Webinar: Using Fiber Plant as a Distributed Temperature and Strain Sensor

Thank you for joining us. We will begin shortly

NOTE: This presentation includes Q&A. We will be taking questions during the presentation with answers at the end using the questions section of your control panel.

VIAVI Solutions

TRS RenTelco℠
Equipment Now. Service Beyond.

Agenda

- Welcome and Introductions
  - Diane Norwood
- TRS-RenTelco: Test & Measurement Solutions
  - Scott Wrinkle, Regional Sales Director
- VIAVI: Using Fiber Plant as a Distributed Temperature and Strain Sensor
  - Jeremy Davis
- TRS-RenTelco: Equipment & Special Promotions
  - Scott Wrinkle, Regional Sales Director
- Q&A – Joint TRS and VIAVI

We provide comprehensive Test & Measurement solutions delivering equipment-as-a-service.

Plan, acquire, and efficiently utilize instruments to maximize return on investment.

- End-to-end fulfillment from our Dallas, TX headquarters
- 5,000+ configurable models available, valued at over $500MM
- In-House Financing and flexible procurement programs to Rent, Lease, or Buy
- State-of-the-Art 20,000 sq ft Calibration Lab on site
- Same-Day-Shipping with Next Day Delivery Available

Why Do Customers Choose TRS-RenTelco?

Customer Service Excellence

Talk with a **Live Person** when you call

24/7/365 Technical Support

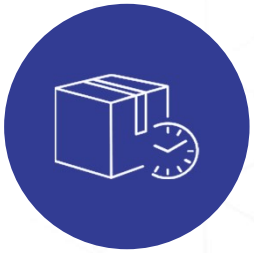
Late-Order processing

Comprehensive Solutions

Customized **In-house Financing**

Deep and wide **Inventory**

Equipment ships **Ready To Use**



Fulfillment Accuracy & Speed

Same-day Shipping

80% of Calibrations Performed In-house

99.72% Customer-Scored Equipment Quality Ranking

Reliable Expertise

Strategic singular focus on the rental market

Top-tier rental partner to all major manufacturers

Financially Secure publicly traded company

VIAVI Solutions

Fiber Sensing

Jeremy Davis
Solutions Engineer

Agenda

- Fiber Sensing Basics
  - DTSS – Brillouin OTDR (B-OTDR) and Applications
    - DTS – Raman OTDR and Applications

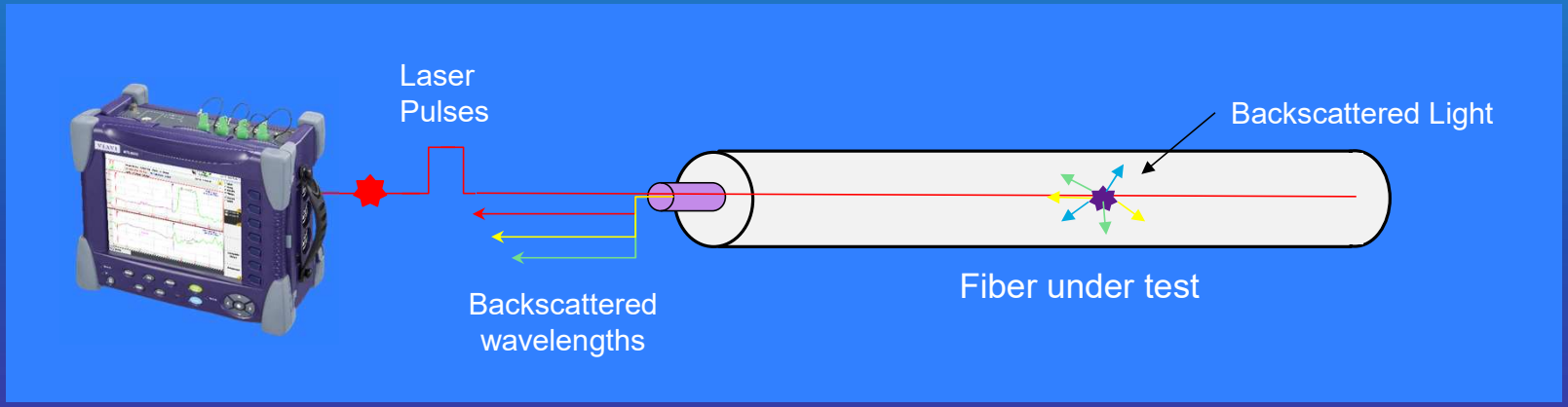
Fiber Sensing Basics

Fiber Sensing Basics 1

- ✓ Converts an optical fiber to thousands of virtual sensors
- ✓ This Technology allows Distributed Temperature and/or Strain measurement
- ✓ Fiber Sensing is compatible with ordinary optical fibers previously installed

Fiber Sensing Basics 2

- VIAVI DTS/DTSS interrogator is a special OTDR
  - A short pulse of light is launched into the fiber.
    - The forward propagating light generates backscattered light at two distinct wavelengths, from all points along the fiber.

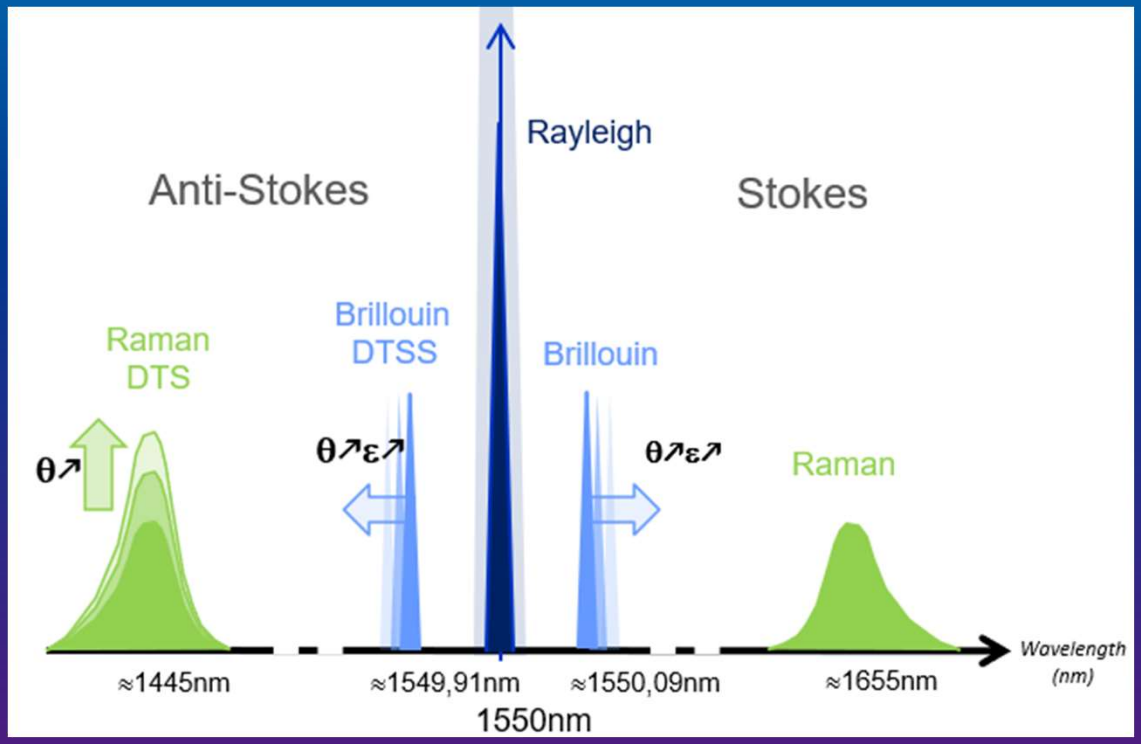


- The wavelengths of the backscattered light are different to that of the forward incident light and are named “Stokes” and “anti-Stokes”.
  - The difference of Stokes and Anti-stokes Brillouin level and frequency is an image of temperature and strain along the fiber.

Fiber Sensing Basics 3

Derived from the **OTDR** using **Direct or Coherent technologies**

- Brillouin Reflection will give Temperature and Strain data (DTSS)
- Raman Reflection will give Temperature Data (DTS)



Fiber Sensing Basics - Summary

- ✓ Can see issues that a regular OTDR cannot detect (proactive testing)
  - ✓ Truly a Distributed Measurement, rather than sensors at different locations
    - ✓ OTDR on one side, far away from sensing area
      - ✓ Fiber sensor doesn't need any electrical sources
        - ✓ Immune to radiation, EMI , ESD , … (optical fiber)
          - ✓ Compatible with ATEX zone (ATmospheres EXplosives).
            - ✓ Compatible with harsh environments (dust, cold, heat…)
              - ✓ Bigger challenge is protecting the fiber

Brillouin OTDR

DTSS
Distributed Temperature and Strain Sensing

DTSS – Brillouin (BOTDR)

The DTSS module comes in two form factors for flexibility in customer applications

DTSS Portable

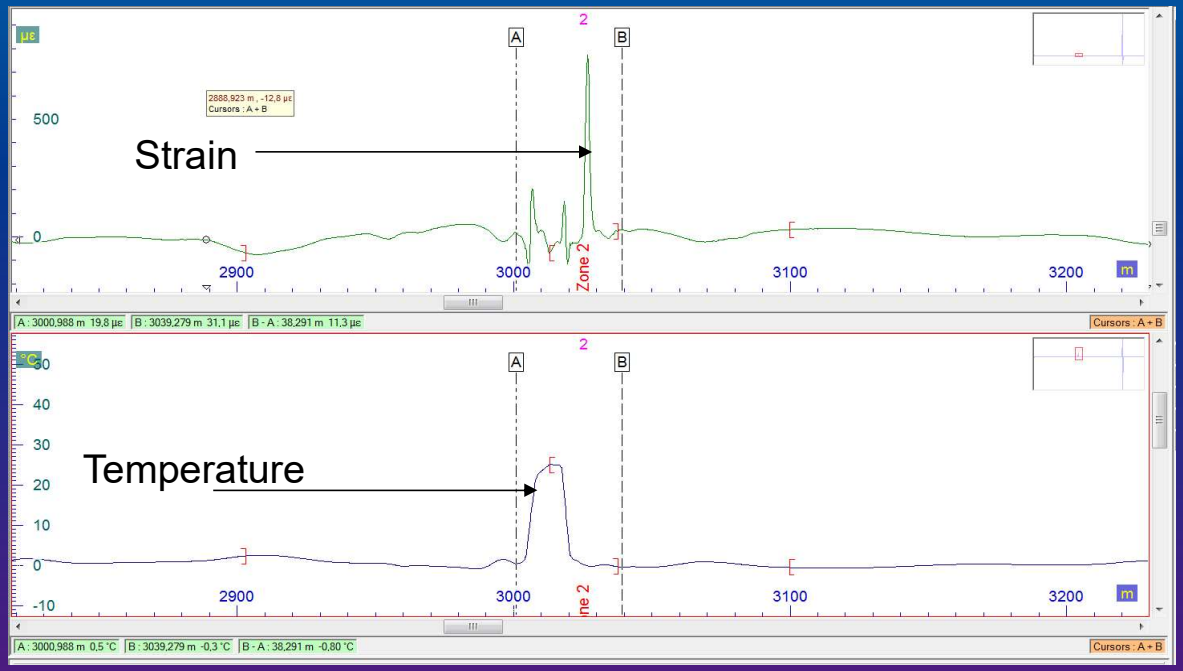
- TBERD 8000 + DTSS OTDR is the only portable DTSS product in the market
- Great for maintaining / troubleshooting large, distributed fiber networks

DTSS Rack Mount

- The DTSS module can be rack mounted in the FTH9000 (or OTU8000)
- For long term, more permanent monitoring
- Remote access for testing and reporting via a LAN or Internet connection

Why is the Viavi DTSS Module Unique?

- *80km range – very good fit for telecom plant testing*
  - *2 tests in one - Both Temperature and Strain from a single measurement*
    - *Portability and ruggedness*



DTSS Distributed Fiber Optic Sensing: DTSS Application

Typical Applications

- **Temperature Variation (TV)** – track TV to detect hot spots, icing or power leakage
  - **Strain Analysis** - analyze strain to detect ground movement, seismic activity, impact and structure
    - **Fiber Degradation** – find overstressed cables before they are an issue

Oil & Gas

- Fatigue monitoring.
- Leaks and flow lines blockage
- Reservoir monitoring
- Thermal oil recovery

Pipeline

- Leak detection
- Ground movement monitoring

Power Cable

- Hot spot detection and localization
- Ampacity (Real Time Thermal rating..)
- Smart Grid

Telecom Cables

- Buried fiber optic cables monitoring
- Aerial Cable monitoring
- Overstressed fiber ident
- Fiber aging

SHM
(Structural Health Monitoring)

- Crack detection
- Infrastructure mgmt & design
- Dam, Dike
- Seismic areas

Telecom Use Case

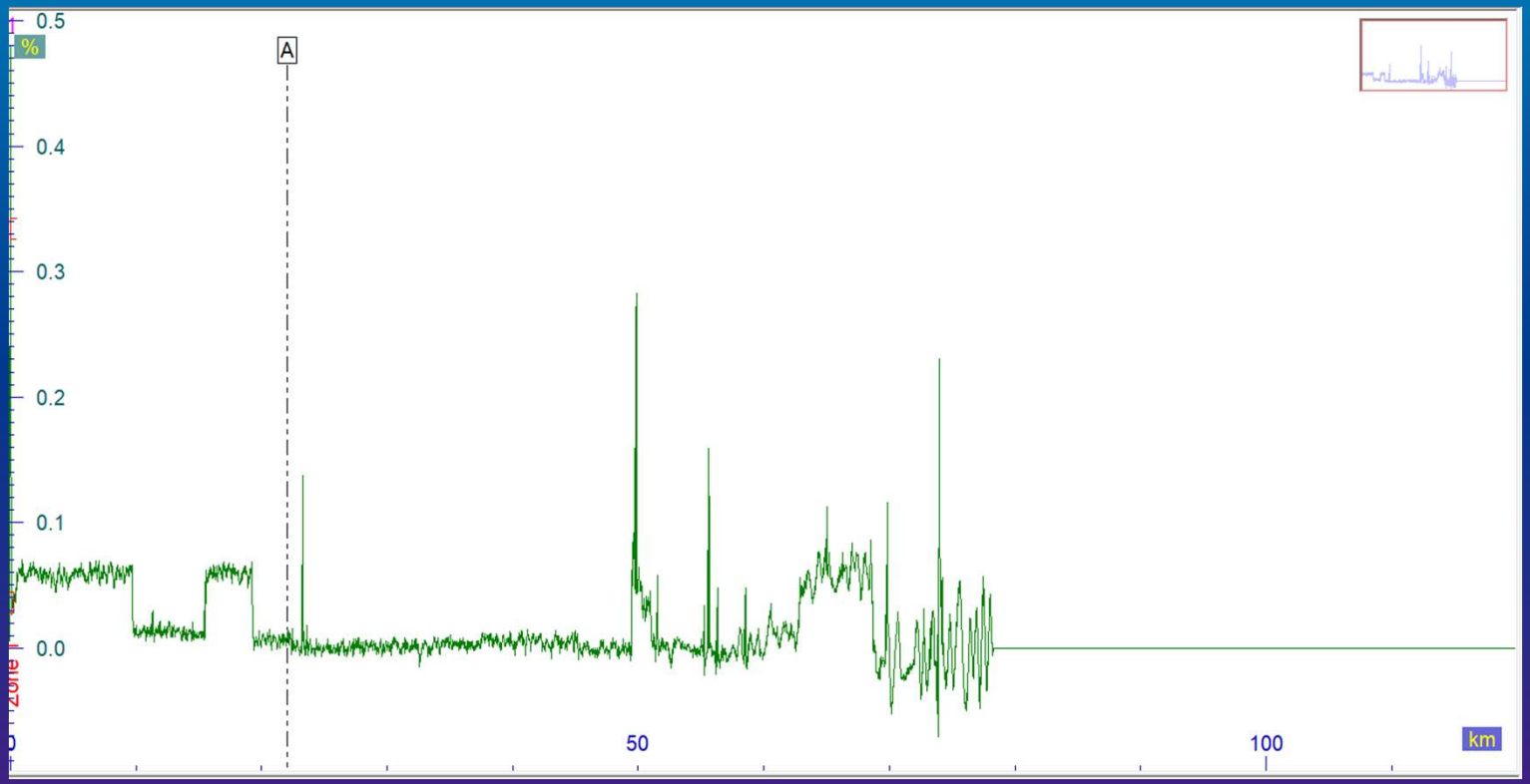
- Aerial Fiber in a cold environment subjected to ice loads each winter
- OTDR monitoring would show faults when ice present, but return back to normal after ice melts
- B-OTDR shows residual (lasting) strain that makes the fiber more susceptible to normal fiber losses

Rayleigh OTDR

B-OTDR

How do I know if there is too much strain?

- *Above .20% is the tipping point*



Raman OTDR

DTS
Distributed Temperature Sensing

Raman OTDR (DTS)

- The DTS OTDR performs two unique functions – OTDR and Distributed Temperature Sensing
- The DTS module is a full functioning 1550 and 1625nm Rayleigh OTDR
- The DTS OTDR can test long fiber distances, up to 80km

DTS Module

OneAdvisor 800

- OneAdvisor 800 + DTS OTDR is the 1st ruggedized, lightweight, battery powered portable DTS and OTDR

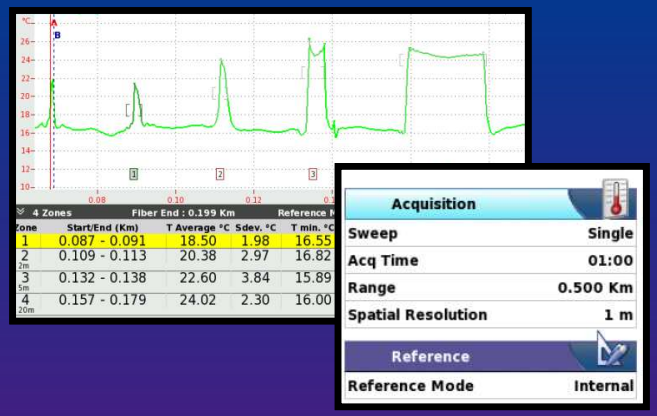
FTH9000

- DTS can be rack mounted in the FTH9000 (or OTU8000) for long term or remote access testing

DTS – One Module, Two Functions

1. **OTDR Measurement**
   - The DTS module performs a Rayleigh OTDR measurement which will show the quality of the fiber (loss, connectors, splices, etc), determine the fiber length, detect fiber bends and automatically set up acquisition range and section.
   - No expertise needed – ‘Auto’ mode will configure OTDR test parameters automatically.

2. **Temperature Measurement**
   - Making a distributed temperature test is easy.
   - Select DTS Mode, enter your desired test time (Acq Time) and desired resolution (Spatial Resolution), press ‘START’.
   - Your temperature trace will appear immediately and smooth over the acquisition period.



DTS Module - Use Cases

Applications

Radiation and temperature monitoring

- Harsh environment

Strucutral Health Monitoring

- Dam, Dike monitoring

Pipeline monitoring

- Leak detection

Power Cable Monitoring

- Hot spot detection and localization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Questions?

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