Correlation between surface motion and heart-breast distance for DIBH-patients

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SGRT Europe: A new view of SGRT
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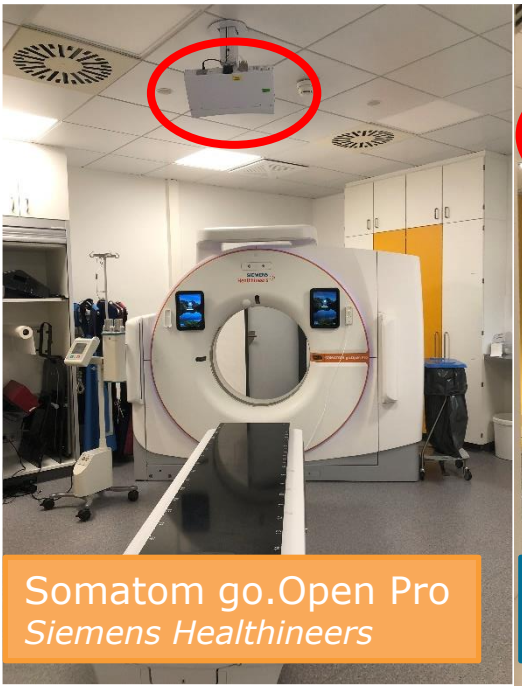
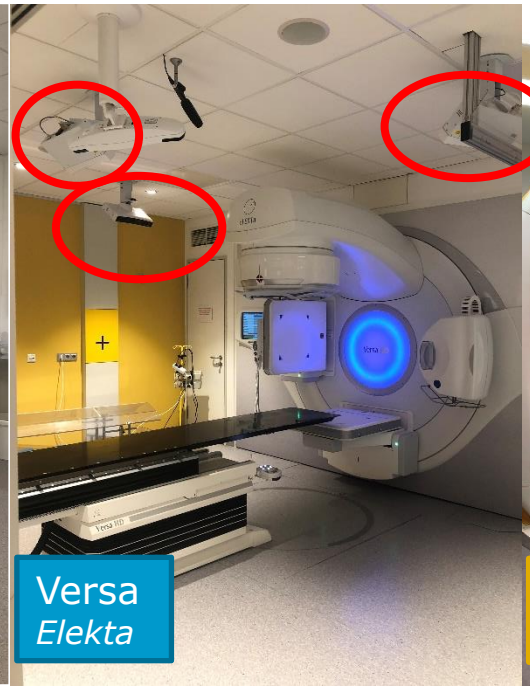
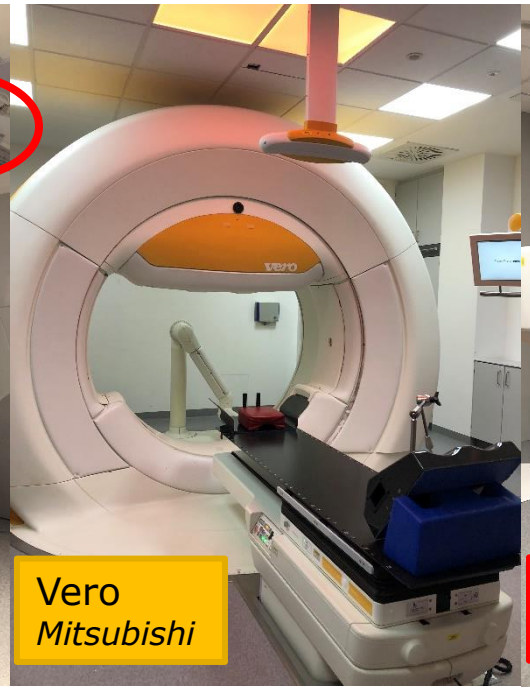
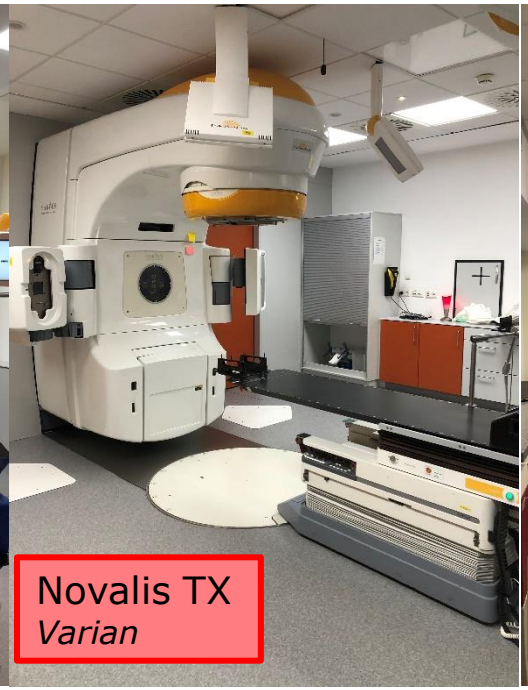
Erlangen

University Hospital Erlangen
Department of Radiation Oncology









University Hospital Erlangen
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SimRT
VisionRT

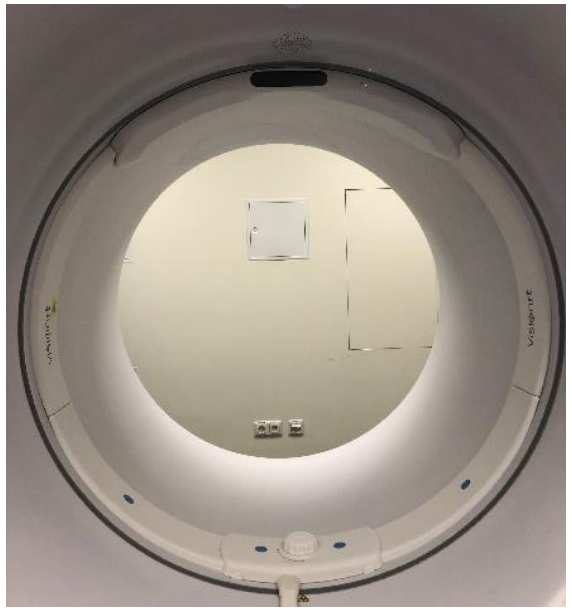
AlignRT
VisionRT

Somatom go.Open Pro
Siemens Healthineers

Versa
Elekta

Halcyon
Varian

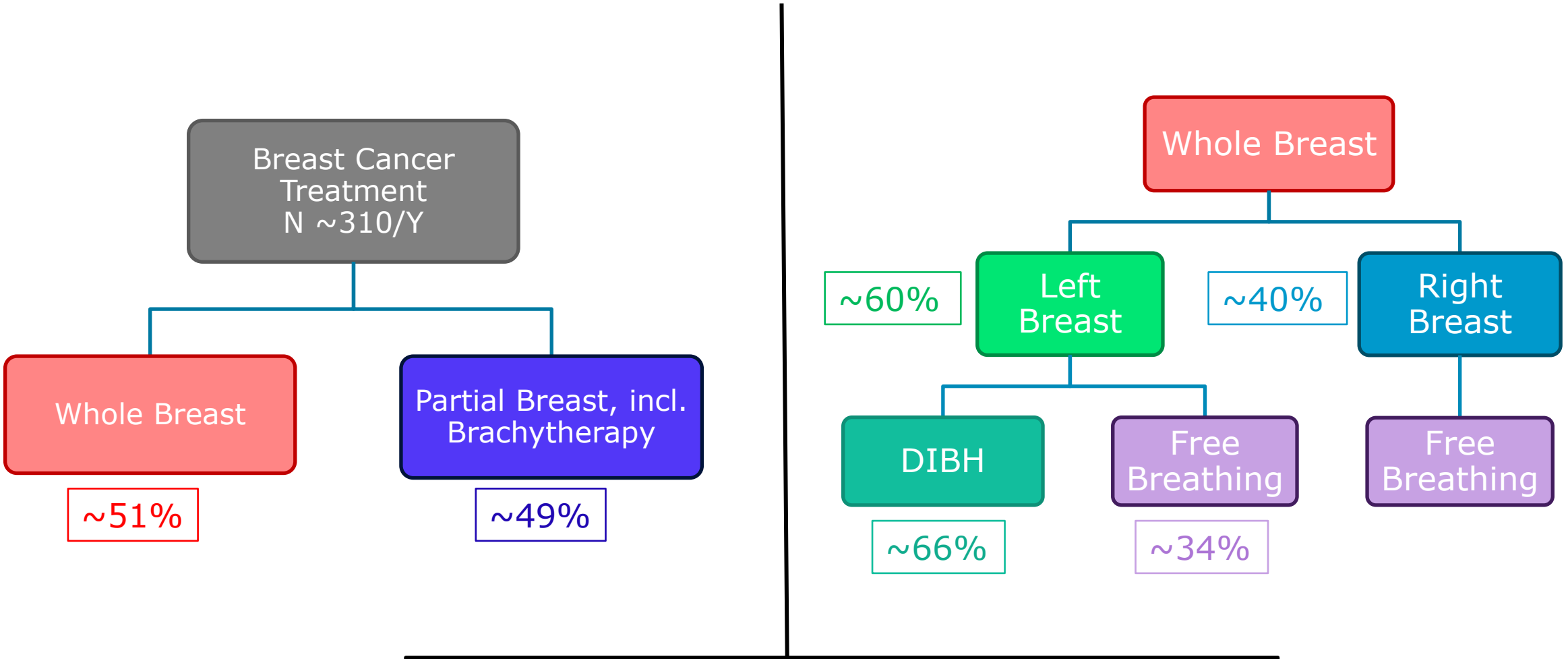
Halcyon
Varian



AlignRT InBore
VisionRT

Treatment methods for breast cancer in Erlangen

Overview

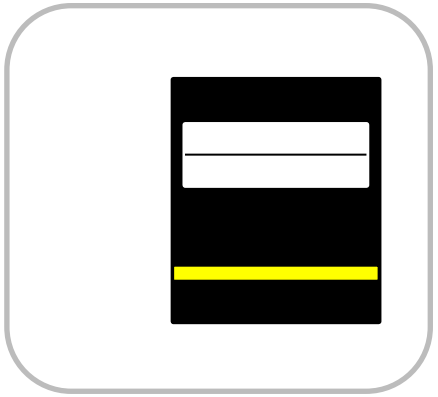


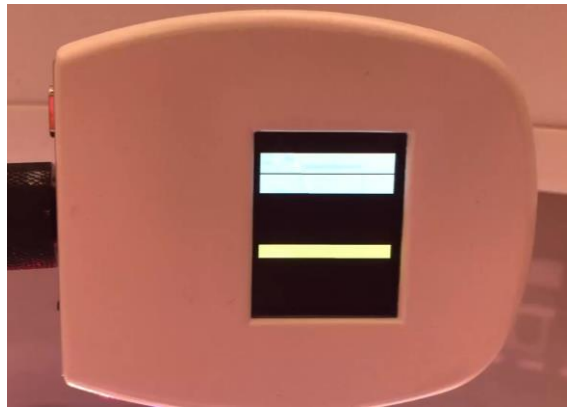
DIBH: ~20% of all Breast Cancer Treatments

Treatment methods for breast cancer in Erlangen

SimRT

- Go Live: January 2023
- Using SimRT for:
  - Breath hold training
  - Controlling state of breathing
- Reasons for implementation
  - Improvement of DIBH state
  - Better reproducability
  - Controlling DIBH-CT

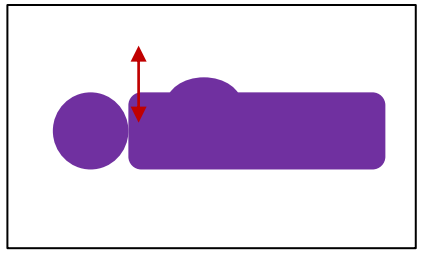
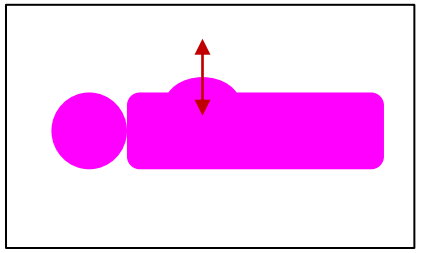
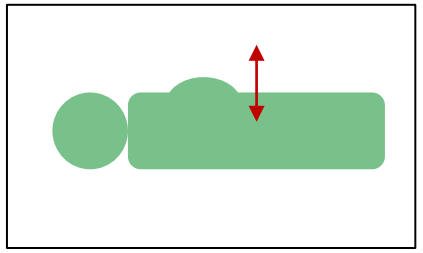




First Observation

Breathing pattern

- Different breathing patterns

- AAPM Task Group Report 322:

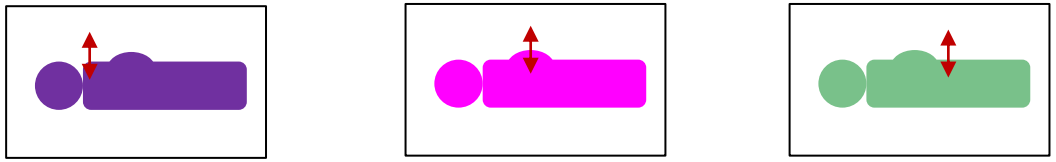
„Currently, there is no algorithm for automatic ROI selection or for prediction of the accuracy associated with the chosen ROIs. These should be determined by the QMP and clinical or treatment teams and may need to be altered on a patient-by-patient basis. […] (regarding DIBH) The amplitude of the chest at mid-sternum over several breath holds may be used to assess the reproducibility […]

- Does breathing pattern influence my treatment?

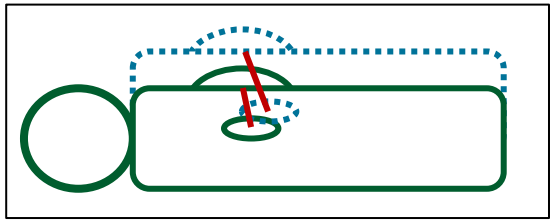
Methods

Structure of research

- Investigating patient cases regarding:
  - Breathing pattern



  - Correlation heart-breast distance (HBD) increase to surface motion

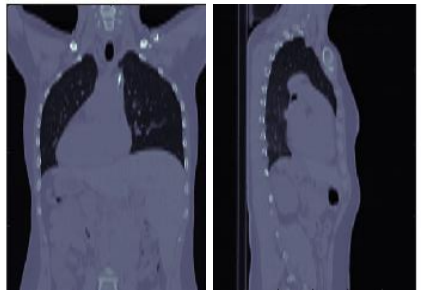


  - What influences HBD more? Surface motion or heart motion?

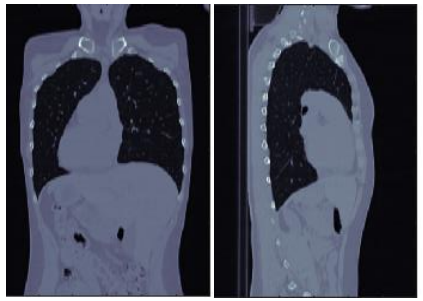
Methods
Procedure

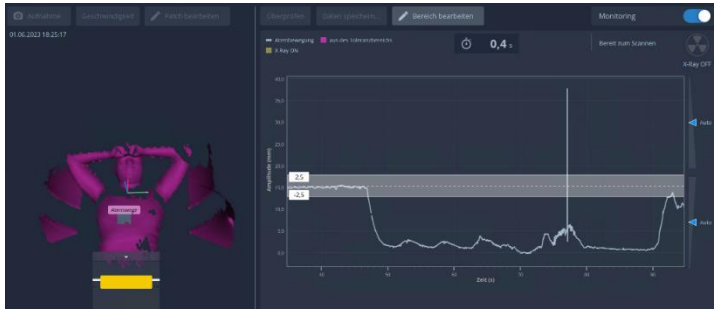
- Two CTs with SimRT: DIBH and free breathing

Free Breathing

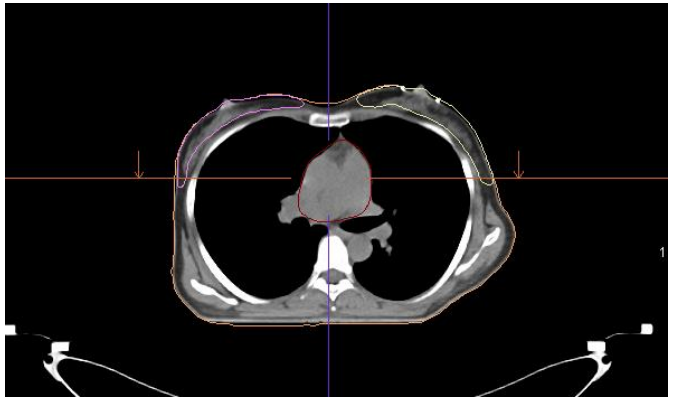


DIBH





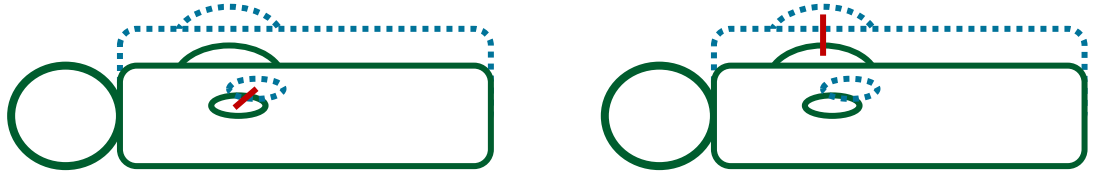
- Segmentation of heart, breasts and surface

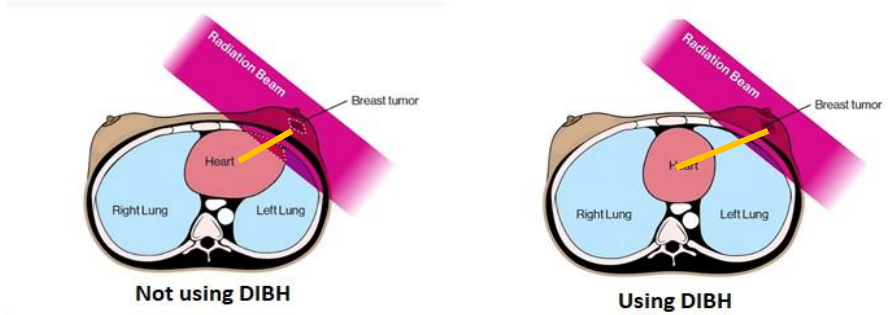


- CT images and structures are used for analysis

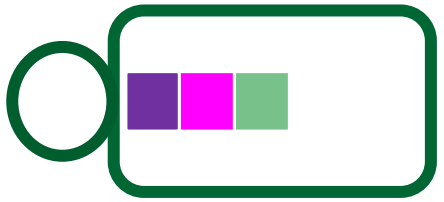
Methods
Procedure

- Determination of center of mass (CoM) of breast and heart
- Calculation of breast, heart and HBD increase between CoMs



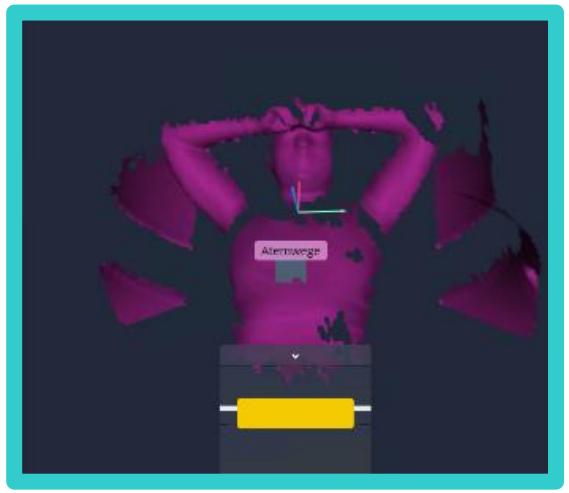


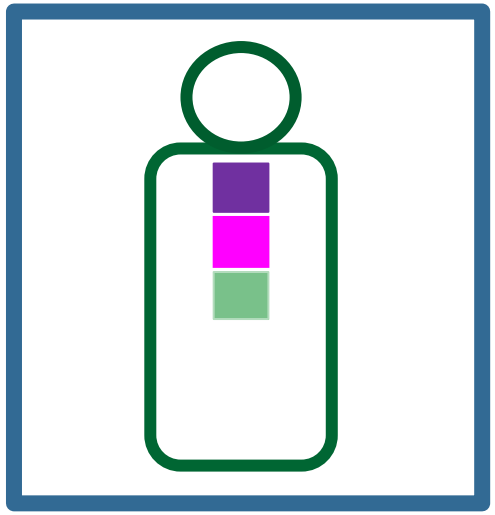
- Calculation of surface movement along three patches
  - ROI size = SimRT patch size

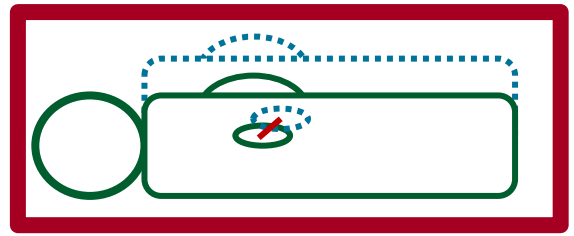


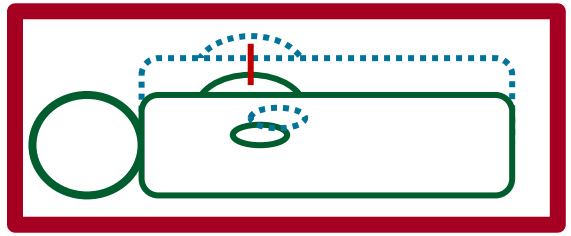
Methods
Core elements

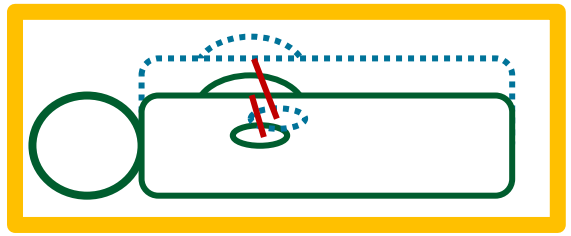
- We consider:
  - Movement of the heart and breast (CoM)
  - HBD increase (HBD before vs. after (CoM))
  - VisionRT output (Sternum)
  - Surface movement CT (upper chest, sternum, stomach)





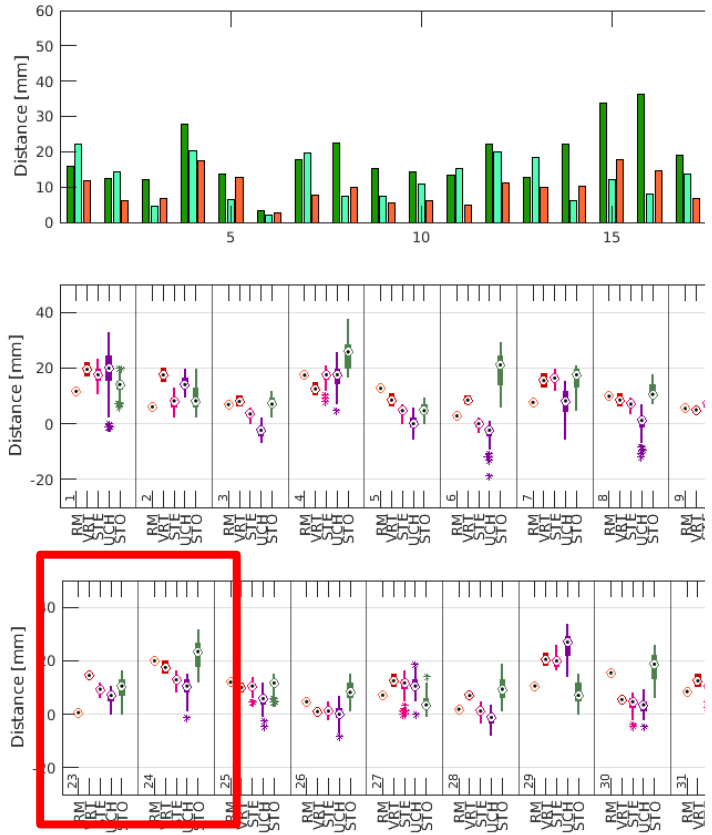


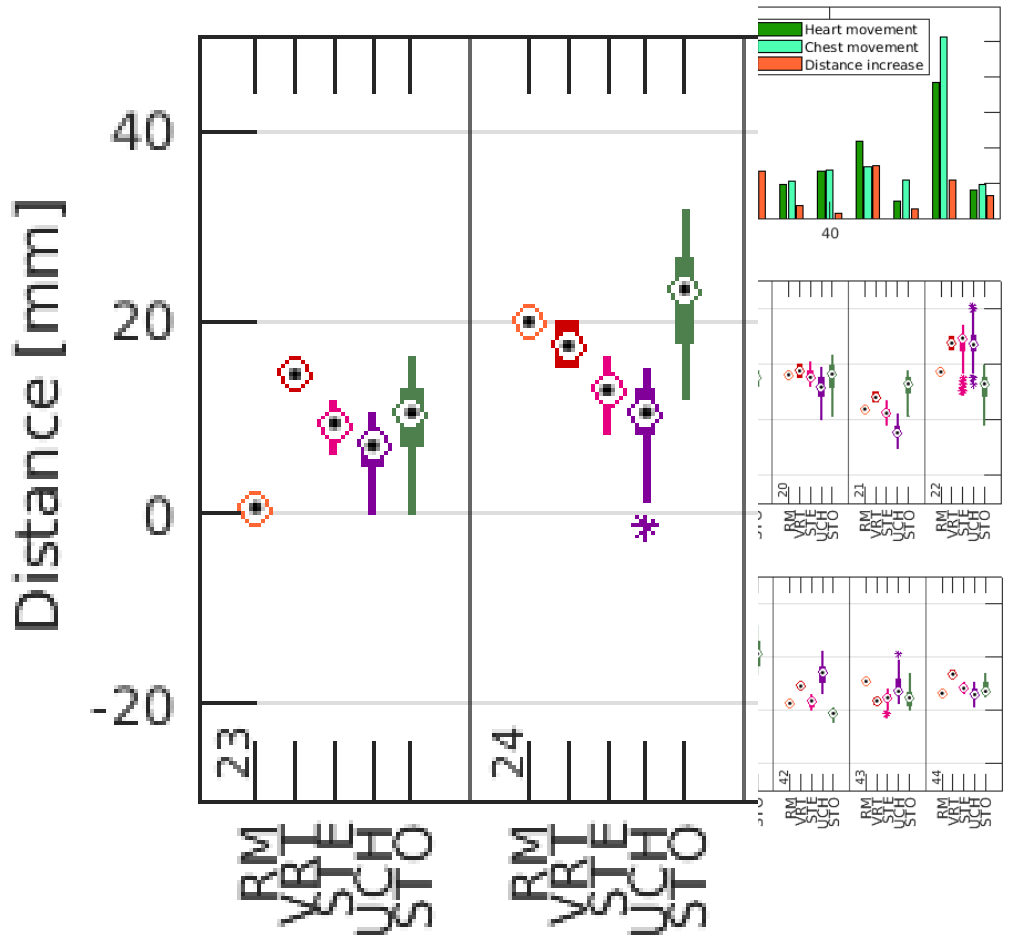




Results

Correlation heart-breast distance





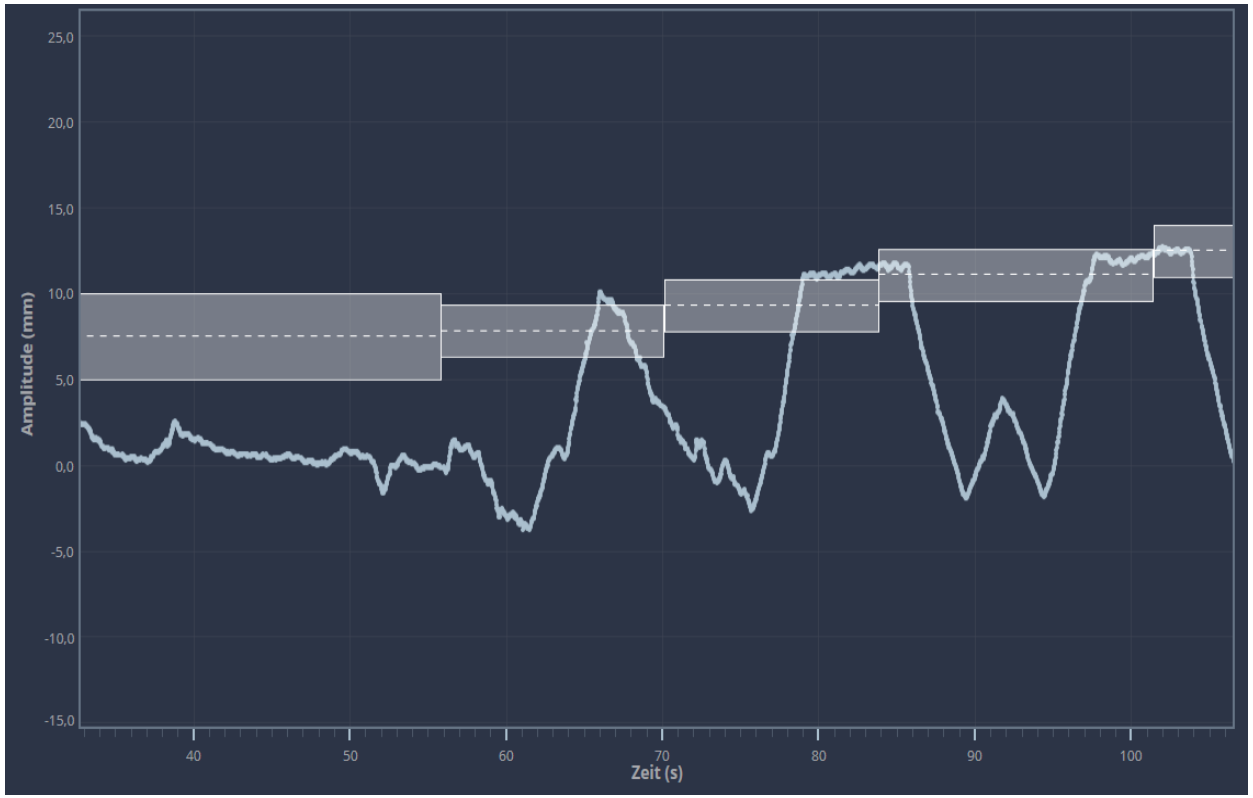
- Breathing pattern
  - Stomach: 70,5%
  - Upper Chest: 13,6%
  - Sternum: 15,9%
- Heart movement correlates more with HBD

Results

Correlation heart-breast distance

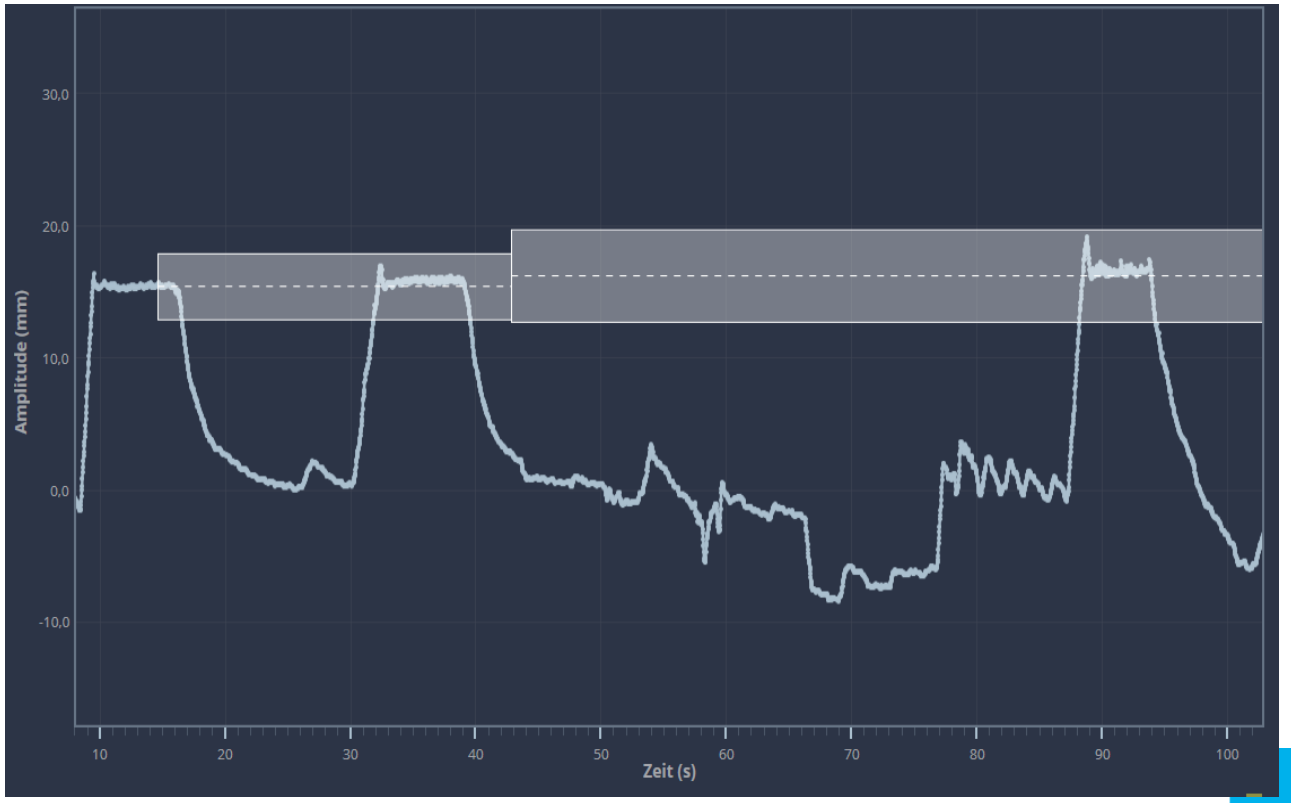
Patient 23

worst DIBH patient



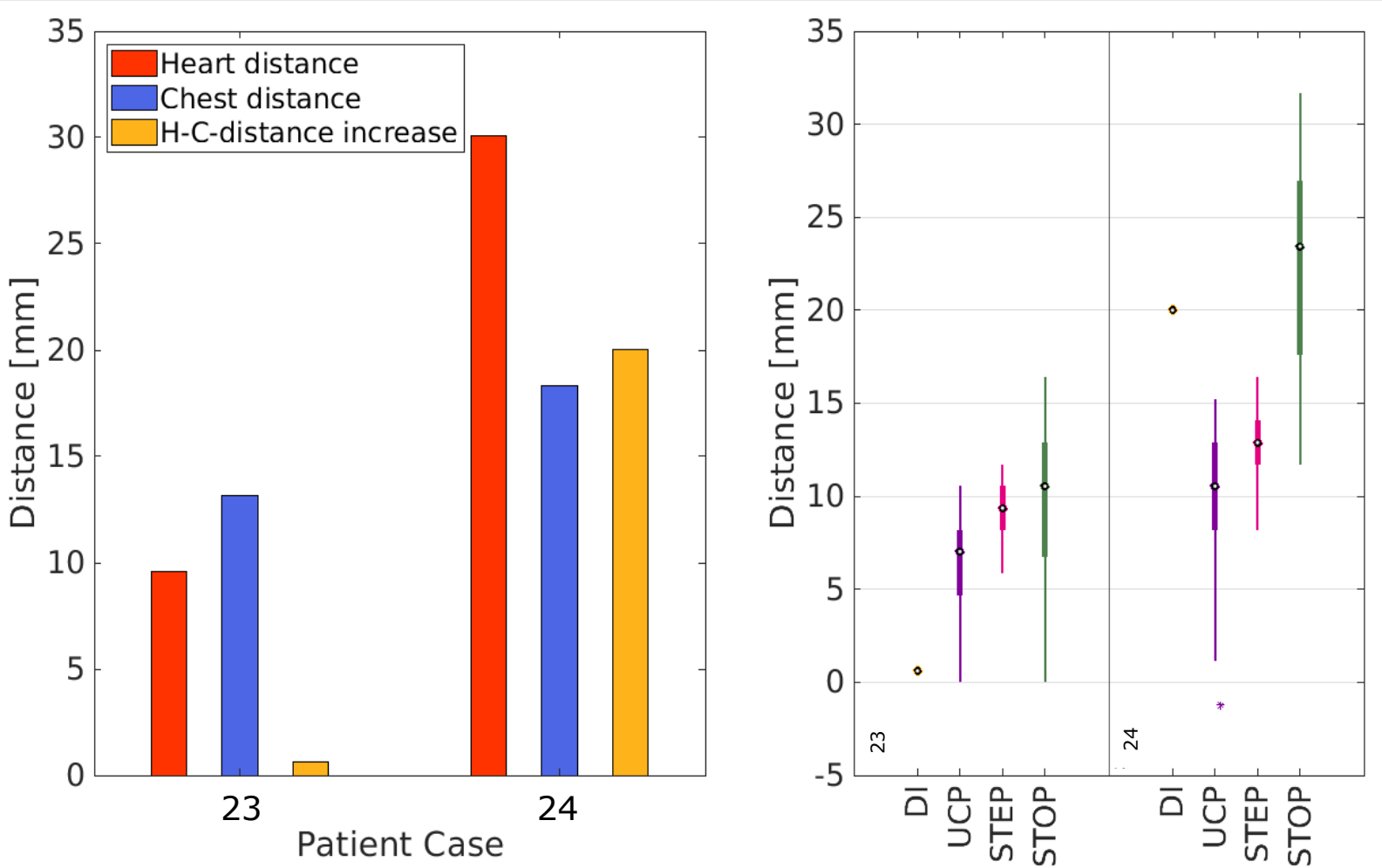
Patient 24

best DIBH patient



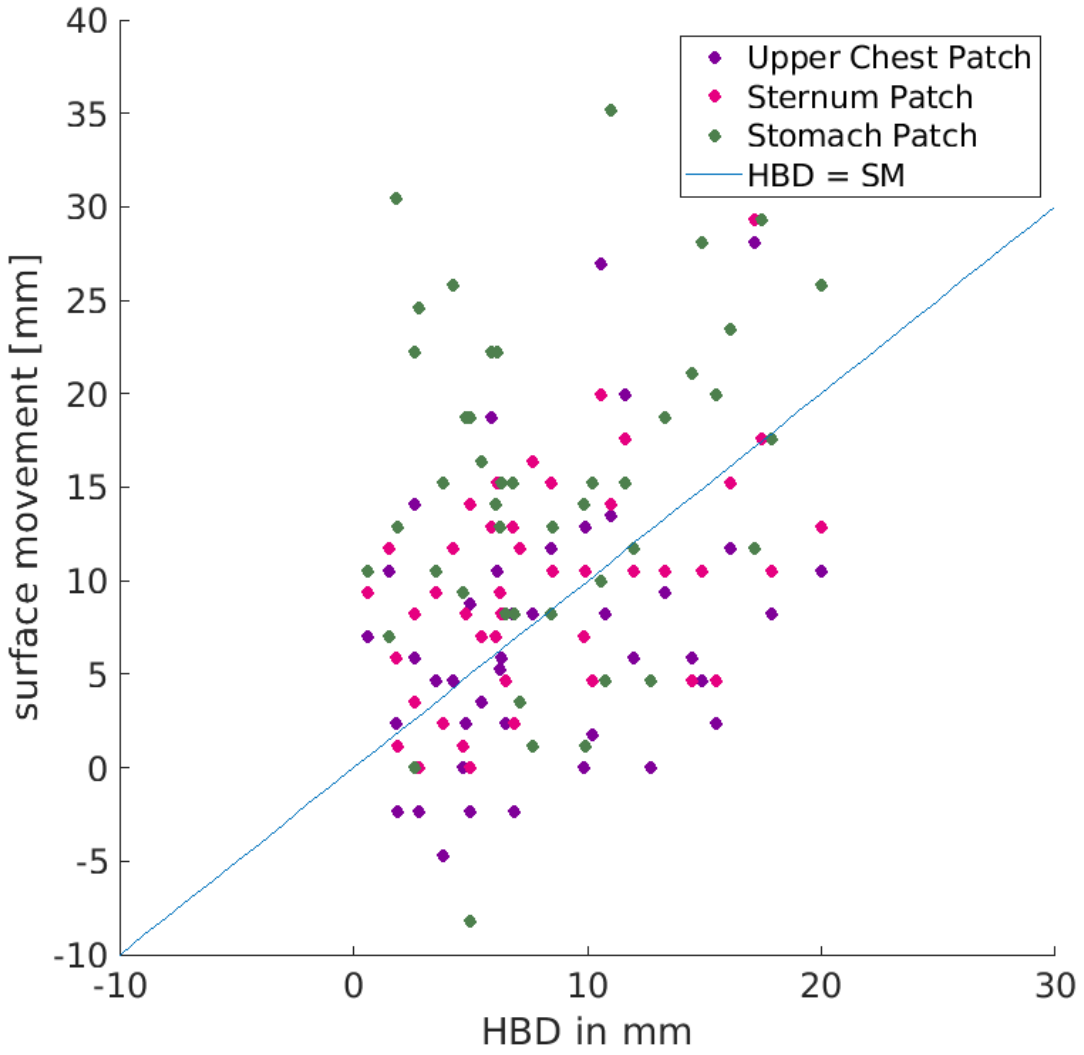
Results

Correlation heart-breast distance



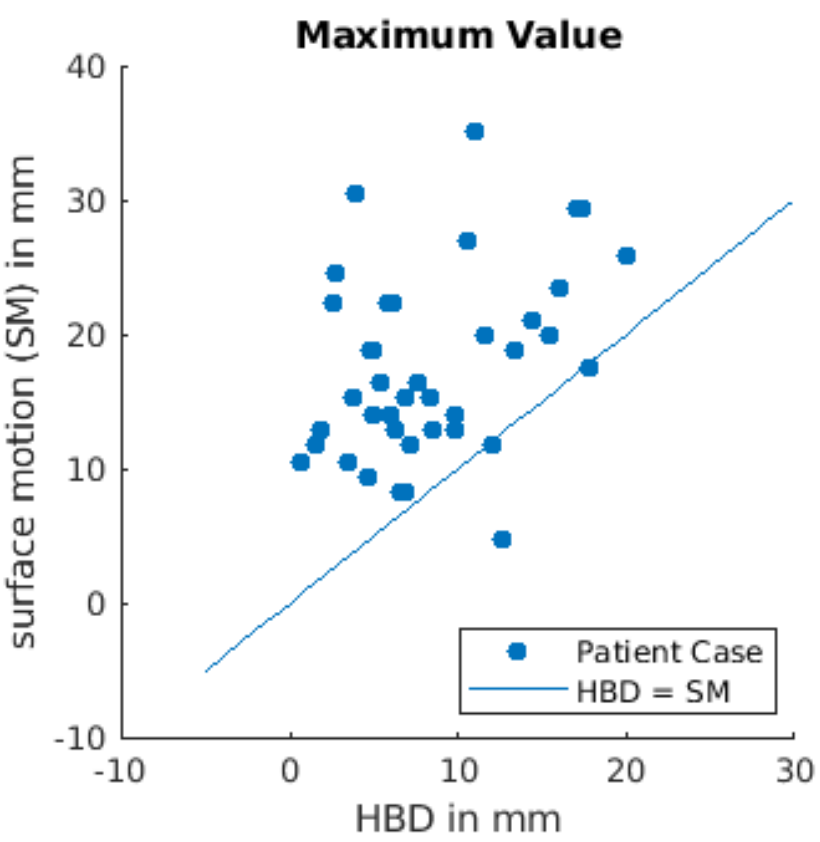
Results

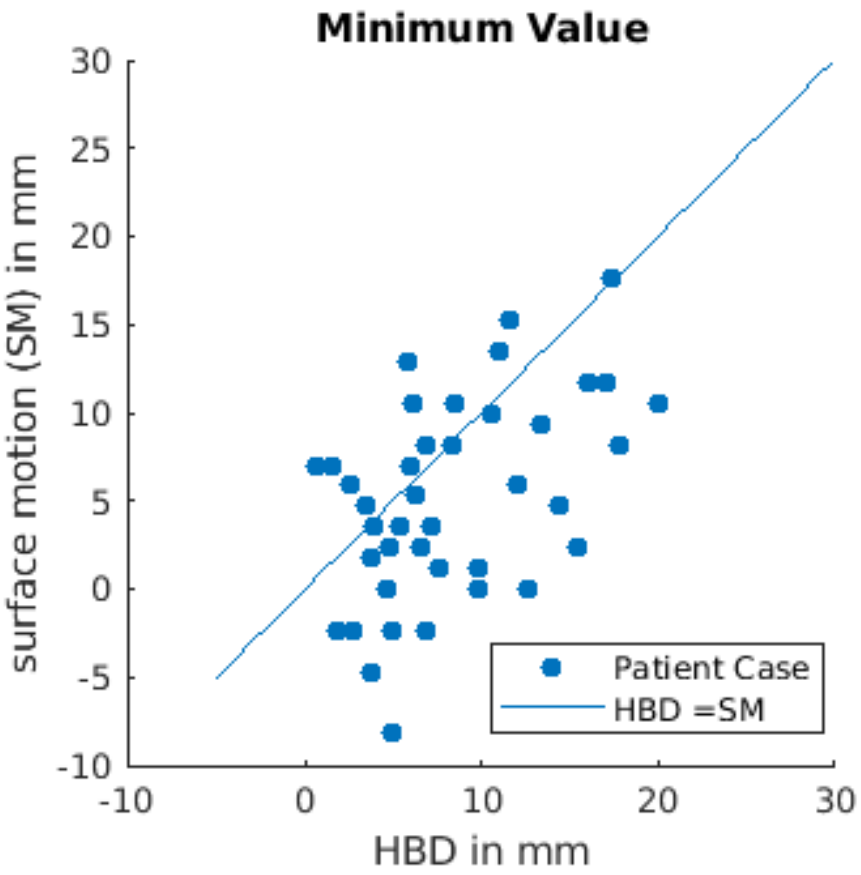
Correlation heart-breast distance



Results

Correlation heart-breast distance

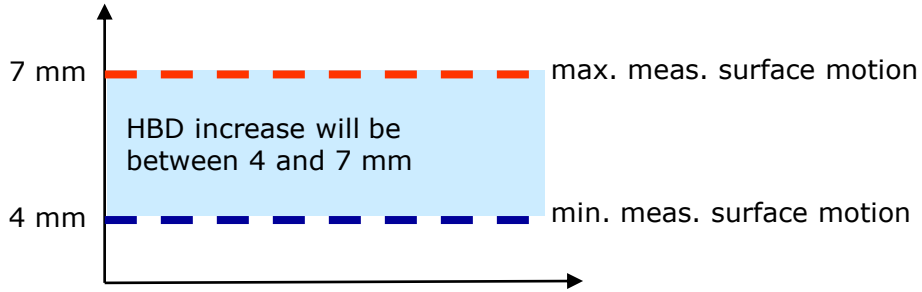




Results

Correlation heart-breast distance

- No direct correlation between surface and organ movement but:
  - HBD increase < max. meas. surface motion in 90%
  - HBD increase > min. meas. surface motion in 72%

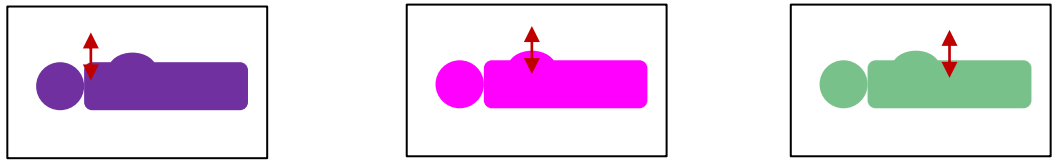


➡ Prediction of HBD increase possible

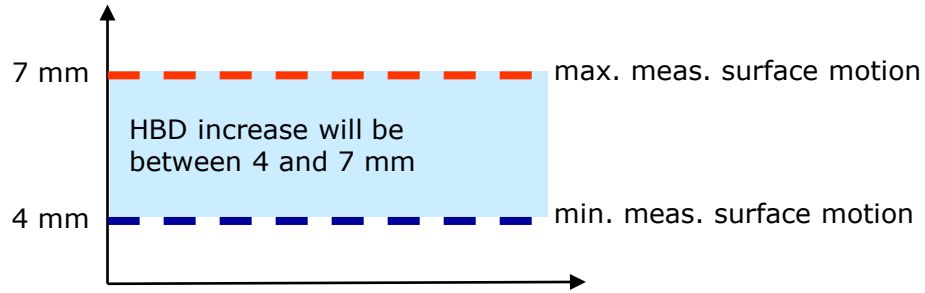
- Cases with low surface motion
- Saves time in all following treatment steps

Conclusion

- Type of breathing is not relevant

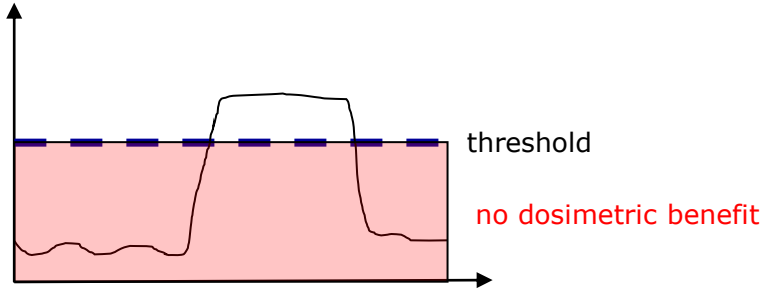


- Heart movement correlates more with HBD increase
- No direct correlation between surface and organ movement
- Prediction of HBD increase possible



Outlook

- Dosimetric implications need to be studied
  - Determination of a threshold



- Currently one patch at a time is possible with SimRT
  - Solution needed to predict range before treatment

- Export of SimRT to AlignRT
  - Ensuring same breathing state at treatment

Thank you for your attention!