

Appendix: Drawing procedures

1. Heart and Breasts.

Create **Body** contour on all phases.

Select the first respiratory phase.

Draw new **Heart** contours: from apex to top of left atrium, including base of vessels, corresponding to Feng *et al.*¹³ level 3B to 10B; do not include level 1B and 2B (Fig 1).

Draw **Breast Right**:

Cranio-caudal from 1 cm below clavicular head (mid-manubrium) to inframammary fold.

Medial: 2 cm from border of sternum. Lateral: mammary fold.

Depth: do not extend beyond pectoralis muscle/ribs.

Skin: crop at Body surface.

Draw **Breast Left**: same as Breast Right. Ref: Offersen.⁷

Propagate to all respiratory phases.

Verify Heart and Breasts contours. If needed, redraw.

2. Breasts subregions.

2.1 Drawing subregions of Breast Right using **relative** levels.

Select the first respiratory phase.

Goto slice through nipple of Breast Right: assign as reference center.

2.1.1 Upper quadrants.

Go to slice two-third-upper-breast cranial from nipple.

Use 3D sphere brush of 4 cm diameter for each of the following subregions.

UIQ R:

Make a ray from centroid to farthest *inner anterior* point on contour of Breast Right. Set the center of brush on the ray, 2 cm inside. Draw the sphere (Fig 2, Top).

UOQ R:

Make a ray from the nipple to farthest *outer posterior* point on contour of Breast Right. Set the center of brush on the ray, 2 cm inside. Draw the sphere.

2.1.2 Lower quadrants.

Go to slice two-third-lower-breast 4 cm caudal from the nipple.

LOQ R:

Same procedure as UOQ R.

LIQ R:

Same procedure as UIQ R.

2.1.3 Central subregion.

CEN R:

Go to the nipple. Place the sphere center inside the nipple, flush with Breast surface (Fig 3).

When all spheres are drawn, crop parts outside the breast (Fig 2 & 3, Bottom).

2.2 Drawing subregions of Breast Left.

Mirror procedure of subregions of Breast Right.

2.3 Propagate to all respiratory phases.

Verify subregions, redraw if needed.

3. Skin markers.

If available, draw up to 7:

IR1 - IR7.

4. Other structures.

If not already done, draw and propagate to all respiratory phases:

Hart ori (either the original planning's, or use automatic segmentation),

Lung Right,

Lung Left,

Myelum,

Esophagus,

GTV T.

Keep if available and propagate to all respiratory phases, do not redraw if not available:

GTV N,

Bronchial tree.

Optional:

LAD (left anterior descending coronary artery).

5. Create ITV of structures:

Heart (new)

Hart (ori)

Lung Right

Lung Left

Breast Right

Breast Left

IRx's.

Appendix A: Preliminary on-screen raw measurements of breast motion

Display the body contours of all respiratory phases.

At each of the above locations, measure the breast's surface displacement perpendicularly to its surface, do the measurement on the transverse and on the sagittal views.

1. Locate nipple. Center on nipple flush with breast contour. Draw sphere 4cm radius. In unilateral mastectomy, mirror the contralateral nipple on the same slice at the same distances ant-post and lateral from the ribs, project perpendicularly onto the chest wall, set the intercept as virtual nipple.
2. Go up two-third-upper-breast from nipple slice. Center on crosshair. Move cursor 45 degrees inward and backward to the skin (i.e., get virtual projection of nipple). Measure medially at two-third-in and laterally at two-third-out.
3. Go down two-third-lower-breast from nipple slice. Do as in 2).

Appendix B: Summary of changes

Version 3:

- Reformatted literature citations using IJROBP's style.
- Inserted "mid-manubrium" into the sentence:
"Draw Breast Right: Cranio-caudal from 1cm below the clavicular head (mid-manubrium) to inframammary fold."
- "Ref: Offersen Radioth Oncol 2015;114:3-10" is replaced with "Offersen.⁷"
- "Feng *et al.*, IJROBP 2011;79(1):10-18." is replaced with Feng *et al.*¹³
- Change absolute measurement levels to 4cm above and below nipple, instead of 6cm:
"2. Preliminary raw measurements.

Record the maximum skin displacement between all respiratory phases: at the nipple's mean position, ~~6cm~~ 4cm above the nipple, medially and laterally, ~~6cm~~ 4cm below the nipple, medially and laterally, repeated for right and left side."

"2.1.1 Upper quadrants.

Go to slice ~~6cm~~ 4cm cranial from nipple."

"2.1.2 Lower quadrants.

Go to slice ~~6cm~~ 4cm caudal from nipple."

- Added a paragraph for relative measurement levels:
"2.4 Drawing subregions of Breast Right and Left using relative levels.

The same procedure as using absolute levels, except instead of a fixed distance of 4 cm cranial and caudal to nipple, use relative levels: cranial to nipple two-thirds of the upper breast size, and caudal to nipple two-thirds of the lower breast size."