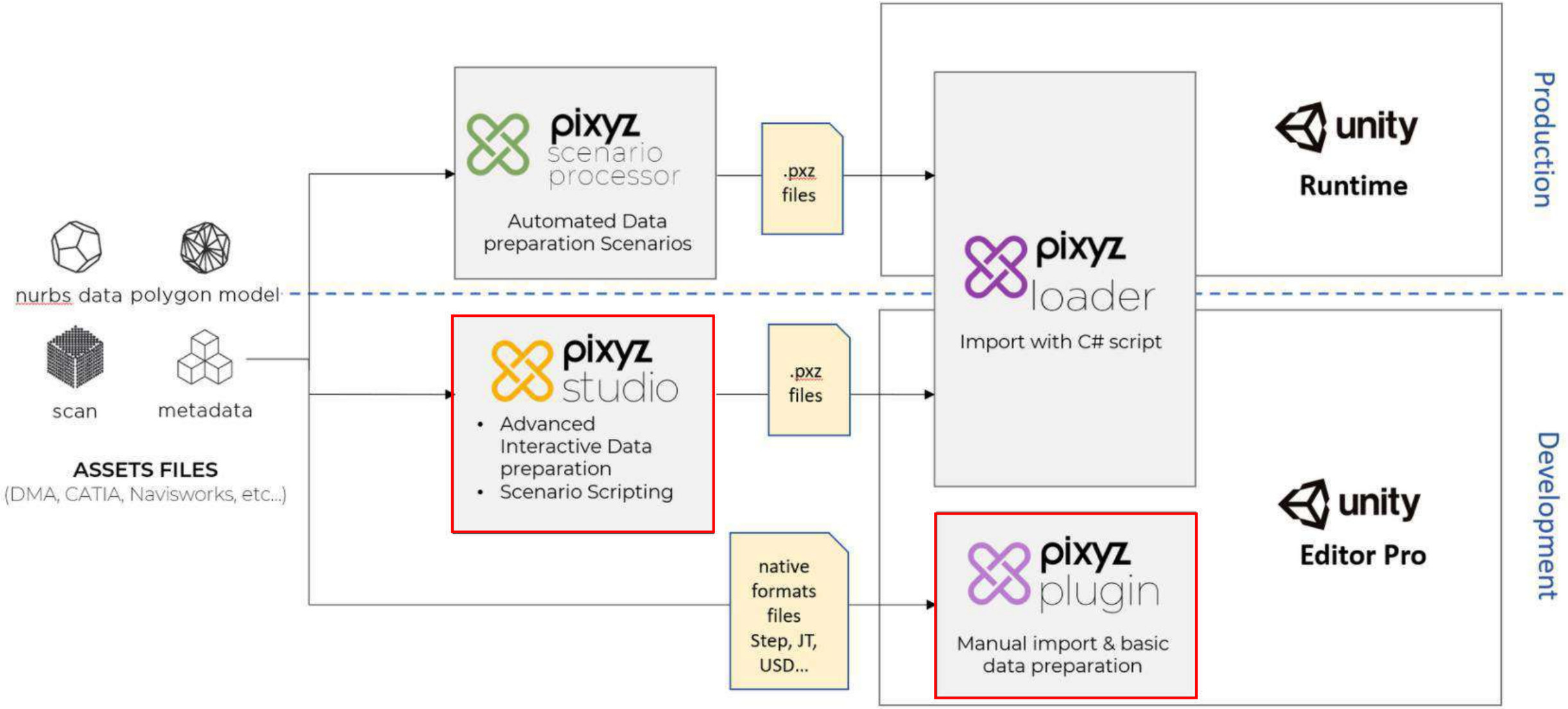
Pixyz를 활용한 CAD 데이터 최적화 방법

목차

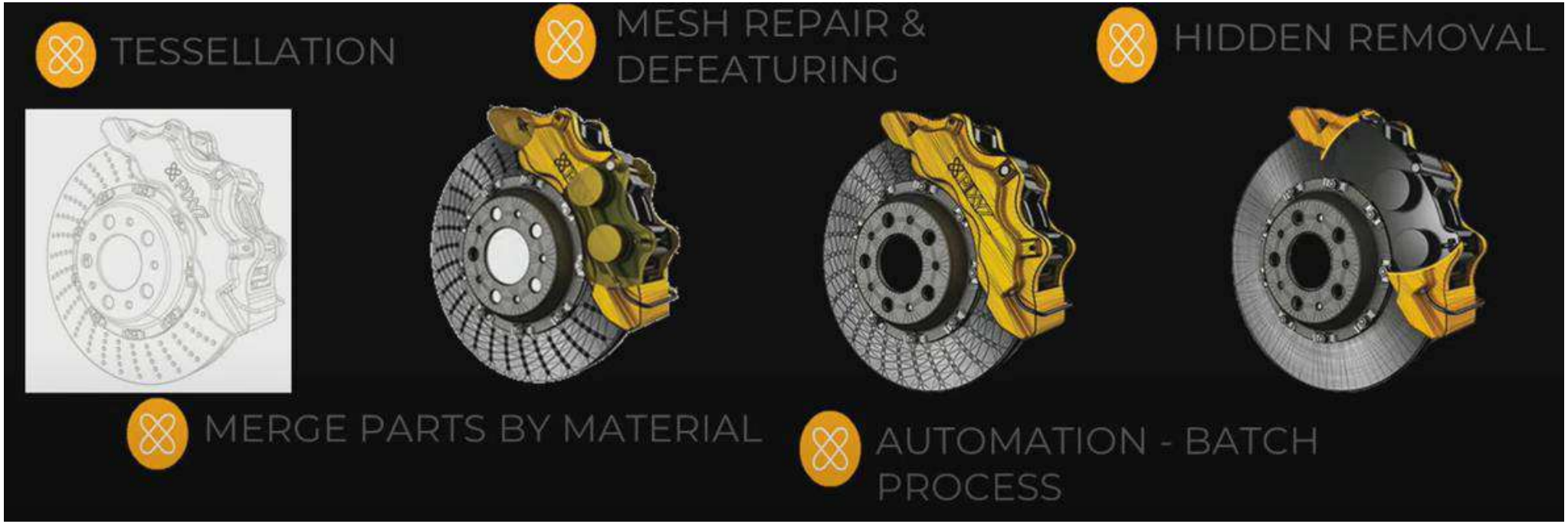
1. Introduction - Pixyz



Pixyz Studio

1. Quick Optimization Training
2. Advanced Preparation Features
3. Advanced Optimization Features

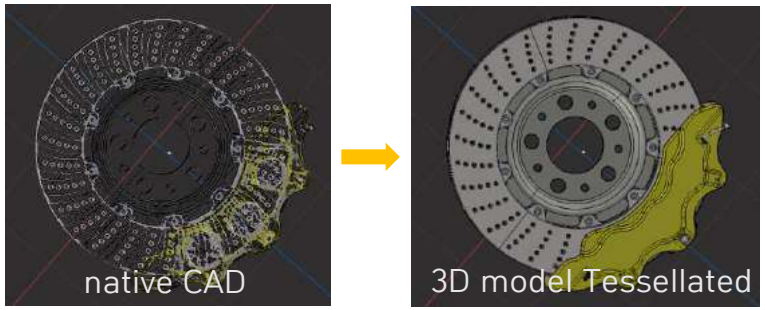
1. Quick Optimization Training



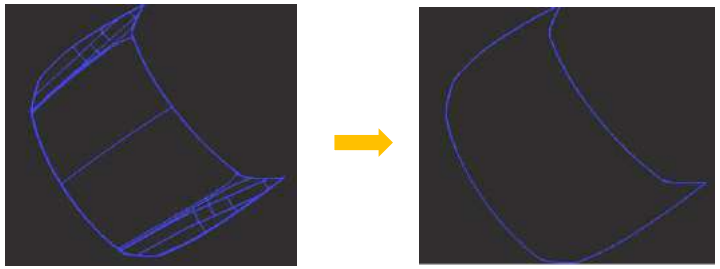
2. Advanced Preparation Features : Mesh Creation

: 경량화 하기 전, 사전 준비 단계라고 할 수 있다.

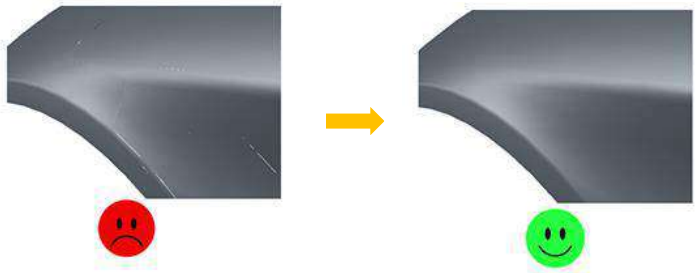
1) TESSELLATE



2) CAD Repair



3) Mesh Repair



TESSELLATE

: CAD models, turning them into light 3D meshes
using powerful tessellation algorithms, with automatic UV creation.

CAD Repair

: Automatically repairs native CAD / BRep geometries
(CAD faces assembly and optimization, CAD faces automatic orientation, ...)

Mesh Repair

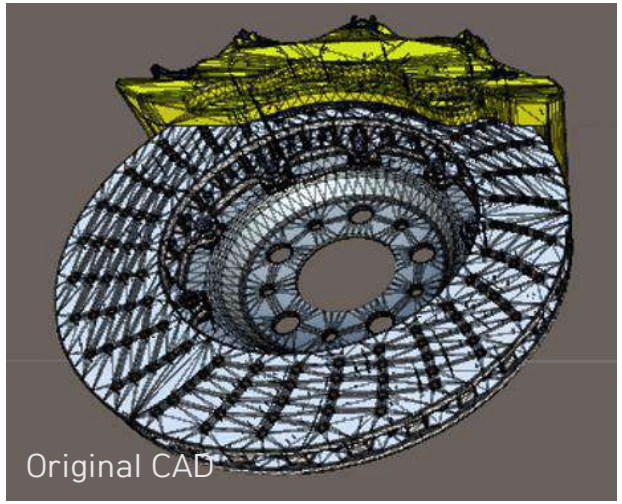
: Automatically repairs selected meshes (tessellated geometries)
(stitches disconnected edges within the given tolerance, orients faces consistently, ...)

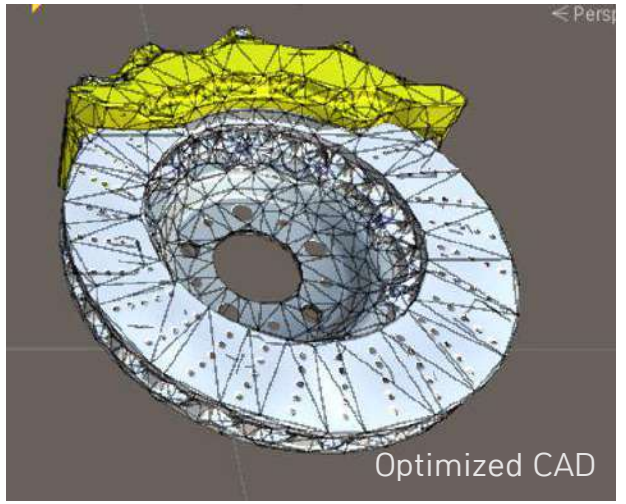
REPAIR FUNCTIONS

: Pixyz offers CAD and Mesh repair features, such as CAD topology correction, removal of duplicated faces/patches, face reconnection, polygon reconnection, normals/faces orientation unification, etc…

3. Advanced Optimization Features : Polygon Reduction

: 경량화 하기 위한 단계





Polygon Reduction

: Choose among Dozens of Algorithms, Reduce, Optimize and Transform models to high-quality and lightweight Meshes.

WORKFLOW

1. 경량화가 필요한 부품 수집

2. CAD파일 import

3. Tessellation 기능을 이용해 수집한 CAD model을 가벼운 mesh로 변환

4. 다양한 경량화를 해주며 모델 최적화

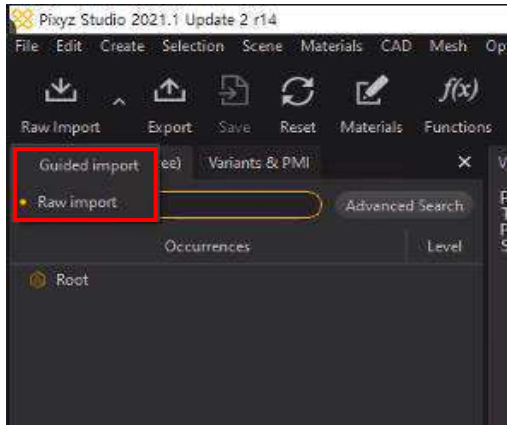
5. 재질을 입히기 위한 작업 필요시 UV 생성 가능

6. Part 수를 줄이기 위해 병합 가능

7. 원하는 형태로 사용 가능

Import

: Pixyz Studio 내 CAD 파일 가져오기

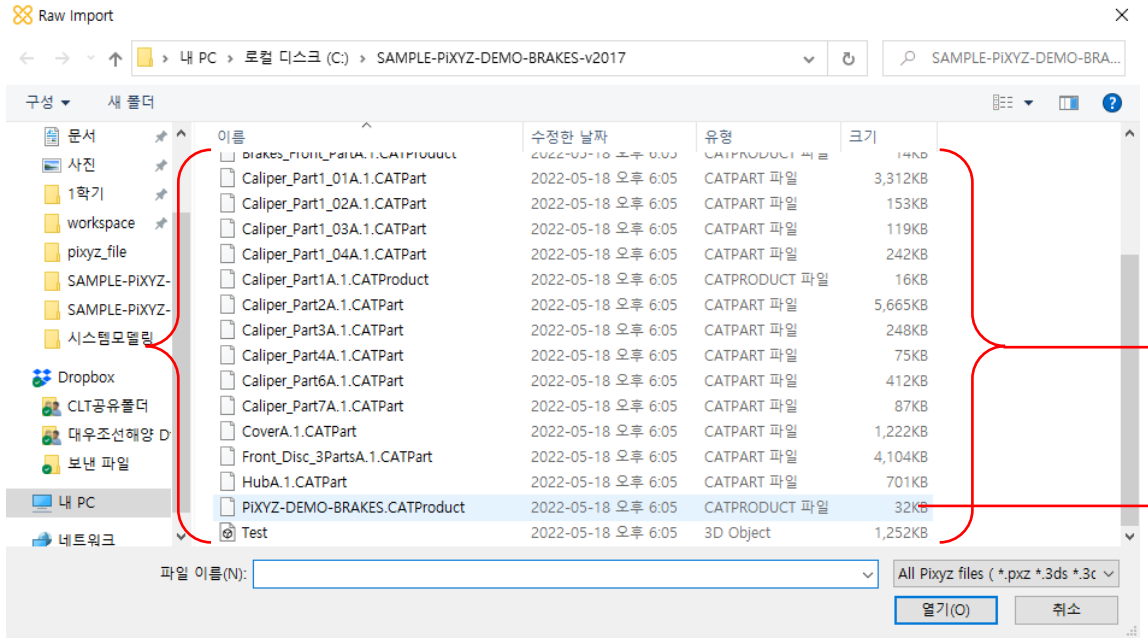


- Guided import

: 이미 기능이 추가되어 있는 CAD 파일을 불러와서 사용할 수 있음

- Raw import

: 기능이 추가 되어있지 않은 초기 도안

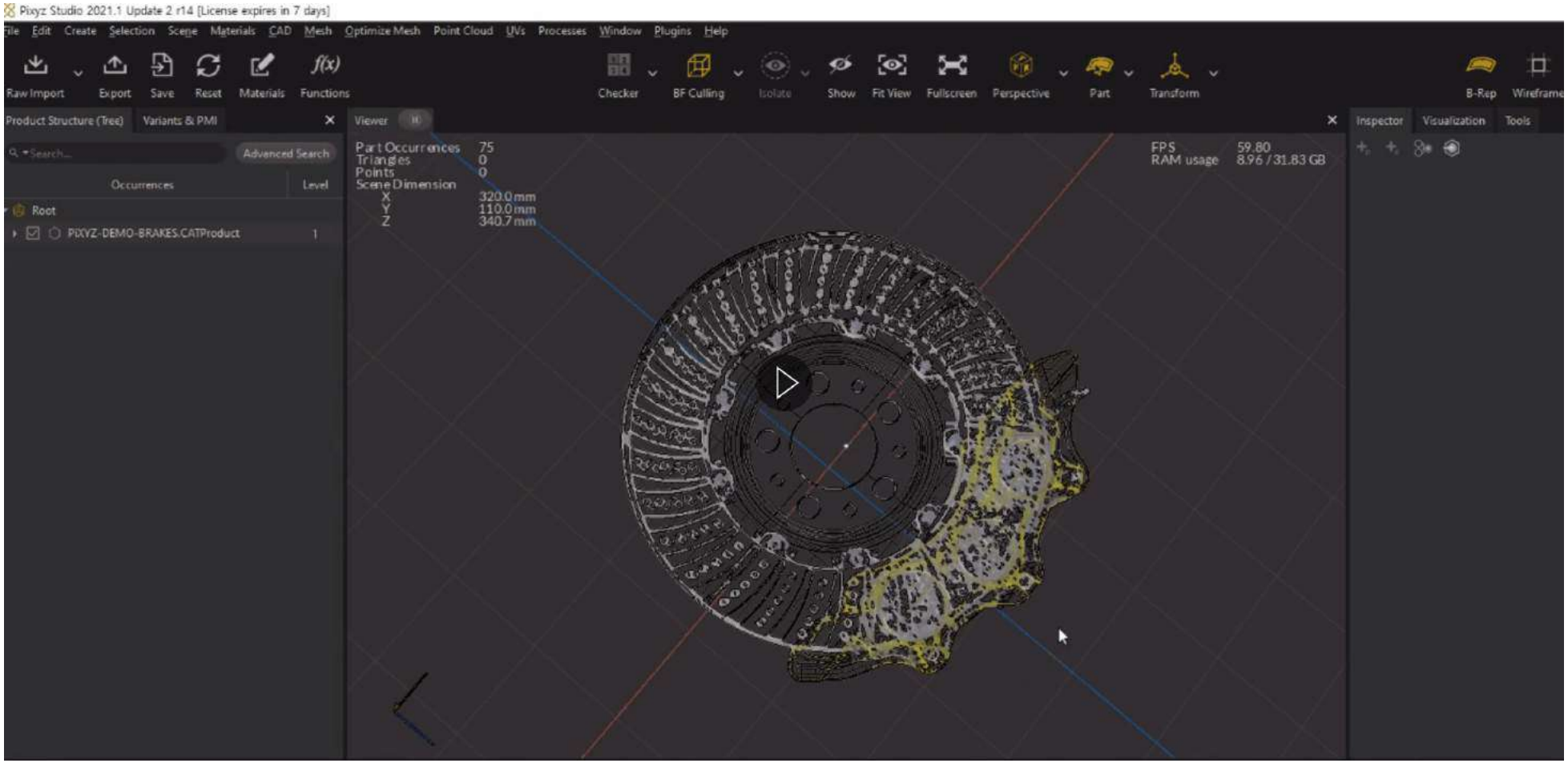


세부부품의 CAD파일들

모든 세부부품이 하나로 묶인 CAD파일 Import

회전 기능

360도 회전하여 도면 전체를 볼 수 있다. (Alt + 마우스 왼쪽)



Pixyz Studio 2021.1 Update 2 r14 [License expires in 3 days]

File Edit Create Selection Scene Materials CAD Mesh Optimize Mesh Point Cloud UVs Processes Window Plugins Help

Raw Import | Export | Save | Reset | Materials | Functions

Checker | BF Color | Isolate | Show | Fit View | Fullscreen | Top | Part | Transform

B-Rep | Wireframe | Shaded | Outlines | Points | Skeleton

Product Structure (Tree) | Variants & PMI

Search... | Advanced Search

Occurrences	Level
Root	
PiXYZ-DEMO-BRAKES.CATProduct	1
Demo-BrakesA.1	2
Brakes_Front_Part (*Brakes_Front_PartA.*)	3
Caliper_Part6 (*Caliper_Part6A.1*)	3
Caliper_Part5 (*Caliper_Part6A.1*)	3
Caliper_Part3 (*Caliper_Part3A.1*)	3
Caliper_Part2 (*Caliper_Part2A.1*)	3
Caliper_Part1 (*Caliper_Part1A.1*)	3
Caliper_Part7 (*Caliper_Part7A.1*)	3
Caliper_Part4 (*Caliper_Part4A.1*)	3
Bolt (*BoltA.1*)	3
Brakes_Back_Part (*Brakes_Back_PartA.1*)	3
Produit2.3 (*BoltA.1*)	3
Produit2.4 (*BoltA.1*)	3
Produit2.5 (*BoltA.1*)	3
Produit2.6 (*BoltA.1*)	3
Produit2.7 (*BoltA.1*)	3
Produit2.8 (*BoltA.1*)	3
Produit2.9 (*BoltA.1*)	3
Produit2.10 (*BoltA.1*)	3
Produit2.11 (*BoltA.1*)	3

Viewer

Part Occurrences	75
Triangles	0
Points	0
Scene Dimension	
X	320.0 mm
Y	110.0 mm
Z	340.7 mm

FPS	0.57
RAM usage	9.12 / 31.83 GB

Inspector | Visualization | Tools

Output

```
[2022/05/22 17:16:39]
[2022/05/22 17:16:39] executing command io.importScene
[2022/05/22 17:16:39] fileName: "C:/SAMPLE-PiXYZ-DEMO-BRAKES-v2017/PiXYZ-DEMO-BRAKES.CATProduct"
[2022/05/22 17:16:39] root: 0
[2022/05/22 17:16:42] Command execution time : 2.983 s
```

Scripting

Sample Scripts | Synchronous Execution

rkdrkd.py*

```
1 algo.repairCAD([1], 0.100000, True)
```

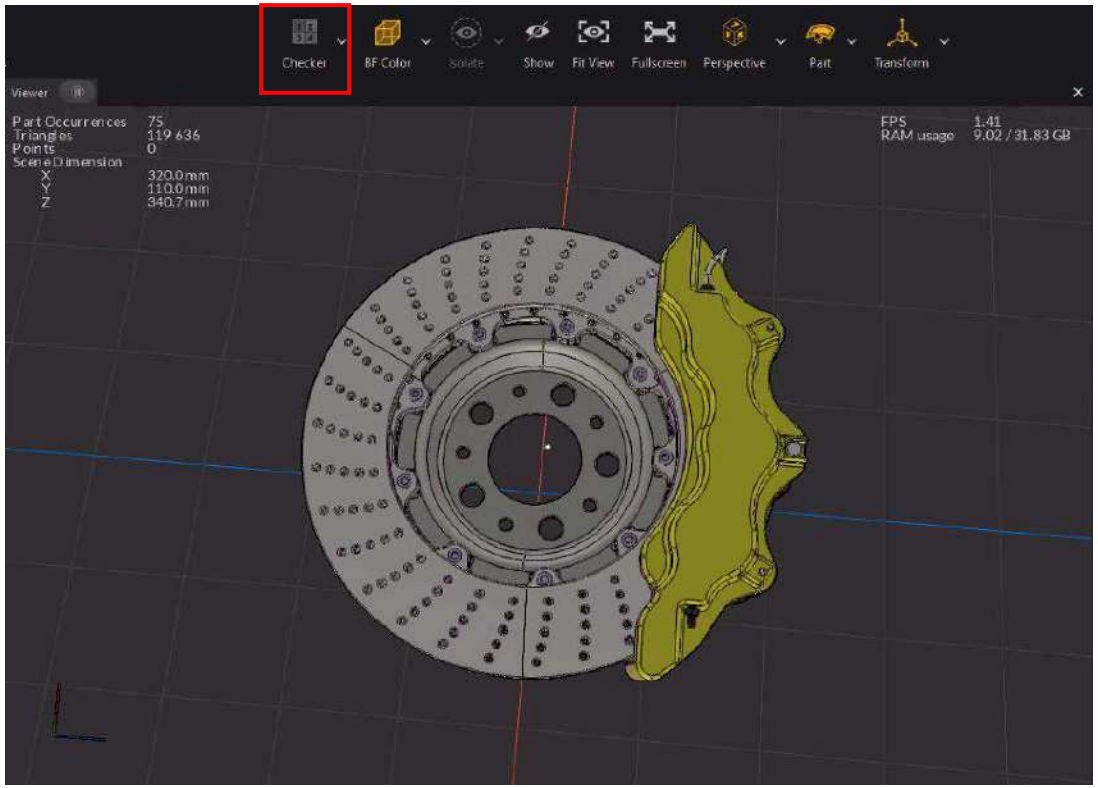
History

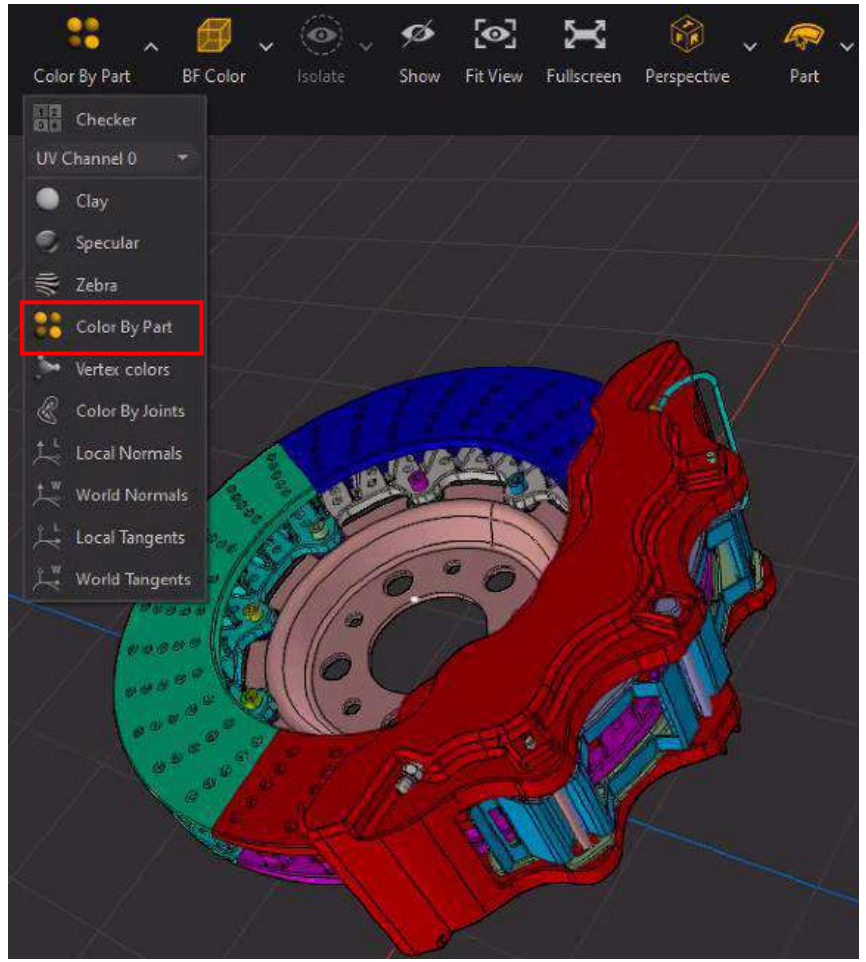
Set visibility
Set visibility
Import Scene
<empty>

Checker

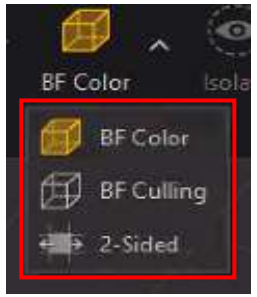
: Material 재질 변경.

특히 Color by part는 부품별로 다른 색상 표현 가능.

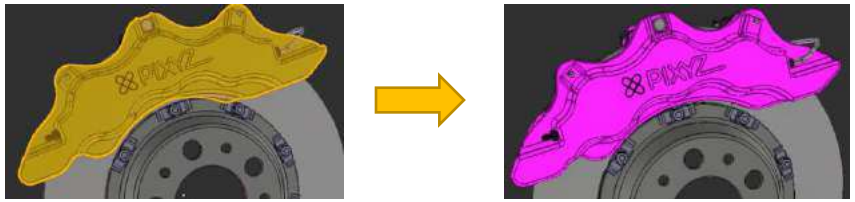




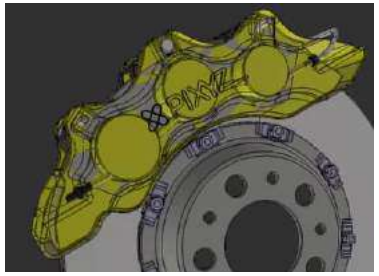
렌더링(표현)하는 방법



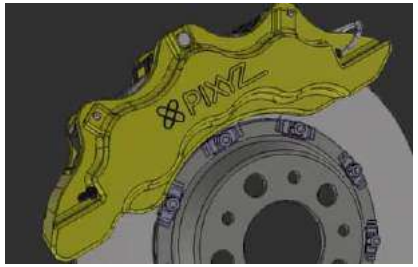
1. BF color (BF : BackFace라고도 함)
: 전면만 렌더링,
부품이 뒤집어져 있을 경우 분홍색을 나타내는 기능



2. BF culling
: 후면은 투명으로 처리하여 렌더링,
뒤집어져 있는 부품은 나타내지 않도록 하는 기능 =>시각적으로 확인 불가능

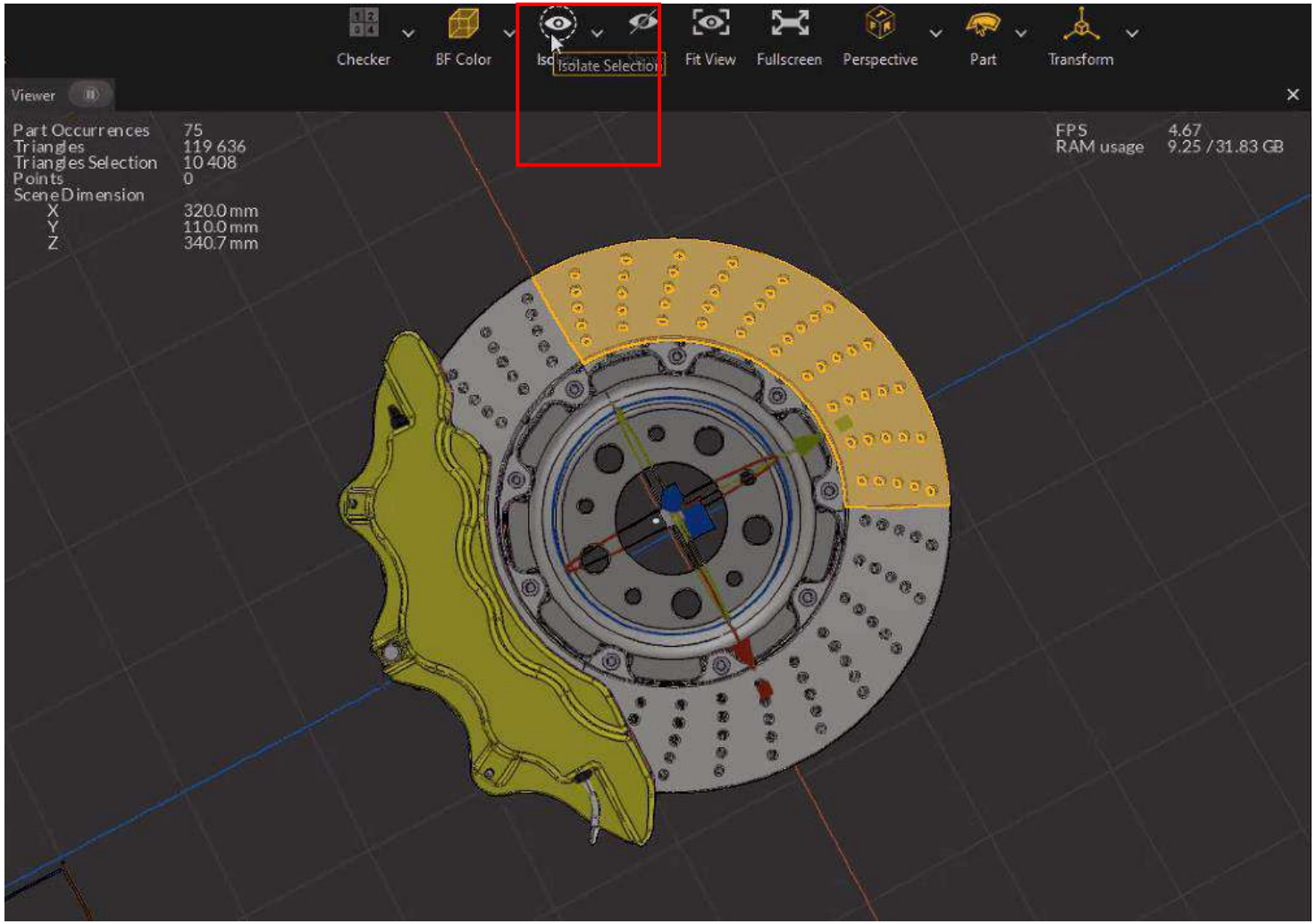


3. 2 - Side : 양면을 다 렌더링,
뒤집혀져 있더라도 무조건 나타내기 때문에 뒤집혀져 있는지 확인 불가능



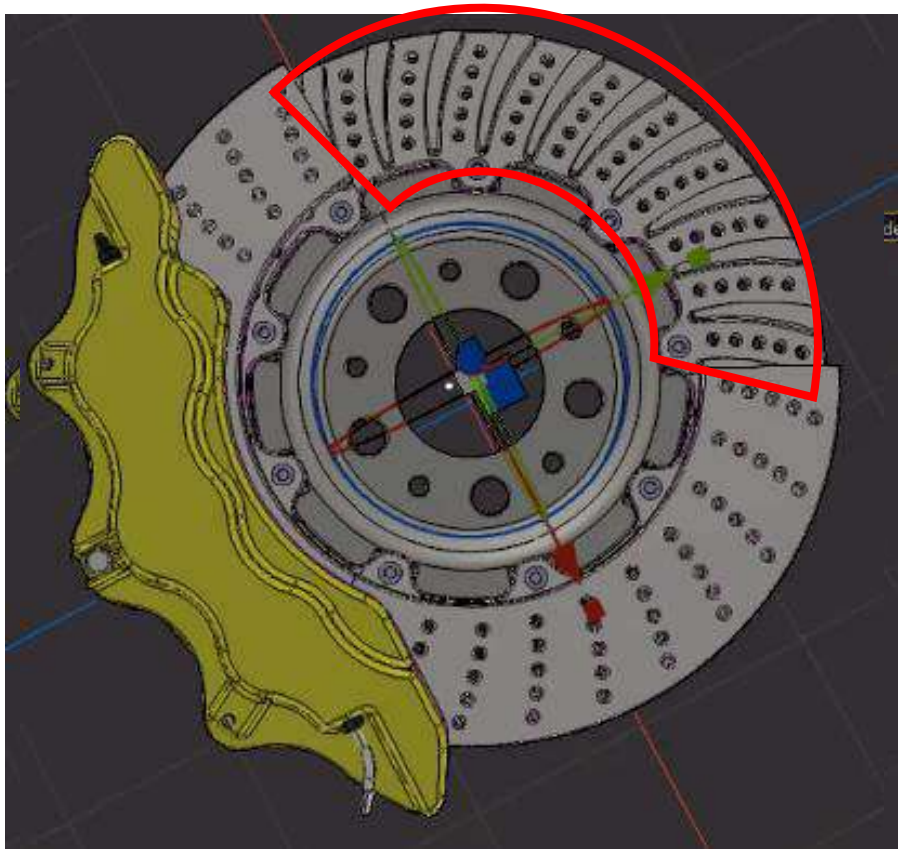
Isolate

: 특정 부품 분리 처리하여
그 이외 부품들을 조절하여 그림자로 처리 가능.



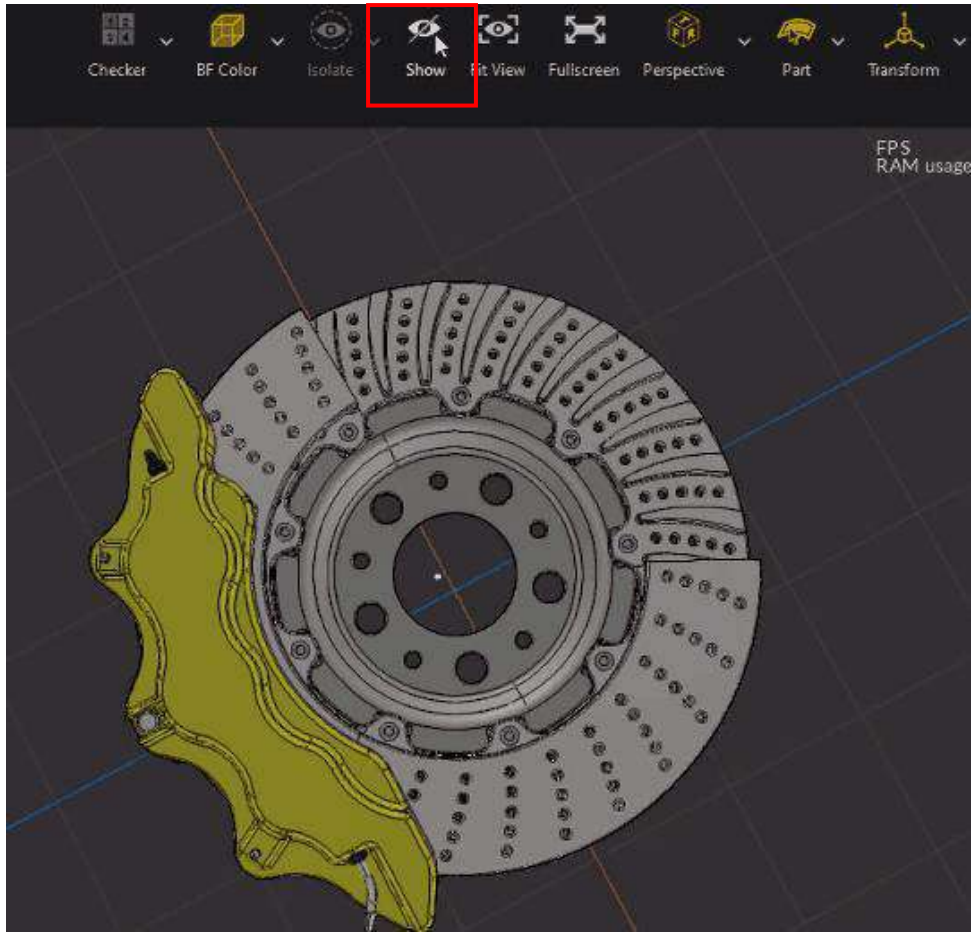
Hide

: 특정 부품 숨기는 기능



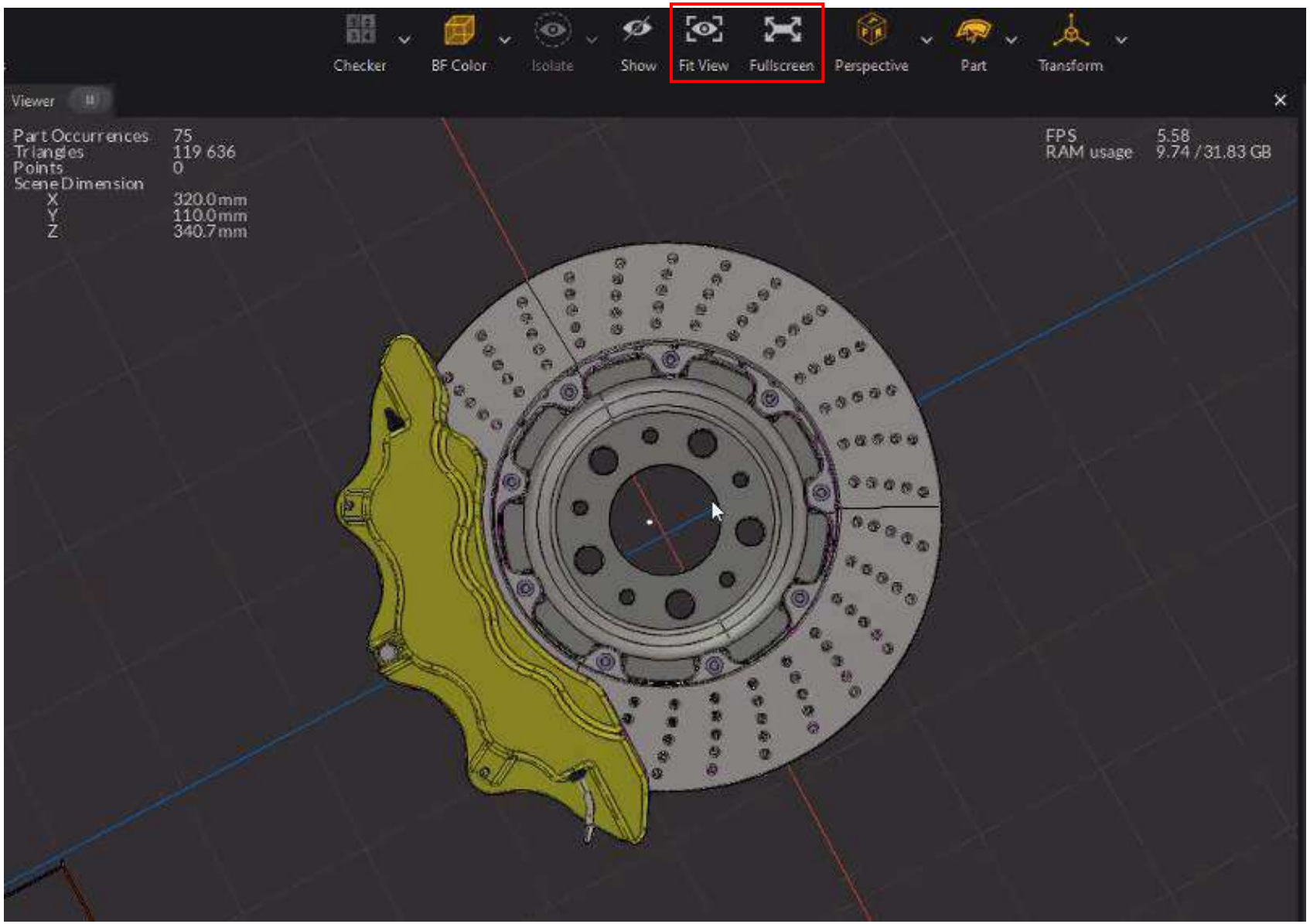
Show

: Hide 시킨 부품 보여주는 기능



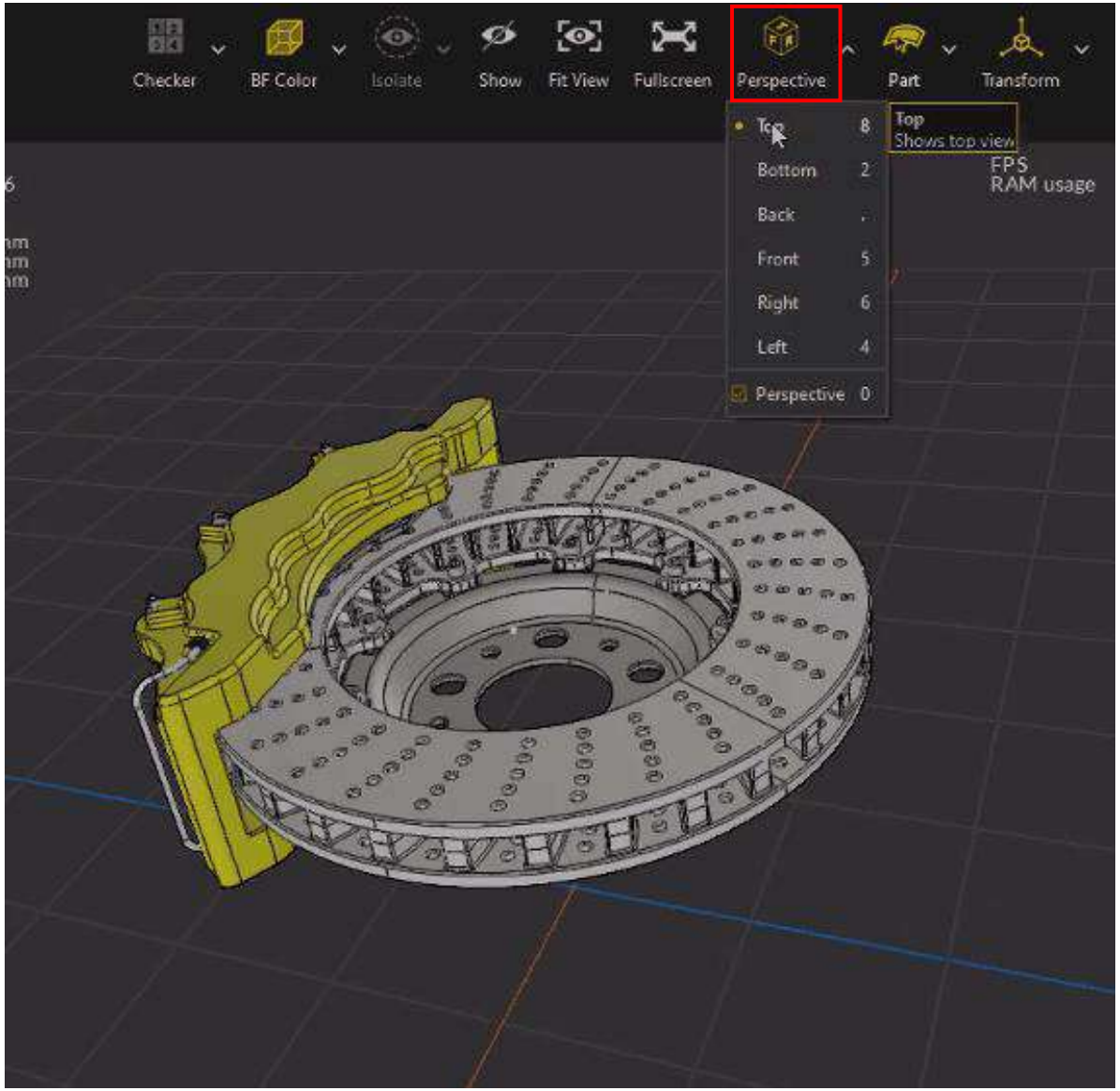
Fit View
: Viewer화면에 있는 개체에
가까이 다가가는 기능

FullScreen : Viewer를 전체화면



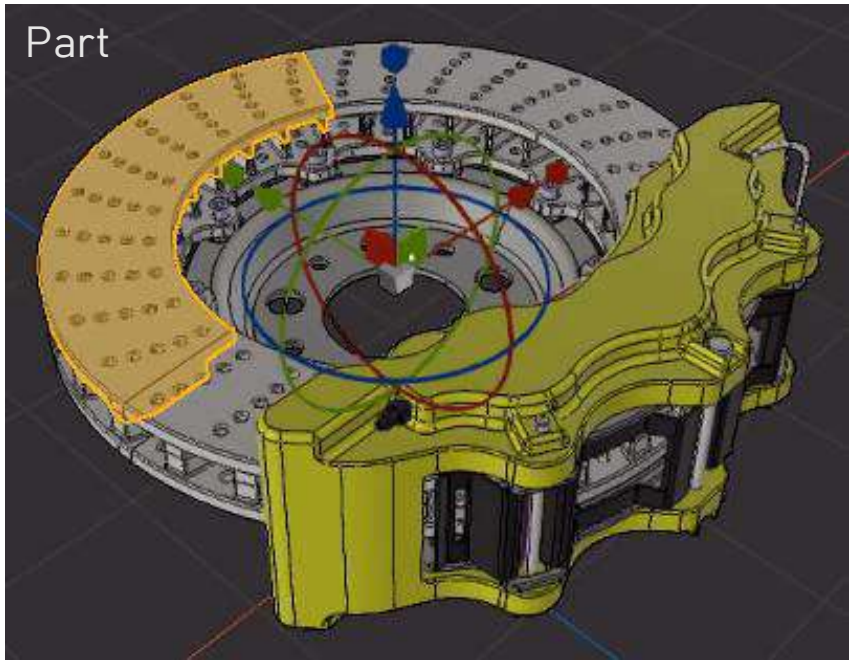
Perspective

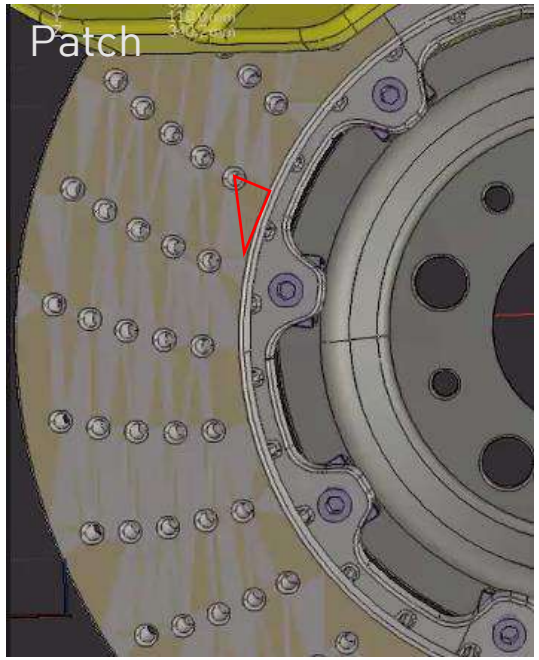
: 개체를 바라보는 시점을 변경해주는 기능
마치 사진을 찍은 것처럼 2D 화면처럼 보여주는 기능

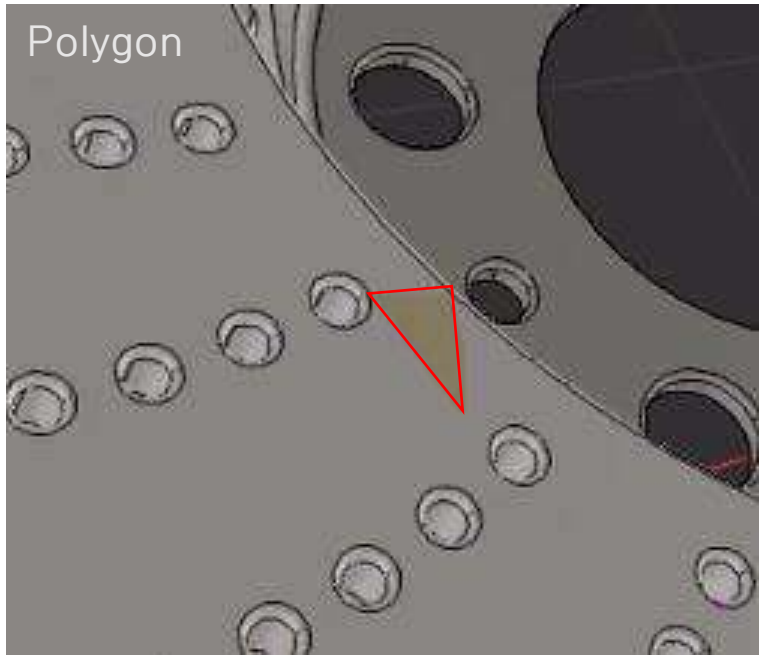


부품을 선택하는 방식

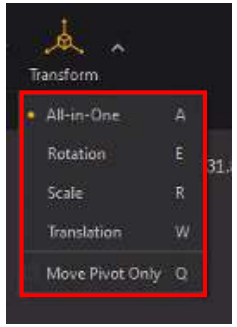
: Part, (Patch, Connected Mesh는 동일), Polygon







Transform



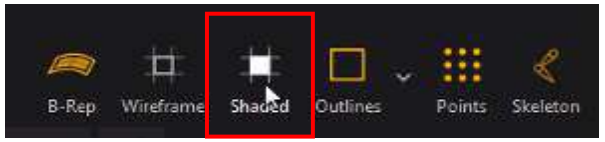
All-in-One : 이동, 회전, 크기 조절 기능 다 있음

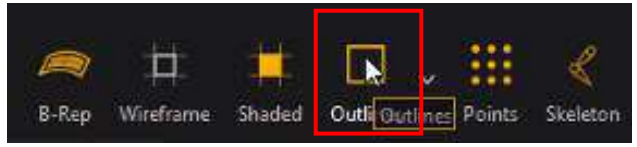
Rotation : 회전

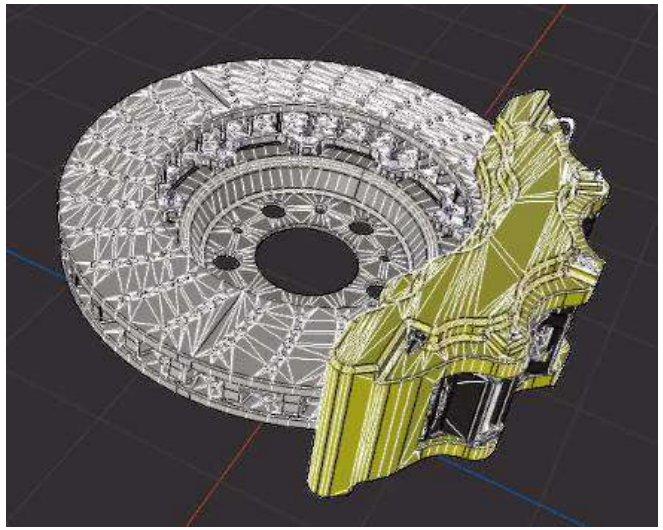
Scale : 크기

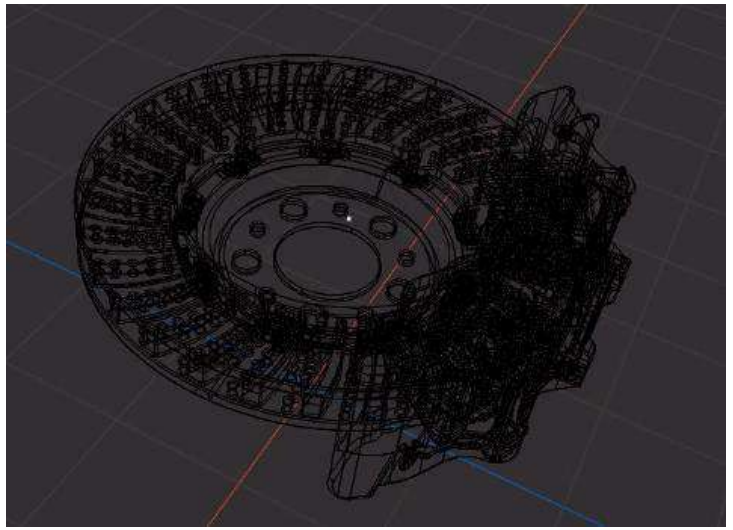
Translation : 이동

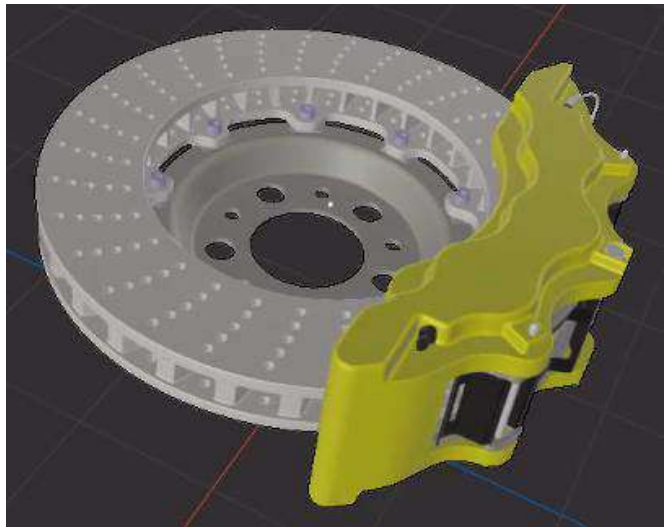
Wireframe : Polygon의 Wire 구성 정보







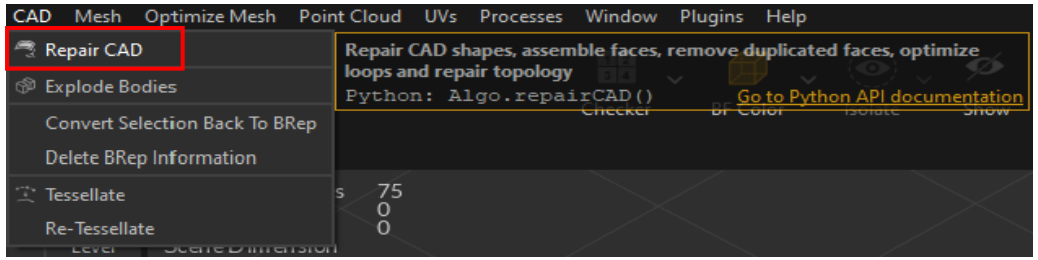


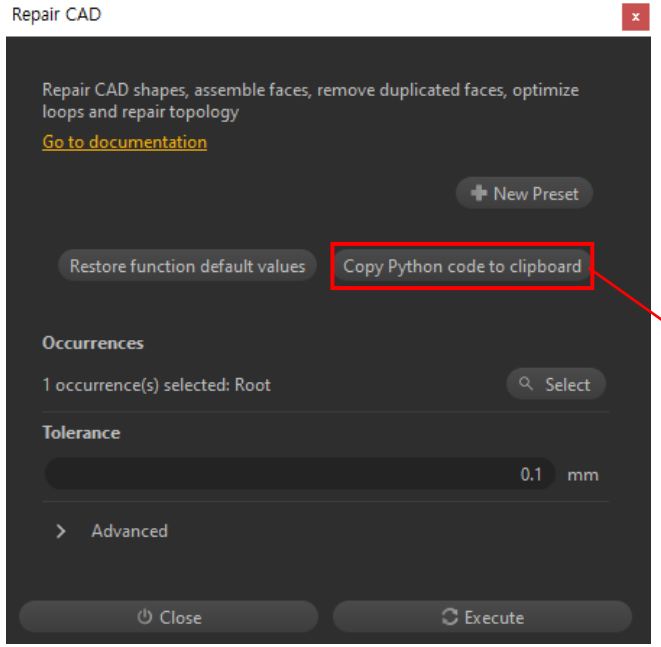


CAD DATA의 색상정보도 알아내서 Material까지 만들어낼 수 있는 기능

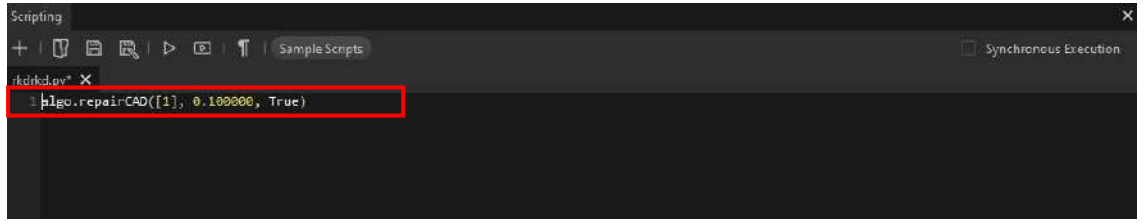
Repair CAD

: Automatically repairs native CAD / BRep geometries
(CAD faces assembly and optimization, CAD faces automatic orientation, ...)





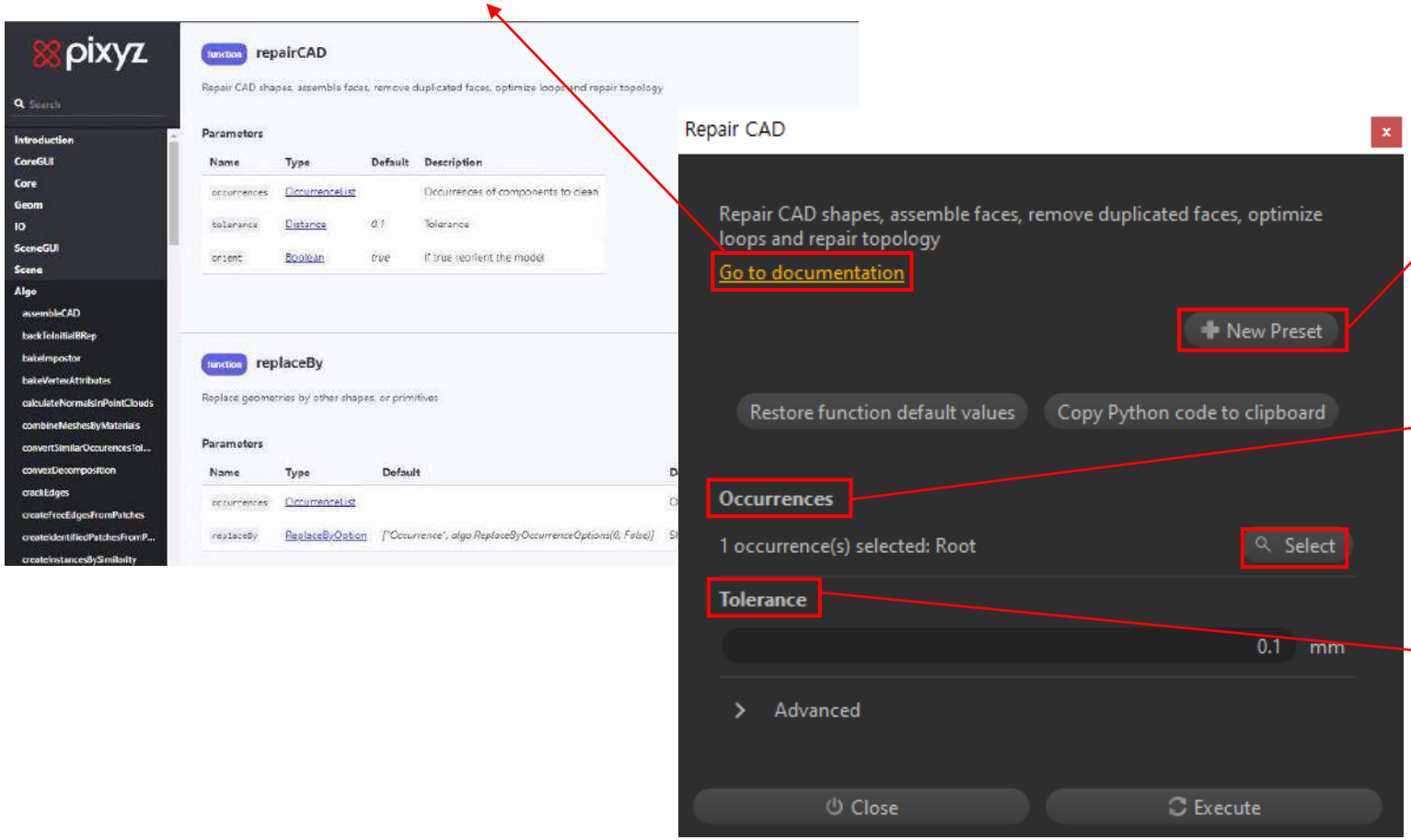
Python Code Scripting 창에 입력 가능



모든 기능에 공통으로 적용되어 있는 기능들

Go to documentation

: 해당 기능의 옵션들에 대한 설명서



New Preset

: 자주 사용되는 옵션들을 Preset으로 저장 후 빠르게 옵션을 적용할 수 있는 기능

Occurrences

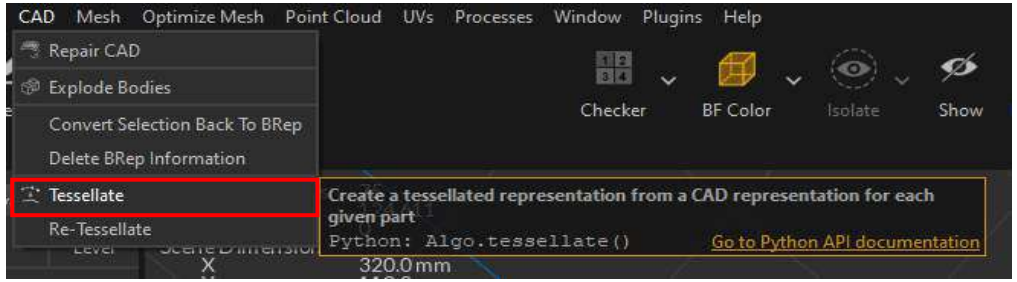
: 해당 기능을 적용할 부품이 올바르게 선택되어있는지 확인할 수 있는 기능.

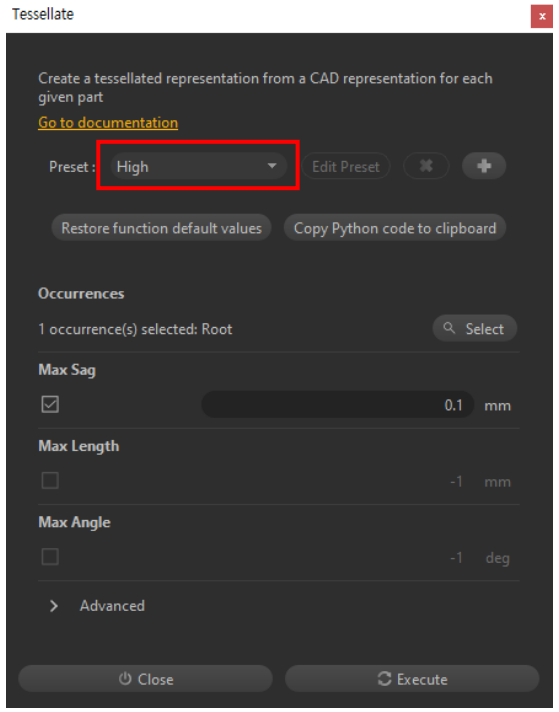
Tolerance

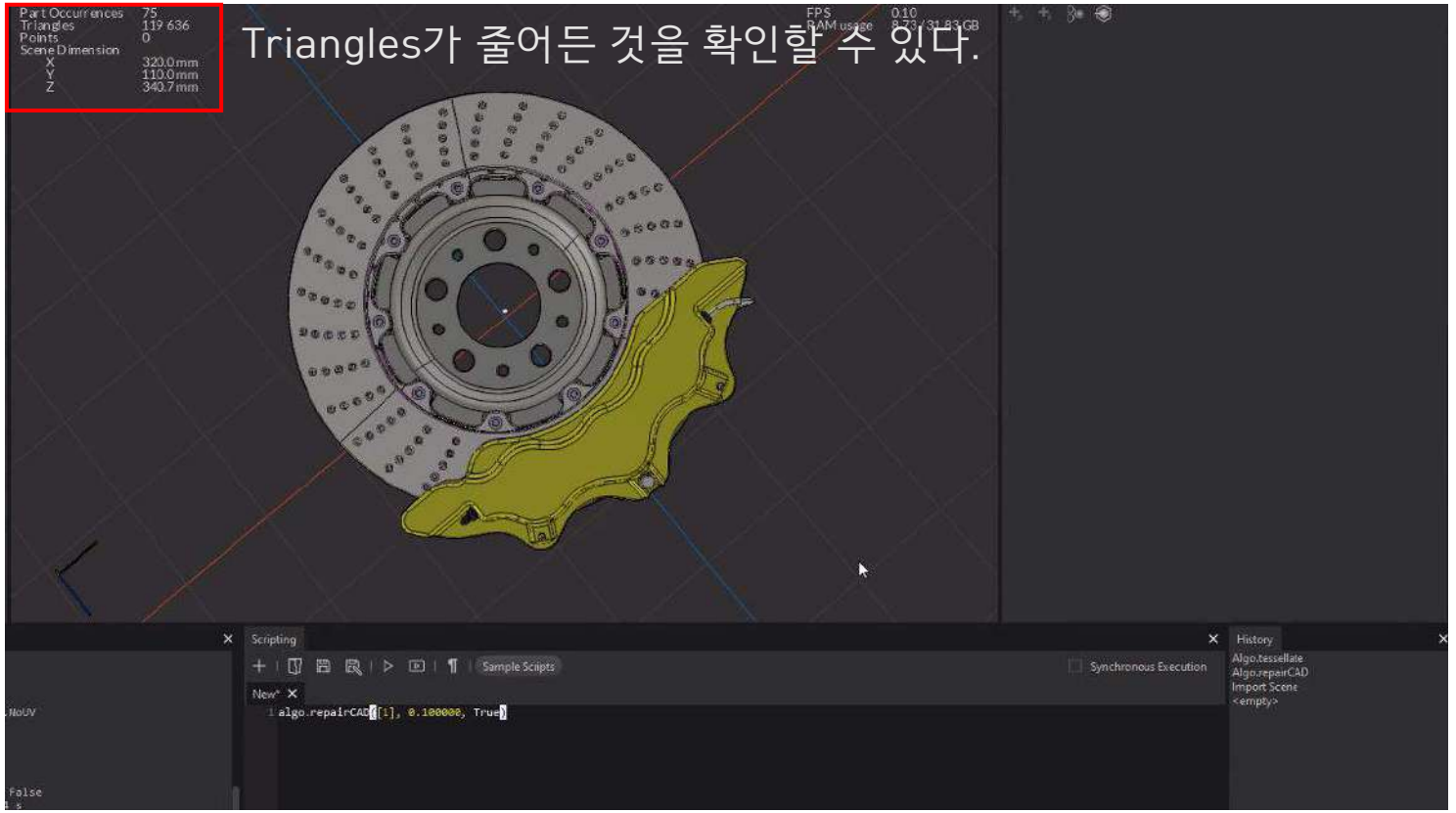
: 표면에 결합하기 위한 임계값, 해당 값보다 작은 곳에 위치한 가까운 부품들을 결합하는 기능

TESSELLATE

: CAD models, turning them into light 3D meshes
using powerful tessellation algorithms, with automatic UV creation.



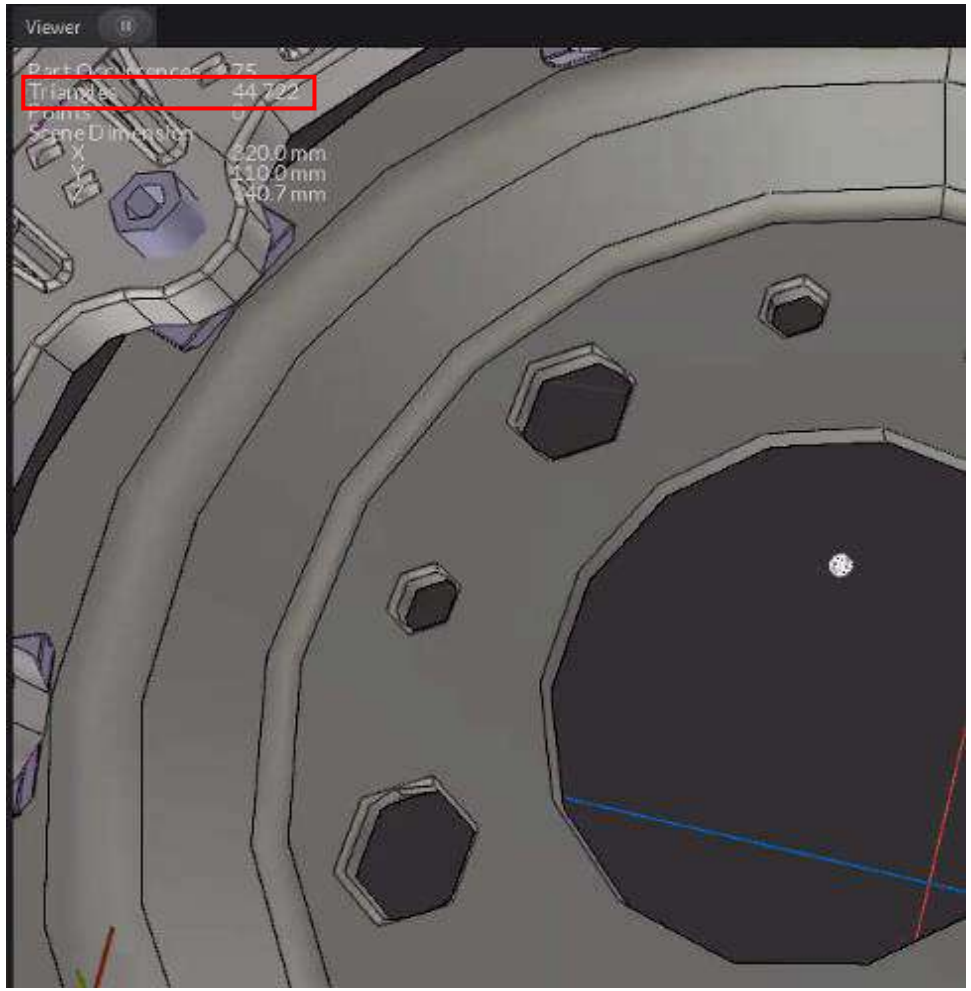




TESSELLATE

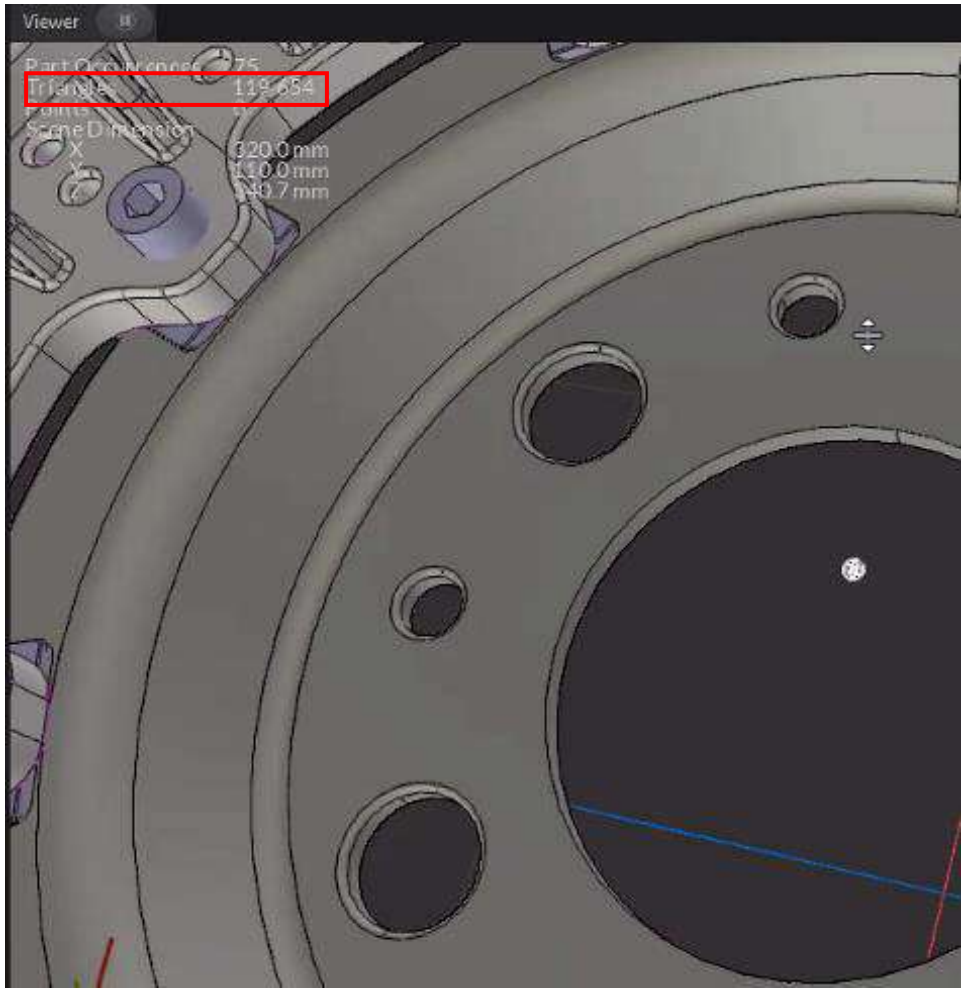
Preset : Low

=>Triangles : 44726 (해상도 낮고 단순화)



Preset : High

=> Triangles : 119654 (더 조밀하게 표현)

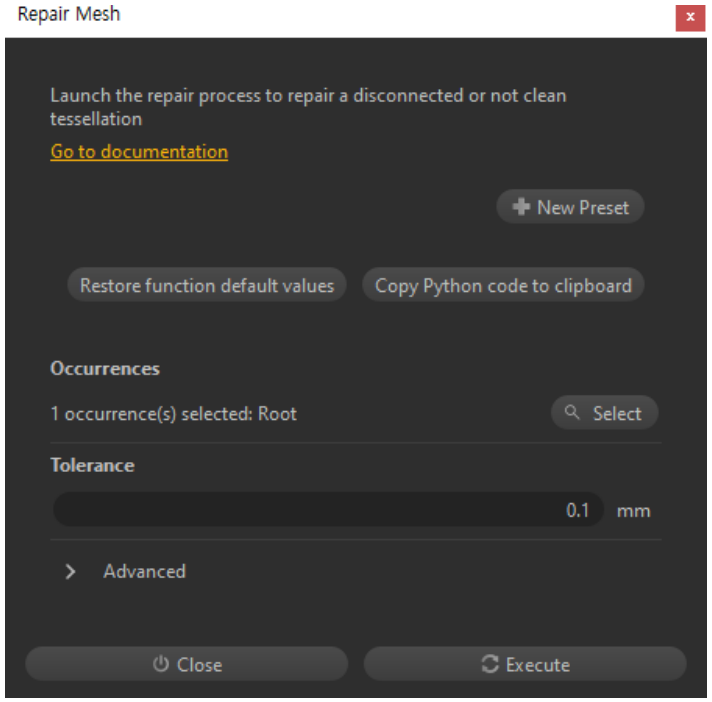


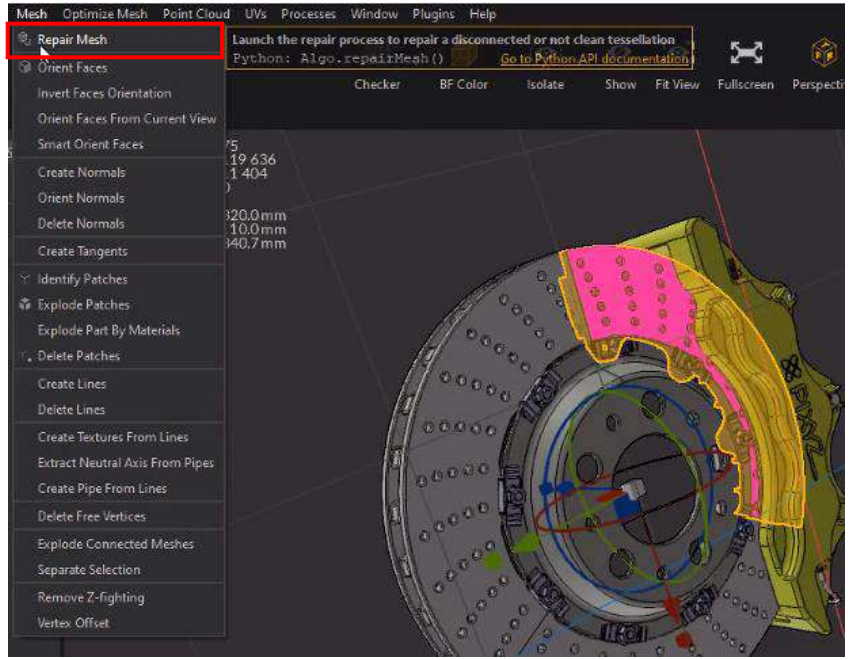
Invert Faces Orientation

: 부품을 뒤집는 기능

Repair Mesh

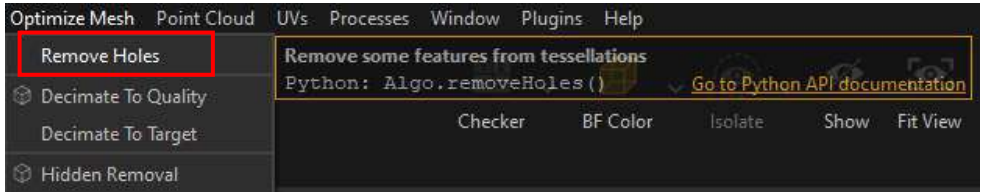
: 뒤집어진 부품을 원래상태로 돌려줌

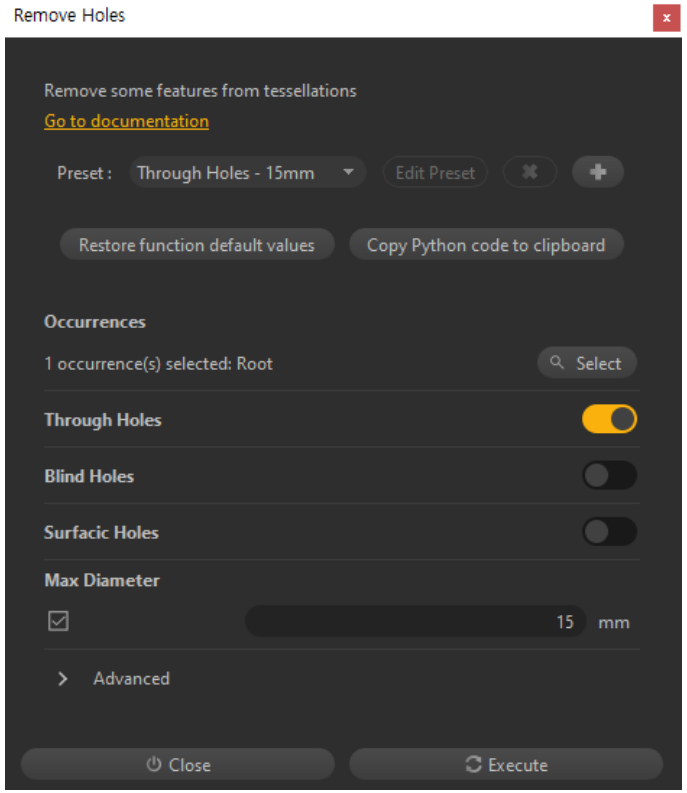


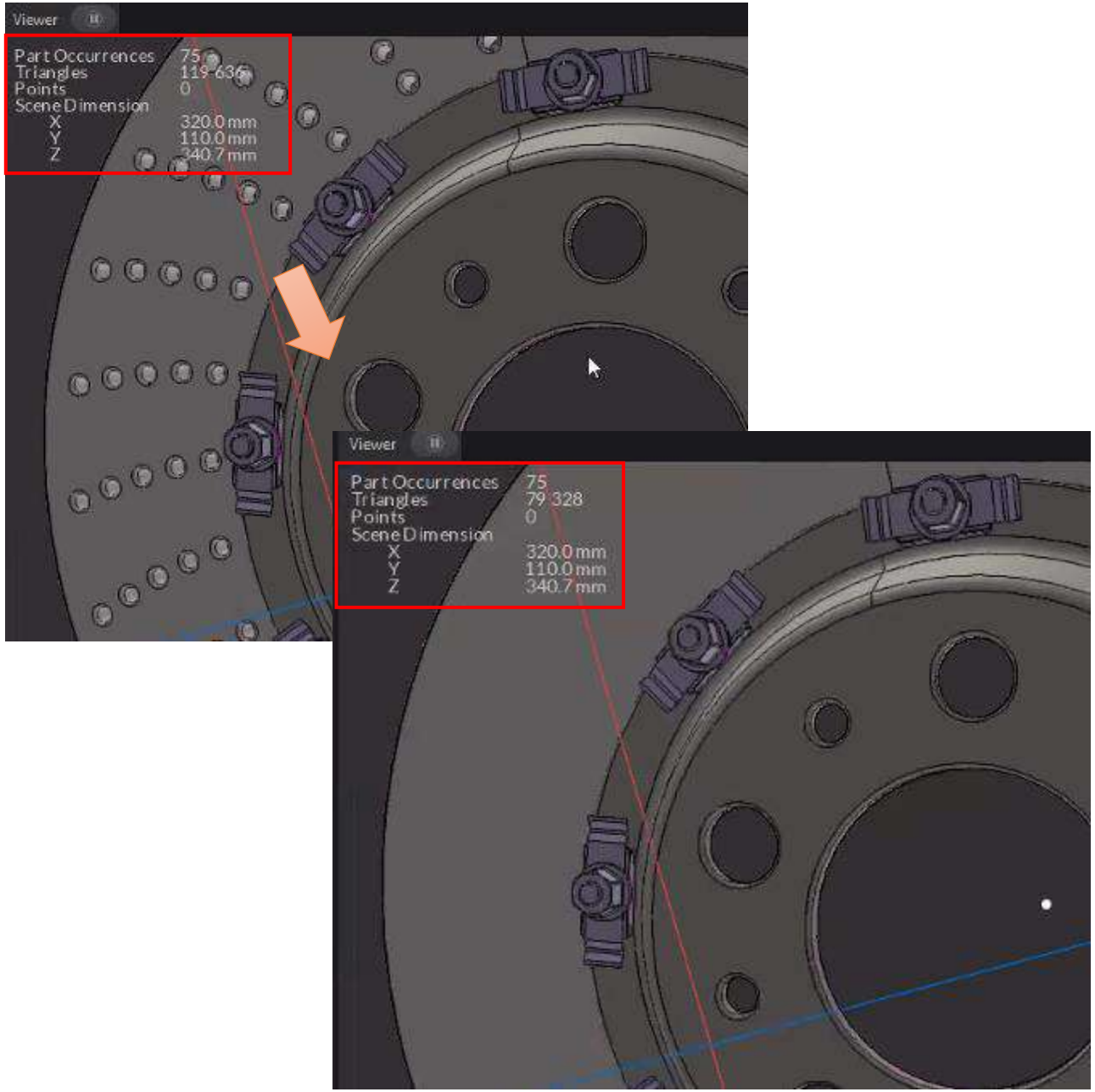


Remove Holes

: 구멍의 사이즈에 따라 구멍 없애기 기능.
(제한할 구멍 사이즈 조정 가능)

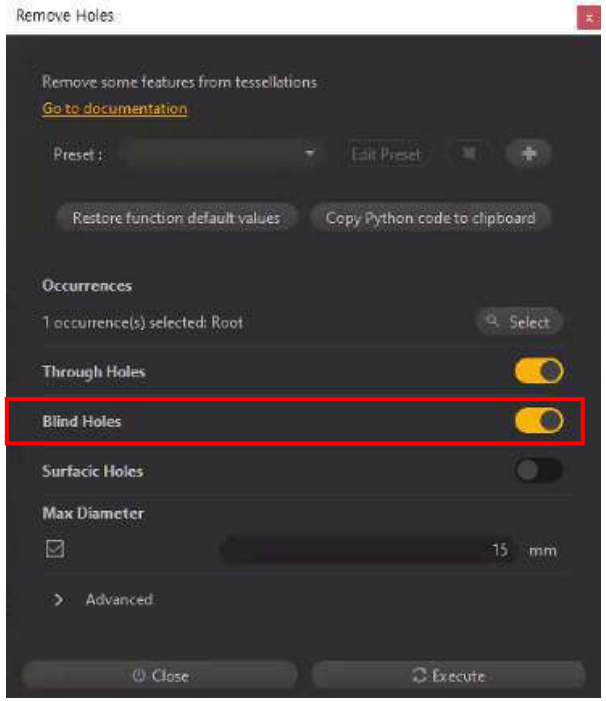


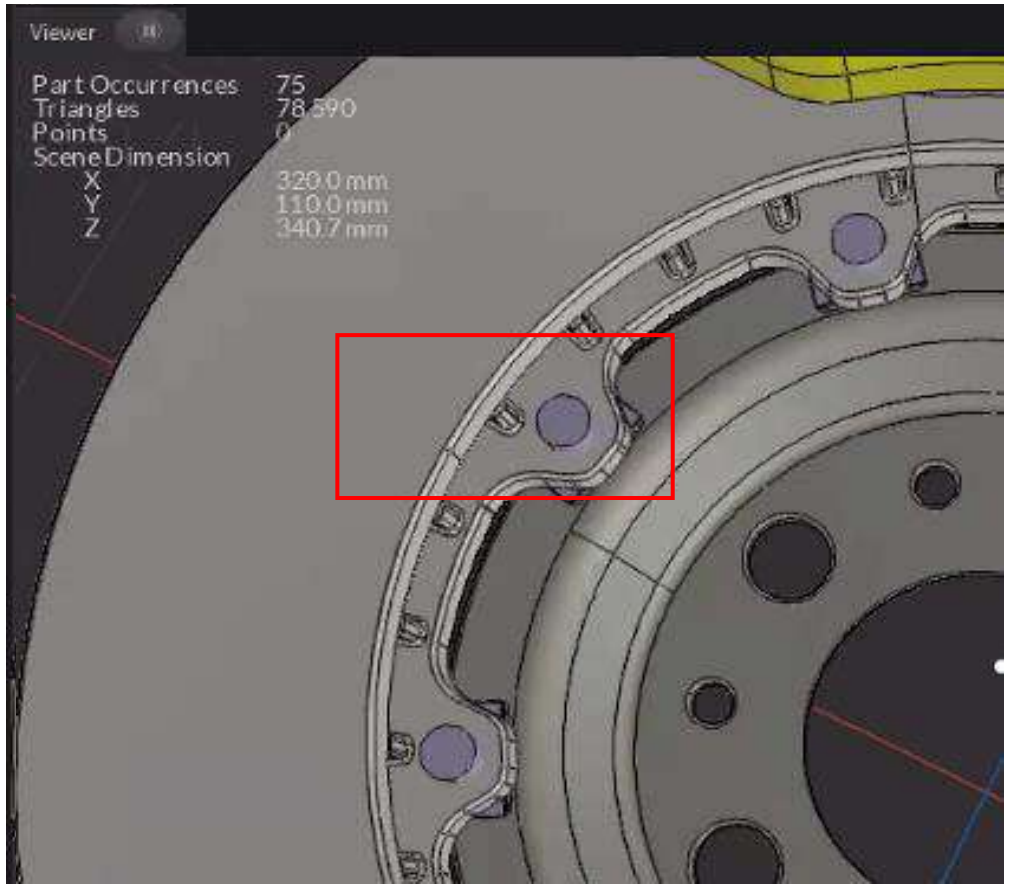




Remove Holes - Blind Holes

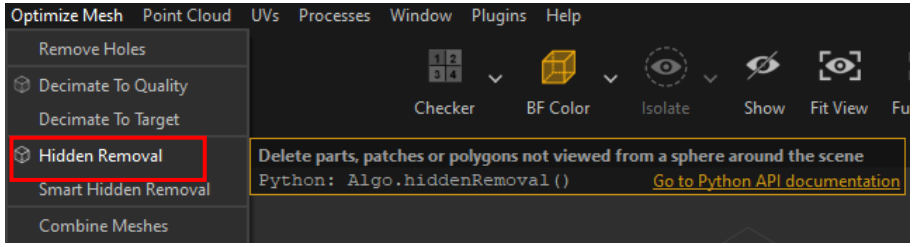
: 앞은 뚫어져있고 뒤는 막혀있는 구멍을 막아주는 기능.

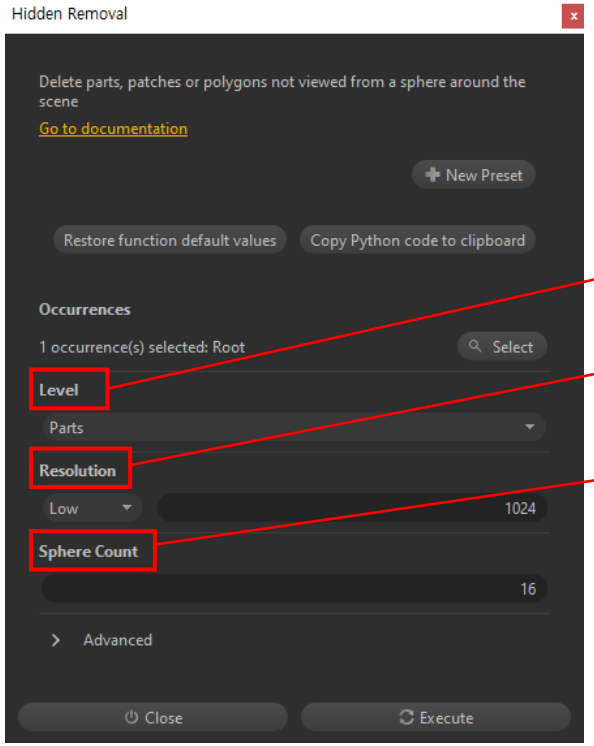




Hidden Removal

: 겉으로 보이지 않는 부품을 제거하는 기능 (불필요한 부품 제거 가능)





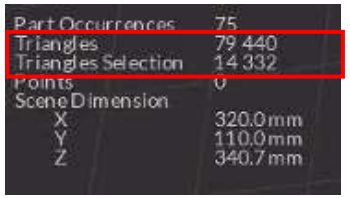
Level : 부품 선택 단위 (Parts, Patches, Polygons)

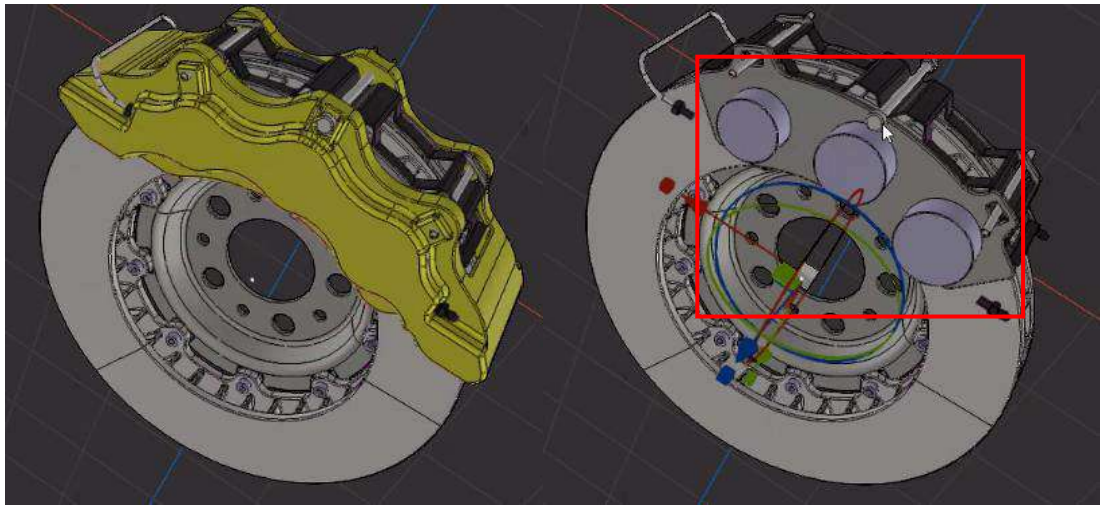
Resolution : 해상도

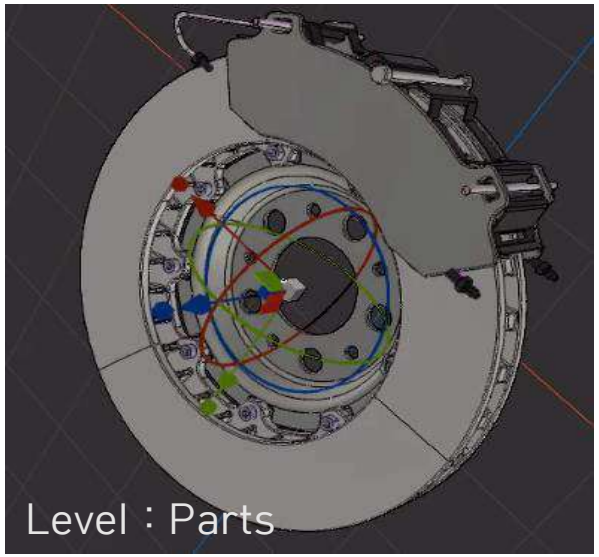
Sphere Count

: 카메라 개수라고 생각할 수 있다.
⇒ 숫자가 클수록 정밀하게 볼 수 있다.
⇒ But 처리시간 오래 걸림

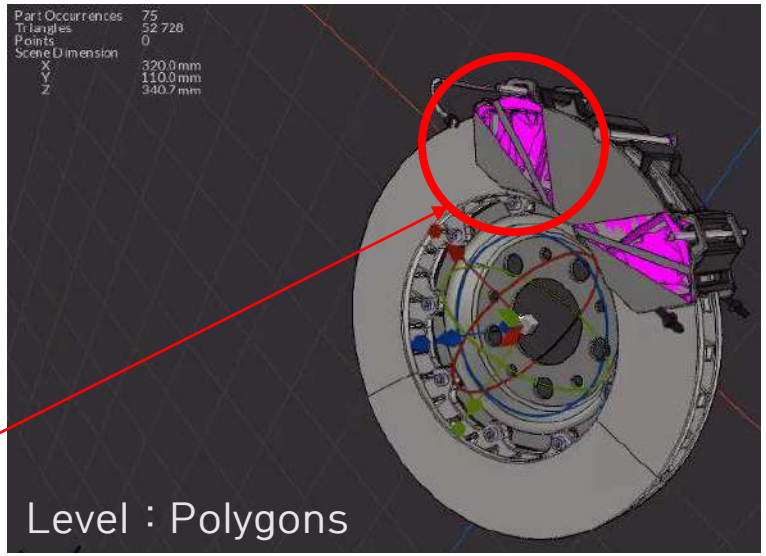
Hidden Removal







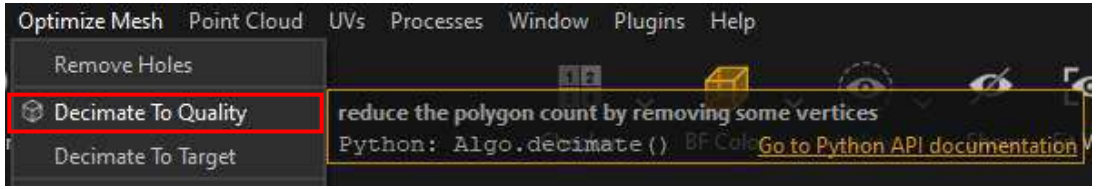
숨겨져 있던 구멍이 사라진 것을 확인 할 수 있다.

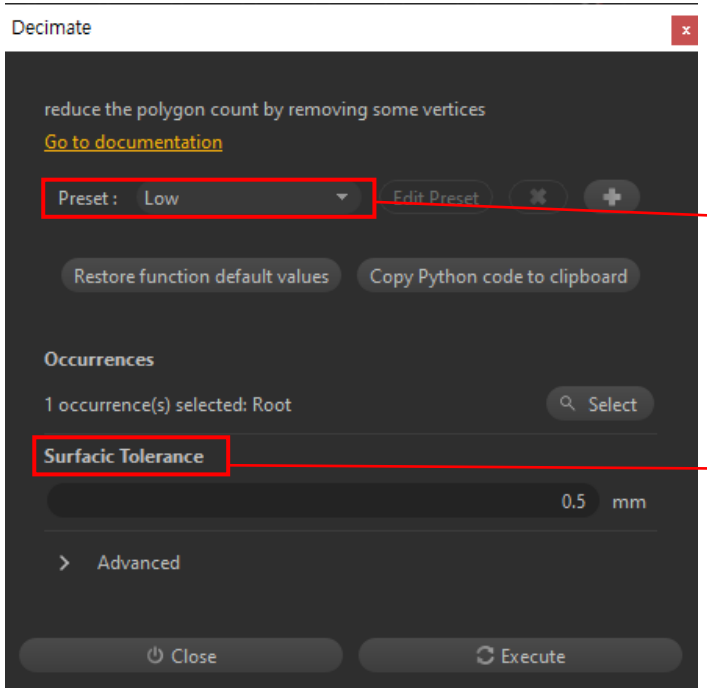


Polygons는 세밀한 부분까지 제거하기 때문에 깨진 것을 볼 수 있다.

Decimate To Quality

: Polygon이 구성되는 정점(꼭짓점)을 없애는 방법





Preset

: Strong/Medium/Low

Surfacic Tolerance

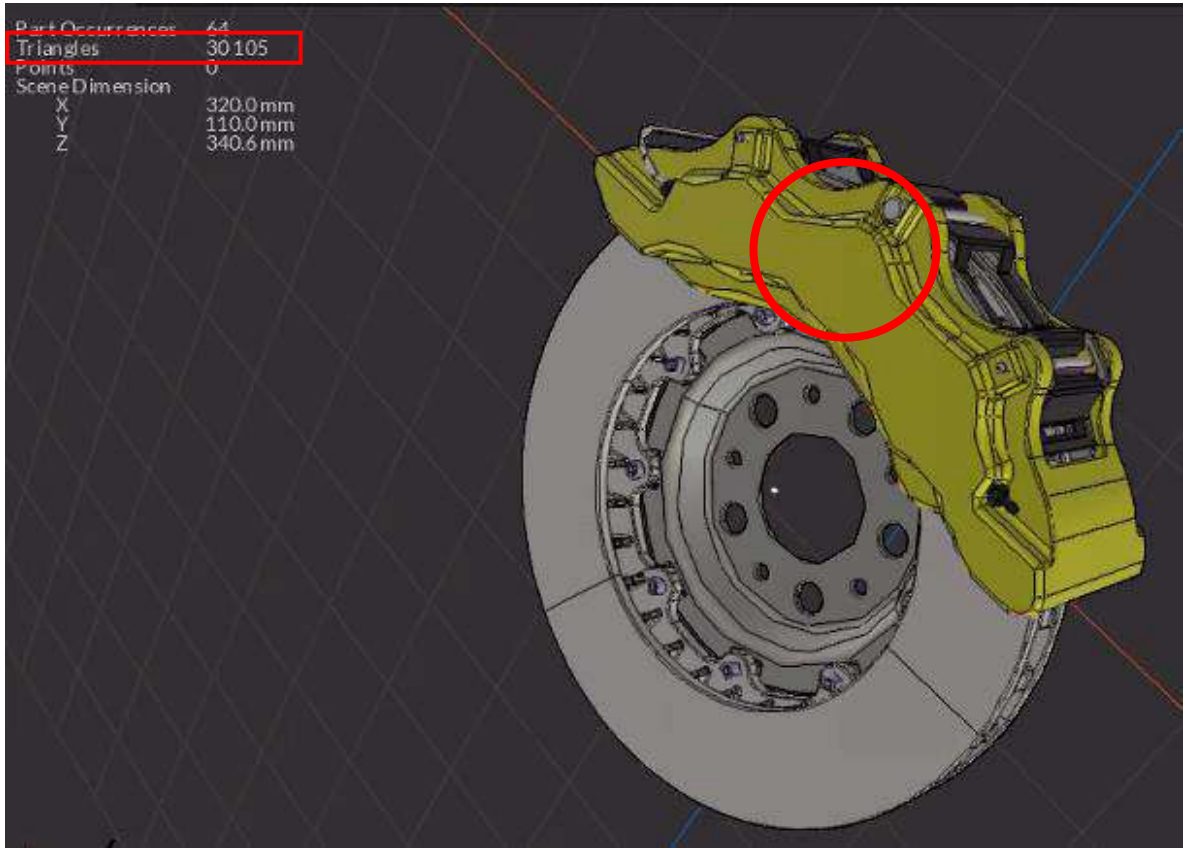
: 제거할 정점(꼭짓점)들의 최소 간격

ex) Strong을 선택할 시 3mm
이는 정점 간의 간격이 3mm 이하인 정점들 제거하는 기능을 의미.

Decimate To Quality

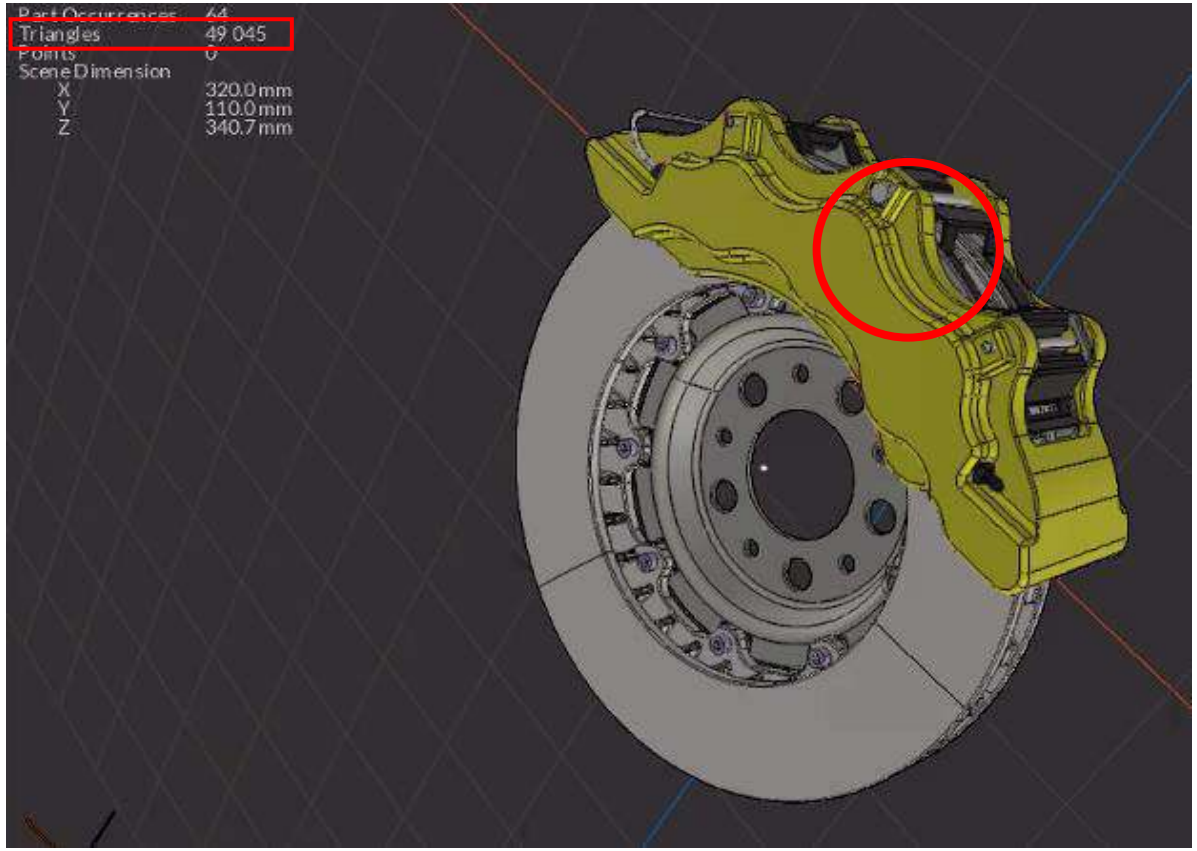
Triangles : Strong < Low

Preset : Strong



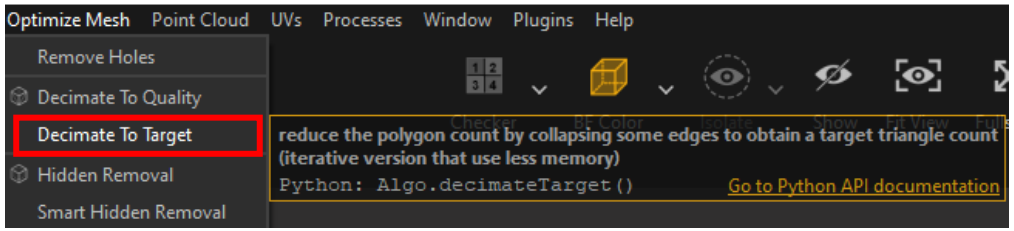
찌그러지는 현상이 발생할 수도 있다.

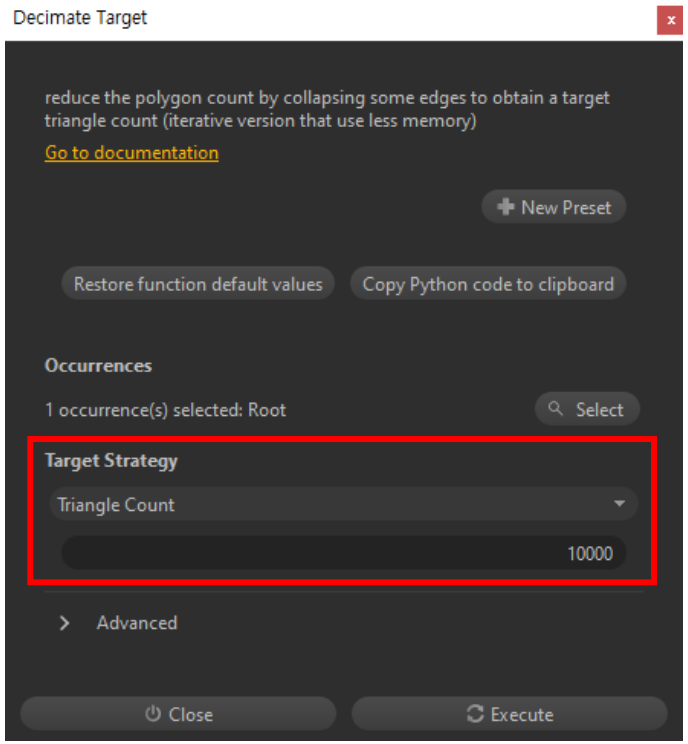
Preset : Low

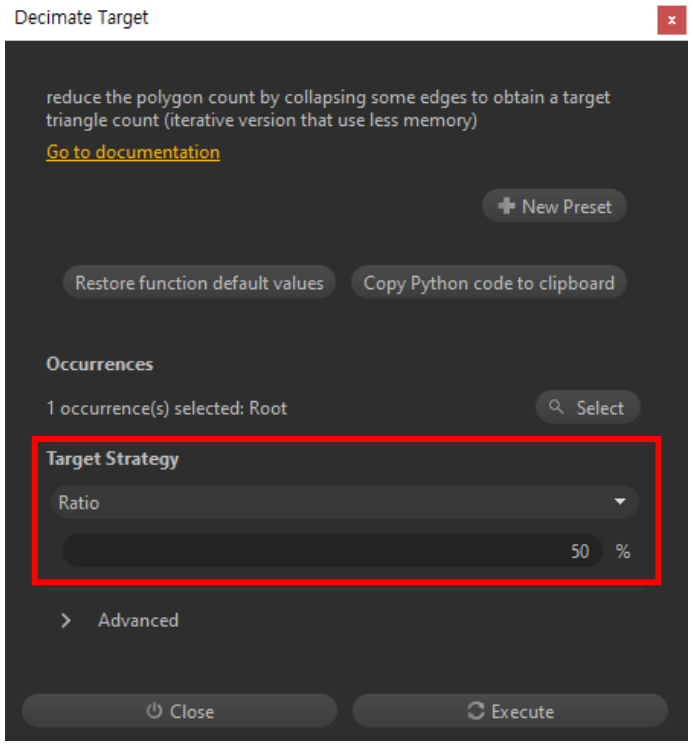


Decimate To Target

: Decimate To Quality와 동일한 기능
But ! Target을 기준으로 경량화 진행
=> 기준이 다르다.







Target Strategy

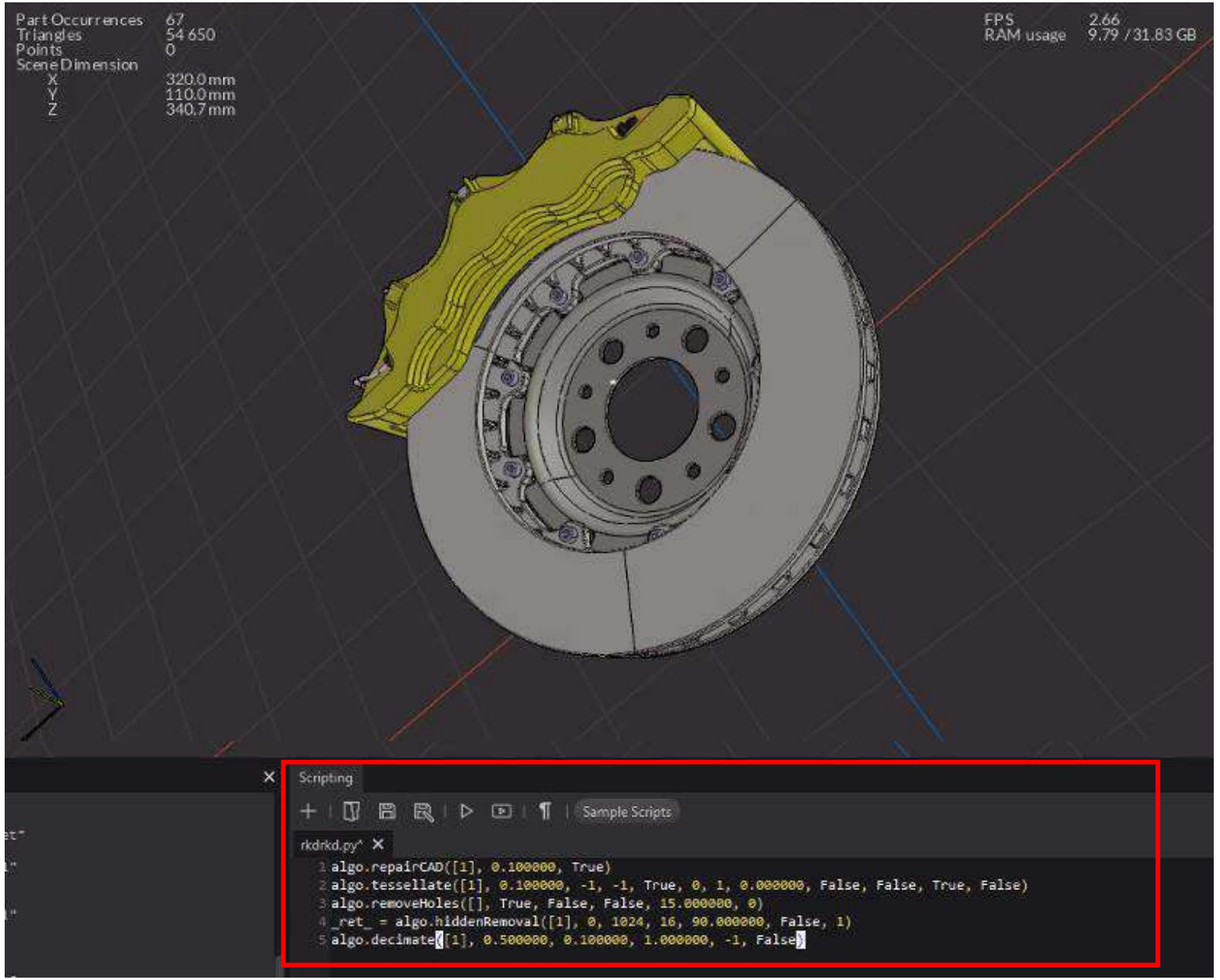
- Triangles Count
: Triangles 수에 맞추어 경량화

- Ratio
: Triangles 수의 비율에 맞추어 경량화

Scripting

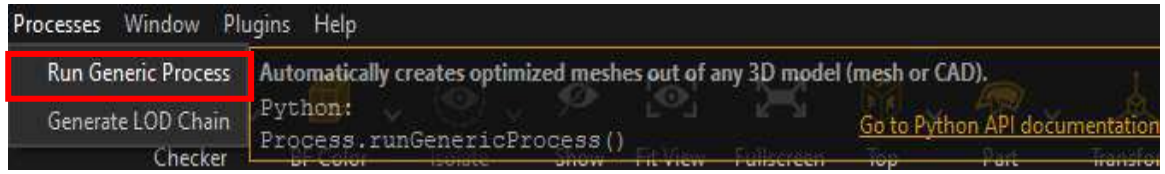
: 이전에 실행했던 기능들을 Scripting 창에서 python코드를 통해 한번에 실행 가능.

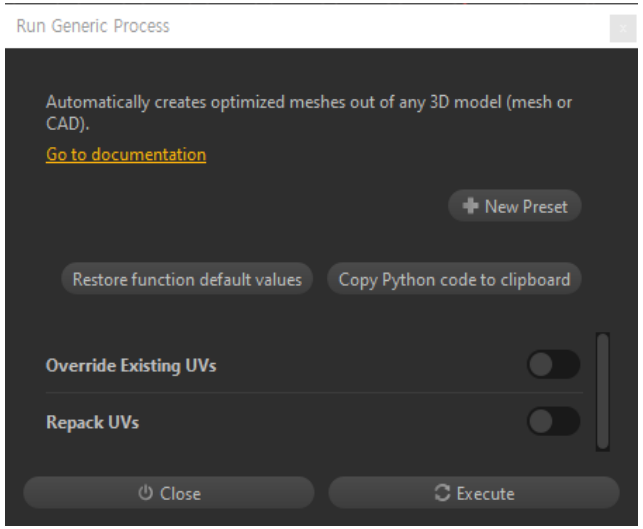
원하는 기능들만 Scripting에 모아 놓고 사용할 수 있는 장점이 있다.

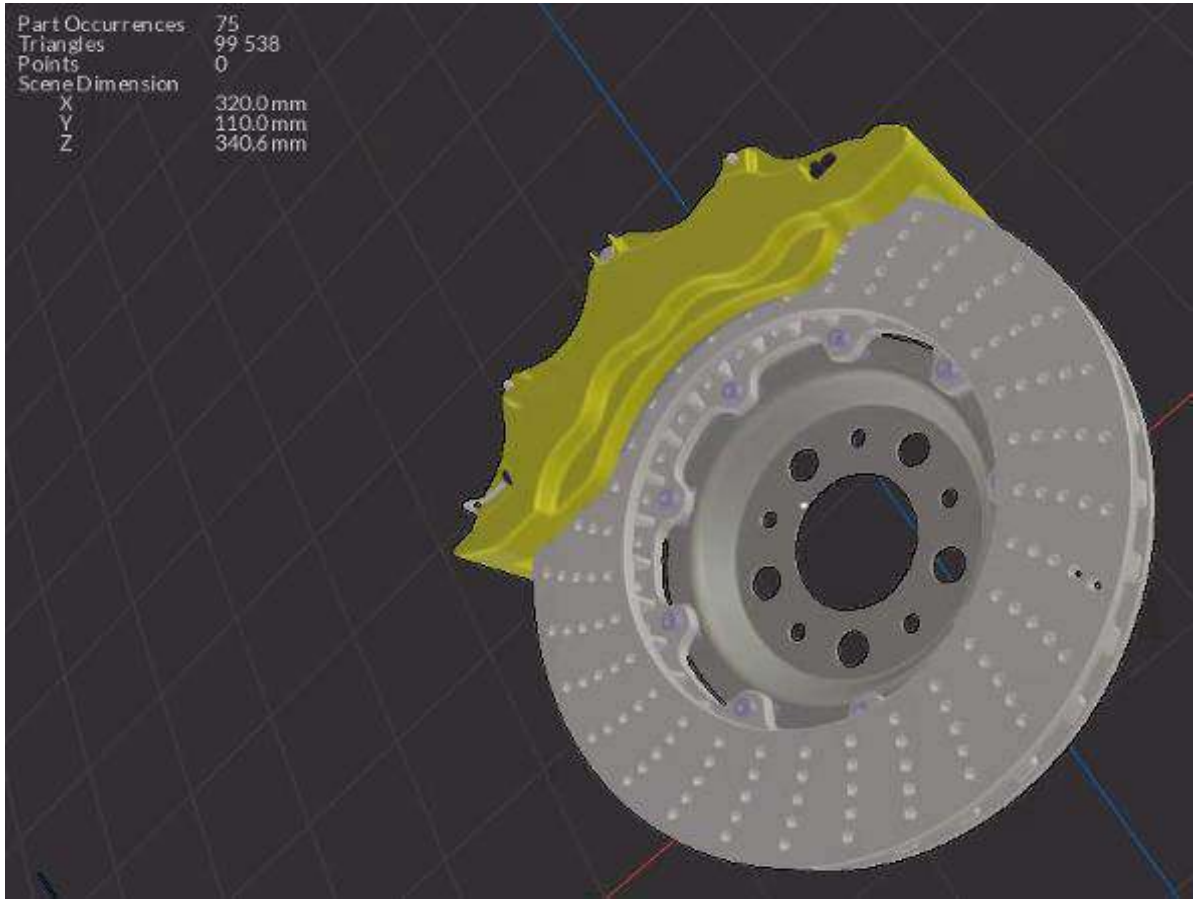


Run Generic Process

: 자동으로 경량화 시키기

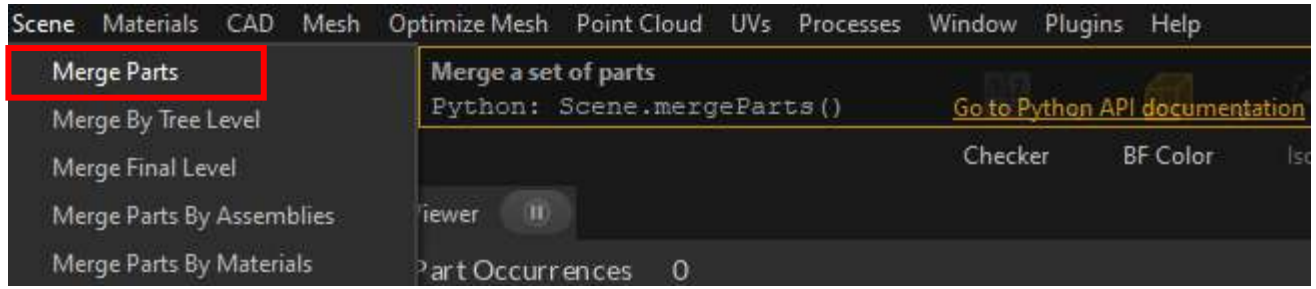


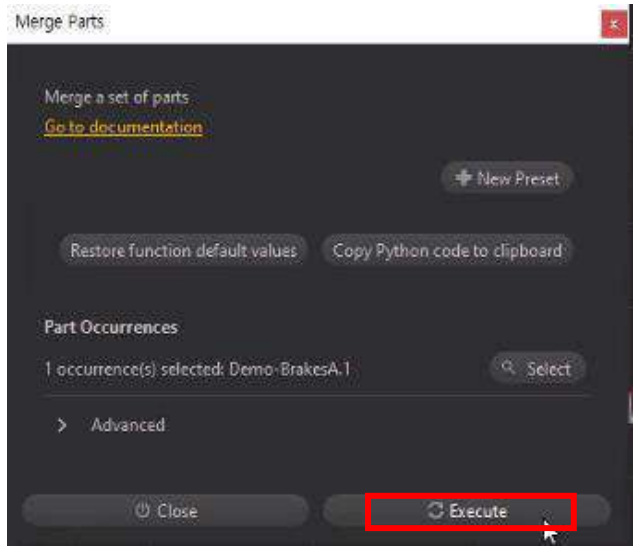


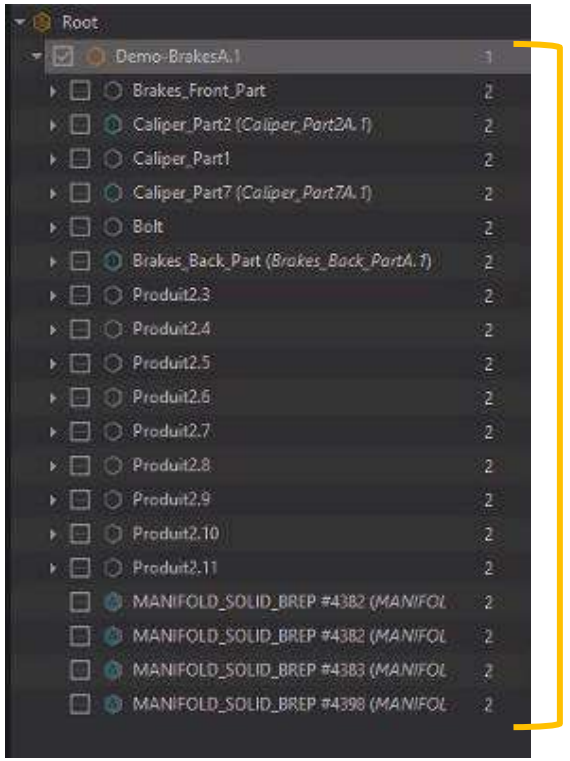


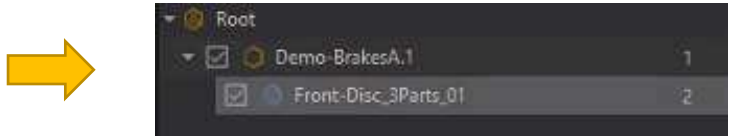
Merge

: 여러 개의 각 부품을 하나의 부품으로 만드는 기능



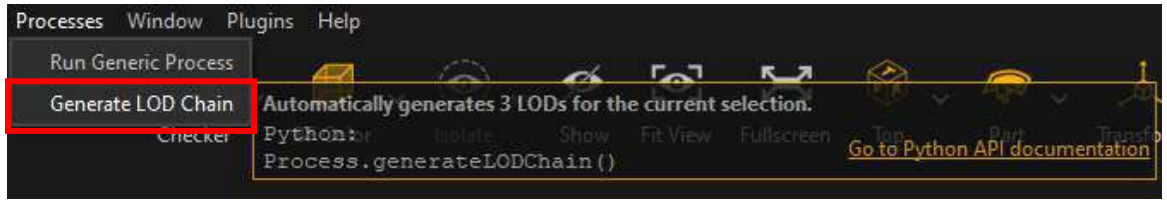


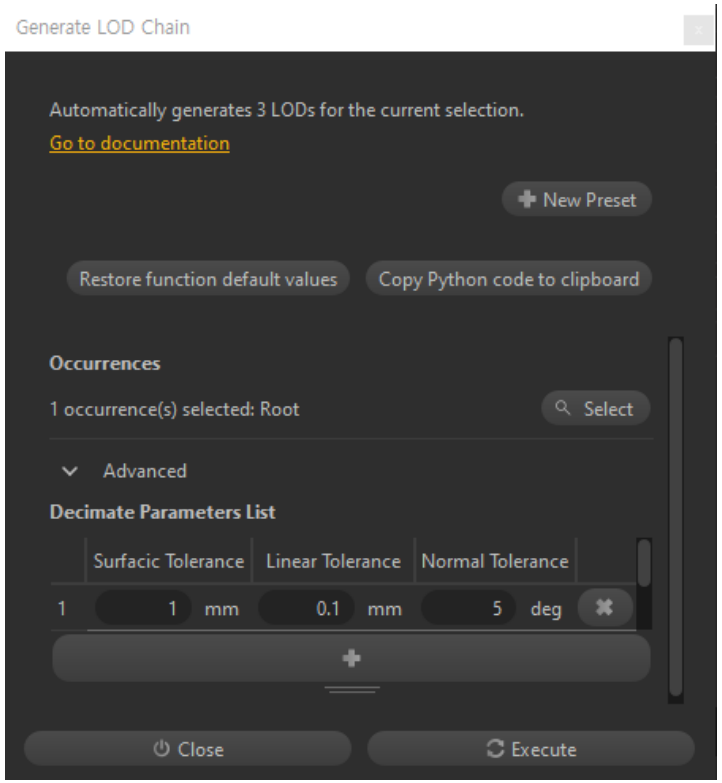


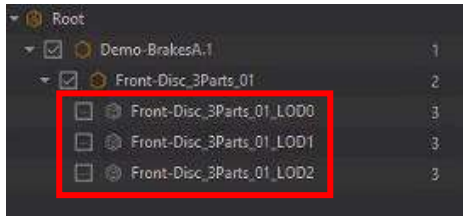


Generate LOD Chain

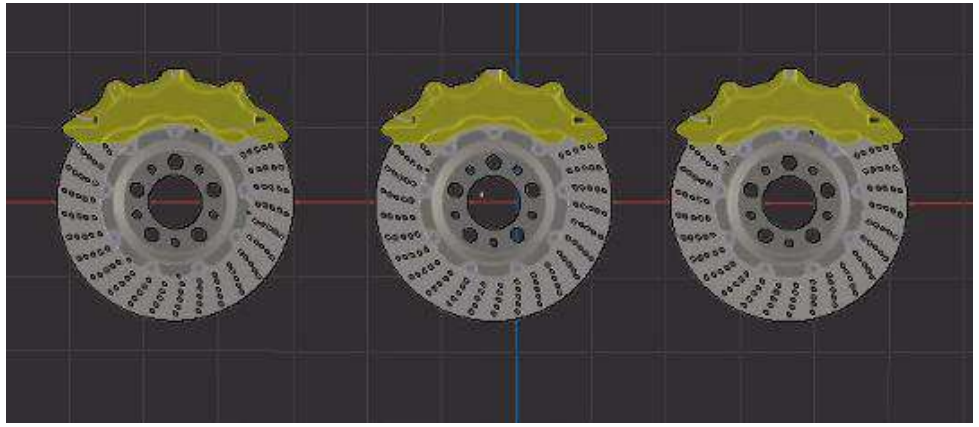
: Merge된 하나의 부품을 복제하여 일괄적으로 관리할 수 있는 기능







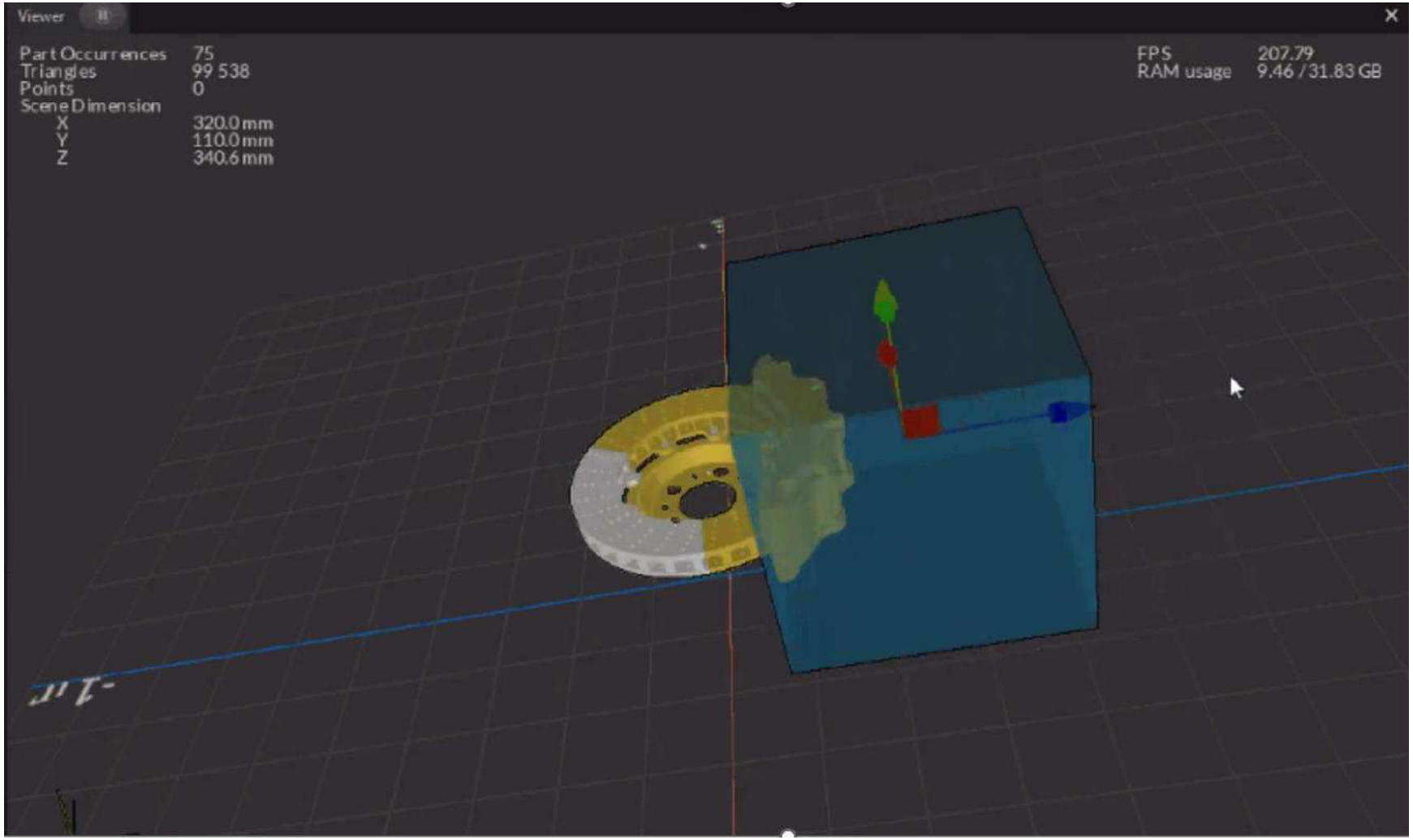
총 3개의 개체가 생성된 것을 볼 수 있다.



실제 산업 현장에서 수십만개의 부품을 다룰 때 사용하는 기능

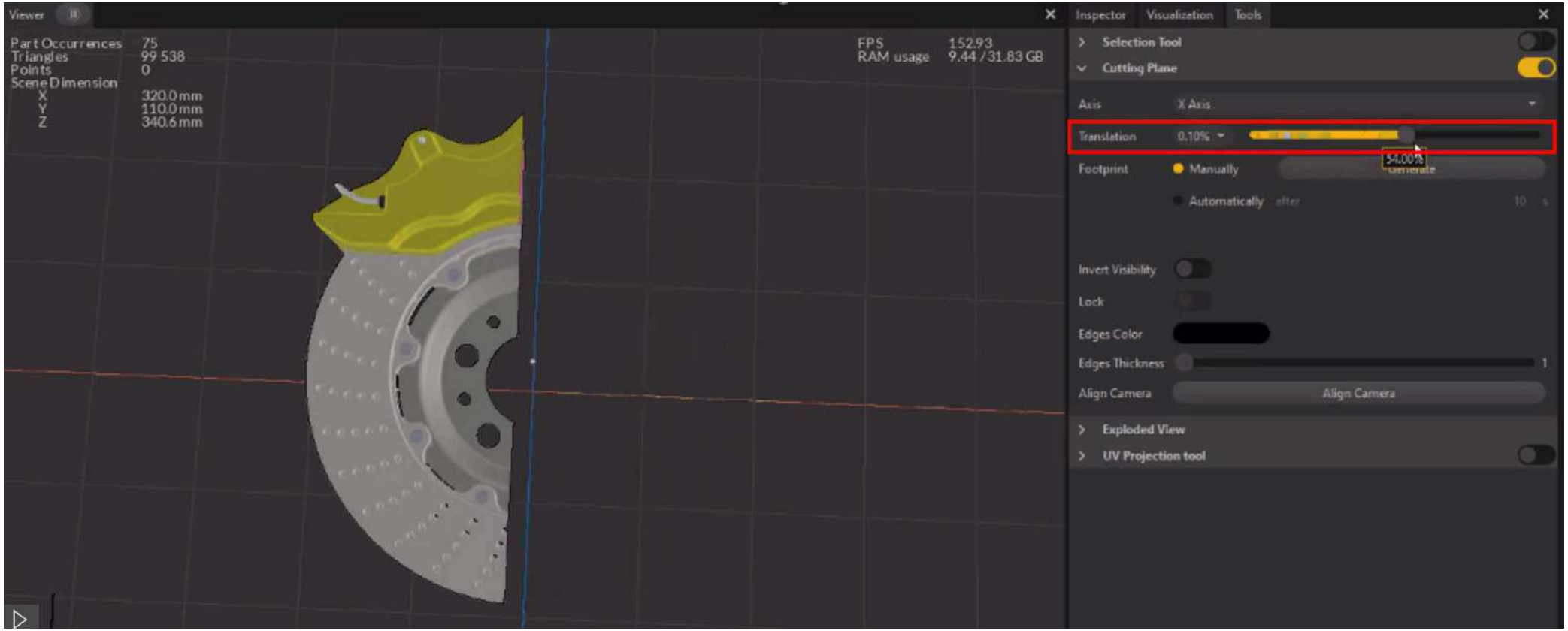
Selection Tool

: 박스 안에 든 부품만 선택



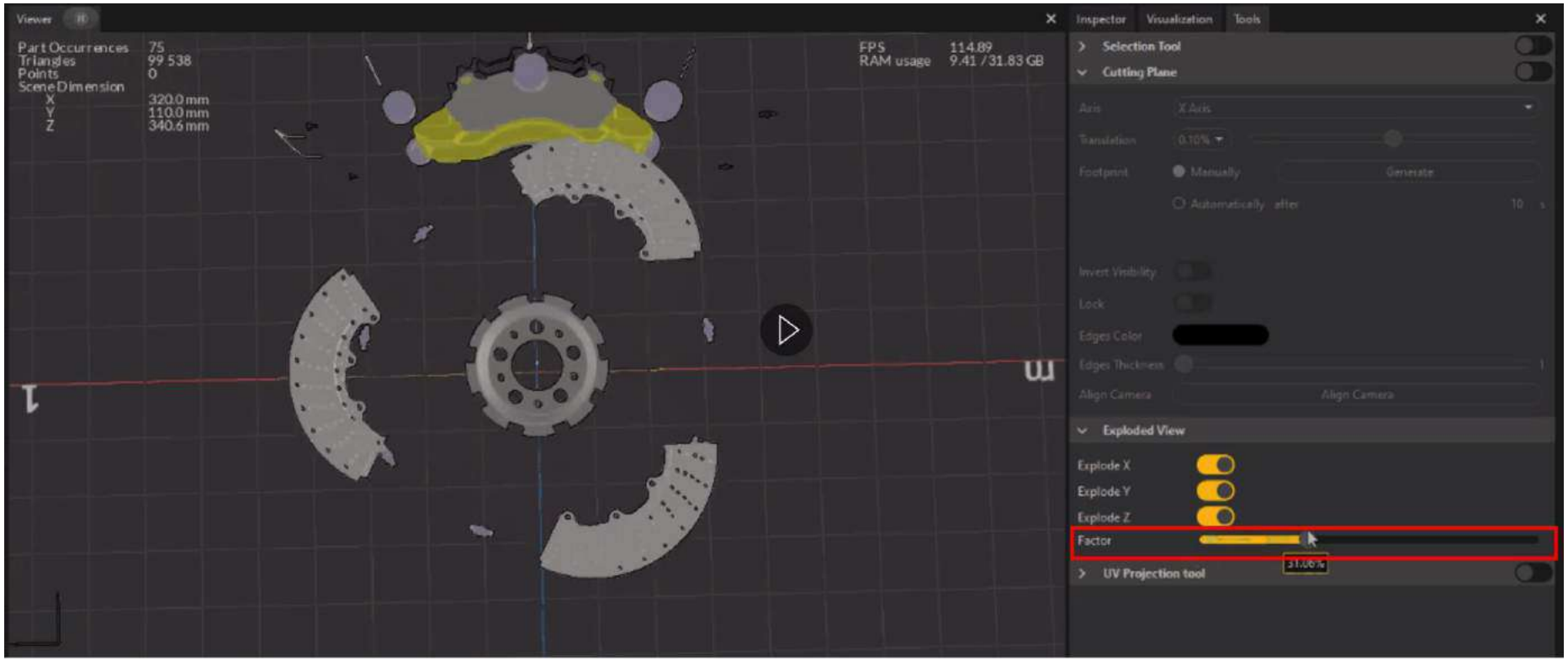
Cutting Plane

: 얼만큼 Cutting 할 것인 지 Translation을 조정하여 확인할 수 있는 기능

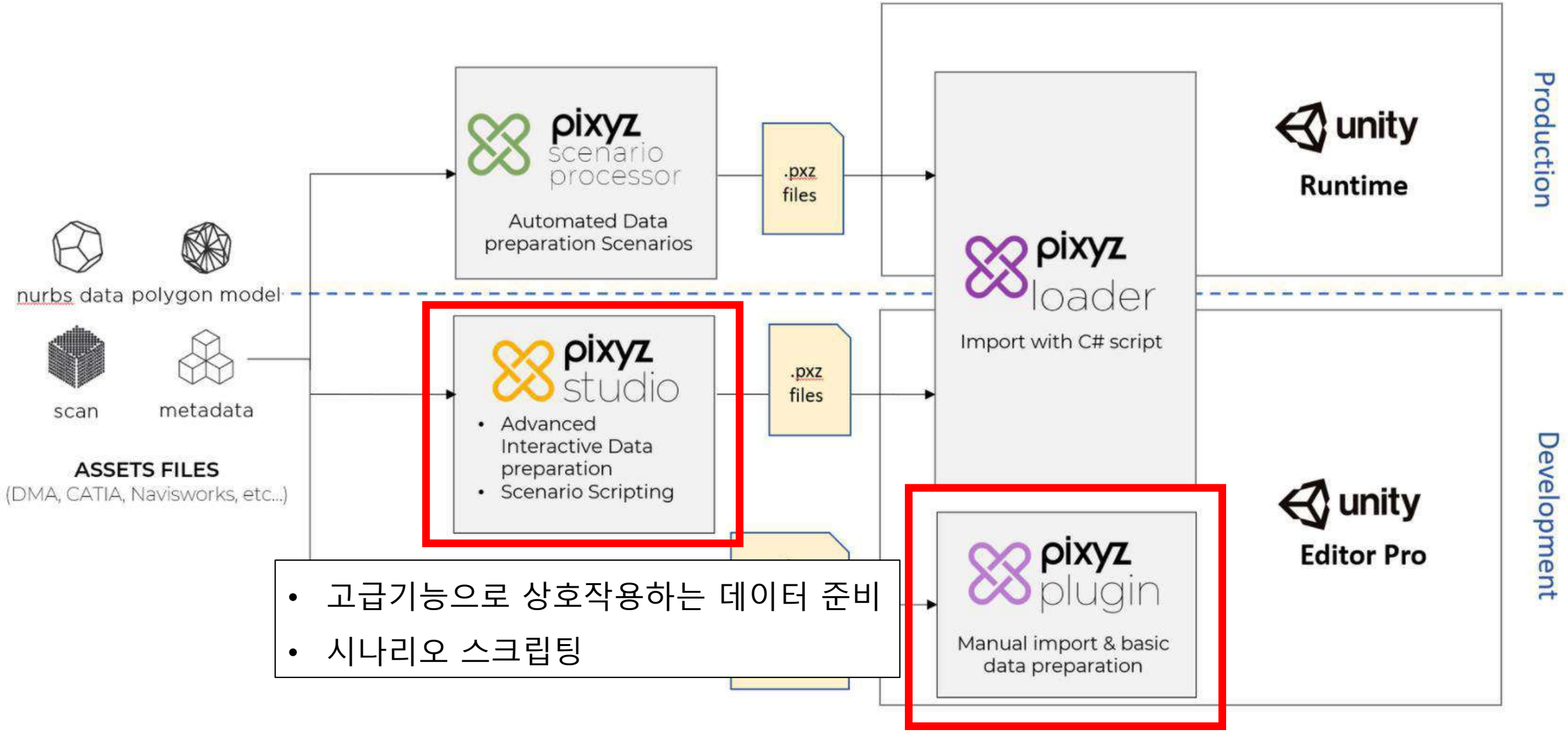


Exploded View

: 각 부품들을 분리시켜 Factor를 조정하여 확인할 수 있는 기능



Pixyz Plugin for Unity



- 고급기능으로 상호작용하는 데이터 준비
- 시나리오 스크립팅

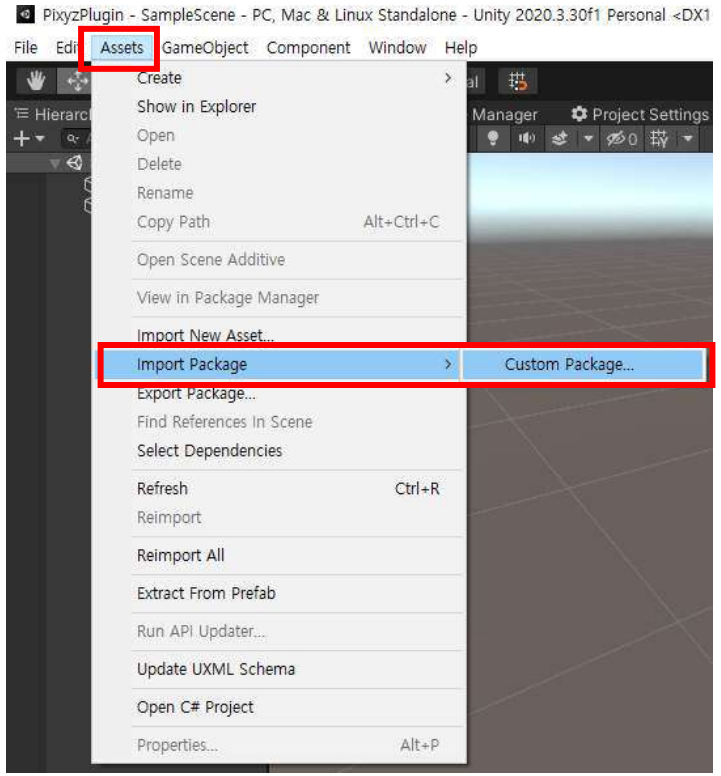
- 매뉴얼 임포트 및 기본적인 데이터 준비

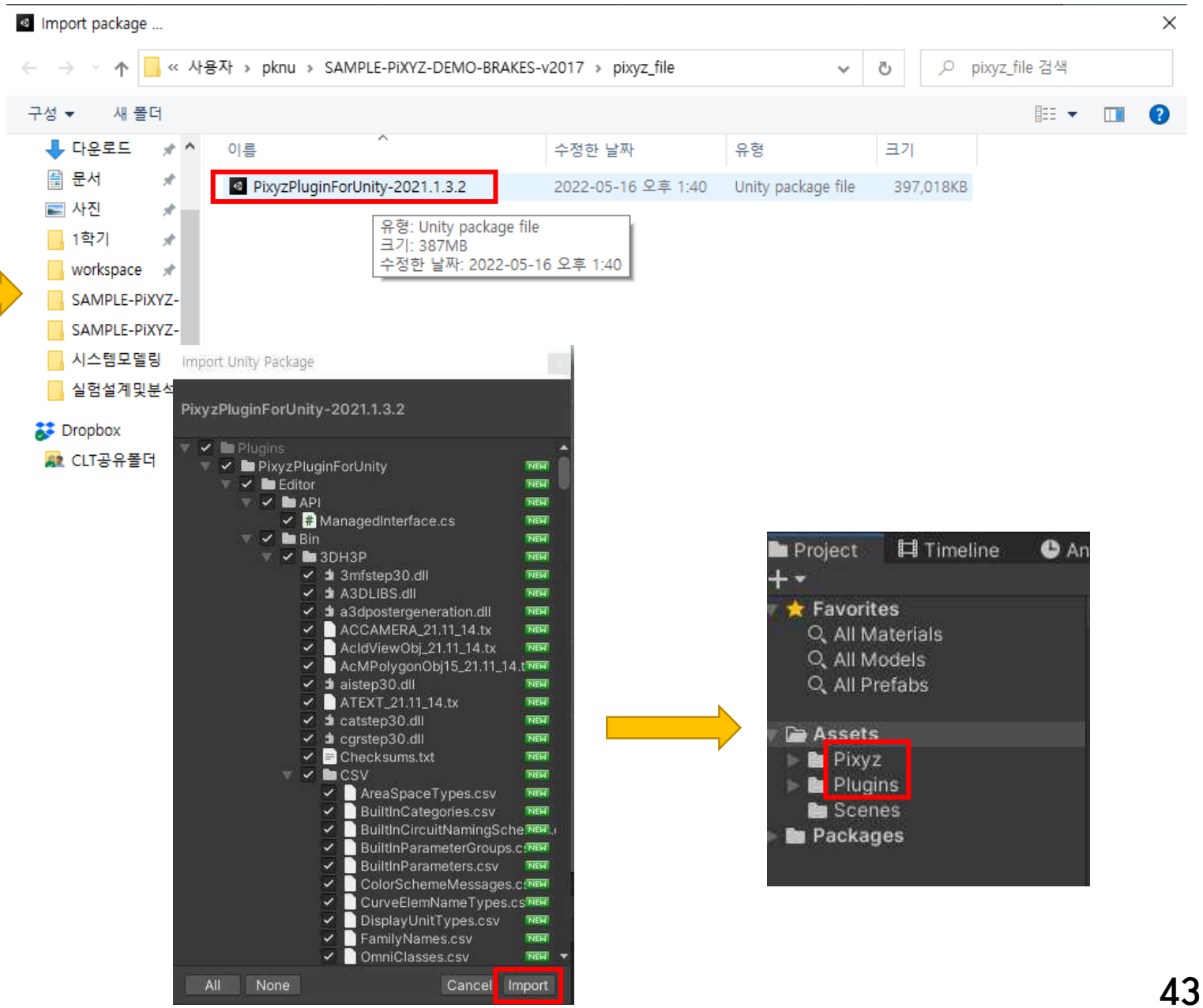

mesh creation

Pixyz Plugin의 장점

1. Unity Editor 안에 Import하여 사용
2. 최적화(경량화) 기능 지원
3. Rule Engine 기능 지원

1. Unity Editor 안에 Import하여 사용





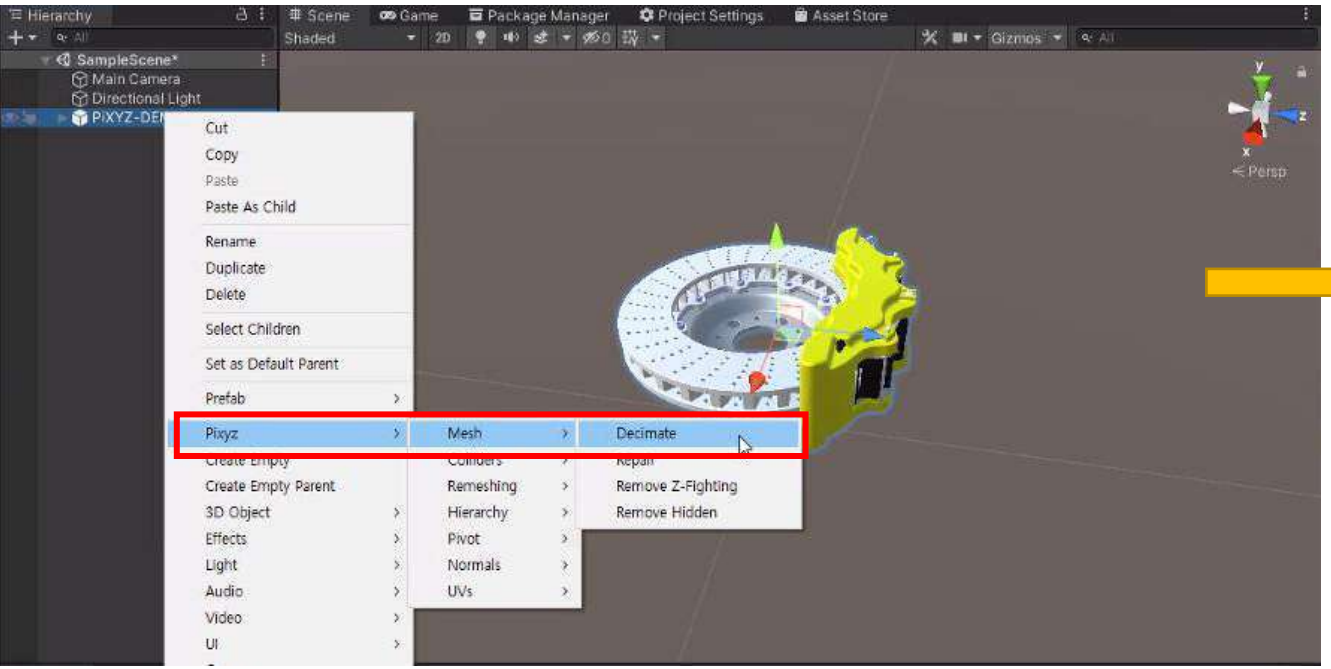
Import Package
- PixyzPlugin Package import

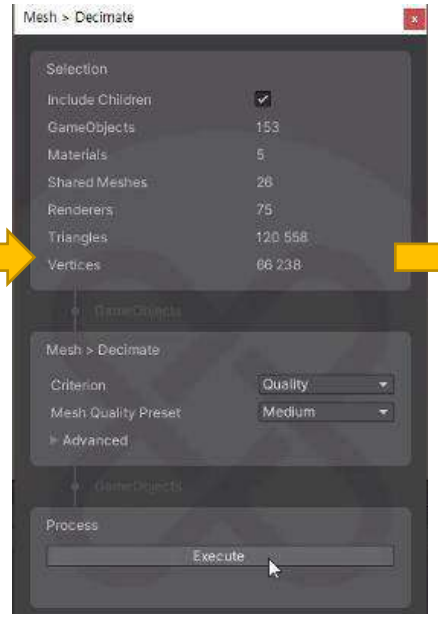
2. 최적화(경량화)기능

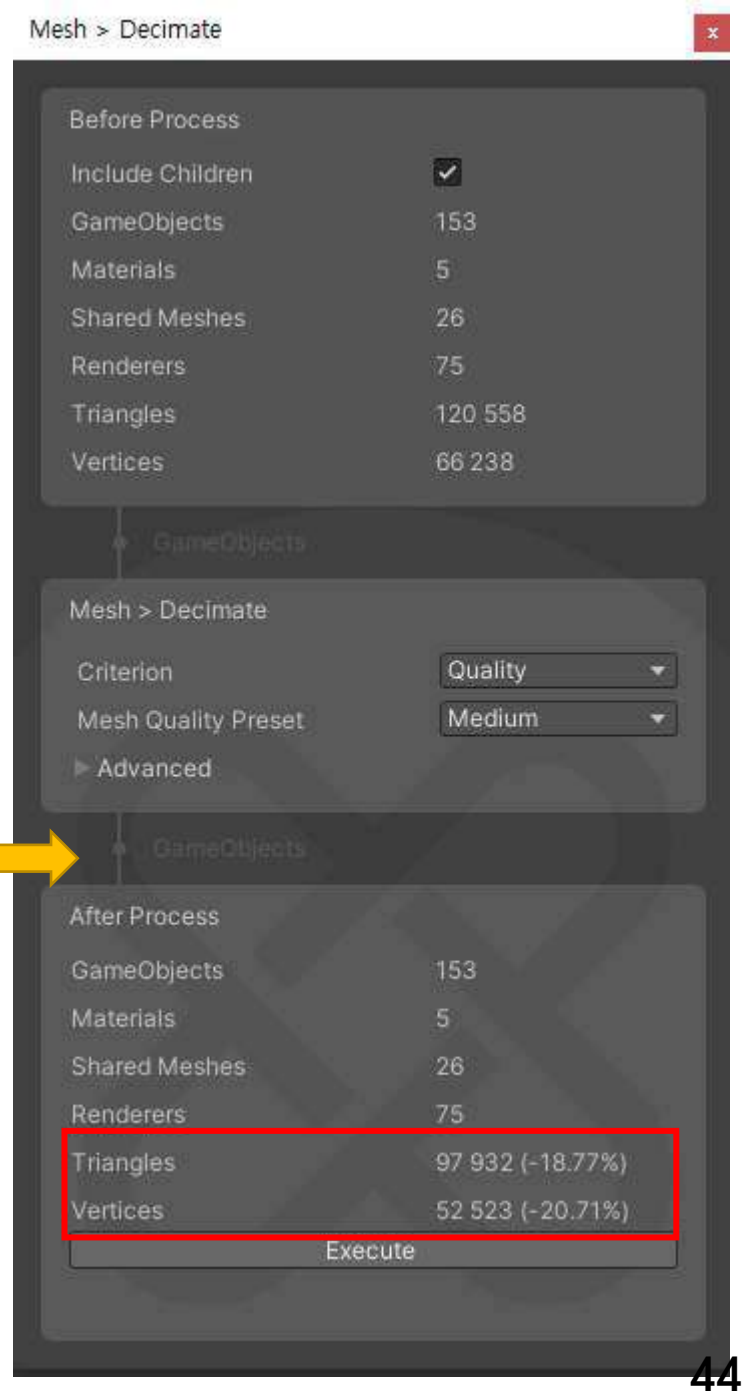
- **Mesh > Decimate**

- Pixyz Studio에서는 Decimate To Quality, Decimate Target이라는 똑같은 역할이지만, 기준이 다른 기능이 있었음. (전자는 꼭짓점 기준, 후자는 Triangles 수 기준.)

- Plugin에서의 Mesh Decimate는 Plugin내의 알고리즘이 자동으로 Triangles를 줄여서 경량화 시켜줌



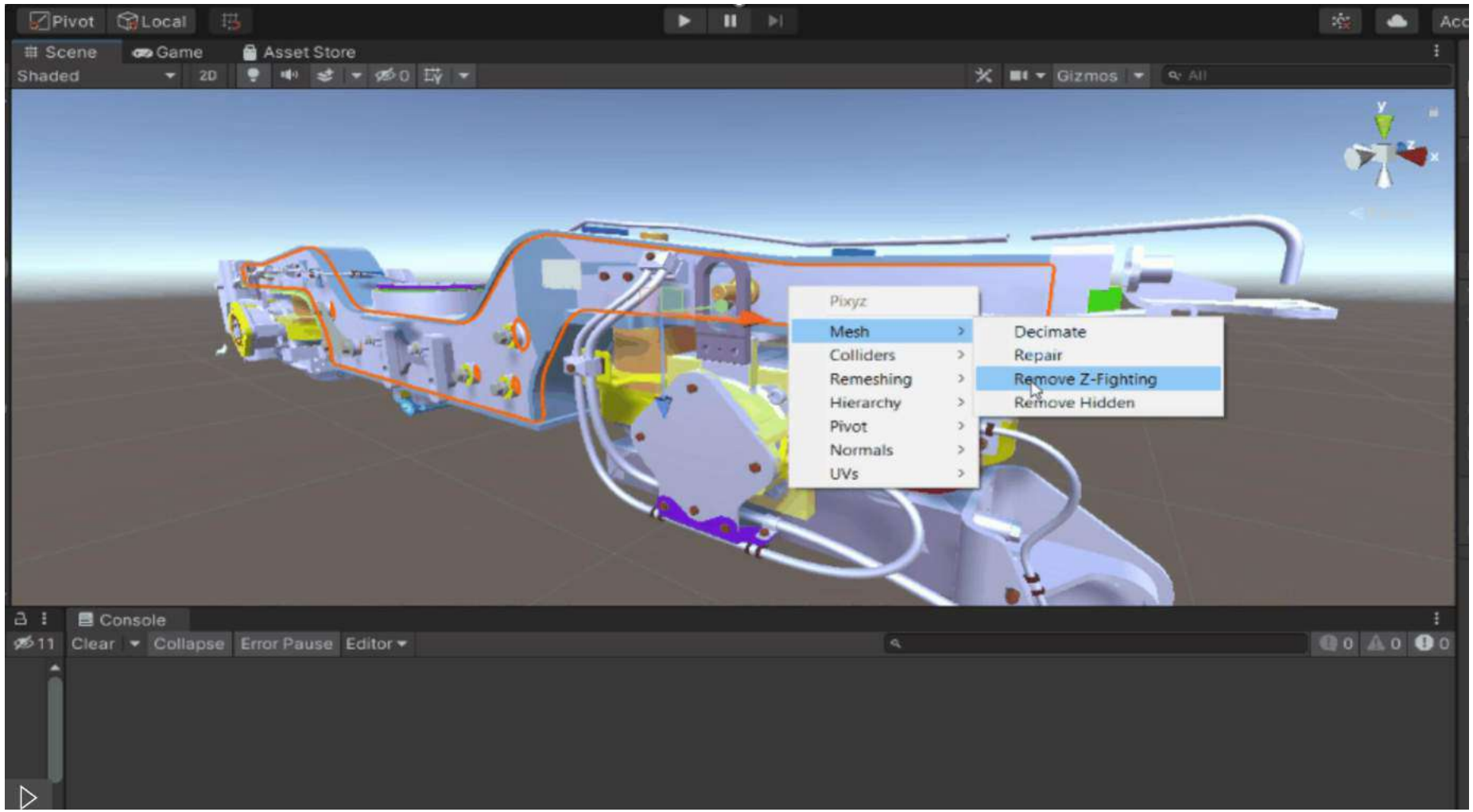




2. 최적화(경량화)기능

- **Remove Z-Fighting**

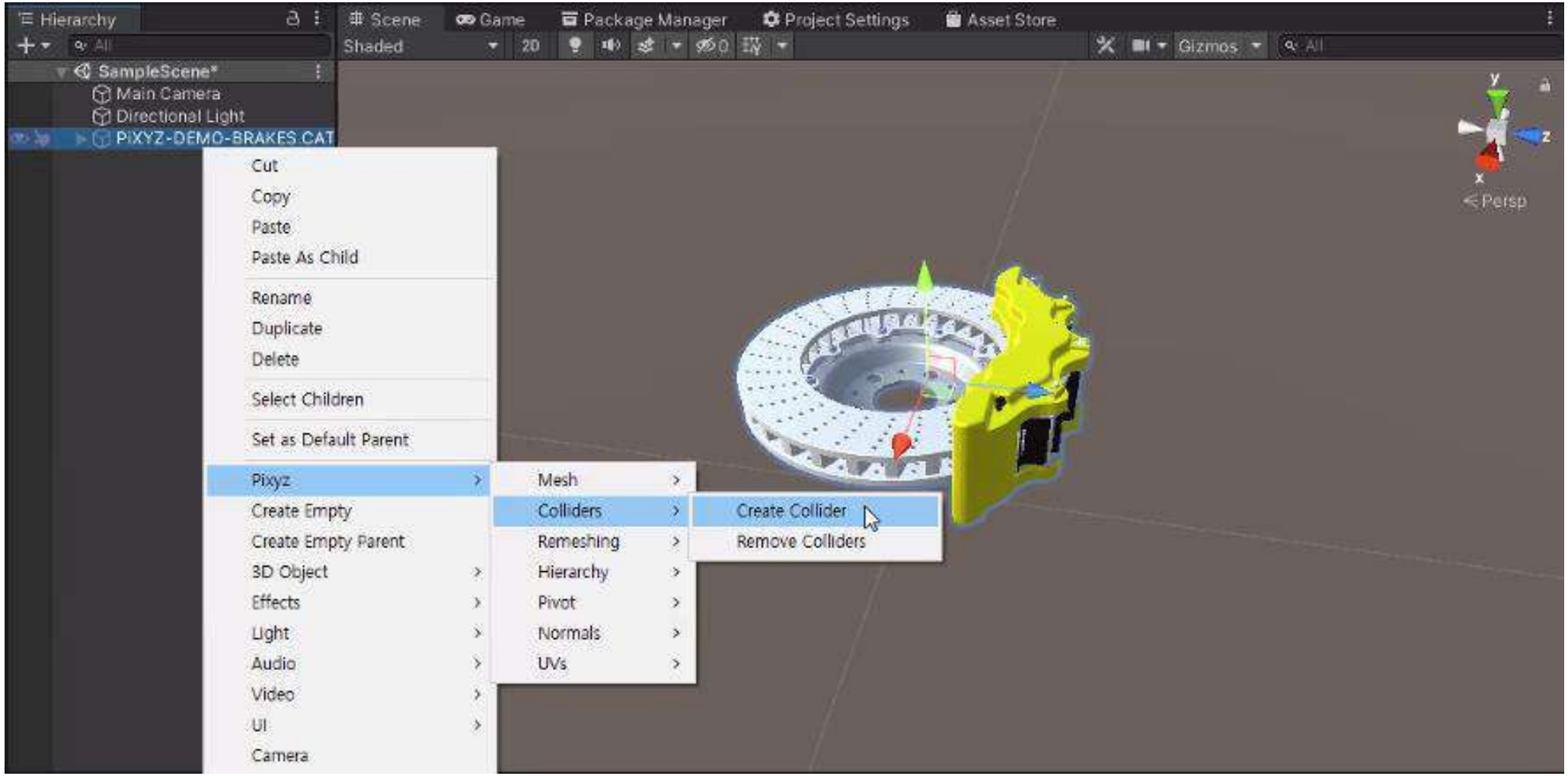
: 부품들 간의 겹쳐진 면들을 삭제해주는 기능 (화면의 반짝거리는 부분이 겹치는 부분)



2. 최적화(경량화)기능

- **Colliders 생성**

: 4 종류의 Collider 생성가능. (Retopology, Convex decomposition, Axis aligned bounding box, Original mesh)

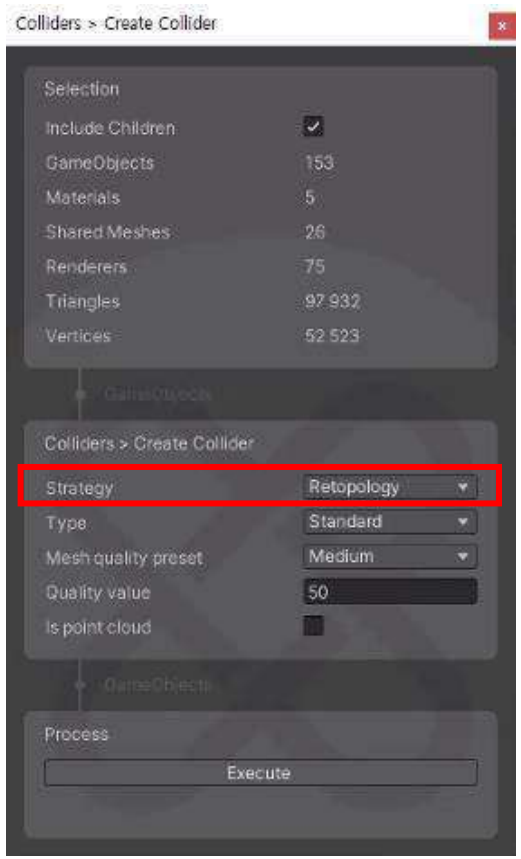


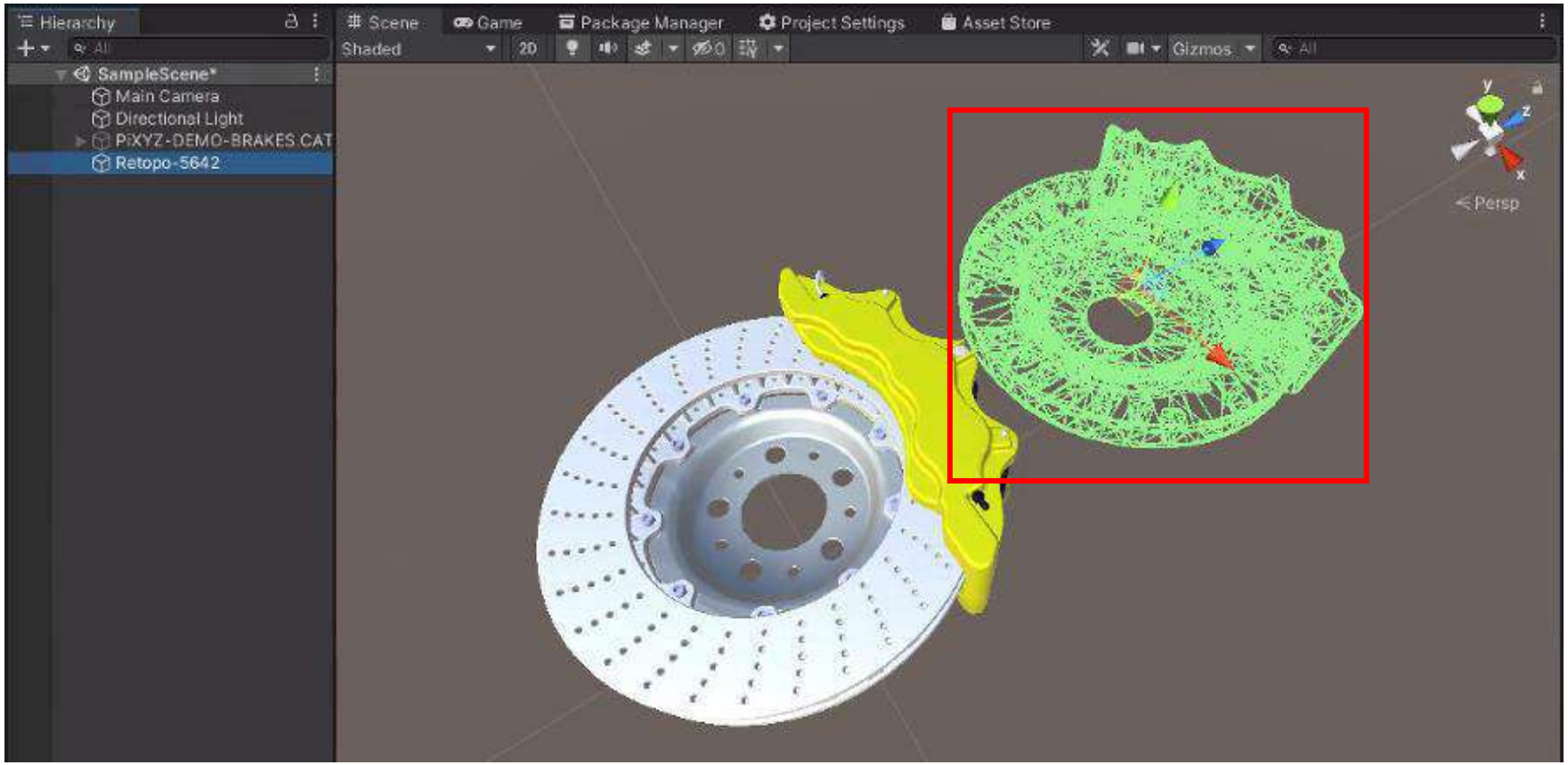
***콜라이더(Collider)** : 물리 충돌 처리를 위한 오브젝트의 형태를 정의

2. 최적화(경량화)기능

1. Strategy : Retopology

: Collider가 **하나의 형태**로 존재 => 모든 부품을 하나의 부품으로 통째로 바꾼다. 각 부품별로 나눌 수 없음

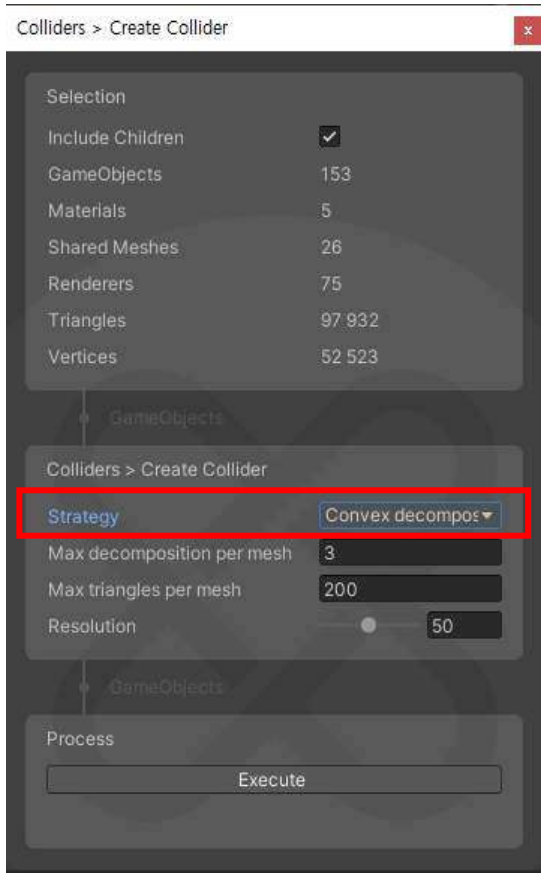


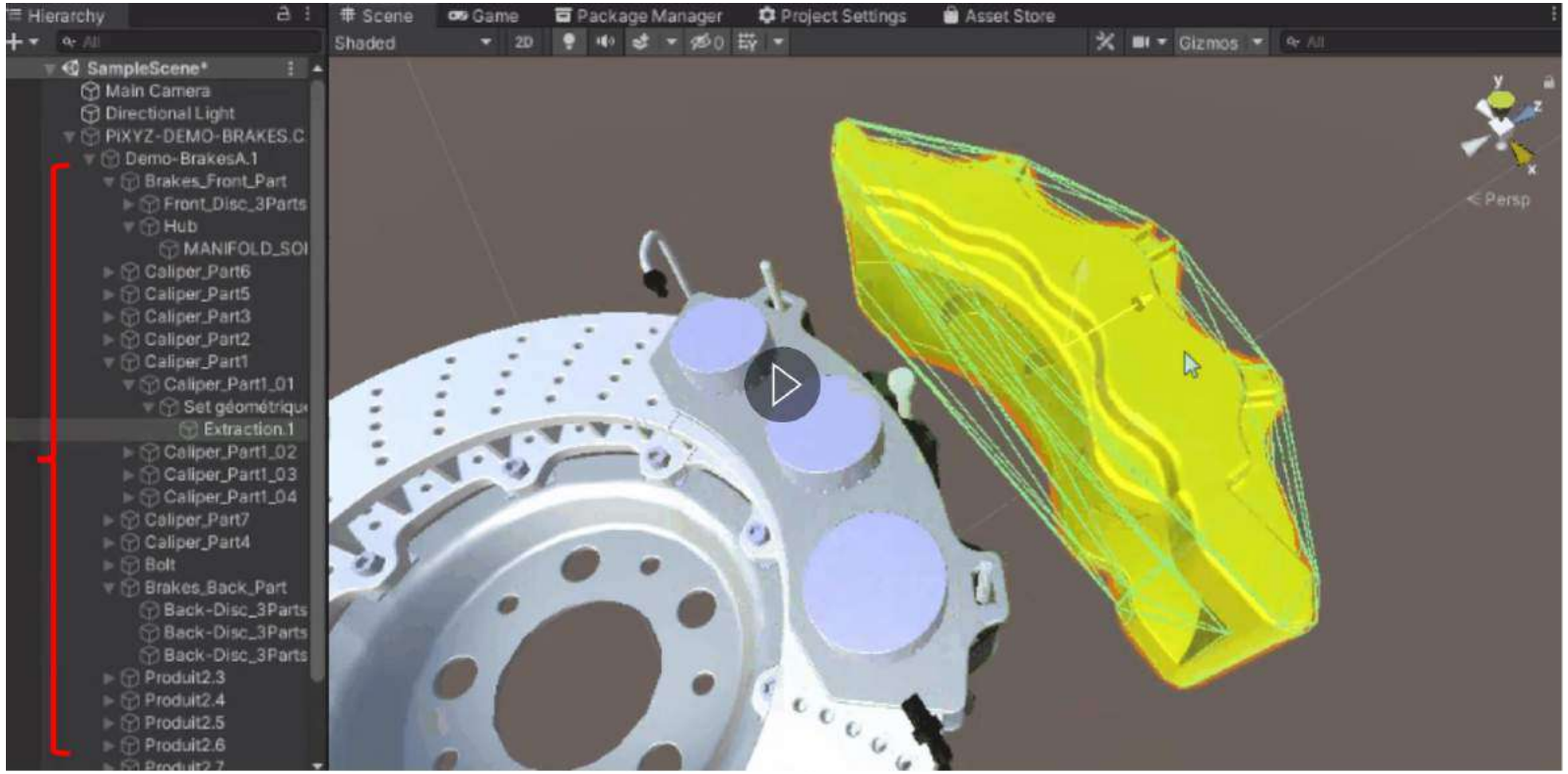


2. 최적화(경량화)기능

2. Strategy : Convex decomposition

: Collider가 하나의 형태로 있는 것이 아닌 각 **부품별**로 Collider 생성
모든 세부 부품의 Collider가 생성되기 때문에 경량화와는 거리가 멀다.

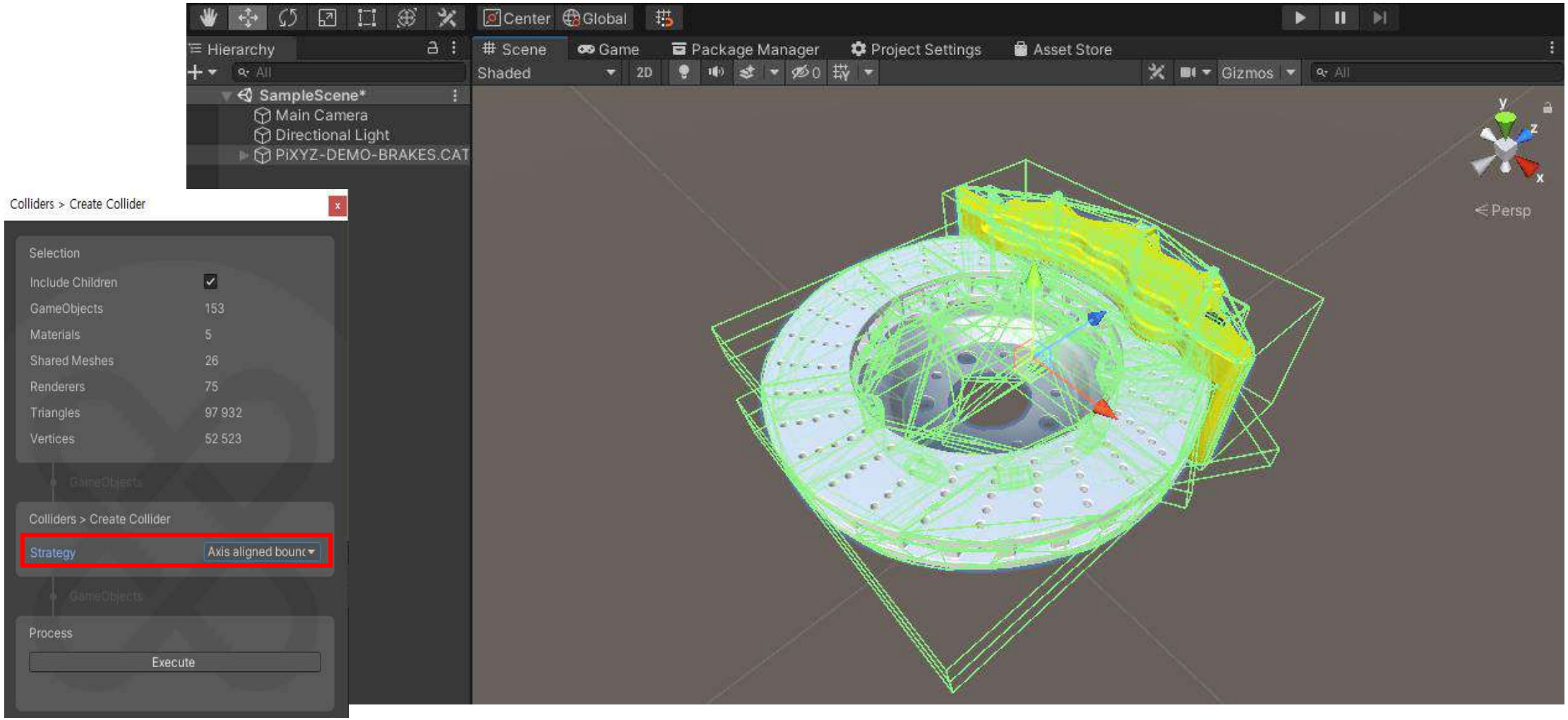




2. 최적화(경량화)기능

3. Strategy : Axis aligned bounding box

: 해당 모델에 **네모 박스 형태**의 Collider 생성
=> 단순한 형태의 Collider라서 정밀한 충돌이 발생하지 않는 상황에서 성능이 좋음

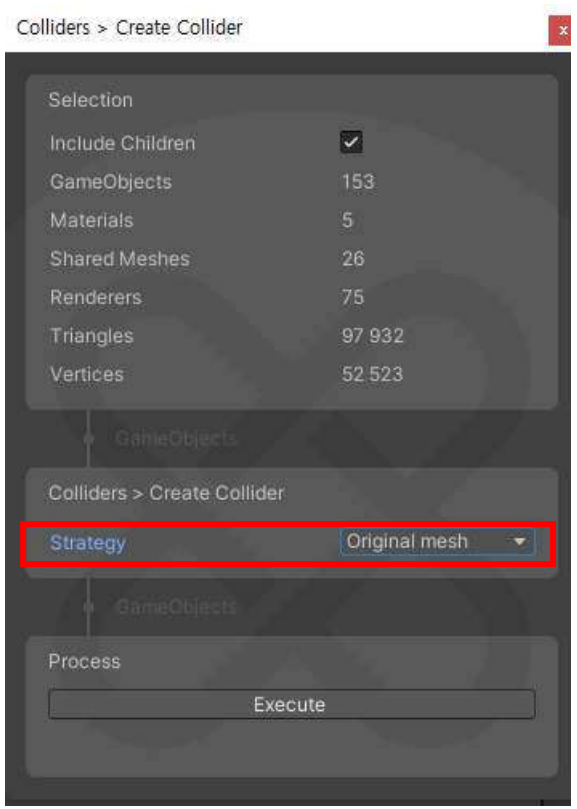


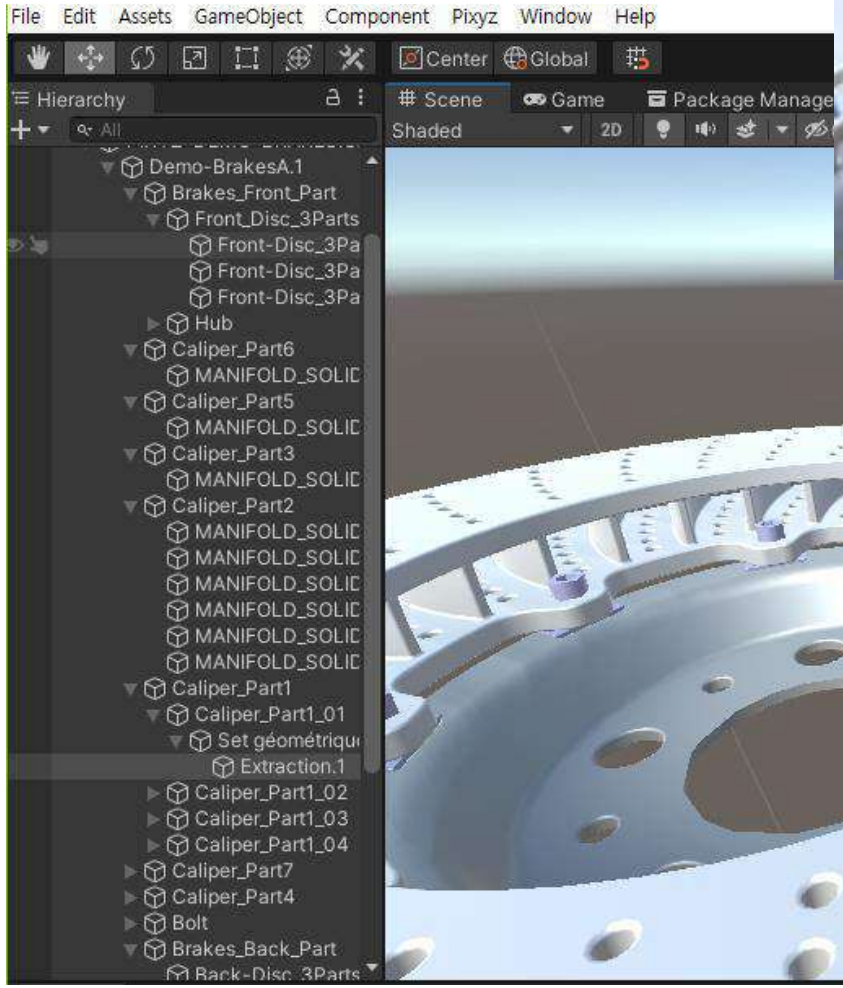
2. 최적화(경량화)기능

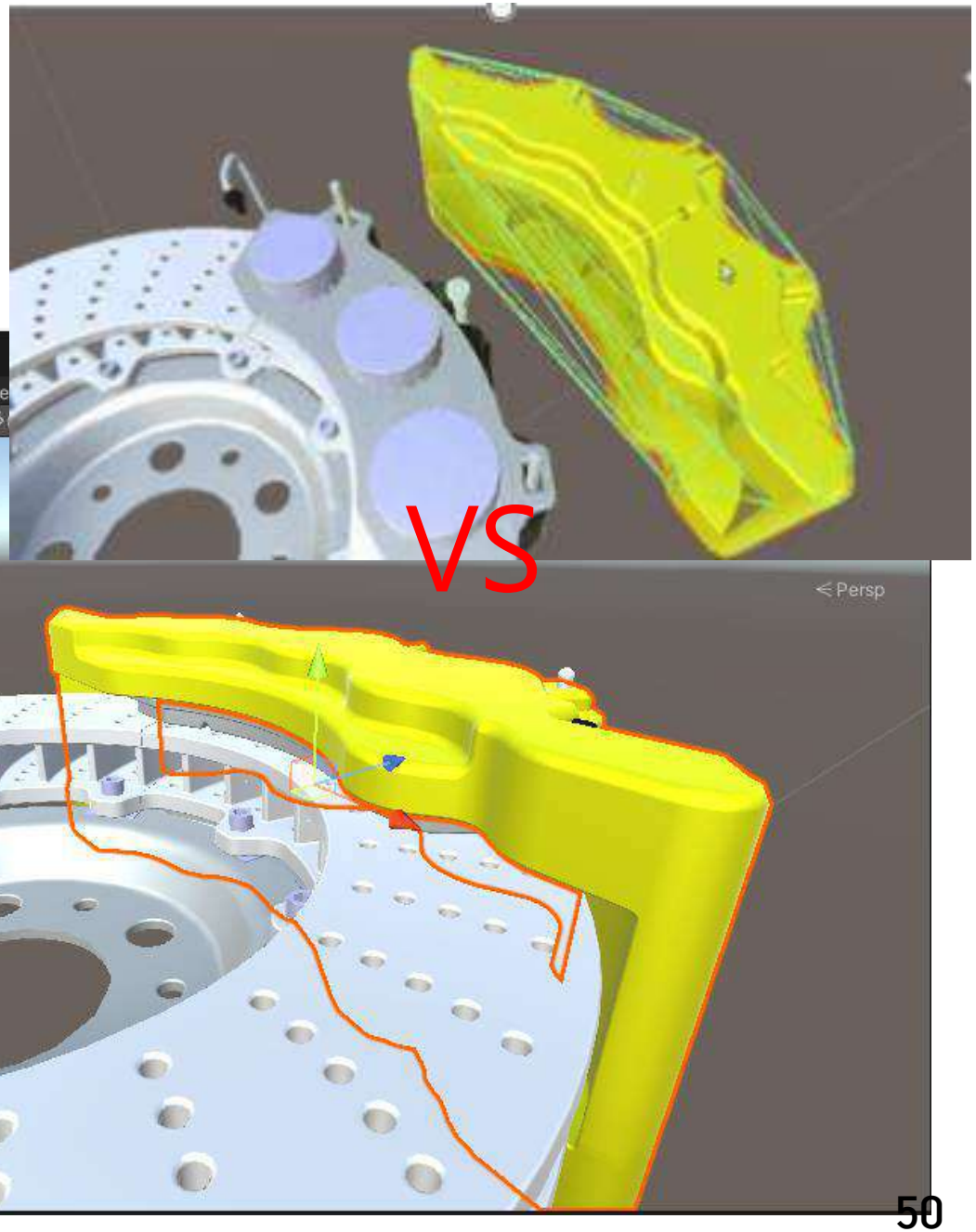
4. Strategy : Original mesh

: Mesh의 형태를 그대로 Collider 생성
=> 충돌 여부 판별이 더 정확해짐 (충돌 Quality 높음)

*Strategy : Convex decomposition





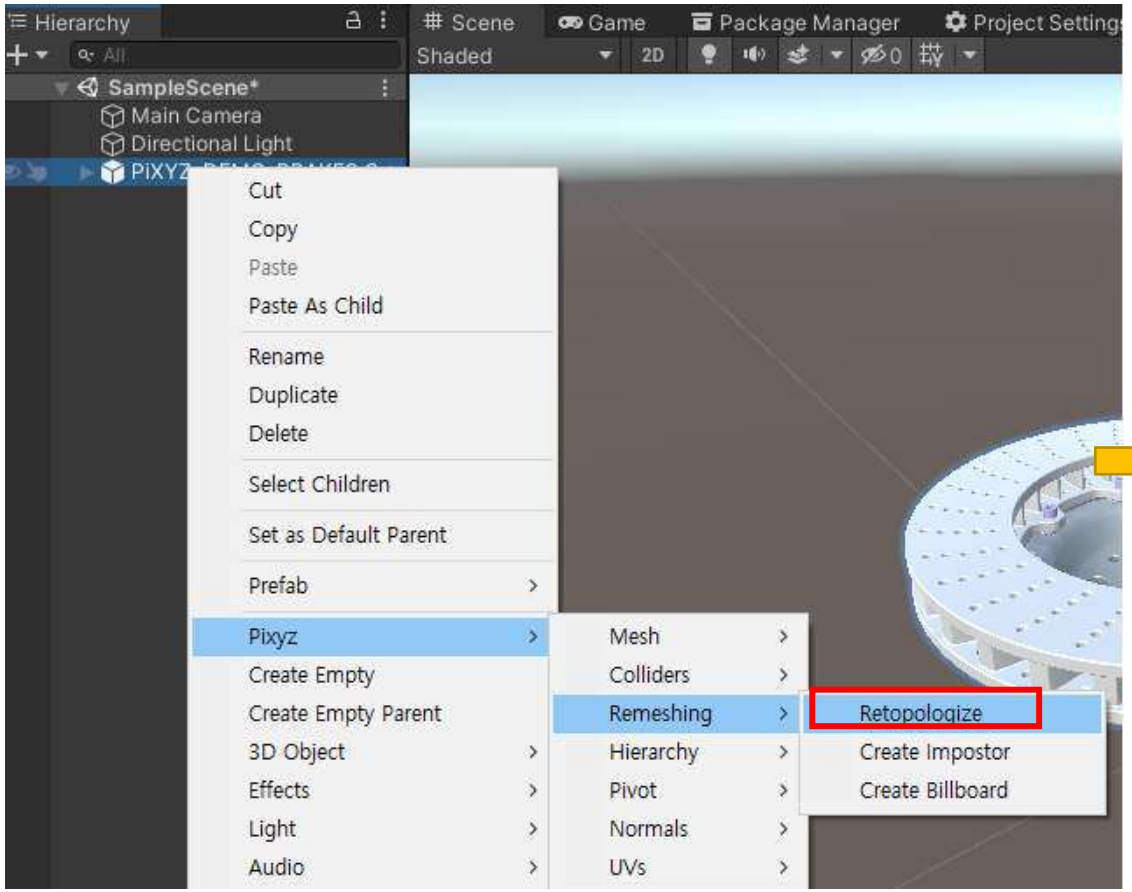


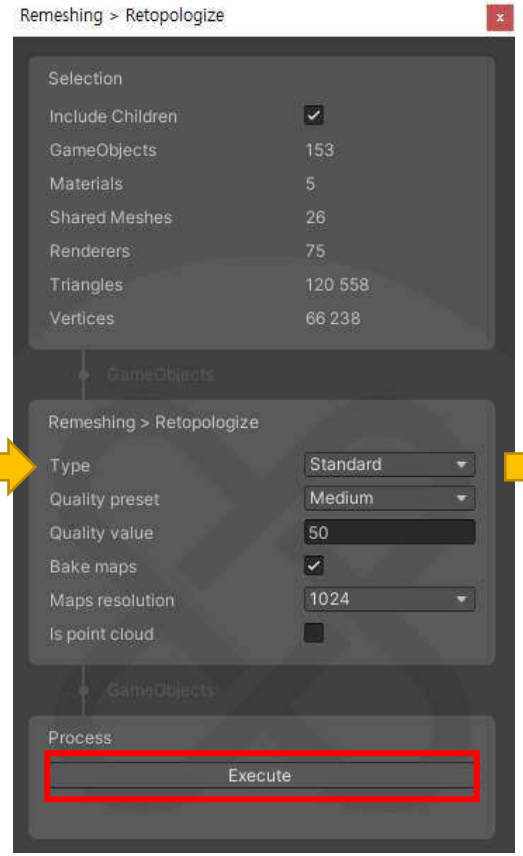
원본은 보존하고 복사본을 만들어
작업을 진행하는 기능들

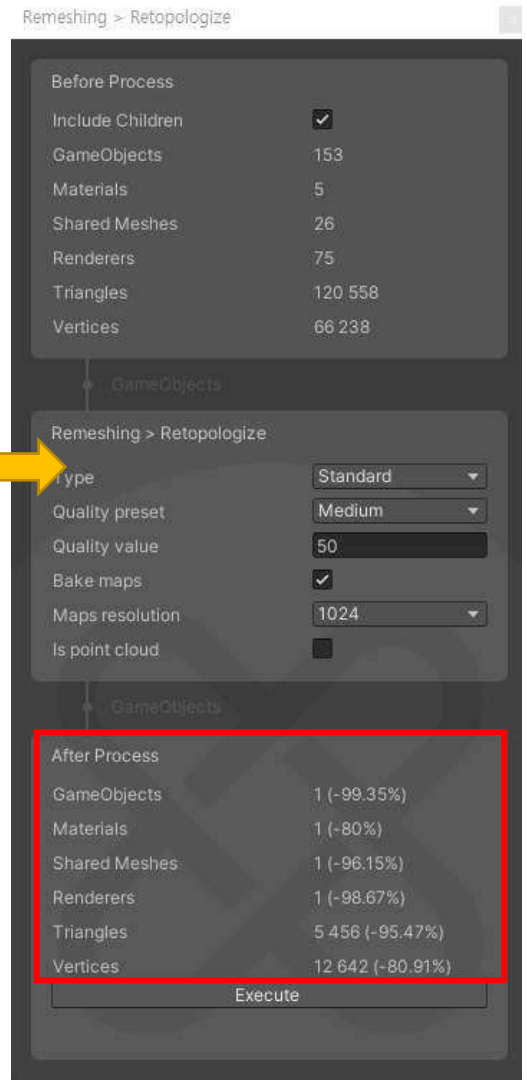
2. 최적화(경량화)기능

- **Remeshing > Retopologize**

: Polygon 배열들을 Plugin 내의 알고리즘을 통해 경량화 하며, 깔끔하게 정리해주는 기능



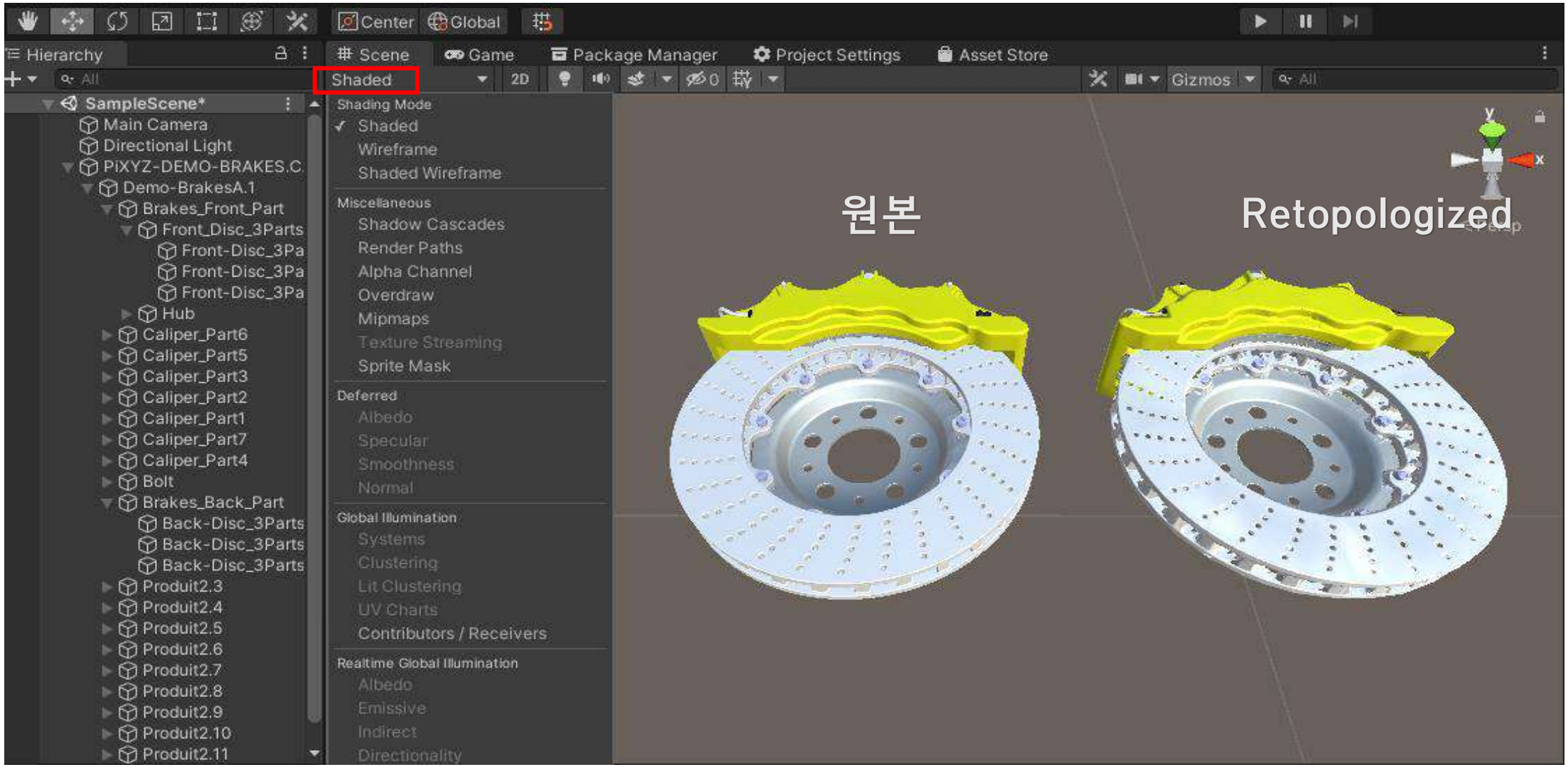




경량화 확인 가능

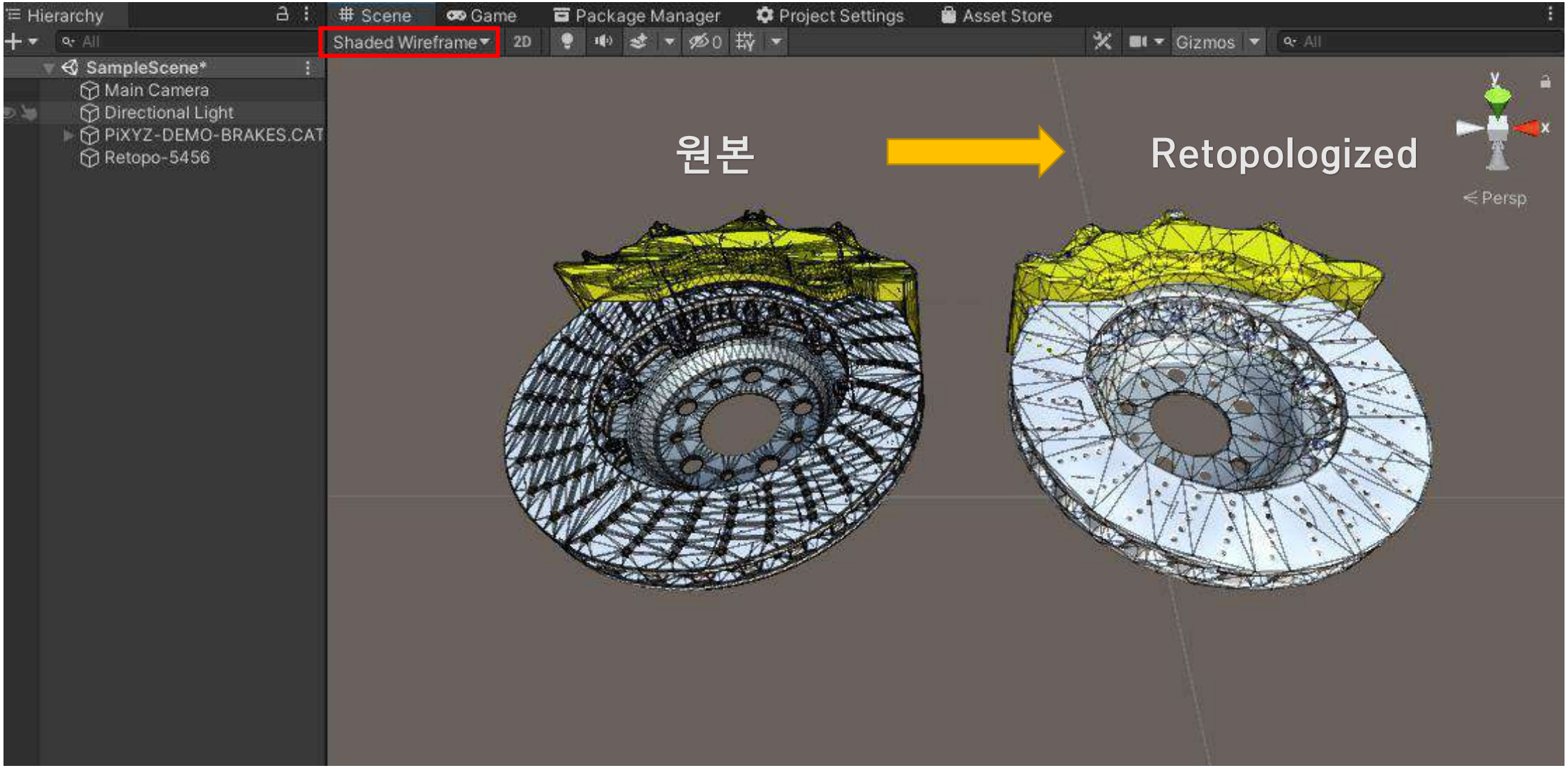
2. 최적화(경량화)기능

현재 표면적으로는 어떤 변화가 일어났는지 보이지 않음 (Mode : shaded)



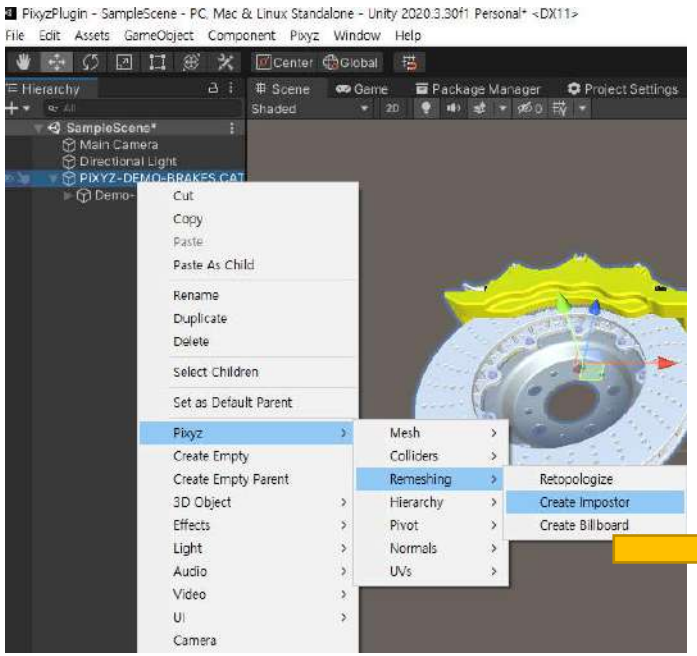
2. 최적화(경량화)기능

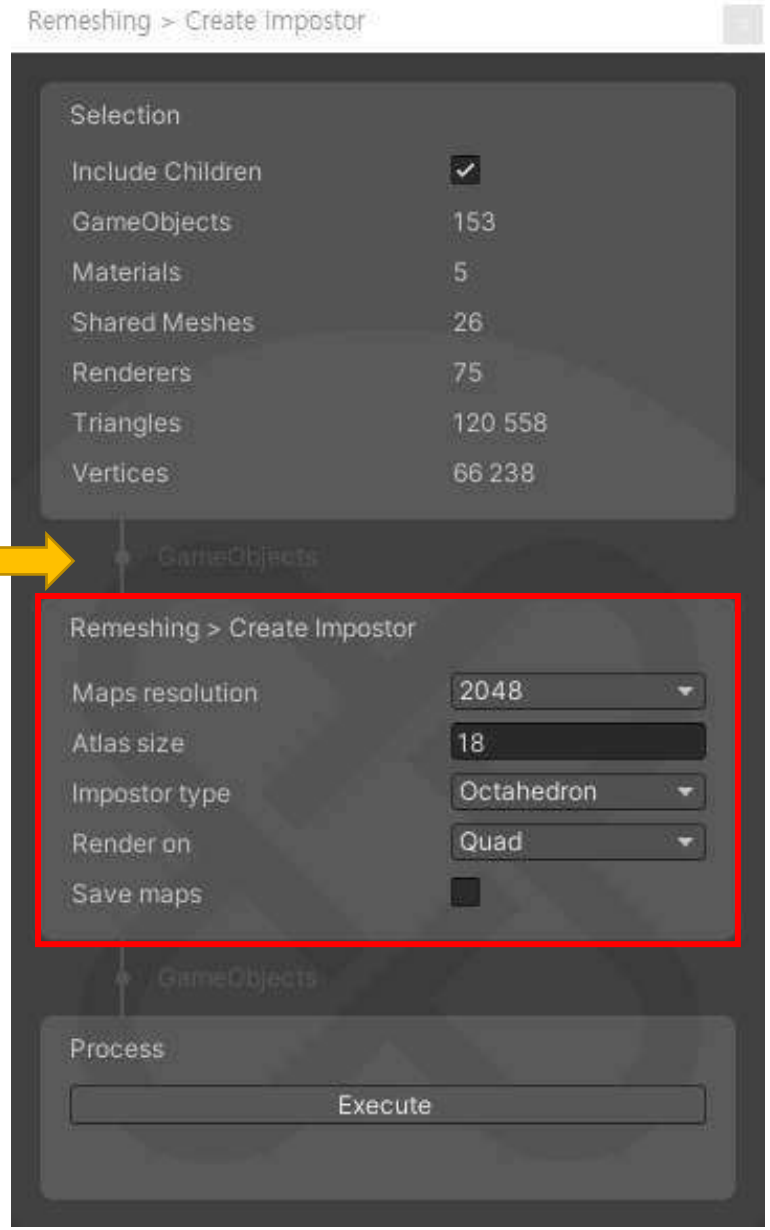
Retopologize 기능을 사용하여 복잡했던 Polygon 배열을 정리해주었다. (Mode : Shaded Wireframe)



2. 최적화(경량화)기능

- Remeshing > Create Imposter





- **Maps resolution**

: 임포스터를 렌더링하기 위해 베이크된 텍스처 맵의 해상도

- **Atlas size**

: 프레임의 크기의 제곱근.
값이 높을수록 프레임 간의 전환이 더 부드러워진다.

- **Imposter type**

- **Octahedron** : 임포스터를 360° 방향으로 렌더링.
- **Hemi octahedron** : 임포스터의 상반부(180 °)만 렌더링.

- **Render On**

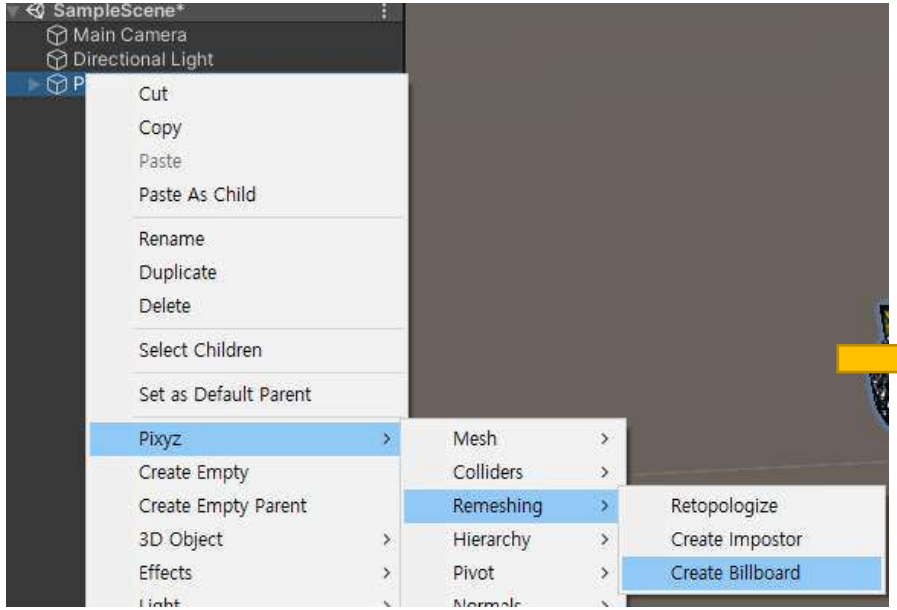
- **Quad** : 면
- **Oriented bounding box** : 박스(네모)

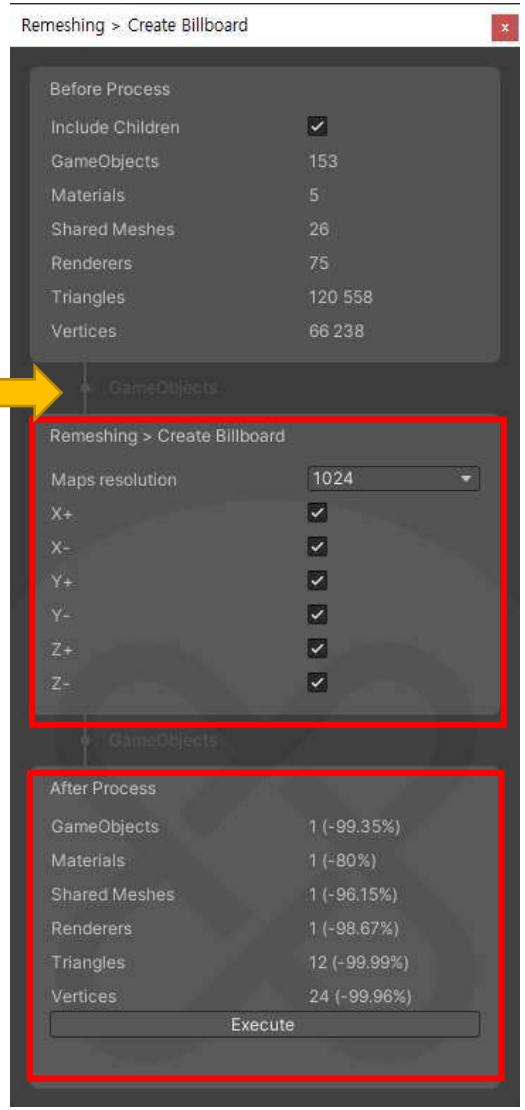
임포스터가 렌더링되는 지오메트리
(Quad, Orien선택은 장면에 대해 수행할 FPS 분석에 의해 정의된다.)

2. 최적화(경량화)기능

- **Remeshing > Create Billboard**

: 해상도를 정한 뒤, 각 축별로 마치 사진을 찍은듯이 사본 Object를 만들어내는 기능





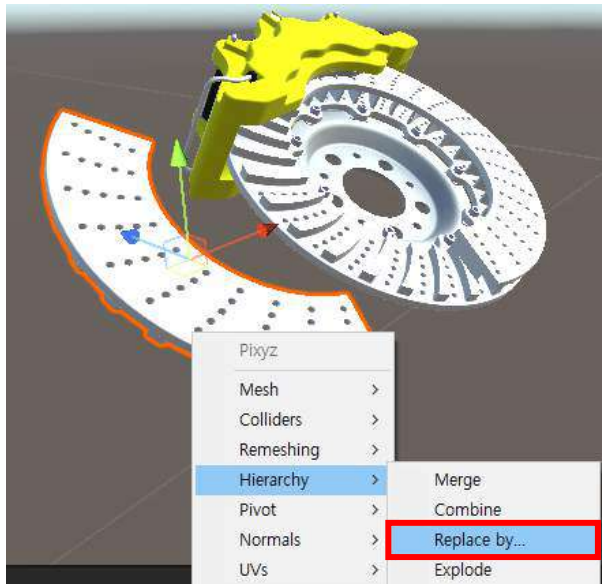
어떤 축에서 사진을 찍을 것인가

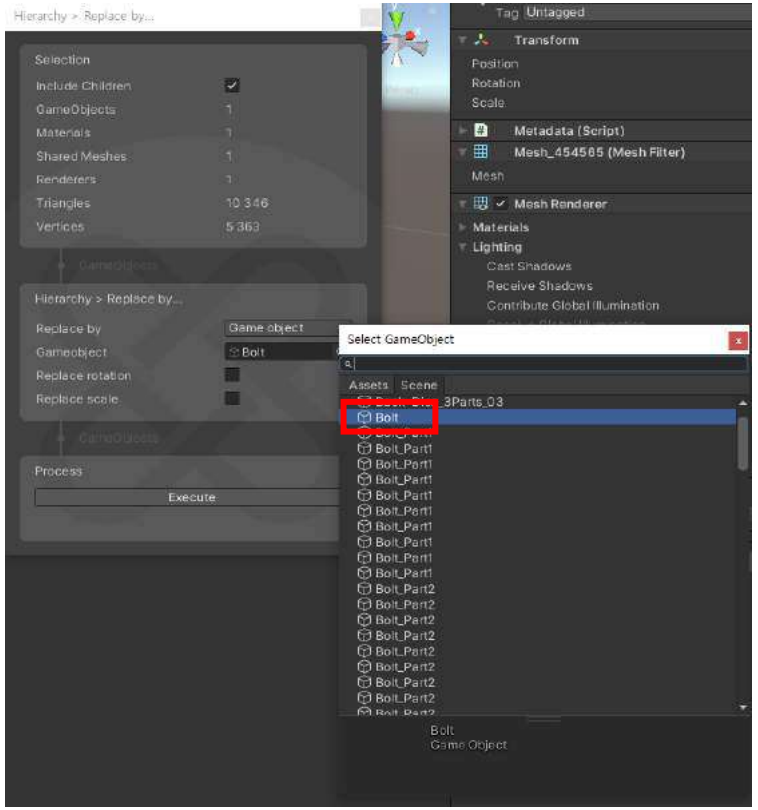
2. 최적화(경량화)기능

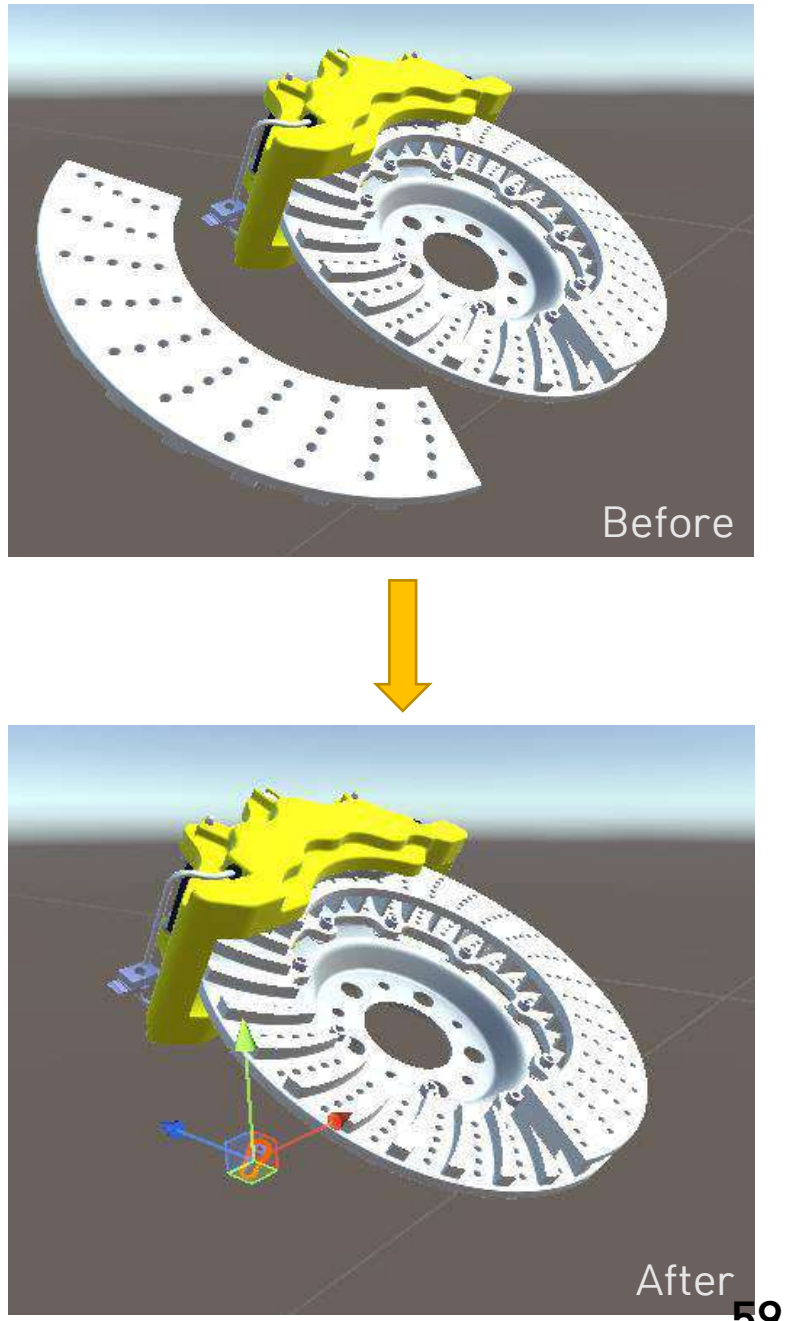
- **Hierarchy > Replace by**

: 선택한 Game Object를 다른 Game Object 형태로 변경하는 기능

*선택한 부품을 Bolt로 변경.



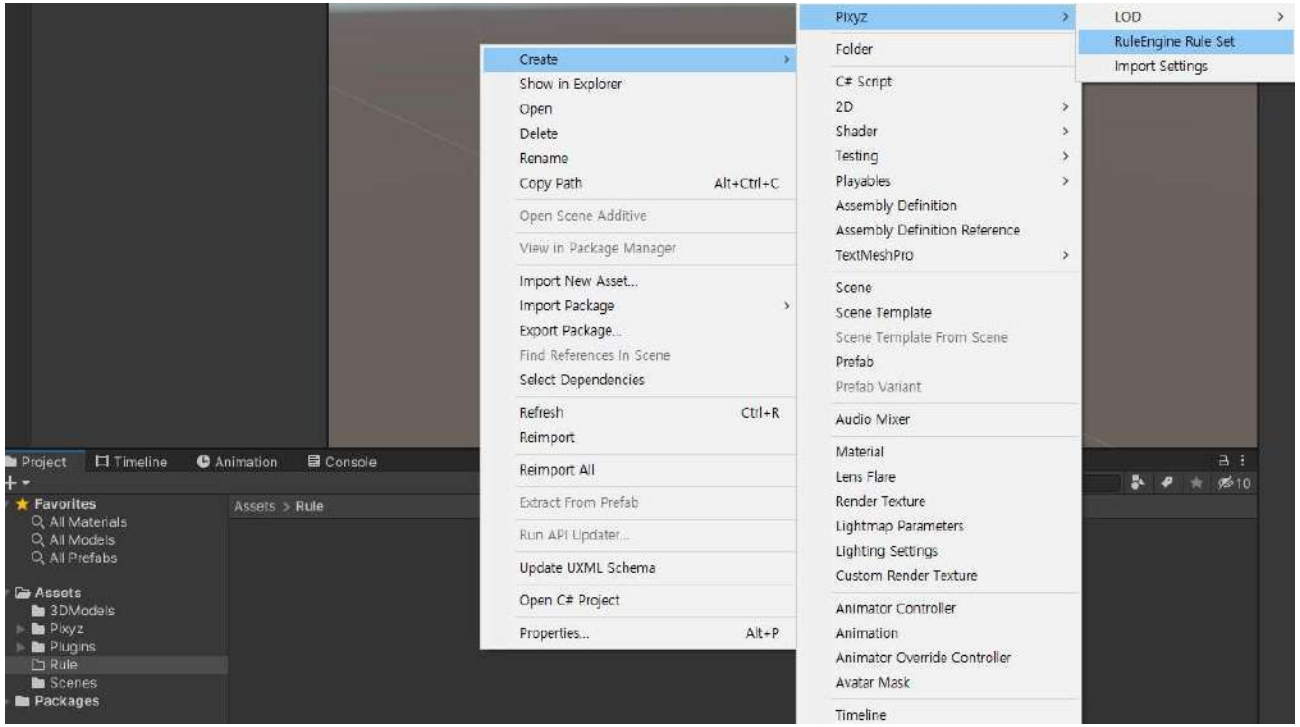


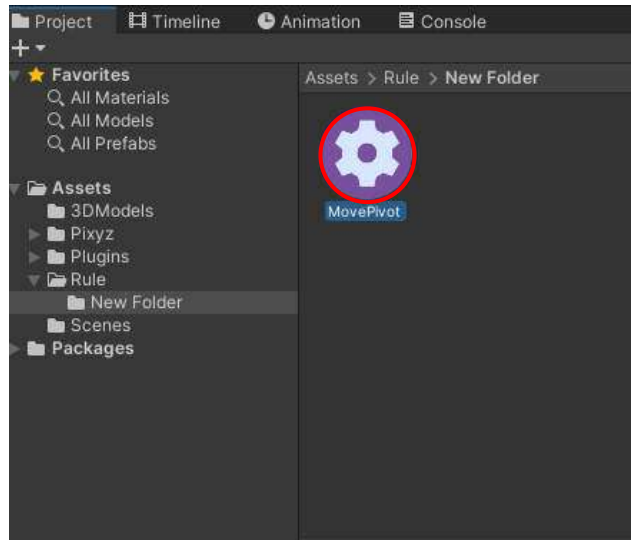


3. Rule Engine기능 지원

- **Rule Engine**

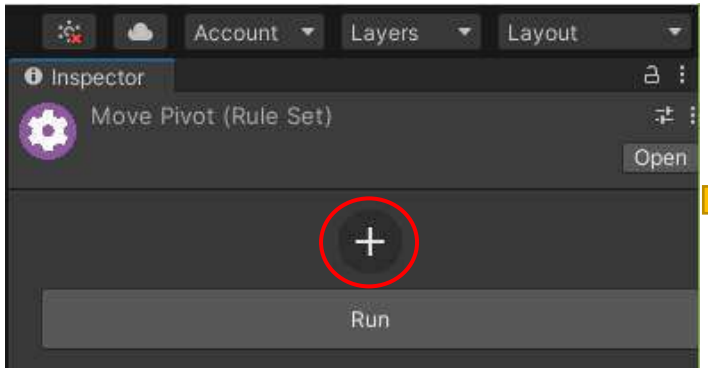
: Unity , Pixyz Plugin에 존재하는 기능들을 사용자가 원하는 대로 Custom하여 한 번의 실행으로 처리 가능.



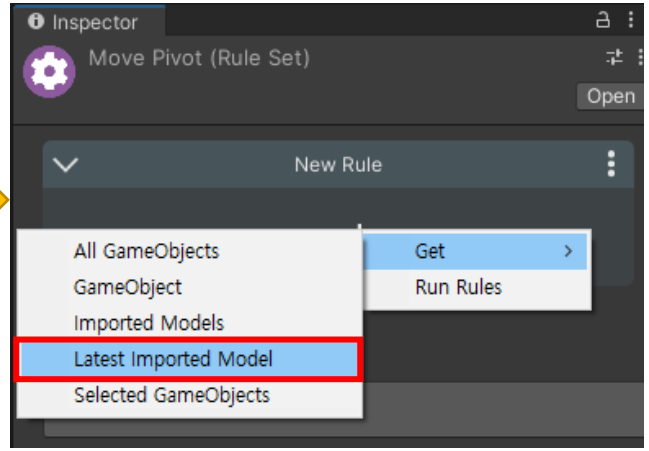


Rule 폴더 생성 후 RuleEngine Rule Set을 만든다.

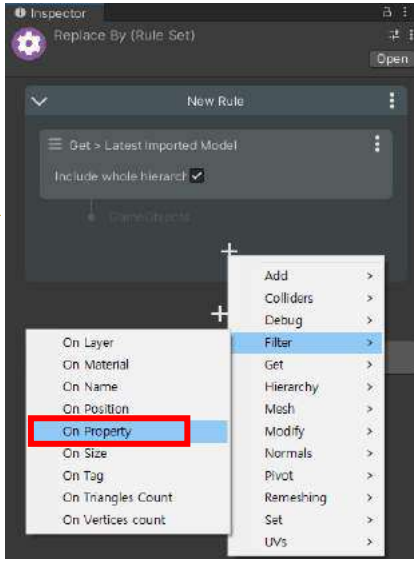
1. + 클릭하여 새로운 Rule 생성



2. Rule을 적용시켜줄 대상(Object) 선택

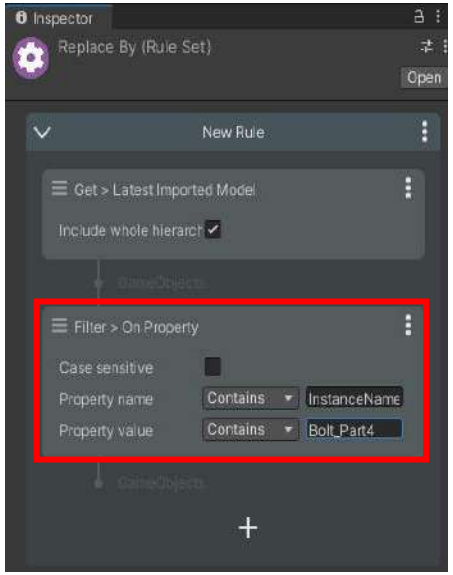


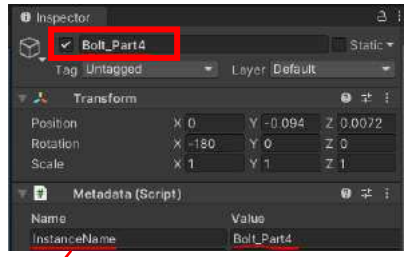
3. 동작 설정



On Property
: 다른 부품으로 대체

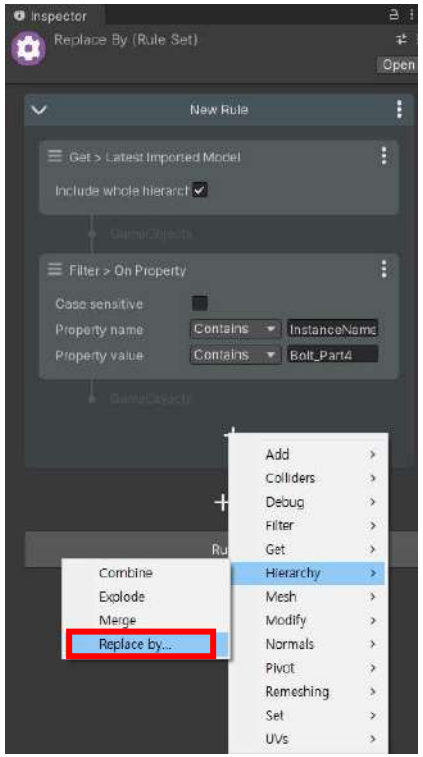
4. 변경시킬 부품 선택



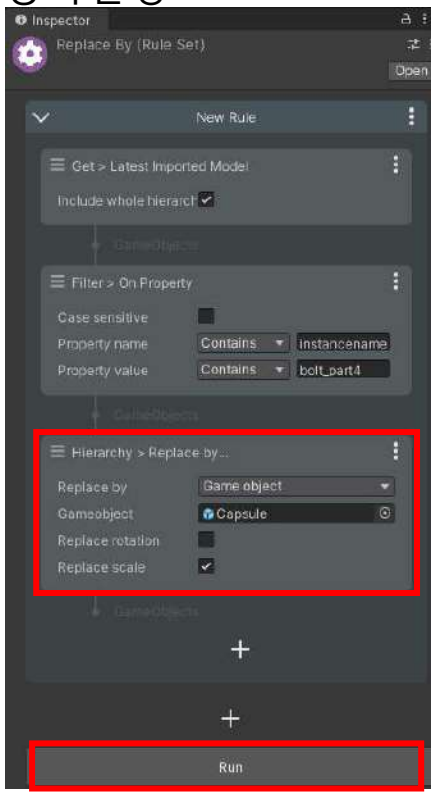


변경시킬 부품의
name, value 입력

5. 어떤 부품으로 변경할 지 정의



6. Capsule Object로 부품 변경하는 동작실행



3. Rule Engine기능 지원