

The Coastal Path to Artificial Intelligence in Digital Pathology.

*Digesting the experience of a South West UK Specialist GI
“Path” vs the Ibex Gastric AI*

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Declaration of Competing Interest

I have no competing financial interests or personal relationships that could influence the work reported in this presentation

The Coastal Path to AI in Digital Pathology

- A bit about me and my curious career path!
- How digital pathology enabled my “nomadic” regional upper GI role
- Digital pathology in the Peninsula Cancer Network
- Some classical and unusual gastric pathology cases
- How could adding AI into the workflow benefit patients and Pathology departments?
- Do we need to worry about AI replacing us?





**Curious
Nature Nerd**



Biologist



**Cancer cell
Biology PhD**



Surgeon



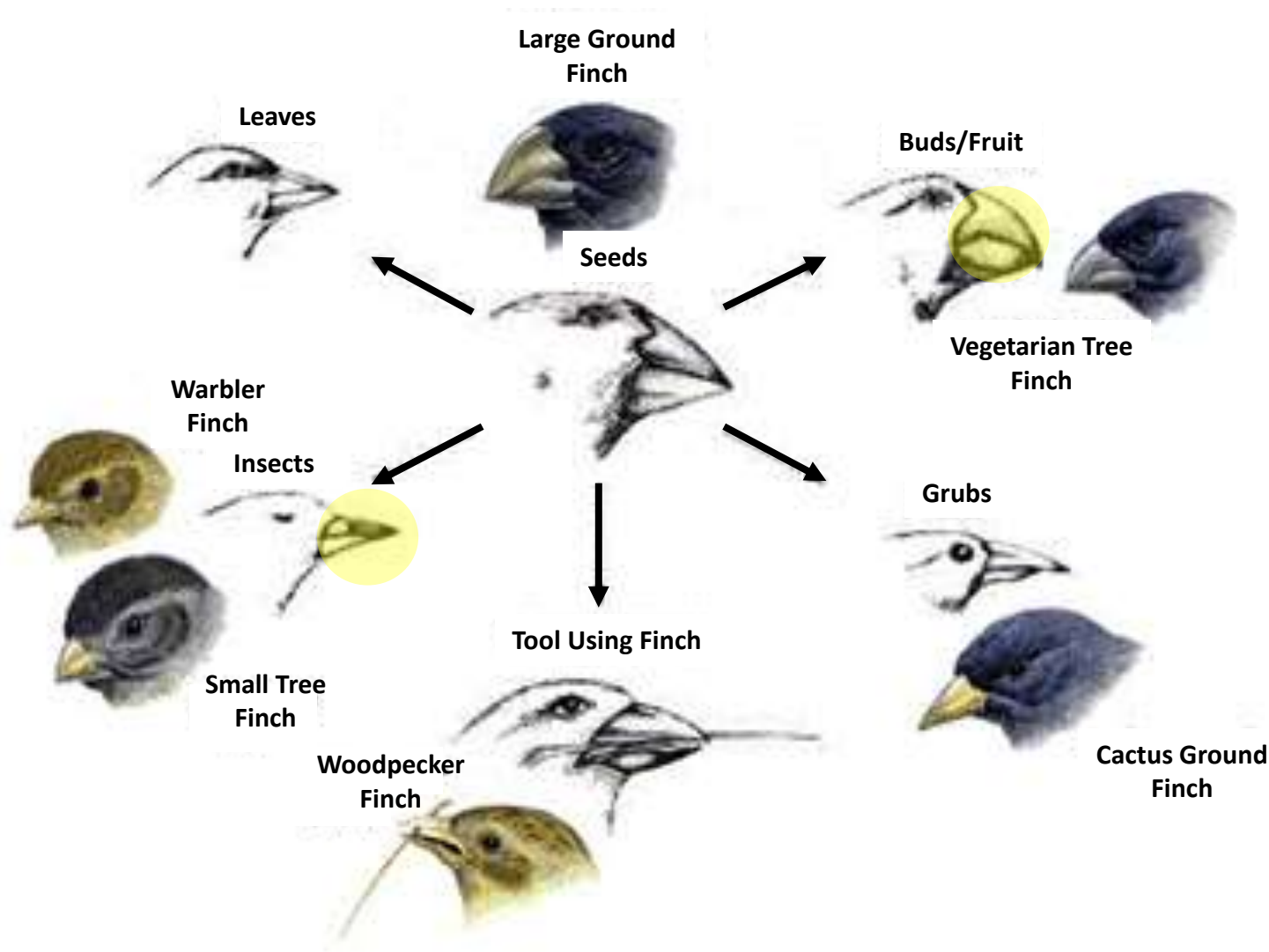
Pathologist



Royal Cornwall Hospitals
NHS Trust

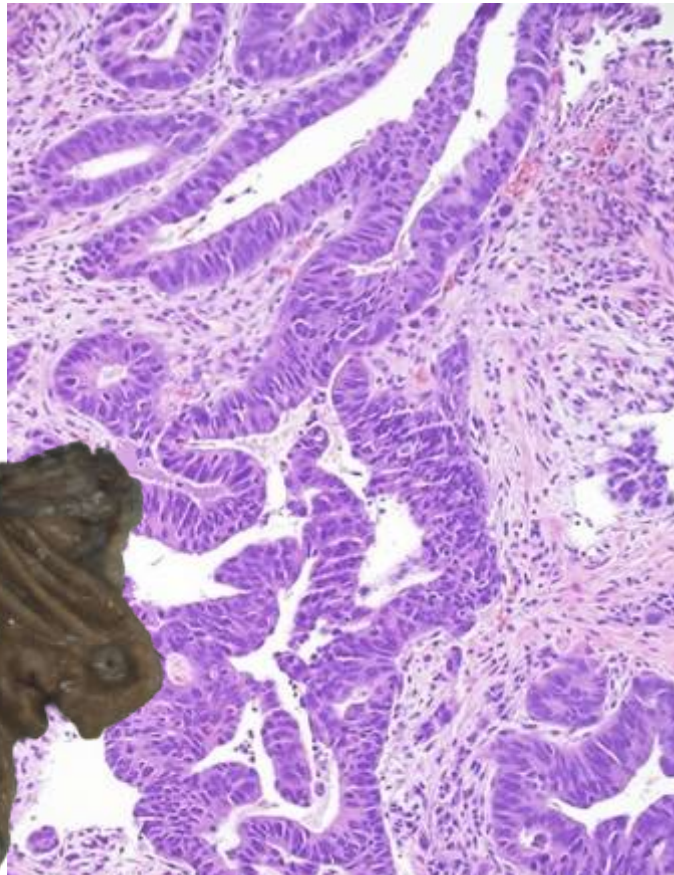
*Outstanding
Care for One+All*

Predicting Behaviour by Morphology

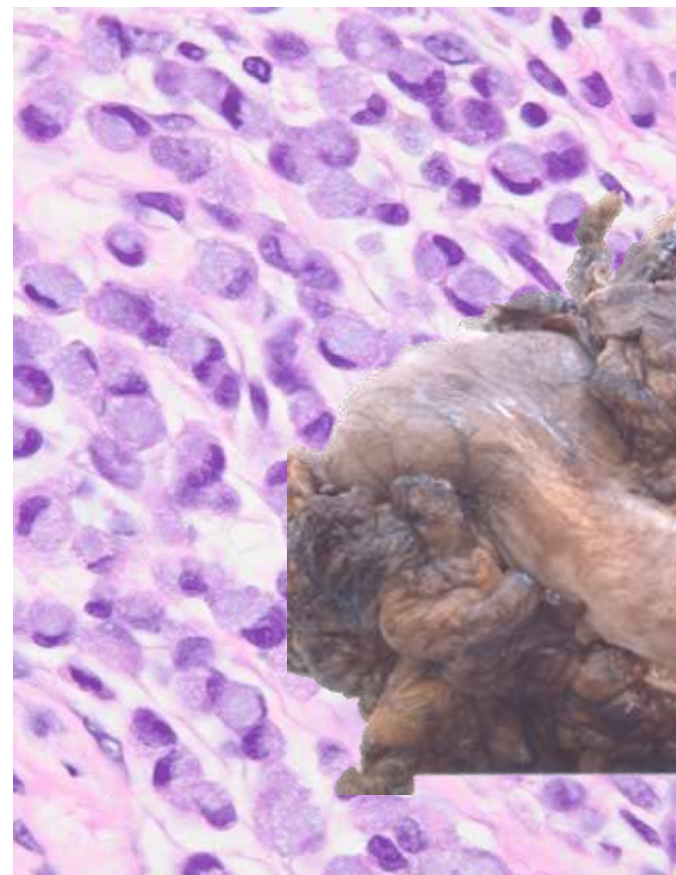


Predicting Behaviour by Morphology

Pekka Laurén (1965)



Intestinal-type



Diffuse-type



Welcome to the Plymouth Oesophago-Gastric Cancer Centre

Plymouth Hospitals **NHS**
NHS Trust

Specialist Team



The Plymouth Oesophago-Gastric Centre has a large team of specialists dedicated to providing first class care to patients with diseases of the oesophagus and stomach.

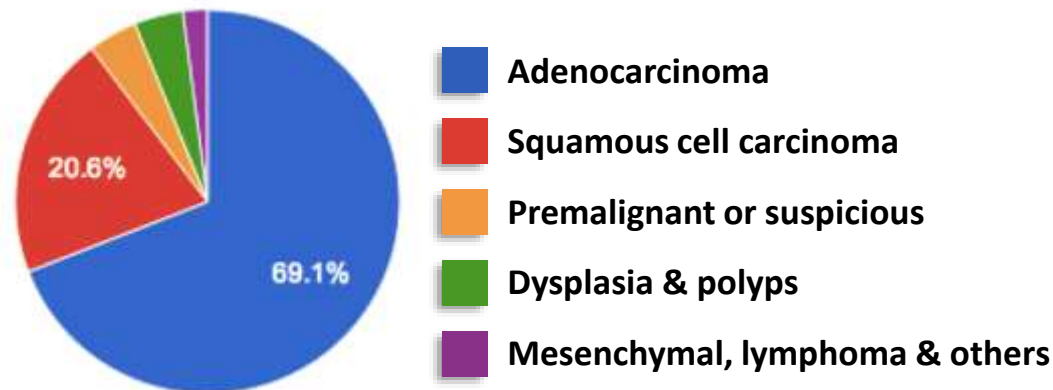
The team includes:

- Surgeons
- [Oncologists](#)
- Clinical Nurse Specialists
- Radiologists
- [Histopathologists](#)
- [Anaesthetists](#)
- [Gastroenterologists](#)
- Nurse Endoscopists
- MDT co-ordinators
- [Dieticians](#)
- [Palliative care physicians](#)

You can access some further information about these specialists by clicking on the links above.

- I joined as Pathology Lead in 2011
- >100 major resections per year from 5 Trusts
- 7 Surgeons
- ~500-600 biopsy case reviews from 5 Trusts
 - 90% time spent on 10% of the cases!
 - *Subjectivity, extra work, second opinions*
- 6% major discordance on central review

Range of pathology encountered on biopsy





NHS
Northern Devon Healthcare
NHS Trust

NHS
Peninsula Pathology
NHS Network

NHS
Royal Cornwall Hospitals
NHS Trust

60 miles

46 miles

42 miles

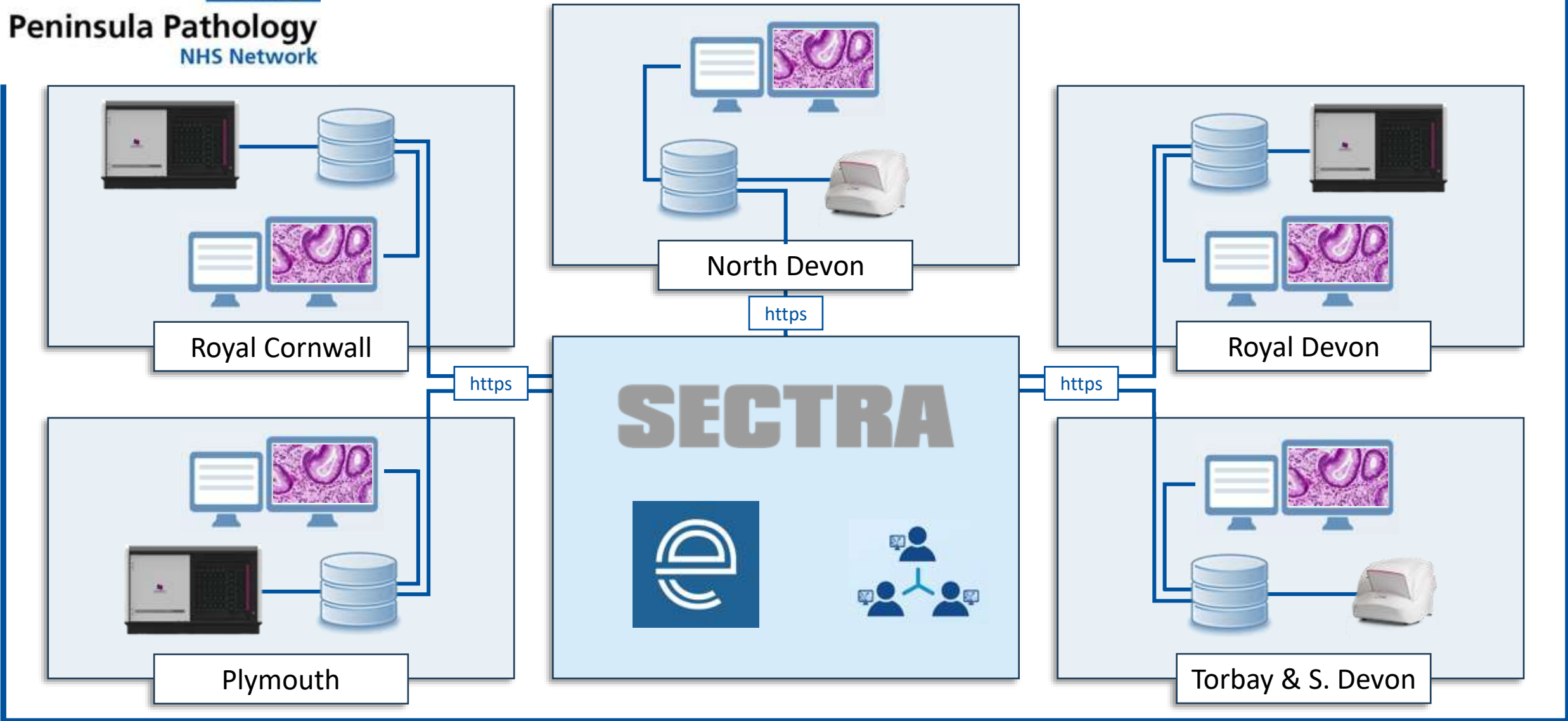
58 miles

NHS
University Hospitals
Plymouth
NHS Trust

NHS
Royal Devon
University Healthcare
NHS Foundation Trust

NHS
Torbay and South Devon
NHS Foundation Trust





NHS
Northern Devon Healthcare
NHS Trust

NHS
Peninsula Pathology
NHS Network

NHS
Royal Cornwall Hospitals
NHS Trust

NHS
University Hospital
Plymouth
NHS Trust

In 2018 I moved from Plymouth to the North Coast of Cornwall

The coastal path



Journal of Pathology Informatics (2022)

The Nomadic Digital Pathologist. Validation of a simple, dual slide scanner with remote reporting for a regional upper gastrointestinal specialist multidisciplinary meeting

Tim S Bracey, MBChB, PhD, FRCPath

Royal Cornwall Hospital, Treliske, Truro TR1 3LJ, UK



As a result I had a range of gastric pathology digital slides available to test with AI



Digital Pathology & AI Landscape



Products

- Prostate, Breast (H&E), Breast (IHC), Gastric

Clearance & Certification

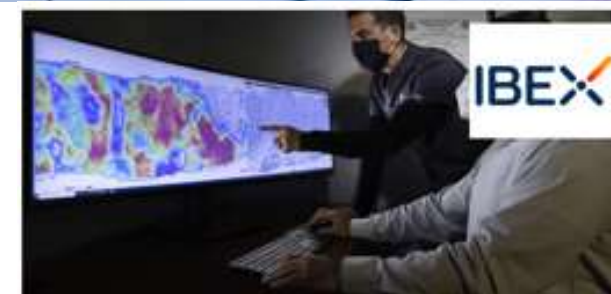
- CE-IVDR (Prostate, Breast & Gastric)
- HMRA, Cyber Essentials+

Key Publications

- Prostate (The Lancet)
- Breast (Nature NPJ)

Awards

- NHSx AI Award: Prostate (2021)
- NHSx AI Award: Breast (2023)



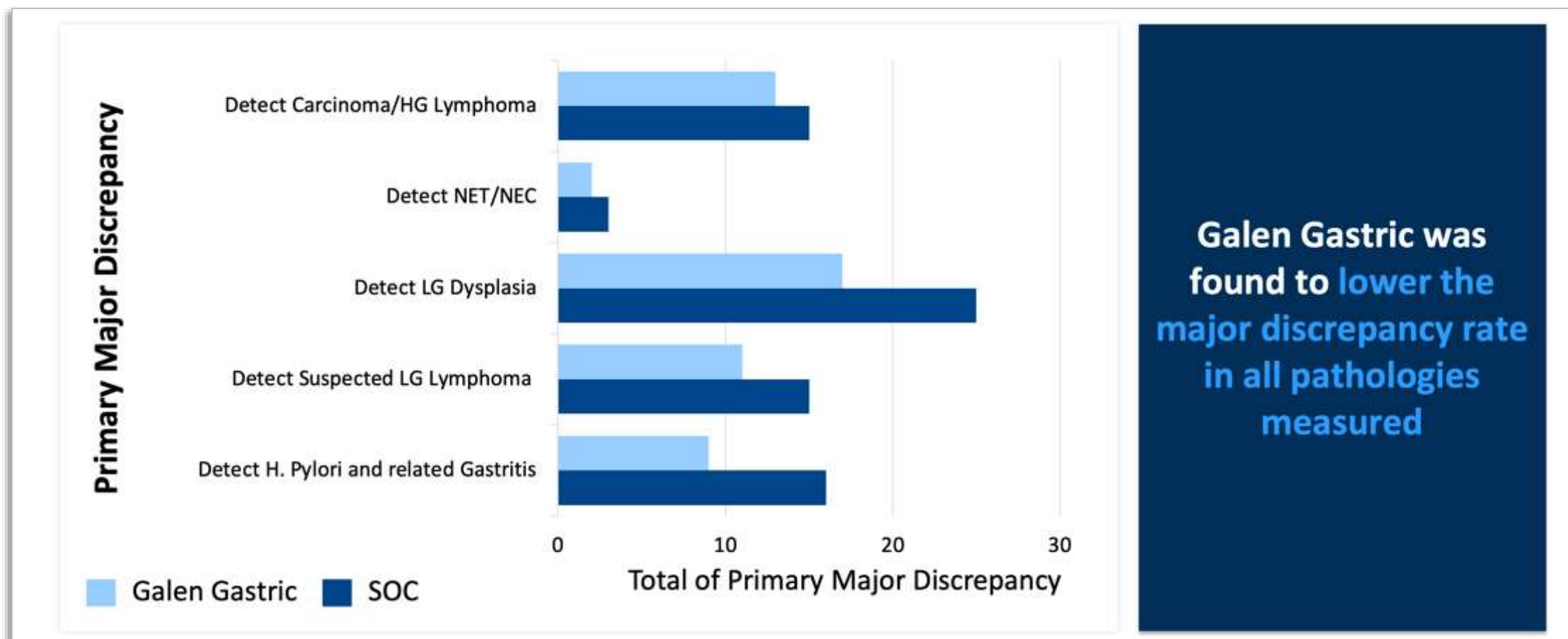
» The Galen™ Platform

CE | H&E

Galen is a clinically proven, AI-powered platform for supporting pathologists during routine cancer diagnosis. The platform helps pathologists improve the accuracy of diagnosis, enhance lab efficiency and implement 100% quality control.

Multi-Site Validation of AI-assisted gastric biopsy diagnosis

Manuel Rodriguez-Justo at University College London, UK



Simple Evaluation Design



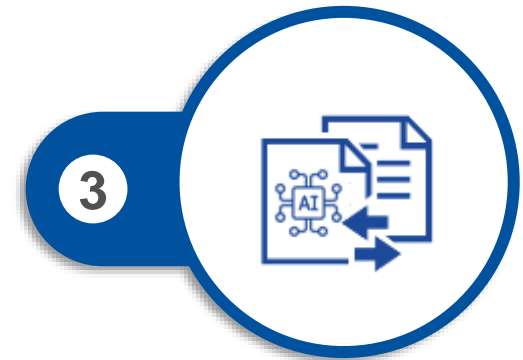
Select

Select **interesting & challenging cases** from the archive



Anonymize

Anonymize & upload to **Ibex AI Platform**



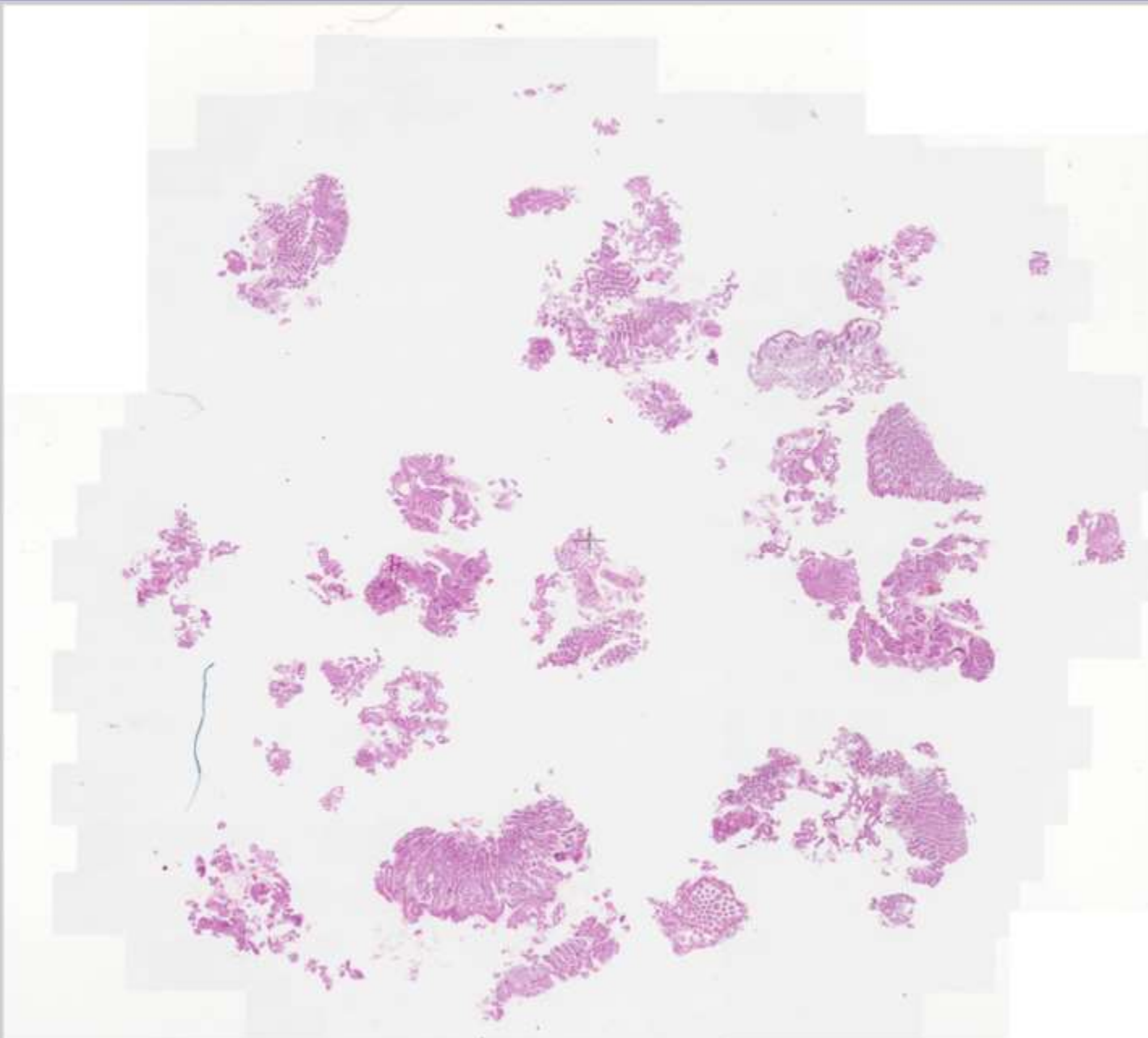
Compare

Compare results & assess **performance**
Can I beat it?

Case #1

- 60 year old man
- Gastric outlet obstruction
- High clinical suspicion of cancer
- Second attempt to find cancer in gastric biopsies

Heatmaps

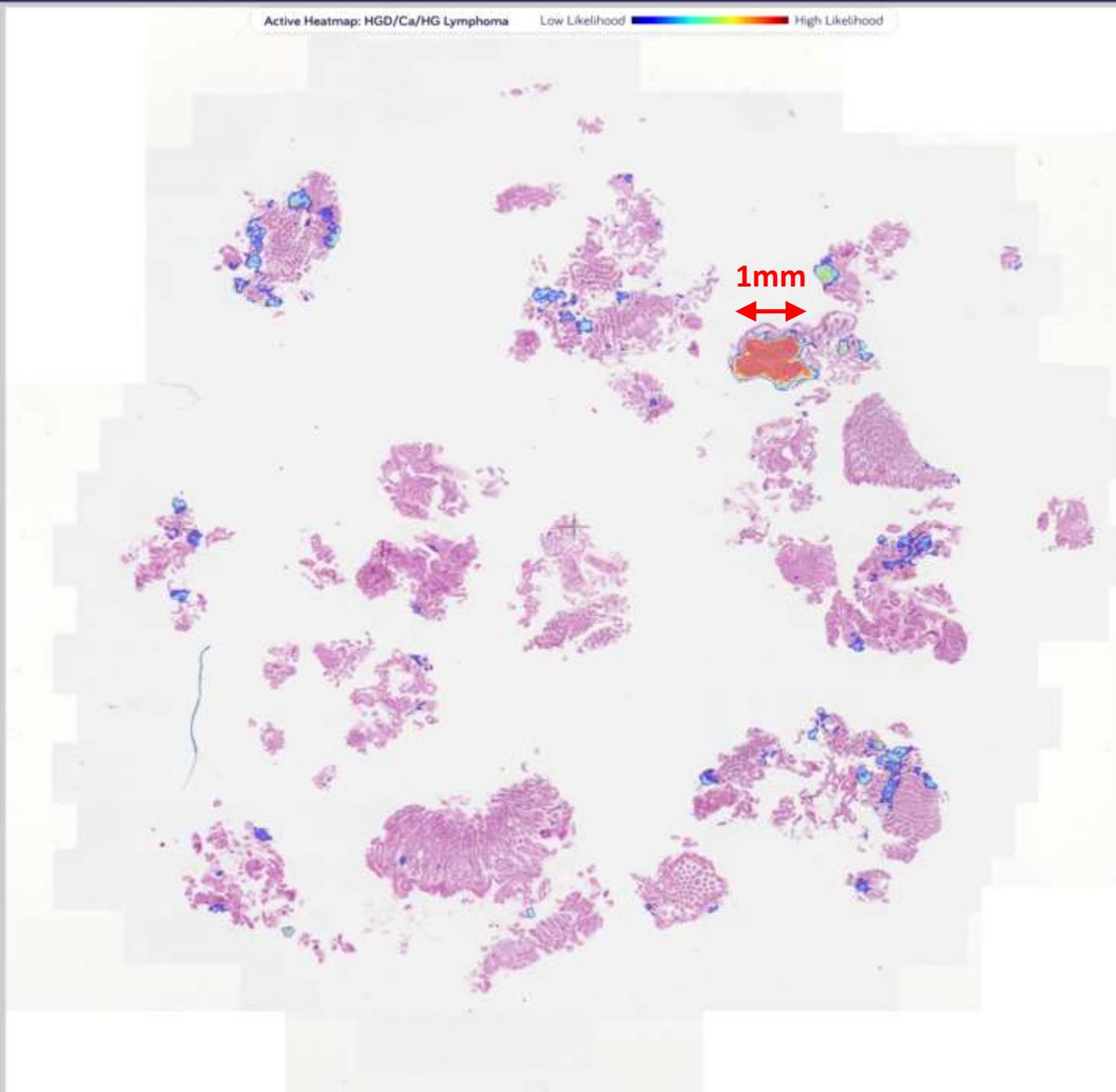
**Case #1***60 year old man***H&E**

0.7x



Heatmaps

Active Heatmap: HGD/Ca/HG Lymphoma Low Likelihood High Likelihood



Case #1

60 year old man

Cancer h/m

(Red = High Prob.)

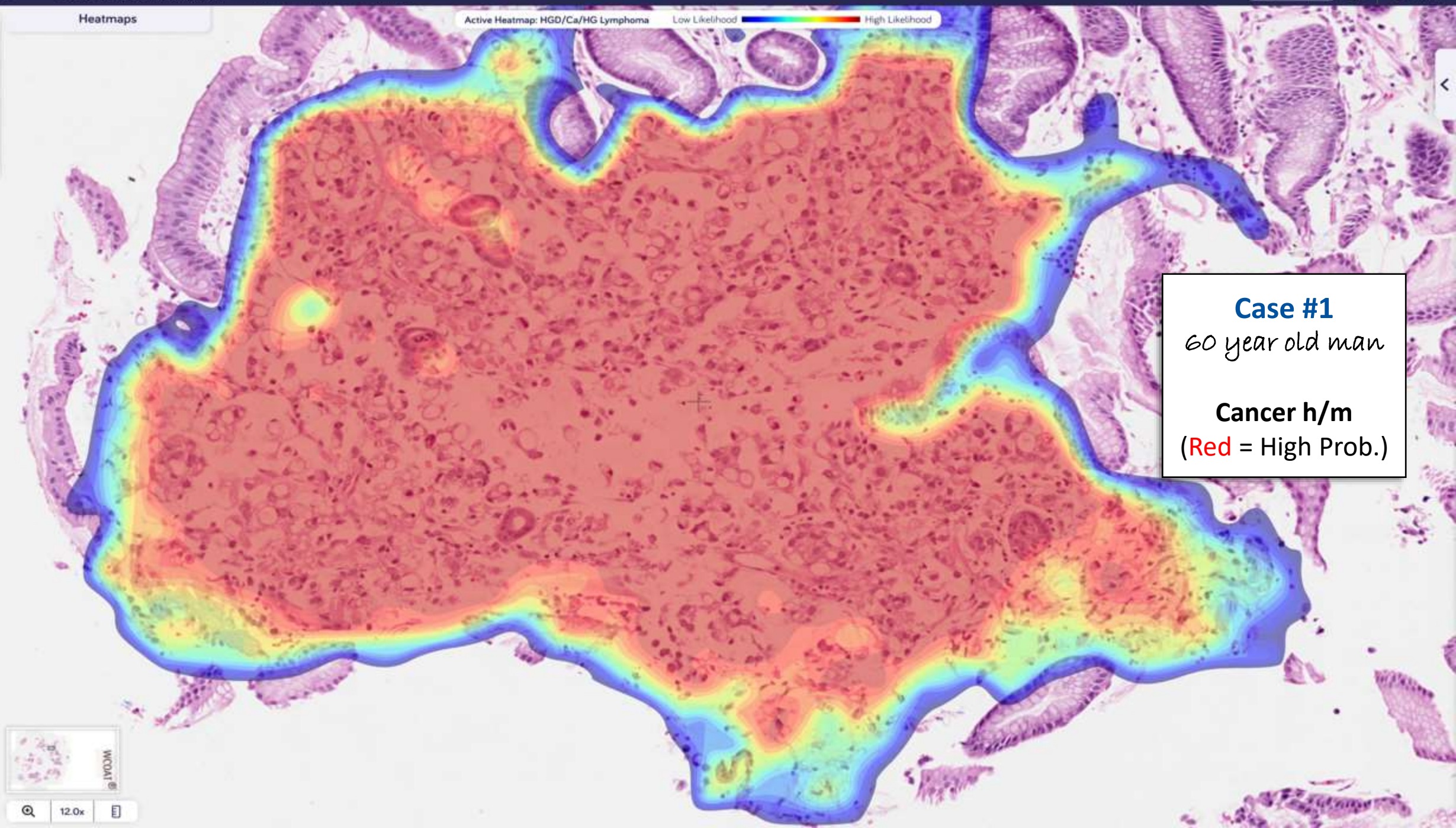


0.7x



Heatmaps

Active Heatmap: HGD/Ca/HG Lymphoma Low Likelihood High Likelihood



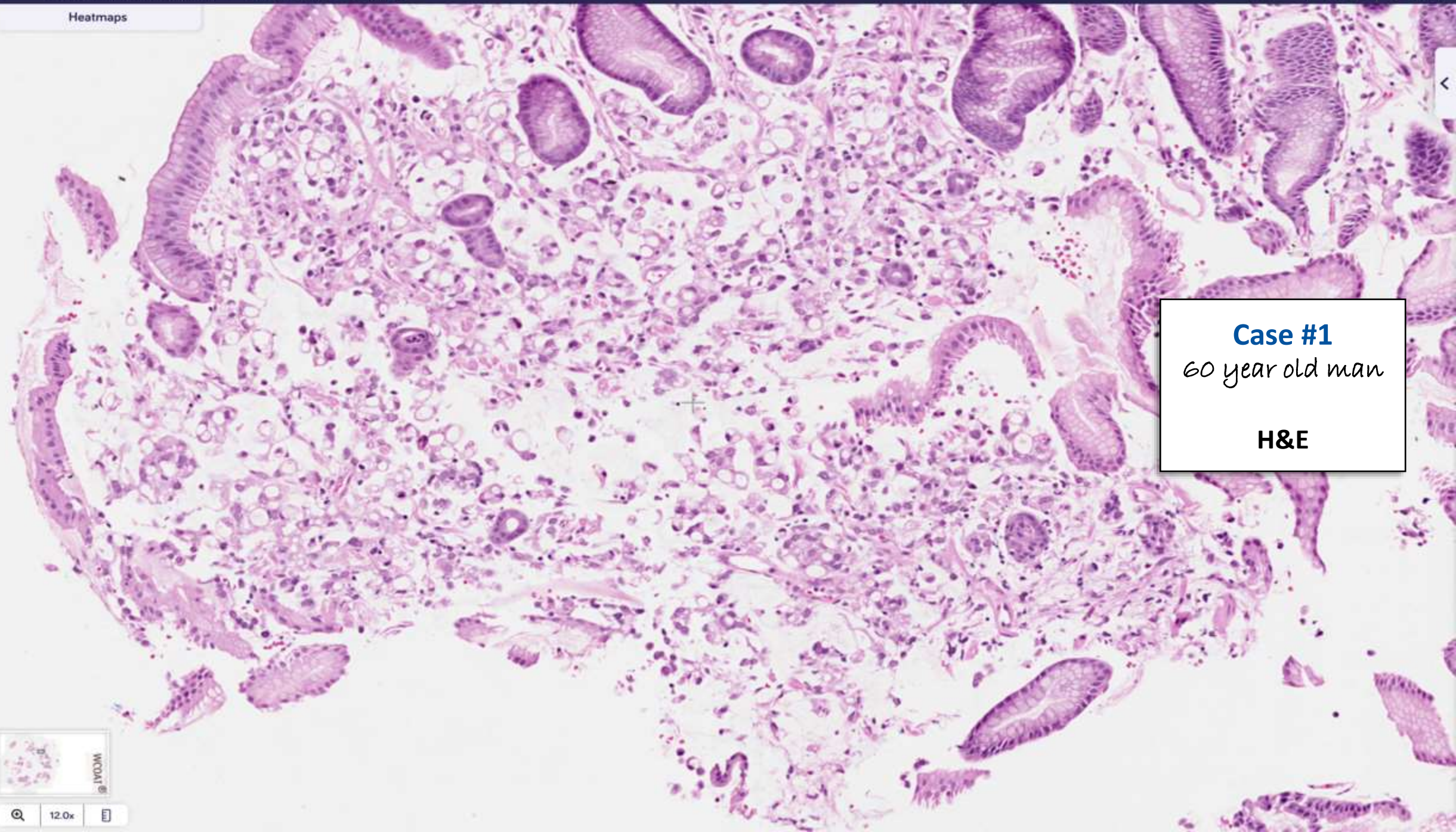
Case #1

60 year old man

Cancer h/m

(**Red** = High Prob.)

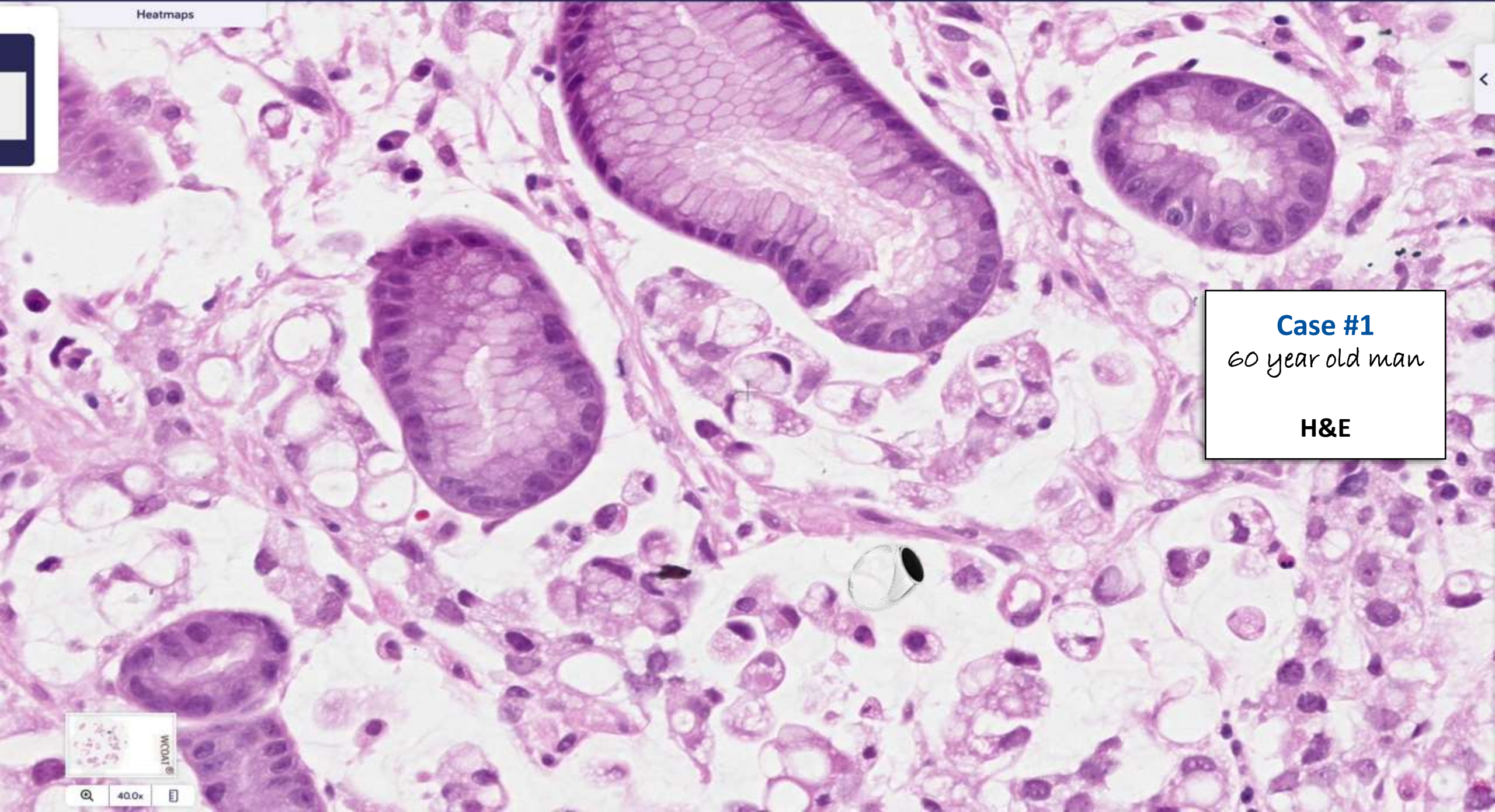
Heatmaps



Case #1
60 year old man

H&E





Case #1
60 year old man

H&E



Heatmaps

HER2 IHC

Benign Gland Positive Control
Negative Signet ring cancer cells

Case #1
60 year old man

HER2



Case #1

Summary & learning points

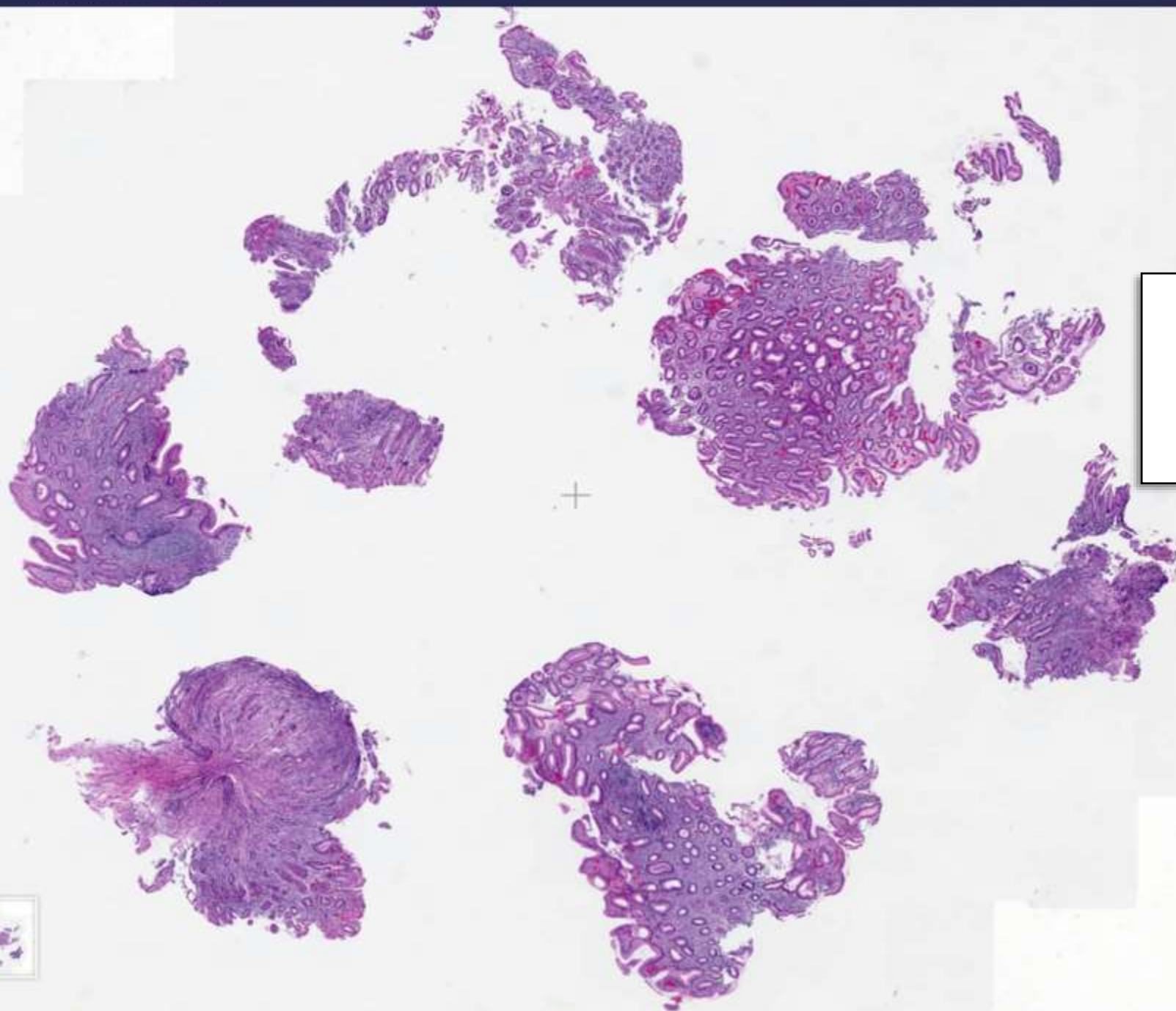
- 60 year old man
- Even clinically extensive gastric carcinoma can be difficult to confirm in biopsy material
- Even a less than 1mm focus of cancer can be sufficient for surgical management but many predictive tests can require at least 500 tumour cells

Ibex AI is very sensitive for detecting tiny foci of cancer easily overlooked by a busy pathologist

Case #2

- 80 year old female
- Gastritis with friable area in upper stomach ? H. pylori

Heatmaps

**Case #2**

80 year old female

H&E

1.5x

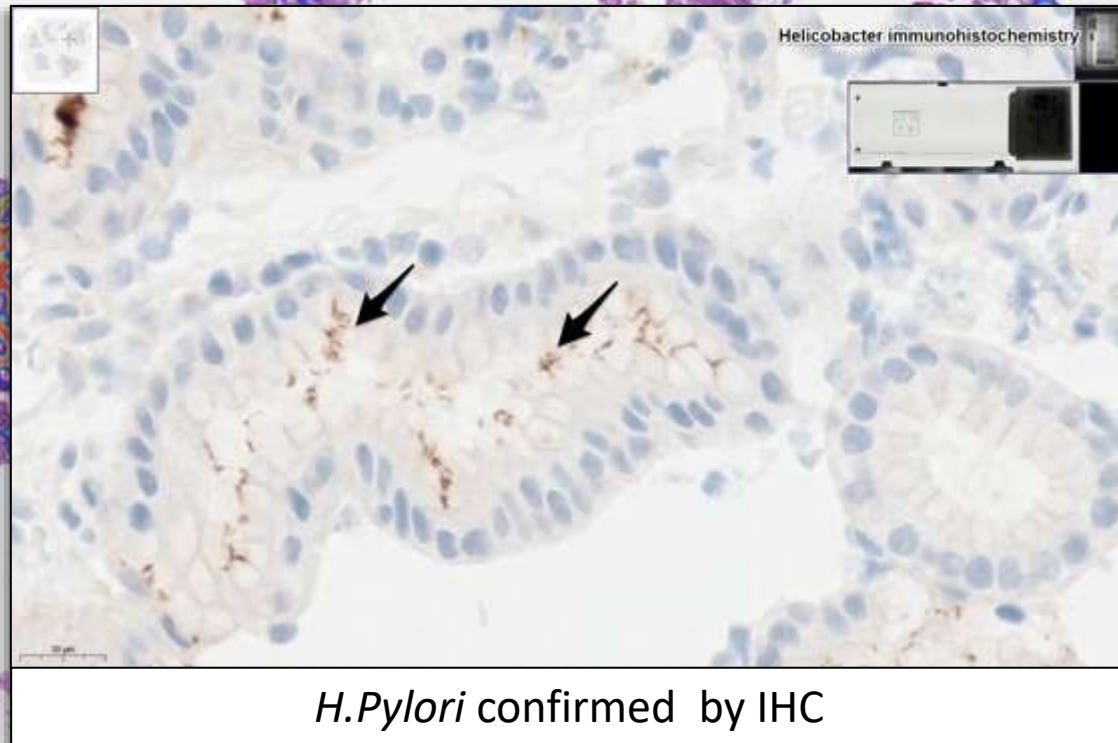


Heatmaps

Active Heatmap: H. pylori-related gastritis

Low Likelihood

High Likelihood



Case #2

80 year old female

H.Pylori gastritis h/m
(Red = High Prob.)



1.5x



Heatmaps

Active Heatmap: LG Lymphoma

Low Likelihood



High Likelihood

Case #2

80 year old female

LG Lymphoma h/m
(Red = High Prob.)



20.0x



Heatmaps

Case #2*80 year old female***H&E**

suspicious of low
grade MALT
lymphoma



20.0x

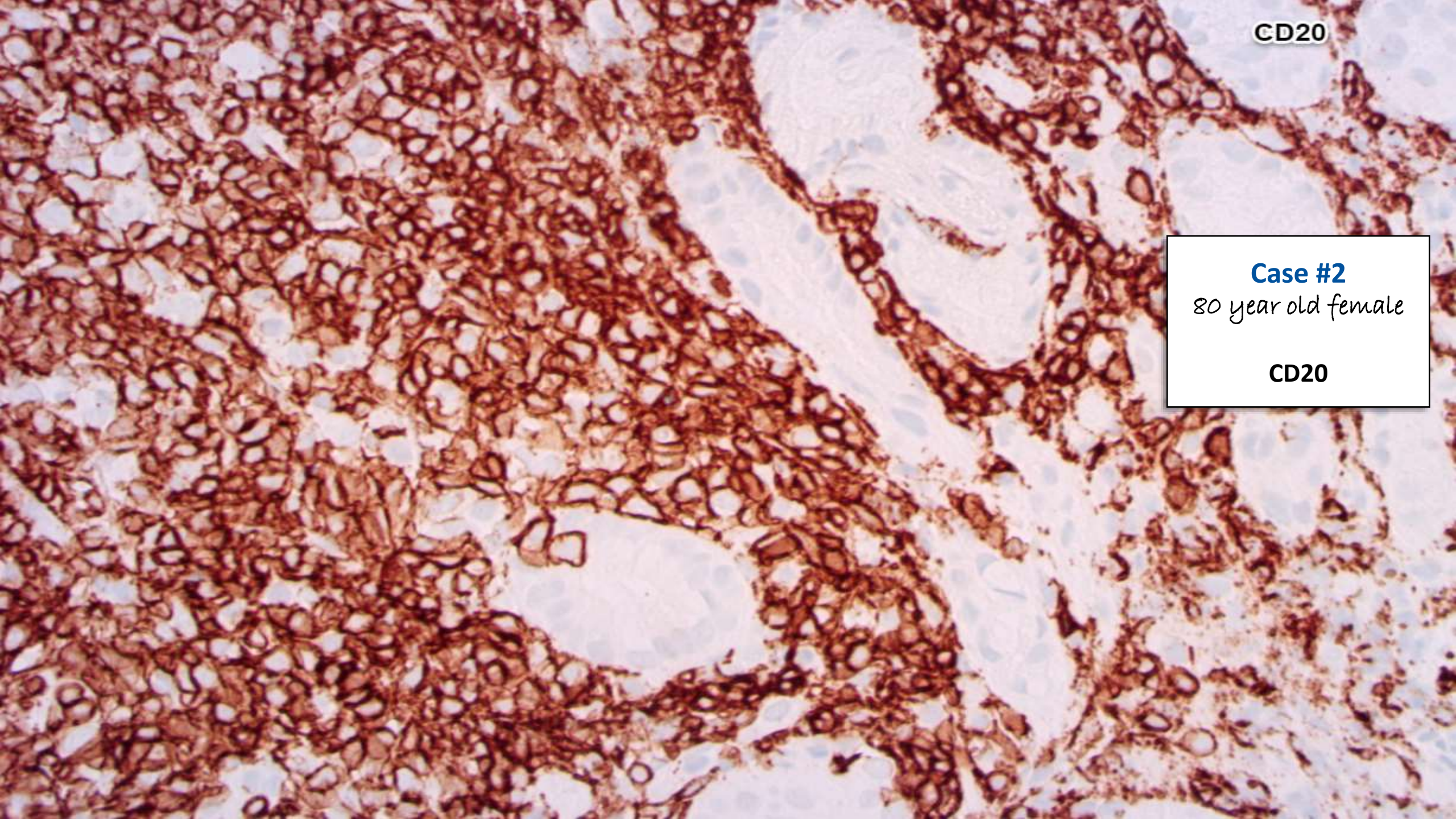


CD20

Case #2

80 year old female

CD20

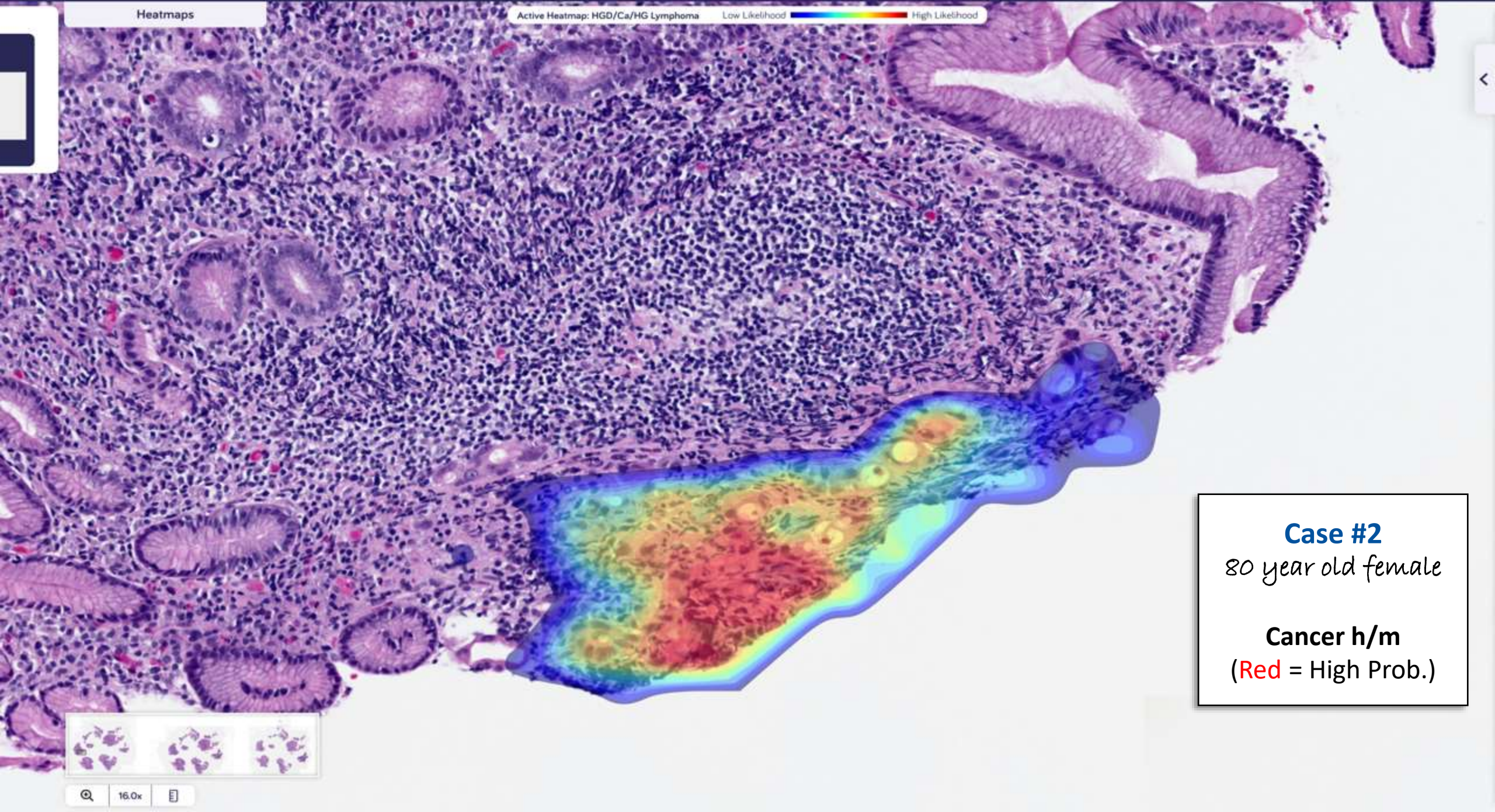




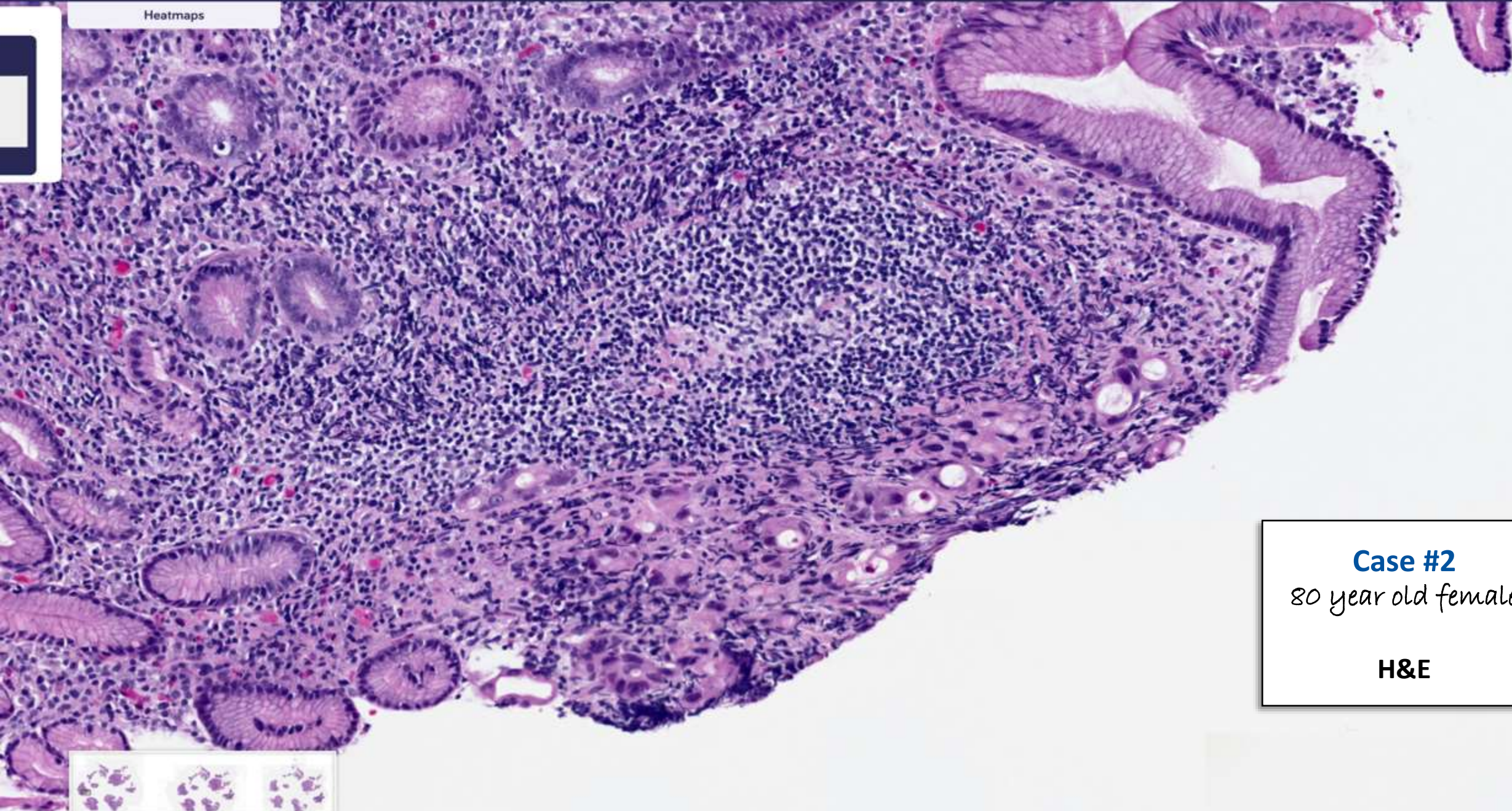
Case #2

80 year old female

Cytokeratin AE1/3

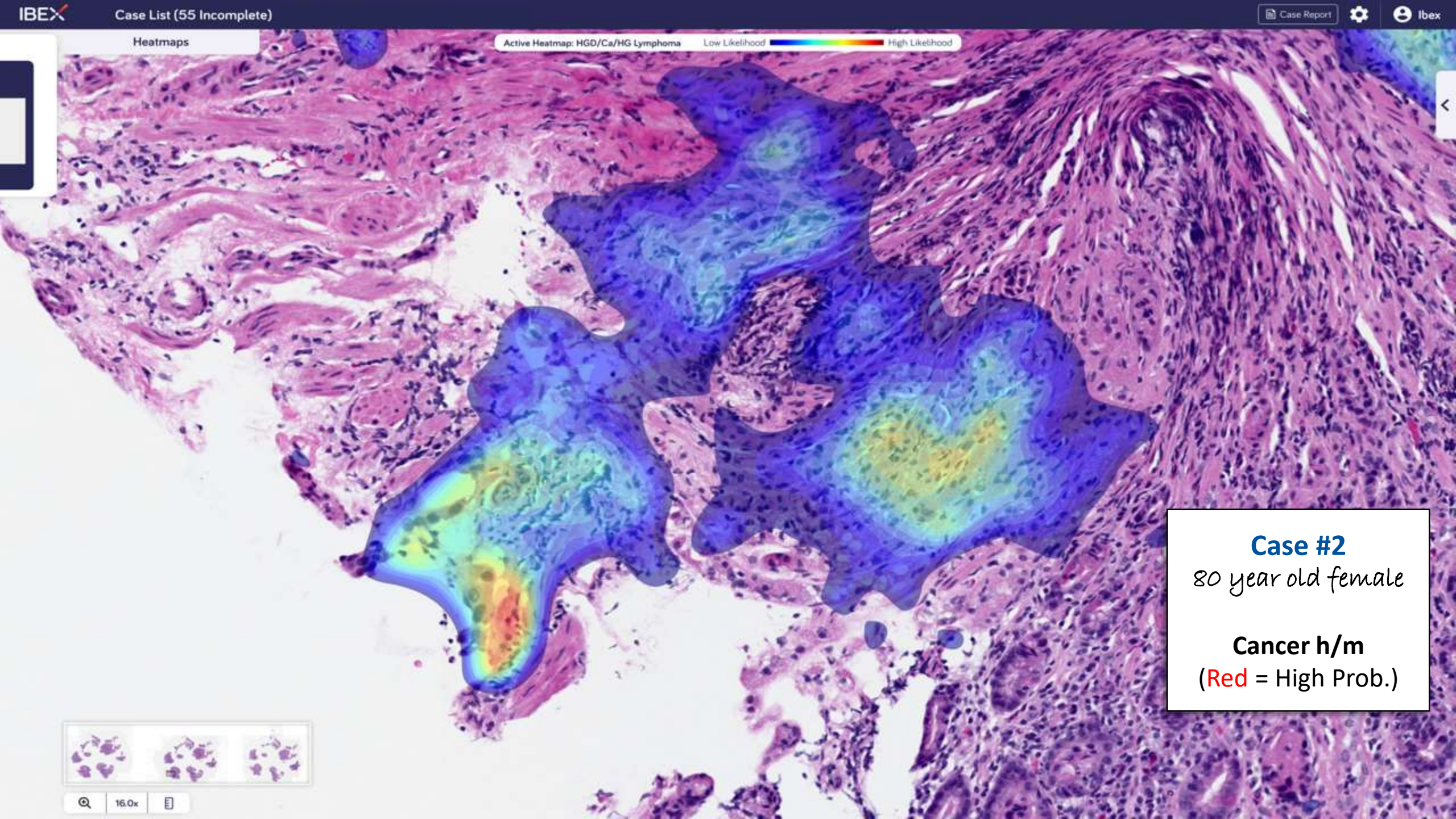


Heatmaps



Case #2
80 year old female
H&E



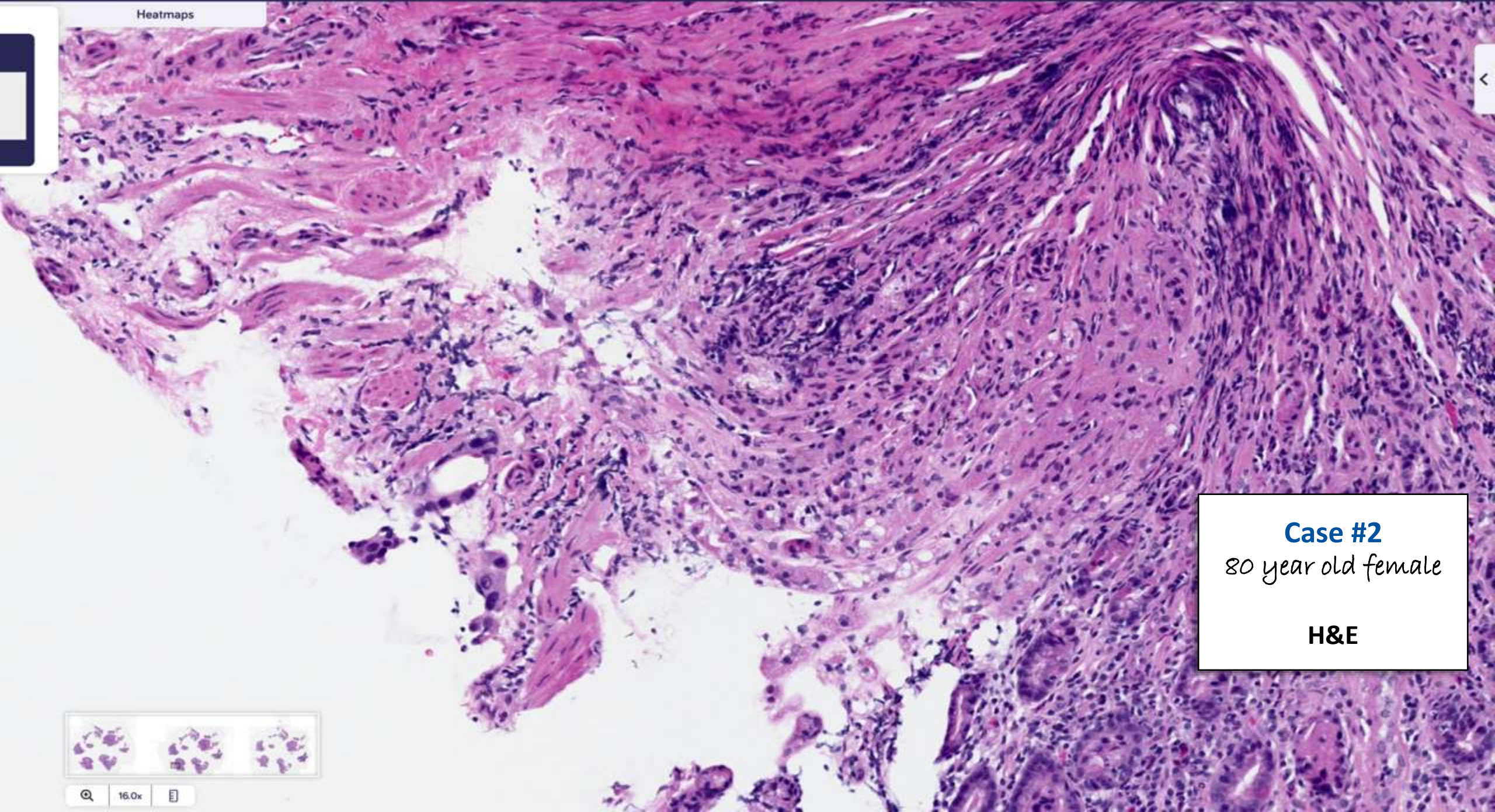


Case #2

80 year old female

Cancer h/m

(Red = High Prob.)



Heatmaps

Case #2
80 year old female
H&E

Case #2

Summary and learning points

- 80 year old female
- *Helicobacter pylori* gastritis
- Low grade MALT lymphoma with synchronous adenocarcinoma
- *H. pylori* eradication can be effective treatment for stage MALT lymphoma

Ibex AI sensitive for
H. pylori gastritis,
lymphoma & small foci
of adenocarcinoma

Ibex AI seems
particularly good at
finding cancer, even in
crush artefact

Case #3

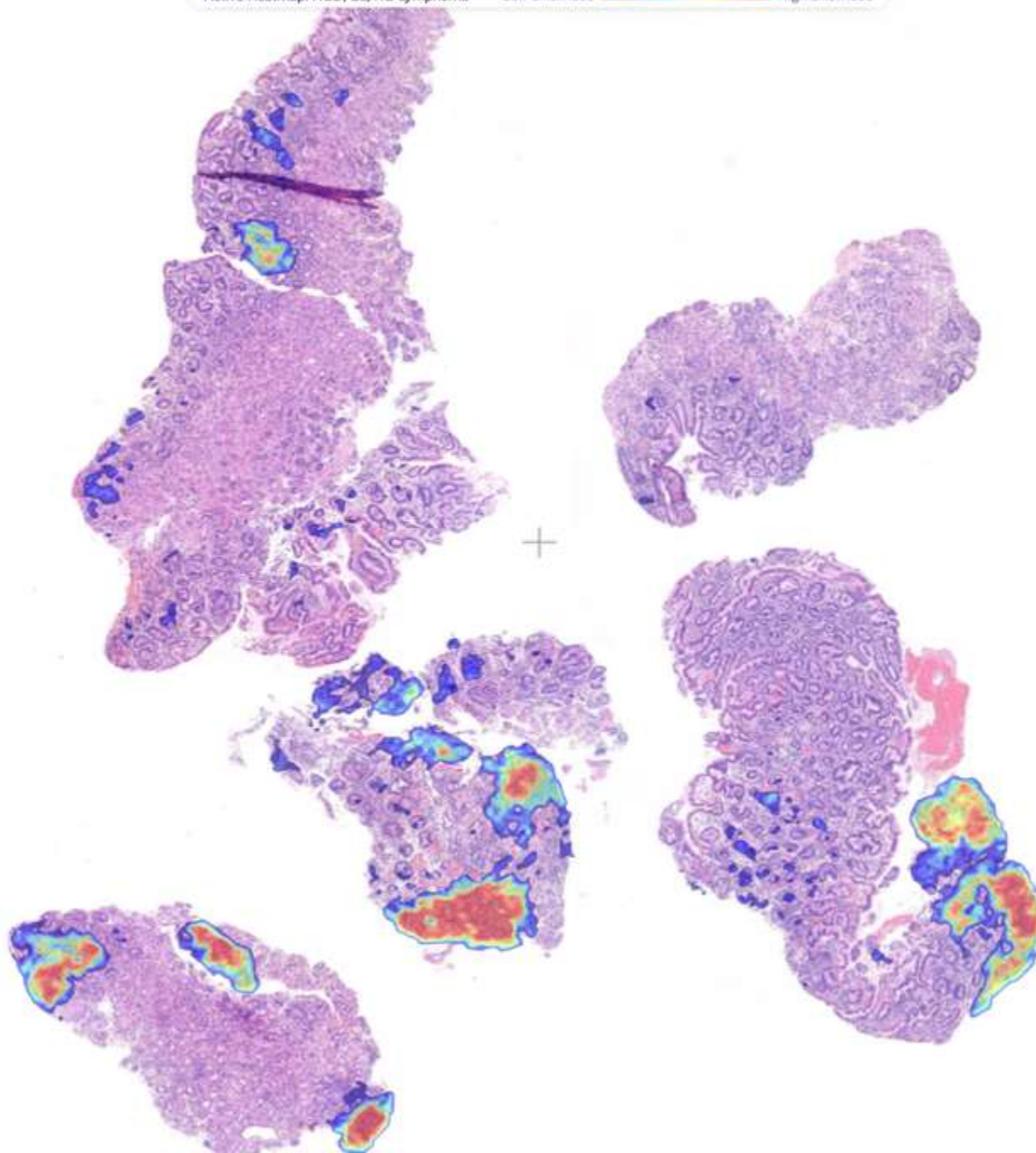
- 60 year old female
- Multiple superficial ulcers in corpus with thickened gastric folds

Heatmaps

Active Heatmap: HGD/Ca/HG Lymphoma

Low Likelihood

High Likelihood

Case #3*60 year old female***Cancer h/m****(Red = High Prob.)**

1.5x

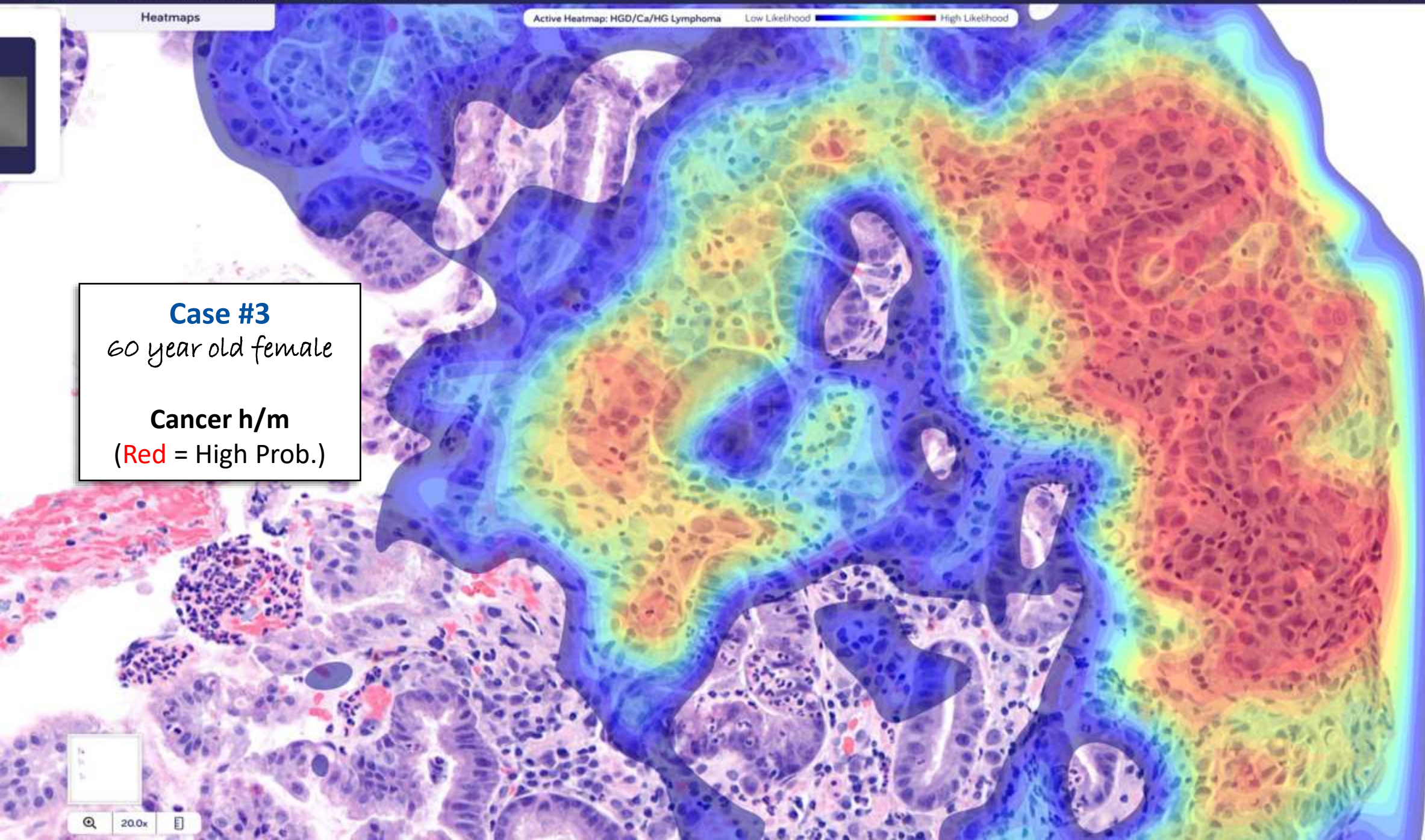


Heatmaps

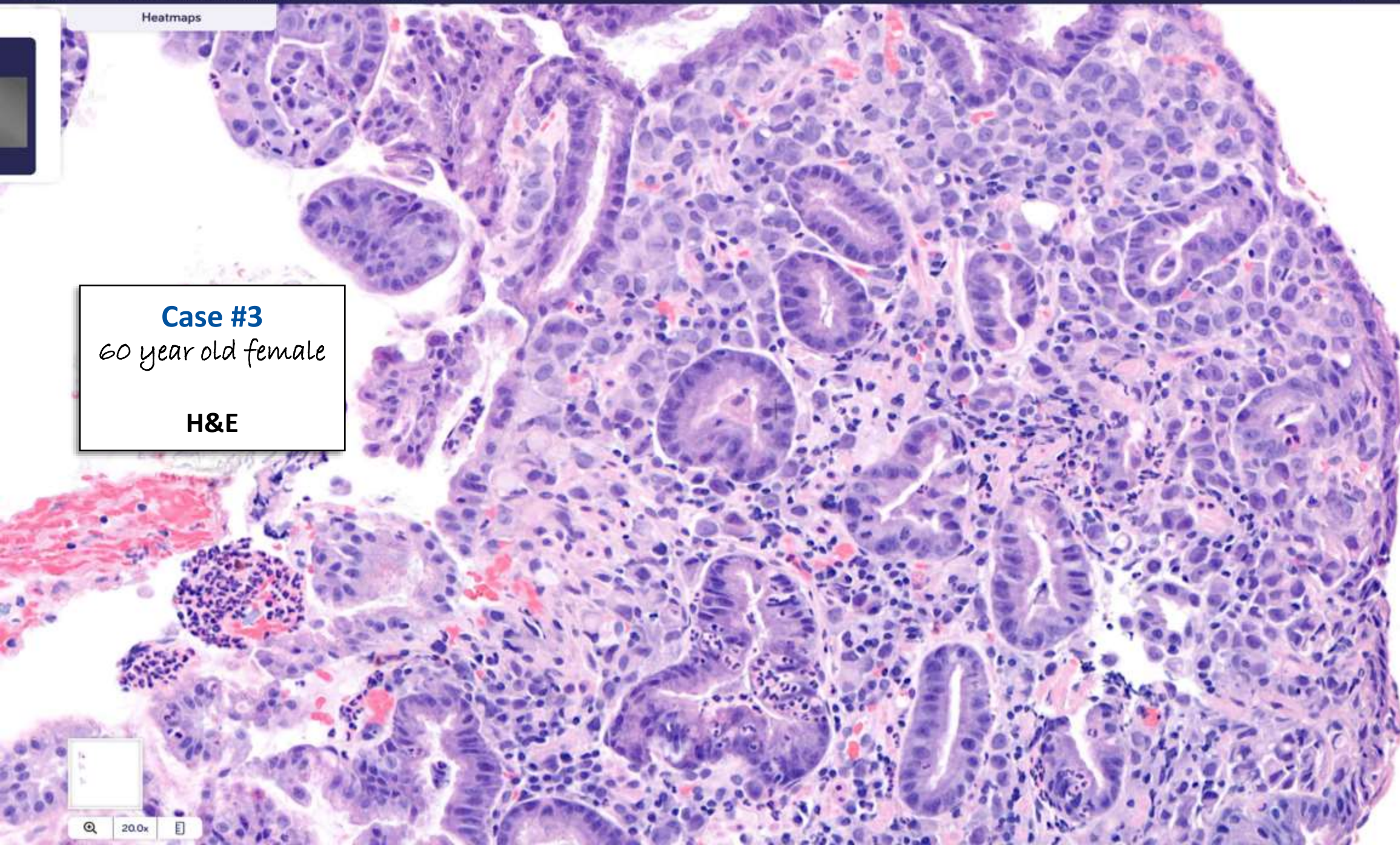
Active Heatmap: HGD/Ca/HG Lymphoma

Low Likelihood

High Likelihood

Case #3*60 year old female***Cancer h/m****(Red = High Prob.)**

Heatmaps

Case #3*60 year old female***H&E**

20.0x



Case #3

60 year old female

E-cadherin

E-cadherin

Case #3

60 year old female

ER

ER



Royal Cornwall Hospitals
NHS Trust

Outstanding
Care for One+All

Heatmaps

Active Heatmap: HGD/Ca/HG Lymphoma

Low Likelihood

High Likelihood

Another case of
lobular breast
carcinoma
Cancer h/m
(Red = High Prob.)



12.0x



Heatmaps

Another case of
lobular breast
carcinoma

H&E



12.0x



Heatmaps



**Another case of
lobular breast
carcinoma
H&E**

Classical signet
ring cells



Case #3

Summary and learning points

- 60 year old female
- Metastatic Lobular Breast Carcinoma mimicking diffuse gastric cancer
- May not be suspected clinically and can also mimic primary gastric cancer on scans (linitis plastica)
- Pathologists must be aware of this to help avoid unnecessary surgery
- Although rare, direct spread / metastasis of other cancer types to the stomach does occur and may be difficult to identify in biopsy material

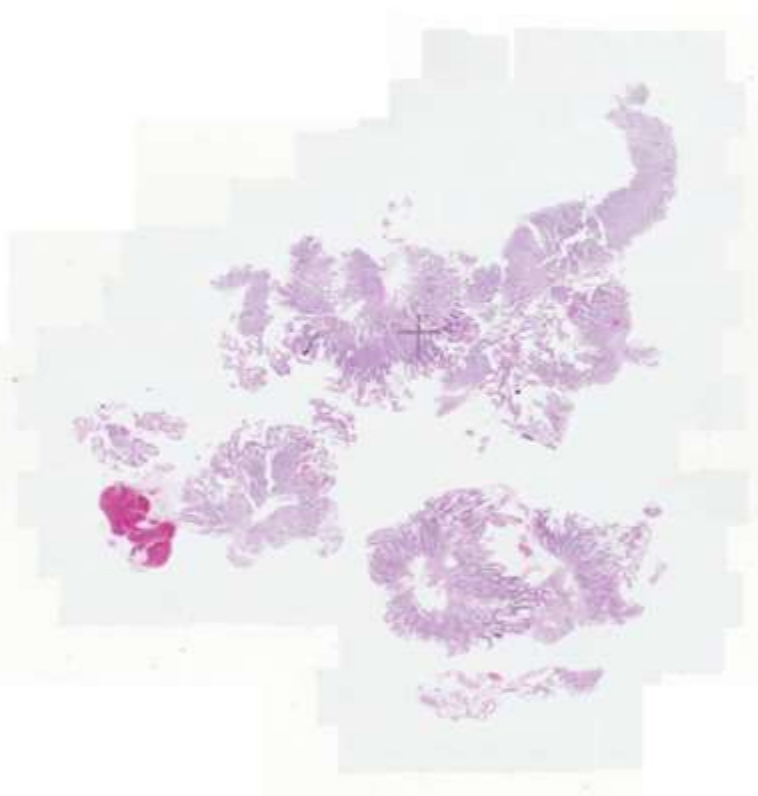
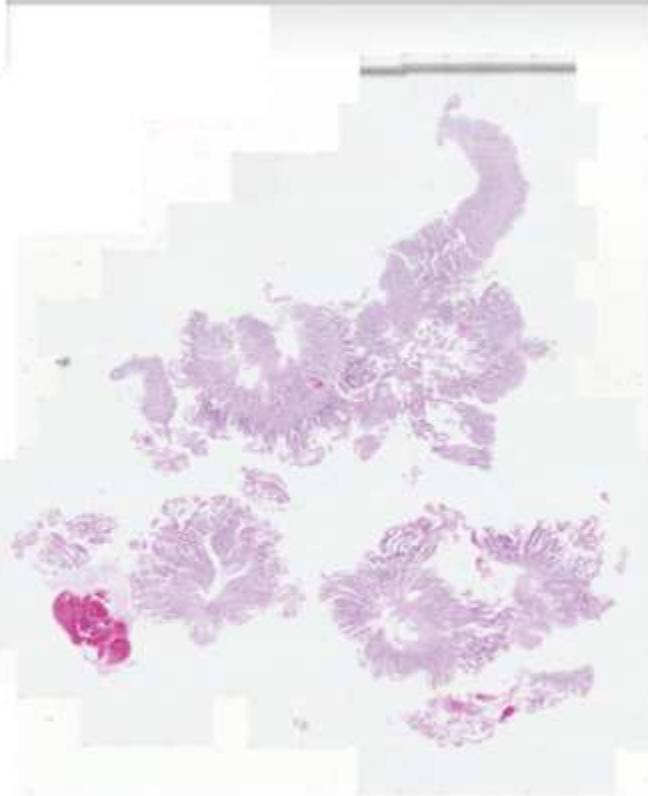
Ibex AI is able to recognise metastatic breast cancer

Case #4

- 67 year old female
- Suspected primary gastric cancer
- Linitis plastica features on CT



Heatmaps

**Case #4**

67 year old F

H&E

0.5x



Heatmaps

Case #4

67 year old F

H&E

Levels 11 and 12 !
Abnormal vessels?



2.5x



Heatmaps

Active Heatmap: HGD/Ca/HG Lymphoma Low Likelihood High Likelihood

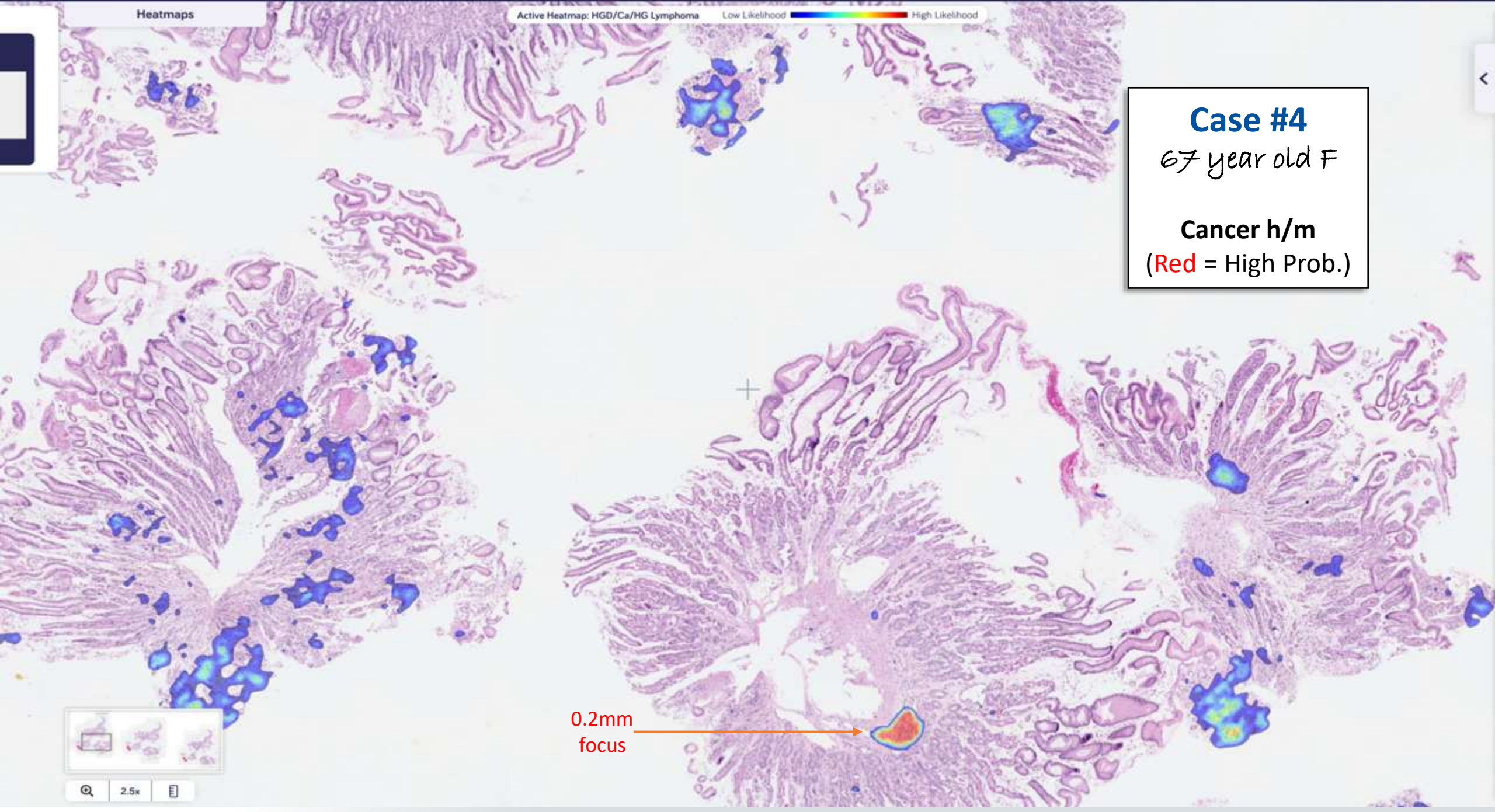
Case #4

67 year old F

Cancer h/m

(Red = High Prob.)

0.2mm
focus



Heatmaps

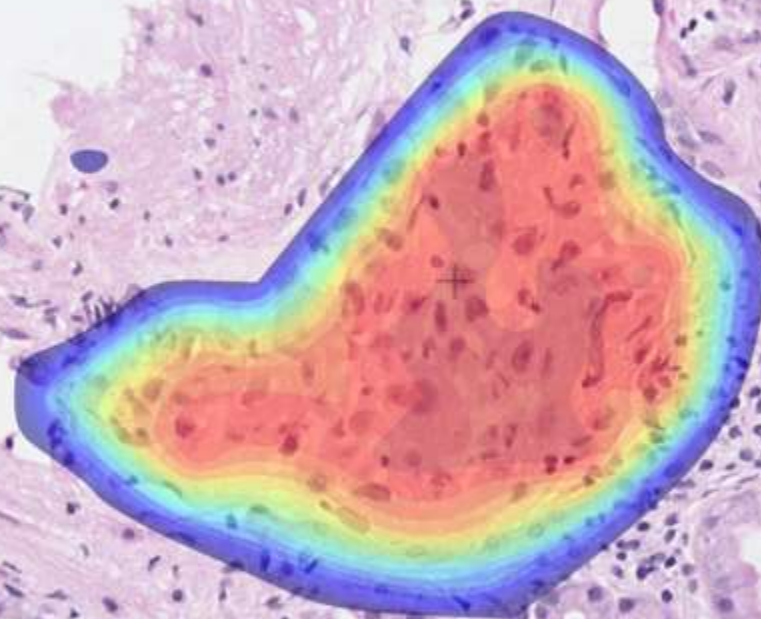
Active Heatmap: HGD/Ca/HG Lymphoma Low Likelihood High Likelihood

Case #4

67 year old F

Cancer h/m

(Red = High Prob.)



Heatmaps



Case #4
67 year old F
H&E

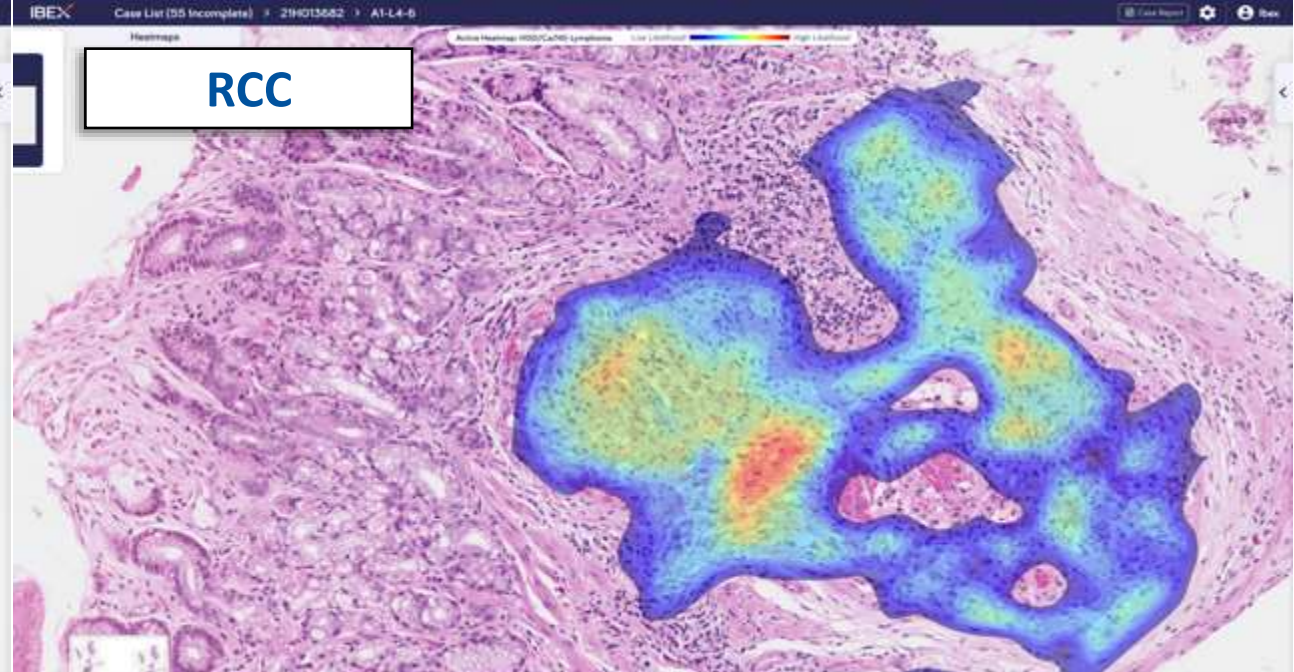
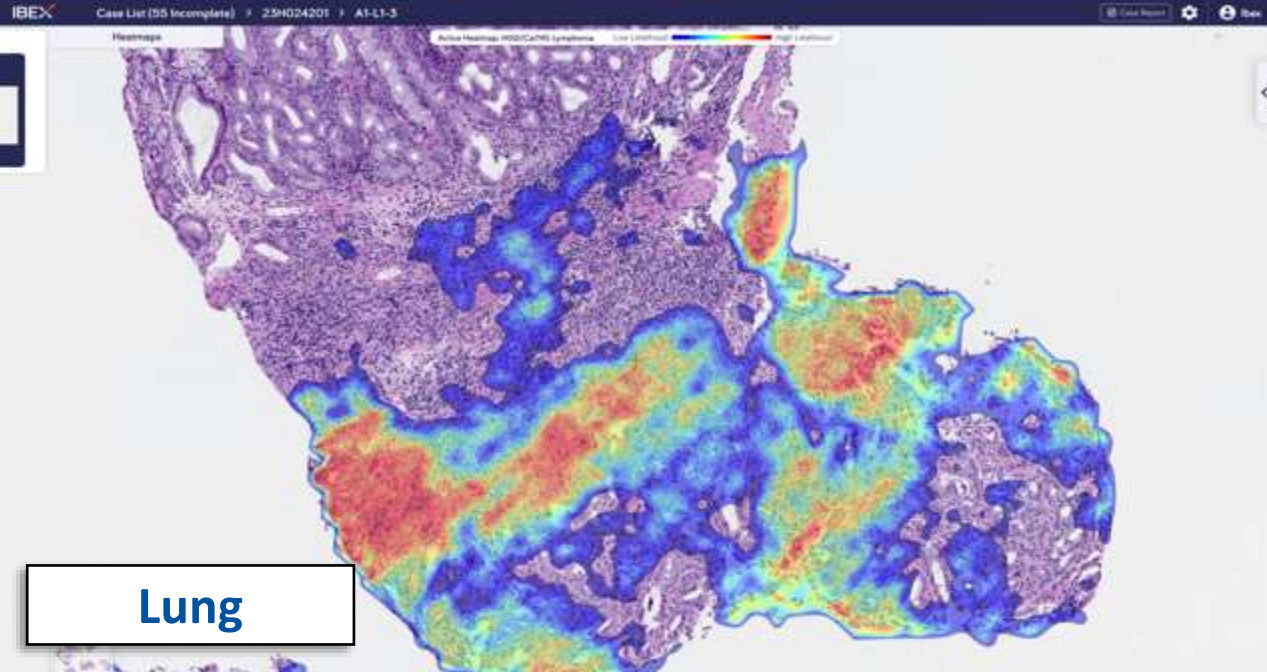


Case #4

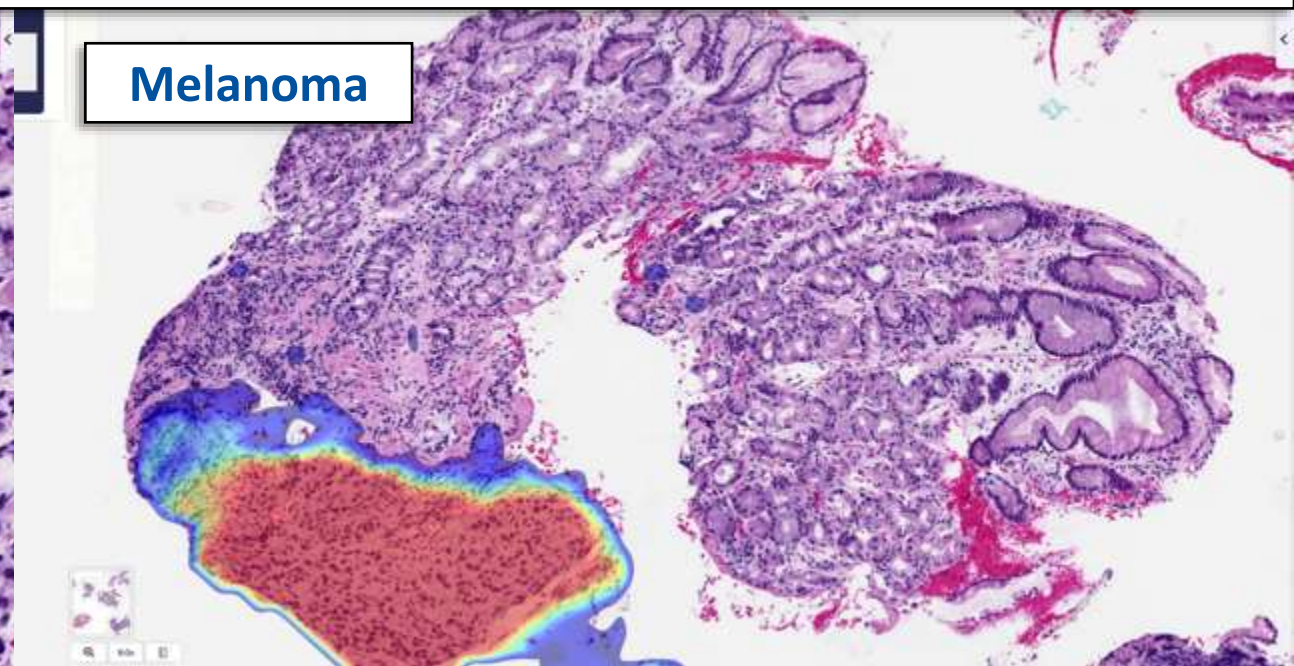
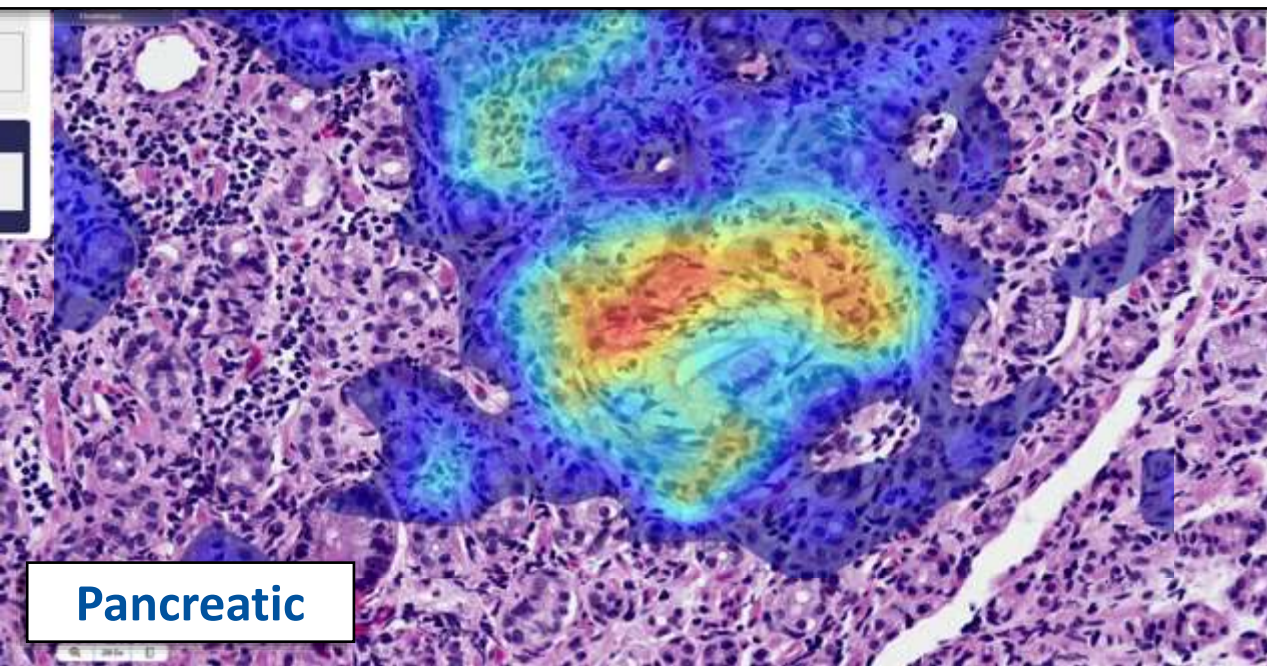
Summary & learning points

- 67 year female
- Suspected primary gastric cancer
- Metastatic lung cancer (entirely intravascular) mimicking linitis plastica primary gastric cancer!
- Previous lung cancer resection "up the road"!

Ibex AI is very sensitive for detecting tiny foci of cancer easily overlooked by a busy pathologist



Metastatic spread of other cancer types to the stomach Cancer h/m (Red = High Prob.)



Could AI be *too sensitive*
and call everything
cancer?



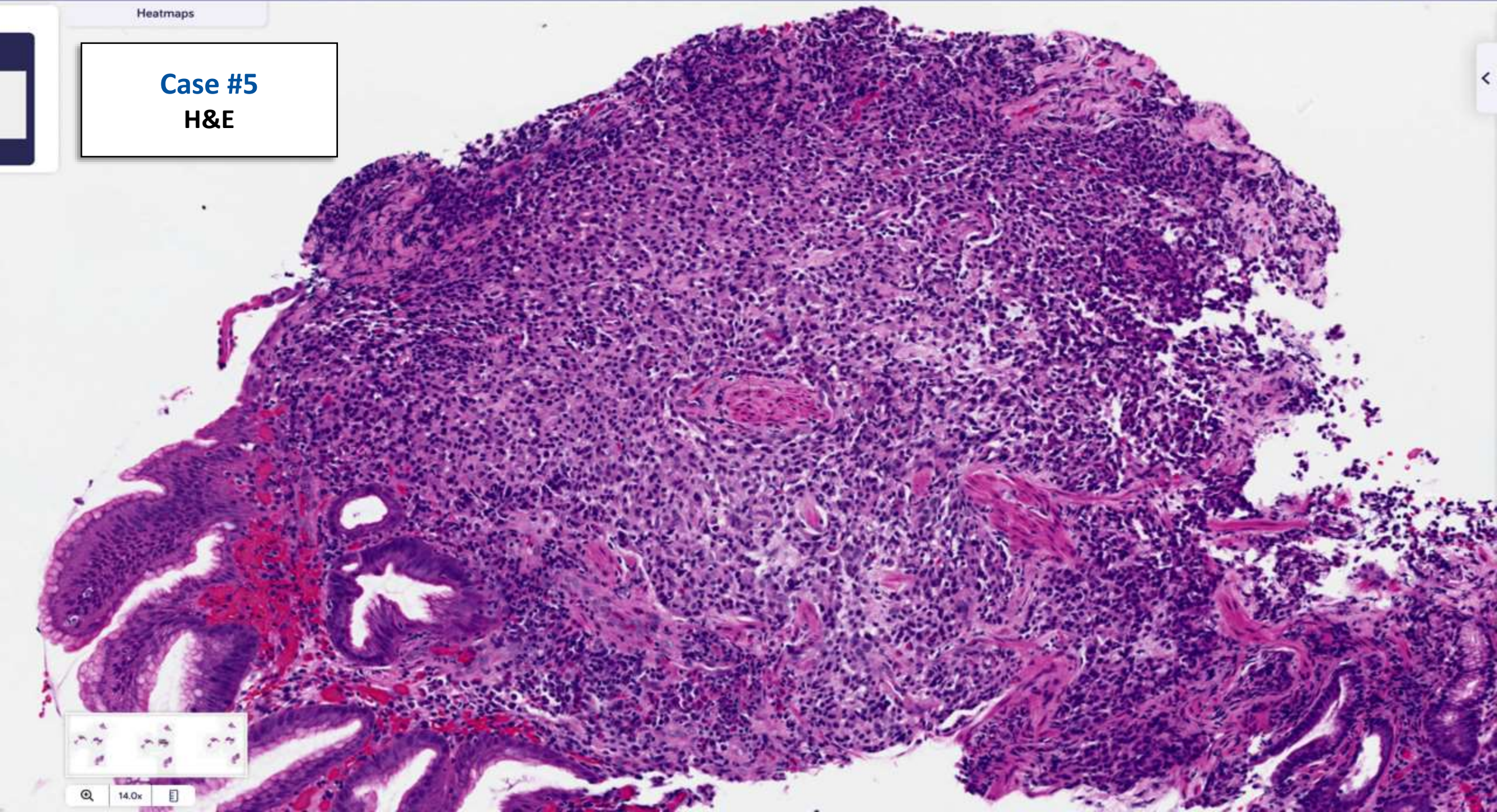
Cases #5, #6 and #7

- Biopsies of polyps/lesions in stomach
- Sent for external reporting in a time of short staffing
- Reported externally as cancer, and suspicious of cancer respectively

Heatmaps

Case #5

H&E



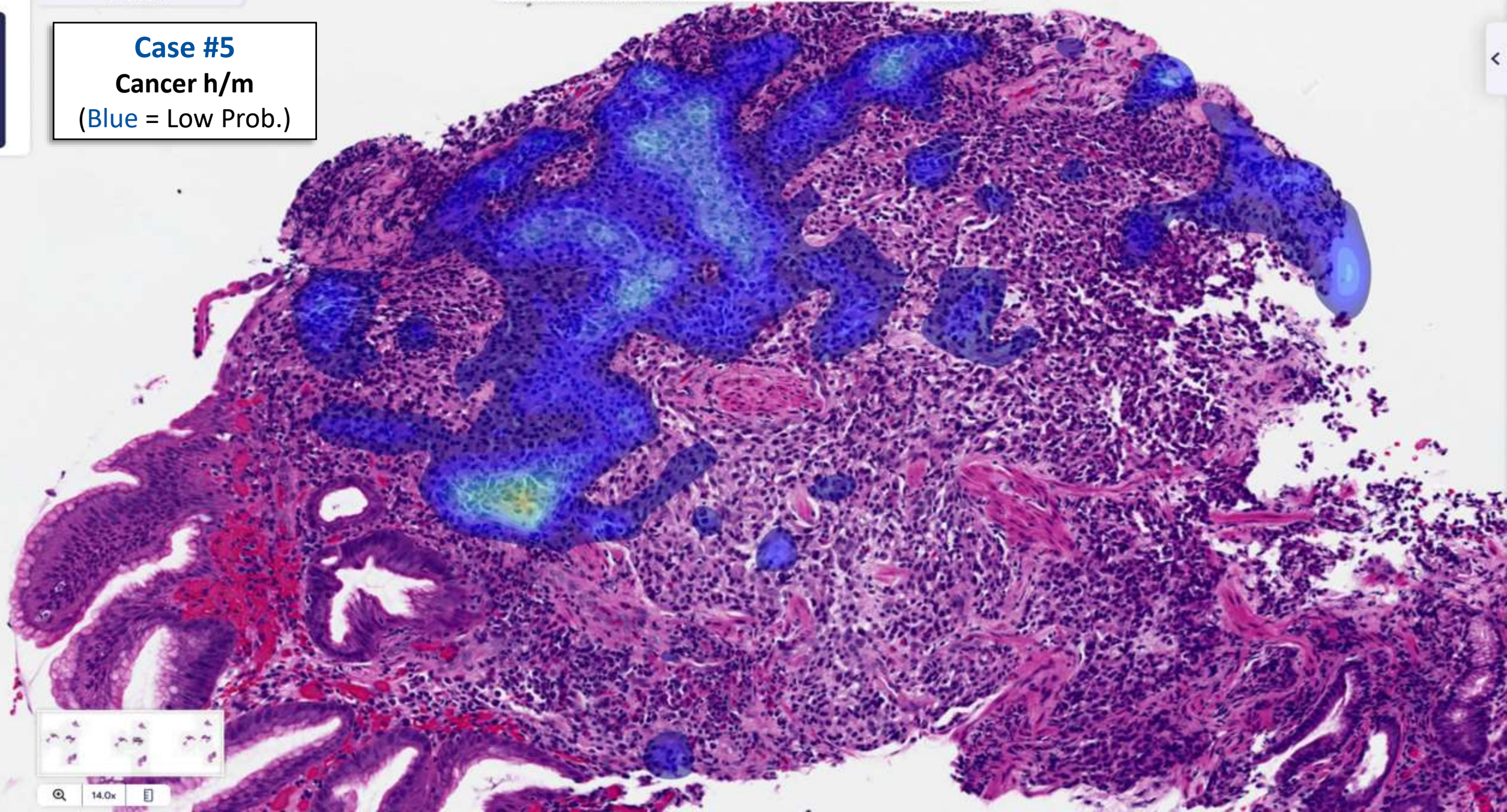
Heatmaps

Active Heatmap: HGD/Ca/HG Lymphoma

Low Likelihood

High Likelihood

Case #5
Cancer h/m
(Blue = Low Prob.)



14.0x



Heatmaps

Active Heatmap: Neuroendocrine Lesions

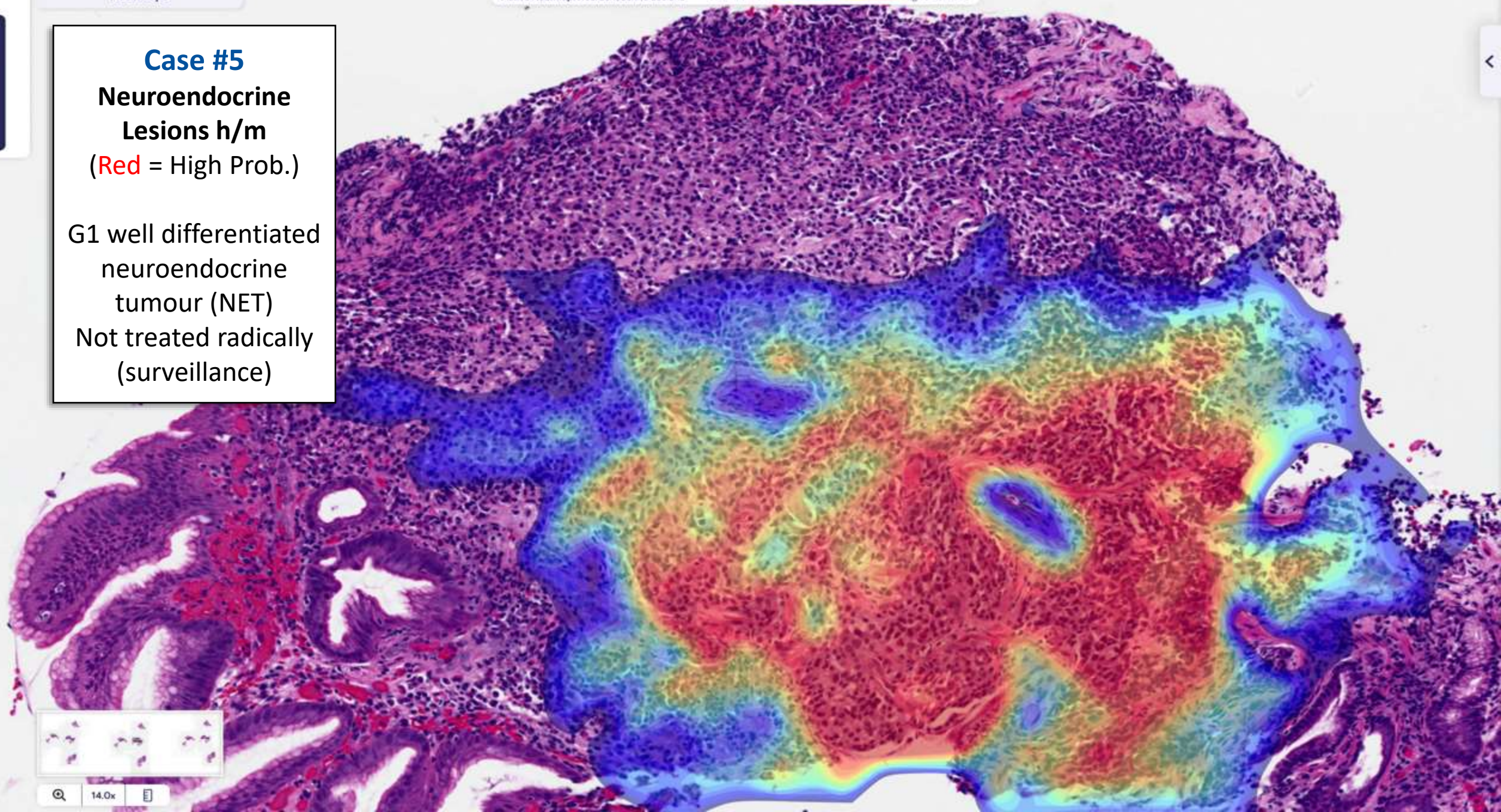
Low Likelihood

High Likelihood

Case #5**Neuroendocrine
Lesions h/m**

(Red = High Prob.)

G1 well differentiated
neuroendocrine
tumour (NET)
Not treated radically
(surveillance)



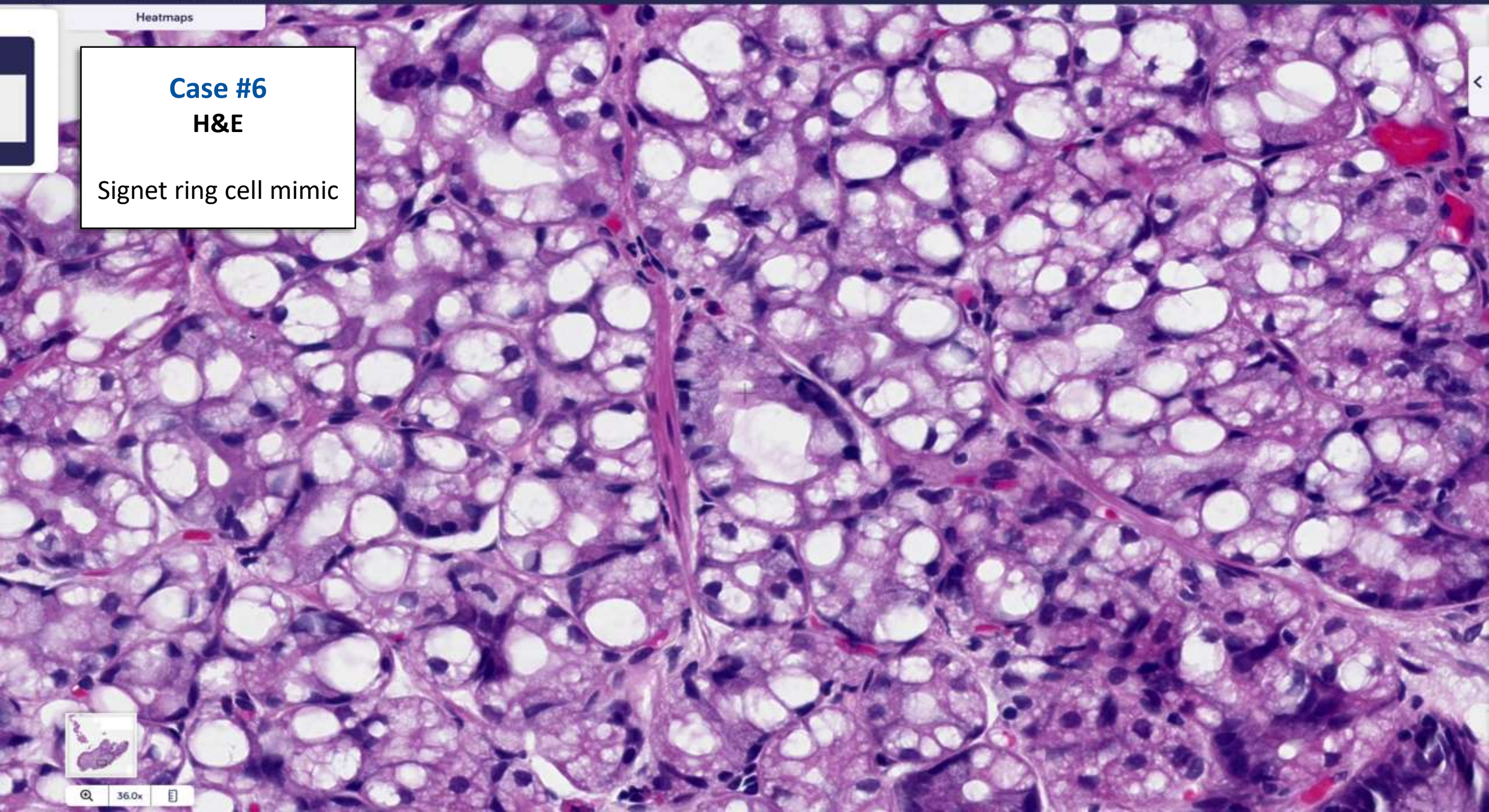
14.0x



Heatmaps

Case #6**H&E**

Signet ring cell mimic



Case #6**Cancer h/m**

(Blue = Low Prob.)

Signet ring cell mimic
In a benign polyp

Histopathology

Histopathology 2013, 63, 735–737. DOI: 10.1111/his.12217

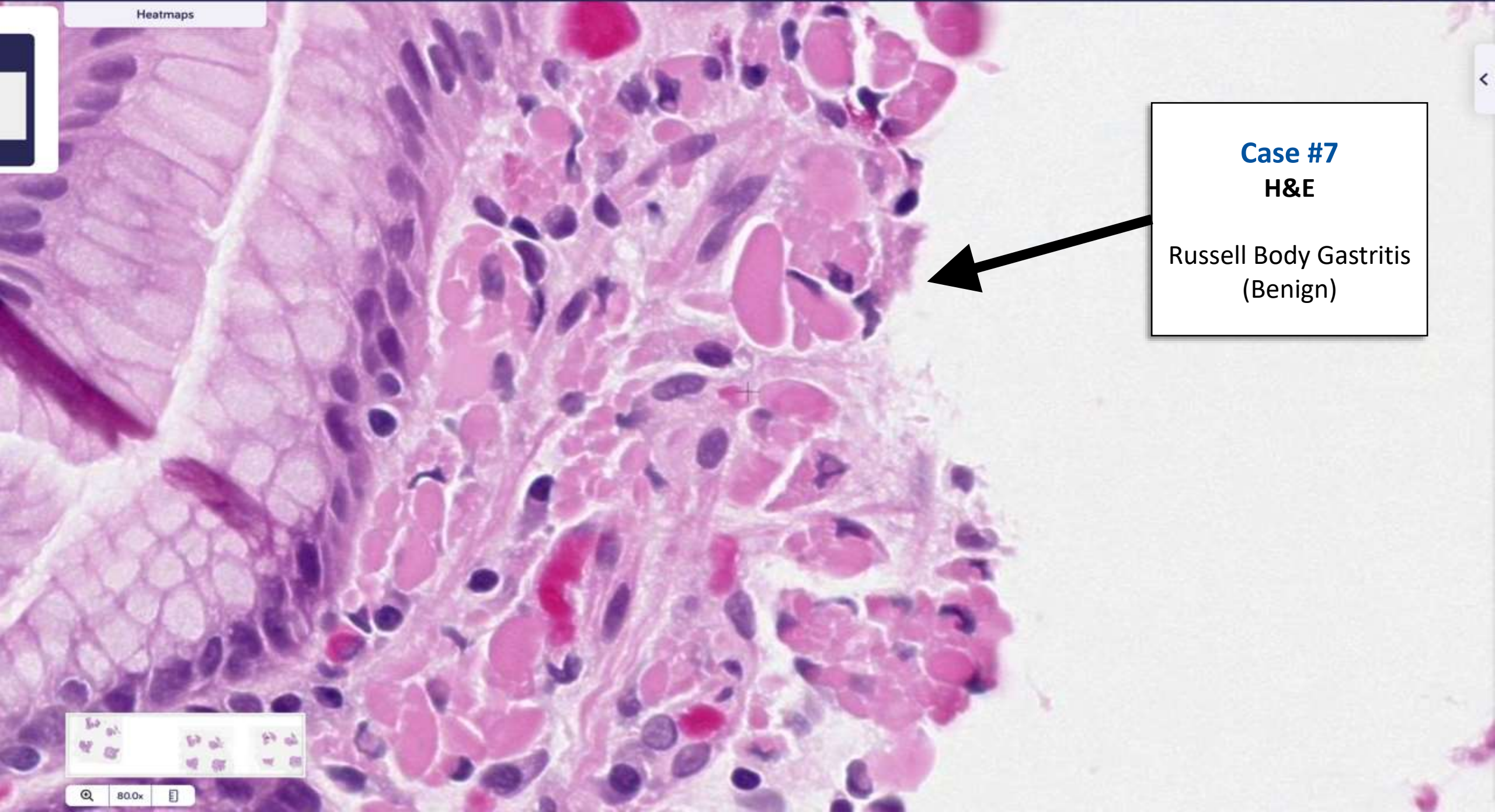
I concur that this clear cell change is an important diagnostic pitfall that pathologists should be aware of as part of the histological spectrum of proton pump inhibitor-induced change.

Runjan Chetty

*Department of Pathology, Laboratory Medicine Program,
University Health Network, University of Toronto,
Toronto, ON, Canada*

Endoscopic biopsies of the upper gastrointestinal tract account for a significant amount of workload for general and specialist histopathologists. The most common indications for gastric biopsy include diagnosis of various types of gastritis, peptic ulcer disease, confirmation of the presence of *Helicobacter pylori*, and neoplastic lesions. Histological recognition of subtle gastric mucosal infiltration by diffuse-type (signet-ring) adenocarcinoma is a well-recognized area of diagnostic difficulty. We present two examples of marked cytoplasmic vacuolation of parietal cells mimicking signet ring cell carcinoma.

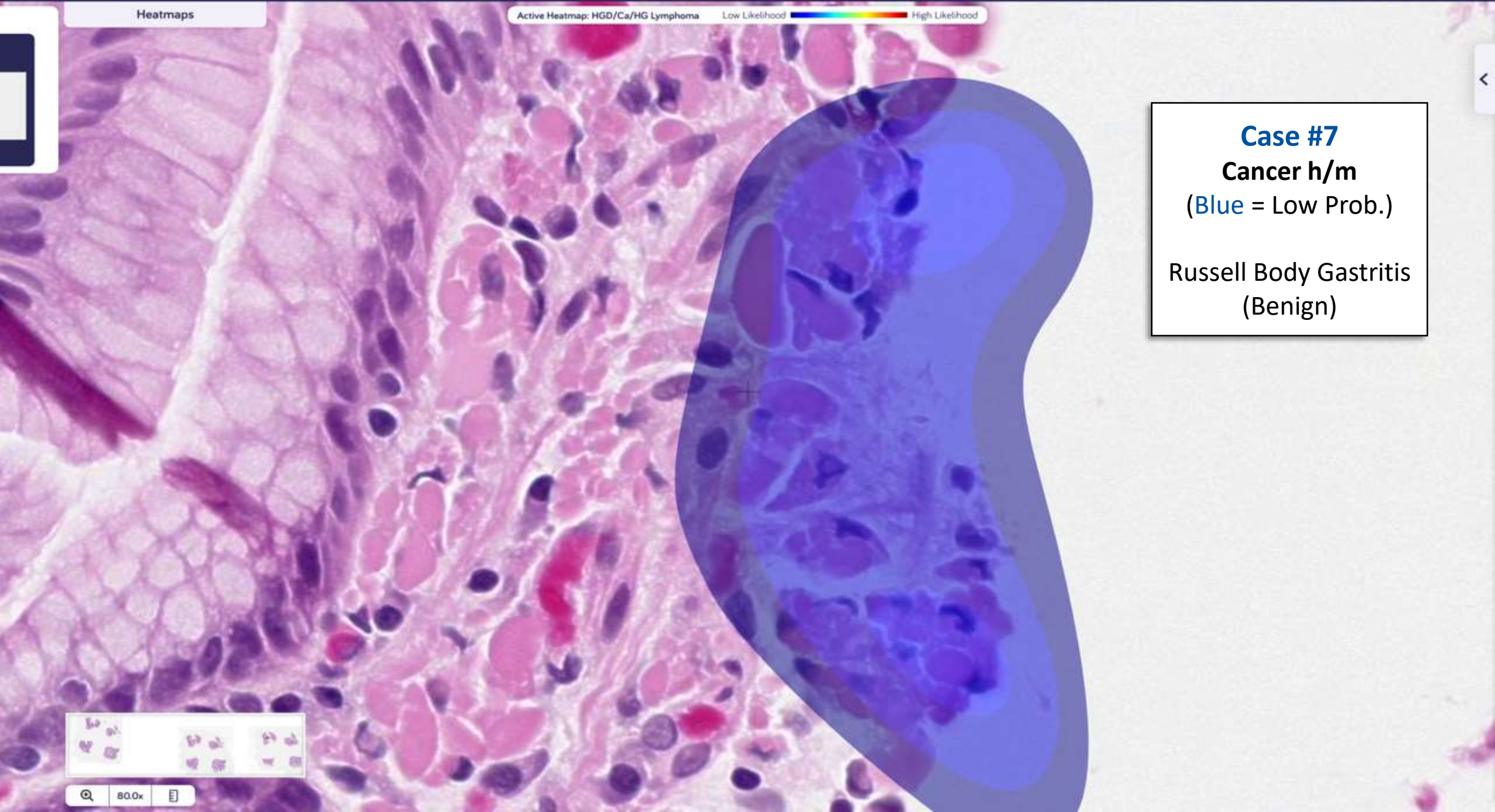
Heatmaps



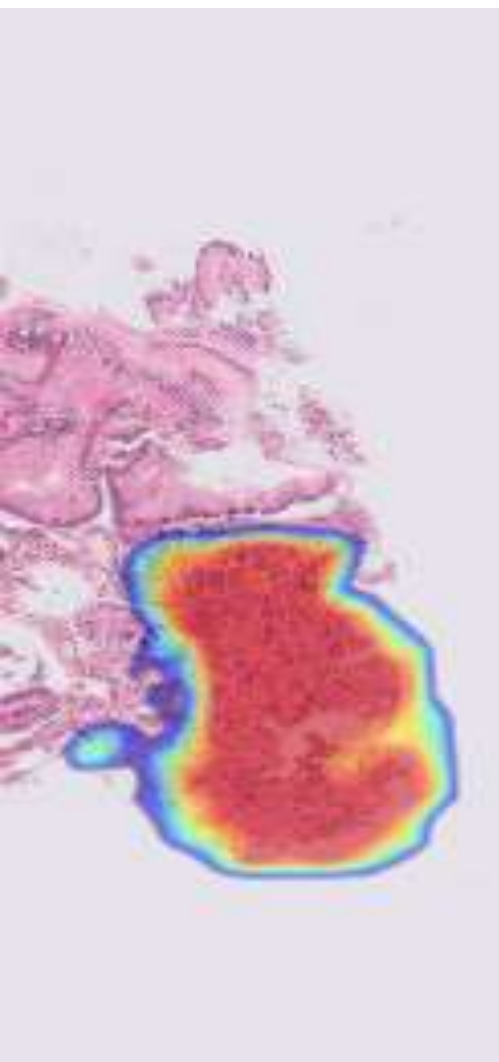
Case #7
H&E

Russell Body Gastritis
(Benign)





My experience of where the Ibex AI adds value for Gastric Biopsies



- 1) **Small focus** of signet ring diffuse gastric cancer
 - Identify, locate & quantify using the heatmap
- 2) **Complex pathology** (H.pylori gastritis, MALT lymphoma & adenocarcinoma) in same biopsy
 - Helps pathologist not overlook additional findings
- 3) **Malignancy of non-gastric origin** (e.g. breast cancer)
 - Lung, RCC, pancreatic & melanoma also detected
- 4) Well differentiated **Neuroendocrine tumour**
 - Could be misinterpreted as poorly differentiated carcinoma but usually treated conservatively
- 5) **Mimics**: Benign & drug induced changes mimicking signet ring cells
 - Galen Gastric AI can be trained to recognise or ignore artefacts

How could Ibex AI benefit patients in South West Peninsula?



- 1) **Screening** batches of slides to detect cancer
- 2) Rapidly identifying & directing pathologists' **attention to benign & malignant features**
- 3) Enabling the generalist to **work as a specialist**
- 4) **Oesophageal dysplasia**
 - “Expert” review is a limited and "retiring" resource
- 5) Morphological subtyping & **quantification**
- 6) Predicting **molecular phenotype from morphology**

Take Home Message

AI is a very powerful tool

“Guiding the Pathologist’s eye”... and more?

Pathologist + AI
=
Best Possible Outcomes for Patients

Acknowledgements



Plymouth colleagues

Steve Blunden
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Dr Samer Nassif
Tima Ghandour

Exeter colleagues

Dr. Leonid Semkin
Dr. Trupti Mandalia
Sarah Saunders

RCHT & regional colleagues, too many to name!

Ibex team

Stuart Shand
Richard Nicholson
Daniel Ignatov
Sebastiaan Vroomen

Questions?

