CHERNE 2018 - 14th Workshop on European Collaboration in Higher Education on Radiological and Nuclear Engineering and Radiation Protection

Macugnaga

MEET-CINCH

A Project for the European Cooperation in Education in Nuclear and Radio Chemistry

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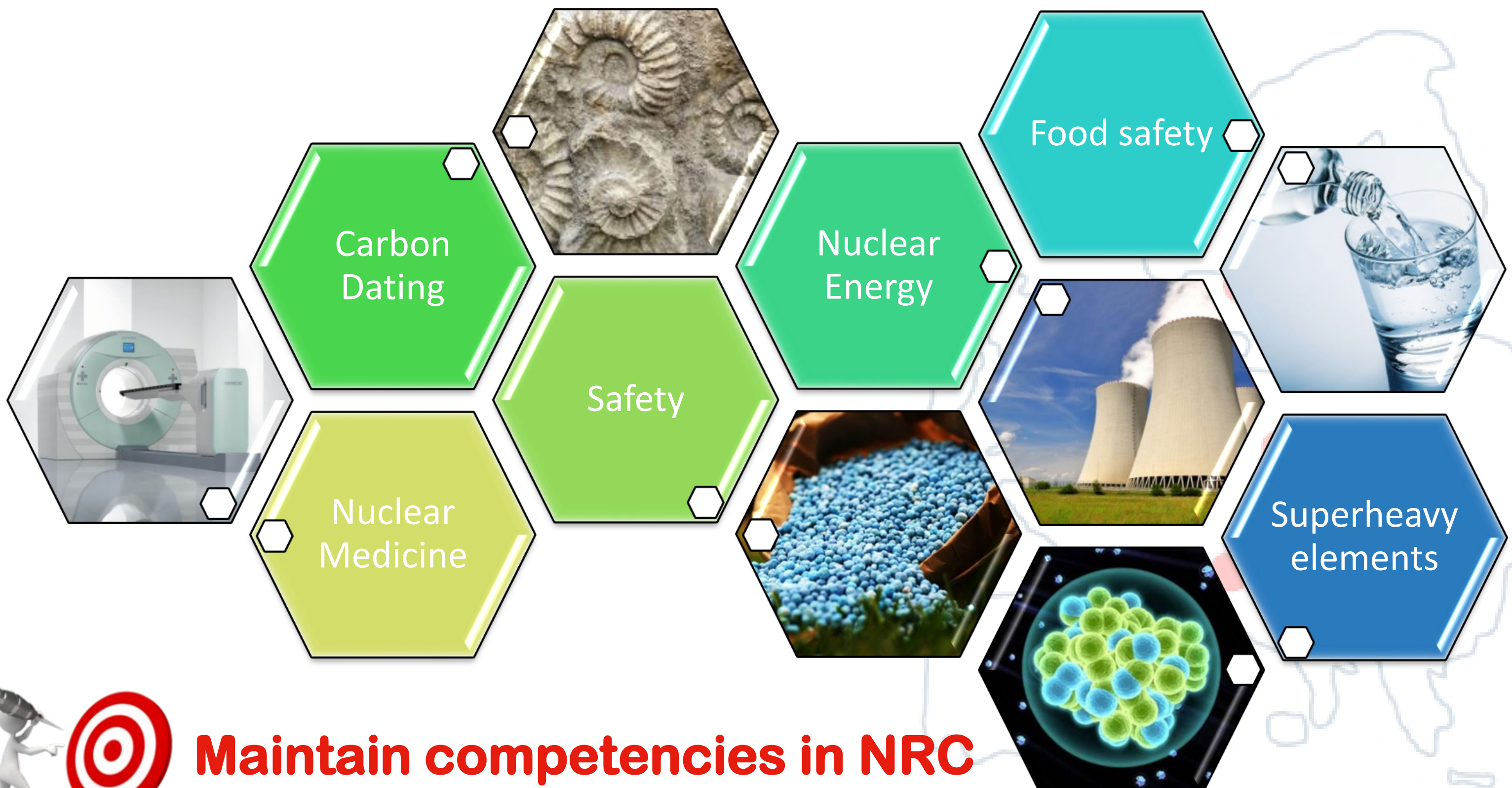
On behalf of the MEET-CINCH collaboration

Nuclear Radiation Chemistry

There are many beneficial uses of nuclear and radiochemistry tecniques:



Maintain competencies in NRC

The CINCH Projects

In 2010 – 2016 Euratom FP7 founded two projects:

- **CINCH-I**: Cooperation in Education in Nuclear Chemistry
- **CINCH-II**: Cooperation and Training in Education in Nuclear Chemistry

Objective

Mitigating the special skill-based deficits within **nuclear chemistry** at master and doctorate levels and the decline of number of staff qualified in this field

Systematic Approach to Training by IAEA

SAT

Systematic Approach to Training by IAEA

CINCH-I | **CINCH-II**

Analysis – Design – Development → **Implementation – Evaluation**

Identify the learing needs & competencies to perform a job

Setting aims and objectives, design the training strategy

Prepare the training material

Conduct training

Evaluate the method:
Quality – Effectiveness -Worthness

The CINCH Projects

The Projects Design

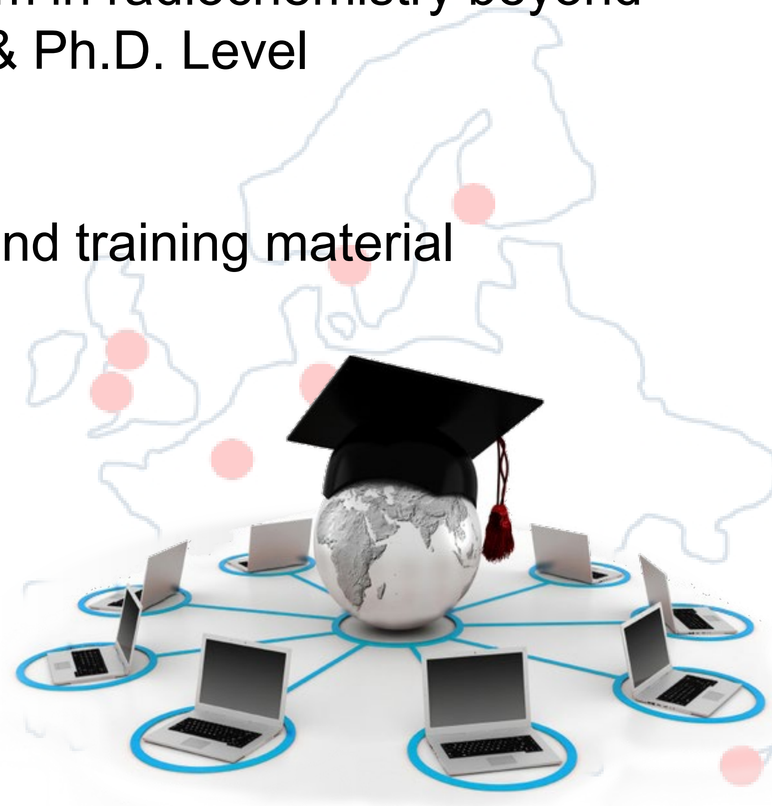
Education

Offering possibilities of master program in radiochemistry beyond the regular curricula - at both Master & Ph.D. Level

Training

Provide a **flexible** modular teaching and training material that can be adapted to the end-user

The project **focus** is on:



Distance Learning

Flexible

- Minimize time away from workspace
- Focus on trained skills
- Choose the needed topics

Results

Education

- **European Master in Nuclear Chemistry** (NRC EuroMaster) quality label

Training

- **Vocational and Educational Training** (VET) courses.
  descriptions of each course, syllabus, various pedagogical tools, hands-on courses
- **NucWik** – NRC study material database
  http://nucwik.wikispaces.com/

NucWik

Distance Learning

- **RoboLab** remote controlled exercises.
- e-learning courses on **CINCH Moodle**
  Including Talisman, ASGARD, SACSESS
  http://moodle.cinch-project.eu

Results

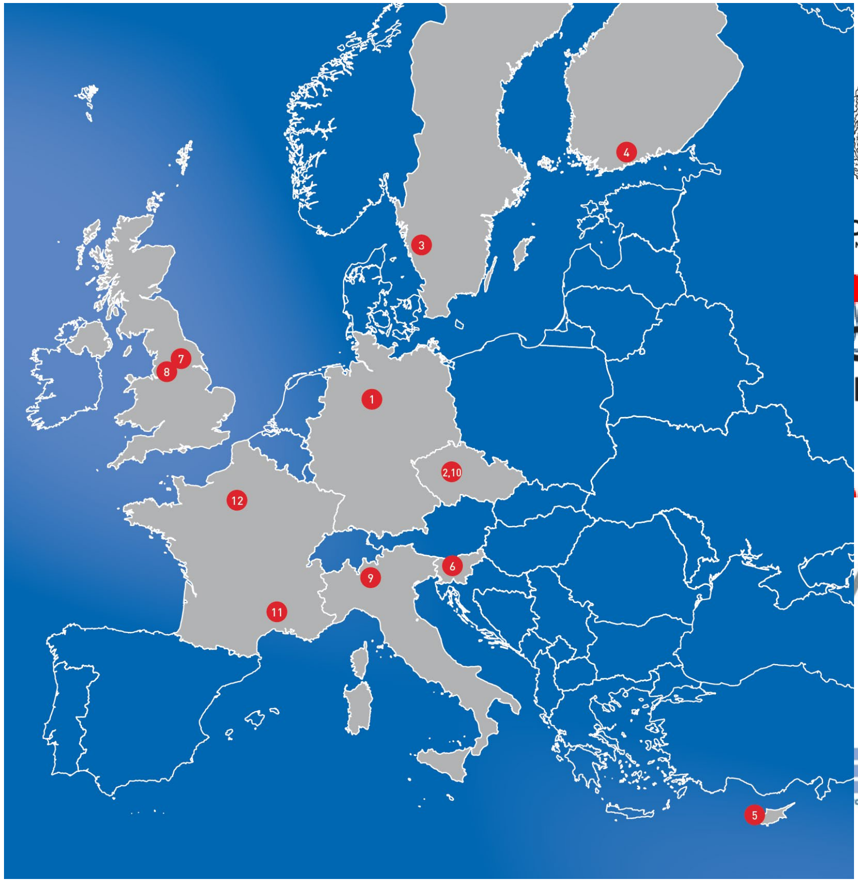
Sustainability

- **European NRC Network** "*European Network on Nuclear and Radiochemistry Education and Training*" as a new Euratom Fission Training Scheme (EFTS)
  http://nrc-network.org/
  Including 9 CINCH-II founding partners and 18 new non-CINCH institutions.

Objectives

- to cooperate in NRC education and training in Europe
- to promote development of NRC education and training in Europe
- to represent NRC education and training community towards other organizations and society
- to promote and organize student and teacher exchange between partners
- to organize common courses in NRC

The MEET-CINCH Project



Participant No *	Participant organisation name	Country
1	LEIBNIZ UNIVERSITÄT HANNOVER	Germany
2	CESKE VYSOKE UCENI TECHNICKE V PRAZE	Czech Republic
3	CHALMERS TEKNISKA HOEGSKOLA AB	Sweden
4	HELSINGIN YLIOPISTO	Finland
5	UNIVERSITY OF CYPRUS	Cyprus
6	JOZEF STEFAN INSTITUTE	Slovenia
7	UNIVERSITETY OF LEEDS	UK
8	NATIONAL NUCLEAR LABORATORY LIMITED	UK
9	POLITECNICO DI MILANO	Italy
10	EVALION SRO	Czech Republic
11	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	France
12	RESEAU EUROPEEN POUR L ENSEIGNEMENT DES SCIENCES NUCLEAIRES	France

The MEET-CINCH Project

Objective

Mitigating the special skill-based deficits within **nuclear chemistry** at master and doctorate levels and the decline of number of staff qualified in this field

Systematic Approach to Training by IAEA

Analysis – Design – Development – Implementation – Evaluation

CINCH-I

CINCH-II

MEET-CINCH

Reach the complete sustainability of the previous results

Attracting **new talents** by incresing the **nuclear awareness**

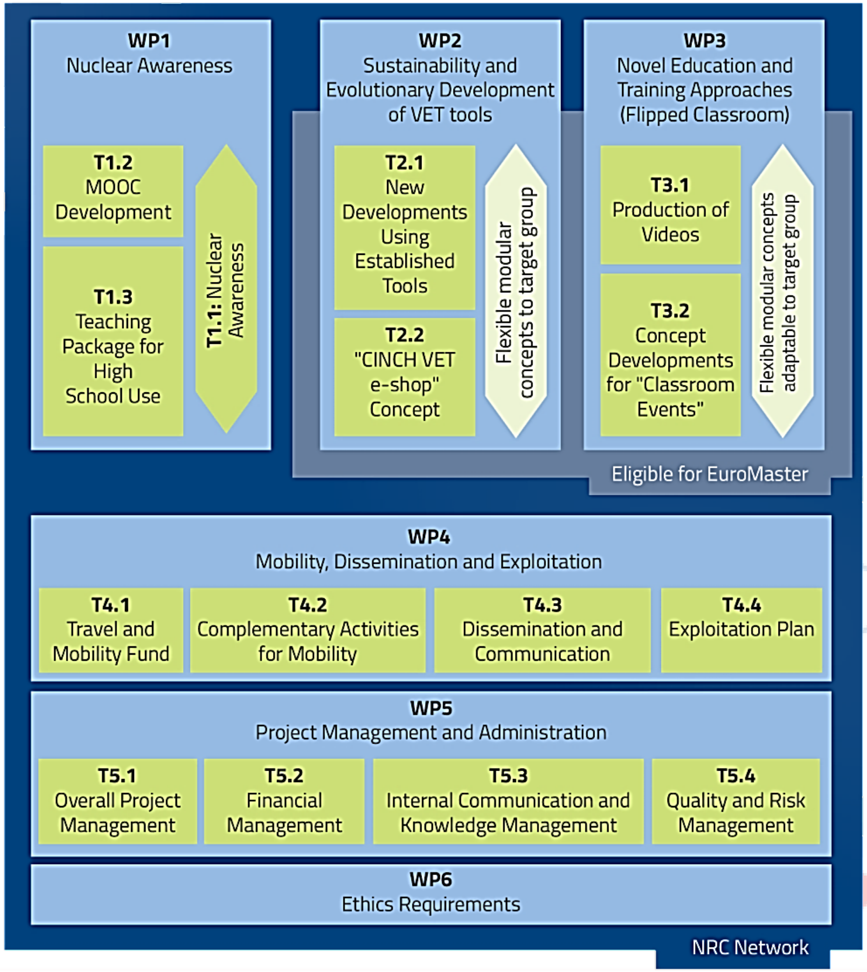
Organization of the Work

The project is build around three pillars:

1. Nuclear Awareness
2. Sustainability & Evolutionary Development of VET tools
3. Novel Education and Training Approaches

Supported by three cross-cutting activities:

4. Mobility, Dissemination, Exploitation
5. Management & Administration
6. Ethics requirements



The MEET-CINCH Project

Objectives

1. Nuclear Awareness

increasing the awareness of the importance of NRC for society

BACHELOR STUDENTS → MOOC

+ Mobility fund

HIGH SCHOOLS → **Teaching package**

Importance of NRC & work opportunities

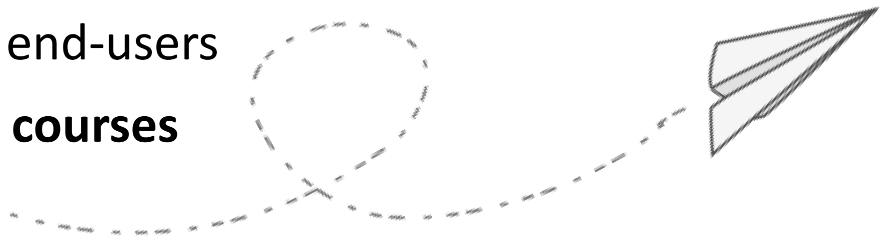
GENERAL PUBLIC → MOOC **Introductive Lessons**

The MEET-CINCH Project

Objectives

2. Sustainability & Development of VET courses

Bring the results achieved to their end-users



- Extend the number of **VET courses**
- Bring them to PILOT level
- Combination of all the existing tools

  Robolab, CINCH Moodle, NukWik…
- **CINCH VET- e-shop**

3. Novel Education and Training Approaches

Flipped Classroom

+ available tools (NucWik , RoboLab, CINCH Moodle)

Role in MEET-CINCH

POLITECNICO
MILANO 1863

- WP1 Leader: Mario Mariani
- Support staff:
  - **METID** Francesca Concia
  - **LAB** Elena Macerata, Maddalena Negrin, Giulia Maria Liosi

TASKS

WP1: MOOC development and production

WP2: 3-days hands-on training on *Chemical Dosimetry* & new RoboLab for dose calibration and mobile radiation monitors

WP3: *video lectures* on chemical dosimetry for industrial and medical applications for Flipped Classroom

The MOOC:

What is a MOOC?

Definition: **“**A massive open online course **(MOOC)** is an online course aimed at unlimited participation and open access via the web (Kaplan et. al). **„**

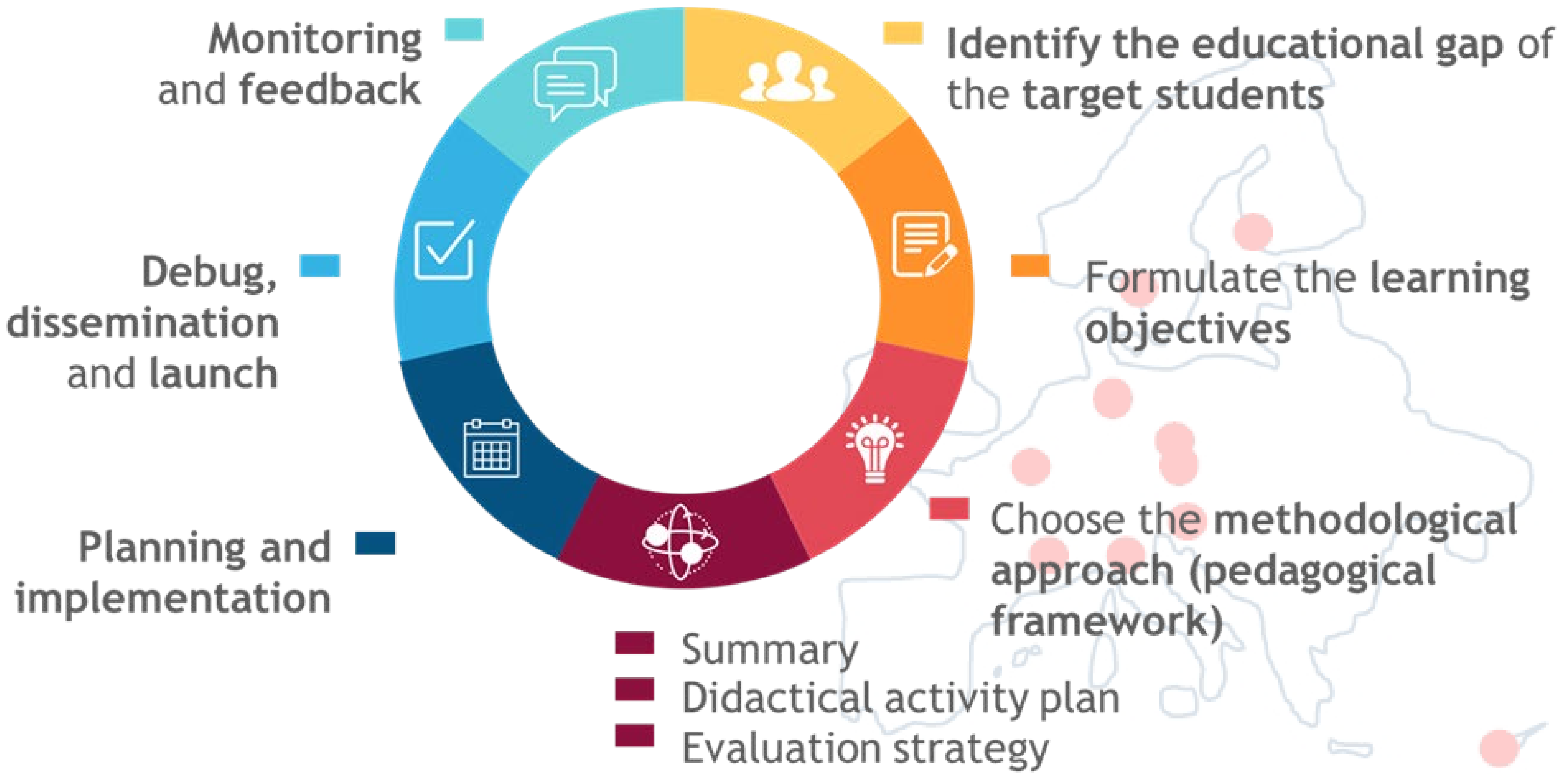
Why to develop a MOOC?

General Learning Goals

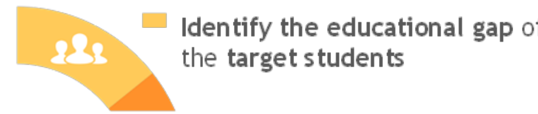
- To let users discover an unknown discipline
- To stimulate the interest towards a specific discipline
- To let users be aware of the possibility and the progress of the science
- To stimulate users toward experimental activities and applications

MOOC: Essential Radiochemistry for Society

MOOC design process



1. Target group



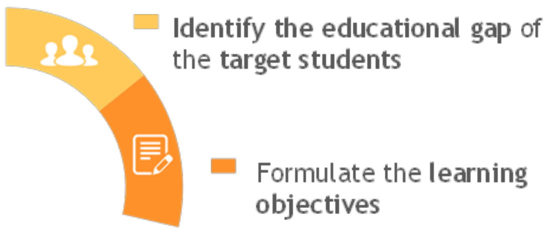
Bachelor students
in chemistry/physics/engineering/scientific areas

✓ **Prerequisites**: scientific background knowledge deriving from high school and higher education, in particular on chemistry, physics and math – Scientific critical consciousness

✓ **Time**: availability of free time and flexibility, used to studying and to web tools

✓ **Motivation**: to increase the knowledge and curiosity on nuclear themes and their applications, to identify new possible job opportunities, to help choosing future university studies and career in nuclear and radio-chemistry

2. Learning Objectives



16 learning goals were identified

to let users be able to:

- understand ionizing radiation origin
- recognize properties and differences of main ionizing radiations
- understand the applications of radiations in several fields and the advantages
- be aware of the involvement of NRC in everyday life
- be aware of the advantages/improvements introduced in everyday life by nuclear/radiation technologies
- be aware of the impacts of nuclear technologies on the safety and security of citizens/civil society
- be aware of the issue of radioactive waste produced by several nuclear anthropogenic activities

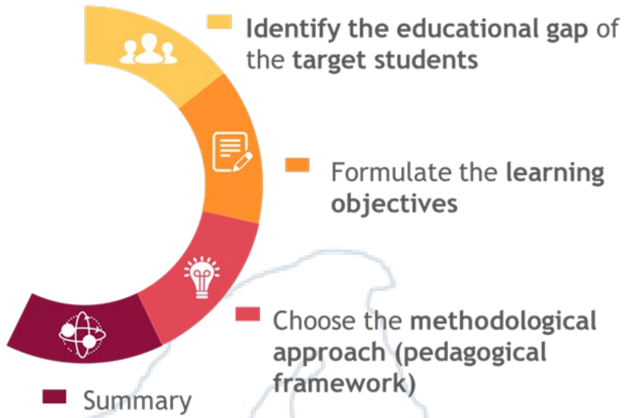
and so on…

3. Pedagogical Framework

MEET CHINCH PEDAGOGICAL FRAMEWORK

01	DIVING	User dives into a situation thanks to an experiment, the recreation of a real situation or thanks to the observation of nature
02	CONTENT ANALYSIS	User gets some criteria to understand and read the phenomenon
03	CONTENT SYSTEMATIC ORGANIZATION	User is lead throuogh a systematic explanation of the observed experiment / process / situation / event
04	STRENGTHENING	User examines some application cases and other exemples and learns the specialized terminology
05	APPLICATION	User applies the learned knowledge solving exercises
06	SELF-ASSESSMENT	User answers some quizzes and verifies the real acquired knoewledge; the automatic feedbacks address him tomisundestood topics and to the supplementary worksheet
07	SUPPLEMENTARY WORKSHEET	User chooses which topic to examine in depth, which kind of didactical materials to understand all the aspects of the learned phenomenon / process / situation / event and he has the possibility to choose the better way to learn
08	ASSESSMENT	User answers some true/false or multiple-choice quizzes and receives a grade

4. Table of Contents



Week 1: Radiochemistry for the environment

1.1 Environmental monitoring
(NORM - Agriculture)
1.2 Environmental remediation
1.3 TENORM

PROTOTYPE VIDEO CLIP

Week 2: Radiochemistry for health

2.1 Nuclear medicine
2.2 Medical sterilization
2.3 Food irradiation/ disinfestation

Week 3: Radiochemistry for industry

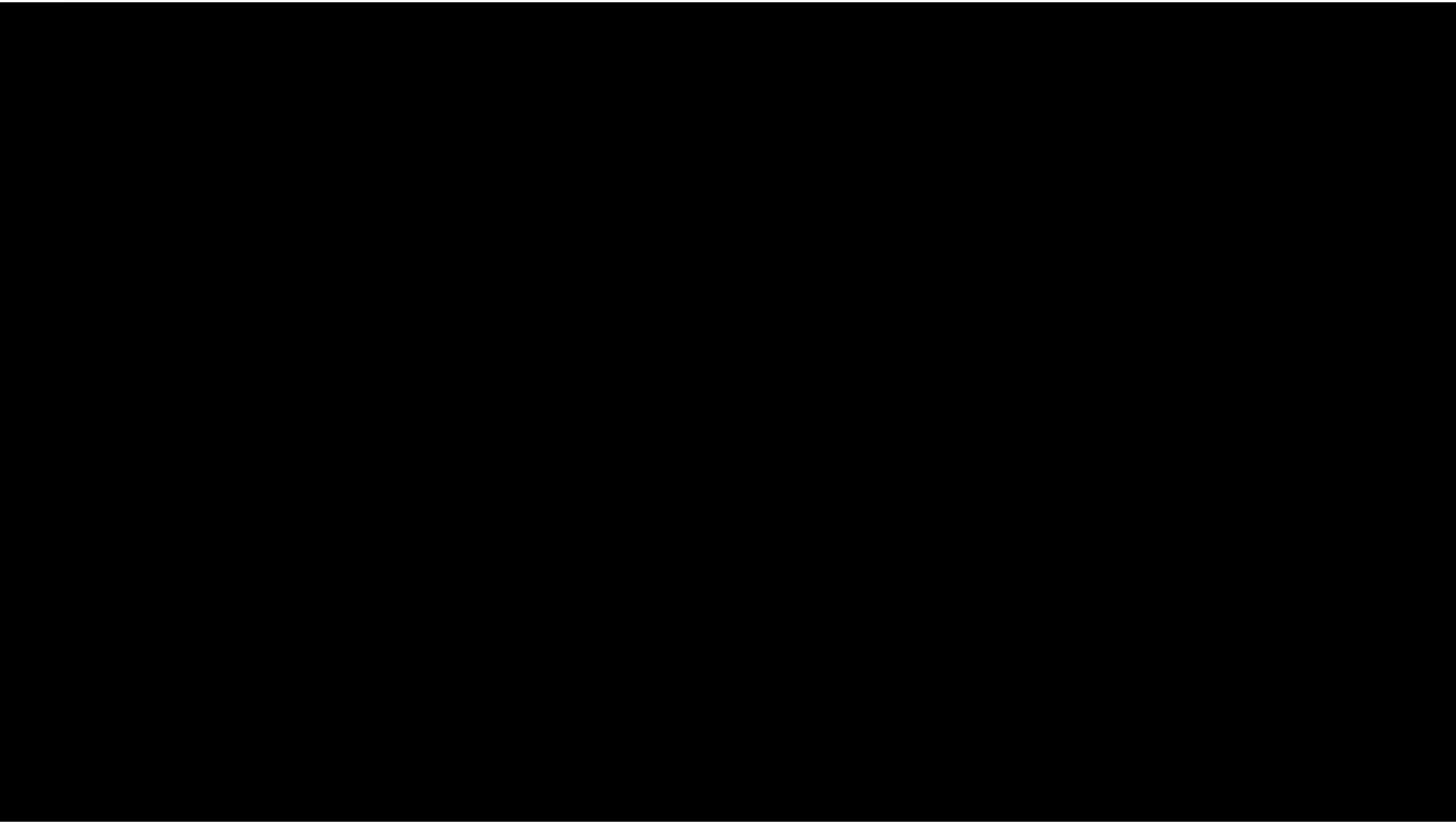
3.1 Tracer technology
(Oil and fuel production)
3.2 Radiation processing

Week 4: Radiochemistry for nuclear energy production

4.1 Reprocessing of spent fuel
4.2 Confinement
4.3 Decommissioning of nuclear/industrial plants
4.4 Waste management

Week 5: Radiochemistry for society

5.1 Cultural heritage (Dating, conservation)
5.2 Nuclear forensics and proliferation
5.3 SHE



High School Teaching Package

- Produce an engaging teaching package for high school/A-level students (16-18 y)
- Self-sustaining material for teachers to use independently
- Raise awareness of radiochemistry
- Promote degrees and careers in nuclear chemistry and chemical engineering

Sustainability and Evolutionary Development of VET tools

New developments using established tools:

update of existing and development of new training courses that will combine these tools to optimise the course delivery and its impact to the students and trainees.

Course	Lead Partner	Delivery Method
Chemical Dosimetry	POLIMI	e-LEARN / Practical
Decommissioning of Nuclear Facilities	LEEDS	MOOC
Hands on Training in Nuclear Chemistry	CTU	MOODLE / Hands On
Radioanalytical Methods	CTU	CLASS / Hands On
Separation Methods in Radiochemistry	CTU	MOODLE / Hands On
Spectroscopic Analysis for Alpha / Beta-Gamma Materials	JSI (UCY)	Lecture / E-learning
Determination of Po-210 in environmental samples by alpha-particle spectrometry	JSI	Lecture / Practical / e-learn
Determination of Ra-226 and Ra-228 in water samples	JSI	Lecture / Practical / e-learn
Alpha-Spectroscopic Analysis of Uranium in Seawater	UCY	Practical

RoboLab

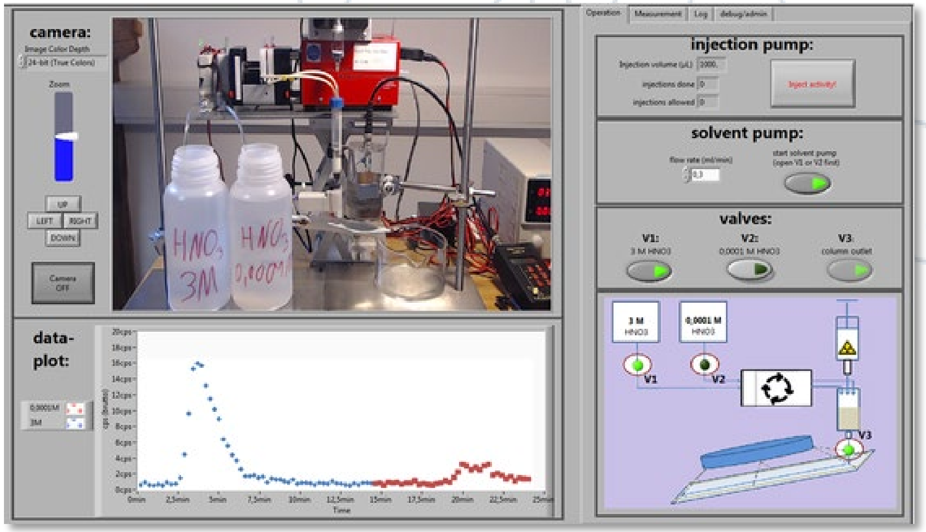
Robolab are **remote controlling exercises**.

They allow students **anywhere** in the world to perform experiments in a real radiochemistry laboratory through the use of a **web control panel** and watching what is going on in the Lab trough a **video feed**.

Six RoboLabs produced.

IonLab
Ion-chromatography setup

Conditoning
↓
Injection of radiaactive solution
↓
Elution



The Flipped Classroom

Traditional Classroom Teacher's role: Sage on the Stage	**Flipped Classroom** Teacher's role: Guide on the Side

Key-Facts

- Implemented by 29% of higher education faculty in the US; 27% planning implementation.
- No single model/definition of the **Flipped Classroom Model**.

  Standard, Discussion-oriented, Demostration oriented, Group based, …

- **Reviews show that Flipped Classroom Model tends to be more effective than traditional lectures.**

The Flipped Classroom

Traditional Classroom Teacher's role: Sage on the Stage	Flipped Classroom Teacher's role: Guide on the Side

Electronic video material is provided and has to be worked with individually

90 minutes – subsections of 15 min – self evaluation

Classroom events can be scheduled

- After each lesson
- Block course of ½ days

Hands-on …
+ Robolabs

The Flipped Classroom

PROS

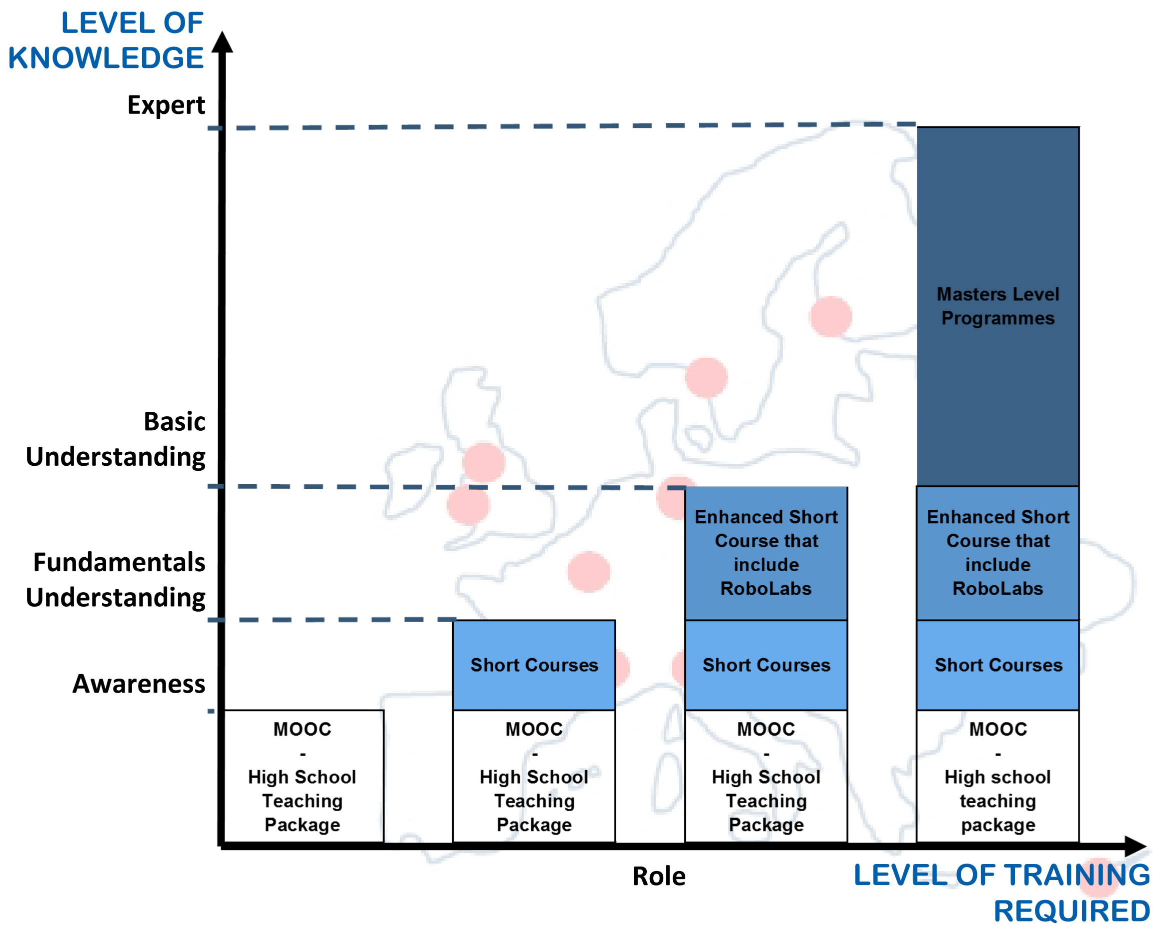
- Students may perform better
(Stone, 2012; Mason et al., 2013; Karabulut-Ilgu 2017)
- Students can (re)watch lectures at their own pace (pre-class)
- Students are engaged in higher order thinking skills (in-class)
(Lee & Lai 2017)
- Teachers are more flexible in class
(Bergmann & Sams, 2014)
- Positive student perception
(Bishop & Verleger, 2013)
- Reuse of lectures

CONS

- Requieres access to internet and technology
(Clemens et al. 2013; Everett et al. 2014)
- Students feel overwhelmed when faced with a new approach
(Amresh et al., 2013; Bland, 2006)
- Some students have problems organizing themselves and their learning in the FCM
(Margoniner, 2014)
- Success relies heavily on student preperation
(Karanicolas et al., 2016)

Flexibility

MEET-CINCH will provide a **flexible modular** teaching and training toolkit to serve the needs of the **nuclear energy industry**, **industry working with radioactive substances**, such as radiopharmaceutical chemistry or using radioactive sources and probes for analytical purposes in all relevant fields



Conclusions

Objective

Mitigating the special skill-based deficits within **nuclear chemistry** at master and doctorate levels and the decline of number of staff qualified in this field

To maximize the impact, the MEET CINCH will concentrate on the **dissemination** and **exploitation** of the results.

The **MOOC** will significantly help to achieve this goal.

The **CINCH VET e-shop** will contribute to the maintenance and dissemination of the teaching material produced.

NRC Network has already 27 partners from industry, research institutes and universities.

meet cinch

www.cinch-project.eu