The ARDENT European Union project

Advanced **R**adiation **D**osimetry **E**uropean **N**etwork **T**raining initiative

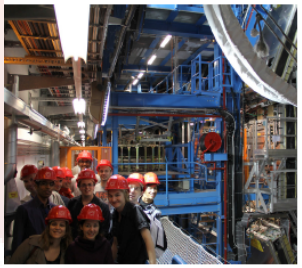
www.cern.ch/ardent

Marco Silari (CERN)

on behalf of the ARDENT consortium

ARDENT and the Politecnico

POLITECNICO DI MILANO



ARDENT

Contacts
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stefano.agosteo@polimi.it
Marco Silari, CERN, Ginevra, Svizzera :
marco.silari@cern.ch

Nell'ambito delle celebrazioni per il 150° anniversario del Politecnico di Milano sarà possibile ascoltare la testimonianza di quindici giovani ricercatori, provenienti da diversi Paesi (Italia, Inghilterra, Australia, Svezia, Colombia, Mauritius, Grecia, Germania, Slovacchia, India) che, grazie al **Progetto ARDENT Marie Curie ITN** (finanziato dall'Unione Europea), studiano nuovi strumenti per misurare le radiazioni per applicazioni mediche, industriali, nella ricerca e nello spazio.

I giovani ricercatori del progetto ARDENT - Advanced Radiation Dosimetry European Network Training initiative - spiegheranno personalmente la loro ricerca e illustreranno le possibilità offerte dall'Università e dall'Unione Europea per accedere a questa carriera.

Racconteranno come, nel corso di questa affascinante esperienza, studiano lo sviluppo di nuovi rivelatori, ossia di strumenti di misura delle radiazioni sempre più accurati, per poter migliorare i trattamenti dei pazienti e limitare i rischi di danno alla salute degli astronauti e alla strumentazione elettronica nelle missioni spaziali.

Nella stessa occasione sarà possibile visitare l'area espositiva, dove verranno mostrati i rivelatori sviluppati nell'ambito del progetto.

PROGRAMMA

9:30 Saluti di benvenuto

9:45 Il programma ARDENT della Unione Europea
(Marco Silari, CERN e coordinatore del Progetto ARDENT)

10:30 ARDENT per tutti
(Silvia Puddu, ricercatrice ARDENT al CERN)

11:00 – 12.30 incontri con i ricercatori ARDENT e dimostrazione delle attività di ricerca

14:30 ARDENT per tutti
(Silvia Puddu, ricercatrice ARDENT al CERN)

15:00 – 16.30 incontri con i ricercatori ARDENT e dimostrazione delle attività di ricerca

Mercoledì 16 ottobre 2013 ore 9.30
Politecnico di Milano
Aula De Donato

ARDENT

February 2012 – January 2016

Marie Curie Initial Training Network under EU FP7 – 4 M€

8 Full Partners and **6 Associate Partners**

Coordinator: CERN, Scientist-in-Charge: Dr. M. Silari

CERN (coordinator), Geneva, Switzerland
AIT Vienna, Austria
CTU - IAEP Prague, Czech Republic
IBA Dosimetry, Schwarzenbruck, Germany
Jablotron, Jablonec nad Nisou, Czech Republic
MI.AM, Piacenza, Italy
Politecnico of Milano, Italy
Seibersdorf Laboratories, Austria

INFN Legnaro National Laboratories, Italy
ST Microelectronics, Italy
University of Erlangen, Germany
University of Houston, USA
University of Ontario, Canada
University of Wollongong, Australia

Marie Curie ITN

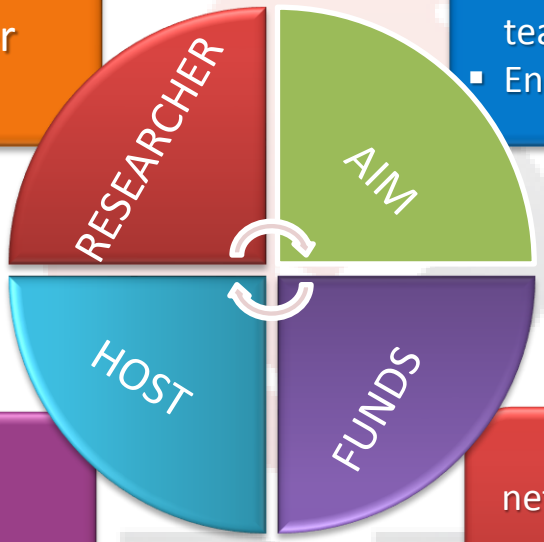
Initial Training Networks

Embarking on a research career is not always easy. And yet today's young researchers are vital to Europe's future. At Marie Curie Actions, we are well aware of that. So we want to make research careers more attractive to young people.

Marie Curie ITN

Initial Training Networks

Researchers within the first five years of their career



- Improving skills
- Integration in established research teams
- Enhancement of career prospects

- Universities
- Research Centres
- Companies
- Small and Medium Enterprises

Successful proposals from a network receive funding for up to 4 years to cover costs of the researchers and for network activities including conferences and equipment

Further information:

European Commission – Marie Curie Actions:
http://ec.europa.eu/research/mariecurieactions

Marie Curie Actions at CERN:
http://jobs.web.cern.ch/join-us/marie-curie-actions

The ARDENT researchers


Eleni Aza – ESR 1

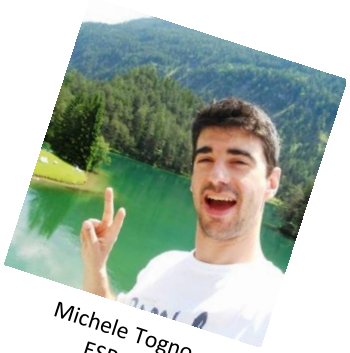

Andrej Sipaj – ESR 6


Alvin Sashala Naik
ESR 13

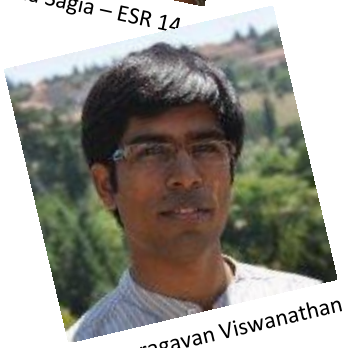

Elena Sagia – ESR 14


Benedikt Bergmann
ESR 9


Silvia Puddu – ESR 3


Michele Togno
ESR 11


Jayasimha V. BAGALKOTE
ESR 5


Vijayaragavan Viswanathan
ESR 12


Kevin Loo – ESR 8


Stuart George – ESR 4

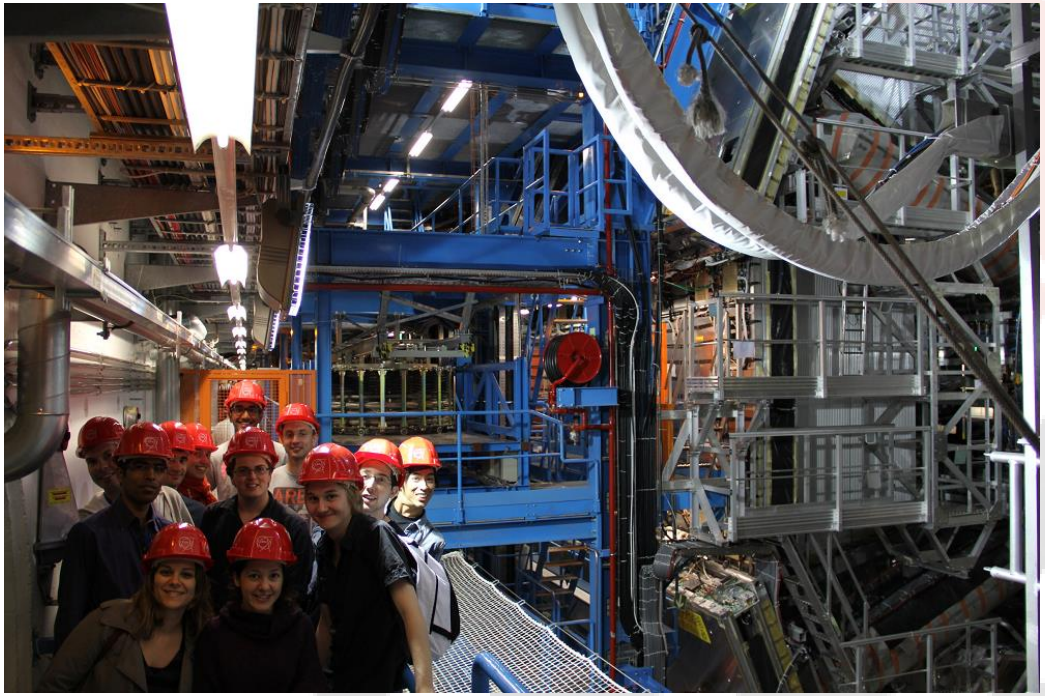

Ivan Caicedo – ESR 7


Francesca Bisello – ESR 10


Erik Frojd – ESR2


Chris Cassel – ESR 15

The ARDENT researchers



The ARDENT researchers vising the ATLAS experiment at CERN

Stuart and Silvia at a conference (yeah…yeah…) in Disneyland

ARDENT institutes

What do we do in ARDENT?

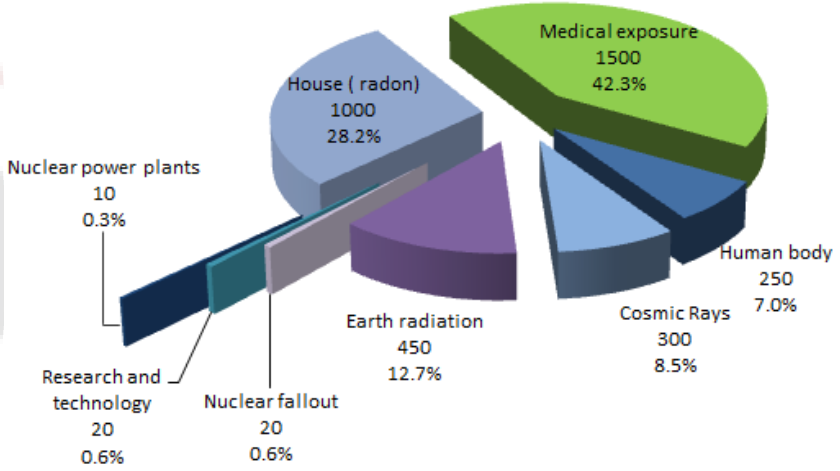
What we do in ARDENT is to develop techniques to better measure radiation

Radiation is everywhere around us!

- ✓ Natural
- ✓ Artificial

Dosimetry = measurement of radiation dose (amount of radiation absorbed by the body, or more precisely, the amount of energy deposited in tissue)

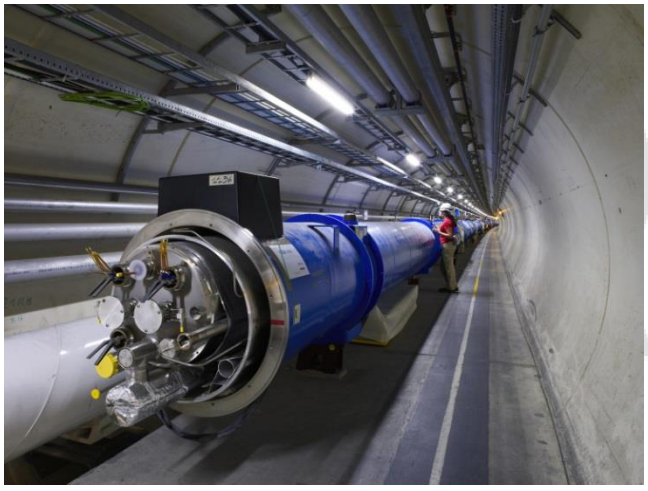
Radiation is all around us



Peaceful uses of radiation

Energy production

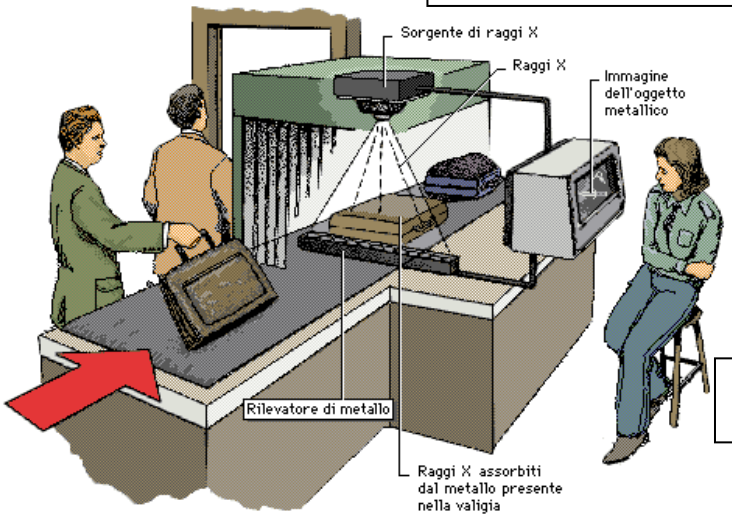
Medicine: diagnostics and therapy

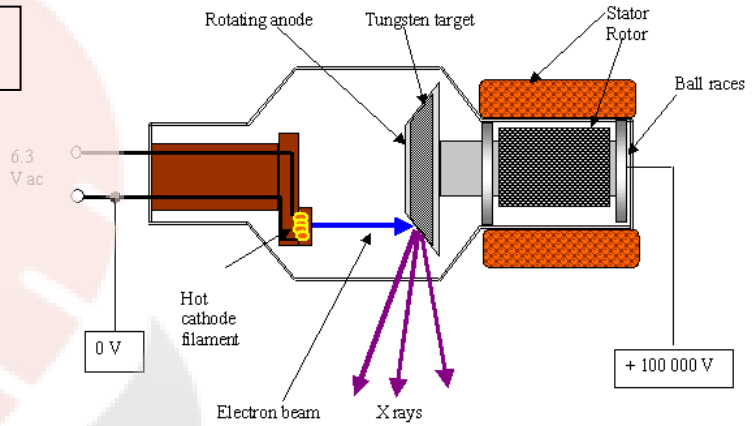


Scientific research / particle accelerators

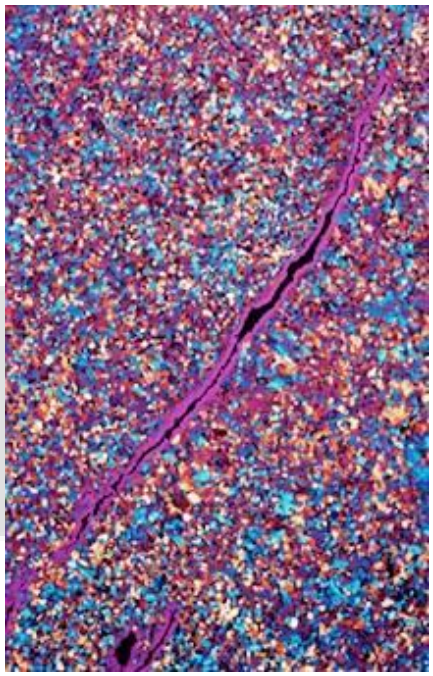
Peaceful uses of radiation

Safety in airports





Industrial radiography



Sterilization of food and medical material

What is Radon (^{222}Rn)?

Produced *naturally* from Uranium products such as Radium (^{226}Ra)

Colourless and odourless gas

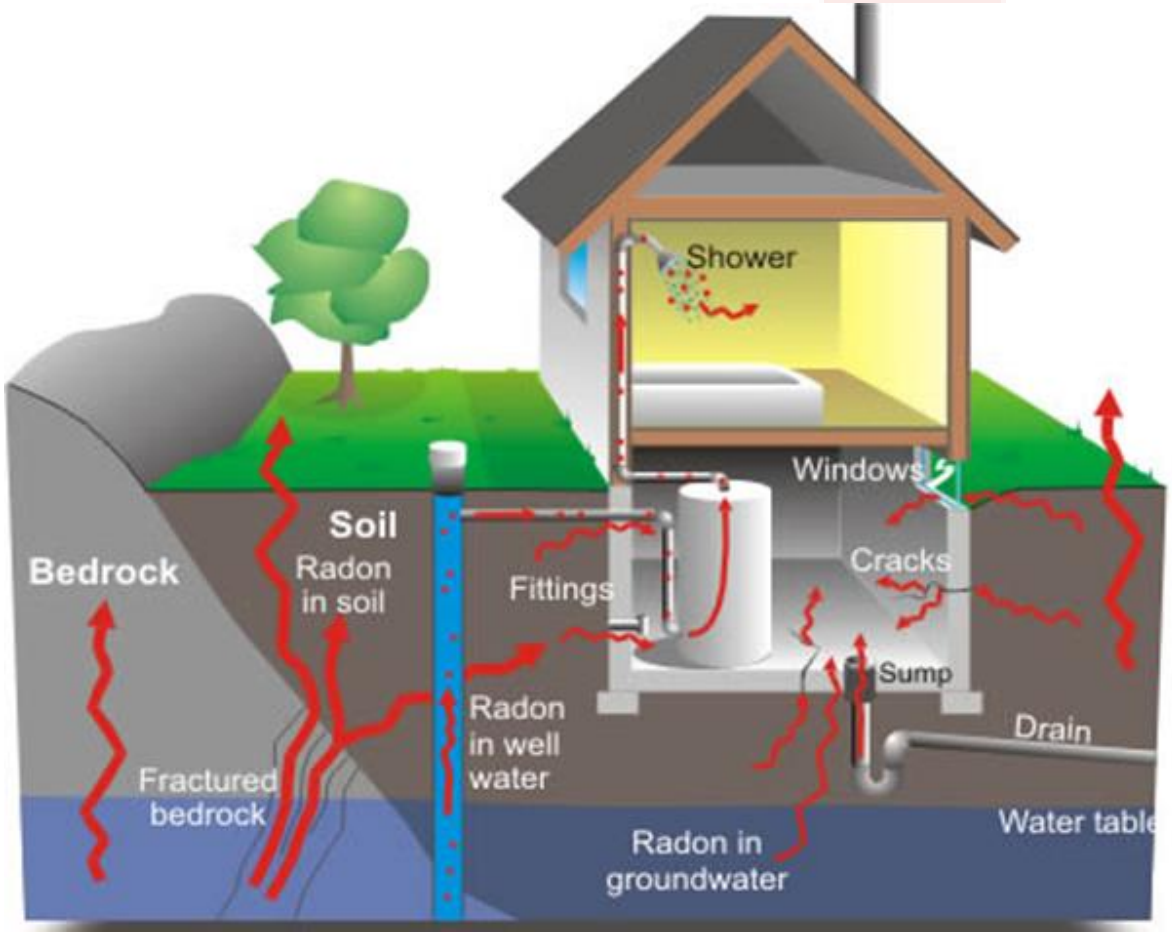
Radon is highly radioactive and is a carcinogen. Its decay products, such as Polonium are toxic and radioactive

Radon is present in most homes and is the second cause of lung-cancer after smoking, with 15,000 to 22,000 lung cancer deaths in the United States each year related to radon

www.cancer.org/radon

Radon and Cancer, Fact sheet N°291, World Health Organisation

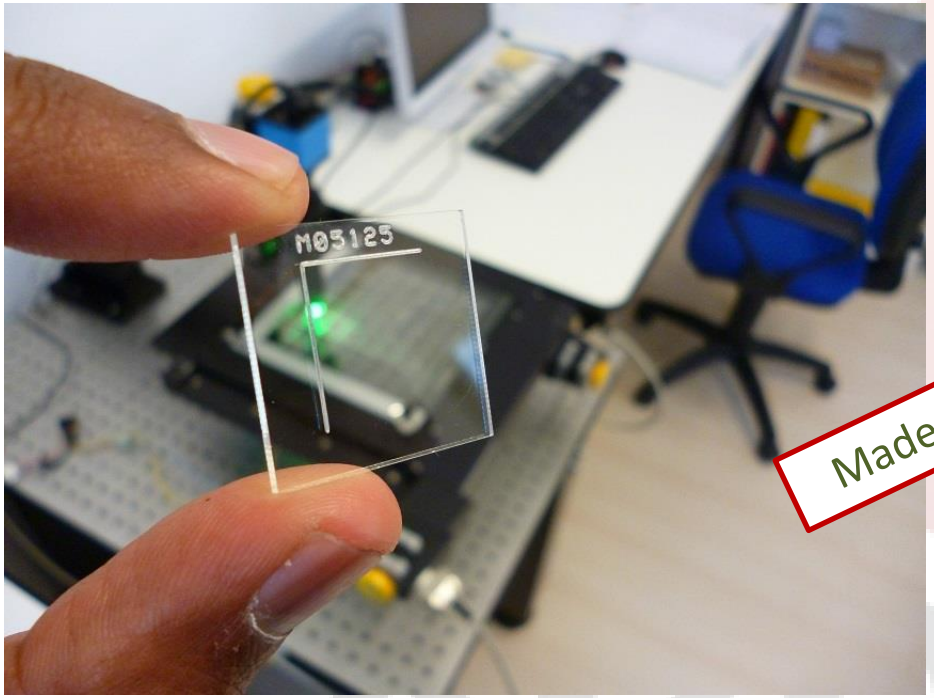
Where do we find Radon?



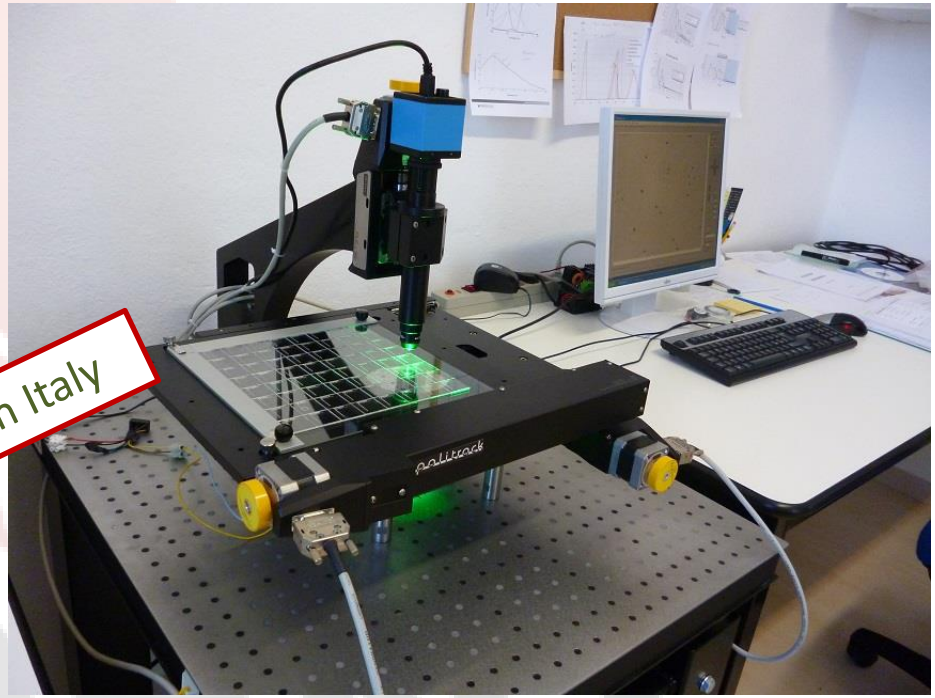
- Radon is emanated from the Uranium rich soil or rocks
- Radon can also be found in water
- Radon escapes easily from the ground into air where it decays into its *progeny* ^{214}Po, ^{218}Po

Radon and Cancer, Fact sheet N°291, World Health Organisation

Measuring Radon exposure at home



Intercast™ CR-39 detector

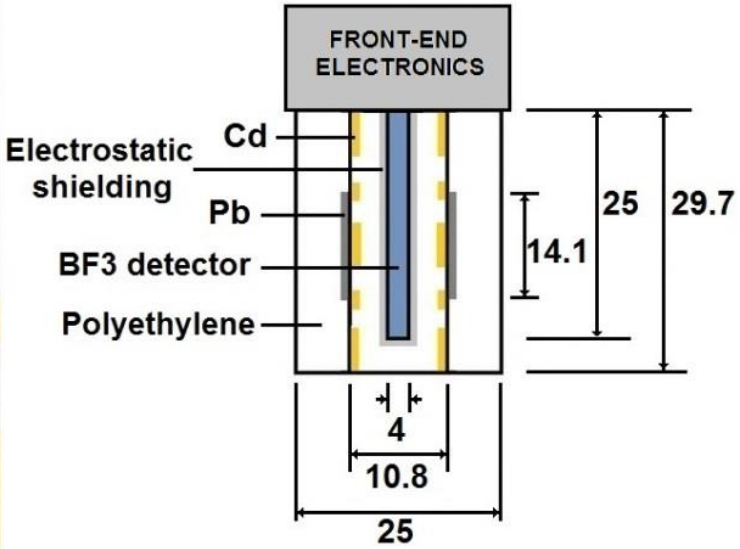


Politrack™ Reader

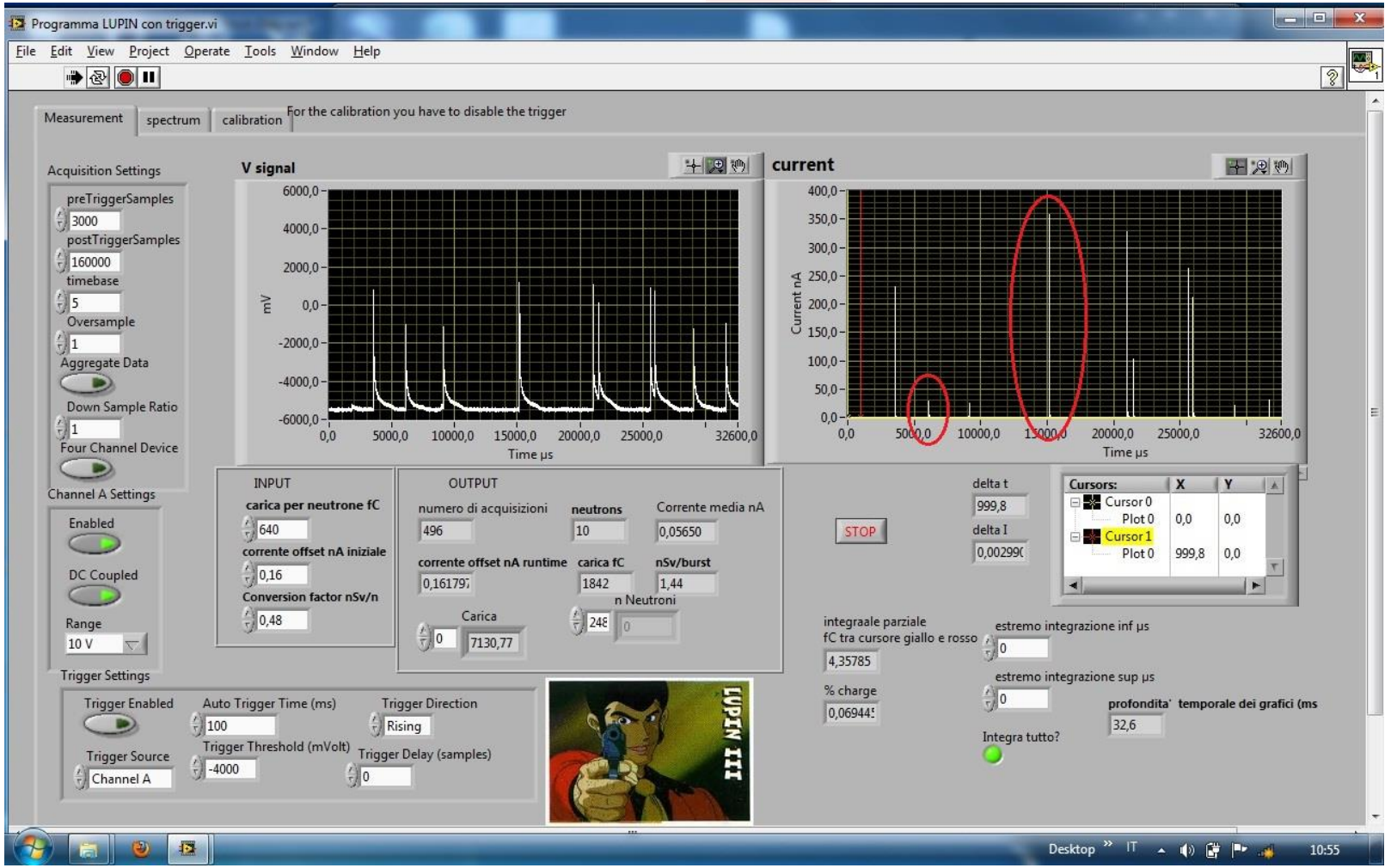
LUPIN

A **radiation safety device** for measuring radiation field around particle accelerators

- Designed to detect **neutrons** produced during accelerator operation
- The incoming neutron is slowed by the outer material, then interacts with the gas (BF_3) inside the detector, which causes an increased current in the circuit
- This is then acquired with a laptop, and the number of neutrons are counted



LUPIN



Screenshot of the acquisition software. The peaks in the right side plot are neutrons interacting with the detector

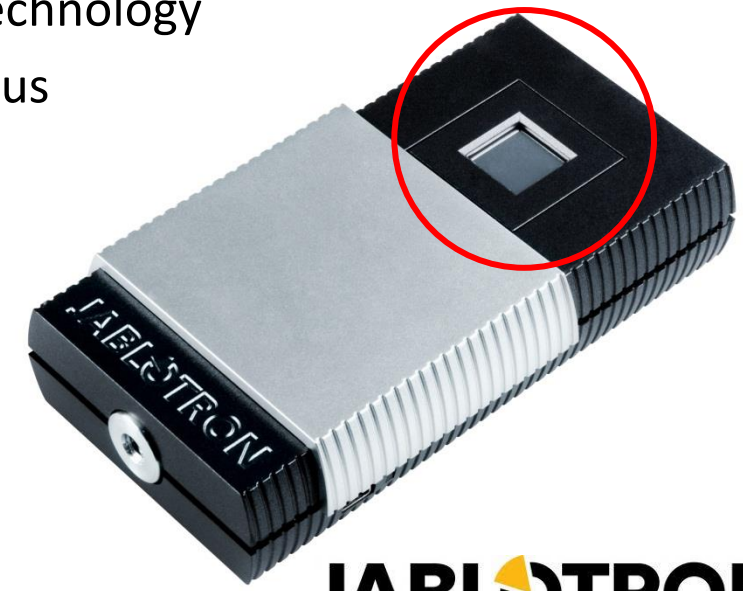
Medipix

MX-10

Digital Particle Camera

See a different world ..

- Radiation detecting device based on Timepix technology
- Can see invisible particles which are all around us
- Application can be used for
  - educational, research, medical and industrial purpose
- Technology has been developed at CERN
- Outcome of more than 10 years of research
- Goal: take research outcome to Society



JABLOTRON
CREATING ALARMS

Medipix

Basic MX-10 edukit

MX-10

- Unique educational aid for students
- Developed at JABLOTRON ALARMS a.s
- Collaboration: CERN/IEAP/Medipix/ARDENT
- Product launched in the market

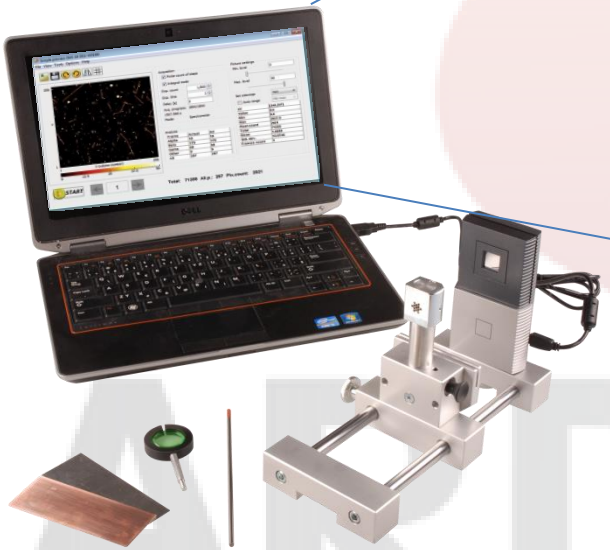
Features

- 256 x 256 pixels, Pixel size: 55 x 55 μm^2
- Active area 14 x 14 mm^2
- Recognition of particles (α,β,γ,MIP)
- Real time display using Pixelman
- Experimental guide for teachers
- Portable

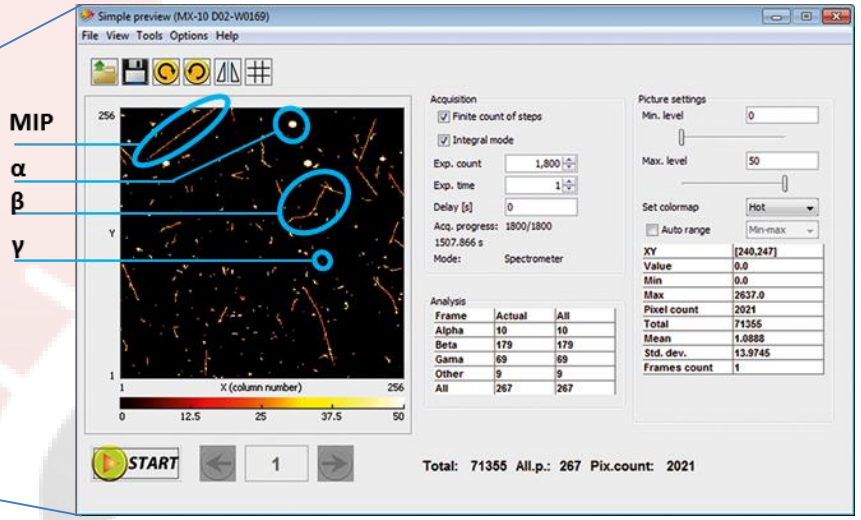
Medipix

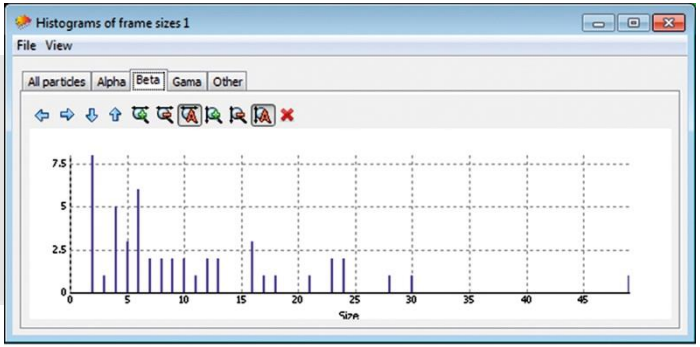
Educational kit setup

- MX-10 – digital particle camera
- Test bench with source
- Pixelman software



Pixelman software output

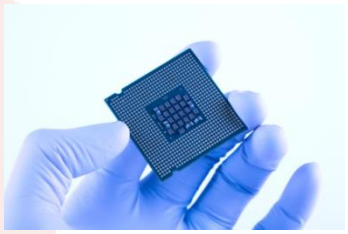


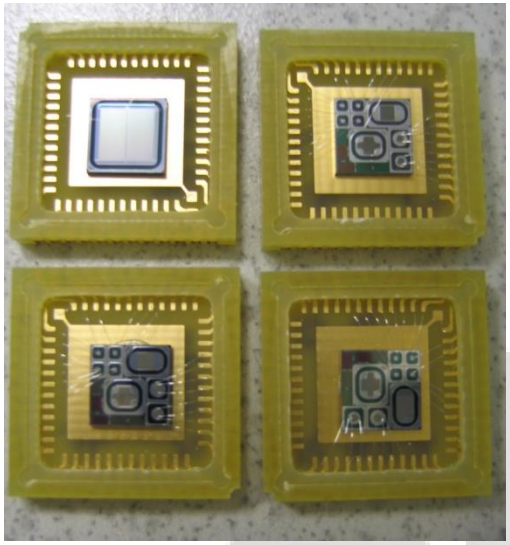


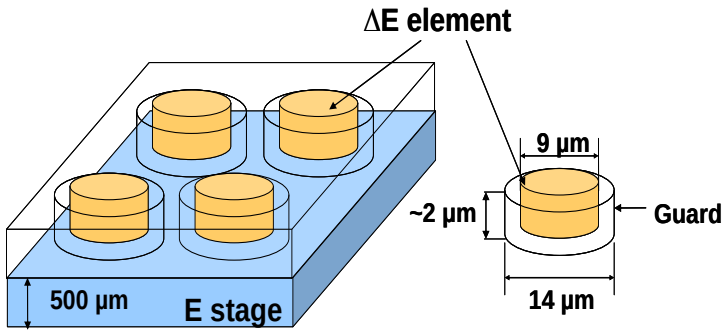
Silicon microdosimeter

Si 14 28.09

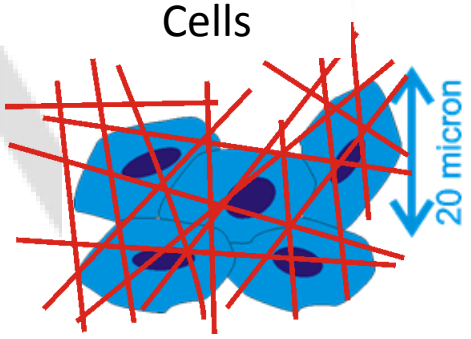
Common material







Cells

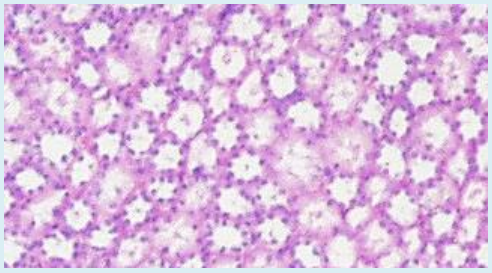


Courtesy of P. Colautti, INFN-LNL, Italy

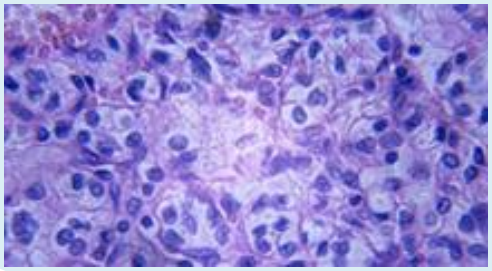
Silicon microdosimeter

Dosimetry in micrometric scale

1 µm = 0, 000001 m
1 millionth of a metre



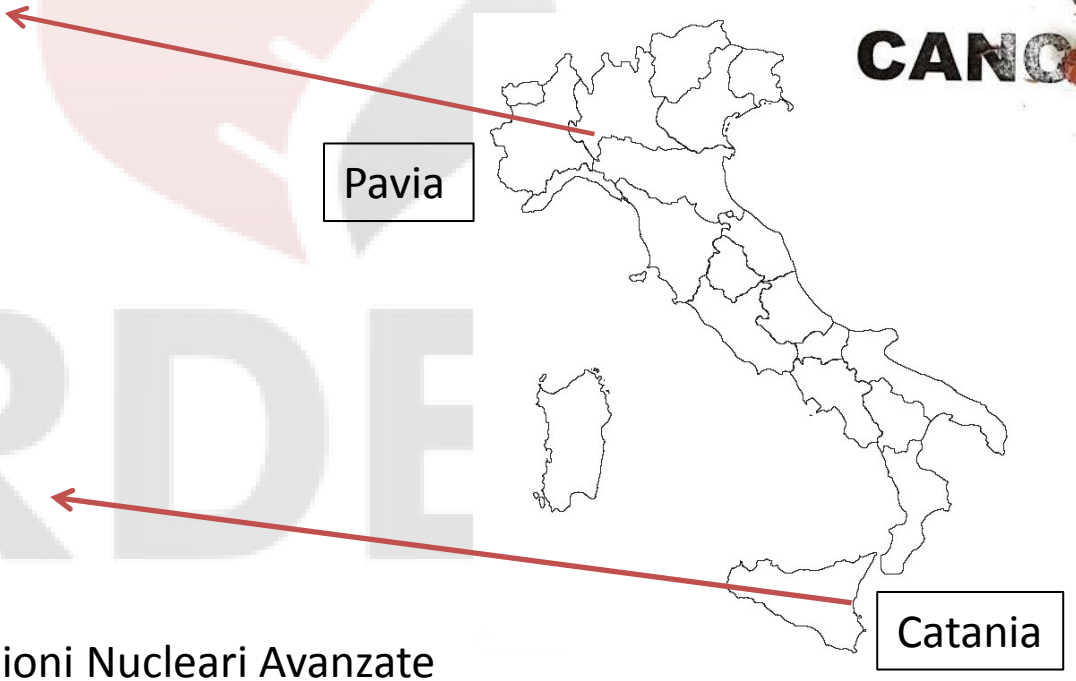
HEALTHY TISSUE

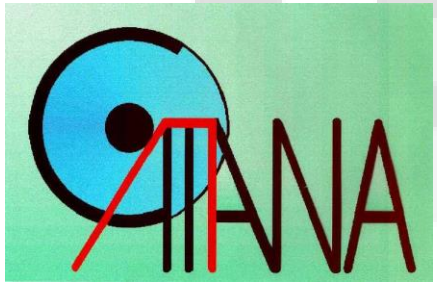


CANCER

Cancer radiation therapy

Radiation can be a useful tool used for cancer treatment by killing the cancer cells though a procedure called radiotherapy
Radiotherapy is performed in specialized facilities
The application of **microdosimetry** helps for more effective treatment





Centro di AdroTerapia e Applicazioni Nucleari Avanzate

EDUCATION AND RESEARCH

Knowledge and Training at CMRP

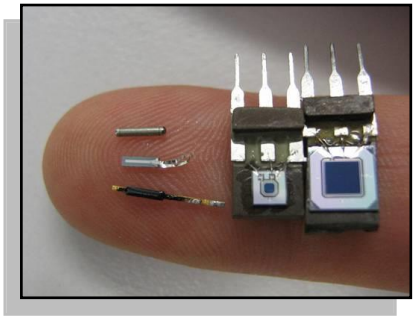
70% of medical physicists in NSW were trained at CMRP

Technology Solutions

Excellence in Education

Partnerships in Business

Sensors for Real-time Solutions in Radiotherapy and Nuclear Medicine

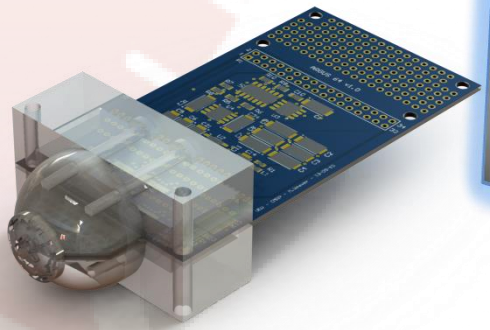


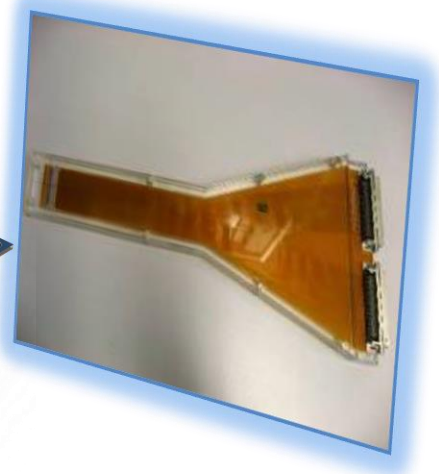
Live Longer, Live Healthy

Dose Magnifying Glass-
Brain tumor fighter

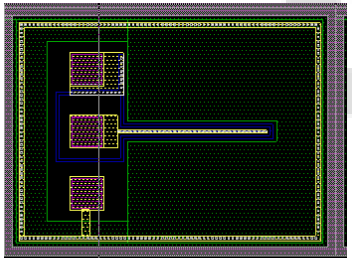
Panoptes-eye cancer fighter

Magic Plate-
cancer fighter

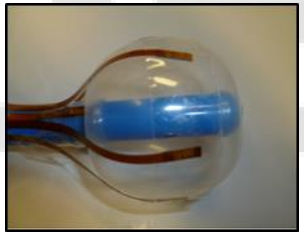


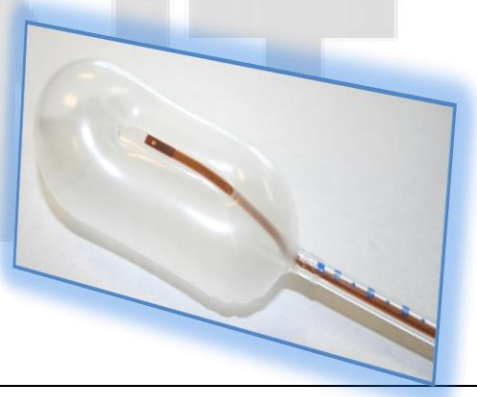


SSD-child cancer fighter

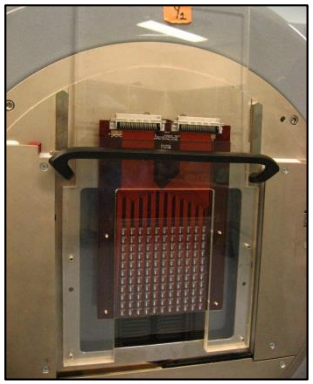


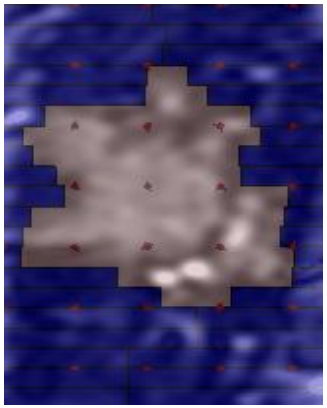
MOS*kin* –prostate cancer fighter

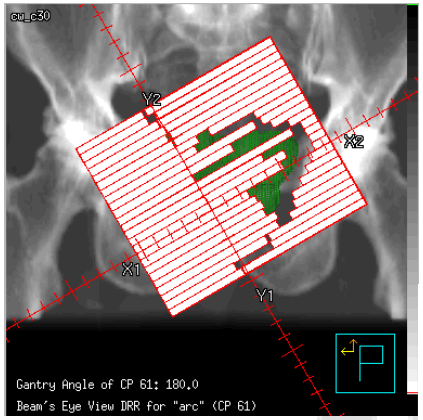


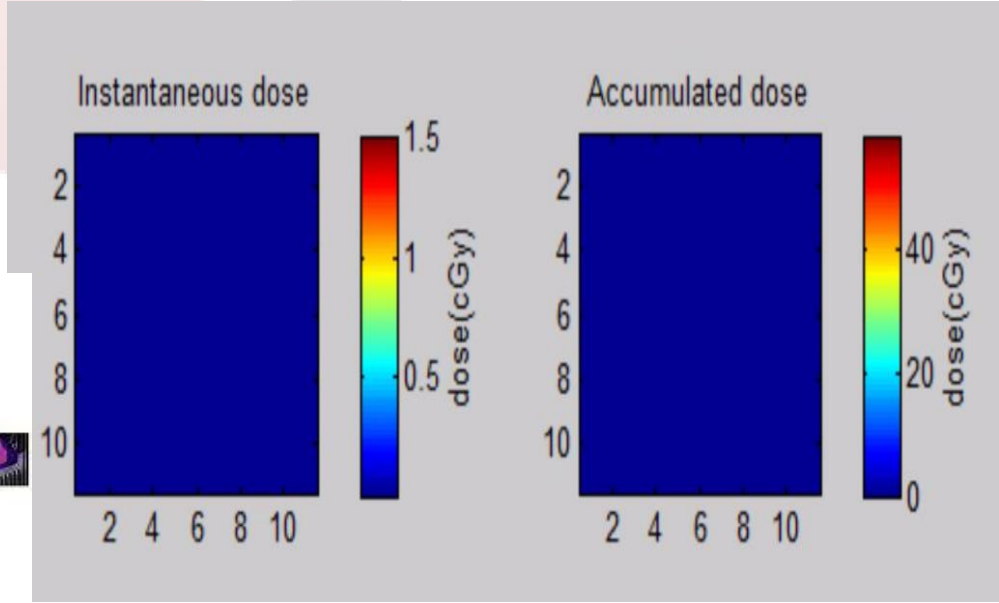


Photon Therapy: MiniDosimetry





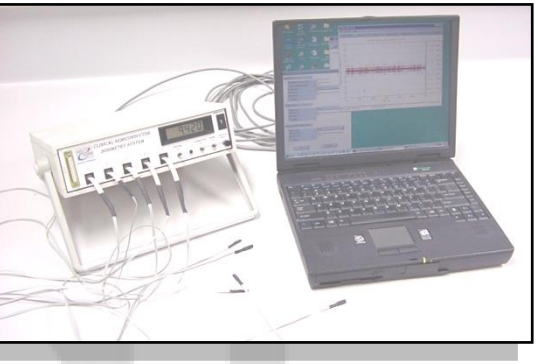




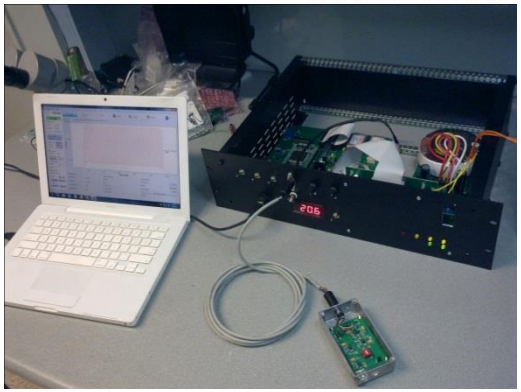
CMRP Radiation Sensor Systems

Radio-guided Surgery Probe

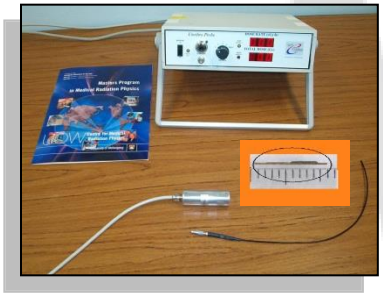
Microdosimeter



MOS*kin* Dosimetry



Microbeam Dosimetry



Urethra Probe

Sponsorships and partnerships

African School of Physics
Stellenbosch (SA) –August 2010

African School of Physics 2012
Kumasi, Ghana – July 2012

African School of Physics 2014
Dakar, Senegal, August 2014

CERN national teacher programme

The **National Teacher Programmes** are held in the mother tongue language of the participants from CERN member states:

http://education.web.cern.ch/education/Chapter1/Page3_IT.html

Italian Teacher Programme September/October 2013:

http://indico.cern.ch/conferenceDisplay.py?confId=266032
http://indico.cern.ch/conferenceDisplay.py?confId=275120

About 80 high-school teachers took part

CERN takes care of the organization, there is no fee, only travel and accomodation expenses has to be covered by the school

What you are going to see next…

- A presentation by Silvia Puddu, ARDENT researcher at CERN, Geneva:

  «ARDENT for all» (*ARDENT per tutti*)

- You will meet our ARDENT researchers who will show you their scientific activities on:
  - Instrumentation for dosimetry and microdosimetry
  - How to measure radon
  - Medipix, LUPIN,…
  - How to measure radiation employed to kill cancer
- And you can ask them all sorts of questions (sometimes in English – good exercise for you!)