

ROCOCO: Radiation Oncology Collaborative Comparison

An International, Multicentric *In Silico* Clinical Trial in Lung Prostate and Head & Neck Cancer: Evaluation of Feasibility

Qamhiyeh S, Pijls-Johannesma M, Verhaegen F, de Ruyscher D, Baumert B, Verheij M, Rasch C, Langendijk JA, van de Water T, de Neve W, de Meerleer G, Madani I, Fonteyne V, Eble M, Lomax T, Schippers M, Mazal A, Habrand JL, Engelsman M, Tjuii H, Kanematsu N, Tatsuya O, Baba M, Scholz M, Jaekel O, Debus J, Lambin P.

Erik Roelofs, Lucas Persoon
#124, ICTR 2009
Geneva

Overview

- Introduction
 - Who, why, what
- Project setup
 - Design, protocol, management
- Challenges
 - Access, interoperability, consistency
- Conclusion

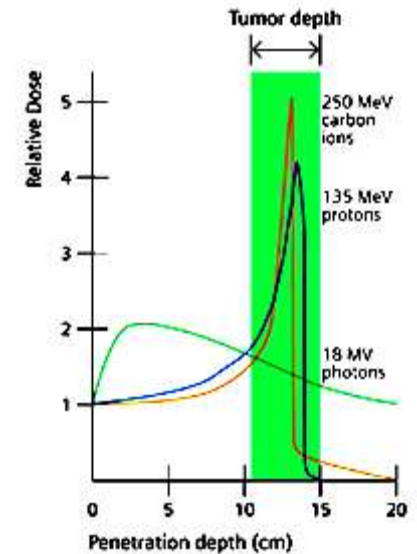
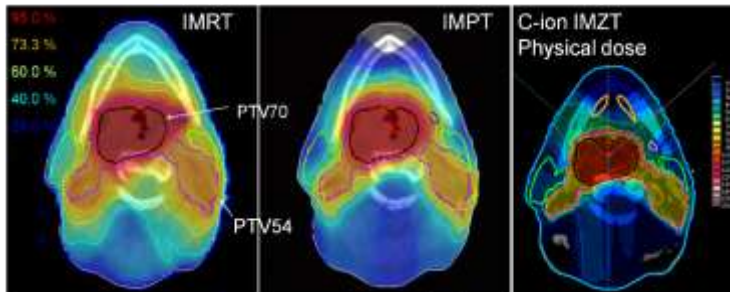
Partners

- Maastricht Radiation Oncology (MAASTRO), GROW Research Institute, University Hospital Maastricht, The Netherlands.
- Netherlands Cancer Institute (NKI), The Netherlands.
- University Medical Center Groningen (UMCG), The Netherlands.
- University Hospital Ghent (UHG), Belgium.
- University Hospital Aachen, Germany.
- Centre de Protontherapie d'Orsay (CPO), France.
- Massachusetts General Hospital and Harvard Medical School (MGH/HMS), USA.
- National Institute of Radiological Sciences (NIRS), Japan.
- Gesellschaft für Schwerionenforschung (GSI), Germany.
- Heidelberger Ionenstrahl-Therapie (HIT), Germany.



Purpose trial

- Why ROCOCO?
 - Find evidence of benefit of particle therapy.
 - Better dose distribution
 - more in the tumour
 - less in the healthy tissue



- Installation: ~120 M€ (175 MCHF)

Purpose trial

– Why ROCOCO?

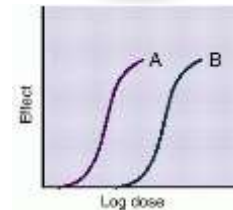
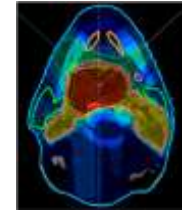
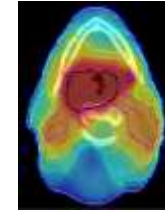
- (more) cost effectiveness studies needed*
 - Gain expected for late side effects
 - Clinical evidence is still weak (level 1 is lacking)
- normal clinical trials take too long
 - “By the time the medical profession has established the required evidence on clinical performance, the technology has developed further and we are left with today’s evidence on yesterday’s technology” ‡

* Lodge M (2007) / Pijls-Johannesma M (2008), Radiother Oncol.

‡ Olsen et. al. , Radiother Oncol. 2007

In Silico planning study

- What is ROCOCO?
 - Emulate a real Clinical Trial
 - Lung, Prostate, H&N (25 pat. each)
 - Calculate optimal dose distr.
 - With TCP/NTCP models predict outcome
- Using Markov modeling, estimate Quality of Life Years (QALY) and cost effectiveness



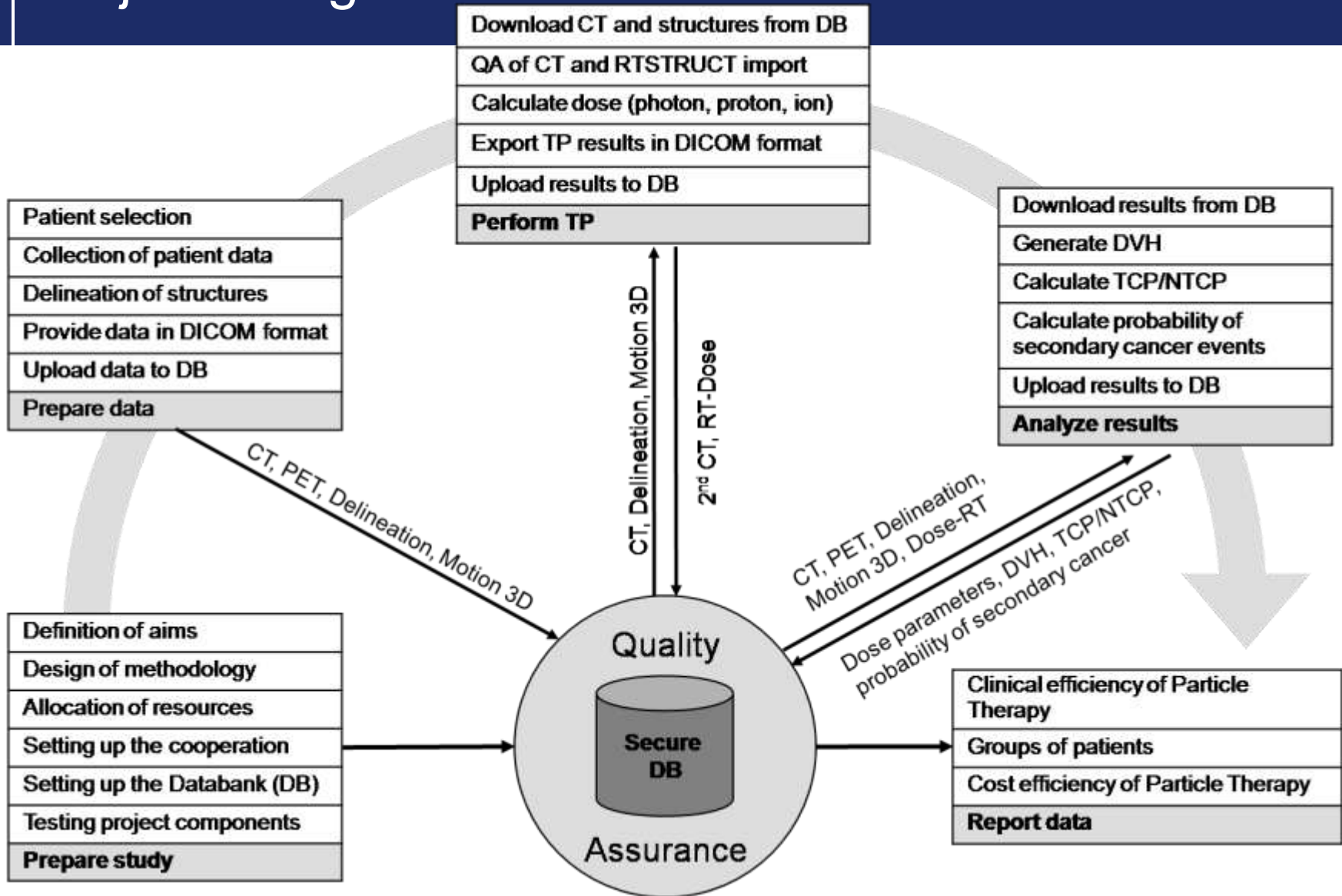
Study endpoints

- Part I: iso-effective tumor control
 - Less dose to normal tissue, same to the tumour
- Part II: dose-escalation
 - Same to normal tissue, more to tumour
- Part III: hypo-fractionation
 - Increase dose per fraction, less fractions, less costs
- Part IV: expanding project
 - More indications
 - More modalities (e.g. Tomotherapy)
 - Validation dataset for future studies

ROCOCO protocol

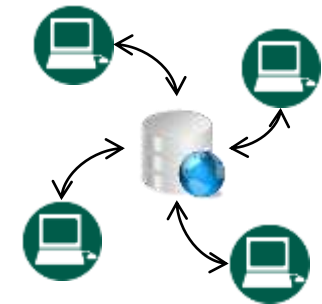
- Not a regular planning study
 - pre-selected patients (25 per tumour type)
 - images same patients for comparison of different treatment modalities
 - every patient is its own control
 - same delineation of volumes (CTV, GTV, PTV, OAR)
 - same radiation schedule
 - pre-defined criteria

Project design



Common challenges for multicenter studies

- Nomenclature, ontology, consistency
 - Covered by strict protocol, pre-selected datasets
- Centralized vs. distributed setup
 - Centralized storage
 - Distributed intelligence
 - Access restrictions (unable to use FTPS)
- Ownership, authorship rights
 - Covered by Material Transfer Agreement (MTA)



Secured data sharing



MISTIR - Multicenter In Silico Trials In Radiotherapy

Home Rococo Thunder

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- File Manager
- My account
- Log out

File Manager



File Upload

Search

Name	Modified	Size	Owner
Protocol.pdf	09/02/09 23:19	190 KB	rococo

- Link: www.mistir.info
 - Data secured by SSL/TLS protocol
 - Accepted in hospital environments (instead of FTPS)

Special challenges for *in silico* trials

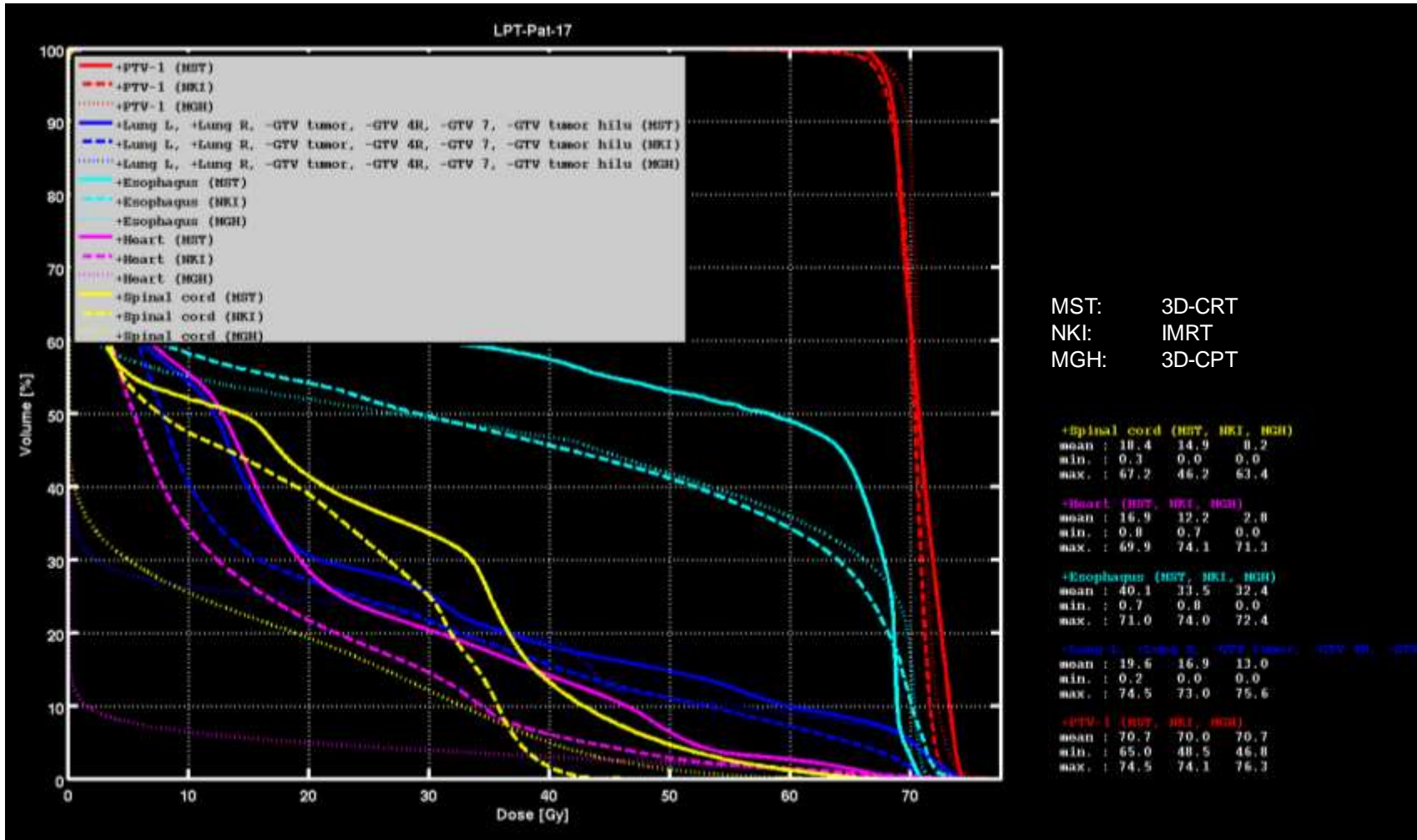
– Interoperability

- DICOM (-RT) definition too open
 - Breathing phase information of 4D PET/CT datasets are not encoded uniformly. Dataset unusable for now.
- Treatment Planning System (TPS) issues
 - Not able to import DICOM data (convert to RTOG)
 - Variable slice thickness not always supported
 - Coordinate shifts introduced in TPS export

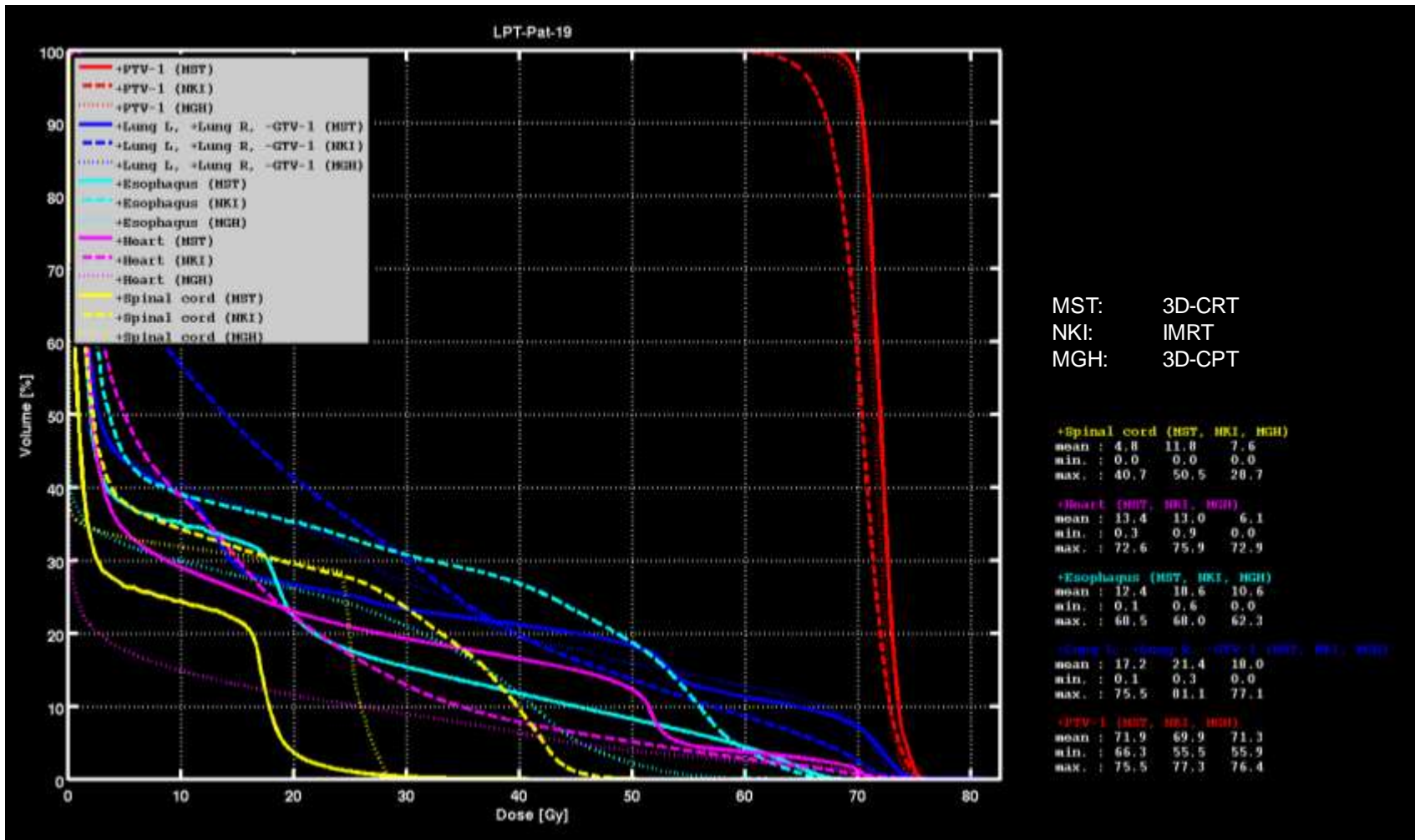
Results

- Lung data almost complete
 - 25 3D-CRT (photons)
 - 22 IMRT (photons)
 - 18 3DC protons
- 60% of 3D-CRT plans had to lower the TTD (70Gy) to meet criteria for OAR (mean 53 Gy, min. 46 Gy)
- Prostate data in progress
- H&N dataset currently being prepared

Results: lung patient 1



Results : lung patient 2



Conclusions

- ROCOCO is feasible and endorsed by PTCOG
- MTA is distributed and signed
- Current setup of ROCOCO is a good framework for more multicenter in silico trials in RT (MISTIR)

Acknowledgements

Baumert, Brigitta (UMC+, MAASTRO, The Netherlands)

Debus, Jurgen (HIT, Germany)

Dekker, Andre (MAASTRO, The Netherlands)

De Neve, Wilfried (UH, Ghent, Belgium)

De Meerleer, Gert (UHG, Ghent, Belgium)

De Ruyscher, Dirk (UMC+, MAASTRO, The Netherlands)

Eble, Michael (UH Aachen, Germany)

Engelsman, Martijn (MGH, Boston, USA)

Fonteyne, Valerie (UHG, Ghent, Belgium)

Habrand, Jean-Louis (CPO, France)

Jäkel, Oliver (HIT, Germany)

Jongen, Ramon (MAASTRO, The Netherlands)

Kanematsu, Nobuyuki (NIRS, Chiba, Japan)

Lambin, Philippe (UMC+, MAASTRO, The Netherlands)

Langendijk, Hans (UMCG, The Netherlands)

Lomax, Tony (PSI, Switzerland)

Madani, Indira (UHG, Ghent, Belgium)

Masayuki Baba (NIRS, Chiba, Japan)

Matsufuji, Naruhiro (NIRS, Chiba, Japan)

Mazal, Alejandro (CPO, France)

Moonen, Harald (MAASTRO, The Netherlands)

Oelers, Michel (MAASTRO, The Netherlands)

Oelfke, Uwe (DKFZ, Germany)

Qamhiyeh, Sima (WPE, Germany)

Pijls-Johannesma, Madelon (MAASTRO, The Netherlands)

Persoons, Lucas (MAASTRO, The Netherlands)

Schilstra, Kees (UMCG The Netherlands)

Schippers, Marco (PSI, Switzerland)

Schlegel, Wolfgang (DKFZ, Germany)

Scholz, Michael (GSI, Germany)

Tsujii, Hirohiko (NIRS, Chiba, Japan)

Verhaegen, Frank (MAASTRO, The Netherlands)

Verheij, Marcel (NKI, The Netherlands)

Rasch, Coen (NKI, The Netherlands)

Water van de, Tara (UMCG, The Netherlands)

Thank you for your attention!



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