Overview of the European Underground Facilities

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Abstract. Deep underground laboratories are the only places where the extremely low background radiation level required for most experiments looking for rare events in physics and astroparticle physics can be achieved. Underground sites are also the most suitable location for very low background γ-ray spectrometers, able to assay trace radioactive contaminants. Many operational infrastructures are already available worldwide for science, differing for depth, dimension and rock characteristics. Other underground sites are emerging as potential new laboratories.
In this paper the European underground sites are reviewed, giving a particular emphasis on their relative strength and complementarity. A coordination and integration effort among the European Union underground infrastructures was initiated by the EU-funded ILIAS project and proved to be very effective.

Keywords: Deep underground science laboratories, Europe, astroparticle physics, γ-ray spectrometry
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INTRODUCTION

Underground laboratories provide the low radioactive background environment which is necessary for most key experiments in the field of rare events and astroparticle physics. While some experiments (e.g. dark matter search, neutrinoless double beta decay, solar neutrinos) require very deep sites (> 2 km w.e.), other experiments - neutrino beam, proton decay - can be accommodated in shallower sites, since their requirements on the residual muon flux are weaker.

The low-radioactivity environment of underground laboratories is extremely beneficial also for ultra low-background γ-ray spectroscopy. In fact experiments must be built out of very radiopure materials, and most of them place very stringent requirements on radioactive contaminants. Therefore, materials and components to be used for experiments must be screened by ultra-sensitive Ge spectrometers in order to be qualified for actual use. The background level required for HPGe spectrometers to be sensitive to radioactive contamination down to a few mBq/kg can be practically achieved in underground laboratories only. In principle, ultra-sensitive γ-ray spectrometry does not require very deep sites since after a few hundreds of m w.e. the total background is dominated by the radioactivity of the passive shielding. Nevertheless, virtually all underground laboratories host one or more Ge spectrometers as a screening facility for ultra low-background radioactivity assays. Furthermore, ultra-sensitive γ-ray spectrometers in underground laboratories are used for a variety of additional scientific applications, e.g. environmental monitoring and radio-dating, as well as for the development of new detector technologies.

Several underground facilities are presently operational in Europe, differing for depth, dimension and scope. At the moment there are nine cavities with overburden larger than about 600 m w.e. that can be used for science. They are displayed in Fig. 1 and their main facts are summarized in Table 1. The sites will be described in more detail in the following Sections, based on Refs. [1, 2]. Nevertheless only a fraction of these sites can be regarded as an operational "science infrastructure" (with technical and technological support, safe access, supplies, etc.) and is able to host full-scale astroparticle physics experiments. Other sites are either emerging, namely are cavities in the potential state to become a full infrastructure in the future, or are located at shallower depth and are mainly targeted to γ-ray spectrometry or to specific projects, as LAGUNA[1].
There are five deep underground sites in Europe that can be regarded as operational scientific infrastructures: one in

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[1] LAGUNA [3] is a Design Study (DS) project, funded by the European Commission under the 7^{th} Framework Program focusing on the design of a new European underground infrastructure able to host large-scale experiments (tens of ktons up to 1 Mton) on low-energy neutrino astronomy and proton decay search.

TABLE 1. Summary table of the European underground sites available for science that are described in this paper. References for the laboratory characteristics and fluxes are reported in the text. Sites are ordered in decreasing depth.

	Surface profile	**Surface (m^2)**	**Minimum depth (m.w.e.)**	**Muon flux ($m^{-2}s^{-1}$)**	**Neutron flux ($m^{-2}s^{-1}$)**
Baksan (Ru)	Mountain	ca. 3000	850→4800	$3.03 \cdot 10^{-5}$	$0.23 \cdot 10^{-2}$ (1 – 11 MeV)
Modane (F)	Mountain	ca. 400	4000 (min) 4800 (average)	$5.76 \cdot 10^{-5}$	$1.1 \cdot 10^{-2}$ (> 1 MeV) $1.9 \cdot 10^{-2}$ (thermal)
Gran Sasso (I)	Mountain	17 000	3100 (min) 3800 (average)	$2.87 \cdot 10^{-4}$	$0.86 \cdot 10^{-2}$ (> 1 keV) $2.93 \cdot 10^{-2}$ (< 1 keV)
Boulby (UK)	Flat	1500	2850 (min) 3450 (average)	$4.1 \cdot 10^{-4}$	$1.72 \cdot 10^{-2}$ (> 0.5 MeV)
Canfranc (E)	Mountain	ca. 1000	≈ 2400 (max)	$2 - 4 \cdot 10^{-3}$	$3.82 \cdot 10^{-2}$ (> 1 MeV) at old site
Pyhäsalmi (Fin)	Flat	ca. 1000	200→2400	N/A	N/A
Sieroszowice (Pol)	Flat	many 1000's	≈ 2200	N/A	N/A
Solotvina (Ukr)	Flat	1000	≈ 1000	$1.7 \cdot 10^{-2}$	$< 2.7 \cdot 10^{-2}$ (thermal)
Unirea (Rom)	Flat	70 000 (tot)	≈ 600	N/A	N/A

Russia (Baksan Neutrino Observatory) and four in the European Union: Gran Sasso National Laboratory (LNGS), Italy; Modane Underground Laboratory (LSM), France; Boulby Palmer Laboratory, United Kingdom; Canfranc Underground Laboratory (LSC), Spain. All these laboratories are established since more than ten years, they have hosted key experiments and have a rich scientific program for the future, encompassing dark matter searches, neutrinoless double beta decay, neutrino physics and astroparticle physics.

The four laboratories in Western Europe took part in the ILIAS (Integrated Large Infrastructures for Astroparticle Science) project [4] between 2004 and 2009, which was funded by the European Commission under the 6^{th} Framework Program for a total amount of 7.5 million euro. The ILIAS project was beneficial for a closer coordination of the activities of the laboratories and for the optimization of the available resources, taking into account the different characteristics of the infrastructures. The common activity encompassed coordination for environmental background measurement and control, safety procedure and outreach. A program of Trans-National access was active within ILIAS to favor visits of new scientific groups in the underground infrastructures. The underground site at the Pyhäsalmi mine (Finland), which is not an operational underground infrastructure yet, did not take part in the ILIAS Transnational Access program, but it was included in the coordination activity related to background measurements and safety procedures.

The long-term continuation of the coordination among the four main EU deep underground infrastructures was favored by ASPERA [5] after the end of the ILIAS program[2]. A new collaboration agreement called EULab was signed in 2009 by the agencies that run the laboratories.

THE ILIAS LABORATORIES

In the following subsections, the four ILIAS deep underground laboratories and the Pyhäsalmi site will be described in more detail. Most information is taken from Refs. [1, 2] and from the reports of the ILIAS N2 coordination network ("Deep underground science laboratories") and JRA1 joint research activity ("Low background techniques for deep underground science"), available at `http://www-ilias.cea.fr`. Facilities are reported in chronological order since their establishment.

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[2] ASPERA is a network of national government agencies, funded by the European Commission under the 7^{th} Framework Program, which is responsible for coordinating national research efforts in Astroparticle Physics in Europe.

FIGURE 1. Position of the European underground sites described in this paper.

Laboratoire Subterrain de Modane (LSM), France

The Modane underground laboratory is located under the Frejus mountain, in France, near the Italian border. The infrastructure is run jointly by CNRS/IN^{2}P^3 and by CEA/DSM. It is the deepest underground infrastructure available in Western Europe, its minimum rock overburden being 4000 m w.e. (average overburden: 4800 m w.e.). The access to the laboratory is horizontal, through the single-way Frejus roadway tunnel. Intervention of the tunnel control is actually requested to stop the traffic and allow the entrance/exit of vehicles to the laboratory. The excavation started in 1979 and the first experiment - a 900 ton iron tracking calorimeter to search for proton decay ("Frejus experiment") - was commissioned in 1982. The underground site is composed by a Main Hall, $30 \times 10 \times 11$ m^3, a 70 m^2 Gamma Spectrometry Hall hosting 13 HPGe detectors, and two secondary halls (18 and 21 m^2), totaling about 400 m^2. Surface facilities located in the city of Modane include offices and a warehouse.

The muon flux has been measured to be $5.76 \cdot 10^{-5}$ $\mu/$(m^2·s) [6], namely five muons per m^2 per day. The flux of fast neutrons (above 1 MeV) which has been re-measured in the framework of the EDELWEISS experiment is $(1.1 \pm 0.1) \cdot 10^{-2}$ n/(m^2·s) [7]. The thermal neutron flux is about $1.9 \cdot 10^{-2}$ n/(m^2·s) [8]. The laboratory has been also characterized in term of primordial radionuclides contained in the rock(concrete): 0.84(1.9) ppm for ^{238}U and 2.45(1.4) ppm for ^{232}Th. The Potassium content of the rock is 6.9‰ (= 213 Bq/kg of ^{40}K). The average ^{222}Rn content in the underground site is about 15 Bq/m^3 when ventilation is on (1.5 volumes per hour). Recently, an "anti-radon" facility was built underground which is able to produce Rn-free air (about 15 mBq/m^3) at a rate of 150 m^3/h. The Rn-free air is necessary to meet the background specifications for the NEMO3 neutrinoless double beta decay ($0\nu2\beta$) experiment.

At the moment, the laboratory is completely filled by two main experiments, EDELWEISS-II (dark matter search) and NEMO3 ($0\nu2\beta$), and by a low-radioactivity counting facility. Other experiments having a smaller footprint, TGV-II ($0\nu2\beta$ decay) and SHIN (nuclear physics), are also located in the laboratory.

The Gamma Spectrometry Hall hosts 13 HPGe low-background detectors, belonging to six different institutions. They are routinely used for radio-assay and qualification of materials to be used for the experiments but also for other applications, including environmental measurement and applications (wine dating, salt origin, etc.).

An extension of the laboratory of 60 000 m^3 (ULISSE project) is planned in coincidence with the excavation of a new safety tunnel, which started in September 2009. Two new large Halls (Hall A, 24×100 m^2, and Hall B, 18×50 m^2) are expected to be operational in 2013.

Laboratori Nazionali del Gran Sasso (LNGS), Italy

The Gran Sasso underground laboratory is one of the four national laboratories run by the INFN (Istituto Nazionale di Fisica Nucleare). It is located under the Gran Sasso mountain, in central Italy, and it is by far the largest underground laboratory in the world, serving the largest and most international scientific community. The vehicle access to the laboratory (cars and trucks) is through the A24 freeway (two-way) tunnel and does not require any specific safety procedure.

The total underground area is 17 000 m^2 (volume: 180 000 m^3). The laboratory encompasses three main halls (named A, B and C), each about $100 \times 20 \times 18$ m^3, plus ancillary tunnels, providing space for services, plants and smaller-scale experiments. After the initial proposal by the INFN President A. Zichichi in 1979, the actual excavation started in 1982, in coincidence with the freeway 10-km tunnel, and was completed in 1987. The rock overburden of the laboratory is about 3100 m w.e. (minimum depth), or 3800 m w.e. (average depth). Surface facilities are located in the town of Assergi and include offices, mechanical and electronics workshops, storage facilities, chemistry lab, computer and networking, canteen, conference rooms. The total personnel (physicists, engineers, technicians, administration) includes a permanent staff of about 80 and about 20 non-permanent positions. Major civil engineering works have been accomplished between 2004 and 2007 to upgrade the safety conditions as well as the interface with the freeway system and the drinking water collection system.

The muon flux in the underground laboratory is $(2.87 \pm 0.03) \cdot 10^{-4}$ $\mu/(m^2{\cdot}s)$ [9, 10], corresponding to about one muon per m^2 per hour. Measured thermal and fast neutron fluxes are $2.93 \cdot 10^{-2}$ n/($m^2{\cdot}s$) below 1 keV and $0.86 \cdot 10^{-2}$ n/($m^2{\cdot}s$) above 1 keV, respectively [11]. The ^{222}Rn specific activity in the underground halls is between 50 and 120 Bq/m^3 when the ventilation is on (one volume in 3.5 hours). The abundance of primordial radionuclides in the rock(concrete) is about 0.42(1.05) ppm for ^{238}U and 0.062(0.656) ppm for ^{232}Th, respectively. The Potassium concentration in the Gran Sasso rock (Hall B) amounts to 160 ppm, corresponding to 4.9 Bq/kg of ^{40}K; the Hall A rock has a much higher Potassium concentration, approx. 7‰.

The current experimental program at LNGS is very rich, including CERN to Gran Sasso beam experiments (OPERA and ICARUS); neutrinoless double beta decay searches (CUORE, GERDA and COBRA); dark matter searches (DAMA/Libra, WArP, CRESST and XENON); solar and geo-neutrinos (Borexino); supernova neutrinos (LVD); nuclear astrophysics (LUNA). The laboratory is operated as an international science facility and hosts also non-INFN physics experiments, whose scientific value is assessed by an international advisory Scientific Committee. The laboratory is also supporting small-scale measurements on geology, biology and environmental issues. Many former experiments located at Gran Sasso - and now decommissioned - were at the leading frontier at that time. Among them, Gallex/GNO (solar neutrinos) and MACRO (atmospheric neutrinos and cosmic rays).

The laboratory hosts an underground low-background facility, STELLA (SubTErranean Low Level Assay), consisting of about 10 HPGe γ spectrometers. Applications of the facility include material screening for experiments (radiopurity assay), background characterization, physics measurements (e.g. search for rare decays) and environmental measurements (^{222}Rn in ground water, radio-dating). The facility occupies a surface of about 32 m^2 in a connection tunnel and it hosts the most sensitive HPGe γ-spectrometer in the world, GEMPI2. The total background rate of the GEMPI2 detector is 44 counts/(kg·day) (integral between 40 and 2700 keV); the background rate at the ^{40}K 1460-keV peak is 0.13 counts/(kg·day) [12, 13].

Laboratorio Subterràneo de Canfranc (LSC), Spain

The first underground facility under the Mount Tobazo in the Spanish Pyrenees, near the French border, was created at the beginning of 80s, close to a dismissed railway tunnel. The laboratory was composed by three separated small halls along the railway tunnel, having a total surface of about 140 m^2 and maximum rock overburden ranging from 780 m w.e. to 2400 m w.e. The laboratory was operated by the University of Saragossa and fully characterized in terms of background. Several experiments were performed in the old Canfranc laboratory, notably IGEX ($0\nu2\beta$ decay), ROSEBUD and ANAIS (dark matter searches).

Taking profit from the excavation of a new parallel road tunnel, a new laboratory has been recently built. Excavation started in 2005 and the underground laboratory has been completed after the civil engineering on July 2010. The new Canfranc laboratory is managed by a Consortium including the Spanish Ministry for Education and Science, the Government of Aragon and the University of Saragossa. The new underground facility contains two main halls (labeled Hall A and Hall B) having surface of 600 m^2 ($40 \times 15 \times 12$ m^3) and 150 m^2 ($15 \times 10 \times 8$ m^3), respectively, and ancillary tunnels and services (e.g. clean room). Surface infrastructures, for a total area of about 1500 m^2 are also being built. The access is horizontal via one of the available road tunnels. The maximum rock overburden in the new laboratory is about 2400 m w.e. allowing a residual muon flux between 2 and $4 \cdot 10^{-3}$ $\mu/(m^2{\cdot}s)$ [1], depending on the location. The new site still has to be characterized in terms of neutron flux, γ-ray flux and ^{222}Rn activity[3]. The total ventilation power is about 11 000 m^3/h, corresponding to 1.5 volumes per hour. The underground laboratory is presently empty, but six experiments have been approved by the International Scientific Committee, on $0\nu2\beta$ decay (BiPo and NEXT), dark matter searches (ANAIS and ROSEBUD), low-background assays for liquid scintillators (SuperK-Gd) and geo-dynamics (GEODYN).

Boulby Palmer Laboratory (BUL), United Kingdom

The Boulby Palmer Laboratory was established in 1998 and it is located under an active potash mine in the North-East of England operated by Cleveland Potash Ltd. The underground scientific infrastructure has a total area of about 1500 m^2, sub-divided in several tunnels, and is located at about 1100 m depth under a flat surface. Surface facilities (about 200 m^2) are also available, hosting ancillary services, as computing, chemical labs, mechanical workshop, electronic and offices. The access is vertical through a shaft operated by the mine company. The minimum rock overburden is 2850 m w.e. (average depth is 3450 m w.e.), giving a residual muon flux of $4.1 \cdot 10^{-4}$ $\mu/(m^2{\cdot}s)$ [15]. The fast neutron flux above 0.5 MeV has been measured to be $(1.72 \pm 0.72) \cdot 10^{-2}$ n/($m^2{\cdot}s$) [16]. The particular composition of the rock, which is mainly salt, turns out in a very low γ-ray and ^{222}Rn background. In particular, the abundance of primordial radionuclides in the laboratory salt is 67 ppb for ^{238}U, 125 ppb for ^{232}Th and 1130 ppm for Potassium. The average ^{222}Rn content in the underground site is less than 3 Bq/m^3.

The scientific activity of the Boulby laboratory is mainly focused on dark matter searches. The laboratory hosted the ZEPLIN-II experiment (completed in 2008) and is presently hosting its upgraded version, ZEPLIN-III, as well as the DRIFT-II R&D. The future planning is still focused on dark matter searches but it pursues the further development of very low-background facilities for material screening and is open to future small and large projects, as LAGUNA.

The underground site hosts a ultra-low background HPGe spectrometer (about 2 kg weight), which is used for material activity measurements. Radon emanation measurements are routinely performed in the laboratory using low-background commercial detectors (Durridge Rad7), with sensitivity better than 0.02 Bq/sample.

Center for underground physics in Pyhäsalmi (CUPP), Finland

The center is hosted since 2001 in a working mine close to Pyhäsalmi, in central Finland. Several cavities, that were excavated between 1962 and 2001 and have been dismissed by the mine, are available at different depths between 75 and 980 m. The total usable underground area is about 1000 m^2. New scientific facilities could be excavated at the depth of 1400 m (about 4 km w.e. minimum overburden), where the mining activities are currently taking place. Access is both via a vertical shaft and via a long inclined tunnel, which can be also accessed by trucks. The EMMA experiment on cosmic ray muons is currently hosted underground at the 75 m level. Small surface facilities are available, including offices and a guesthouse. The site is open for small and medium-scale experiments which may fit in the existing cavities.

LABORATORIES IN EASTERN EUROPE

In the following subsections, the four underground sites located in Eastern Europe will be described in more detail. As in the previous section, facilities are reported in chronological order since their establishment. Unless specifically

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[3] The fast neutron flux (above ca 1 MeV) measured in the old Canfranc laboratory is $(3.82 \pm 0.44) \cdot 10^{-2}$ n/($m^2{\cdot}s$) [14].

quoted, fluxes and other information are taken from Ref. [1] and references therein.

Baksan Neutrino Observatory (BNO), Russia

The Baksan Neutrino Observatory, located under the Mount Andyrchi in the Russian Caucasus, is the oldest underground facility in the world which was explicitly built for scientific purposes. The excavation started in 1966 and experimental activities started in the 70s. A new village, called 'Neutrino', was built as a part of the original project to host personnel and services (offices, water supply, heating). The laboratory is operated by the Institute for Nuclear Research (INR) of the Russian Academy of Sciences. The underground facilities are located along two parallel horizontal tunnels, each 4 km long, excavated into the side of Mt. Andyrchi. The access is horizontal through the entrance tunnel, which is equipped with a rail system for the transportation of personnel and equipment. Several experimental halls are available, which are located at different distance from the entrance and have a different rock overburden. The BUST Hall ($24 \times 24 \times 16$ m^3) has the least rock overburden (about 850 m w.e.) and hosts the BUST neutrino telescope, ready since 1978 to detect neutrinos from a galactic supernova explosion. The other main hall, having dimension $60 \times 10 \times 12$ m^3 and much larger overburden (4800 m w.e. vertical depth) hosts the SAGE solar neutrino experiment, which is operational since 1992. The SAGE site is lined with 60 cm of low-background concrete, to further reduce the neutron and γ-ray fluxes coming from the rock. The excavation of a larger and deeper hall, which started in 1990, was abandoned at the time of the collapse of the Soviet Union and its status is presently undefined. A few smaller halls with intermediate rock overburden are used for R&D on dark matter and $0\nu2\beta$ decay and host a screening facility with HPGe detectors. The laboratory is actually operated as an observatory, in the sense that its program foresees very long duration measurements.
The muon flux in the SAGE hall is $3.03 \cdot 10^{-5}$ $\mu/(\text{m}^2{\cdot}\text{s})$ [17]. The total neutron flux between 1 and 11 MeV is less than $2.3 \cdot 10^{-3}$ n/(m^2·s) [18]. The total ^{222}Rn contamination in the laboratory is about 40 Bq/m^3, when the ventilation (7 volumes per hour) is on.

Solotvina Underground Laboratory (SUL), Ukraine

The Solotvina underground laboratory is located in an active salt mine, at 430 m depth. The Laboratory was established in 1984 and it is operated by the Institute for Nuclear Research of the Ukrainian Academy of Sciences. The total underground area is about 1000 m^2, composed by a main hall ($25 \times 18 \times 8$ m^3) and four smaller halls, each $6 \times 6 \times 3$ m^3. The access to the laboratory is vertical through the mine shaft. A small surface facility is available with offices and living rooms. The rock profile is practically flat and the minimum overburden is about 1000 m w.e., giving a muon flux in the experimental hall of $1.7 \cdot 10^{-2}$ $\mu/(\text{m}^2{\cdot}\text{s})$ [19, 20]. The thermal neutron flux is $< 2.7 \cdot 10^{-2}$ n/(m^2·s) [19]. The particular rock composition (salt) yields a lower γ-ray background with respect to laboratories excavated in ordinary rock, as discussed for the Boulby Laboratory, because of the lower concentration of primordial radionuclides of the ^{232}Th and ^{238}U series. The radon concentration in the laboratory air is 33 Bq/m^3.
The laboratory hosts a number of small- and medium-scale R&D projects focused on $0\nu2\beta$ decay (especially for SUPER-NEMO) and on the development of radiopure scintillating crystals for $0\nu2\beta$ decay and dark matter experiments. Dedicated experiments on the $\beta\beta$ decay of ^{116}Cd are also performed using pure ^{116}CdWO$_4$ crystals.

Unirea mine, Romania

Starting from 2006, scientific activities are ongoing underground in the Unirea salt mine, close to the Slanic town (Romania), in the sub-Carpatian hills. The mine has a hive-like structure composed by several galleries, each 32-36 m wide and 54-58 m high. The total floor area amounts to more than 70 000 m^2. A Low Background Radiation Laboratory with HPGe detectors is sitting at a depth of 208 m beneath the surface, corresponding to about 580 m w.e. [21]. The access to the mine is vertical, through two elevators connected to the surface, each with 45-ton capacity. While the site is too shallow for most astroparticle physics experiments (dark matter search, $0\nu2\beta$ decay) because of the μ-induced background, it is an ideal place for a very low-background γ-spectrometry facility. In fact, the salt in the mine is extremely poor in primordial radionuclides of the ^{232}Th and ^{238}U series. The total dose measured in the underground area is 1.17 ± 0.14 nGy/h, which is about 80 times smaller than the value on the surface. No dedicated measurements have been performed up to now to evaluate the muon and neutron fluxes. The Unirea site is a possible candidate to host the LAGUNA initiative. A few HPGe detectors are presently operational underground.

Polkowice-Sieroszowice mine, Poland

The active Polkowice-Sieroszowice salt mine, located near Wrocław, in the South-West of Poland, and operated by the KGHM holdings, is a candidate site for a new scientific underground laboratory in the near future (SUNLAB). The total excavated area covers many tens of km^2 and several large chambers in salt ($85 \times 15 \times 20$ m^3) are presently available at the depth of 950 m, corresponding to about 2200 m w.e. The access to the mine is vertical, with many shafts available. Measurements performed in the underground area with portable γ spectrometers indicate very low levels of Uranium and Thorium, as expected for a salt mine, and a total dose of 1.9 ± 0.14 nGy/h [3]. The Radon content in the air is between 10 and 38 Bq/m^3, mainly due to the pumping of external air through the mine ventilation system. Muon and neutron backgrounds have not been measured yet, but dedicated activities for the background characterization of the site started in 2010. The Polkowice-Sieroszowice mine is a possible candidate to host the LAGUNA initiative.

CONCLUSIONS

Many underground sites are presently available for science in Europe with depth larger than 1 km w.e. The four main deep-underground laboratories in Western Europe (LNGS, LSM, Boulby and LSC) are very well established and all of them have a rich experimental program encompassing dark matter searches, neutrinoless double beta decay, neutrino physics and astroparticle physics. The four laboratories are the backbone of the EU deep underground scientific infrastructures. A closer coordination among them started in the framework of the ILIAS program, funded by the EU between 2004 and 2009. A memorandum of understanding (EULab) was signed after the end of ILIAS to improve the long-term laboratory coordination.

The Baksan underground laboratory, in Russia, is still operational, in spite of difficulties, mainly providing an observatory service to the scientific community.

Other "emerging" sites are becoming available, especially in Eastern Europe. While at the moment they lack of the necessary infrastructures to host full-scale physics experiments, their background is being characterized and they are potential hosts for future physics programs.

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