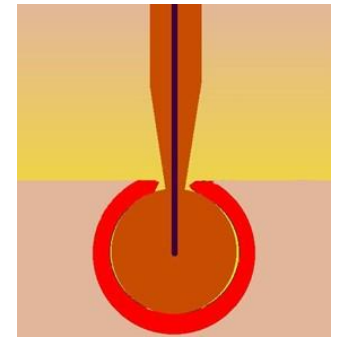


# UK audit of intraoperative radiotherapy dosimetry



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Peter Faulkner, Neil Dancer

On behalf of the  
North East Thames Regional Audit Group



# Electronic brachytherapy

steep dose gradient

**Brachytherapy**

small radiation sources

single dose in theatre

short distance

**Intraoperative**

dedicated suite

**Electronic**

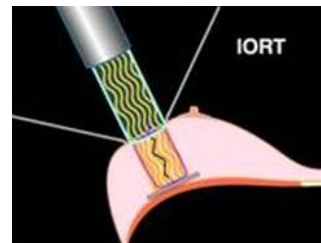
**Afterloading**  
HDR 192Ir 350keV

Electron linac ~4-12MeV

**INTRABEAM**  
50kVp  
(Xoft)  
(Papillon)



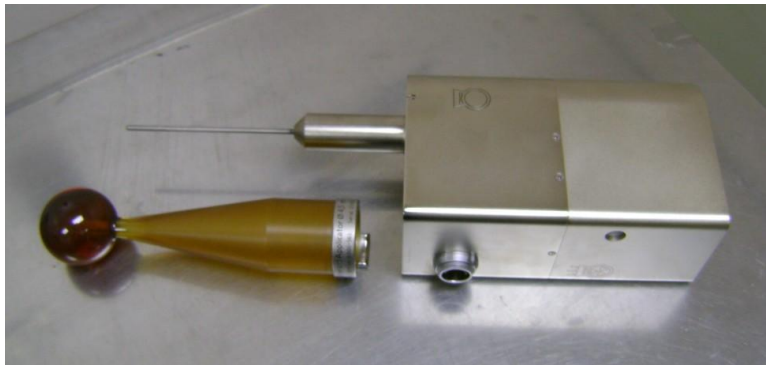
125I seeds ~30keV



- ✓ Low energy = less shielding
- ✓ Compact x-ray source
- ✓ Minimal fading
- ✓ Can switch on and off
- ✓ No risk of contamination

# Intraoperative radiotherapy

## Carl Zeiss INTRABEAM™ PRS500



Compact mobile x-ray source

50kVp, 40 $\mu$ A

1-5cm – 5.0cm applicators

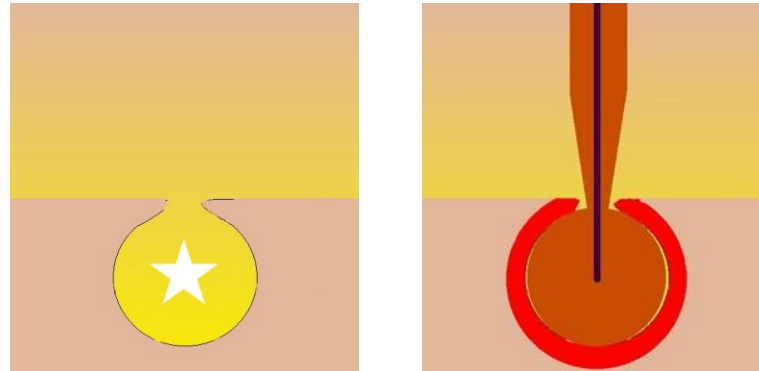
Unshielded dose rate ~1Gy/min



# IORT in practice

Conform the patient to the dose

6Gy @ 1cm (25-40mins)



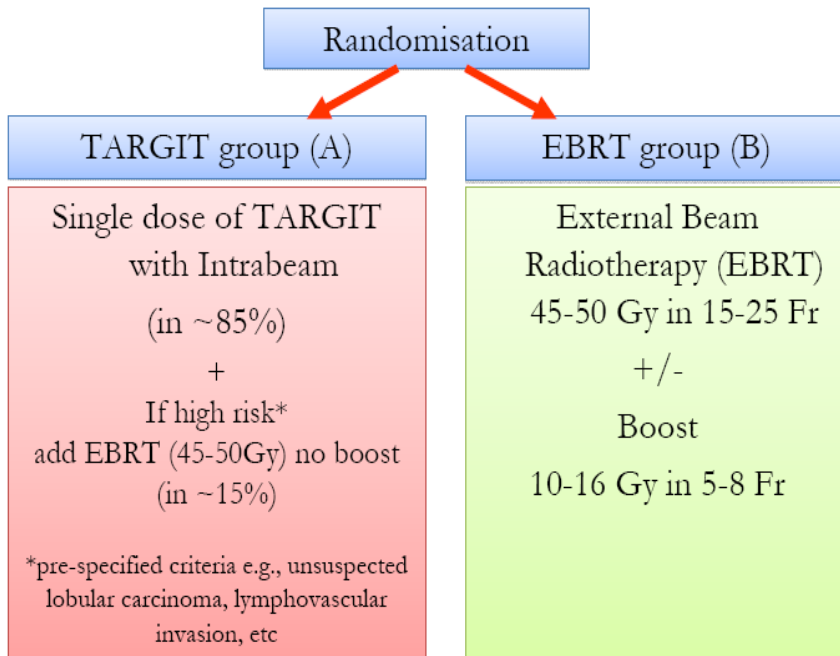
- Multi-disciplinary team-working essential
- MPE must be closely involved
- Radiation protection is straightforward but important



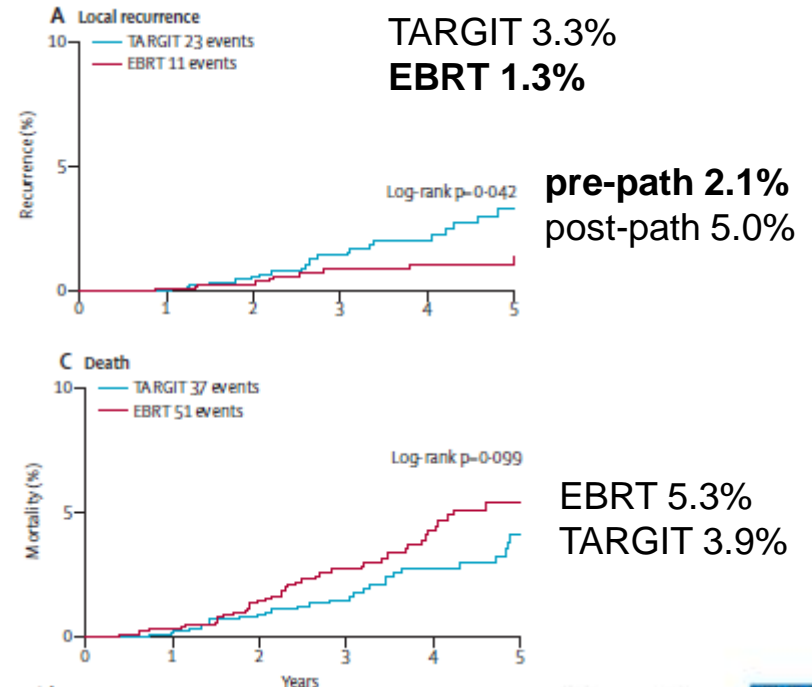
# Does it work?



Breast cancer being treated with Breast Conserving Surgery



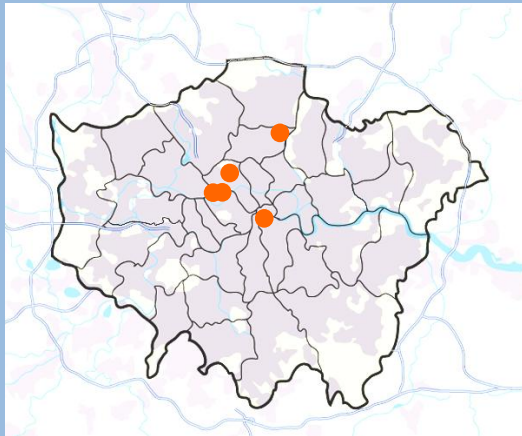
- Phase III RCT
- 33 Centres in 11 countries
- 2000-2010
- 3451 patients (Royal Free 112, UK 707)





# National audit

- 7 centres clinical (or planning to be) in 2012
- 5 in London (2 private)
- Single visiting centre

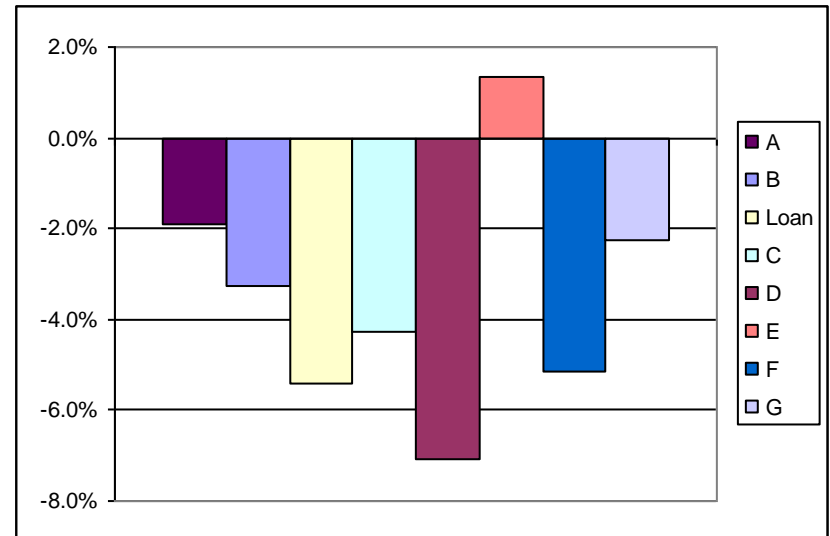
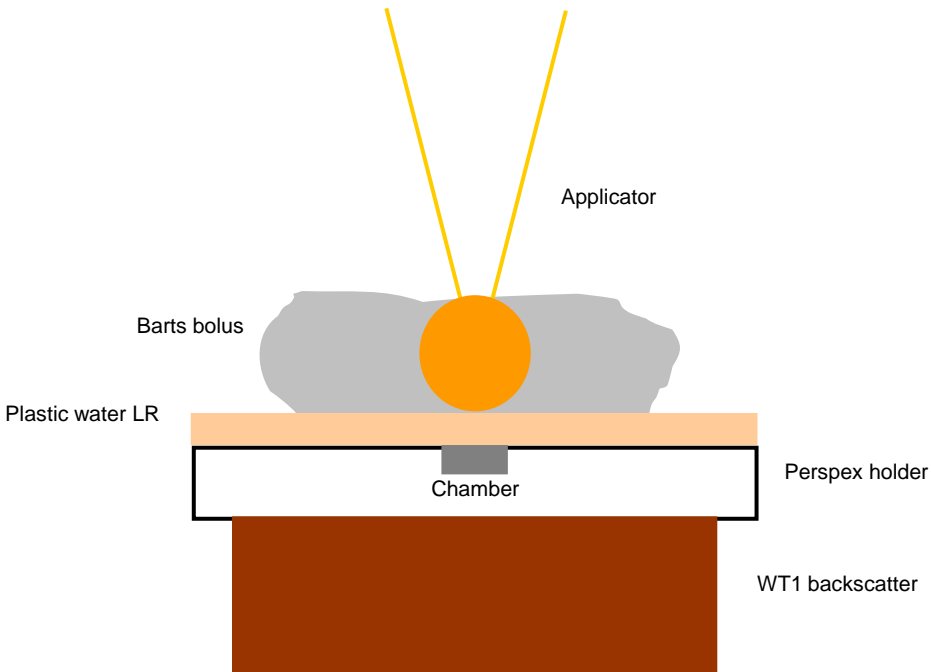


# Output

Absorbed dose in water-equivalent phantom

Compared to system  
prescribed dose

$0.968 \pm 0.027$



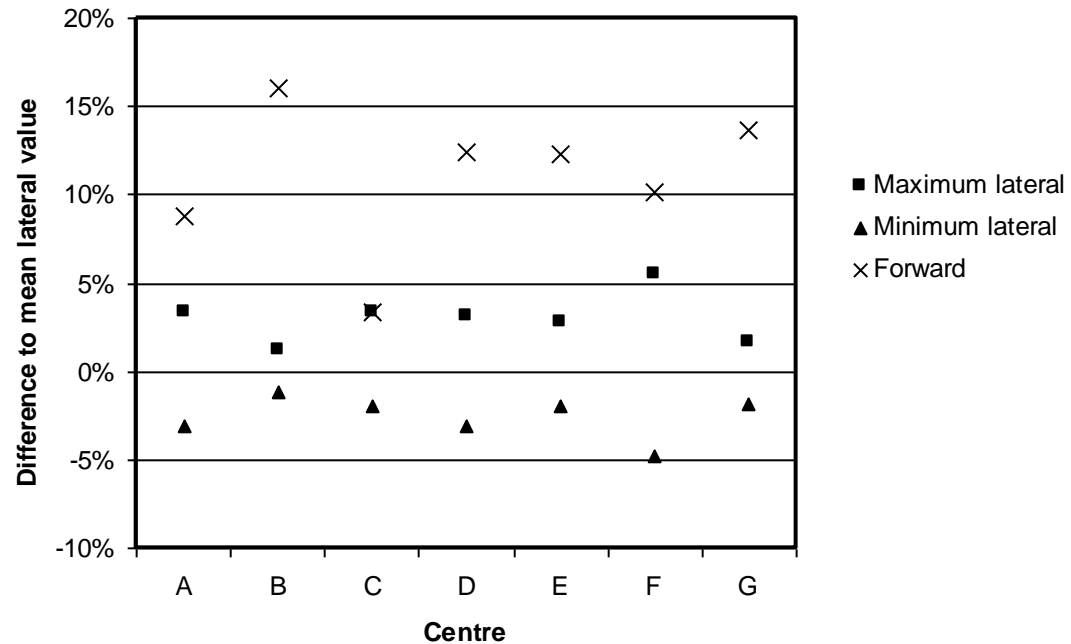
Tolerance 5%, action level 10%, uncertainty 6%

# Isotropy

TLDs around applicator in water – tolerance 10%

Lateral variation (mean)  $\pm 3\%$

Forward / distal  $+11 \pm 4\%$



Unlikely to be clinically significant

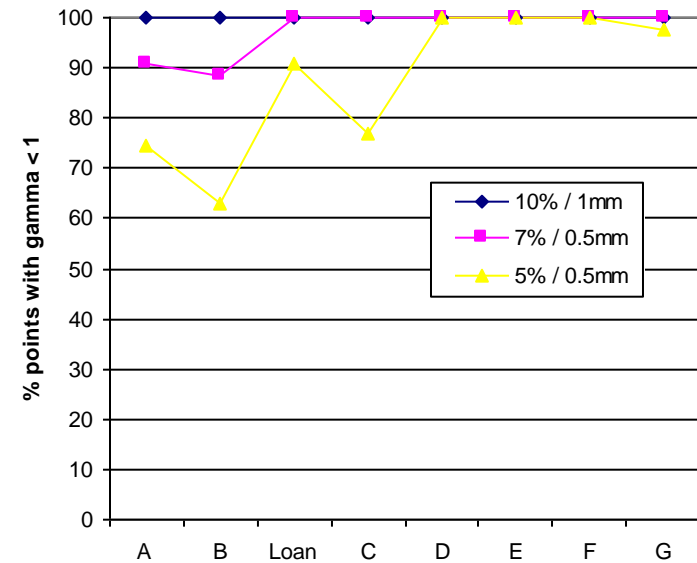
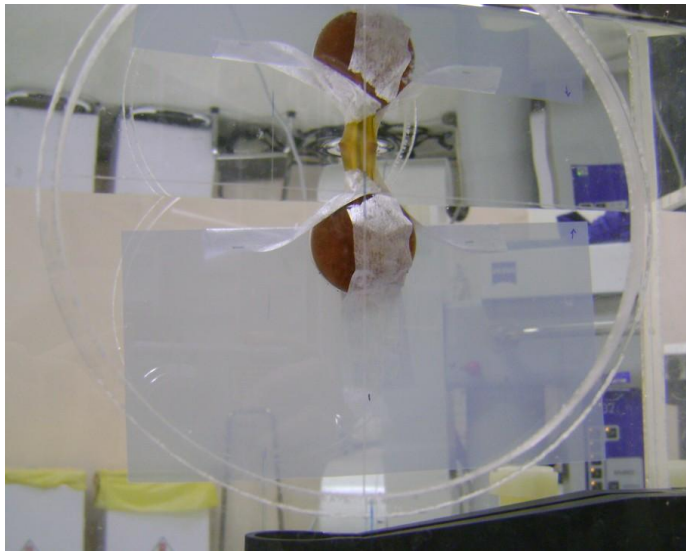


# Depth dose

Gafchromic film around applicator in water – tolerance 10% / 1mm

Compared to manufacturer data  $5 \pm 2\%$

1D gamma analysis (7%/0.5mm) mean 98%



# Conclusions

- Uncertainties greater owing to steep dose gradients
- Acceptable agreement between centres
- Forward anisotropy unlikely to be clinically significant
- Practical tests for inter-departmental audit and local baseline comparison
- NICE evaluation ongoing!

*Full results in BJR Dec 2013*

