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**Quantum Electronics and Plasma Physics Research Group**
Industrial Engineering Department

# La fisica e l'antiterrorismo: un nuovo approccio per affrontare le minacce globali naturali e quelle provocate dall'uomo

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# Andrea Malizia , born 18/07/1980

***-RESEARCHER AT DEPARTMENT OF INDUSTRIAL ENGINEERING, UNIVERSITY OF ROME «TOR VERGATA»***
***-DIDACTICAL COORDINATOR OF POST GRADUATE COURSES IN PROTECTION AGAINST CBRNE EVENTS***
***-TUTOR ASSISTANT in PHYSICS, LASER APPLICATION AND CBRNE PROTECTION***

- **PhD in Quantum Electronics and Plasma Physics**
- **2° level Post Graduate Course in Protection against CBRN events**
- **Master Degree in Environmental Engineering**

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***Students of Bachelor and Master Degree in Physics, Enginnering and Biology***


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**NUCLEAR FUSION – Magnetic Confinement**

- Energy production
- Material studies (Fast particle production and radioprotection)
- Safety studies (Loss of Vacuum Accident) with STARDUST facility
- Develope of genetic code to process database to find connection and physics law (computational work)

**NUCLEAR FUSION – Inertial Confinment**

-Controlled nuclear explosions for energy production
-Equation state in Warm Dense Matter (Stars, giant Planets core)
-Material studies (Fast particle production and radioprotection)
-Development in diagnostic and detectors (opteration in extreme regime)
-Hydrodynamic simulations


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**LASER MONITORING**

-SAI - LIDAR system (smoke/pollutants at long distance)
-TELEMACO (particle analysis with laser in air at long distance)
- SNIFF – LIDAR & DIAL systems (environmental pollutants source and diffusion control)

**MATERIAL SCIENCE**

-Material characterization (SEM, XRD, X-ray and Optical Spectroscopy)
-New structure growth and possible applications (new detectors, specific material properties,etc…)

**DIDACTICAL ACTIVITIES**

-Undergraduate Courses in General Physics, Laser Systems, Fusion Energy
-Post Graduate Courses in:

- CBRNe Protection : www.mastercbrn.com (info@mastercbrn.com)
- Nuclear fusion : (segreteriafusione@gmail.com)


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# TOPICS

1. What do we mean with terrorism
2. Needs of international community
3. An idea realized by physicists
4. New opportunities with a degree in physics


# What do we mean with terrorism

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## NBC IN THE PAST

no.203.078

**NUCLEAR EVENTS**

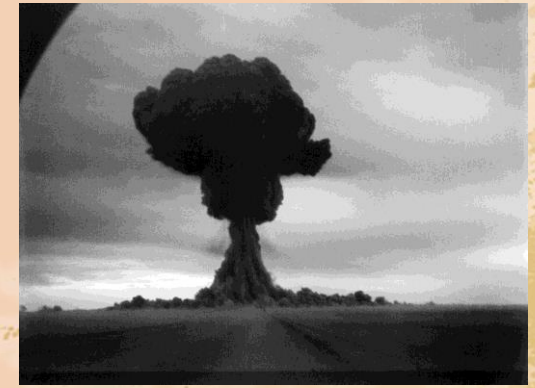
### Accidental and Natural events

Chernobyl (1986)

### War

Nagasaki –Hiroshima (WWII)

### Terrorism



Use of N Weapons


# What do we mean with terrorism

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## NBC IN THE PAST

no.203.078

**BIOLOGICAL EVENTS**

**Accidental and Natural events**

Spanish flu

**War**

(WWII)

**Terrorism**

*Y. pestis*
(Middle Ages)


# What do we mean with terrorism

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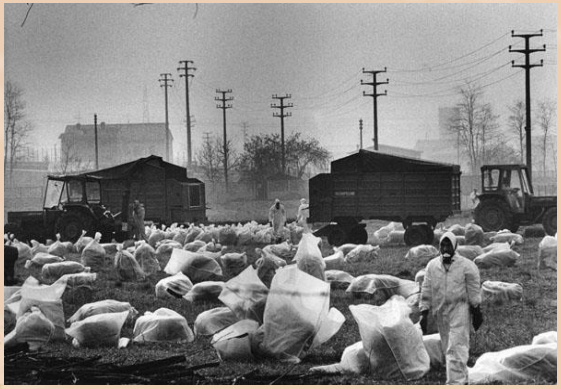
## NBC IN THE PAST

no.203.078

### CHEMICAL EVENTS

**Accidental and Natural events**



Seveso (1976)

**War**

Ypres (WWI)

**Terrorism**

Tokio (1995)

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# CBRNe Risk TODAY

**CHEMICAL EVENTS**

**Accidental and Natural events**

**War** ⟷ **Terrorism**

Viareggio (2009)




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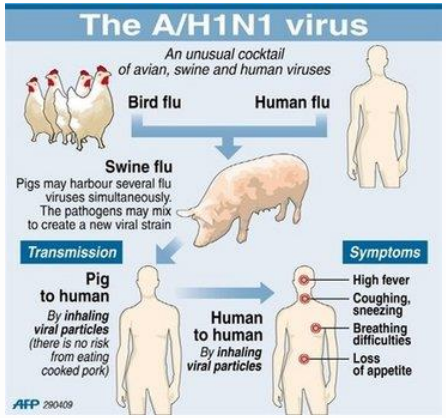
# CBRNe Risk TODAY

**BIOLOGICAL EVENTS**

**Accidental and Natural events**




Swine Flu (2009)

**War** ⟷ **Terrorism**

Amerithrax (2001)

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# CBRNe Risk TODAY

**RADIOLOGICAL-NUCLEAR EVENTS**

**Accidental and Natural events**

Fukushima (2011)

**War** ⟷ **Terrorism**




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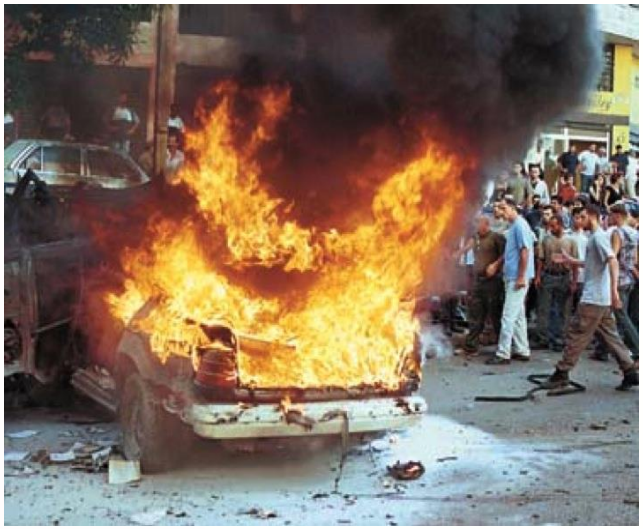
# CBRNe Risk TODAY

**eXPLOSIONS EVENTS**

**Accidents? ⟷ War? ⟷ Terrorism?**



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# EXTREME EVENTS

## NATURAL

- volcanos / earthquakes
- storms / inundations
- hydrogeological disasters
- food / water lack
- epidemic / pestilences ....

## ACCIDENTAL

- fires
- incidents ...

## MIXED

- migration fluxes

## MAN - MADE

- war
- terrorism


## Needs of international community

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- **The erosion of national control and the global spread of knowledge related to chemical, biological, radiological and nuclear weapons and technologies have been a long-standing concern in the post-Cold War world.**

- **In times of tightening security budgets, the way in which countries prepare for Chemical, Biological, Radiological and Nuclear (CBRNe) incidents, deserves renewed scrutiny. This involves the prioritization of capabilities against C, B, R, or N in the Analysis, Prevention and Response (APR) phases.**

- **Overall, experts agree that in the 21st century, CBRNe materials may be utilized and deployed as weapons in novel ways, both in the military and civil domain. The CBRNe-policy benchmark reveals how the countries formulate and execute their respective CBRNe policies. The conclusion is that some countries deal with CBRNe as a single policy issue in its own right; other countries approach CBRNe as part of a larger security policy approach; CBRNe crisis management has shifted from the military to the civil domain resulting in a duplication of efforts.**


# Needs of international community

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**1) IT IS IMPORTANT HAVE EXPERTS THAT LOOK AT…**

→ Products and New Technologies

- CBRNe agents and weapons
- Detection and Protection
- Decontamination
- DSSs
- Cybersecurity
- Nanotechnologies

**2) .. AND ALSO EXPERTS THAT LOOK AT…**

Old Risk and New Risks ←

**3) ..AND EXPERTS THAT ARE ABLE TO FACE THE..**

→ First Response

- New Strategies and Laws
- Development and application of International Procedures
- Manage an Emergency
- Cooperate with Decision Makers And First Responders
- Communication, Investigation and Comprehensive approach

- Specific Training
- High Level Preparation
- International Simulation of Emergency


## An idea realized by physicists

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# MISSION

Military Entities

Academic & Research Entities

Multidisciplinary

CBRNe

Education & Training

Public Entities

Private Entities


## An idea realized by physicists

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# VISION

## Need

**CBRNe First Responders**

**CBRNe Advisors for Decision Makers**

IDEA : 2 POST GRADUATE COURSES IN CBRNe

PROJECT
SINERGY BETWEEN ENTITIES

**2 MASTER COURSES IN "PROTECTION AGAINST CBRNe EVENTS"**

SOLUTION

SOLUTION

**1st Level Course**

- ***120 ECTS → 2 Academic Years***
- Practical Preparation
- Training activities:
  - ✓ JCBRNE COE NATO (Vyskov)
  - ✓Scuola NBC di Rieti (Italy)
  - ✓ VVU (Czech Rep.))
  - ✓ Seiesdoorf Laboratories (Austria)
  - ✓ Chornobyl Center (Ukraine)

**2nd Level Course**

- ***60 ECTS → 1 Academic Year***
- Theoretical Preparation - Management
- Training activities:
  - ✓NATO SCHOOL (Oberammergau)


## An idea realized by physicists

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**The Courses are organised in cooperation with the following International Entities, that have signed formal Agreements with the University**

**Italian Public Entities**

- **Prime Minister's Office**
- **Ministry of Defence:**
  - ✓Italian Army
  - ✓Italian Navy
  - ✓Italian Air Force
  - ✓Carabinieri
- **Ministry of Interior:**
  - ✓Fire Brigades
  - ✓Police

- **ENEA**
- **INGV**
- **ISS**
- **COPIT**
- **CRATI**
- **MARIS**
- **SCIRE**

**International Entities:**

- OPCW
- JCBRNe COE NATO (Czech Republic)
- NATO SCHOOL of Oberammergau (DE)
- HotZone Solutions (Holland)
- VVU-026 Sternberk (Czech Republic)
- Seibersdorf Labor GmbH (Austria)
- Chornobyl Centre (Ukraine)

**Sponsors & Partners**

- ❑ SELEX SE
- ❑ THALES GROUP
- ❑ WL GORE & ASS.
- ❑ INTERGRAPH LLC
- ❑ CRISTANINI SPA
- ❑ AEROSEKUR SPA
- ❑ BMD SPA
- ❑ PAX LUDENS
- ❑ NBC SYSTEM SRL
- ❑ BMA SRL
- ❑ POLLUTION SRL
- ❑ PETROLTECNICA SRL
- ❑ OTOMELARA
- ❑ DRAEGER
- ❑ PRINCIPIUM SRL
- ❑ SERVIZI PI
- ❑ RA.SE.T SRL
- ❑ DPI SEKUR


## An idea realized by physicists

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Both Master Courses have been granted the **NATO SELECTED** status by the **NATO HQ SACT** (Supreme Allied Commander Transformation – Norfolk, Virginia, USA).

The Tor Vergata University has signed a **Cooperation Agreement** with the **OPCW** (Organization for the prohibition of Chemical Weapons), which will support the **Master Courses.**

As it is stated in the **OPCW Press Release,**

**"It is the first such agreement the OPCW has made with a university in this field"**

(https://www.opcw.org/index.php?id=242&tx_ttnews%5Btt_news%5D=1719&cHash=a51e455b9203696a4d17771ae5282b11)


# New opportunities with a degree in physics

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- Detection
- Protection
- Decontamination
- Medical managment
- Emergency managment
- Emergency planning
- National and International funding
- Private factories
- Didactic activities
- Software development
- Training activities
- Research


# New opportunities with a degree in physics

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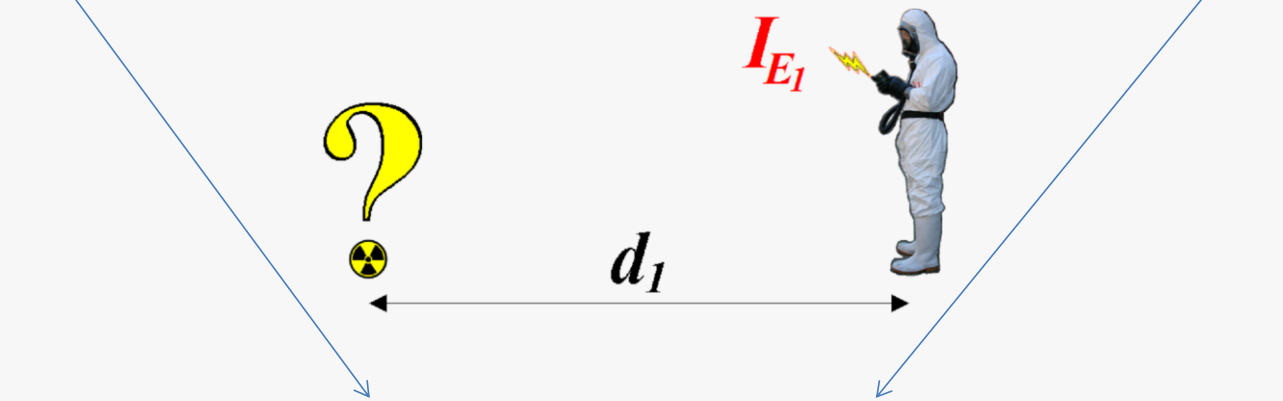
$$I_{E1} = \frac{\Gamma \cdot A}{d_1^{\,2}}$$

$$I_{E2} = \frac{\Gamma \cdot A}{d_2^{\,2}}$$

$I_x$ = Exposition Intensity [$C/(Kg*h)$],
$\Gamma$ = Gamma specific constant (it is a characteristics of each radionuclides), [$(C*m^2) / (Kg*h*Bq)$],
$A$ = Source activity [$Bq$],
$d$ = Source distance [$m$].




$$I_{E_2} = I_{E1} x \frac{d_1^2}{d_2^2}$$

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- ***Locate the area actually affected by the radiation problem***
- ***Evaluate the possibility to move the source by a distance sufficient to avoid at least the evacuation of particular buildings, such as hospitals or allow the reopening of communication routes important.***

The authors thought that the achievement of this task can be facilitated by geo-referencing the results of radiological calculations.

For this reason the authors have developed a software (interfaced with Intergraph's geospatial solutions) for this case, an unknown source, by applying the equation outlined above, taking as a simplifying assumption that the source is punctual.


# New opportunities with a degree in physics

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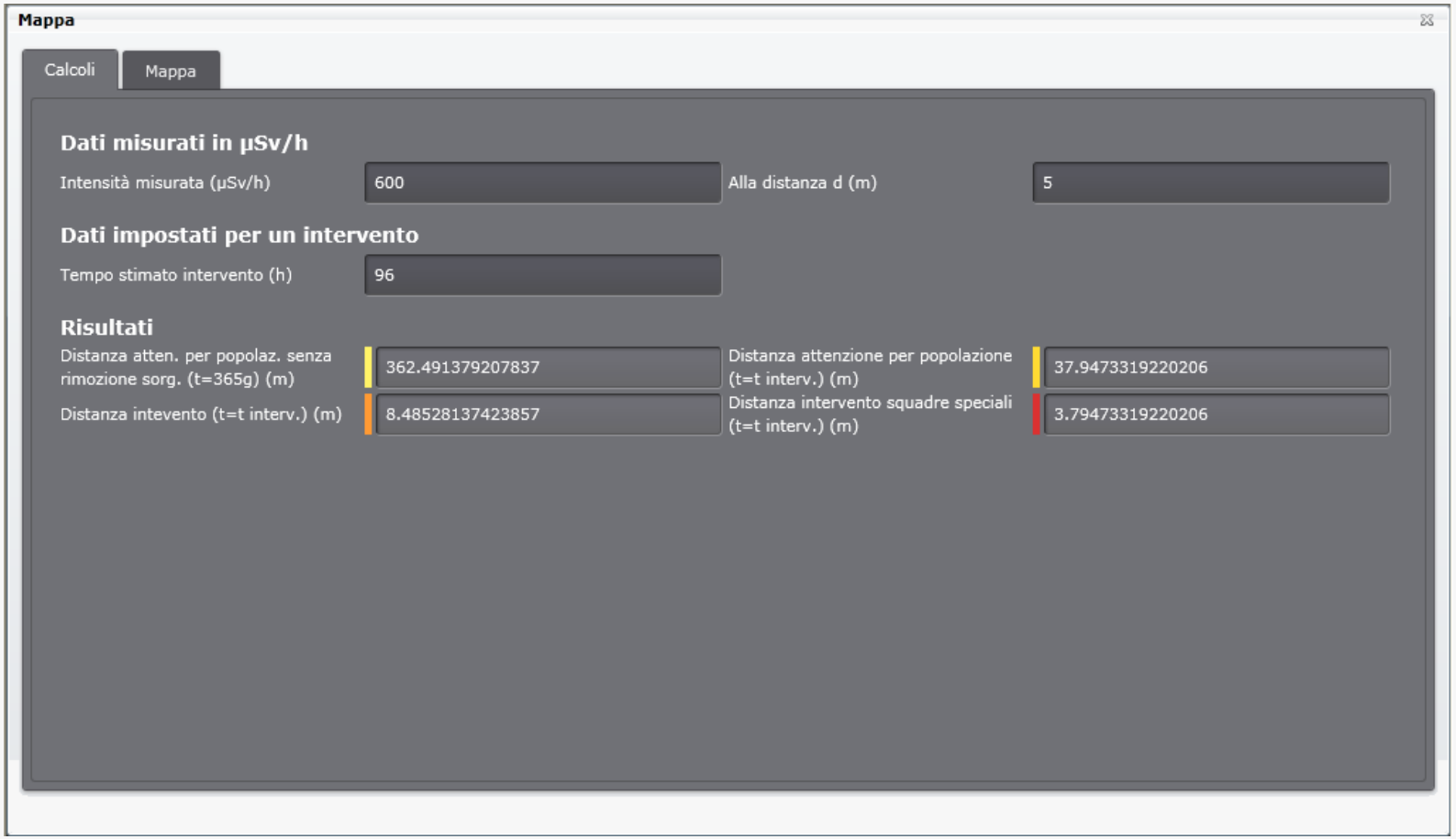


# New opportunities with a degree in physics

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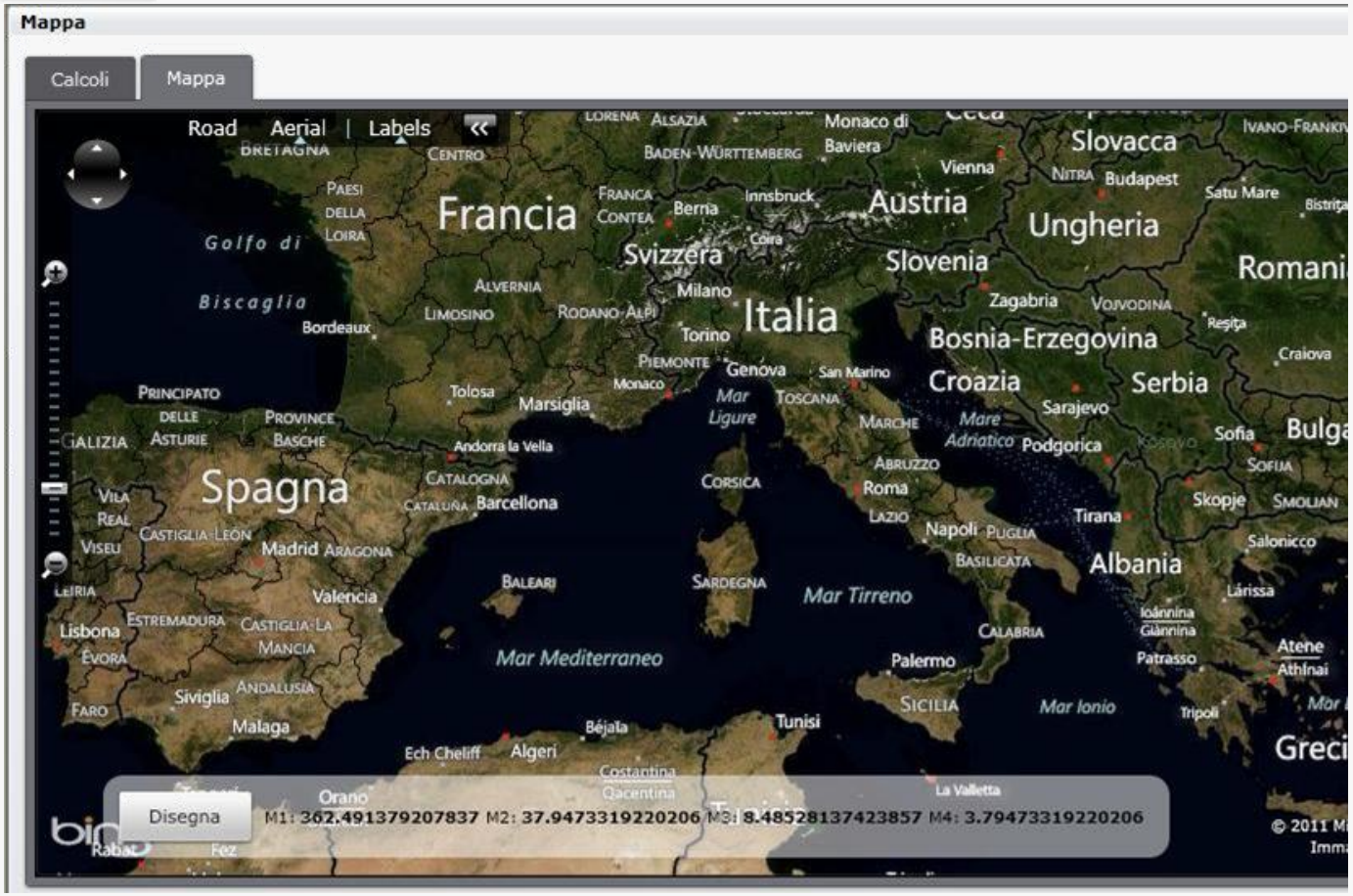


# New opportunities with a degree in physics

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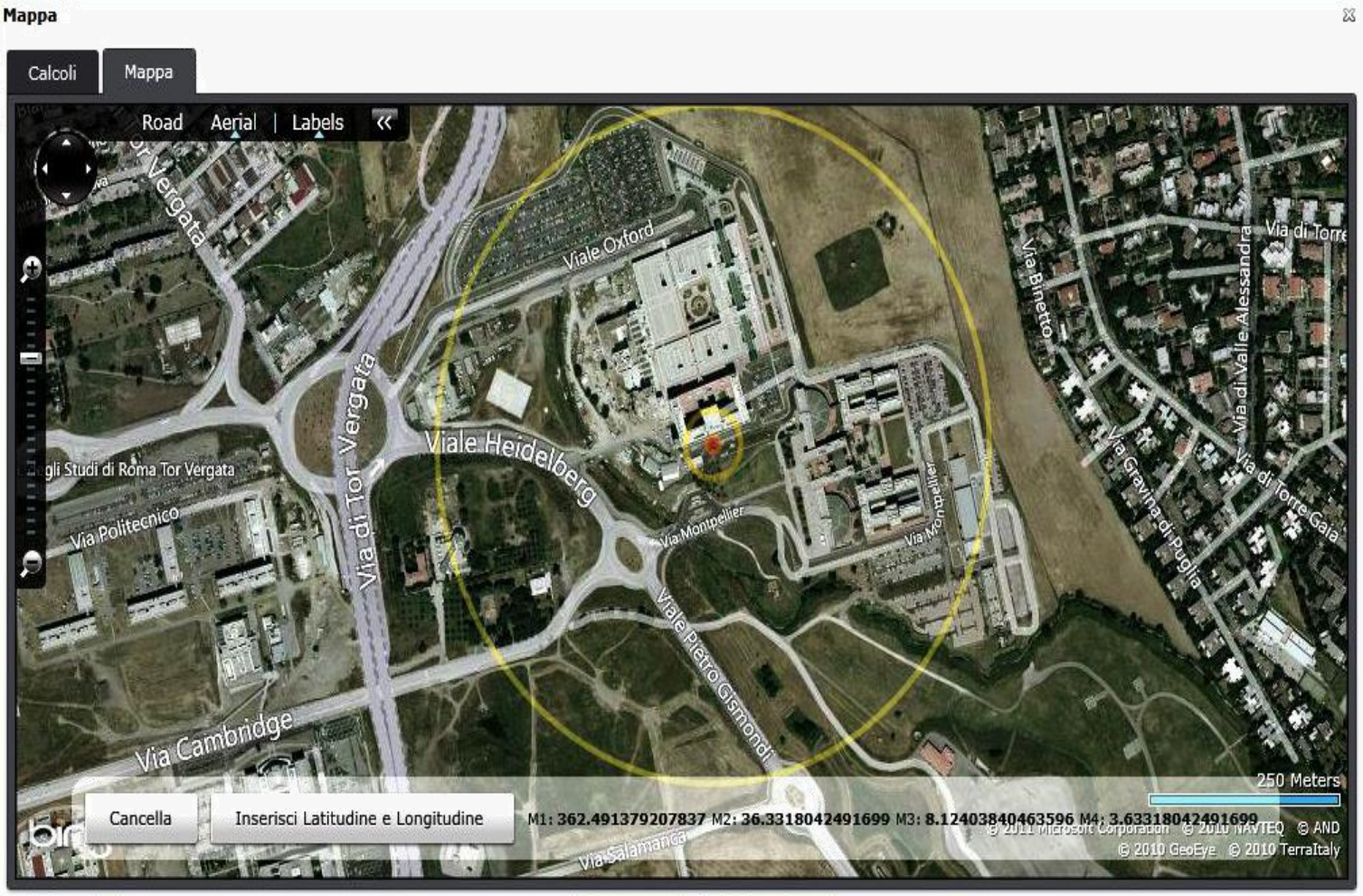


# New opportunities with a degree in physics

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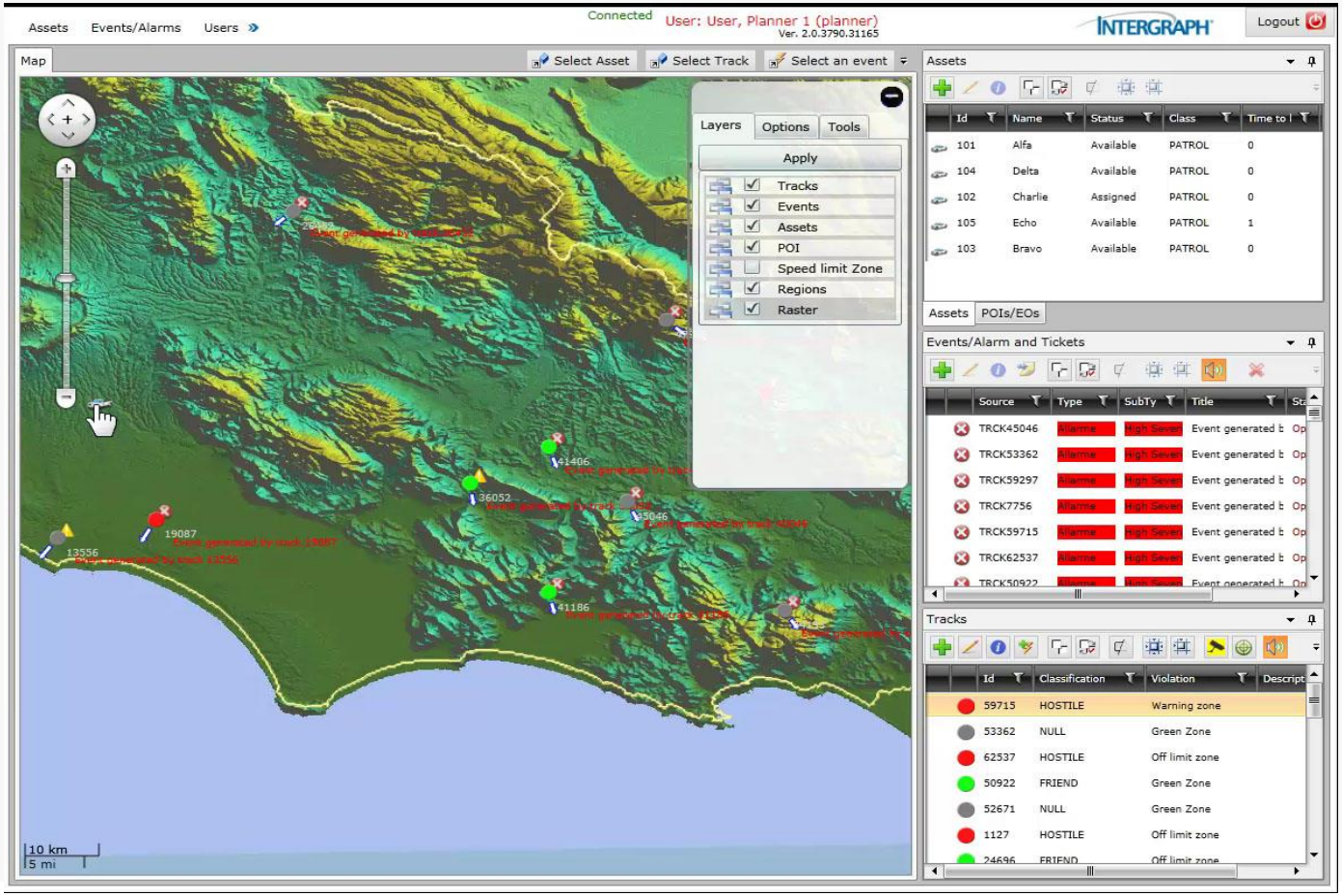
***Intergraph has developed an incident command tool: I²RMS Intergraph Incident & Resource Management System***



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Orphan sources are a potential danger to the population.

In case of their occurrence is important to take the necessary radiation protection measures.

The use of a geo-referenced software makes simpler to achieve good safety and security standards.

The detection of a different area in which place safely, temporarily, the source is relatively simple and can be readily verified using the software.

The program routine can also be a useful aid for companies that deal with transport of radioactive sources, with the possibility to check, for the intended path, the areas potentially affected as a result of an accident with the exposure source.

The program routine, finally, may be potentiated with a mask for the case of known source, for which it is known in addition to the type of radionuclide activity value, as well as with the inclusion of other fields for the evaluation of additional elements such as values of doses taken by those who is the field of radiation.


# New opportunities with a degree in physics

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**Detection BWA by LIF**

**Water vapour and trace gases concentration profile measurement in low troposphere (DIAL)**

**Plume evolution measurements: concentration maps (DIAL and LIDAR)**

**Forest fire detection (LIDAR)**

**Pollutants source detection (LIDAR)**

**Particulate measurements (LIDAR)**

**Absorption cell measurements: gas trace detection (DIAL)**


# New opportunities with a degree in physics

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## TODAY

**WE ARE LOOKING FOR NEW COLLABORATIONS FOR**

**TRAINING ACTIVITIES**

**IMPROVE THE NETWORK**

**IMPROVE ENROLLMENTS & MEDIA ACTIVITIES**

**IMPROVE DIDACTICAL BOARD**

**(Today from: EUROPE, AMERICA, ASIA, AFRICA)**


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감사합니다 Natick
Grazie Danke Ευχαριστίες Dalu Obrigado
Thank You Köszönöm
Tack
Спасибо Dank Gracias
谢谢 Merci Seé
ありがとう


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***info@mastercbrn.it***