

# WE-21 Development of 3D Raman Spectra Analysis System for TCAD Stress Simulation in FinFET Structure

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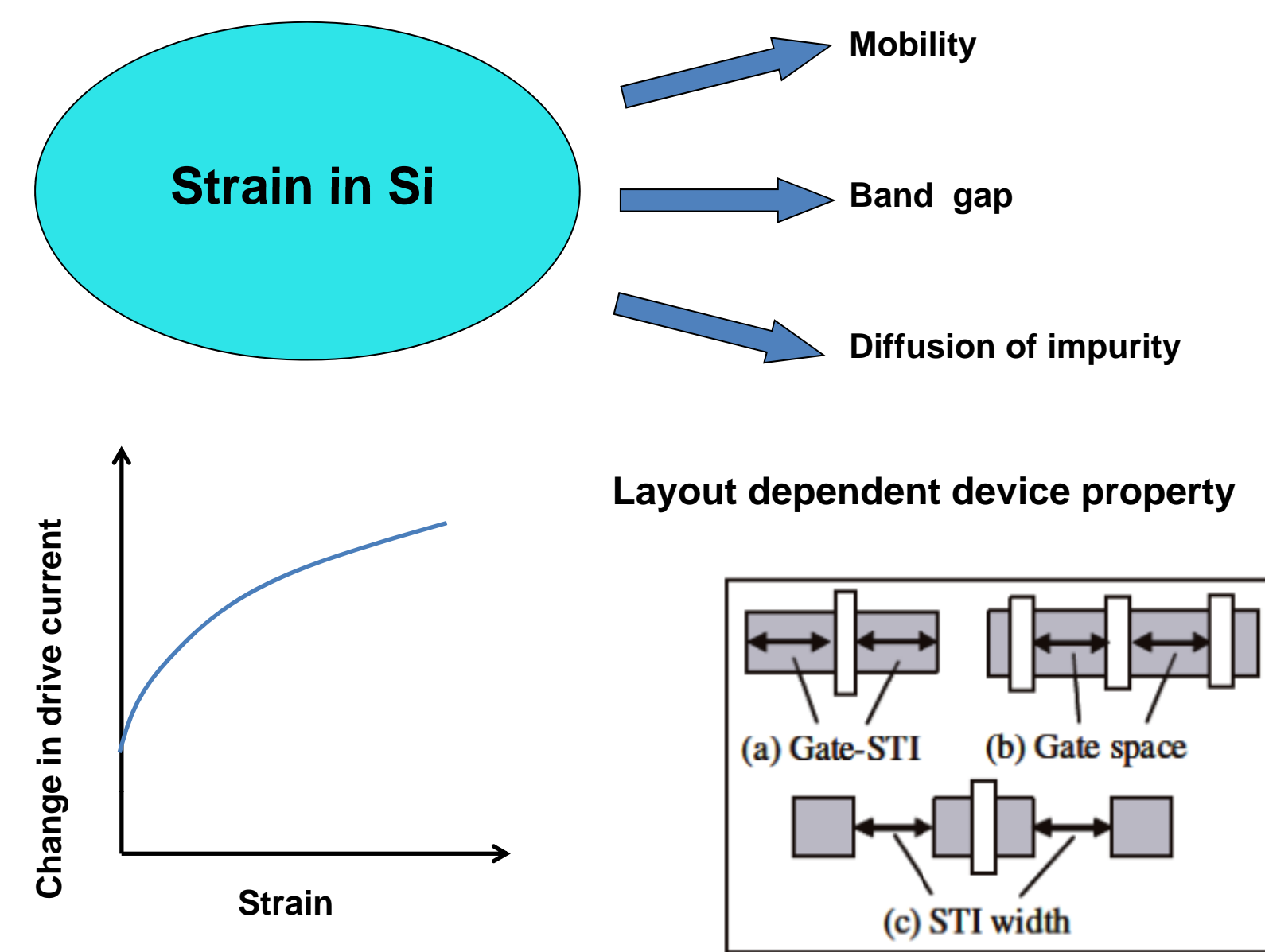
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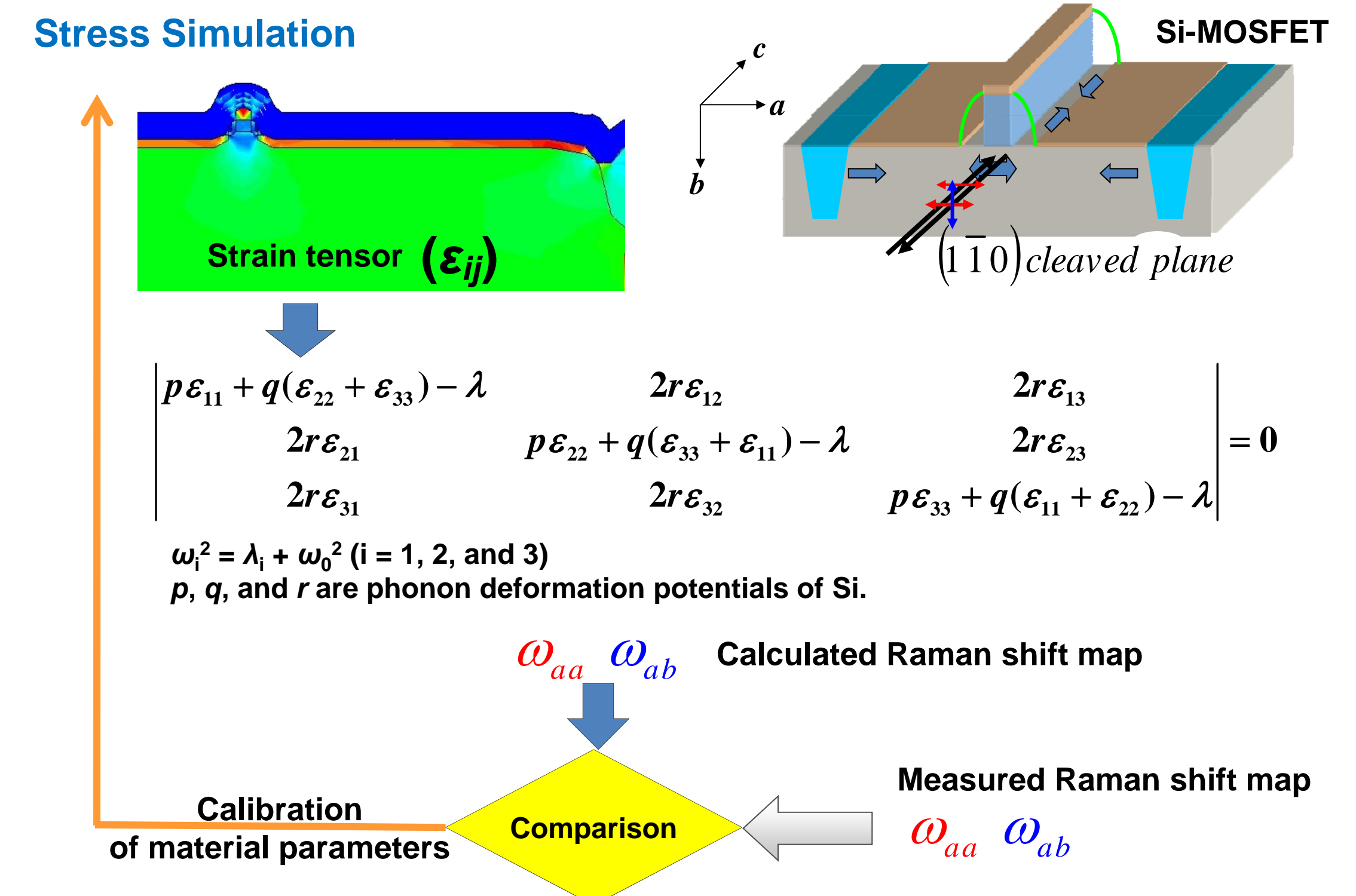
## Background

Micro-Raman spectroscopy is simple and useful for evaluating the local stress and calibrating stress simulations. Stress simulations can be calibrated by adjusting the stress parameters or the profiles of the device structure so that the calculated Raman shifts may agree with the measured ones. The Raman spectra analysis for FinFET-like structures should be treated three dimensionally and the propagation of excitation and scattered light should be strictly simulated. Because of this, we developed 3D Raman spectra analysis system using finite-difference time-domain (FDTD) electromagnetic simulation.

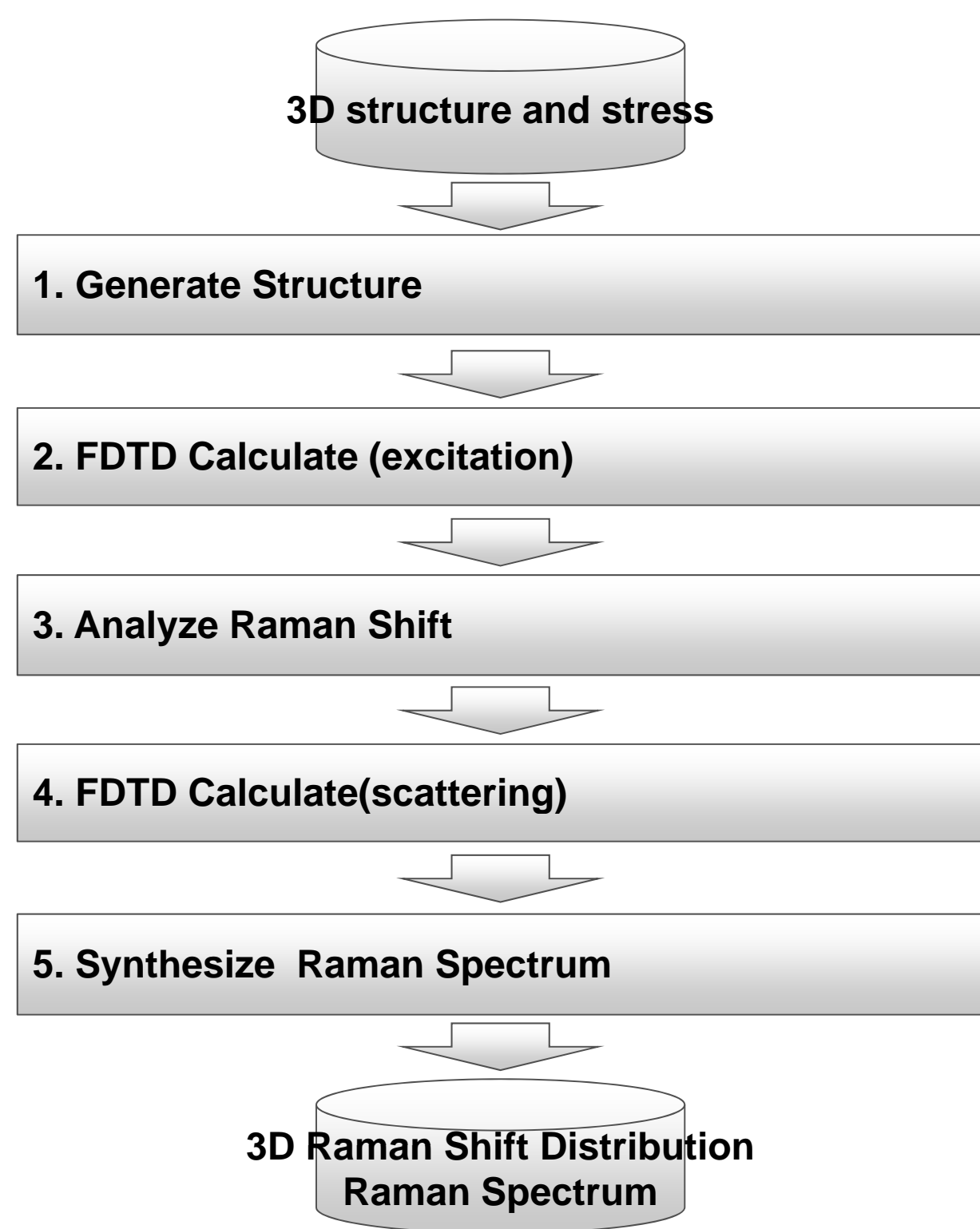
## Stress technology is key for advanced CMOS



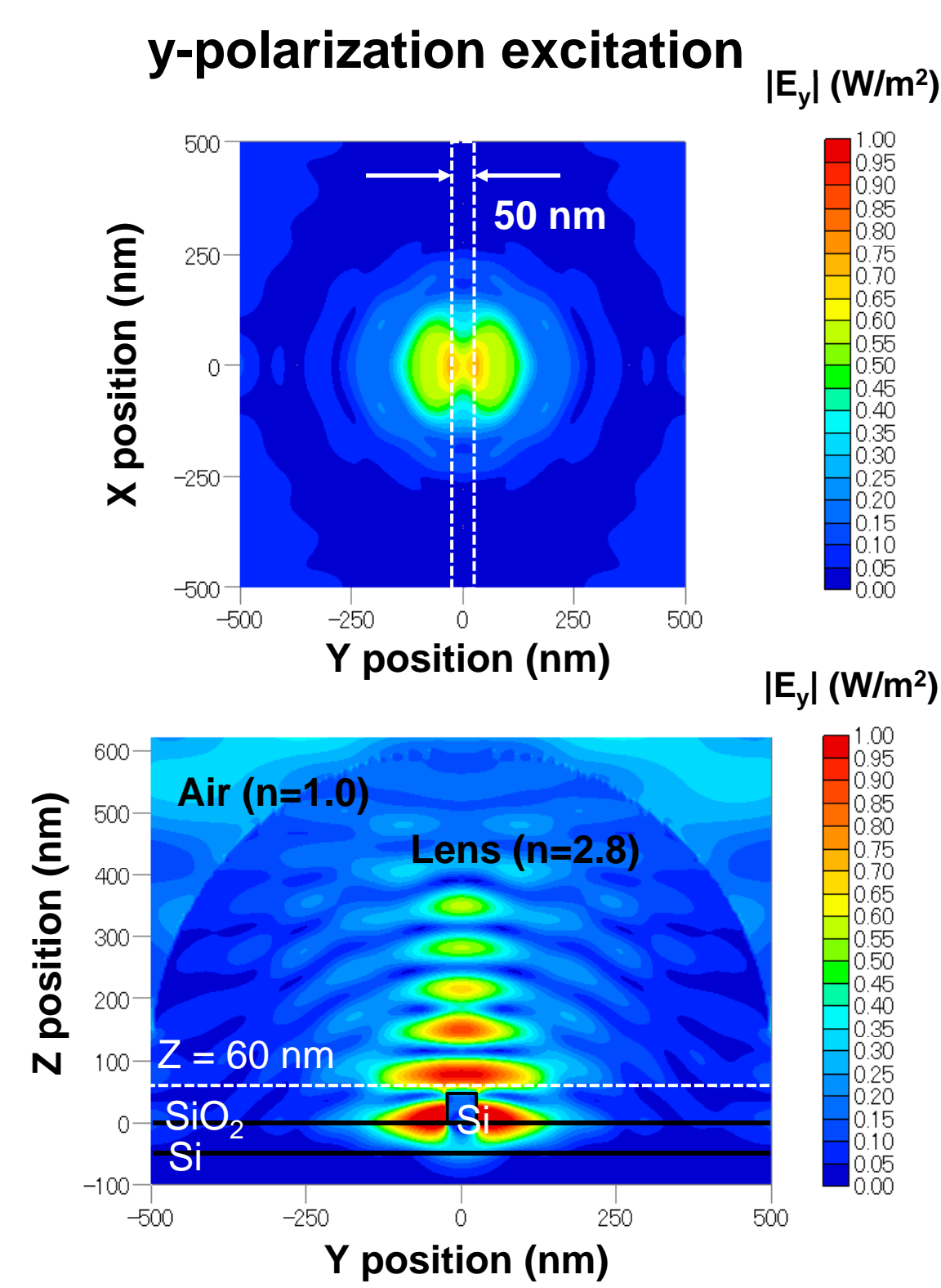
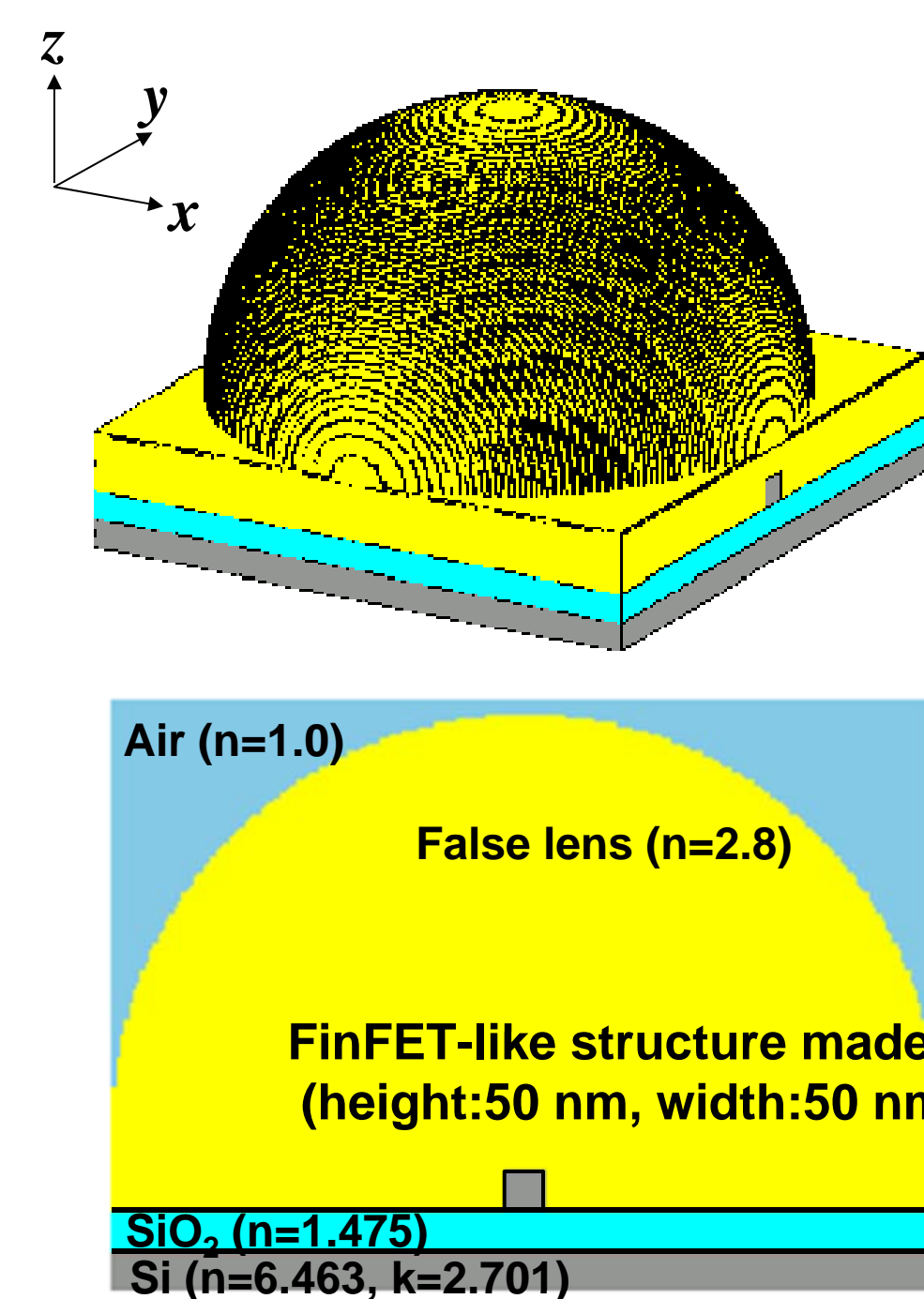
## Calibration using Raman spectroscopy analysis



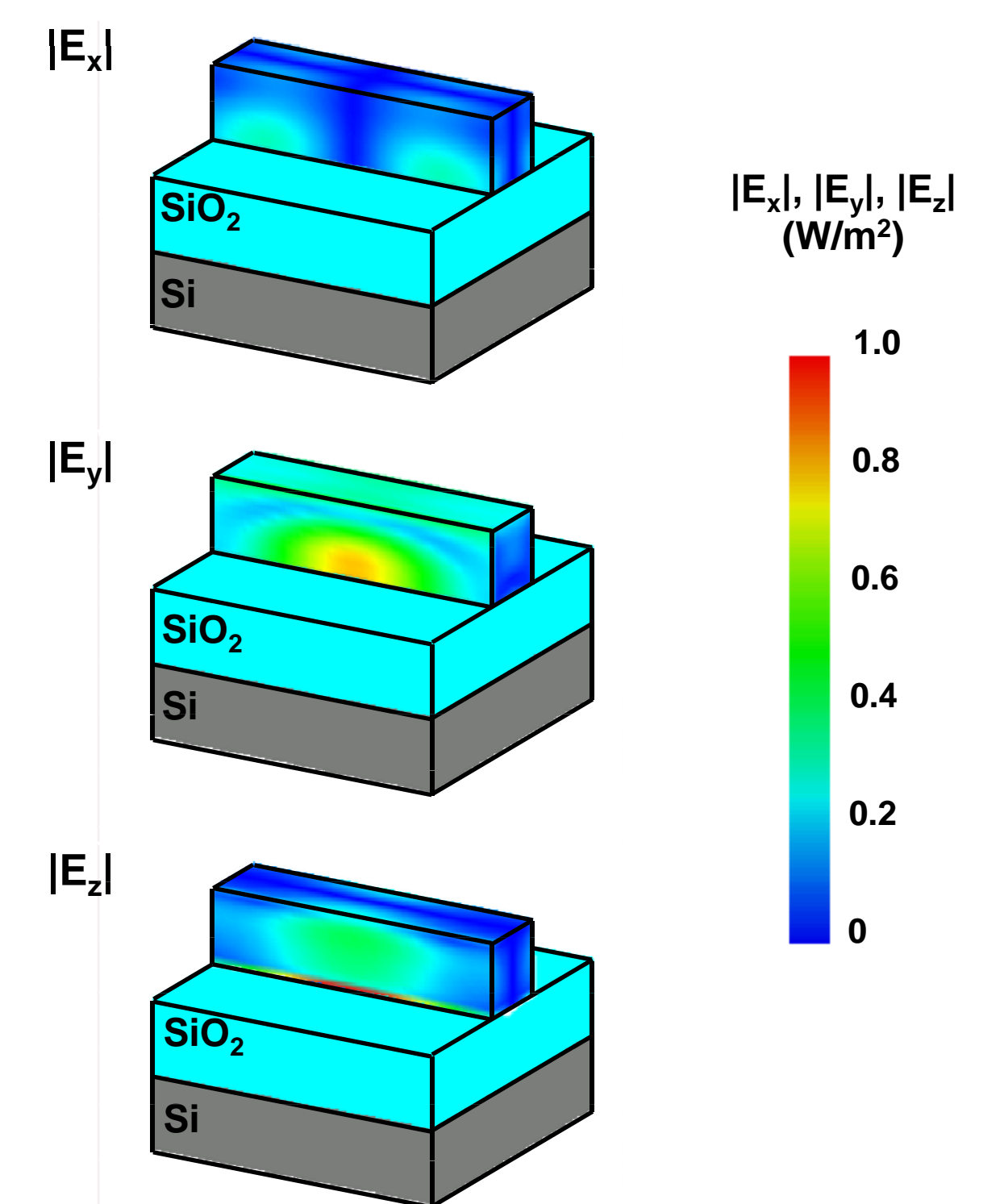
## Flow diagram of Raman spectra analysis



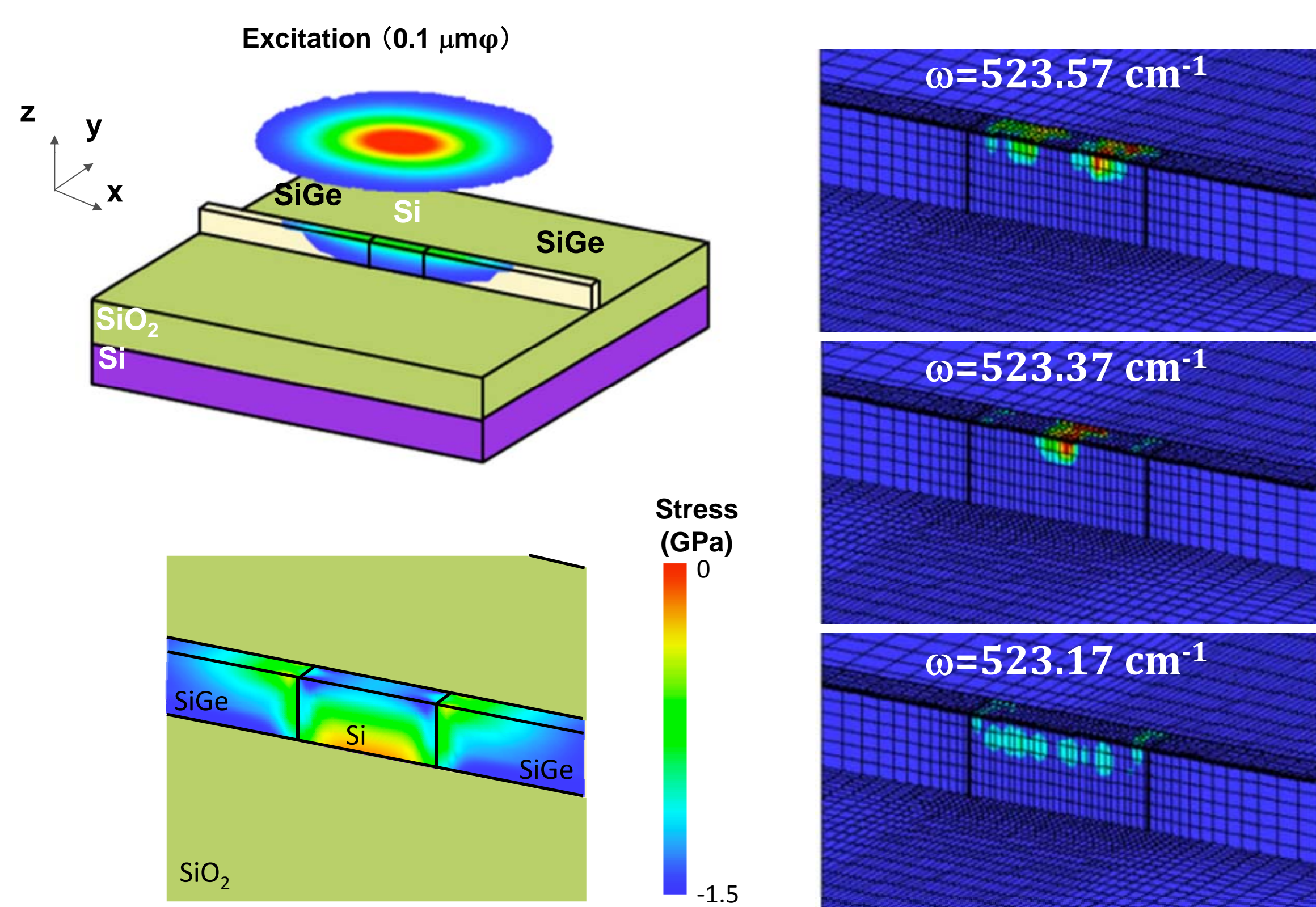
## Simulation for lens effects



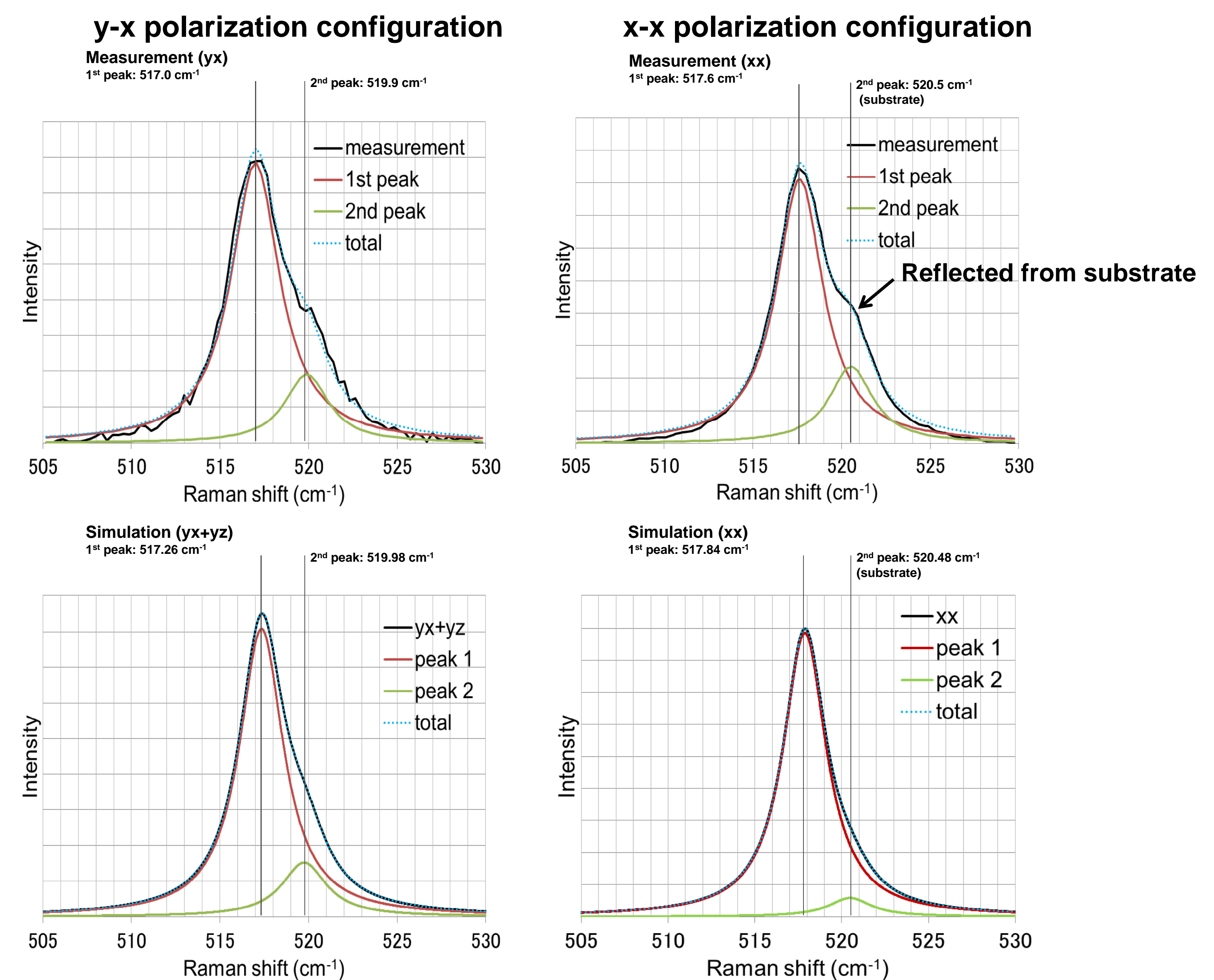
## Absorbed light intensity



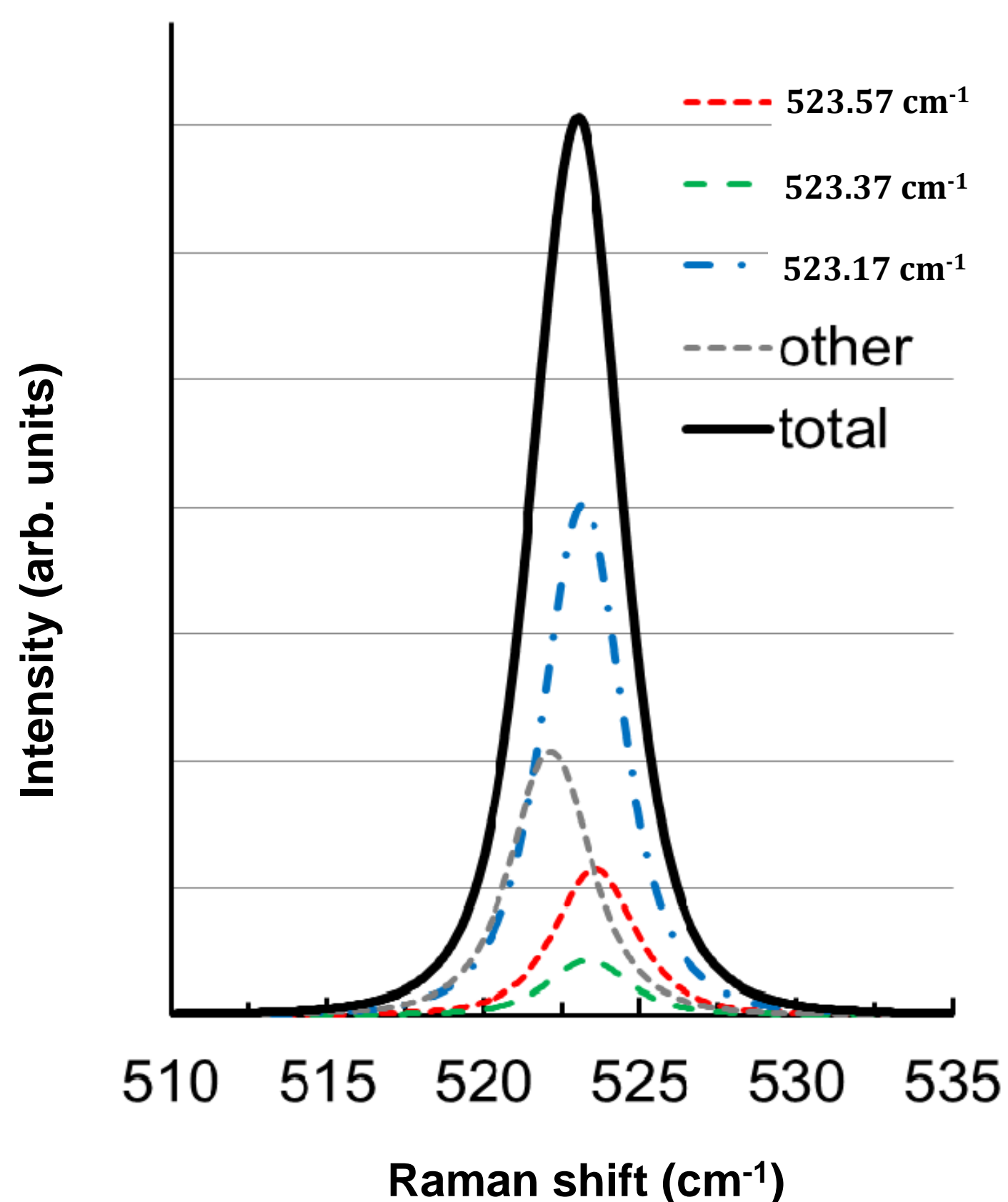
## Distributions for absorbed and scattered light intensity



## Comparison of measured Raman spectra with calculated results



## Synthesized Raman spectrum



## Conclusion

1. We developed 3D Raman spectra analysis system combining an FDTD electromagnetic simulation and TCAD stress simulation.
2. This system enables us to accurately calculate a Raman spectrum reflecting nanometer scale modulation effects in the light intensity distribution.
3. This system is useful for evaluating the stress in the FinFET like structures based on the stress simulations.