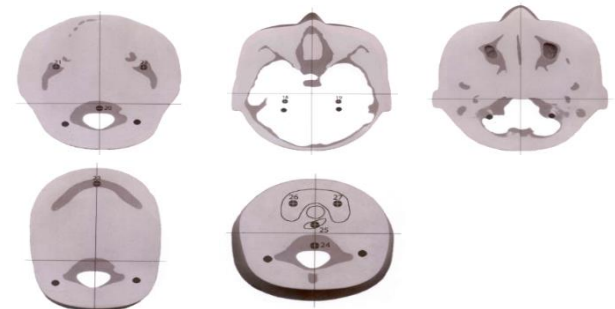
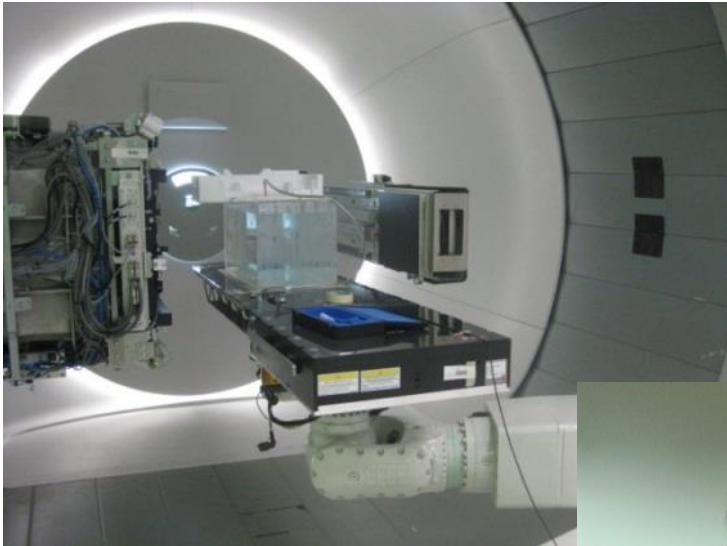


# EURADOS Working Group 9: Radiation Dosimetry in Radiotherapy



## The European Radiation Dosimetry Group (EURADOS)

A self-sustainable network of more than 60 European institutions and 300 scientists active in the field of radiation dosimetry.

The aim: to promote research and development and European cooperation in the field of dosimetry of ionizing radiation.

Working Groups (WGs) in various dosimetric disciplines:

- Harmonization of individual monitoring
- Environmental dosimetry
- Computational dosimetry
- Internal dosimetry
- **Radiation dosimetry in radiotherapy**
- Dosimetry in diagnostic imaging
- Retrospective dosimetry
- Dosimetry in high energy radiation fields.

## WG9 Objectives



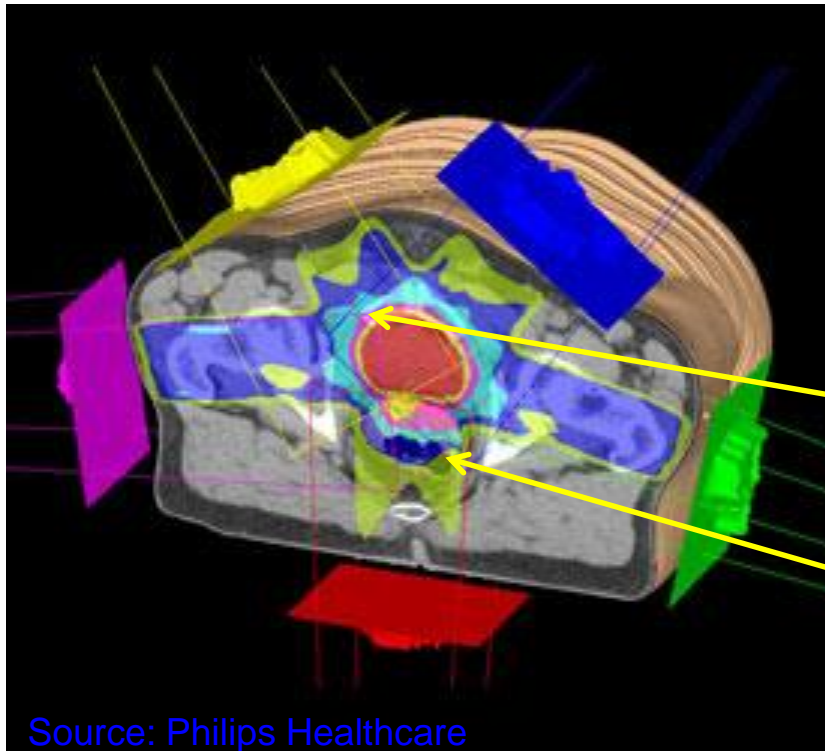
- **Develop & harmonise dosimetry** techniques in radiotherapy
- Measure **out-of-field doses** for input to secondary malignancy risk models and epidemiological studies of late effects
- Facilitate development and application of **novel dosimeters**

- Investigate dosimetric aspects of **proton radiotherapy**, including patient dosimetry and the measurement and modelling of ambient neutron and proton fields
- Development of **“the complete dose specification”** from all sources of radiation to all parts of the body, delivered as part of radiotherapy planning & treatment (collaboration with WG12)



# Radiotherapy

A key component of cancer therapy

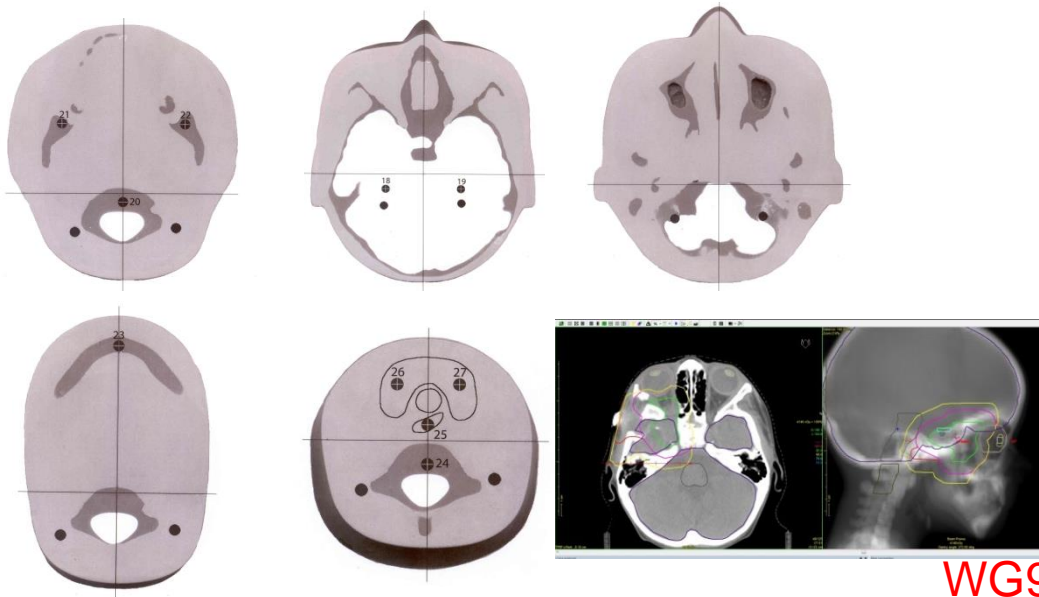


- Doses to target calculated with sufficient accuracy
- Out of field doses are less easily measured or calculated
- Epidemiological studies need (ideally) a complete dose specification

# Photon radiotherapy: Paediatric treatments

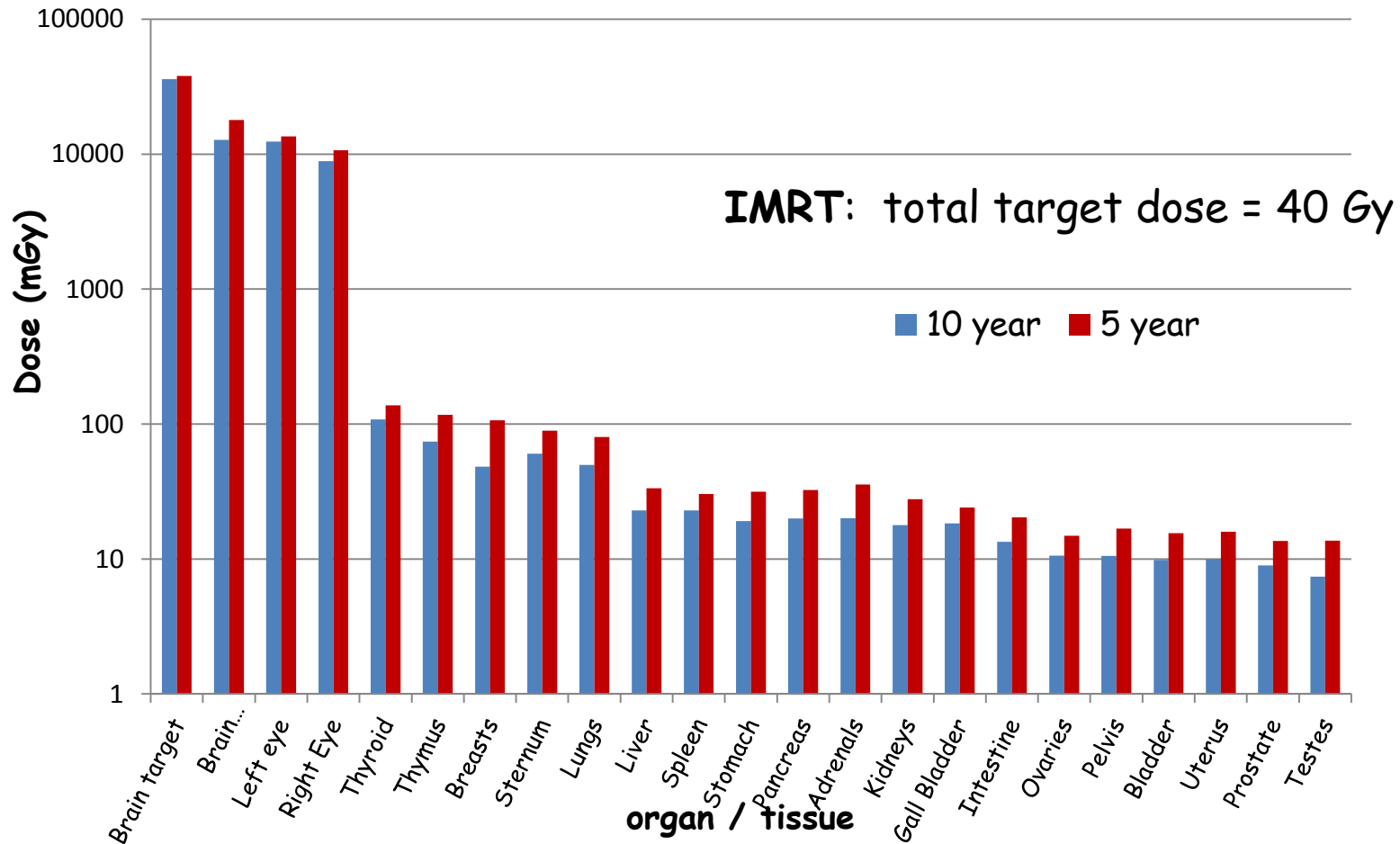
## Measuring out-of-field doses from a paediatric brain tumour treatment (photons)

Institute of Nuclear Physics (IFJ) and  
Centre of Oncology, Krakow  
Ruđer Bošković Institute, Clinical Hospital  
for Tumours & Clinical Hospital Centre,  
Zagreb



# Photon radiotherapy: Paediatric treatments

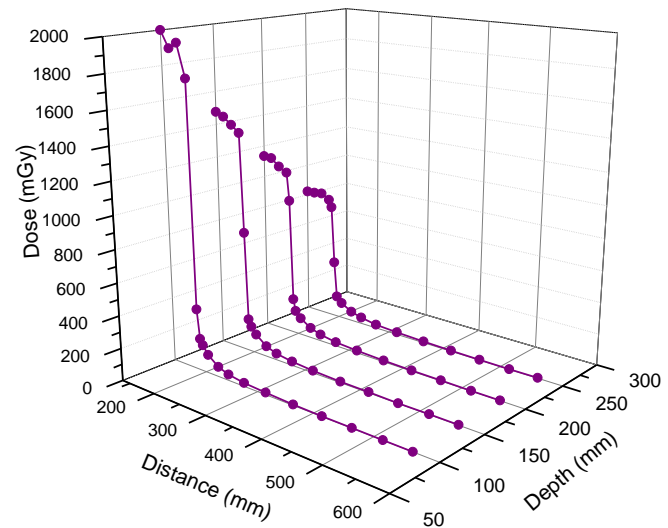
## Paediatric brain tumour treatment (photons)



# Input to analytical models

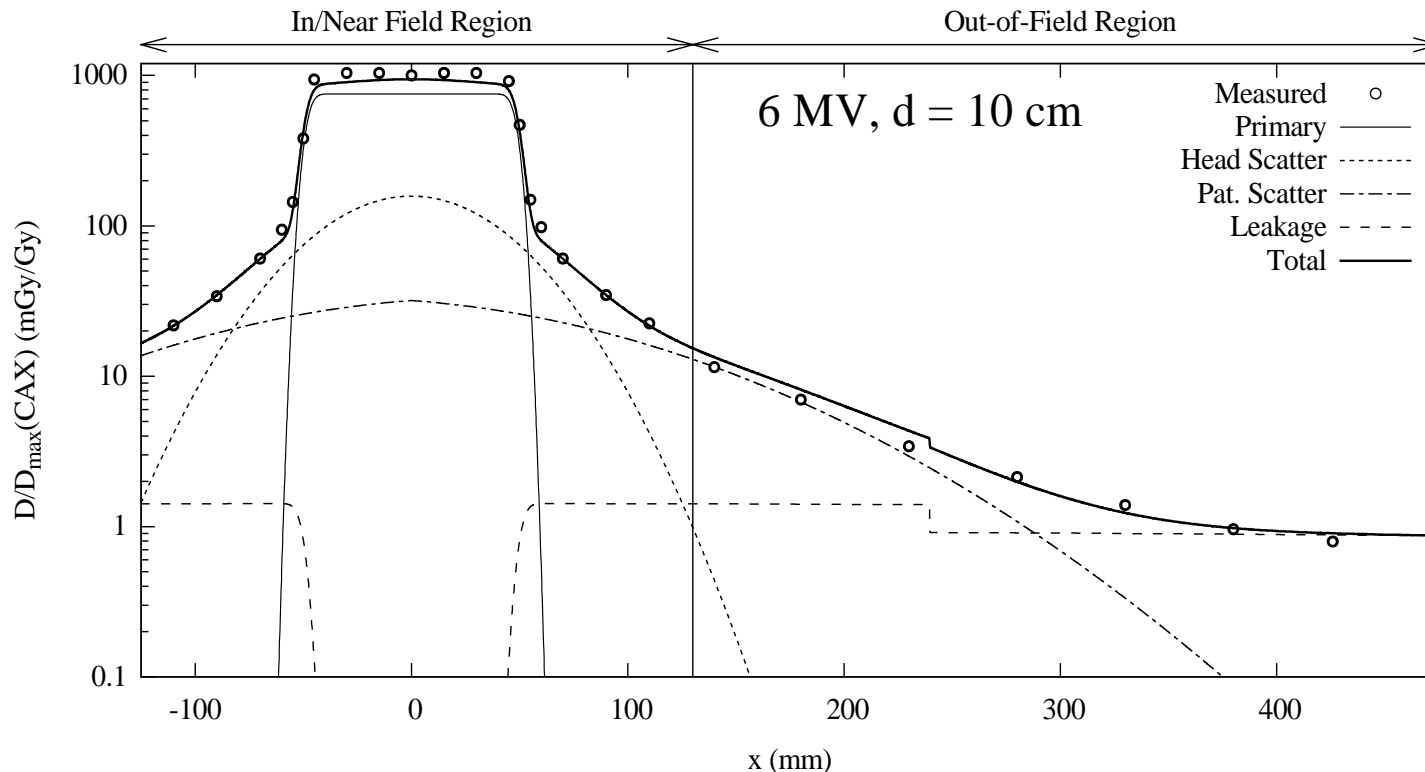
## Photon dosimetry: water tank experiments

Commissariat à l'Énergie Atomique (CEA, LIST, LNE/LNHB) **Saclay, 2010, 2011**



# Input to analytical models

Collaboration with Prof. Wayne Newhauser, Louisiana State University



Measured and calculated relative absorbed doses for 6 MV beam and 10 cm depth in water from the EURADOS dataset, following training of the model

**A simple, descriptive, and broadly applicable model of therapeutic and stray absorbed dose from 6 MV to 25 MV photon beams**

Christopher Schneider, Wayne D Newhauser, Lydia Jagetic, Uwe Schneider, Robert Kaderka, Saveta Miljanić, Željka Knežević, Liliana Stolarczyk, Marco Durante, Roger Harrison (manuscript in preparation)



## Total dose from radiotherapy and imaging: the complete dose specification (WG9/12 collaboration)

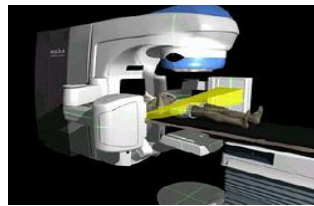
### Objective:

- Measure total dose for out-of-field organs in selected paediatric RT treatments (CT dose + OBI dose + RT dose)
- Determine the fractional contribution of each component in the total organ and tissue dose
- Anthropomorphic phantoms (10y + 5y) + several dosimeter types (RPL, TLDs, OSLs)



CT

+



OBI

+



Linac

## Total dose from radiotherapy and imaging: the complete dose specification (WG9/12 collaboration)

### Objective:

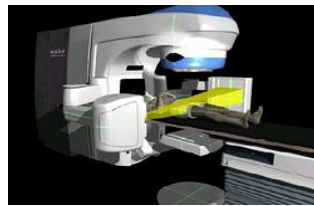
- Measure total dose for (paediatric RT treatment)
- Determine the fractional contribution to the total organ and tissue dose
- Anthropomorphic phantoms (10y + 5y) + several dosimeter types (RPL, TLDs, OSLs)

+ PET, SPECT, SPECT / CT, molecular radiotherapy.....?



CT

+



OBI

+

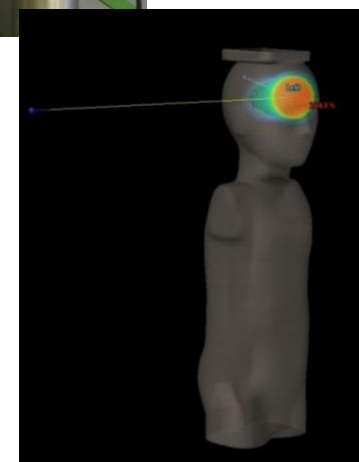


Linac

## Sub-Group WG9.2 Hadron Radiotherapy: Pawel Olko

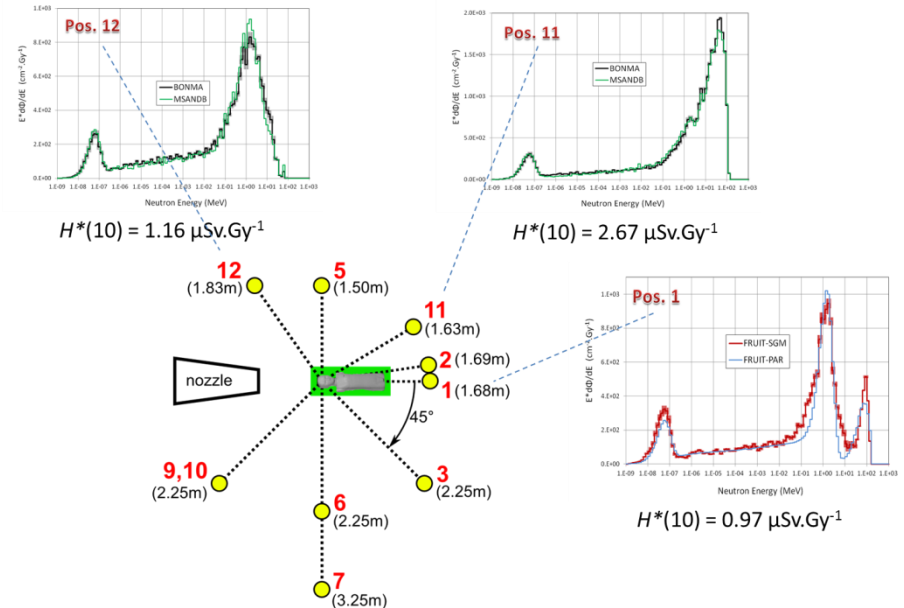
### Topics of interest:

- In-phantom dosimetry of secondary and scattered radiation in hadron therapy



## Topics of interest:

- In-phantom dosimetry of secondary and scattered radiation in hadron therapy
- Environmental neutron and gamma radiation dosimetry in hadron therapy facilities (patient oriented)



**A comprehensive spectrometry study of stray neutron radiation field in scanning proton therapy.**  
Mares et al. Phys. Med. Biol. 61 (2016) 4127–4140

**WG9 CERN meeting 17-18 October 2016**

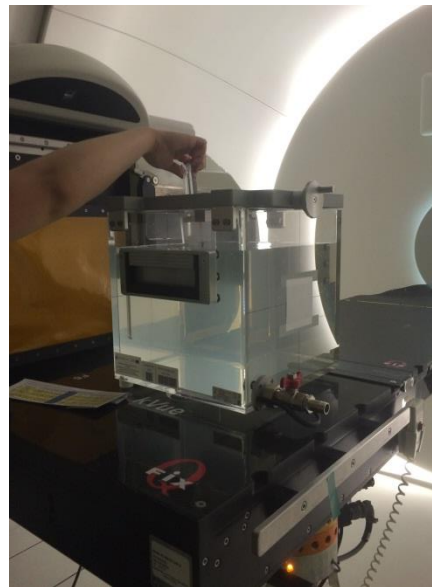
# EURADOS Working Group 9: Sub-Group WG9.2 Hadron Radiotherapy

## Topics of interest:

- In –phantom dosimetry of secondary and scattered radiation in hadron therapy
- Environmental neutron and gamma radiation dosimetry in hadron therapy facilities (patient oriented)
- System for mailed dosimetry audits of proton therapy radiotherapy beams (in progress: experiments to determine suitable detectors)

## Experiments in Bronowice Cyclotron Center IFJ PAN, Kraków

1	SCK-CEN	EPR	Alanine
2	ISS	EPR	Alanine
3	IFJ-PAN	EPR	Alanine
4	SCK-CEN	OSL	Luxel
5	RBI	RPL	GD-302M
6	RBI	RPL	GD-352M
7	SCK-CEN	TLD	MCP-n
8	IFJ-PAN	TLD	MTS-N
9	IFJ-PAN	TLD	MCP-N



- Modulation width
- Range
- Dose response

# EURADOS Working Group 9: Sub-Group WG9.1 Computational Methods in Medical Physics: Sebastian Trinkl

## Objectives

- Supporting experiments with simulations
  - pediatric phantom measurements
  - Supporting mailed proton therapy audit measurements
- Joint WG activities (high energy neutron benchmarking: WG6, 9, 11)  
(To validate computational and measurement methods at high energies)
- Treatment planning system (TPS) validation
- Overall dose estimation in radiotherapy

# Summary

- **Out-of-field doses** to organs in photon and proton therapy for input to risk calculations
- The complete dose specification (WG9/12 collaboration) (**total dose from radiotherapy and imaging**)
- Out-of-field measurements for **validation of analytical models > TPS development**
- Inter-centre proton dose intercomparisons & **mailed dosimetry audits** of proton dosimetry
- **Spectrometry studies of stray neutron radiation fields** in scanning proton therapy.
- **Neutron benchmarking** (WG 9, 6 and 11)
- **Computational** simulation support for experiments

Thank you