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# How I Use Angio-Based Physiology to Guide My Case in the Cath Lab: Practical Appraisal

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# Disclosures

*Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.*

## Affiliation/Financial Relationship

Grant/Research Support

Consulting Fees/Honoraria

Major Stock Shareholder/Equity

Royalty Income

Ownership/Founder

Intellectual Property Rights

Other Financial Benefit

## Company

Abbott, Medtronic

NIH R61 HL139929-01A1 (PI)

CathWorks (previous), HeartFlow



# Why isn't Coronary Physiology Used More?

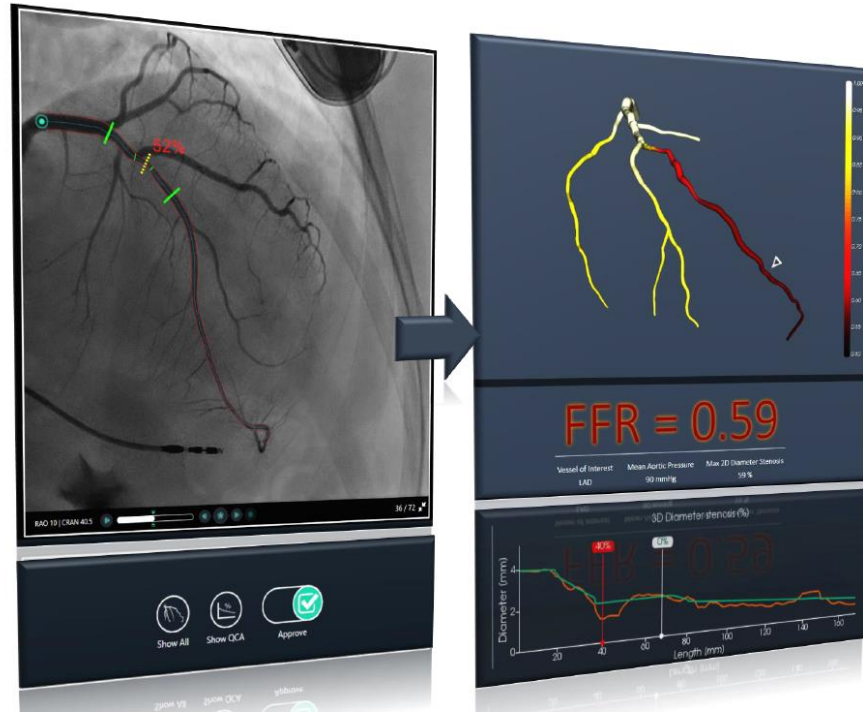
- It takes time...
- Wire handling characteristics...
- Pressure drift is frustrating...
- Side effects of adenosine...
- It is expensive...
- There is a small risk...

***Coronary Pressure  
Wire***



# Angiography-Derived FFR

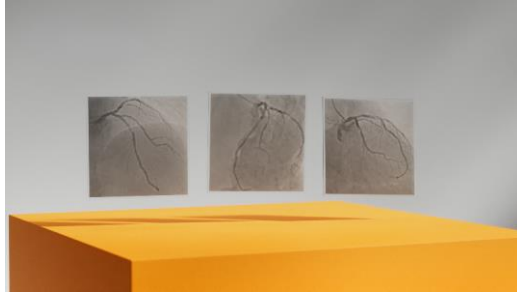
*Measurement of FFR without the need of a pressure wire or adenosine*



# Drug-free, Wire-free Coronary Physiology

1

Optimal 2D  
Angiography



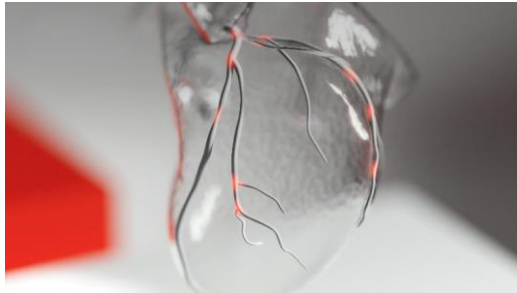
2

3D Model  
Reconstruction



3

Resistance  
Analysis



4

Comprehensive  
Physiological  
Assessment



# Case Presentation

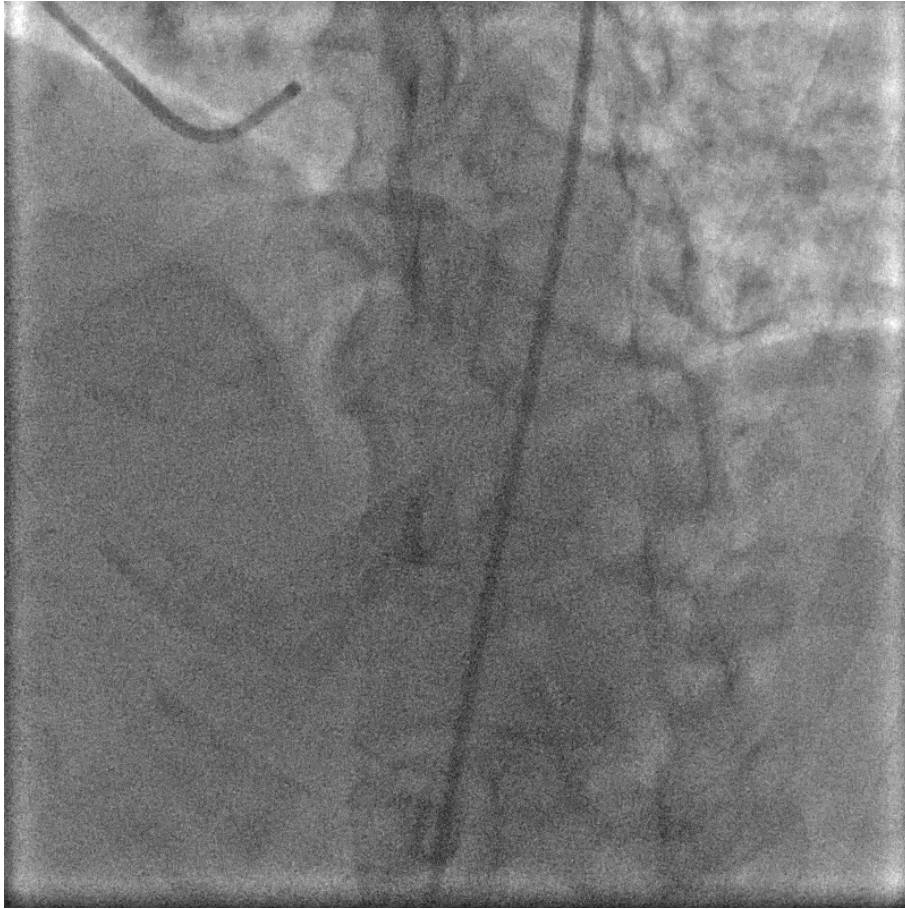
- 43 yo woman with HTN, dyslipidemia, diabetes and kidney transplantation in 2016
- History of PCI of her LAD at an outside hospital
- Has developed daily exertional angina despite beta blocker and long-acting nitrate
- PET scan revealed small, moderate area of ischemia in the anterior wall
- Referred for cath...















# Pre-processing Angiograms

The screenshot shows the CATHWORKS software interface. At the top, the name "John Smith" and date "11 Mar 2018 10:11" are displayed. The interface features a central 3D heart model with labeled coronary arteries: RCA, LAD, RAMUS, LCX, and MARG. A "Select target vessel" dialog is open over the LAD, showing a "Recommended" list: RAO 30 | CRAN 30, LAO 10 | CRAN 30, and RAO 30 | CAUD 30. Two green boxes highlight the "LAO 10 | CRAN 30" view on the right and the "RAO 30 | CAUD 30" view on the left. A white arrow points from the "LAO 10 | CRAN 30" view to a red circle containing a mouse cursor icon and the text "Hover over the target vessel". At the bottom, a numeric keypad is used to "Set mean aortic pressure" in mmHg, with the value "0" currently set. The bottom status bar shows two steps: "1 Select target vessel" and "2 Set mean aortic pressure".



# Dynamic Selection of Angiograms

John\_Smith  
03-Oct-2017 12:20:27

Target Vessel: LAD  
Aortic Pressure (mmHg): 90

CATHWORKS

Angiograms 36 angiograms ready

Invalid: Too close to a selected angiogram

Invalid: Too close to a selected angiogram

Not recommended: All cranial angle

Not recommended: All cranial angle

Invalid: Too close to a selected angiogram

Not recommended: All cranial angle

Not Recommended: Close to a selected angiogram

RAO 30 | CRAN 30

RAO 30 | CAUD 30

Select an angiogram and verify optimal frame

Recommended

RAO 30 | CRAN 30

LAO 10 | CRAN 30

RAO 30 | CAUD 30

Drag marker to lesion location

Drag marker to lesion location

1 | Select 3 angiograms and verify optimal frame

2 | Mark lesion

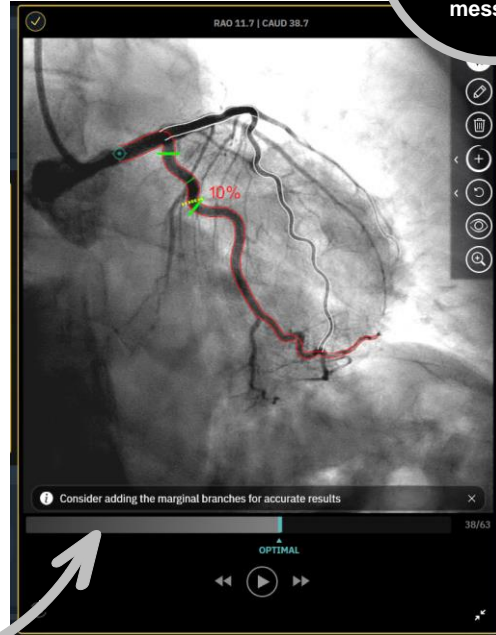
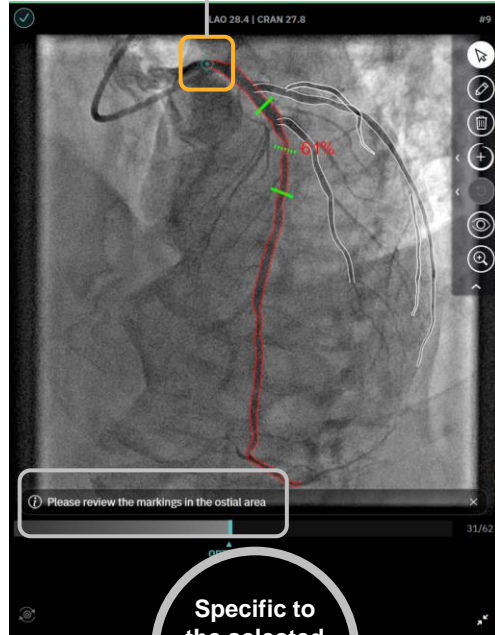
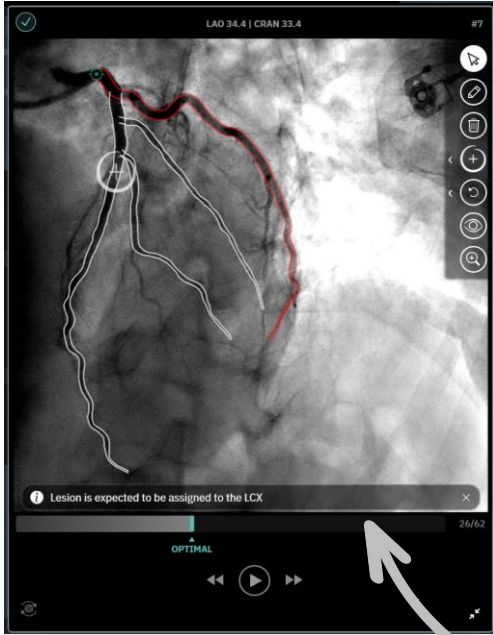
3 | Review lesion boundaries and vessel markings





# AI Communication and Editing Toolbar

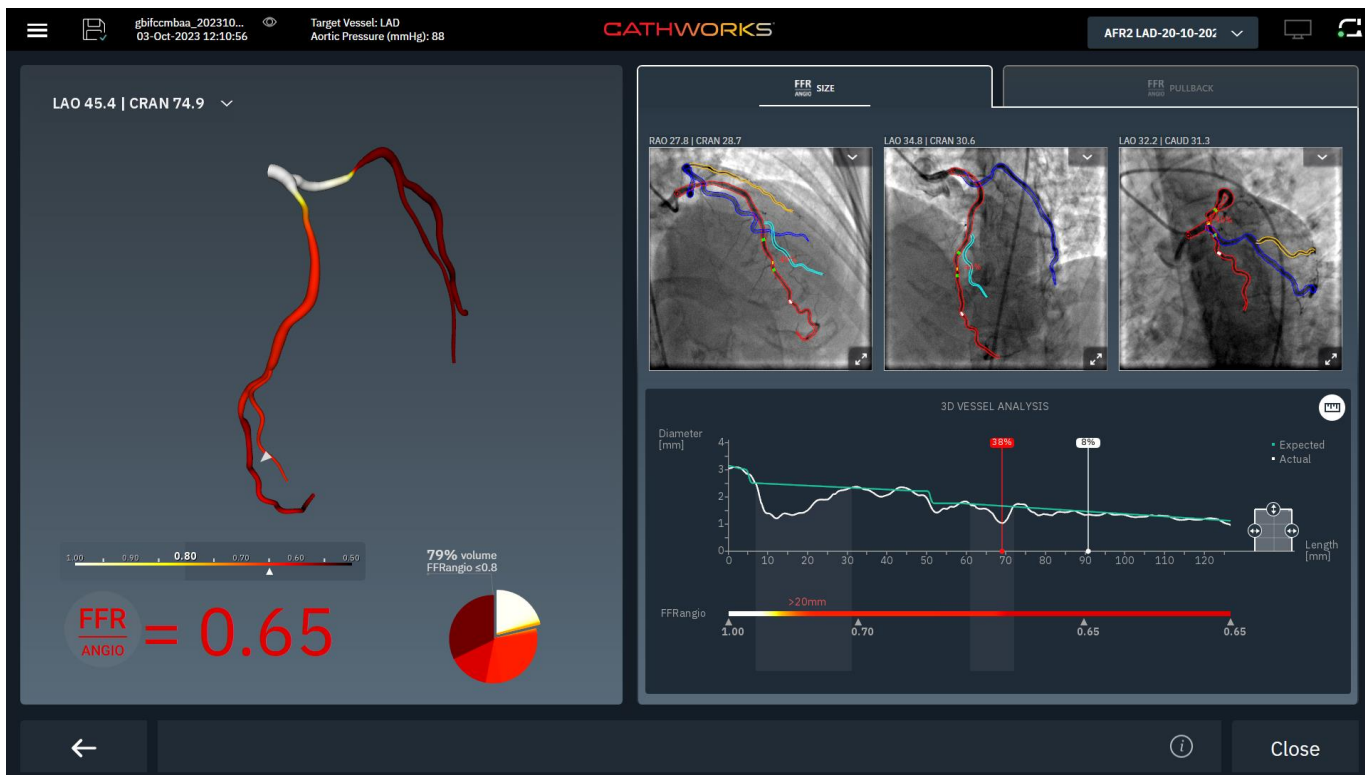
Consider correcting radii or moving ostium location with this message



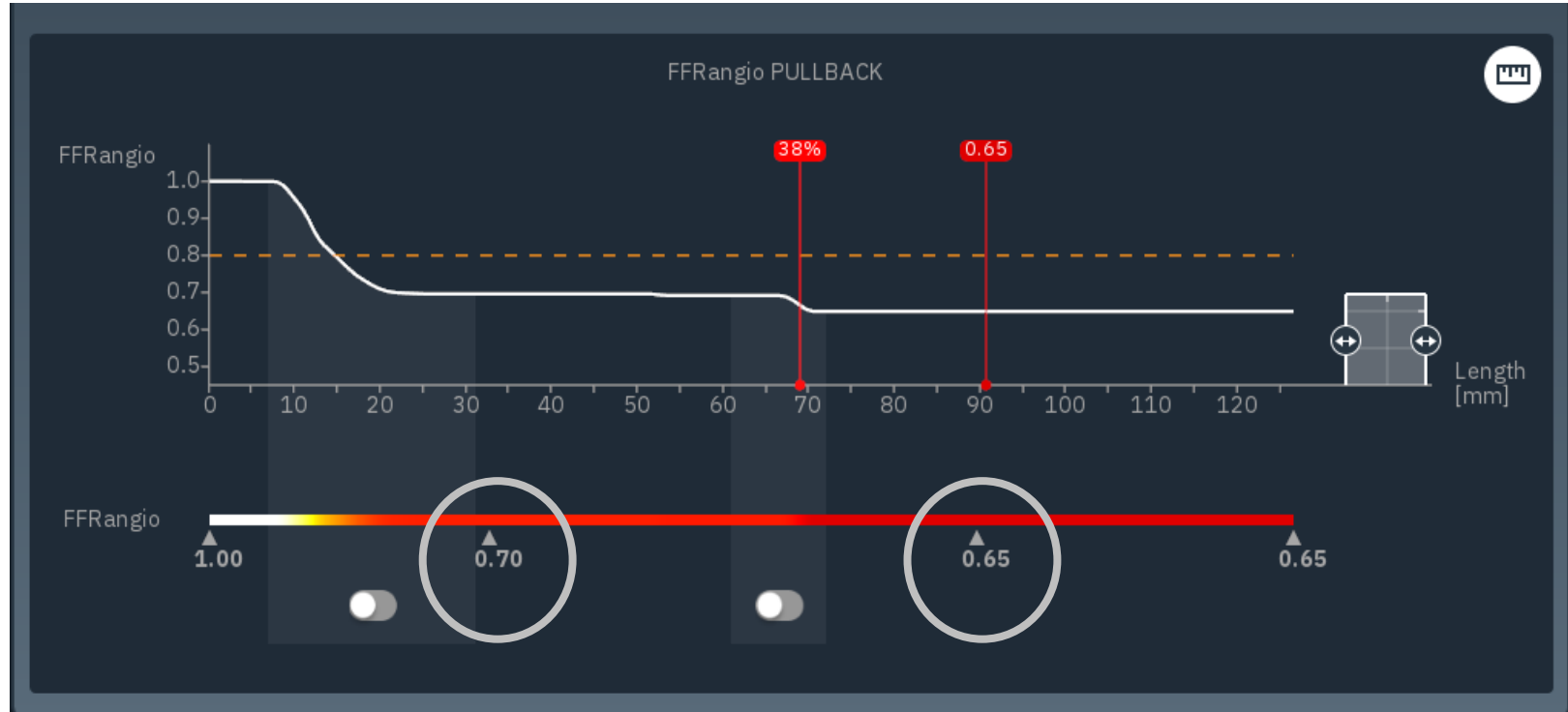
Specific to the selected target vessel



# Back to Our Case...



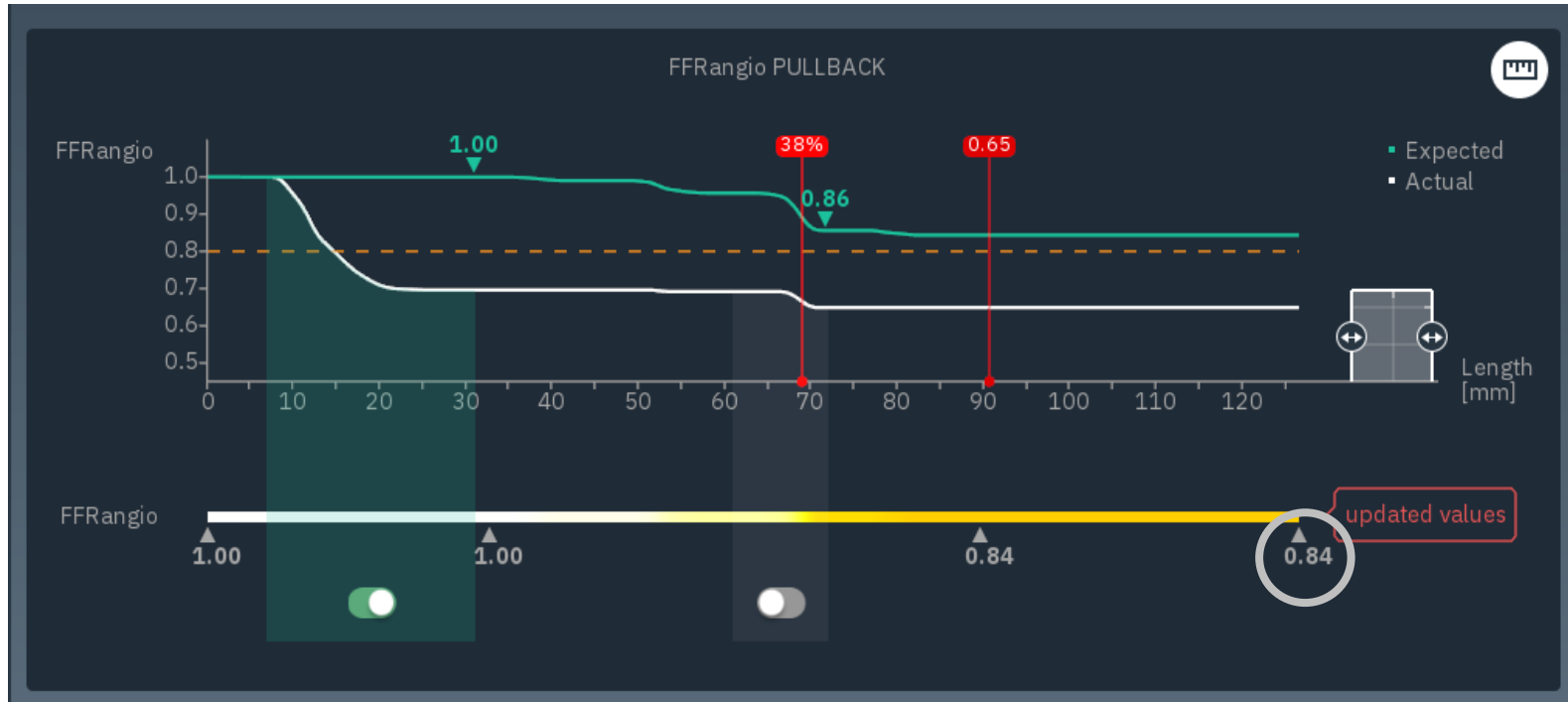
# Pullback Curve





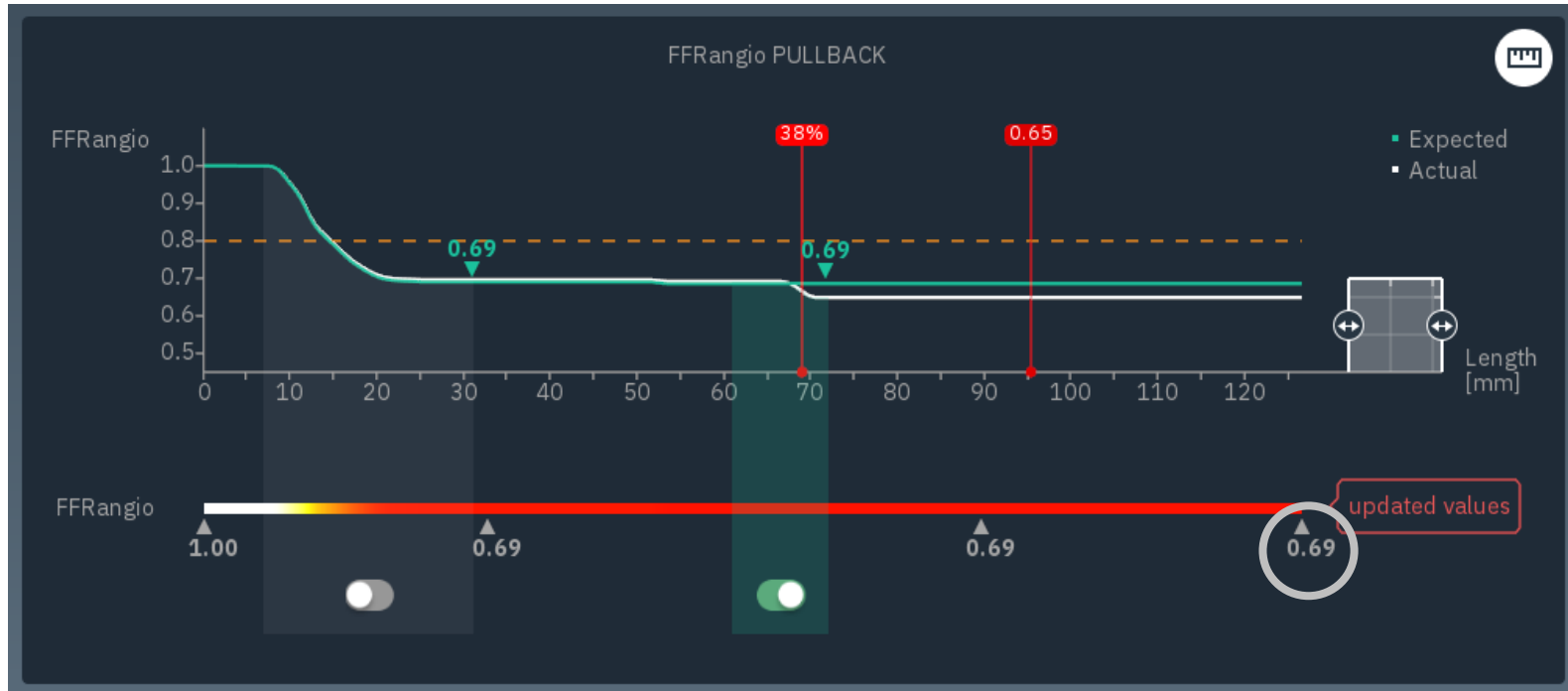
# Pullback Curve

## *Virtual Stenting of the Proximal Lesion*



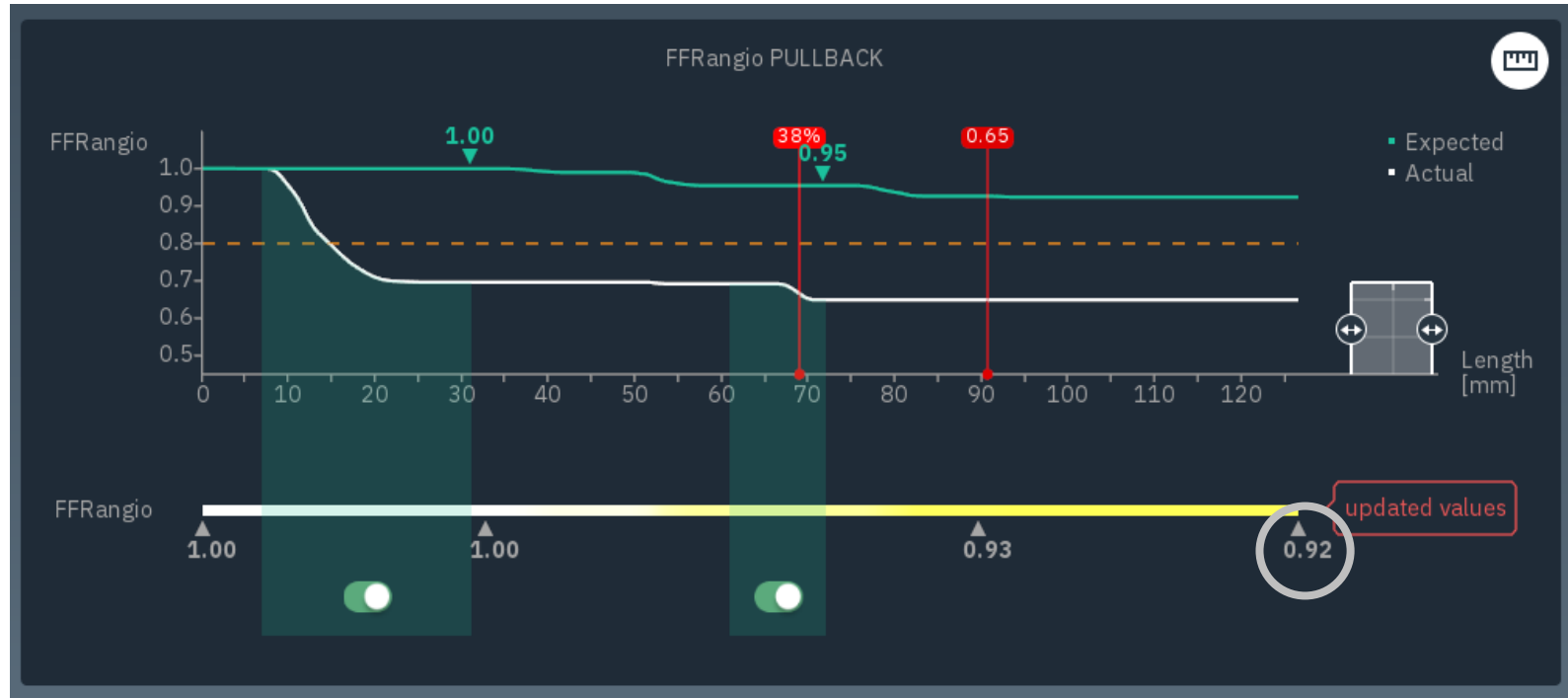
# Pullback Curve

## *Virtual Stenting of the Distal Lesion*

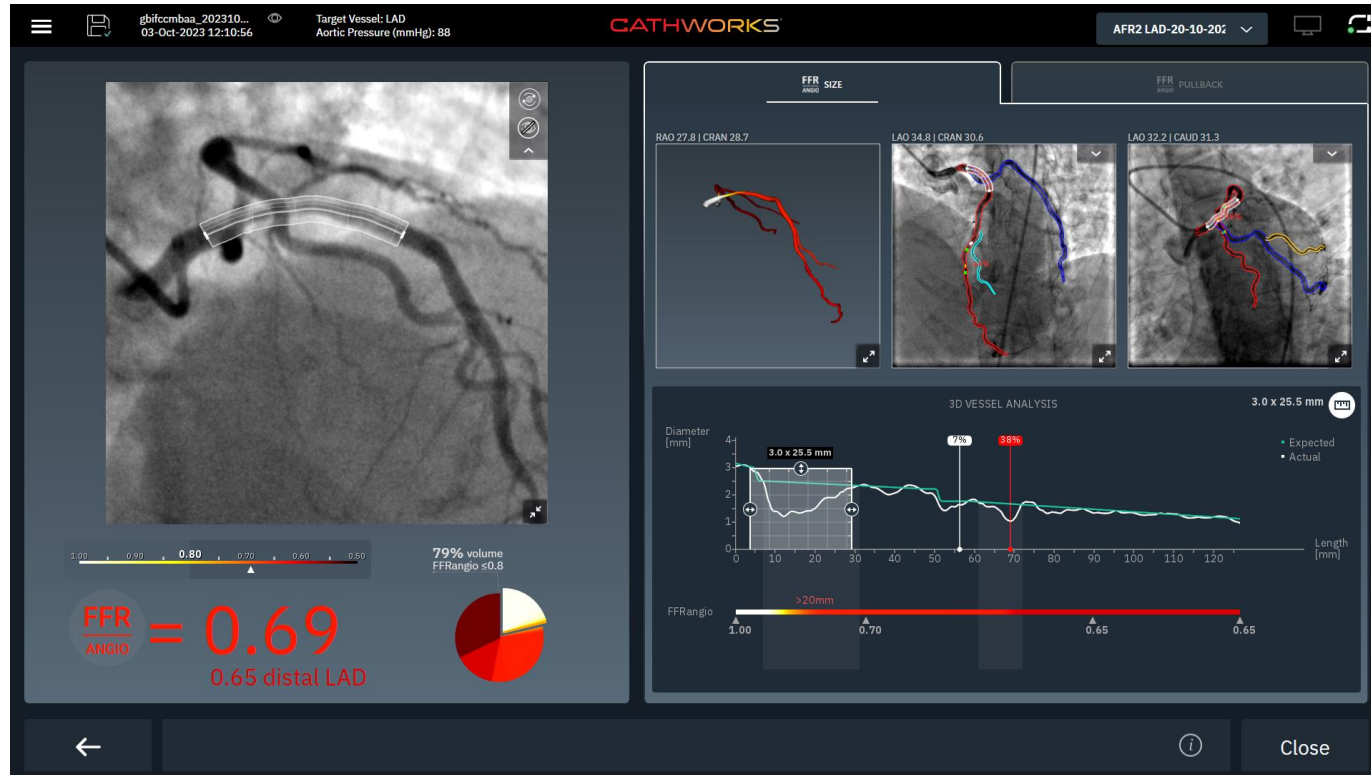


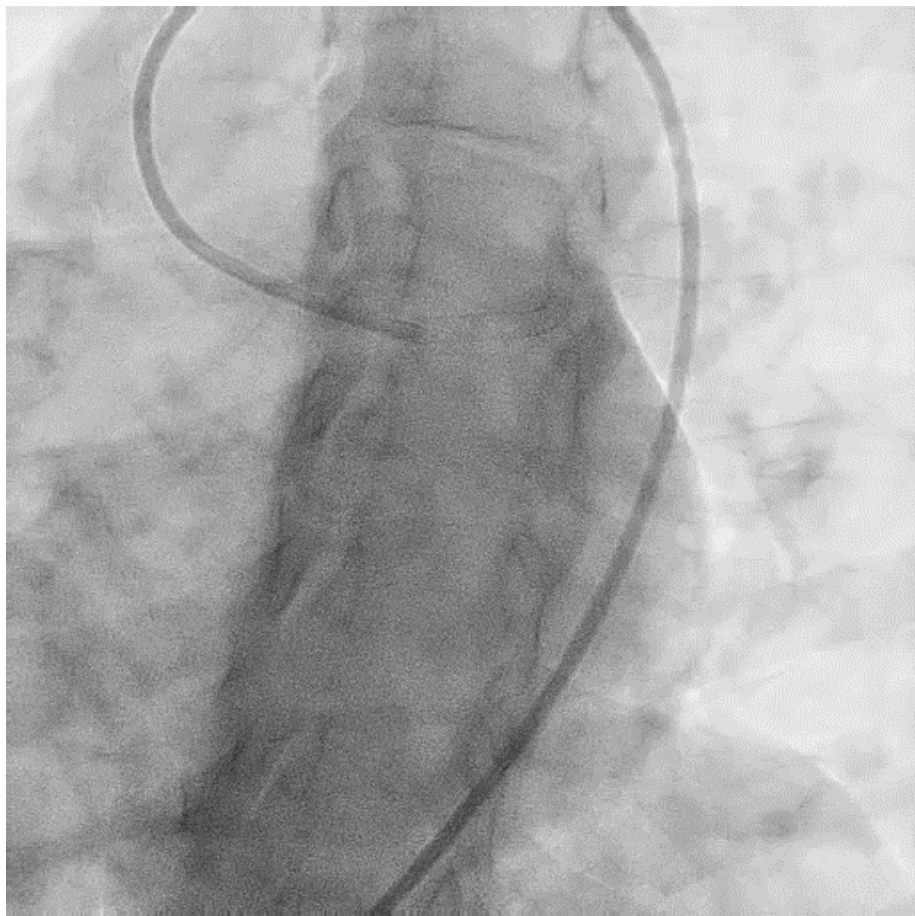
# Pullback Curve

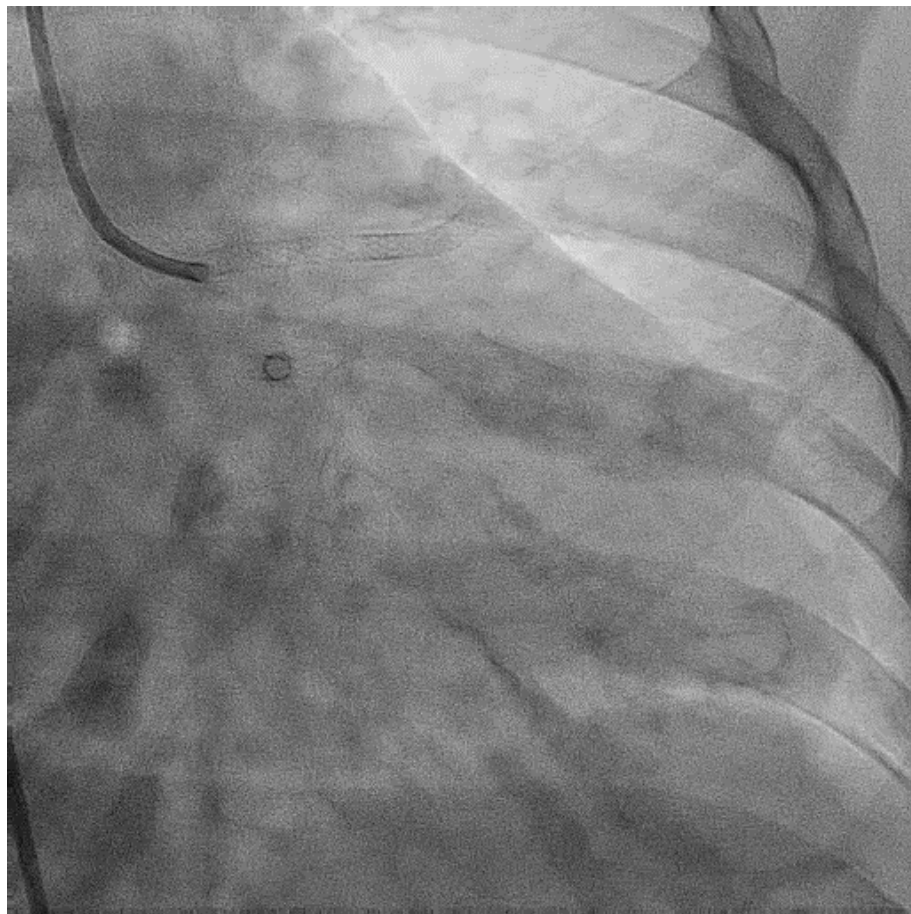
## *Virtual Stenting of Both Lesions*



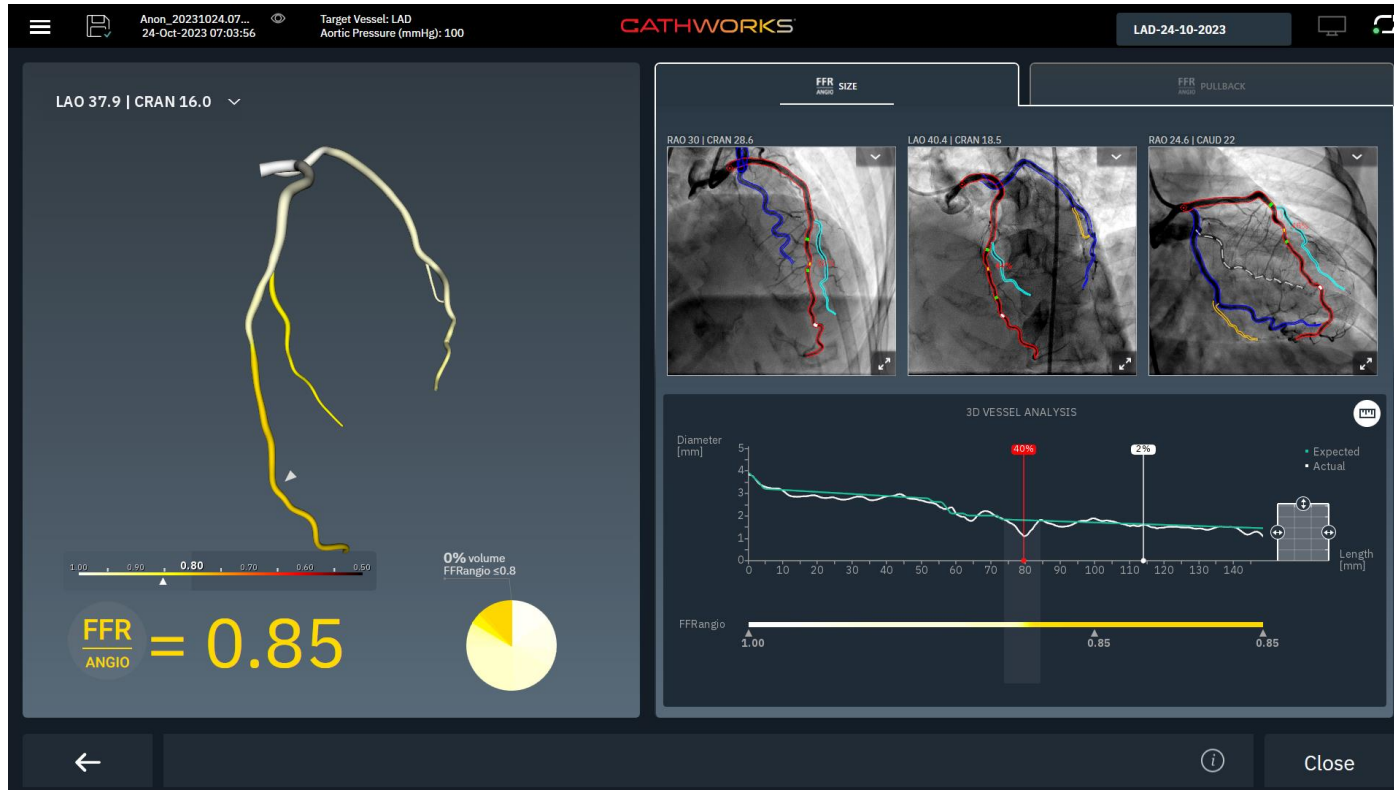
# Measuring Tool



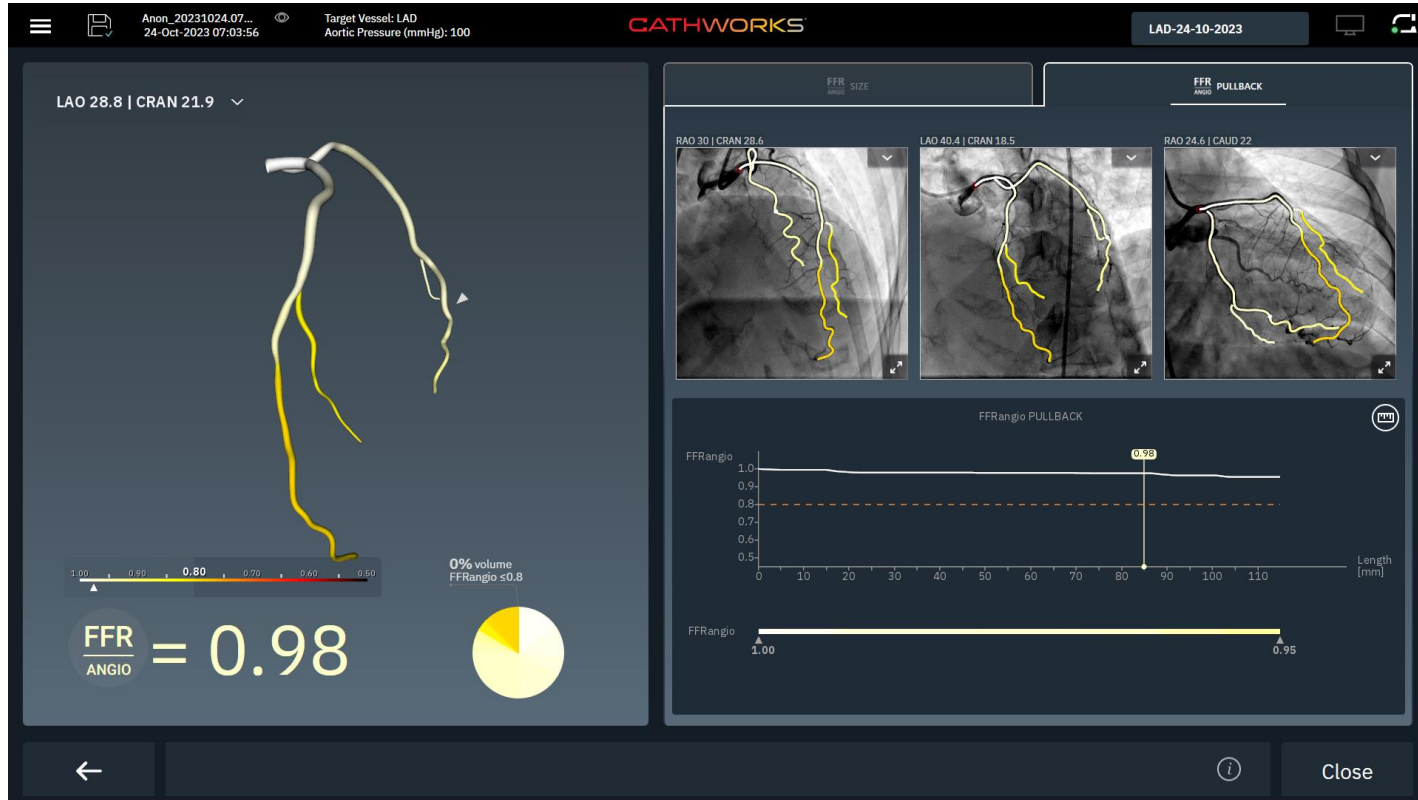




# FFR<sub>angio</sub> Post-PCI of Proximal LAD



# FFR<sub>angio</sub> Post-PCI of Proximal LCx





# Outcomes

The FAST-FFR trial demonstrated a high sensitivity, specificity and accuracy of FFRangio compared with coronary pressure wire-based physiology



## Characteristic

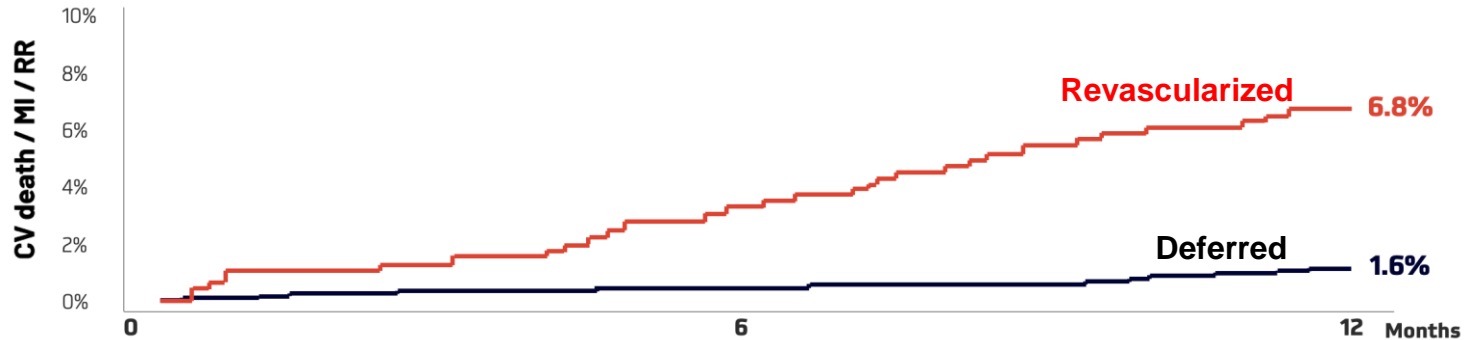
<b>Sensitivity</b>	<b>93.5%</b> (87.8, 96.6)
<b>Specificity</b>	<b>91.2%</b> (86.0, 94.6)
<b>Diagnostic Accuracy</b>	<b>92.2%</b> (88.7, 94.8)
Positive Predictive Value	89.0% (82.6, 93.2)
Negative Predictive Value	94.8% (90.3, 97.3)

## Grey zone Accuracy (0.75-0.85)

Sensitivity	88.5%
Specificity	85.1%
Diagnostic Accuracy	86.9%



# 1-Year Clinical Outcomes Study – Results



	Deferred (n=888)	Revascularized (n=547)
CV death / MI / RR	1.6%	6.8%
CV death	0.4%	0%
Myocardial infraction	0.1%	1.0%
Repeat revascularization	1.2%	6.8%
Target vessel MI	0%	0.4%
Target vessel revascularization	0.3%	2.3%
Target lesion revascularization	0.3%	0.9%



# ALL-RISE Trial



**1924 Patients**

Patients presenting w/ coronary lesion(s) with clinical indication for physiology-based assessment

Declare angio-based treatment plan, in detail

1:1 Randomization

Stratified by FFR/NHPR and presentation (ACS/SAP)

962 FFRangio-guided treatment

FFRangio  
 $\leq 0.80$

PCI

FFRangio  
 $> 0.80$

Defer

962 Pressure wire-guided Treatment

FFR  $\leq 0.80$   
NHPR  $\leq 0.89$

PCI

FFR  $> 0.80$   
NHPR  $> 0.89$

Defer

**Primary Endpoint: MACE**

(death, MI, clinically indicated revascularization)

Non-inferiority Design

Secondary Endpoints: Cost-effectiveness, QOL, procedure time, complications

1924 patient to be enrolled in up to 60 sites globally, with a limit of up to 200 patients per site.



# Conclusion

- FFRangio can allow efficient and accurate assessment of your multivessel CAD patient.
- The pullback curve and virtual stenting and measurement tool have potential to improve pre-PCI planning and prediction of outcome.
- There are excellent data demonstrating correlation with pressure wire-based FFR. The ALL-RISE study will provide clinical outcomes data.



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***Thank You!***

