IBEX

AI IN PRIMARY DIAGNOSIS:

Advances in AI to support the Primary Diagnosis of Breast Pathology

Richard Nicholson, Senior Commercial Director, UK & Nordics

Agenda

Overview of Ibex & our technology

How can AI help in the Practice of Breast Pathology

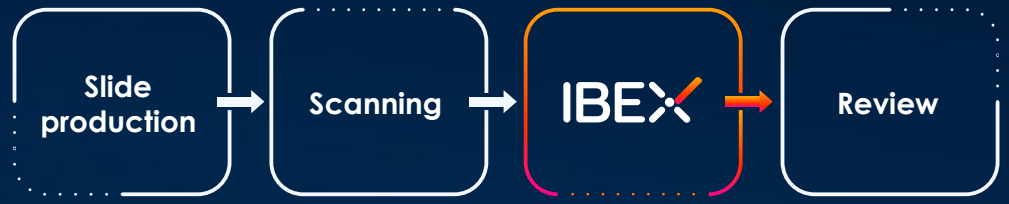
Update on the latest clinical evidence

Ibex / AstraZeneca HER2 Study Results

Q&A


IBEX
Trusted Cancer Diagnostics for All
Clinical grade, AI-based solution for cancer diagnosis
Accuracy
Efficiency
Insights

Ibex Platform: AI -supported Cancer Diagnosis



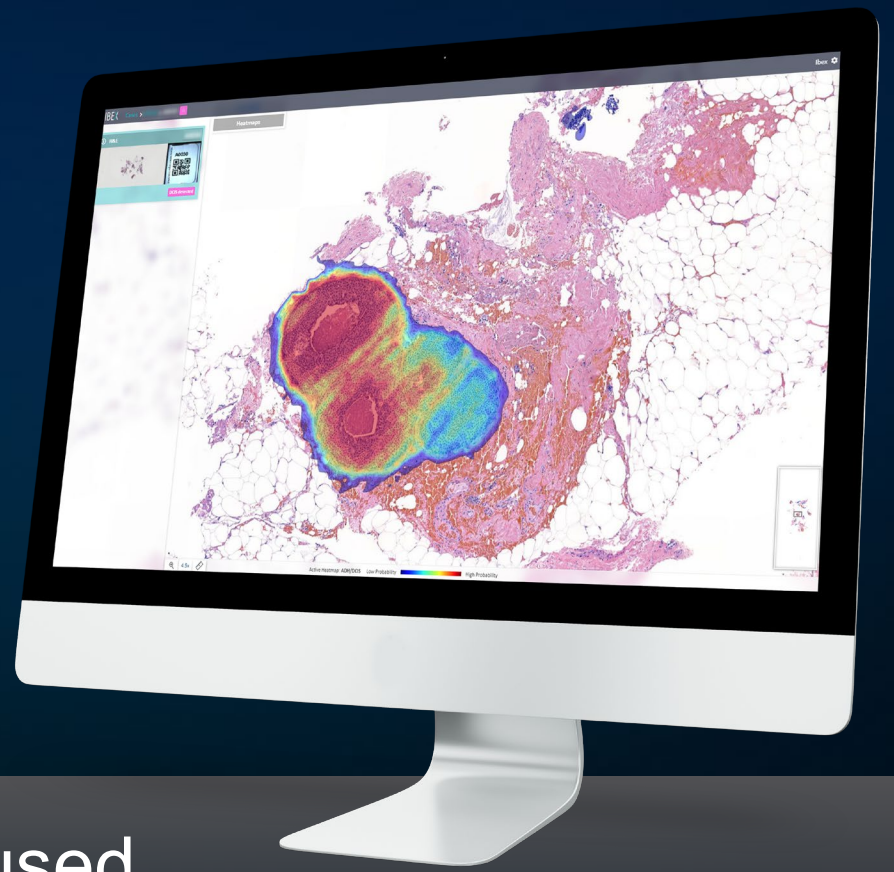
Available in multiple workflows:

- Supporting case review during primary diagnosis
- AI-powered second reads on all cases

Multi tissue detection:
Prostate, breast & gastric

AI-based diagnostic tools: case prioritization worklist, slide viewer, IHC preordering, cancer heatmaps, grading, measurements, non-cancer findings, AI-driven reporting

Open API for AI-integration: scanning, workflow & LIS



Deployed at labs worldwide & used by pathologists in everyday practice

Ibex Breast

The most powerful and comprehensive AI solution for breast diagnosis

- **Trained** on >200K manual annotations in >4,300 slides, selected by clinical findings and other criteria
- Rigorously **validated** in large-scale multi-site studies
- **Deployed** and used in routine clinical practice since 2019

H&E

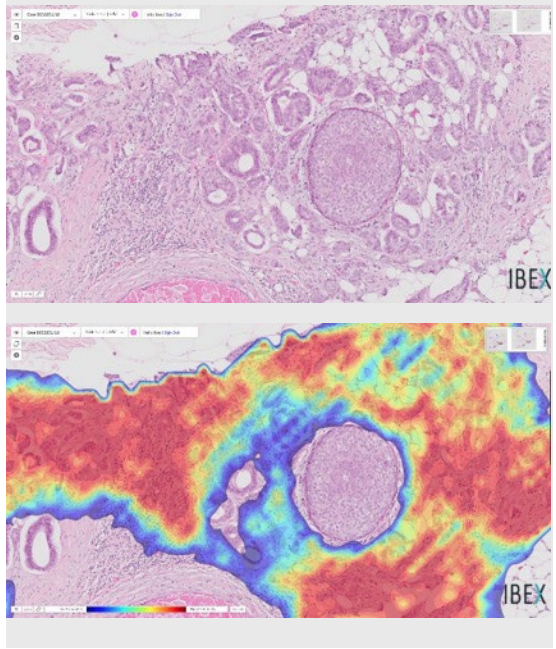
- AI identifies **51 morphological features** , including: Invasive cancer (+special subtypes), DCIS (+grading), TILs, ALI, lobular neoplasia, microcalcifications, hyperplasia, CCC, biphasic tumors, …

IHC (breast panel)

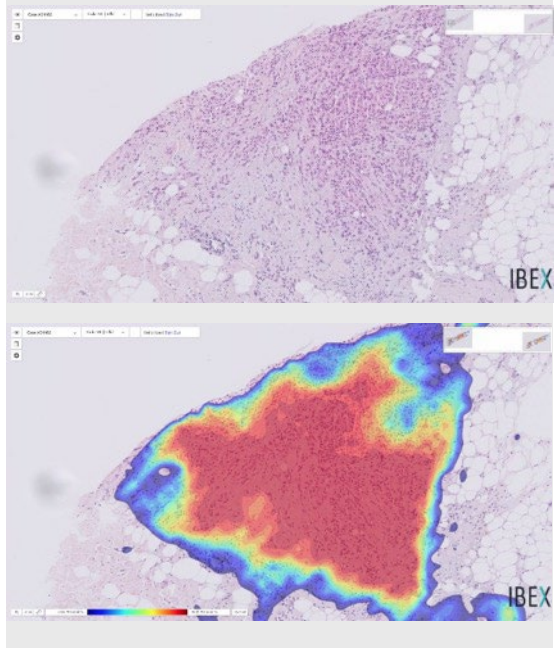
- **Fully automated quantification** : AI detects invasive cancer, identifies tumor cells, classifies their staining pattern and provides a slide-level score
- Apps: **Her2**, **Ki67, ER, PR**

Ibex Breast

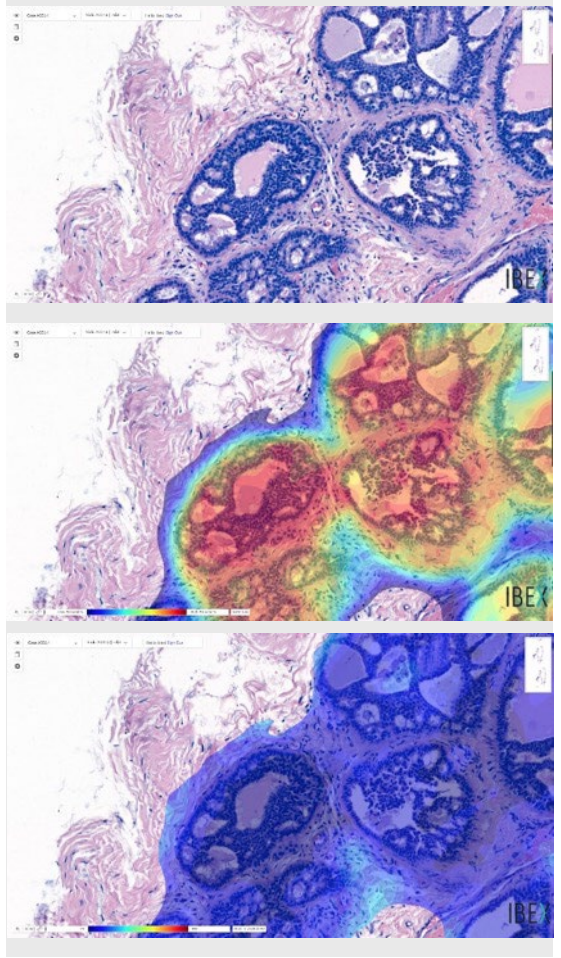
IDC



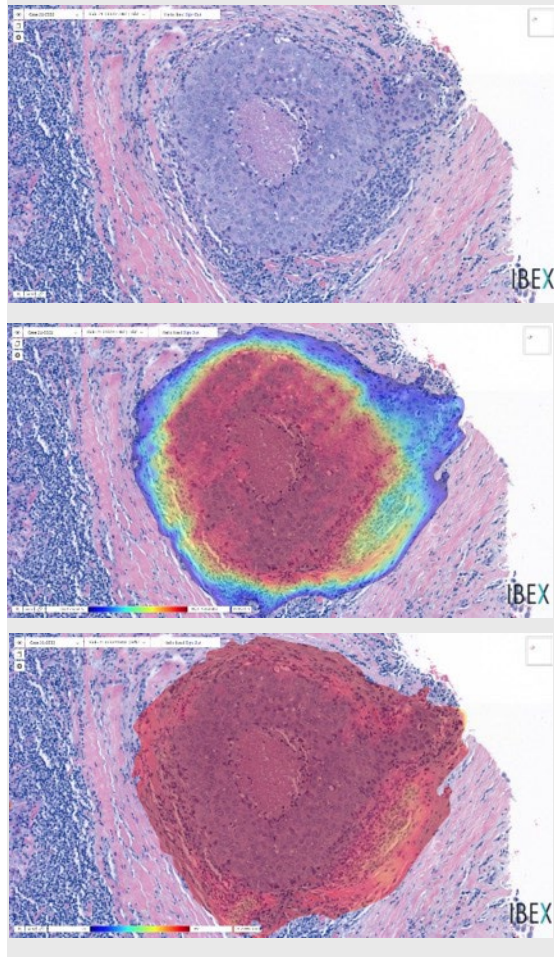
ILC



DCIS (low grade)



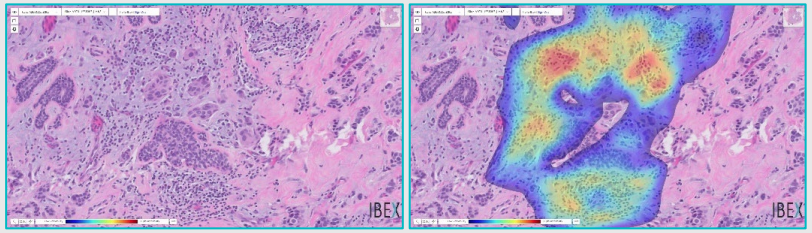
DCIS (high grade)



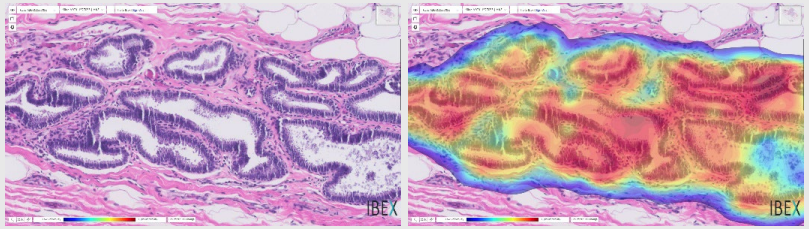
AI accurately **detects** & grades **multiple types** of invasive & in- situ breast cancer

Ibex Breast: More Than Just Cancer

TILs



Columnar Cell Change

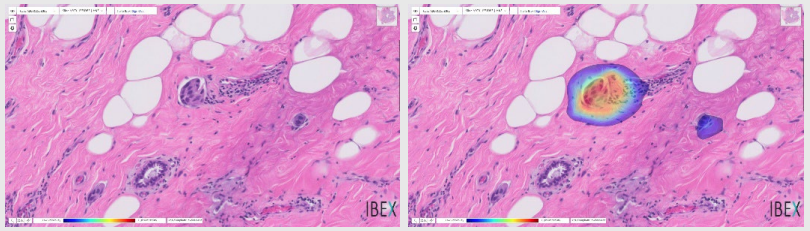


Additional features

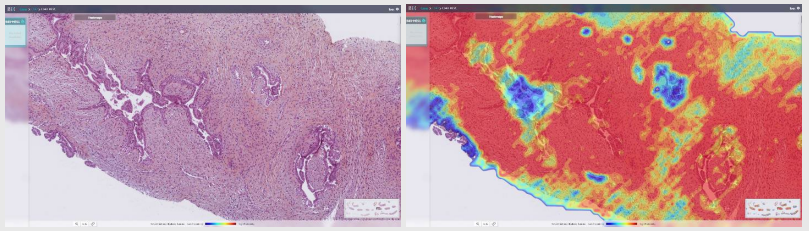
Angiolymphatic involvement	Biphasic tumor	Tumor infiltrating lymphocytes
Hyperplasia	Inflammation	Fibrocystic change
Elastosis	Tumor necrosis	Normal ducts & lobules
Stromal changes	Lobular neoplasm	Sclerosing adenosis

and many more…

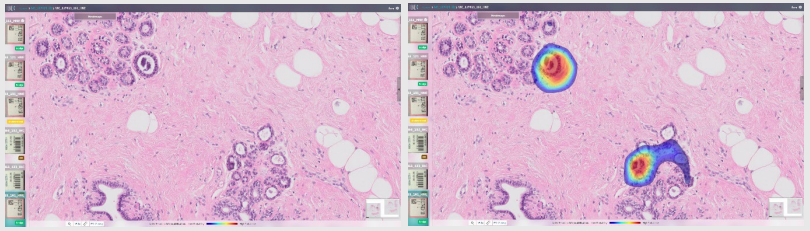
ALI



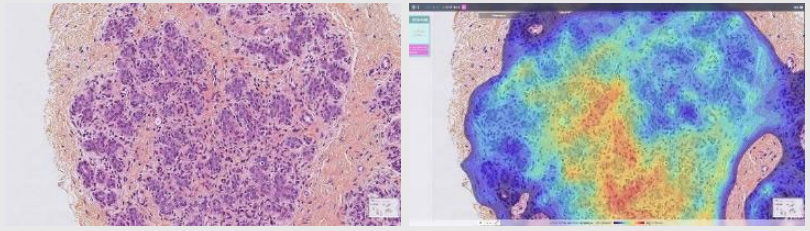
Phyllodes Tumor grade I



Microcalcifications



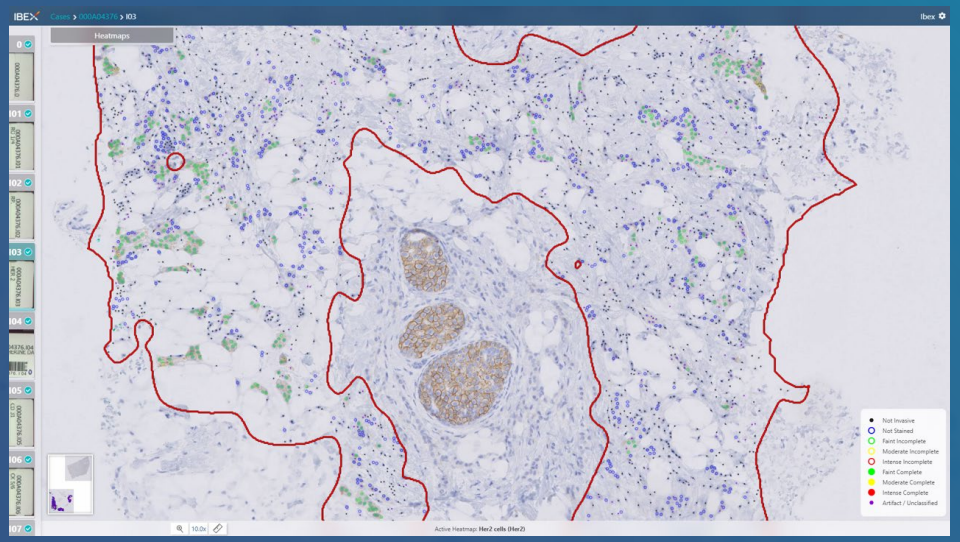
Adenosis



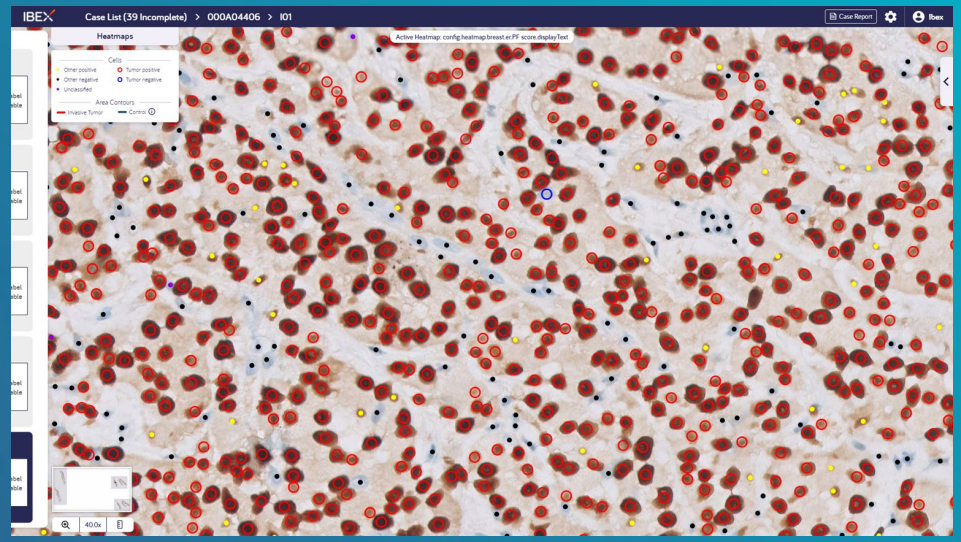
The Broadest Range of Detection Capabilities Available In the Field

Ibex Breast Panel

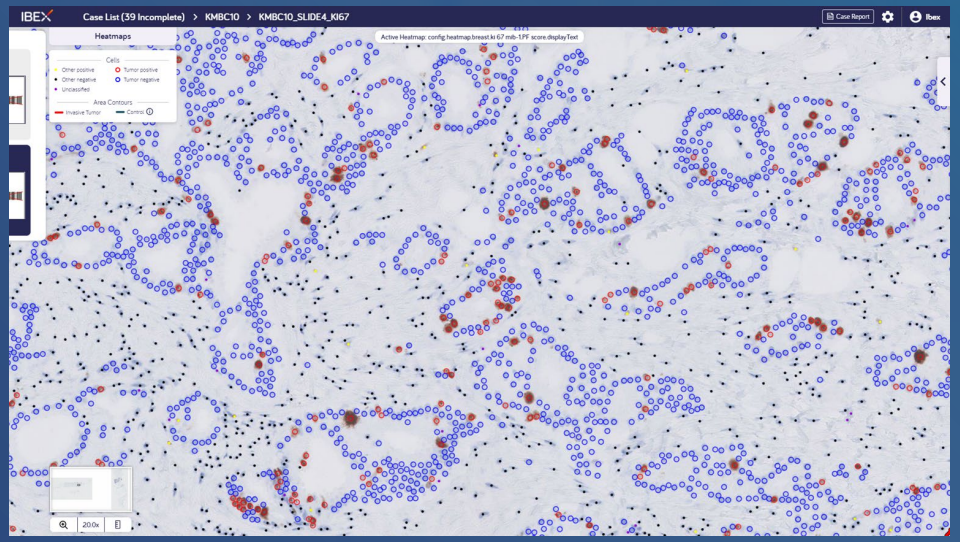
HER2



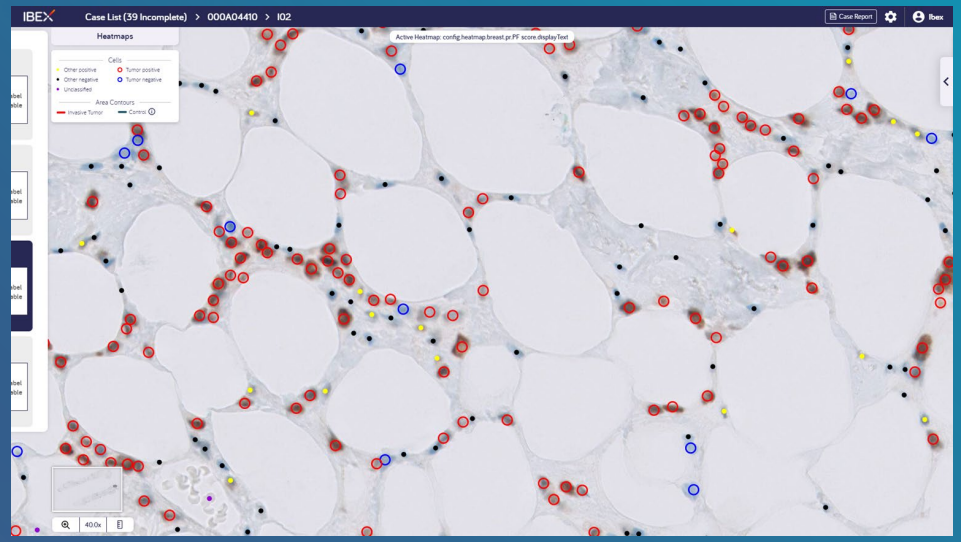
ER



Ki67



PR



How Can AI Help in the Practice of Breast Pathology?

Improve Quality

- **AI decision support** - Highlight clinically important lesions and other morphological features in primary diagnostic workflow
- **AI Diagnostic QA** - Provide second a read before final sign out to ensure clinically significant lesions have not been missed
- **AI Quantification of IHC**

Improve workflow & reduce TAT

- Prioritisation of cases
- Pre-order receptor IHC's for invasive cancers and DCIS
- Pre-order additional levels (e.g., for calcifications)
- Eliminate need for diagnostic IHC for some cases

Ibex Breast:
AI-powered Accuracy

npj | breast cancer

www.nature.com/npjbcancer

ARTICLE OPEN

Validation and real-world clinical application of an artificial intelligence algorithm for breast cancer detection in biopsies

Judith Sandbank[1,2], Guillaume Bataillon[3,7], Alona Nudelman[1], Ira Krasnitsky[2], Rachel Mikulinsky[2], Lilach Bien[2], Lucie Thibault[3], Anat Albrecht Shach[4], Geraldine Sebag[2], Douglas P. Clark[2], Daphna Laifenfeld[2,8], Stuart J. Schnitt[5,6], Chaim Linhart[2], Manuela Vecsler[2] and Anne Vincent-Salomon[3]

Detection	AUC	Specificity	Sensitivity
Invasive Breast Cancer	**0.990**	93.6%	95.5%
DCIS	0.980	93.8%	93.2%
IDC vs ILC	0.973	92.7%	92.9%
IG / HG DCIS vs. ADH / LG DCIS	0.921	84.8%	84.1%

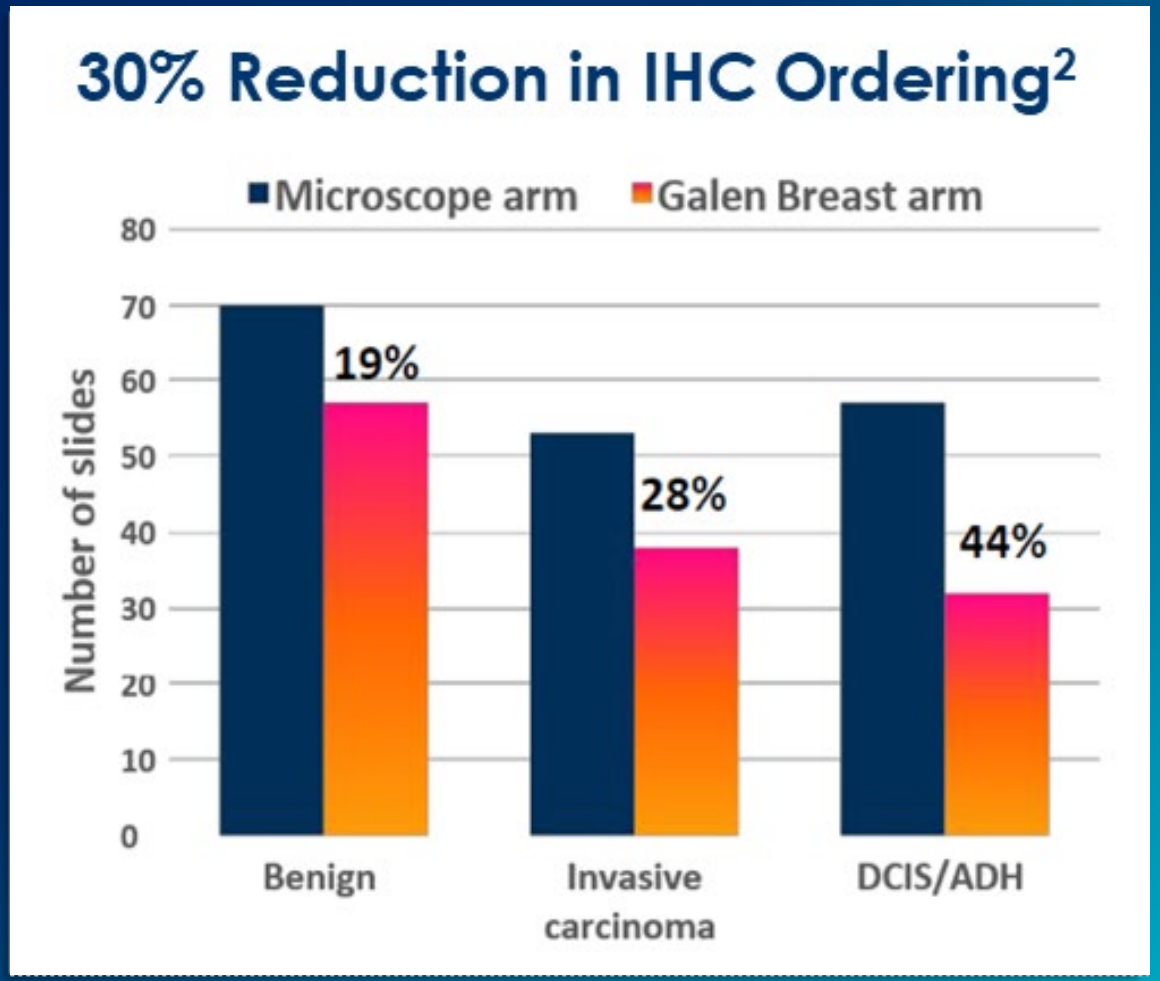
institut Curie

Maccabi The Best Healthcare Group in Israel

- A multi-site study of 436 breast biopsies (841 H&E/HES slides): 156 invasive, 135 DCIS/ADH, 145 benign[1]
- Cohort enriched with rare subtypes
- Multiple scanning systems and staining platforms
- The study **successfully validated** the performance of Galen Breast:
  - **Very high performance** for invasive carcinoma & DCIS detection
  - AI differentiated well between subtypes/grades of invasive & in-situ cancers

1) Vincent-Salomon et al, npj Breast Cancer 2022

Ibex Breast:
AI for Primary Diagnosis



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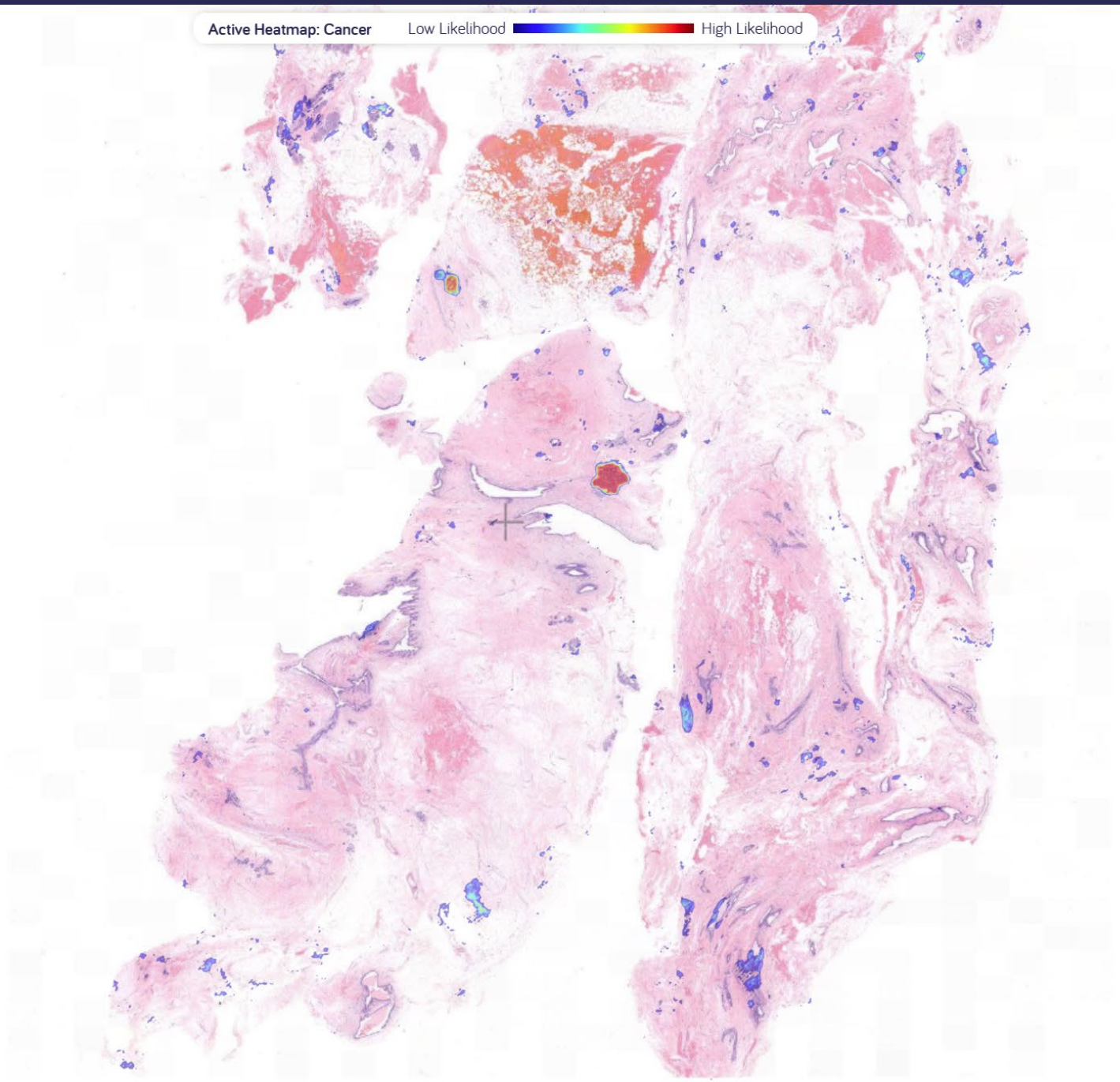
Maccabi
The Best Healthcare Group in Israel

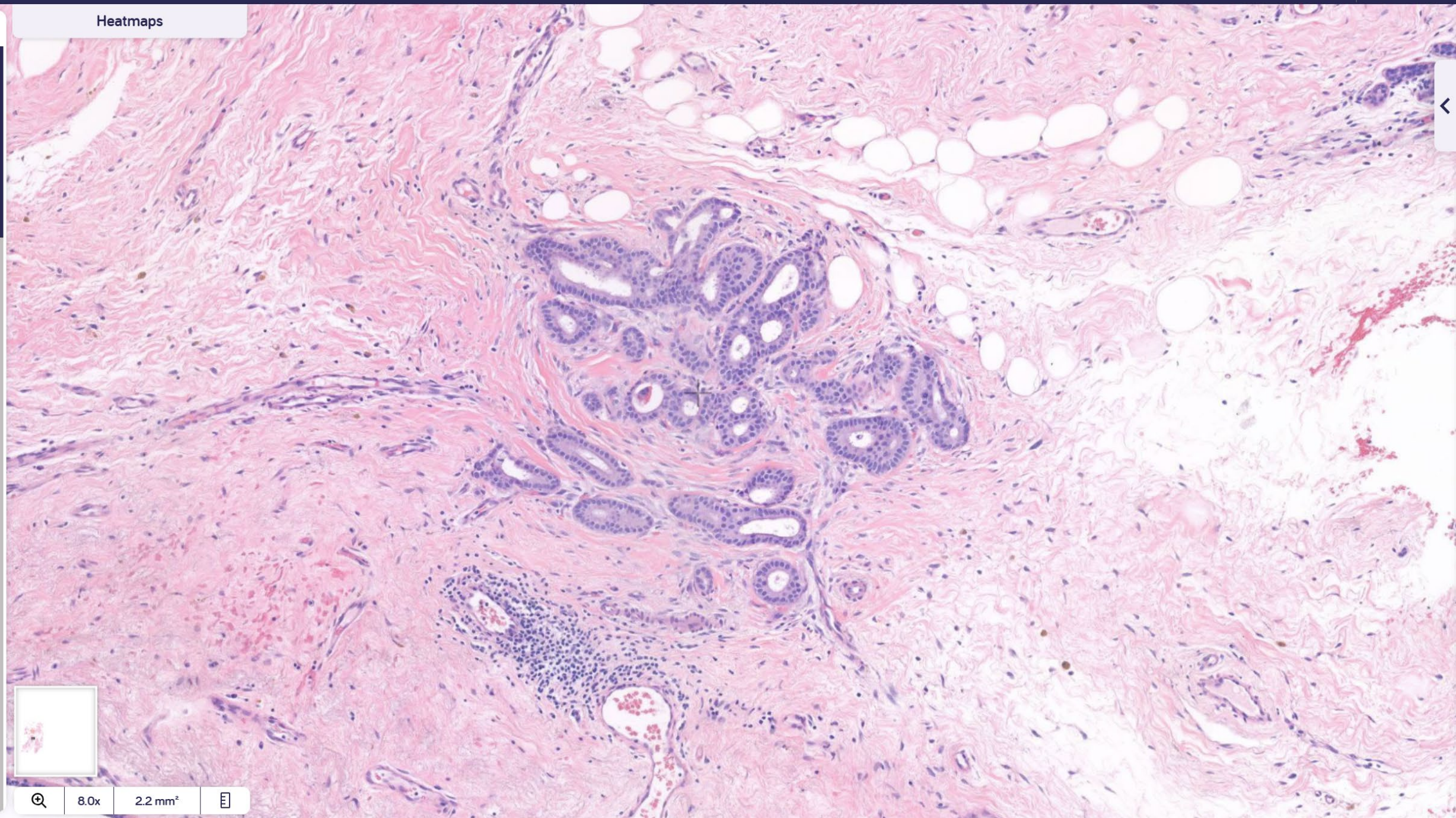
- Multiple studies of Galen Breast in primary diagnosis (485 cases collectively)
- Parallel arms comparing pathologists with AI to pathologists with microscope
- Galen Breast was found to help pathologists **improve diagnostic quality and efficiency:**
  - Improved overall accuracy (by 29%)[1]
  - Improved sensitivity for invasive cancer [1]
  - Reduced IHC ordering (by 30%)[2]

1) Unpublished data from clinical studies. Subject to further analysis
2) Sandbank et al. Presented at USCAP 2022

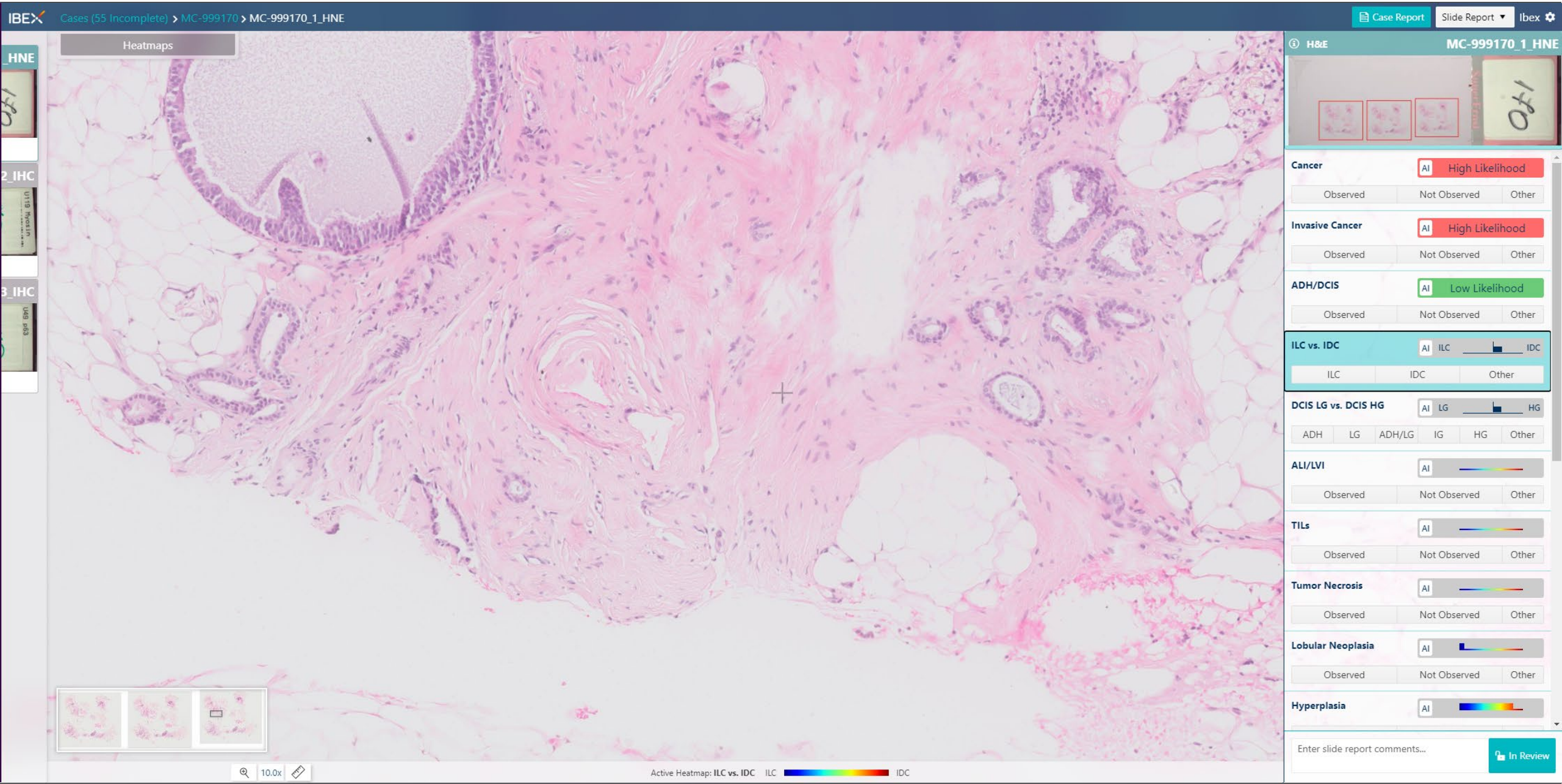
Heatmaps



Heatmaps



Small foci of IDC detected with Galen Breast AI



Case Prioritisation, Triage & IHC Pre-ordering

IBEX

IBEX Cases (55 Incomplete) Ibex

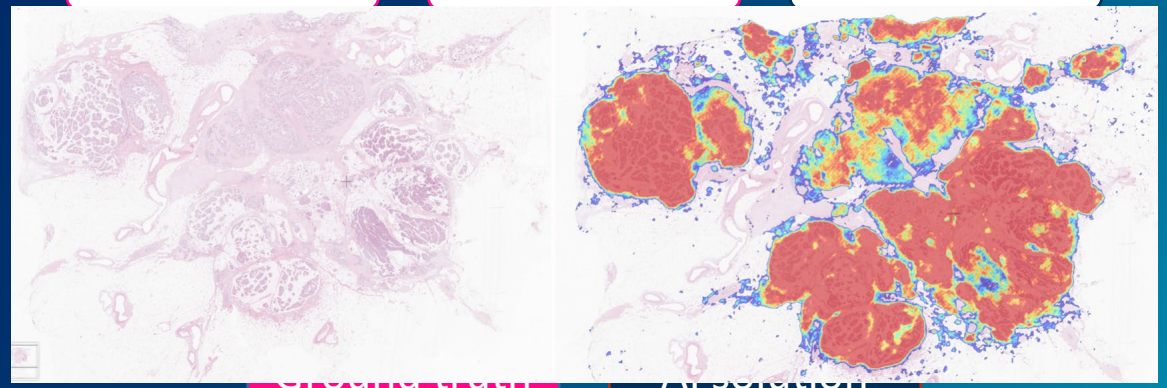
Breast

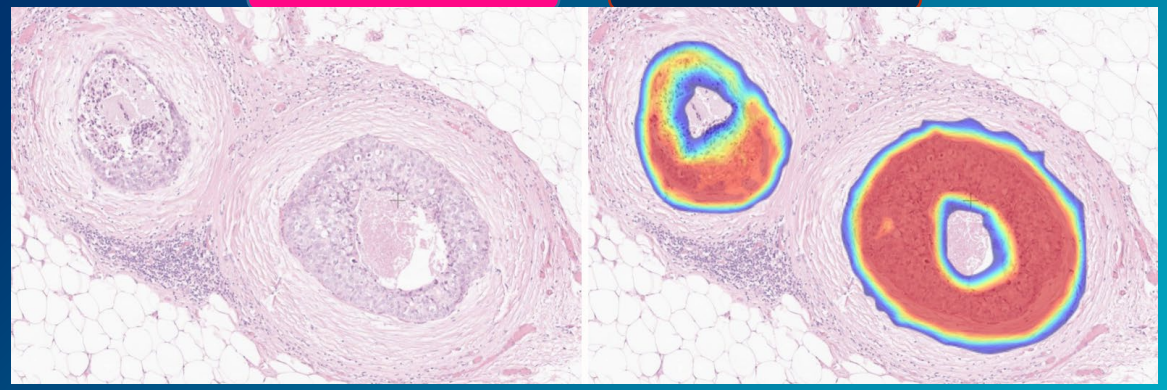
Case ID	Date	Tissue	No. of Slides	Findings	Assigned to
MP-004417	2022-05-23	breast	15	Cancer Invasive Cancer ADH/DCIS	Pathologist
MC-999070	2022-05-25	breast	3	Cancer Invasive Cancer ADH/DCIS	Pathologist
MP-004402	2022-05-25	breast	8	Cancer Invasive Cancer	Pathologist
MC-117463	2022-05-25	breast	9	Cancer Invasive Cancer	Pathologist
CP-000030	2022-05-25	breast	1	Cancer Invasive Cancer	Pathologist
MP-004354	2022-05-25	breast	3	Cancer Invasive Cancer	Pathologist
CP-000014	2022-05-25	breast	1	Cancer Invasive Cancer	Pathologist
MP-004485	2022-05-25	breast	12	Cancer Invasive Cancer ADH/DCIS	Pathologist
MP-009618	2022-05-25	breast	6	Cancer Invasive Cancer ADH/DCIS	Pathologist
MP-004357	2022-05-25	breast	4	Cancer ADH/DCIS	Pathologist
MC-023811	2022-05-25	breast	6	Cancer ADH/DCIS	Pathologist
MC-999170	2022-05-25	breast	3	Cancer ADH/DCIS	Pathologist
MC-008566	2022-05-25	breast	13	Cancer ADH/DCIS	Pathologist
MC-134340	2022-05-25	breast	1		Pathologist
MC-032851	2022-06-07	breast	2		Pathologist
KM-000040	2022-06-07	breast	9		Pathologist
CP-000098	2022-06-07	breast	17		Pathologist
IC-000129	2022-06-07	breast	1		Pathologist
MC-045262	2022-08-16	breast	1		Pathologist

1 - 19 of 19 items

Galen Breast: Excisions Study

Detection	AUC	Sensitivity	Specificity
Invasive Breast Cancer	373 breast excisions		92%
ADH/DCIS	0.981	91.9%	94.1%
	Expert 1	Expert 2	Ibex Galen™



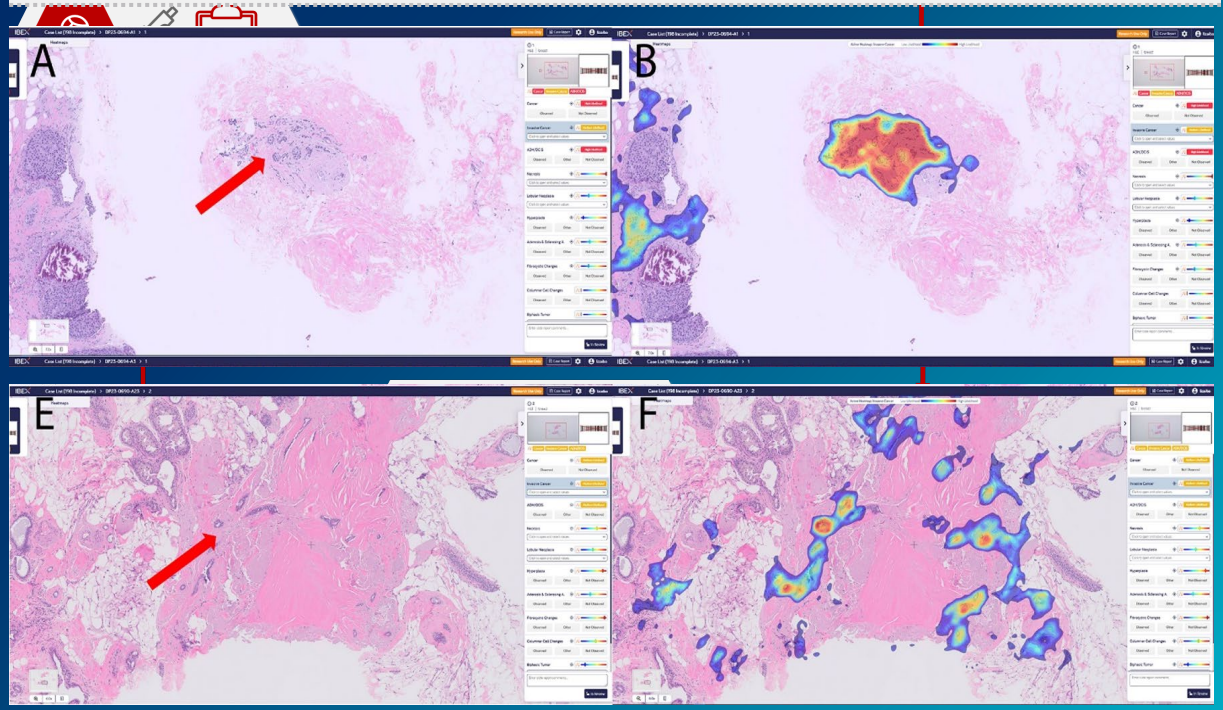


- A multi-site study of 373 breast excision cases: invasive, DCIS & ADH
- Ground Truth established by 3 export breast pathologists
- Multiple scanning systems and staining platforms
- The study **successfully validated** the performance of Ibex Breast on excision cases:
  - **Very high performance** for invasive carcinoma & DCIS detection
  - AI differentiated well between subtypes/grades of invasive & in-situ cancers

Ohio State University

Automated Classification of Breast Lesions

Detection	AUC	Sensitivity	Specificity
Invasive Breast Cancer	0.976	91.7%	95%
DCIS	0.976	93.3%	96.6%



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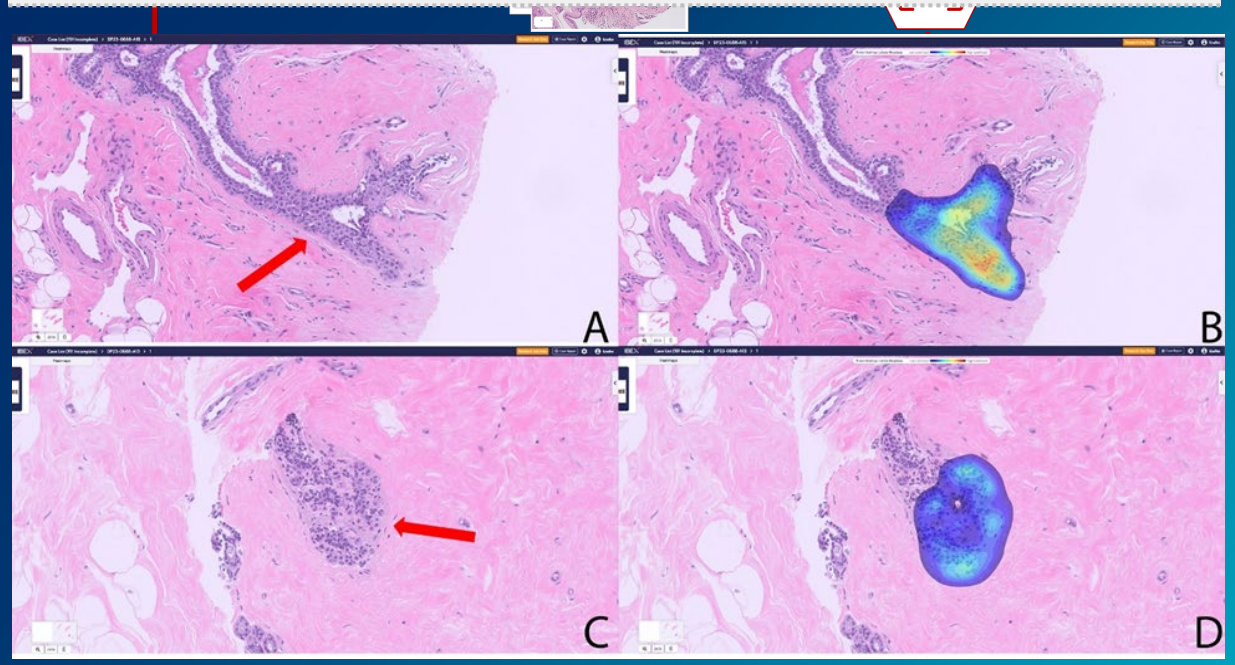
IBEX

- Study of **104 breast biopsy cases**: 24 invasive, 4 microinvasion, 15 DCIS & 65 benign
- Ground Truth based on original report by expert breast pathologist
- The study **successfully validated** the performance of Ibex Breast on biopsy cases:
  - **Very high performance** for classification of invasive carcinoma & in situ breast cancer
  - Accurately identified multiple other pathologies, such as lobular neoplasia, and multiple benign lesions

Ohio State University

Detection of Lobular Neoplasia in Breast Biopsies

Detection	AUC	Sensitivity	Specificity
Lobular Neoplasia	0.953	94.1%	95.6%



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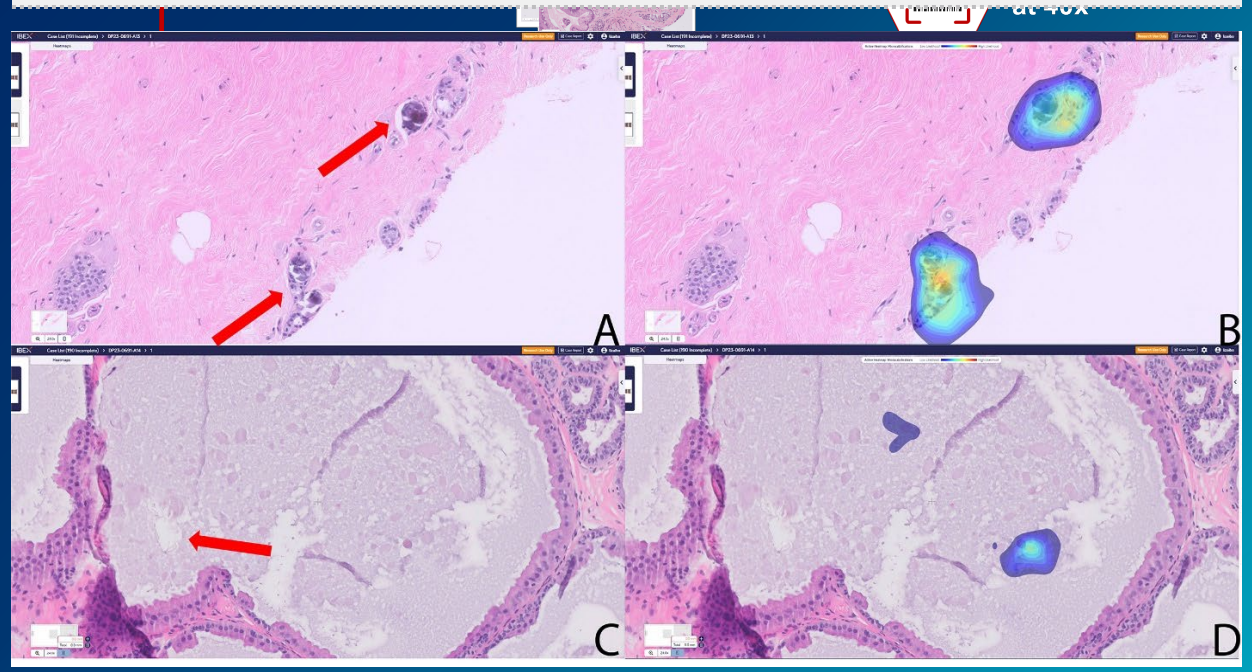
IBEX

- Study of **65 breast biopsy cases**: 17 lobular neoplasia & 48 benign
- Ground Truth based on original report by expert breast pathologist
- AI results were compared with the ground truth, which was confirmed by loss of E-cadherin staining
- The study **successfully validated** the performance of Ibex Breast on biopsy cases:
  - **Very high performance** for detection of Lobular Neoplasia

Ohio State University

Detection of Microcalcifications in Breast Biopsies

Detection	AUC	Sensitivity
Microcalcification	0.925	95%



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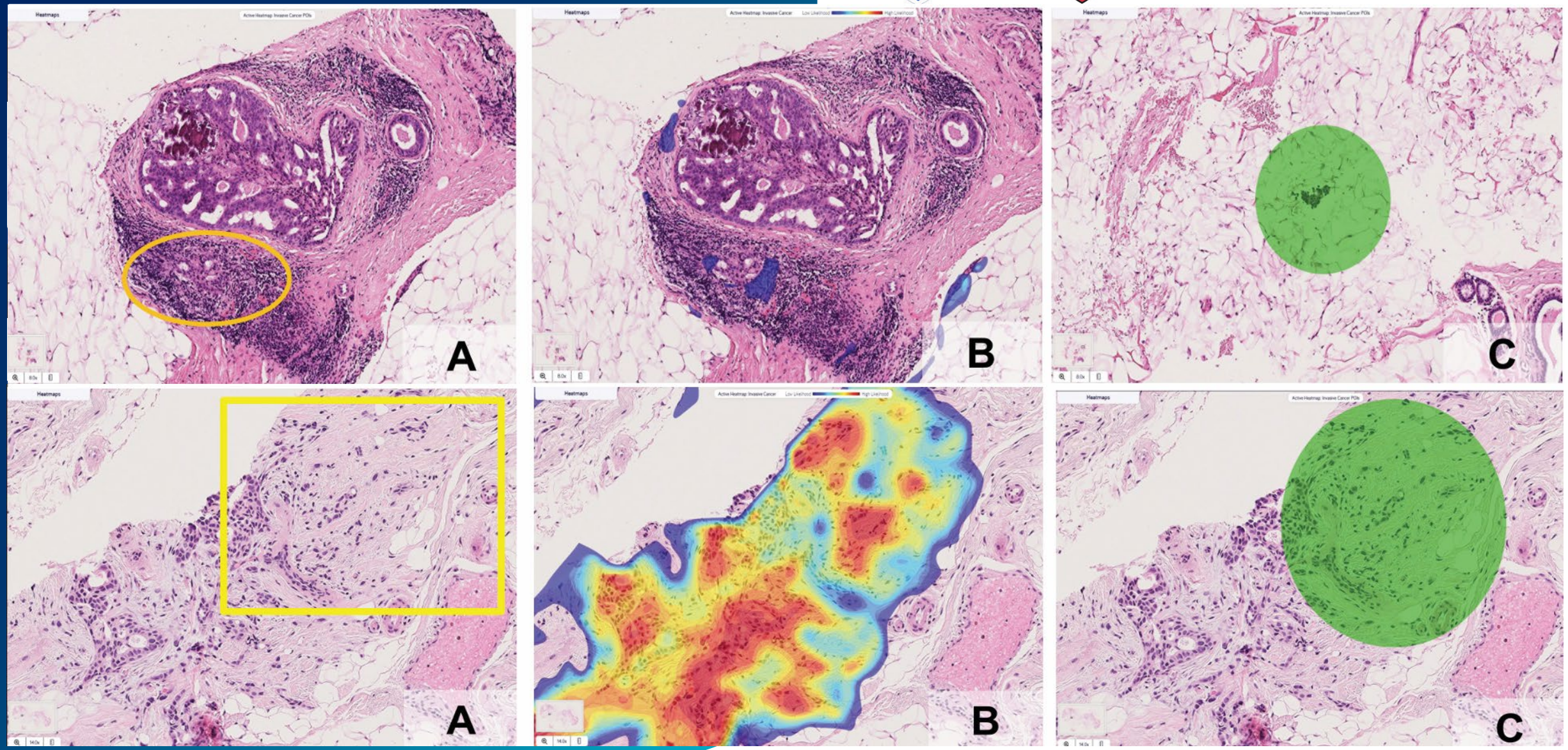
IBEX

- Study of **53 non-cancerous breast biopsy cases**: 21 with microcalcifications & 33 without microcalcifications
- Ground Truth based on original report by expert breast pathologist
- The study **successfully validated** the performance of Ibex Breast on biopsy cases:
  - **High performance** for detection of microcalcifications

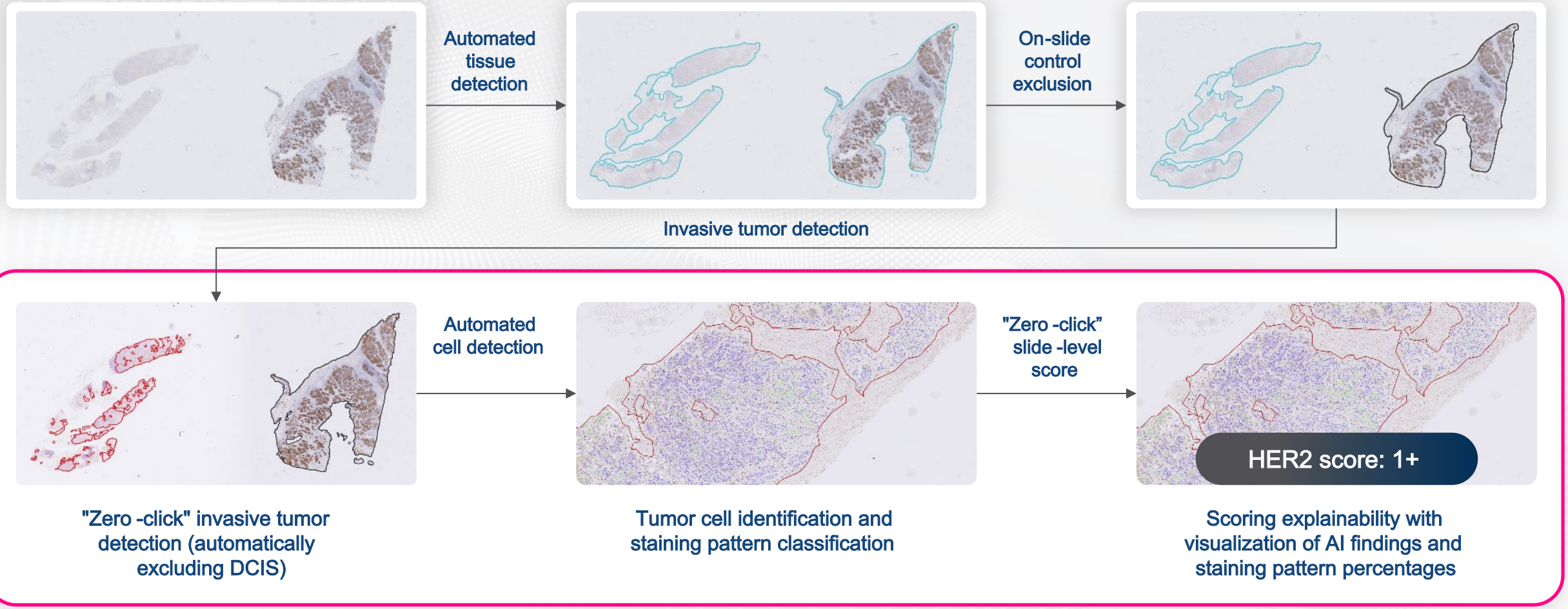
Galen Breast: Detection of Microinvasive Carcinoma



Ibex Breast HER2

Fully automated "zero-click", AI-enhanced accuracy and reproducibility

The AI-powered computational pipeline automates and optimizes case review:



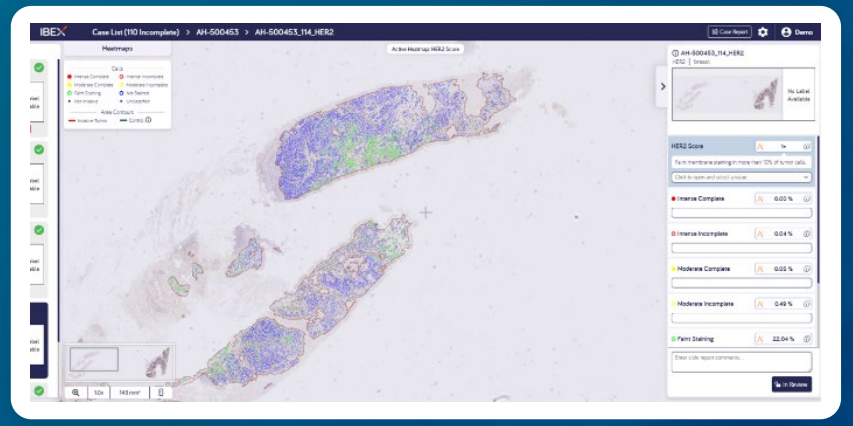
Ibex Breast HER2

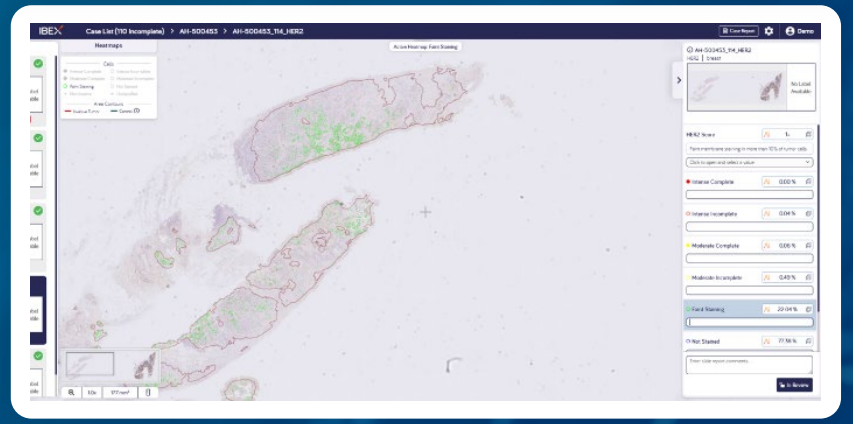
Fully automated “zero-click” AI-powered decision support tool for pathologists scoring HER2 immunohistochemistry (IHC)

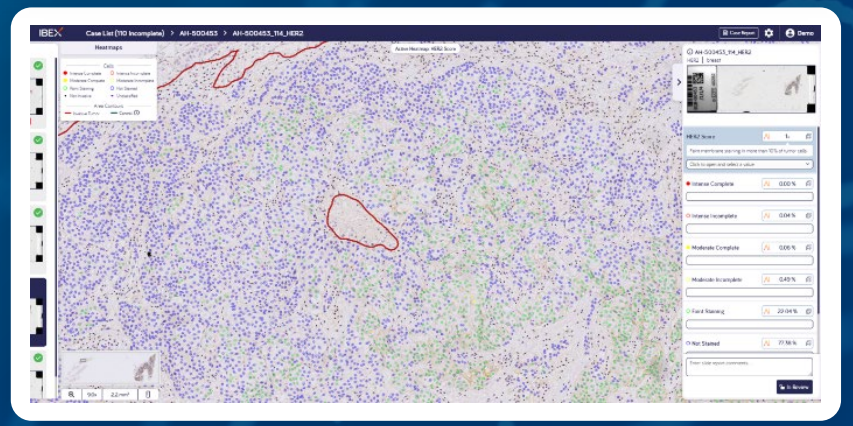
Delineates HER2 expression into four standard scores: 0, 1+, 2+ and 3+, based on the 2023 ASCO/CAP guidelines

Increases accuracy and reproducibility of HER2 IHC scoring, including the highly subjective HER2-low cases

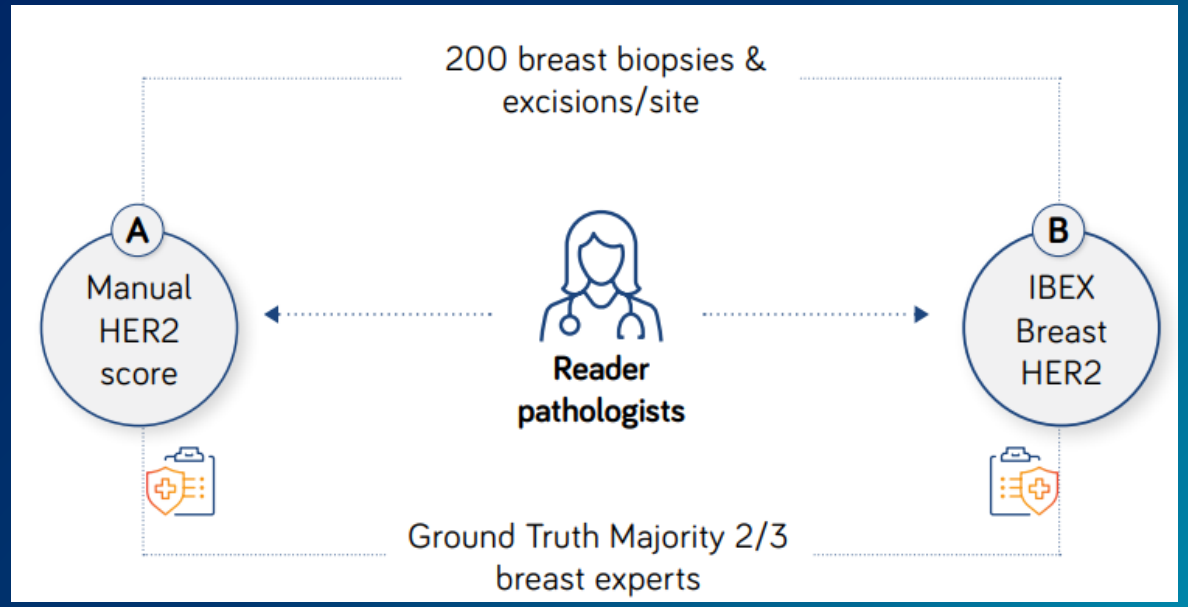
Bolsters pathologists’ confidence in their HER2 scoring accuracy with explainable visualization of AI findings and staining pattern percentages







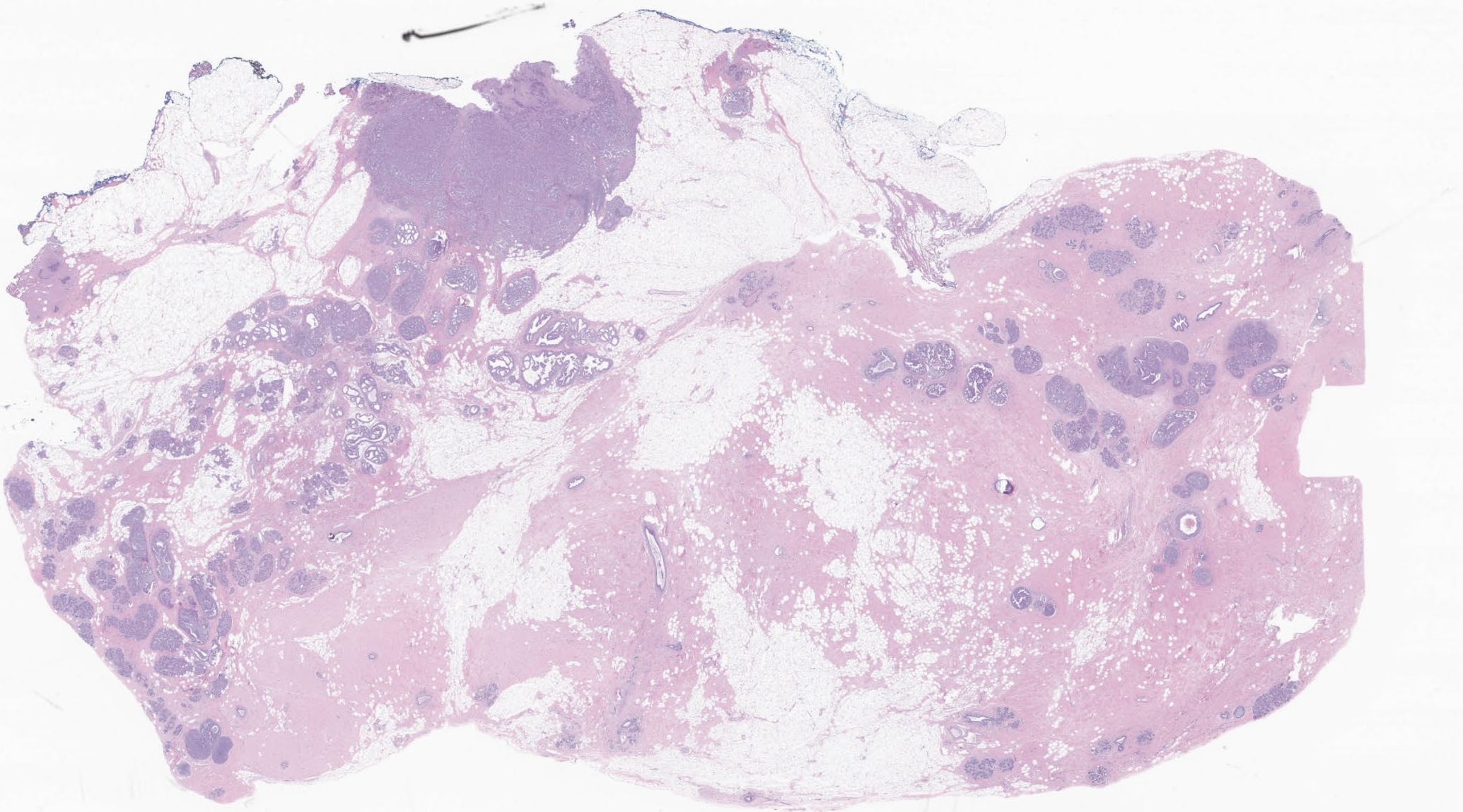
Ibex Breast HER2: Early Evidence Program



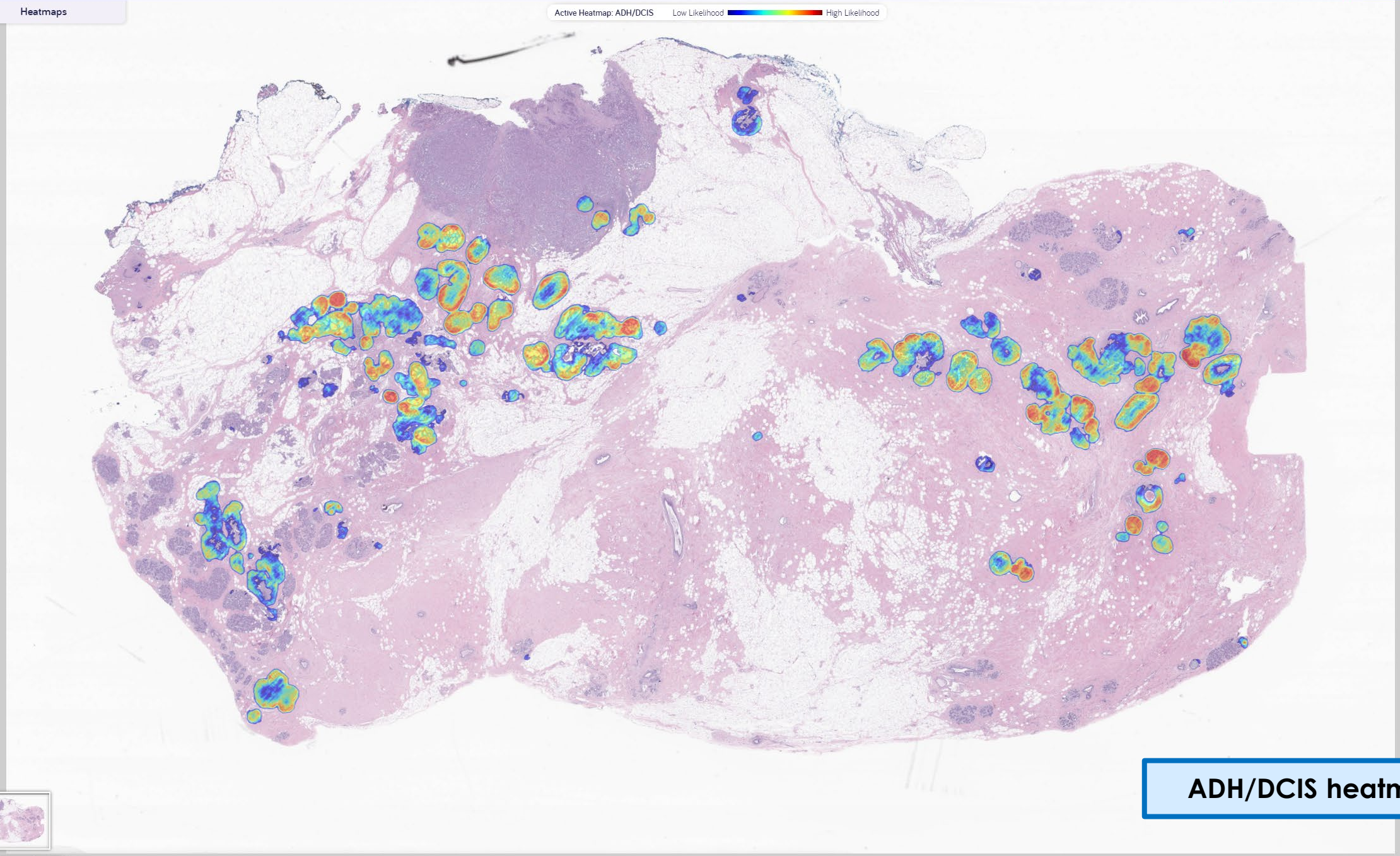
- 28 "reader" pathologists from 13 pathology labs scored HER2 IHCs according to the 2023 ASCO/CAP guidelines
  - **Arm A** - unassisted digital review
  - **Arm B** - AI assisted digital review
- Ground truth (GT) established as majority score of 3 breast experts/site, scoring slides per standard of care (no AI)
  - 43 GT pathologists in total - 19 internal, 24 external
- Reader performance in each arm was compared to GT

AstraZeneca IBEX

- Study of 2,300 patients from 13 academic and reference/private laboratories (US, EU, UK)
- 100-200 anonymized breast biopsies/site (HER2 + corresponding H&E)
- Diverse invasive carcinoma subtypes from primary and metastatic tumors
- Real-world distribution of HER2 scores (15-20% HER2 positive, 80-85% HER2 negative)
- Variety of scanners

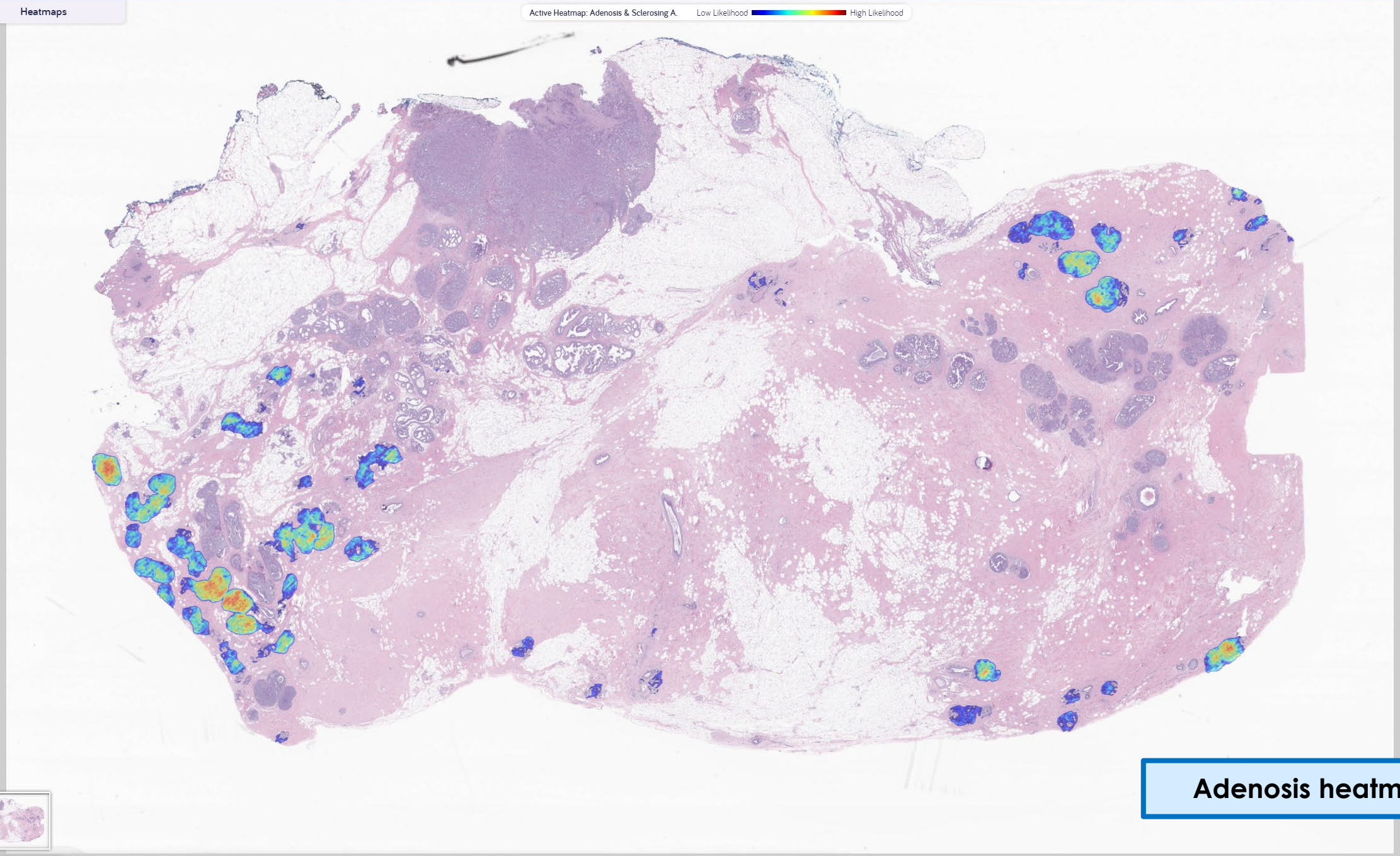


Heatmaps



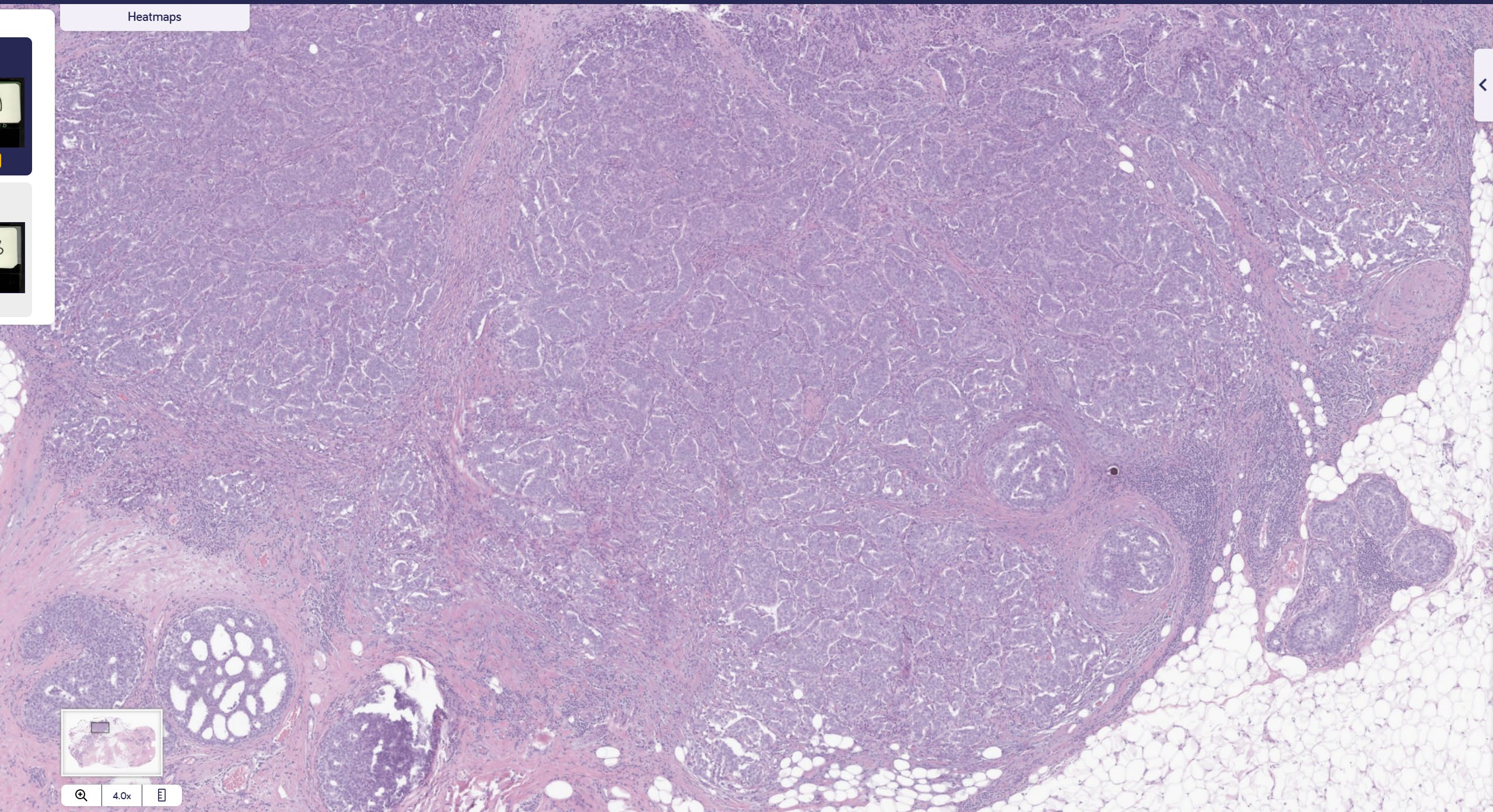
ADH/DCIS heatmap

Heatmaps



Adenosis heatmap

Heatmaps



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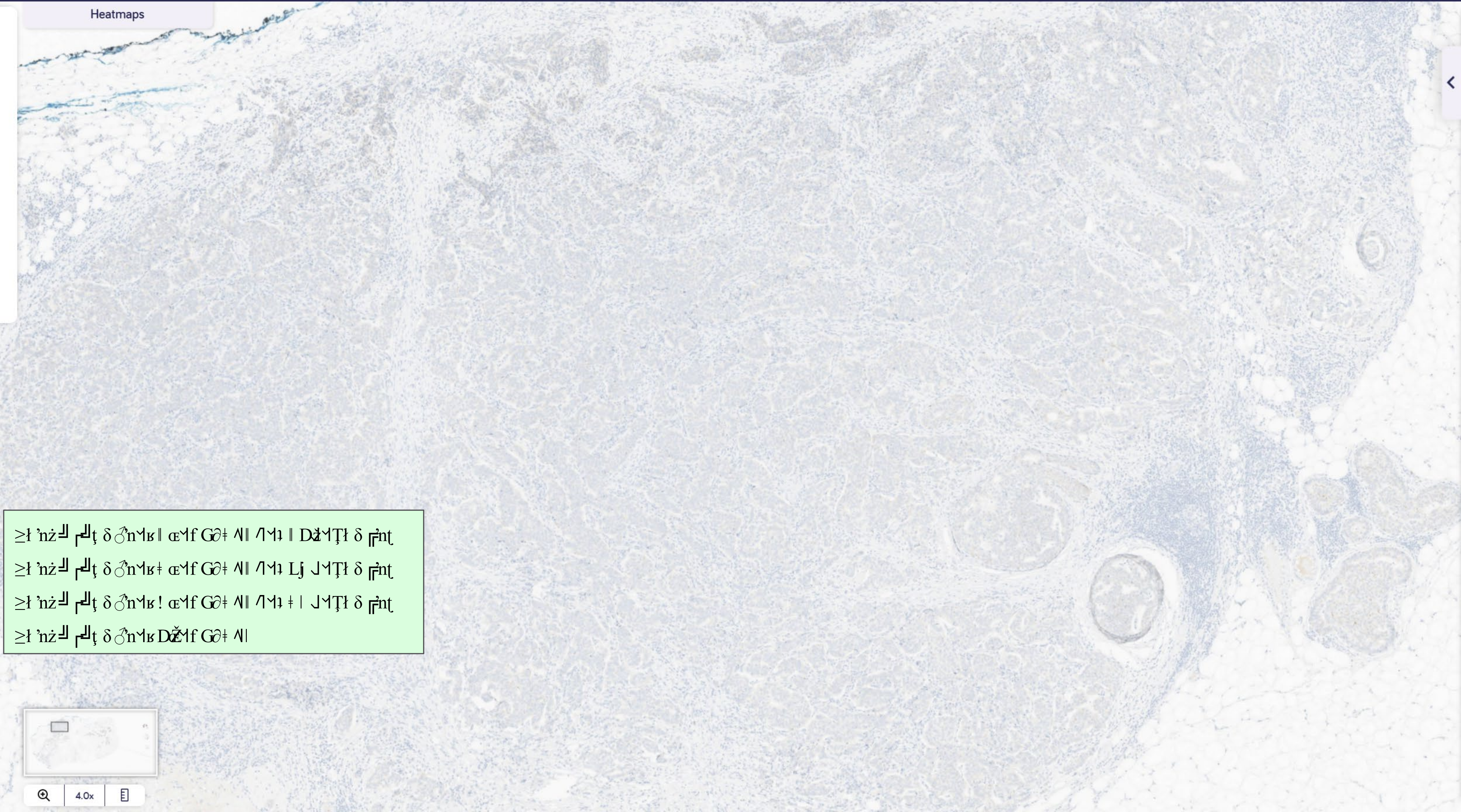
For Investigational Use Only

Case Report

Ibex

Heatmaps



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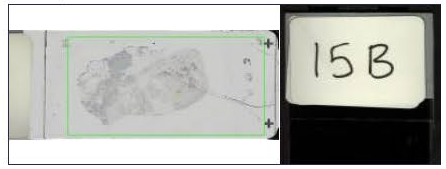
Heatmaps

Active Heatmap: HER2 Score

Cells
- Intense Complete
- Intense Incomplete
- Moderate Complete
- Moderate Incomplete
- Faint Staining
- Not Stained
- Not Invasive
- Unclassified

Area Contours
- Invasive Tumor
- Control

15B
HER2 | breast



HER2 Score 0

Faint membrane staining in 10% or less of tumor cells.

Click to open and select a value

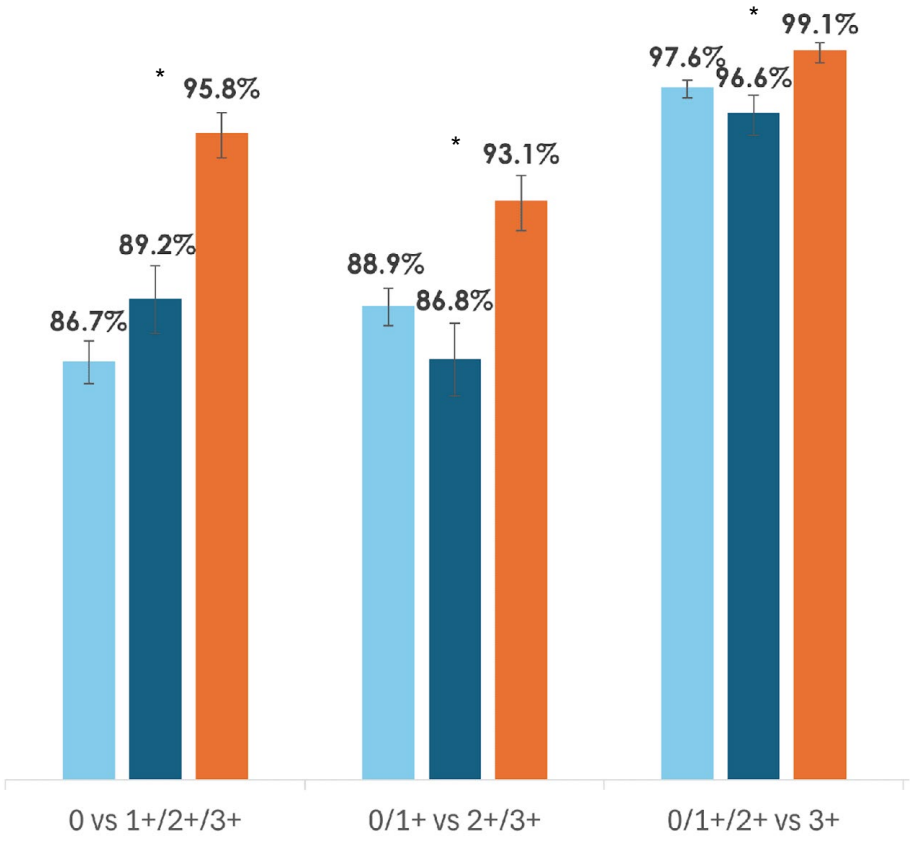
Intense Complete	0.00 %
Intense Incomplete	0.00 %
Moderate Complete	0.03 %
Moderate Incomplete	0.13 %
Faint Staining	4.15 %
Not Stained	95.69 %
Invasive Cancer Cells Total Count	58174

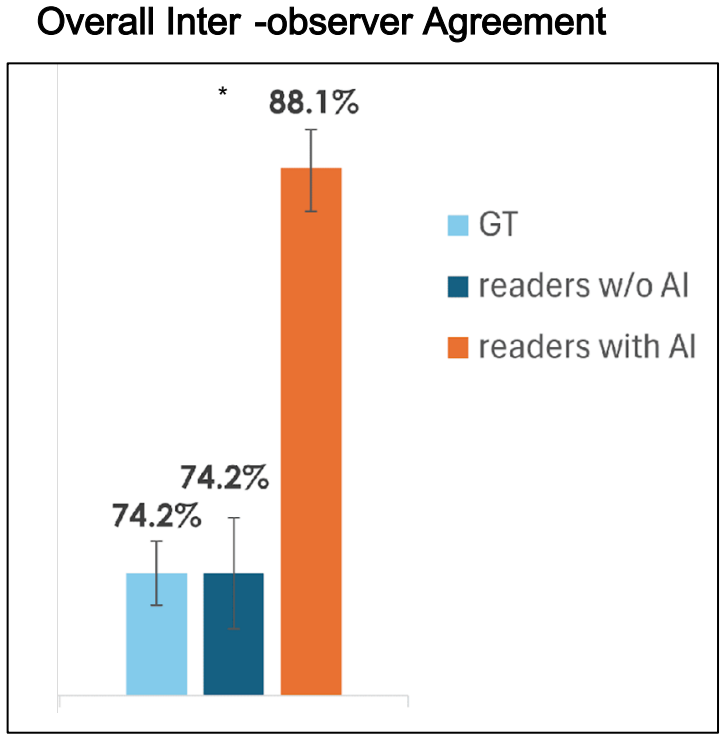
Enter slide report comments...

In Review

4.0x

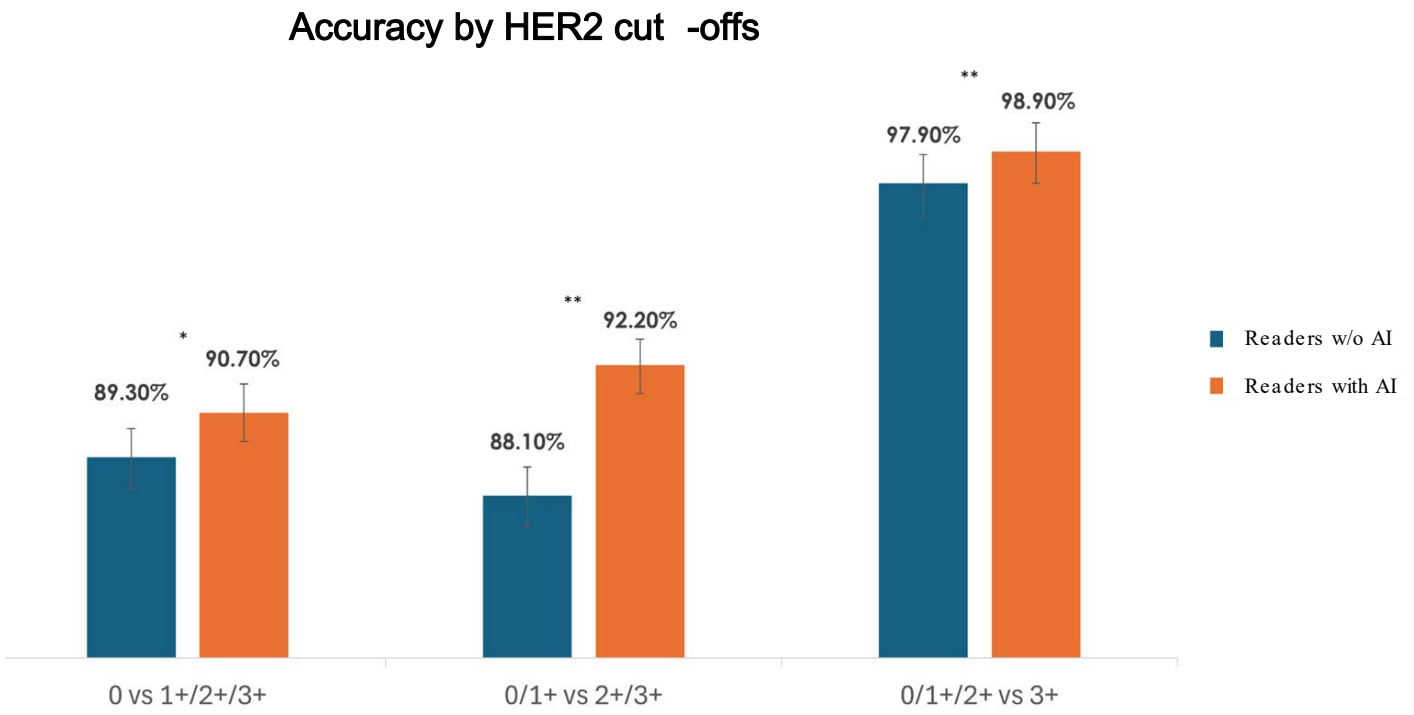
Increased Consistency: Inter-observer Agreement

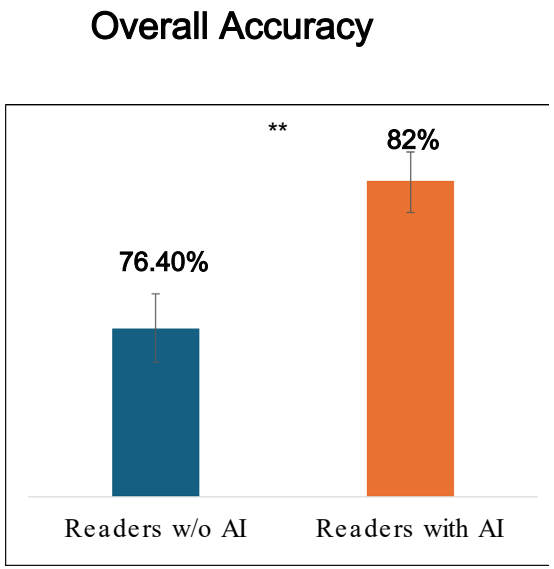




Pathologists' average inter-observer agreement was significantly higher when assisted by AI

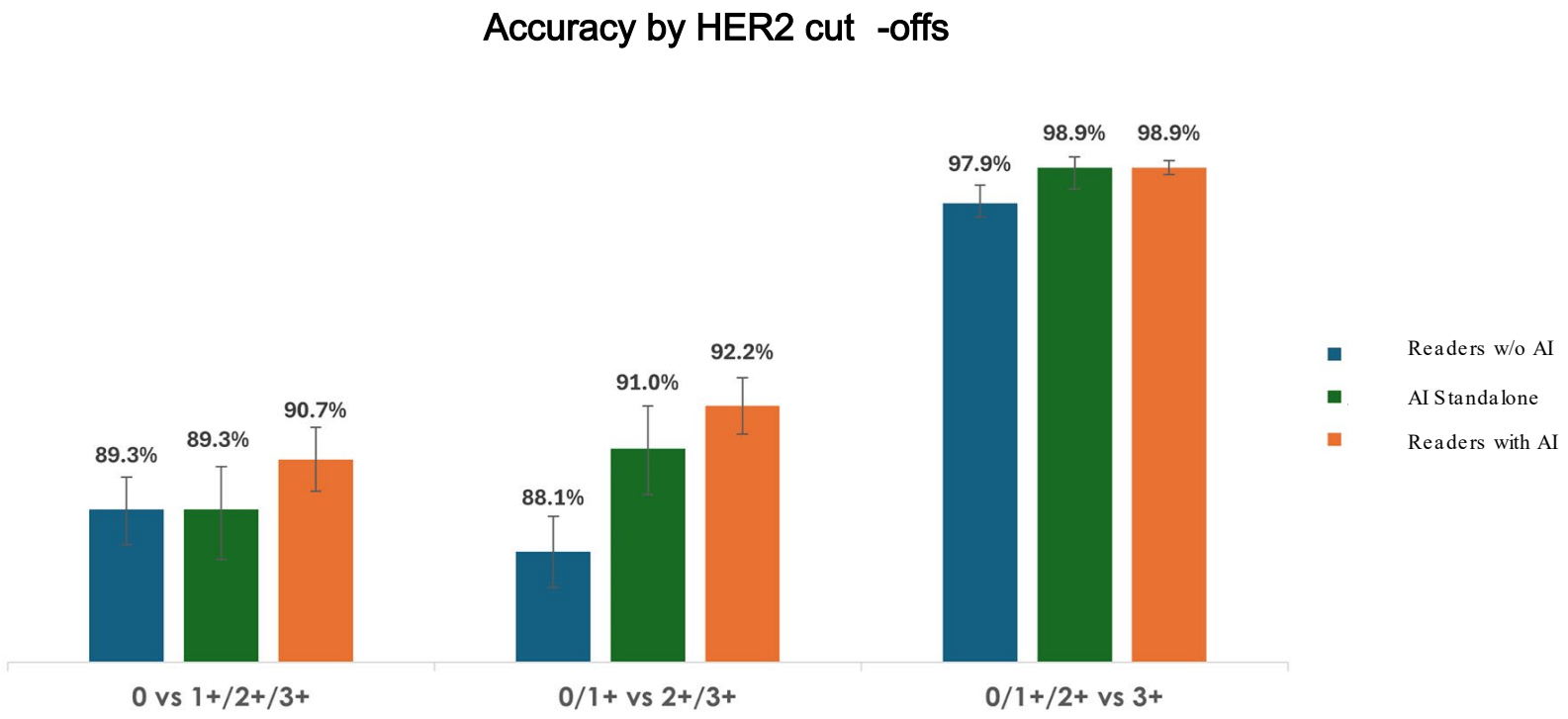
Improved Accuracy: Agreement with Ground Truth

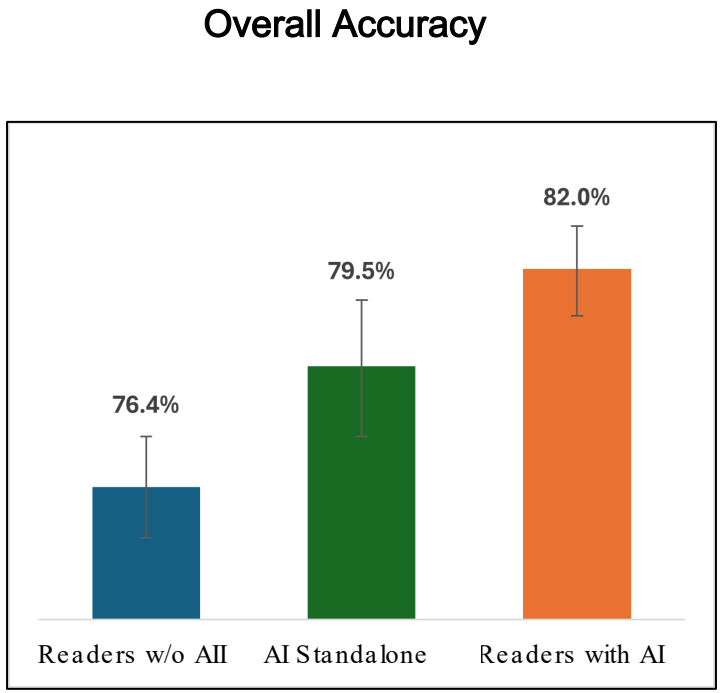




- **82%** overall agreement with GT when assisted by the AI vs. **76.4%** without AI
- Significantly improved agreement with GT at all HER2 cut-offs

Agreement with Ground Truth: AI and Readers





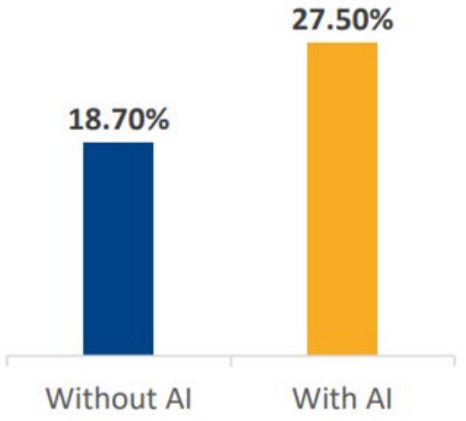
The AI standalone accuracy was higher than the readers w/o AI accuracy but lower than the accuracy of readers when supported by AI

HER2 2+ cases and FISH Tests

Rate of HER2 1+ and 2+ scored by readers without and with AI

	1+ cases	2+ cases
Without AI	36.2%	17.2%
With AI	44.8%	10.1%
Change	**+8.6%**	**-7.1%**

Percentage of FISH positive cases from cases scored by readers as 2+

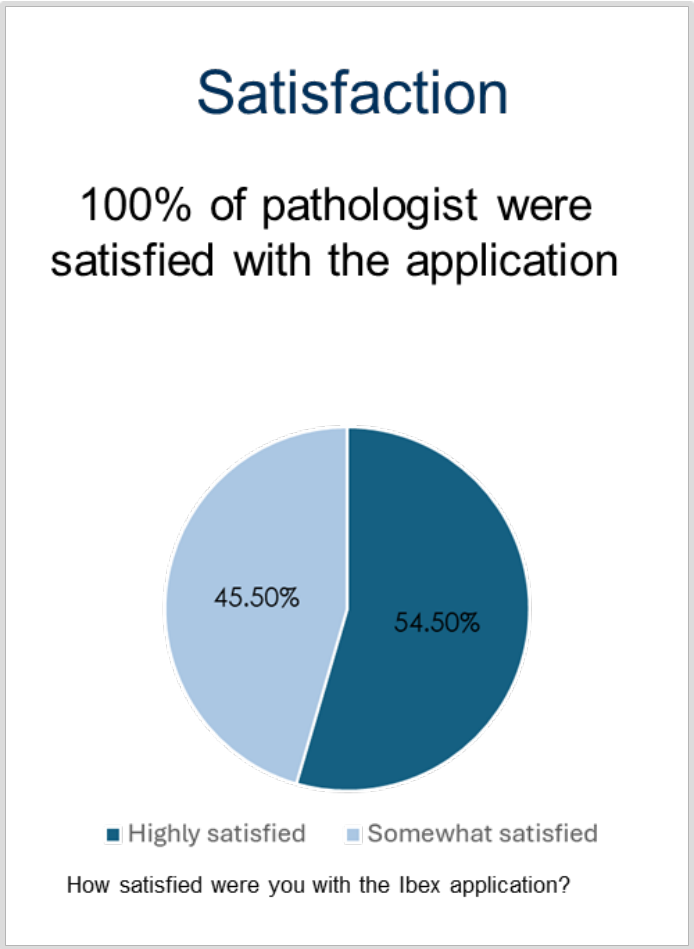


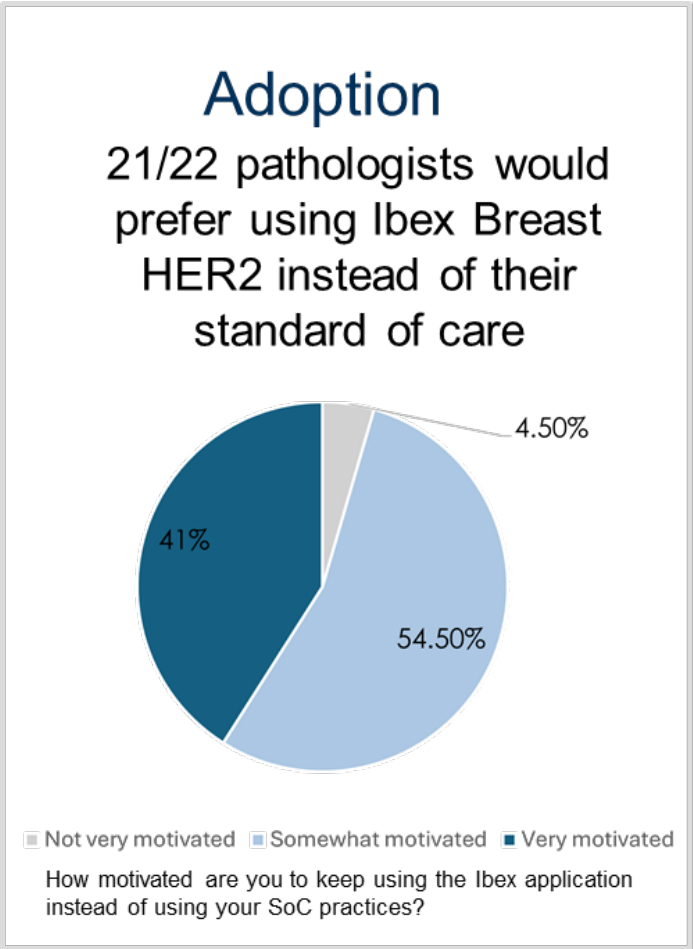
A decrease of 41% in the required number of FISH tests

*Data from Cambridge University Hospitals NHS site, Presented at the ECP 2024

AI assistance led to a decrease in the ISH tests, thus a decrease in TAT to patients' results.

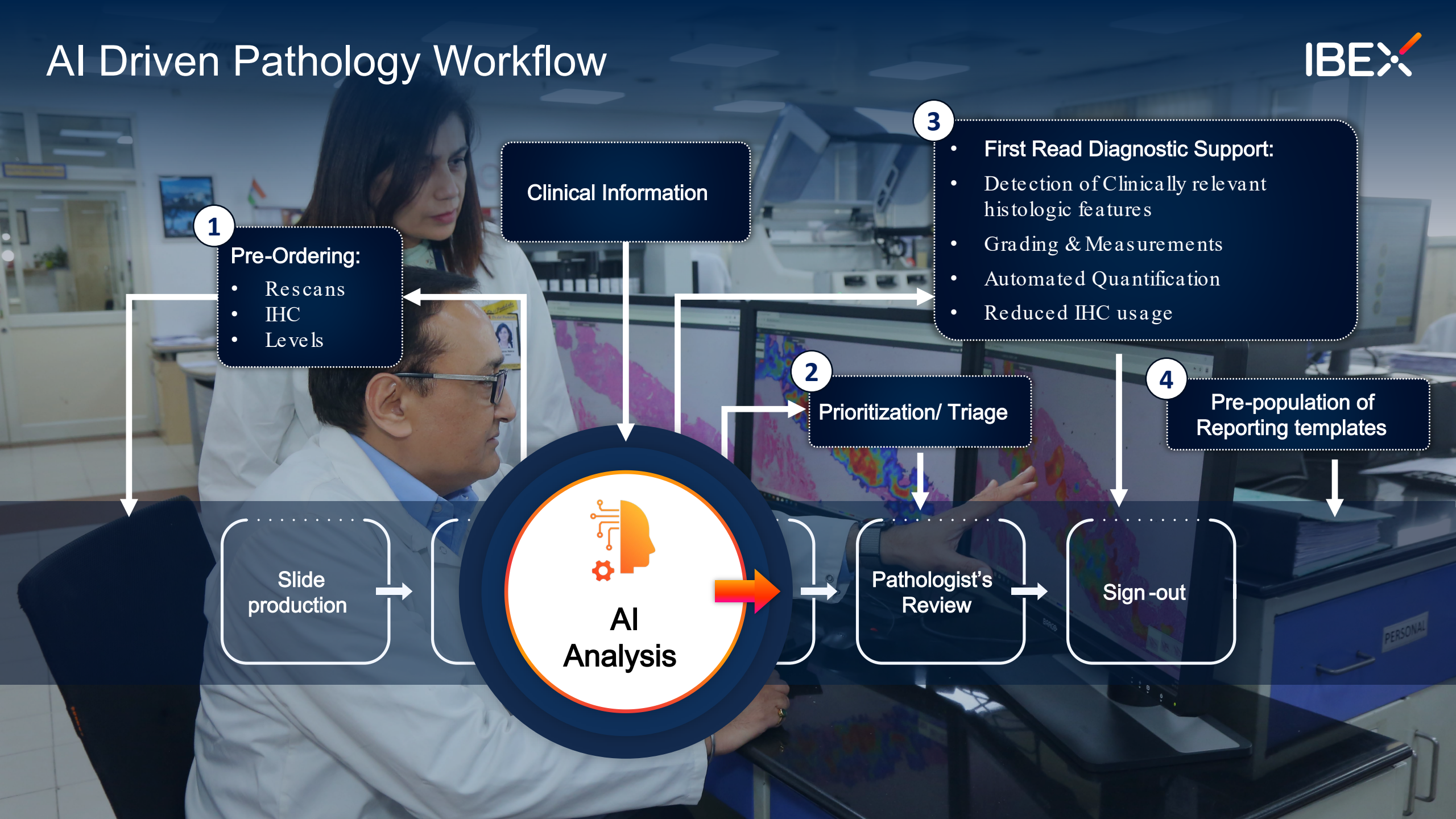
Pathologist Feedback Survey



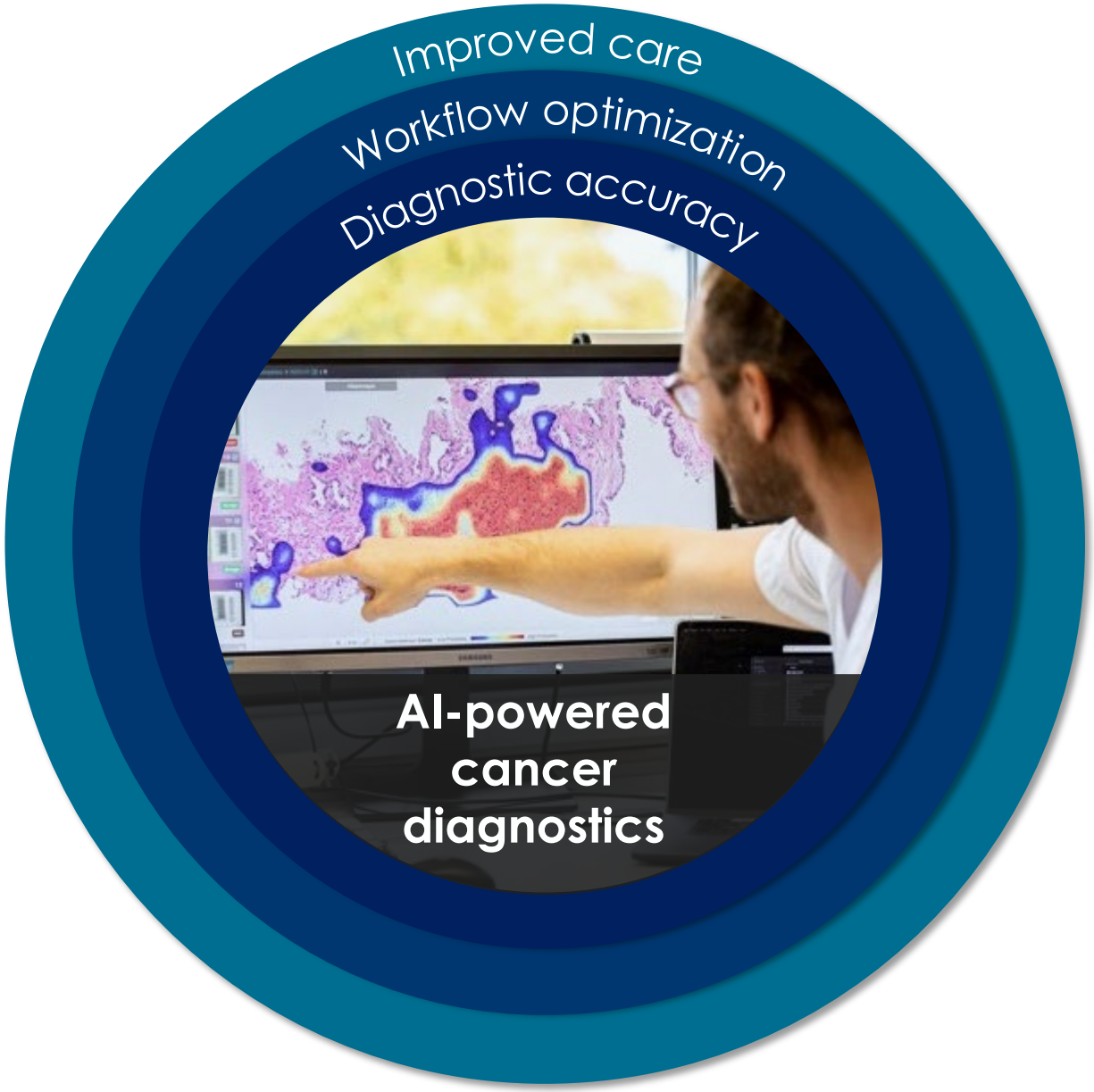


- All Pathologists felt more confident about their scoring accuracy when assisted by the AI
- All Pathologists felt more consistent in their HER2 scoring when assisted by the AI

AI Driven Pathology Workflow



Revolutionising Cancer Diagnosis With AI



- Improved **accuracy**
- **Reduced error rate** and nearly eliminated missed cancers
- Improved **productivity**
- Shorter **turnaround** times
- Reduction of **IHC ordering**
- Improved **IHC quantification**: accuracy, subjectivity, reproducibility
- Ready for integration with scanning platforms, pathology workflow and lab information software
- Improved **lab workflows** with AI insights: Breast IC/DCIS detection, TILS, ALI, microcalcifications & more…
- **Reduced physician burnout** with better working experience and alleviated workloads

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