

Prediction and Mitigation of Methane Explosions Effects for Improved Protection of Mine Infrastructure and Critical Equipment



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I N S T Y T U T
G Ó R N I C T W A

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Experimental Mine 'Barbara' - history

The Experimental Mine 'Barbara' was founded in 1925 and its main functions were to be the Central Office of Mining Rescue and the Magnetic Observatory. Since the end of the Second World War, the mine has worked as one of the main components of the project of the Central Mining Institute to improve the security and the speed of removing dust and gas hazards, which often occur in mines.



Scope of Activities in Experimental Mine 'Barbara'

- research in the field of dust and methane explosions as well as fire hazards in mines
- new mining technologies
- testing of prototype equipment in underground conditions

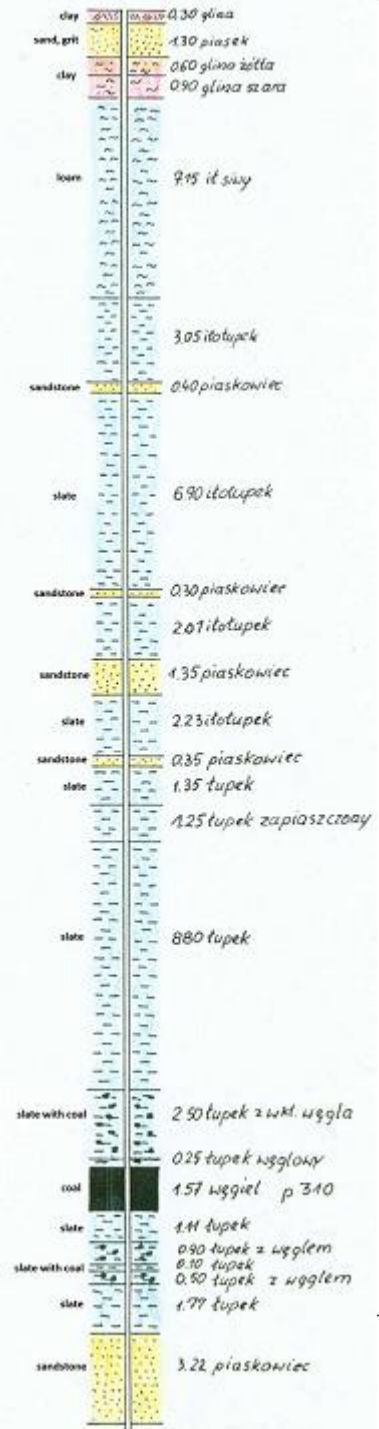




The greatest assets of EM „Barbara” are:

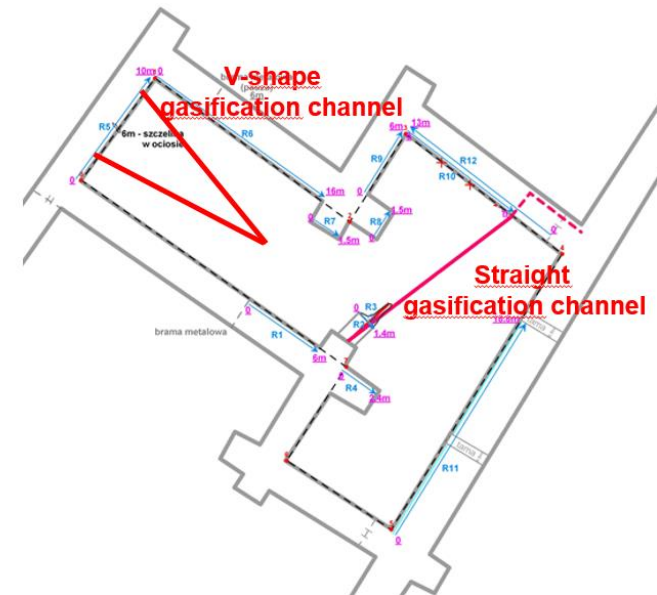
- scientific and technical personnel
- possibility to perform research works and large scale tests
- location, construction and equipment of workings



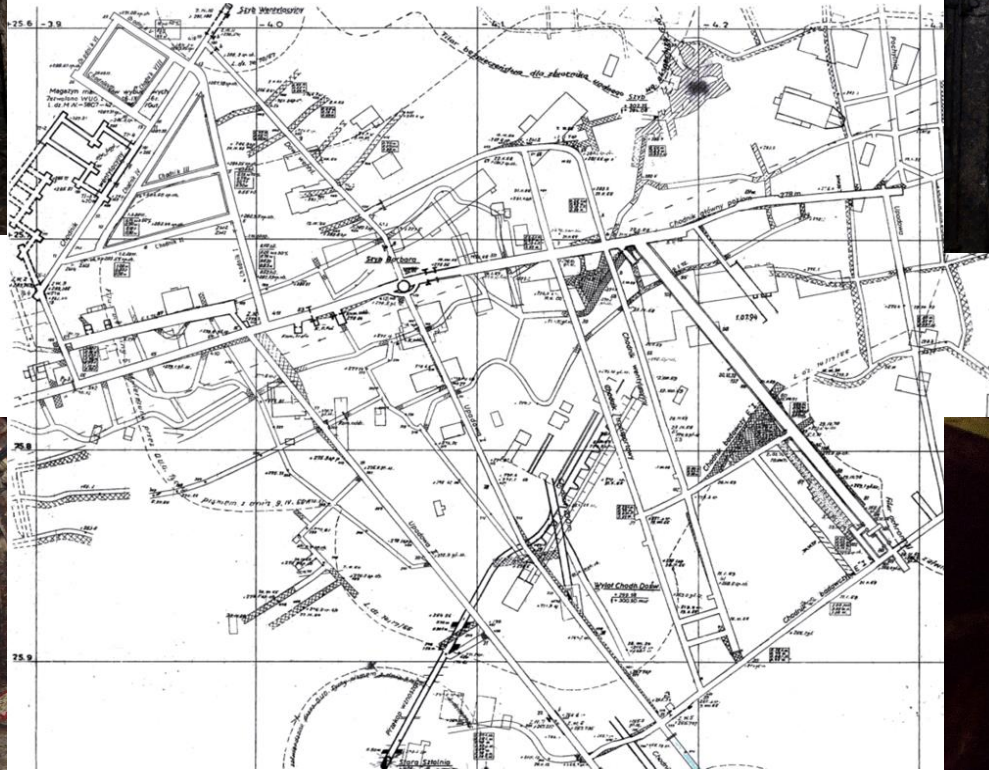


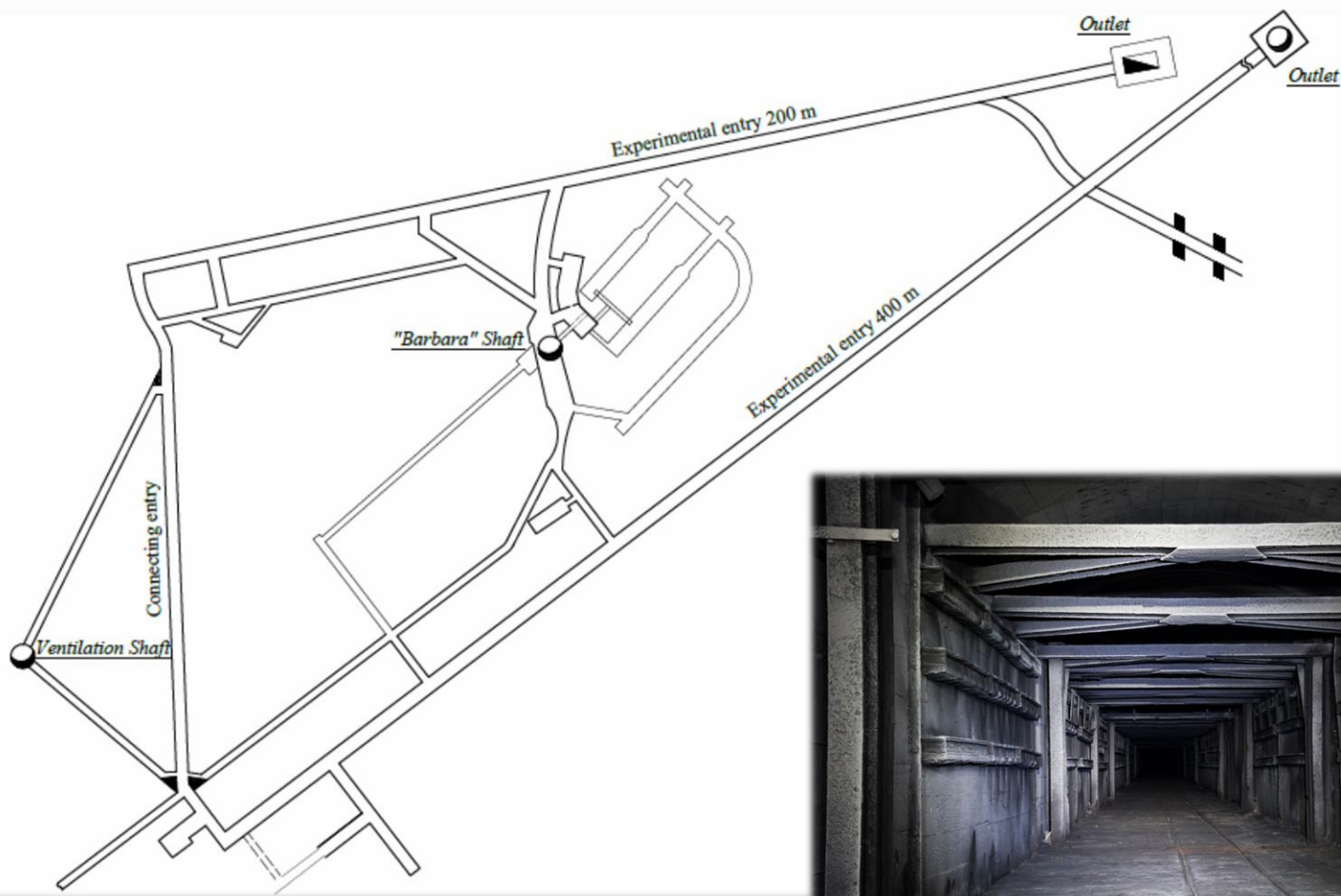
There are two levels in Experimental Mine 'Barbara': 30 m and 46 m underground.

As the mine used to be an ordinary coal mine in the 20s all of the galleries on that level are drilled in a coal seam. It is there, that all the mining solutions and machinery are being tested.



Level 30m





Level 46m



All the experiments related to explosions, fire and gas research are conducted at 46m

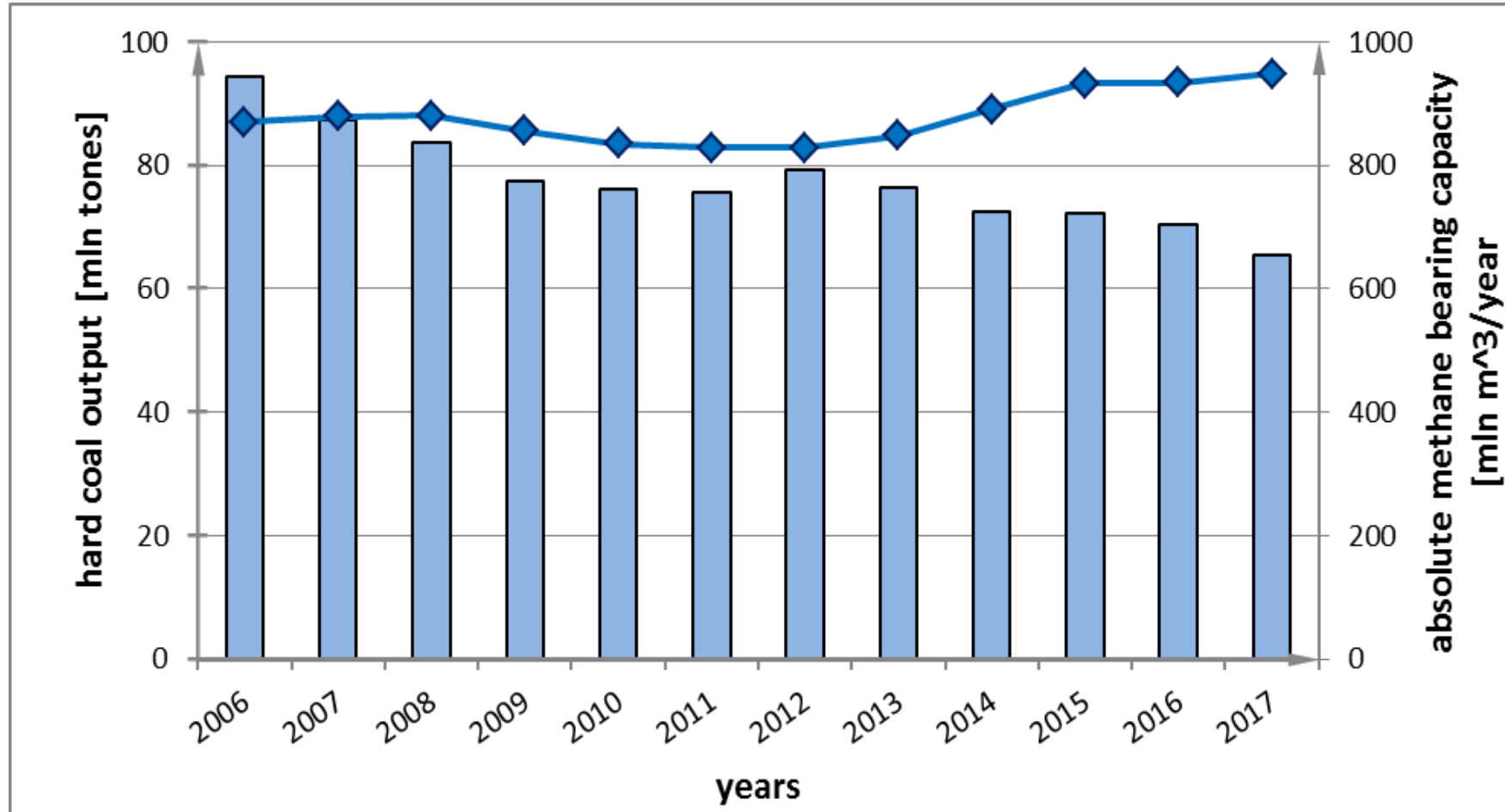
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EXPRO

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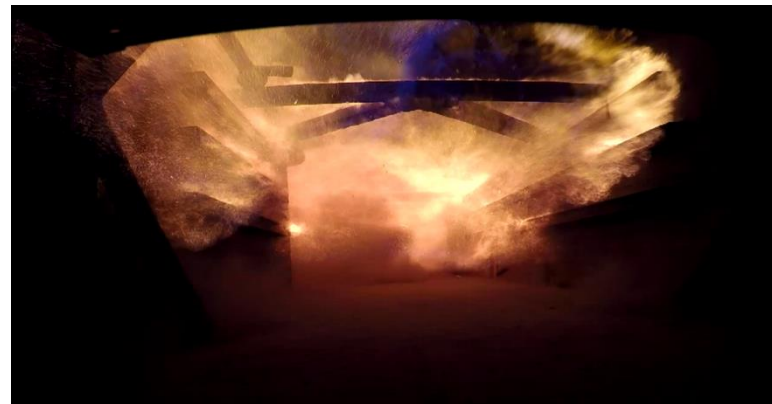
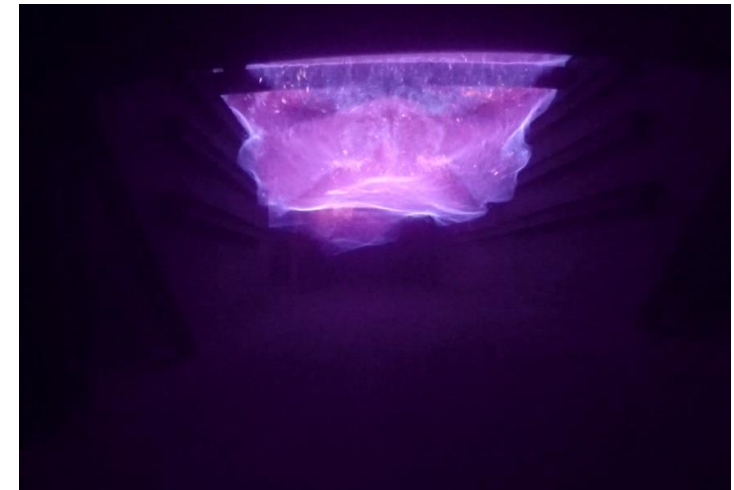


Absolute methane bearing capacity and coal production output in Polish hard coal mines in the years 2006-2017

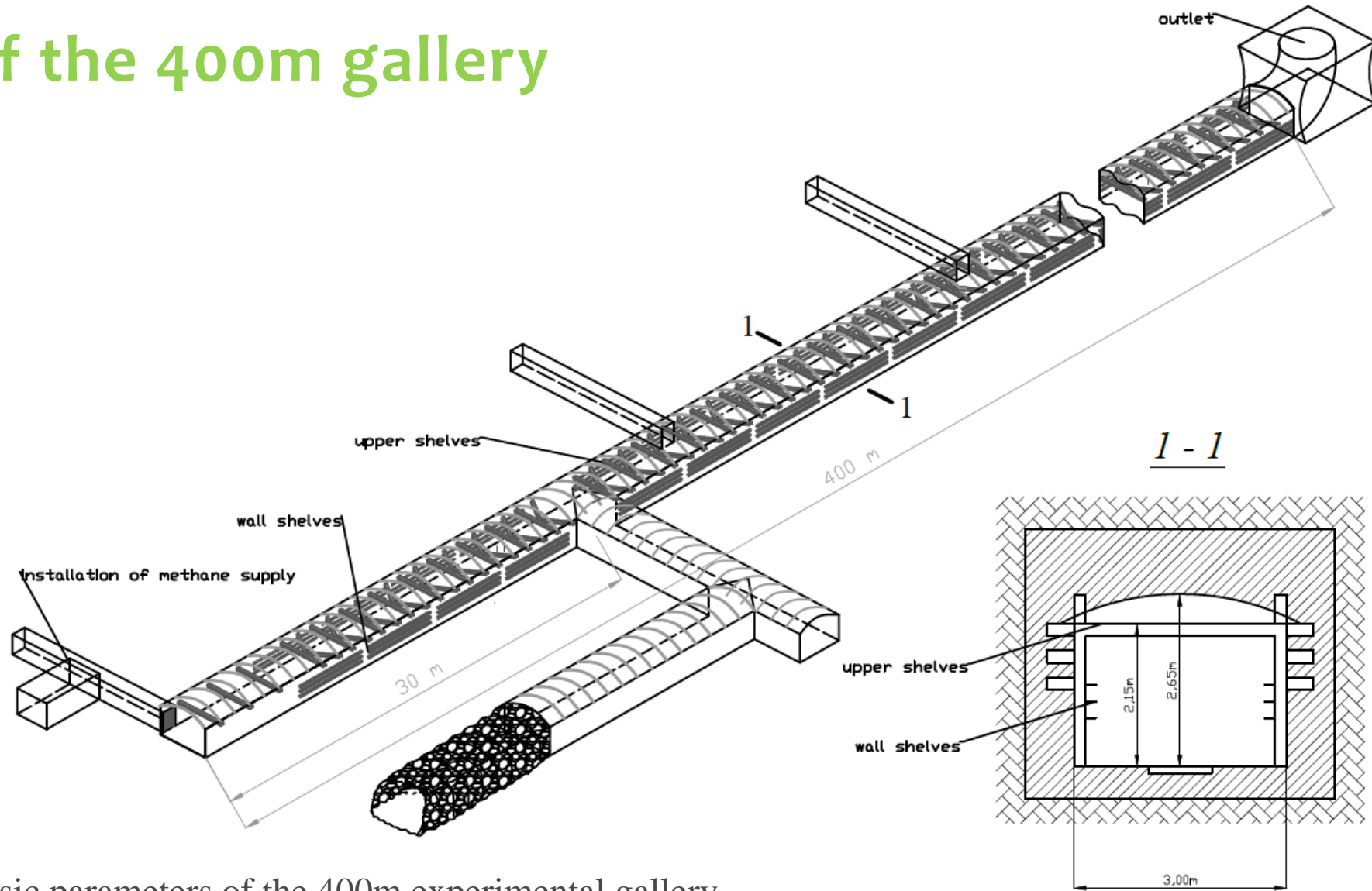


Some of the main aims of the **EXPRO** project were to:

- obtain a better understanding of the mechanical and thermal effects caused by methane explosions, by developing numerical models of explosions in different mine geometries and conditions, which were validated with real scale explosion tests
- differentiate the basic parameters of methane explosions and burnings, caused by slow and fast release



Outline of the 400m gallery



Outline and basic parameters of the 400m experimental gallery

Site of the experiments



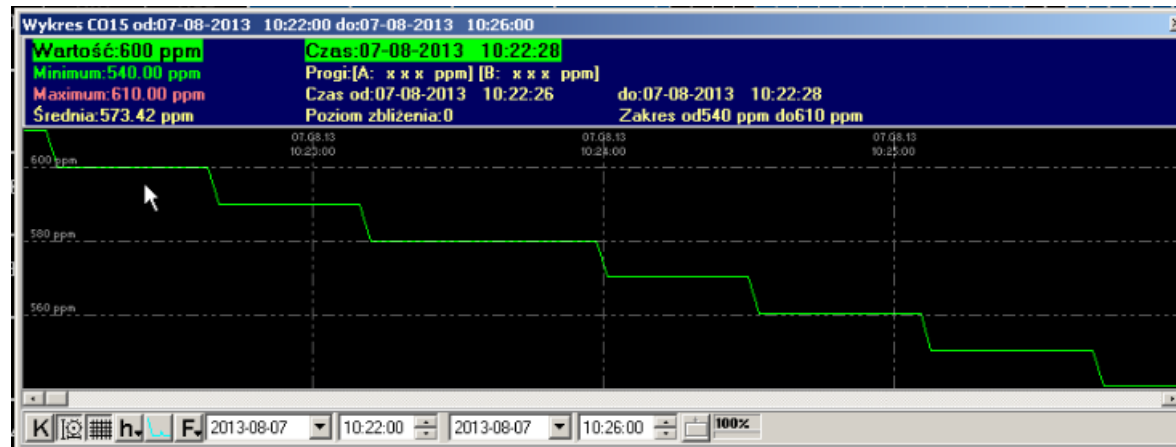
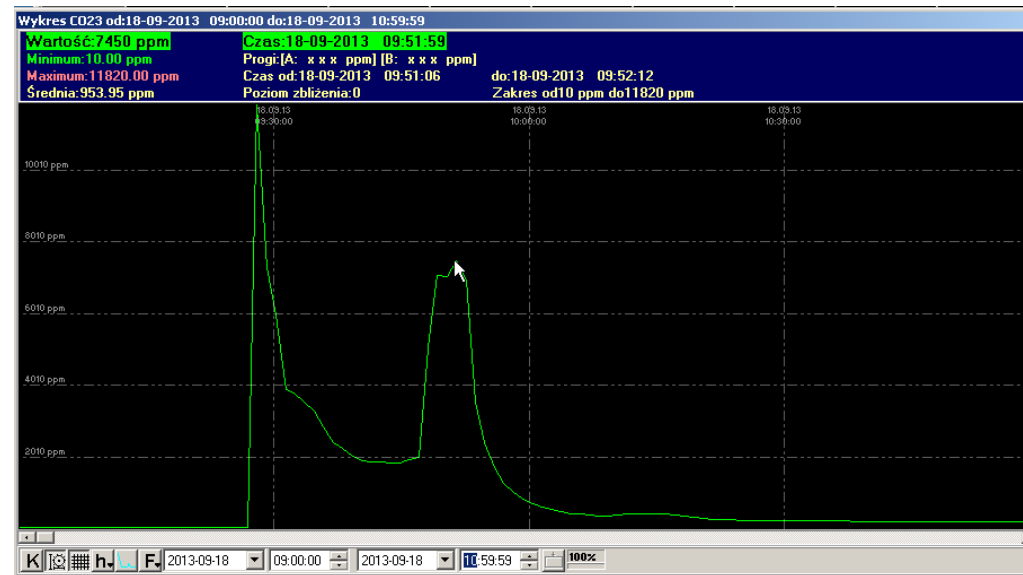
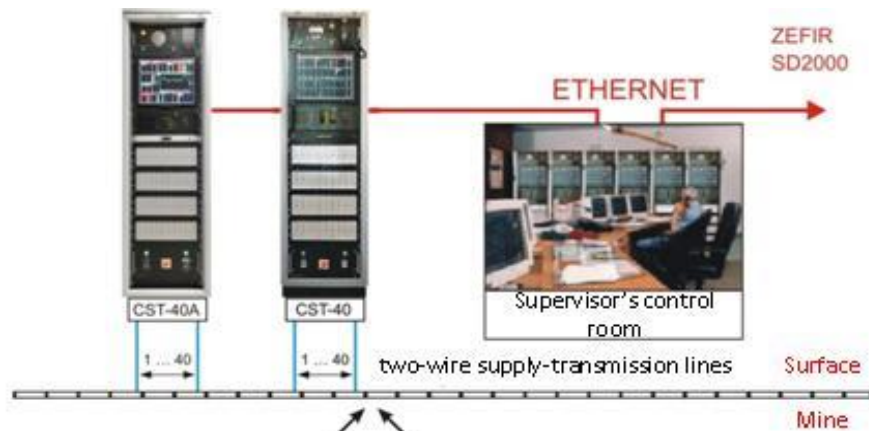
Real scale tests conditions of 400 m gallery

Site of the experiments



Measurement system – methane sensor

Gas and air monitoring system

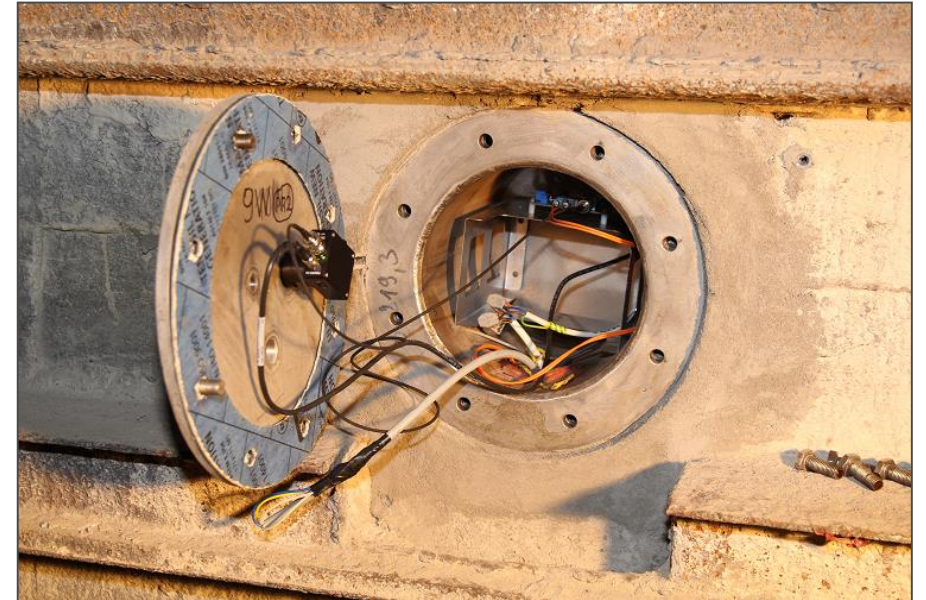




Site of the experiments

Regarding industrial safety tests, research tunnels equipped with modern measurement systems make it possible to obtain various parameters of physical phenomena, dust and gas explosions as well as fires.

There is also an integrated monitoring system on the surface and visualization of the development of the experiments.

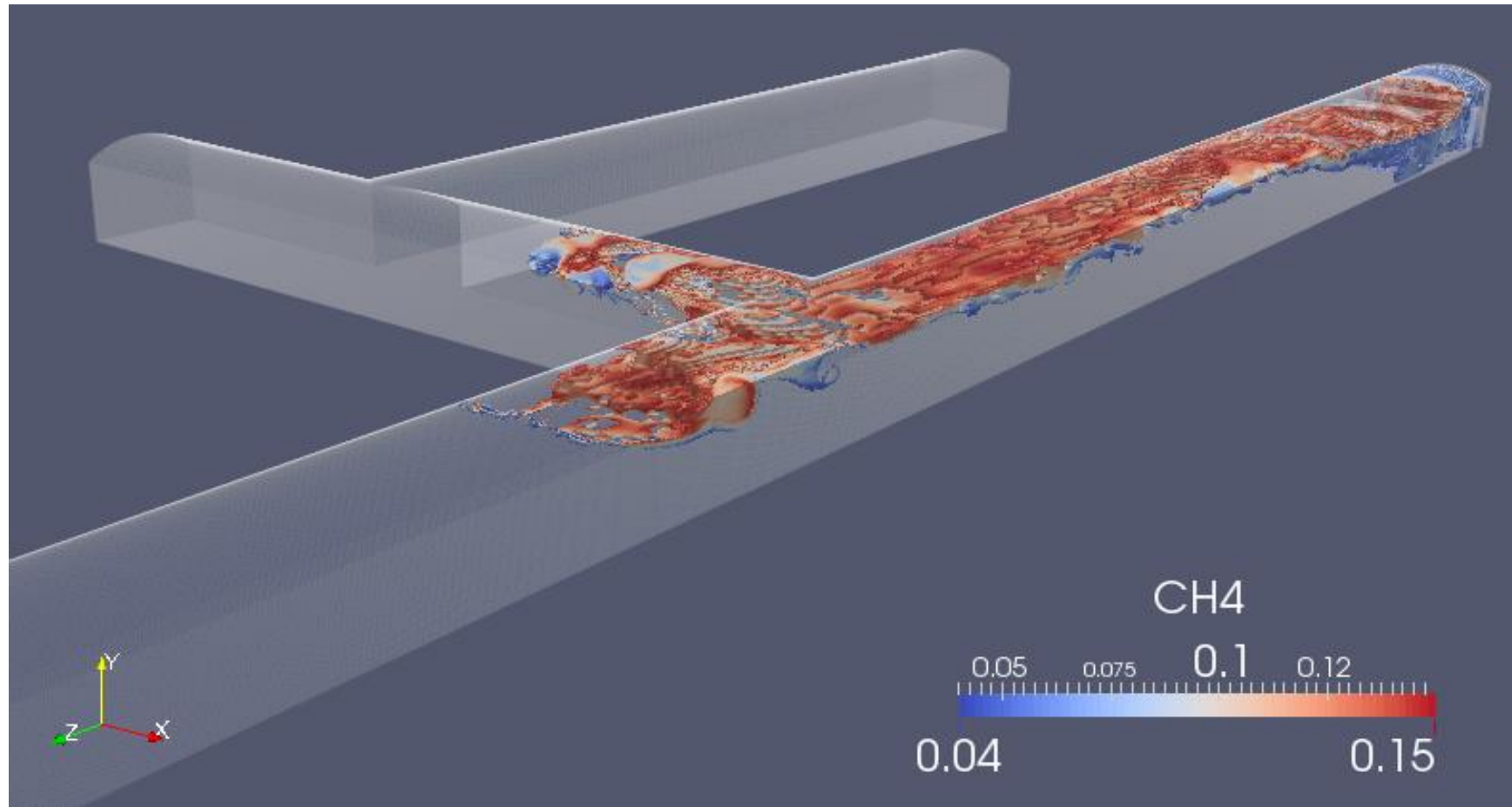


Methane supply system



Underground methane supply chamber

Modelling of methane distribution for real scale tests conditions



Distribution of methane under given conditions of ventilation in 400m gallery

Methane burnings and explosions short video



Research of methane explosions



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CENTRAL MINING INSTITUTE

Experimental Mine *Barbara*

Underground Research Department

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Methane release in 400 m gallery under different conditions

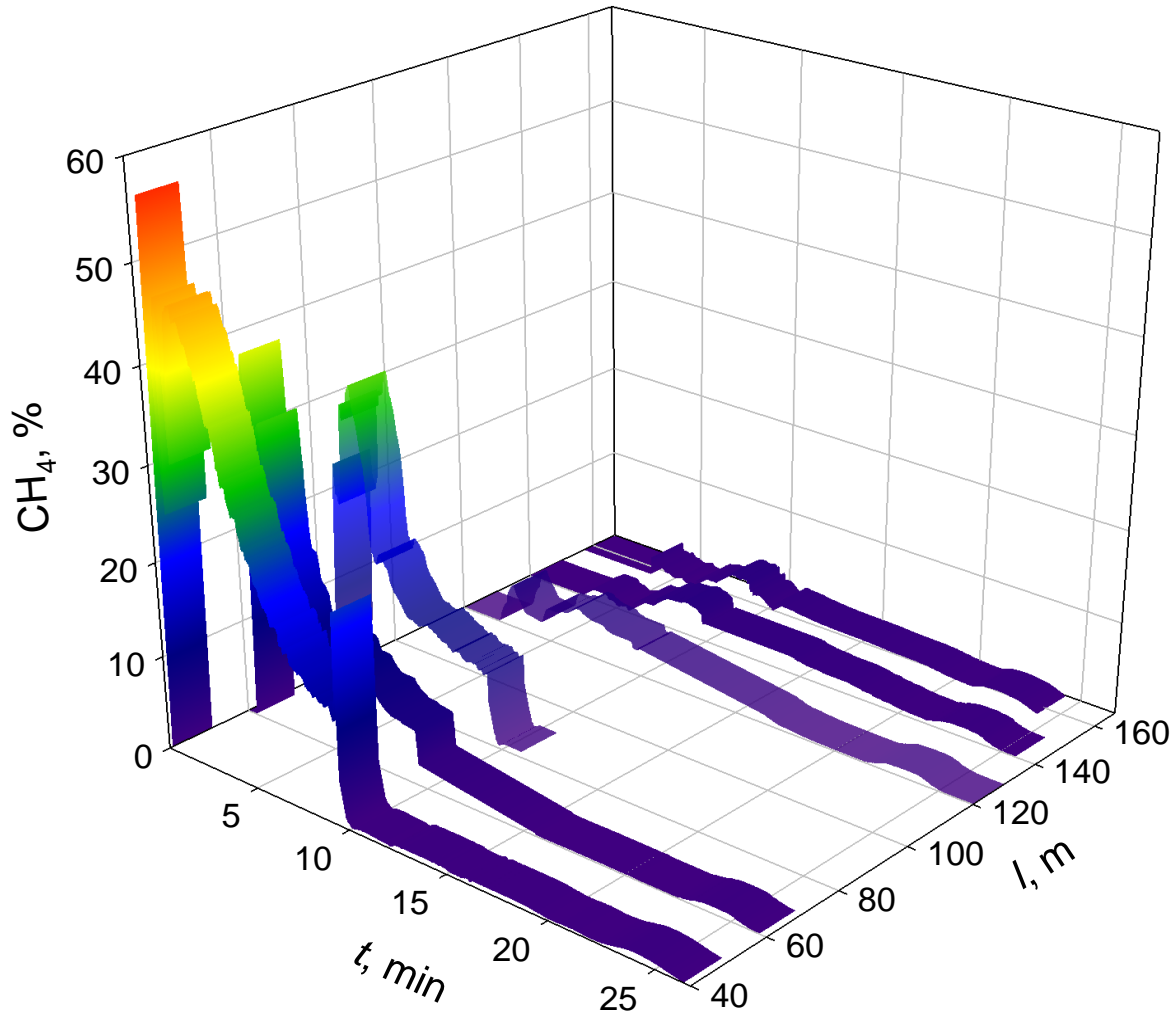


Fast release of methane using plastic bag

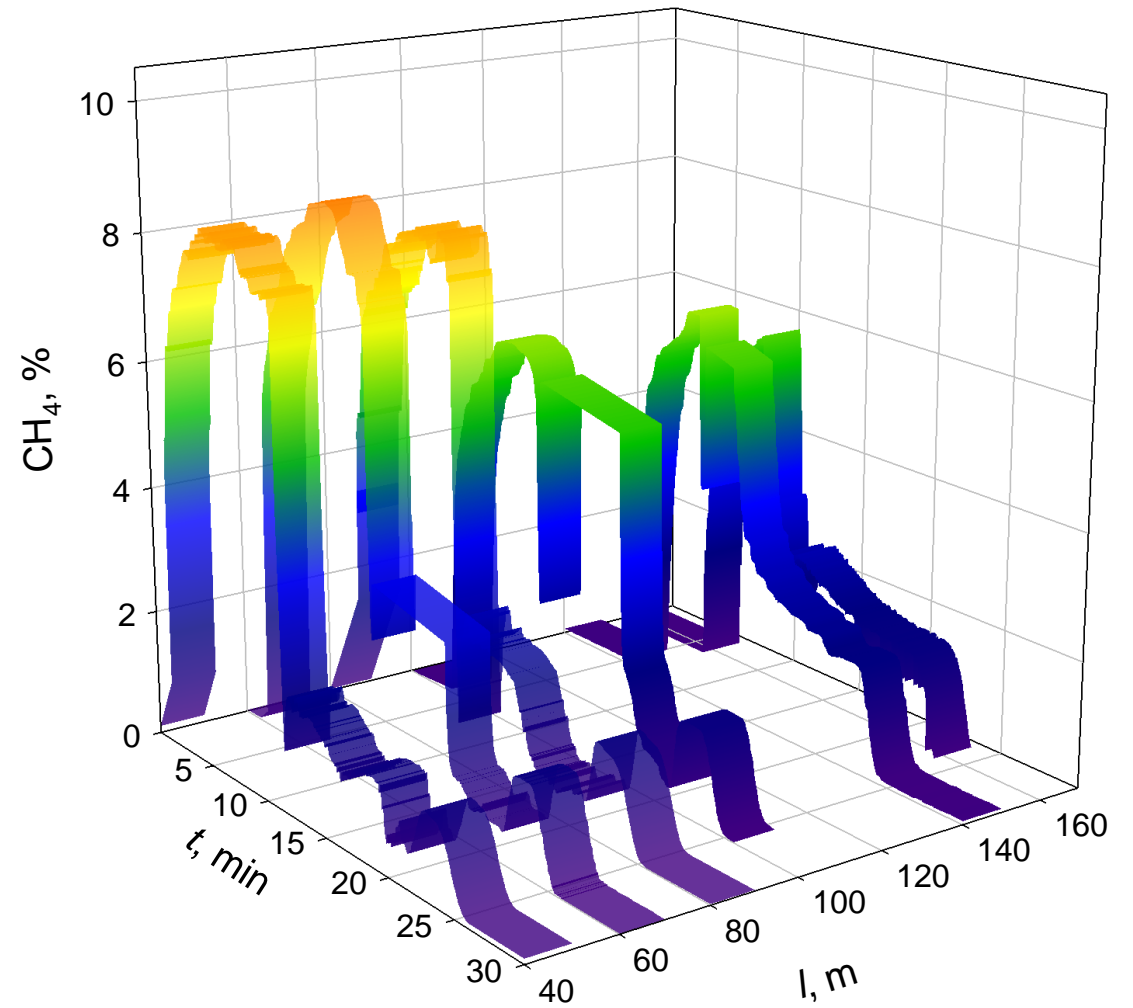


Slow release of methane with dispersion endings

Methane dispersion in 400 m gallery under different conditions



Fast release of methane



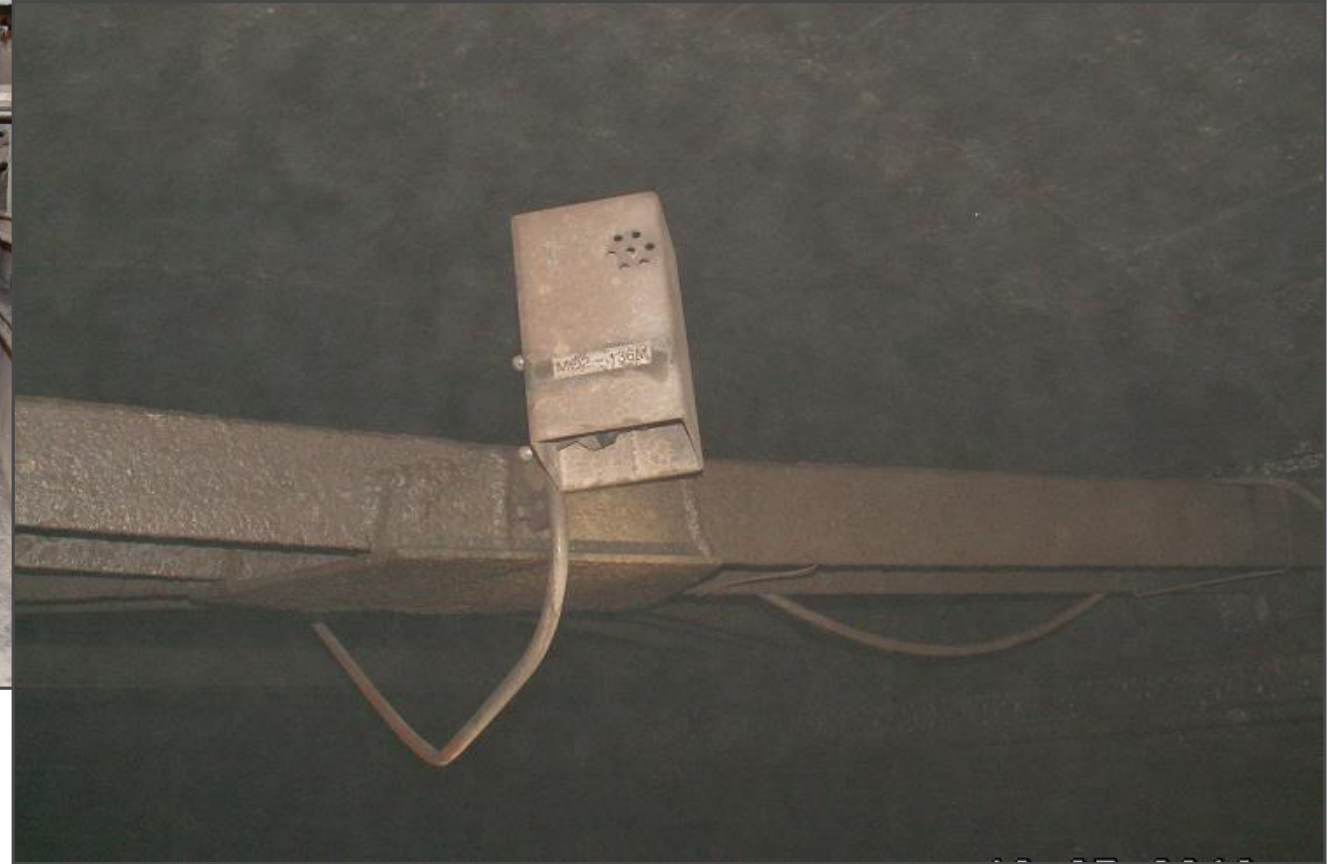
Slow release of methane

Equipment before and after experiments

Before the test

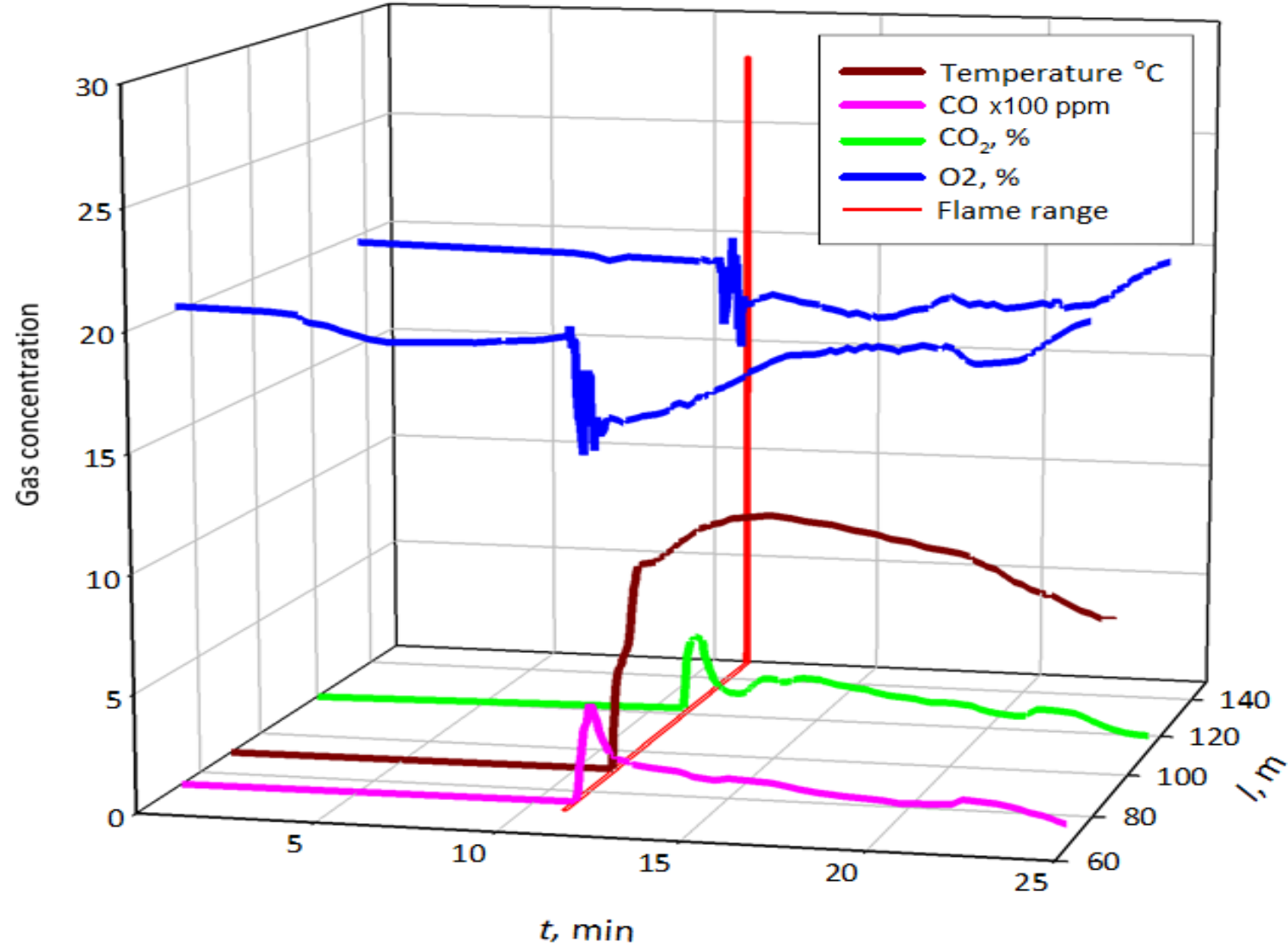


After the test

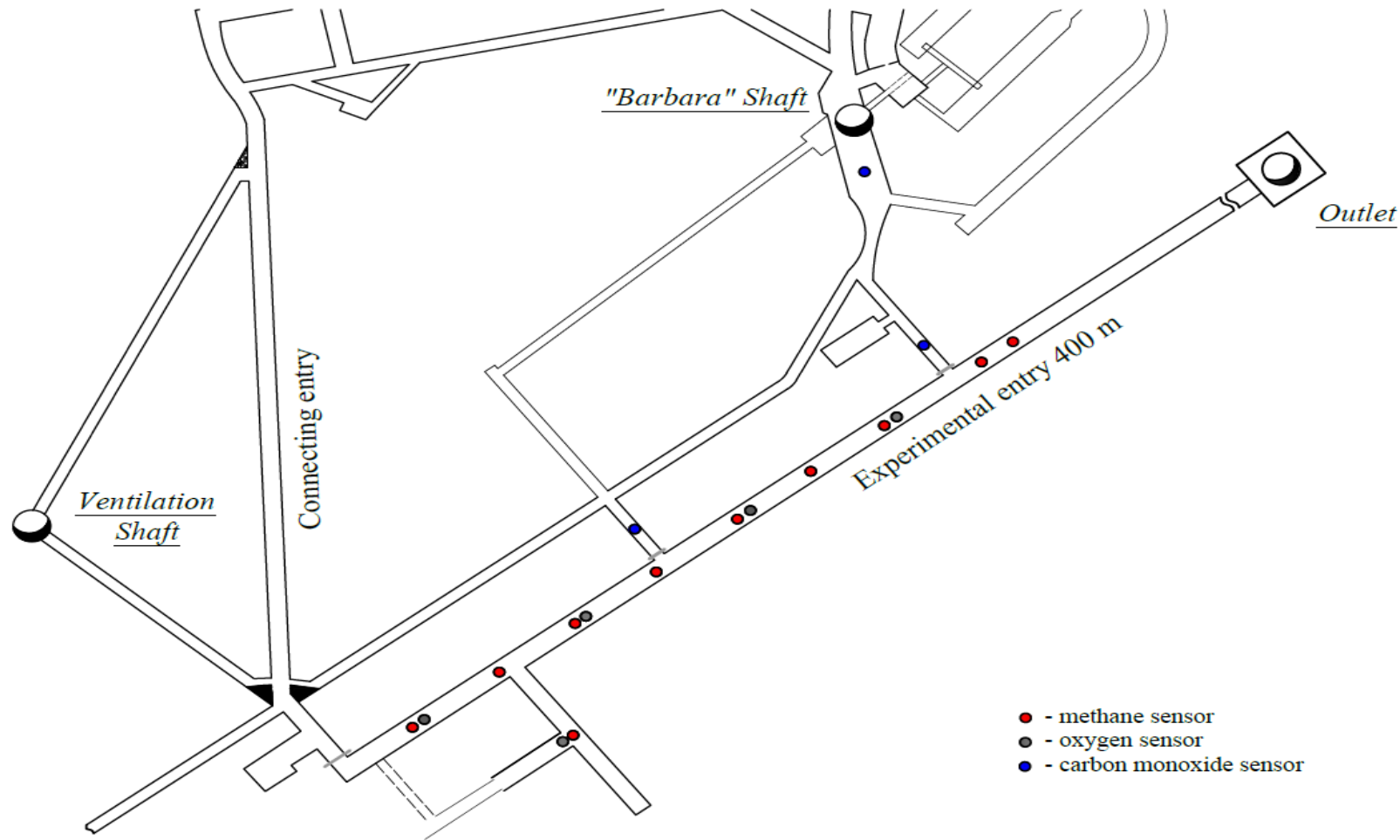


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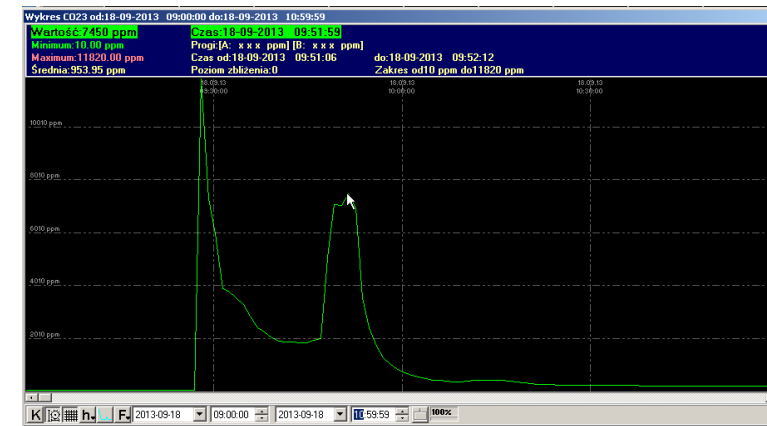
Changes of parameters during the time of explosion



Underground gas sensors



Location of sensors in the area of the 400m gallery



CO concentration after opening a dam at 0m



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**Thank you for your
attention**

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