

ROCOCO (<http://rococo.mistir.info>) Radiation Oncology Collaborative Comparison



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MAASTRO, GROW, MUMC+



euroCAT

Content

- About ROCOCO
- Partners
- Objectives
- So far....
- New set of ROCOCO studies initiated within the EuroCAT project

ROCOCO

Radiation

Oncology

Collaborative

Comparison



ROCOCO

- Coordination started Aug 2007
- 27 participant from 10 centers worldwide
- 3 centers provided patient data (MAASTRO,UMCG,UHG)
- MAASTRO acts as data host and coordinator

ROCOCO

***In silico* (on a computer) planning study**

- Emulation of phase III clinical trial
- Compare photons/protons/c-ions
- Lung, Prostate, H&N
- Initial project; Current clinical practice

Partners worldwide... still expanding

Maastricht Radiation Oncology (MAASTRO), GROW Research Institute, MUMC+,
The Netherlands.



Netherlands Cancer Institute (NKI), The Netherlands.



University Medical Center Groningen (UMCG), The Netherlands.

University Hospital Ghent (UHG), Belgium.



University Hospital Aachen, Germany.

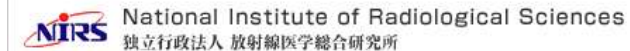


Centre de Protontherapie d'Orsay (CPO), France.

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.

University Hospital Vienna (UHV), Austria



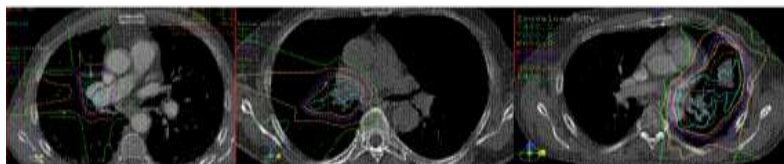
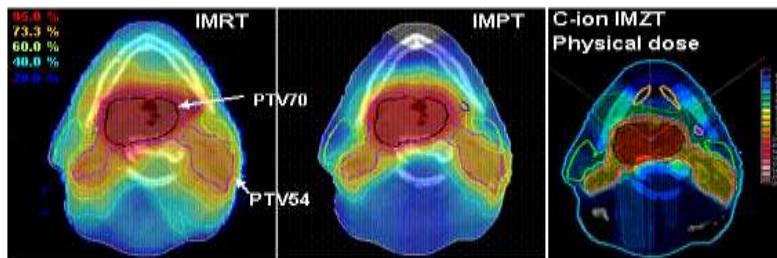
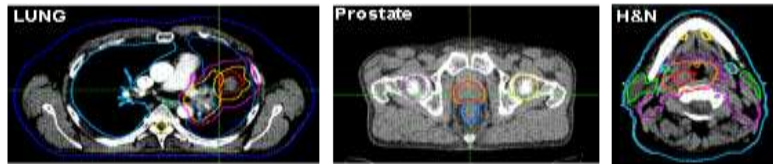
University of Wisconsin-Madison, (Upenn), USA

Asset of this methodology

- non-selected patients
- State of the art images (4D-CT, 4D-PET, ...)
- images of same patients will used for comparison of different treatment modalities
- every patients it's own control
- same delineation of volumes (CTV, GTV, (PTV), OAR)
- same radiation schedule
- pre-defined criteria

Phases of the study

- Phase I: iso-effective tumor control
- Phase II: dose-escalation
- Phase III : hypo-fractionation



3 Tumor Indications

Lung, prostate and H&N



X 3

Modalities

Photon, Proton, C-ion



X 25

Patients

Phases of the study

Phase I : iso-effective tumor control

- Compare NTCP for the same tumor coverage and fractionation scheme

Phase II : dose-escalation

- Compare TCP for the same dose to normal tissue with pre-defined normal tissue constraints and same fractionation scheme

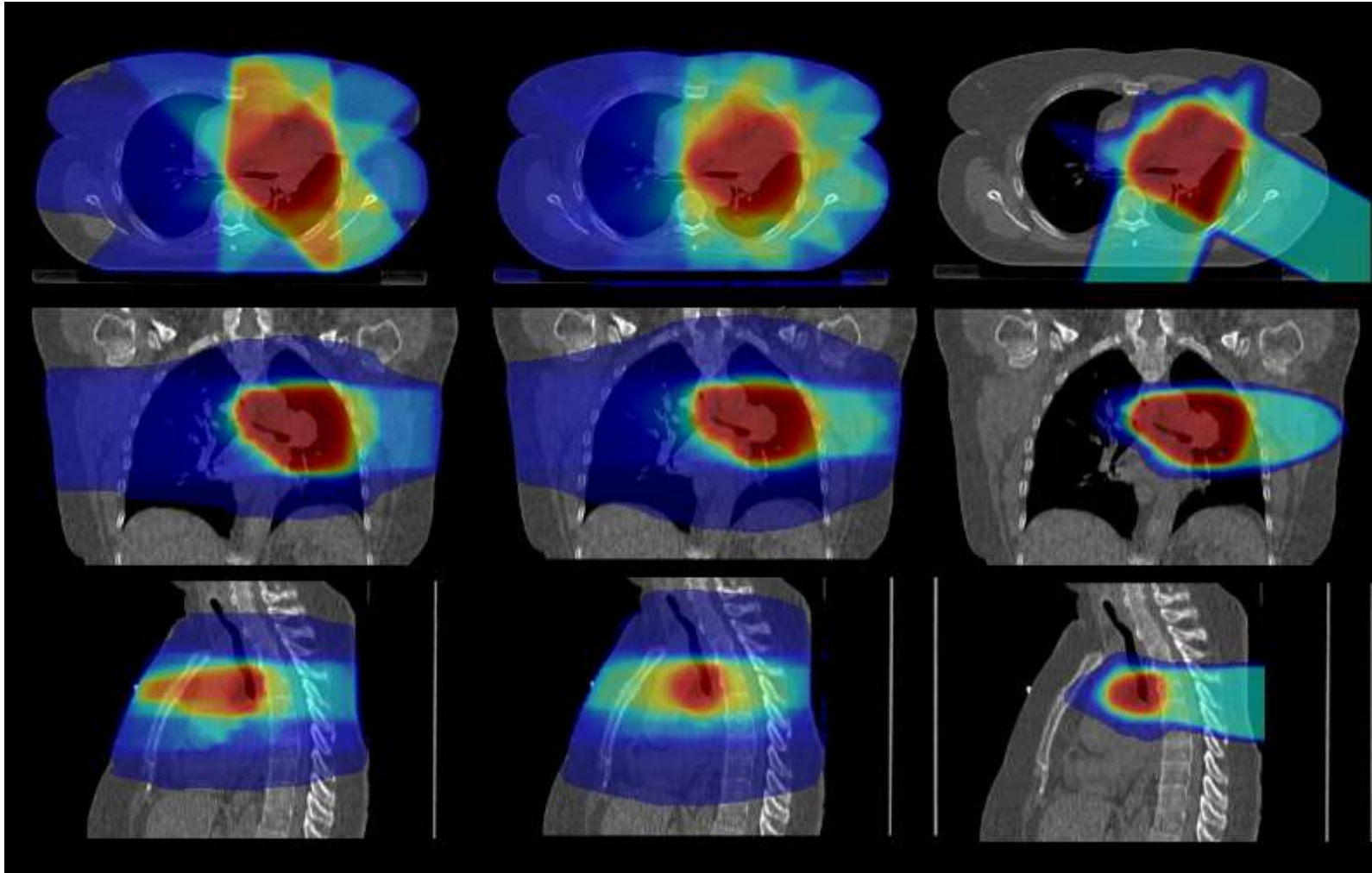
Phase III : hypo-fractionation

- Reducing the number of fractions with protons and 12C-ion therapy

In all phases

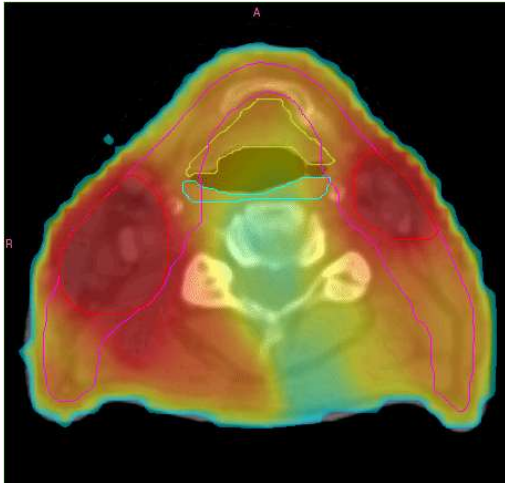
- Dose parameters as well as NTCP and TCP will be calculated for all relevant structures
- If possible, identify subgroup of patients who would benefit from PT

Results; lung

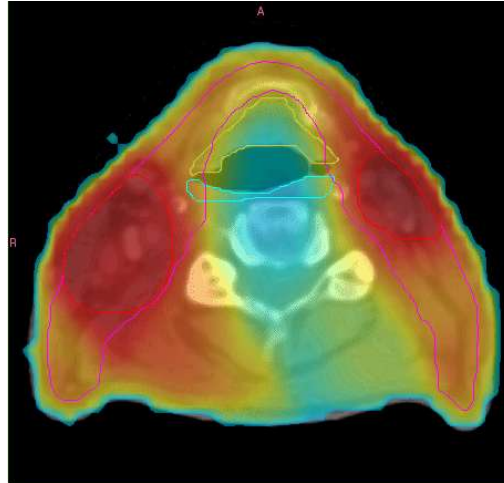
3D-CRT**IMRT****3D-CPT**

Results, H&N

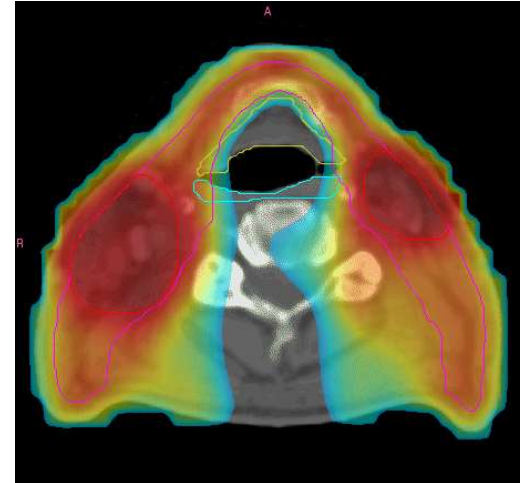
IMRT



SW-IMRT



SW-IMPT



Scientific publications

- Roelofs E, Persoon L, Qamhiyeh S, Verhaegen F, De Ruyscher D, Scholz M, Iancu G, Engelsman M, Rasch C, Zijp L, Meerleer GD, Coghe M, Langendijk J, Schilstra C, Pijls-Johannesma M, Lambin P.; Design of and technical challenges involved in a framework for multicentric radiotherapy treatment planning studies. *Radiother Oncol.* 2010 Dec;97(3):567-71.
- Roelofs E, Engelsman M, Rasch C, Persoon L, Qamhiyeh S, De Ruyscher D, Verhaegen F, Pijls-Johannesma M, Lambin P.; Results of a multicentric in silico clinical trial (ROCOCO): comparing radiotherapy with photons and protons for non-small cell lung cancer. *Journal of Thoracic Oncology* (in press).
- Miranda E.M.C. Christianen, Cornelis Schilstra, Ivo Beetz, Christina T. Muijs, Olga Chouvalova, Fred R. Burlage, Patricia Doornaert, Phil W. Koken, René Leemans, Rico N.P.M. Rinkel, Marieke J. de Bruijn, G.H. de Bock, Jan L.N. Roodenburg, Bernard F.A.M. van der Laan, Ben J. Slotman, Irma M. Verdonck-de Leeuw, Hendrik P. Bijl, Johannes A. Langendijk.; Predictive modelling for swallowing dysfunction after primary (chemo)radiation: Results of a prospective observational study. *Radiother Oncol.* (in press).
- Hans Paul van der Laan, Miranda E.M.C. Christianen, Hendrik P. Bijl, Cornelis Schilstra, Johannes A. Langendijk. The potential benefit of swallowing sparing intensity modulated radiotherapy to reduce swallowing dysfunction: an in silico planning comparative study. *Radiother Oncol.* (under review).
- Hans Paul van der Laan, Tara A. van de Water, Heleen E. van Herpt, Miranda E.M.C. Christianen, Henk P. Bijl, Erik. W. Korevaar, Coen R. Rasch, Aart A. van 't Veld, Cornelis Schilstra, Johannes A. Langendijk, on behalf of the ROCOCO cooperative group. The potential of intensity-modulated proton radiotherapy to reduce swallowing dysfunction in head and neck cancer. *JCO* (in submission).

Presentations

- PTCOG 47, Florida (US) 2008 (Poster)
- ESTRO 27, Göteborg (S) 2008 (Oral)
- ICTR, Geneva (CH) 2009 (Oral)
- Proton conference, Delft (NL) 2009 (2 Awarded Posters)
- Enlight meeting, Valencia (ES) 2009 (Posters)
- ESTRO Physics, Maastricht (NL) 2009 (Oral)
- PTCOG 48, Heidelberg (D) 2009 (Poster)
- ESTRO 29, Barcelona (ES) 2010 (Oral)
- PTCOG 49, Gunma (JP) 2010 (Poster)
- ESTRO 30, London (UK) 2011 (Oral)

Next steps

-Photons:

- MAASTRO: create DVHs of prostate modalities, analyze results, send to UGH
- UHG: start drafting prostate paper

-Protons:

- GSI/UHMG: discuss RBE lung
- AKH: delineate ITV lung based on predefined algorithm on prostate imaging
- MUV: IMPT prostate
- MUV: delineate ITV prostate (pencil beam)

Carbon-ions:

- UHMG/HIT/GSI: Carbon-ion treatment planning for prostate and lung

**Cost efficiency study prostate and lung;
Oxford in collaboration with University of Maastricht**

ROCOCO

In silico (on a computer) planning study

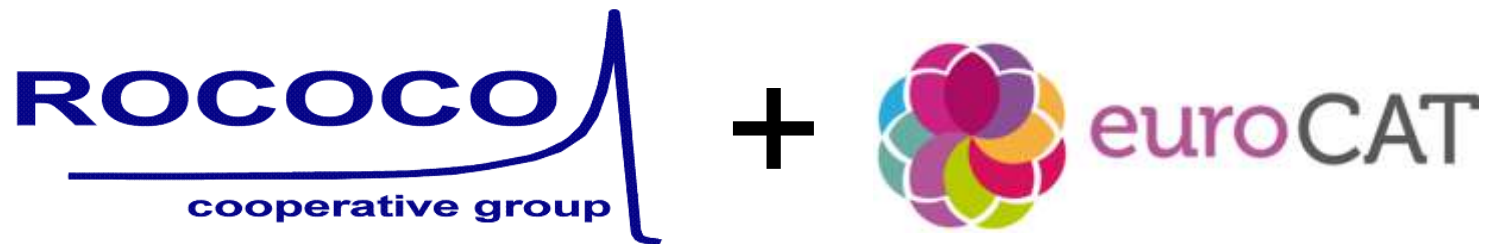
- Emulation of phase III clinical trial
- Compare photons/protons/c-ions
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➔ *Next phase: Expand project (modalities/
treatment sites)*

➔ *Collaboration with euroCAT!!!*

Collaboration euroCAT

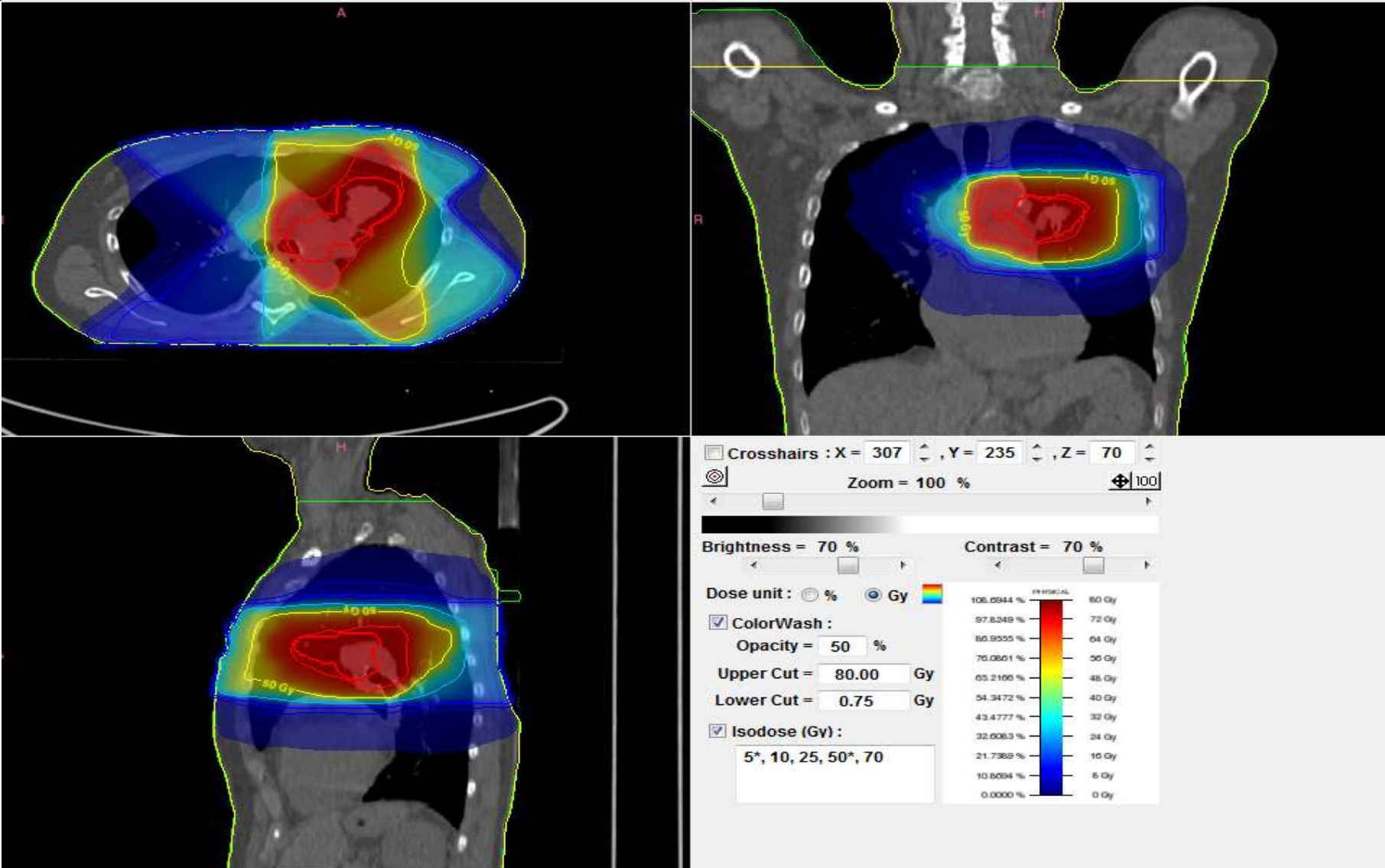
- New logo; integration ROCOCO and euroCAT logo



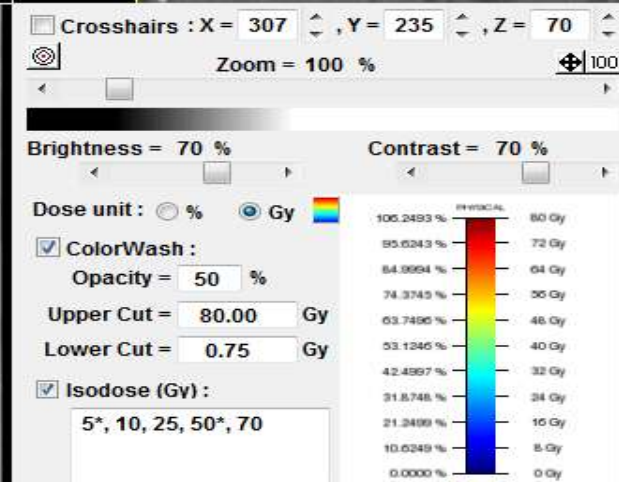
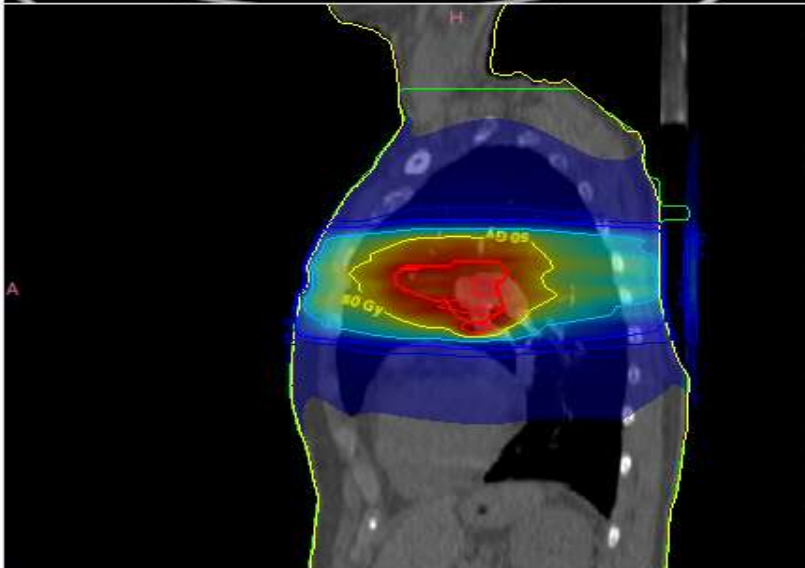
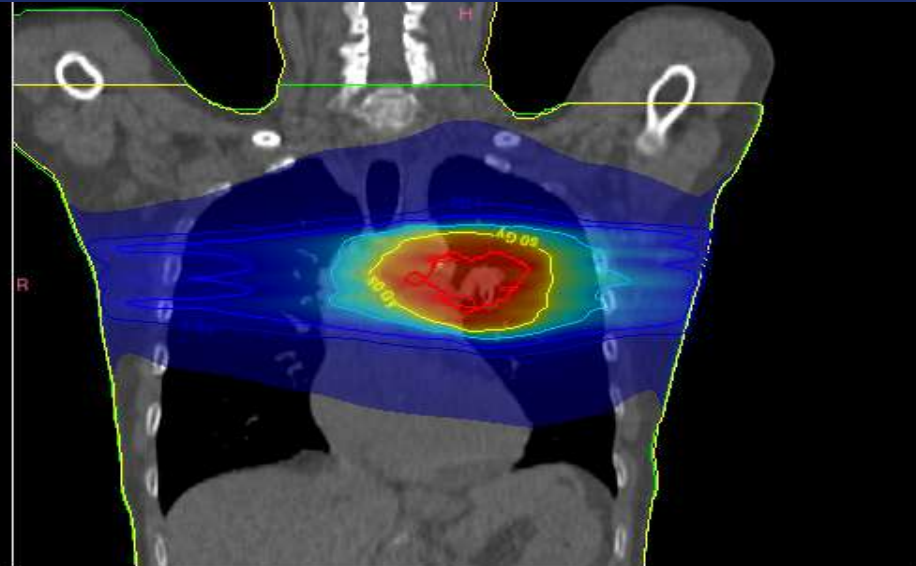
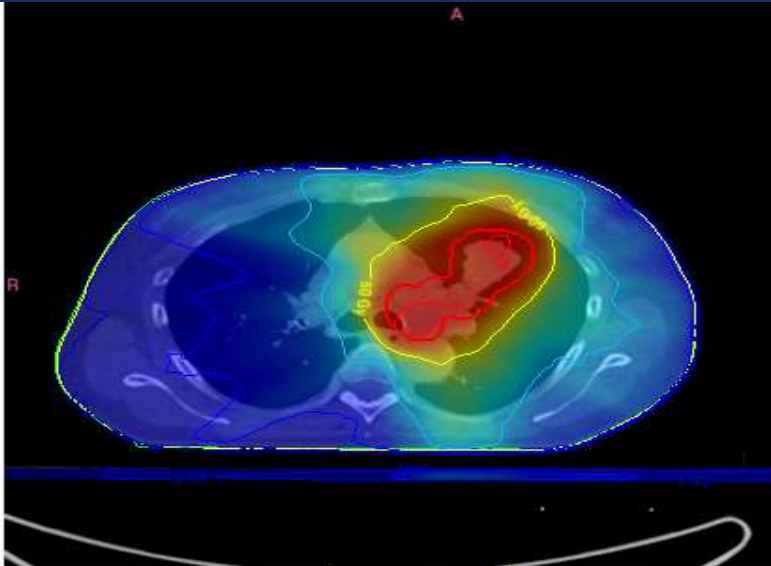
Contribution so far...

- LOC (Limburg oncology centre): Liege and Hasselt
 - Cyberknife treatment planning for lung
 - Dummy run was executed successfully
 - First treatment plan available
 - Discuss protocol (slice thickness, position of arms, markers for tumor tracking, OARs,.....)
- Interest other partners for the study

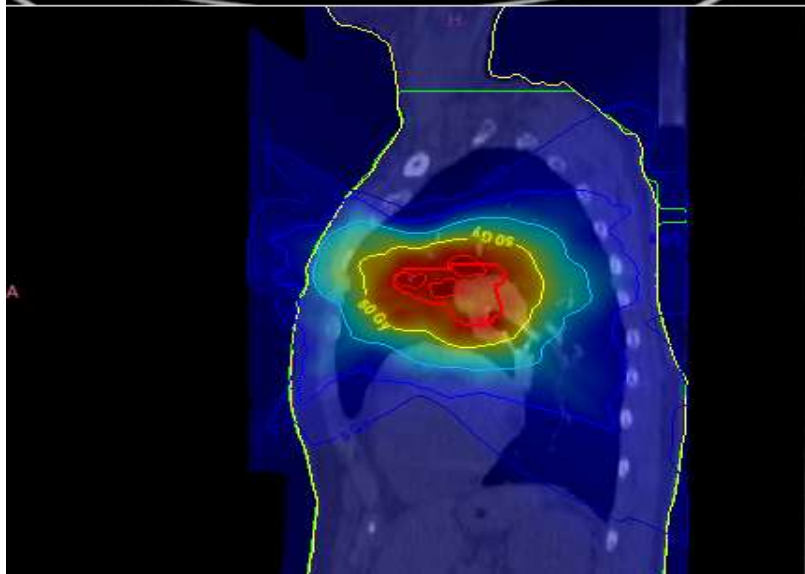
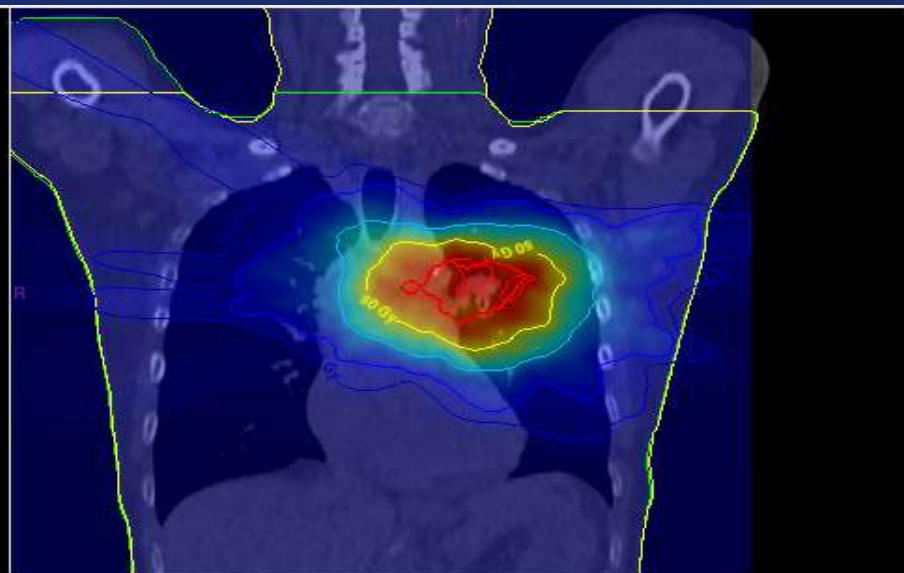
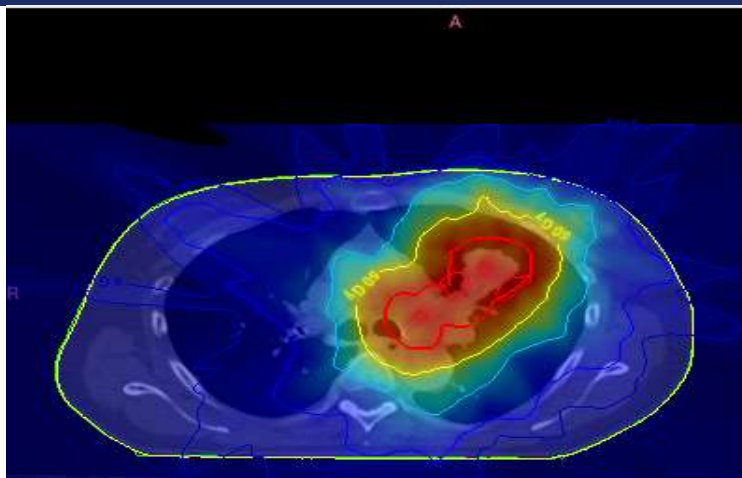
Dummyrum: 3D-CRT



Dummyrun: RapidArc



Dummyrum: CyberKnife



Crosshairs : X = 307 \updownarrow , Y = 235 \updownarrow , Z = 70 \updownarrow
 Zoom = 100 % 100

Brightness = 70 % Contrast = 70 %

Dose unit : % Gy 100.0000 % 80 Gy

ColorWash :
 Opacity = 50 % 96.0000 % 72 Gy

Upper Cut = 80.00 Gy 85.3333 % 64 Gy
 Lower Cut = 0.75 Gy 74.0000 % 56 Gy

Isodose (Gy) :
 5*, 10, 25, 50*, 70 64.0000 % 48 Gy

53.3333 % 40 Gy
42.0000 % 32 Gy
32.0000 % 24 Gy
21.3333 % 16 Gy
10.0000 % 8 Gy
0.0000 % 0 Gy

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