

NX PCB.xchange

PCA Modeling & Exchanging Data With ECAD Systems

Mouloud Bourbel

Maya Heat Transfer Technologies Ltd.

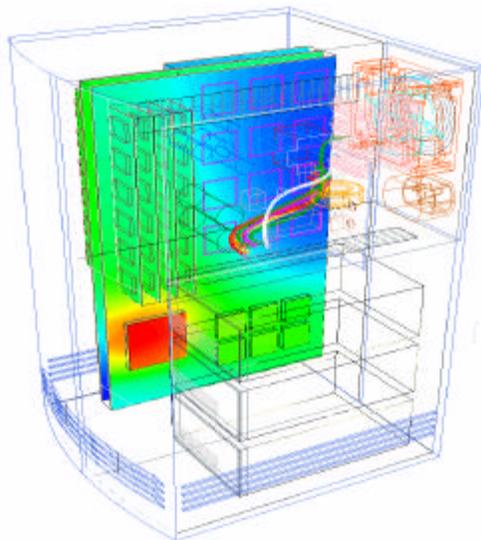
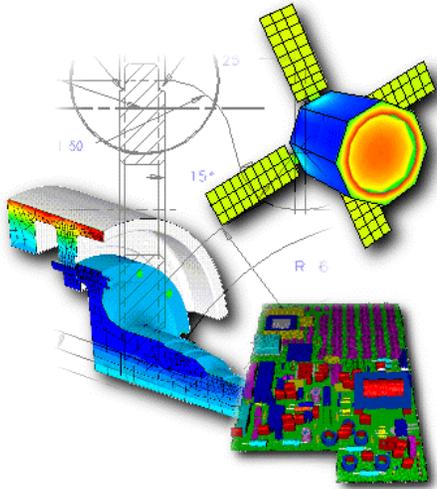
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Maya Heat Transfer Technologies Ltd.



- ❑ Founded in 1982
 - Headquarter in Montreal
 - Offices in Boston, Dallas & Phoenix

- ❑ Leading supplier of advanced thermal, fluid flow and structural analysis software

- ❑ Long-term partnership with UGS

MAYA's Authored Products

Fully integrated software solutions for I-DEAS, FEMAP and NX

I-DEAS & Femap TMG

NX Thermal

NX Space Systems Thermal

➤ Simulate nonlinear and transient heat transfer processes including coupled conduction, radiation, free and forced convection. 1D duct flow hydraulic networks. Material phase change. Solar/Orbital heating, ray-tracing, view-factors, shadowing, ray-tracing,...

I-DEAS & Femap Electronic Systems Cooling

NX Electronic Systems Cooling

NX Flow

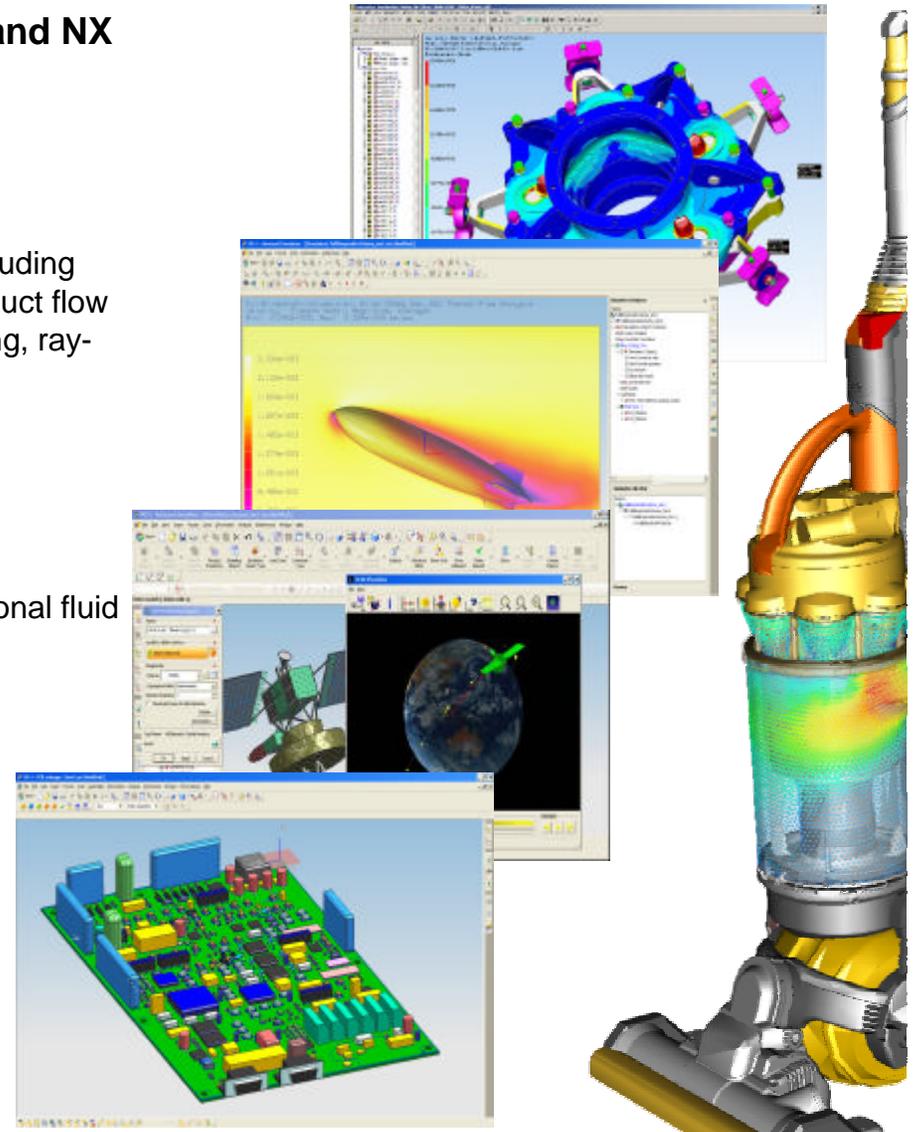
➤ Provide a powerful and comprehensive solution to computational fluid dynamics (CFD) problems.

I-DEAS & NX FE Translators

➤ FE Data Interface to NASTRAN, ABAQUS, ANSYS

I-DEAS & NX PCB.modeler & PCB.xchange

➤ Bring electrical and mechanical design together



Typical PCB Design Process

ECAD PCB Design

Define the Initial Board Profile

Place the remaining Components

Route the Board

MCAD Design

Determine the initial Board Profile

Pre-place Connectors, Critical Components & Mechanical Parts

Assembly Fit and Tolerance

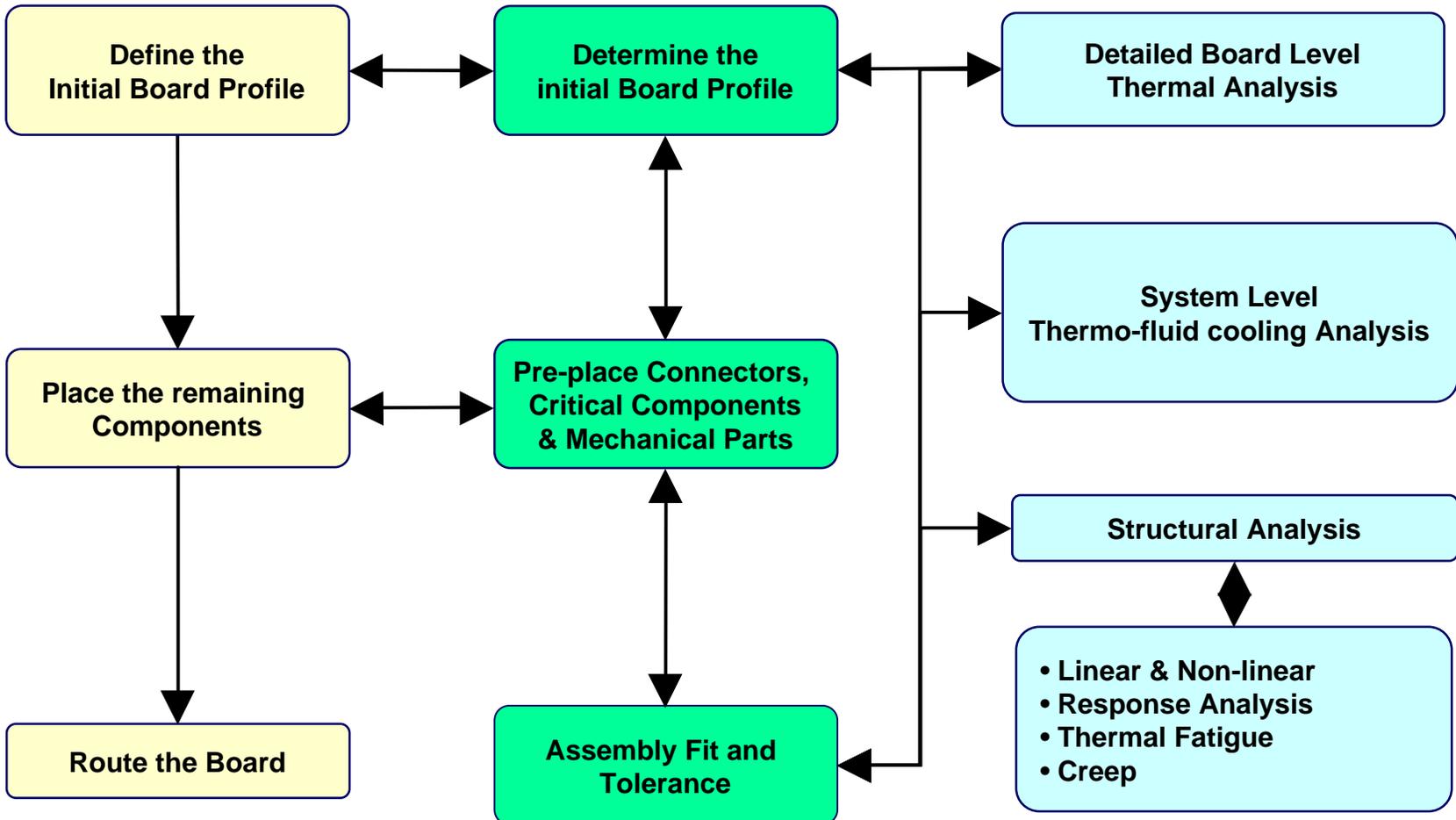
Simulation

Detailed Board Level Thermal Analysis

System Level Thermo-fluid cooling Analysis

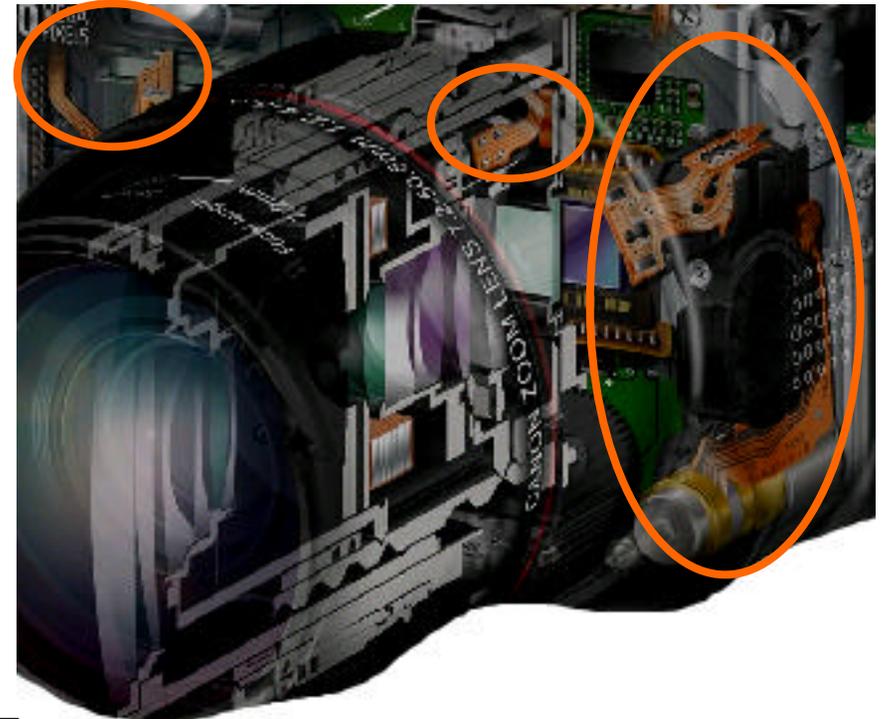
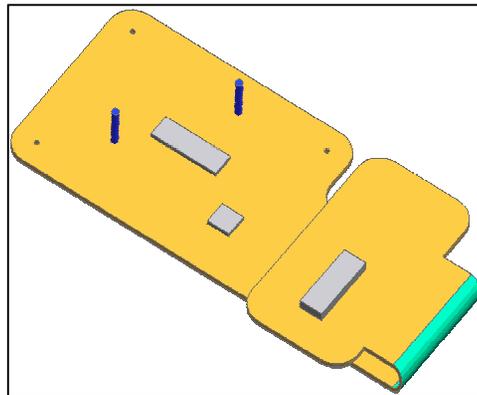
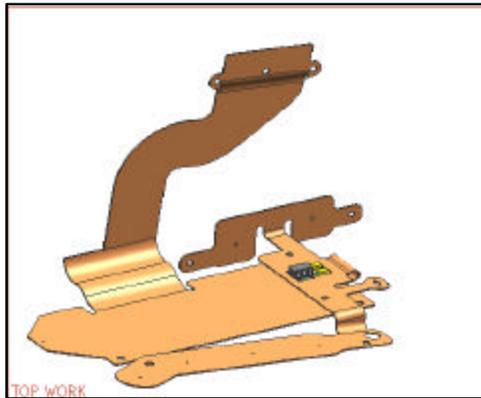
Structural Analysis

- Linear & Non-linear
- Response Analysis
- Thermal Fatigue
- Creep



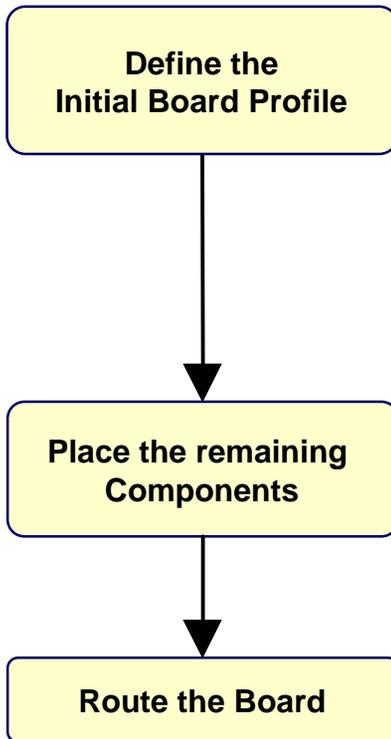
Flexible PCs

- ❑ Designed to bend around tight corners and fit in cramped spaces
- ❑ Used to solve packaging problems
- ❑ Designed as all flex or combination of rigid & flex
- ❑ Used across multiple industries (Consumer Electronics, Automotive, Aerospace, Medical Instruments, Telecommunications, Etc.)

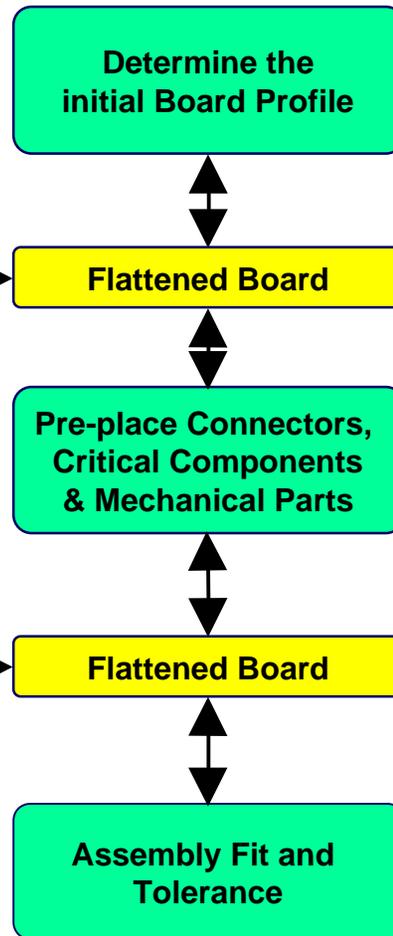


Typical Design Process for FPCs

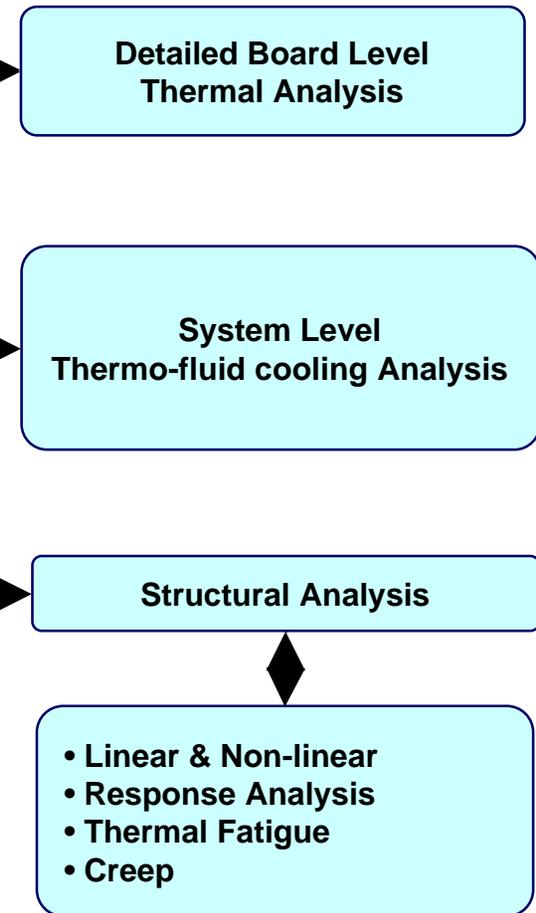
ECAD PCB Design



MCAD Design

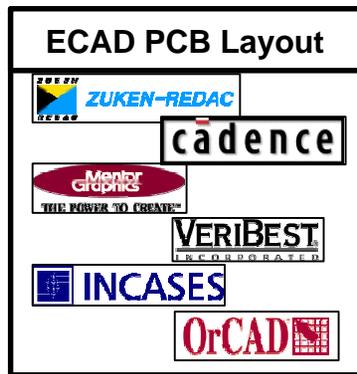


Simulation

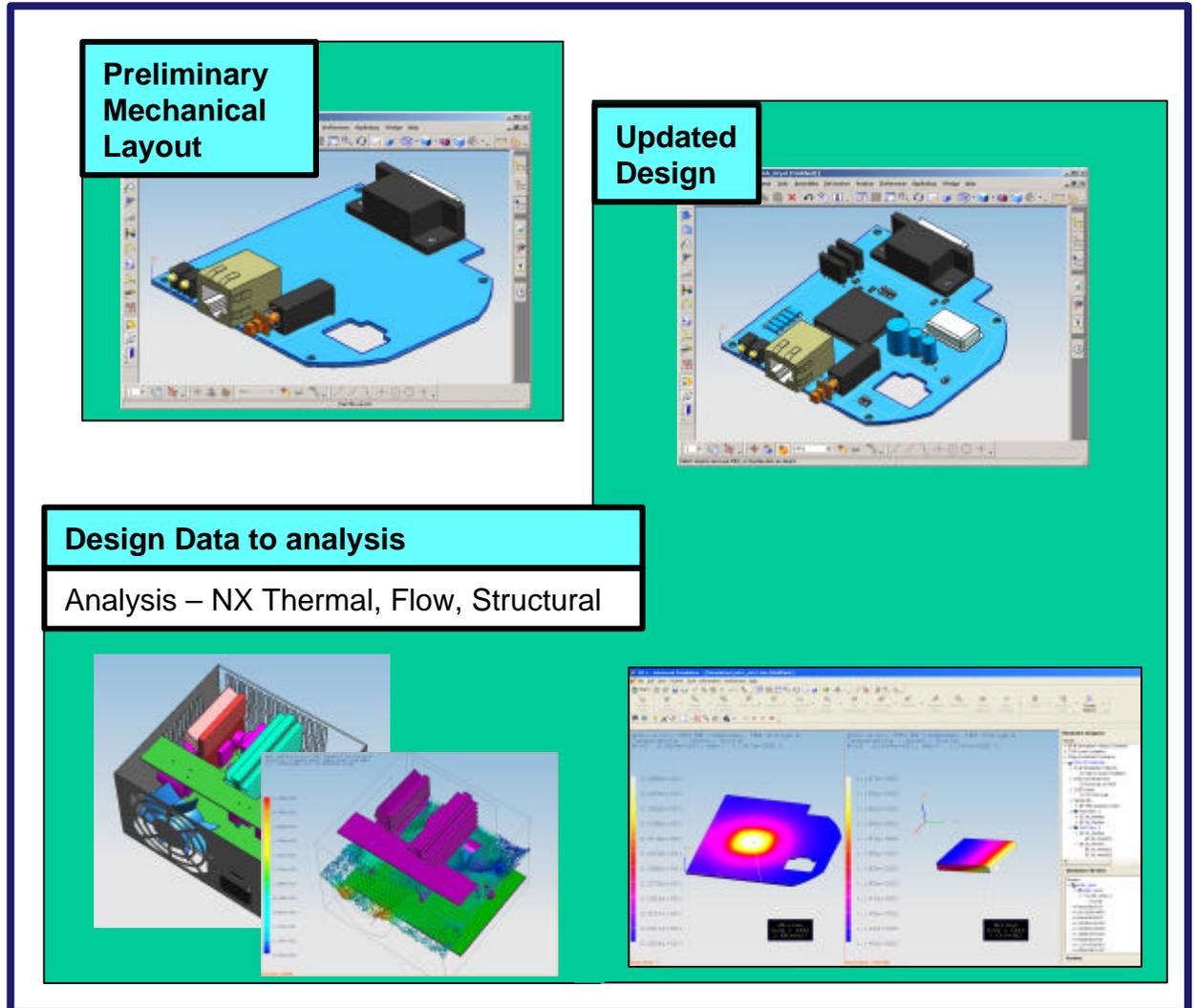


Typical Managed Design Process in NX

ECAD PCB Design



NX MCAD Design & Simulation



Intermediate Data Format “IDF”

- ❑ Many Standards such as IGES, DXF,... do not contain the semantic content to communicate PCA product design data

Step & IDF

- ❑ Bridge the gap between ECAD, MCAD and CAE with rich definition of PCA design
- ❑ **PCB.xchange uses IDF**

Why IDF ?

1. Historical reasons

- IDF was developed by UGS (formerly SDRC) & Mentor
- PCB.xchange successor of I-DEAS Open Data PCB

2. Widely Used

- Supported by all major MCAD and ECAD vendors

IDF Data Contents

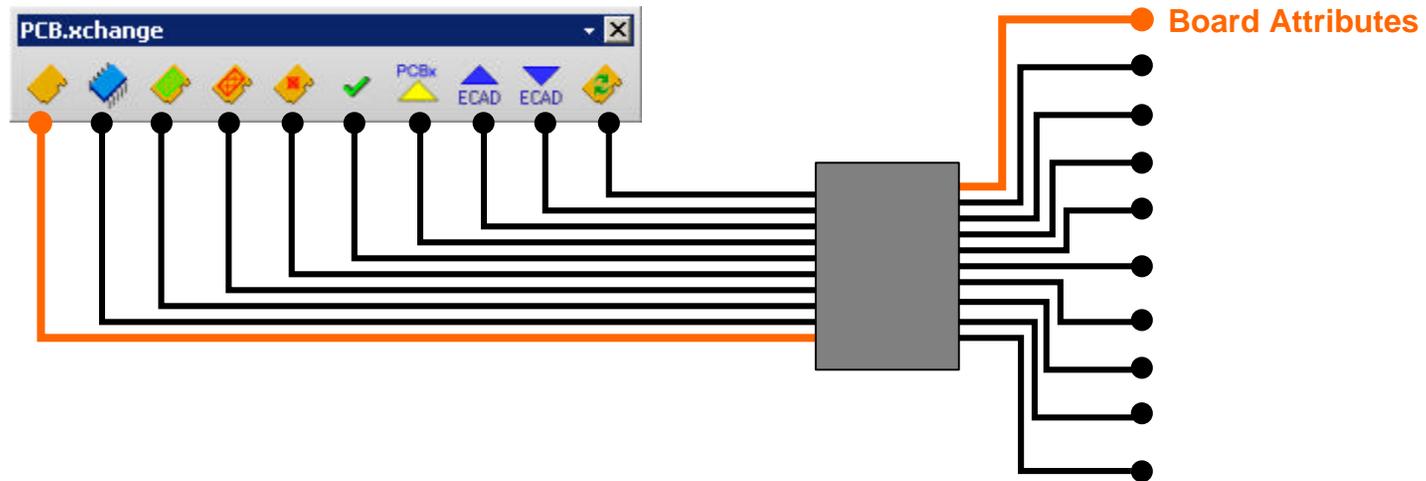
Entity Type	IDF 2	IDF 3	IDF 4
Panel Assembly Definitions & Instances	Not supported	Partially Supported	Fully Supported
Board Assembly Definitions & Instances	Fully Supported	Fully Supported	Fully Supported
Panel Part Definitions & Instances	Not supported	Partially Supported	Fully Supported
Board Part Definitions & Instances	Fully Supported	Fully Supported	Fully Supported
Component Part Definitions & Instances	Fully Supported	Fully Supported	Fully Supported
3D Part Shapes with Cutouts & Cavities	Partially Supported	Partially Supported	Fully Supported
Holes (Mounting, Tooling, Pin, Via)	Partially Supported	Partially Supported	Fully Supported
Conductors (Pads, Traces, Filled Areas)	Not supported	Not supported	Fully Supported
Routing & Placement Outlines	Fully Supported	Fully Supported	Fully Supported
Keepouts (Routing, Trace, Via)	Fully Supported	Fully Supported	Fully Supported
Graphics	Not supported	Not supported	Fully Supported
Annotations	Not supported	Partially Supported	Fully Supported
Figures	Not supported	Not supported	Fully Supported
Footprints	Not supported	Not supported	Fully Supported
Sublayouts	Not supported	Not supported	Fully Supported
Component Thermal Characteristics	Not supported	Partially Supported	Fully Supported
Board Design Variants	Not supported	Not supported	Fully Supported
Miscellaneous Properties	Not supported	Not supported	Fully Supported
Entity Owners	Not supported	Partially Supported	Fully Supported

Not supported

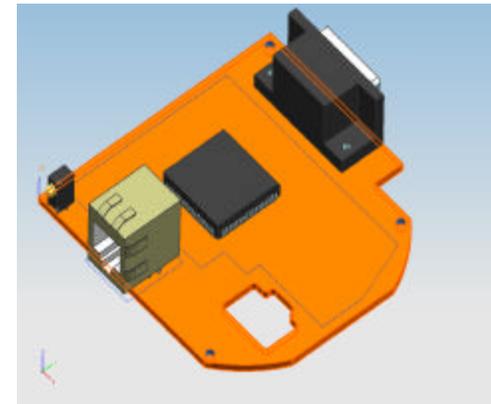
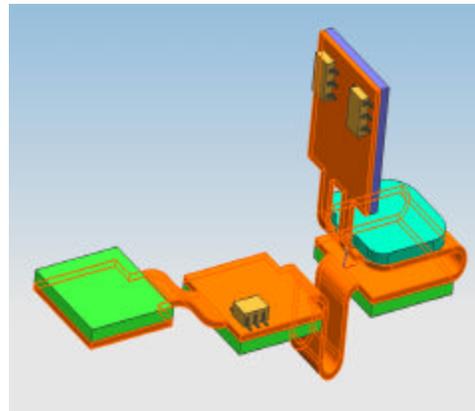
Partially Supported

Fully Supported

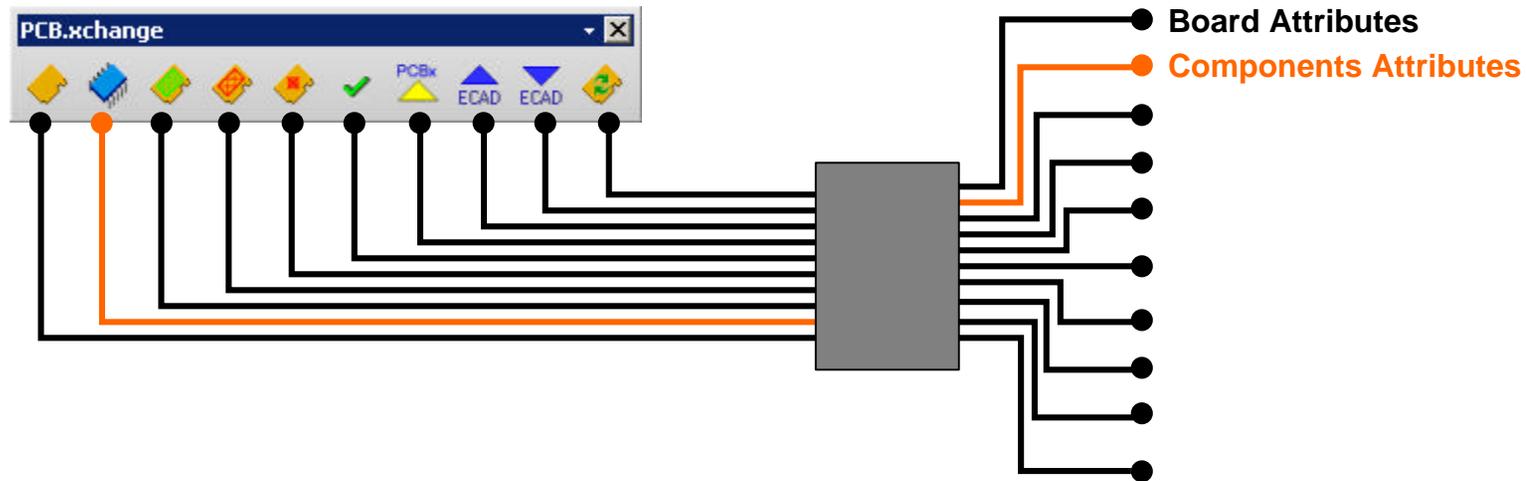
NX PCB.xchange



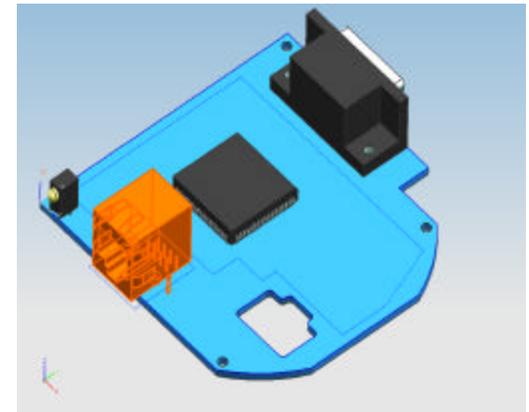
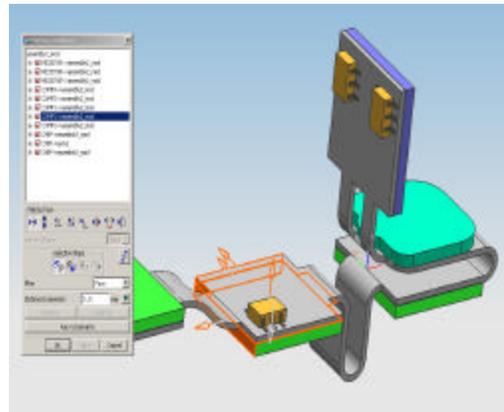
- The Board Identification, Rigid or Flex
- The Board CSYS, Ownership and Revision.



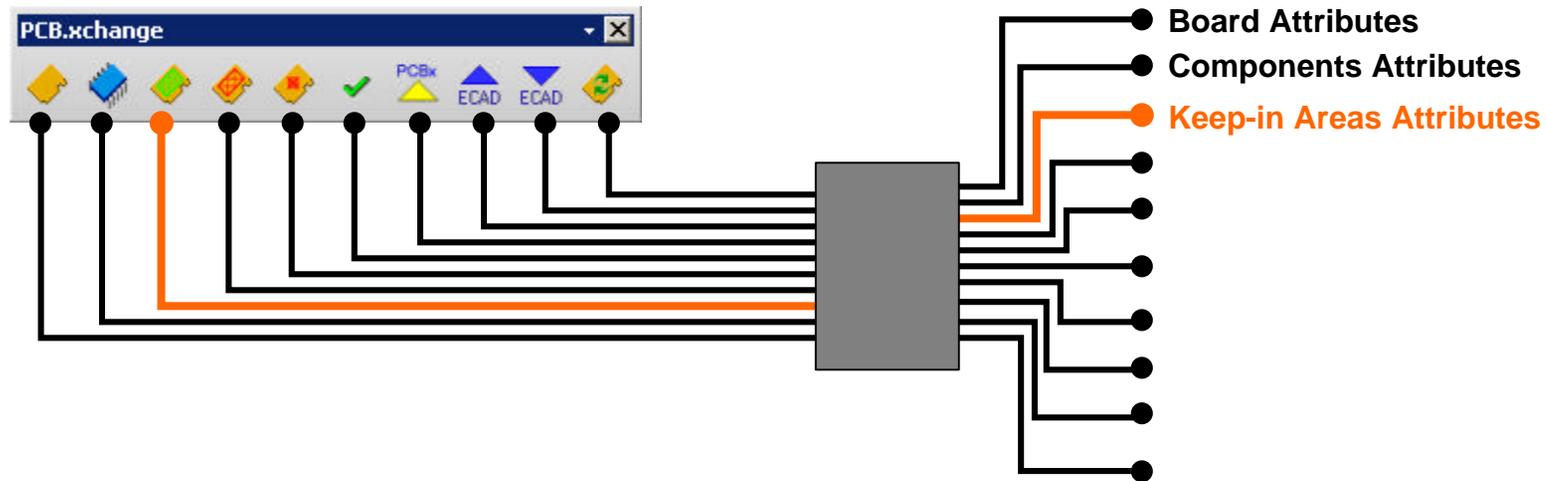
NX PCB.xchange



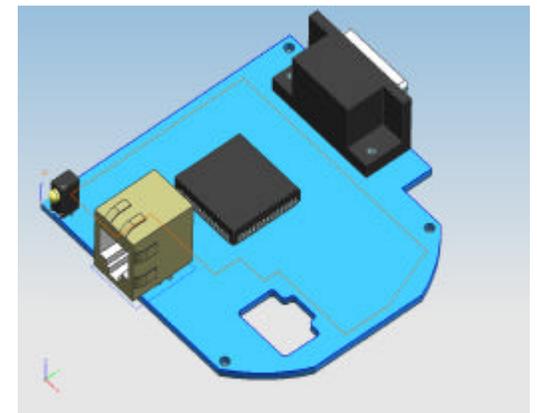
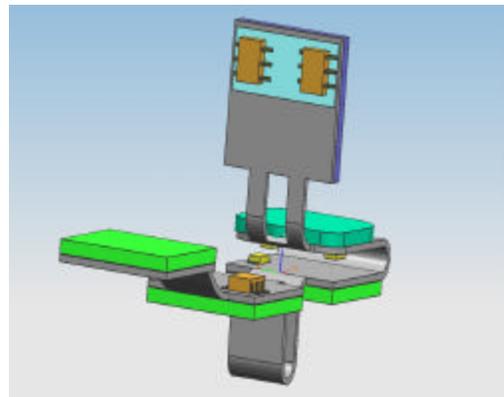
- Components Identification
- Part Number
- Components Lock Information
- Components Ownership



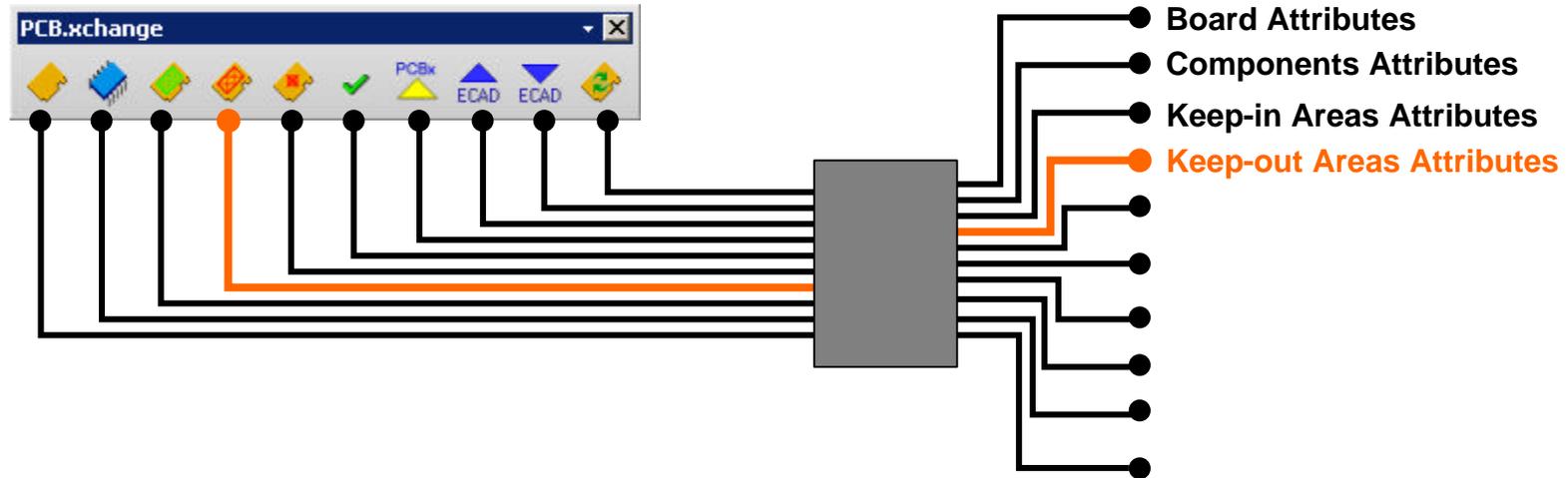
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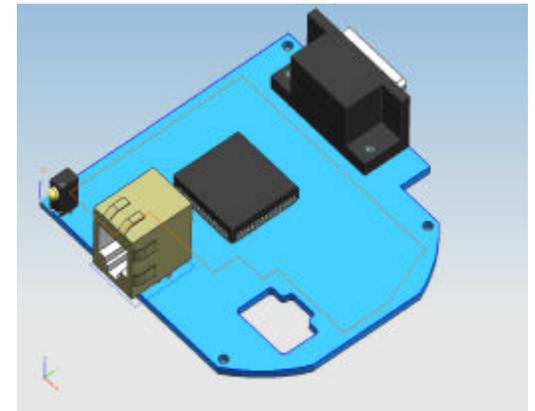
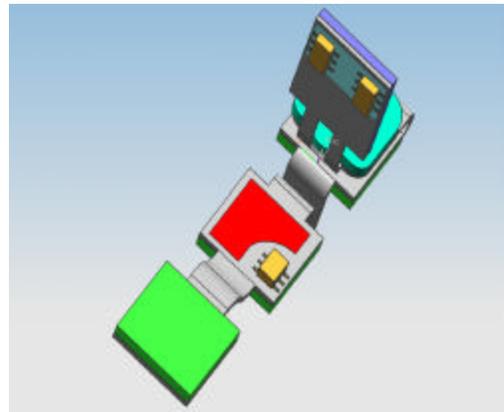
- Placement, Routing or Other Outlines
- Placement Group Areas
- Name, Height, Layer and Ownership



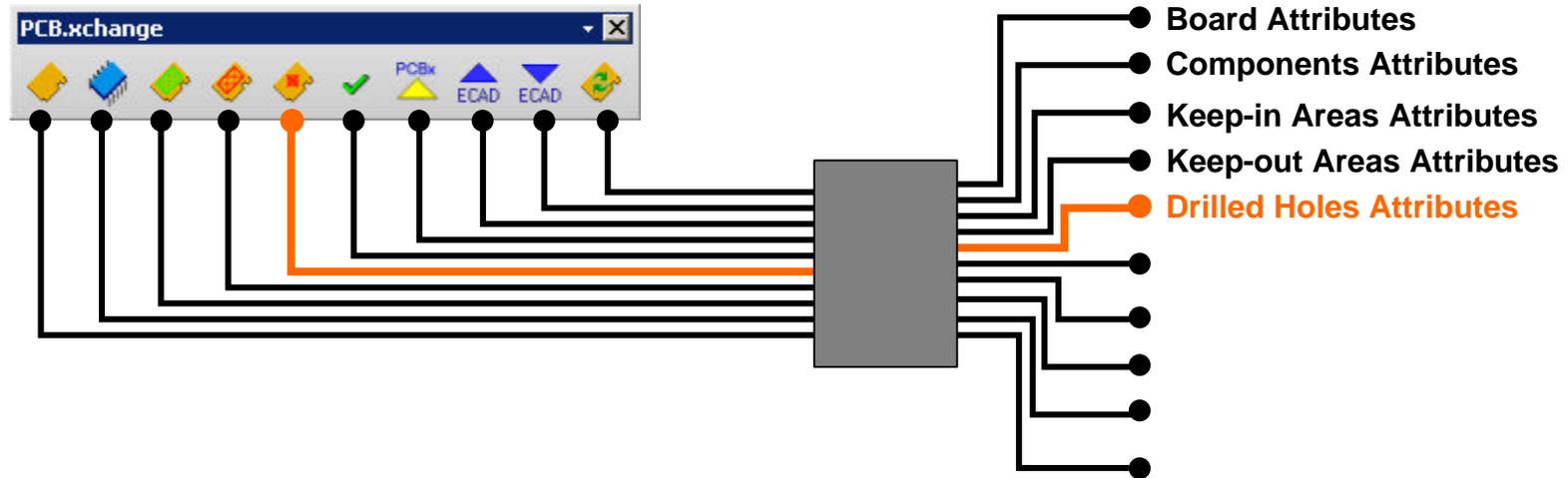
NX PCB.xchange



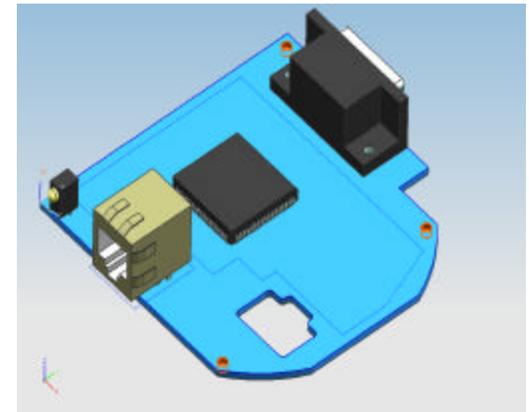
- Placement, Routing or Via Keep-outs
- Height, Layer and Owner



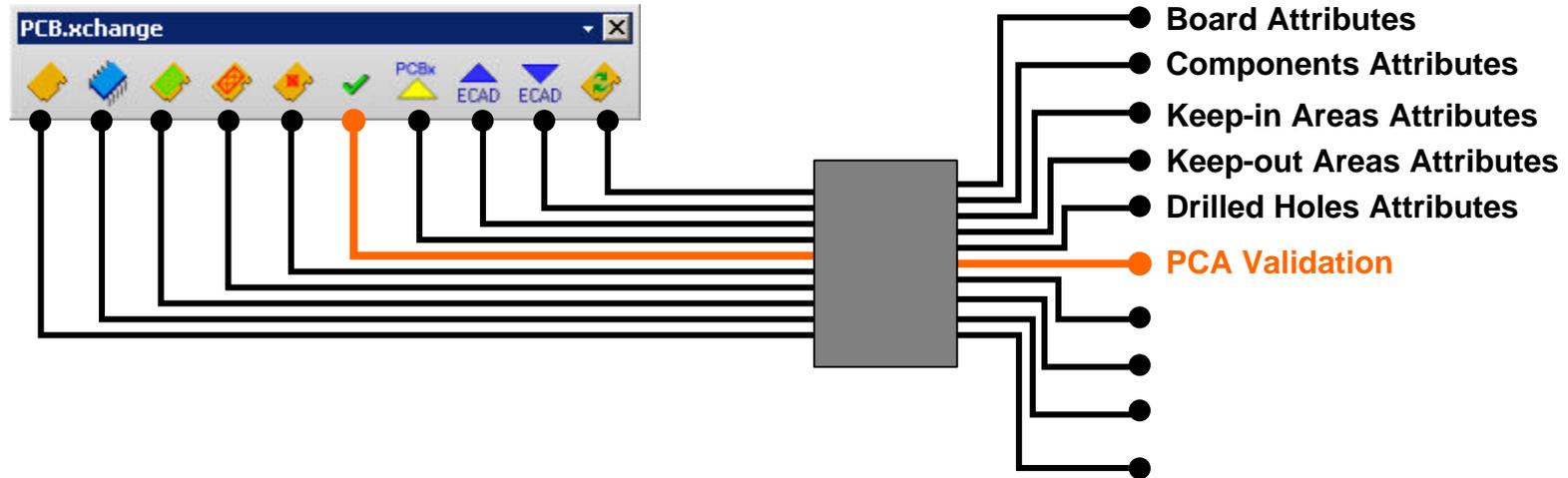
NX PCB.xchange



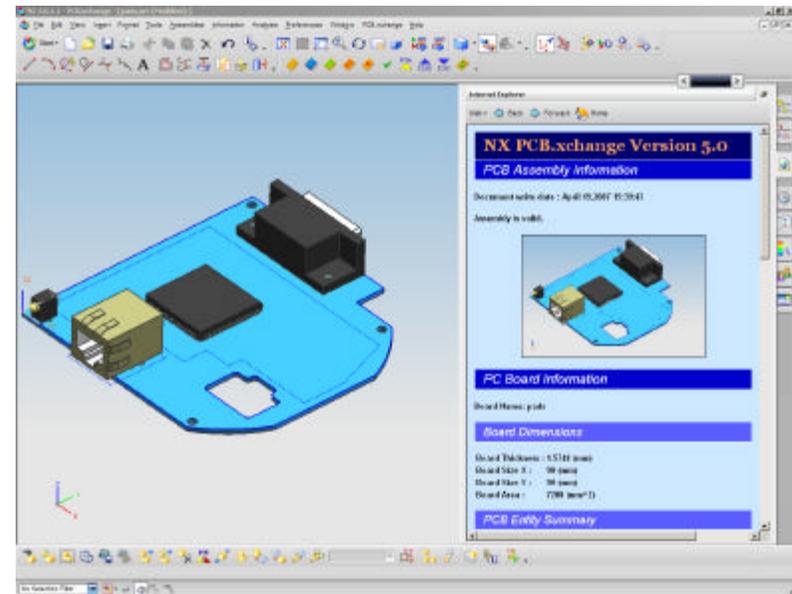
- ❑ Pin, Via, Mounting, Tooling and Other holes
- ❑ Hole's Plating Style, Associated Part & Ownership



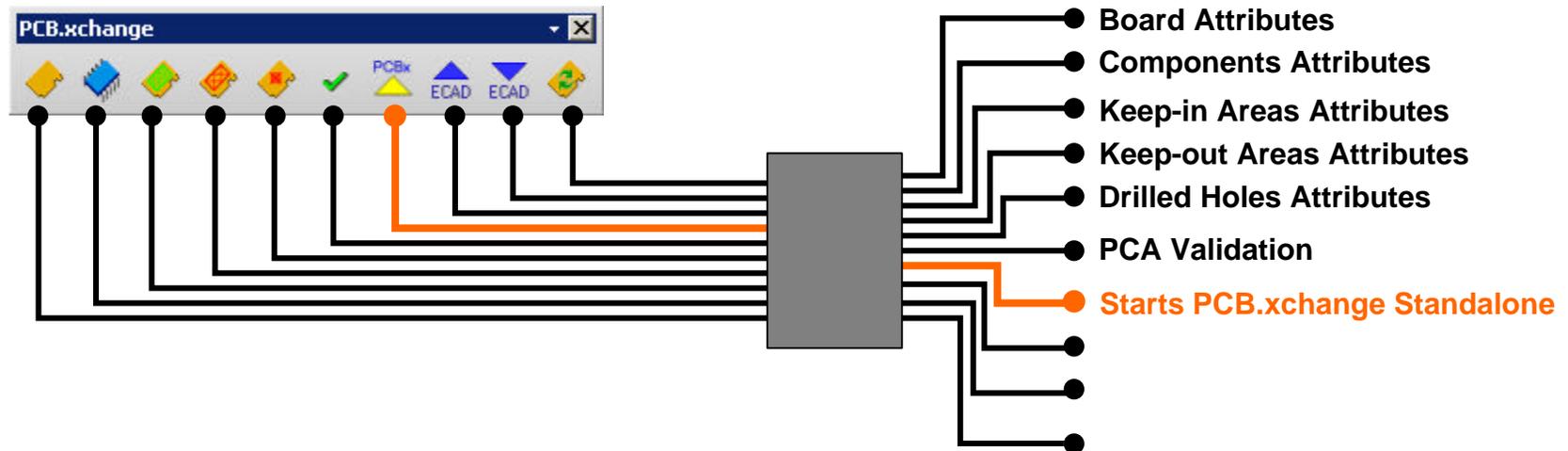
NX PCB.xchange



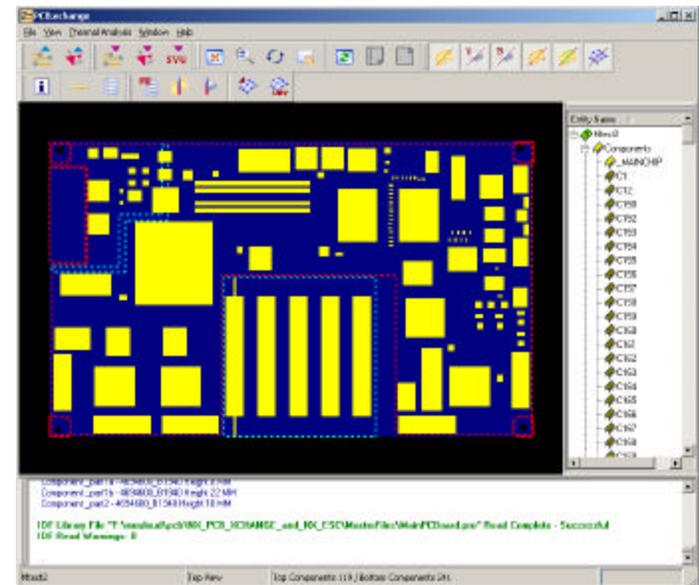
- ❑ Validates the PCA
- ❑ Generates Detailed HTML Report
 - Assembly & Board Information
 - Drilled Holes
 - Restriction Areas
 - Components Information
 - BOM



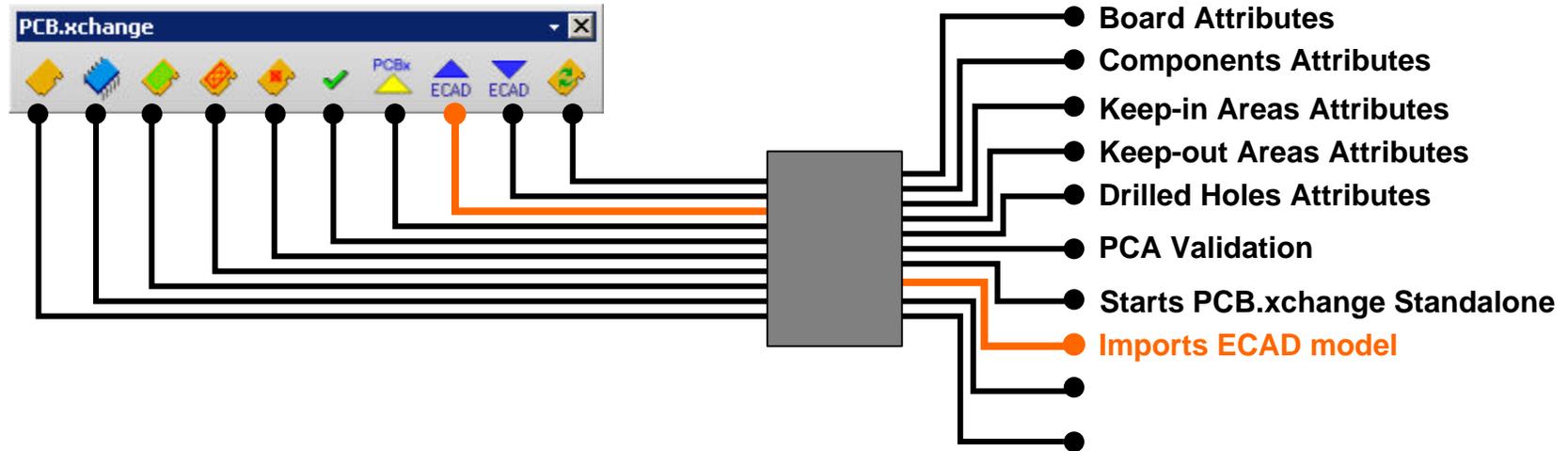
NX PCB.xchange



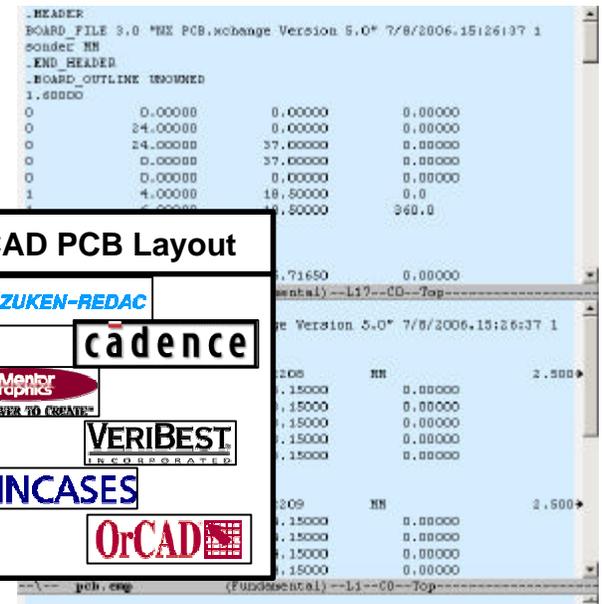
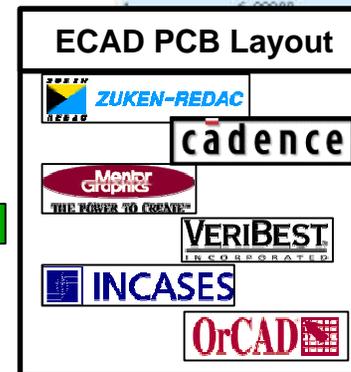
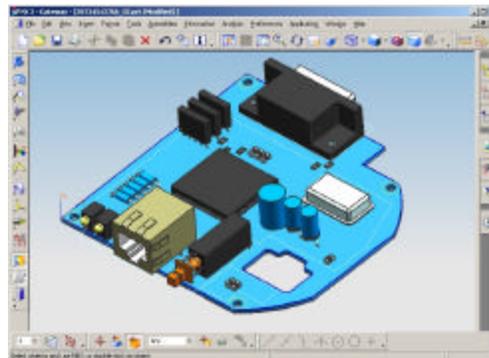
- ❑ Launches PCB.xchange standalone
- Fast creation of NX Assembly Parts from ECAD models
- Generate ECAD models from NX Assemblies
- Data Filtering in both ways
- Preserves Data between NX and ECAD systems
- Models preview



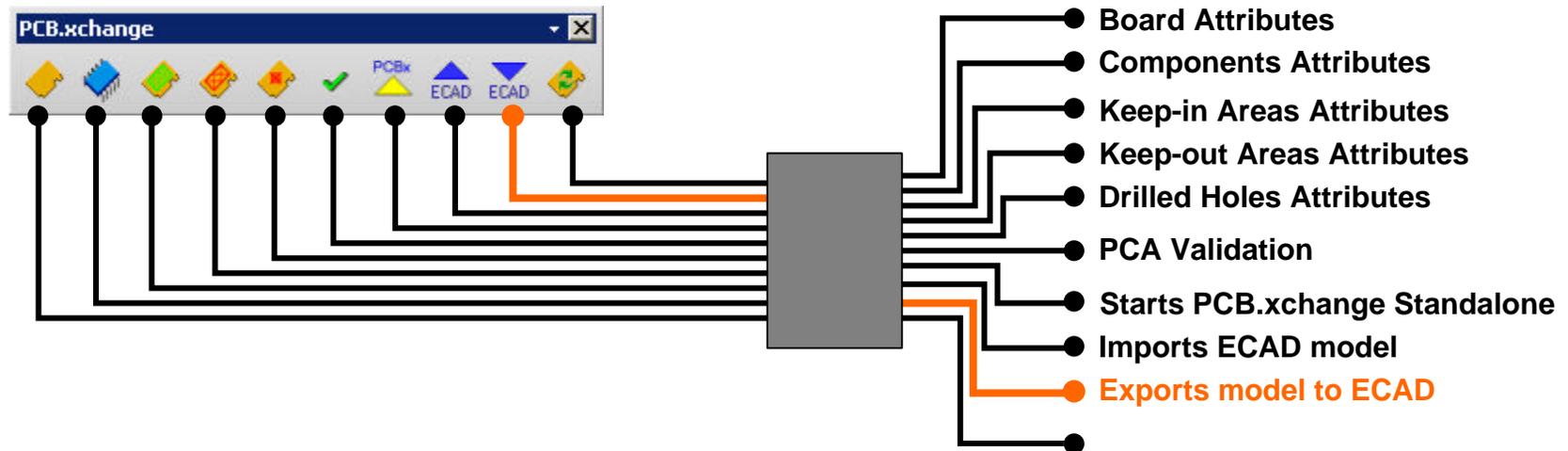
NX PCB.xchange



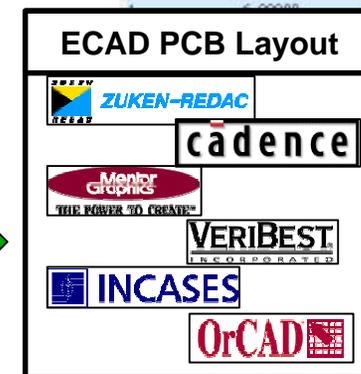
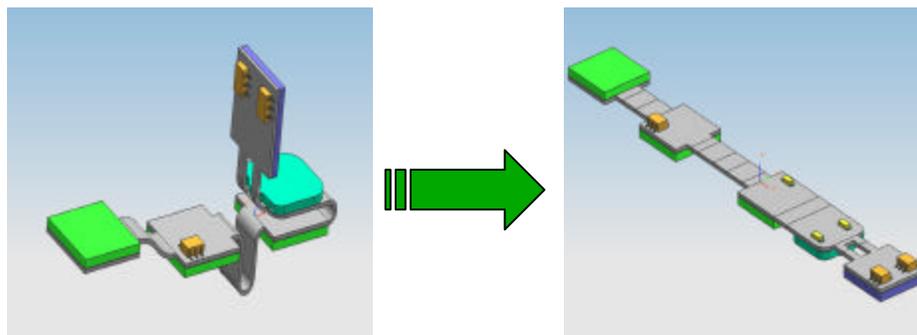
- ❑ Fast Creation of NX assemblies from ECAD model definition
- ❑ Provide Filtering of unwanted design entities
- ❑ Detailed Components from Teamcenter or User's Libraries



NX PCB.xchange



- ❑ Exports NX PCA to any ECAD System
- ❑ Provide Filtering of unwanted design entities

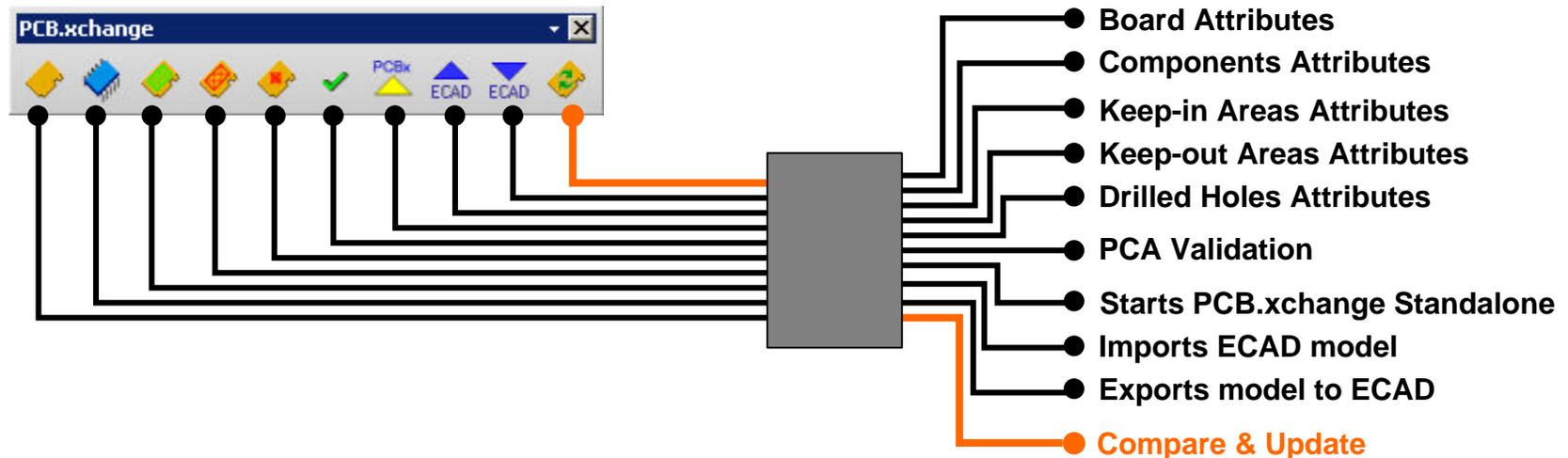


```

.HEADER
BOARD_FILE 3.0 *NX PCB.xchange Version 5.0* 7/8/2006.15:26:37 1
SOURCE NH
.END HEADER
.BOARD_OUTLINE UNOWNED
1.0000
0 0.0000 0.0000 0.0000
0 24.0000 0.0000 0.0000
0 24.0000 37.0000 0.0000
0 0.0000 37.0000 0.0000
0 0.0000 0.0000 0.0000
1 4.0000 18.5000 0.0
1 7.0000 18.5000 360.0
0.71650 0.0000
(Principal) --L17--C0--Top
NX PCB.xchange Version 5.0* 7/8/2006.15:26:37 1
208 NH 2.500
.15000 0.0000
.15000 0.0000
.15000 0.0000
.15000 0.0000
209 NH 2.500
.15000 0.0000
.15000 0.0000
.15000 0.0000
.15000 0.0000

```

NX PCB.xchange



A complete design requires many iterations between MCAD & ECAD

In each iteration:

- Identify changes
- Update the initial model

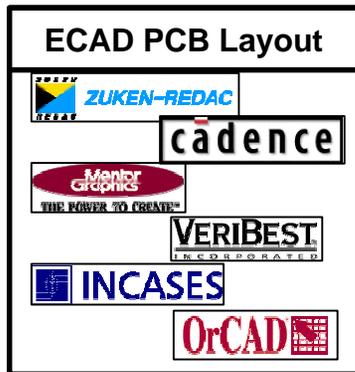
□ PCB.xchange offers Compare & Update Utilities

- Elimination of tedious work
- Faster turnaround time
- Elimination of errors

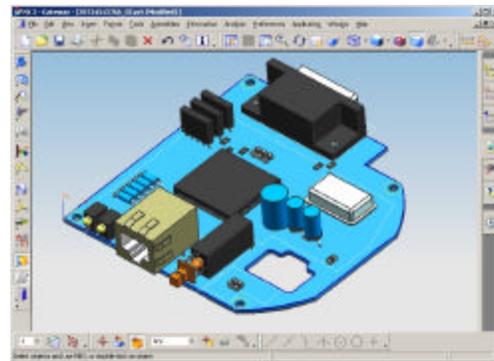


Data Management – NX Native

- ❑ Component parts found in the user's libraries are automatically used
- ❑ New components are created from their ECAD footprints



NX Native



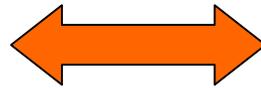
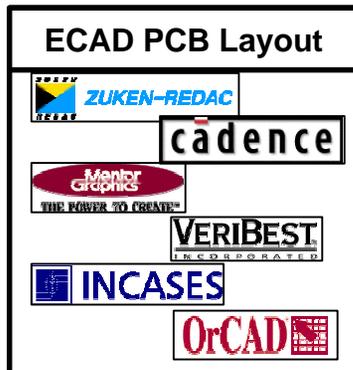
User's Lib 1

User's Lib N

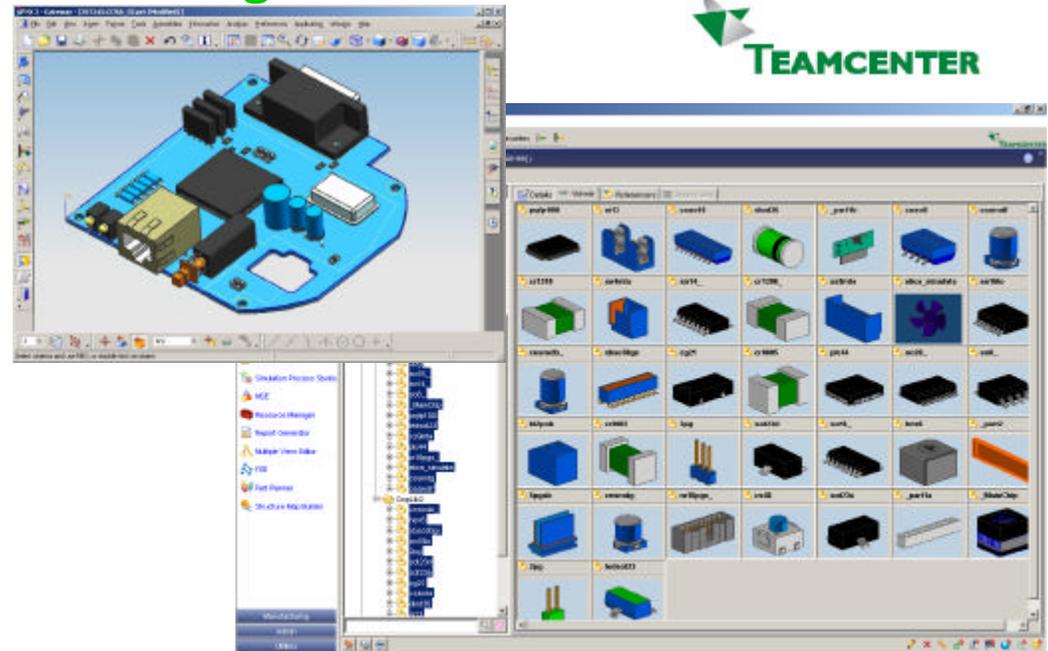
...

Data Management – Teamcenter

- ❑ Component parts found in Teamcenter database are automatically used
- ❑ New components are created from their ECAD footprints
- ❑ PC Assembly is created directly in Teamcenter Database



NX Manager



Component Mapping

- ❑ PCB.xchange provides a mapping utility to map ECAD component names/numbers to NX Parts

```
#  
# Map from ECAD to NX  
# ECAD name, ECAD number, NX name, NX number  
#  
RES_H, PN1234, RES-H, 1234      # horiz mount resistor  
RES_H, PN5678, RES-H, 5678     # if pckg same for PN1234 & PN5678  
RES_H, PN9876, RES-H-9876, 9876 # package diff than RES-H  
RES_V, PN1234, RES-V, 1234     # same number, but vert mounting
```

In this Example:

- ECAD components RES_H and Number PN1234, PN5678 both use Part RES-H in NX, maintain Part Number
- ECAD PN9876 has same package name in ECAD but physically different so use different NX part
- ECAD RES_V is a vertical mount, so use different part in NX to represent this

- ❑ PCB.xchange provides also mapping from NX to ECAD

```
#  
# Map from NX to ECAD  
# NX name, NX number, ECAD name, ECAD number  
#  
RES-H, *, RES_H, PN$          # all horiz mount resistor  
RES-H-9876, *, RES_H, PN9876  # package diff than RES-H  
RES-V, *, RES_V, PN$          # same number, but vert mounting
```

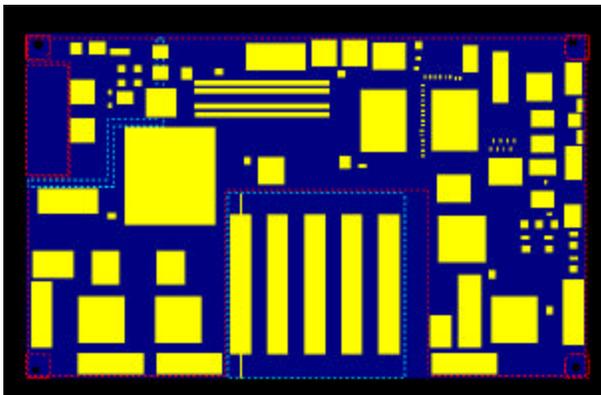
Simplification - Filtering

- ❑ You don't always want to transfer all features and components between MCAD & ECAD
- ❑ Filtering could be done by PCB.xchange when exporting or importing data

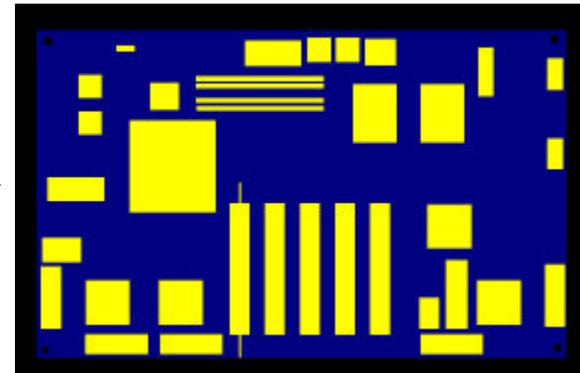
Examples:

- Eliminate small pin holes from ECAD
- Eliminate small surface mount components, they have no impact on the mechanical layout, add unnecessary complexity to the assembly.
- Eliminate components based on names, numbers, designators to simplified analysis (for example, passive components that do not generate heat)

Initial PCA



Simplified PCA



Simplification - Filtering

- ❑ You can create your own filters, select which filter you want to use when you export or import

```
# this filter removes small drilled holes
[Remove Small Holes D<1mm]
DrilledHoleMinDiam=0.001

# this filter removes small components
[Remove Small Comp Sz<3mm H<1mm]
ComponentMinSize=0.003
ComponentMinHeight=0.001

# this filter removes PIN holes
[Remove Hole Type=PIN]
DrilledHoleTypes= ALL, -PIN

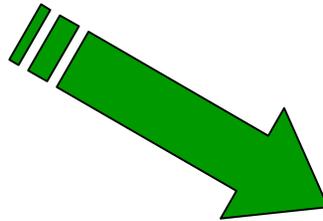
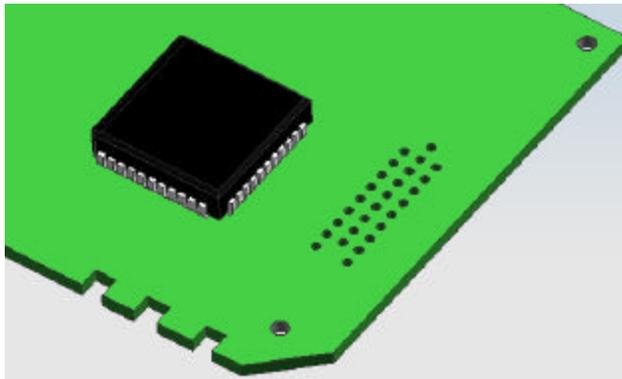
# this filter removes all keep-ins and
keep-outs
[Remove All Keep-in/outs]
KeepinTypes=NONE
KeepoutTypes=NONE
```

Simplification - Idealization

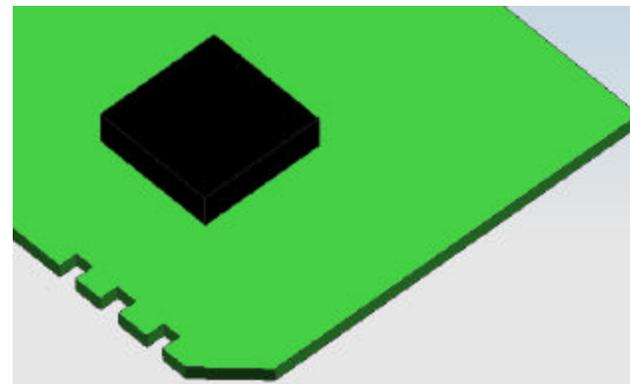
Idealization as support for Concurrent Engineering.

- ❖ Master Assembly remains unchanged - Associativity to Master Assembly
- ❖ Removing geometry: holes, blends, etc
- ❖ Adding Modeling Features: holes, blends, chamfers, ribs, bosses etc
- ❖ Different materials from the ones in the master assembly

Master Assembly

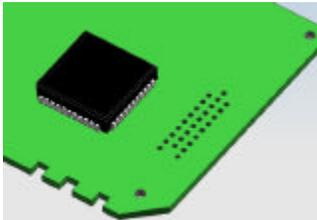


Idealized Assembly

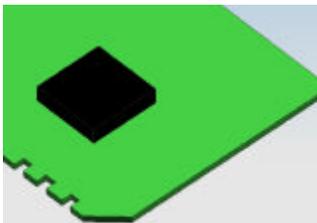


Thermal & CFD Analysis

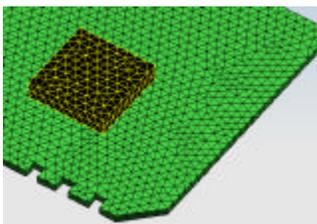
Master PCA



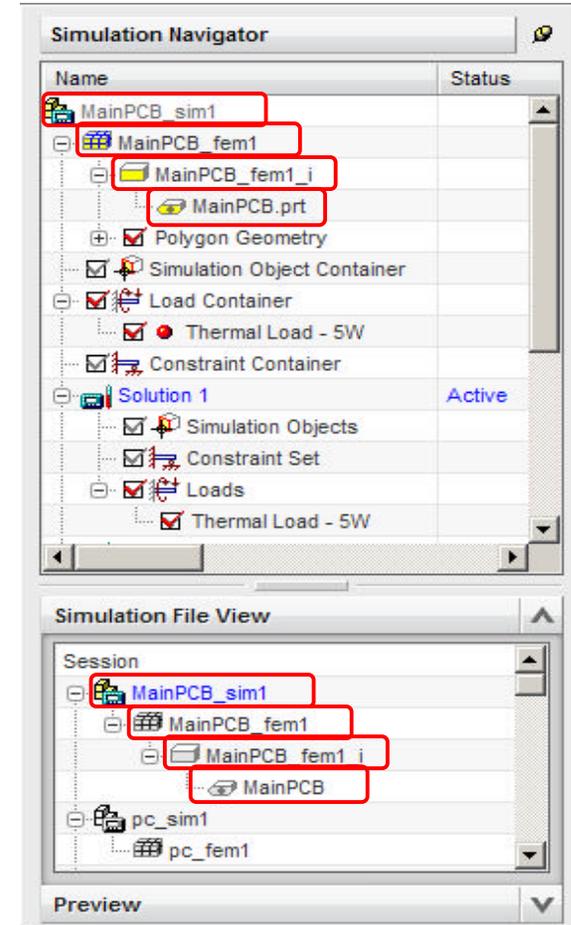
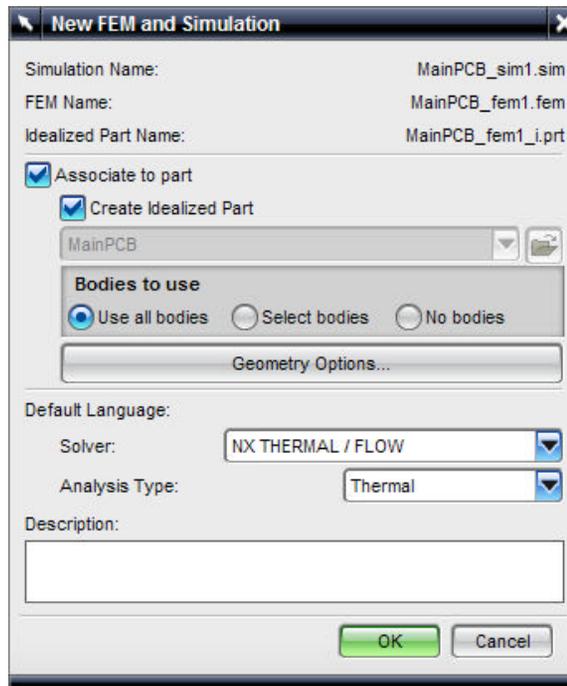
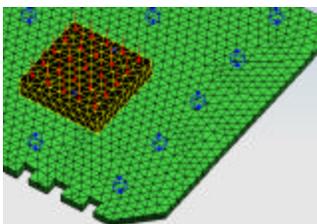
Idealized PCA



FEM Part

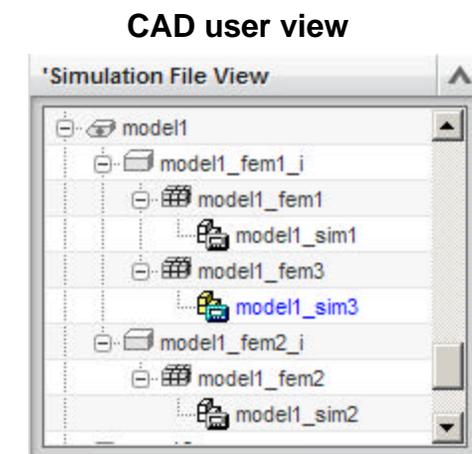
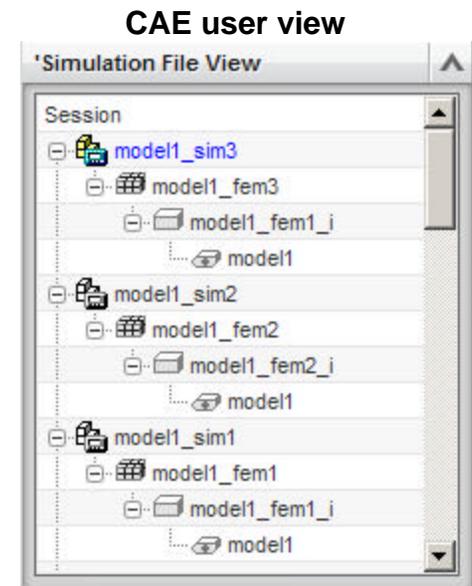
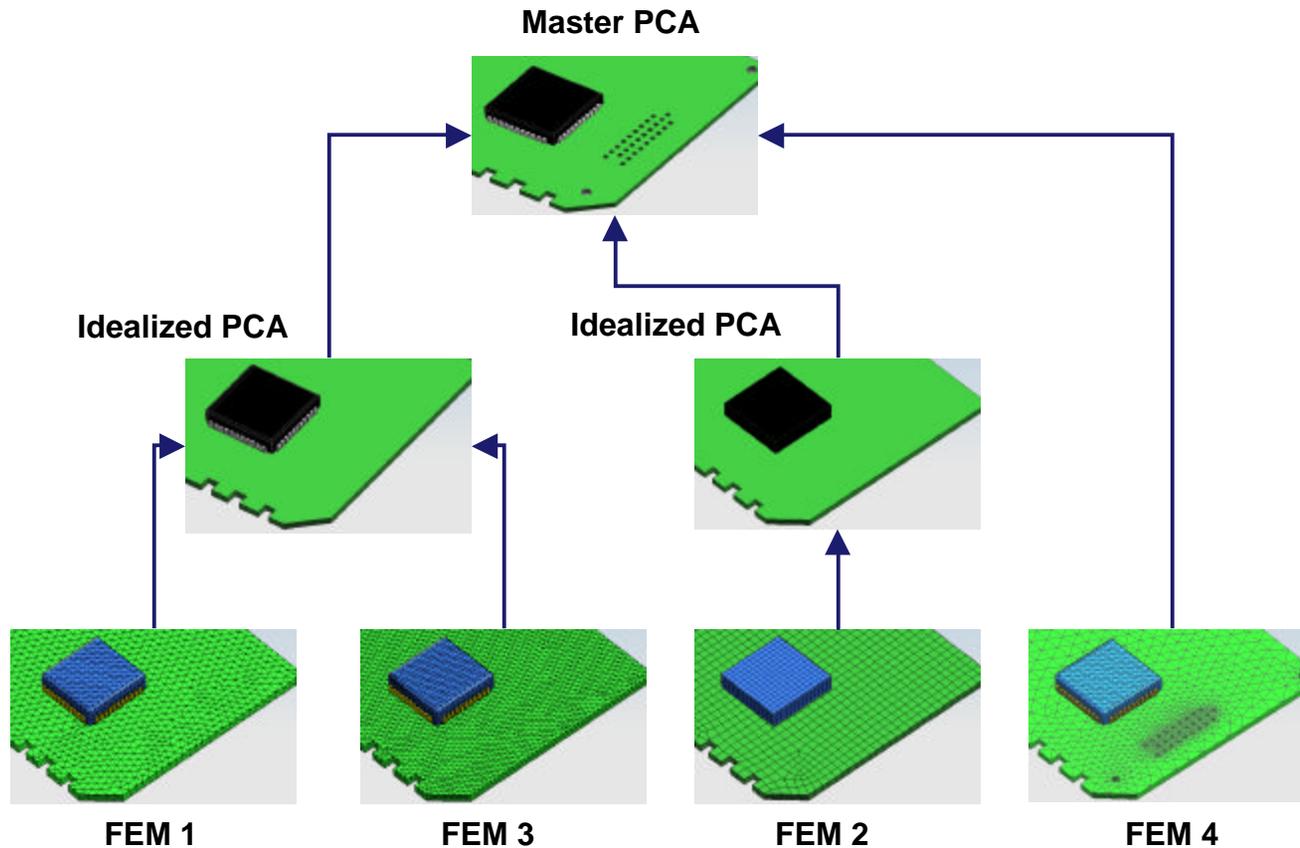


Simulation Part



- ✓ Easy Creation of Fem & Sim
- ✓ Working in a concurrent environment
- ✓ Efficient use of model and data re-use
- ✓ Write access to Master PCA is not required

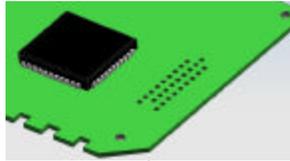
Single Master, Multiple FEM's.



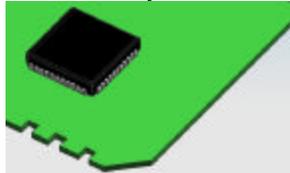
- ✓ Multiple analyses for the same PCA
- ✓ Multiple representation for different analysis needs from the same PCA

Multiple Solutions

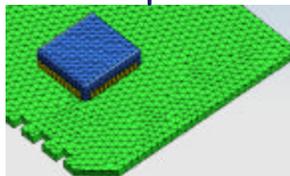
Master



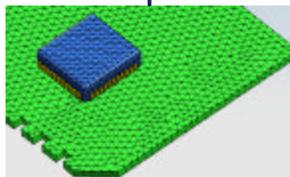
Idealized



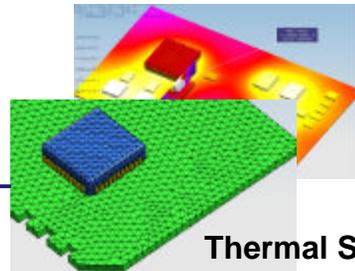
FEM



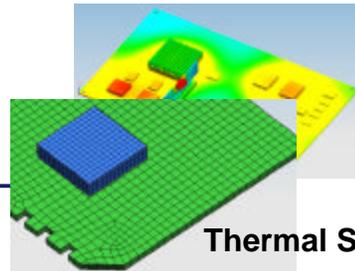
SIM



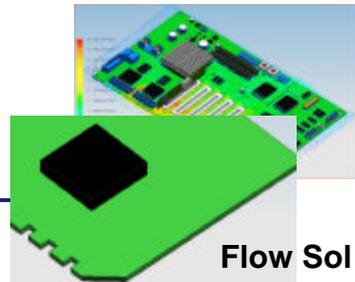
- ✓ Quickly and easily explore effects of different loading conditions
- ✓ Efficient analysis in complex environments



Thermal Sol 1



Thermal Sol 2



Flow Sol 1

Simulation Containers

Multiple Solutions

Name	Status
pca_sim1	
pca_fem1	
pca_fem1_i	
pca.prt	
<input checked="" type="checkbox"/> Polygon Geometry	
<input checked="" type="checkbox"/> 3D Collectors	
<input checked="" type="checkbox"/> Simulation Object Container	
<input checked="" type="checkbox"/> Load Container	
<input checked="" type="checkbox"/> B-IC Heat Load	
<input checked="" type="checkbox"/> S-IC Thermal Load	
<input checked="" type="checkbox"/> L-ICs Thermal Load	
<input checked="" type="checkbox"/> R-ICs Thermal Load	
<input checked="" type="checkbox"/> L-IC Thermal Load	
<input checked="" type="checkbox"/> Constraint Container	
<input checked="" type="checkbox"/> Convection to Environ...	
<input checked="" type="checkbox"/> Convection to Environ...	
<input checked="" type="checkbox"/> Thermal Solution 1	Active
<input checked="" type="checkbox"/> Simulation Objects	
<input checked="" type="checkbox"/> Constraint Set	
<input checked="" type="checkbox"/> Convection to Environ...	
<input checked="" type="checkbox"/> Loads	
<input checked="" type="checkbox"/> B-IC Heat Load	
<input checked="" type="checkbox"/> S-IC Thermal Load	
<input checked="" type="checkbox"/> L-ICs Thermal Load	
<input checked="" type="checkbox"/> R-ICs Thermal Load	
<input checked="" type="checkbox"/> L-IC Thermal Load	
<input checked="" type="checkbox"/> Results	Results may
Thermal Solution 2	
<input type="checkbox"/> Simulation Objects	
<input checked="" type="checkbox"/> Constraint Set	
<input type="checkbox"/> Convection to Environ...	
<input type="checkbox"/> Loads	
<input type="checkbox"/> B-IC Heat Load	
<input type="checkbox"/> S-IC Thermal Load	
<input type="checkbox"/> L-ICs Thermal Load	
<input type="checkbox"/> R-ICs Thermal Load	
<input type="checkbox"/> L-IC Thermal Load	

Drag & Drop



New requirements

- ❖ Exchange more electrical data: traces, pads, etc
 - ❖ Exchange more mechanical data: Flex PC bend info, support multi-extrusions with different thicknesses, etc
 - ❖ Exchange more CAE data: material, thermo-optical data, heat loads, thermal resistances, etc
 - Other format !?
- 



Thank you

