

Project: 902401 Geo-Sense.

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Reviewing:

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Reference document: “Geosense Deployment Feb 2026 Rev 2.pptx”

Geo-Sense DAS system deployment

Fiber strain events.

Background:

The DAS (Distributed Acoustic Sensing) with a single channel ONYX OEM DAS interrogator (by Sintela of Bristol, UK) at its core, was deployed as a part of Geo-Sense project from on-board of R/V Rachel Carson on February 3, 2026. The system was deployed on autonomous Elevator platform and was constructed as fully self-contained with DAS, on-board data processing and storage, contained in Ti pressure sphere, as well as three glass spheres with Electrochem primary battery packs for about 6 weeks of continuous operation. The optical fiber, ~1047 meters long, was supplied by Linden Photonics and was deployed on the same day, using ROV Ventana by unspooling from the compact spool held by ROV manipulator. DAS data was continuously recorded during the deployment. Next day, February 4, 2026, the second dive was performed to attend to the fiber deployment geometry, to connect to the system to verify operation, and to download data.

First connection to the system: After the initial deployment to the ocean floor, but before deploying the fiber from the spool using the ROV, the system was connected to, using Deep Sea Connect system, to check the operation and performance, and to measure noise floor. At that time, the system was operated correctly: built-in OTDR system measured the fiber length correctly at 1047 meters, and noise floor was at -76db.

Second connection to the system and discovering the issue: following the first connection to the system at depth, the fiber was deployed using ROV Ventana. Deployment took about 1.5 hours, and condition of poor visibility at times was a factor complicating operations. However, when the second connection to the system was performed, after the fiber deployment, the condition of degraded noise floor was discovered (about -60 db) and the build-in OTDR did not measure the full length of the fiber as expected, showing about 25 meters of the fiber instead. It was further discovered that the fiber was wrapped-up around the elevator platform, and the rest of the day, and the next day, the team attempted to rectify fiber geometry, and to free it from the Elevator frame interference.

Data recording: DAS system was continuously powered-on during the deployment of the system as well as deployment of the fiber, and the hope was, that the recorded data would help identify nature of the issue which affected the system performance. Indeed, following the data download, Sintela personnel were able to analyze the data and to pin-point to two particular UTC times, when the fiber experienced strain event(s) causing irreversible degradation in the noise floor figures (**Fig. 1, 2**). Continuous video recording was performed during the dive, and the MP4 video files were subsequently analyzed around “Strain Event” times supplied by Sintela, with a number of frame-grabs taken (**Fig 3-37, Table 1**).

Results: it seems, that the First Strain event was caused by the stress on the fiber, when the 12 ft of free loops of the fiber on the frame were exhausted, and the fiber went from free-hanging condition (**T-minus 00:11, Fig 17**), to the spool rotation (**T-plus 00:02, Fig. 21**). Also, the manipulator experienced visible vibration at **T-minus 00:01 (Fig 19)** suggesting that at the time the free loop was exhausted, fiber went into tension, and the “jerk” needed in order to start rotating the spool, is what stressed the fiber at T-time of First Strain Event.

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Time, UTC	Strain event time, UTC	Video start, UTC	T-minus, T-plus time	Time in video	Fig. ##	Note
18:12:42	18:17:53	18:12:42	0:05:11	0:00:00	3	V4718_20260203T181242Z_h265.mp4 video file
18:12:50	18:17:53	18:12:42	0:05:03	0:00:08	4	Manipulator grabs spool handle first time, fiber loop clearly visible
18:13:49	18:17:53	18:12:42	0:04:04	0:01:07	5	Manipulator grabs spool handle second time
18:13:57	18:17:53	18:12:42	0:03:56	0:01:15	6	Manipulator is locked on a spool handle; camera full zoom in
18:14:27	18:17:53	18:12:42	0:03:26	0:01:45	7	First attempt of spool removal from the plastic tub, fiber loop clearly visible
18:14:58	18:17:53	18:12:42	0:02:55	0:02:16	8	Spool is lifted but not completely out of the tub
18:15:35	18:17:53	18:12:42	0:02:18	0:02:53	9	Spool is lifted clear of the tub, but fiber is in the side channel of the tub
18:15:38	18:17:53	18:12:42	0:02:15	0:02:56	10	Fiber is clear out of the tub
18:15:54	18:17:53	18:12:42	0:01:59	0:03:12	11	Spool moved ~ 2 meters out, paused, discovered fiber under the corner of the tub
18:16:51	18:17:53	18:12:42	0:01:02	0:04:09	12	Fiber is freed from under the tub, "Alana said; You got it!", distance ~ 3 m, 2 fiber loops visible
18:17:07	18:17:53	18:12:42	0:00:46	0:04:25	13	Elevator barely visible, fiber clearly visible, right of the spool, towards elevator, not in tension
18:17:24	18:17:53	18:12:42	0:00:29	0:04:42	14	Fiber is visible left of the spool, not in tension
18:17:30	18:17:53	18:12:42	0:00:23	0:04:48	15	Fiber is visible further left of the spool, still not in tension
18:17:39	18:17:53	18:12:42	0:00:14	0:04:57	16	Fiber is visible waiving to the right, then left, not in tension
18:17:42	18:17:53	18:17:42	0:00:11	0:00:00	17	V4718_20260203T181742Z_h265.mp4 video file; Fiber is visible, free-hanging, not in tension
18:17:48	18:17:53	18:17:42	0:00:05	0:00:06	18	Bad visibility, Alana said: "I am guessing, we are on a port side"
18:17:52	18:17:53	18:17:42	0:00:01	0:00:10	19	Vibration on manipulator, fiber not visible, Alana said: "yea"
18:17:53	18:17:53	18:17:42	0:00:00	0:00:11	20	First strain event
18:17:55	18:19:22	18:17:42	0:01:27	0:00:13	21	Spool clearly visible, it is rotating
18:17:58	18:19:22	18:17:42	0:01:24	0:00:16	22	Fiber is visible, spool rotating
18:18:00	18:19:22	18:17:42	0:01:22	0:00:18	23	Paul said: "she is spinning"
18:18:01	18:19:22	18:17:42	0:01:21	0:00:19	24	Fiber sharp to the side, spool rotating
18:18:03	18:19:22	18:17:42	0:01:19	0:00:21	25	Fiber is visible, Alana said: "Oh!"; vibration on manipulator
18:18:06	18:19:22	18:17:42	0:01:16	0:00:24	26	Fiber not visible, manipulator rotated clockwise.
18:18:11	18:19:22	18:17:42	0:01:11	0:00:29	27	Fiber is visible, sharp to the side; Alana said: "Hey, Ethan, can we stop?"
18:18:17	18:19:22	18:17:42	0:01:05	0:00:35	28	Manipulator rotated clockwise, fiber visible.
18:18:18	18:19:22	18:17:42	0:01:04	0:00:36	29	Spool not rotating, fiber visible more straight from the spool
18:18:20	18:19:22	18:17:42	0:01:02	0:00:38	30	Manipulator moved up; Alana said: "It is not spooling"
18:18:25	18:19:22	18:17:42	0:00:57	0:00:43	31	Fiber is visible, it is free-hanging down from the spool
18:19:14	18:19:22	18:17:42	0:00:08	0:01:32	32	Spool started rotating, visible red line moved
18:19:19	18:19:22	18:17:42	0:00:03	0:01:37	33	Red mark visible, spool is rotating, vibration on manipulator is visible
18:19:22	18:19:22	18:17:42	0:00:00	0:01:40	34	Second strain event
18:19:29	18:19:22	18:17:42	0:00:07	0:01:47	35	Fiber is visible, very faint, looks straight
18:19:33	18:19:22	18:17:42	0:00:11	0:01:51	36	Fiber is clearly visible, looks straight
18:20:05	18:19:22	18:17:42	0:00:43	0:02:23	37	Fiber is visible, free-hanging down, Alana said: "I think you either right over it..."

Table 1. Summary of frame-grabs saved from the video files. “UTC Time” is a time of the event or frame-grab. “Strain event time, UTC” are two times identified by Sintela (Fig 1, 2). “Video start, UTC” are times of the first frame in 5-minute MP4 video file. “T-minus” and “T-plus” are data offset, to and from Fiber Strain Event. “Time in video” is the time counter in the video file, used to identify the UTC time the particular frame was taken. “Fig ##” is the figure number of the frame taken, 3-37.

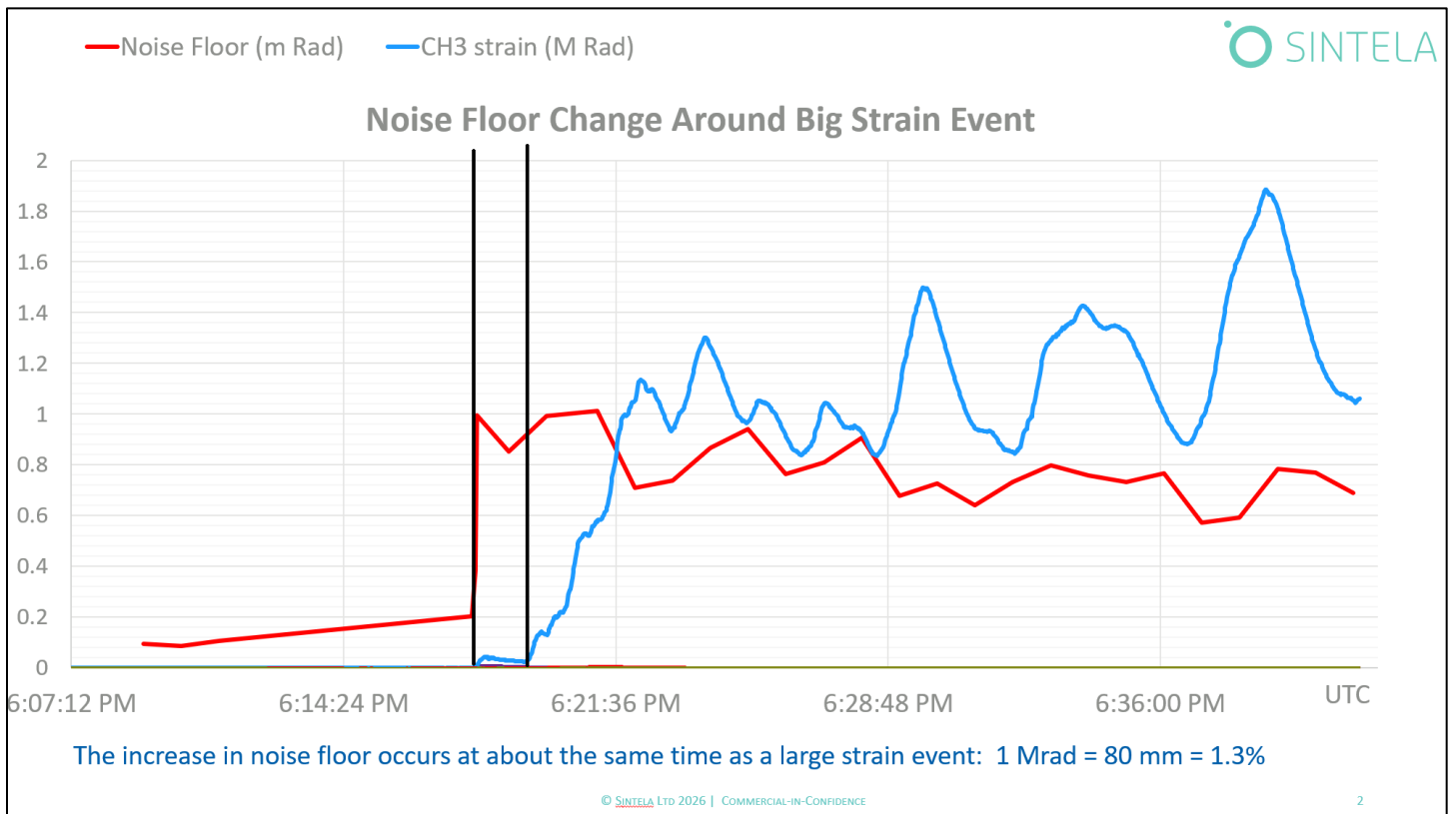
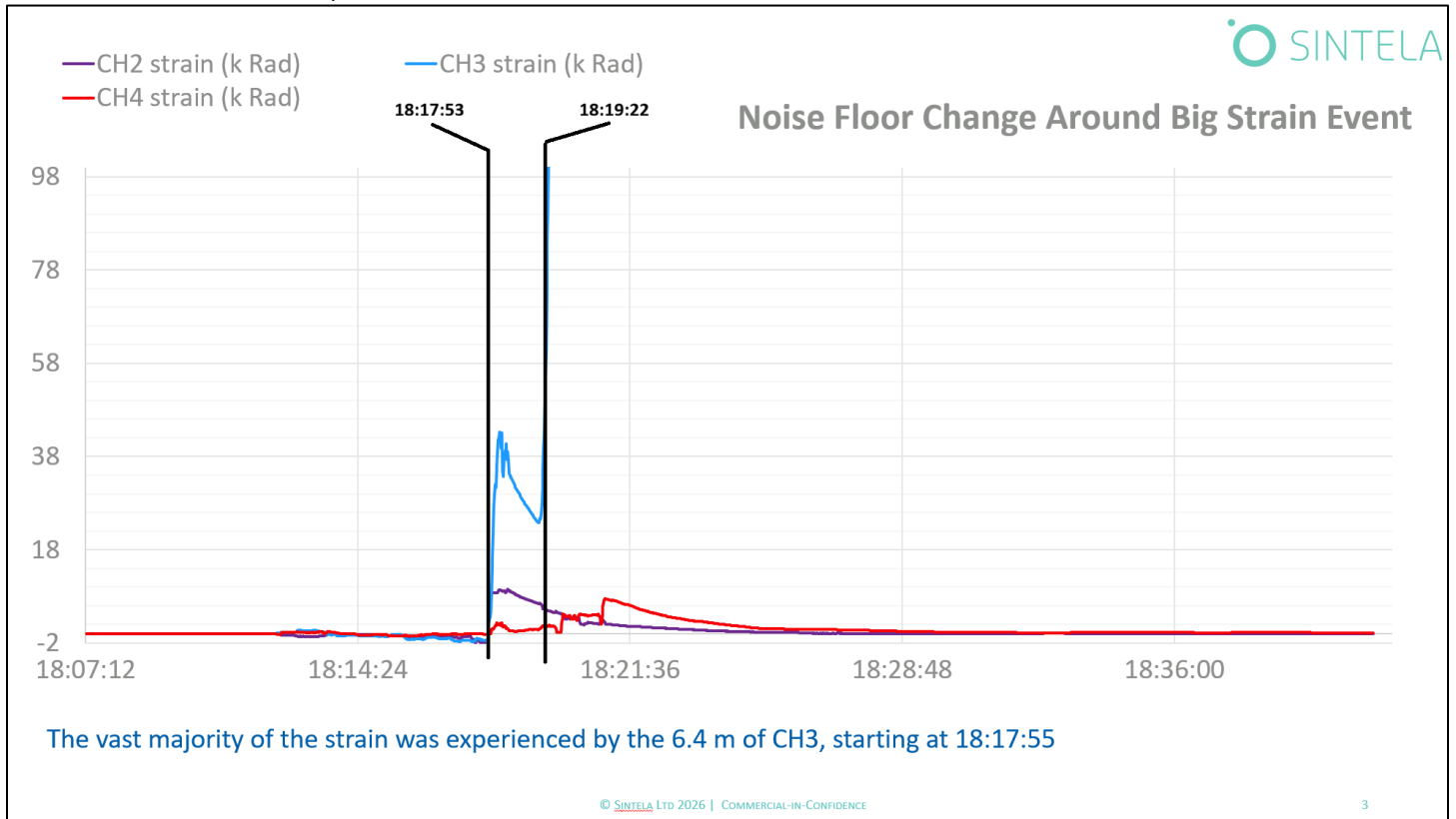


Fig 1, 2. Strain and noise floor figures with two strain event times: **UTC 18:17:53**, and **UTC 18:19:22**

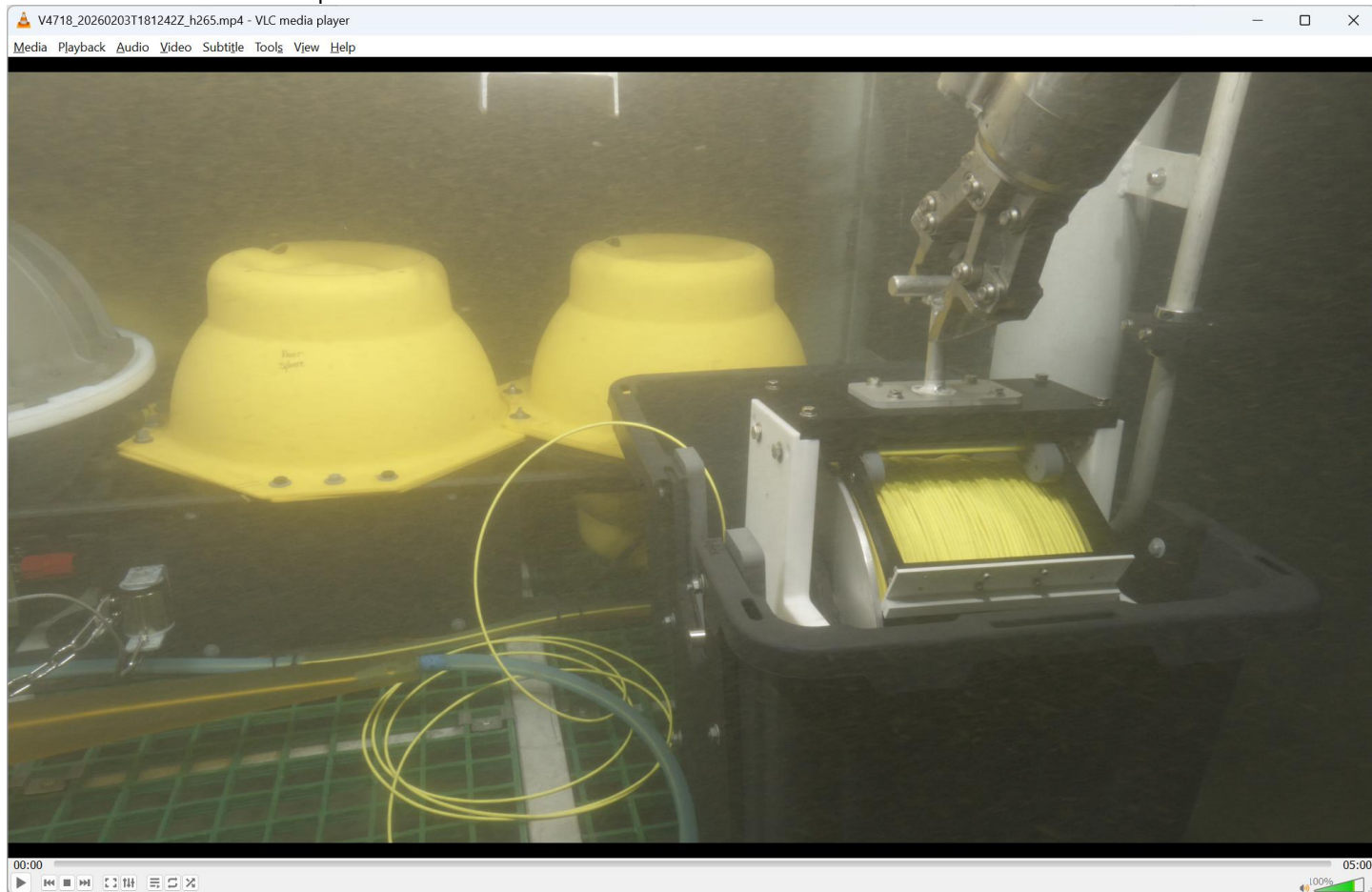


Fig 3. T-minus 05:11 to the First Strain Event. V4718_20260203T181242Z_h265.mp4 video file

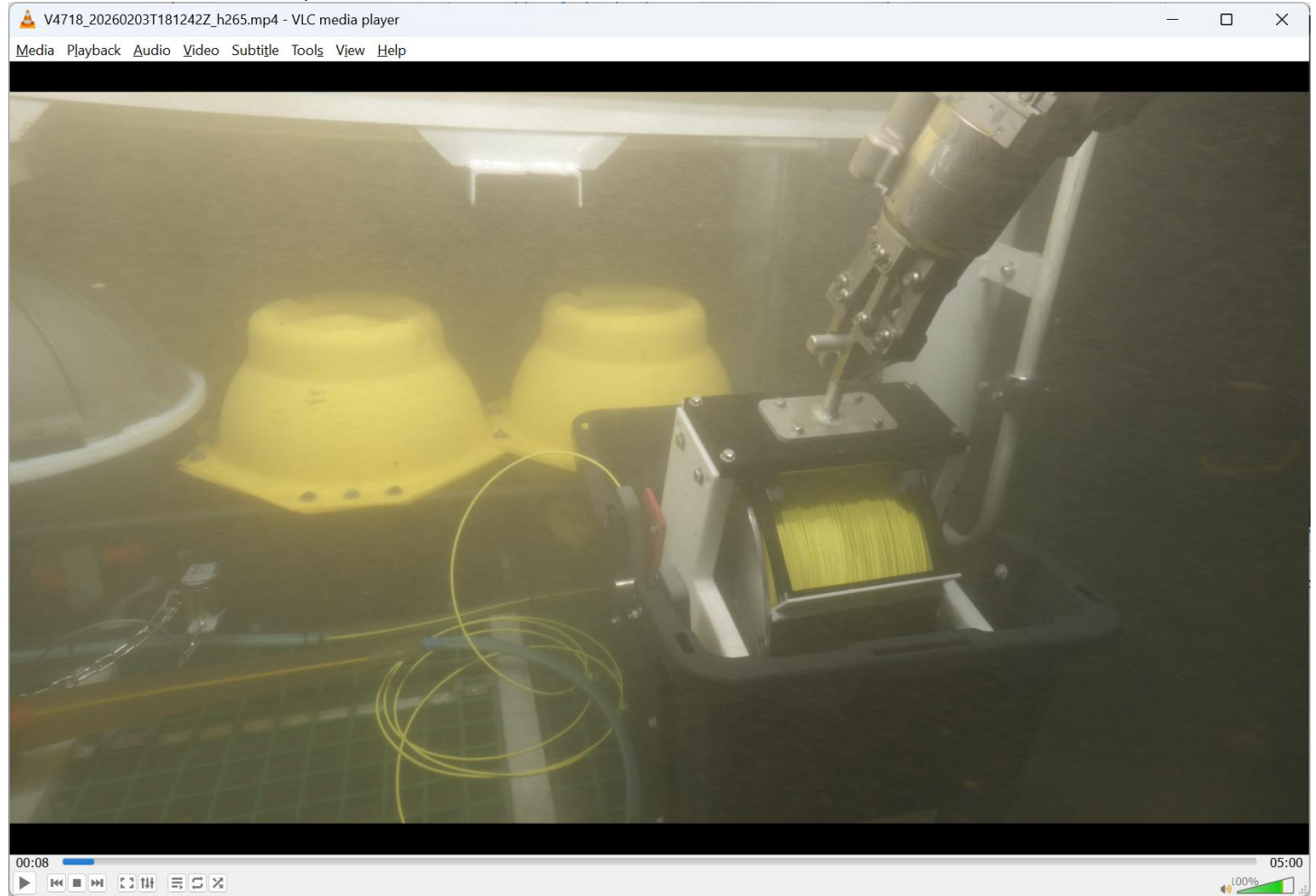


Fig 4. T-minus 05:03 to the First Strain Event. Manipulator grabs spool handle first time, fiber loop clearly visible

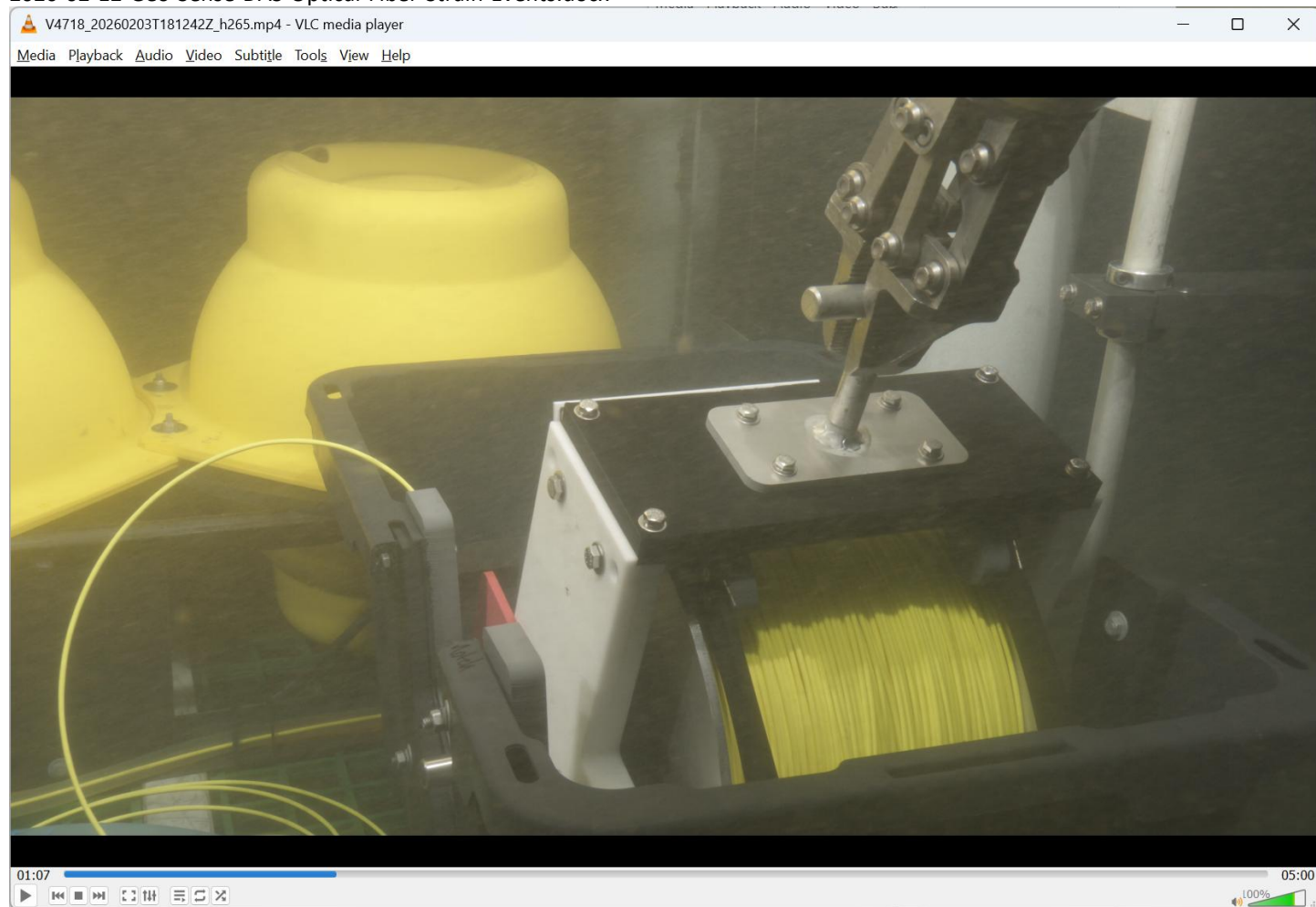


Fig 5. T-minus 04:04 to First Strain Event. Manipulator grabs spool handle second time

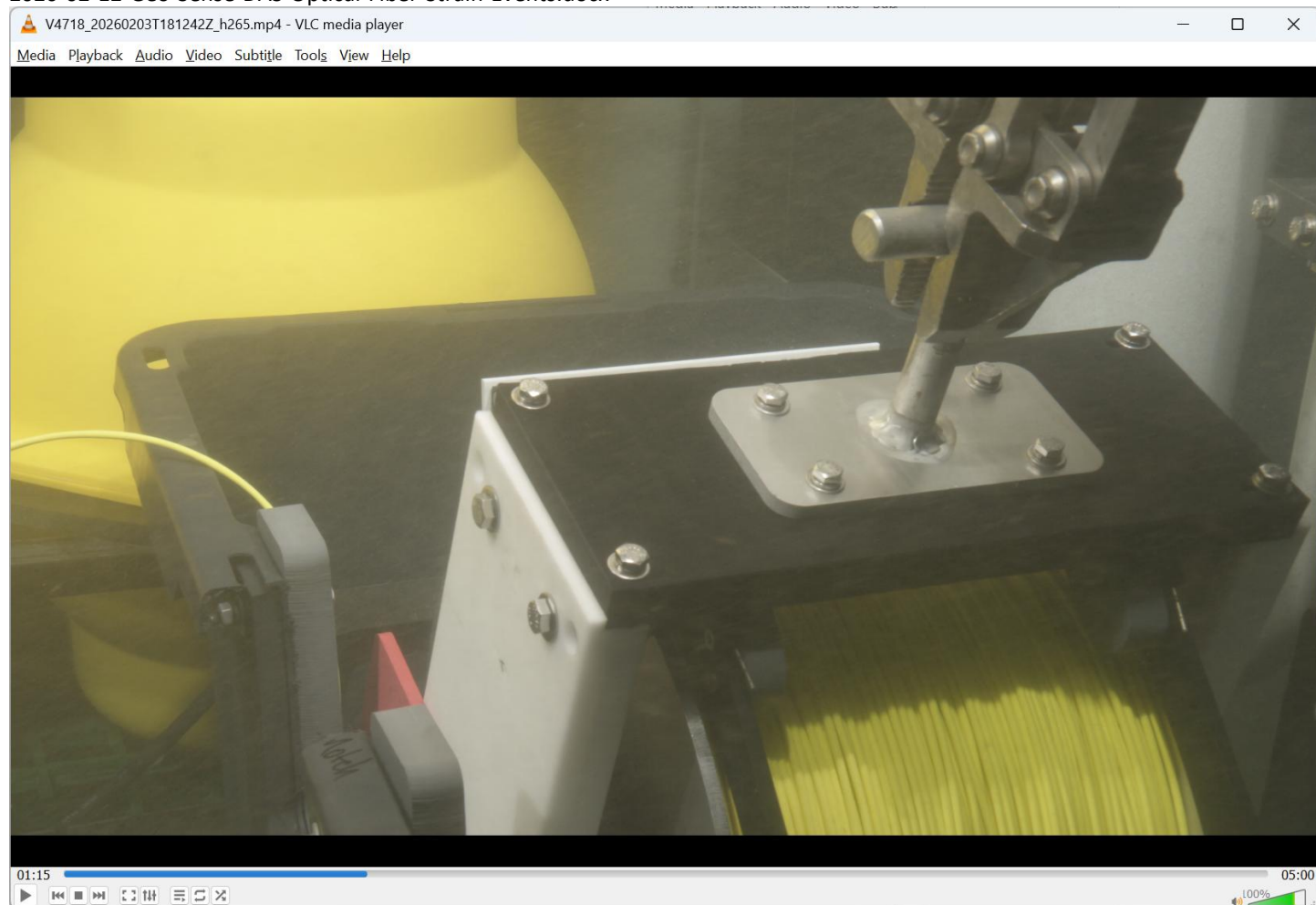


Fig 6. T-minus 03:56 to First Strain Event. Manipulator is locked on a spool handle; camera full zoom in.

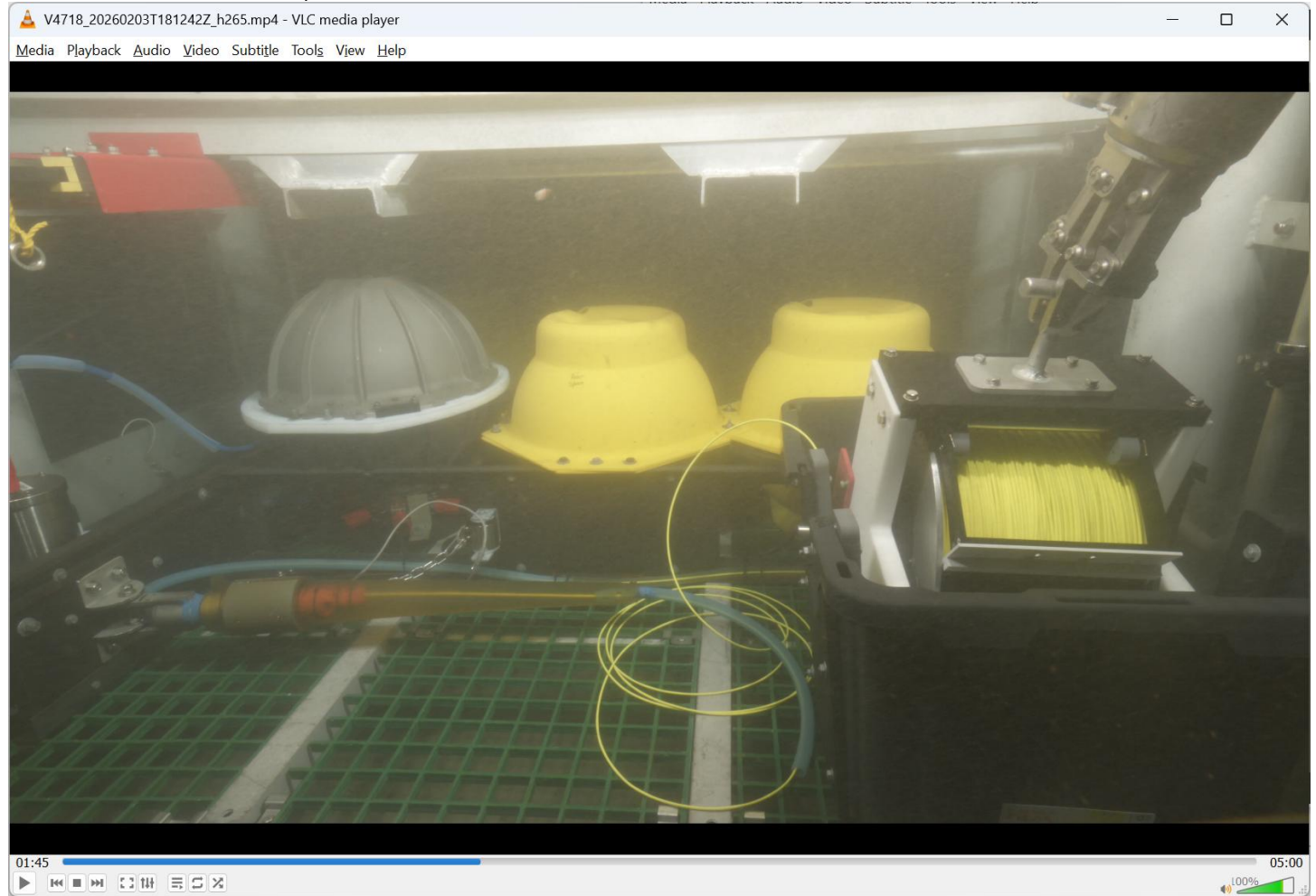


Fig 7. T-minus 03:26 to First Strain Event. First attempt of spool removal from the plastic tub, fiber loop clearly visible

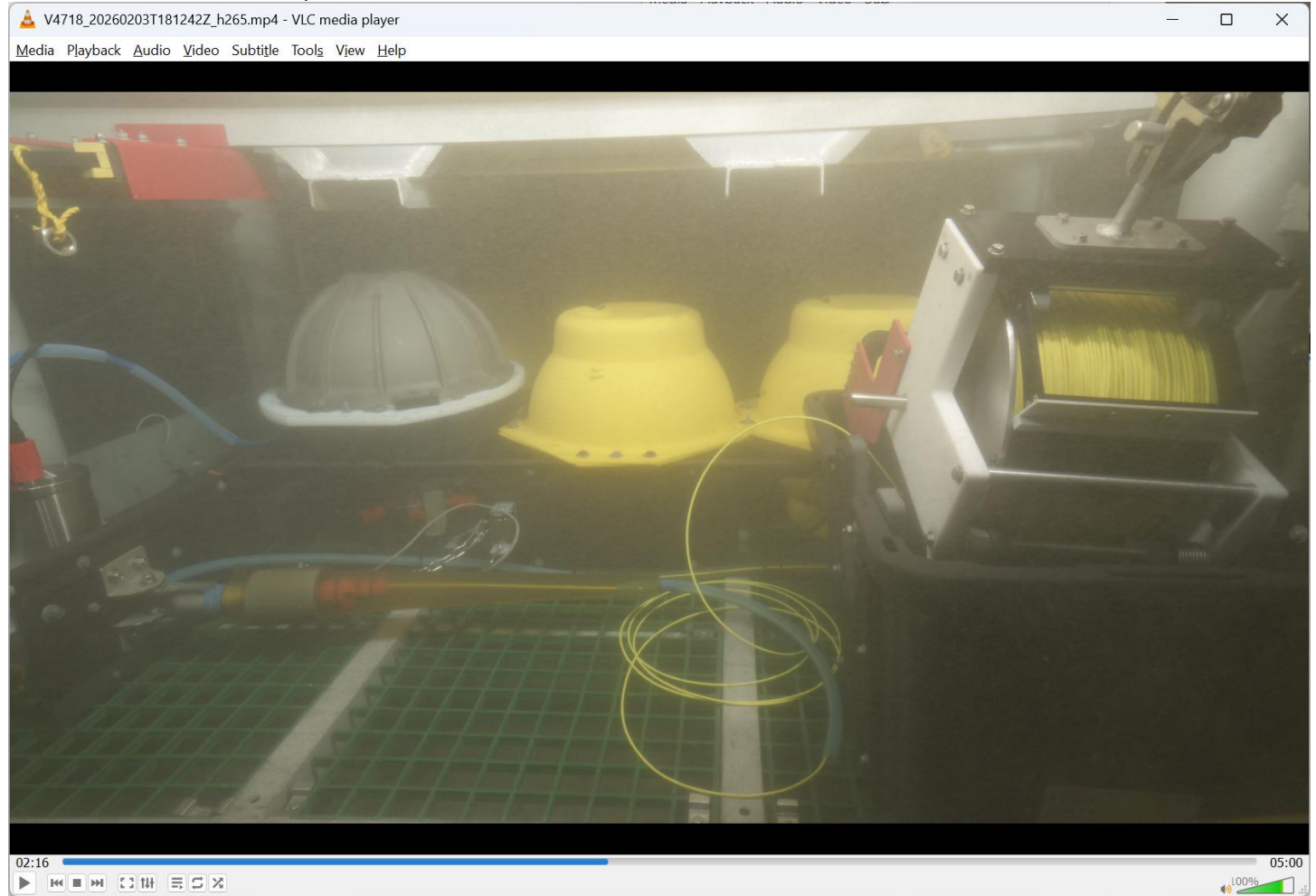


Fig 8. T-minus 02:55 to First Strain Event. Spool is lifted but not completely out of the tub

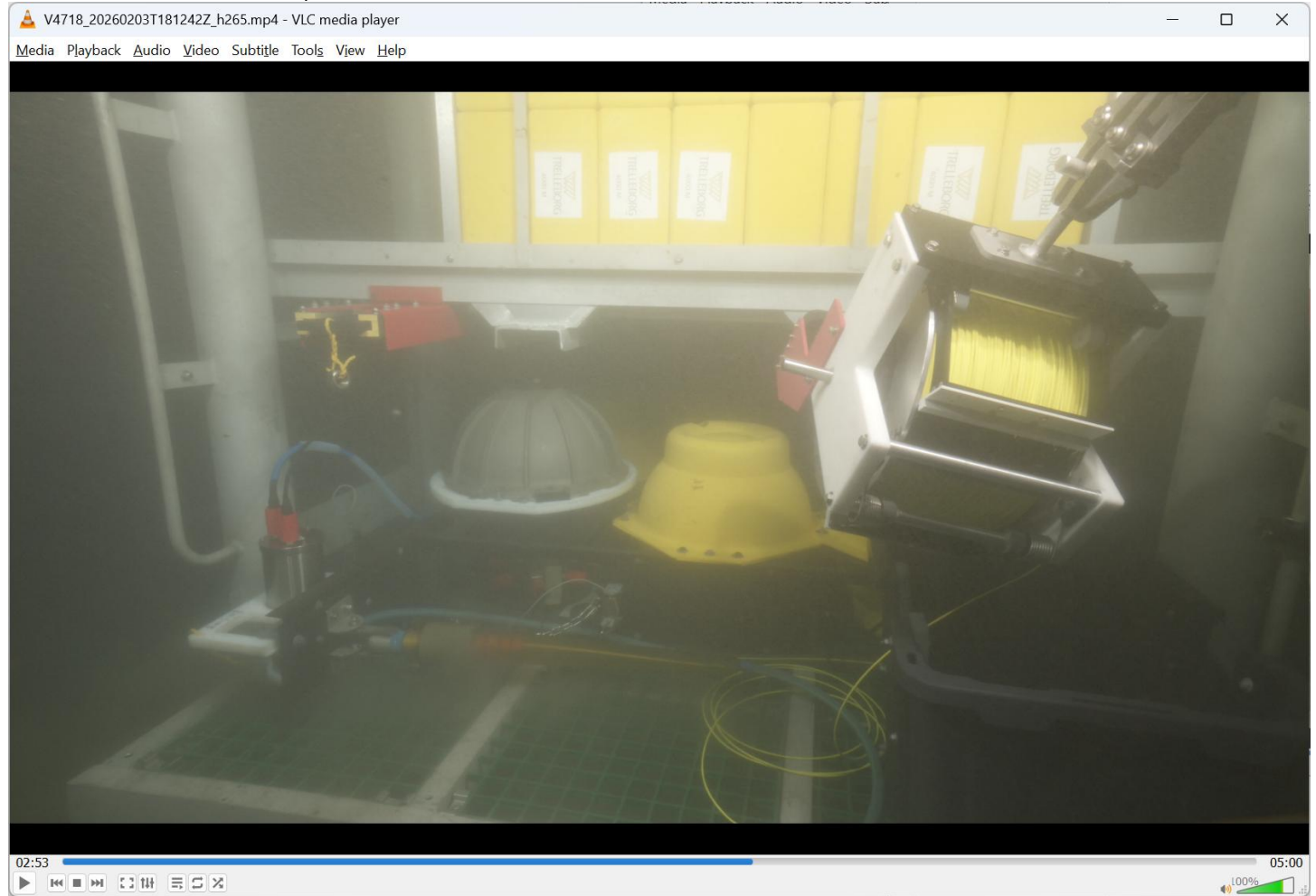


Fig 9. T-minus 02:18 to First Strain Event. Spool is lifted clear of the tub, but fiber is in the side channel of the tub.

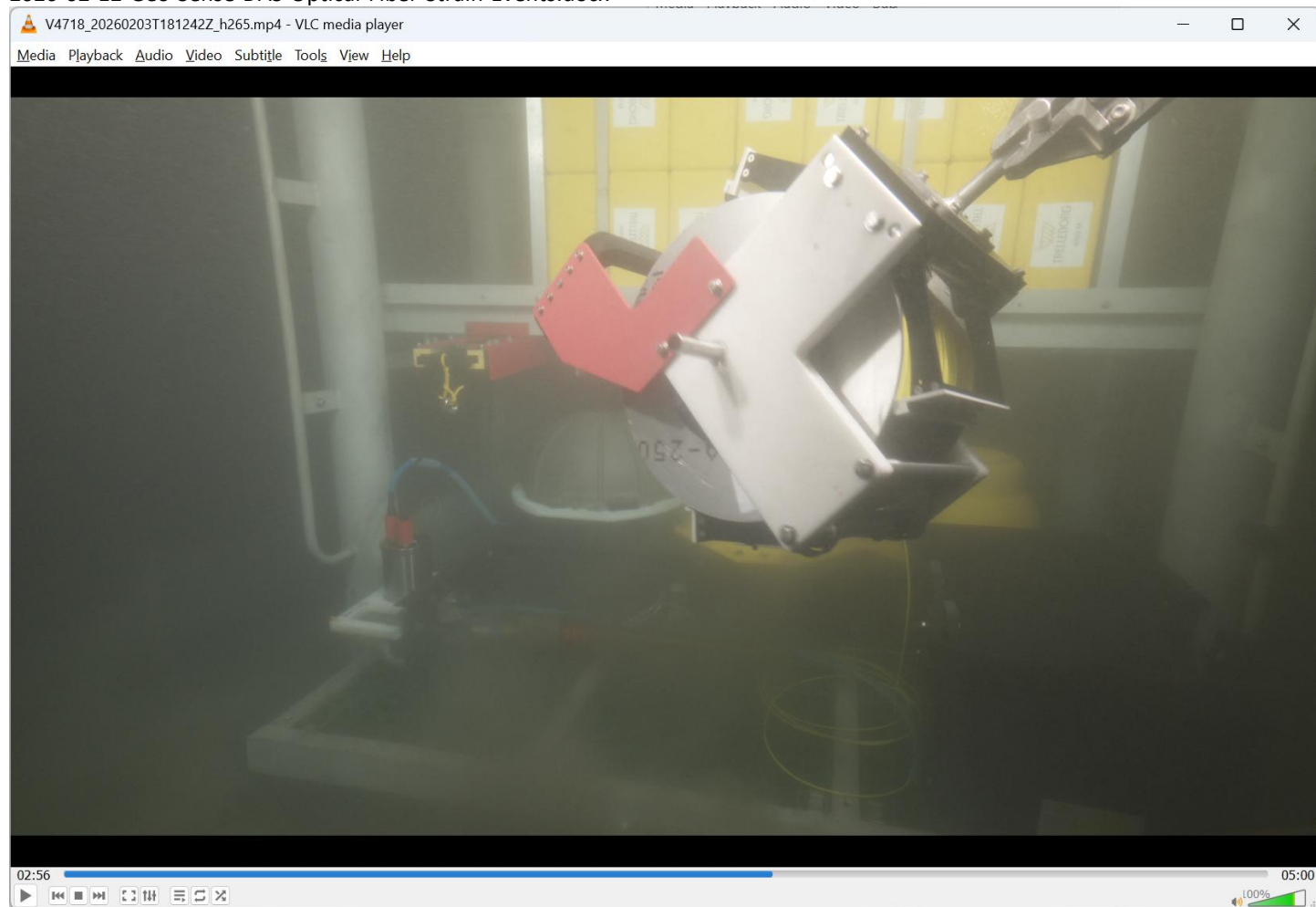


Fig 10. T-minus 02:15 to First Strain Event. Fiber is clear out of the tub.



Fig 11. T-minus 01:59 to First Strain Event. Spool moved ~ 2 meters out, paused, discovered fiber under the corner of the tub



Fig 12. T-minus 01:02 to First Strain Event. Fiber is freed from under the tub, "Alana said; You got it!", distance ~ 3 m, 2 fiber loops visible.

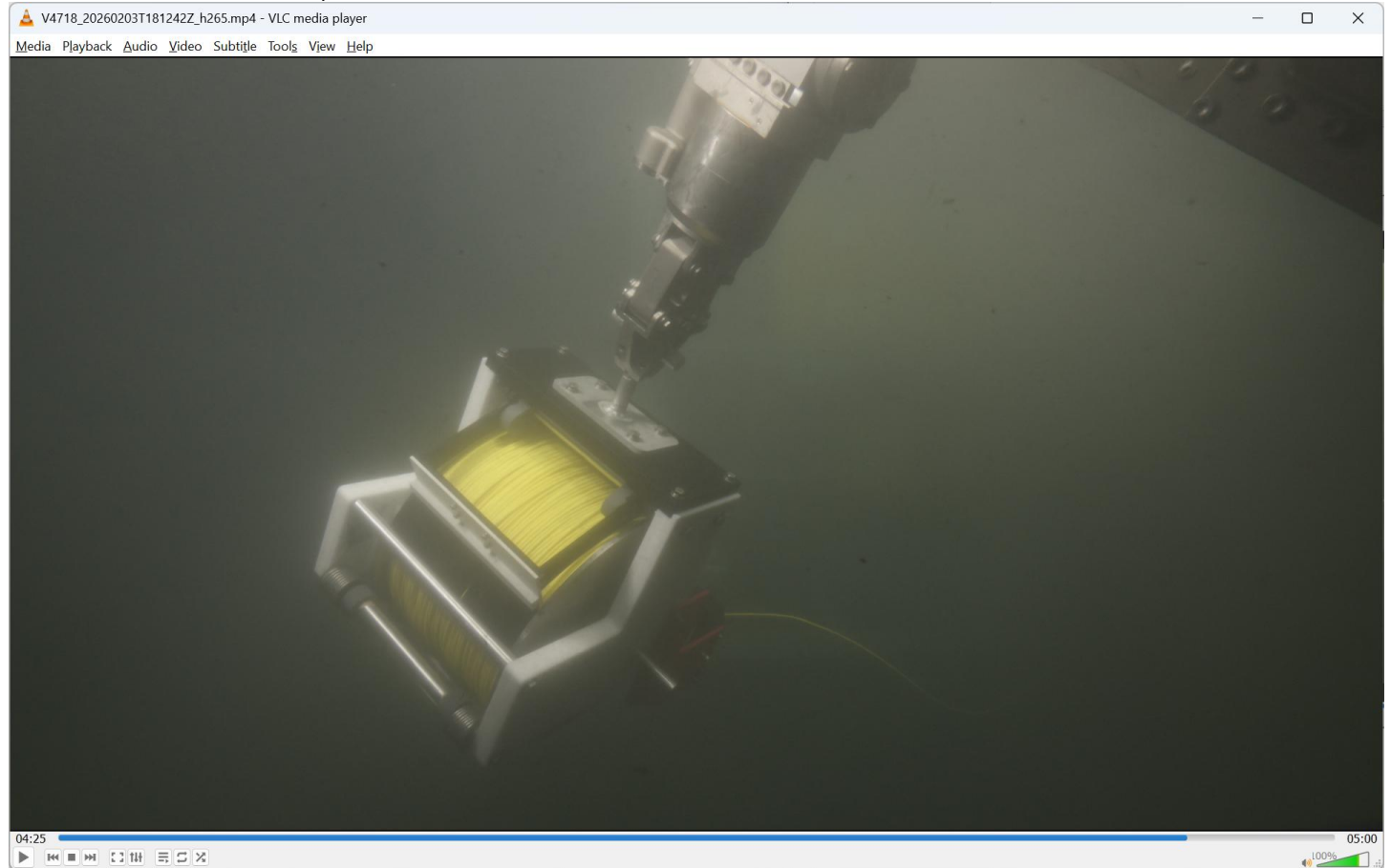


Fig 13. T-minus 00:46 to First Strain Event. Elevator barely visible, fiber clearly visible, right of the spool, towards elevator, not in tension.



Fig 14. T-minus 00:29 to First Strain Event. Fiber is visible left of the spool, not in tension.

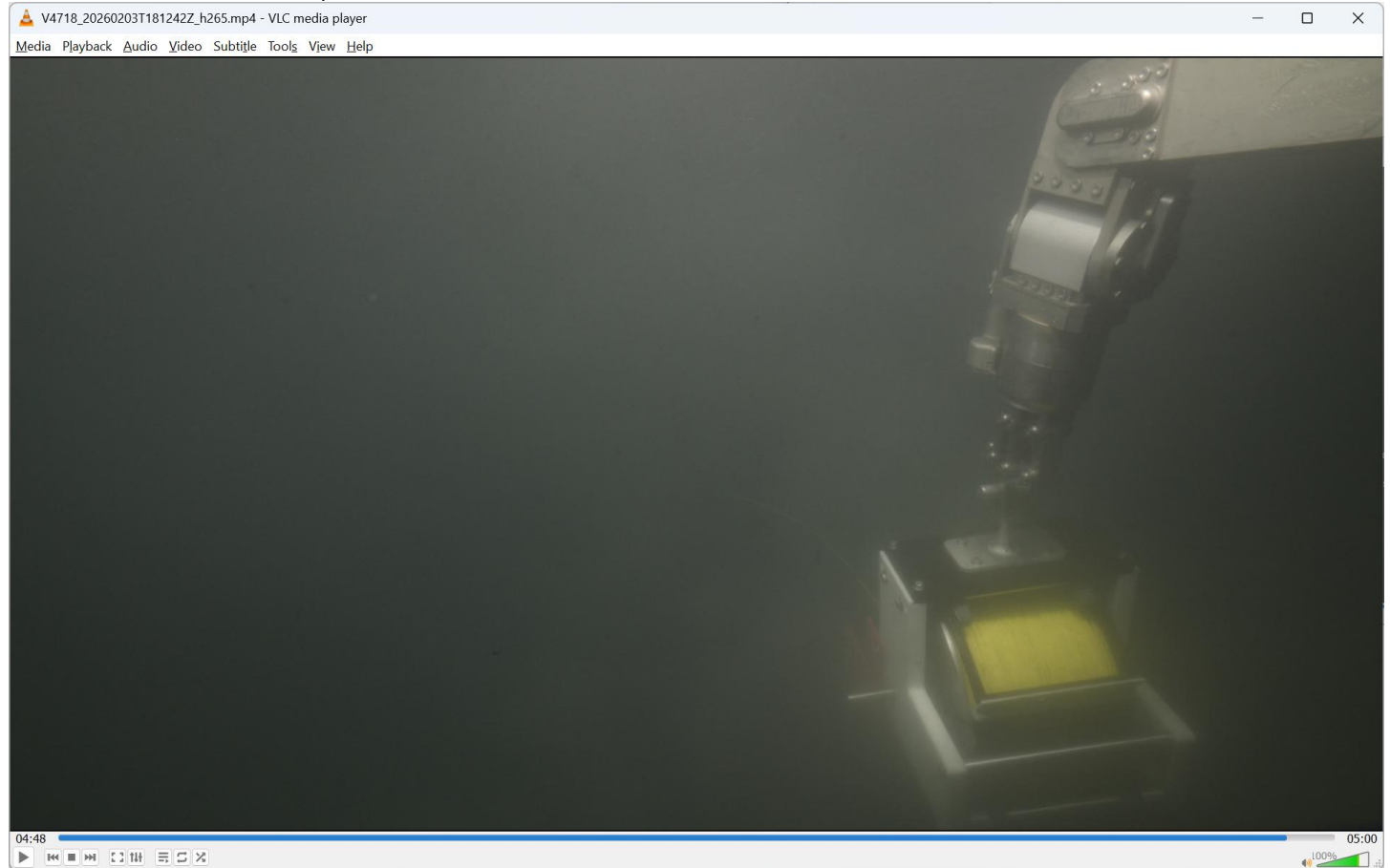


Fig 15. T-minus 00:23 to First Strain Event. Fiber is visible further left of the spool, still not in tension



Fig 16. T-minus 00:14 to First Strain Event. Fiber is visible waiving to the right, then left, not in tension.

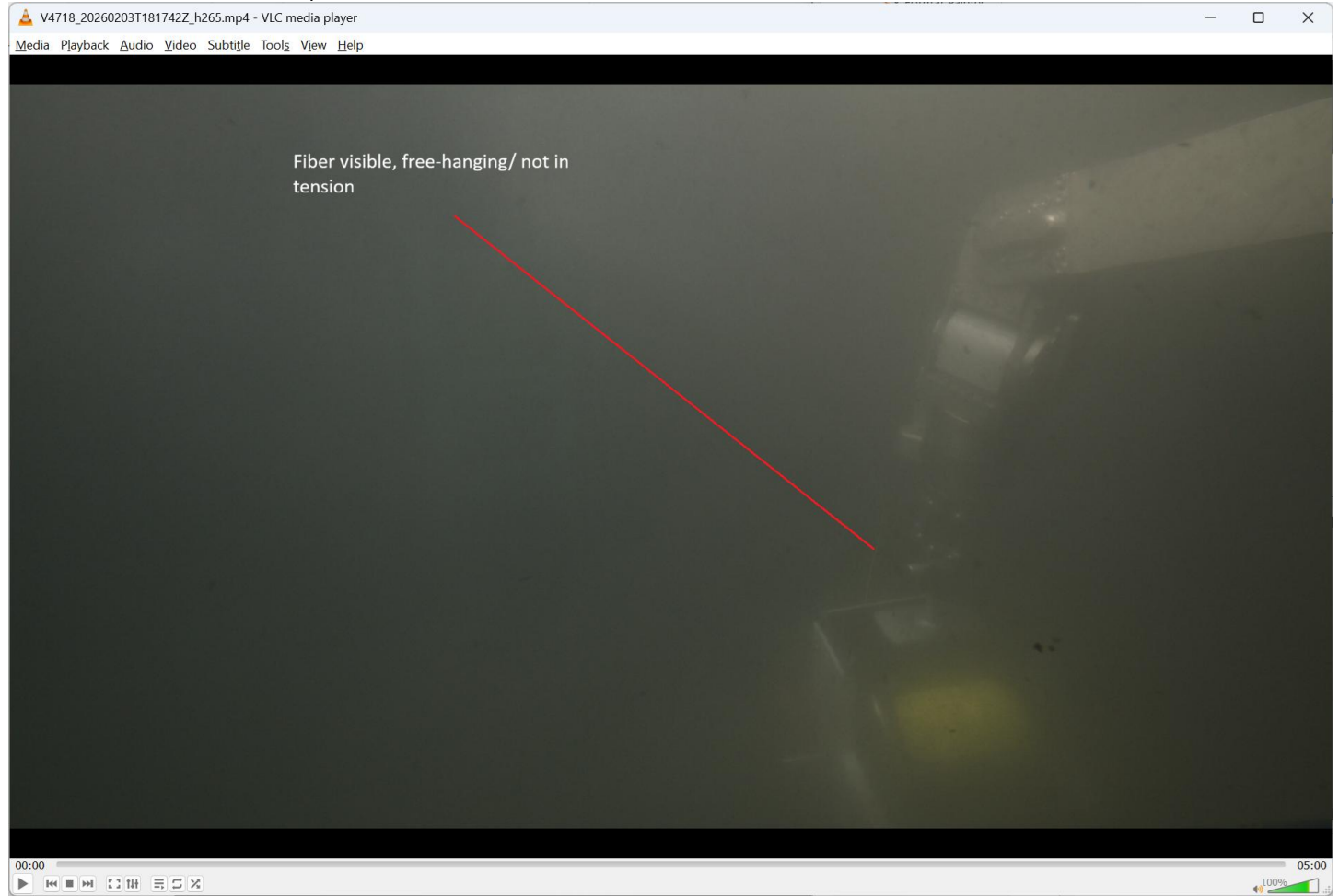


Fig 17. T-minus 00:11 to First Strain Event. Fiber is visible, free-hanging, not in tension; beginning of video file V4718_20260203T181742Z_h265.mp4



Fig 18. T-minus 00:05 to First Strain Event. Bad visibility, Alana said: "I am guessing, we are on a port side".



Fig 19. T-minus 00:01 to First Strain Event. Vibration on manipulator, fiber not visible, Alana said: "yea".



Fig 20. T-time. First strain event.



Fig 21. T-plus 00:02 from First Strain Event. Spool clearly visible, it is rotating.



Fig 22. T-plus 00:05 from First Strain Event; T-minus 01:24 to Second Strain Event. Fiber is visible, spool rotating



Fig 23. T-minus 01:22 to Second Strain Event. Paul said: "she is spinning"



Fig 24. T-minus 01:21 to Second Strain Event. Fiber sharp to the side, spool rotating



Fig 25. T-minus 01:19 to Second Strain Event. Fiber is visible, Alana said: "Oh!"; vibration on manipulator



Fig. 26. T-Minus 01:16 to Second Strain Event. Fiber not visible, manipulator rotated clockwise.



Fig. 27. T-minus 01:11 to Second Strain Event. Fiber is visible, sharp to the side; Alana said: "Hey, Ethan, can we stop?"



Fig. 28. T-minus 01:05 to Second Strain Event. Manipulator rotated clockwise, fiber visible.



Fig. 29. T-minus 01:04 to Second Strain Event. Spool not rotating, fiber visible more straight from the spool

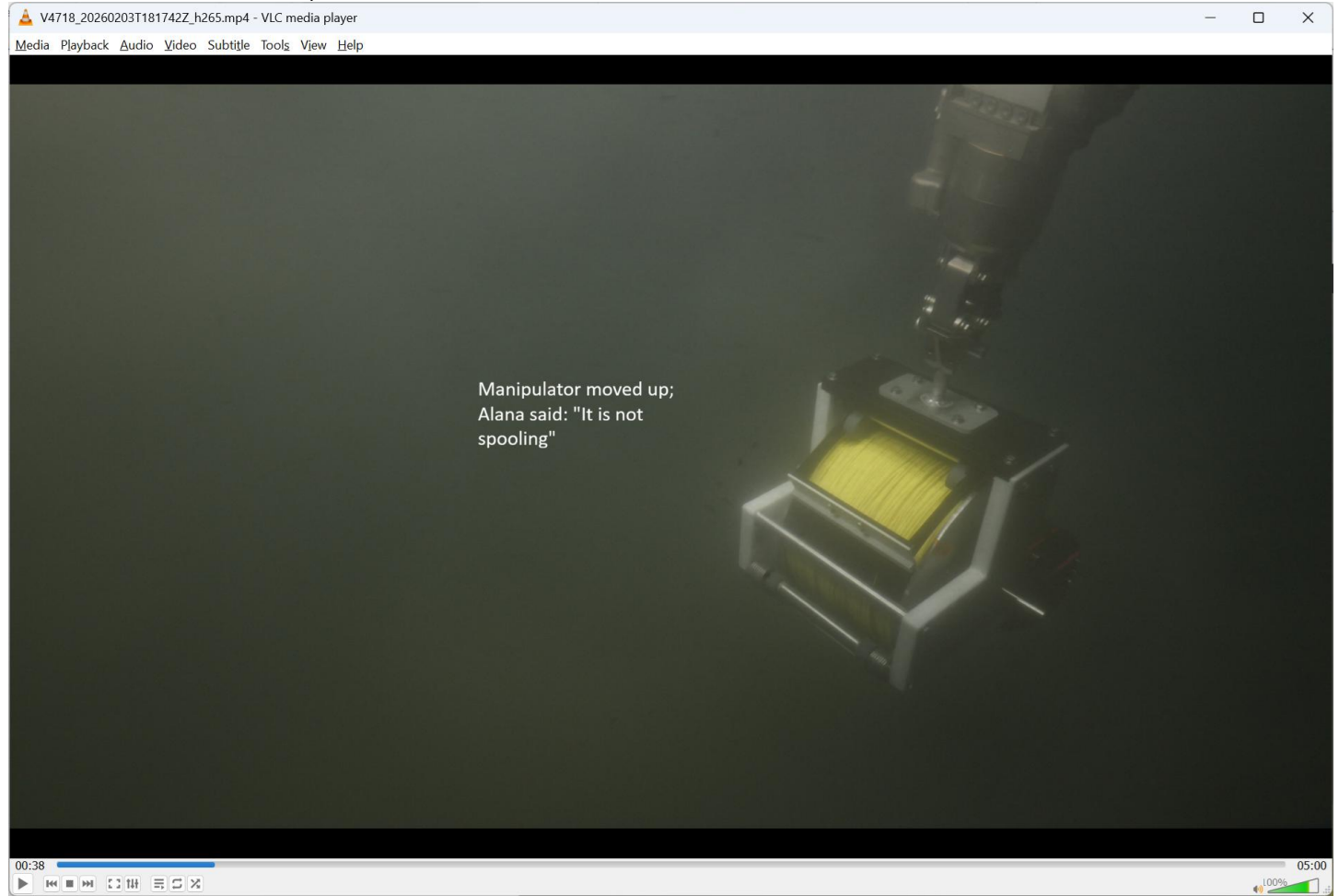


Fig. 30. T-minus 01:02 to Second Strain Event. Manipulator moved up; Alana said: "It is not spooling"



Fig. 31. T-minus 00:57 to Second Strain Event. Fiber is visible, it is free-hanging down from the spool.

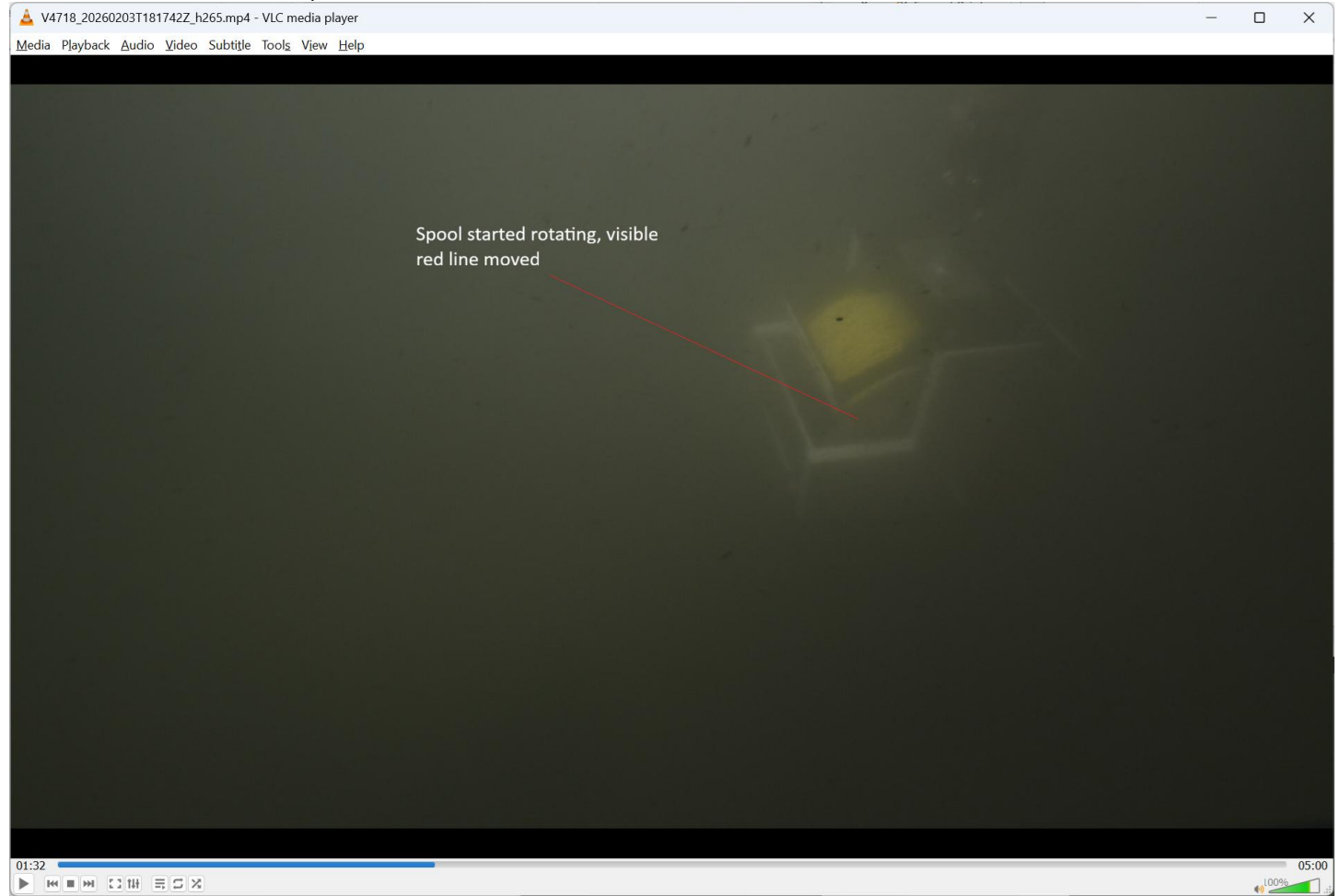


Fig. 32. T-minus 00:08 to Second Strain Event. Spool started rotating, visible red line moved

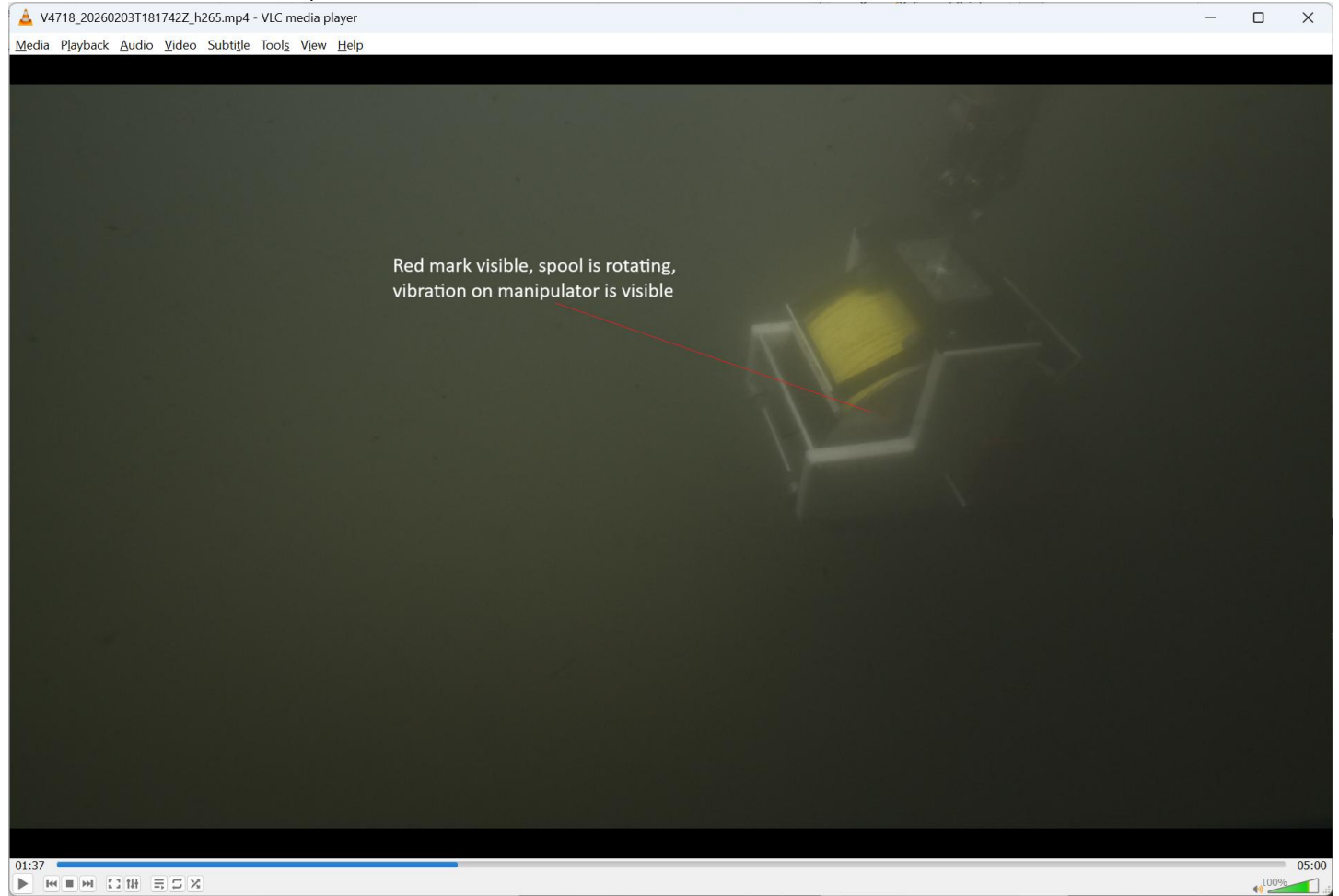


Fig. 33. T-minus 00:03 to Second Strain Event. Red mark visible, spool is rotating, vibration on manipulator is visible.



Fig. 34. T-time: Second strain event

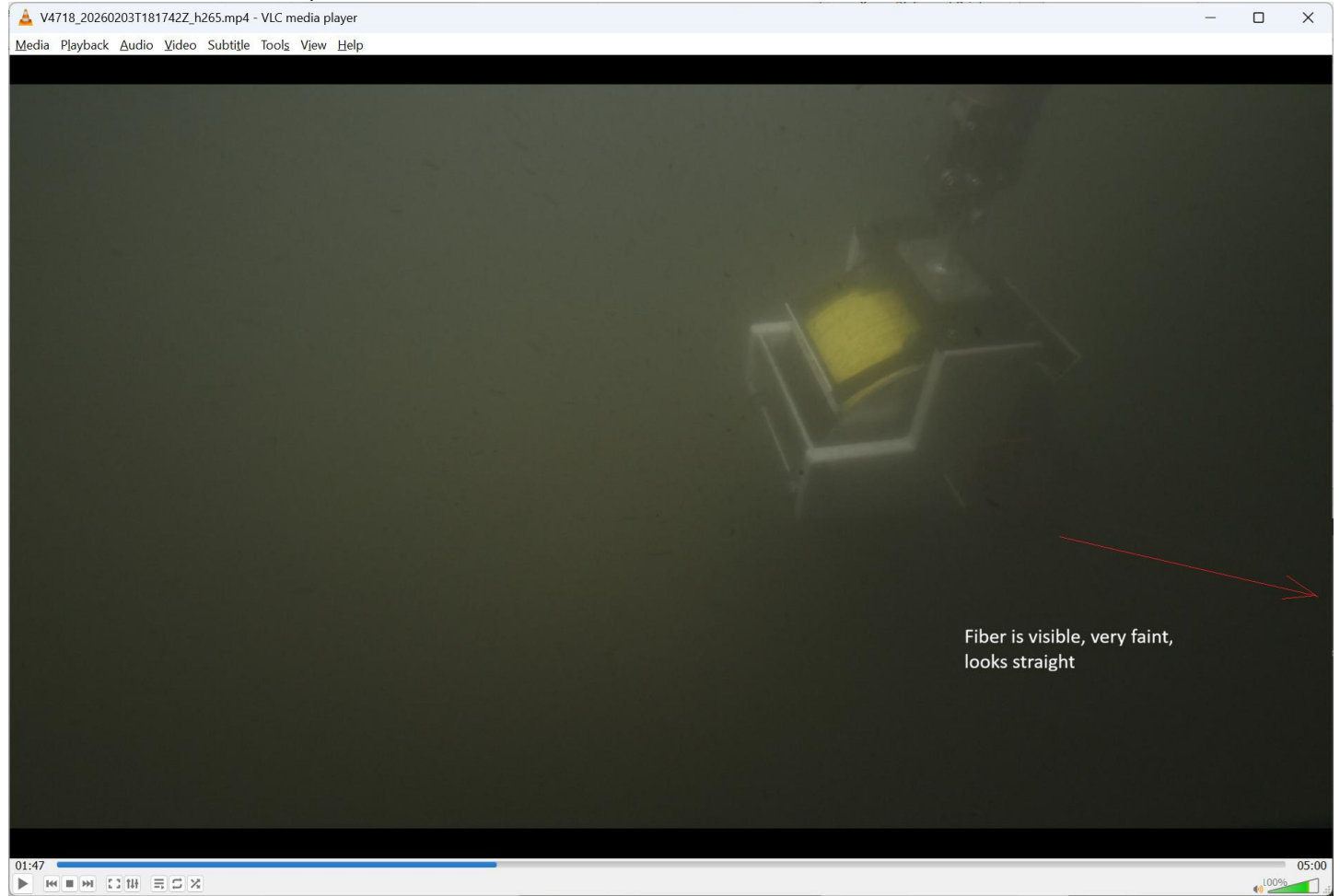


Fig. 35. T-plus 00:07 from Second Strain Event. Fiber is visible, very faint, looks straight

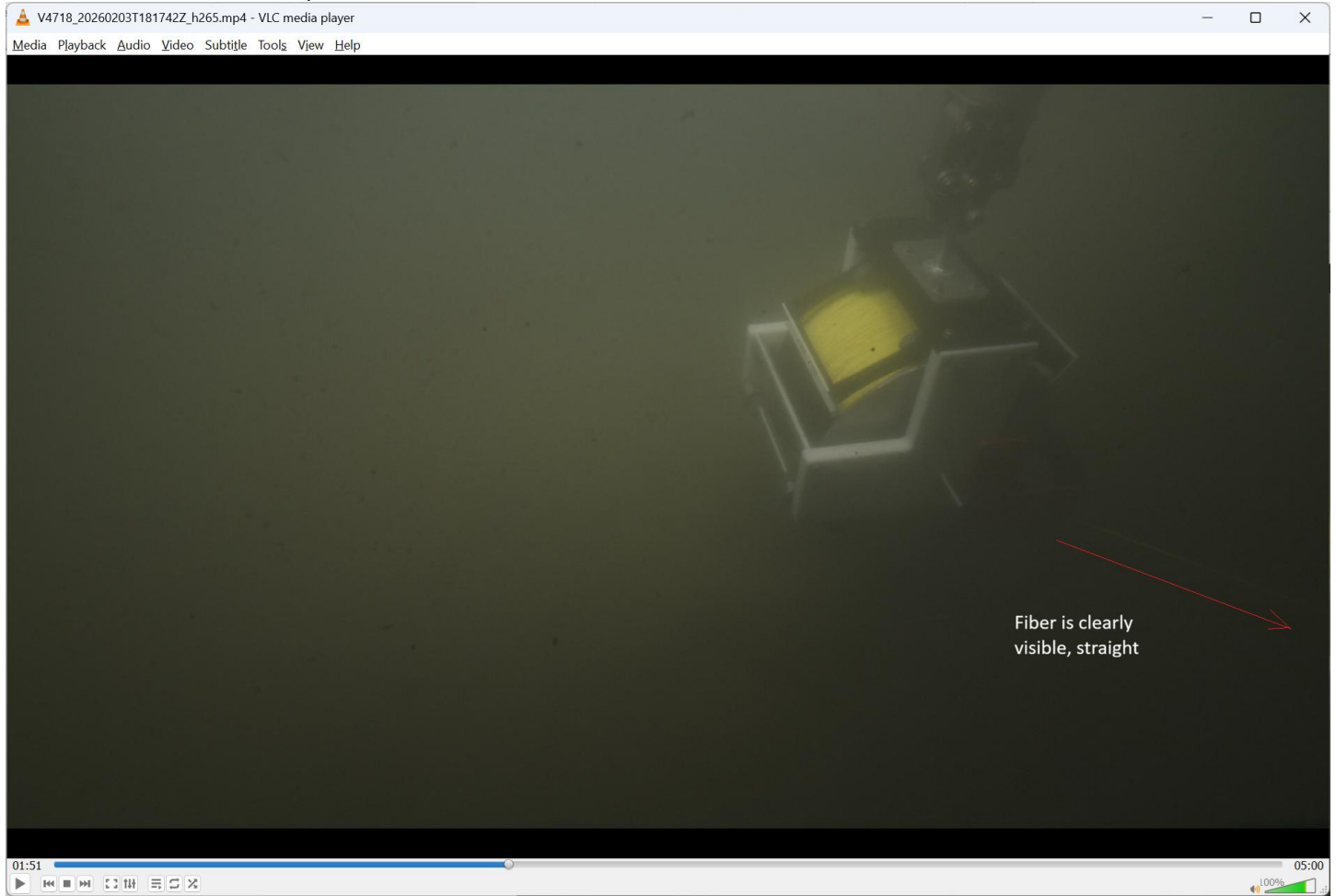


Fig. 36. T-plus 00:11 from Second Strain Event. Fiber is clearly visible, looks straight

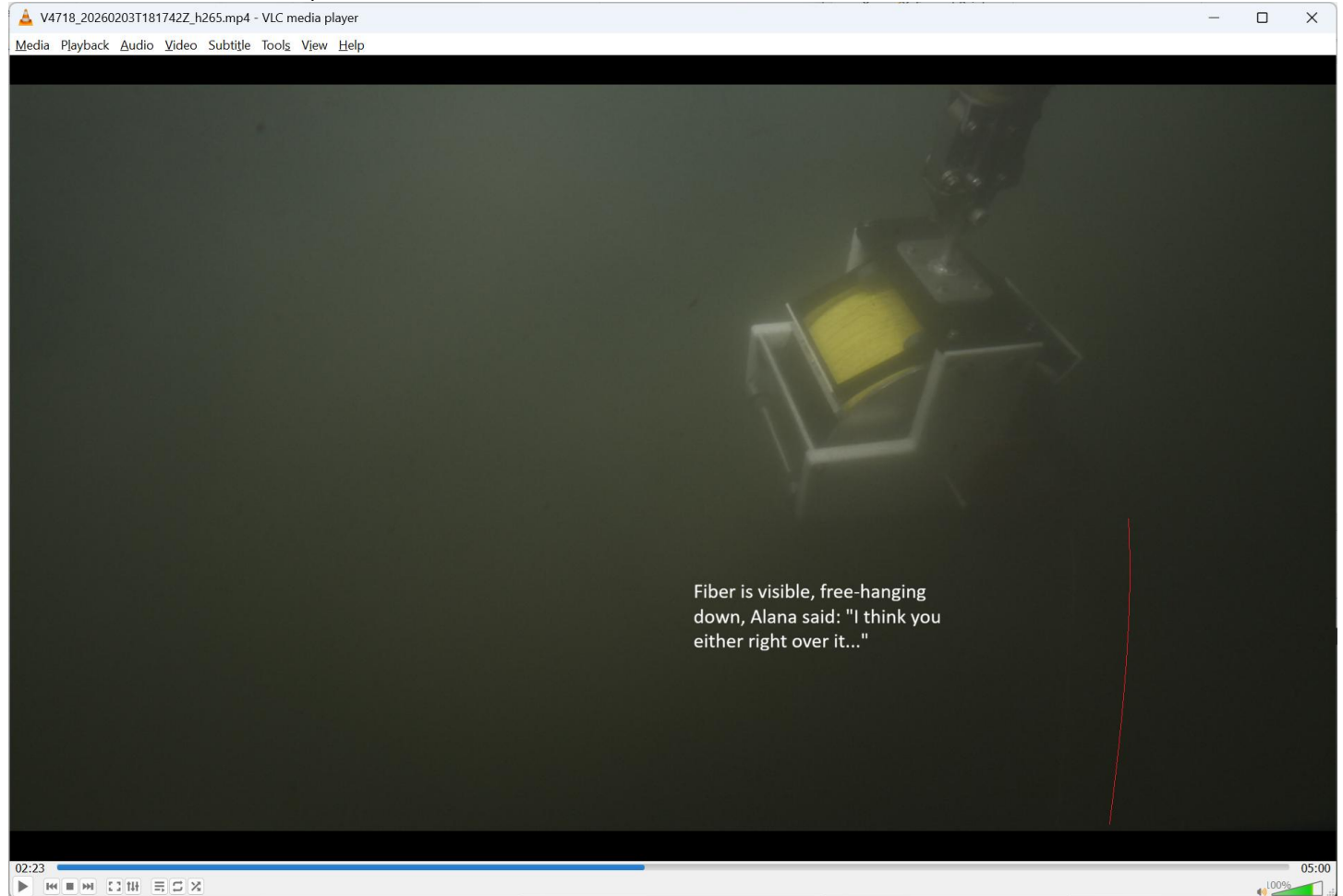


Fig. 37. T-plus 00:43 from Second Strain Event. Fiber is visible, free-hanging down, Alana said: "I think you either right over it..."

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