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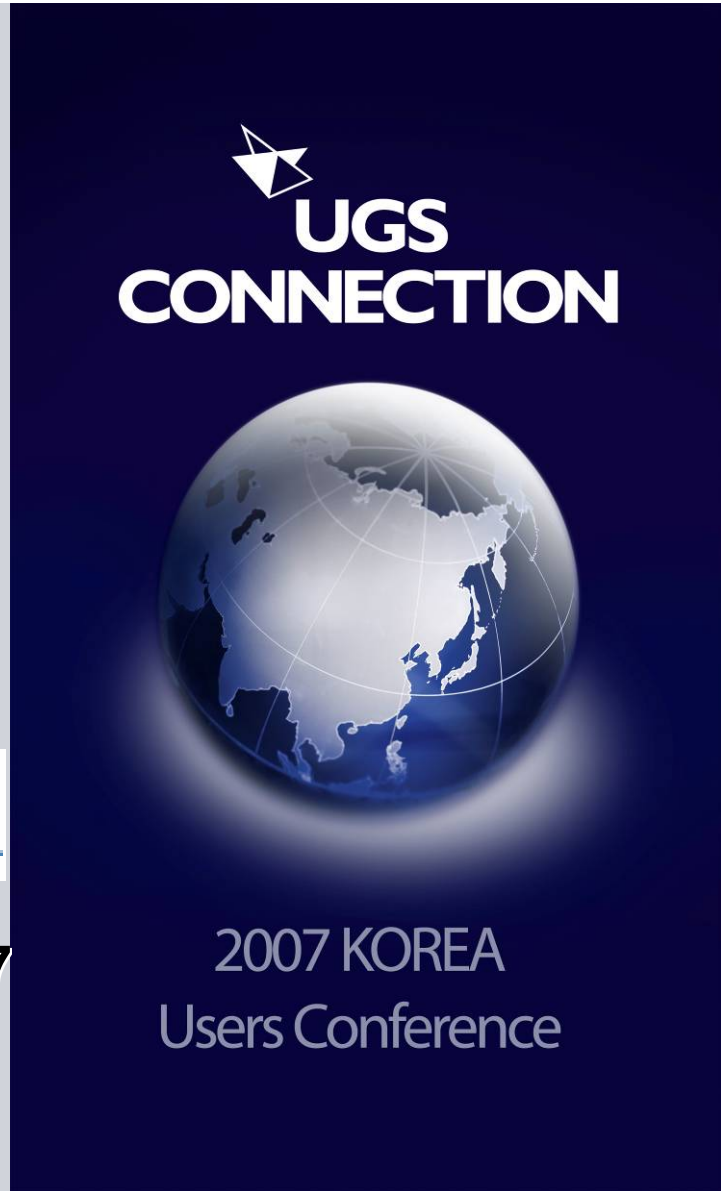
UG Re-mastering for Automotive Engineering



RÜCKER

19th October 2007

Modeling Issues

- **Re-mastering**
- **Takes time**
  - **Release of prototype data happens soon.**
- **Skill set not fully developed**
  - **users need time.**
- **May not be necessary.**

Modeling Issues

- **Why re-master ?**
- **Translated data is unparameterized.**
- **Need to produce solid models.**
- **Confusion about unparameterized data.**
  - **Unparameterized data does not contain history of how it was created.**
  - **Unparameterized data can be used in UG to create new solid models.**
  - **Newly created solid body can be used later in design process.**

The Overall Re-mastering Processes

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Concept		ALT. 1 Complete Parametric Design	ALT. 2 Semi-Parametric Design	Remark
Process	**Step 1** **CATIA Data Conversion**	W/F, SUR, FAC, SOL	←	Unparameterized feature
	Step 2-1 **Create Primary Sheet or Solid Bodies**	Creating Sheet or Solid Bodies on the basis of CATIA surface		Parameterized feature
	Step 2-2 **Primary Remodeling**		Reusing CATIA Main Surfaces	Unparameterized feature
	Step 3 **Evaluate Primary Sheet or Solid Bodies**	Checking Model Quality	←	
	Step 4 **Modify Primary Sheet or Solid Bodies**	Modifying Model Problem	←	**ALT.1: Parameterized Feature** **ALT.2** **Parents: Unparameterized Features** **Children: Parameterized Features**
	Step 5 **Final Operations**	Trimming, Sewing, Hole, Filleting, Hollowing, Boolean Ops	←	
	Step 6 **Evaluate Final Model**	Checking Model Quality Reporting Deviation Sheet	←	

Step 1 : CATIA Data Conversion

- ❑ Translated CATIA surface and solid data is high quality
- Only four CATIA elements can be translated in precise. They are W/F, SUR, FAC and SOL (per UG documentation).
- Currently translating surface or face data to UG.
  - Surface in CATIA becomes untrimmed surface in UG.
  - Face in CATIA becomes trimmed surface in UG.
- CATIA solid models should be translated to UG.
- ❑ To use CATIA data after translating
- Sew surfaces in UG.
- Use “Thicken Sheet” to create solid body.
- ❑ Newly created solid body can be used later in design process.

Step 1 : CATIA Data Conversion

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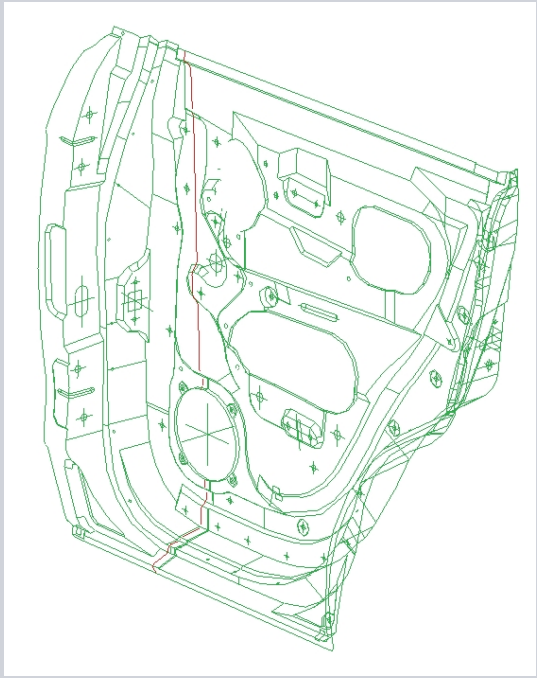
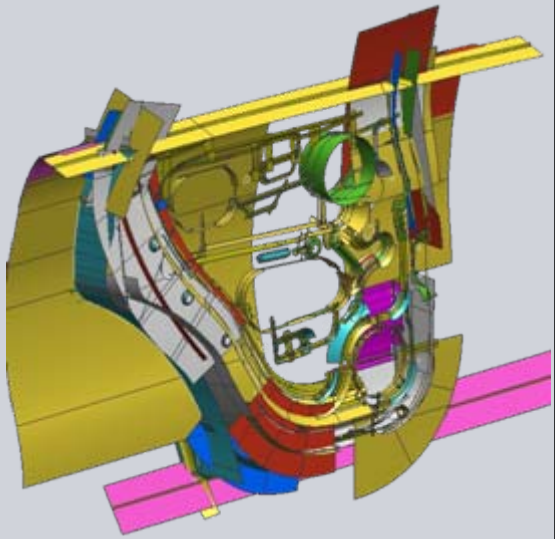
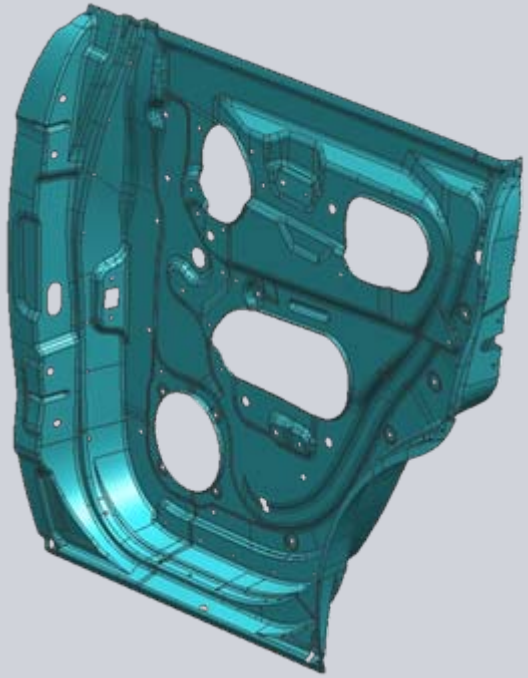
CATIA Data Conversion Result (in case of BIW)

Wire-frame	Surface	Face
		
- Lines, Curves, Splines	- Surfaces(Main, Fillet)	- Trimmed Surface

Step 1 : CATIA Data Conversion

Data Conversion Processes(CATIA ➔ UG)

	CATIA	Neutral File	UG	Dept.	Remark
Objects	Wire-frame	iges	Wire-frame	All	
	Surface	iges	Sheet Body	Body Trim	Unparameterized feature
	Face	iges	Sheet Body	Body Trim	Unparameterized feature
	Solid	step	Solid Body	Chassis	Unparameterized feature

- Glossary

  Sheet Body - A object consisting of one or more faces not enclosing a volume. A body of zero-thickness.

  Solid Body – An enclosed volume.

  Unparameterized feature – A feature which cannot define and control the relationships between the features of a model.

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Requirements for CATIA Data Conversion

- File Naming
  - Observe the CATIA modeling standard(file naming) basically.
  - Always underscore the blank column of file name.
  - Do not use the special characters(ex : %, $, &, #, ?, ! …).
- Layer
  - Observe the CATIA modeling standard basically.
  - Use different layers for overlapping geometry.
- No Show / No Pick
  - Observe the CATIA modeling standard basically.
  - A surface which do not include a face must be deleted before data conversion.
- Model Tolerance
  - Observe the CATIA modeling standard basically.
  - Do not change the default value of model tolerance in order to minimize the data conversion problem.

Step 1 : CATIA Data Conversion

Requirements for CATIA Data Conversion

- Surface Model
  - Observe the CATIA modeling standard basically.
  - Must be included the wire-frame, surfaces and faces in UG conversion data.
  - A surface which do not include a face must be deleted before data conversion.
- Solid Model
  - Observe the CATIA modeling standard basically.
  - Must be included the wire-frame, surfaces, faces and solids in UG conversion data.
  - Do not use the ghost function of a parent management.
- CATIA Model Cleaning
  - Delete planes, point, CST, unused details.
  - Delete unnecessary elements in No Show and No Pick.
  - Identify – Renumbering, Updating
  - /CLN
- Axis(=Coordinate System)
  - All working coordinate system must be deleted and the coordinate system must be located from a absolute zero point in CATIA model before data conversion.

Step 2-1 : Create Primary Sheet / Solid Bodies (ALT. 1)

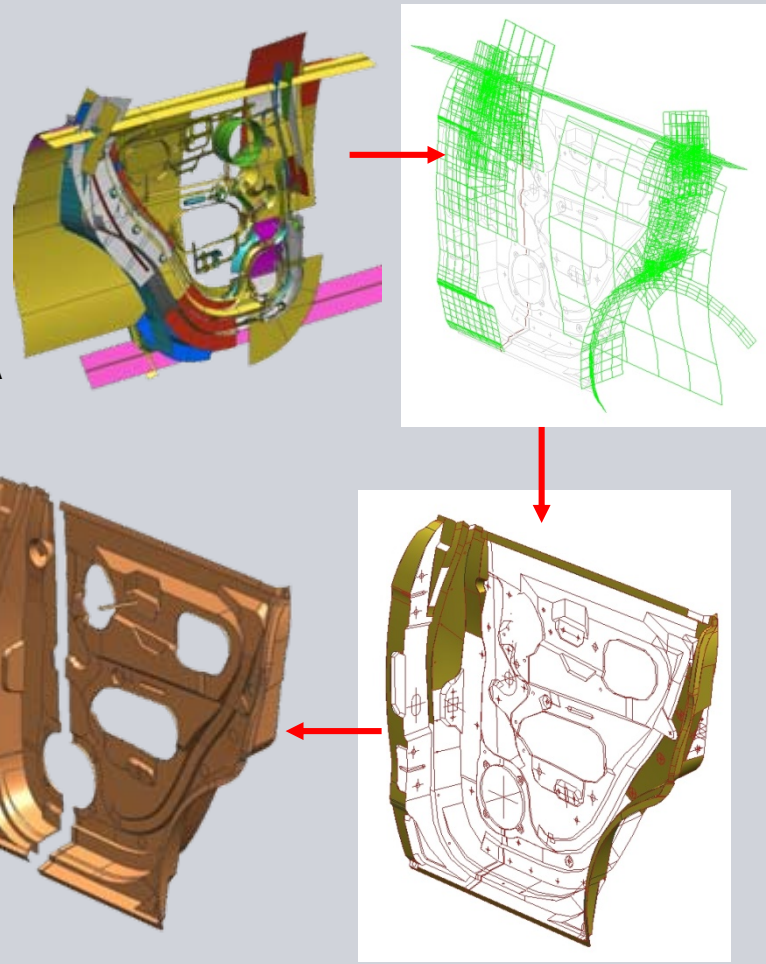
- Extract curves from CATIA surface.
- Create several sheet bodies using extracted curves and CATIA wire-frame.
- Trim sheet bodies.

- Parents : Extracted Curves from CATIA surface and CATIA wire-frame.

  Parameterized feature

- Children : Several Sheet Bodies of zero-thickness and trimmed bodies.

  Parameterized feature



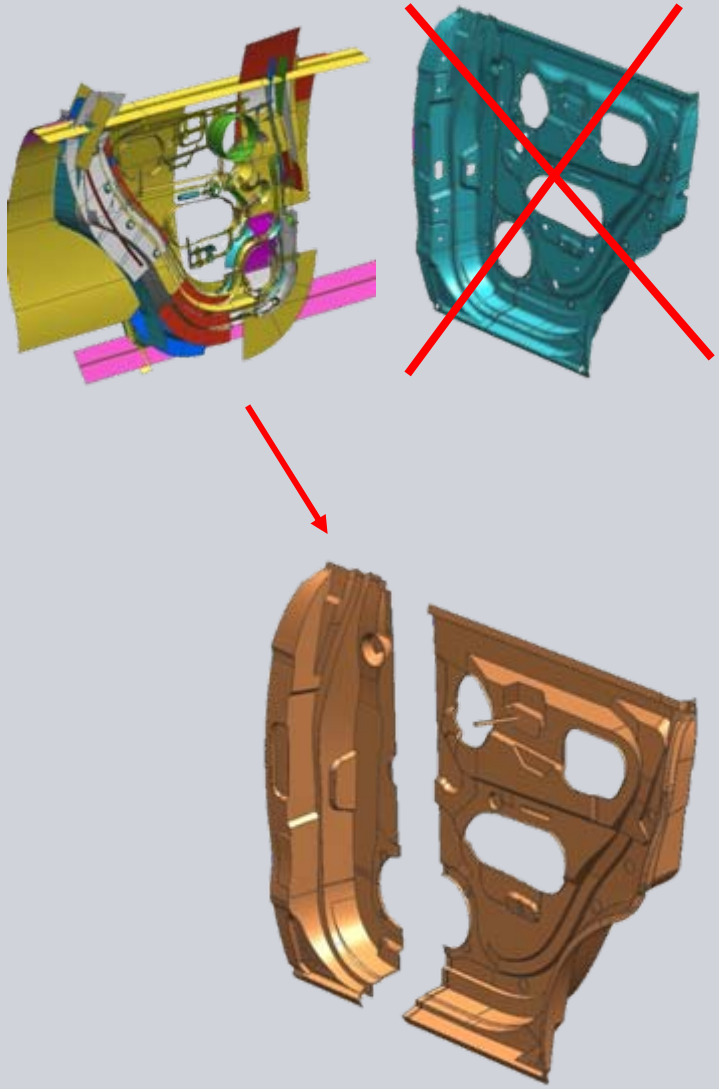
Step 2-2 : Primary Remodeling (ALT. 2)

- Reuse CATIA surface data to create the primary model and do not use CATIA face data basically.
- Trim CATIA surface data on the basis of CATIA wire-frame. This operation is similar to the face operation at CATIA.
- Trimming - To shorten or extend a surface.
- Parents : Imported surface from CATIA

  Unparameterized feature

- Children : Trim body of zero-thickness

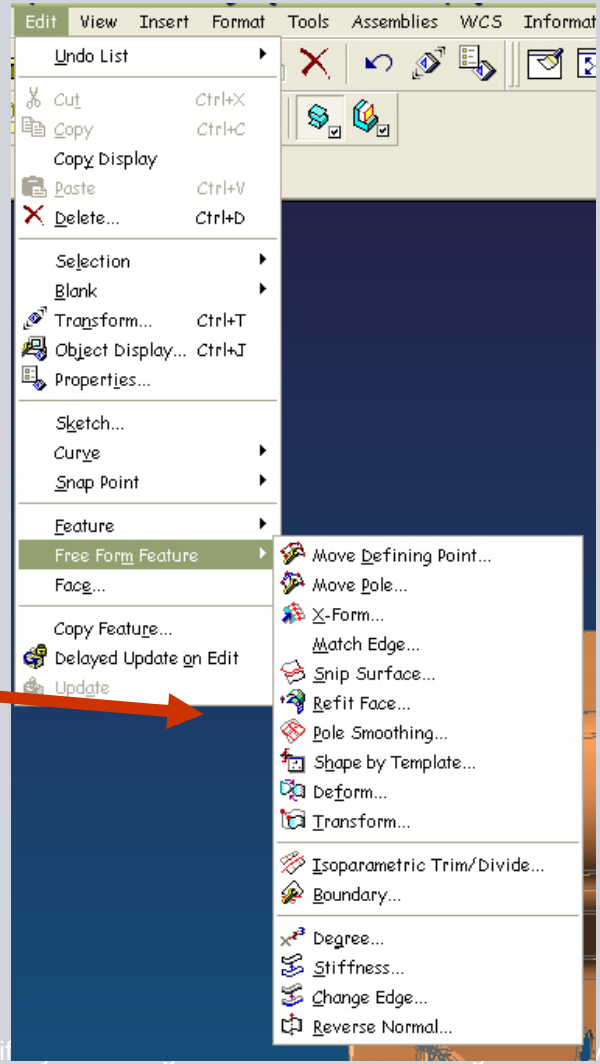
  Parameterized feature



Model Editing

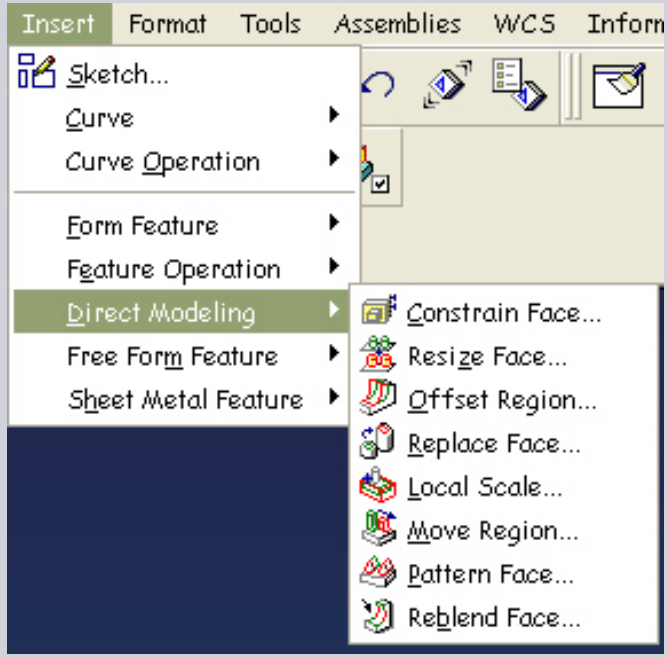
- UG tools for editing unparameterized data
  - To remove trim :

    Edit → Freeform → Boundary
  - To modify topology :
    - Edit → Freeform → X-Form
    - Edit → Freeform → Move Pole
  - Many editing tools work with any surface.
- If necessary, part features can be replace by trimming away and replacing with new data.



Model Editing

- Direct Modeling techniques represent extended capabilities for some of the more basic UG NX functions.
- Among these are face-oriented operations, constraint-based methods, blend regeneration and independence of feature history.
- You can use Direct Modeling functions on models that have been brought in from other CAD systems and are unparameterized.



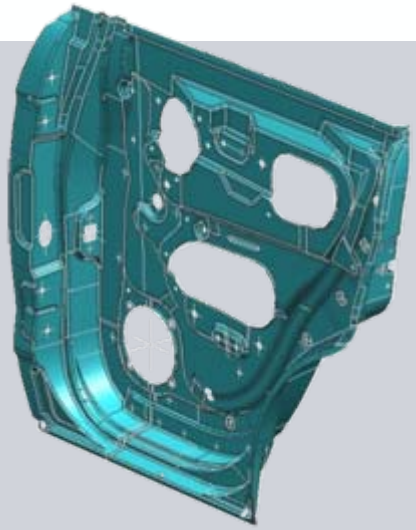
Model Editing – Direct Modeling

- Constrain Face - Lets you impose 3D constraints on face collections of geometric models. You can then move the faces to meet the constraints, while retaining the original topology, if possible.
- Resize Face - Lets you change the diameter of cylindrical or spherical faces, as well as the half-angle of conic faces, with adjacent blends recreated.
- Offset Region - Lets you offset a set of faces or a whole body in a single step. Adjacent blends can be optionally recreated. Faces are specified either as target faces or by region extraction methods
- Replace Face - Lets you replace a set of faces with another face, with the ability to regenerate adjacent blends. You can use this option when you want to change the geometry of a face, such as to make it simpler, or to replace it with a complex surface.
- Local Scale - Unlike the Scale option, which lets you scale solid and sheet bodies, Local Scale lets you scale faces within a local face set.
- Move Region - Provides simple methods to let you locally move the faces on a body. It can be useful if you want to adjust a prototype model, and is fast and easy to use.
- Pattern face - Lets you make copies of a face set. It is similar to the Instance function, but is easier to use and you do not have to have a feature-based model to use it.
- Reblend Face - Lets you edit blend faces, regardless of their feature history. The function works with translated files and unparameterized solids, and you can use it to create a parametric feature while maintaining tangency properties.

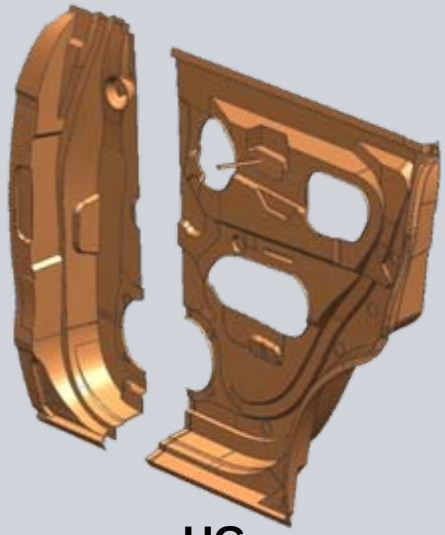
Step 3 : Evaluate Primary Sheet / Solid Bodies

- Evaluate primary sheet or solid bodies between CATIA surface data and UG surface data.
- Examine with the naked eye.
- Assess surface quality to use face analysis tools.
  - Radius, Reflection, Slope, Distance
- Use diagnostic tools Examine Geometry.

(see the next page.)



CATIA



UG

Step 3 : Evaluate Primary Sheet / Solid Bodies

Math Data Quality

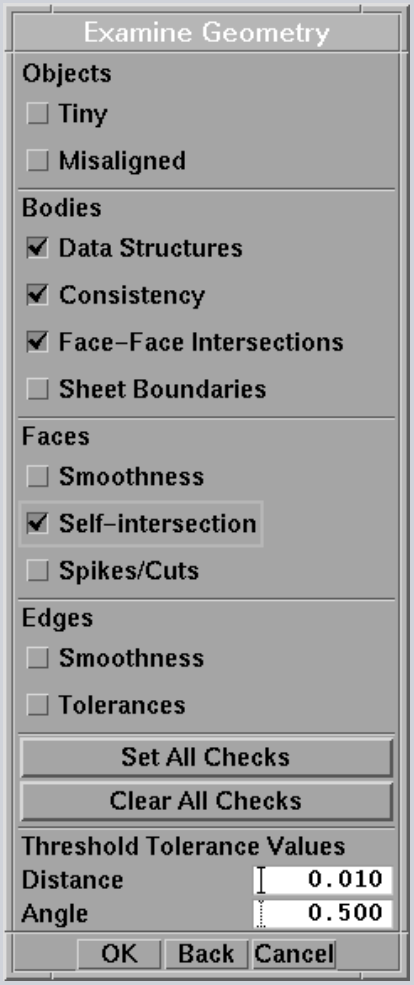
A certain level of data quality is required in UG datasets, to easy editing, change and handling of these files.

The function *Analysis/Examine Geometry* is available in UG to analyze data quality. It is important that the analysis is *performed regularly during the design process* and not simply once at the end, as correction of unacceptable geometry can potentially involve significant effort.

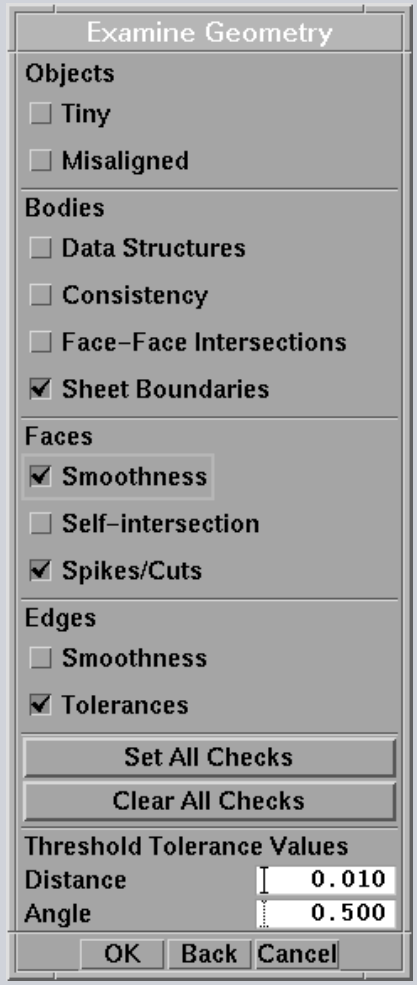
Step 3 : Evaluate Primary Sheet / Solid Bodies

- **Examine Geometry – Main menu**

Mandatory Checks



Additional Tests



Step 3 : Evaluate Primary Sheet / Solid Bodies

- **Examine Geometry – Check Results**
- **Check results are displayed in an information Window and in the graphics window.**

Step 3 : Evaluate Primary Sheet / Solid Bodies

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❑ Math Data Quality

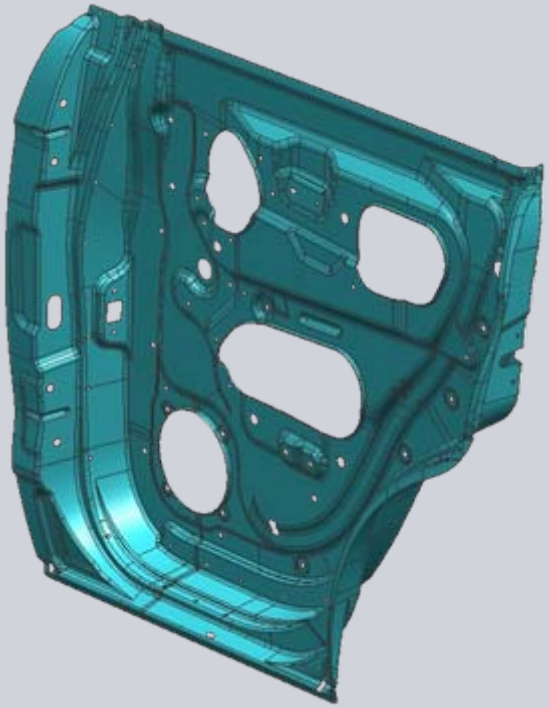
Check Items		Description
Objects	Tiny	Searches for all tiny bodies, faces, edges, or curve in the selected bodies or geometry.
	Misaligned	Checks all of the selected geometry that is close to being orthogonal with respect to the WCS, but is not exactly aligned with it.
Bodies	Data Structures	Checks each selected body for data structure problems, such as corruption.
	Consistency	Checks each selected body for inconsistencies.
	Face-Face Intersections	Checks each selected body for face-to-face intersections, and that all faces of the selected body meet each other at their edges and nowhere else.
	Sheet Boundaries	Searches for all the boundaries(or gaps) in the selected bodies.
Faces	Smoothness	Checks the b-surfaces(of faces that have them) to make sure the surfaces are smooth along their patch boundaries.
	Self-intersection	Checks for faces that self-intersect.
	Spikes / Cuts	Searches the selected faces for possible spikes or cuts.
Edges Checks	Smoothness	Searches for all edges whose adjoining faces do not join smoothly.
	Tolerance	Checks the tolerance of all the selected edges against the distance tolerance.

Step 3 : Evaluate Primary Sheet / Solid Bodies

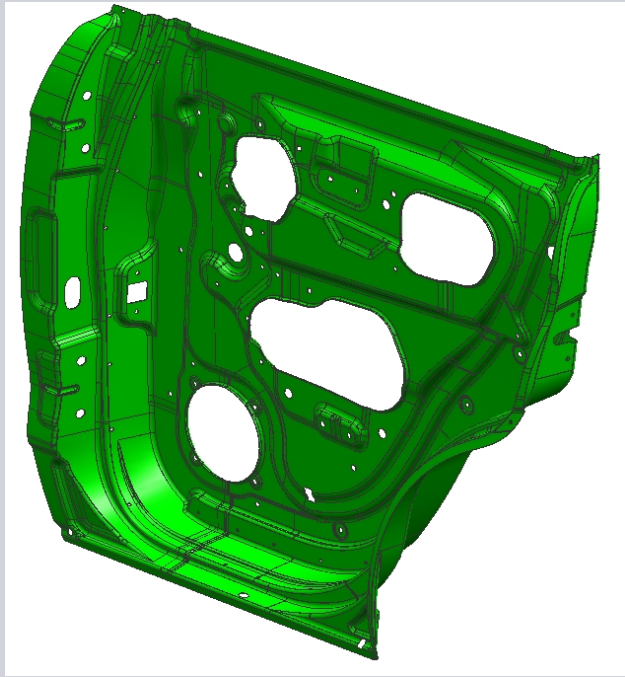
- **Further Analysis Functions**
  - **Information ⇨ B-Surface**
  - **Analysis ⇨ Face ⇨ Radius, Reflection, Slope and Distance**
  - **Analysis ⇨ Deviation ⇨ Checking**

Step 4 : Modify Primary Sheet or Solid Bodies

- **Modify all problems in primary sheet or solid bodies.**



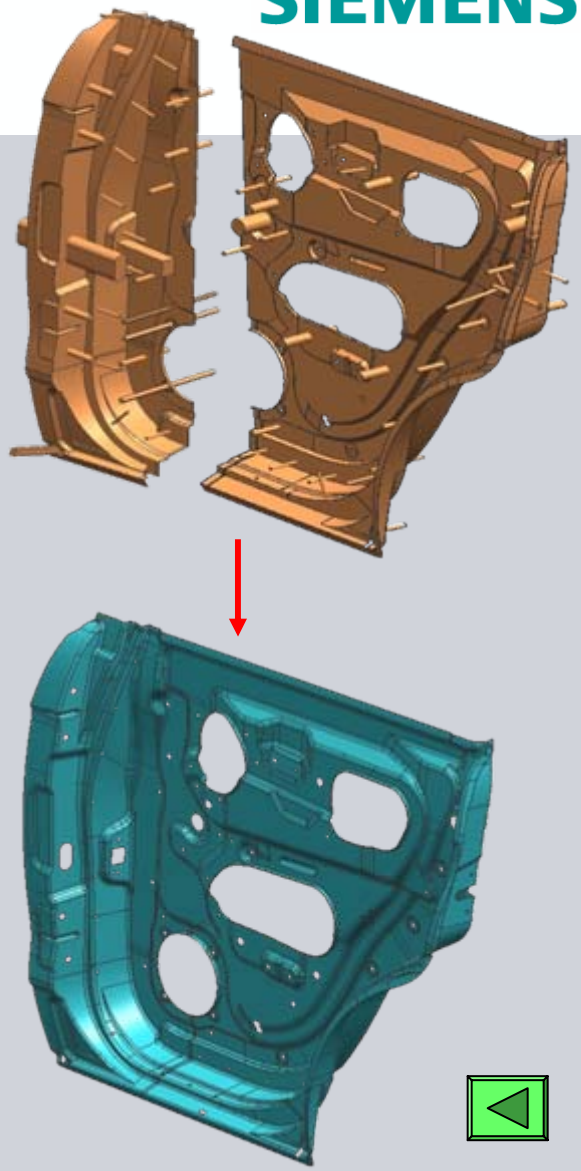
Before



After

Step 5 : Final Operations

- **Trimming, Sewing, Hole, Bead,**
  Filleting, Hollowing, Boolean Operations.
- **Create solid bodies finally.**
- **Assemble components using mating condition.**



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Step 6 : Evaluate Final Solid Bodies

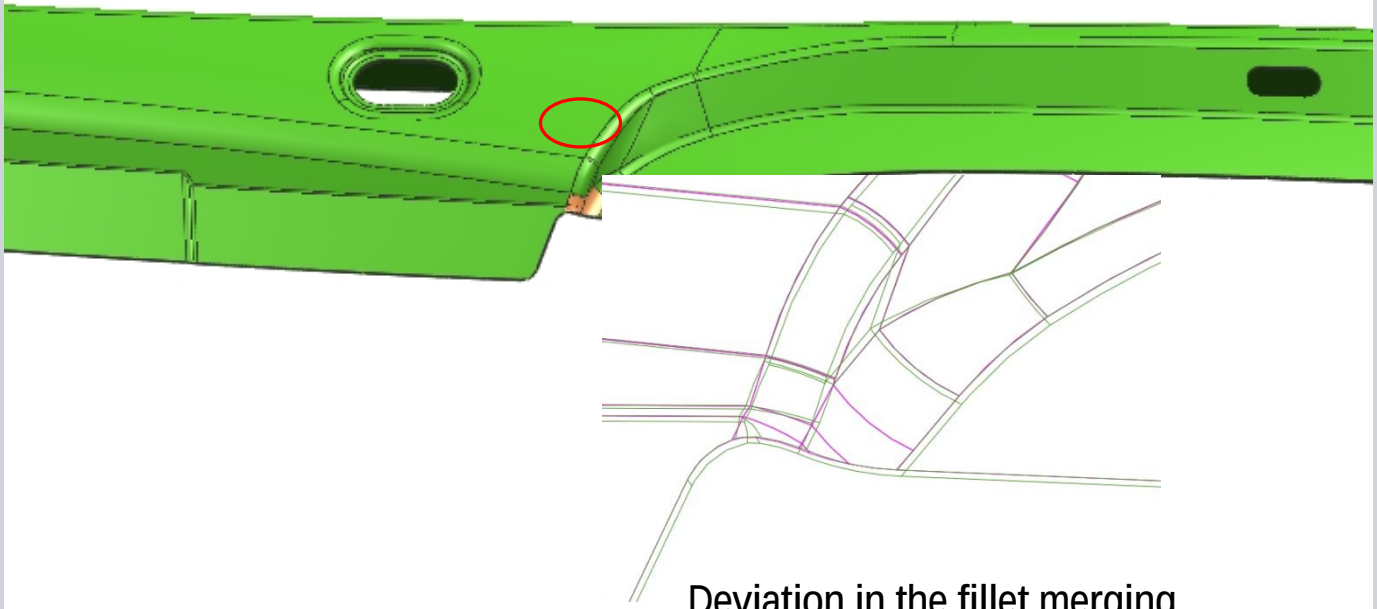
- **Evaluate final solid bodies between CATIA surface data and UG surface data.**
- **Examine with the naked eye.**
- **Assess surface quality to use face analysis tools.**
  - **Radius, Reflection, Slope, Distance**
- **Reporting Deviation Sheet.**

  (see next pages)

Deviation Report (Sample)

Part No. : 00000000

Part Name : Reinforcement – XXX XXX XXX

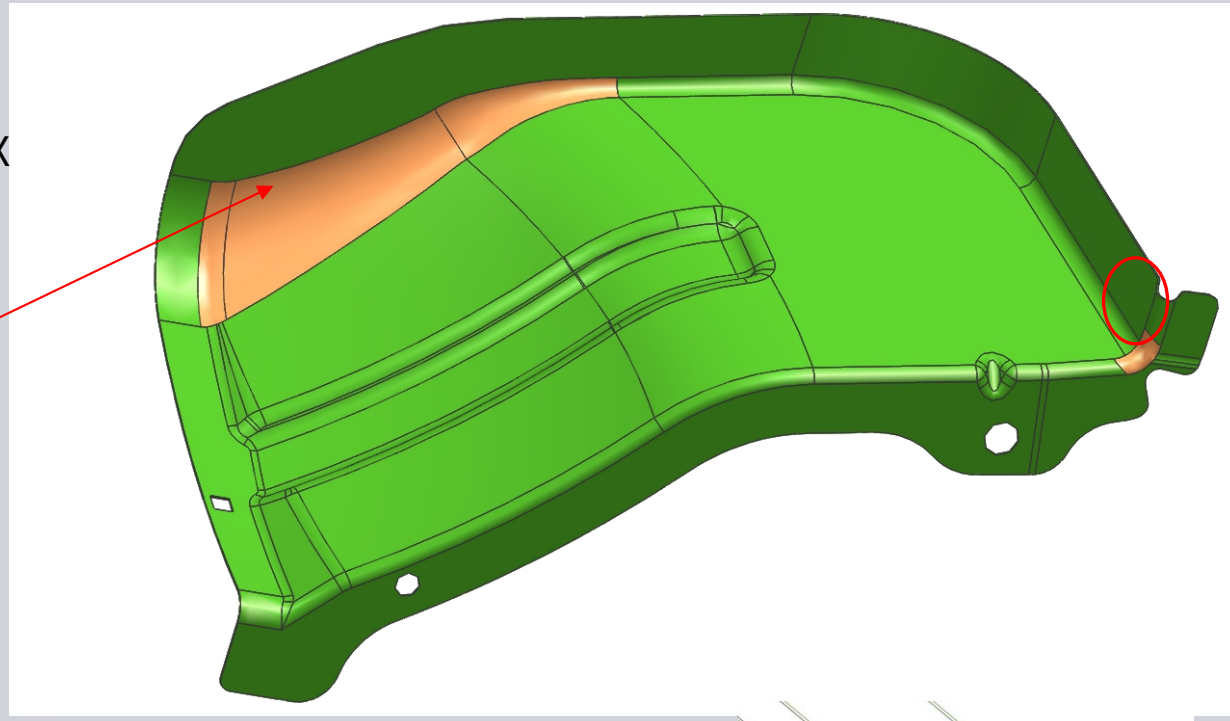


Deviation in the fillet merging region, near trim lines, 0.2mm

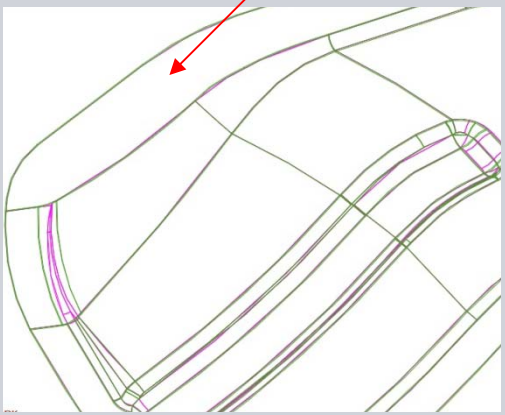
Deviation Report (Sample)

Part No. : 00000000

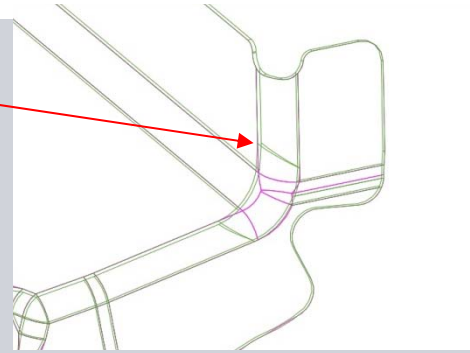
Part Name : Panel – XXX XXX XXX



Trajectories are matching, but surface deviating by 0.23mm



Unable to control the fillet flow, hence the deviation of 0.21mm



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Mandatory Requirements

General	3D models are to be submitted in UG data format (created in UG). A conversion to UG from another CAD system is not permitted.
	All design must be done in UG and TcAE. A supplier can outsource work to fulfill obligations providing the design house is approved by the appropriate organization responsible.
	The valid Automotive Supplier Toolkit must be available at and utilized by the supplier in the version which is demanded. Automotive Supplier Toolkit including programs and templates for DCS
	All data sets stored (including interim sets and data which is based on migrated data from CGS or UGMX) by the supplier must be organized according to DCS and pass the File-Checker.

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Mandatory Requirements

UG 3D models	All 3D design must be carried out as parametric SOLID. Any exception to this rule must be agreed by the responsible department. All parameters of a UG model must be retained in order to enable later changes.
	FEATURES used during raising of a 3D model are to be unambiguous and comprehensible. Only as many FEATURES as are necessary may be used. FEATURES that provide multiple descriptions or overspecify the geometry must be avoided.
	3D models based on already available data must not have been derived from non-parametric FEATURES in order to ensure a high flexibility of the model when changed are required.
	3D models may not contain any SUPRESSED FEATURES.
	UPDATE FEATURE must be able to be carried out. All parameters must be retained.
	EXAMINE GEOMETRY must be carried out for fixed data.
	TINY or LARGE OBJECTS are not allowed.
	PART CLEANUP must be carried out for fixed data.
	The BLANK level must be empty.

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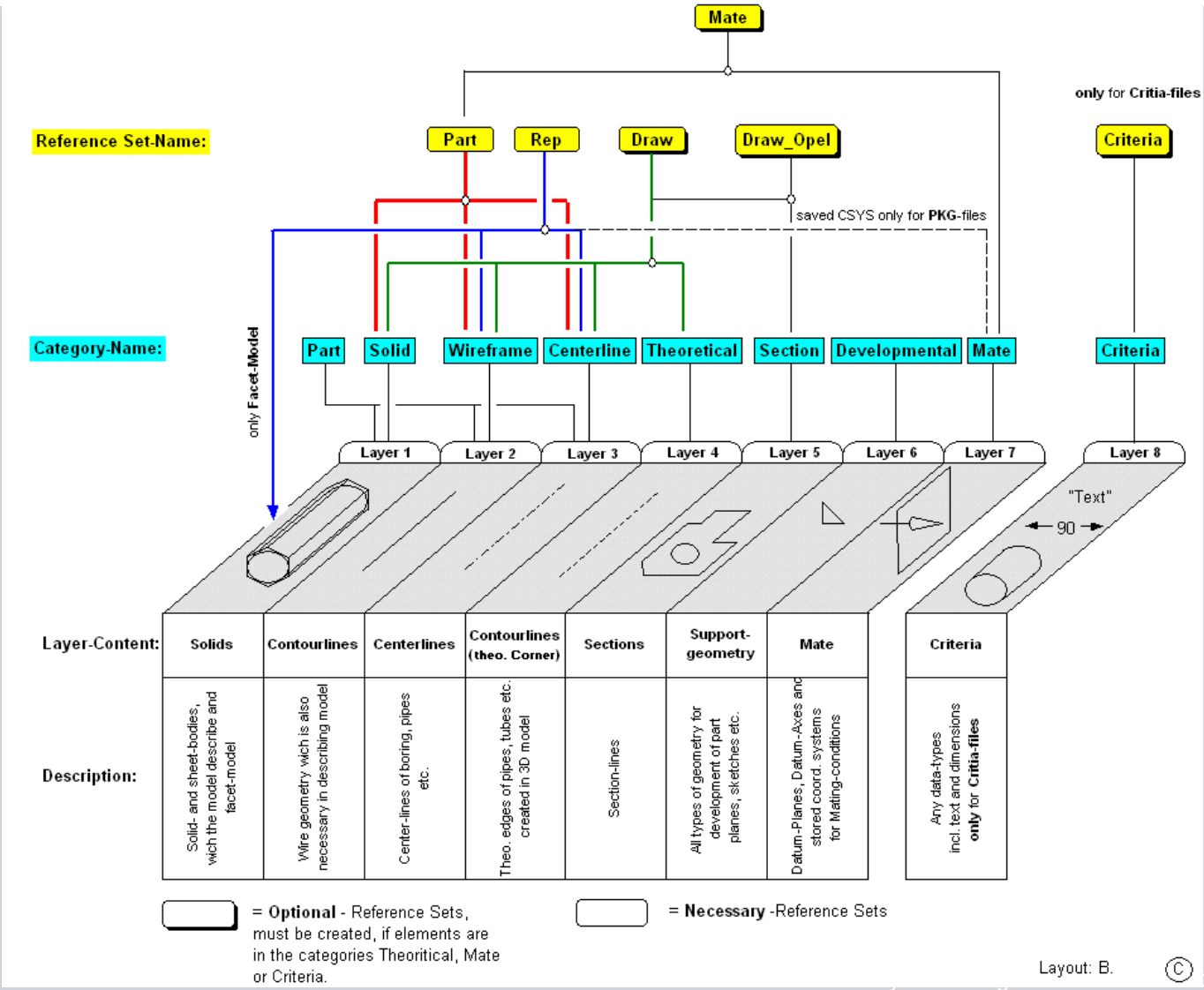
Mandatory Requirements

UG 3D models	All derivations of the final geometry, both parameter and basic geometry dependent, which are required for changes, are to be retained.
	The specified tolerances (surface separations and tangential constancy) must be met.
	Requirements for SKETCHES ▪ Each SKETCH must be separately identified. The identifier must start with “SK_” (for example, “SK_front”). ▪ The SKETCH geometry of each sketch must be on separate layer. ▪ Every layer used for a SKETCH must have a USER DEFINED CATEGORY and the DEVELOPMENTAL CATEGORY added. The UDC must use the same name as the SKETCH, but with a leading underscore, I.e. “SK_Front”.

UG Assemblies	Separate parts listed in the BOM must be shown as components of an assembly, i.e., assemblies must be structured to match the BOM.
	Components must be included in an assembly by means of LAYER OPTION = ORIGINAL.
	Assemblies may not contain SUPPRESSED COMPONENTS.
	All levels of a fixed Assembly must be saved precise.

Layer & Category Assignments



The end

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Thank you very much

for your attention !!!