m+w zander

total facility solutions

New ways of Modelling with Phoenics

Dr. Eckehard Fiedler, IAC, Bergisch-Gladbach, Germany

Contents

- general overview
- our projects
- our workflow
- some new tools

Dr. Eckehard Fiedler

company

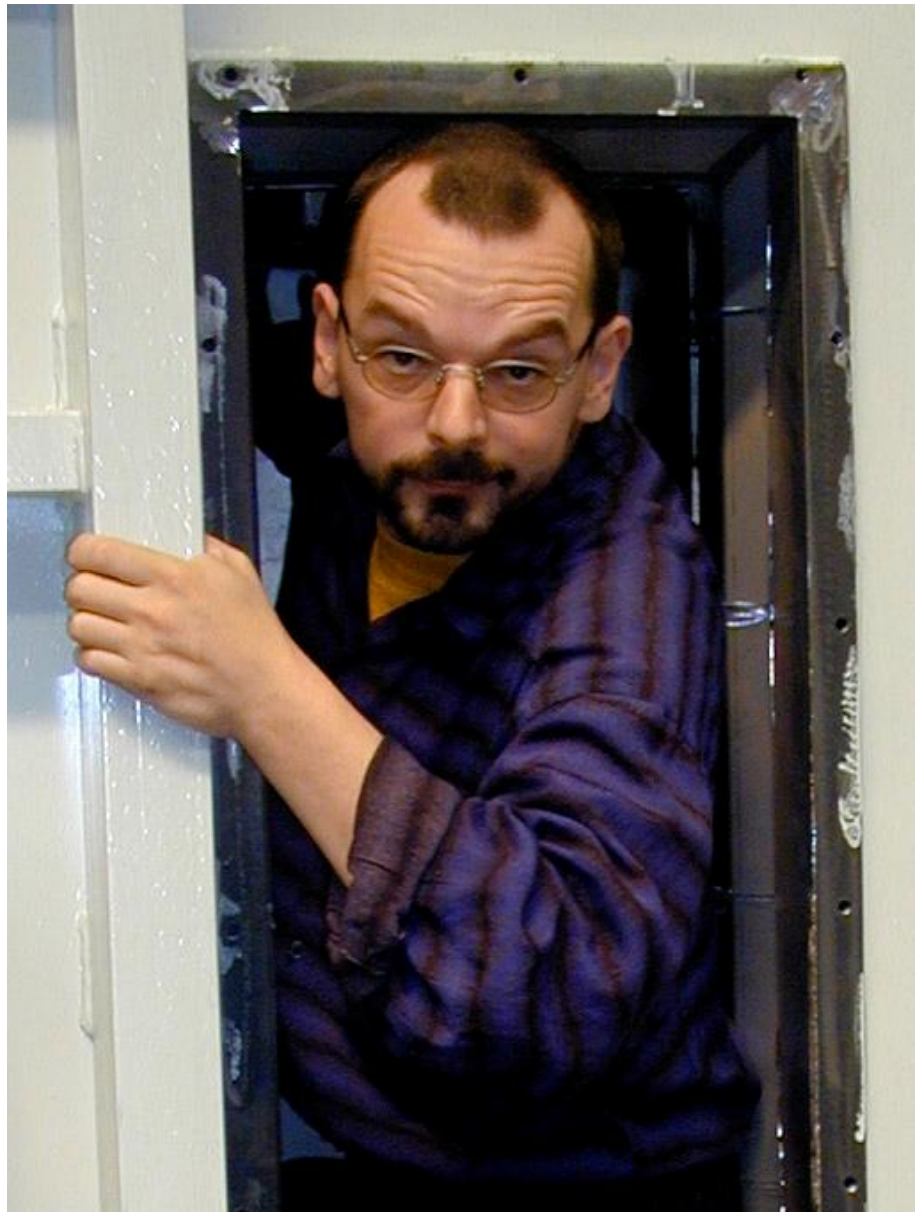
MW-Zander Facility engineering

R&D-department

- CFD
- Thermal building simulation
- general calculations

working with phoenics ~ 5 years

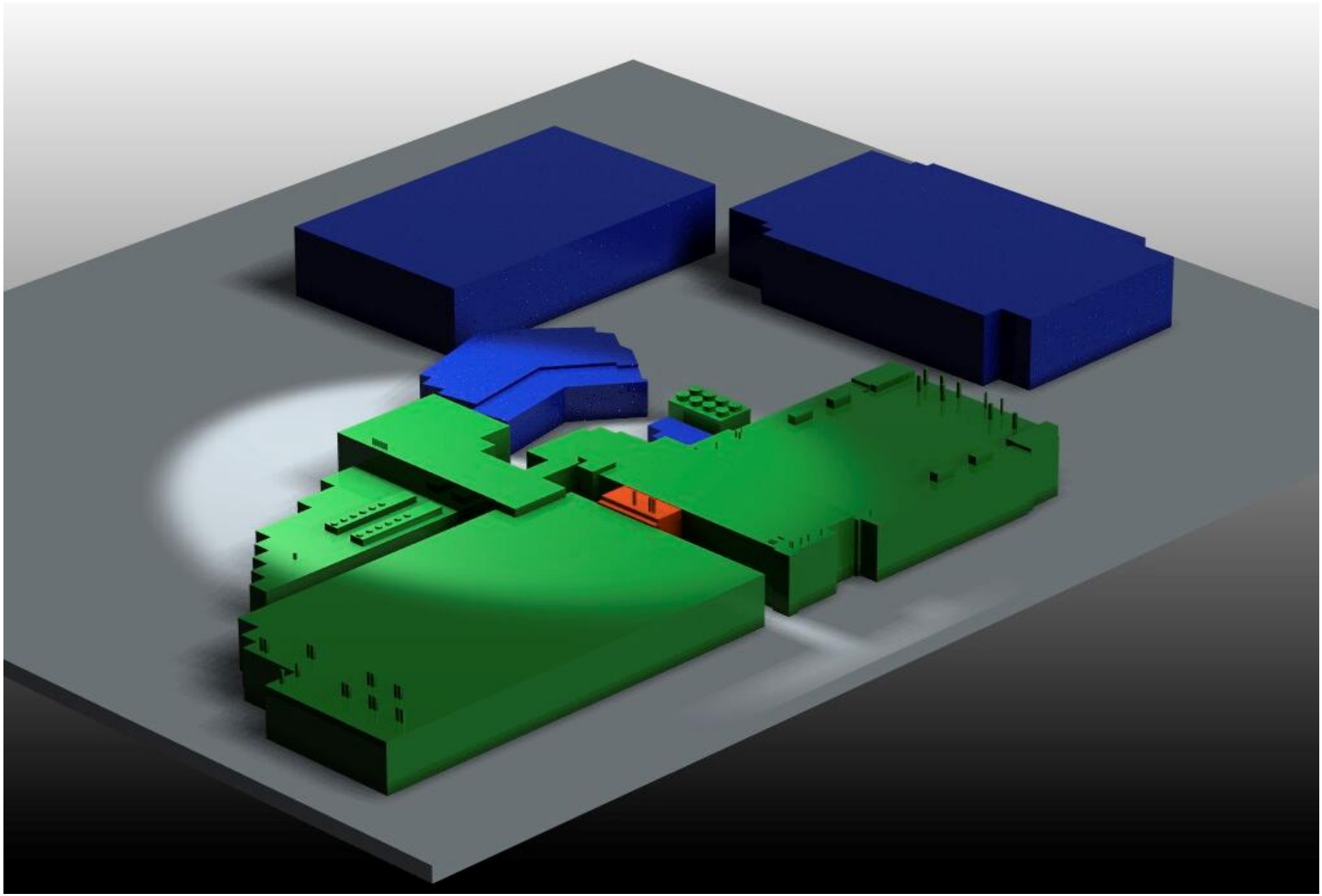
more than 10 years experimental work with industrial fluid techno-logy, heat transfers, windtunnel tests etc..



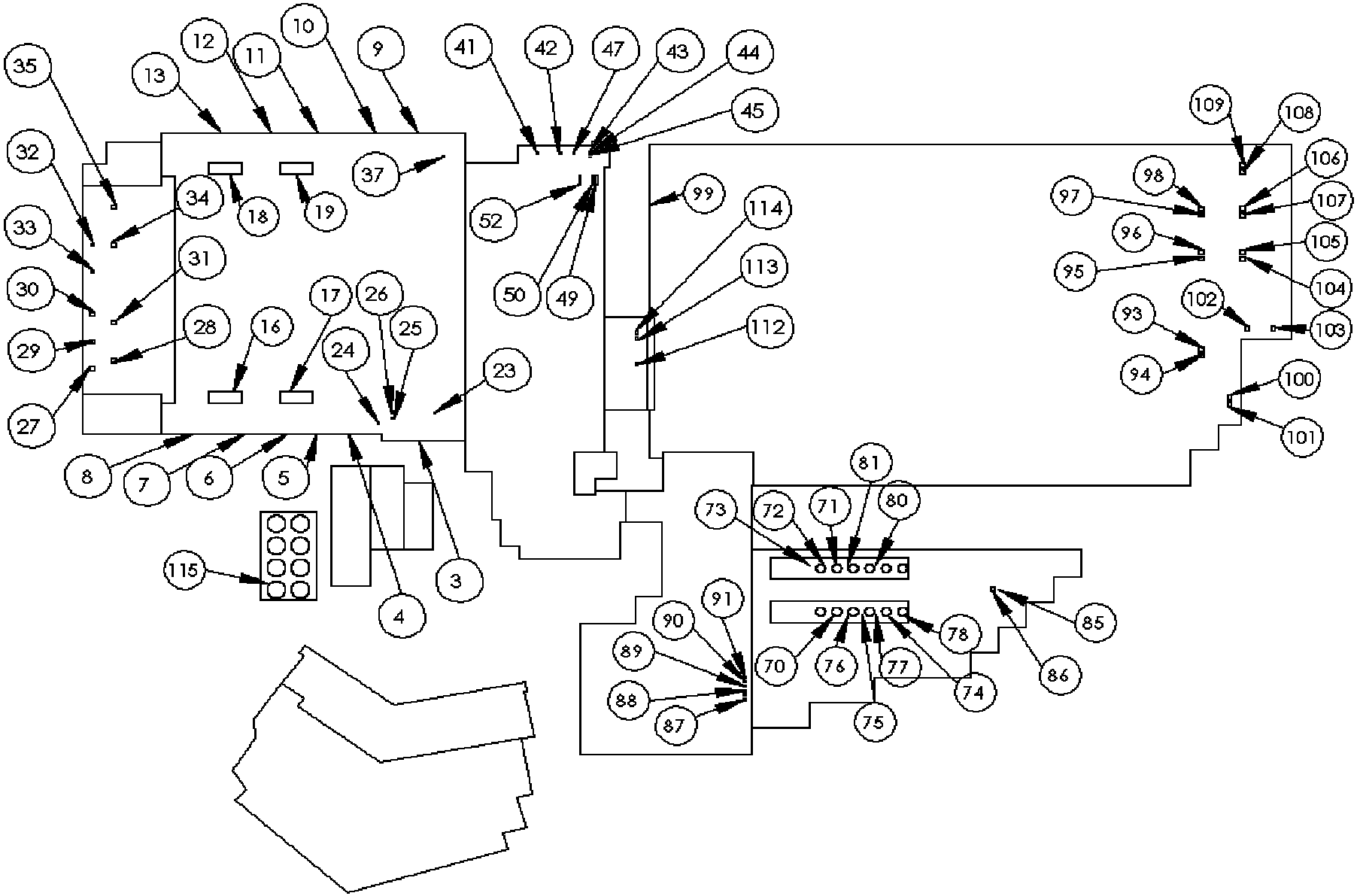
PROJECT EXAMPLES

exhaust dispersion studies

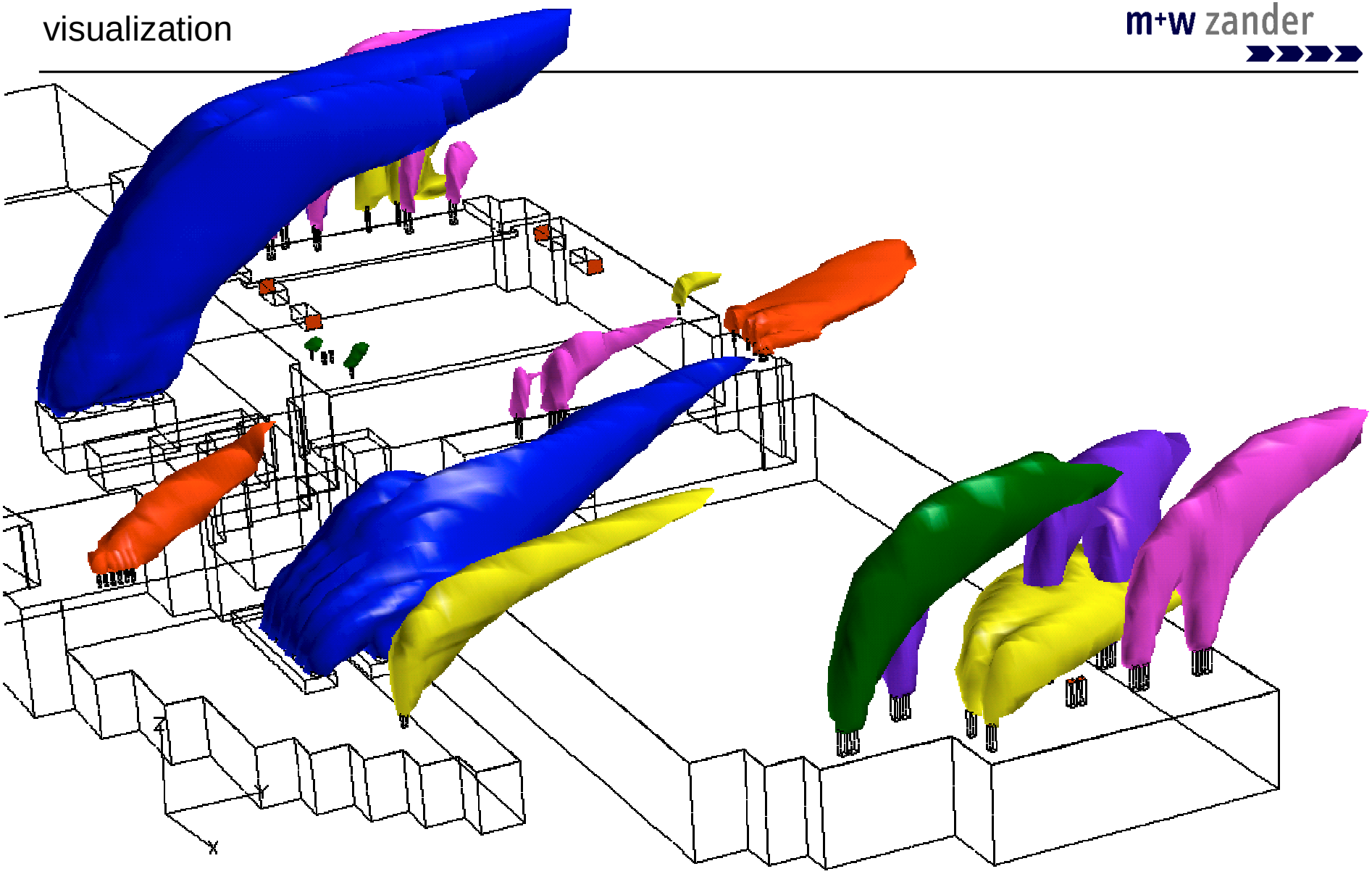
m+w zander



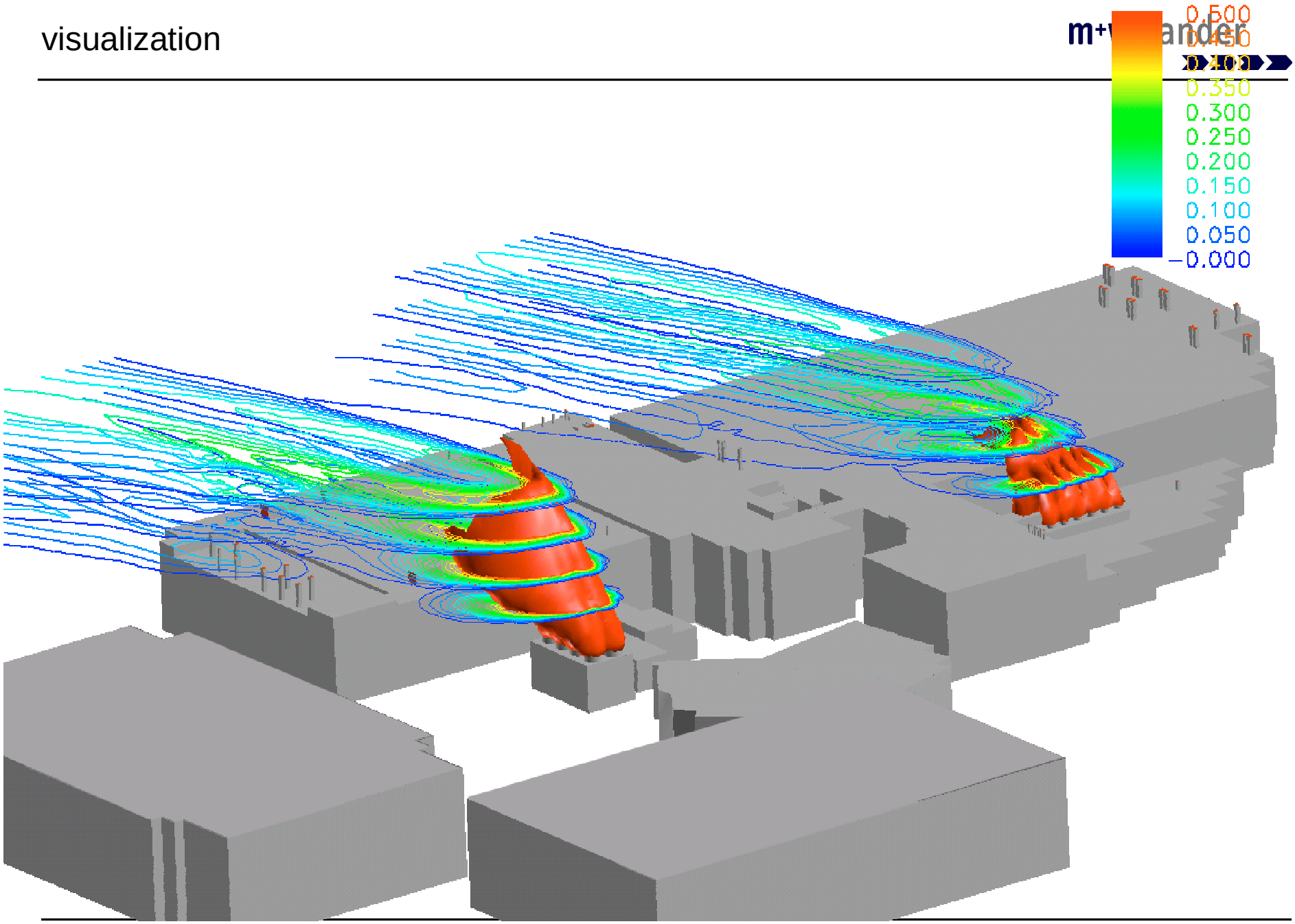
Stack layout



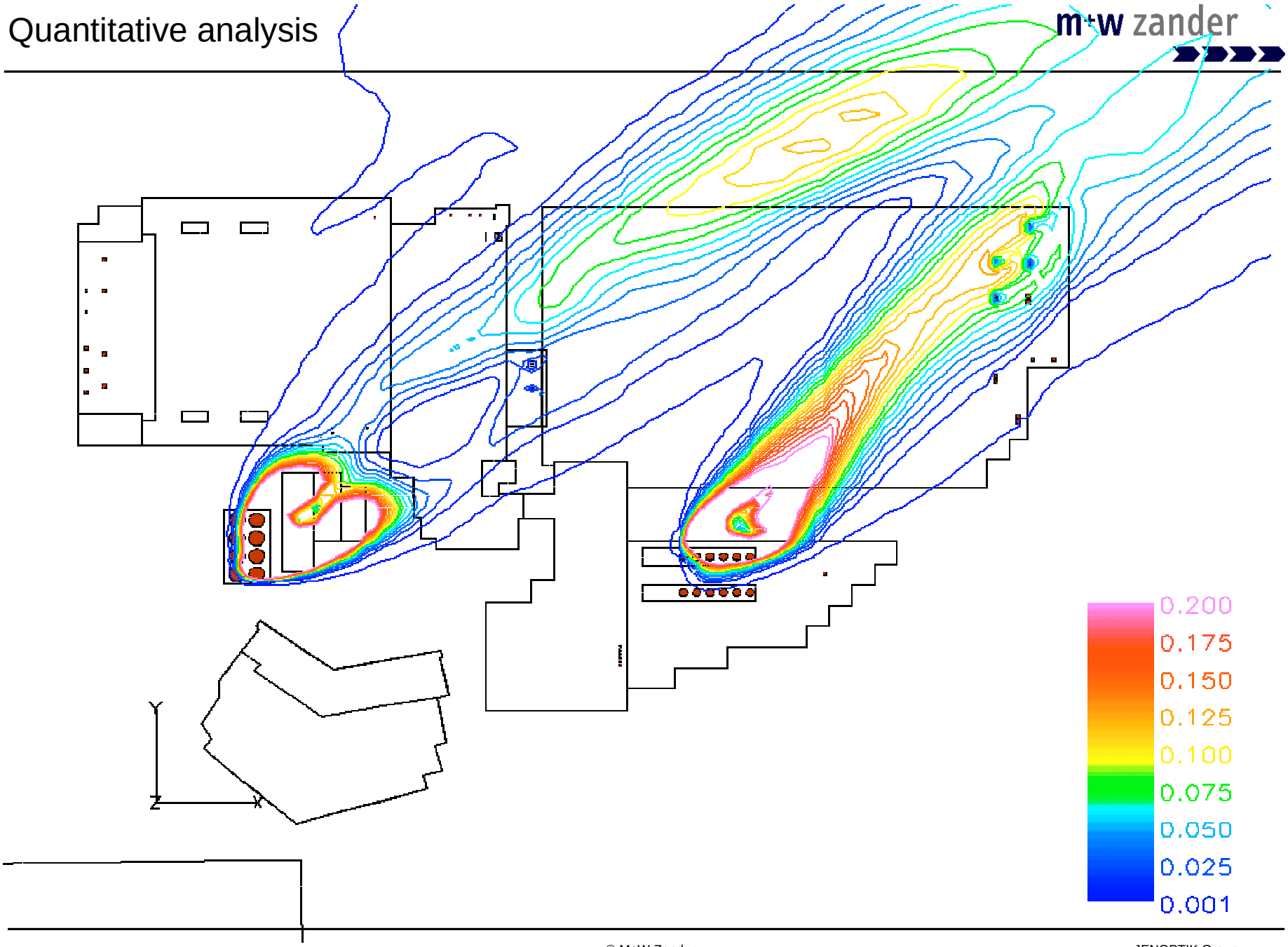
visualization



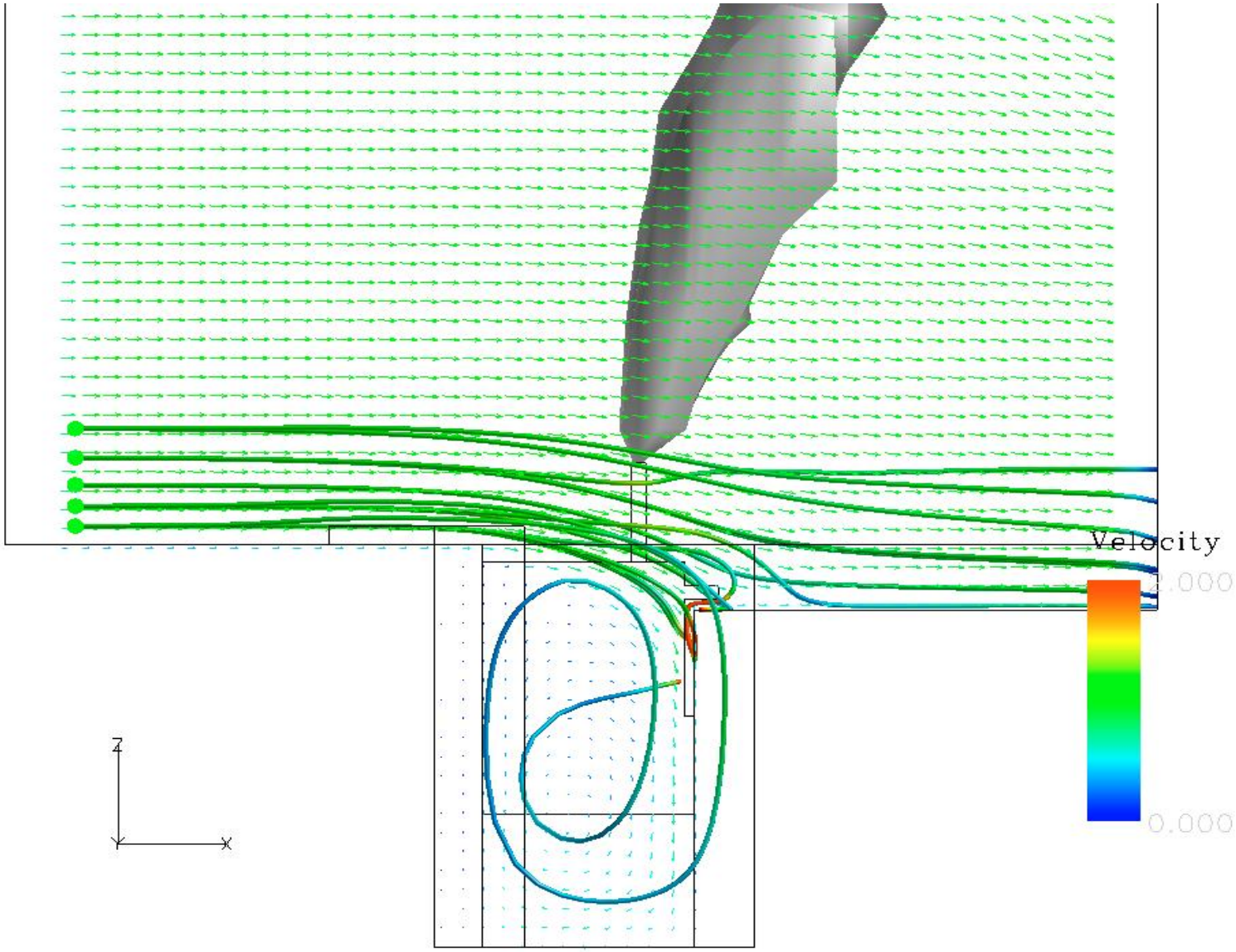
visualization



Quantitative analysis

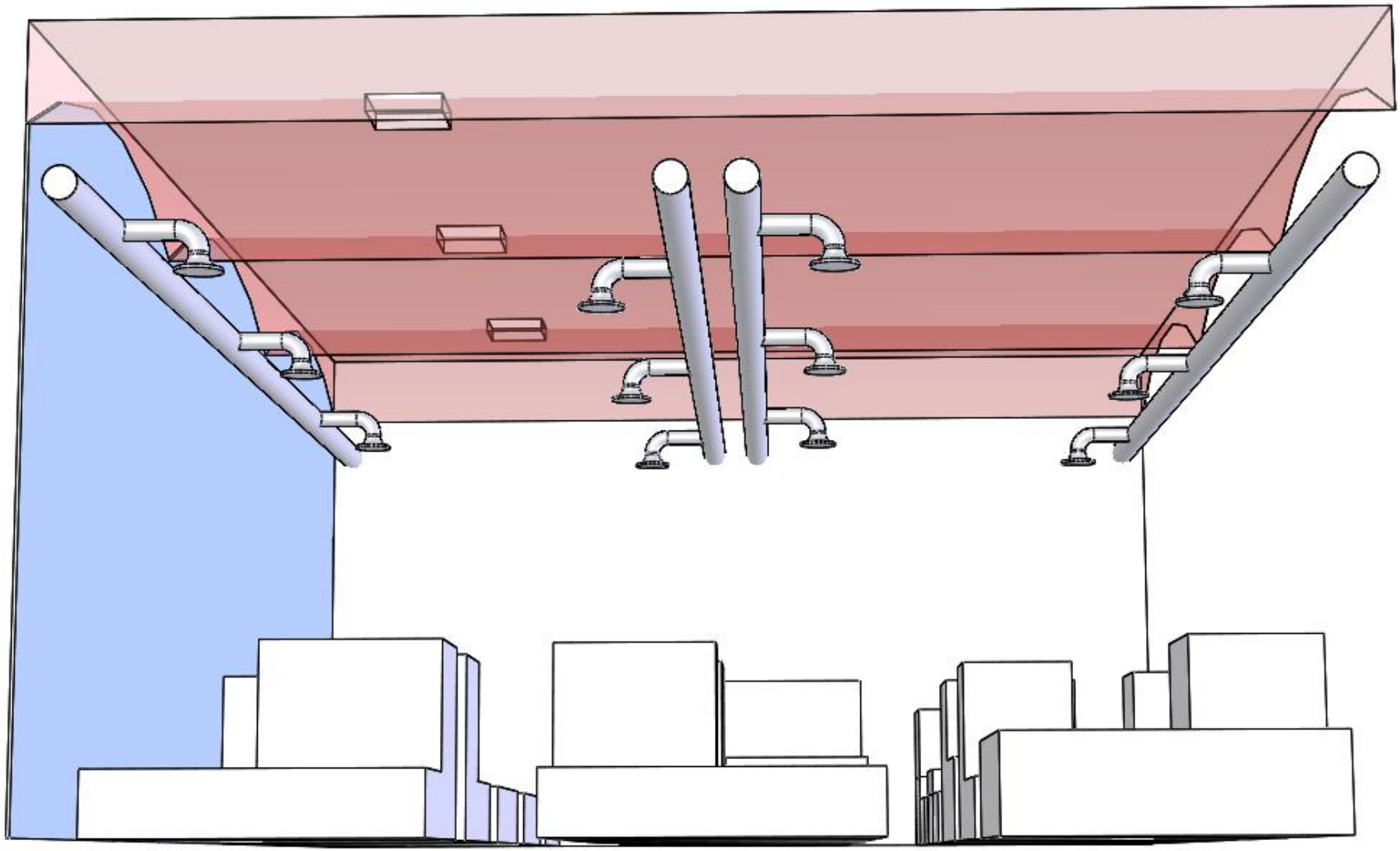


Recirculaion detail

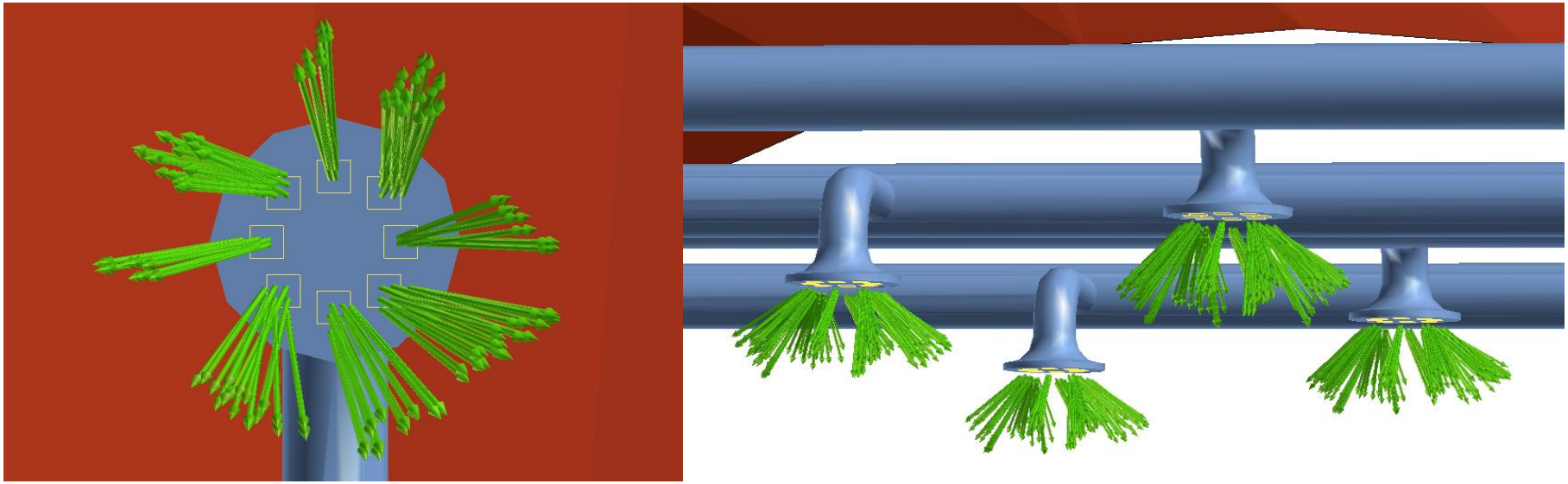


EXHIBITION HALL

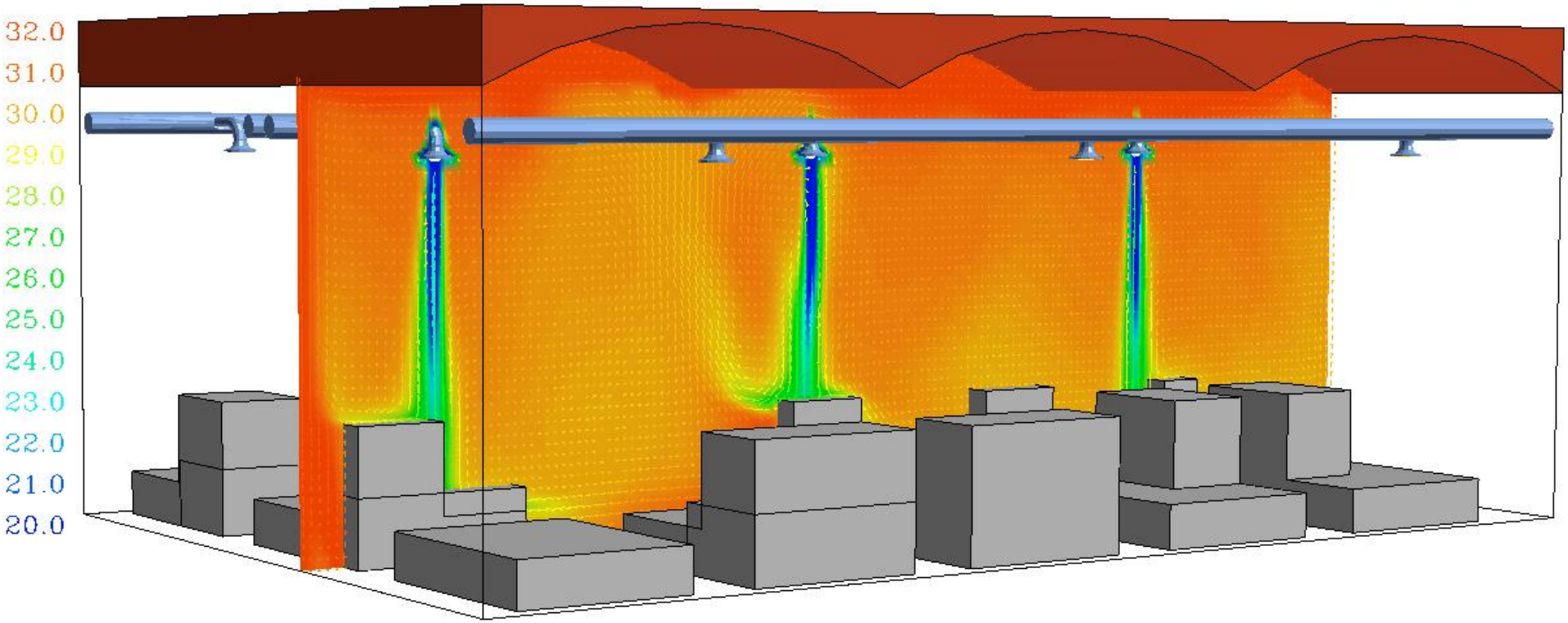
exhibition hall



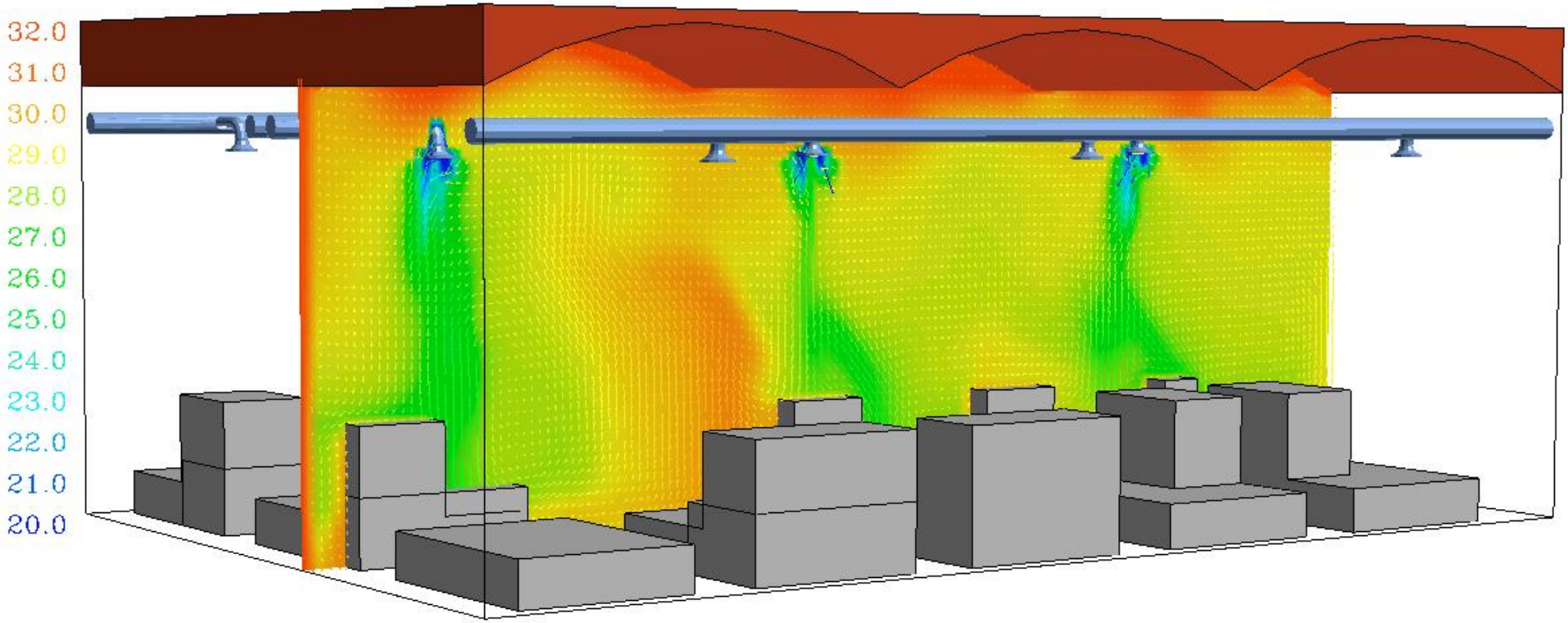
exhibition hall swirl outlets



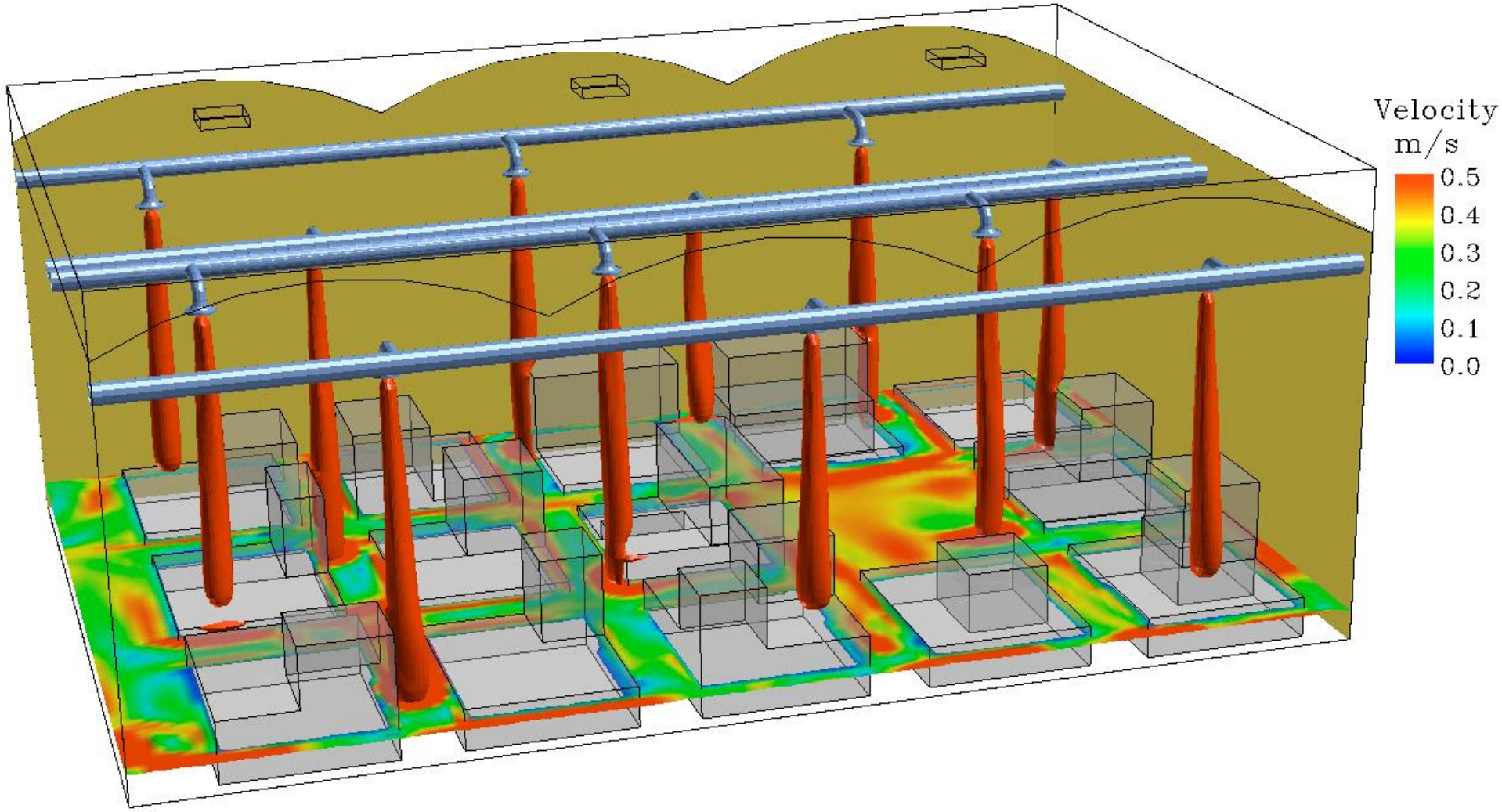
exhibition hall temperature field



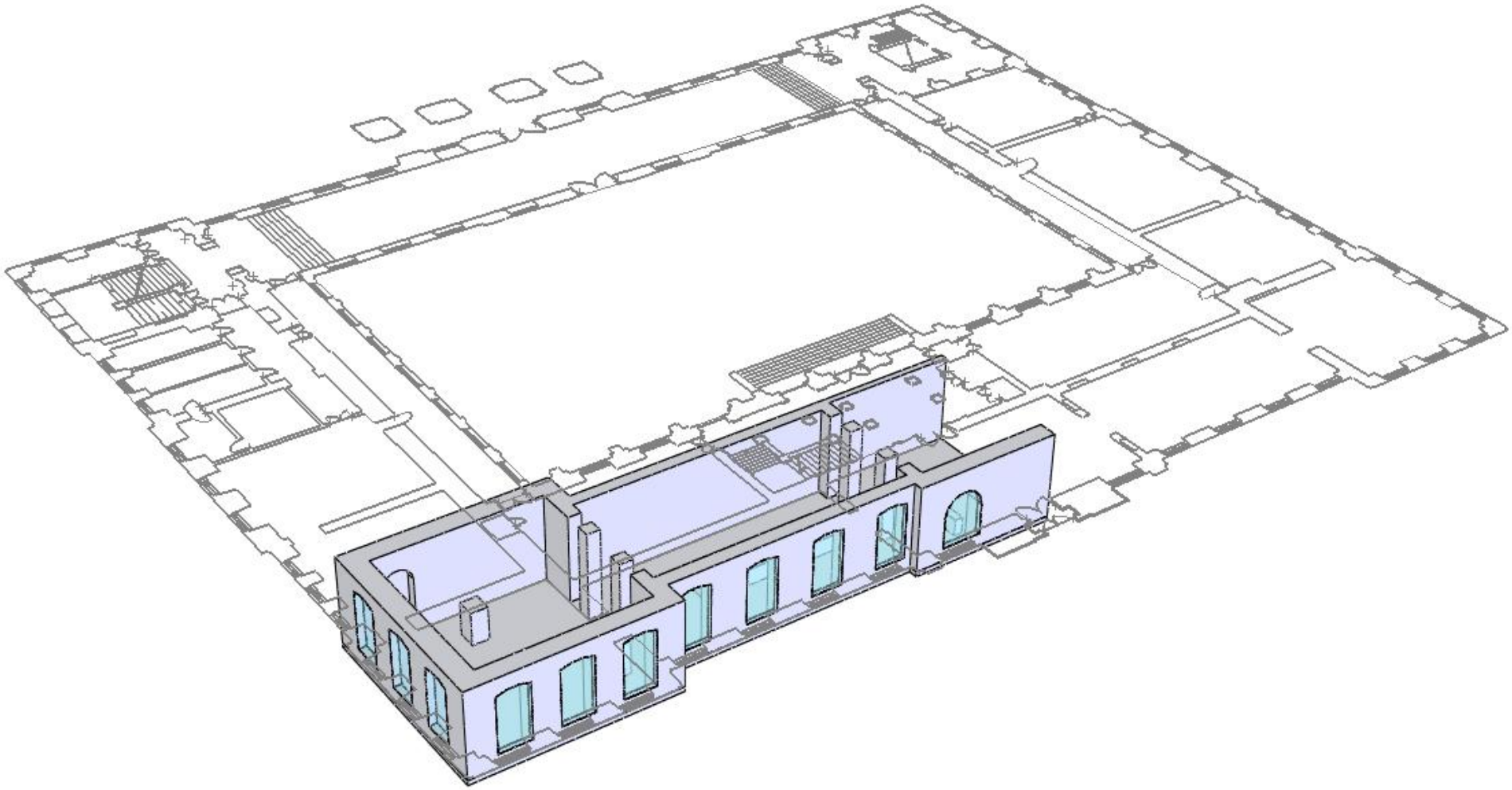
exhibition hall system comparison



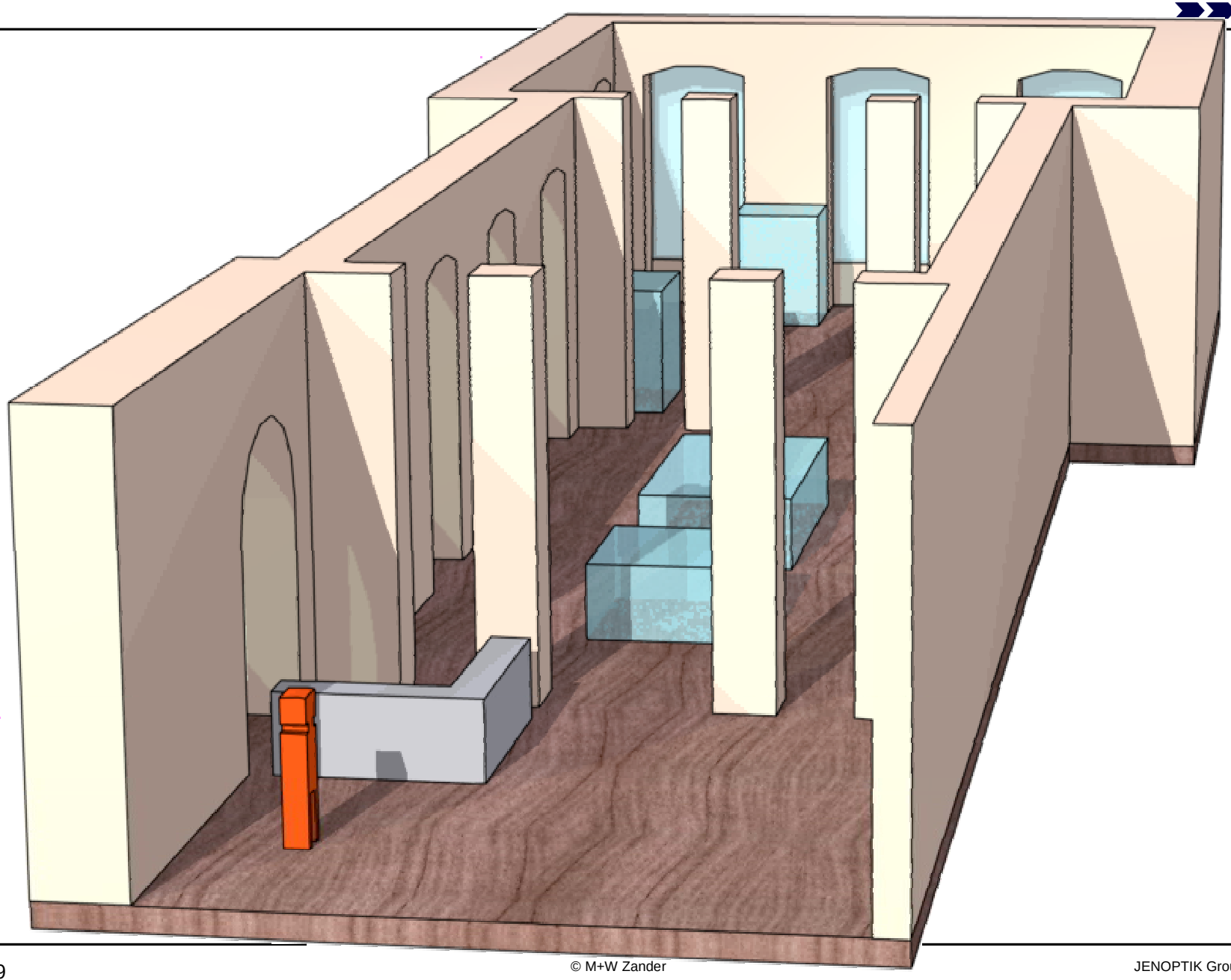
exhibition hall flow visualization



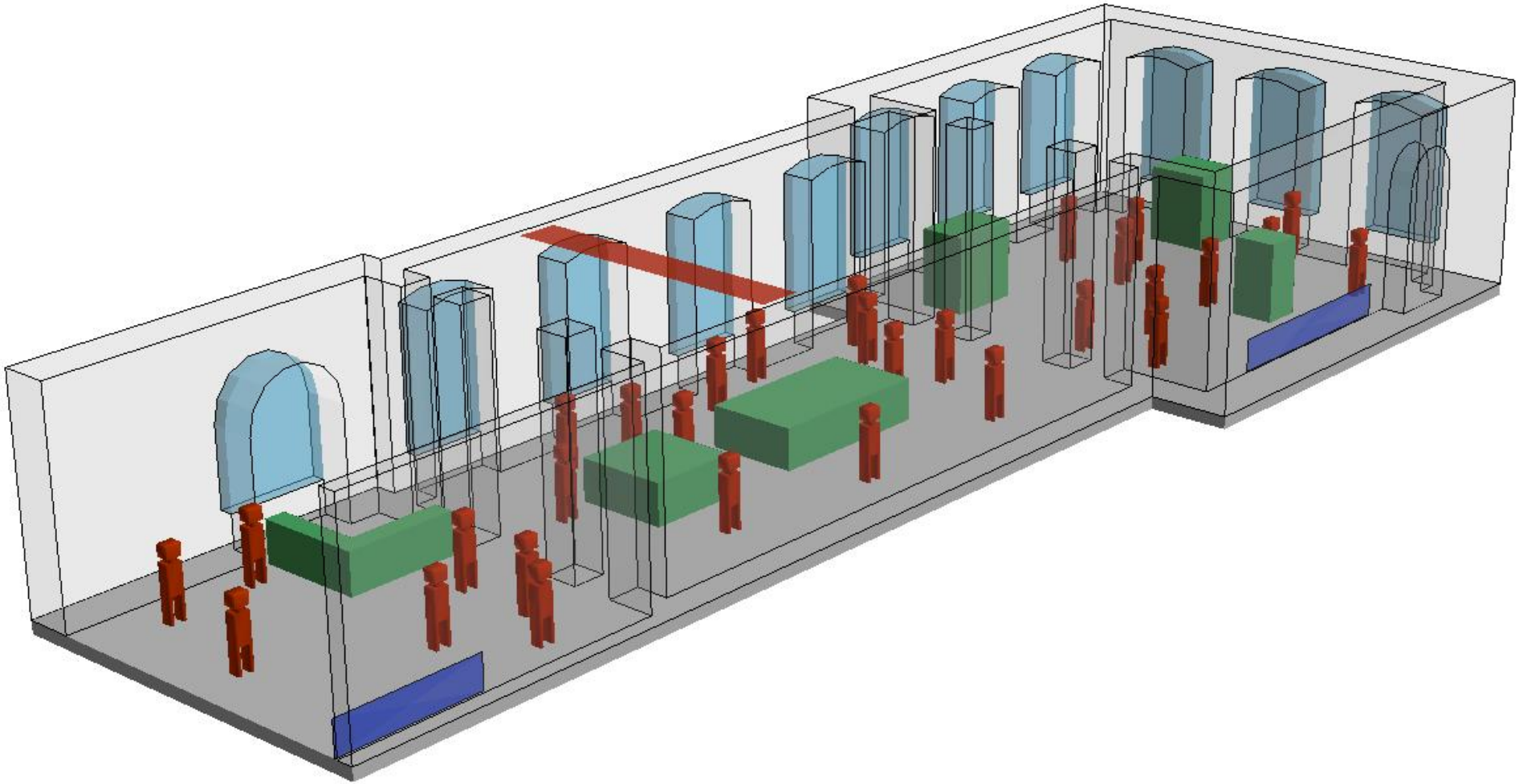
VENTILATION STUDIES



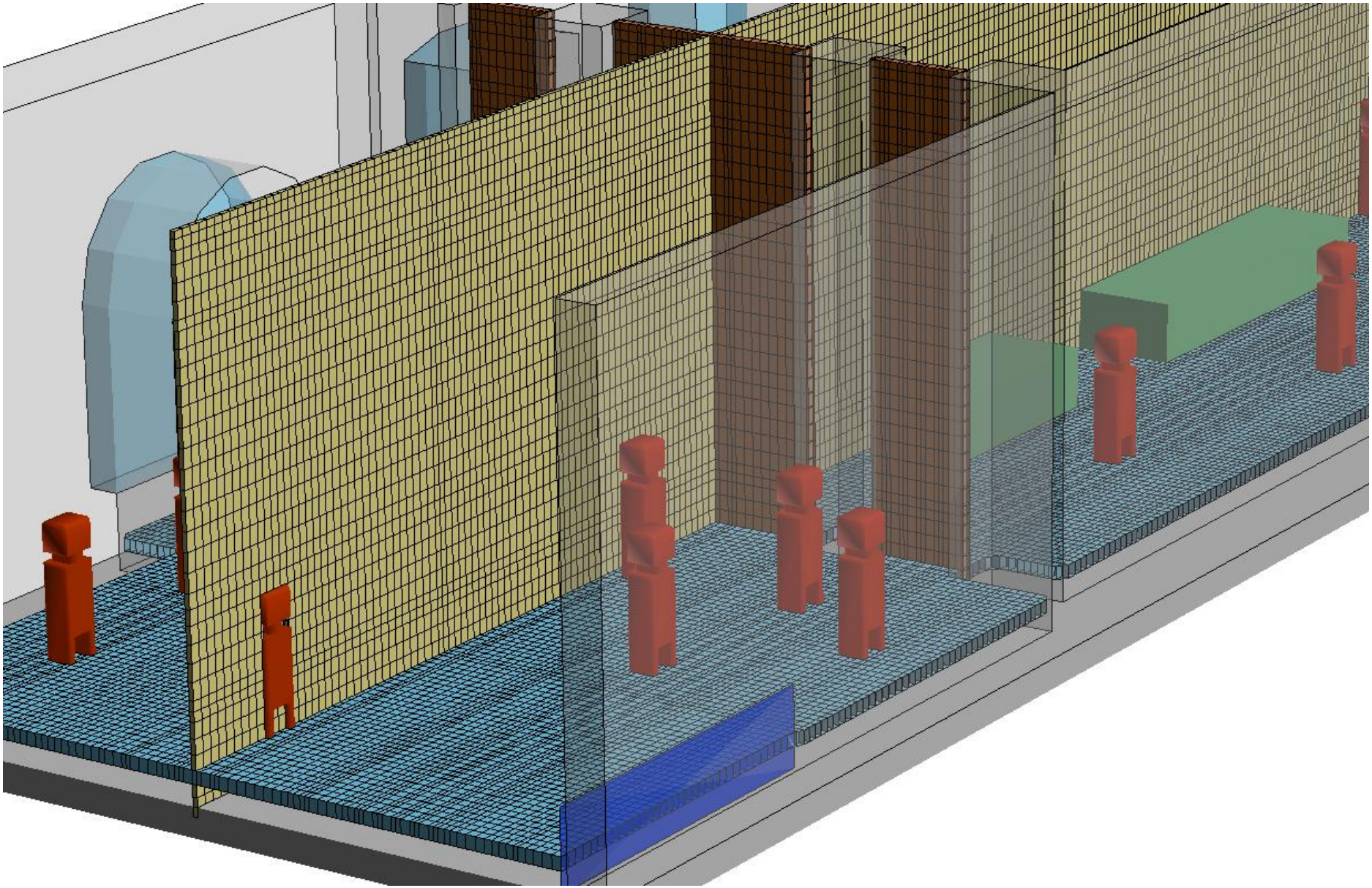
model visualization



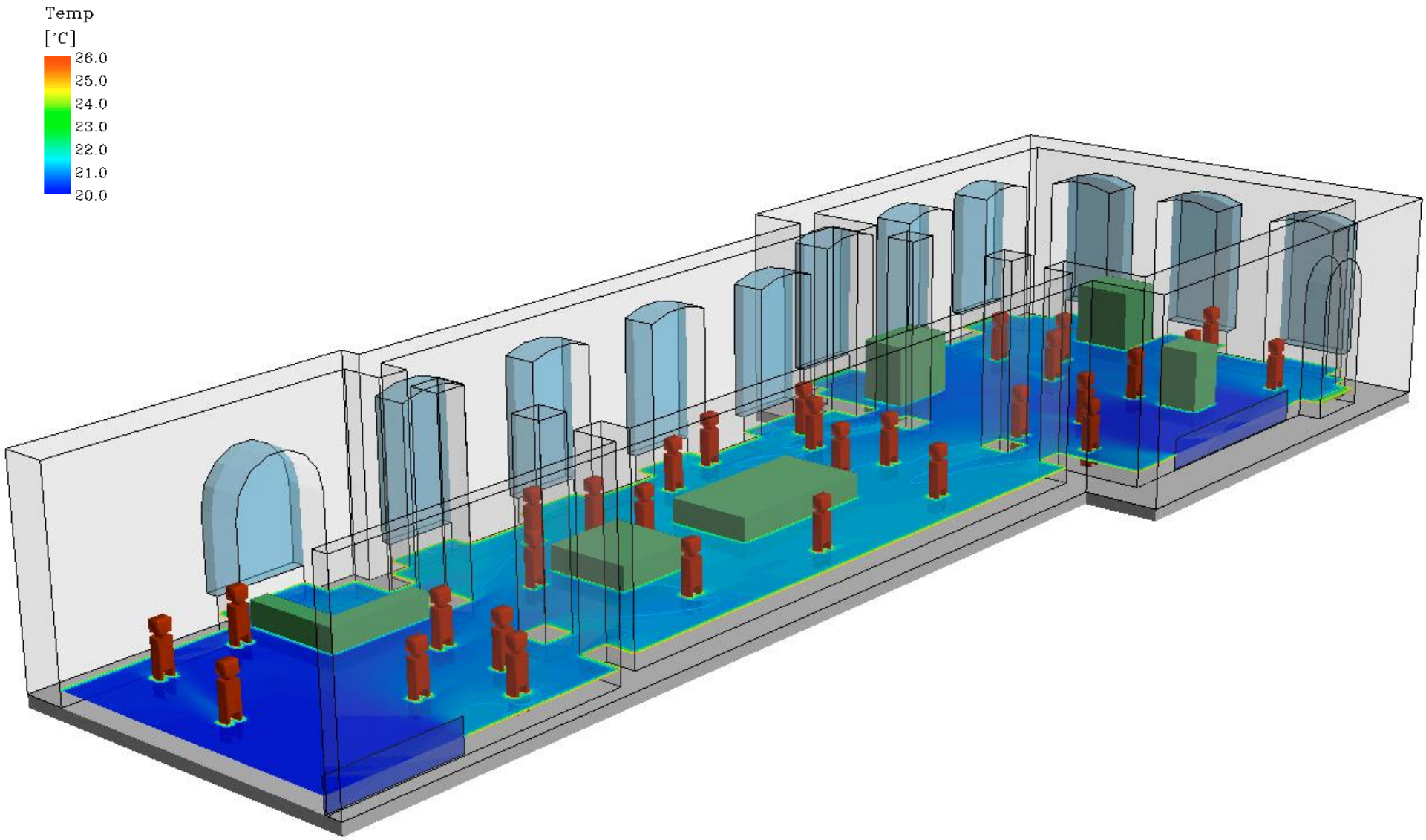
model explanation



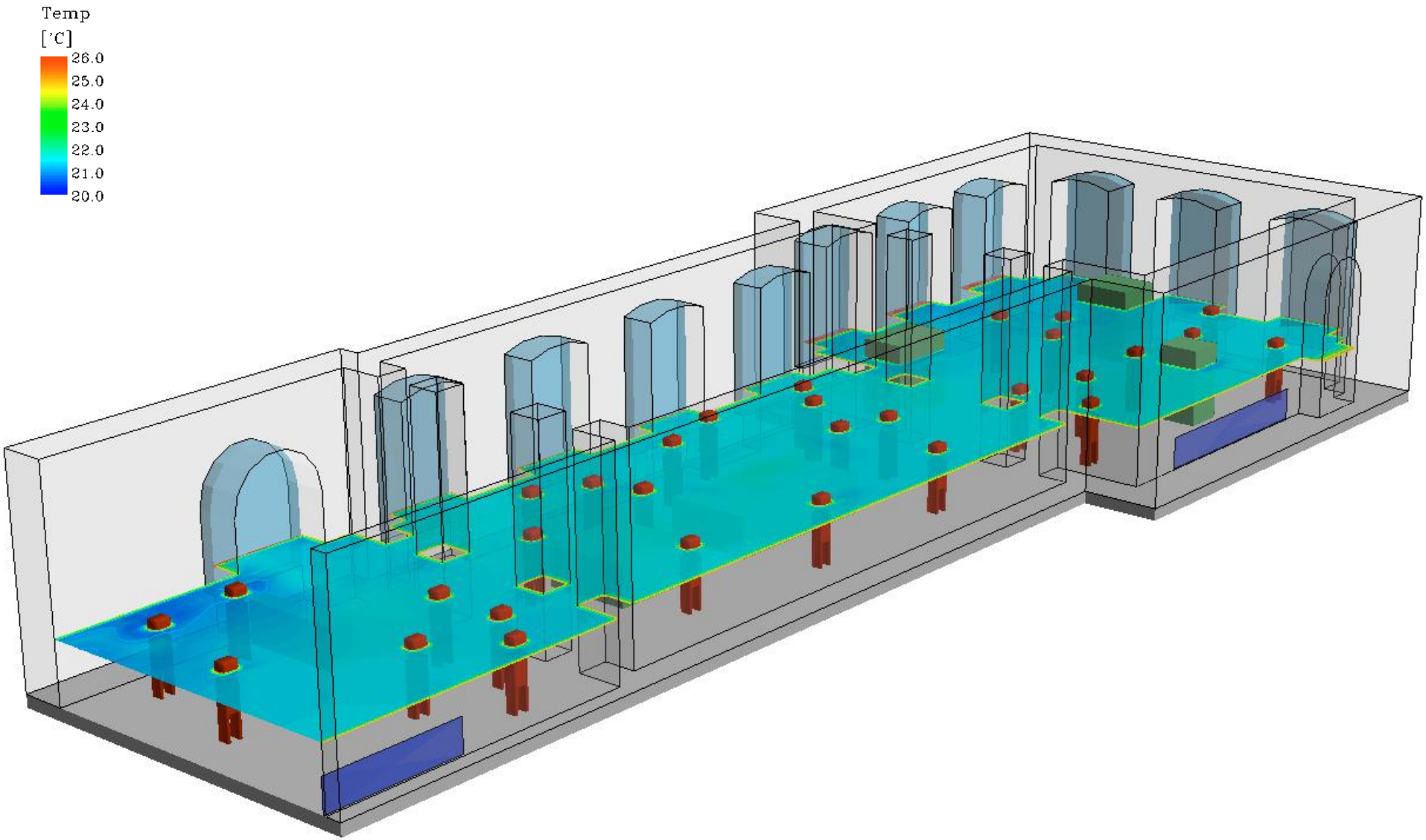
model explanation



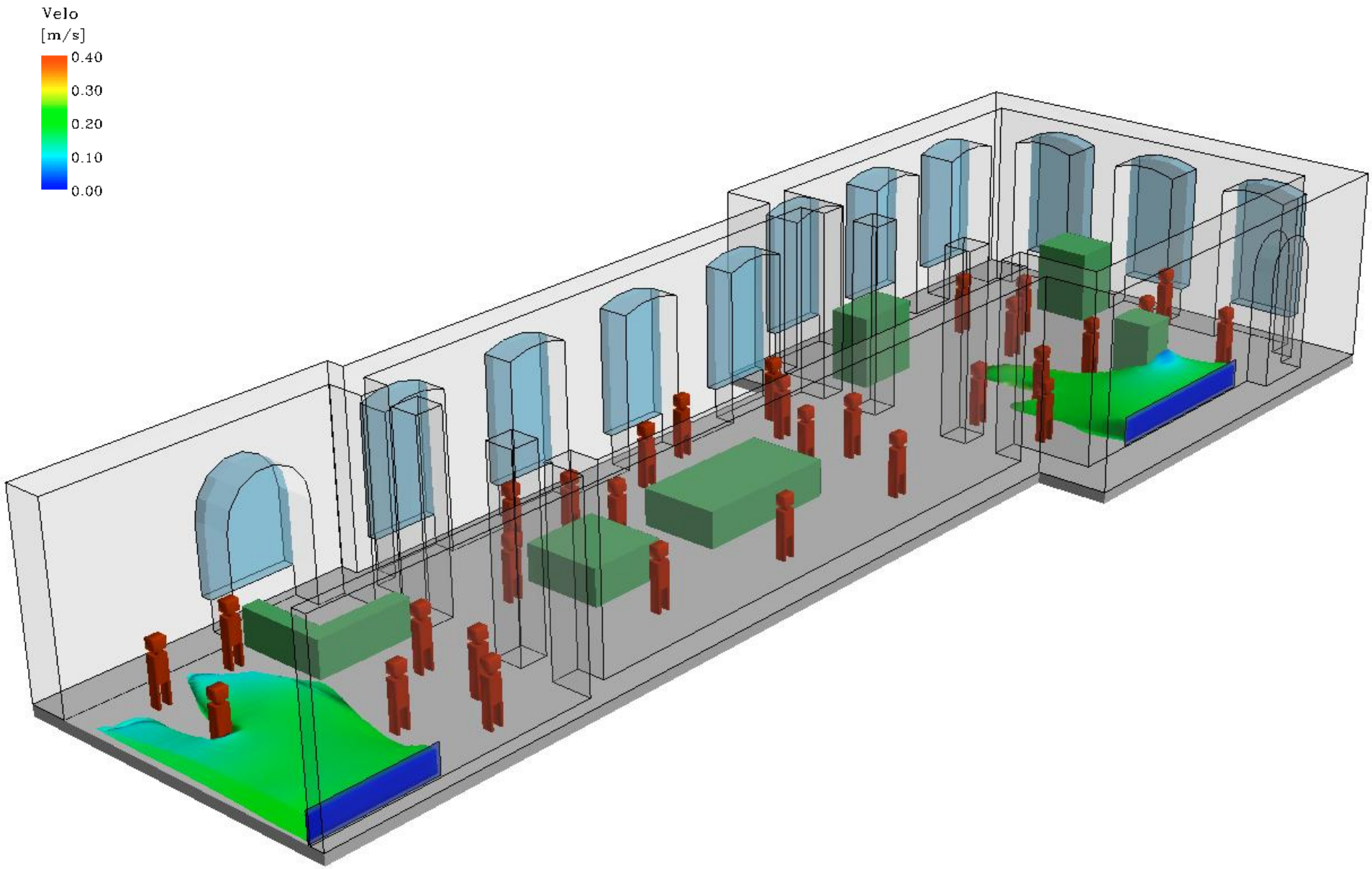
Horzontal temperature profile



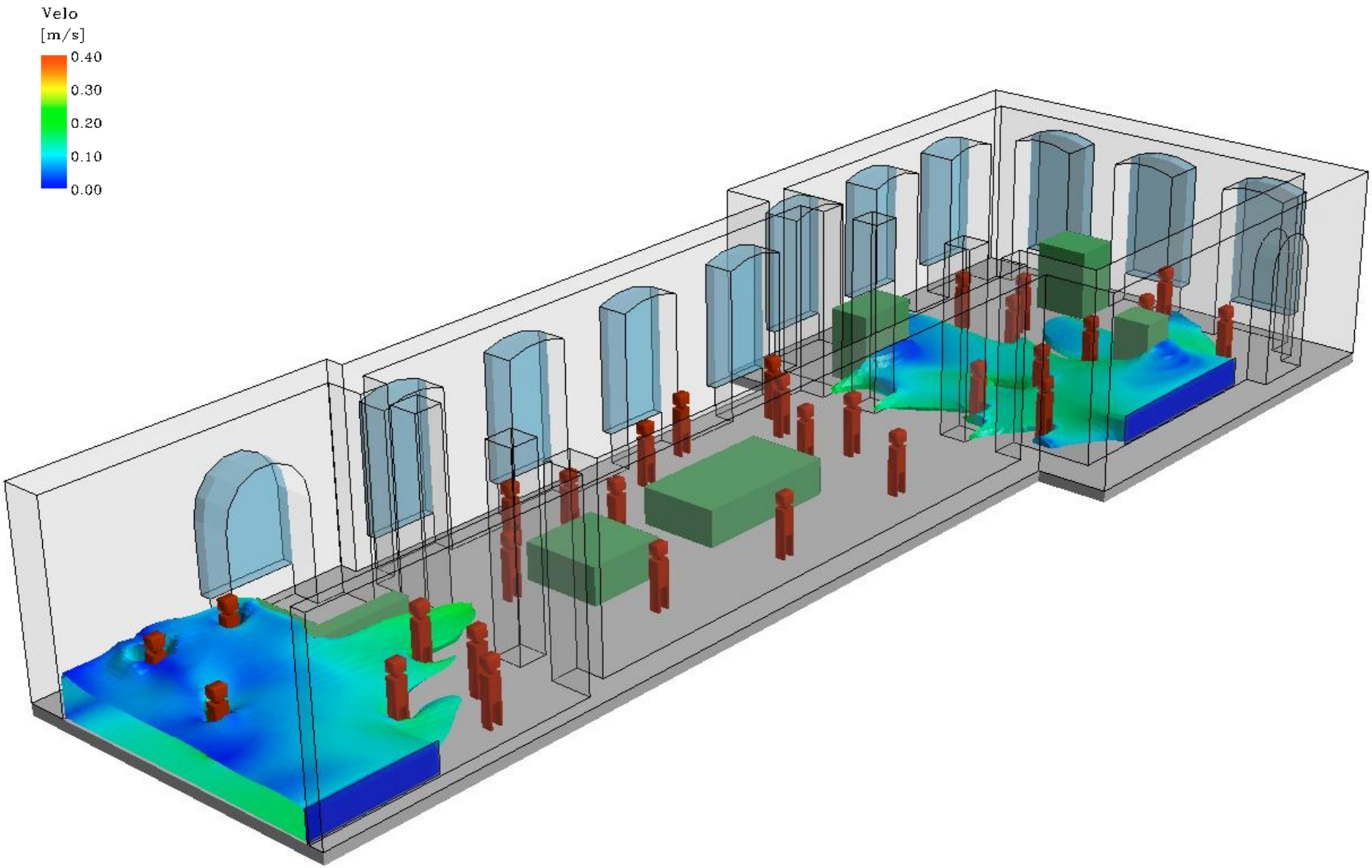
Horzontal temperature profile



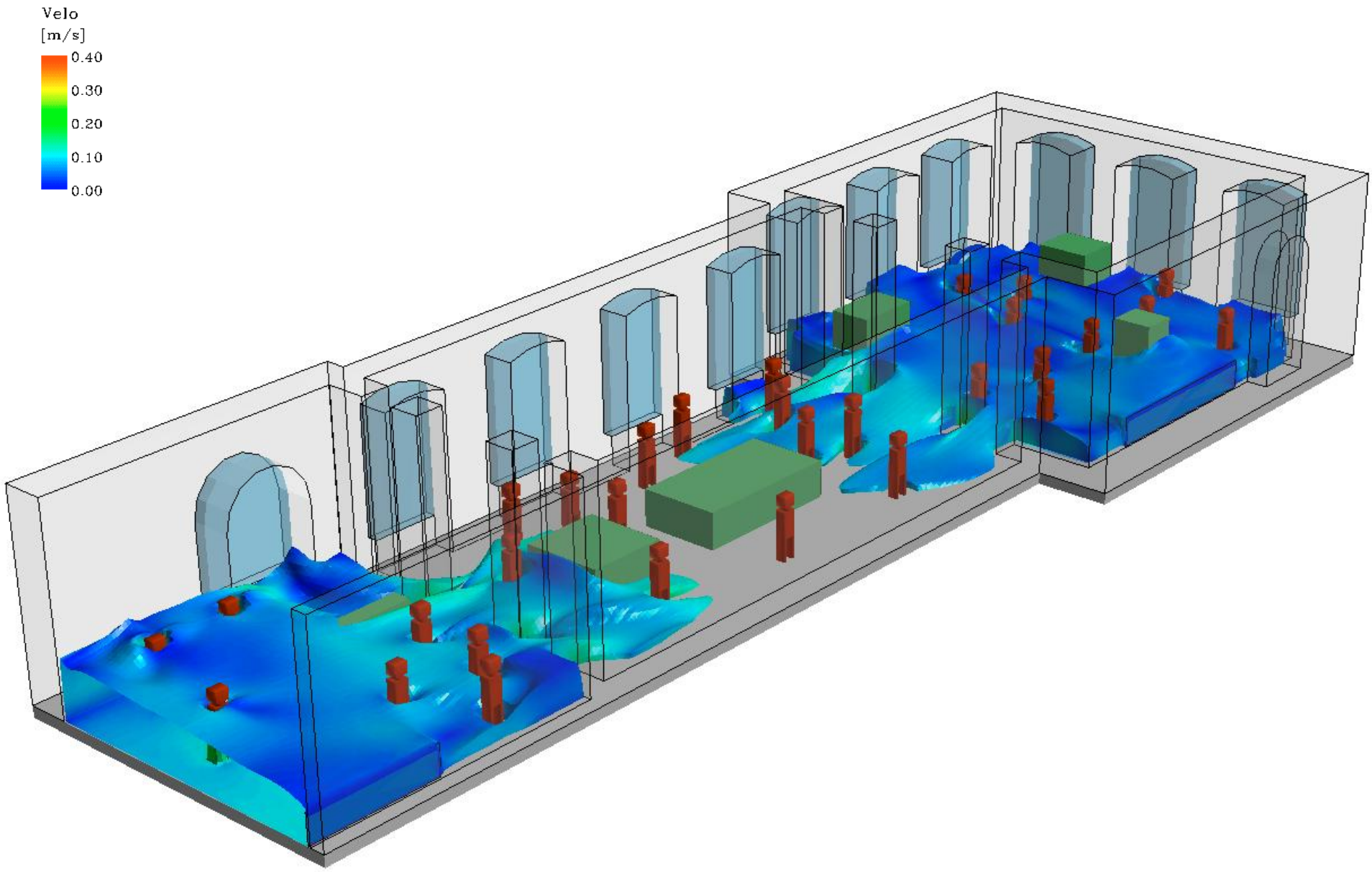
Iso-surface 20.1°C



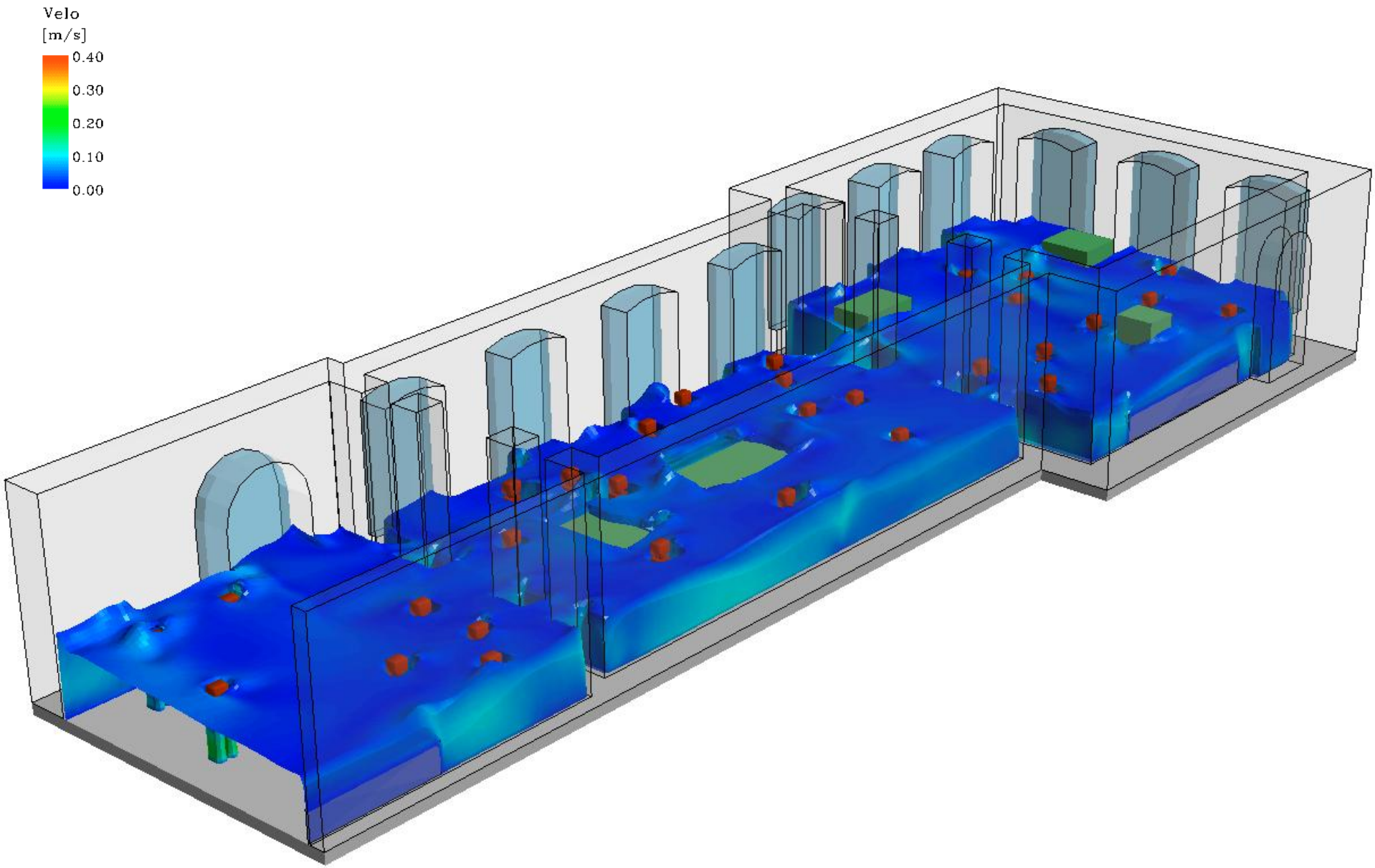
Iso-surface 20.5°C



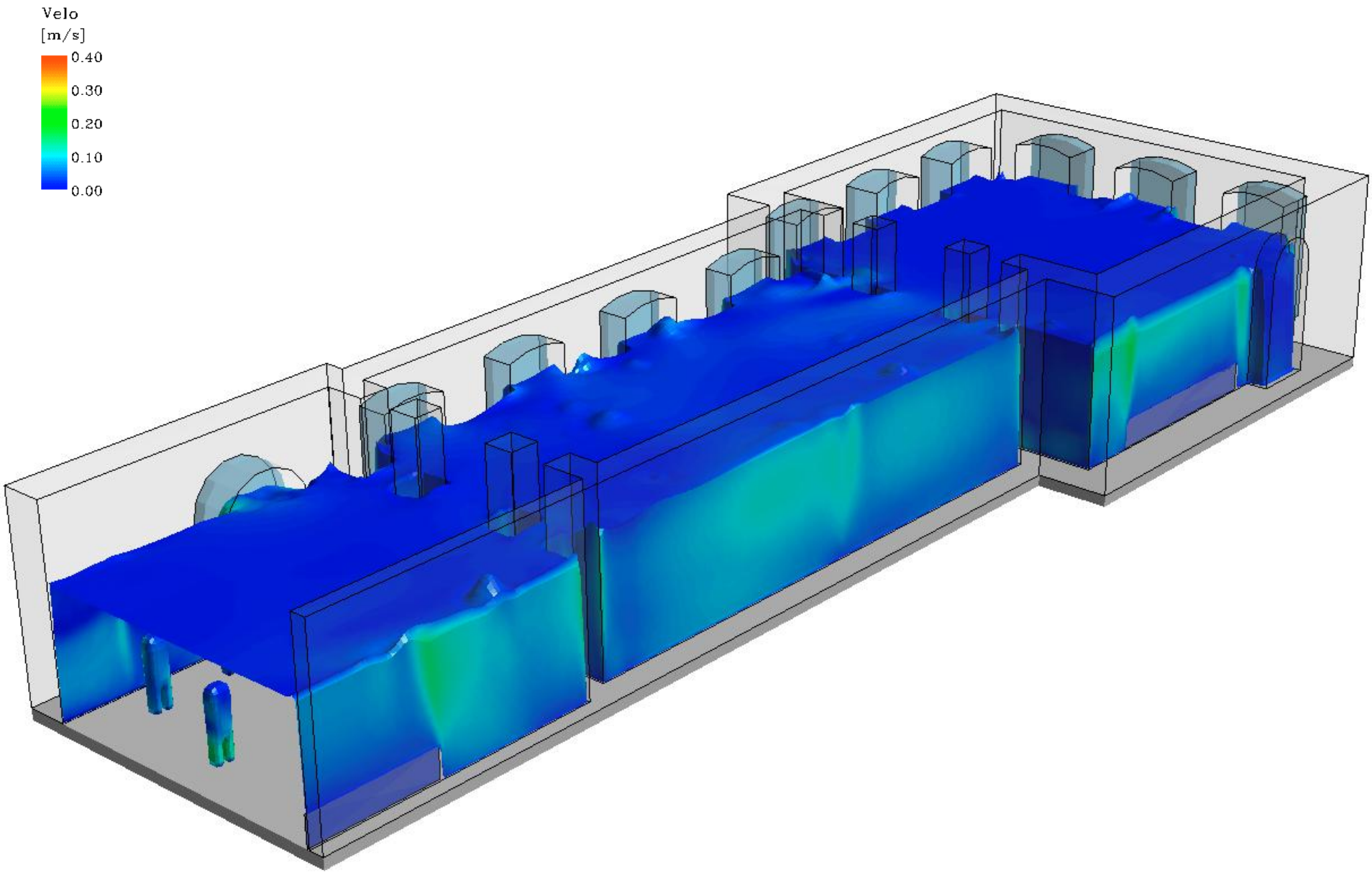
Iso-surface 21.0°C



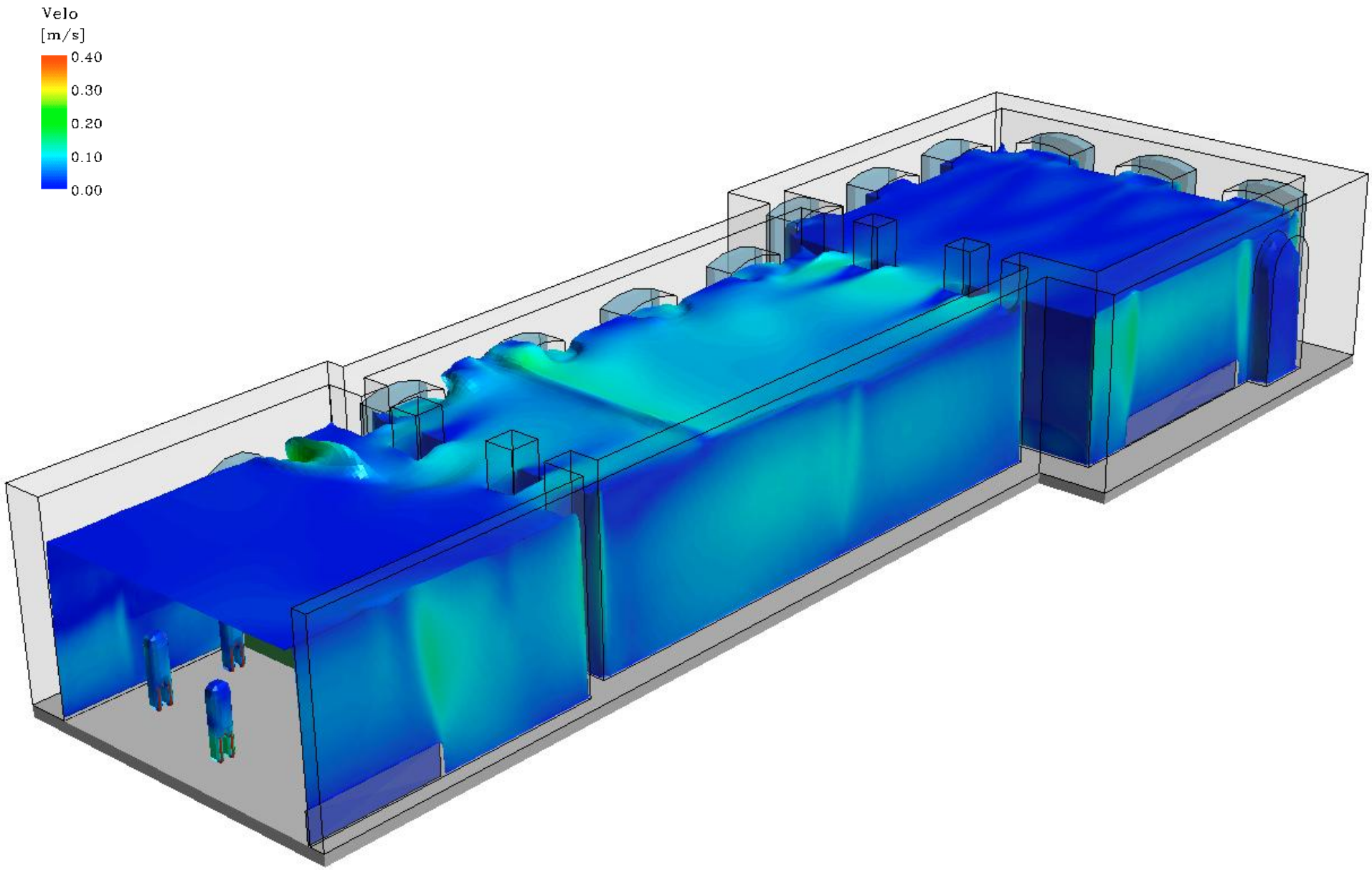
Iso-surface 20.2°C



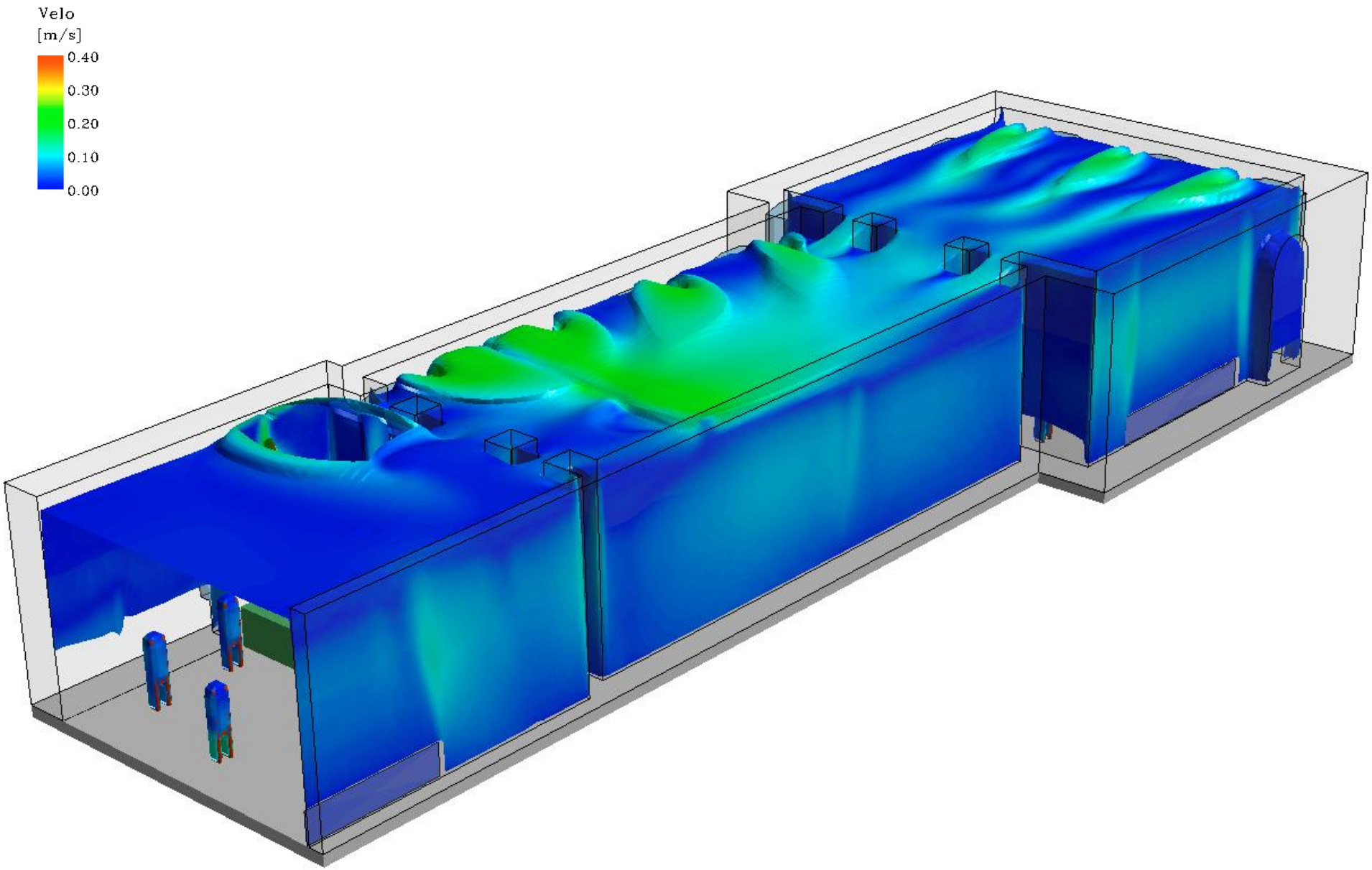
Iso-surface 23.0°C



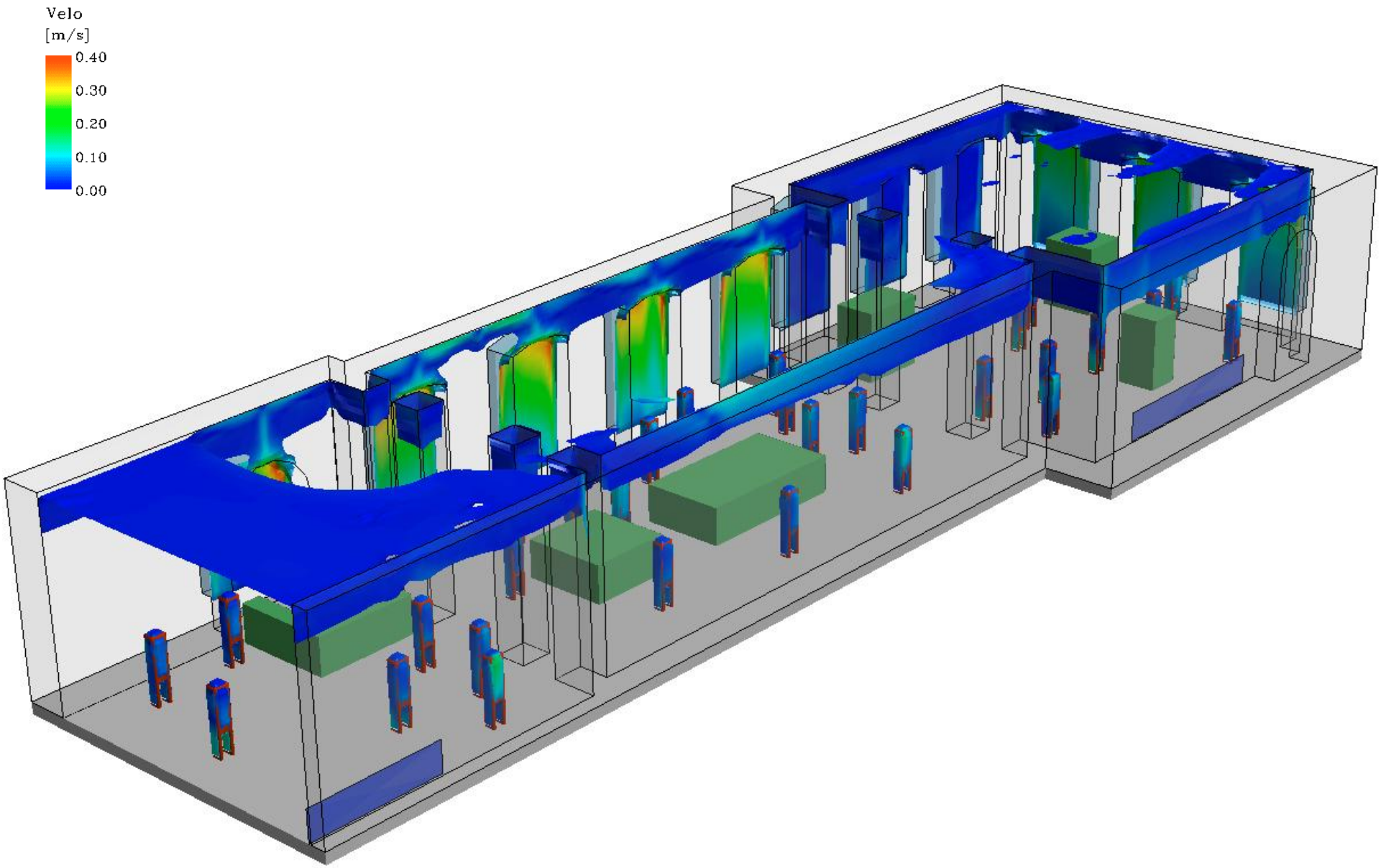
Iso-surface 24.0°C



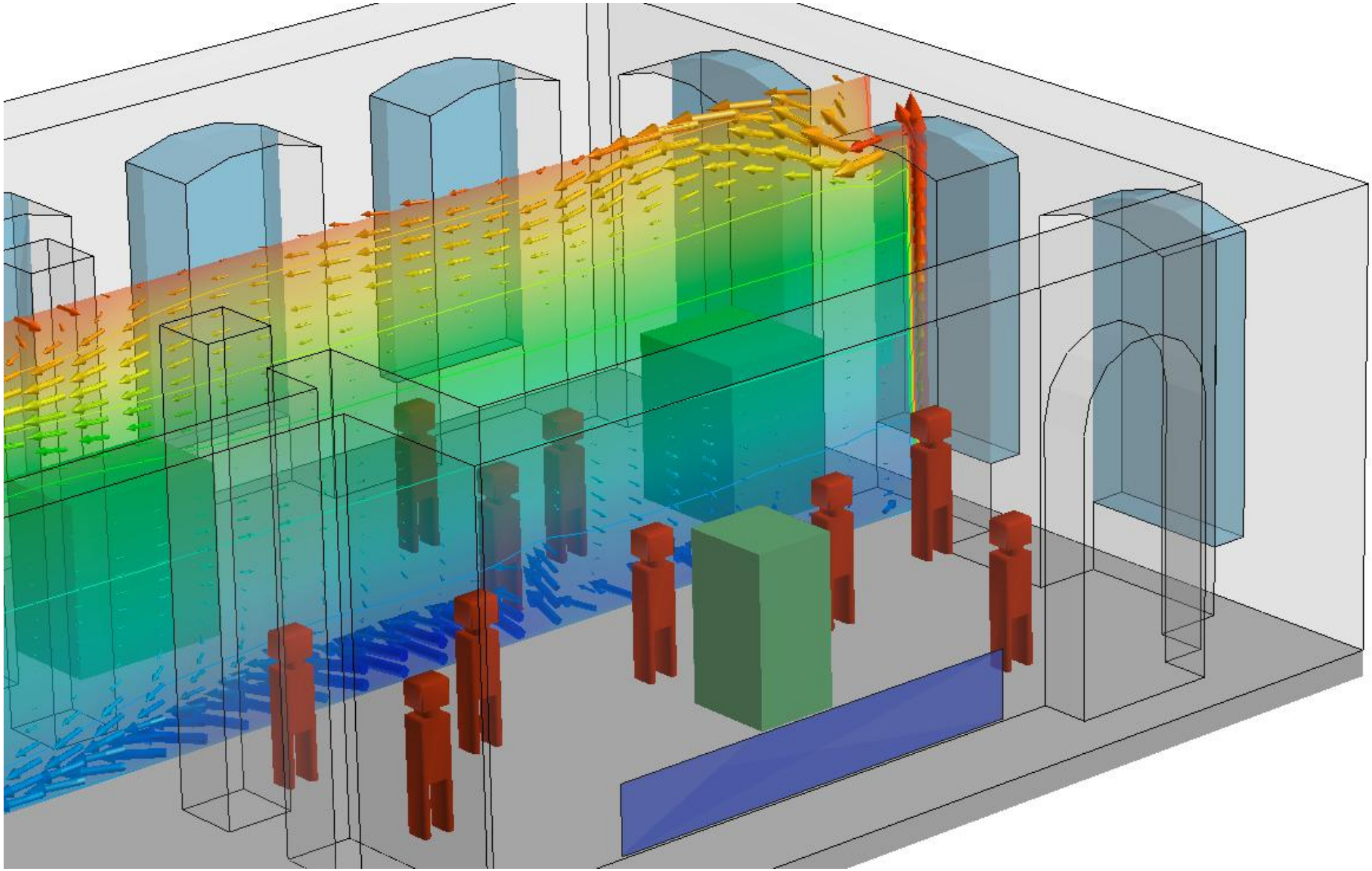
Iso-surface 25.0°C



Iso-surface 26.0°C



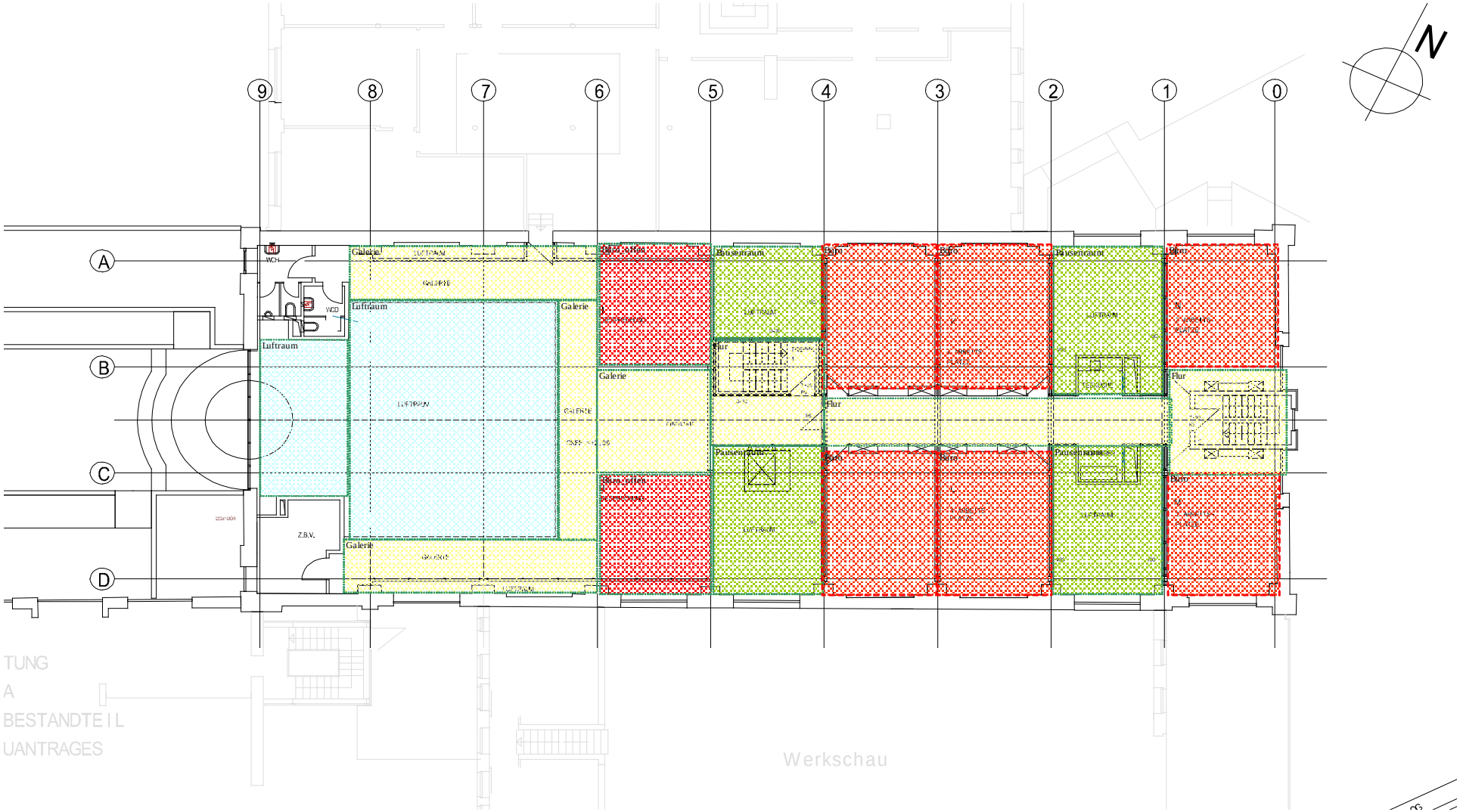
making our customers understand what happens



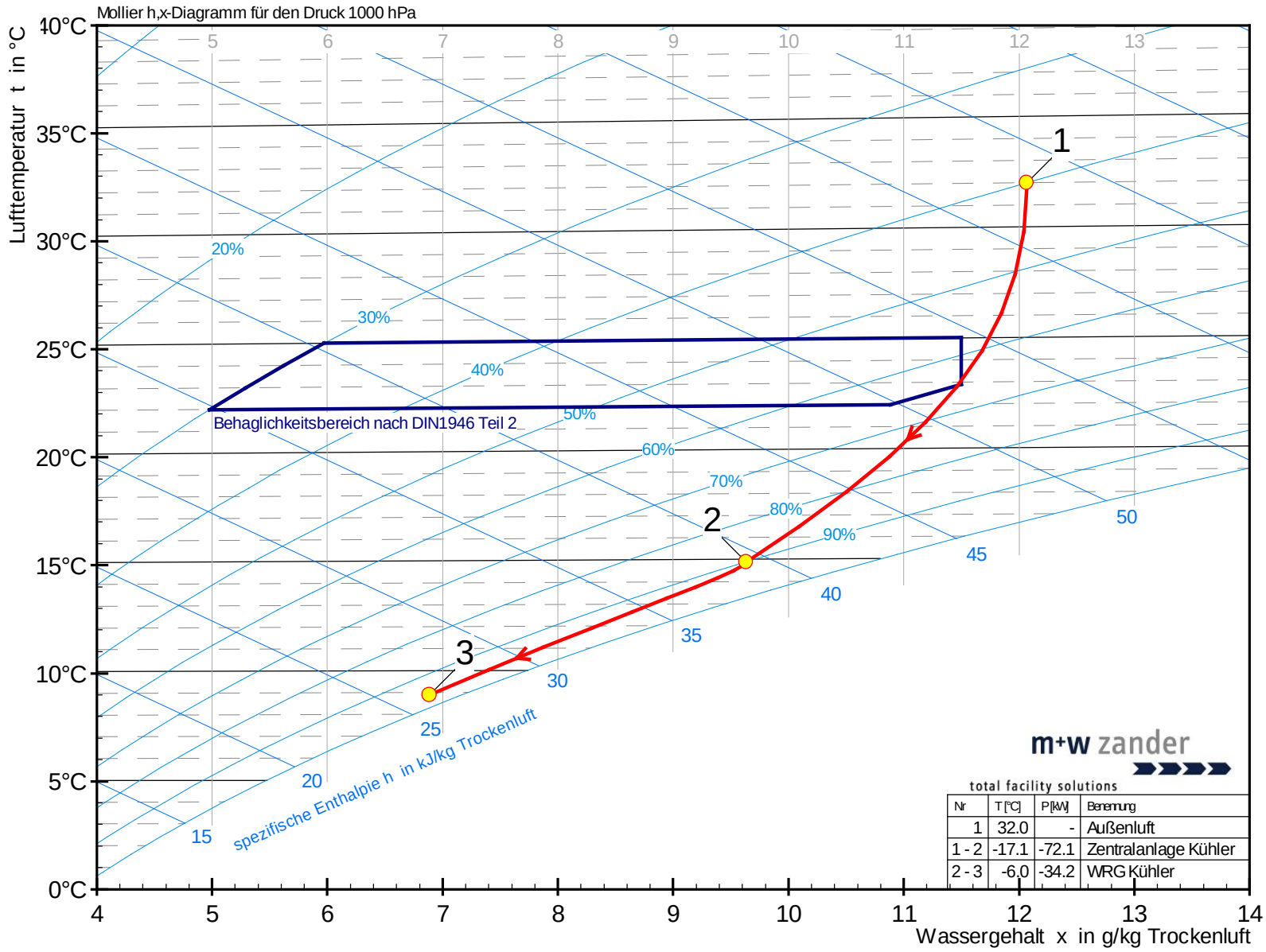
BUILDING ANALYSIS

building analysis

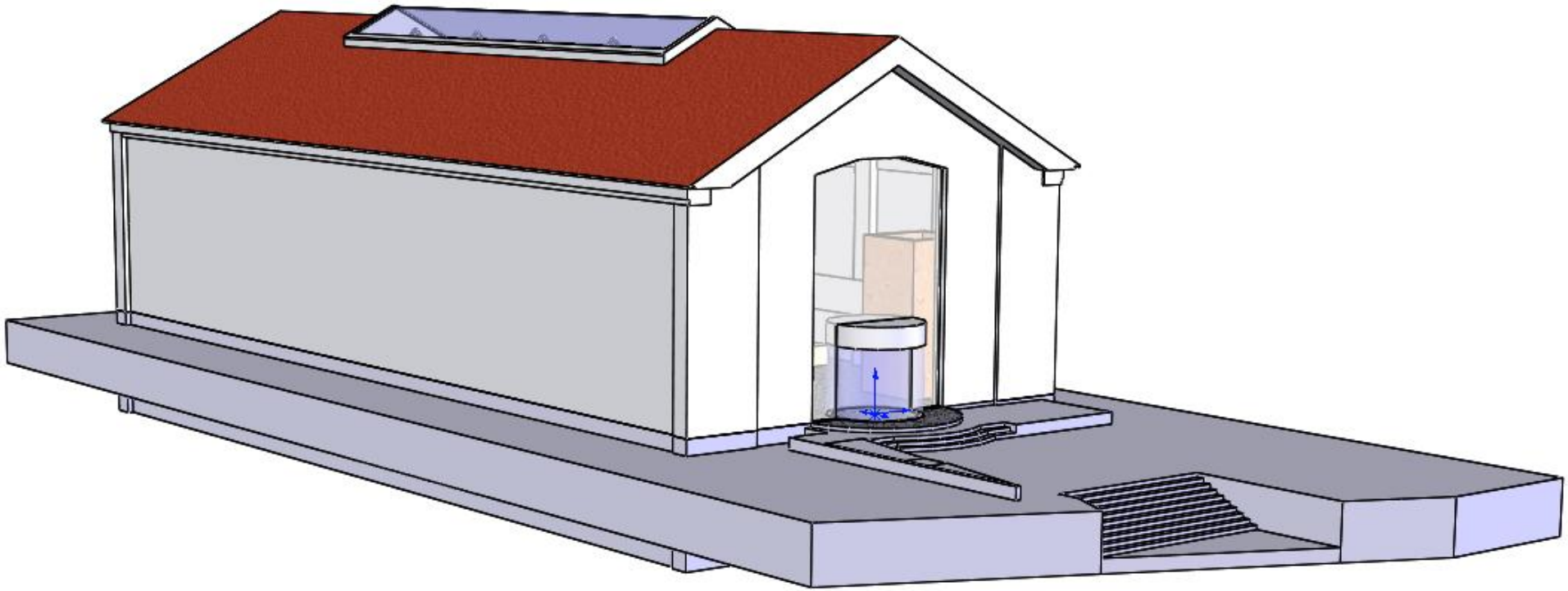
do you understand this?



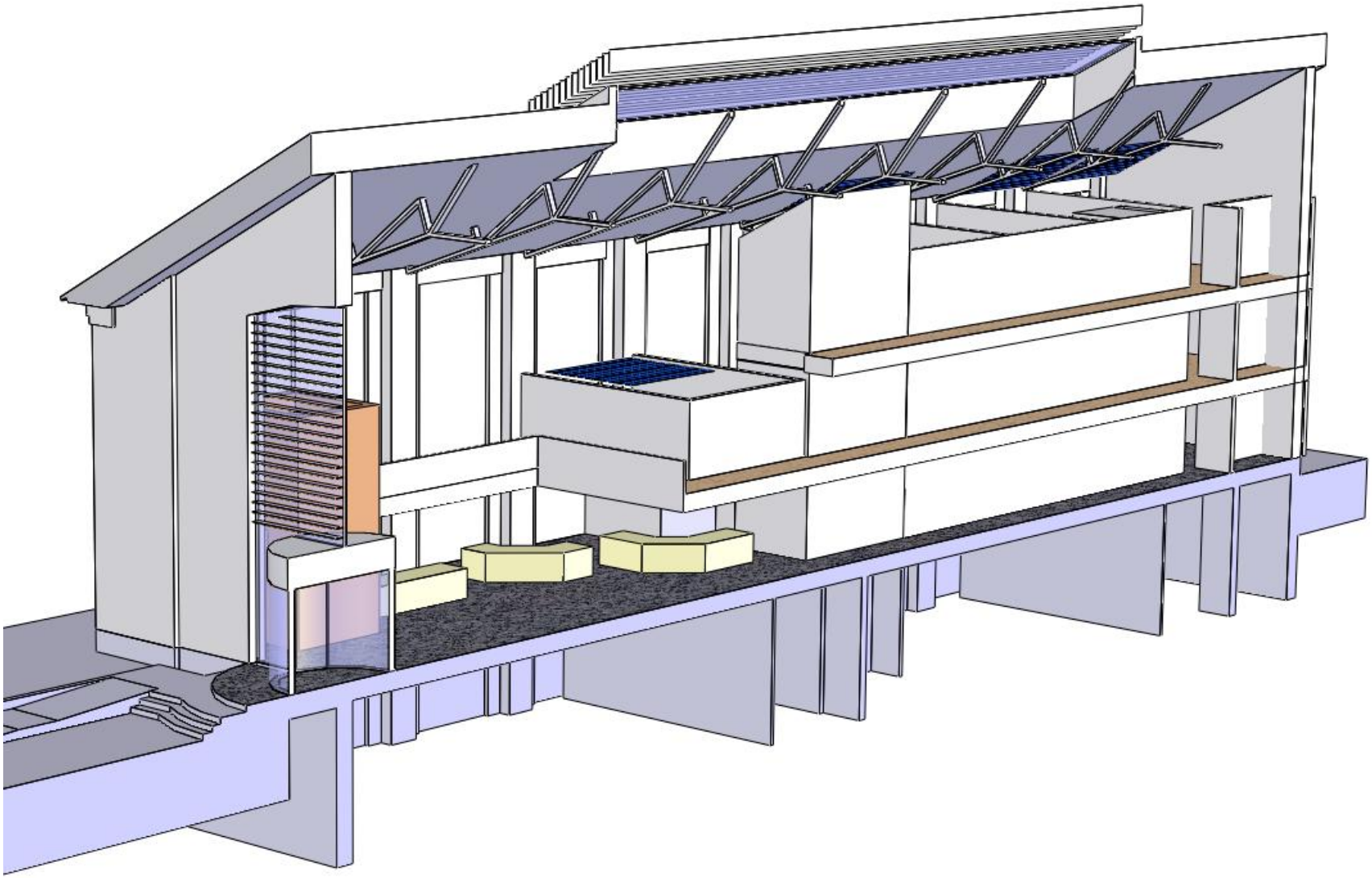
or this?



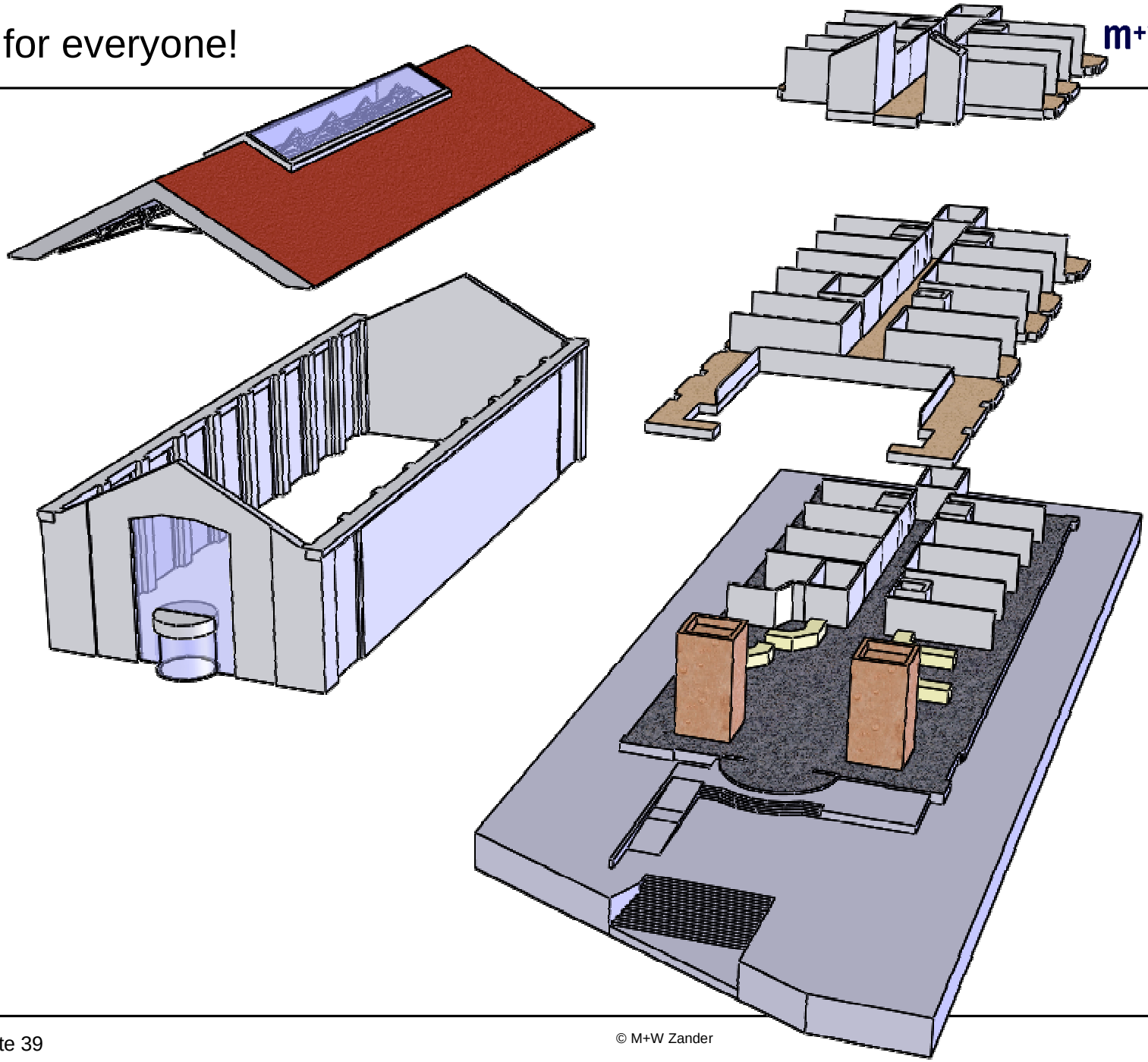
but that...



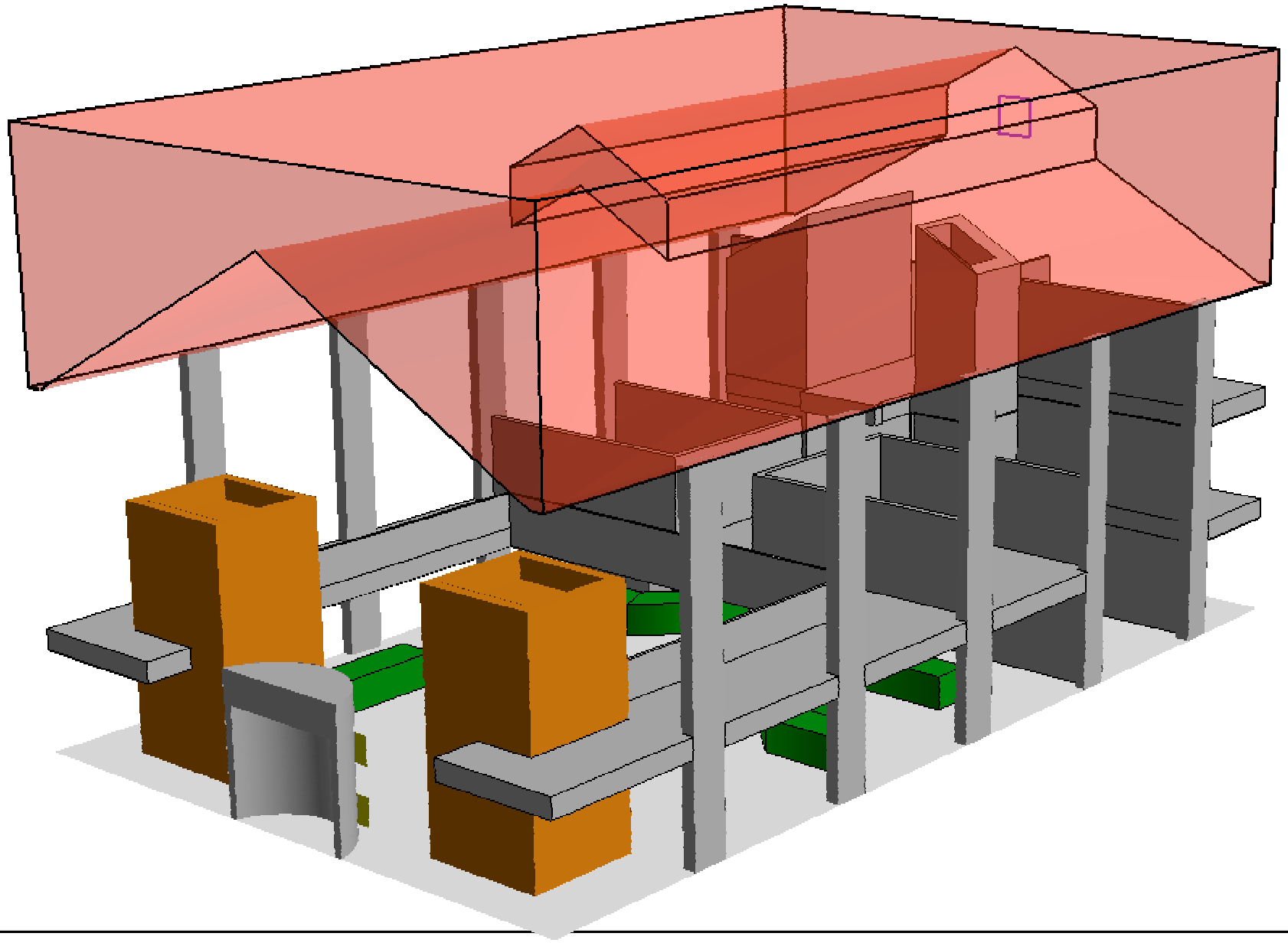
...is clear...



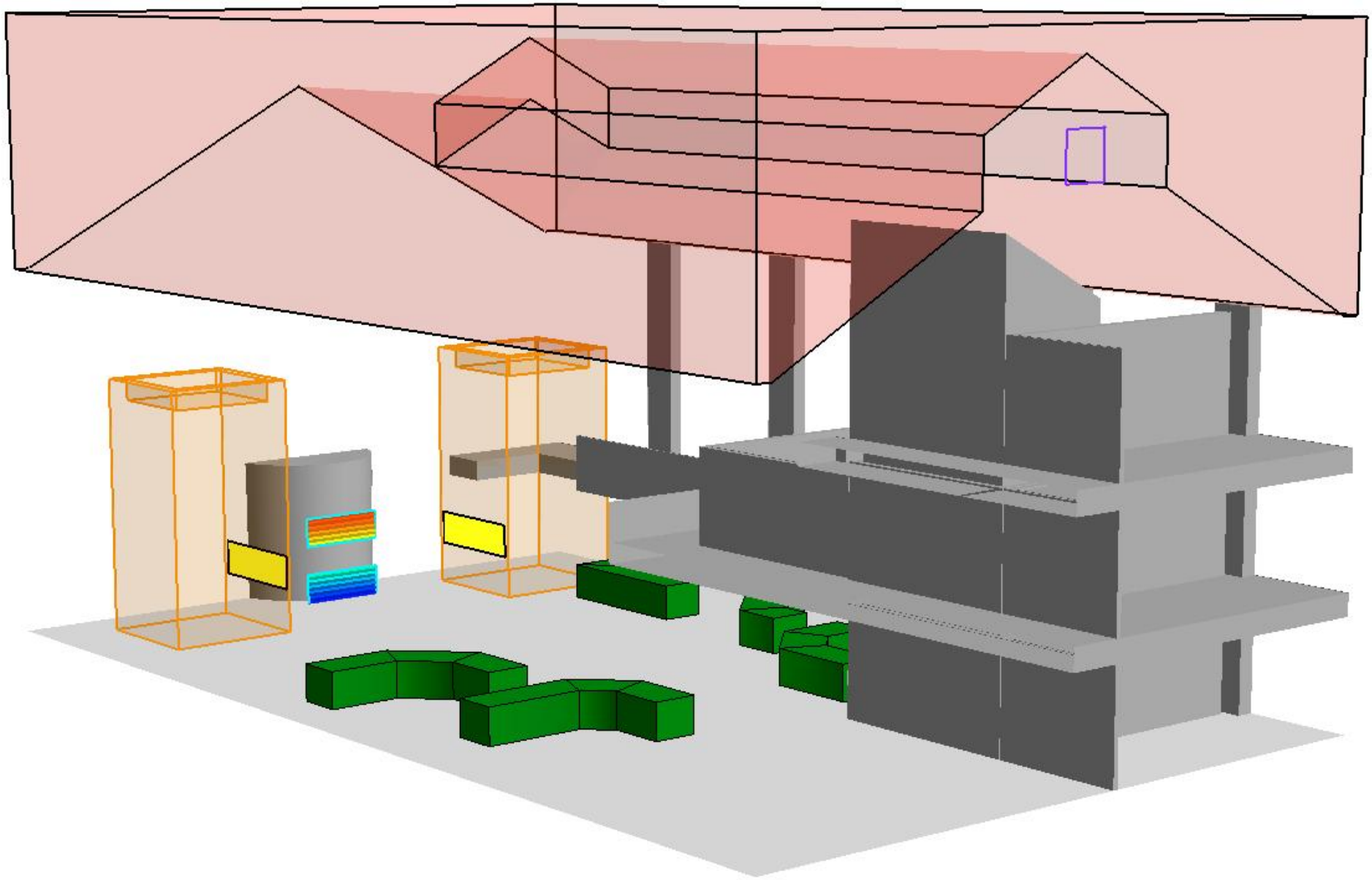
...for everyone!



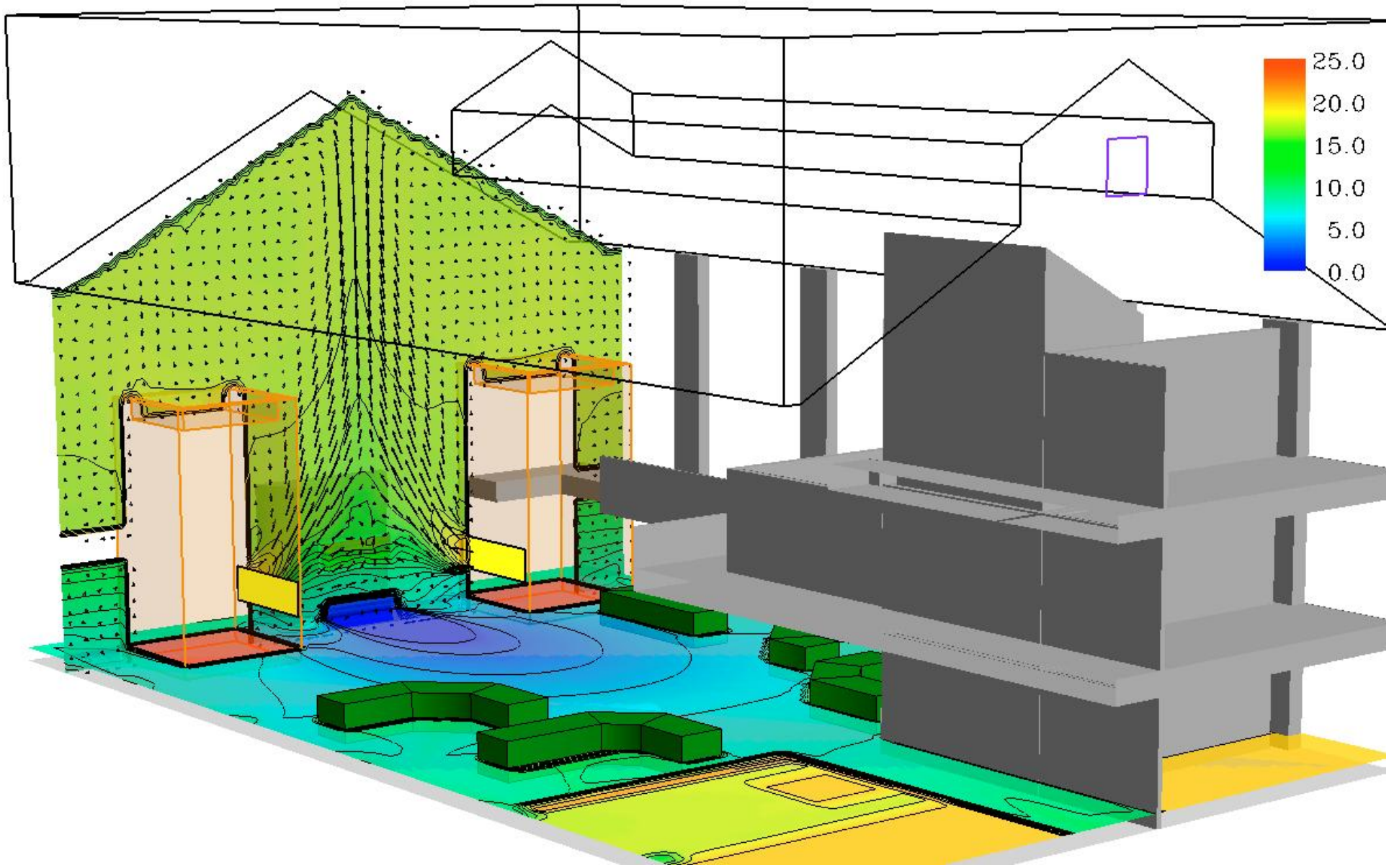
We bring the geometry to phoenics directly!

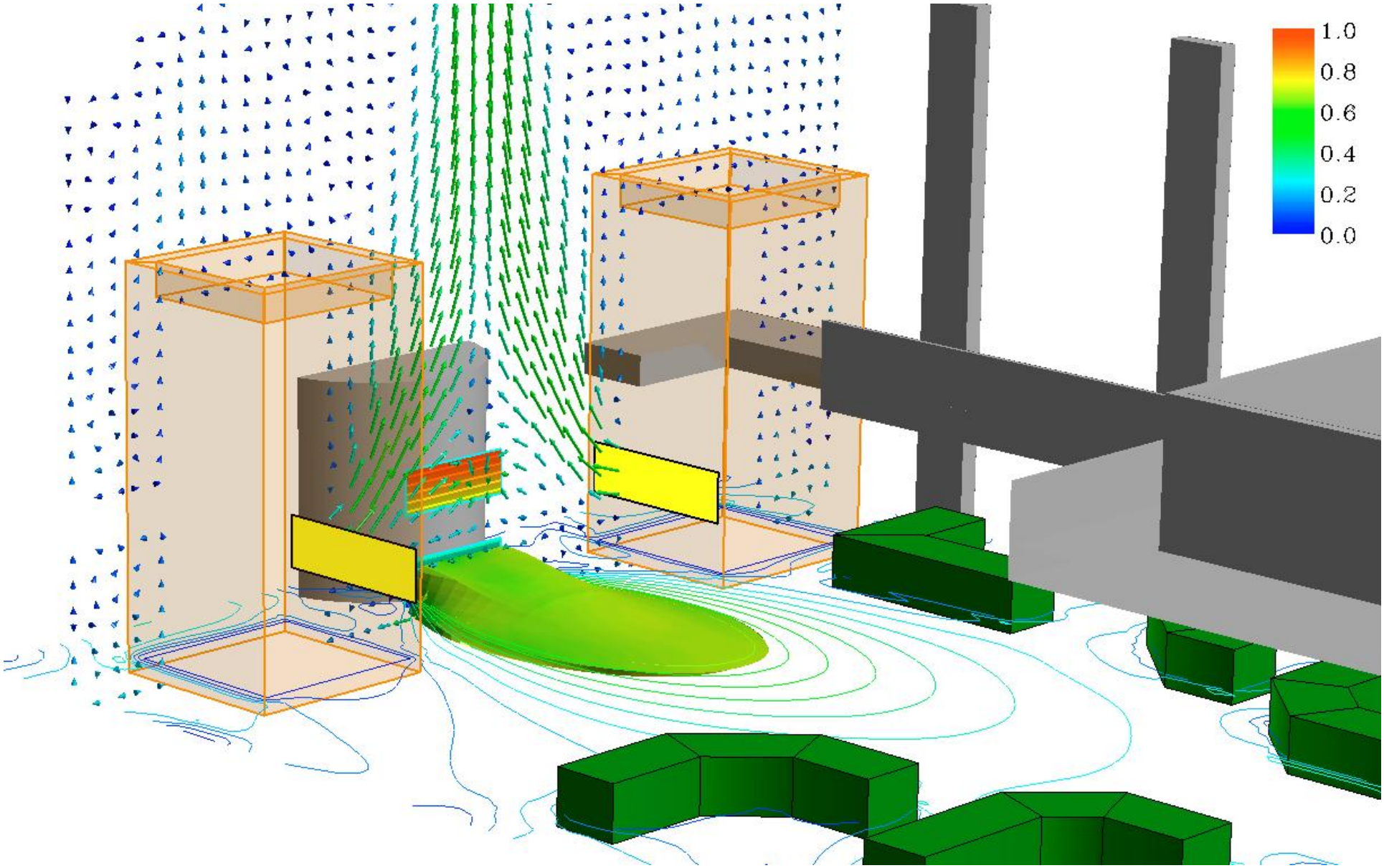


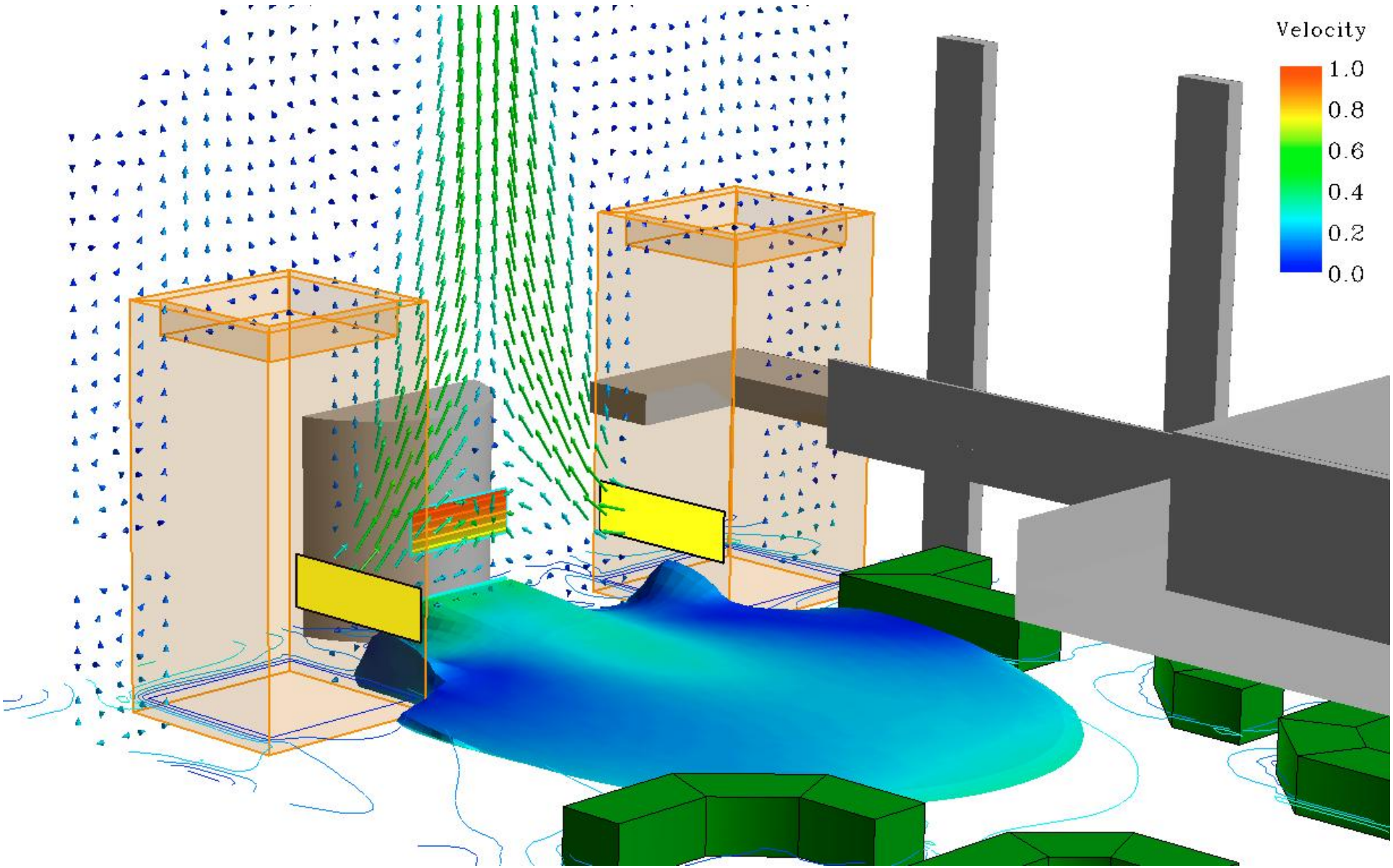
We bring the geometry to phoenics directly!

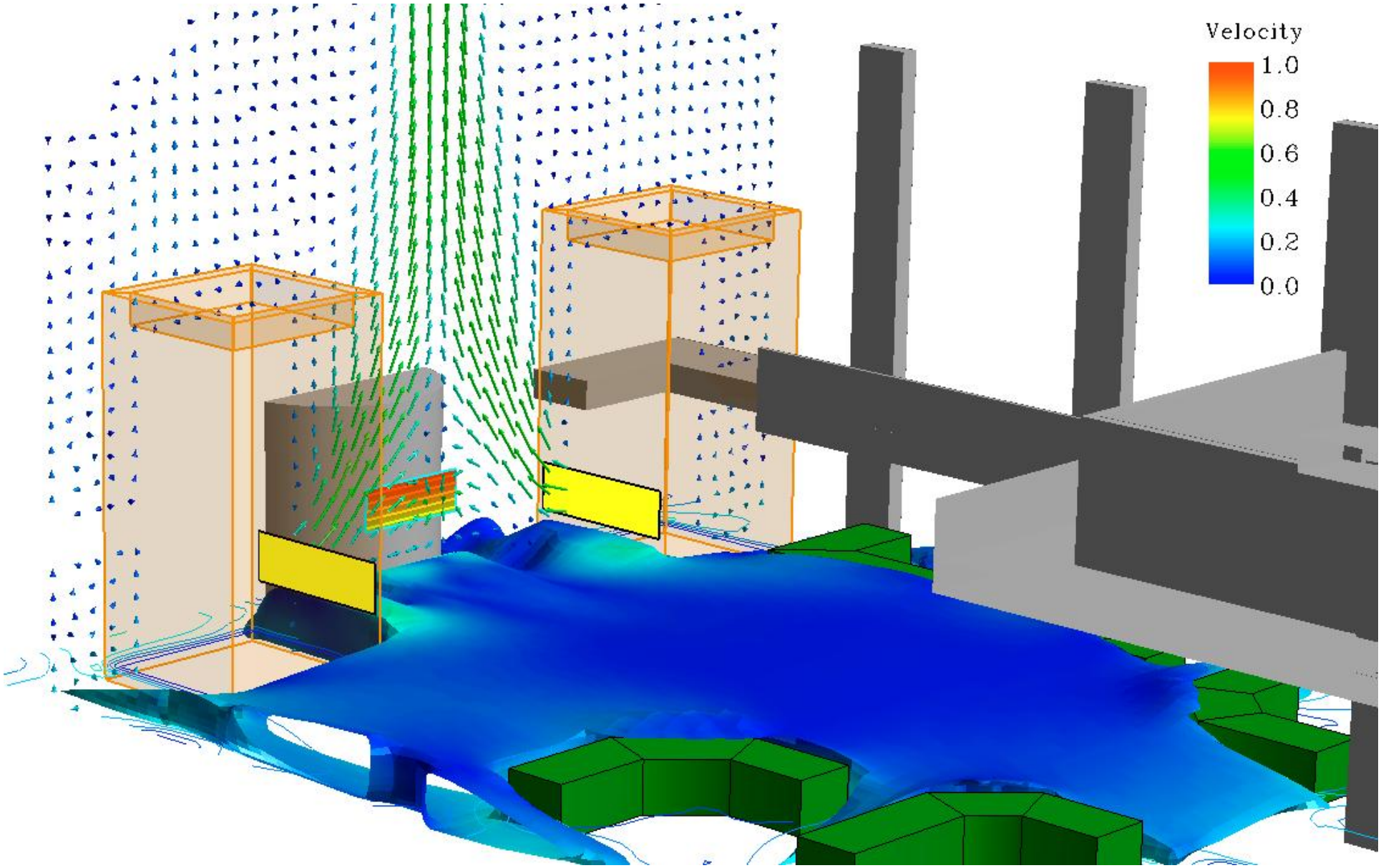


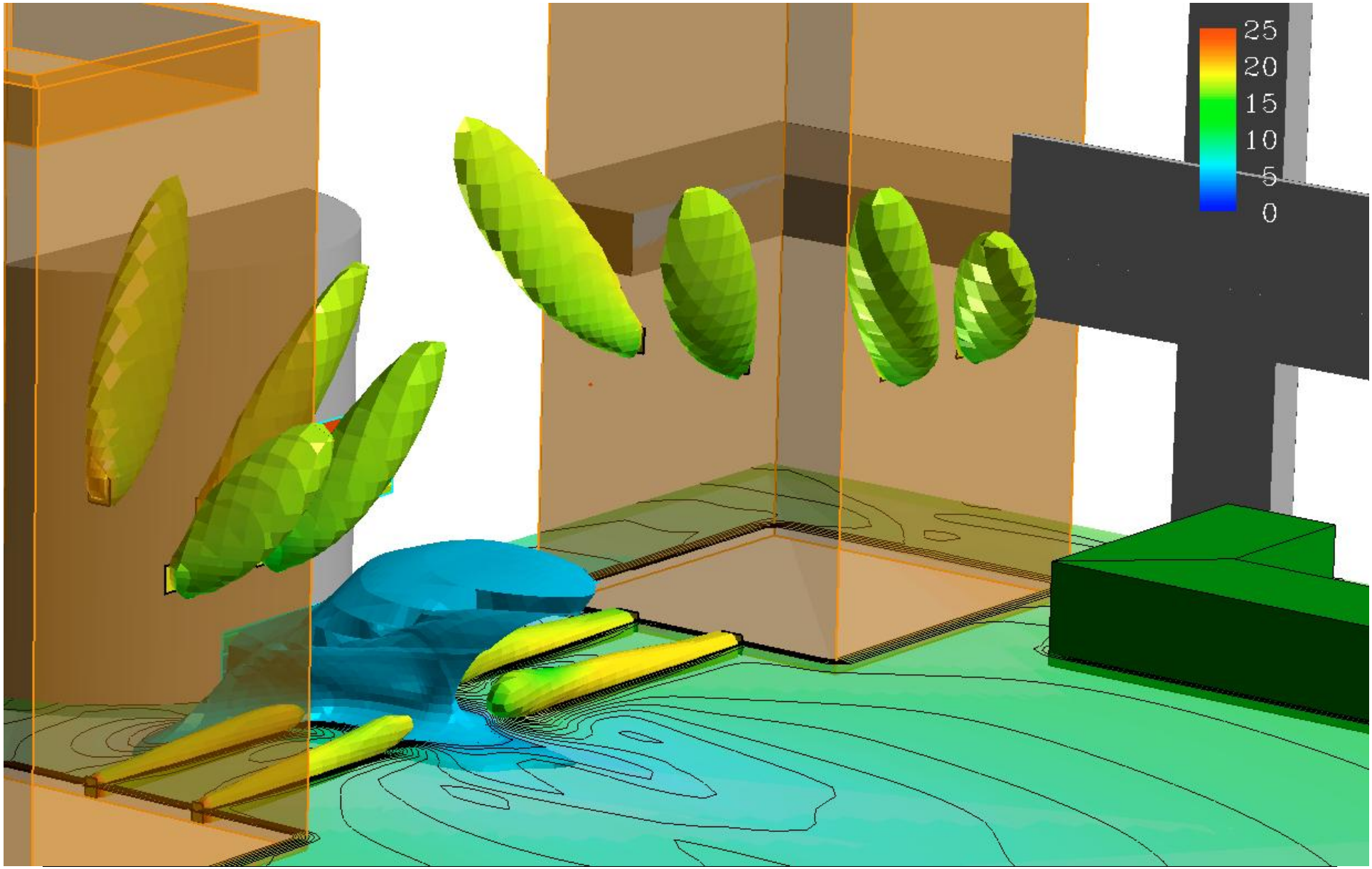
and we move everything to fieldview!

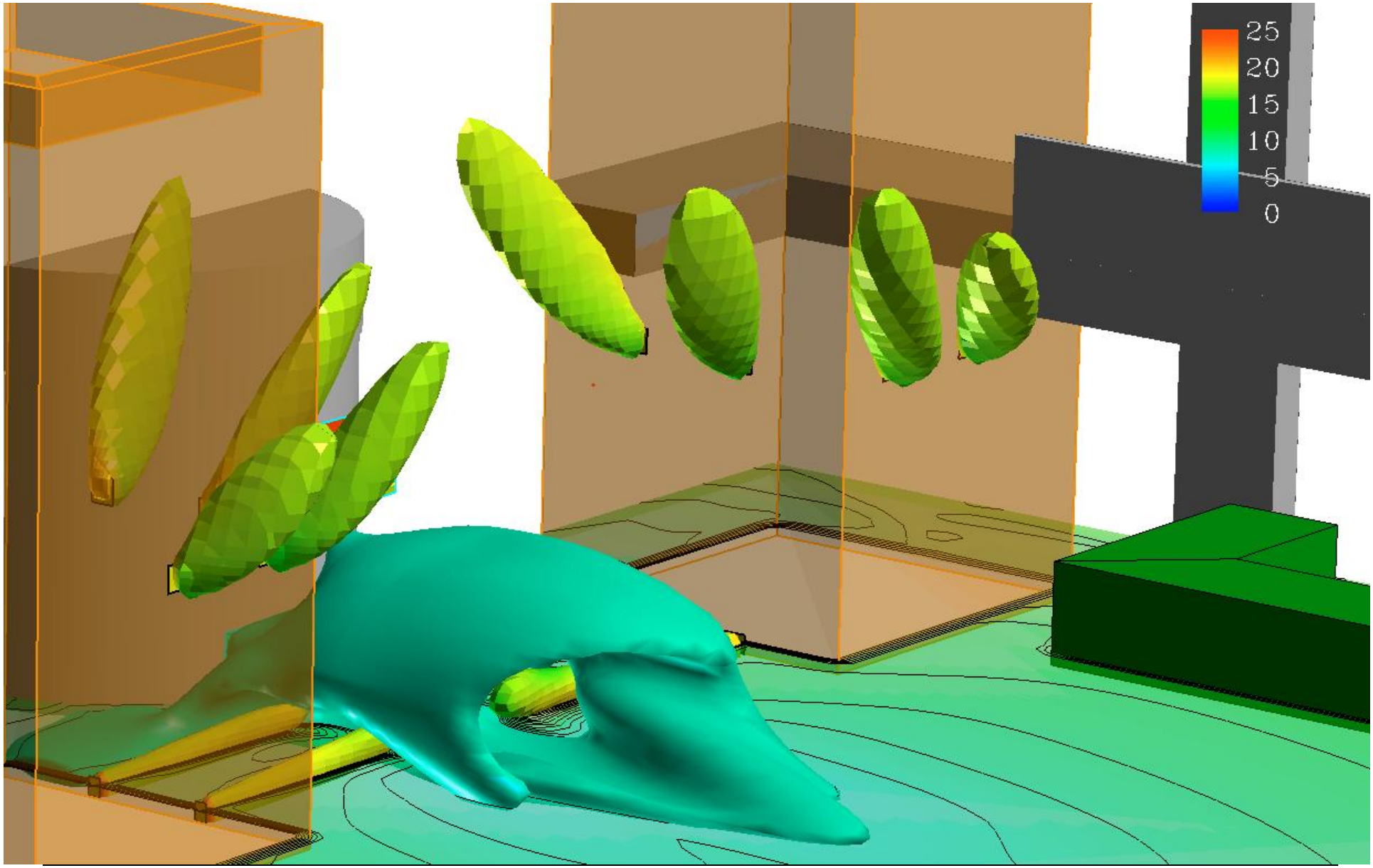


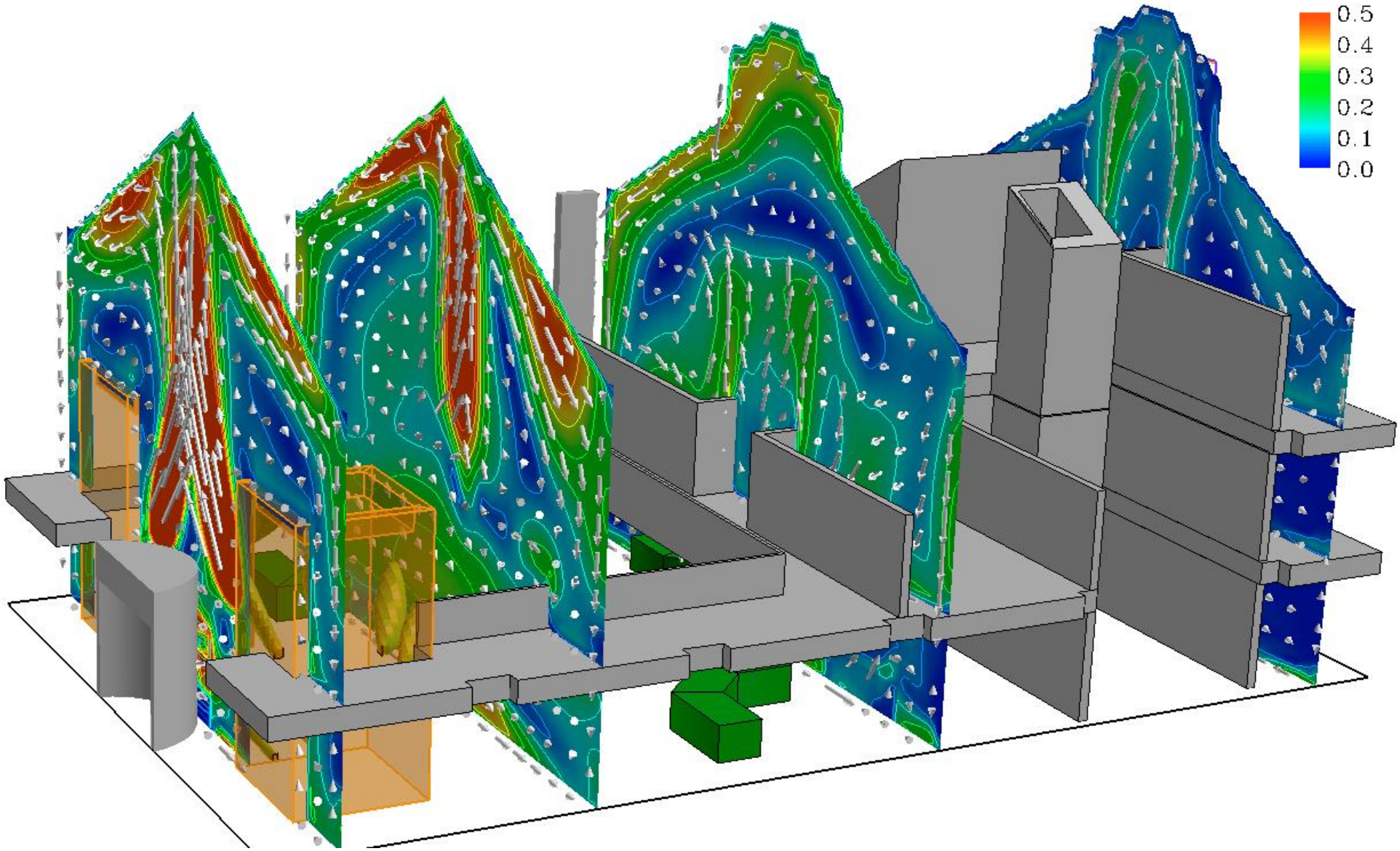






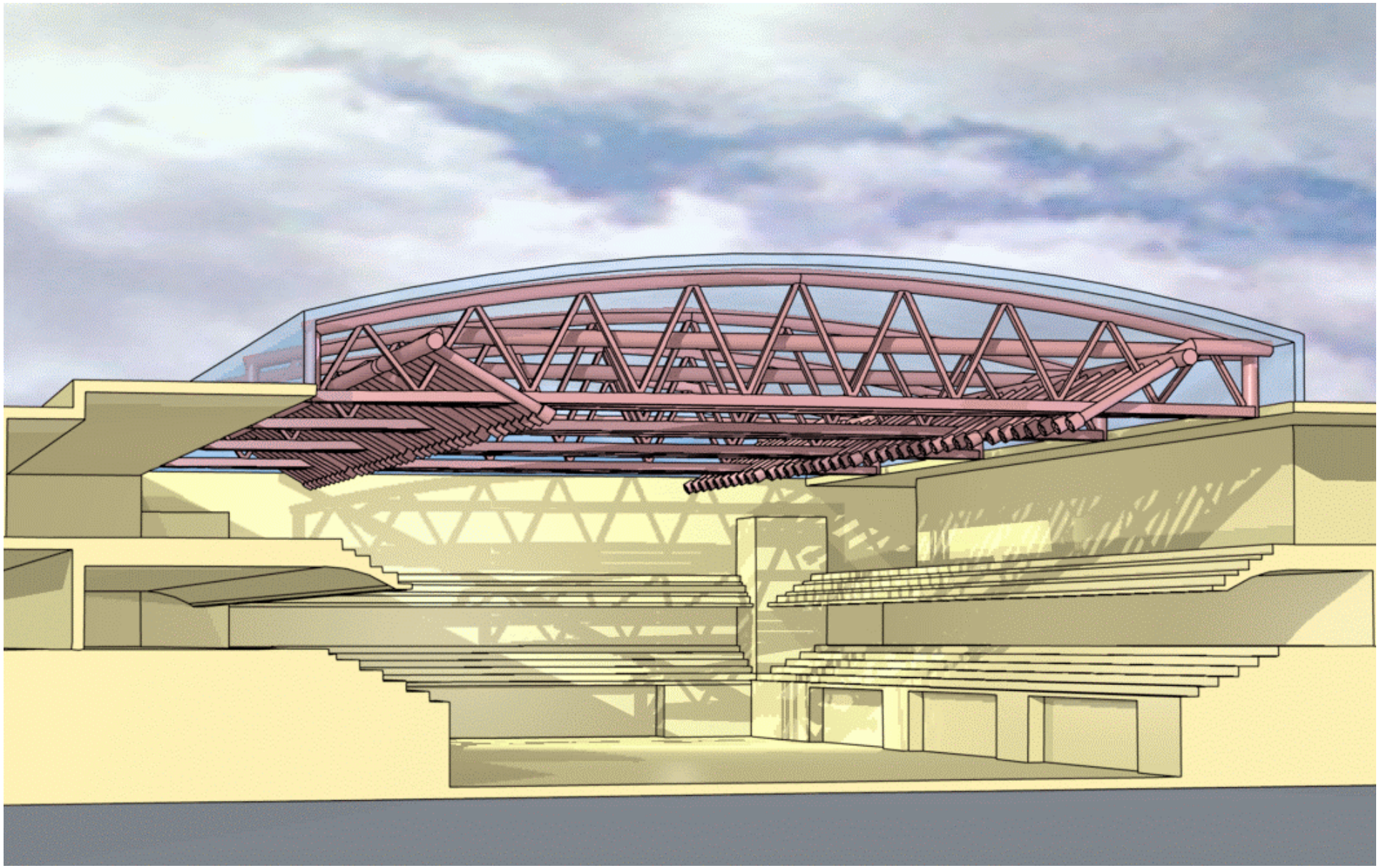




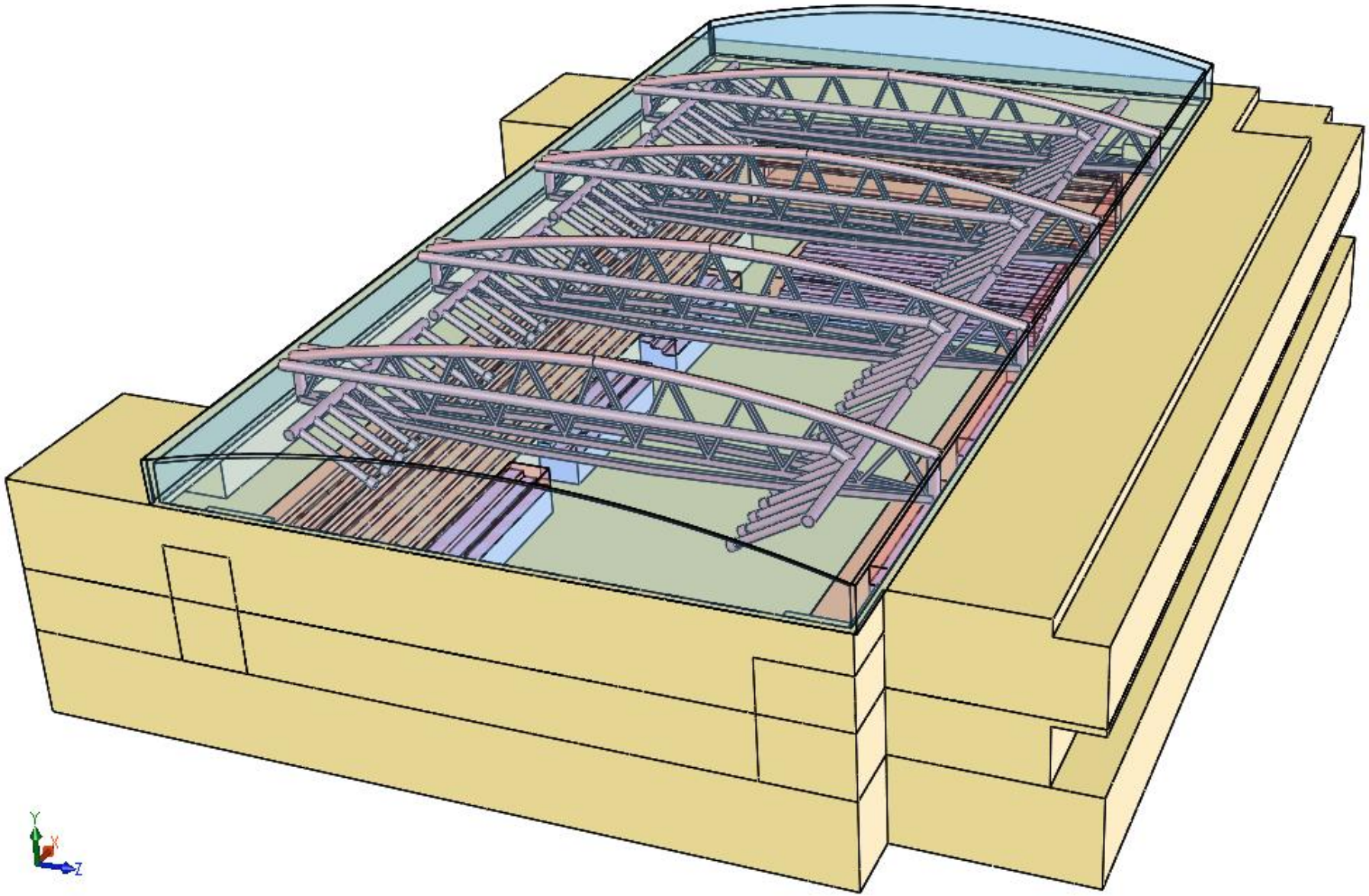


SYSTEM DESIGN

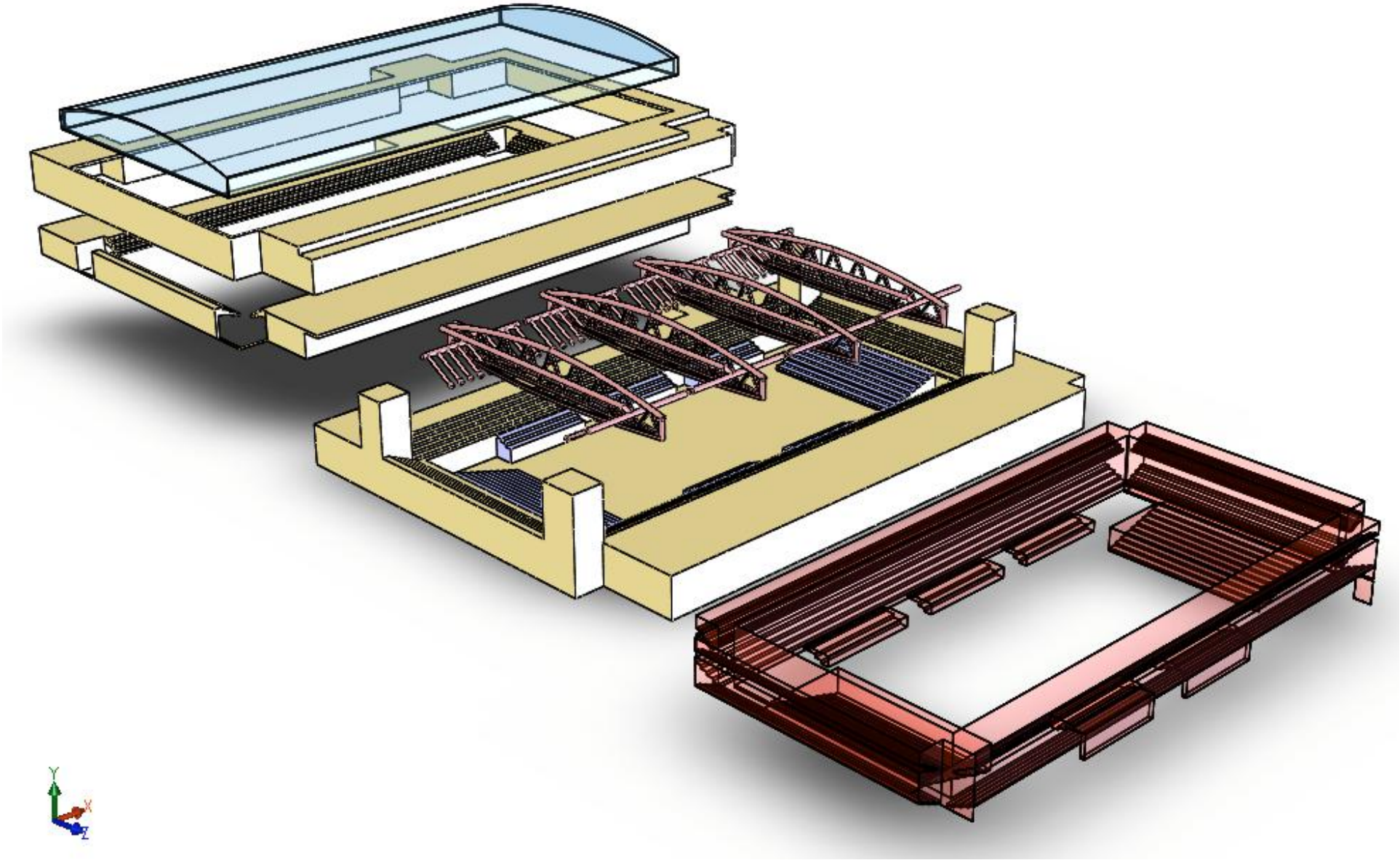
Sportpalace



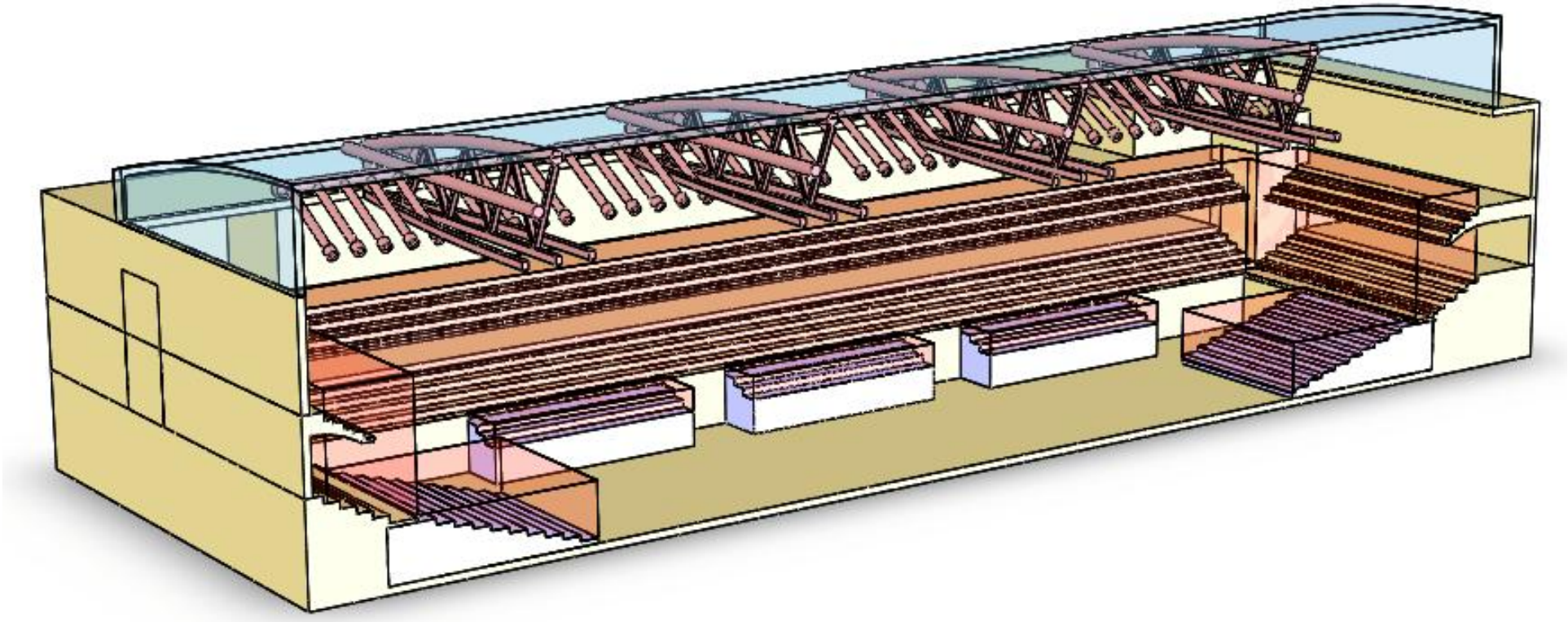
Model overview



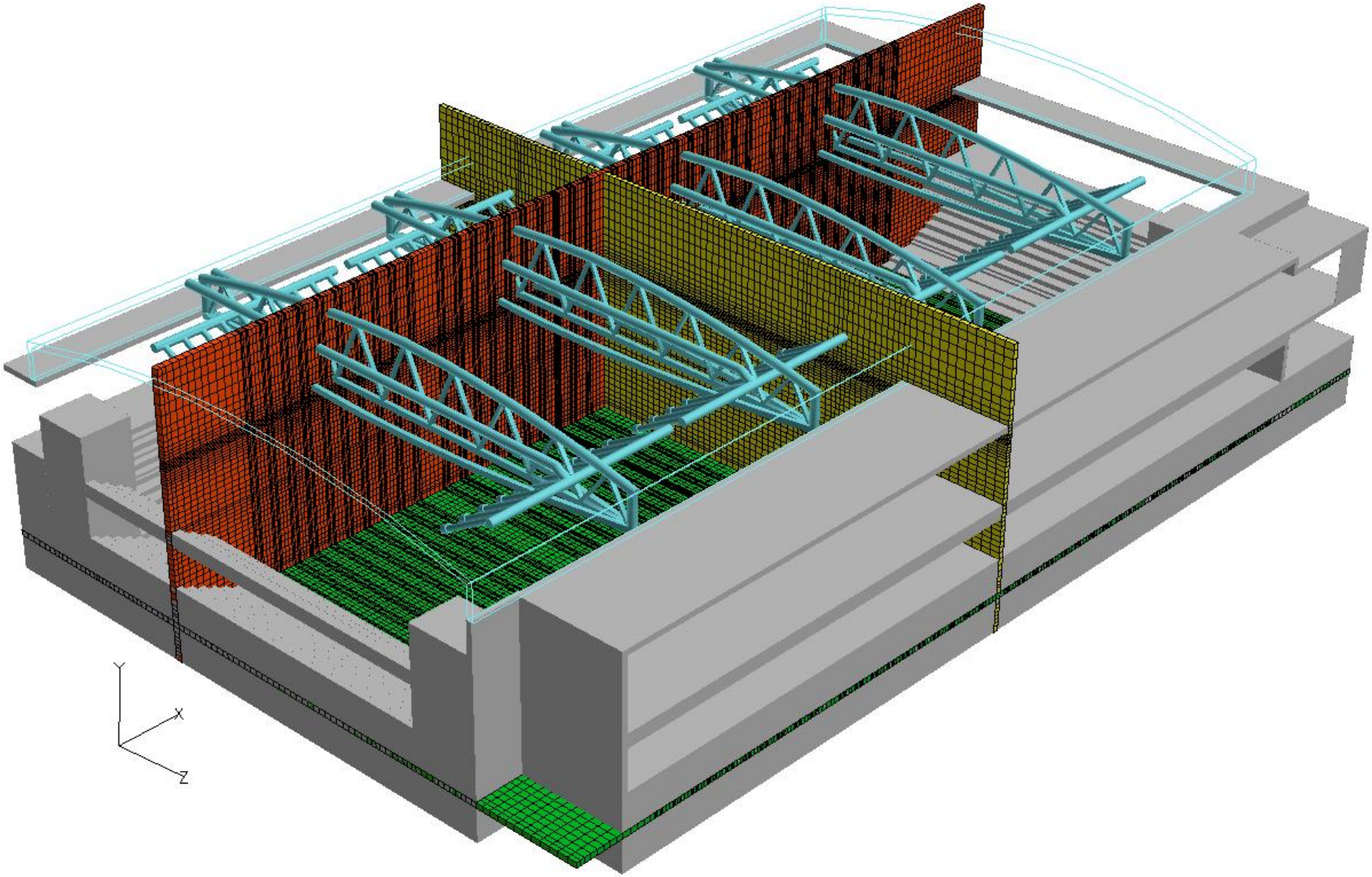
Model explanation



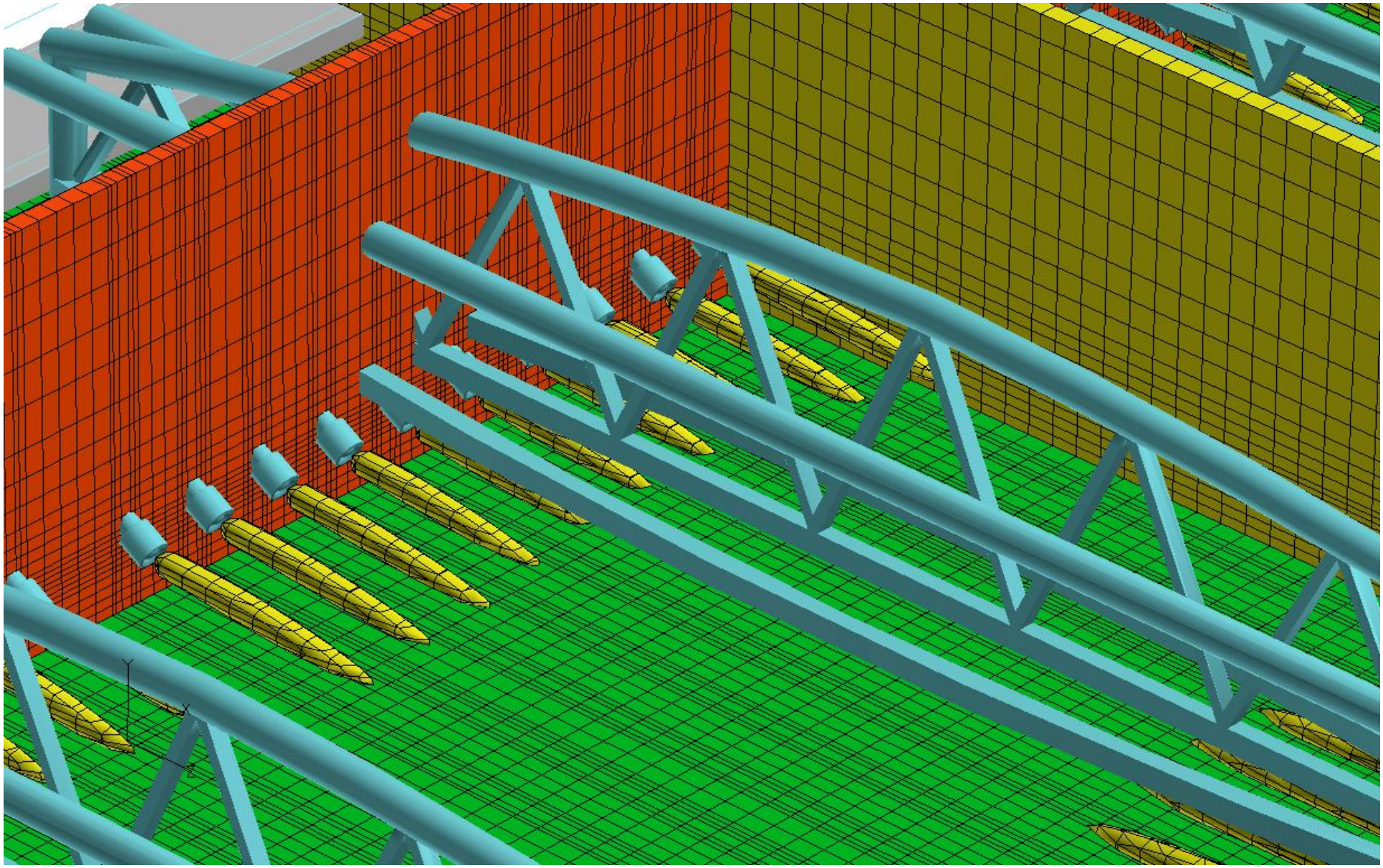
Model explanation



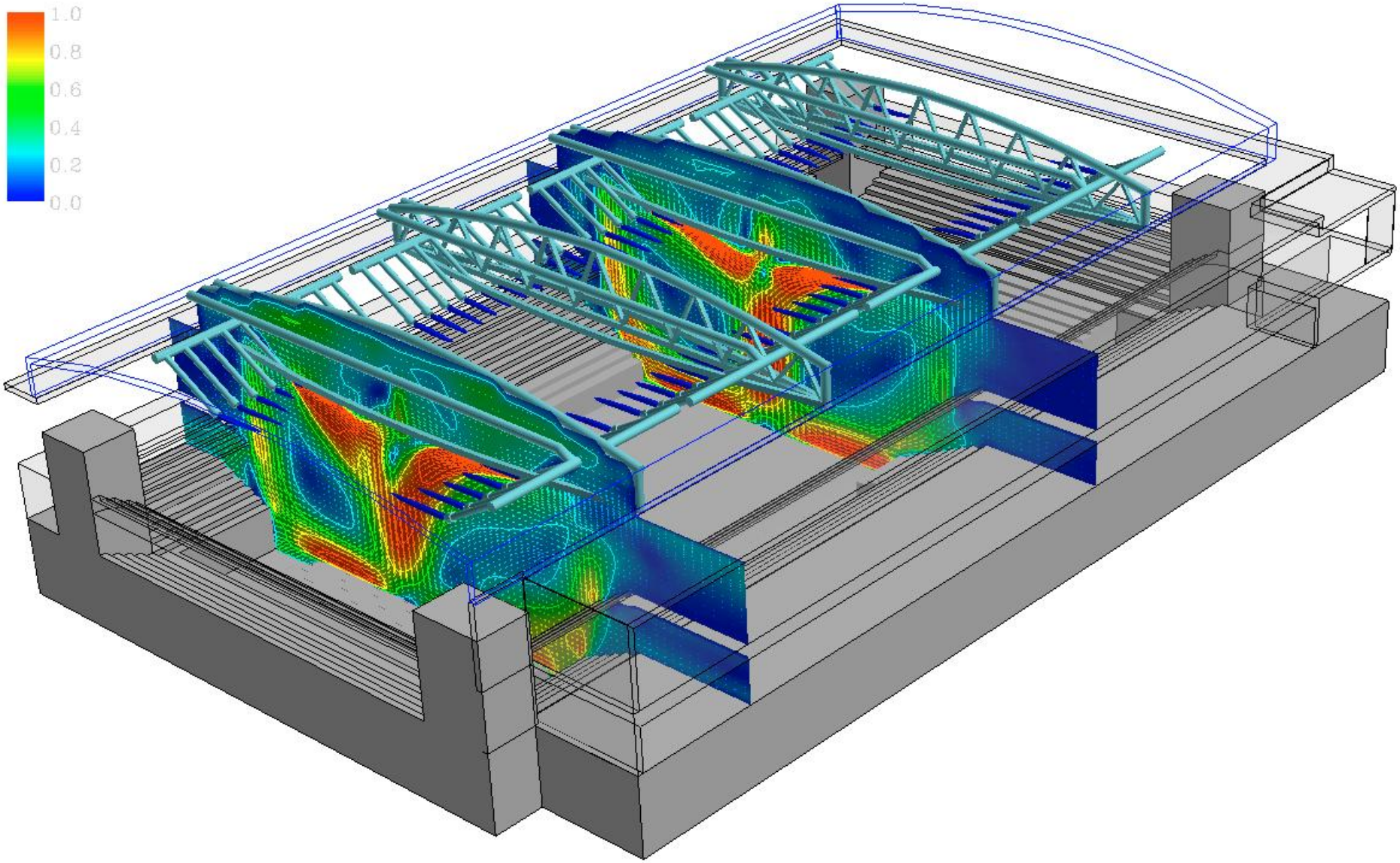
Model explanation



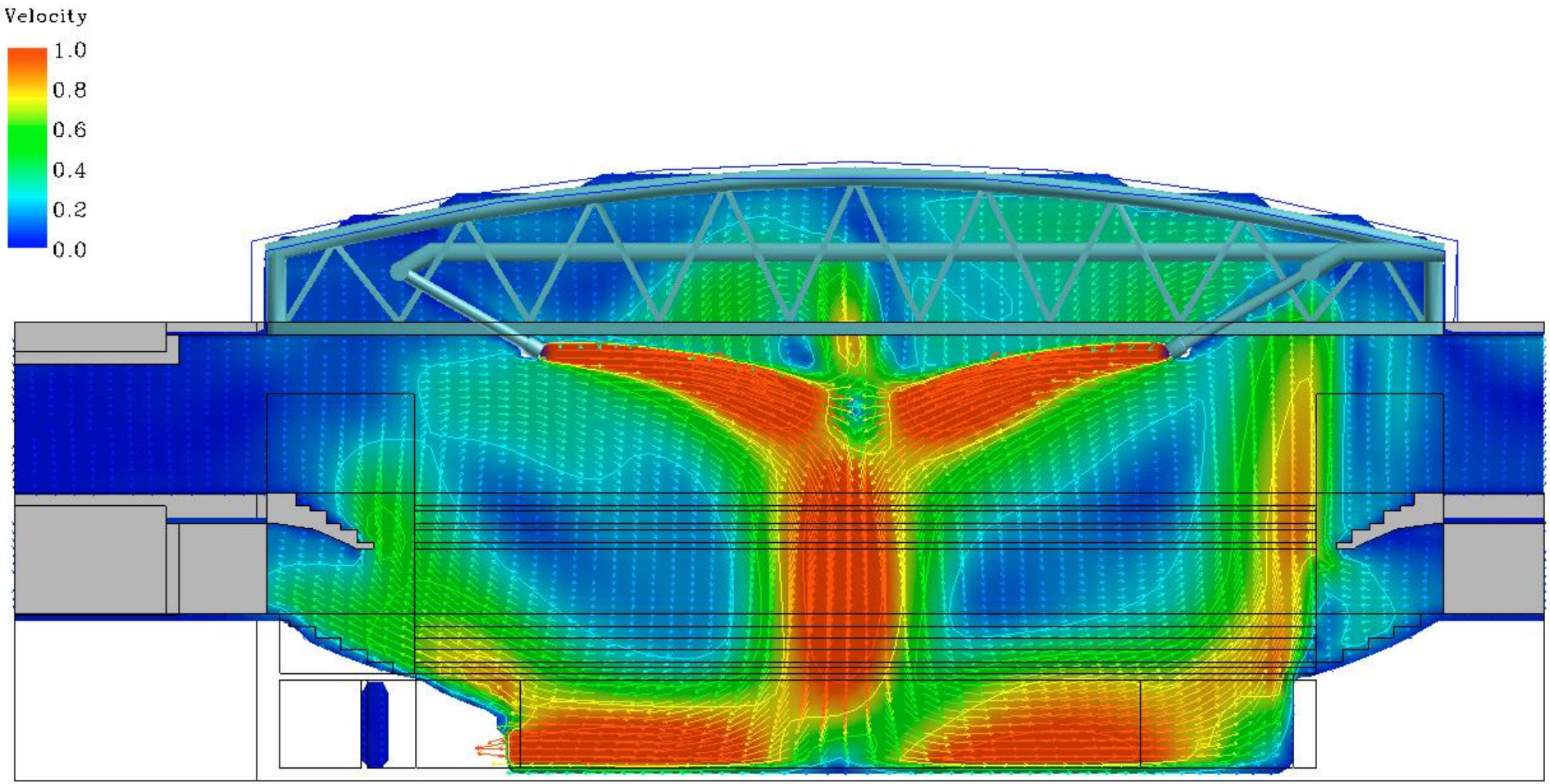
Mesh visualization



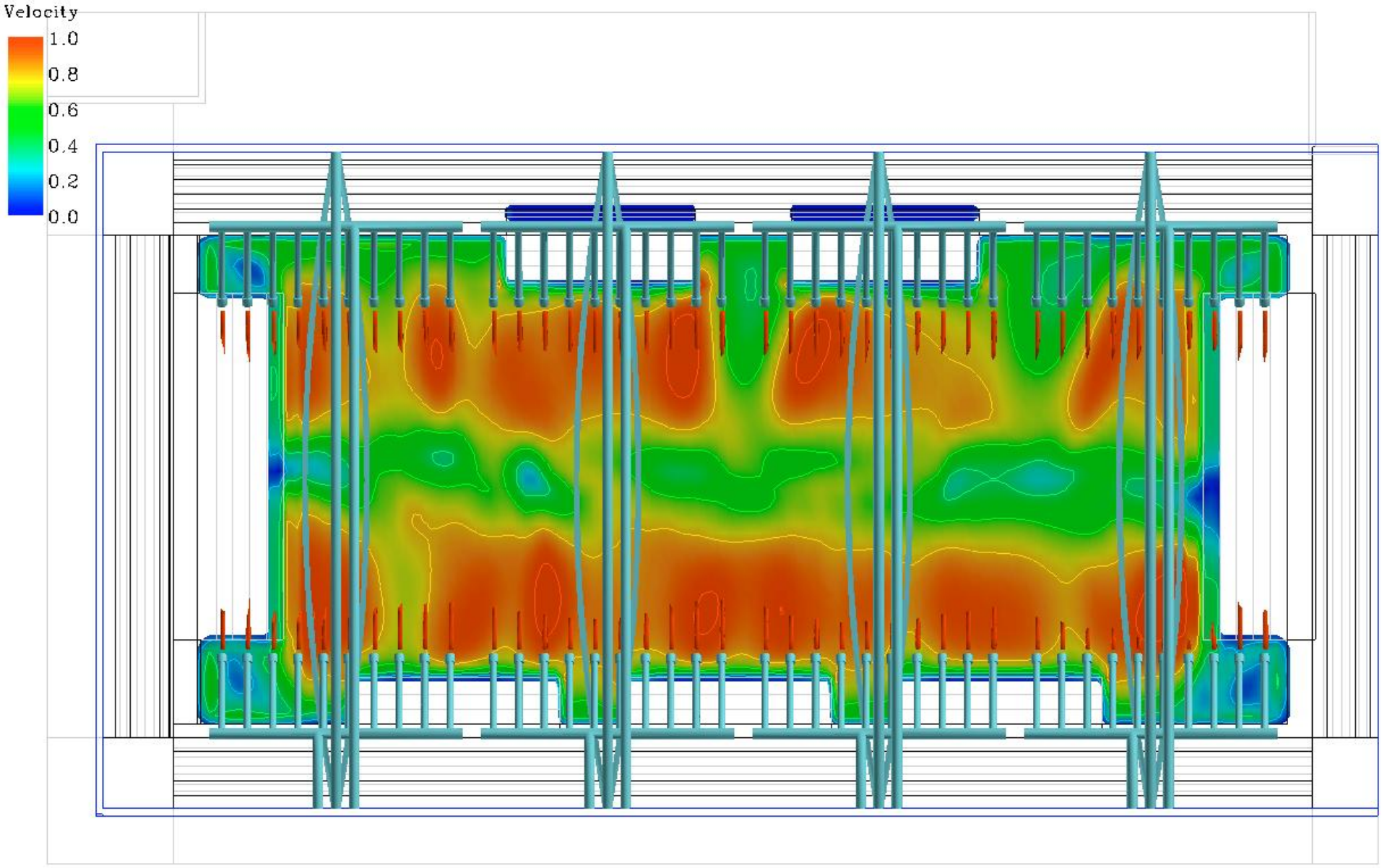
Flowfield



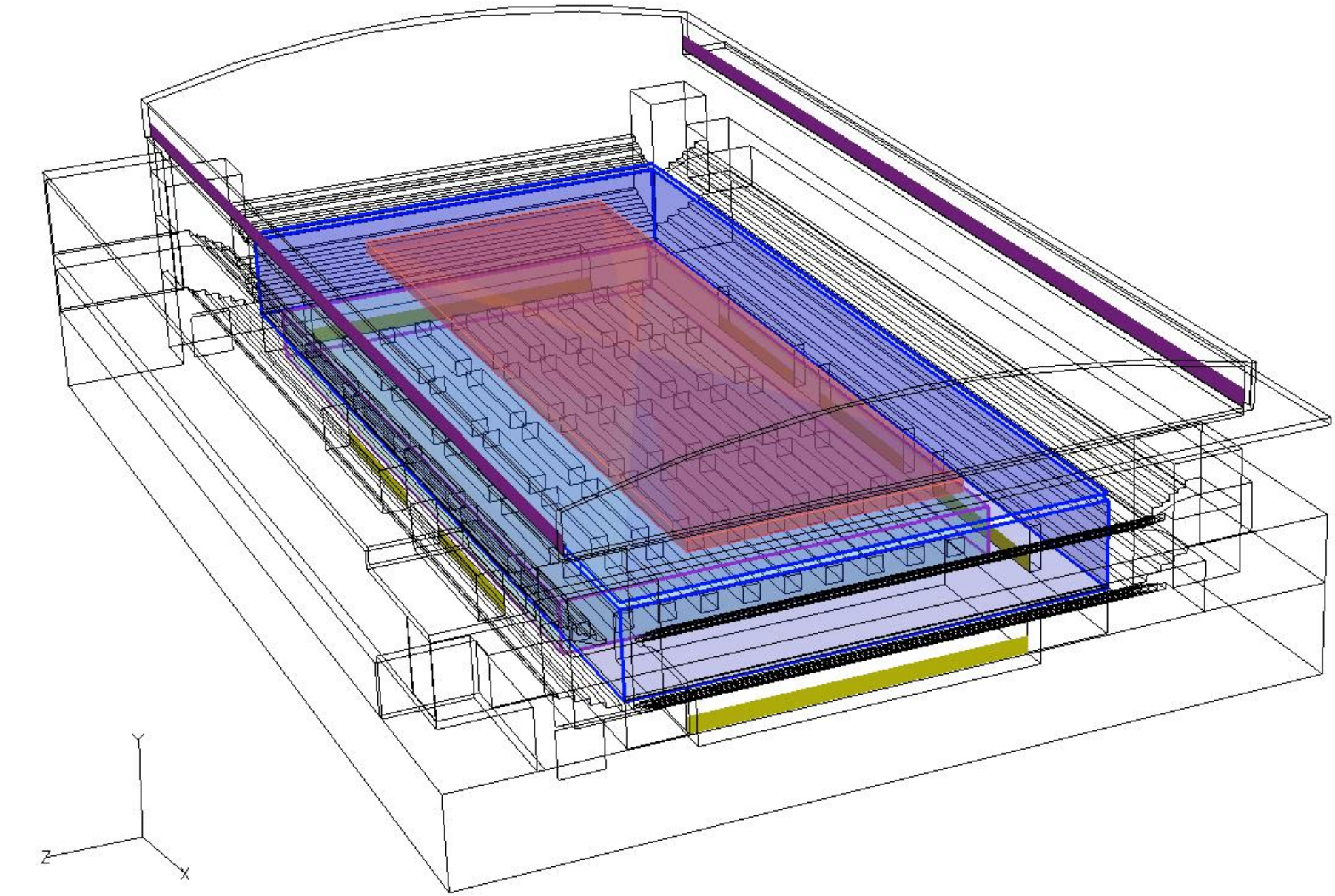
Flowfield



Flowfield

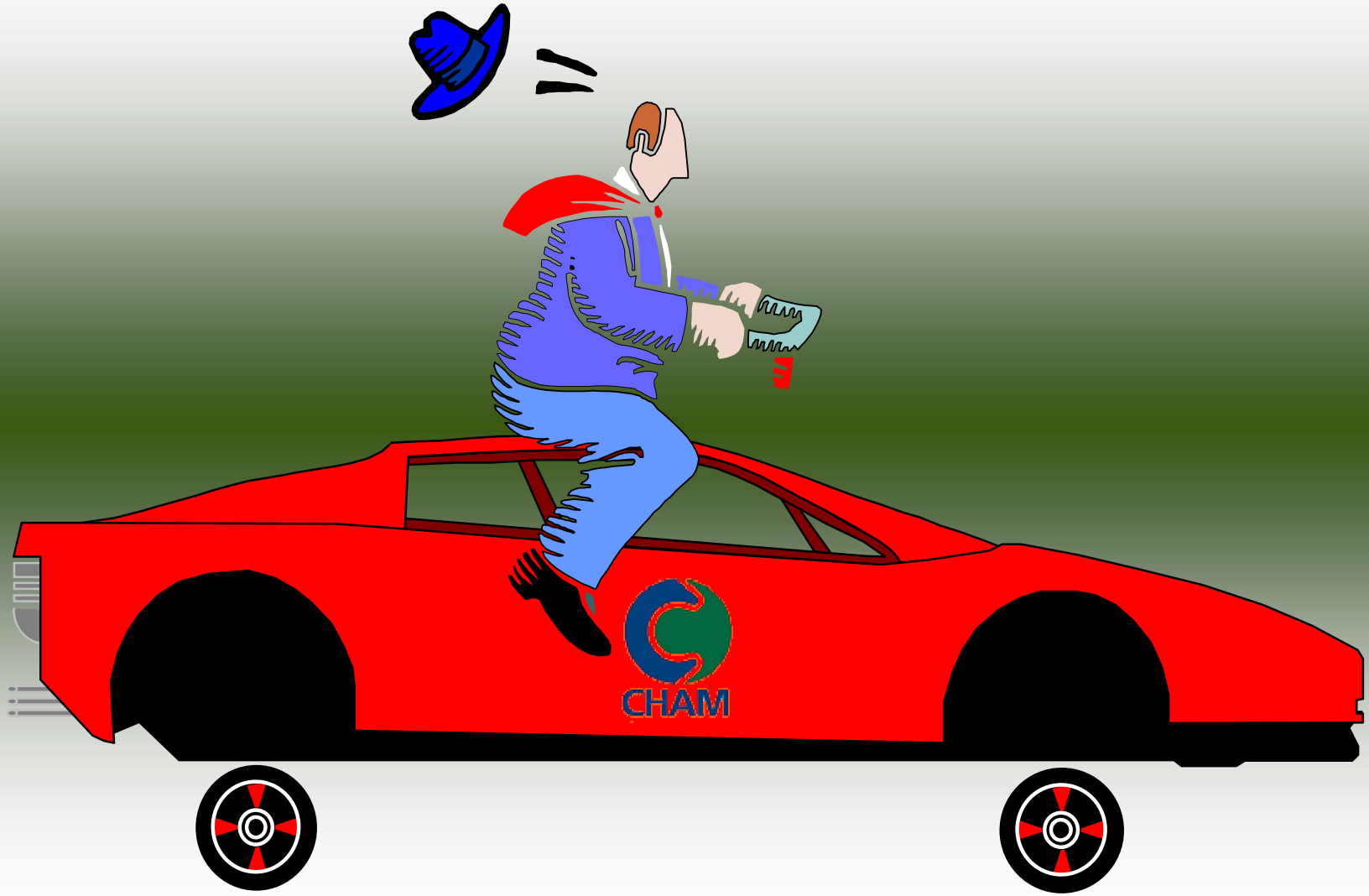


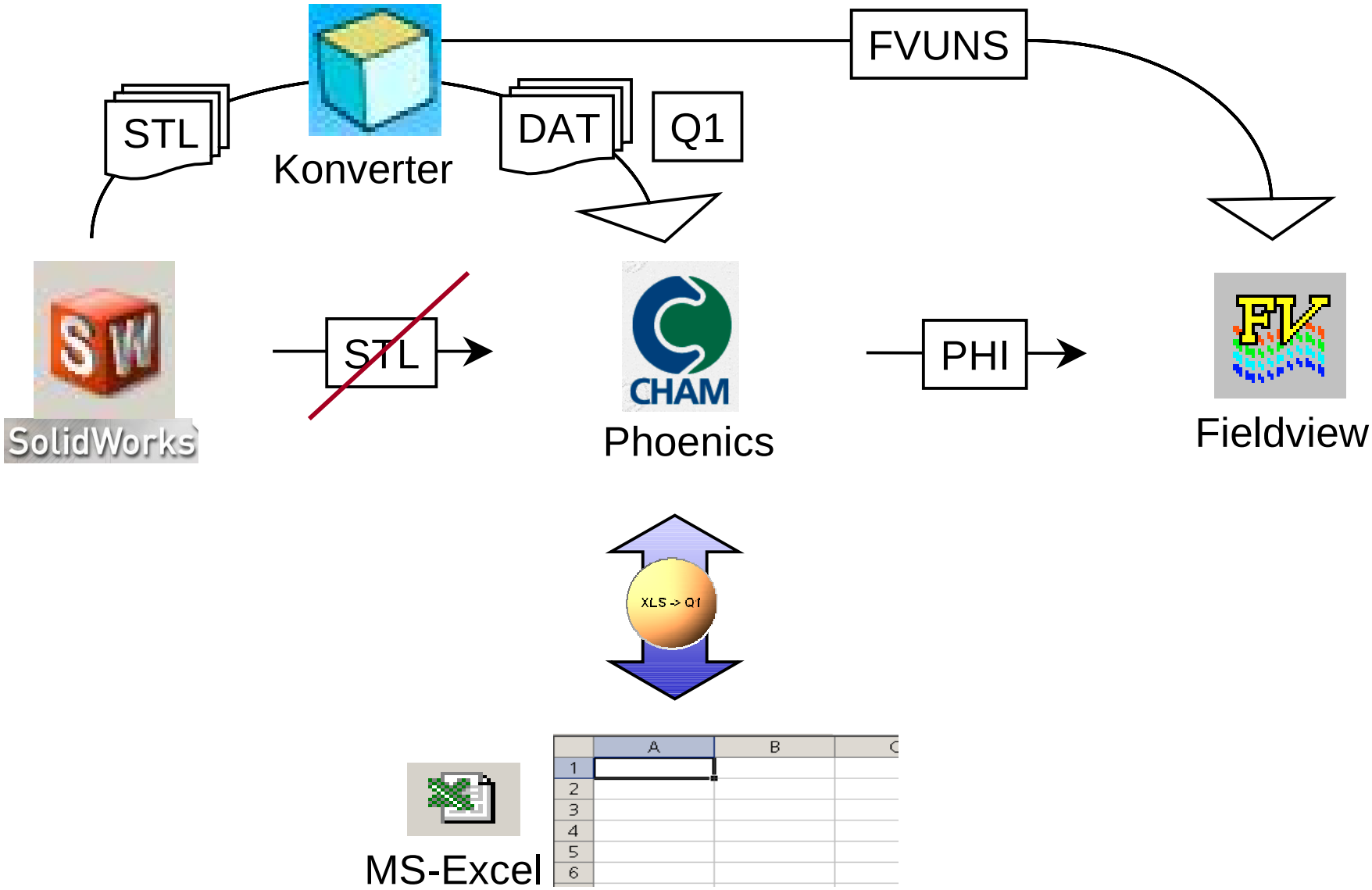
Variant setup



ALL CASES WHERE SIMULATED WITH PHOENICS!

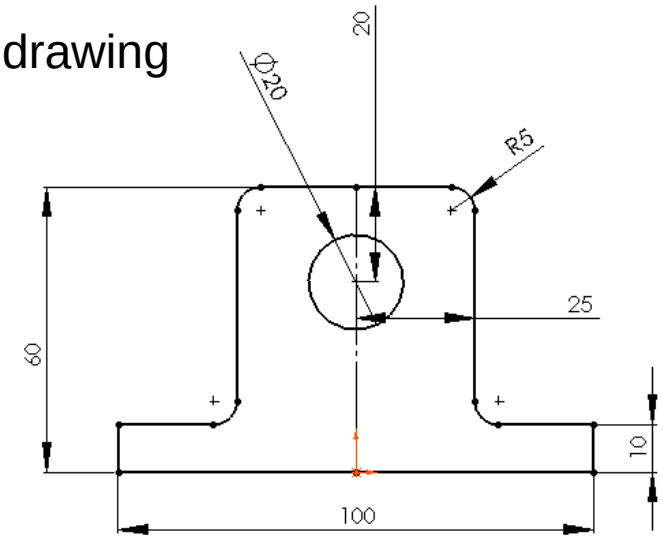
But phoenics needs some help!



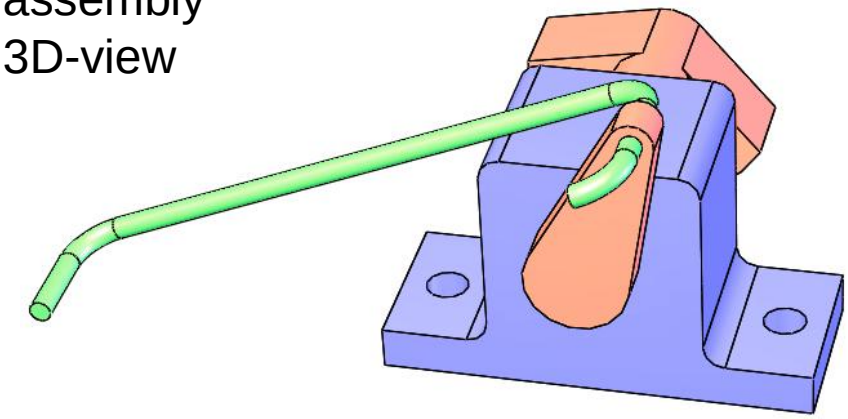

FVUNS
STL
Konverter
DAT
Q1
SolidWorks
STL
CHAM
Phoenics
PHI
Fieldview
XLS -> Q1
MS-Excel
A
B
1
2
3
4
5
6

Why do we need a solid modeller?

drawing

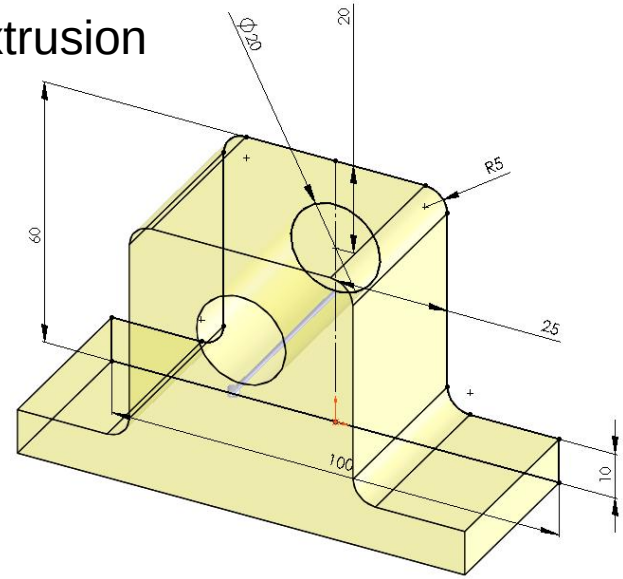


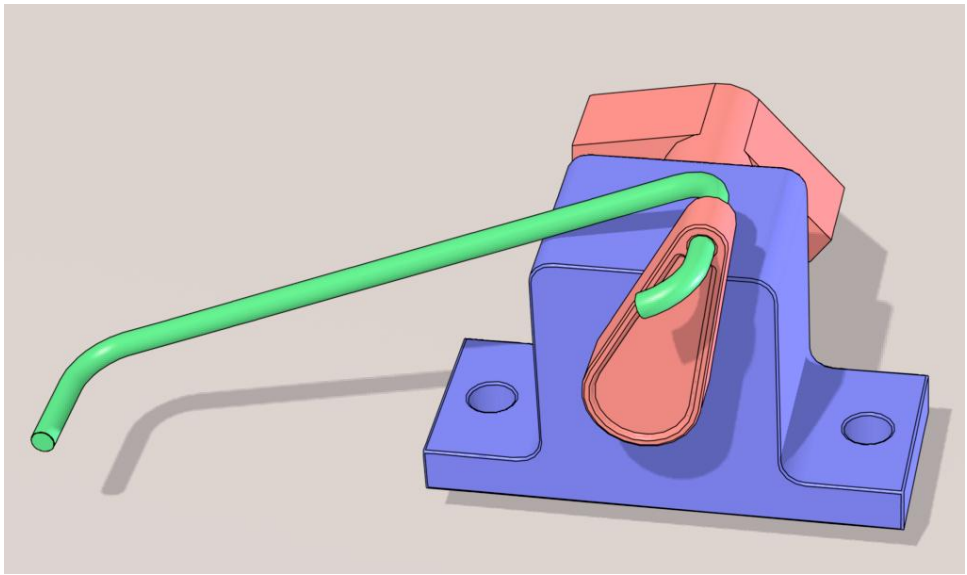
assembly
3D-view



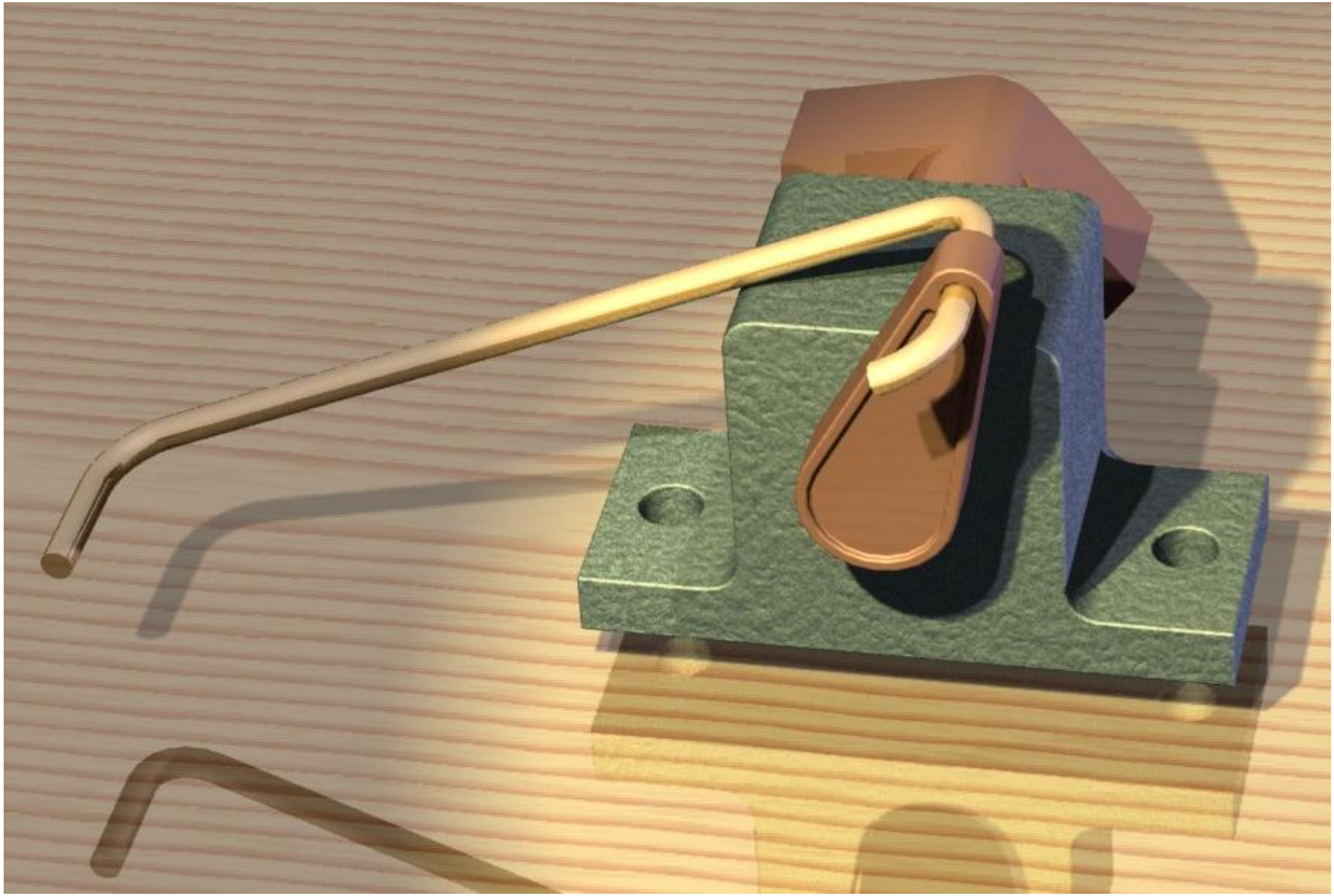
Simple shadow
calculation

extrusion

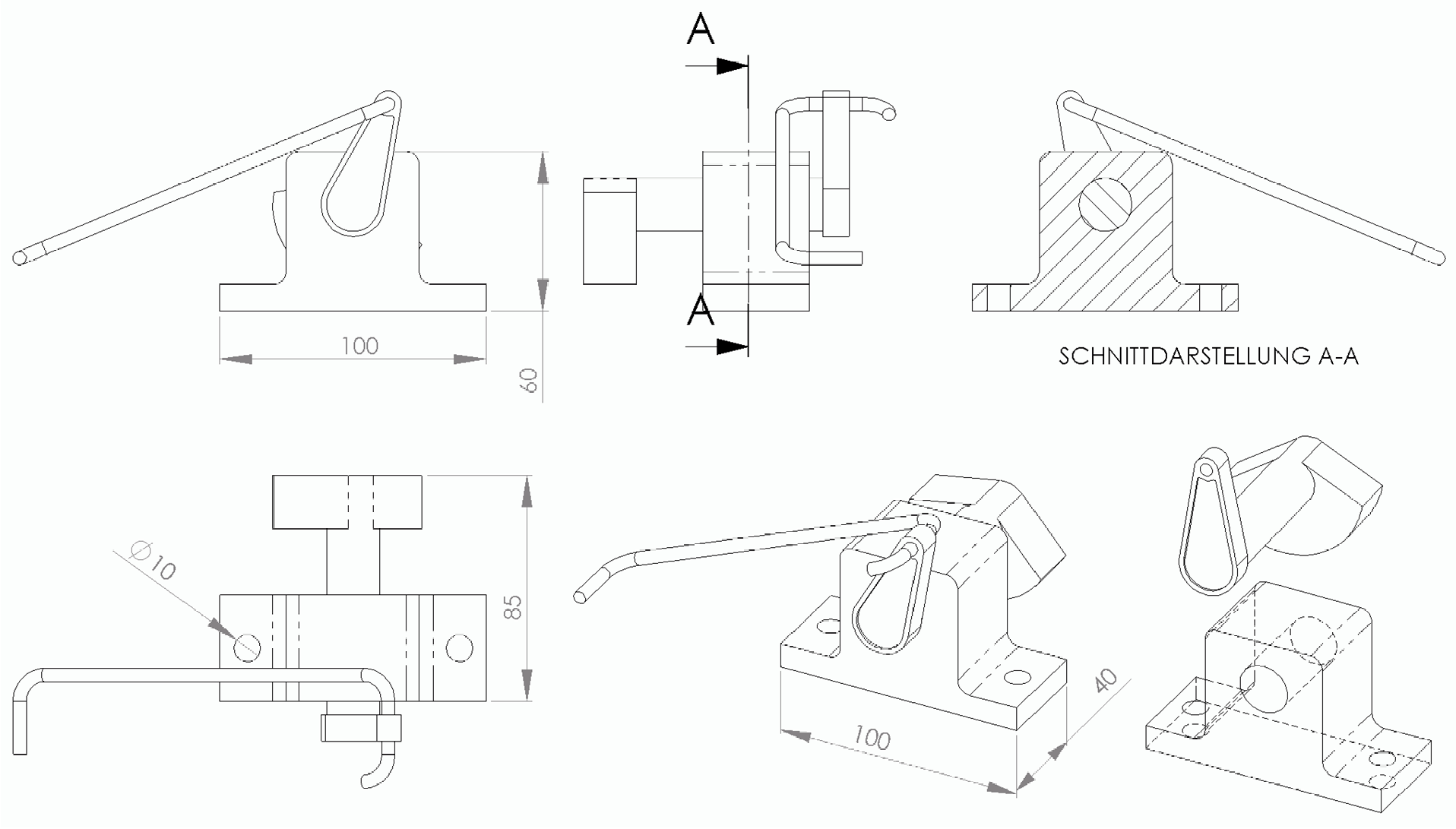




Advanced rendering



Drawings



Using a modern 3D-CAD program has multiple benefits for our work:

- Ø Used for geometry creation (-> STL)
- Ø Speeds up model setup dramatically
- Ø Handle complex geometry easily
- Ø Convert a multitude of 3D formats
- Ø Build geometry based on 2D drawings
- Ø Change geometry through parametric design
- Ø High quality output is important for most customers
- Ø Has a lot of „spin off“ for your work

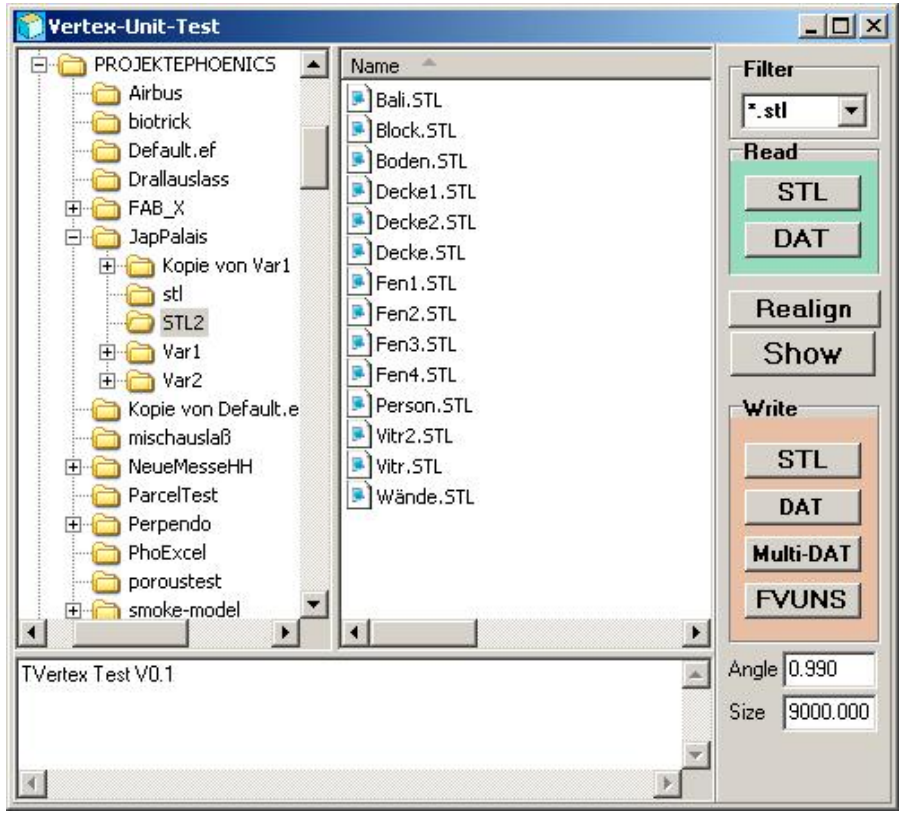
Our tools

Reading

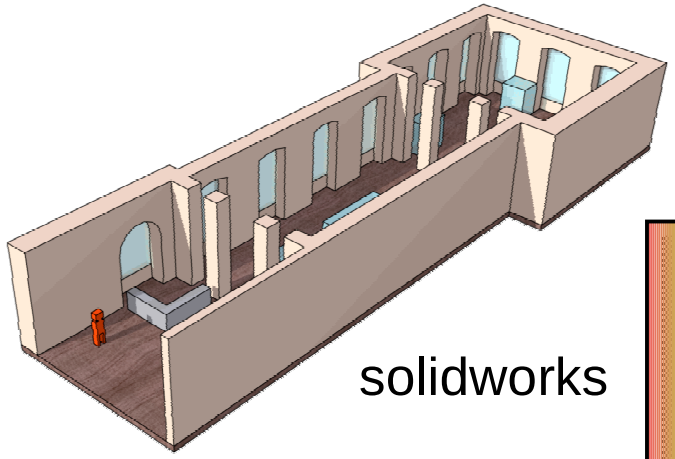
- **STL**
- **DAT**

Writing

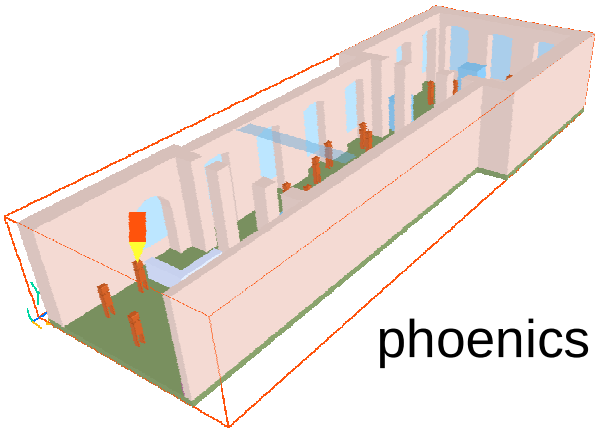
- **STL**
- **DAT**
- **Multi-Dat +Q1**
- **FVUNS**



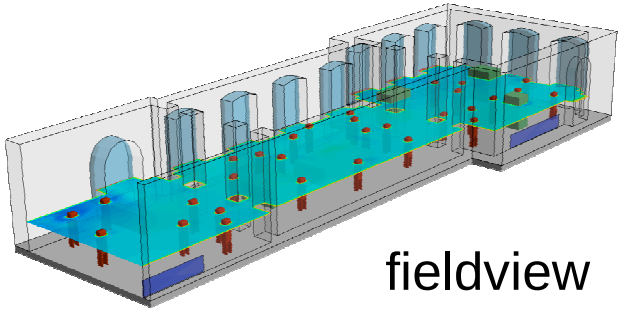
We can convert a complete Assembly
from **Solidworks (via STL)** to **Phoenics** and **fieldview**



solidworks



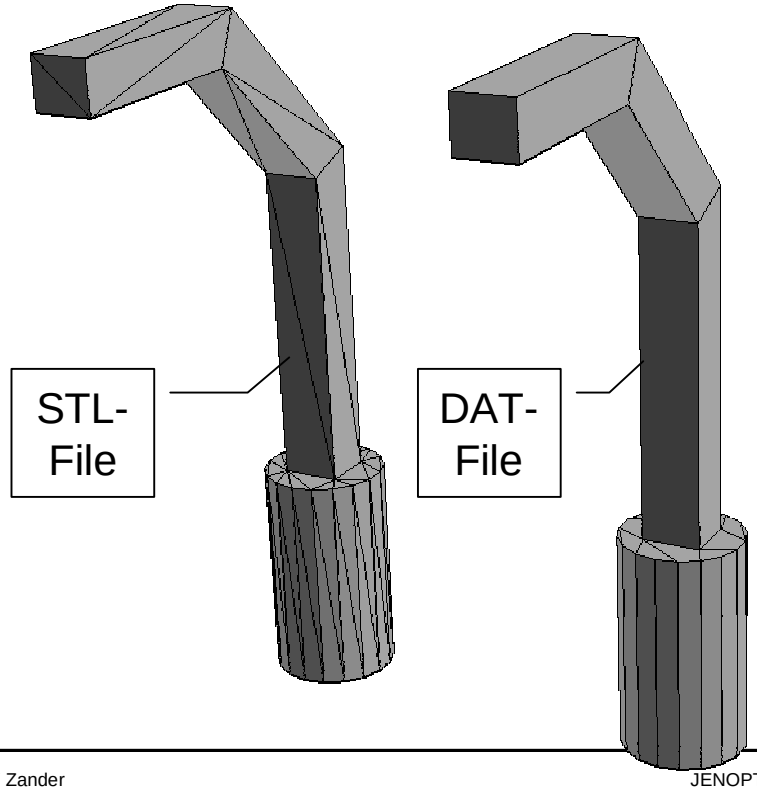
phoenics



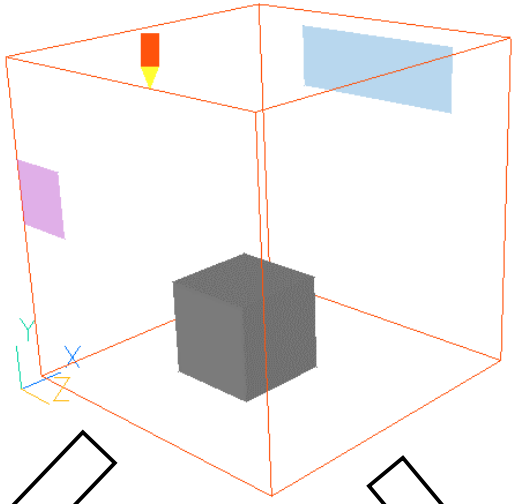
fieldview

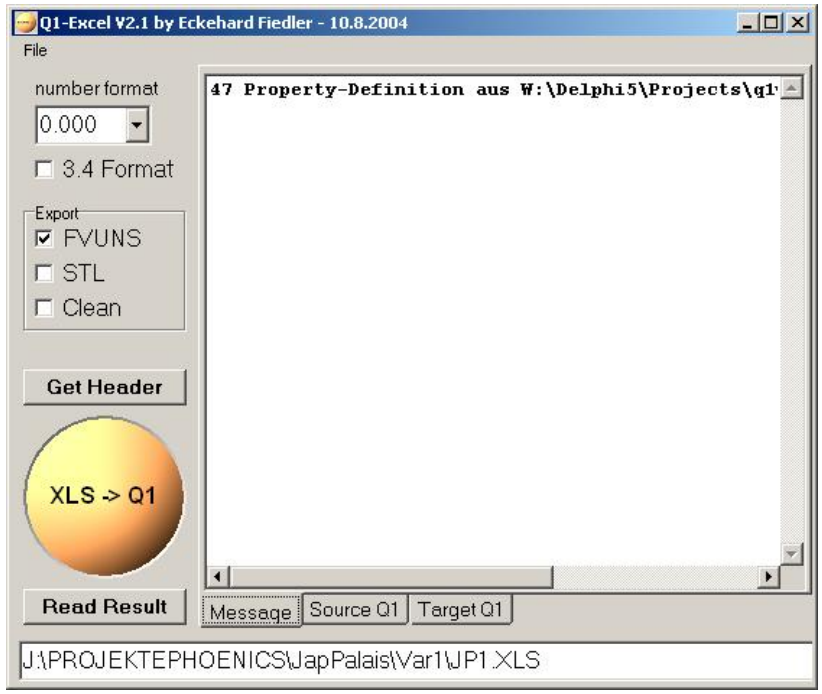
Geometry Conversion brings all the power of a Solid Modeller to Phoenics!

And we can solve some problems with the STL-files....



Q1-Excel is a conversion tool, that converts the complete VR-geometry into an excel-file and vice versa





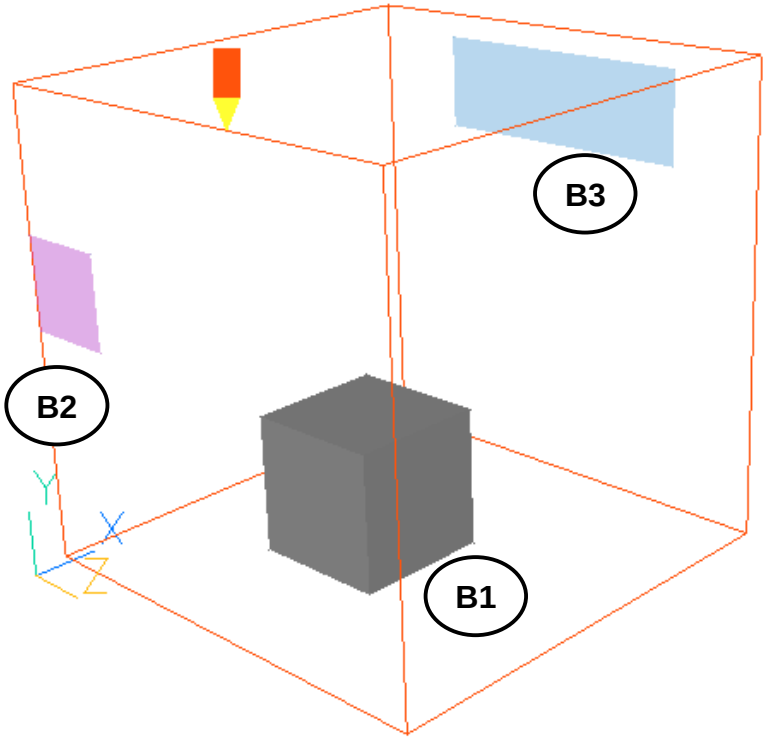
header

JP1.XLS

	A
1	TALK=T;RUN(1, 1)
2	
3	**********
4	Q1 created by VDI menu, Version 3.5, Date 20/10/03
5	CPVNAM=VDI;SPPNAM=Core
6	**********
7	IRUNN = 1 ;LIBREF = 0
8	**********
9	Group 1. Run Title
10	TEXT(Japanischen Palais)
11	**********
12	Group 2. Transience
13	STEADY = T
14	**********
15	Groups 3, 4, 5 Grid Information

VR

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
9																					
10	* Sourcefile: J:\PROJEKTEPHOENICS\TEST\TEST\q1																				
11	* Typ	Name	PX	PY	PZ	SX	SY	SZ	SHAPE	R24											
12	BLOCKAGE	B1	3.000	0.000	3.000	3.000	3.000	3.000	cube14	1							MATERIAL	198			
13	INLET	B2	0.000	5.000	0.000	0.000	2.000	2.000	cube3t	1							PRESSURE	0	VELOCITY	2	
14	OUTLET	B3	10.000	7.500	2.000	0.000	2.000	6.000	cube12t	1							PRESSURE	0	TEMPERATURE	SAME	COEFFICI
15																					



One VR-object gives one line in Excel. And the clou is:

We got a two way conversion

Q1 -> Excel

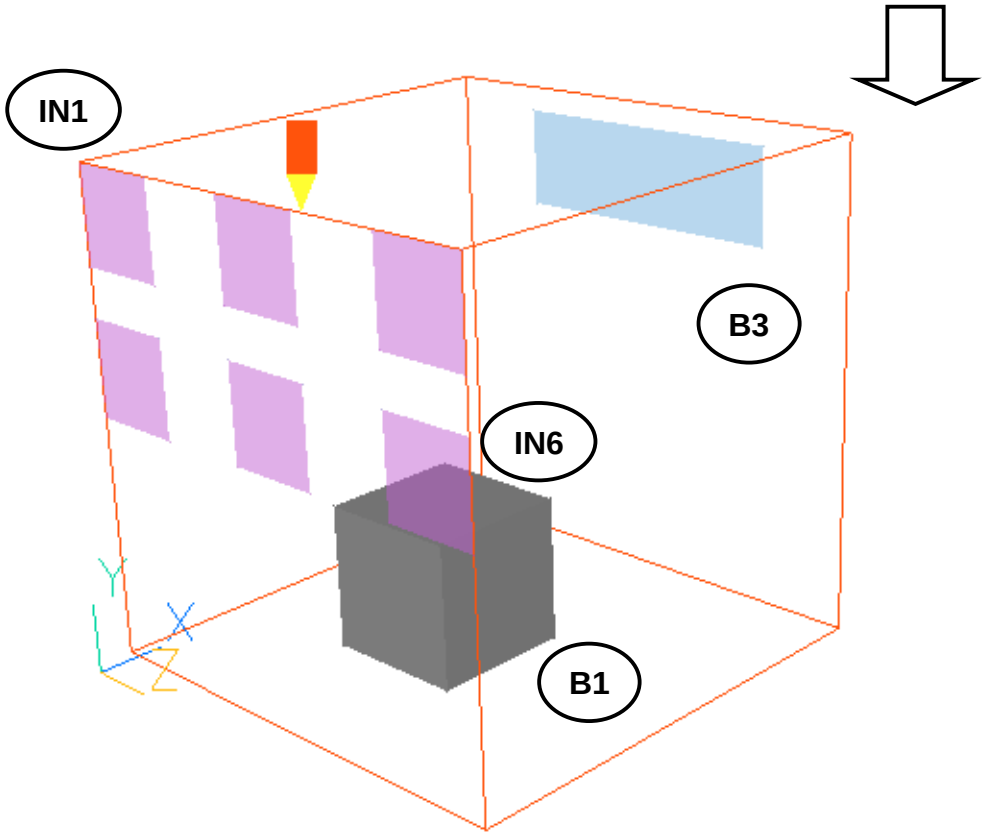
Excel -> Q1

So you can modify, copy, change, calculate anything you want

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
9																					
10	* Sourcefile: J:\PROJEKTEPHOENICS\TEST\TEST\q1																				
11	* Typ	Name	PX	PY	PZ	SX	SY	SZ	SHAPE	R24											
12	BLOCKAGE	B1	3.000	0.000	3.000	3.000	3.000	3.000	cube14	1							MATERIAL	198			
13	INLET	B2	0.000	5.000	0.000	0.000	2.000	2.000	cube3t	1							PRESSURE	0	VELOCITY	2	
14	OUTLET	B3	10.000	7.500	2.000	0.000	2.000	6.000	cube12t	1							PRESSURE	0	TEMPERATURE	SAME	COEFFICIE
15																					

Beispiele

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
9																										
10	* Sourcefile: J:\PROJEKTEPHOENICS\TEST\TEST\q1																									
11	* Typ	Name	PX	PY	PZ	SX	SY	SZ	SHAPE	R24																
12	BLOCKAGE	B1	3.000	0.000	3.000	3.000	3.000	3.000	cube14	1							MATERIAL	198								
13	INLET	IN1	0.000	5.000	0.000	0.000	2.000	2.000	cube3t	1							PRESSURE	0	VELOCITY	2	0	0	TEMPERATURE	0	TURB-INTENS	5
14	INLET	IN2	0.000	5.000	4.000	0.000	2.000	2.000	cube3t	1							PRESSURE	0	VELOCITY	2	0	0	TEMPERATURE	0	TURB-INTENS	5
15	INLET	IN3	0.000	5.000	8.000	0.000	2.000	2.000	cube3t	1							PRESSURE	0	VELOCITY	2	0	0	TEMPERATURE	0	TURB-INTENS	5
16	INLET	IN4	0.000	8.000	0.000	0.000	2.000	2.000	cube3t	1							PRESSURE	0	VELOCITY	2	0	0	TEMPERATURE	0	TURB-INTENS	5
17	INLET	IN5	0.000	8.000	4.000	0.000	2.000	2.000	cube3t	1							PRESSURE	0	VELOCITY	2	0	0	TEMPERATURE	0	TURB-INTENS	5
18	INLET	IN6	0.000	8.000	8.000	0.000	2.000	2.000	cube3t	1							PRESSURE	0	VELOCITY	2	0	0	TEMPERATURE	0	TURB-INTENS	5
19	OUTLET	B3	10.000	7.500	2.000	0.000	2.000	6.000	cube12t	1							PRESSURE	0	TEMPERATURE	SAME	COEFFICIENT	1000	TURBULENCE	SAME	SAME	



Q1-Excel is simple, but very powerful:

- direct Excel access
- self learning new properties
- does some model checks (input balance)
- can read and format result files -> Excel
- can export FVUNS and STL-files from Q1-definition

Example for a result readout

NAME	OBJ	R1	TEM1	
OUT1	OB18	-1.871339	-557562.5	24.7 °C
DECKE	OB9		32.56225	
DECKE1	OB10		198.726	
DECKE2	OB11		47.27589	
INLET1	OB16	0.7598234	224281.4	22.0 °C
INLET2	OB17	1.105495	326315.5	22.0 °C

Result	R1	TEM1
pos. sum	1.865318	550875.4
neg. sum	-1.871339	-557562.5
Nett sum	-0.006021	-6687.063

Final TimeStep	1
Final Sweep	223

And, what´s the big button for?

imagine, how fast it is...

Example for a balance check

Domain Size	73.50499	19.4 m²	19.4 m/s	
Typ	Name	A	u	V
IN	IA002	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB002	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA003	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB003	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA004	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB004	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA005	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB005	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA006	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB006	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA007	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB007	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA008	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB008	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA009	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB009	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA010	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB010	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA011	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB011	0.2 m²	5.0 m/s	0.8 m³/s
IN	IA012	0.2 m²	5.0 m/s	0.8 m³/s
IN	IB012	0.2 m²	5.0 m/s	0.8 m³/s
Inlets:		85		
Outlets :		43.0 m²	1.5 m/s	64.0 m³/s

Q1-Excel: repeat command

BLOCKAGE	HLBASK	0.602	0.400	3.997	68.906	9.460	34.406	hlbask	1
*	HLBUEHN	0.602	0.400	3.997	50.303	9.460	34.406	hlbuehn	1
*	HLSTUEHL	6.305	0.400	8.700	47.500	3.000	25.000	hlstuehl	1
*	HLPublikm	17.000	0.400	13.000	37.000	1.500	18.000	cube4	
*	HLBuehne	58.000	3.200	14.000	8.000	1.500	15.000	cube4	
BLOCKAGE	HLam1	10.000	12.800	7.500	50.000	0.700	1.000	cubet1	
BLOCKAGE	Hmiddle	10.000	12.800	8.500	50.000	0.700	25.400	cubet1	
BLOCKAGE	HLam2	10.000	12.800	33.900	50.000	0.700	1.000	cubet1	
REPEAT	Inlets	* **********				**********			
BLOCKAGE	BA	6.000	13.000	11.000			0.400	cube	
BLOCKAGE	BB	6.000	13.000	31.000			0.400	cube	
NULL	NA	6.100	13.100	11.900			0.500	WIREX	
NULL	NB	6.100	13.100	30.000	0.200	0.200	0.500	WIREX	
NULL	NC	5.900	12.900	12.900	0.600	0.600	0.500	WIREX	
NULL	ND	5.900	12.900	29.000	0.600	0.600	0.500	WIREX	
INLET	IA	6.000	13.000	11.400	0.400		0.000	cube3	
INLET	IB	6.000	13.000	31.000			0.000	cube3	
ENDREPEAT		* **********				********			
BLOCKAGE	BO1	38.705	0.400	32.000	8.000	1.000	1.000	cube	
BLOCKAGE	BO2	23.005	0.400	32.000	8.000	1.000	1.000	cube	
BLOCKAGE	BO3	16.205	0.400	9.300	9.000	1.000	1.000	cube	
BLOCKAGE	BO4	31.205	0.400	9.300	9.000	1.000	1.000	cube	
BLOCKAGE	BO5	46.205	0.400	9.300	9.000	1.000	1.000	cube	

	A	B	C
1	0	0	0
2	1.4	0	0
3	2.8	0	0
4	4.2	0	0
5	5.6	0	0
6	7	0	0
7	8.4	0	0
8	9.8	0	0
9	11.2	0	0
10	12.6	0	0
11	15	0	0
12	16.4	0	0
13	17.8	0	0
14	19.2	0	0
15	20.6	0	0
16	22	0	0
17	23.4	0	0
18	24.8	0	0
19	26.2	0	0
20	27.6	0	0
21	30	0	0
22	31.4	0	0
23	32.8	0	0
24	34.2	0	0
25	35.6	0	0
26	37	0	0
27	38.4	0	0

Tabelle1 | Header | Inlets | VR | VR (2) | Inlet-

Phoenics VR is the fastest and best tool on the market to calculate the flow through complex geometry:

- **Fast semi-automated meshgeneration**
- **Parcel solid treatement**

There are some significant improvements, if we combine PHOENICS with a powerful 3D CAD package and a more advanced postprocessor.

Some of the features could be included into phoenics easily:

- **Direct Data Exchange with Excel via OLE2**
- **Some improvements on the VR-viewer (fieldview gives a good guideline!)**

! The annual costs for our Tools where less than one Fluent-license for the first year, and less than a half Fluent license for the next years!