

OpenMC Module: Detailed Geometry Specification and Visualization

Computational Reactor Physics Group

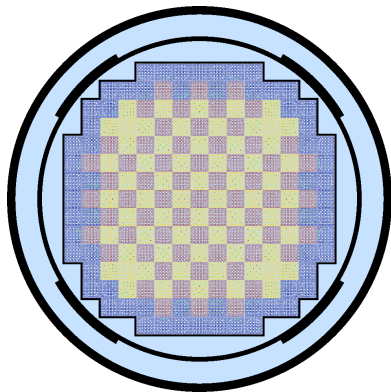
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Building Complex Models is Straightforward

- Universes
- Lattices
- Building a full-core model
- Visualizing geometry



It's Easy to Hierarchically Build Models with Universes

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>      <!-- fuel OR -->
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>      <!-- gap OR -->
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>      <!-- clad OR -->
  <cell id="21" universe="2" material="2" surfaces=" -1"/>          <!-- fuel -->
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>          <!-- clad -->
  <cell id="23" universe="2" material="1" surfaces=" 2"/>          <!-- water -->

</geometry>
```

- Instead of using a *material*, cells can be *filled* with a universe
- By default universes share the same global coordinate system
 - Can be translated and rotated - e.g. in lattices
- Universes **must** be defined for **all** space
 - Or you may encounter particle tracking errors!
- Provides the easiest way to define multiple pincells, lattices, and more complicated structures

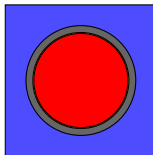
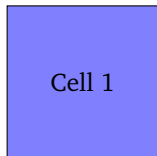
Cell Filling Example

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>      <!-- fuel OR -->
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>      <!-- gap OR -->
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>      <!-- clad OR -->
  <cell id="21" universe="2" material="2" surfaces=" -1"/>          <!-- fuel -->
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>          <!-- clad -->
  <cell id="23" universe="2" material="1" surfaces=" 2"/>            <!-- water -->

  <!-- Main Universe -->
  <surface id="4" type="x-plane" coeffs="-0.62992" boundary="reflective"/>
  <surface id="5" type="x-plane" coeffs=" 0.62992" boundary="reflective"/>
  <surface id="6" type="y-plane" coeffs="-0.62992" boundary="reflective"/>
  <surface id="7" type="y-plane" coeffs=" 0.62992" boundary="reflective"/>
  <surface id="8" type="z-plane" coeffs="-5.00000" boundary="reflective"/>
  <surface id="9" type="z-plane" coeffs=" 5.00000" boundary="reflective"/>
  <cell id="1" universe="0" fill="2" surfaces="4 -5 6 -7 8 -9" />

</geometry>
```



Filled by
Universe 2

Cell Filling Example

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>      <!-- fuel OR -->
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>      <!-- gap OR -->
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>      <!-- clad OR -->
  <cell id="21" universe="2" material="2" surfaces=" -1"/>          <!-- fuel -->
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>          <!-- clad -->
  <cell id="23" universe="2" material="1" surfaces=" 2"/>            <!-- water -->

  <!-- Main Universe -->
  <surface id="4" type="x-plane" coeffs="-0.0" boundary="reflective"/>
  <surface id="5" type="x-plane" coeffs=" 0.62992" boundary="reflective"/>
  <surface id="6" type="y-plane" coeffs="-0.62992" boundary="reflective"/>
  <surface id="7" type="y-plane" coeffs=" 0.62992" boundary="reflective"/>
  <surface id="8" type="z-plane" coeffs="-5.00000" boundary="reflective"/>
  <surface id="9" type="z-plane" coeffs=" 5.00000" boundary="reflective"/>
  <cell id="1" universe="0" fill="2" surfaces="4 -5 6 -7 8 -9" />

</geometry>
```



Smaller cells
clip universes

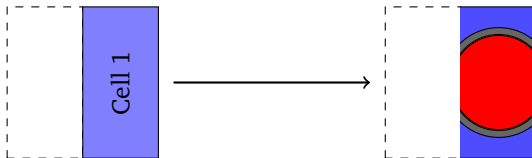
Cell Filling Example

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>      <!-- fuel OR -->
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>      <!-- gap OR -->
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>      <!-- clad OR -->
  <cell id="21" universe="2" material="2" surfaces=" -1"/>          <!-- fuel -->
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>          <!-- clad -->
  <cell id="23" universe="2" material="1" surfaces=" 2"/>            <!-- water -->

  <!-- Main Universe -->
  <surface id="4" type="x-plane" coeffs="-0.0" boundary="reflective"/>
  <surface id="5" type="x-plane" coeffs=" 0.62992" boundary="reflective"/>
  <surface id="6" type="y-plane" coeffs="-0.62992" boundary="reflective"/>
  <surface id="7" type="y-plane" coeffs=" 0.62992" boundary="reflective"/>
  <surface id="8" type="z-plane" coeffs="-5.00000" boundary="reflective"/>
  <surface id="9" type="z-plane" coeffs=" 5.00000" boundary="reflective"/>
  <cell id="1" universe="0" fill="2" surfaces="4 -5 6 -7 8 -9"
    translation="0.31496 0.0 0.0" />

</geometry>
```



Fills can
be translated

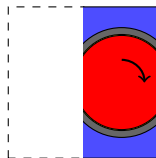
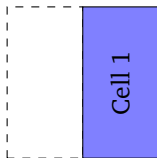
Cell Filling Example

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>      <!-- fuel OR -->
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>      <!-- gap OR -->
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>      <!-- clad OR -->
  <cell id="21" universe="2" material="2" surfaces=" -1"/>          <!-- fuel -->
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>          <!-- clad -->
  <cell id="23" universe="2" material="1" surfaces=" 2"/>            <!-- water -->

  <!-- Main Universe -->
  <surface id="4" type="x-plane" coeffs="-0.0" boundary="reflective"/>
  <surface id="5" type="x-plane" coeffs=" 0.62992" boundary="reflective"/>
  <surface id="6" type="y-plane" coeffs="-0.62992" boundary="reflective"/>
  <surface id="7" type="y-plane" coeffs=" 0.62992" boundary="reflective"/>
  <surface id="8" type="z-plane" coeffs="-5.00000" boundary="reflective"/>
  <surface id="9" type="z-plane" coeffs=" 5.00000" boundary="reflective"/>
  <cell id="1" universe="0" fill="2" surfaces="4 -5 6 -7 8 -9"
    translation="0.31496 0.0 0.0"
    rotation="90.0 0.0 0.0" />

</geometry>
```



Fills can
be rotated

Rotation is always first!

Lattices Automate Filling of Repetitive Structures

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>
  <cell id="21" universe="2" material="2" surfaces=" -1"/>
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>
  <cell id="23" universe="2" material="1" surfaces=" 2"/>

  <!-- Pin-Lattice -->
  <lattice id="100" type="rectangular" dimension="2 2">
    <lower_left> -1.25984 -1.25984 </lower_left>
    <width> 1.25984 1.25984 </width>
    <universes>
      2 2
      2 2
    </universes>
  </lattice>
  <surface id="99" type="sphere" coeffs="0.0 0.0 0.0 400.0"/>
  <cell id="1000" universe="0" fill="100" surfaces="-99"/>

</geometry>
```

See examples/exercises/02_simple_lattice

- Lattices set up a grid of cells filled by other universes, handling fill translation automatically
- Lattices are themselves very similar to universes - to use them, other cells must be filled with them

Lattices Automate Filling of Repetitive Structures

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>
  <cell id="21" universe="2" material="2" surfaces=" -1"/>
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>
  <cell id="23" universe="2" material="1" surfaces=" 2"/>

  <!-- Pin-Lattice -->
  <lattice id="100" type="rectangular" dimension="2 2">
    <lower_left> -1.25984 -1.25984 </lower_left>
    <width> 1.25984 1.25984 </width>
    <universes>
      2 2
      2 2
    </universes>
  </lattice>
  <surface id="99" type="sphere" coeffs="0.0 0.0 0.0 400.0"/>
  <cell id="1000" universe="0" fill="100" surfaces="-99"/>

</geometry>
```

No boundary condition!

← Bad!

There is undefined space!

- Lattices set up a grid of cells filled by other universes, handling fill translation automatically
- Lattices are themselves very similar to universes - to use them, other cells must be filled with them

Lattice Example

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>      <!-- fuel OR -->
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>      <!-- gap OR -->
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>      <!-- clad OR -->
  <cell id="21" universe="2" material="2" surfaces=" -1"/>          <!-- fuel -->
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>          <!-- clad -->
  <cell id="23" universe="2" material="1" surfaces=" 2"/>            <!-- water -->

  <!-- Pin-Lattice -->
  <lattice id="100" type="rectangular" dimension="2 2">
    <lower_left> -1.25984 -1.25984 </lower_left>
    <width> 1.25984 1.25984 </width>
    <universes>
      2 2
      2 2
    </universes>
  </lattice>

  <!-- Main Universe -->
  <surface id="4" type="x-plane" coeffs="-1.25984" boundary="reflective"/>
  <surface id="5" type="x-plane" coeffs=" 1.25984" boundary="reflective"/>
  <surface id="6" type="y-plane" coeffs="-1.25984" boundary="reflective"/>
  <surface id="7" type="y-plane" coeffs=" 1.25984" boundary="reflective"/>
  <surface id="8" type="z-plane" coeffs="-5.00000" boundary="reflective"/>
  <surface id="9" type="z-plane" coeffs=" 5.00000" boundary="reflective"/>
  <cell id="1" universe="0" fill="100" surfaces="4 -5 6 -7 8 -9"/>

</geometry>
```

← Good!

Lattice Example

```
<?xml version="1.0" encoding="UTF-8"?>
<geometry>

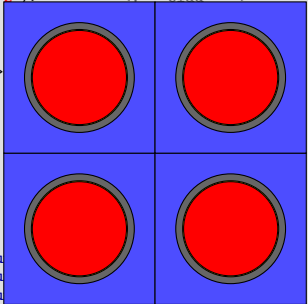
  <!-- Fuel Rod Pincell Universe -->
  <surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.39218"/>
  <surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.40005"/>
  <surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.45720"/>
  <cell id="21" universe="2" material="2" surfaces=" -1"/>
  <cell id="22" universe="2" material="3" surfaces="1 -2"/>
  <cell id="23" universe="2" material="1" surfaces="

  <!-- fuel OR -->
  <!-- gap OR -->
  <!-- clad OR -->
  <!-- fuel -->
  <!-- clad -->

  <!-- Pin-Lattice -->
  <lattice id="100" type="rectangular" dimension="2 2">
    <lower_left> -1.25984 -1.25984 </lower_left>
    <width> 1.25984 1.25984 </width>
    <universes>
      2 2
      2 2
    </universes>
  </lattice>

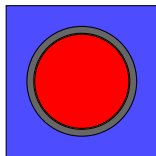
  <!-- Main Universe -->
  <surface id="4" type="x-plane" coeffs="-1.25984" bou
  <surface id="5" type="x-plane" coeffs=" 1.25984" bou
  <surface id="6" type="y-plane" coeffs="-1.25984" bou
  <surface id="7" type="y-plane" coeffs=" 1.25984" boundary="reflective"/>
  <surface id="8" type="z-plane" coeffs="-5.00000" boundary="reflective"/>
  <surface id="9" type="z-plane" coeffs=" 5.00000" boundary="reflective"/>
  <cell id="1" universe="0" fill="100" surfaces="4 -5 6 -7 8 -9"/>

</geometry>
```



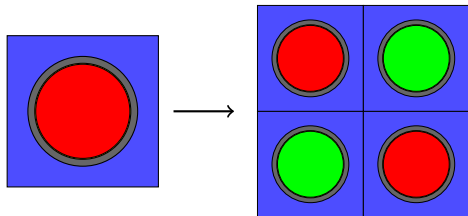
Now Let's Build a Core!

- 1 Make all pincell universes
 - Fuel rod, control rod, burnable absorber, etc.



Now Let's Build a Core!

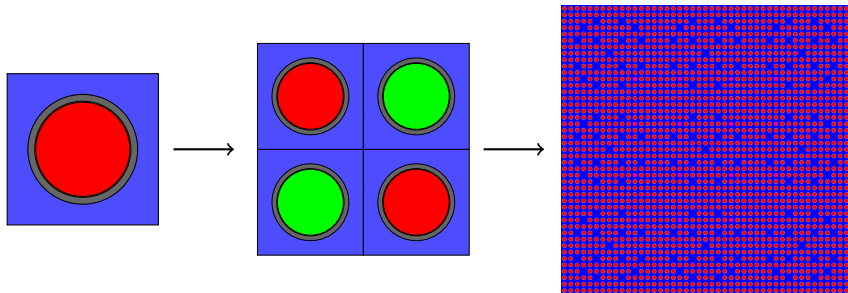
- 1 Make all pincell universes
 - Fuel rod, control rod, burnable absorber, etc.
- 2 Make assembly pin-lattices
 - Different enrichment assemblies, different burnable absorber configurations, etc.



Now Let's Build a Core!

- 1 Make all pincell universes
 - Fuel rod, control rod, burnable absorber, etc.
- 2 Make assembly pin-lattices
 - Different enrichment assemblies, different burnable absorber configurations, etc.
- 3 Make core assembly-lattice

See input xml files in `examples/demos/plotting`



Pincells

```
<!-- Blank Water Universe -->
<surface id="99" type="sphere" coeffs="0.0 0.0 0.0 400.0"/> <!-- dummy -->
<cell id="11" universe="1" material="1" surfaces="-99"/>
<cell id="12" universe="1" material="1" surfaces=" 99"/>

<!-- Fuel Rod -->
<surface id="1" type="z-cylinder" coeffs="0.0 0.0 0.514858"/> <!-- fuel OR -->
<surface id="2" type="z-cylinder" coeffs="0.0 0.0 0.602996"/> <!-- fuel clad OR -->
<cell id="21" universe="2" material="2" surfaces=" -1"/> <!-- fuel -->
<cell id="22" universe="2" material="3" surfaces="1 -2"/> <!-- clad -->
<cell id="23" universe="2" material="1" surfaces=" 2"/> <!-- water -->

<!-- Control Rod -->
<surface id="3" type="z-cylinder" coeffs="0.0 0.0 0.585000"/> <!-- pyrex OR -->
<cell id="31" universe="3" material="4" surfaces=" -3"/> <!-- pyrex -->
<cell id="32" universe="3" material="1" surfaces=" 3"/> <!-- water -->
```

Central Fuel Assembly

```
<!-- Central Fuel Assembly -->
<lattice id="11" type="rectangular" dimension="15 15">
  <lower_left> -12.2682 -12.2682 </lower_left>
  <width> 1.63576 1.63576 </width>
  <universes>
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 1 2 2 2 1 2 2 2 2 2
    2 2 2 3 2 2 2 2 2 2 2 3 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 1 2 2 1 2 2 2 1 2 2 1 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 1 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 1 2 2 1 2 2 2 1 2 2 1 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 3 2 2 2 2 2 2 2 3 2 2 2
    2 2 2 2 2 1 2 2 2 1 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
  </universes>
</lattice>
<cell id="111" universe="111" fill="11" surfaces="" />
```


North, South, East, and West Assemblies

```
<!-- North Fuel Assembly -->
<lattice id="22" type="rectangular" dimension="15 15">
  <lower_left> -12.2682 -12.2682 </lower_left>
  <width>      1.63576 1.63576 </width>
  <universes>
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 1 2 2 2 1 2 2 2 2 2
    2 2 2 1 2 2 2 2 2 2 2 1 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 1 2 2 1 2 2 2 1 2 2 1 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 1 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 1 2 2 1 2 2 2 1 2 2 1 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 3 2 2 2 2 2 2 2 3 2 2 2
    2 2 2 2 2 1 2 2 2 1 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
  </universes>
</lattice>
<cell id="222" universe="222" fill="22" surfaces=""/> <!-- north -->
<cell id="444" universe="444" fill="222" surfaces="" rotation="0 0 90"/> <!-- west -->
<cell id="555" universe="555" fill="222" surfaces="" rotation="0 0 180"/> <!-- south -->
<cell id="666" universe="666" fill="222" surfaces="" rotation="0 0 270"/> <!-- east -->
```

Northeast, Southeast, Northwest, and Southwest Assemblies

```
<!-- Northeast Fuel Assembly -->
<lattice id="33" type="rectangular" dimension="15 15">
  <lower_left> -12.2682 -12.2682 </lower_left>
  <width>      1.63576 1.63576 </width>
  <universes>
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 1 2 2 2 1 2 2 2 2 2
    2 2 2 1 2 2 2 2 2 2 2 1 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 1 2 2 1 2 2 2 1 2 2 1 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 1 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 1 2 2 1 2 2 2 1 2 2 1 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 3 2 2 2 2 2 2 2 1 2 2 2
    2 2 2 2 2 1 2 2 2 1 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
    2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
  </universes>
</lattice>
<cell id="333" universe="333" fill="33" surfaces=""/>      <!-- NE -->
<cell id="777" universe="777" fill="333" surfaces="" rotation="0 0 90"/> <!-- NW -->
<cell id="888" universe="888" fill="333" surfaces="" rotation="0 0 180"/> <!-- SE -->
<cell id="999" universe="999" fill="333" surfaces="" rotation="0 0 270"/> <!-- SW -->
```

Core-Lattice and Main Universe

Done!

```
<!-- Core lattice -->
<lattice id="99" type="rectangular" dimension="3 3">
  <lower_left> -36.8046 -36.8046 </lower_left>
  <width> 24.5364 24.5364 </width>
  <universes>
    777 222 333
    444 111 666
    888 555 999
  </universes>
</lattice>

<!-- Main Universe -->
<surface id="10" type="x-plane" coeffs="-36.8046" boundary="vacuum"/>
<surface id="20" type="x-plane" coeffs=" 36.8046" boundary="vacuum"/>
<surface id="30" type="y-plane" coeffs="-36.8046" boundary="vacuum"/>
<surface id="40" type="y-plane" coeffs=" 36.8046" boundary="vacuum"/>
<surface id="50" type="z-plane" coeffs="-80.0000" boundary="vacuum"/>
<surface id="60" type="z-plane" coeffs=" 80.0000" boundary="vacuum"/>

<cell id="1000" universe="0" fill="99" surfaces="10 -20 30 -40 50 -60"/>
```

Visualizing The Geometry

```
<?xml version="1.0"?>
<plots>

  <plot id="1" type="slice" basis="xy" color="mat">
    <filename>plot_name</filename>
    <origin>0 0 0</origin>
    <width>155 155</width>
    <pixels>1000 1000</pixels>
  </plot>

</plots>
```

- Any number of plots can be specified in `plots.xml`
- Plots are slices along the `xy`, `xz`, or `yz` planes
 - The user specifies the extents of the plotting window
 - The user specified the pixel resolution of the plot
- OpenMC generates a `ppm` image - can be converted into `png` to reduce size

Plotting Options

```
<?xml version="1.0"?>
<plots>

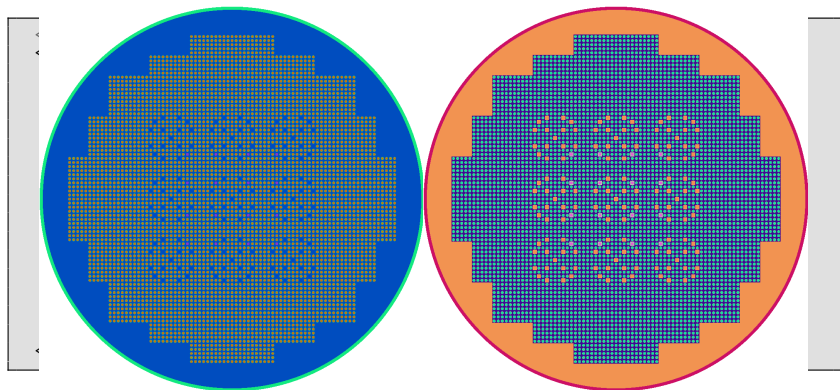
  <plot id="1" type="slice" basis="xy" color="mat">
    <filename>material_coloring</filename>
    <origin>0 0 0</origin>
    <width>155 155</width>
    <pixels>1000 1000</pixels>
  </plot>

  <plot id="2" type="slice" basis="xy" color="cell">
    <filename>cell_coloring</filename>
    <origin>0 0 0</origin>
    <width>155 155</width>
    <pixels>1000 1000</pixels>
  </plot>

</plots>
```

- Can color by cell ID
 - Repeated cells in lattices and fill cells have the same color
- Can color by material ID

Plotting Options



- Can color by cell ID
 - Repeated cells in lattices and fill cells have the same color
- Can color by material ID

Plotting Options

```
<?xml version="1.0"?>
<plots>

<plot id="4" type="slice" color="mat">
  <filename>col_spec</filename>
  <origin>0 0 0</origin>
  <width>155 155</width>
  <basis>xy</basis>
  <pixels>2000 2000</pixels>
  <!-- Change background color to black -->
  <!-- This is the color used where no cell is found -->
  <background>0 0 0</background>
  <!-- Specify material colors -->
  <col_spec id="1" rgb="0 0 255"/>      <!-- Water: blue -->
  <col_spec id="2" rgb="255 0 0"/>      <!-- Fuel: red -->
  <col_spec id="3" rgb="160 160 160"/>  <!-- Clad: gray -->
  <!--The remaining material colors will be randomly selected -->
</plot>

</plots>
```

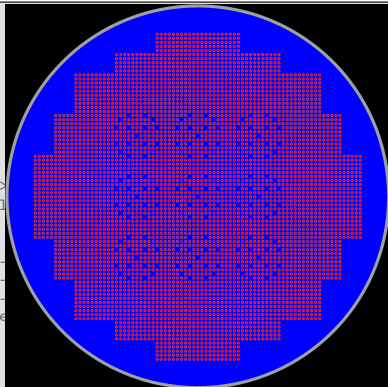
- Can specify colors for cells or materials manually

Plotting Options

```
<?xml version="1.0"?>
<plots>

<plot id="4" type="slice" color="mat">
  <filename>col_spec</filename>
  <origin>0 0 0</origin>
  <width>155 155</width>
  <basis>xy</basis>
  <pixels>2000 2000</pixels>
  <!-- Change background color to black -->
  <!-- This is the color used where no cell is present -->
  <background>0 0 0</background>
  <!-- Specify material colors -->
  <col_spec id="1" rgb="0 0 255"/>
  <col_spec id="2" rgb="255 0 0"/>
  <col_spec id="3" rgb="160 160 160"/>
  <!--The remaining material colors will be specified in the col_spec file-->
</plot>

</plots>
```



- Can specify colors for cells or materials manually

Plotting Options

```
<?xml version="1.0"?>
<plots>

  <!-- Use a mask to plot only specific cells -->
  <plot id="5" type="slice" color="cell">
    <filename>col_spec</filename>
    <origin>0 0 0</origin>
    <width>155 155</width>
    <basis>xy</basis>
    <pixels>2000 2000</pixels>

    <!-- Here we plot only cells 31 and 1112, coloring all other cells white -->
    <mask components="31 1112" background="255 255 255"/>

    <!-- We can still set specific colors while using a mask -->
    <col_spec id="31" rgb="0 255 0"/>      <!-- Control: green -->
    <col_spec id="1112" rgb="0 0 0"/>      <!-- Barrel: black -->

    <!-- we can still set the background color when using a mash -->
    <background>0 255 255</background>
  </plot>
</plots>
```

- Use a mask to isolate features of interest

Plotting Options

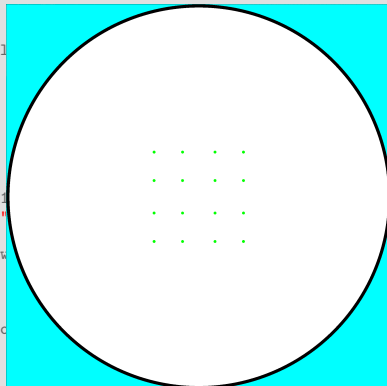
```
<?xml version="1.0"?>
<plots>

  <!-- Use a mask to plot only specific cells -->
  <plot id="5" type="slice" color="cell">
    <filename>col_spec</filename>
    <origin>0 0 0</origin>
    <width>155 155</width>
    <basis>xy</basis>
    <pixels>2000 2000</pixels>

    <!-- Here we plot only cells 31 and 1112 -->
    <mask components="31 1112" background="0 255 255">

      <!-- We can still set specific colors with col_spec -->
      <col_spec id="31" rgb="0 255 0"/>
      <col_spec id="1112" rgb="0 0 0"/>

      <!-- we can still set the background color -->
      <background>0 255 255</background>
    </plot>
  </plots>
```



- Use a mask to isolate features of interest

Questions?

Now you can model anything with OpenMC!

User's Guide: <http://mit-crp.github.com/openmc/>

