BrickMe

Convert 3D models in Fusion 360 to bricks!

BrickMe Fusion AddIn - Manual

Media Computing Project - RWTH Aachen WiSe 2020/2021

Group 1

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Beta Plugin - Documentation

Description

BrickMe is an AddIn for the popular CAD software Fusion 360.
It allows you to transform an existing 3D model in Fusion to a model consisting of interlocking plastic bricks with a few clicks.
You can select a body to transform and the bricks you already have available and BrickMe will create a model using only these bricks.

Getting Started

Installation

To use the Add-In, its source files need to be manually copied to the right destination. The following instructions were tested with Fusion 360 v 2.0.9512 in January 2021. Should you encounter difficulties with the installation in the future, please refer to the general instructions on AddIn installation as provided by Autodesk[1].
The source code for BrickMe can be found in the BrickMe directory of the archive this document was found in, or downloaded via Git[2].

Windows

Copy the "BrickMe" directory to the following path:
%appdata%\Autodesk\Autodesk Fusion 360\API\AddIns

macOS
Copy the "BrickMe" directory to the following path:
~/Library/Application Support/Autodesk/Autodesk Fusion 360/API/AddIns

Activate the Add-In

After the files are copied to the correct directory, BrickMe can be activated through the "Scripts and Add-Ins" dialog box in Fusion 360.
The "Scripts and Add-Ins" dialog can be found in the "Tools" Tab of the tool bar at the top.
Click on "Add-Ins" and select "Scripts and Add-Ins" from the drop-down menu.
The "Scripts and Add-Ins" dialog should appear.
In the "Add-Ins"-tab, select "BrickMe" from the "My Add-Ins" section and click on the "Run"

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[1]
h[ttps://knowledge.autodesk.com/support/fusion-360/troubleshooting/caas/sfdcarticles/sfdcarticles/](https://knowledge.autodesk.com/support/fusion-360/troubleshooting/caas/sfdcarticles/sfdcarticles/How-to-install-an-ADD-IN-and-Script-in-Fusion-360.html)
[How-to-install-an-ADD-IN-and-Script-in-Fusion-360.html](https://knowledge.autodesk.com/support/fusion-360/troubleshooting/caas/sfdcarticles/sfdcarticles/How-to-install-an-ADD-IN-and-Script-in-Fusion-360.html)
[2] https://git.rwth-aachen.de/liam.tirpitz/mcp-project-group1

button in the bottom right corner of the dialog.

If "BrickMe" does not appear in the list, click on the green "+" button at the top and select the "BrickMe" folder from the dialog box.

Additionally, the "Run on Startup" checkbox may be selected to automatically load "BrickMe" when Fusion 360 starts.

Usage

After the Add In is installed and activated, it appears in the Fusion menu under Solid->Create->BrickMe.
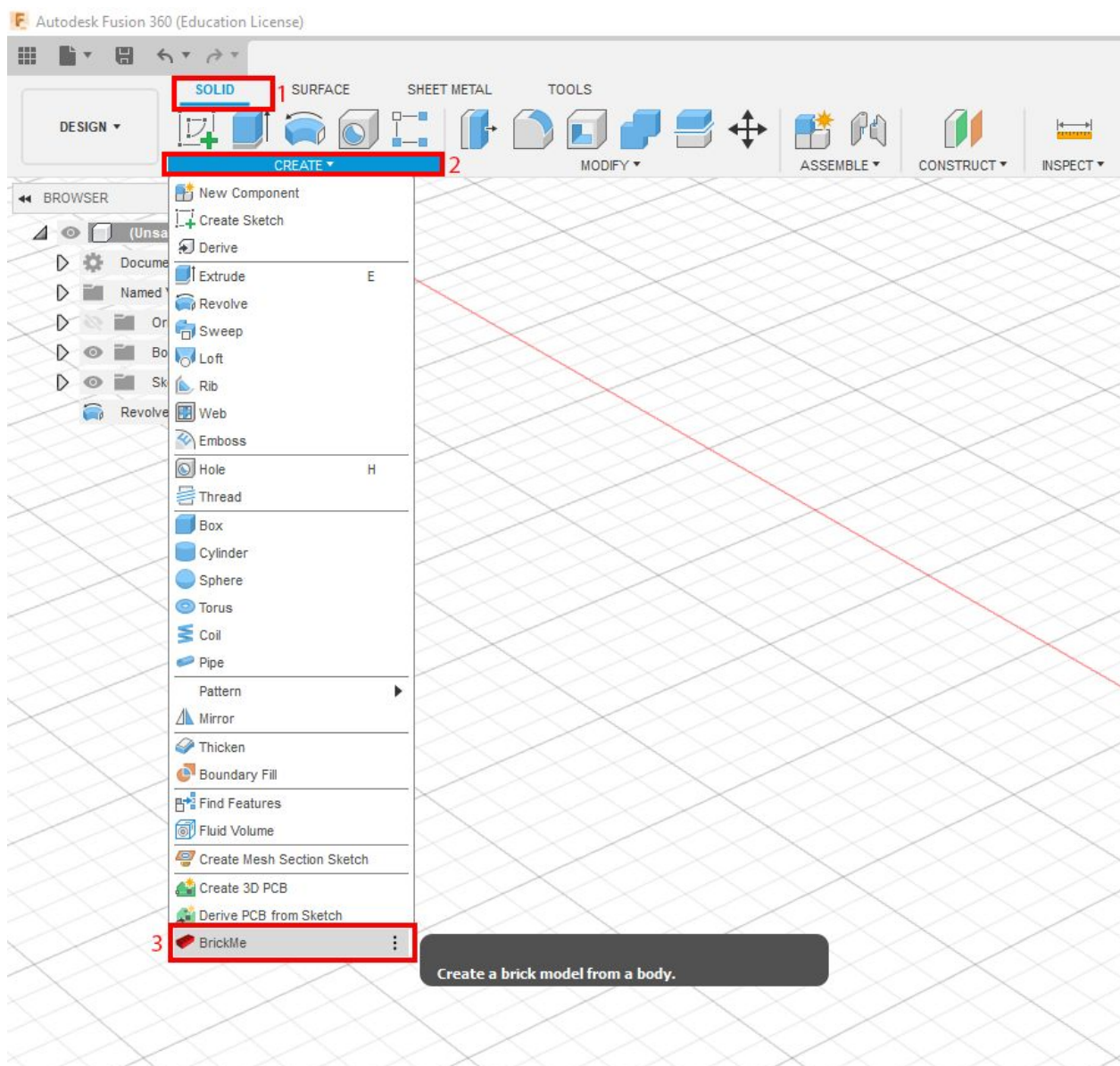

Clicking on this menu item opens a small configuration panel with two options. First, the

Add In requires you to select a body that you want transformed to brick form. This can be done by activating the selection (by clicking on the "Select" button in the configuration panel) and selecting, for example, a body from your current model by clicking on it. For this example, we select the displayed torus fragment.

Be aware that BrickMe creates models layer by layer, where each layer is parallel to the x-y plane and each row of every layer is parallel to the x axis. Depending on your goals, you may need to reorient your model before using BrickMe.

The configuration panel also allows you to configure the types of bricks that are used for the brick model, by clicking on "Available bricks" and selecting the bricks that should be used from the drop down menu. This can be helpful, if you want to recreate the brick model in real life later, but only have certain brick types available.
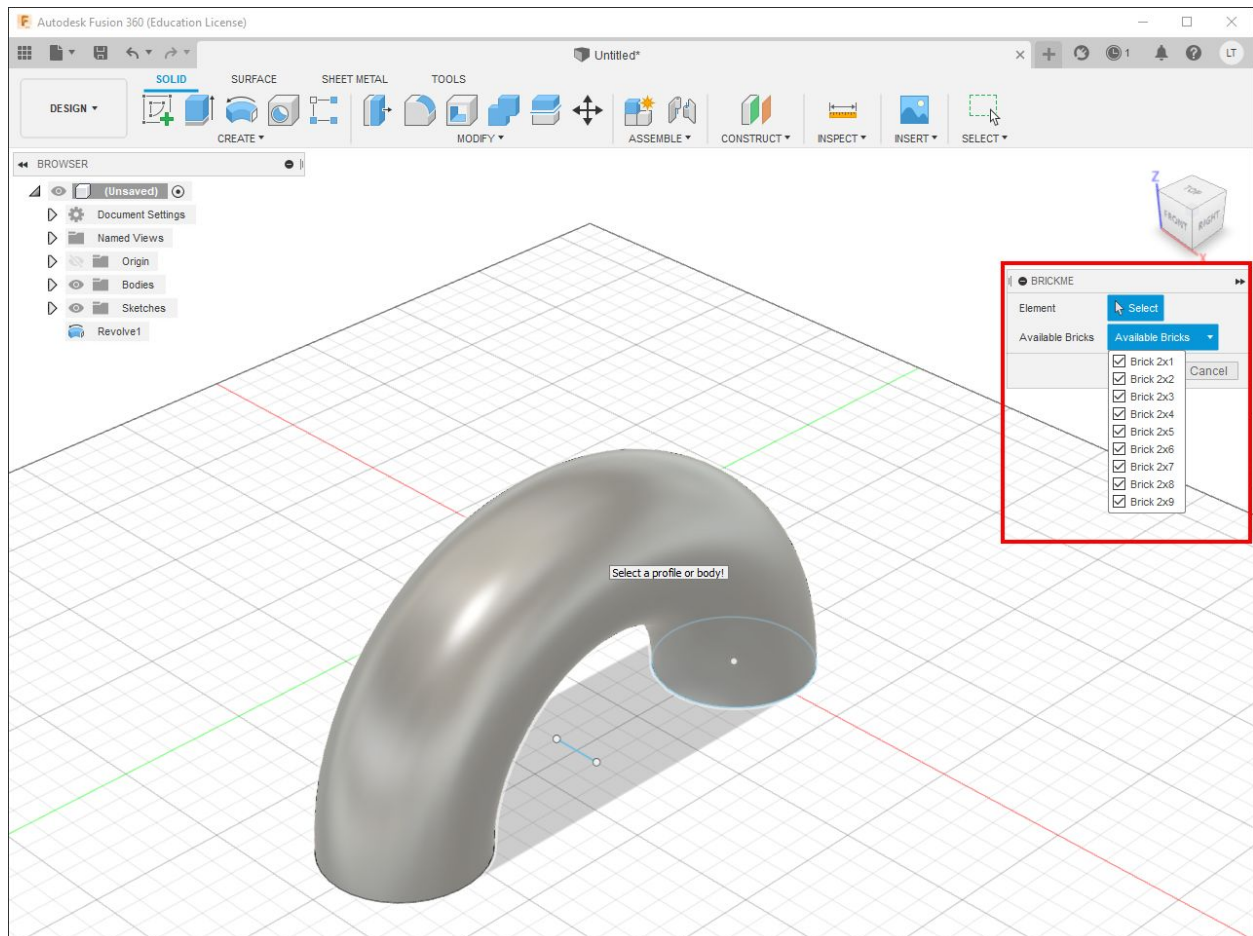
After you selected the desired body and bricks, you can start the creation of the brick model, by clicking "OK" on the configuration panel. A progress dialog will appear, which indicates how many layers still need to be placed. Depending on your model size, this step may take a while. The brick model creation can be interrupted at any point, by clicking the

"Cancel" button on the progress dialog. In this case, the bricks that were already placed at that point will remain and the Add In stops adding more bricks. If the model creation completes successfully, you should see your model in brick form! Additionally, a "Bill of Material" is displayed, which lists all types of bricks that were used, as well as the quantity they were used in.
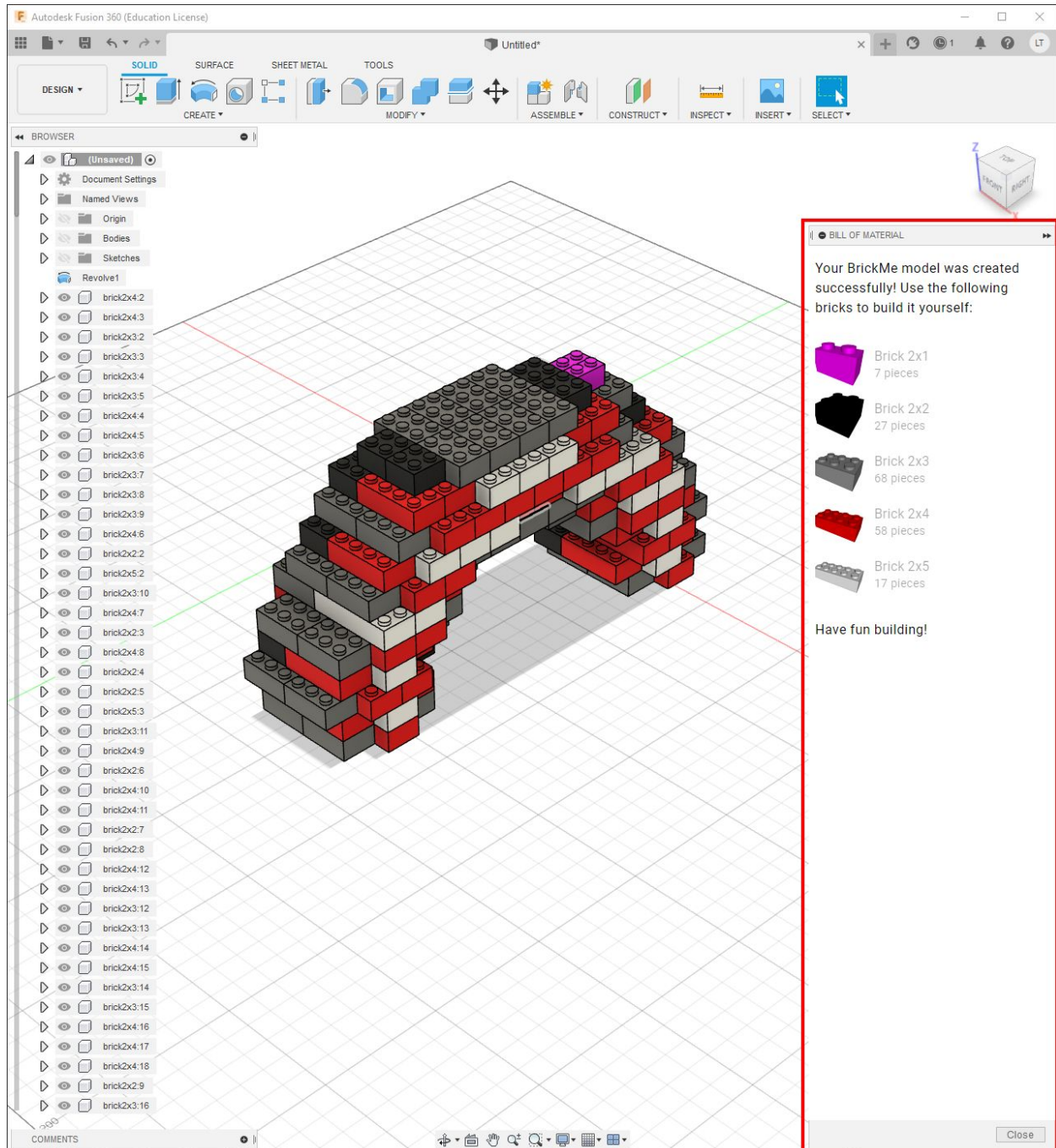
Additionally, each BrickMe model is created as its own component and each layer of the model can be selected and displayed individually, to help you get the positioning of each

layer right. Now you can start building the model in real life!
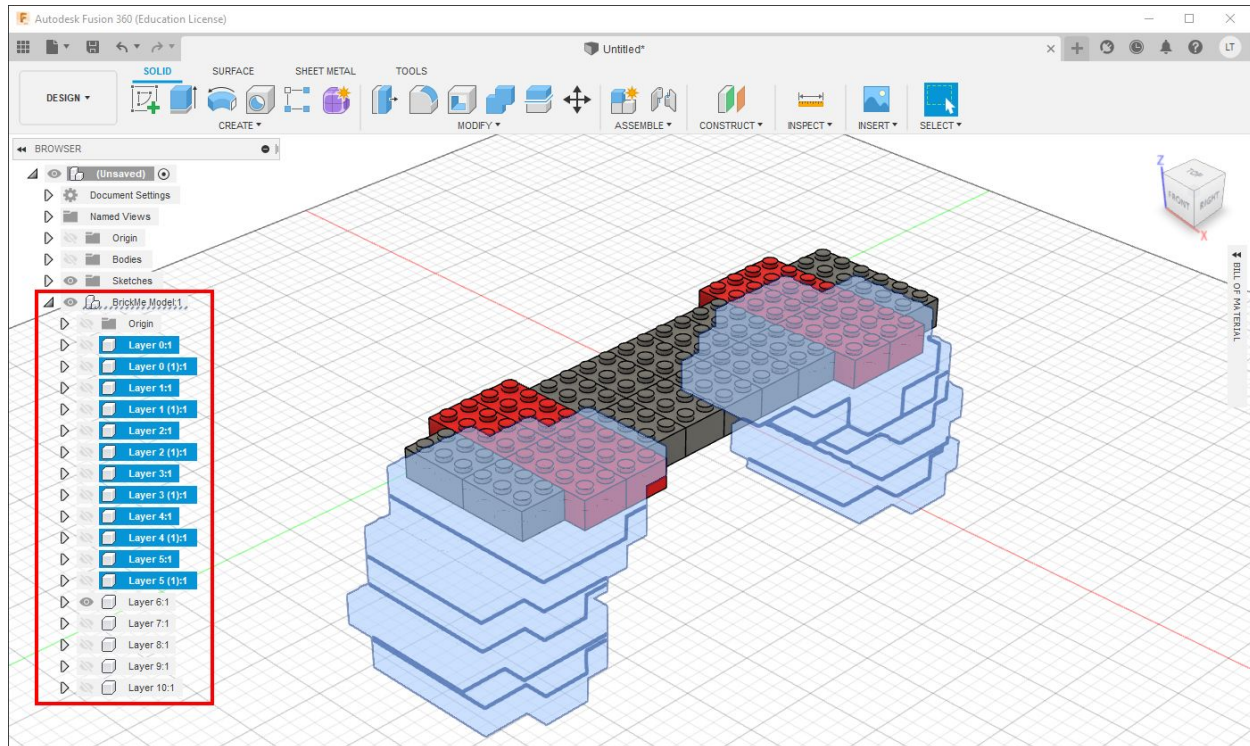
Under the hood

Limitations

The current implementation of BrickMe has various limitations due to design choices during development.

Most importantly, a naive, greedy algorithm for the placement of bricks is used.
While the algorithm produces usable results in most cases, it does not *guarantee* a correct model. Bricks *may* be disconnected from the rest of the model, or flying parts of the model may be so heavy that the model breaks.

Further, the model is built in a fixed orientation that has to be respected by the user, i.e., bricks are oriented such that the xy plane is the ground and each row is parallel to the x axis, while each layer is parallel to the xy plane. If users want the brick layers to be oriented differently, they have to reorient the original body.

How it works

To recreate a given body with bricks, it is deconstructed to smaller, elementary forms.
The 3D body is sliced into 2D profiles, and each profile is filled row by row, one D at a time.

Slicing the body
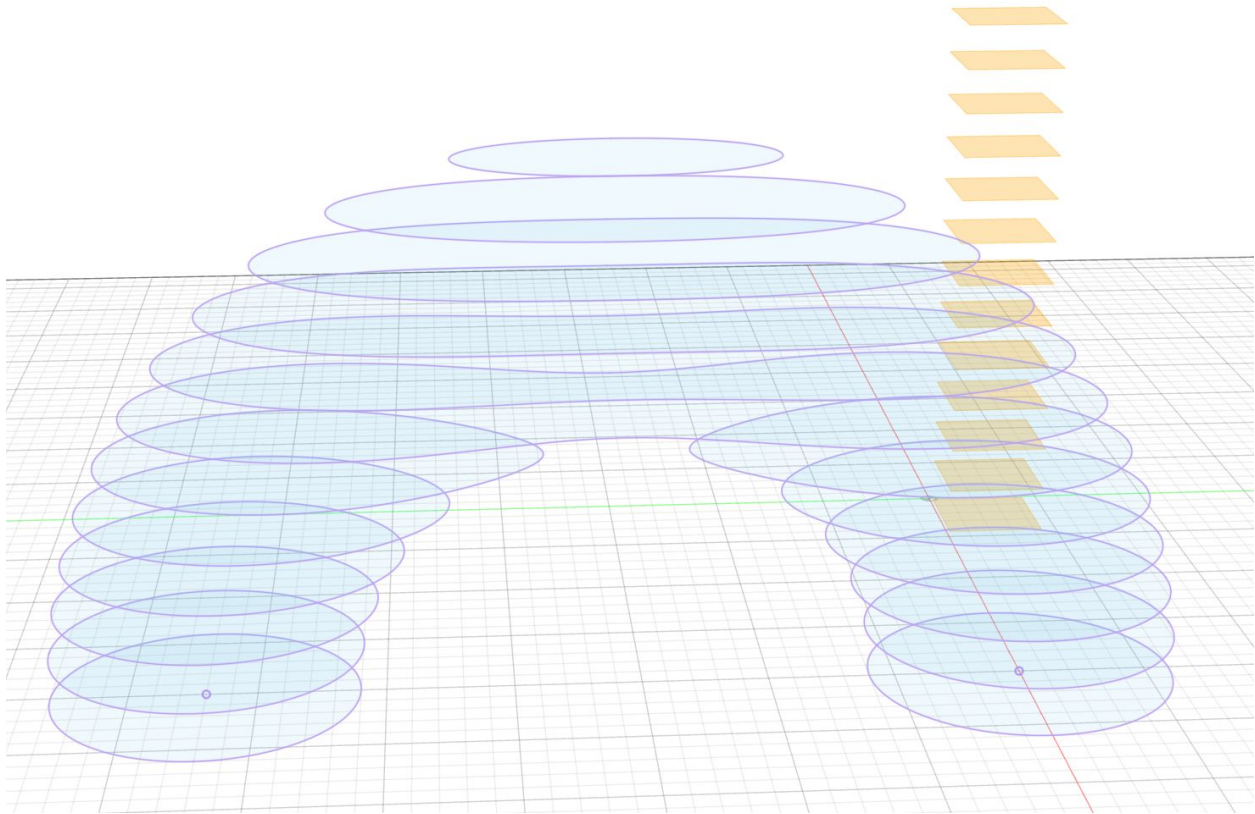
To slice a body into profiles, BrickMe first creates individual planes (yellow) with the distance of a brick height while stacked for the full height of the body. Afterwards, an intersection of a single plane with the body results in a list of profiles that can be filled individually (blue).

Filling a Profile

Each profile is filled individually, but adheres to a global grid to enable stackability. The individual profiles are filled row by row, starting from the center.
Each row starts from the center of the profile in positive x direction and the largest brick is placed, that the user selected and that fits inside the profile (1). A brick is considered fitting when its entire length is inside the profile, i.e. when the brick would cover a hole in the profile it will not be placed. This step is repeated, until the smallest brick does not fit inside the profile anymore. Additionally to stop the step the smallest brick must not fit inside the bounding box around the profile to assure that the current row does not continue behind a hole (2). The same procedure is repeated on the same row, in negative x direction (3). After a single row is filled, the next row is filled similarly (4, 5). First, the rows are filled in positive y direction from the center, until the next brick would not fit inside the profile anymore.

After the positive y range is filled, the same procedure is repeated in negative y direction (6).