SUNLAB – Sieroszowice Underground LABoratory - introduction

A. Zalewska

Epiphany 2010 conference, 7.01.2010

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KGHM Polska Miedź S.A.

M.Chorowski, J.Poliński

Wroclaw University of Technology

W. Pytel

Wroclaw University of Technology, KGHM CUPRUM

K. Urbańczyk, J. Ślizowski

Mineral and Energy Economy Research Institute PAN, Kraków

J. Kisiel, J. Dorda, A. Konefał, T. Szeglowski

University of Silesia, Katowice

M.Budzanowski, S.Grabowska, K.Kozak, J.Mazur,

J.W. Mietelski, M.Puchalska, E.Tomankiewicz, A.Zalewska

IFJ PAN Kraków

Introduction (1)

December 2003 – the NOVE conference in Venice- presentations of MEMPHYS and GLACIER – could one locate the GLACIER detector somewhere in Poland?

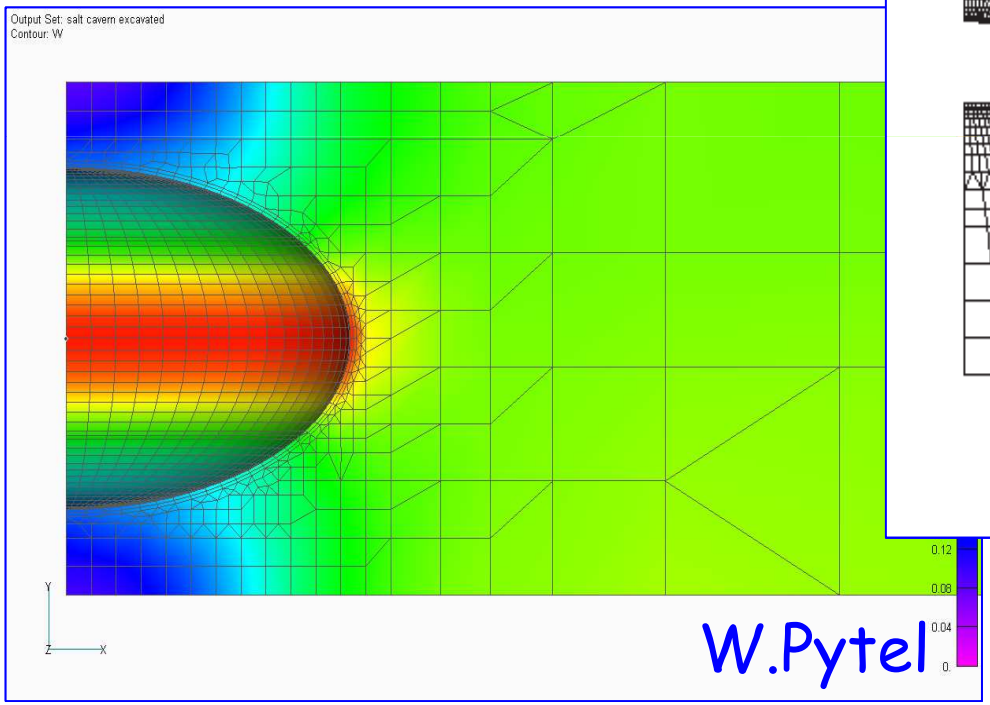
Contacts with geologists and geo-physicists at the University of Science and Technology (AGH) in Cracow (thanks to D.Kisielewska from the physics department!)
→ choosing the Polkowice-Sieroszowice mine through elimination of other potential locations

2004 – first geomechanical simulations for the location in a salt rock (KGHM CUPRUM and IGSMiE PAN) – optimistic!

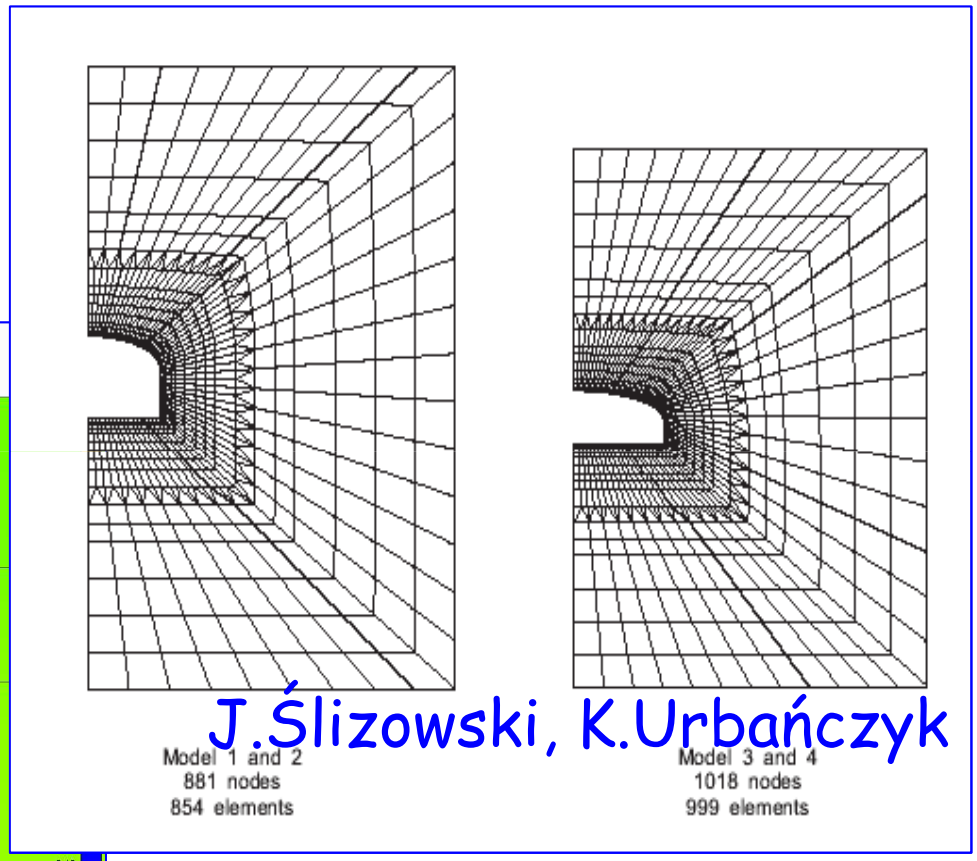
2004-2005 – measurements of background due to natural radioactivity – very low background (presentation by J.Kisiel)

Can one dig a football yard at 950 m?

Requirement: a cavern with a diameter 70-100m and stable for 30 years



W.Pytel



J.Ślizowski, K.Urbańczyk

Two parallel geomechanical analyses

Introduction (2)

2005 – first official contacts with the Management Board of the KGHM Polska Miedź S.A., - positive reaction

2006 – SUNLAB (Sieroszowice UNderground LABoratory) put on the roadmaps of the Polish particle and nuclear physics

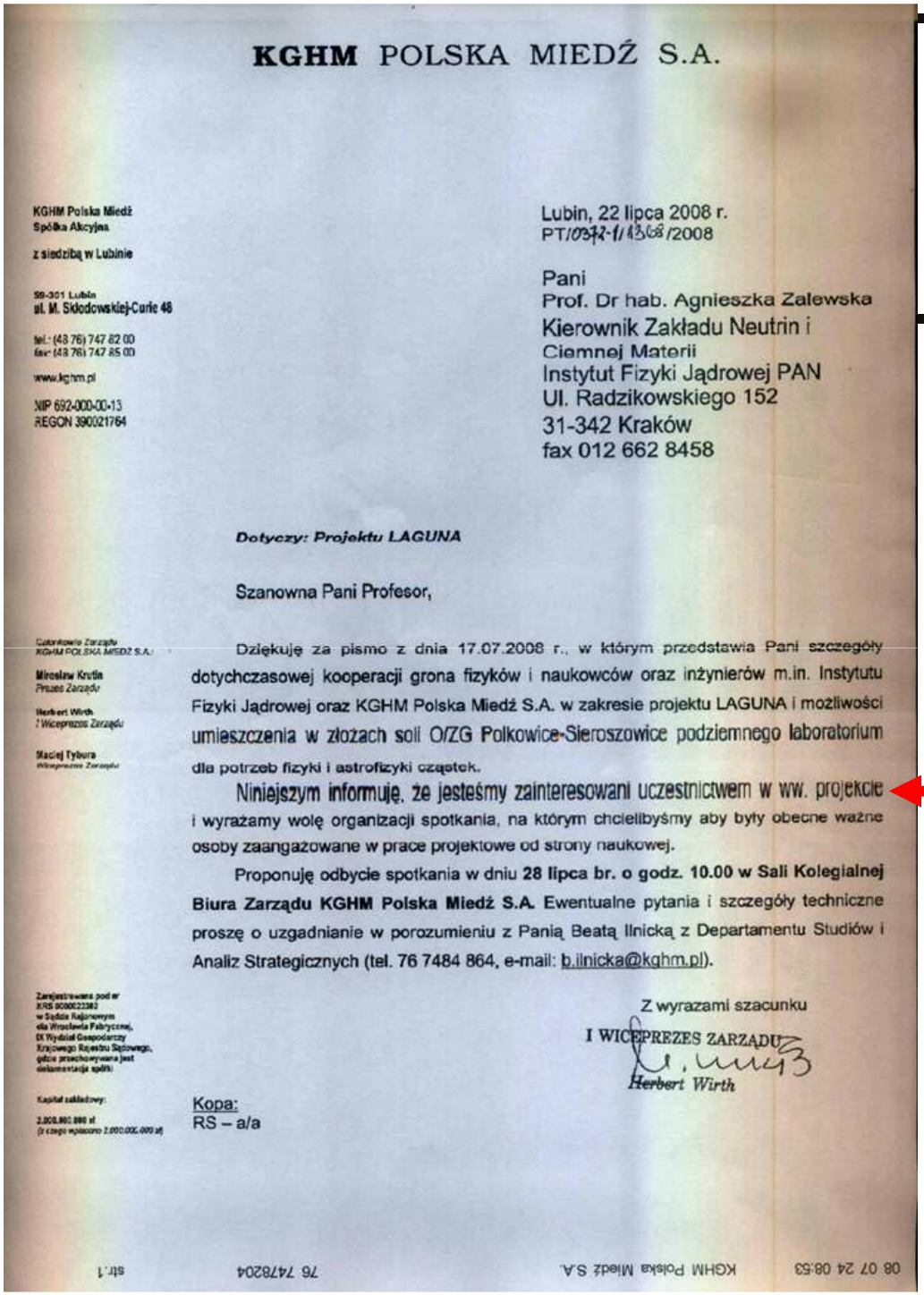
2007 – one of the sites concidered in the LAGUNA aplication (KGHM CUPRUM as an industrial partner, IGSMiE PAN, IFJ PAN representing Polish physicists. A.Zalewska as a coordinator for the Polish site)

2008 – the LAGUNA start up (geomechanical work for LAGUNA presented by W.Pytel), official letter of interest from the KGHM Vice-President.

KGHM is one of the largest Polish exporters, the largest employer in Lower Silesia, and a significant part of the WIG20 index – winner of a prestigious statuette for achievements in 2005. The Company was awarded the Bull and Bear prize by the Market Paper „Parkiet” in the category of best investment in a WIG20 company and the Pearl of the Polish Market prize in the raw materials and energy sector.

The Company generates enormous profits, and holds a strategic interest for the Polish economy. The year 2007 saw record results in the production of electrolytic copper – 532 974 t – and of metallic silver – 1 215 t, and above all a record profit – nearly PLN 3.8 billion and a future promising steady growth and an increase in the value of the Company.

Letter of Interest from KGHM Polska Miedź S.A.



KGHM POLSKA MIEDŹ S.A.

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REGON 390021764

Lubin, 22 lipca 2008 r.
PT/0972-1/13568/2008

Pani
Prof. Dr hab. Agnieszka Zalewska
Kierownik Zakładu Neutrin i
Ciemnej Materii
Instytut Fizyki Jądrowej PAN
Ul. Radzikowskiego 152
31-342 Kraków
fax 012 662 8458

Dotyczy: Projektu LAGUNA

Szanowna Pani Profesor,

Dziękuję za pismo z dnia 17.07.2008 r., w którym przedstawia Pani szczegóły dotychczasowej kooperacji grona fizyków i naukowców oraz inżynierów m.in. Instytutu Fizyki Jądrowej oraz KGHM Polska Miedź S.A. w zakresie projektu LAGUNA i możliwości umieszczenia w złożach soli O/ZG Polkowice-Sieroszowice podziemnego laboratorium dla potrzeb fizyki i astrofizyki cząstek.

Niniejszym informuję, że jesteśmy zainteresowani uczestnictwem w ww. projekcie i wyrażamy wolę organizacji spotkania, na którym chcielibyśmy aby były obecne ważne osoby zaangażowane w prace projektowe od strony naukowej.

Proponuję odbycie spotkania w dniu **28 lipca br. o godz. 10.00 w Sali Kolegialnej Biura Zarządu KGHM Polska Miedź S.A.** Ewentualne pytania i szczegóły techniczne proszę o uzgadnianie w porozumieniu z Panią Beatą Ilnicką z Departamentu Studiów i Analiz Strategicznych (tel. 76 7484 864, e-mail: b.ilnicka@kghm.pl).

Z wyrazami szacunku

I WICEPREZES ZARZĄDU
Herbert Wirth

Członkowie Zarządu
KGHM POLSKA MIEDŹ S.A.:
Mirosław Krutin
Prezes Zarządu
Herbert Wirth
I Wiceprezes Zarządu
Maciej Tybura
Wiceprezes Zarządu

Zarejestrowana pod nr
KRS 0000022382
w Sądzie Rejonowym
dla Wrocławia Fabrycznej,
IX Wydział Gospodarczy
Krajowego Rejestru Sądowego,
gdzie przechowywana jest
dokumentacja spółki

Kapitał zakładowy:
2.000.000.000 zł
(z czego wpłacono 2.000.000.000 zł)

Kopa:
RS – a/a

str.1 76 7478204 KGHM Polska Miedź S.A. 08 07 24 08:53

„….We inform you about our interest in the above mentioned project….”

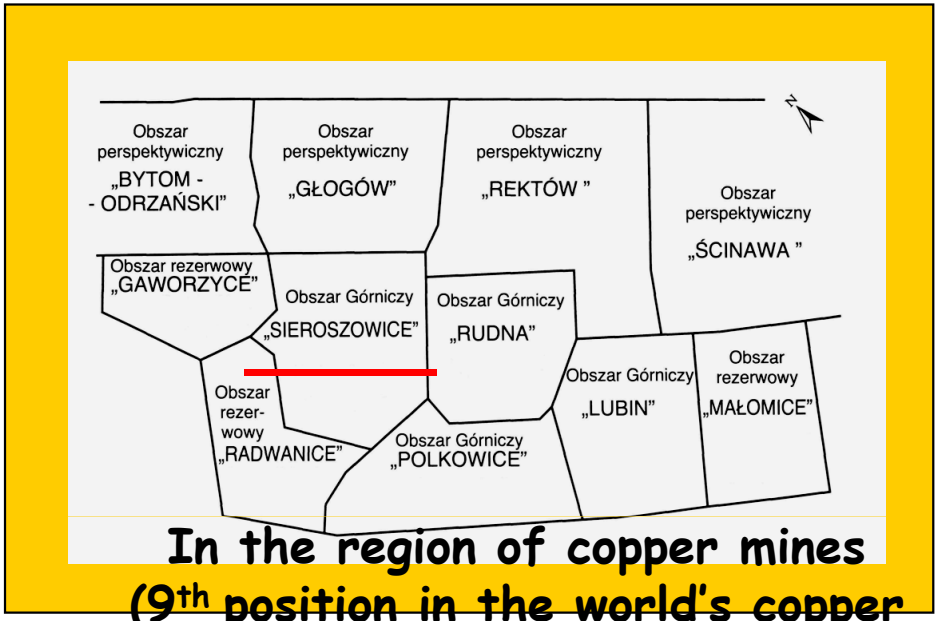
Introduction (3)

2009 – March/April – LAGUNA GM in Wroclaw, visit in the Polkowice-Sieroszowice mine, discussions about a possibility to locate ArDM detector there

2009-June- aplication for the DARWIN project within the first ASPERA call – Polish groups in WP on underground locations with ArDM as demontrator for the Polkowice-Sieroszowice location – failed, this WP cancelled

2009-July SUNLAB considered one of the four most interesting proposals for the new reasearch infrastructures in Poland, but the selection process restarted in autumn by the new minister, 76 aplications

SUNLAB - where?

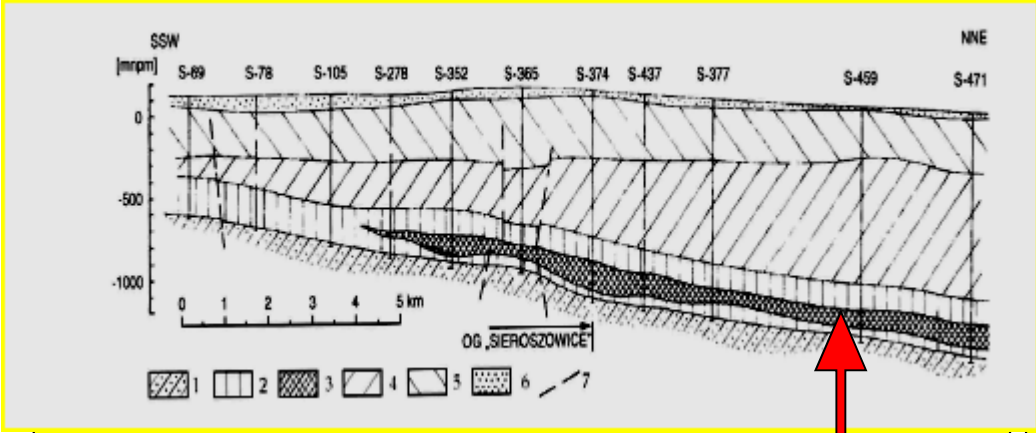


In the region of copper mines (9th position in the world's copper production and 3rd position for silver

Near Wrocław, south-west of Poland - easily accessible from the Wroclaw airport and from the A4 motor-way, 950 km from CERN

The Sieroszowice mine (part of the KGHM holding)

A thick salt layer above copper ores



Geological cutoff – salt

Existing big chambers in salt:

- volume: 85 x 15 x 20 m^3
- at a depth ~950 m from the surface (2200 m.w.e.)
- very low humidity, temperature ~35^0

Measurements of the wall movements

LAGUNA meeting in Wroclaw (31.03 – 2.04).2009

Meeting in ZG Polkowice-Sieroszowice – April 2009

Dedicated to starting up of a smaller, initial laboratory with a possibility to install the ArDM detector there

1. Two Polish PhD students in the ArDM group at CERN during summer 2009 to participate in detector tests and to learn.
2. Constructing the necessary infrastructure in the Polkowice-Sieroszowice mine to host the ArDM detector in 2011

The real challange but also the real chance for Polish astrophysics !

ArDM (Argon Dark Matter)

http://neutrino.ethz.ch/ArDM

ETH Zurich (spokesman: *A.Rubbia*), Zurich University, University of Granada, CIEMAT Madrid, Soltan Institute for Nuclear Studies (Warsaw-Świerk), University of Sheffield

- Measurement of the recoils of target nuclei [30-100 keV].
- Recoil energy → scintillation & ionization of Argon

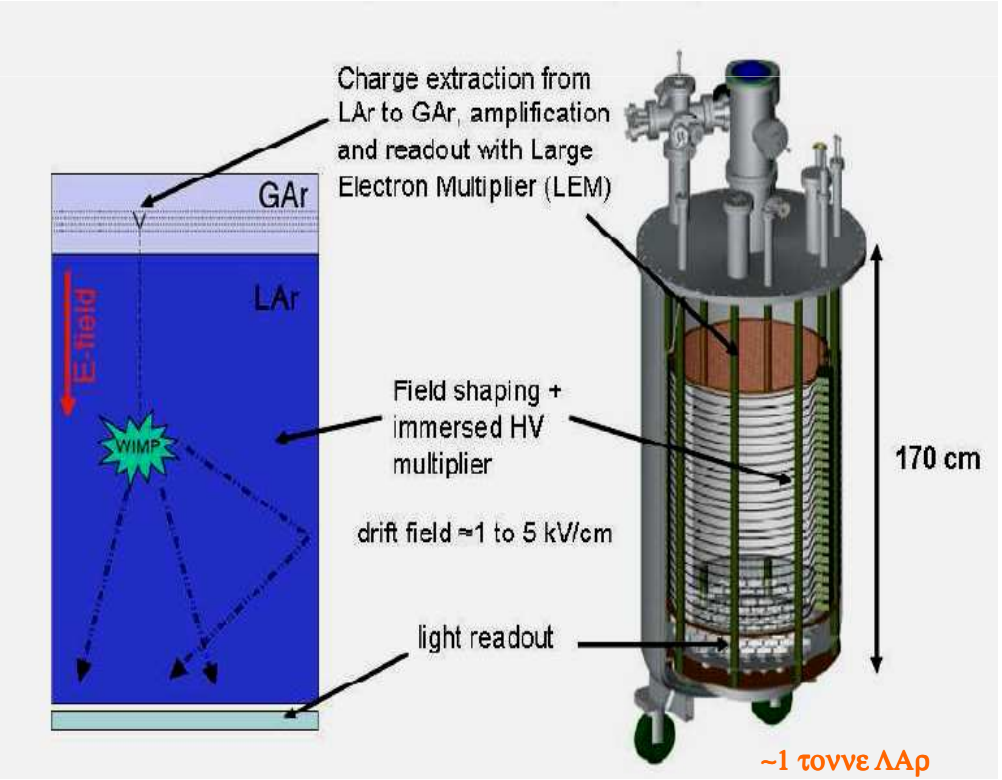
GOAL: independently detect the light (PMTs) and the charge (Large Electron Multiplier)

- light/charge ratio allows to discriminate background events (e/γ vs. nuclear recoils)

Elastic scattering reaction:

$\chi + Ar_{at\ rest} \rightarrow \chi + Ar_{recoil}$

STATUS:
Recognised experiment ar CERN since Dec.2008
ongoing assembly@**CERN**; tests on surface , good progress



Polish institutions working for SUNLAB

1. KGHM CUPRUM (industrial partner)
2. IGSMiE PAN (experts in salt caverns)
3. IFJ PAN (Inst. of Nucl. Physics in Cracow)
4. IPJ (Institute for Nuclear Studies, Warsaw)
5. University of Katowice
6. Wroclaw University
7. Wroclaw University of Technology (experts in cryogenic installations)
8. University of Zielona Gora

With strong support of KGHM Polska Miedź S.A.

Advantages of the location

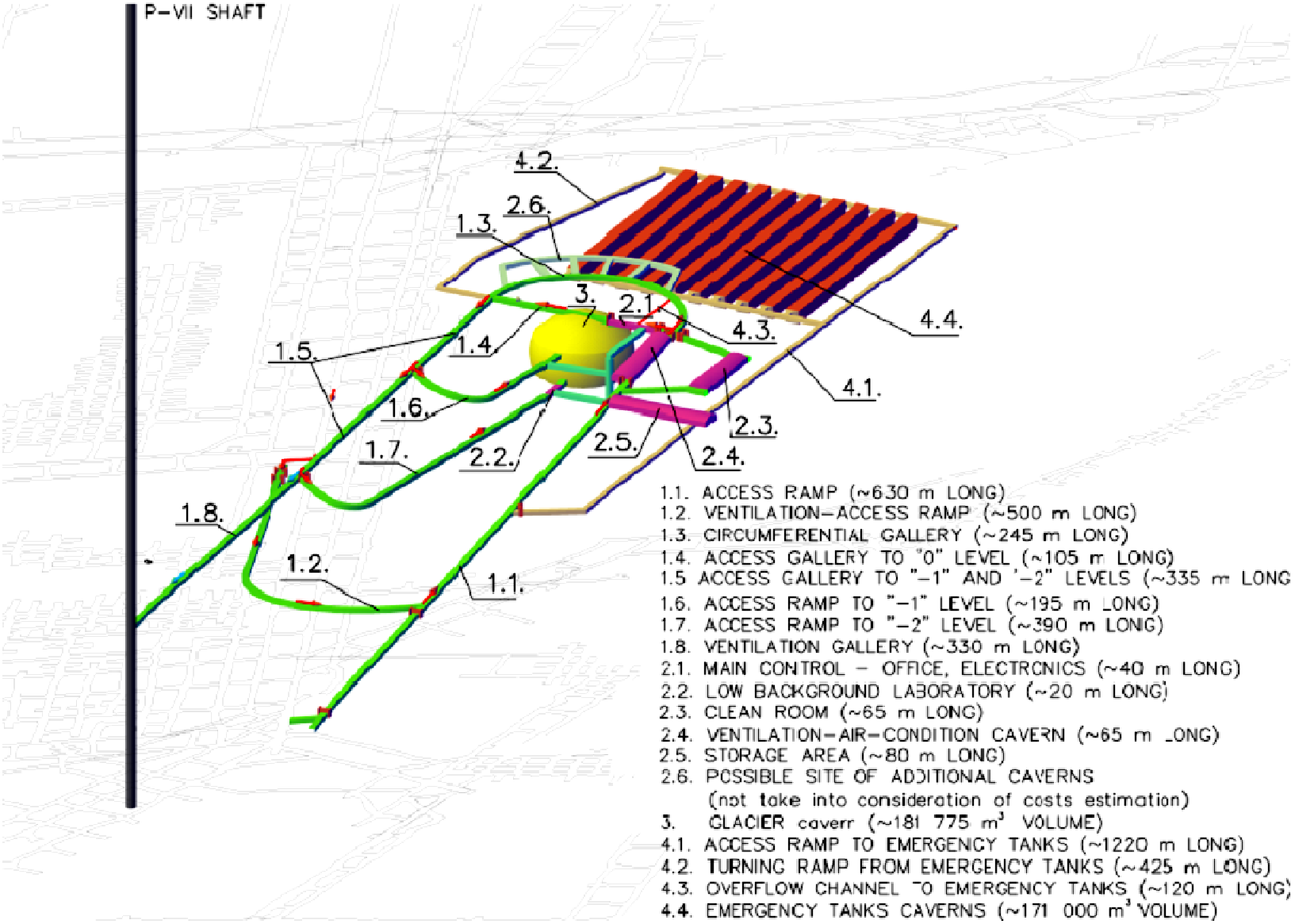
Easy access to the mine – good roads, int. airport in Wroclaw

Two towns with hotels, restaurants etc. at a distance ~20 km, Wroclaw with its universities, reasearch intitutes and rich cultural life 90 km away

Use of the existing modern infrastructure of the mine (shafts, underground transport) and all mine services (rescue and fire teams, control system)

Very experienced industrial partner – KGHM CUPRUM with all expertise needed in designing underground facilities

Strong support from the KHGM Polska Miedź S.A.



1.1. ACCESS RAMP (~630 m LONG)
1.2. VENTILATION–ACCESS RAMP (~500 m LONG)
1.3. CIRCUMFERENTIAL GALLERY (~245 m LONG)
1.4. ACCESS GALLERY TO "0" LEVEL (~105 m LONG)
1.5 ACCESS GALLERY TO "–1" AND "–2" LEVELS (~335 m LONG
1.6. ACCESS RAMP TO "–1" LEVEL (~195 m LONG)
1.7. ACCESS RAMP TO "–2" LEVEL (~390 m LONG)
1.8. VENTILATION GALLERY (~330 m LONG)
2.1. MAIN CONTROL – OFFICE, ELECTRONICS (~40 m LONG)
2.2. LOW BACKGROUND LABORATORY (~20 m LONG)
2.3. CLEAN ROOM (~65 m LONG)
2.4. VENTILATION–AIR–CONDITION CAVERN (~65 m LONG)
2.5. STORAGE AREA (~80 m LONG)
2.6. POSSIBLE SITE OF ADDITIONAL CAVERNS
(not take into consideration of costs estimation)
3. GLACIER caverr (~181 775 m^3 VOLUME)
4.1. ACCESS RAMP TO EMERGENCY TANKS (~1220 m LONG)
4.2. TURNING RAMP FROM EMERGENCY TANKS (~425 m LONG)
4.3. OVERFLOW CHANNEL TO EMERGENCY TANKS (~120 m LONG)
4.4. EMERGENCY TANKS CAVERNS (~171 000 m^3 VOLUME)

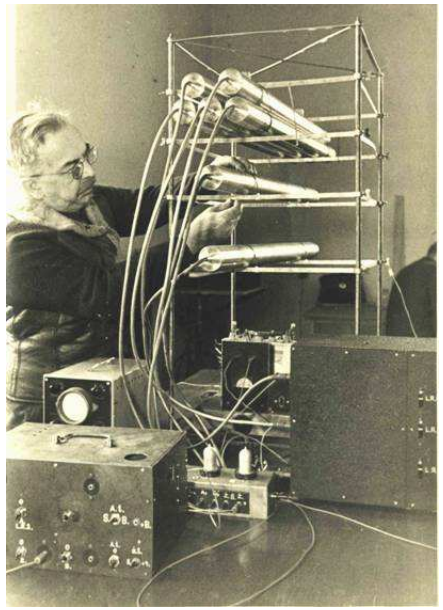
Great tradition

PHYSICAL REVIEW VOLUME 77, NUMBER 3 FEBRUARY 1, 1950

On Some Low Ionizing Radiation Observed by Measurements of Cosmic Radiation at Great Depths

M. Miesowicz, L. Jurkiewicz, and J. M. Massalski
Physical Laboratory of the Mining Academy, Cracow, Poland
(Received September 22, 1949)

By measurements of twofold, threefold, and fourfold coincidences with a Geiger counter telescope, the underground rays at 660 and 540 m w.e. (water equivalent) have been divided into two components. One of the components is ionizing, discharging the counters with almost 100 percent efficiency, and has a strong maximum in the vertical direction. The other component discharges the counters with a very low efficiency, producing numerous twofold coincidences but practically no threefold or fourfold coincidences. It is isotropic in direction and rapidly absorbed in lead. This second component is thought to be composed of γ-rays of local radioactive origin. The telescope used in these experiments differed from that of Barnóthy and Forró in that it was protected from side showers by anticoincidence counters. The ratio of twofold to threefold coincidences was found to be about 1.4 instead of 20 as reported by Barnóthy and Forró at 1000 m w.e.



Professor Marian Mięsowicz -father of particle physics and of nuclear geophysics in Cracow

conf.,