GenISys
Advancing the Standard

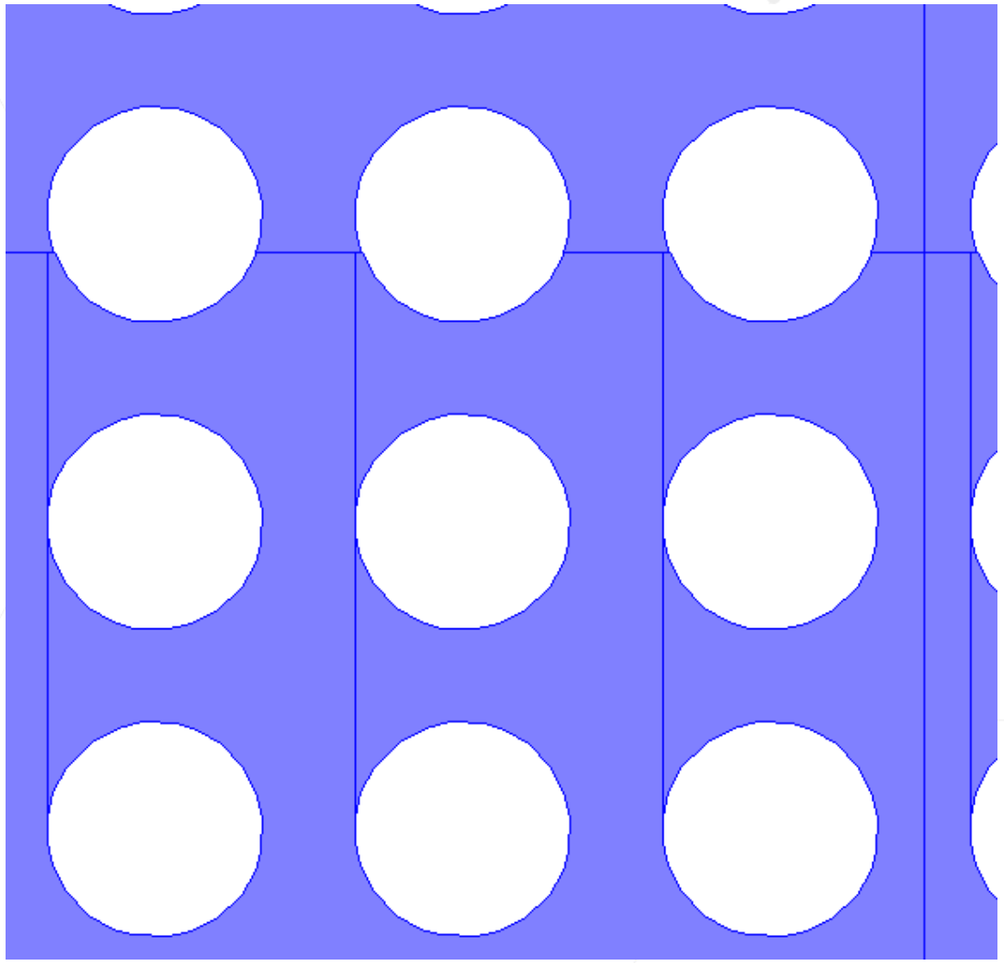
APPLICATIONS

Fracturing Reversed Tone Photonic Crystals

The GenISys Applications Team

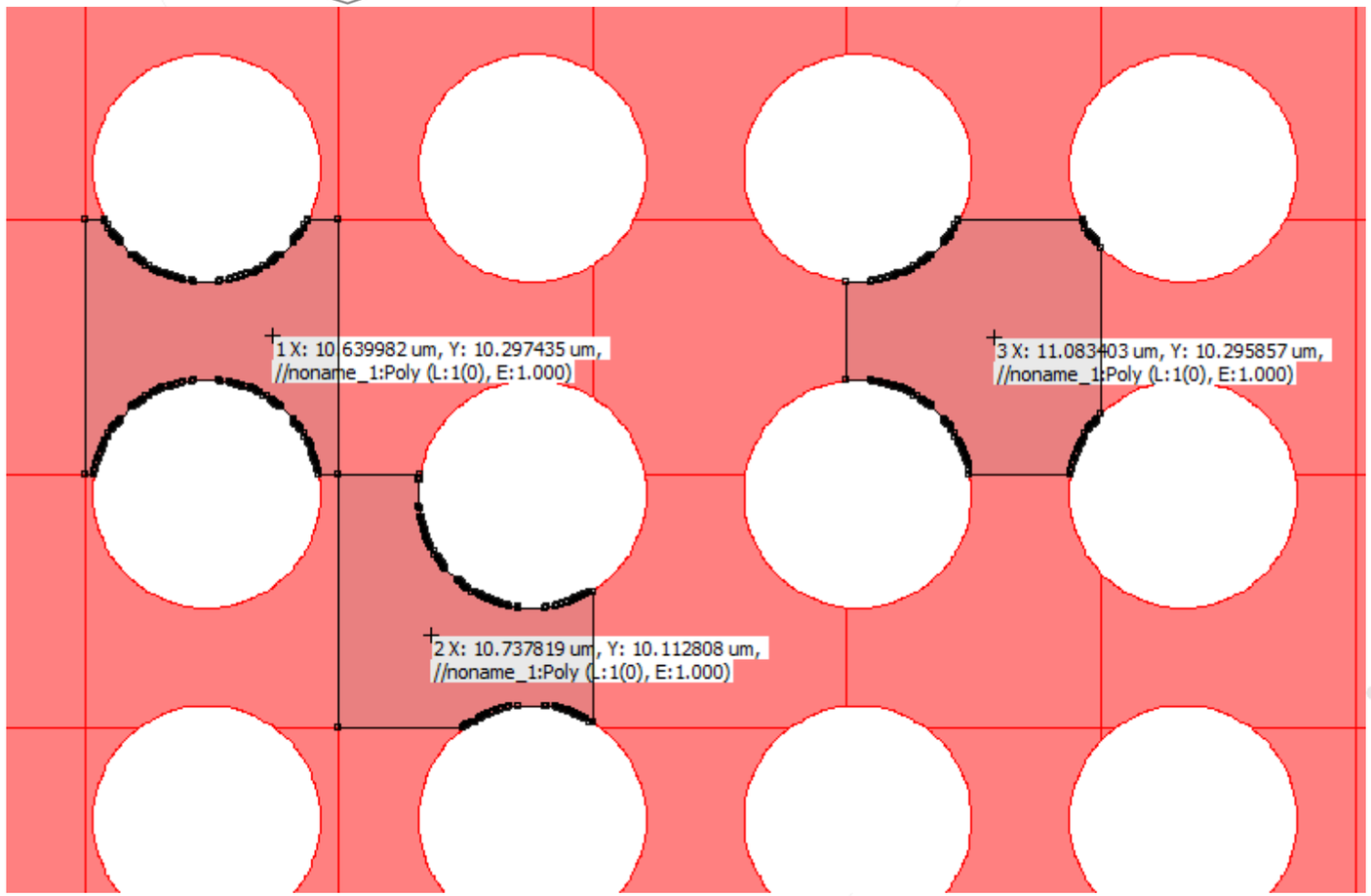
Reverse Tone Photonic Crystals

Is there a solution to optimize fracturing?



Flattened Design

In a flattened design, cuts influence non-uniform fracturing.



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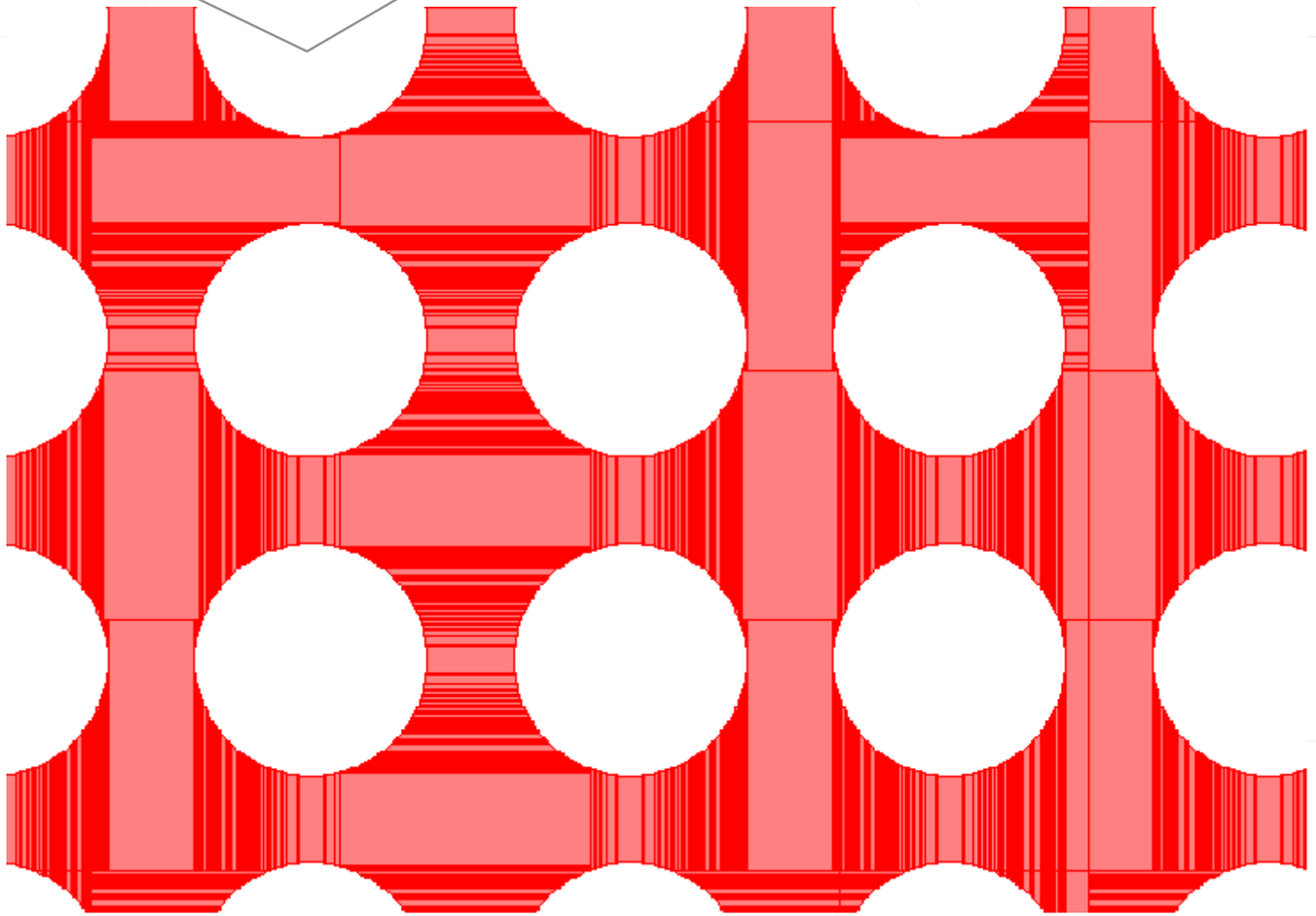
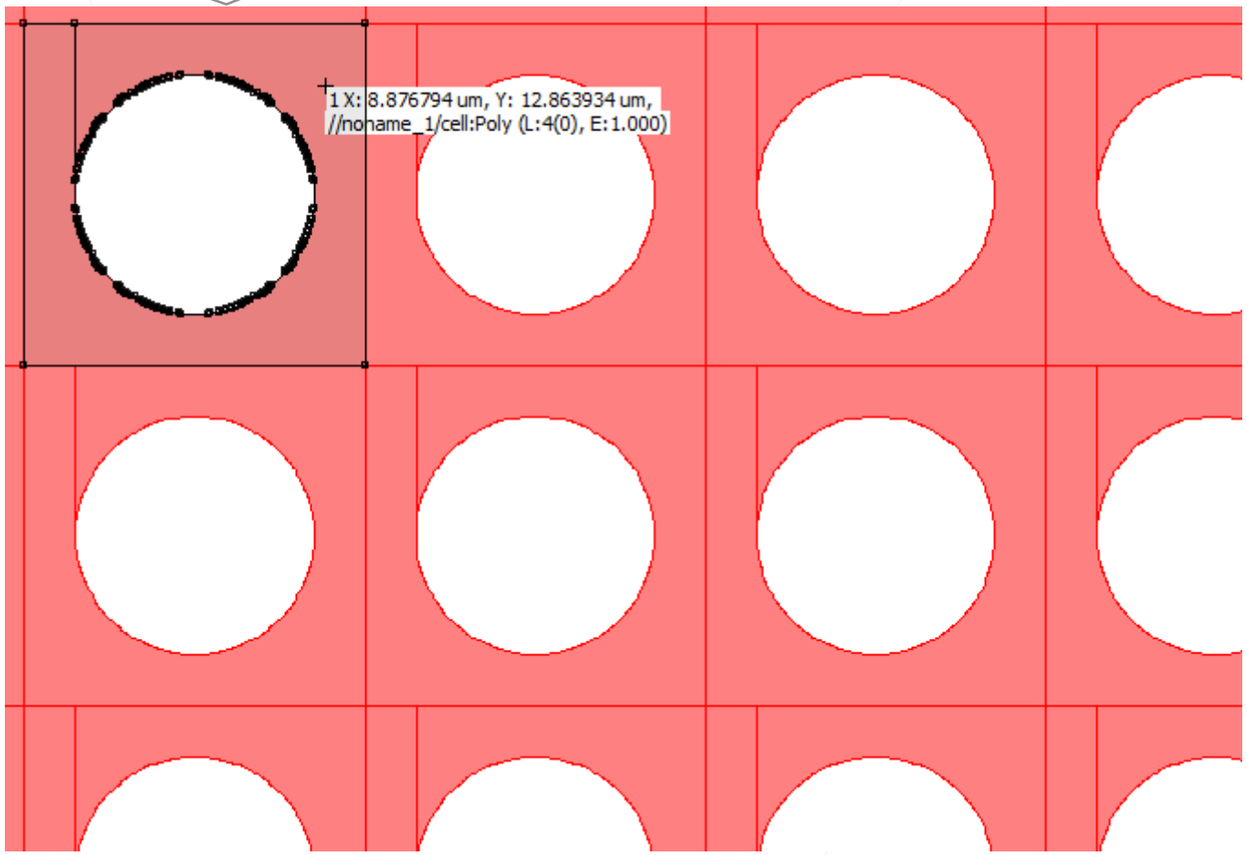


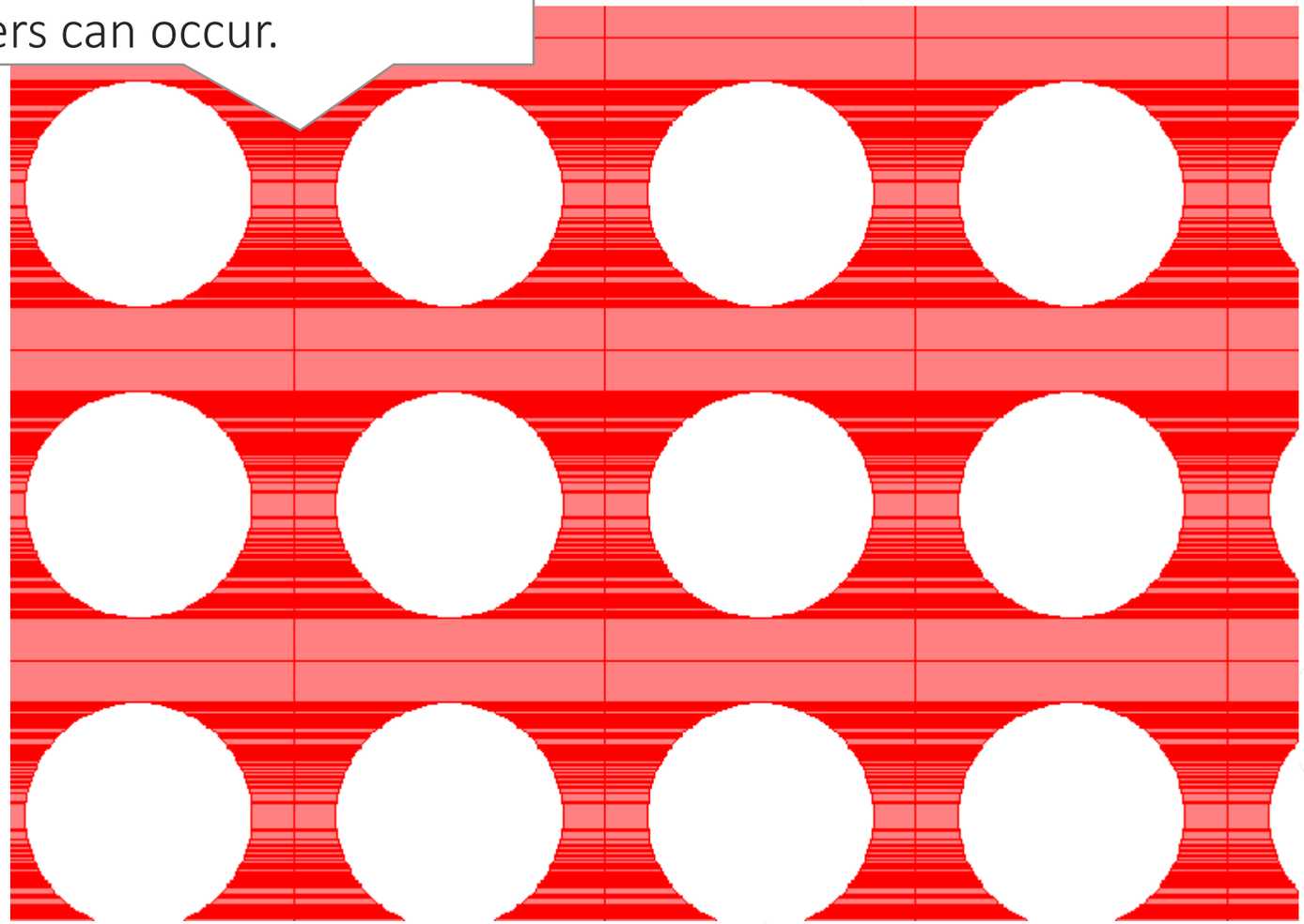
Hierarchical Design

In a hierarchical design, cuts could influence more uniform fracturing.



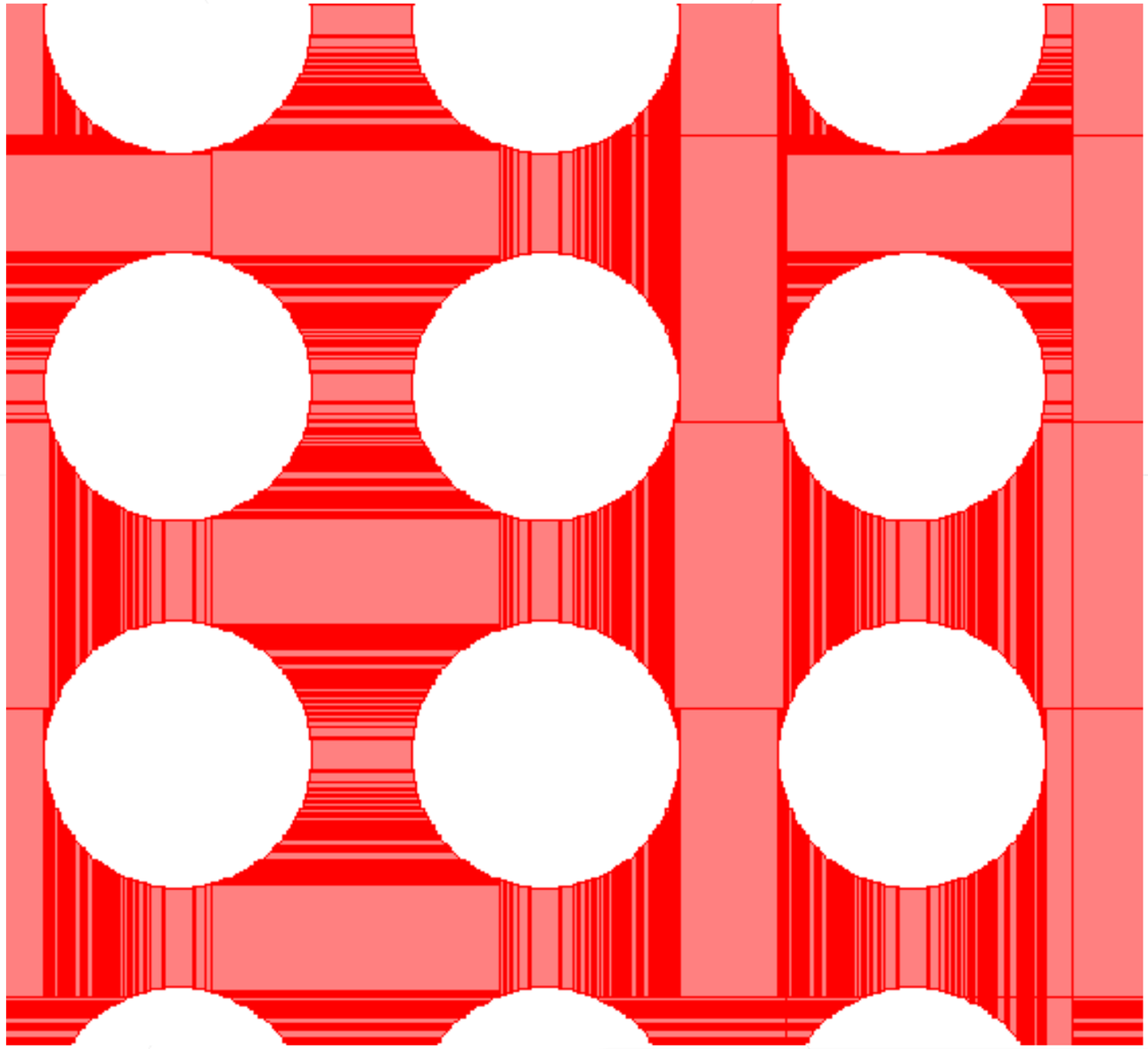
Hierarchical Design

In a hierarchical design, cuts influence more uniform fracturing; however slivers can occur.



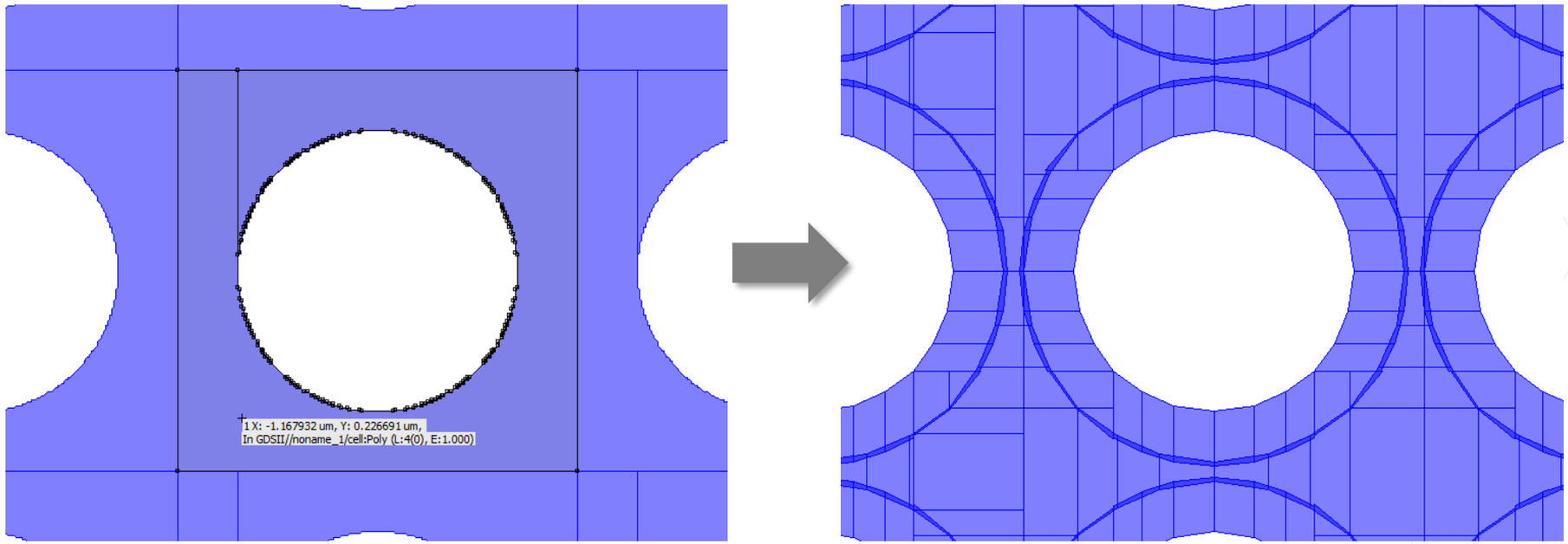
Caveats of Both Options

- Limitation of the designers ability to plan for data-prep to machine format.
- Number of vertices for curve digitization can be arbitrary:
  - Too many vertices influences the creation of too many shapes.
  - Too many vertices can increase the fracturing computation time.



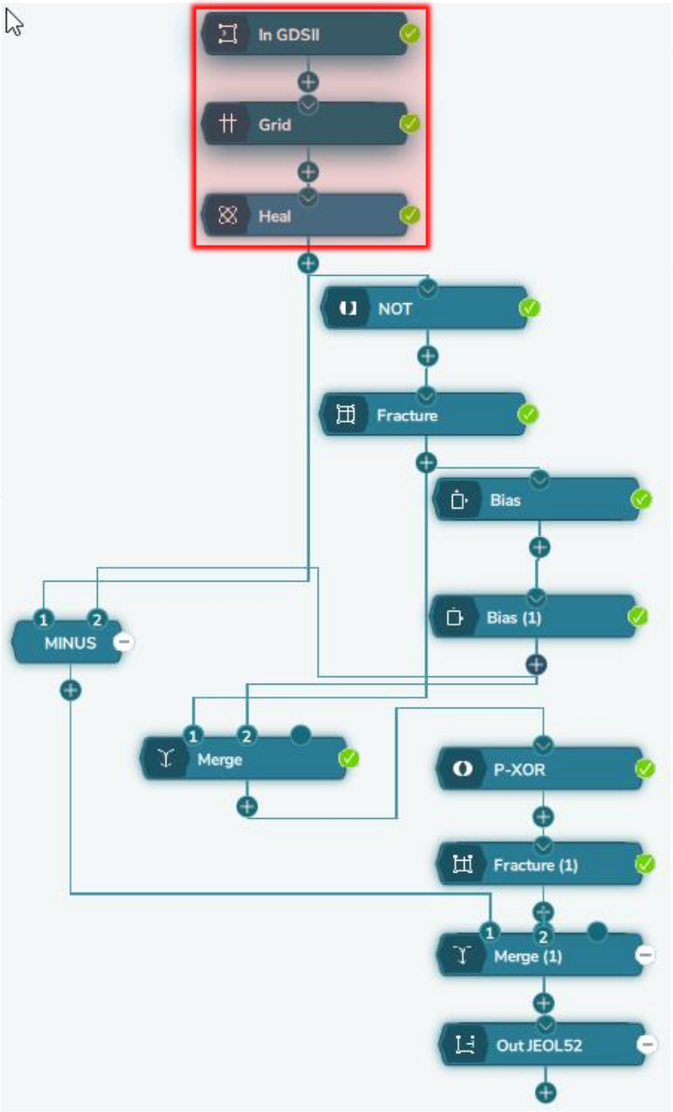
Spoiler: Here's a Solution

Use Curved Fracturing to optimize the final fracture:

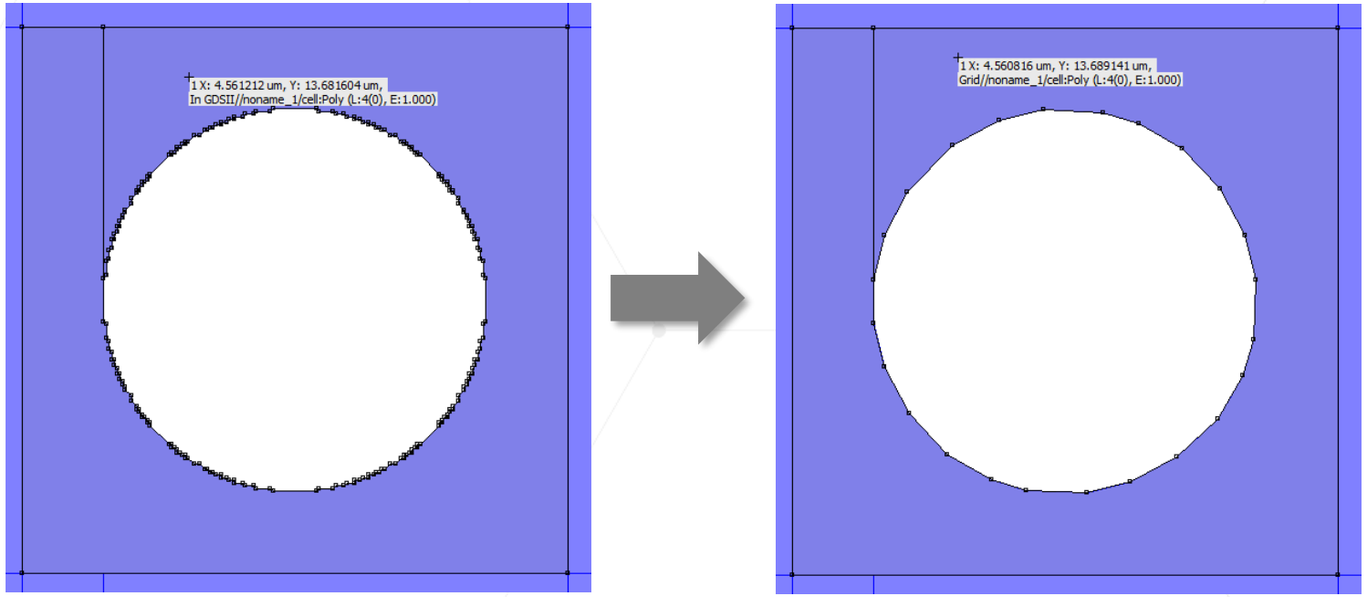


How is this done? …

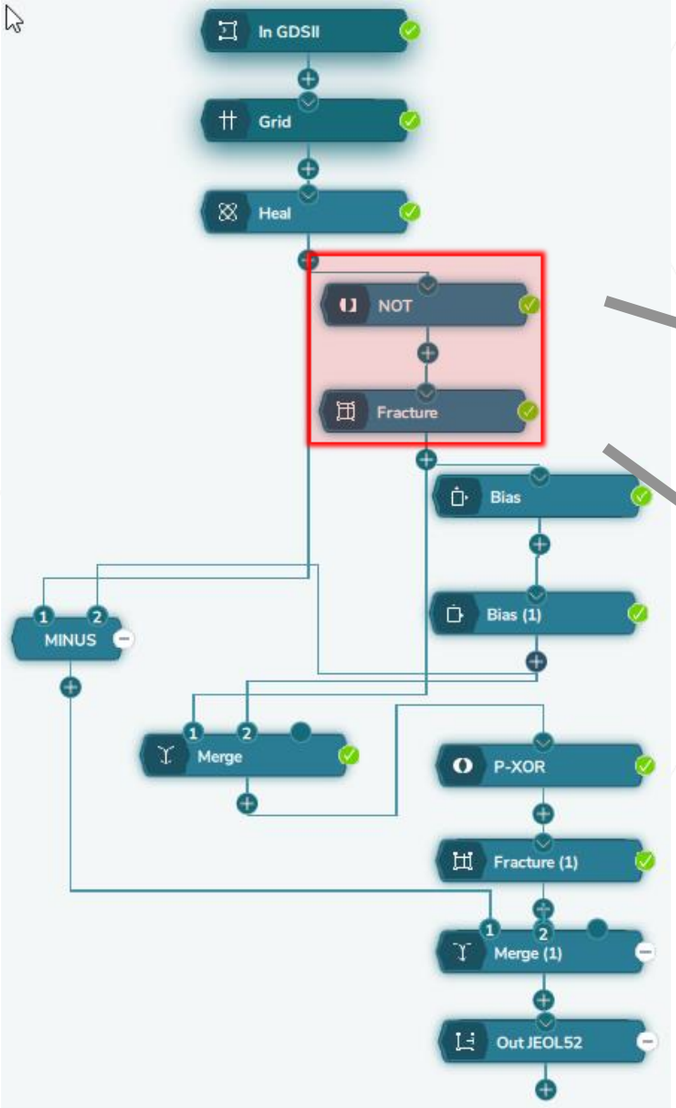
Step 1: Reduce Vertices



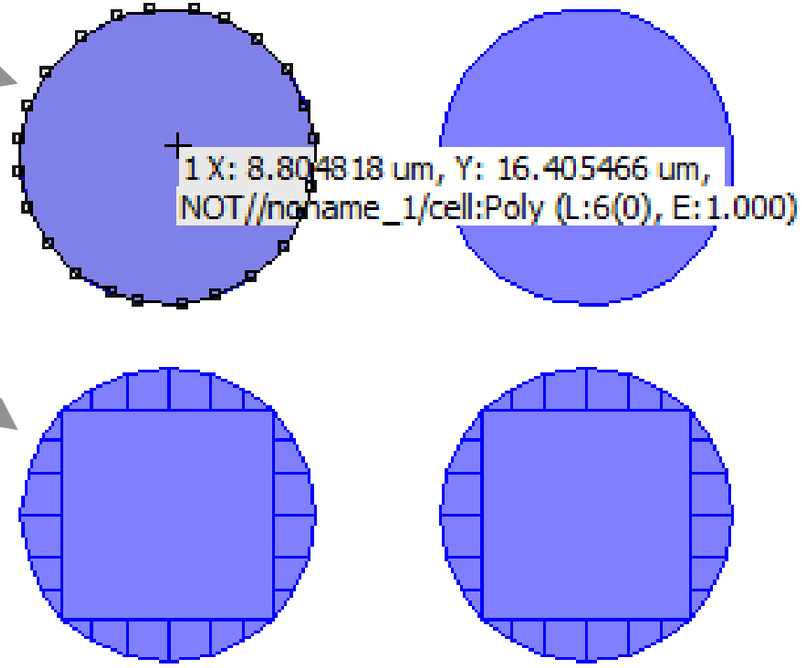
- Import the file
- Reduce the number of vertices to reduce computation time downstream
- Heal the pattern for any overlaps



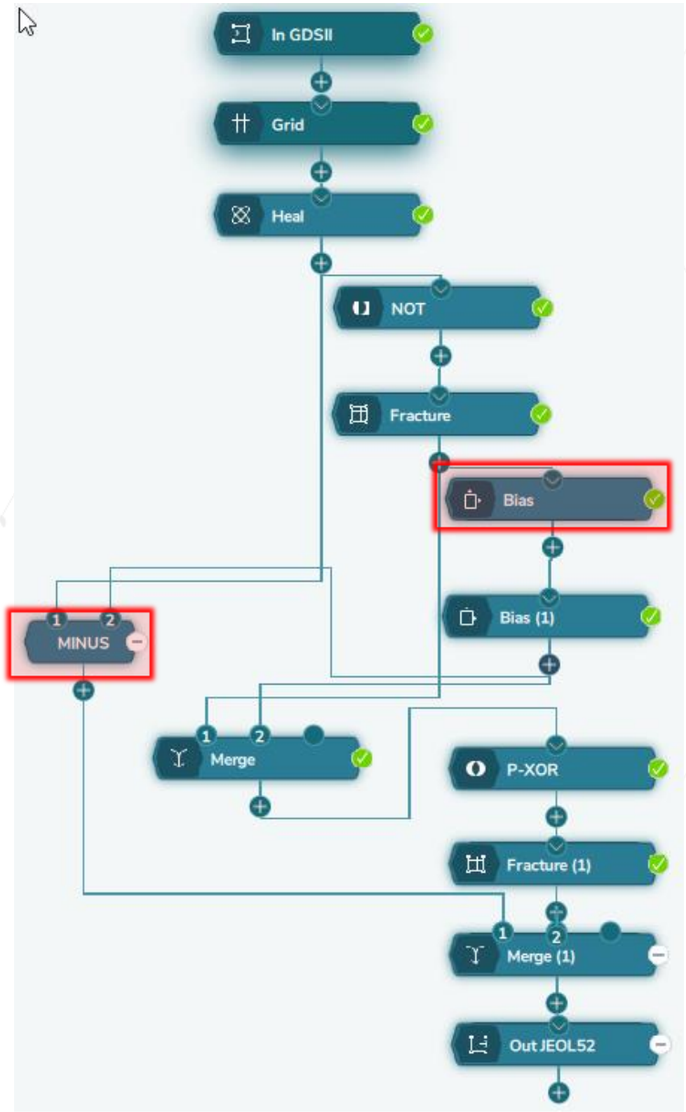
Step 2: Create Perfect Circles



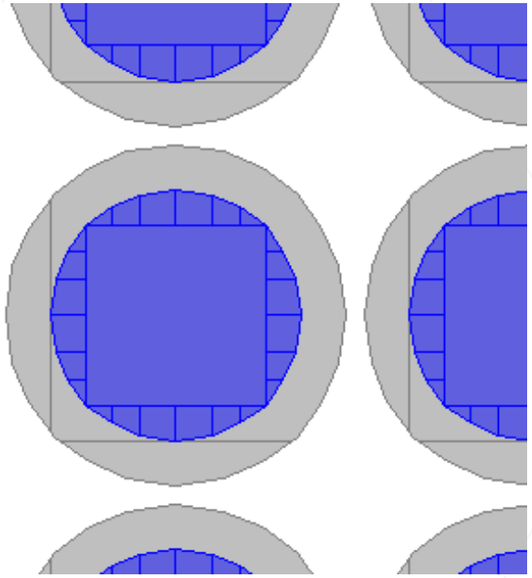
- Reverse tone the pattern
- Re-align vertices

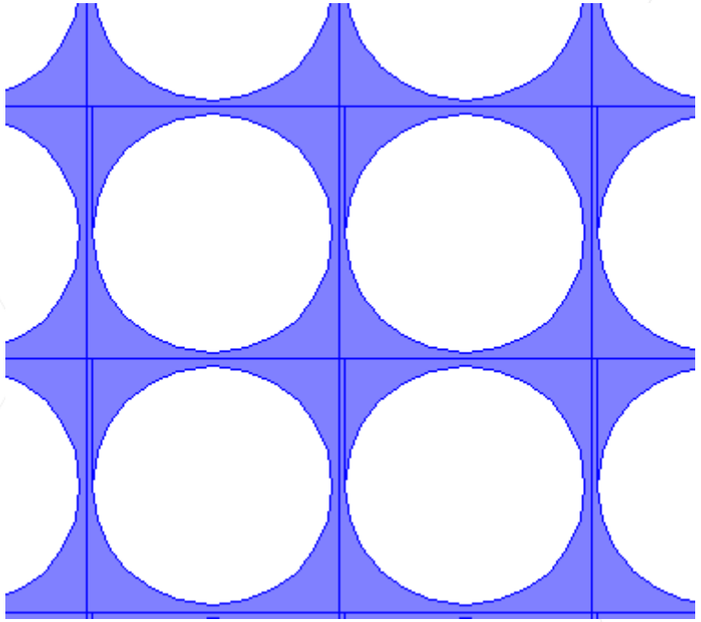


Step 3: Make Room for Rings

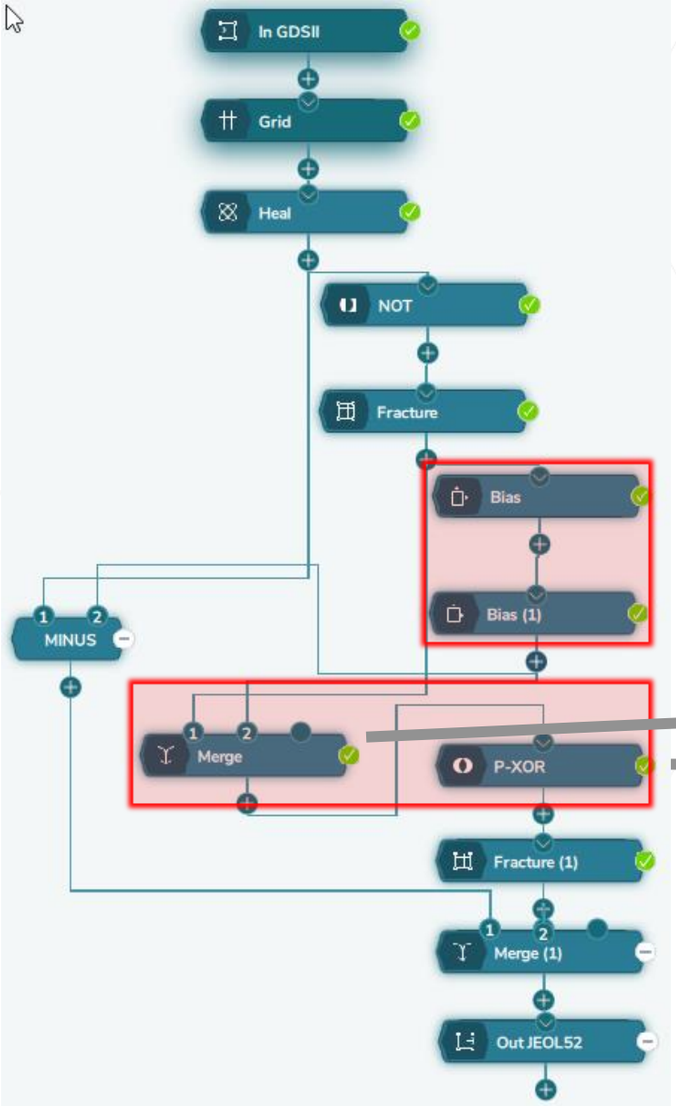


- Bias the circles larger (grey). The bias determines the width of the rings.
- Create room for the rings by subtracting the biased circles from the original pattern.

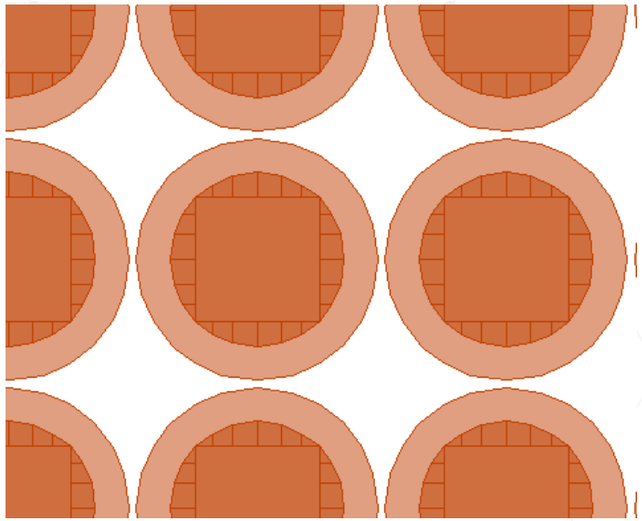


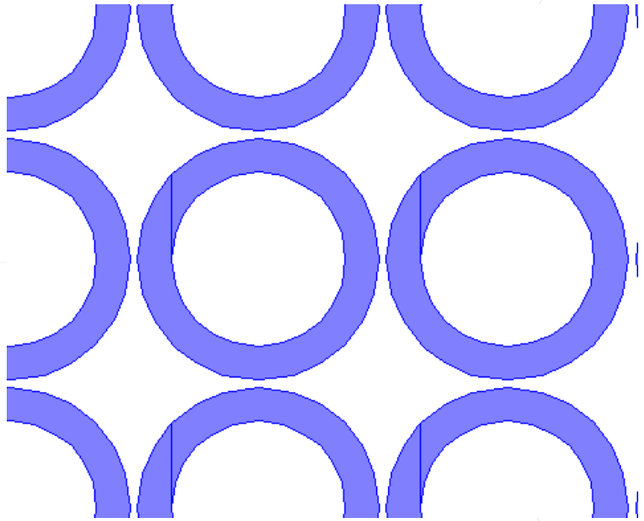


Step 4: Create the Rings

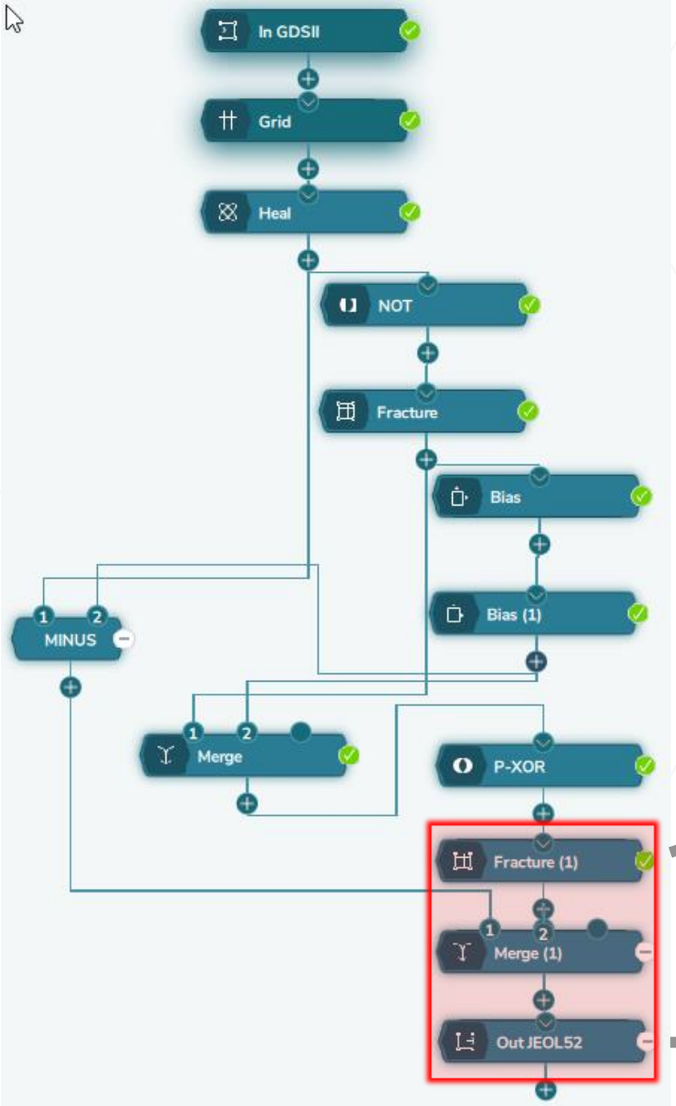


- Add a 2 nm bias to create a small overlap for the last merge
- Merge the fractured circles with the larger circles and create rings with a P-XOR

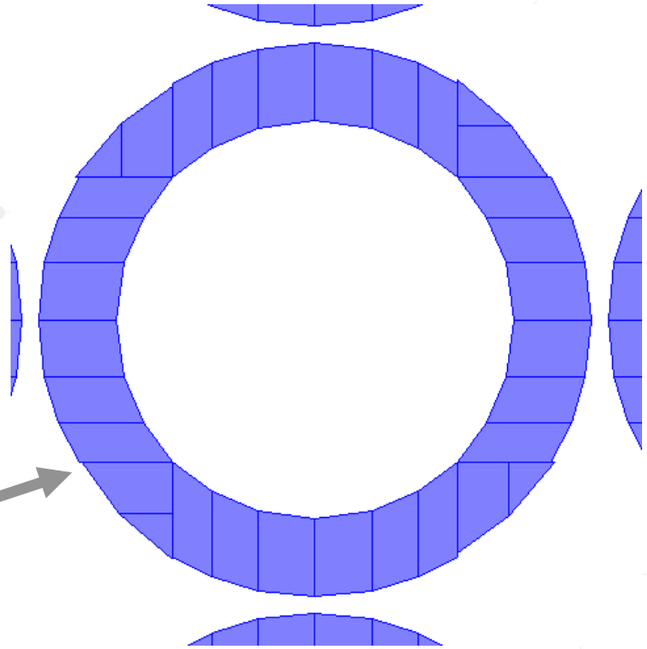


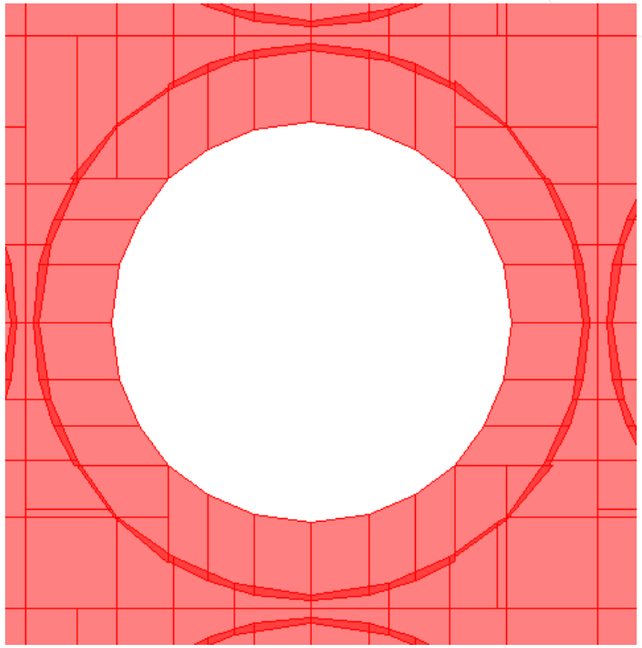


Solution Summary

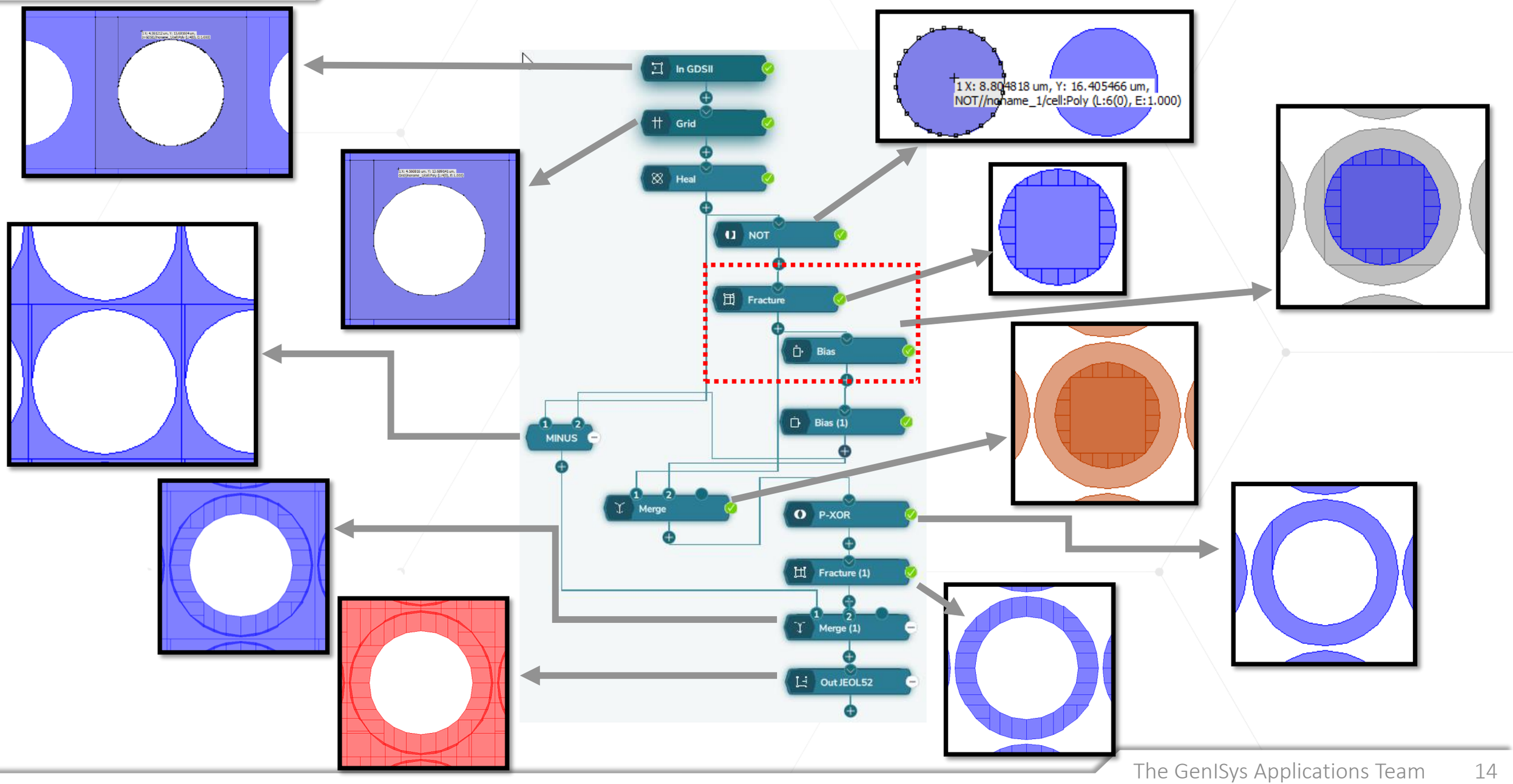


- Fracture the rings with Curved Fracturing and merge it all together.

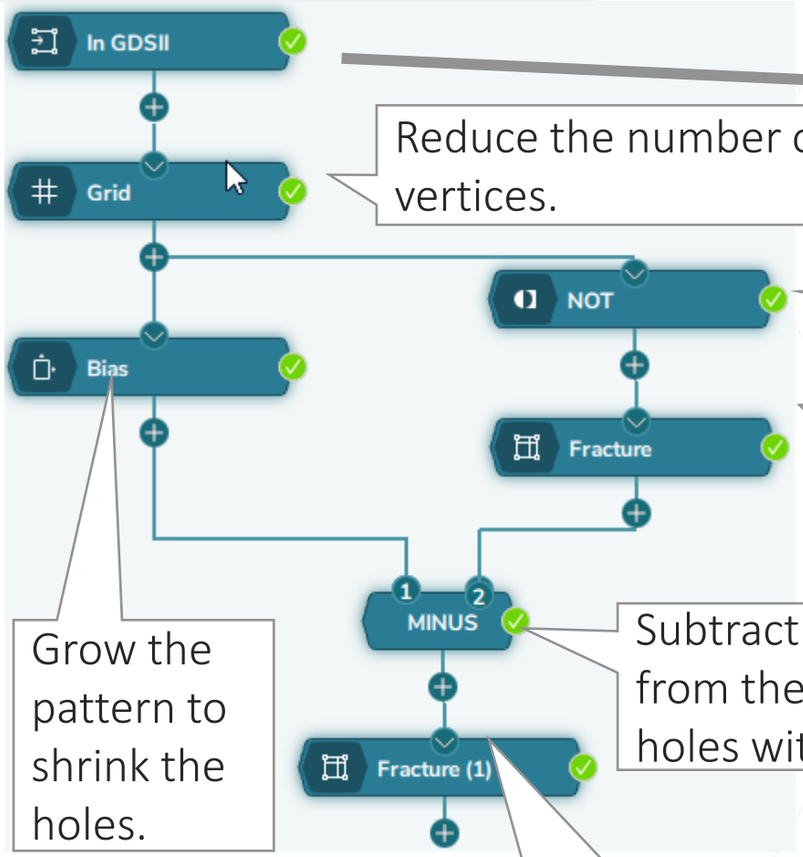




Flow overview



Alternative Solution



Reduce the number of vertices.

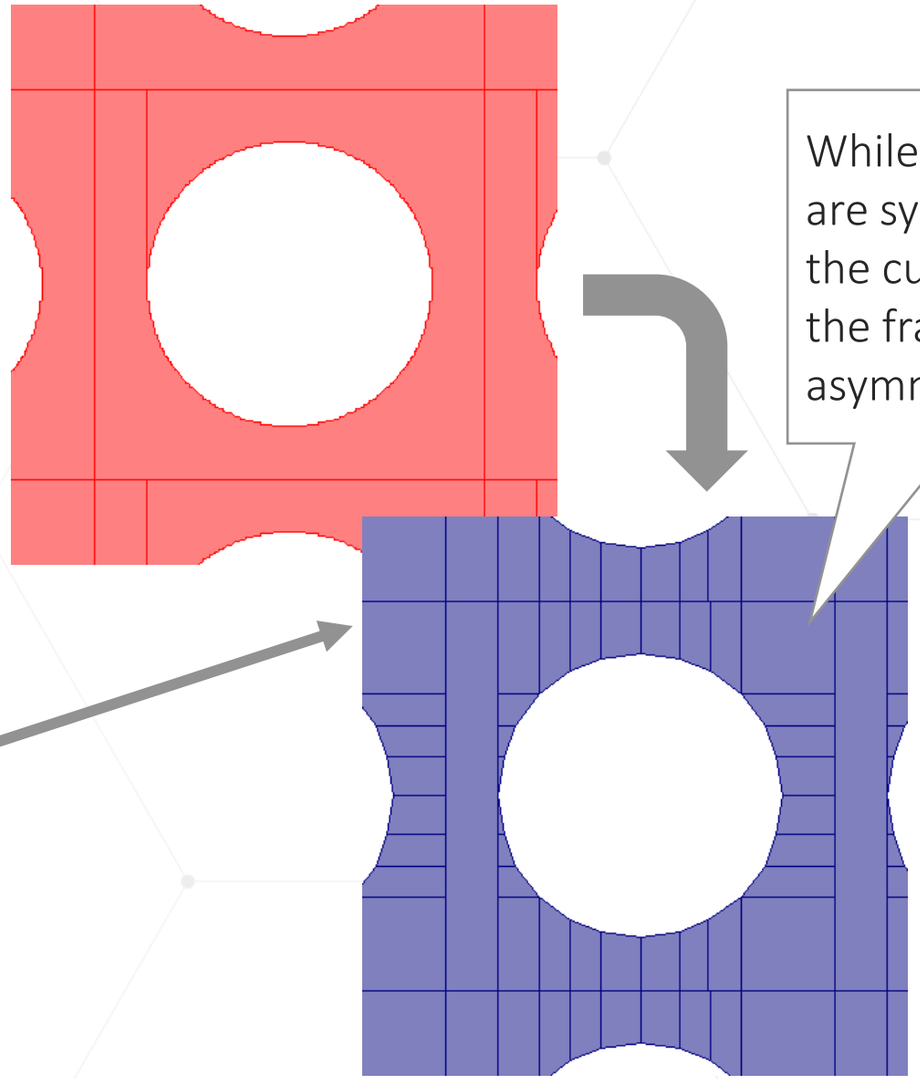
Create circles.

Curve fracture the circles to symmetrically realign the vertices.

Grow the pattern to shrink the holes.

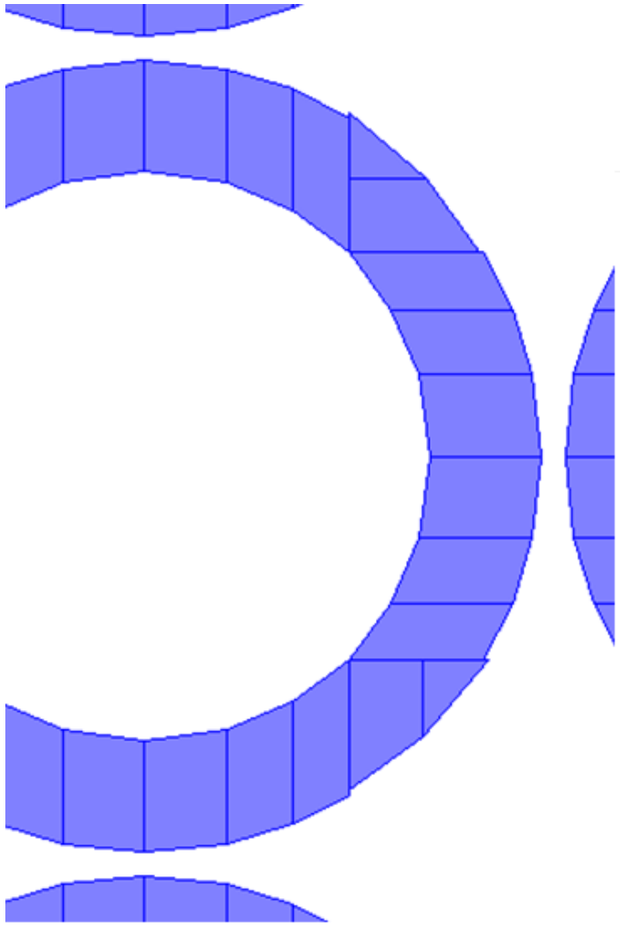
Subtract the symmetric circles from the biased pattern to create holes with symmetric vertices.

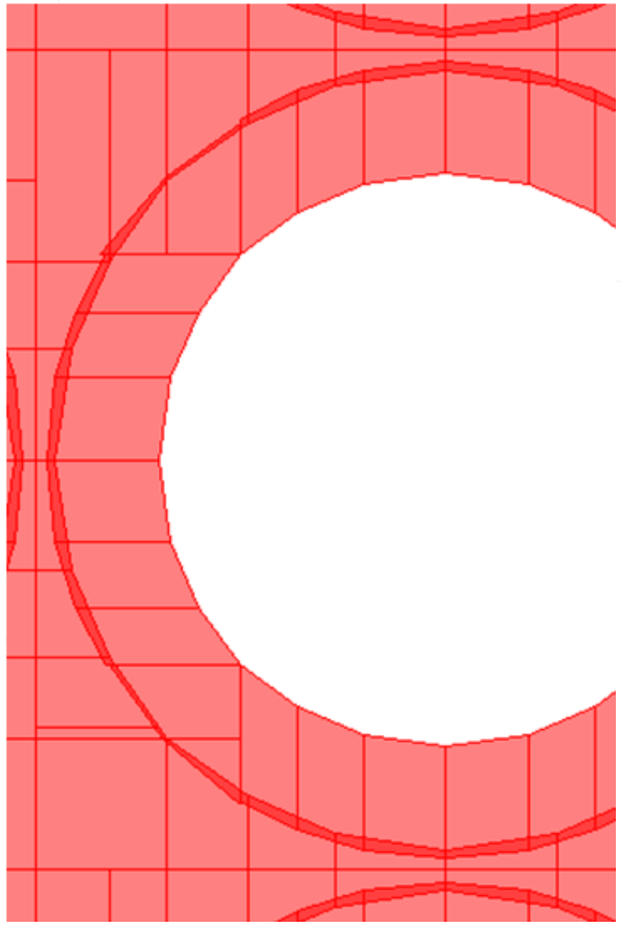
Fracture the pattern using LRFT.



While the vertices are symmetric, the cut influences the fracture to be asymmetric.

Summary





- The idea is to decouple vertices from adjacent features to help optimize the fracture.
- Applied Technologies:
  - Grid: Layout Smoothing Tolerance
  - P-XOR
  - Curved Fracturing
- Curved fracturing works for photonic crystals
  - Positive tone
  - Negative tone
- Solution is independent of the design whether it is hierarchical or flattened
- Because Curved fracturing is unique to BEAMER, this can only be done with BEAMER.

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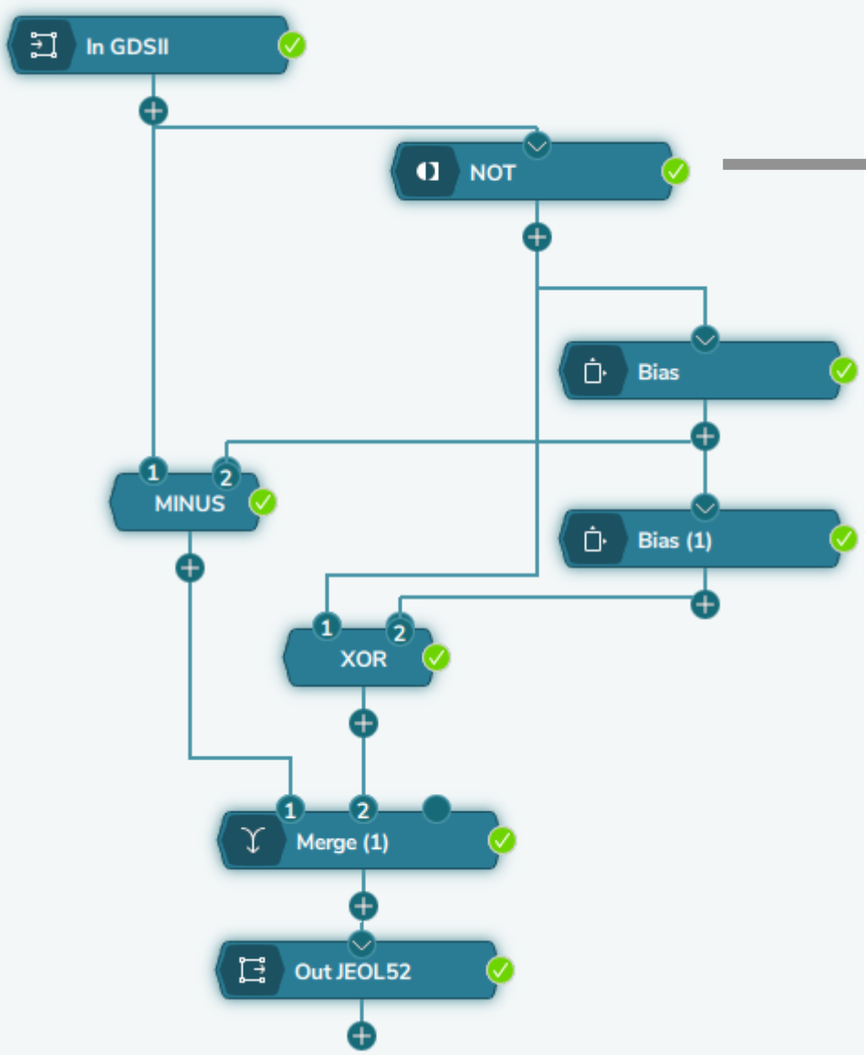
Gerald Lopez, Ph.D.
Wednesday, May 17, 2023

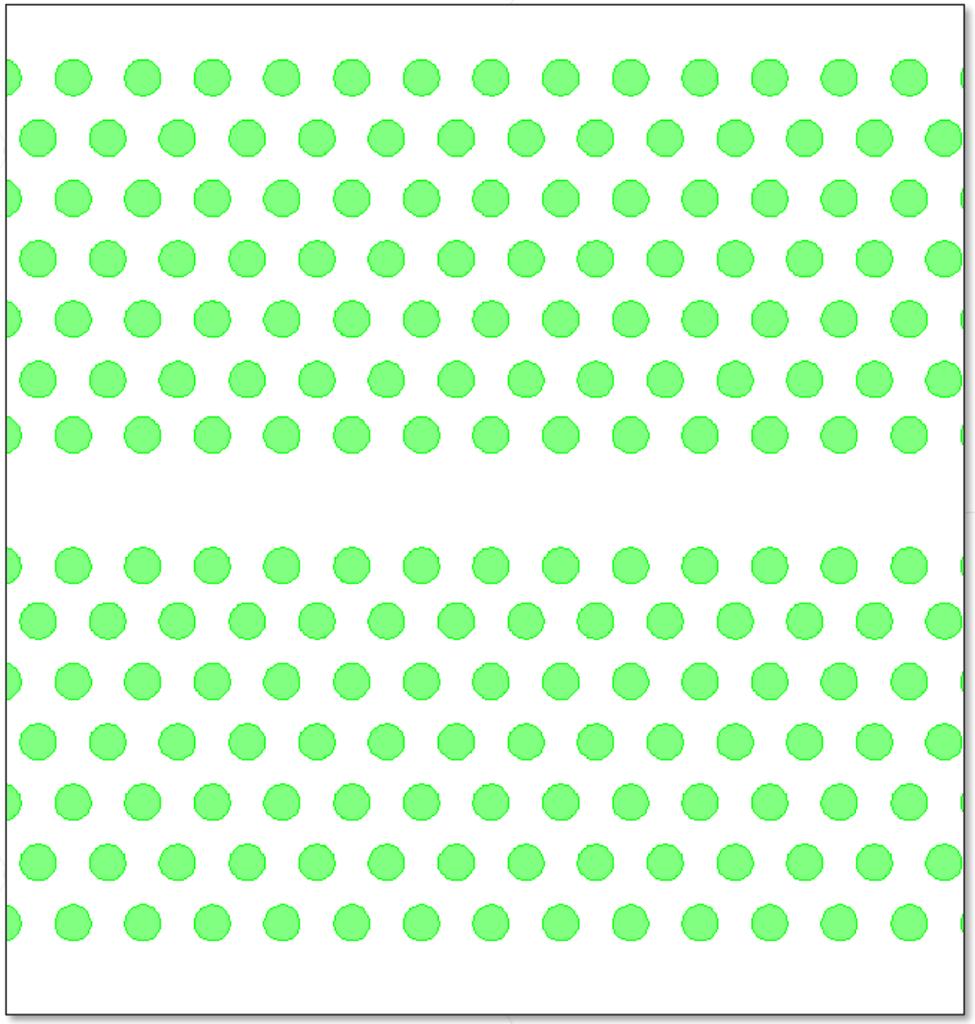
APPLICATIONS

Case Study:
University of California Santa Barbara

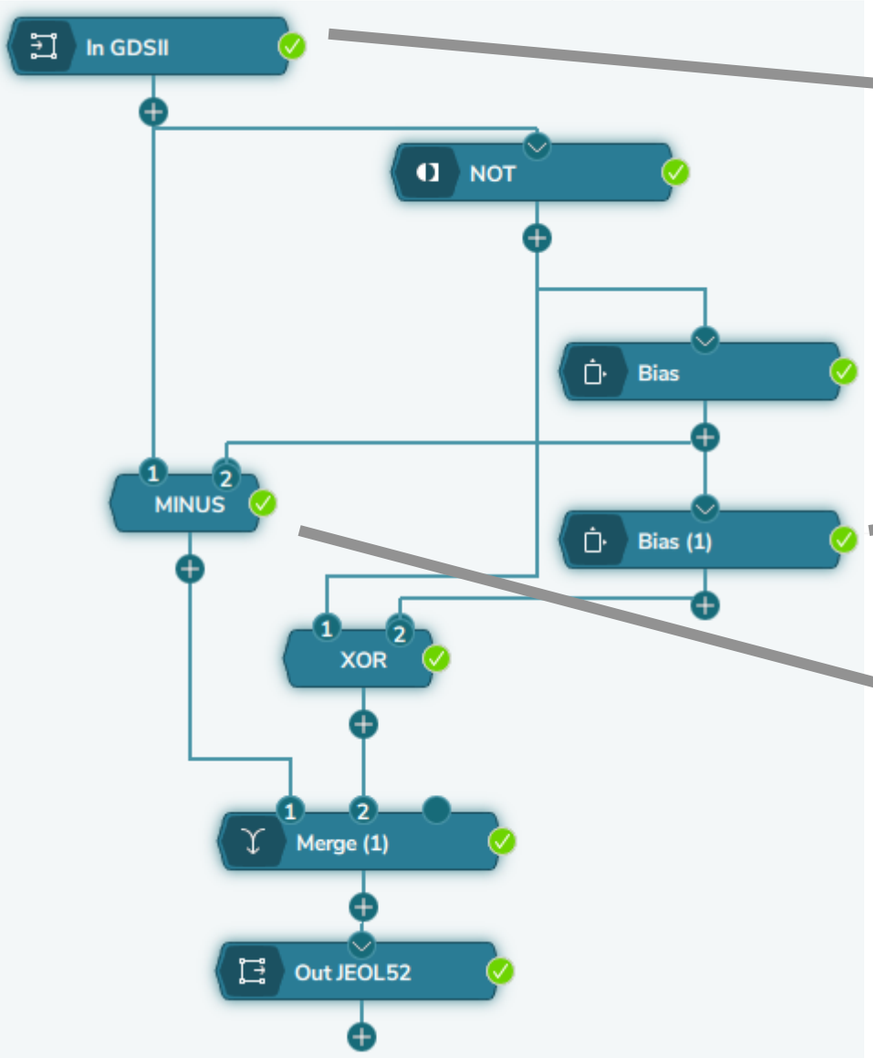
The GenISys Applications Team

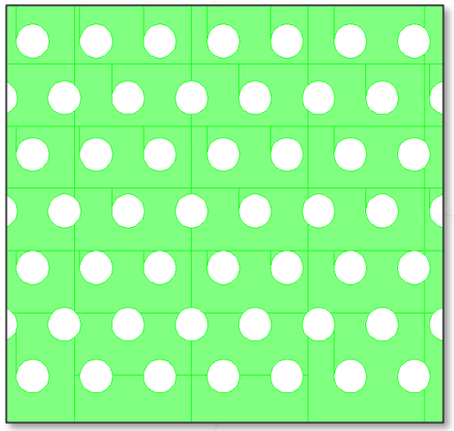
UCSB Application

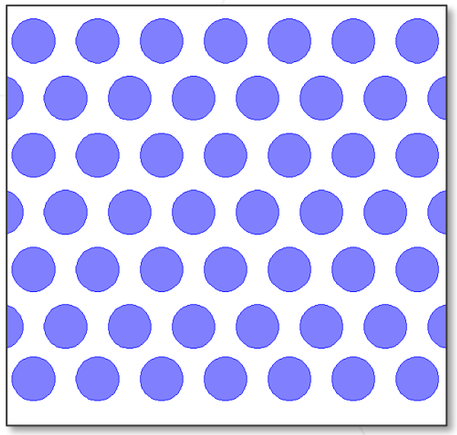


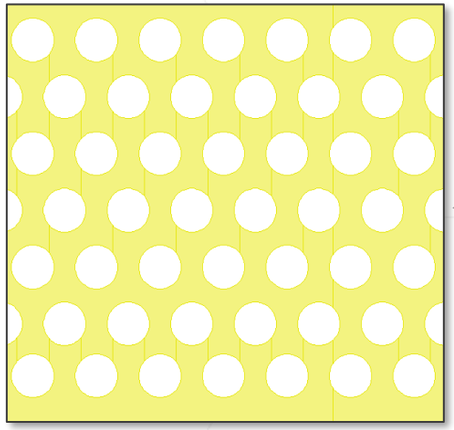


UCSB Application



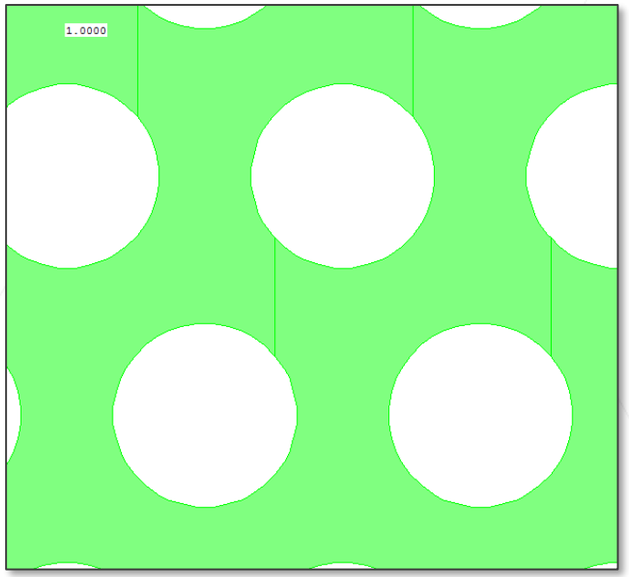


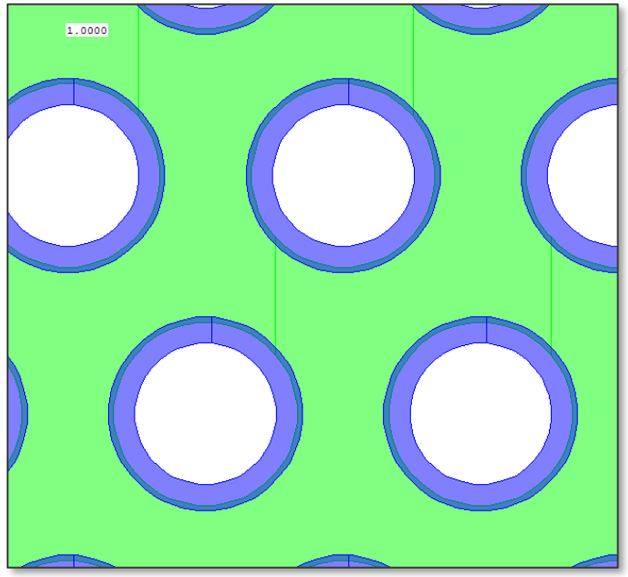


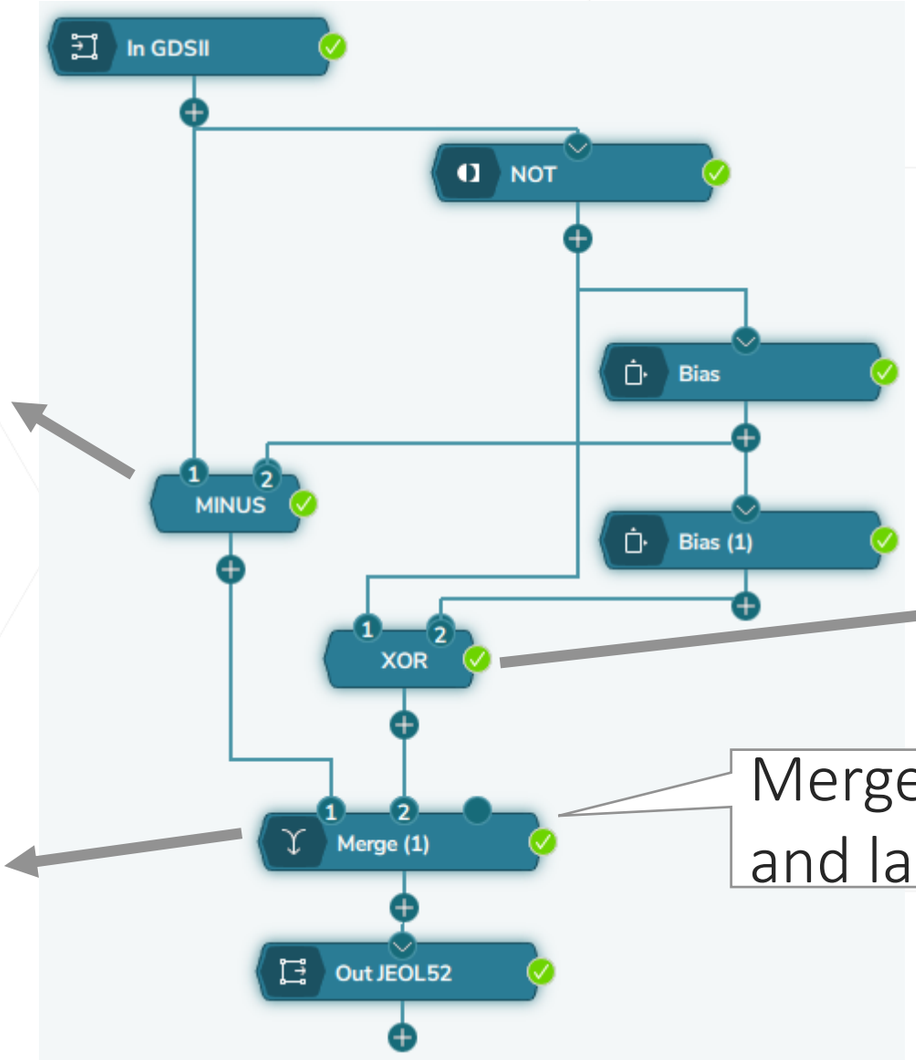


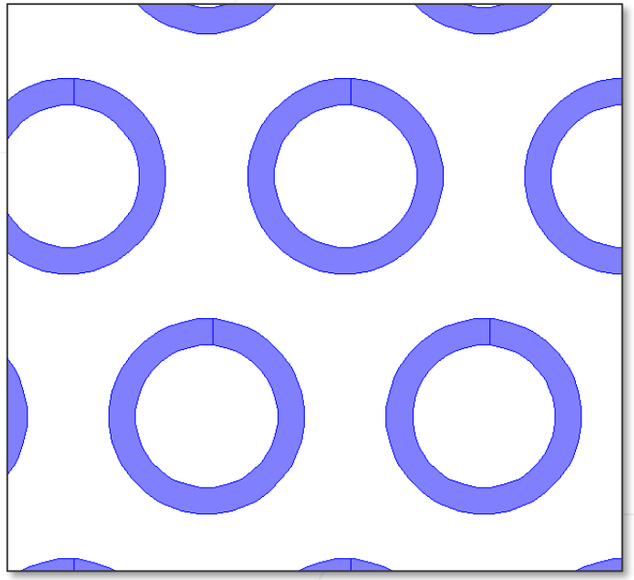
Green – Blue = Yellow
Make the holes larger so that we can put the rings inside later with a little bit of overlap.

UCSB Application





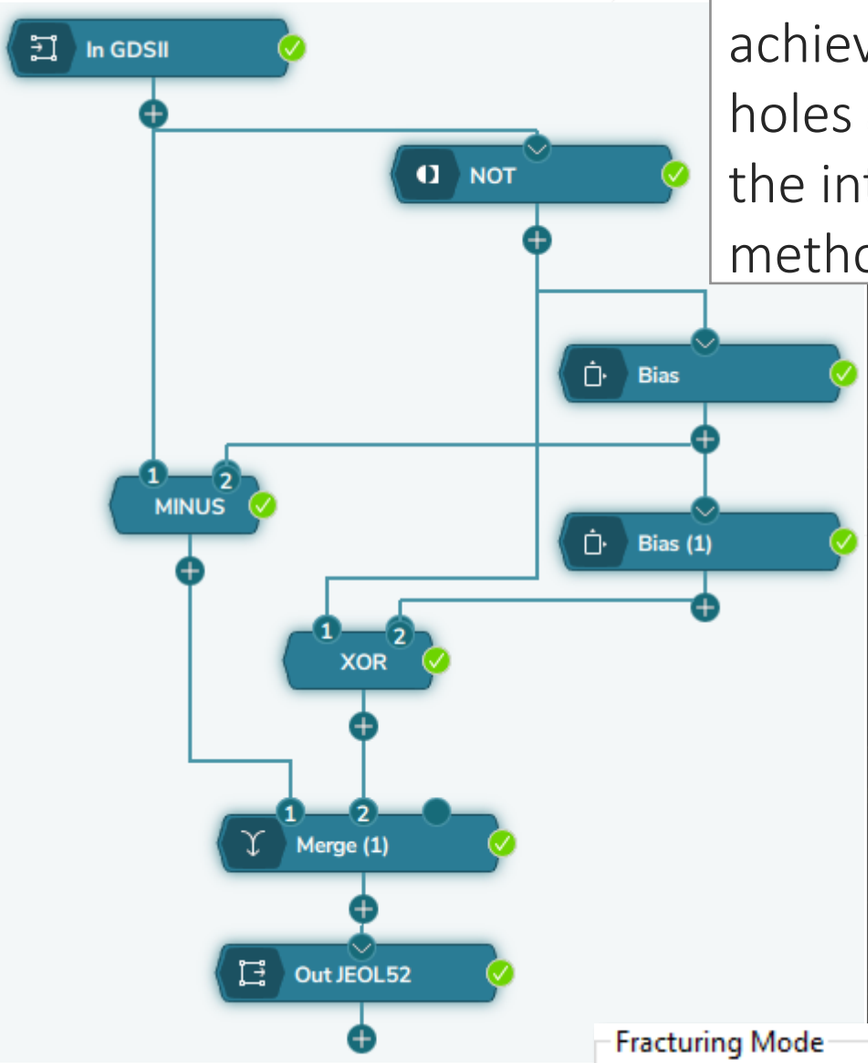


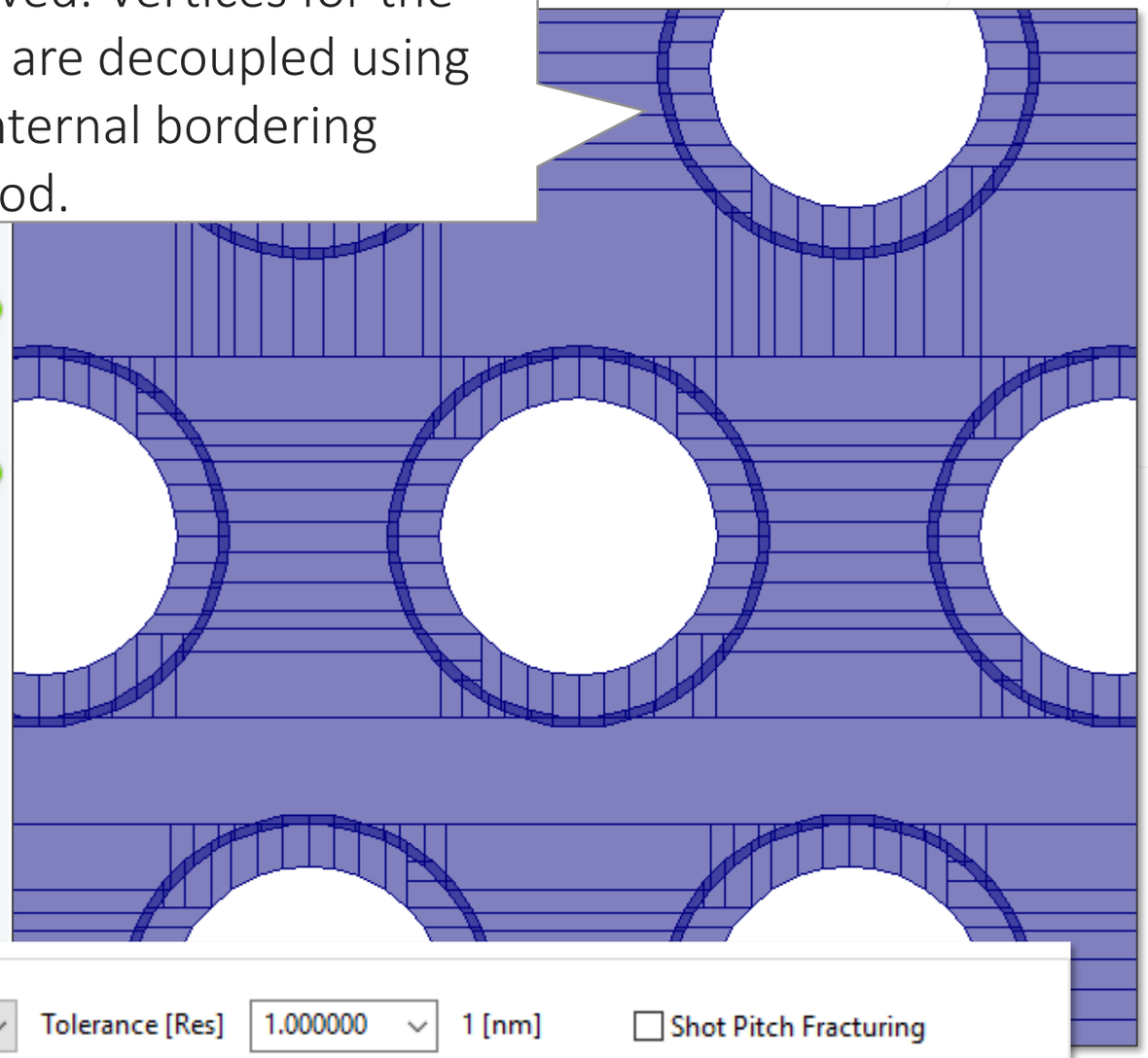


Merge together the rings and large hole pattern.

UCSB Application

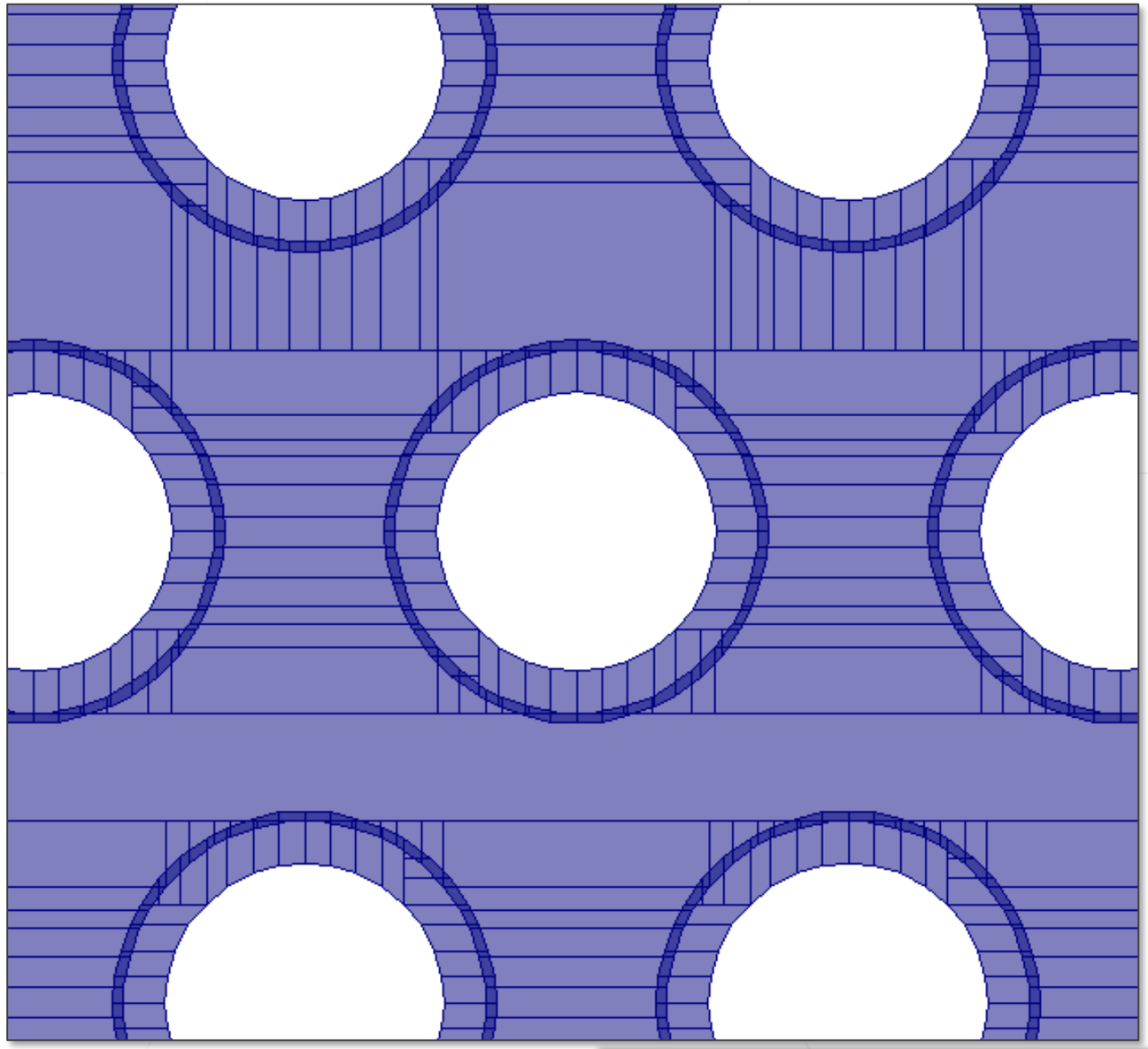
Fracture optimization achieved. Vertices for the holes are decoupled using the internal bordering method.





Summary

- Again, the idea is to decouple vertices from adjacent features to help optimize the fracture
- Applied Technologies:
  - Curved Fracturing
- Curved fracturing works for photonic crystals
  - Positive tone
  - Negative tone
- Solution is independent of the design whether it is hierarchical or flattened



Thank You!

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