Working with EOM cables in UNOLS

A Technician’s Perspective

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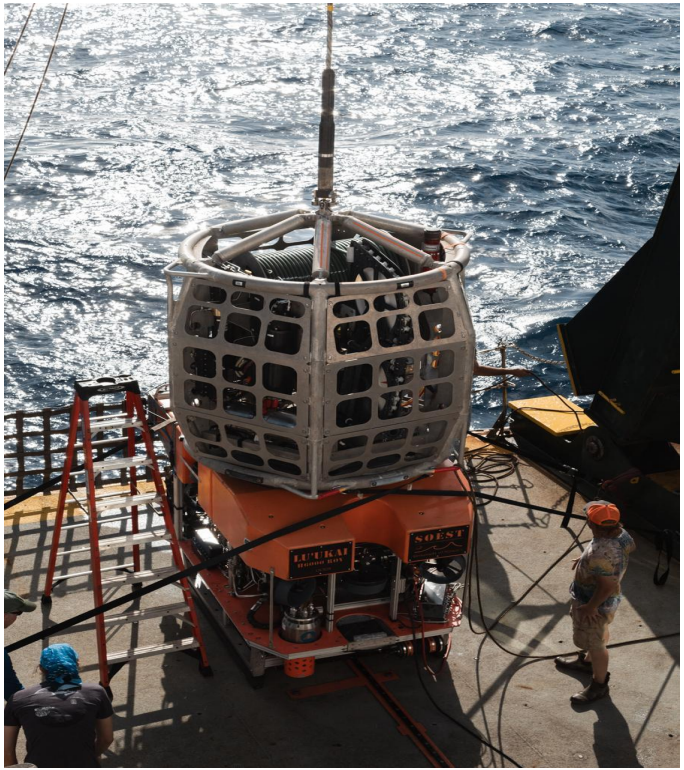
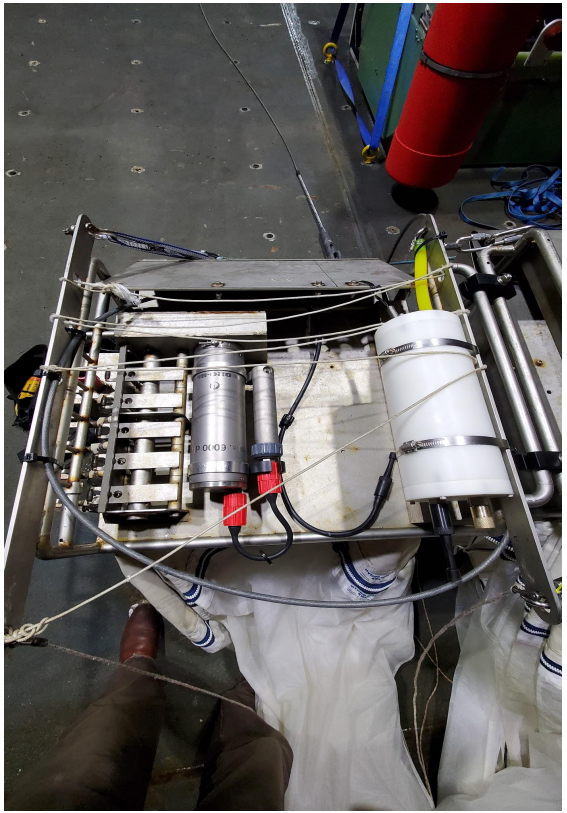
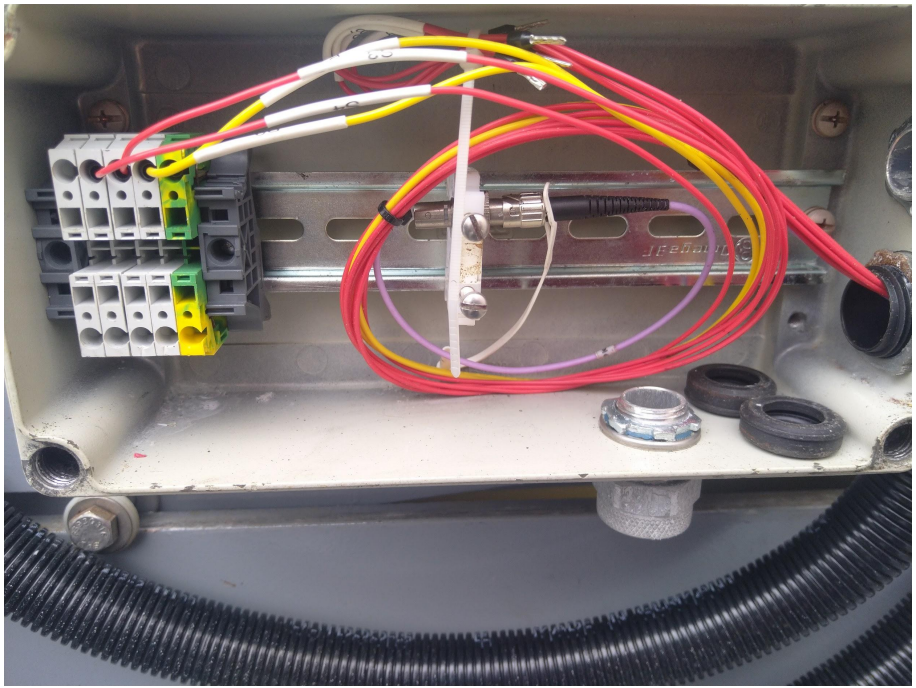
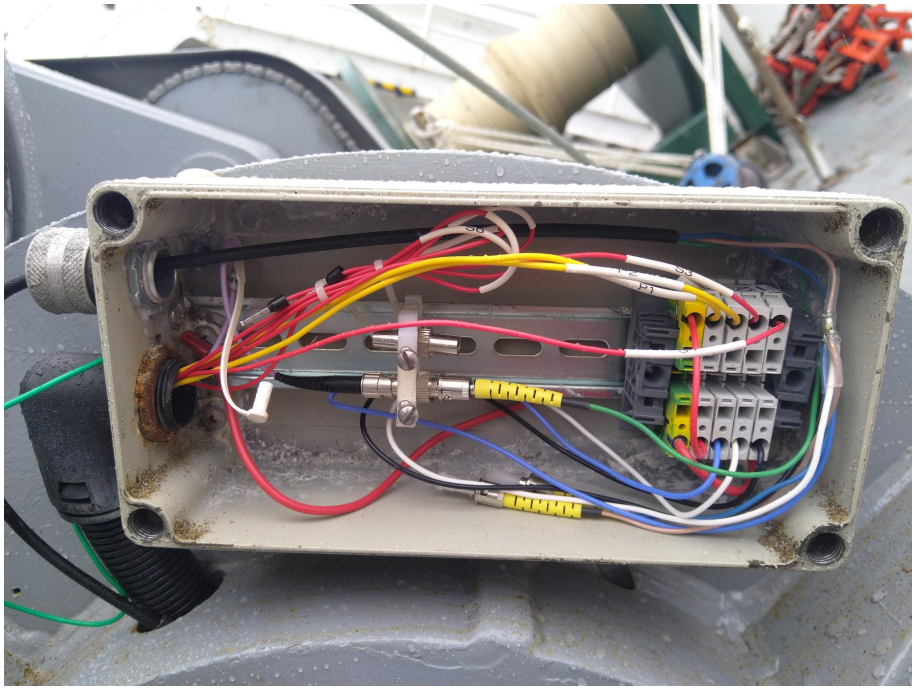
Terminations: .681 and .322 EOM





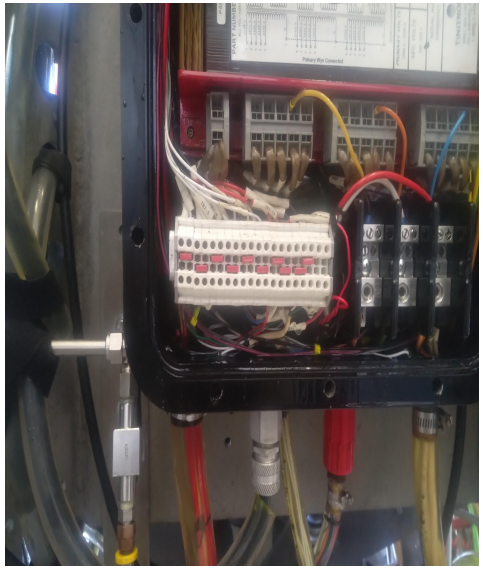
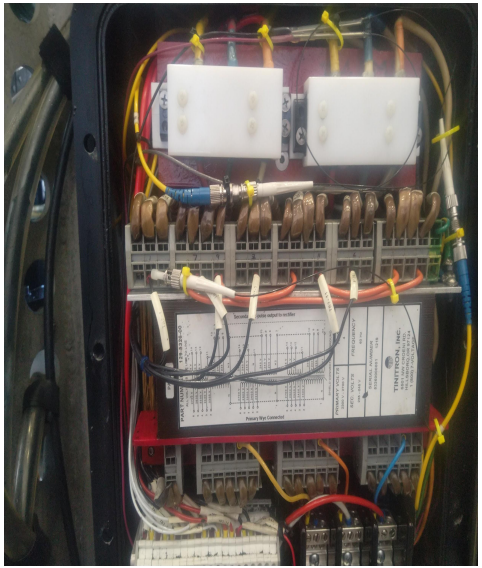
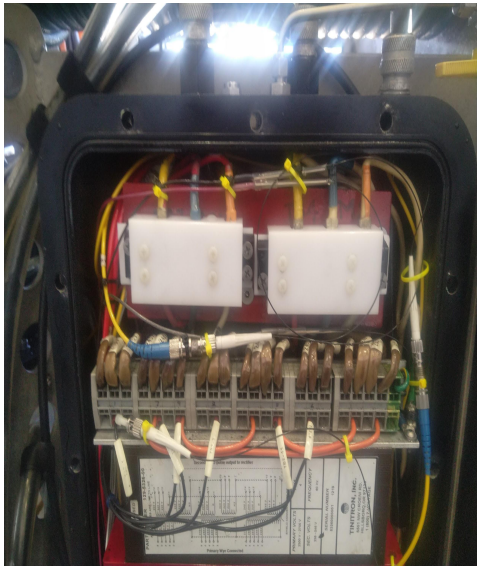
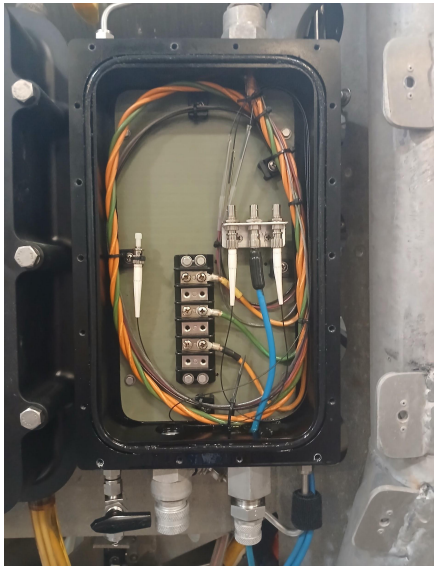
Slip Rings: .322 EOM



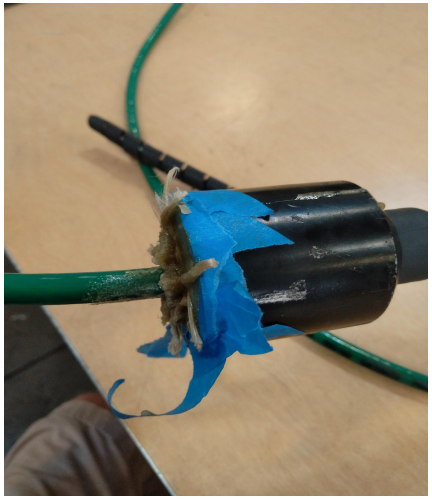


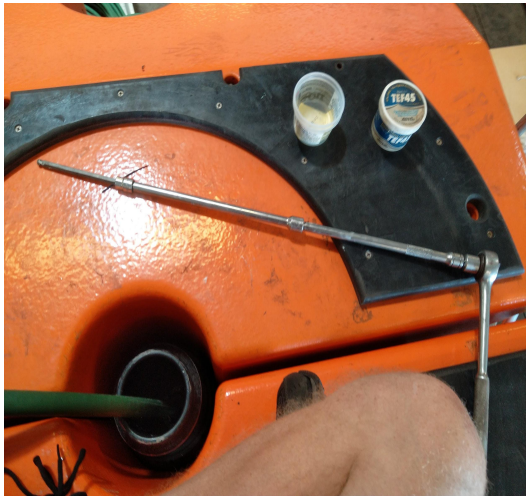
.681 to Vehicle

.681 to Vehicle Plus Slip Ring

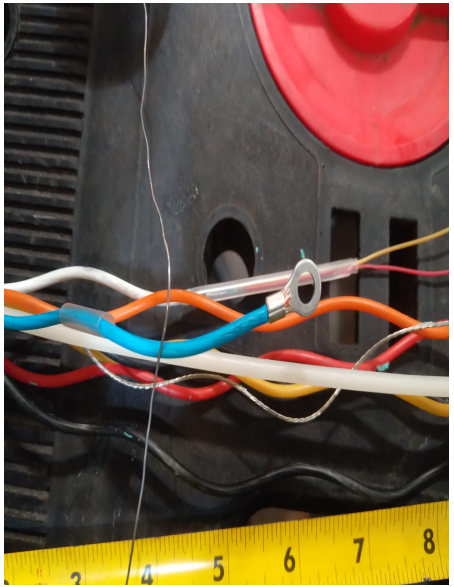





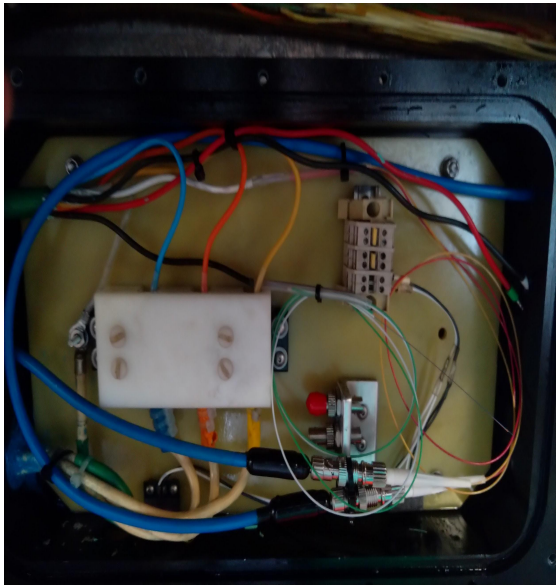
Tether to Vehicle



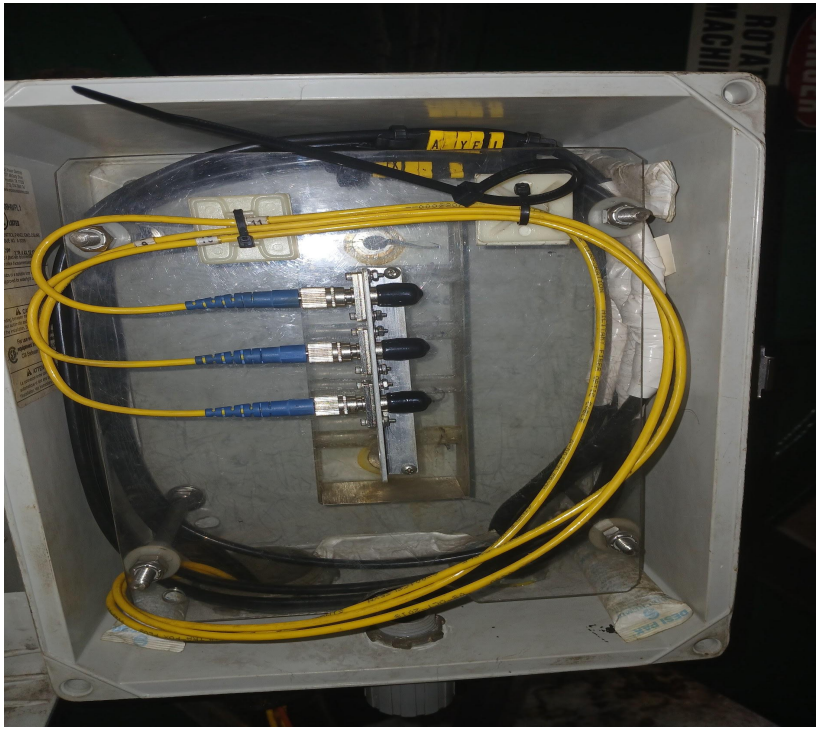


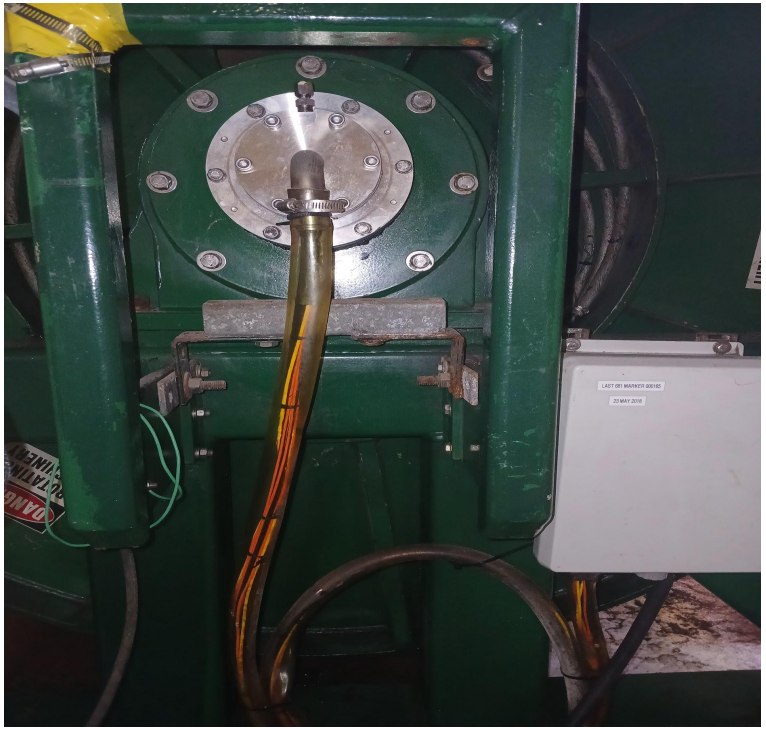
A Look at Tether and K tubes





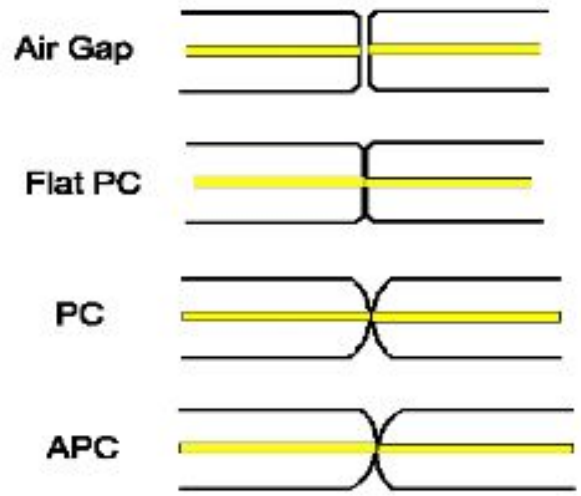
Slip Rings, .681



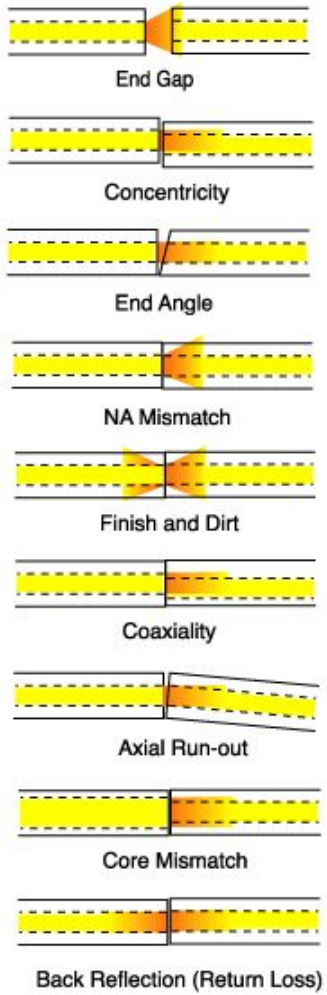


Fiber Toolkit

- Fusion splicer
- Fiber specific wipes/pads
- 3 hole fiber striping tool
- Cleaver
- Special grade fiber solution vs iso. Alcohol (get both)
- OTDR and endface inspection tool (microscope)
- Optical Power meter and light source
- Visual Fault detector
- Fiber bulkhead/connector quick cleaners
- Fiber q-tips
- Heat shrink, fiber sleeves, and heat gun
- Kevlar scissors
- LOTS of connector adapters (sc to st) (st to st) (fc to st) (lc to st) (mu to st)
- Canned air



Ferrule types should not be mixed and matched.



Connectors and Splices:

Fiber cores are exceptionally small. Dust particles and dirt can significantly increase return loss.

Poorly cleaved/polished end faces will cause problems.

Splice on pigtail connector loss includes the splice, and the connector end face. End faces from the factory should always be inspected.

Precision cleavers are very important for splicing, and they need to be cleaned and maintained.

Cleaving and polishing hot melt connectors for singlemode is traditionally considered difficult. This method often results in high reflectance, however experienced techs can do them quickly and the cost is low.

Splicing on pigtail connectors is generally fast and is traditionally considered to result in lower return loss and reflectivity. However it's not foolproof and the start up cost is high.

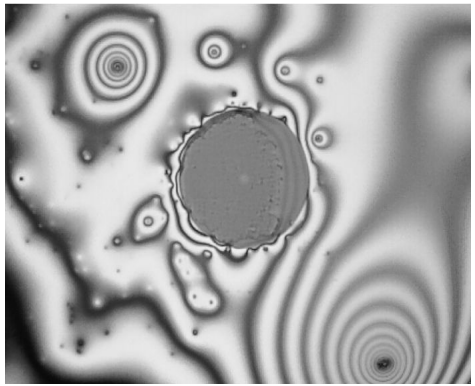
Cleaning Tools and Methods

- Quick clean pens
- Cletop-s
- Wipes with alcohol
- Wipes with cleaning solution
- Fiber wipes vs. fiber pads
- Q tips
- Alcohol and canned air (for Omicron cables.. More on this later)

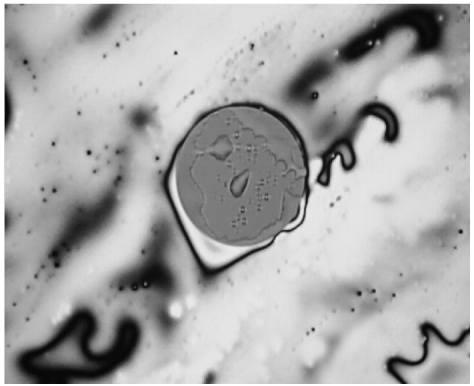
Cleaning schedule

- Follow manufacturer recommendations where possible or make your own schedule for things like:
  - Fusions splicers
  - Cleavers
  - Fiber strippers
  - Adapters
  - Connector endfaces

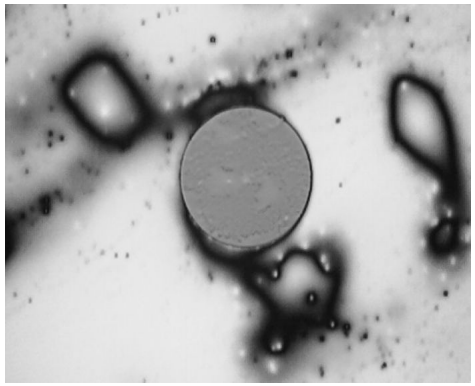
Fiber End Face Inspections



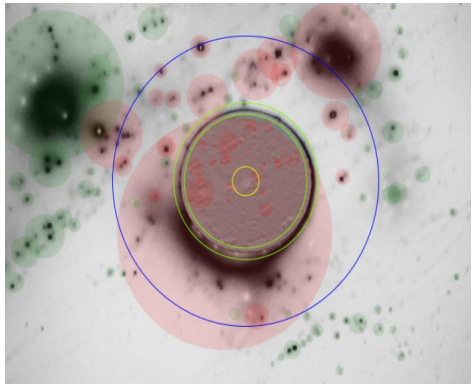
Launch fiber endface 1: uncleaned



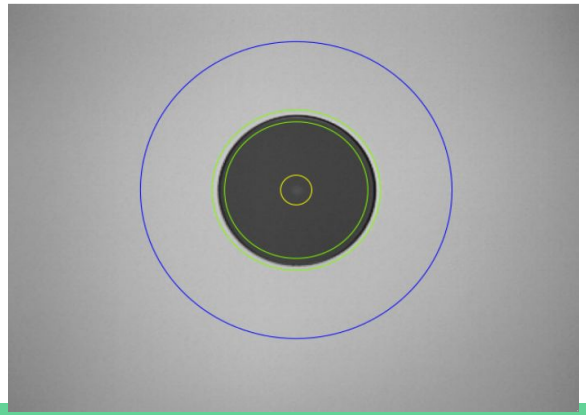
Launch fiber endface 1: quick clean pen, 2 pushes.



Launch fiber endface 1: 5min resident time on bench after quick clean.

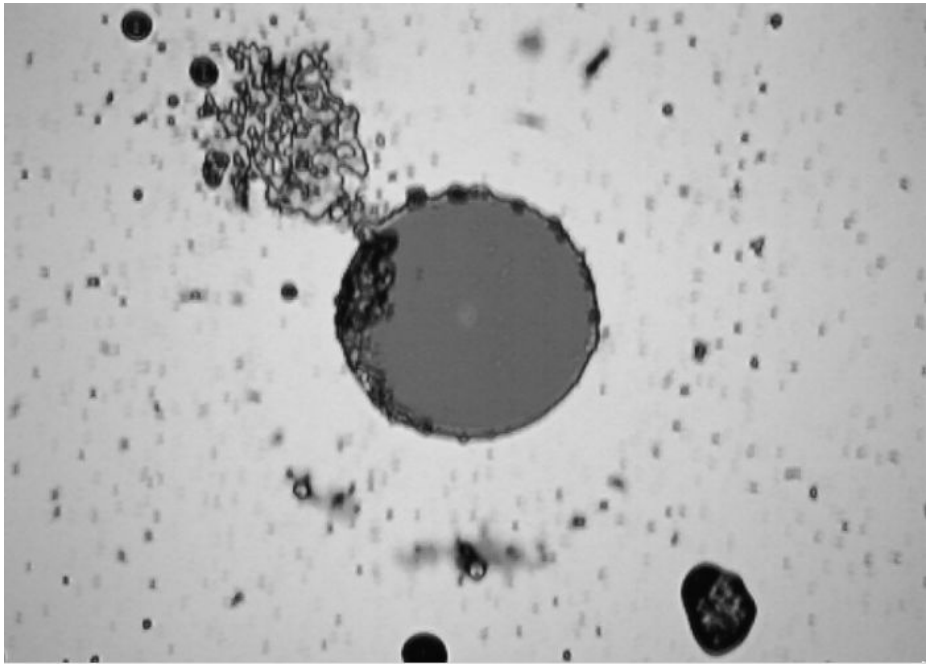


Launch fiber endface 1: 10min resident time on bench after quick clean.

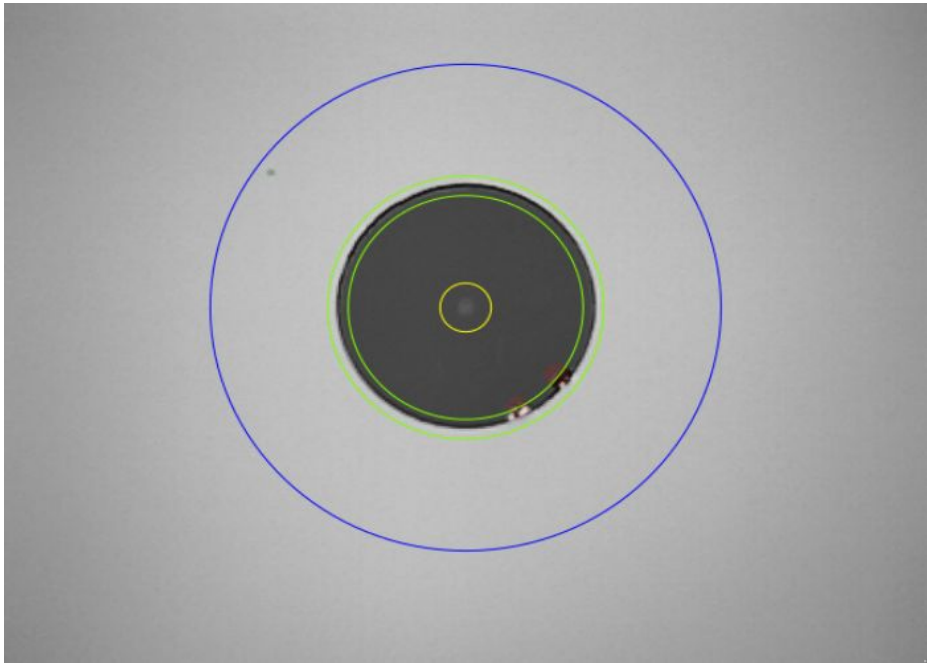


Launch Fiber endface 1: Fiber specific solution and fiber specific wipes.

Fiber End Face Inspections

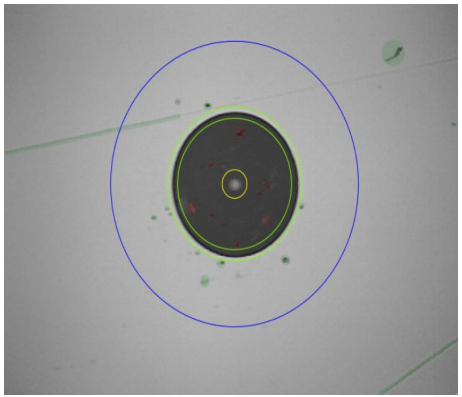


Launch endface 2: Uncleaned.

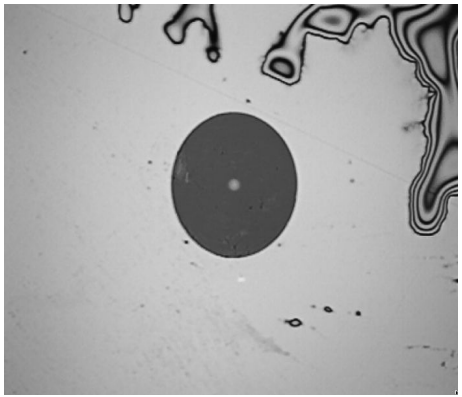


Launch endface 2: Fiber specific solution and non-woven pads

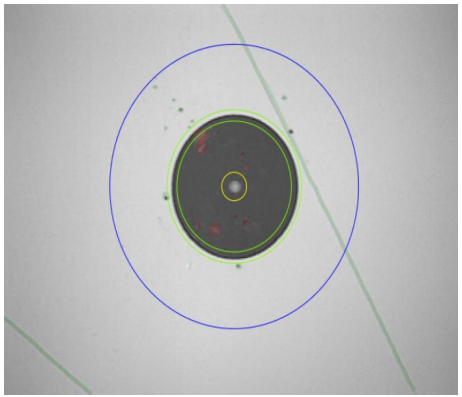
Fiber End Face Inspections



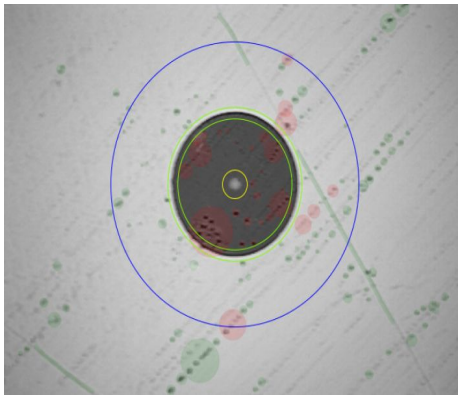
Test whip end 1: Uncleaned



Test whip end 1: Quick Clean pen, 2 pushes.

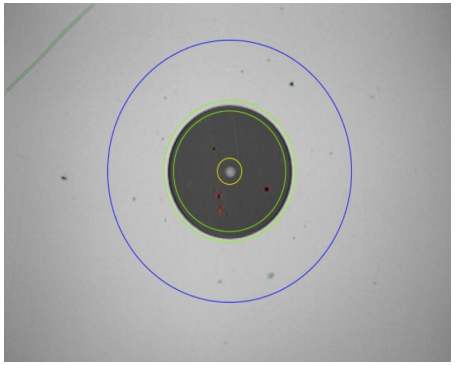


Test whip end 1: Cletop-s only.

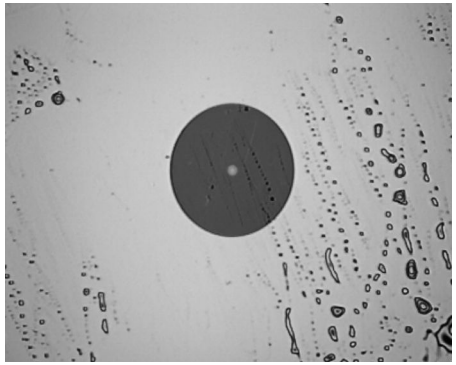


Test whip end 1: Quick clean pen, 2 pushes, then Cletop-s

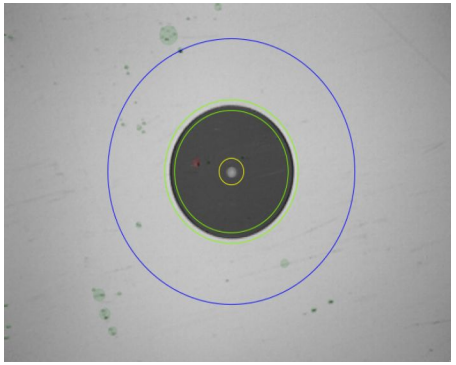
Fiber End Face Inspections



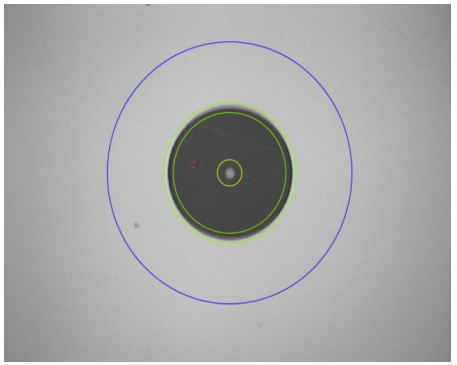
Test end 2: Uncleaned



Test end 2: Quick clean pen, 2 pushes.



Test end 2: Quick clean pen 2 pushes, then non woven pad.



Test end 2: Fiber specific solution and fiber wipes.

At the end of the day, the gain of having immaculate looking endfaces is probably not going to be what makes or breaks the loss budget. However, dirty end faces that get pressed together in our adapters can lead to scratches/imperfections/pits/reflective layers/scattering layers/permanent damage to our connectors.

Quick Points On Our Core Troubleshooting Tools

- Optical light source and power meter are not replaced by the OTDR and the cost is lower (a good set costs around $500 and comes with patch cords and some accessories)
- Modern OTDRs are very powerful and come in multiple varieties, but be prepared for a price tag above $10k. If you're new to the fiber world, training on the specific model you may purchase is recommended.
- Visual Fault Finder/Locator come built into some OTDRs but it's always good to have a dedicated light pen.
- Rusty wire strippers can be okay for copper, not for fiber. Especially when working with K-tubes, use new and sharp tools.

VFL

Use visual fault finders for basic things.

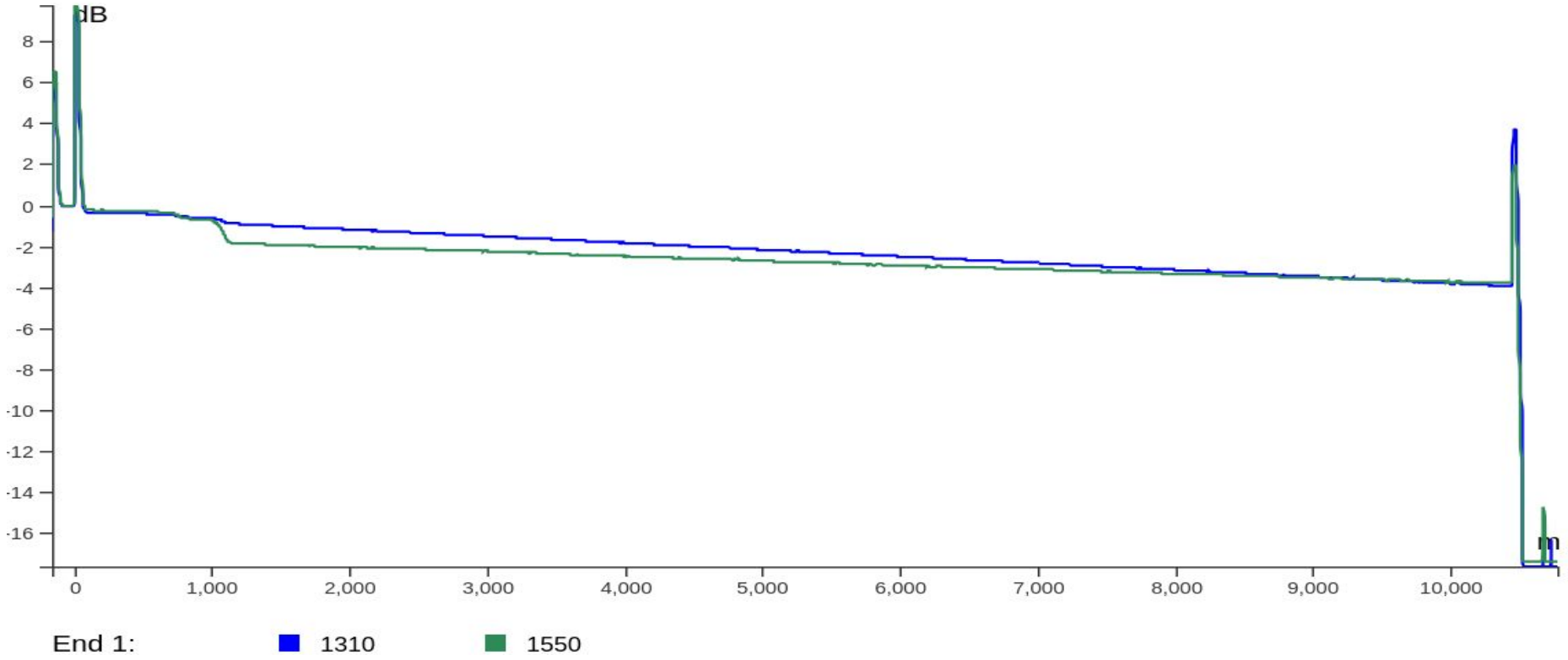
- Utilize them for “fault” finding only after you have determined there is one with seperate tools.
- Can be useful in identifying unlabeled fiber runs.
- Don't be overly alarmed by a splice that emits a bit of light. If your light pen is injecting light a foot away, and light is still coming out of the other end of the run under test, there's usually nothing to worry about.

Optical Light Source and Power Meter

- These measure Insertion loss. Mimicking the optical transmitter and receiver of the science instruments, more or less.
- Fast, simple, and robust.
- Small and compact.
- Little training and fiber theory required to operate effectively.

OTDR

- Modern OTDRs will give you multiple intuitive visual aids to interpret the results.
- OTDR with launch and tail cable can give you loss of the first and last splice on connectors in the run.
- OTDR will identify location of faults and typically the nature of the fault.
- Traces and “jobs” can be saved to create a history of the fiber and slip ring health.
- Requires some understanding of theoretical concepts, vocabulary, and specific model to unleash its full potential. These instruments measure Reflective loss.
- Fiber runs that contain lots of connectors, slip rings, and adapters will have a high amount of reflectivity, usually concentrated on the ends of our fiber run. These reflections create dead zones. Some parameters can be changed around to tune for higher resolution, but it still may not provide detail unless you start separating the fiber runs at the connectors/adapters. As with many other things that we deal with, higher resolution results in less useable range. It's always a give and take.



OTDRs are excellent at characterizing long cable runs.

		1310 NM		1550 NM	
	STATUS	VALUE	LIMIT	VALUE	LIMIT
Overall Length	INFO	10449		10449	
Overall Loss	INFO	3.91		3.76	
ORL (dB)	INFO	31.41		34.04	

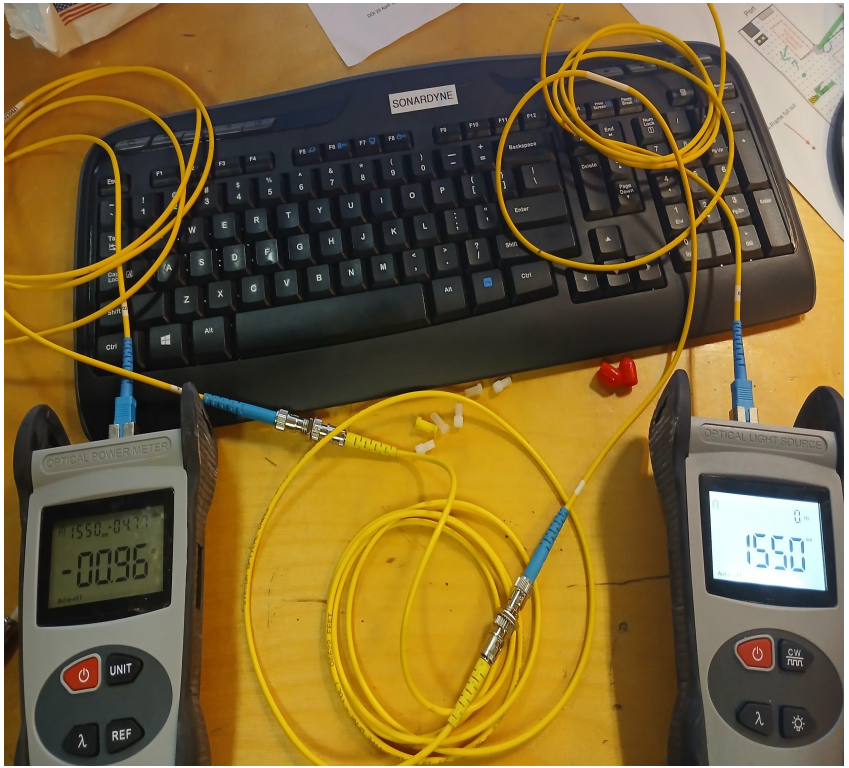
Events

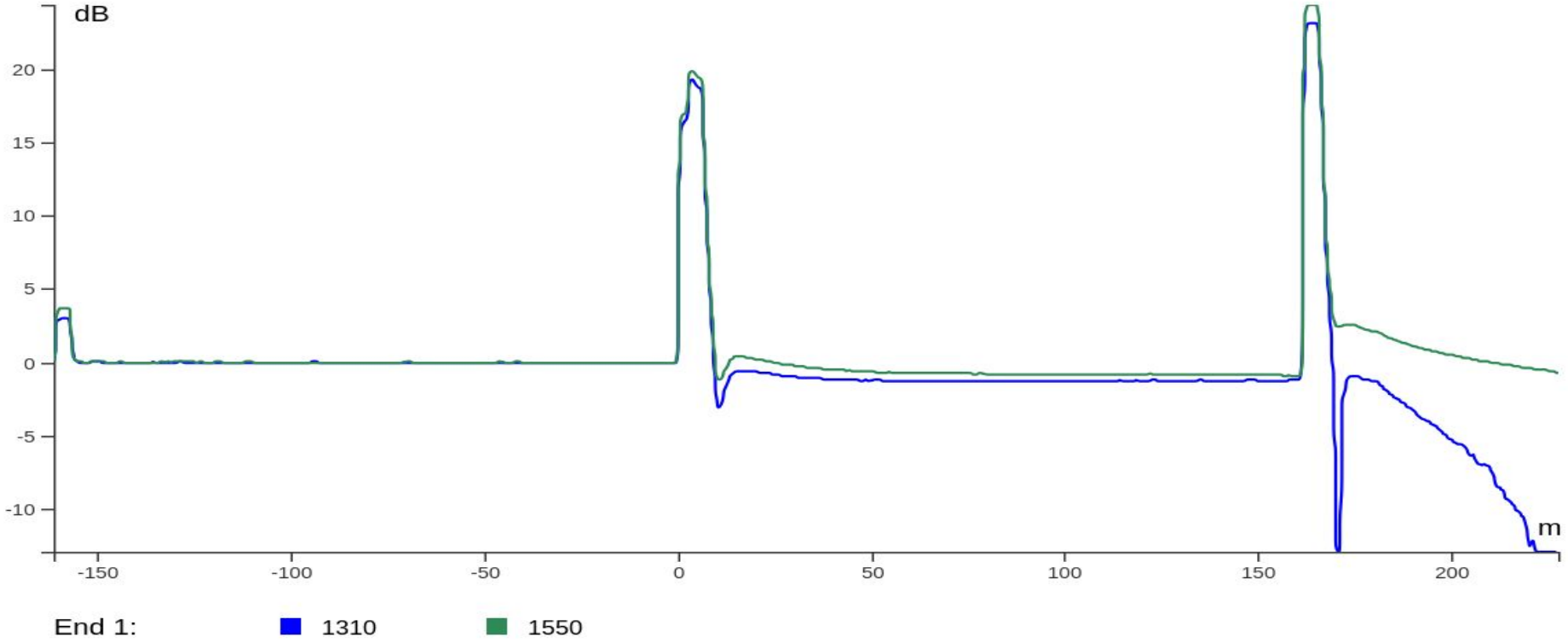
10449m End	INFO				
Loss (dB)		N/A		N/A	
Attn Coeff (dB/km)		0.33		0.22	
Reflectance (dB)		-39.45		-46.01	
1067m Bend	INFO				
Loss (dB)		0.19		0.72	
Attn Coeff (dB/km)		0.47		0.00	
Reflectance (dB)		< -63.78		< -66.32	
733m Loss	INFO				
Loss (dB)		0.15			
Attn Coeff (dB/km)		0.23			
Reflectance (dB)		< -66.32			
0m Launch	INFO				
Loss (dB)		0.12		0.21	
Attn Coeff (dB/km)		0.35		0.23	
Reflectance (dB)		-36.06		-37.96	
-159m OTDR Port	INFO				
Loss (dB)		N/A		N/A	
Attn Coeff (dB/km)		N/A		N/A	
Reflectance (dB)		-43.03		-44.36	

Auto OTDR settings for long runs

	1310	1550
Range (Auto)	10935.43	10937.68
Resolution (Auto)	0.26	0.26
Pulse Width	300	300
Averaging	1.0	1.4
Loss Threshold (Auto)	0.10	0.10
End Threshold (Auto)	0	0

Testing short fiber runs or jumper cables with with LS-PM VS OTDR



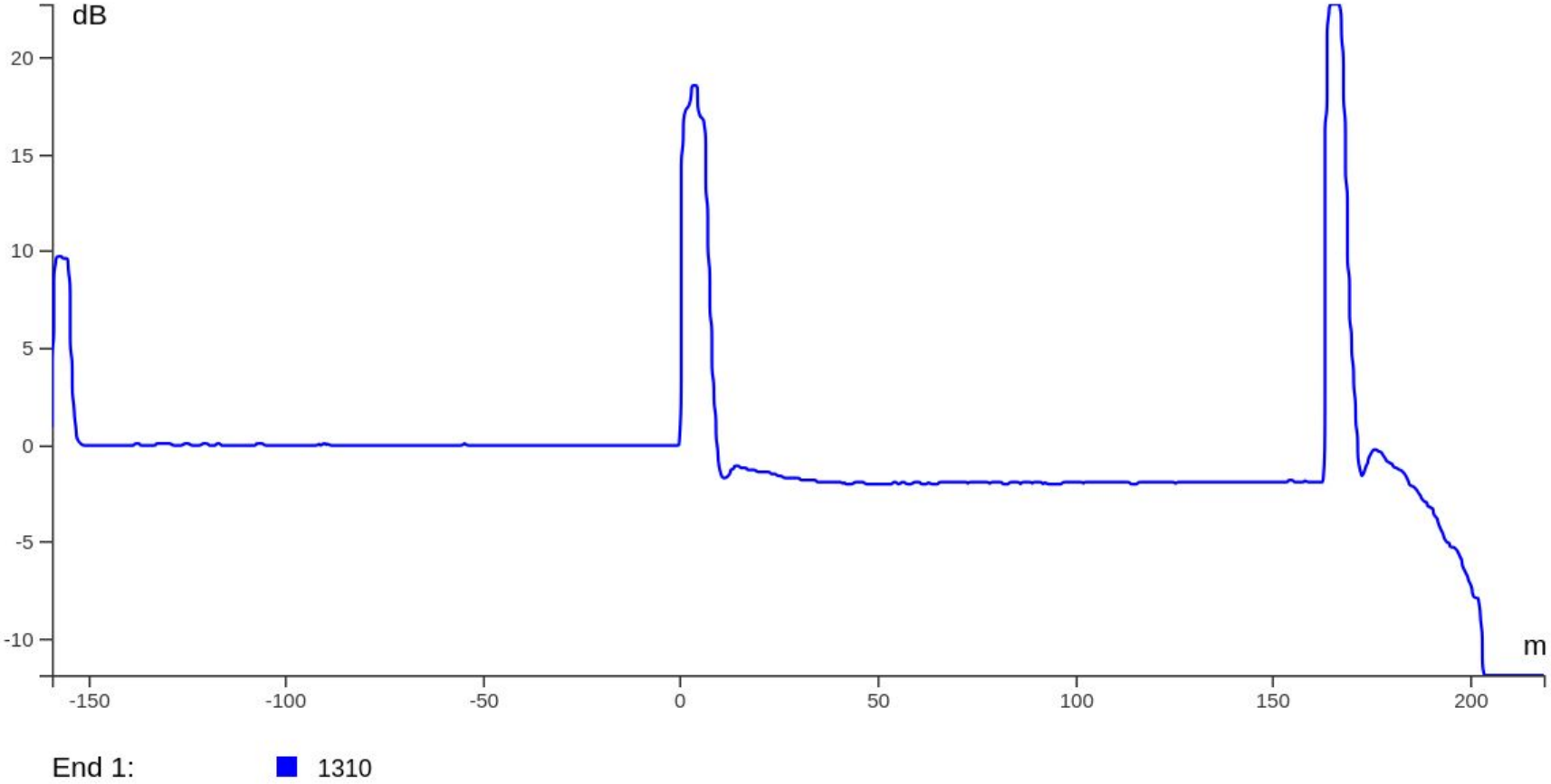


OTDR trace with launch and tail whip. Can you find the test cable in these trace’s?

		1310 NM		1550 NM	
	STATUS	VALUE	LIMIT	VALUE	LIMIT
Overall Length	INFO	1.47		1.47	
Overall Loss	INFO	1.15		0.72	
ORL (dB)	INFO	24.90		26.19	
Events					
161.35m End	INFO				
Loss (dB)		N/A		N/A	
Attn Coeff (dB/km)		0.00		0.94	
Reflectance (dB)		-14.97		-15.03	
1.47m Trail	FAIL				
Loss (dB)		N/A		N/A	
Attn Coeff (dB/km)		N/A		N/A	
Reflectance (dB)		-22.74	-35.00	-24.40	-35.00
0.00m Launch	FAIL				
Loss (dB)		1.15	0.75	0.72	0.75
Attn Coeff (dB/km)		0.43		0.18	
Reflectance (dB)		-30.85	-35.00	-31.67	-35.00

	1310	1550
Range (Auto)	388.41	388.81
Resolution (Auto)	0.03	0.03
Pulse Width	30	30
Averaging	6.4	9.9
Loss Threshold (Auto)	0.10	0.10
End Threshold (Auto)	0	0


OPTICAL POWER METER
1310nm -05.31 dBm
00.04 dB
UNIT
REF
OPTICAL LIGHT SOURCE
0 Hz
1310 nm
Auto-off
CW


dB
20
15
10
5
0
-5
-10
m
-150
-100
-50
0
50
100
150
200
End 1:
1310

1310 NM

	STATUS	VALUE	LIMIT
Overall Length	INFO	0.00	
Overall Loss	INFO	1.75	
ORL (dB)	INFO	26.59	

Events

163.29m End	INFO		
Loss (dB)		N/A	
Attn Coeff (dB/km)		1.41	
Reflectance (dB)		-14.24	
0.00m Launch	FAIL		
Loss (dB)		1.76	0.75
Attn Coeff (dB/km)		0.27	
Reflectance (dB)		-26.60	-35.00
-159.24m OTDR Port	INFO		
Loss (dB)		N/A	
Attn Coeff (dB/km)		N/A	
Reflectance (dB)		-45.32	

Settings

DataCenter OTDR

	1310
Range (Auto)	378.09
Resolution (Auto)	0.03
Pulse Width	30 (Manual)
Averaging	4.2
Loss Threshold (Auto)	0.10
End Threshold (Manual)	3.5