MASTERARBEIT

Nucleus
Automatisierung in generativer Architektur

Nucleus
Automation in generative architecture

ausgeführt zum Zwecke der Erlangung des akademischen Grades eines Diplom-Ingenieurs
unter der Leitung

Manfred Berthold
Prof Arch DI Dr

E253
Architektur und Entwerfen

eingereicht an der Technischen Universität Wien
Fakultät für Architektur und Raumplanung

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_000 ACKNOWLEDGEMENT

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My very first credits go to Manfred Berthold, he opend my mind during the first years of studies and kept me interested in exploring new ways to dispute with architecture. Furthermore he gave me confidence that there is not only one way to work as an architect, rather there are many ways to express architectural thinking.
A big thank goes to my nearest former/international fellow students - who we all started at the UT Vienna; Andreas Körner, Christoph Müller, Herwig Scherabon, Johannes Czieger, Konrad Zellner. I would like to thank you all for the never ending feedback loop we still keep running together, for inspiring me in my very first architectural moments with great ideas and for your support in all matters. At last thanks for the endless evenings we spend together in front of the screen.

All of this could not happen without my family, I am more than thankfull for their year-long full support, the love they gave me and their endless patience during my career.
Anna Ritscher, there are no words to thank you for all your support on my side. During my studies you have been my motivation, my muse and my critic - thanks for going with me through hard times, same like through easy times.
Another thank you goes to all my friends who encouraged me in my studies, endured me in being absent from real [not digital] life and gave me advises and help in so many technical situations.

There are so many people who crossed my way during my studies, workshops and vistis - I want to give credit to each of you who inspired me as an architect and as a human. Andrei Padure, Ján Pernecký, Mateusz Zwierzycki, Michael Pryor, you are a byte of this project through the open source community of grasshopper and processing, you gave me input and feedback during workshops and sessions and you taught me how to spend even more time in front of the screen, thank you!

[]{}Ralf
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The intention of this architectural work was to react on climatic changes and, along with this, environmental changes on our planet.
The scenario is set in an dystopian future where resources getting short and cities begin to decay. The „Nucleus Project“ should be seen as a new starting point to vanquish climatic and resource crisis. The aim is to create architecture that is able to develop itself in various surroundings with varying environmental influences.

To obtain this Nucleus adheres close to nature, so its base code is leant on a chemical reaction which is transformed into digital, driven by parameters of the „host environment“. The fractal appearance tries to simulate the natural behavior of cells, membranes and their growing properties.

The architectural process itself starts with gathering information about the site. Since Nucleus could be placed everywhere on this planet, grabbing information is vital. With this information about specific parameters of the site [e.g. density, headroom, pollution, still existing infrastructure] Nucleus is able to develop itself in decent directions. This development process is leant on state of the art mechanical and biomechanical apperatures which are specificly designed for this intend.
Nucleus literally acts as a single „cell“ which could be placed in e.g. a decaying building. From the time of the placement the building [and site] acts as a host for the growing Nucleus. A multi-axis drone inside Nucleus is liable for the [bio]mechanical development process via printing units. Feeding this system is inalienable, so the Nucleus nutrition system gathers nourishment from its surroundings. It is connected to its site by a vein lilke pipe system, driven by mechanical cutterheads. This ducted system feeds Nucleus by chemically disolving construction material and moving it towards the cell.

To react at a fast changing environment this archtectural sequence is able to change its appearance during a lifetime cycle. By the provided information of its surrounding, Nucleus is able to react similar to a Taxis in nature.
E.g. if the lighting situation is changing radical during the development process the growing Nucleus is able to change its faces, openings in the faces and alignment of the extrusion to the light source. This is provided by steady lightning analysis during the recursive growing process.

The created architectural environment is stable in all conceivable surreal, hostile, contaminated, earthquake prone or desert alike peripheries. Its created space gives human kind host and shelter. The fractal design of the outside reflects to the inside of the object and offers a vast amount of layouts for all different needs of human residence. Because of the ongoing development and growing process human needs could be easily implemented into the architectural program of a object.

Architecture designed around life.
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Die Intention dieser architektonischen Arbeit ist es auf Klimaänderungen und damit einhergehende Umweltänderungen auf unserem Planten zu reagieren.
Das Szenario ist in einer dystopischen Zukunft platziert in der Ressourcen knapp werden und Städte zu verfallen beginnen. Das „Nucleus Projekt“ ist der neue Startpunkt um diese Klima- und Ressourcenkrise zu überwinden. Das Ziel ist es Architektur zu erschaffen die fähig ist sich in einer stetig ändernden Umgebung mit ändernden Umwelteinflüssen selbst zu entwickeln.

Um dies zu erreichen hält sich Nucleus an die Natur, der Ausgangs - Code ist an eine chemische Reaktion angelehnt welche digital transferiert wurde. Gesteuert wird dieser Prozess von Parametern welche die „Wirts Umgebung“ liefert. Das fraktale Äussere versucht das Verhalten von natürlichen Zellen, Membranen und deren Wachstumseigenschaften zu simulieren.

Der architektonische Prozess beginnt mit dem Sammeln von Informationen über den Standort. Da Nucleus überall auf diesem Planeten platziert werden kann, ist es essentiell Informationen aufzunehmen. Mit diesen spezifischen Informationen über den Standort [zB. Bebauungsdichte, Bauhöhe, Verschmutzung, vorhandene Infrastruktur] ist es Nucleus möglich sich in vorgegebene Richtungen zu entwickeln. Dieser Entwicklungsprozess ist an mechanische und biomechanische Apparaturen, für diesen Zweck entworfen, und am letzen Stand der Technik angelehnt.
Nucleus agiert sprichwörtlich als einzelne „Zelle“ welche zB. in einem verfallenden Gebäude platziert werden kann. Ab dem Zeitpunkt der Platzierung agiert das Gebäude [und der Standort] als Wirt für den wachsenden Nucleus. Eine mehrachsige Drohne im Inneren des Nucleus ist für den [bio]mechanischen Entwicklungsprozess durch Druckereinheiten verantwortlich. Dabei ist die Speisung des Systems unverzichtbar. Das Ernährungssystem des Nucleus sammelt Nahrung aus seiner Umgebung. Nucleus ist mit seinem Standort durch ein venenhaftes Rohrsystem verbunden welches durch Schneidköpfe angetrieben wird. Dieses Rohrsystem speist den Nucleus durch chemisches Zersetzen von Baumaterialien und dessen Beförderung in die Zelle.

Um auf eine sich schnell ändernde Umgebung reagieren zu können ist dieser architektonische Ablauf fähig seine Erscheinung während eines Lebenszyklus zu ändern. Durch die gegebene Information aus seinem Umfeld ist es Nucleus möglich sich ähnlich einem Taxi - in der Natur vorkommend - zu verhalten.
ZB. Ändert sich die Belichtungssituation während des Entwicklungsprozesses radikal, so kann der wachsende Nucleus seine Flächen ändern, den Öffnungsgrad in diesen Flächen variieren und die Ausrichtung der Extrusionen zur Lichtquelle verändern. Dies ist durch eine ständige Belichtungsanalyse während dem Wachstumsprozess möglich.

Die erschaffene architektonische Umgebung ist in jedem erdenkbaren, surrealen, feindseligen, kontaminierten, erdbebengefährdeten oder auch wüstenähnlichen Umfeld beständig. Der geschaffene Raum dient der Menschheit als Schutz und Zuflucht. Das fraktale Äussere spiegelt sich auch im Inneren des Bauwerks wieder und bietet eine schier unerschöpfliche Anzahl an Grundrissen für die verschiedenen Bedürfnisse menschlichen Lebens an. Durch den immer fortschreitenden Entwicklungs- und Wachstumsprozess können menschliche Erfordernisse jederzeit in dem architektonischen Programm umgesetzt werden.

Architecture designed around life.
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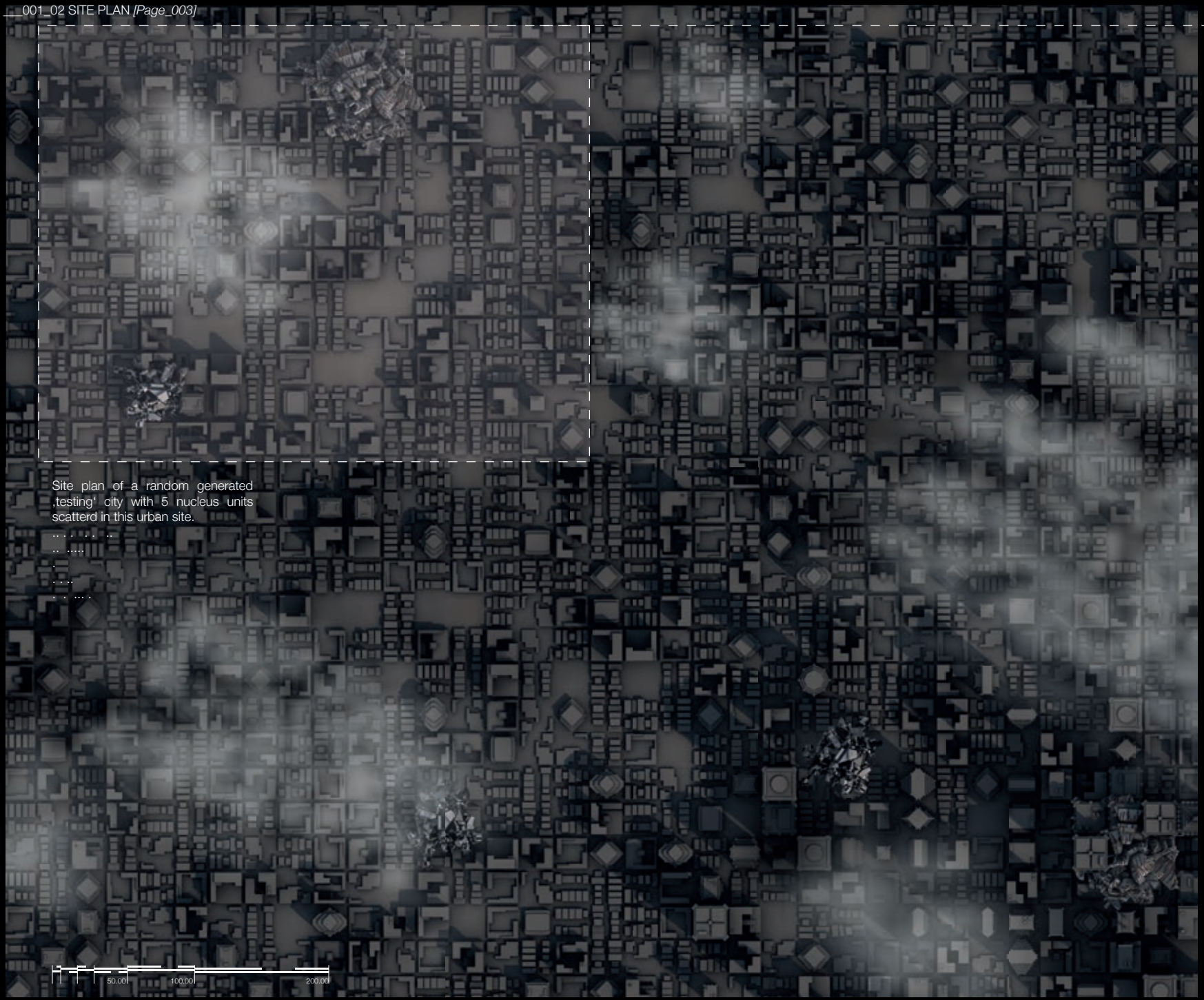
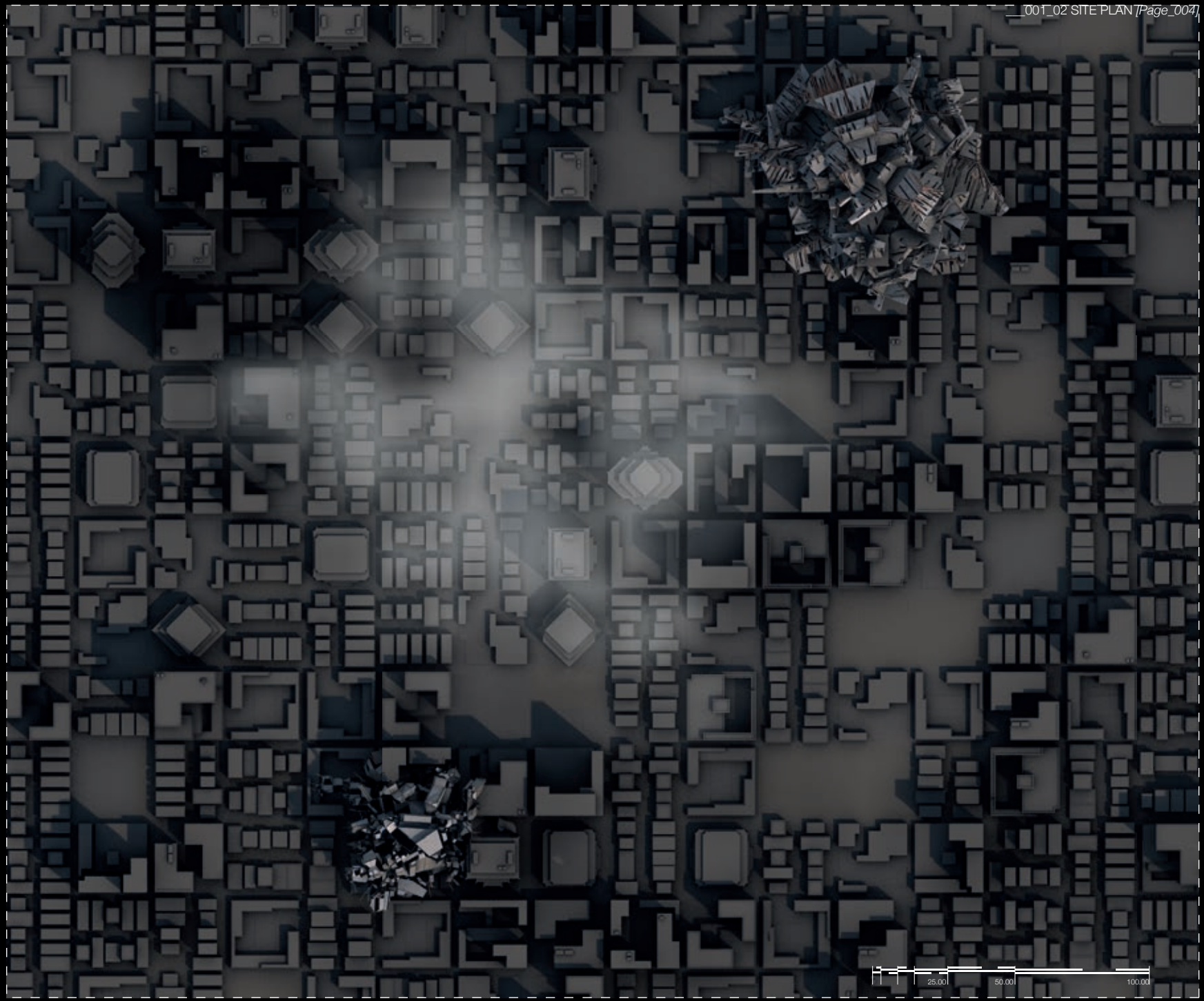


Site plan of a random generated ‚testing' city with 5 nucleus units scatterd in this urban site.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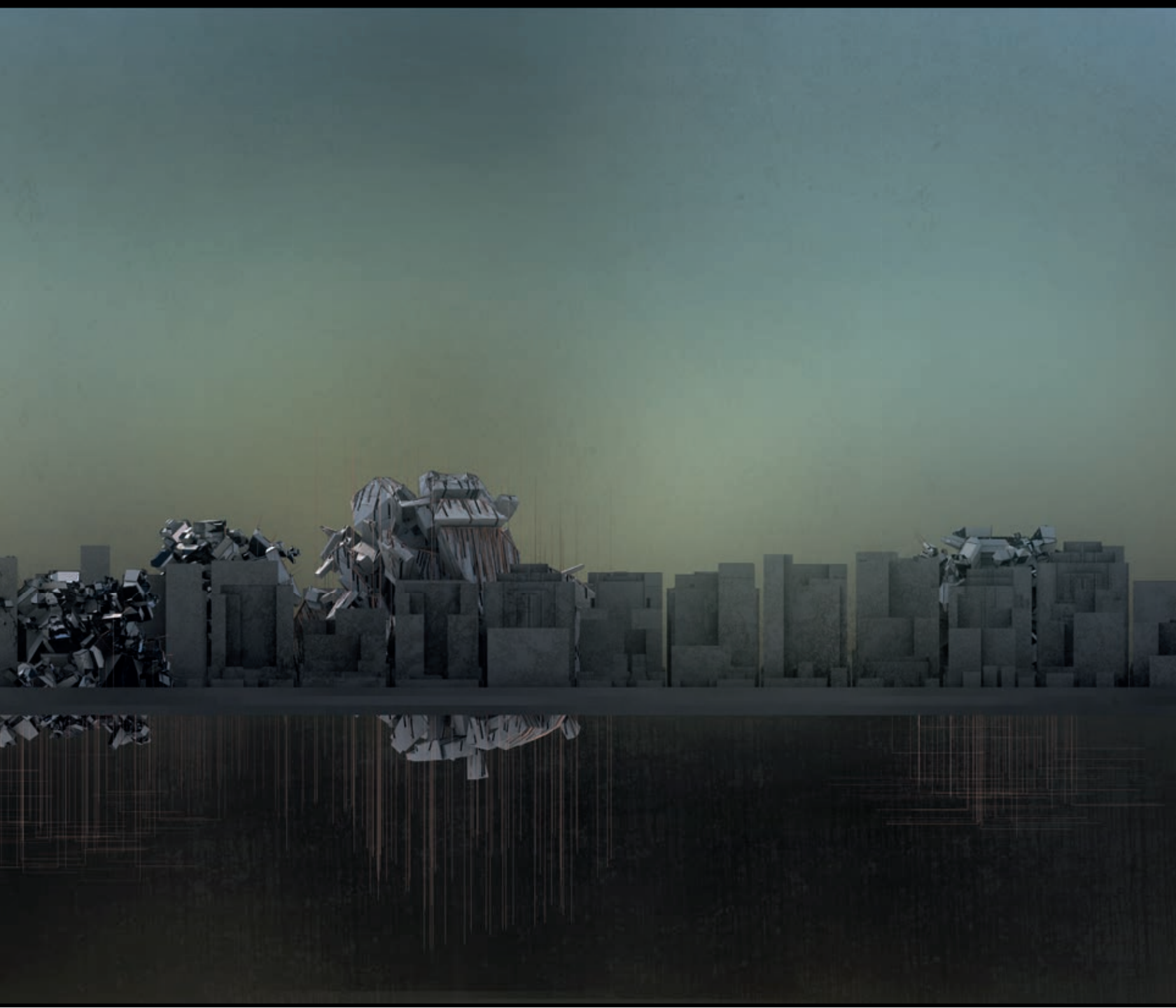
___001_03 SITE ELEVATION VIEW *[Page_005-006]*

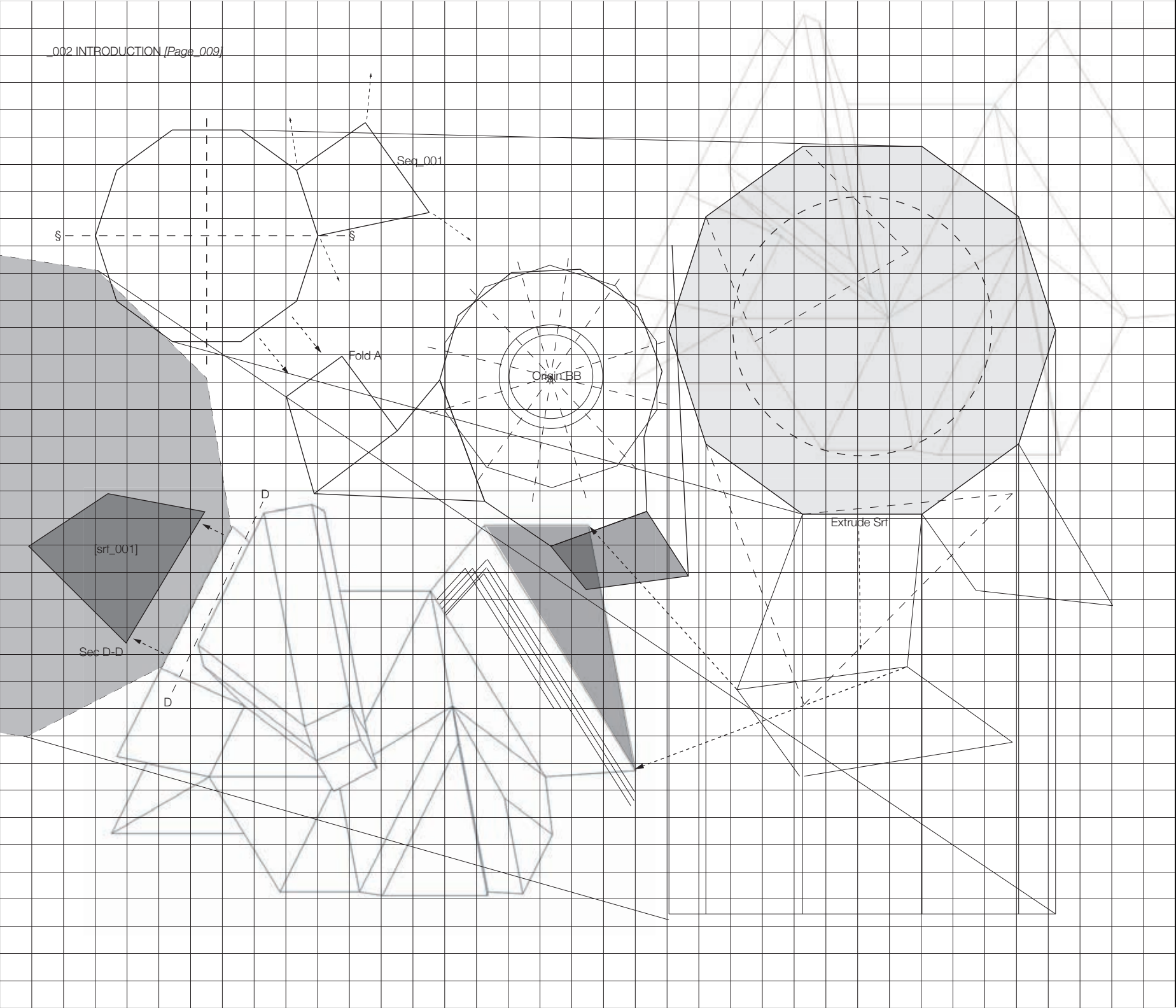


___001_04 DETROIT CITY BIRDS EYE VIEW *[Page_007-008]*

Detroit City in the United States could be seen as a nowadays target for the nucleus project. The city is more or less in a capital crisis since a huge part of its industry [the city's motor] moved out of Detroit. The population had a maximum of 1.850.000 in 1950, now there are only around 700.000 inhabitants left.

Big parts of Detroit are in a state of urban decay. Humans are forced to leave the city by the lack of space, workstations and future visions.
This is where the nucleus project injects new hope into the city. As a ongoing architectural process, nucleus needs humans for parts of its maintenance and the construction process itself - as a refund humanity gets back extraordinary space quality, a new scene to start visions for future generations and shelter from a more or less life unfriendly environment.

Nucleus will locate itself in the most needed parts of Detroit - where the decay is advanced, and so nutrition for the nucleus is given. A city that is left unused, gets transformed into a future vision of human habitat in dense urban environments.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CoSO4 in NaSiO3 solution

Magnification of the ongoing chemical process. Simple interpretation of geometry to a chemical structure.
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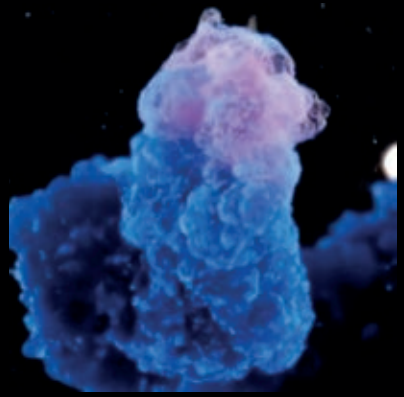

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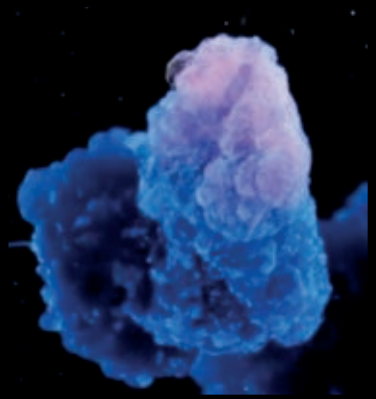

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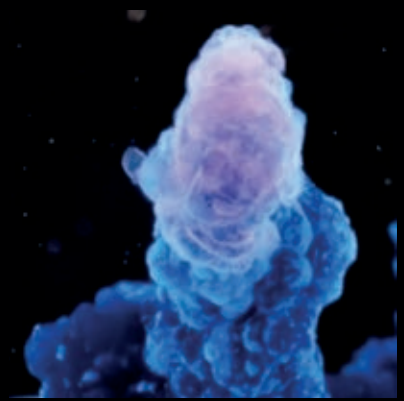

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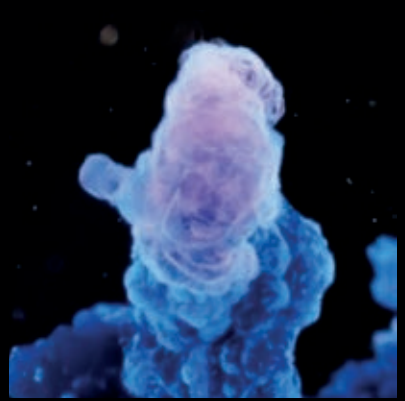

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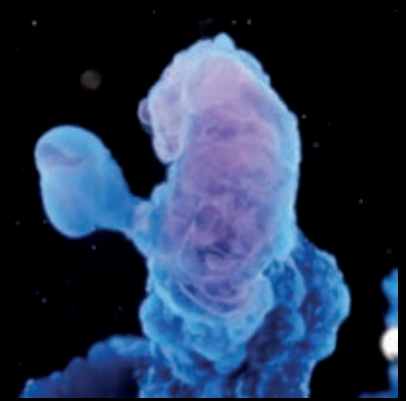

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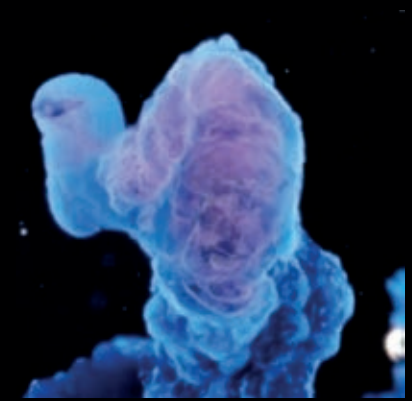

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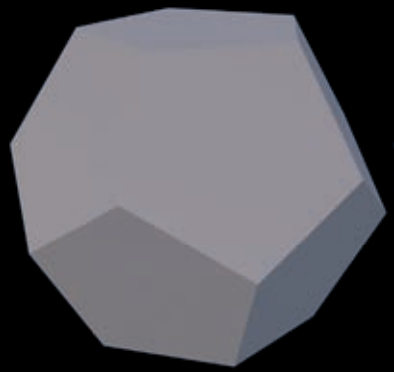

The dodecahedron is the nucleus of the entire system and acts virtually as a starting point for all further iterations of geometrical movement.
With its already very fractal seeming faces it brings perfect variety in the crystalline like growing process.
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The figure shows the very first iterations of a chemical growing process, converted into a digital [scripted] growing process.
The basis is the reaction -CoSO4 in NaSiO3 solution-. Metal salt dissolves in water - this forms insoluble cobalt silicate. This silicate is a semipermeable membrane. The ionic strength inside of the membrane is higher than the sodium silicate solution outside - osmotic effects increases the pressure inside the membrane. This causes the membrane to tear, forming a hole - the cobalt cations react with the silicate anions at this tear and form a new solid. And the process starts over.
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Converted into digital this means a variety of tasks to be done at once to mimic this complex chemical process. Starting point of the geometry is the nucleus, a dodecahedron mesh.
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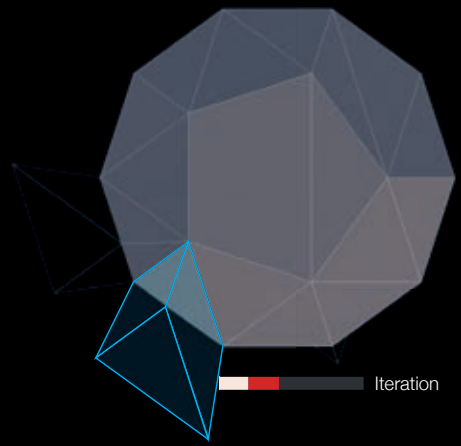
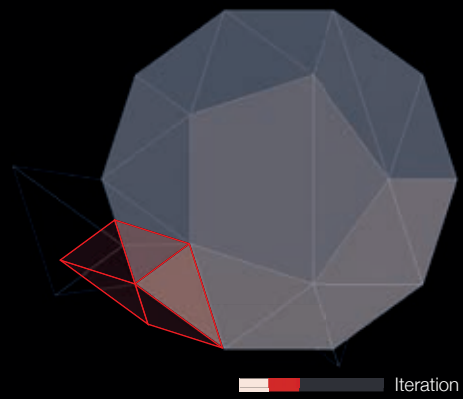
Iteration

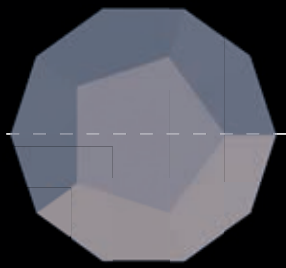
Iteration



Iteration



Iteration



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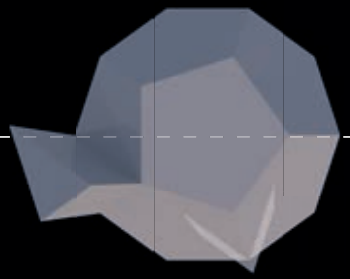

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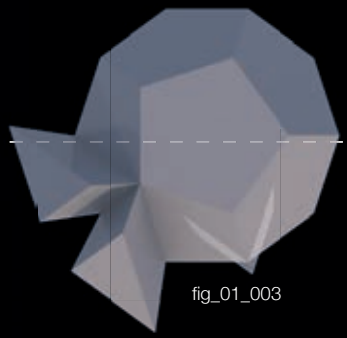

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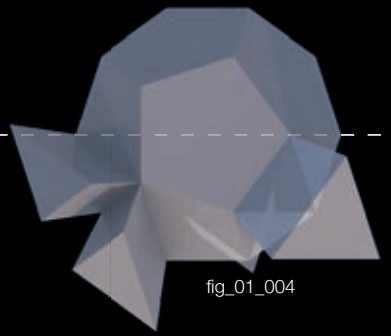

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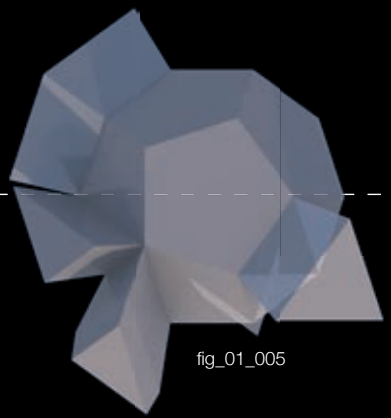

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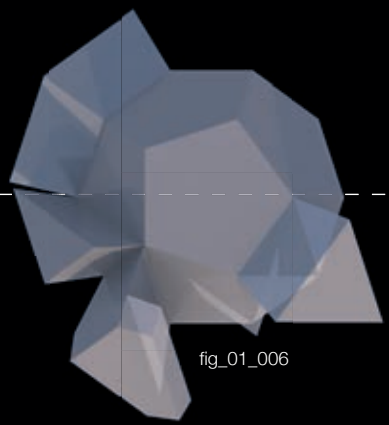

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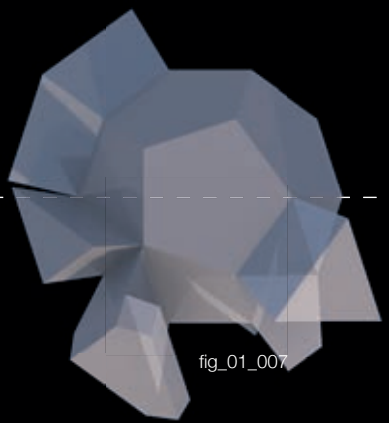

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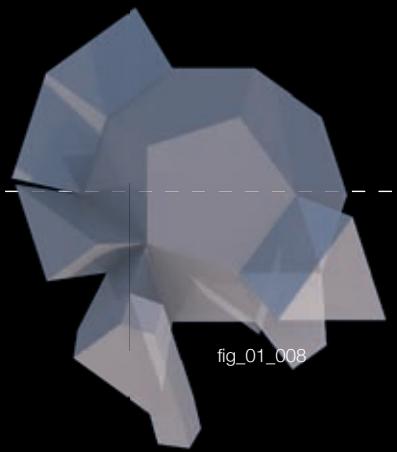

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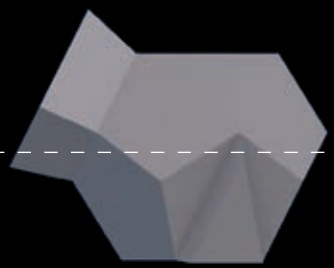
fig_01_001



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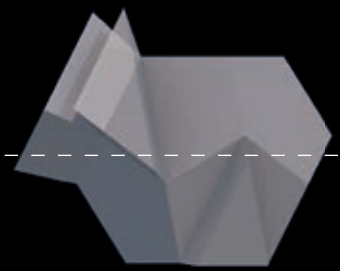

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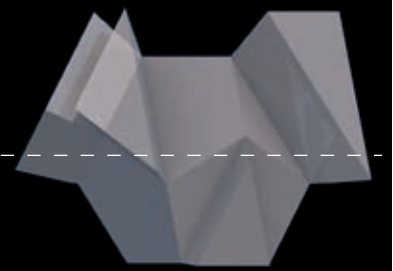

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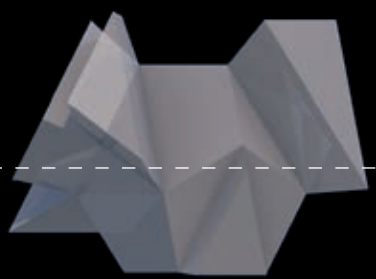

fig_01_005

fig_01_006

fig_01_007

fig_01_008

Formal translation of the chemical garden growing process CoSO4 in Na2SiO3 Solution. This chemical reaction forms water-permeable metal silicate membranes. Through osmotic effects the pressure within the membrane will increase which causes the membrane to tear and form kind of a hole. Through this tear new material from the outside comes in contact with the solution and forms new solid. The growing process is defined.

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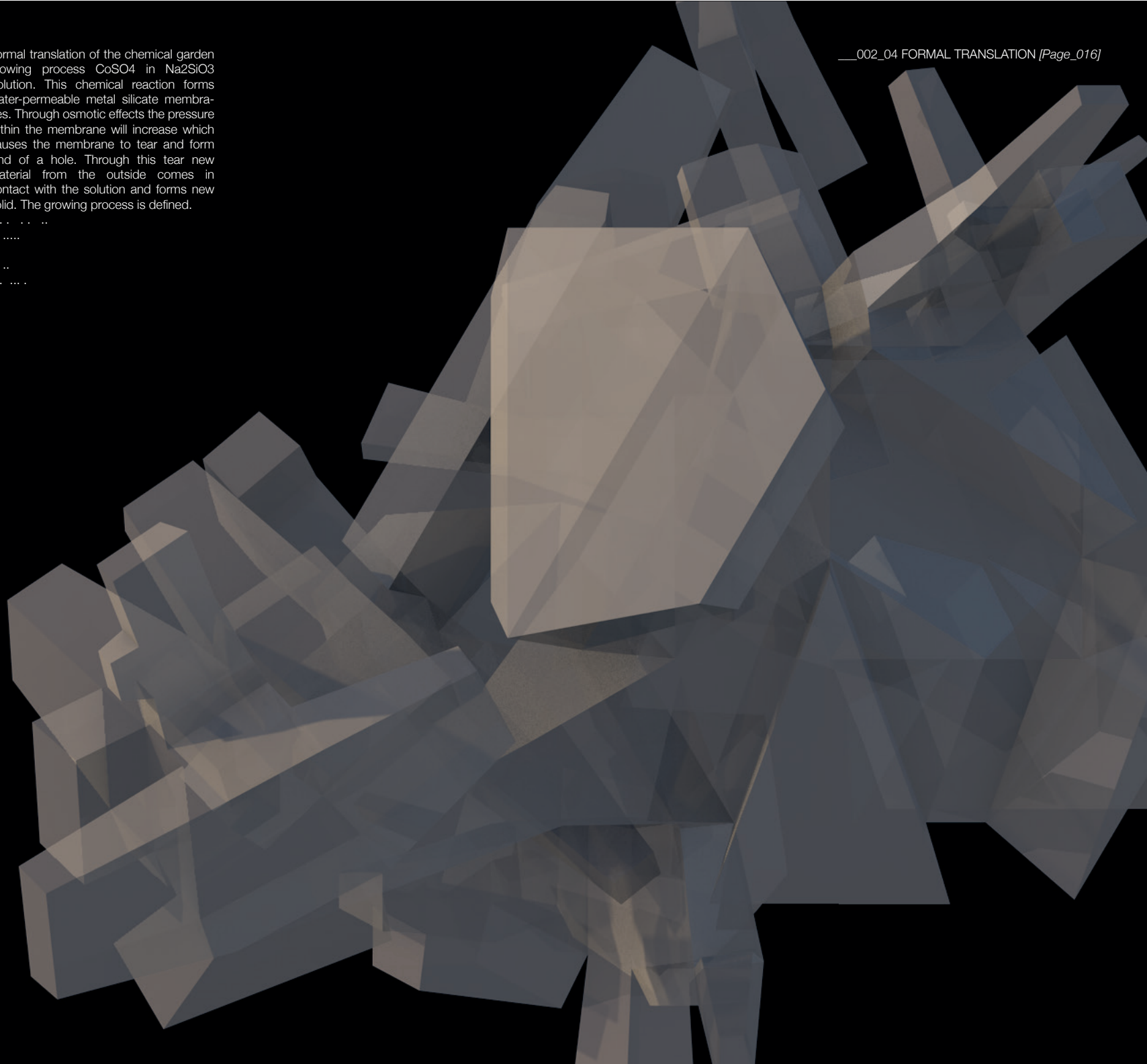

Growing automation through different iterations and with different membrane adjustments.

Iteration
Mesh face scale
Selected mesh face

Iteration
Mesh face scale
Selected mesh face

Iteration
Mesh face scale
Selected mesh face

Iteration
Mesh face scale
Selected mesh face

Iteration
Mesh face scale
Selected mesh face

Primary fractal structure generated through the chemical growing process - stopped at a specified amount of iterations for further studies on the geometry.
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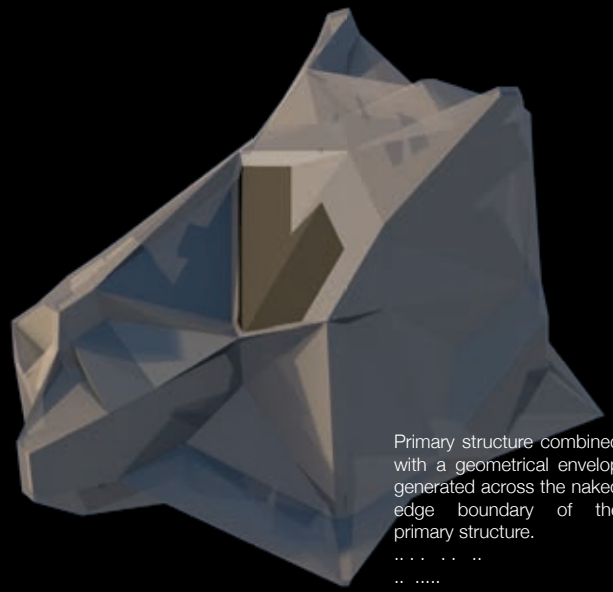

Primary structure combined with a geometrical envelop generated across the naked edge boundary of the primary structure.
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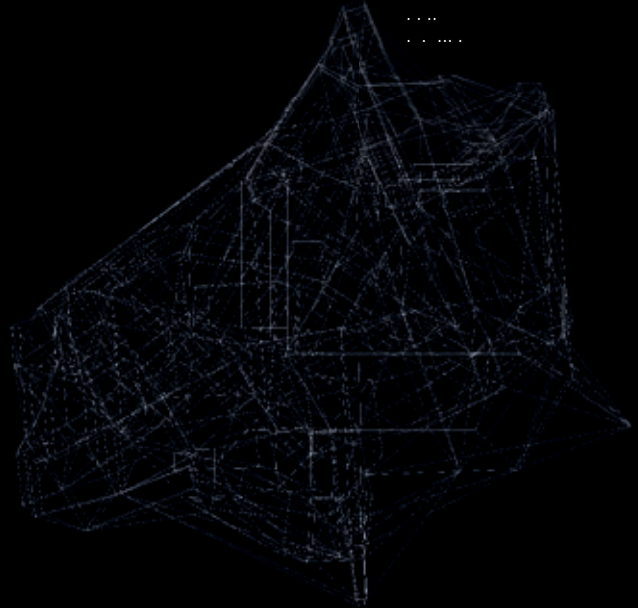

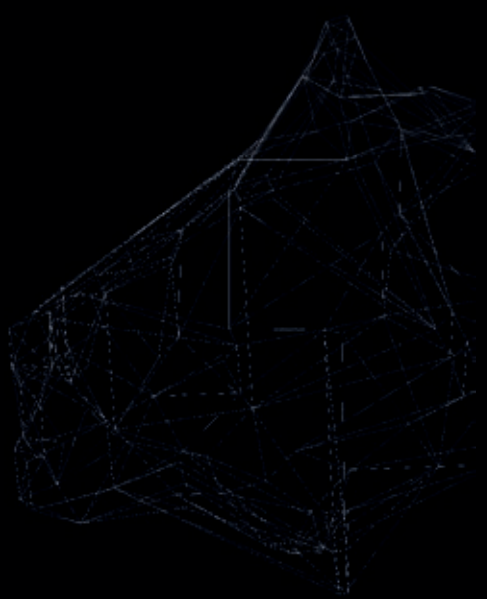

___002_04 FORMAL TRANSLATION *[Page_019]*

Morphogenesis through the first series of growing iterartiones with their related geometrical envelop.

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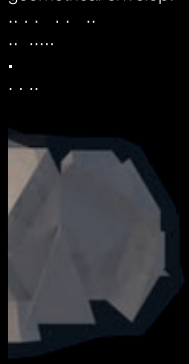

fig_01_001

fig_01_002

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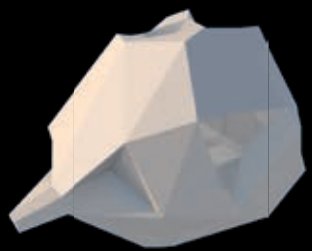

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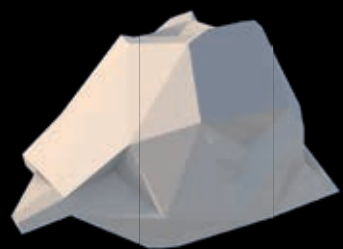

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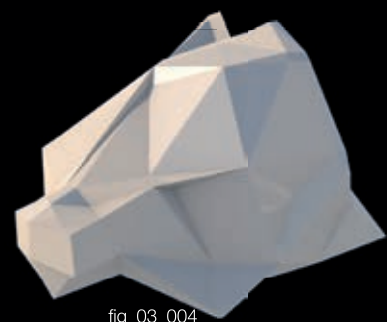

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fig_03_005

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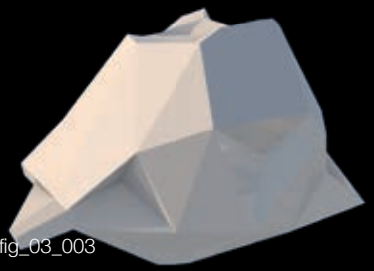
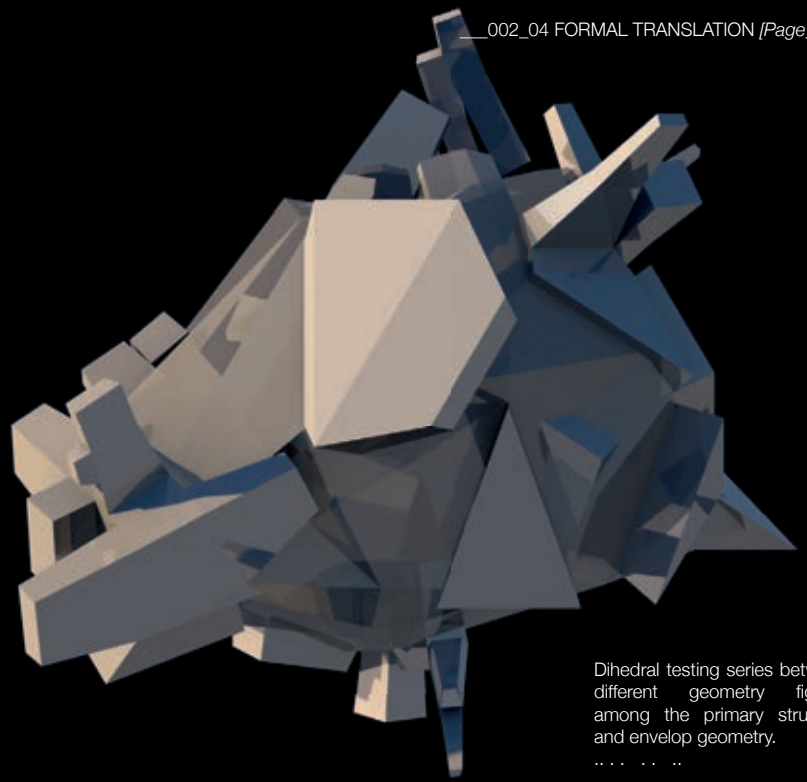


fig_03_003



Dihedral testing series between different geometry figures among the primary structure and envelop geometry.

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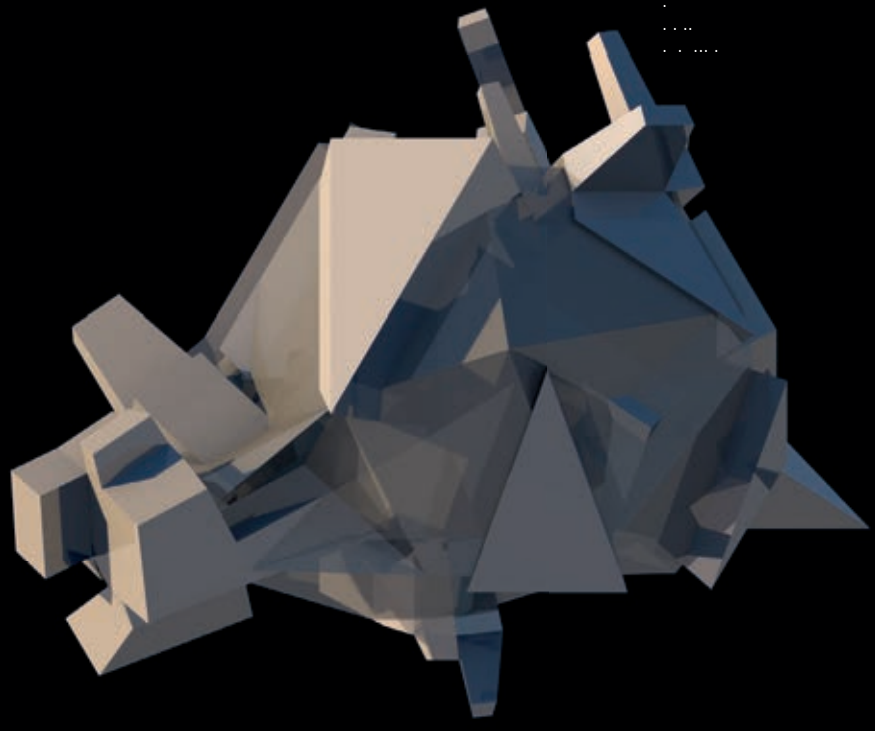
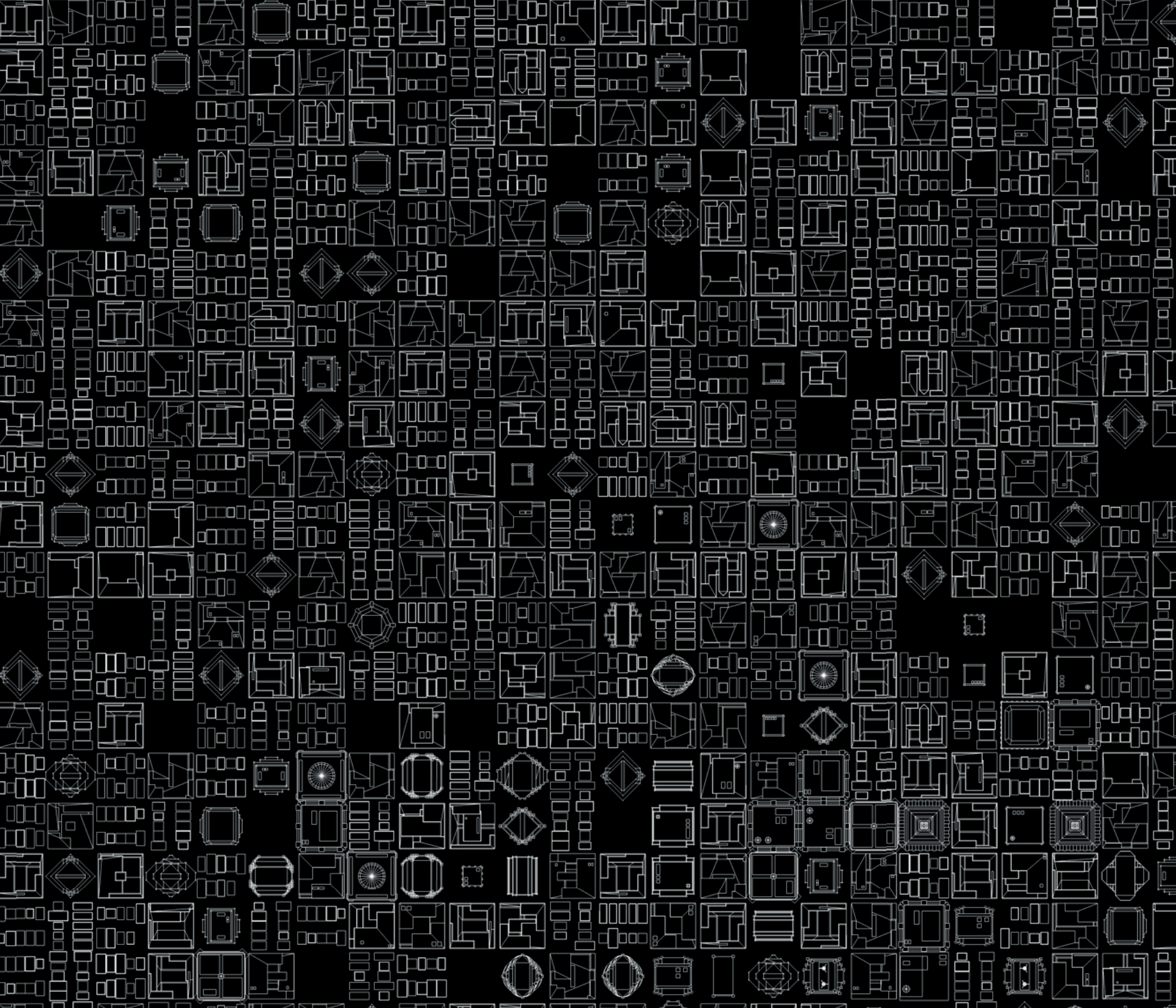
fig_01_004

fig_03_001

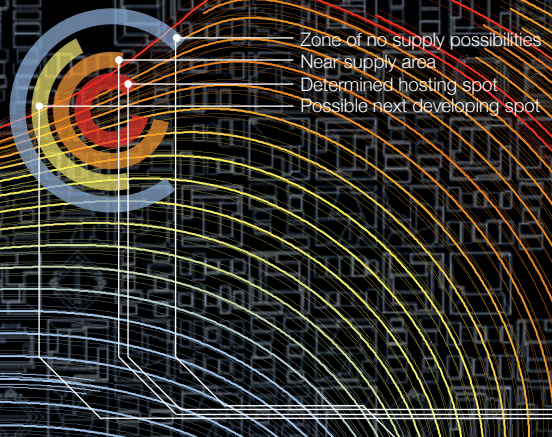


Random generated dense city structure to run test cycles on the analysing algorithms prior the nucleus is placed and starts its chemical/mechanical reaction.
The algorithm searches inside this city area for contemplable host units to feed the nucleus.
The nucleus by itself is able to digest construction materials in addition with chemical substances; e.g. water, electricity, gas, fluid, hot steam, district heating, chemicals, sewage; with this additional substances the nucleus develops itself.



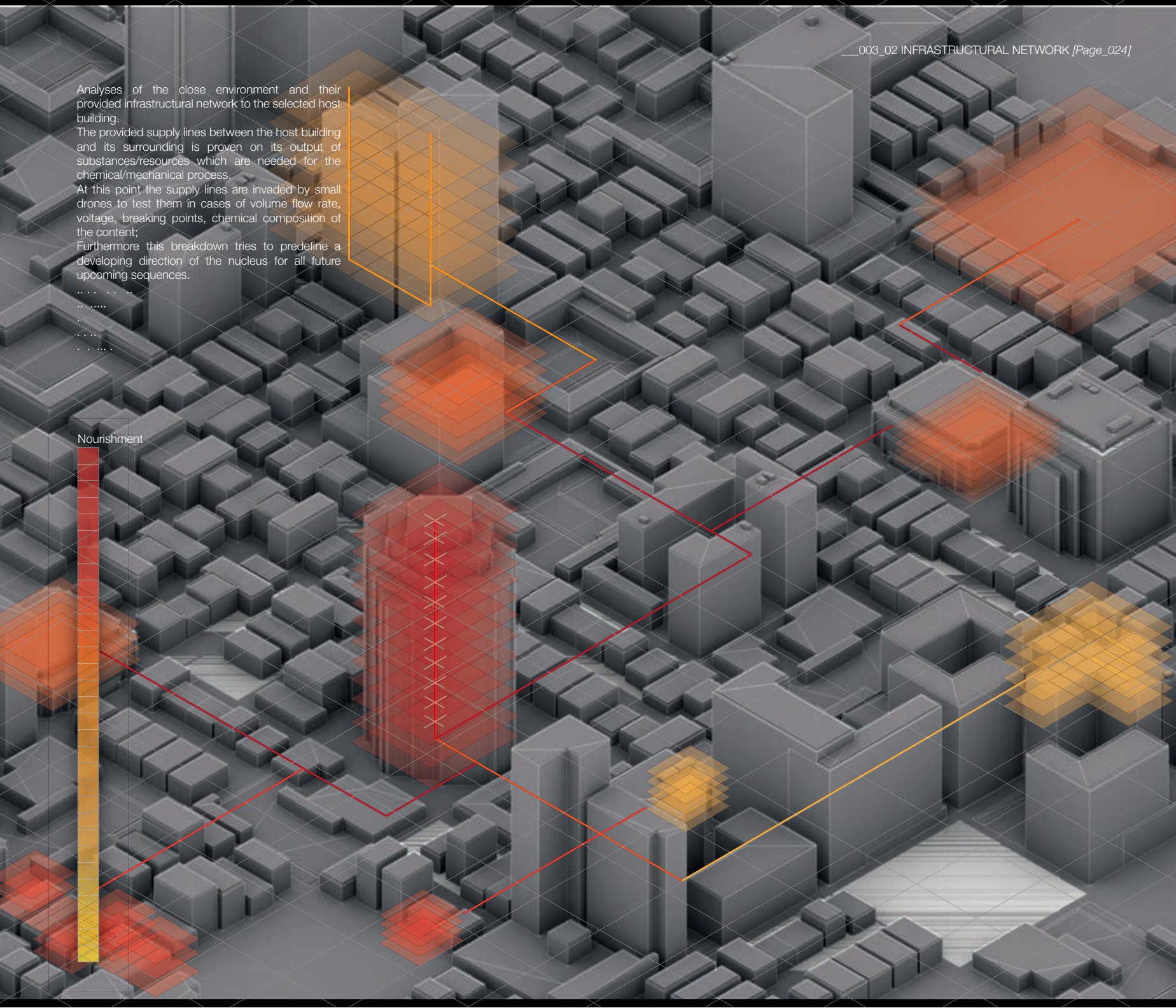
City map with tension lines between analysed spots for siting the nucleus. This tension lines show possible directions for future development of the nucleus system. At a first sight, red lines show weak city structures with ‚good enough' supplies for starting the chemical/mechanical reaction of the nucleus.

Possible zones to develop the nucleus further
Areas to nourish the nucleus from
Transition zone
Areas out of the reach capability of the nucleus harvesting system



Analyses of the close environment and their provided infrastructural network to the selected host building.
The provided supply lines between the host building and its surrounding is proven on its output of substances/resources which are needed for the chemical/mechanical process.
At this point the supply lines are invaded by small drones to test them in cases of volume flow rate, voltage, breaking points, chemical composition of the content;
Furthermore this breakdown tries to predefine a developing direction of the nucleus for all future upcoming sequences.

Nourishment



Phase diagram of the chemical structure of the host building. Testing the main structural integrity of the building - to serve as a founding for the nucleus and the following sprout sequence.
The diagram shows the coherences between pressure and temperature of concrete. This point is necessary for the nucleus developing because it digest the concrete. For this digest process the concrete needs to get liquefied by the nucleus inside chemical reactions.
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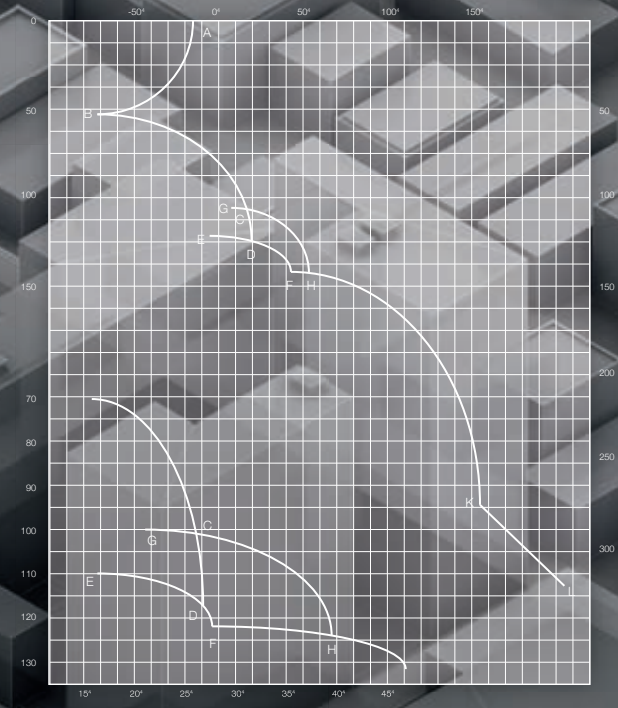

Cross connections of the host building with its very near environment. Confirming connection integrity to ensure continuous supply for the nucleus.
Each dot outside the circle shows a typical building around the nucleus site. Each connection of the dots inside the circle shows the connection ability of this building/buildings. The coloured bars show the different chemical substances the buildings are able to supply to the nucleus.
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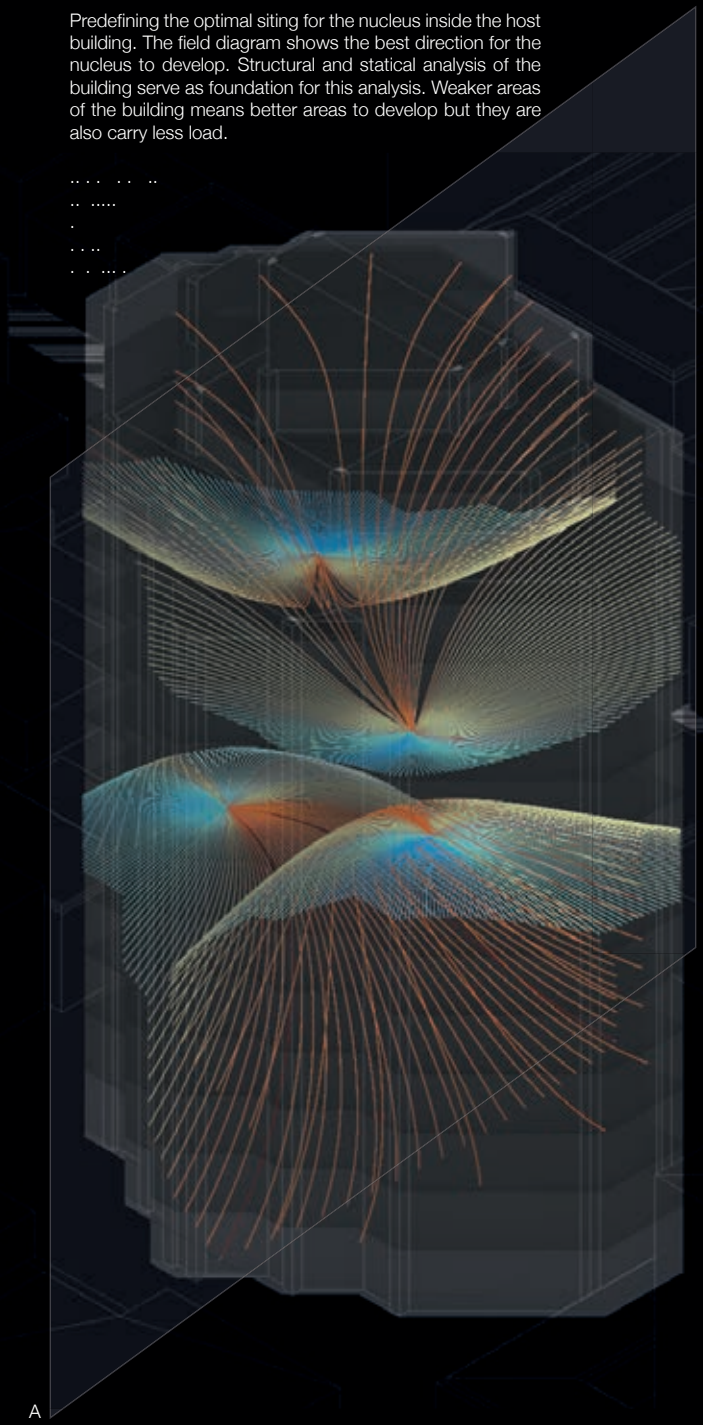
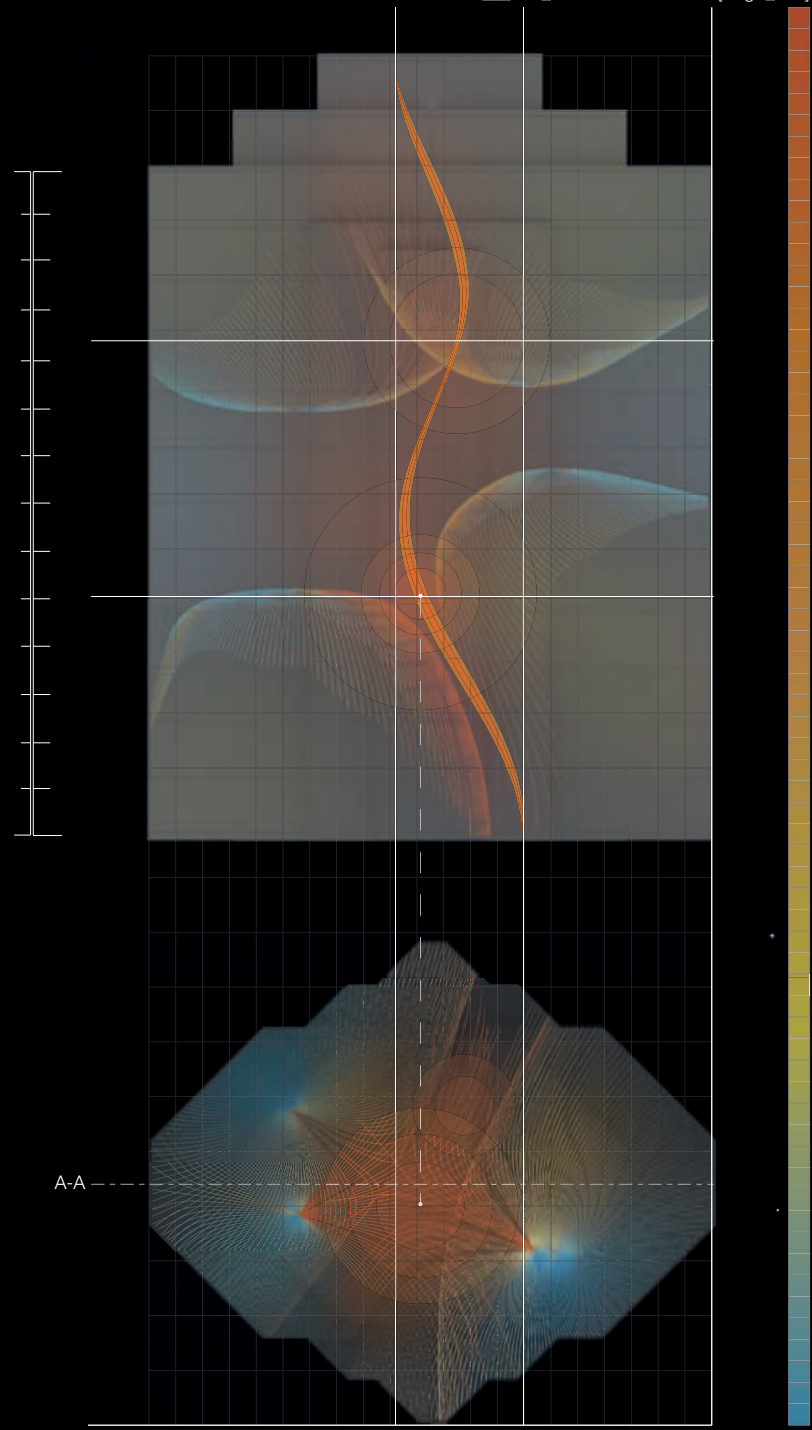
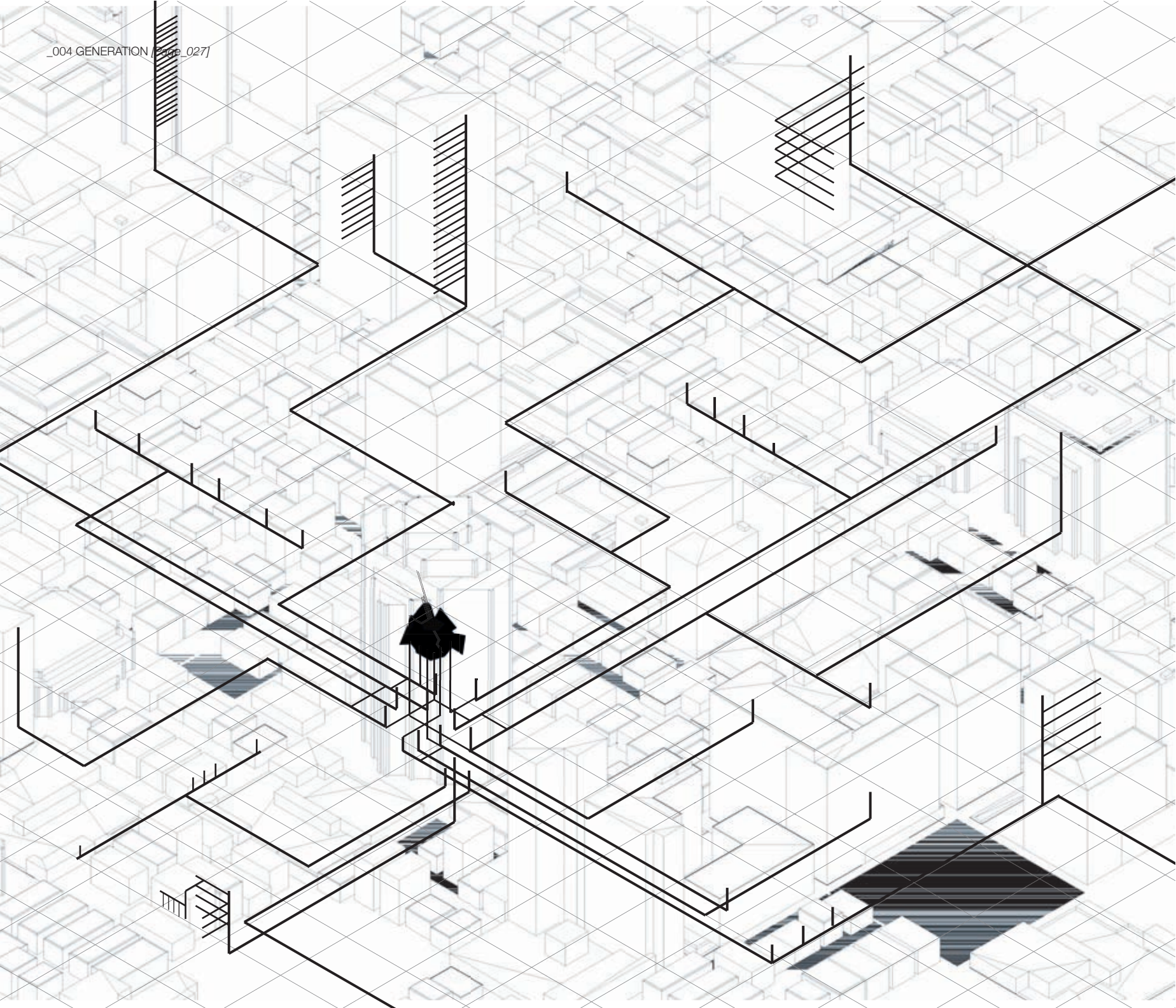
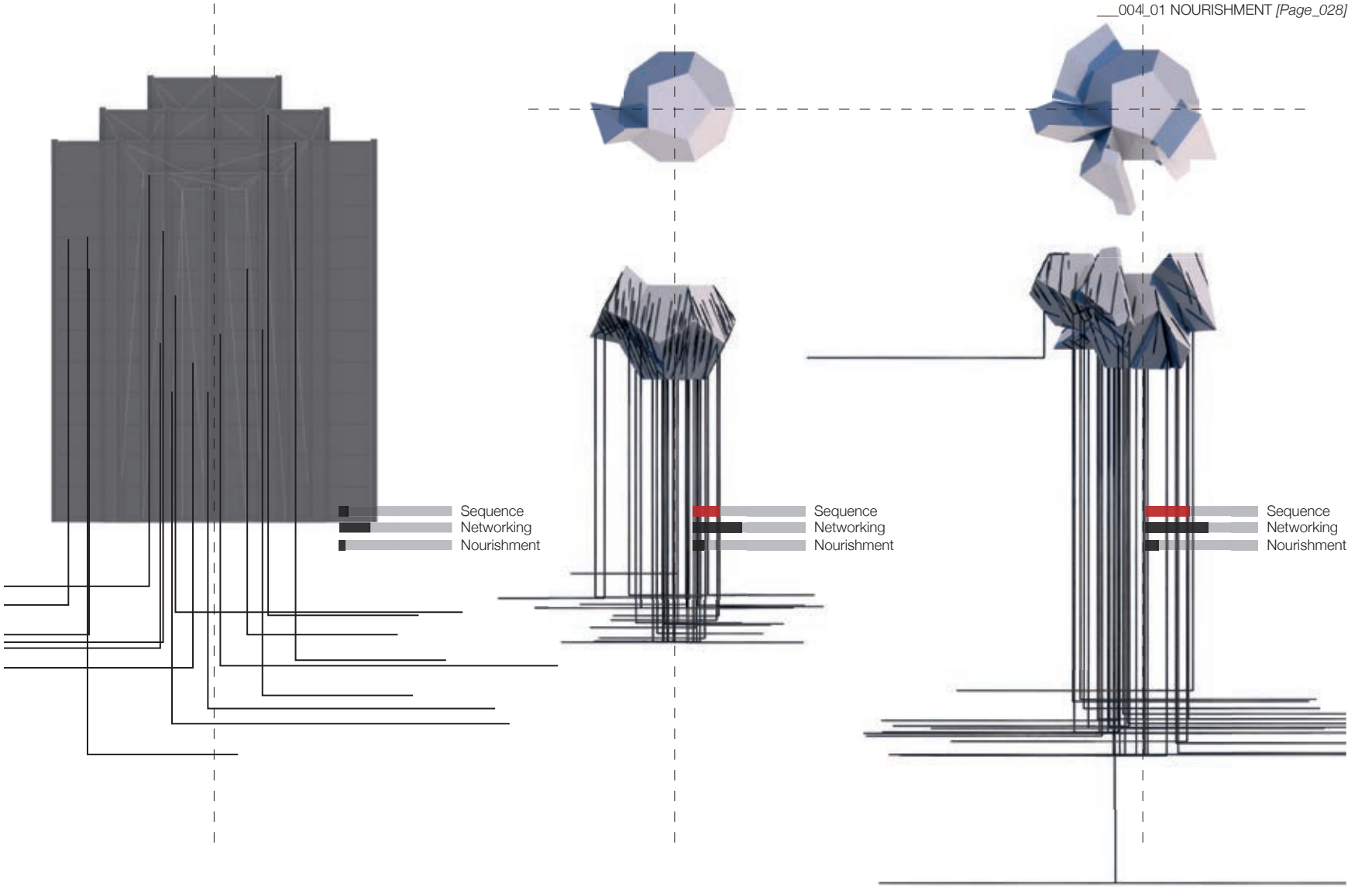
Predefining the optimal siting for the nucleus inside the host building. The field diagram shows the best direction for the nucleus to develop. Structural and statical analysis of the building serve as foundation for this analysis. Weaker areas of the building means better areas to develop but they are also carry less load.









The nucleus needs a solid support structure to develop itself. The infrastructural network which is gathered around the nucleus connects it to the surrounding buildings and infrastructure to support the chemical process with nourishment.
The more existing connections available the more nubile the building gets for the nucleus.
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With each sequence the biomechanical nucleus is developing itself on base of the {chemical script} and on base of the nourishment it gets from its surrounding and it gathers from its environment.
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When proceeding through the chemical and mechanical sequences the nucleus tries to digest its host building to drive its developing sequences.
This digest process goes alongside with a sprouting network system between the nucleus and its near environment. The sprouting passes very subtile and infests every building which fits in the preceding analysis.
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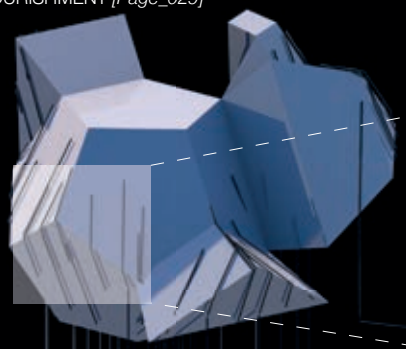

The biomechanical-vein system of the nucleus is able to sprout at its own. It intrudes supply elements; e.g. water, electricity, gas, fluid, hot steam, district heating, chemicals or sewage.
The veins overgrow even the nucleus as a part of a sensory reaction to its environment.
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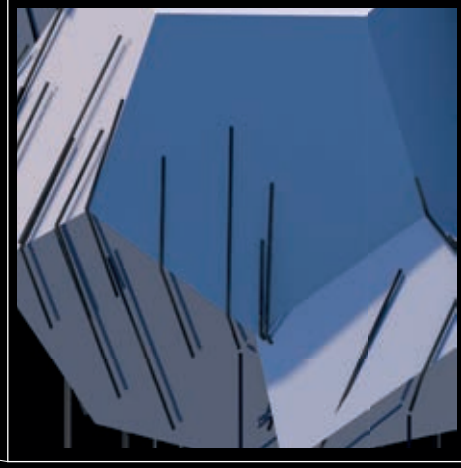

The veins are biomechanical adapted and highly emergent in their construction.
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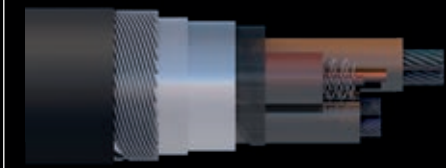

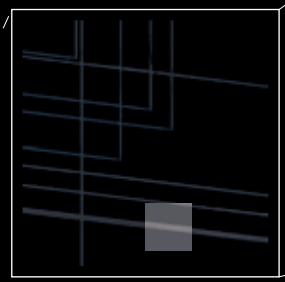

Each vein is driven by a autonomous cutterhead at its end. The cutterheads crawl through a vast amount of materials by spalling stone or stone like material and dissolving it by its intern aggregates.
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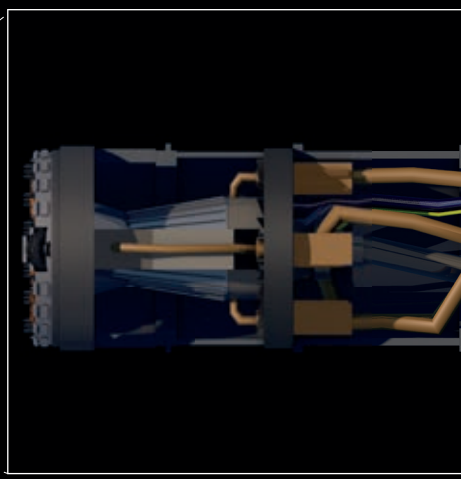
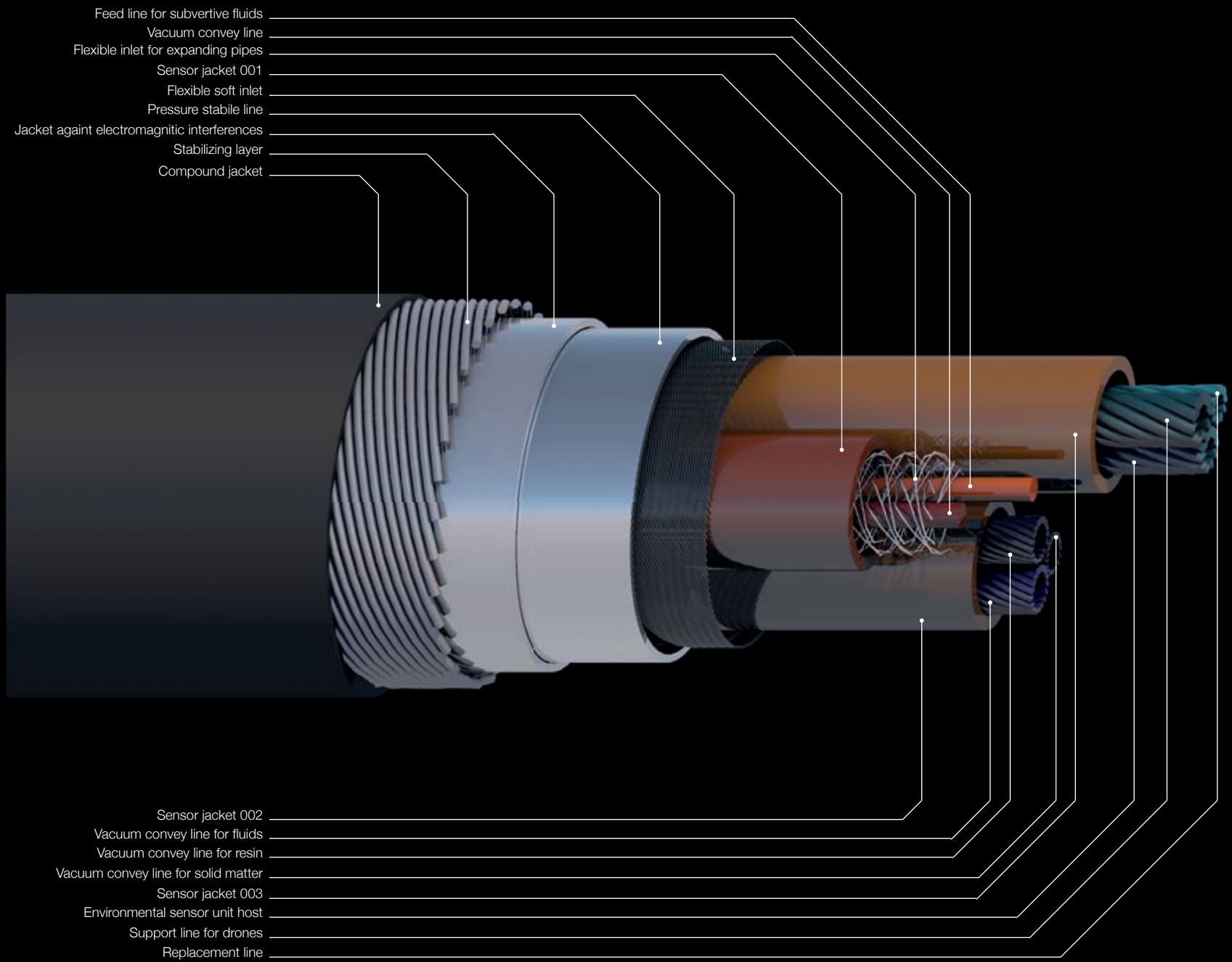
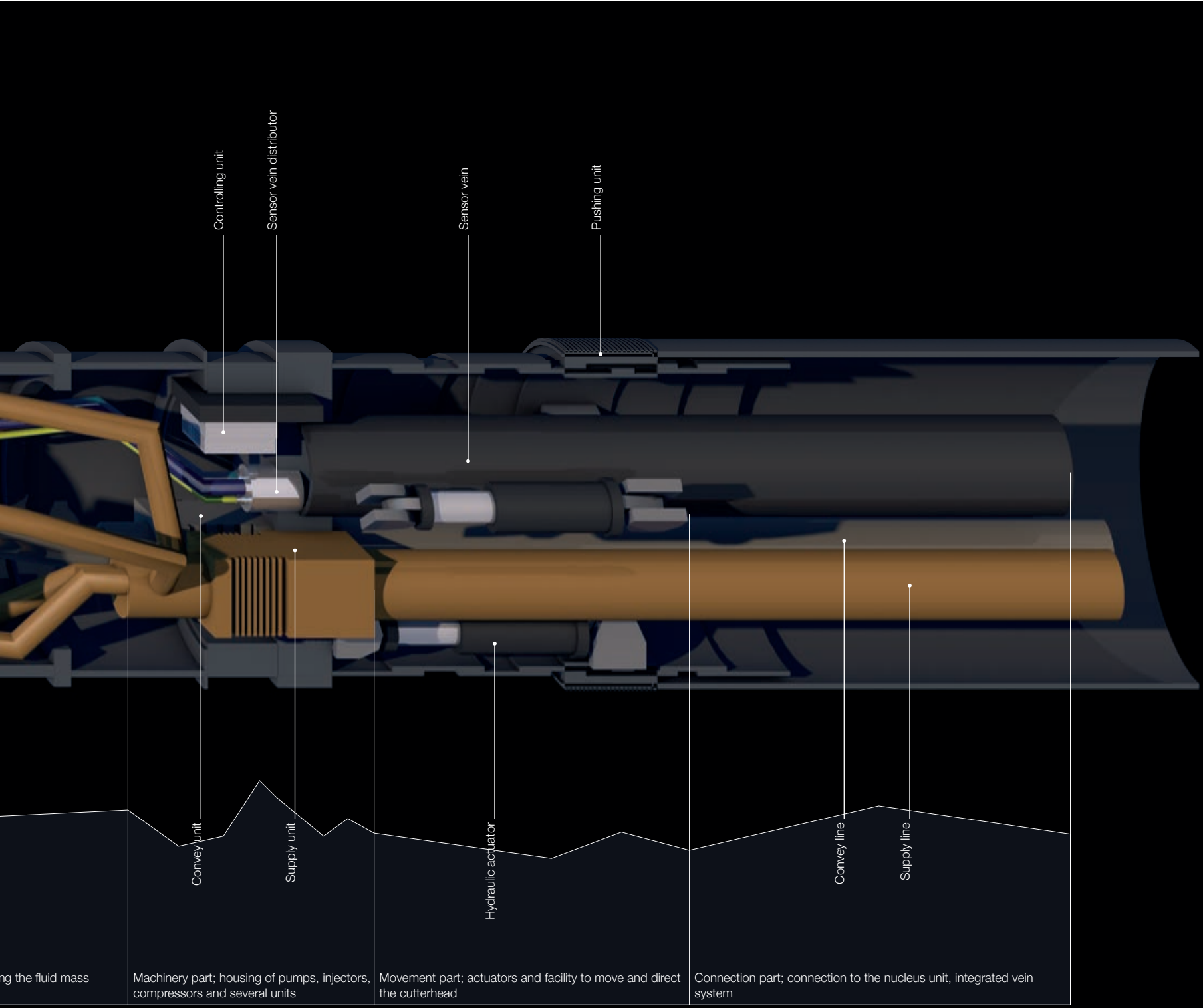



Feed line for subvertive fluids
Vacuum convey line
Flexible inlet for expanding pipes
Sensor jacket 001
Flexible soft inlet
Pressure stabile line
Jacket againt electromagnitic interferences
Stabilizing layer
Compound jacket
Sensor jacket 002
Vacuum convey line for fluids
Vacuum convey line for resin
Vacuum convey line for solid matter
Sensor jacket 003
Environmental sensor unit host
Support line for drones
Replacement line

Main cutting plates
Grinding edge
Side cutting plates
Additional drill head on a telescopic hydraulic shaft
Front plate [turning]
Sensor unit with 3 devices for envíromental measurements

Liquifier feed
Crushing area
Liquifier nozzle
Main bearing
Feeding pump
Abrasive part; mechanical destruction of const. material
Fluid part; chemical injection and dissolving of the const. material
Convey part; hoisting and preprocessi

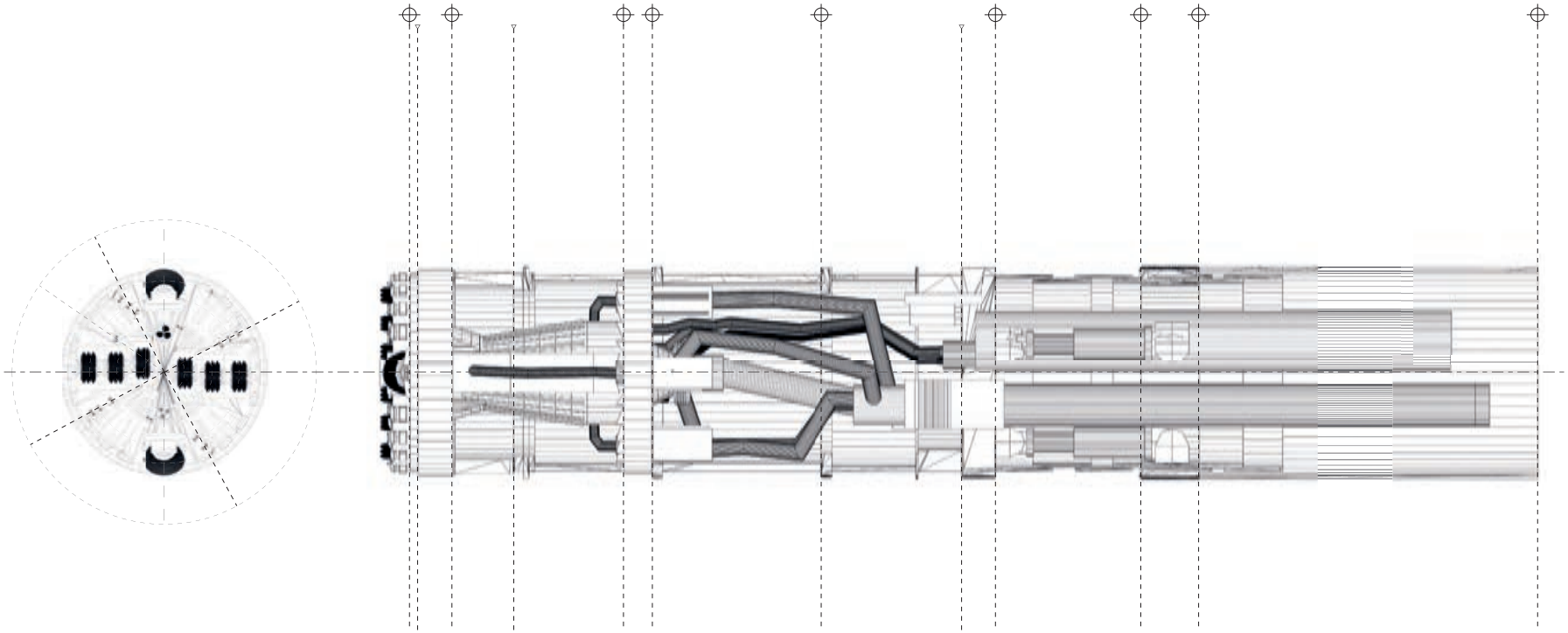


ng the fluid mass

Machinery part; housing of pumps, injectors, compressors and several units

Movement part; actuators and facility to move and direct the cutterhead

Connection part; connection to the nucleus unit, integrated vein system



Initial nucleus outside. The structure is a multi layered shell with a compound structural frame.
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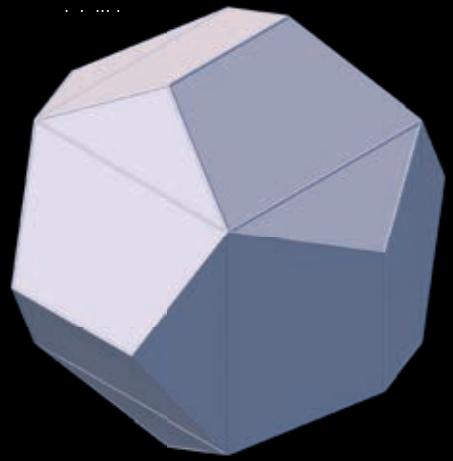

SAGU [Spherical Autonomous Grab Unit] unit in mobile position. This unit is placed inside the nucleus and drives a main part of the mechanical process during the nucleus development.
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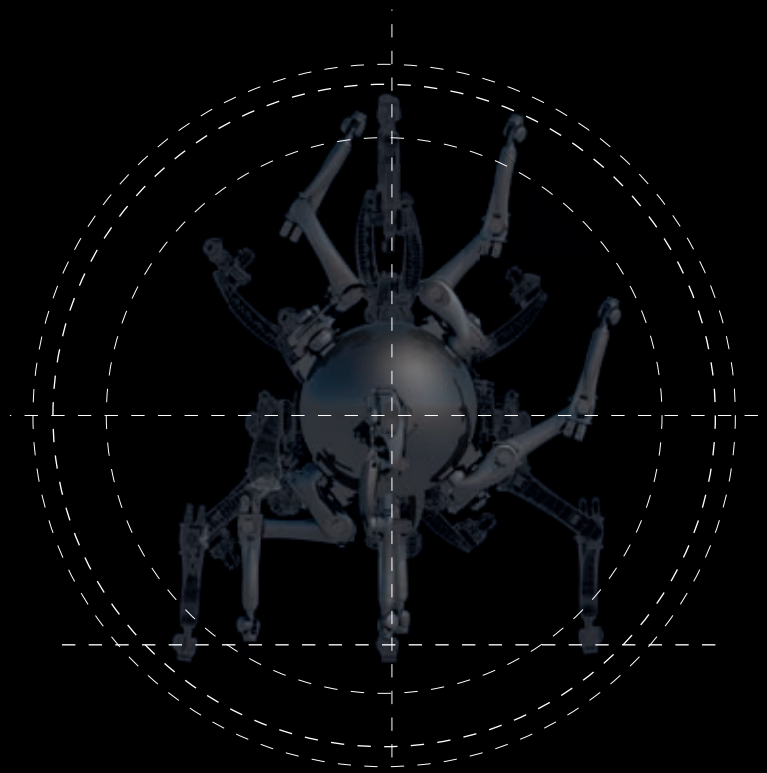

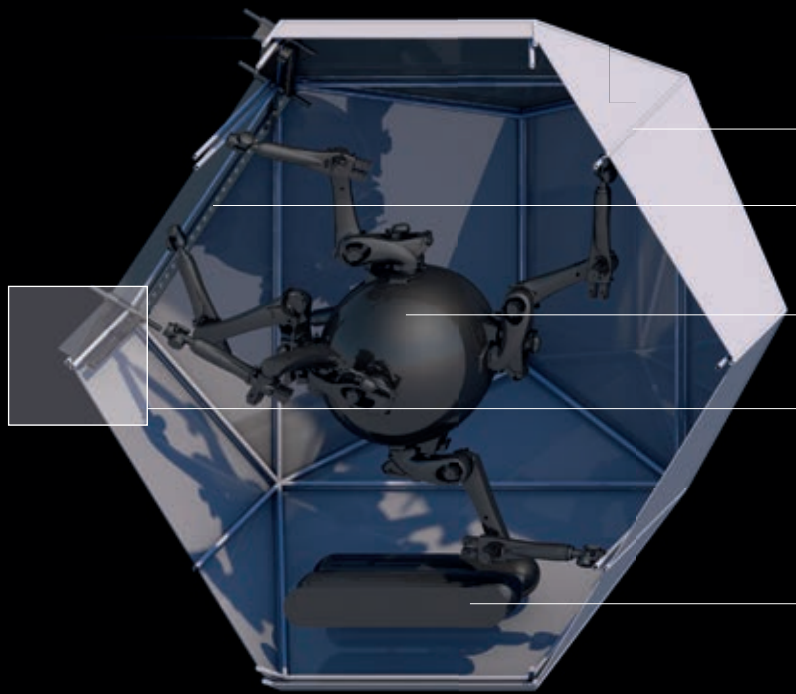

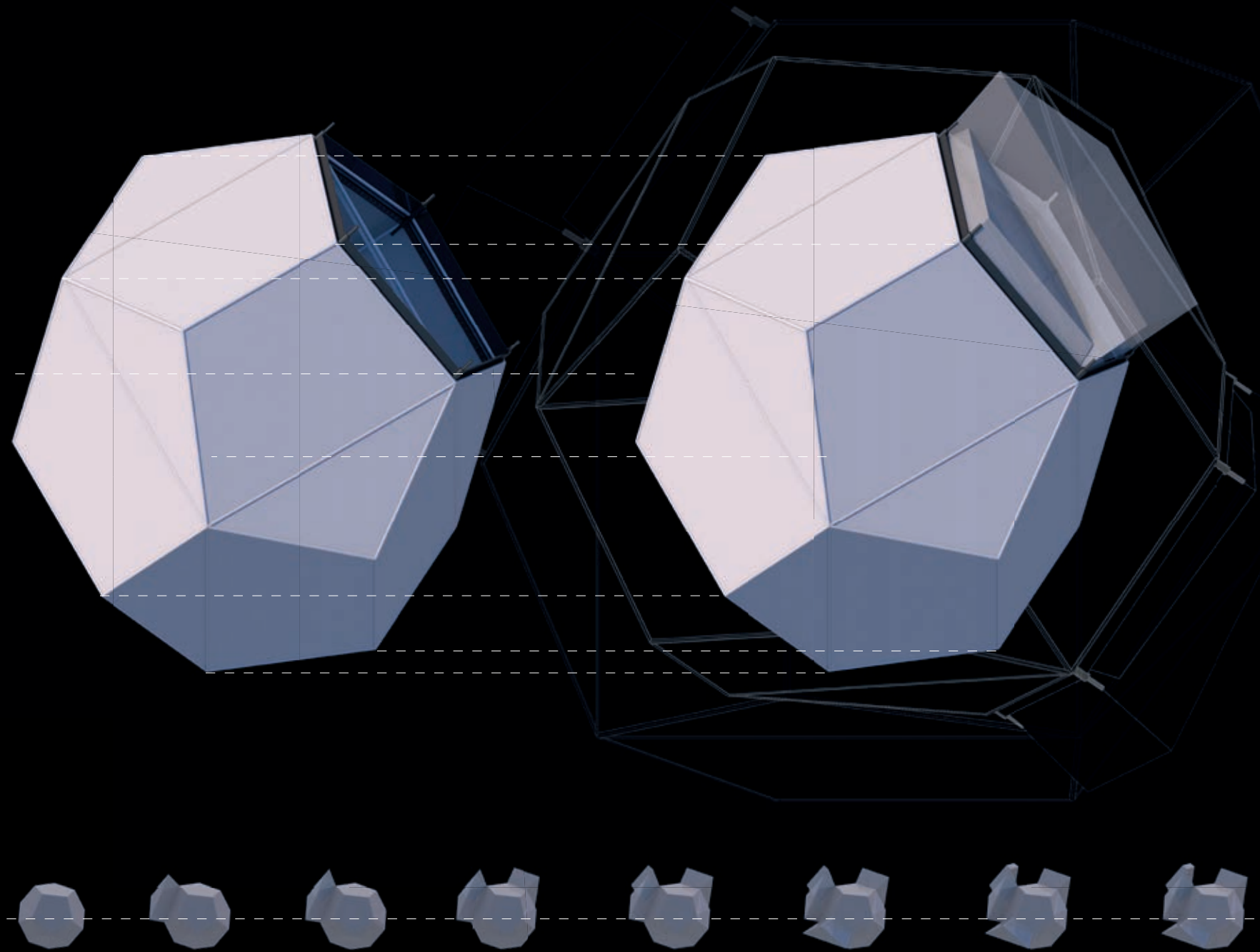

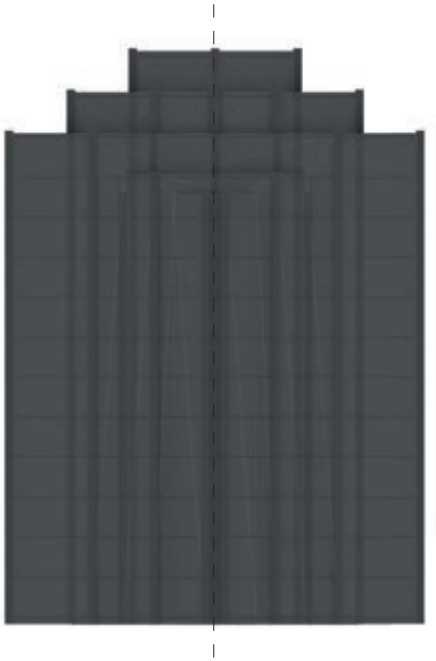

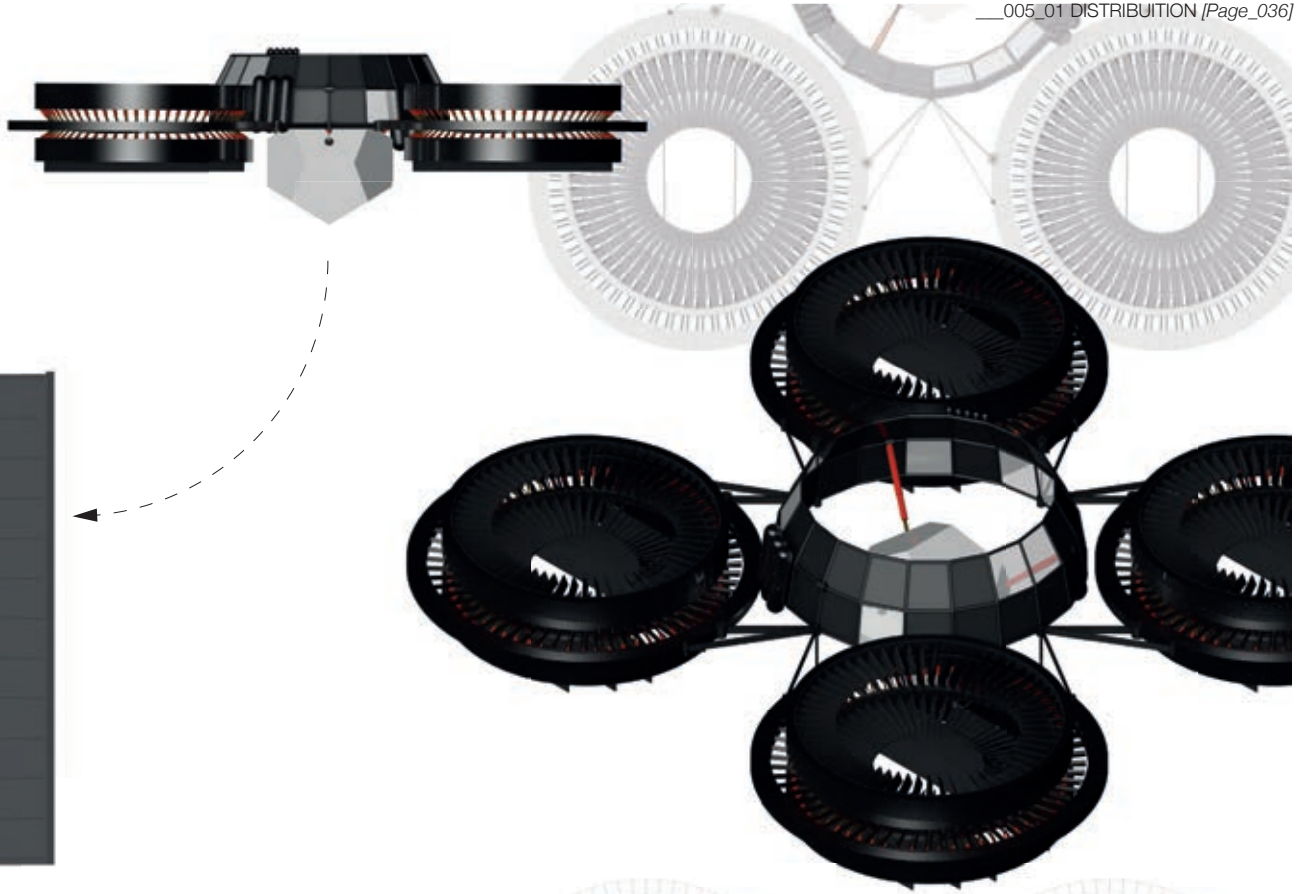

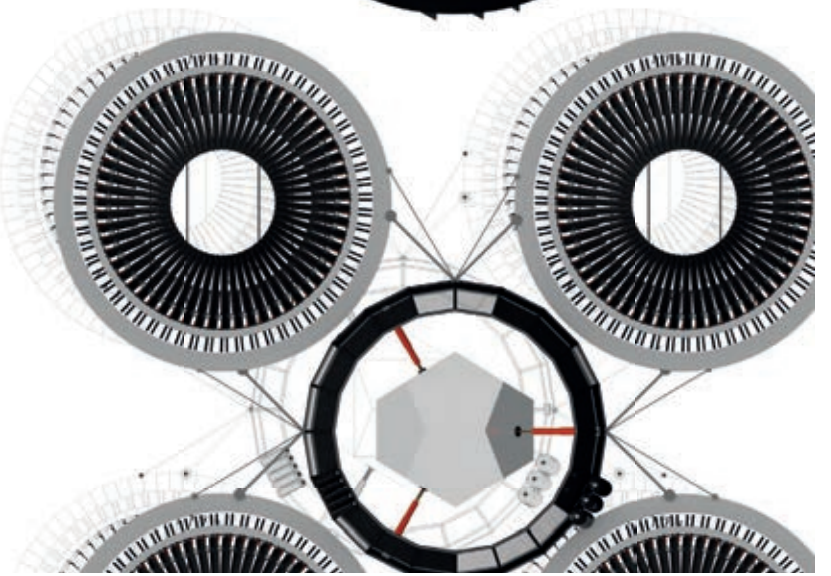

Carrier drones locate the investigated host building und place the nucleus inside the building with a triangular hydraulic placement system.
The nucleus is sited inside on base of the building analysis for the best siting spot. Once the nucleus is placed the developing begins. The SAGU prepares the nucleus for the first developing sequence.

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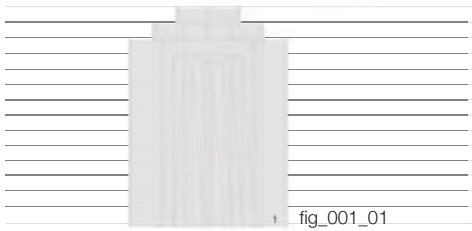

fig_001_01

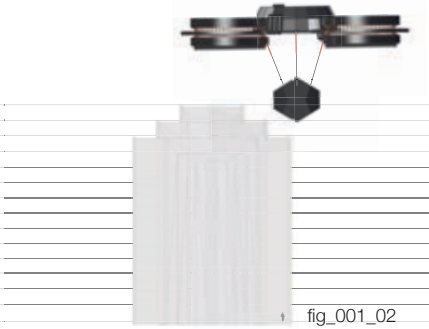

fig_001_02

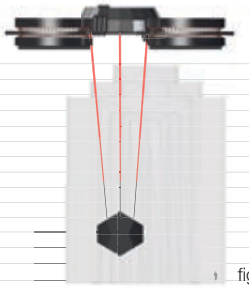

fig_001_03

time

progress

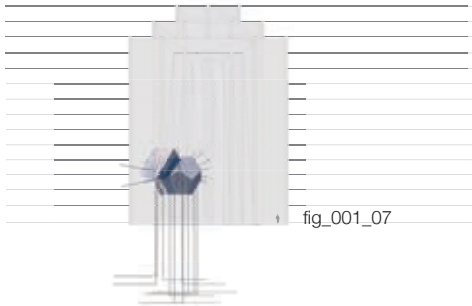

fig_001_07

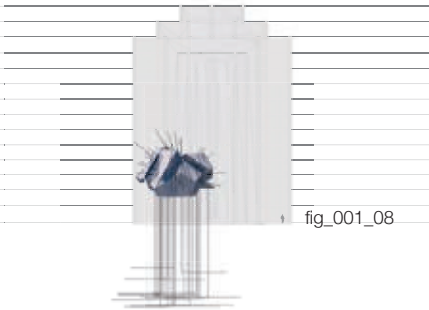

fig_001_08

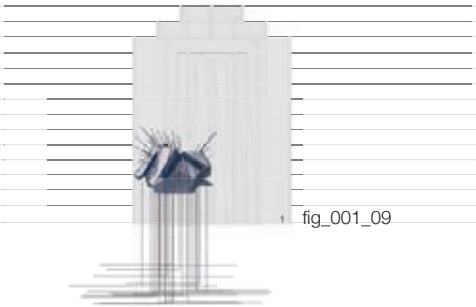

fig_001_09

time

progress

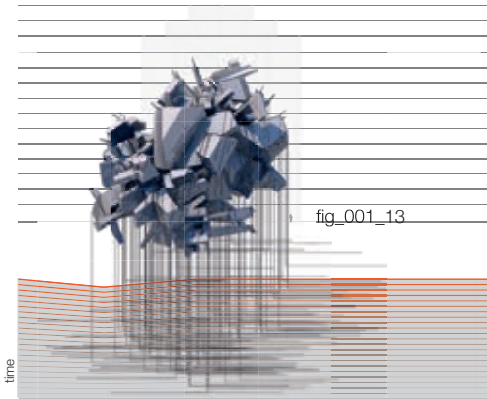

fig_001_13

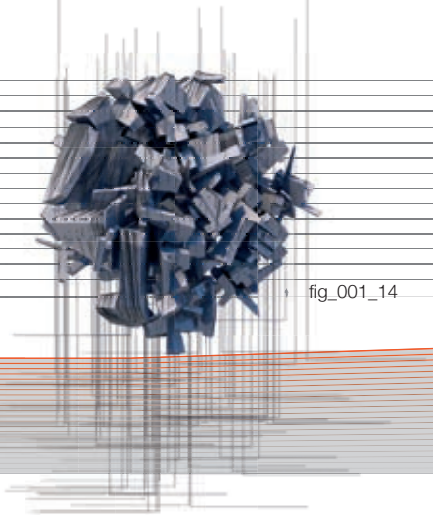

fig_001_14

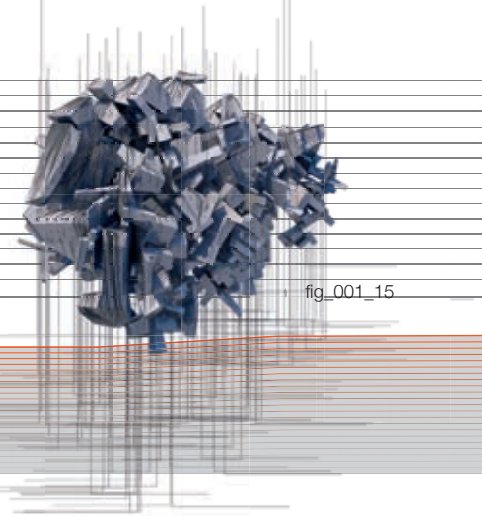

fig_001_15

time

progress

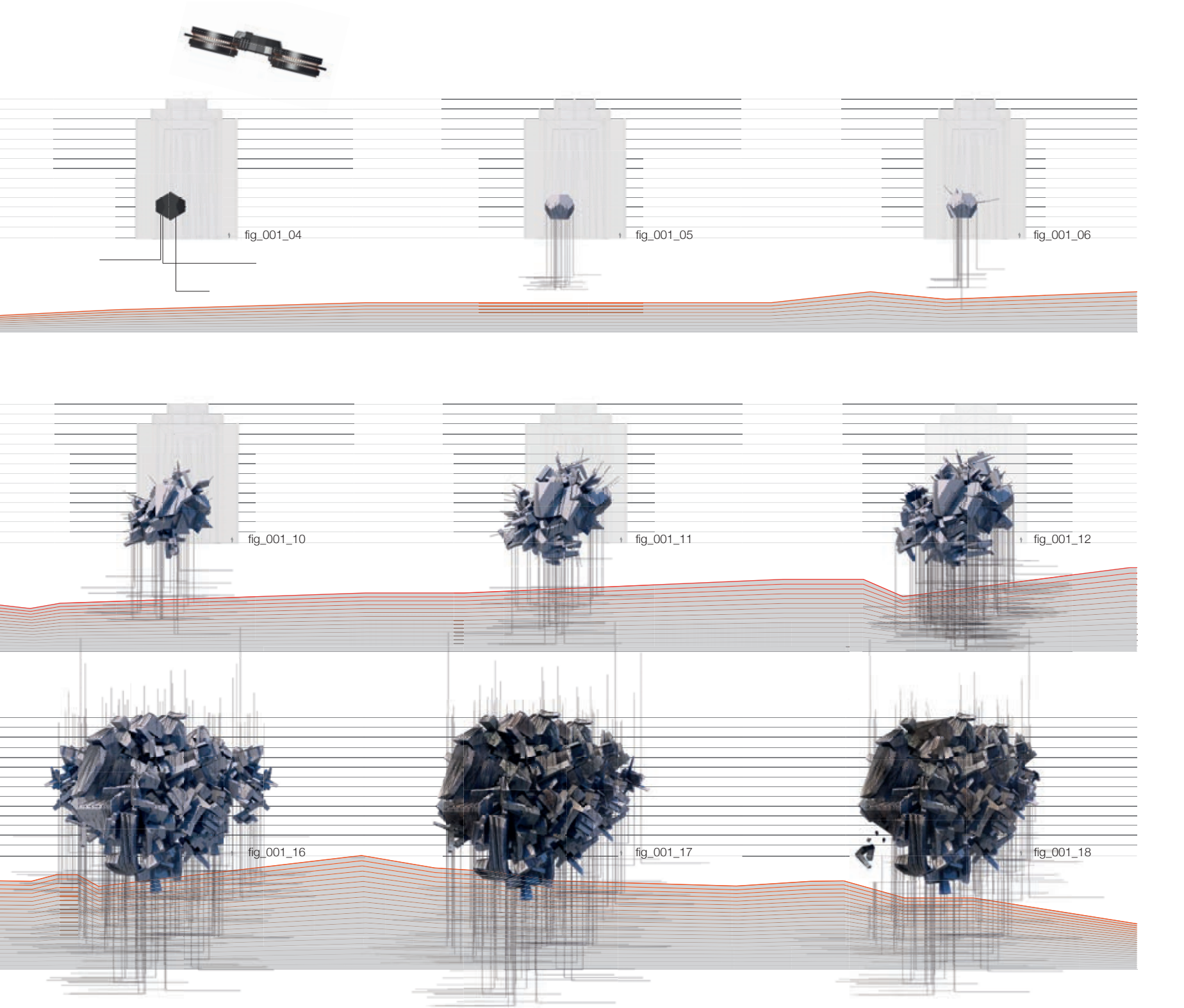
fig_001_04
fig_001_05
fig_001_06
fig_001_10
fig_001_11
fig_001_12
fig_001_16
fig_001_17
fig_001_18

The biomechanical organism could be told as a digital Taxis. The nucleus responses to several stimulus from the outside and tries to arrange or move itself in reference to this stimuli.

Starting with the first iteration of its development process the nucleus and furthermore the organism scans and recognizes its environment it is set in. Based on this parameters the SAGU controls the development in da decent direction and with a decent shape. During the development process there is always a loop between feeding the nucleus unit with information form the outside and the outcome of the growing process. The loop could be told as a closed loop because every change in information causes a change in the growing process.

This behavior allows the biomechanical organism to spread in a vast amount of environments and ensure a life friendly habitat in every surrounding condition.

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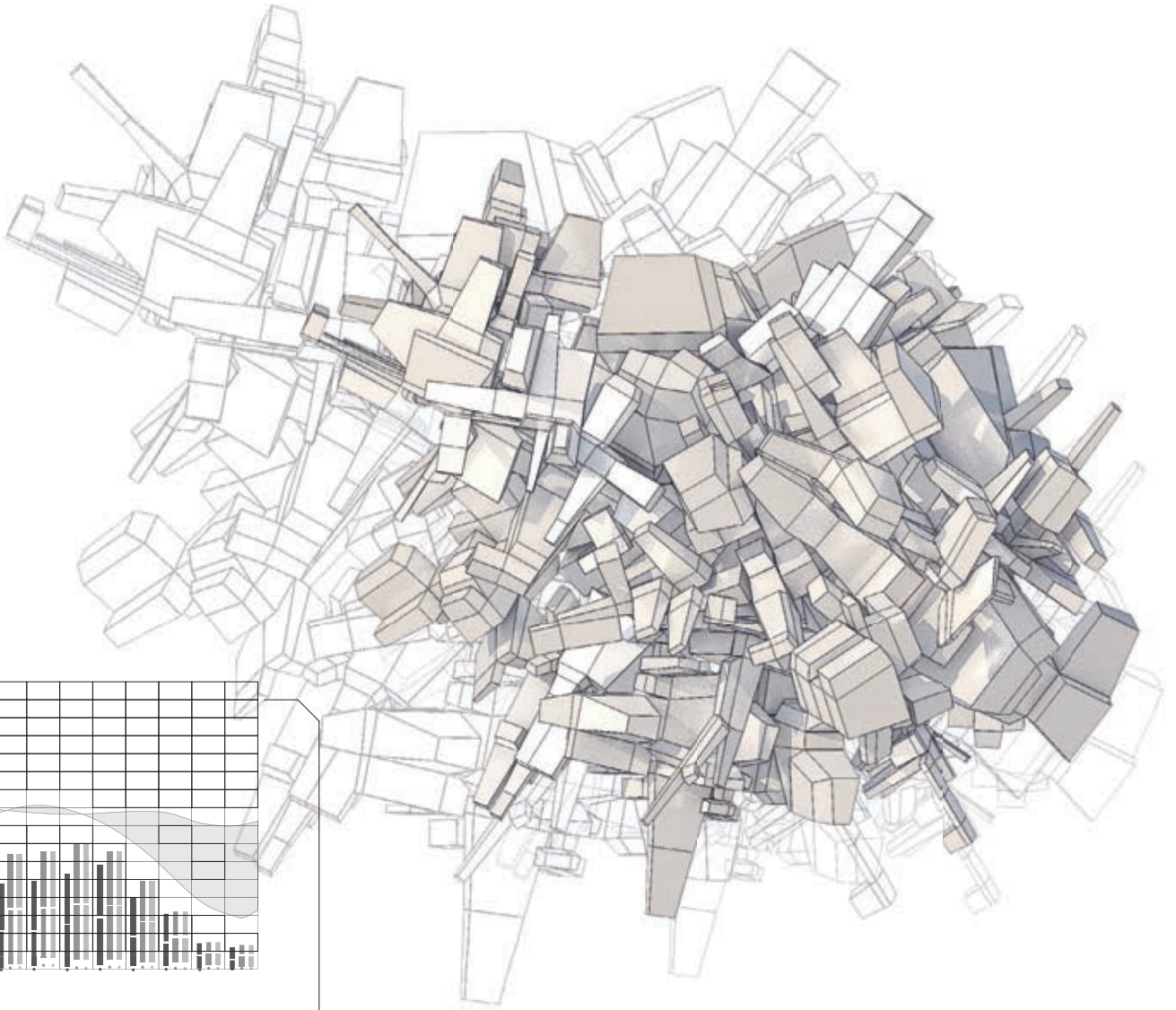
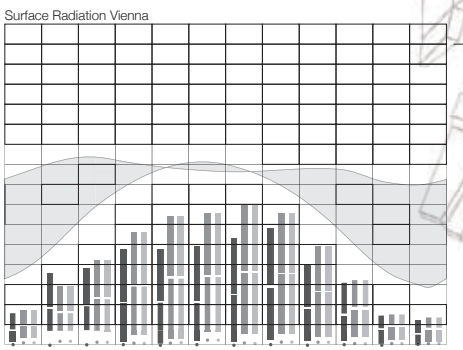
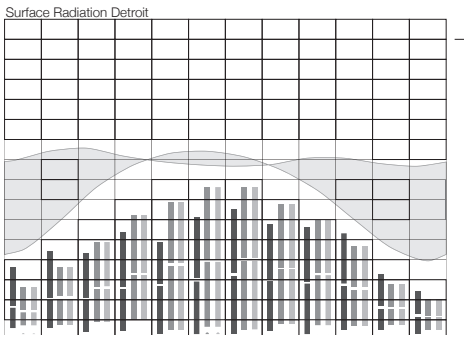


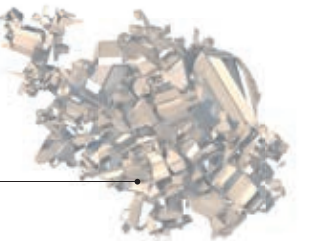
Surface Radiation Input

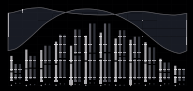
Theoretical
Direct Normal
Global Horizontal
Total Surface

Average High
Mean
Average Low









Reaction of the nucleus to different illumination situations during the development process. The organism tries to response on the most important outside stimuli - in this case a shifting light situation with more radiation input in the winter months as usual in Detroit. The outer hull is scattered and adapts the inside of the organism to increase the illumination to a high level.
The arrangement of the shading pattern delivers in most cases a very efficient illumination condition in the inside of the organism - a genomic script tries in this case to set the inside daylight factor to 2.4.

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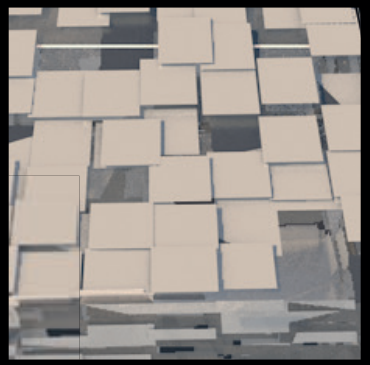
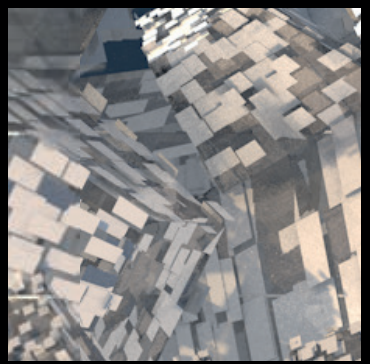
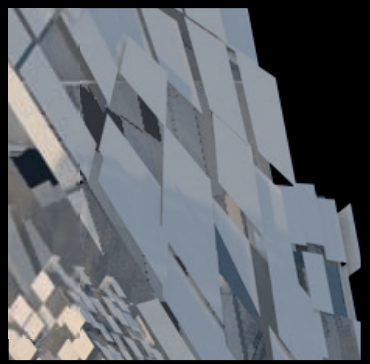
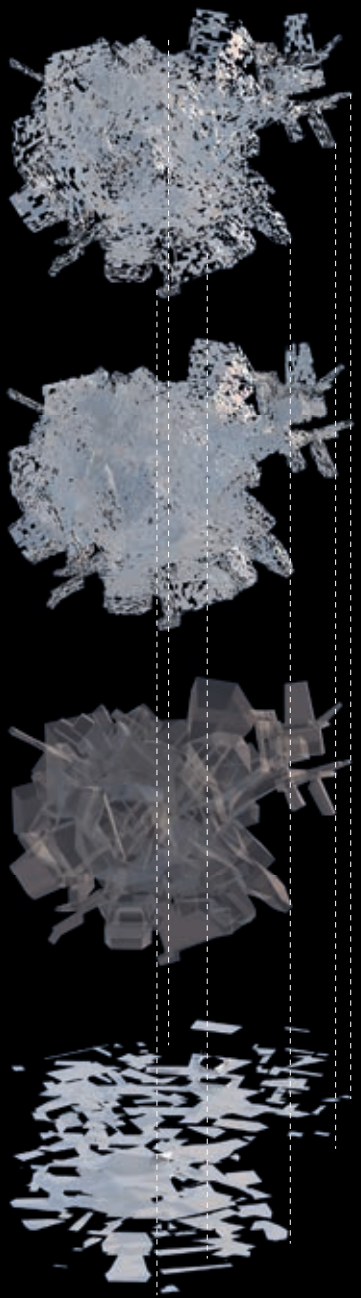
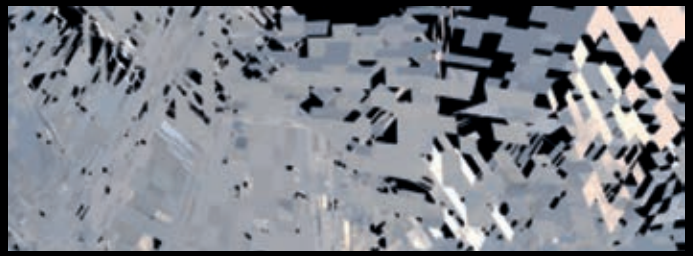








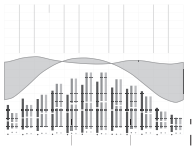


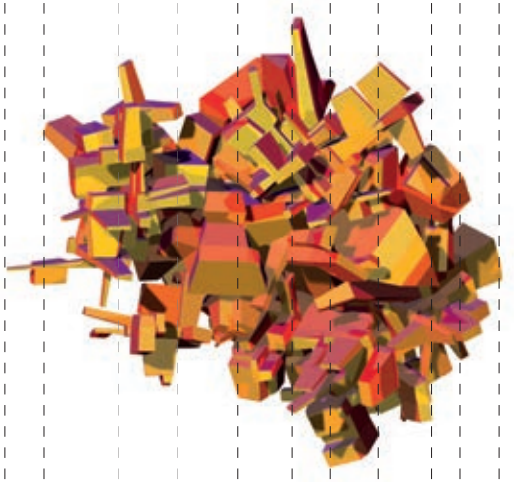
Second layer of the scattered shading hull. Two layers allow different angles of exposure inside the organism without overheating at the same time.

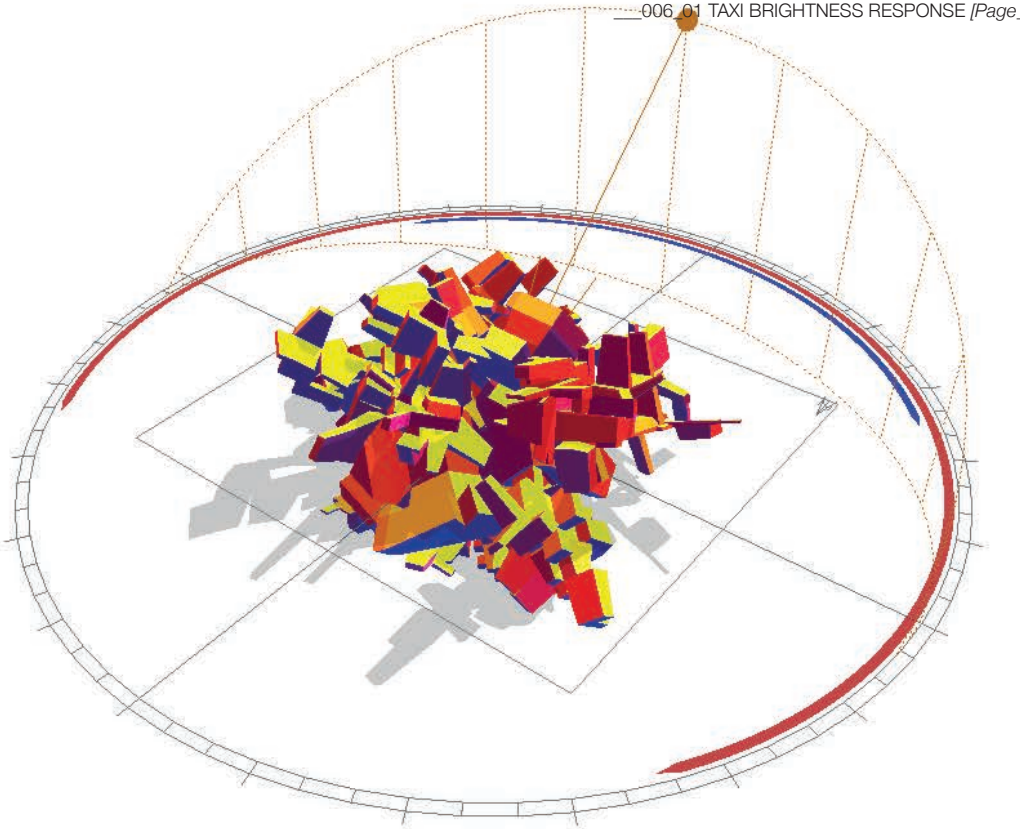
First layer of scattered shading hull attached to the transparent supporting structure beneath it.

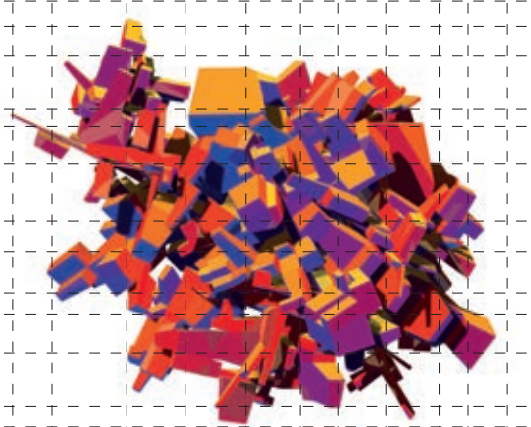
Transparent and partly translucent first hull of the organism to achieve a closed structure and serve as a supporting structure for the scattered shading attachments.

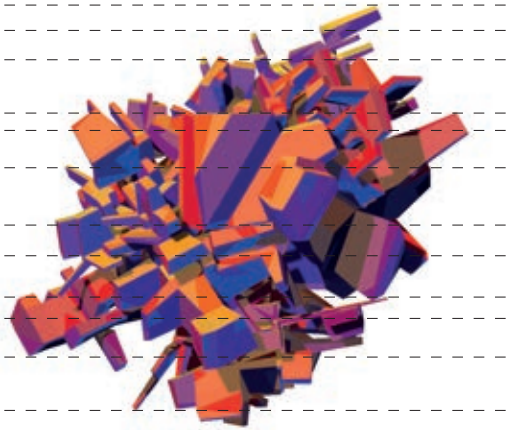
Story arrangement inside the organism.



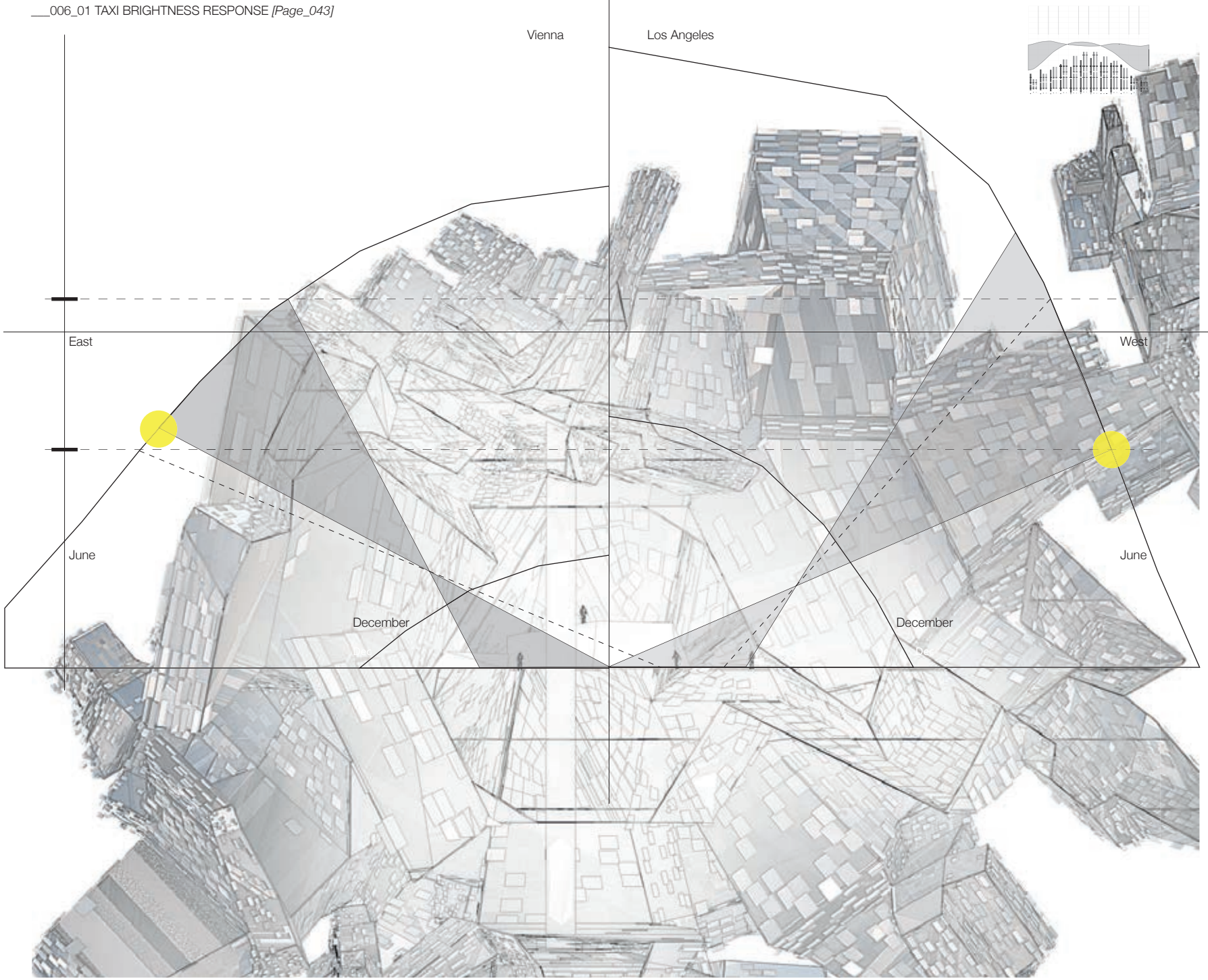


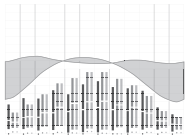


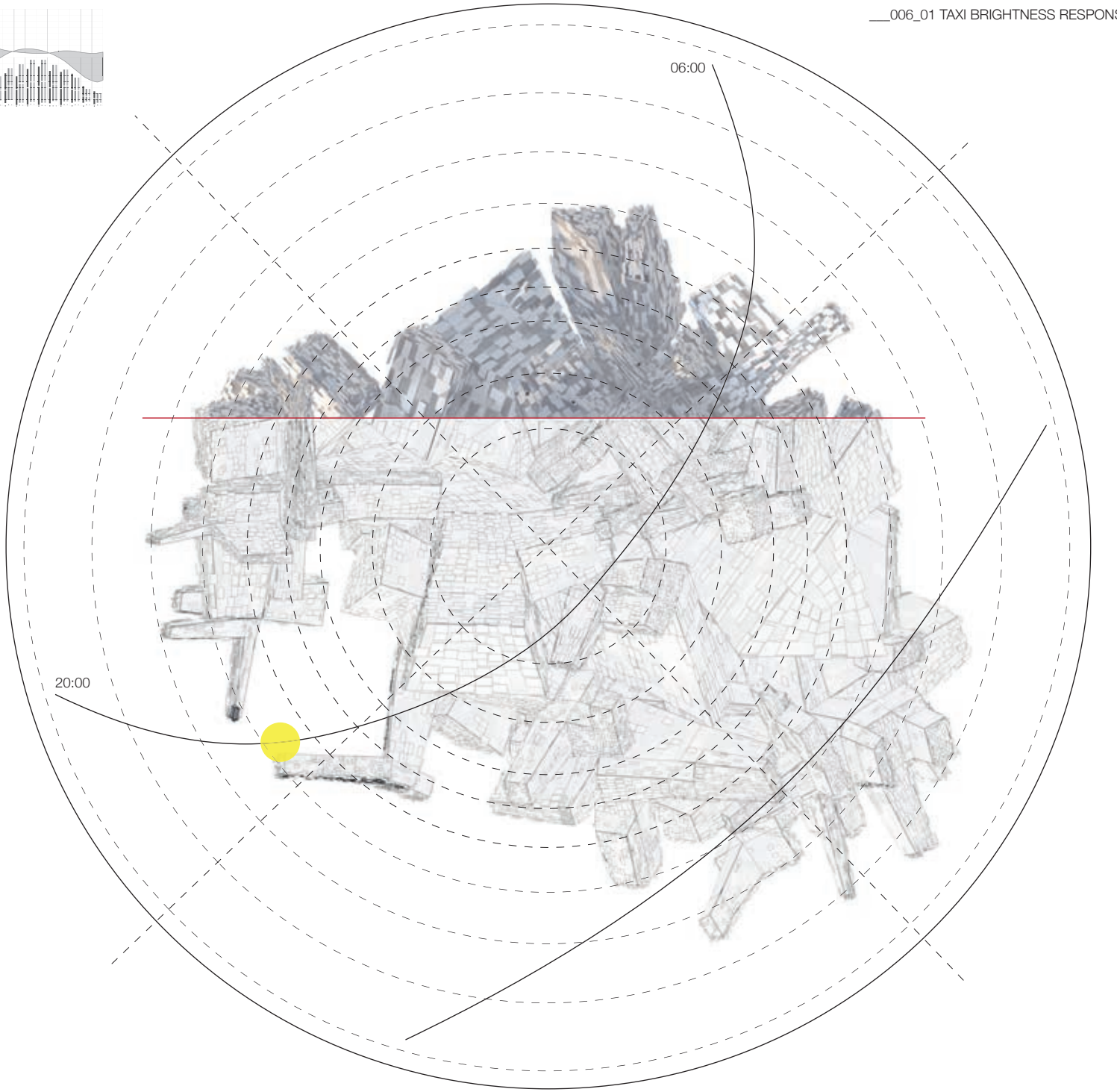




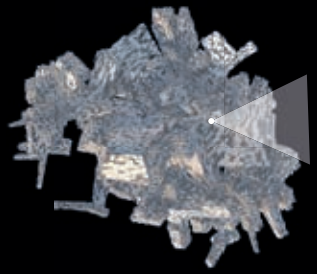
___006_01 TAXI BRIGHTNESS RESPONSE *[Page_043]*

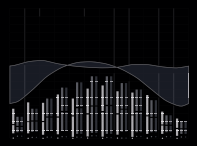


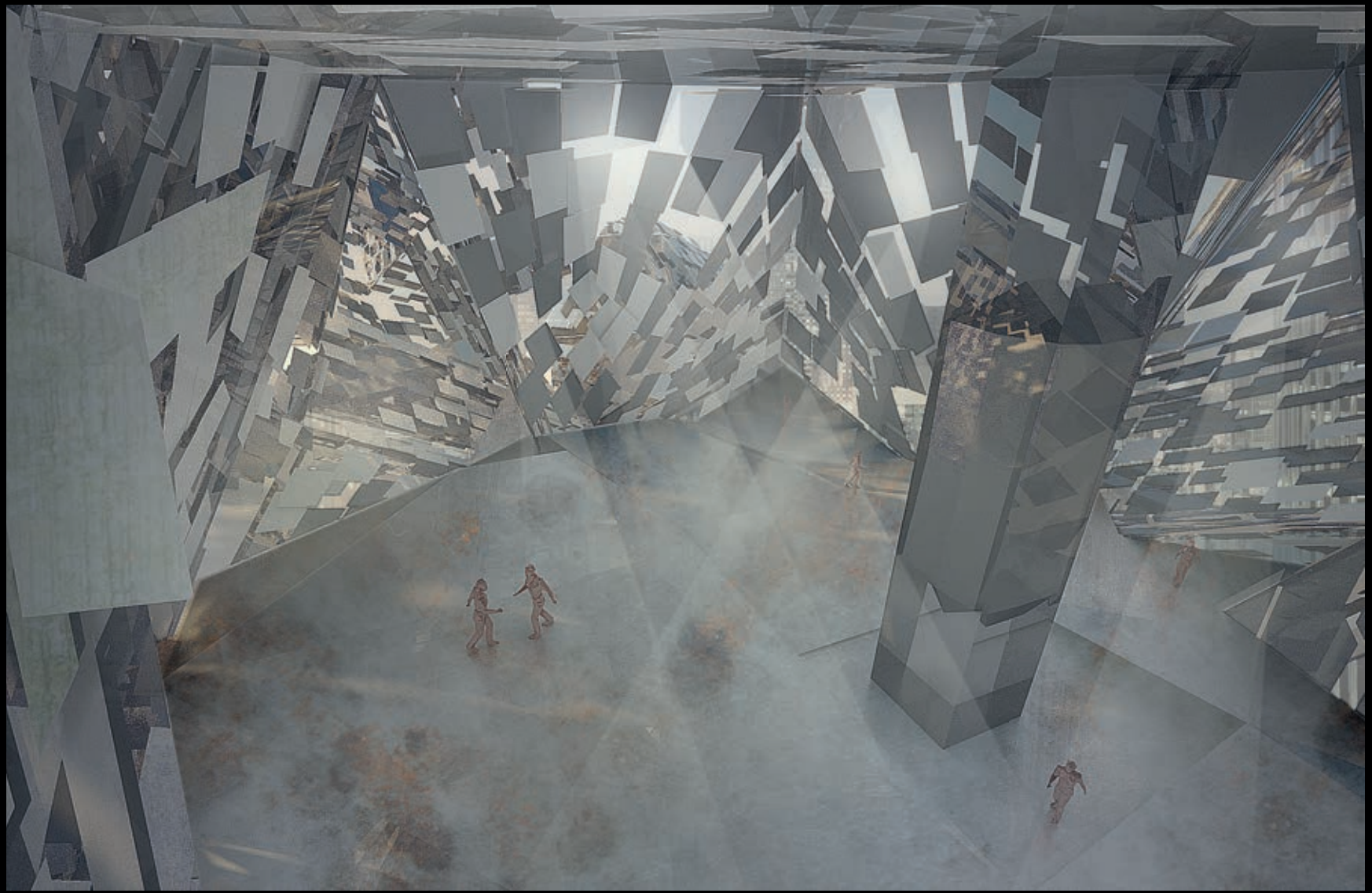


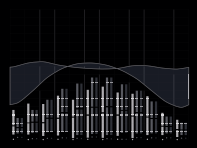

06:00
20:00

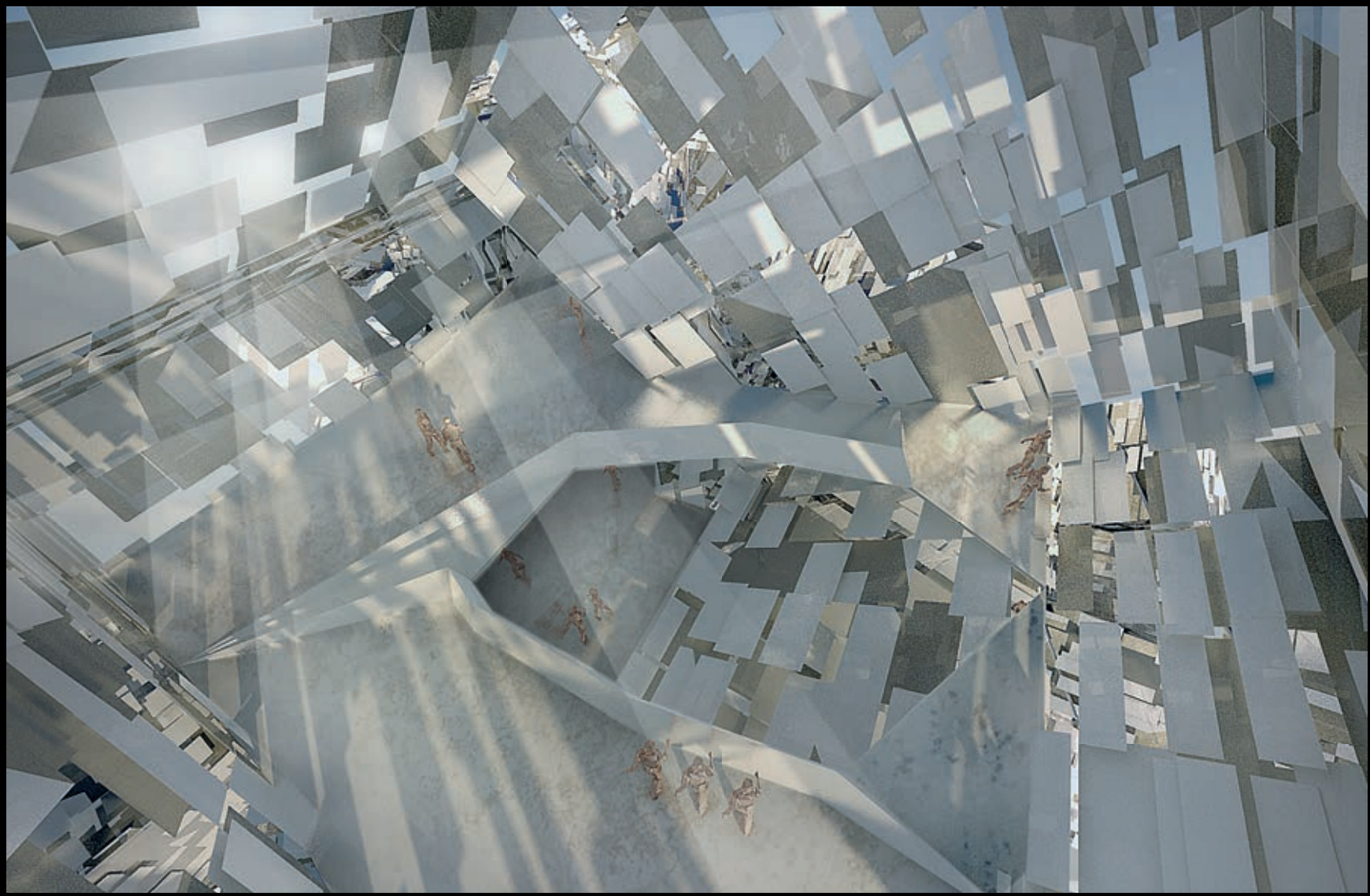
___006_01 TAXI BRIGHTNESS RESPONSE *[Page_045]*



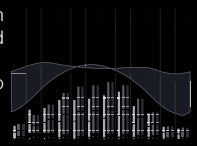


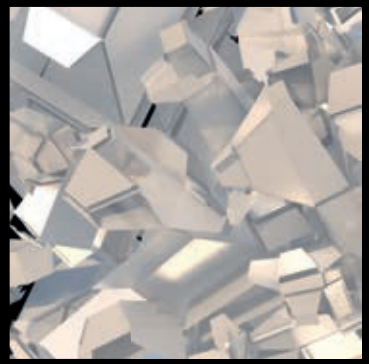


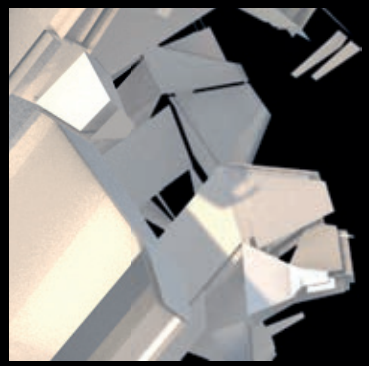


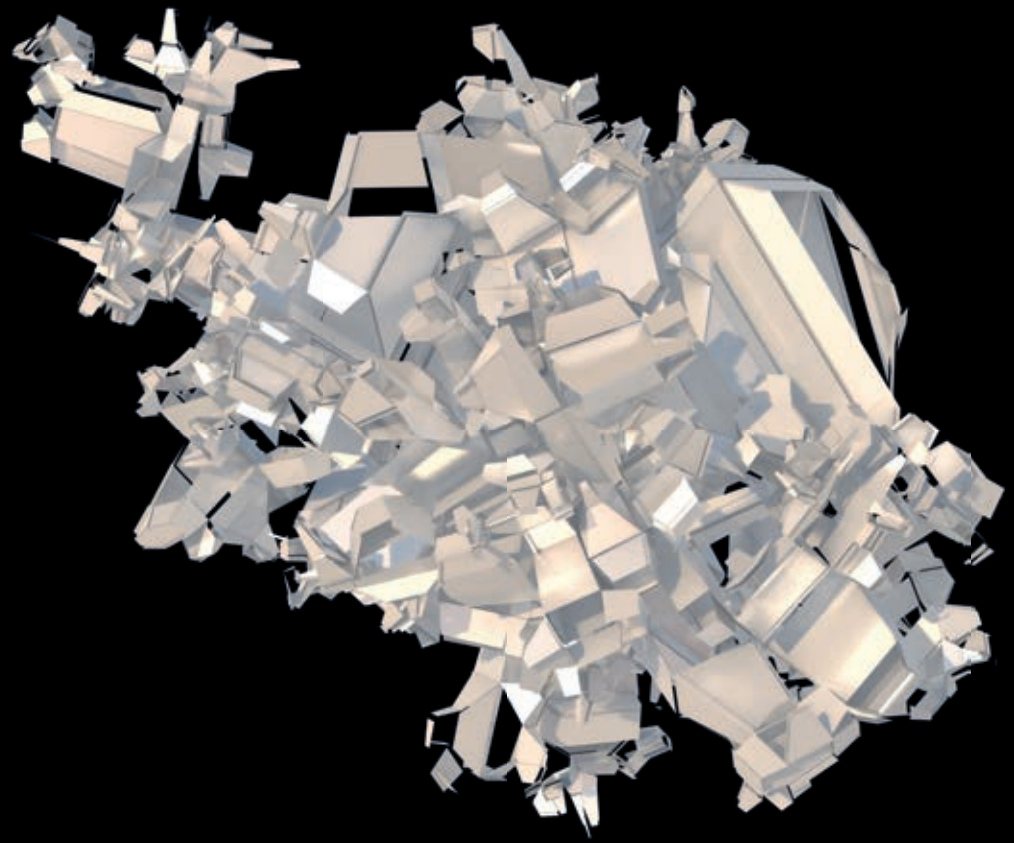


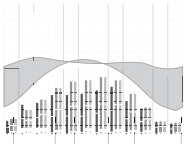
Reaction of the nucleus to a environment with less radiation input in the winter months, as common in Vienna or parts of Central Europe. The biomechanical organism stops expanding its size at some point and tries to maximize its surface area by scaling down the extrusion elements at each iteration.
Through this downscaling of single elements the overall window opening precentage can be increased to catch enough light to reach a daylight factor of 2.4.

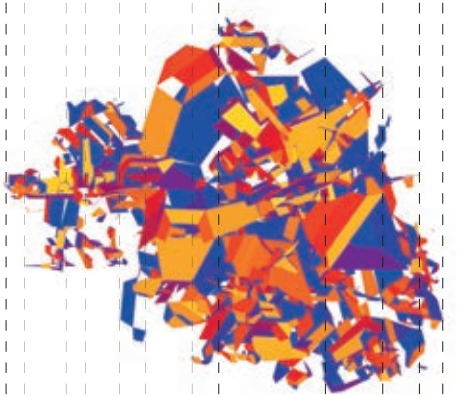


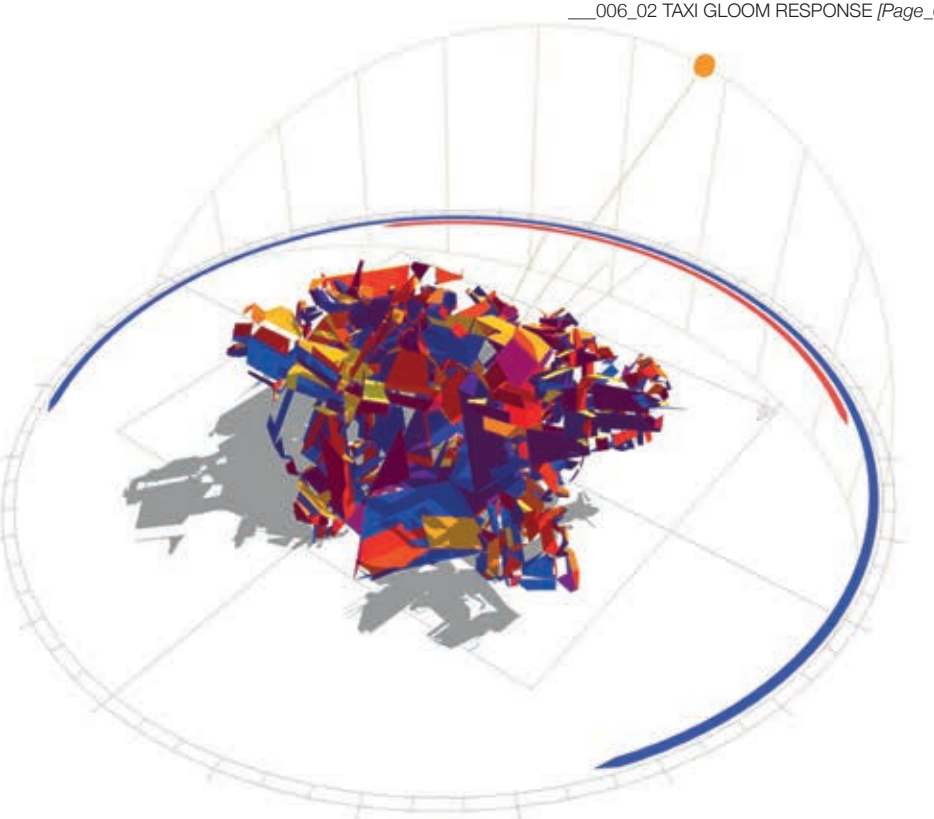


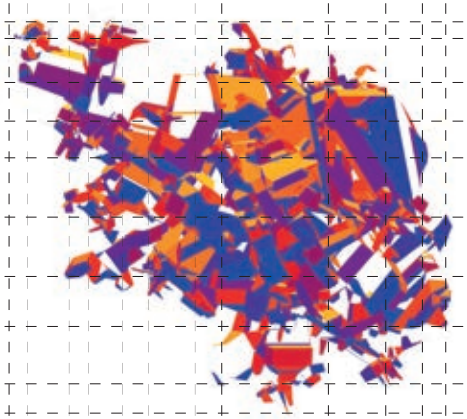


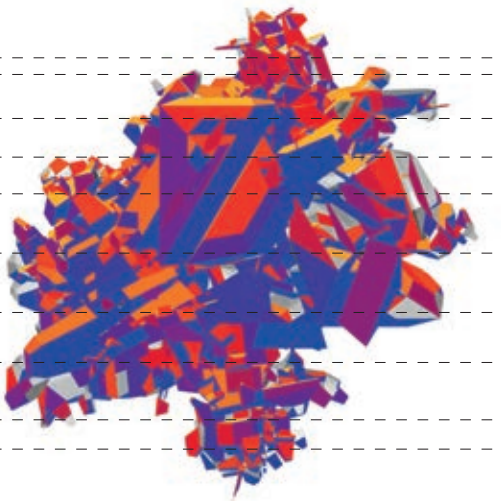


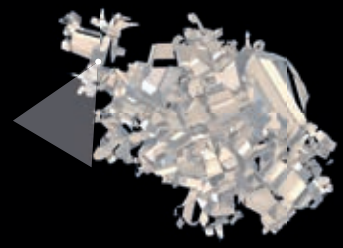


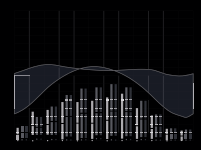


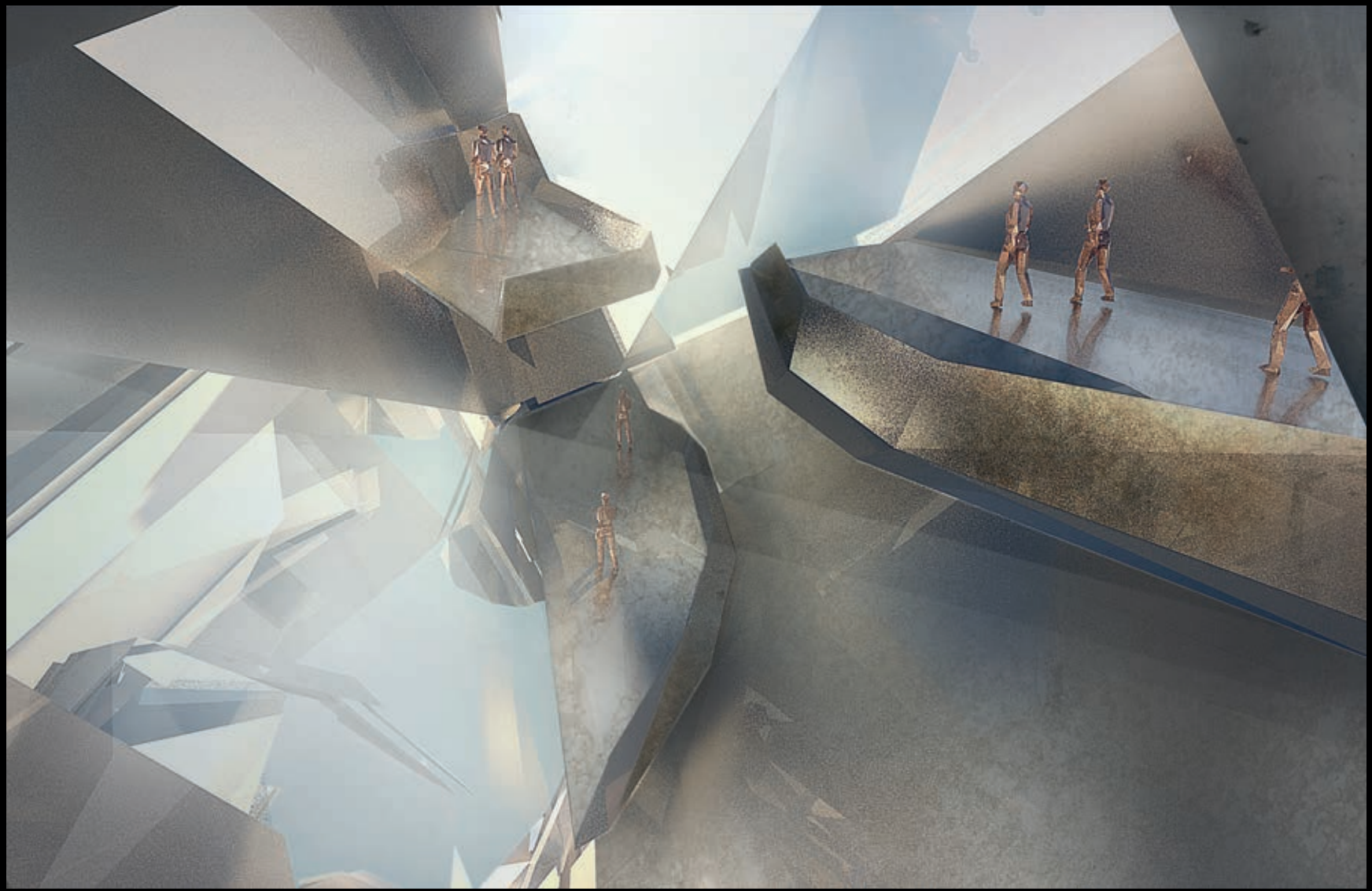


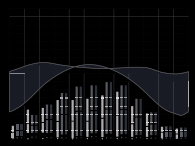


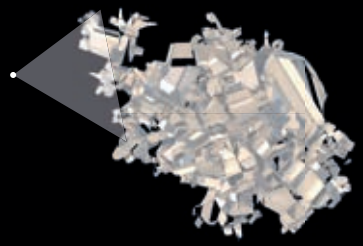


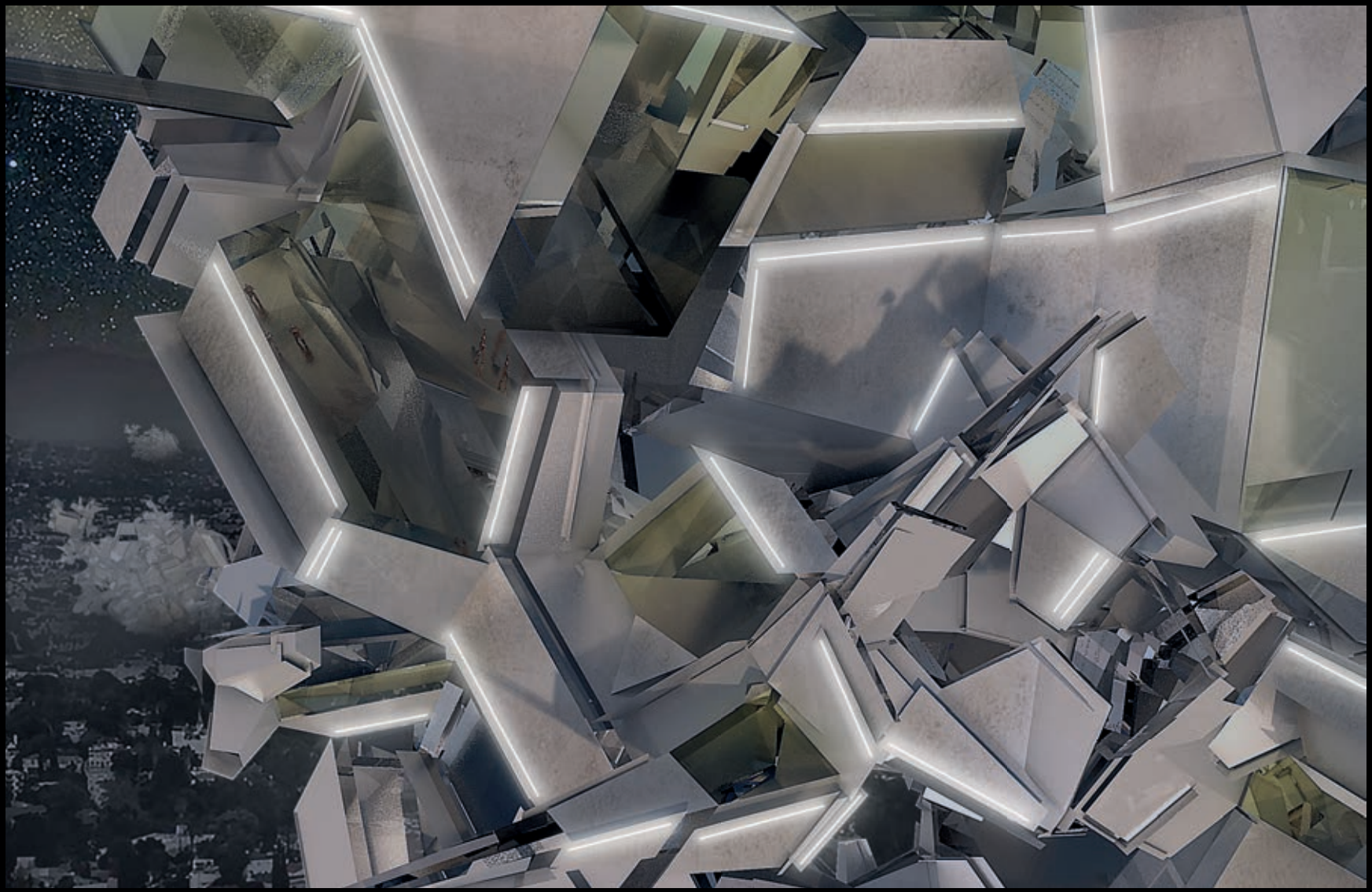


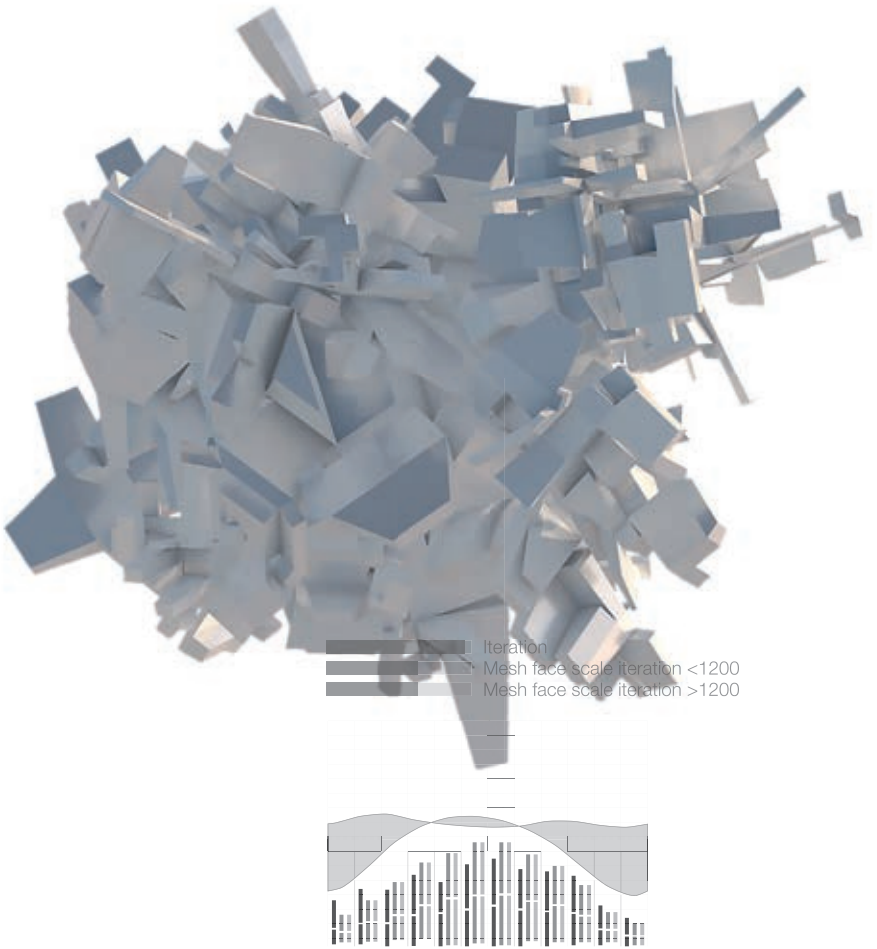


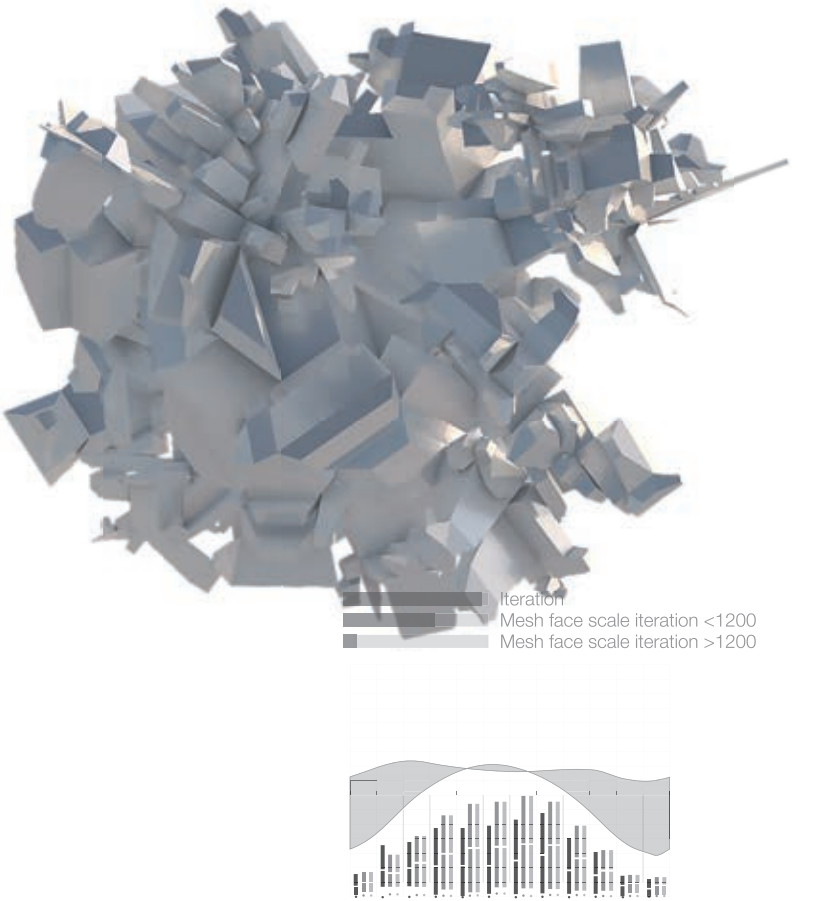


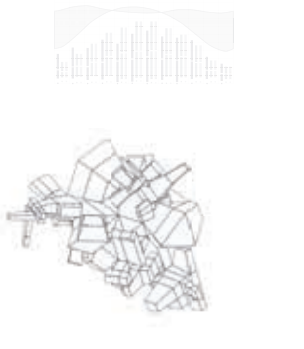






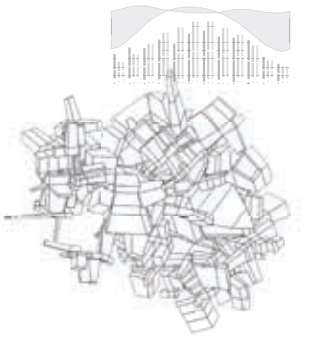

Iteration
Mesh face scale iteration <1200
Mesh face scale iteration >1200


Iteration
Mesh face scale iteration <1200
Mesh face scale iteration >1200

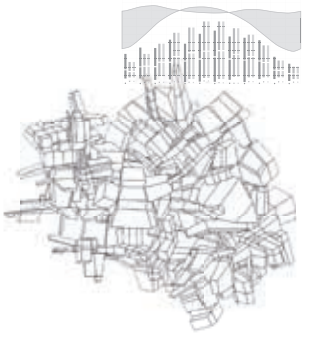


Iteration
Mesh face scale

Iteration
Mesh face scale



Iteration
Mesh face scale



Iteration
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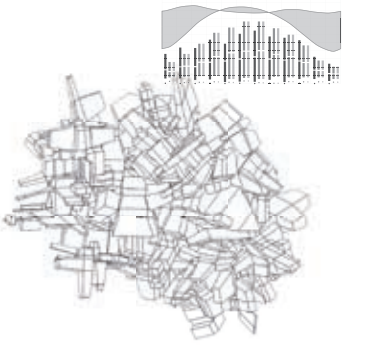
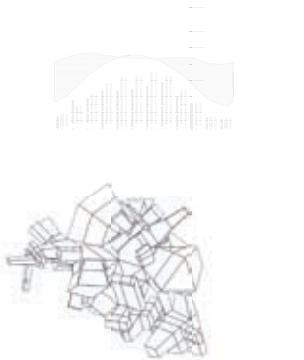
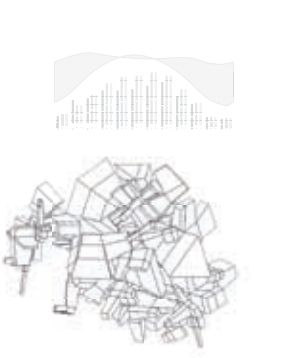


Iteration
Mesh face scale

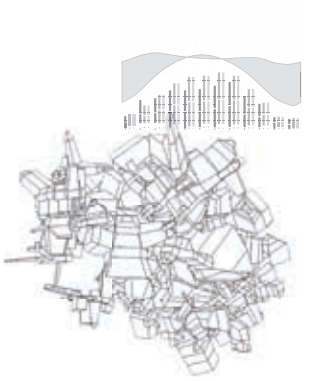


Iteration
Mesh face scale

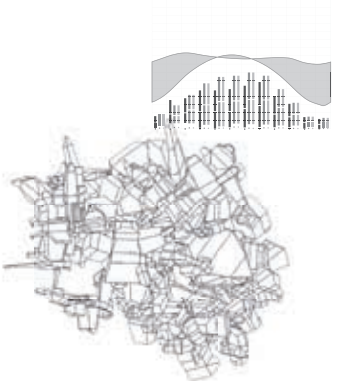


Iteration
Mesh face scale

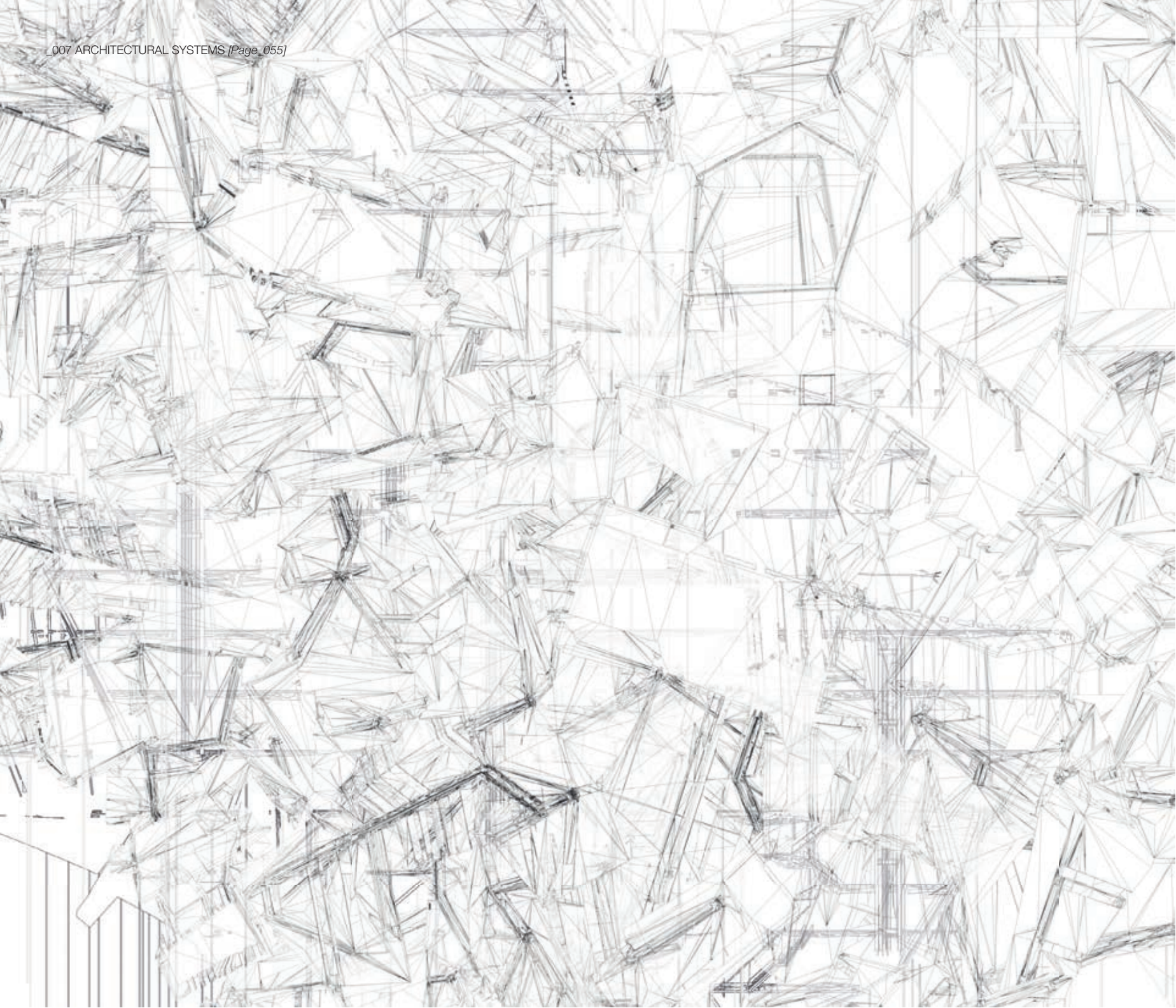
Iteration
Mesh face scale

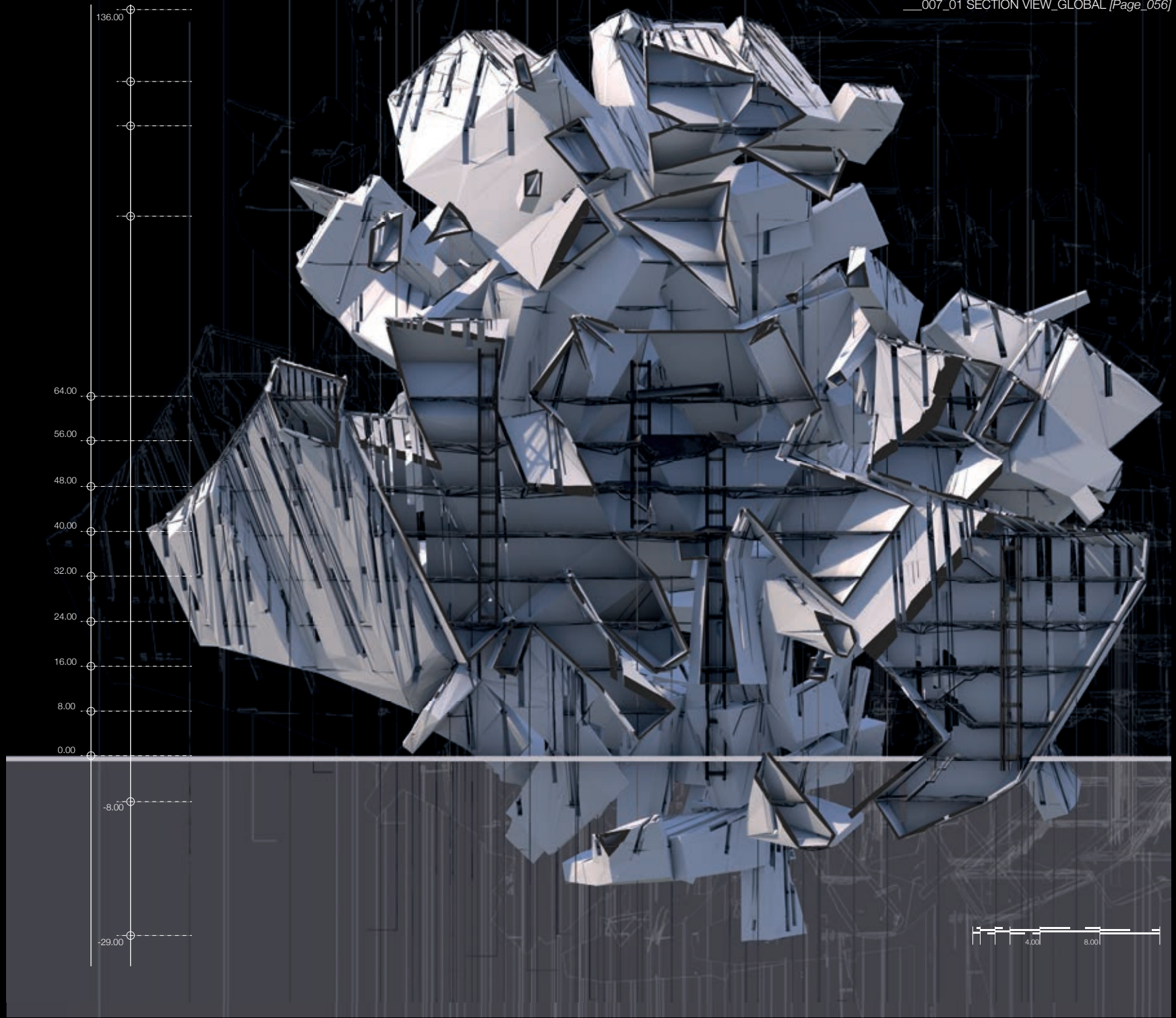


Iteration
Mesh face scale



Iteration
Mesh face scale




136.00
64.00
56.00
48.00
40.00
32.00
24.00
16.00
8.00
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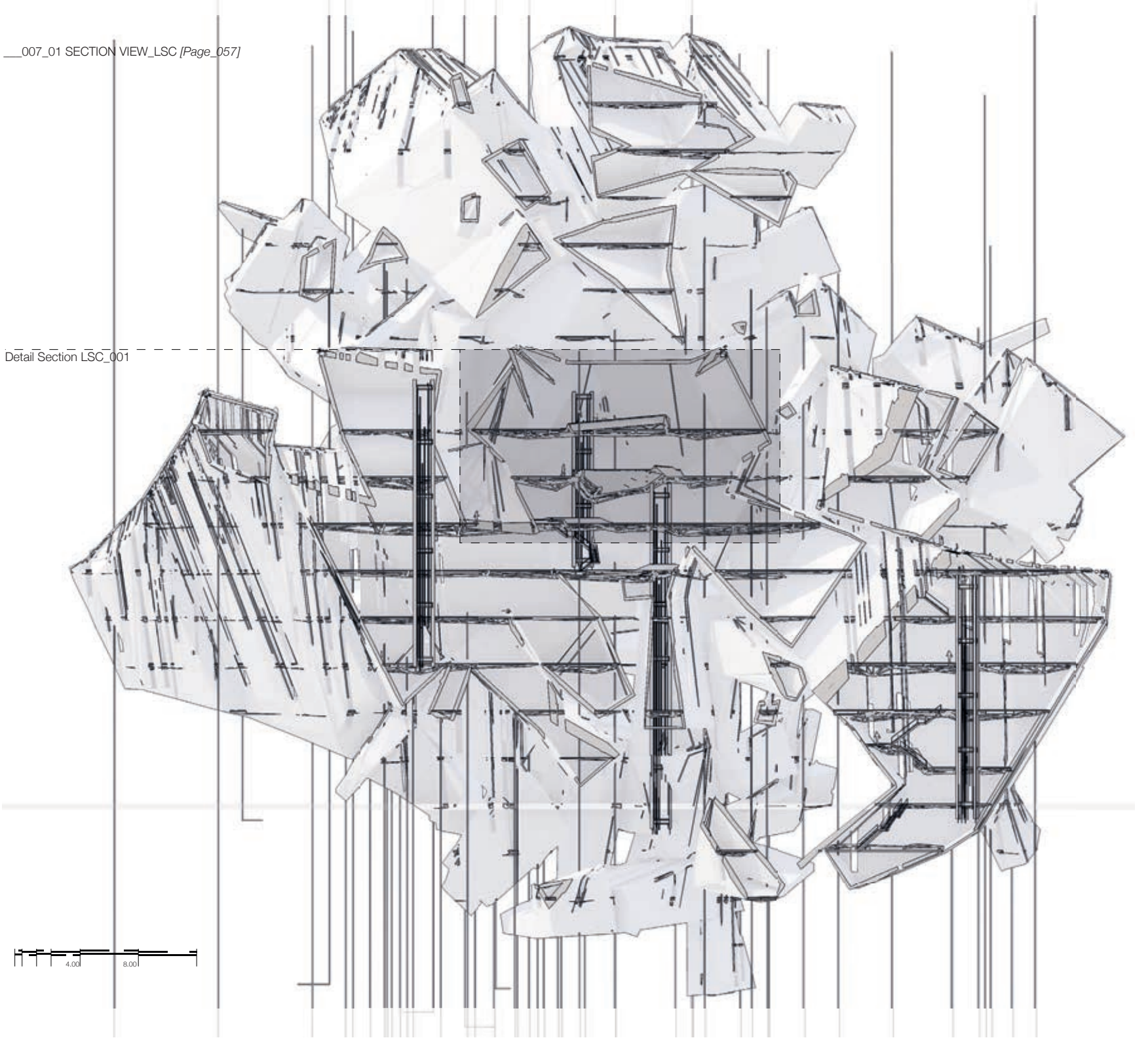
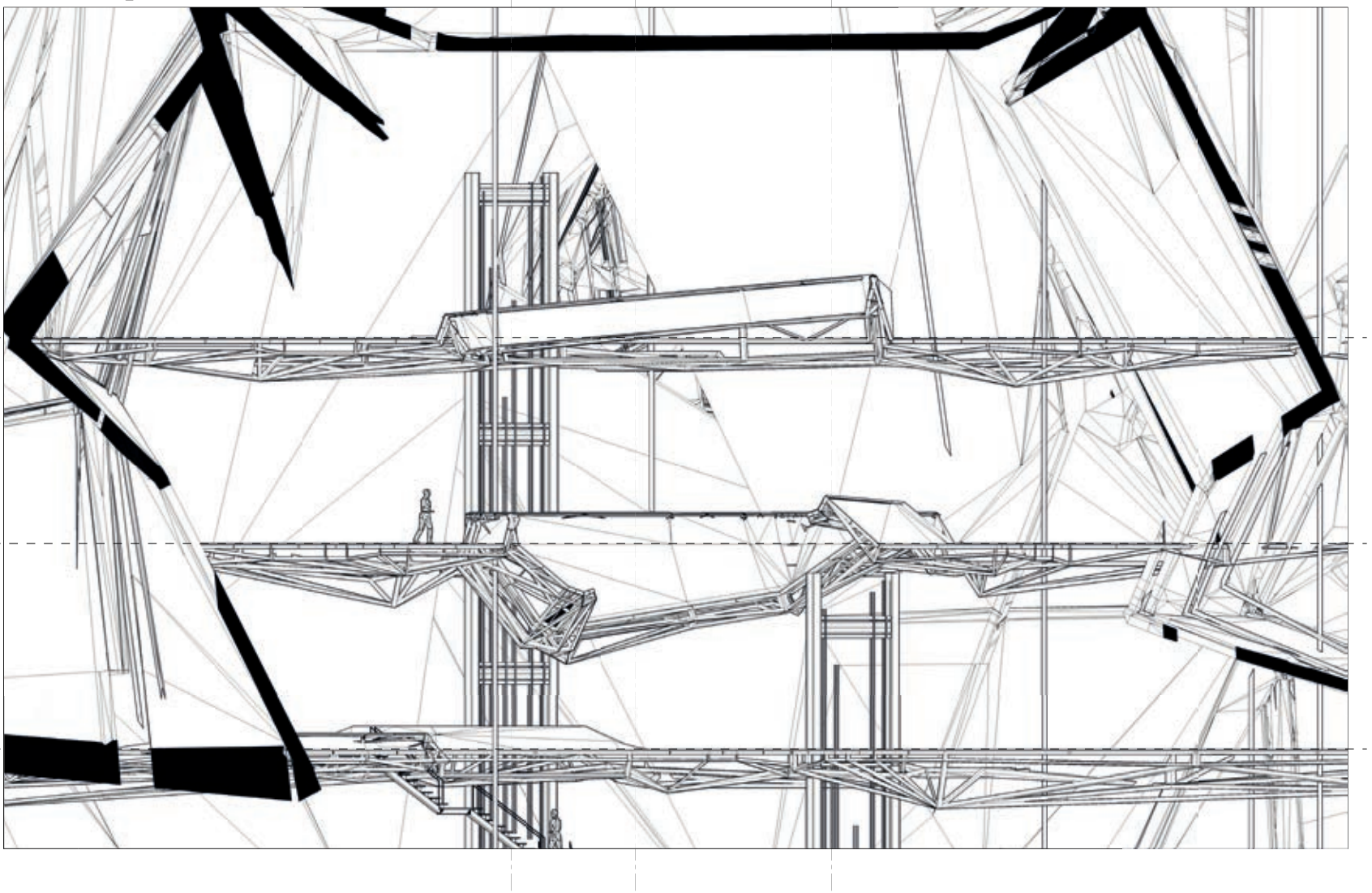
-8.00
-29.00
4.00
8.00

___007_01 SECTION VIEW_LSC *[Page_057]*

Detail Section LSC_001

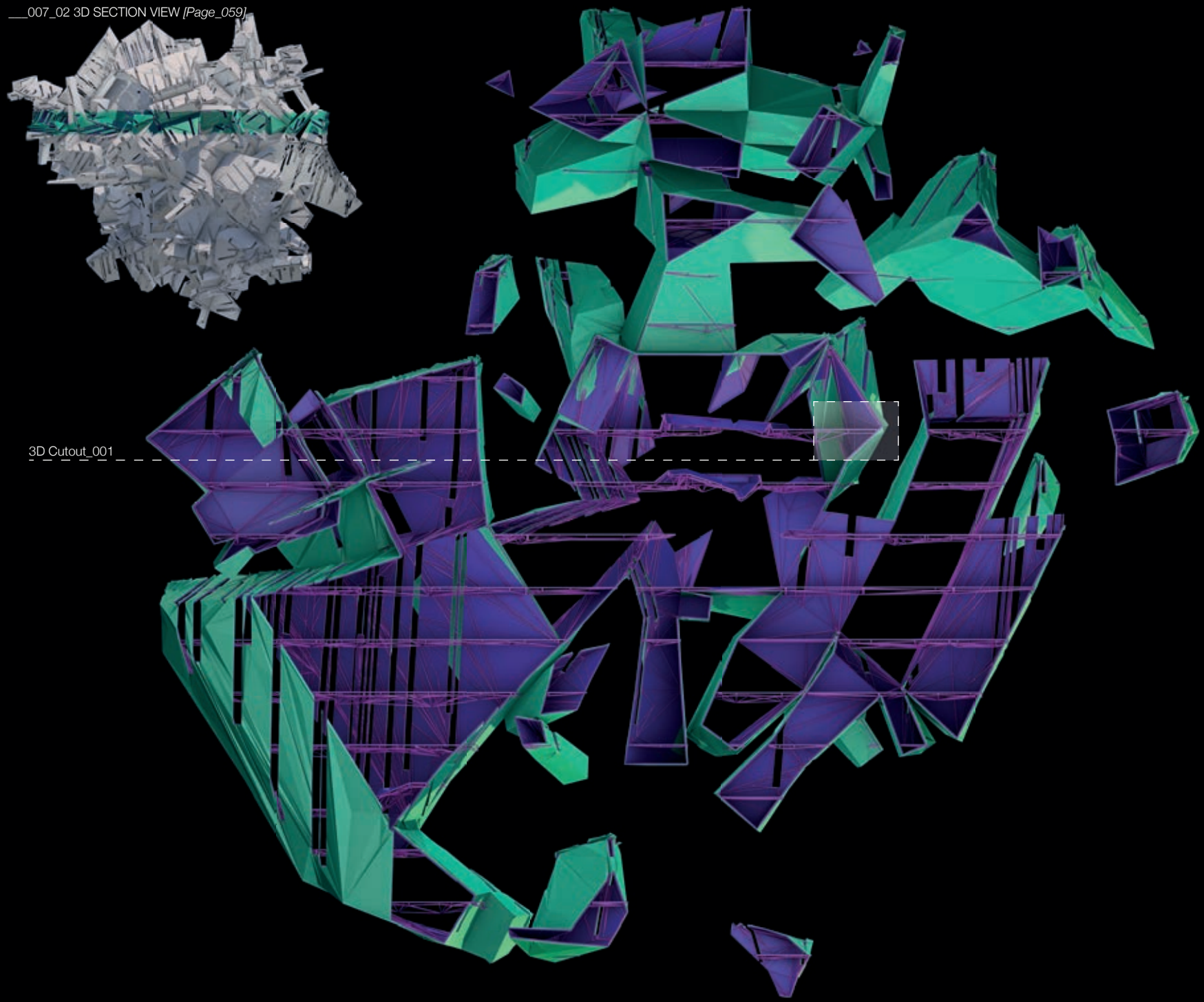


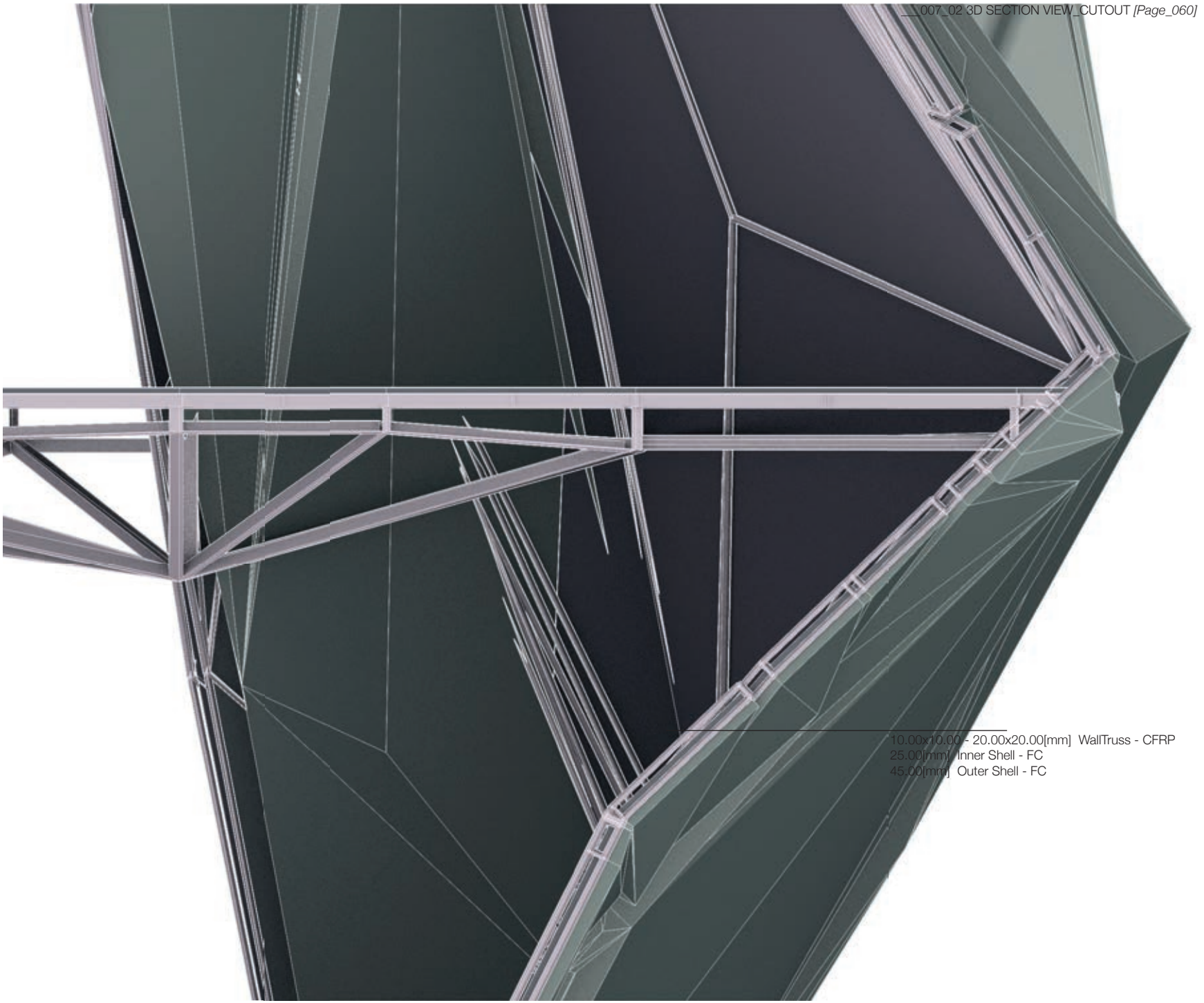
Detail Section LSC_001



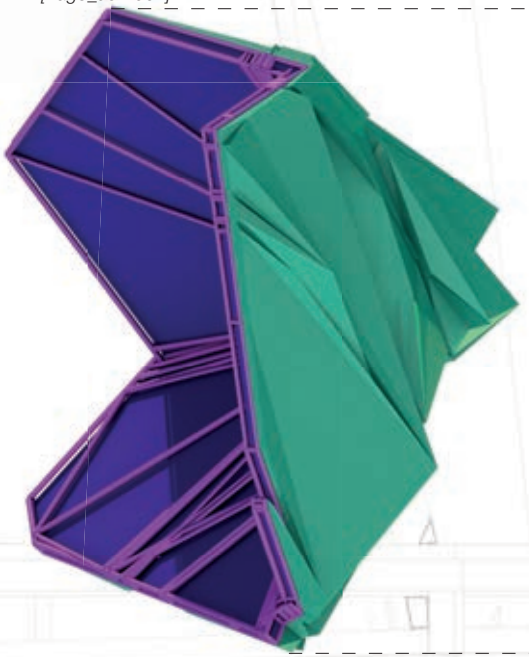
1.00 2.00 4.00

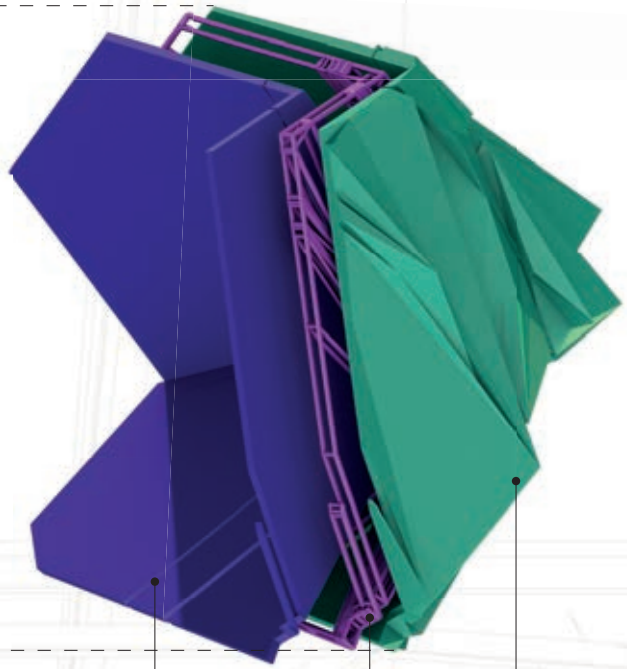
___007_02 3D SECTION VIEW *[Page_059]*





10.00x10.00 - 20.00x20.00[mm] WallTruss - CFRP
25.00[mm] Inner Shell - FC
45.00[mm] Outer Shell - FC





Floor system as shown in ___007_06 FLOOR SYSTEM

Inner shell{wall} out of fiber composite material extruded and grown on base of the wall support truss.

The wall support truss acts as a statical precursor for the following wall building process.
The truss also acts as a extended vein system to transport nourishment to the building spot. At the building spot, the truss extrudes material and forces a overgrow of itself.

The biomechanical vein network acts as a decentralized support for the facade and wall construction all around on the nucleus.
Through the decentralized arrangement of the vein system the nucleus is able to develop itself continuously on several sides at the same time. If more nourishment is needed on a specific side, the vein system is able to react fast and aggregate more veins.
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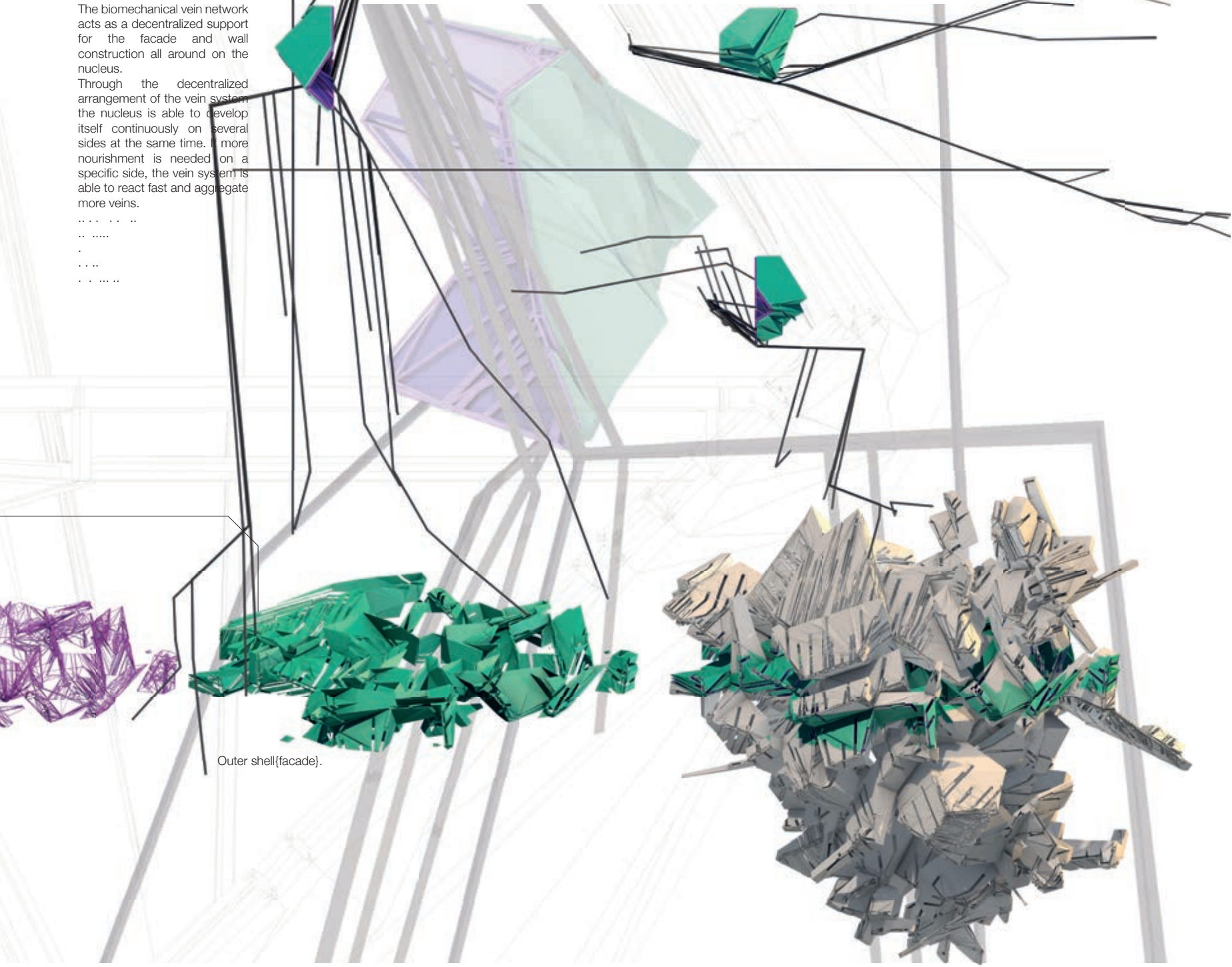

Outer shell{facade}.

Section diagram about the inside constellation of a 1500 iterations grown nucleus.
The levels are coloured depending on their function and privacay setting. The inside constellation of spaces follows the scatterd outside impression. Space shapes continuously change from entrance halls to private rooms to hidden spots and otherwise.
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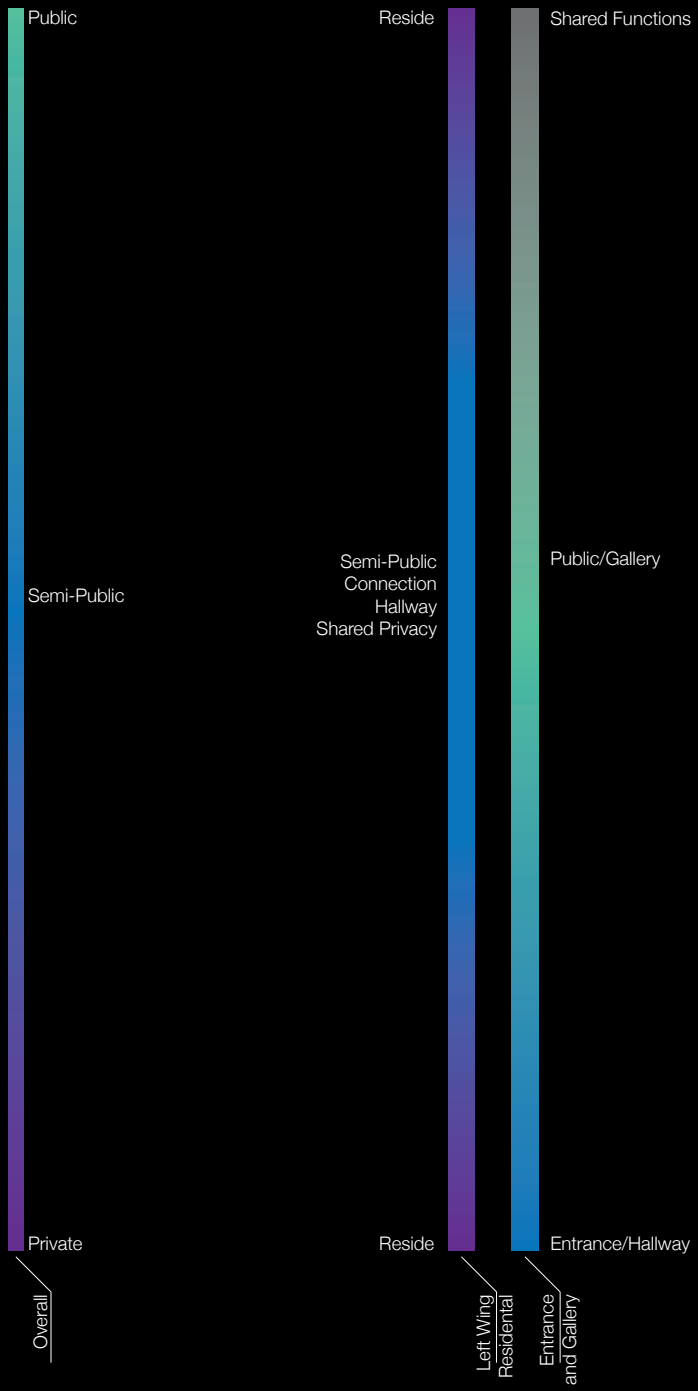
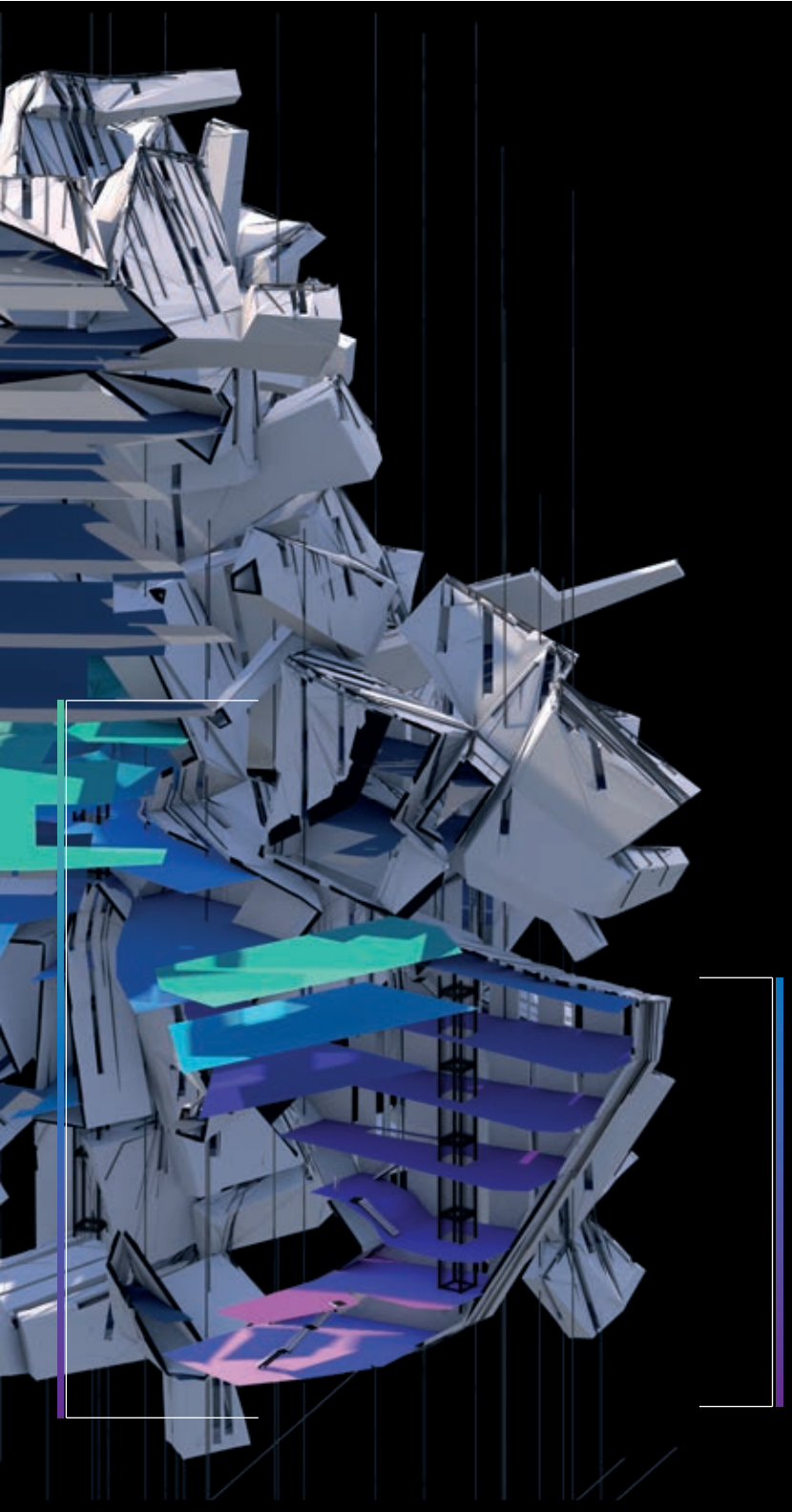
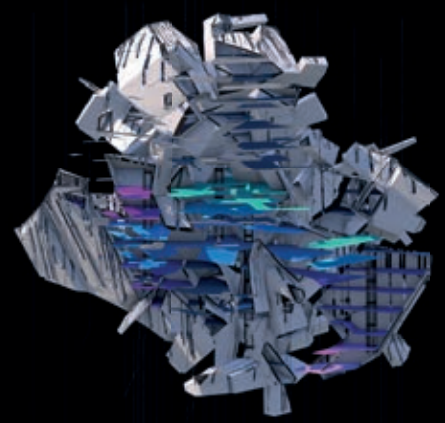


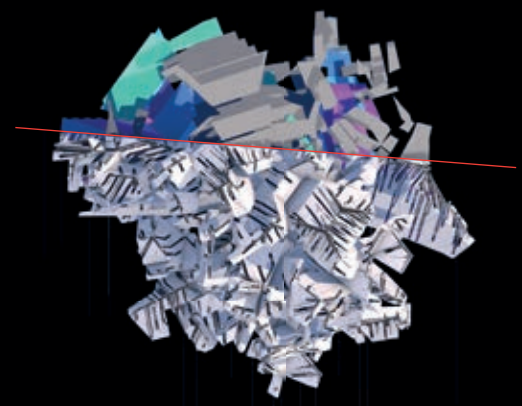


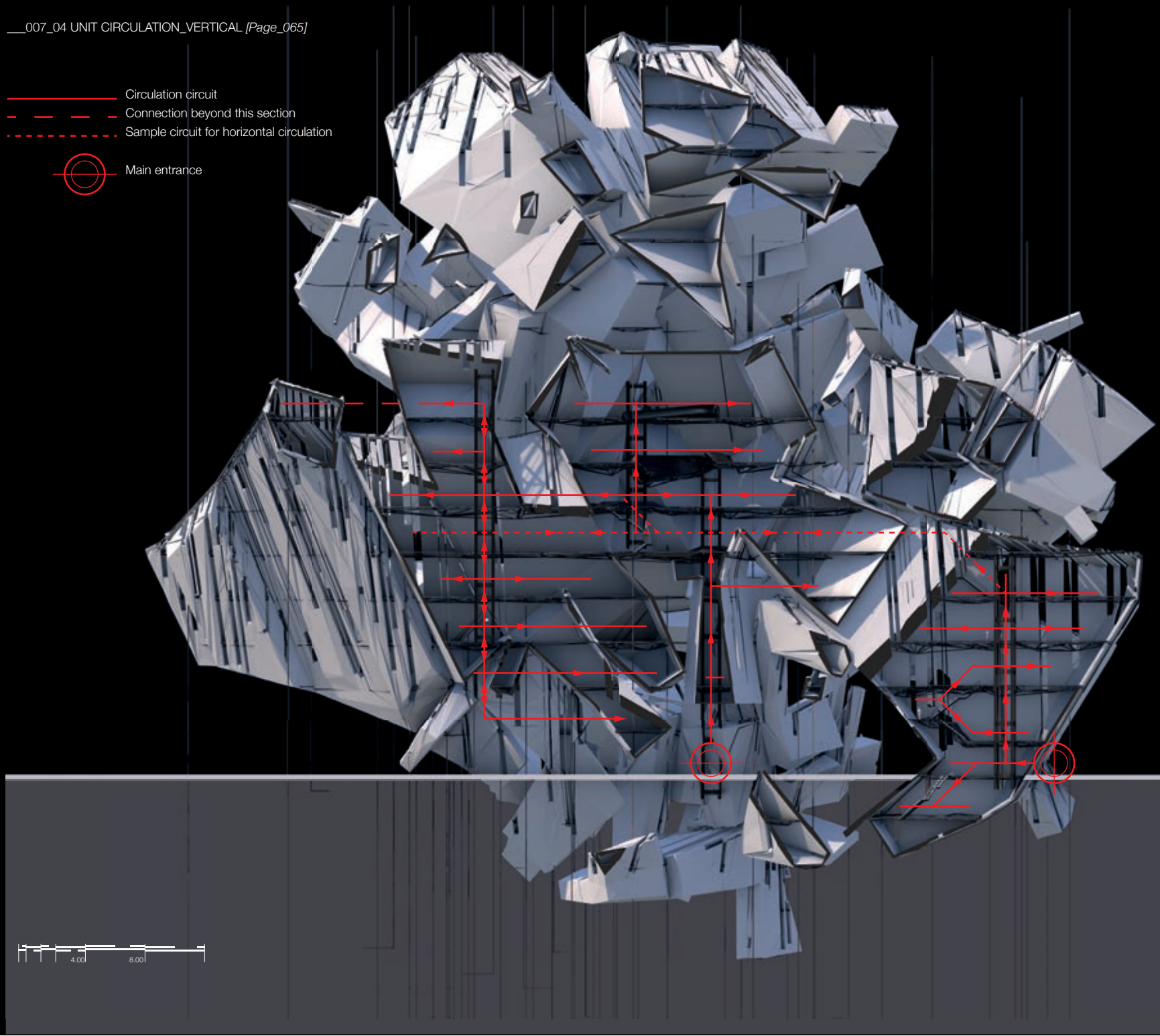
Connection/Hallway

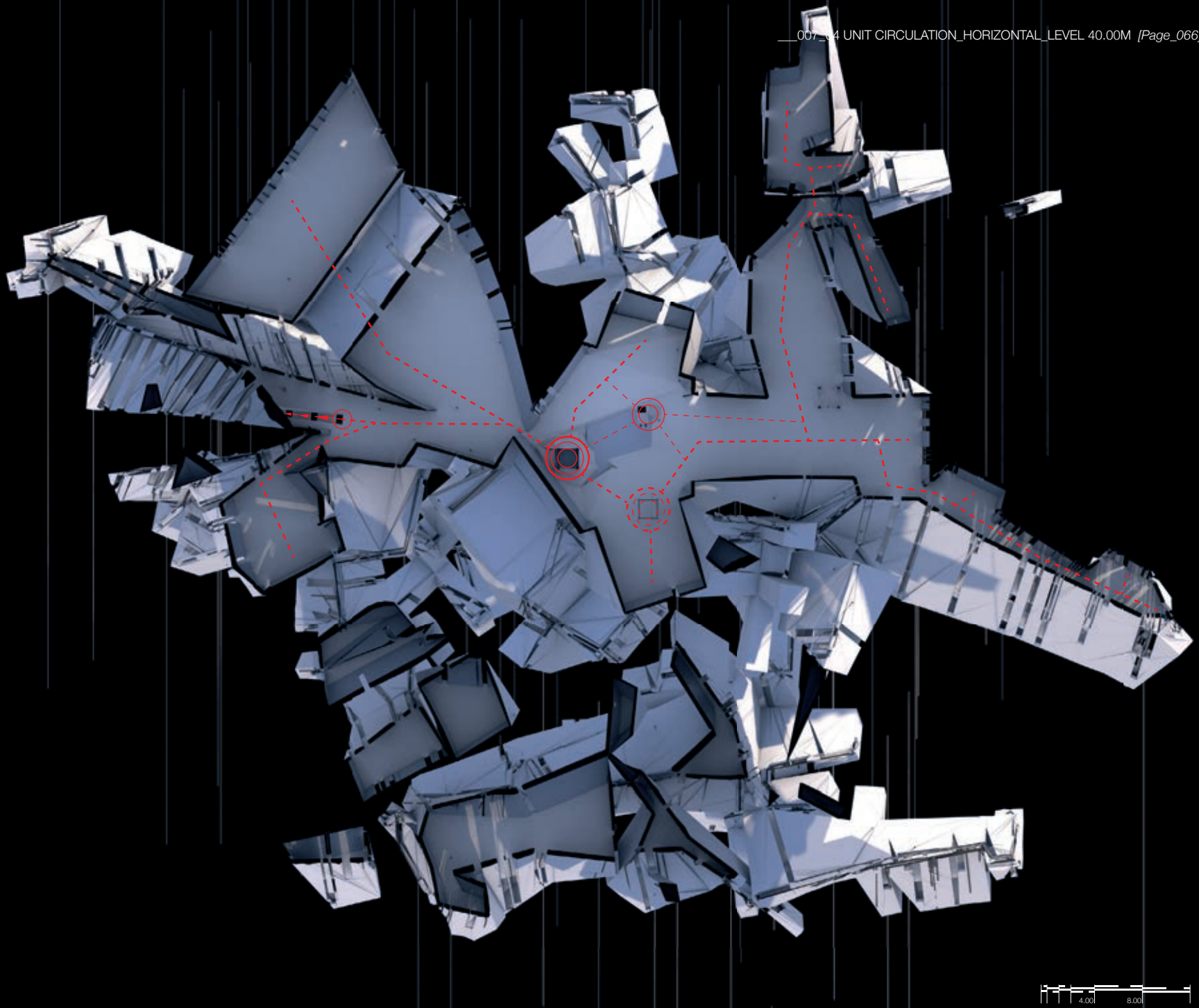
Full Privacy

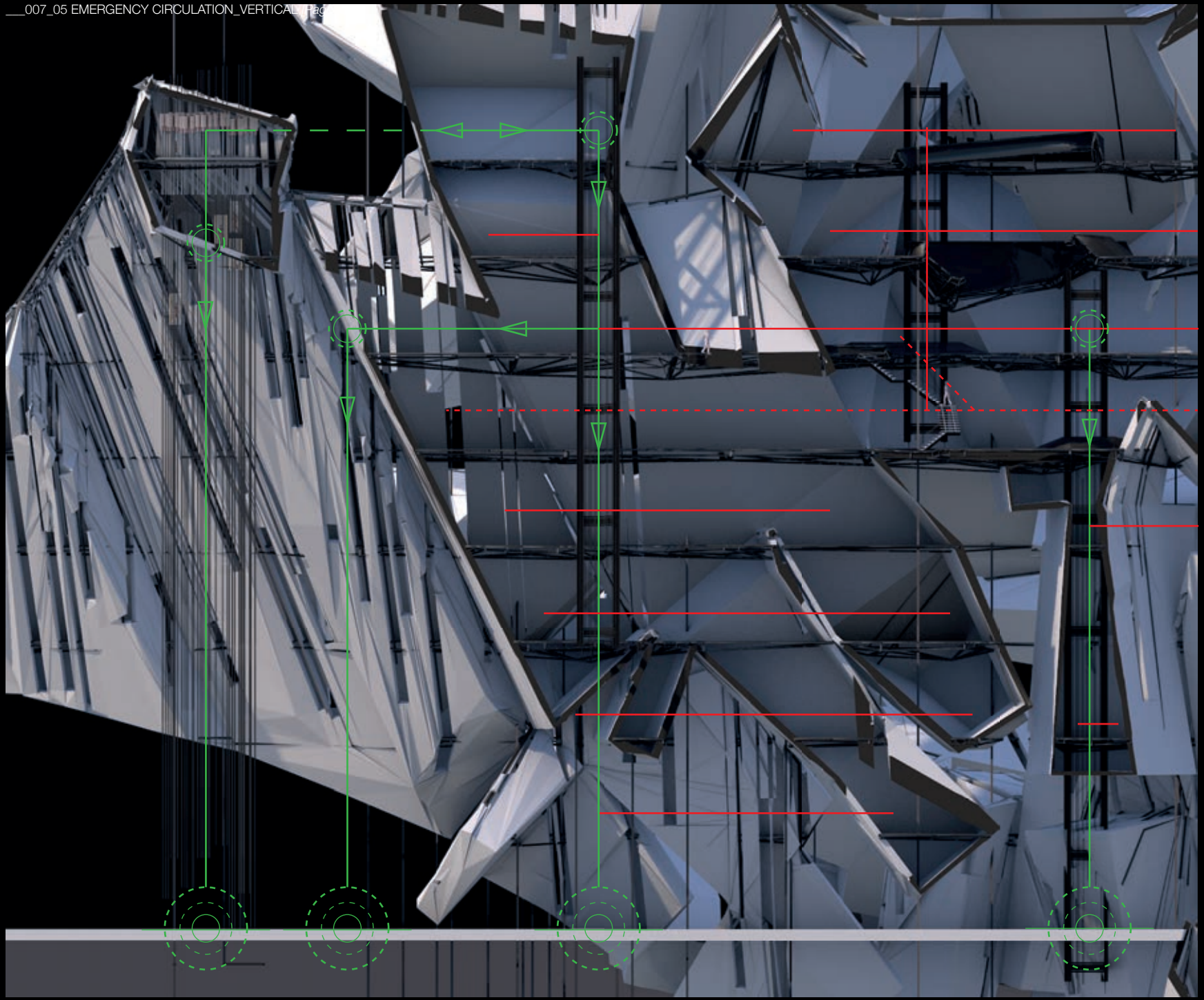
Right Wing
Residental

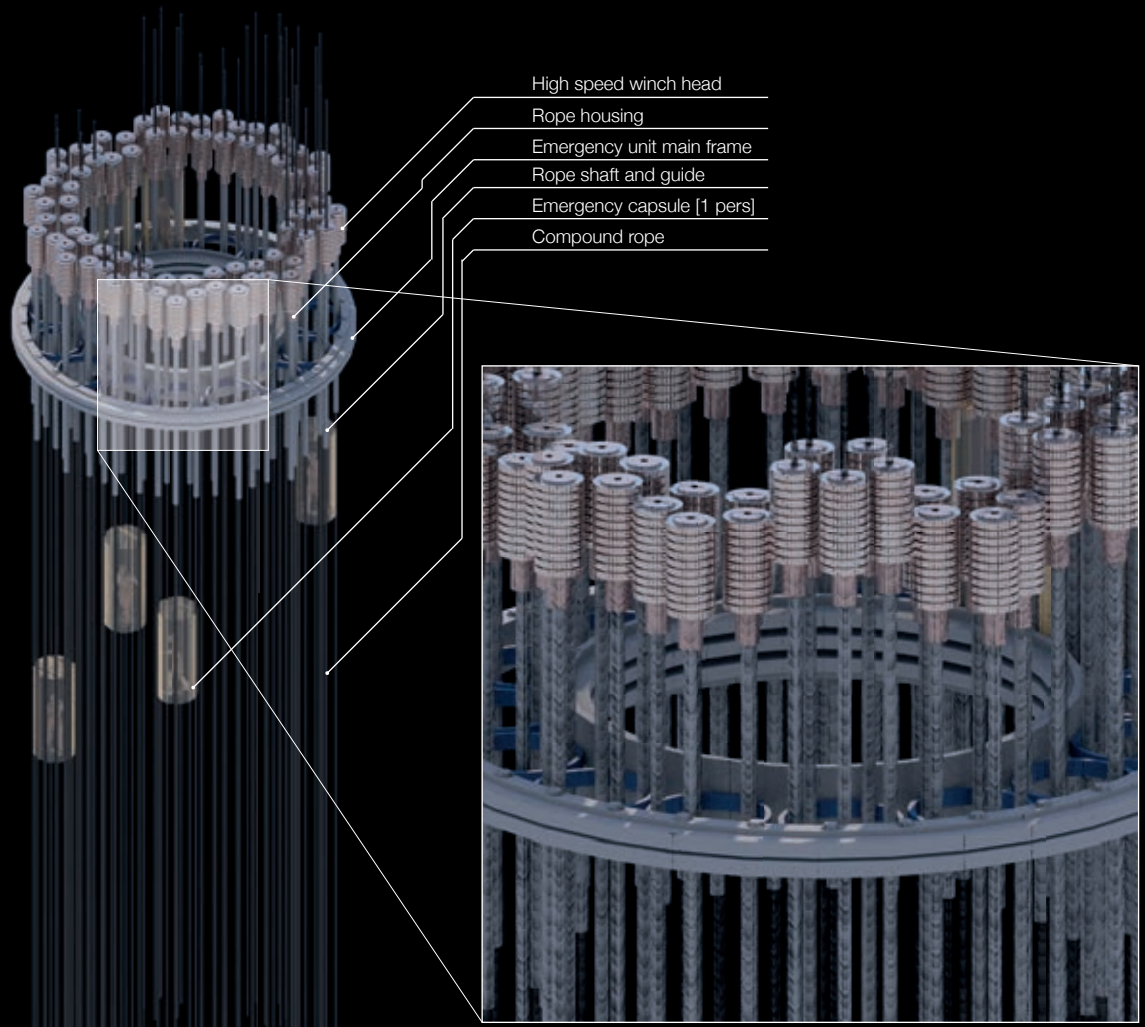


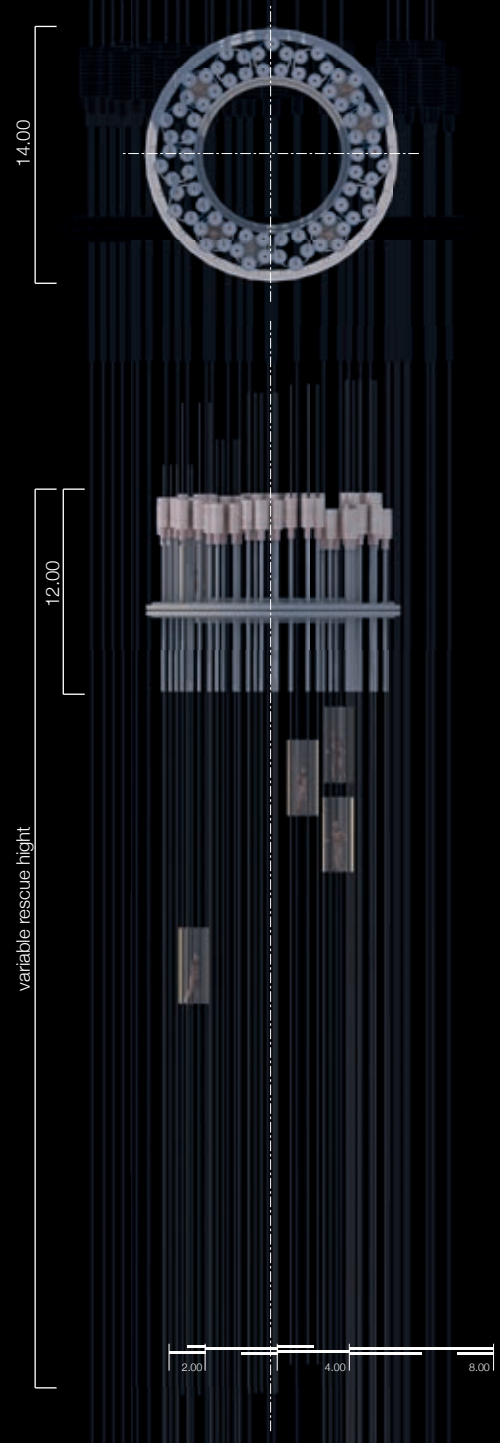



Circulation circuit
Connection beyond this section
Sample circuit for horizontal circulation
Main entrance
4.00
8.00


4.00
8.00







Circulation circuit

Emergency route to launcher

Emergency connection beyond this section

Emergency launcher entry

Outside landing spot

Self supporting floor system based on load calculation over the floor span.

A lightweight spaceframe floor under - construction enables each floor to support itself. The spaceframe for each floor is calculated with standard mass distribution over its span.

The calculation is based on FEM and a automation process to generate the truss connections and to keep the strut dimensions at a minimum.
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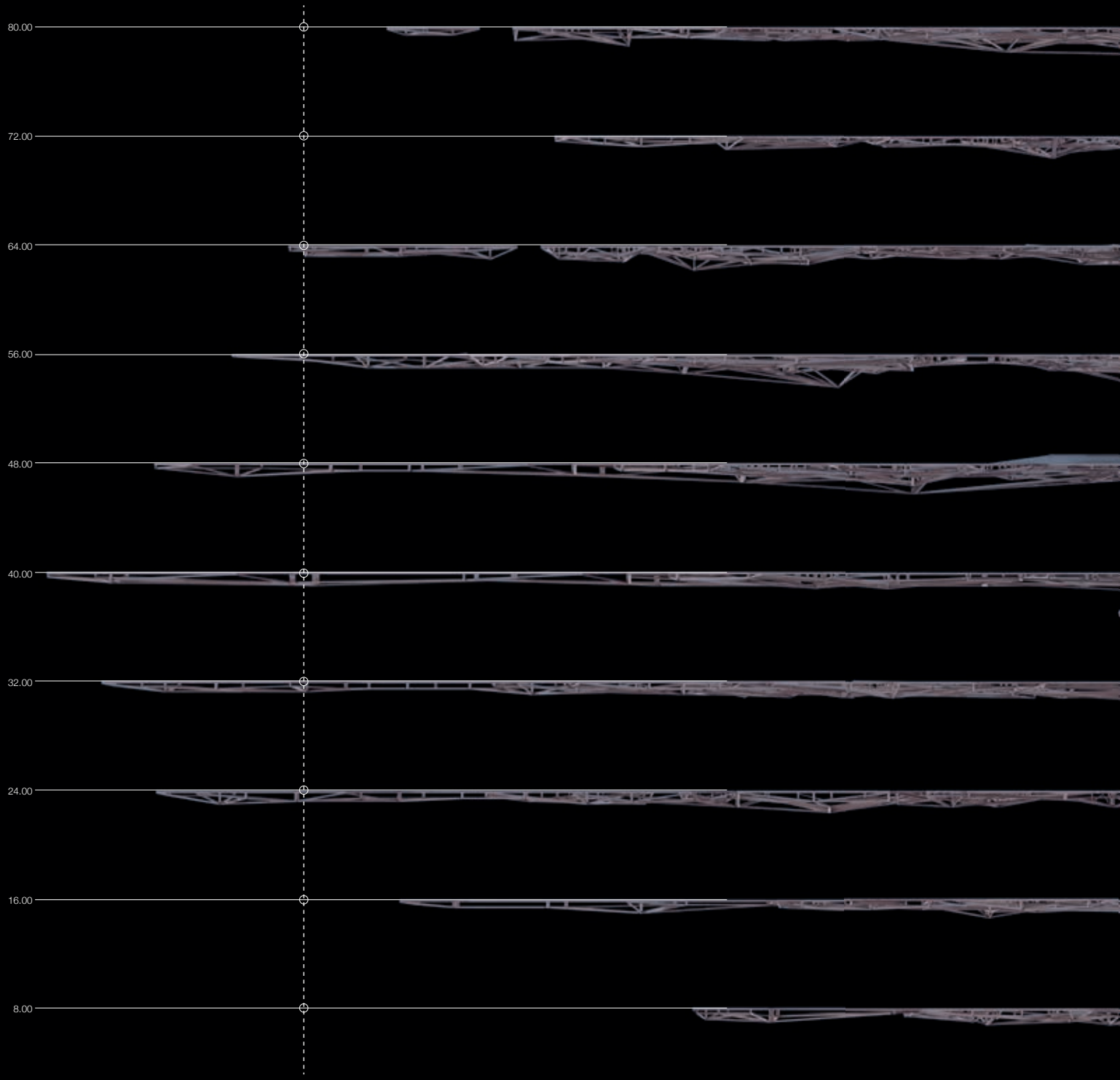


2.00
4.00

Floor bottom view from the height level of 64.00m with gallery opening.
The spaceframe encloses the whole floor. Truss and strut dimensions vary with the floor range and span direction.
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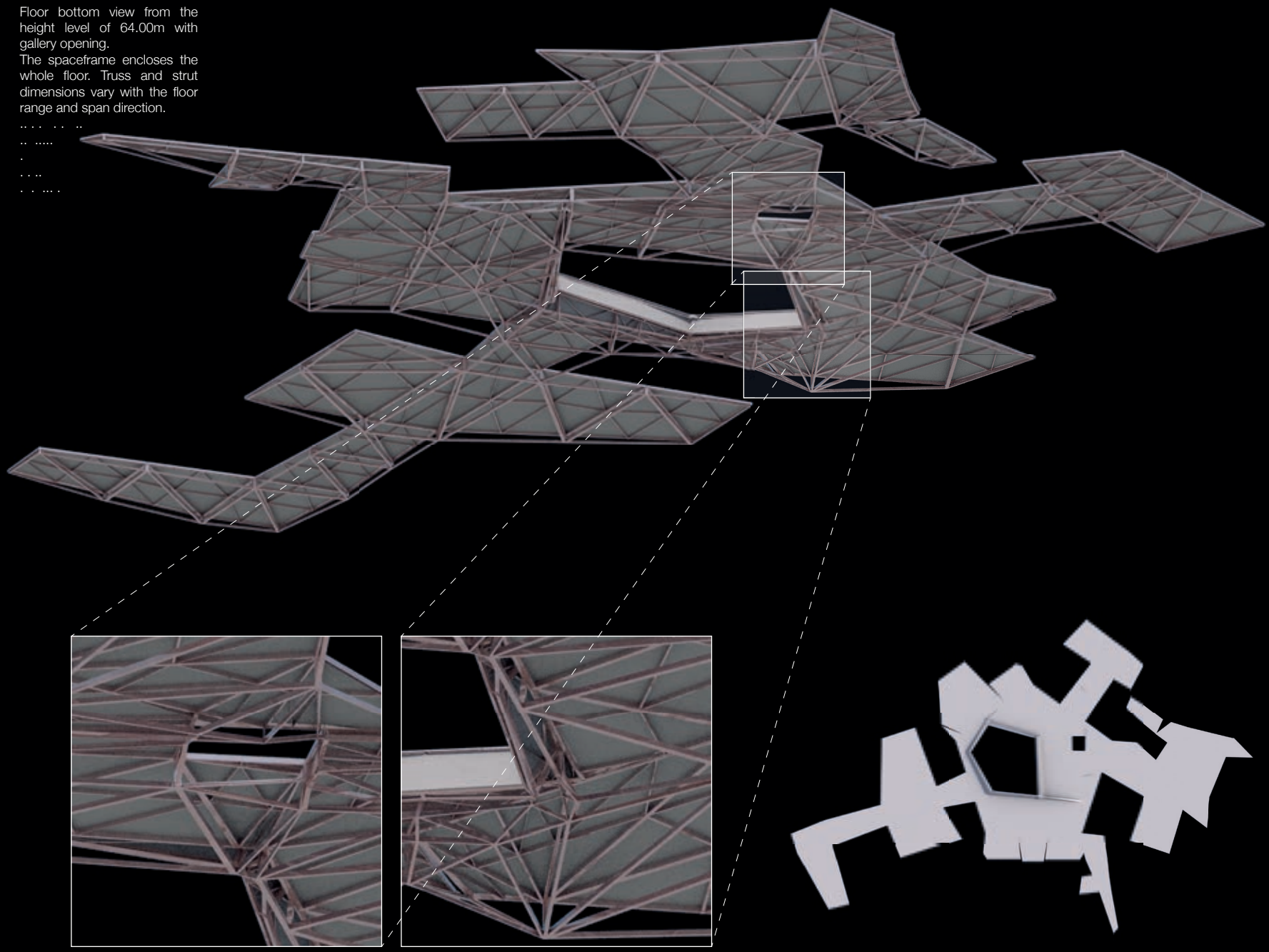
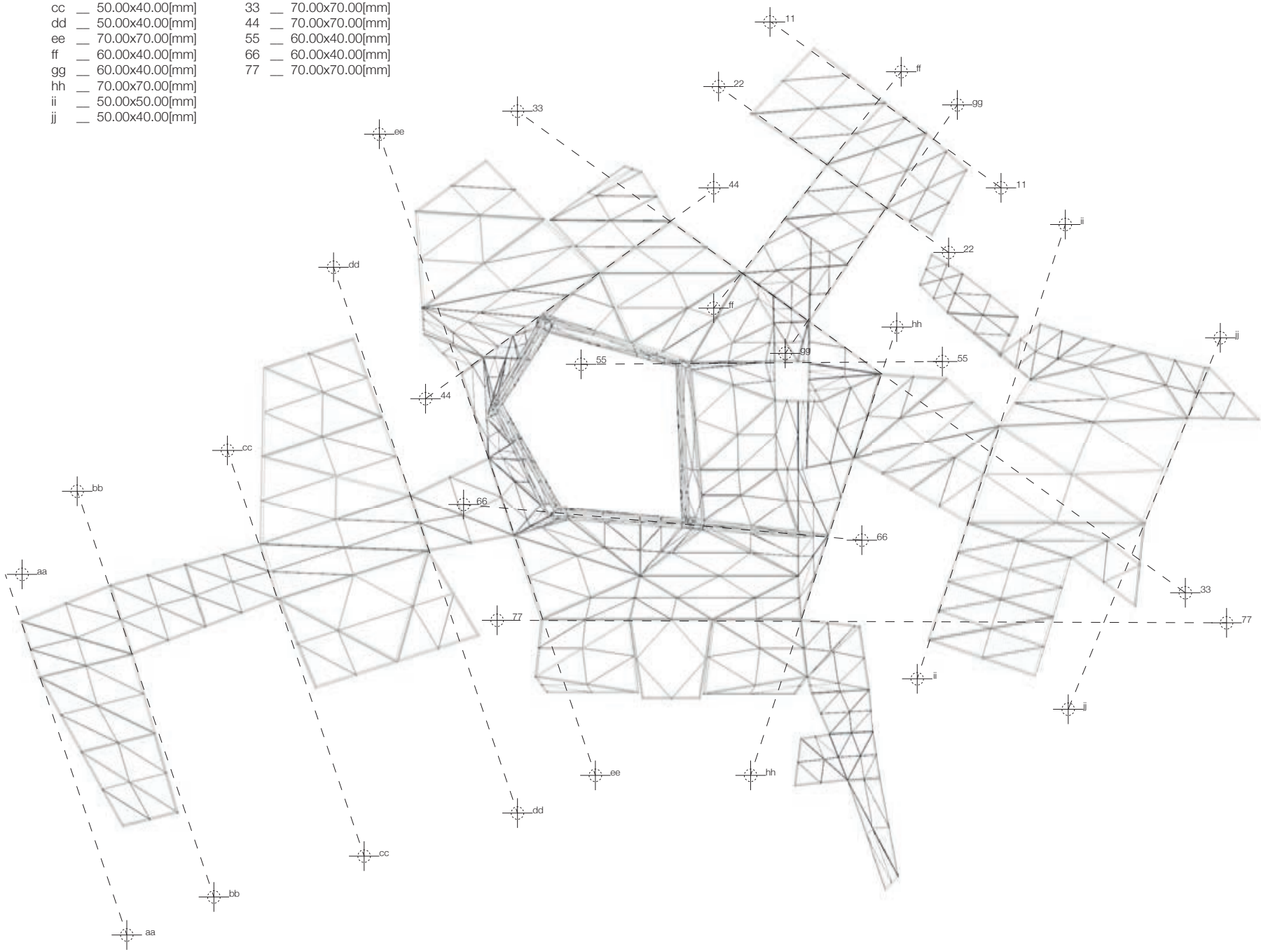
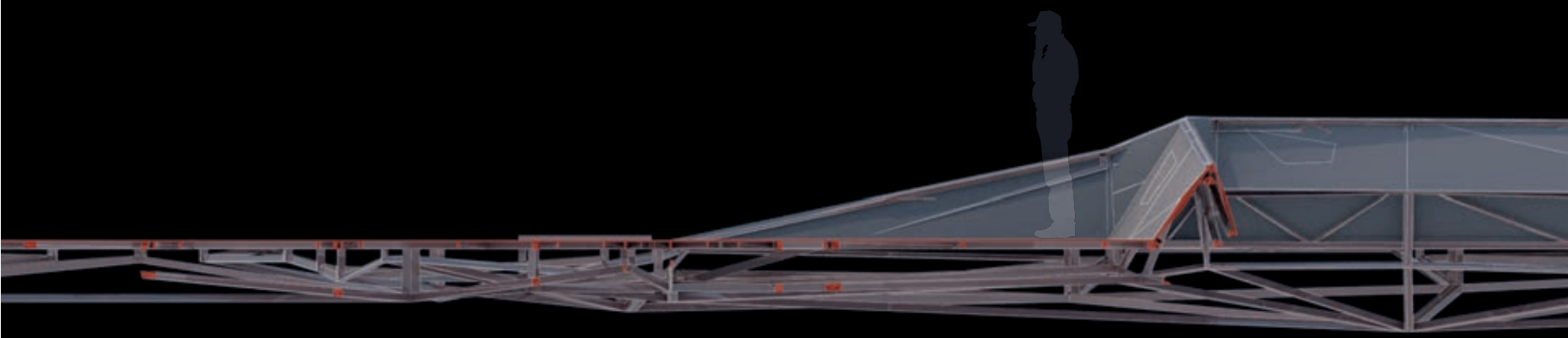
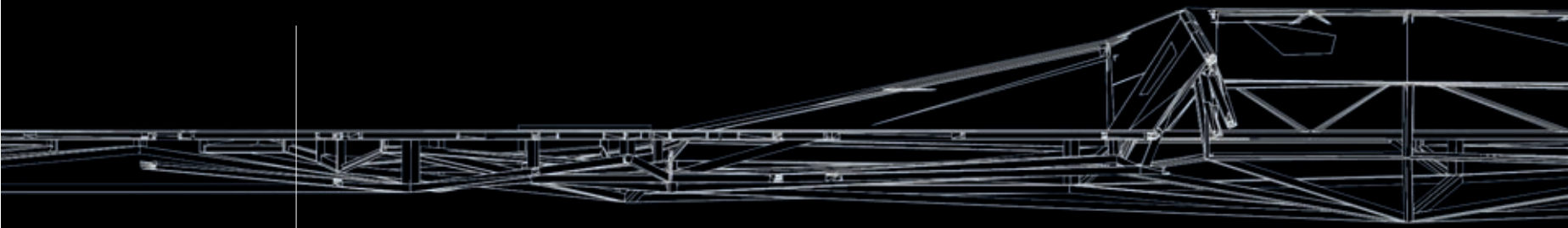


aa __ 50.00x50.00[mm]
bb __ 50.00x50.00[mm]
cc __ 50.00x40.00[mm]
dd __ 50.00x40.00[mm]
ee __ 70.00x70.00[mm]
ff __ 60.00x40.00[mm]
gg __ 60.00x40.00[mm]
hh __ 70.00x70.00[mm]
ii __ 50.00x50.00[mm]
jj __ 50.00x40.00[mm]

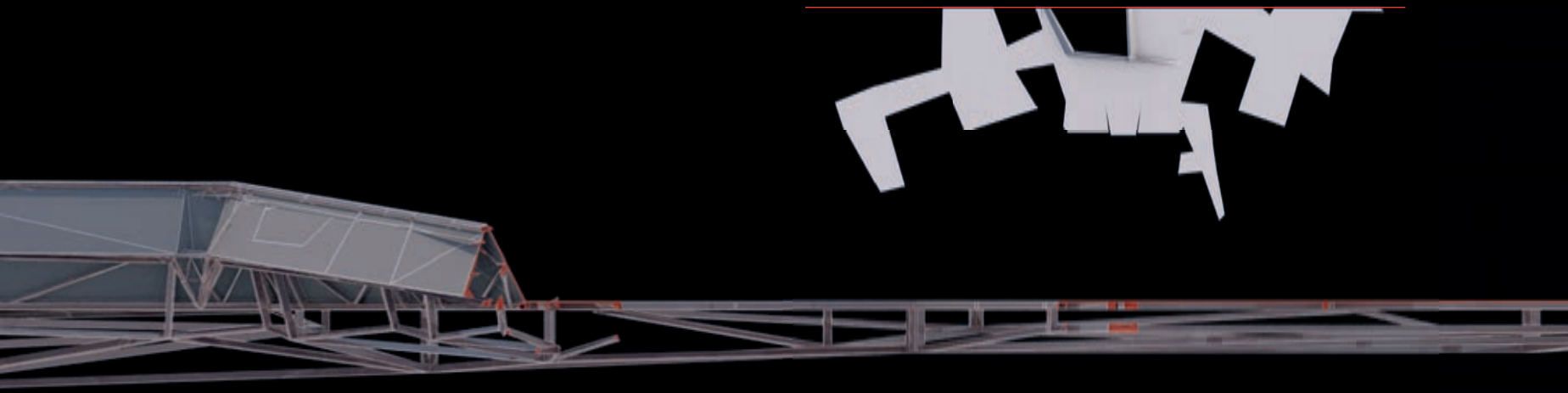
11 __ 50.00x50.00[mm]
22 __ 50.00x40.00[mm]
33 __ 70.00x70.00[mm]
44 __ 70.00x70.00[mm]
55 __ 60.00x40.00[mm]
66 __ 60.00x40.00[mm]
77 __ 70.00x70.00[mm]



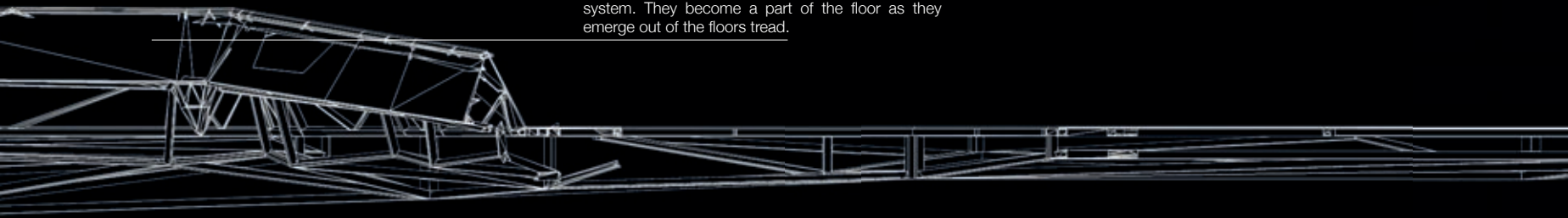




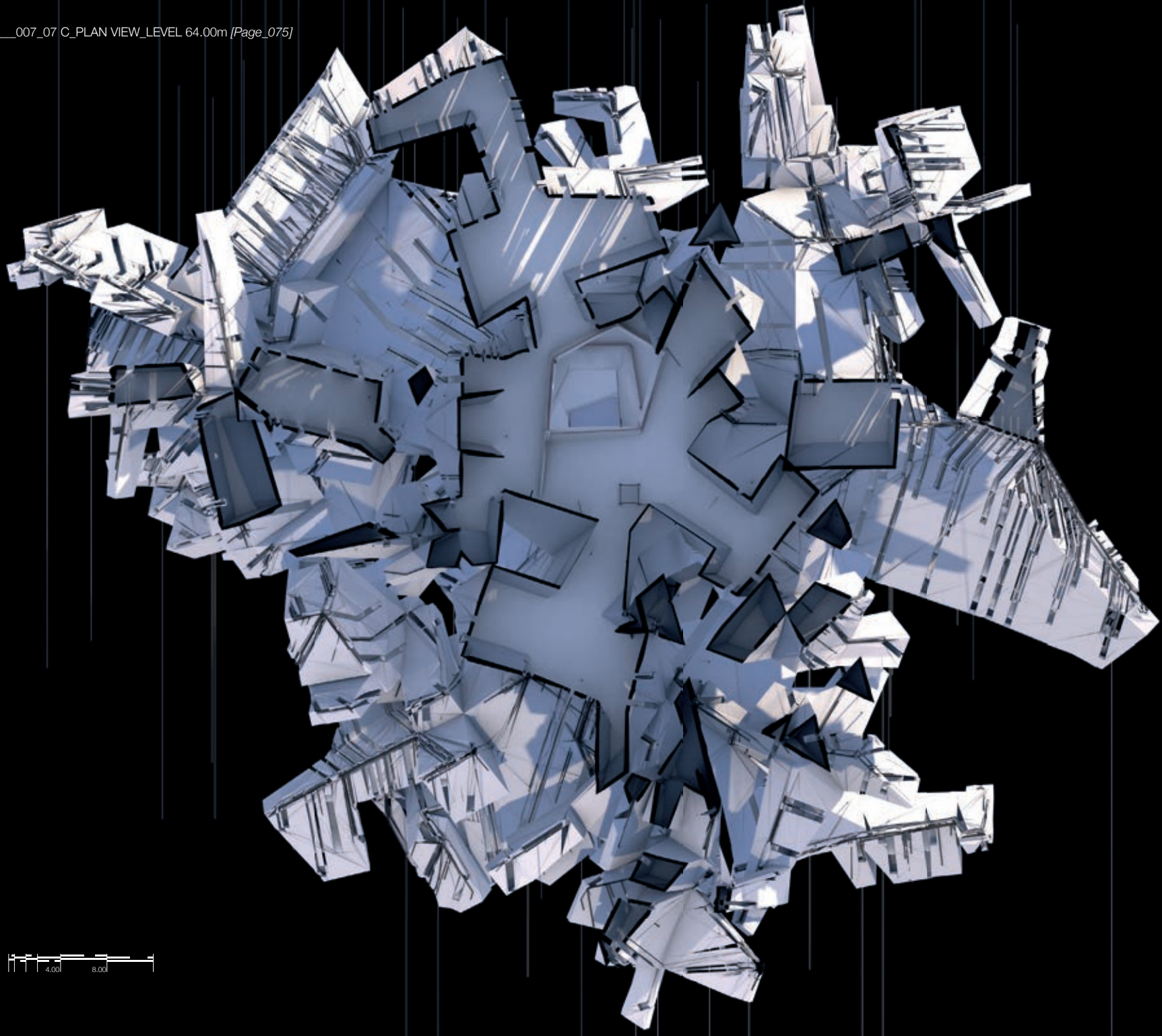
5.00[mm] Deck - Fiber Composite
20.00x50.00 - 70.00x70.00[mm] Main Truss - Carbon Fiber Reinforced Polymer
50.00x50.00[mm] Lower Truss Space Arrangement - Carbon Fiber Reinforced Polymer
20.00x20.00 - 50.00x50.00[mm] Bridging Truss Space Arrangement - Carbon Fiber Reinforced Polymer



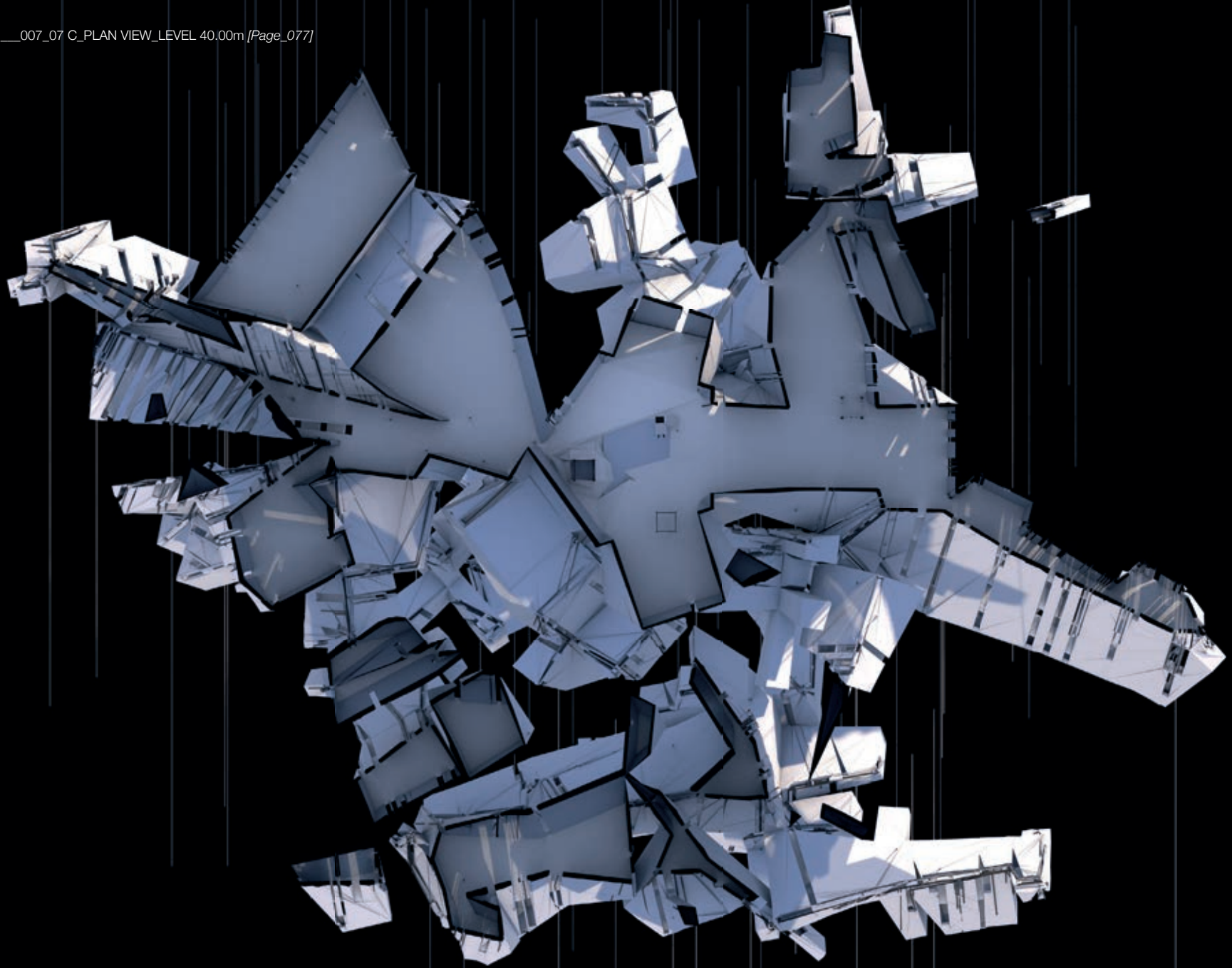
All handrails have a minimum hight of 1.00m across the nucleus. The handrails and fall protection at the ‚main gallery' are integrated in the floor statical system. They become a part of the floor as they emerge out of the floors tread.



___007_07 C_PLAN VIEW_LEVEL 64.00m *[Page_075]*



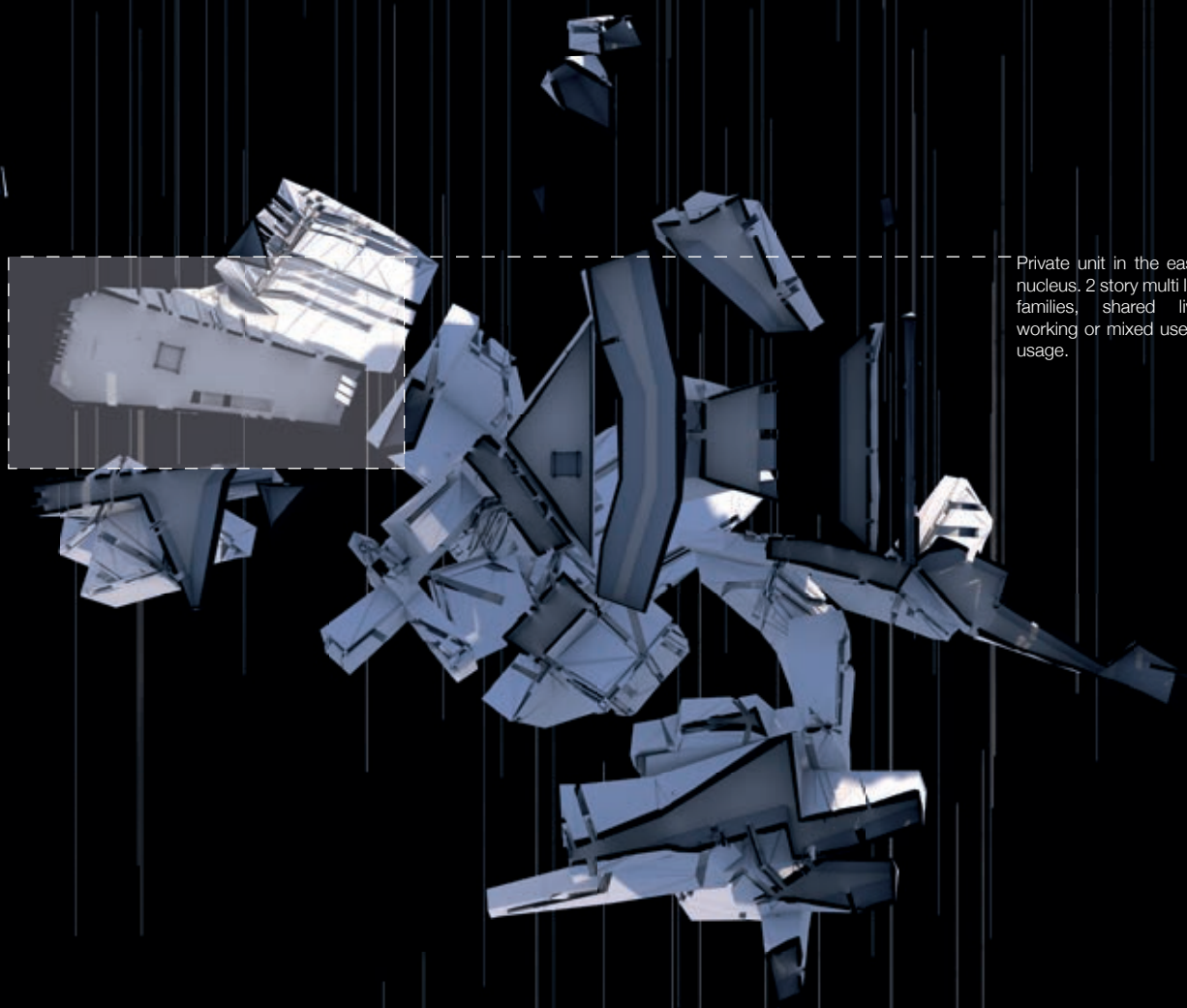

4.00
8.00


4.00
8.00

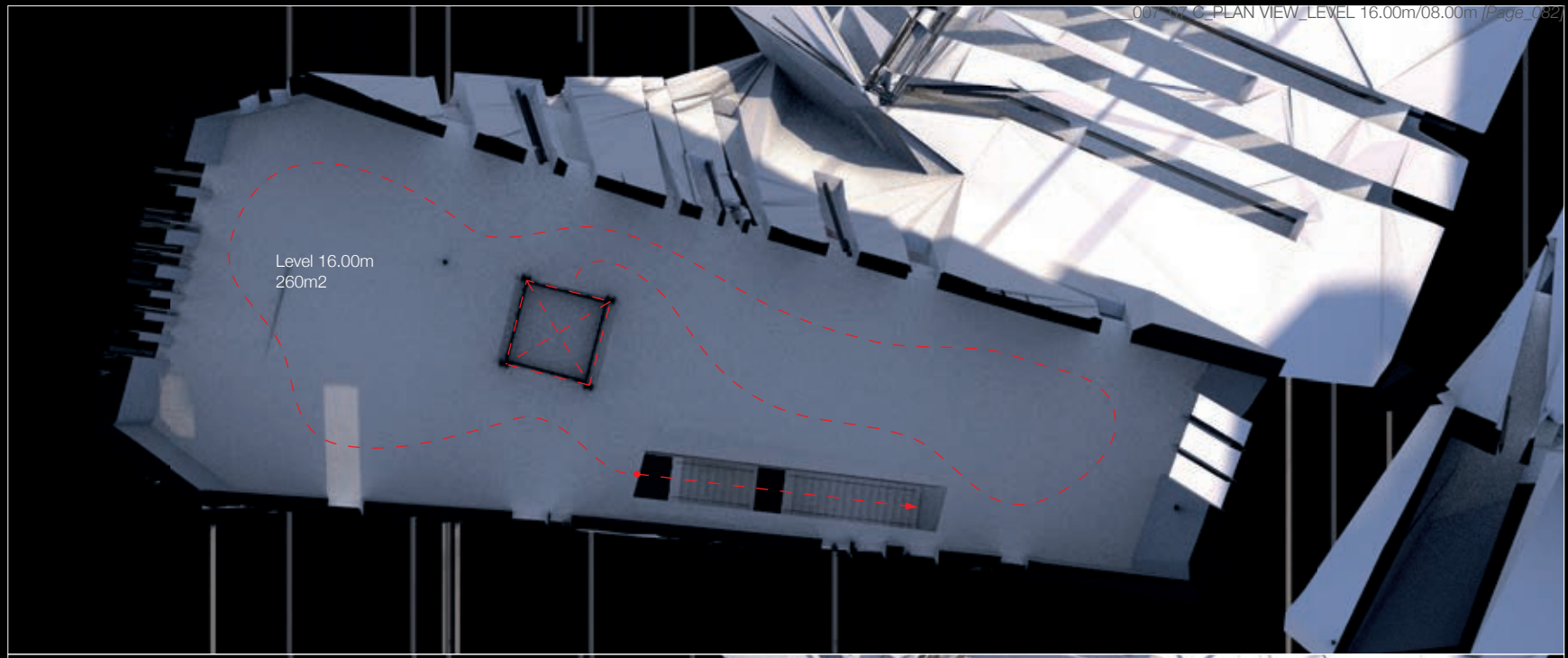
_01_1 Main Gallery
_01_2 Gallery Hallway
_01_3 Hallway
_02_1 Private Seperation
_02_2 Private Room
_02_3 Private Room
_03_1 Open Seperation Room
_03_2 Private Seperation Room
_04_1 Hallway
_05_1 Auditorium/Mixed Use
_06_1 Office Room
_06_2 Private Office Room

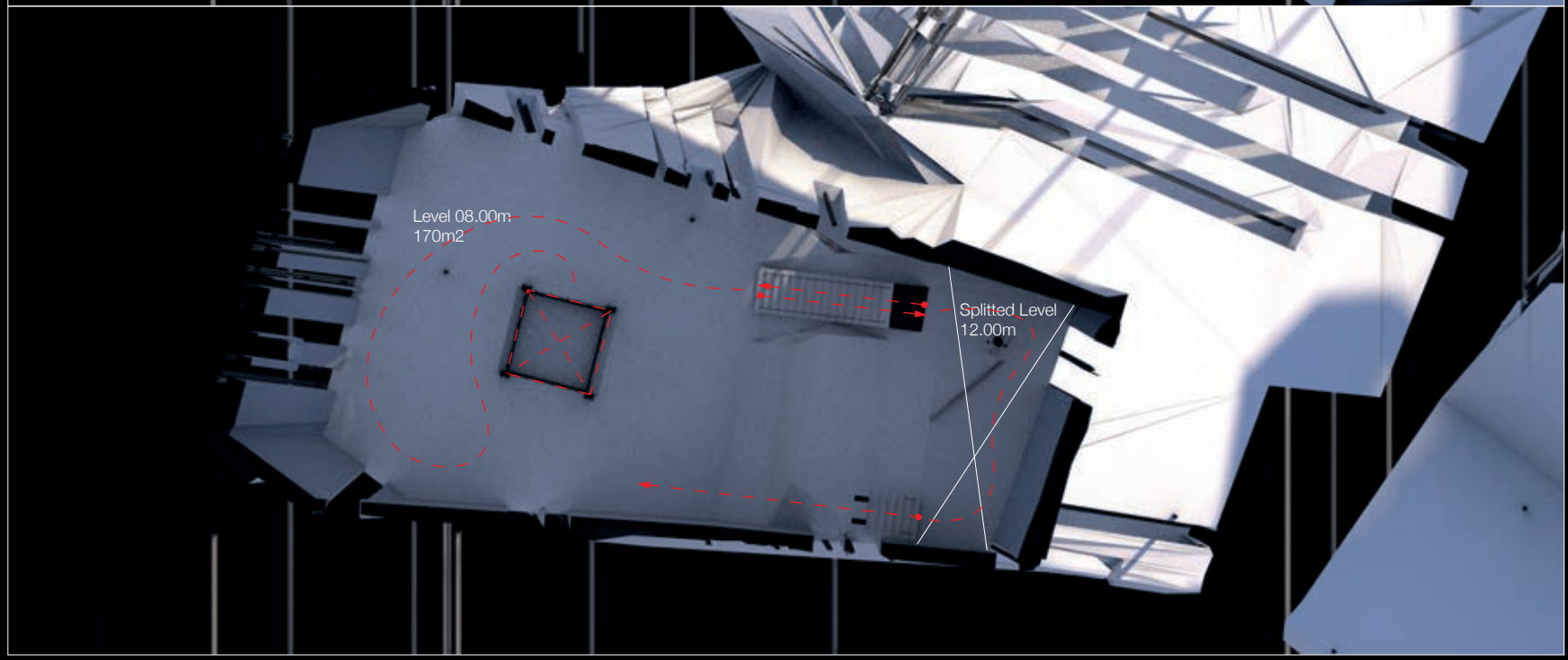

2.00
8.00

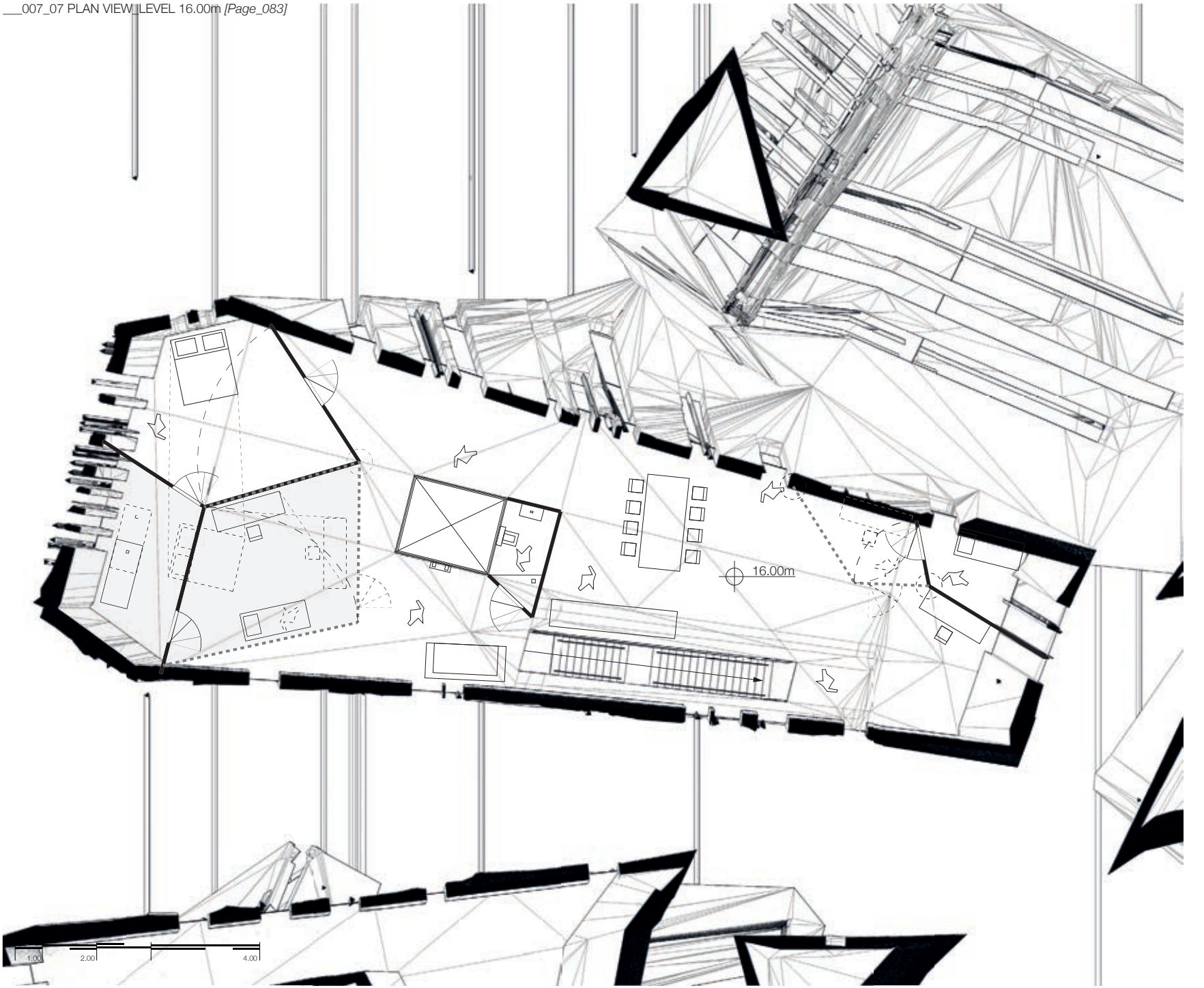

2.00
4.00
8.00

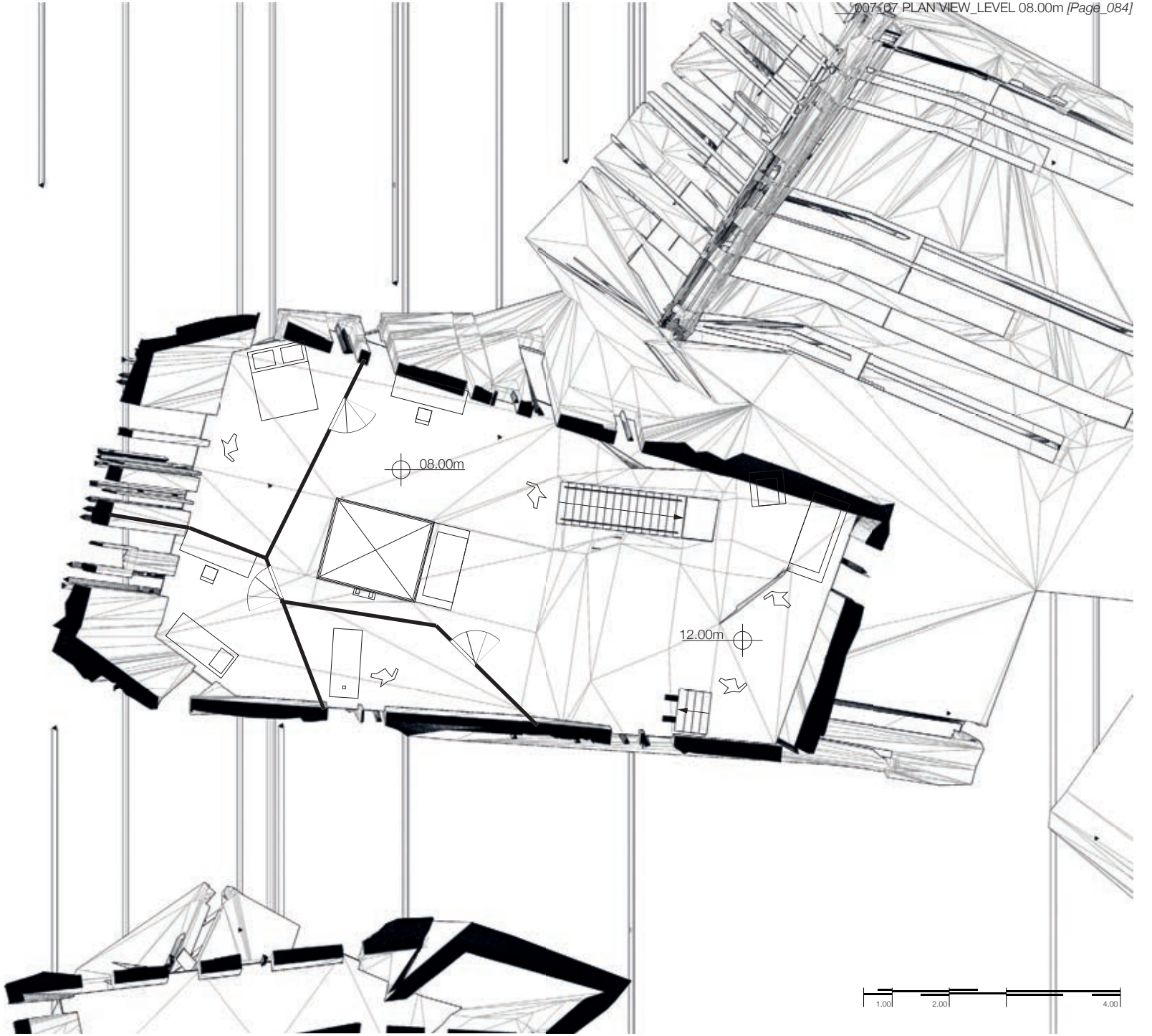


Private unit in the east wing of the nucleus. 2 story multi level habitat for families, shared living, shared working or mixed use without office usage.


Level 16.00m
260m2


Level 08.00m
170m2
Splitted Level
12.00m

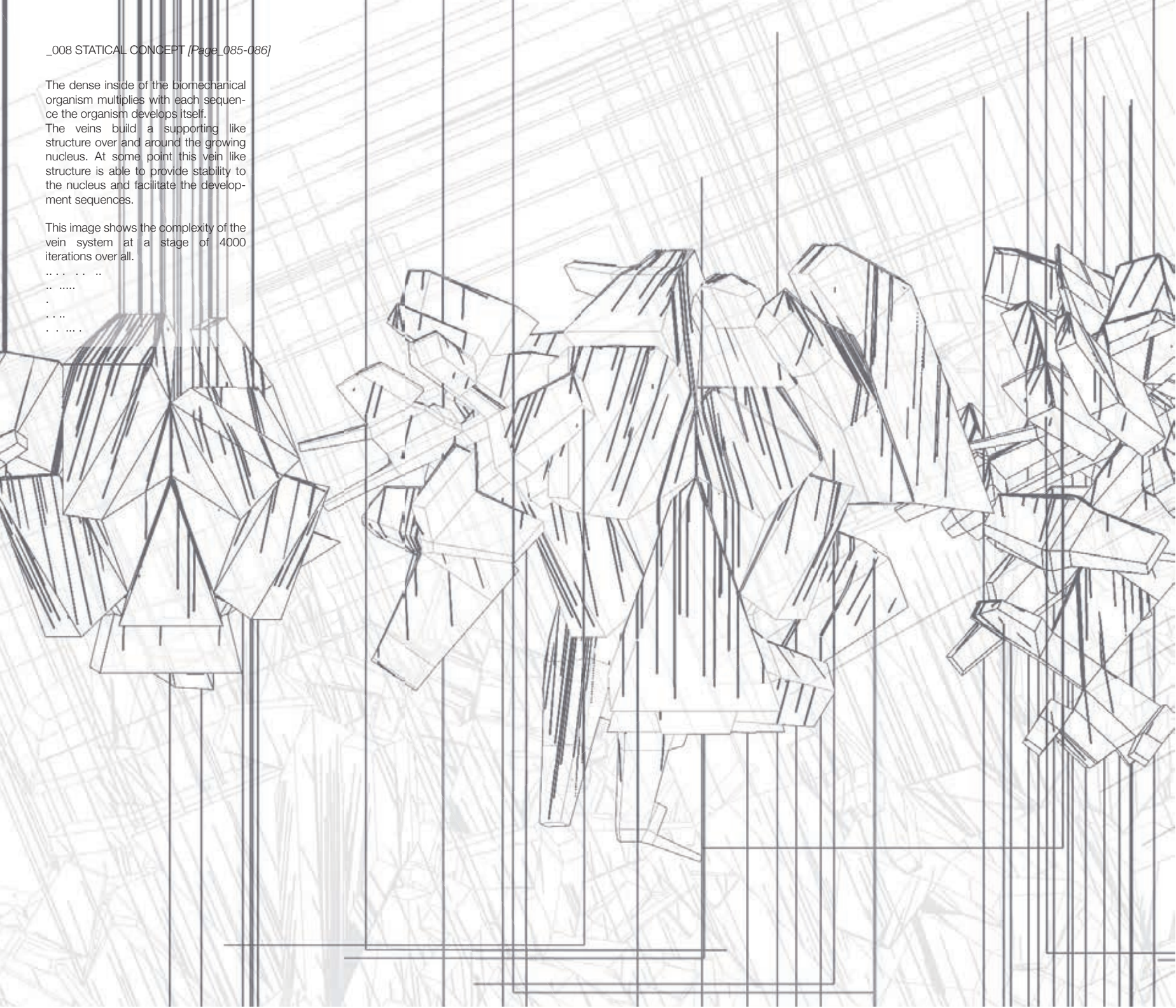

16.00m
1.00
2.00
4.00

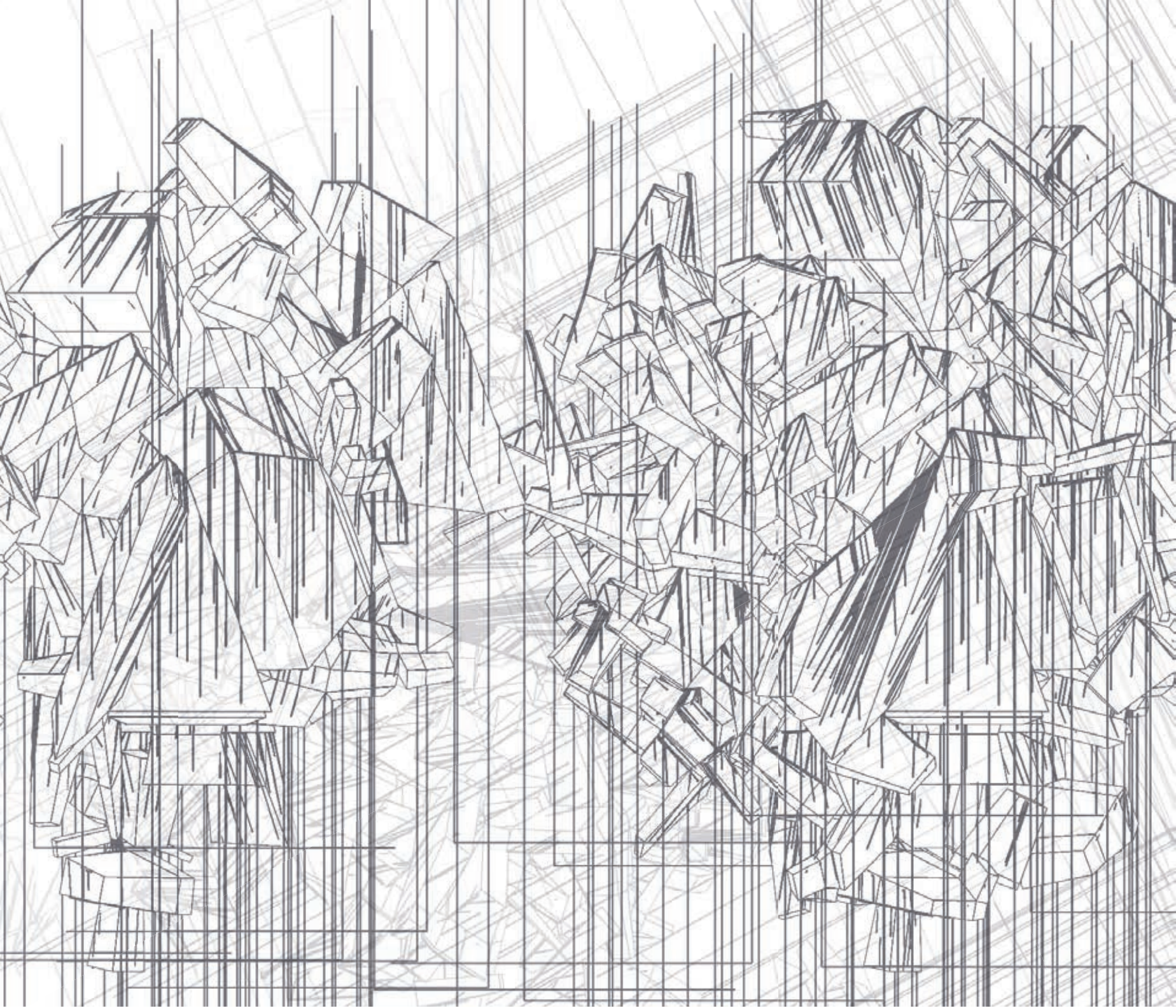

08.00m
12.00m
1.00
2.00
4.00

_008 STATICAL CONCEPT *[Page_085-086]*

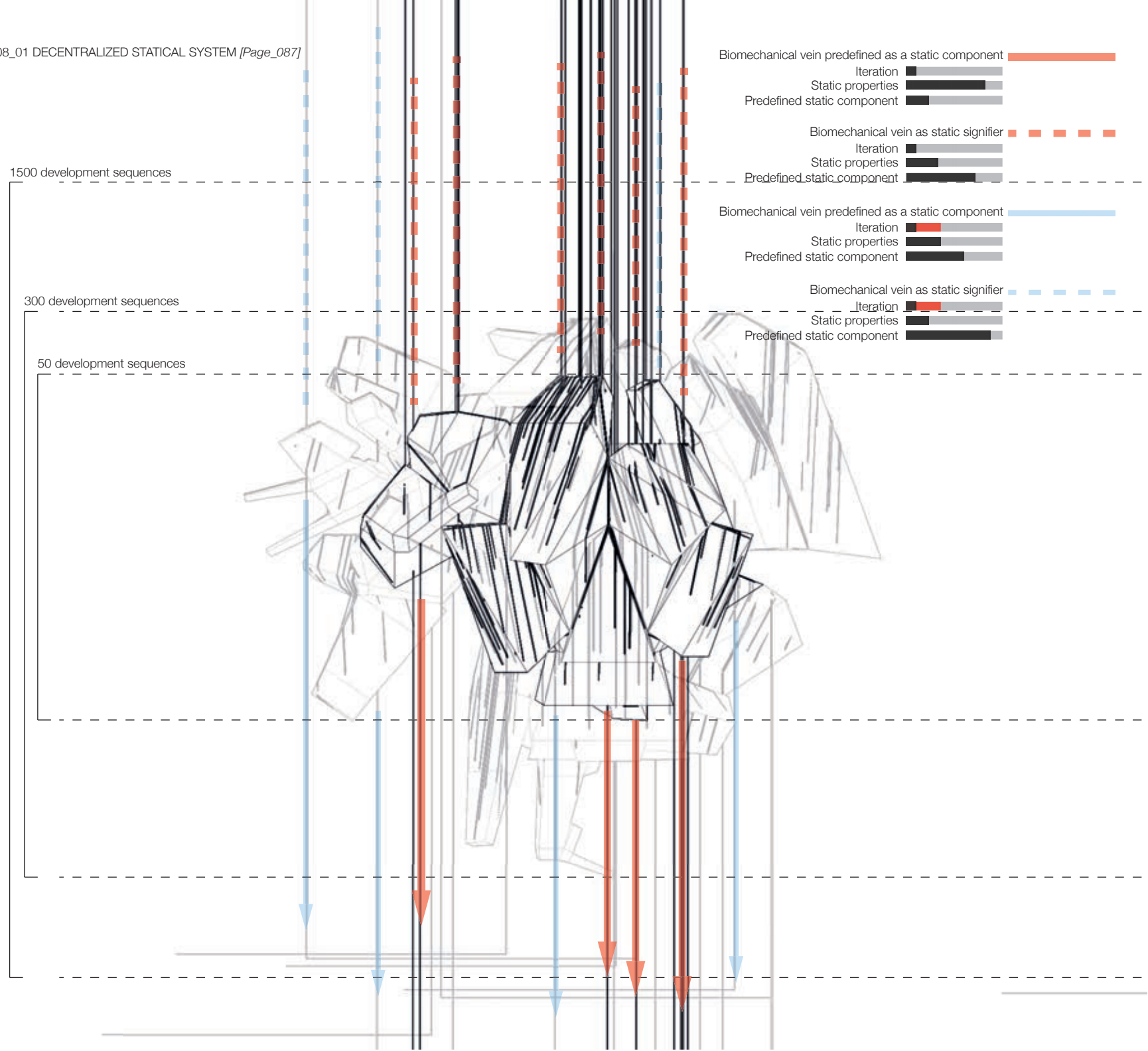
The dense inside of the biomechanical organism multiplies with each sequence the organism develops itself.
The veins build a supporting like structure over and around the growing nucleus. At some point this vein like structure is able to provide stability to the nucleus and facilitate the development sequences.

This image shows the complexity of the vein system at a stage of 4000 iterations over all.





___008_01 DECENTRALIZED STATICAL SYSTEM *[Page_087]*



Because of the enduring development and growing sequences of the nucleus the biomechnical vein system is besides of the nourishment, introduced as a decentralized statical ‚by-system'.
With this decentralized static system there is no need to anticipate the growing direction of the nucleus for its inside static concept. If a growing change in any direction is pending, the vein system in this area will be increased an enlarged to be able to serve as static system.
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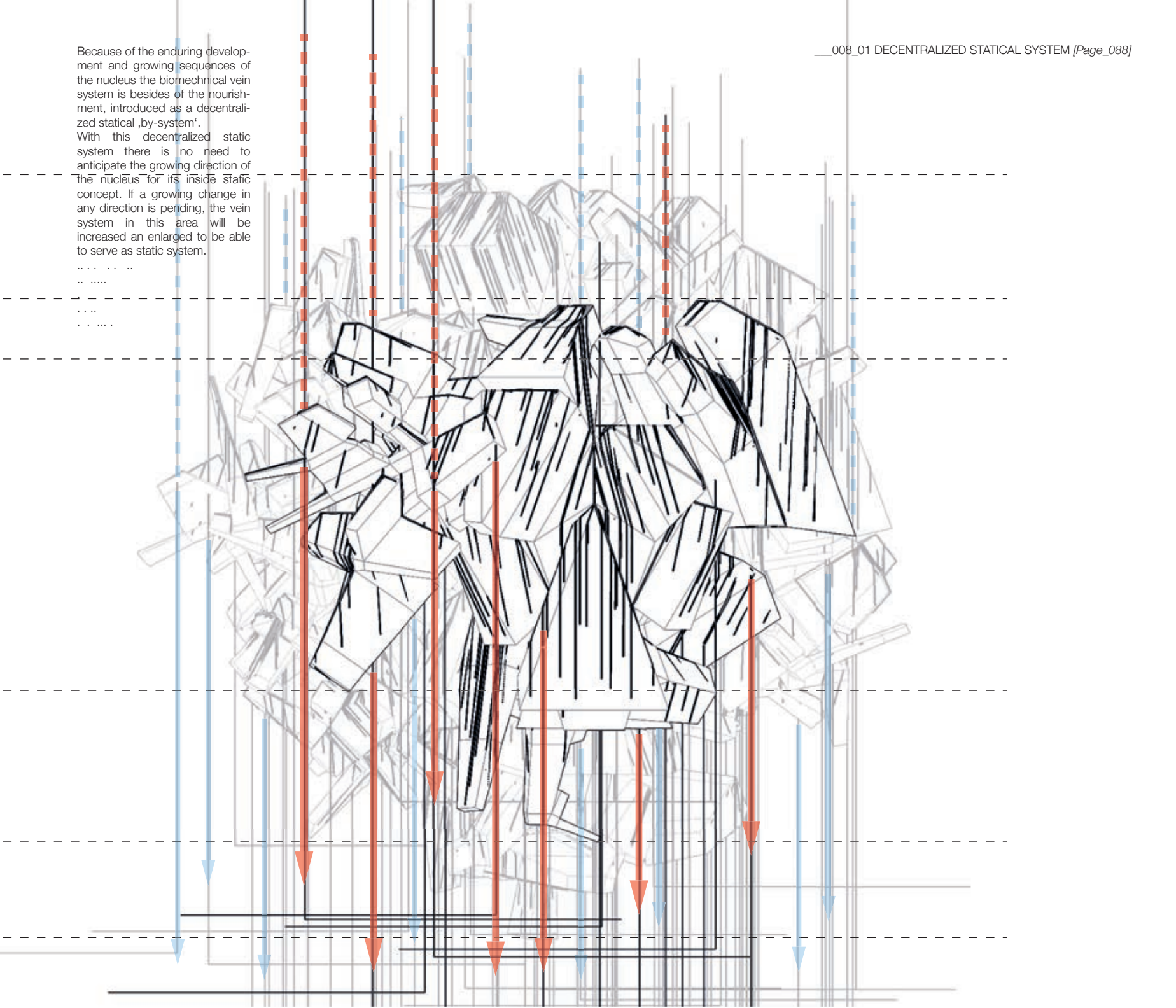
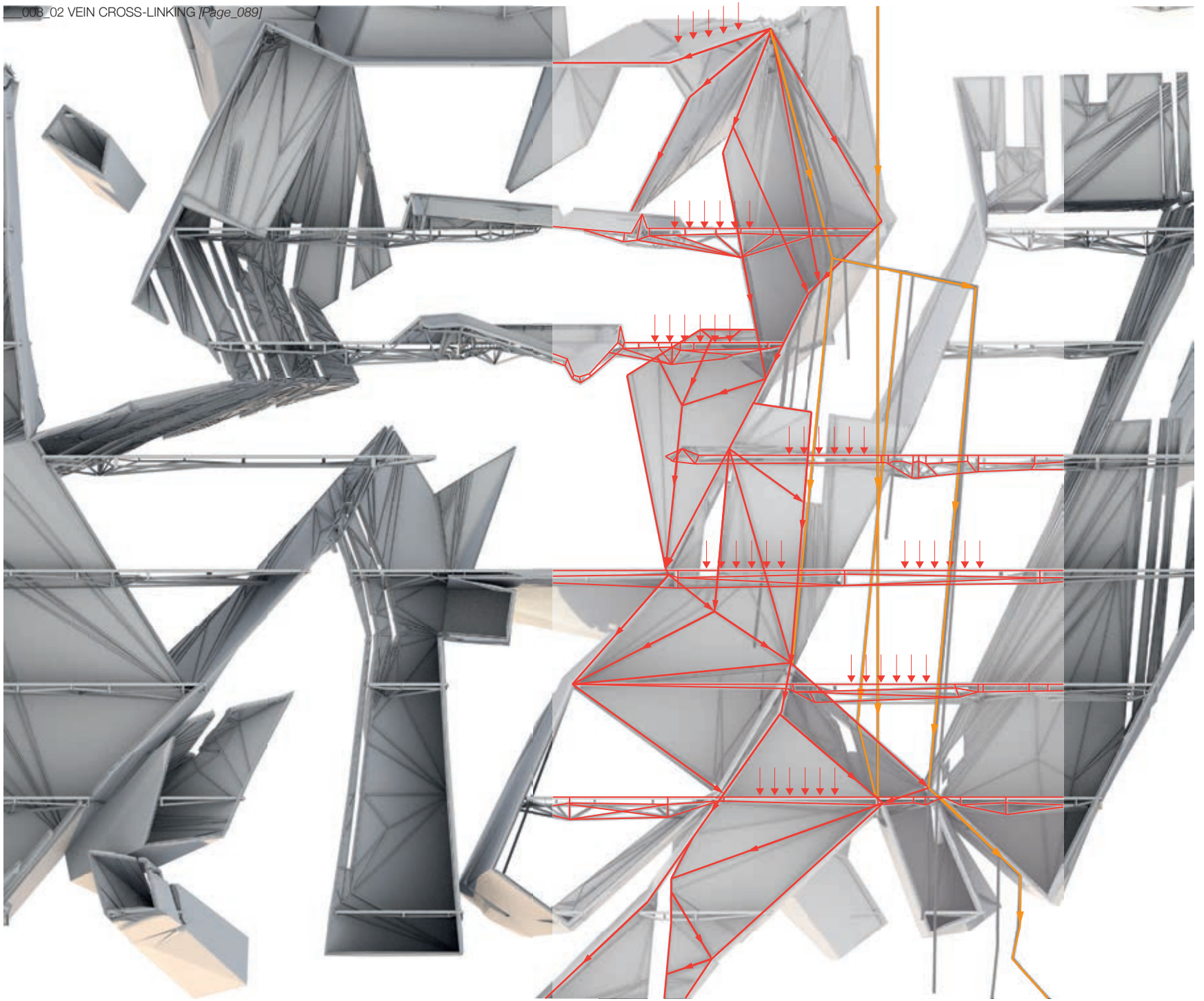
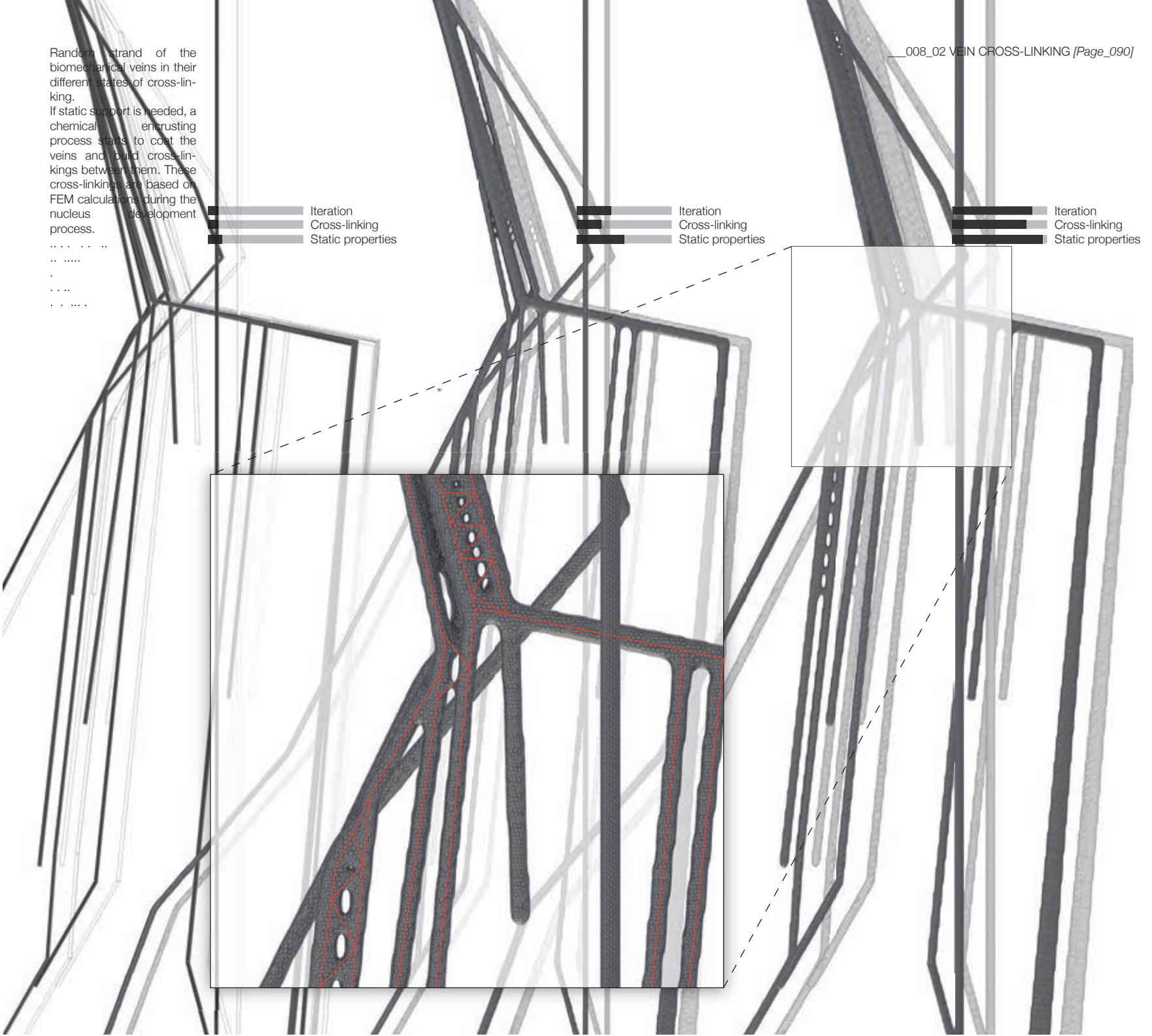
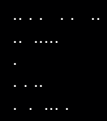




Random strand of the biomechanical veins in their different states of cross-linking.
If static support is needed, a chemical encrusting process starts to coat the veins and build cross-linkings between them. These cross-linkings are based on FEM calculations during the nucleus development process.

Iteration
Cross-linking
Static properties





_011 TABLE OF IMAGES *[Page_095]*

____ All non referenced sources by Ralf Bliem
___001_04 Bird View Detroit; Websource: https://www.bing.com/maps/ {accessed: 2015.09.15/14:00}
_002 Chemical Reaction; Websource: http://beautifulchemistry.net/reactions.html {accessed: 2015.01.24/09:00}
___002_01 Chemical Reaction; Websource: http://beautifulchemistry.net/reactions.html {accessed: 2015.01.24/09:00}

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nationality: Austria

EDUCATION

2013-2015	Master studies of Architecture, University of Technology Vienna, Austria Master thesis: Nucleus, Automation in generative architecture
2009-2013	Bachelor studies of Architecture, University of Technology Vienna, Austria Bachelor thesis: Industrial Parasites
2008-2009	Automation Engineering, School for higher technical education Wiener Neustadt, Austria school leaving exam 06/2009
2007-2008	Mechatronics and Microsystems Technology, FH Wiener Neustadt / University of Applied Sciences, Austria
2003-2006	Mechanical engineering, School for higher technical education Eisenstadt, Austria passed with success
2000-2003	Aeronautics, School for higher technical education Eisenstadt, Austria
1996-2000	Secondary school, BG/BRG/BORG Eisenstadt, Austria

INTERNATIONAL EXPERIENCE

2015/04	rese arch LAB - printing on tensile space structures - team fellow	Bratislava, SK
2014/09	Trans-Computational Membranes 2.0 / AA Visiting School Madrid	Madrid, ES
2014/07	Iterative Interpretations - Parametric Berlin Summerschool	Berlin, DE
2014/04	Spring Species - Grasshopper Workshop	Bratislava, SK
2013/03-2014/03	Master studies of Architecture, Technische Universität Berlin, Germany research topic: active noise reducing residential buildings with climatic optimization	Berlin, DE

PROFESSIONAL EXPERIENCE

2015/09 — D2 Digital Design Conference, Vienna, Austria
organization crew

2013 — Founder of pixelkompressor, Vienna, Austira, Berlin, Germany
computational architecture, digital art, digital design

2013/08-09 — Baum- und Gartenservice Trimmel, Forchtenstein, Austria
intern, landscape management and design

2012/09 — Baum- und Gartenservice Trimmel, Forchtenstein, Austria
intern, landscape management and design

2010/06-08 — Co. Stapf, Ebreichsdorf, Austria
Intern, landscape management

2007/04-08 — Co. Rollo, Brunn am Gebirge, Austria
technical drawer, prototype design and mechanical engineering & construction

2006/10-2007/04 — Military Service, Bruck a.d. Leitha, Eisenstadt, Austria
assistance deployment in Rattersdorf, Austria

2004/07-08 — Baum- und Gartenservice Trimmel, Forchtenstein, Austria
holiday work, exterior finish

2003/07 — Metallbau Lang, Wulkaprodersdorf, Austria
holiday work, drafting and manufacturing of metall makings

2002/07 — Diamond Aircraft, Wr. Neustadt, Austira
holiday work, aircraft maintance

LANGUAGES

German: Mother toungue
English: Fluent in spoken and written
Croatian: Basic

TECHNICAL SKILLS

Software
Cinema 4D
Autodesk
Autocad
Maya
Revit
Inventor
Rhino
Grasshopper
ZBrush
Adobe
Illustrator
InDesign
Photoshop
After Effects

Hardware
ZCorp ZPrinter® 650
Trotec Speedy 500
Rapid Prototyping - Dimension Elite

PUBLICATIONS

2015/08 — Millepora
pitcrit [www.pitcrit.com]

2015/07 — Secession_Adpt
pitcrit [www.pitcrit.com]

2015/05 — Secession_Adpt
suckerpunchdaily [www.suckerpunchdaily.com]

2015/01 — Short mention of Project Millepora by Stefan Rutzinger & Kristina Schinegger @ MECS Conference, Leuphana University, Germany
MECS Institute, Leuphana University Lüneburg, Germany

EXHIBITIONS

2015/09 — void subdivide (){} @ cafe strudekla, Berlin, Germany
exhibition about computer generated graphics, their randomness, repeatability and singularity.

HONORS

2014/08 — Philips scholarship for the AAVS Madrid 2014
The Architectural Association