HÔPITAL RIVIERA-CHABLAIS
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L’intelligence artificielle au service de la thérapie

Marc Pachoud, PhD

Physicien médical – Chef de service Radiothérapie

Congrès CIPIQ-S 2024 - Rennaz

03.10.2024

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Disclosures

- Elekta GmbH

- Mvision GBS™ AI https://www.mvision.ai/

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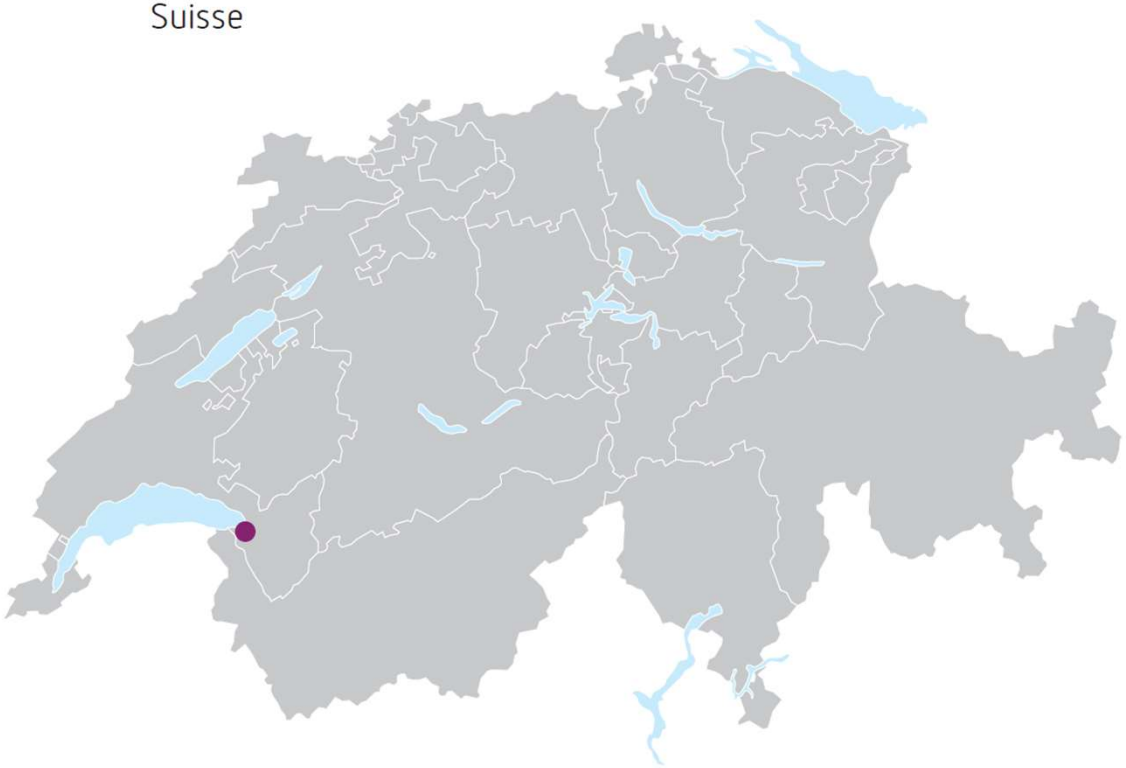
Riviera Chablais Hospital

Localisation

Route du Vieux-Séquoia 30, 1847 Rennaz
Suisse



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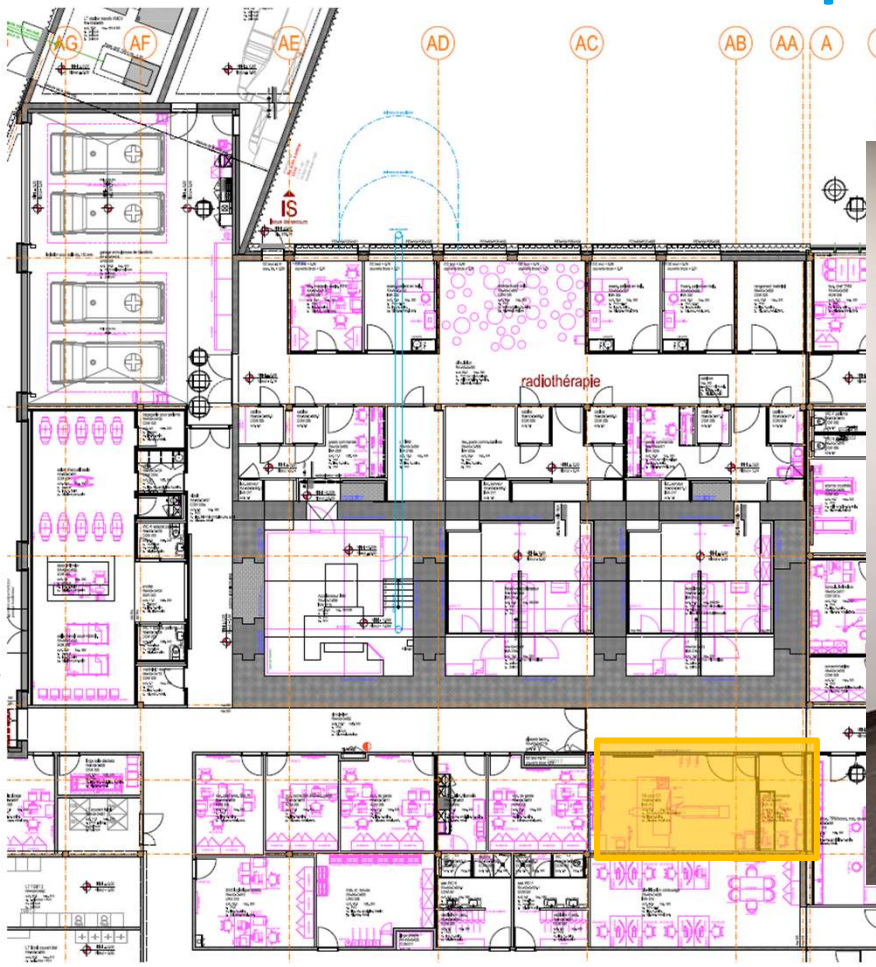

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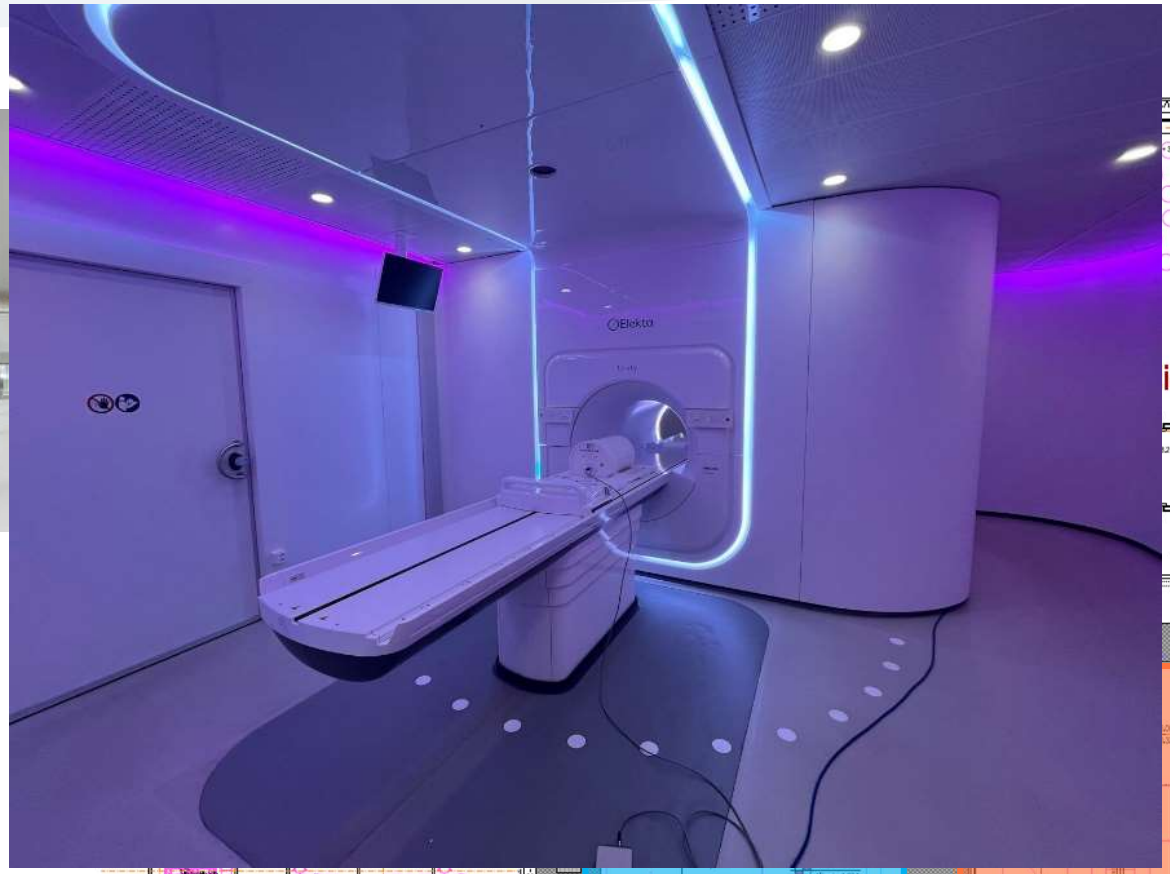

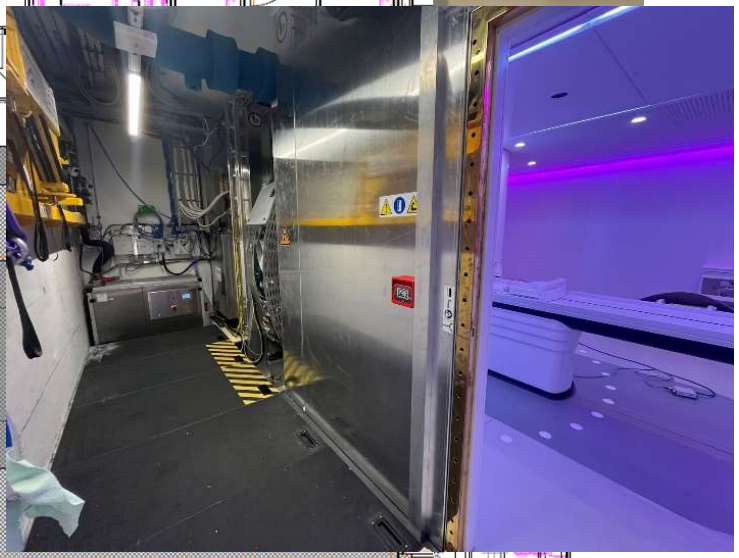

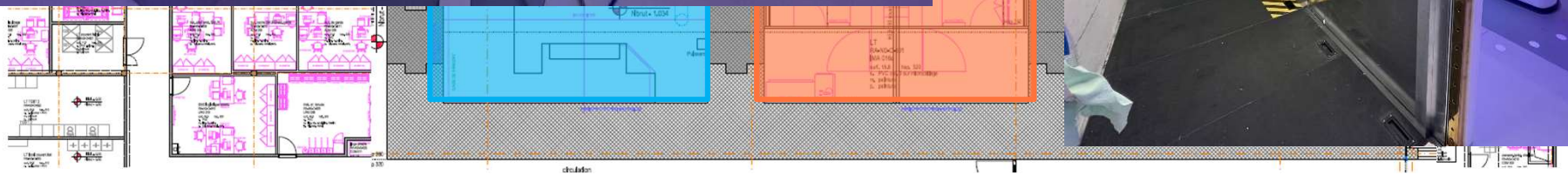

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Department - Staff

- 3 Physicists (2.5 full time)
- 8 RTTs (6.8 full time)
- 3 Med Radio oncologists senior
- 2 Med in training
- 3 Secretaries (2.8 full time)
- 3 Nurses (2.8 full time)

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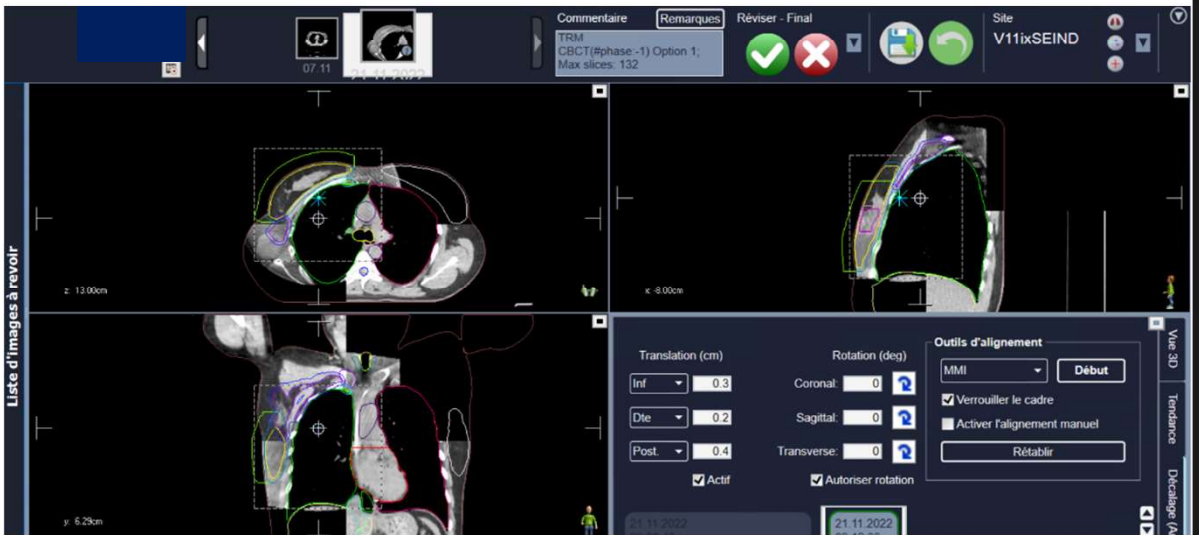
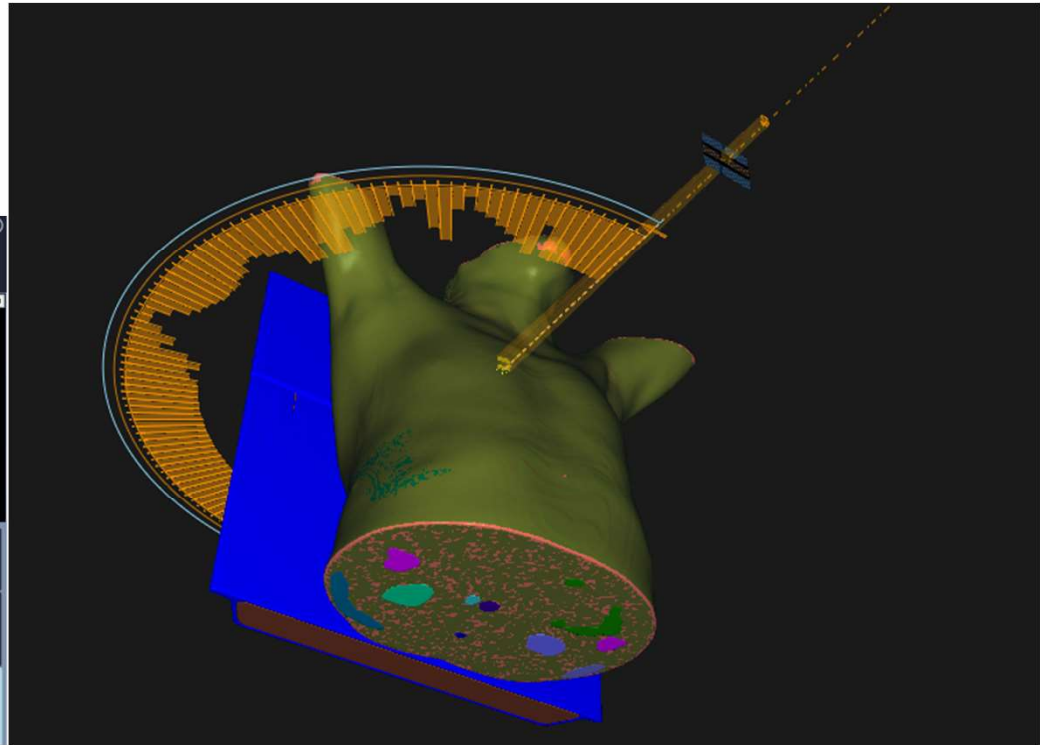
IT Equipment

- Paperless department
- MosaiQ 2.83
- RayStation 11B
- Monaco 5.51
- Mvision AI for contouring





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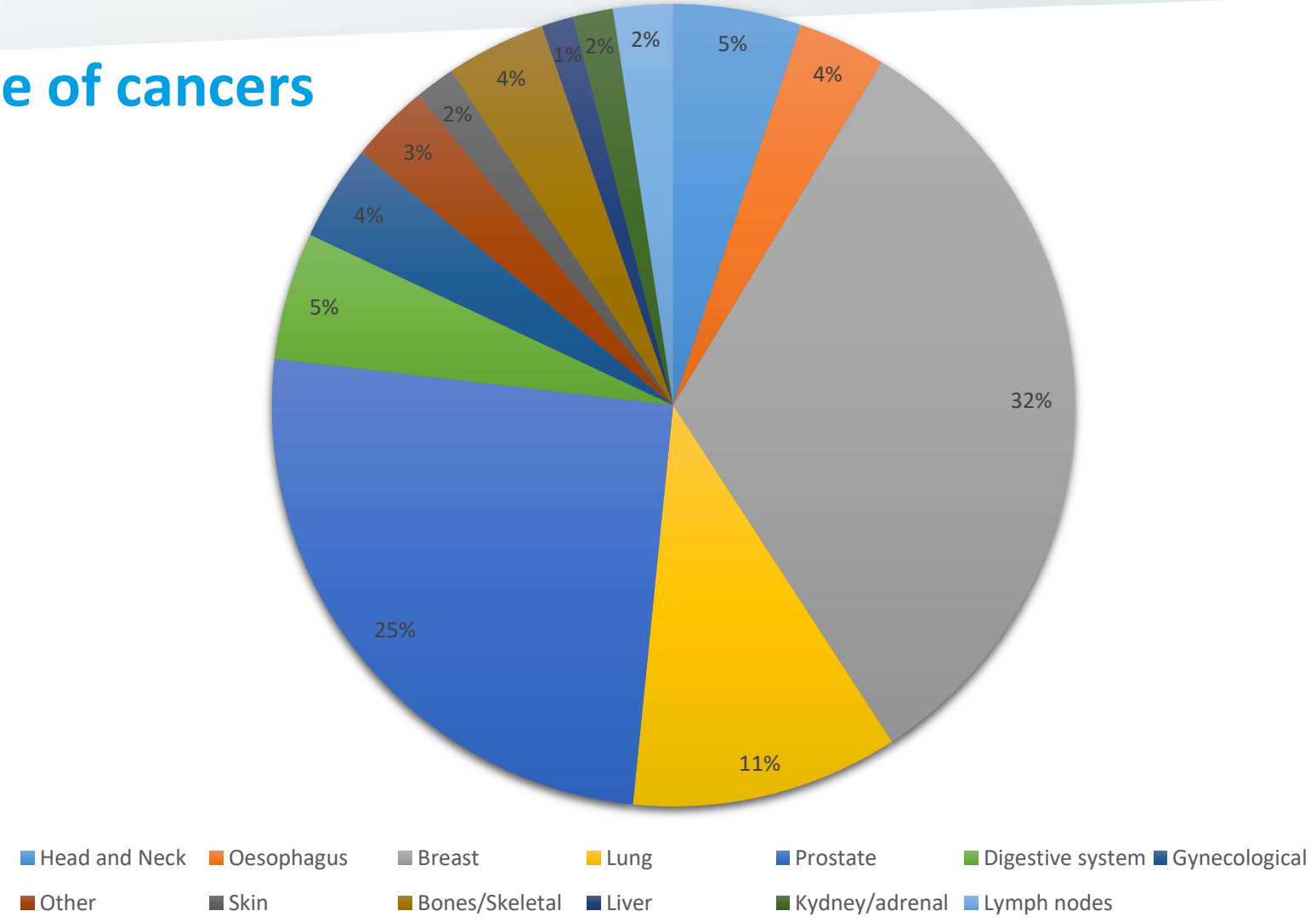
Type of cancers



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Challenges

- Increase of workload
  - No more staff
  - Improve deadline
- Large volumes involving lymph nodes
  - Pelvis, Breast, Head and Neck,…
- Improvement of time spend by staff for contouring
- Variety of tumor localization

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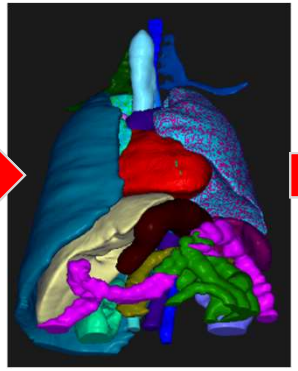
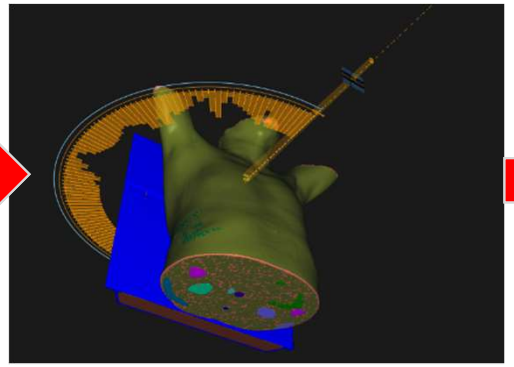
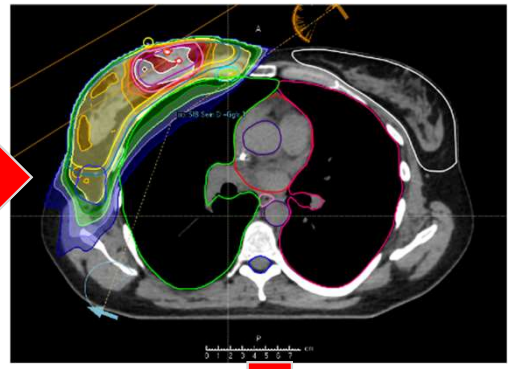
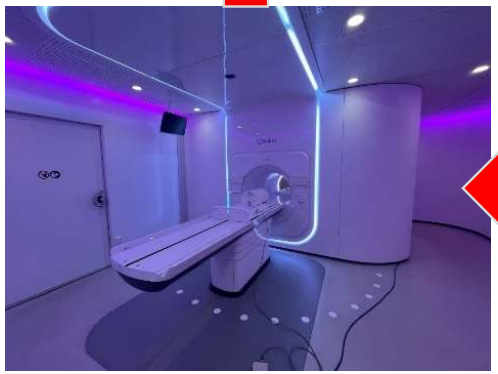
Clinical workflow in radiotherapy









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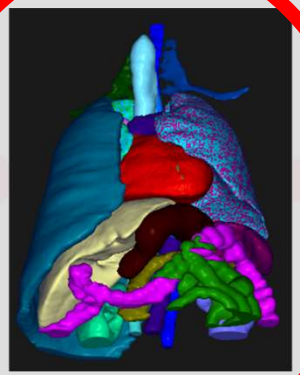
Clinical workflow in radiotherapy



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Our needs

- Contouring time reduction of target and organs at risks
- Quality, not user dependent – Increase of consistency
- Neutral – Not dependent of imaging equipment and TPS
- Decrease of our IT workload – No new IT infrastructures

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Solution – Project time line

- August 2021 – Demonstration at Booth MVision @ ESTRO
- August-December 2021 – Discussion with our local distributor
  - Evaluation using MVision demo tool on our clinical data
- December 2021 – Budget accepted by our hospital direction
- May 2022 – Product installed and in clinical use for all our patients

MVISION
- Artificial Intelligence in Medical Imaging -

intelliAed

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Solution

- Efficiency – Less than 5 min to generate contours
- Robustness
- Data privacy
- Customizable – color/names/type of structures
- Cloud based solution – Minimum resources of IT staff
- **Based on international Guidelines and Atlases**
  - **RTOG, ESTRO,….**
- Easy integration in our clinical workflow
- Pay per use model

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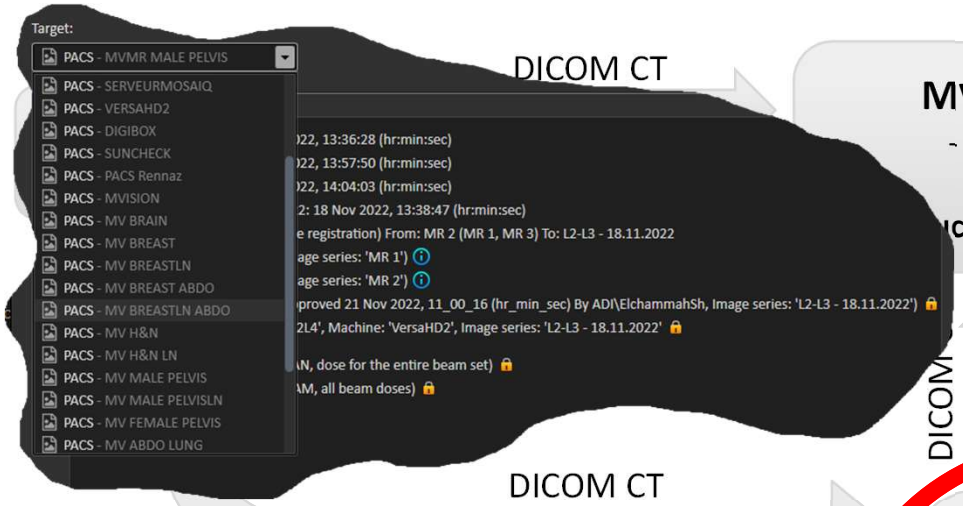
Clinical workflow

MVision AI Segmentation Service

Hospital Firewall



DICOM CT

MVision Daemon
- **Anonymization**
- **CT Protocol**
- **ctures Name/Type/Color**

Treatment machines

DICOM RT

DICOM

DICOM RT-Structures

DICOM CT

MosaiQ
EMR and R&V

DICOM RT

Elekta Versa HD

PET/CT Modality
Nuclear medicine

MR Modality
Radiology

PACS

DICOM

TPS
RayStation

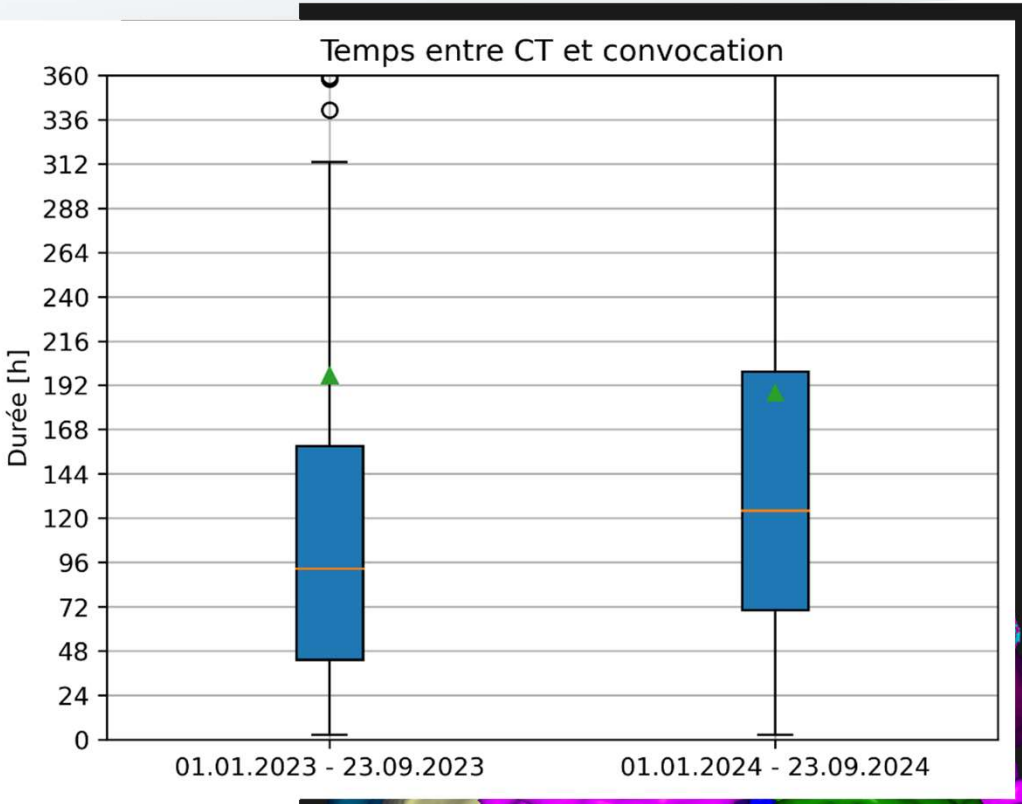
DICOM RT

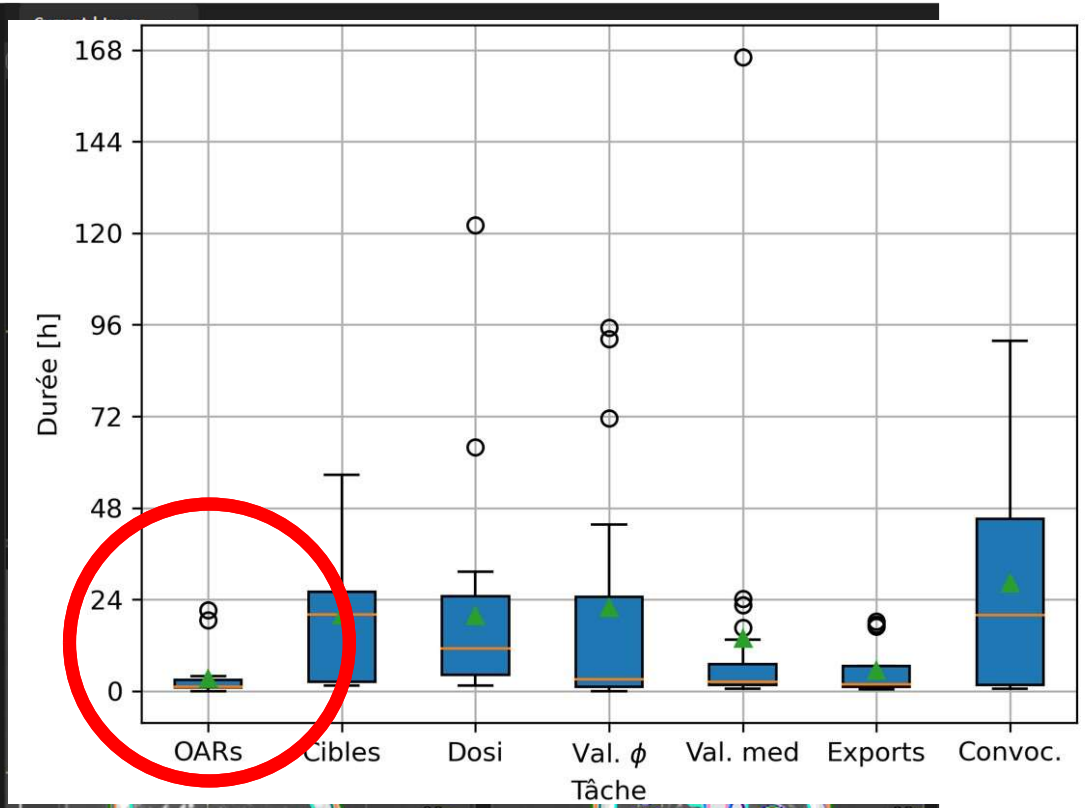
Elekta Unity

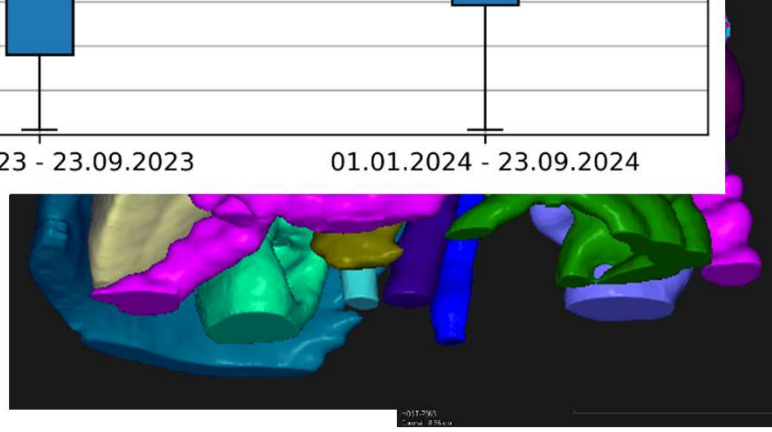
DICOM RT

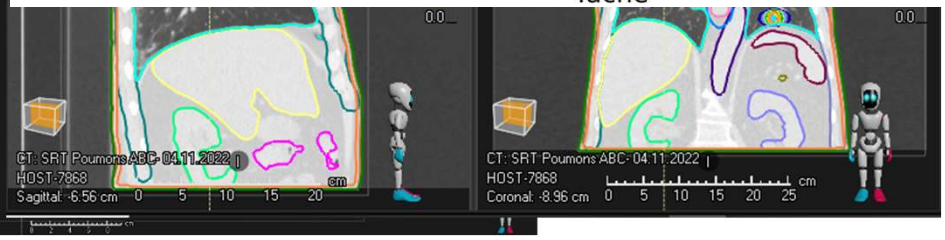
TPS
Monaco

Lung SBRT (8x7.5 Gy)









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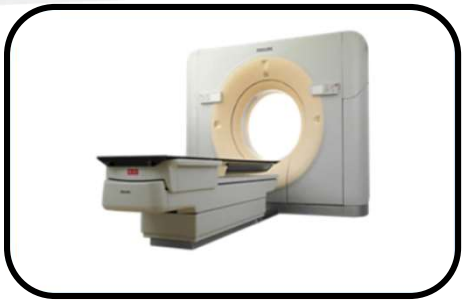
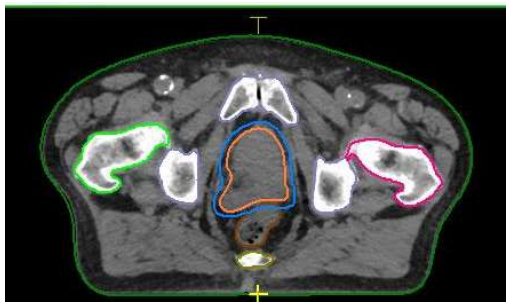
Next step using AI…

Current established clinical workflow



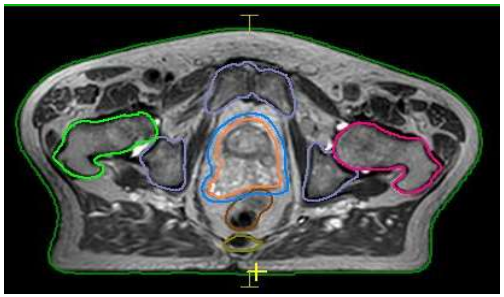
Patient setup and CT imaging

45 min



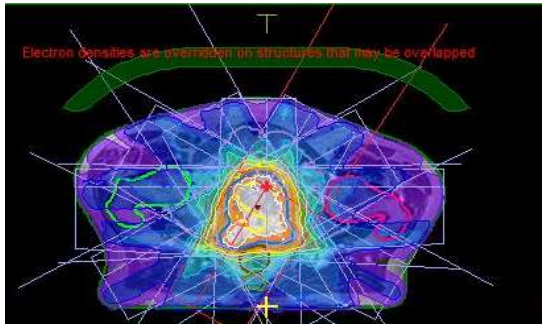
Contouring

5 min



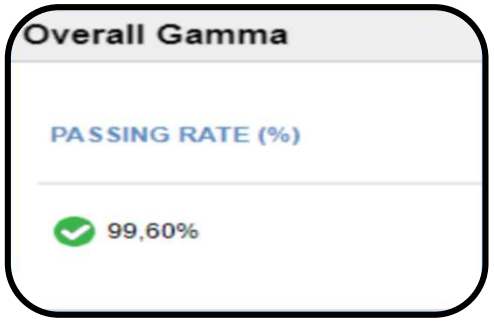
Contouring

50 min



Dose calculation

60-80 min



Patient's QA

15 min

Patient setup and treatment delivery

20 min

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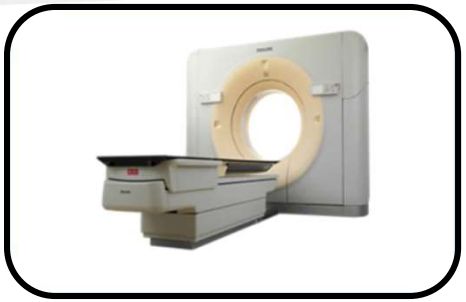
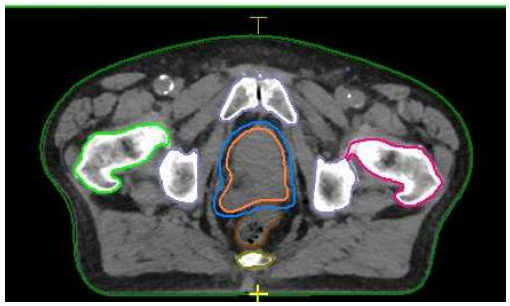
Current established clinical workflow



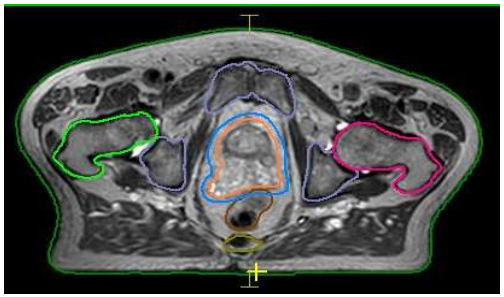
Patient setup and CT imaging

45 min



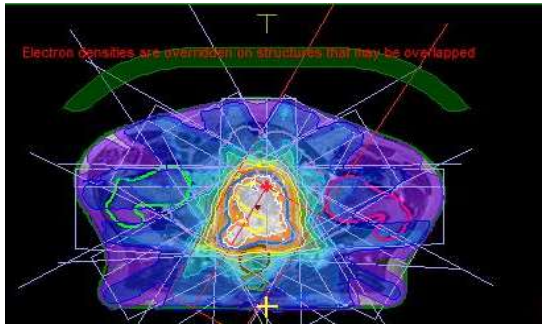
Contouring

5 min



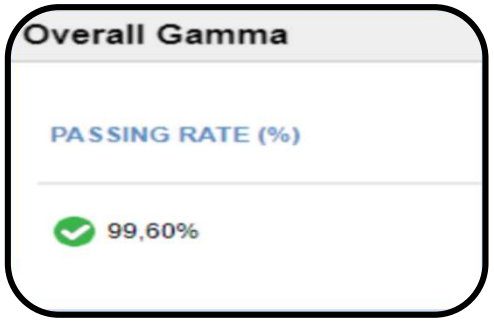
Contouring

50 min



Dose calculation

60-80 min



Patient's QA

15 min

Patient setup and treatment delivery

20 min

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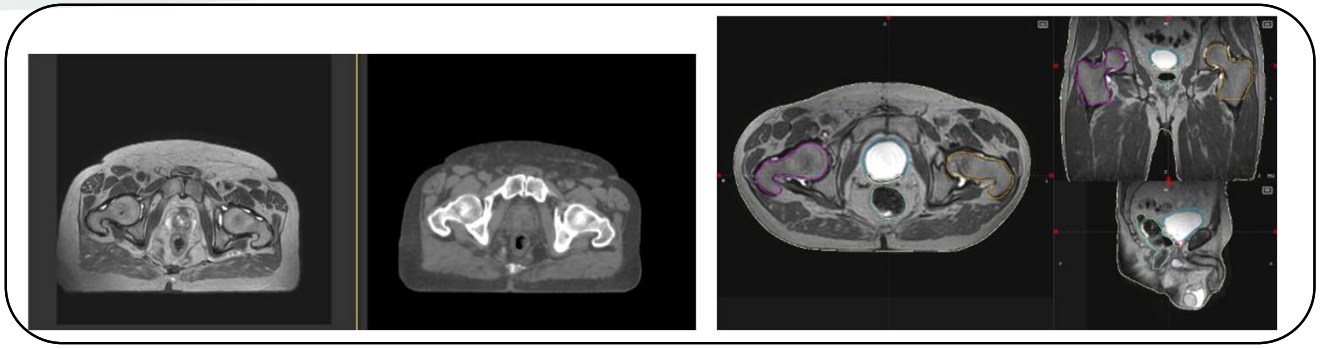
Future established clinical workflow

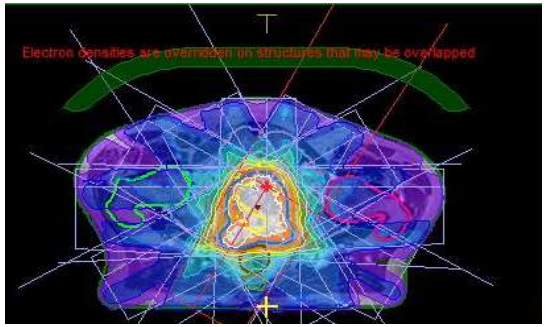
Patient setup and MR imaging

30 min



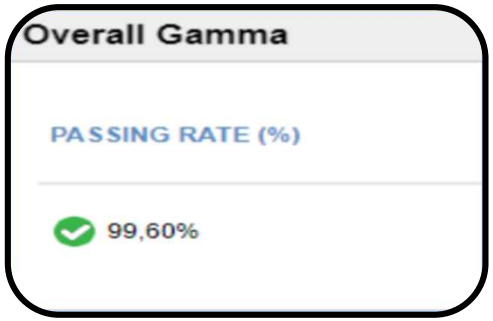
Contouring & sCT generation

5 min



Dose calculation

60-80 min



Patient's QA

15 min

Patient setup and treatment delivery

20 min

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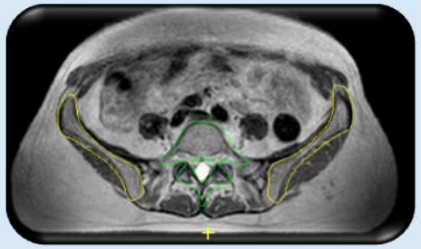
Current established clinical workflow

Simulation & Treatment delivery

High quality imaging



AI-powered auto-segmentation

MR-only workflow on Unity

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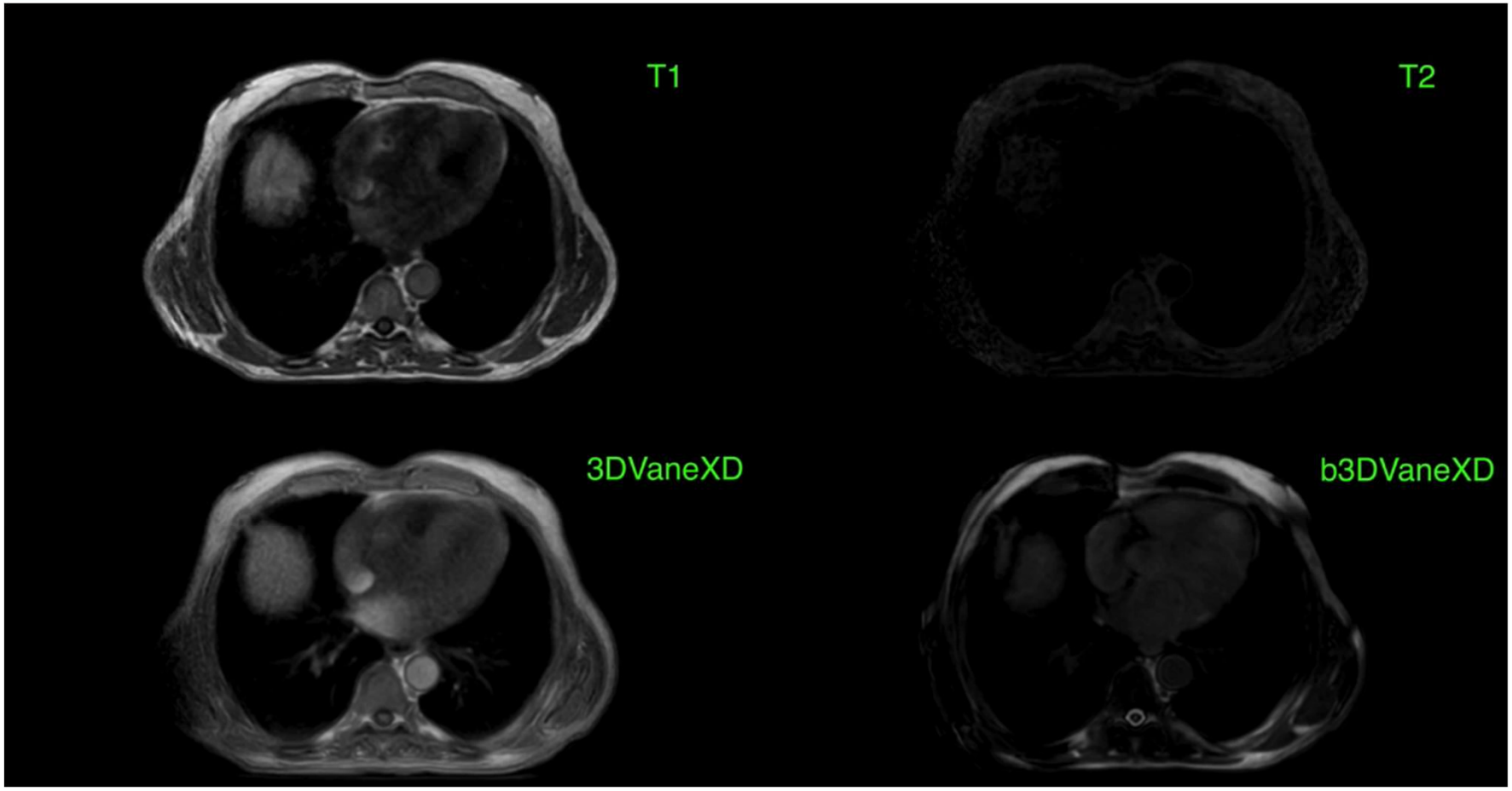
MR-only workflow on Unity



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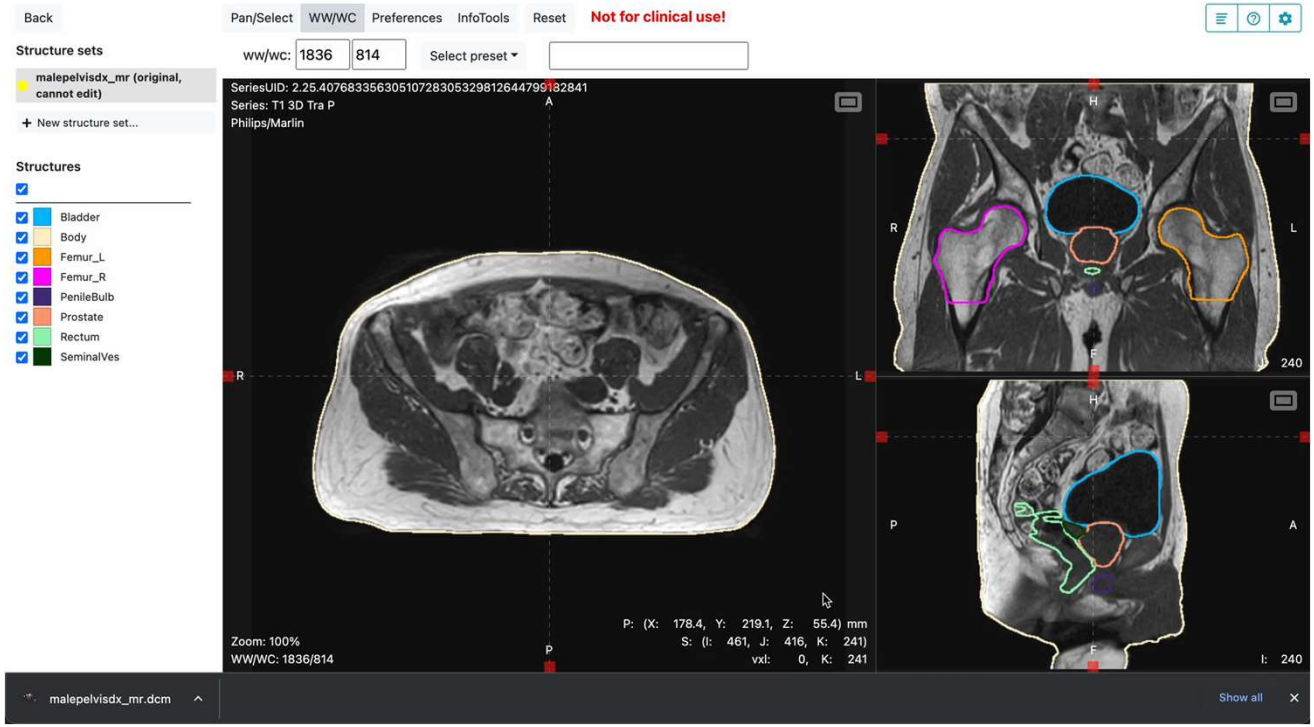
MR-only workflow on Unity

- Auto-segmentation early results below from current running project with very limited, unpaired training samples
- Main structures (including bony anatomy) in less than 3 minutes



*MVision AI, work in progress

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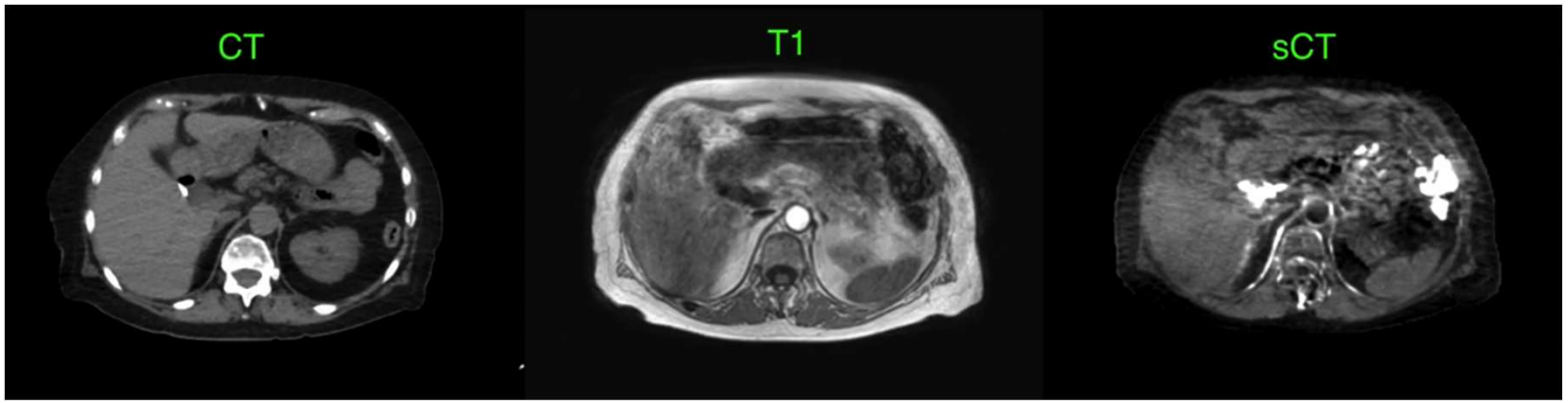
MR-only workflow on Unity

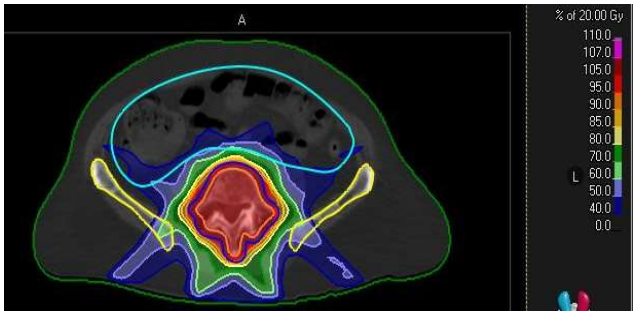
- sCT early results below from current running project with very limited, unpaired training samples

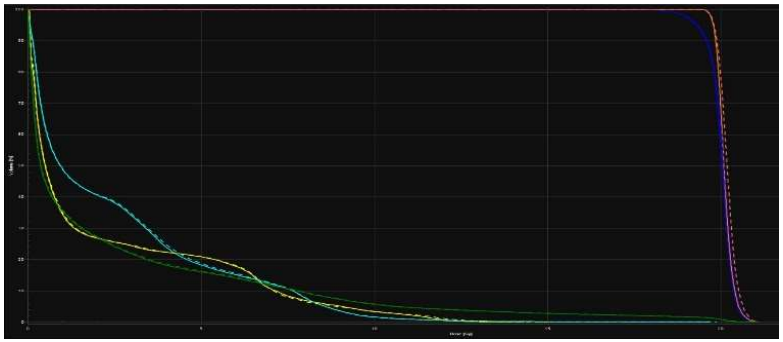


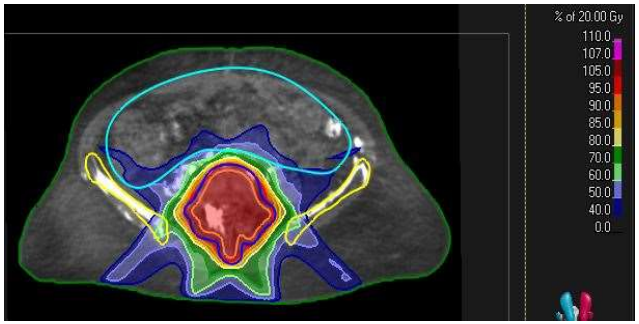
*MVision AI, work in progress

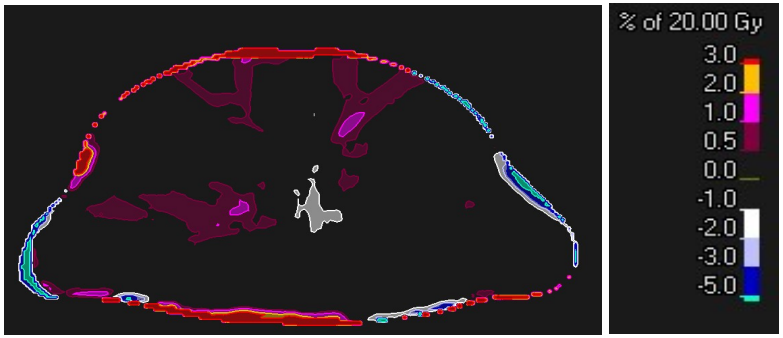
Early results- Dose distribution assessment on sCT

- The plan calculated on the original CT was recalculated on the sCT using the same beam parameters
  - DVH parameters were compared between the CT and the sCT for all ROIs
  - ΔDose [%]









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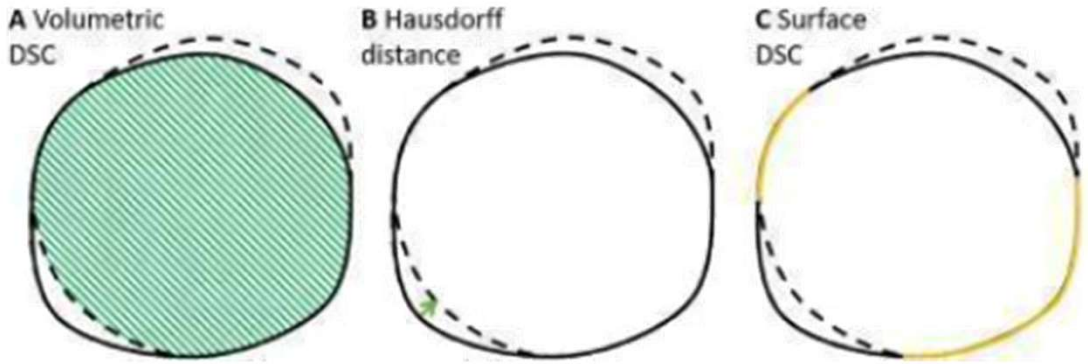
Validation of MR Male pelvis T2 model

- Quantitave evaluation of version 1.2.4 MR Male Pelvis T2 model versus manual contouring on Unity 1.5T:
  - DICE
  - Surface Dice
  - Hausdorff distance 95%



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Validation of MR Male pelvis T2 model

- Quantitave valuation of version 1.2.4 MR Male Pelvis T2 model versus manual contouring on Unity 1.5T:

Structure	Test volume (cm^3)	Reference volume (cm^3)	Volume difference (%)	DSC	S-DSC (@2mm)	HD95 (mm)
Body	14464.48	14687.44	-1.5	0.979	0.770	5.3
Femur_L	128.07	151.29	-15.3	0.885	0.816	17.3
Femur_R	130.69	159.40	-18.0	0.869	0.774	20.4
Bladder	148.91	140.48	6.0	0.952	0.957	2.0
PenileBulb	3.57	2.68	33.2	0.687	0.797	10.9
Rectum	46.16	49.92	-7.5	0.905	0.923	2.4

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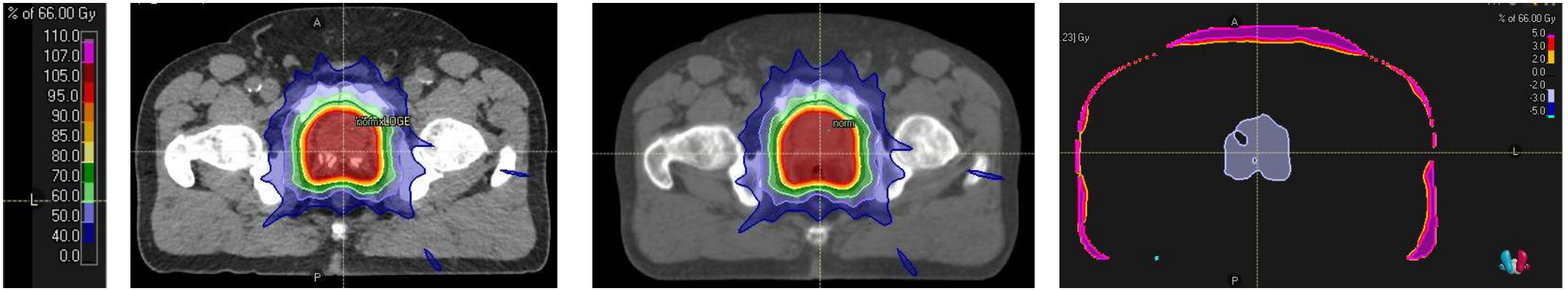
Quantitative comparison manual vs AI contours per organ

	DSC			S-DICE @2mm			HD95 (mm)			Volume (cc) HRC	Volume (cc) MVision AI	Volume diff (%)	
ROI	mean	Std	median	mean	std	median	mean	std	median	mean	mean	mean	std
Bladder	0.919	0.034	0.921	0.853	0.144	0.914	3.1	1.1	3.0	106.4	121.6	-12.9	6.5
Femur_L	0.872	0.036	0.875	0.766	0.124	0.825	14.0	9.2	11.3	123.5	111.3	10.8	14.2
Femur_R	0.861	0.034	0.854	0.724	0.163	0.773	15.8	9.8	13.7	129.9	111.7	16.04	16.6
PenileBulb	0.668	0.114	0.691	0.765	0.119	0.765	5.5	3.2	4.6	3.0	3.0	10.07	43.4
Rectum	0.805	0.063	0.805	0.700	0.119	0.680	11.6	5.8	11.7	59.9	55.3	11.32	27.1

Early results- Dose distribution assessment on sCT

- The plan calculated on the original CT was recalculated on the sCT using the same beam parameters
  - ΔDose [%]



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Conclusions

- Efficiency in a clinical workflow – Less than 5 min to generate contours
- Robustness
- Data privacy
- Cloud based solution – Minimum resources of IT staff – Easy to implement
- “Objective” – No user dependent
- Improve clinical workflow – Less radiation by tomodensitometry – Replace by MR-Only workflow
- Patient safety improvement
- We lose expertise
- We lose control of the workflow on some steps

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Thank you for your attention