

REGISTRATION OF THE EMOTIONAL BACKGROUND AT THE OPERA PERFORMANCE

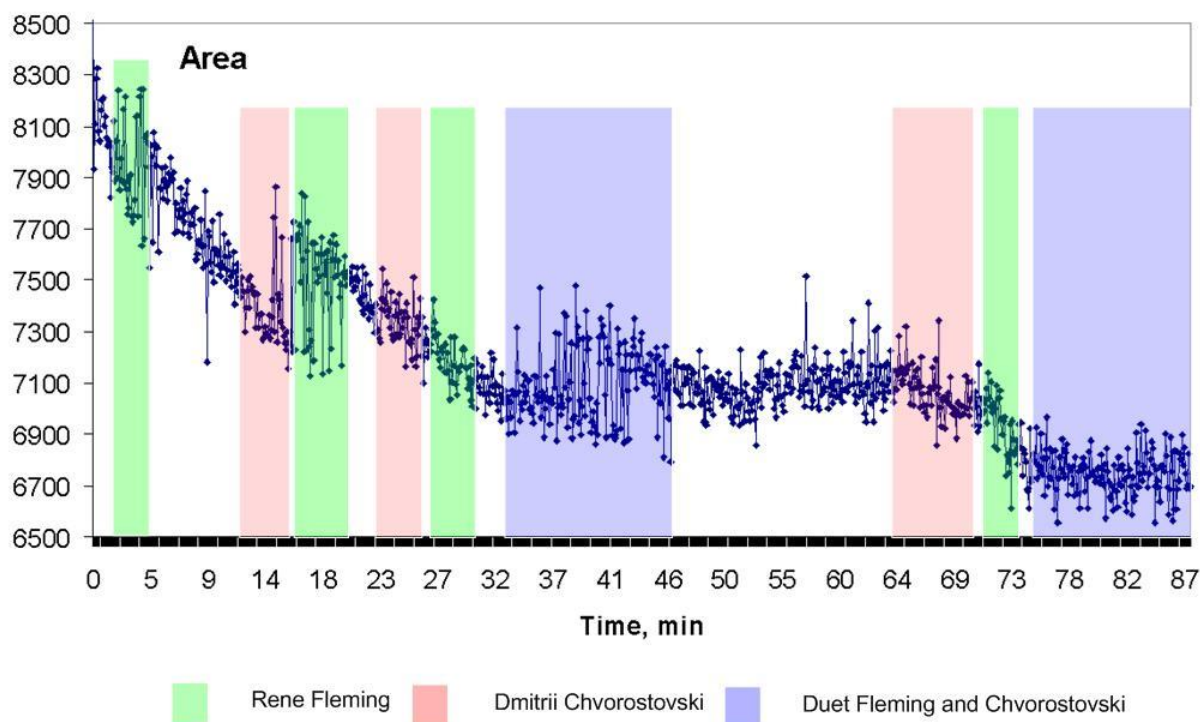
KOROTKOV KONSTANTIN

July 13 and 15 in Saint Petersburg TV filming of the two world-class opera singers – Rene Fleming and Dmitri Chvorostovski in St. Petersburg palaces was conducted. Performance was organized in two parts, with twice repetitions of the same program, which was conducted by the organization of filming. July 13 filming was performed in the Ball Hall of the Great Peterhof Palace and only technical personnel and organizers of the event were presented. It was raining all the time. July 15 filming was performed in Usupovski Palace and public was invited to the performance. By the end off the concert started a strong thunderstorm. In both cases singers were accompanied by symphony orchestra with conductor Konstantin Orbeljan.

We were lucky to be invited to both events and make registration of the signal with “Eco-Tester” instrument. Recording was done in automatic mode with 5 second interval. July 13 EPC/GDV instrument running on 12 V battery with air antenna and personal computer, and July 15 stand-alone “Eco-Tester” was used.

Results

Fig.1 presents time dynamics of Area and Intensity recorded July 13. Shaded areas at the graphs mark the moments of singers’ performance. We pay attention to two moments: strong descending trend of the area graph and big difference between scales of data (difference between maximum and minimum values at the given interval) at the moments of performance and moments of intermission. The advantage of this performance was in big intermissions necessary for filming which allowed calculating statistical difference of data recorded during performance and intermission.



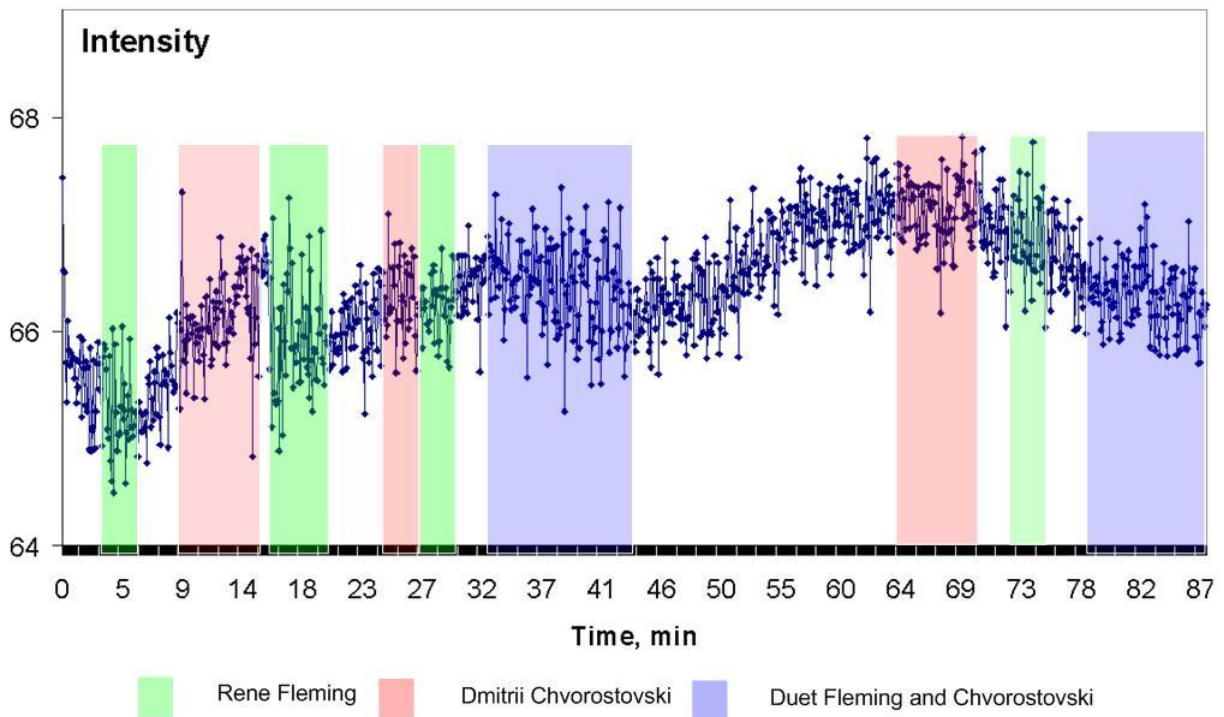


Fig.1. Time dynamics of Area and Intensity recorded July 13, 2009.

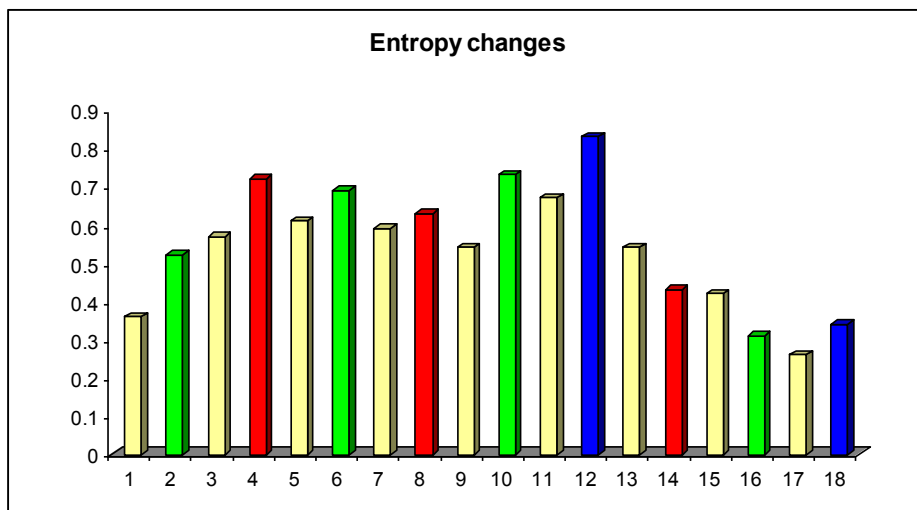
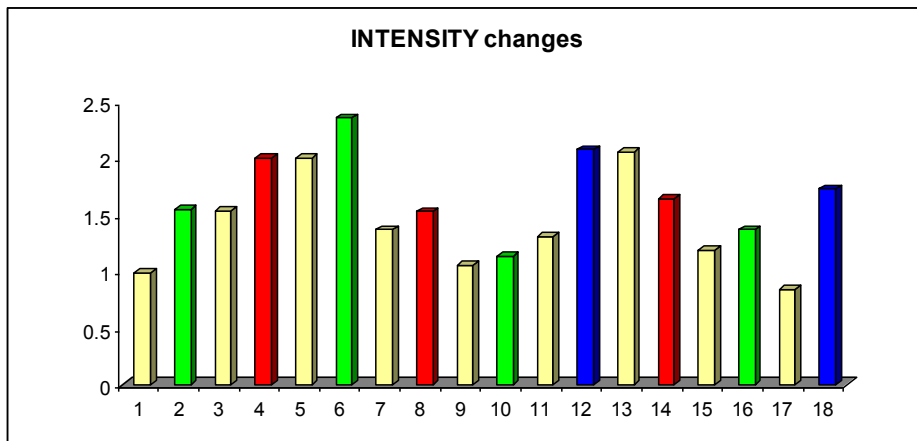
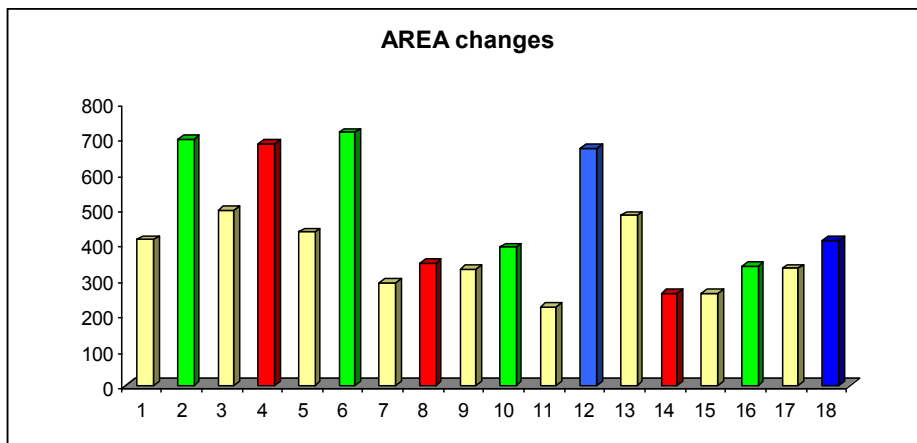
Descending trend of the area graph may be connected with meteorological conditions (torrential rain), but the influence of the recorded process may not be excluded. At the same time difference of parameters in the moments of performances and intermissions is clear visible at both graphs.

Results of statistical comparison of data at the particular moment of performance with the data in the subsequent intermission are presented in Table 1.

Table 1. Results of statistical comparison of EPC parameters at the particular moment of performance July 13 with the parameters in the subsequent intermission (values of probability by ANOVA t-test).

	Area	Intensity	Form Coeff	Entropy	Fractality
Fleming	0.0279	0.4949	0.5843	0.4565	0.9131
Chvorostovski	0.0687	0.5668	0.9351	0.2280	0.6117
Fleming	0.0000	0.0320	0.9621	0.0057	0.0183
Duet	0.0867	0.1439	0.0027	0.2862	0.0004
Chvorostovski	0.0437	0.0661	0.2399	0.0004	0.0254
Fleming	0.1785	0.0565	0.2527	0.0412	0.0158
Duet	0.1356	0.0000	0.1115	0.2895	0.7843

As we see from Table 1 for all parameters we may see statistical difference at particular intervals (should be $p < 0.05$). Significant conclusions may be done from analysis of scale of parameters presented at fig.2. As we see from the graphs the scale of data during performances was significantly higher compared with intermissions. Mann-Whitney statistical test of these data demonstrate their statistically significant difference with $p < 0.05$ both for Area and Intensity (Table 2 – rank for 7 events should be 37 or less for the first column).



■ Fleming
 ■ Chvorostovski
 ■ Duet
 ■ Pause

Fig.2. Scale of data July 13, 2009.

Table 2. Mann-Whitney statistical analysis of EPC parameters at the particular moment of performance July 13 with the parameters in the subsequent intermission.

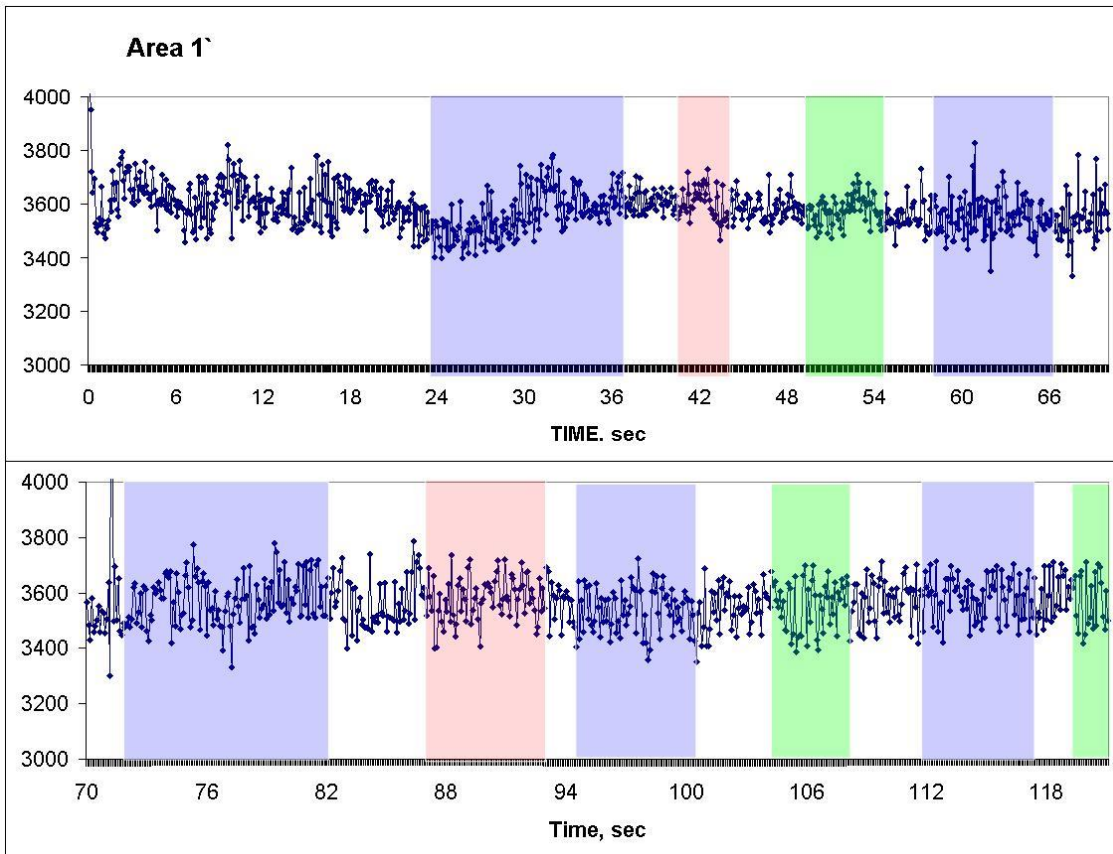
Mann-Whitney test Area				
	Performance	Rank	Intermission	Rank
Fleming	696	3	413	7
Chvorostovski	684	2	496	5
Fleming	716	1	434	6

Duet	672	4	291	12
Chvorostovski	346	9	328	11
Fleming	338	10	222	14
Duet	410	8	261	13
		37		68

Mann-Whitney test Intensity

	Performance	Rank	Intermission	Rank
Fleming	1.55	7	0.99	14
Chvorostovski	2	3.5	1.54	8
Fleming	2.36	1	2	3.5
Duet	2.08	2	1.37	9.5
Chvorostovski	1.64	6	1.06	13
Fleming	1.37	9.5	1.31	11
Duet	1.73	5	1.19	12
		34		71

Processing of data recorded July 15 is presented at fig.3-4 and in Table 3-4. Mann-Whitney statistical test of scale data demonstrate their statistically significant difference with $p < 0.05$ for Area but no difference for Intensity (Table 4 – rank for 6 events should be 26 or less for the first column).



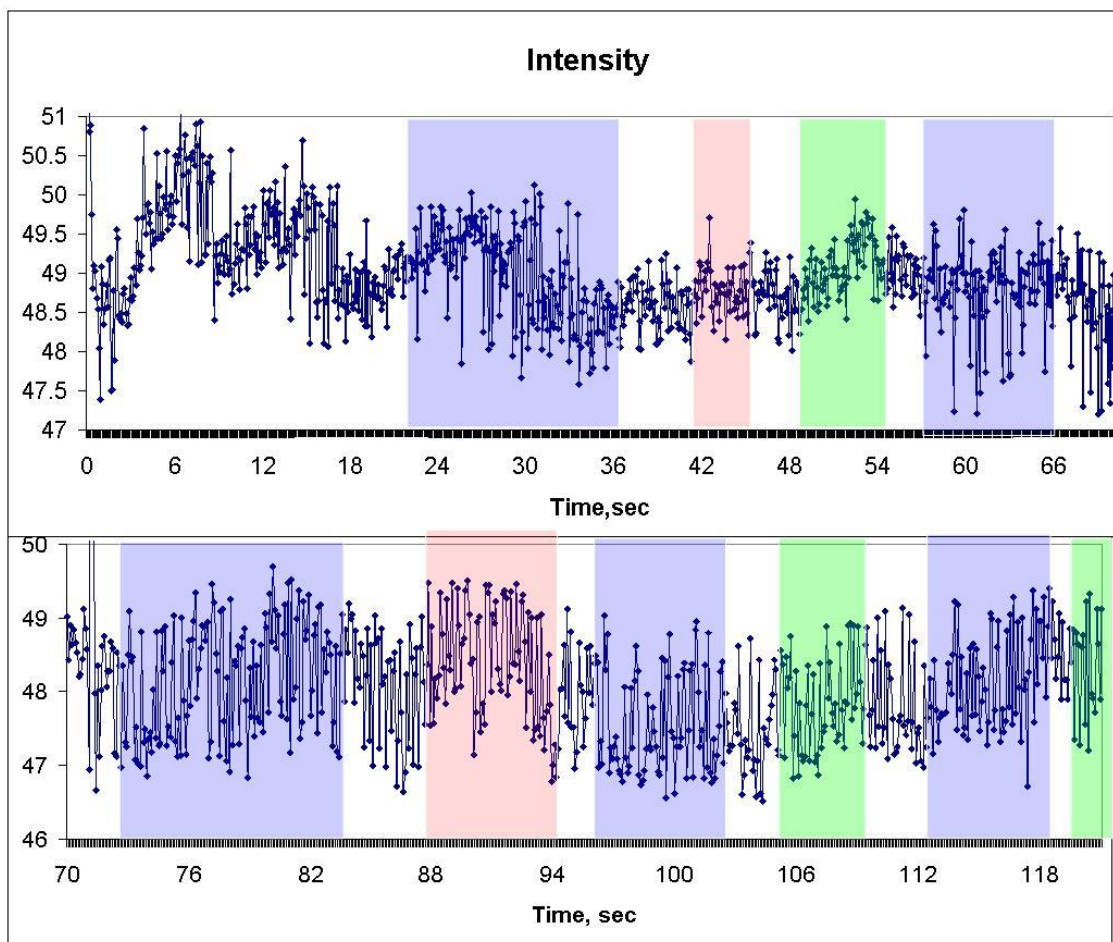
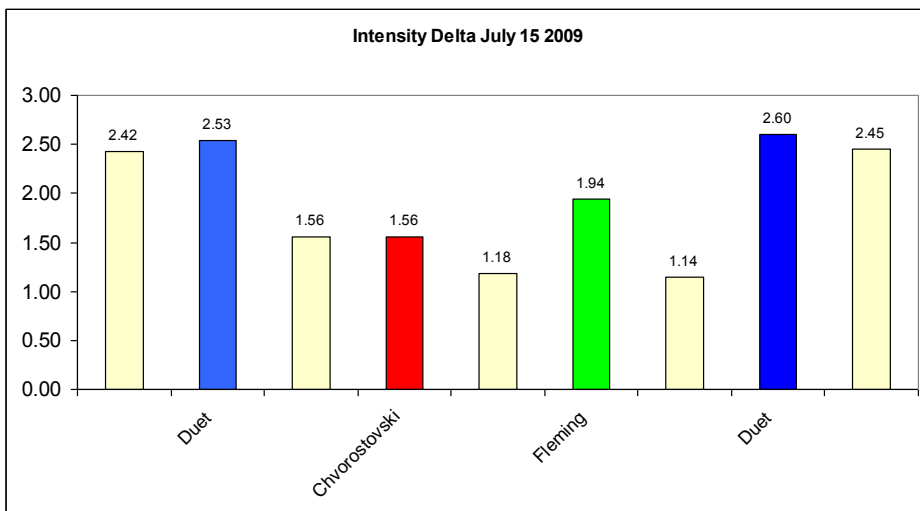
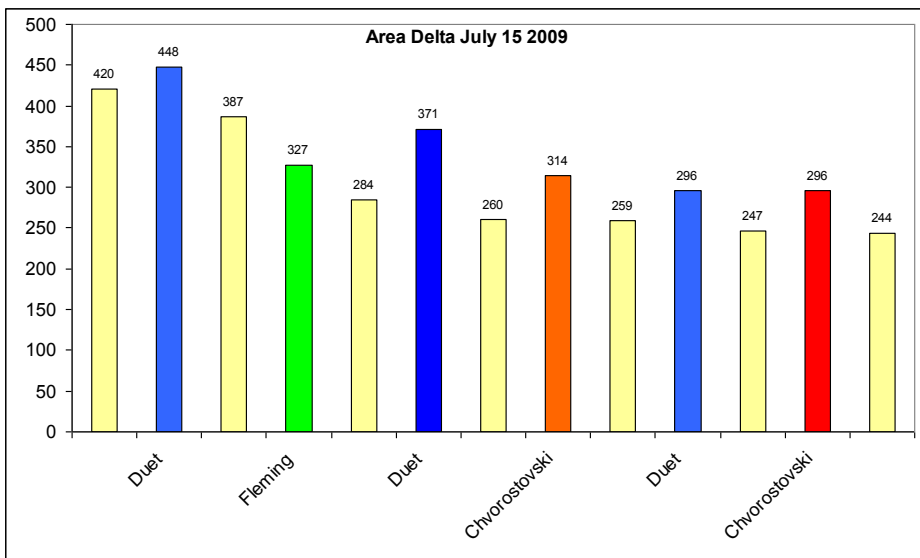
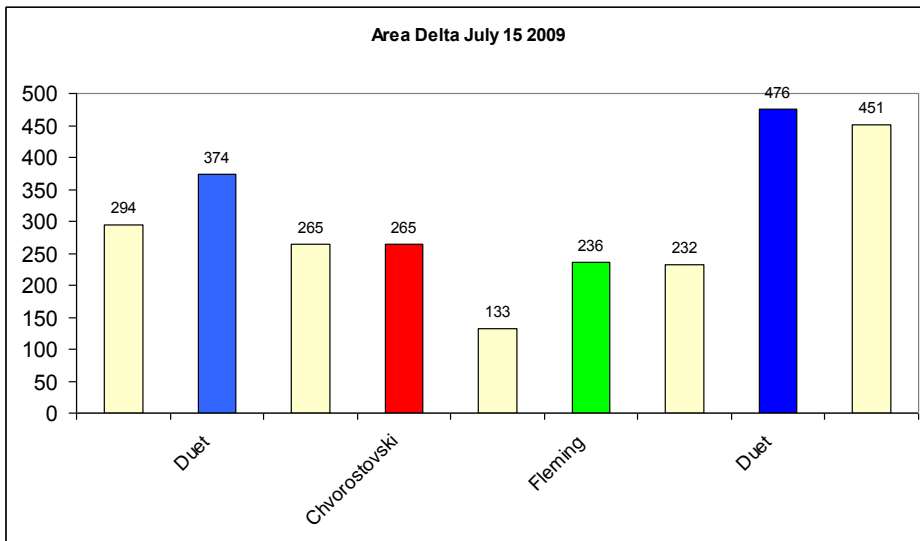


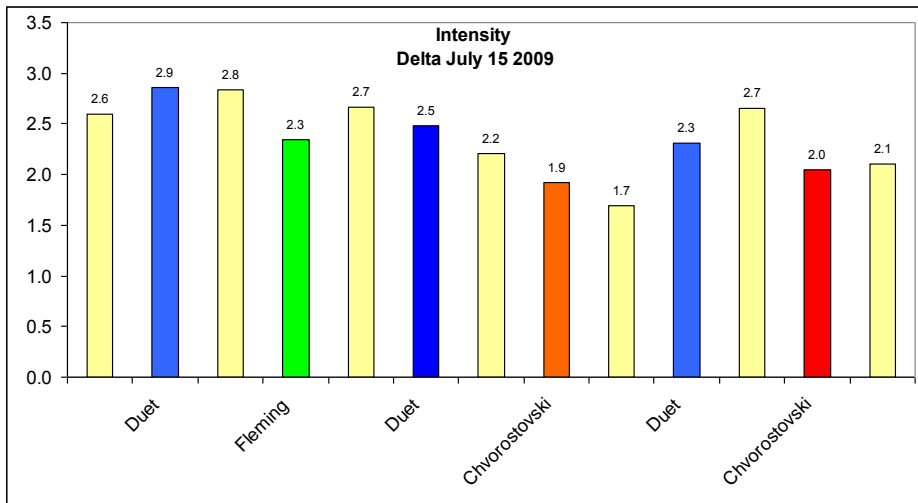
Fig.3. Time dynamics of Area and Intensity at the performance July 15, 2009.

Table 3. Results of statistical comparison of EPC parameters at the particular moment of performance July 15 with the parameters in the subsequent intermission (values of probability by ANOVA t-test).

	Area	Intensity	Form Coeff	Entropy	Fractality
Duet	0.184	0.072	0.030	0.151	0.002
Chvorostovski	0.477	0.718	0.758	0.925	0.808
Fleming	0.126	0.011	0.559	0.088	0.501
Duet	0.110	0.188	0.313	0.159	0.966

	Area	Intensity	Form Coeff	Entropy	Fractality
Duet	0.260	0.033	0.614	0.450	0.039
Fleming	0.085	0.001	0.037	0.476	0.452
Duet	0.213	0.510	0.807	0.180	0.728
Chvorostovski	0.127	0.405	0.897	0.187	0.669
Chvorostovski	0.582	0.020	0.000	0.715	0.707
Duet	0.452	0.034	0.311	0.853	0.381
Chvorostovski	0.728	0.277	0.236	0.364	0.614





■ Fleming
 ■ Chvorostovski
 ■ Duet
 ■ Pause

Fig.4. Scale of parameters July 15, 2009.

Table 4. Mann-Whitney statistical analysis of EPC parameters at the particular moment of performance July 15 with the parameters in the subsequent intermission.

Mann-Whitney test Area

	Performance	Rank	Intermission	Rank
Duet	448	1	387	2
Fleming	327	4	284	8
Duet	371	3	260	9
Chvorostovski	314	5	259	10
Duet	296	6.5	247	11
Chvorostovski	296	6.5	244	12
		26		52

Mann-Whitney test Intensity

	Performance	Rank	Intermission	Rank
Duet	2.9	1	2.8	2
Fleming	2.3	5	2.7	3.5
Duet	2.5	5	2.2	7
Chvorostovski	1.9	10	1.7	11
Duet	2.3	6	2.7	3.5
Chvorostovski	2.0	9	2.1	8
		36		35

Discussion

As we see from the presented above data at the moments of singing parameters of sensor signal were significantly different from the parameters in intermissions. For many parameters this difference was statistically significant. This may be presented as the change of entropy of signal at the moments of performance compared with background. We may even say that performance of world-class singers change the entropy of space. While there we may see quite different character of signal July 13 and July 15. One of the main differences in conditions was that July 13 performance was practically without public while July 15 it was organized as a public concert and people from the very beginning were in the state of emotional excitation. At the moment we

are unable to make the conclusion how the emotional condition of either public or performers influence the sensor signal.

July 13 Electrophotonic (GDV) parameters from fingers of the conductor Konstantin Orbeljan before and after the performance were recorded. As we see from the presented graphs, three hours of conducting resulted in full energy depletion of the artist.

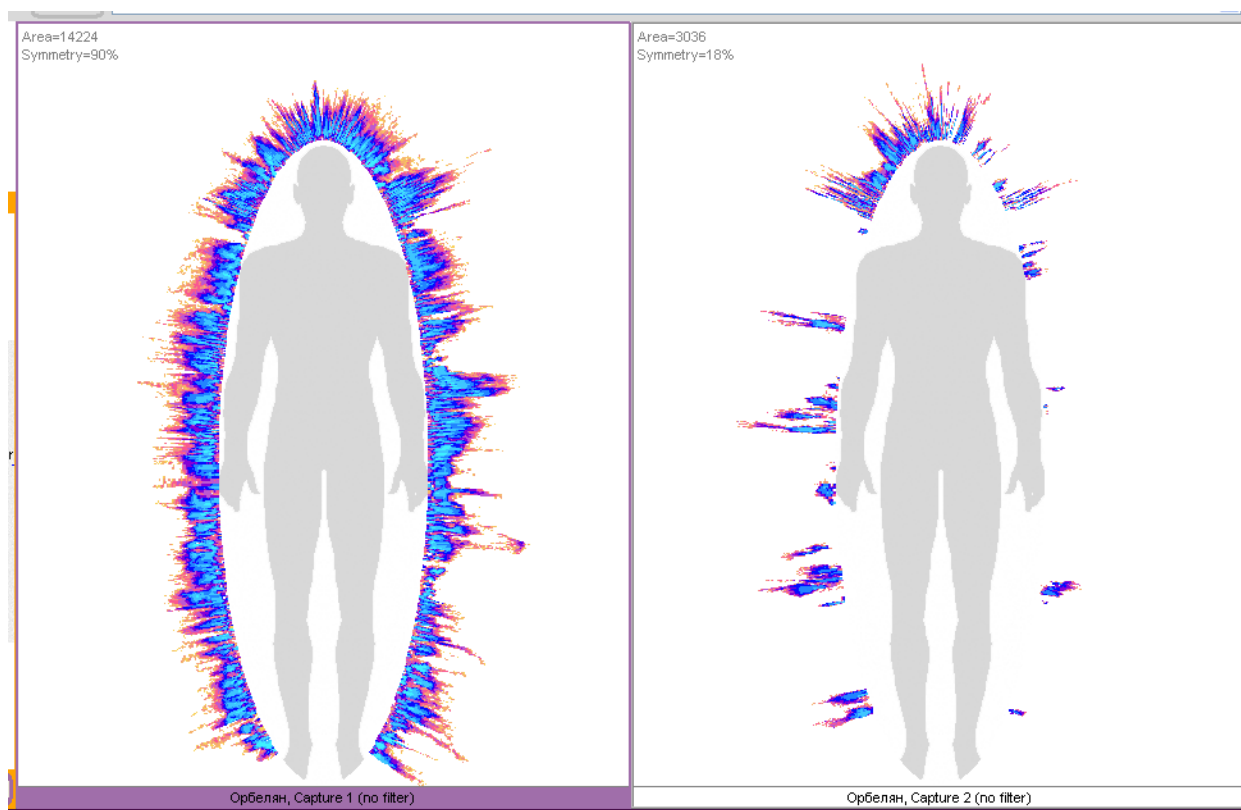


Fig.5. Energy Field of the conductor Konstantin Orbeljan before and after the performance.