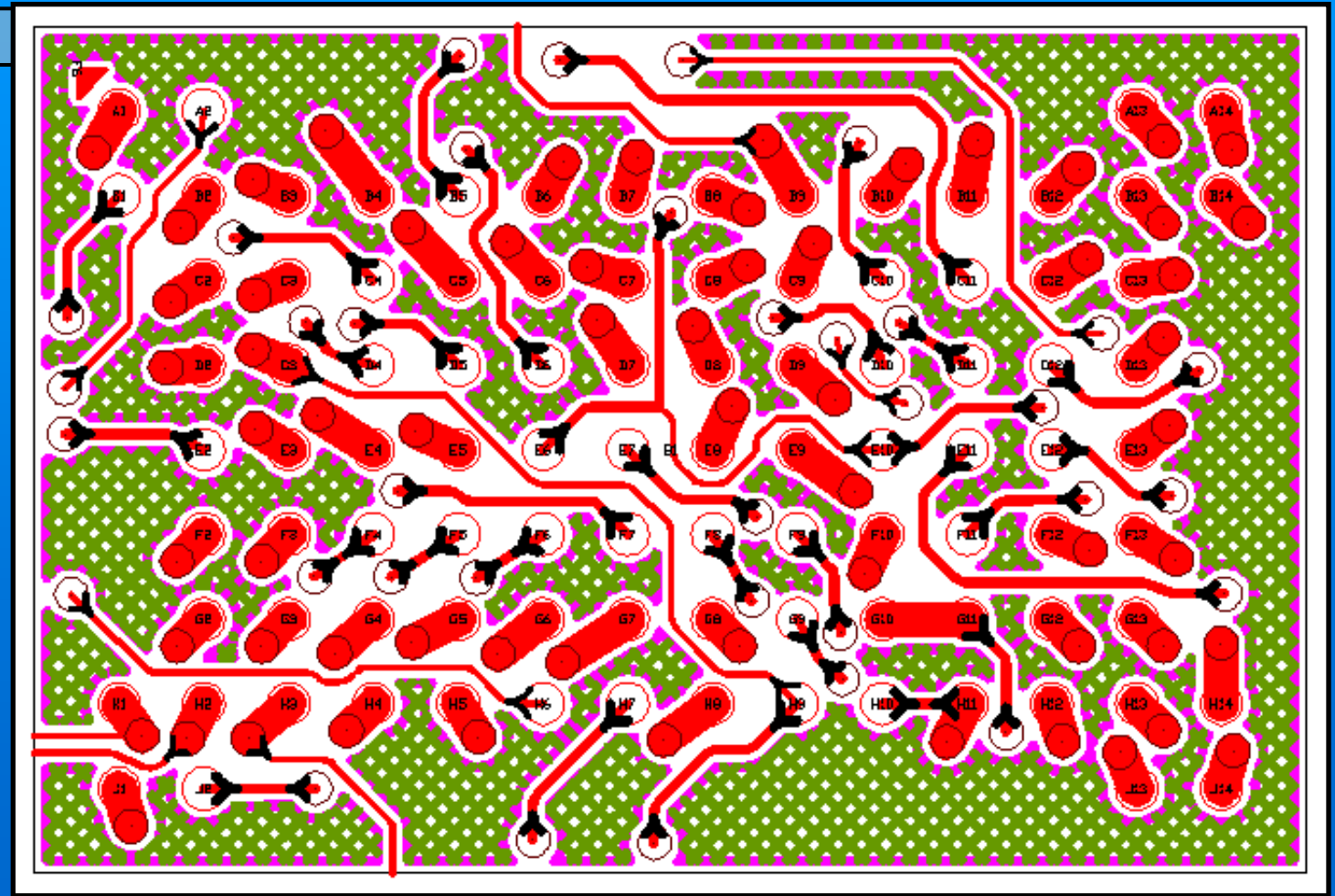
After bondwire analysis, the package is ready for routing,...



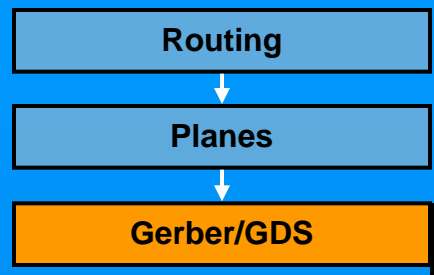
STEP 9: Substrate Design



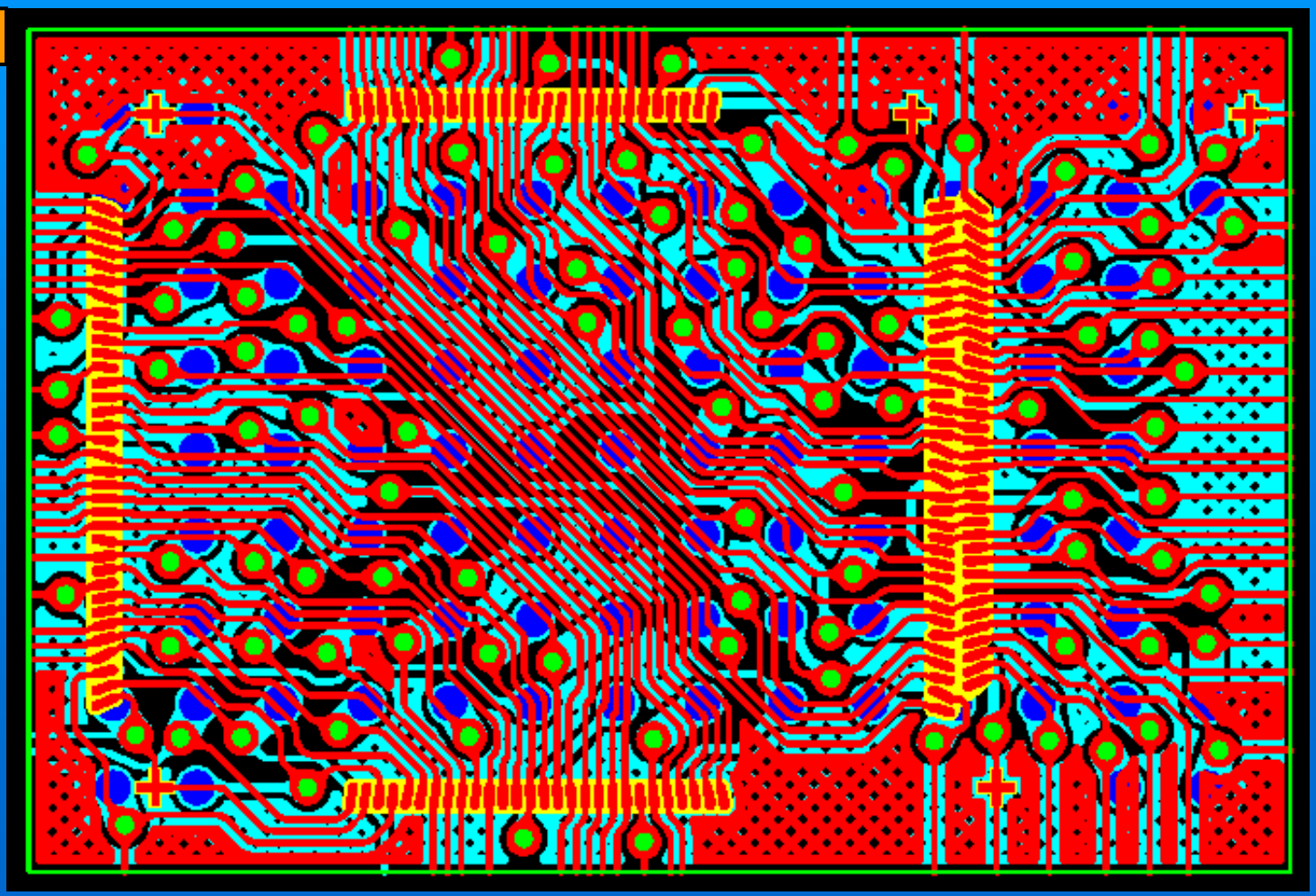
Ground Planes,...



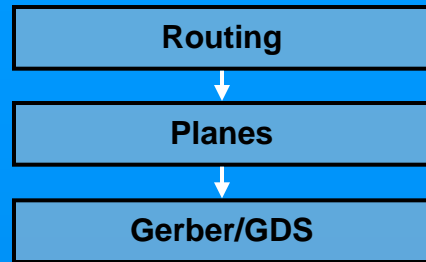
STEP 9: Substrate Design



And fabrication artwork.



STEP 9: First to market!



The design is finished ahead of the competition, thanks to a concurrent design methodology.

The design is finished correctly the first time,...

Without multiple design spins,...

As a result of collaboration between all designers and engineers involved in the project.

