

Appendix to report:

SBJ-33-C5-OON-22-RE-021

K12 - DESIGN OF MOORING AND ANCHORING

Appendix title:

APPENDIX A – LOW CYCLE FATIGUE

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CONCEPT DEVELOPMENT FLOATING BRIDGE E39 BJØRNAFJORDEN

Norconsult 

 DR. TECHN.
OLAV OLSEN

 Prodtex
Production / Technology / Excellence

 IFE

 Pure Logic
The science of production reasoning

 HEYERDAHL ARKITEKTER AS

 H&BB

 MIKO
MARINE AS

 BUKSÉR og
BERGING

 FORCE
TECHNOLOGY

 SWERIM

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1 COMBINATION MATRIX

Case	WindseaNo	WindNo	SwellNo	p_combi
1	1	1	29	1.66E-03
2	1	1	0	3.55E-02
3	2	1	55	1.85E-05
4	2	1	0	2.94E-04
5	3	2	38	8.33E-05
6	3	2	0	9.54E-05
7	4	3	49	7.40E-05
8	4	3	0	6.00E-05
9	5	4	54	2.78E-05
10	5	4	0	2.44E-05
11	6	4	43	1.39E-05
12	6	4	0	1.02E-06
13	7	5	39	4.63E-04
14	7	5	0	3.13E-02
15	8	5	50	3.70E-05
16	8	5	0	1.42E-04
17	9	6	56	3.70E-05
18	9	6	0	7.70E-06
19	10	7	51	1.30E-04
20	10	7	0	3.44E-02
21	11	7	32	2.50E-04
22	11	7	0	6.73E-04
23	12	8	46	1.76E-04
24	12	8	0	1.96E-03
25	13	9	43	1.39E-05
26	13	9	0	1.59E-05
27	14	10	8	3.30E-02
28	14	10	0	6.51E-02
29	15	10	1	3.70E-05
30	15	10	0	4.20E-03
31	16	11	27	4.72E-04
32	16	11	0	6.02E-03
33	17	12	11	1.23E-02
34	17	12	0	1.46E-02
35	18	13	48	2.13E-04
36	18	13	0	2.67E-03
37	19	14	41	3.42E-04
38	19	14	0	2.24E-03
39	20	15	47	2.31E-04
40	20	15	0	3.94E-04
41	21	16	35	2.04E-04
42	21	16	0	5.60E-02
43	22	16	53	7.40E-05
44	22	16	0	1.73E-03
45	23	17	25	1.65E-03
46	23	17	0	1.11E-02
47	24	17	15	8.33E-04
48	24	17	0	1.71E-03

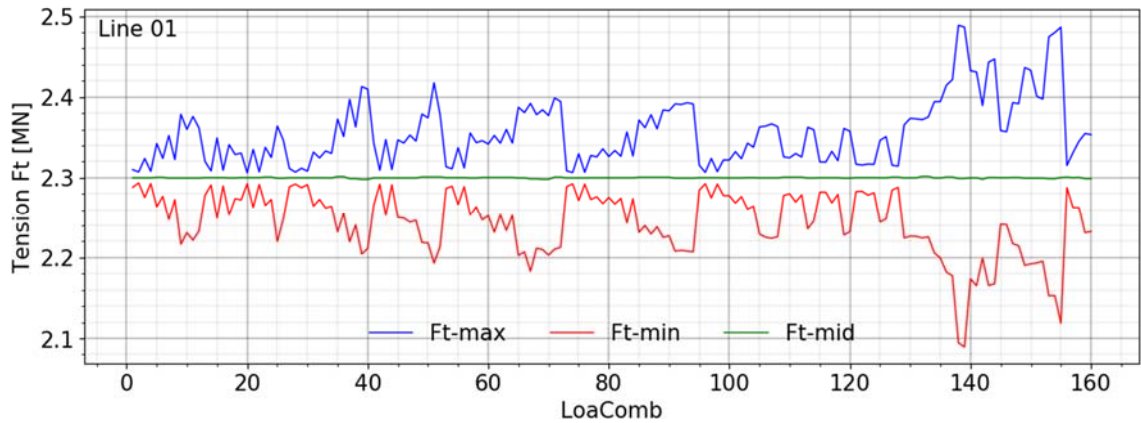
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51	26	18	57	5.55E-05
52	26	18	0	1.01E-04
53	27	19	18	2.00E-02
54	27	19	0	4.66E-02
55	28	19	28	3.15E-04
56	28	19	0	1.01E-03
57	29	20	31	2.68E-04
58	29	20	0	2.16E-02
59	30	21	13	3.72E-03
60	30	21	0	9.60E-03
61	31	21	21	2.41E-04
62	31	21	0	1.18E-03
63	32	21	42	7.40E-05
64	32	21	0	1.53E-05
65	33	22	44	1.11E-04
66	33	22	0	1.06E-03
67	34	23	52	4.16E-05
68	34	23	0	1.05E-05
69	35	24	34	6.01E-04
70	35	24	0	1.65E-04
71	36	25	16	7.40E-05
72	36	25	0	5.25E-05
73	37	26	3	2.37E-02
74	37	26	0	4.13E-02
75	38	26	45	3.70E-04
76	38	26	0	2.85E-03
77	39	27	9	3.86E-03
78	39	27	0	3.24E-03
79	40	27	33	1.52E-03
80	40	27	0	5.49E-03
81	41	27	20	4.90E-04
82	41	27	0	2.37E-03
83	42	27	52	4.16E-05
84	42	27	0	9.24E-05
85	43	28	23	2.22E-04
86	43	28	0	6.41E-04
87	44	28	24	2.96E-04
88	44	28	0	1.65E-04
89	45	29	37	6.57E-04
90	45	29	0	8.47E-04
91	46	30	30	1.73E-04
92	46	30	0	7.29E-05
93	47	30	30	1.73E-04
94	47	30	0	5.80E-05
95	48	31	22	1.19E-02
96	48	31	0	8.92E-02
97	49	31	30	1.73E-04
98	49	31	0	3.77E-03
99	50	32	4	3.15E-02
100	50	32	0	3.29E-03

101	51	32	14	1.50E-03
102	51	32	0	3.33E-04
103	52	33	26	3.07E-03
104	52	33	0	6.95E-04
105	53	34	19	3.88E-03
106	53	34	0	6.82E-05
107	54	34	36	1.68E-03
108	54	34	0	2.48E-03
109	67	41	5	3.85E-02
110	67	41	0	5.68E-03
111	68	41	12	2.00E-03
112	68	41	0	4.90E-04
113	69	42	12	2.99E-03
114	69	42	0	8.09E-04
115	71	44	2	2.27E-02
116	71	44	0	2.25E-02
117	72	44	12	2.99E-03
118	72	44	0	5.86E-04
119	73	45	10	3.68E-03
120	73	45	0	6.09E-04
121	77	49	6	5.57E-02
122	77	49	0	2.91E-02
123	78	49	17	4.30E-02
124	78	49	0	6.29E-04
125	79	50	10	1.47E-02
126	79	50	0	4.27E-03
127	91	57	7	4.04E-02
128	91	57	0	2.83E-03
129	55	34	0	3.35E-04
130	56	35	0	1.49E-03
131	57	35	0	9.01E-04
132	58	36	0	1.71E-04
133	59	36	0	1.14E-03
134	60	37	0	7.40E-06
135	61	37	0	3.42E-04
136	62	38	0	4.47E-05
137	63	38	0	1.27E-04
138	64	39	0	7.40E-06
139	65	39	0	1.49E-05
140	66	40	0	1.49E-05
141	70	43	0	5.14E-04
142	74	46	0	1.00E-03
143	75	47	0	2.83E-04
144	76	48	0	6.70E-05
145	80	51	0	7.26E-03
146	81	51	0	4.76E-04
147	82	52	0	1.39E-03
148	83	52	0	4.09E-04
149	84	53	0	3.27E-04
150	85	53	0	5.14E-04
151	86	54	0	7.44E-05
152	87	54	0	4.61E-04

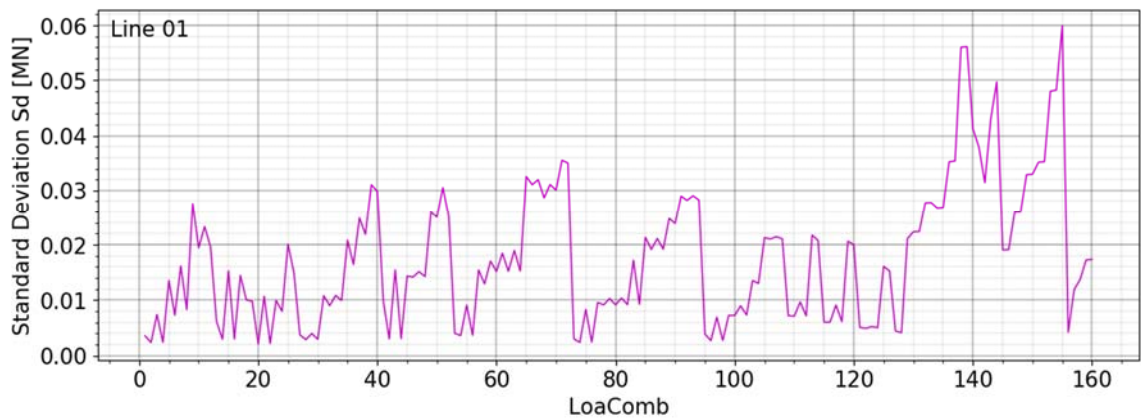
153	88	55	0	1.41E-04
154	89	55	0	8.19E-05
155	90	56	0	6.70E-05
156	92	57	0	1.34E-02
157	93	58	0	7.00E-04
158	94	59	0	1.26E-03
159	95	60	0	2.08E-04
160	96	60	0	7.44E-05

2 LINE 01

2.1 Tension

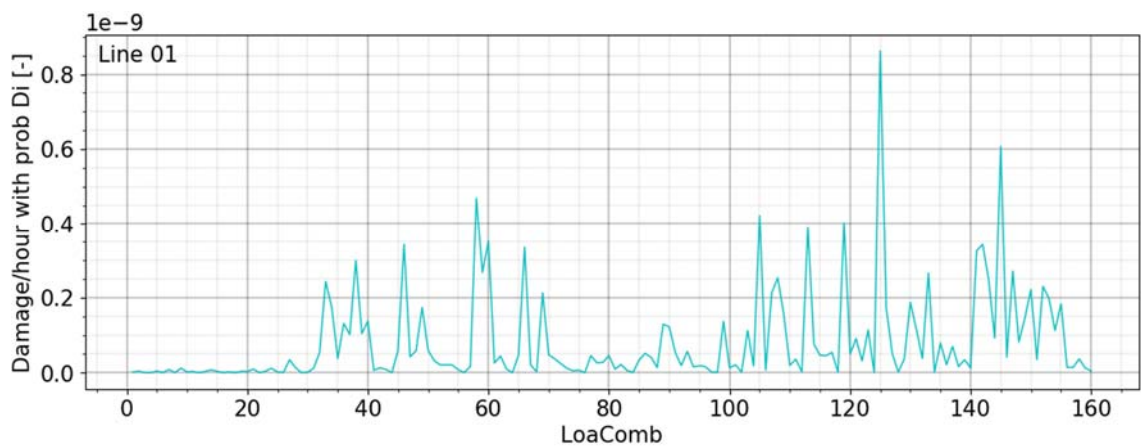


2.2 Standard Deviation

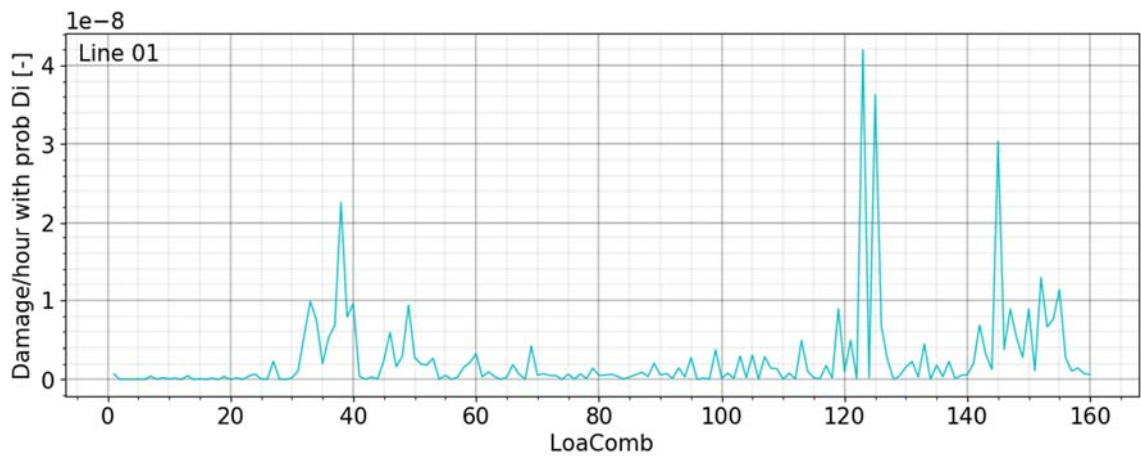


2.3 Damage

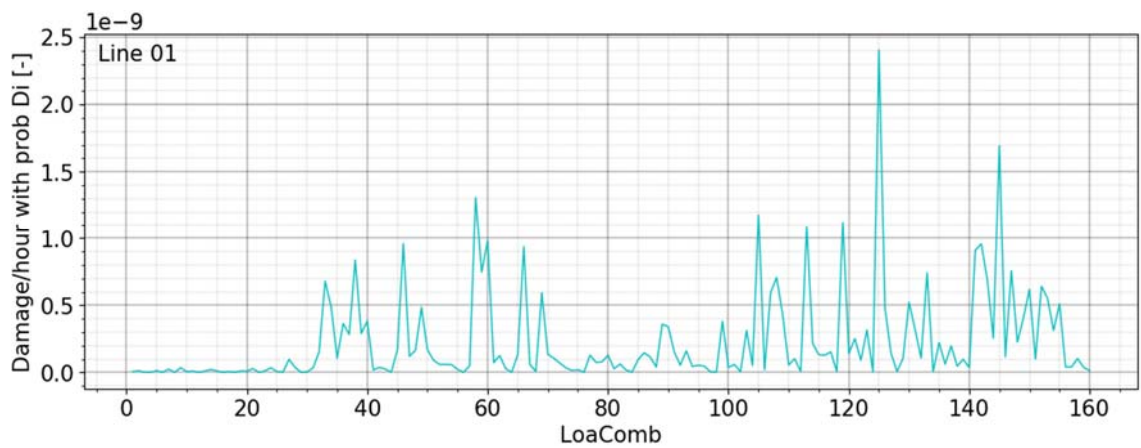
2.3.1 TT-Top chain



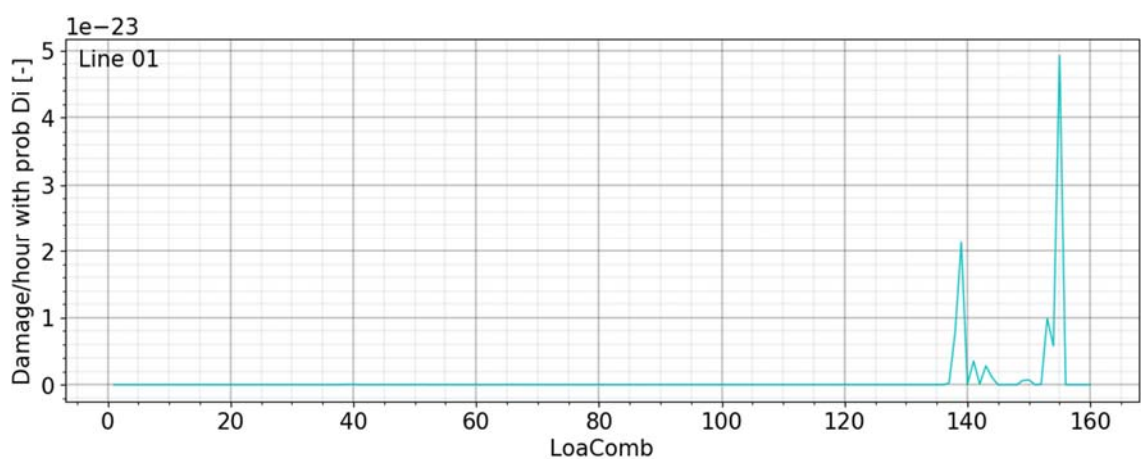
2.3.2 IPB OPB Top chain



2.3.3 TT Bottom chain

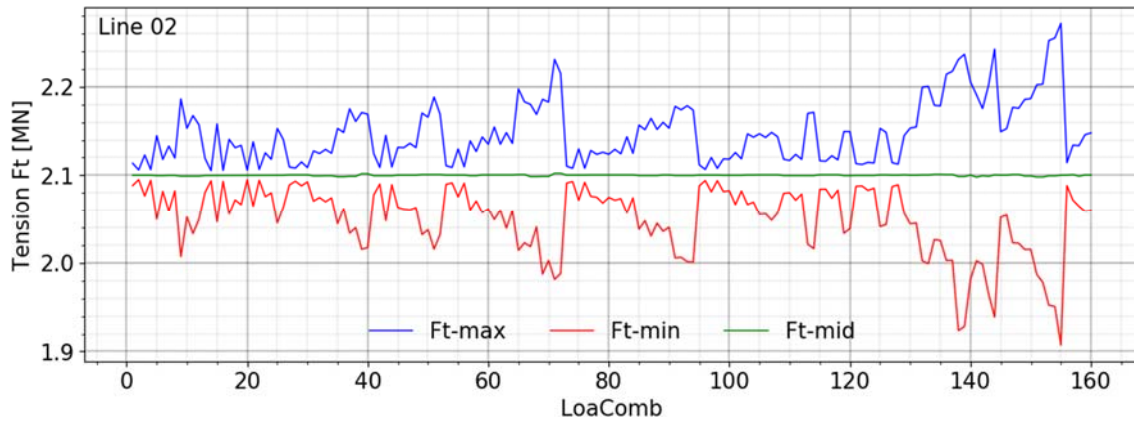


2.3.4 TT Fibre Rope

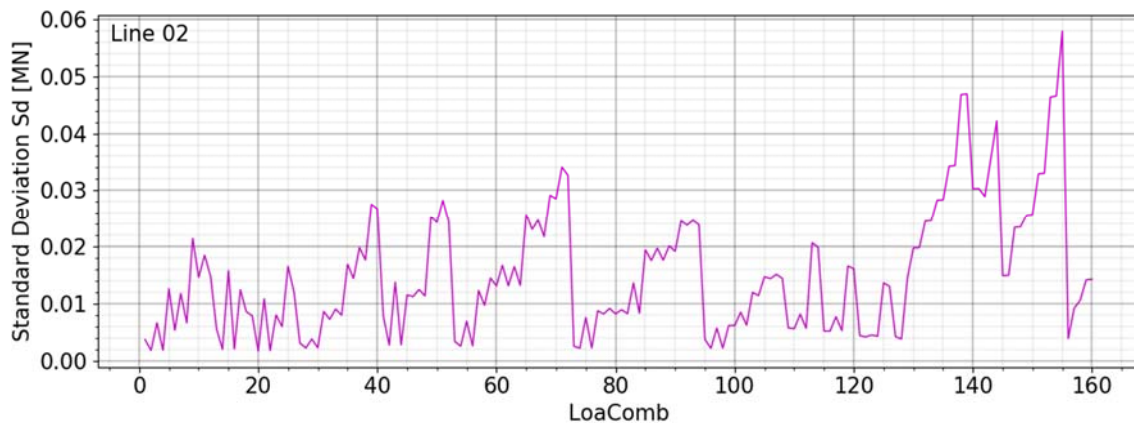


3 LINE 02

3.1 Tension

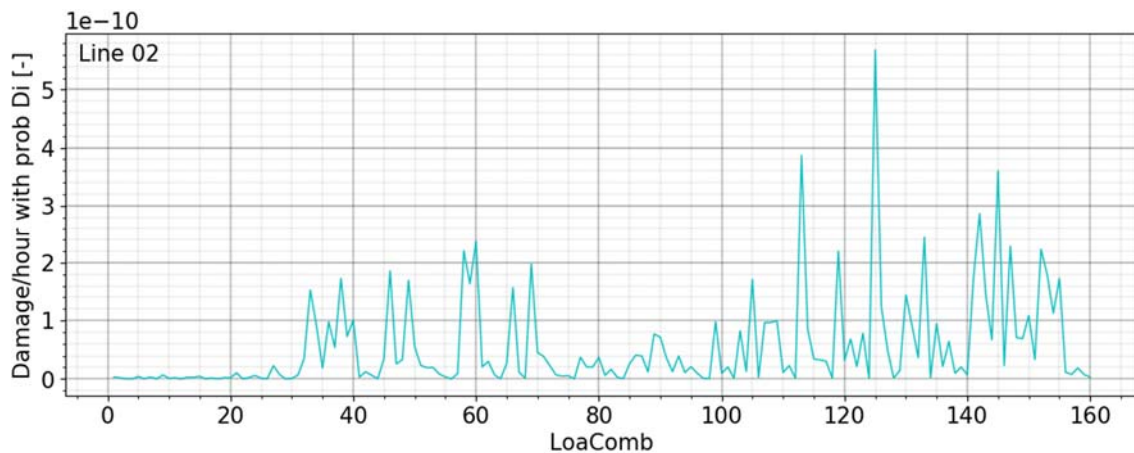


3.2 Standard Deviation

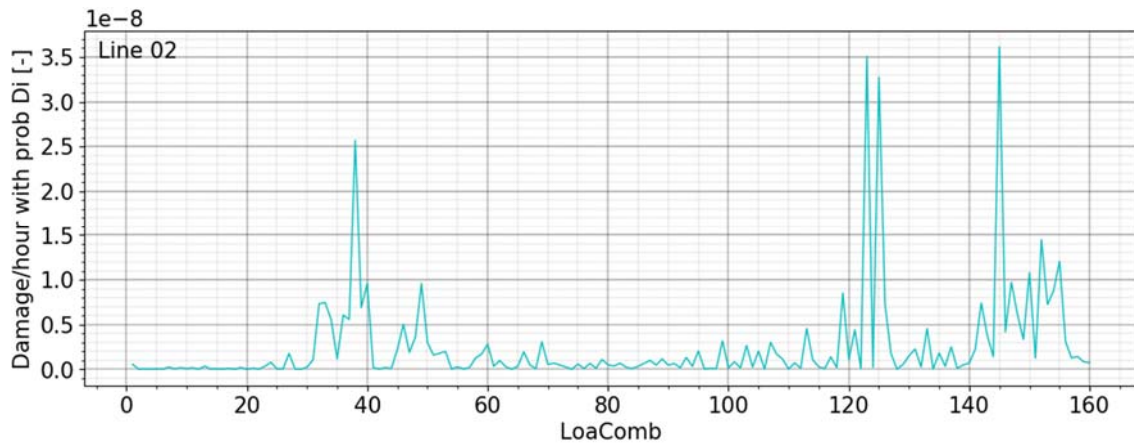


3.3 Damage

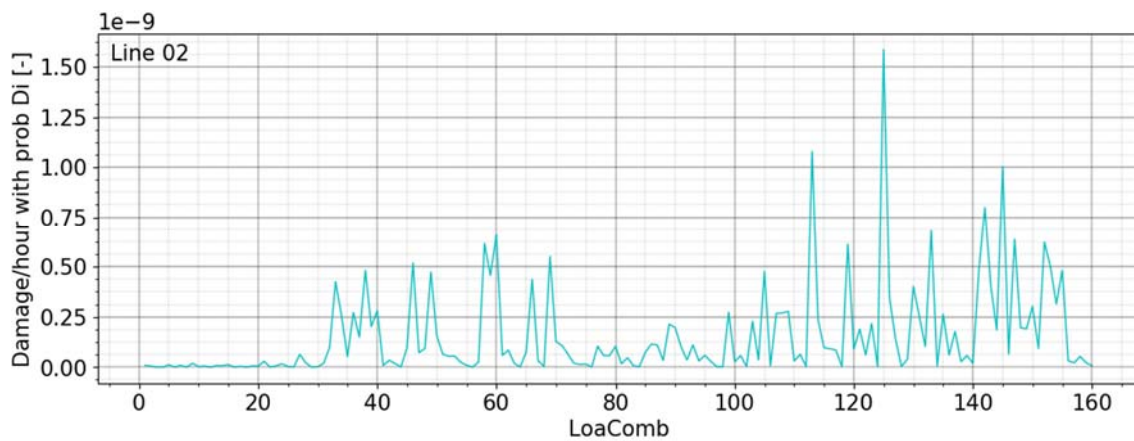
3.3.1 TT-Top chain



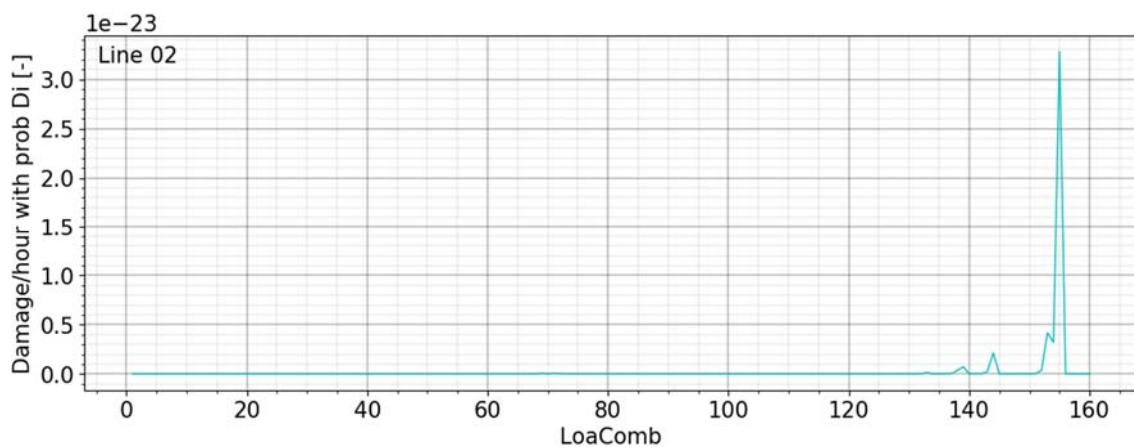
3.3.2 IPB OPB Top chain



3.3.3 TT Bottom chain

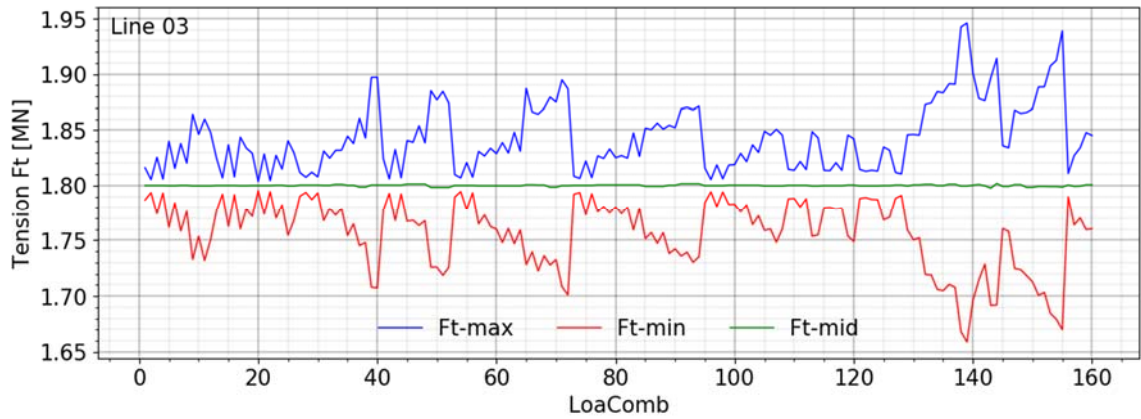


3.3.4 TT Fibre Rope

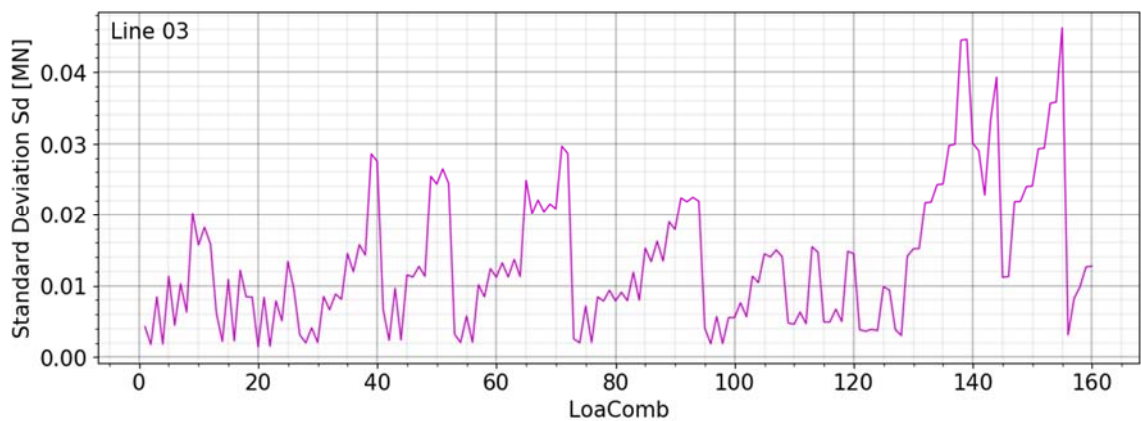


4 LINE 03

4.1 Tension

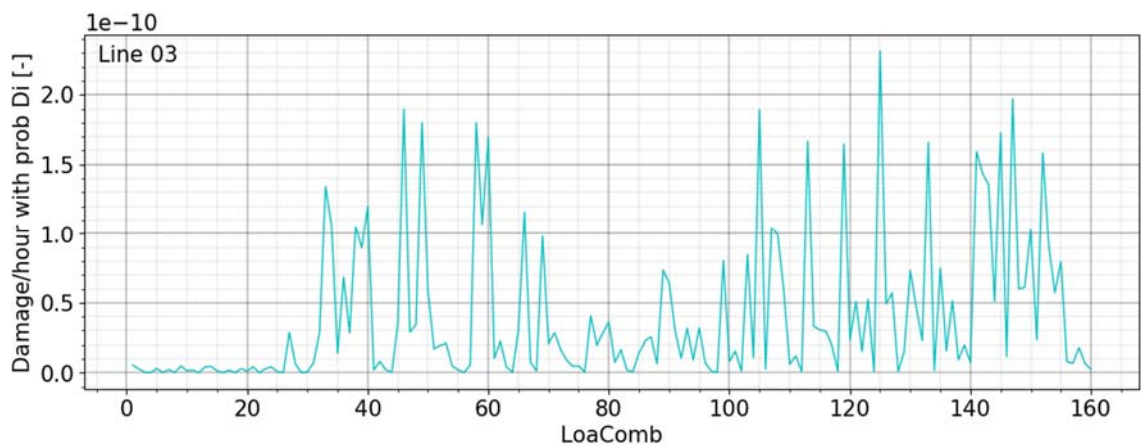


4.2 Standard Deviation

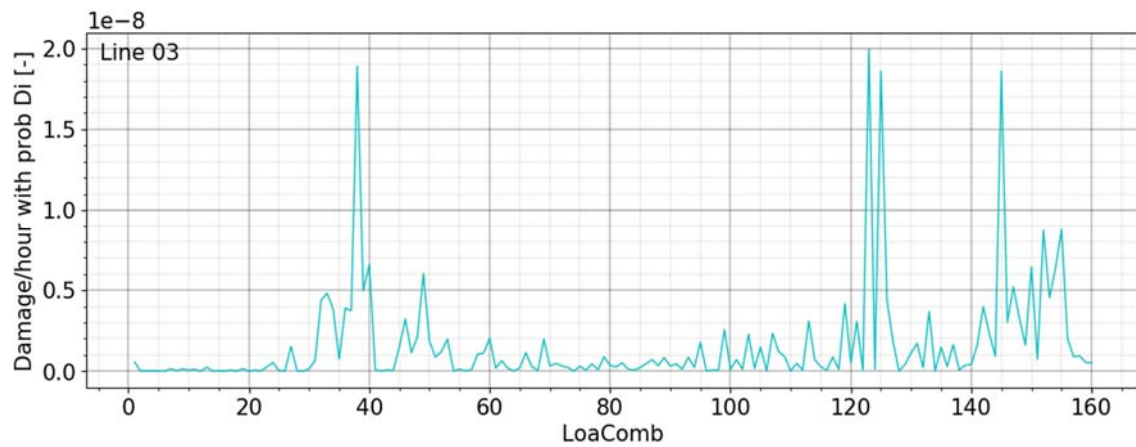


4.3 Damage

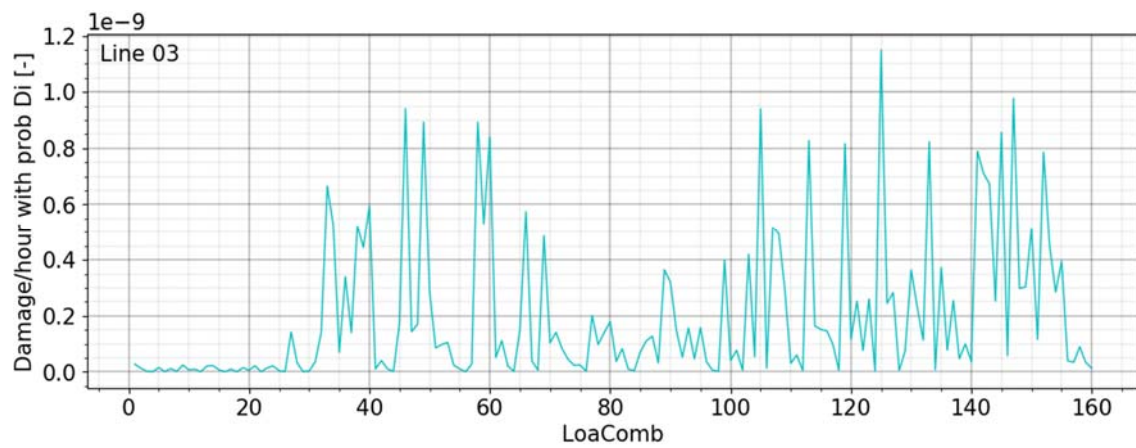
4.3.1 TT-Top chain



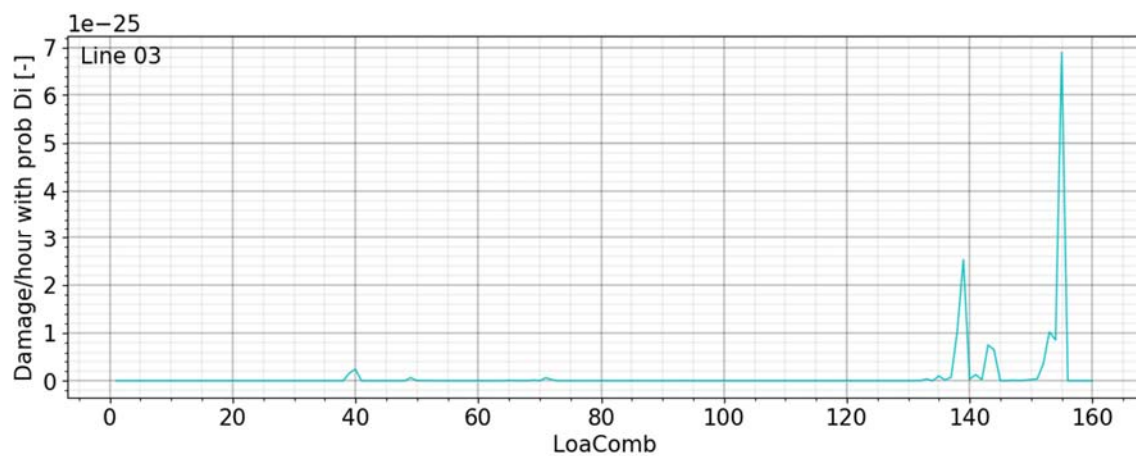
4.3.2 IPB OPB Top chain



4.3.3 TT Bottom chain

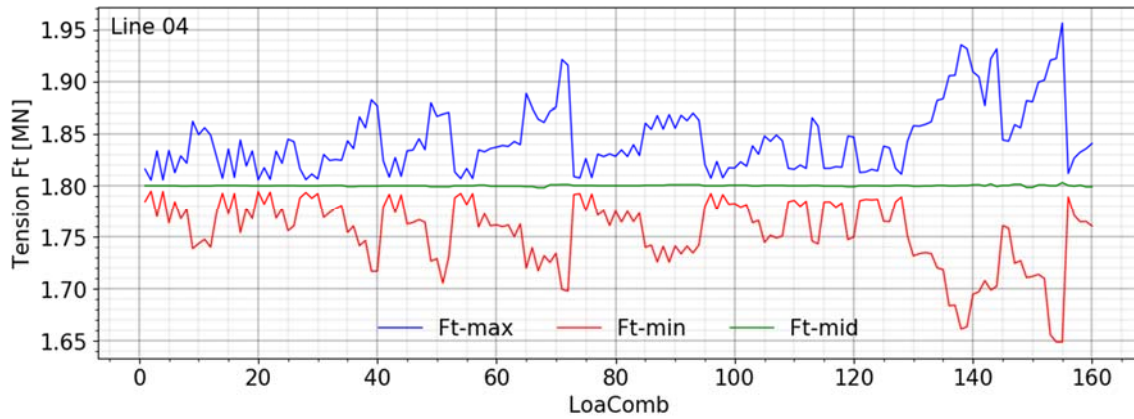


4.3.4 TT Fibre Rope

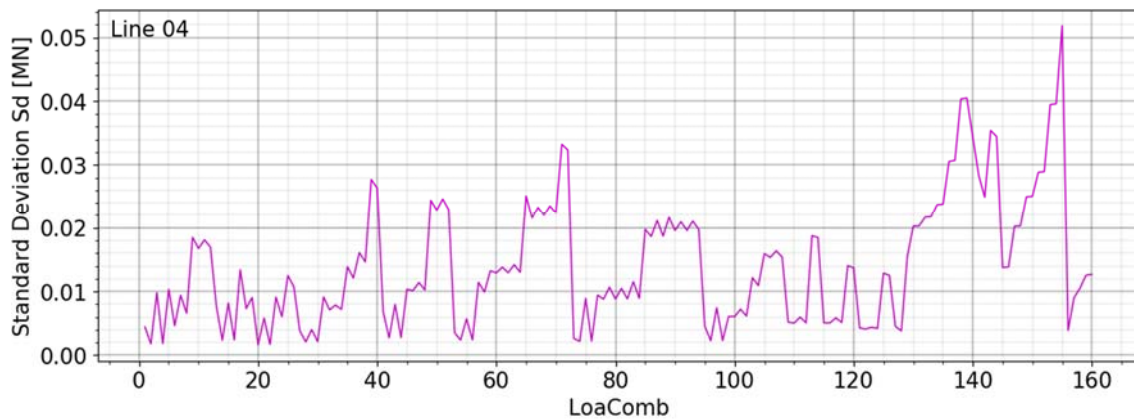


5 LINE 04

5.1 Tension

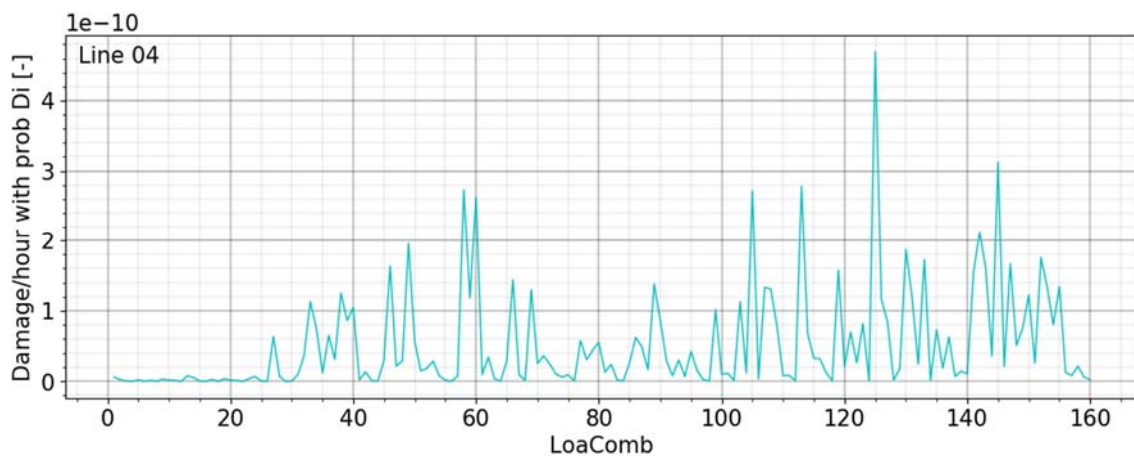


5.2 Standard Deviation

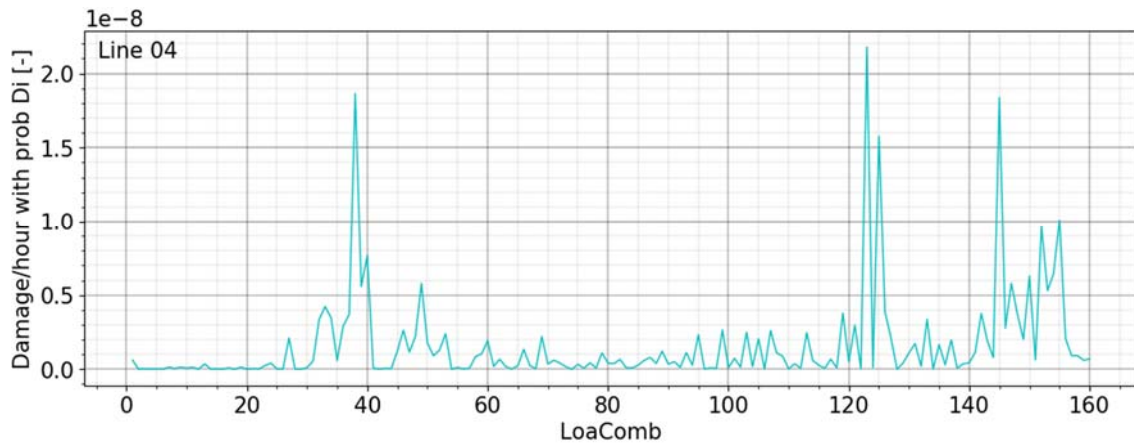


5.3 Damage

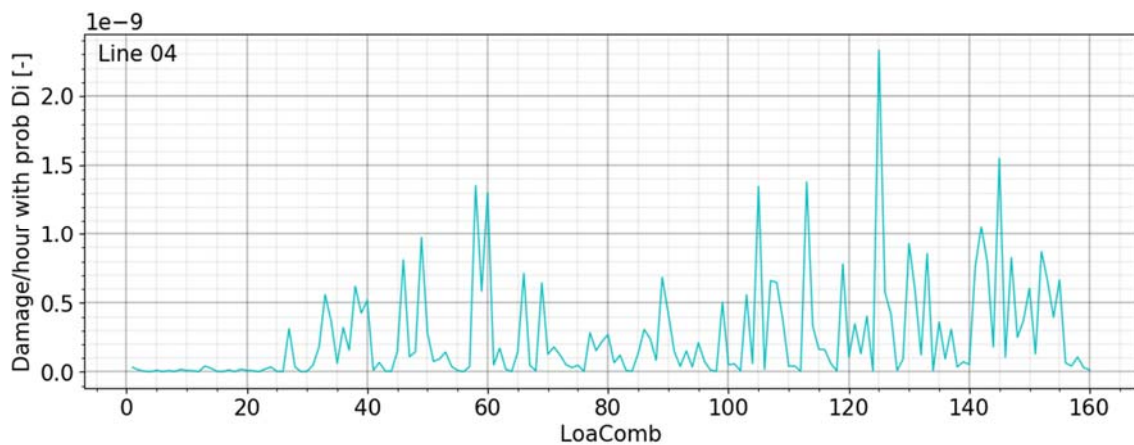
5.3.1 TT-Top chain



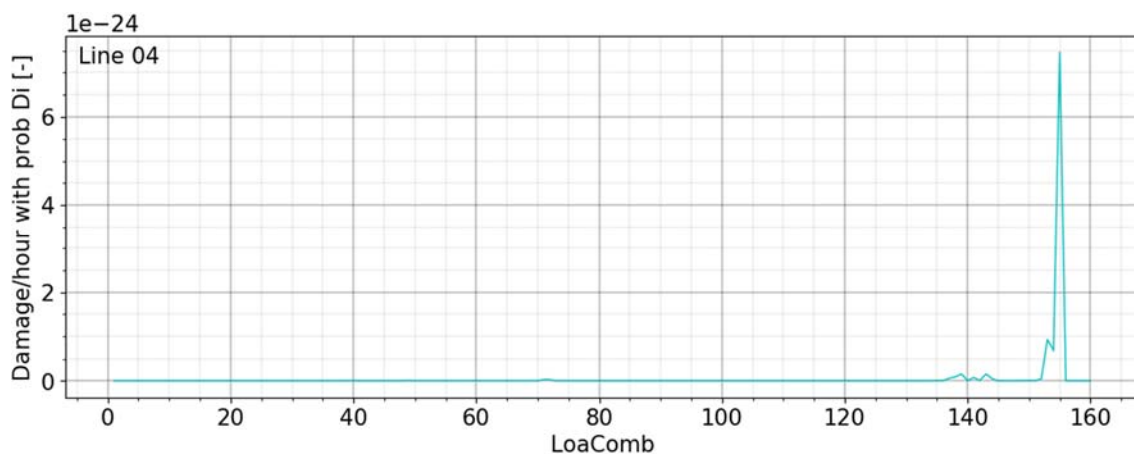
5.3.2 IPB OPB Top chain



5.3.3 TT Bottom chain

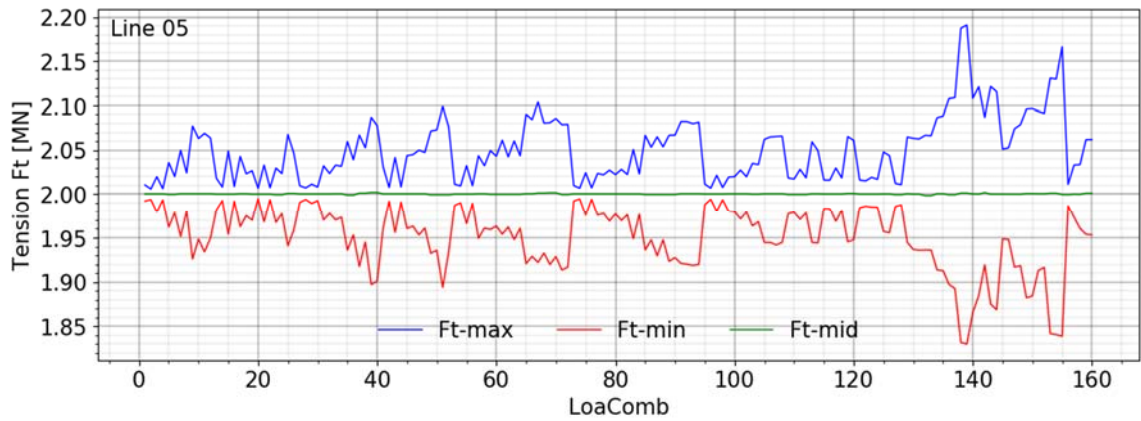


5.3.4 TT Fibre Rope

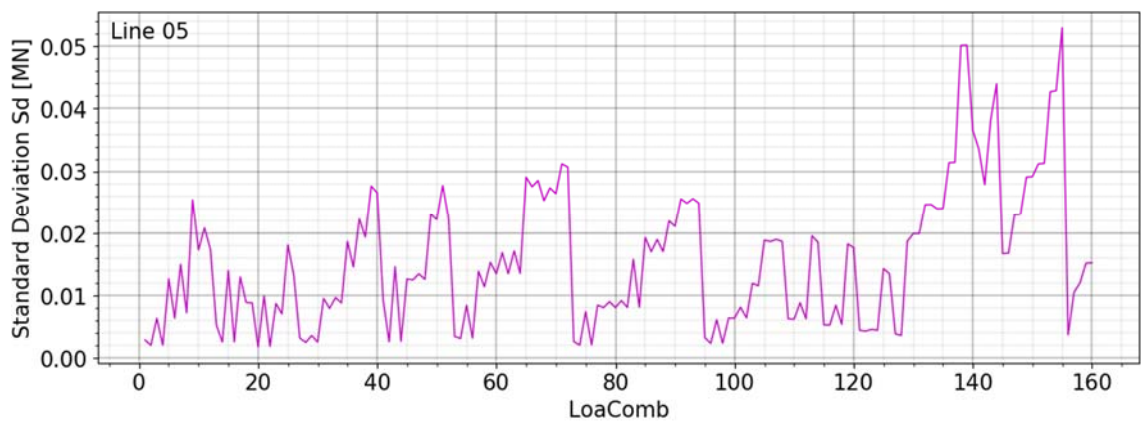


6 LINE 05

6.1 Tension

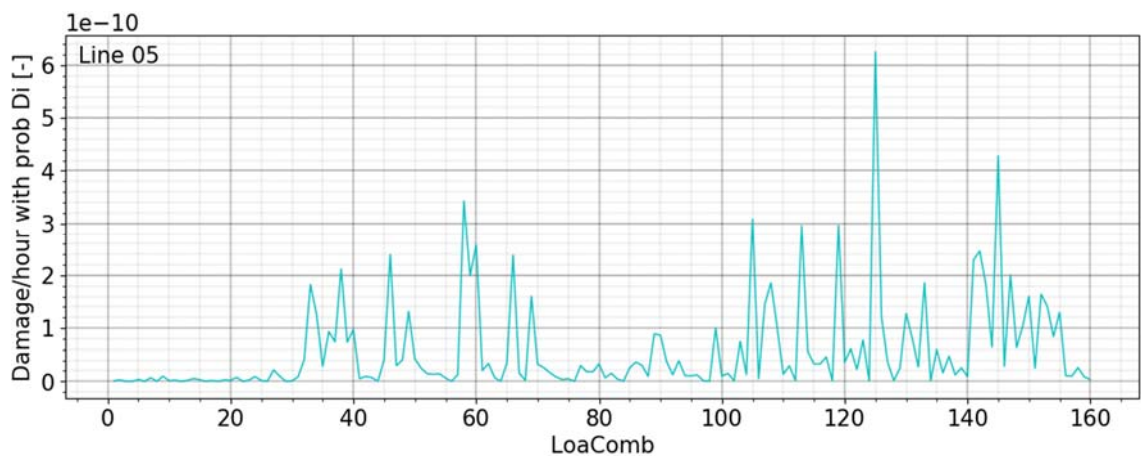


6.2 Standard Deviation

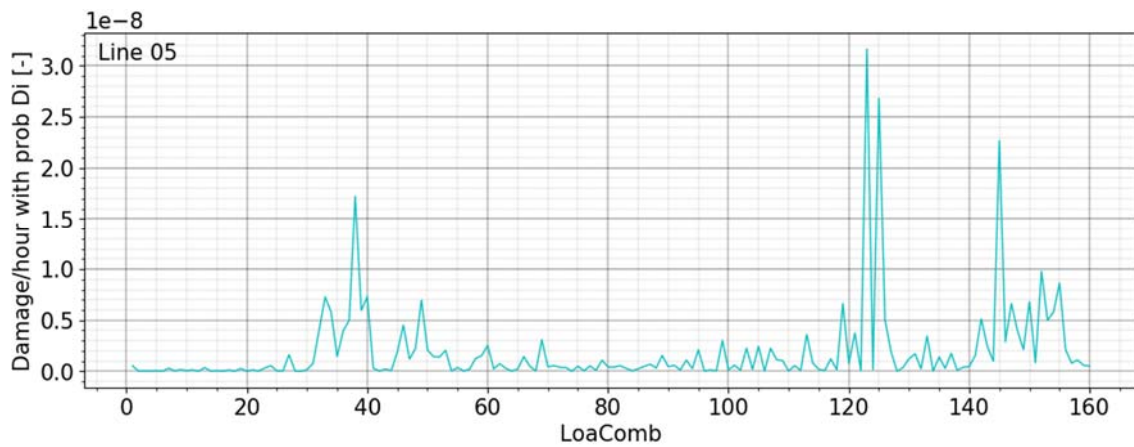


6.3 Damage

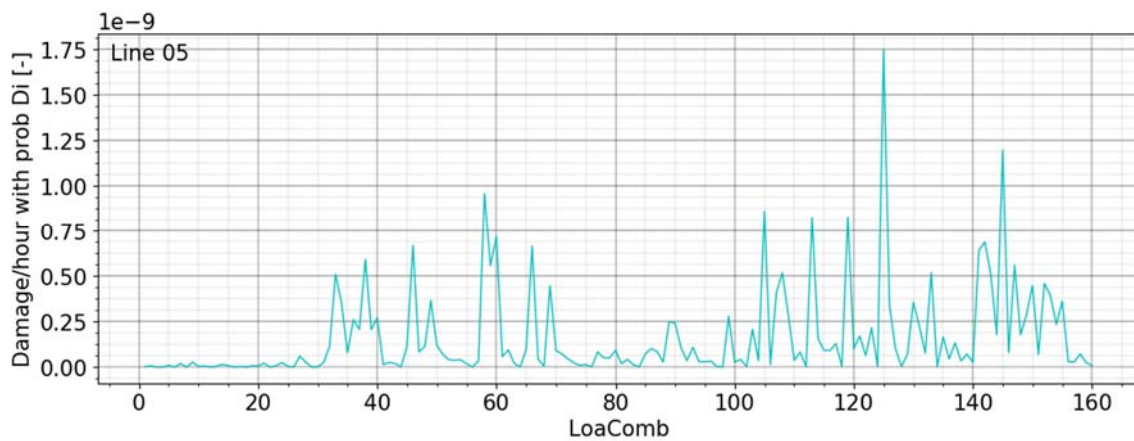
6.3.1 TT-Top chain



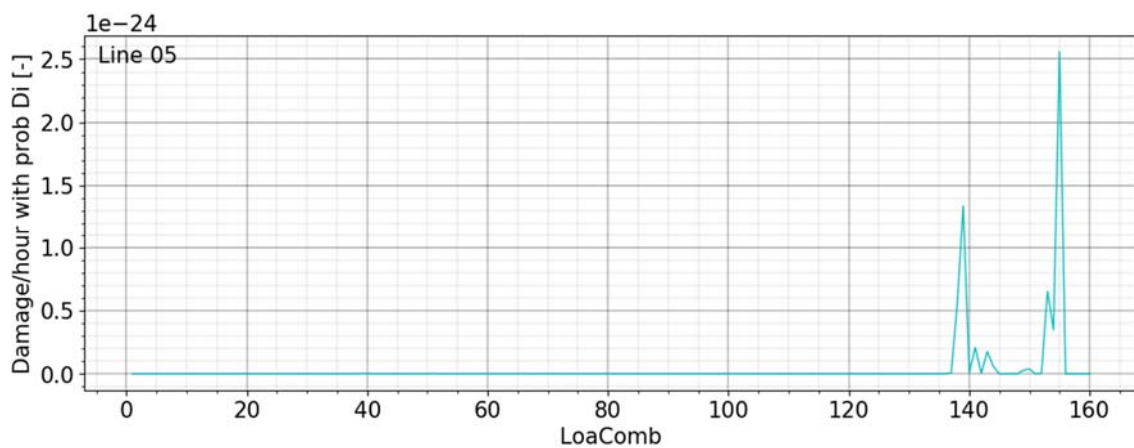
6.3.2 IPB OPB Top chain



6.3.3 TT Bottom chain

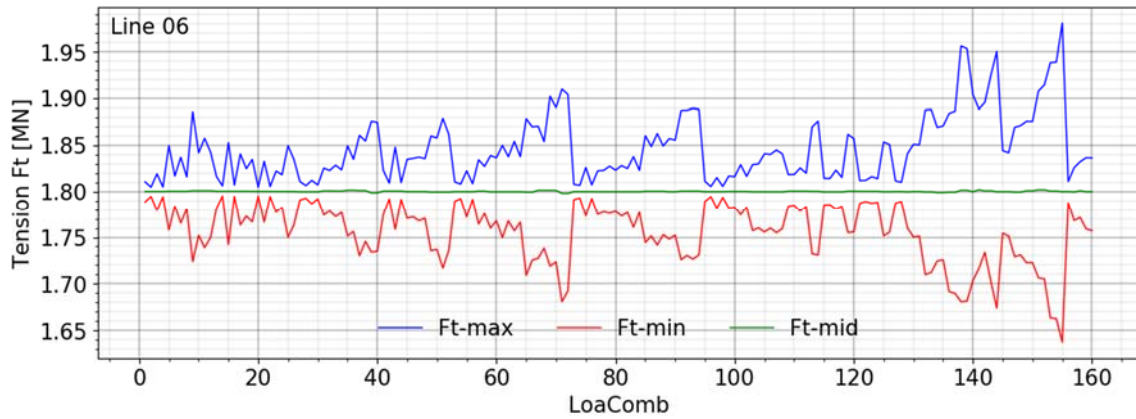


6.3.4 TT Fibre Rope

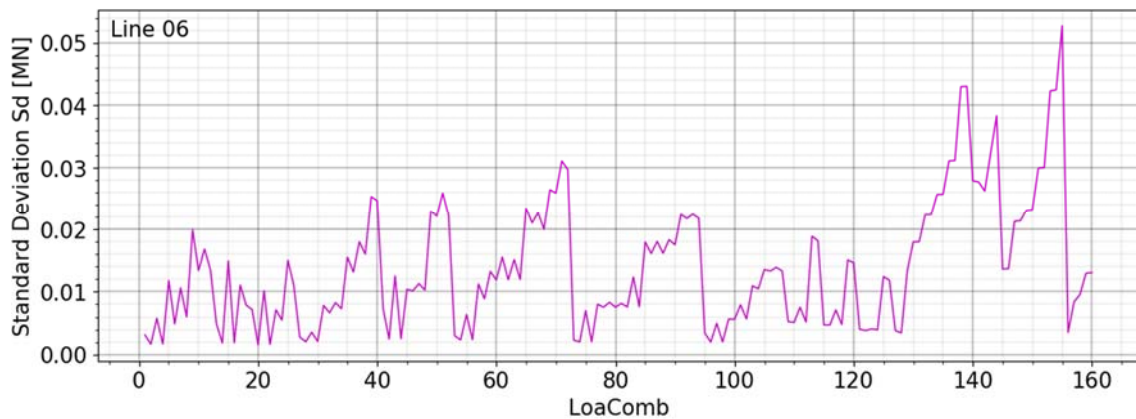


7 LINE 06

7.1 Tension

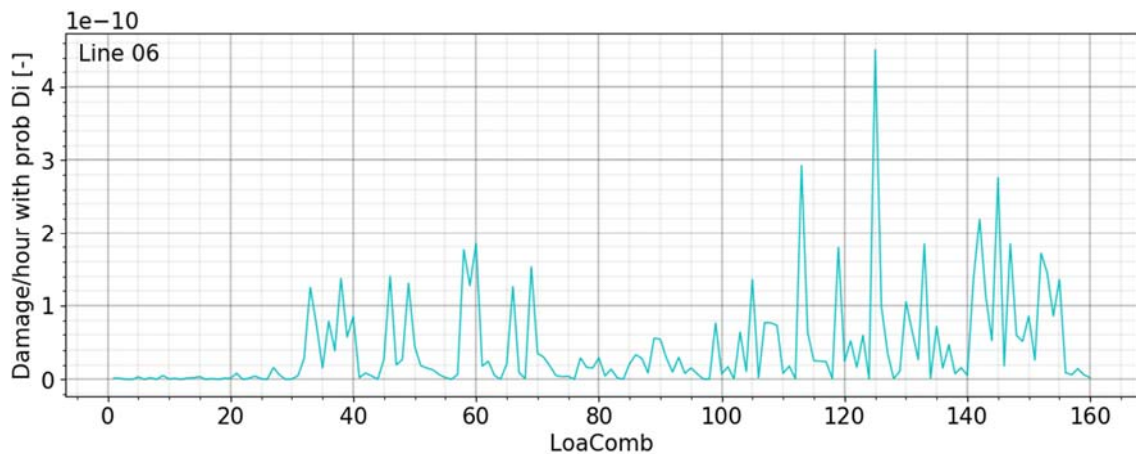


7.2 Standard Deviation

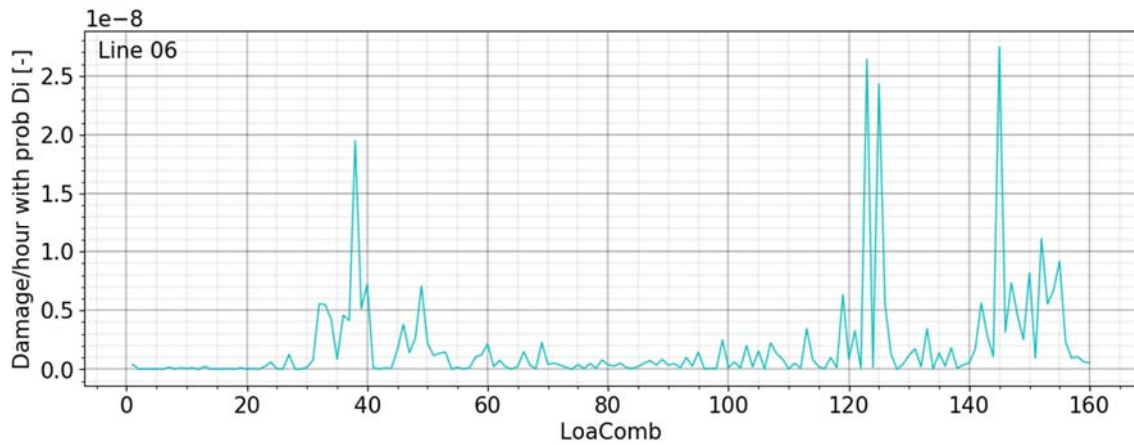


7.3 Damage

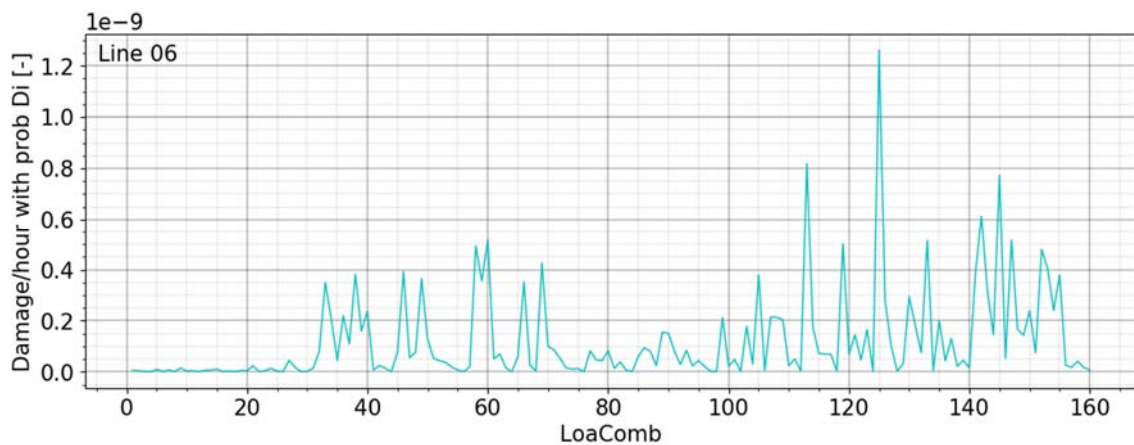
7.3.1 TT-Top chain



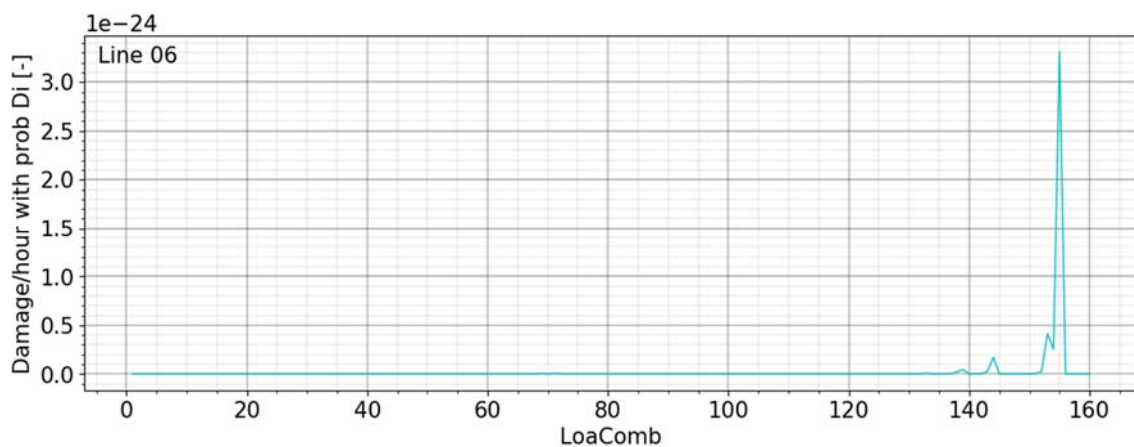
7.3.2 IPB OPB Top chain



7.3.3 TT Bottom chain

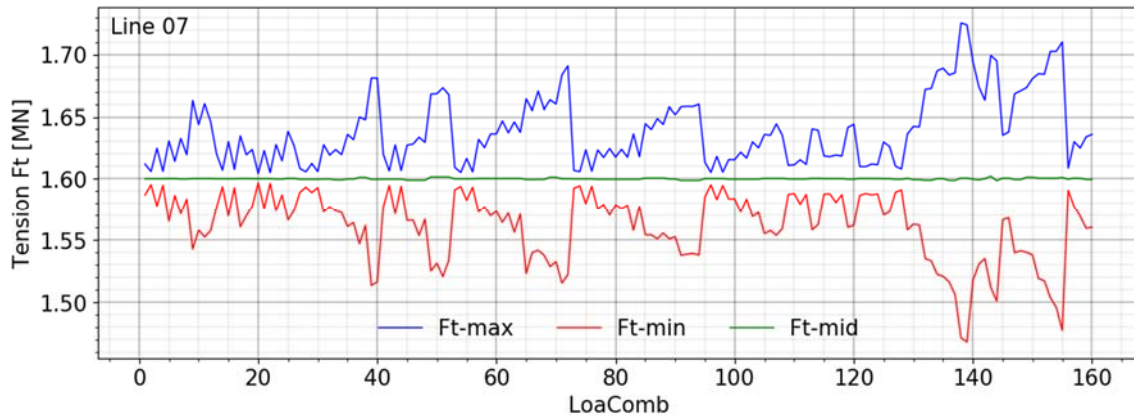


7.3.4 TT Fibre Rope

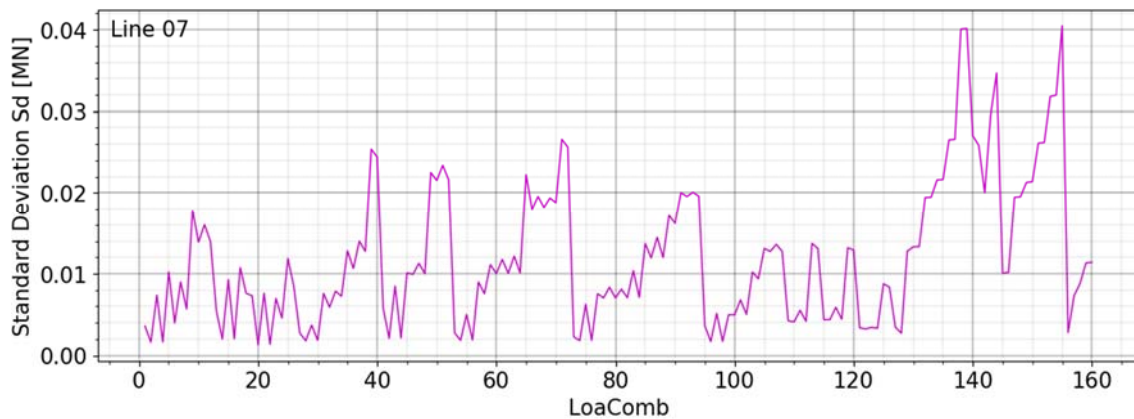


8 LINE 07

8.1 Tension

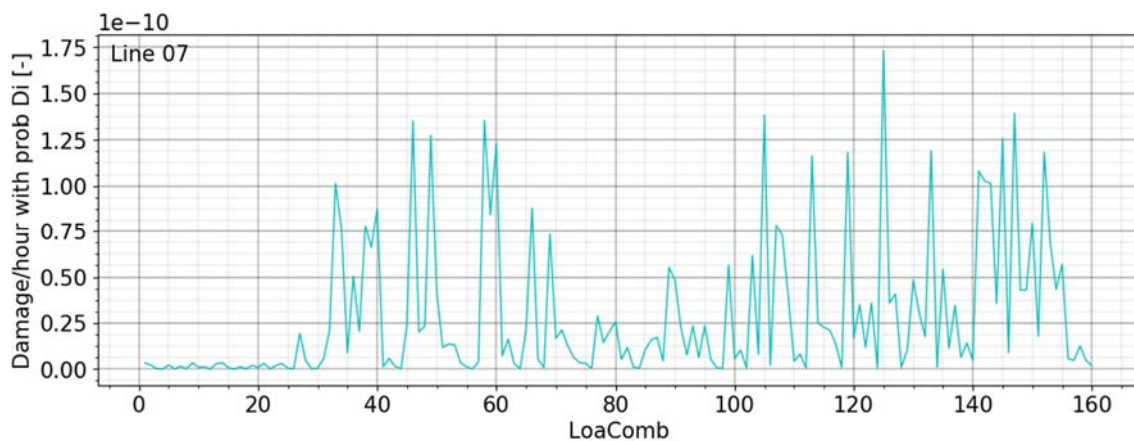


8.2 Standard Deviation

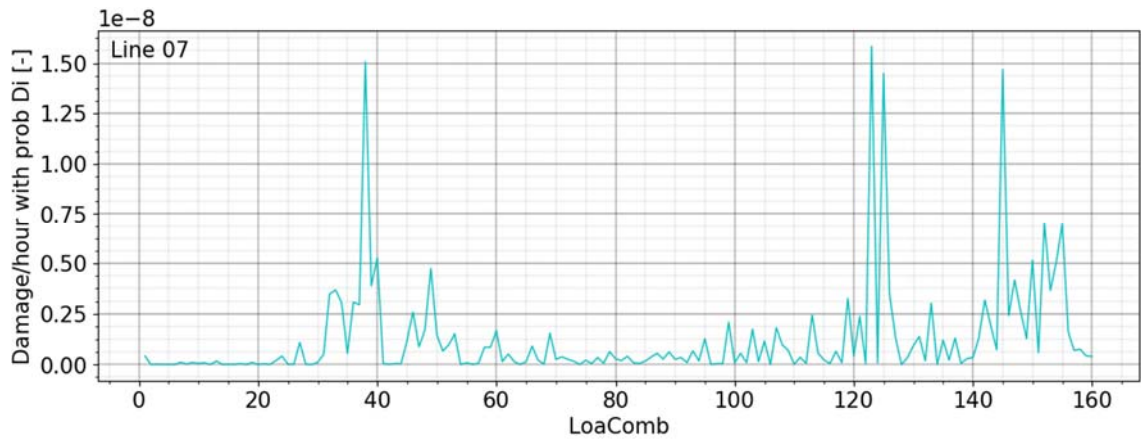


8.3 Damage

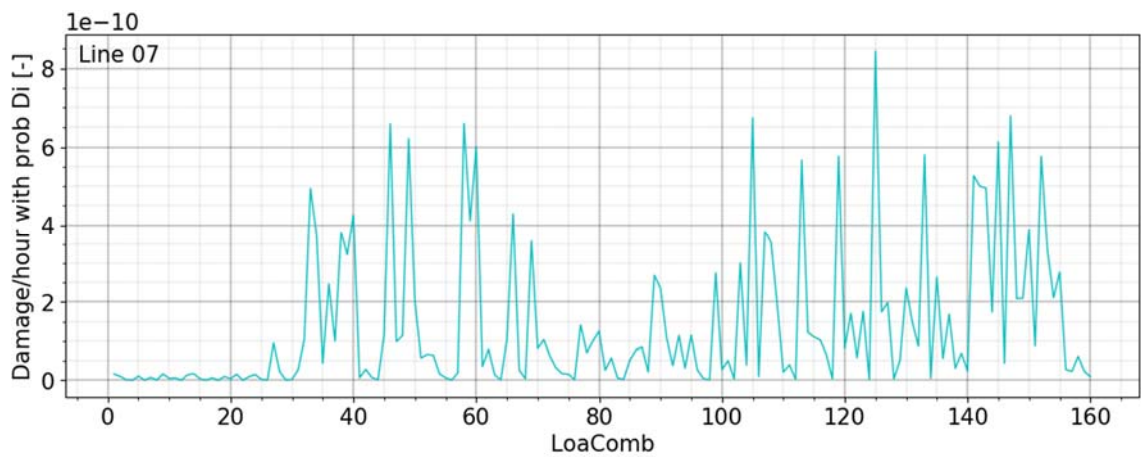
8.3.1 TT-Top chain



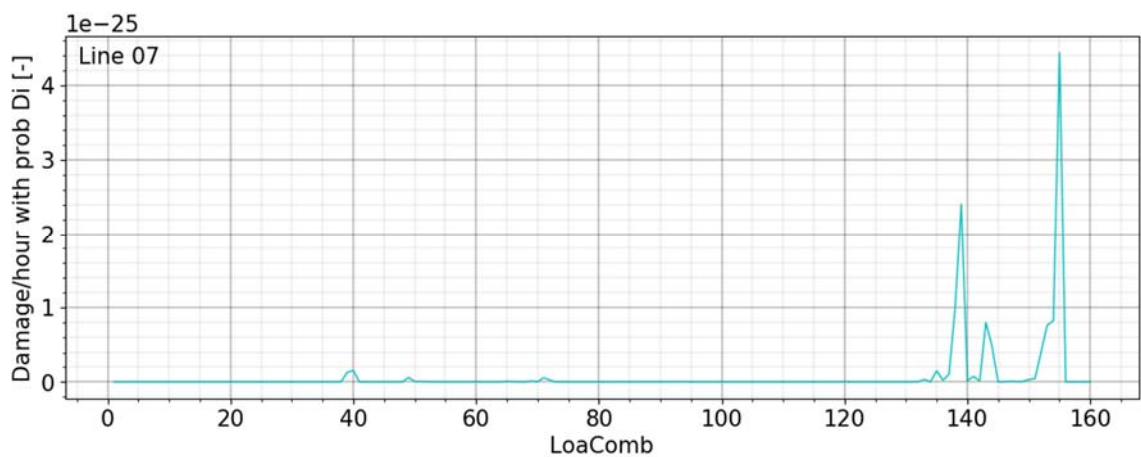
8.3.2 IPB OPB Top chain



8.3.3 TT Bottom chain

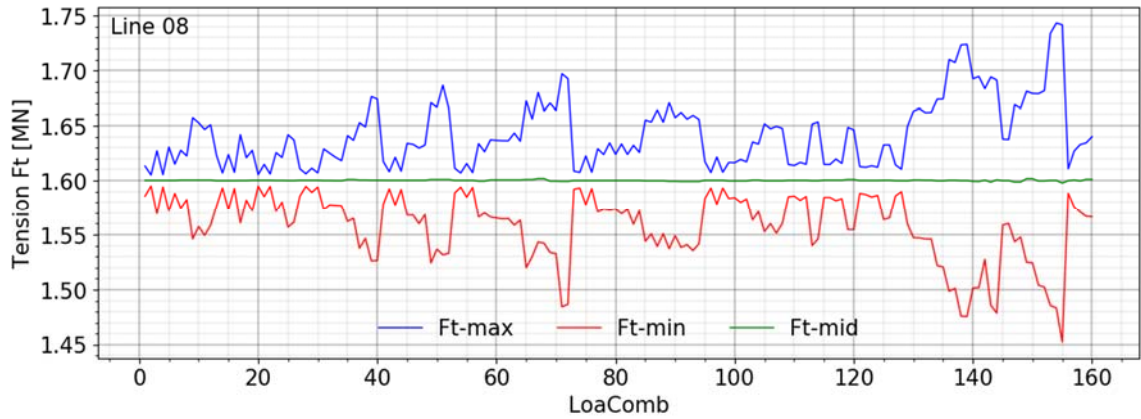


8.3.4 TT Fibre Rope

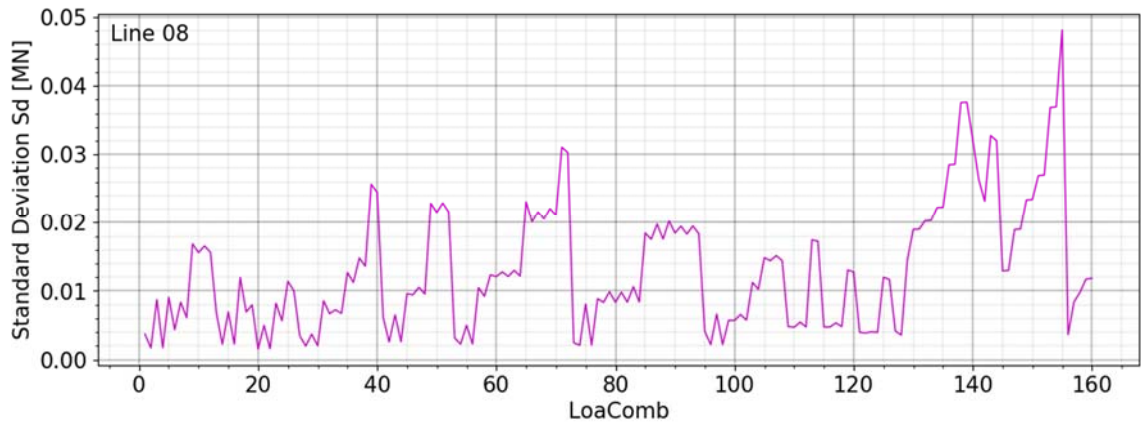


9 LINE 08

9.1 Tension

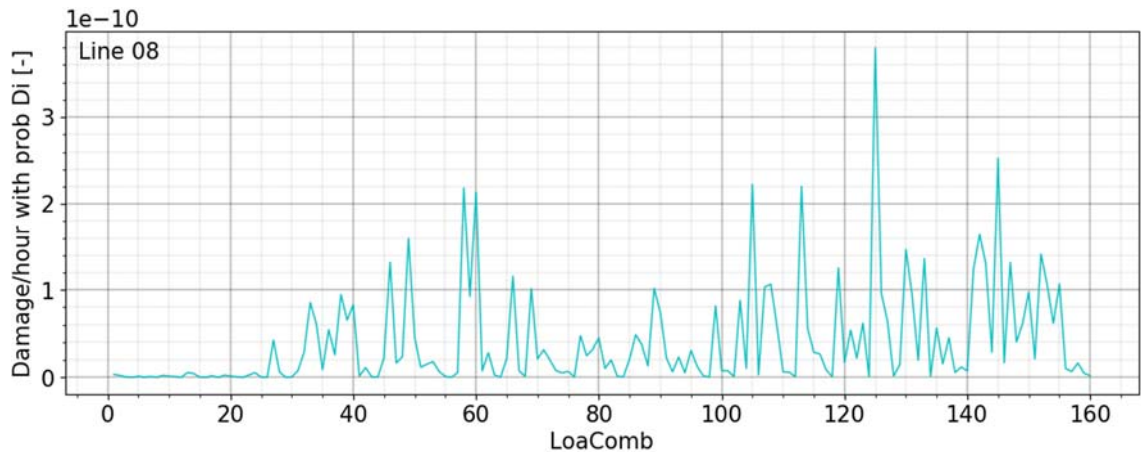


9.2 Standard Deviation

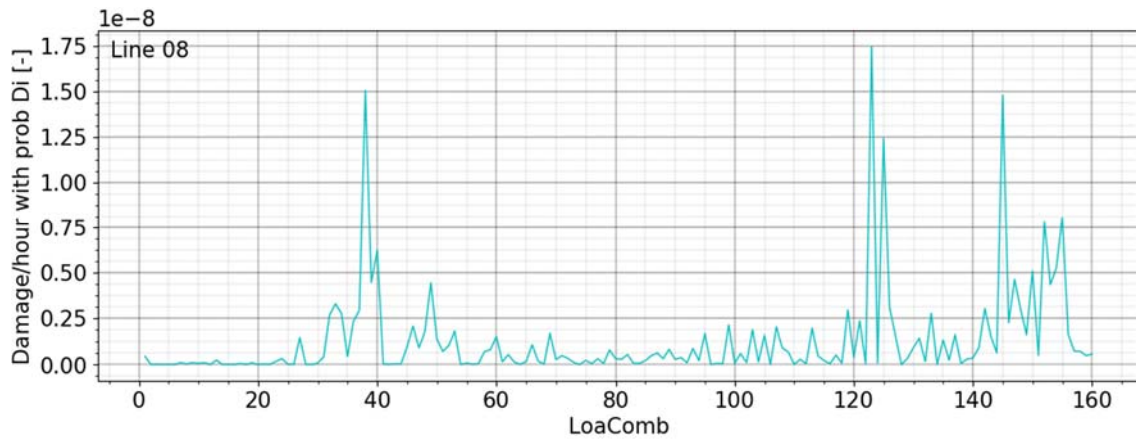


9.3 Damage

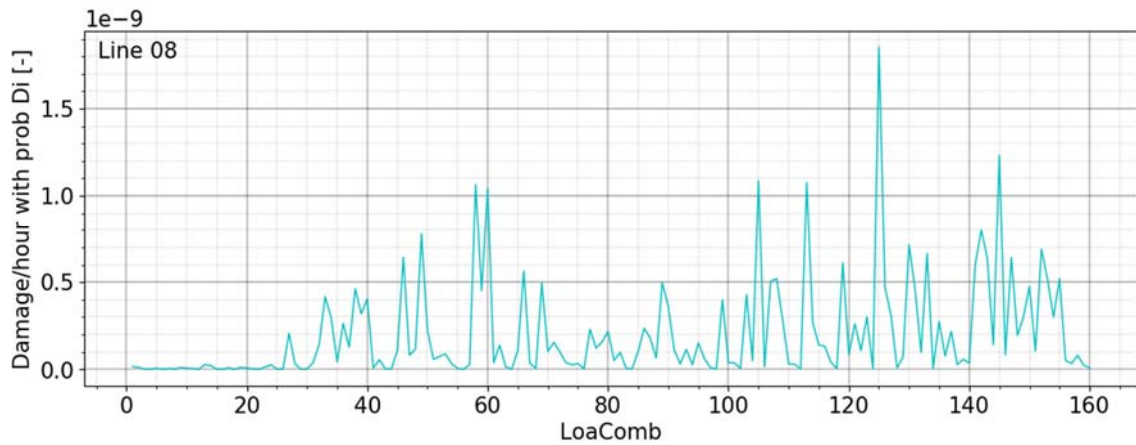
9.3.1 TT-Top chain



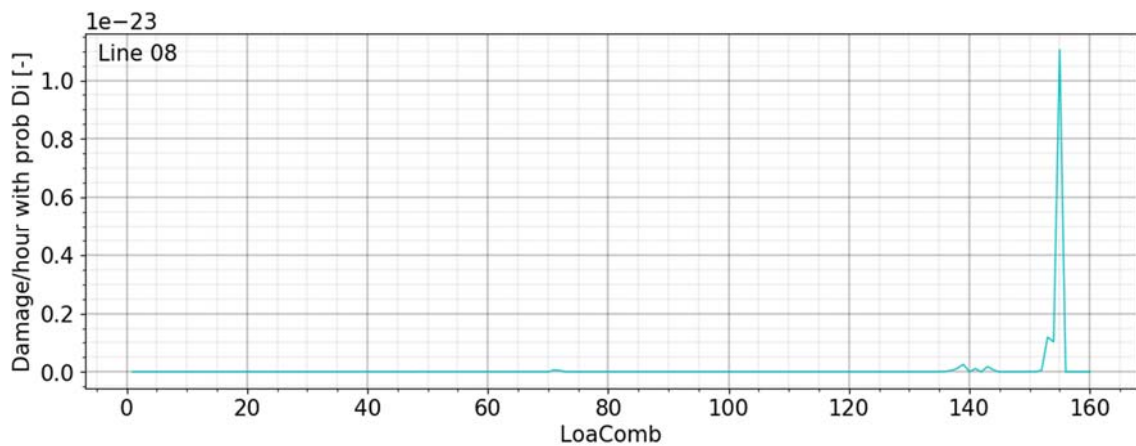
9.3.2 IPB OPB Top chain



9.3.3 TT Bottom chain

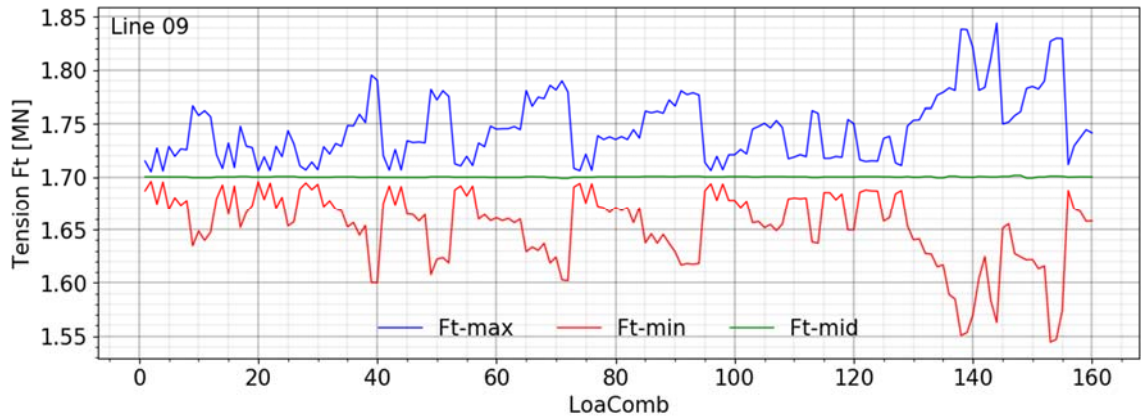


9.3.4 TT Fibre Rope

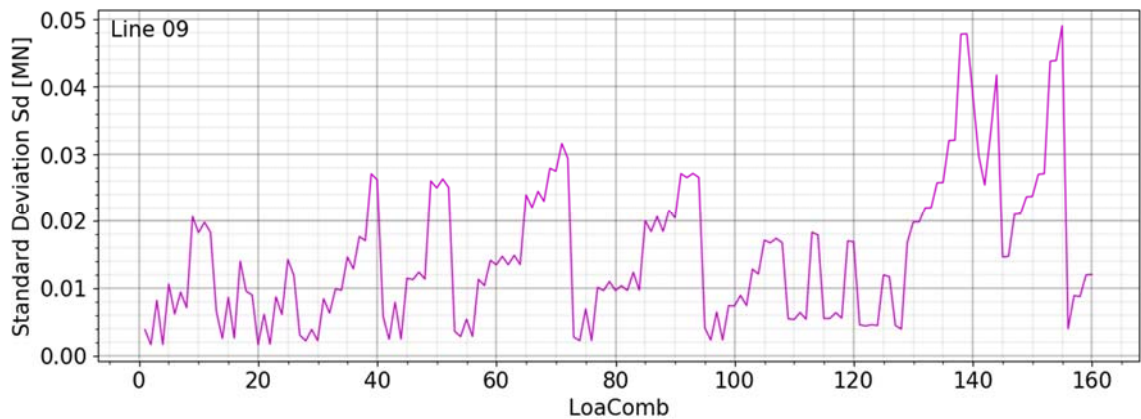


10 LINE 09

10.1 Tension

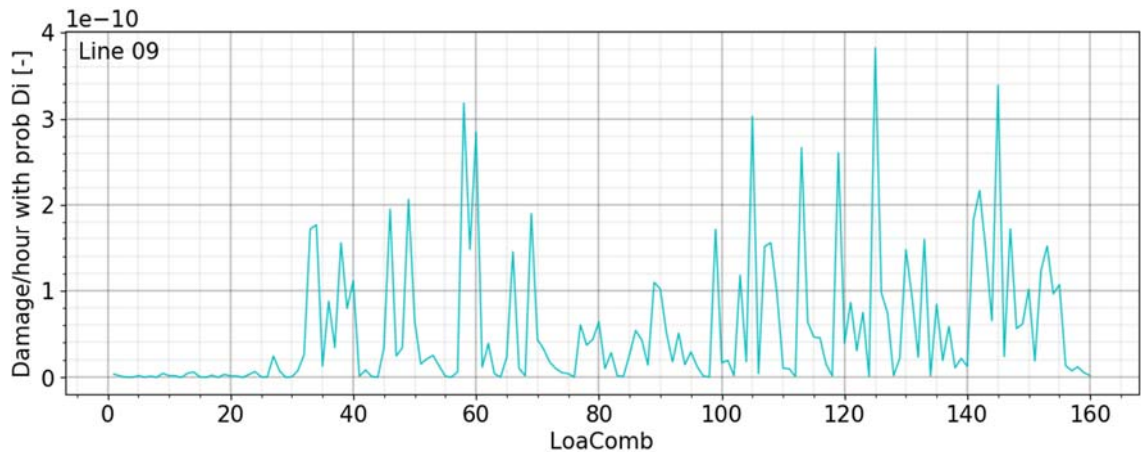


10.2 Standard Deviation

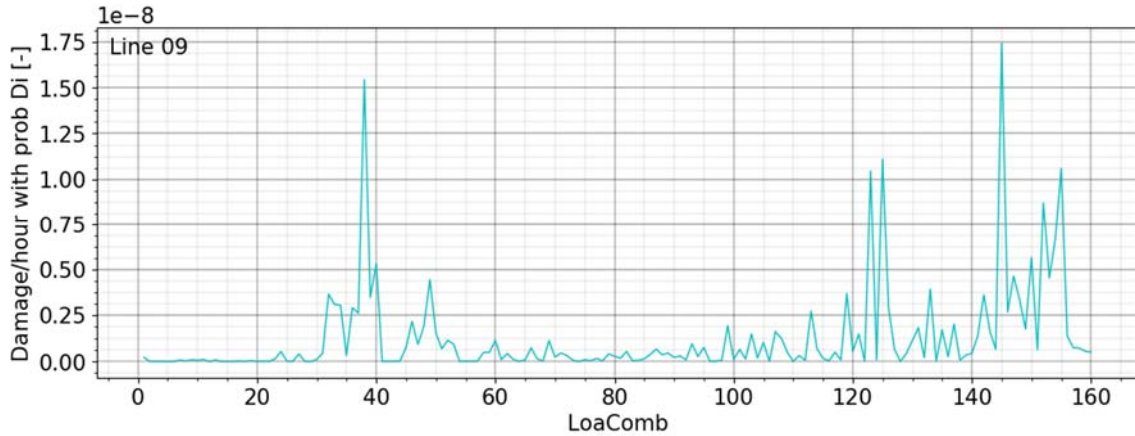


10.3 Damage

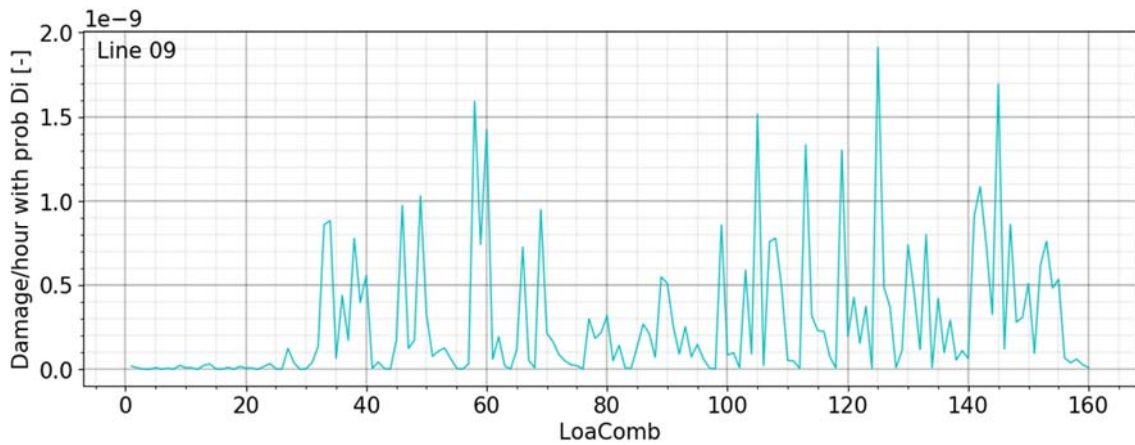
10.3.1 TT-Top chain



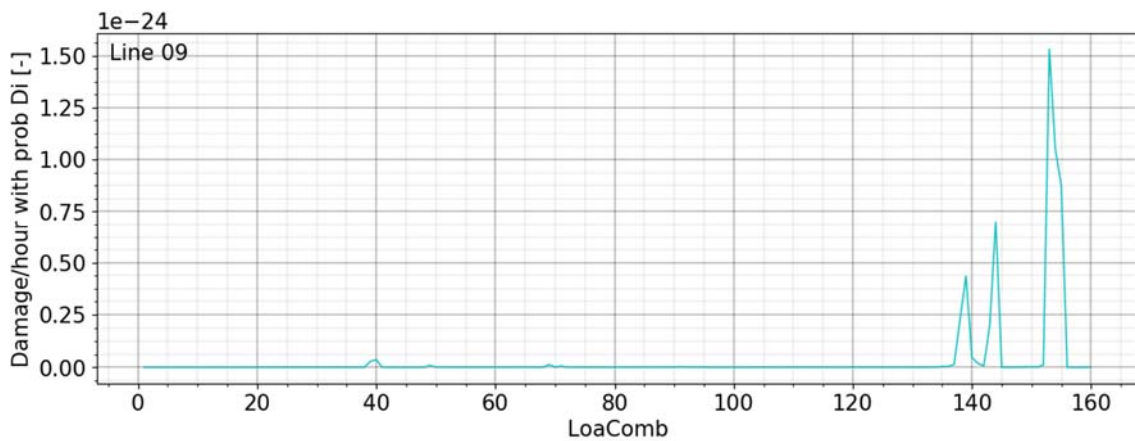
10.3.2 IPB OPB Top chain



10.3.3 TT Bottom chain

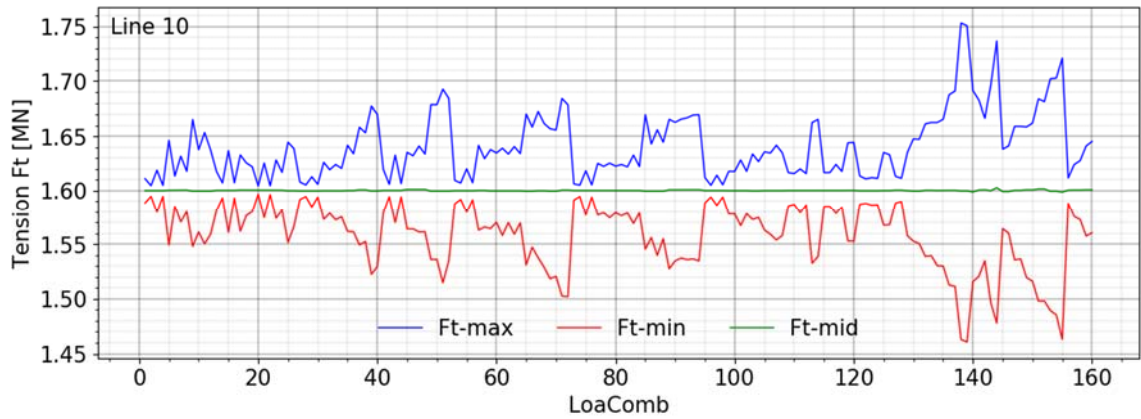


10.3.4 TT Fibre Rope

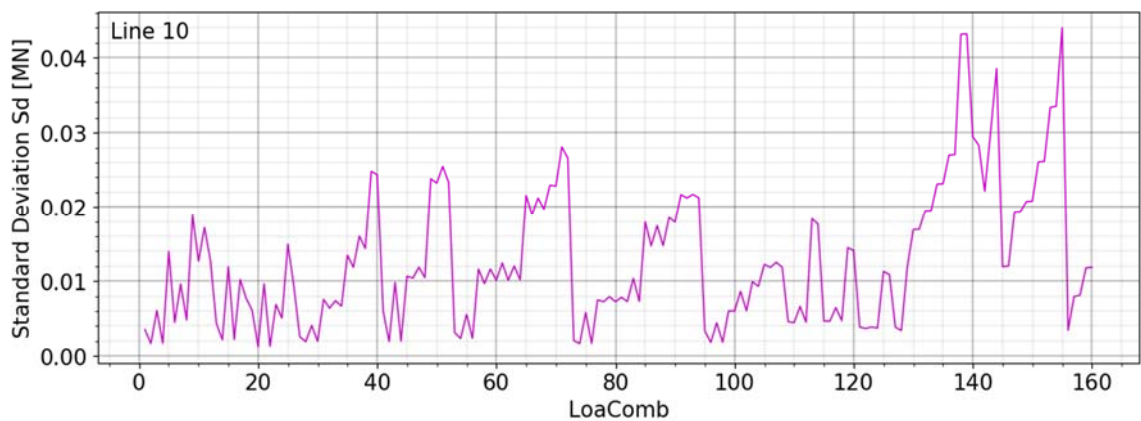


11 LINE 10

11.1 Tension

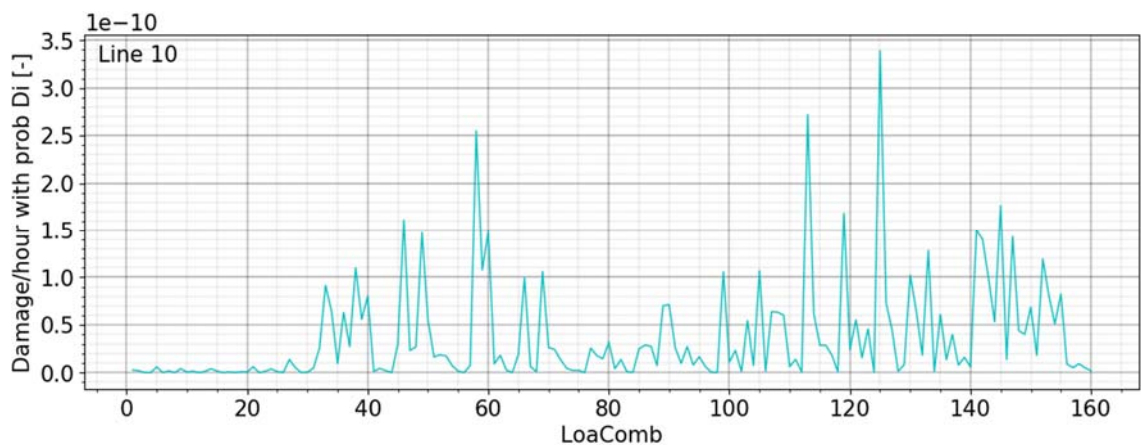


11.2 Standard Deviation

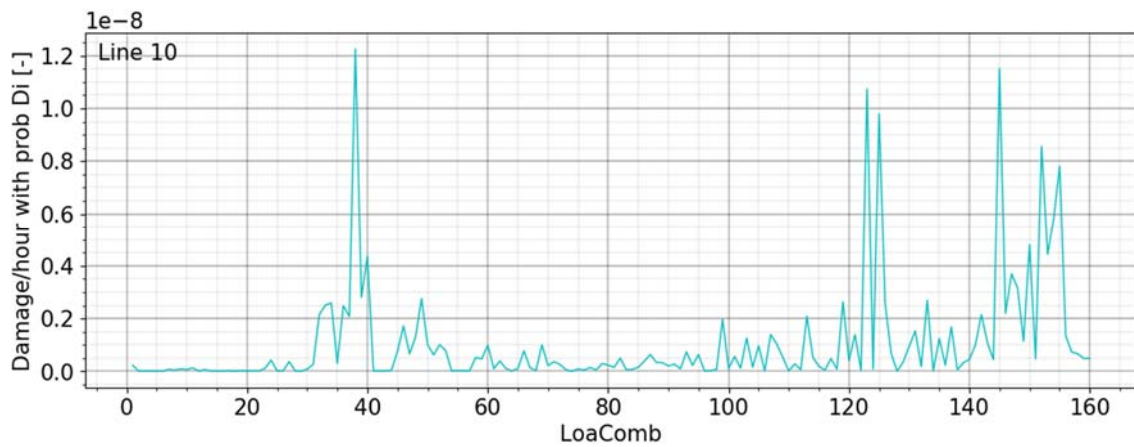


11.3 Damage

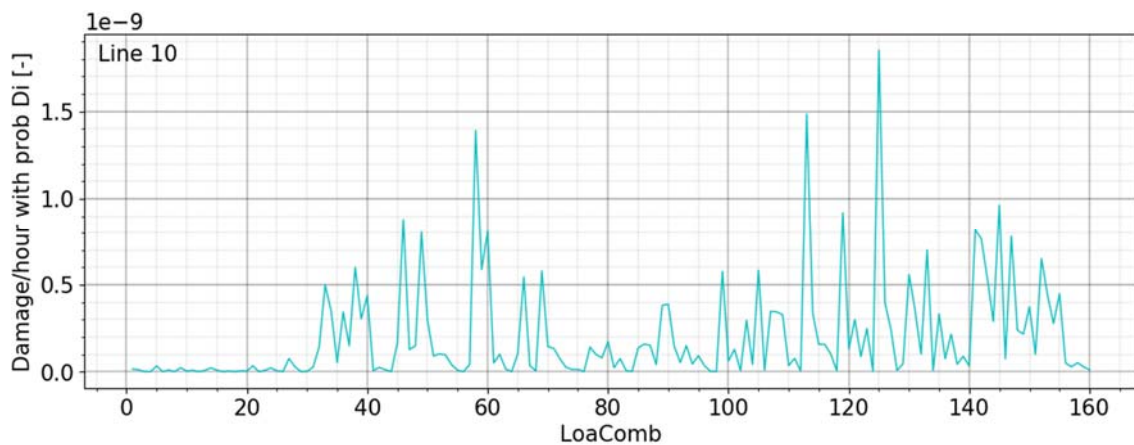
11.3.1 TT-Top chain



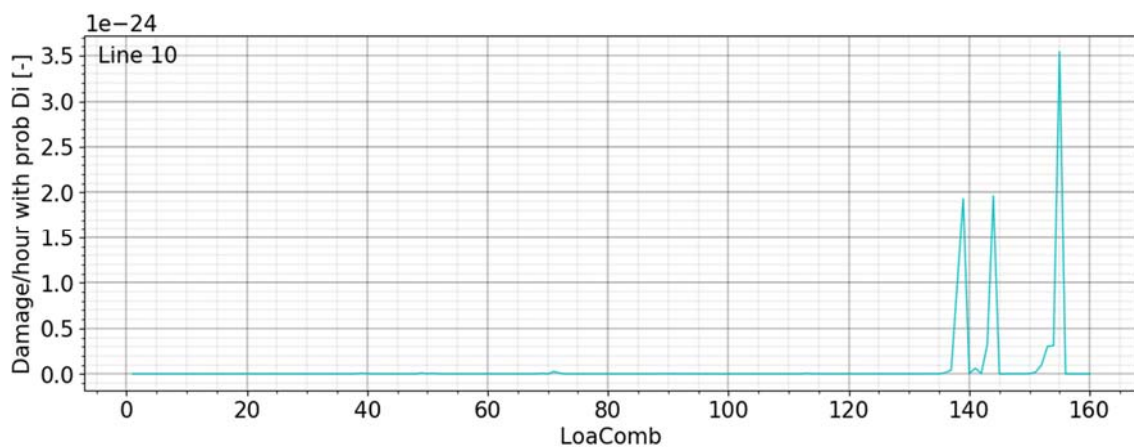
11.3.2 IPB OPB Top chain



11.3.3 TT Bottom chain

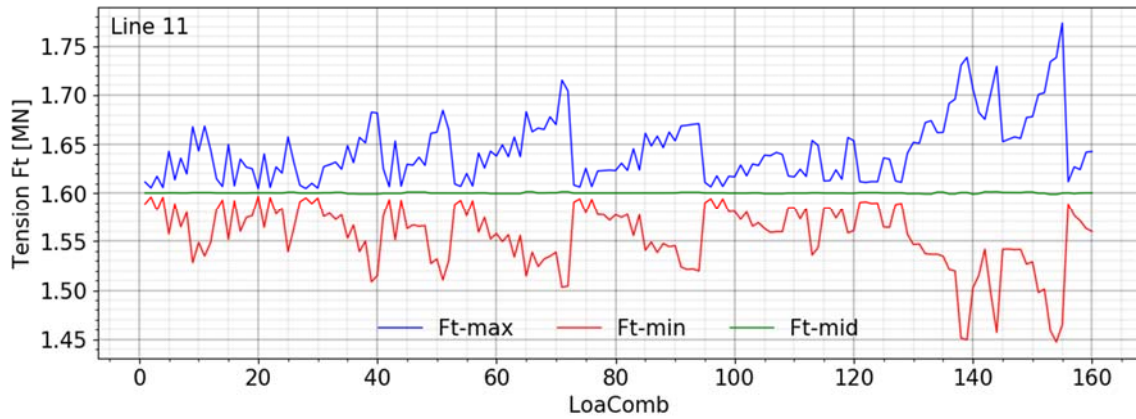


11.3.4 TT Fibre Rope

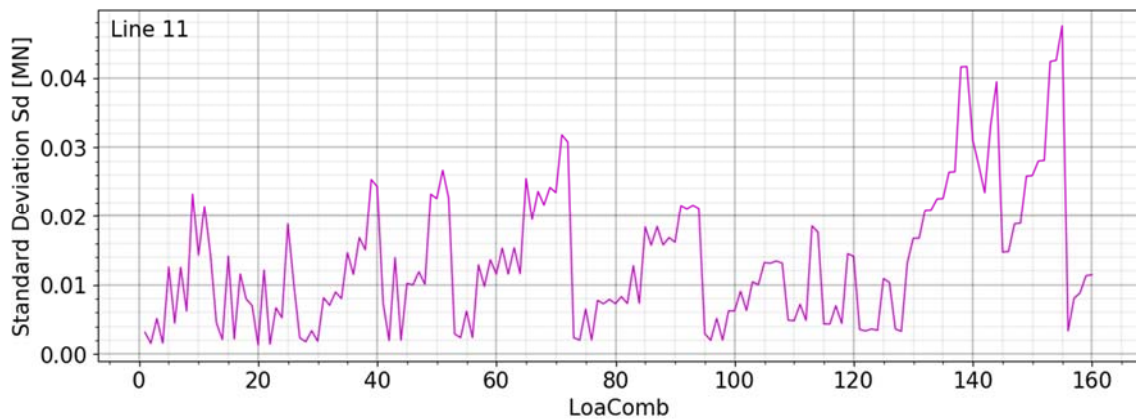


12 LINE 11

12.1 Tension

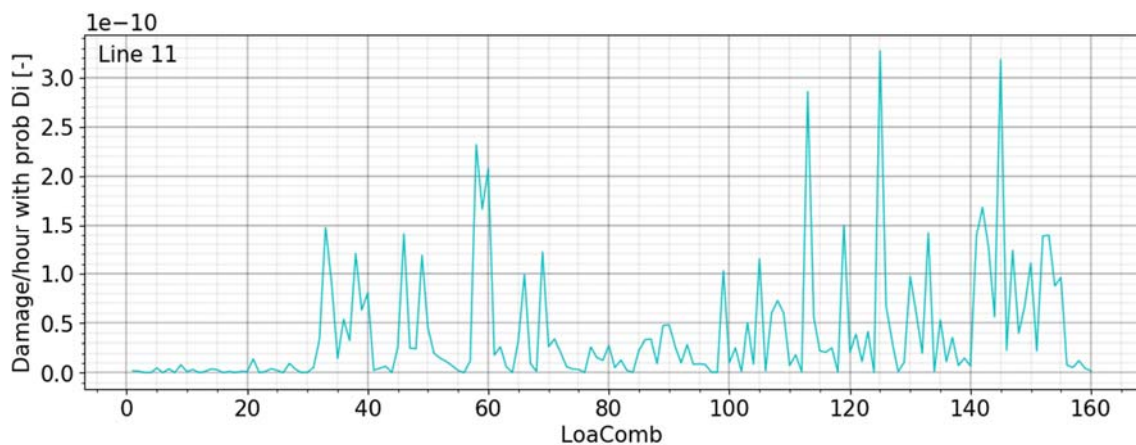


12.2 Standard Deviation

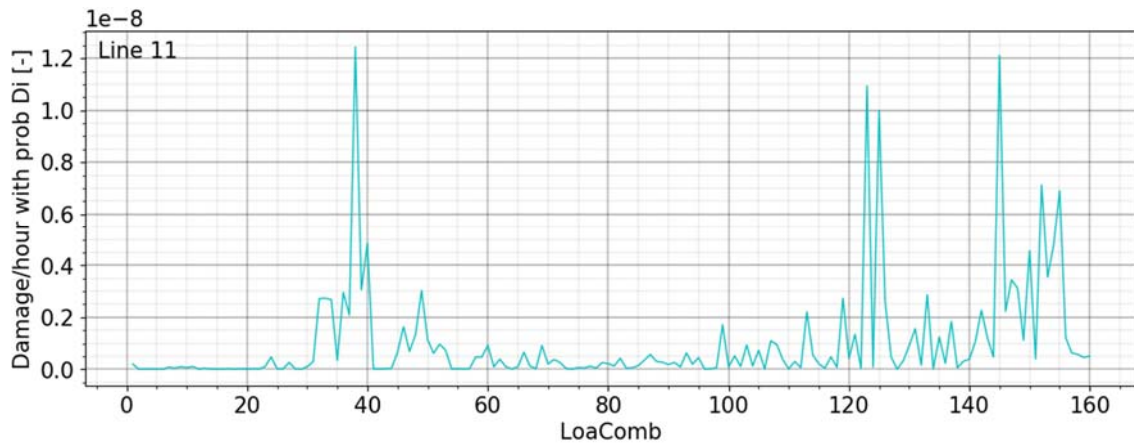


12.3 Damage

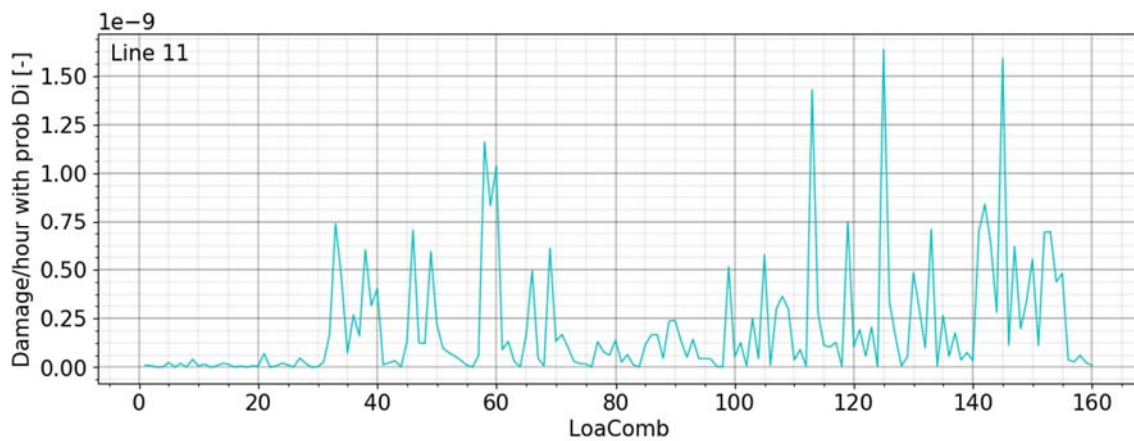
12.3.1 TT-Top chain



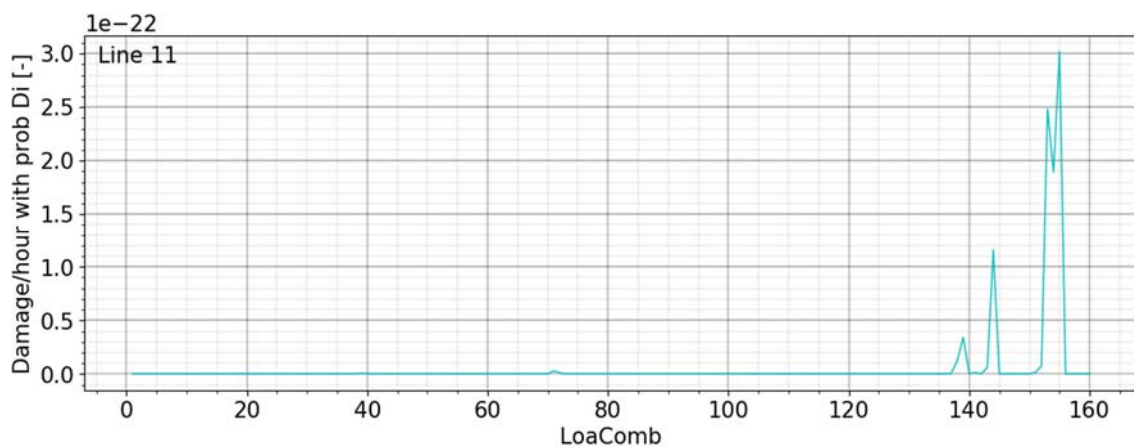
12.3.2 IPB OPB Top chain



12.3.3 TT Bottom chain

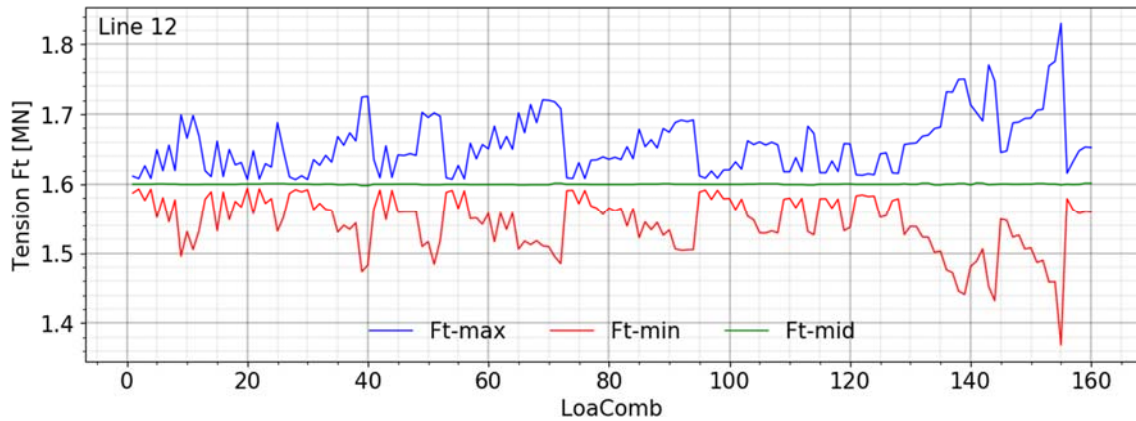


12.3.4 TT Fibre Rope

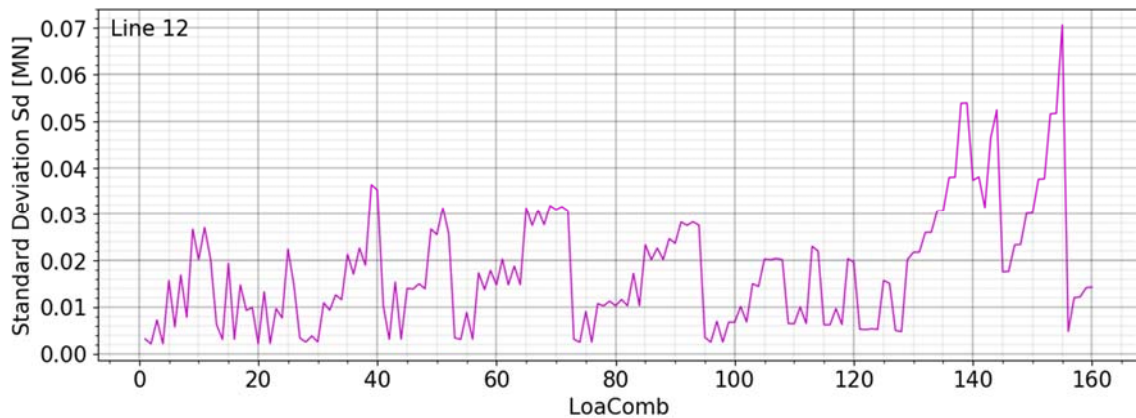


13 LINE 12

13.1 Tension

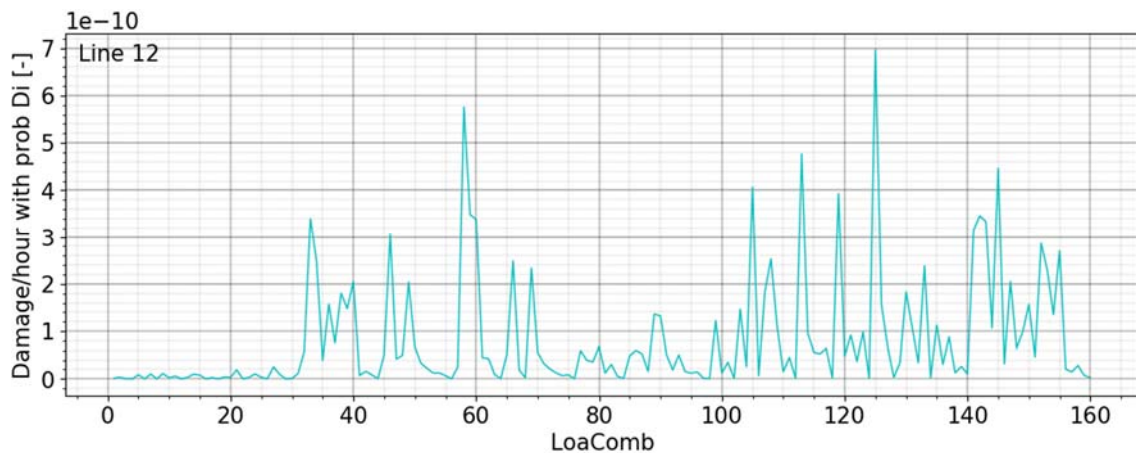


13.2 Standard Deviation

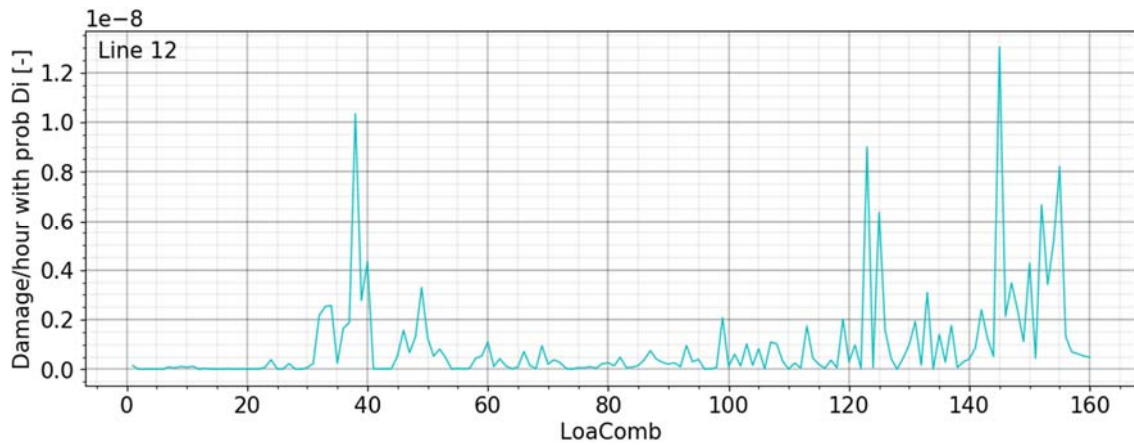


13.3 Damage

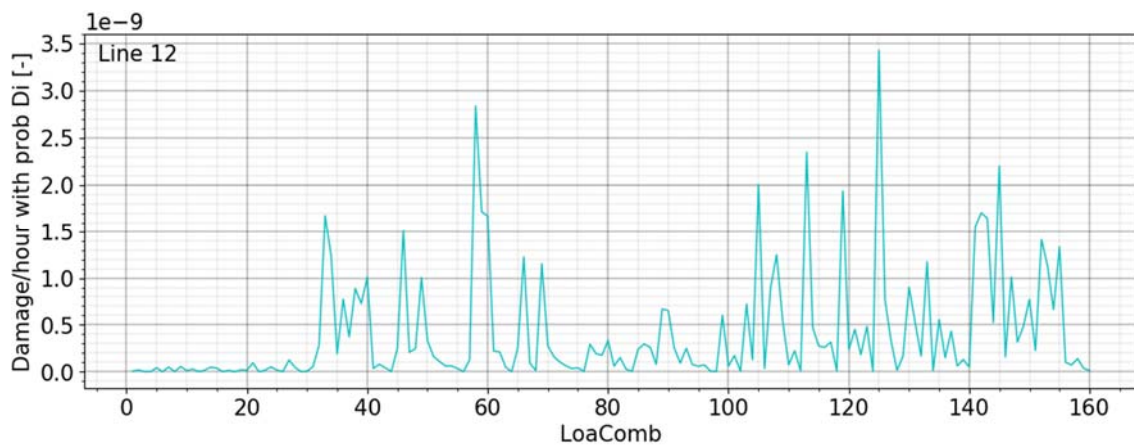
13.3.1 TT-Top chain



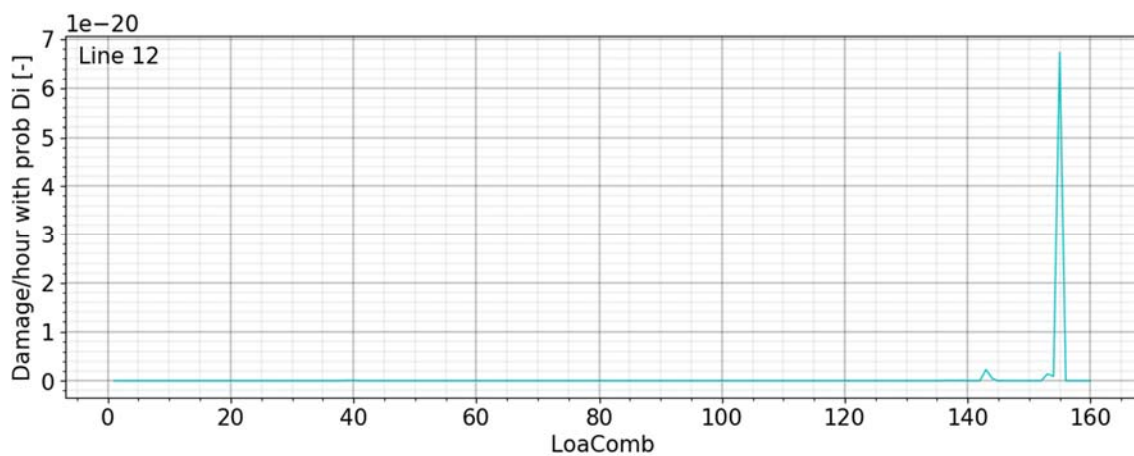
13.3.2 IPB OPB Top chain



13.3.3 TT Bottom chain

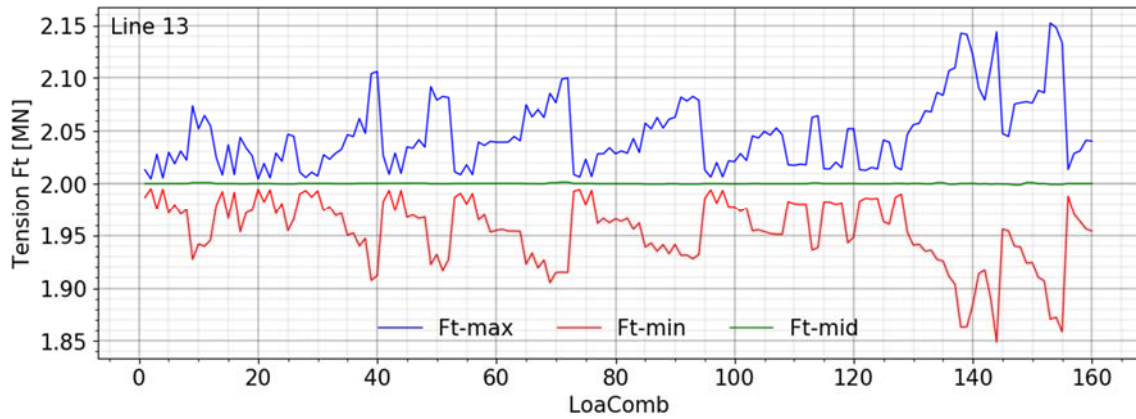


13.3.4 TT Fibre Rope

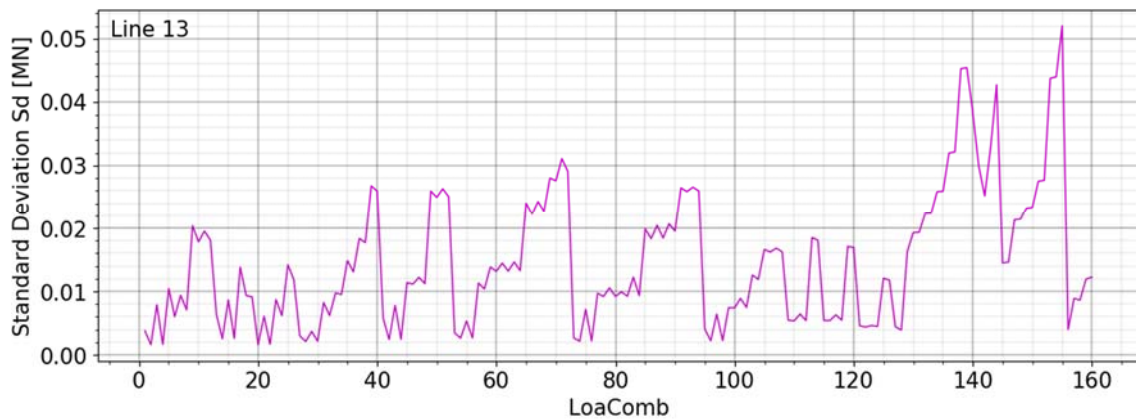


14 LINE 13

14.1 Tension

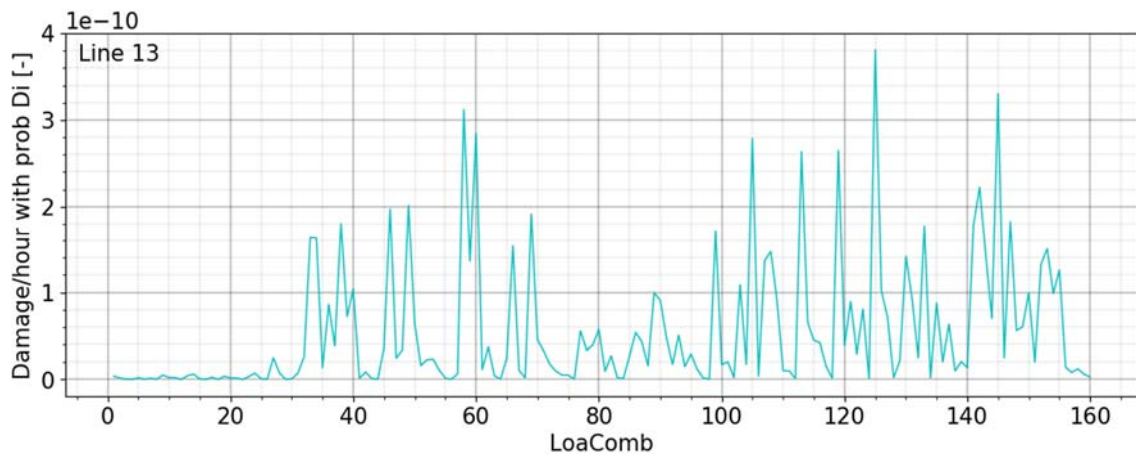


14.2 Standard Deviation

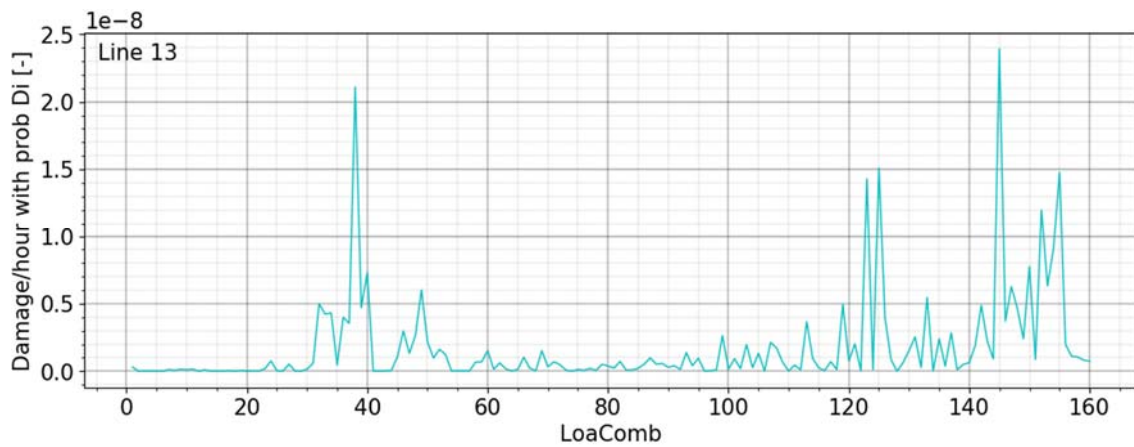


14.3 Damage

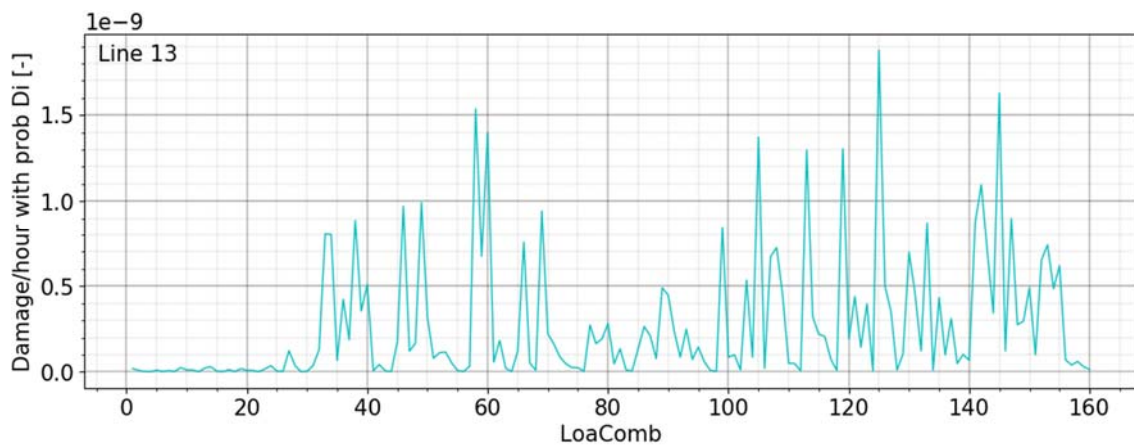
14.3.1 TT-Top chain



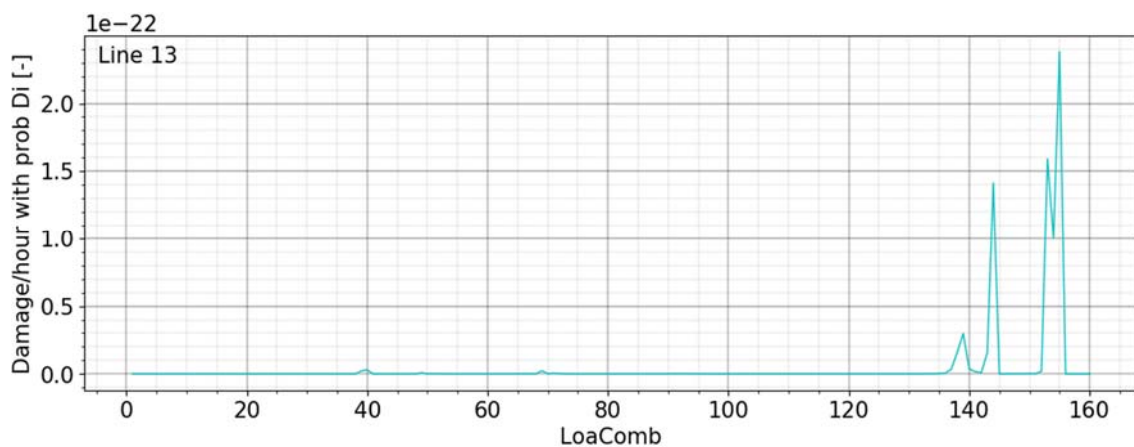
14.3.2 IPB OPB Top chain



14.3.3 TT Bottom chain

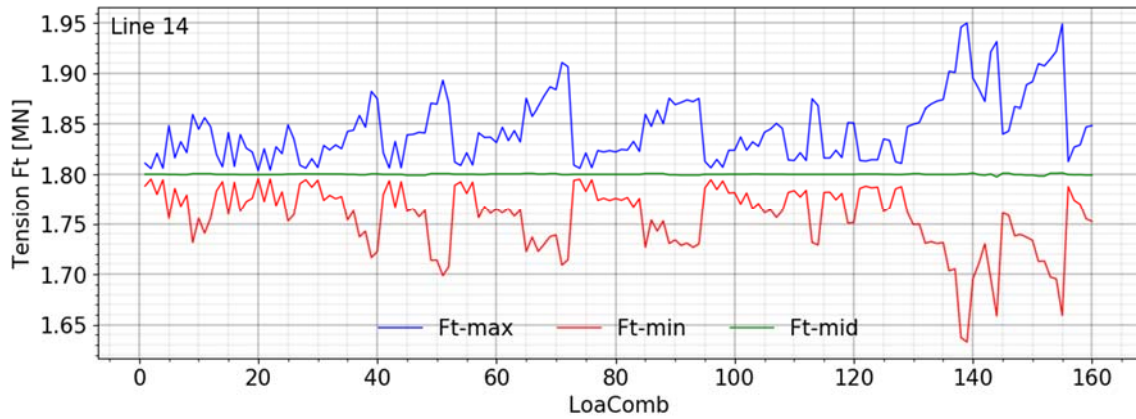


14.3.4 TT Fibre Rope

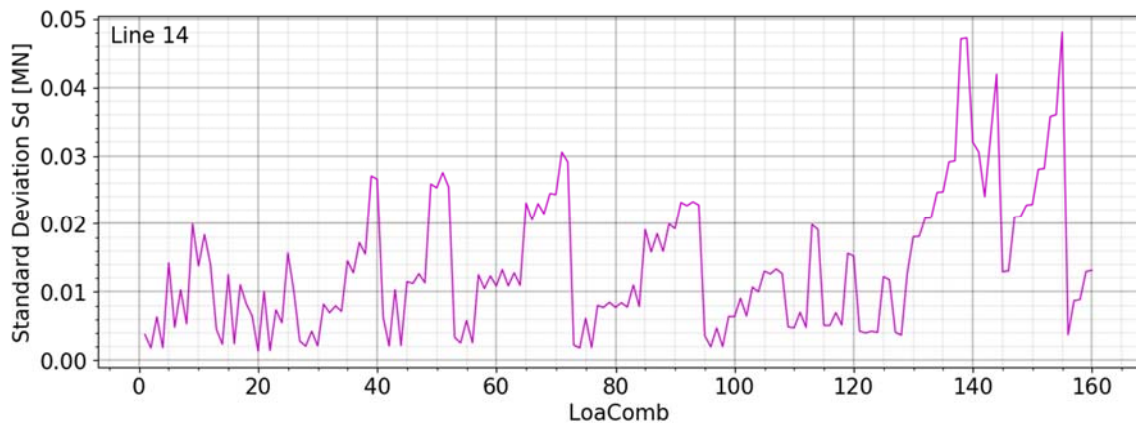


15 LINE 14

15.1 Tension

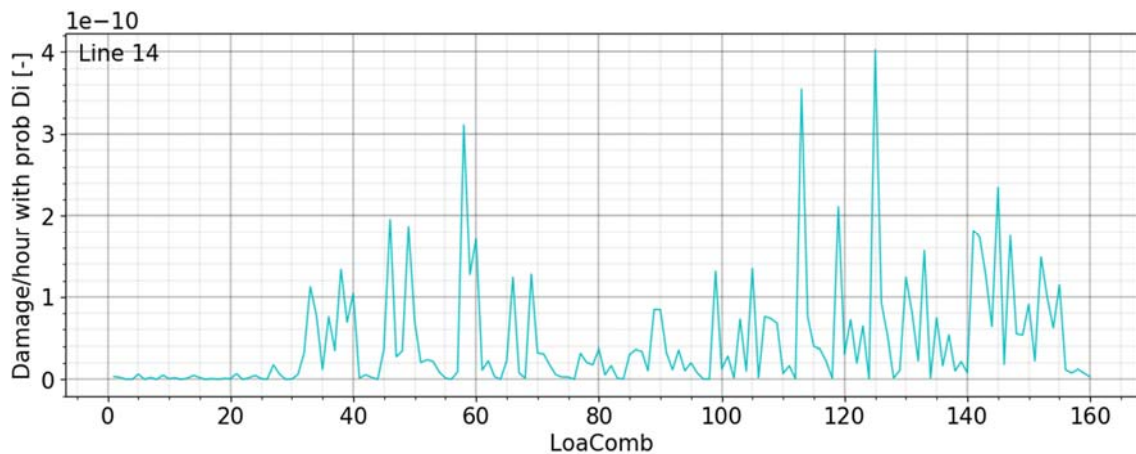


15.2 Standard Deviation

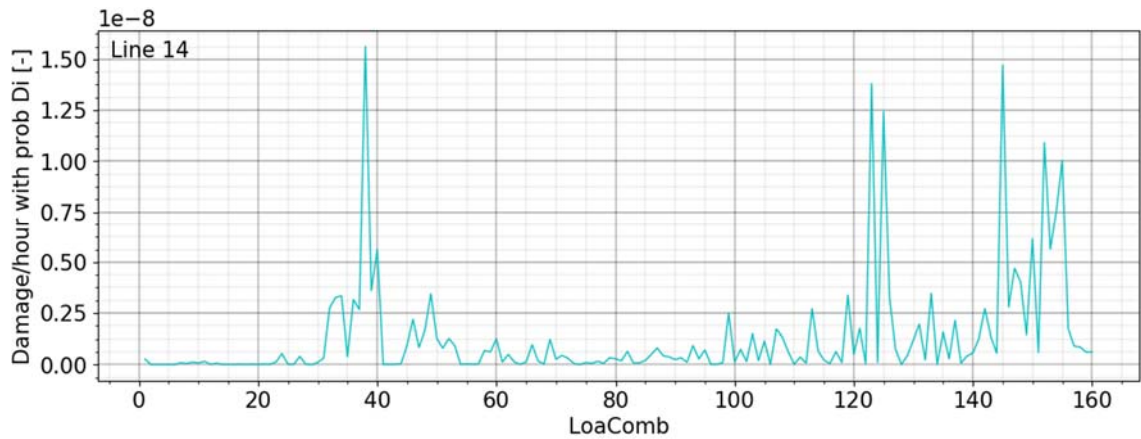


15.3 Damage

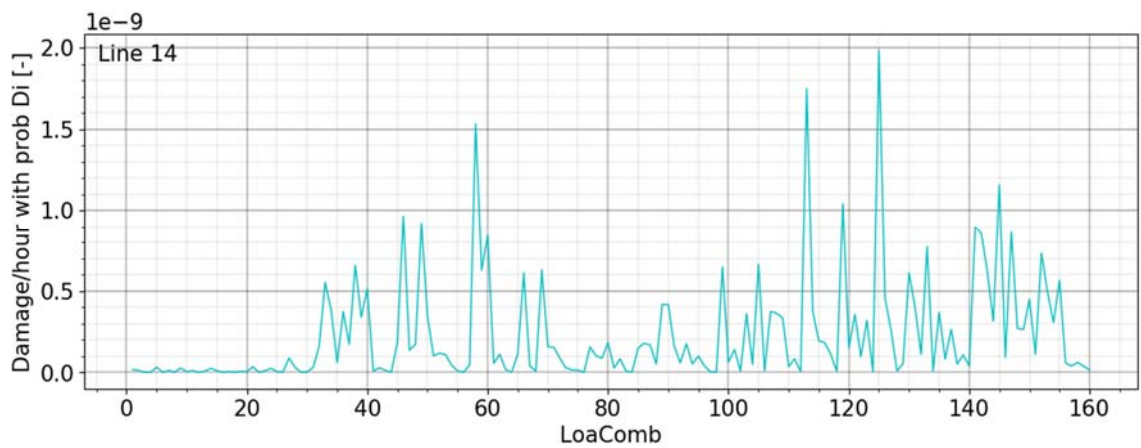
15.3.1 TT-Top chain



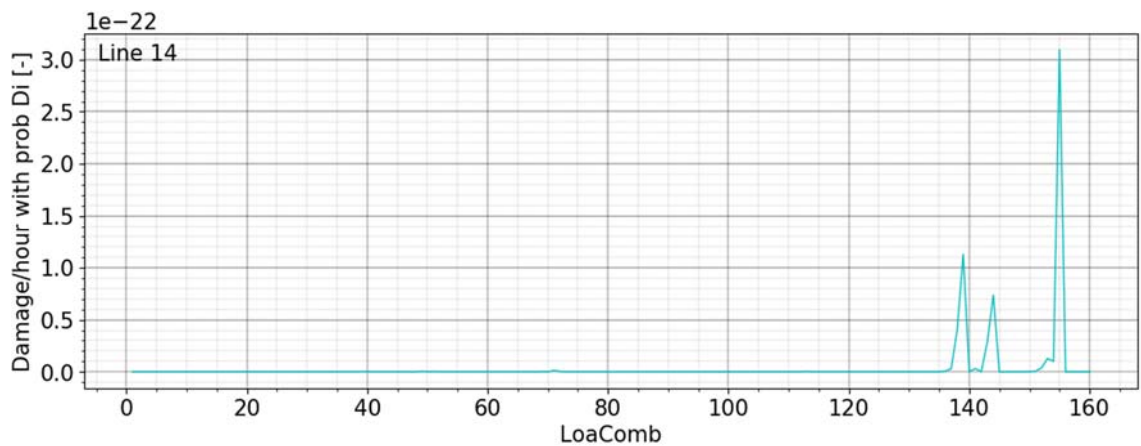
15.3.2 IPB OPB Top chain



15.3.3 TT Bottom chain

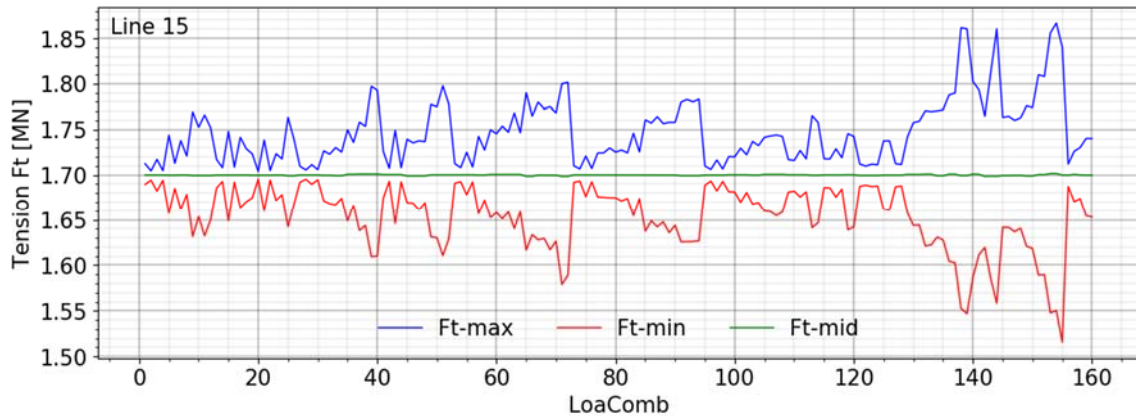


15.3.4 TT Fibre Rope

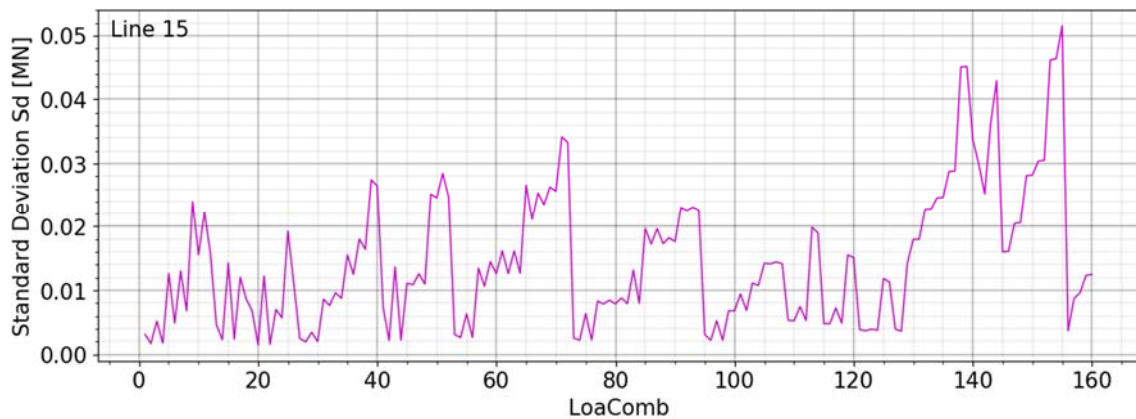


16 LINE 15

16.1 Tension

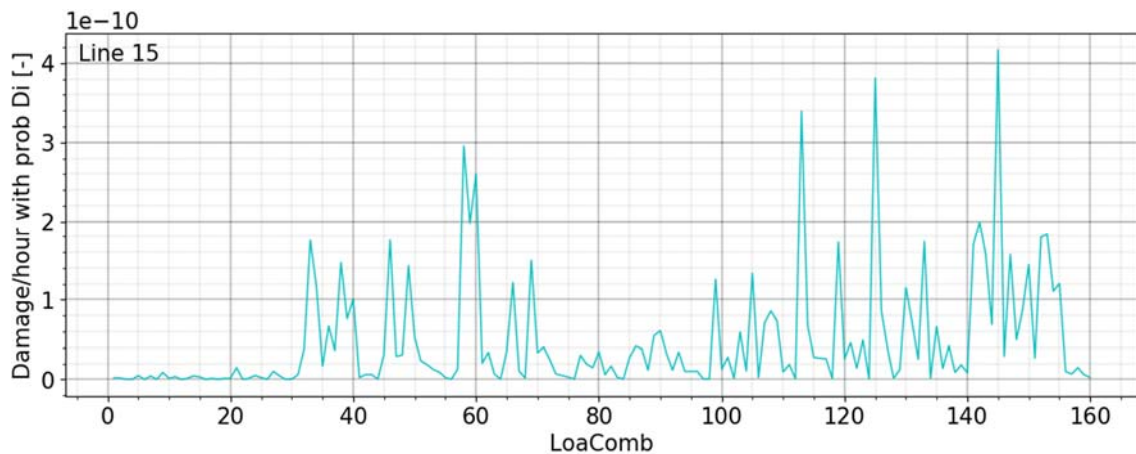


16.2 Standard Deviation

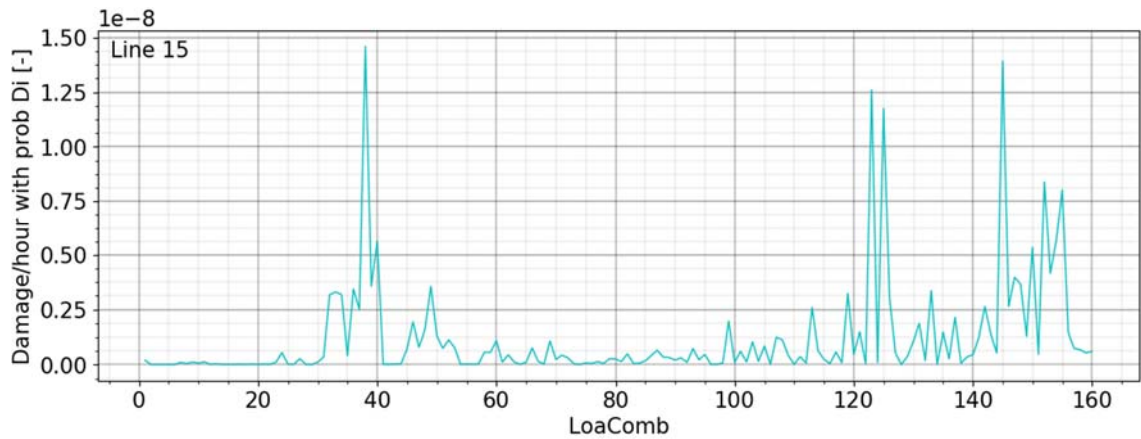


16.3 Damage

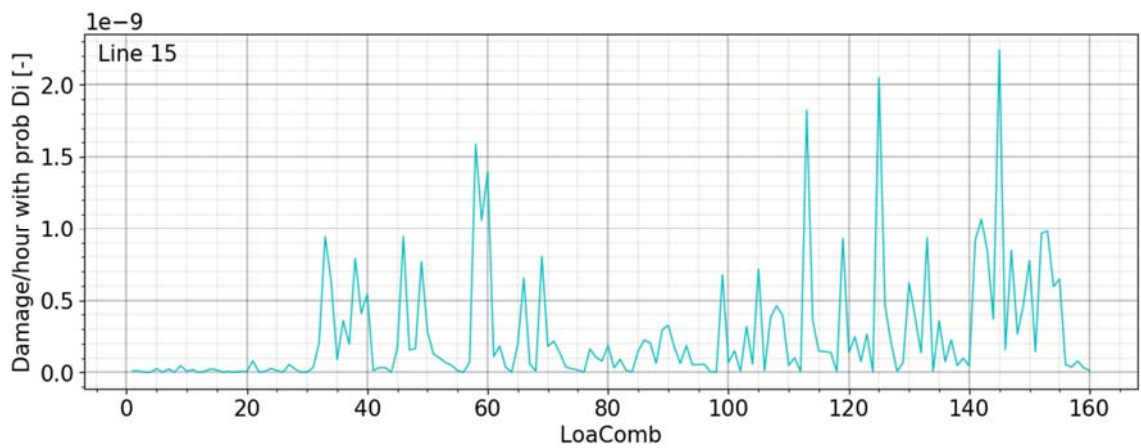
16.3.1 TT-Top chain



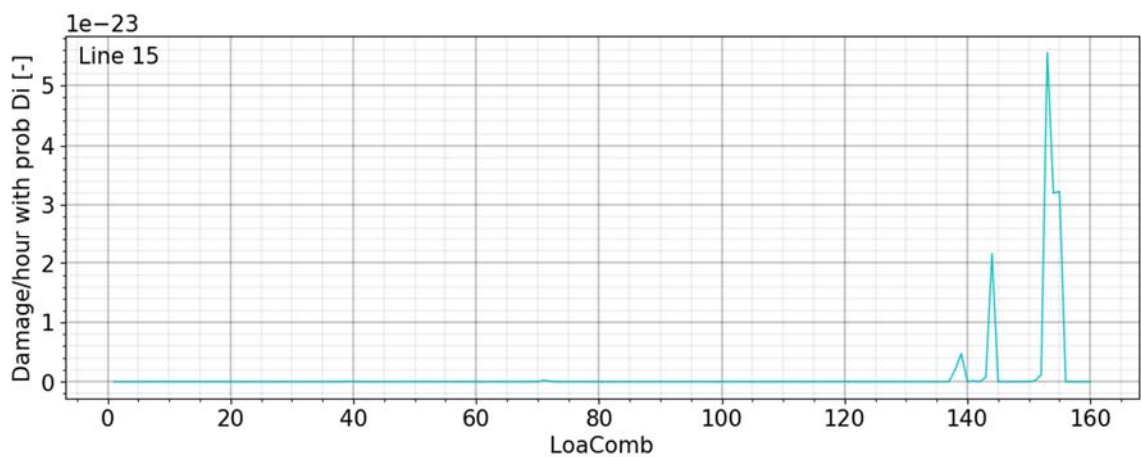
16.3.2 IPB OPB Top chain



16.3.3 TT Bottom chain

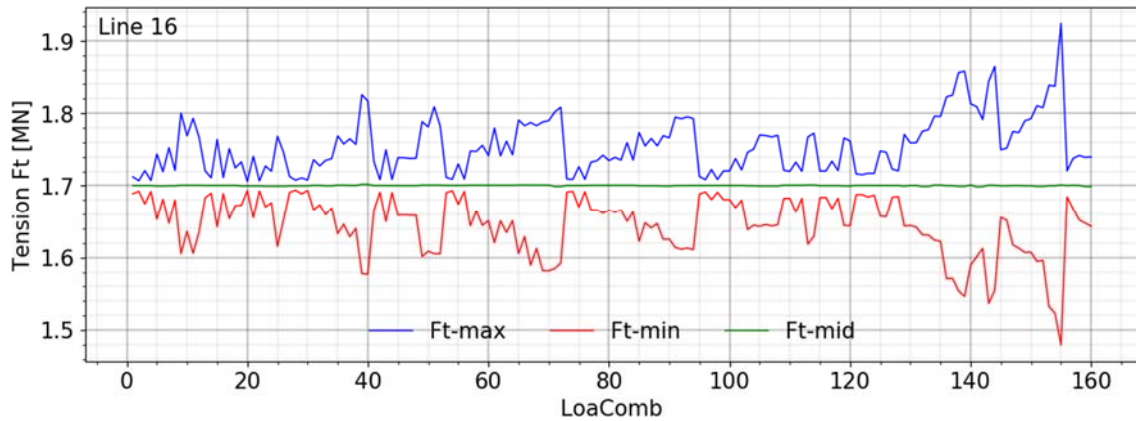


16.3.4 TT Fibre Rope

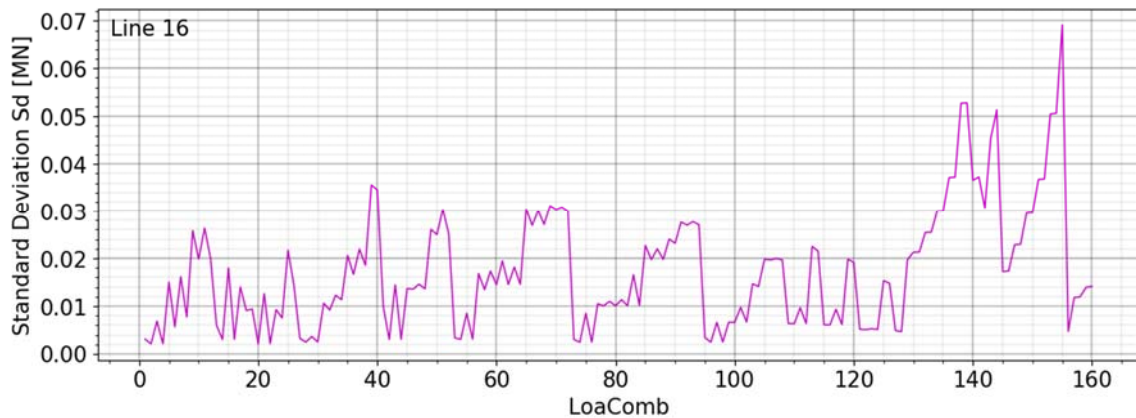


17 LINE 16

17.1 Tension

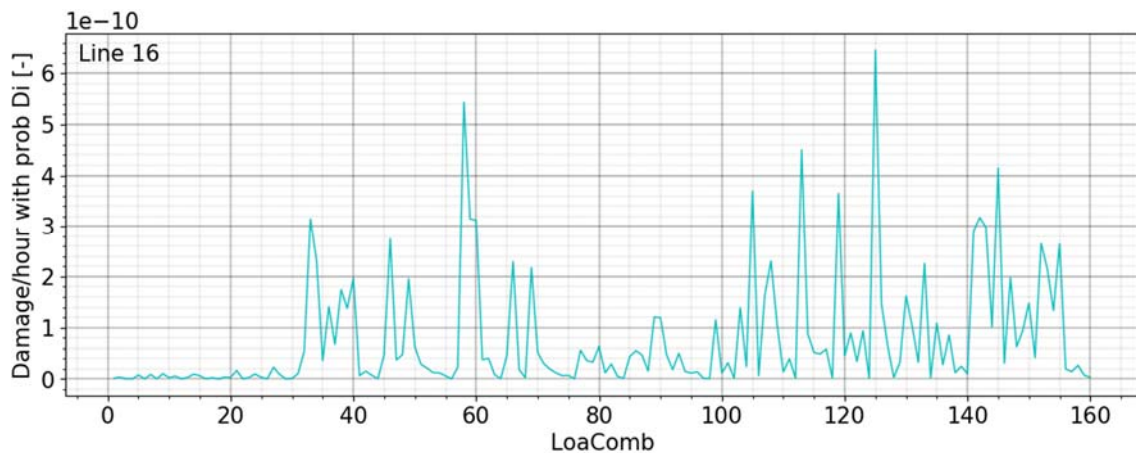


17.2 Standard Deviation

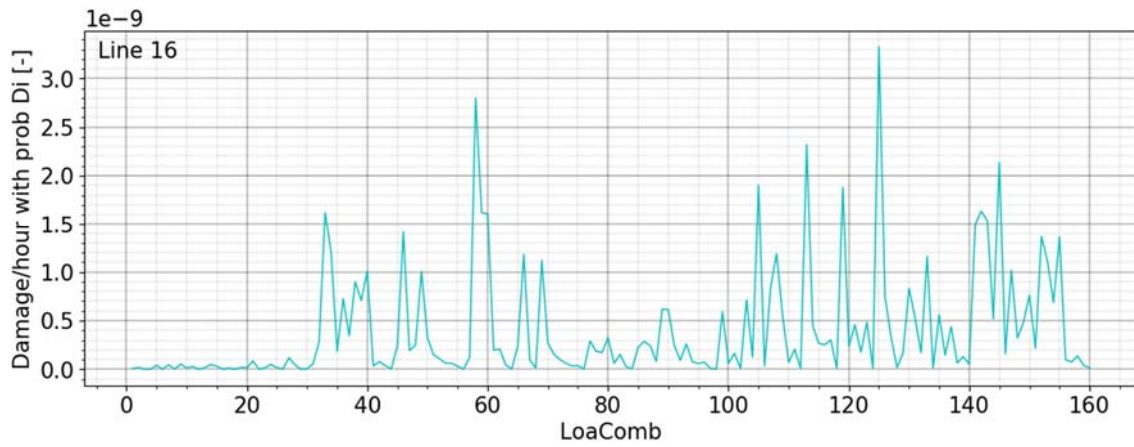


17.3 Damage

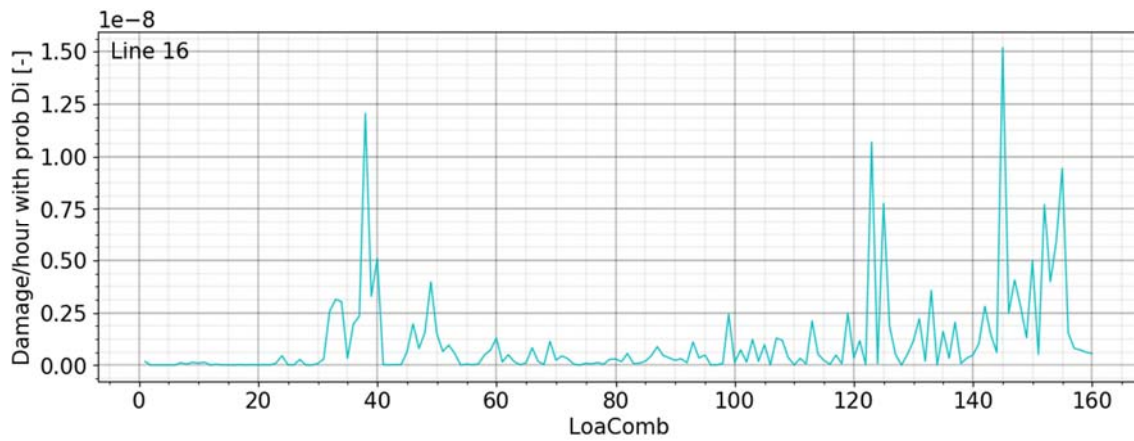
17.3.1 TT-Top chain



17.3.2 IPB OPB Top chain



17.3.3 TT Bottom chain



17.3.4 TT Fibre Rope

