

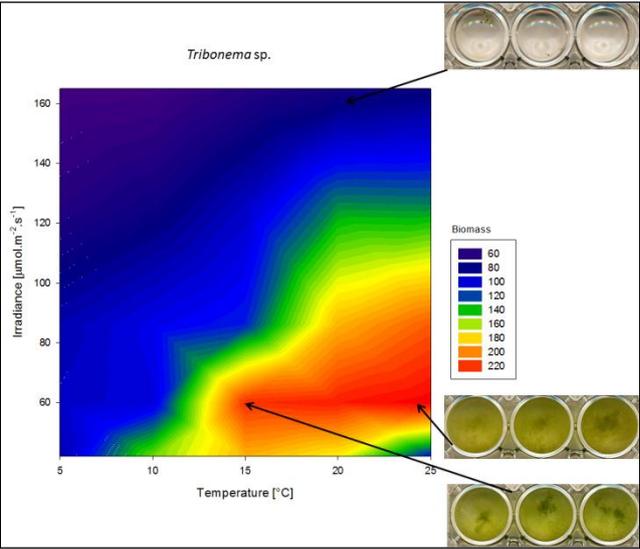
## Annex 1.

**Table 1.** The list of strains used in growth experiments and/or in anti-fouling tests. Information concerning the selected optimal medium, isolation and optimal culture conditions (where investigated) is provided.

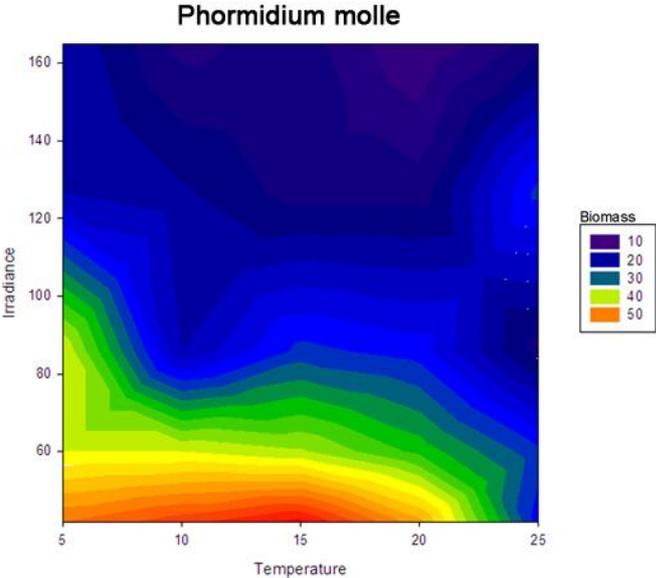
Taxonomical groups of algae are differentiated by color boxes. SAG = Sammlung von Algenkulturen Gottingen (SAG Culture Collection), CUNI – Charles University in Prague, INNOPOL – Innowacja Polska, UGOE – University of Goettingen, BrM – Brakish water medium, BBM - Bold's basal medium, WC – WC culture medium (see Table 2).

Strain	Medium	Isolated by	Optimal growth cond.		Anti-fouling test
			temp. °C	irradiance $\mu\text{mol.m}^{-2}.\text{s}^{-1}$	
<b>Cyanobacteria</b>					
<i>Phormidium molle</i> SAG 26.99	BBM	SAG strain	15	42	CUNI/ UGOE
<i>Leptolyngbya</i> sp.HR5	BBM	UGOE	new		
<i>Calothrix</i> sp. Probe 11 Klon 5_1	BBM	UGOE			UGOE
<i>Pseudanabaena lonchoides</i> (Zurek)		INNOPOL			INNO POL
<b>Diatoms</b>					
<i>Achnantheidium minutissimum</i> SAG RJ D410	WC	SAG strain			UGOE
<i>Achnantheidium</i> sp.EH1 Klon 1	WC	UGOE	20	42-60	UGOE
<i>Navicula</i> sp.1 Lovosice	WC	CUNI	25	127	
<i>Navicula</i> sp.2 Lovosice	WC	CUNI	25	60	CUNI
<i>Navicula</i> sp.3 Lovosice	WC	CUNI	20	86	CUNI
<i>Gomphocymbella</i> sp. Lovosice	WC	CUNI	20-25	42-60	
<i>Nitzschia</i> sp. Lovosice	WC	CUNI	25	42	
<i>Achnantheidium</i> sp. EH1 Klon 3	WC	UGOE	20	140-160	
<i>Achnantheidium</i> sp. FH3 Kl. 2A	WC	UGOE	15	60	
<i>Nitzschia</i> sp. Probe 8 Klon 11	WC	UGOE	20	86-127	
<i>Achnanthes</i> sp. KATS 09425	BrM	UGOE			UGOE
<i>Navicula perminuta</i> Zurek		INNOPOL			INNOPOL
<b>Xanthophyceae</b>					
<i>Tribonema</i> sp. Lovosice	BBM	CUNI	20-25	60	
<b>Trebouxiophyceae</b>					
<i>Heterochlorella luteoviridis</i> (bottle alga)	BBM	UGOE			UGOE
<i>Chlorella</i> sp. Lovosice	BBM	CUNI	15-20	86-127	CUNI
<i>Diplosphaera</i> sp. Lovosice	BBM	CUNI	new		
<i>Sphaerochlamydeella</i> sp. Lovos.	BBM	CUNI	20	86	
<b>Chlorophyceae</b>					
<i>Stigeoclonium</i> sp. Lovosice	BBM	CUNI	15-25	42-60	
<i>Stigeoclonium</i> sp. EX07 K01	BBM	UGOE			UGOE
<i>Chlorococcum</i> sp. Zurek 04	BBM	INNOPOL	5-15	42-60	CUNI/ UGOE
<i>Chlorococcum</i> sp. Lovosice	BBM	CUNI	25	42	
<i>Ankistrodesmus</i> sp. V.H.S 5	BBM	UGOE	20	86	UGOE
<b>Streptophyta</b>					
<i>Klebsormidium</i> sp.Lovosice	BBM	CUNI	20-25	42	CUNI

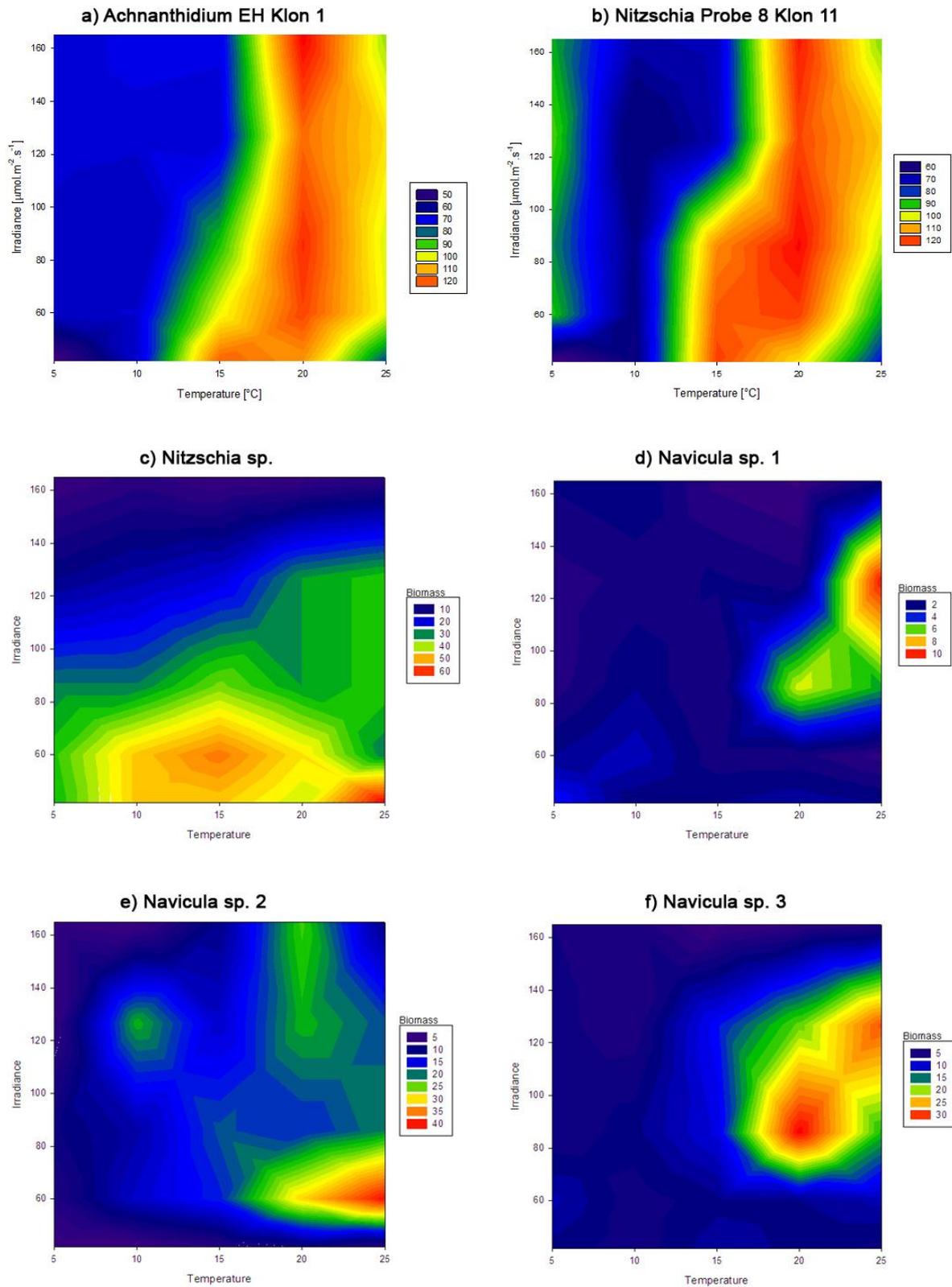
**Figure 1.** Assessment of optimal growing conditions in *Tribonema* sp. (Lovosice). Inserted figures show the amount of biomass produced in a triplicate of wells under the conditions tracked by an arrow.



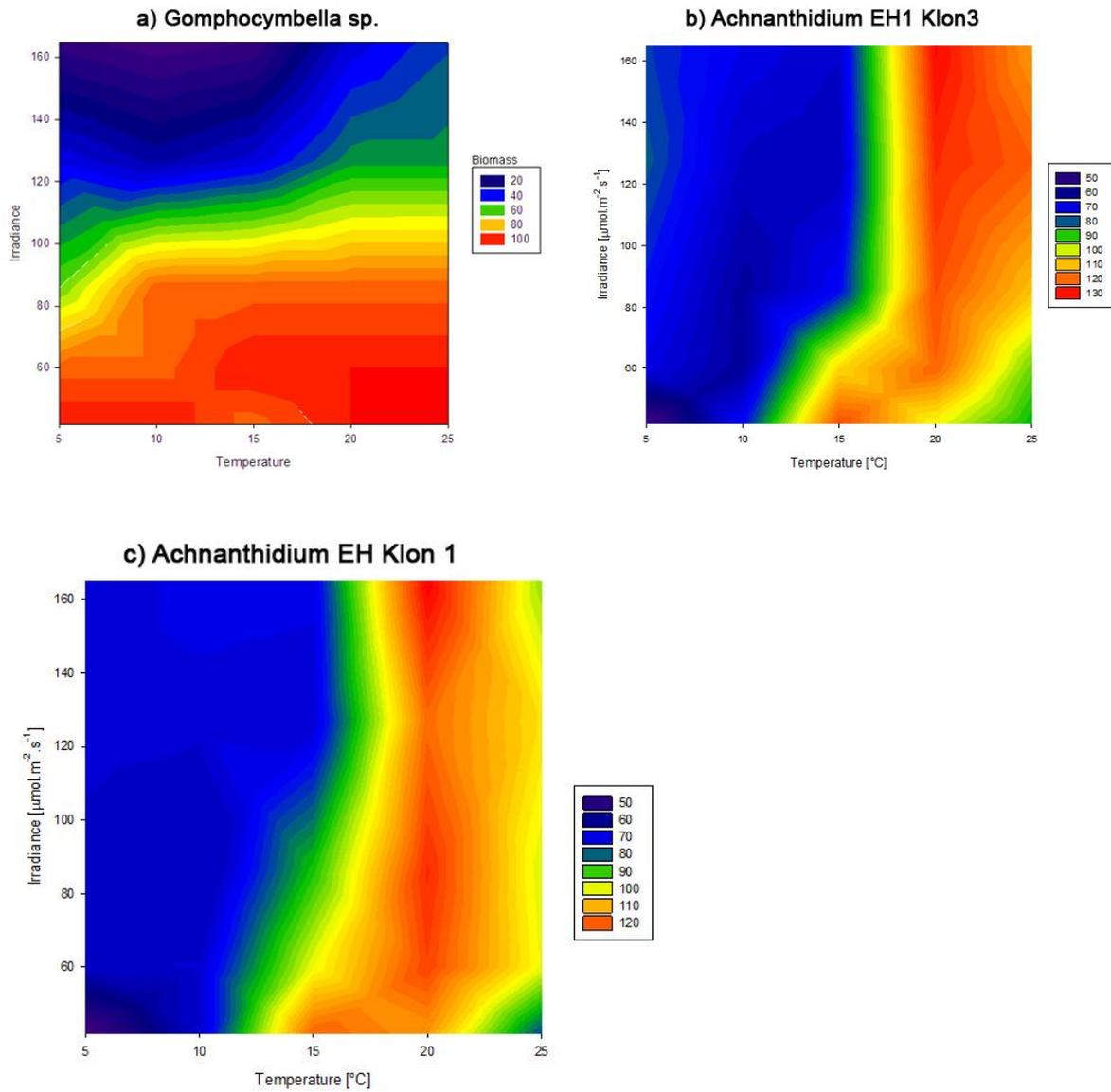
**Figure 2.** *Phormidium molle* SAG 26.99 - a graph illustrating biomass amount at the end of the cultivation period (9 days) on the crossed gradients. Maximum amount of biomass indicated in red, minimum in blue color.



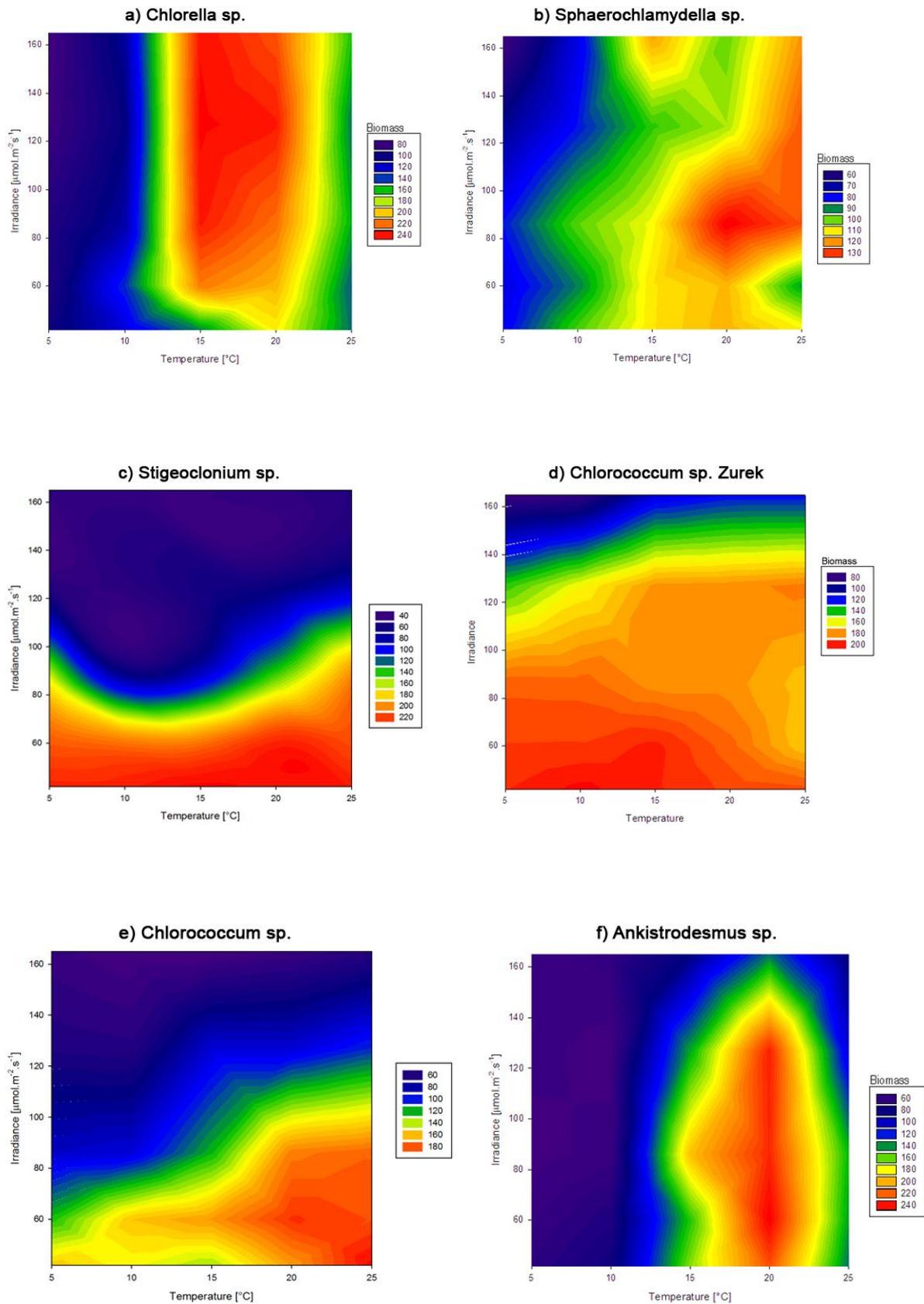
**Figure 3.** Graph illustrating biomass amount at the end of the cultivation period (15 days) on the crossed gradients in diatoms. a) *Achnanthisdium* sp. (EH1 Klon 1. b) *Nitzschia* sp. Probe 8 Klon 11. c) *Nitzschia* sp. Lovosice. d) *Navicula* sp.1 Lovosice. e) *Navicula* sp.2 Lovosice. f) *Navicula* sp.3 Lovosice. Maximum amount of biomass indicated in red, minimum in blue color.



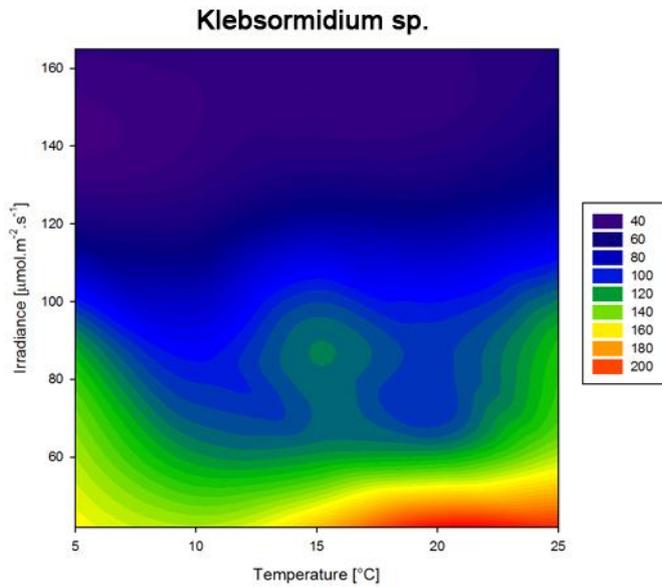
**Figure 4.** Graph illustrating biomass amount at the end of the cultivation period (15 days) on the crossed gradients in diatoms. a) *Gomphocymbella* sp. Lovosice. b) *Achnanthydium* sp. EH1 Klon 3. c) *Achnanthydium* sp. FH3 Kl. 2A.



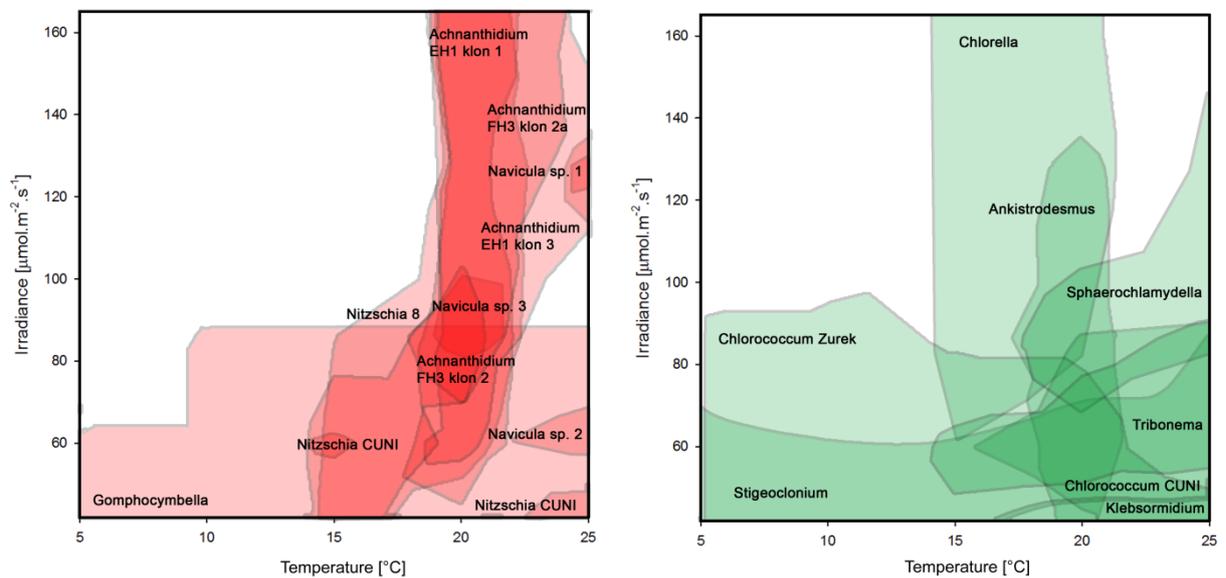
**Figure 5.** Graph illustrating biomass amount at the end of the cultivation period (9 days) on the crossed gradients in green algae. a) *Chlorella* sp. Lovosice. b) *Sphaerochlamyde* sp. Lovosice. c) *Stigeoclonium* sp. Lovosice. d) *Chlorococcum* sp. Zurek 04. e) *Chlorococcum* sp. Lovosice f) *Ankistrodesmus* sp. V.H.S. Maximum amount of biomass indicated in red, minimum in blue color.



**Figure 6.** Graph illustrating biomass amount at the end of the cultivation period (9 days) on the crossed gradients in a streptophyta alga *Klebsormidium* sp. (Lovosice). Maximum amount of biomass indicated in red, minimum in blue color.



**Figure 7.** The summary of the optimal growth conditions in diatoms and green algae. The image arose by projection of the growth optimum ranges of diatoms (green algae) into a single 2D diagram.



**Table 2.** The culture media used for maintenance, growing experiments and anti-fouling tests. BBM = Bold's basal medium.

<b>BBM - freshwater medium</b>		
<b>Component</b>	<b>Stock Solution (g·L<sup>-1</sup> of distilled H<sub>2</sub>O)</b>	<b>Quantity used for 1 L of medium</b>
<i>Macronutrients</i>		
<b>NaNO<sub>3</sub></b>	25.0	10 ml
<b>CaCl<sub>2</sub> · 2H<sub>2</sub>O</b>	2.5	10 ml
<b>MgSO<sub>4</sub> · 7H<sub>2</sub>O</b>	7.5	10 ml
<b>K<sub>2</sub>HPO<sub>4</sub> · 3H<sub>2</sub>O</b>	7.5	10 ml
<b>KH<sub>2</sub>PO<sub>4</sub></b>	17.5	10 ml
<b>NaCl</b>	2.5	10 ml
<i>Alkaline EDTA Solution</i>		1 ml
<b>EDTA</b>	50.0	
<b>KOH</b>	31.0	
<i>Boron solution</i>		1 ml
<b>H<sub>3</sub>BO<sub>3</sub></b>	11.42	
<i>Solution H-Fe</i>		1 ml
<b>FeSO<sub>4</sub> · 7H<sub>2</sub>O</b>	4.98	
<b>conc. H<sub>2</sub>SO<sub>4</sub></b>	1 ml	
<i>Trace Metal Solution</i>		1 ml
<b>ZnSO<sub>4</sub> · 7H<sub>2</sub>O</b>	8.82	
<b>MnCl<sub>2</sub> · 4H<sub>2</sub>O</b>	1.44	
<b>(NH<sub>4</sub>)<sub>6</sub>Mo<sub>7</sub>O<sub>24</sub> · 4H<sub>2</sub>O</b>	0.88	
<b>CuSO<sub>4</sub> · 5H<sub>2</sub>O</b>	1.57	
<b>Co(NO<sub>3</sub>)<sub>2</sub> · 6H<sub>2</sub>O</b>	0.49	
<b>WC – freshwater diatom medium</b>		
<b>Component</b>	<b>Stock Solution (g·100ml<sup>-1</sup> of distilled H<sub>2</sub>O)</b>	<b>Quantity used for 1L of medium</b>
<i>Macronutrients</i>		
<b>CaCl<sub>2</sub></b>	3.18	1 ml
<b>MgSO<sub>4</sub> · 7H<sub>2</sub>O</b>	3.70	1 ml
<b>NaHCO<sub>3</sub></b>	1.26	1 ml
<b>K<sub>2</sub>HPO<sub>4</sub> · 3H<sub>2</sub>O</b>	0.87	1 ml
<b>NaNO<sub>3</sub></b>	8.50	1 ml
<b>Na<sub>2</sub>SiO<sub>3</sub> · 9H<sub>2</sub>O</b>	2.84	4 ml
<i>Micronutrient Solution</i>		1 ml
<b>Na<sub>2</sub>EDTA</b>	0.436	
<b>FeCl<sub>3</sub> · 6H<sub>2</sub>O</b>	0.315	
<b>CuSO<sub>4</sub> · 5H<sub>2</sub>O</b>	0.100	
<b>ZnSO<sub>4</sub> · 7H<sub>2</sub>O</b>	0.220	
<b>CoCl<sub>2</sub> · 6H<sub>2</sub>O</b>	0.100	

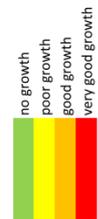
<b>MnCl<sub>2</sub> . 4H<sub>2</sub>O</b>	<i>0.018</i>	
<b>Na<sub>2</sub>MoO<sub>4</sub> . 2H<sub>2</sub>O</b>	<i>0.060</i>	
<b>H<sub>3</sub>BO<sub>3</sub></b>	<i>0.100</i>	
<b>HEPES</b>		115 mg

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**Brackish water medium with 1% Silicate**

<b>Component</b>	<b>Stock Solution (g·100ml<sup>-1</sup> of distilled H<sub>2</sub>O)</b>	<b>Quantity used for 1L of medium</b>
<i>Macronutrients</i>		
<b>KNO<sub>3</sub></b>	<i>1</i>	20 ml
<b>KHPO<sub>4</sub></b>	<i>0.1</i>	20 ml
<b>MgSO<sub>4</sub> . 7H<sub>2</sub>O</b>	<i>0.1</i>	20 ml
<i>Soil extract</i>		30 ml
<i>Micronutrient Solution</i>		5 ml
<b>ZnSO<sub>4</sub> . 7H<sub>2</sub>O</b>	<i>0.1</i>	1 ml
<b>MnSO<sub>4</sub> . 4H<sub>2</sub>O</b>	<i>0.1</i>	2 ml
<b>H<sub>3</sub>BO<sub>3</sub></b>	<i>0.2</i>	5 ml
<b>Co(NO<sub>3</sub>)<sub>2</sub> . 6H<sub>2</sub>O</b>	<i>0.02</i>	5ml
<b>Na<sub>2</sub>MoO<sub>4</sub> . 2H<sub>2</sub>O</b>	<i>0.02</i>	5ml
<b>CuSO<sub>4</sub> . 5H<sub>2</sub>O</b>	<i>0.0005</i>	1ml
<b>distilled water</b>		981ml
<b>EDTA</b>		0.8 g
<b>FeSO<sub>4</sub> . 7H<sub>2</sub>O</b>		0.7 g
<i>Distilled water</i>		450 ml
<i>Filtered seawater</i>		455 ml

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Strains	Cyanobacteria		diatoms		Trebouxiophyceae		Chlorophyceae		Streptophyta												
	Phormidium molle SAG 26.99	Phormidium molle SAG 26.99	Achnanthes minutissima SAG RJ D4 10	Achnanthes Klon 1.1	Navicula sp. 2 Lovosice	Navicula sp. 3 Lovosice	Heterochloris luteoviridis (Bottle-alga)	Chlorella sp. Lovosice	Stigeoclonium m.sp. EX 07	Chlorococcum m.sp. (Zurek)											
0	0	0	3	3	3	3	3	3	3	3	2-3	2	2-3	0	2-3	2	2-3	0	2-3	0	
1 (A4)	1	0	3	0	3	0	2-3	3	2-3	3	0	2-3	3	3	0	2-3	2	2-3	2	2-3	0
3G	0	0	1	0	3	2	2-3	3	1-2	3	3	3	3	3	3	3	3	3	3	3	3
5	3	3	3	3	3	3	2-3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
81	3	3	2-3	0-1	1	0	2	1-2	3	3	3	3	3	3	3	3	3	3	3	3	3
82	3	0-1	3	1	3	1	2	3	0	2	0	2	0	2	0	2	0	2	0	2	0
83	3	0-1	2	0-1	3	0	3	0	2-3	0	2	0	2	0	2	0	2	0	2	0	2
84	2	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3
85 (A5)	3	0-1	3	1	3	0	2-3	3	2	3	3	2	3	3	2	3	3	2	3	3	2
CT	3	0-1	3	2	3	2	2	2	3	3	3	2	3	3	3	3	3	3	3	3	3
CT (A3)	3	0-1	3	1	3	3	2-3	1	3	2	3	1	3	3	3	3	3	3	3	3	3
N2	3	1-2	3	2	3	3	3	2	3	2	3	3	3	3	3	3	3	3	3	3	3
IC-13	3	0-1	1	0	2	0	2	1	2-3	3	3	3	3	3	3	3	3	3	3	3	3
IC-14	0-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IC-17(F)	0-1	0	0-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IC-6	0-1	0	0-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IC-7	2-3	1	3	2-3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
IC-8	3	2-3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3

**Table 3.** The results of anti-fouling tests on freshwater strains. Ability of algae to grow in the culture medium (=culture) and simultaneously their ability to foul on a coating paint sample (=coat) were assessed. Four-degree scale was used: 0 – no growth (green), 1 – poor growth (yellow), 2 – good growth (orange), 3 – very good growth (red).



**Table 5.** The results of anti-fouling tests on marine strains. Ability of algae to grow in the culture medium (=culture) and simultaneously their ability to foul on a coating paint sample (=coat) were assessed. Four-degree scale was used: 0 – no growth (green), 1 – poor growth (yellow), 2 – good growth (orange), 3 – very good growth (red).

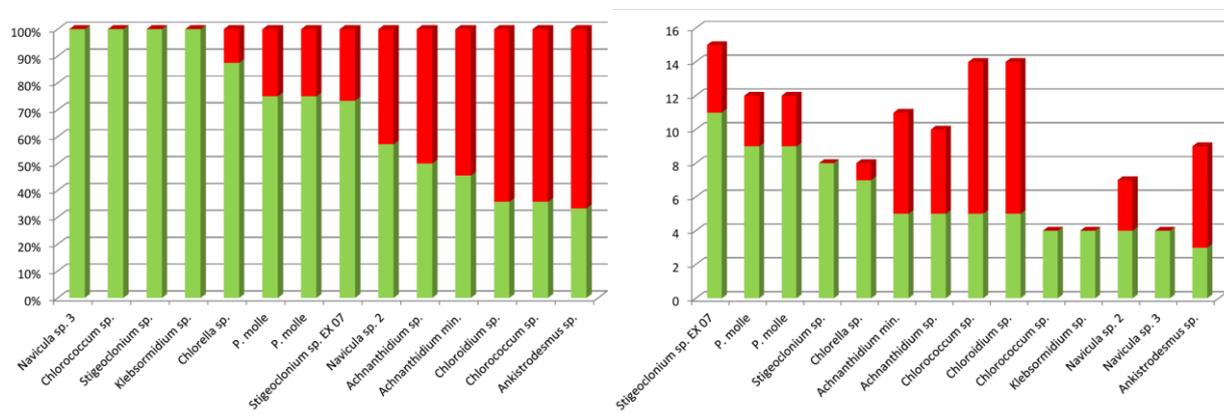
		Seawater			
		KATS09425_ K11 (sea water)		INNO N. perminuta	
Samples		culture	coat	culture	coat
	0		1-2	1	
1 (A4)		3	1		
3G		1	1		
5		2-3	1		
81		0	0	3	2
82		2-3	0	3	0
83		2-3	3	3	3
84		2	0-1	1-2	0
85 (A5)		3	3	1-2	1-2
CT		3	3		
C1 (A3)		2	0	3	1-2
N2		1	1		
IC-13		2-3	1		
IC-14		3	3		
IC-17(F)				3	3
IC-6				3	1-2
IC-7		2	0-1		
IC-8		3	0		

**Table 6.** Results of anti-fouling tests on marine strains in a 20 l aquarium and 150 ml beakers. Four-degree scale was used: 0 – no growth, 1 – poor growth, 2 – good growth, 3 – very good growth.

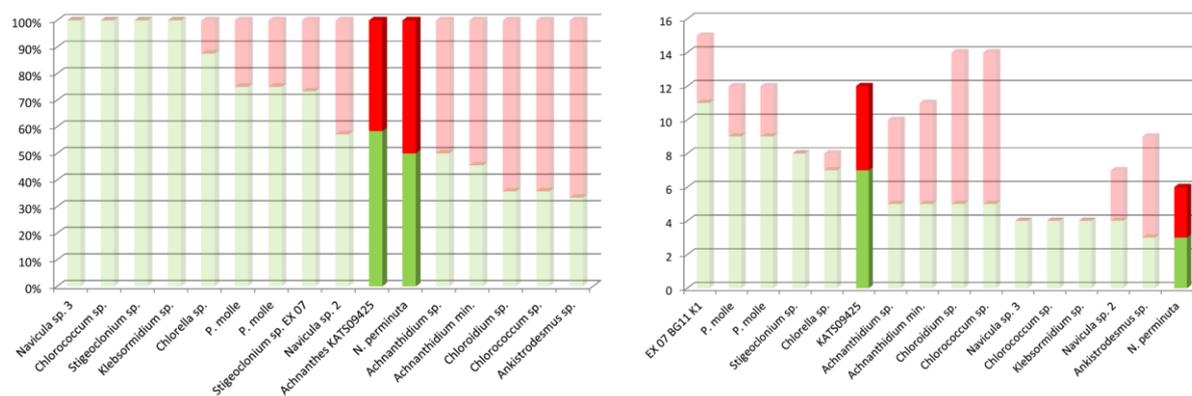
series	Aquarium test, F_camera, <i>Pseudanabaena lonchooides</i>		<i>Pseudanabaena lonchooides</i> beaker test		<i>Navicula perminuta</i> , beaker test	
	7 days	14 days	2 days	15 days	7 days	14 days
	A1	3	1	3	3	3
A2	1	1	1	1	3	1
A3	1	3	2	3	2	1
A4	3	3	3	3	3	3
A5	2	3	1	3	1	1
A6	2	3	3	1	3	3
J1	0	0	0	0	0	0
J2	1	3	0	0	0	0
J3	1	3	0	0	0	0
J4	1	3	0	0	0	0
J5	2	2	3	3	3	3
J6	2	3	1	2	1	3
J7	2	3	0	1	3	2
J8	3	3	0	1	1	1



**Figure 9.** Congruency of the results of laboratory experiments conducted on freshwater strains with the data obtained in real marine environment a) relative ratios of pass/fail in tested freshwater strains. b) absolute ratios of pass/fail in tested freshwater strains. See text for details.



**Figure 10.** Congruency of the results of laboratory experiments conducted on freshwater and marine strains with the data obtained in real marine environment (marine strains are highlighted).



**Table 8.** Species selected for IATS test technology accompanied by optimal growth conditions (temperature and light intensity) and the type of selected culture medium.

Strain	Me- dium	Isolated by	Optimal growth cond.		Anti- fouling test
			temp. °C	irradiance $\mu\text{mol.m}^{-2}.\text{s}^{-1}$	
<b>Species selected for IATS test technology:</b>					
<i>Stigeoclonium</i> sp. EX07 K01	BBM	UGOE			UGOE
<i>Phormidium molle</i> SAG 26.99	BBM	SAG strain	15	42	CUNI/ UGOE
<i>Stigeoclonium</i> sp. Lovosice	BBM	CUNI	15-25	42-60	CUNI
<i>Chlorella</i> sp. Lovosice	BBM	CUNI	15-20	86-127	CUNI
<b>Potentially good strains for IATS test technology (additional testing is required)</b>					
<i>Klebsormidium</i> sp. Lovosice	BBM	CUNI	20-25	42	CUNI
<i>Navicula</i> sp.3 Lovosice	WC	CUNI	20	86	CUNI
<i>Chlorococcum</i> sp. Zurek 04	BBM	INNOPOL	5-15	42-60	CUNI/ UGOE

Fig.11. IATS prototype tester. Front view.



Fig.12. IATS prototype tester. Mechanical construction levels.



Fig.13. Level I. XYZ robot's manipulator unit. Robotic arm.



Fig.14. Level I. XYZ robot's manipulator unit. Step motors for the X-axis (master, slave).



Fig.15. Level I. Rotary pneumatic actuator of the XYZ robot.

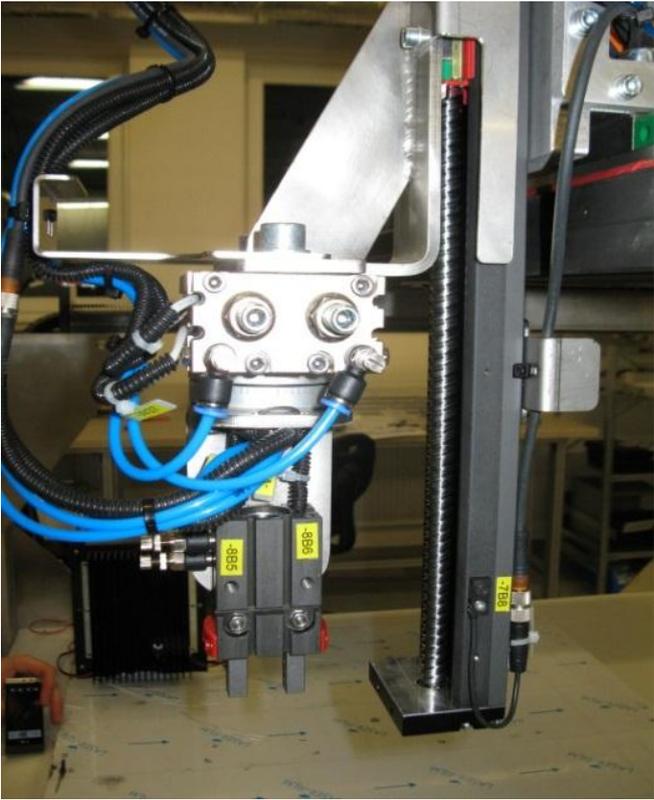


Fig.16. Level I. XYZ robot's manipulator unit. Robot's pneumatic grip.



Fig.17. Level II. Bioreactor in the docking station. View from the side. The cover contains a mechanism tightening the grip.

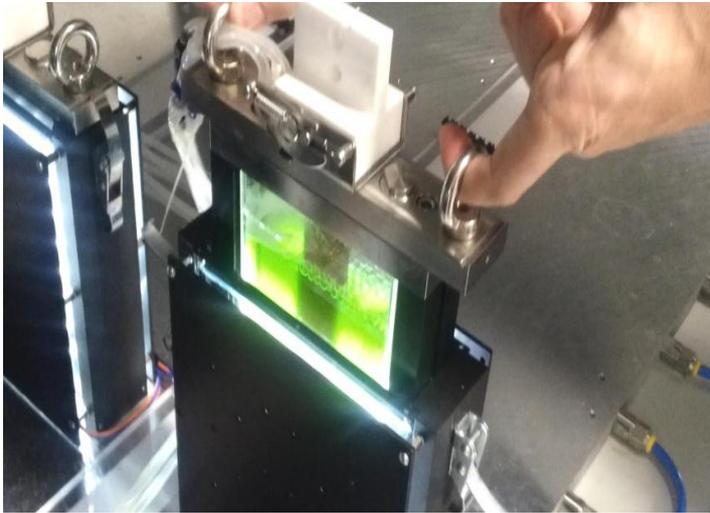


Fig.18. Level II. Detox Chamber.



Fig.19. Level II. Washing Chamber



Fig.20. Level II. Fluorcam.

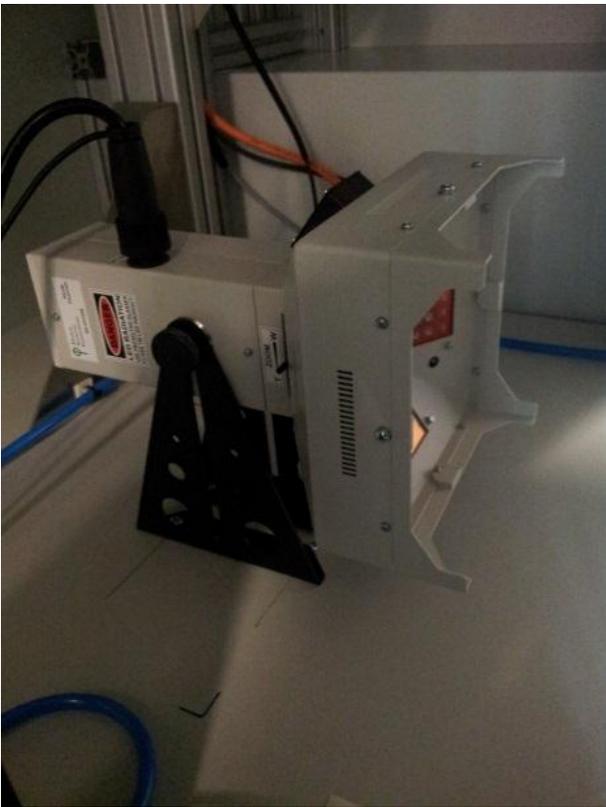


Fig.21. The principle of operation of the FluorCam device. IATS.

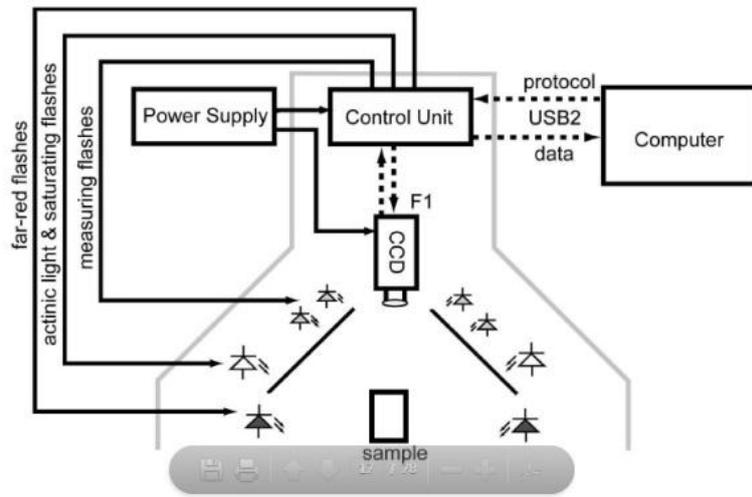


Fig. 22 Arrangement of the elements of the control box.

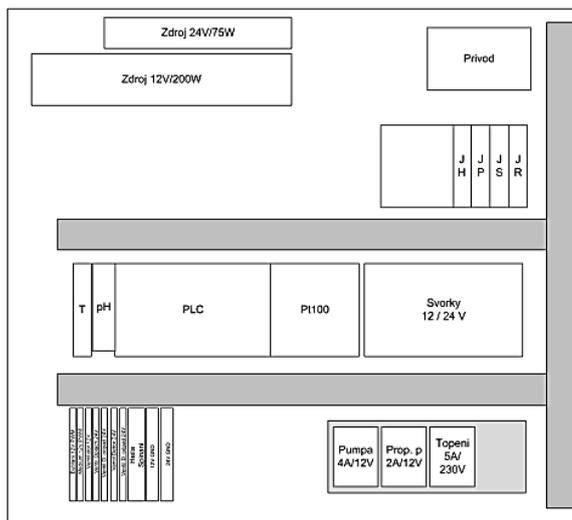


Fig. 23 Level IV. IATS prototype. Compressor



Fig. 24 Level IV. From the left: IATS computer, heat exchanger.



Fig. 25. IATS control scheme.

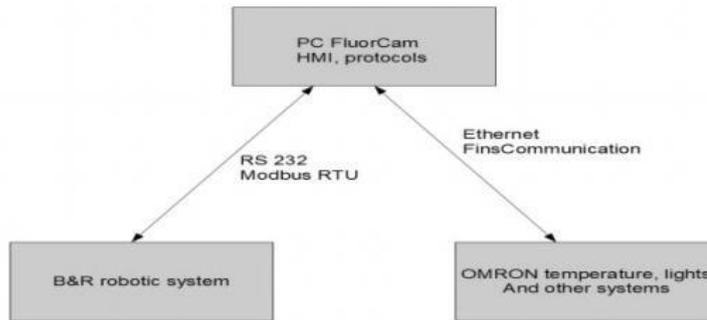


Fig. 26. IATS Management High-Level Software. Main screen.

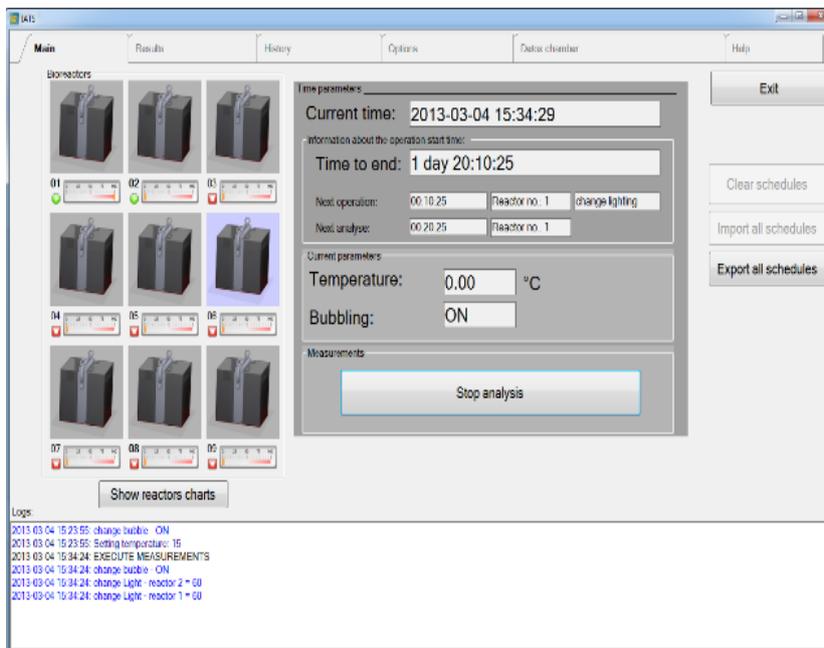


Fig. 27. Graphical interface allowing for quick programming XYZ robot's movements.

The interface displays error status for four axes:

- Bledy OS1 -X
- Bledy OS2 -X/slave/
- Bledy OS3 -Y
- Bledy OS4 -Z

Buttons: STOP OS (red), Potwierdz bledy osi (green).

Pozycja	Reaktor 1	Reaktor 2	Reaktor 3	Reaktor 4	Reaktor 5	Speed	Control
X	36328.00	36383.00	36400.00	24235.00	24380.00	0.00	<<< JOG OS X >>>
Y	2980.00	14690.00	26390.00	3020.00	14750.00	11420.00	<<< JOG OS Y >>>
Z - GORA	0.00	0.00	0.00	0.00	0.00	7970.00	<<< JOG OS Z >>>
Z - SRODEK	3000.00	3000.00	3000.00	3000.00	3000.00		
Z - DOL	14380.00	14380.00	14380.00	14380.00	14380.00		

Pozycja	Reaktor 6	Reaktor 7	Reaktor 8	Reaktor 9	Reaktor 10	Speed	Control
X	24410.00	12290.00	12400.00	12432.00	0.00	0.00	MM->UNIT
Y	26500.00	3090.00	14820.00	26520.00	0.00	0.00	UNIT->MM
Z - GORA	0.00	0.00	0.00	0.00	0.00	0.00	Predkosc OS X
Z - SRODEK	3000.00	3000.00	3000.00	3000.00	0.00	0.00	Jazda na pozycje
Z - DOL	14380.00	14380.00	14380.00	14380.00	0.00	0.00	Przejazd odcinka

Pozycja	Reaktor 11	Reaktor 12	Reaktor 13	Reaktor 14	Reaktor 15	Speed	Control
X	0.00	0.00	0.00	0.00	0.00	0.00	MM->UNIT
Y	0.00	0.00	0.00	0.00	0.00	0.00	UNIT->MM
Z - GORA	0.00	0.00	0.00	0.00	0.00	0.00	Predkosc OS Y
Z - SRODEK	0.00	0.00	0.00	0.00	0.00	0.00	Jazda na pozycje
Z - DOL	0.00	0.00	0.00	0.00	0.00	0.00	Przejazd odcinka

Pozycja	Kamera	Przed kamera	Spryskiwacz	REZERWA	Speed	Control
X	0.00	0.00	0.00	0.00	0.00	MM->UNIT
Y	6181.00	11420.00	17978.00	0.00	0.00	UNIT->MM
Z - GORA	0.00	0.00	0.00	0.00	0.00	Predkosc OS Z
Z - SRODEK	15000.00	15000.00	0.00	0.00	0.00	Jazda na pozycje
Z - DOL			14380.00	0.00	0.00	Przejazd odcinka

0,0,0 Y  
GORA  
SRODEK  
DOL  
Z  
X  
Kierunki osi

EKRAN MODBUS

**Movie – IATS tester prototype:** <http://www.youtube.com/watch?v=yNTcgpcQupY>