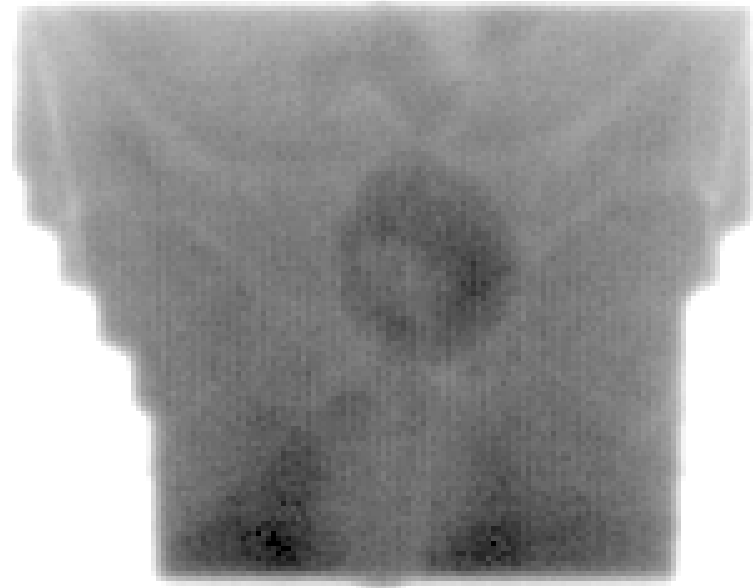
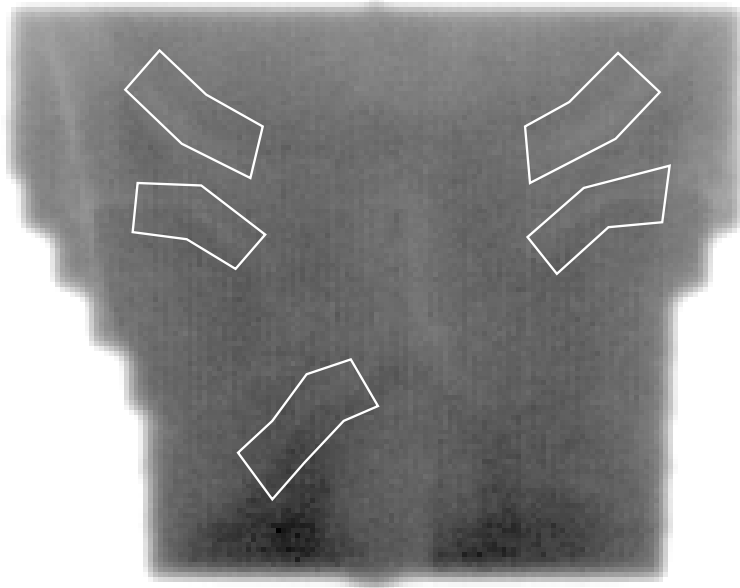
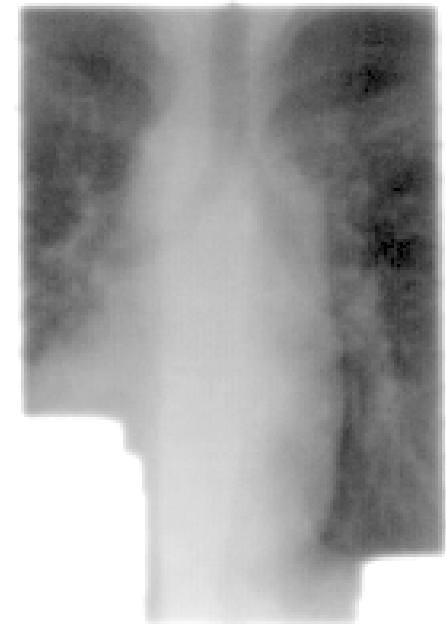
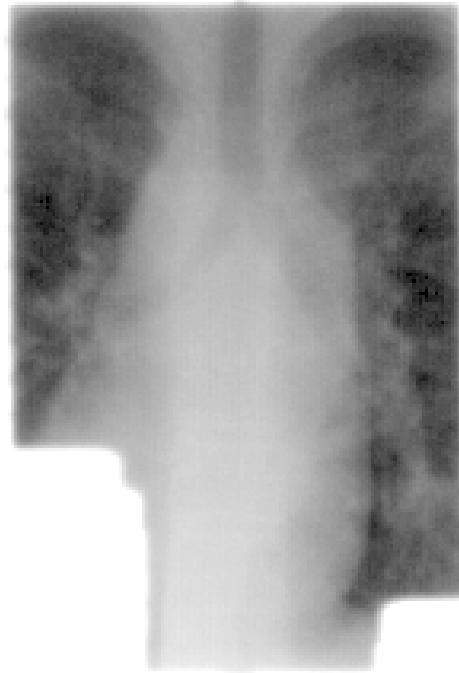
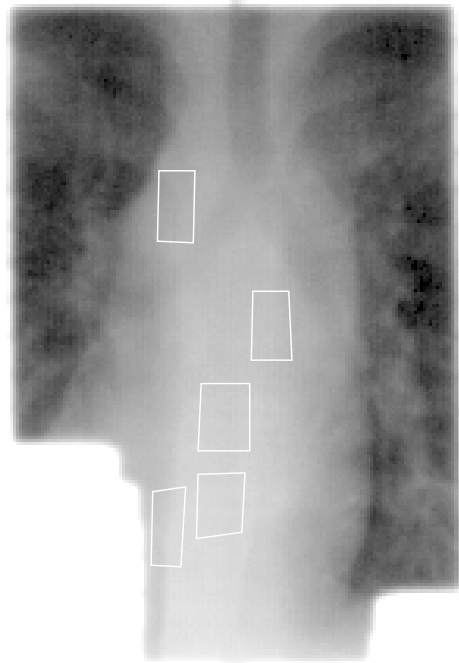

imagery — pelvis ap



imagery — thorax



imagery — digitally simulated portal images



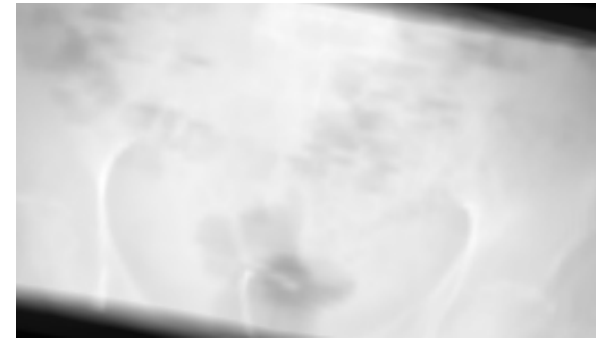
reference image



24 translated images



10 rotated images



100 images rotated
around x axis



100 images rotated
around z axis

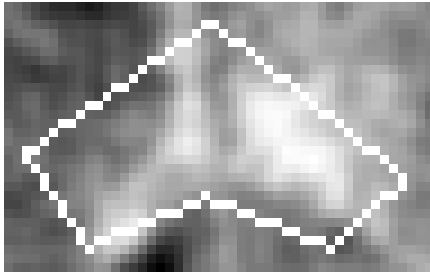


reference image

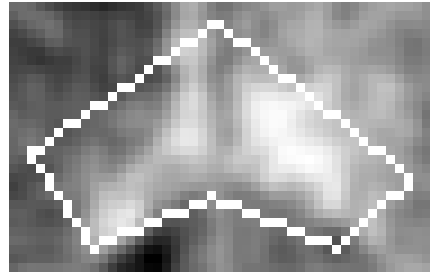
method — least squares template matching



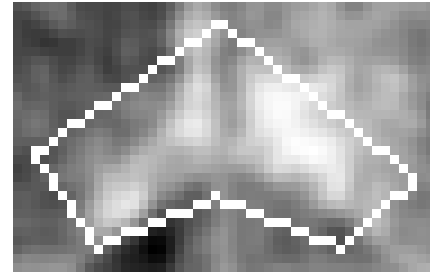
$t = 0$



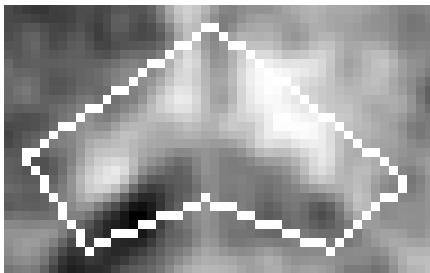
$t = 2$



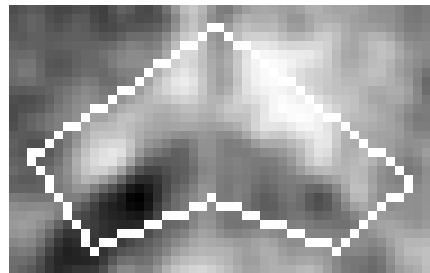
$t = 4$



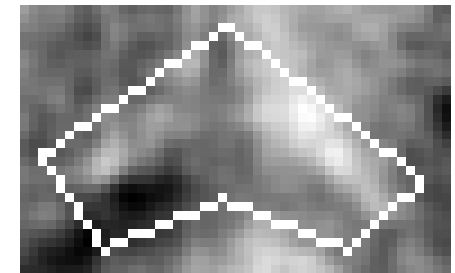
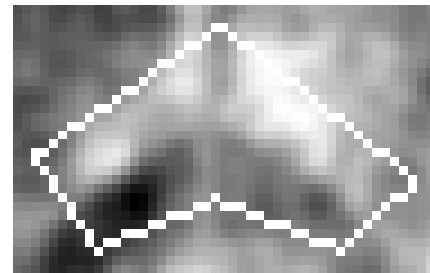
$t = 7$



$t = 9$



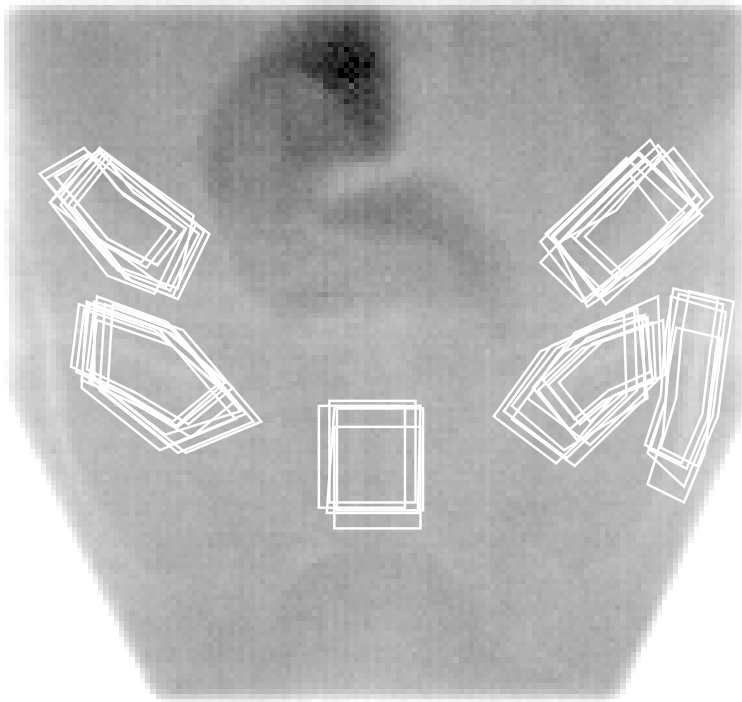
$t = 17$



patches

template

results — sensitivity to template selection



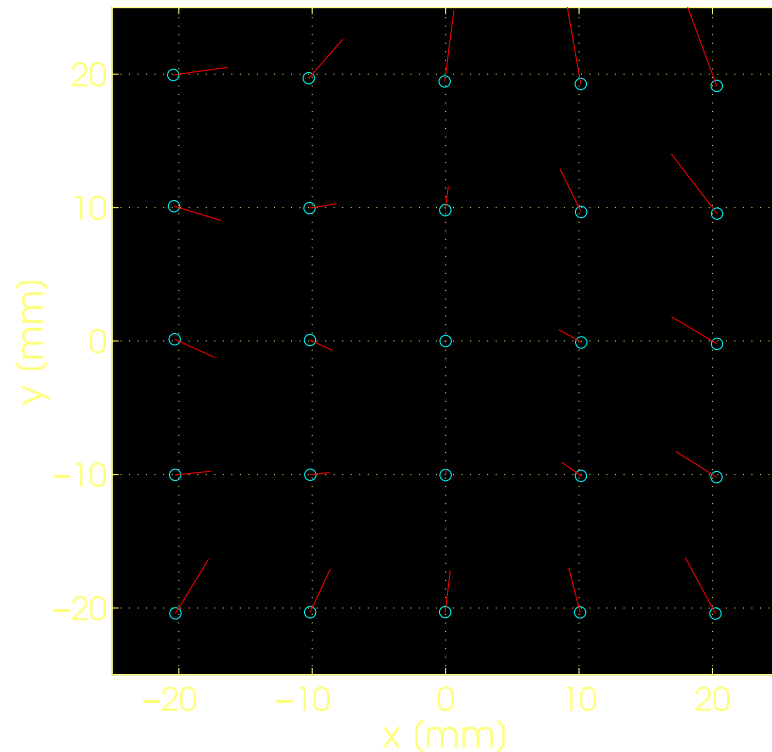
standard deviations

$$\sigma_x = 0.28 \text{ pixel} = 0.24 \text{ mm}$$

$$\sigma_y = 0.22 \text{ pixel} = 0.19 \text{ mm}$$

$$\sigma_{rot} = 0.29 \text{ deg}$$

results — error analysis on in-plane dataset



standard deviations

along x-axis: $\sigma_x = 0.23 \text{ mm}$

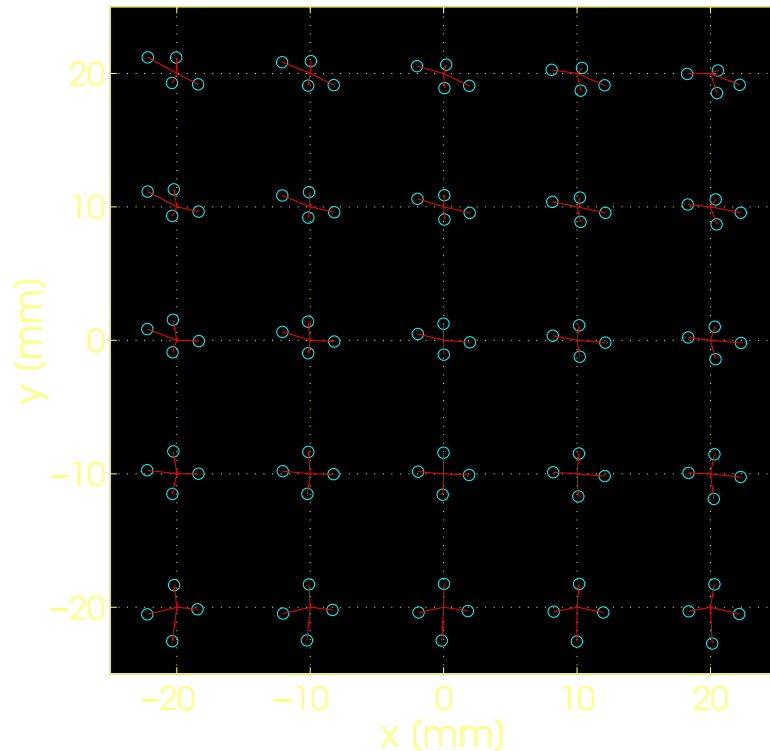
along y-axis: $\sigma_y = 0.33 \text{ mm}$

distance: $\sigma_{dist} = 0.29 \text{ mm}$

rotation: $\sigma_{rot} = 0.19 \text{ deg}$

(cyan circles represent measurements, red lines error vectors enlarged by 10)

results — error analysis on out-of-plane dataset ($\pm 2^\circ$)



standard deviations

along x-axis: $\sigma_x = 1.4 \text{ mm}$

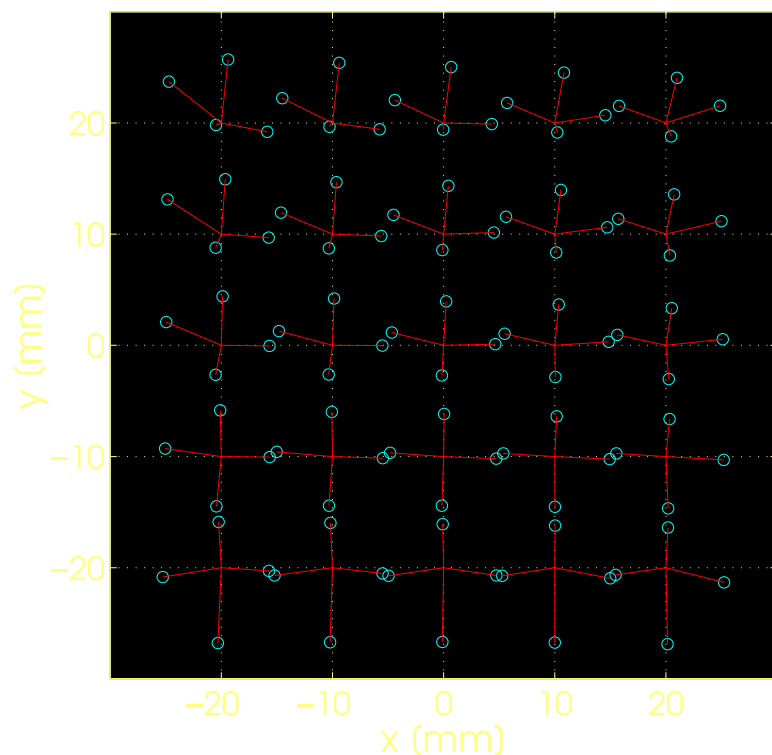
along y-axis: $\sigma_y = 1.1 \text{ mm}$

distance: $\sigma_{dist} = 1.3 \text{ mm}$

rotation: $\sigma_{rot} = 0.3 \text{ deg}$

(cyan circles represent measurements, red lines error vectors)

results — error analysis on out-of-plane dataset ($\pm 5^\circ$)



standard deviations

along x-axis: $\sigma_x = 3.3$ mm

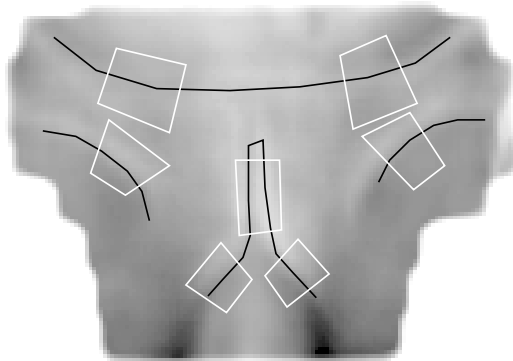
along y-axis: $\sigma_y = 3.0$ mm

distance: $\sigma_{dist} = 3.2$ mm

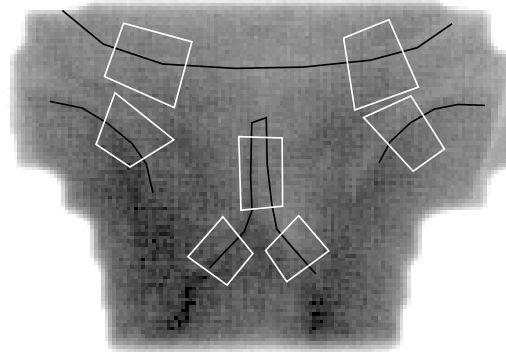
rotation: $\sigma_{rot} = 0.6$ deg

(cyan circles represent measurements, red lines error vectors)

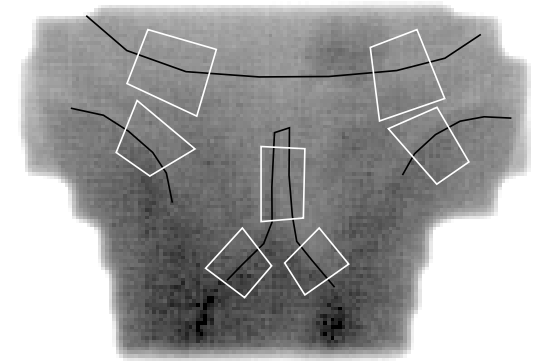
results — multi-modal match



reference image
(DRR)



translation (0,-4) mm
rotation 1.5°



translation (3,-3) mm
rotation 2.6°