World Sailing

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World Sailing Manufacturer Control System

Title: Scanner Report for Hydrofoil Registration with Class

Olympic Class: IKA Formula Kite

Equipment Item: – Levitaz Frontwing R6 V1

Project				
World Sailing Manufacturer Control System				
Title				
Scanner Report: IKA Formula Kite – Levitaz Frontwing R6 V1				
Revision	**By**	**Date**	**Description of change**	**Checked**
A	A.S.	19/03/2024	Draft Issue	J.N

Overview

As part of the World Sailing Manufacturer Control System project, which focuses on improving the quality of Olympic Equipment, World Sailing Technical Department performed an audit to Levitaz, in World Sailing Office in London.

In order to register new equipment models for the 2028 Olympic Quad, the IKA Formula Kite Class registration process requires manufacturers to produce for inspection 10 items of each model that they seek to register.

The analysis presented in this report is limited to a number of control points on specific cross sections following the scanning of the items. However, the data compiled and hold on record by World Sailing permits to analyse more aspects and areas of the geometry of the equipment.

Coordinate System

Figure 1 shows the coordinate system defined to analyse the Frontwing.

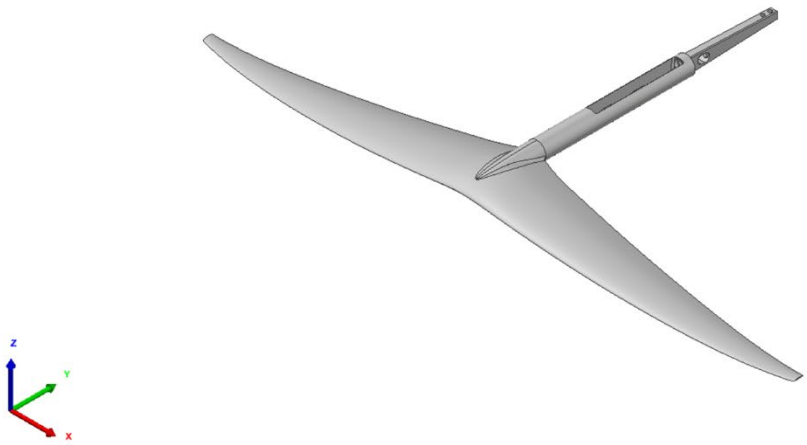


Figure 1 - Definition of the Coordinate System

Cross Sections

Figure 2 shows the Cross Sections (in yellow) defined to analyse the Frontwing.

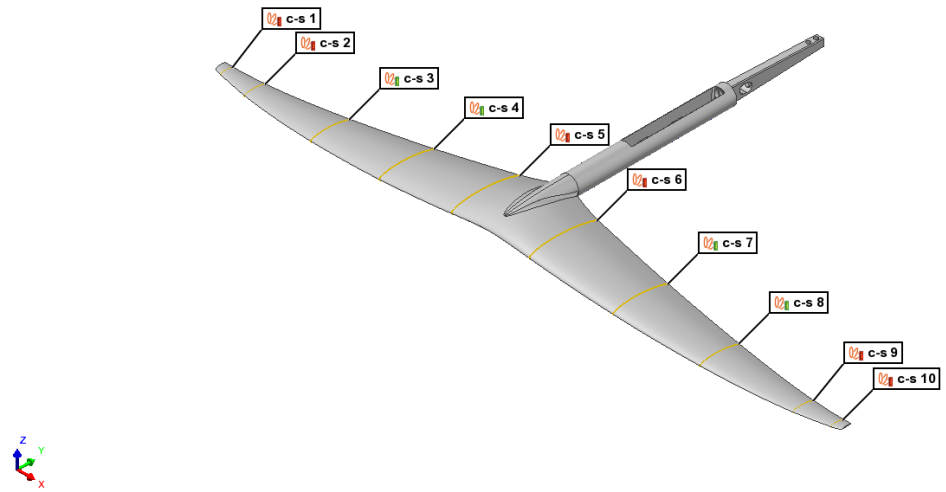


Figure 2 - Definition of Cross Sections

Name	Positioning
c-s 1	10 mm from the tip
c-s 2	50 mm from the tip
c-s 3	250 mm from the symmetry plane (X=0)
c-s 4	150 mm from the symmetry plane (X=0)
c-s 5	50 mm from the symmetry plane (X=0)
c-s 6	50 mm from the symmetry plane (X=0)
c-s 7	150 mm from the symmetry plane (X=0)
c-s 8	250 mm from the symmetry plane (X=0)
c-s 9	50 mm from the tip
c-s 10	10 mm from the tip

Callipers

For each Cross Section, 3 Callipers are defined. Figure 3 shows the positioning of the Callipers per Cross Section. The Callipers measure the thickness in specific points of the Cross Sections.

Figure 3 - Callipers definition for one of the Cross Sections

Name	Positioning
#_LE	5 mm from the Leading Edge of the Cross Section
#_MAX	On the maximum thickness of the Cross Section
#_LE	5 mm from the Trailing Edge of the Cross Section

A Calliper is used to measure the span of the Frontwing, Figure 4 shows the positioning.

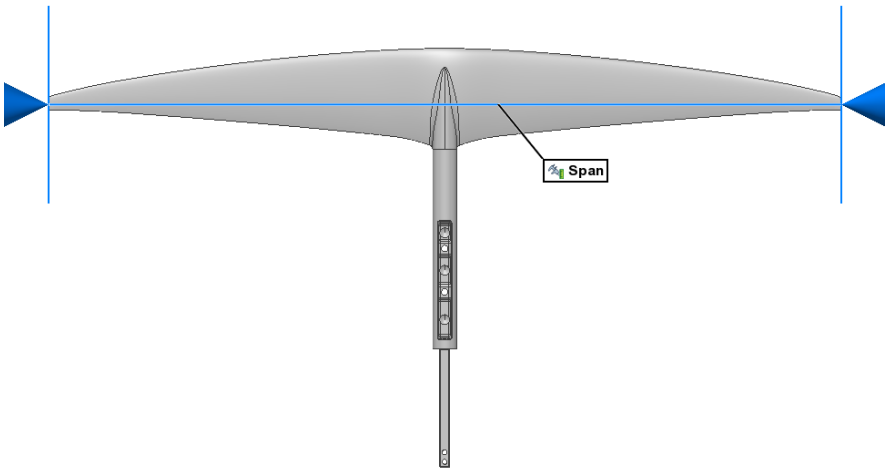


Figure 4 – Calliper to measure the Span

Surface Distance Points

For each Cross Section, 2 Surface Distance Points are defined. Figure 5 shows the positioning of the Surface Distance Points.

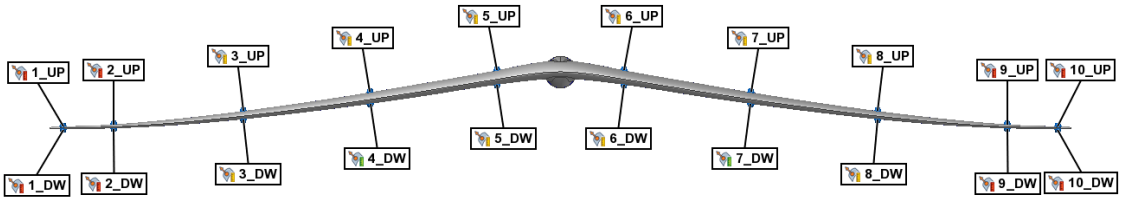


Figure 5 - Surface Distance Points definition

The Surface Distance Points measure the spatial distance between the Upper (Z positive) and Lower (Z negative) surfaces of the CAD file and the scanned equipment. Figure 6 shows a Surface Distance Point in a specific Cross Section measuring the spatial distance between the CAD file (grey) and the scanned equipment (yellow).

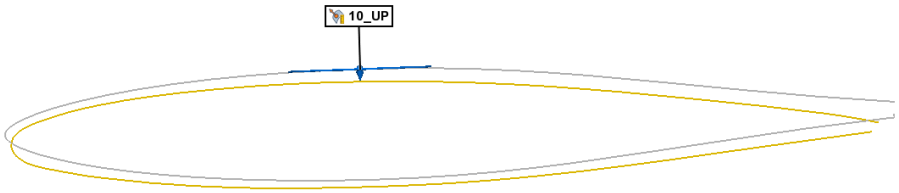


Figure 6 - Definition of Surface Distance Points on a Cross Section

Colour Map

Figure 7 shows the Colour Map of both Upper and Lower surfaces of a Frontwing.

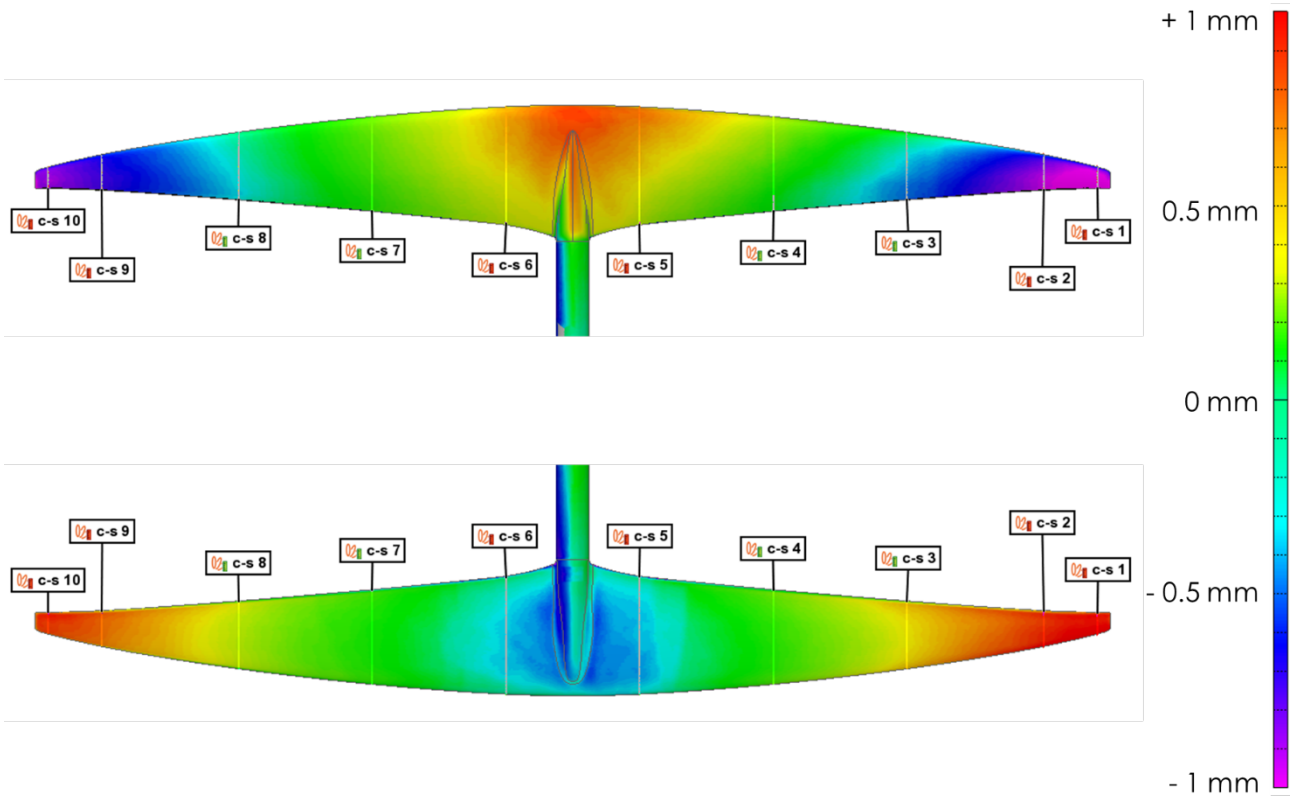


Figure 7 - Colour Map of the Upper (top) and Lower (bottom) surfaces of the Frontwing

The Colour Map shows the measure of the spatial distance between the Upper (Z positive) and Lower (Z negative) surfaces of the CAD file and the scanned equipment, as the Surface Distance Points.

Analysis

For each Frontwing the following measurement (Value) are evaluated:

- Upper Surface Distance for each Cross Section (#_UP)
- Lower Surface Distance for each Cross Section (#_DW)
- Thickness at 5mm from the Leading Edge for each Cross Section (#_LE)
- Maximum Thickness for each Cross Section (#_MAX)
- Thickness at 5mm from the Trailing Edge for each Cross Section (#_TE)
- Span of the foil as distance from Tip to Tip

Surface Distance	Surface Distance	Calliper	Calliper	Calliper	Calliper
1_UP	1_DW	1_LE	1_MAX	1_TE	Span
2_UP	2_DW	2_LE	2_MAX	2_TE	
3_UP	3_DW	3_LE	3_MAX	3_TE	
4_UP	4_DW	4_LE	4_MAX	4_TE	
5_UP	5_DW	5_LE	5_MAX	5_TE	
6_UP	6_DW	6_LE	6_MAX	6_TE	
7_UP	7_DW	7_LE	7_MAX	7_TE	
8_UP	8_DW	8_LE	8_MAX	8_TE	
9_UP	9_DW	9_LE	9_MAX	9_TE	
10_UP	10_DW	10_LE	10_MAX	10_TE	

For each measurement the average (Mean) is calculated:

$$Mean = \frac{\sum_1^{10} Value}{10}$$

In order to have a uniform scale to compare the results of measurements, all the Values are normalized against the Mean:

$$Norm.Value = Value - Mean$$

Results

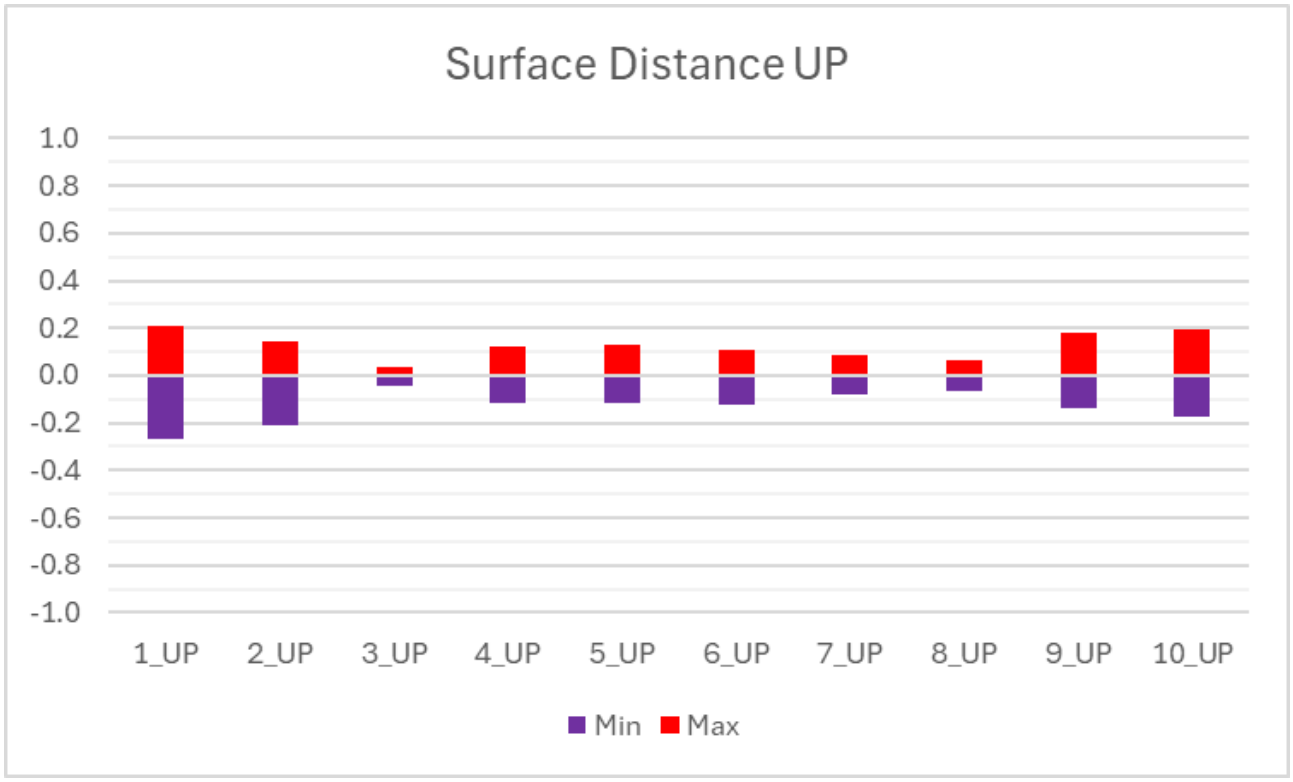
The table in the next page shows the normalised values (in mm) for each foil, minimum and maximum deviations and the standard deviation for each control. ±0.4 mm has been selected for visualisation purposes. The maximum, minimum and standard deviation values are also plotted.

World Sailing Manufacturer Control System

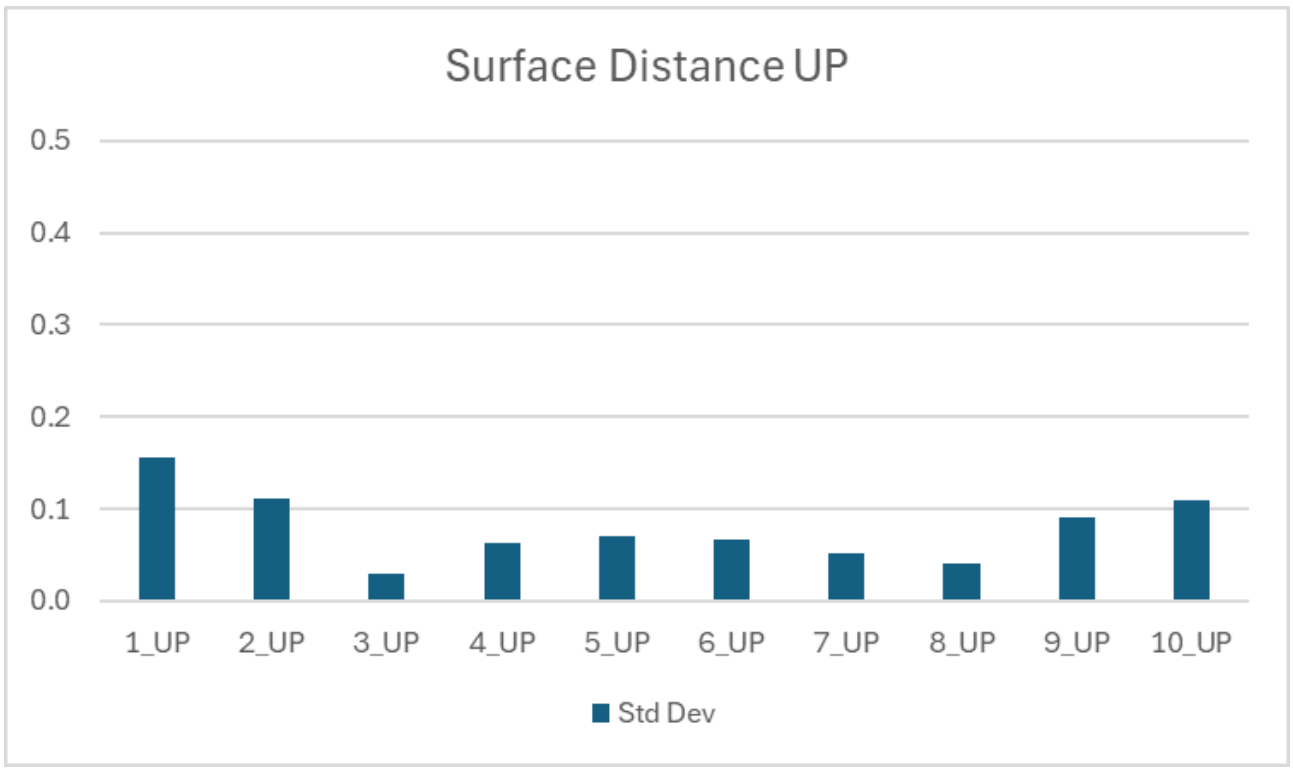
Scanner Report: IKA Formula Kite – Levitaz Frontwing R6 V1

Control	Foil 1	Foil 2	Foil 3	Foil 4	Foil 5	Foil 6	Foil 7	Foil 8	Foil 9	Foil 10	Min	Max	StdDev
1_UP	-0.269	0.151	0.098	-0.017	-0.072	-0.031	0.168	0.208	-0.182	-0.056	-0.269	0.208	0.156
2_UP	-0.213	0.105	0.081	0.002	-0.039	-0.034	0.105	0.144	-0.117	-0.029	-0.213	0.144	0.112
3_UP	-0.036	0.038	0.015	0.015	0.002	-0.038	-0.043	0.039	0.013	0	-0.043	0.039	0.030
4_UP	0.12	-0.014	-0.047	-0.001	0.015	-0.034	-0.113	0.024	0.067	-0.017	-0.113	0.120	0.064
5_UP	0.133	-0.016	-0.116	0.01	-0.007	0.014	-0.089	0.004	0.076	-0.011	-0.116	0.133	0.071
6_UP	0.108	-0.043	-0.02	-0.026	0.004	0.031	-0.123	-0.044	0.036	0.079	-0.123	0.108	0.067
7_UP	0.084	-0.009	-0.02	-0.019	0.018	0.003	-0.081	-0.029	-0.03	0.082	-0.081	0.084	0.051
8_UP	0.018	0.041	-0.01	-0.023	-0.036	-0.064	-0.006	0.045	-0.031	0.063	-0.064	0.063	0.041
9_UP	-0.109	0.059	0.015	-0.02	-0.045	-0.139	0.047	0.179	-0.03	0.041	-0.139	0.179	0.091
10_UP	-0.177	0.031	0.021	0.033	-0.058	-0.131	0.071	0.196	-0.067	0.082	-0.177	0.196	0.110
1_DW	0.294	-0.134	-0.077	0.068	0.021	0.014	-0.167	-0.213	0.2	-0.003	-0.213	0.294	0.159
2_DW	0.244	-0.068	-0.053	0.036	0.008	0.024	-0.104	-0.162	0.111	-0.032	-0.162	0.244	0.115
3_DW	0.09	-0.003	-0.009	0.011	-0.027	0.035	0.029	-0.101	0.018	-0.046	-0.101	0.090	0.051
4_DW	0.003	0.05	0.007	-0.005	-0.027	0.035	0.087	-0.098	-0.019	-0.033	-0.098	0.087	0.051
5_DW	-0.065	0.08	0.094	0.072	-0.063	-0.033	0.082	-0.053	-0.075	-0.036	-0.075	0.094	0.072
6_DW	-0.015	0.005	0.046	0.043	-0.048	-0.054	0.006	0.01	0.005	0.002	-0.054	0.046	0.033
7_DW	0.01	0.016	-0.004	0.009	-0.102	-0.056	-0.033	0.039	0.119	0.006	-0.102	0.119	0.058
8_DW	0.024	-0.046	-0.013	0.009	-0.005	0.004	-0.072	-0.053	0.113	0.035	-0.072	0.113	0.053
9_DW	0.155	-0.082	-0.042	0.016	0.021	0.073	-0.147	-0.171	0.11	0.07	-0.171	0.155	0.109
10_DW	0.223	-0.04	-0.011	-0.043	0.021	0.068	-0.161	-0.211	0.14	0.01	-0.211	0.223	0.128
1_LE	0.047	0.032	0.01	0.044	-0.069	-0.024	0.007	0.004	0.004	-0.057	-0.069	0.047	0.039
2_LE	0.087	0.049	0.009	0.019	-0.073	-0.013	-0.028	0	-0.011	-0.034	-0.073	0.087	0.045
3_LE	0.162	0.038	-0.014	0.004	-0.102	-0.014	0.014	-0.059	0.005	-0.029	-0.102	0.162	0.069
4_LE	0.191	0.021	-0.064	0.009	-0.074	0.011	0.019	-0.096	0.004	-0.018	-0.096	0.191	0.079
5_LE	0.095	0.009	0.02	0.081	-0.075	0.016	0.028	-0.103	-0.09	0.022	-0.103	0.095	0.068
6_LE	0.058	-0.085	0.076	0.069	-0.042	-0.026	-0.011	-0.043	-0.004	0.008	-0.085	0.076	0.053
7_LE	0.044	-0.04	-0.001	0.03	-0.059	-0.055	-0.024	-0.001	0.046	0.062	-0.059	0.062	0.044
8_LE	-0.002	-0.062	0.006	0.031	-0.035	-0.06	-0.048	0.047	0.064	0.06	-0.062	0.064	0.049
9_LE	0.005	-0.042	-0.024	0.015	-0.002	-0.052	-0.086	0.031	0.075	0.08	-0.086	0.080	0.053
10_LE	0.033	-0.019	0.017	0.001	-0.014	-0.066	-0.097	-0.001	0.069	0.078	-0.097	0.078	0.054
1_MAX	0.025	0.017	0.022	0.051	-0.051	-0.017	0.002	-0.006	0.018	-0.059	-0.059	0.051	0.035
2_MAX	0.03	0.036	0.026	0.037	-0.031	-0.012	0	-0.018	-0.007	-0.062	-0.062	0.037	0.033
3_MAX	0.054	0.035	0.005	0.027	-0.025	-0.003	-0.014	-0.062	0.031	-0.046	-0.062	0.054	0.037
4_MAX	0.125	0.037	-0.04	-0.007	-0.012	0.002	-0.027	-0.075	0.049	-0.05	-0.075	0.125	0.058
5_MAX	0.07	0.064	-0.024	0.083	-0.072	-0.019	-0.009	-0.05	0.002	-0.048	-0.072	0.083	0.055
6_MAX	0.095	-0.039	0.025	0.017	-0.044	-0.022	-0.119	-0.034	0.042	0.082	-0.119	0.095	0.065
7_MAX	0.096	0.006	-0.024	-0.01	-0.085	-0.054	-0.116	0.01	0.09	0.09	-0.116	0.096	0.074
8_MAX	0.043	-0.004	-0.022	-0.013	-0.04	-0.06	-0.078	-0.006	0.084	0.099	-0.078	0.099	0.058
9_MAX	0.047	-0.023	-0.026	-0.004	-0.023	-0.066	-0.1	0.008	0.08	0.111	-0.100	0.111	0.064
10_MAX	0.047	-0.01	0.012	-0.011	-0.036	-0.062	-0.09	-0.014	0.073	0.092	-0.090	0.092	0.058
1_TE	-0.043	-0.015	0.065	0.058	-0.017	0.032	-0.019	-0.016	0.043	-0.088	-0.088	0.065	0.049
2_TE	-0.026	0.017	0.058	0.059	0	0.022	-0.023	-0.031	0.025	-0.1	-0.100	0.059	0.048
3_TE	0.009	0.047	0	0.018	0.006	0.022	-0.025	-0.062	0.07	-0.089	-0.089	0.070	0.048
4_TE	0.084	0.072	-0.024	-0.016	0.028	0.026	-0.051	-0.074	0.075	-0.118	-0.118	0.084	0.068
5_TE	0.057	0.088	-0.013	-0.007	0.046	0.015	-0.079	-0.041	-0.032	-0.037	-0.079	0.088	0.051
6_TE	0.131	0.057	0.003	-0.042	-0.017	0.002	-0.155	-0.022	0.026	0.021	-0.155	0.131	0.073
7_TE	0.136	0.097	-0.064	-0.062	-0.077	-0.038	-0.151	-0.012	0.092	0.079	-0.151	0.136	0.095
8_TE	0.096	0.074	-0.059	-0.032	-0.099	-0.048	-0.123	-0.031	0.106	0.119	-0.123	0.119	0.090
9_TE	0.084	0.037	-0.043	-0.022	-0.095	-0.061	-0.11	-0.039	0.093	0.152	-0.110	0.152	0.087
10_TE	0.085	0.032	-0.009	-0.037	-0.087	-0.072	-0.089	-0.064	0.093	0.143	-0.089	0.143	0.084
Span	-0.002	0.228	-0.063	0.078	-0.16	-0.048	0.018	0.052	-0.115	0.011	-0.160	0.228	0.109

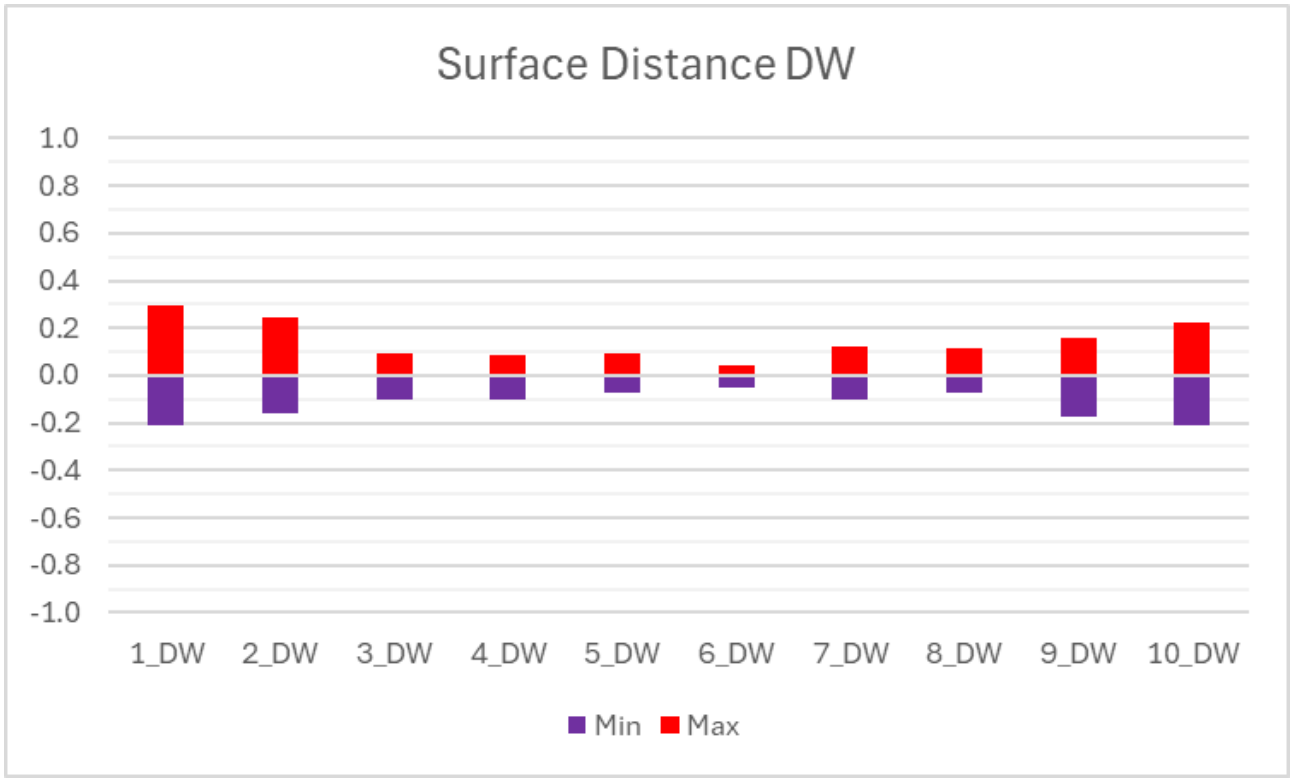
Maximum and minimum 'Surface Distances' on the upper surface at each cross section (mm):



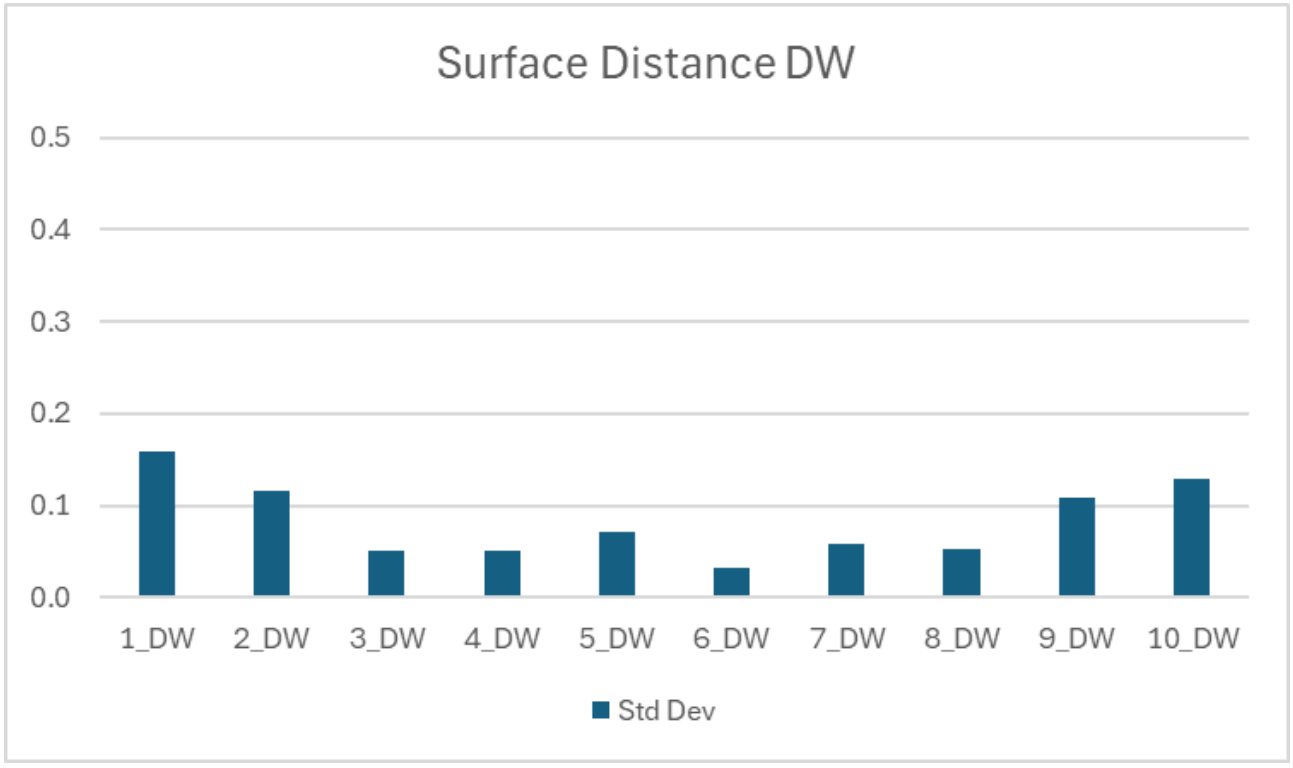
Standard deviation of 'Surface Distances' on the upper surface at each cross section (mm):



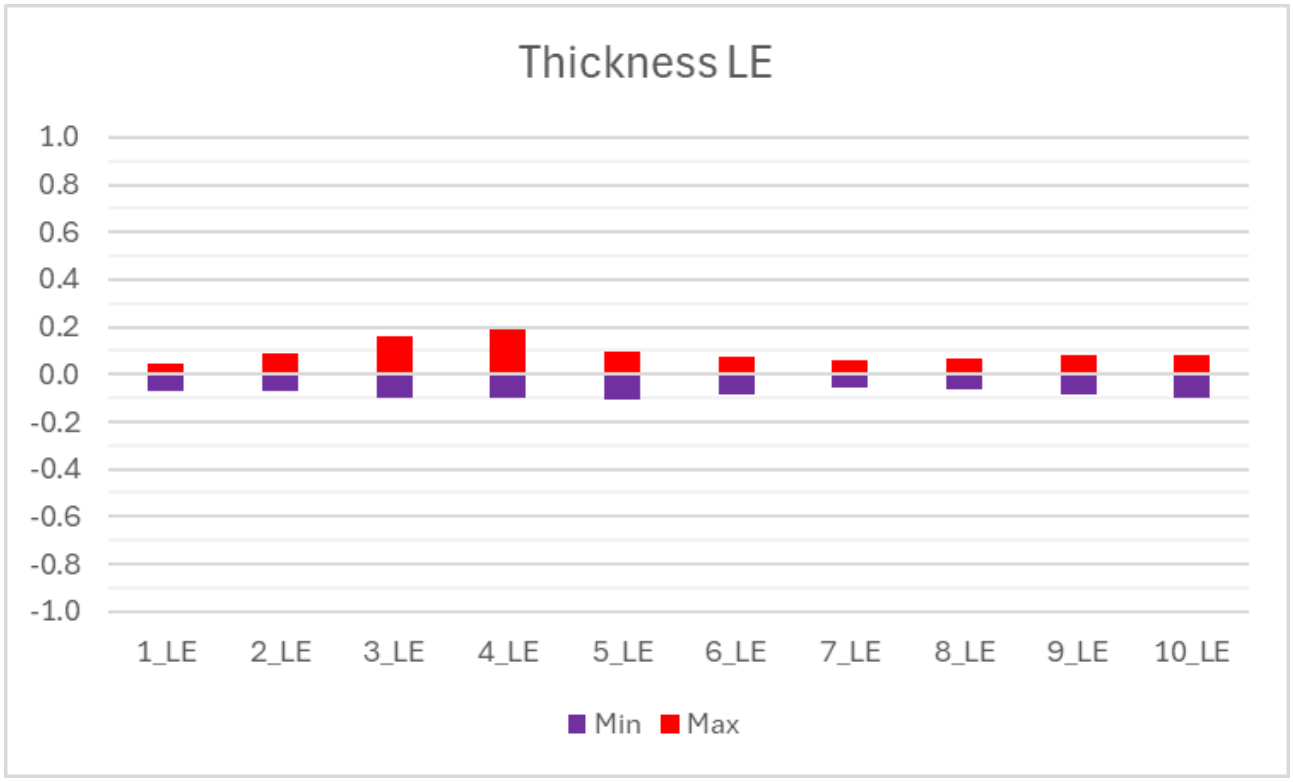
Maximum and minimum 'Surface Distances' on the lower surface at each cross section (mm):



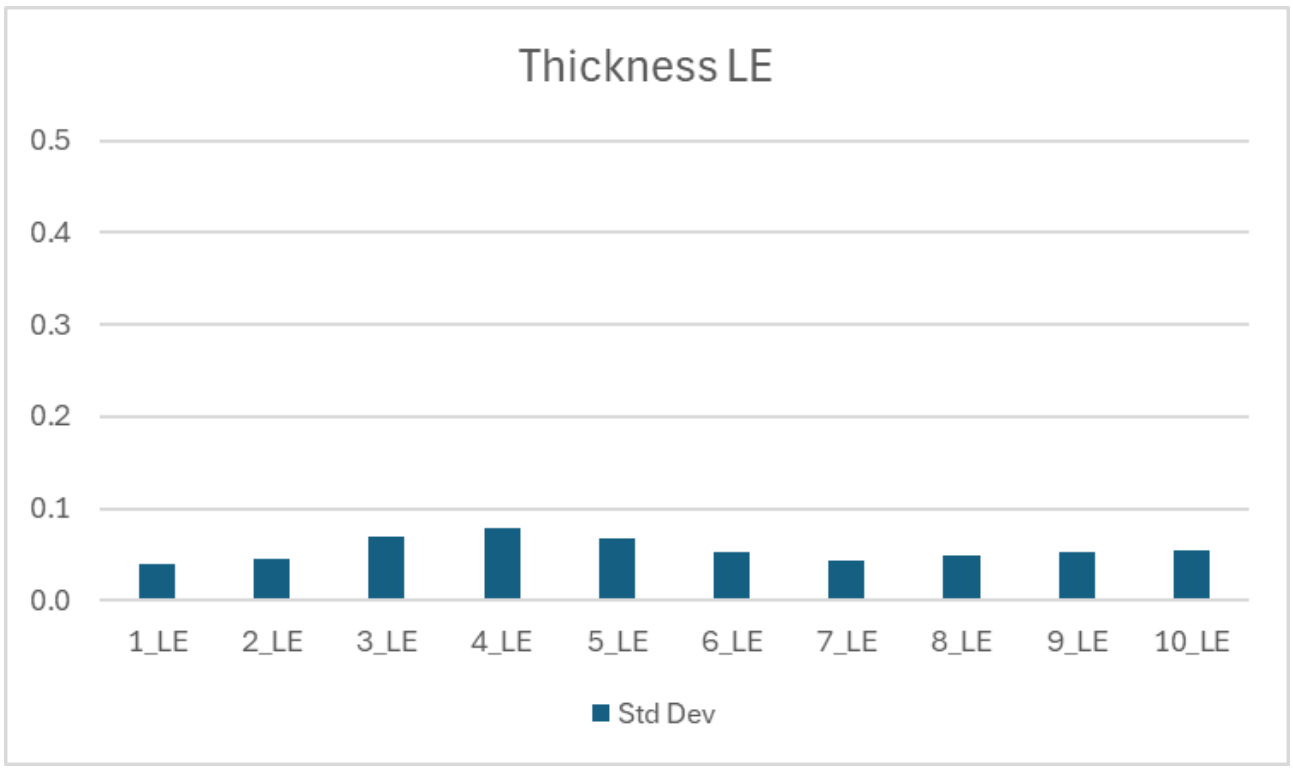
Standard deviation of 'Surface Distances' on the lower surface at each cross section (mm):



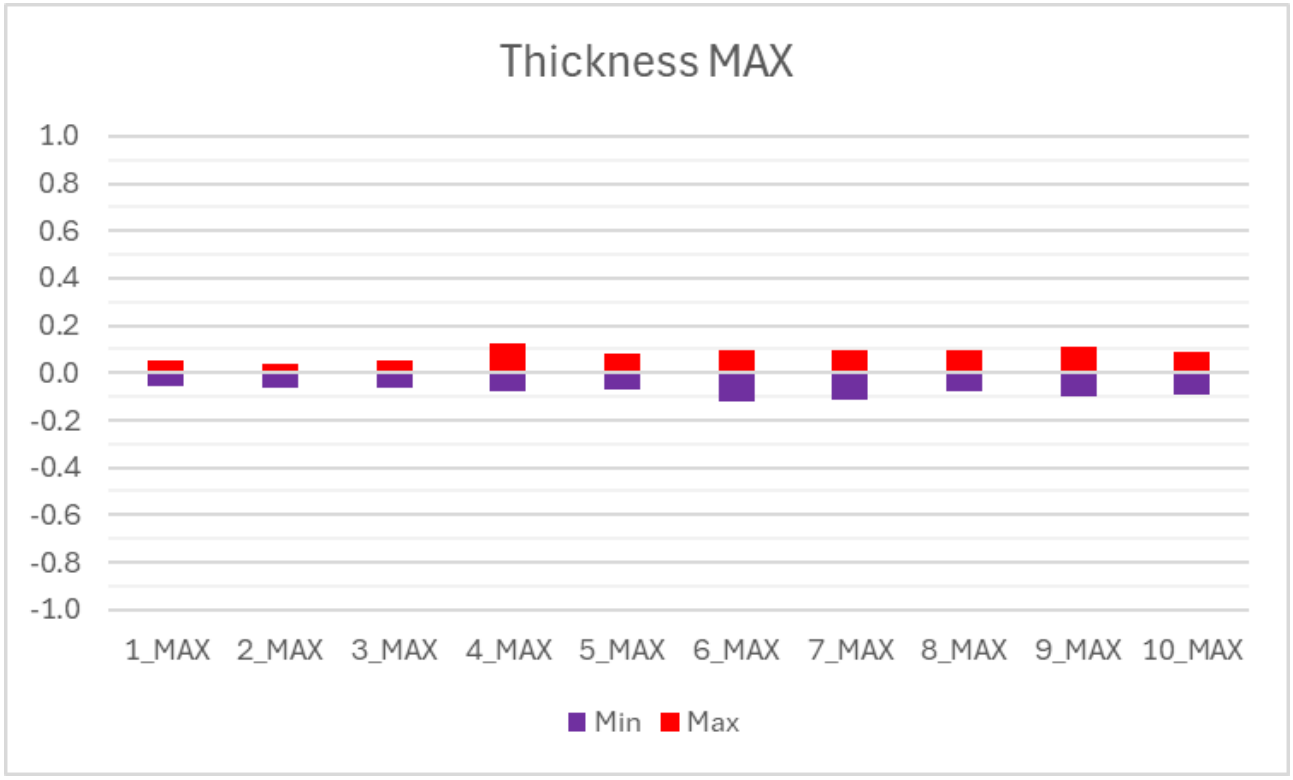
Maximum and minimum Thickness at the 'Leading Edge point' at each cross section (mm):



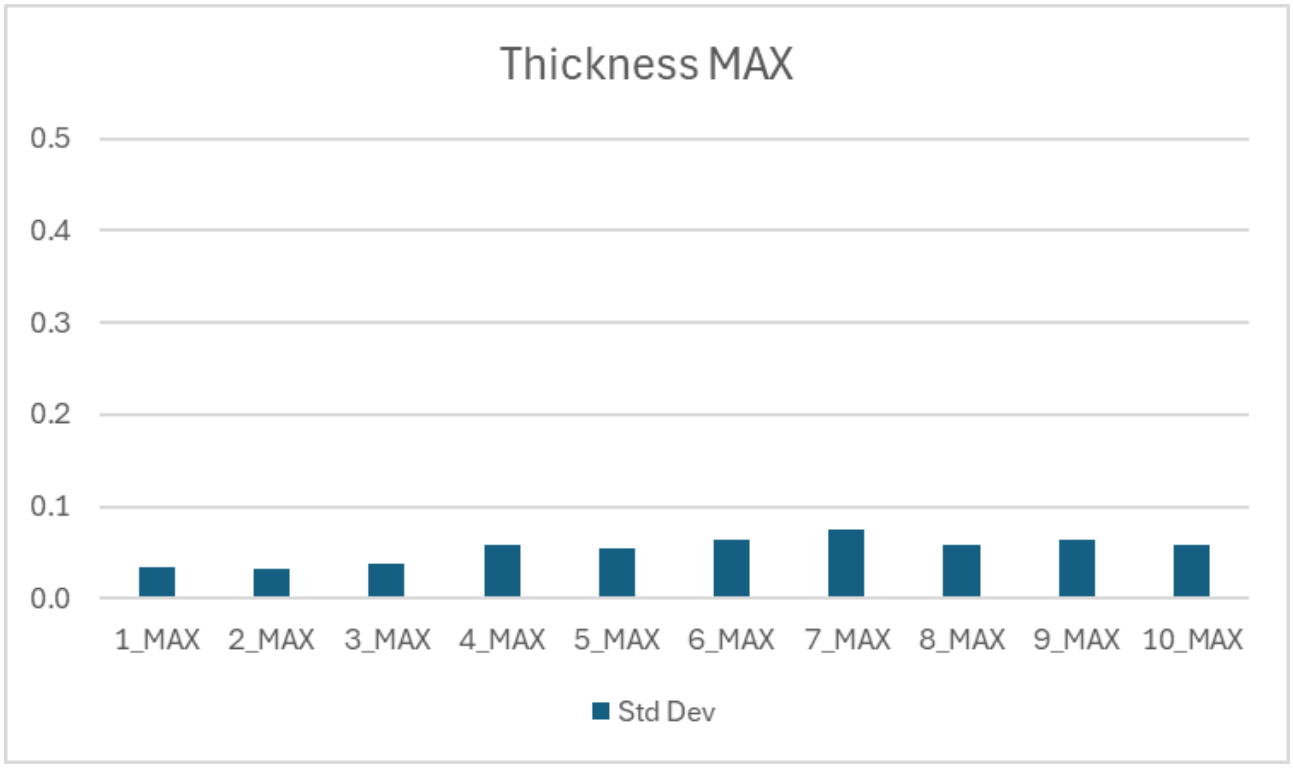
Standard deviation of Thickness at the 'Leading Edge point' at each cross section (mm):



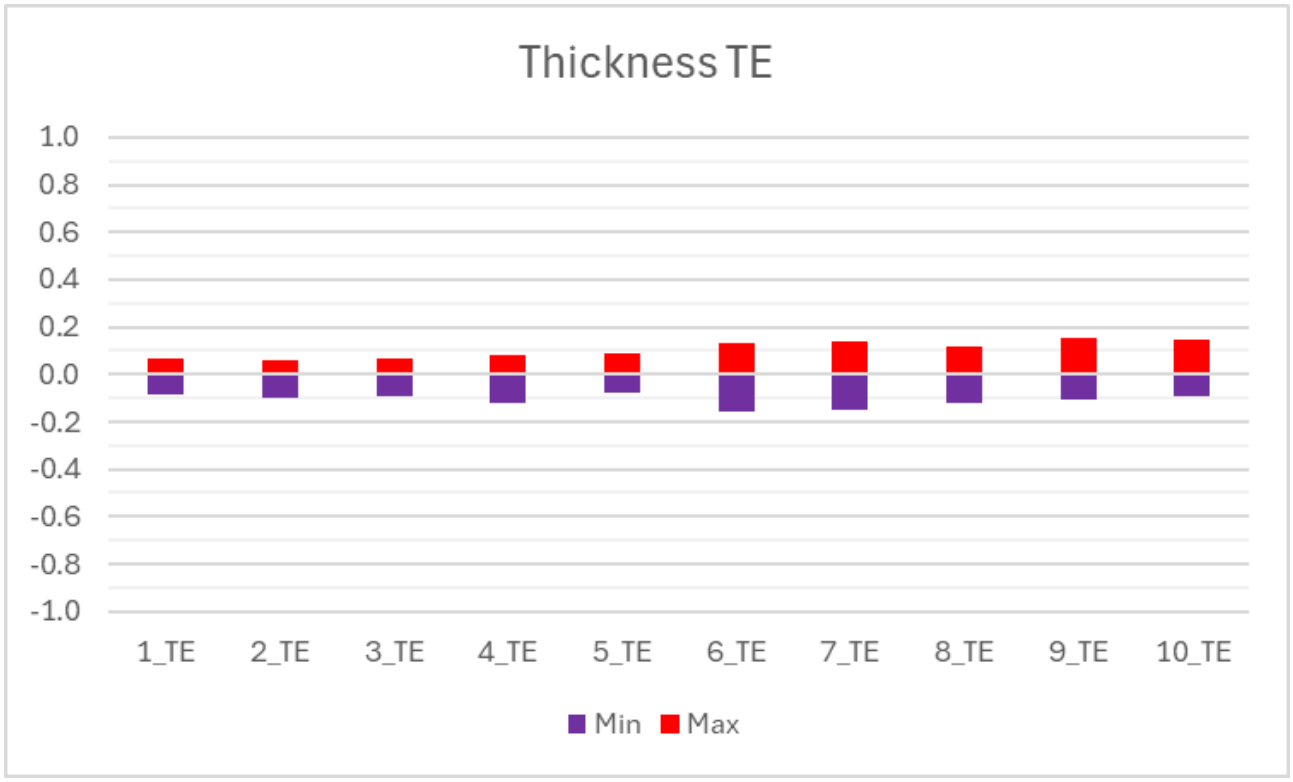
Maximum and minimum Thickness at the 'Maximum thickness point' at each cross section (mm):



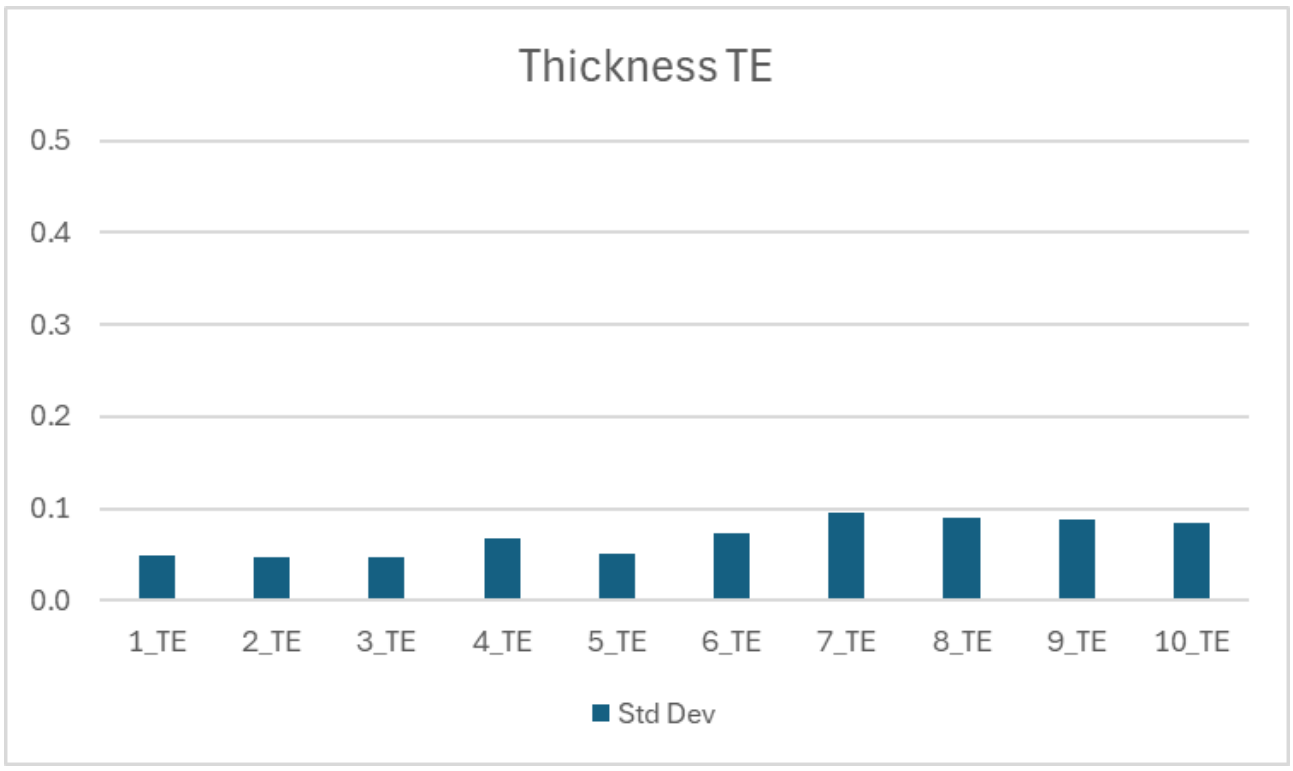
Standard deviation of Thickness at the 'Maximum thickness point' at each cross section (mm):



Maximum and minimum Thickness at the 'Trailing Edge point' at each cross section (mm):



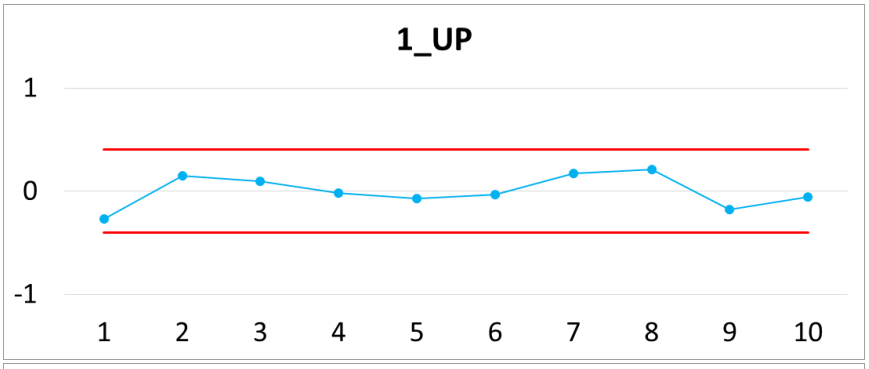
Standard deviation of Thickness at the 'Trailing Edge point' at each cross section (mm):

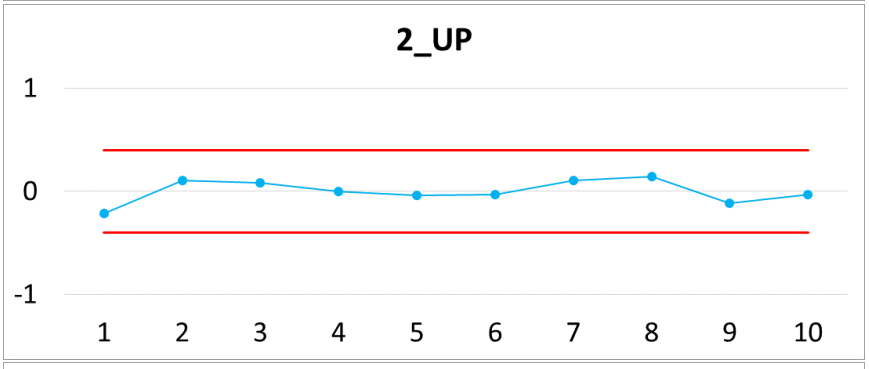


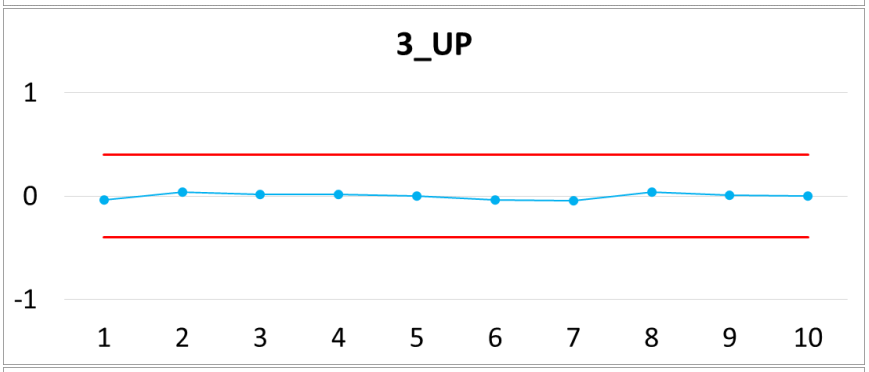
World Sailing Manufacturer Control System

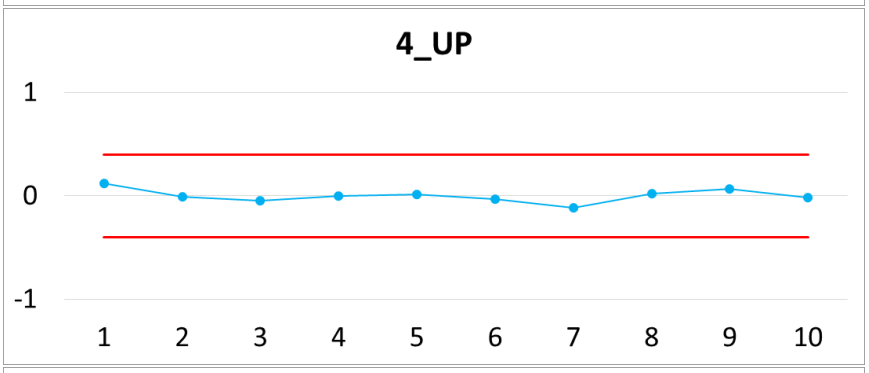
Scanner Report: IKA Formula Kite – Levitaz Frontwing R6 V1

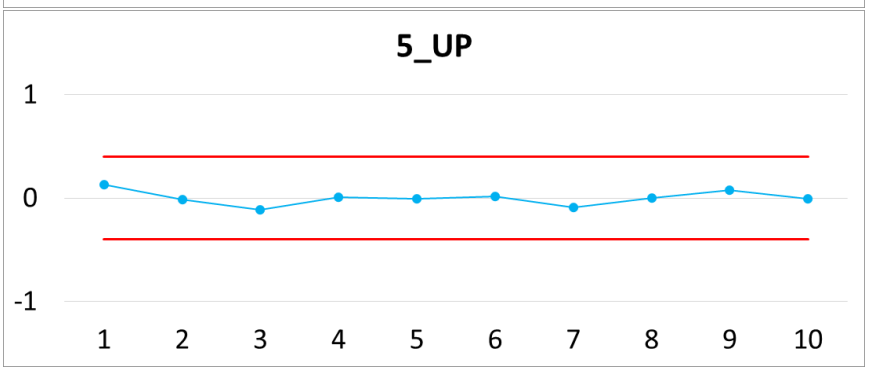
- Blue Lines: Normalised values (mm) for each control point
- Red Lines: ±0.4 mm for visualisation purposes
- X-Axis: 1 to 10 foils

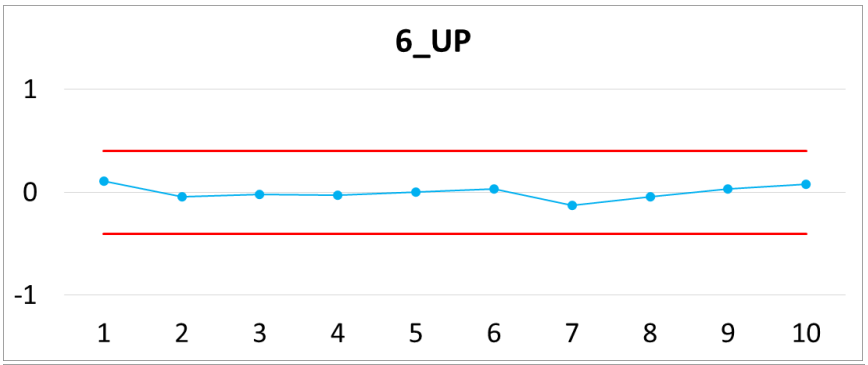


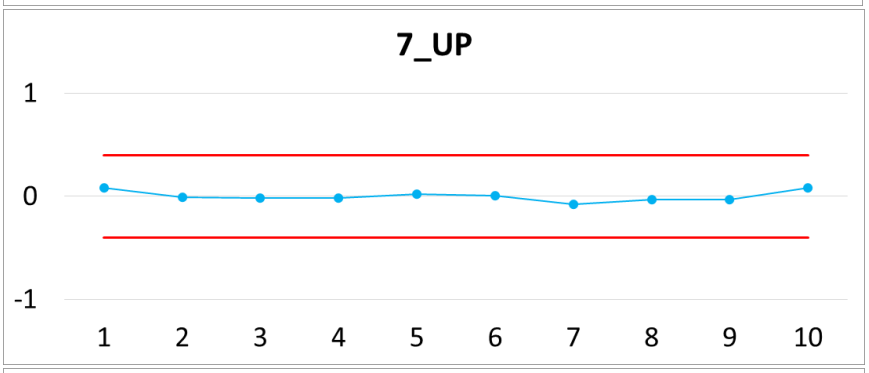


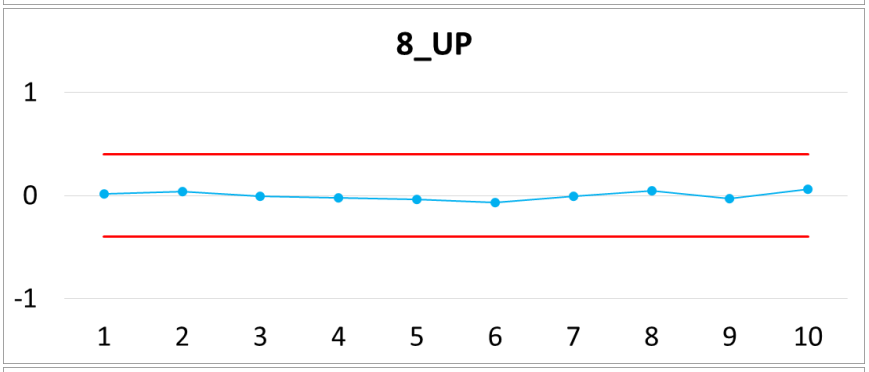


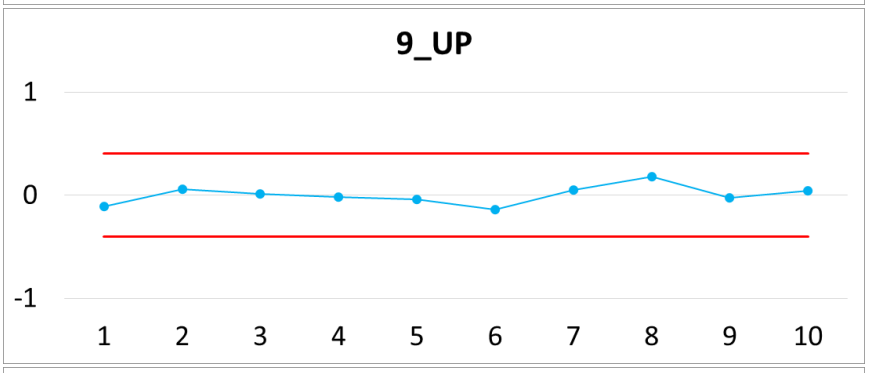





6_UP
1
0
-1
1 2 3 4 5 6 7 8 9 10


7_UP
1
0
-1
1 2 3 4 5 6 7 8 9 10


8_UP
1
0
-1
1 2 3 4 5 6 7 8 9 10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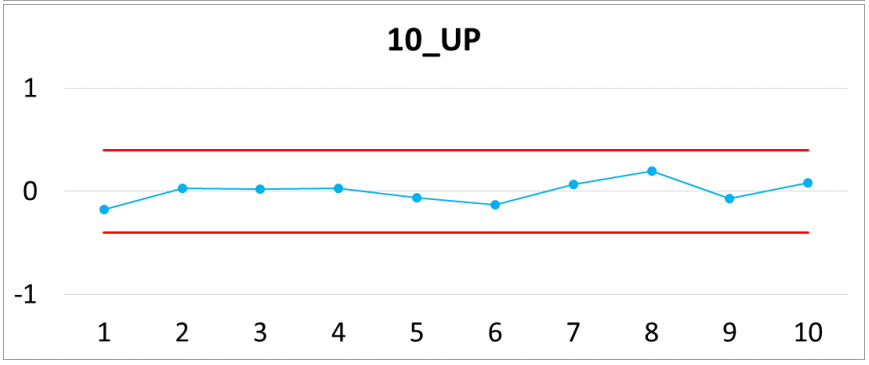
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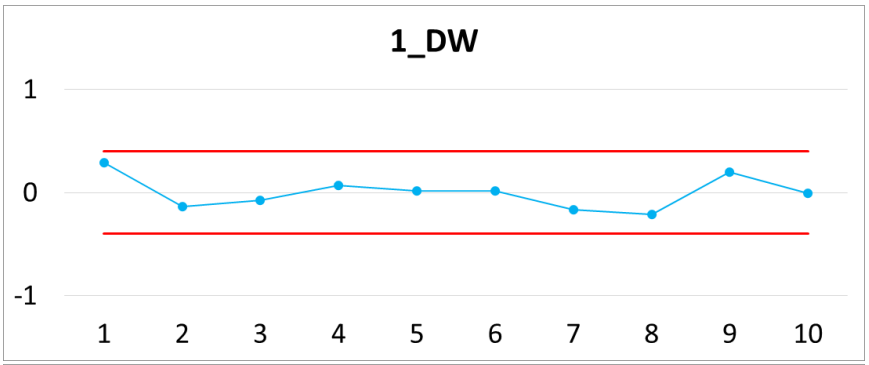
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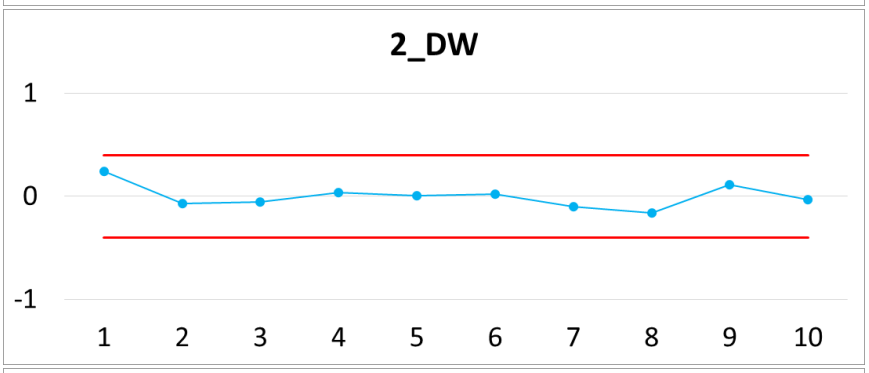
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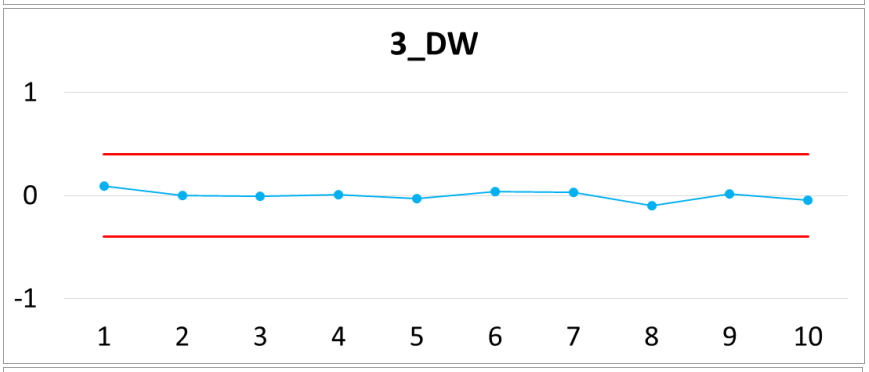
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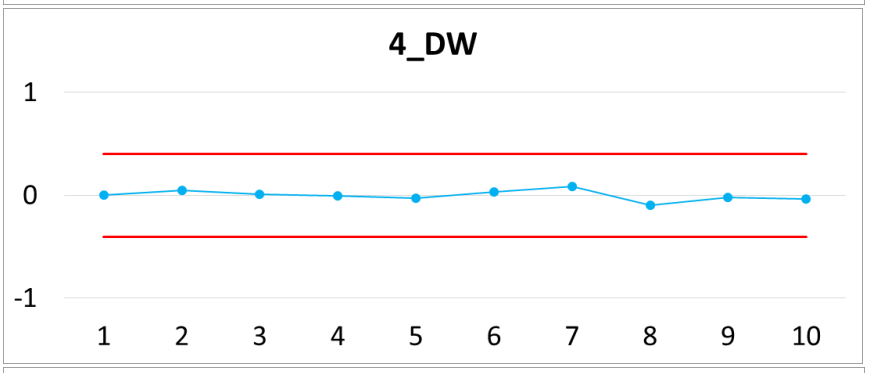
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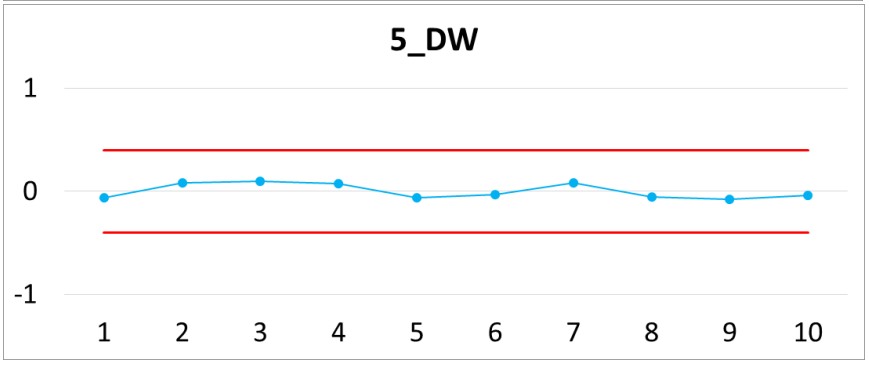
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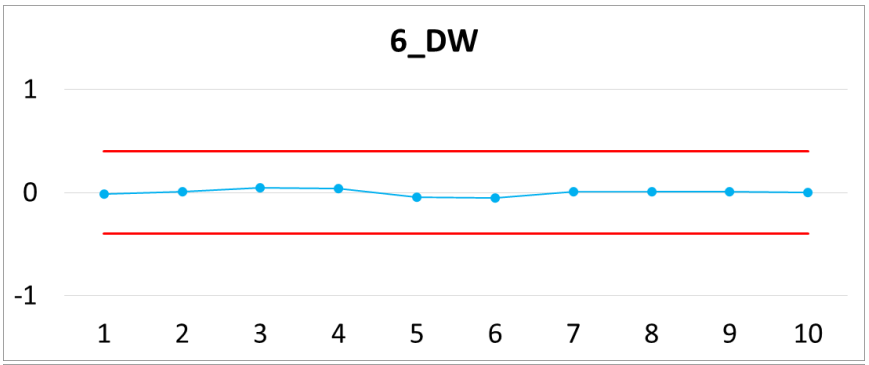
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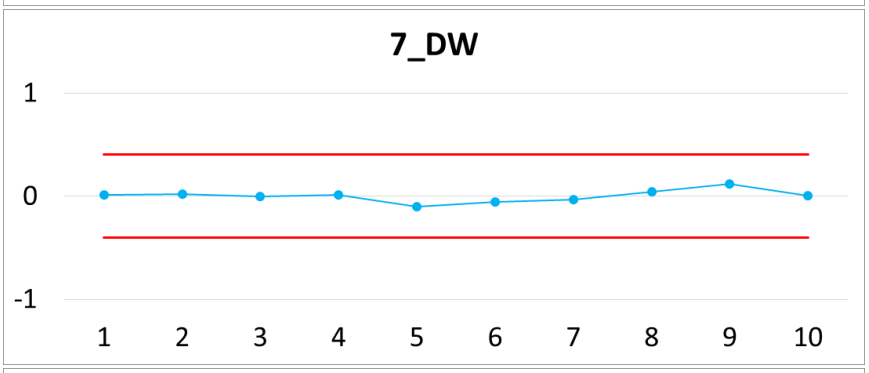
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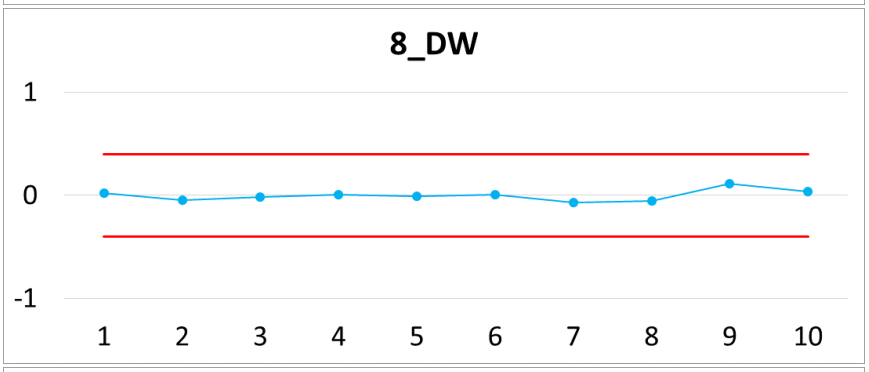
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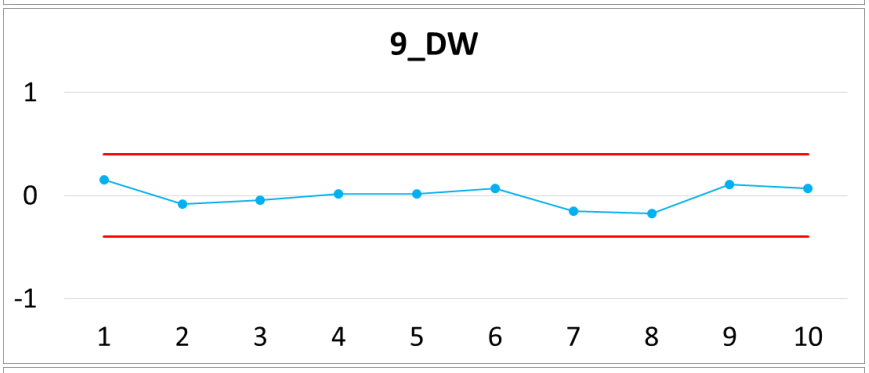
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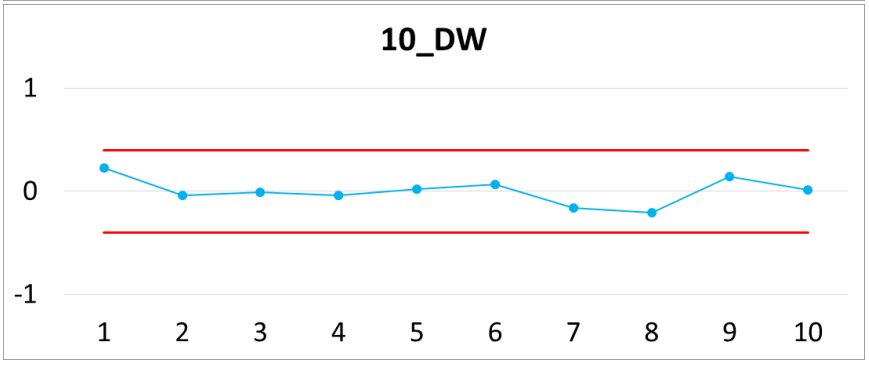
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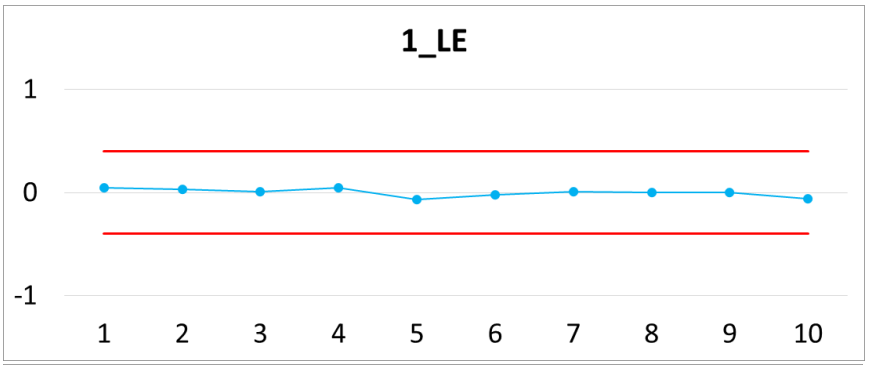
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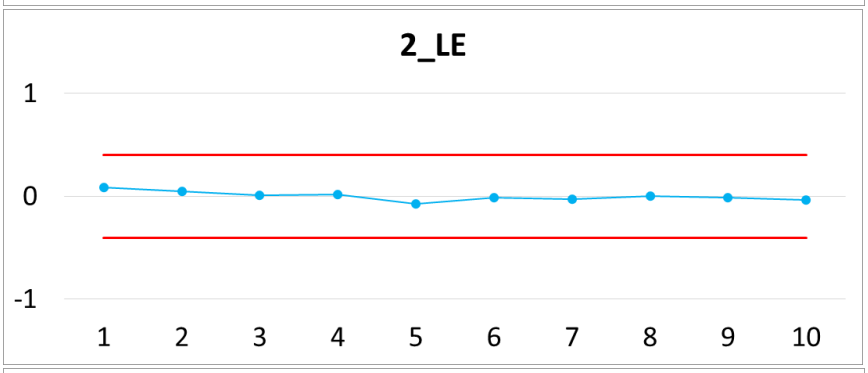
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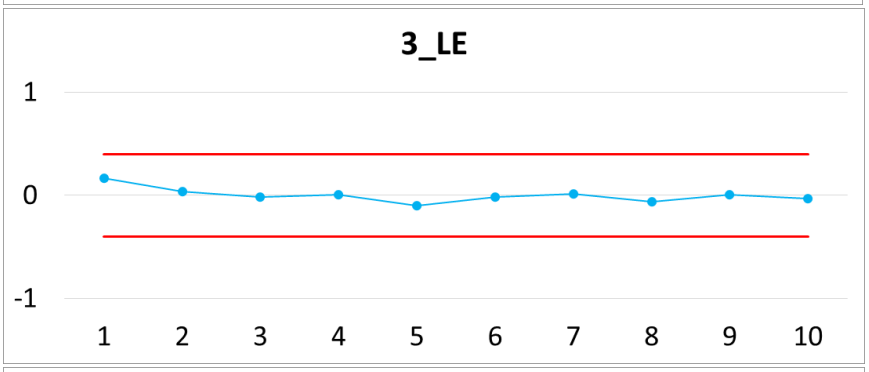
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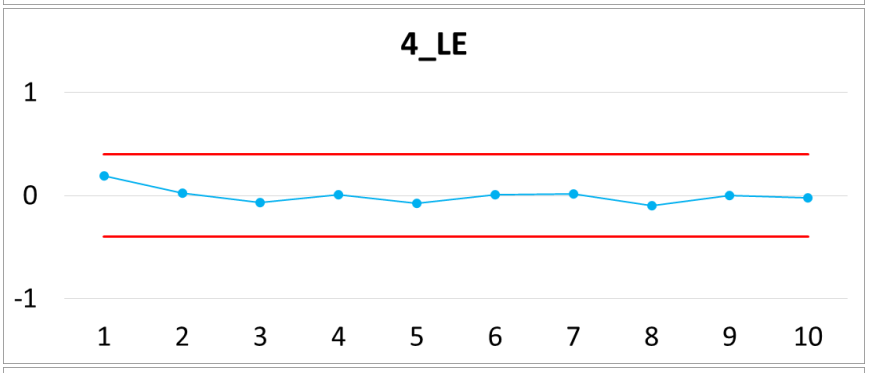
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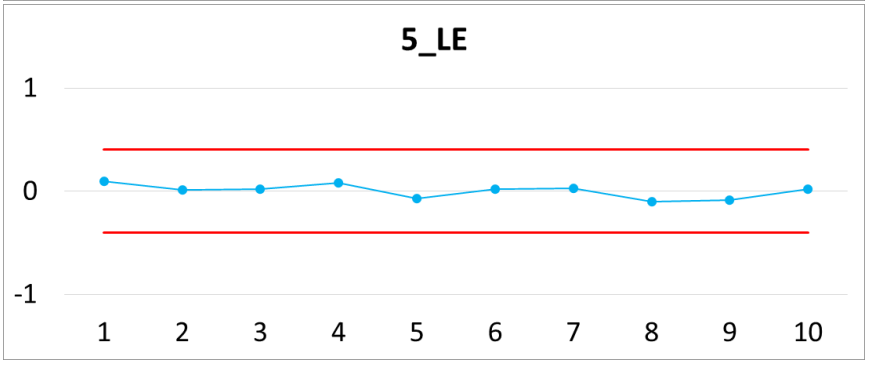
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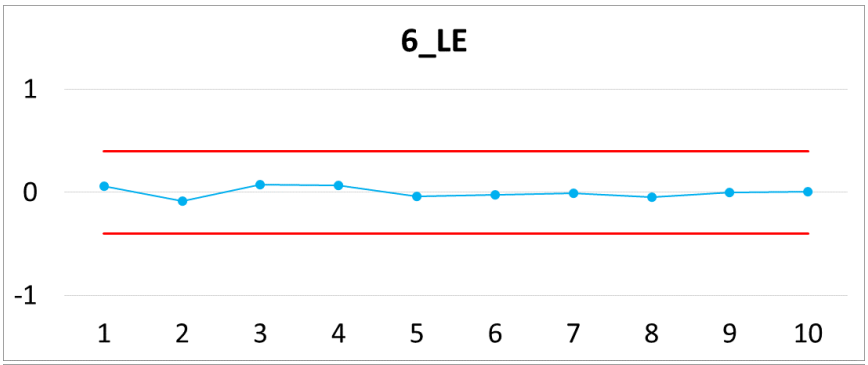
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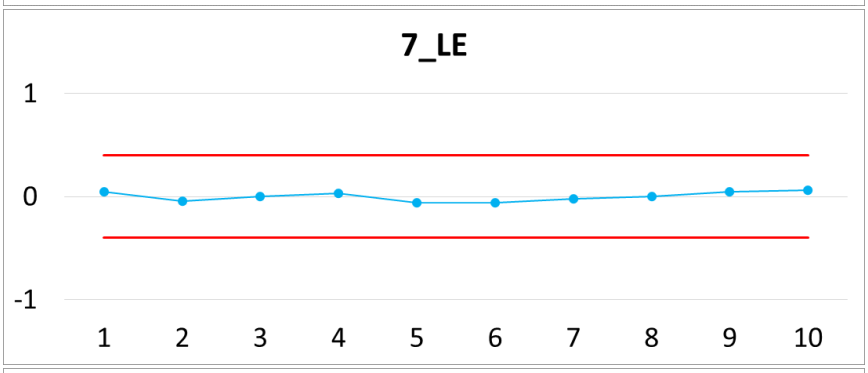
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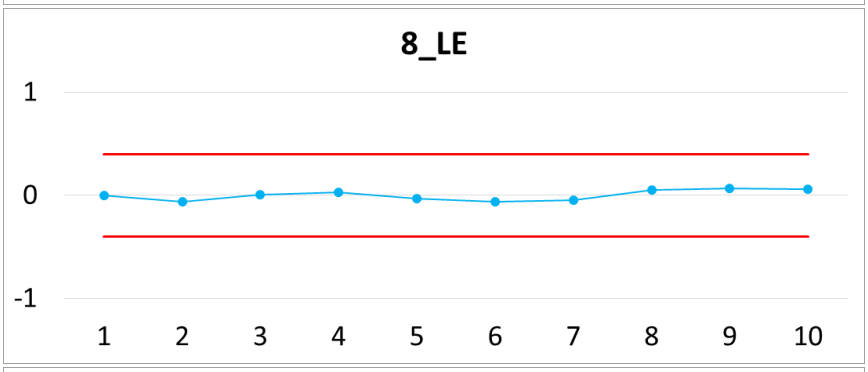
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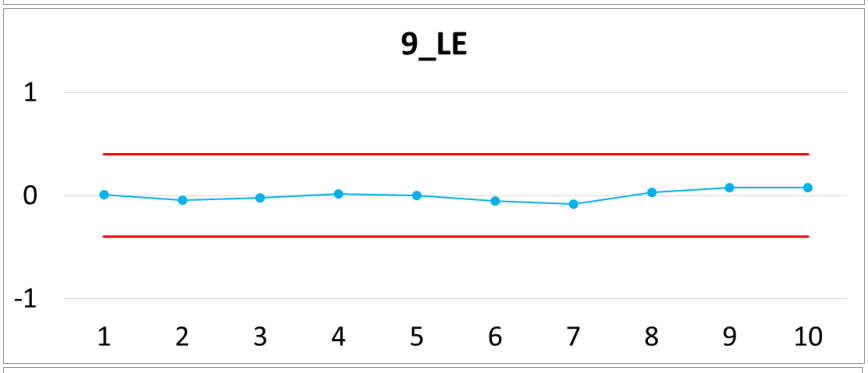
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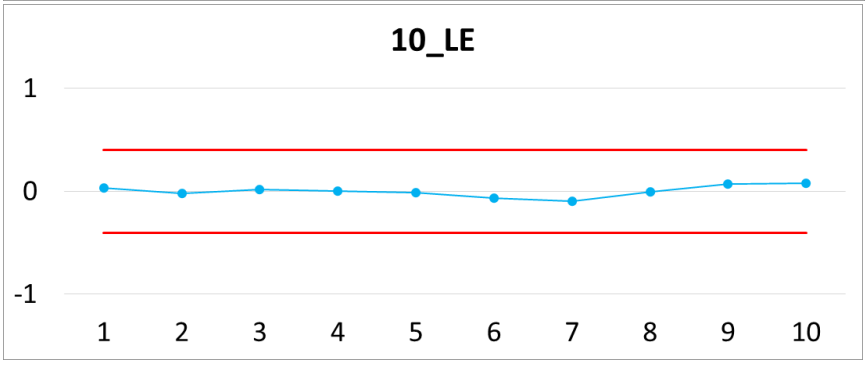
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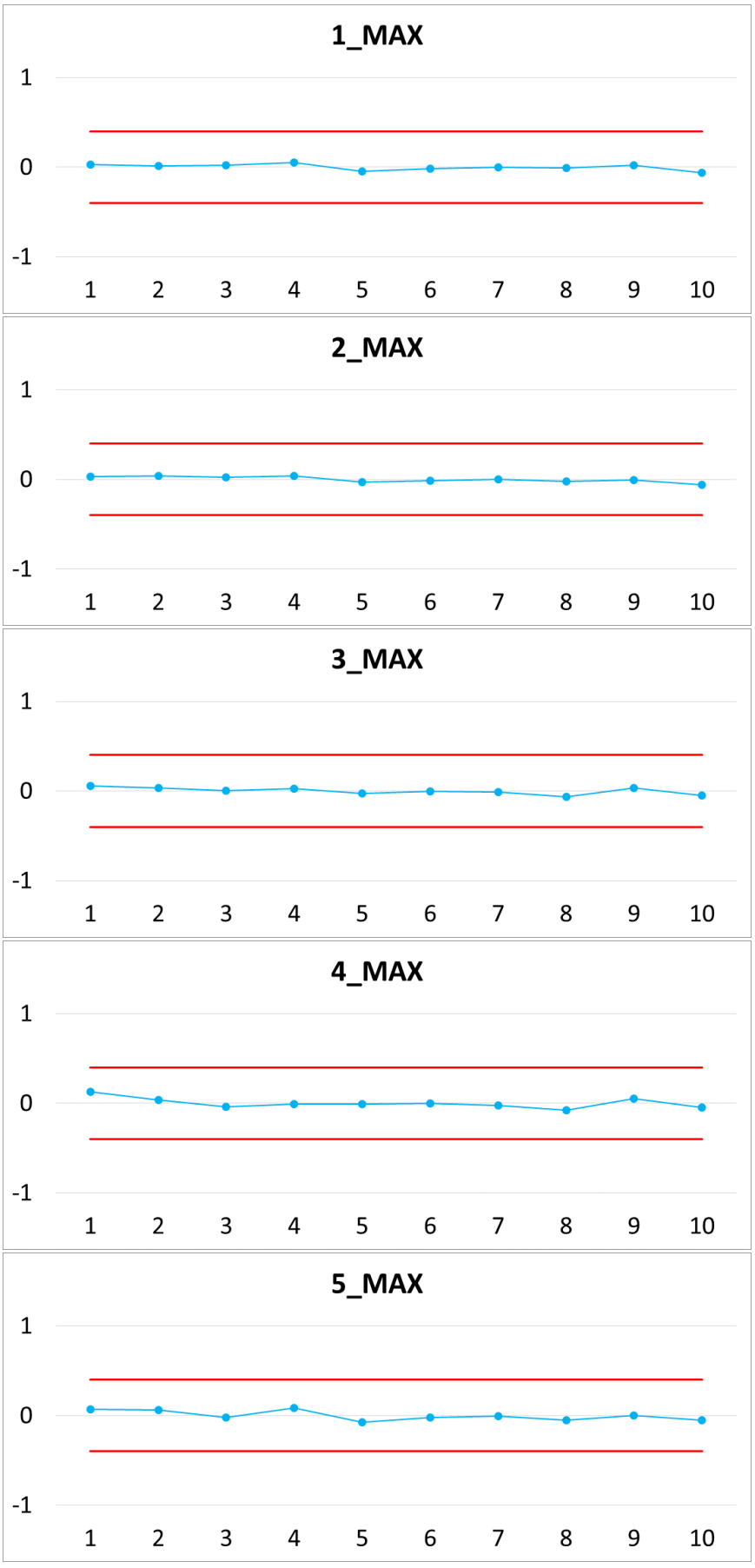
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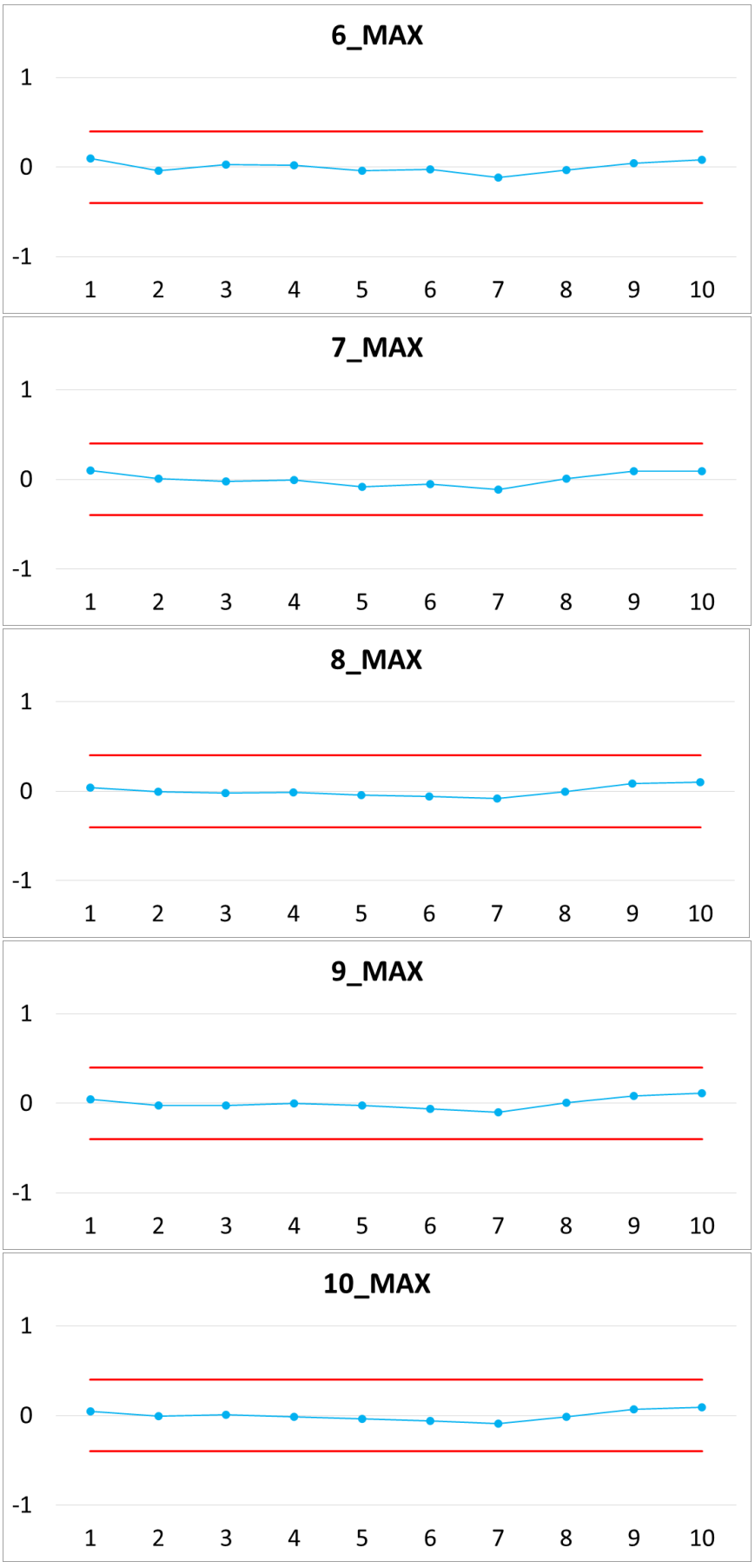
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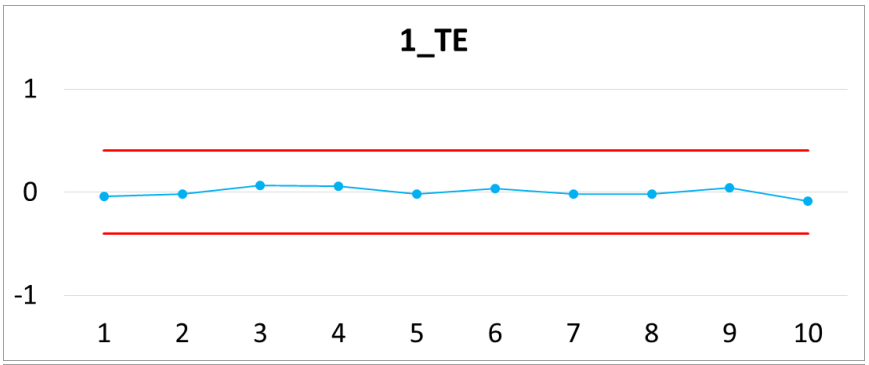
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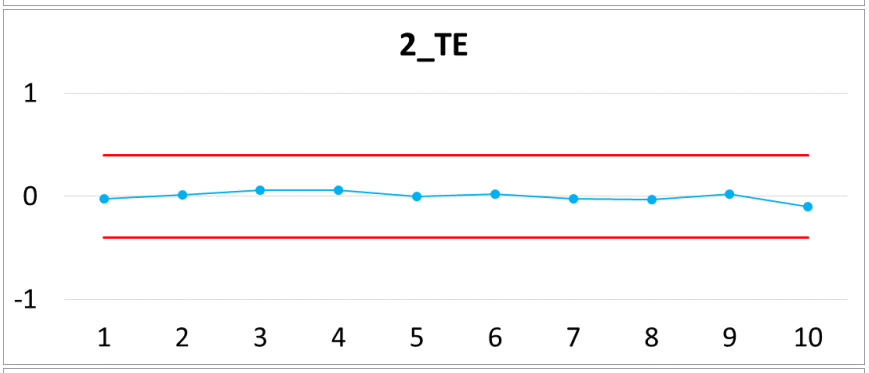
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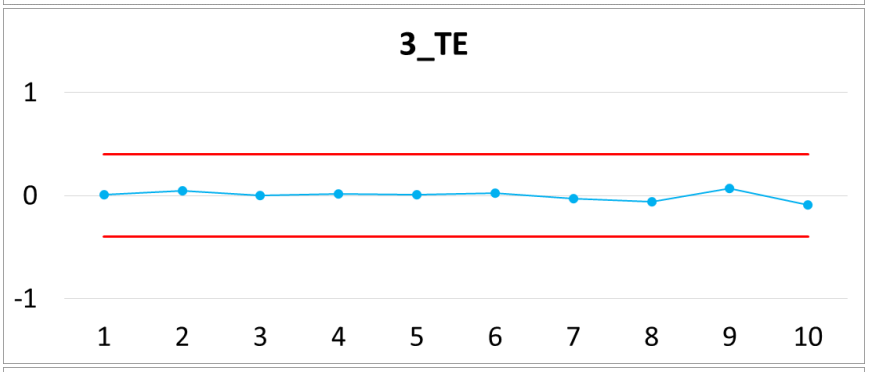
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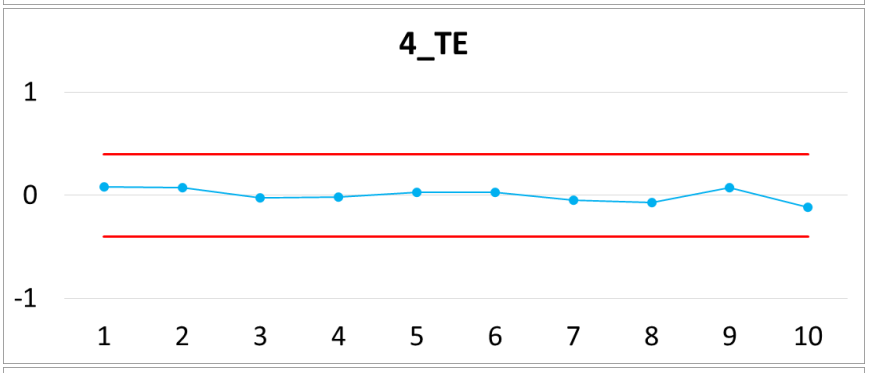
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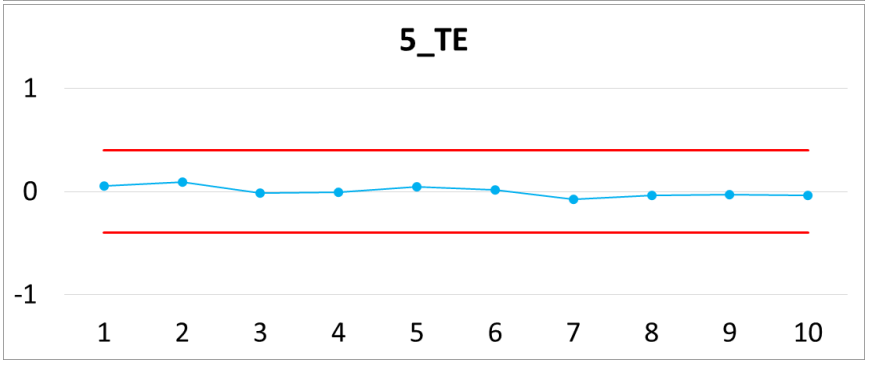
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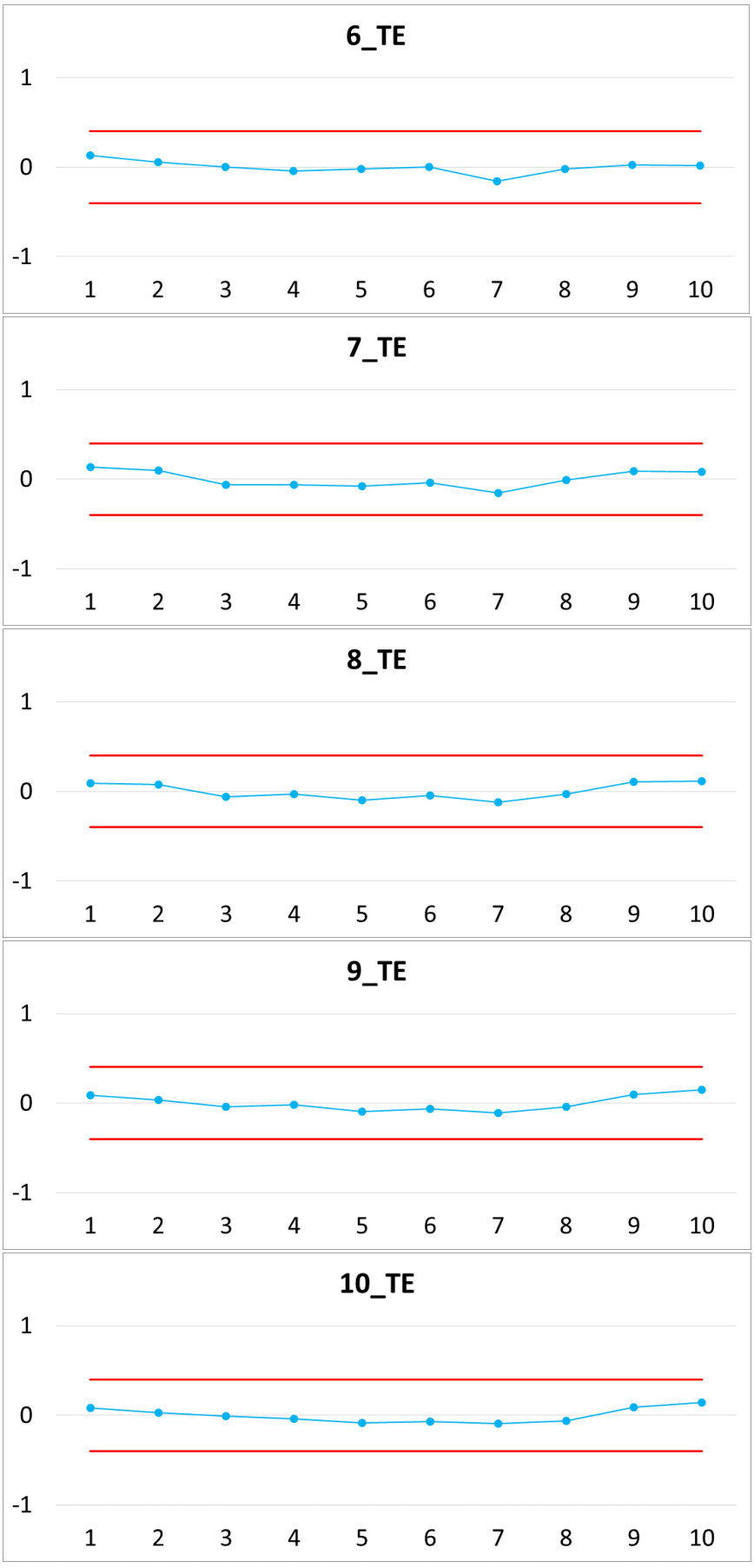
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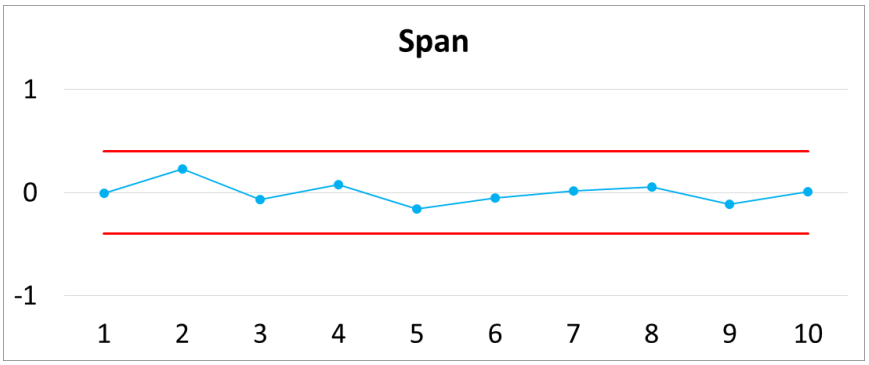
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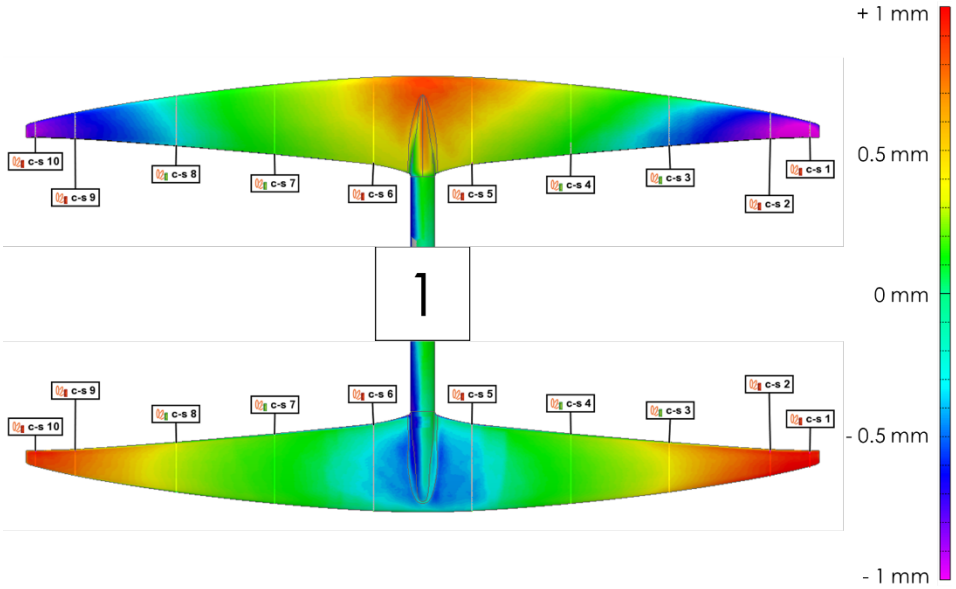
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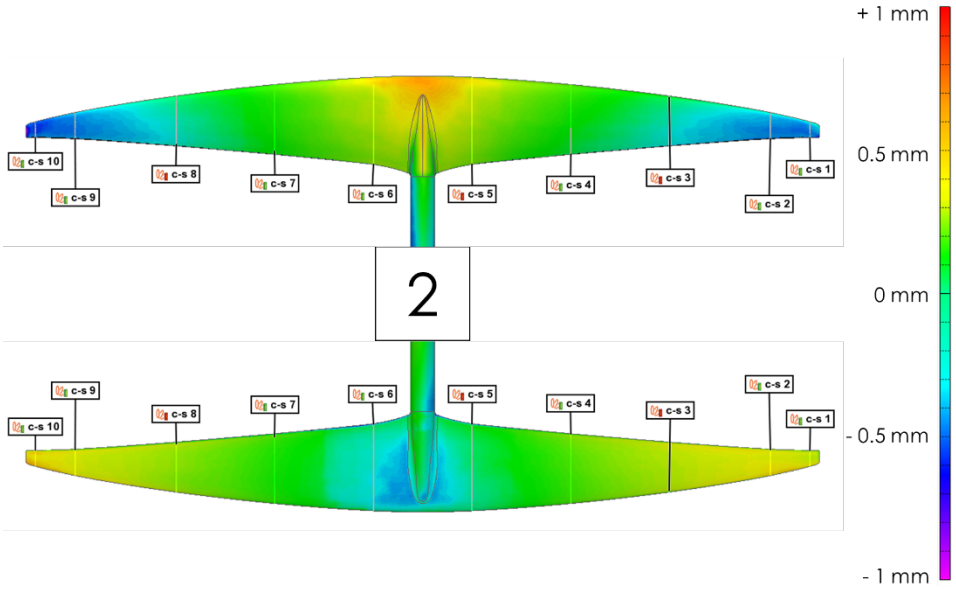
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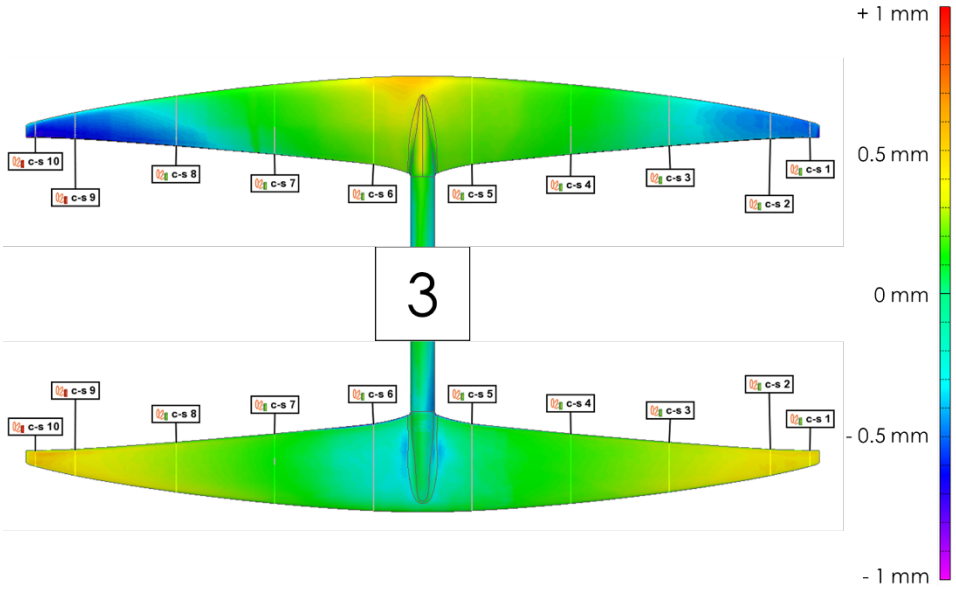
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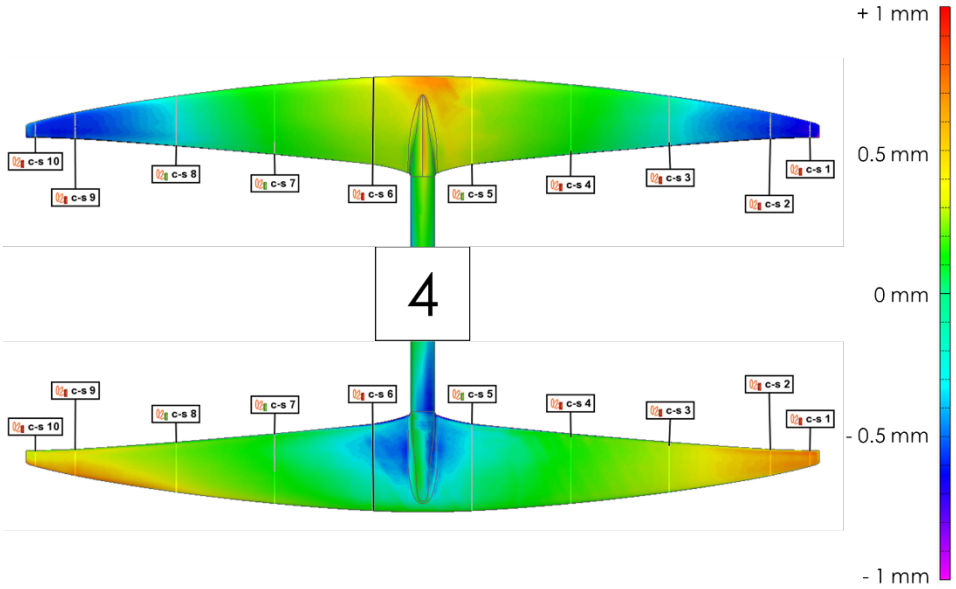
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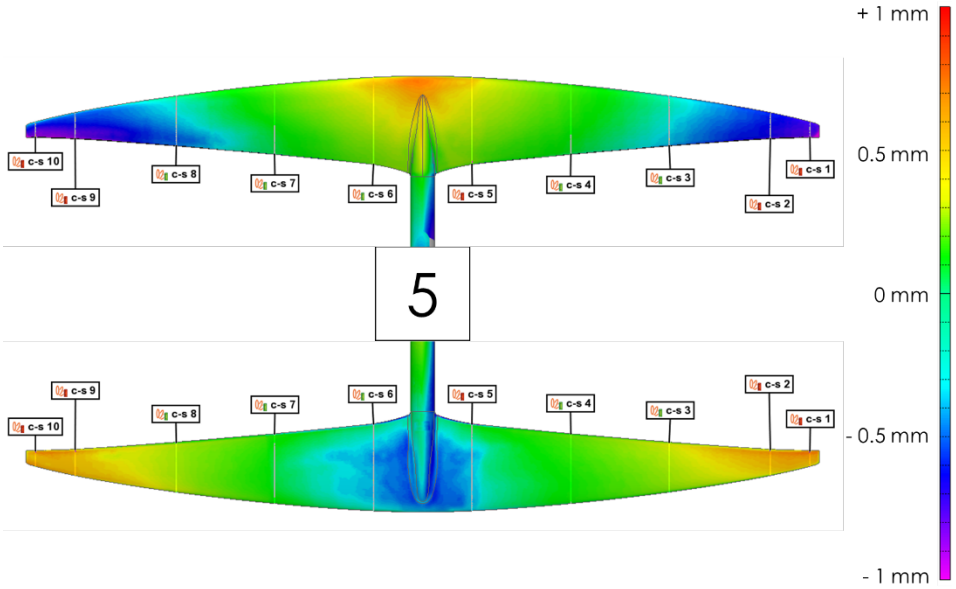
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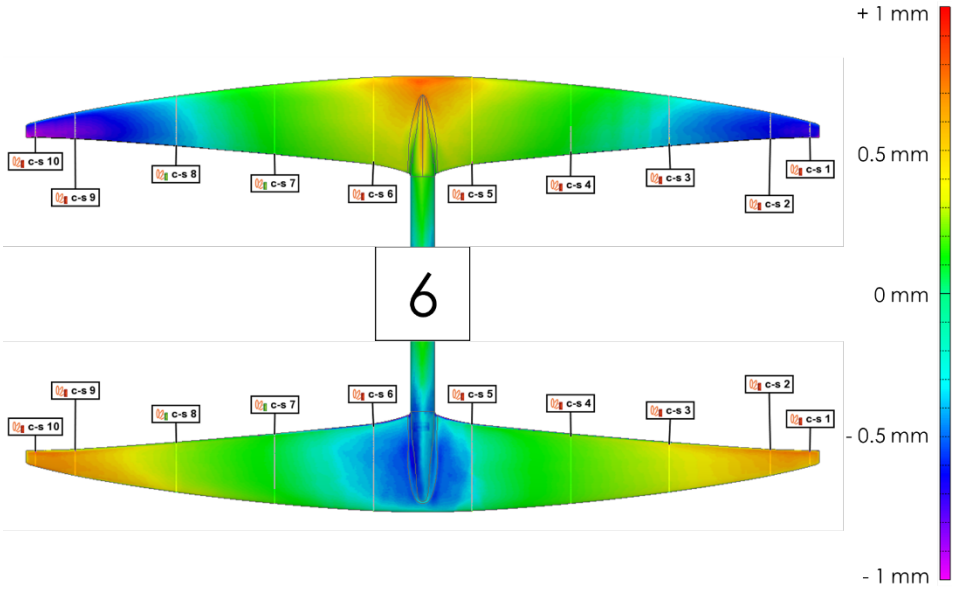
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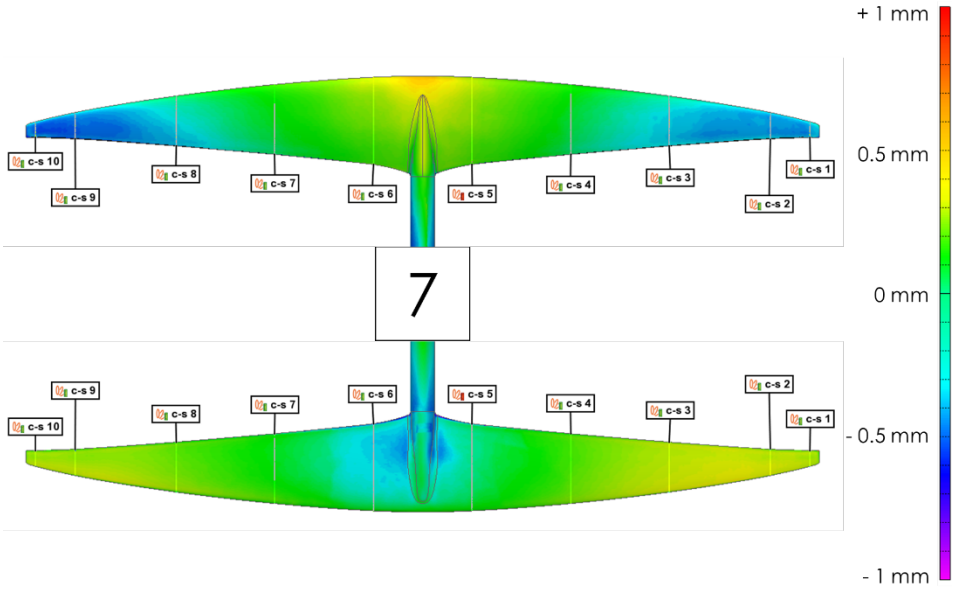
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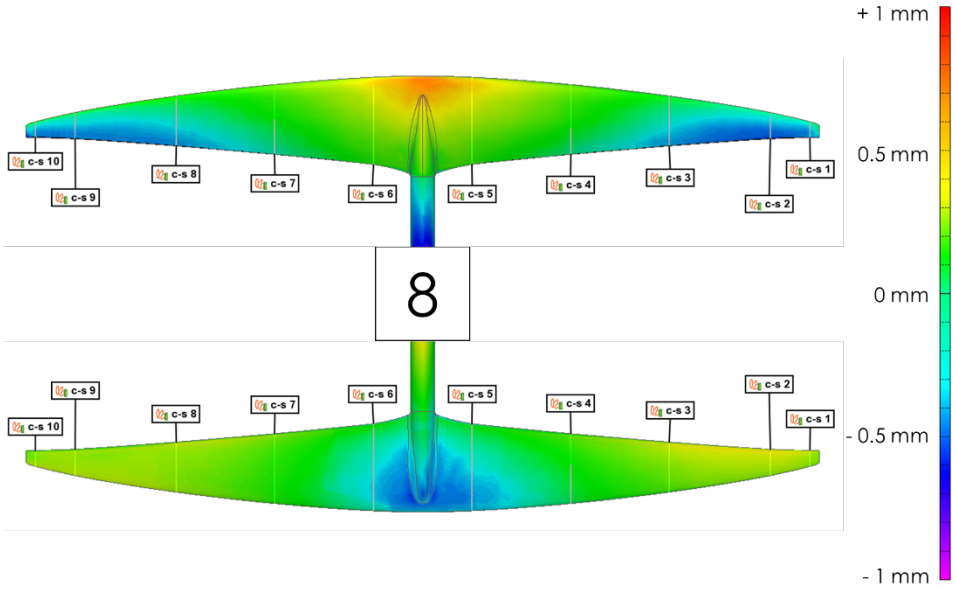
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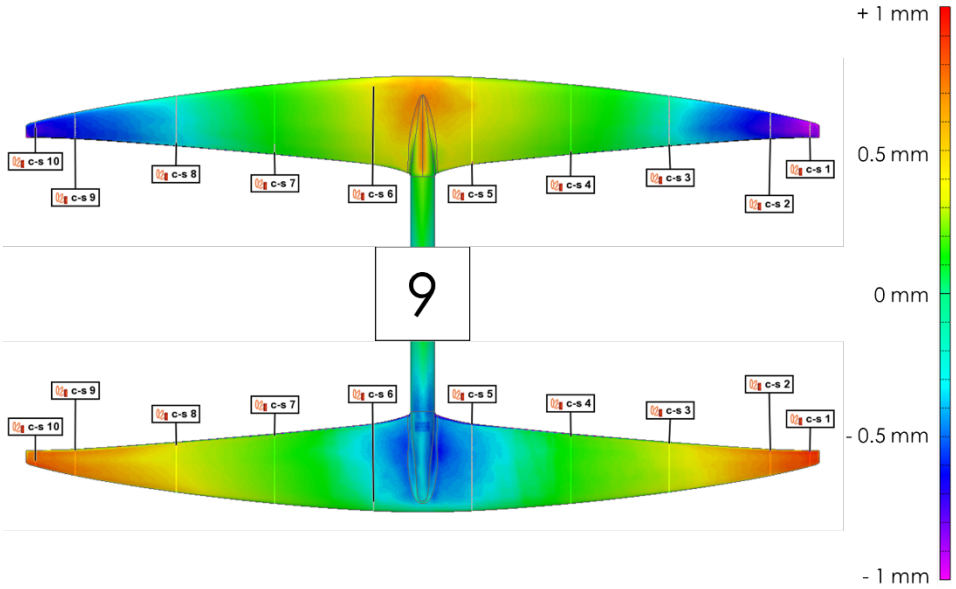
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9

World Sailing Manufacturer Control System

Scanner Report: IKA Formula Kite – Levitaz Frontwing R6 V1