# A new propagation prediction approach based on Ray Launching and Diffusion Equation techniques for complex environments

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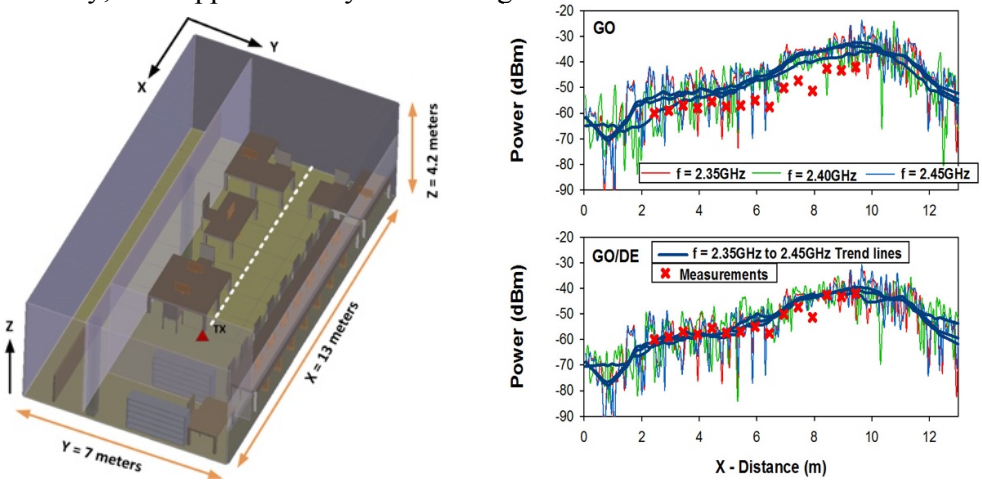
With the growing demand of wireless communications systems over the past two decades, it is highly important to have a deep understanding in radio wave propagation in indoor and outdoor environments, to have the capability of determining optimum transceivers locations, and predicting their coverage, without carrying out a series of measurements, which are very expensive and time-consuming. Deterministic models potentially represent the most accurate and versatile methods for urban and indoor, multipath propagation prediction. In this work, a new hybrid Ray Launching-Diffusion Equation (RL-DE) technique for joint prediction of radio wave propagation is presented, which is more computationally efficient as compared to the conventional RL technique. This technique combines a 3-D Ray Launching algorithm based on Geometrical Optics with a Diffusion Equation method based on the equation of transfer. Diffusion process is added to GO to account for material absorption and non-specular scattering by obstacles. The explicit form of the solution to the diffusion equation (DE), based on the equation of transfer, circumvents the much more complicated Hemholtz equation, providing a simple way to predict radio wave propagation when combined with GO methods, improving prediction accuracy. Figure 1a represents the considered scenario which has been assessed with the new approach. Results are shown in Figure 1b, which represent the comparison of both methodologies with measurements. The new hybrid RL-DE approach achieves better agreement with measurements, while resulting in high computational efficiency, with approximately 40% savings in simulation time.




(a) (b)

Fig. 1 (a) Schematic considered scenario. (b) Comparison simulation versus measurements.