World Sailing

sport / nature / technology

World Sailing Manufacturer Control System

Title: Scanner Report for Hydrofoil Registration with Class

Olympic Class: IKA Formula Kite

Equipment Item: Flying Sardine Frontwing Flow V2

Project				
World Sailing Manufacturer Control System				
Title				
Scanner Report: IKA Formula Kite – Flying Sardine Frontwing Flow V2				
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 Flying Sardine, 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.

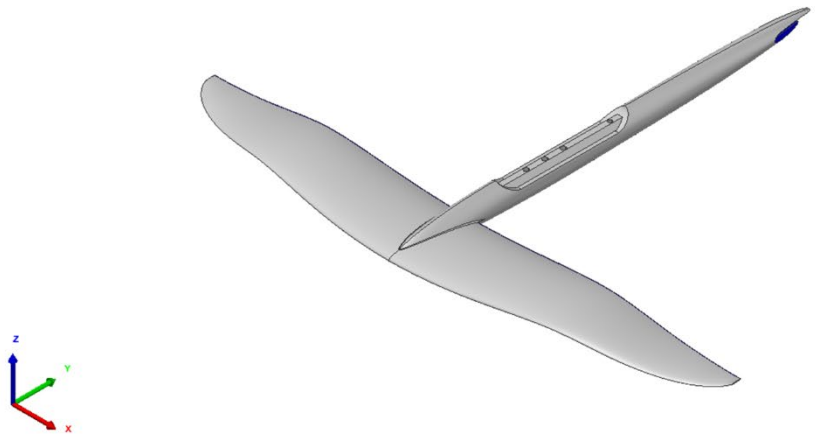


Figure 1 - Definition of the Coordinate System

Cross Sections

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

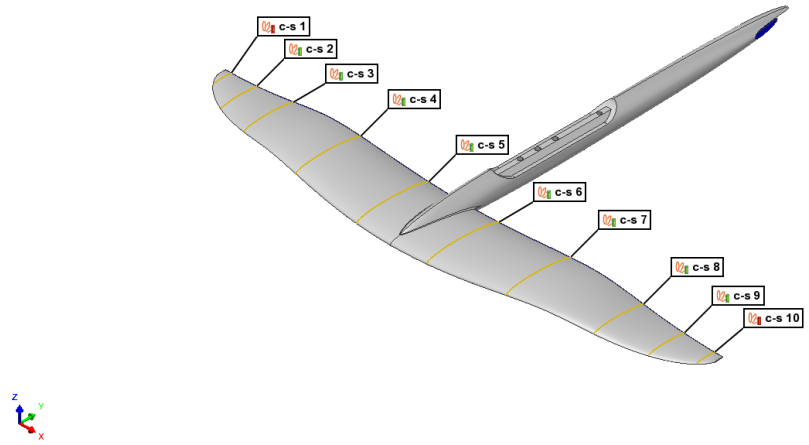


Figure 2 - Definition of Cross Sections

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.

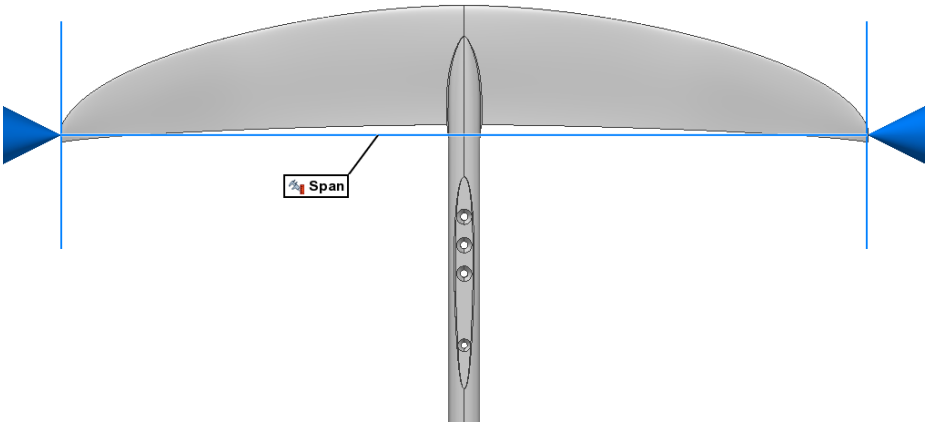


Figure 4 – Calliper to measure the Span

Surface Distance Points

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

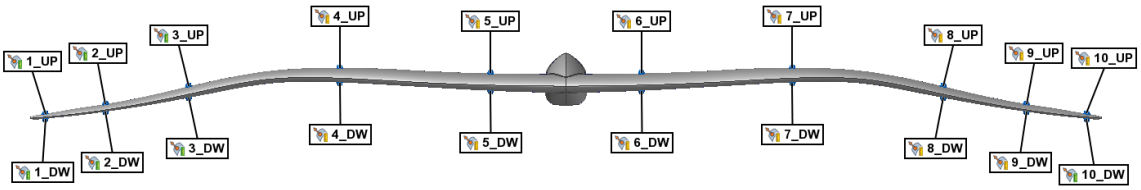


Figure 5 - Surface Distance Points definition

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).

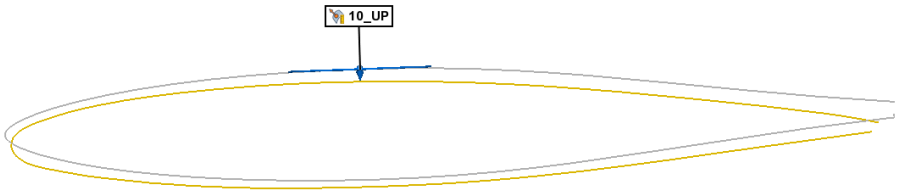


Figure 6 - Definition of Surface Distance Points on a Cross Section

Colour Map

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

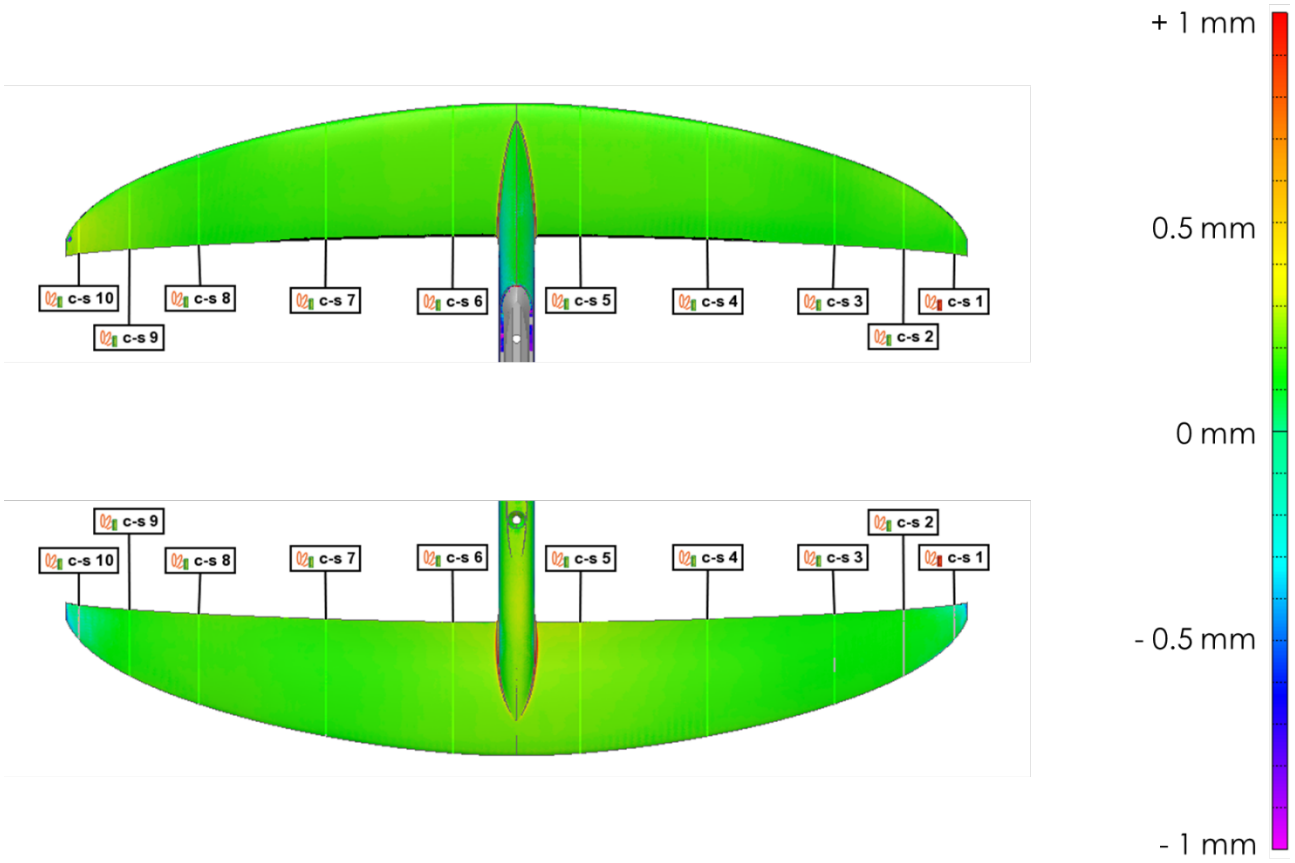


Figure 7 - Colour Map of the Upper (top) and Lower (bottom) surfaces of the Frontwing

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 measurements 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

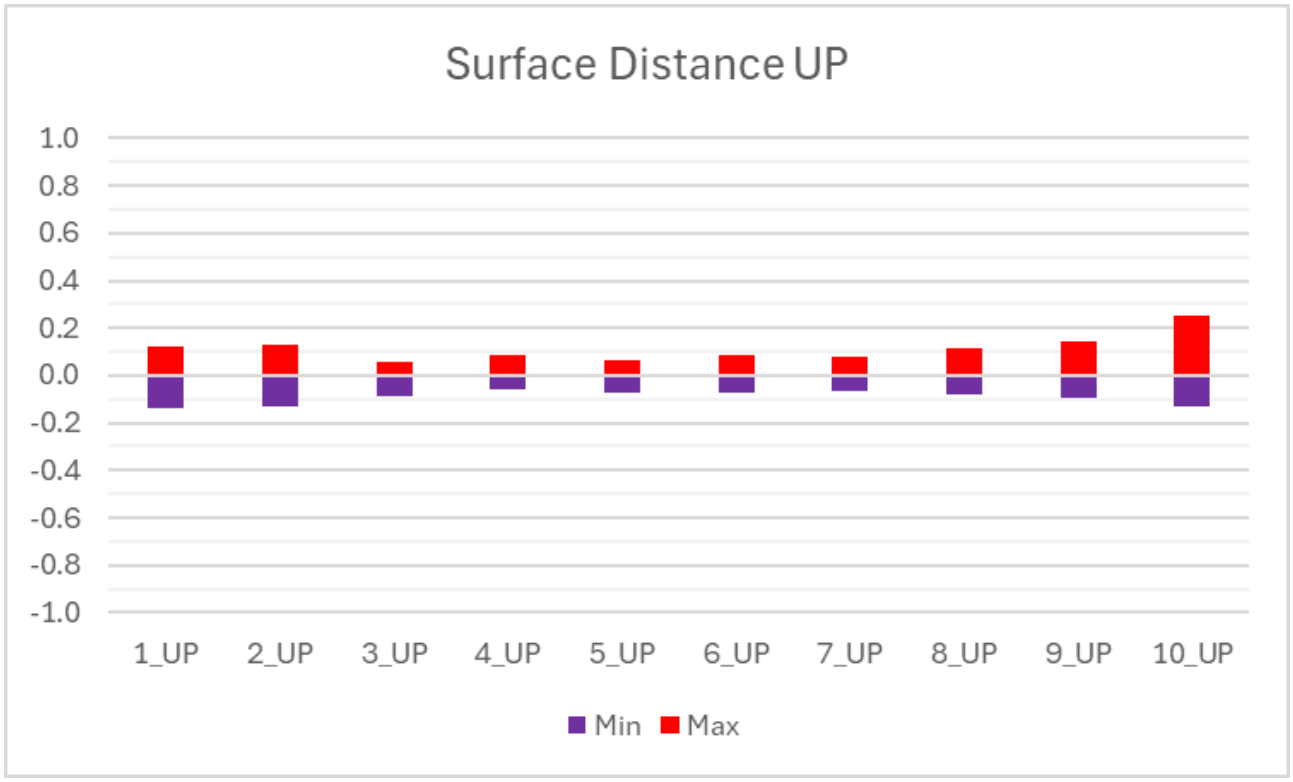
The table in the next page shows the normalised values (in mm) for each foil, minimum and maximum deviations and the standard deviation for each control. ±0.4 mm has been selected for visualisation purposes. The maximum, minimum and standard deviation values are also plotted.

World Sailing Manufacturer Control System

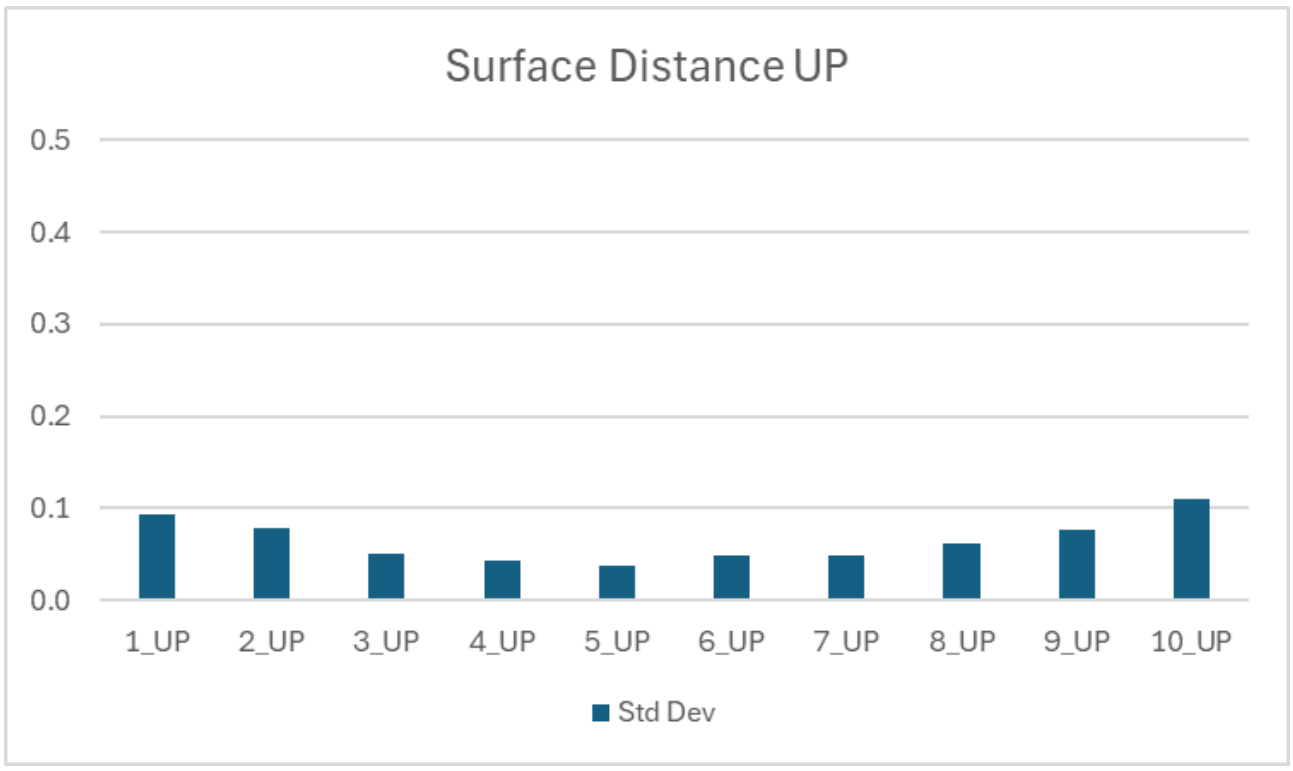
Scanner Report: IKA Formula Kite – Flying Sardine Frontwing Flow V2

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	0.124	-0.086	-0.091	-0.021	0.084	0.124	0.044	-0.138	0.012	-0.049	-0.138	0.124	0.093
2_UP	0.126	-0.003	-0.085	0.002	0.037	0.092	0.026	-0.129	0.001	-0.071	-0.129	0.126	0.078
3_UP	0.047	0.015	-0.089	0.027	0.021	0.054	0.042	-0.08	-0.016	-0.022	-0.089	0.054	0.051
4_UP	-0.023	-0.023	-0.061	0.086	-0.003	0.01	0.011	-0.026	-0.022	0.048	-0.061	0.086	0.042
5_UP	-0.036	-0.071	-0.006	0.068	0.024	0.021	0.019	0.014	-0.015	-0.016	-0.071	0.068	0.038
6_UP	-0.033	-0.074	-0.005	0.02	0.04	0.087	-0.013	0.044	-0.032	-0.035	-0.074	0.087	0.048
7_UP	-0.021	-0.034	-0.019	-0.035	0.076	0.069	-0.016	0.056	-0.068	-0.01	-0.068	0.076	0.049
8_UP	0.062	-0.072	-0.017	-0.081	0.114	-0.017	0.007	0.019	-0.052	0.038	-0.081	0.114	0.061
9_UP	0.142	-0.069	-0.039	-0.097	0.108	-0.034	0.039	-0.025	-0.046	0.018	-0.097	0.142	0.077
10_UP	0.253	0.002	-0.02	-0.132	0.104	-0.047	0.019	-0.074	-0.086	-0.016	-0.132	0.253	0.110
1_DW	-0.208	0.031	-0.141	0.141	-0.188	0.05	-0.104	0.105	0.151	0.159	-0.208	0.159	0.146
2_DW	-0.178	0.006	-0.062	0.167	-0.144	0.061	-0.12	0.05	0.072	0.146	-0.178	0.167	0.121
3_DW	-0.147	0	-0.093	0.141	-0.105	0.109	-0.096	0.039	0.067	0.085	-0.147	0.141	0.103
4_DW	-0.011	-0.084	-0.035	0.05	0.038	0.098	0.002	-0.043	-0.03	0.014	-0.084	0.098	0.053
5_DW	0.037	-0.092	-0.056	0.003	0.1	0.047	0.041	-0.076	0.012	-0.016	-0.092	0.100	0.061
6_DW	0.014	-0.088	-0.082	0.02	0.109	-0.008	0.056	-0.017	0.022	-0.029	-0.088	0.109	0.059
7_DW	-0.03	-0.081	-0.037	0.024	0.077	0.007	-0.01	0.057	0.004	-0.012	-0.081	0.077	0.046
8_DW	-0.076	0.009	0.08	-0.077	0.019	-0.031	-0.086	0.114	-0.025	0.069	-0.086	0.114	0.071
9_DW	-0.13	0	0.142	-0.062	-0.022	-0.041	-0.111	0.13	-0.034	0.124	-0.130	0.142	0.099
10_DW	-0.228	-0.073	0.149	-0.105	-0.02	-0.001	-0.039	0.17	-0.059	0.204	-0.228	0.204	0.136
1_LE	-0.044	-0.061	-0.131	0.022	-0.044	0.083	0.005	0.042	0.046	0.086	-0.131	0.086	0.069
2_LE	-0.015	-0.018	-0.126	0.111	-0.098	0.127	-0.049	-0.006	0.009	0.069	-0.126	0.127	0.083
3_LE	-0.032	-0.015	-0.131	0.134	-0.033	0.165	-0.047	-0.025	-0.032	0.011	-0.131	0.165	0.087
4_LE	0.019	-0.083	-0.054	0.1	0.096	0.134	0.031	-0.089	-0.072	-0.085	-0.089	0.134	0.087
5_LE	0.024	-0.073	-0.049	0.046	0.107	0.133	0.048	-0.096	-0.033	-0.107	-0.107	0.133	0.084
6_LE	-0.005	-0.116	-0.066	0.07	0.173	0.045	0.059	-0.04	0.041	-0.164	-0.164	0.173	0.099
7_LE	-0.003	-0.071	-0.06	0.008	0.144	0.043	-0.013	0.055	-0.006	-0.094	-0.094	0.144	0.069
8_LE	-0.001	-0.073	0.095	-0.114	0.126	-0.093	-0.097	0.078	-0.021	0.097	-0.114	0.126	0.093
9_LE	0.01	-0.021	0.139	-0.138	0.055	-0.088	-0.04	0.061	-0.087	0.114	-0.138	0.139	0.092
10_LE	0.03	-0.057	0.192	-0.166	0.029	-0.121	-0.061	0.043	-0.056	0.164	-0.166	0.192	0.115
1_MAX	-0.084	-0.056	-0.236	0.121	-0.105	0.176	-0.06	-0.034	0.163	0.112	-0.236	0.176	0.136
2_MAX	-0.05	0.004	-0.148	0.171	-0.107	0.156	-0.095	-0.08	0.074	0.076	-0.148	0.171	0.114
3_MAX	-0.101	0.015	-0.187	0.172	-0.085	0.168	-0.054	-0.042	0.052	0.065	-0.187	0.172	0.116
4_MAX	-0.033	-0.107	-0.096	0.136	0.036	0.108	0.013	-0.069	-0.052	0.061	-0.107	0.136	0.085
5_MAX	0.001	-0.164	-0.063	0.07	0.123	0.067	0.06	-0.062	-0.003	-0.033	-0.164	0.123	0.084
6_MAX	-0.018	-0.162	-0.086	0.04	0.149	0.079	0.044	0.027	-0.01	-0.064	-0.162	0.149	0.089
7_MAX	-0.051	-0.115	-0.055	-0.01	0.153	0.077	-0.026	0.113	-0.064	-0.021	-0.115	0.153	0.086
8_MAX	-0.015	-0.065	0.065	-0.162	0.137	-0.048	-0.081	0.136	-0.079	0.11	-0.162	0.137	0.105
9_MAX	0.014	-0.07	0.105	-0.162	0.088	-0.076	-0.072	0.107	-0.081	0.144	-0.162	0.144	0.105
10_MAX	0.026	-0.071	0.13	-0.24	0.084	-0.049	-0.021	0.096	-0.147	0.19	-0.240	0.190	0.132
1_TE	-0.127	0.023	-0.206	0.204	-0.171	0.188	-0.131	-0.119	0.202	0.136	-0.206	0.204	0.169
2_TE	-0.104	0.026	-0.157	0.189	-0.164	0.153	-0.106	-0.089	0.155	0.094	-0.164	0.189	0.139
3_TE	-0.119	-0.003	-0.139	0.236	-0.115	0.179	-0.121	-0.107	0.113	0.076	-0.139	0.236	0.141
4_TE	-0.041	-0.087	-0.015	0.134	0.008	0.049	-0.021	-0.102	0.012	0.065	-0.102	0.134	0.071
5_TE	0.064	-0.202	0.005	0.1	0.092	0.023	0.028	-0.036	-0.045	-0.032	-0.202	0.100	0.088
6_TE	0.018	-0.144	-0.018	-0.006	0.133	0.056	0.05	0.023	-0.081	-0.031	-0.144	0.133	0.077
7_TE	-0.018	-0.142	0.016	-0.068	0.138	0.11	-0.02	0.108	-0.13	0.008	-0.142	0.138	0.097
8_TE	0.024	-0.061	0.121	-0.167	0.134	-0.085	-0.104	0.146	-0.144	0.139	-0.167	0.146	0.127
9_TE	0.044	-0.071	0.1	-0.16	0.094	-0.053	-0.077	0.11	-0.138	0.149	-0.160	0.149	0.112
10_TE	0.031	-0.015	0.058	-0.228	0.081	-0.062	-0.037	0.089	-0.116	0.199	-0.228	0.199	0.120
Span	0.092	0.131	0.346	0.039	0.129	0	0.102	-0.162	-0.568	-0.108	-0.568	0.346	0.244

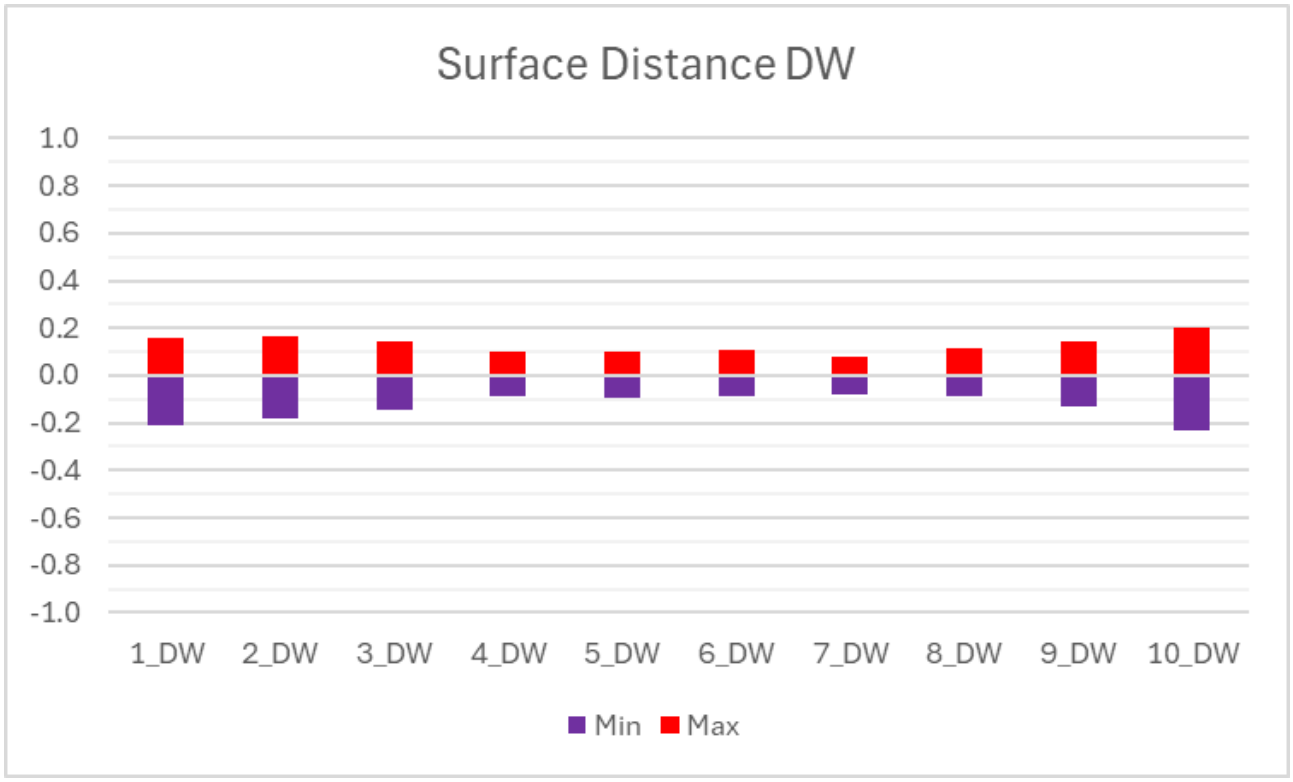
Maximum and minimum 'Surface Distances' on the upper surface at each cross section (mm):



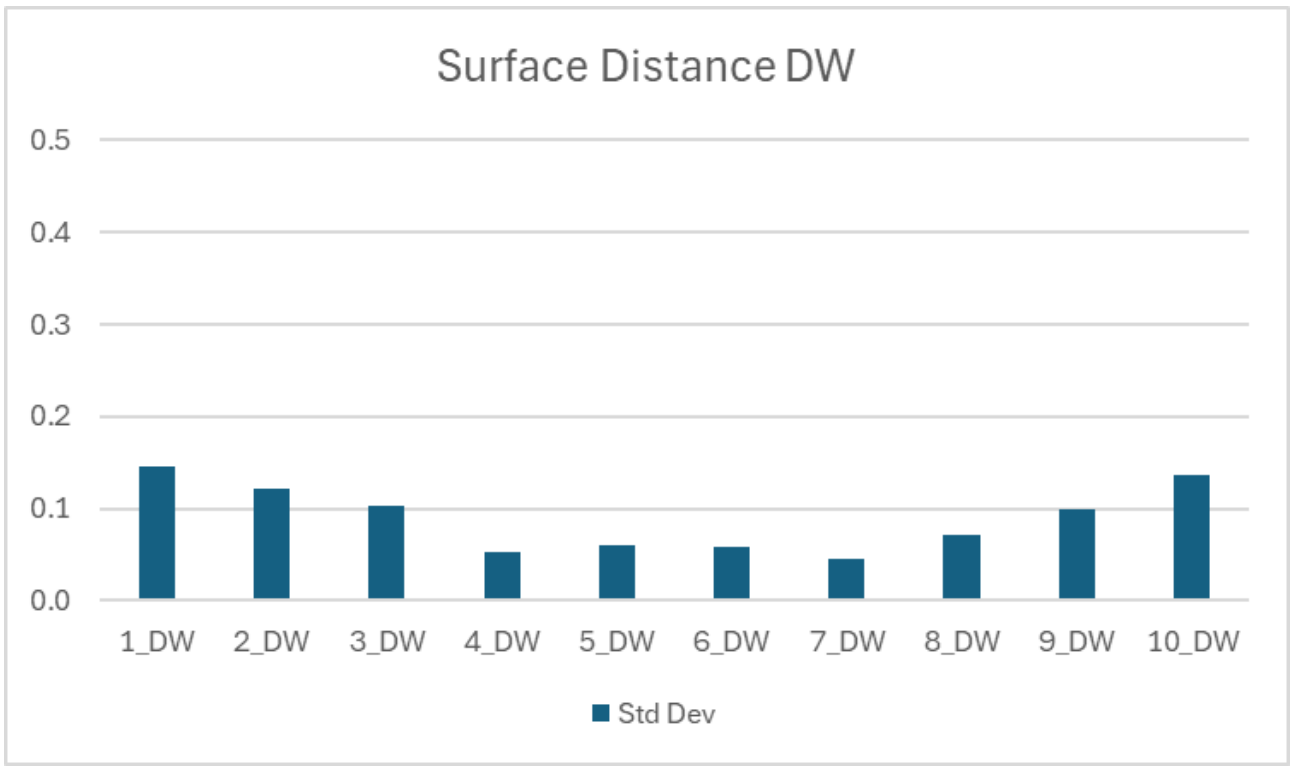
Standard deviation of 'Surface Distances' on the upper surface at each cross section (mm):



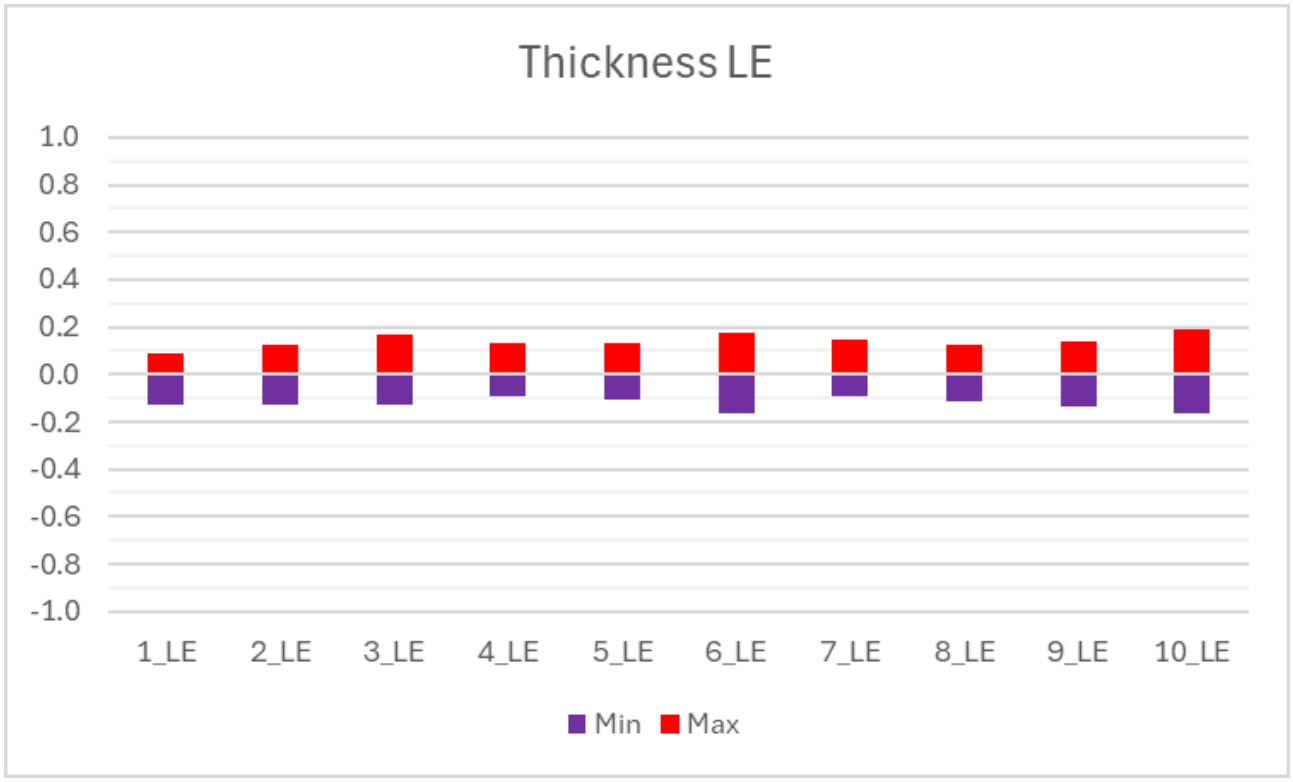
Maximum and minimum 'Surface Distances' on the lower surface at each cross section (mm):



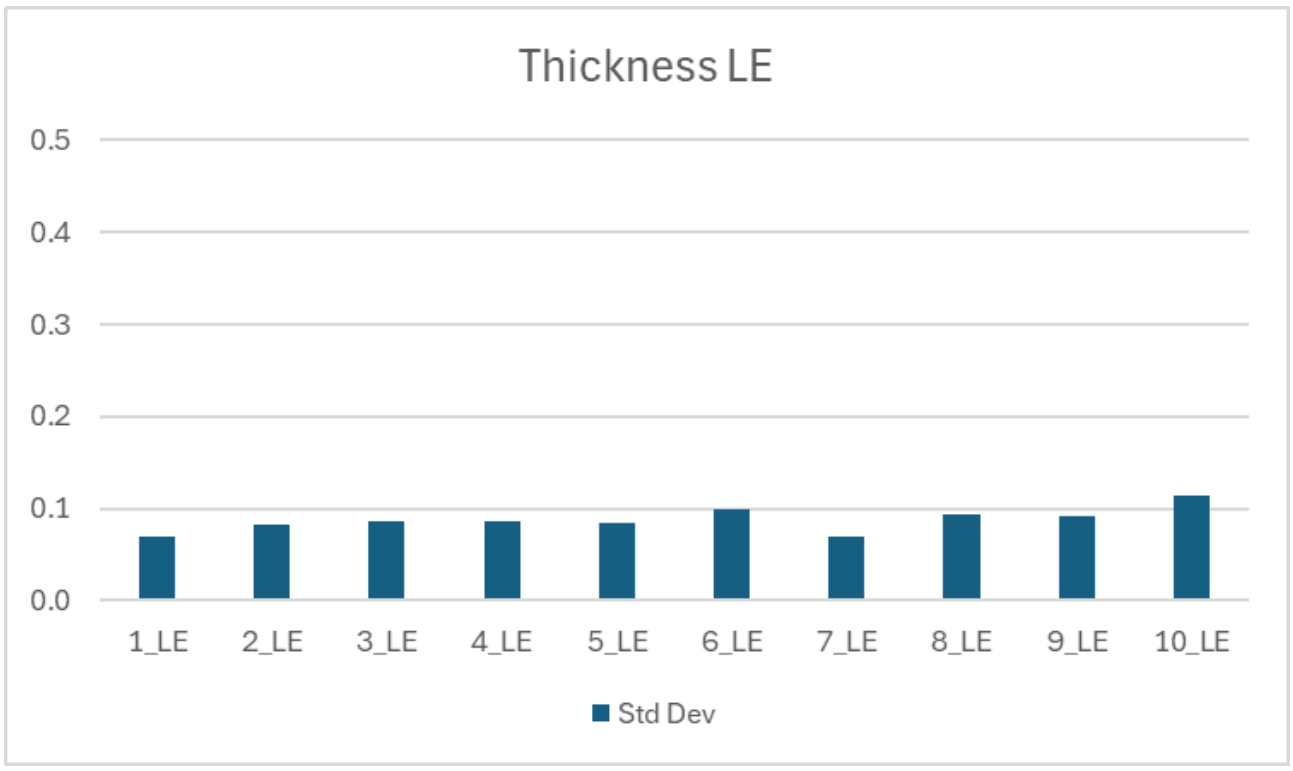
Standard deviation of 'Surface Distances' on the lower surface at each cross section (mm):



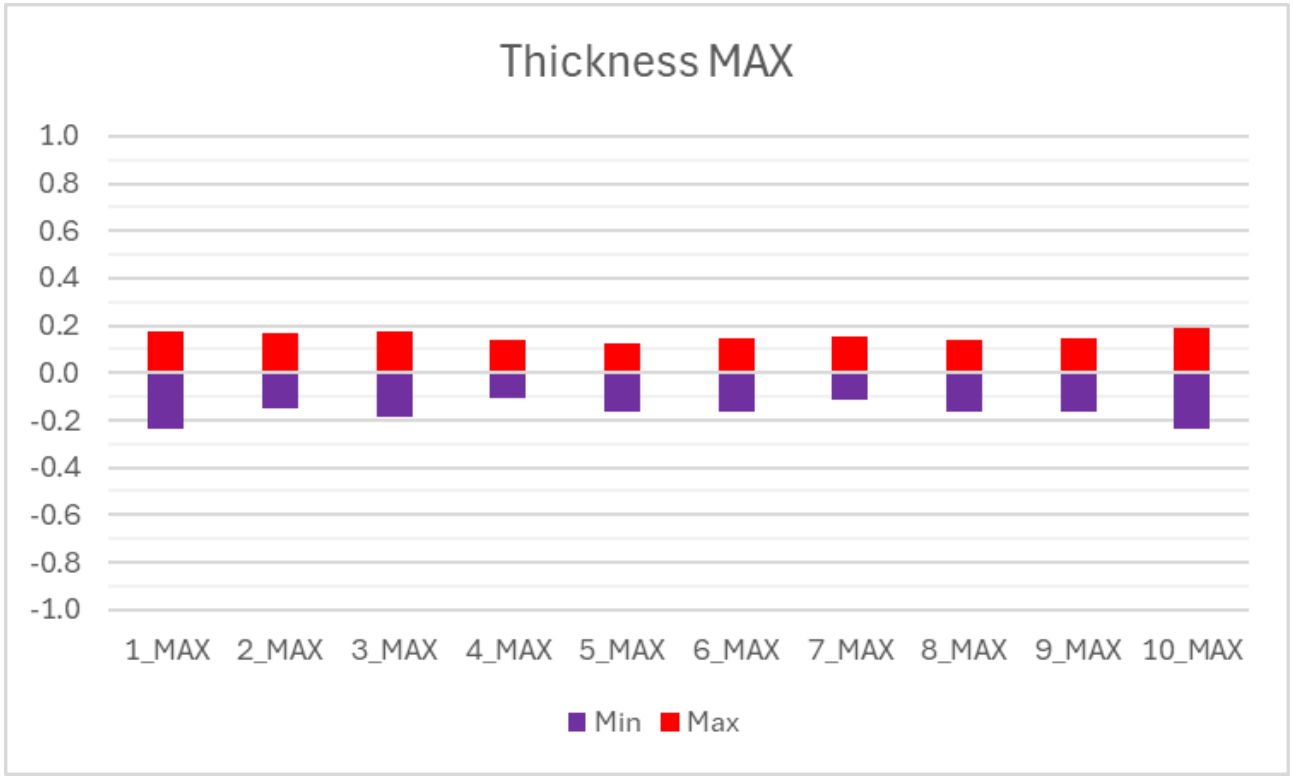
Maximum and minimum Thickness at the 'Leading Edge point' at each cross section (mm):



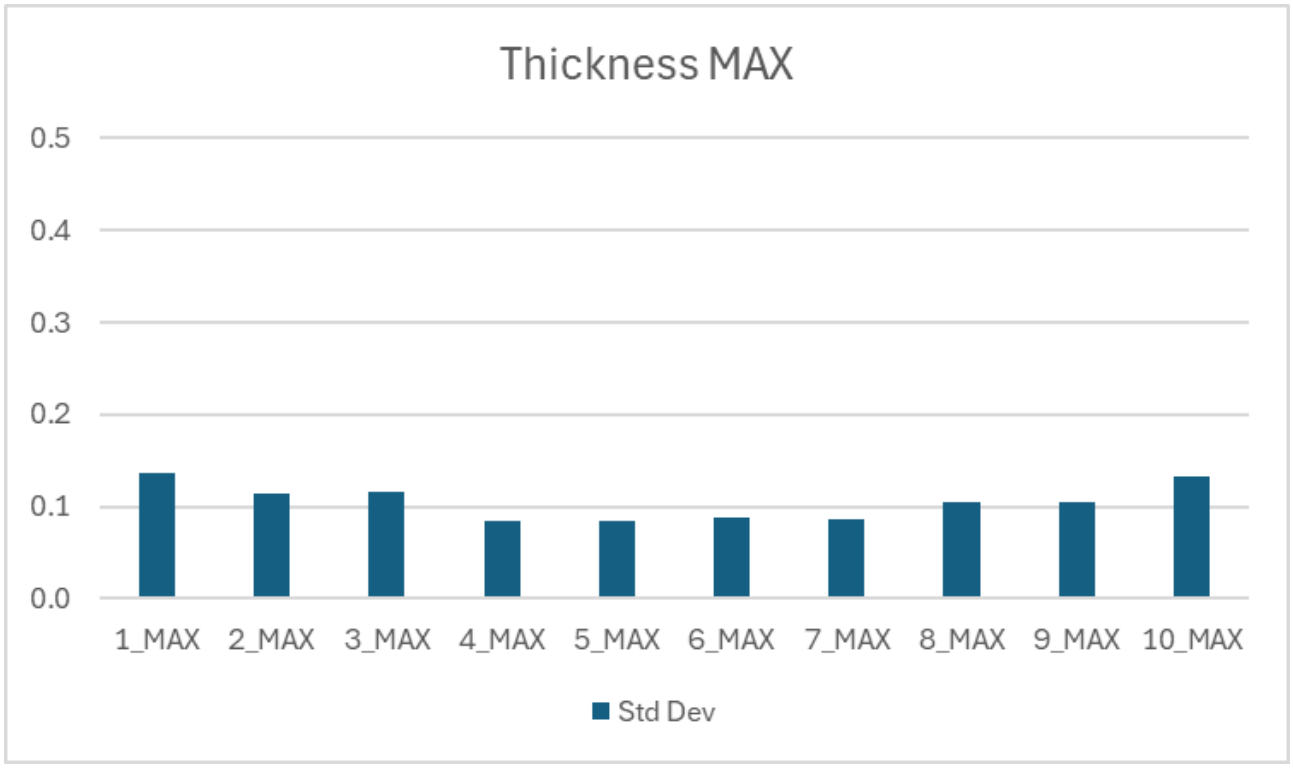
Standard deviation of Thickness at the 'Leading Edge point' at each cross section (mm):



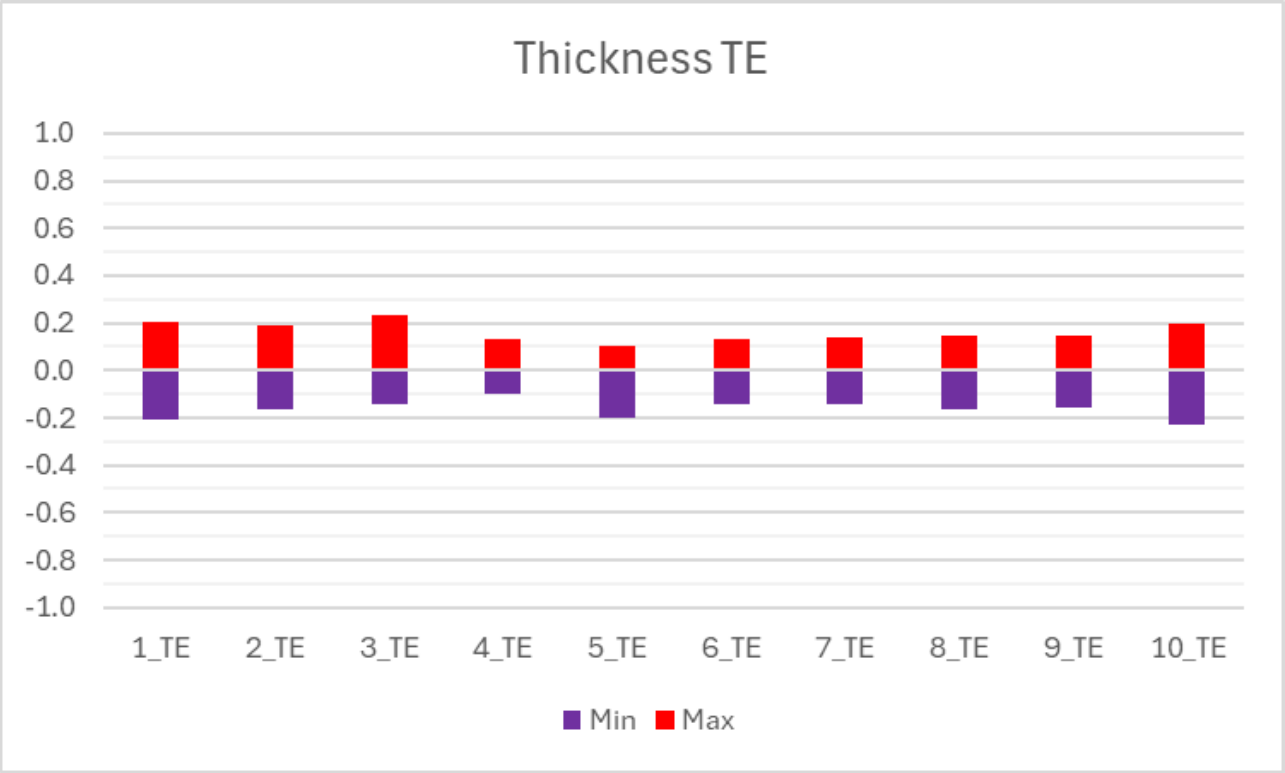
Maximum and minimum Thickness at the 'Maximum thickness point' at each cross section (mm):



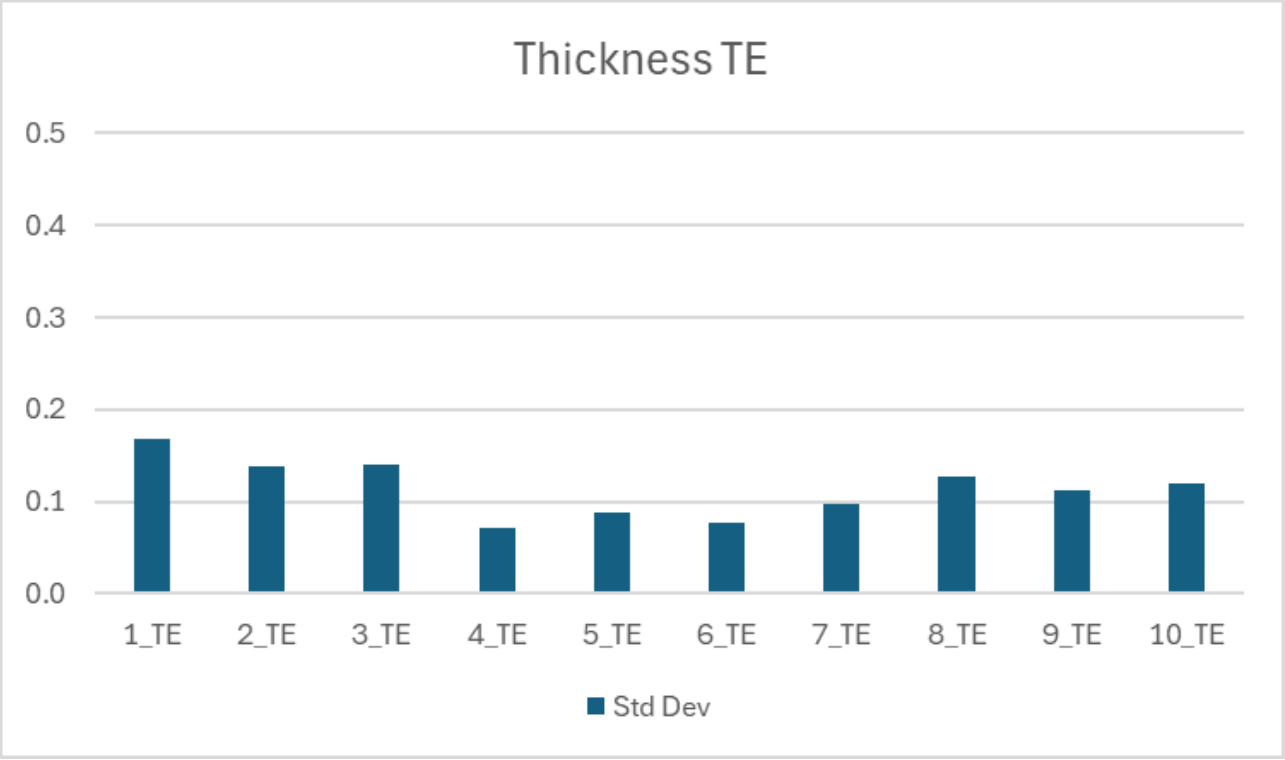
Standard deviation of Thickness at the 'Maximum thickness point' at each cross section (mm):



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



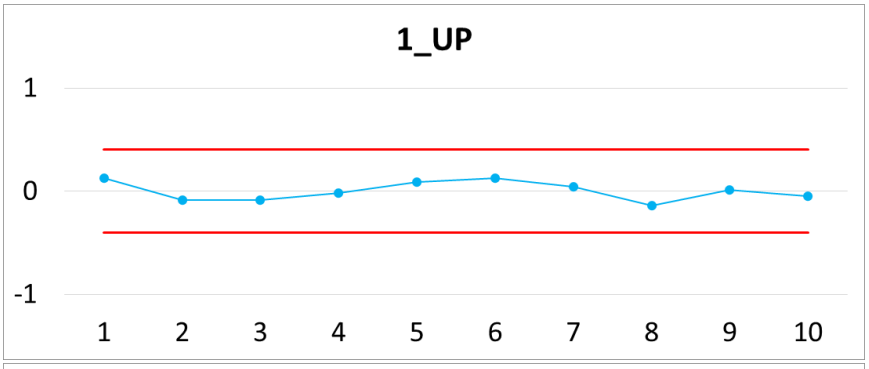
Standard deviation of Thickness at the 'Trailing Edge point' at each cross section (mm):

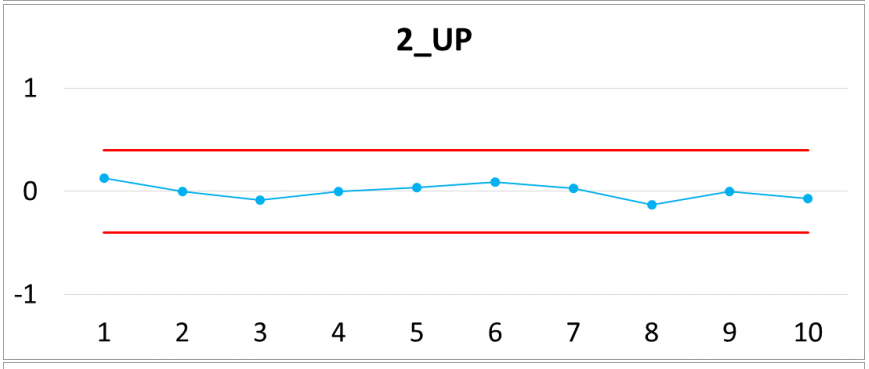


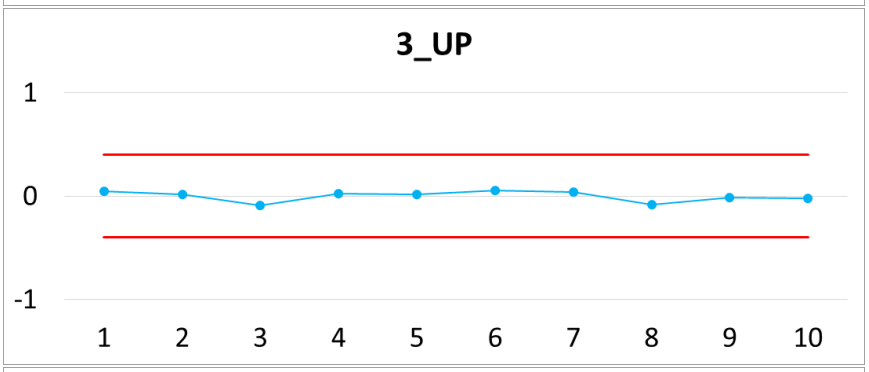
World Sailing Manufacturer Control System

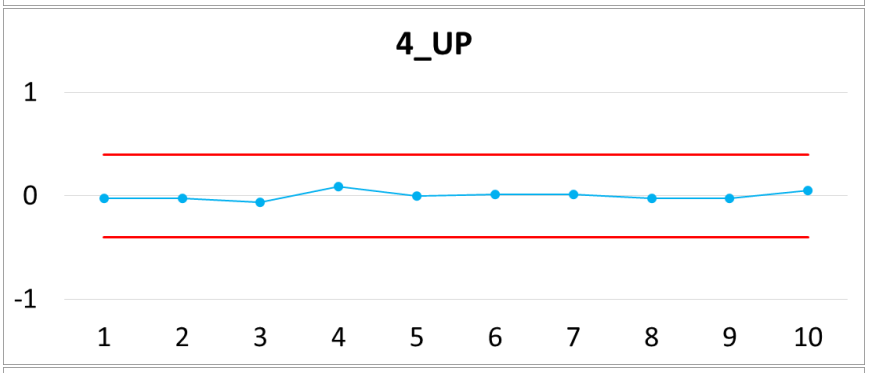
Scanner Report: IKA Formula Kite – Flying Sardine Frontwing Flow V2

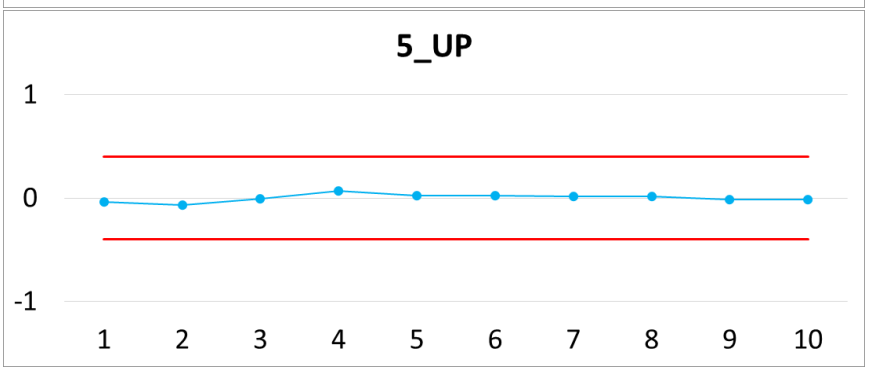
- Blue Lines: Normalised values (mm) for each control point
- Red Lines: ±0.4 mm for visualisation purposes
- X-Axis: 1 to 10 foils

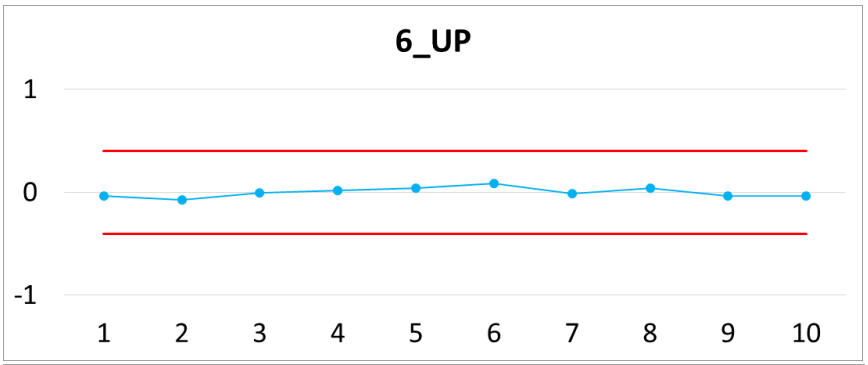


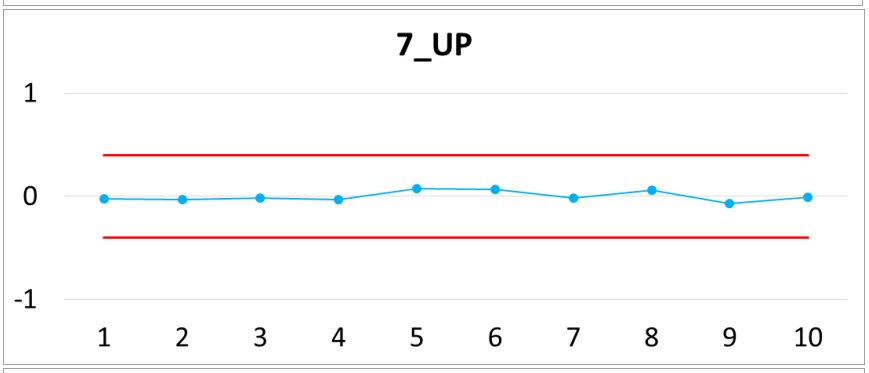


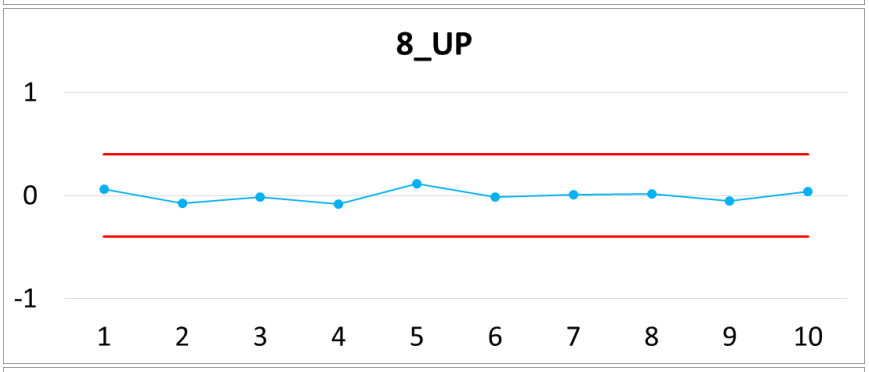


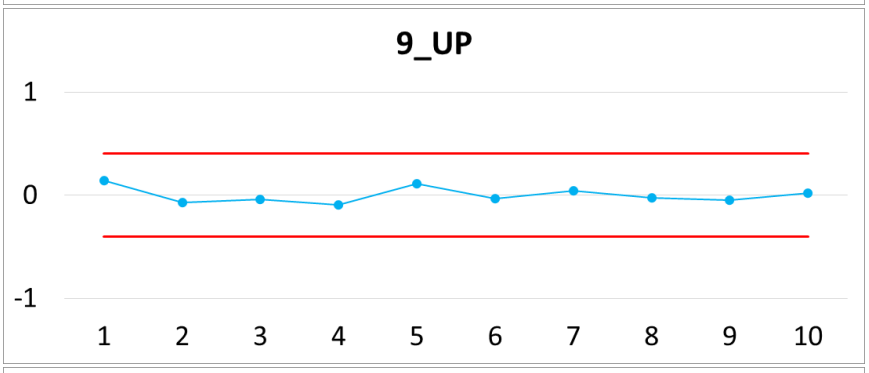





6_UP
1
0
-1
1 2 3 4 5 6 7 8 9 10


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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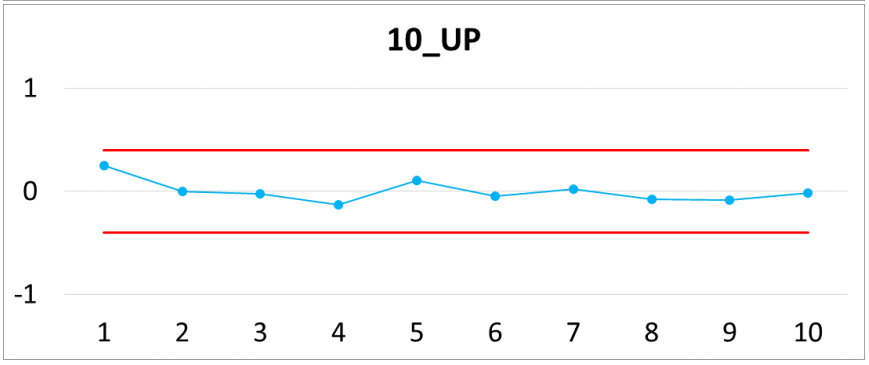
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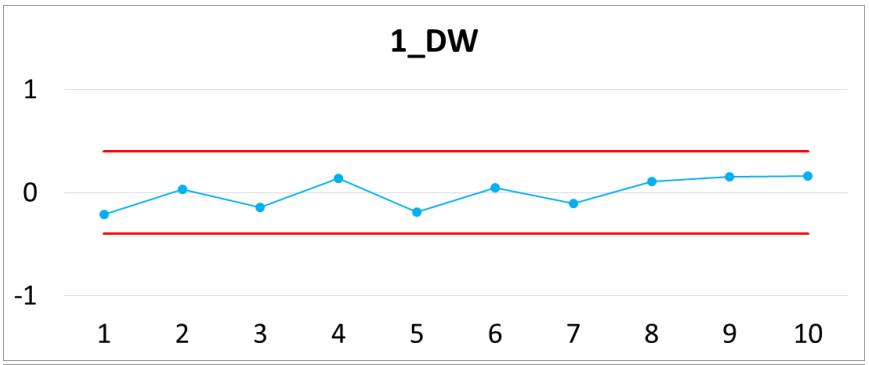
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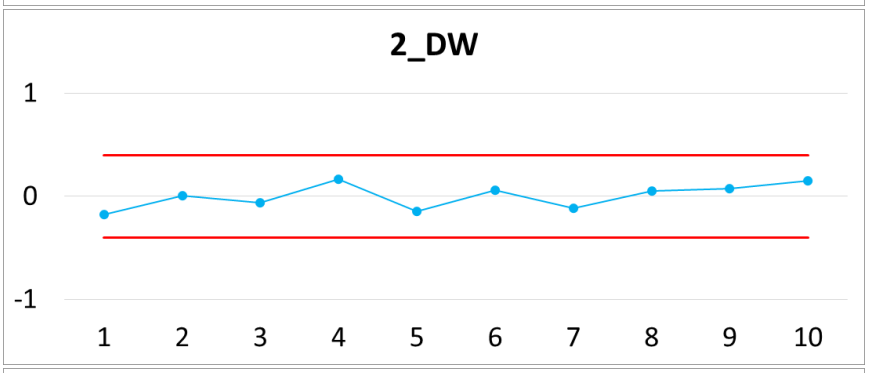
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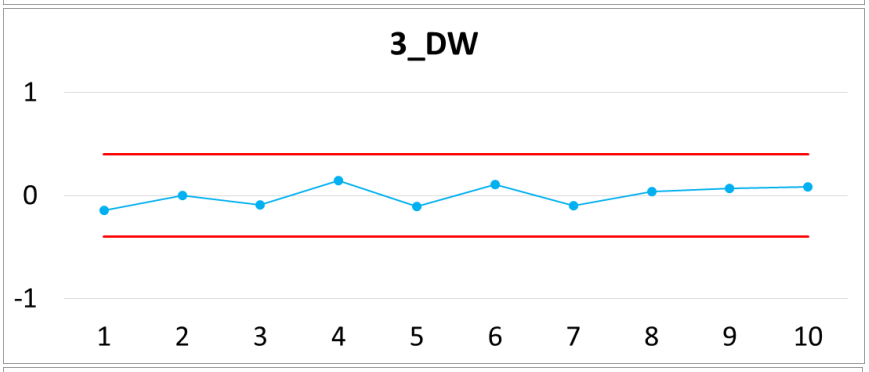
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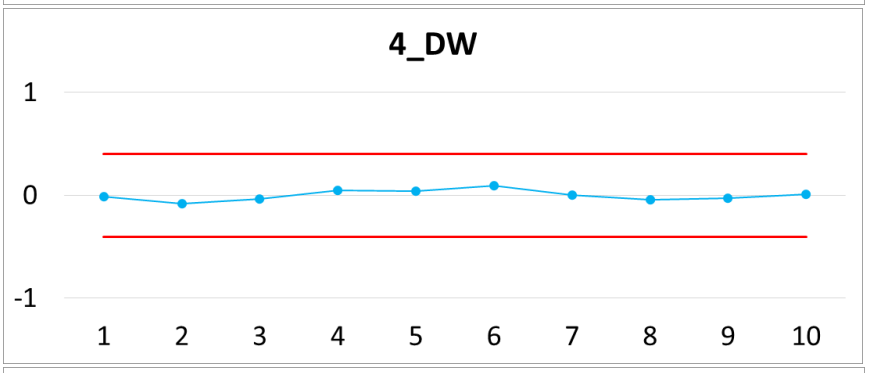
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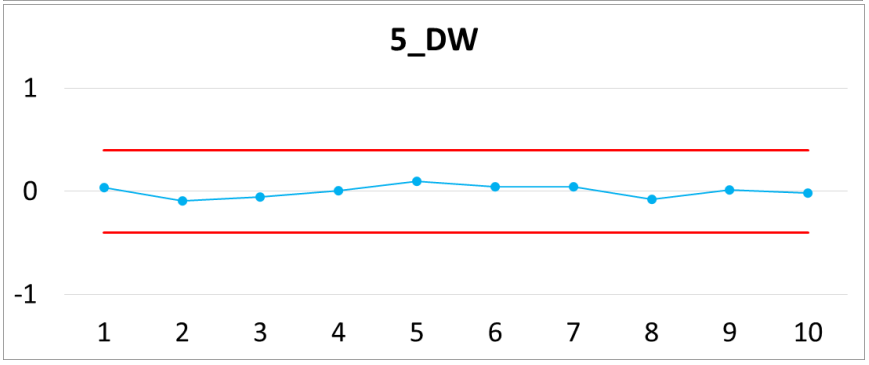
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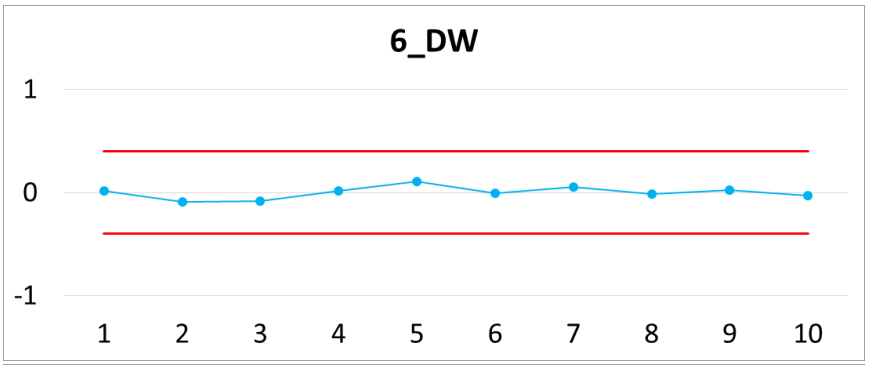
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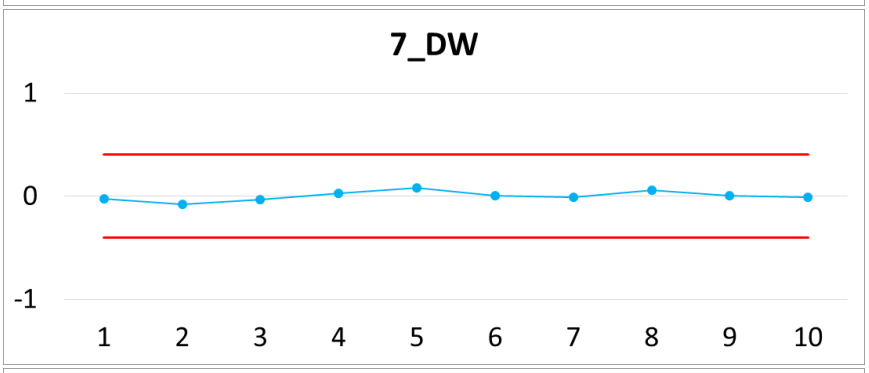
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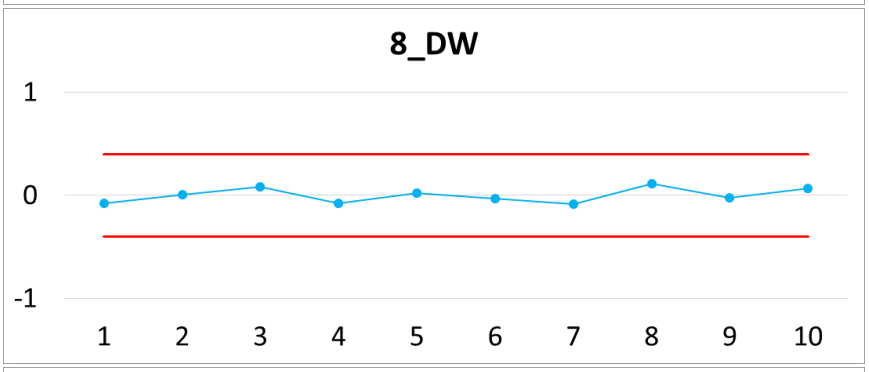
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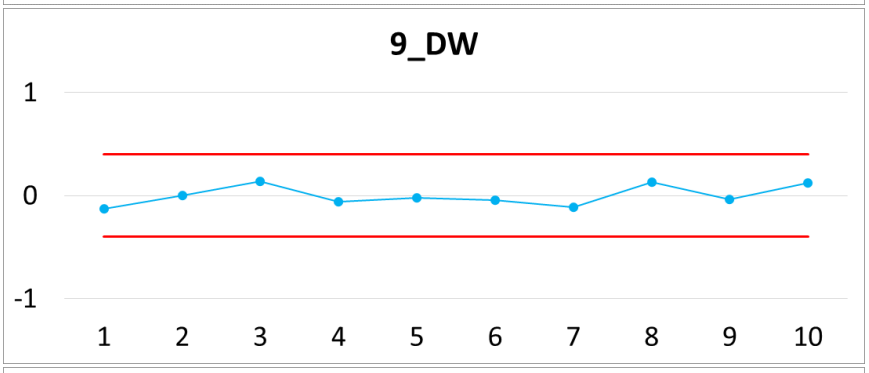
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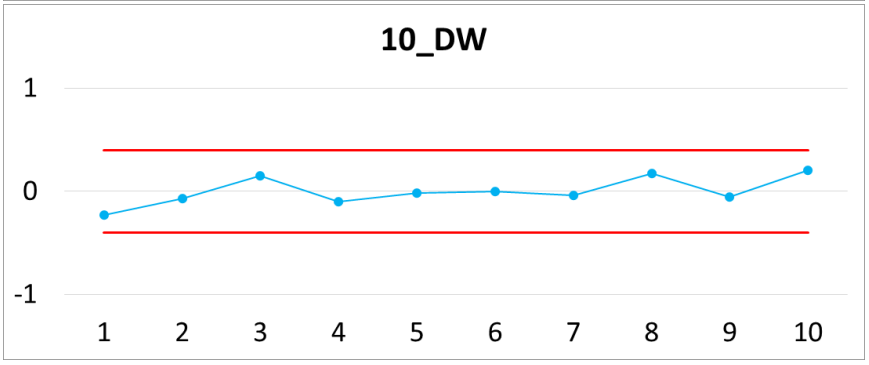
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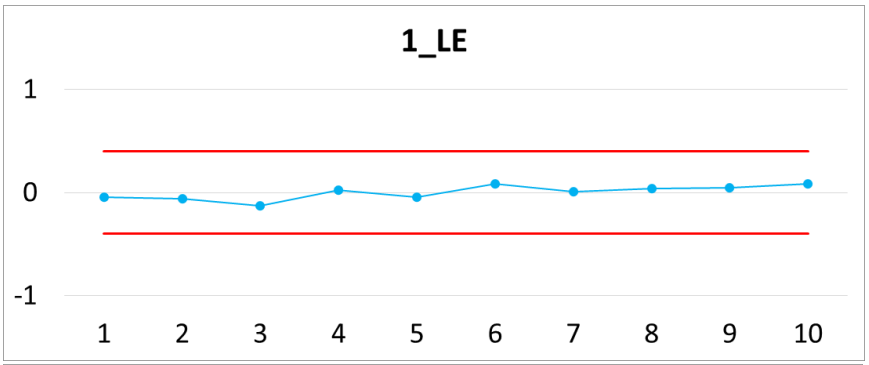
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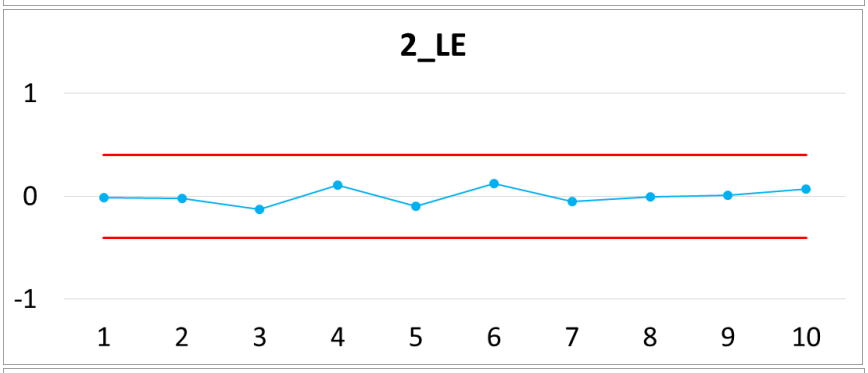
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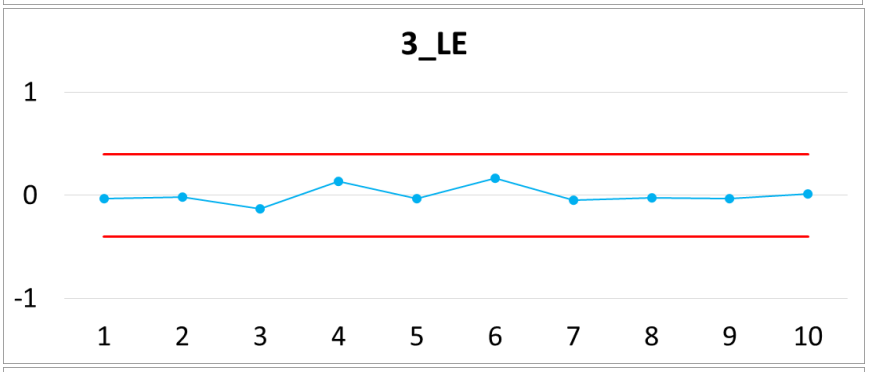
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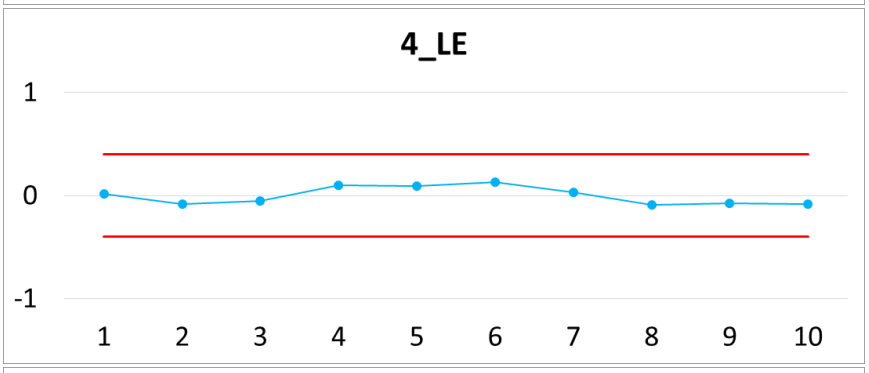
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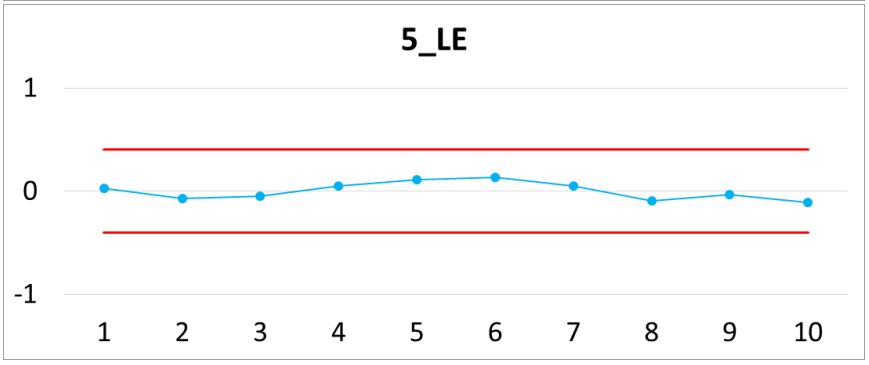
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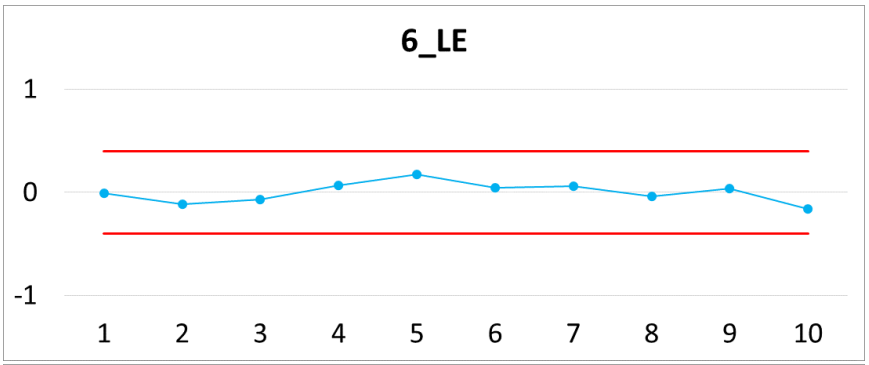
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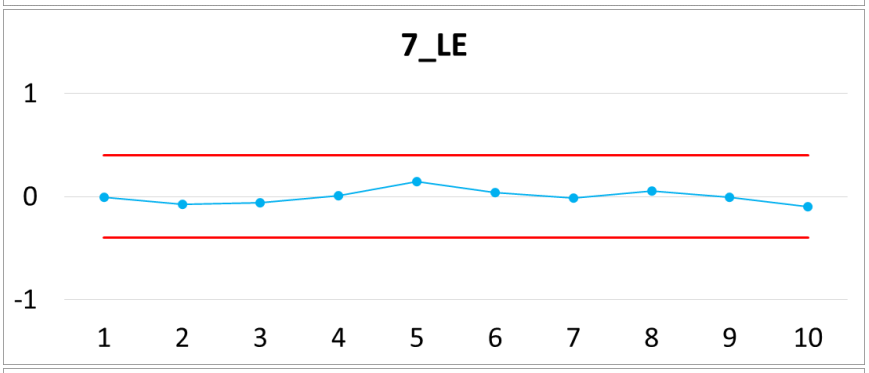
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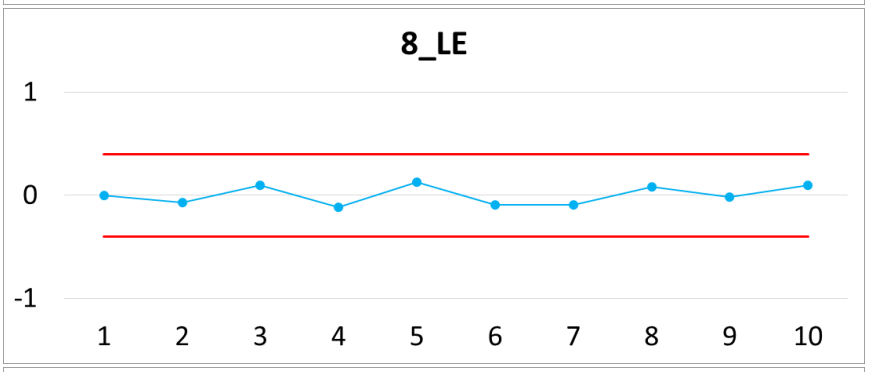
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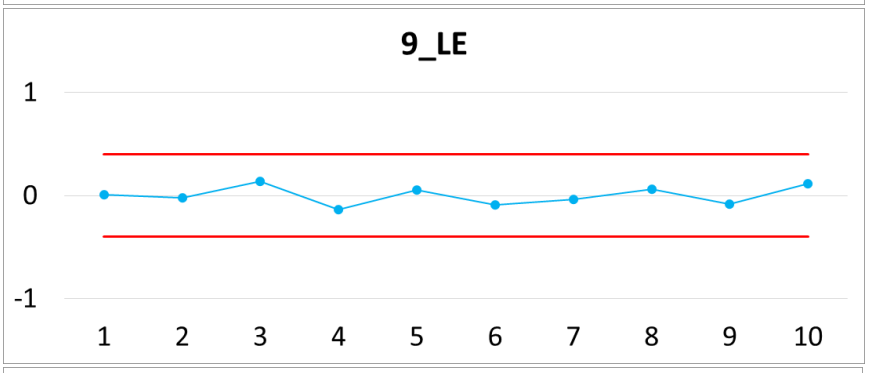
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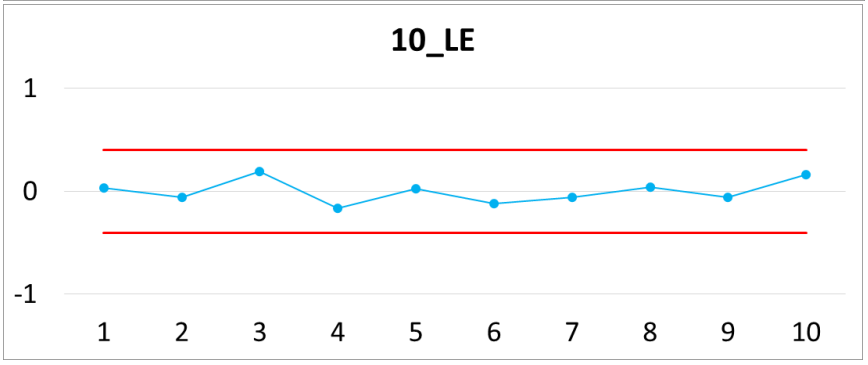
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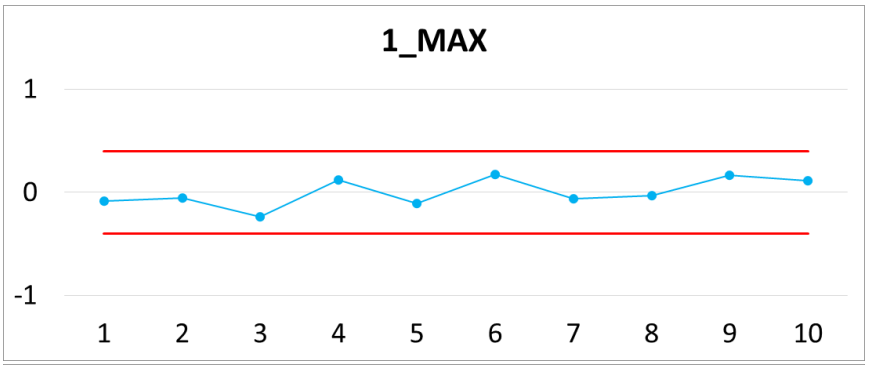
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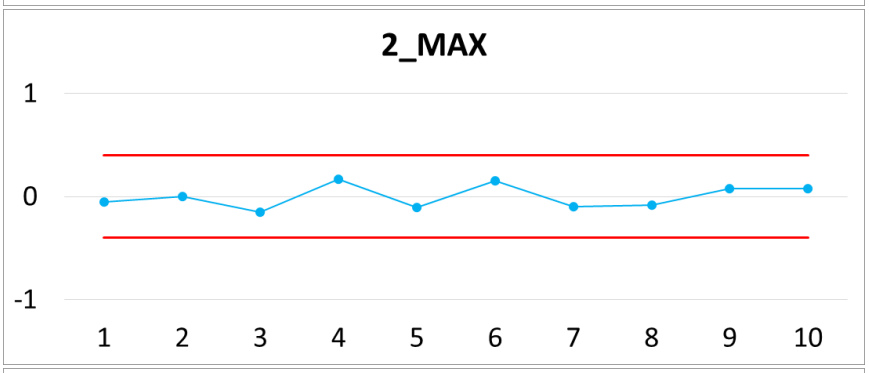
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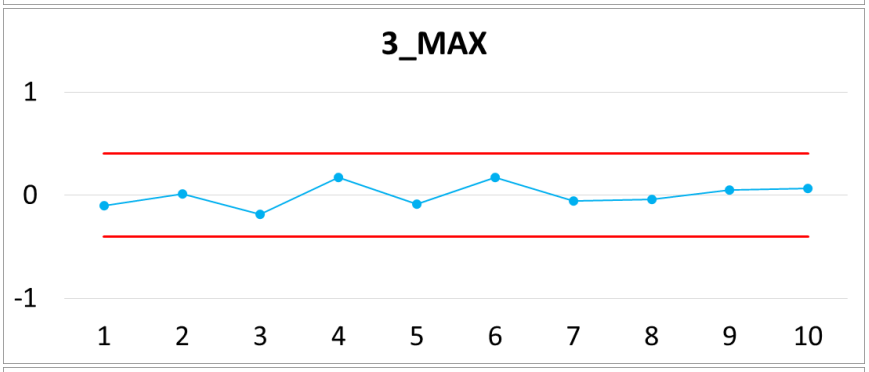
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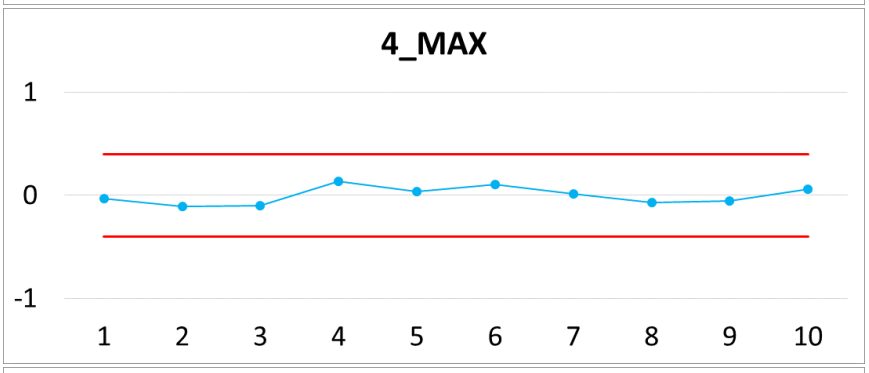
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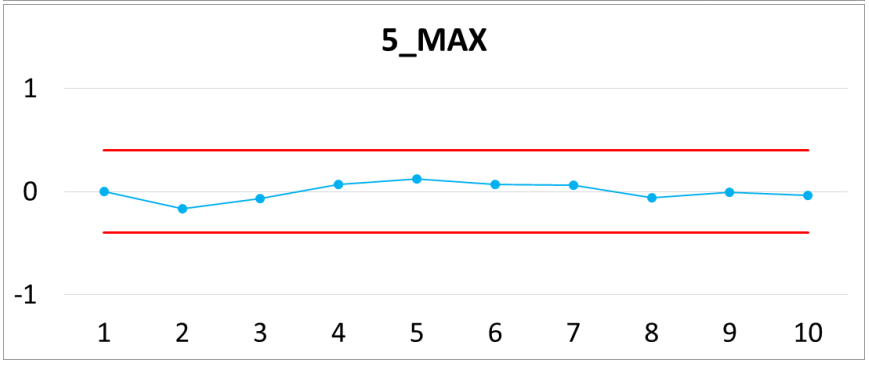
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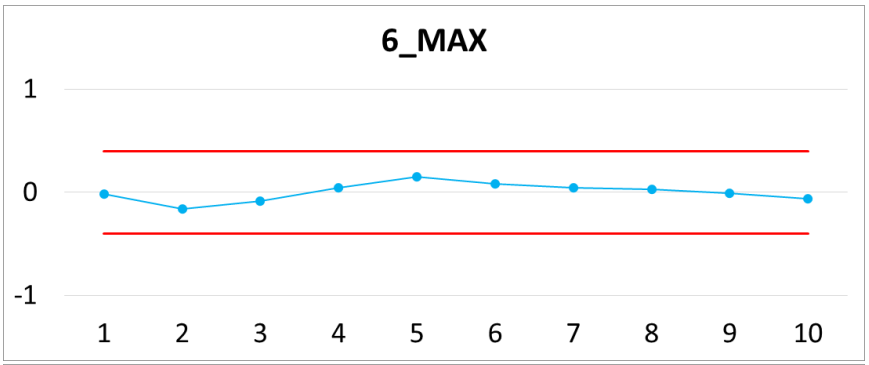
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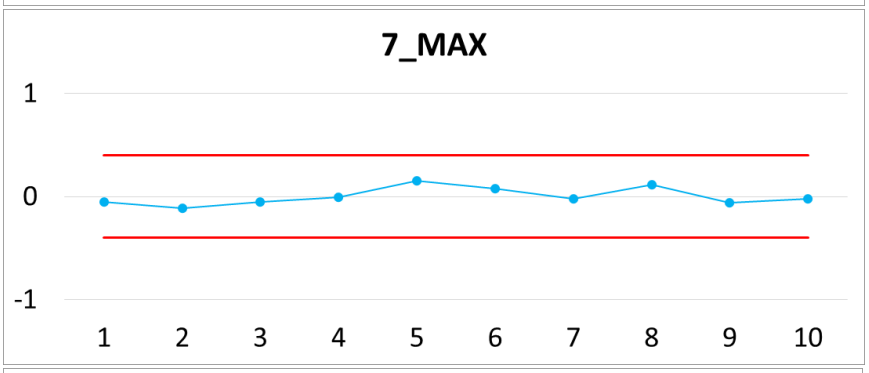
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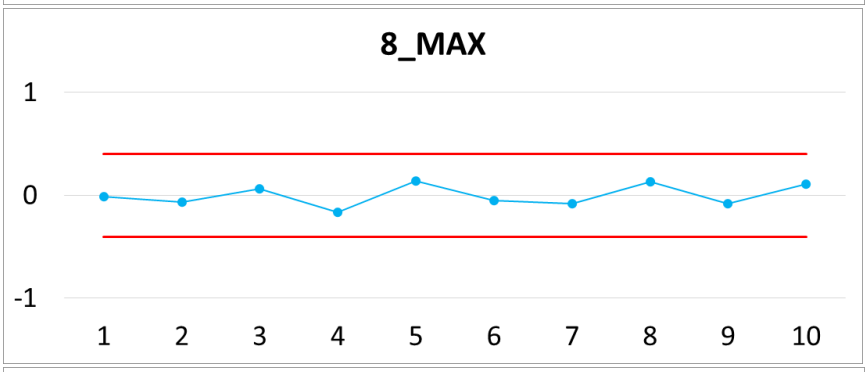
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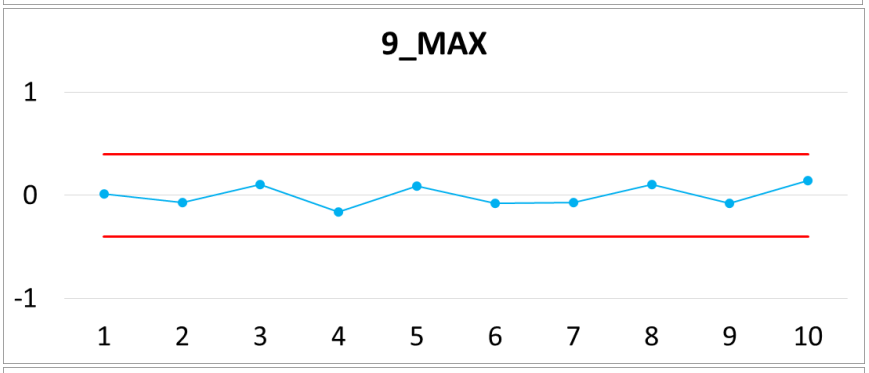
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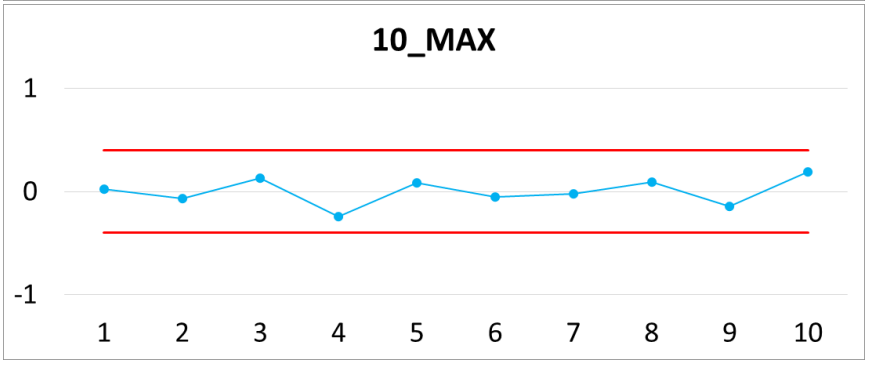
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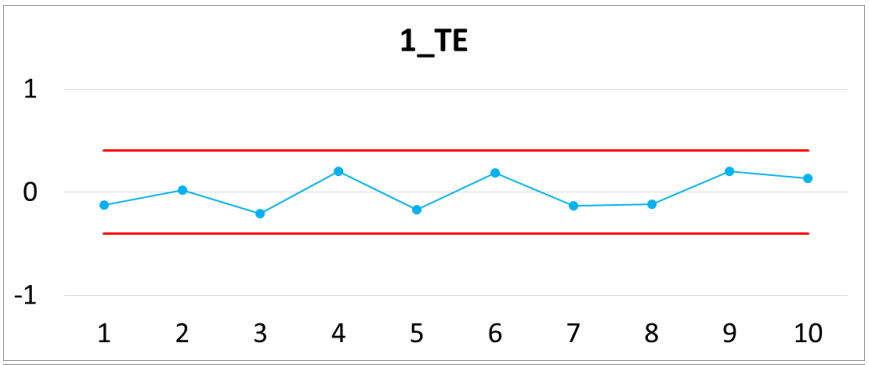
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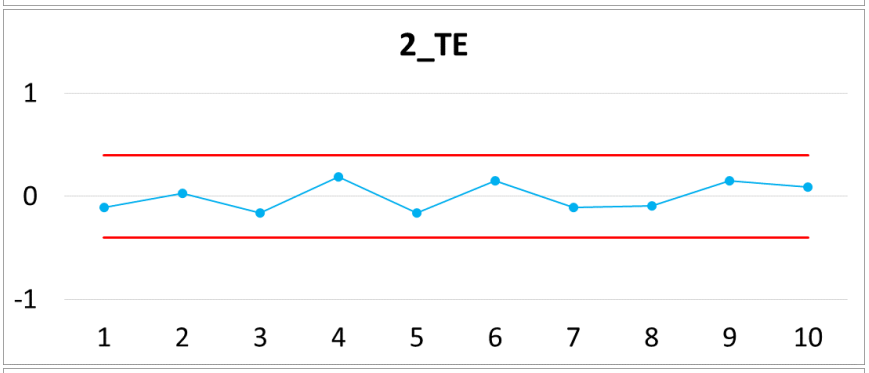
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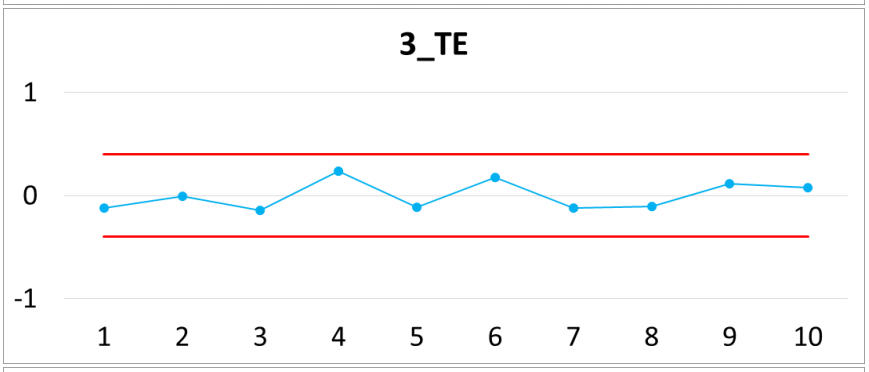
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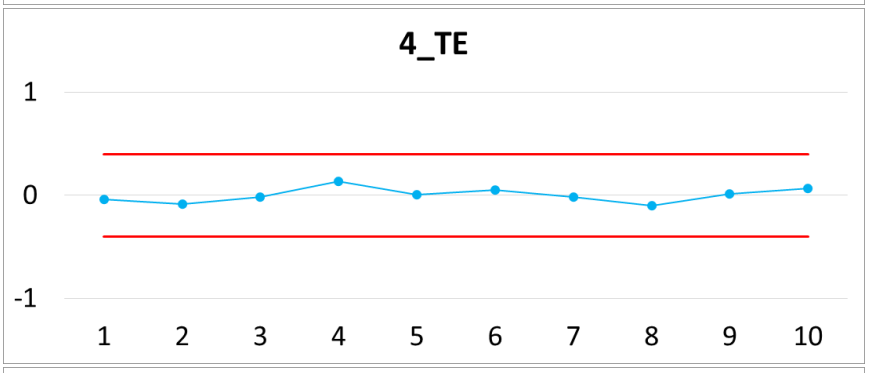
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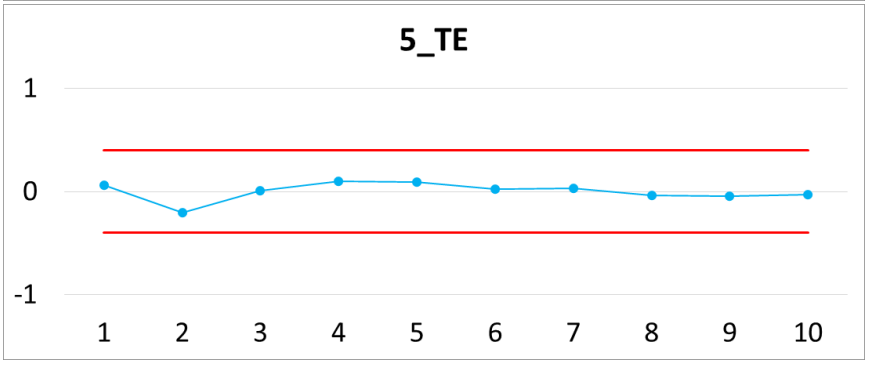
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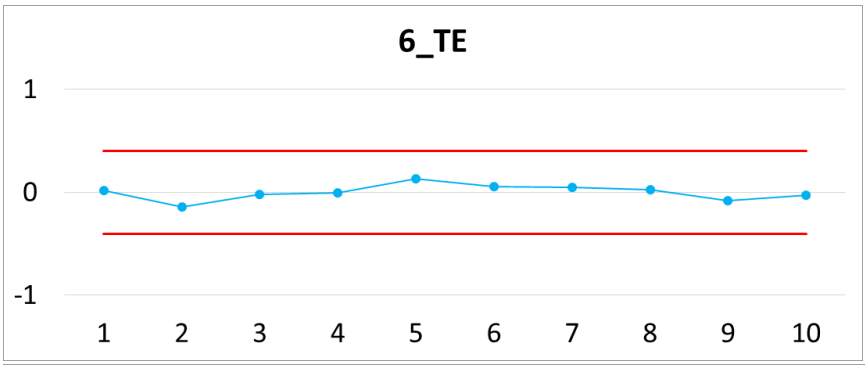
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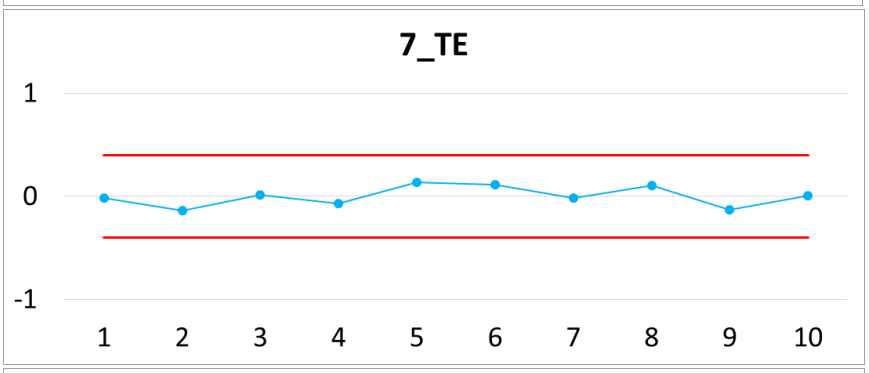
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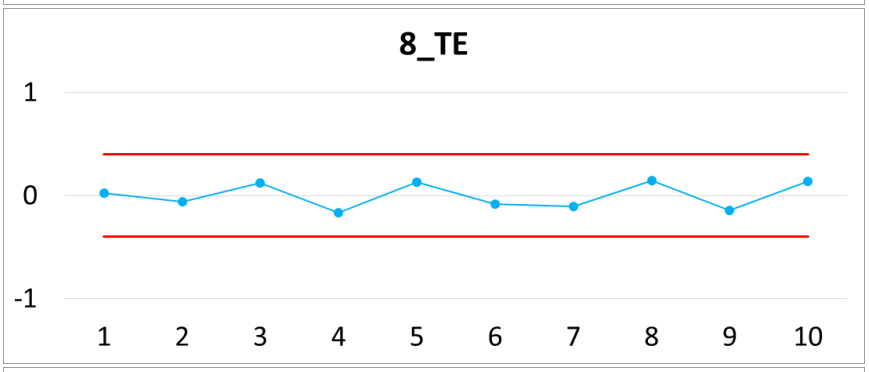
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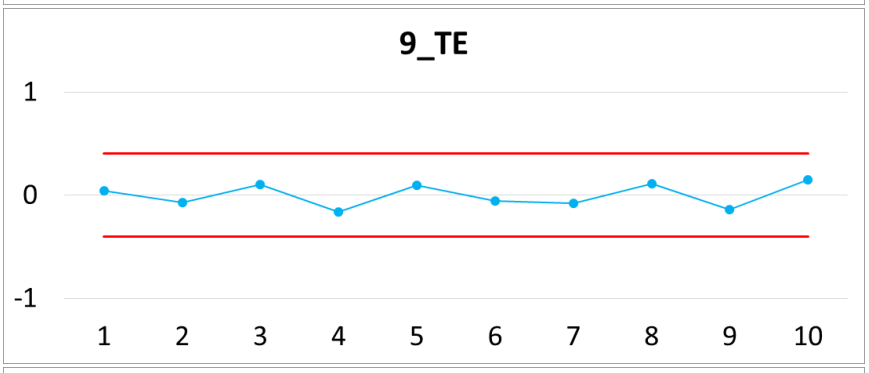
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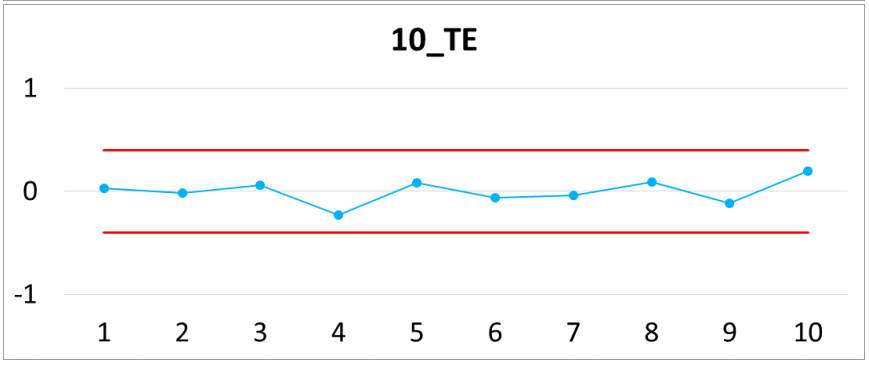
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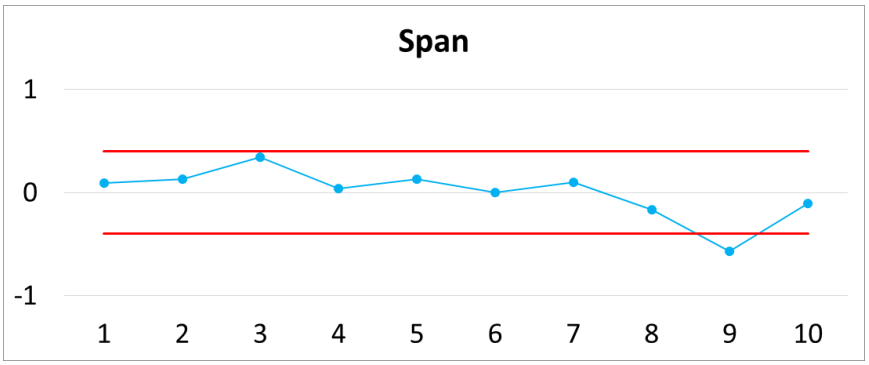
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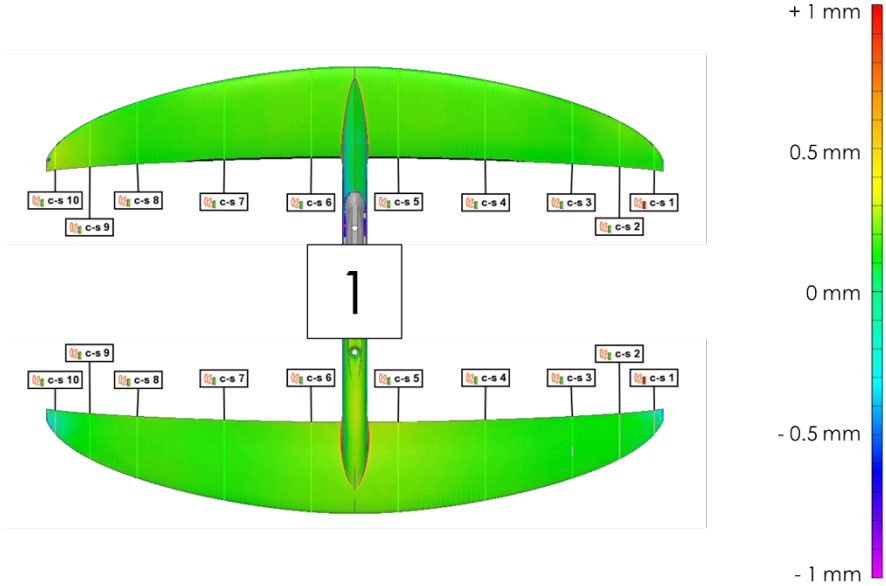
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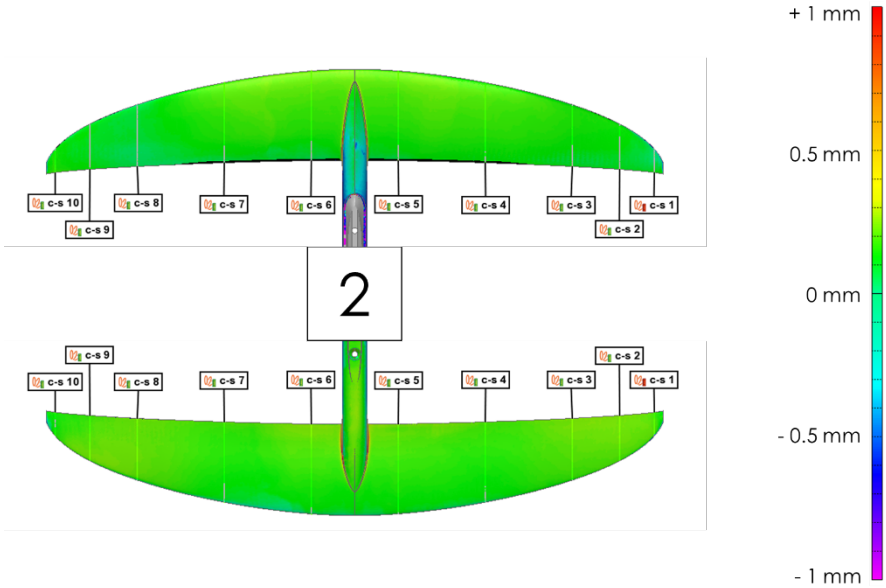
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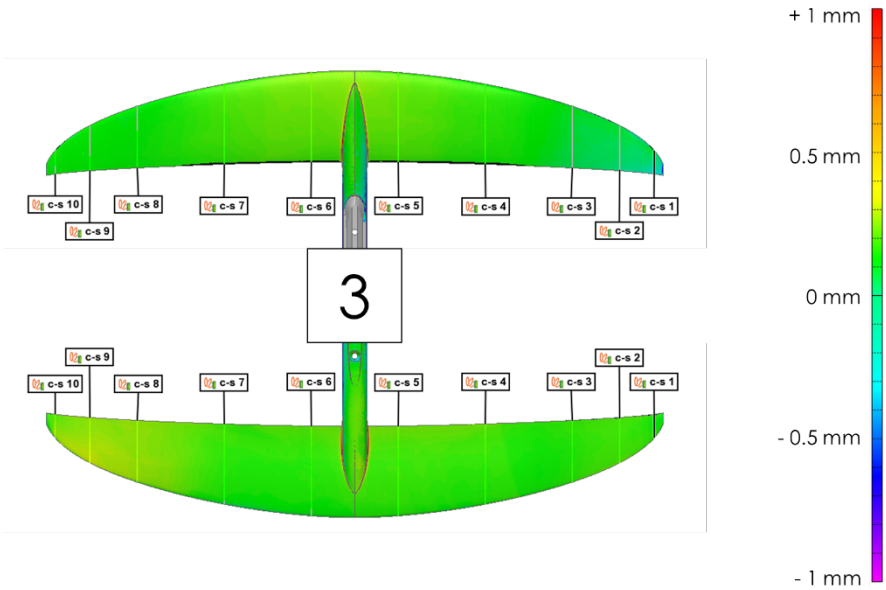
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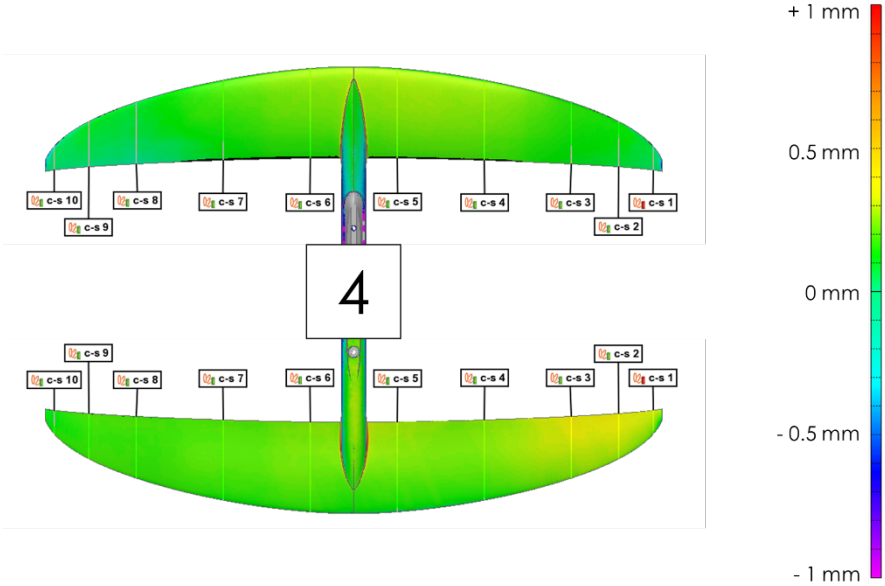
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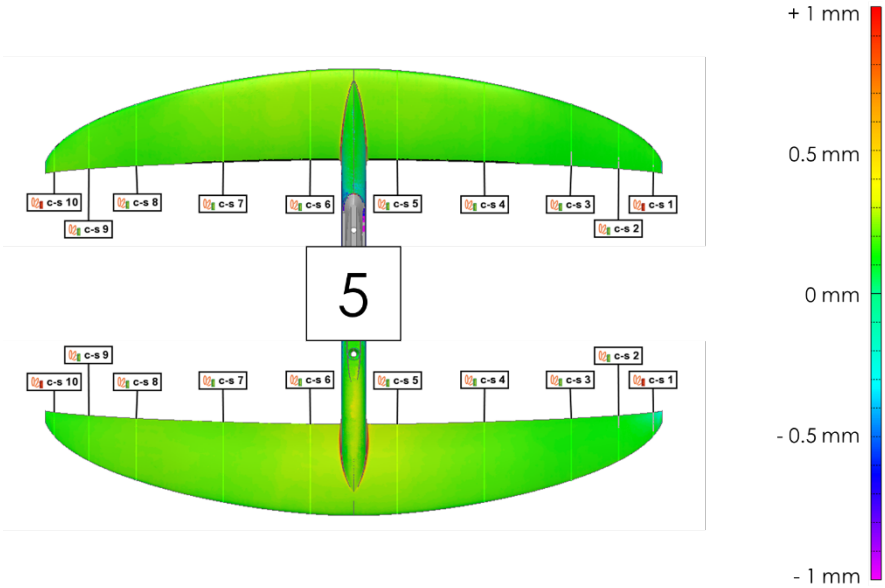
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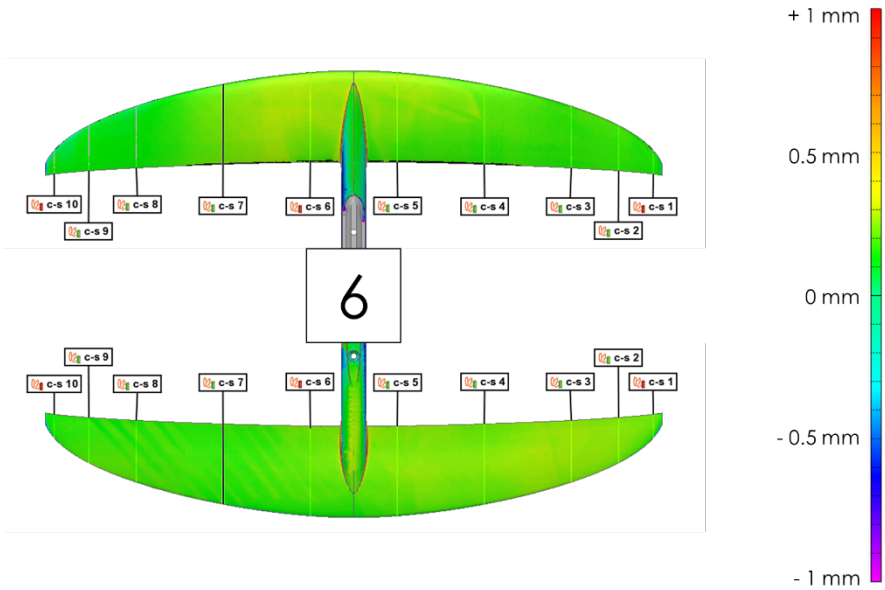
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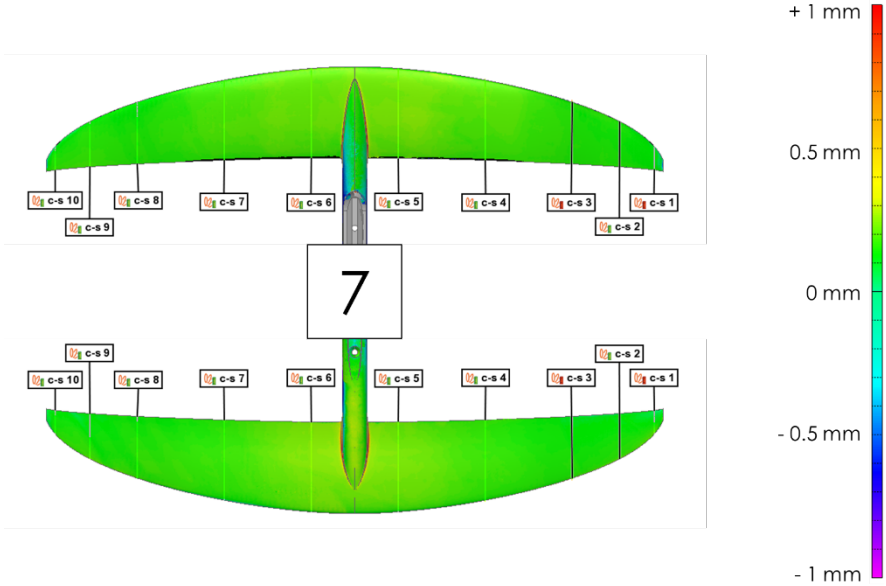
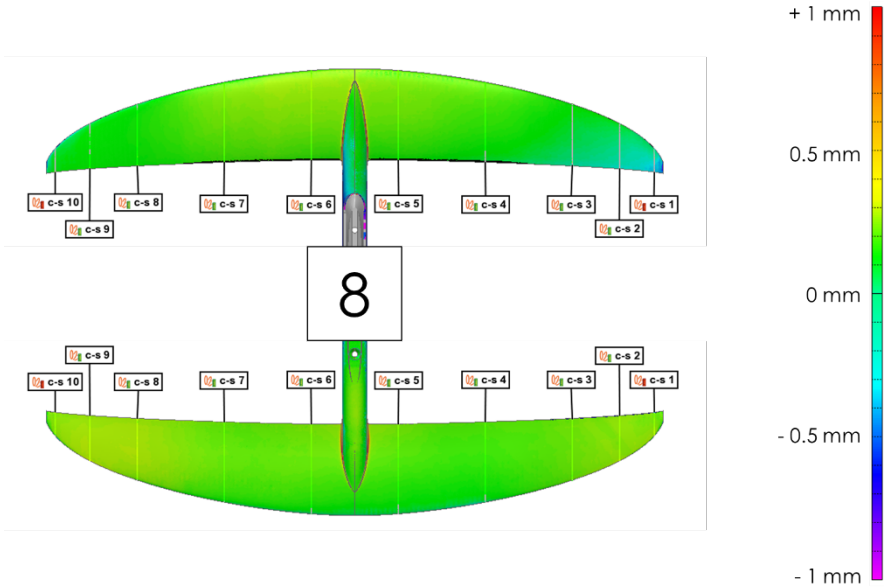
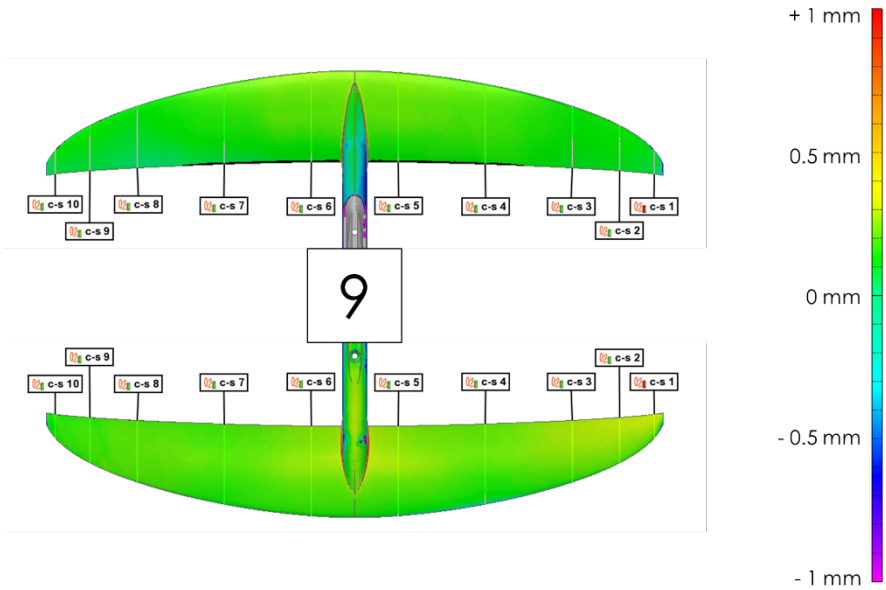

+ 1 mm
0.5 mm
0 mm
- 0.5 mm
- 1 mm
c-s 10
c-s 9
c-s 8
c-s 7
c-s 6
c-s 5
c-s 4
c-s 3
c-s 2
c-s 1
7


+ 1 mm
0.5 mm
0 mm
- 0.5 mm
- 1 mm
c-s 10
c-s 9
c-s 8
c-s 7
c-s 6
c-s 5
c-s 4
c-s 3
c-s 2
c-s 1
8


+ 1 mm
0.5 mm
0 mm
- 0.5 mm
- 1 mm
c-s 10
c-s 9
c-s 8
c-s 7
c-s 6
c-s 5
c-s 4
c-s 3
c-s 2
c-s 1
9

World Sailing Manufacturer Control System

Scanner Report: IKA Formula Kite – Flying Sardine Frontwing Flow V2