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PetraSim Examples: 3D Five Spot with Layers

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3D Five Spot with Layers

This example shows how to manage layers in your model. Save the previous 3D Five Spot model in a new folder and with a new name.

Edit Layers

The Z coordinates (depth) of a layer can be defined as a constant, a linear function of X and Y, or by a file that contains an unordered list of XYZ values. For this example, we will use a file with the values given below. This defines points along the $y=0$ and $y=500$ edges, but that was only done for convenience, there is no constraint on the order or position of the points.

Table 1: XYZ points used to define the layer

-500	0	150
-400	0	106
-300	0	79
-200	0	79
-100	0	106
0	0	150
100	0	194
200	0	221
300	0	221
400	0	194
500	0	150
-500	500	150
-400	500	150
-300	500	150
-200	500	150
-100	500	150
0	500	150
100	500	150
200	500	150
300	500	150
400	500	150
500	500	150

Create a text file with these points. To add a new layer to the model:

1. On the **Model** menu, click **Edit Layers...**
2. Click **New...** and then click **OK** to add the new layer. The default name will be *Layer 2*.
3. By default, the new layer is added below the model. To use our XYZ points to define the layer, for the **Base** option, select **From File** and then **Open** the file with the XYZ data.
4. Click **OK** to save the new layer

PetraSim will recognize that these points are above the previous layer and move Layer 2 to the top.

Create Mesh

To create a mesh that respects the layer data:

1. On the **Model** menu, click **Create Mesh**
1. On the **Model** menu, click **Create Mesh**
2. For **Mesh Type**, select *Polygonal*
3. In the **Maximum Cell Area** box, type *2500*
4. In the **Max Area Near Wells** box, type *250*
5. Click **OK** to create the mesh

Your mesh should follow the layer, Figure 1. By default, the number of cells in the Z direction of the new layer is 5, the number of cells in the original layer remains 6 as specified earlier.

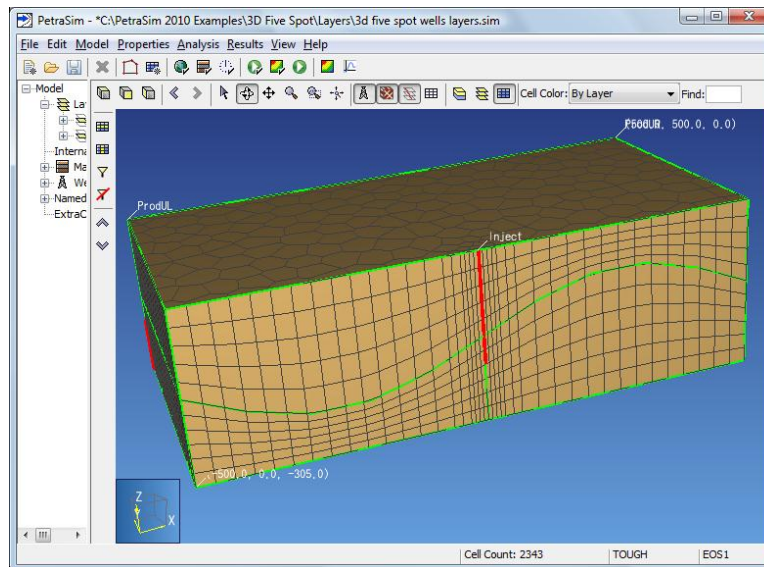


Figure 1: 3D Five Spot model with layer

Click the **Internal Boundaries** button to see a display of the layer boundary:

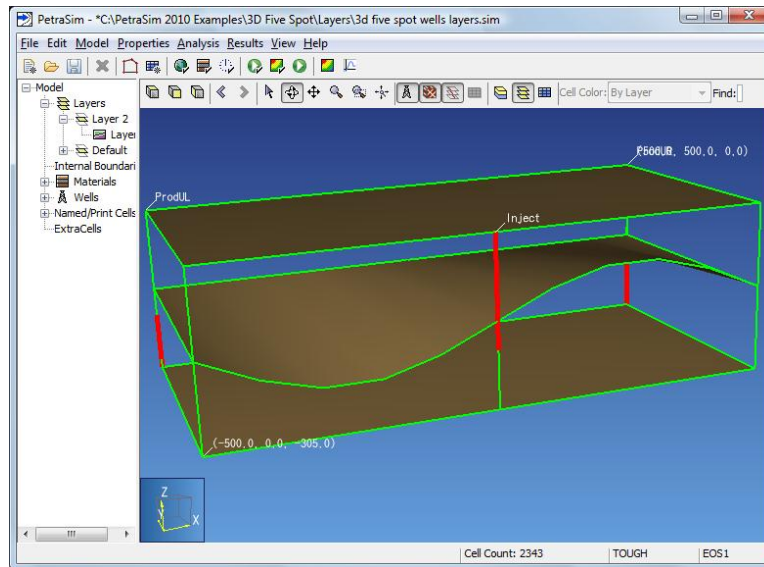


Figure 2: Display of layers in the model

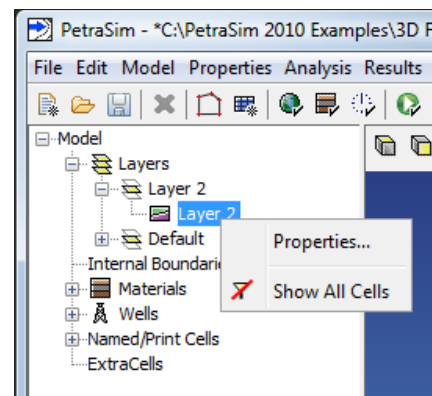
Change Material Properties in New Layer

Use of layers will usually mean the need to specify different properties for each layer. To illustrate this, we create a second material:

1. On the **Properties** menu, click **Edit Materials...**
2. Click **New**
3. In the **Name** box, type *MAT2*, and click **OK**.
4. In the **XY Permeability** box, type $6e-14$
5. Click **OK** to save changes and exit the dialog.

Material properties can be assigned by cell, to regions, or globally. A layer is a horizontal division of the model. It is also possible to define *Internal Boundaries* that can split layers. In our case, we do not have any internal boundaries so there is only one region in each layer. To assign the new material to the new layer (region):

1. In the **Tree View**, expand **Layer 2** and then right-click on the region labeled **Layer 2**.
2. Click **Properties...**
3. For the **Material**, select *MAT2*.
4. Click **OK** to save changes and exit the dialog.



Save and Run

The input is complete and you can run the simulation. Save your model and run the simulation:

1. On the **Analysis** menu, click **Run TOUGH2**

The **Simulation Complete** dialog will notify you when the end time has been reached. Click **OK** to dismiss the notification and click **Close** to exit the **Running TOUGH2** dialog.

View 3D Results

To open the **3D Results** dialog:

1. On the **Results** menu, click **3D Results**

By default, the display will show isosurfaces corresponding to pressure for the first output step.

To show temperature isosurfaces for the last time step:

1. In the **Scalar** list, click **T**
2. In the **Time(s)** list, click the last entry (t = **1.15183E9**)
3. You can add slice planes and display and mesh.

Comparing Figure 3 to the previous results shows the effect of greater permeability in the upper layer. The flow spreads horizontally.

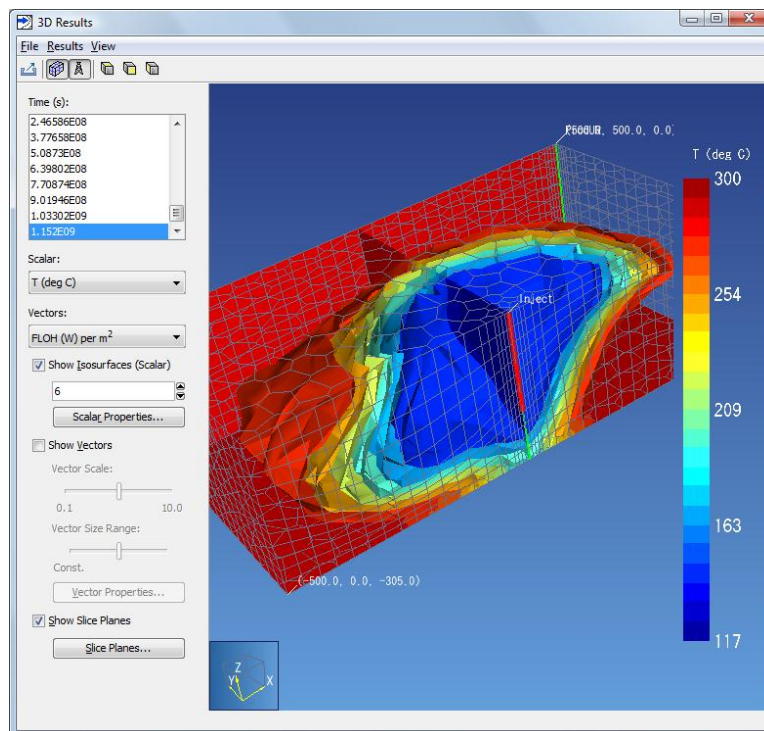


Figure 3: Temperature isosurfaces for layered model at end of solution