A background image showing a patient lying on a table inside a Tomotherapy HI-ART system. The machine's gantry is visible, and the patient is positioned for treatment. The text is overlaid on this image.

# Set up accuracy of patients with head and neck tumors using the megavoltage computed tomography image capacity of a helical Tomotherapy system

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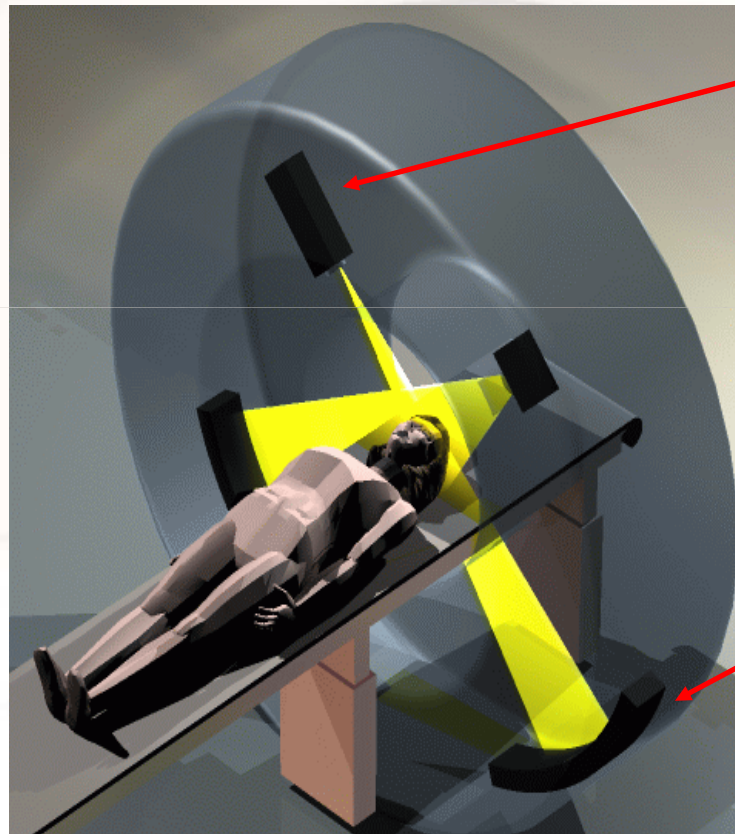
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# Introduction

TomoTherapy  
HI-ART

Linear  
accelerator



Imaging  
device

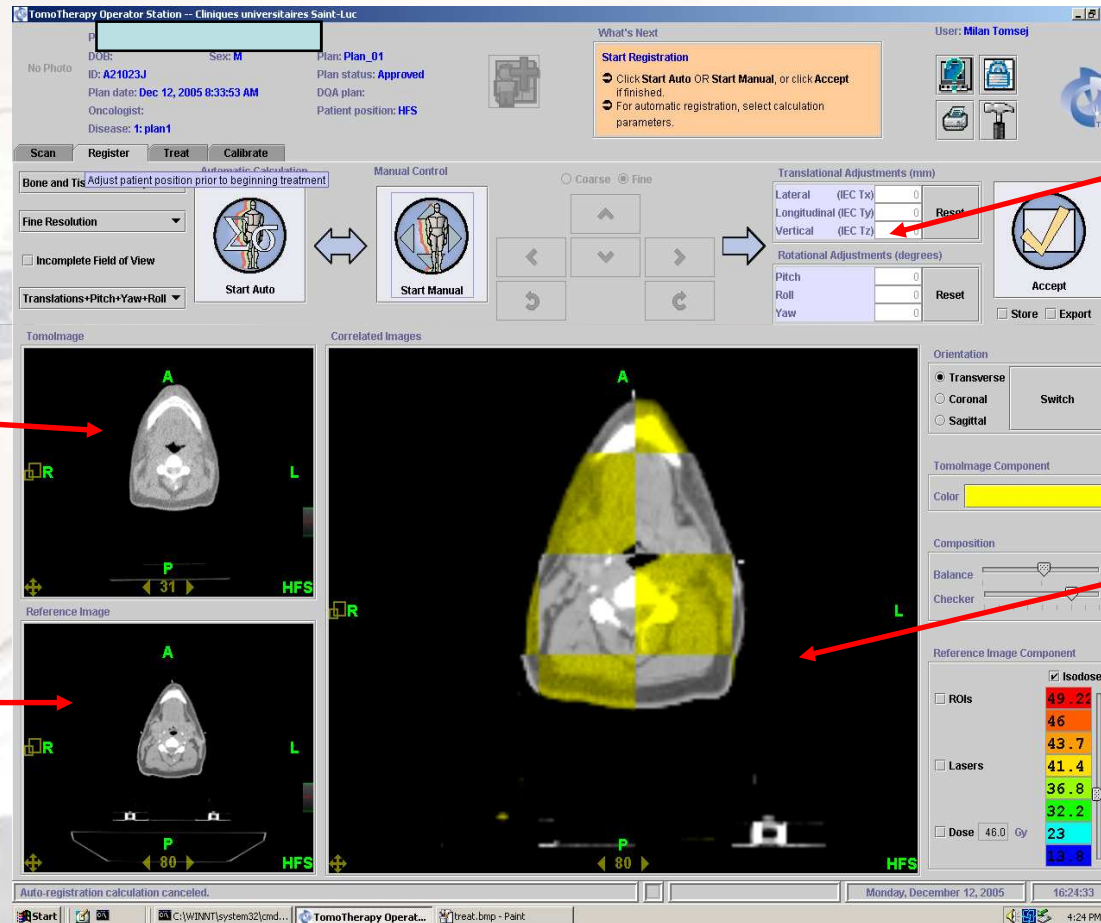
Helical tomotherapy system

# Objectives

- Compare the automatic deviations to the accepted deviations
- Calculate the systematic and random positioning deviations of patients immobilized by head and shoulder masks
- Evaluate if MVCT realized during the five first fractions were sufficient to predict the systematic deviations for the rest of the treatment in head and neck patients.

# Materials and Methods I

TomoTherapy  
HI-ART



Detected deviations

Superposition of the MVCT on the kVCT

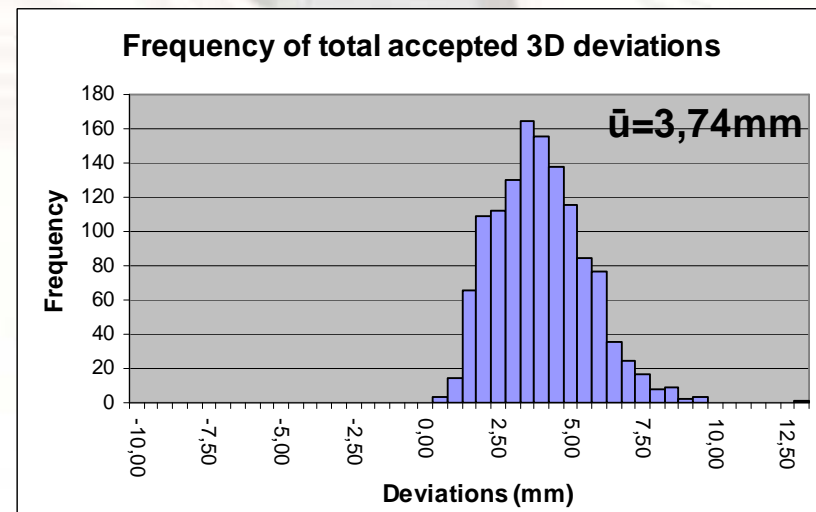
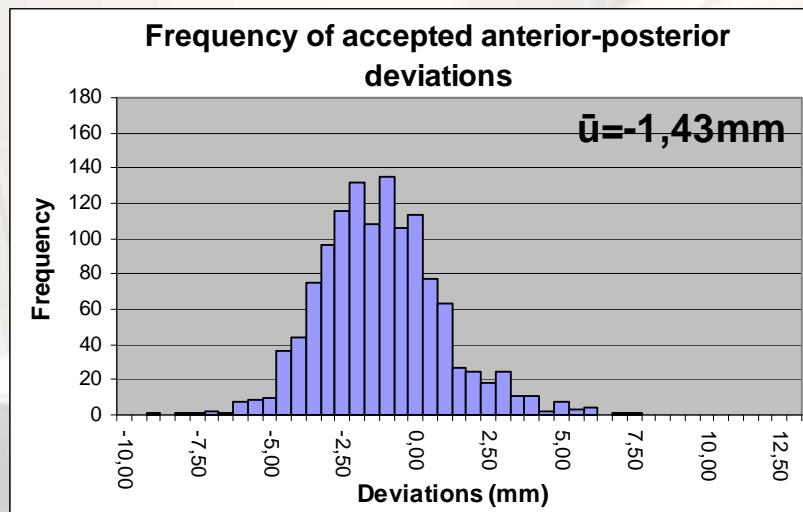
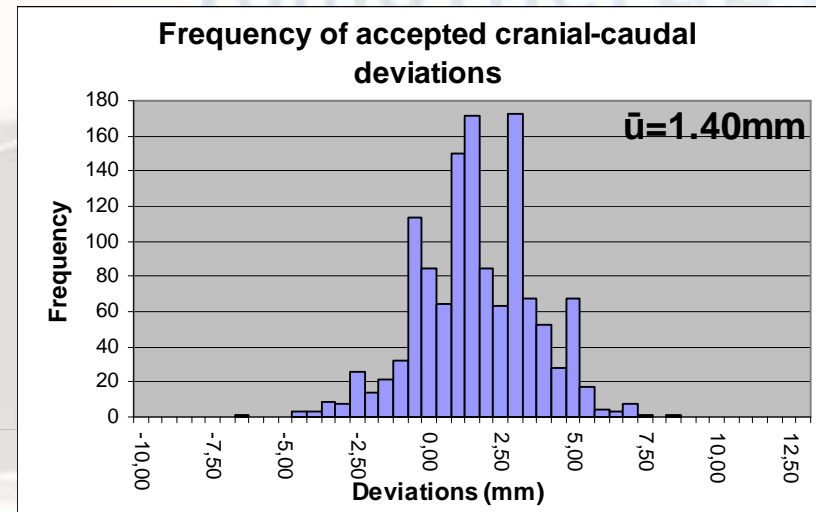
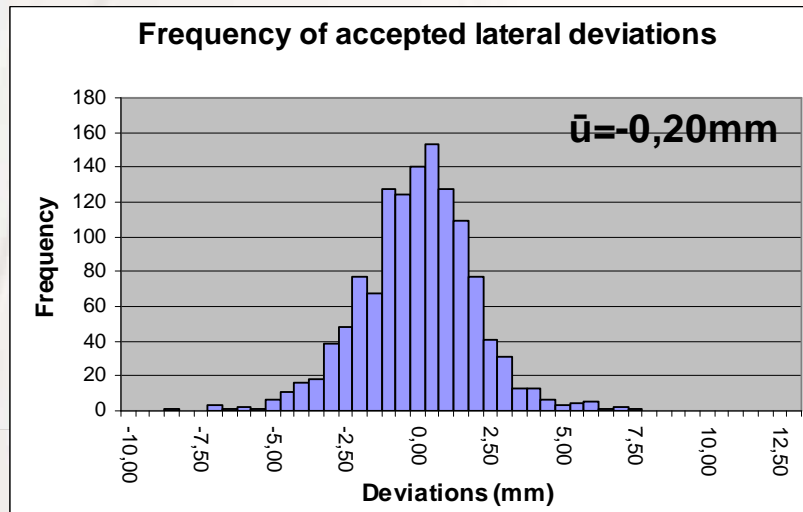
MVCT

kVCT

# Materials et Methods II

- Accepted and automatic deviations were obtained for
  - 41 patients immobilized by shoulder and neck thermoplastic masks
  - Which accounts for a total of 1269 MVCTs
- These measures where then statistically studied on a patient and population basis

# Results I: Accepted deviations



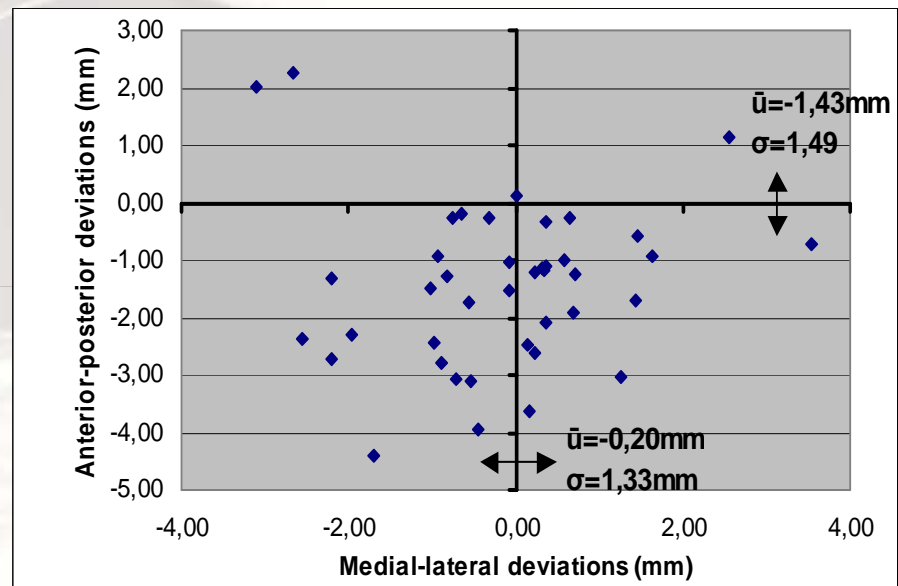
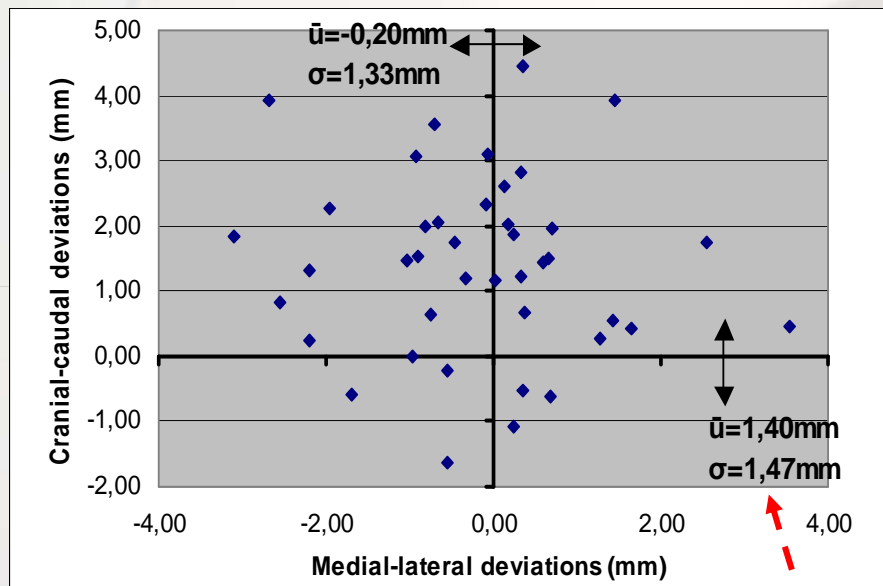
# Results II: Comparison of automatic and accepted deviations

	Automatic deviations (mm)	Accepted deviations (mm)	Difference between accepted and automatic deviations (mm)	Paired T-test Automatic v.s Accepted
Medial-lateral deviations	-0,09	-0,20	0,11	p<0,001
Cranial-caudal deviations	1,28	1,40	-0,12	p<0,001
Anterior-posterior deviations	-1,64	-1,43	-0,21	p<0,001

Patients with differences between automatic and accepted deviations superior to 1mm:

- 3 patients in the medial-lateral direction
- 1 patient in the cranial-caudal direction
- 8 patients in the anterior-posterior direction

# Results III: Accepted deviations



$\bar{u}$  = mean of systematic deviations  
 $\sigma$  = mean of random deviations

# Results IV: Systematic deviation predictive power of MVCTs

	Systematic deviation after 5 days	Systematic deviation for the rest of the treatment	CTV to PTV margin ( $2 \cdot \bar{u} + 0,7\sigma$ )	
			not corrected	corrected
Lateral deviations (mm)	-0,14	-0,27	1,32	1,04
Cranial-Caudal deviations (mm)	1,62	1,39	3,84	1,45
Anterior-posterior deviations (mm)	-0,80	-1,54	3,91	2,31

# Conclusion

- Automatic deviations are significantly different from the accepted deviations yet the difference is minimal
- On a population basis, the systematic deviations are in the same order of magnitude as the random deviations however differences were observed on a patient basis
- The systematic deviations calculated based on the first 5 MVCTs are different from the systematic deviations existing during the rest of the treatment but the clinical relevance of this difference can be discussed
- Nevertheless, if the systematic deviations calculated during the first 5 days are corrected for during the rest of the treatment, it is possible to significantly reduce the CTV to PTV margin