European Training and Education for Medical Physics Experts in Radiology (EUTEMPE-RX)

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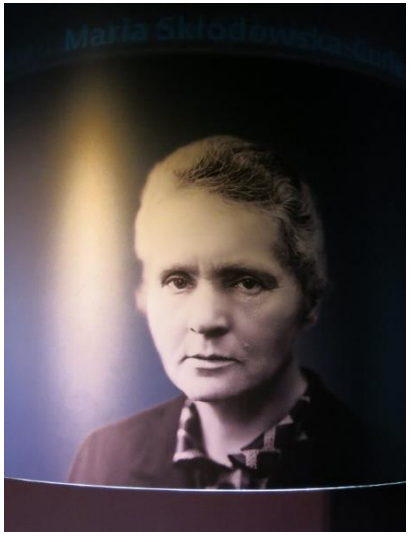
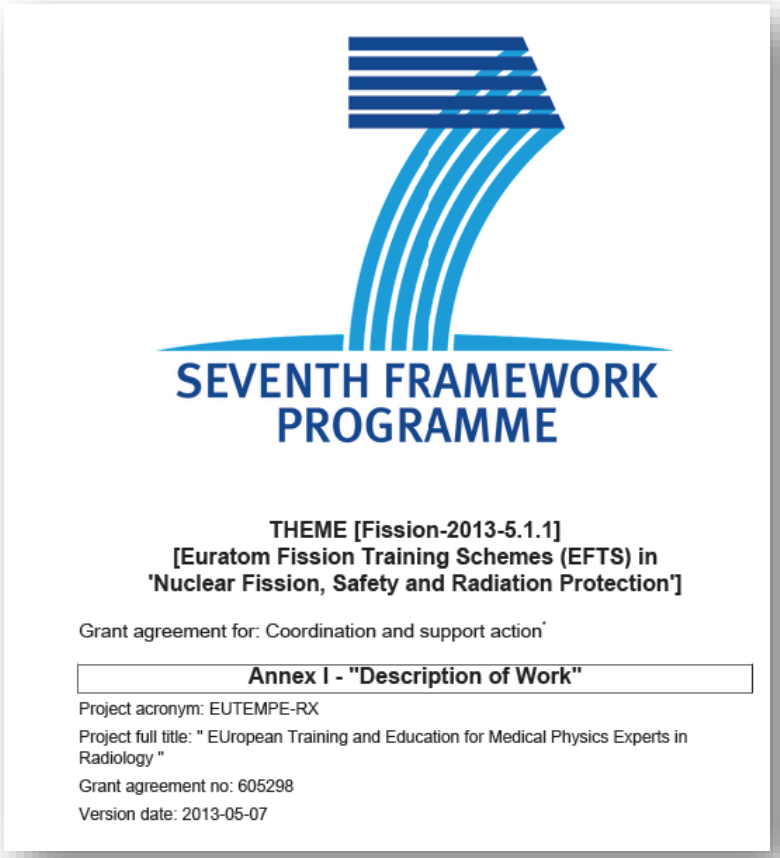
SEVENTH FRAMEWORK PROGRAMME



EUTEMPE-RX

I. Facts leading to EUTEMPE-net


SEVENTH FRAMEWORK PROGRAMME

THEME [Fission-2013-5.1.1]
[Euratom Fission Training Schemes (EFTS) in 'Nuclear Fission, Safety and Radiation Protection']

Grant agreement for: Coordination and support action*

Annex I - "Description of Work"

Project acronym: EUTEMPE-RX

Project full title: " EUropean Training and Education for Medical Physics Experts in Radiology "

Grant agreement no: 605298

Version date: 2013-05-07

- Successful application to a Euratom 'Fission Training Scheme' call
- EU support: 1.7M€
- Timing:

  01/08/2013 - 31/07/2016

10th birthday

EUTEMPE-RX

European Teaching and Education for Medical Physics Experts in (diagnostic and interventional) Radiology

It started as an EU supported project.

Now it is a network of motivated teachers,

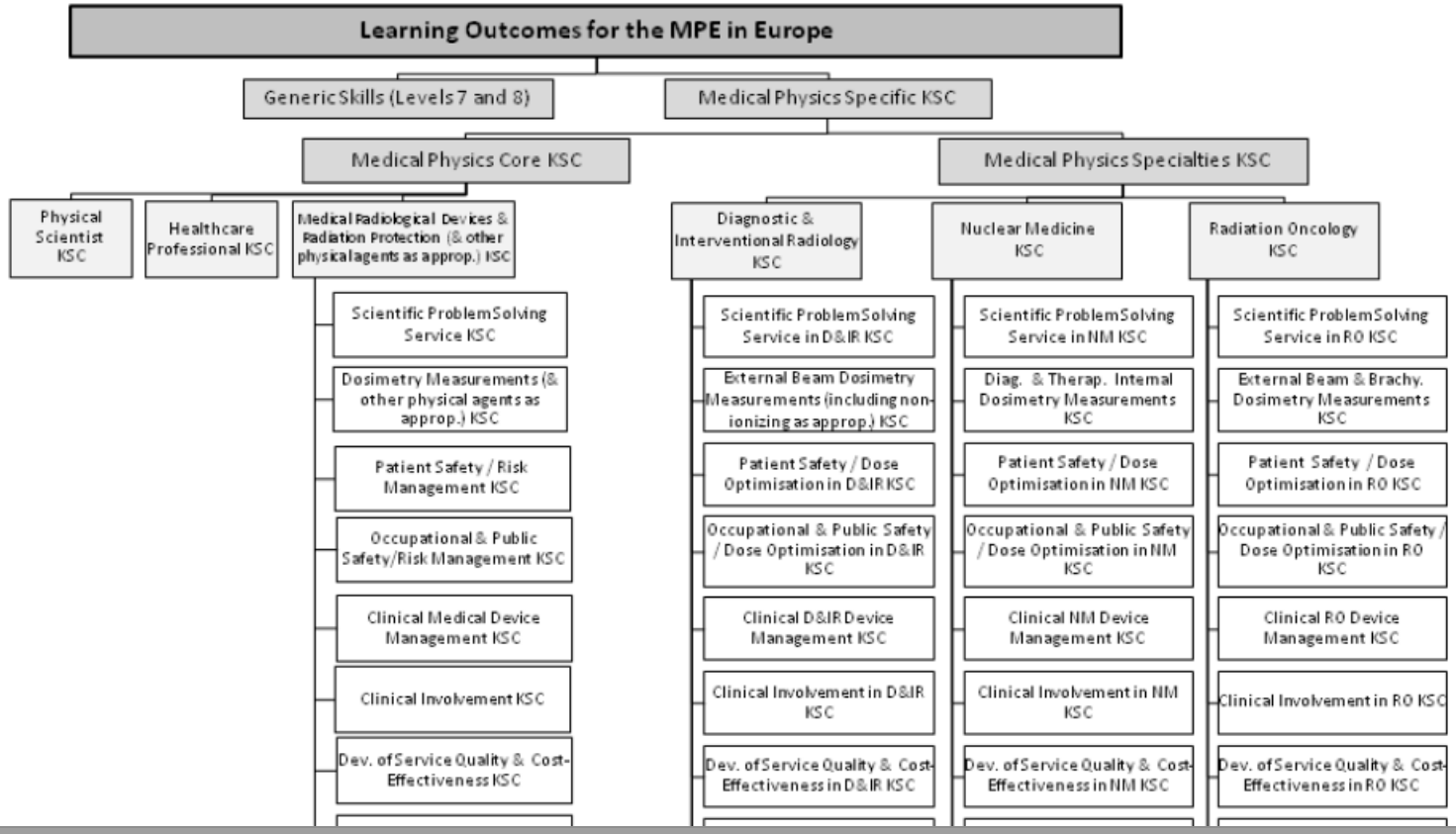
the EUTEMPE-net, running EUTEMPE-RX courses

(without EU support)

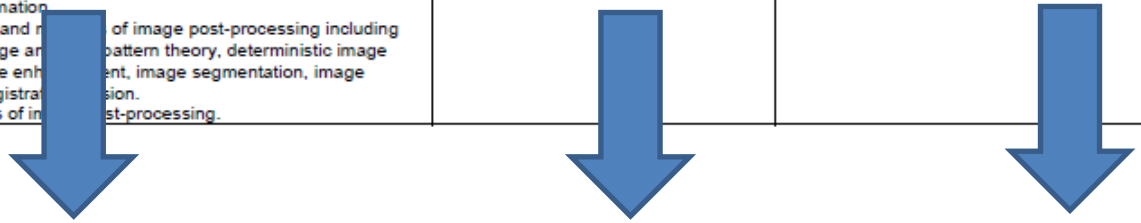
RADIATION PROTECTION NO 174

EUROPEAN GUIDELINES ON MEDICAL PHYSICS EXPERT

Directorate-General for Energy
Directorate D — Nuclear Safety & Fuel Cycle
Unit D.3 — Radiation Protection
2014


Learning Outcomes for the MPE in Europe
Generic Skills (Levels 7 and 8)
Medical Physics Specific KSC
Medical Physics Core KSC
Medical Physics Specialties KSC
Physical Scientist KSC
Healthcare Professional KSC
Medical Radiological Devices & Radiation Protection (& other physical agents as approp.) KSC
Diagnostic & Interventional Radiology KSC
Nuclear Medicine KSC
Radiation Oncology KSC
Scientific Problem Solving Service KSC
Dosimetry Measurements (& other physical agents as approp.) KSC
Patient Safety / Risk Management KSC
Occupational & Public Safety/Risk Management KSC
Clinical Medical Device Management KSC
Clinical Involvement KSC
Dev. of Service Quality & Cost-Effectiveness KSC
Scientific Problem Solving Service in D&IR KSC
External Beam Dosimetry Measurements (including non-ionizing as approp.) KSC
Patient Safety / Dose Optimisation in D&IR KSC
Occupational & Public Safety / Dose Optimisation in D&IR KSC
Clinical D&IR Device Management KSC
Clinical Involvement in D&IR KSC
Dev. of Service Quality & Cost-Effectiveness in D&IR KSC
Scientific Problem Solving Service in NM KSC
Diag. & Therap. Internal Dosimetry Measurements KSC
Patient Safety / Dose Optimisation in NM KSC
Occupational & Public Safety / Dose Optimisation in NM KSC
Clinical NM Device Management KSC
Clinical Involvement in NM KSC
Dev. of Service Quality & Cost-Effectiveness in NM KSC
Scientific Problem Solving Service in RO KSC
External Beam & Brachy. Dosimetry Measurements KSC
Patient Safety / Dose Optimisation in RO KSC
Occupational & Public Safety / Dose Optimisation in RO KSC
Clinical RO Device Management KSC
Clinical Involvement in RO KSC
Dev. of Service Quality & Cost-Effectiveness in RO KSC

	Knowledge (facts, principles, theories, practices)	Skills (cognitive and practical)	Competence (responsibility and autonomy)
Scientific Problem Solving Service	K1. Explain statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Scientific Problem Solving Service. K2. Explain the common imaging modalities (general projection x-ray imaging (DDR, CR and film-screen where this is still valid), chest systems, mammography, dental systems (intra-oral, OPG, cephalometric systems), mobile, flat panel / image intensifier fluoroscopes including C-arms, interventional systems, tomosynthesis, paediatric systems, radiostereometric (RSA) systems, stereotactic systems, dual energy X-ray absorptiometry (DXA), axial and helical mode CT, cone-beam CT, MRI, ultrasound) and explain their function as instruments for the measurement, mapping and imaging of the spatial distribution of different physical variables within the human body. Each imaging modality/dedicated device has its utility in the various applications of medical imaging i.e., diagnosis, population screening, patient monitoring, intervention and specialised use such as paediatric. K3. Discuss the advantages and disadvantages of imaging as a means of displaying spatially dependent signals and variables. K4. Explain in detail the principles of image quality measurement: linear systems theory, types of contrast (subject, image and display), unsharpness (LSR, PSF, LSF, MTF), lag, noise (including sources, noise power spectra, effect of lag on noise, noise propagation in image subtraction), SNR (including Rose model, Wagner's taxonomy, CNR, relation to dose, NEQ, DQE, NPS etc). K5. Explain inverse problem mathematical techniques used in image reconstruction (including both convolution and iterative methods and the advantages and disadvantages of each). K6. Explain at an advanced level the following: temporal / frequency domain representation of signals, Fourier transform, statistical description of signals, power spectral density, autocorrelation function, sampled (discrete) signals, delta function and its Fourier transform, Fourier transform of aperiodic discrete signal (DFT), the FFT, the effects of finite sample intervals, linear processors, impulse response, convolution integral and theorem, various types of filters used in the processing of medical signals. K7. Explain in detail the way that acquisition data is processed to facilitate the extraction of information. K8. Explain the principles and r[illegible] of image post-processing including knowledge based image an[illegible]pattern theory, deterministic image processing and feature enh[illegible]ent, image segmentation, image registration and co-registrat[illegible]sion. K9. Discuss the limitations of in[illegible]st-processing.	S1. For each modality, operate imaging devices at the level necessary for give advice on optimization of imaging protocols, quality control, image quality manipulation, and carry out research when the available evidence for advice is not sufficient. S2. For each modality predict the effect on image quality and diagnostic accuracy when changing scanning and reconstruction parameters. S3. Manipulate acquisition parameters for all forms of projection x-ray imaging devices (e.g., kV, filtration, mAs, sensitivity ('speed'), collimation, magnification, SID, SSD, frame rate, screening time, manual/AED modes, compression), explain the effect on image quality and relevant patient dose quantities (and occupational dose particularly when this is correlated with patient dose) and relevance to specific clinical studies.	C1. Take responsibility for statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Scientific Problem Solving Service. C2. Carry out or supervise as appropriate the measurement of physical quantities relevant to the effective, safe and economical use of medical devices / ionizing radiations and other physical agents in Diagnostic and Interventional Radiology.



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Our project application was convincing:

- We can increase nuclear safety in RX with MPEs
- Doses in X-ray imaging can be considerable (risks)
- Radiology is important (business)
- None of the EU Member States has the required (complete) training programs for medical radiation physics at EQF level 8
- We can realize borderless, life long learning, with e-learning and other modern teaching methods
- Yes, there is excellence in Europe

-> Cherry-picking !

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II. Objectives

1. Provide a modular training scheme for the MP in Radiology to bring him to EQF level 8

II. Objectives

1. Set up a multicampus education combining online with face-to-face learning
2. Serve as a model for harmonised courses
3. Get accredited (by EFOMP) (now EBAMP)
4. To achieve excellence in:
   - module content (RP174) and organization
   - fulfillment of quality objectives
   - participant and stakeholder satisfaction

EUTEMPE-RX

III. Methods

- Different expert teams were selected to organize a module
  - Excellent publication record or excellent teachers
  - Geographical spread / gender
    - Belgium, Malta (Czech Republic), Italy, Spain, Bulgaria, UK, The Netherlands, Swiss, Greece, Germany
    - Hilde, Virginia, Annalisa, Kristina, Federica, Saartje, Sofie
  - Website
  - Common e-learning platform

EUTEMPE-RX

III. Methods

- Quality manual describing all the procedures & forms
  - Module abstract in the required format.
  - CVs of course leader(s)
  - Appropriate aims of the modules
  - Sufficiently comprehensive list of learning outcomes (10 – 15 learning outcomes) and at EQF level 8
  - EFOMP accreditation achieved

Module MPE01: Development of the profession and the challenges for the MPE (D&IR) in Europe

ABSTRACT

Title: Development of the profession and the challenges for the MPE (Diagnostic and Interventional Radiology) in Europe

Module Code: MPE01

Module Level: EQF level 8

Aims: This module aims to help t
acquire the knowledge, skills and
address the development of the r
phase participants will have the o
latest EU directives, guidelines

Learning Outcomes: At the end

MPE01.01	Take re Europe
MPE01.02	Implen
MPE01.03	Evaluat
MPE01.04	Take re and cli
MPE01.05	Take re
MPE01.06	Discuss
MPE01.07	Resear profes
MPE01.08	Manag
MPE01.09	Manag
MPE01.10	Implen
MPE01.11	Partici
MPE01.12	Take re
MPE01.13	Interpr

Date and Location of Face-to-Fa

Module Leaders:

Prof. Carmel J. Caruana (carme
Past EFOMP Chair for E&T and
radiation protection, medical d
development of the role defini
in MEDRAPET. He also represe

Prof. Eliseo Vano (eliseov@me
Full Professor of Medical Phys
Health for radiation protectio
Chairman of the Committee on

Faculty: Carmel J. Caruana, Elis

Delivery of the module: The
phase will be mostly asynchro
learning is required this woul
assessment).

Total participant effort time: 8

Assessment Mode: The assess
are expected to demonstrate
the profession. Participants ar
during the course.

MODULE CONTENT: AIM and SUMM	
Aim	This module will help the future MPE (Diagnostic and Interventional Ra department) acquire the knowledge, skills and competences necessary The content of the module would address the development of the role other modules. *In the face-to-face phase participants will have the op* *profession. The participants would also be updated with the latest E* *forefront of these developments.*
Learning Outcomes (10 – 15 learning outcomes which provide an overview of the KSC addressed in the module)	MPE01.01 Take responsibility for researching, evaluating, leadin in the ambit of European and national legislation and MPE01.02 Implement and evaluate strategic solutions to the cha MPE01.03 Evaluate the various models of management suitable MPE01.04 Take responsibility for researching, evaluating, leadin service quality and clinical governance in D&IR. MPE01.05 Take responsibility for ethical issues in the area of rad MPE01.06 Discuss the role of the MPE (D&IR) in health technolog MPE01.07 Research, develop and lead the development of the other healthcare professionals. MPE01.08 Manage inter-professional issues in D&IR. MPE01.09 Manage priorities regarding radiation protection rese MPEs. MPE01.10 Implement safety culture in their management practic MPE01.11 Participate in networks for research and development

III. Methods

- consortium meetings with educational workshops:
    - the use of e-learning tools
    - the creation of e-learning material
    - activation of the audience
    - assessment methods at the expert level
    - teaching methods
- sharing teaching experiences, hints & tricks
- feed-back by professionals in education

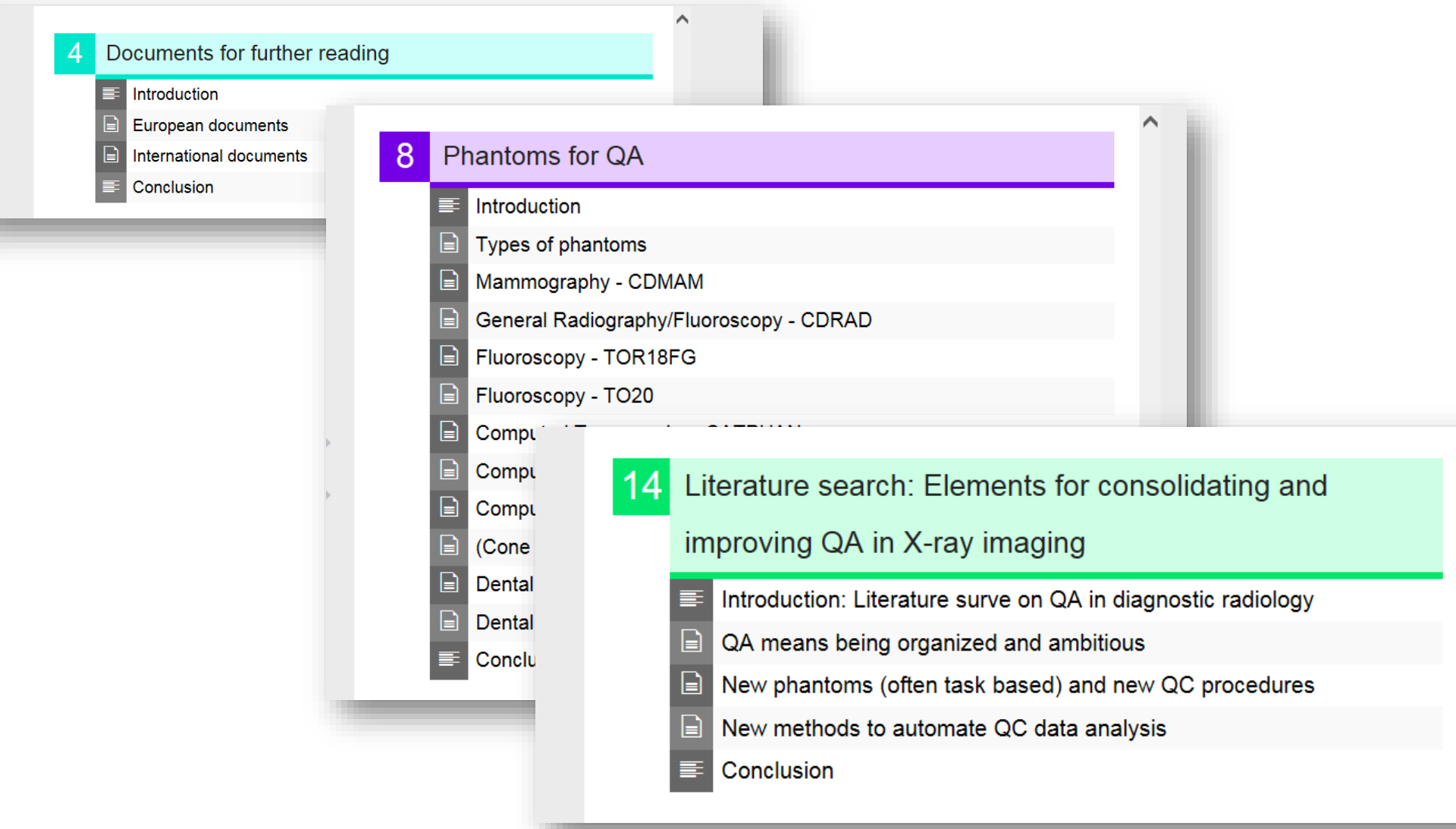
III. Methods

- ‘My’ lessons learned
  - We learned a lot from teaching experts. Enthusiasm is at the core of success
  - What can be taught with a power point presentation, should be taught upfront, online
  - Group work / group disucssion is appreciated most by our participants
  - The use of different teaching methods is appreciated
  - Videos should be maximally 5min long
  - No multiple choice exams for EQF level 8

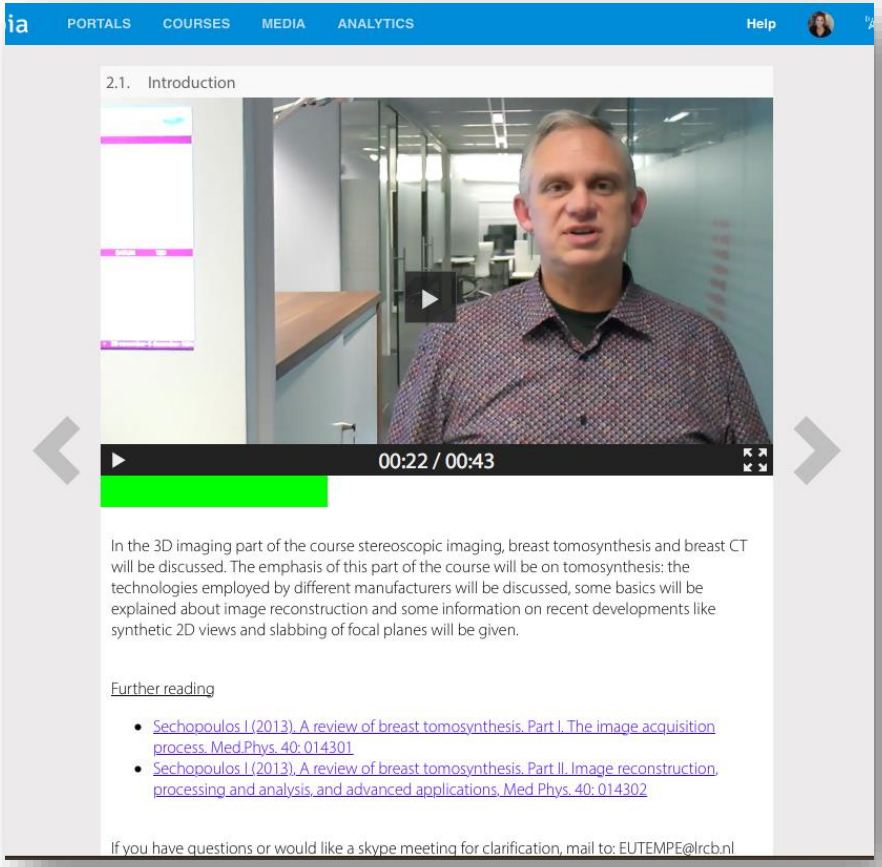
Characteristics EUTEMPE-RX modules

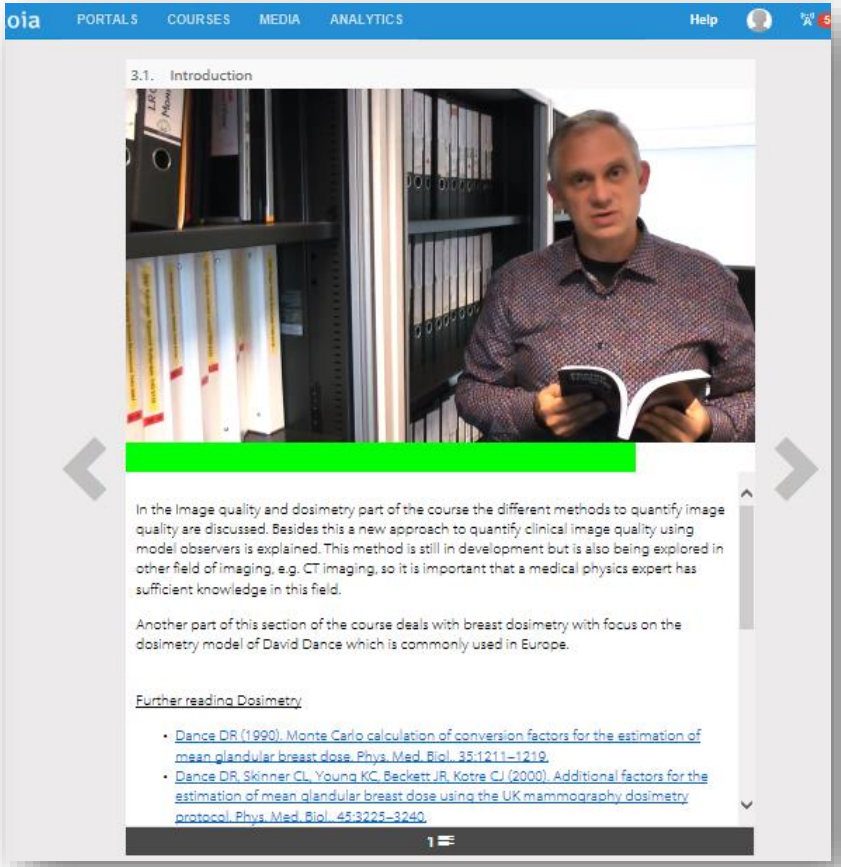
- Half of the effort in the online platform
- On site, small group (nearly individual) teaching in particular skills and competences
  - knowledge is more covered online
- An enthusiastic team of teachers
- Important ‘social program’
- Very different from a attending a conference:
  - Learn by doing
  - Different topics. Example: it is not perse about innovation, but how to embrace it in the practice

Results: Example of e-learning material

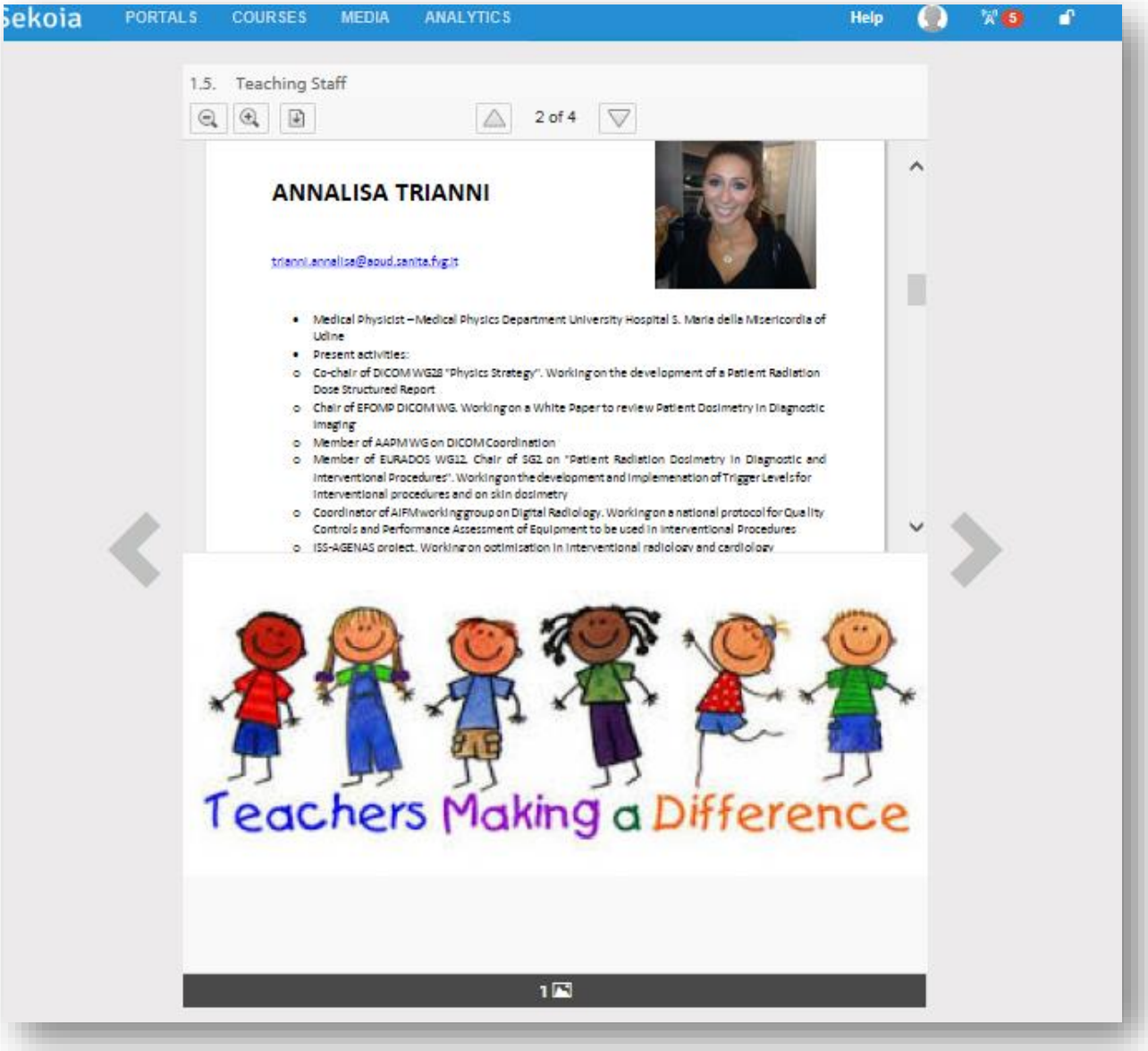


Example of e-learning teaching

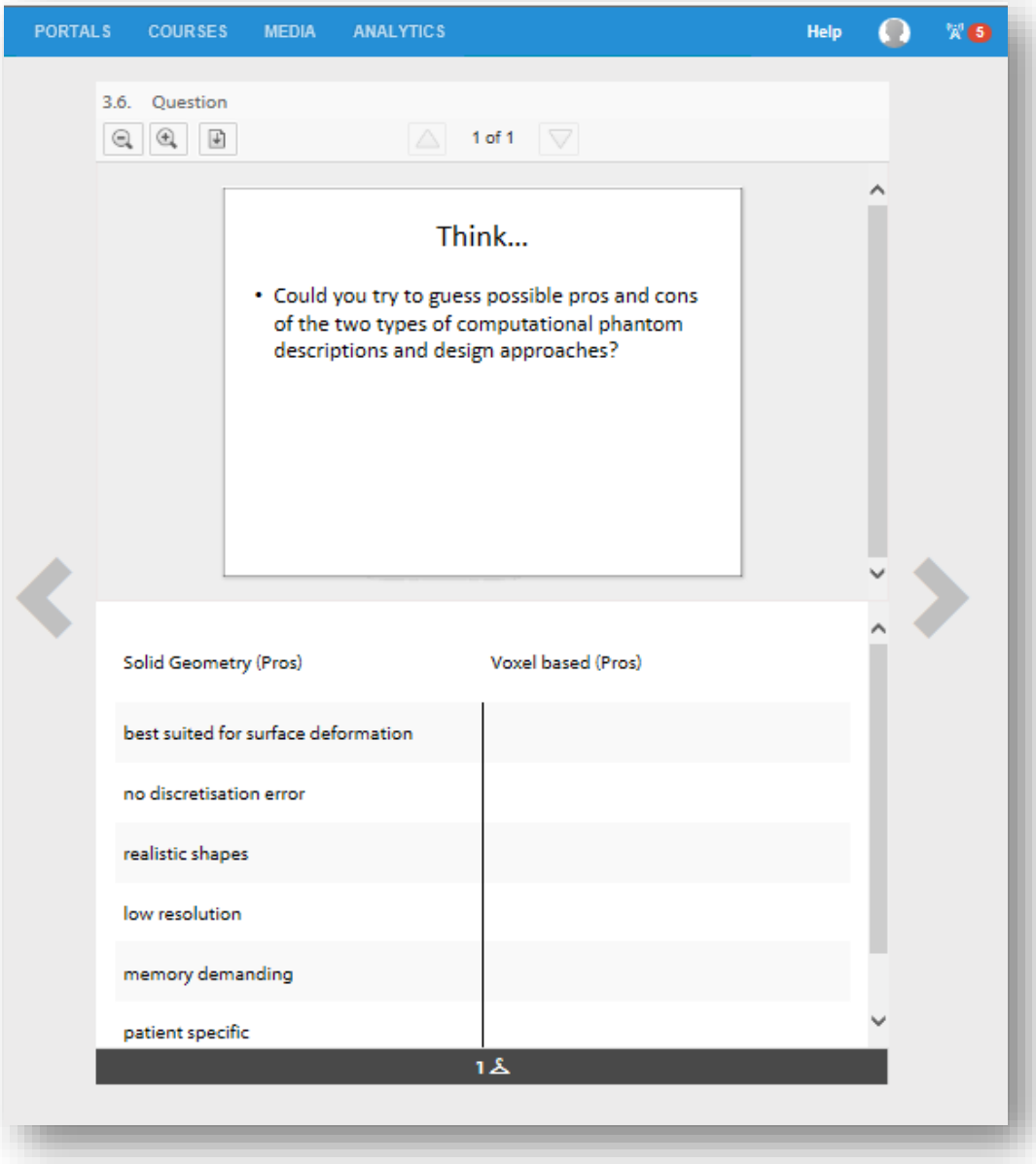




Upfront introduction of the teachers



Interaction

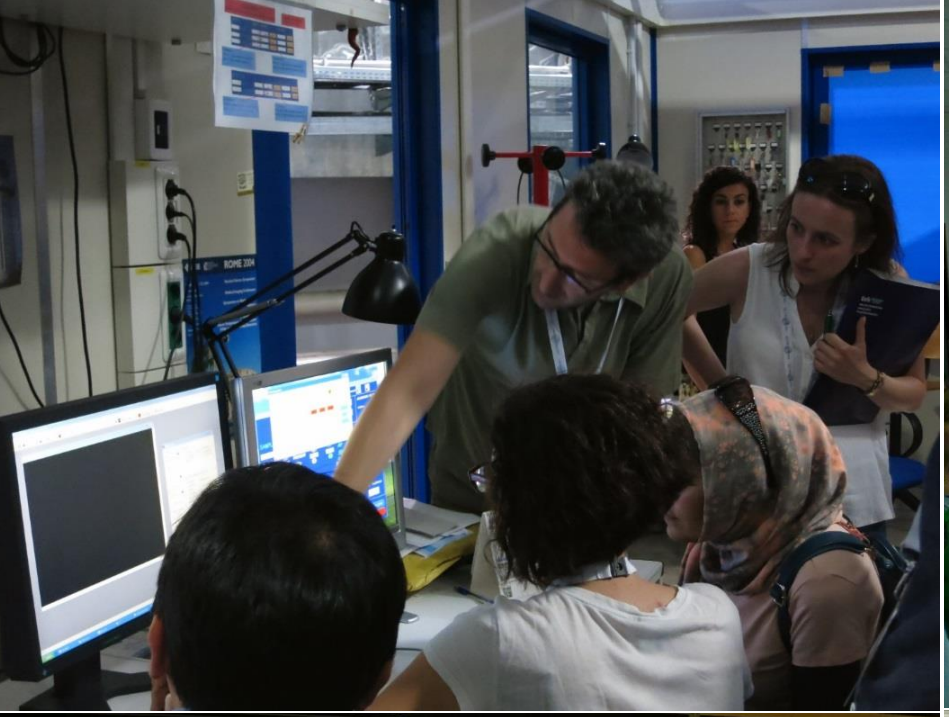


Example of Module 6 in Leuven

"From basic to advanced QA: why & how"

- Invited: Industrial rep. & President of article 31 group: 'what is QA?'
- Invited speaker: 'create QA from the start'
- Practical sessions showing how QA is done in Leuven & discussion
- Case study: normal QA protocols, but what is missing?
- Show case: phantoms, reading studies, dosimetry
- Group work: compile a new QA protocol – discuss – report to all
- Advanced QA science by local expert: 'Digital opportunities and measurements of digital systems explained', Q& A.
- Hints and tricks competition
- Assessment: make the outline for a task based QA protocol

	Monday, 13 Nov 2023	Tuesday, 14 Nov 2023	Wednesday, 15 Nov 2023
8.30 - 10.30	Wake Up Poll: Hello world! Do you need advanced QA protocols? We surely do. Guess why !	Wake Up Poll: "Help, this purchase request is special." Can we help with MPE advice/input?	Wake Up Poll: We have systems with many protocols. Which type of protocol management could help?
	Typical QA protocols and the development of new protocols - N. Marshall	Patient dosimetry: large scale surveys versus dedicated MC - R. Trevisan Mass.	QA following IEC guidelines, by the manufacturer - R. Klausz (GE)
	From basic QC to advanced QA in the MPE practice - H. Bosmans	Automatic expsure control in mammo, fluoroscopy and CT - N. Marshall	MDR and the development of AI algorithms (by the MPE?) - K. Koukoutegos
Coffee break			
10.30 - 11.00			
11.00 - 12.30	Example QA reports from Leuven and all, of systems without problems	Example phantoms for several applications.	What you always wanted to know on MTF, NNPS and DQE
	Example QA reports: find the problems. How could testing be improved?	Bring in your experience with phantoms. Hints and tricks competition !	DQE workshop or repeat of Monday's QA database or Contrast Detail workshop
lunch break			
12.30 - 13.30			
13.30 - 15.00	Introduction to patient dose monitoring systems - J. Binst	Introduction to dual energy CT and photon counting detectors (PCCT) - J. Vignero	Introduction to digital breast tomosnthesis (DBT) and Synt. Mammo - K Houbrechts
	Introduction to task based testing and figures of merit - N. Marshall	Introduction to (dental) Cone Beam CT (CBCT) - K. Merken	Introduction to contrast enhanced mammography - L. Cockmartin
15.00 - 17.00	Choose one practical:	Choose one practical:	Choose one practical:
	1. The use of QA data bases	1. Review of annual CT testing	1. Review of digital breast tomo testing
	2. Patient dose monitoring: a tool for MPEs	2. Create protocol outline for PCCT	2. Create protocol outline for CE Mammo
	3. Contrast detail analysis and 4AFC	3. Create protocol outline for CBCT	3. Create protocol outline for CAD algor.
17.00 - 17.30	Working groups report to all	Working groups report to all	Working groups report to all
Break			
18.00 - 19.00	Tour of the radiology department	Hands-on testing of the PCCT	Hands-on testing of CE mammo
Facultative	Tour to the proton therapy center		
	Tour of the Medical Physics lab		
19.30 - ...	Social Program with all in Leuven		




Opportunities
Design
Inspiration
Information
Evolution
Imagination
Progress


Bijelac

EUTEMPE characteristics

- Unique opportunities & encounters
  - with the local MPEs showing how they solve their challenges
  - with the team of teachers
  - with medical doctors
  - in modern hospitals
  - in top screening organisation
  - visit a synchrotron facility
  - visit a calibration lab, …
- Social events are an integral part of the module. (Most courses take place in nice historical cities)
- Registration fees covering the costs of organizing the module by the module leader

Why attend EUTEMPE-RX modules ?

- You learn to defend medical physics in front of medical boards
- You set up your Monte Carlo simulation platform and you run your simulation
- You can make your task specific QA protocols
- You formulate and run an optimization plan of your choice
- You use a simulation platform and truly understand breast imaging
- You get organized for your individualized dose calculations (patients and personnel)(pregnant patients and CT in general)
- You become an expert, in diagnostic and interventional radiology

Why attend EUTEMPE-RX modules ?

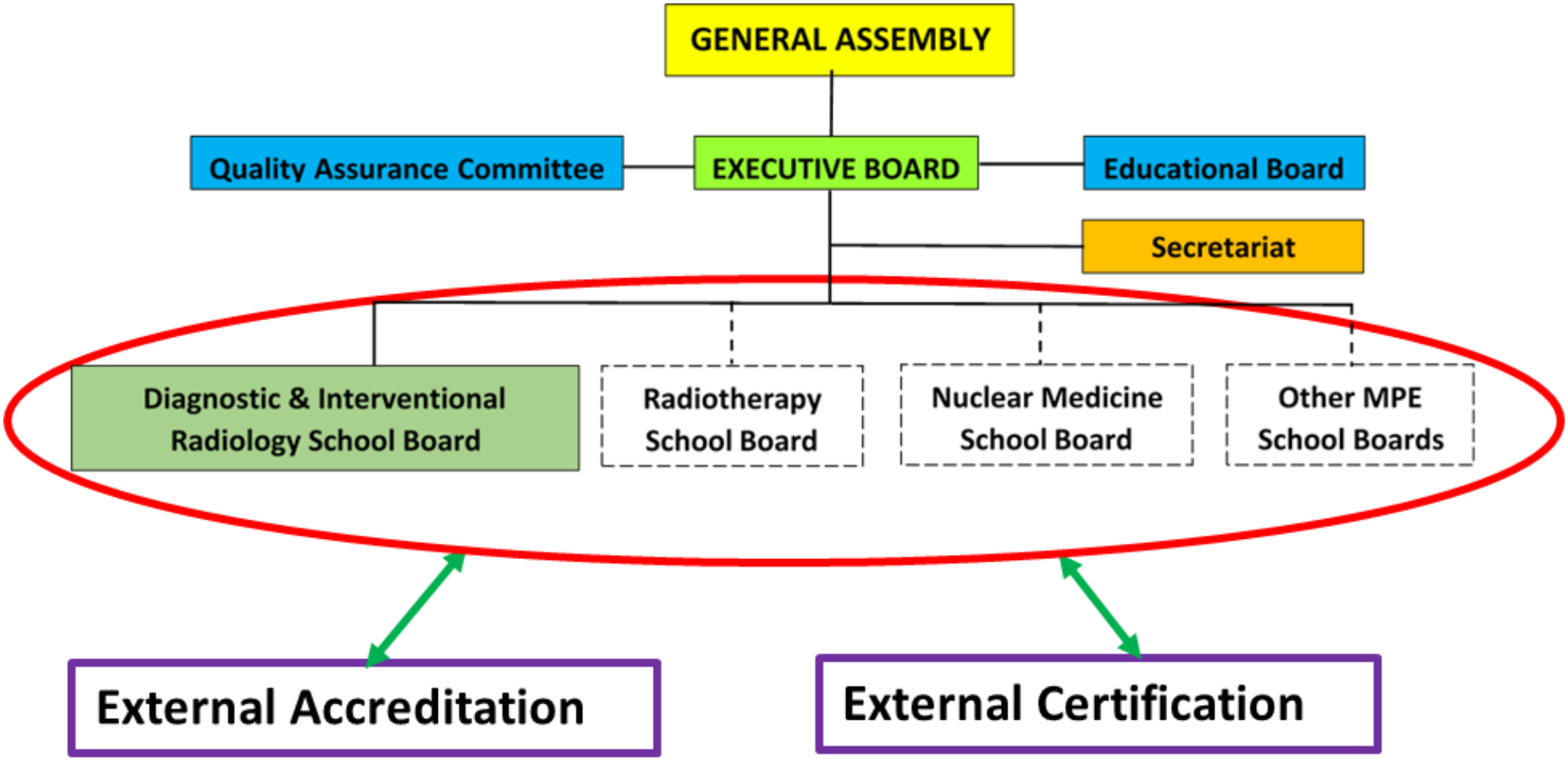
EUTEMPE-RX is all about skills and competences.

You learn to do something very interesting for your profession that you did not do before.

IV. Sustainability (2016)

- Memorandum of Understanding: let's replicate the effort !
- Creation of the EUTEMPE-net, to repeat the modules
- The consortium plans to go on with yearly meetings
  - for harmonization
  - for feedback and follow-up
  - to plan, learn about and explore new teaching methods
- Modules have to be self supporting, from the registration fees
- Coordination by prof. H. Bosmans
- We reached out to several organisations for support but that part of the work failed

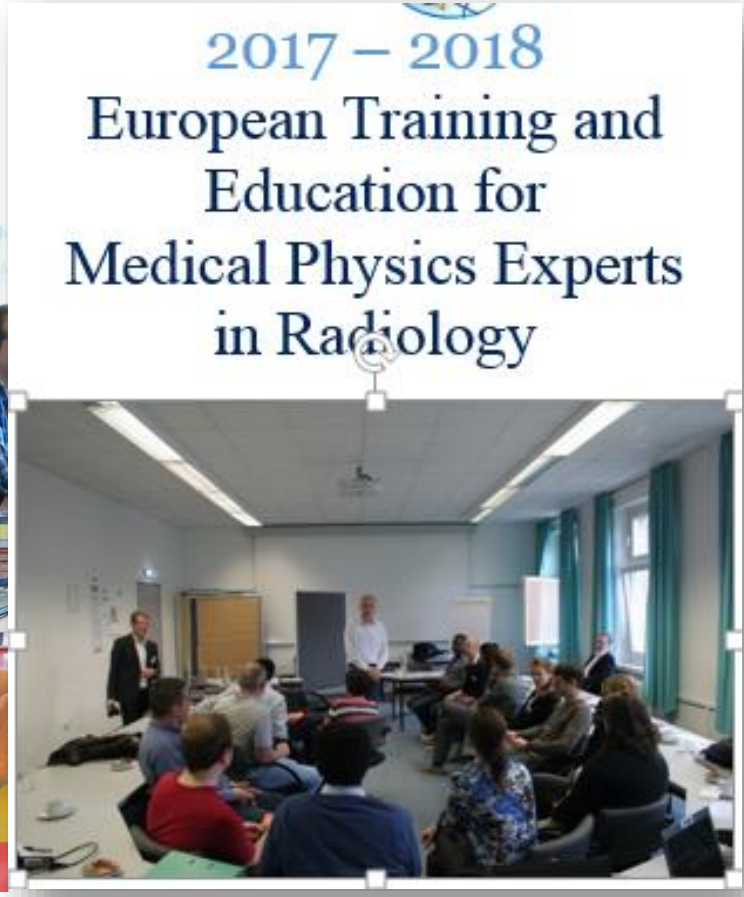
IV. Sustainability (2016)



The 1st repetition of the modules

Module 12: communication of risks and RP

Also for RPE



Lead: prof. Martin Fiebich & Markus Borowski, PhD

Content: Focus on dosimetry and methods to assess dose to the personnel. A visit to a calibration lab in Berlin is included

EUTEMPE-RX

2nd repetition of the modules

Program 2019-2020

11 modules in 2019-2020,
11 opportunities
to boost your career!

- Expert teachers
- Prepare online
- Meet and learn onsite
  (opt. exam for **extra EBAMP credits**)
- Travel to various cities in Europe
- Many countries eligible for reduced fees
  (check website)

Information & Registration
www.eutempe-net.eu

Course fees and dates may still be subject to change

(MPE01) LEADERSHIP
C. Caruana &. V. Tsapaki
online: 1 Nov 2018
onsite: 4 – 8 Feb 2019
Prague, Czech Republic
€ 450 (€ 250)

(MPE09) BREAST X-RAY IMAGING
R. E. van Engen & I. Sechopoulos
online: 21 Jan 2019
onsite: 25 – 29 March 2019
Nijmegen, The Netherlands
€ 950 (€ 570)

(MPE08) IMAGE QUALITY IN CT
F. Verdun & F. Bochud
online: 1 Feb 2019
onsite: 6 – 10 May 2019
Lausanne, Switzerland
€ 520

(MPE05) ANTHROPOMORPHIC PHANTOMS
K. Bliznakova
online: 1 April 2019
onsite: 3 – 7 June 2019
Varna, Bulgaria
€ 380 (€ 240)

(MPE03) MONTE CARLO SIMULATION
J. Sempau
online: 10 June 2019
onsite: 8 – 12 July 2019
Barcelona, Spain
€ 760 (€ 380)

(MPE04) NEW DEVELOPMENTS
A. Taibi & P. Cardarelli
online: 1 July 2019
onsite: 24 – 28 Sept 2019
Ferrara, Italy
€ 540 (€ 270)

(MPE07) OPTIMISATION
A. Mackenzie
online: 3 June 2019
onsite: 6 – 10 Oct 2019 (tbc)
Guildford, UK
£ 630 (online only £ 450)

(MPE06) NEW QA PROTOCOLS
H. Bosmans, N. Marshall & E. Vano
online: 1 Sept 2019
onsite: 18 – 22 Nov 2019
Leuven, Belgium
€ 590 (€ 280)

(MPE12) OCCUPATIONAL DOSIMETRY
M. Borowski & M. Fiebich
online: 1 Feb 2020
onsite: 30 March – 3 April 2020
Braunschweig, Germany
€ 760 (€ 400)

(MPE11) DOSE MANAGEMENT
J. Damilakis
online: 1 April 2020
onsite: 25 – 29 May 2020
Iraklion (Crete), Greece
€ 700 (€370)

(MPE10) INTERVENTIONAL RX
A. Trianni, R. Padovani & N. Marshall
online: 1 May 2020
onsite: 22 – 26 June 2020 (tbc)
Udine, Italy
€ 600 (€ 300) (tbc)

Self-evaluation…

V. During the Corona pandemic…

-> educational webinars (1h each)

-> master classes (2h each)

Unique approaches, polls, … and very well attended ☺

	Webinar	Masterclass	Topic	Who
1	Oct 13	Oct 27	Tellin' ain't Teachin'	Danielle Dobbe
2	Nov 10	Nov 24	Webinar: Building robust QC protocols for the assessment of medical x-ray imaging systems Masterclass: Assessing the imaging performance of the Synthetic Mammography mode: what should a QC physicist do?	Hilde Bosmans & Nick Marshall
3	Dec 8	Dec 22	Webinar: The philosophy of QC protocols Masterclass: Digging deeper: The why behind a quality control protocol and how to adapt to varying realities	Ruben van Engen Ruben van Engen & Ioannis Sechopoulos
4	Jan 12	Feb 2	Webinar: An introduction to strategic and robust leadership in medical physics Masterclass: Medical physics leadership – real world case studies from the trenches	Carmel Caruana
5	Feb 23	March 9	Webinar: Personnel Dosimetry – a first step to radiation protection of the staff Masterclass: Personnel Dosimetry – two steps ahead	Markus Borowski
6	March 23	X	Webinar: A guided tour of x-ray CT through dosimetry and image quality assessment	John Damilakis
7	April 13	April 27		
8	May 11	May 25	Webinar: Beyond X-ray tubes: Innovation in radiological imaging with monochromatic sources	Paolo Cardarelli

VI. Sustainability (today)

- Help with practical aspects from the Nijmegen team (R. van Engen; D. Dobbe)
- Coordinator: H. Bosmans
- Registration via EFOMP's website
- Hopefully included in EFOMP mailings

VI. Sustainability (today)

- We ran EUTEMPE ateliers in Dublin ECMPE conf. 2022
- Modules have restarted.
  - Successfully finished
    - Module RPE (Braunschweig, D)
    - Module Digital Mammography (Nijmegen, NL)
  - Planned
    - Module Digital measurements (Guildford, UK)
    - Module advanced QA protocols (Leuven, B)
  - Being reworked: Module 1, on Leadership, addressing also nuclear medicine and radiotherapy. New module leader – probably – P. Gilligan

VI. Sustainability (today)

- Strengths
  - Unique course content; small group teaching; efficient
- Opportunities
  - Growing number of (young) MPEs in radiology
  - Fast technological development
  - Reach out to nuclear medicine, radiotherapy, other
- Threats
  - Work by volunteers; some of them very busy/ retire soon.
  - How to ensure we fill the needs of the ‘people out there’
- Weaknesses
  - There is no financial reserve; all effort went into keep registration fees low
  - Cannot financially support expansion of modules

Summary

- There are still a few places for the Module in Leuven
- The last 4 modules have been successful (number of participants; updated content; enthusiasm)
- If we can cope with the work load, we will continue. However, we have to plan the future (better)
- The EUTEMPE team is open for any offer to expand topics and to reach out better to the world of MPEs/RPEs (announcing the courses)