

# **Automatisierte Fassadenplanung – ein Praxisbericht aus München und London**

DI (FH) MAS CAAD ETH Dominik Zausinger





**REALIZING  
REALITY**

**DIGITAL  
SOLUTIONS FOR  
COMPLEX  
DESIGNS**

*Was, Wie, Wieso?*

*Praxisbeispiele aus München und London*

*Aktuelle Herausforderungen*

*BIM*

*Wohin geht's?*



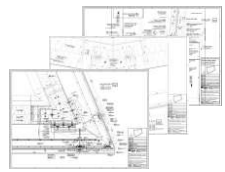
tmagine  
computation

## 3D-Werkplanung für komplexe Bauten



# 3D-Werkplanung für komplexe Bauten

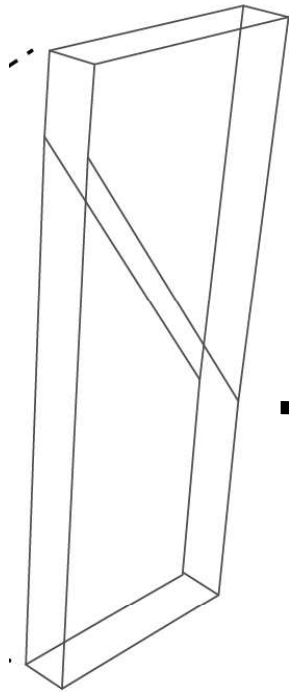
## Input



Leitdetails



Standards



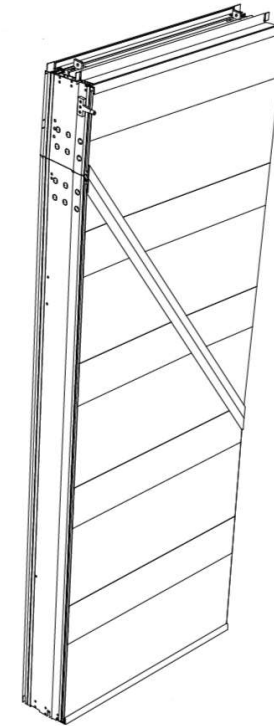
Einfache Geometrie



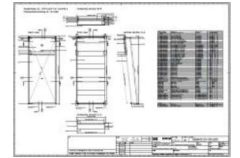
Imagine  
computation



## Output



Detaillierte Geometrie  
& angereicherte Information



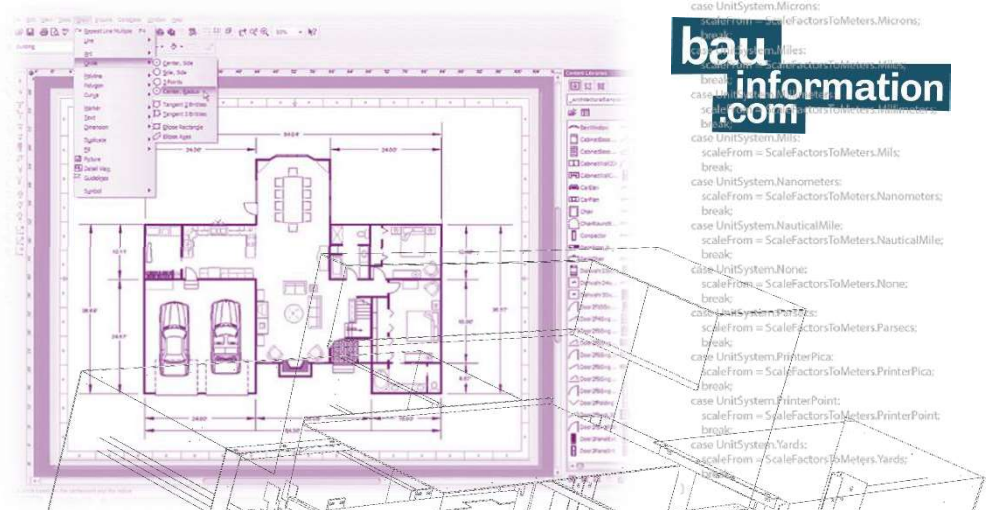
2D-drawings



CNC Data



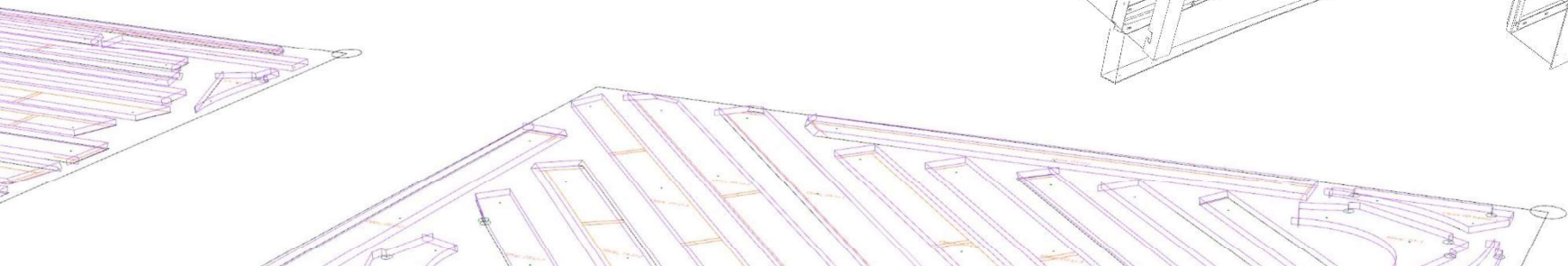
ERP System



**bau**  
**information**  
**.com**

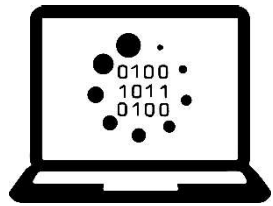
**Imagine**  
computation

# Entwicklung & Optimierung digitaler Prozesse für die Werkplanung

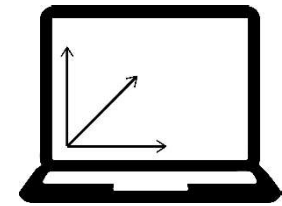


```
case UnitSystem.Microns:  
  scaleFrom = ScaleFactorsToMeters.Microns;  
  break;  
case UnitSystem.Miles:  
  scaleFrom = ScaleFactorsToMeters.Miles;  
  break;  
case UnitSystem.Nanometers:  
  scaleFrom = ScaleFactorsToMeters.Nanometers;  
  break;  
case UnitSystem.NauticalMile:  
  scaleFrom = ScaleFactorsToMeters.NauticalMile;  
  break;  
case UnitSystem.None:  
  scaleFrom = ScaleFactorsToMeters.None;  
  break;  
case UnitSystem.Parsecs:  
  scaleFrom = ScaleFactorsToMeters.Parsecs;  
  break;  
case UnitSystem.PrinterPica:  
  scaleFrom = ScaleFactorsToMeters.PrinterPica;  
  break;  
case UnitSystem.PrinterPoint:  
  scaleFrom = ScaleFactorsToMeters.PrinterPoint;  
  break;  
case UnitSystem.Yards:  
  scaleFrom = ScaleFactorsToMeters.Yards;  
  break;  
case UnitSystem.Angstroms:  
  scaleTo = ScaleFactorsToMeters.Angstroms;  
  break;  
case UnitSystem.Astronomical:  
  scaleTo = ScaleFactorsToMeters.Astronomical;  
  break;  
case UnitSystem.Centimeters:  
  scaleTo = ScaleFactorsToMeters.Centimeters;  
  break;  
case UnitSystem.CustomUnitSystem:  
  scaleTo = ScaleFactorsToMeters.CustomUnitSystem;  
  break;  
case UnitSystem.Decimeters:  
  scaleTo = ScaleFactorsToMeters.Decimeters;  
  break;  
case UnitSystem.Dekameters:  
  scaleTo = ScaleFactorsToMeters.Dekameters;  
  break;  
case UnitSystem.Feet:  
  scaleTo = ScaleFactorsToMeters.Feet;  
  break;  
case UnitSystem.Gigameters:  
  scaleTo = ScaleFactorsToMeters.Gigameters;  
  break;  
case UnitSystem.Hectometers:  
  scaleTo = ScaleFactorsToMeters.Hectometers;  
  break;  
case UnitSystem.Inches:  
  scaleTo = ScaleFactorsToMeters.Inches;  
  break;  
case UnitSystem.Kilometers:  
  scaleTo = ScaleFactorsToMeters.Kilometers;  
  break;  
case UnitSystem.Lightyears:  
  scaleTo = ScaleFactorsToMeters.Lightyears;  
  break;  
case UnitSystem.Megameters:  
  scaleTo = ScaleFactorsToMeters.Megameters;  
  break;  
case UnitSystem.Meters:  
  scaleTo = ScaleFactorsToMeters.Meters;  
  break;  
case UnitSystem.Microinches:  
  scaleTo = ScaleFactorsToMeters.Microinches;  
  break;  
case UnitSystem.Microns:  
  scaleTo = ScaleFactorsToMeters.Microns;  
  break;  
case UnitSystem.Miles:  
  scaleTo = ScaleFactorsToMeters.Miles;  
  break;  
case UnitSystem.Millimeters:  
  scaleTo = ScaleFactorsToMeters.Millimeters;  
  break;  
case UnitSystem.Mils:  
  scaleTo = ScaleFactorsToMeters.Mils;  
  break;  
case UnitSystem.Nanometers:  
  scaleTo = ScaleFactorsToMeters.Nanometers;  
  break;  
case UnitSystem.NauticalMile:  
  scaleTo = ScaleFactorsToMeters.NauticalMile;  
  break;  
case UnitSystem.None:  
  scaleTo = ScaleFactorsToMeters.None;  
  break;  
case UnitSystem.Parsecs:  
  scaleTo = ScaleFactorsToMeters.Parsecs;  
  break;  
case UnitSystem.PrinterPica:  
  scaleTo = ScaleFactorsToMeters.PrinterPica;  
  break;
```

**Imagine**  
computation

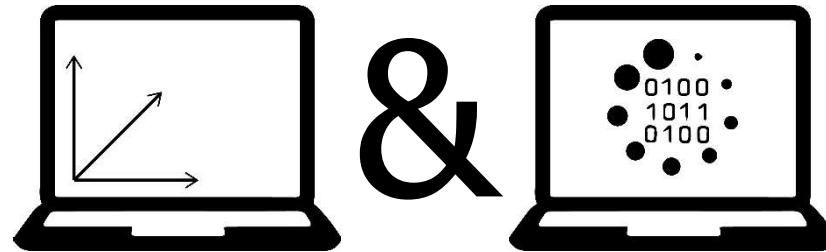


IT



3D

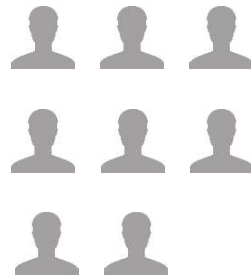
## Digitaler Werkzeugkasten



**CEO**



**3D**



**IT**



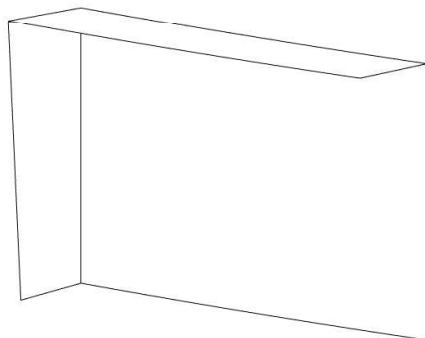
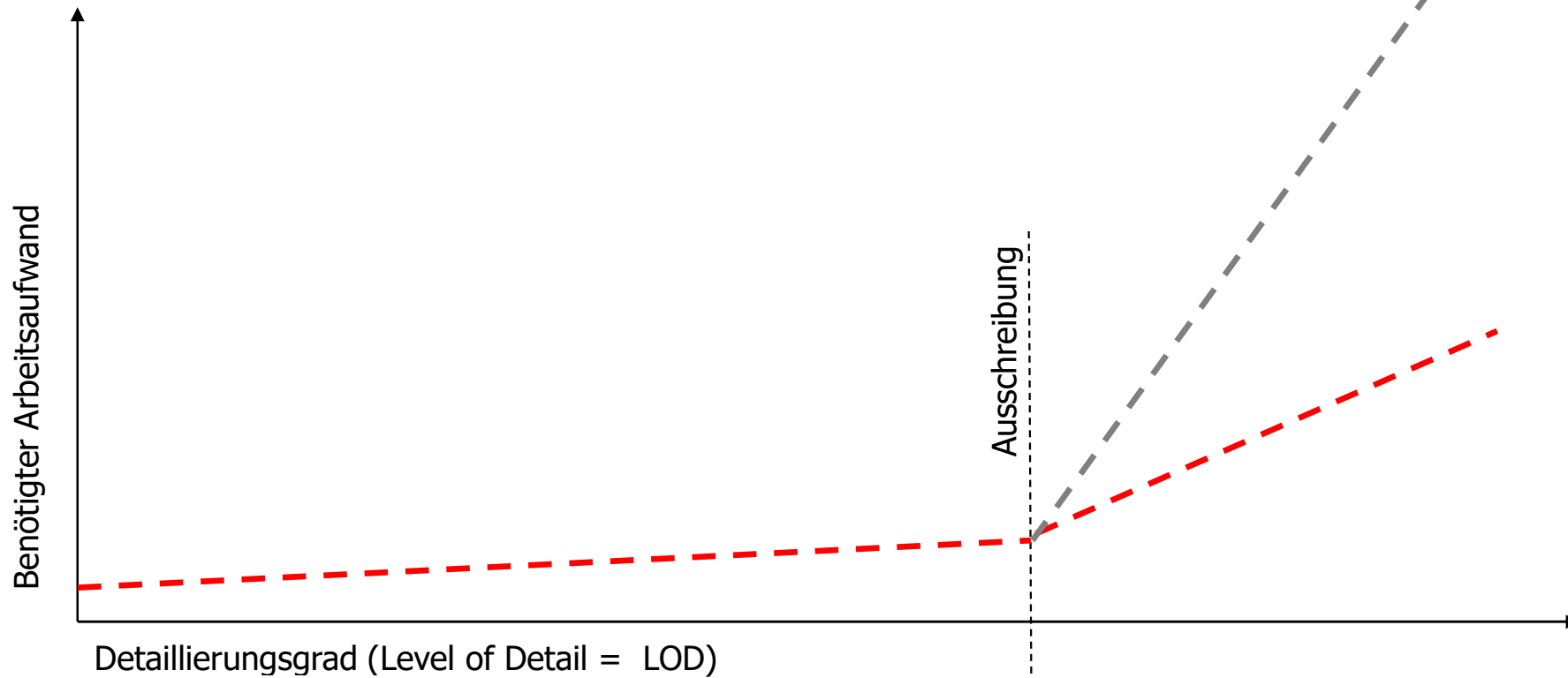
**PL**



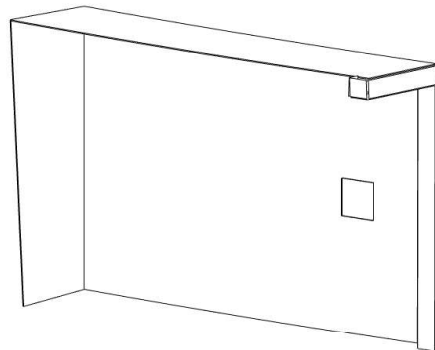
**founded : 2011 /// Office: Frankfurt**



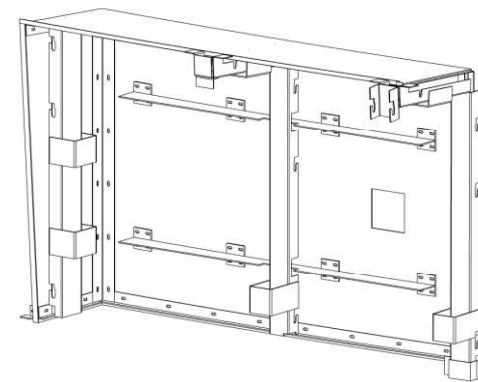
# Reduktion der Arbeitszeit und Kosten



LOD 200



LOD 300

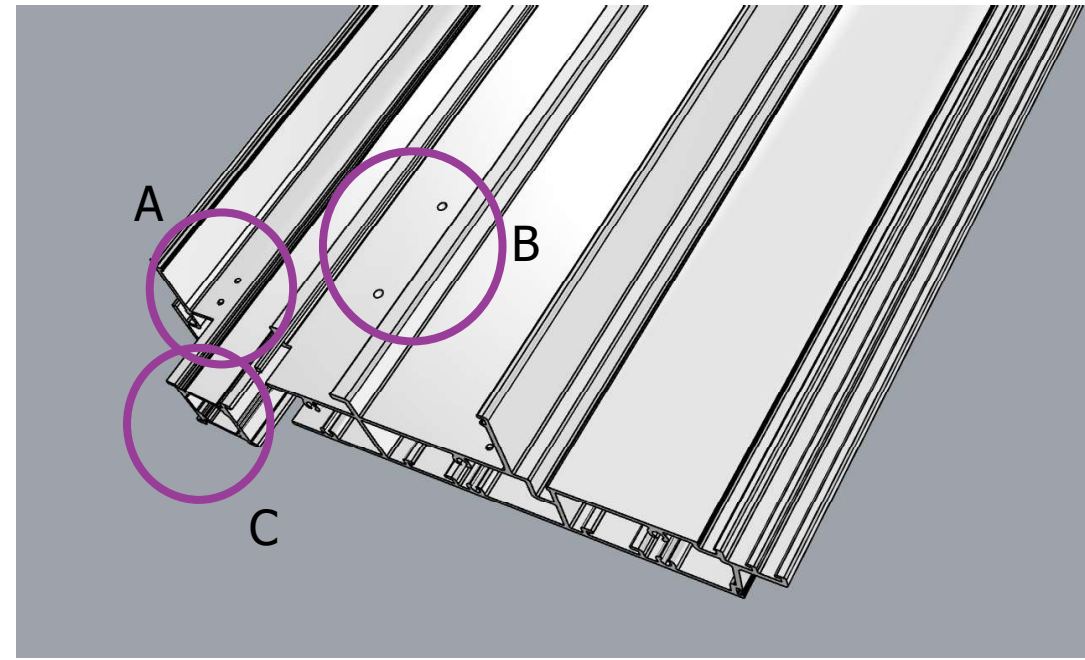
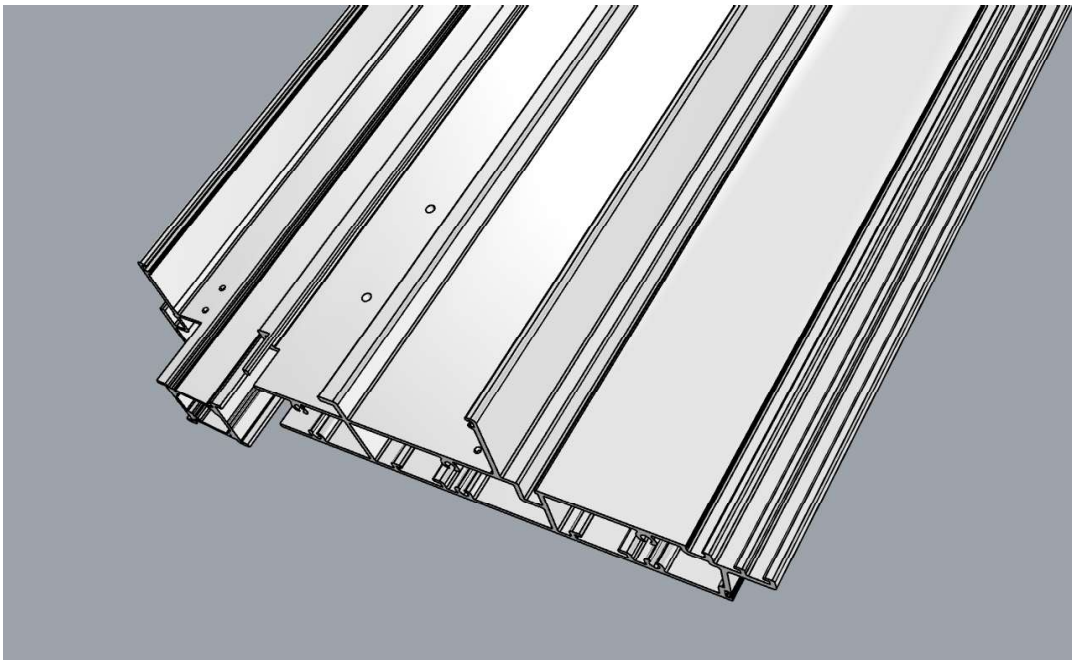


LOD 400

# Höchste Ansprüche an 3D Qualität

## Fehler

- Bohrung sind 2mm versetzt (A)
- Durchmesser ist 6mm anstatt 5.5mm (B)
- Extrusion ist 2mm zu kurz (C)



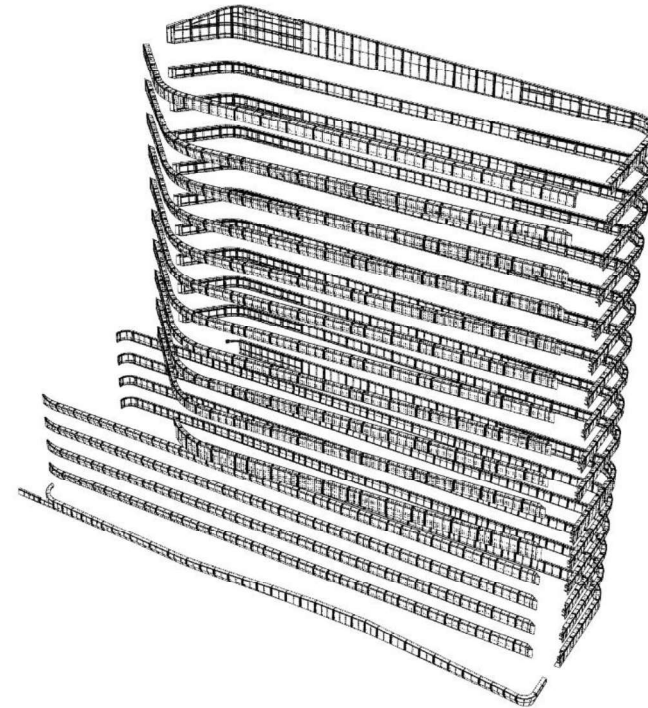
*Fischers Fritze fischte frische Fische, frische  
Fische fischte Fischers Fritze.*

# NEO (Baumkirchen, München)



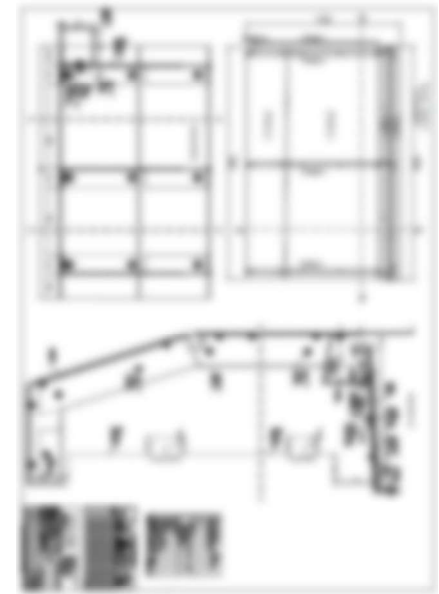
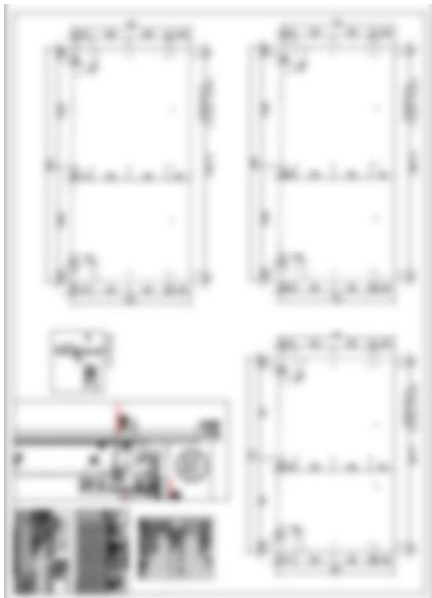
**Architect:**  
UN Studio, Amsterdam

**Fassadenbauunternehmen**  
Schindler Fenster + Fassaden, Roding

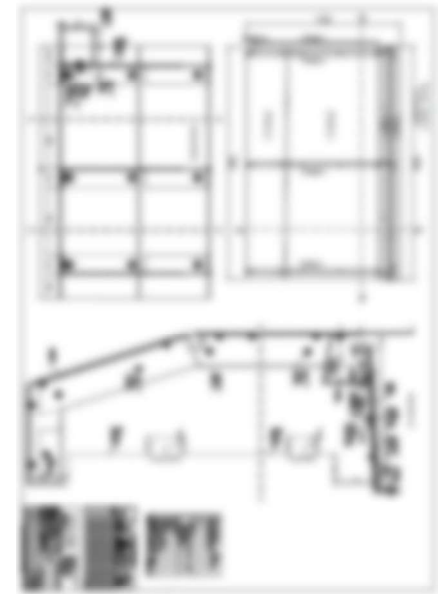
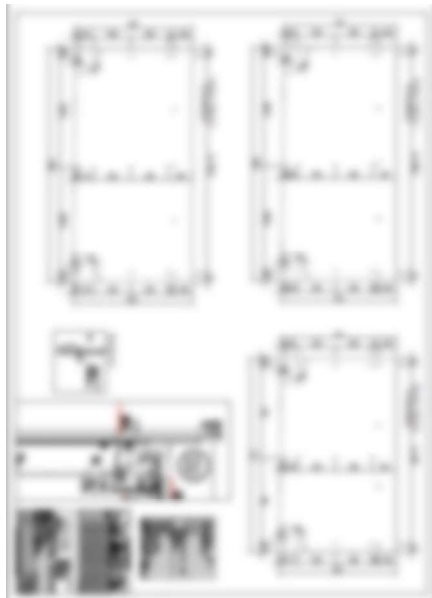


3.800m<sup>2</sup> Blechverkleidung

# NEO - Aufgabe



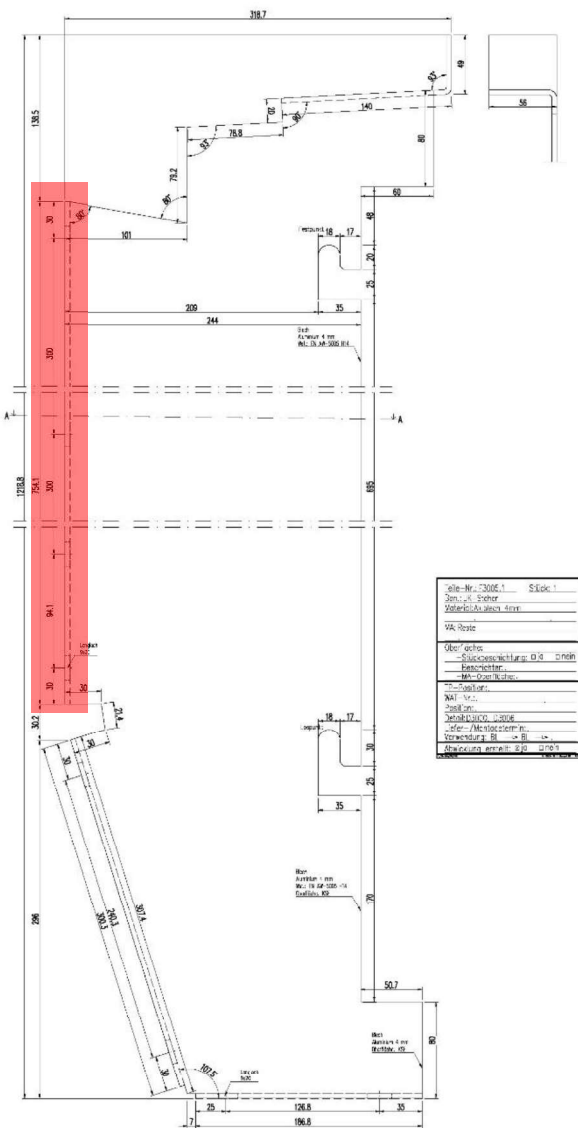
# NEO - Aufgabe



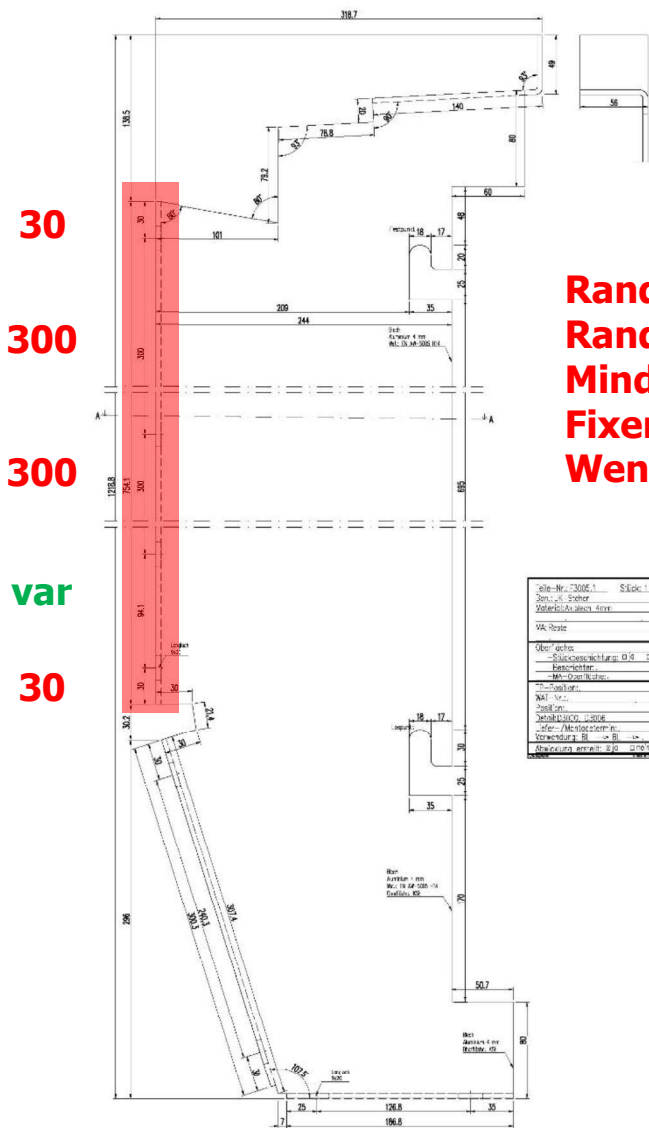
# NEO – Klärung der Regeln



30  
 300  
 300  
 94,1  
 30



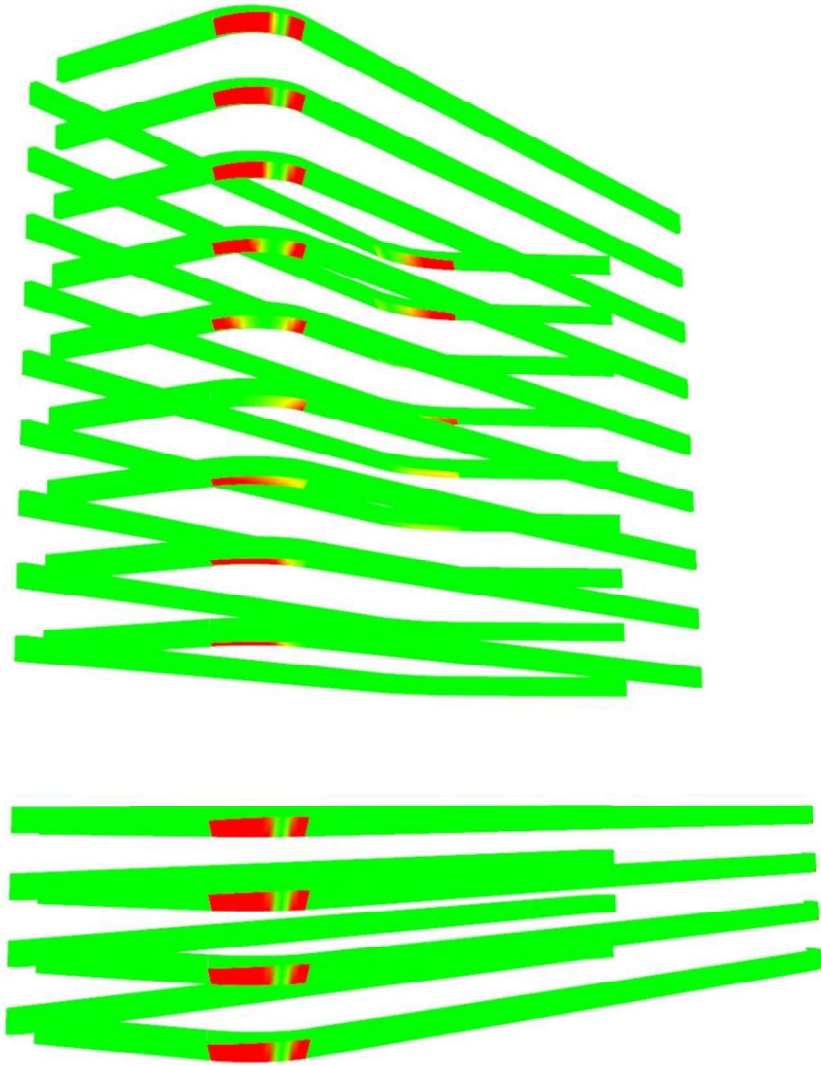
# NEO – Klärung der Regeln



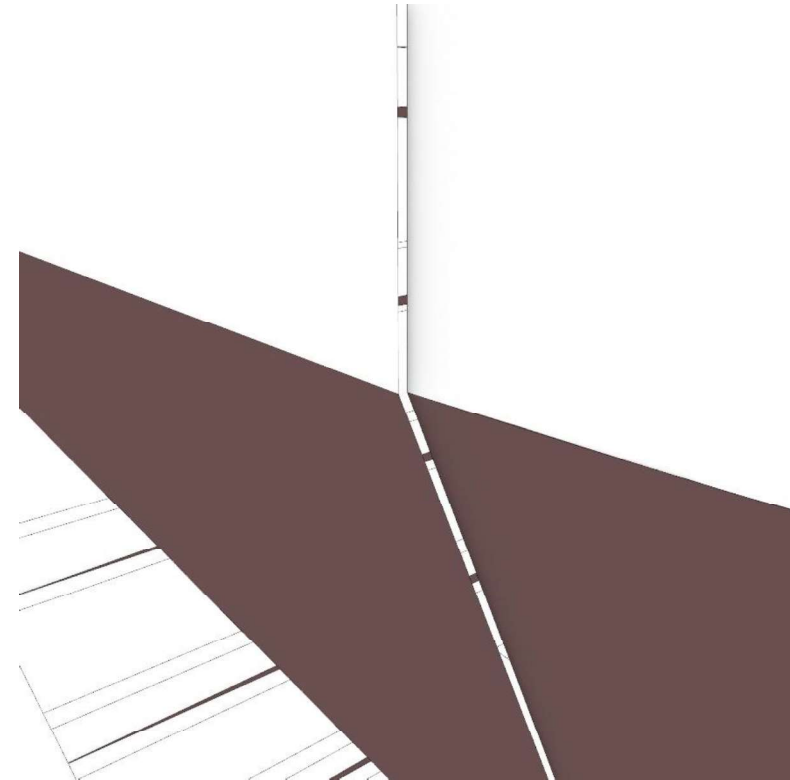
- Randabstand 1. Bolzen von oben: 30**
- Randabstand letzter Bolzen von unten: 30**
- Mindestabstand Bolzen: 50**
- Fixer Bolzenabstand alle 300 von oben anfangend**
- Wenn Restlänge unten  $300 < 350$ , dann Bolzen auf halber Strecke**

Zeile-Nr.	1	Stück	1
Bem.	1. Bohrer		
Werkstoff	Alu-Bohrer		
VA	Rechte		
Gewinde	Ø 10		
Stückzahl	1		
Material	Alu-Bohrer		
Stück	1		
Werkstoff	Alu-Bohrer		
VA	Rechte		
Gewinde	Ø 10		
Stückzahl	1		
Material	Alu-Bohrer		
Stück	1		
Werkstoff	Alu-Bohrer		
VA	Rechte		
Gewinde	Ø 10		
Stückzahl	1		
Material	Alu-Bohrer		





Krümmungsanalyse



nicht geschlossene Flächen

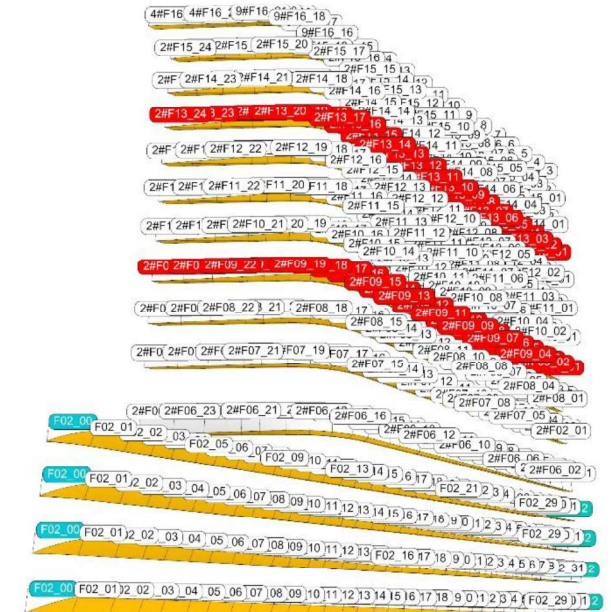
# NEO – Aufbau eines Grundlagenmodells



Flächenmodell

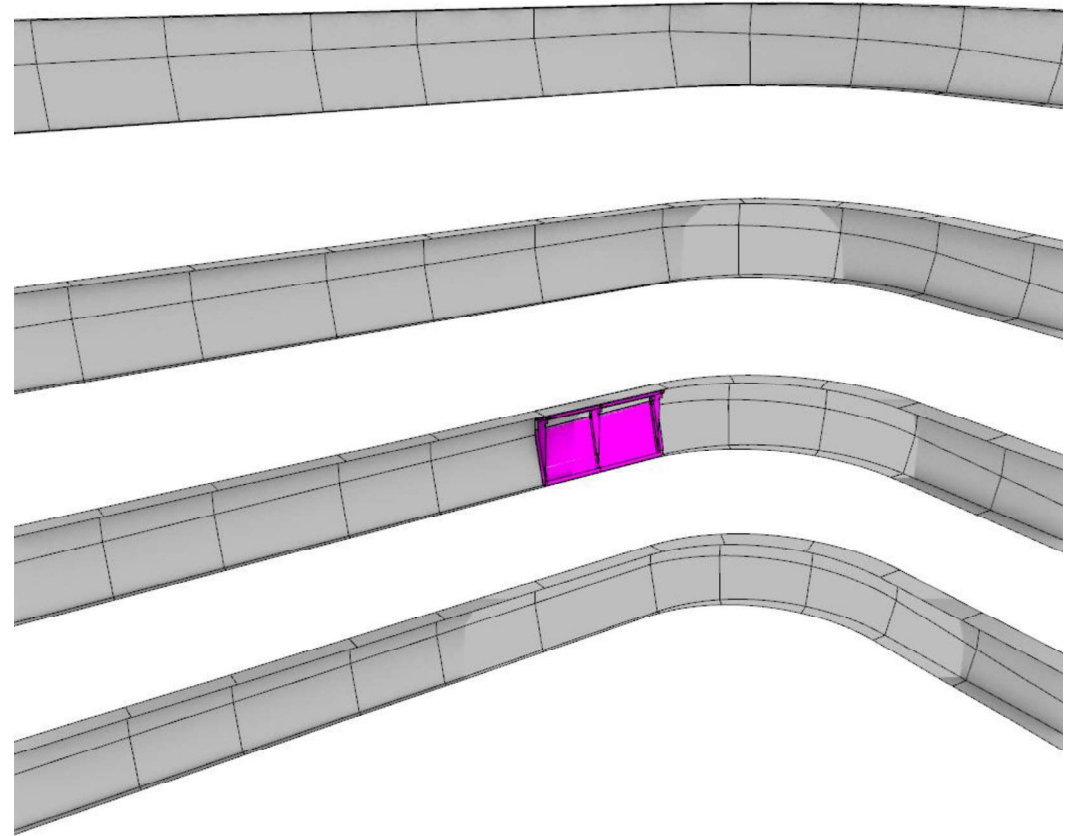
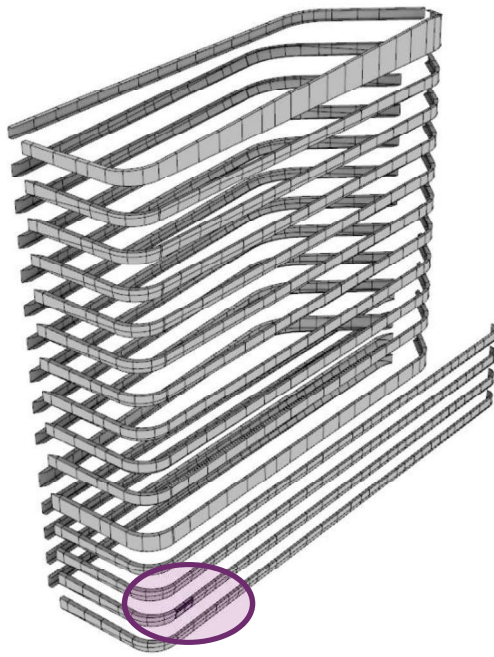


Flächenmodell inkl.  
Fugen

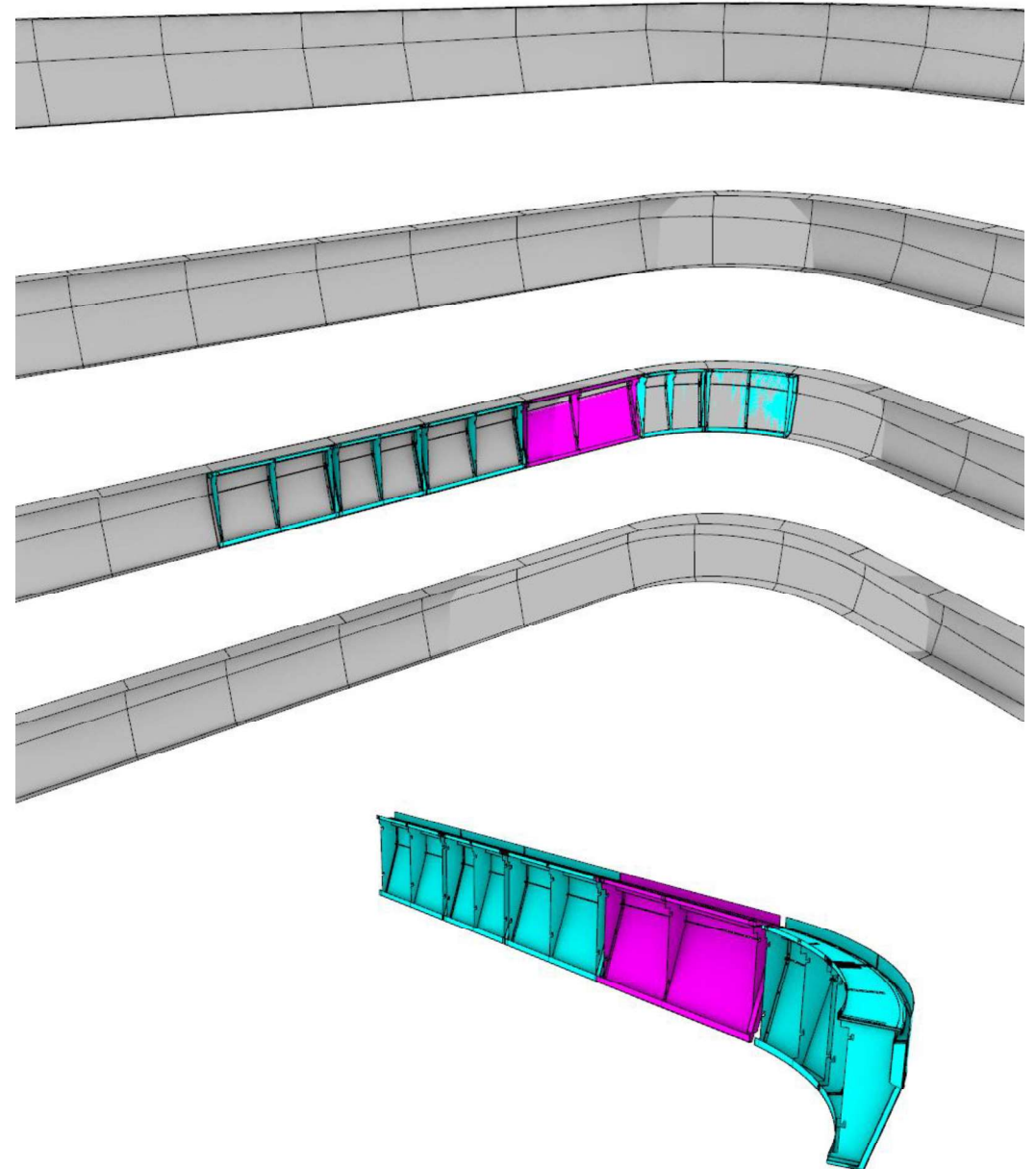


Flächenmodell inkl. Fugen &  
Fertigungsanforderungen

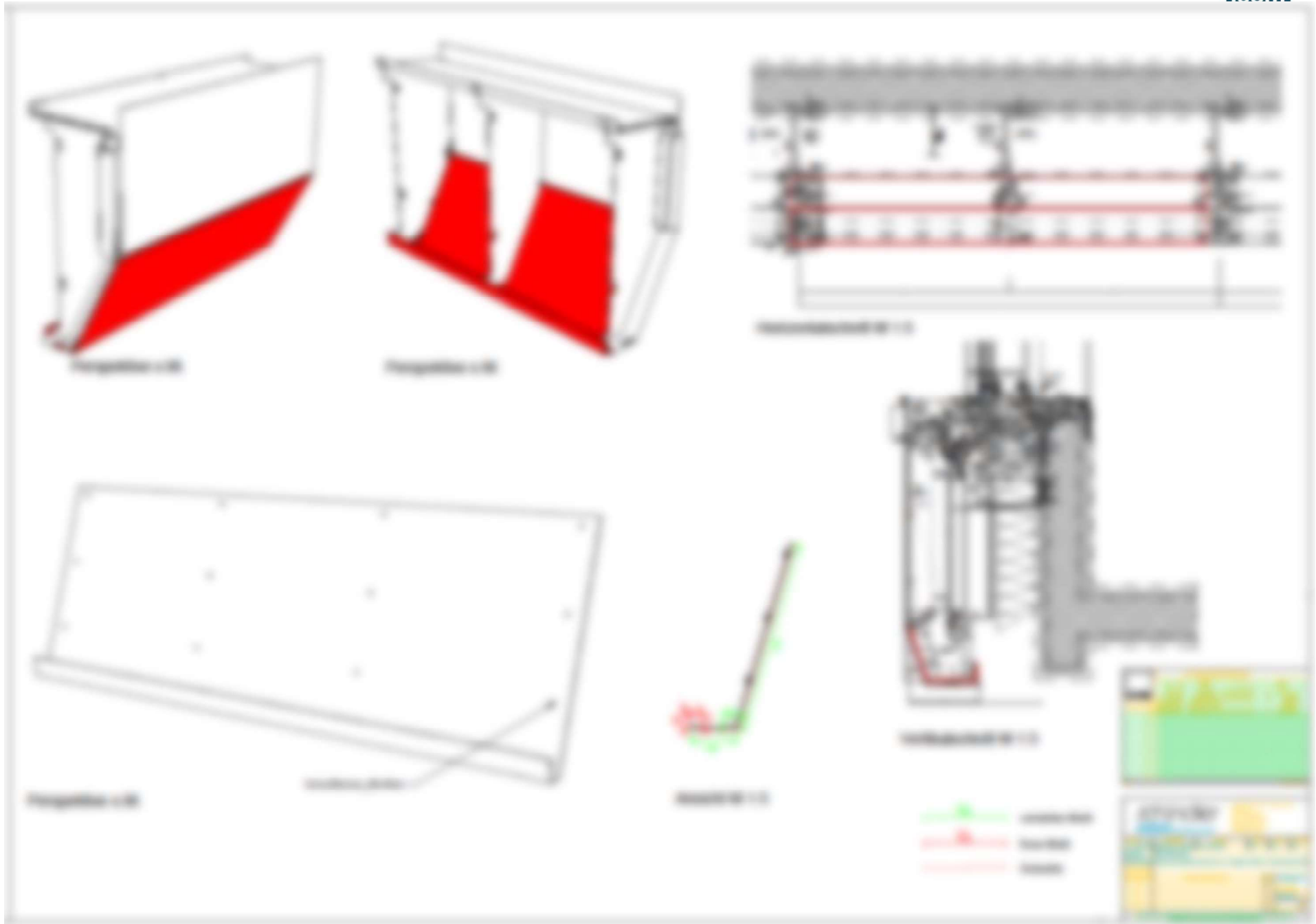
# NEO – 1. MockUp (digital)



# NEO – 2. MockUp (digital + gebaut)



# NEO – Regeln definieren



# NEO – Code-Entwicklung, 3. MockUp (digital)

```
using System;
using System.Collections.Generic;
using System.Linq;
using Rhino;
using Rhino.Commands;
using Rhino.Geometry;
using Rhino.DocObjects;
using Rhino.Input;

namespace NETSLOT
{
    public partial class NETSLOT
    {
        // Summary:
        // Change value to current Rhino Unit System
        // Summary:
        // custom name: Value to be used in units
        // returns: Value to current Unit System (meters)
        public static double GetValidRhinoUnitSystem(double value)
        {
            return GetValidRhinoUnitSystem(UnitSystem.Millimeters);
        }

        // Summary:
        // Change value to current Rhino Unit System
        // Summary:
        // custom name: Value to be used in input Unit System (meters)
        // custom name: "Input Unit System" > Unit System of input Value (parameter)
        // returns: Value to current Unit System (meters)
        public static double GetValidRhinoUnitSystem(double value, UnitSystem inputUnitSystem)
        {
            // Set current Rhino Unit System
            UnitSystem current = Rhino.Doc.ActiveDoc.ActiveUnitSystem;

            // If the are the same, just return the value
            if (current == inputUnitSystem)
            {
                return value;
            }

            // Get Scale factor between the Unit systems
            return value * ScaleFactor(inputUnitSystem, current);
        }

        public static bool SaveAs(string completePath, bool overwrite = true, int version = 5, bool saveSmall = true)
        {
            // Check if file exists
            if (System.IO.File.Exists(completePath) && !overwrite)
            {
                RhinoApp.WriteLine("File already Exist - No Overwrite: (0) | completePath");
                return false;
            }

            if (completePath.EndsWith(".idm?"))
            {
                RhinoApp.WriteLine("String Format File MCF Save - Must end with .3dm (0) | completePath");
                return false;
            }

            // Check the existence of a path
            string directory = System.IO.Path.GetDirectory(completePath);
            if (System.IO.Directory.Exists(directory))
            {
                System.IO.Directory.CreateDirectory(directory);
            }

            string command = "";
            command = ". SaveAs";
            command = String.Format("Version{0}", version).ToLower();
            if (saveSmall)
            {
                command += " -saveSmall -f";
            }
            else
            {
                command += " -saveSmall -nb";
            }
            command = String.Format("{0}", completePath);
            RhinoApp.RunScript(command, false);

            return true;
        }

        // Summary:
        // Opens a 3dm file, document to be set to RhinoApp.ActiveDoc after calling this function
        // (I.E. MD3) HAVE BEEN SAVED BEFORE - NOT handling it asks "Would you like to save"
        // Summary:
        // custom name: "path" -> parameter
        // returns: true or false
        public static bool Open3dmFile(string path, bool saveChangesOrSaveAs = false)
        {
            if (System.IO.File.Exists(path))
            {
                RhinoApp.WriteLine("String Format File MD3 doesn't exist: path");
                return false;
            }

            if (path.EndsWith(".idm?"))
            {
                RhinoApp.WriteLine("String Format File MD3 must end with .3dm (0) | path");
                return false;
            }

            string command = "";
            command = ". open";

            if (Rhino.Doc.ActiveDoc.Mode.Is && saveChangesOrSaveAs)
            {
                command += " No";
            }

            // command = ". UpdateFromTopUpdat@@"@@"@";
            command = String.Format("{0}", path);
            RhinoApp.RunScript(command, true);

            return true;
        }

        private struct ScaleFactorToMeters
        {
            public const double None = 1; // Seen as Meters
            public const double Angstroms = 10e-10;
            public const double Nanometers = 1.0e-9;
            public const double Micrometers = 1.0e-6;
            public const double Millimeters = 1.0e-3;
            public const double Centimeters = 1.0e-2;
            public const double Decimeters = 1.0e-1;
            public const double Meters = 1;
            public const double Kilometers = 1.0e+3;
            public const double Hectometers = 1.0e+2;
            public const double Gigameters = 1.0e+9;
            public const double Terameters = 1.0e+12;
            public const double Petameters = 1.0e+15;
            public const double Exameters = 1.0e+18;
            public const double Zettameters = 1.0e+21;
            public const double Yottameters = 1.0e+24;
            public const double CustomUnitSystem = 1; // Seen as Meters
        }

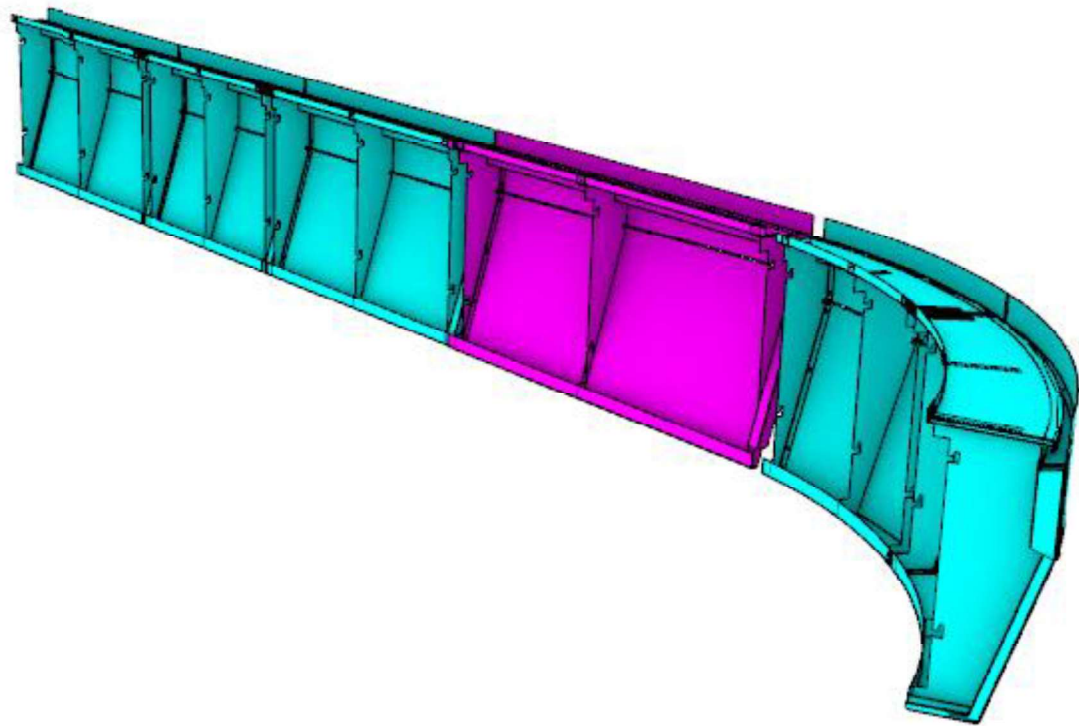
        // Summary:
        // custom name: "vector" -> Vector to set -> parameter
        // Summary:
        // custom name: "length" -> new Length of the vector (Negative Values will reverse the vector) -> parameter
        // custom name: "reverse" -> if the vector will be reversed -> parameter
        // returns: Vector3d Vector3d Vector3d Length of Vector3d vector, double length, bool isReversed, Vector3d
        public static Vector3d Vector3dLength(Vector3d vector, double length, bool isReversed, Vector3d boundingBox)
        {
            Vector3d newVector = new Vector3d(vector);
            newVector.Normalize();
            newVector *= length;

            if (reverse)
            {
                newVector.Reverse();
            }

            return newVector;
        }

        // Summary:
        // evaluates the line surface that is orthogonal to two planar brags
        // Summary:
        // custom name: "brag" -> first Brag (parameter)
        // custom name: "secondBrag" -> second Brag (parameter)
        public static Plane ToOrthogonalPlaneFromTwoBrags(Brag firstBrag, Brag secondBrag)
        {
            // Get biggest plane surface of the first input Brag and get the normal
            Vector3d normal = firstBrag.Normal;
            if (secondBrag.Faces.Count > 0)
            {
                Vector3d normal2 = secondBrag.Faces[0].Normal;
            }
            else
            {
                Vector3d normal2 = secondBrag.Faces[0].Normal;
            }
            Vector3d normal = normal.CrossProduct(normal2).Unitize();
            Plane plane = Plane.FromNormalAndPoint(normal, normal2);
            return plane;
        }

        // Summary:
        // custom name: "brag" -> first Brag (parameter)
        // custom name: "secondBrag" -> second Brag (parameter)
        public static Plane ToOrthogonalPlaneFromTwoBrags(Brag firstBrag, Brag secondBrag)
        {
            // Get biggest plane surface of the first input Brag and get the normal
            Vector3d normal = firstBrag.Normal;
            if (secondBrag.Faces.Count > 0)
            {
                Vector3d normal2 = secondBrag.Faces[0].Normal;
            }
            else
            {
                Vector3d normal2 = secondBrag.Faces[0].Normal;
            }
            Vector3d normal = normal.CrossProduct(normal2).Unitize();
            Plane plane = Plane.FromNormalAndPoint(normal, normal2);
            return plane;
        }
    }
}
```



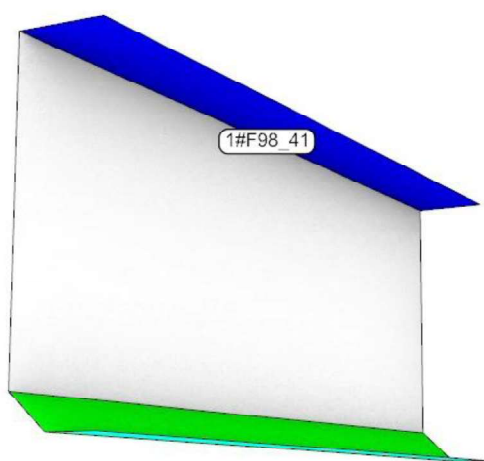
# NEO – Panelerzeugung

File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels Help

Command: VV  
Command: !\_SetView  
Choose coordinate system ( CPlane World ): \_World  
Choose world view ( Top Bottom Left Right Front Back Perspective TwoPointPerspective ): \_Perspective  
Command: \_Zoom  
Drag a window to zoom ( All Dynamic Extents Factor In Out Selected Target 1To1 ): \_Extents  
Command: PlayAnimation  
Command: |

Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools Mesh Tools Render Tools Drafting New in V6

Perspective



1#F98\_41

Properties Layers Rendering Materials Libraries Help

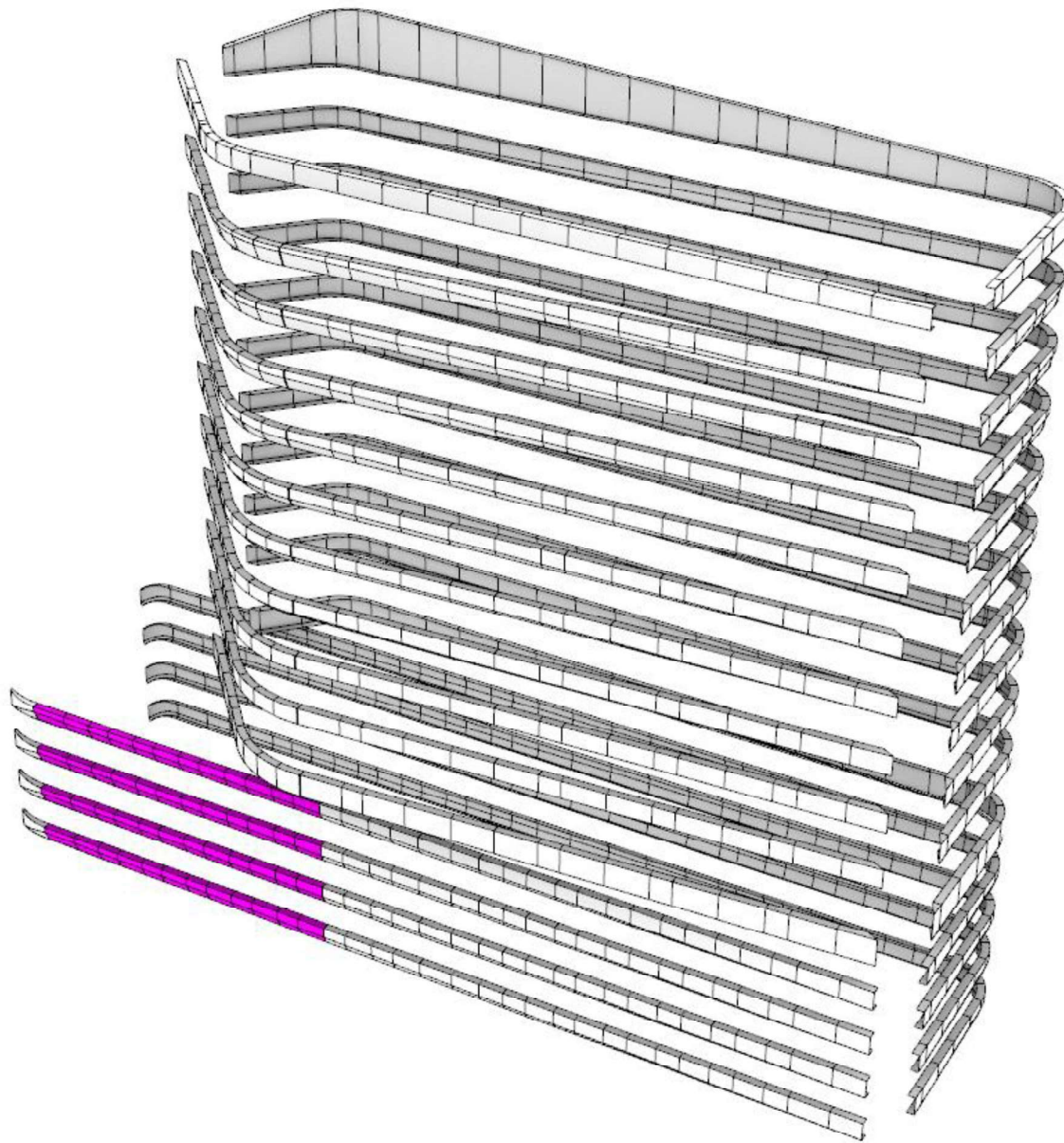
Name	Material	Linety
2_IC		Contir
3D		Contir
_BMUCutters		Contir
_dashedLined		Contir
06OG		Contir
07OG		Contir
exampleSectionInnerSchott		Contir
exampleSectionOhneGeneigtesBlech		Contir
exampleSectionOuterSchottAttika		Contir
exampleSectionOuterSchottAttikaSouth		Contir
exampleSectionOuterSchottBüro		Contir
exampleSectionOuterSchottHotel		Contir
exampleSectionOuterSchottOG16Nord		Contir
exampleSectionOuterSchottOG16Süd		Contir
exampleSectionOuterSchottOG16SüdHotel		Contir
exampleSectionOuterSchottOG6		Contir
exampleSectionOuterSchottOG6TH		Contir
exampleSectionOuterSchottTH		Contir
Schindler_AgraffeType2_Links		Contir
Schindler_AgraffeType2_Löspunkt_Links		Contir
surfaces		Contir
_beschreibung		Contir
cut		Contir
schattenPlanes		Contir

Perspective Top Front Perspective

End  Near  Point  Mid  Cen  Int  Perp  Ian  Quad  Knot  Vertex  Project  Disable

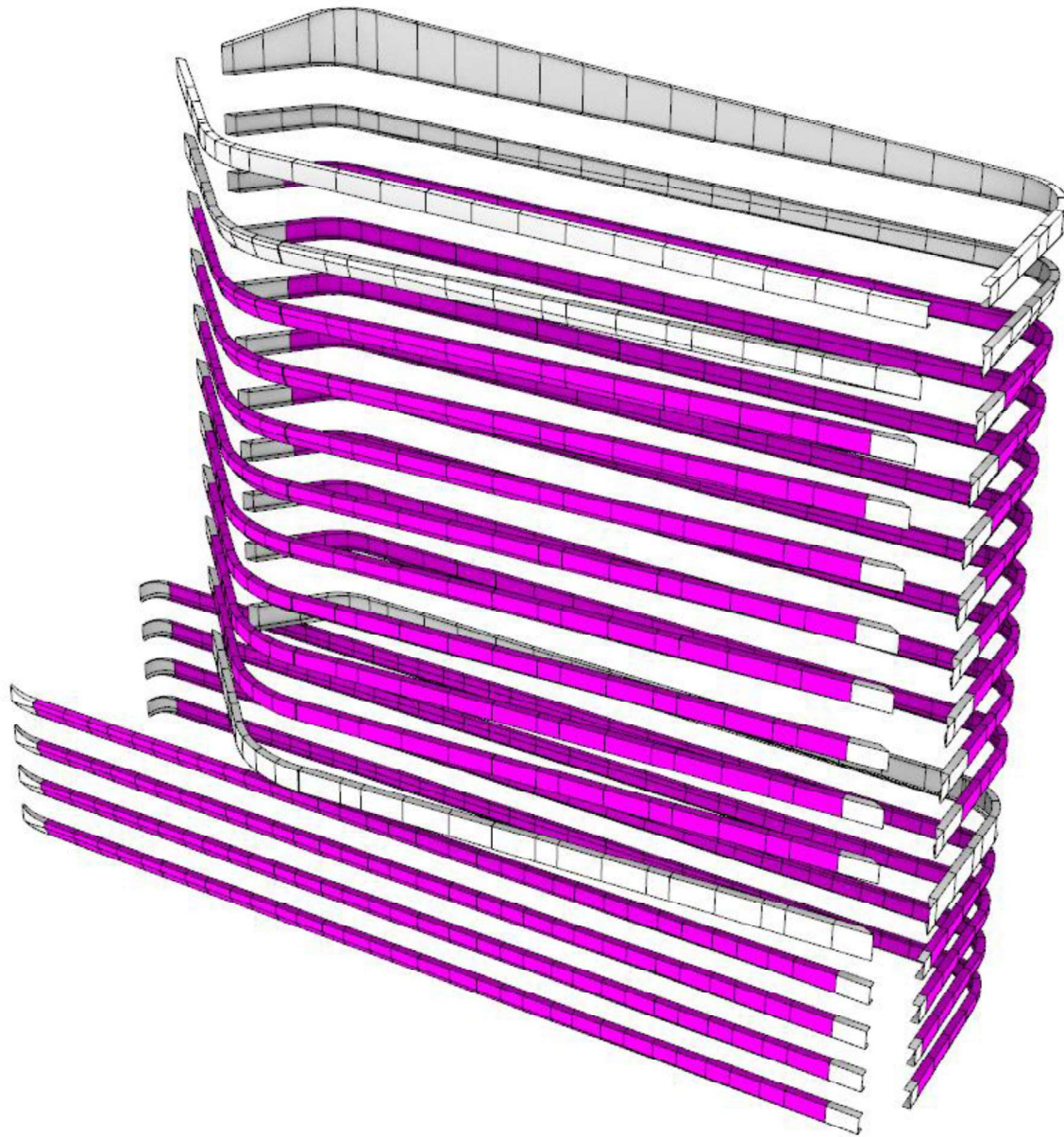
# NEO – erster Abruf Serie

12.10.18: 48 Baugruppen





# NEO – weitere Abrufe Serie



12.10.18: 48 Baugruppen

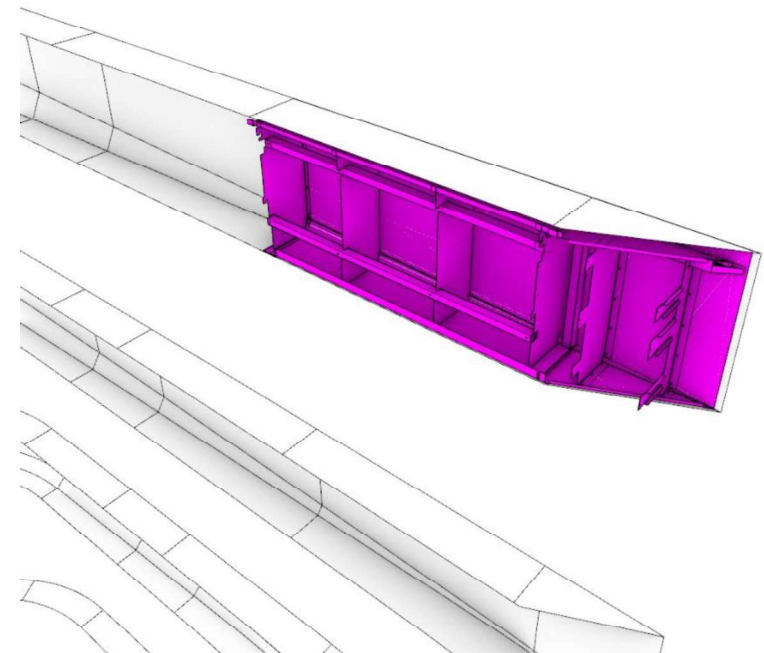
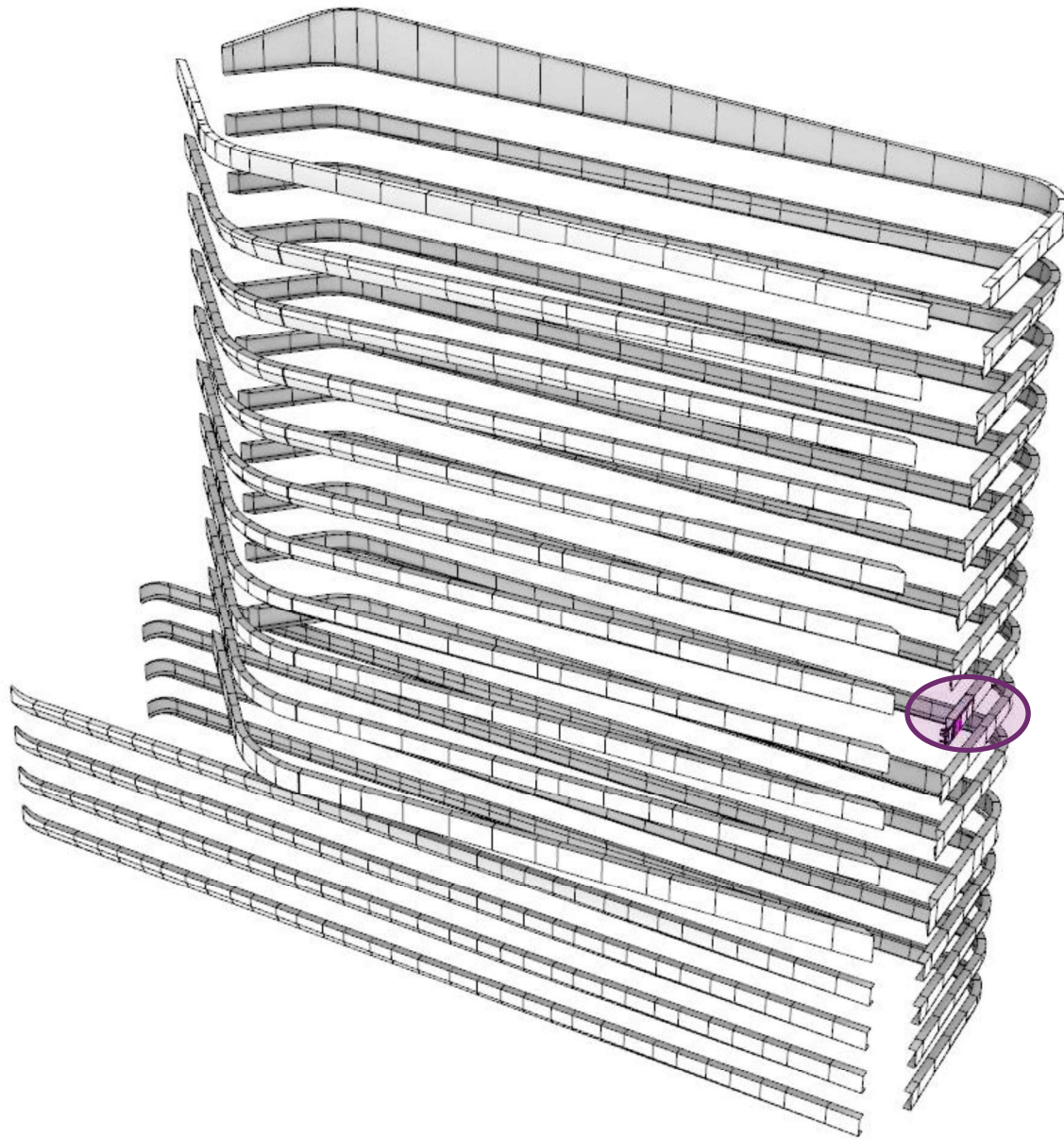
22.10.18: 188 Baugruppen

20.01.19: 264 Baugruppen

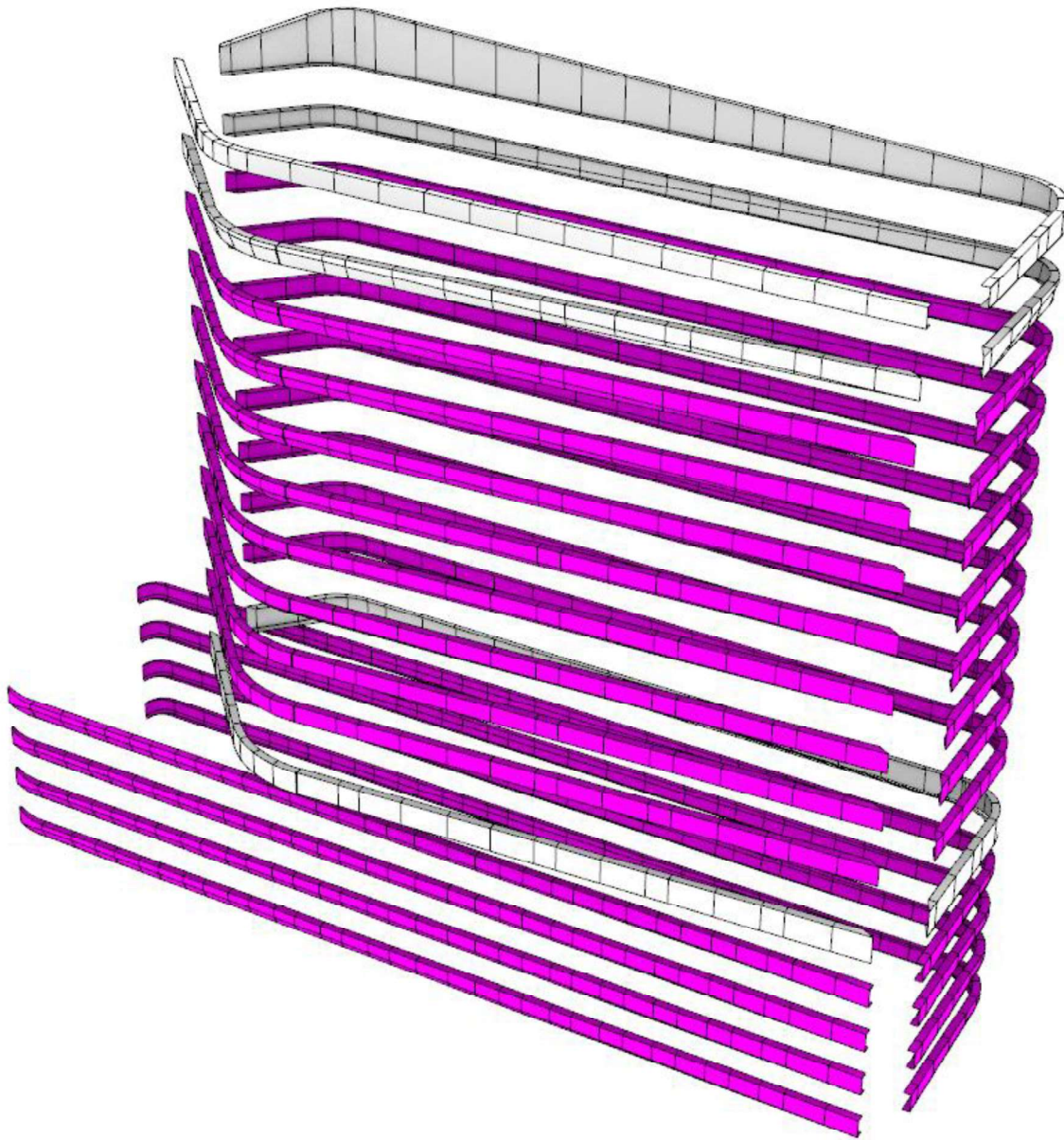
01.02.19: 8 Baugruppen (rund)

18.02.19: 80 Baugruppen (rund)

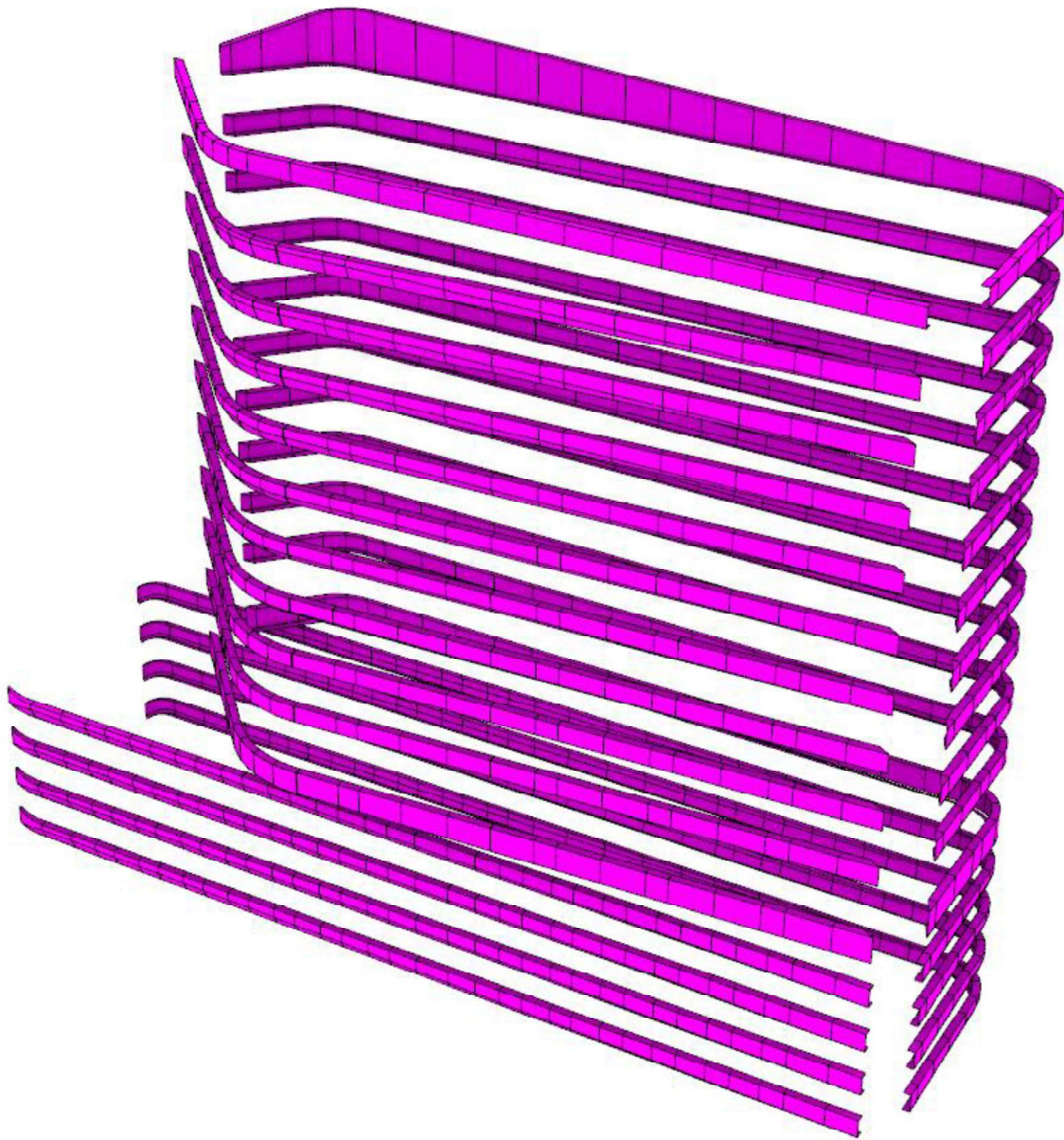
# NEO – Lösen von Sondersituationen



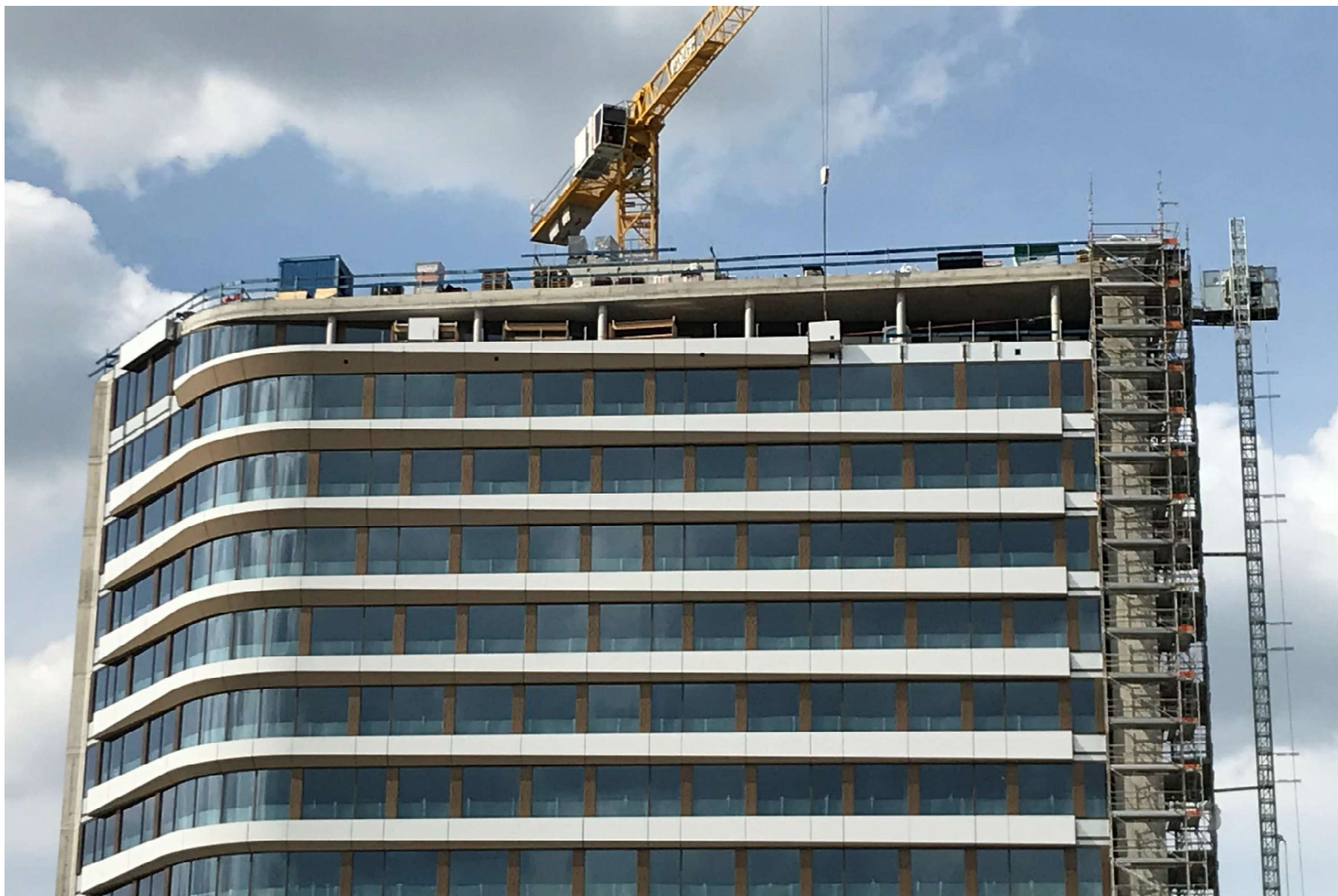
# NEO – Abschluß Auftrag

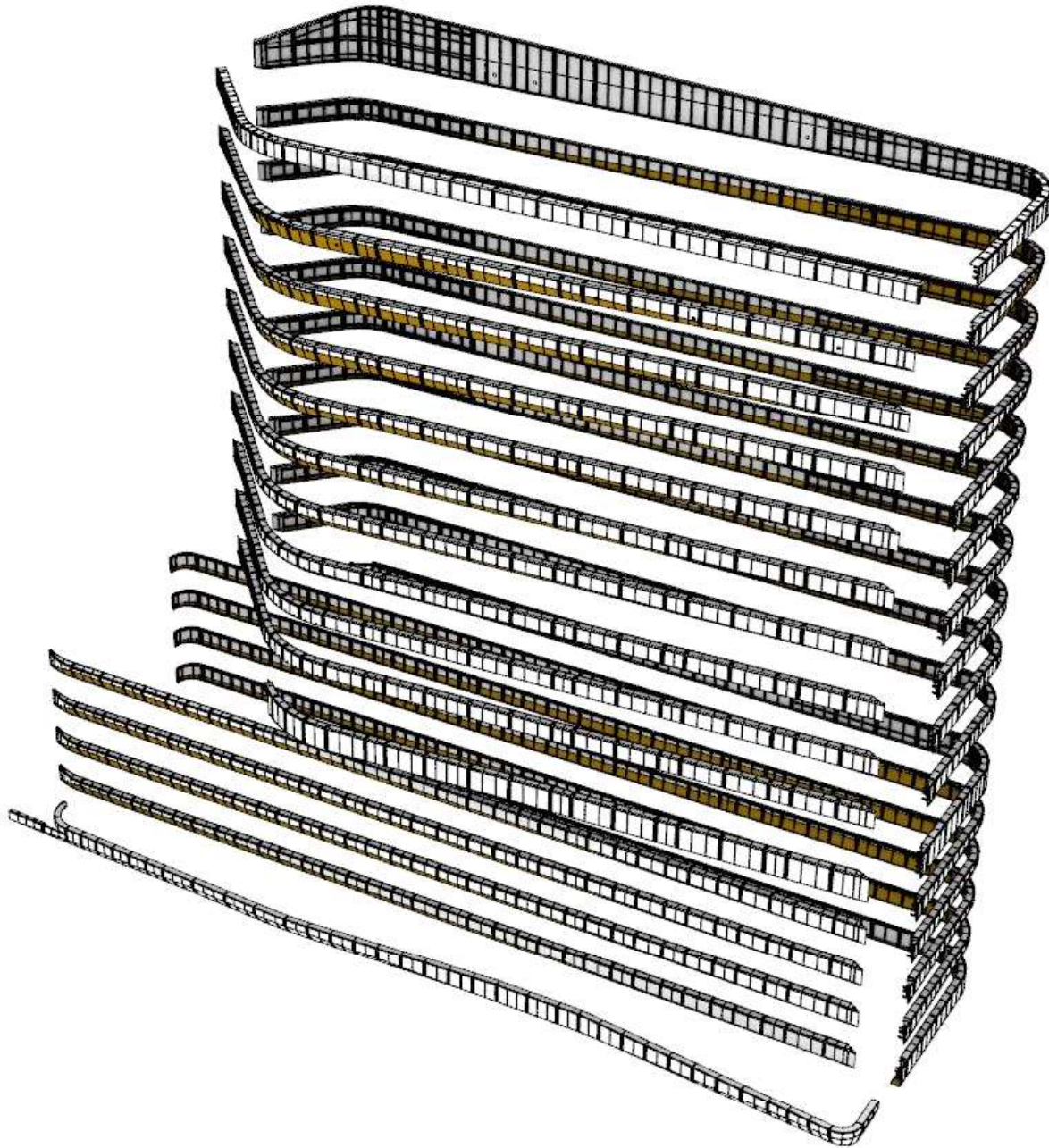


12.10.18: 48 Baugruppen  
22.10.18: 188 Baugruppen  
20.01.19: 264 Baugruppen  
01.02.19: 8 Baugruppen (rund)  
18.02.19: 80 Baugruppen (rund)  
27.02.19: 16 Baugruppen  
28.02.19: 16 Baugruppen  
08.03.19: 66 Baugruppen  
15.04.19: 25 Baugruppen  
30.04.19: 8 Baugruppen  
16.05.19: 39 Baugruppen



- 12.10.18: 48 Baugruppen
- 22.10.18: 188 Baugruppen
- 20.01.19: 264 Baugruppen
- 01.02.19: 8 Baugruppen (rund)
- 18.02.19: 80 Baugruppen (rund)
- 27.02.19: 16 Baugruppen
- 28.02.19: 16 Baugruppen
- 08.03.19: 66 Baugruppen
- 15.04.19: 25 Baugruppen
- 30.04.19: 8 Baugruppen
- 16.05.19: 39 Baugruppen
- Juli 2019 : Nachbeauftragung OG6 + OG15 + OG16 + Attika**
- 07.08.19: 9 Baugruppen
- 09.08.19: 37 Baugruppen
- 15.08.19: 12 Baugruppen
- 07.10.19: 3 Baugruppen
- Oktober 2019 : Nachbeauftragung OG1**
- 15.11.19: 22 Baugruppen
- 10.12.19: 12 Baugruppen
- 30.12.19: 18 Baugruppen
- 09.01.20: 12 Baugruppen





**3.800m<sup>2</sup> Blechverkleidung**

**900 Baugruppen**

**15.000 Bauteile**

**10.000 Blechtypen**

**7 falsche Bleche = 0,05%**

# The Crown (Fenchurch Avenue 10, London)



## Architect:

Eric Parry Architects, London

## Fassadenbauunternehmen

Josef Gartner, Gundelfingen

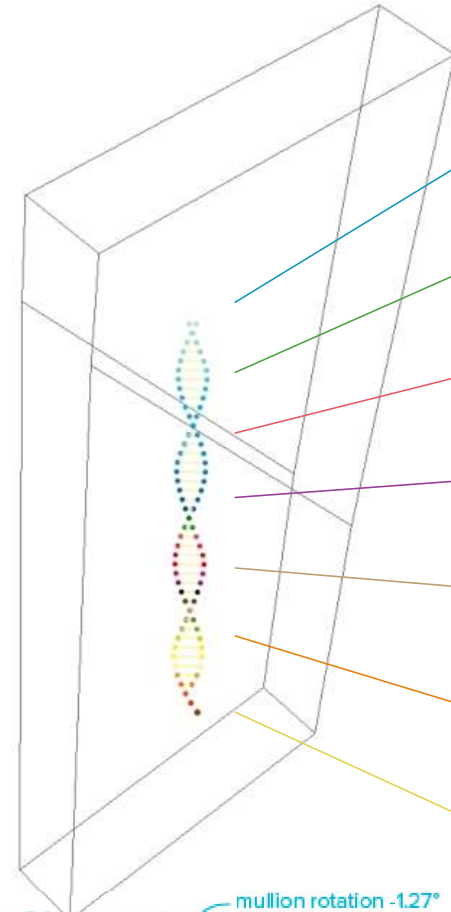
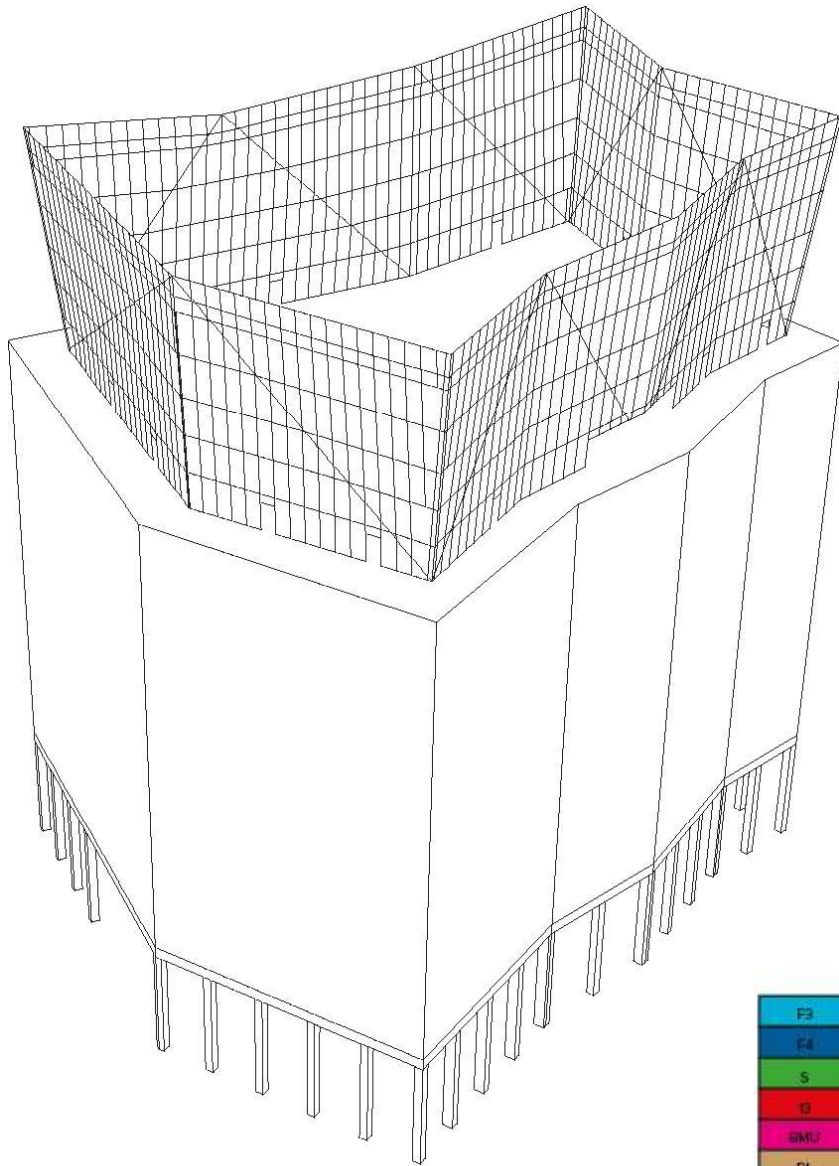
5000m<sup>2</sup> Closed Cavity Facade (CCF)

Bedeckt in dichroic Streifen

1056 Facade Elements

Keines der Elemente ist ein perfektes Rechteck

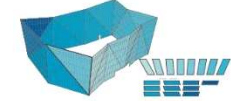
# The Crown – Anlegen Basismodell



F3
F4
S
L3
BMU
DL
K
G2

- face 3 for lower part
  - mullion rotation  $-1.27^\circ$
  - face angle  $+3.85^\circ$
- face 4 for upper part
  - mullion rotation  $+1.28^\circ$
  - face angle  $+5.68^\circ$
- has shading
- level 13: height 4170mm
- has a BMU
- is mounted down-left — needs special cut-outs
  - mullion kink  $+1.84^\circ$
  - transom kink  $+2.56^\circ$
  - face kink angle  $+3.14^\circ$
- is kinked: valley 9
- glass type ...

**FACES**  
if there is any in rotation angles of mullions and transoms



**SHADING**  
without, with standard or with fixed blind



**LEVELS**  
the levels in four of facade heights



**BMU**  
has a building maintenance unit or not



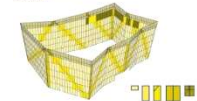
**MOUNTING DIRECTION**  
elements are mounted downwards, down-left or down-right



**FACADE TYPES**  
standard, lower, standard, glass and translucent glass

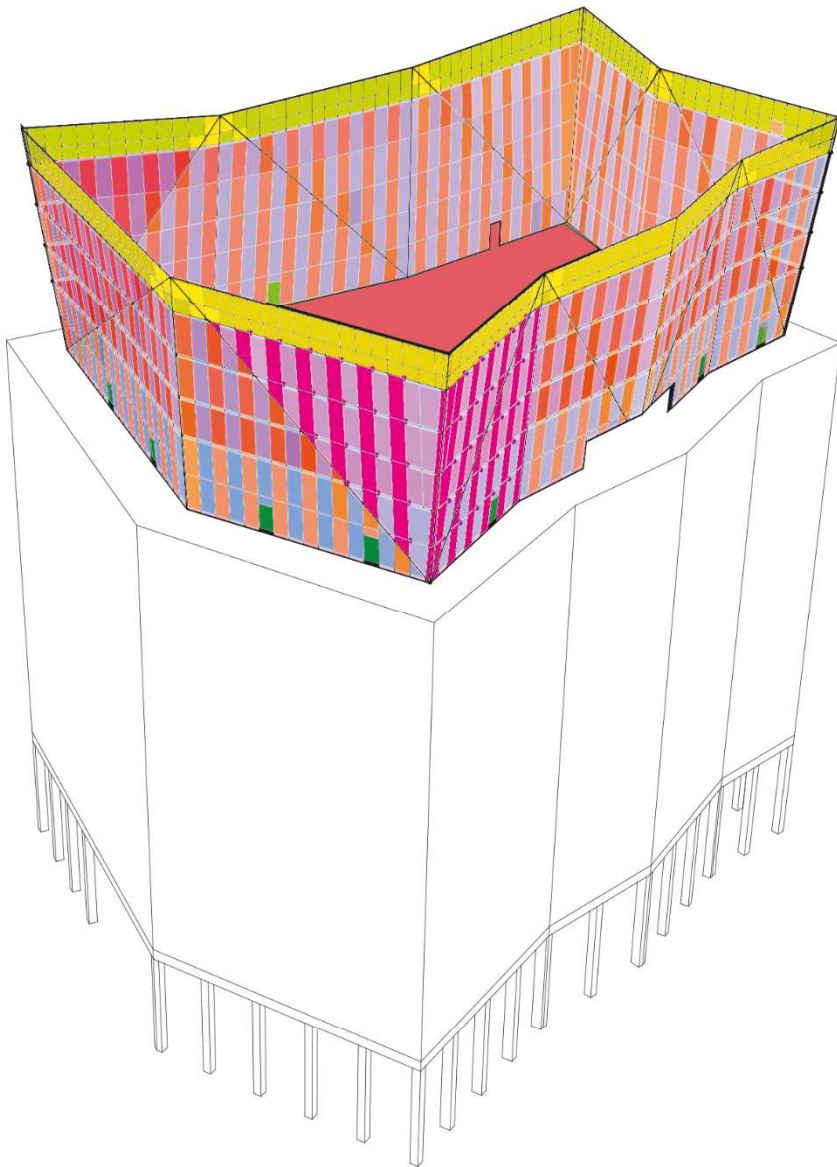


**ELEMENT GEOMETRY**  
standard, standard, kinked, corner, 3D outside



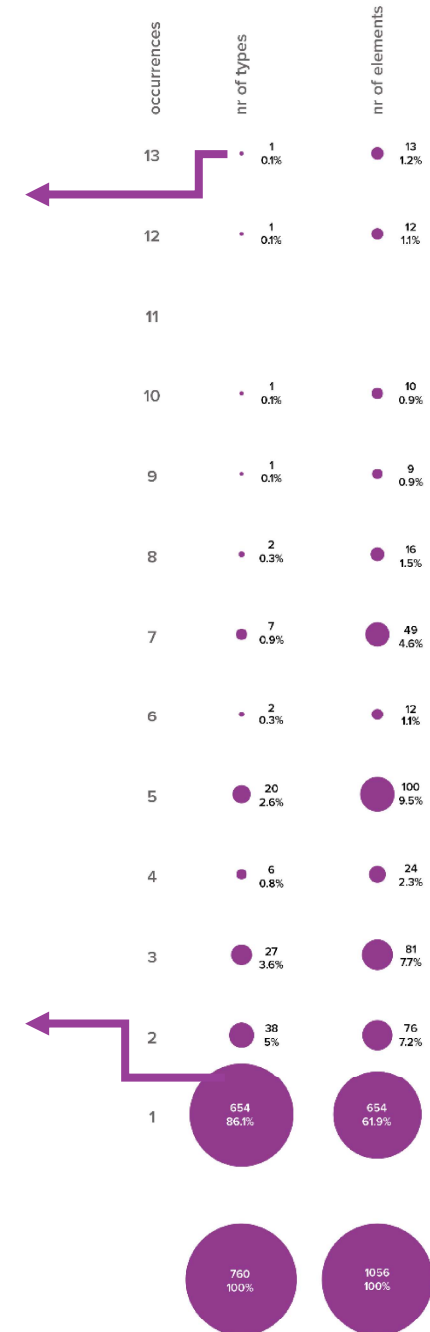


# The Crown – Analyse Basismodel

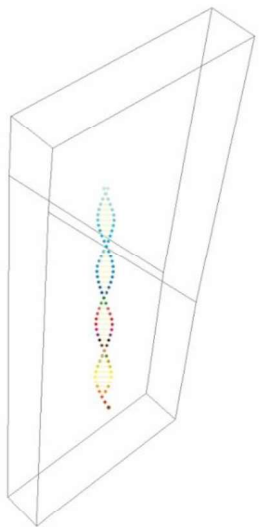


**Max Wiederholung: 1  
Fenstertyp kommt  
genau 13x vor**

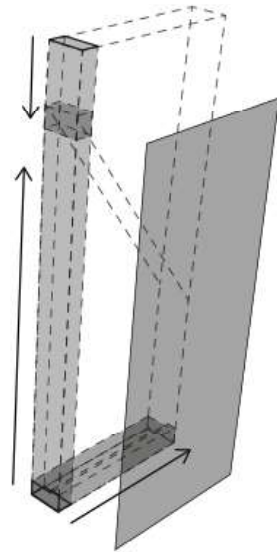
**86% der Fenstertypen  
kommen genau 1x vor**



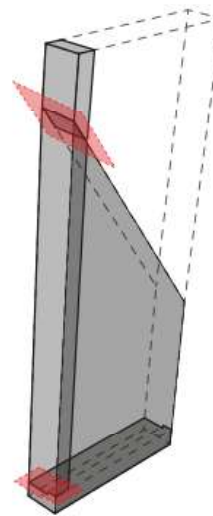
# The Crown – Erzeugung Fertigungsmodell



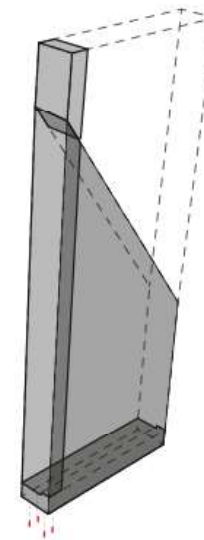
Geometrie &  
Genotyp



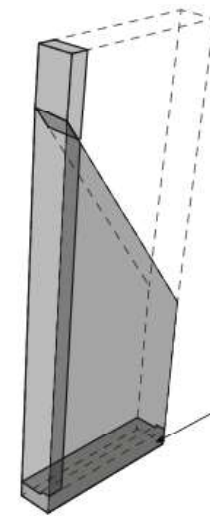
Platzieren der Profile,  
Gläser, Bleche etc.



Schneiden der Profile,  
Gläser, Bleche etc.



Platzieren Schrauben,  
Passtücke

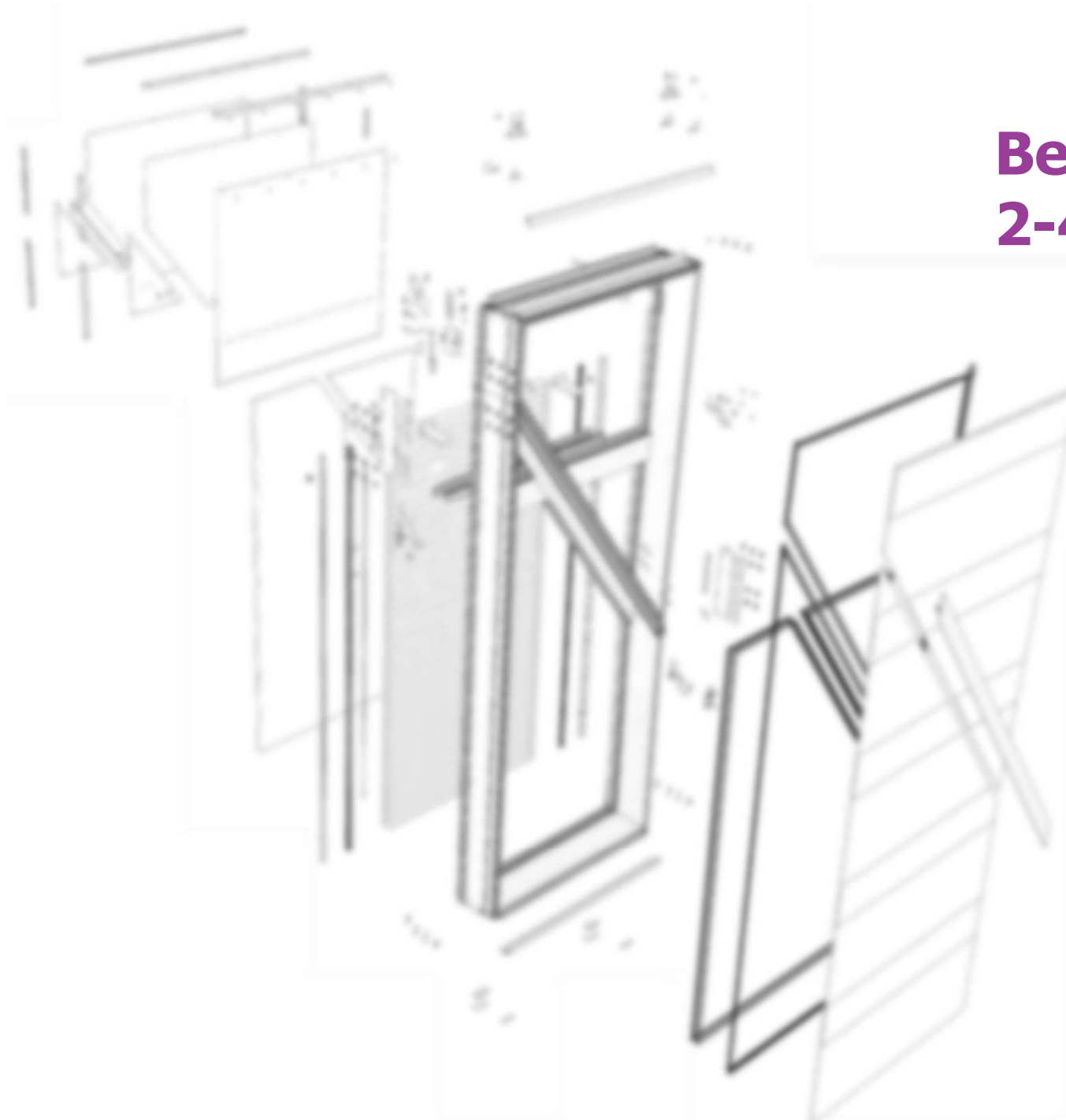


Vergabe individuelle  
Namen, Attribute etc.

transom ABC-001  
• material: EN AW-5005A H14  
• finish: RAL 9006 30%  
• description: transom bot 012924  
• length: 1245.5  
• level: T3  
•  
•



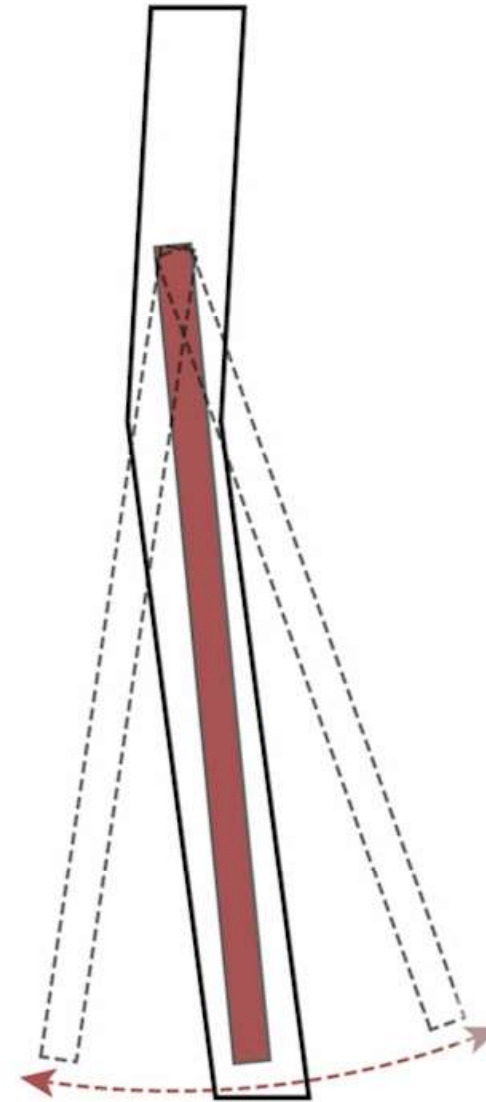
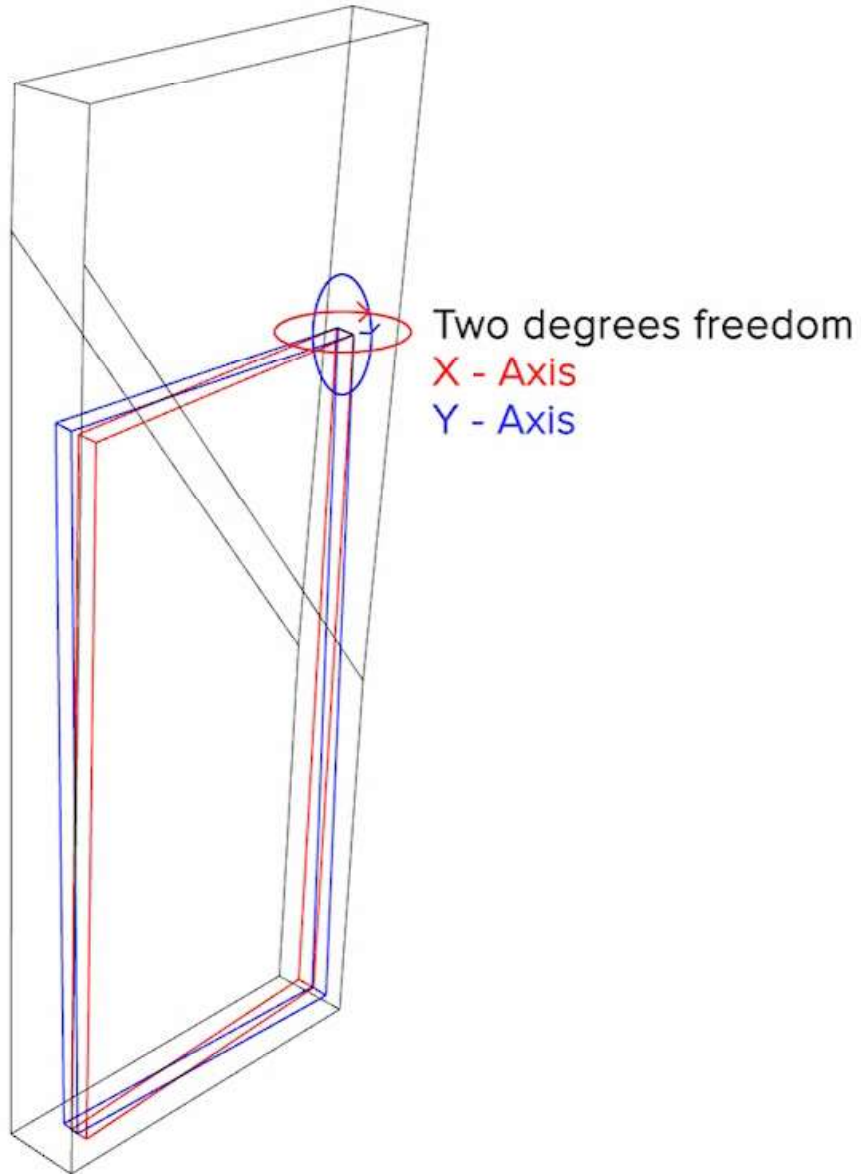
# The Crown - Resultat Element



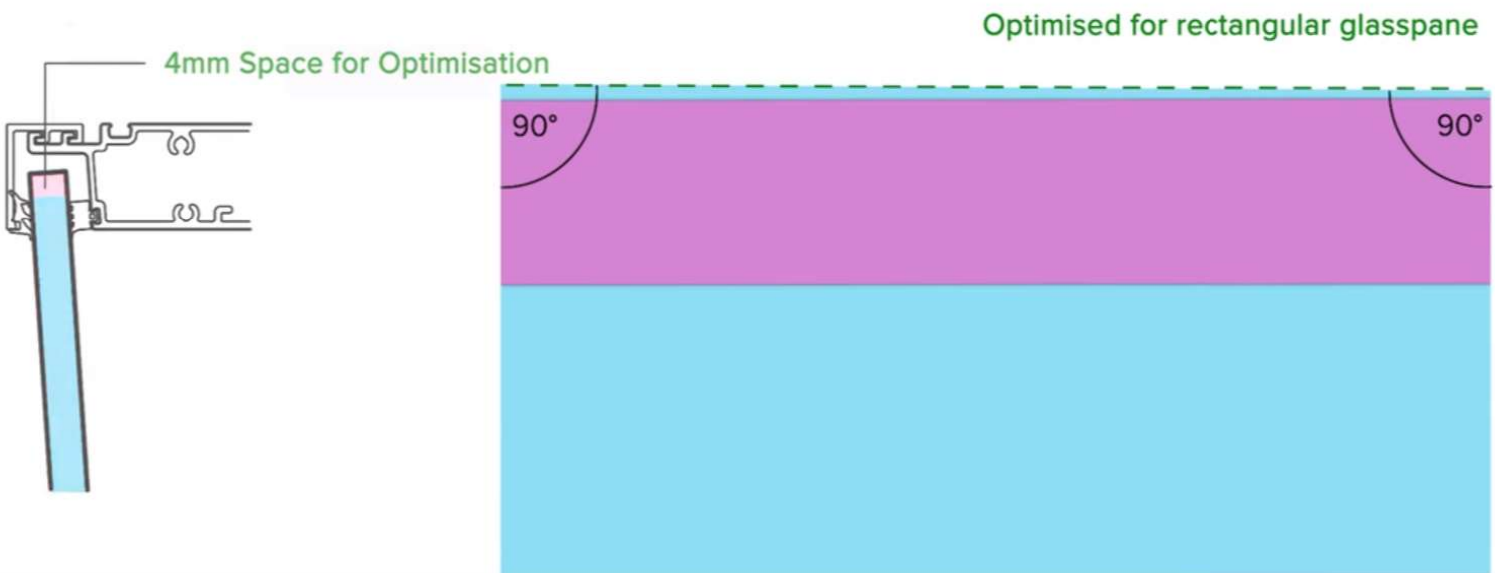
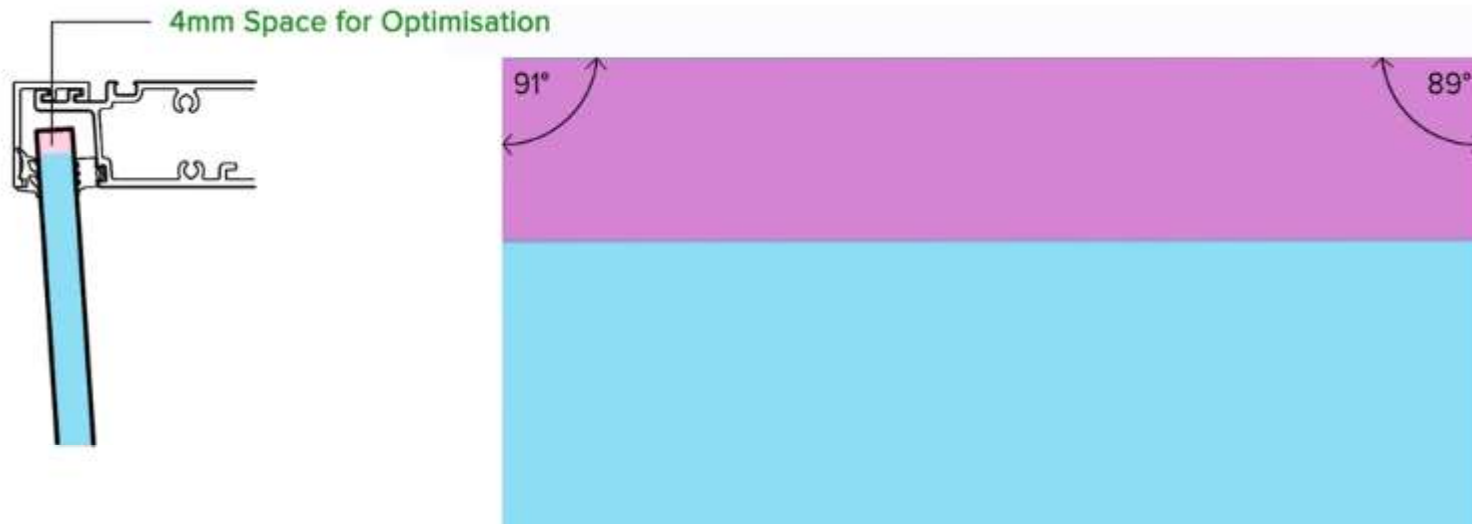
**Berechnungsdauer:  
2-4 Minuten**

20 Profile  
4 Gläser  
25 Bleche  
36 Dichtungen  
350 Schrauben  
47 Passstücke

# The Crown - Lösungsfindungsalgorithmus



# The Crown - Glasoptimierungsalgorithmus











**RKM740**  
**Jürgen Mayer H.**  
**Düsseldorf**



**Google HQ**  
**BIG + Heatherwick**  
**London**



**George Lucas Museum**  
**MAD**  
**Los Angeles**

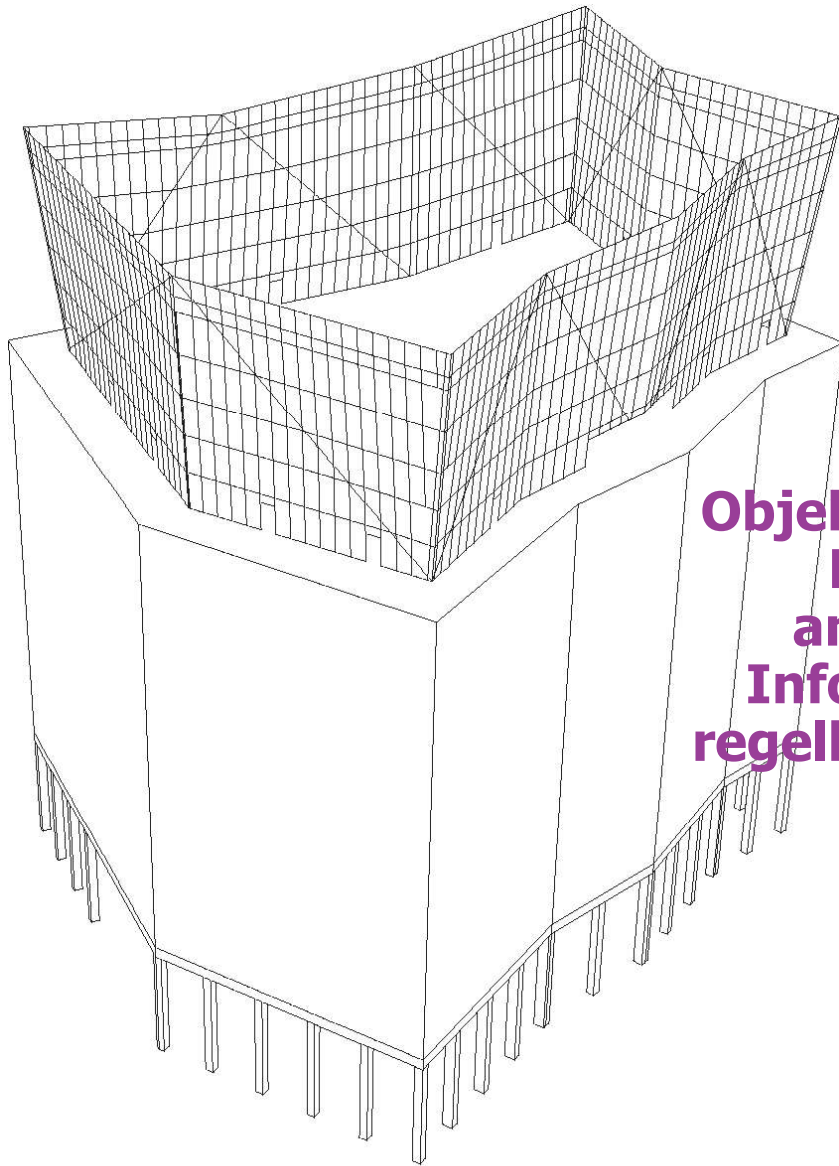


**HSS Hotel**  
**Dissing + Weitling**  
**Kopenhagen**

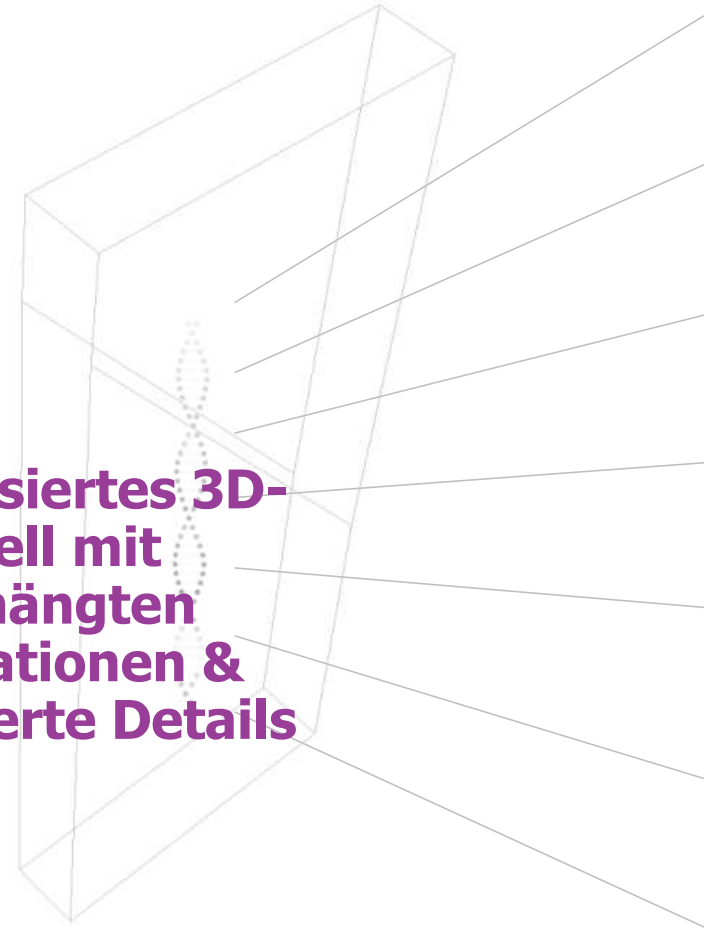


## Aktuelle Herausforderungen

# 1. Planungsumgebung



**Objektbasiertes 3D-Modell mit angehängten Informationen & regelbasierte Details**



**FACES**  
if there is any in relation to  
influence and lighting



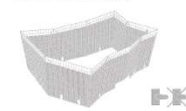
**SHADING**  
with/without, left/attached or with facade



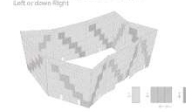
**LEVELS**  
the levels in form of facade changes



**BMU**  
with a building, maintenance unit or not



**MOUNTING DIRECTION**  
elements are mounted downwards, down,  
left or down-right



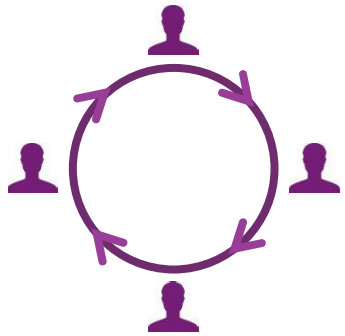
**FACADE TYPES**  
with/without, simple facade, double  
glass and landscape glass



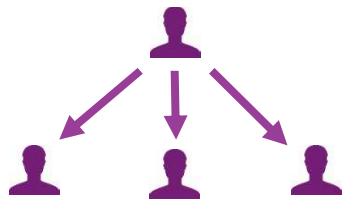
**ELEMENT GEOMETRY**  
vertical, horizontal, curved, etc.



## 2. Wissensmanagement & Kollaboration



**Digitale Prozesse für  
Kommunikation,  
Aufgabenverwaltung  
& Datenaustausch**



**IFC**



**BCF**

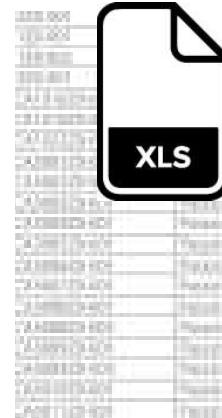


**Database**

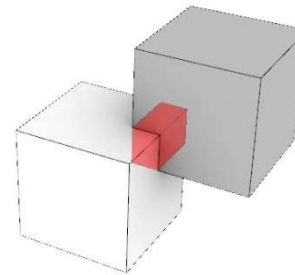
# 3. Arbeit am 3D-Modell & Datenverarbeitung

Ca. 310.000 Bauteile

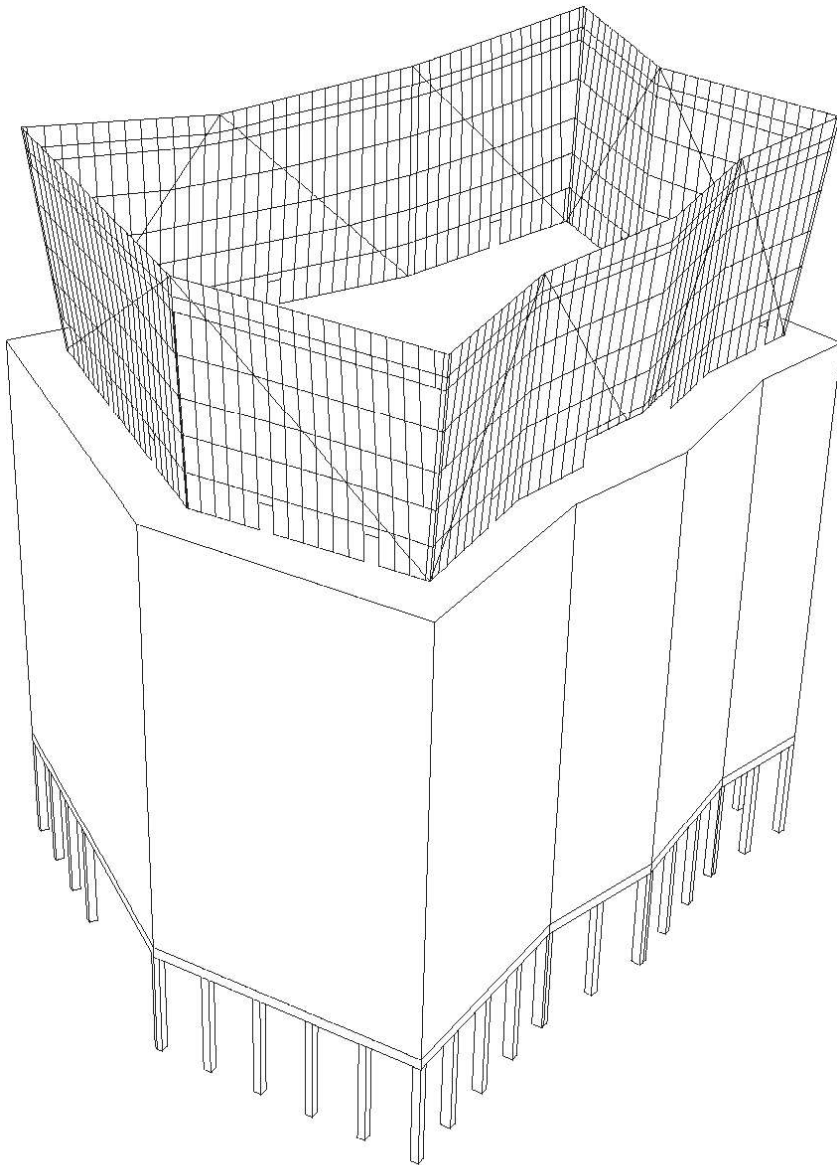
BOM



**Digitale Prozesse  
zur Erzeugung,  
Verarbeitung,  
Auswertung von  
Modellen**



**Kollisionskontrolle**



**Digitale Prozesse für  
Kommunikation,  
Aufgabenverwaltung  
& Datenaustausch**



**Objektbasiertes 3D-  
Modell mit  
angehängten  
Informationen &  
regelbasierte Details**



**Digitale Prozesse  
zur Erzeugung,  
Verarbeitung,  
Auswertung von  
Modellen**

Projekt: **2015 Messestand AUDI Shanghai**

Bauteile: **3.600+**

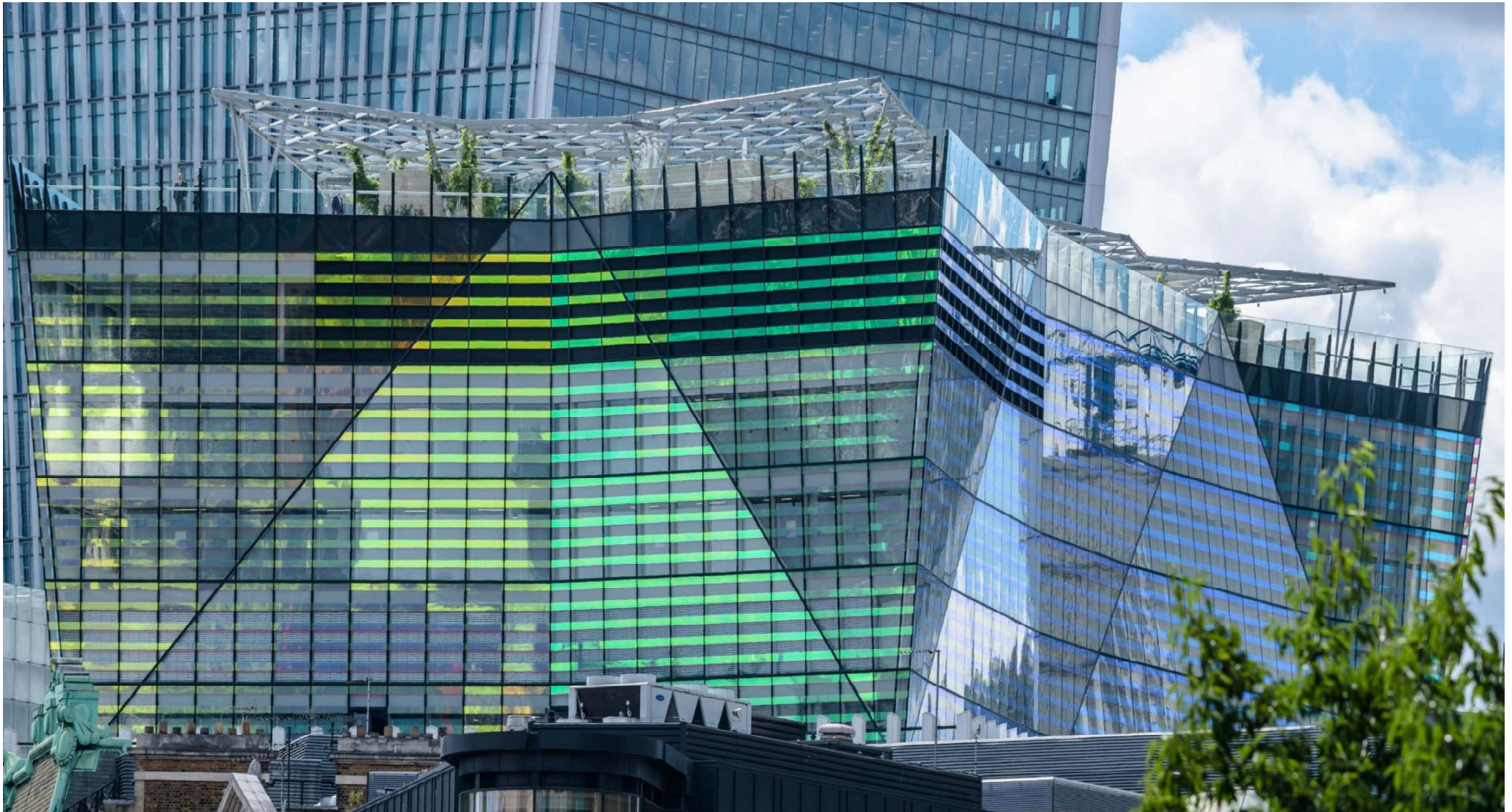
Informationsverwaltung: **Bauteilbasierte im 3D-Modell**



Projekt: **2015 Fenchurch Avenue**

Bauteile: **310.000+**

Informationsverwaltung: **XML**

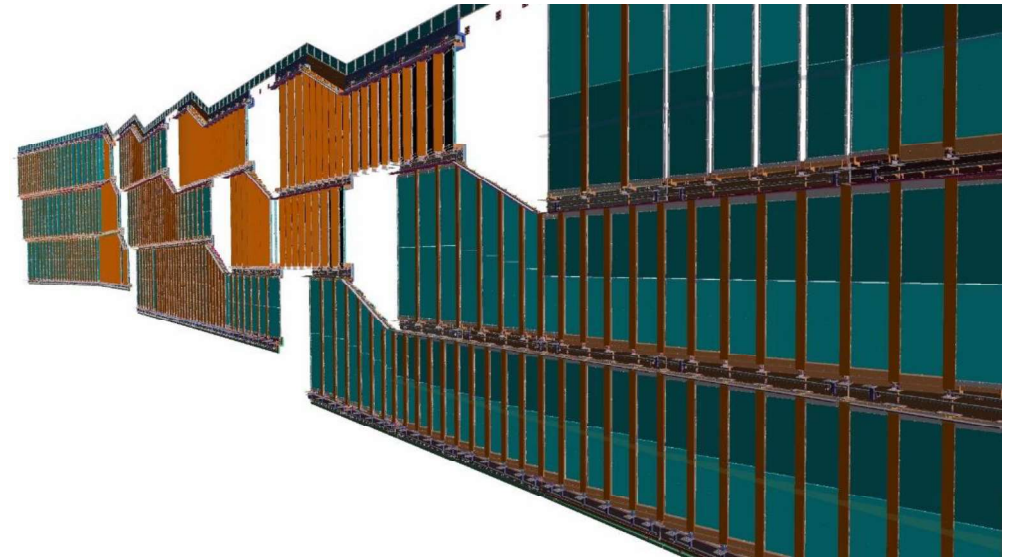




Projekt: **KGX Google HQ (Kingscross, London)**

Bauteile: **410.000+** (Stand 02.06.2020)

Informationsverwaltung: **Database Microsoft SQL**



## Architect:

BIG + Heatherwick

## Fassadenbauunternehmen

Josef Gartner, Gundelfingen

11.000m<sup>2</sup> Ost-Fassade (unser Auftrag)

Planungsstand: ca. 80%

Derzeit:

- ca. 80.000 Bauteile
- ca. 4.000 Baugruppen
- ca. 330.000 Schrauben
- ca. 39 km Dichtungen
- ca. 450 GB Daten

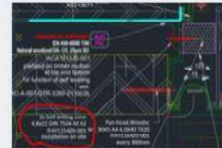
- KGX IC Internal Software project
- Alle Interne The... Board
- Kanban board
- Reports
- Releases
- Issues and filters
- Pages
- Components
- Add item
- Project settings

Projects / KGX IC Internal / ICKGX-246

## DZA // add screws for OnSite Klotz to VertGlassKlotz Block

Attach Link issue

### Description



### Attachments



### Activity

Show: **Comments** History Work log

DZ Add a comment...

Pro tip: press **M** to comment

1

Offen

Datum der Info

2019/08/03

Assignee

DZ Dominik Zausinger

Reporter

DZ Dominik Zausinger

Priority

Low

Due date

None

In Charge IC

Dominik Zausinger

Ansprechpartner IC

Dominik Simon

Ansprechpartner GTR

None

Arbeitspaket

Serie

Components

AR-All PA-Timber Mullion TK-Script

TV-Construction

Tags

None

Created August 3, 2019, 12:24 PM

Configure

Updated August 5, 2019, 4:51 PM



Database



Modelling



Issue-Tracking

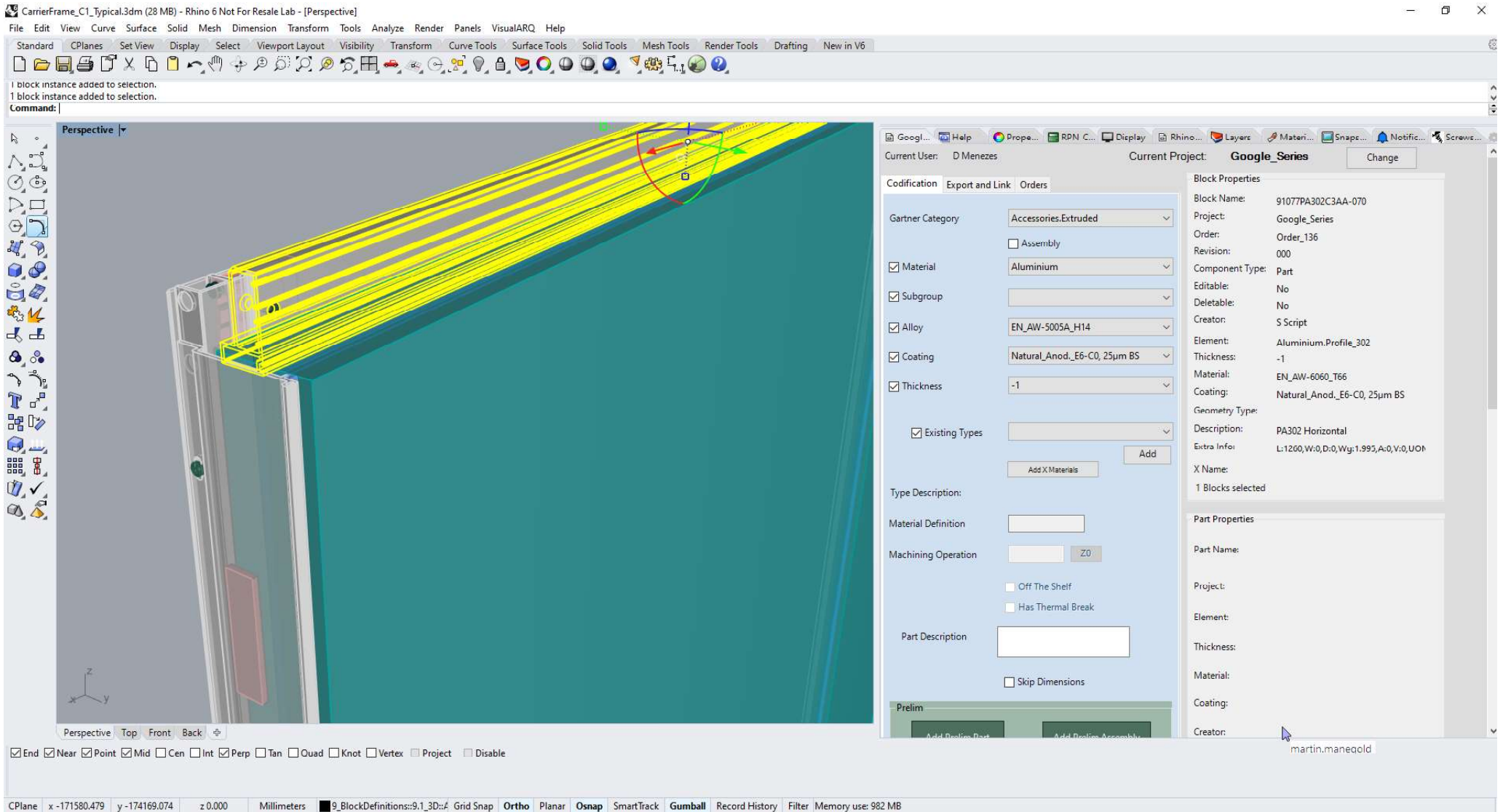
# Bauteil-, Informations- und Aufgabenverwaltung

CarrierFrame\_C1\_Typical.3dm (28 MB) - Rhino 6 Not For Resale Lab - [Perspective]

File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels VisualARQ Help

Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools Mesh Tools Render Tools Drafting New in V6

1 block instance added to selection.  
1 block instance added to selection.  
Command:



**Perspective**

Current User: D Menezes Current Project: **Google\_Series** Change

**Codification** Export and Link Orders

Gartner Category: Accessories,Extruded

Assembly

Material: Aluminium

Subgroup

Alloy: EN\_AW-5005A\_H14

Coating: Natural\_Anod\_E6-C0, 25µm BS

Thickness: -1

Existing Types

Add X Materials Add

Type Description:

Material Definition

Machining Operation: Z0

Off The Shelf

Has Thermal Break

Part Description

Skip Dimensions

Prelim

**Block Properties**

Block Name: 91077PA302C3AA-070  
Project: Google\_Series  
Order: Order\_136  
Revision: 000  
Component Type: Part  
Editable: No  
Deletable: No  
Creator: S Script  
Element: Aluminium.Profile\_302  
Thickness: -1  
Material: EN\_AW-6060\_T66  
Coating: Natural\_Anod\_E6-C0, 25µm BS  
Geometry Type:  
Description: PA302 Horizontal  
Extra Info: L:1200,W:0,D:0,Wy:1.995,A:0,V:0,UOH  
X Name:  
1 Blocks selected

**Part Properties**

Part Name:

Project:

Element:

Thickness:

Material:

Coating:

Creator: martin.manegold

End  Near  Point  Mid  Cen  Int  Perp  Tan  Quad  Knot  Vertex  Project  Disable

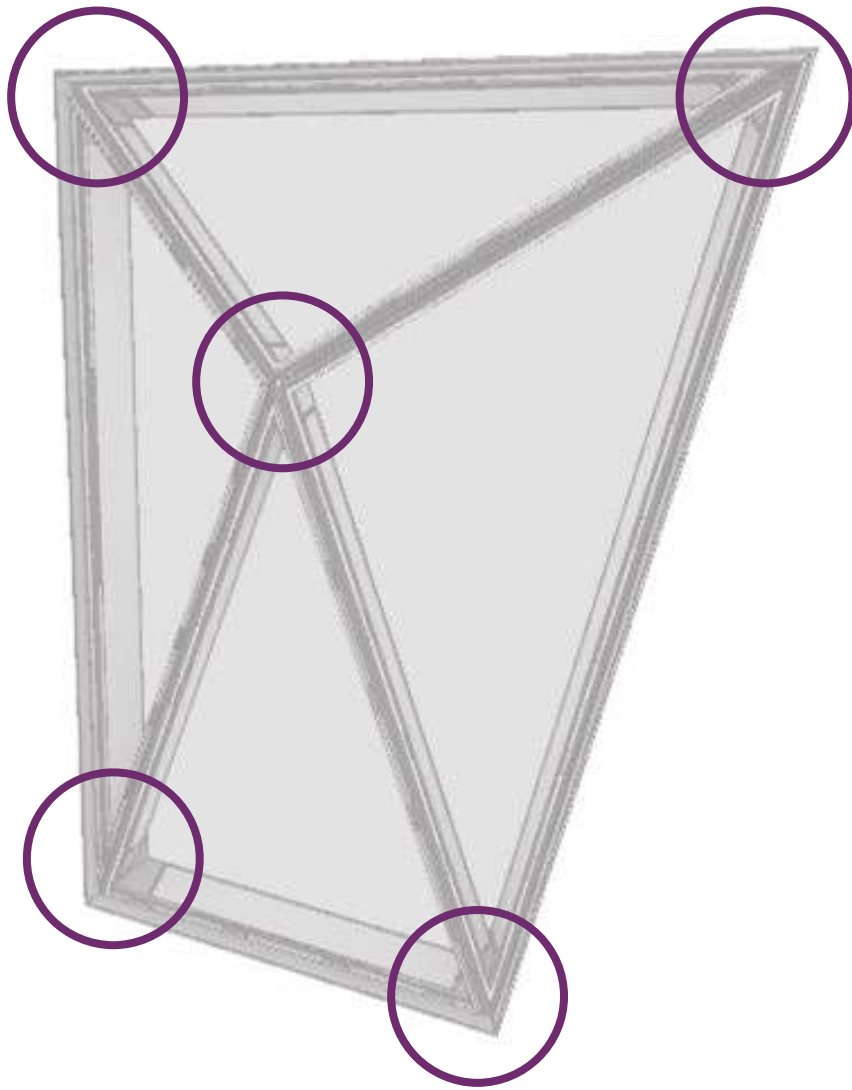
CPlane x -171580.479 y -174169.074 z 0.000 Millimeters 9\_BlockDefinitions:9,1\_3D::F Grid Snap Ortho Planar Osnap SmartTrack Gumball Record History Filter Memory use: 982 MB

Projekt: -

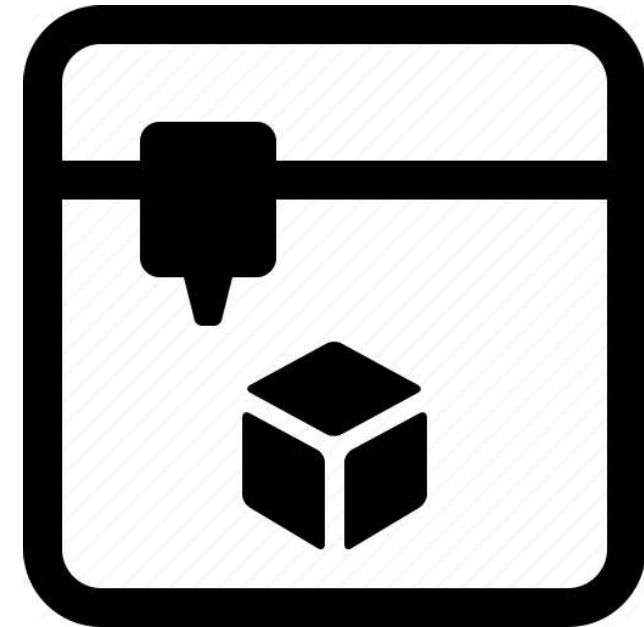
Bauteile: -

Informationsverwaltung: **Database Mongo DB**

**What's next?**



&

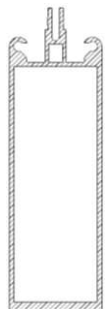
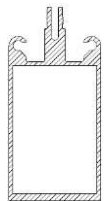
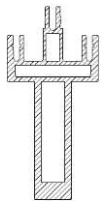
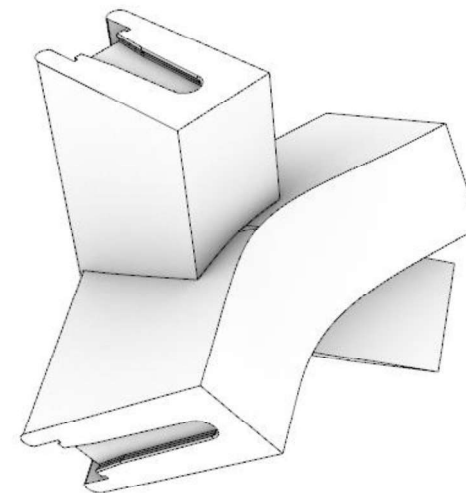
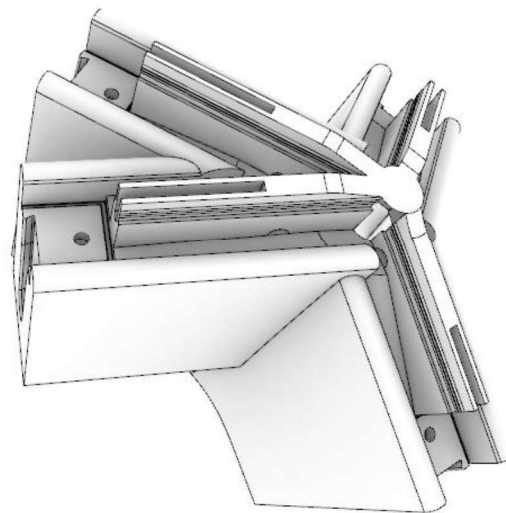
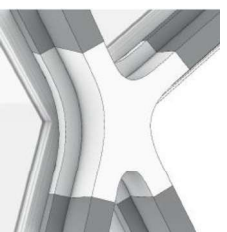
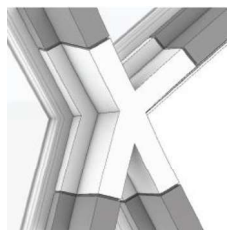
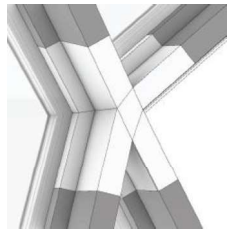


**3D-Druck**

# Forschungsprojekt



TECHNISCHE  
UNIVERSITÄT  
DARMSTADT







*Wenn sie einen Scheißprozess digitalisieren,  
dann haben sie einen scheiß digitalen Prozess*

*Thorsten Dirks, CEO der Telefónica Deutschland AG*



*[www.imagine-computation.com/](http://www.imagine-computation.com/)*



*[www.amvelope.com/](http://www.amvelope.com/)*

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[www.imagine-computation.com](http://www.imagine-computation.com)

**Live & Online.**

**Aktuelles Bauwissen aus erster Hand.**