Application Note
An infrared streak camera

SINGLE QUANTUM
Excellence in photon detection

To simultaneously measure light intensity in the temporal and wavelength axes within the visible light range, streak cameras are commonly employed. These detectors offer ultrafast time resolution, single photon detectivity for high sensitivity, and a broad spectral range (200 - 1600 nm). However, their quantum efficiency declines significantly beyond 1100 nm and they don't cover the mid-infrared (MIR) wavelength regime above 1600 nm.

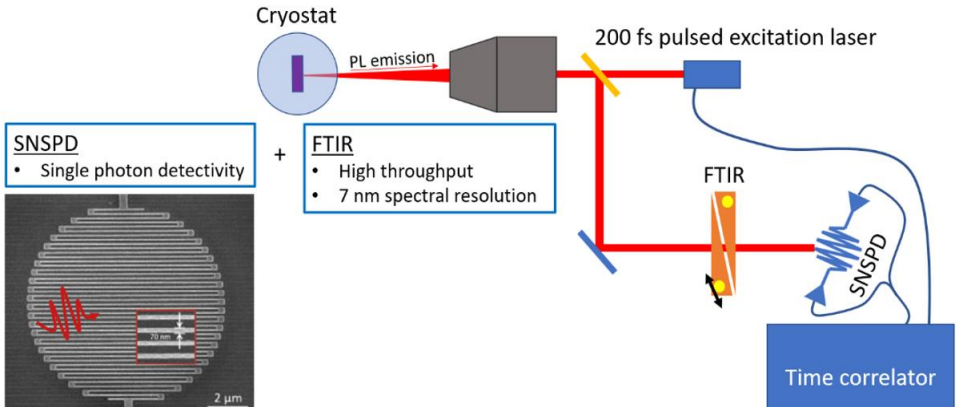

Figure 1: Experimental setup for time-resolved Fourier transform infrared (TR-FTIR) measurement.

Measurement setup

The solution involves pairing a highly sensitive superconducting nanowire single photon detector (SNSPD) from Single Quantum with the Gemini Nireos Fourier transform spectrometer, creating a time-resolved Fourier transform infrared (TR-FTIR) measurement system. This setup offers a wavelength resolution of 7 nm and temporal resolutions of <15 ps, applicable in the MIR. The signal is visualized using the PicoQuant PicoHarp 300 time-correlated single-photon counter.

SNSPDs exhibit >90% quantum efficiency in the 800-1550 nm spectral range, and of up to 35% in the MIR (1600-2300 nm), providing unprecedented sensitivity for time-resolved spectral measurements in the near-infrared. This innovative combination serves not only for measuring weak photoluminescence spectra in the MIR but also functions as an infrared streak camera, enabling the observation of the evolution of a photoluminescence spectrum with time delay.

Results

This system has been used for studying the carrier dynamics in a semiconductor with a bandgap at 2.2 µm. This novel combination has proven to be ideal for studies of the time behavior of the photoluminescence spectrum at a ps time scale or the measurement of the photoluminescence spectrum of a single nanowire.

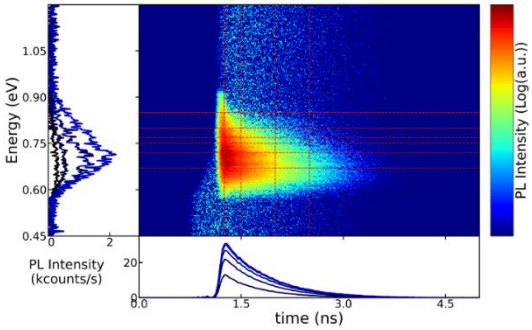

Figure 2: Typical data set obtained by one TR-FTIR measurement. The colored 2-dimensional representation shows the evolution of the measured photoluminescence intensity over time and energy.

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY
NIREOS
PICOQUANT

Visiting address:
Molengraaffsingel 10
2629 JD Delft
The Netherlands

T: +31 (0)15 20 26 140
E: info@singlequantum.com
W: www.singlequantum.com