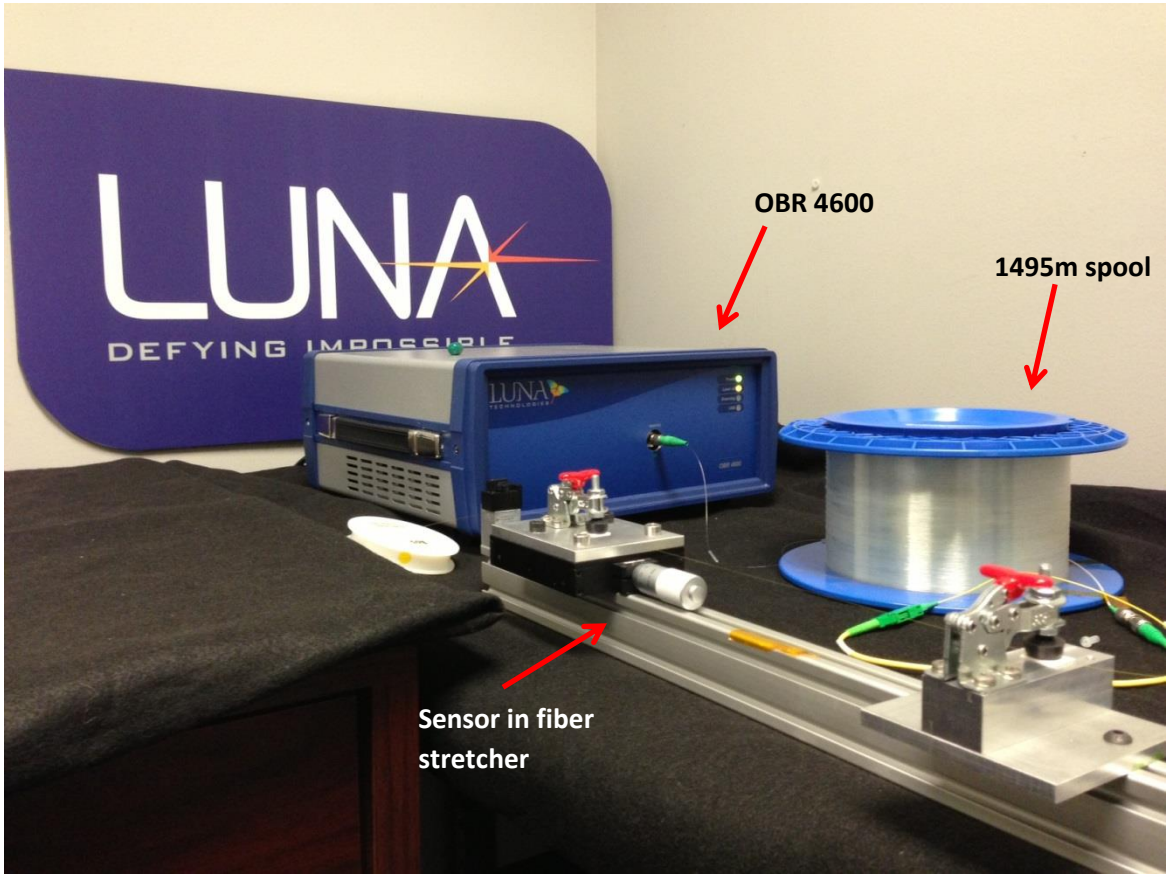
OBR4600:
Extended Range Strain Sensing

LUNA

LUNA | Setup

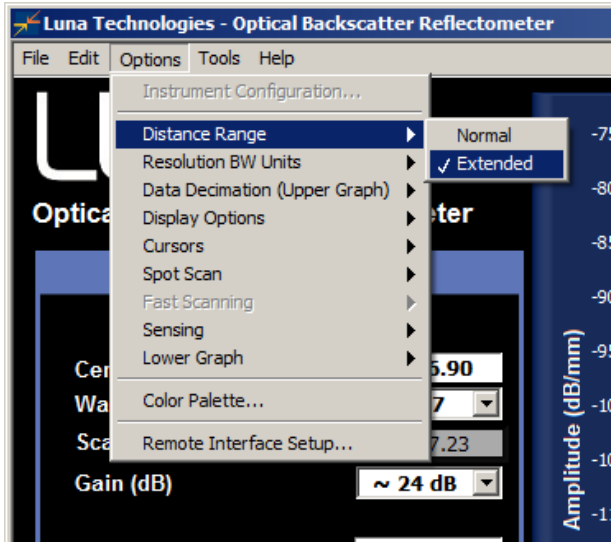
- OBR 4600 connected to a spool of ~1495m fiber which is then connected to a 2m sensor in a fiber stretcher

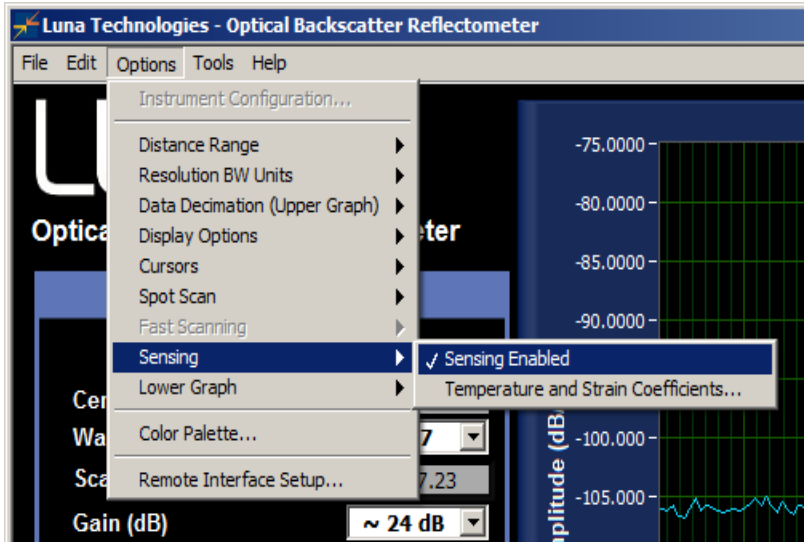


LUNA | Step 1

After powering on OBR, aligning optics, and calibrating:

- Turn on Extended Range mode – enables measurements up to 2km
- Then Enable Sensing – enables capability for strain/temperature sensing





LUNA | Extended Range

- Sensing plus Extended Range Mode extends strain and temperature measurement capability up to a range of 2km for applications located in a benign vibration environment

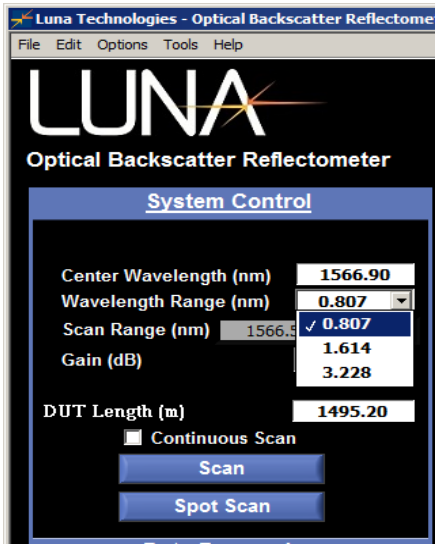
- In Extended Range Mode, Wavelength Range is set by the software, depending on the resolution set by the user in 'Instrument Configuration'
  - i.e. 0.4nm or 0.8nm wavelength range

- Spatial resolution will go down when operating in the Extended Range mode due to the shorter wavelength ranges discussed above
  (See the OBR 4600 Specifications Sheet for details.)

- Spot Scan adds benefit in Extended Range by allowing options for longer wavelength ranges (1.6nm and 3.2nm) which results in higher spatial resolution and strain/temp range

LUNA | Step 2

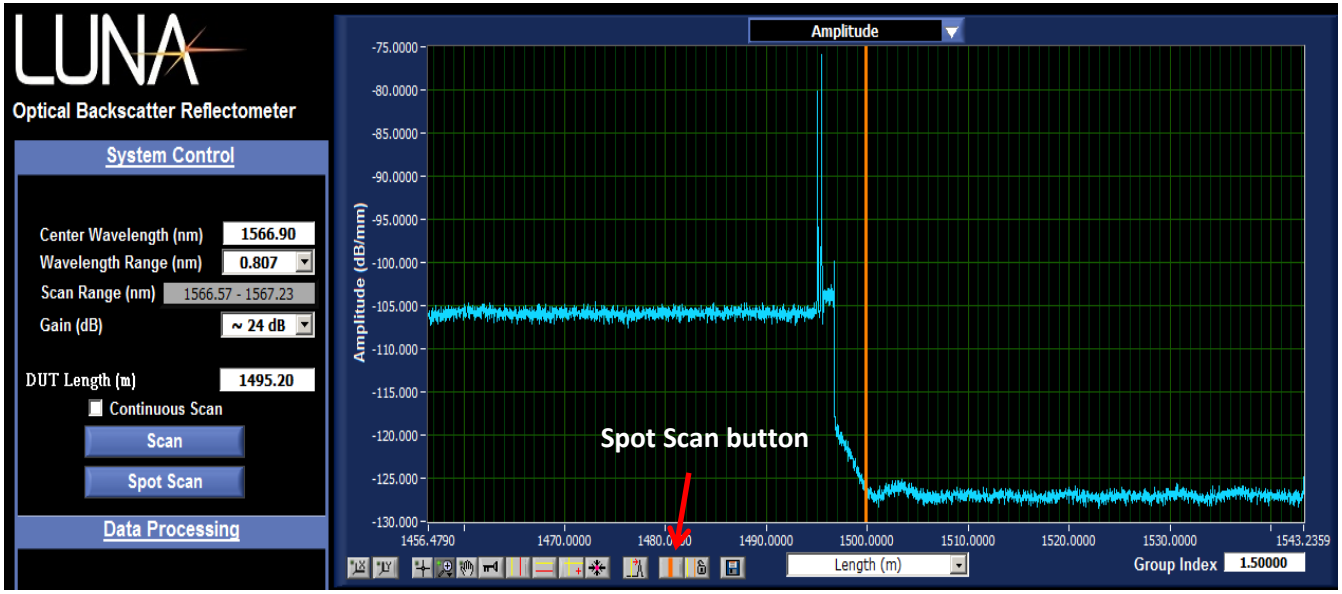
- Enter the Device Under Test (DUT) Length
  - DUT Length should be set to the approximate location of interest for strain/temperature sensing along the fiber
    - i.e. If interested in measuring strain halfway through a 2km spool, DUT Length should be set to 1000m
  - When measuring near the end of the range of DUT Length, it is important to enter an accurate DUT Length, ±20m. At the beginning of the Distance Range, accuracy within 100 meters is sufficient.



In this example, DUT Length is set to 1495m because we are interested in measuring strain along the sensor in the fiber stretcher attached at the end of the 1495m spool

LUNA | Step 3

- Click ‘Scan’ to take measurement
- Then enable Spot Scan option by clicking button below graph with orange vertical line icon.



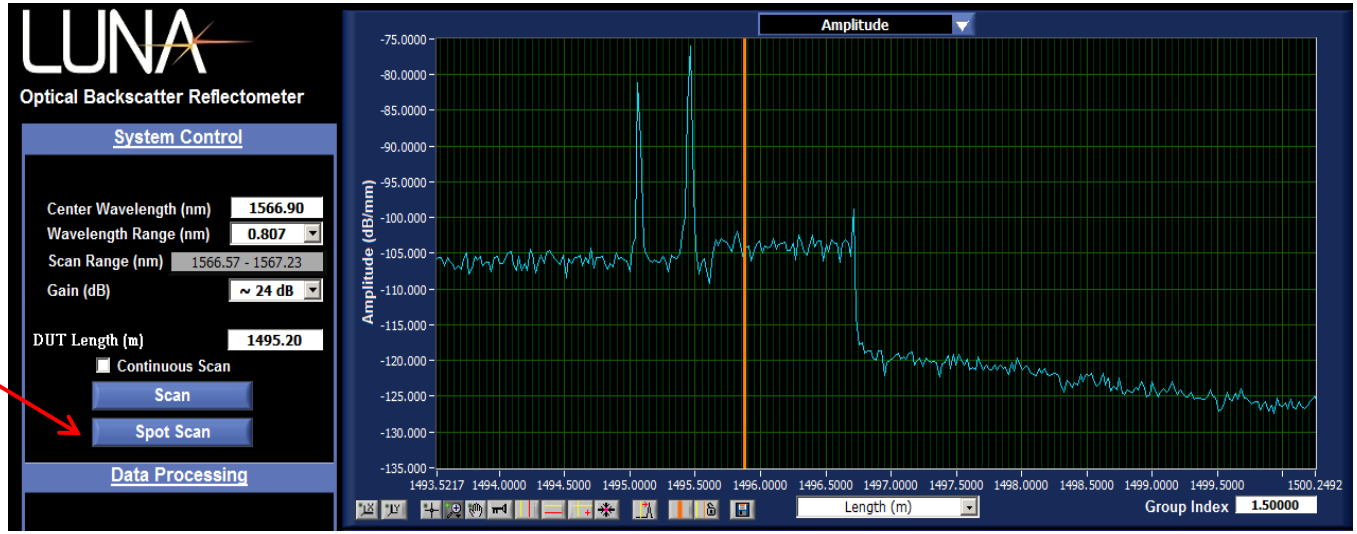
LUNA | Spot Scan

- What is Spot Scan?
  - Spot Scan mode allows user to scan a shorter region of the DUT
    - In Normal Mode: 1 or 2 meters of length centered at vertical orange line
    - In Extended Range Mode: 80 meters of length centered at vertical orange line
  - Allows for shorter measurement times and smaller data files. Spot Scans may be performed in both the Single Scan and Continuous Scan modes, at default or user-set scanning speeds
  - In extended range mode, Spot Scan is useful because shorter region (80 meters) results in faster scan times than a full scan
  - See pg. 44 of OBR 4600 User Guide for details on Spot Scan

LUNA | Step 4

- Next, zoom into area of interest
- In this example, we are interested in the attached sensor in the fiber stretcher after the long fiber spool

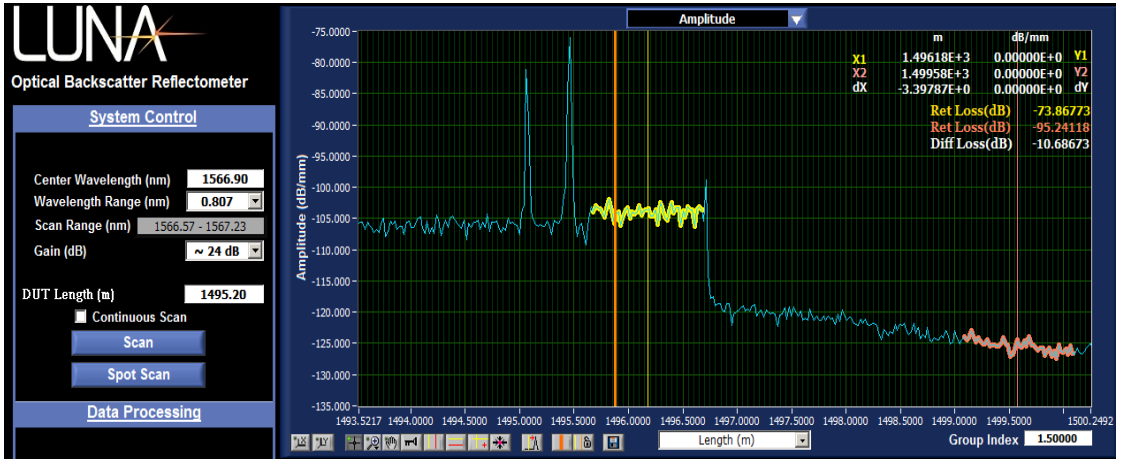
Spot Scan results in a 80m scan centered around orange vertical line



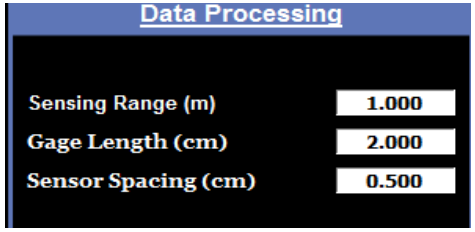
- After zooming in, move your spot scan line to around your strain sensing region of interest and click the Spot Scan button to rescan

LUNA | Step 5

- Enable vertical cursors and highlight area of interest for sensing

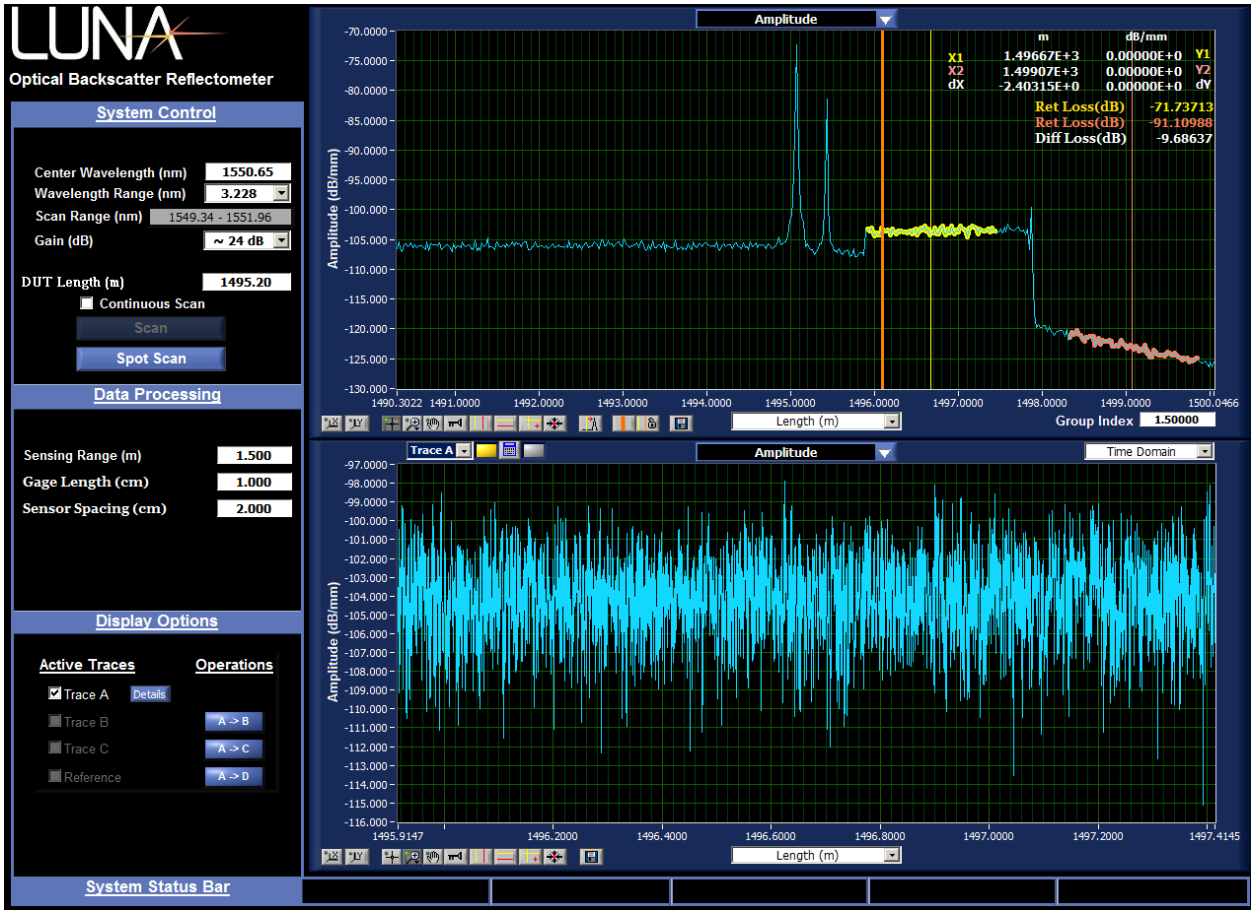


You can adjust length of highlighted region by adjusting Sensing Range value:



LUNA | Step 6

- Once region of interest is set, click ‘calculator’ button to bring it down to lower graph.



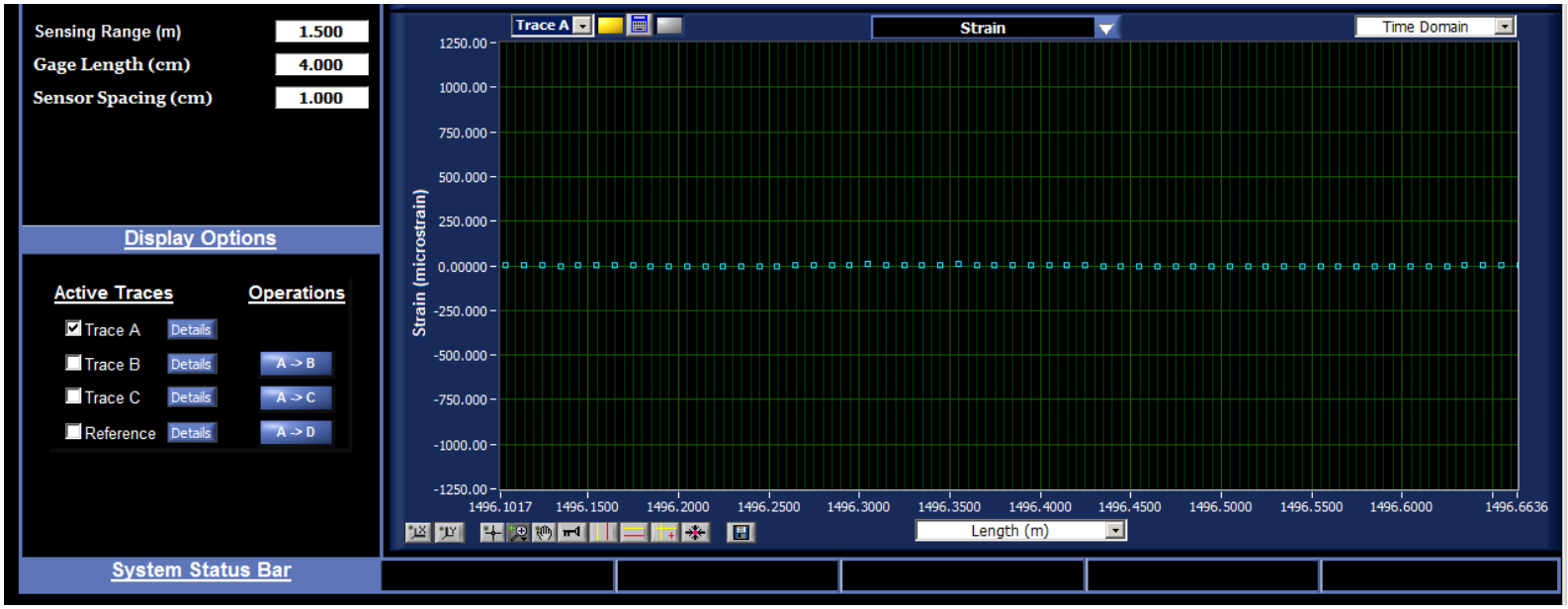
LUNA | Step 7

- If you wish to make this scan your baseline, then click A->D to make this scan your reference trace.
- Then click ‘Spot Scan’ again to take another scan.
- Click ‘Calculate’ button again to bring the latest scan down to lower graph.
- You should now see the strain profile along the length of your chosen region

LUNA | Step 7 (continued)

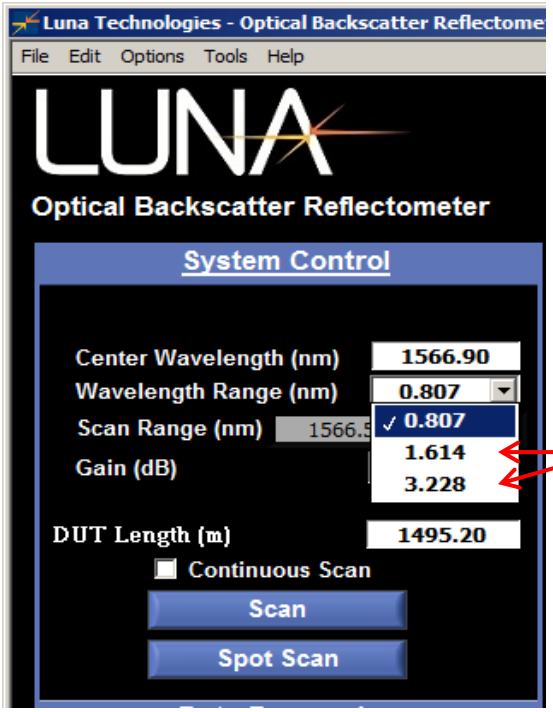
- Graph below shows strain along the sensor

- Right now, we see a flat strain profile of around 0 microstrain along the sensor since no extra strain was induced after the baseline scan was taken



LUNA | Step 8

- Set Wavelength Range:



Note:
In order to use wavelengths of 1.6nm and 3.2nm, **Spot Scan** must be enabled

- Wavelength range should be chosen to best fit the user's application

Step 8 (continued)

- Wider wavelength range results in a longer scan time but will allow for a higher strain range and higher spatial resolution
  - i.e. At a wavelength of 3.228nm, strain range is +/- 1250 microstrain.

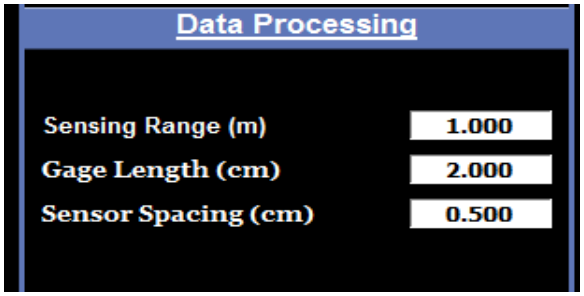
- See pg. 20 and 36 of OBR 4600 User Guide for more details.

LUNA | Step 9

- After storing the baseline in the Reference trace, tension is applied to the sensor using the fiber stretcher and another ‘Spot Scan’ is taken
- After graph updates, we can re-click the ‘Calculate’ button and see the new strain profile along the sensor
- Traces A and B show strain profile along the sensor as more tension is induced

LUNA | Step 10

- Parameters in ‘Data Processing’ can be adjusted depending on application



  - Smaller gage lengths are useful when interested in capturing strain events over a small area (i.e. strain gradients composite materials)
  - Larger gage length and small sensor spacing is useful when interested in measuring small changes in strain
  - Large sensor spacing would be used when not interested in sensing points that are located close to each other

More details on parameters available in pages 51 and 189 of OBR 4600 User Guide