

# Donetsk national technical university



**TATU**   
EU TEMPUS Project 2013-2016

## TATU in DonNTU: challenges and advantages

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Speakers :

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# TATU in DonNTU: challenges and advantages



## Challenges

- Forced relocation of the Donetsk National Technical University to the city of Krasnoarmeysk:
  - inability to bring all the types of lab equipment, documents and books;
  - almost complete upgrade of the DonNTU TATU team;
  - loss of contacts with enterprises which used to be our partners;
- Restart of TATU project work in February, 2015.

# TATU in DonNTU: challenges and advantages

## GM3, Villach, February, 2015







# TATU in DonNTU: challenges and advantages

## DonNTU TATU team



### Advantages

- Possibility for the development and training of the university staff.
- Invaluable experience of teamwork, especially with international partners.
- Implementation of advanced automation technologies in teaching and research.
- A new level of students training while using TSL.
- Co-operation with new partners for introduction and use of modern means of automation and staff training.
- Development e-learning courses and virtual lab

# TATU in DonNTU: challenges and advantages

## TATU 2nd Training in Ivano-Frankivsk





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## Our TSL's







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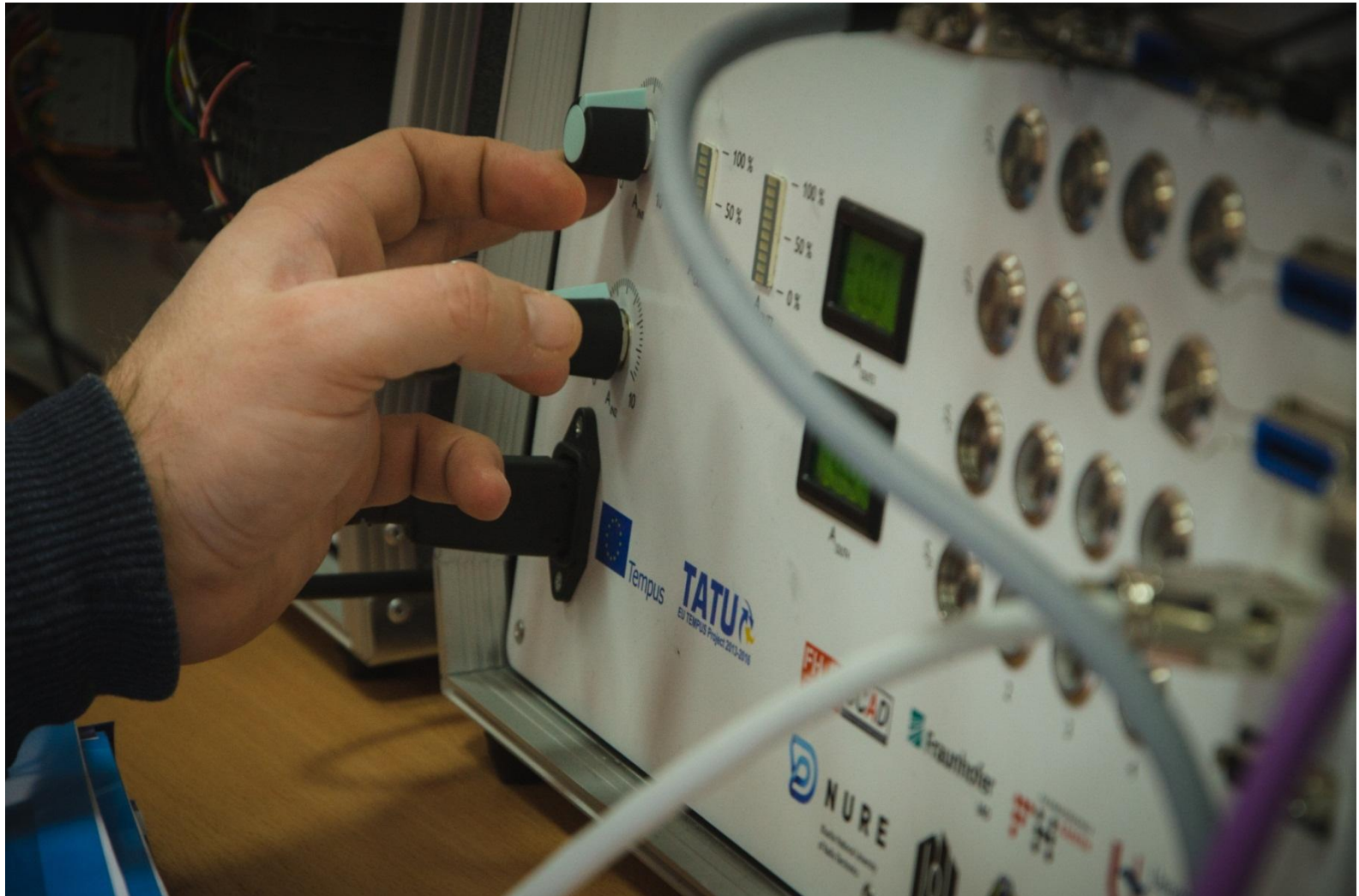
## Discussing TATU issues in DonNTU





# TATU in DonNTU: challenges and advantages

## How does it work?



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## Discussing TATU issues in DonNTU



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# TATU in DonNTU: challenges and advantages

## Broad discussion



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## TATU dissemination





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## Students training



11.02.2016



# TATU in DonNTU: challenges and advantages

## Students training



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## Laboratory work

Subject: Development of automation system for mine drainage installation

Objective: To obtain skills of development and implementation of automation systems based on TSL

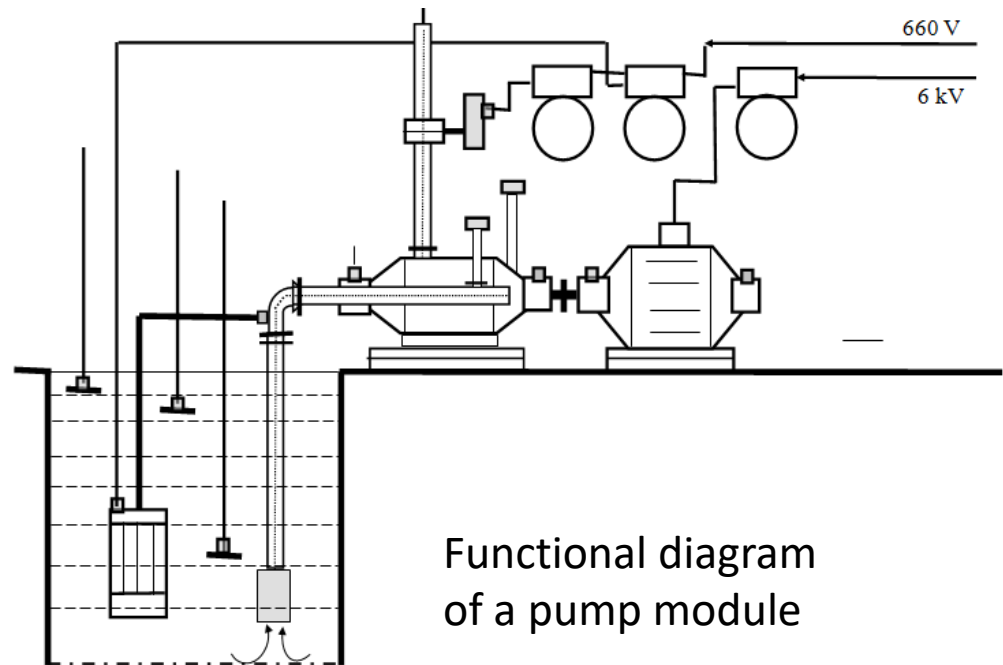
### The order of performance

#### 1. General information about the control object

Mine drainage installation equipped with powerful pumps. Drive motors with feed voltage of 6 kV.

The water rises to the height of 1200 m.

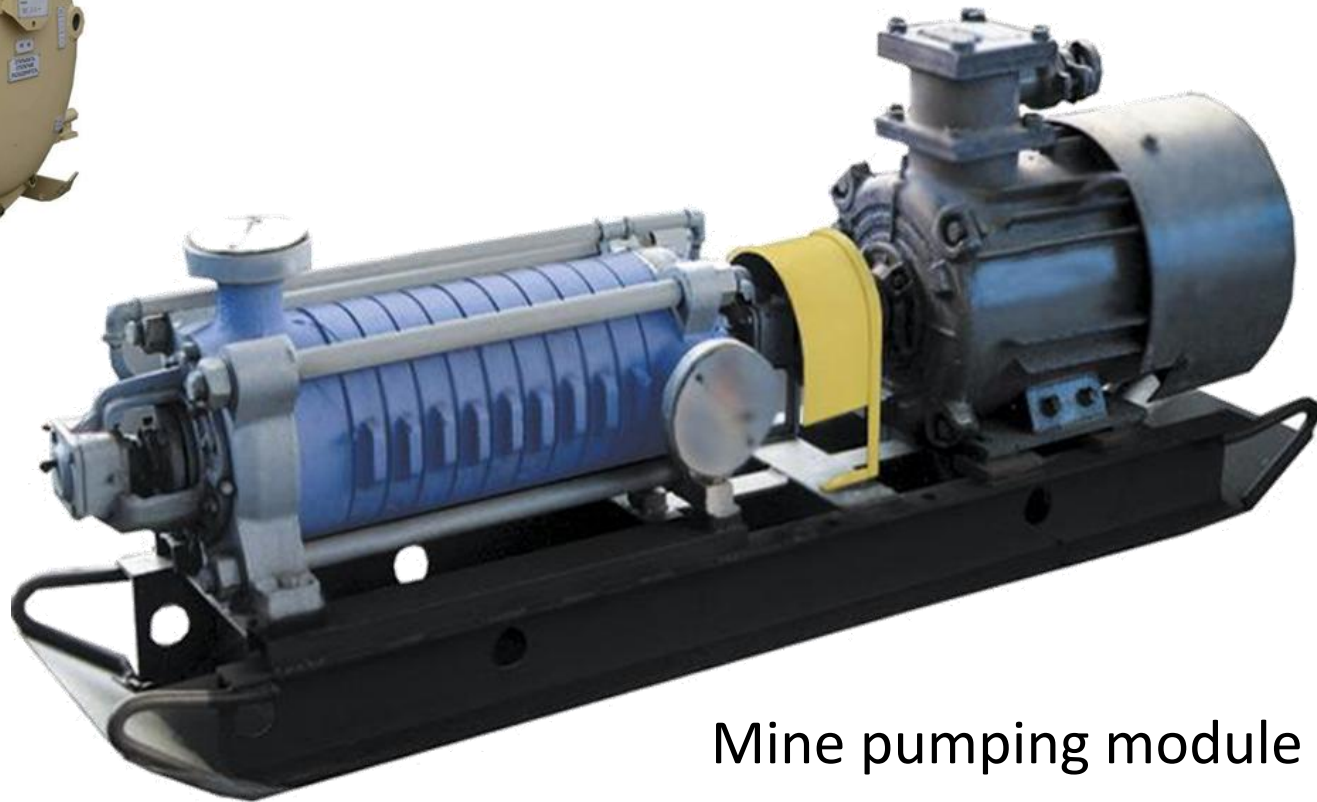
Drainage installation must include at least 3 pumps.



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High-voltage  
explosion-proof  
switching device



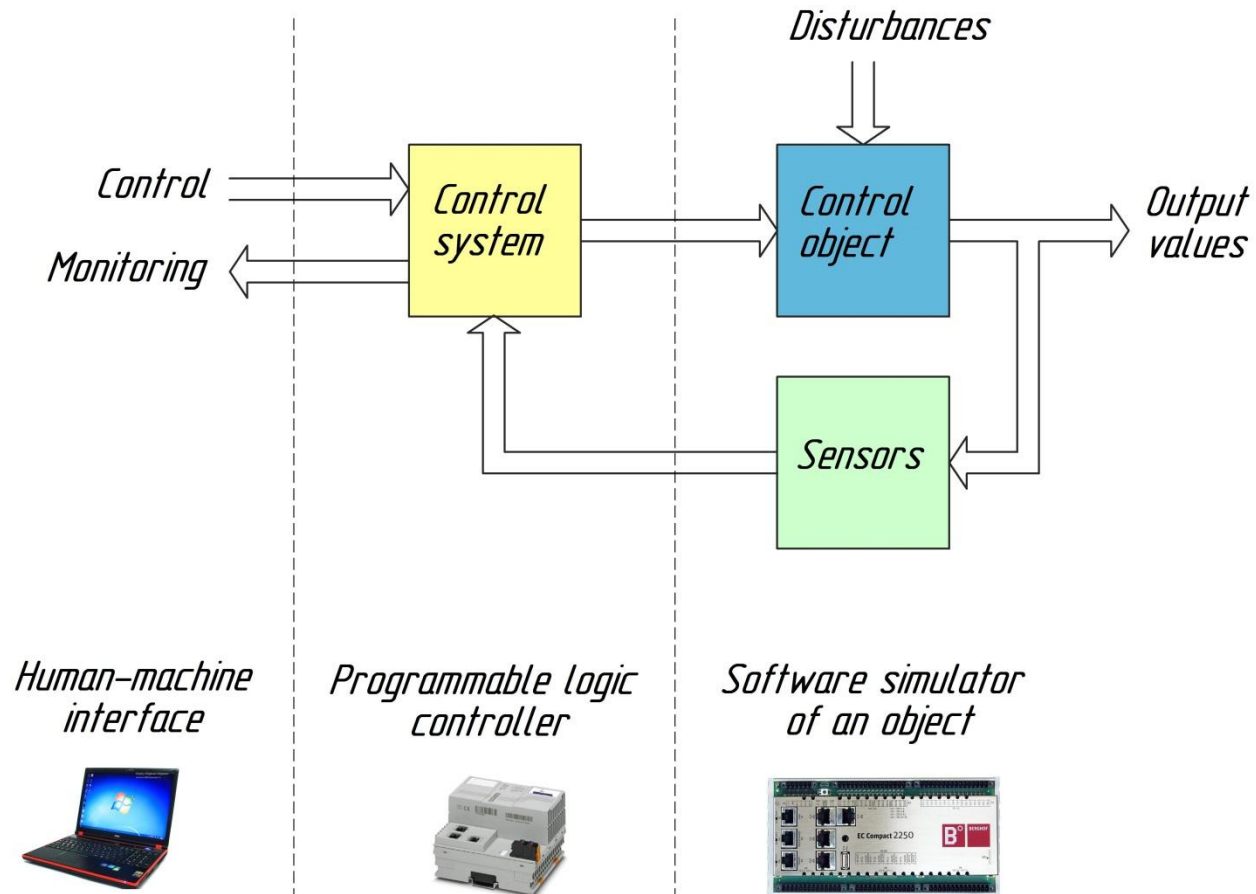
Mine pumping module



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## 2. The general structure of the control system

- The control device is based on PLC
- The control object is simulated by Berghof EtherCAT Compact-Controller
- HMI is implemented via web



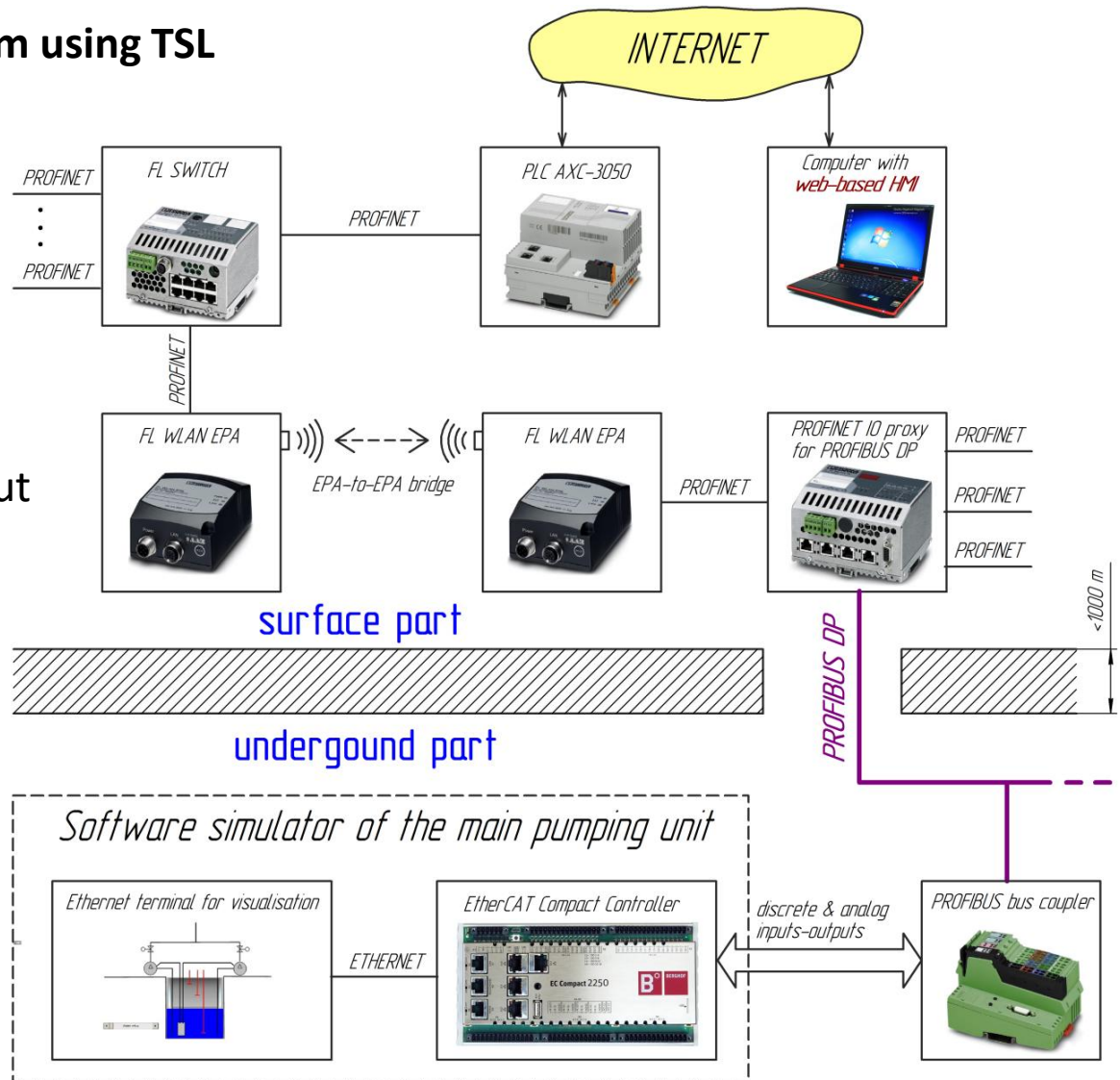
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## 3. Design of the control system using TSL

The surface part of the control system uses **PROFINET** and wireless network technology.

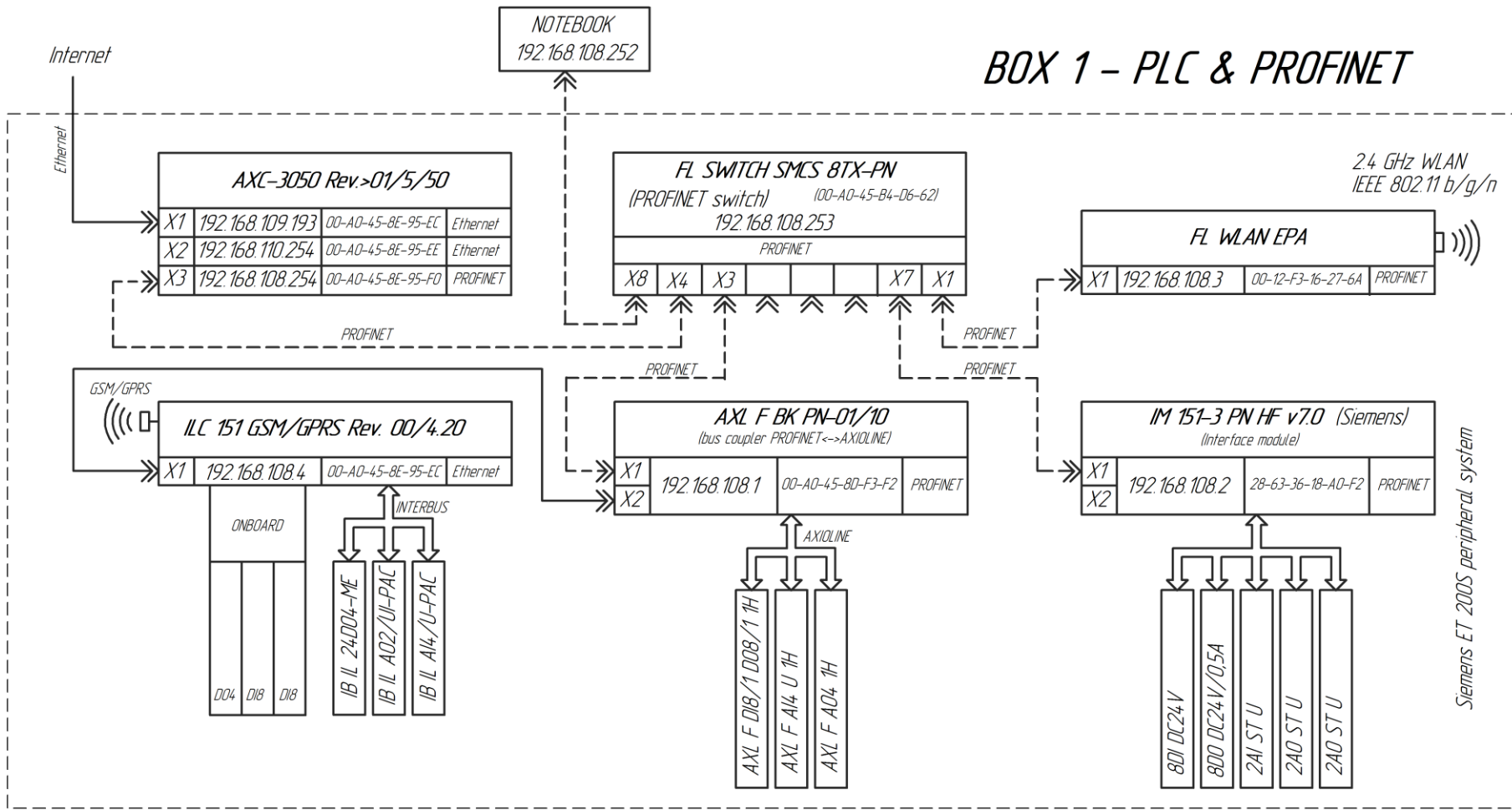
Communication with the underground part is carried out via **PROFIBUS DP**.

The networks are connected using PROFINET IO proxy for PROFIBUS DP.



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## 4. The following scheme is used for configuration of the PROFINET-devices

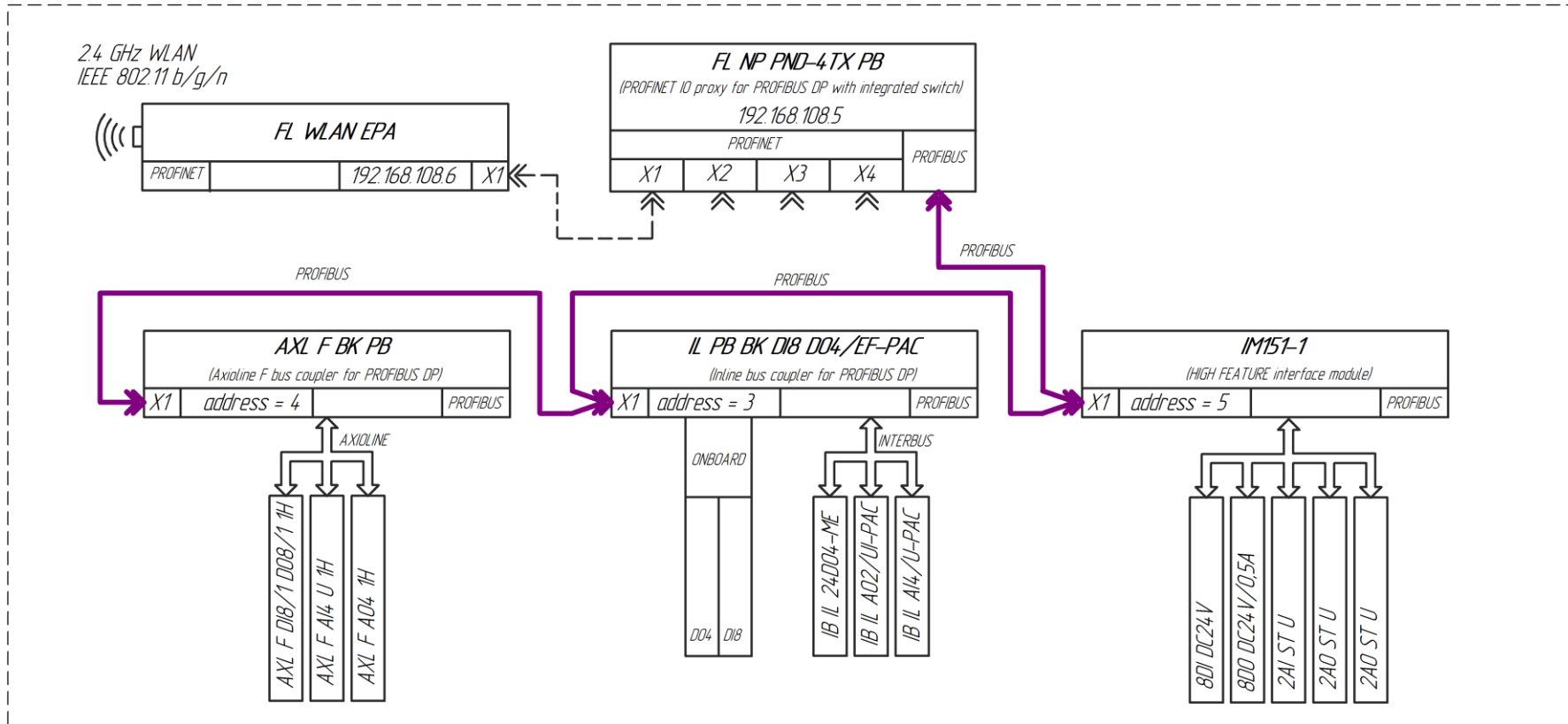




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## 5. The following scheme is used for configuration of the PROFIBUS-devices

BOX 2 - PROFIBUS



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## 6. Programming of the AXC-3050 controller in PC Worx environment using FBD language

The screenshot displays the PC WORX software environment for programming an AXC-3050 controller. The main workspace shows a Function Block Diagram (FBD) with the following components and connections:

- Inputs:** bit0, bit1, and bit2.
- Logic:** AND and EQ blocks are used to combine bit inputs. For example, bit0 and bit1 are ANDed and compared with LowLevel and HighLevel constants. Bit2 is compared with EmLevel.
- Coils:** RS\_2 (SET Q1, RESET 1) and RS\_3 (SET Q1, RESET 1) are set by the logic. TON\_2 (TON IN Q, PT ET) and TON\_3 (TON IN Q, PT ET) are timer coils.
- Outputs:** Motor1, Motor2, and EmLevel are controlled by the logic. Motor1 and Motor2 are controlled via MOVE blocks and BOOL\_TO\_BYTE blocks. EmLevel is controlled via a MOVE block.
- Constants:** (\*LowLev\*), (\*HighLev\*), (\*6vr0\*), (\*6vr1\*), and cons2 are used throughout the diagram.

The interface also shows a Project Tree Window on the left, a Message Window at the bottom with the following text:

```

Generating IEC code for RESOURCE 'STD_RES' ...
Building instance tree for RESOURCE 'STD_RES' ...
----- Generating specific Code for CONFIGURATION STD_CNF -----
----- Generating specific Code for RESOURCE STD_RES -----
0 Error(s), 9 Warning(s)

```

The bottom status bar indicates "For Help, press F1" and "188,49 E: >2GB".

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## 7. Simulation of the object in CoDeSys

The screenshot displays the CODESYS environment for a PLC project named 'Proj1'. The main workspace shows a ladder logic program for 'PLC\_PRG'. The program includes a variable declaration 'VAR INTEG1: INTEGRAL;' and a network of logic involving multiplication (MUL), addition (ADD), subtraction (SUB), division (DIV), and an integral block (INTEGRAL). The integral block has inputs for 'INTEGRAL', 'OUT', and 'OVERFLOW', and an output 'REAL\_TO\_WORD'. Below the main network, there are two comparison blocks (GT) for 'LowLev' and 'HighLev'. The left sidebar shows the project tree with 'Application' and 'MainTask' selected. The right sidebar contains a 'Панель инструментов' (Toolbox) with various symbols for logic and math. The bottom status bar shows 'Последняя компиляция: 0 ошибок, 0 предупреждений, 0 сообщений' and 'Текущий пользователь: (никто)'.



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## 8. Visualization of the control object in CoDeSys

The screenshot shows the CODESYS environment with a project named 'Proj1'. The main workspace displays a visualization of a control object, which is a tank with two pumps and a 'Water influx' input. The left sidebar shows the project tree with 'Application' and 'VISU\_TASK' folders. The right sidebar shows the 'Properties' panel for the selected element, listing various attributes like 'Name', 'Type', 'Value', and 'Position'.

Свойство	Значения
Имя элем...	GenElemInst_85
Тип элем...	Полоса прокрутки
Значение	pritok
Минимал...	10
Максимал...	150
Размер ст...	
Прокрутка...	<input checked="" type="checkbox"/>
<b>Позиция</b>	
X	19
Y	412
Шири...	219
Высота	23
<b>Линейка</b>	
Орие...	Горизонтально
Напра...	Слева направо
<b>Тексты</b>	
Текст	Water influx
Подск...	
<b>Перемен...</b>	
Невид...	
Откл...	

Это свойство содержит имя экземпляра, который будет представлять выбранный визуальный элемент в визуализации.

Панель инструментов Свойства

Сообщения - всего 0 ошибок, 0 предупреждений, 0 сообщений

Список перекрёстных ссылок

X : 858, Y : 265

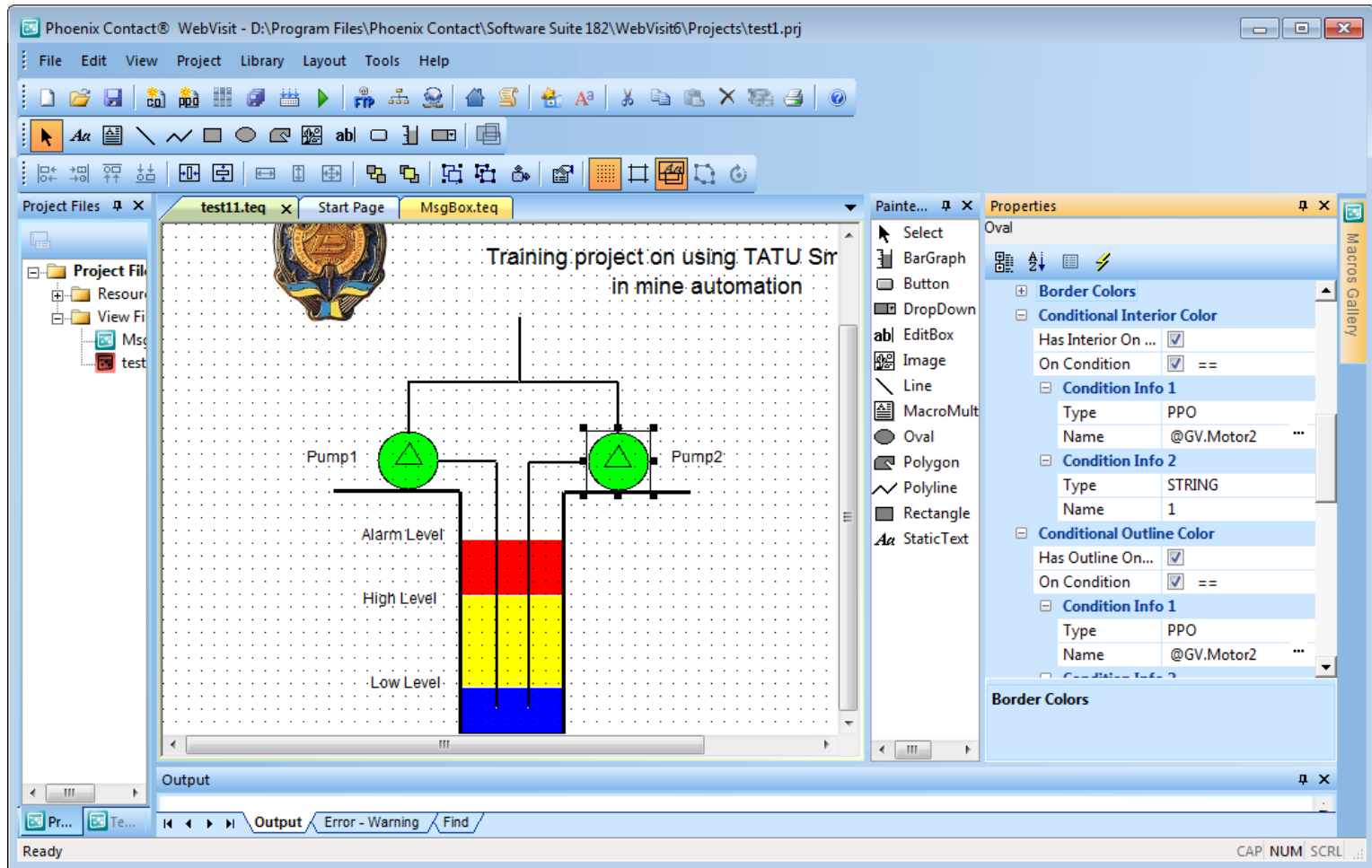
Последняя компиляция: 0 0 0

Предкомпил.: ✓

Текущий пользователь: (никто)

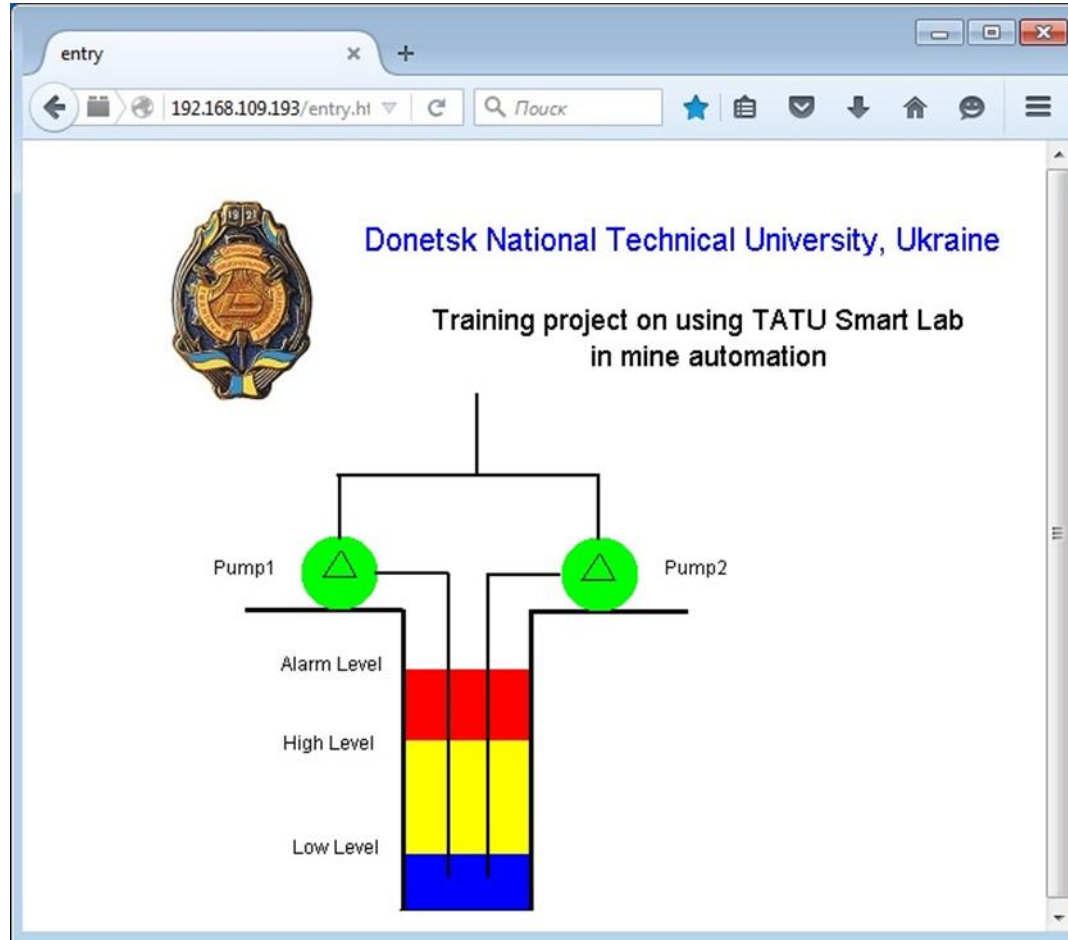
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## 9. Design of the web-based interface using WebVisit (PHOENIX CONTACT)



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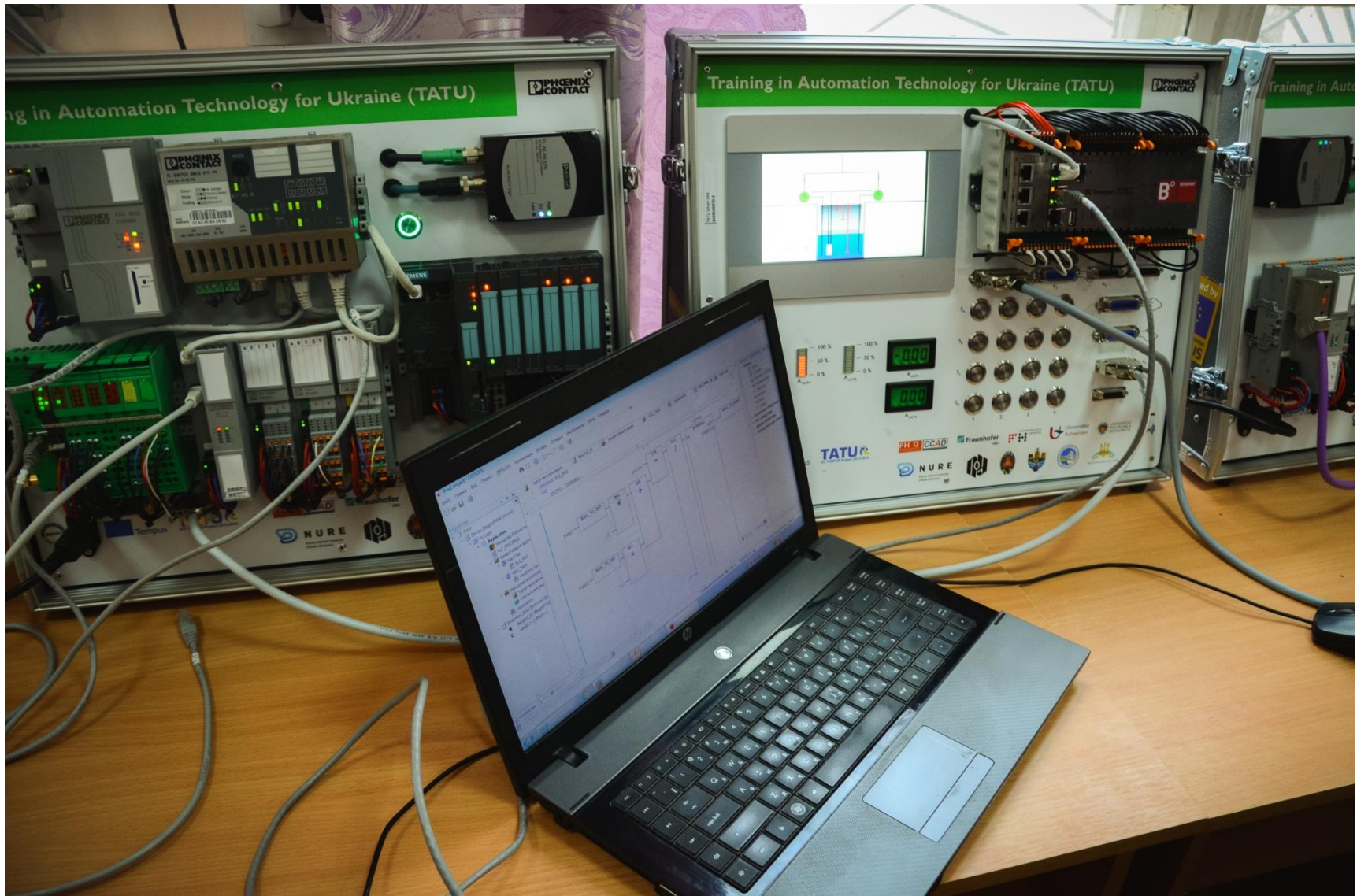
## HMI of the control system in the web-browser



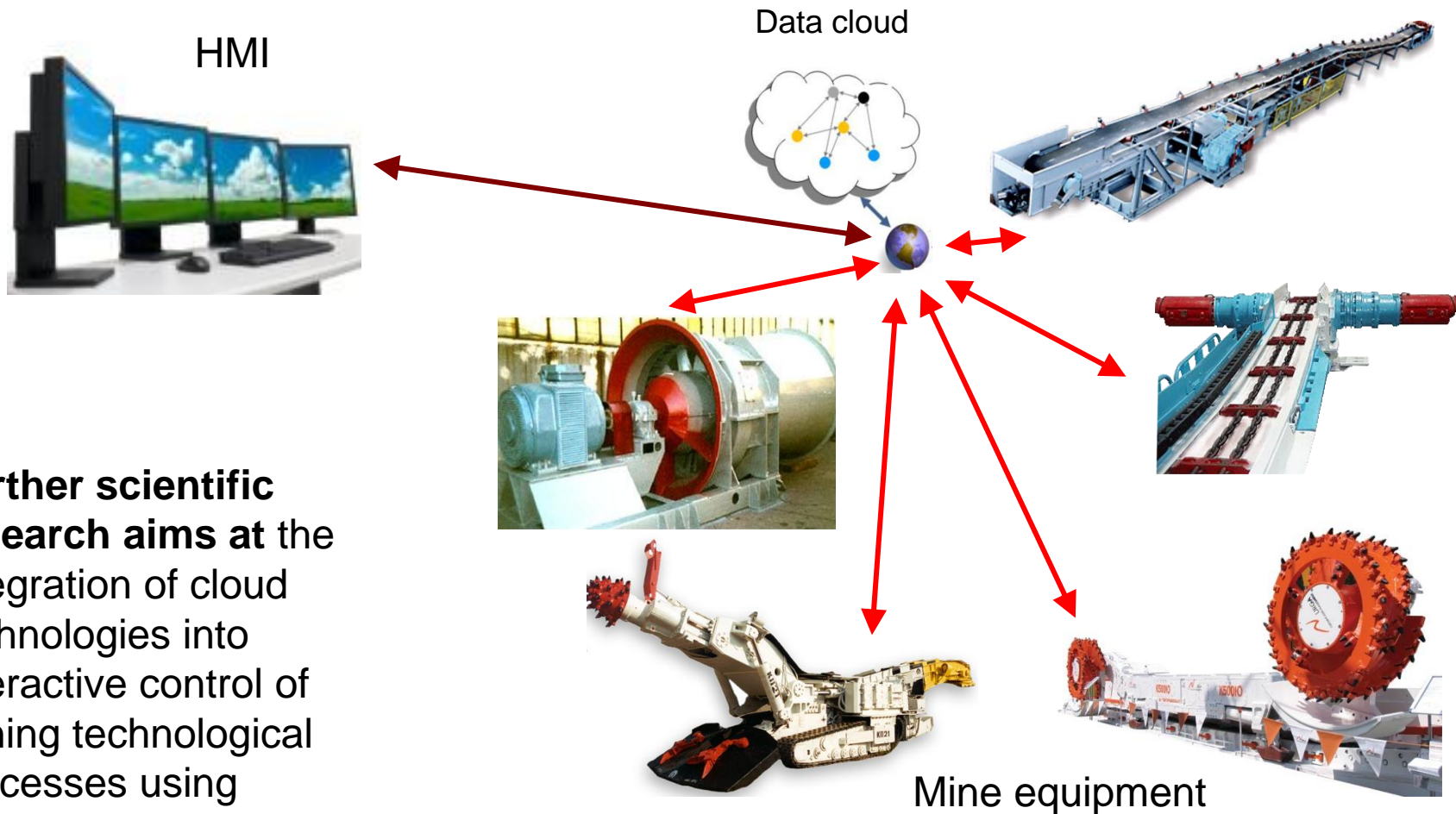


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**Further scientific research aims at the integration of cloud technologies into interactive control of mining technological processes using INDUSTRY4.0**

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*Thanks for your attention!*



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