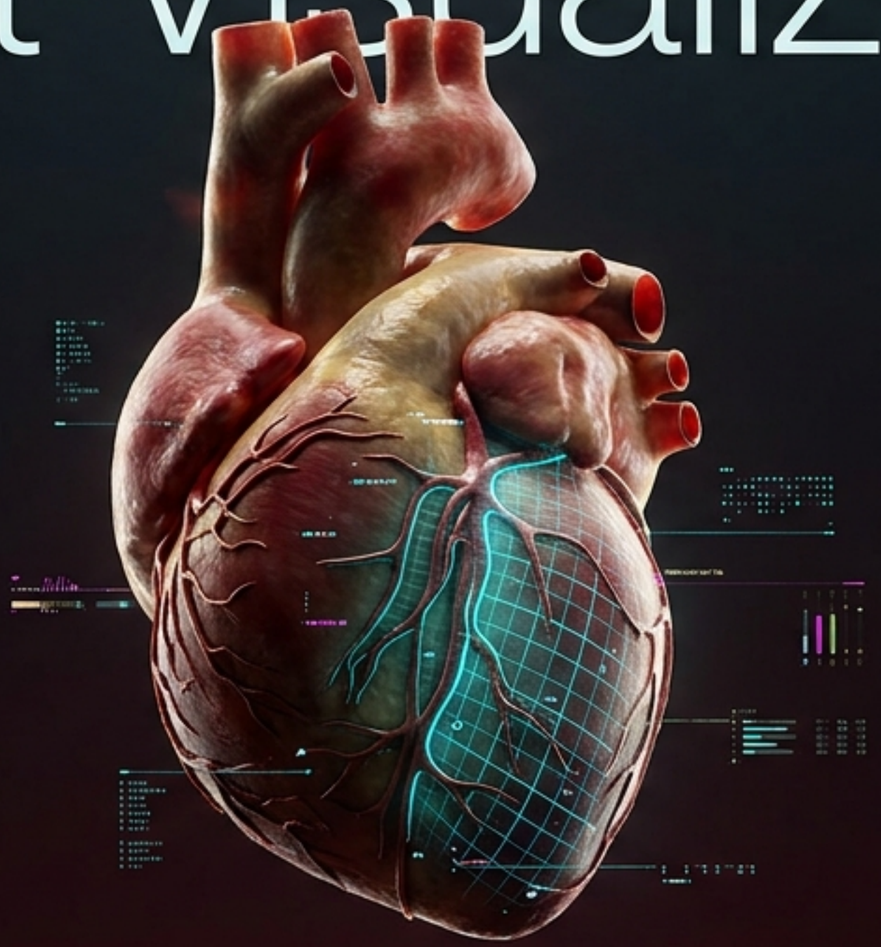
Direct Visualization



Advanced AI-driven Coronary CT Angiography and the search for biological truth in heart attack prediction.

Risk factors are proxies. AI-QCT measures the disease itself.

THE SURROGATE

Age

Sex

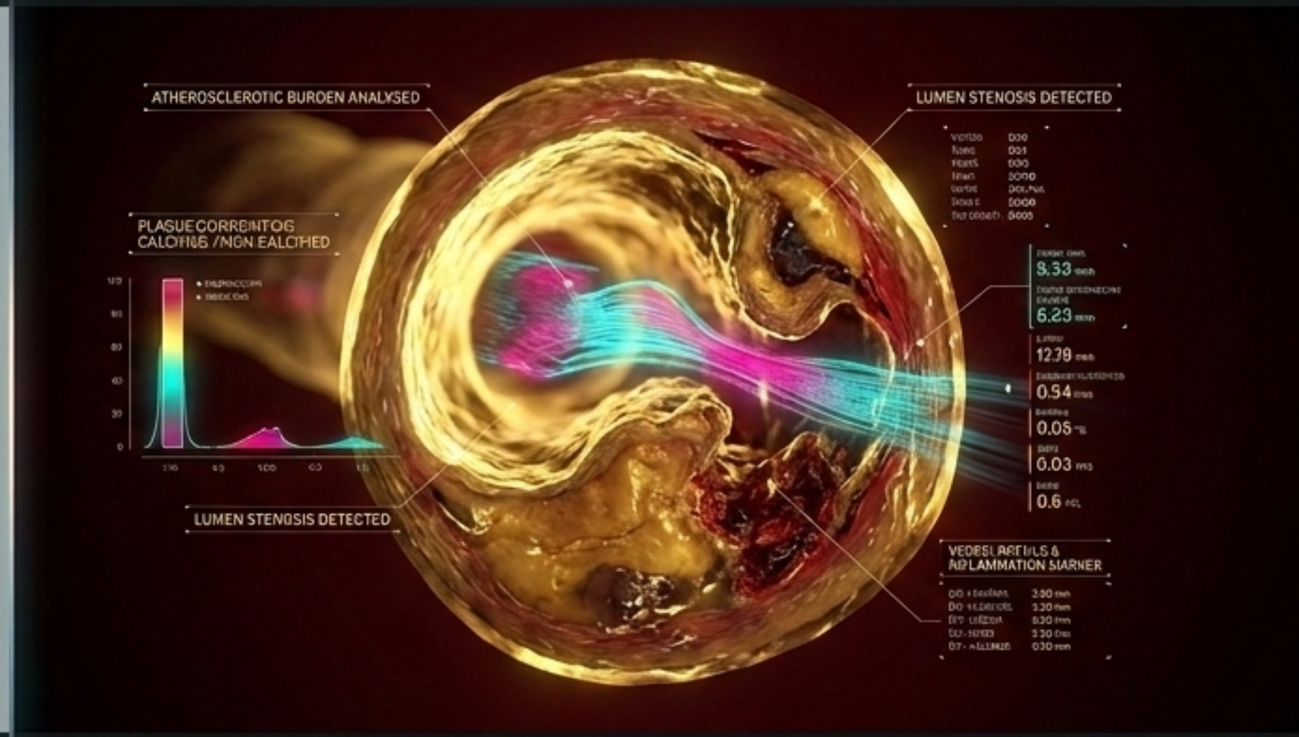
Blood Pressure

Lipids

Smoking

Traditional risk models (Pooled Cohort Equations, Framingham) infer vascular risk from heterogeneous population data. Two patients with identical risk-factor profiles can have vastly different arteries.

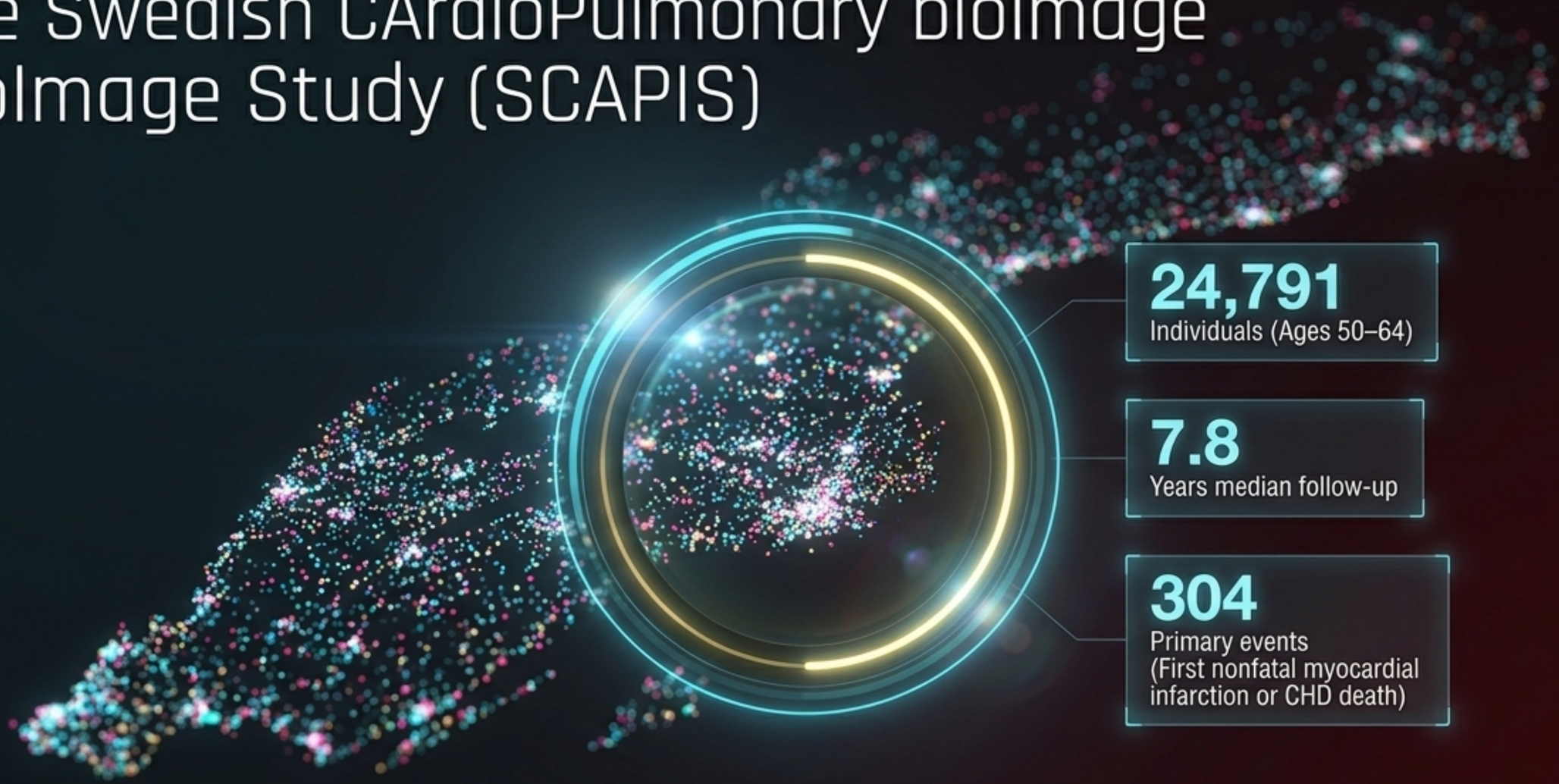
THE DIRECT



Quantitative Coronary CT Angiography (CCTA) visualizes the actual atherosclerotic burden, moving prevention from statistical probability to biological reality.

BY: PETER MEGDAL, PHD

The Swedish CArdioPulmonary bioImage bioImage Study (SCAPIS)

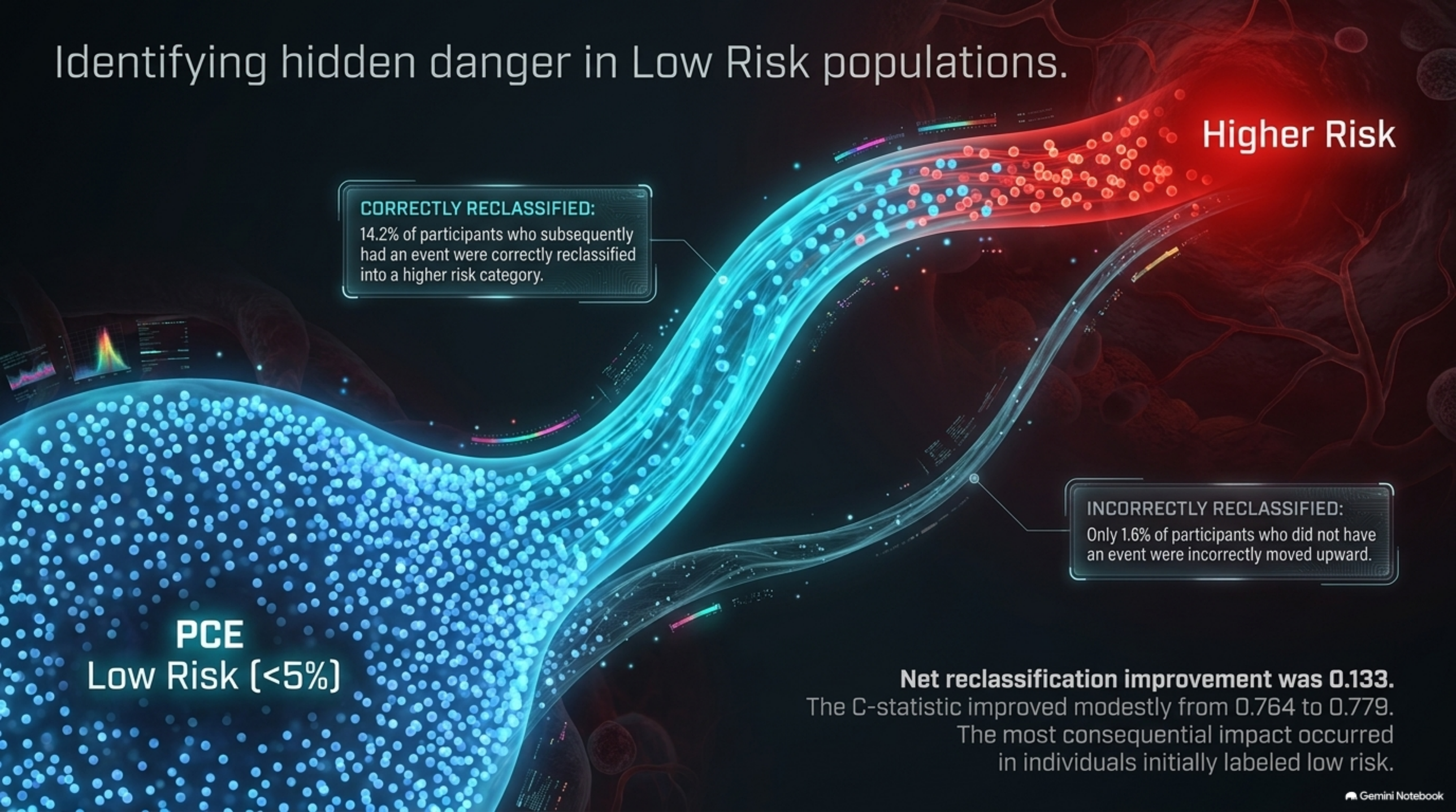


SCAPIS asked a simple question: Does looking directly at the coronary arteries tell you something that risk factors (PCE) and a calcium score (CACS) do not?

Plaque extent drives risk more than any single stenosis.

In a fully adjusted model, once plaque extent is accounted for, ≥50% stenosis does not independently predict first events.

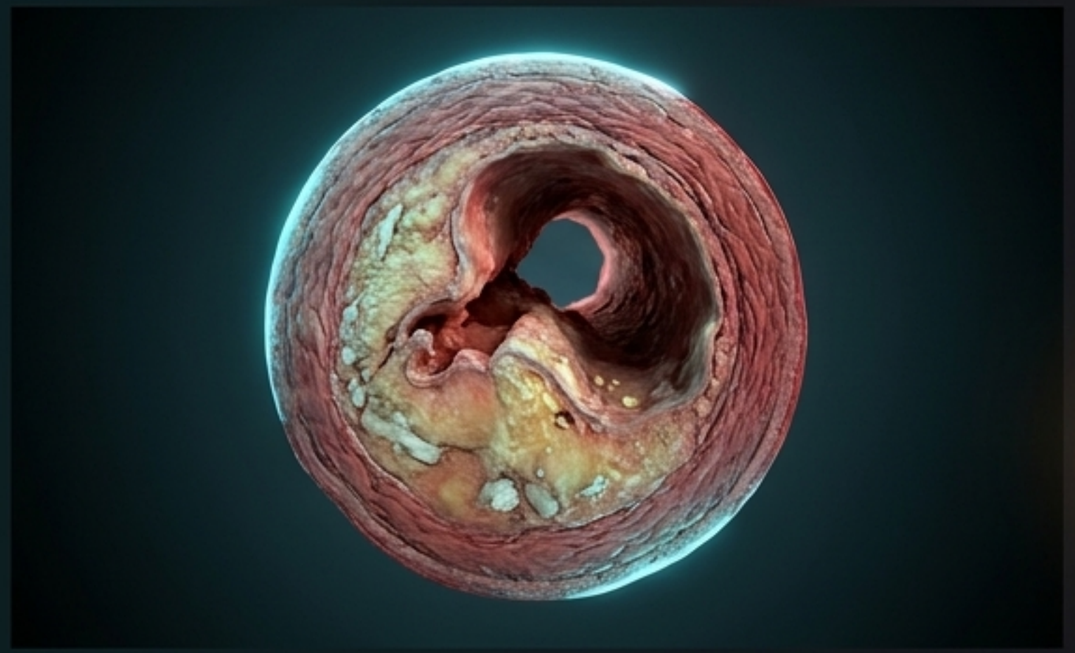
Identifying hidden danger in Low Risk populations.



Net reclassification improvement was 0.133.
The C-statistic improved modestly from 0.764 to 0.779.
The most consequential impact occurred in individuals initially labeled low risk.

The core confusion: Detecting stenosis is not the same as predicting events.

DIAGNOSTIC ACCURACY



frozen in time / right now

What is there right now?

How well does the test agree with invasive angiography about anatomy right now?

AUC 0.91 (AI-QCT vs QCA, PACIFIC-1 cohort)

PROGNOSTIC DISCRIMINATION

the uncertain future / prediction

What will happen in the future?

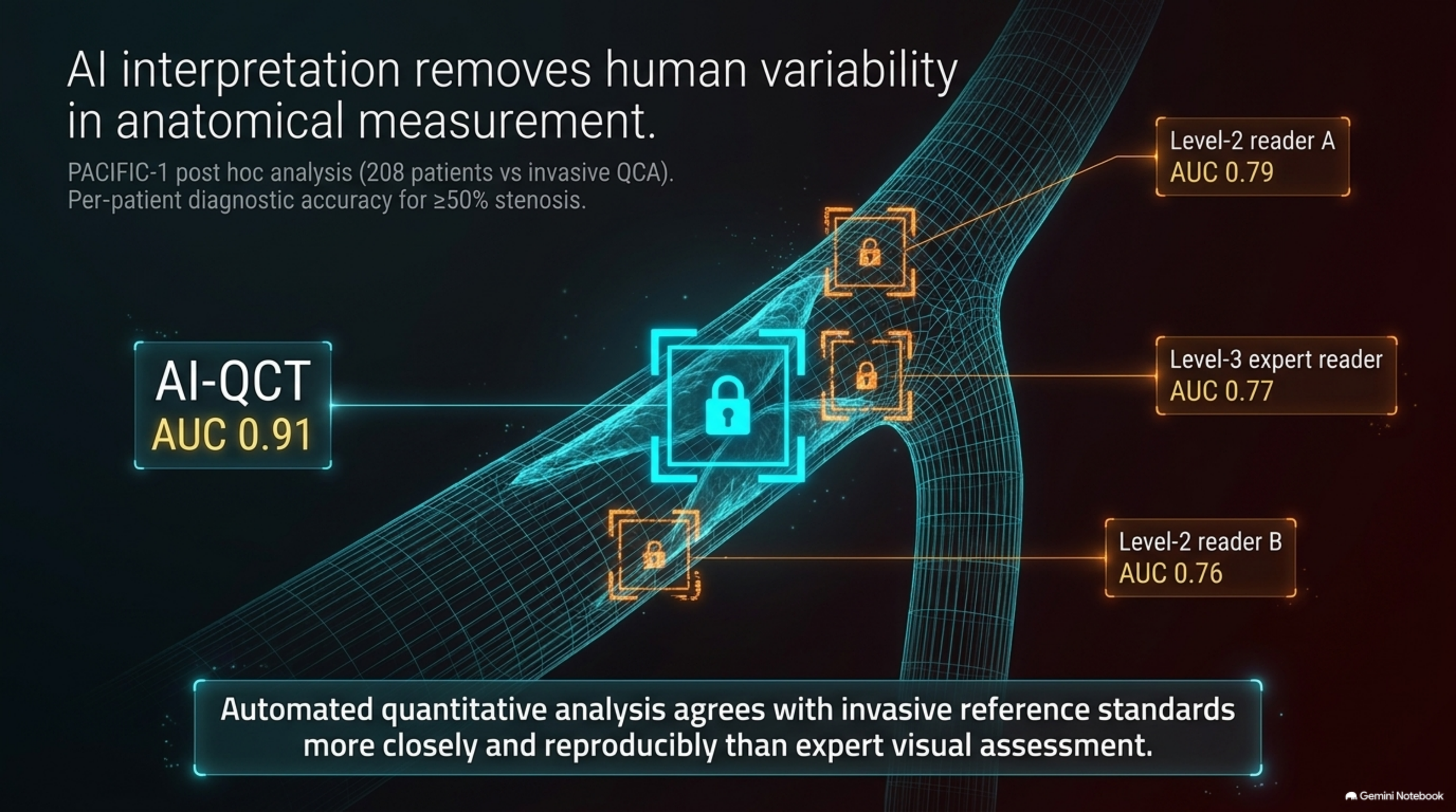
How well does the test rank people by likelihood of a cardiovascular event in the future?

AUC 0.76–0.81 (SCAPIS & CONFIRM2 models)

Future events depend on plaque biology, hemodynamics, and chance—not only on present anatomy. Do not conflate these AUCs.

AI interpretation removes human variability in anatomical measurement.

PACIFIC-1 post hoc analysis (208 patients vs invasive QCA).
Per-patient diagnostic accuracy for ≥50% stenosis.



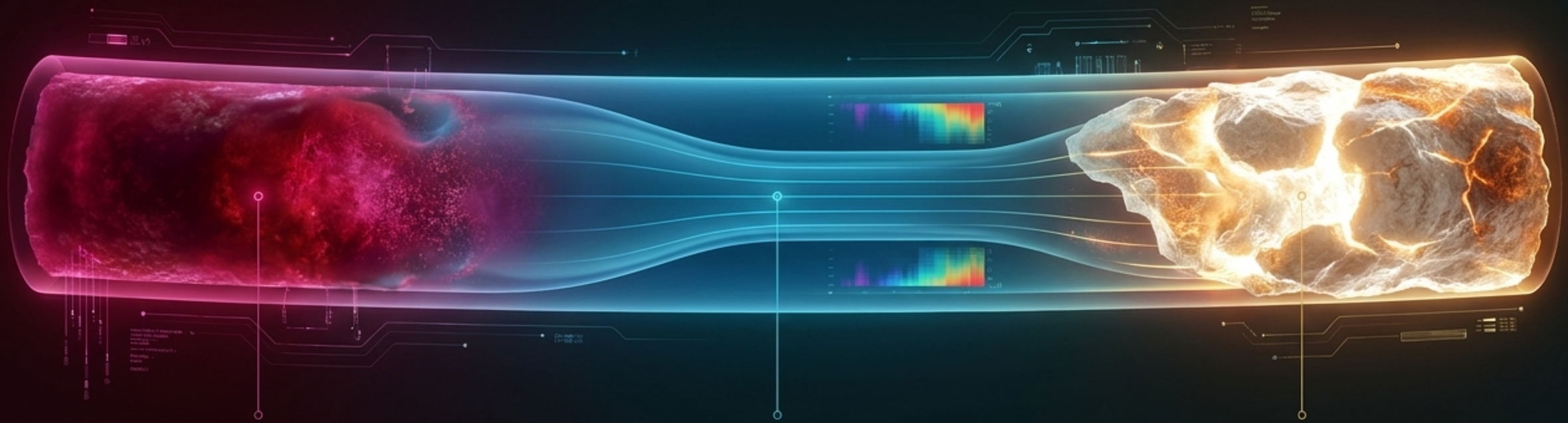
Automated quantitative analysis agrees with invasive reference standards more closely and reproducibly than expert visual assessment.

Incremental prognostic value in symptomatic patients.

CONFIRM2 registry event prediction.

These metrics are model-specific.
There is no universal event-prediction AUC for AI-QCT; contemporary studies show ranges of 0.75 to 0.81.

Beyond the calcium score:
The plaque phenotype spectrum.



Low-Attenuation Plaque (≤30 HU)

CT marker for lipid-rich/necrotic-core. SCOT-HEART: Strongest predictor of MI; burden >4% carries HR 4.65.

Noncalcified Plaque (NCP) Volume

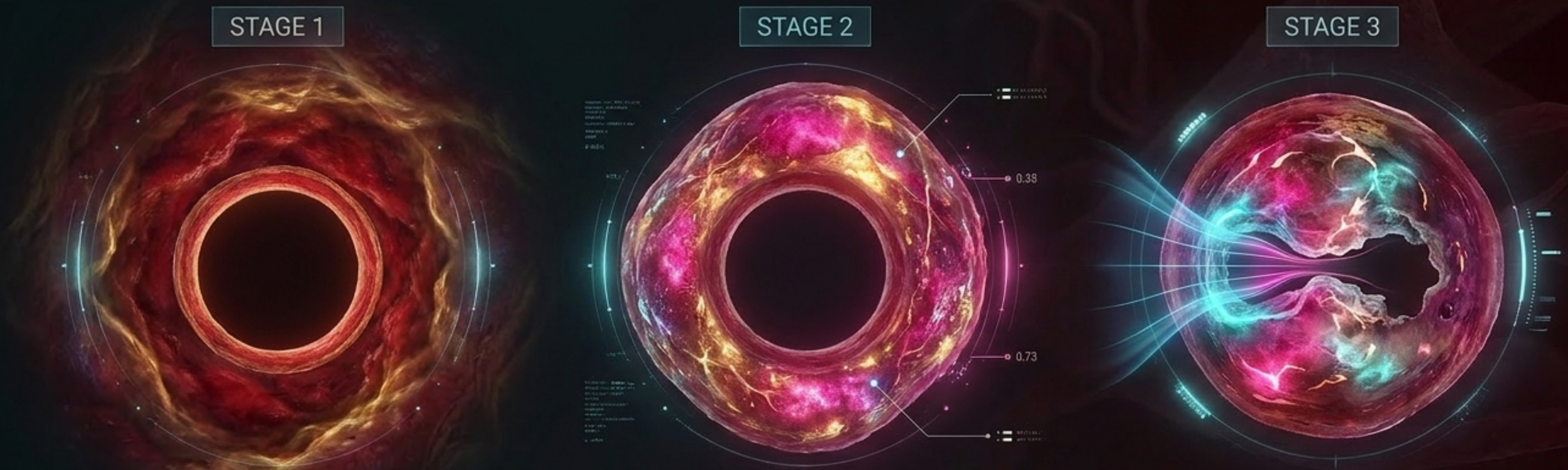
A heterogeneous category carrying distinct prognostic weight beyond total volume.

Total Plaque Volume (TPV) & Calcium

Dense calcification implies more stable lesions, but remains a strong marker of overall atherosclerotic disease.

Plaque biology is not a simple binary of safe calcium vs. dangerous soft plaque.

The invisible accumulation: Positive Remodeling.



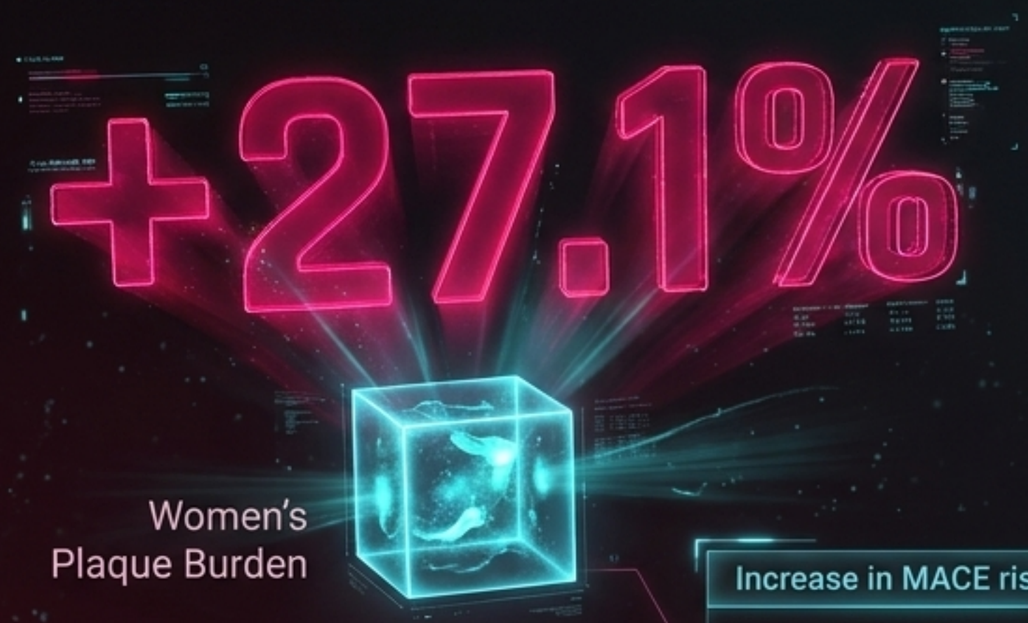
Outward remodeling: Outward expansion hides substantial plaque burden from standard lumen-focused (stenosis) assessments.

Late-stage inward narrowing

Many acute coronary events arise from lesions that were not severely obstructive on prior imaging.
Plaque volume and composition matter before the vessel narrows.

The Sex Paradox: Smaller burden, steeper risk curve

CONFIRM2 registry (3,551 patients). Women had roughly half the physical plaque burden and half the baseline MACE rate of men.



Women's Plaque Burden

WOMEN

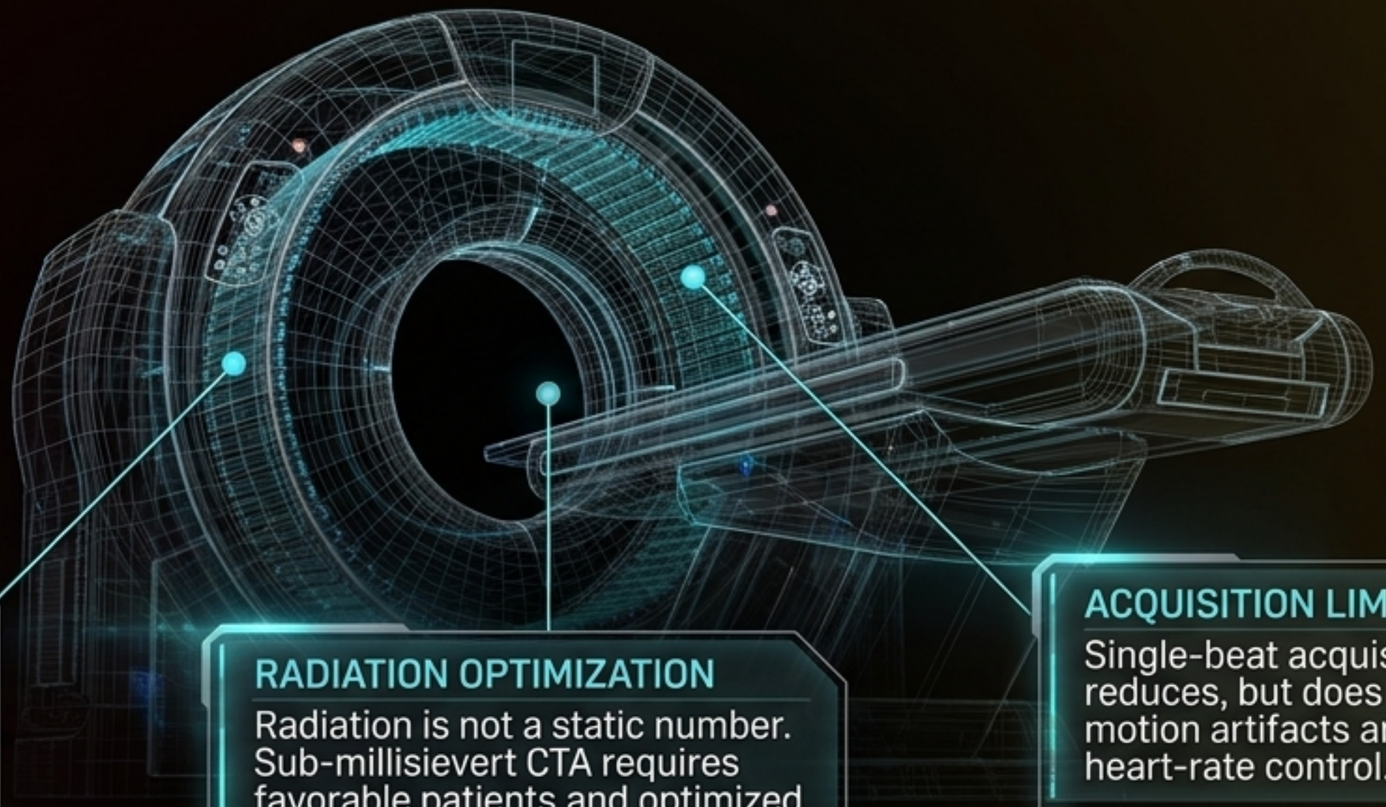
Men's Plaque Burden

MEN

Increase in MACE risk per 50-mm³ increment		
	Women	Men
Noncalcified plaque:	+27.1%	+11.6%
Calcified plaque:	+22.9%	+5.4%
Total plaque volume:	+17.7%	+5.3%

A plaque volume that looks low by absolute standards derived largely from men carries massive prognostic weight in women.

Hardware realities: What wide-detector CT actually delivers.



DETECTOR COVERAGE

640-slice is marketing. It describes a reconstruction characteristic, not an independent measure of image quality or outcome prediction. Detector coverage (e.g., 16 cm) matters more.

RADIATION OPTIMIZATION

Radiation is not a static number. Sub-millisievert CTA requires favorable patients and optimized protocols. It depends on gating, body habitus, and heart rate.

ACQUISITION LIMITS

Single-beat acquisition reduces, but does not eliminate, motion artifacts and the need for heart-rate control.

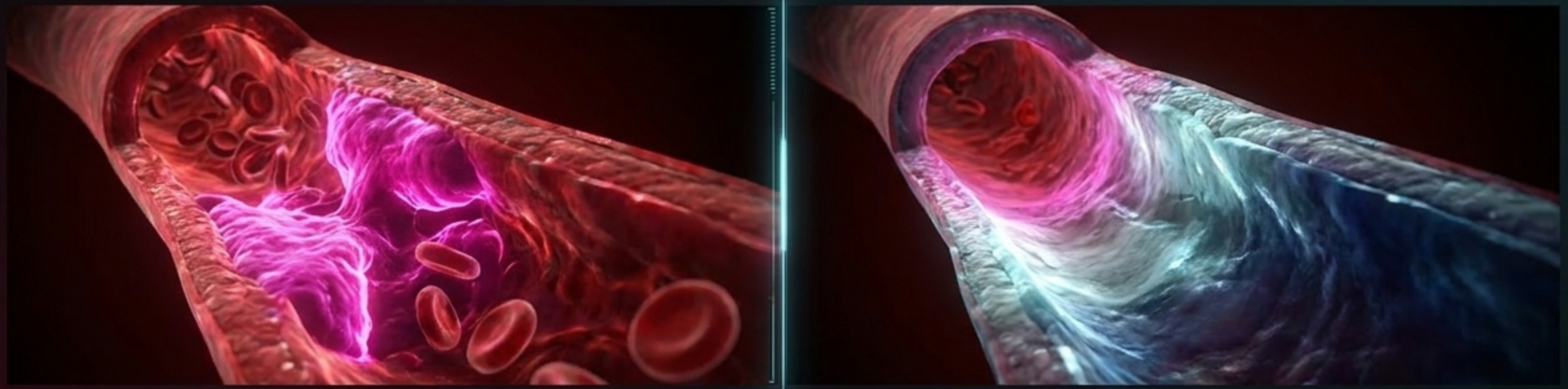
Advanced scanners make serial longitudinal plaque tracking technically feasible, but optimized protocols are mandatory.

Plaque is modifiable over time.

The EVAPORATE Trial (80 patients, 18-month serial CCTA).

BASELINE

18 MONTHS LATER



Demonstrated a reduction in low-attenuation plaque volume using icosapent ethyl in patients on statin therapy, alongside progression in the placebo arm.

CAVEAT: EVAPORATE is a mechanistic imaging trial. **It was not powered for clinical events and does not validate the outcome performance of** AI-QCT **platforms.**

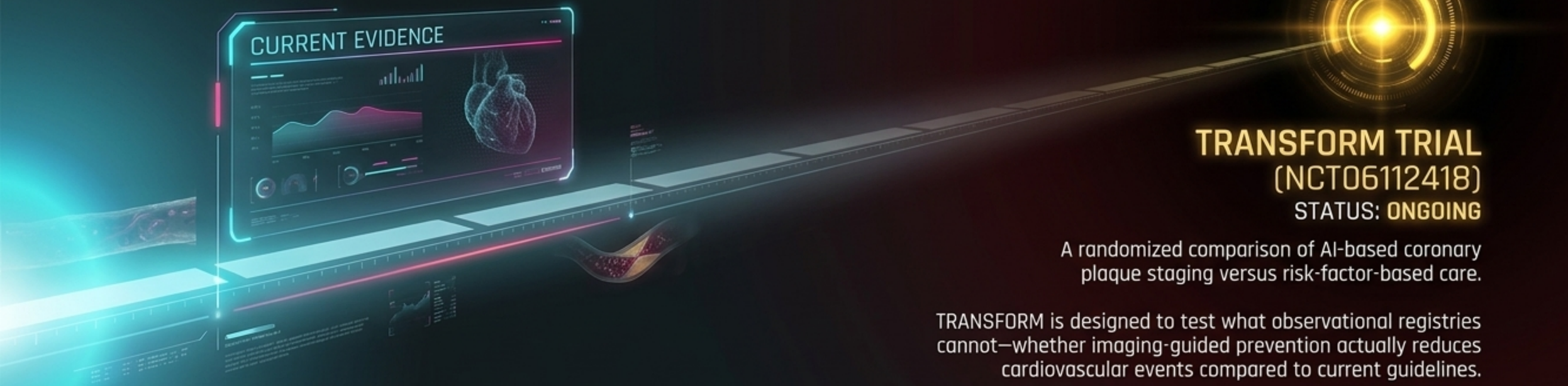
Advanced imaging changes clinical intent.

The CERTAIN study (750 crossover patients at expert sites)

Measured physician intent at expert centers is highly encouraging, but intent to prescribe is not proof of improved patient outcomes.

The final unanswered question: Does it save lives?

Identifying disease is not the same as proving that acting on it improves survival.



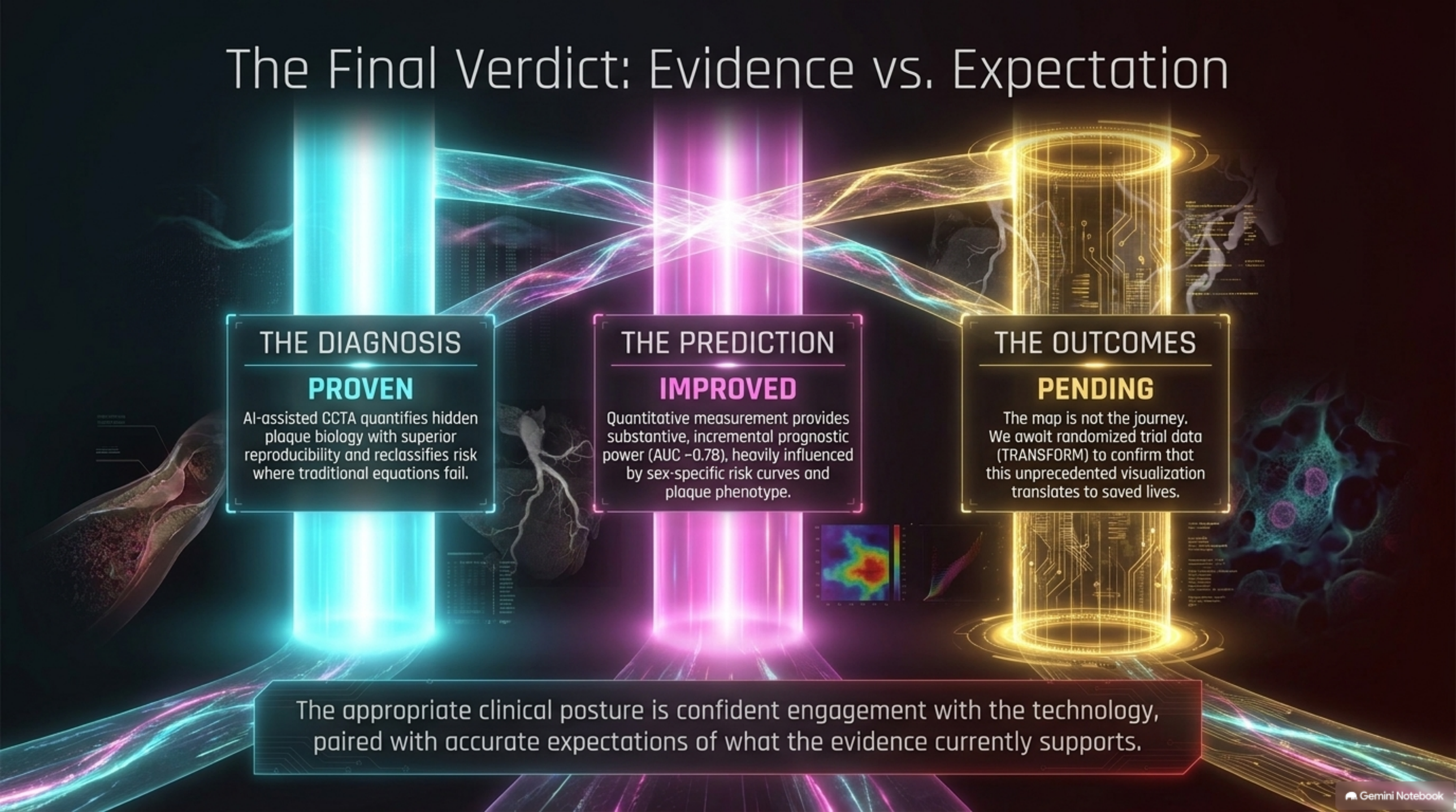
TRANSFORM TRIAL (NCT06112418)

STATUS: **ONGOING**

A randomized comparison of AI-based coronary plaque staging versus risk-factor-based care.

TRANSFORM is designed to test what observational registries cannot—whether imaging-guided prevention actually reduces cardiovascular events compared to current guidelines.

The Final Verdict: Evidence vs. Expectation



THE DIAGNOSIS

PROVEN

AI-assisted CCTA quantifies hidden plaque biology with superior reproducibility and reclassifies risk where traditional equations fail.

THE PREDICTION

IMPROVED

Quantitative measurement provides substantive, incremental prognostic power (AUC ~0.78), heavily influenced by sex-specific risk curves and plaque phenotype.

THE OUTCOMES

PENDING

The map is not the journey. We await randomized trial data (TRANSFORM) to confirm that this unprecedented visualization translates to saved lives.

The appropriate clinical posture is confident engagement with the technology, paired with accurate expectations of what the evidence currently supports.