

2023 年度年次報告書

リアル空間を強靱にするハードウェアの未来

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Compact and low cost ultra-wide band photonics-based 3D imaging system at millimeter/terahertz  
band

## 研究成果の概要

As outlined in the research plan, two pivotal milestones were successfully accomplished during FY2023: establishing the unique laser source and developing the silicon photonics imaging module at the 300 GHz band.

The operating bandwidth enabled by the laser system has been improved from 20 GHz to 100 GHz, with about 0.6 ms compared with that in FY2022, which achieved the goal of this project. However, the laser system becomes less stable when the bandwidth exceeds ~60 GHz. Since the THz band photonic source is fragile and expensive, the system may need more improvements for 100-GHz bandwidth signals during FY2024.

On the other hand, the preliminary design was validated with existing THz sources, and the imaging results using the proposed module were published. However, the first edition of the modules has insufficient bandwidth of <50 GHz. Thus, two versions of the improved module were designed and fabricated during FY2023. The simulation and measurement results proved its ultrawide bandwidth of ~100 GHz.

In conclusion, the main objectives have been achieved as planned. However, since the PI has moved to a new laboratory at Ibaraki Univ., the experiment condition is insufficient to assemble the two core techniques into the 300-GHz imaging system on time. In light of this, the PI has initiated a collaboration with Gifu Univ. by borrowing the measurement equipment and assembling the 300-GHz imaging system there. Furthermore, the proposed laser system for imaging systems at different frequency bands may be commercialized based on this collaboration during FY2024.

### 【代表的な原著論文情報】

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- 2) Li Yi, Yihan Li, Tadao Nagatsuma, Photonic Radar for 3D Imaging: From Millimeter to Terahertz Waves, IEEE Journal of Selected Topics in Quantum Electronics, 10.1109/JSTQE.2023.3298933. (2023.09)