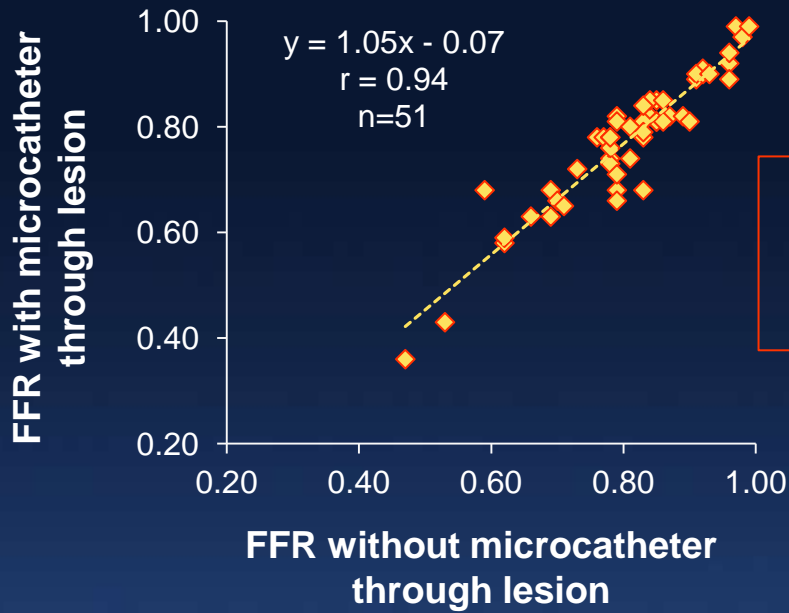
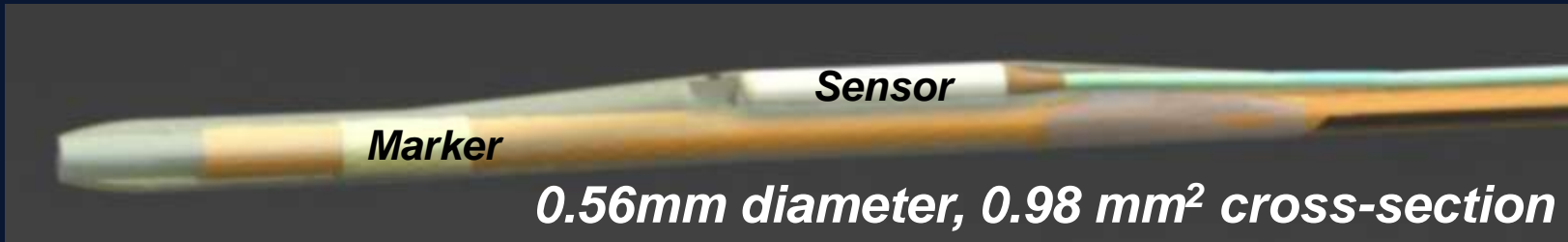


How New Intravascular Imaging Techniques Will Change Clinical Practice

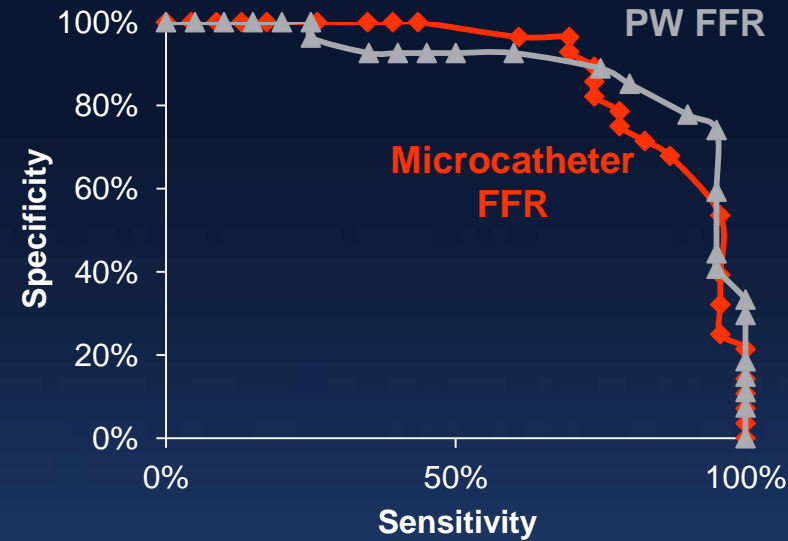
Gary S. Mintz, MD

Cardiovascular Research Foundation

Rapid Exchange FFR Microcatheter



Data in >2.5mm arteries

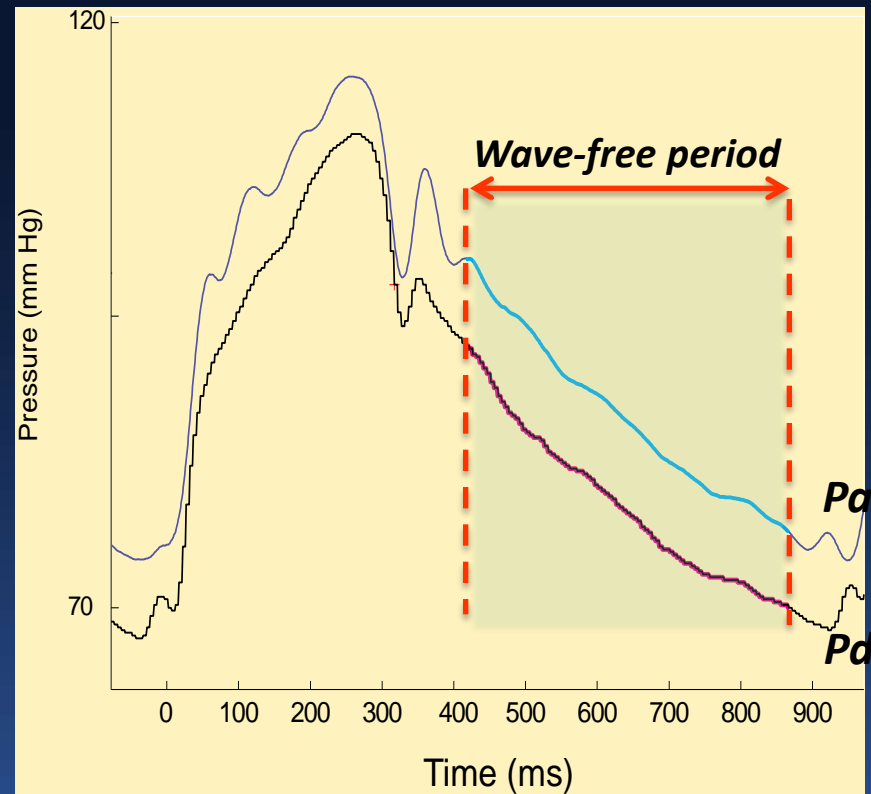


	FFR microcatheter	Pressure wire	P
Drift greater than ± 0.03	13%	33%	0.022
Mean Drift	0.016	0.056	0.014

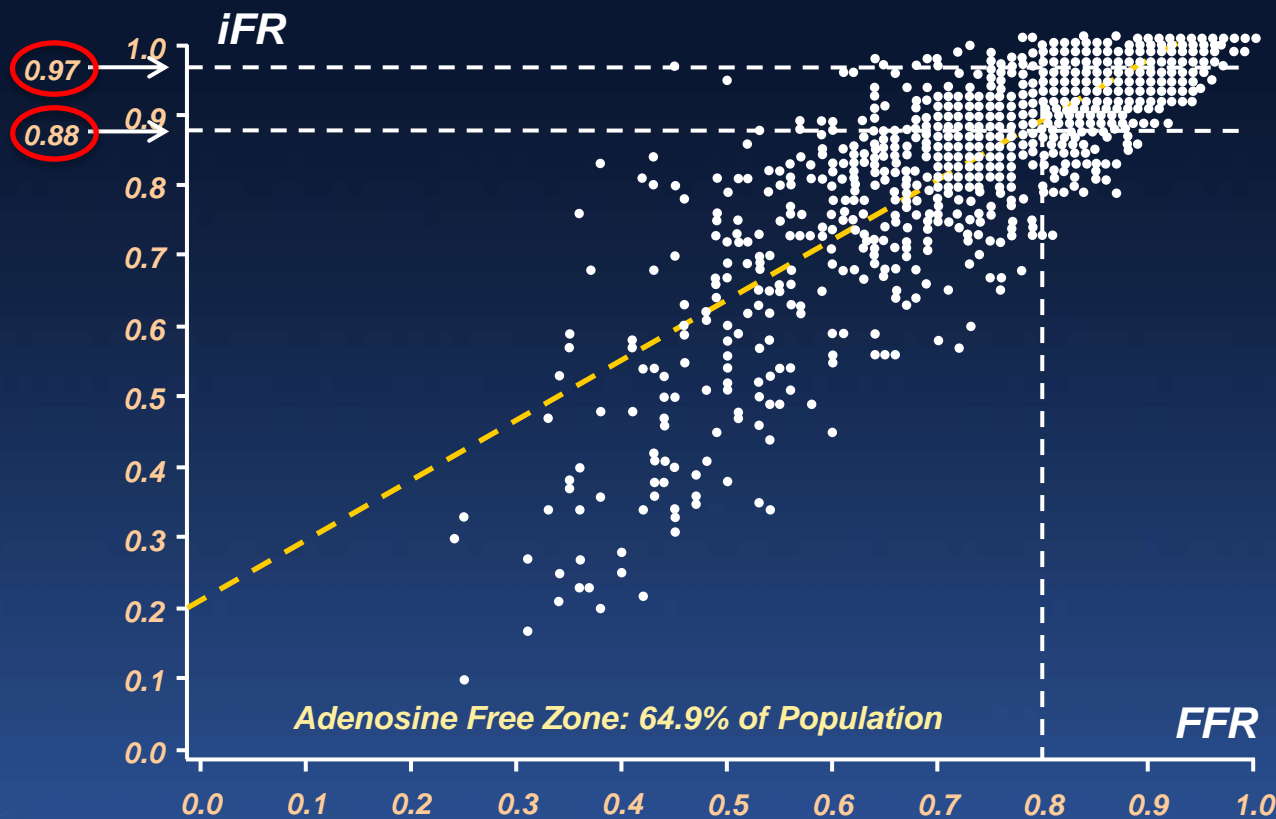
iFR = instantaneous wave-free ratio

Definition:

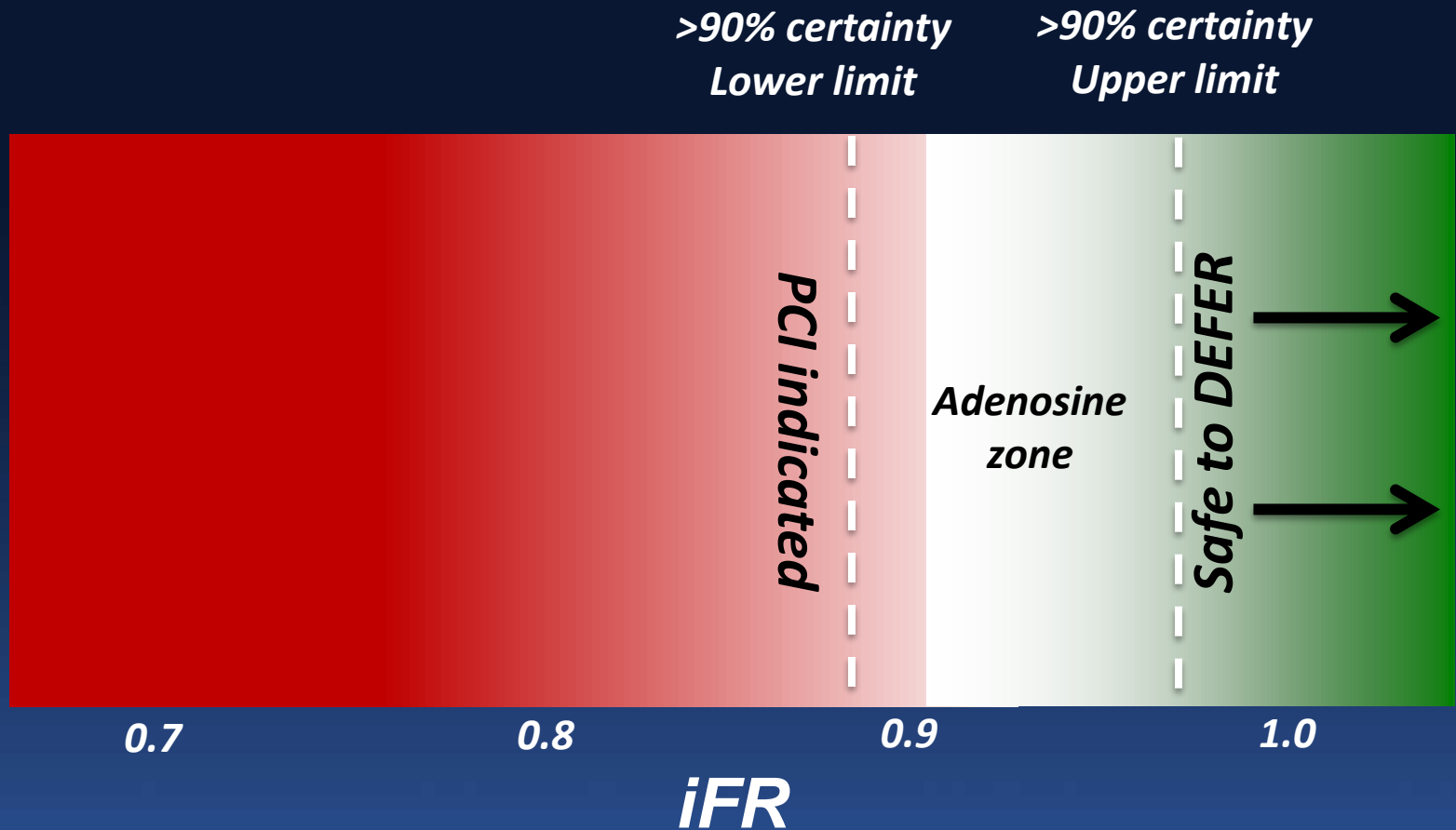
Instantaneous pressure ratio, across a stenosis during the wave-free period, when resistance is naturally constant and minimised in the cardiac cycle



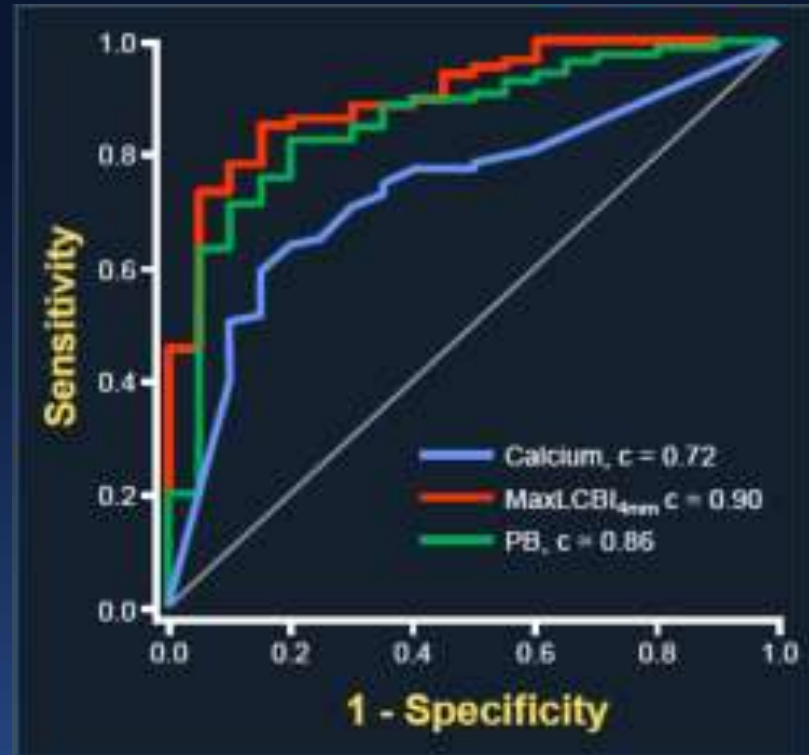
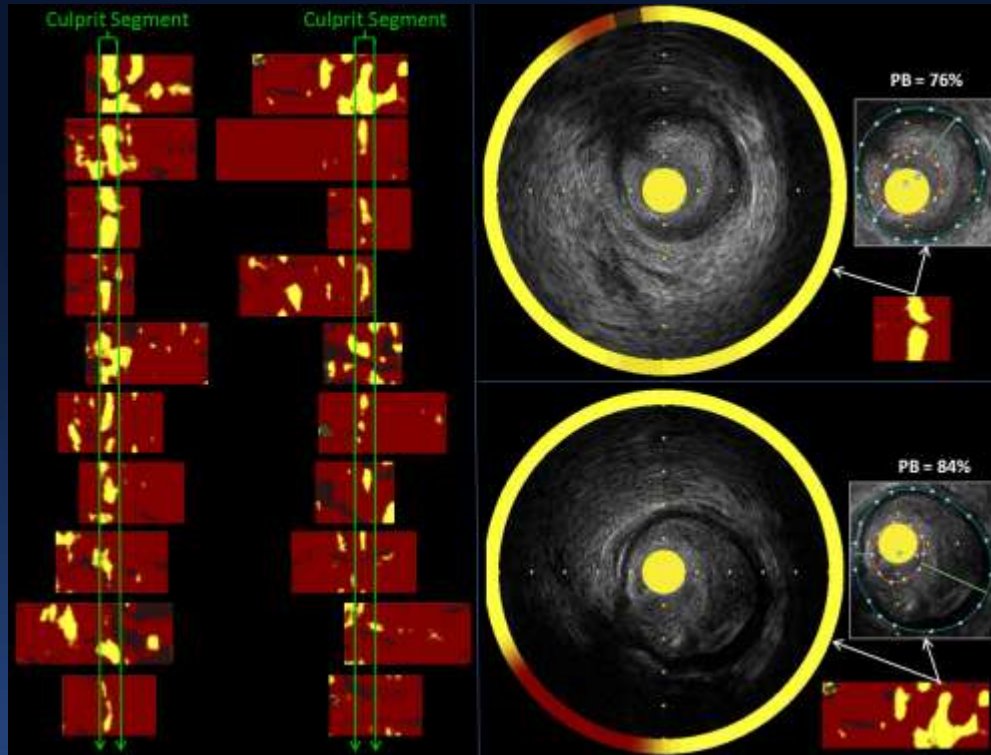
Proportion of pts with	Cut-off	PPV	NPV	Total
90% precision	>0.97		12.9%	57.1%
	<0.88	44.2%		
95% precision	0.82	24.3%		24.3%



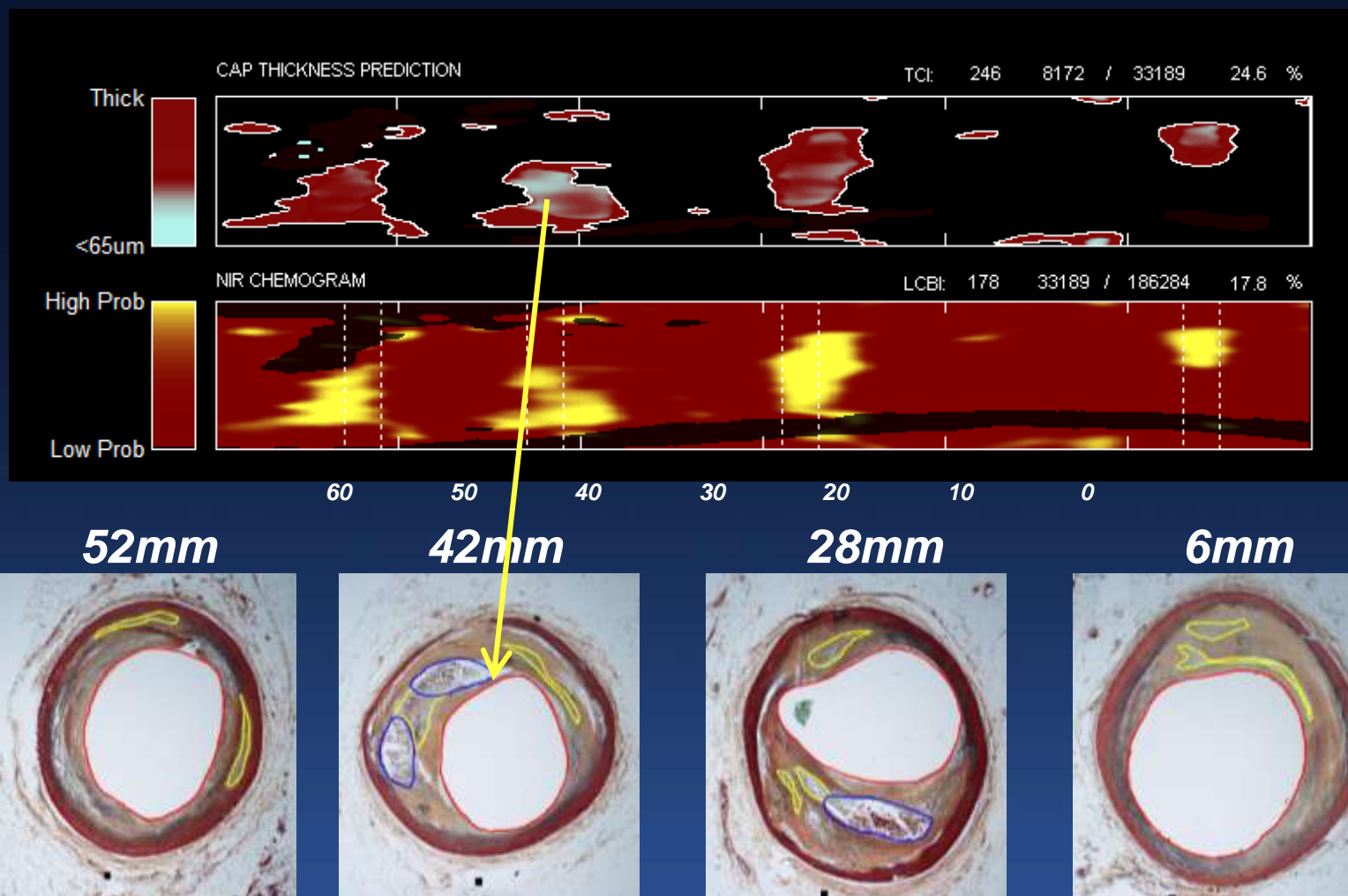
Hybrid iFR-FFR Approach



Culprit segments contained lipid rich plaque in 19 of 20 STEMI cases (95%), all with a large plaque burden.

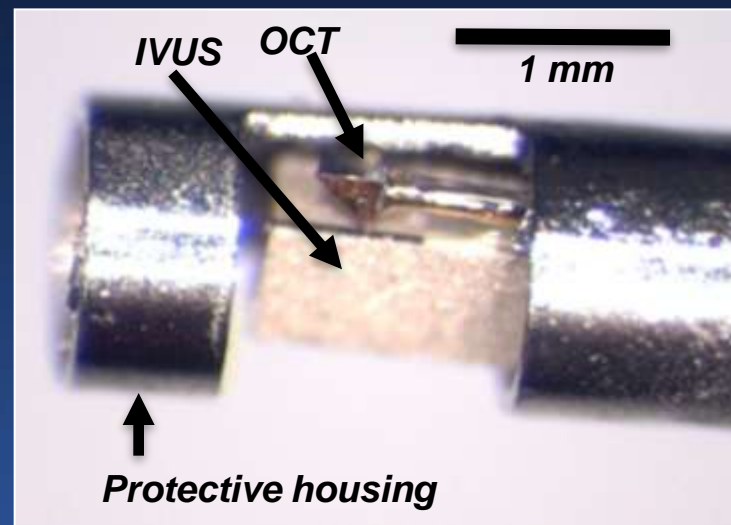
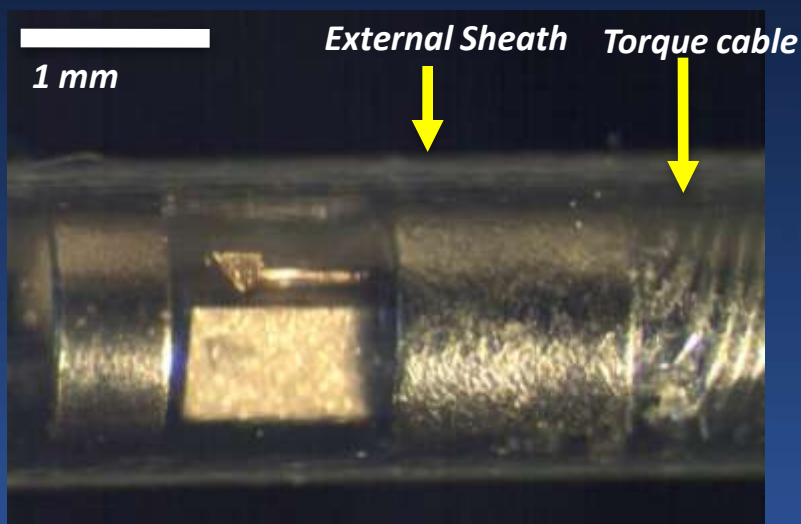


Spectral differences can be used to distinguish LCP with thin fibrous cap (less collagen) from LCP with thicker fibrous cap (more collagen)

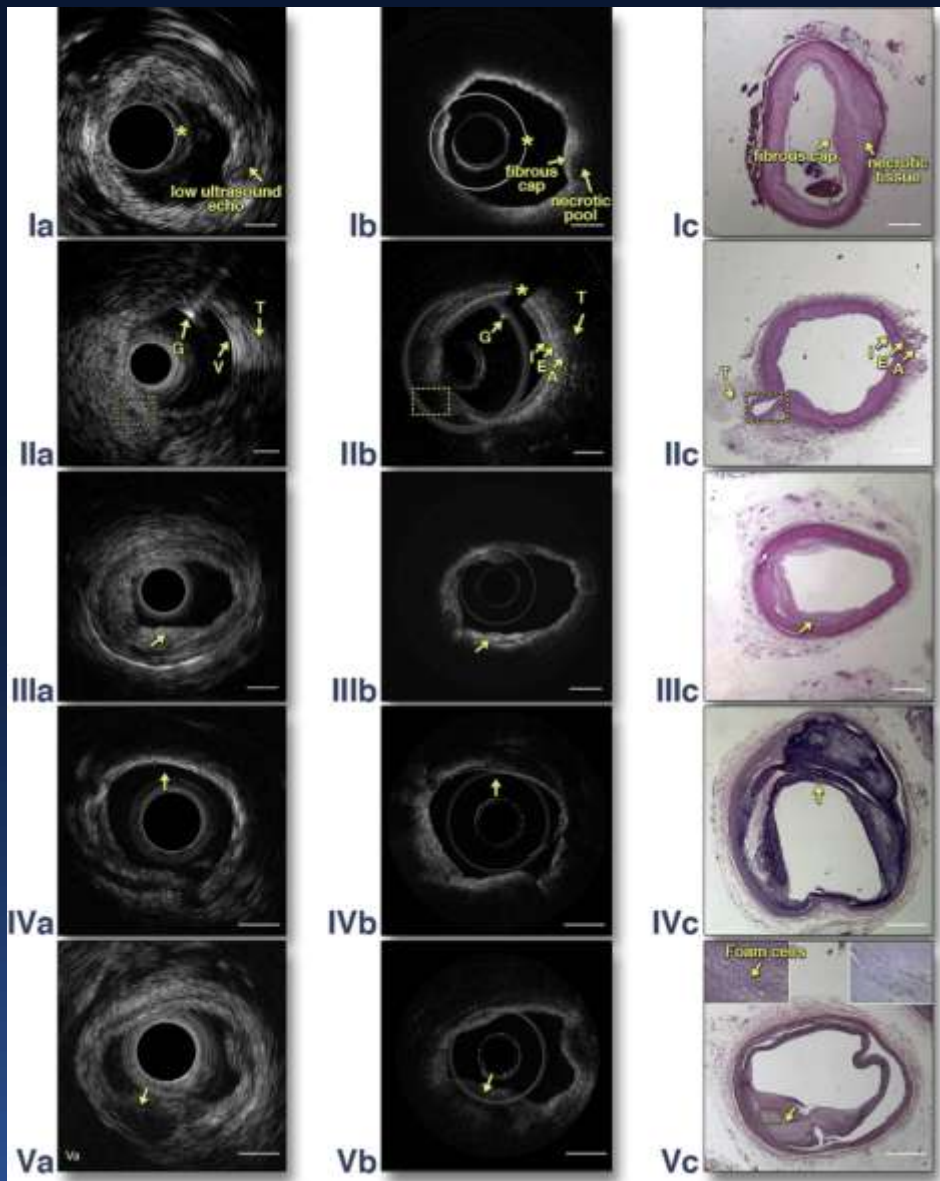


Hybrid IVUS/OCT Catheter - I

- **The imaging catheter was constructed using the following materials:**
 - **External nylon sheath with an outer diameter of 4F**
 - **Custom-built 42 MHz ultrasound transducer, with a 42% 6 dB bandwidth**
 - **1310nm single mode fibre optic spliced to a GRIN lens and beam directing prism (200x200x150 microns) with a focal length of 1.2 mm**
 - **Torque cable, micro-coaxial cable and protective housing for the distal tip**
- **The beam directing prism was positioned at the same location along the longitudinal axis of the catheter as the center of the ultrasound transducer. This configuration was chosen to provide optimal alignment of the ultrasound and optical imaging planes during cross-sectional imaging.**

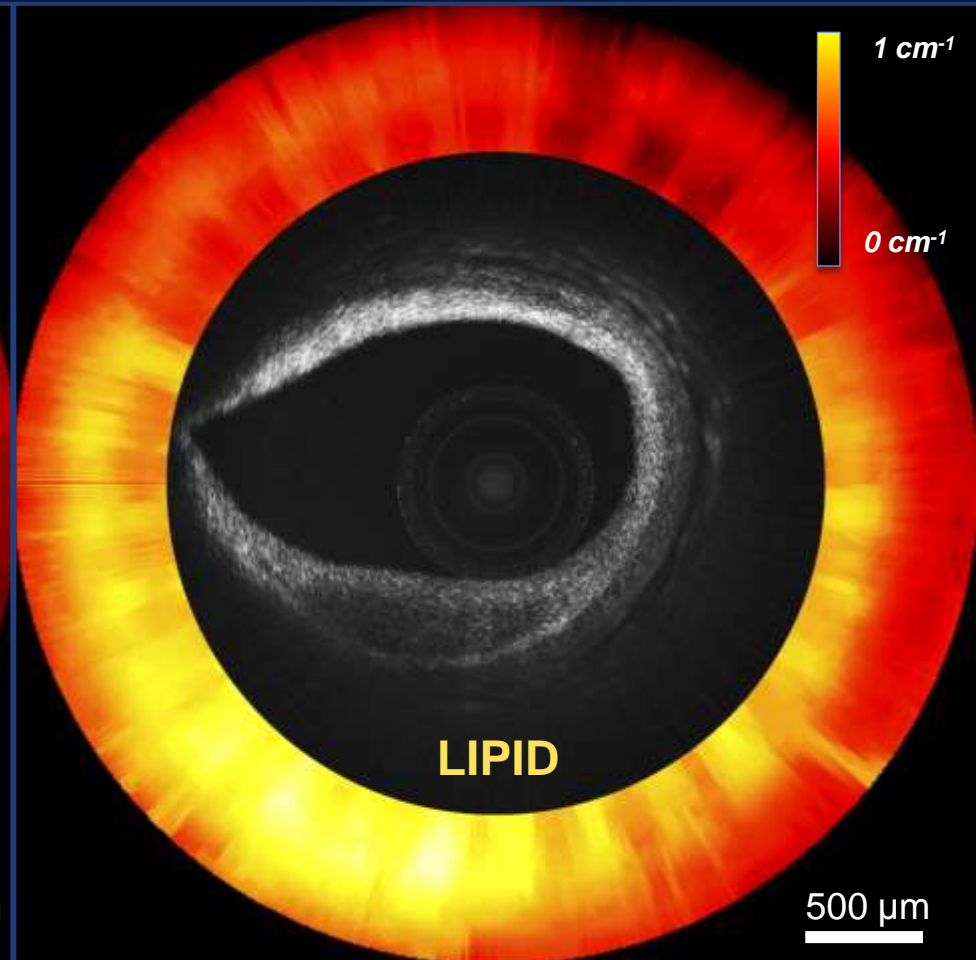
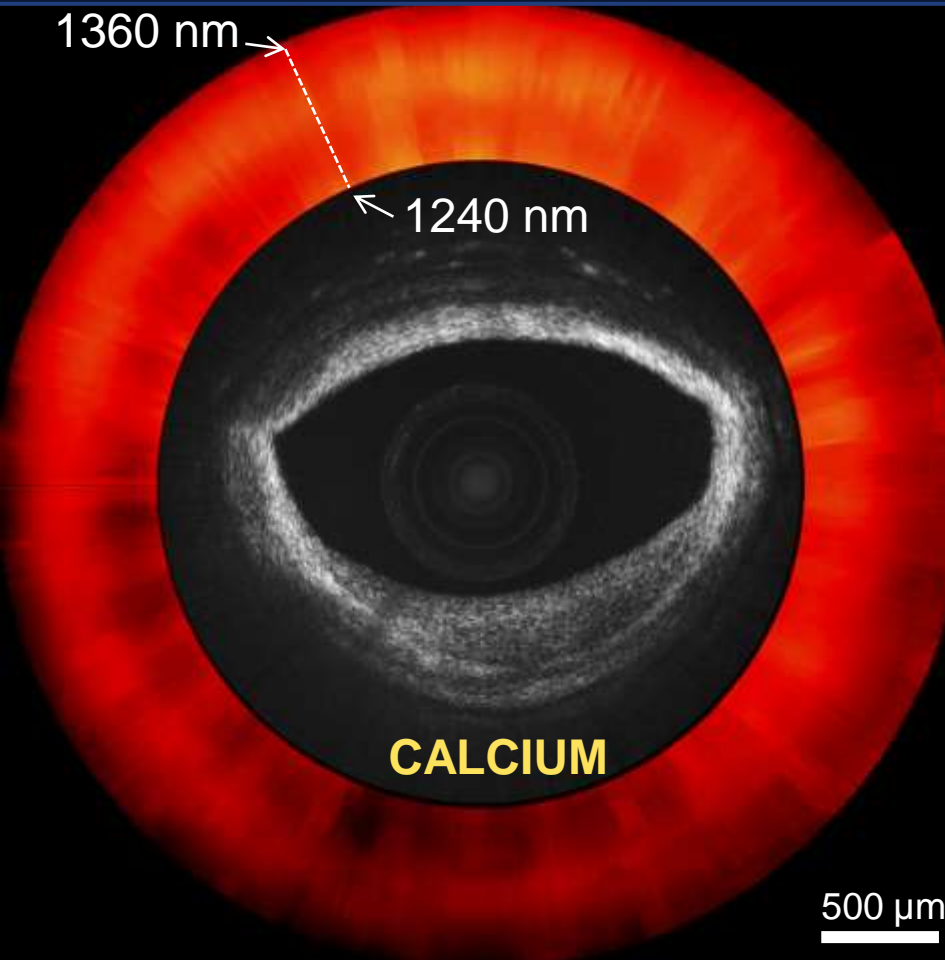


Plaques in rabbit aortas imaged using an integrated 3.4F OCT-IVUS system



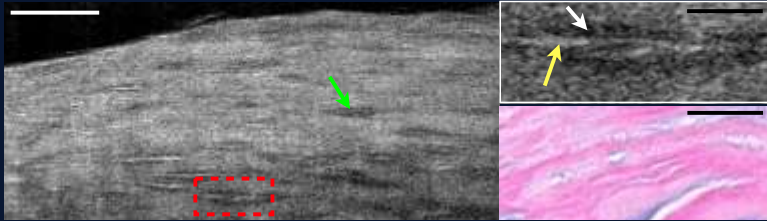
OCT-NIRS

Cadaver Coronary Plaques

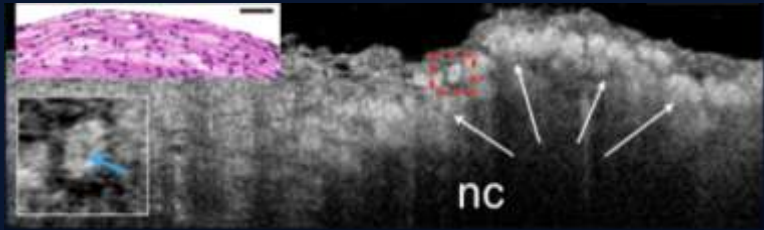


Micro OCT with <1-2 micron resolution

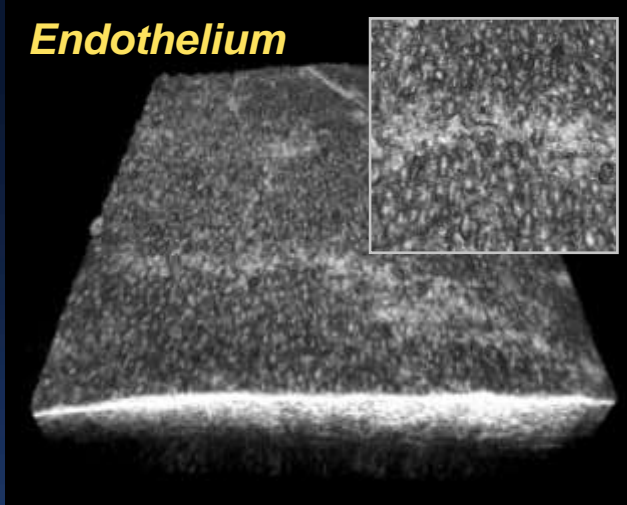
Smooth Muscle Cells



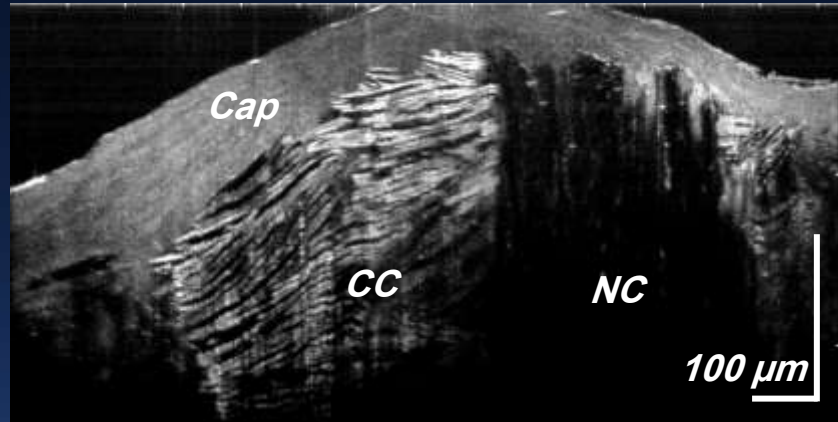
Macrophages



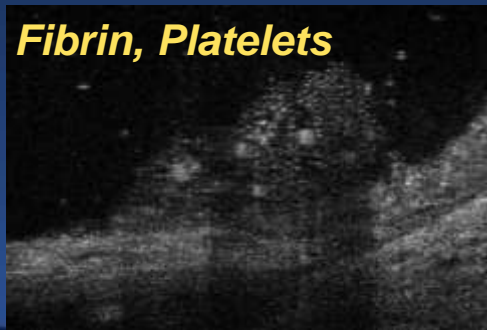
Endothelium



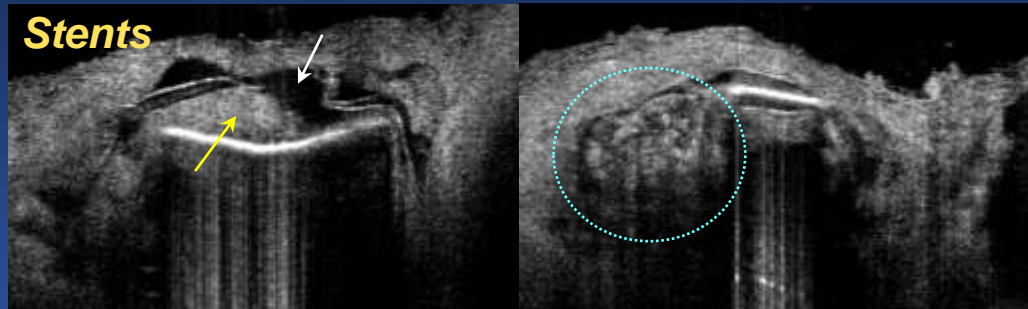
Necrotic Core Cholesterol Crystals



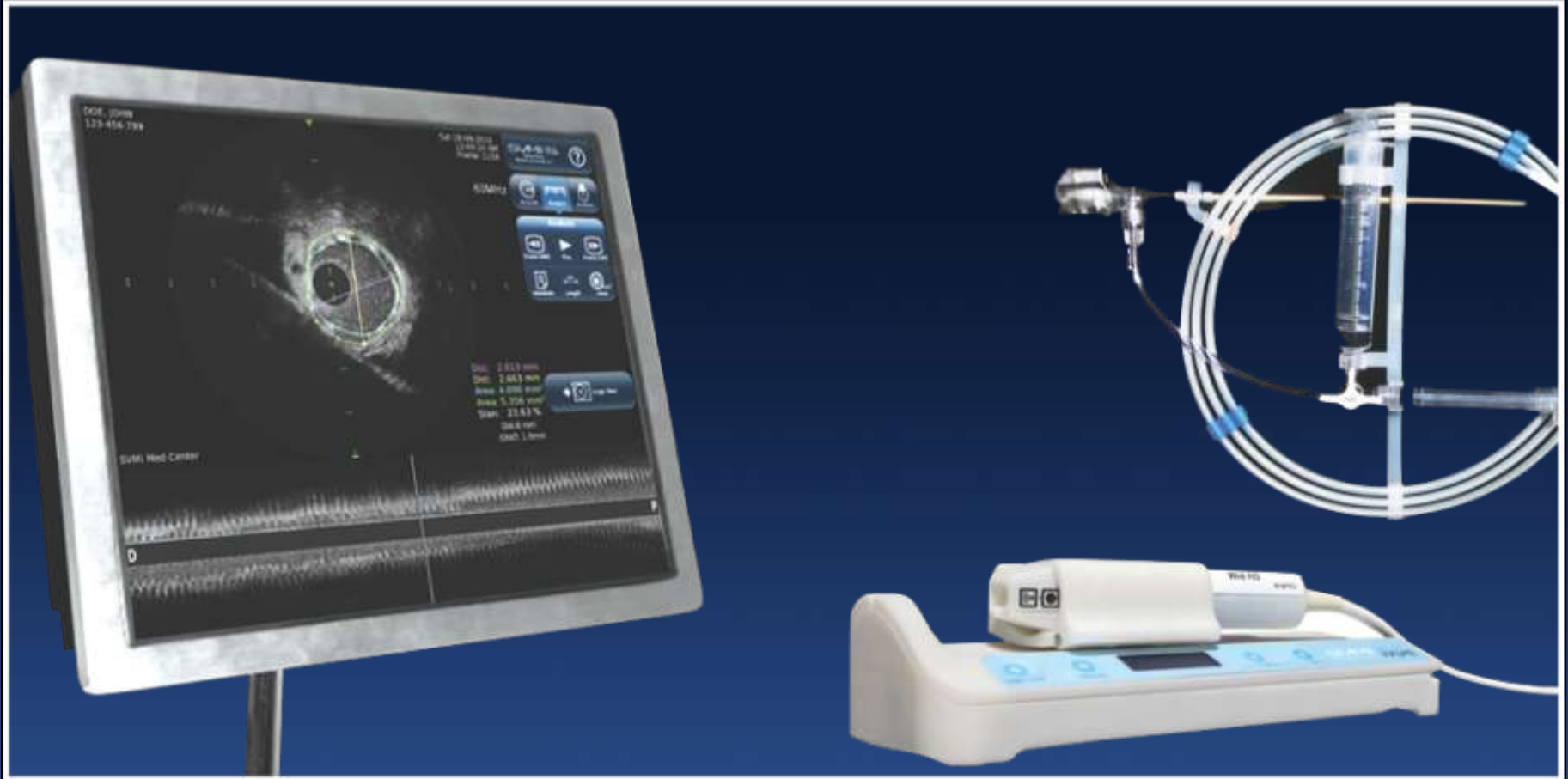
Fibrin, Platelets



Stents

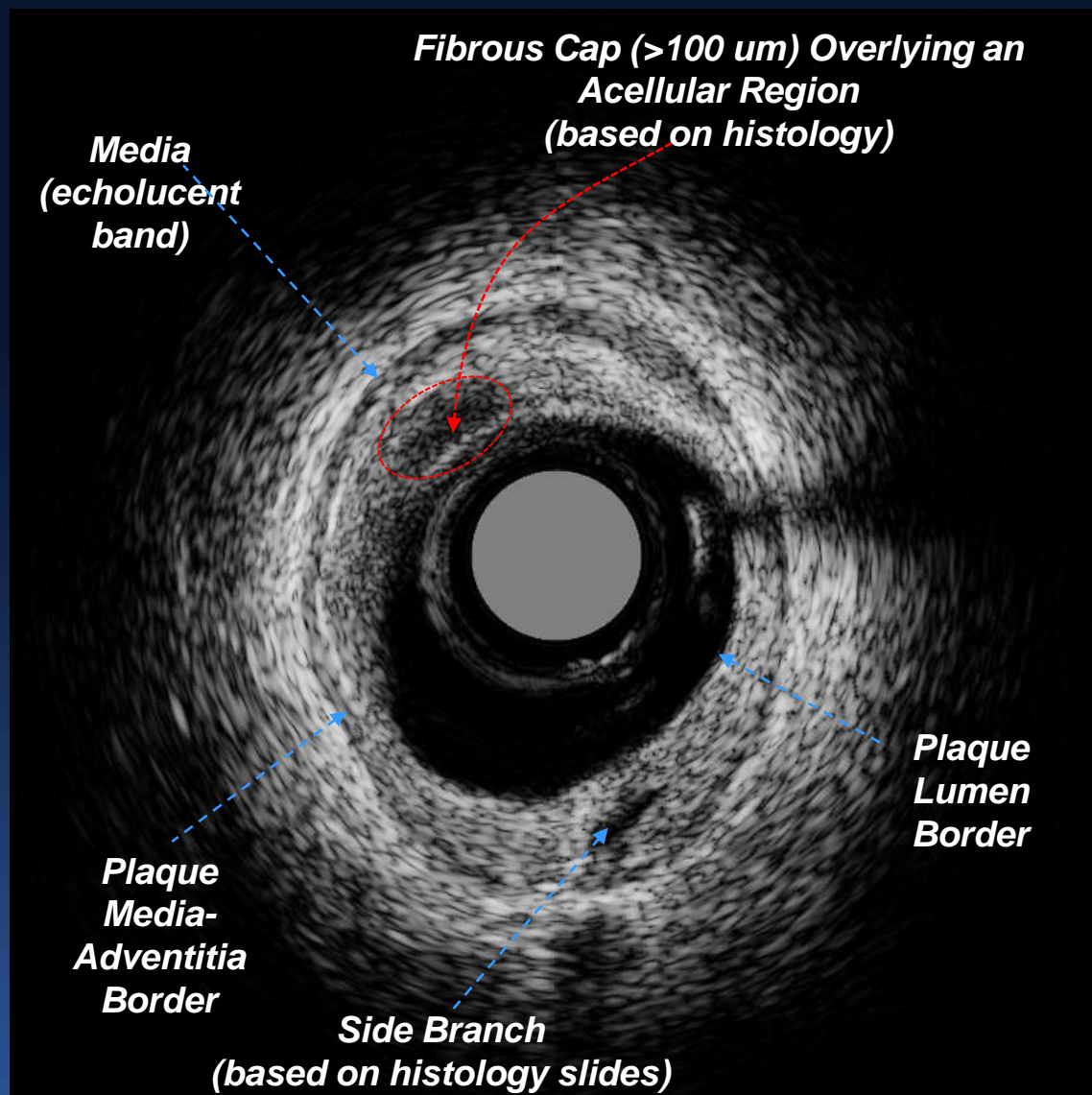


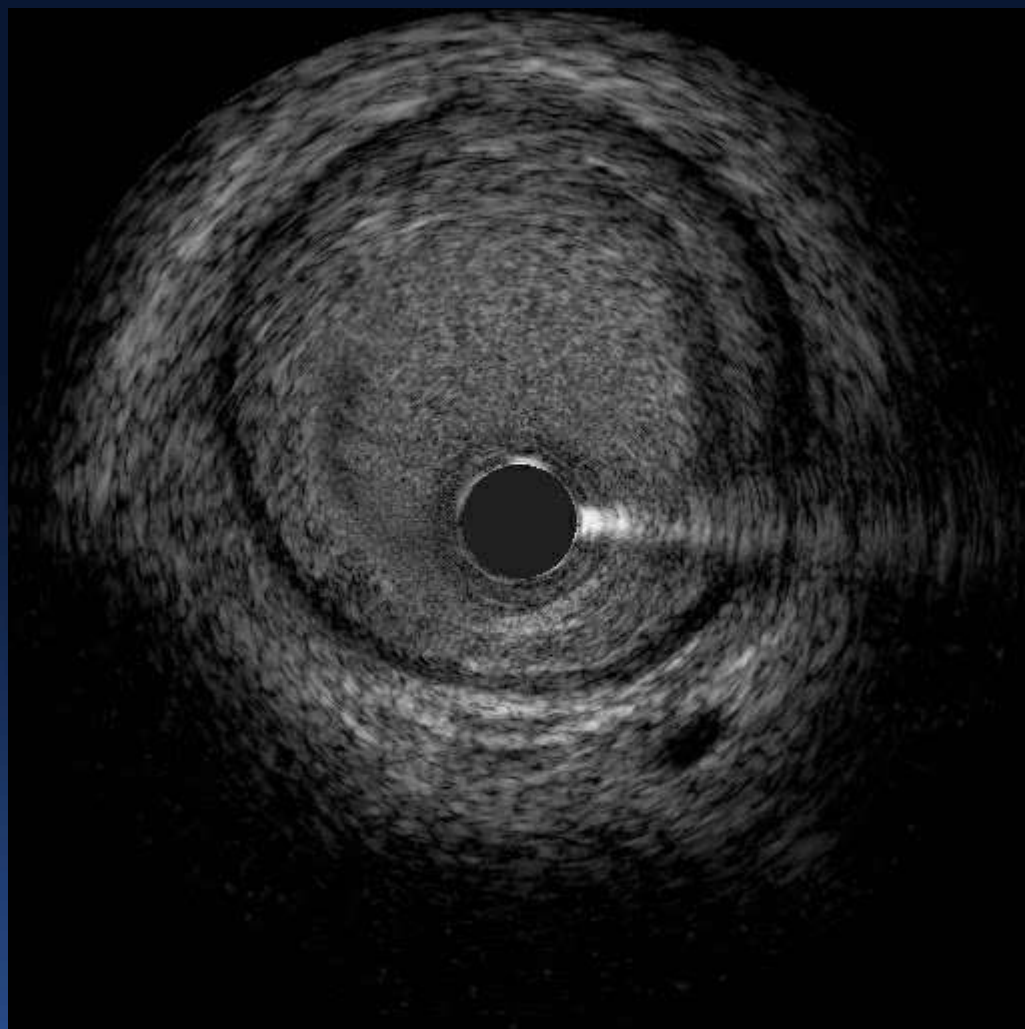
New generation, high resolution IVUS



New generation, high resolution IVUS

Axial Resolution	<50 μm
Lateral Resolution	~200 μm
Max. Frame Rate	60 fps
Max. Pullback Speed	10 mm/sec
Frame Spacing	5-167 μm
Pullback length	120 mm
Tissue Penetration	~3 mm @ 60 Mhz
Imaging in Blood	Yes





tct 25

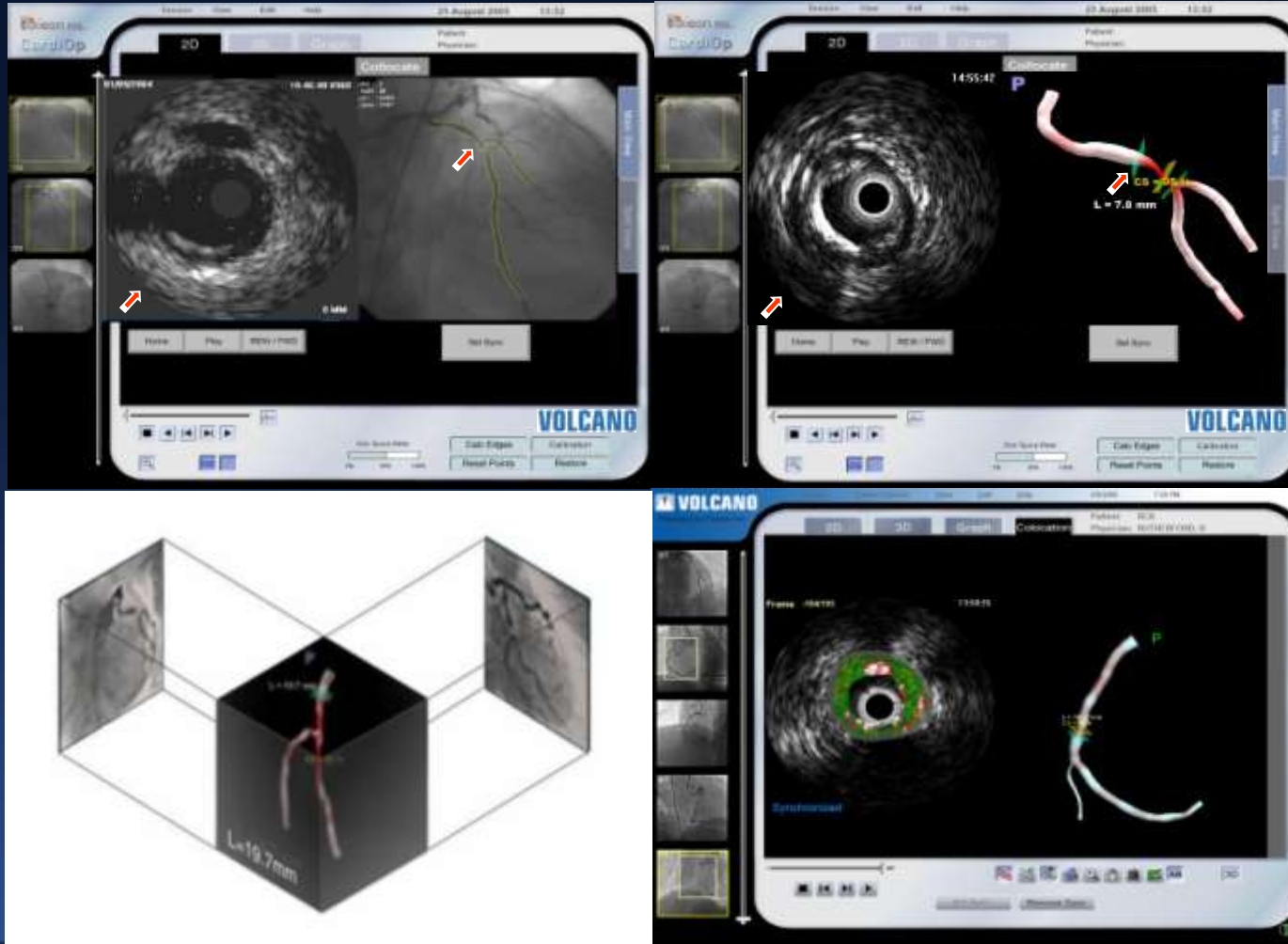
In Partnership with the ACC
Reinventing the Future
Every Year

 **CARDIOVASCULAR
RESEARCH
FOUNDATION**
At the heart of innovation

Co-registration of angio with

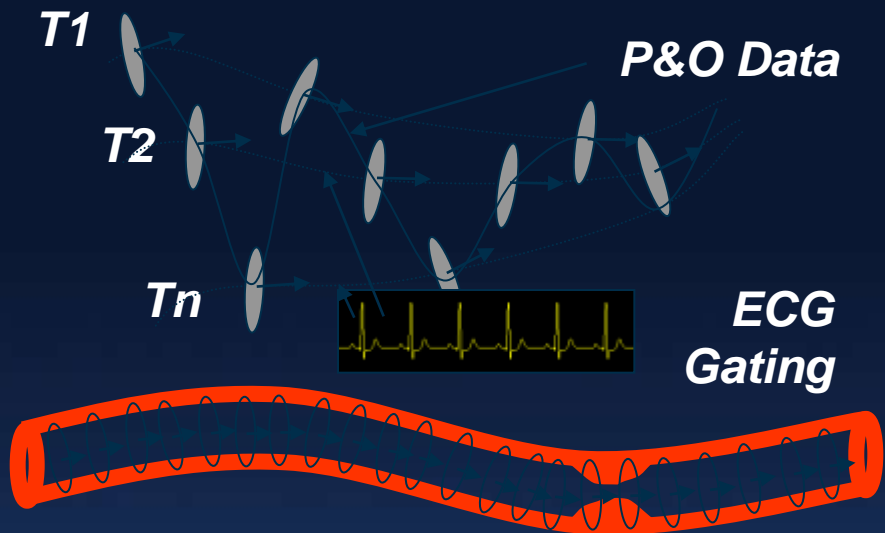
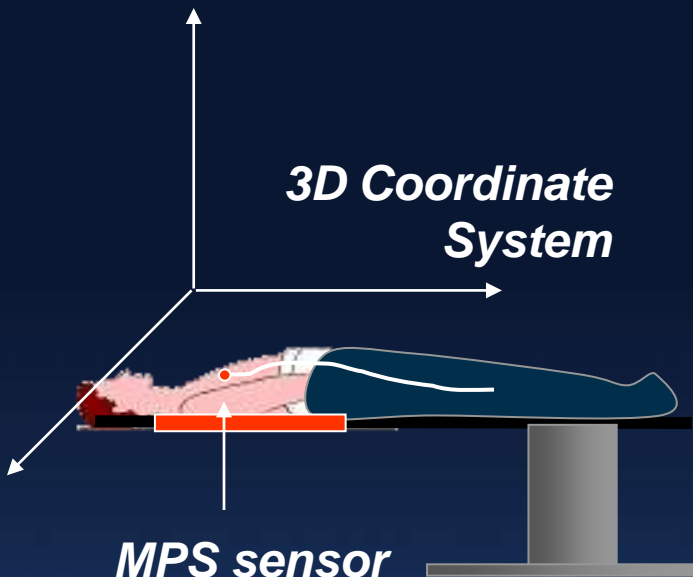
- **MDCT**
 - **Coronary**
 - **Structural**
- **Echo**
- **IVUS**
- **OCT**
- **iFR/FFR**
- **Others**

Co-registration of IVUS and Angiography (Paieon)



Links angiographic roadmap with corresponding grey-scale and VH-IVUS cross-sections using fiduciary points & interpolated images

Co-registration of IVUS and Angiography (MediGuide, MPS)

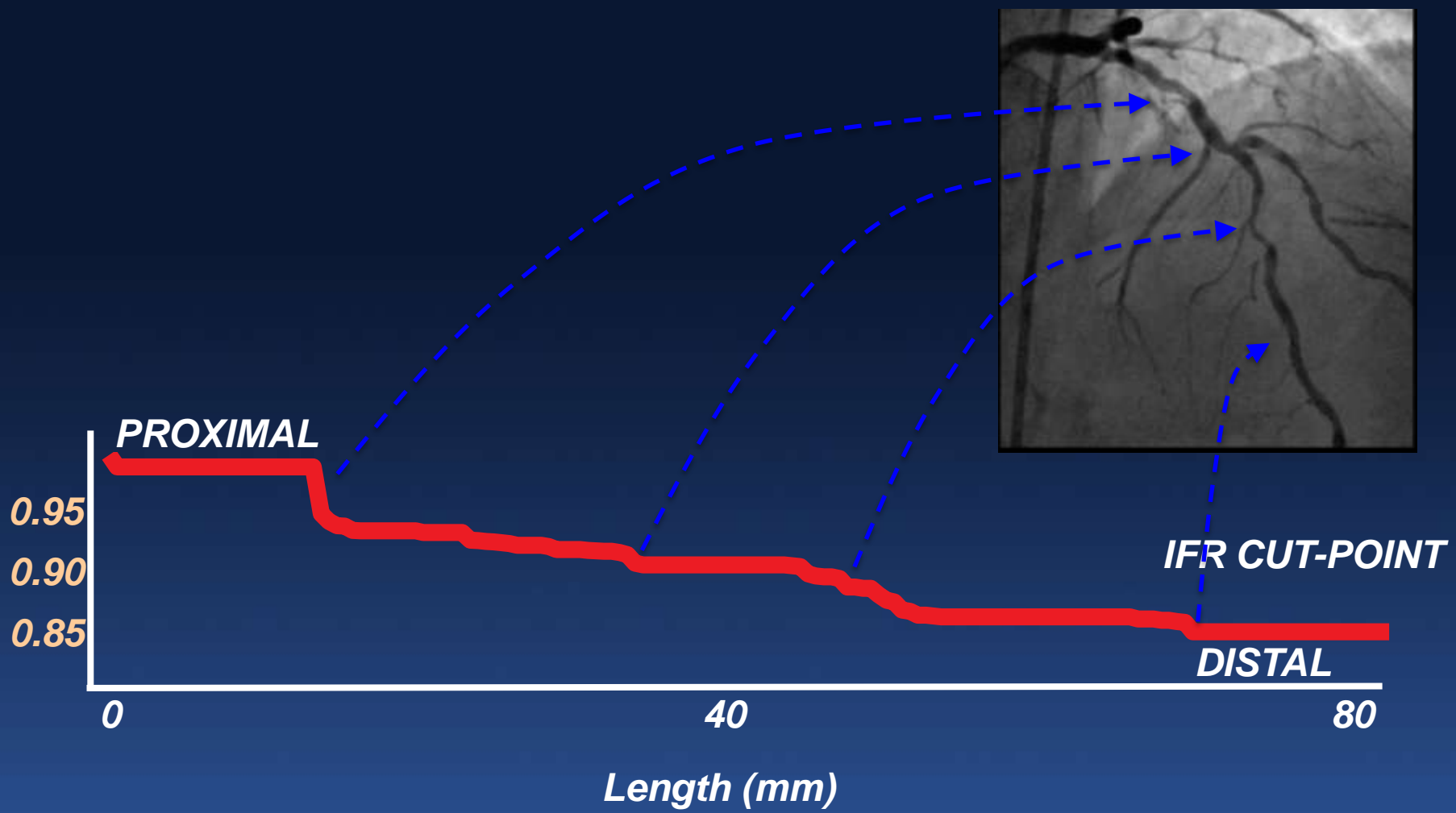


Miniature sensors provide Position and Orientation (P&O) projected on 3D imaging model with an accuracy of $\approx 0.5\text{mm}$



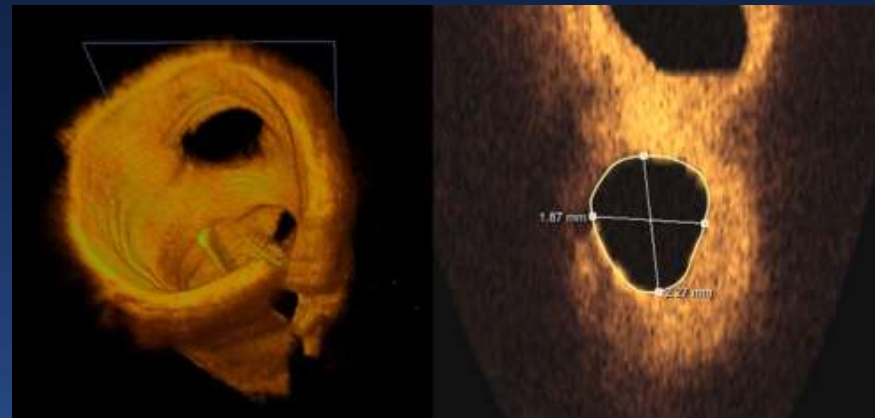
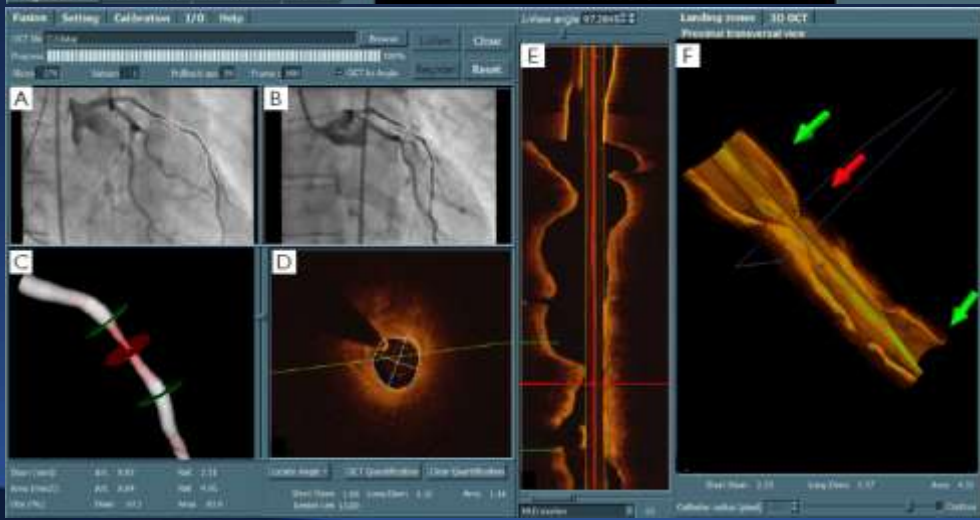
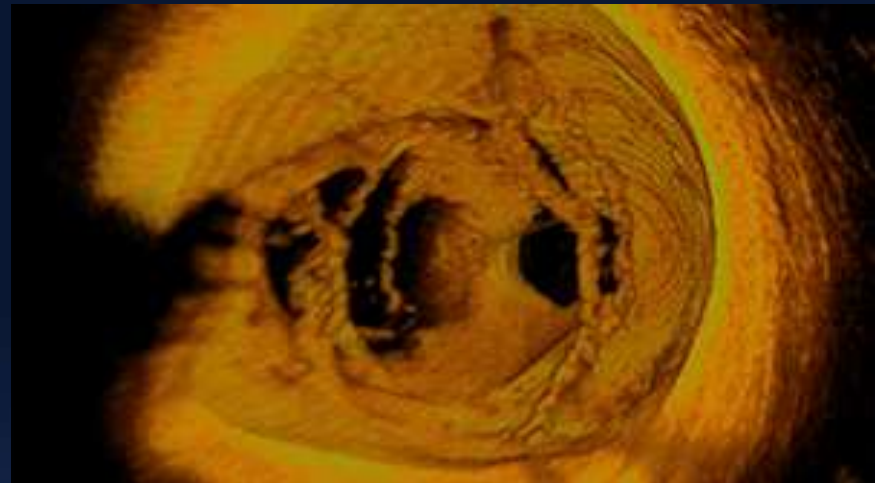
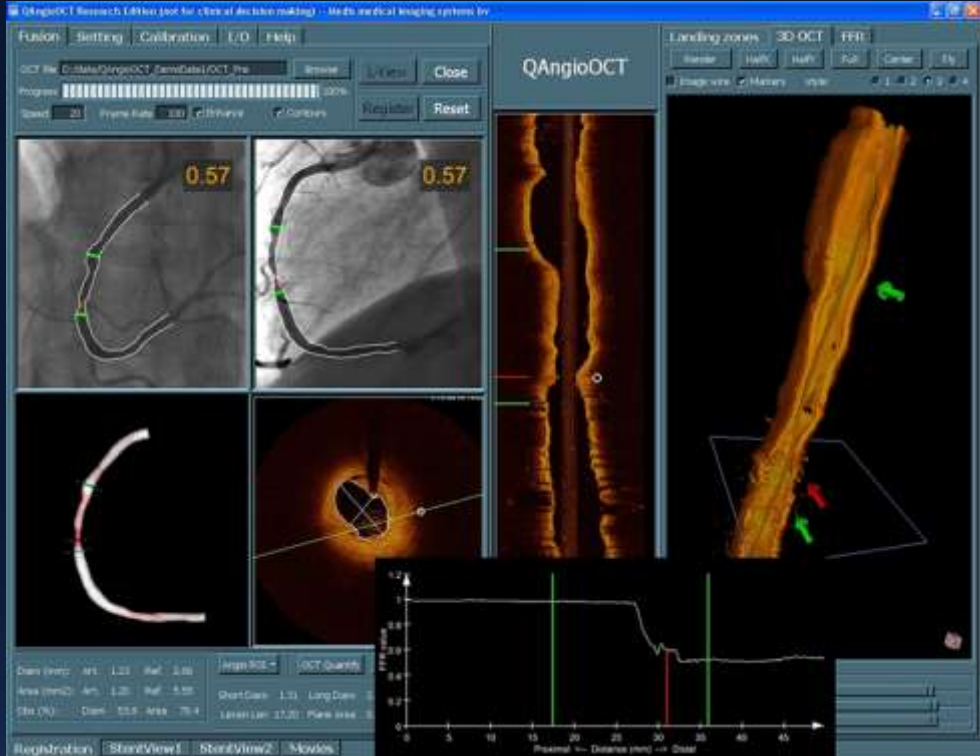
X-ray
 Angio
 QCA & VE
 Deploy.
 Co-reg
 00 mm 10 20 30 40 50
 Image 1/3
 Co-reg
 00:30:05
 Sync-Rx

iFR pullback stenosis mapping





- Directly links OCT and angiography, giving wide-field context to high-resolution pullback
- Enables comprehensive integration of OCT into PCI workflow, both pre- and post-intervention
- Automated software provides coregistration in seconds



After almost two decades of technical stagnation, the field of intravascular imaging and physiology is undergoing a renaissance

- Many different approaches – some easier and some more complicated
- Better resolution
- Combination devices
- Co-registration
- 3D reconstruction

**Will they all succeed and/or
survive?**

Who will adopt them?

**Where is the clinical data that the
newer approaches are better?**

“The enemy of my enemy is my friend”

- Intravascular imaging and physiology are underutilized even though there is undeniable data that these techniques improve patient outcomes.**
- Interventionalists will give the newer modalities a chance to expand the overall reach of intravascular imaging.**
- Competition is good. But the main competition is not “OCT vs IVUS” or “HD-IVUS vs IVUS” or “NIRS/IVUS vs OCT,” but intravascular imaging vs angiography alone.**
- My concern is the possibility that in the end we will be left with nothing.**