Symmetry Mode

Introduction

Symmetry mode allows mirrored building using the BlockPlacer. It is built on the principle of *rotating* blocks to achieve the mirrored shape.

Symmetry is inherent to the blockplacer and not an external tool. Each grid separately defines 3 optional symmetry planes for each cardinal axis in the **BuildingInfoComponent**.

See: **BlockPlacerEntityComponent.Place** (method), **BlockPlacerEntityComponent.Preview.cs**, and **BuildingInfoComponent.cs**

The plane is defined by the plane's starting point relative to the grid using the normal+distance definition.

When attempting to place or preview a block, the block is reflected around the symmetry planes in order to work as a mirror. I.e; the block's position relative to the plane on said axis will be negated. Extra care is taken to preserve integer/cell positions and not drop into floating point when doing the mirroring, in order to reduce errors.

Each plane is reflected in turn, which means that 2 active symmetry planes will reflect the block once into two copies, and then reflect each copy, leading to 4 blocks.

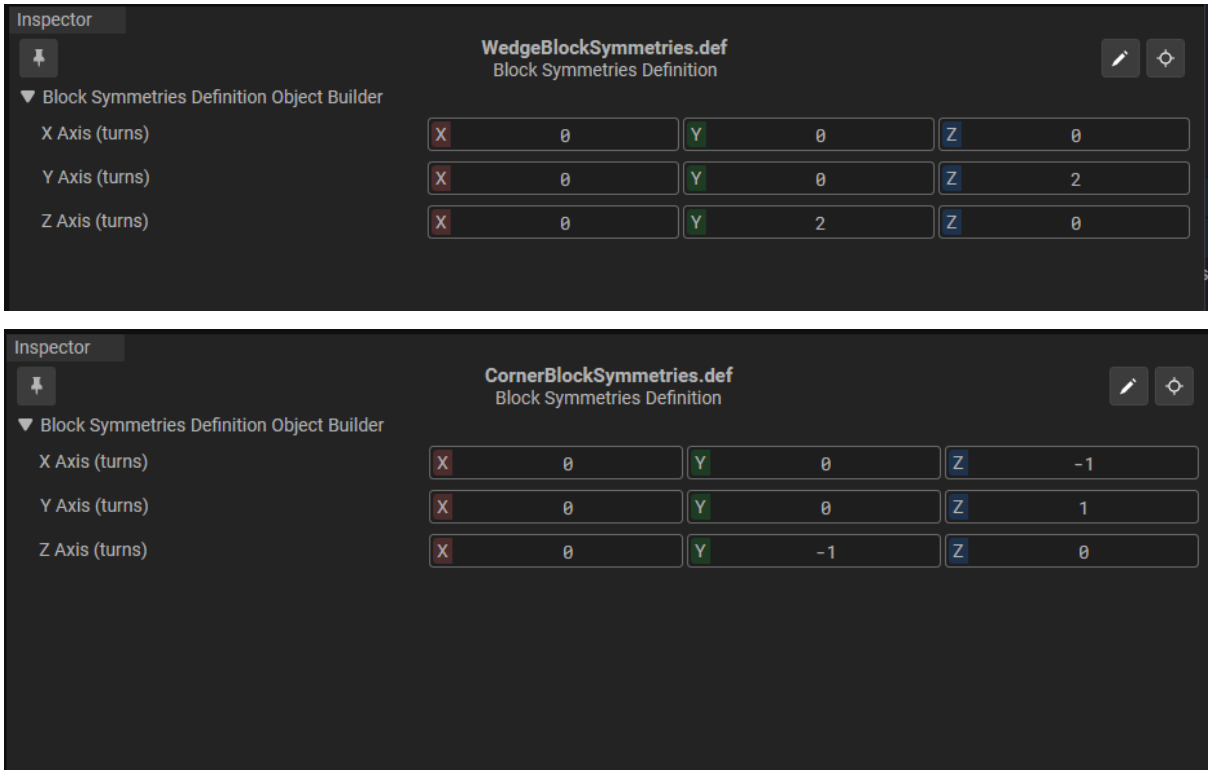
Definitions

Mirroring the position of the block is not enough for symmetric building. The block's rotation also needs to change to achieve the same *functional* placement. I.e; wedges and corners must also face the mirrored direction after being reflected around each symmetry plane.

Symmetry rotations are defined in the blocks **PlacementDefinition** and depend on the blocks shape, and any conveyor ports or other surface features the designers want to preserve.

For example, a cube block needs no mirroring, while a slope (sloping towards Z) is symmetric in X<->-X, but for Z<->-Z needs to rotate 180° on Y in order to face the opposite direction (back to front). For Y<->-Y it needs to rotate 180° on Z.

Different symmetries are needed for corner shapes blocks, as they need to preserve their corner-like property and similar for the different block shapes.

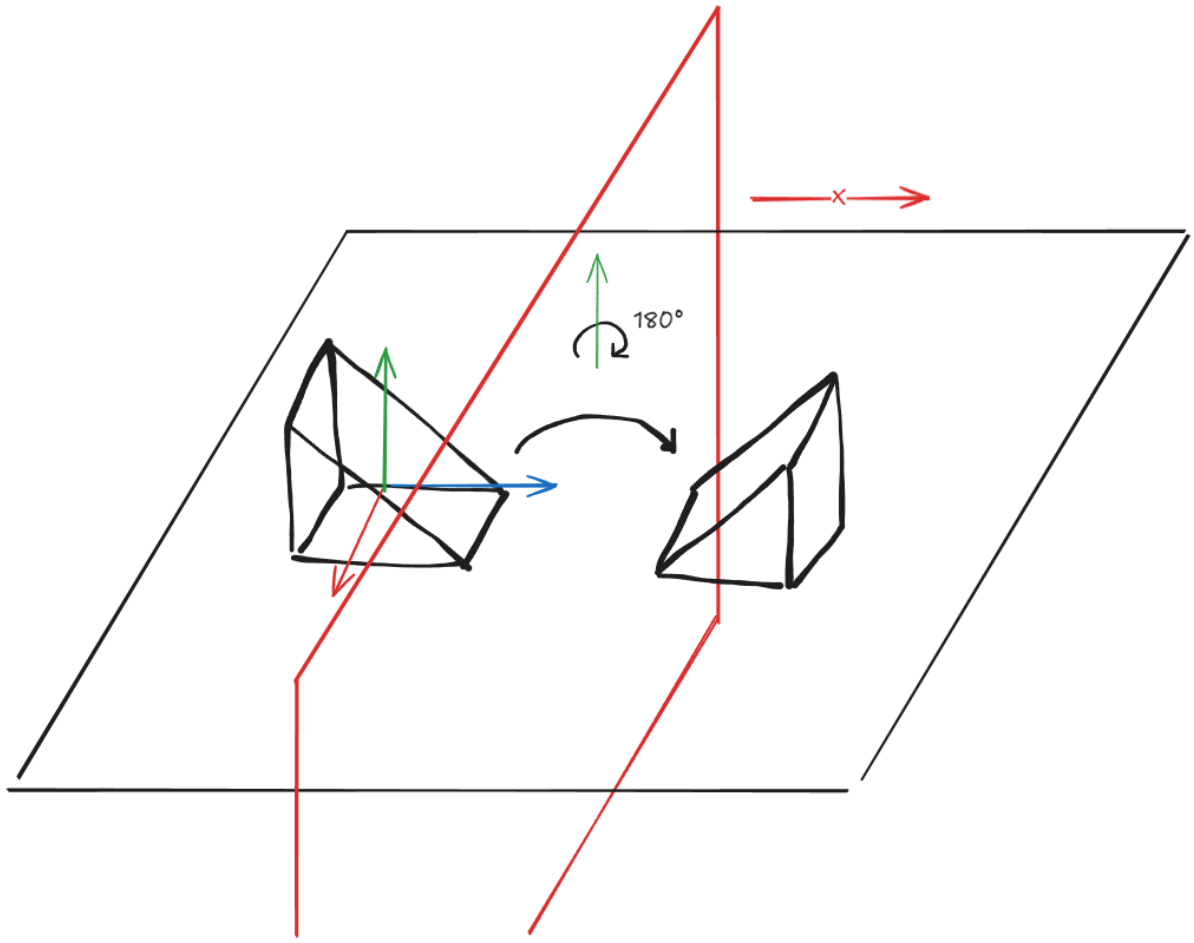


Mirroring Rotation

When a block needs to be mirrored around a plane, the *block-local* facing is calculated with regards to the plane. When mirroring a block along the X plane (relative to rotation of the grid) the block's own axis will be computed in the direction of the grid's X direction. A block axis on the grid's X plane may be the X axis, but may also be the Y or Z axis depending on the individual blocks rotation.

The block's local axis in the direction of the current plane is then used to look up with symmetry rotation to use.

For instance, if a slope (sloping towards Z) is rotated to face along the grid's X axis, the **ZAxis** field will be taken as the rotation.



The process is then repeated iteratively for each plane for each reflected block. This means Y planes will mirror first the original block using the appropriate axis, and then mirror the previously X-plane reflected block using the symmetry rotation axis the block faces *after* having the X reflection already applied.

This is what enables the system to extend to all 8 quadrants using all 3 symmetry planes without needing XY, XZ, and similar combinations defined in the editor.

Pasting Mode

When placing a grid using paste mod, as opposed to a single block, the grid is kept intact and the grid is rotated and positioned as a whole.

The pivot block when copying the grid is taken to be the basis and source of which block symmetries definition to use during placing.

The grid is not deconstructed to then individually mirror each contained block for preview and placement.