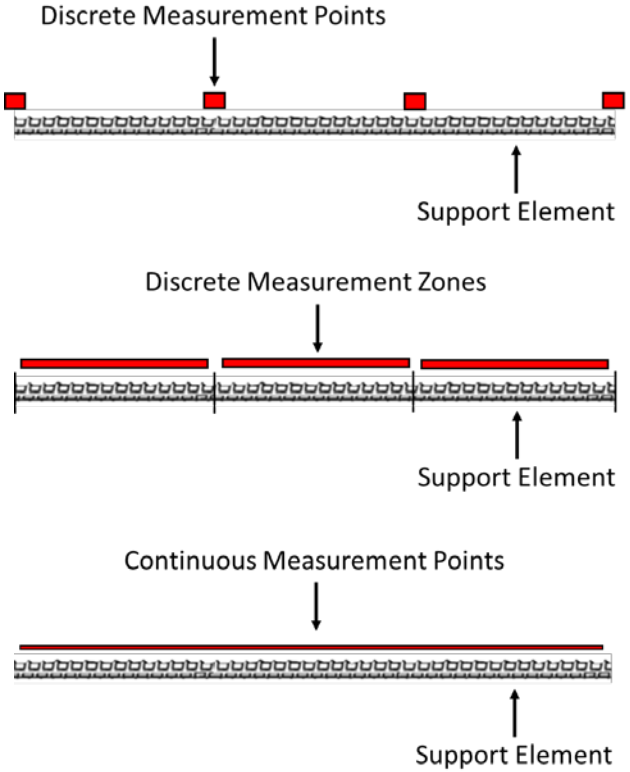
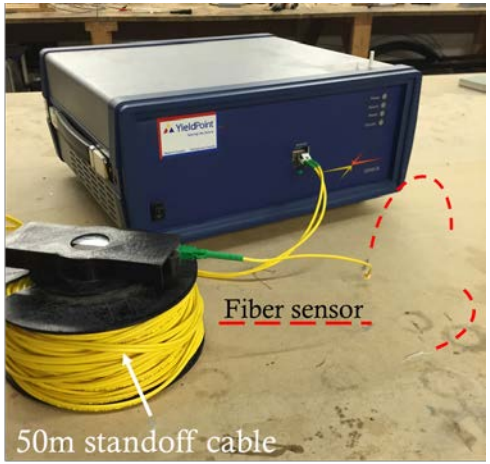
Discrete Versus Continuous Monitoring



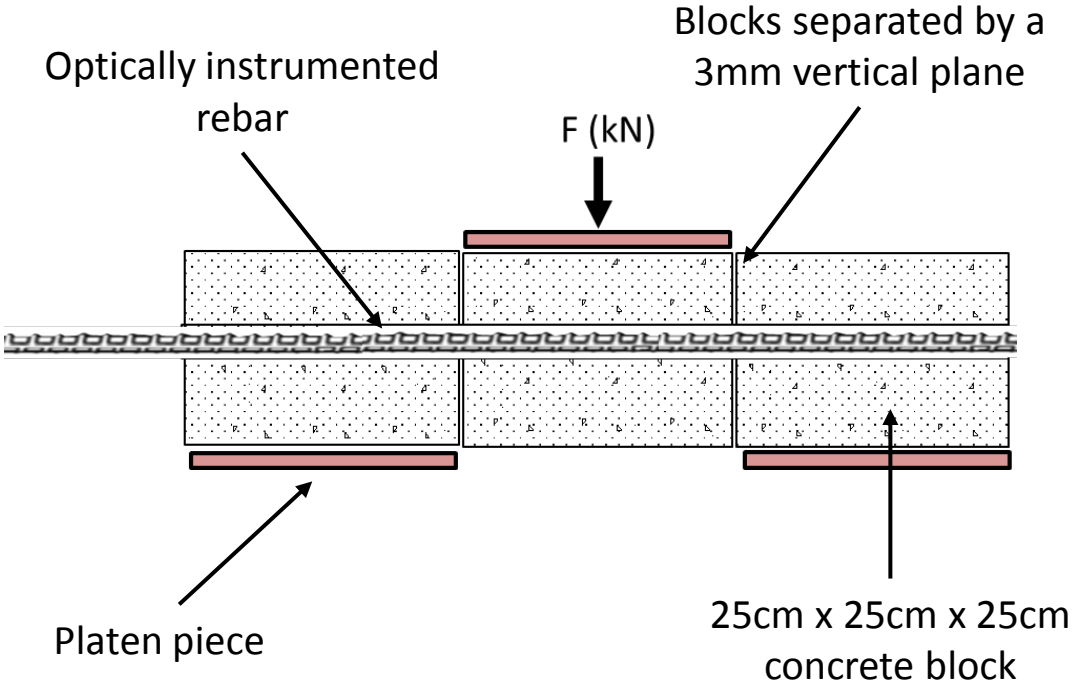


Distributed optical sensing (DOS):

- Standard, low-cost optical fiber (therefore, EM immune, low-shift/degradation)
- Sub-centimeter spatial resolution (one optical sensor provide what is equivalent to thousands of individual discrete sensors)
- Removes uncertainty regarding support loading (and ground deformation)

Is Continuous Monitoring Necessary?

Double shear test example



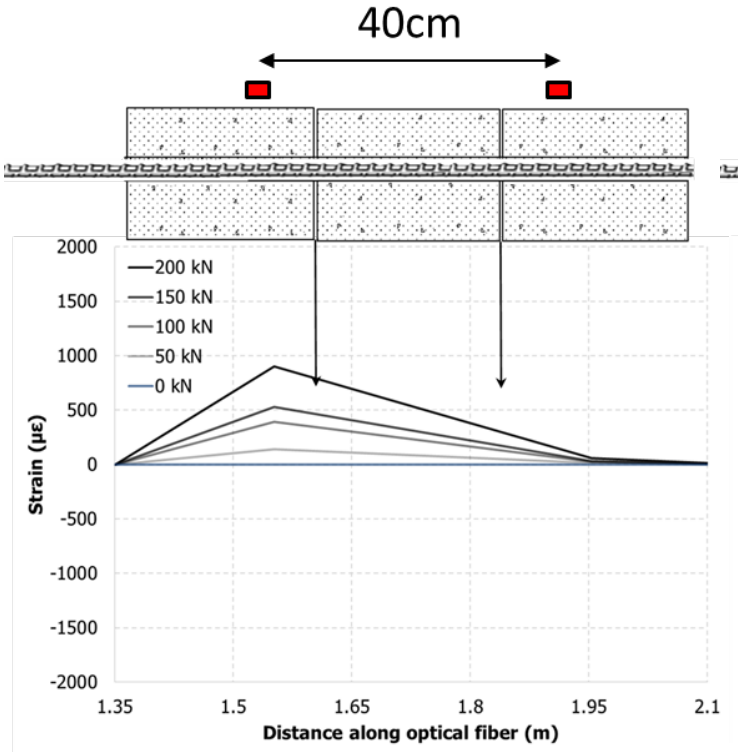
Shear Loading Response: Rebar

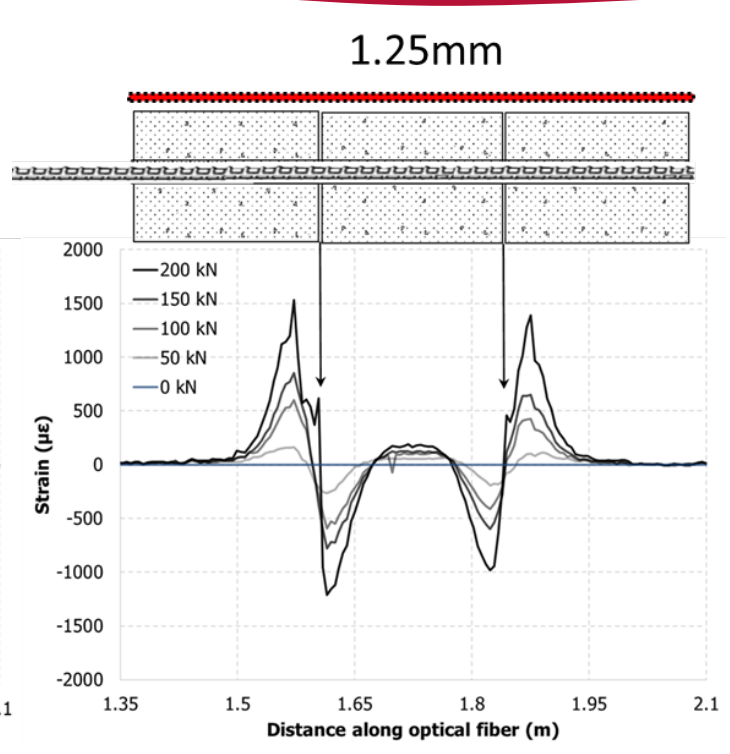
The following plots are experimental strain profiles along the top length of a rebar subjected to varying double shear deformations (displacement of a the central concrete block.

The left figure presents interpolated strain profiles from measurements of two foil strain gauges separated by 40cm.

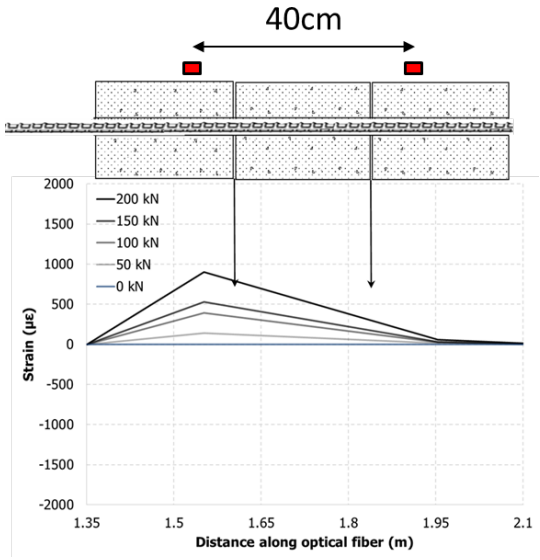
The right figure presents strain profiles captured using DOS with measurements spaced every 1.25mm.

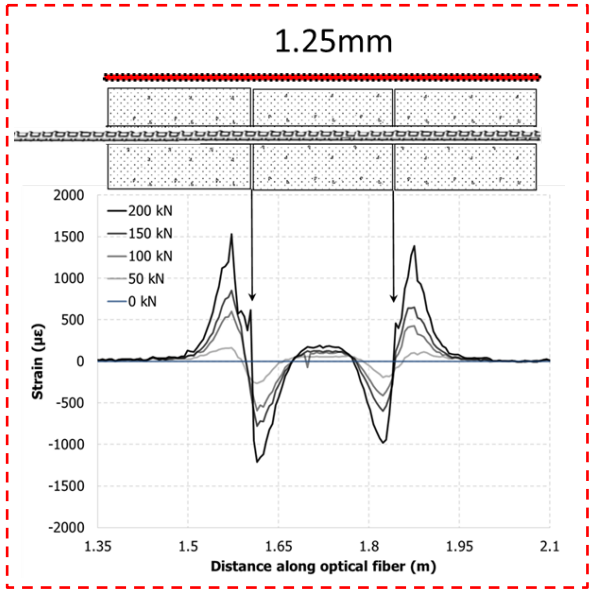
The following two slides present a demonstration of the unparalleled interpretation of measurements that can be provided with DOS

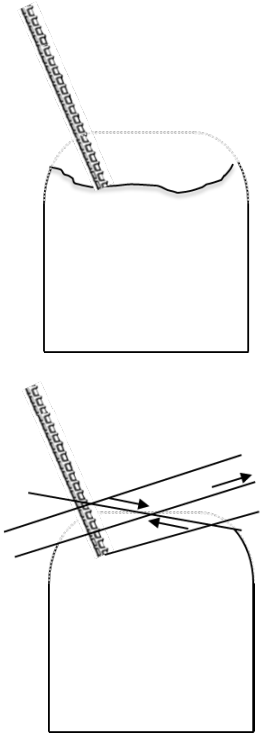


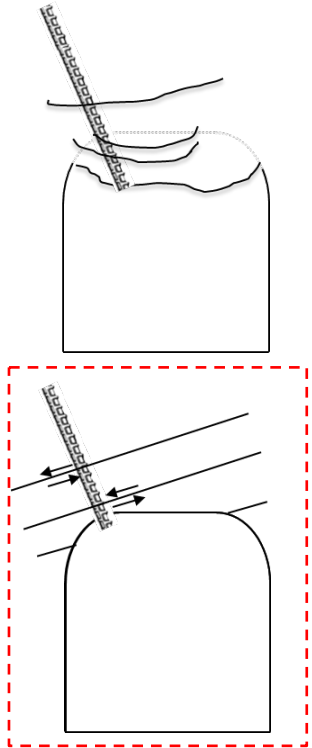


Shear Loading Response: Rebar



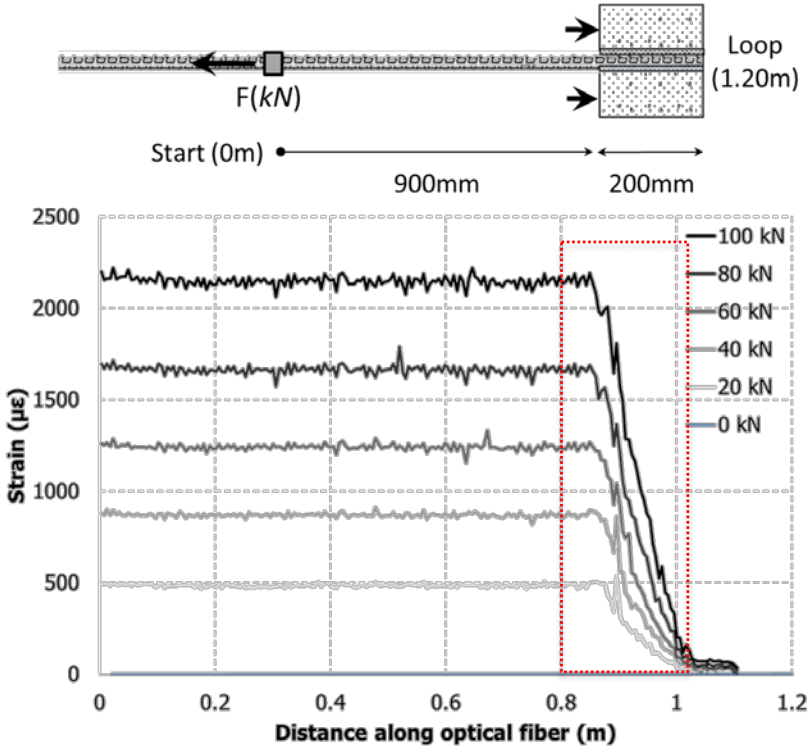


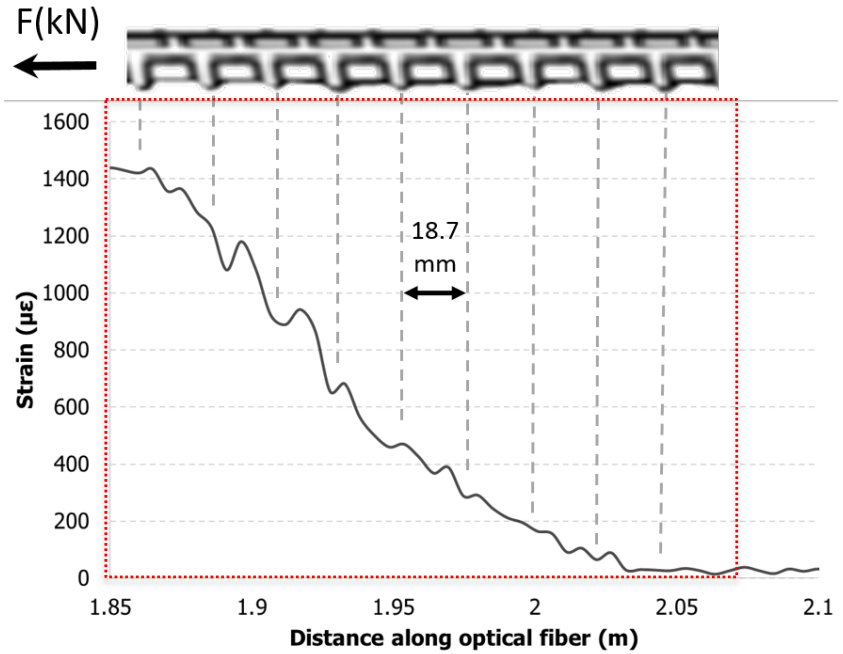




Discrete solution vs. Continuous solution

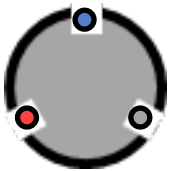
Axial Response: Small Strain Analysis





Three-Dimensional Load/Deformation Sensing

0 deg



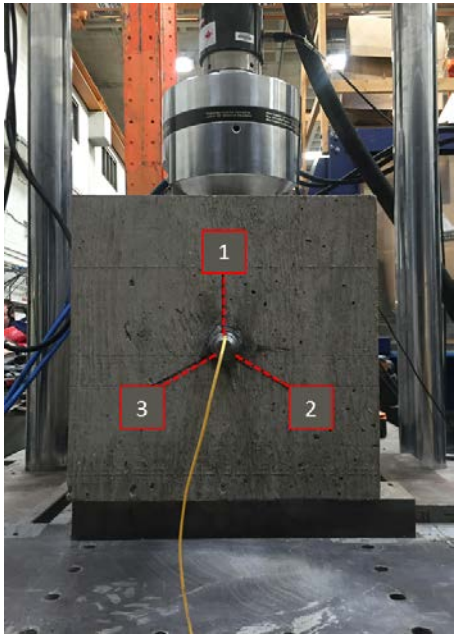
240 deg

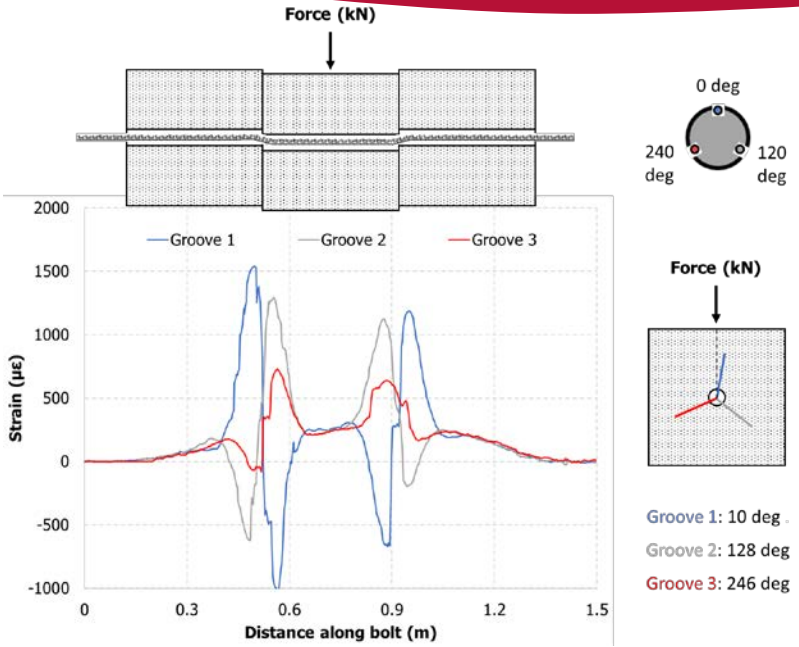
120 deg

Optical sensor at three orientations to capture 3D tensor

This allows for the derivation of strain into <u>axial</u> and <u>lateral</u> components as well as the determination of load/movement <u>direction</u>

Orientation of optical sensing lengths along a rebar subject to double shear displacement





Magnitude of strain captured along each sensing length of the bolt. Also shown is the derived direction of applied load (this can be performed over the full length of the specimen)