

# Interplay effect for IMRT treatments of breast cancer

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# Introduction

- Intensity modulated techniques are now being used for whole breast therapy, in place of (enhanced dynamic) wedged fields
- Some centres are doing forward planned IMRT (or field-in-field), others inverse planned
- For these treatments, leaf motion is anteroposteriorly-aligned
- Interplay is the positive or negative correlation of leaf motion with respiratory motion
  - (not dose blurring)

# Introduction

- Interplay for respiratory motion has been widely studied in lung, both analytically and experimentally
- Consensus is that interplay washes out with multiple fractions
- Not widely studied for breast radiotherapy
  - Sidhu et al reported 15% differences for single fractions
  - George et al reported no significant effect after 25 fractions
  - 25 Fx is common here, 40 Gy/15 Fx has been widely used in UK
- Aim of this work was to characterise interplay effect against number of fractions

# Method

- A wax breast phantom was created with a sheath for the sagittal placement of Gafchromic EBT3 film (in a plastic sleeve)
- Phantom placed on CIRS 008A surrogate motion platform
- Experimental measurements:
  - Enhanced dynamic wedge, field-in-field and IMRT treatments (Eclipse)
  - Deliveries of 1, 2, 4 and 8 fractions (Varian TrueBeam)
    - Single fraction deliveries performed multiple times
  - 3 breathing patterns: static, normal (15 mm, 4 s) and deep (30 mm, 8 s)

# Wax breast phantom

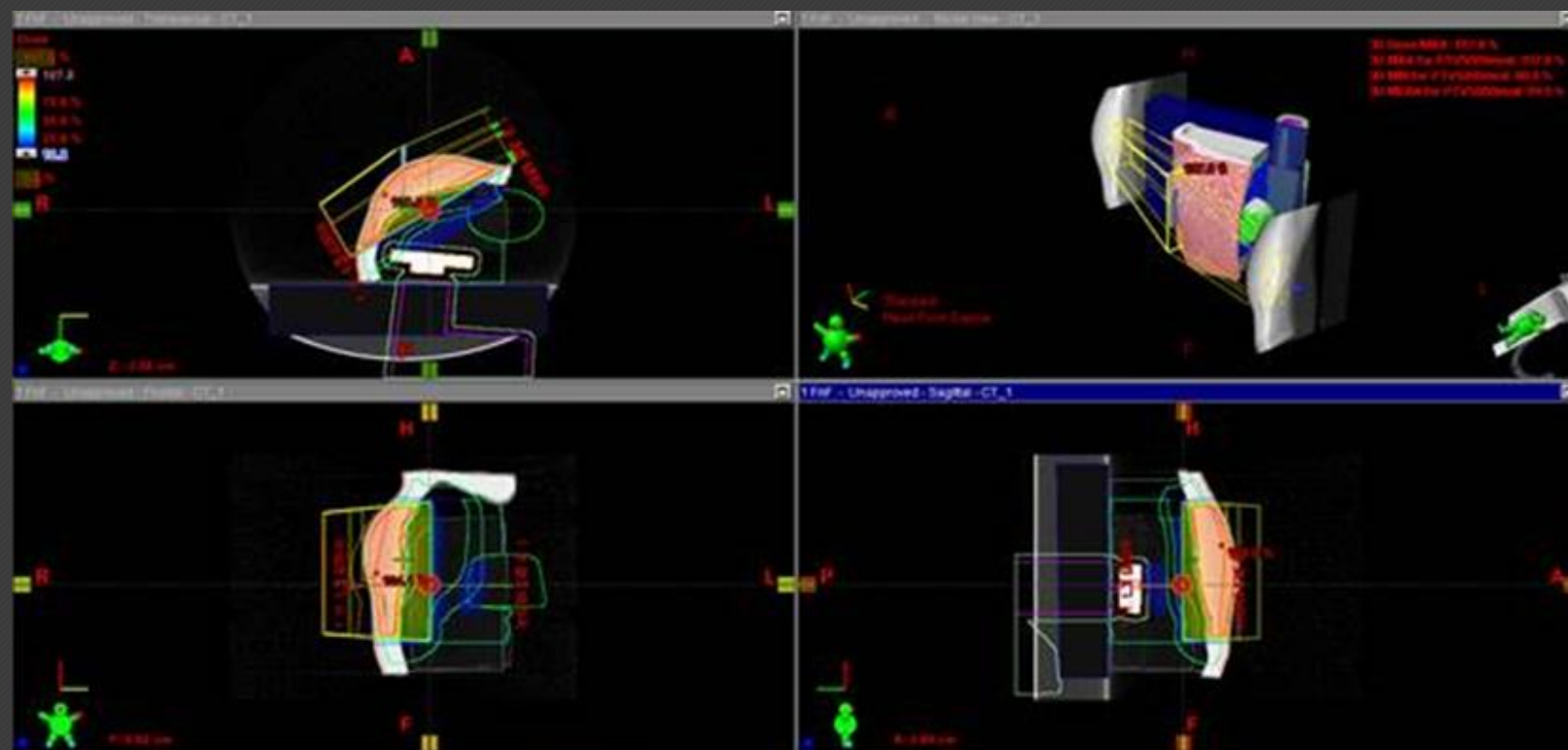


# Wax breast phantom

- Initially we weren't going to use a whole chest, but a wax reproduction of RANDO phantom (circa 1974) breast accessory - but there were objections



# Planning example

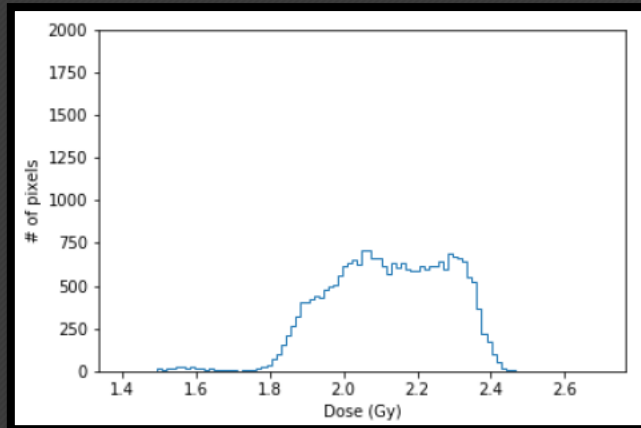


# Results

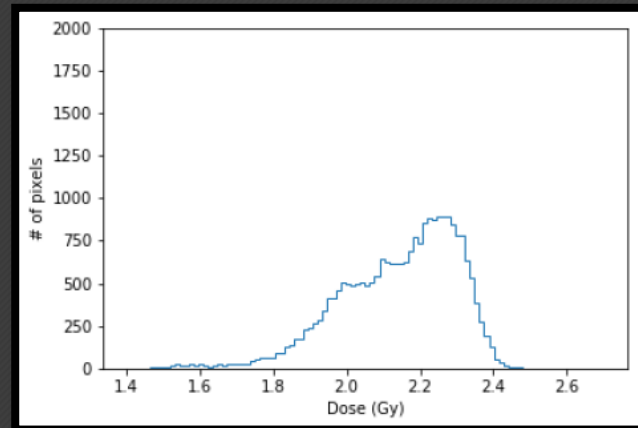
- The combination of dose blurring and interplay effects resulted in reductions in the mean dose (compared to static delivery, with deep breath motion) ranging from:
  - 2.6 to 7.4% for enhanced dynamic wedge
  - 1.2 to 2.5% for field-in-field
  - 0.9 to 4.0% for IMRT
- Analysis of interplay patterns suggested effects started to wash out from 4 fractions, and were no longer present at 8 fractions, for IMRT delivery



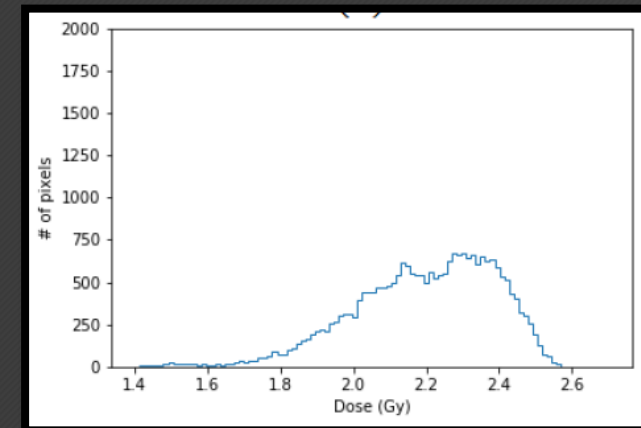
# Example of dDVH results, field-in-field



Static delivery



Interplay? (1 Fx)



Blurring (8 Fx)

# Conclusion

- The observations of this study were consistent with reporting in the literature concerning interplay (i.e. it washes out)
- Whole breast radiotherapy regimens consisting of fewer than 8 Fx are unlikely (poor cosmesis)
- Hypofractionated boosts are unlikely to be used with free-breathing patients
- Alan was a great student - I'd recommend hiring him 😊