



Istituto Nazionale di Fisica Nucleare

RADIOLAB Project

Flavia Groppi

Lab. Acceleratori e Superconduttività Applicata – L.A.S.A., Segrate (MI), Italy

Anna Bazzocchi

INFN Sez. MI & Istituto d'Istruzione Superiore – I.I.S. Mattei, San Donato Milanese (MI), Italy

losette Immè – INFN Sez. Catania & UNICA; Mariagabriella Pugliese - INFN Sez. Napoli & Dipartimento di Fisica "E. Pancini", Università degli Studi di Napoli Federico II

Marco Budinich - INFN Sez. Trieste

Antonio Caciolli - INFN Sez. Padova

Marcella Capua – Gruppo collegato di Cosenza, INFN Sez. LNF

Michela Chiosso - INFN Sez. Torino

Viviana Fanti – INFN Sez. Cagliari

Vera Montalbano - Gruppo collegato di Siena, INFN Sez. Pisa

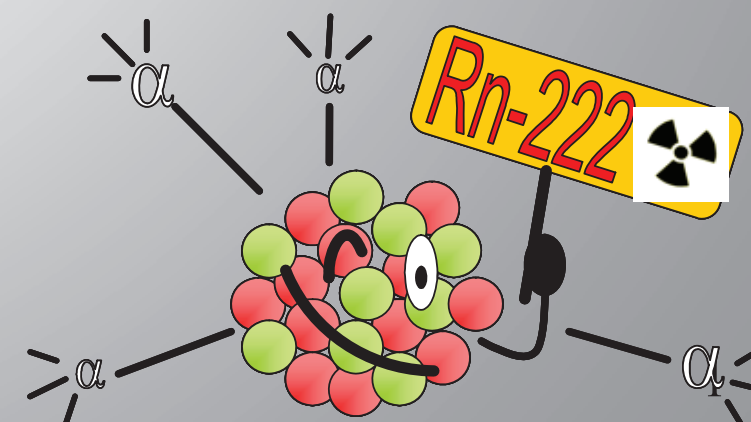
Stefano Romano – INFN LNS

Andrea Ventura - INFN Sez. di Lecce



02-05/06/2019

, Italy



The aim of the Project

- × The **subjective perception (sensation)** of the risk doesn't correspond very often to the **objective and real risk** of an human activity, and natural events as well.
- × The **radioactivity** theme is misleading because it is almost unknown and the public links this concept only to nuclear weapons and to its usage in unsafe way to produce energy in the nuclear power plants, NPPs.



Dissemination of scientific culture

a correct knowledge and information about this subject, permits a discussion and debate in a more objective way and to build up a personal understanding through the population.

The aim of the Project

This process is applied to the measurement of the radioactivity starting from the natural component that is a part of our environment:

- a) the measurement of the ^{222}Rn concentration is particularly suited and, nowadays, is up-to-date;
- b) there are different types of radiations, and ionizing radiations are just a particular type of radiation;
- c) ionizing radiations can be measured;
- d) to prove the fun a student can derive from discovery and detection of ionizing radiation.

Points of strenght of the project

- The real **experimental** approach.
- It is a **no an occasional** experiment: it requires 2 years, giving the possibility to the students to gain a more deep thinking over and acquisition of the theme.
- It allows the **study of the environment** outside the school too.
- The high **multidisciplinary approach** of this matter, permits to link the knowledge of different subjects.
- The development of the **communication ability** and debate between student and their relatives on these topics.
- A final spin-off is the **training and refreshment** for the teachers.

The aim of the Project

The High School students have to develop an experiment along all its phases:

- × the research theme,
- × the build up of their own laboratory at their school,
- × to understand the modality of how to do the measurements,
- × the choice of the instrumentation more suitable, depending of the type of measurements chosen,
- × data analysis,
- × presentation and discussion of the results.

Regions & INFN Sections involved



Le sezioni INFN partecipanti sono:

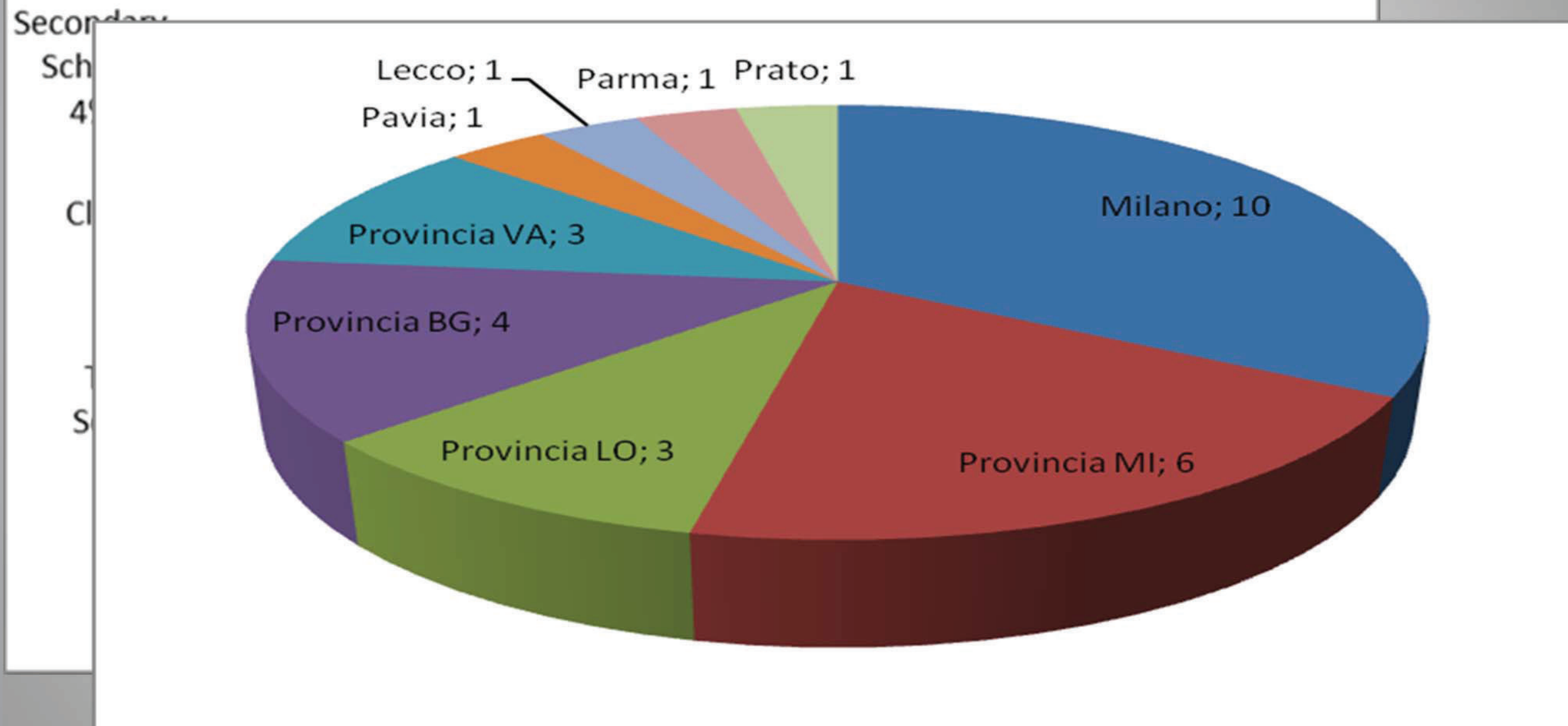
- ✓ CAGLIARI (V. Fanti)
- ✓ CATANIA (J. Immé)
- ✓ LNS (S. Romano)
- ✓ MILANO (F. Groppi)
- ✓ NAPOLI (M. Pugliese)
- ✓ TORINO (M. Chiosso)
- ✓ TRIESTE (M. Budinich)
- ✓ COSENZA/LNF (M. Capua)
- ✓ SIENA/PI (E. Mariotti)
- ✓ LECCE (A. Ventura)
- ✓ PADOVA (A. Caciolli)

Nazionali Responsables:

J. Immé (CT) / F. Groppi (MI)
M. Pugliese (NA)

Schools involved in the Project – Lombardia Region

Total Number of Schools **2005 - 2018**
involved for Lombardia Region = 52



n. of students involved up to now \approx 1400

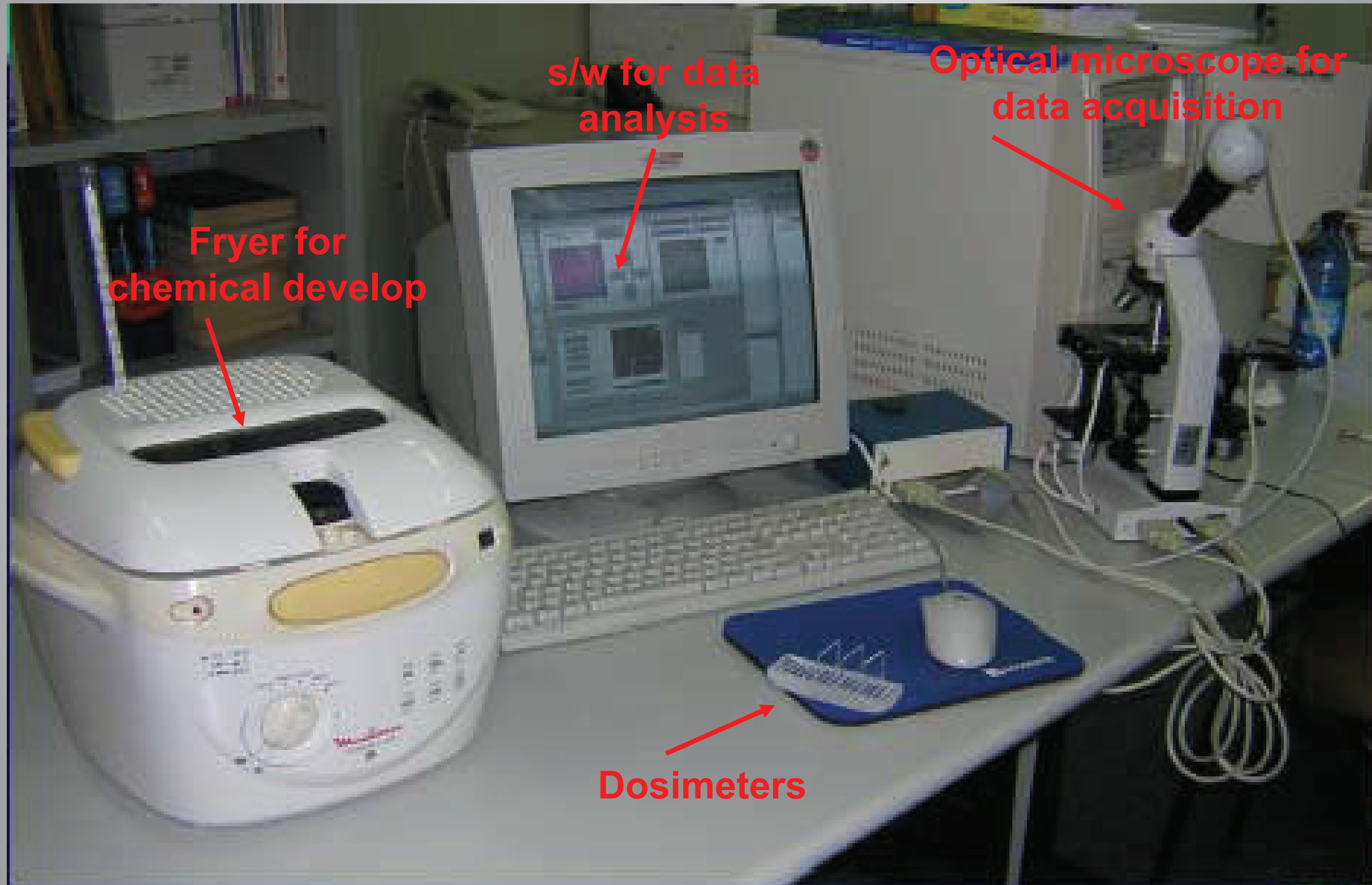
The idea is that:

- × An “assembly box” – school receives a kit
- × with instructions (given by teachers or university experts)
- × *“I construct the instrumentation ...”*
- × *“I build up my laboratory ...”*



- dosimeters - CR39
- plastic box - diffusion chamber
- fryer - as thermostatic bath
- a cheap optical microscope
- a simple webcam

Experiment - STAND 6.D.23a, 6.D.23b, 6.D.25c



Experiment – selection of the sites

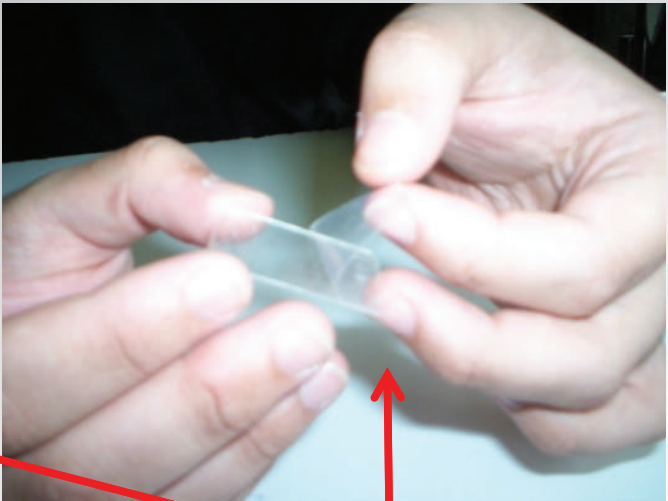


02-05/06/2019 Date di acquisizione delle immagini: 15 Set, 2007-28 Set, 2009

45°25'30.80"N 12°33'62"E Peropolo, Italy

Alt 7.94 km

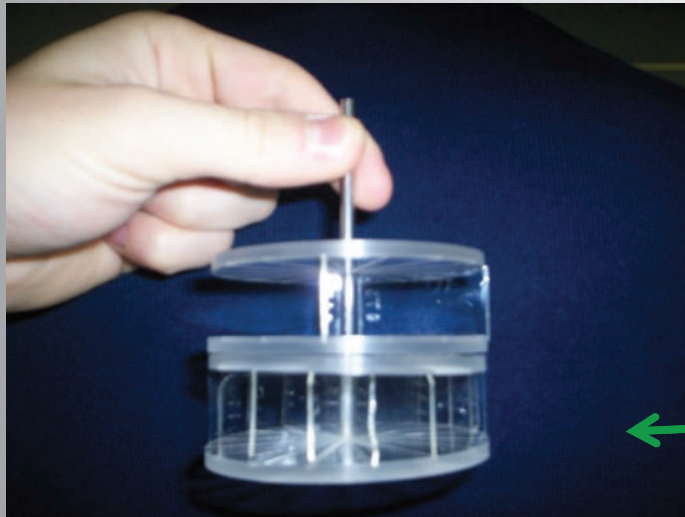
Experiment

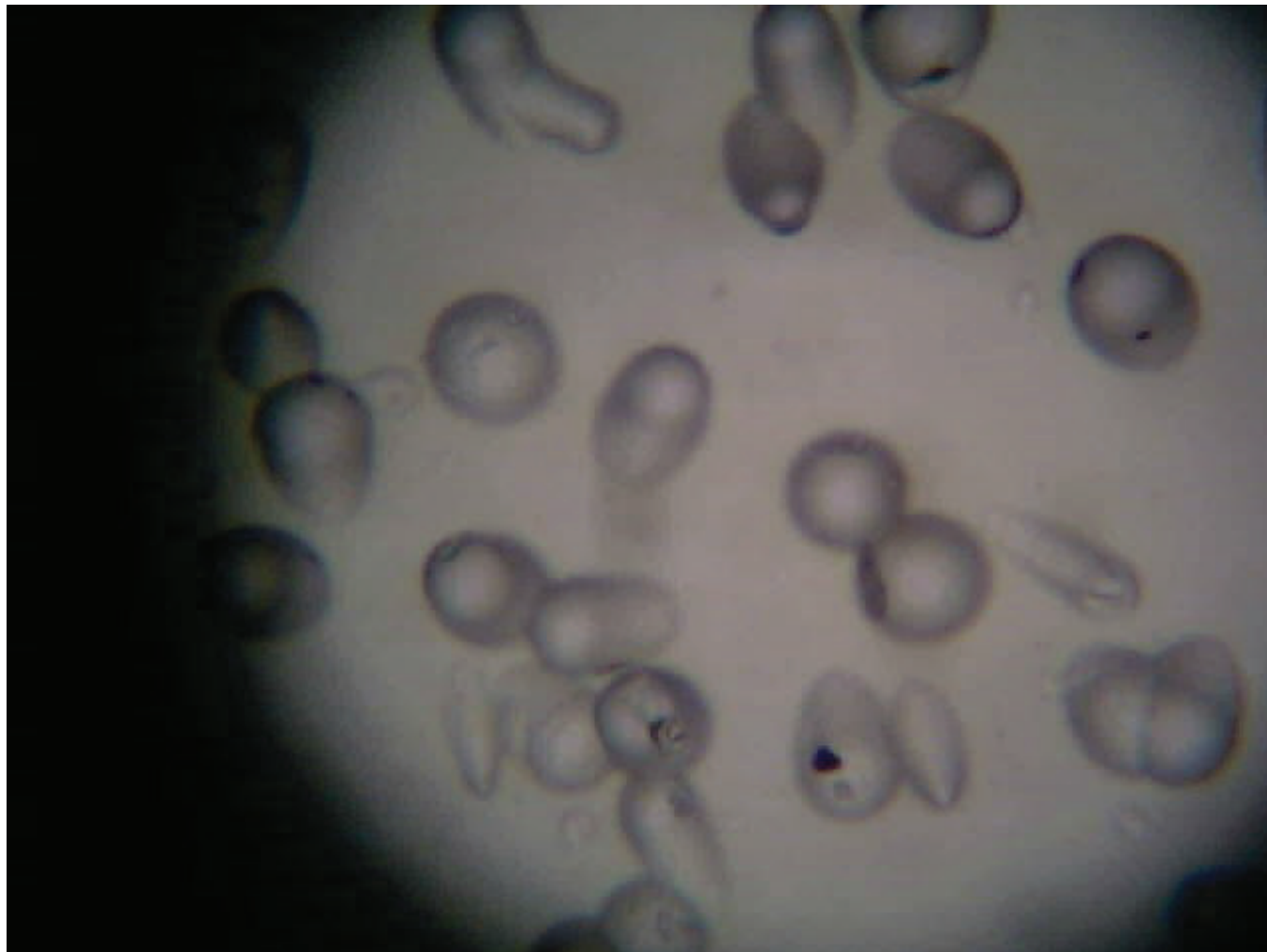


Preparation of the dosimeters

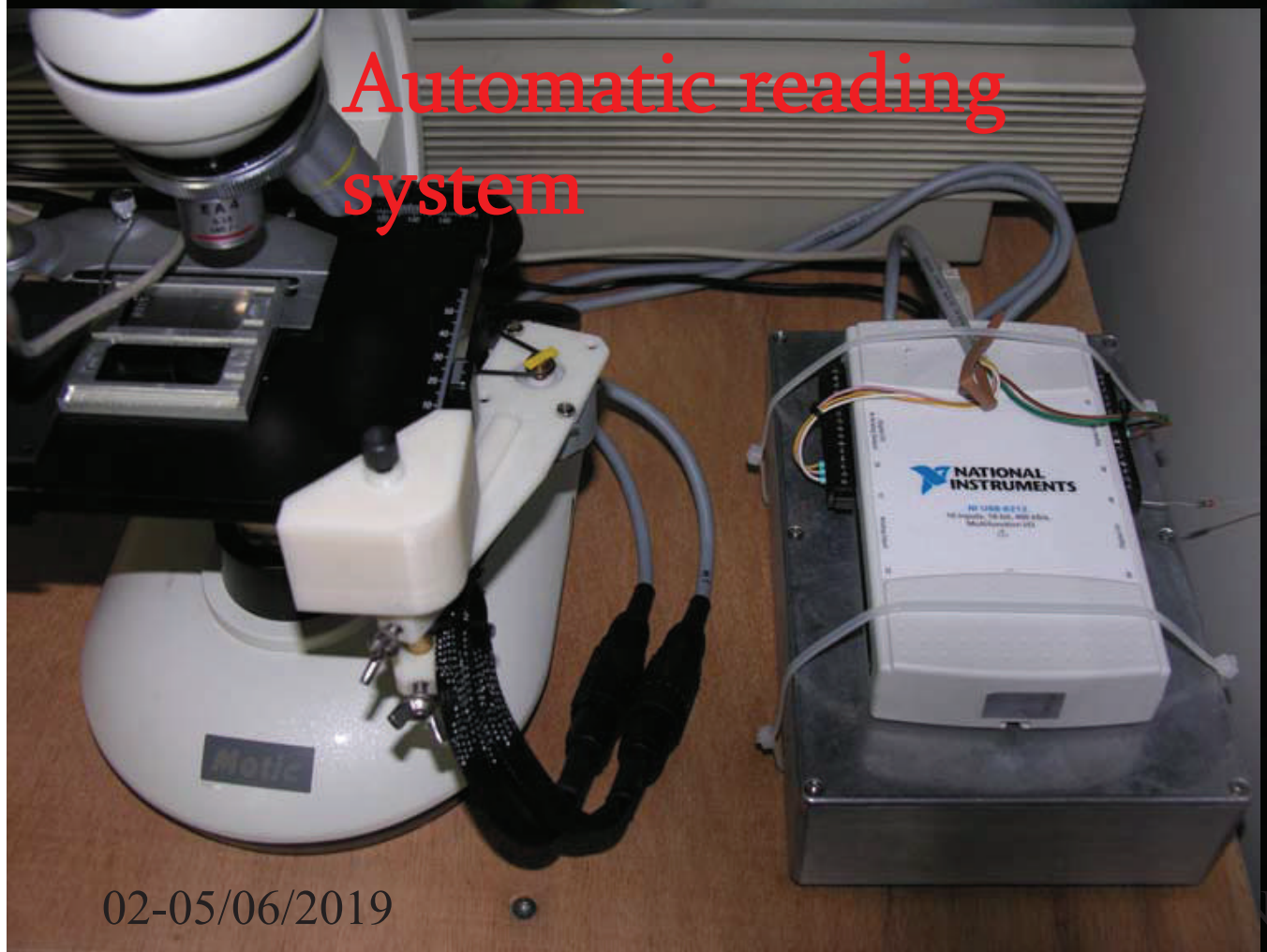
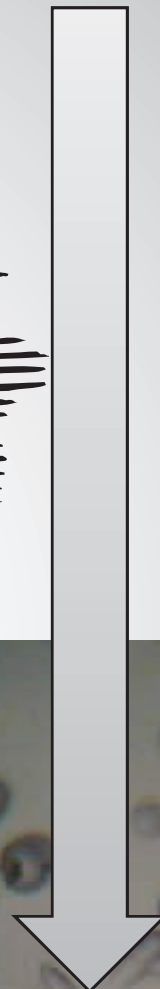
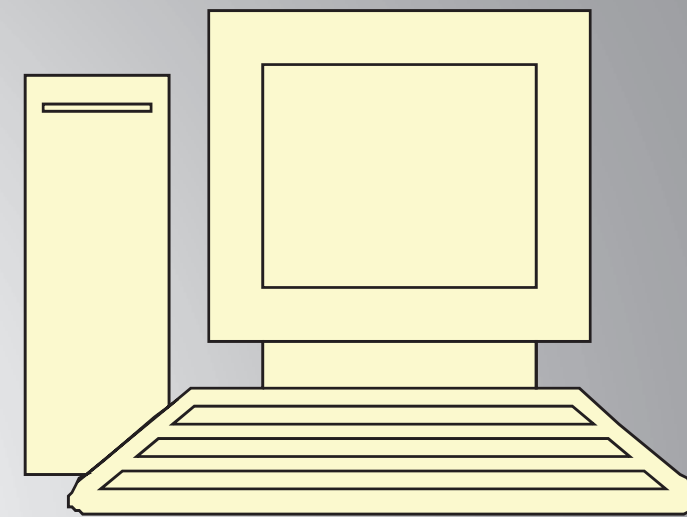
Exposition of the dosimeters

Development procedure of the dosimeters

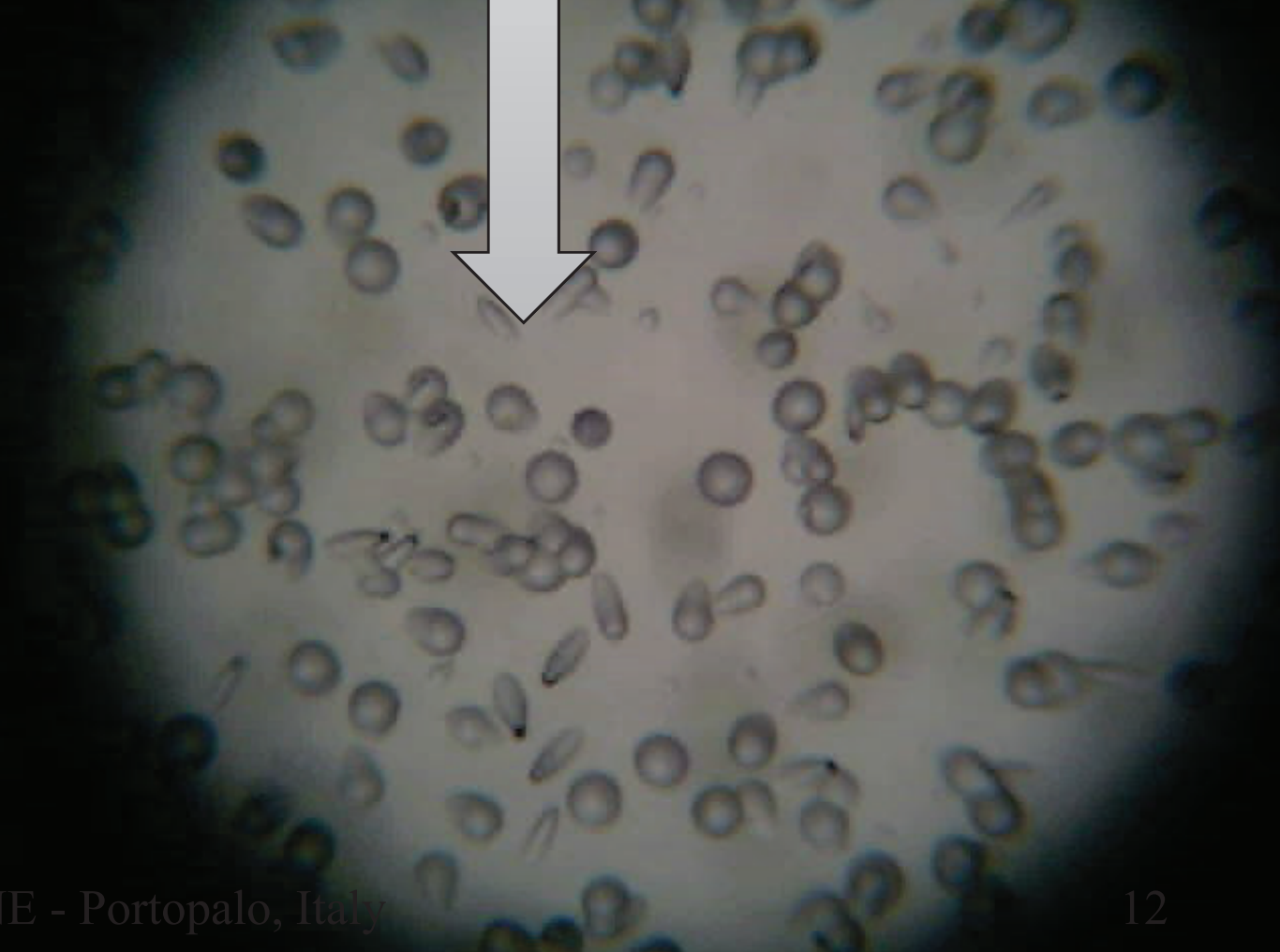


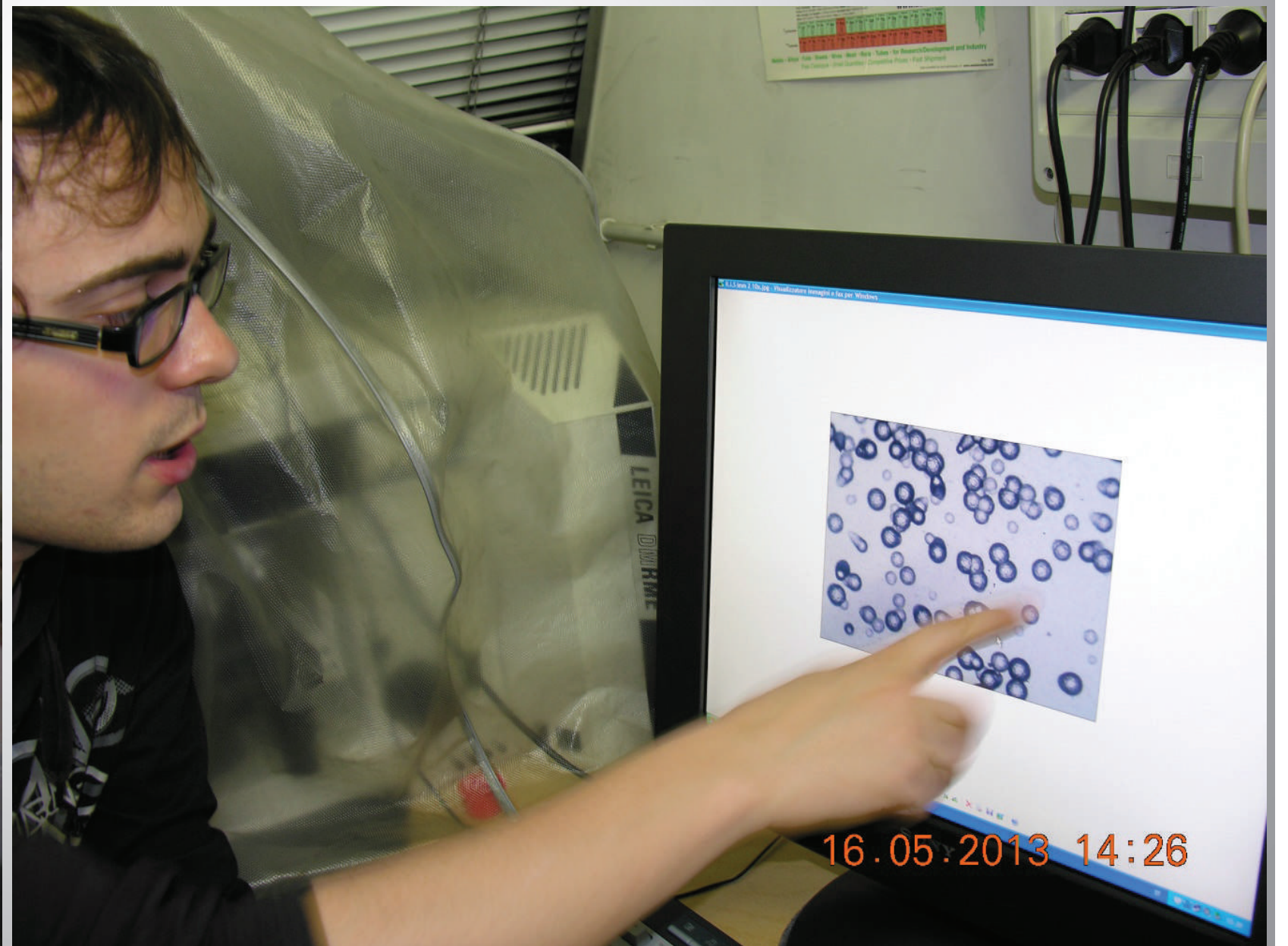
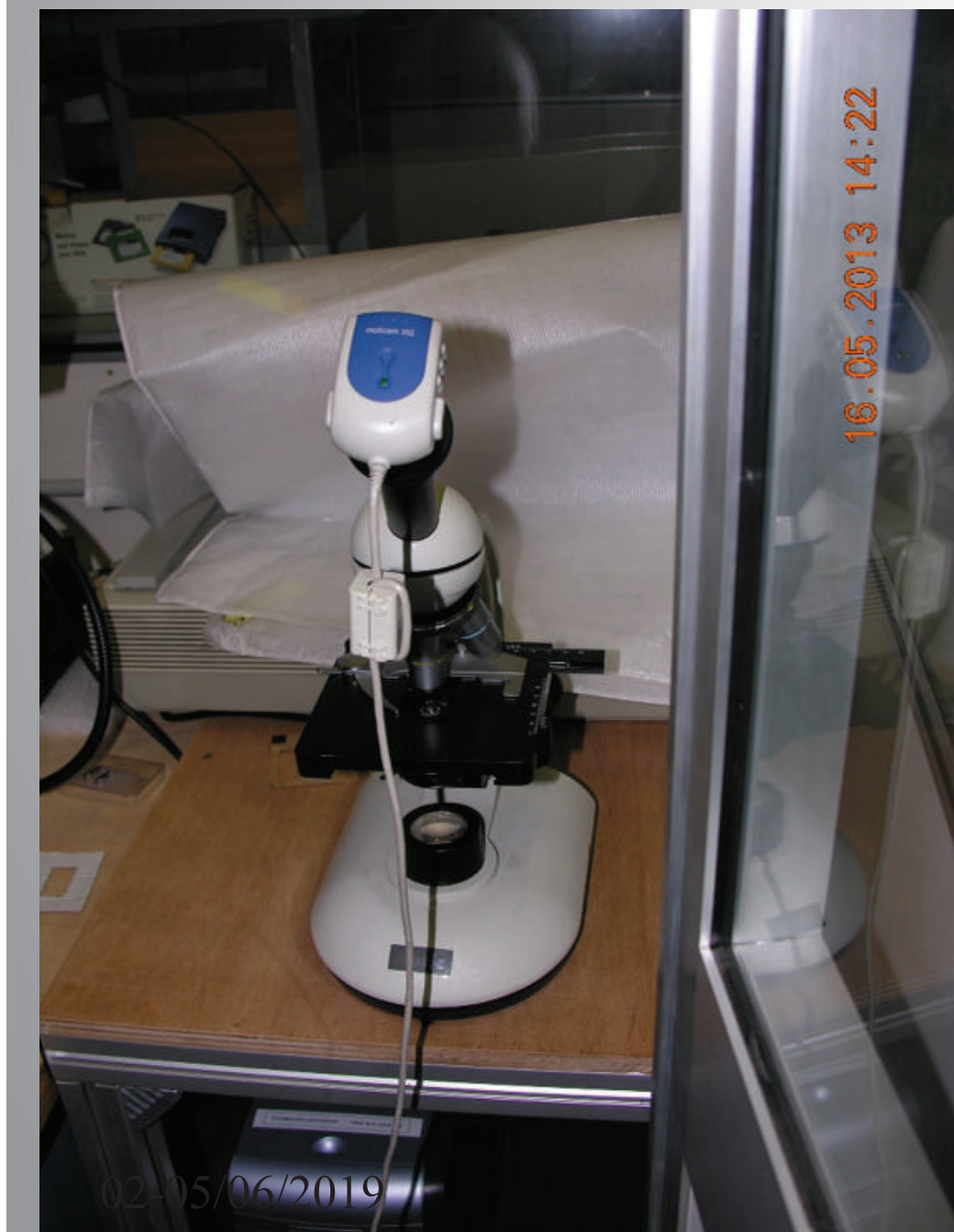
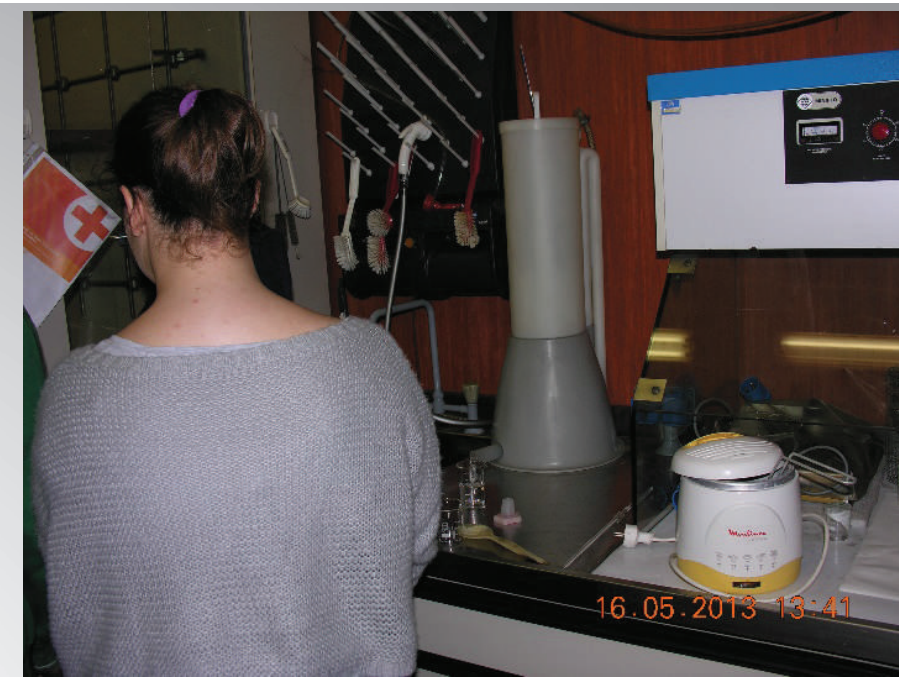


Counting of the alpha tracks



Automatic reading system





Some Results

Indoor Radon concentration measured by the students

	School Rooms	Houses in the same zone of schools	Cellars of the same zone of the schools
“V. Sereni” Luino	23 -163 Bq•m ⁻³	54-553 Bq•m ⁻³	19-1160 Bq•m ⁻³
“E. Mattei” San Donato Mil.	12 - 65 Bq•m ⁻³	15 - 58 Bq•m ⁻³	NO
“G. Gandini” Lodi	48 -169 Bq•m ⁻³	48-169 Bq•m ⁻³	NO
“G. Galilei” Caravaggio 02-05/06/2019	4 - 18 Bq•m ⁻³	NO	NO

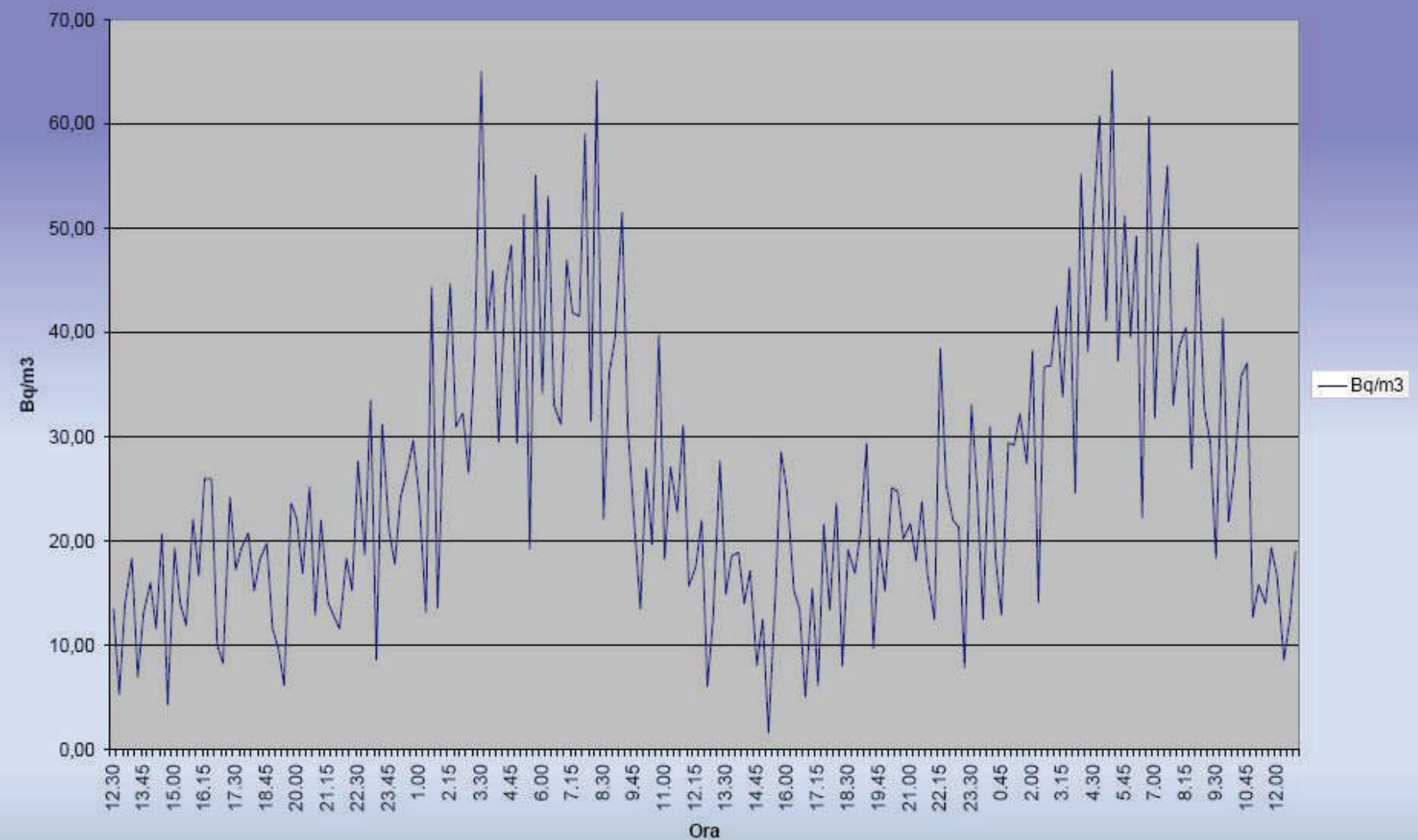
IIS "ENRICO MATTEI" SAN DONATO MILANESE

Camera a
scintillazione



Grafico delle misurazioni

Concentrazione Radon

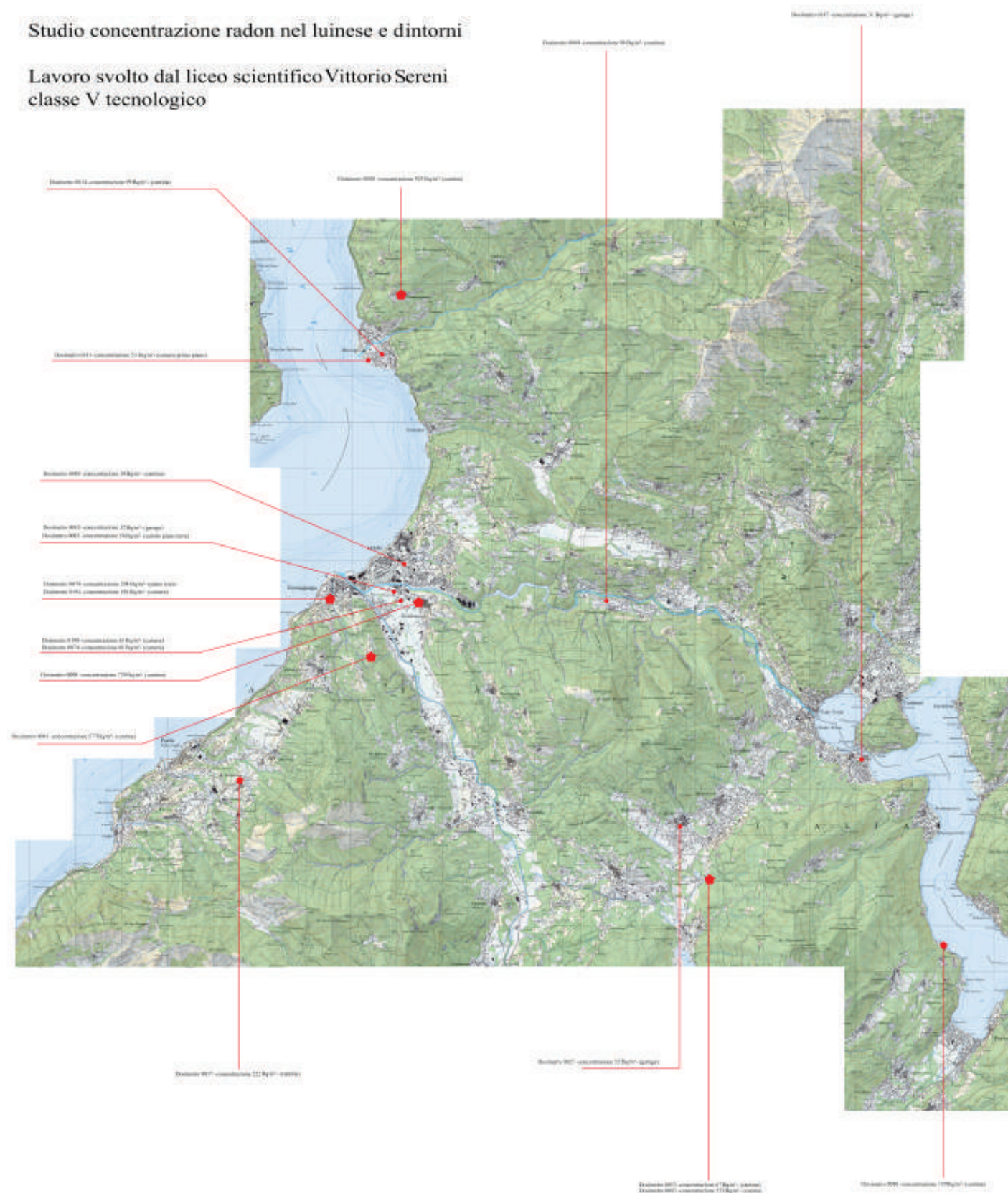


02-05/06/2019

PROGETTO LABORAD

Studio concentrazione radon nel luinese e dintorni

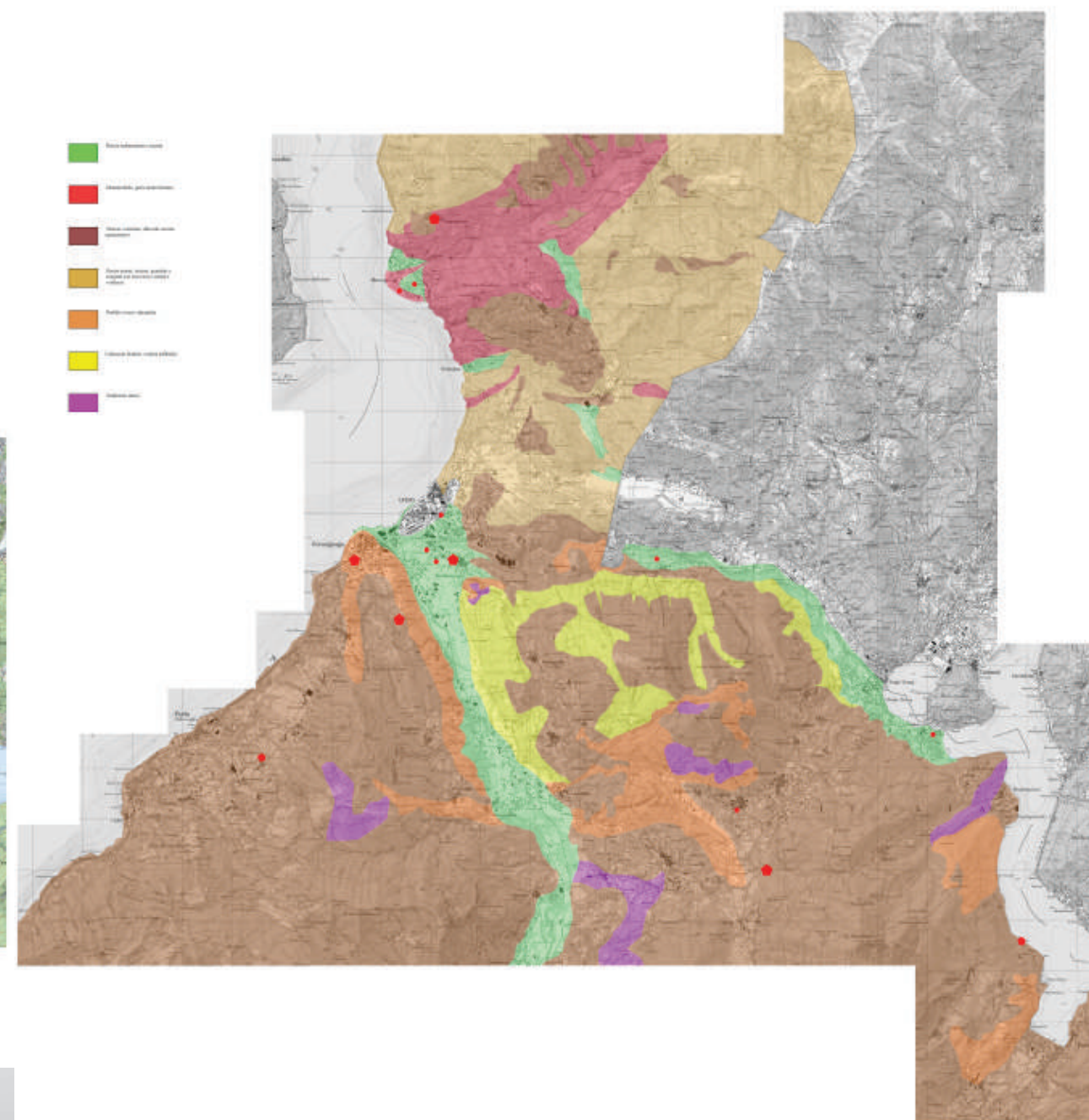
Lavoro svolto dal liceo scientifico Vittorio Sereni
 classe V tecnologico



PROGETTO LABORAD

Studio concentrazione radon nel luinese e dintorni

Lavoro svolto dal liceo scientifico Vittorio Sereni
 classe V tecnologico





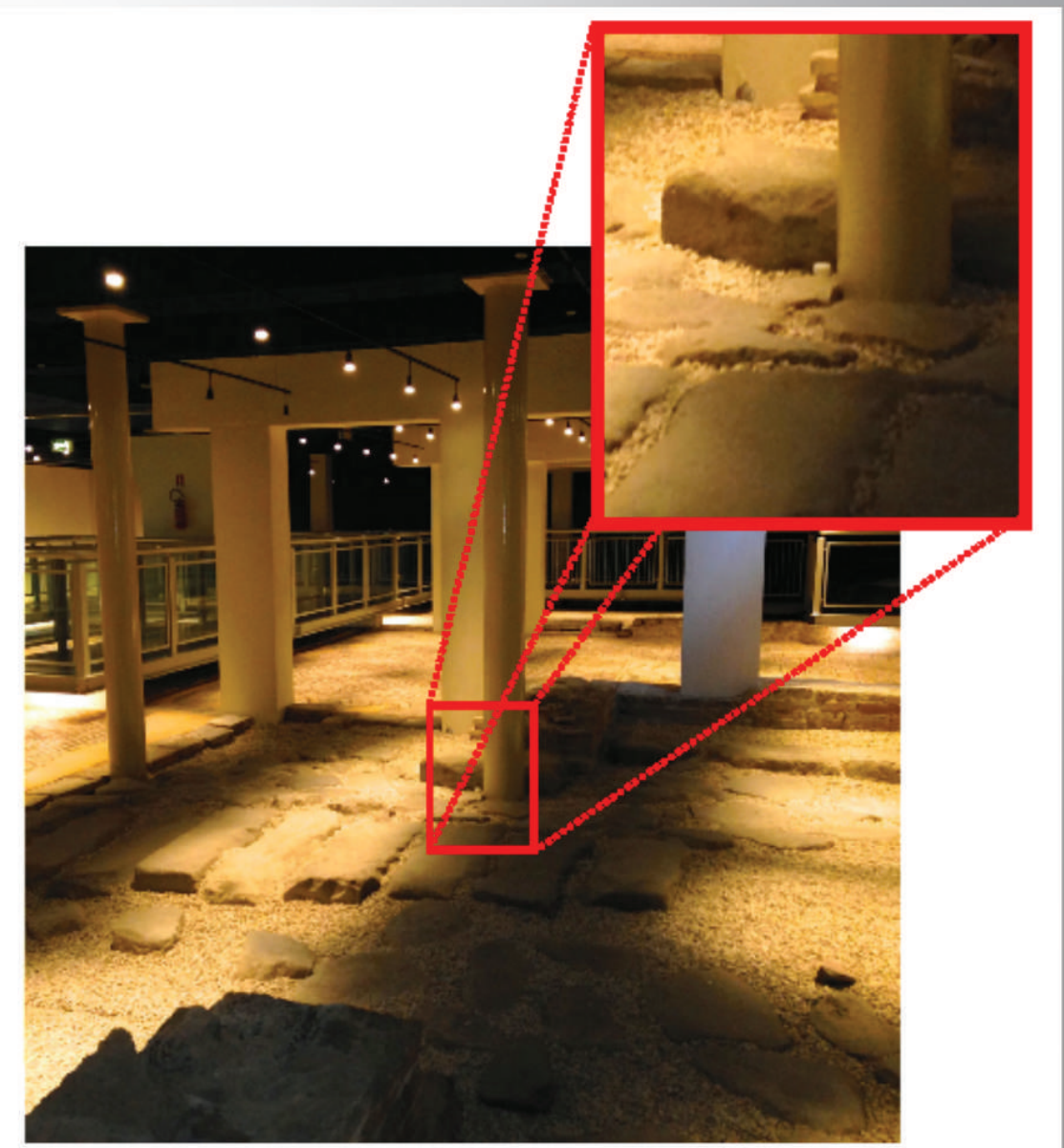
IL RADON IN GROTTA: UN PROBLEMA INTERESSANTE



GROTTA	Periodo esposizione e nro giorni	Concentrazione (Bq/m ³)	Deviazione standard (Bq/m ³)	Errore % ale	Concentraz media (5 SITI DIVERSI) (Bq/m ³)
Antro delle Gallerie (induno olona)	14 Settembre 11 gennaio 119 gg	3911	218	6	2222
		4024	298	7	
		1345	176	13	
		412	56	14	
		1417	557	39	
Frassino (campo dei fiori) (dosimetri umidi)	13 luglio 12 ottobre 86 gg	4535	288	6	3960
		2986	200	7	
		4360	208	5	
		300 DOSIMETRO ROVINATO	58	19	Dato scartato
Frassino (campo dei fiori) (dosimetri asciutti)	12 ottobre 25 gennaio 105 gg	924	198	21	881
		1166	130	11	
		1059	52	5	
		648	129	20	
		610	94	15	
Marelli (campo dei fiori)	30 novembre 15 marzo 105 gg	3697	364	10	5775
		6608	180	3	
		6250	205	3	
		6415	365	6	
		5903	298	5	

Ravenna

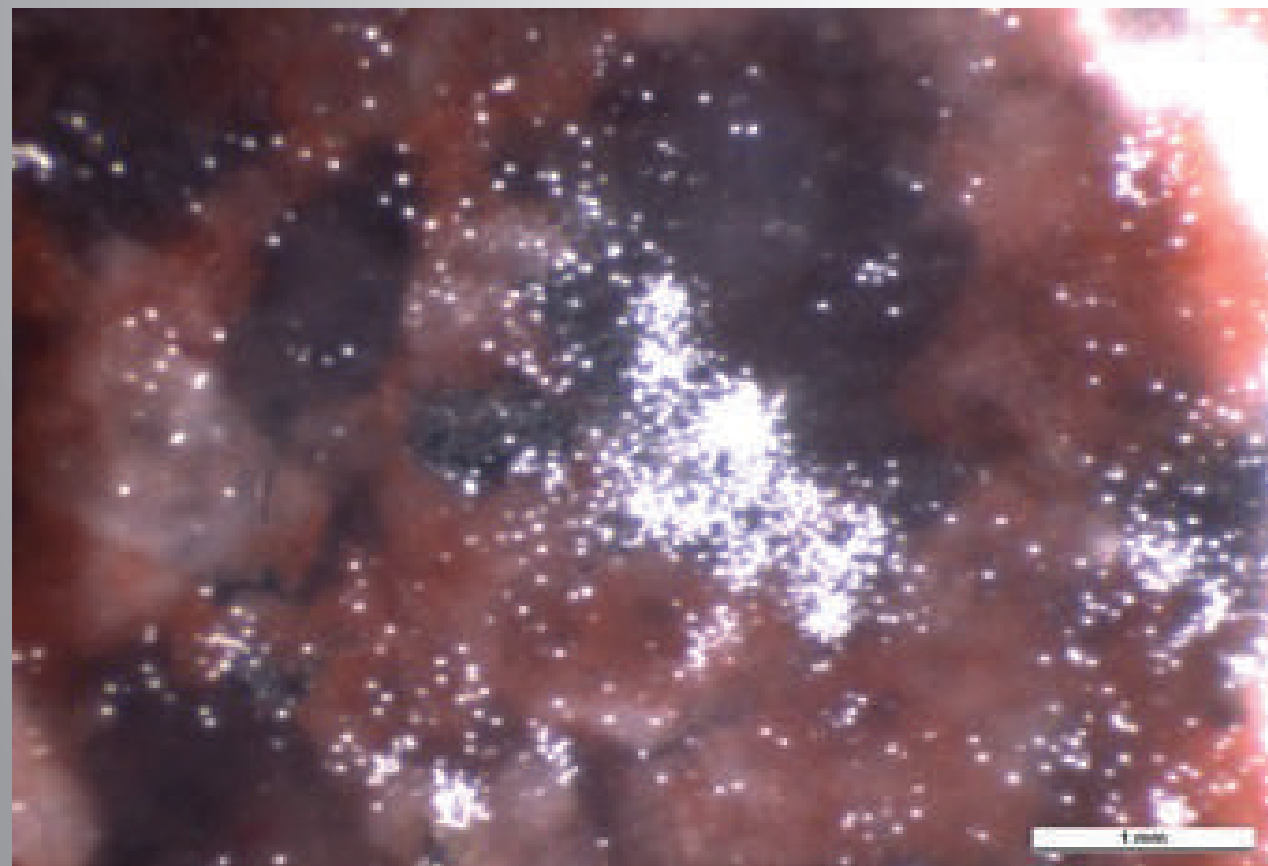
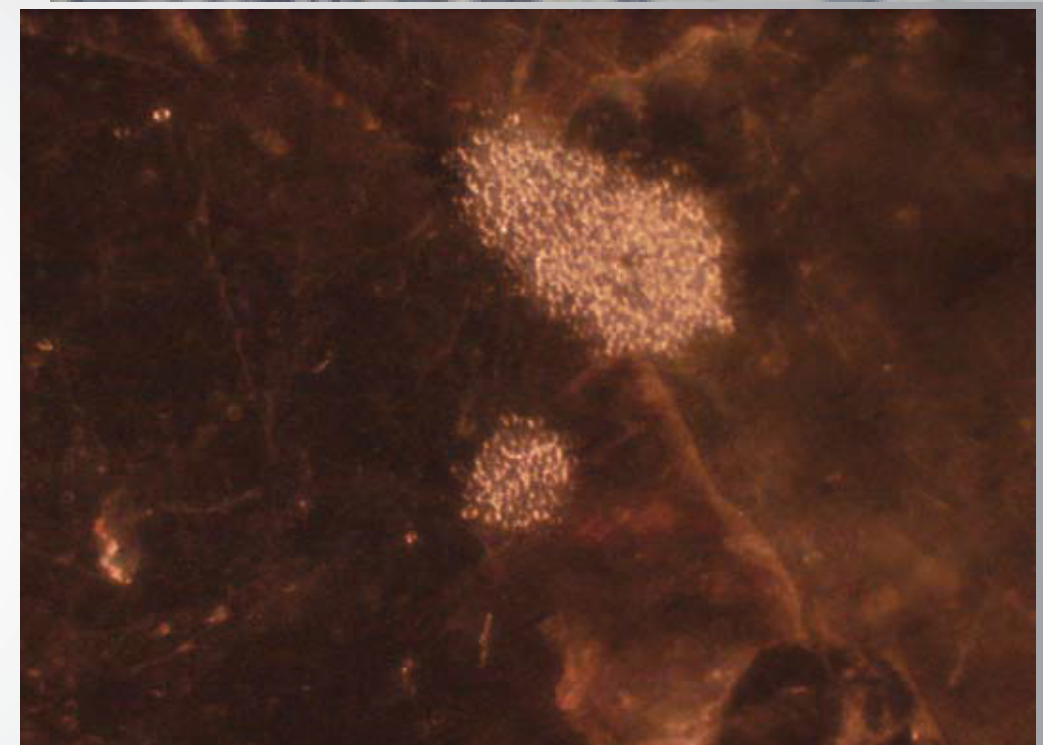
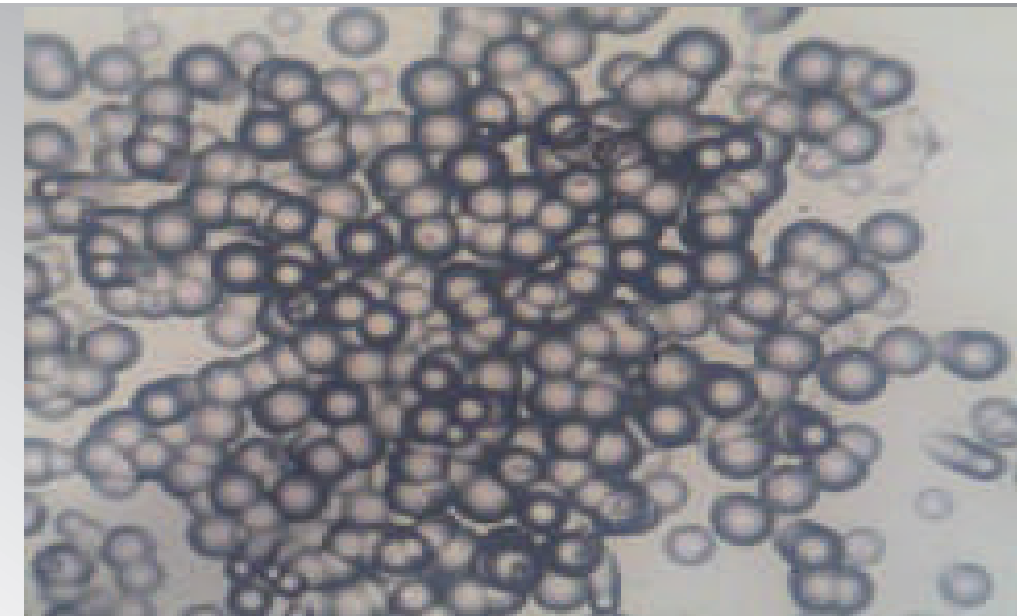
	Domus of stone carpets	home	cellar
Time of exposure [d]	69	70	70
n. of dosimeters	6	2	2
Rn concentration [Bq m ⁻³]	177 ± 14	56 ± 17	73 ± 10

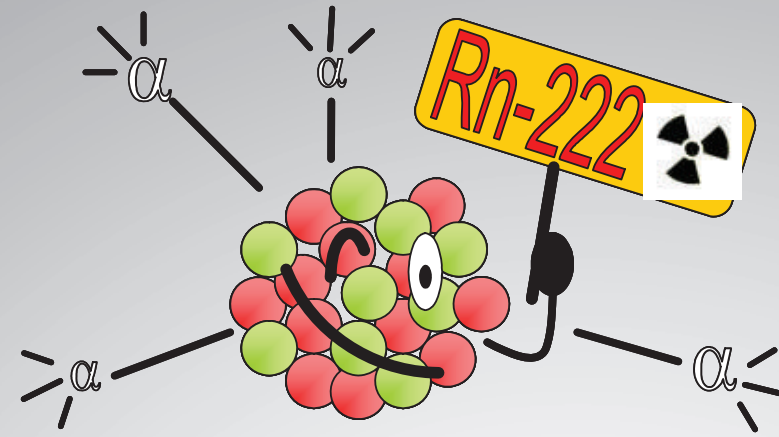


02-05/06/2019

The younger students measure some granitic rocks utilizing the autoradiographic technique.

- The CR39 dosimeters are posed on the sample for one week;
- are developed;
- are read by the microscope, placed on the sample in the same position of the exposure in order to observe the radioactive zones;
- they have to recognize if all the samples are granites.





I Edition of RADIOLAB SUMMER SCHOOL

«ritiro scientifico» ai piedi della parete Est del Monte Rosa

9 – 14 settembre 2018

presso il Rifugio CAI Zamboni Zappa – Macugnaga (VB)

Location of the Summer School

Rifugio Zamboni Zappa – 2050 msl



Target & aim of the Summer School

- **Studenti** delle scuole superiori (3°, 4° e 5° anno), di tutto il territorio nazionale, presso le sezioni che aderiscono al progetto.
- The beneficiaries will also be indirectly **their teachers** and **their families**.
- Deepen the knowledge of natural radioactivity measurements with field measurements.

THE LAB

***not just a physical place but a METHOD of
"KNOW" through the "KNOW-HOW"***

RADIOLAB SUMMER SCHOOL

un "ritiro scientifico" ai piedi della Parete Est del Rosa



9-14
SEPT.
2018

RIFUGIO
ZAMBONI ZAPPA
Macugnaga (VB)
WWW.RIFUGIOZAMBONI.COM
0324 65313 / 340 797767



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Macugnaga - Monte Rosa

RIFUGIO ZAMBONI ZAPPA Macugnaga (VB)



RADIOLAB SUMMER SCHOOL

un "ritiro scientifico" ai piedi della Parete Est del Rosa



OUTFIT A STRATI

Strato PRIMARIO
(comfort, leggerezza, traspirabilità)
maglia termica
pantaloncini corti e lunghi
calze termiche

Strato INTERMEDIO
(calore, comodità, tenuta)
pile

Strato SUPERIORE
(impermeabilità)
giacca a vento
poncho antipioggia
Scarpe
(adatte alle differenti necessità)
scarponcini da trekking
scarponi medio/siti alla caviglia
scarpe da ginnastica
pantofole per il rifugio

EQUIPAGGIAMENTO

Zaino da montagna
(leggero, adattabile e pratico)
guanti
cappellino con visiera
cappello caldo per il freddo
borraccia
crema solare e doposole
occhiali da sole
fazzoletti di carta
Kit prontoso soccorso
(per 4 giorni non si avranno negozi a disposizione)
cerotti
aspirina
eventuali altre medicine
Per dormire
(il rifugio fornisce le coperte)
sacco lenzuolo o lenzuola
biancheria di ricambio

Altro
(opzionale)
cortellino
bastoncini da trekking
cartina topografica (1:25)
pila frontale
altimetro
bussola

DOMENICA 9 SETT

- Ritrovo all'Aeroporto di MALPENSA per trasferimento in BUS a Macugnaga
- Trasferimento in SEGGIOVIA da Pecetto alla Stazione Belvedere (1905 msl)
ultima partenza della seggiovia alle ore 16:00
- Percorso a piedi fino al Rifugio Zamboni-Zappa (2070 msl)
dell'intero totale di 170 m
tempo di percorrenza di circa 50 minuti fra morena e sentiero facile in leggera salita
- Sistemazione nelle camere, cena e presentazione del programma settimanale

LUNEDI' 10 SETT

- 9:00 - Geologia sito Zamboni e radioattività naturale
- Glaciologia e radioattività
G. Mortara (IRPI del CNR)
- 14:00 - Introduzione: "Rivelare e rilevatori"
- Il Radon: una risorsa, non solo un problema
J. Immé (UNICT, INFN-CT)
- 14:00 - "Sentieri del Monte Rosa e popolazioni della Valle Anzasca (i Walser)"
- Materiali bidimensionali e nanomateriali, una piattaforma ideale per sensori e rivelatori alla micro- e nano- scala.
S. Veronesi (Istituto di Nanoscienze, CNR)
- 14:00 - Spiegazione funzionamento di strumentazione per la rivelazione del gas radon diversa da dosimetri CR39; messa in funzione della strumentazione
P. Randaccio (INFN-CA), F. Groppi (UNIMI, INFN-MI)
- 14:00 - "Sentieri del Monte Rosa e popolazioni della Valle Anzasca (i Walser)"
F. Mannoni (guida alpina)

MARTEDI' 11 SETT

- 9:00 - Escursione didattica: "Minerali e Rocce" - percorso: Lago delle Locce
G. Mortara (IRPI del CNR), M. Merini (UNIMI)
- 14:00 - Osservazione sezioni sottili dei minerali
M. Merini (UNIMI)

MERCOLEDI' 12 SETT

- 9:00 - Origine della radioattività
- Geologia delle regioni in cui si realizza RADIOLAB
P. Randaccio (INFN-CA)
- 14:00 - Attività di Laboratorio seguite da "Esperienze Progetto Radiolab in Italia"
S. Miani (UNIMI)
- 14:00 - "Flora e fauna Valle Anzasca"
P. Randaccio (INFN-CA), F. Groppi (UNIMI, INFN-MI)
- Bionda (comparto caccia)

GIOVEDI' 13 SETT

- 9:00 - Dati della ricaduta radioattiva di Fukushima (aria, acqua, ghiaccio, latte & co)
F. Groppi (UNIMI, INFN-MI)
- Percorso letterario-pedagogico (Levi, Fenoglio e Cognetti)
D. Rigotto
- 14:00 - Analisi dati raccolti durante le attività di laboratorio della Summer School
P. Randaccio (INFN-CA), F. Groppi (UNIMI, INFN-MI)
- Presentazione da parte degli studenti dei lavori sulle attività svolte

VENERDI' 14 SETT

- Visita alla Miniera d'Oro della Guia e al Museo dei Walser
- Pranzo al sacco e rientro all'Aeroporto di MALPENSA

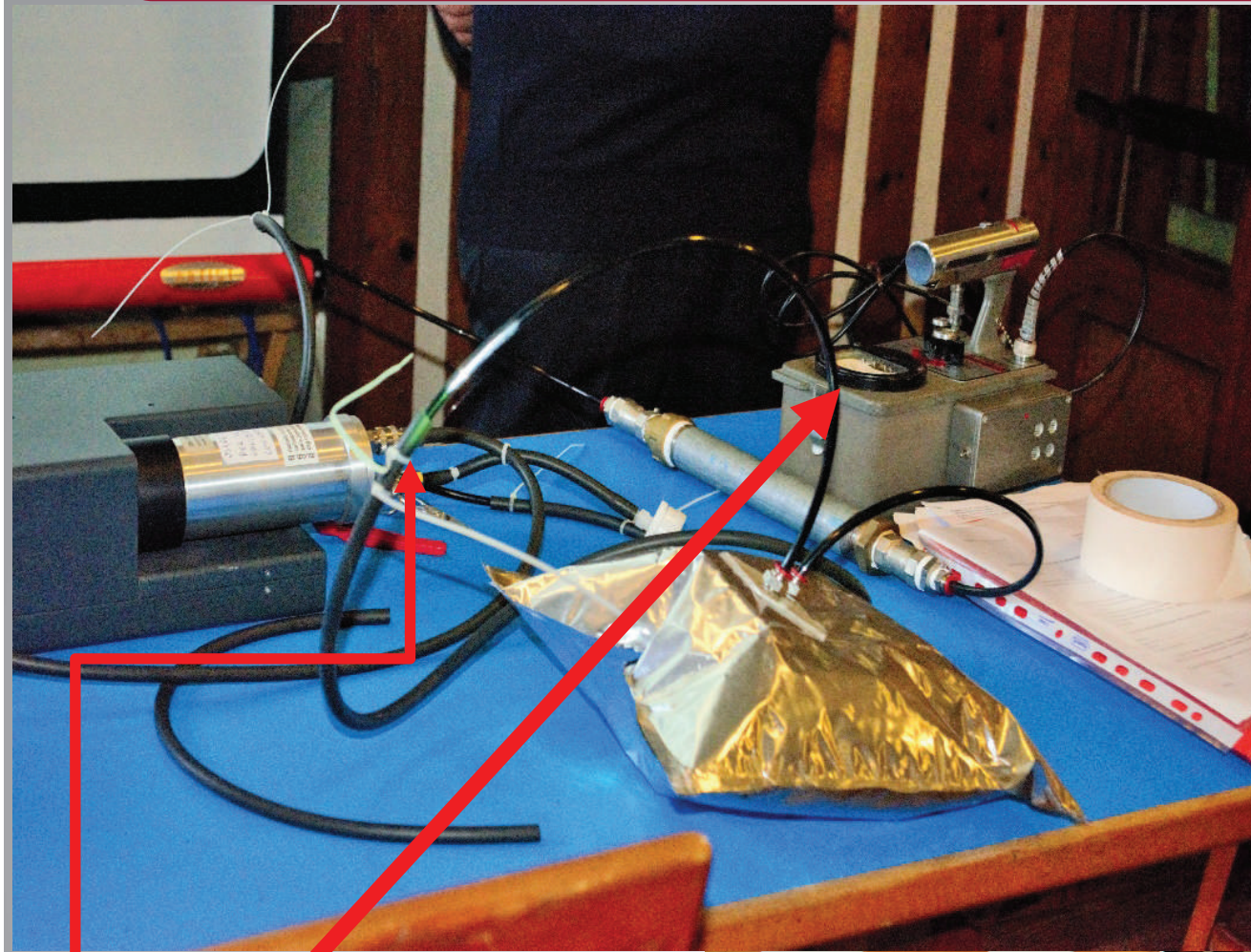
SCOPO DELLA SUMMER SCHOOL? AVVICINARE GLI STUDENTI AL TEMA DELLA RADIOATTIVITÀ!
COME? IMPARANDO A CONOSCERLA SUL CAMPO E ANDANDO A MISURARE IN PRIMA PERSONA E CON
L'ADEGUATA STRUMENTAZIONE LA CONCENTRAZIONE DI RADIOATTIVITÀ AMBIENTALE

E - IN PARTICOLARE - DEL GAS RADON-222



Instrumentations for measurements

Strumentazione attiva con cui i ragazzi hanno effettuato le misure in loco per tutta la settimana.
Trasportata a spalle sino al rifugio.



Geiger Muller

Rivelatore al Si a
barriera superficiale

Cella di Luca'S

02-05/06/2019



Lessons inside



Lessons outside



RADIOLAB at the schools



Presentation of the experimental data



The group



At the end of the Summer School

Il sentiero che ci ha condotti fin qua non è stato di certo semplice o breve (anzi è stato proprio faticoso!), ma ci ha permesso di contemplare lo spettacolo più suggestivo e caratteristico della Valle Anzasca: il ghiacciaio.

La vista della parete a primo impatto può apparire pericolosa, paurosa e perfino soffocante per chi con la montagna non ha nulla a che vedere; ma, con il passare delle ore e dei giorni, il ghiacciaio, che è un potentissimo agente modellatore, ha iniziato a modellare anche noi e i nostri cuori, trasportandoci come detriti lontano dalla città e dalla quotidiana realtà.

Il freddo del ghiaccio ci ha costretti a unirici in calorosi momenti di confronto e riflessione, tra di noi e con i professori.

Proprio come i fiocchi di neve si uniscono per formare questo magico ghiacciaio, anche noi, tanto simili quanto diversi, ritrovandoci qui abbiamo creato un solido blocco che, al contrario della non così nascosta fragilità della montagna, non si fonderà mai.

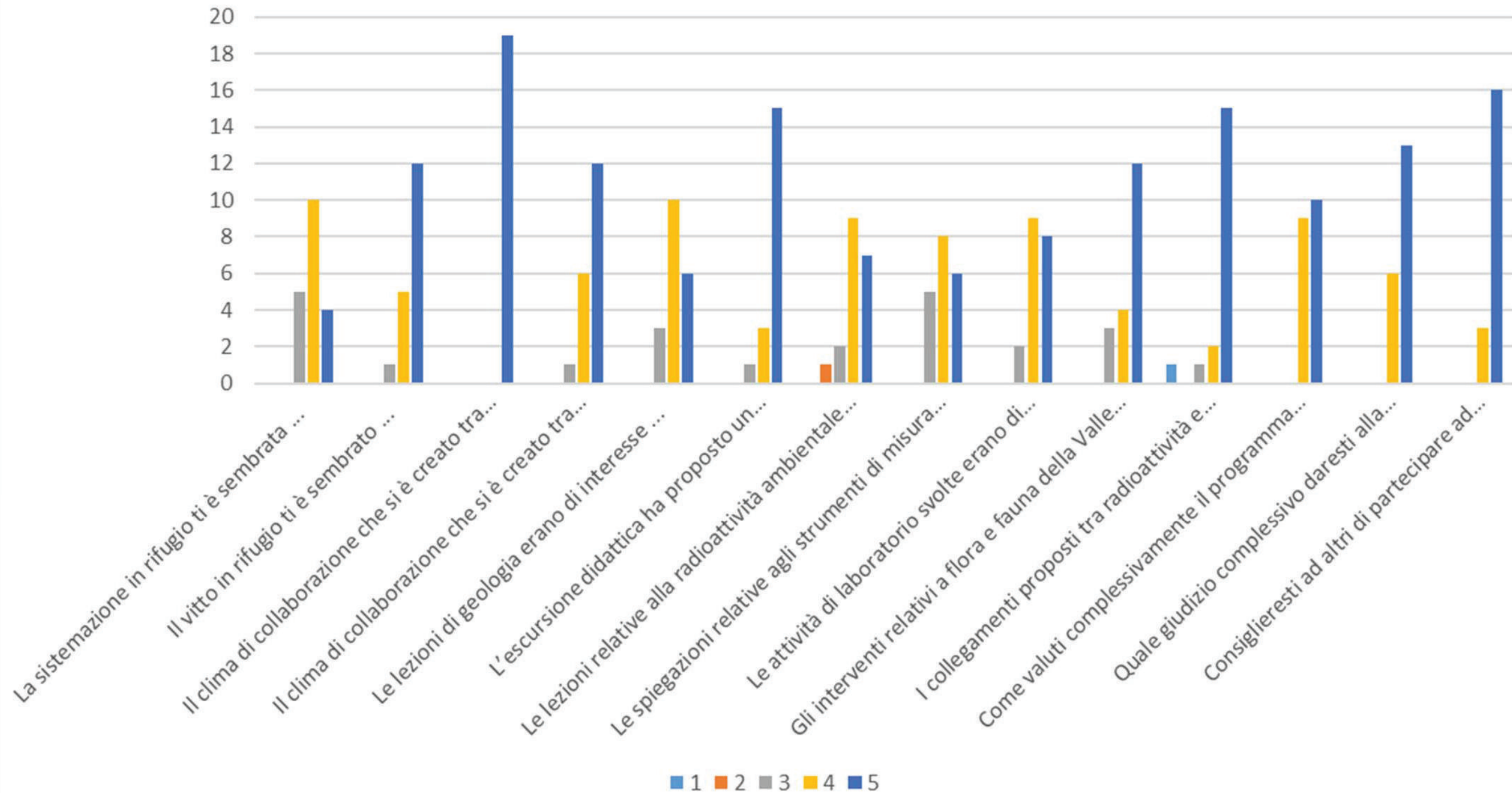
Siamo ormai giunti alla fine di questa avventura, ma noi non vogliamo essere e non saremo un lago effimero! Questa esperienza rimarrà viva, proprio come il Monte Rosa, dentro di noi.

Results for the students

- Experience conducted in "unusual" living conditions;
- Great aggregation - at the end of the period there were no more distinctions between the boys of the various schools;
- Very high scientific commitment: the students understood the different functioning and meaning of the measures, learned to use active tools different from the CR39;
- ability to interpret results;
- Interested with questions and requests for further information.
- Always proactive interaction with university professors.
- Learned, having fun.
- They will be a point of dissemination of experience and subject also to other students of their own school and families.
- A boy told me: "we can learn scientific knowledge even at school, but this experience was another thing."

Results for the students

Risultati Questionario



Results for the teachers

- Extremely positive exchange and exchange experience for teachers;
- The Summer School has made it possible to highlight students' ability to organize themselves, manage time, relate to each other and with teachers;
- The comparison with experts and teachers of different backgrounds allowed the students to open up new horizons to them in view of the choices they will make at the end of their high school studies;
- Cohabitation represented a unique opportunity for the exchange of experiences, development of new ideas, mutual help for the solution of the problems encountered,
- The comparison also made it possible to define unique formats for all the phases of the project to be adopted in the various locations in order to facilitate the comparison of the final results.
- The choice of location was functional to the school's goals.
- The students expressed great enthusiasm for the experience made, in terms of context, company, cultural level and activities carried out.

Results for the public

comunicato sul sito della IAT di Macugnaga

http://www.macugnaga-monterosa.it/it_IT/estate/632,News.html

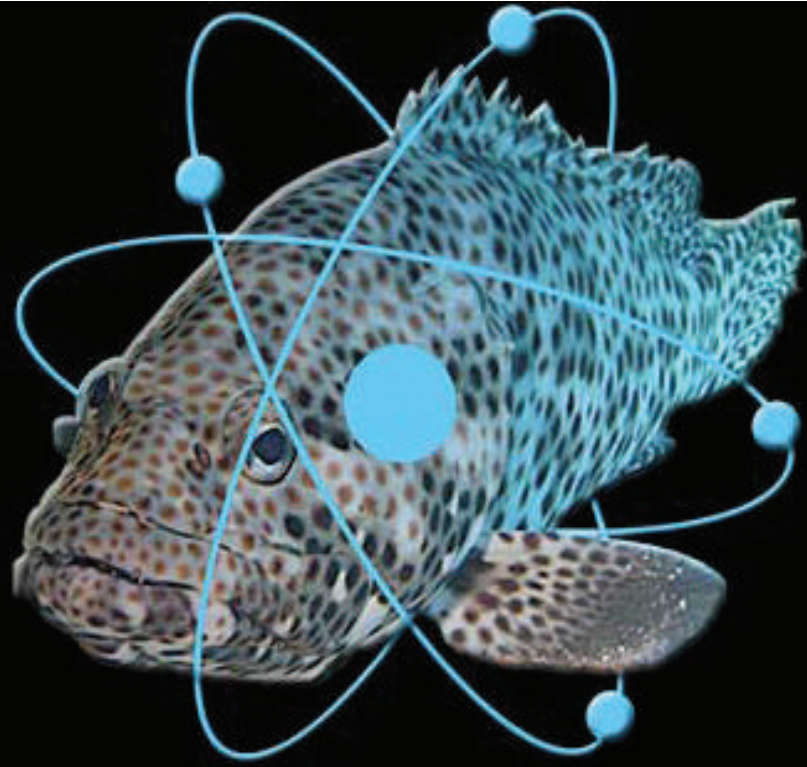
News sul sito del rifugio:

<http://www.rifugiozamboni.com/radiolab-summer-school/>

OssolaNews.it

<http://www.ossolanews.it/prima-pagina/radiolab-summer-school-ritiro-scientifico-al-rifugio-zamboni-15637.html>





CHERNE 2019

Thank you for
your kind
attention





BERGAMOSCIENZA2007





BERGAMO SCIENZA 2007



02-05/06

15th CHERNE - Cortopalo, Italy

YEARS

2007

-
-
-

2013

02-05/06/2019

Progetto ENVTRAD - SPLASH INFN - Sezione di Milano
 & Progetto 'Lawes Scientifiche' Università degli studi di Milano

SPLASH: un tuffo nella radioattività naturale

4° Workshop



Giovedì 08 marzo 2011 ore 14.45
Aula A, Dipartimento di Fisica, via Celoria 16, Milano
Saluti

Prof. Francesco Ragusa, Direttore Dipartimento di Fisica - UNIMI
Prof. Pier Francesco Bortignon, Presidente CCD, Dipartimento di Fisica - UNIMI

Presentazioni

The activity size distribution of radioactive ⁷Be aerosols in different environments in Italy
Prof.ssa Alexandra Ioannidou, Dipartimento di Fisica Università di Salonicco, Grecia

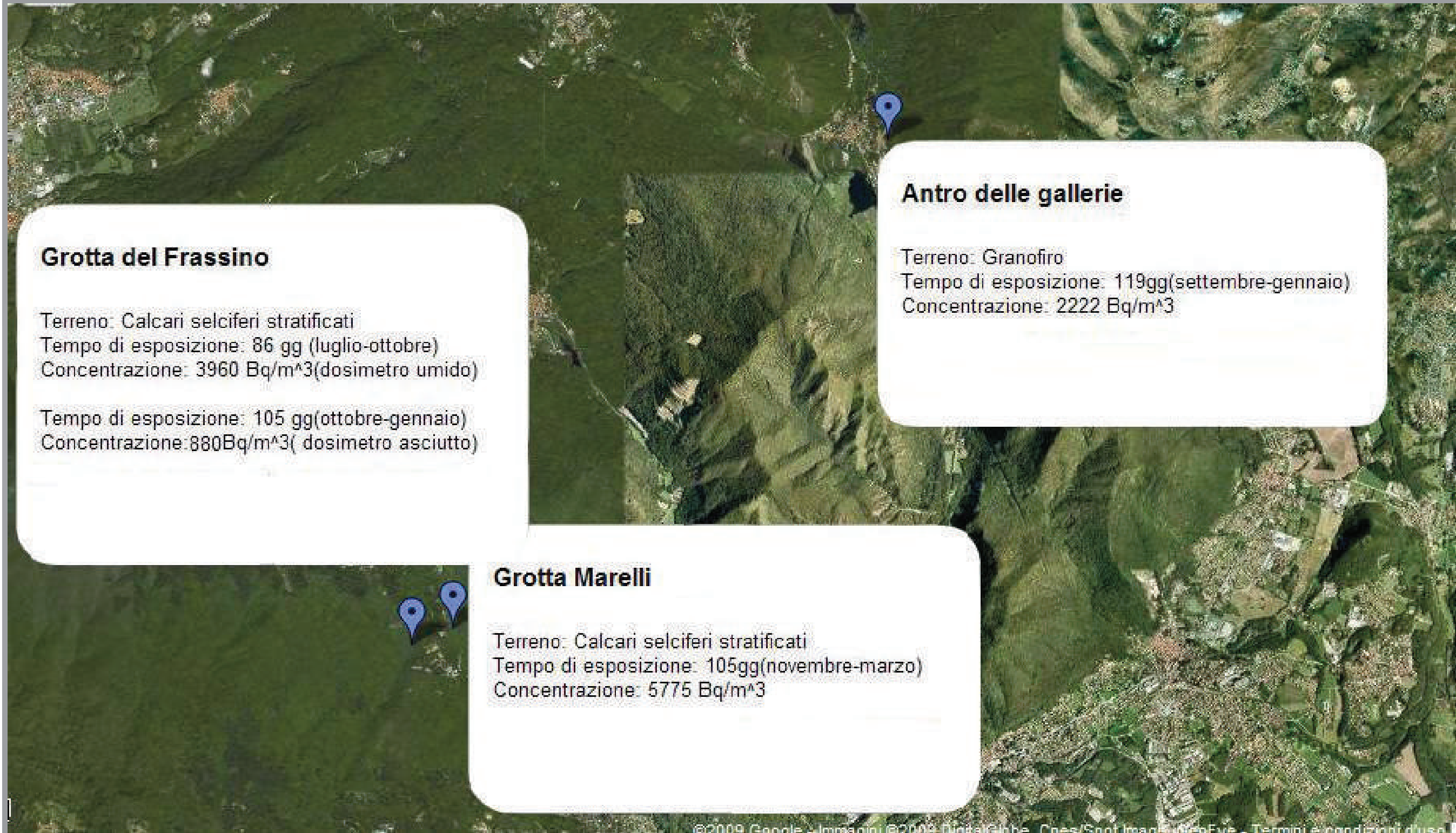
Applicazioni dell'energia del nucleo in campo biomedico ed ambientale
Prof. Mauro Bonardi, Dipartimento di Fisica di UNIMI e Coord. Gr. V Sez. INFN di Milano

Interventi degli studenti delle scuole partecipanti

Discussioni e dinagra dei lavori

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Guardanti gli interventi:
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 Prof.ssa Anna Bazzocchi anna.bazzocchi@gmail.com
 Dr. Simone Manenti simone.manenti@mi.infn.it



Grotta del Frassino

Terreno: Calcari selciferi stratificati
Tempo di esposizione: 86 gg (luglio-ottobre)
Concentrazione: 3960 Bq/m³(dosimetro umido)

Tempo di esposizione: 105 gg(ottobre-gennaio)
Concentrazione: 880Bq/m³(dosimetro asciutto)

Antro delle gallerie

Terreno: Granofiro
Tempo di esposizione: 119gg(settembre-gennaio)
Concentrazione: 2222 Bq/m³

Grotta Marelli

Terreno: Calcari selciferi stratificati
Tempo di esposizione: 105gg(novembre-marzo)
Concentrazione: 5775 Bq/m³

Conclusions

- this kind of activities upper excites a strong interest and the desire to understand more deeply a subject that in general is unusual,
- the beginning from the measurement of natural radioactivity is a good way for the students to approach the nuclear theme on a more rationale basis,
- an experimental activity is a good way to provide for an adequate scientific background,
- through this project also the teachers carry out a training or refresher course on these subjects,
- the measurements are made in accordance to Italian radioprotection law.

Radon Measurements - the future

Formally the European Commission adopted the new Basic Safety Standard (BSS) Directive on 5-th December 2013. Member States are required to bring into force the laws, regulations and administrative by **6-th February 2018**.

There are many topics covered, including:

- specific knowledge, competence and practical skills for RPEs and RPOs figures;
- the core training requirements for RPEs and RPOs.

It will be applied to many items **related to radioprotection of workers and population**, including

- to human activities with the presence of sources of natural radiation that result in a significant increase in the exposure of workers or the population;
- the exposure of workers and the population to radon in confined environments;
- the external exposition due to building materials.



- Reinforce the Health Physics and Radiochemistry branch at the University.
- Establish in collaboration with other partners different initiatives of training for all the figures involved in the Directive.
- One of this is the proposal of a **summer school in Italy** for students but open also to future professionals who will want to "get into the business" of radon concentrations measurements, in order to train on the different measurement techniques and systems.
- Collaborate by providing help on the use of equipment.
- **Educate the teachers of High Schools** to raise awareness of their students about these types of issues.

Conclusions

- *Activities using **ionizing radiation** become each day more and more **employed in every field of our life**. The **real risk**, is related to the **loss of expertise**: the ageing of the workforce, limited prospects for new build and moratoria in a number of countries on the use of nuclear energy are all aspects that impact the level of skills and competence across the whole nuclear sector, particularly in the West Countries **and dramatically in Italy**.*
- *Key indicators of the nature of this problem are: **declining university enrolment, closure or dilution of university departments offering nuclear education and training, demographics of the workforce resulting from retirement over a relatively short period with little or no replacement planned, major reductions in research capacities** as the industry matures, **reducing funding** for experimental research and **closure of dedicated experimental facilities**, which has been accelerated by growing social distrust of experiments involving radioactive materials.*
- *The real “**protection**” is obtained if there are **very well trained personnel that work in this field maintaining the competence, the expertise and the skill**.*
- *It is important to take in mind that the subjects related to these fields require a **constructive collaboration between Physics, Chemistry, Biology, Medicine** that are only different chapters of the **unique great book of the life science**.*

ONLY WITH EDUCATION AND TRAINING
IT IS POSSIBLE TO TRY TO STEM THE SITUATION

Thank you for your kind attention!



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