Attention This slide set contains explicit images of breastcancer operation specimen

Multi-enery "color" X-ray
A new technique for enhanced Radiological-Pathological correlation in Breast Cancer

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Introduction

- Breast cancer develops in a genetically predisposed malformed breast lobe

- Breast cancer is widespread and multifocal in the majority of cases regardless of the size of the largest invasive component

- Multifocality and disease extent are independent prognostic factors not addressed by the TNM classification

- Large-format histological sections are currently considered the only optimal tool for pathological evaluation of a breast cancer resection specimen

Lindquist et al, Pathol Res Int, 2011
Tot et al, Hum Pathol, 2011

Large vs conventional histological slide

1 cm
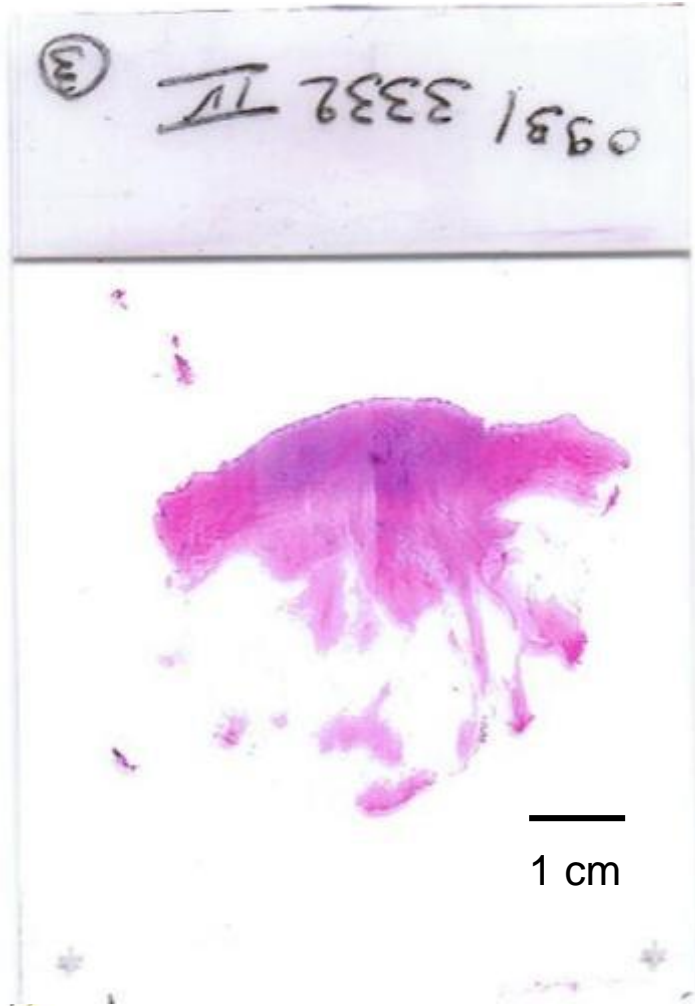
PRO

- Optimal tumor size evaluation
- Radio-Patho tumor correlation
  - → Multifocality
  - → Extent
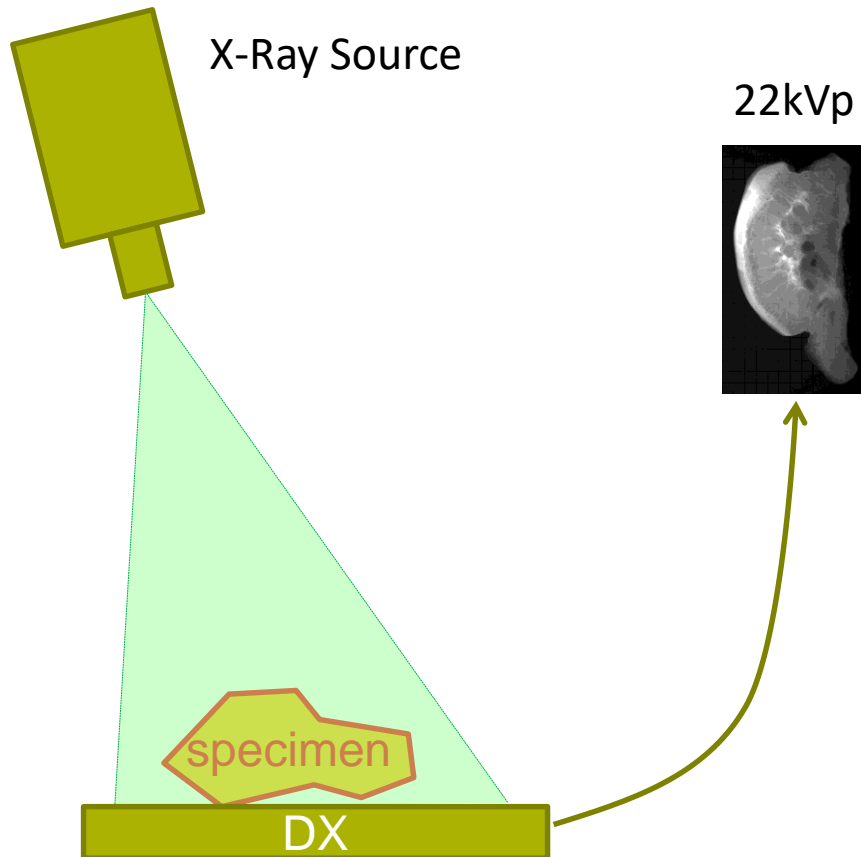 - → Margin assessment

Tibor Tot, The Breast, 2010

CONTRA

- Technical limitation (size, distortion)
- Increased cost
  - → 25% consumables
  - → 50% personnel time
- Non-standard format
  - → Storage problem
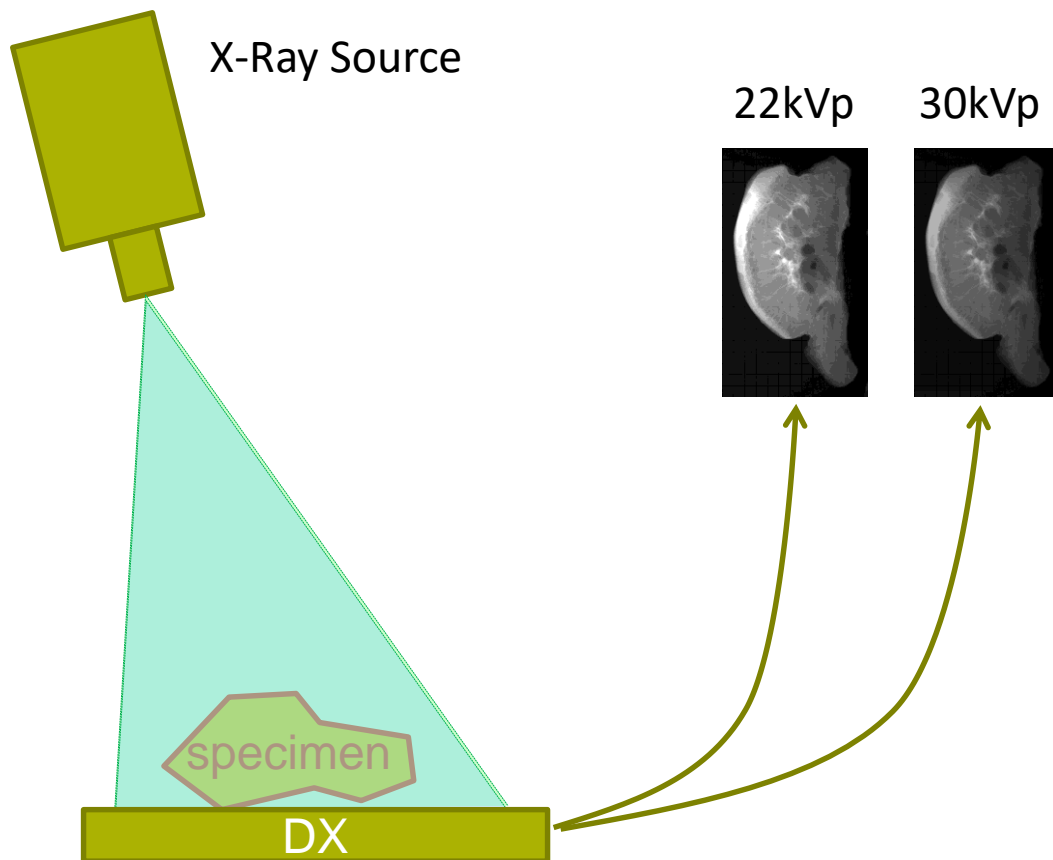 - → Microscope fitting problem

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3-exposure color X-ray

Specimen X-ray

X-Ray Source

22kVp

specimen

DX

B.Dierickx et al, IISW, Hakodate, 2011
B.Dierickx et al, BHPA symposium, Brussels ,2010

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3-exposure color X-ray

Specimen X-ray

X-Ray Source

22kVp   30kVp

specimen

DX

B.Dierickx et al, IISW, Hakodate, 2011
B.Dierickx et al, BHPA symposium, Brussels ,2010

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3-exposure color X-ray

Specimen X-ray

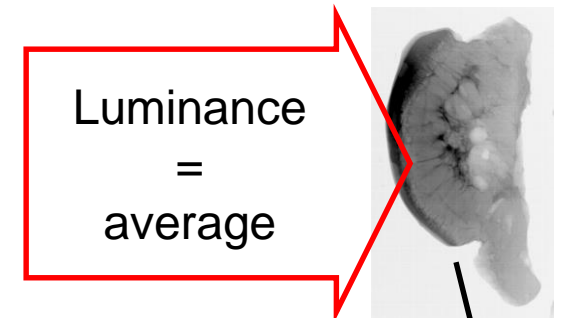X-Ray Source

Compensation of absorption
(inverse Beer's law)

22kVp   30kVp   40kVp

Luminance
=
average

specimen

DX

B.Dierickx et al, IISW, Hakodate, 2011
B.Dierickx et al, BHPA symposium, Brussels ,2010

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3-exposure color X-ray

Specimen X-ray

X-Ray Source

Compensation of absorption
(inverse Beer's law)

22kVp   30kVp   40kVp

Luminance
=
average

Chrominance
=
differences

specimen

DX

empirical white balance
Oxygen/Carbon ratio codes as
magenta/green or red/green/blue

+

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B.Dierickx et al, IISW, Hakodate, 2011
B.Dierickx et al, BHPA symposium, Brussels ,2010

Material and methods

- **Specimen**
  - → 38 breast resection specimens / 35 cancer
  - → Conventional gross slicing 1cm thickness
- **Multi-energy specimen 'color' X-ray**
  - → Identification of tumor
  - → Tumor size
  - → Tumor bed extension
  - → Tumor multifocality
  - → Tissue heterogeneity: necrosis, calcifications, bleeding
- **Radio-pathological correlation**
  - → Conventional histopathological report (8-12 small blocks/slides)
  - → Mapping color X-ray by large- and normal format histopathology
  - → Correlation of tumor extent and node involvement

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Original
diagnosis:
pT1c
Unifocal
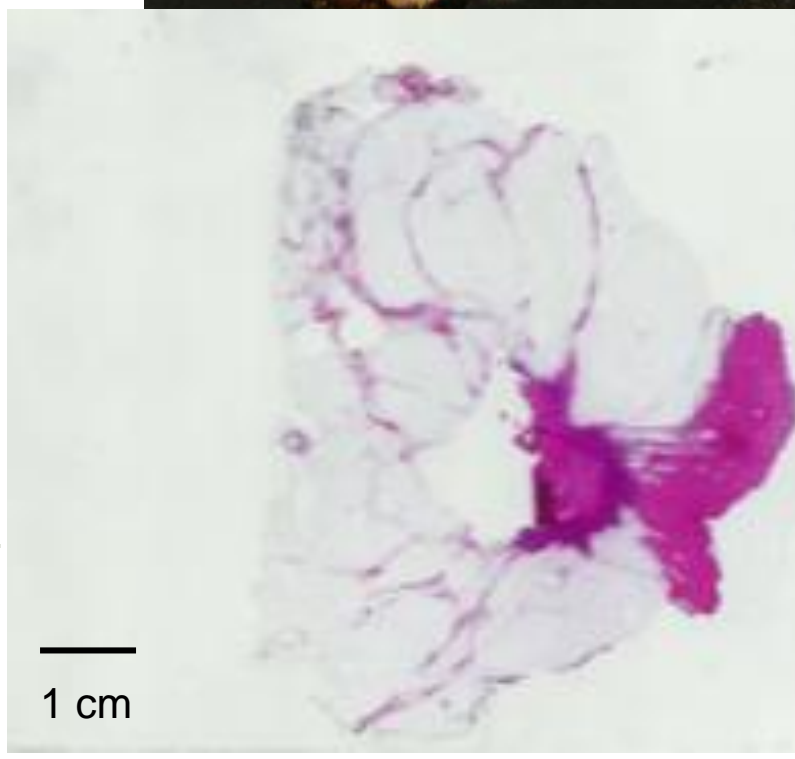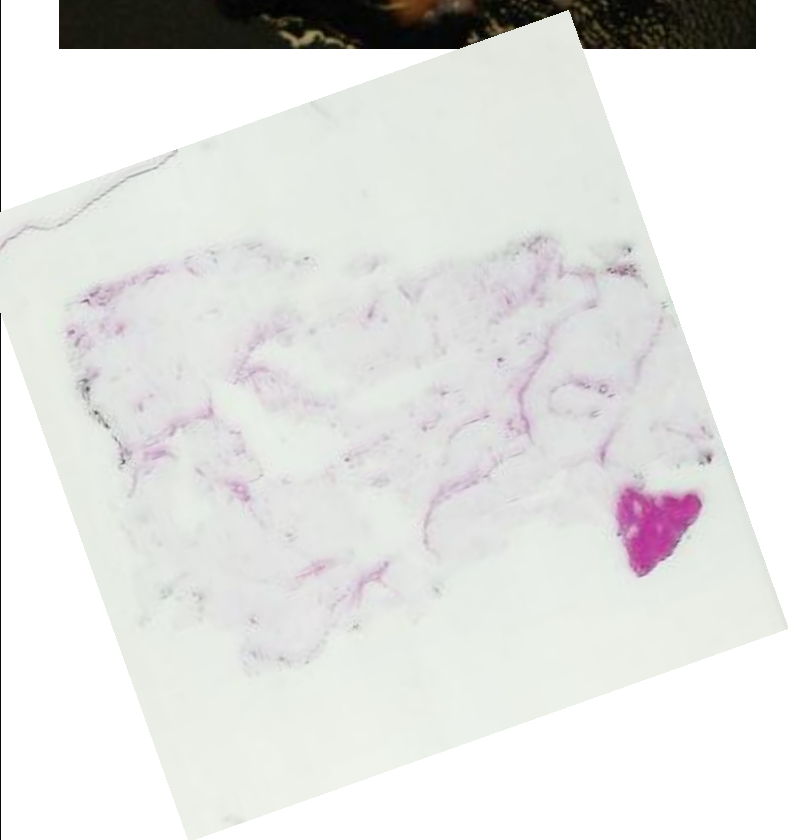
Large
format slide:
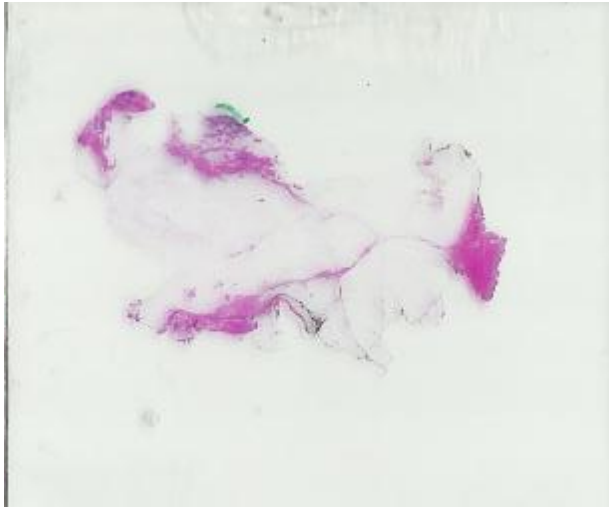pT2
Unifocal
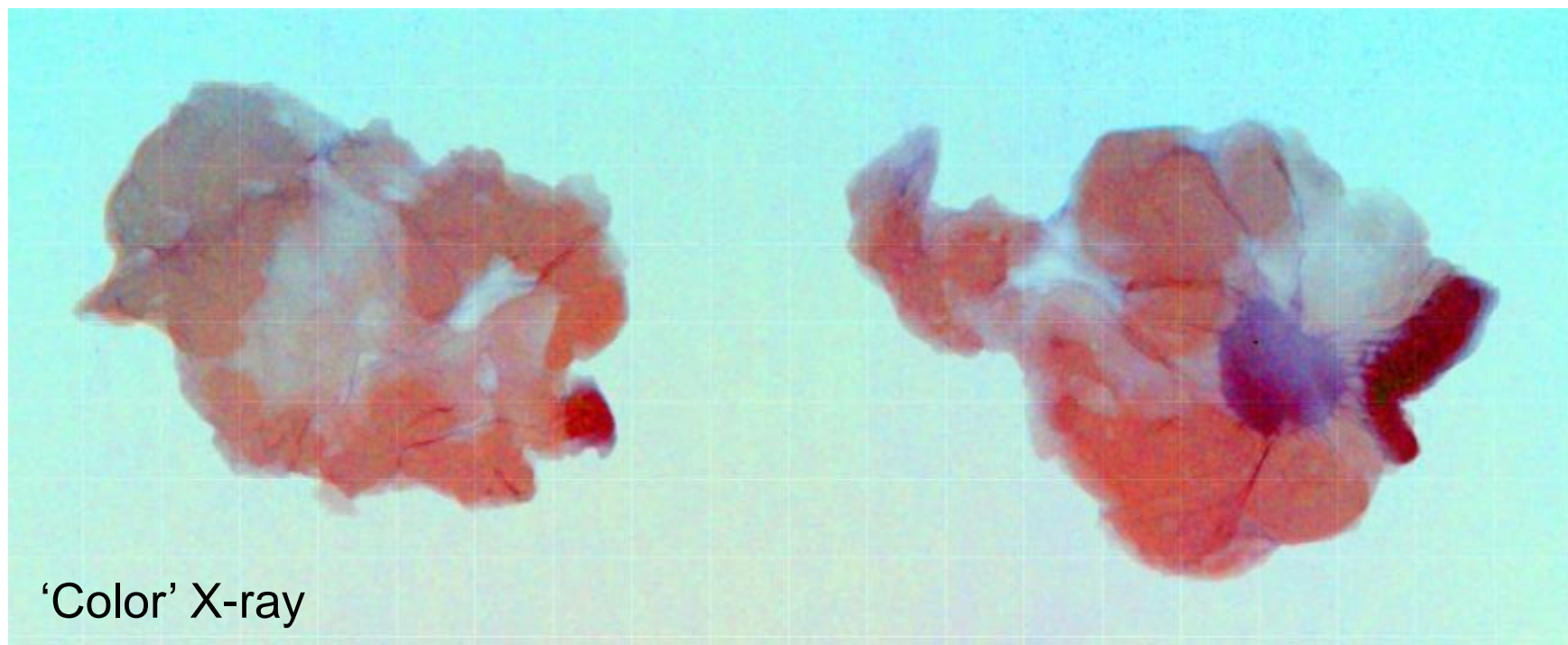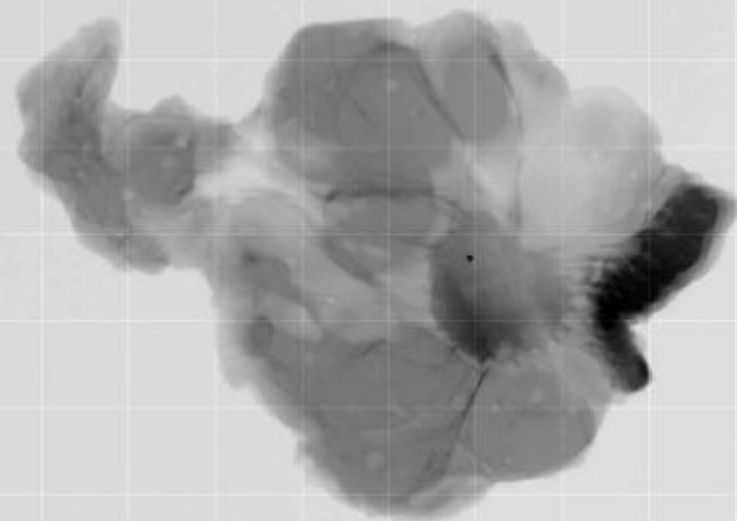
1 cm

Specimen X-ray

'Color' X-ray

Specimen X-ray
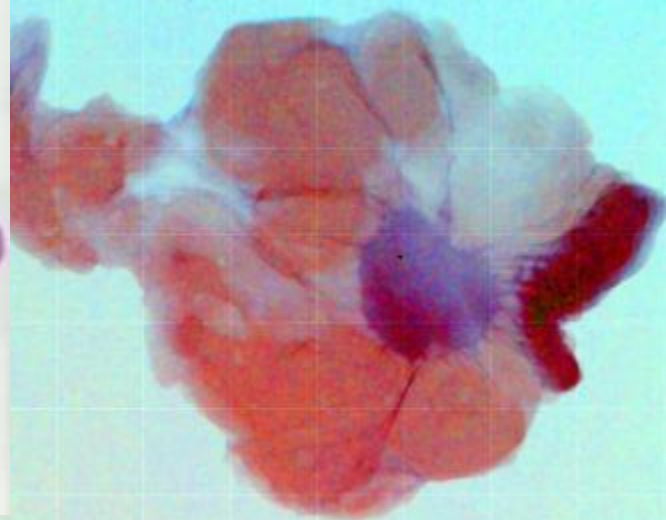
'Color' X-ray

pT2
Unifocal

Original diagnosis:
pT1c, Unifocal,Limited

1 cm

Original diagnosis:
pT1c, Unifocal,Limited

1 cm

pT1c
Multifocal
Extensive

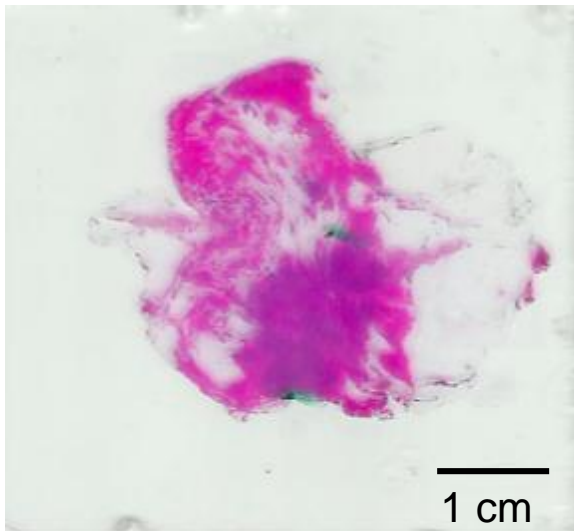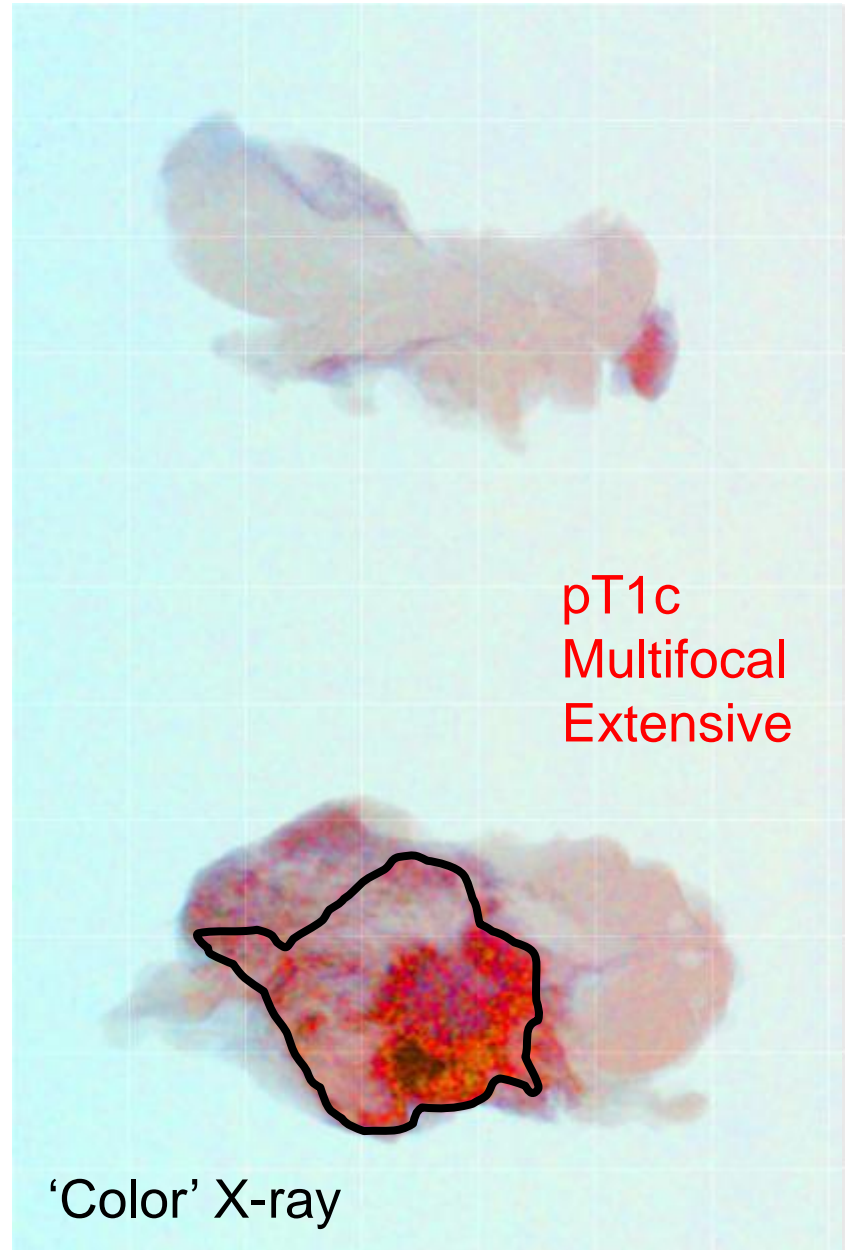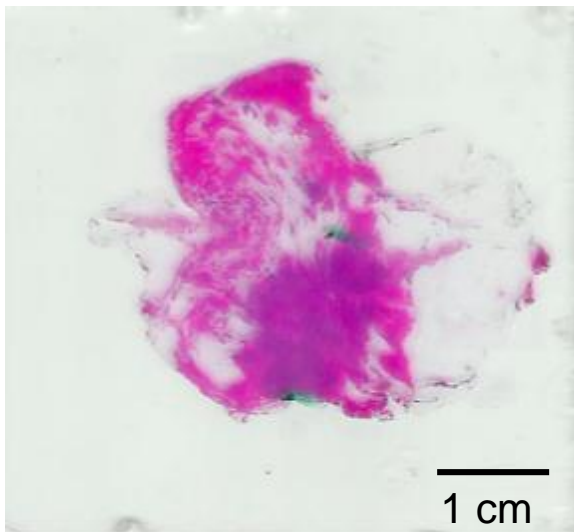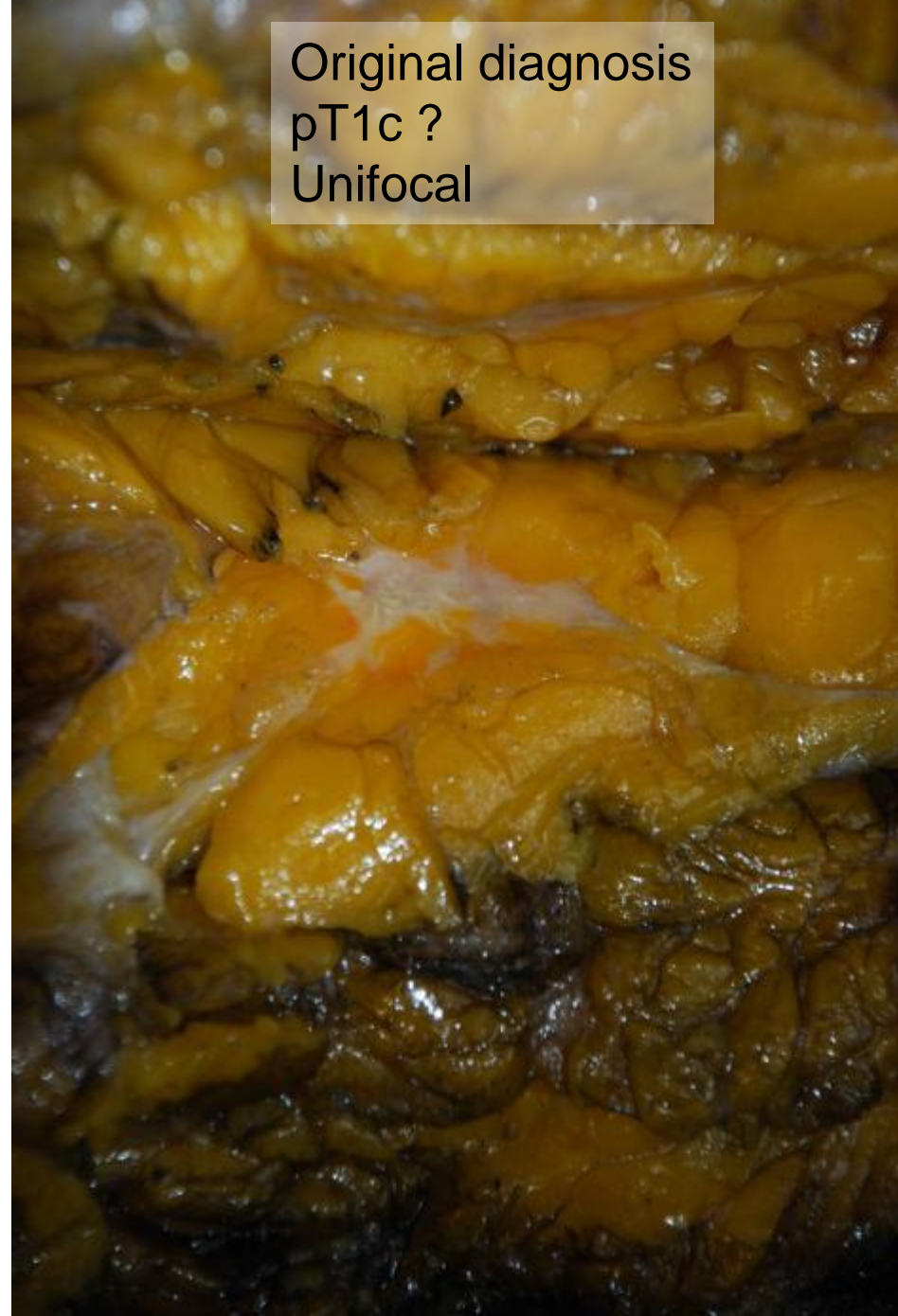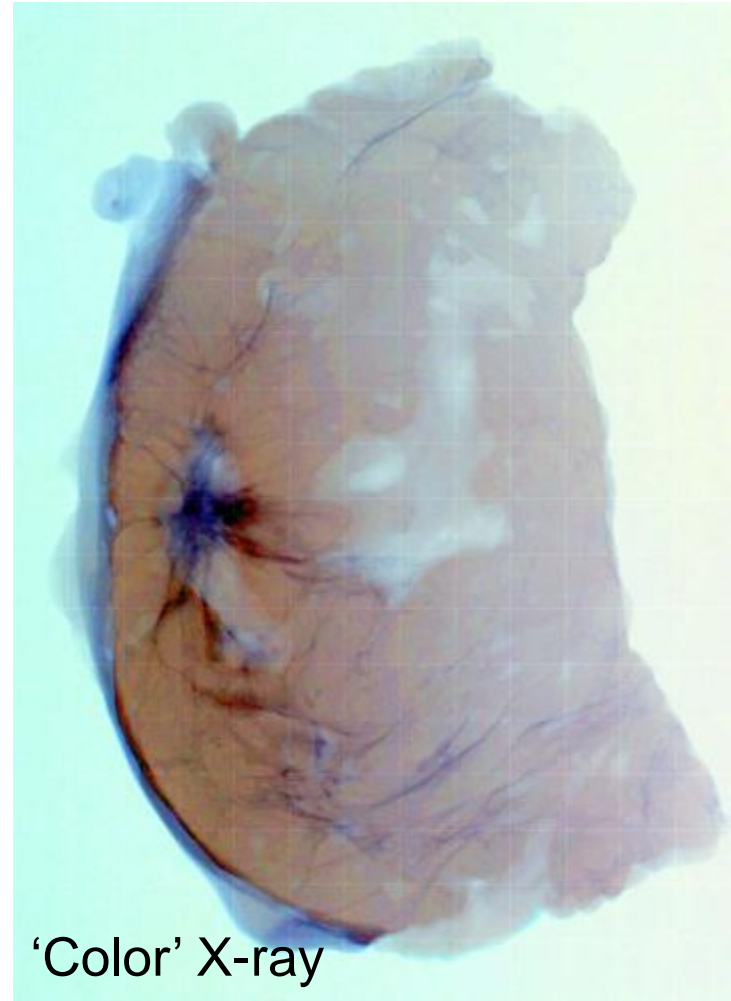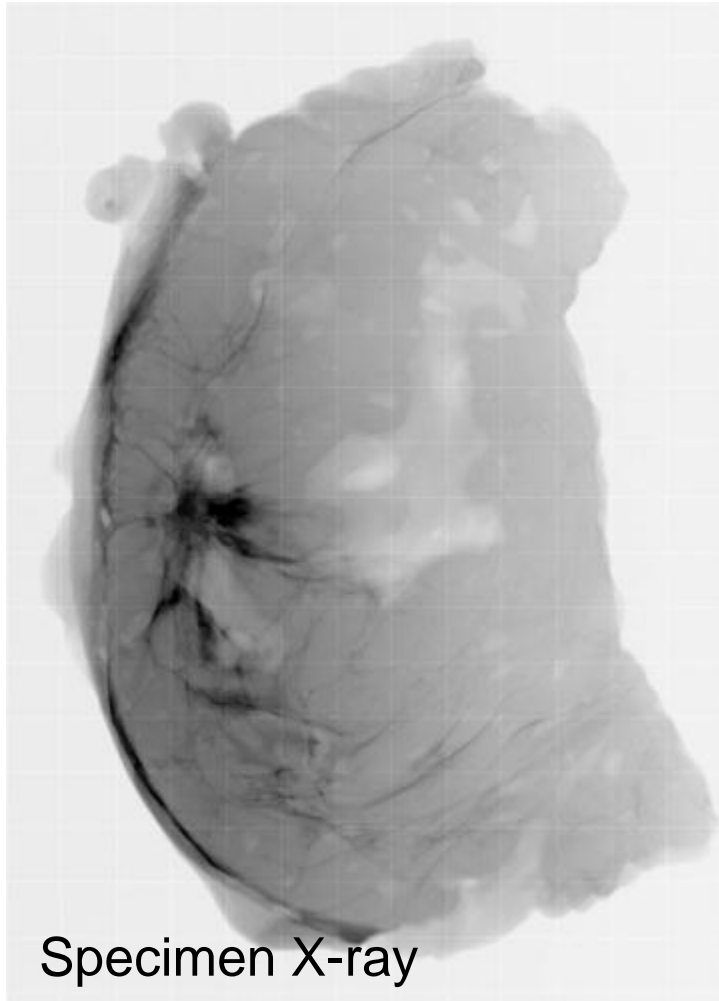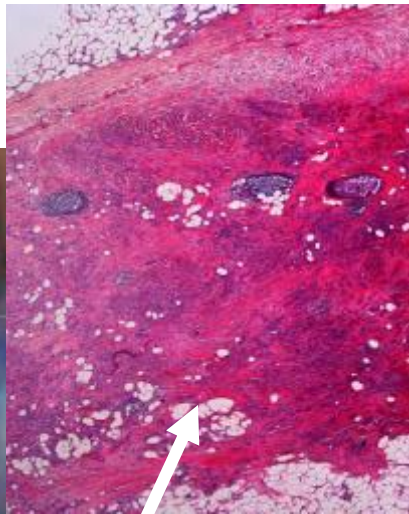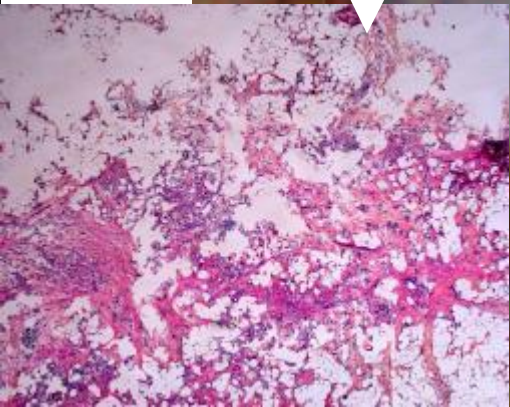'Color' X-ray

1 cm

Original diagnosis
pT1c ?
Unifocal

Specimen X-ray
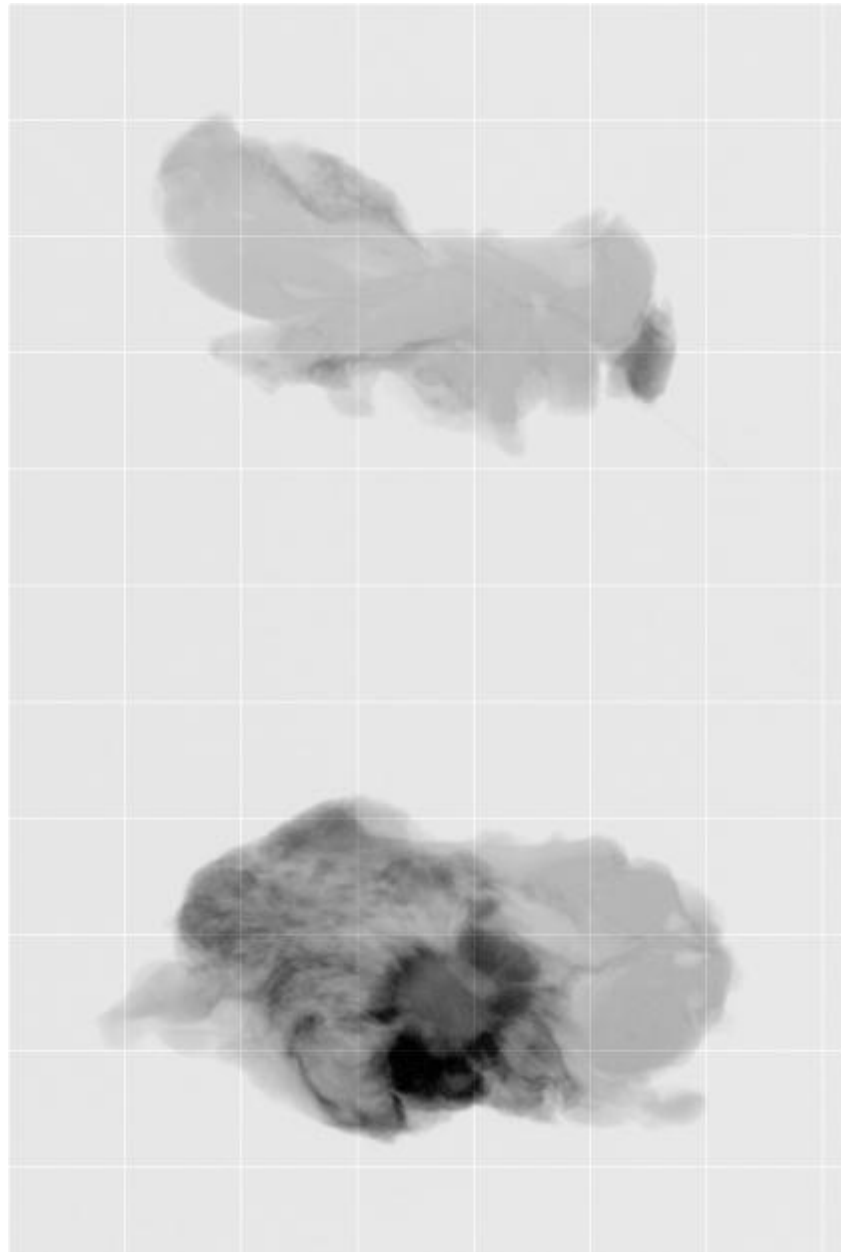
'Color' X-ray
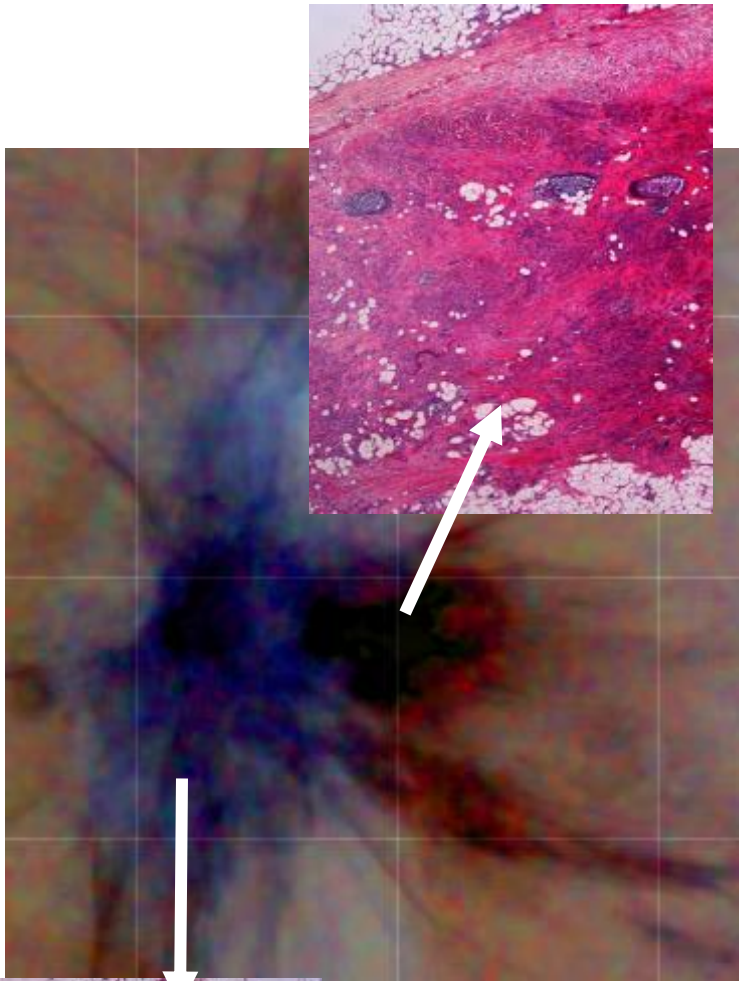
pT2
Multifocal
Extensive
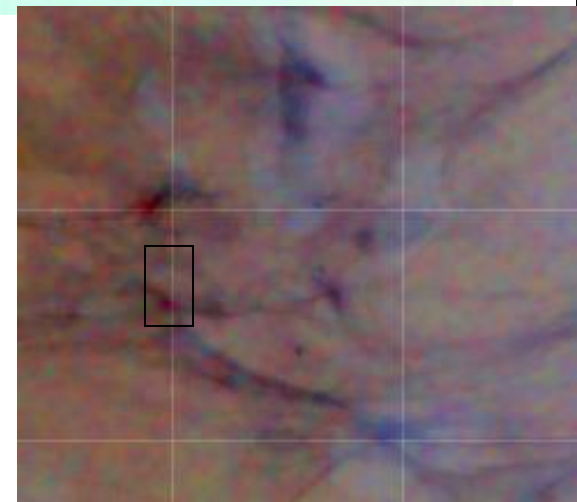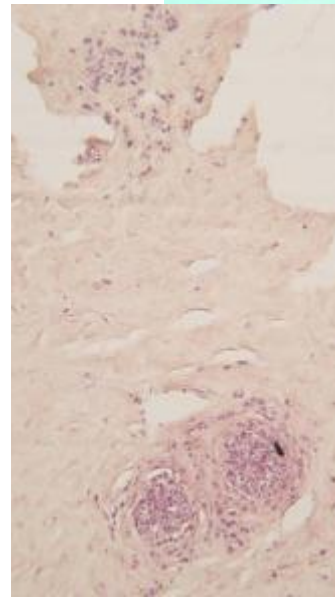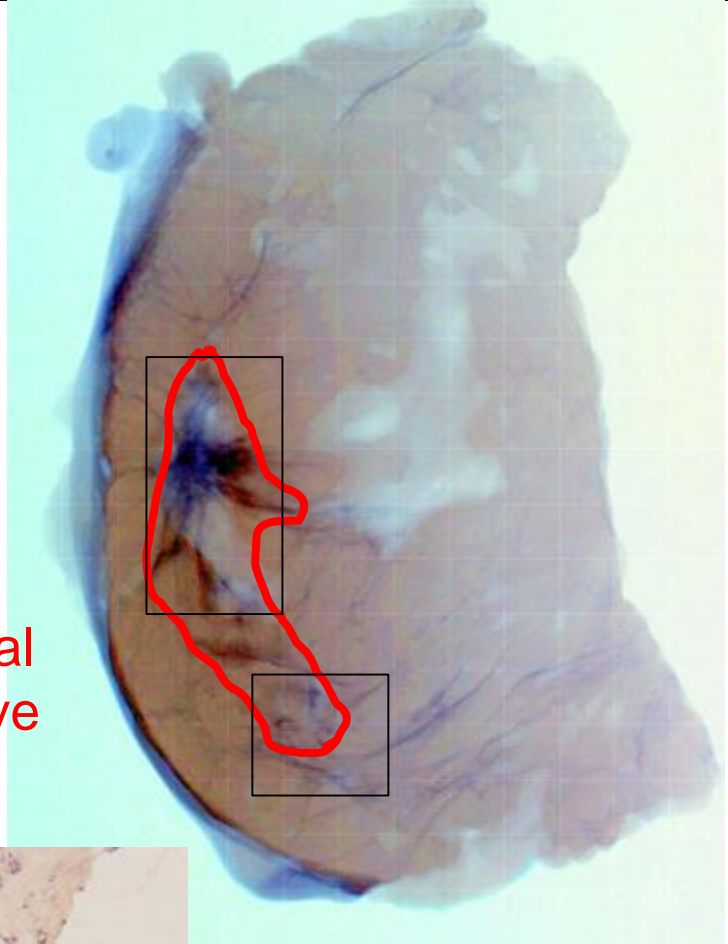
Tumor heterogeneity and calcifications
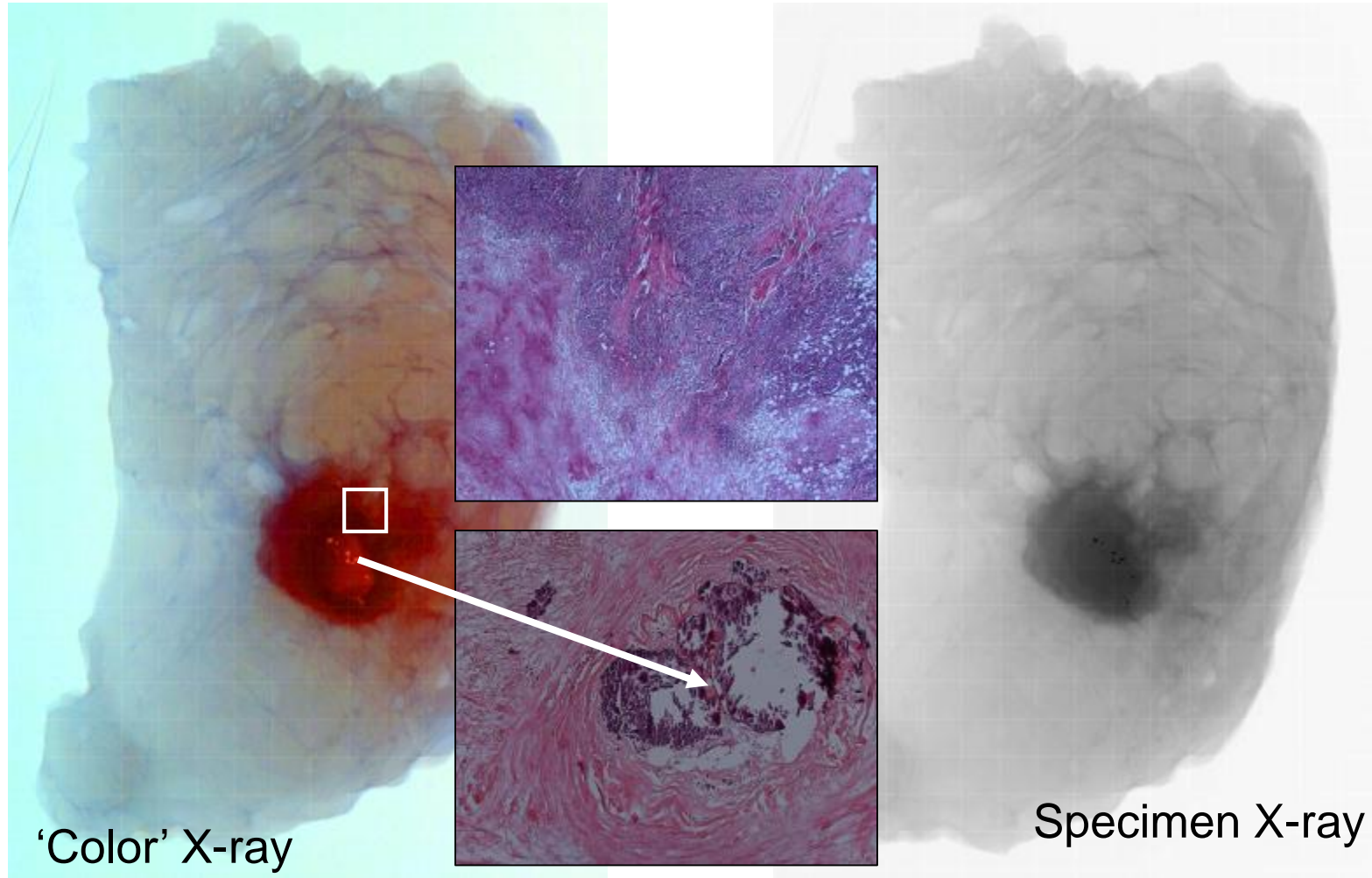
'Color' X-ray

Specimen X-ray

Results

Assessment of multifocality and disease extent

	Primary pathology report	Conventional X-ray (pathologically confirmed)	'Color'X-ray (pathologically confirmed)	p-value colorX vs primary
Multifocal	6/35 (17%)	8/35	12/35 (35%)	0,001*
Extensive disease (> 4 cm^2)	7/35 (20%)	10/35	15/35 (43%)	0,04

p-value calculated on all tumor foci

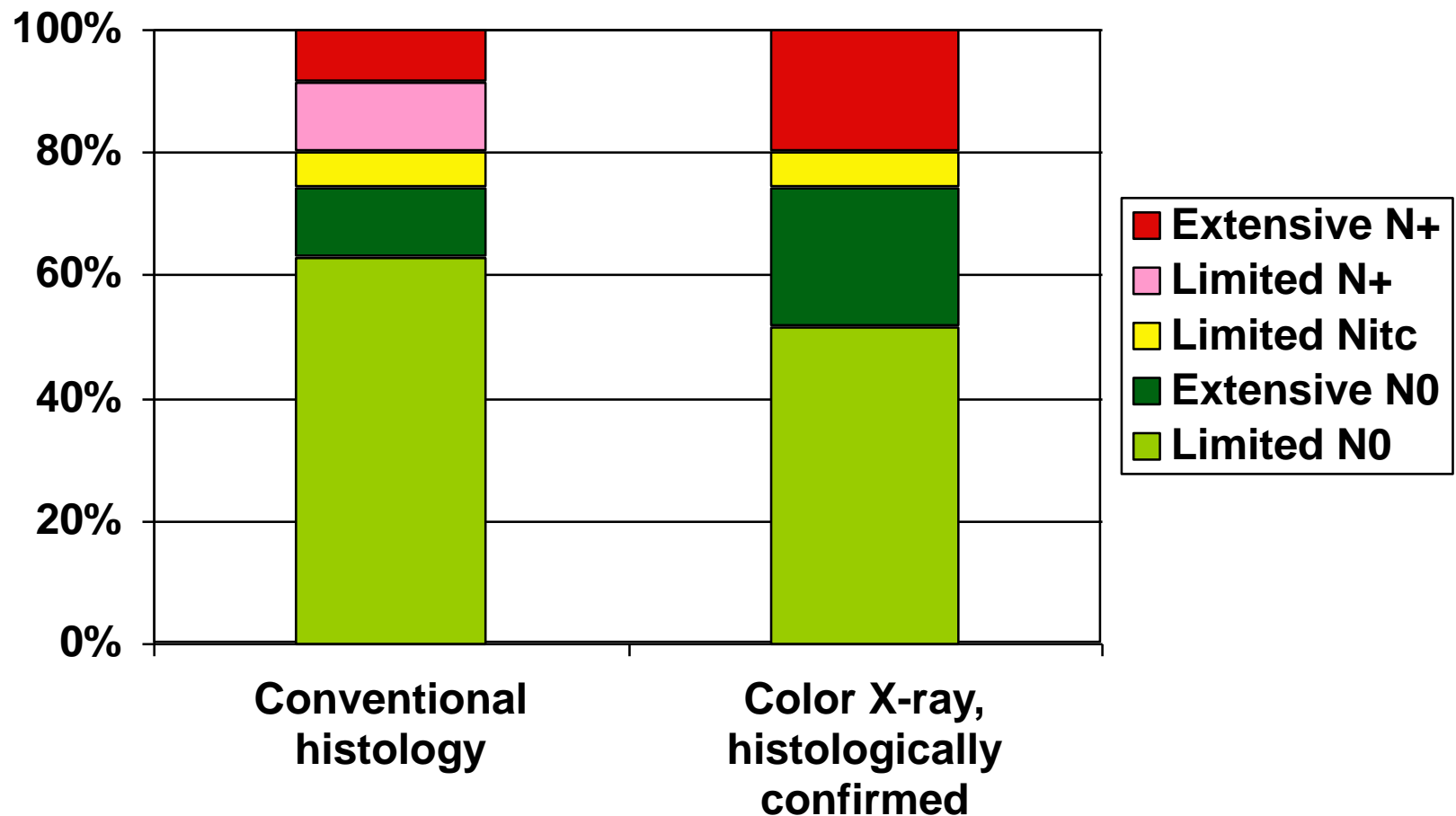# Results

Assessment of tumor size and pT-stage

	Primary pathology report	'Color' X-ray (pathologically confirmed)	p-value
Size (mm) *Largest invasive focus*	10,75 (mean) 3-50 (range)	19,6 (mean) 8-100 (range)	0,01
pT-stage	T1a 1 T1b 2 T1c 13 T2 20 T3 : 0	T1a 0 T1b 1 T1c 9 T2: 23 T3: 2	

Results

Correlation between tumor extension and node status

Conclusions

'Color' X-ray specimen mammography

- detects tumor, heterogeneity, calcifications
- multifocal tumor spots
- tumor extension

- is a promising tool to assess tumor complexity
- may be an adjunct or replacement to large-format histological slides for radio-pathological breast cancer correlation

Thank you!

- **Caeleste**

  Bart Dierickx

- **UZBRUSSEL**

Radiology	Pathology
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Inneke Willekens	Vanessa Ghislain
Cathérine Breucq	Annitta Vleminckx
Ann Schietecatte	
Johan Demey	