Large underground cavities in a salt mine from Slanic-Prahova

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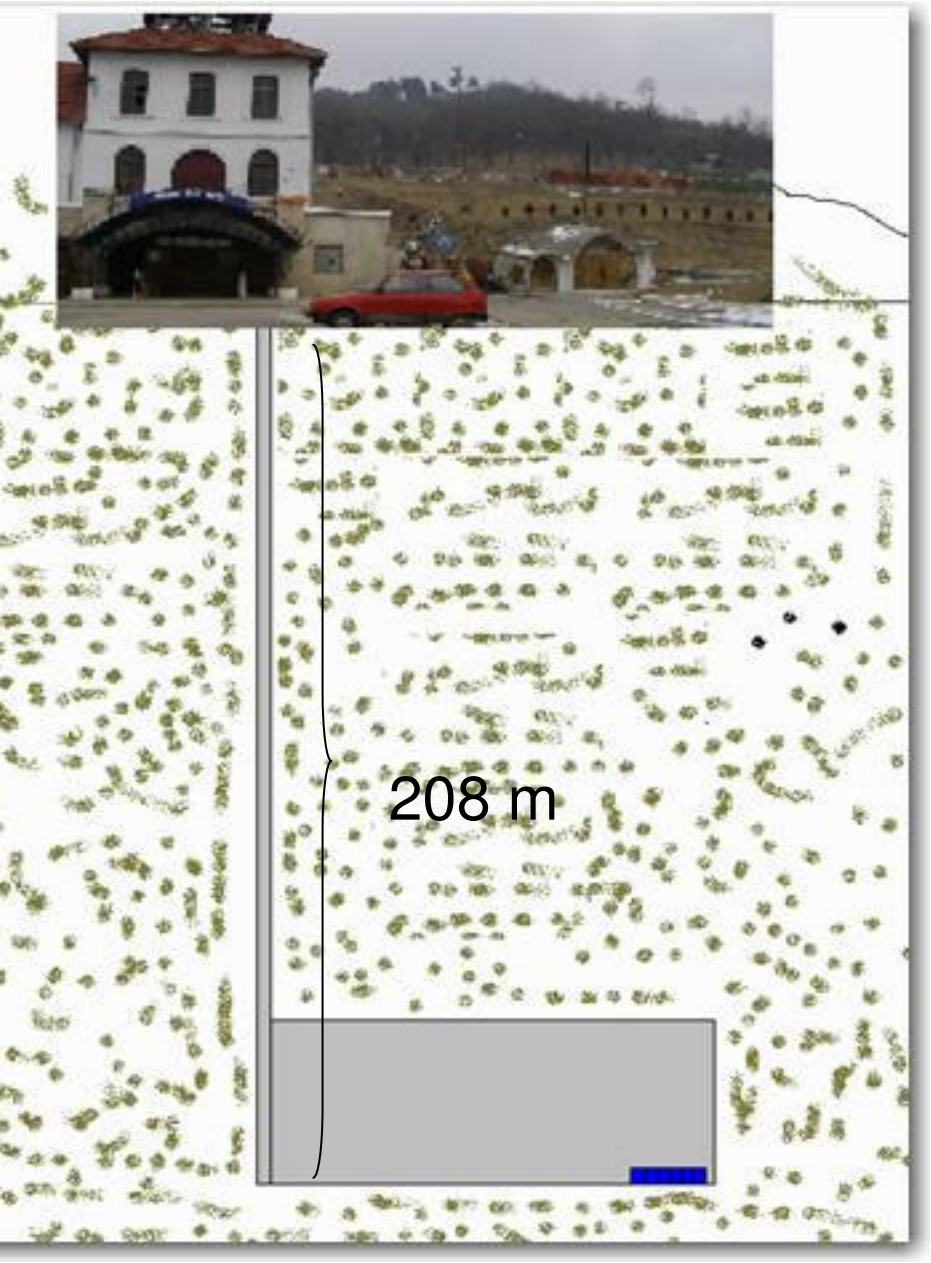
NNN08 Paris, France Sept. 11-13, 2008



The Unirea salt mine environment:

temperature: 12.0 -13.0 °C

humidity: 65-70 %

excavated volume: 2.9 million m^3

floor area: 70000 m^2

average high: 52-57 m

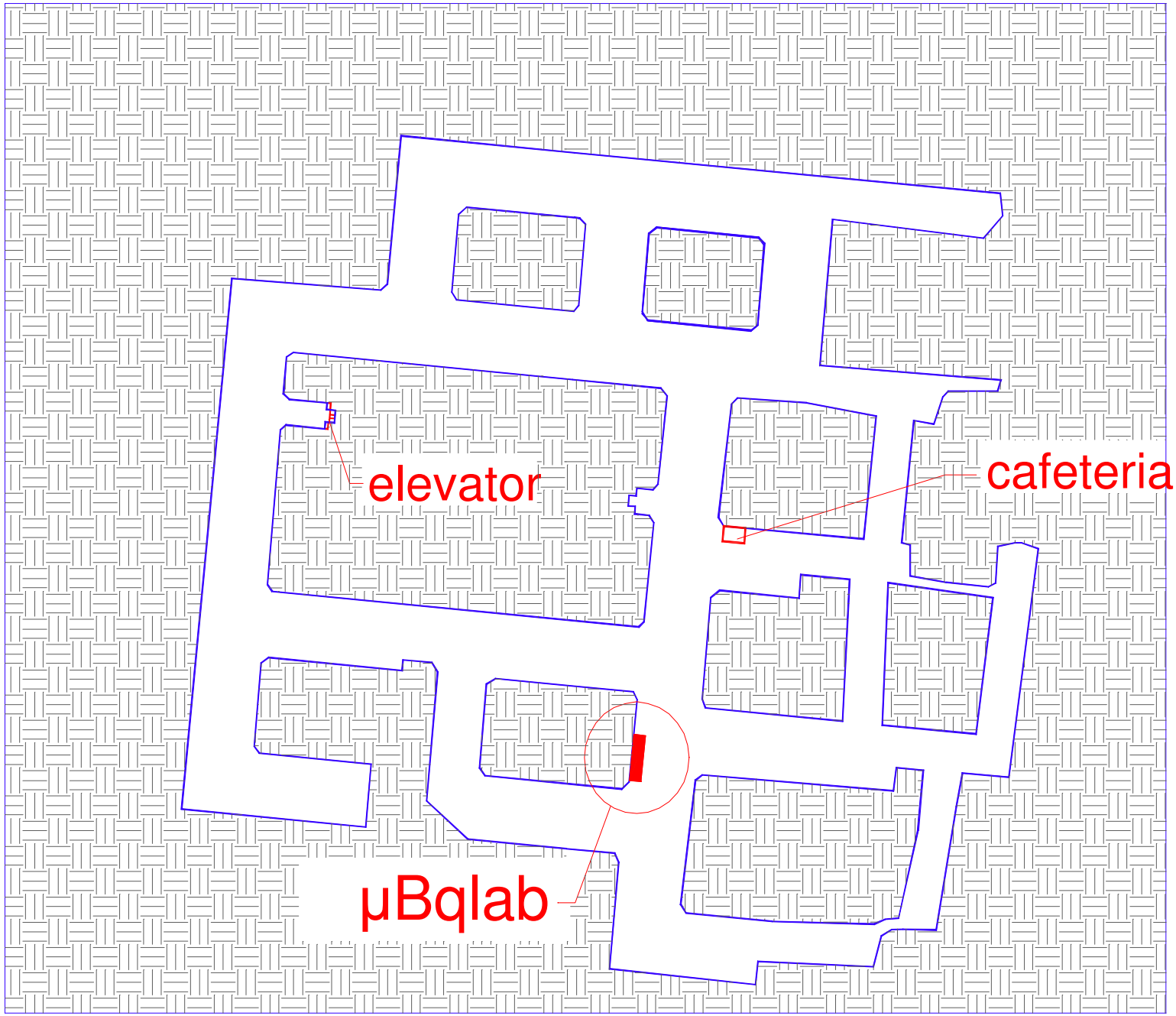
The hill over the mine is about 150m height

Salt lens dimensions:

Length: 5km

Width: 3km

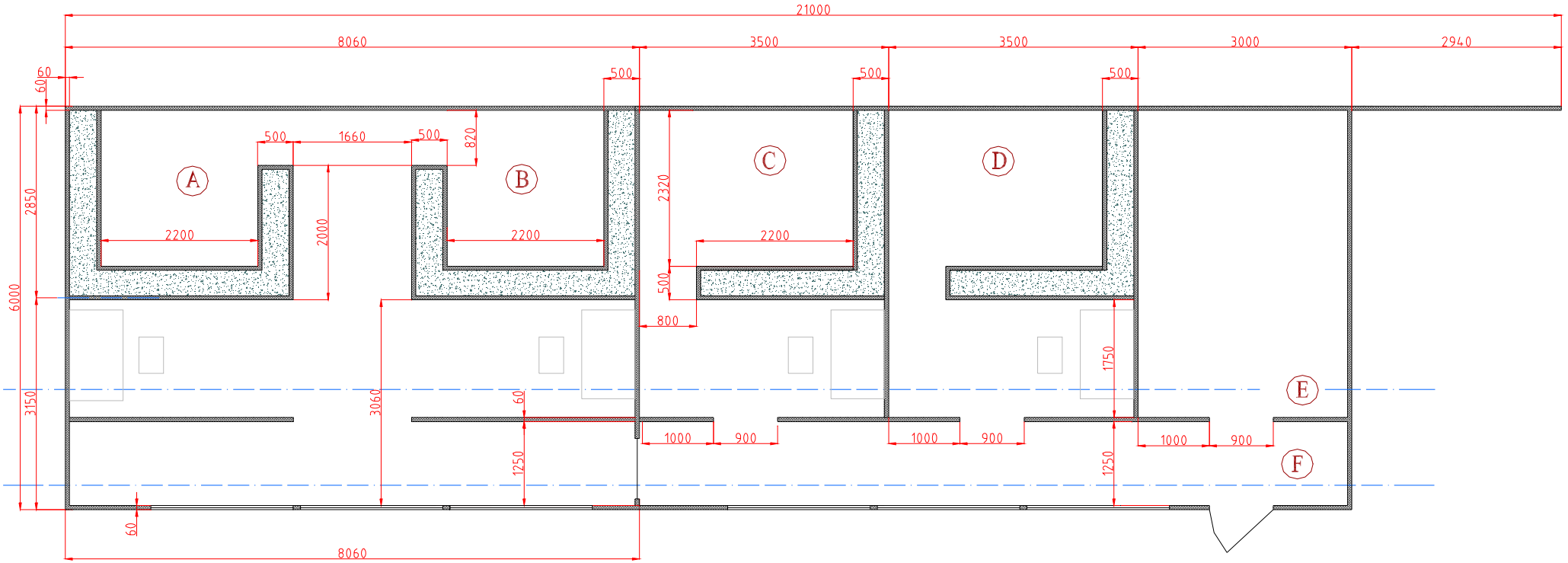
Thickness: 0.5km



UNIREA salt mine gallery

The construction of low-background radiation laboratory started in January 2006 and ended in April 2006.

- – conception, design, constructor selection, material selection;
- – material conditioning, transportation and construction;
- – leveling the mine floor under laboratory using granulated salt,



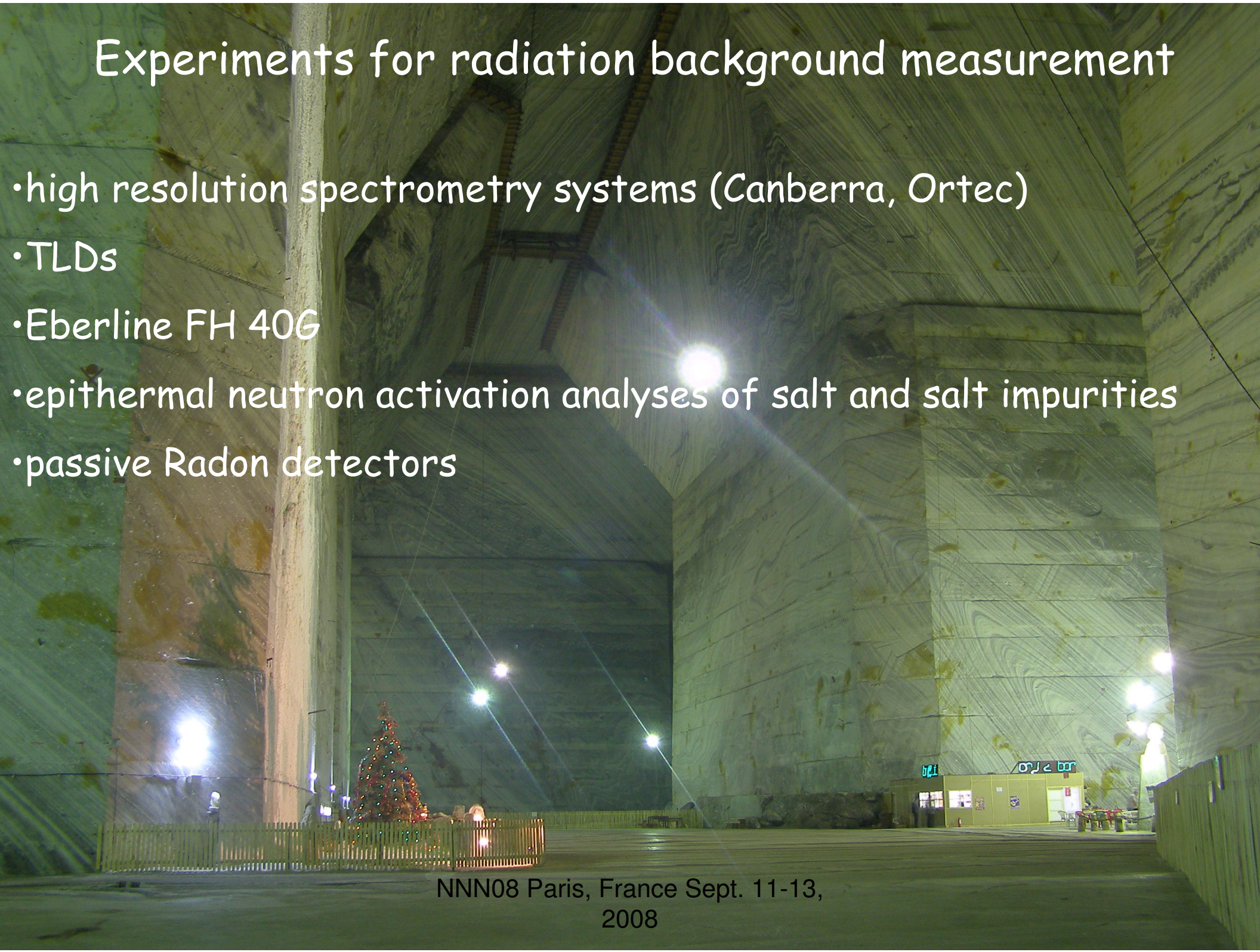
UNDERGROUND LABORATORY

NNN08 Paris, France Sept. 11-13, 2008

The goal was the setting up of an underground laboratory for:

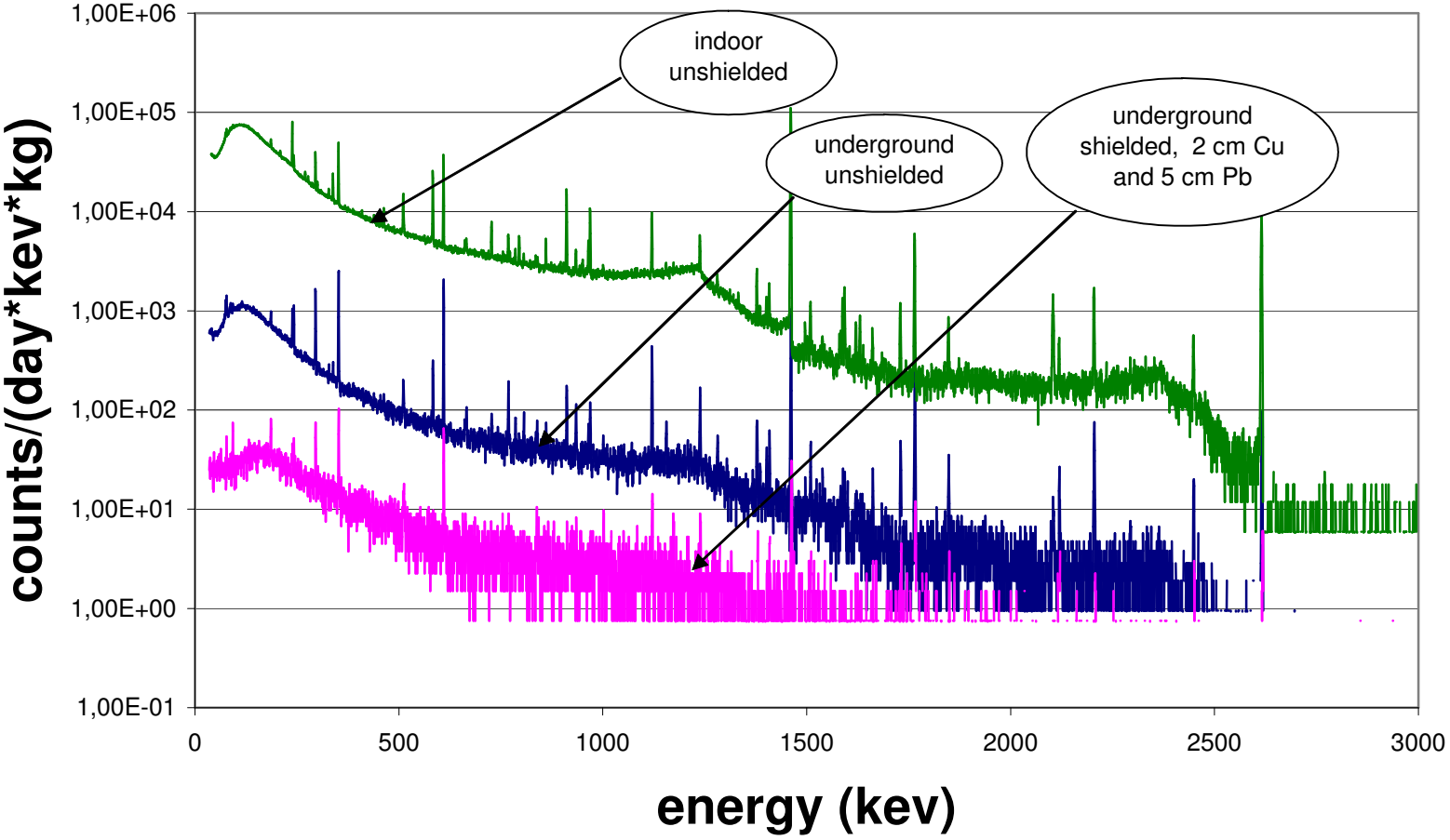
- high resolution gamma ray spectrometry
- whole body counter
- radiation metrology

Experiments for radiation background measurement



- high resolution spectrometry systems (Canberra, Ortec)
- TLDs
- Eberline FH 40G
- epithermal neutron activation analyses of salt and salt impurities
- passive Radon detectors

Background spectra collected with a CANBERRA GeHP detector with 22.8% rel. efficiency



Neutron activation analyses of salt from UNIREA salt mine

Element	Neutron activation analyses
Uranium	<1ppm
Kalium	ND
Thorium	ND

Neutron activation analyses of salt impurities from UNIREA salt mine

Element	Neutron activation analyses
Uranium	6.4 ppm
Kalium	15400 ppm
Thorium	5.5 ppm

Radon concentration in Unirea salt mine gallery

Detector	N tracks	density [tracks/mm^2]	corrected density	Rn conc. [Bq/m^3]*
A112	53	1,132	0,817	11
A439	48	1,026	0,711	9

*uncertainty ~40%

Other measurements are in progress, especially for detectors background correction

minimum = 0,09 mm^{-2} and maximum: 0,55 mm^{-2}, average=0,31 $\pm$ 0.16 mm^{-2}

Measurements performed by Prof. C. Cosma from UBB Cluj Napoca ROMANIA

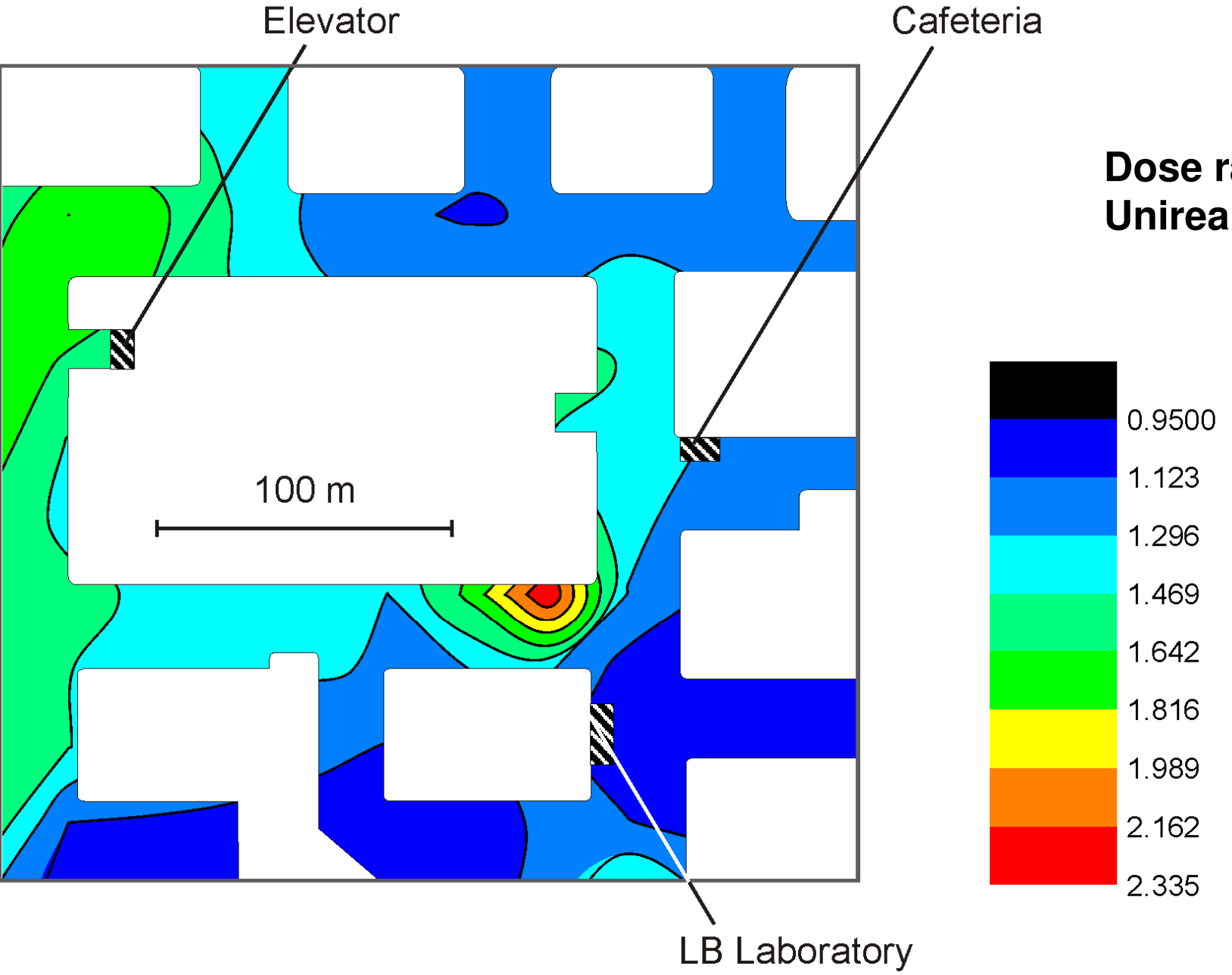
A recent measurement of external dose rate gives:

- in different places in Unirea salt mine - 1.2 ± 0.3 nSv/h
- in underground laboratory - 1.6 ± 0.3 nSv/h.

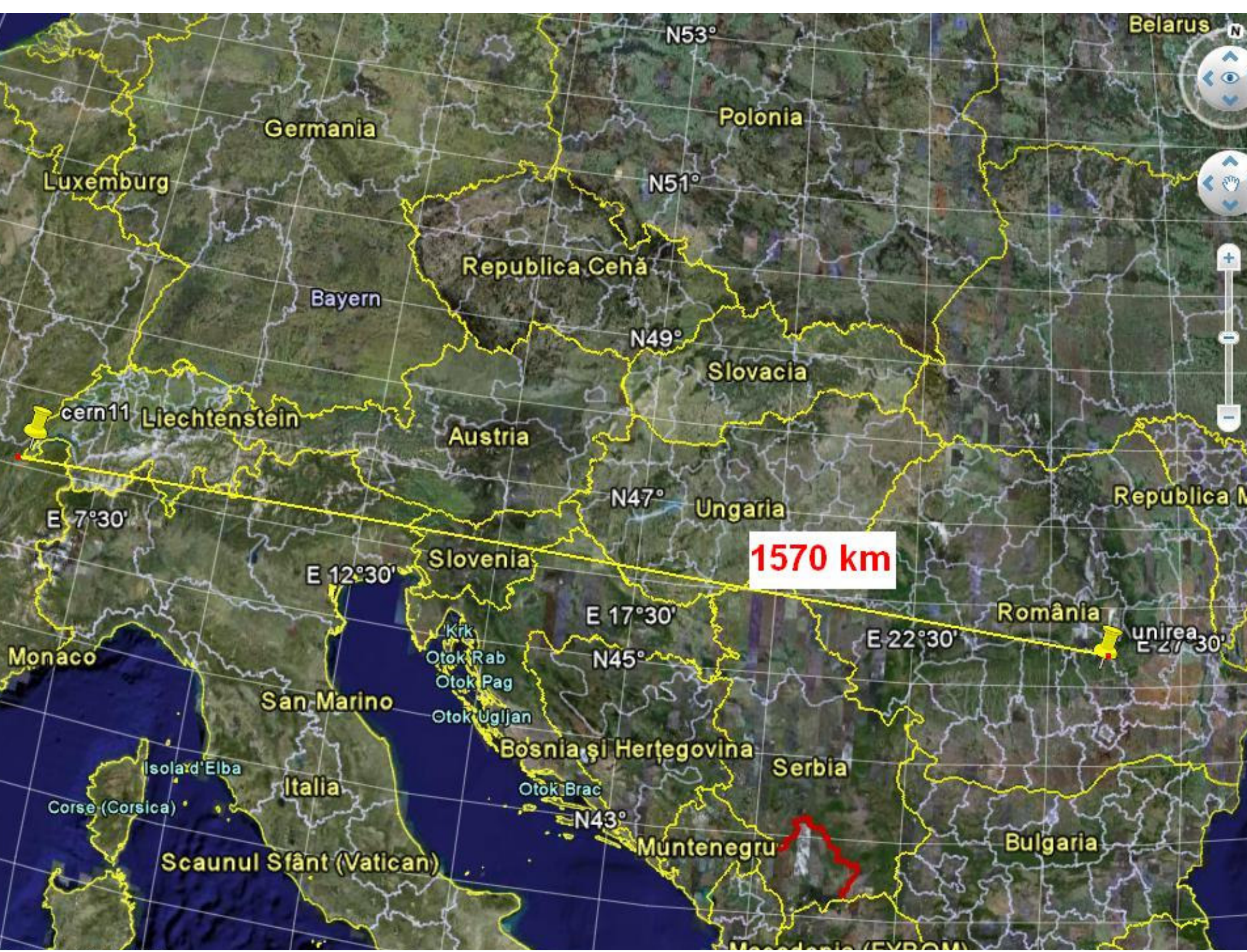
The external dose rate was measured with an EBERLINE FH40G-L10 calibrated by producer.

Radionuclides	External dose rates (nGy/h)
K40	0,41
Th 232 series	0,28
Ra 236 series	0,71
Total	1,40

The separation walls from laboratory, filled with salt, contain 1mg/kg $K_4[Fe(CN)_6]3H_2O$.
In this condition the external dose rate due to $K_4[Fe(CN)_6]3H_2O$ is about 0.35 nGy/h.



Dose rate distribution in Unirea salt mine galleries


N53°
Belarus
Germania
Polonia
Luxemburg
N51°
Republica Cehă
Bayern
N49°
Slovacia
cern11
Liechtenstein
Austria
E 7°30'
N47°
Ungaria
Republica M
1570 km
Slovenia
E 12°30'
E 17°30'
România
E 22°30'
unirea
E 27°30'
Monaco
Krk
Otok Rab
Otok Pag
N45°
San Marino
Otok Ugljan
Bosnia și Herțegovina
Serbia
Isola d'Elba
Italia
Otok Brac
Corse (Corsica)
N43°
Muntenegru
Bulgaria
Scaunul Sfânt (Vatican)

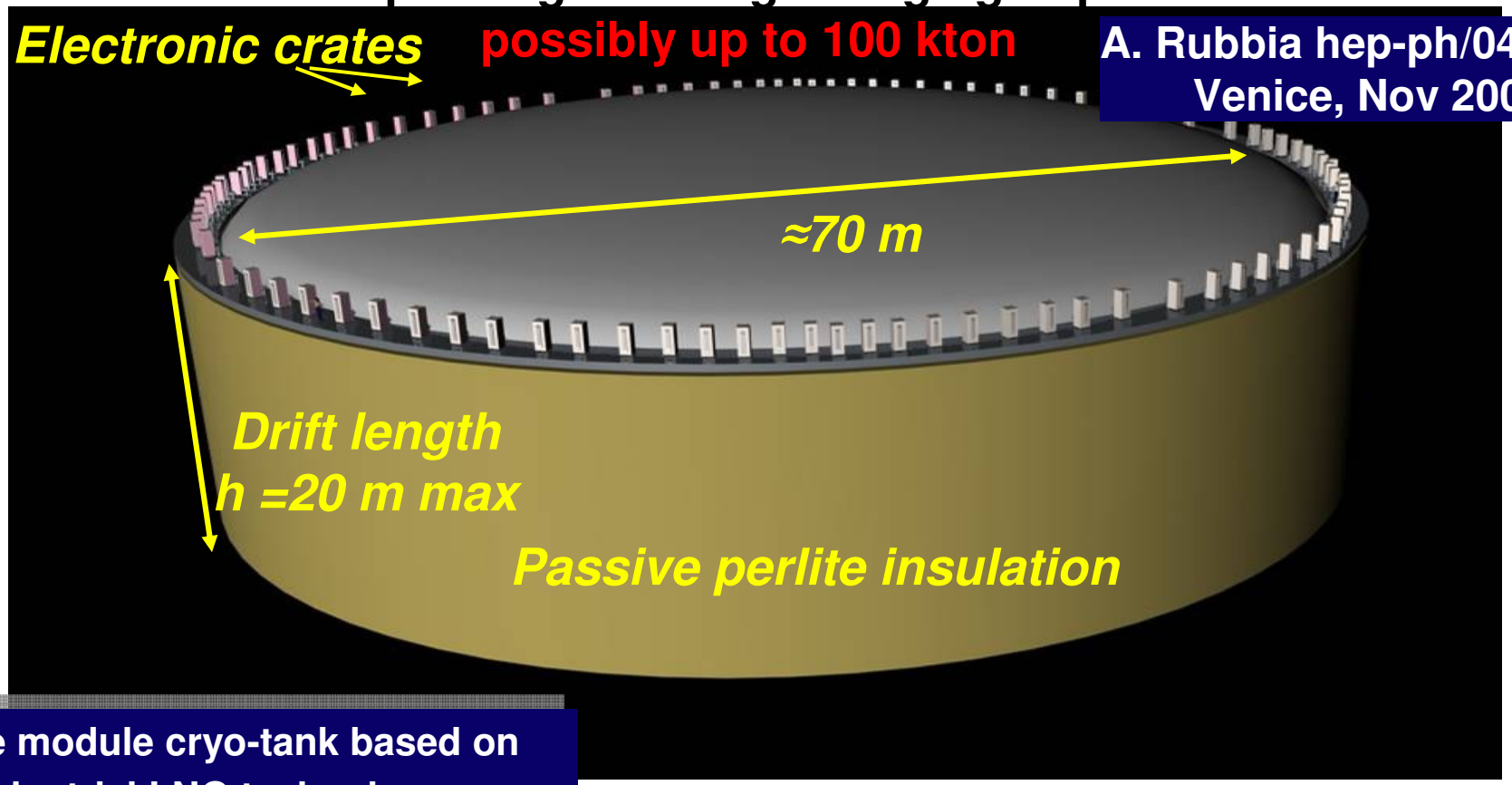
GLACIER: Giant Liquid Ar Charge Imaging ExpeRiment

	Liquid Argon
Density (g/cm3)	**1.4**
dE/dx (MeV/cm)	**2.1**
Refractive index (visible)	**1.24**
Cerenkov angle	**36°**
Scintillation	**Yes (≈50000 g/MeV @ l=128nm)**

GLACIER

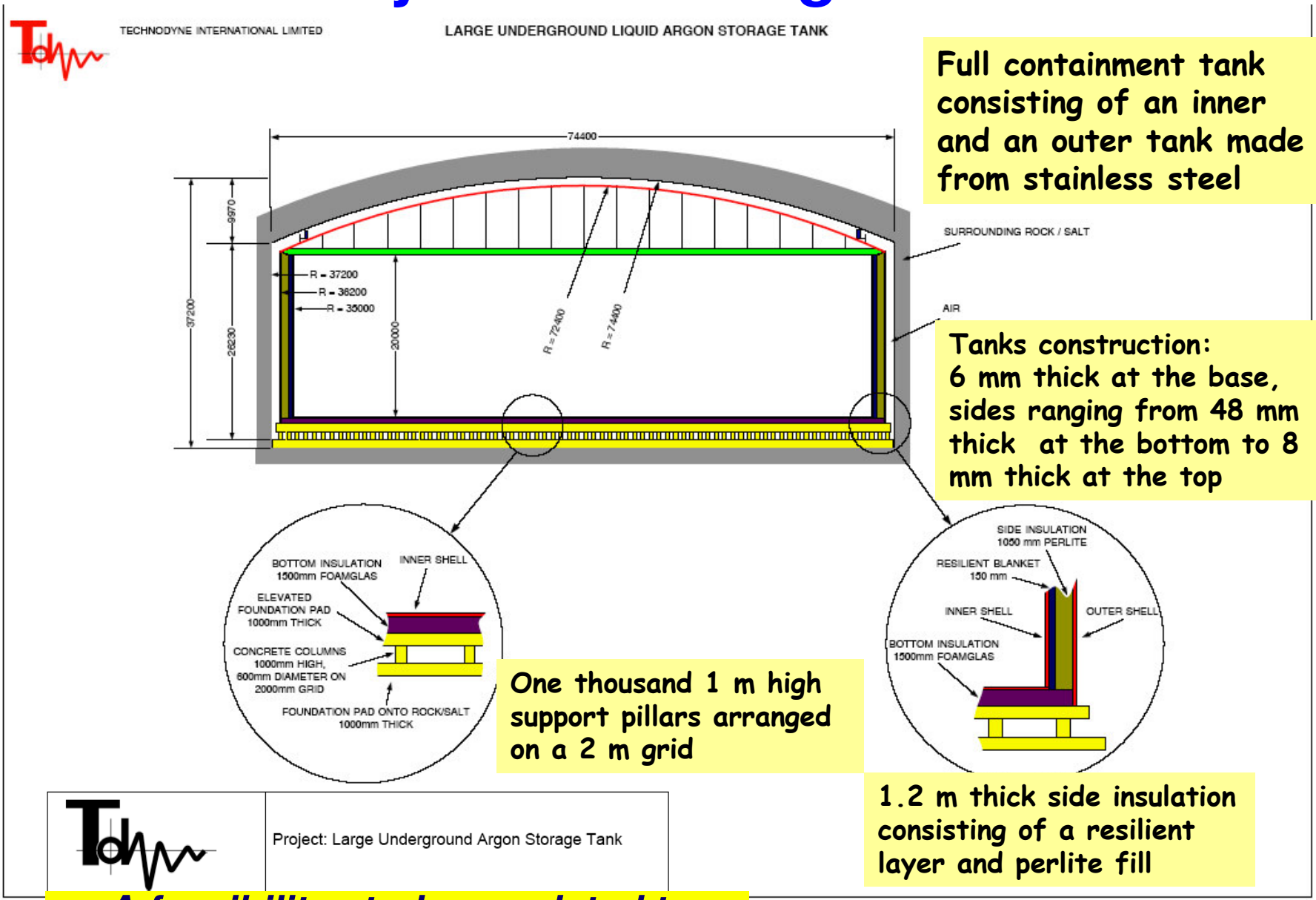
A scalable detector with a non-evacuable dewar and ionization charge detection with amplification

Giant Liquid Argon Charge Imaging ExpeRiment



Single module cryo-tank based on industrial LNG technology

A first study of an underground LAr storage tank



Full containment tank consisting of an inner and an outer tank made from stainless steel

Tanks construction: 6 mm thick at the base, sides ranging from 48 mm thick at the bottom to 8 mm thick at the top

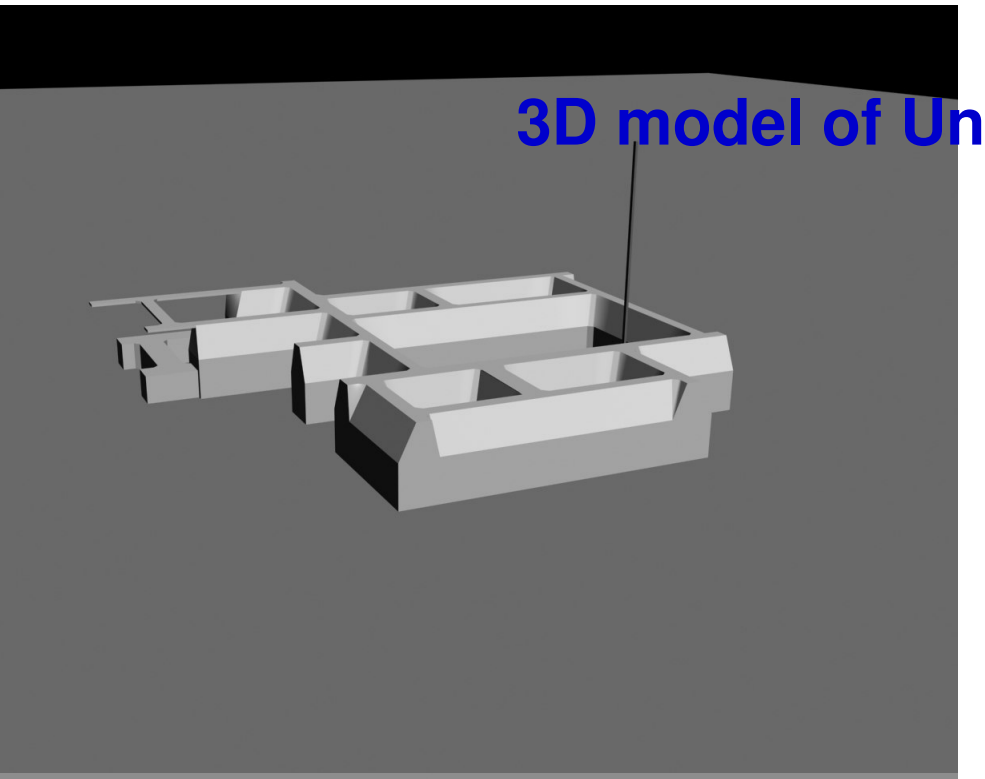
One thousand 1 m high support pillars arranged on a 2 m grid

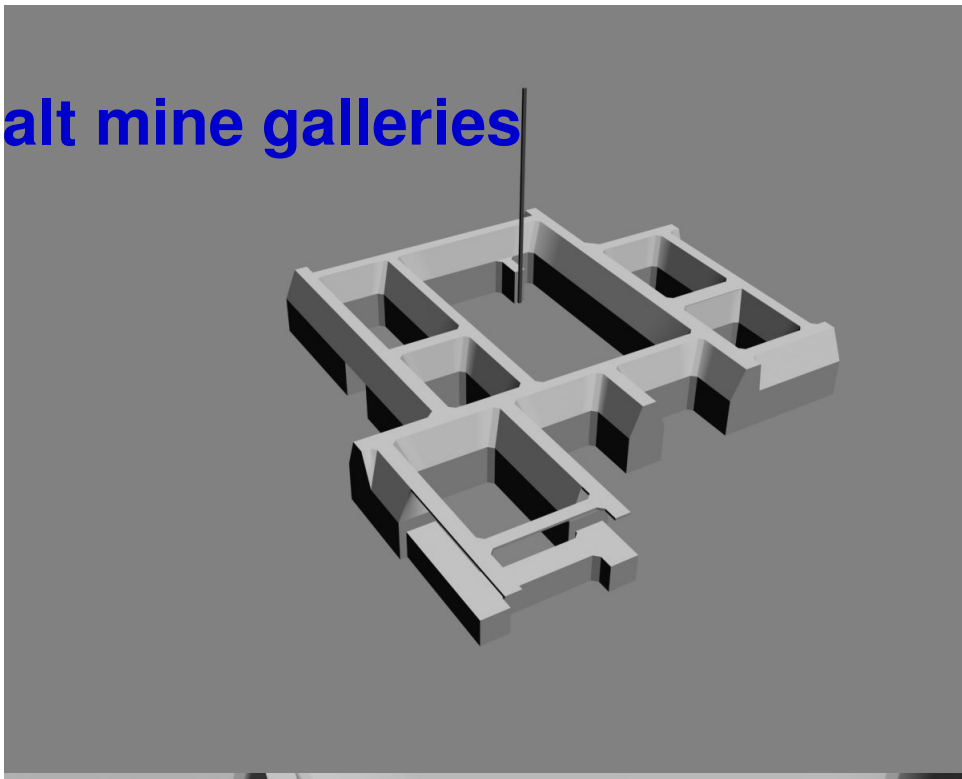
1.2 m thick side insulation consisting of a resilient layer and perlite fill

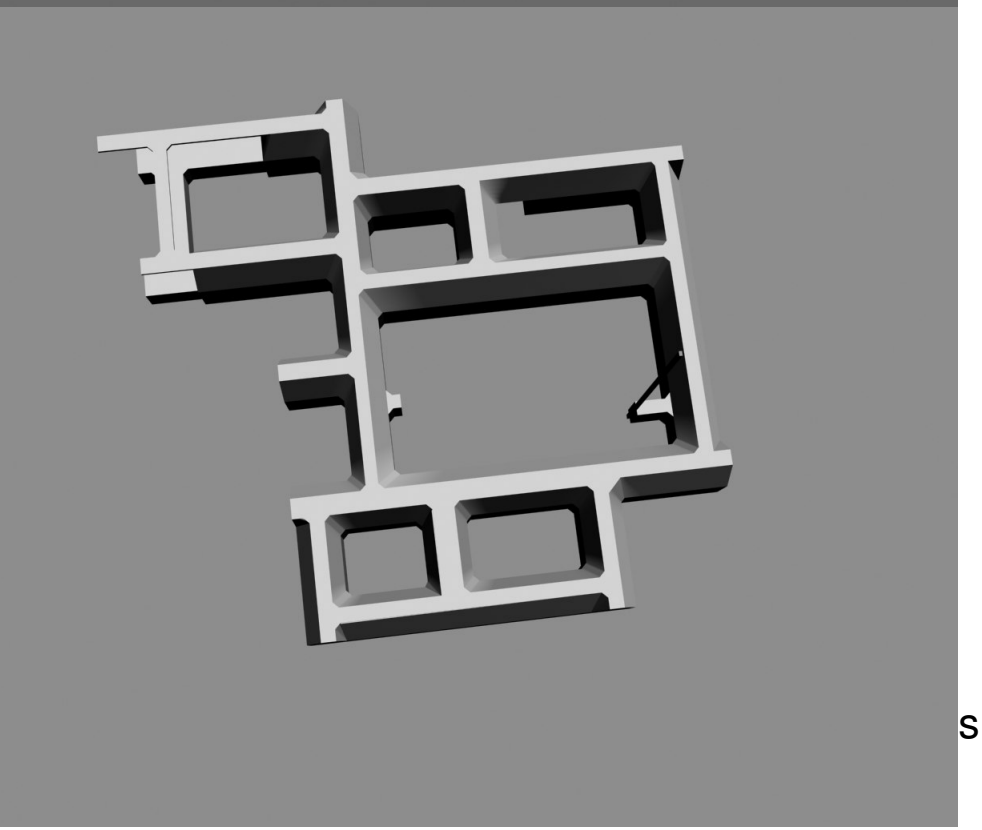
A feasibility study mandated to Technodyne Ltd (UK): Feb-Dec 2004

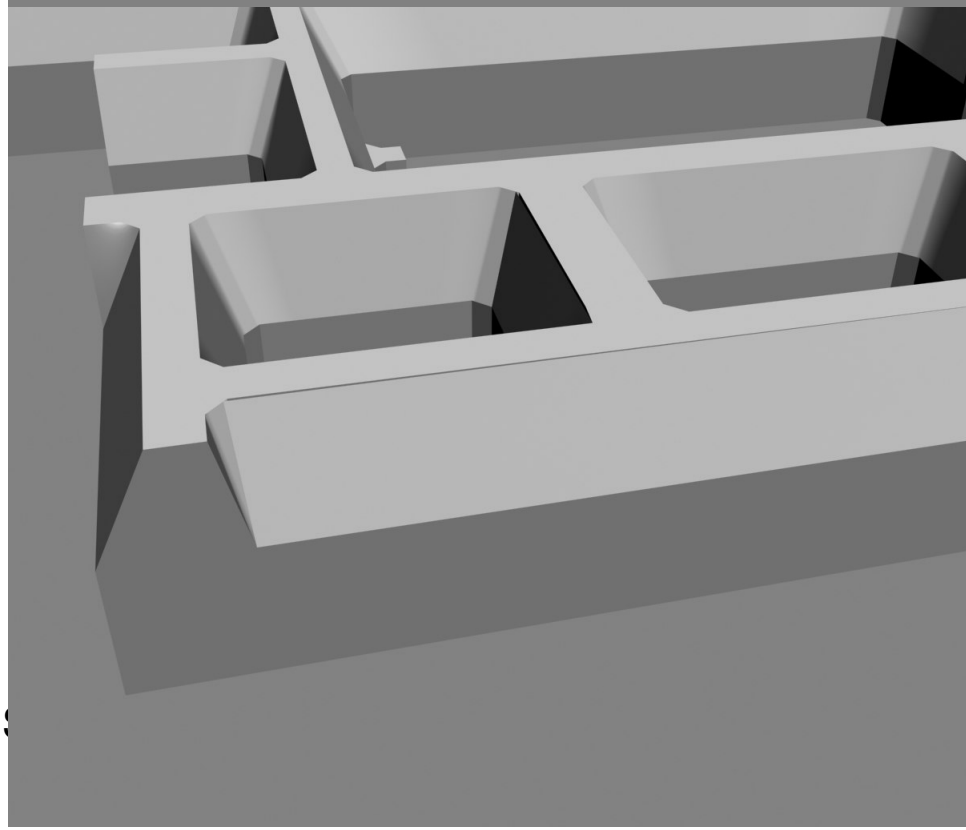
Estimated boil-off 0.04%/day

3D model of Unirea salt mine galleries

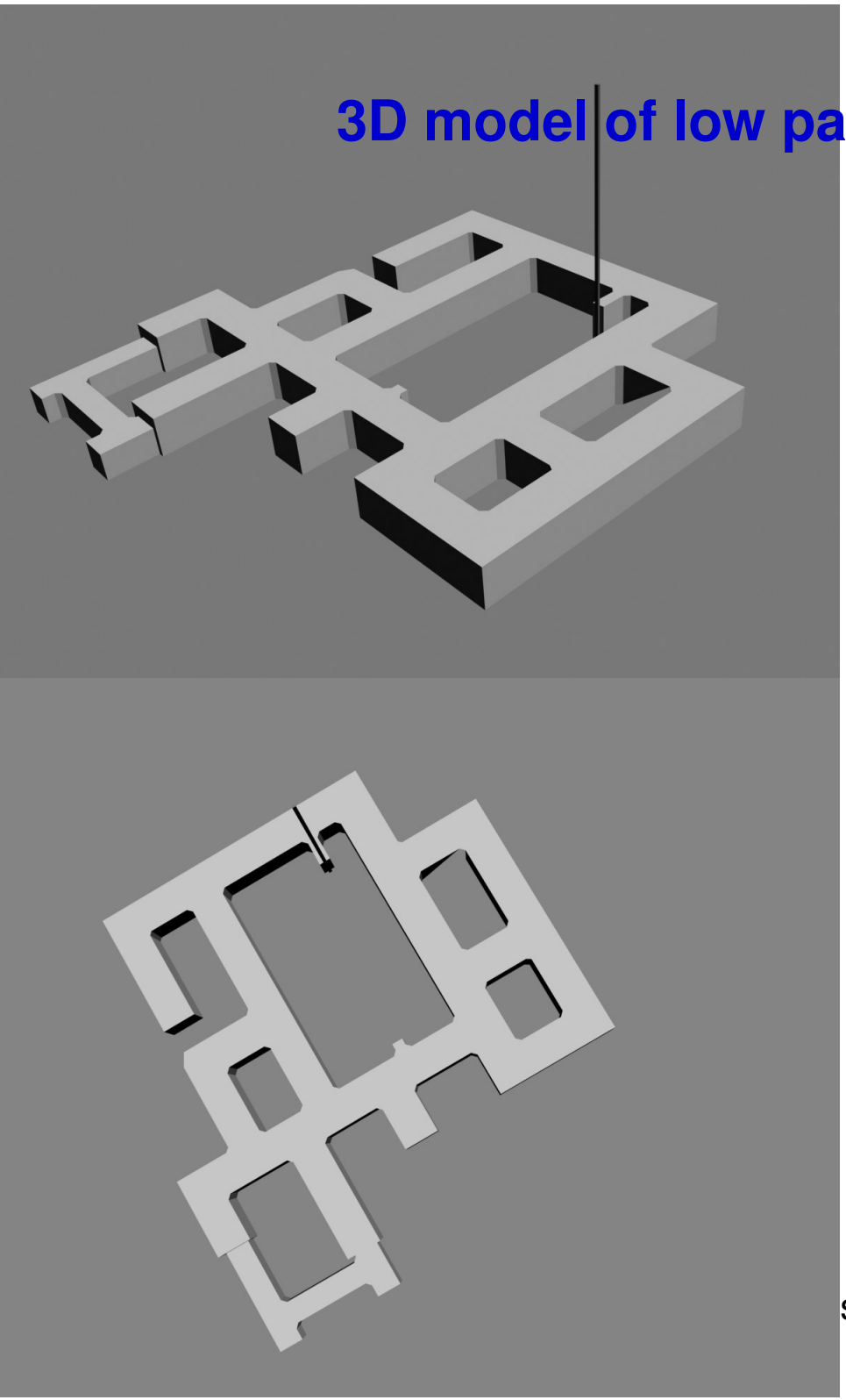


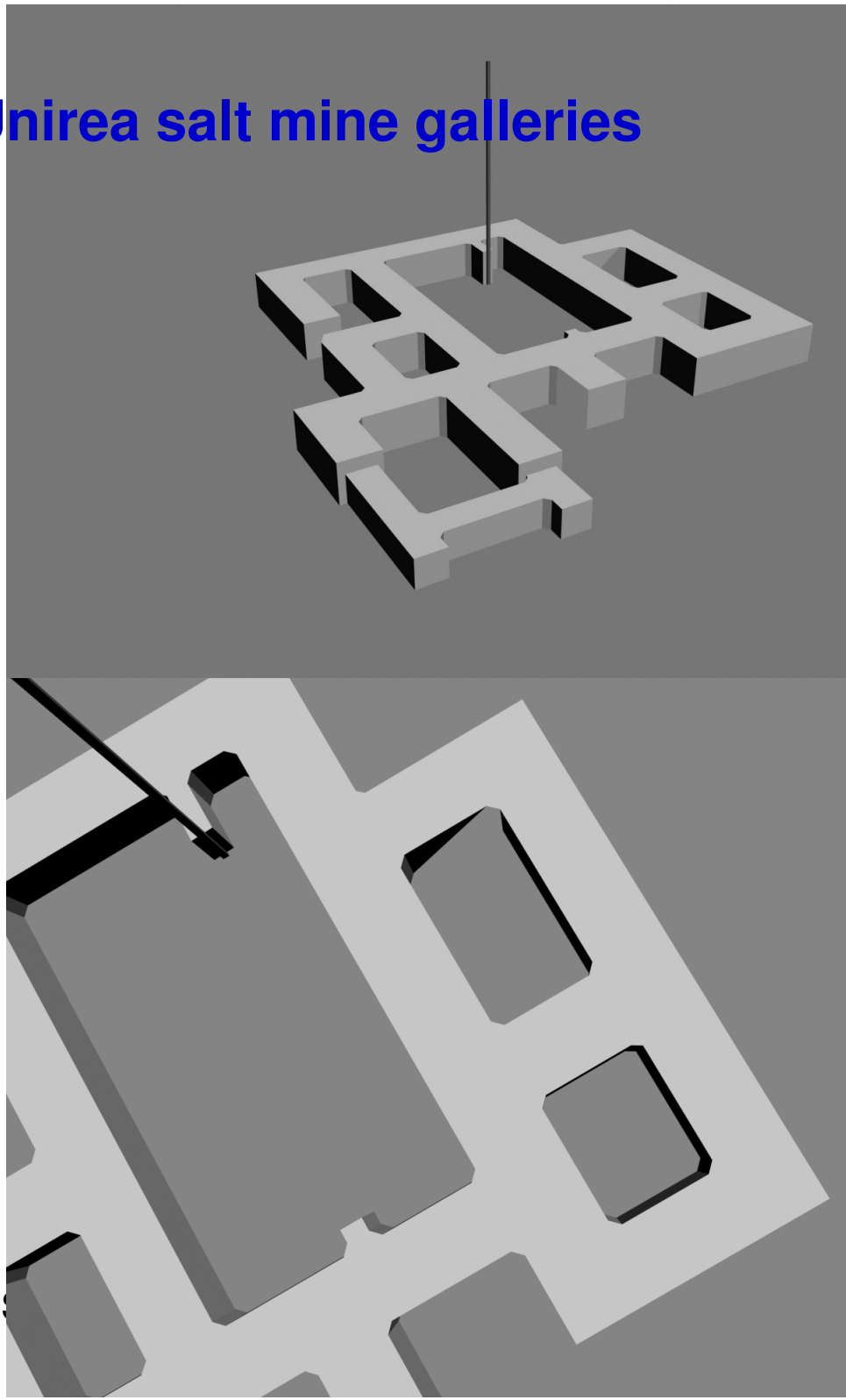




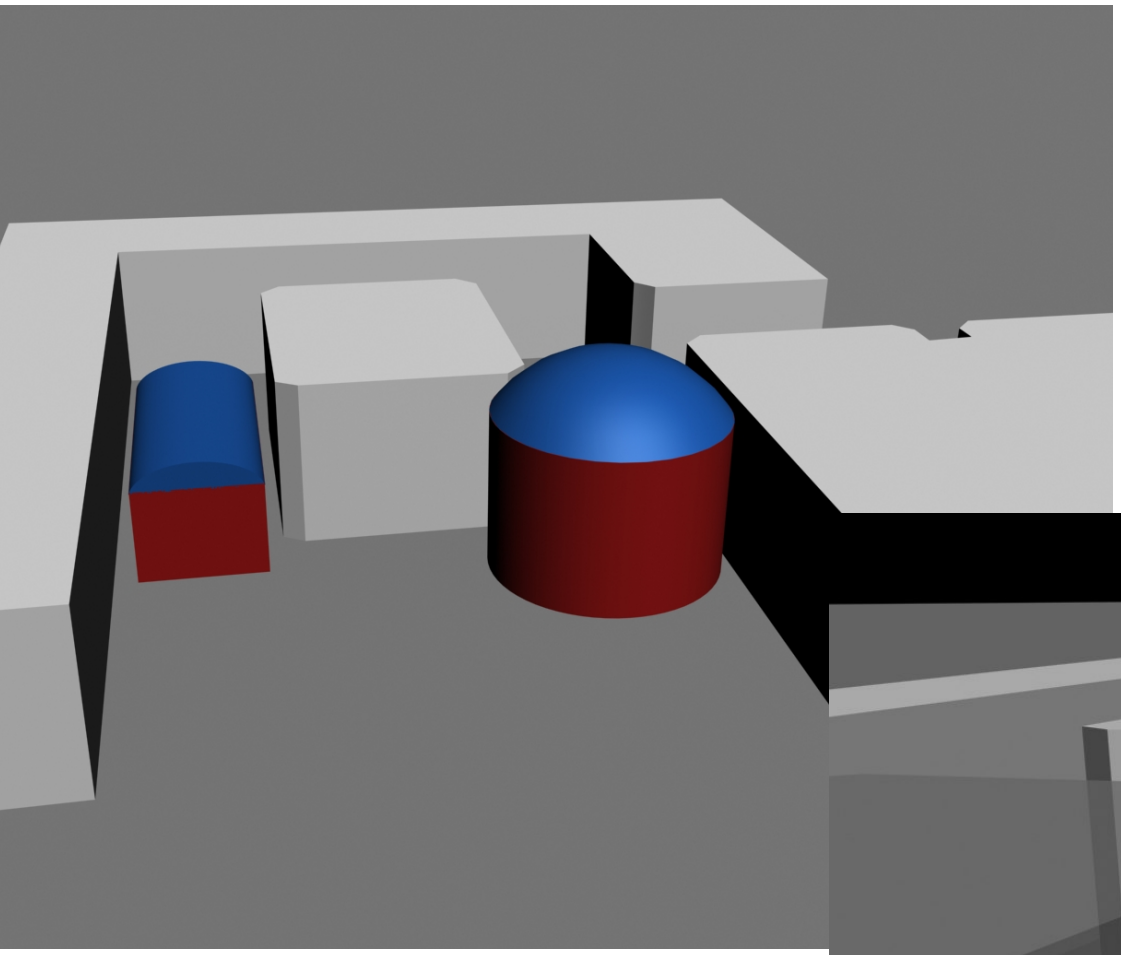


3D model of low part of Unirea salt mine galleries





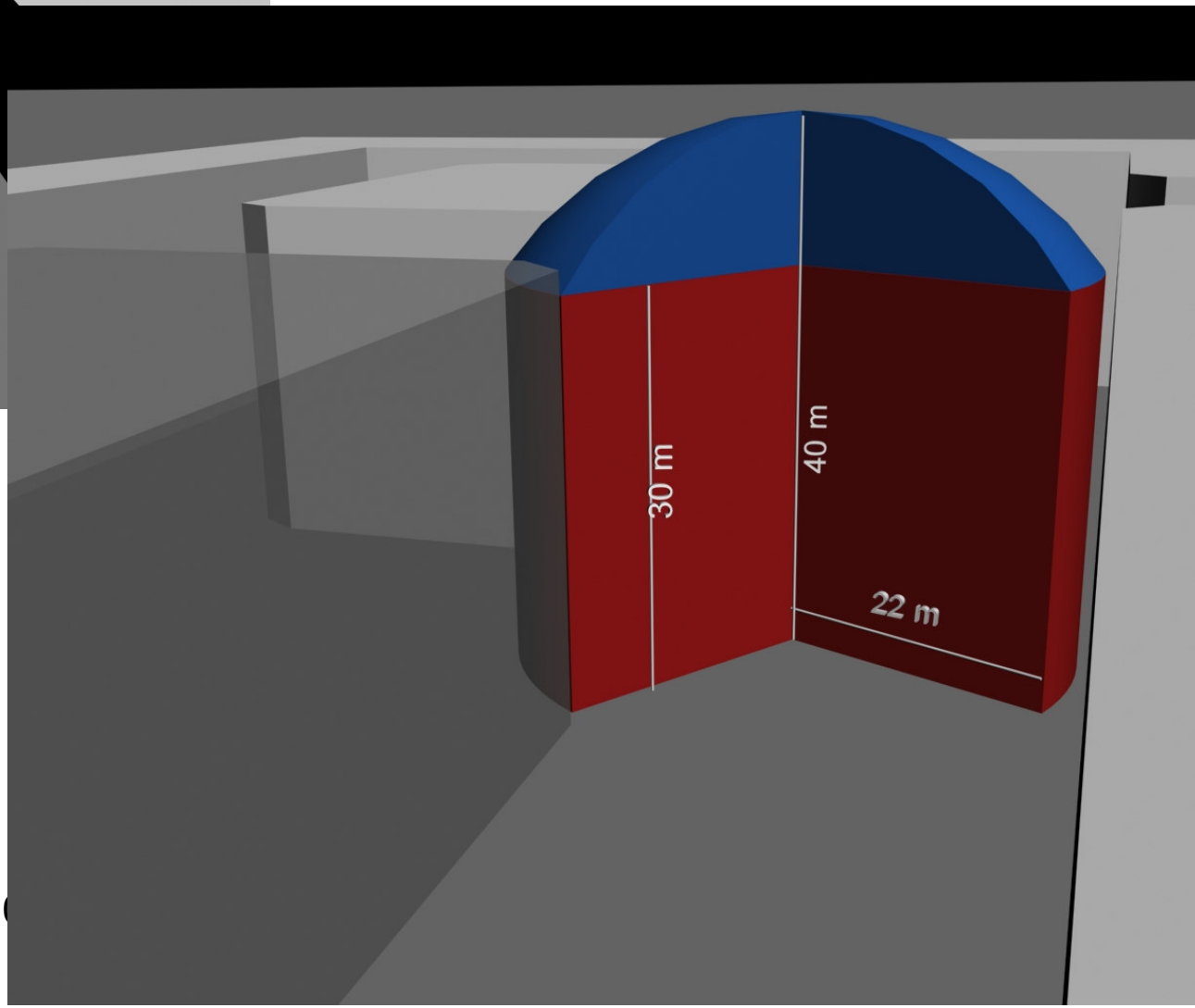
s, France
2008



case 1

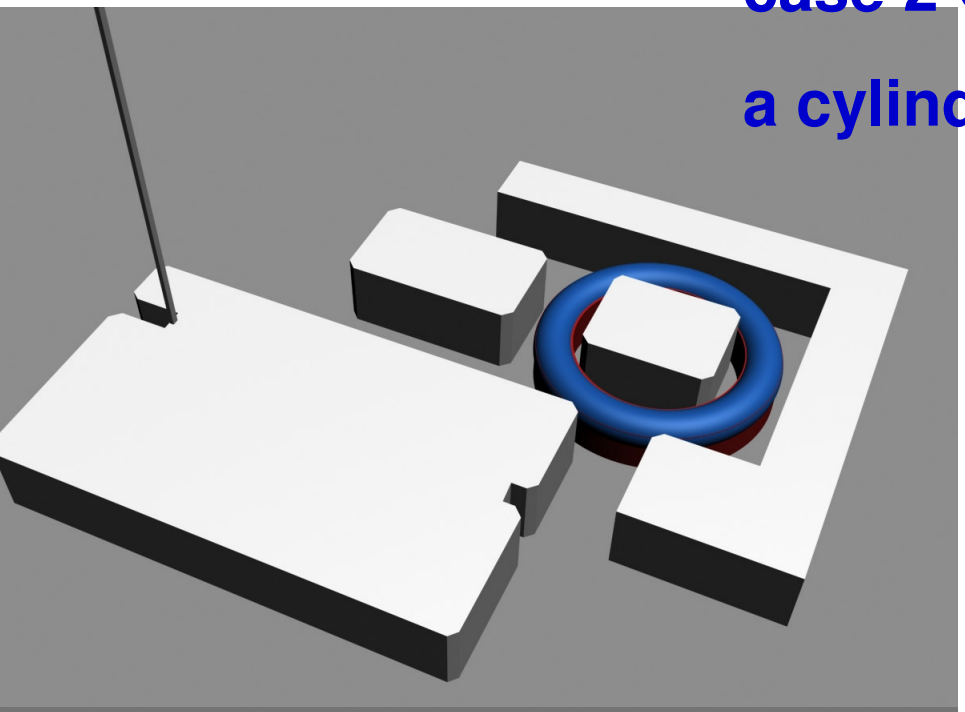
GLACIER detector

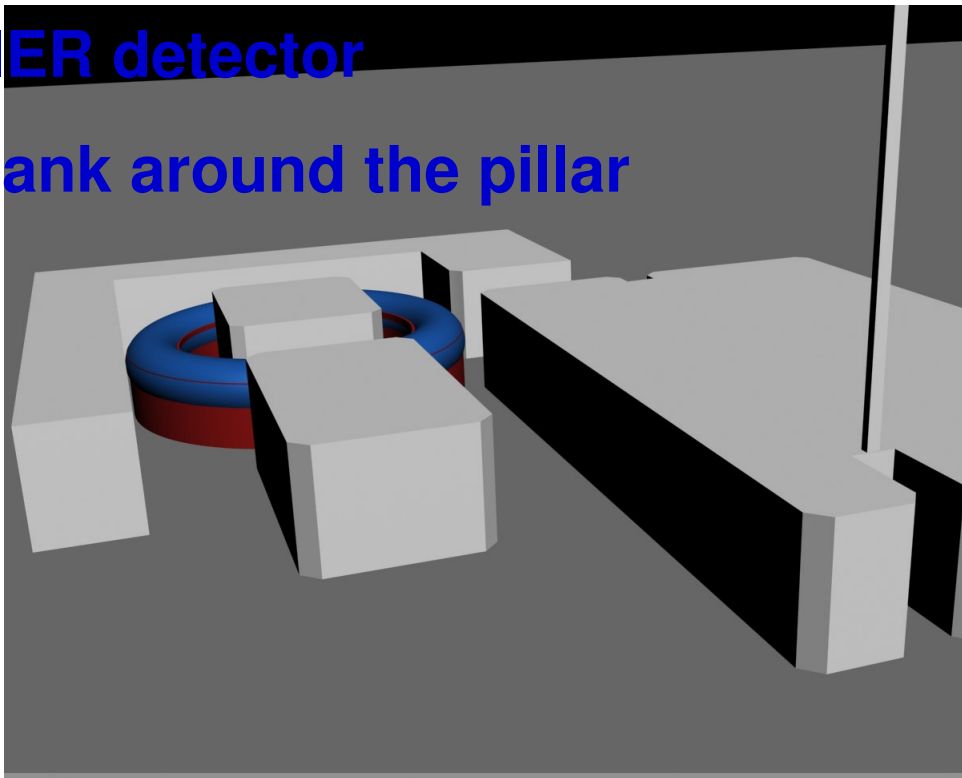
a cylindrical tank

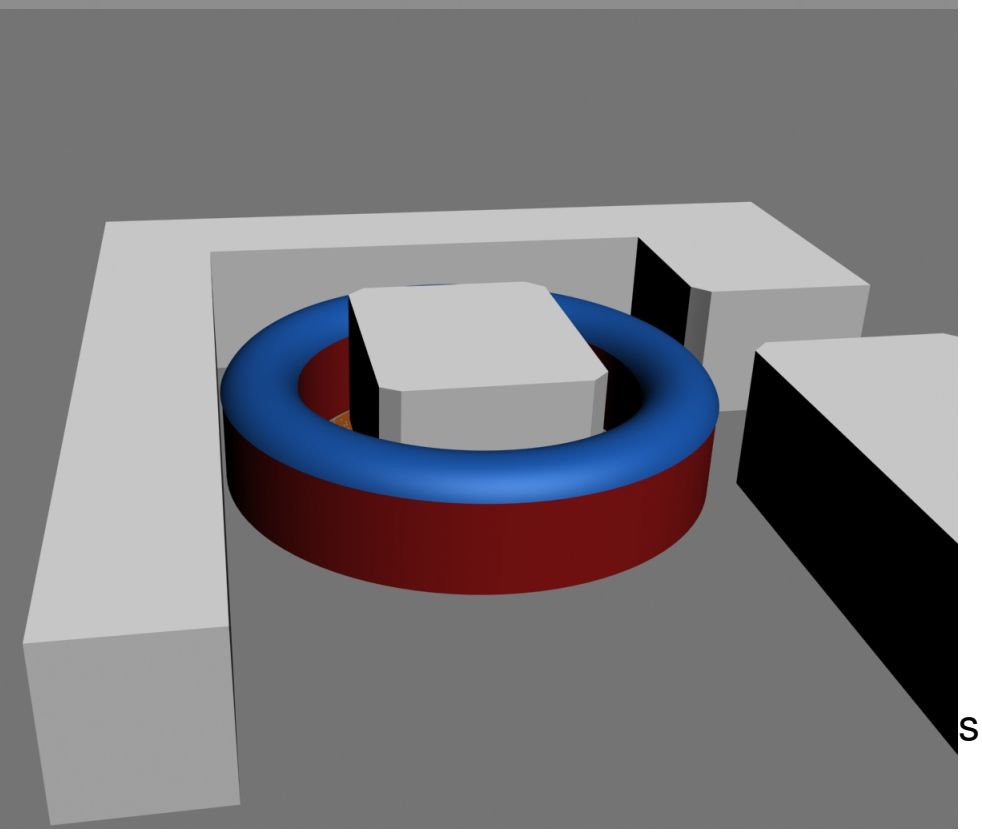


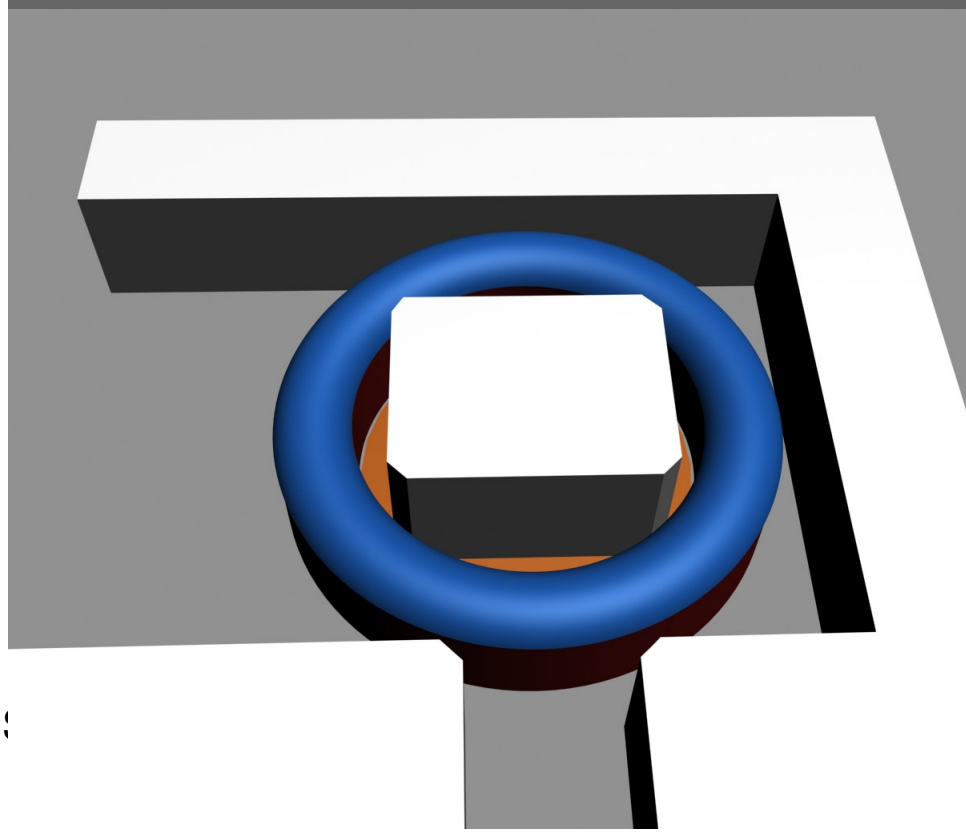
case 2 GLACIER detector

a cylindrical tank around the pillar

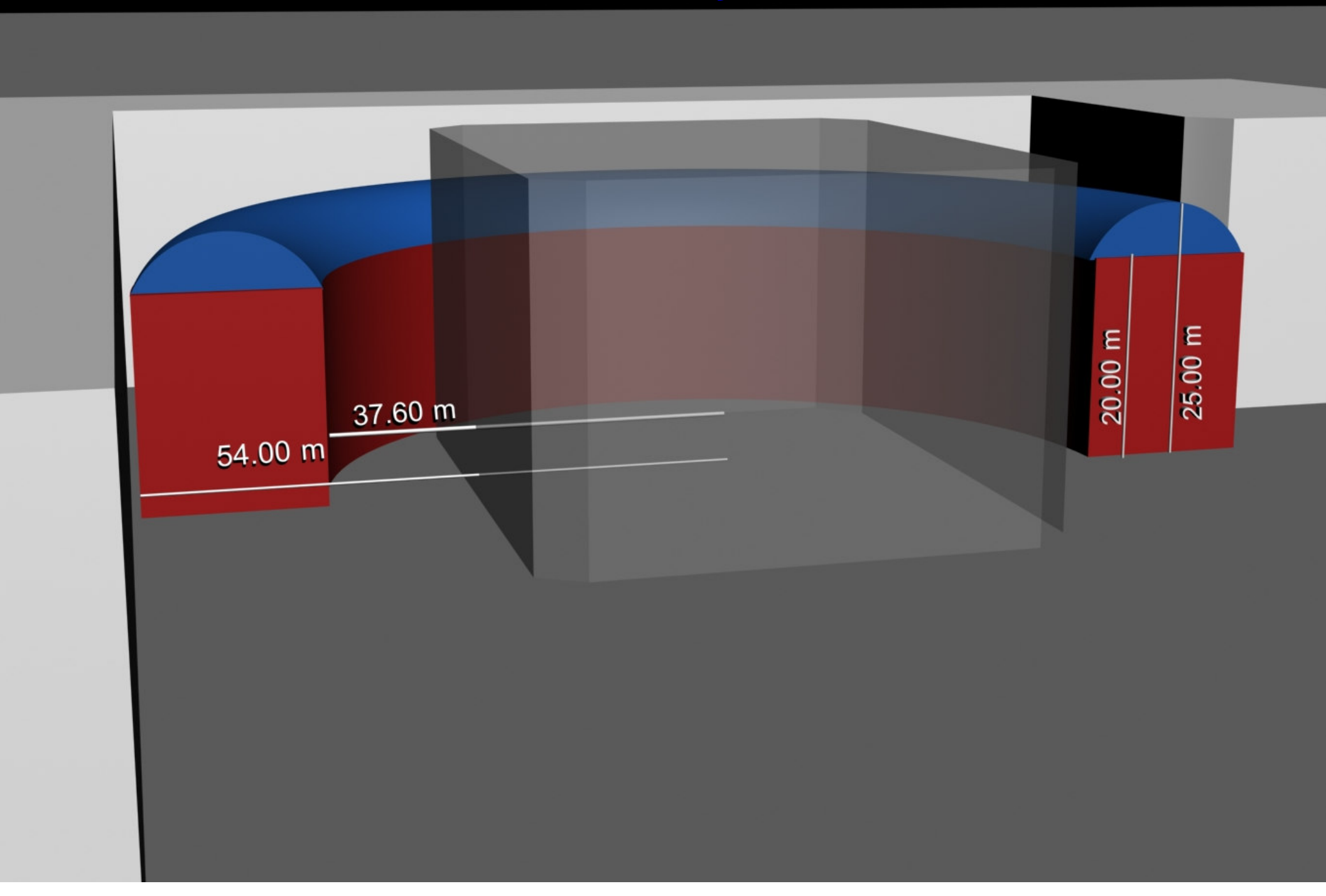




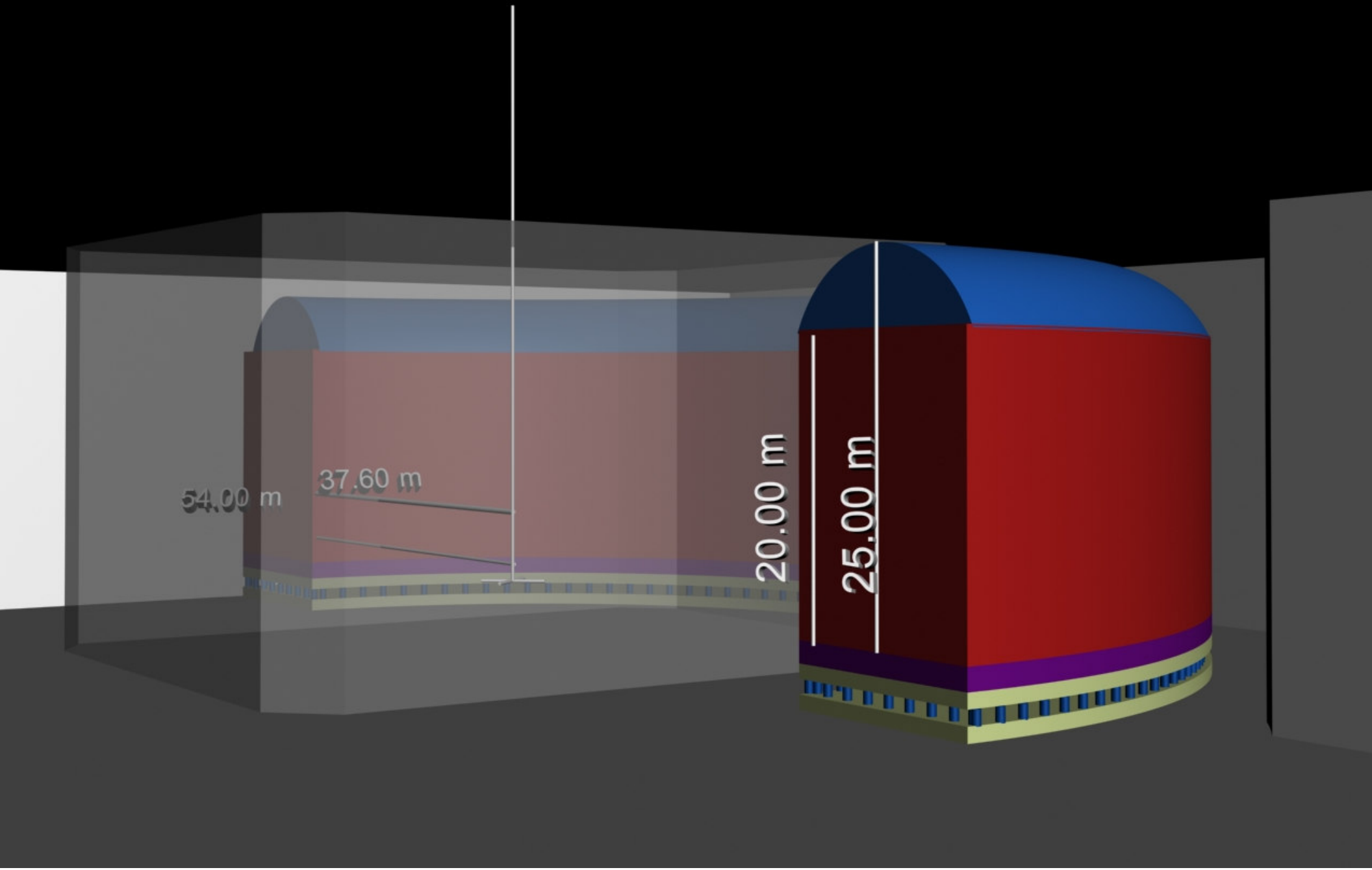


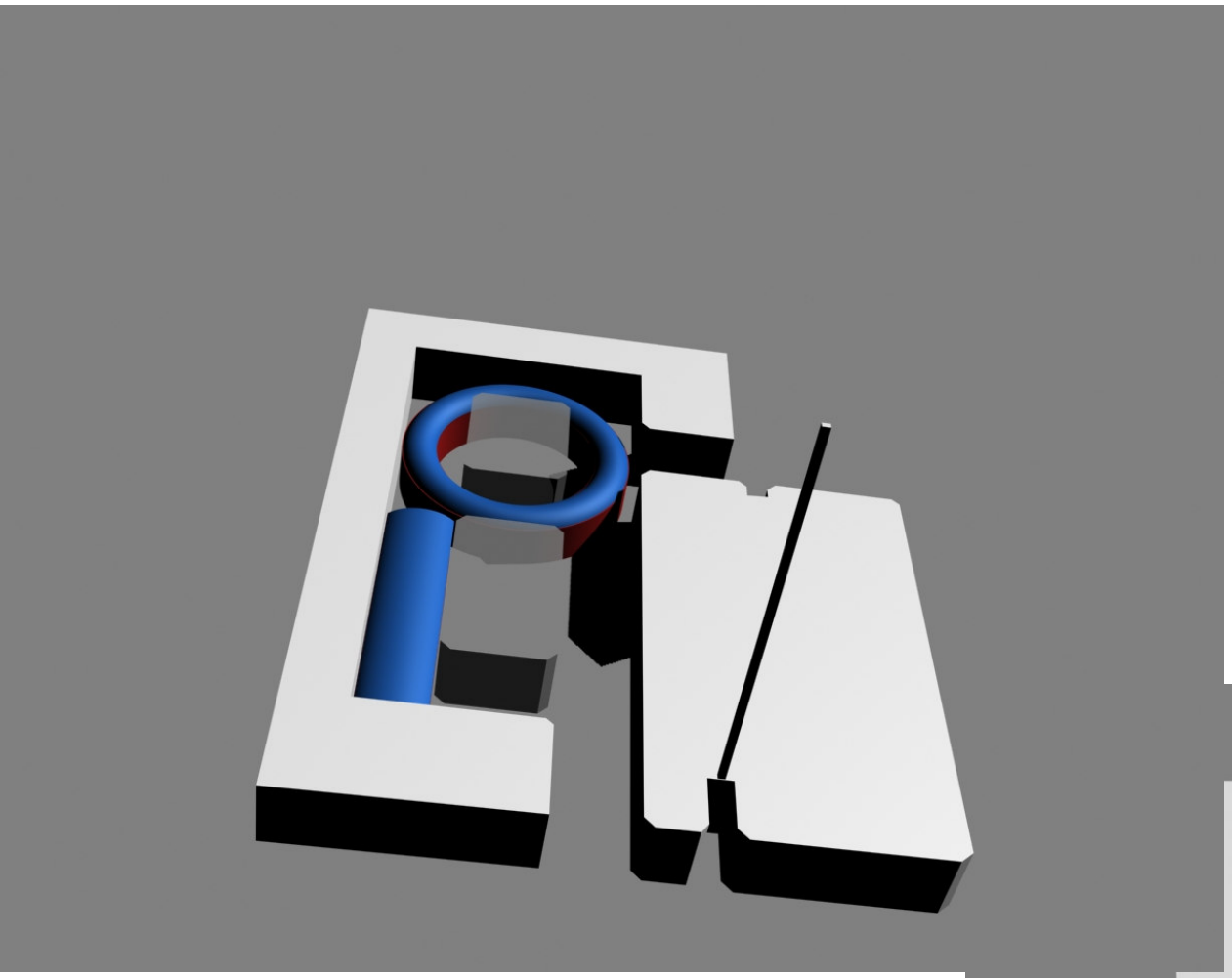


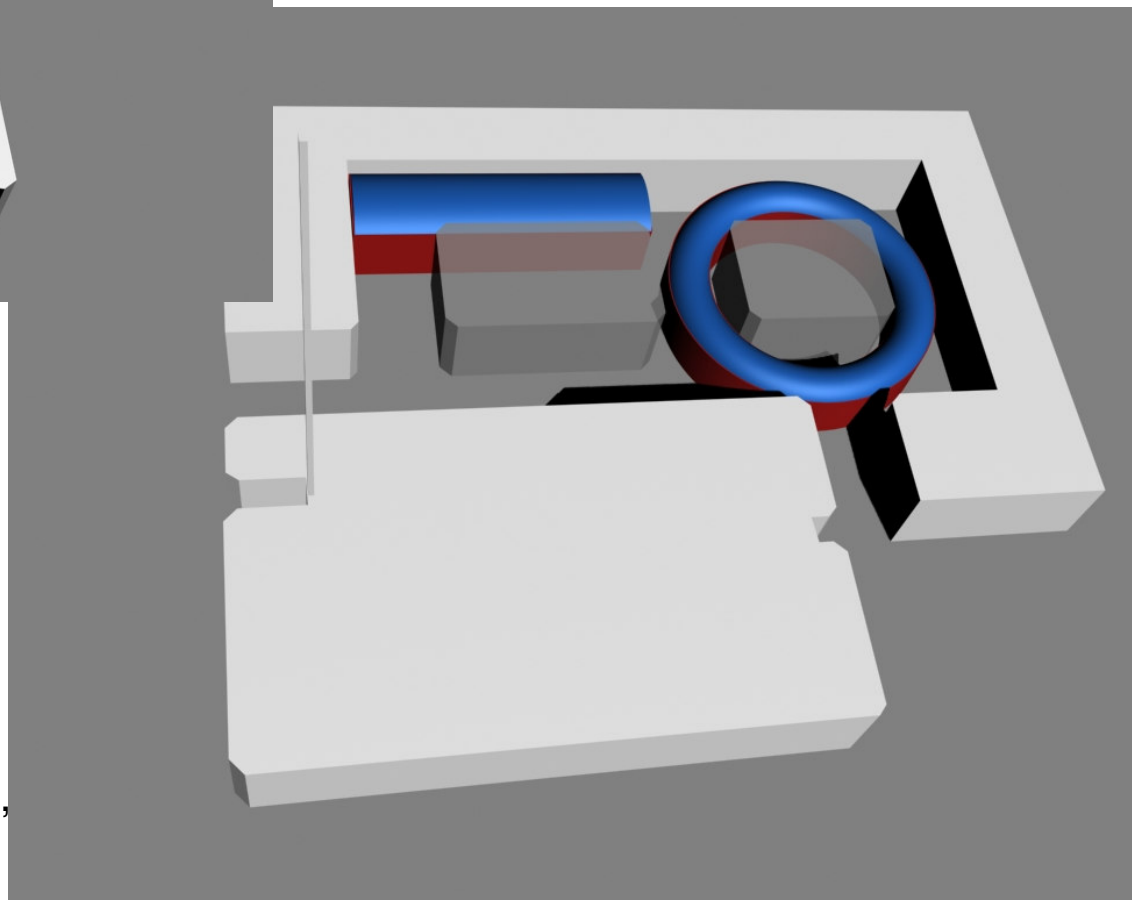
details of cylindrical tank



details of cylindrical tank







Conclusions

The GLACIER detector could be constructed in Unirea salt mine

There are two options:

1. One or more cylinders of r=22m and h=20m (LAr volume about 26000m^3)
2. A cylindrical vessel around the salt pillar with R=109m, r= 37m, h=20m, (LAr volume about 80000m^3)