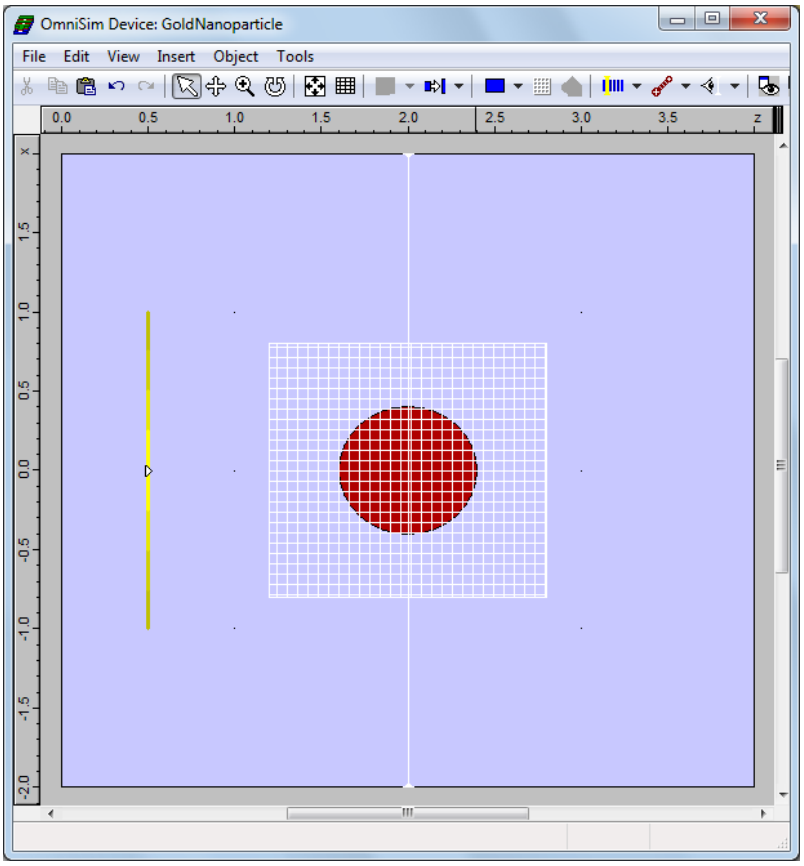
OmniSim Examples

Modelling a Gold Nanoparticle

GoldNanoparticle.prj

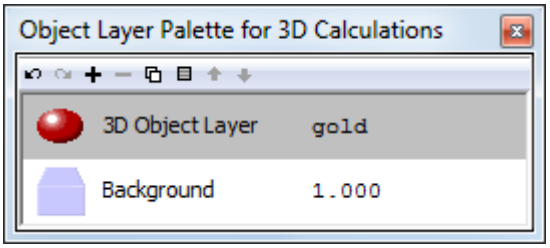
Modelling a gold nanoparticle in 3D FDTD with OmniSim using the sub-gridding region

➢ Open the project GoldNanoparticle.prj in OmniSim and double-click on "GoldNanoparticle". The OmniSim Device will open.



The red shape is a gold nanoparticle. The white grid around the sphere is a sub-gridding region, which can be used to locally increase the spatial resolution. During the FDTD calculation, the grid spacing in the sub-gridding region will be half of the grid spacing in the rest of the device. This is very useful when modelling plasmonic structures such as this one as the resolution needed to model the surface plasmons appropriately is much smaller than the resolution needed to model the field propagation in air. The sub-gridding region can accelerate a 3D calculation by a factor of up to 64 times!

➢ Go to the menu and select /View/Object Layer Palette for 3D calculations.



This palette tells you how the structure is defined for 3D calculations. In this case the background is set to air whilst the red sphere is set to a pre-defined dispersive model of gold. The particle has a diameter of 800nm.

The yellow line is a Gaussian excitor which will launch a Gaussian beam of 1/e width 2um. In the time domain the excitation is a sinusoidal pulse.

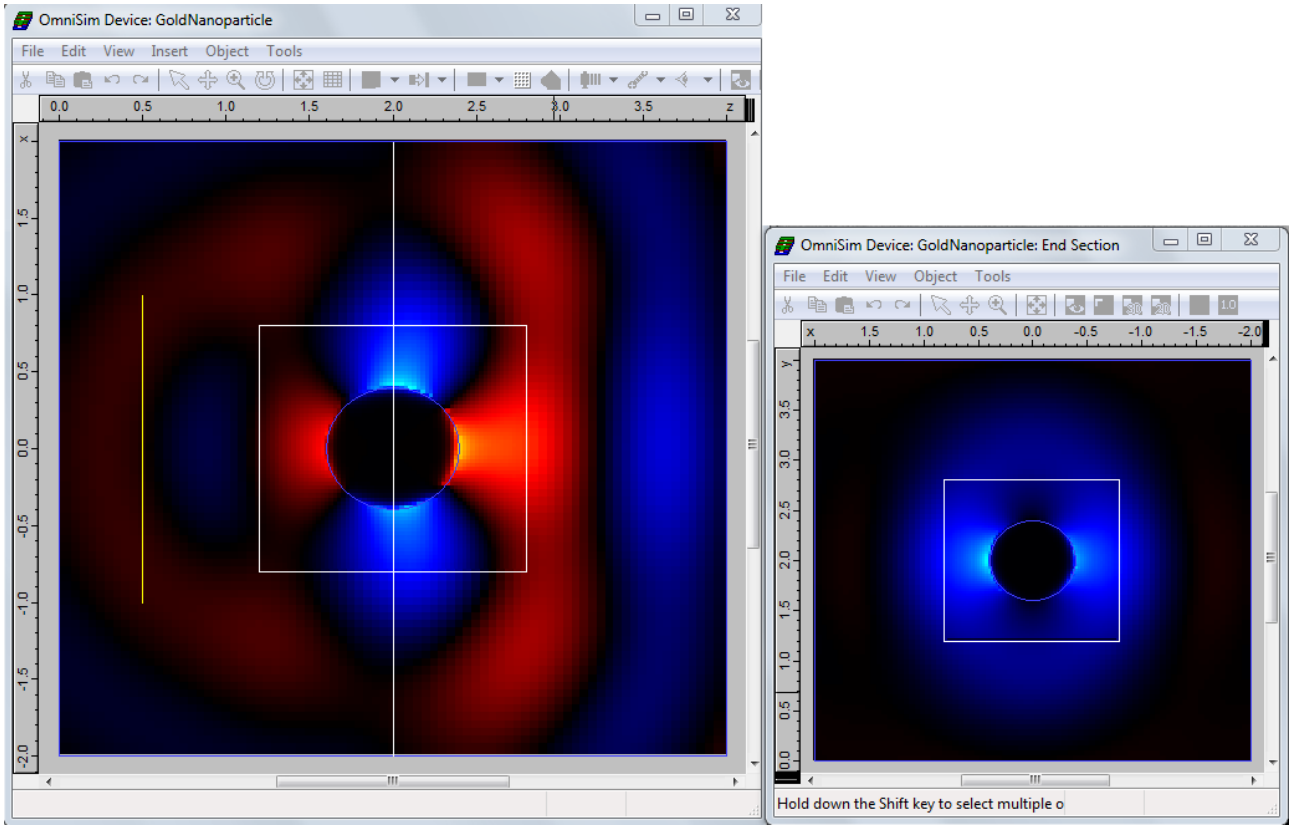
- In the OmniSim Device, double click on the white line. This will display a cross-section, allowing you to see that the particle is indeed a sphere. Keep this cross-section opened but move it away from the OmniSim Device in order to be able to see them both during the FDTD calculation.

We will now run a 3D FDTD calculation on this structure.

- Go to the menu and select /Tools/Calculator/FDTD Calculator…
- If you are working on a computer with multiple CPU cores, go to the "SMP" or "Cluster/SMP" tab. Make sure that "SMP (No cluster)" is selected in the drop-down menu and select your computer in the list, then click on the "+" button until it is disabled to add enable as many CPU cores as available for the calculation.
- Before starting the calculation, go to the "Controls" tab.

OmniSim allows you to plot the field and intensity evolving in the time domain during the calculation in both the OmniSim Editor and the cross-section.

- Select "Show Hy every 16 steps".
- Click on **Calculate** to launch the FDTD calculation. The Hy field profile will be plotted every 16 steps, allowing you to see the field around the sphere. You can observe in particular the difference in grid spacing between the sub-gridding region and the rest of the structure.



During the calculation you can select other field components or the intensity, adjust the brightness and the plotting rate. If you want to speed up the calculation you can set the plotting rate to "none". From this panel you can also easily record videos of your FDTD calculation.