

## Procedure for Measuring Light Extraction Efficiency in Ansys Lumerical FDTD.

1. Install and set up the Ansys Lumerical FDTD software package on your local machine for all the simulations.
2. Create the structure in the FDTD interface using the given structural parameter values.
3. Download the ZnO material data (n.k) from the following website:  
<https://refractiveindex.info/?shelf=main&book=ZnO&page=Stelling>
4. Add the analysis groups named “far\_field\_change\_index” and “dipole\_power”
5. Add two parameter sweeps for the patterned OLED structure and the no\_pattern OLED structure.
6. Set the dipole source positions inside the parameter sweeps using unit square cell symmetry.
7. Run both the sweeps using the command <runsweep>.
8. Open and run the script file named <OLED\_3D\_farfield>, which is uploaded with this doc file.
8. Create a new optimization in the FDTD interface. Set the Algorithm to “Particle\_Swarm\_Optimization” and set the generation numbers to 25 and 20 simulations per iteration.
9. Set the variable and its boundary conditions as mentioned in the original paper.
10. For the result section, select the ‘T\_far’ from the “far\_field\_change\_index” analysis group, which will be optimized.