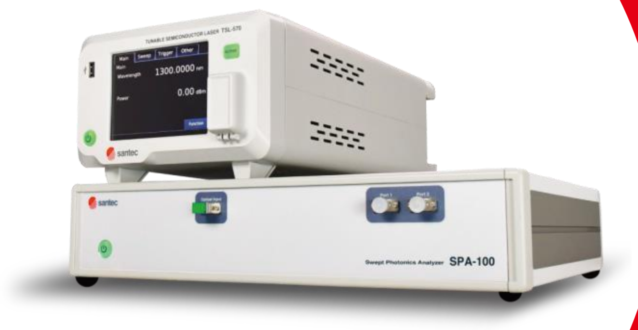
Baba Laboratory, Yokohama National University



Wavelength Swept Photonics Analyzer "SPA-100"

A vital tool for the performance assessment of increasingly intricate silicon photonics integrated circuits.

User Profile

Prof. Toshihiko Baba, Yokohama National University Faculty of Engineering

Professor Baba specializes in optoelectronics with a focus on areas such as photonic crystals, silicon photonics, slow light, LiDAR, nano-lasers in particular.

Papers：M. Kayama and T. Baba, “OFDR analysis of Si photonics FMCW LiDAR chip” Opt. Lett. 31(15), 25245-25252 (2023).

Ideal for Silicon Photonics R&D

The SPA-100 serves as an add-on module for Santec’s TSL series of widely tunable, external cavity lasers. It is well-suited for detailed analysis of silicon photonic devices and is a valuable tool for assessing performance, including the detection of unwanted reflections and defects as well as transmission loss measurement.

Industry-Leading Measurements with High Resolution and Sensitivity

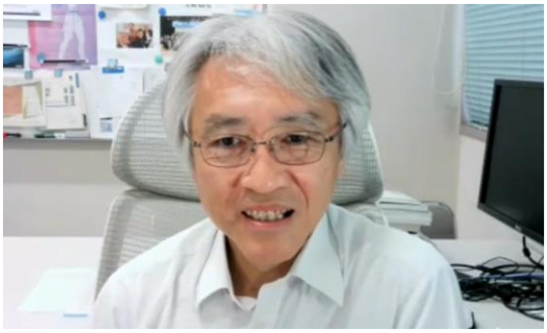
Measurement resolution is determined by the scan range of the tunable laser. Pairing the SPA-100 with Santec’s TSL laser provides a remarkable 5 μm resolution. Allowing precise analysis of protonic integrated circuits. Furthermore, it has a dynamic range exceeding 70 dB in for wavelength dependent loss measurement.

The measurement of optical propagation loss is also possible.

The high resolution and high dynamic range create a unique tool to understand the loses of intricate silicon photonic waveguide devices. The reflection and loss of individual components or sections can be analysed and the propagation loss determined.

User's Voice

Development of the World's First Fully Electronic, Mechanical-Less Beam-Scanning LiDAR



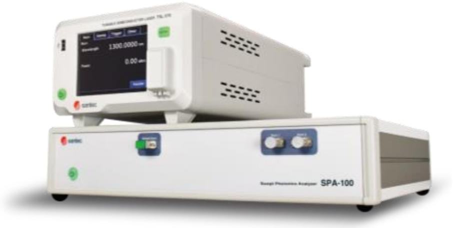
Our research has been focused on "silicon photonics technology" since its early stages. By creating a "photonic crystal" with a precise and periodic nanostructure and allowing light to pass through it, we observed the occurrence of the "slow light phenomenon," wherein the speed of light (group velocity) decelerates. Exploiting this phenomenon, we have successfully developed high-performance optical devices such as modulators, switches and beam scanners. Motivated by these advancements, we shifted our focus to practical applications and directed our attention towards "LiDAR" (Light Detection And Ranging), which is a technology extensively deployed in autonamous cars, robots, drones and similar applications. Historically, these LiDAR devices incorporate mirrors and other mechanical components and as such have been limited by their substantial size. Recognizing the potential of utilizing the slow light phenomenon, I conceptualized the configuration of a LiDAR system. Using silicon photonic waveguides an ultra-compact device comparable in size to a postage stamp could be realized. This innovative approach led to the creation of the world's first fully electronic beam-scanning LiDAR which was demonstrated in real-time.

Our LiDAR chip uses laser light from an external source and transmits it through an optical integrated circuit. Internal optical loss is unavoidable. Minimizing the loss will extend the LiDAR measurement distance of the LiDAR to a practical level. We have successfully used Santec's the SPA-100 to gain a detailed understanding of losses and how they link to the design of our chip.

SPA-100: High Resolution, Wide Dynamic Range, and Excellent Cost Performance

Santec's SPA-100 stands out as an invaluable tool for every silicon photonics researcher and developer. The complexity of optical circuits, often comprising numerous components, creates a huge challenge to pinpoint the exact location of optical loss within the chip. With the SPA-100 a single measurement provides a comprehensive view, revealing details such as the nature of scattered light, optical loss, attenuation and effective length (optical path length).

We have used Santec's wavelength tunable lasers in our laboratory for many years. It was very convenient and cost effective to be able to add the SPA-100 to provide OFDR functionality. While we explored offerings from other companies, the majority of them were lacking in performance and carried hefty price tags. Consequently, we selected the reasonably priced SPA-100. The 5 micron position resolution is a real benefit and well suited to our application. This is a result of the very wide wavelength sweep of Santec's tunable laser compared to products offered by other companies.



Remarkably Swift Measurement Time

Our initial objective was a detailed analysis of optical loss and effective positioning of the fiber for coupling to the LiDAR chip. Notably, the improved efficiency and ease of measurement garnered positive feedback from my researchers. In the typical scenario of directing a laser beam into a chip via an optical fiber, precise adjustment of the optical fiber is imperative. Furthermore, given the necessity for comparative evaluations across multiple devices, the same meticulous adjustments are repeated many time. This requires a high degree of reproducibility of these optical alignment. The SPA-100 accomplishes this with its proximity sensing functionality, providing an accurate measurement of distance between the fiber and chip and eliminating the need for laborious optical alignment procedures. In my estimation, the efficiency of our work has been improved by a factor of between 10 to 100 times.

Realising the Real-Life Implementation of our Research with Santec's Cooperation

As a benefit to society, we aim to implement our LiDAR technology utilizing slow light as rapidly as possible. We would like to improve the performance to a level suitable for integration into self-driving cars. Through collaboration with Santec, our goal is to develop a practical LiDAR chip and introduce it to the world for everyday use.

Contact

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