Modeling Laser Beam Penetration through Foliage

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Applications:

- Optical communication and sensor links through foliage (leaves and tree-top canopies)
- UAV communicating with troops in forested area
- Beacons – search and rescue

MONTE-CARLO SIMULATION

Model Assumptions:

Beam/FOV Characteristics
- Beam spot-size/FOV determined by the user
- Intensity/Power characteristics determined by the user
- Number of pixels in the FOV determined by user

Leaf Characteristics
- Leaf placement in successive planes chosen from appropriate statistical distributions
- Photons hitting leaves are absorbed
- Leaves are uniformly distributed across RX field of view (FOV)
- Leaves can be modeled as ellipses with major and minor axes chosen from Gaussian distributions
- Leaves can be randomly oriented in the FOV.

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INTERIM CONCLUSIONS
- Large diameter laser beams penetrate foliage well
- Wind assists in allowing data packet flow

What’s Next?
- Experimentally show that for a given number of leaves in the FOV, the total area obscured agrees with the model.
- Incorporate time-varying scintillation effects into model and verify experimentally.
- Develop stochastic pixel diversity probability distributions for leaf obscurations.