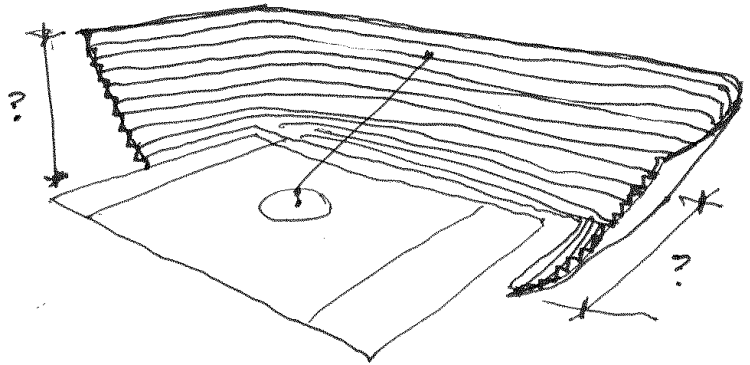
Example

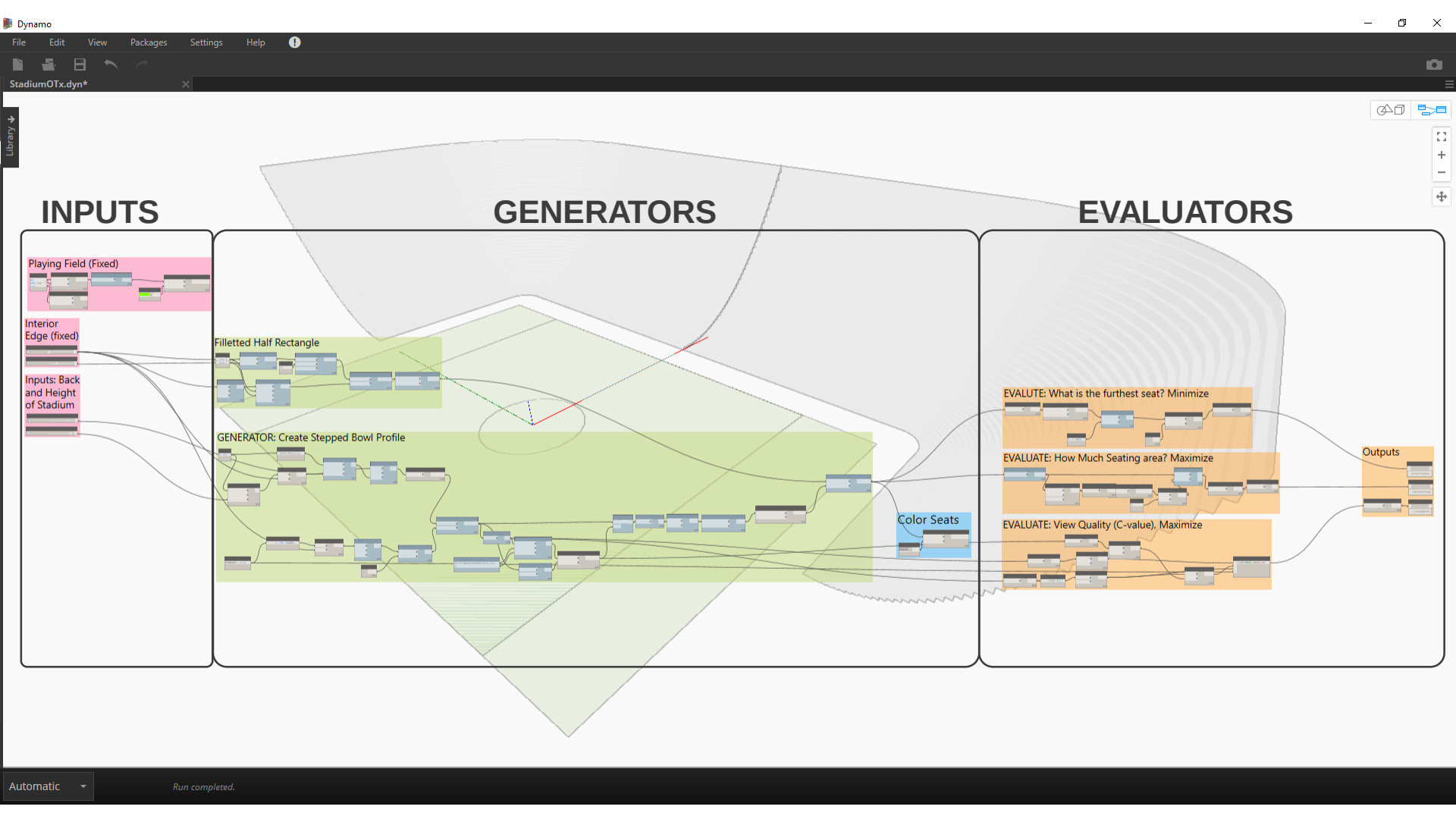
Stadium Seating

Goals

What are we solving for?

- Evaluate the size of a proposed stadium.
- Variable Inputs
  1. Height of seating
  2. Depth of seating
- Goals
  1. Maximize seating area
  2. Maximize view quality
  3. Minimize distance to farthest seat




Dynamo
File
Edit
View
Packages
Settings
Help
StadiumOTx.dyn*
Library
INPUTS
GENERATORS
EVALUATORS
Playing Field (Fixed)
Interior Edge (fixed)
Inputs: Back and Height of Stadium
Filletted Half Rectangle
GENERATOR: Create Stepped Bowl Profile
Color Seats
EVALUTE: What is the furthest seat? Minimize
EVALUATE: How Much Seating area? Maximize
EVALUATE: View Quality (C-value), Maximize
Outputs
Automatic
Run completed.

Dynamo

File Edit View Packages Settings Help

Library

boolean

Cylinder

Solid

ByJoinedSurfaces

ByLoft (crossSectio

ByLoft (crossSectio

ByRevolve

BySweep

BySweep2Rails

ByUnion

Centroid

Chamfer

Difference

DifferenceAll

Fillet

ProjectInputOnto

ThinShell

Union

Area

Volume

Sphere

Surfaces

Tessellation

ImportExport

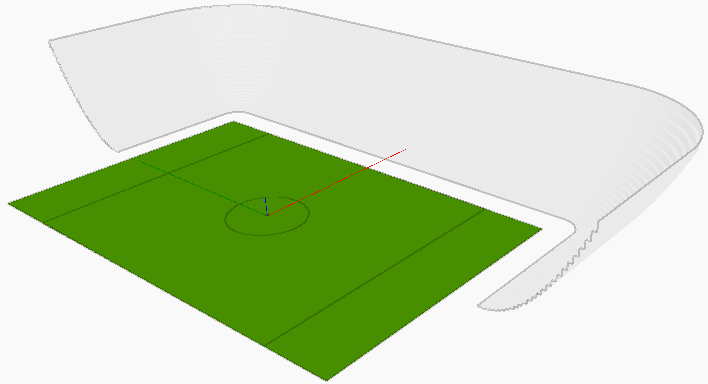
Input

List

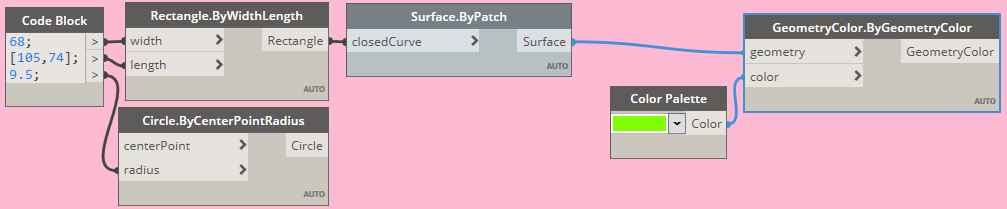
Math

Script

StadiumOTx.dyn*

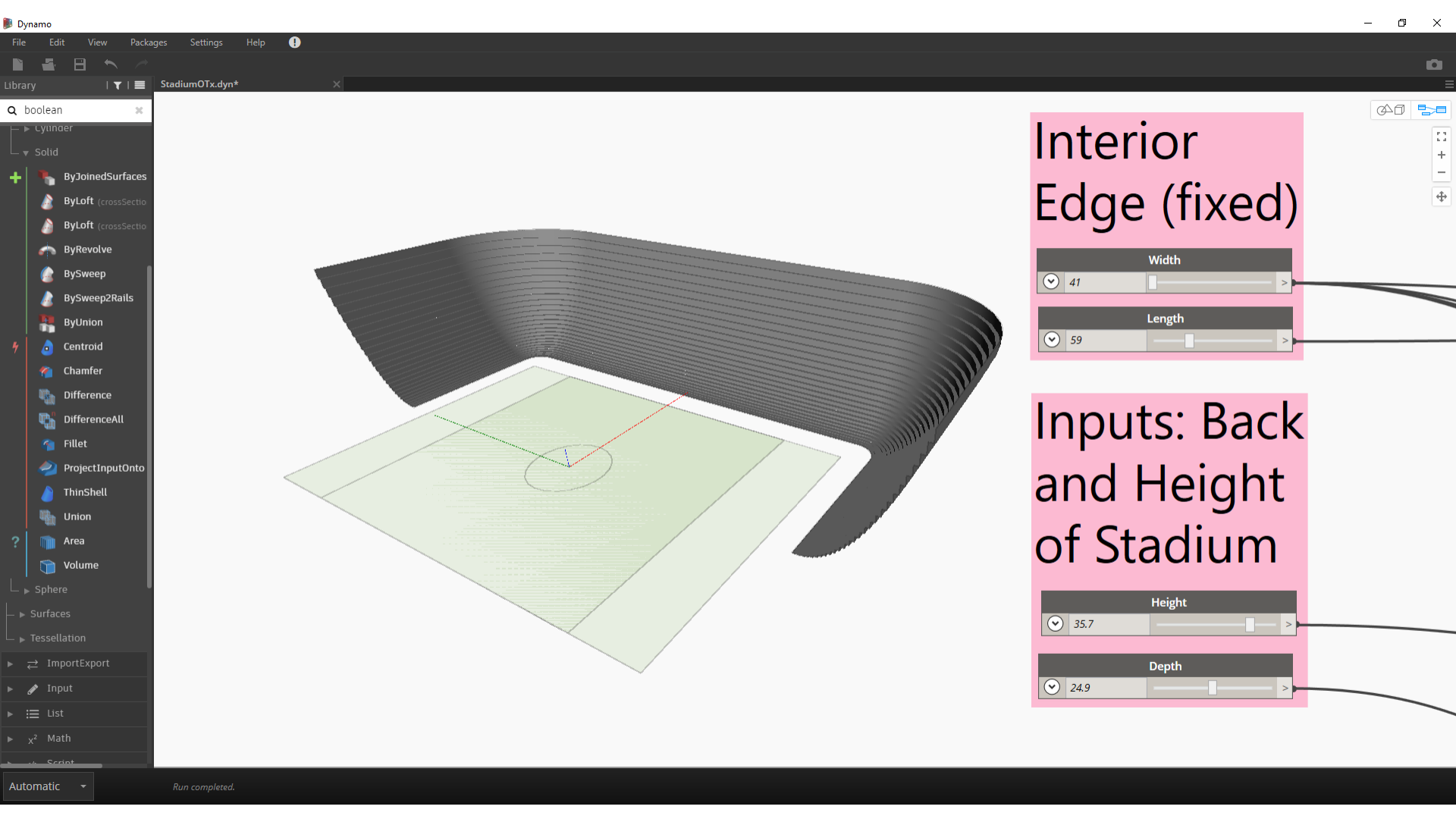


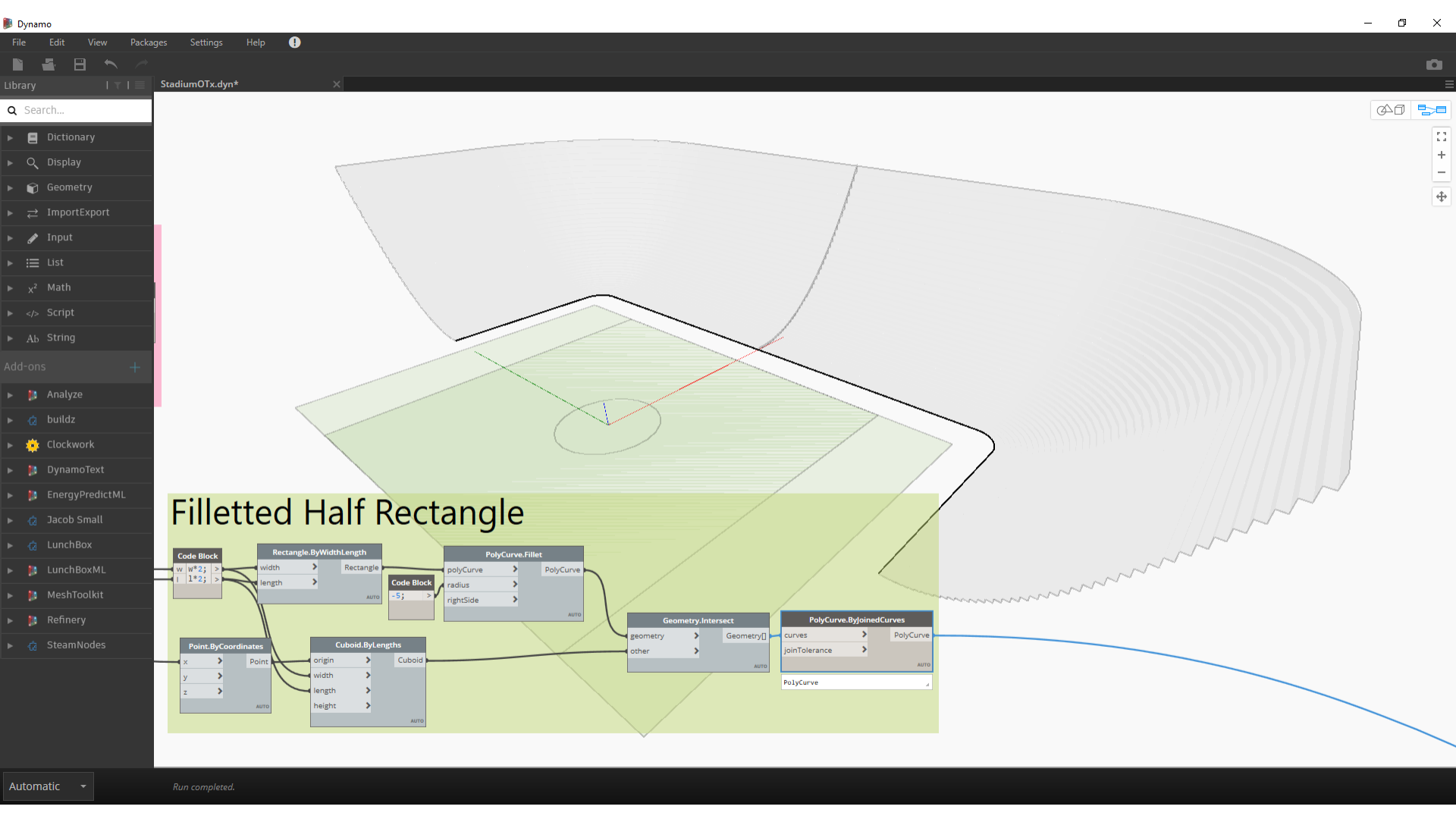
Playing Field (Fixed)

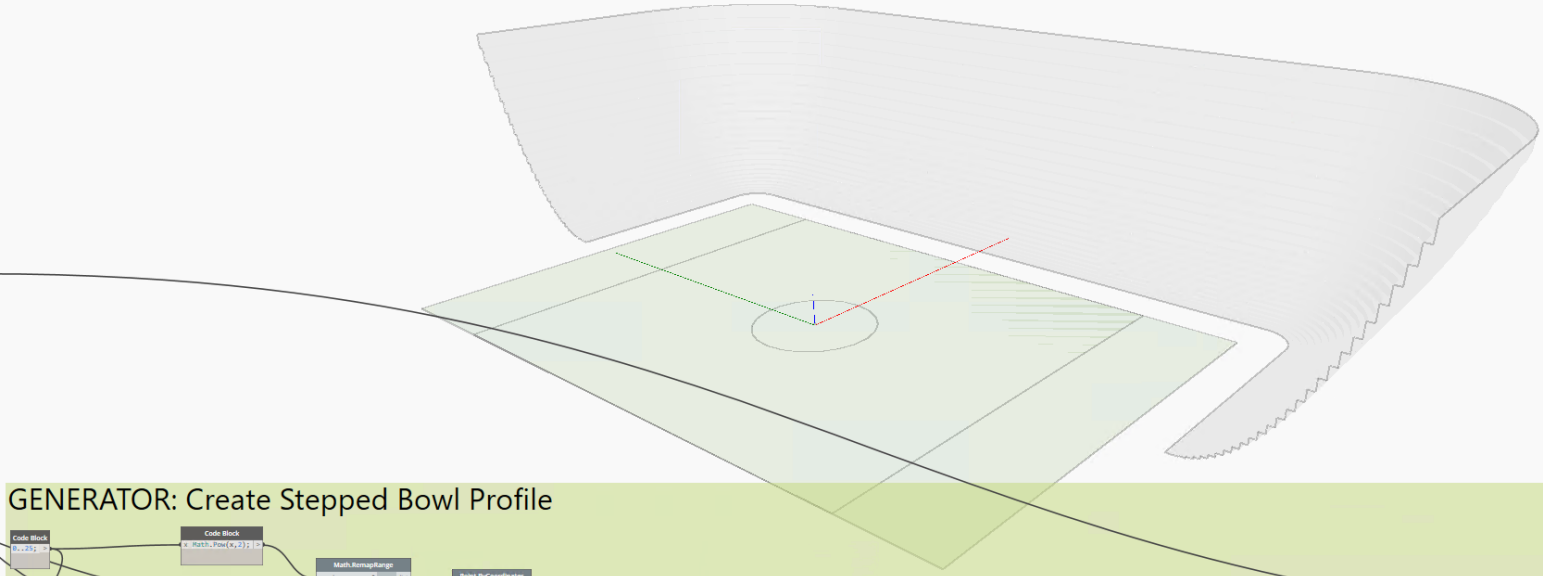


Automatic

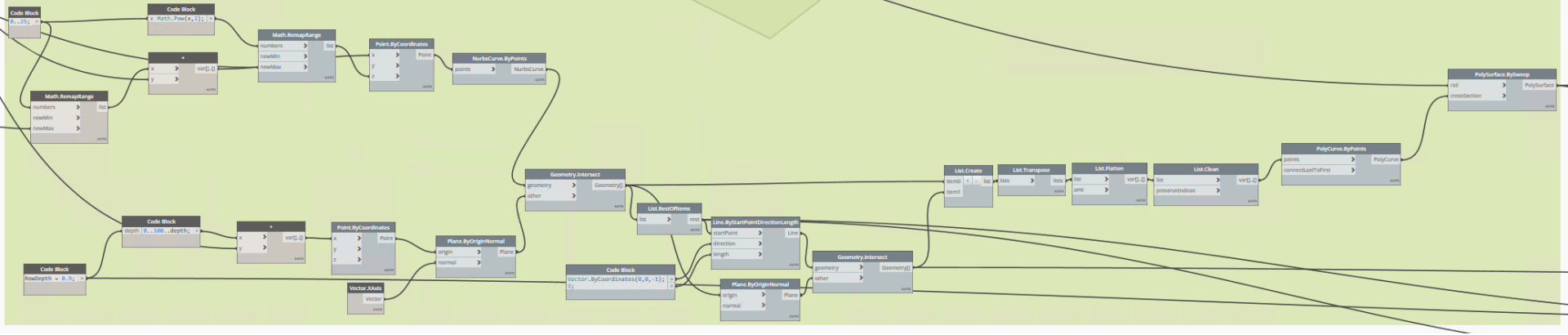
Run completed.


Dynamo
File
Edit
View
Packages
Settings
Help
Library
StadiumOTx.dyn*
boolean
Cylinder
Solid
ByJoinedSurfaces
ByLoft (crossSectio
ByLoft (crossSectio
ByRevolve
BySweep
BySweep2Rails
ByUnion
Centroid
Chamfer
Difference
DifferenceAll
Fillet
ProjectInputOnto
ThinShell
Union
Area
Volume
Sphere
Surfaces
Tessellation
ImportExport
Input
List
Math
Interior Edge (fixed)
Width
41
Length
59
Inputs: Back and Height of Stadium
Height
35.7
Depth
24.9
Automatic
Run completed.


Dynamo
File
Edit
View
Packages
Settings
Help
Library
Search...
Dictionary
Display
Geometry
ImportExport
Input
List
Math
Script
String
Add-ons
Analyze
buildz
Clockwork
DynamoText
EnergyPredictML
Jacob Small
LunchBox
LunchBoxML
MeshToolkit
Refinery
SteamNodes
StadiumOTx.dyn*
Filletted Half Rectangle
Code Block
w*2;
l*2;
Rectangle.ByWidthLength
width
length
Rectangle
Code Block
-5;
PolyCurve.Fillet
polyCurve
radius
rightSide
PolyCurve
Point.ByCoordinates
x
y
z
Point
Cuboid.ByLengths
origin
width
length
height
Cuboid
Geometry.Intersect
geometry
other
Geometry[]
PolyCurve.ByJoinedCurves
curves
joinTolerance
PolyCurve
PolyCurve
Automatic
Run completed.



GENERATOR: Create Stepped Bowl Profile

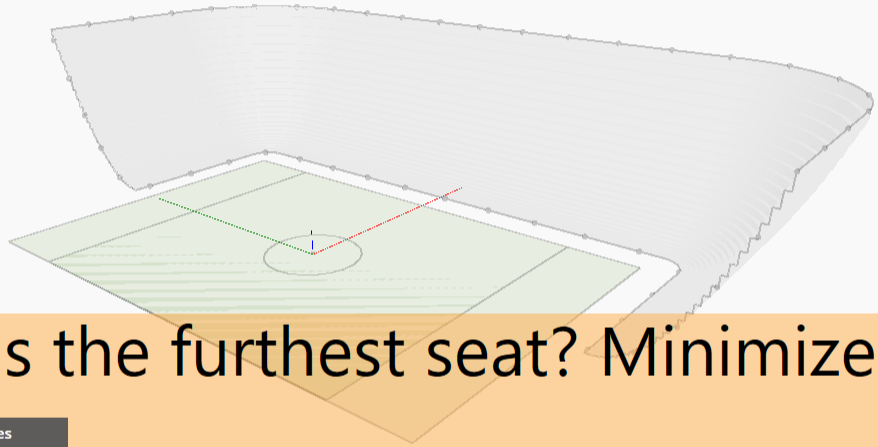


Dynamo

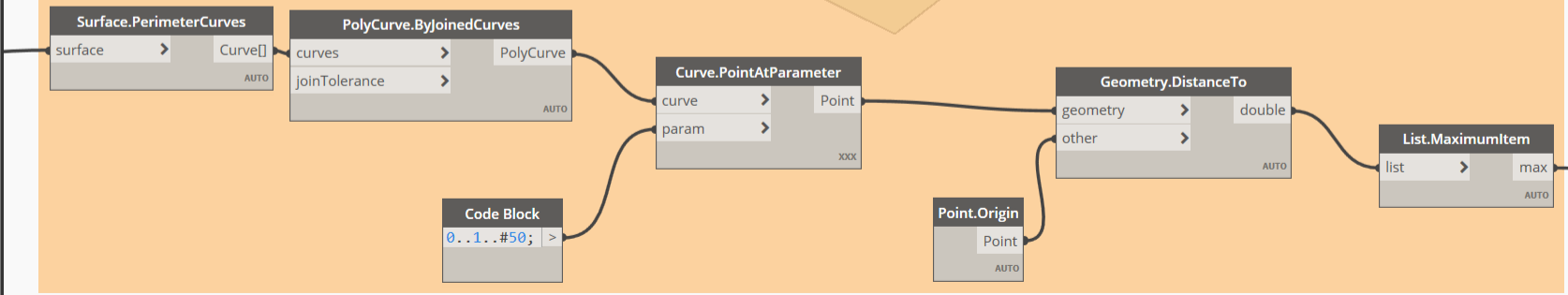
File Edit View Packages Settings Help

StadiumOTx.dyn*

Library



EVALUTE: What is the furthest seat? Minimize



Automatic

Run completed.

Dynamo

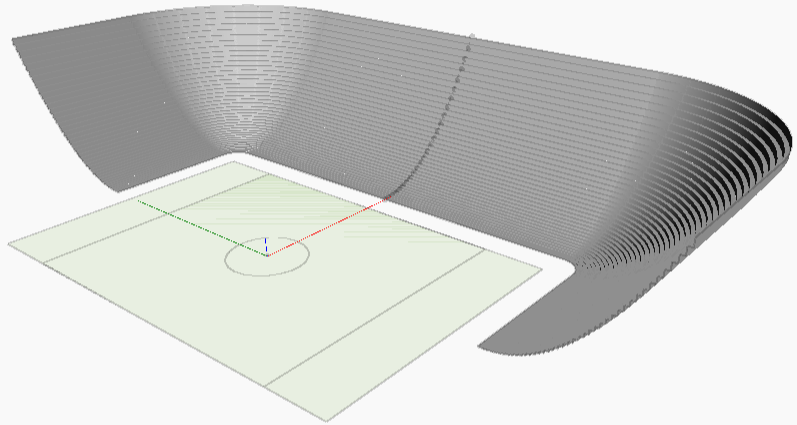
File Edit View Packages Settings Help

Library

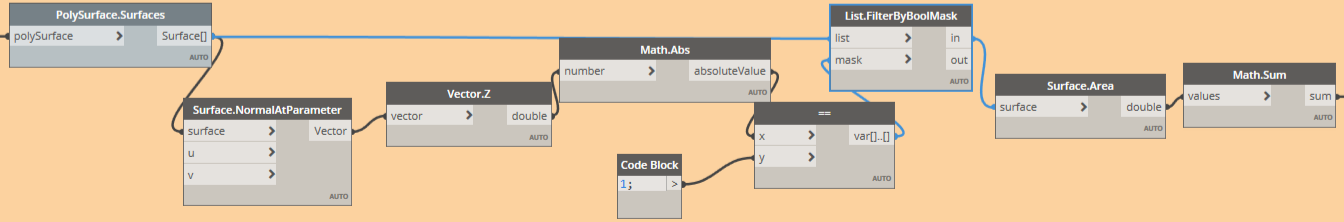
boolean

Cylinder
Solid
ByJoinedSurfaces
ByLoft (crossSectio
ByLoft (crossSectio
ByRevolve
BySweep
BySweep2Rails
ByUnion
Centroid
Chamfer
Difference
DifferenceAll
Fillet
ProjectInputOnto
ThinShell
Union
Area
Volume
Sphere
Surfaces
Tessellation
ImportExport
Input
List
Math

StadiumOTx.dyn*

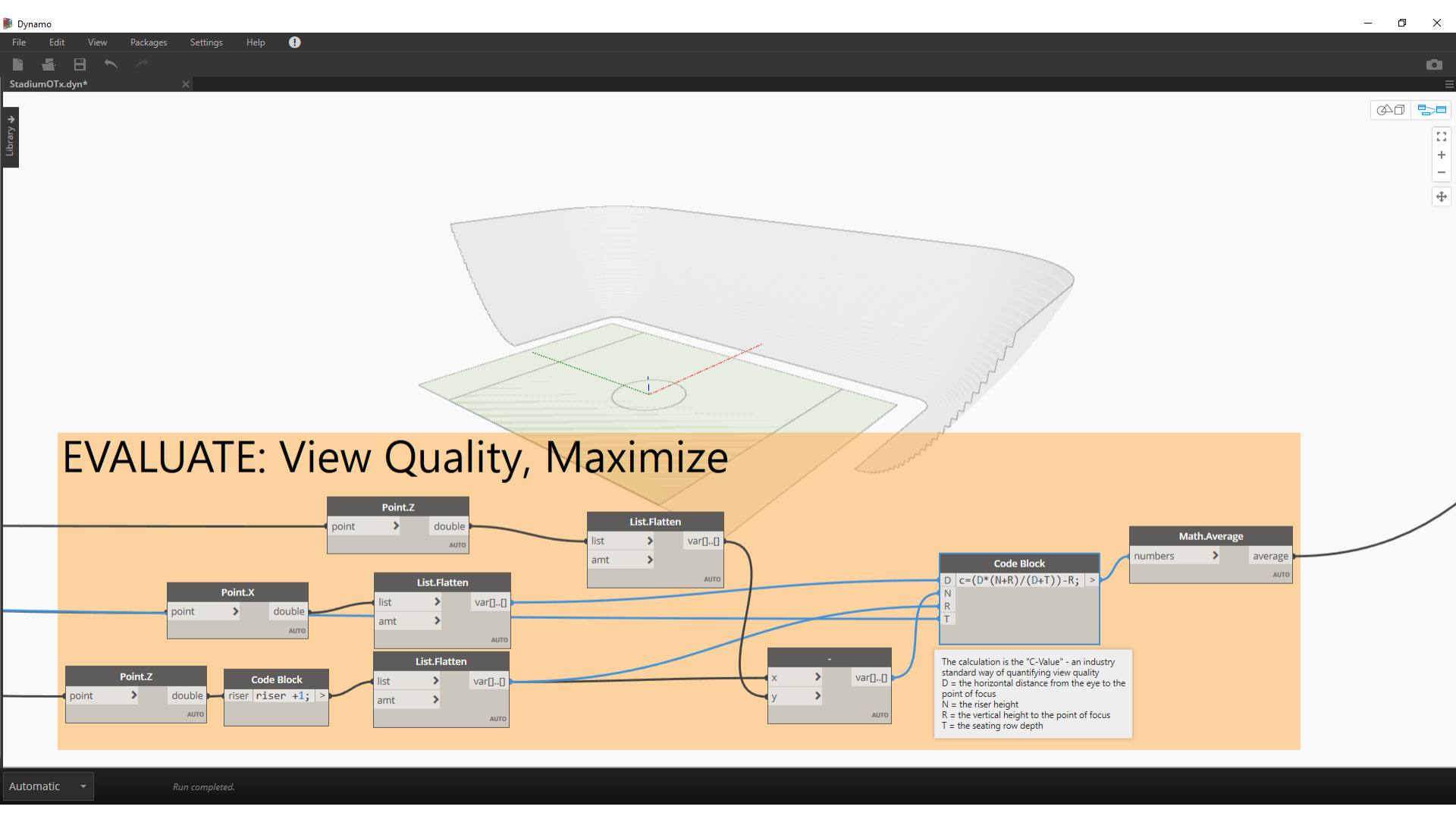


EVALUATE: How Much Seating area? Maximize



Automatic

Run completed.


Dynamo
File
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StadiumOTx.dyn*
Library
EVALUATE: View Quality, Maximize
Point.Z
point
double
AUTO
List.Flatten
list
amt
var[]..[]
Point.X
Code Block
riser +1;
D
N
R
T
c=(D*(N+R)/(D+T))-R;
Math.Average
numbers
average
x
y
The calculation is the "C-Value" - an industry standard way of quantifying view quality
D = the horizontal distance from the eye to the point of focus
N = the riser height
R = the vertical height to the point of focus
T = the seating row depth
Automatic
Run completed.

Dynamo

File Edit View Packages Settings Help

StadiumOTx.dyn*

Library

Outputs

Back Row Distance

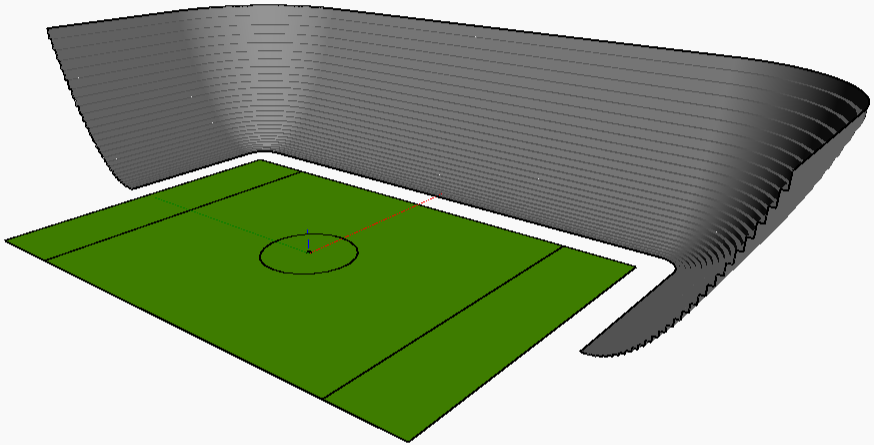
99.976966340646

Seating Area

5683.24254750355

ViewQuality

2.02669355557645



Automatic

Run completed.

Dynamo

File Edit View Packages Settings Help

StadiumOTx.dyn

Library

Playing Field (Fixed)

Interior Edge (fixed)

Inputs: Back and Height of Stadium

Refinery

Studies

New Study

Study		
cee7a24b-feb3-47cf-9649-cc	40/40	✓
842fa7fa-896a-45c9-9713-21	50/50	✓
5311b229-645d-4c0a-b776-4	40/40	✓
24e4b56a-c845-484d-b856-	10/10	✓
14c677f3-c2e8-4c16-a277-35		⚠

Y-Axis

Depth

40
35
25
30
35

Create Study

Generation Method

Randomize

Inputs

Outputs

Settings

Number of solutions

40

Enter a number.

Seed

1

Enter a number to control where randomization starts.

Server is running.

Generate

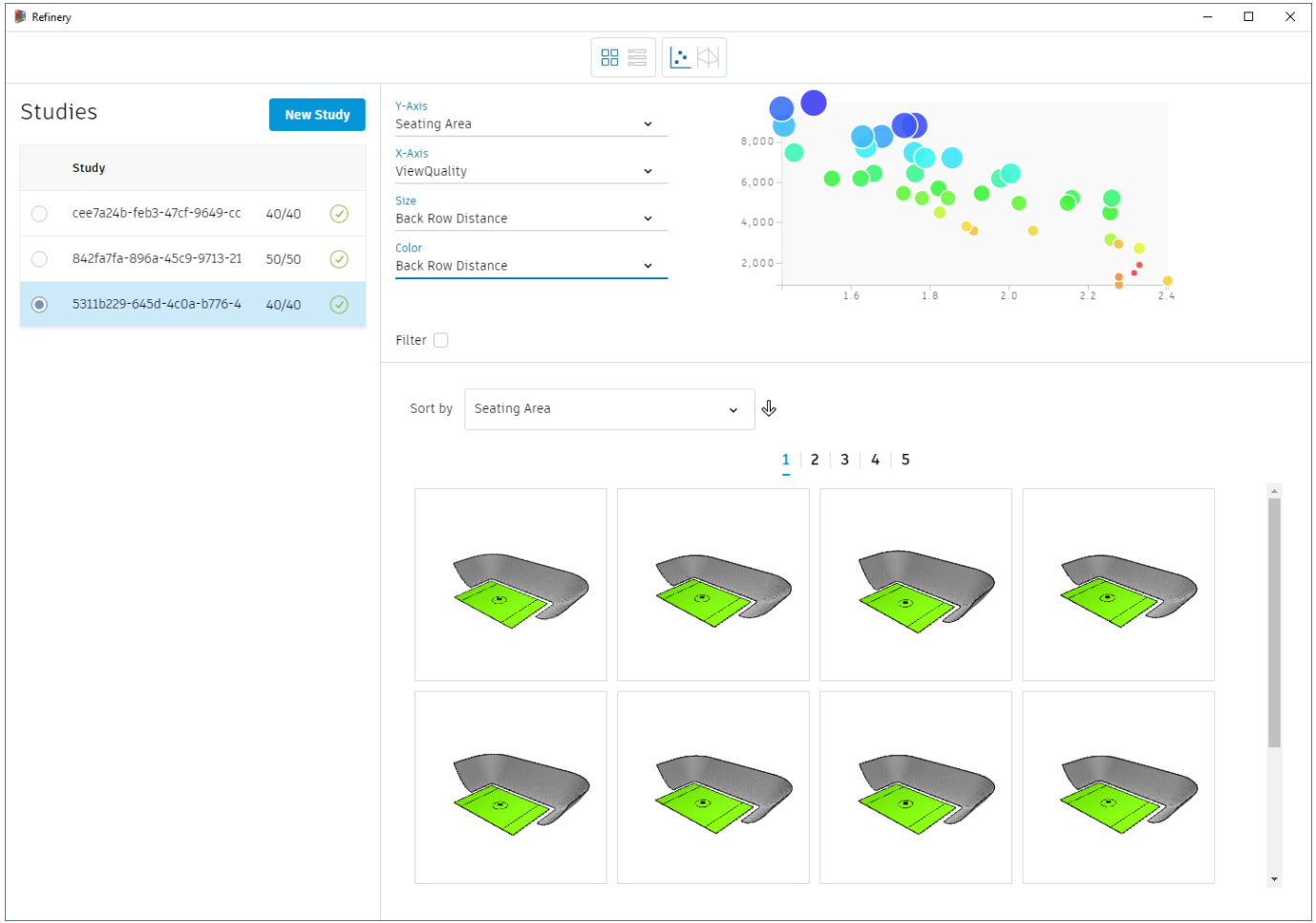
6 | 7

Automatic

Run completed.

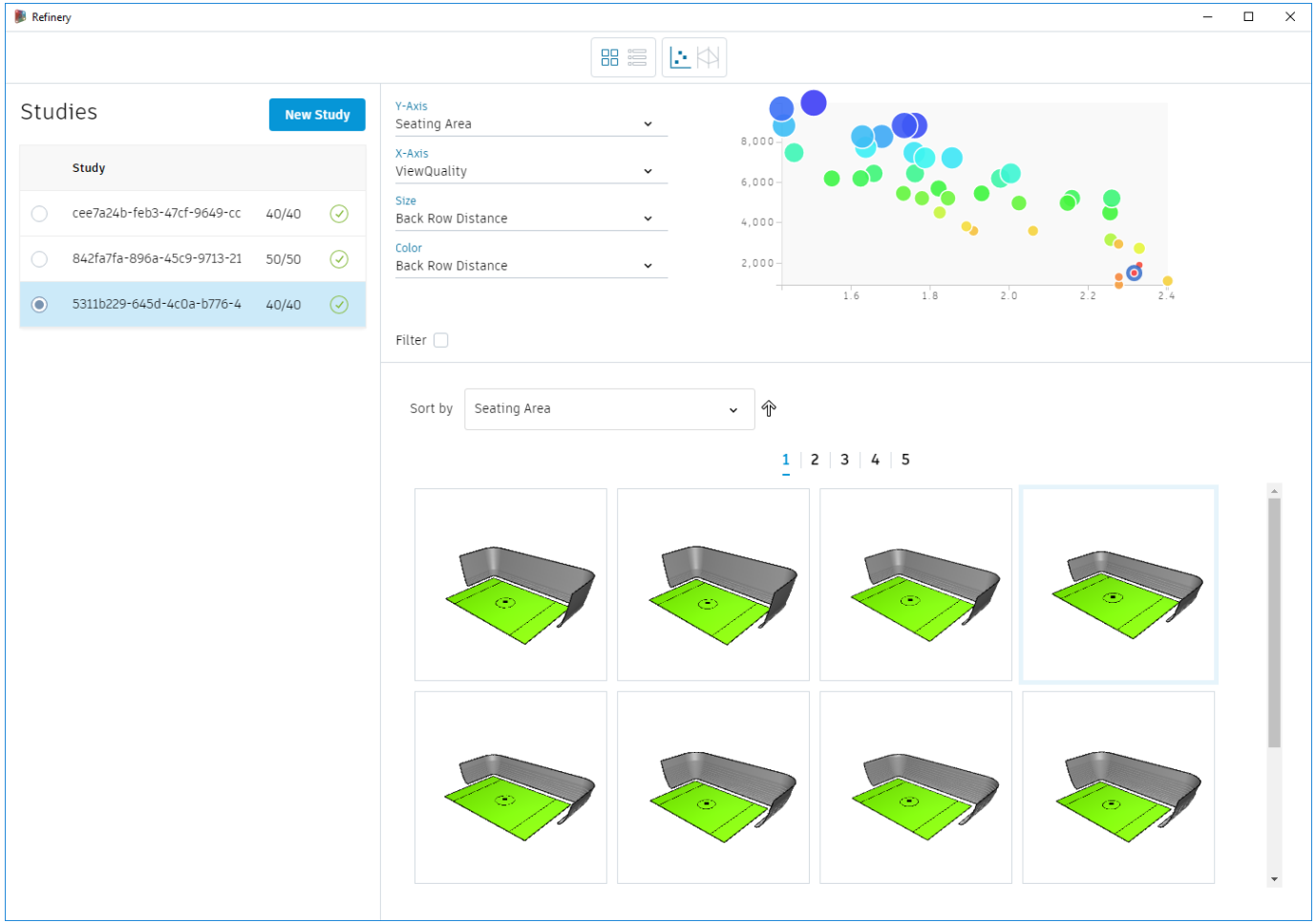
Refinery

40 random runs Sorted by most Seating Area



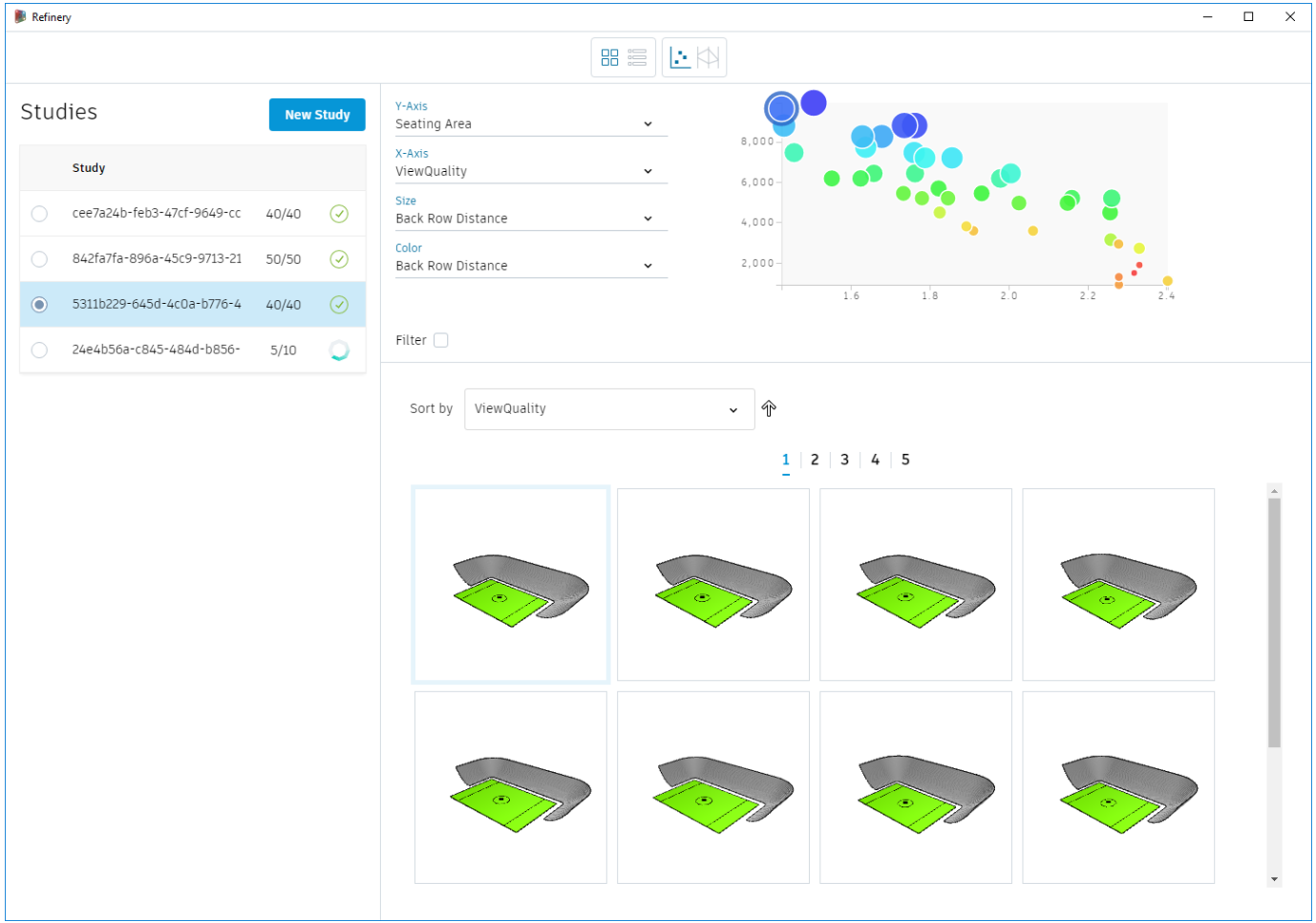
Refinery

40 random runs Sorted by least Seating Area



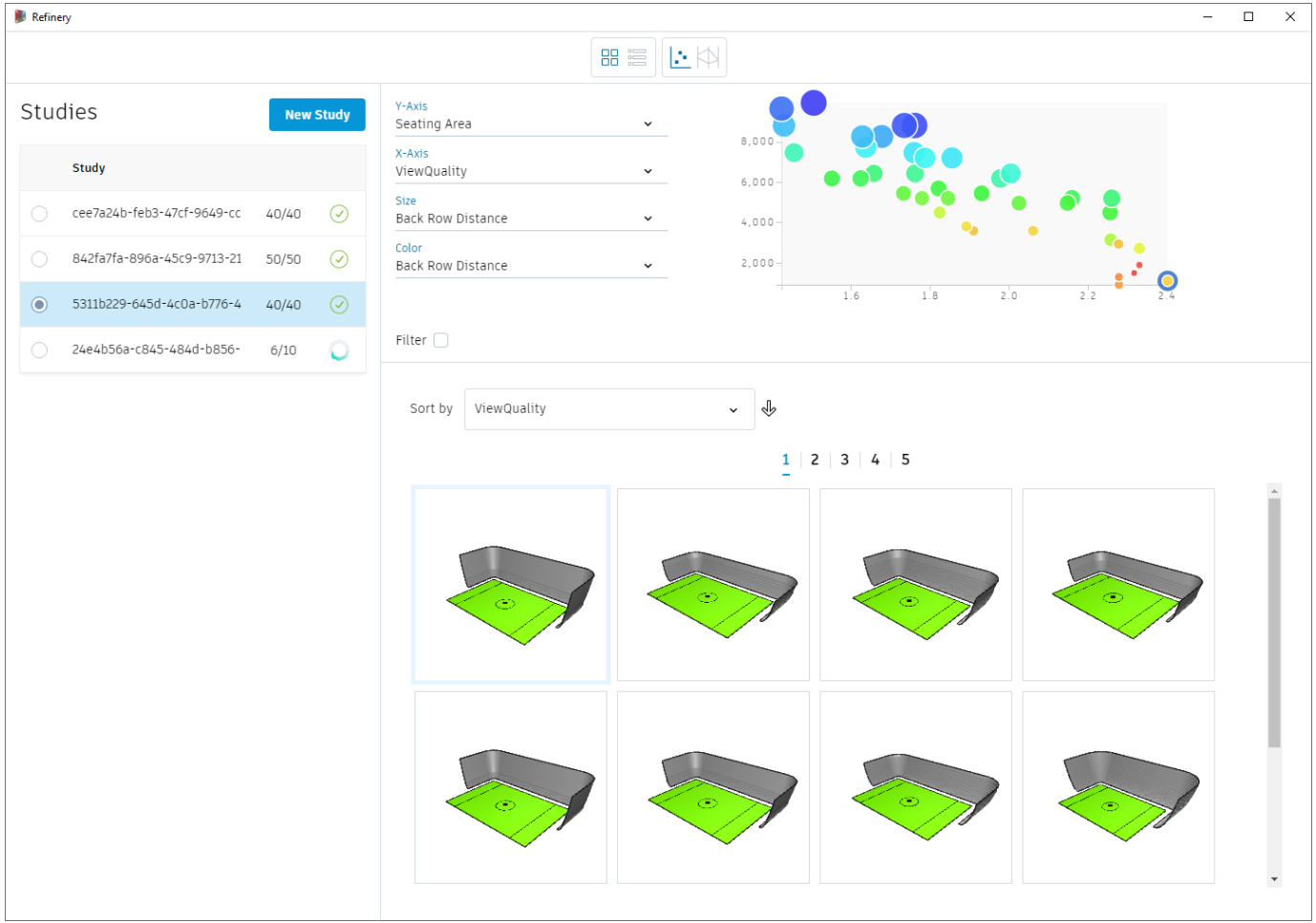
Refinery

40 random runs
Sorted by worst
View Quality



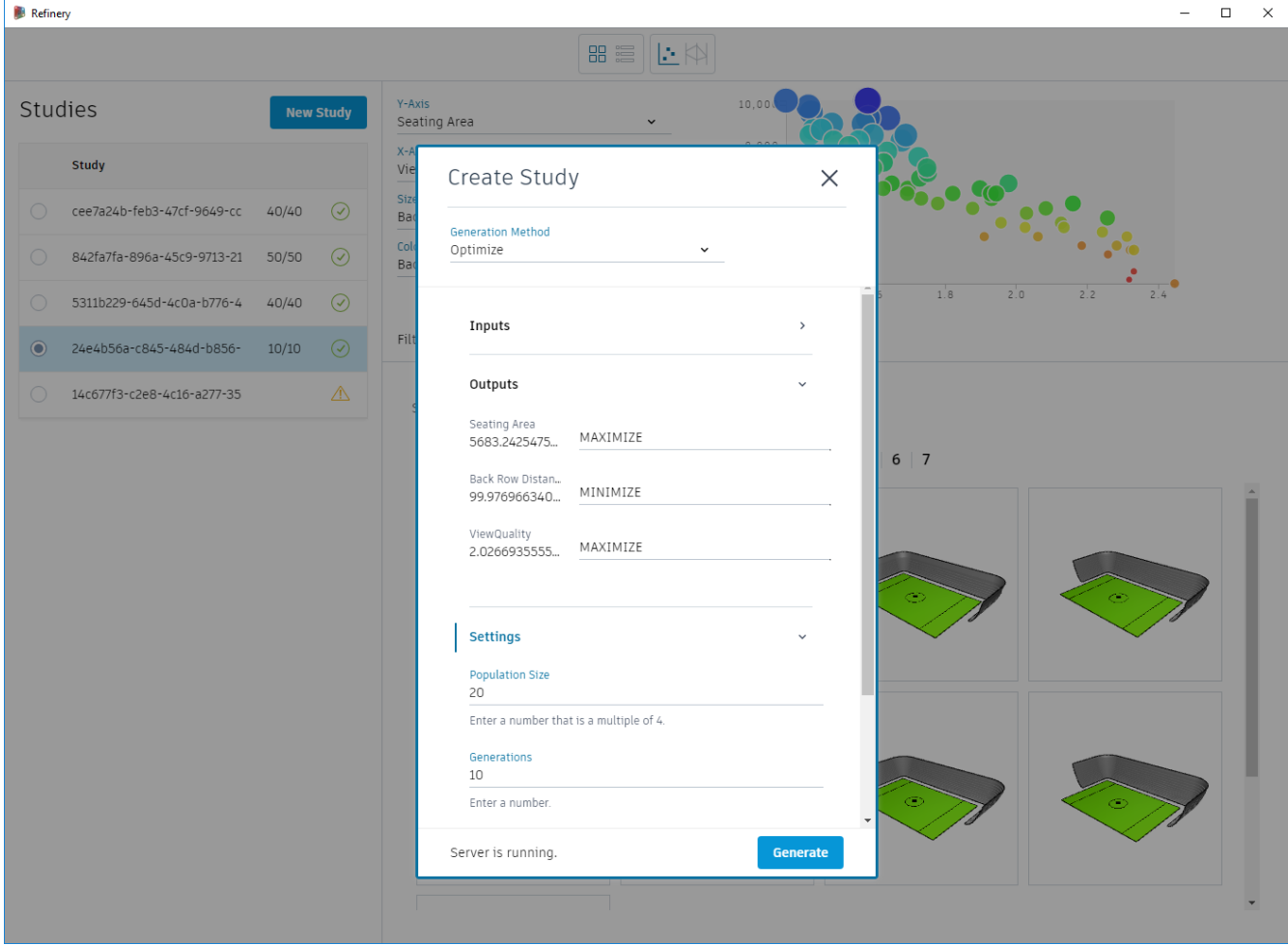
Refinery

40 random runs
Sorted by best
View Quality



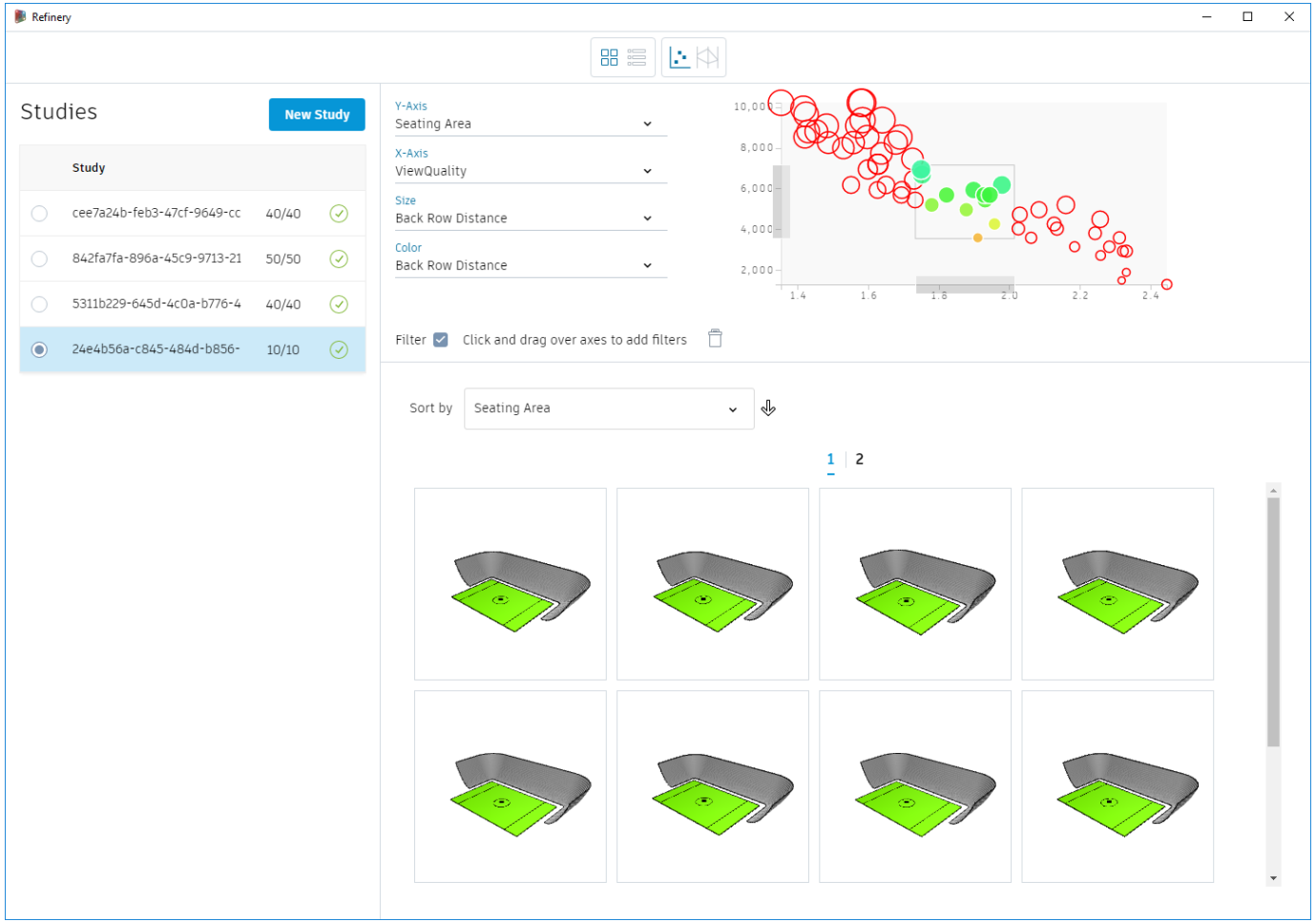
Refinery

Optimization



Refinery

20x10 Optimization Compromise Solutions



Additional Learning Resources

- Getting Started with Dynamo:
  - https://primer.dynamobim.org/
- Dynamo Questions, inspiration:
  - https://forum.dynamobim.com/
- Design Script:
  - https://dynamobim.org/wp-content/uploads/forum-assets/colin-mccroneautodesk-com/07/10/Dynamo_language_guide_version_1.pdf
  - http://designscript.io/DesignScript_user_manual_0.1.pdf
  - https://dynamobim.org/wp-content/links/DesignScriptDocumentation.pdf
  - https://github.com/Amoursol/dynamoDesignScript
- Refinery:
  - https://www.autodesk.com/solutions/refinery-beta
- Generative Design education:
  - https://medium.com/generative-design

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