



Fast laser ranging with telecom components

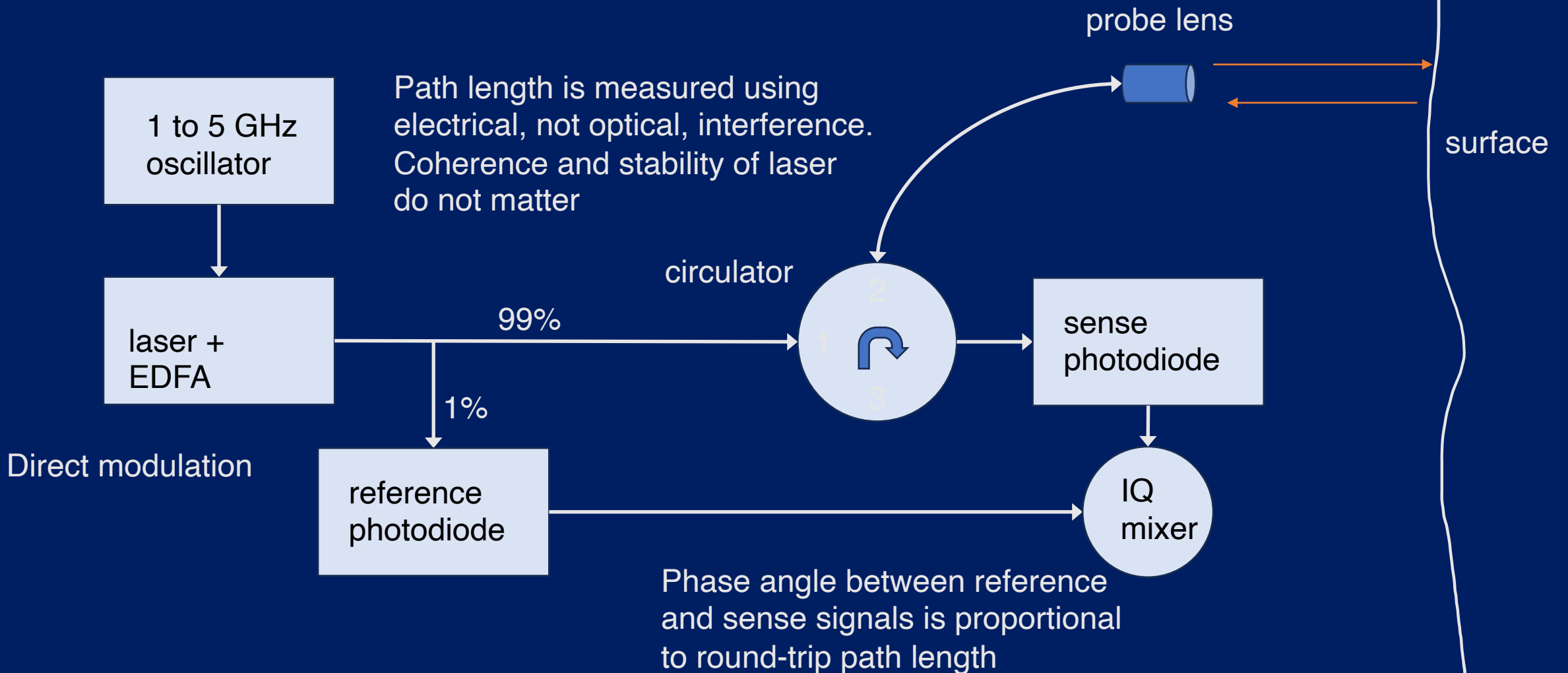
PDV Workshop
May 20, 2026

Paul Munger

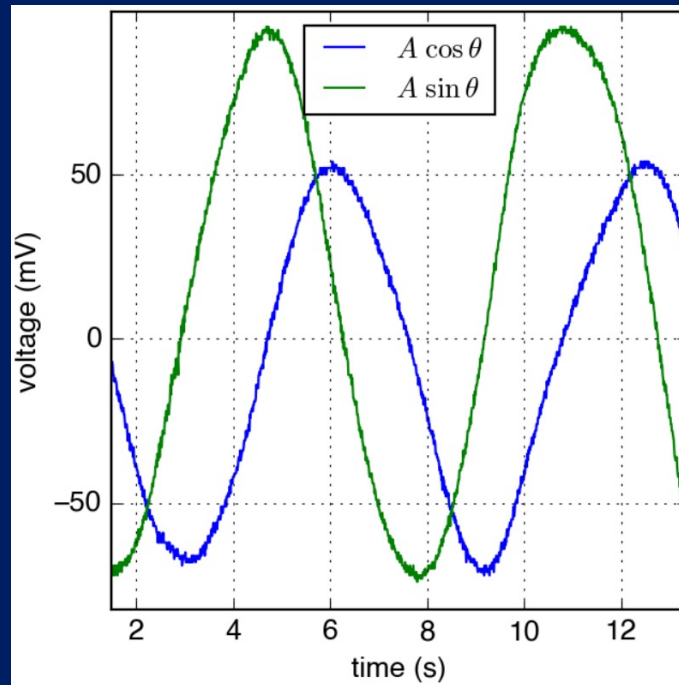
Prepared by LLNL under Contract DE-AC52-07NA27344.



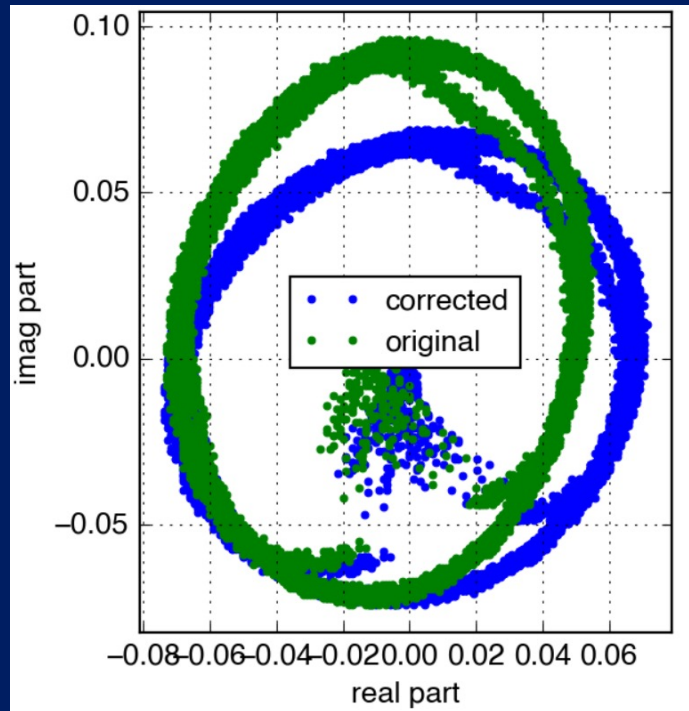
Small and fast LIDAR



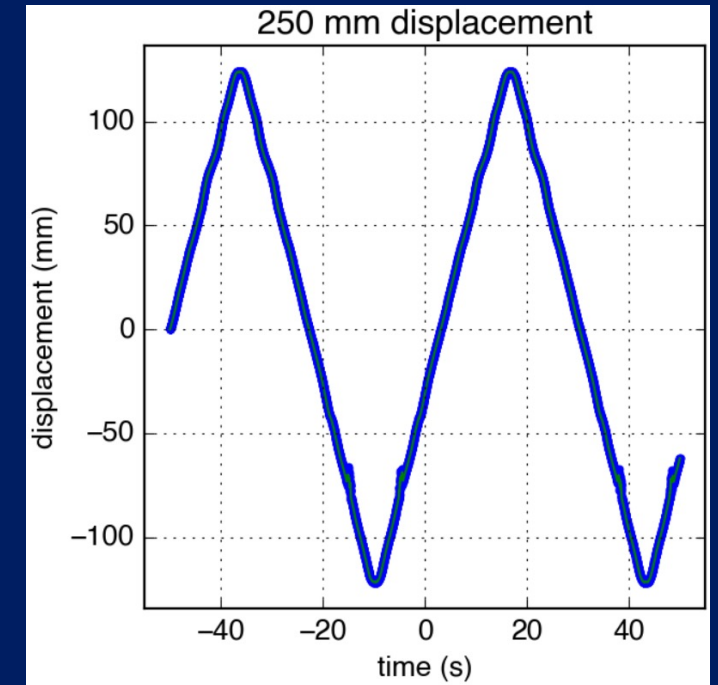
Signals



Output of IQ mixer is a pair of voltages that are the real and imaginary parts of complex sine wave. When modulation is 3 GHz, 360° is 50 mm displacement.



A moving surface traces out a circle in the complex plane. When the reflection is too weak, the angle becomes ambiguous (center dots).



The unwrapped phase is proportional to the displacement. At 3 GHz modulation, $10 \text{ mm}/\mu\text{s} = 72^\circ/\mu\text{s} = 200 \text{ kHz}$. At 100 MHz IQ sample rate, this is $0.0072^\circ/\text{sample}$



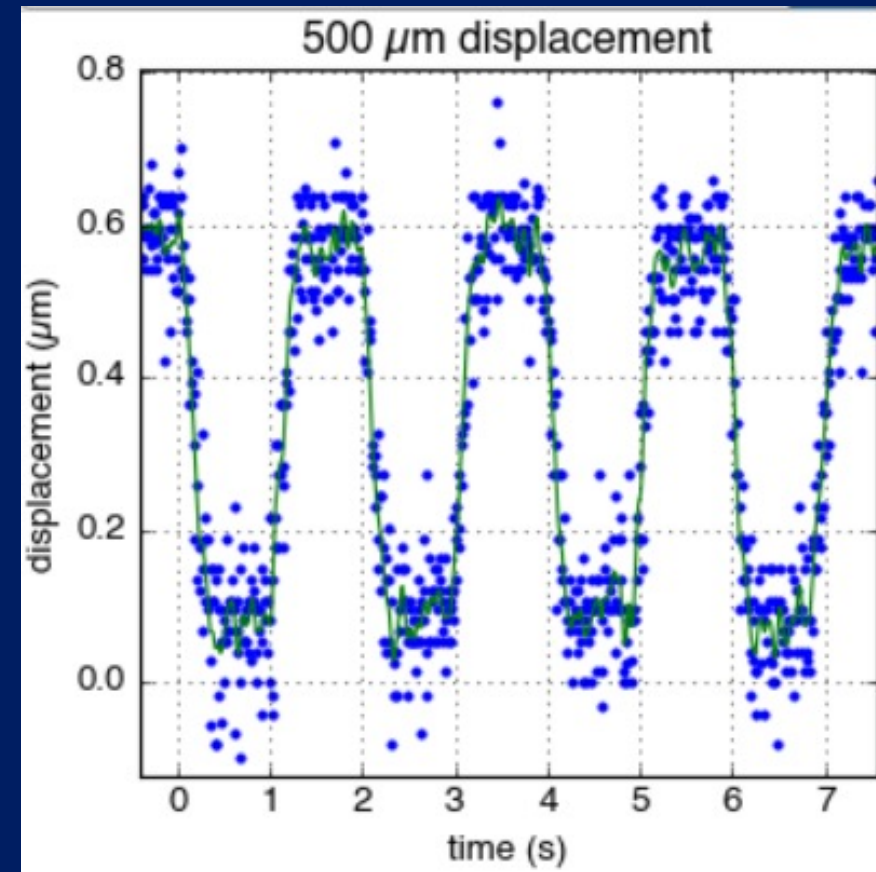
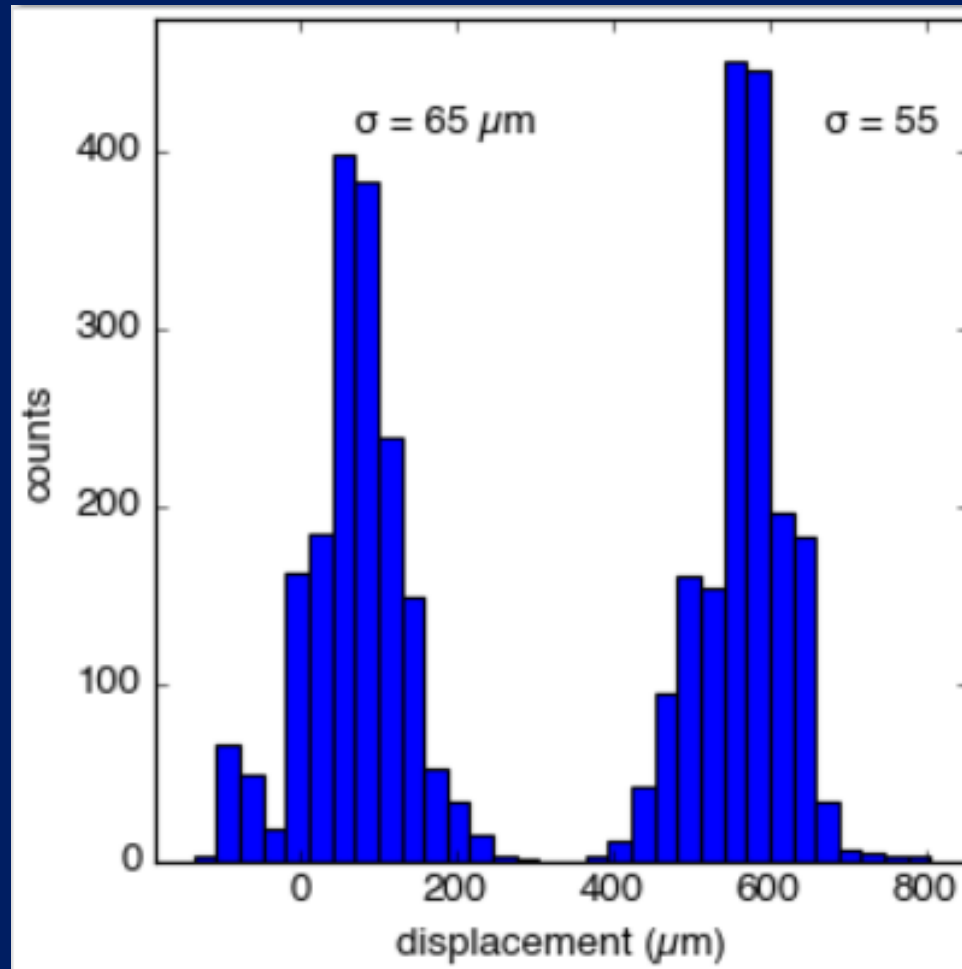
$\sigma < 100 \mu\text{m}$ at 100 MHz bandwidth

Working distance: 30 cm

Power: 60 mW

Laser: 1550 nm Sumimoto electric telecom diode

Modulation: 2.5 GHz direct modulation



Improving the prototype: software-defined radio

