



Component mesh located in the directory **all**

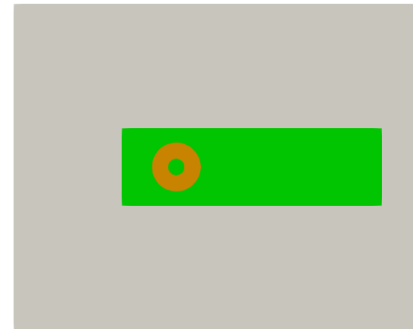


Component mesh located in the directory **refinementZone**



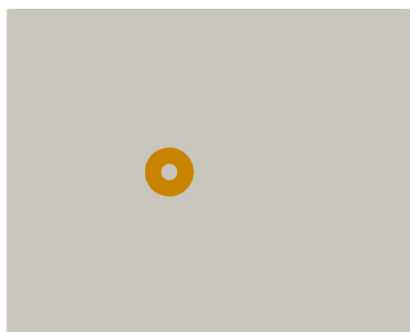
Component mesh located in the directory **cylinder**

- To assemble an overset mesh, you generate the meshes in separated directories, and then you merge the meshes using the utility `mergeMeshes`.
- You merge the meshes in a single directory, in this case we will merge the meshes **cylinder** and **refinementZone** in the directory **all**.
- And we will the mesh **cylinder** into the mesh **all**, and then the mesh **refinementZone** into the mesh **all** again.

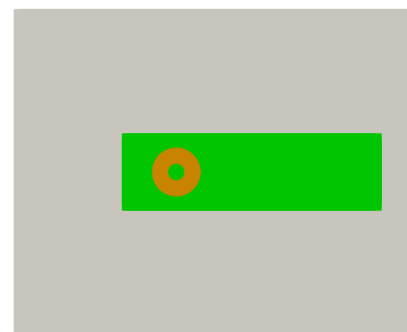


- In theory, it does not matter the order of the merge operations.
- However, all component meshes should be merged into a single component mesh.
- In this case, we will merge component meshes **cylinder** and **refinementZone** into component mesh **all**.
- The zoneID can be assigned after merging the meshes.

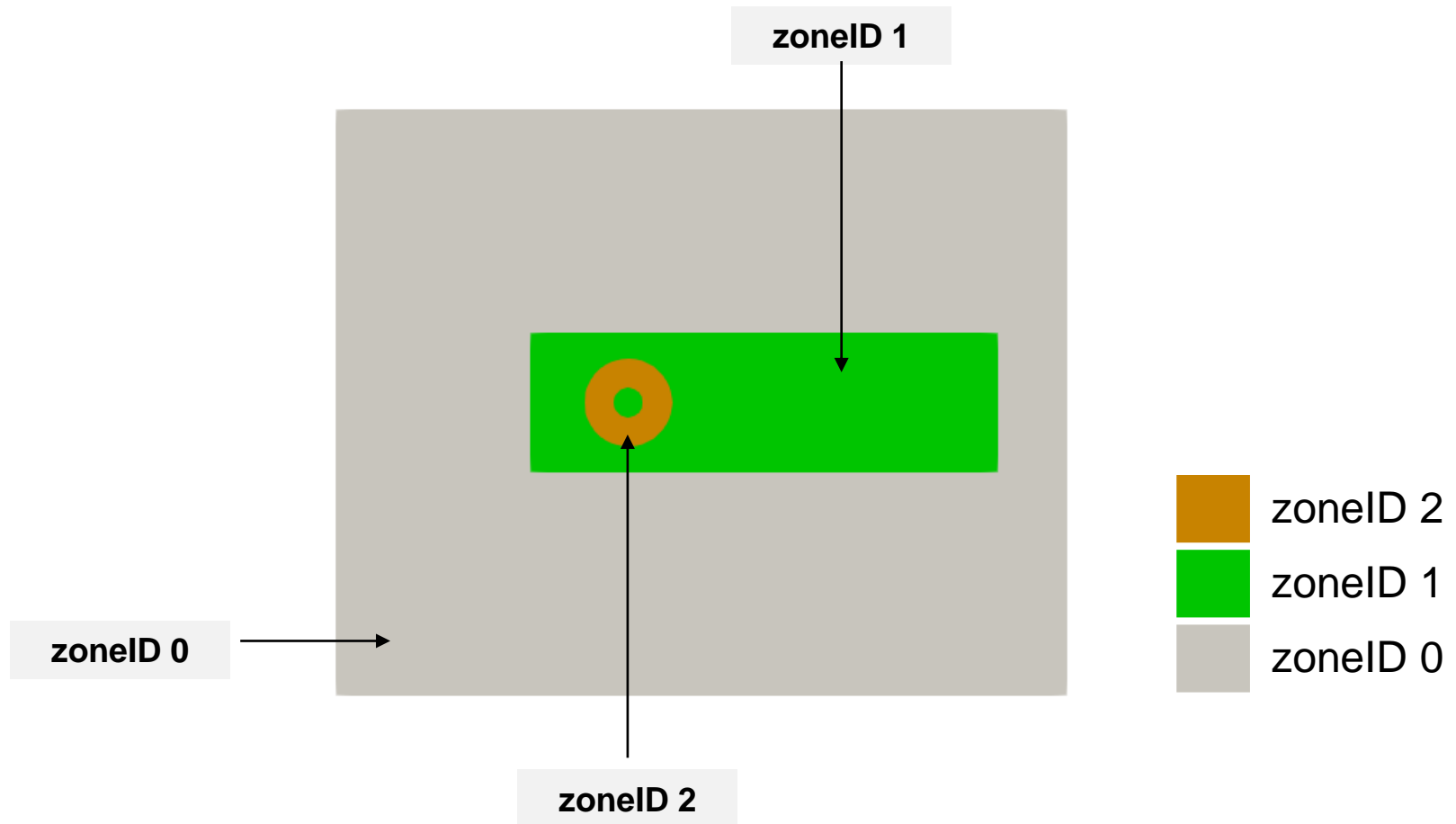
First merge operation → **cylinder + all**



Second merge operation → **refinementZone + all**

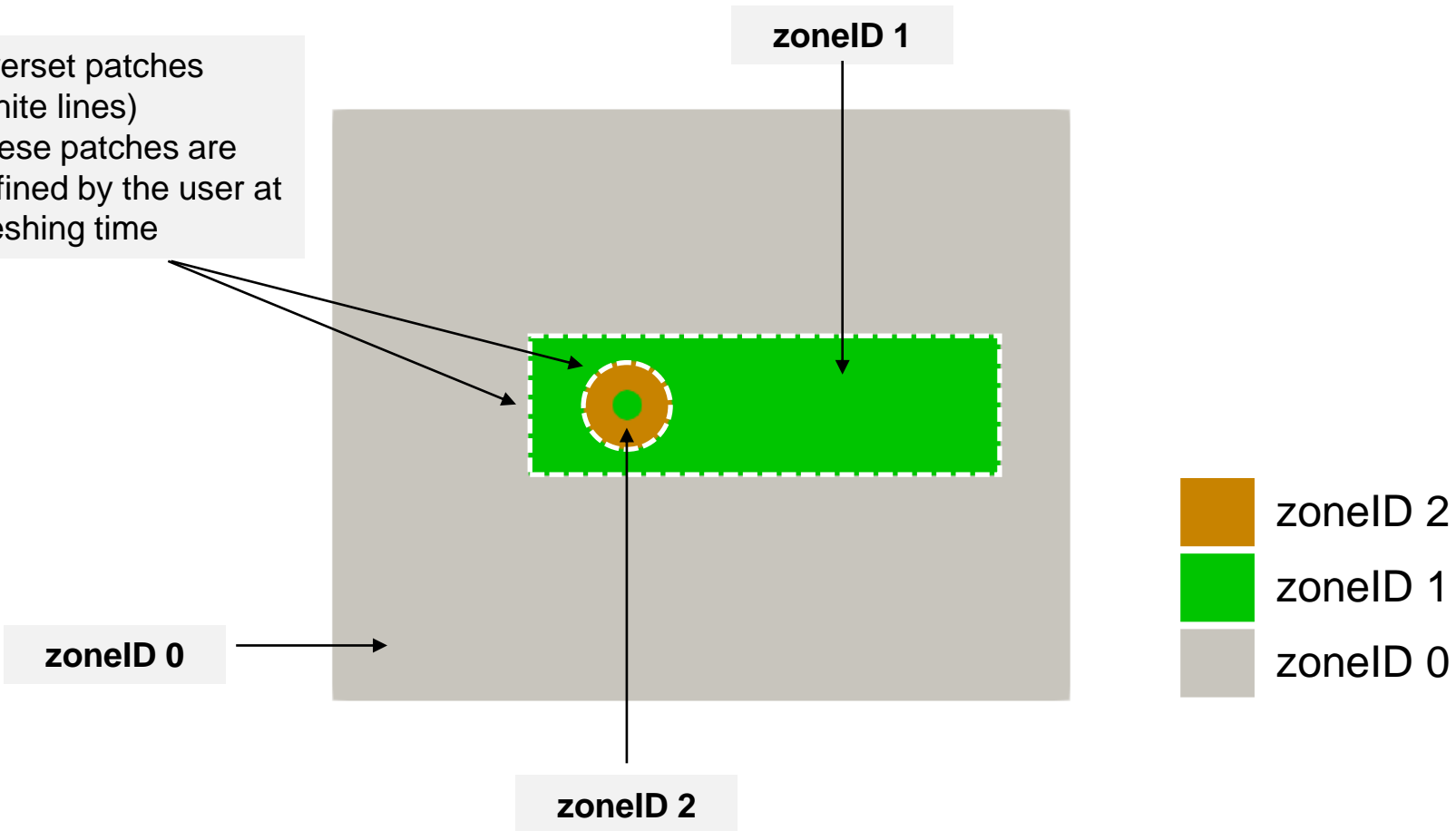


- A zone identification (zoneID) is assigned to each component mesh after all of them have been merged together.
- It is recommended to assign zoneID 0 to the background mesh.
- The background mesh is the mesh that is not moving or the one with inlet and outlet boundary conditions.

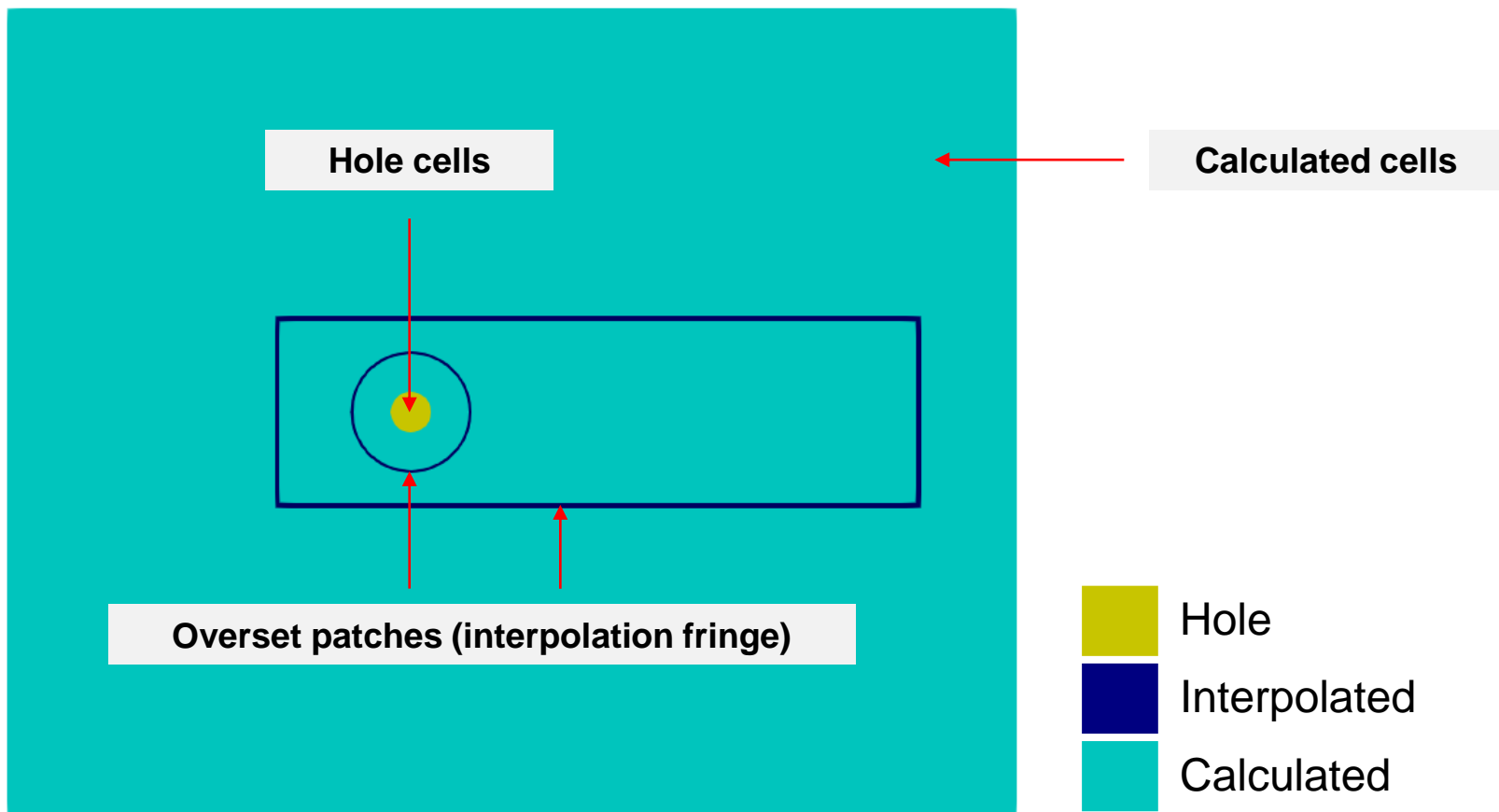


- The overset patches between the component meshes are set by the user.
- The interpolation fringe close to the walls, as well as the hole cells, are computed automatically by the overset solver.

- Overset patches (white lines)
- These patches are defined by the user at meshing time



- The overset patches between the component meshes are set by the user, whereas the interpolation fringe close to the walls, as well as the hole cells, are computed automatically by the overset solver.
- The cell types are defined as follows: **hole** cells (the solution is not computed), **interpolated** cells (the solution is interpolated from mesh to mesh), and **calculated** cells (the solution is computed).



- Structure of *boundary* file for each component mesh.
- No dummy overset patch in component mesh **all**.



cylinder

```
4
(
  oversetPatch
  {
    type      overset;
    inGroups  1(overset);
    nFaces    80;
    startFace 3120;
  }
  cyl
  {
    type      wall;
    inGroups  1(wall);
    nFaces    80;
    startFace 3200;
  }
  back
  {
    type      empty;
    inGroups  1(empty);
    nFaces    1600;
    startFace 3280;
  }
  front
  {
    type      empty;
    inGroups  1(empty);
    nFaces    1600;
    startFace 4880;
  }
)
```

refinementZone

```
3
(
  oversetPatch
  {
    type      overset;
    inGroups  1(overset);
    nFaces    332;
    startFace 9562;
  }
  back
  {
    type      empty;
    inGroups  1(empty);
    nFaces    4864;
    startFace 9894;
  }
  front
  {
    type      empty;
    inGroups  1(empty);
    nFaces    4864;
    startFace 14758;
  }
)
```

all

```
6
(
  inlet
  {
    type      patch;
    nFaces    80;
    startFace 15820;
  }
  outlet
  {
    type      patch;
    nFaces    80;
    startFace 15900;
  }
  bottom
  {
    type      patch;
    nFaces    100;
    startFace 15980;
  }
  top
  {
    type      patch;
    nFaces    100;
    startFace 16080;
  }
  back
  {
    type      empty;
    inGroups  1(empty);
    nFaces    8000;
    startFace 16180;
  }
  front
  {
    type      empty;
    inGroups  1(empty);
    nFaces    8000;
    startFace 24180;
  }
)
```

- Structure of *boundary* file for each component mesh.
- Dummy (empty) overset patch in component mesh **all**.



cylinder

```
4
(
  oversetPatch
  {
    type      overset;
    inGroups  1(overset);
    nFaces    80;
    startFace 3120;
  }
  cyl
  {
    type      wall;
    inGroups  1(wall);
    nFaces    80;
    startFace 3200;
  }
  back
  {
    type      empty;
    inGroups  1(empty);
    nFaces    1600;
    startFace 3280;
  }
  front
  {
    type      empty;
    inGroups  1(empty);
    nFaces    1600;
    startFace 4880;
  }
)
```

refinementZone

```
3
(
  oversetPatch
  {
    type      overset;
    inGroups  1(overset);
    nFaces    332;
    startFace 9562;
  }
  back
  {
    type      empty;
    inGroups  1(empty);
    nFaces    4864;
    startFace 9894;
  }
  front
  {
    type      empty;
    inGroups  1(empty);
    nFaces    4864;
    startFace 14758;
  }
)
```

all

```
7
(
  oversetPatch
  {
    type      overset;
    inGroups  1(overset);
    nFaces    0;
    startFace 15820;
  }
  inlet
  {
    type      patch;
    nFaces    80;
    startFace 15820;
  }
  outlet
  {
    type      patch;
    nFaces    80;
    startFace 15900;
  }
  bottom
  {
    type      patch;
    nFaces    100;
    startFace 15980;
  }
  top
  {
    type      patch;
    nFaces    100;
    startFace 16080;
  }
  back
  {
    type      empty;
    inGroups  1(empty);
    nFaces    8000;
    startFace 16180;
  }
  front
  {
    type      empty;
    inGroups  1(empty);
    nFaces    8000;
    startFace 24180;
  }
)
```

- Structure of final overset mesh *boundary* file.
 - First merge operation → **cylinder + all**
 - Second merge operation → **refinementZone + all**

- Overset patch not located at the beginning of the list.
- Technically this not a problem, however, the solver will give a warning.
- It is recommended to enforce this patch to be at the beginning of the list.



No dummy overset patch

```

8
(
  inlet
  {
    type      patch;
    nFaces    80;
    startFace 28502;
  }
  outlet
  {
    type      patch;
    nFaces    80;
    startFace 28582;
  }
  bottom
  {
    type      patch;
    nFaces    100;
    startFace 28662;
  }
  top
  {
    type      patch;
    nFaces    100;
    startFace 28762;
  }
  back
  {
    type      empty;
    inGroups  1(empty);
    nFaces    14464;
    startFace 28862;
  }
  front
  {
    type      empty;
    inGroups  1(empty);
    nFaces    14464;
    startFace 43326;
  }
  }
  oversetPatch
  {
    type      overset;
    inGroups  1(overset);
    nFaces    412;
    startFace 57790;
  }
  cyl
  {
    type      wall;
    inGroups  1(wall);
    nFaces    80;
    startFace 58202;
  }
)

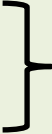
```

Dummy overset patch used

```

8
(
  oversetPatch
  {
    type      overset;
    inGroups  1(overset);
    nFaces    412;
    startFace 28502;
  }
  }
  inlet
  {
    type      patch;
    nFaces    80;
    startFace 28914;
  }
  outlet
  {
    type      patch;
    nFaces    80;
    startFace 28994;
  }
  bottom
  {
    type      patch;
    nFaces    100;
    startFace 29074;
  }
  top
  {
    type      patch;
    nFaces    100;
    startFace 29174;
  }
  back
  {
    type      empty;
    inGroups  1(empty);
    nFaces    14464;
    startFace 29274;
  }
  front
  {
    type      empty;
    inGroups  1(empty);
    nFaces    14464;
    startFace 43738;
  }
  }
  cyl
  {
    type      wall;
    inGroups  1(wall);
    nFaces    80;
    startFace 58202;
  }
)

```



- Overset patch at the beginning of the list.
- This was enforced by adding an empty overset patch at the beginning of the boundary file of the mesh that is receiving the component meshes.
- To do this with blockMesh, just add the following information at the beginning of the boundaries definition in the dictionary blockMeshDict:


```

oversetPatch
{
    type overset;
    faces ();
}

```
- If you are using a third party mesher, this can be also done. Just check the documentation to see how to set the order of the boundary patches.

- This is the warning you will get if the first patch in the file *boundary* is not of the type *overset*:

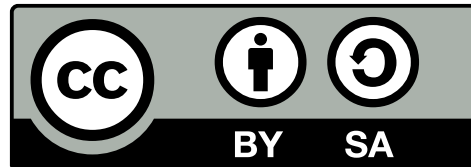
--> FOAM Warning :

From function bool Foam::oversetPolyPatch::master() const
in file oversetPolyPatch/oversetPolyPatch.C at line 149

The master overset patch is not the first patch. Generally the first patch should be an overset patch to guarantee consistent operation.

- Remember, this is only a warning, your simulation will run the same.
- But we have found that it is better to solve this issue. In our experience the solver will run faster, and the interpolation errors are minimized.
- You can have only one overset patch in the overset mesh. That is, you need to give the same name to all the overset patches in your mesh.
- Overset patches can intersect each other.
- It is not recommended that the overset patches intersect inlets or outlets.
- Cells size close to interpolated cells should be of the same size to minimize interpolation errors.
- So far, the overset library cannot handle collision.
- For dynamic meshes, the ideal time step size should be chosen such that the relative mesh motion does not exceed the length of the smallest cell at the overset patches for a given time step. The mesh length used for calculating the time step should be restricted to cells in the overset region. This ensures a more gradual evolution of the overset interface with the motion and is recommended for better accuracy and stability.

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- A help is needed and much appreciated.
- If you find errors, have suggestions for better wording, figures, or new material, let us know.
- Also, if you find a tutorial that does not work, please let us know.
- Follow-up problems, questions, and suggestions at guerrero@wolfdynamics.com