



Lung Module

Appendix C

UPDATED MAY 15TH, 2017

Disclaimer

- This learning module was created as a guideline to standardize and facilitate the education and training of lung IGRT.
- This information was compiled as a result of a province-wide initiative examining the current state of lung IGRT.
- This module is designed to be adjusted to include your centre's site specific policies and procedures, including tolerances and thresholds.
- This material is based on a guideline previously created by members of the Radiation Therapy Community of Practice (CoP) – IGRT Education Working Group, and adapted by the Lung IGRT Working Group under the Lung CoP.

Scope

- This training module pertains to specifically radical, non-SBRT lung cancer patients

Cross Sectional Anatomy

- Knowledge of thoracic cross-sectional anatomy is beneficial.
- <https://www.rtog.org/CoreLab/ContouringAtlases/LungAtlas.aspx>

Imaging Recommendation

- Daily kV CBCT
- Please follow your departmental procedure
- CBCT guidelines:
 - Optimize image quality and dose for the thorax
 - At minimum, include entire tumour volume and vertebrae at the same level
- Due to the challenges inherent to the thorax, it is recommended that there is a level of expertise required

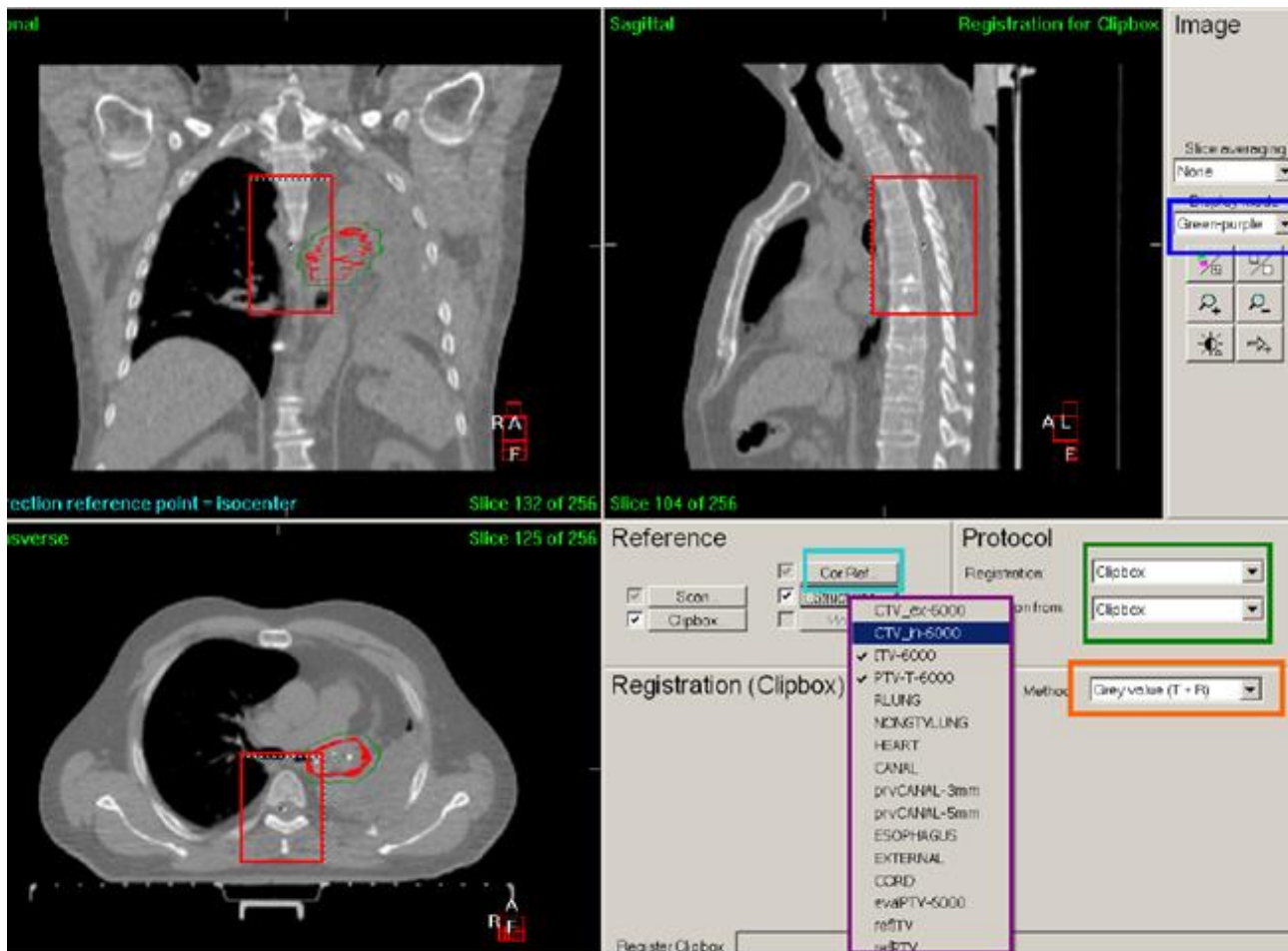
IGRT Guidelines

1. Bony match to spine
2. Ensure the visible mass is within the PTV
3. Evaluate spinal canal
4. Evaluate any OARs, if applicable

1. Bony match to spine

- Bony match to spine, first using automatic matching software (clipboard as per departmental policy), followed by manual adjustments
- Verify SUP/INF positioning (e.g. with carina, insertion of last rib, etc.)

Lung IGRT Clipbox



3. Evaluate spinal canal

- Where critical doses are close to the canal, additional evaluation may be required (isodose lines may be used to flag these situations).

***NB. Do not shift based on isodose lines

3. Evaluate spinal canal

VolumeView Registration: Patient ID: 3020620 Name: [REDACTED]

File Help

Coronal **Sagittal** **Image**

Showing possible correction

Slice averaging: None

Display mode: Localization on

Correction reference point: [REDACTED]

R A

Slice 135 of 270

Transverse **Reference** **Protocol**

Slice 194 of 264

Registration: Clipbox

Correction from: Clipbox

Review Correction

Position Error

Translation (cm)		Rotation (deg)	
X	0.17	X	0.0
Y	0.61	Y	0.0
Z	-0.30	Z	0.0

Accept Correction

Register Clipbox Correction Overview

VolumeView Registration Dismiss Accept

9/20/2012 9:09:07 AM Scan Time: 8/8/2012 2:24:29 PM

Scenarios you may encounter

- Atelectasis (+/- fluid)
- Collapsed lung
- Re-inflated lung
- Growth of tumour
- Shrinkage of tumour
- Shift of tumour (i.e. target outside PTV)
- Poor tumour visibility (i.e. poor image quality)
- Pt rotation/roll/pitch
- Carina mis-match

If you encounter any of the above situations while imaging, please consult with your multi-disciplinary team.

Atelectasis

VolumeView Registration: Patient ID: Name:

File Help

Coronal No previous alignment Sagittal Registration for Clipbox Image

Correction reference point = isocenter Slice 217 of 410 Slice 198 of 410

Transverse Slice 129 of 264

Reference

Scan... Cor Ref...
 Clipbox... Structures...
 Mask...

Protocol

Registration: Clipbox
Correction from: Clipbox

Registration (Clipbox) Method: Grey value (T + R)
Automatic Registration

Position Error

Translation (cm)		Rotation (deg)	
X	-0.40	X	0.0
Y	0.02	Y	0.0
Z	0.24	Z	0.0

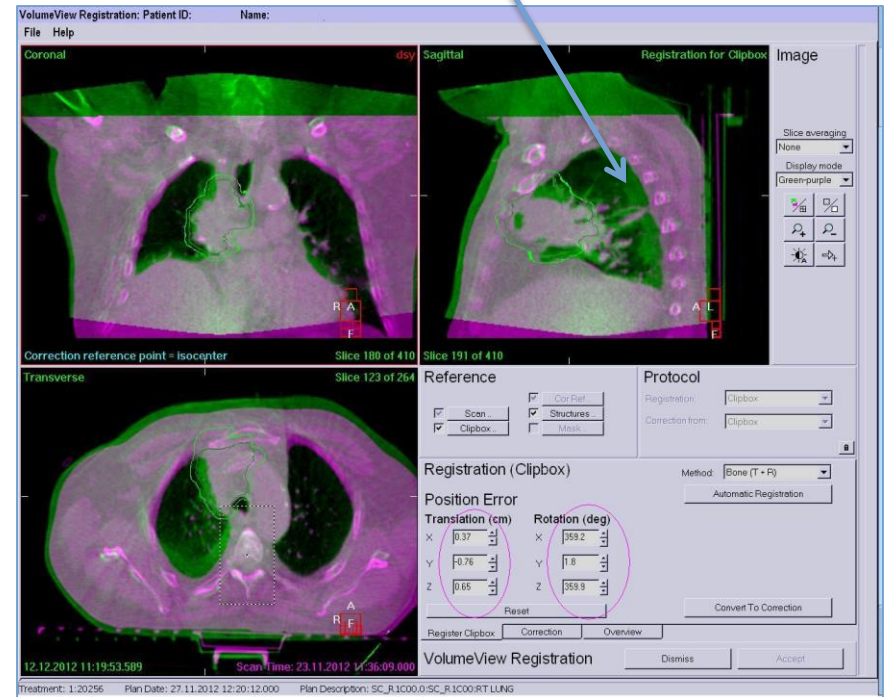
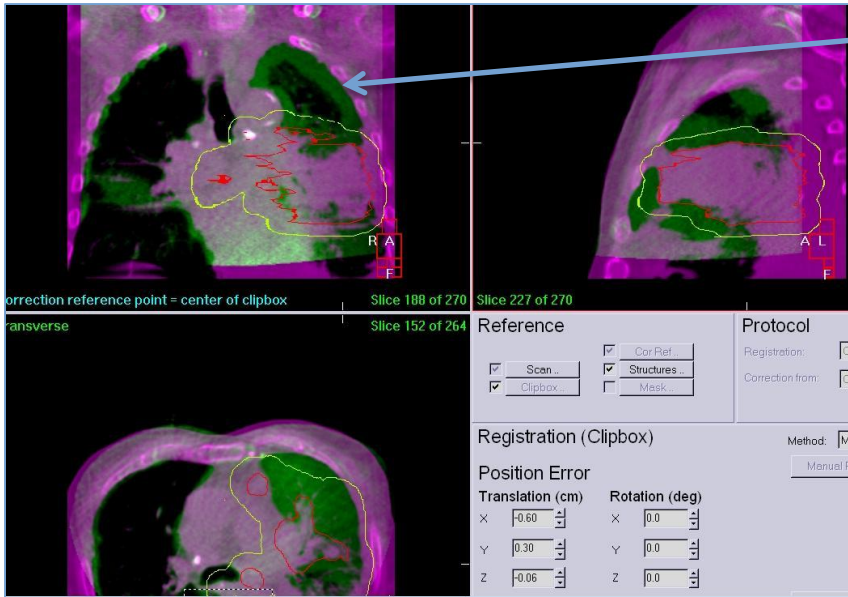
Reset Convert To Correction

Register Clipbox Correction Overview

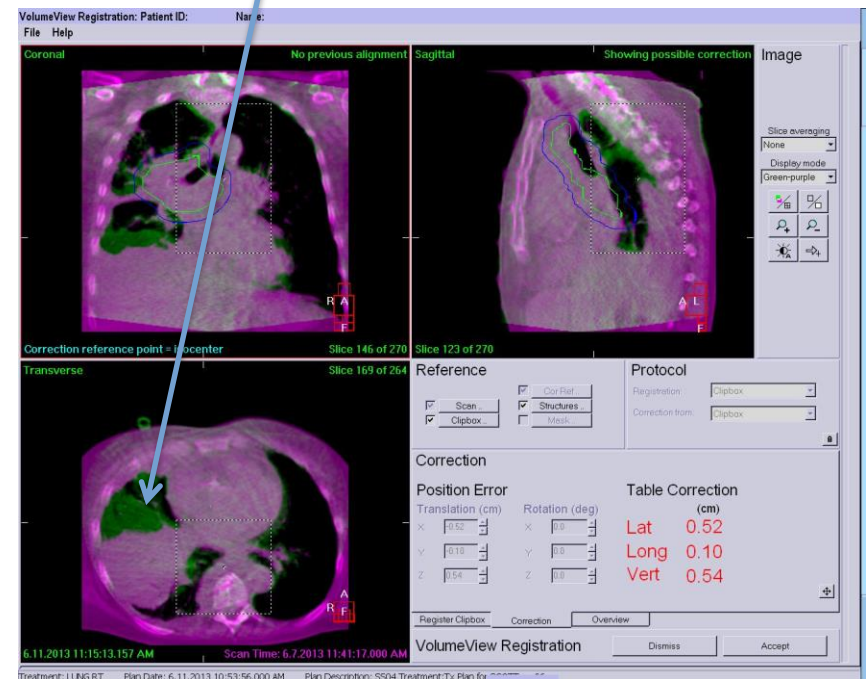
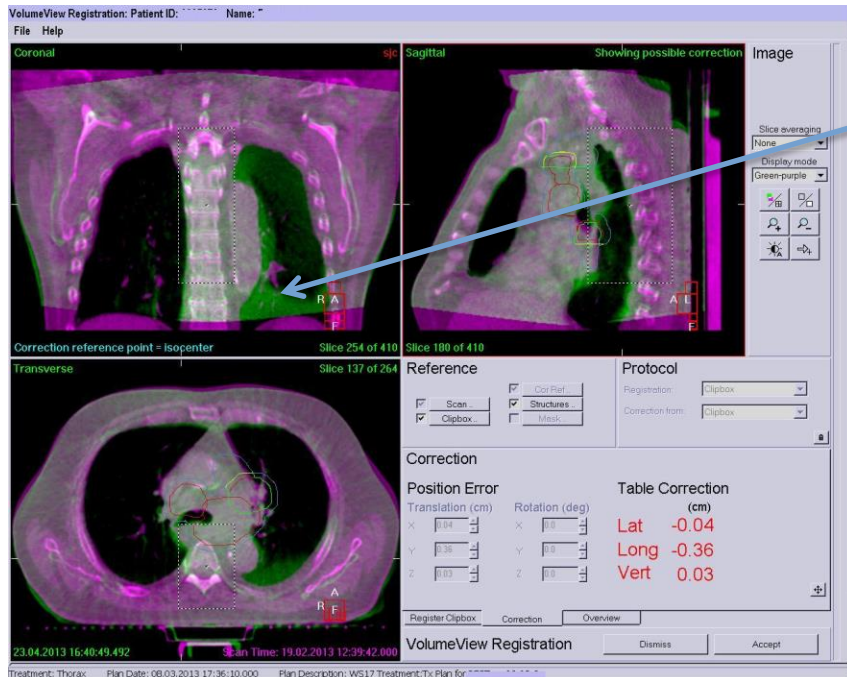
VolumeView Registration Dismiss Accept

26.07.2012 12:14:02.031 Scan Time: 25.06.2012 14:44:28.000

Collapsed Lung/Fluid in Lungs



Collapsed Lung/Fluid in Lungs



Re-Inflated Lung

The screenshot displays a medical software interface for lung registration. It features three main view windows: Coronal (top left), Sagittal (top right), and Transverse (bottom left). Each view shows a CT scan of a chest with a green reference lung and a purple target lung. A yellow box highlights the registration area. The Coronal view is labeled 'Correction reference point = Isqcenter' and 'Slice 222 of 410'. The Sagittal view is labeled 'Showing possible correction' and 'Slice 177 of 410'. The Transverse view is labeled 'Slice 124 of 264'. A control panel on the right includes 'Image' settings (Slice averaging: None, Display mode: Green-purple) and 'Reference' settings (Scan, Clipbox, Cor.Ref., Structures, Mask). Below this is a 'Correction' section with 'Position Error' (Translation and Rotation) and 'Table Correction' (Lat, Long, Vert). At the bottom, a 'VolumeView Registration' dialog box is open with 'Dismiss' and 'Accept' buttons. The status bar at the bottom left shows the date and time '9.6.2016 12:51:28.275 PM' and the scan time 'Scan Time: 9.5.2016 3:15:47.000 PM'.

Reference

- Scan ..
- Clipbox ..
- Cor.Ref ..
- Structures ..
- Mask ..

Correction

Position Error

Translation (cm)		Rotation (deg)	
X	-0.03	X	0.0
Y	-0.13	Y	0.0
Z	0.13	Z	0.0

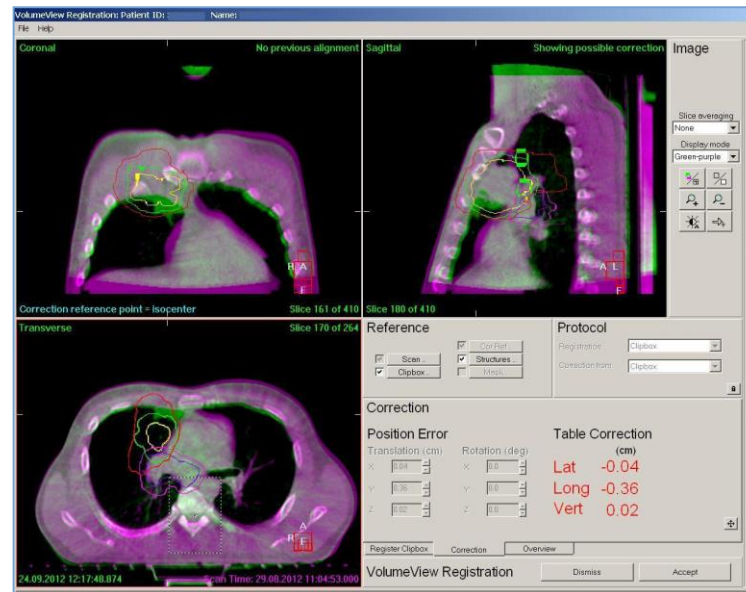
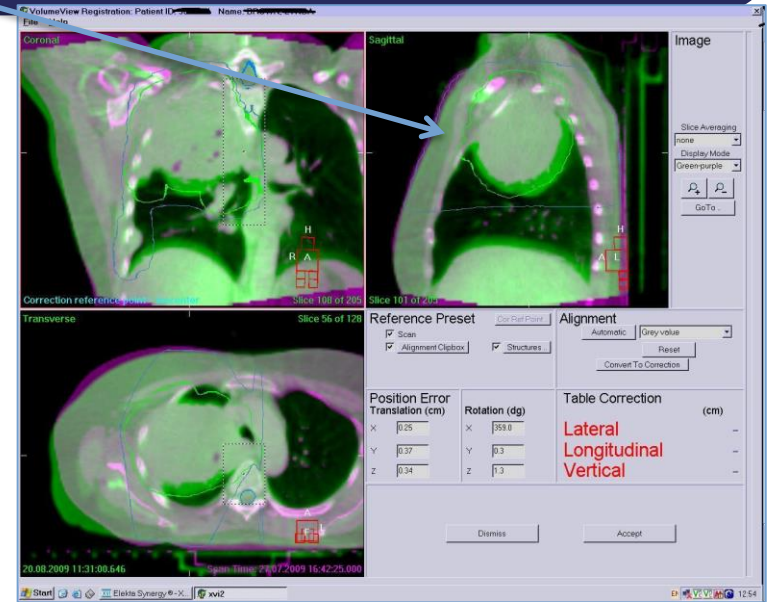
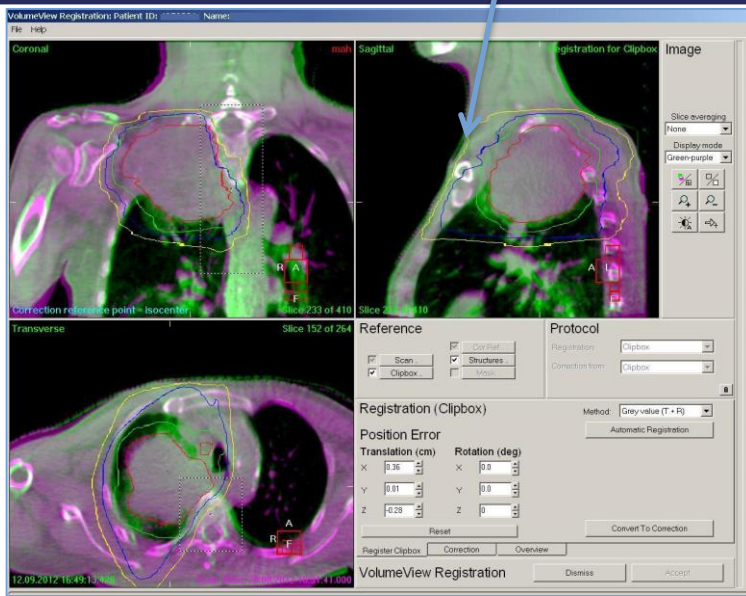
Table Correction

	(cm)
Lat	0.03
Long	0.13
Vert	0.13

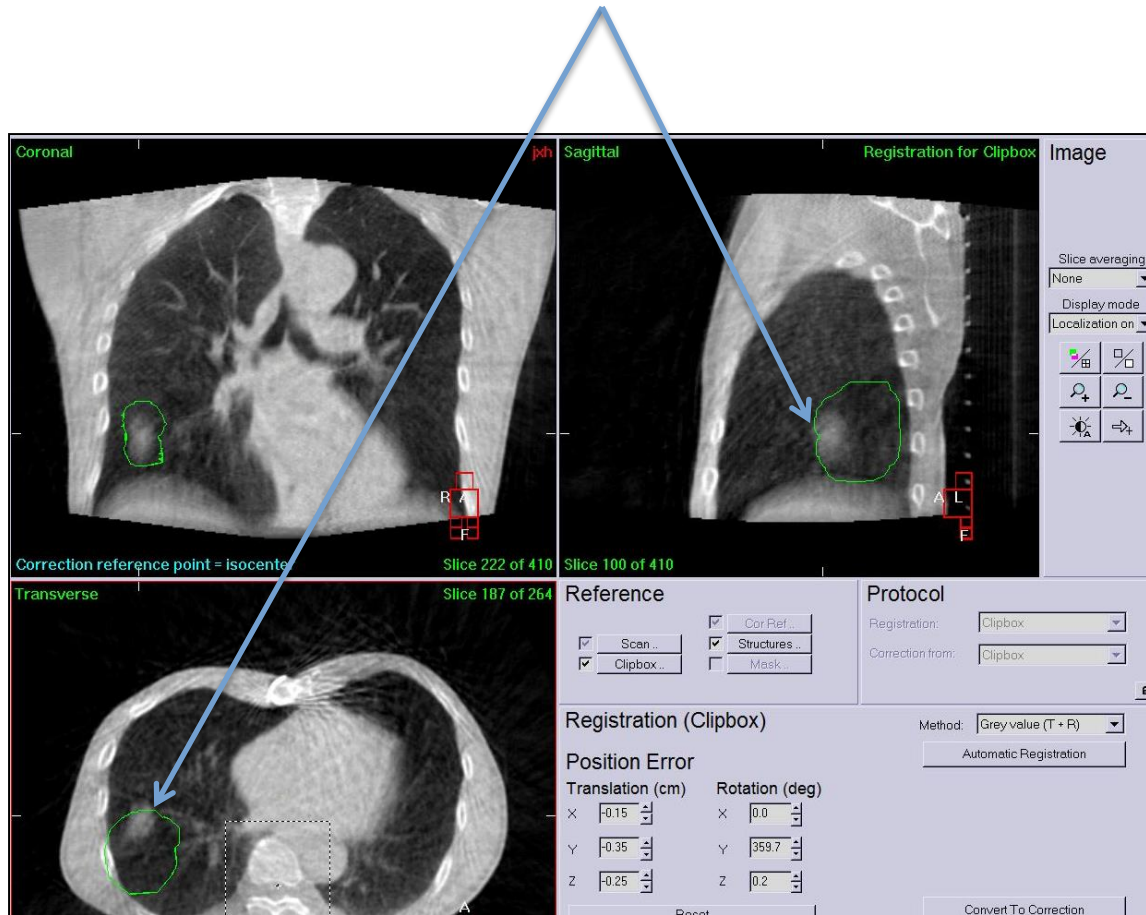
VolumeView Registration

Dismiss Accept

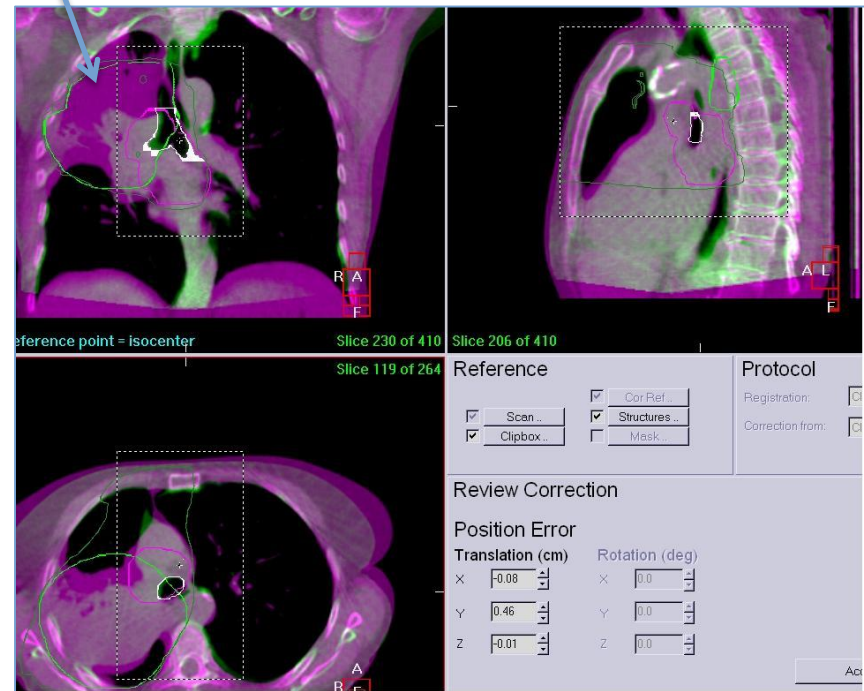
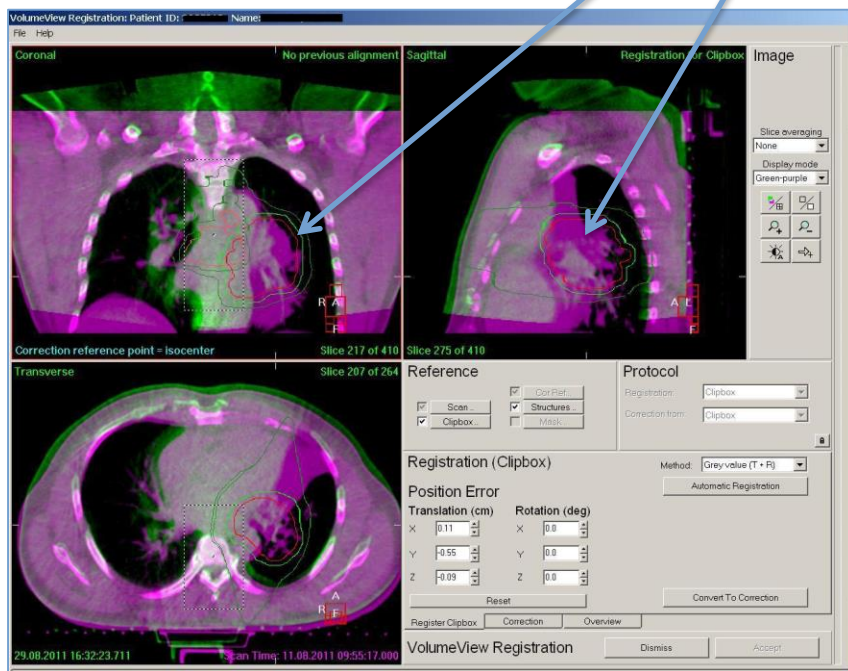
Growth of Tumour



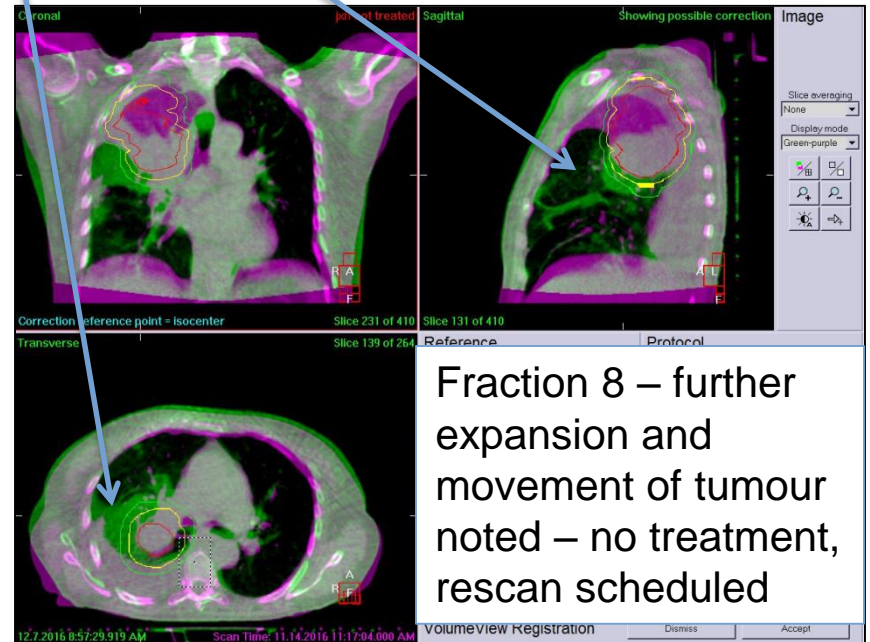
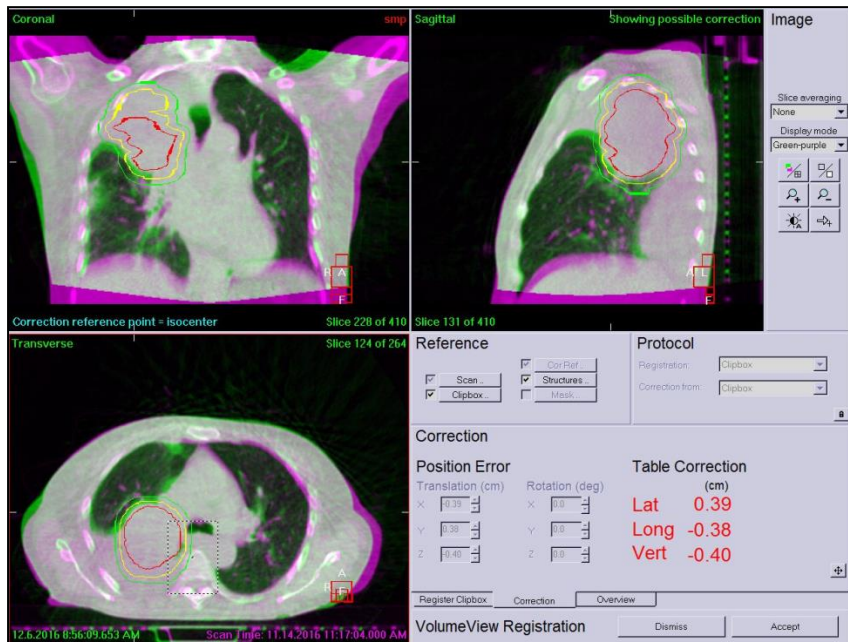
Mass Outside of PTV



Shrinkage of Tumour

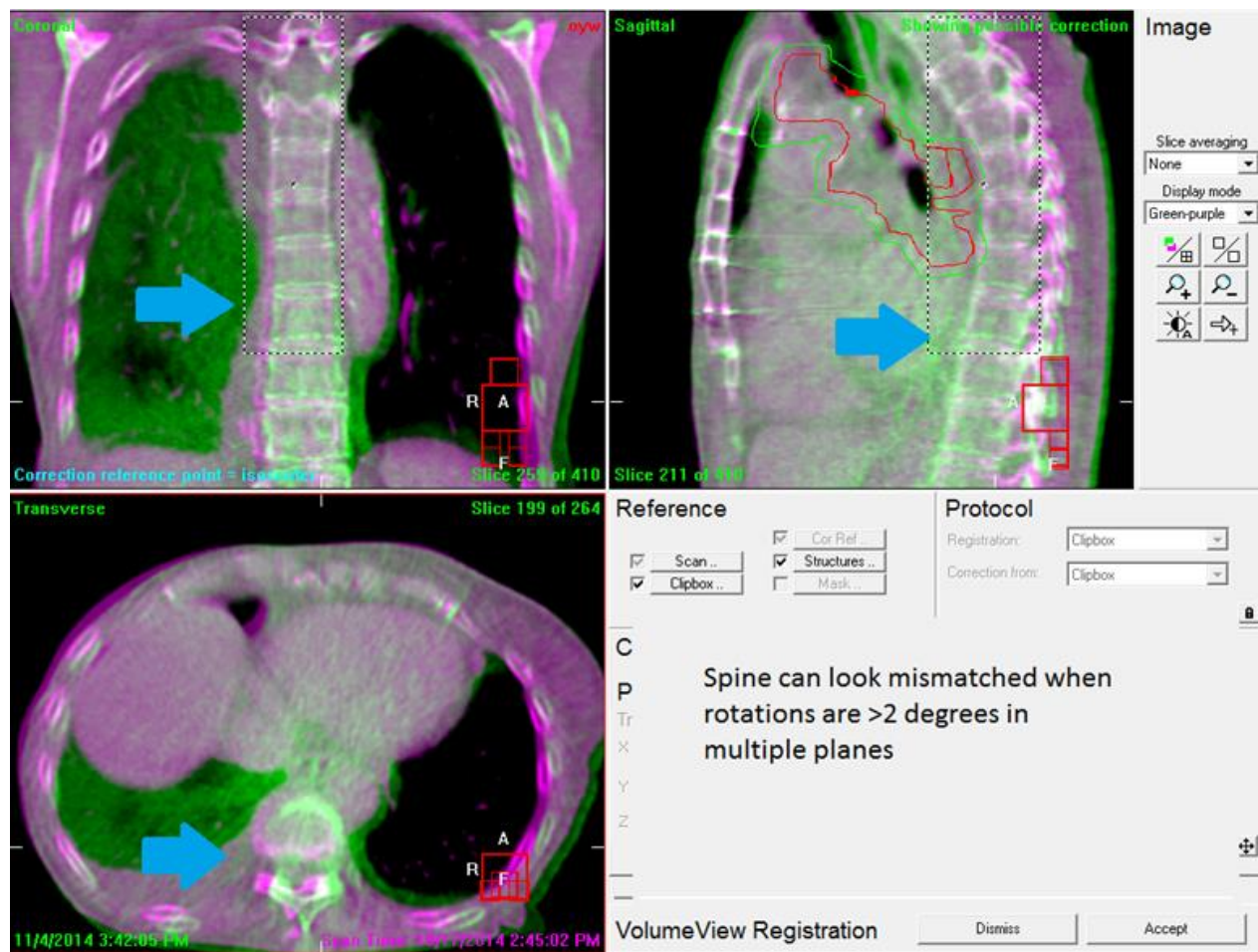


Shift of Tumour



Fraction 8 – further expansion and movement of tumour noted – no treatment, rescan scheduled

Patient Rotation/Roll/Pitch



Carina Mis-Match

Coronal

Sagittal

Registration for Clipbox

Image

Slice averaging: None

Display mode: Green-purple

Correction reference point = isocenter

Slice 229 of 410

Slice 181 of 410

Transverse

Slice 85 of 264

Reference

Scan... Cor.Ref...

Clipbox... Structures...

Mask...

Protocol

Registration: Clipbox

Correction from: Clipbox

Registration (Clipbox)

Method: Bone (T + R)

Automatic Registration

Position Error

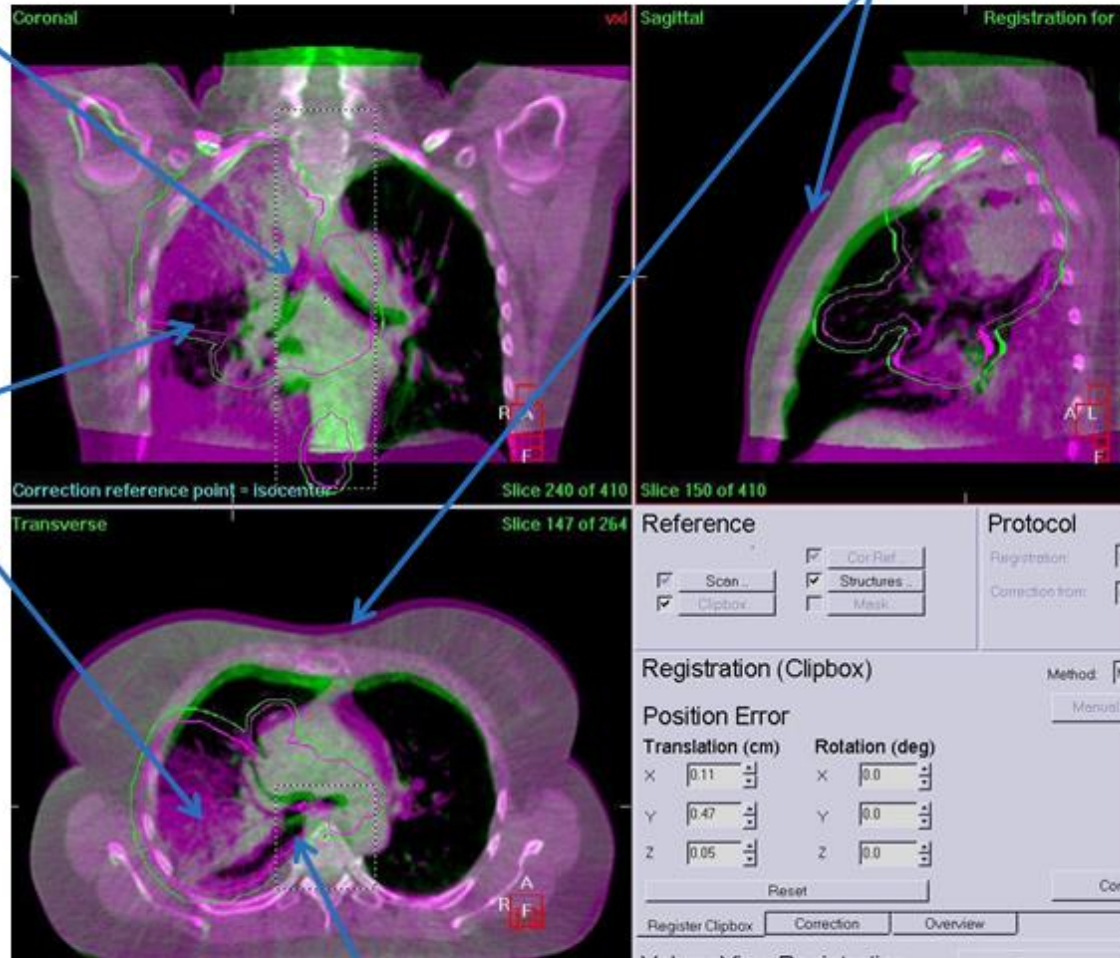
Translation (cm)		Rotation (deg)	
X	Y	X	Y
-0.69	0.92	358.0	2.6
0.16		359.2	

Convert To Correction

Multiple Issues

Airway Changes

Weight Loss



Soft Tissue Displacement

Troubleshooting

- **Large Rotations:** adjust patient's body, and note tattoo displacement for future setup replication
- **Large Displacements:** resetup required?
- **Neck Rotations (Apical Lesions/Nodal Targets):** move patient up/down bed, add padding under head/neck
- **Clavicle Displacement:** adjust patient's arm
- **Weight Loss:** check depths/tolerance, notify RO+physics+planner
- **Target Changes:** notify RO
- **Non-Target Changes:** if PTV coverage is OK, proceed with treatment; if not, call RO to unit – call RO immediately for large effusions or gross lung changes
- Some tips:
 - Ensure clipbox is around spine (do not include ribs/tumour as they do not represent a stable part of anatomy, and results will not provide troubleshooting clues)
 - Avoid manual tweaking unless OK'd by RO
 - Notify RO of changes – the earlier the better