



EURAMED

European Alliance for Medical
Radiation Protection Research

Introductory Presentation: **EURAMED's Vision** **on Medical Radiation Protection (Research)**

Christoph Hoeschen
Otto-von-Guericke University Magdeburg
on behalf of the executive board



EUROPEAN INSTITUTE
FOR BIOMEDICAL
IMAGING RESEARCH

!!!Since last week a legal entity!!!

Vision:

- Leading European research activities in medical radiation protection and harmonising clinical practice to advance the European radiation protection safety culture in medicine.

Mission:

- Improving medical care through sustainable research efforts in medical radiation protection
- Identifying common research areas
- Serving as a platform for medical radiation protection research
- Developing aligned approaches and responses to European research calls

UNITED NATIONS

GENERAL
ASSEMBLY



Distr.
RESTRICTED

A/AC.82/R.605
15 March 2000

ENGLISH ONLY



MEDICAL RADIATION EXPOSURE

Annex D

... The Committee concluded that medical applications are the **largest man-made source of radiation exposure** for the world's population.

... The Committee also concluded the population exposures from the diagnostic and therapeutic uses of ionizing radiation were likely to be **increasing** worldwide, particularly in countries where medical services are in the earlier stages of development. However, further and more **comprehensive analysis would be required** in order to refine global estimates and establish important trends. ...

... The analysis of radiation risk from diagnostic medical exposures requires **detailed knowledge of organ doses and the age and sex of patients**. ...

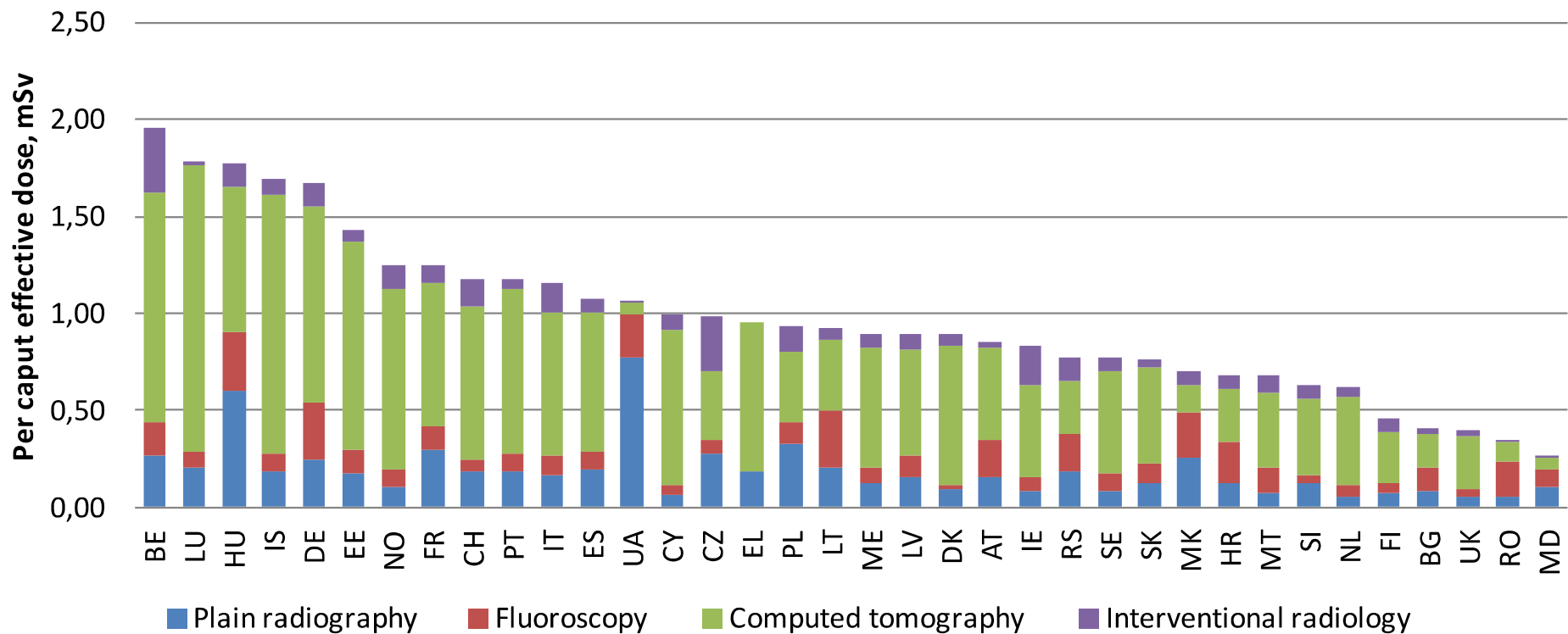


Table 9: Application of ICRP radiation protection principles to the control of radiation exposure

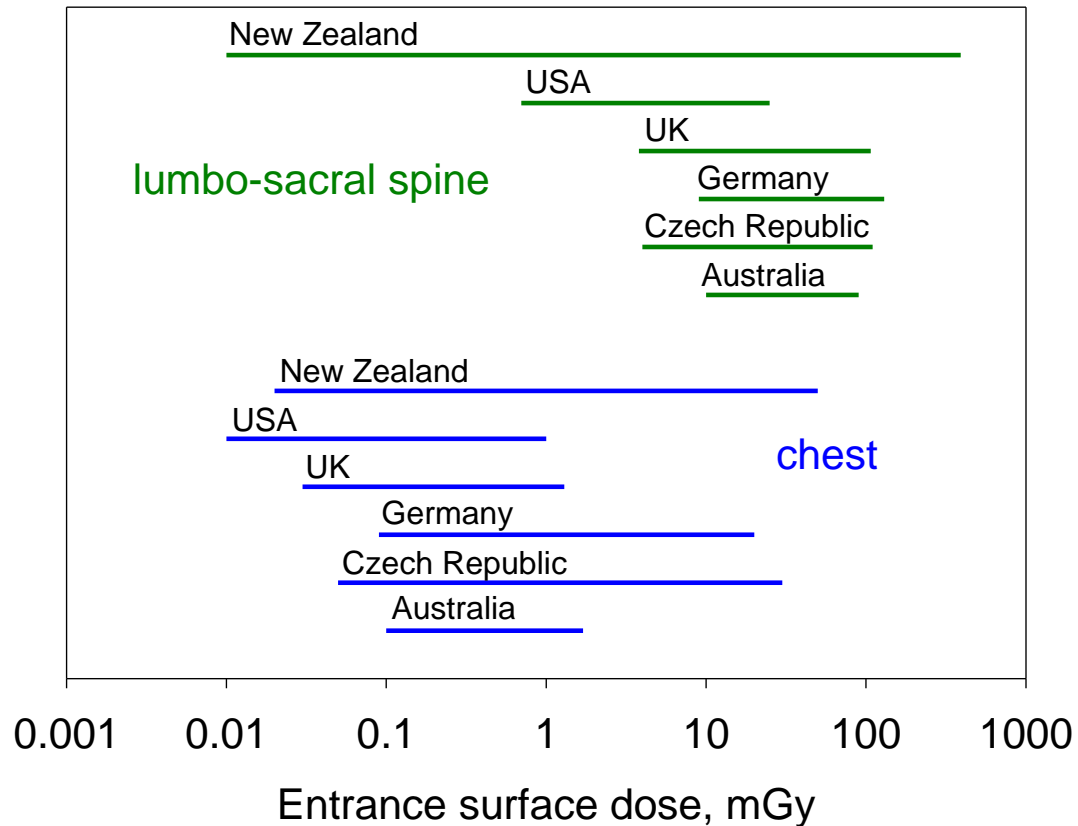
	PLANNED			EXISTING			EMERGENCY		
Public	Green	Yellow	Red	Green	Yellow	White	Green	Yellow	White
Occupational ⁽¹⁾	Green	Yellow	Red	Green	Yellow	White	Green	Yellow	Light Orange
Medical	Green	Yellow	White	White	White	White	White	White	White
(Environmental) ⁽²⁾	Light Green	Light Yellow	White	Light Green	Light Yellow	White	Light Green	Light Yellow	White

Green	JUSTIFICATION
Yellow	OPTIMISATION
Red	LIMITATION

⁽¹⁾ Occupational dose limits are not applicable in emergency situations but doses to individuals should not exceed the thresholds for acute radiation effects.

⁽²⁾ The application of the radiation protection framework for protection of non-human biota under different exposure situations is still in development.

Entrance surface doses (ESD) to patient per examination in different countries, for two types of x-ray examinations (UNSCEAR 1993)



➔ **Harmonisation of practices needed!!!**

Patient exposure in digital radiography

Virtual colonoscopy 36 - 50 mSv

An issue of considerable concern ... is the excessive use of fluoroscopy in interventional procedures:

... in a special "High Level Fluoroscopy Mode" when exceptionally high contrast resolution is required, patient entrance surface dose rates approaching ≈ 1 Gy per minute have been observed.*

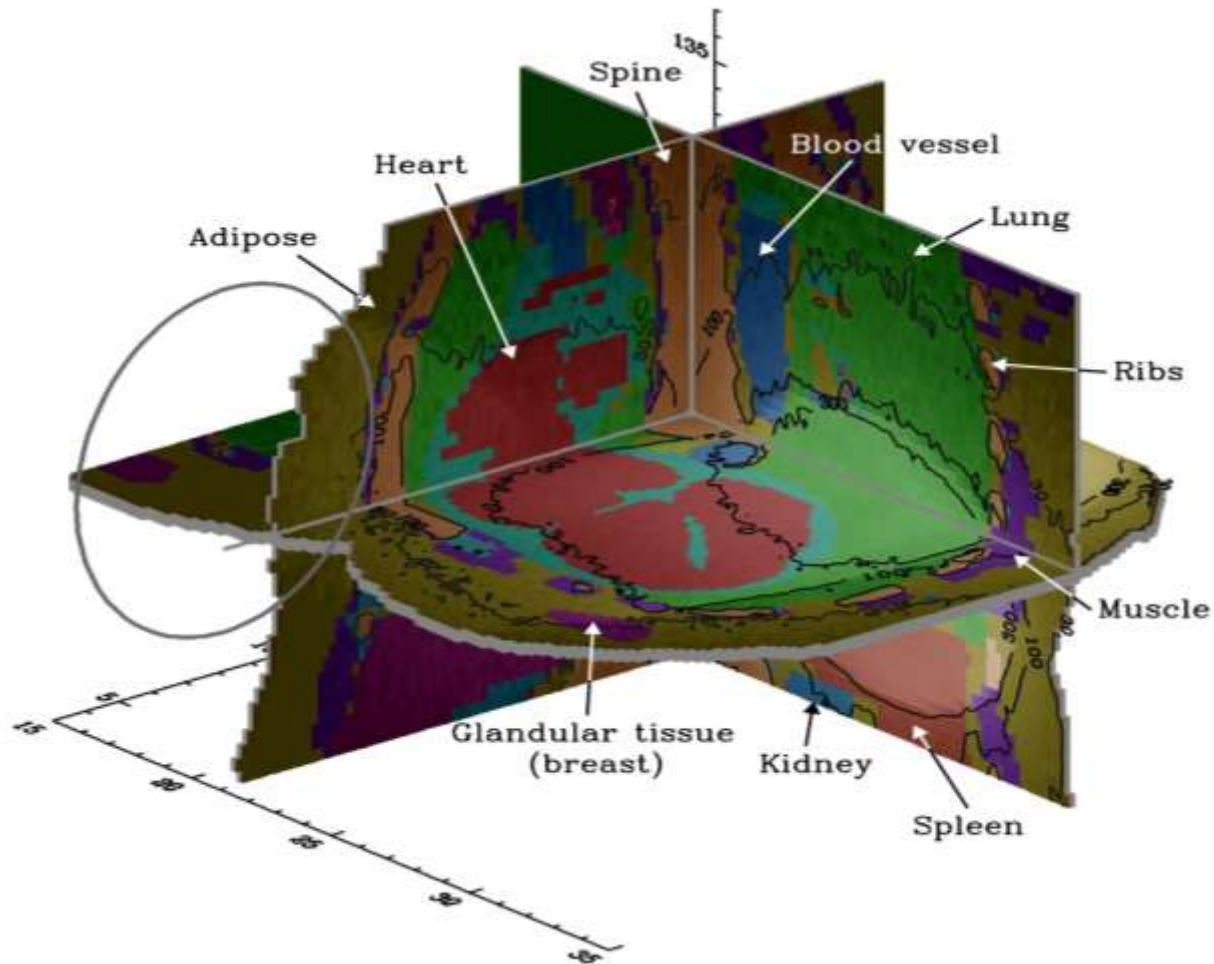
*B. Wall, Radiological Protection Bulletin 152, 24-25 (1994)

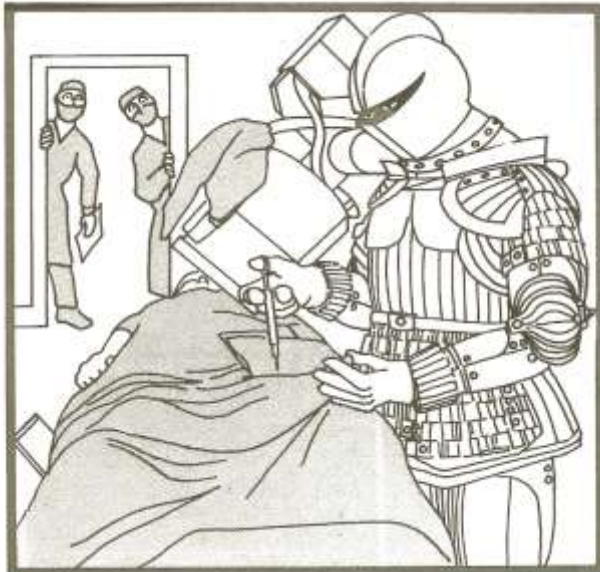
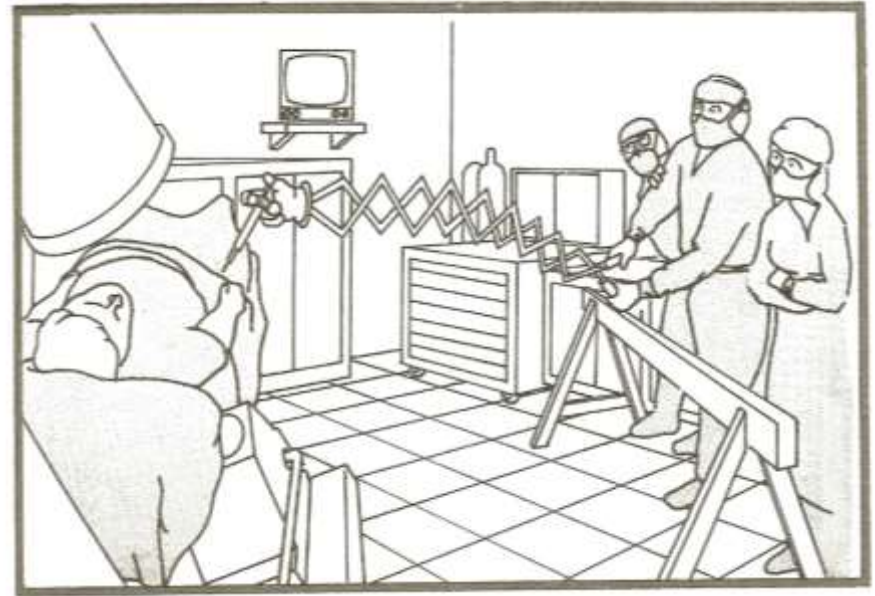
For comparison:
Hiroshima survivors 5 - 200 mSv

GE Innova 2000 All Digital Cardiovascular Imaging System



Calculation of dose-distribution inside an organ





- You need to measure dose
- Reliable
- Easy
- With possible warning
- Applicable in at least medical applications (pulsed radiation, nuclear medical imaging, interventional procedures, (radiation therapy))

$$\text{CP} = \text{HOP} \cdot \text{„DQE}_{I-P}\text{“} \cdot \text{„DQE}_{\text{Det}}\text{“} \cdot \text{„NEQ}_I\text{“}$$

Interpretation
Präsentation
Detektion
Bilderzeugung

der Information

CP = Clinical performance

HOP = Human observer performance

DQE = Detective Quantum efficiency

NEQ = Noise equivalent quanta

kVp, mAs

SID, SOD, focal spot

Patientenbeschaffenheit,

Patientenbewegung, „Patientenrauschen“

Pixelgröße, MTF, NPS

LUT, Frequenzfilterung, Fensterung

Display-Leuchtdichte, Umgebungslicht,

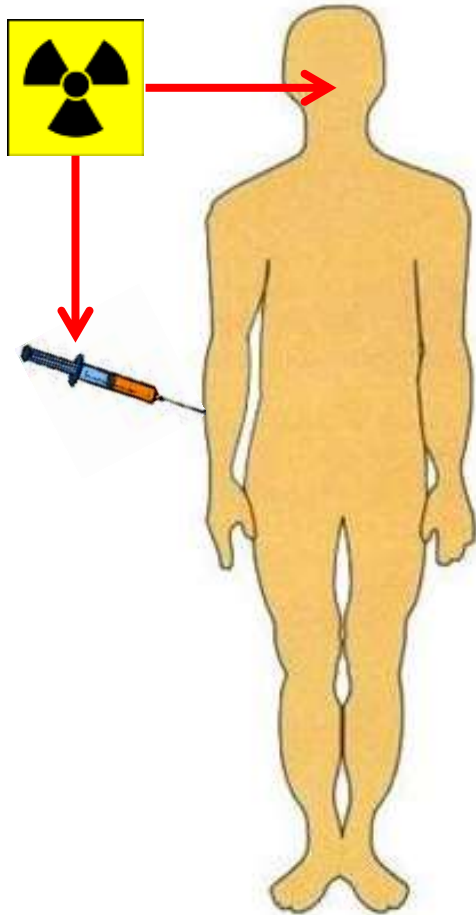
Kontrast, Monitor-MTF

Adaption, Alter

Erfahrung bezüglich Fragestellung, Wissen
über den Patienten, Aufnahmeverfahren

etc.

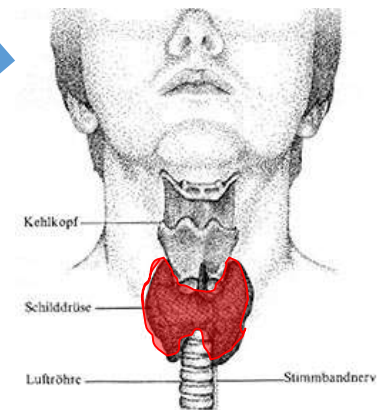
Radiopharmaceuticals in nuclear medicine

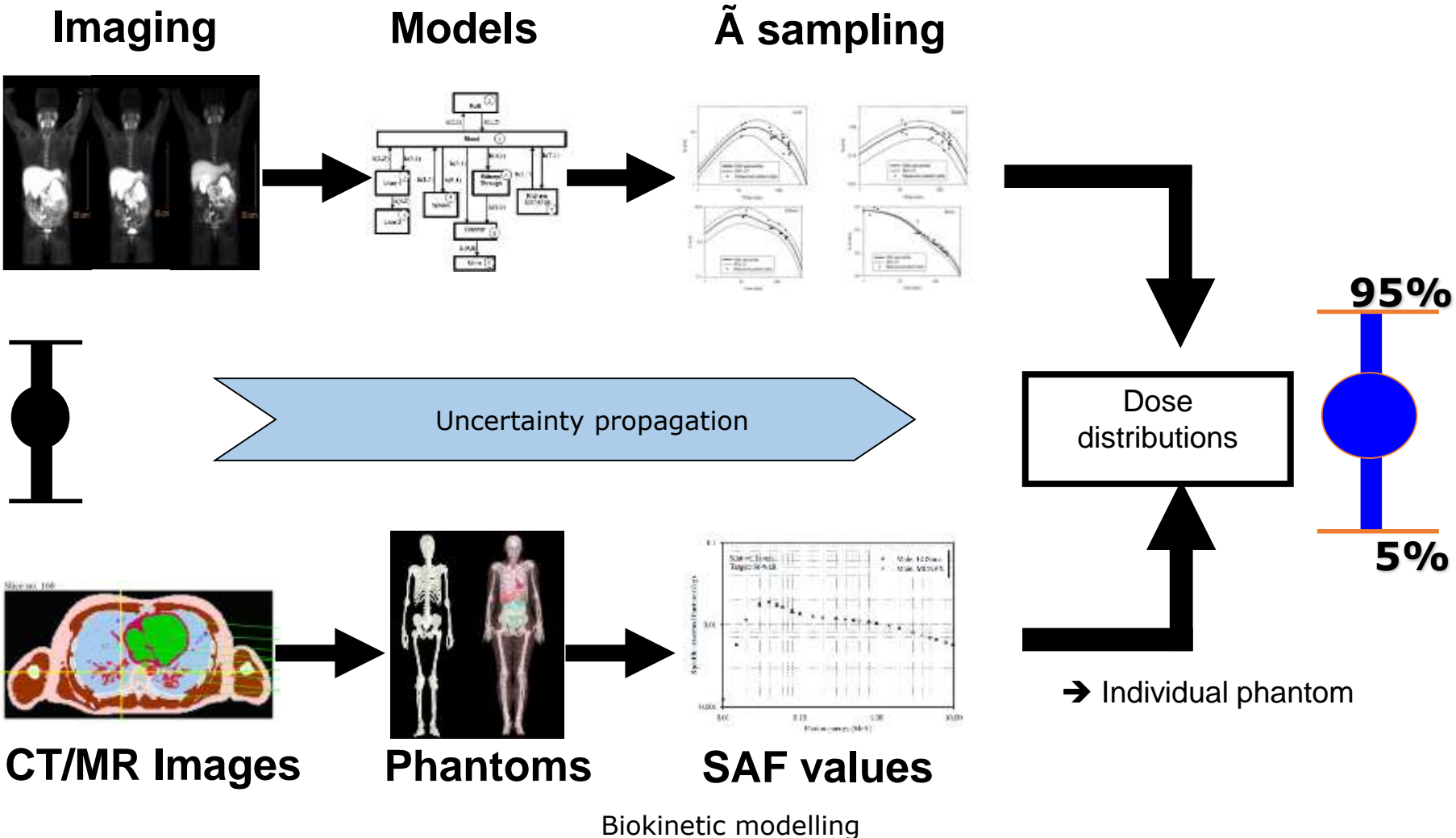


Diagnostics



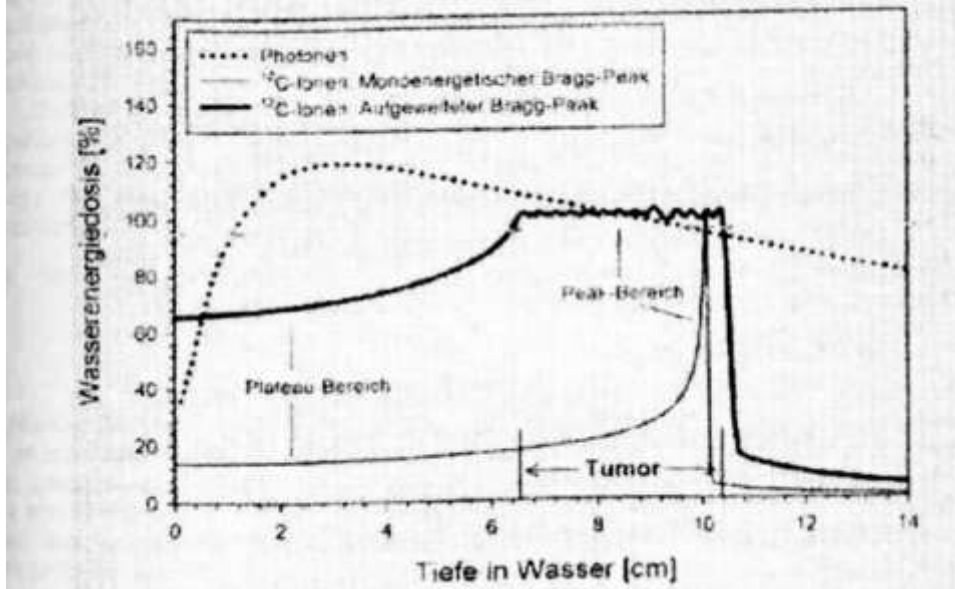
Therapy



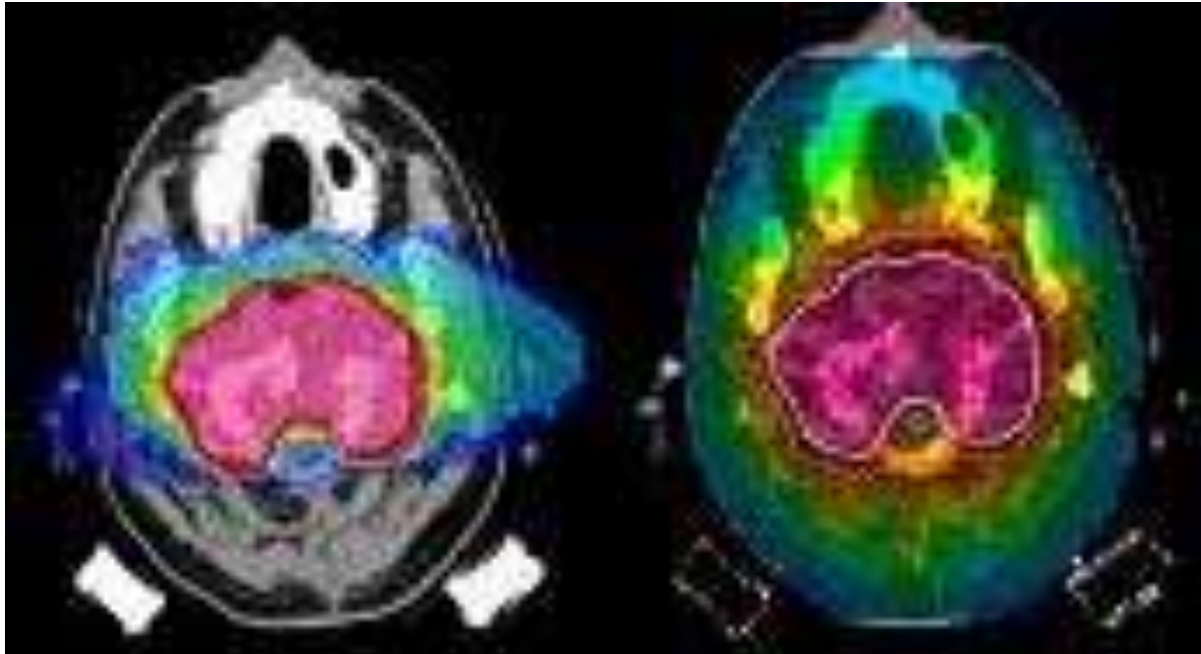


^{12}C -ion therapy

Comparison of ^{12}C -ion and photon penetration depth in water



^{12}C -ion therapy



- How to optimise approaches?
- How to minimize „side effects“ for an individual patient?
- How to optimise TCP/NTCP ratio? What is acceptable?
- How to make procedures comparable?
- For which patient which method is most suitable / necessary?



EURAMED

European Alliance for Medical
Radiation Protection Research

« Improving people's lives through
**innovative multidisciplinary
research** in medical radiation
protection »

In preparation phase hosted by:



- Justification
- Determine risk, determine benefit, communicate
- Harmonisation of practices, especially
- In the context of individual radiosusceptibility and radiosensitivity
- How to individualize procedures (exposure, image quality and outcome) in a standardized way dependent on patient status (weight, height, age, gender, etc.)
- Optimise occupational exposure
- Educated staff and scientists

See: strategic research agenda
(published in Insights into Imaging, 15th of february 2017)

- it would be of great interest for optimising medical radiation applications in terms of radiation protection on a per patient basis to investigate how individual patient sensitivity even on an organ level could be identified fast from investigations done basically just for diagnostic purposes or how to develop specific characterising procedures that allow fast optimisation of medical applications in clinical practice.
- *In terms of dosimetry, it would be of interest also to develop fast applicable methods of dose determination as well for patients as for staff and also for local dose determination for the modern technologies like proton / ion or neutron therapy. In addition the description as well as the effect determination for very strongly localized dose distributions would be an additional possible synergistic interest.*

! Thanks for your attention !