

**BT Group**



# Opportunities and Challenges for Optical Sensing in F5G



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14:00-16:30 Sunday, 1<sup>st</sup> October 2023, M2-M4

# 5th-Generation Fixed Network (F5G)

- 2022, ETSI released the F5G-Advanced white paper
- One area of focus was network transformation, including: digitization of network operations, smart infrastructures, green technologies and carbon emission reduction
- Optical sensing technologies can benefit all of these...



# F5G Sensing Use Cases



**Digitization of network operations:** Accurate, pertinent and live data (Digital Twin)

--> Example: Sensing tells why a signal is low, not just it is low

**Smart infrastructures:** New revenue & protection of assets

--> Example: Sensing that infrastructure has been accessed / damaged

**Green Technologies:** Enable green operations outside of our infrastructure

--> Example: Detecting faults on other utilities

**Carbon Emission Reduction:** Accurate field operations

--> Example: the right person to the right place at the right time



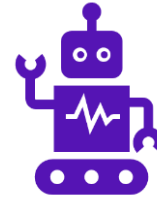
# Many Challenges...



Installed infrastructure



Competing “just good enough” technology or processes



Operations, what more information?!



Deployment Cost < Revenue / Savings

Lets concentrate on cost of deployment

# Cost

- DAS is optically and operationally complex
- At current cost points, **Deployment Cost > Revenue / Savings** for many (not all!) telco use
- What else can we use?
  - Opportunity in **State Of Polarisation (SOP)** sensing
  - SOP is almost free, if extracted from our coherent transceivers
  - Big drawback? An aggregated result, no location data, so what can we use it for?

## ECOC 2022 Paper

### Continuous Fiber Sensing over Field-Deployed Metro Link using Real-Time Coherent Transceiver and DAS

Mikael Mazur<sup>(1)</sup>, Neil Parkin<sup>(2)</sup>, Roland Ryf<sup>(1)</sup>, Asif Iqbal<sup>(2)</sup>, Paul Wright<sup>(2)</sup>, Kristan Farrow<sup>(2)</sup>, Nicolas K. Fontaine<sup>(1)</sup>, Erik Börjeson<sup>(3)</sup>, K.W. Kim<sup>(1)</sup>, Lauren Dallachiesa<sup>(1)</sup>, Haoshuo Chen<sup>(1)</sup>, Per Larsson-Edefors<sup>(3)</sup>, Andrew Lord<sup>(2)</sup> and David Neilson<sup>(1)</sup>

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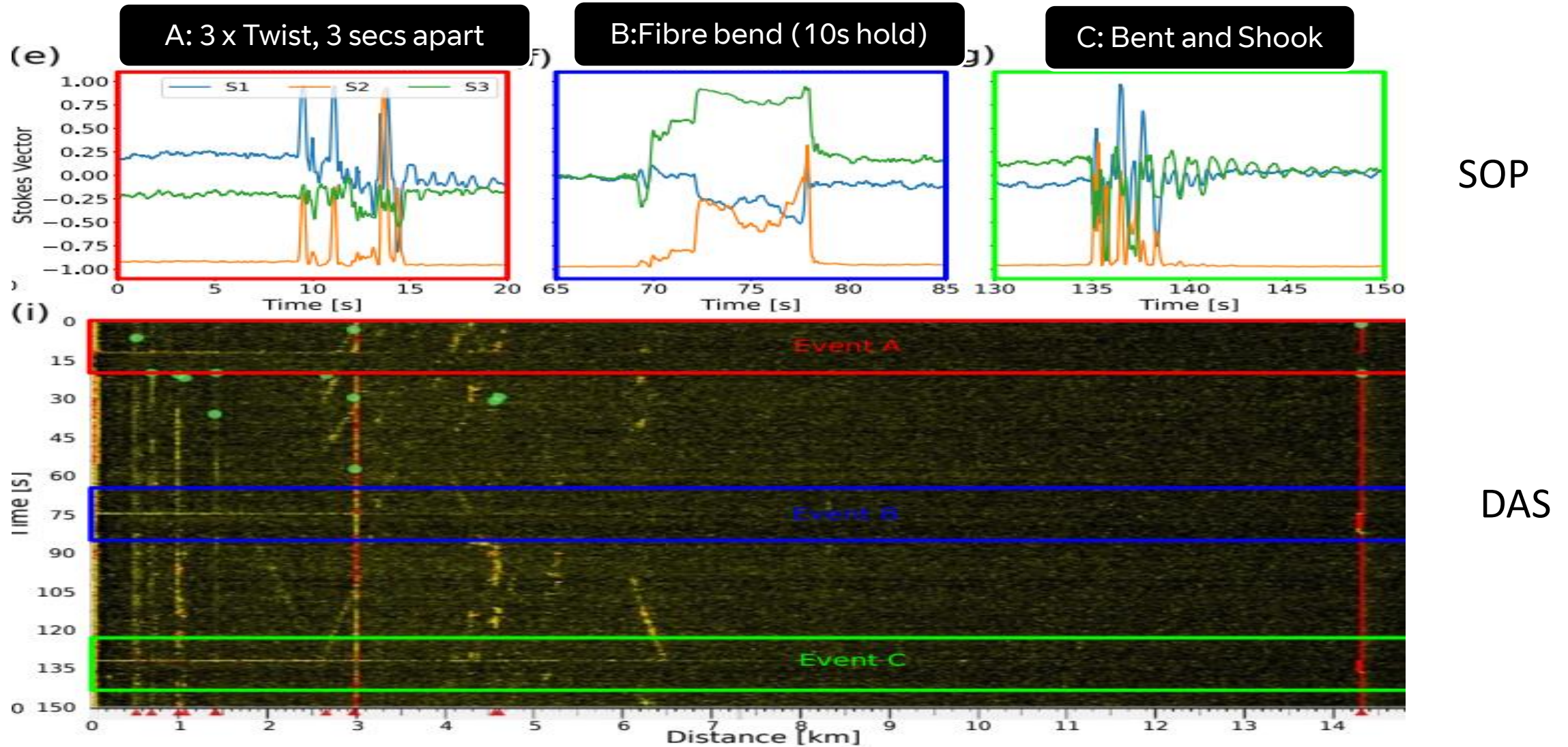
<sup>(2)</sup> BT Research, Adastral Park, Ipswich, IP5 3RE, United Kingdom, [neil.parkin@bt.com](mailto:neil.parkin@bt.com)

<sup>(3)</sup> Department of Computer Science and Engineering, Chalmers University of Technology, Sweden

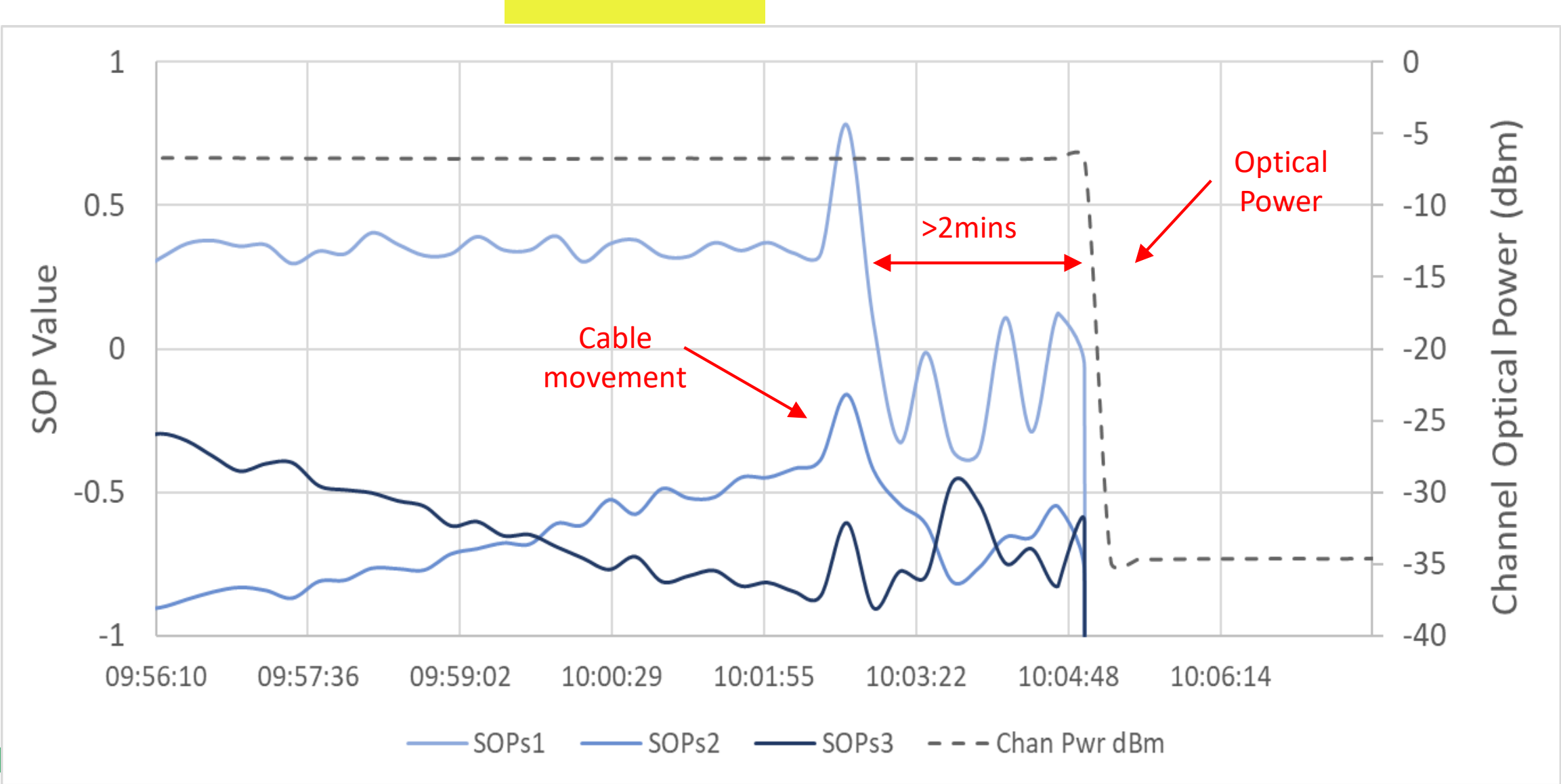
**Abstract** We use an FPGA-based real-time coherent transceiver prototype with continuous  $\mu$ s-level state-of-polarization readouts and a commercial DAS system to perform fiber sensing. Link monitoring and active detection of link tampering is demonstrated using both systems, showing how SOP-based sensing complements DAS in metro environments. ©2022 The Author(s)

# Example BT & Nokia (Bell Labs) Work

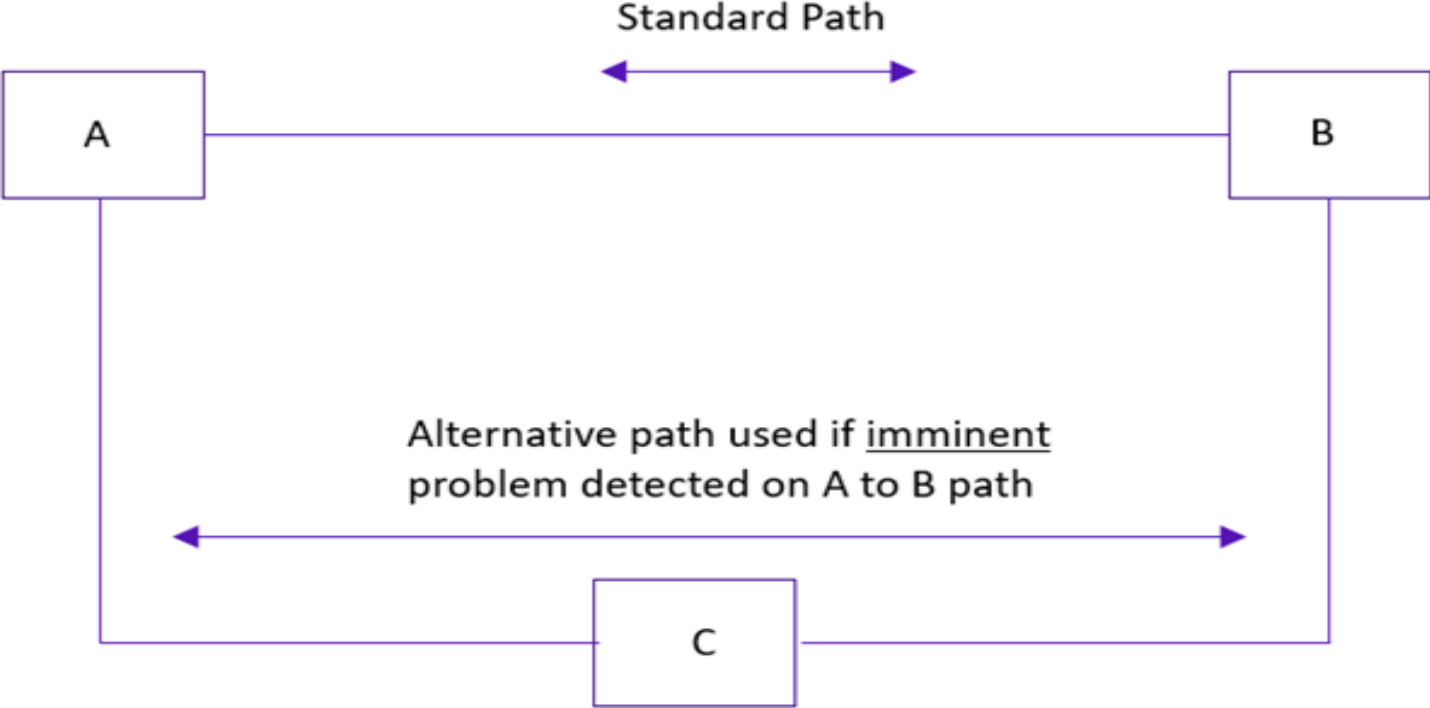
This work proved that useful information at low cost could be gained, location is not always needed!



# Real World...Link Down...SOP Warning!

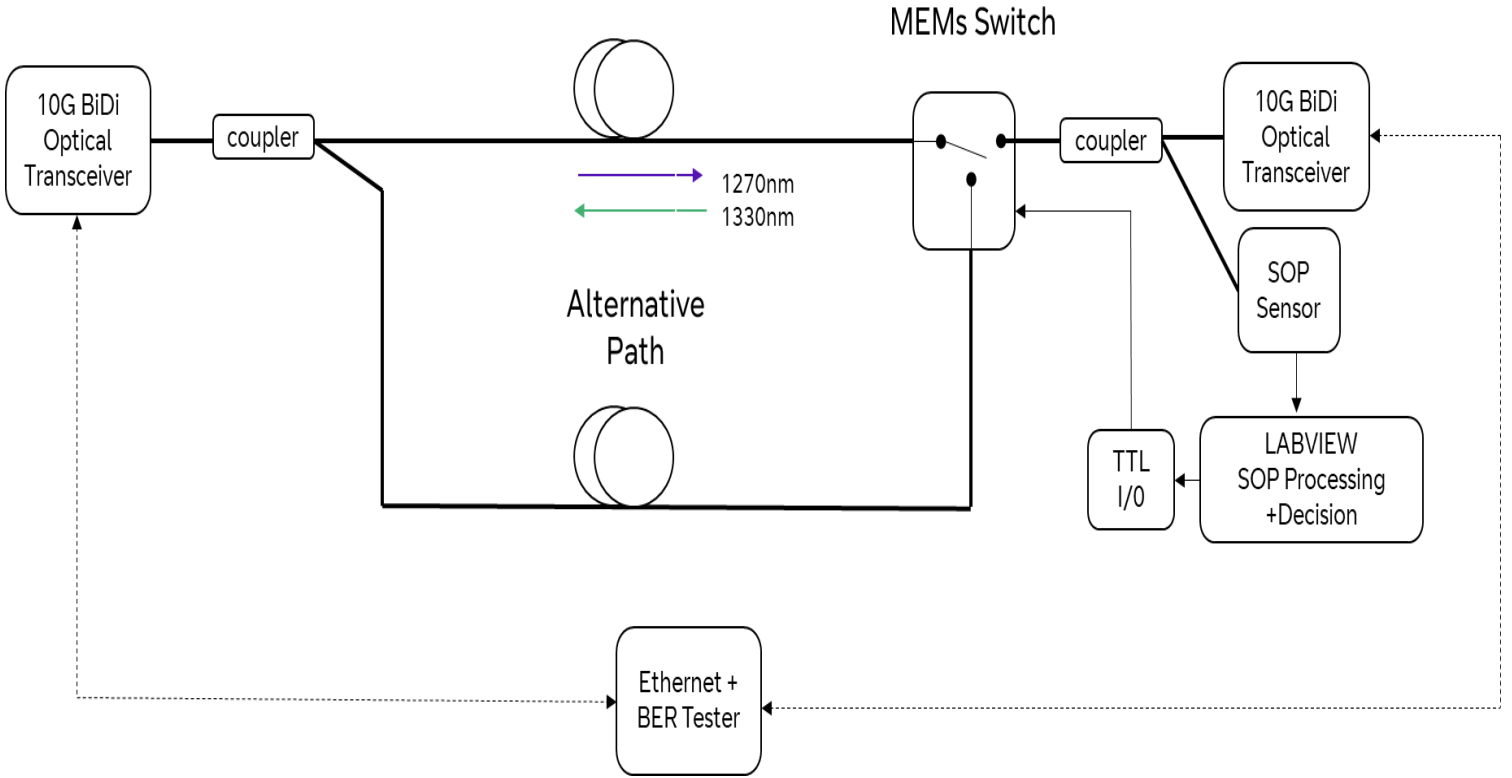


# Use for Path Protection, Protect Customers Data

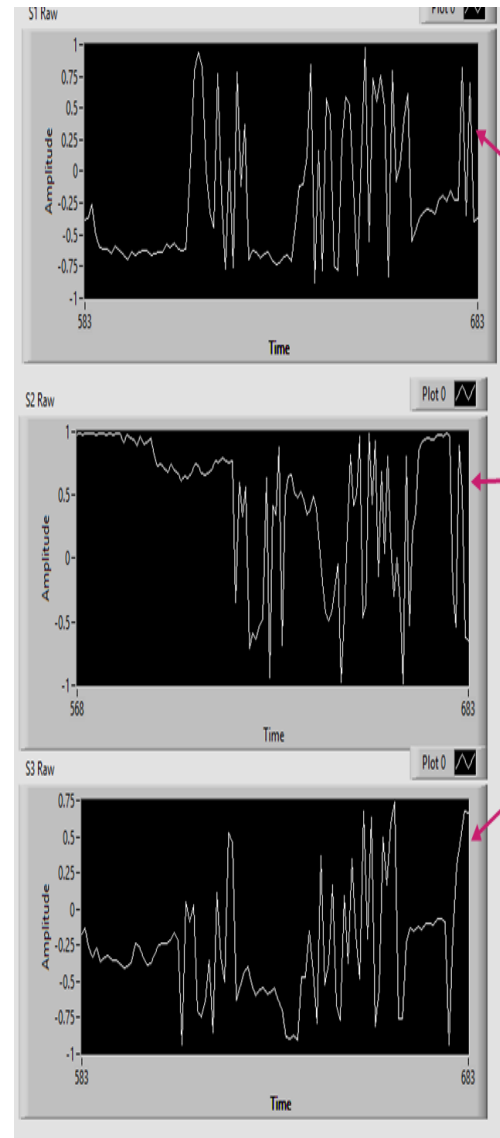




# BT Lab Tests



Setup for SOP based protection switching



Triggered on these peaks

States of Polarisation

# Conclusion

- Sensing can help in almost every facet of the 5<sup>th</sup> Generation Fixed Network
- Cost will always be a major challenge of any “new” Technology
- Fibre sensing doesn’t always have to mean DAS
- SOP based sensing could offer a low-cost route for “network defence”