

# Coronary Physiology with Angiographic Co-Registration

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# DÉCLARATION DE LIENS D'INTÉRÊT AVEC LA PRÉSENTATION

**Intervenant : Prénom Nom, Ville**

Je déclare les liens d'intérêt suivants :

Philips Volcano

Bayer, Pfizer, Astra Zeneca

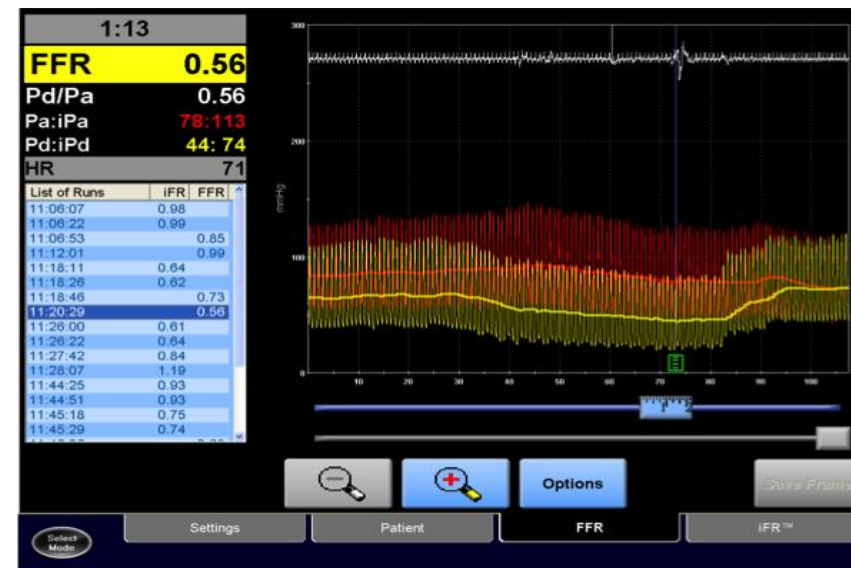
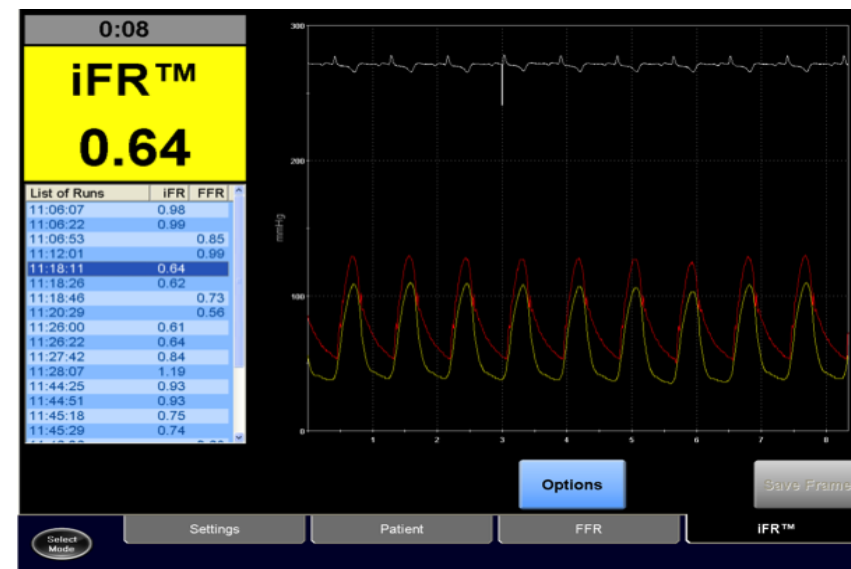
WL: 119 WW: 151

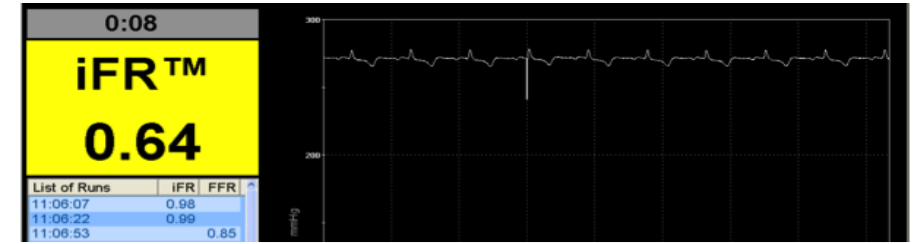


Zoom: 146% Angle: 0  
Im: 1/36

WL: 99 WW: 188

Zoom: 146% Angle: 0  
Im: 1/24





## Important questions for the interventionalist

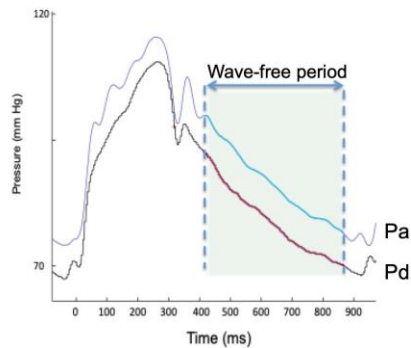
- *Where* to Stent
- How *long*?
- Will there actually be an *improved* physiological result

## Increasingly important

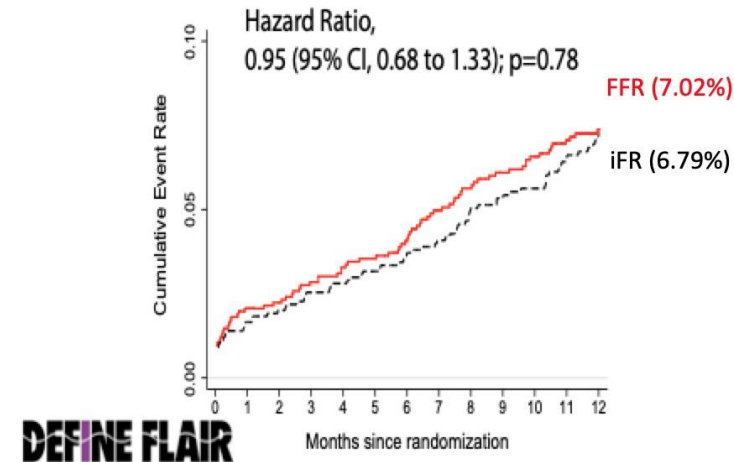
- **Complex & Tandem** disease
- Demonstrate **appropriateness** of the procedure (AUC)
- **Document** effective PCI



$$iFR = \frac{\text{Distal pressure}_{wfp} (Pd)}{\text{Aortic pressure}_{wfp} (Pa)}$$



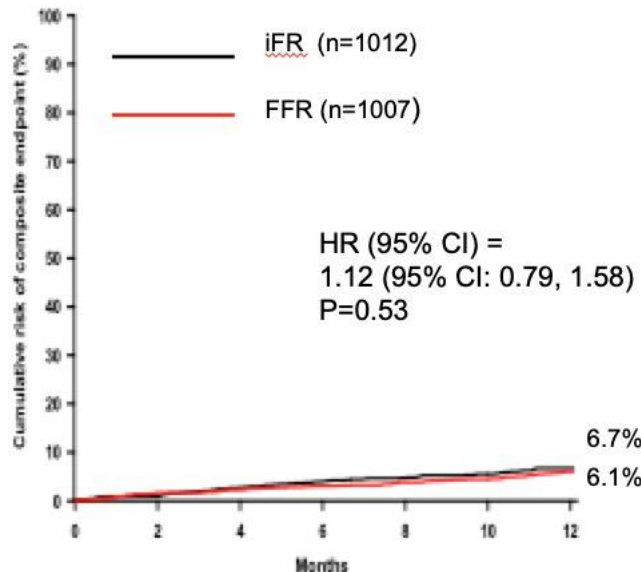
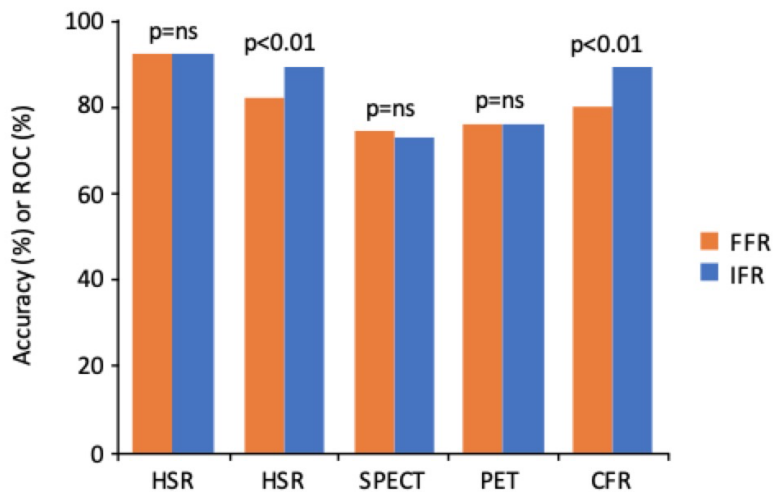
Primary endpoint (MACE)  
iFR equivalent to FFR with less PCI and CABG



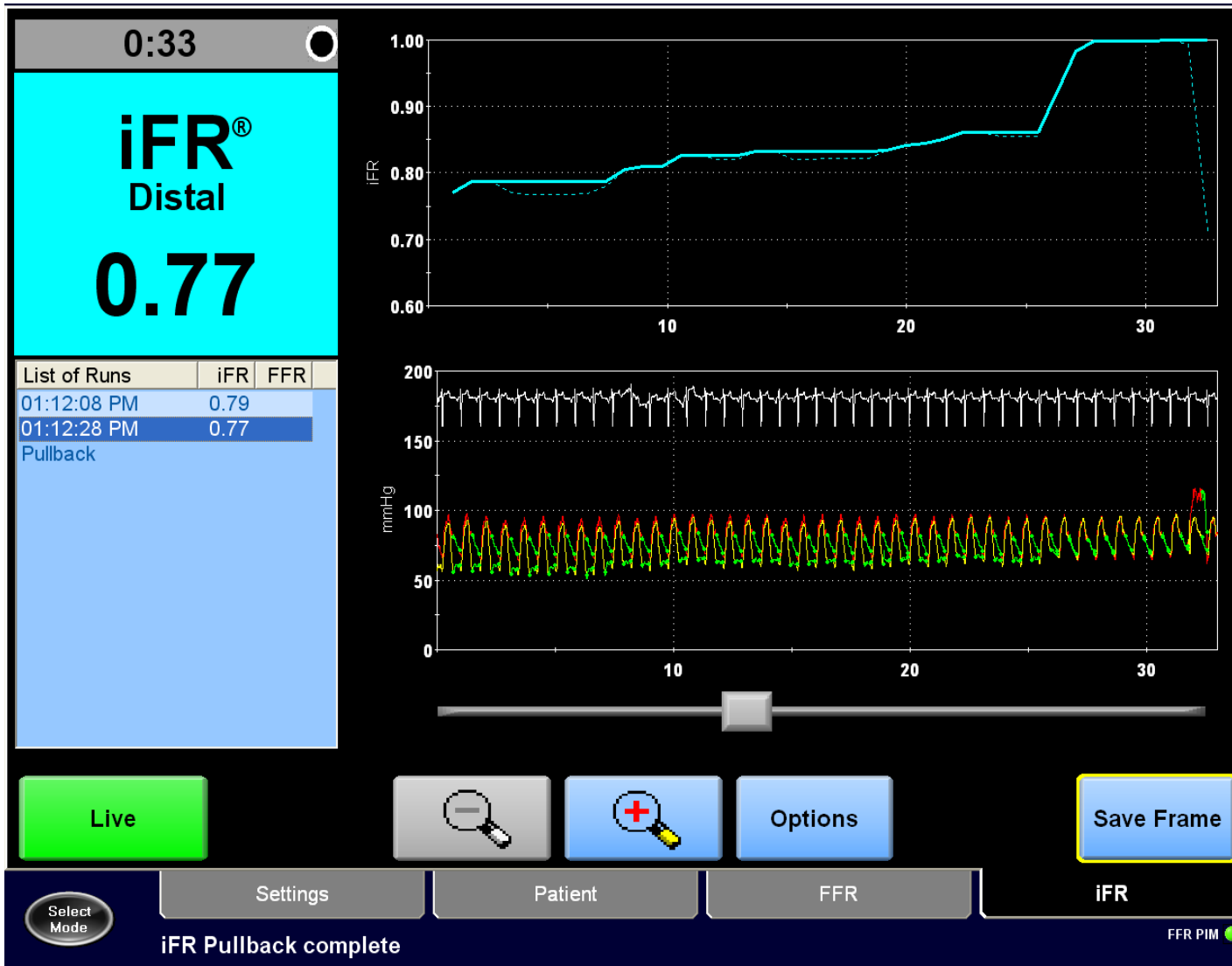
# iFR

- iFR management of patients is non-inferior to FFR approach in 2 large RCTs

iFR and FFR have similar diagnostic power in head-to-head studies



- iFR equivalent ischaemia detection as: FFR, BSR, HSR, PET, CFR



# iFR Pullback

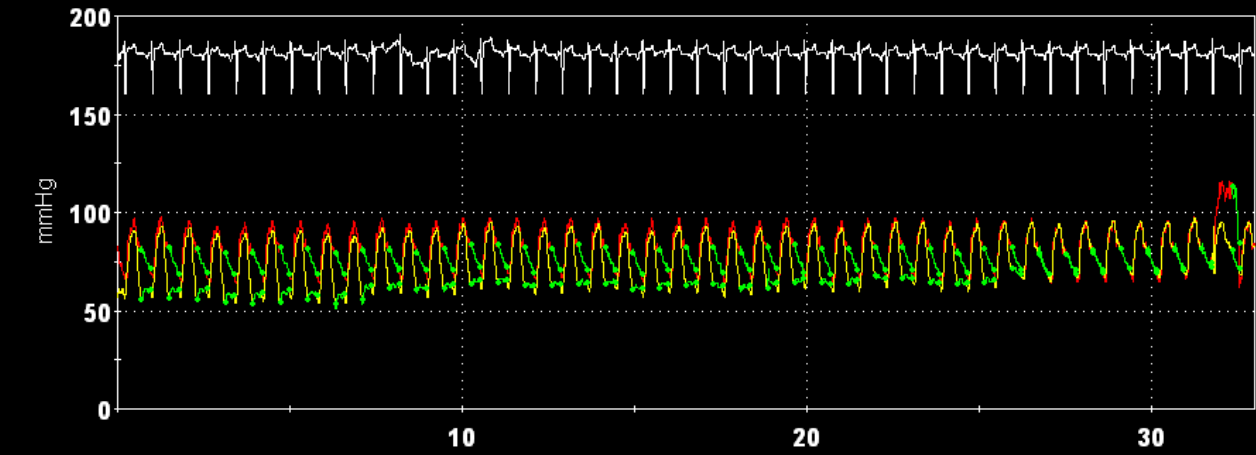
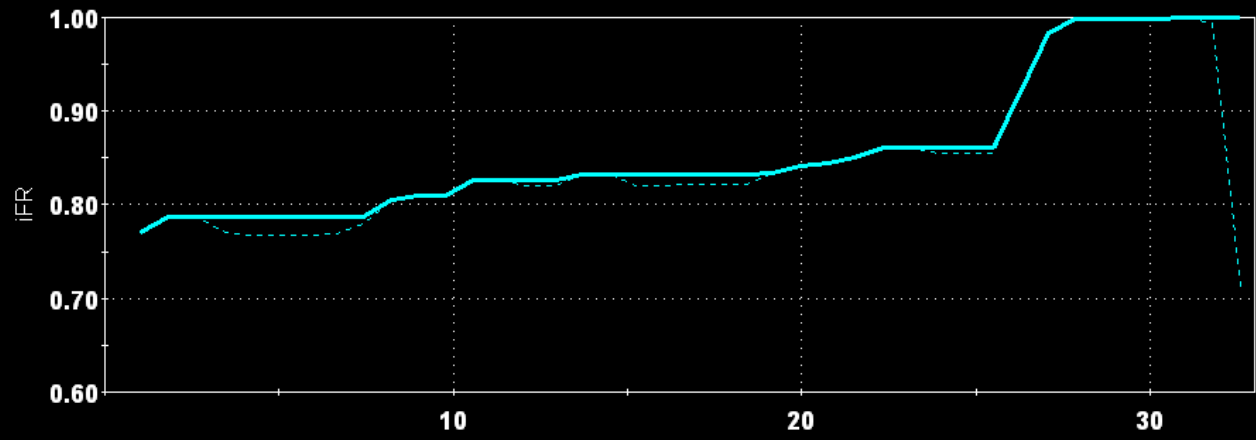
- iFR Pullback can identify diffuse & focal disease
- Predict functional gain from a given PCI strategy

0:33

iFR<sup>®</sup>  
Distal  
**0.77**

List of Runs	iFR	FFR
01:12:08 PM	0.79	
01:12:28 PM	0.77	

Pullback



Live



Options

Save Frame

Select Mode Settings Patient FFR iFR

iFR Pullback complete

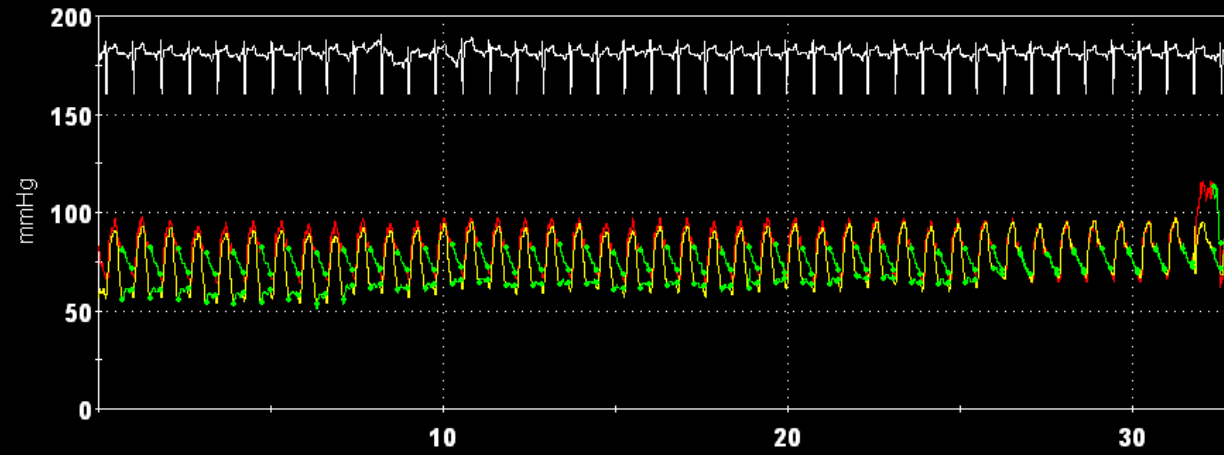
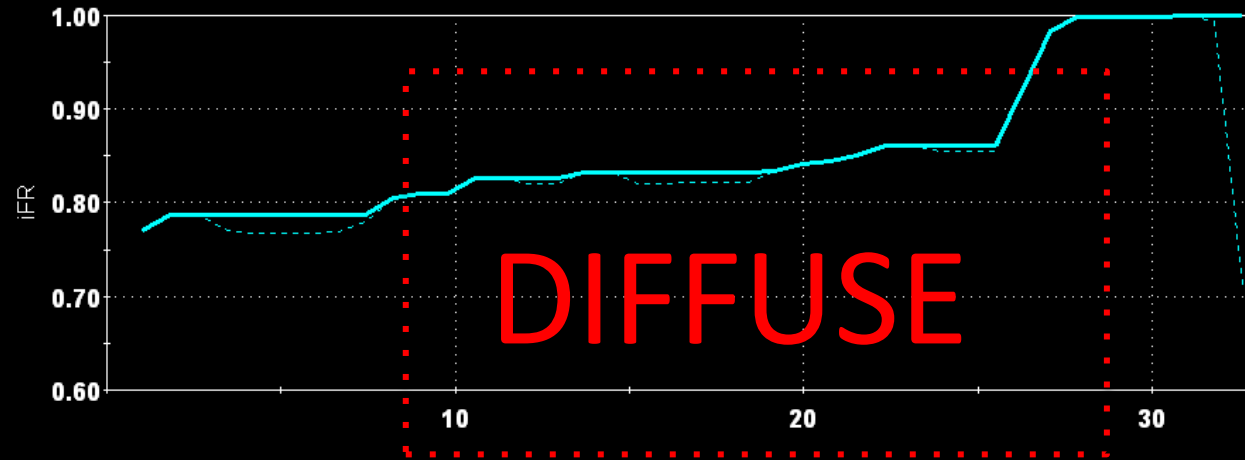
FFR PIM ●



0:33

iFR<sup>®</sup>  
Distal  
**0.77**

List of Runs	iFR	FFR
01:12:08 PM	0.79	
01:12:28 PM	0.77	
Pullback		



Live



Options

Save Frame

Select Mode

Settings

Patient

FFR

iFR

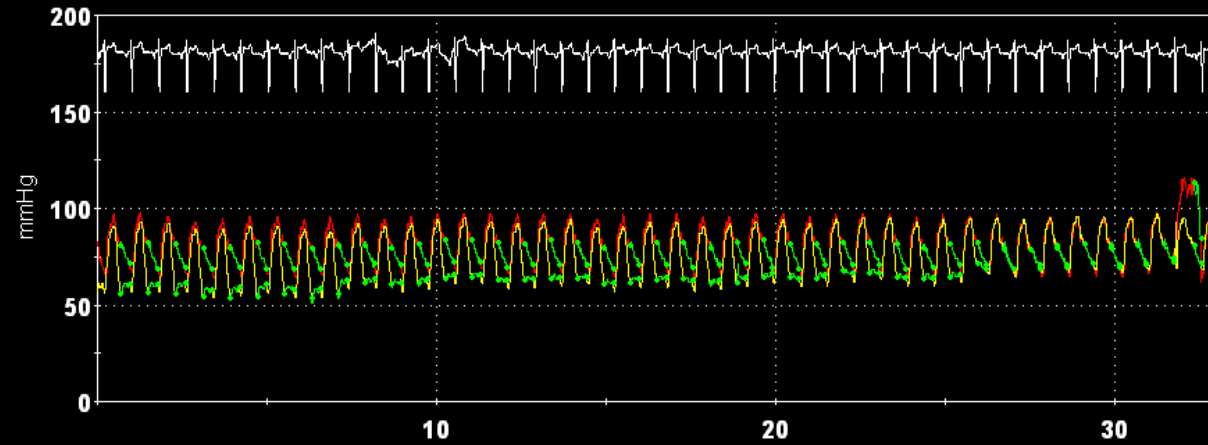
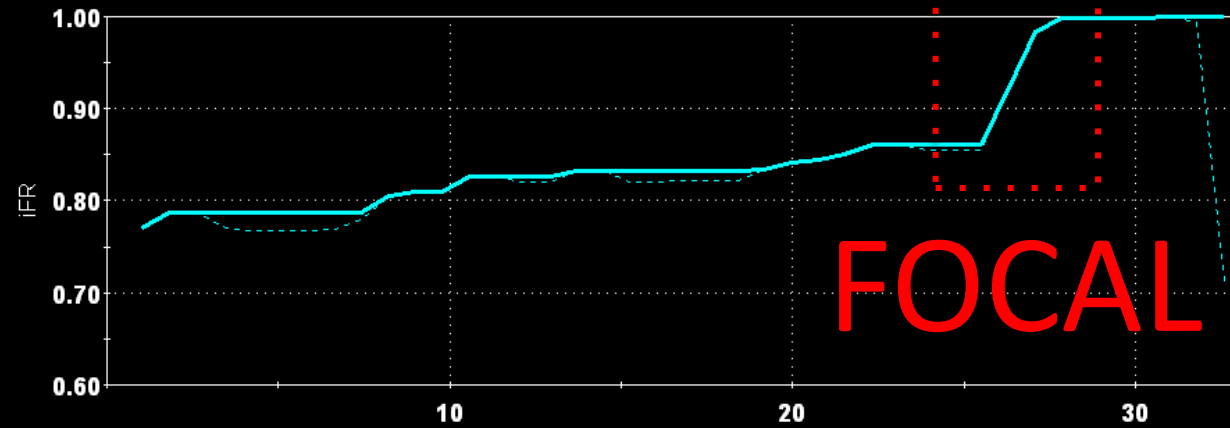
iFR Pullback complete

FFR PIM ●

0:33

iFR<sup>®</sup>  
Distal  
**0.77**

List of Runs	iFR	FFR
01:12:08 PM	0.79	
01:12:28 PM	0.77	
Pullback		



Live



Options

Save Frame

Select Mode

Settings

Patient

FFR

iFR

iFR Pullback complete

FFR PIM ●



## Diffusely ectatic LAD Serial lesions

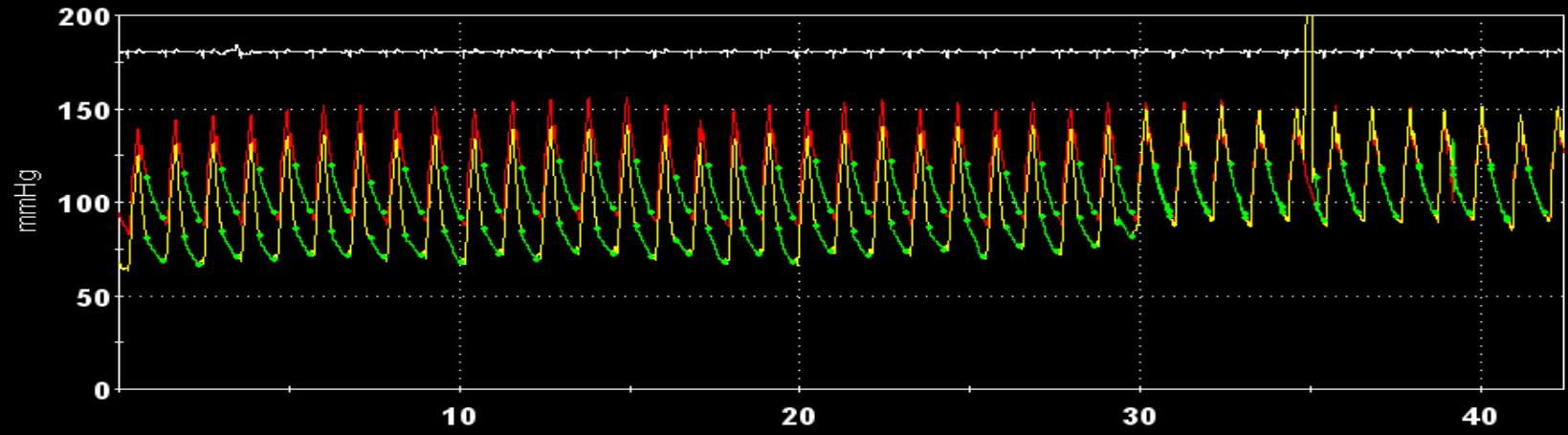
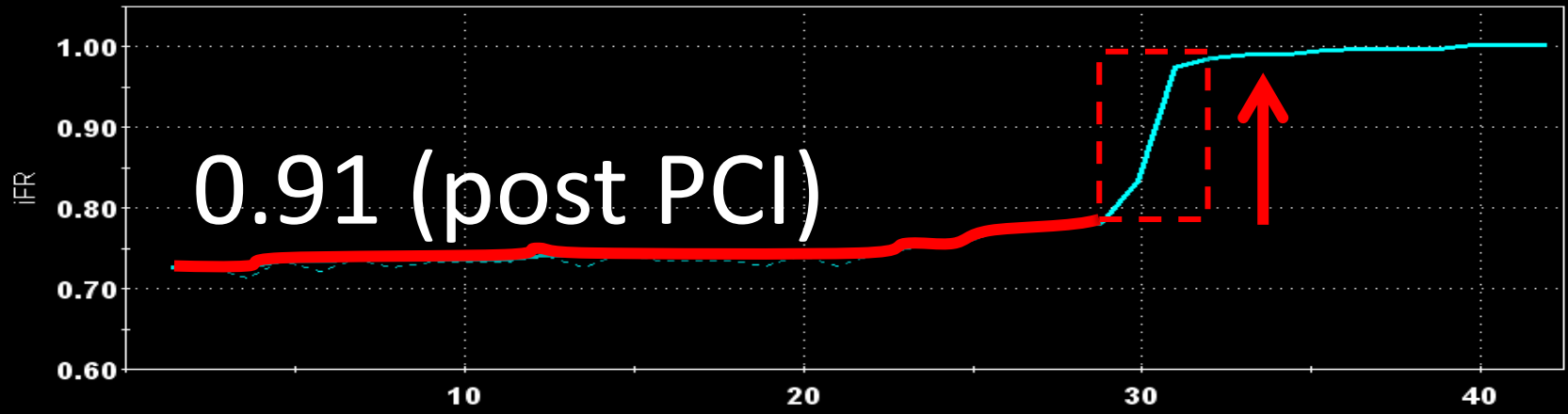
*Hammersmith Hospital March 2015*

0:42

iFR<sup>®</sup>  
Distal

0.73

List of Runs	iFR	FFR
16:28:02	0.72	
16:28:34	0.73	
Pullback		
16:30:13	0.73	
Pullback		
16:31:07	0.75	
Pullback		



Live



Options

Save Frame

Select Mode

Settings

Patient

FFR

iFR

Attach wire to connector

FFR PIM

0:42

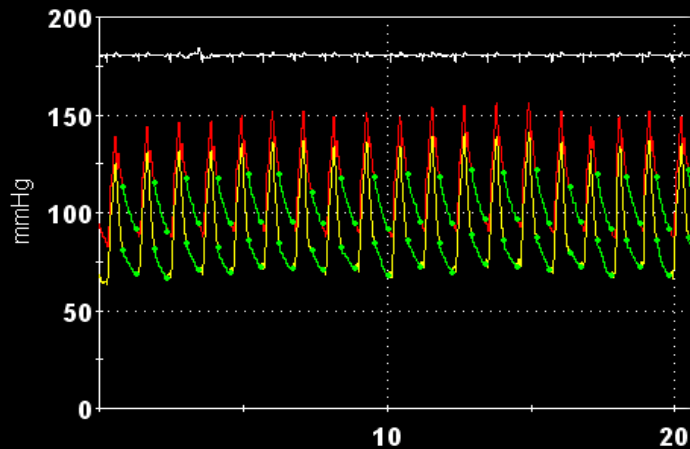
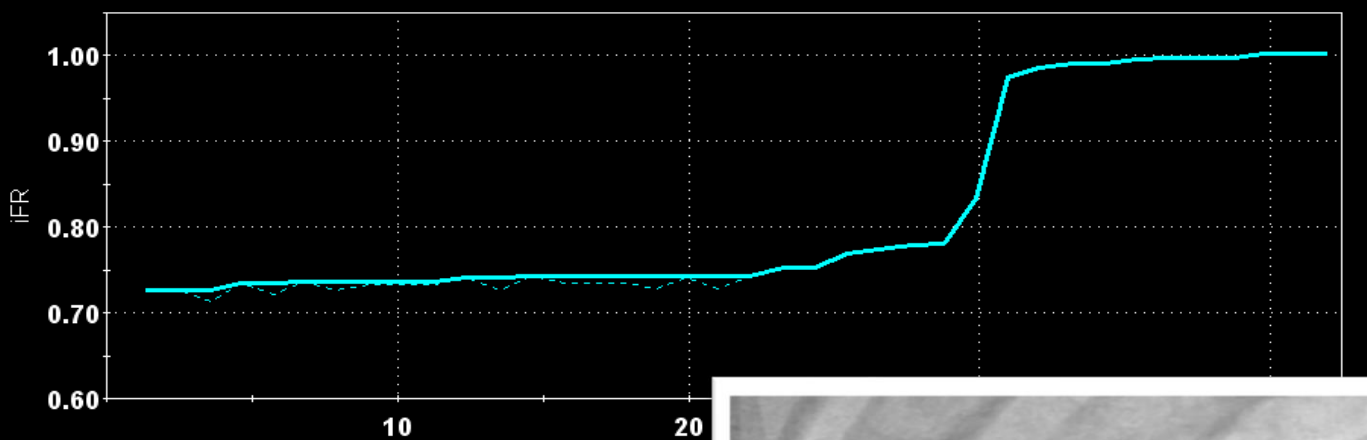


iFR<sup>®</sup>  
Distal

0.73

List of Runs

	iFR	FFR
16:28:02	0.72	
16:28:34	0.73	
Pullback		
16:30:13	0.73	
Pullback		
16:31:07	0.75	
Pullback		

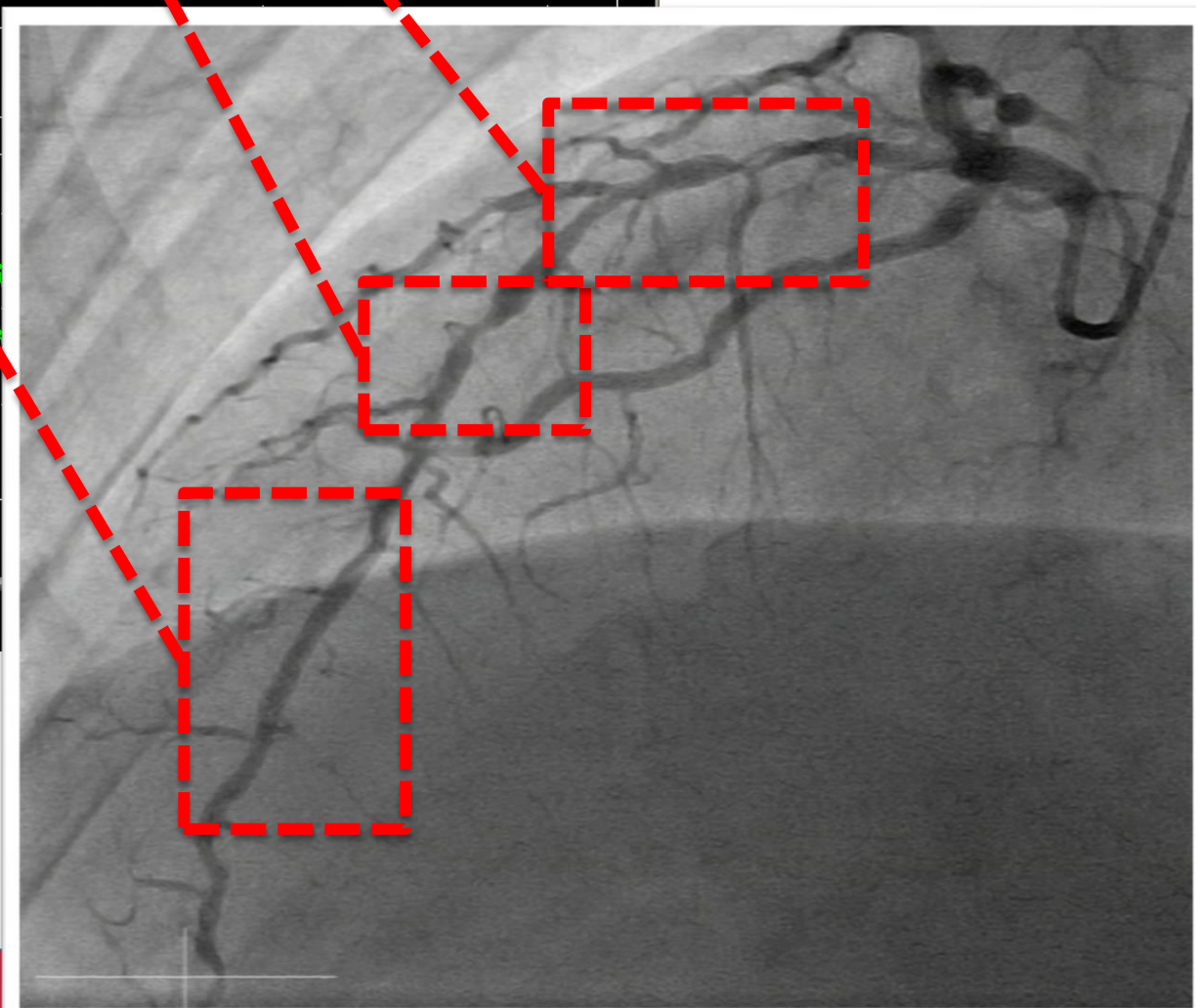
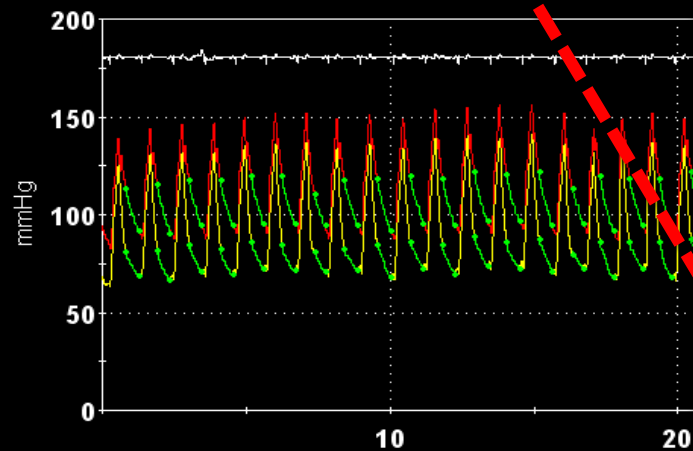
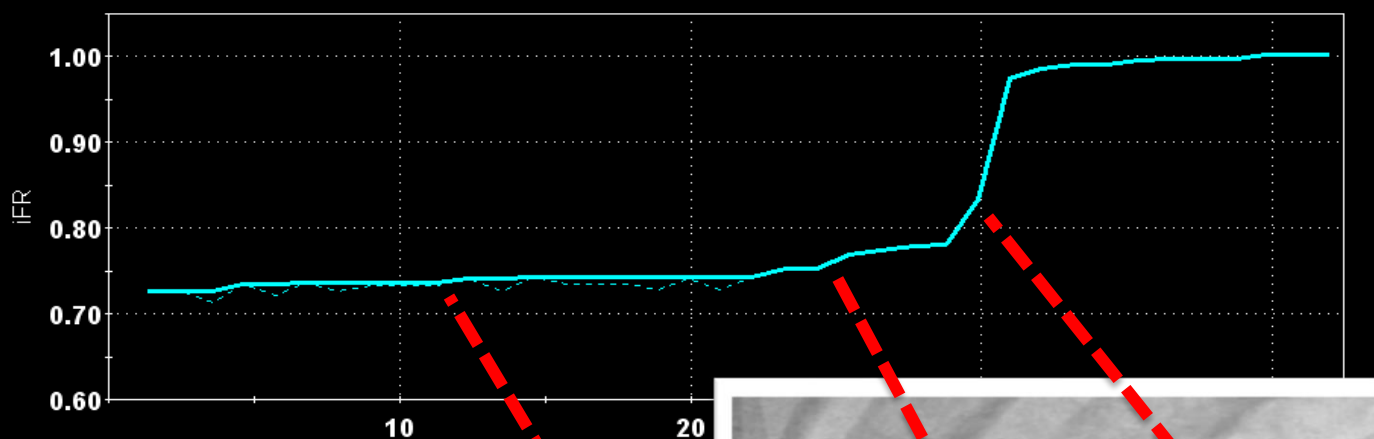


0:42



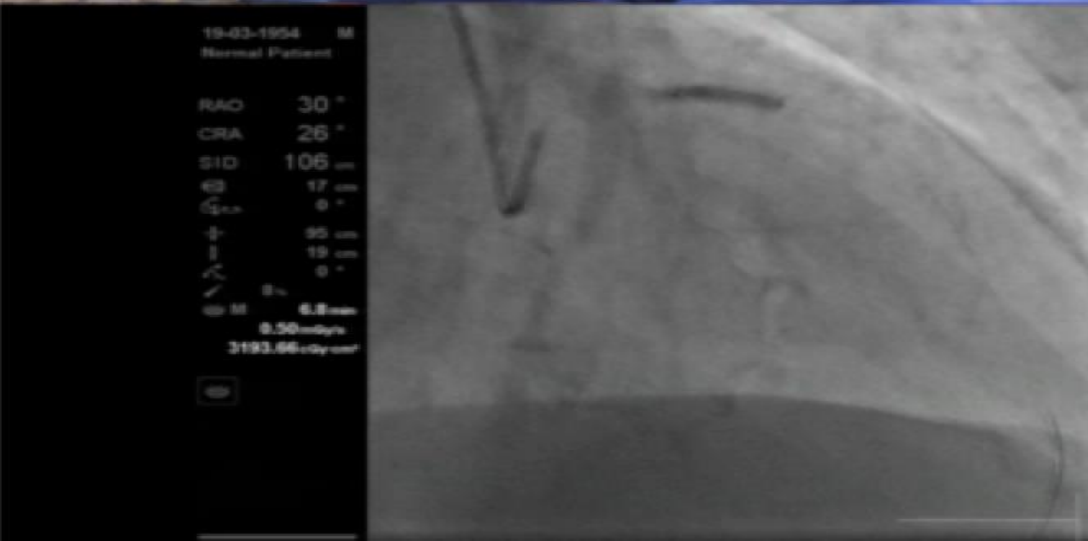
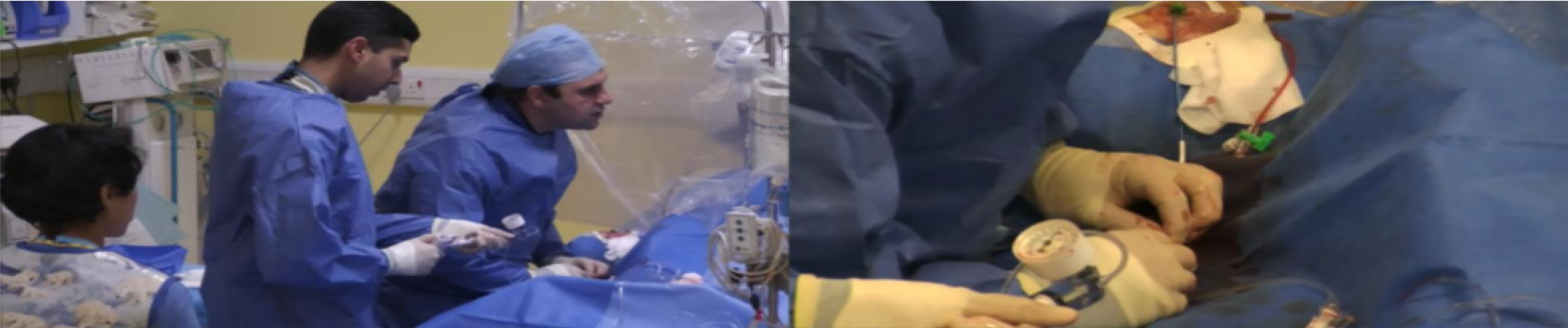
iFR<sup>®</sup>  
Distal  
**0.73**

List of Runs	iFR	FFR
16:28:02	0.72	
16:28:34	0.73	
Pullback		
16:30:13	0.73	
Pullback		
16:31:07	0.75	
Pullback		

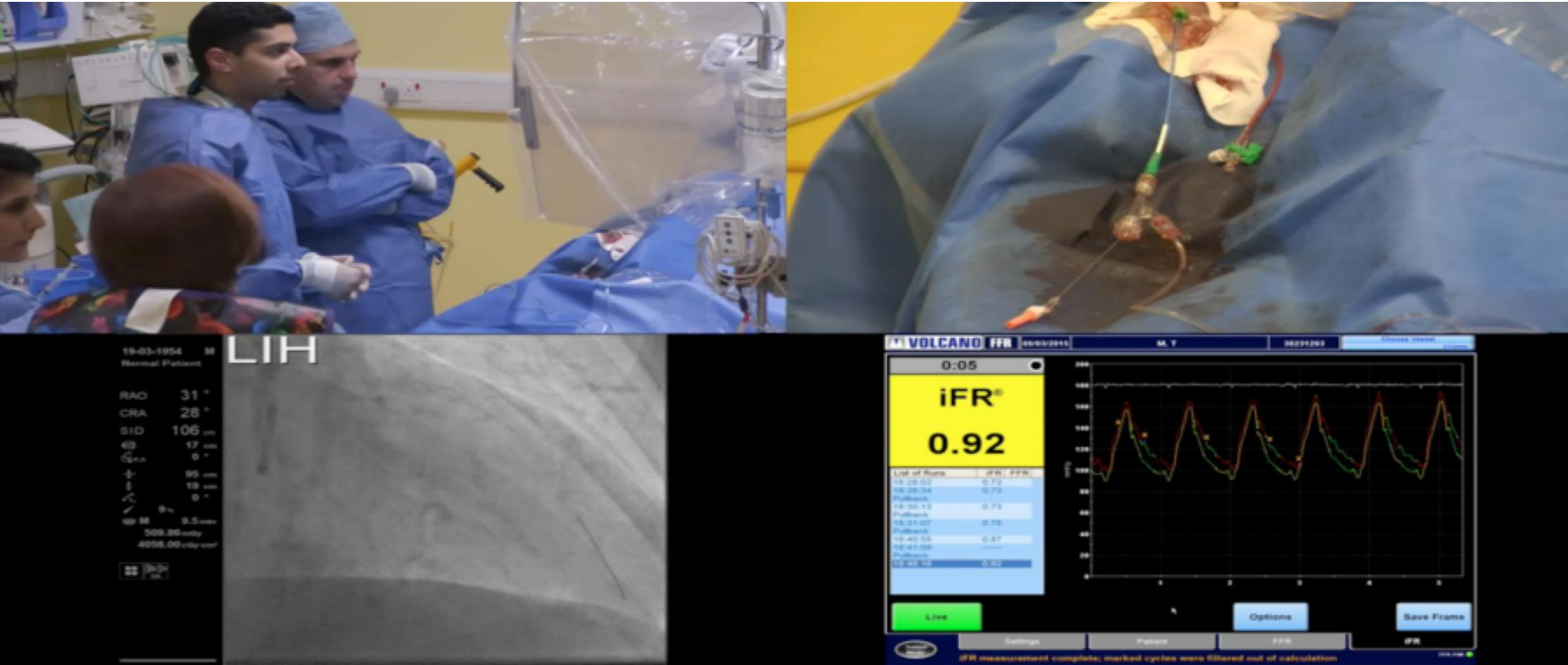




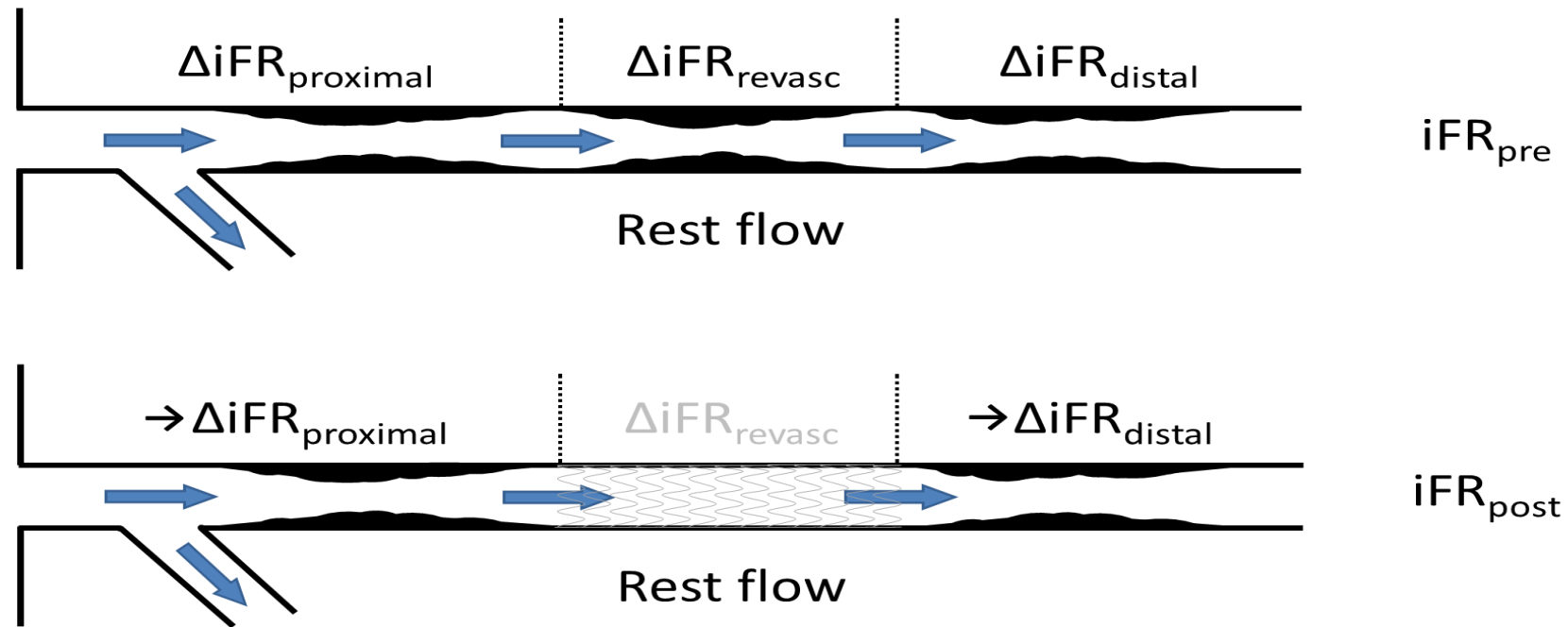
# Performing PCI to proximal lesion



# Performing post PCI assessment



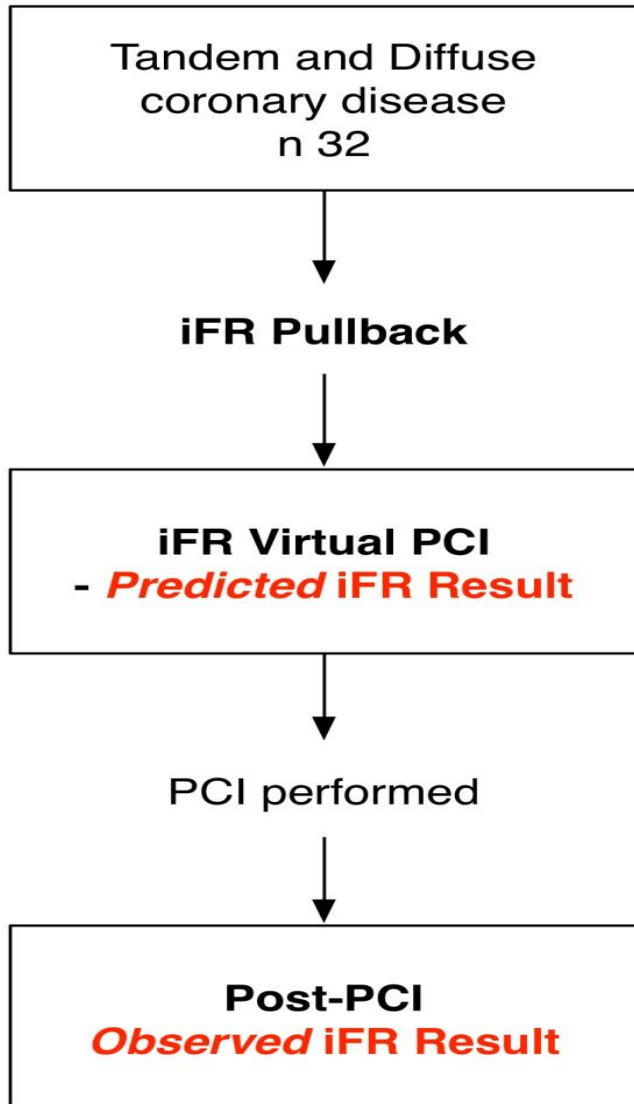
# iFR gradient at each site is stable.



The error of Predicted iFR without correction:  $2 \pm 1\%$

Nijjer et al. 2014. JACC Cardiovasc Interv

# iFR PULLBACK STUDY



Pre-PCI iFR:  $0.78 \pm 0.03$

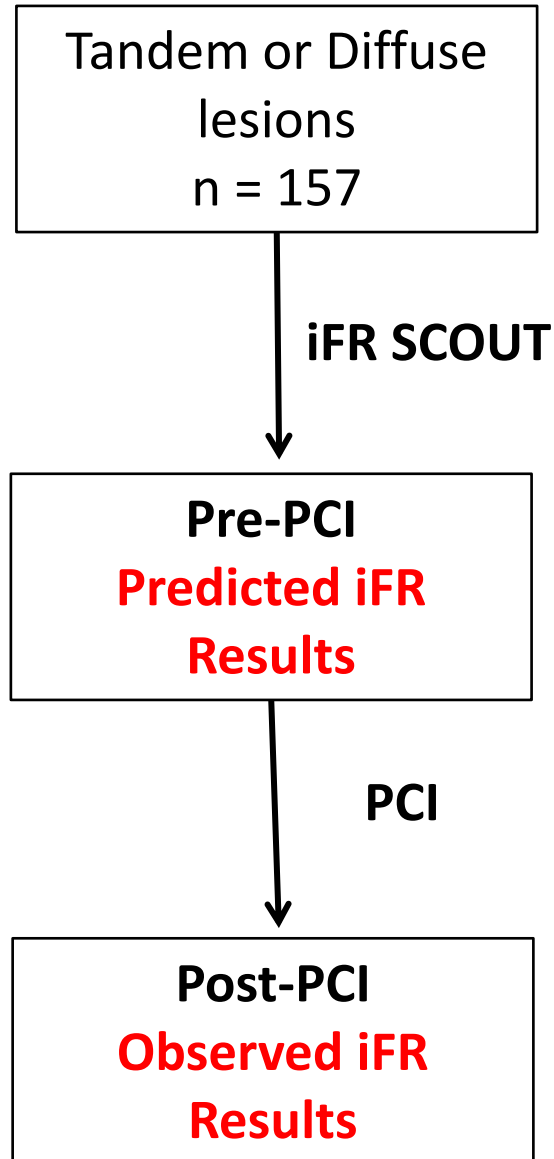
**Predicted iFR:  $0.94 \pm 0.01$**

**Observed iFR:  $0.93 \pm 0.03$**

Non-significant (p=0.48)

*Nijjer et al. 2014 JACC CV intv*

# MULTICENTRE iFR SCOUT REGISTRY



Pre-PCI iFR:  $0.80 \pm 0.15$

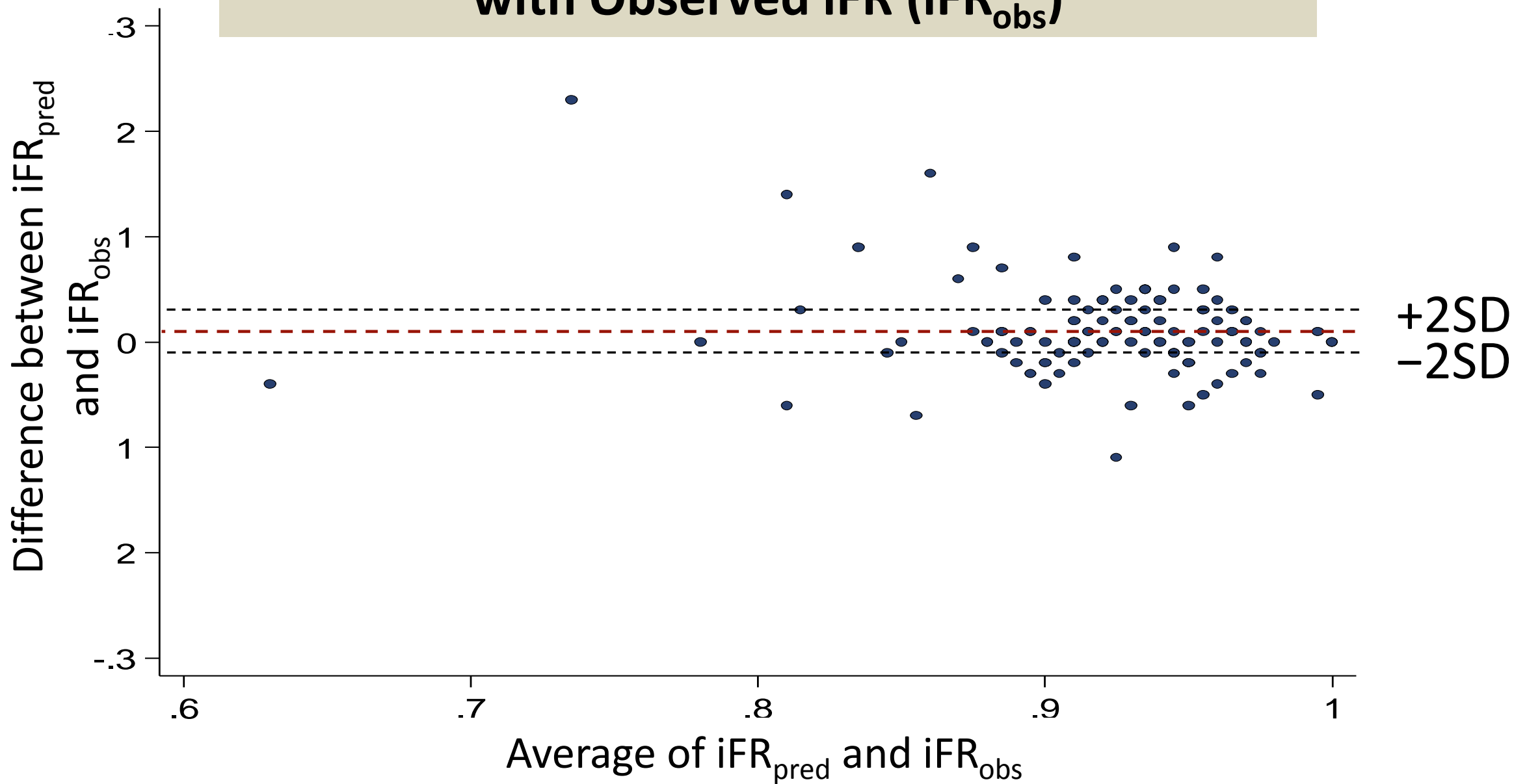
**Predicted iFR:  $0.93 \pm 0.05$**

**Observed iFR:  $0.92 \pm 0.06$**

Mean difference: 0.01  
[95% CI, 0-0.02]

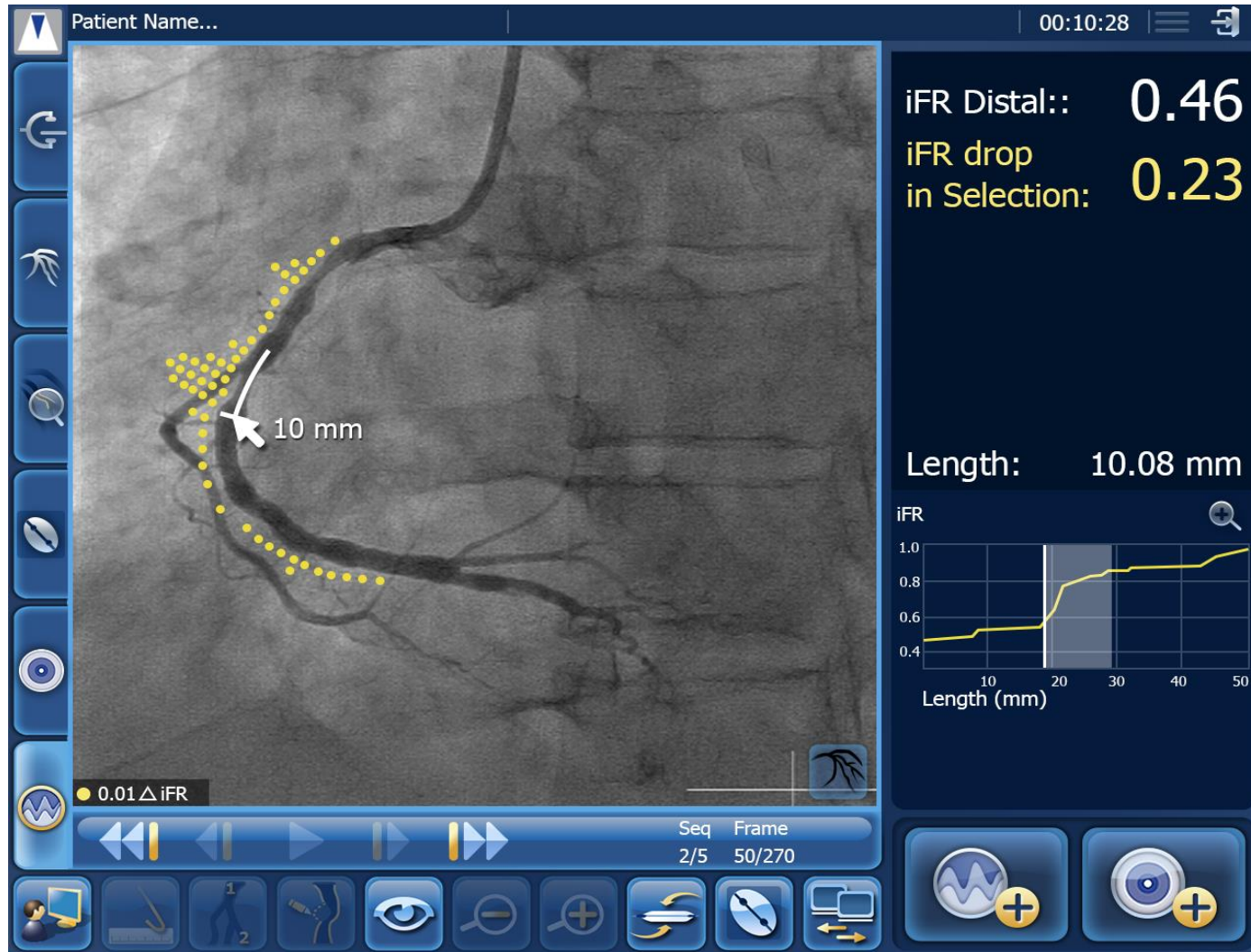
*Multicentre iFR Pullback Registry 2015-2016*

# Agreement of Predicted post-PCI iFR ( $iFR_{pred}$ ) with Observed iFR ( $iFR_{obs}$ )



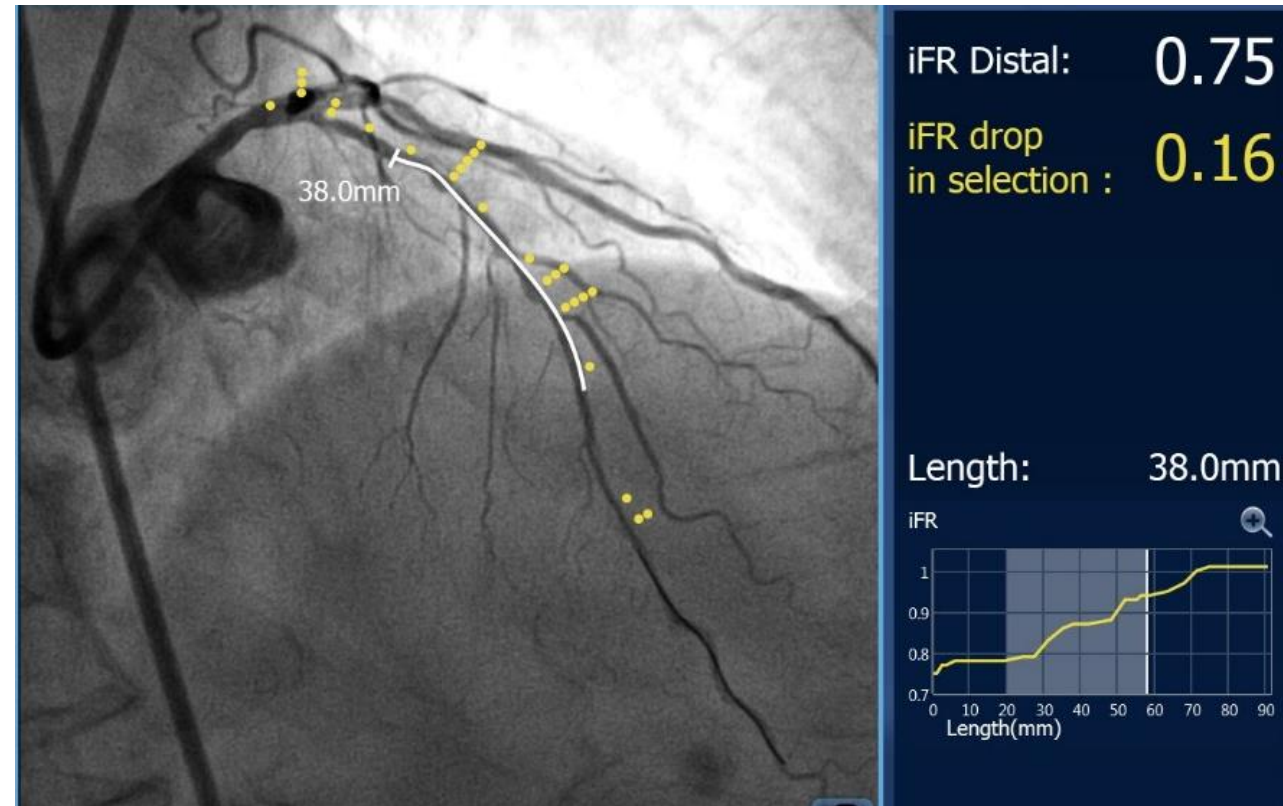
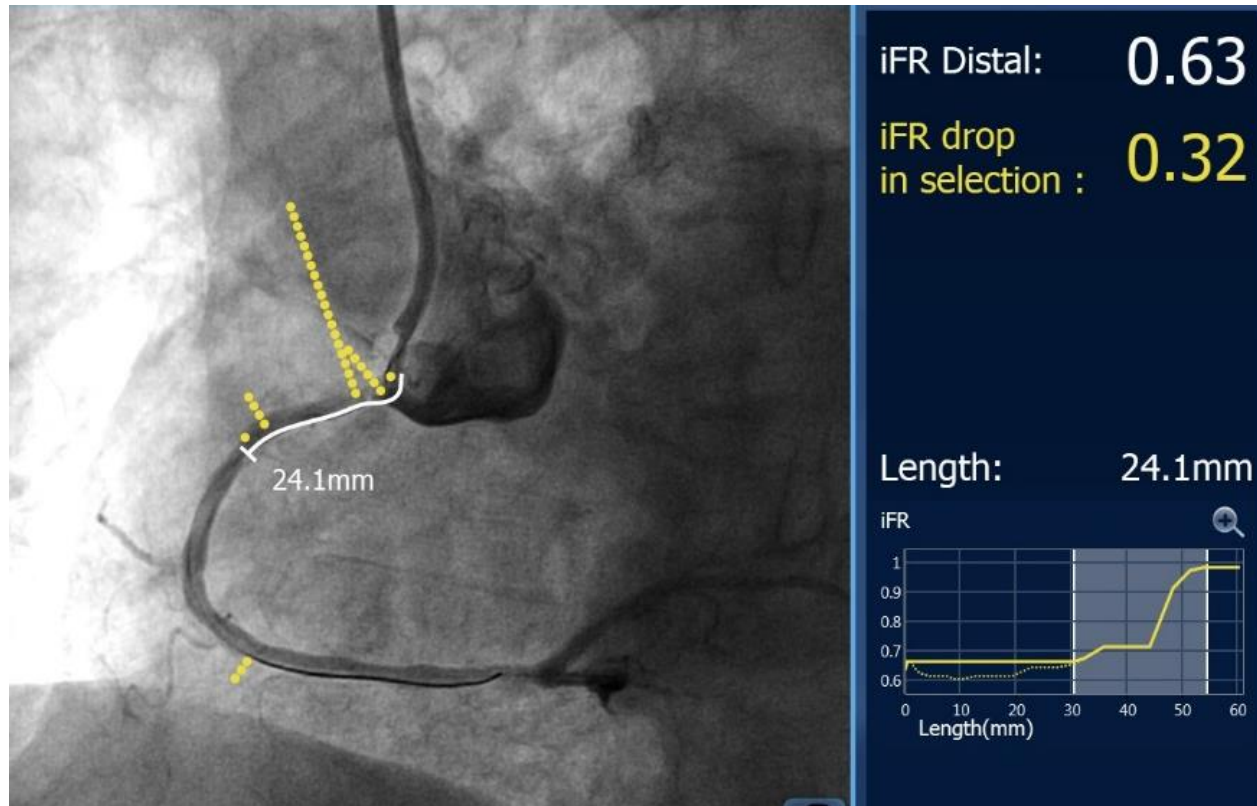


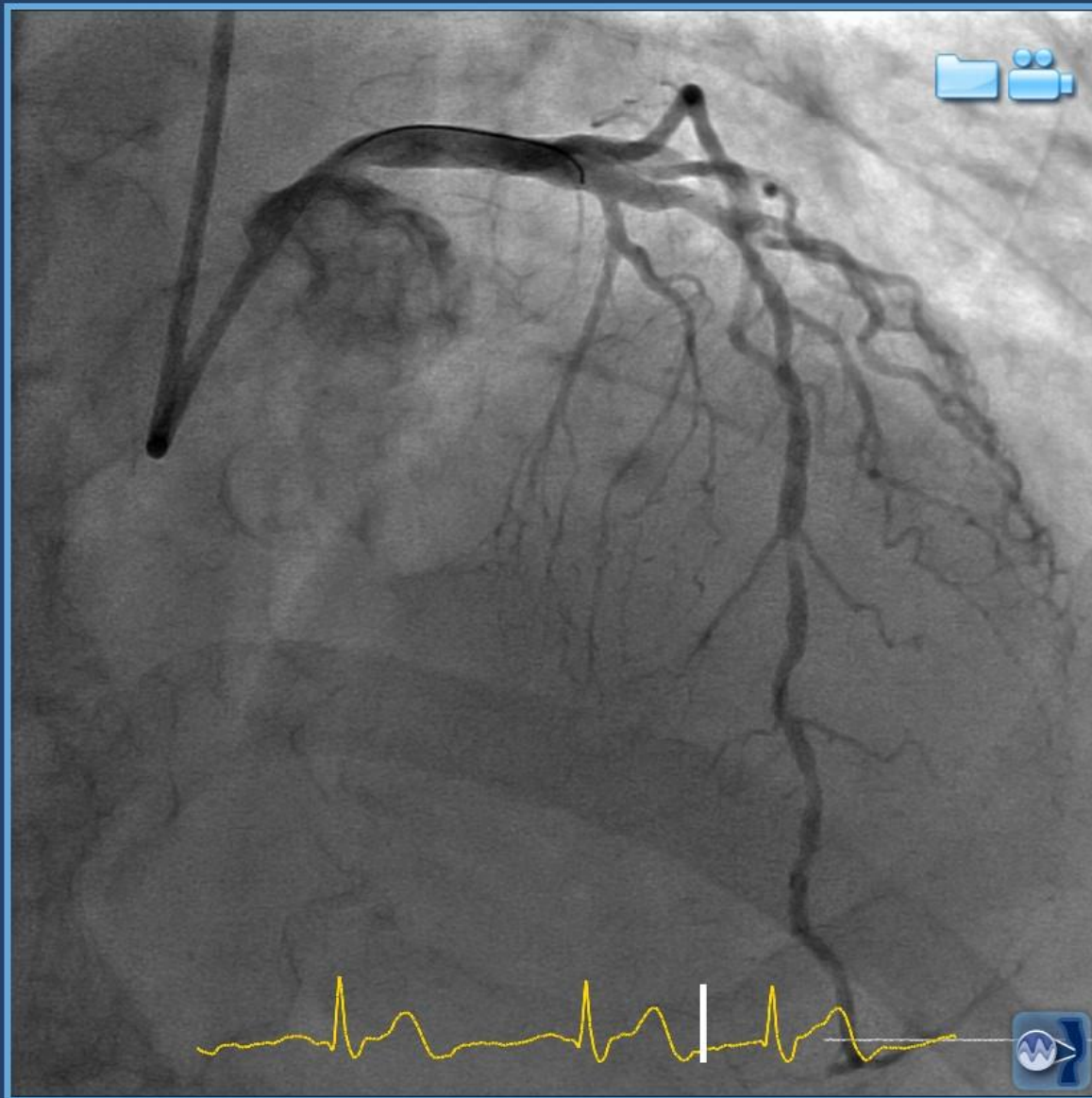
# iFR Co-Registration with Angiography



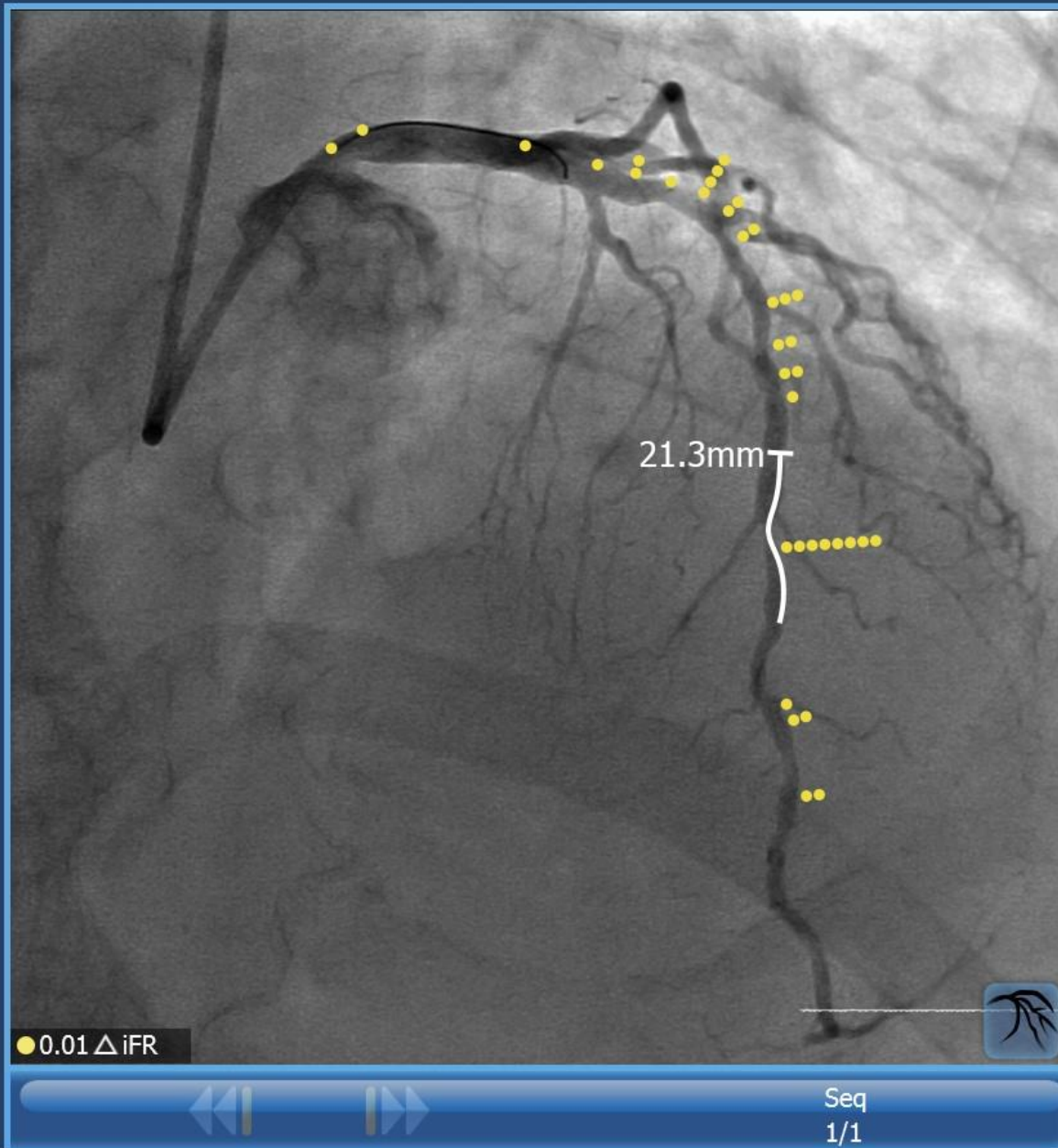
- Pullback of wire under live Fluoro screening
- Automatic 3D tracking of wire tip to co-register pressure drop
- Plot locations of pressure loss onto angiogram in an interactive manner

# Focal vs Diffuse disease





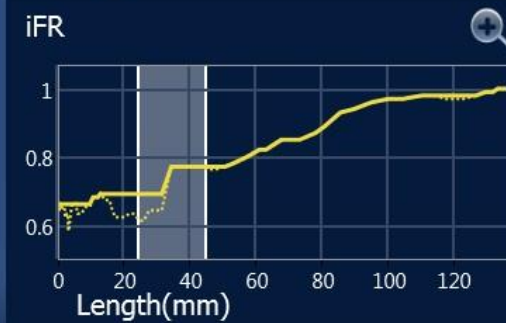




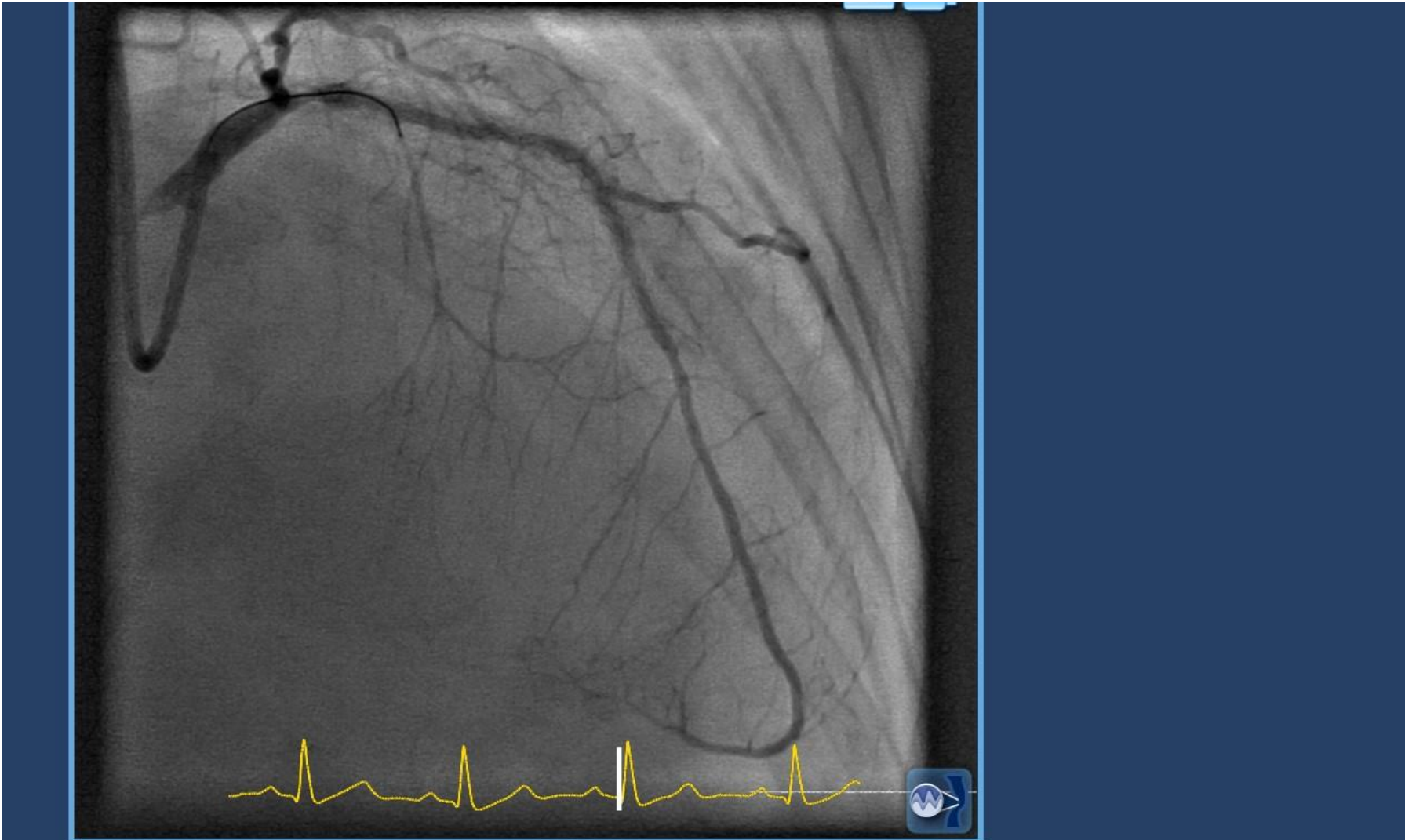
iFR Distal: 0.64

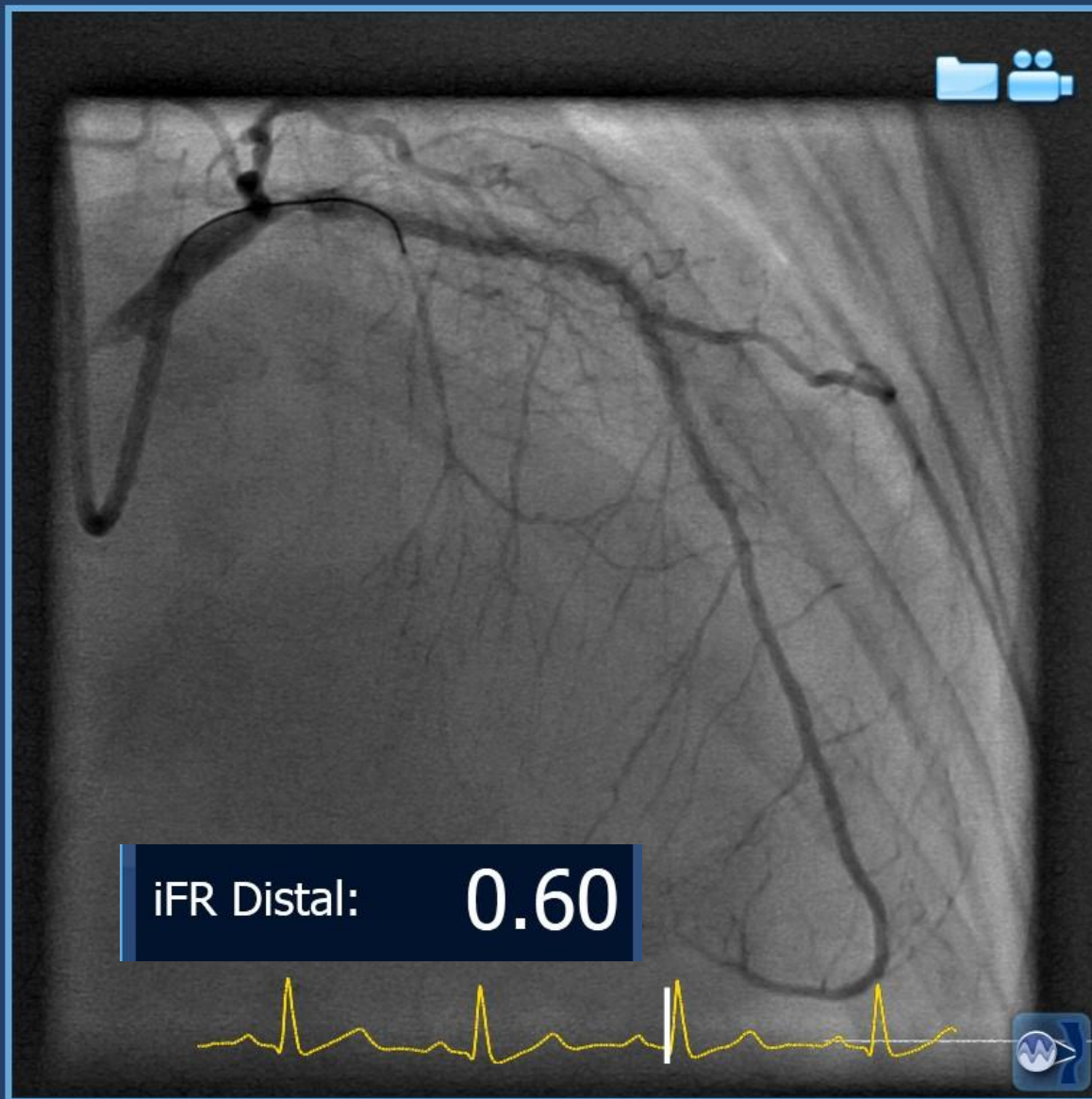
iFR drop  
in selection : 0.08

Length: 21.3mm



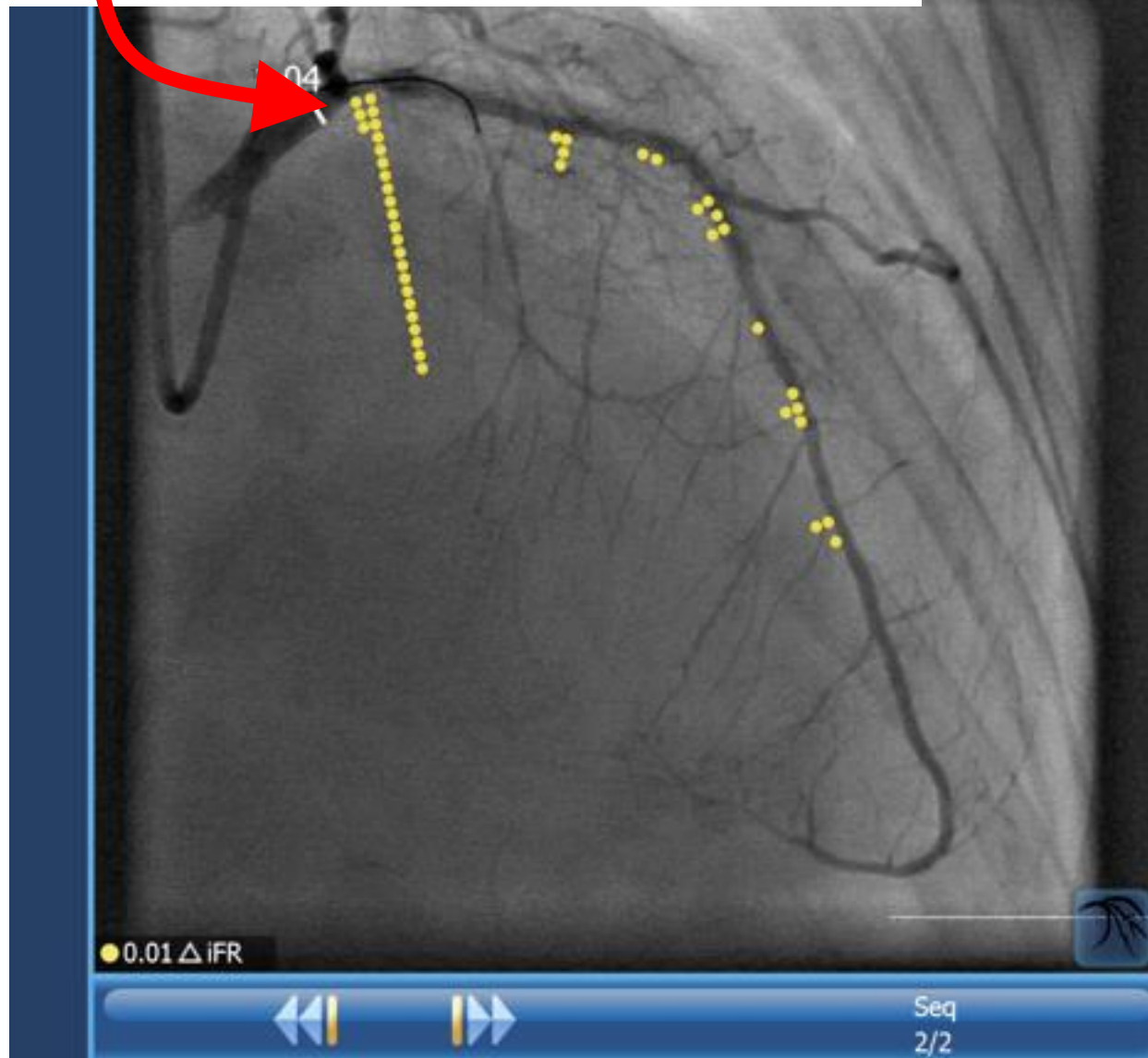
# Is there a focal LAD lesion to treat?



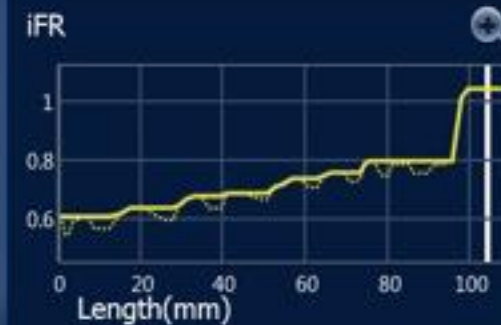




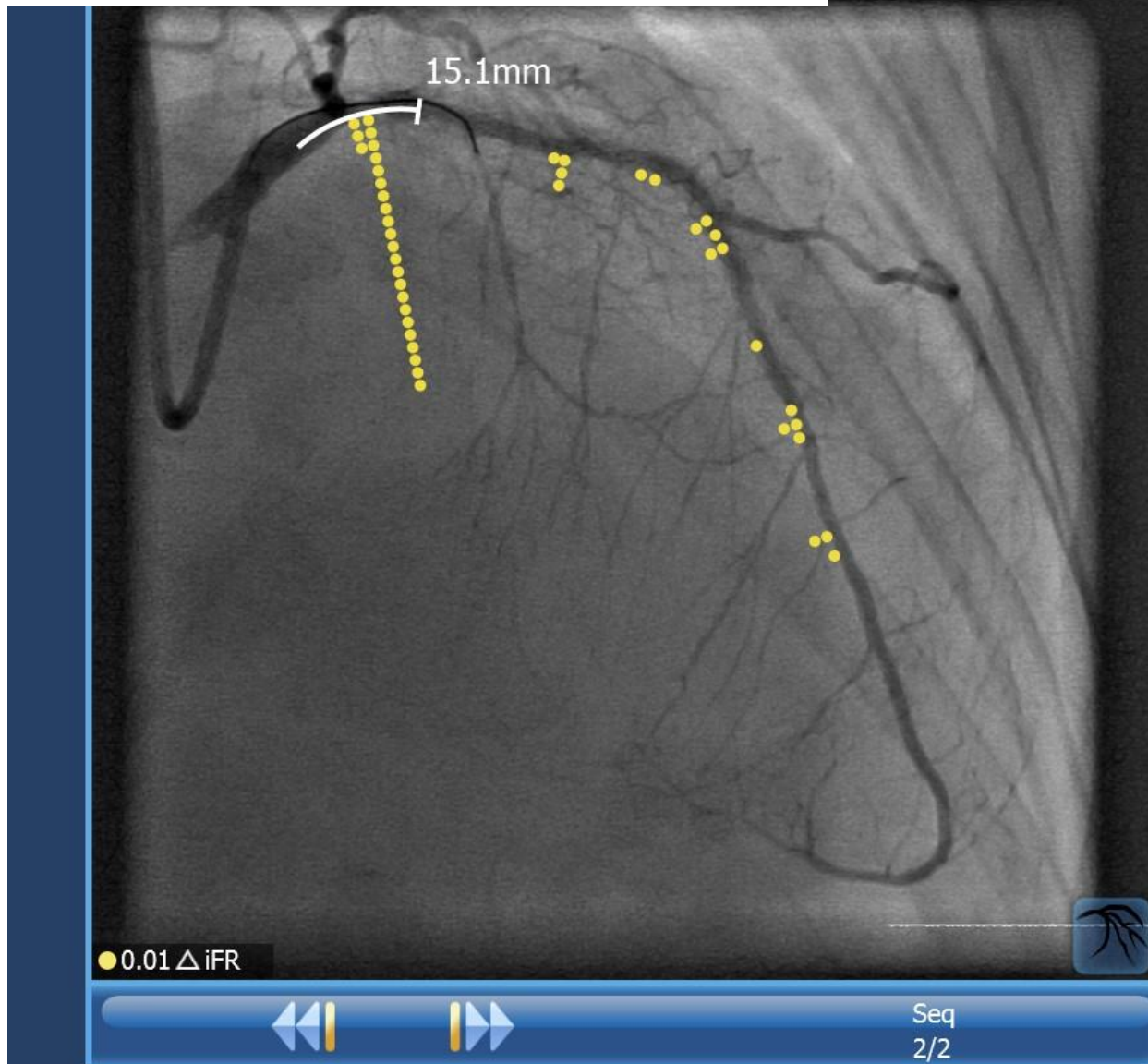
# Treat focal stenosis



iFR Distal: 0.60



# Calibrated length

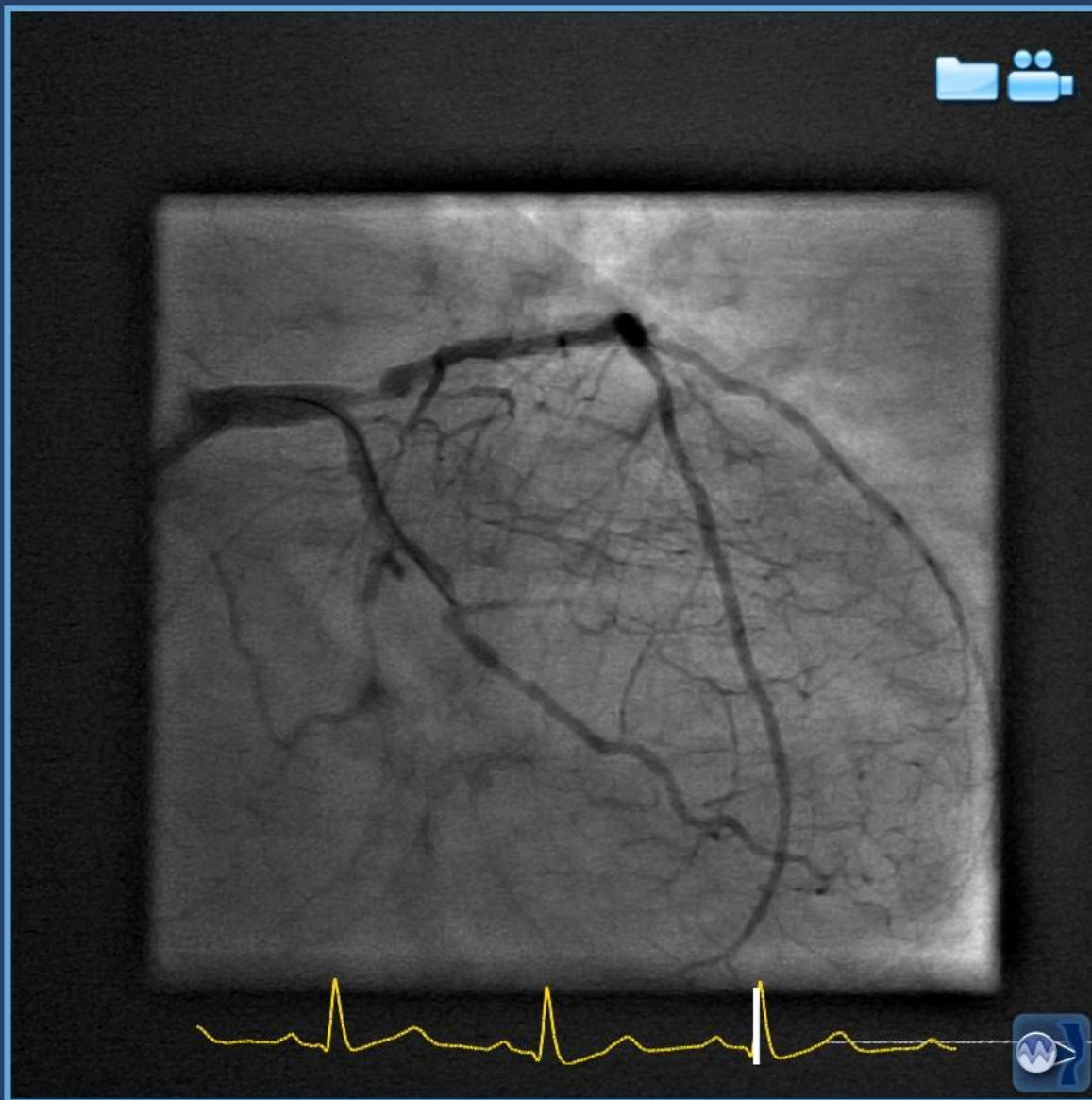


iFR Distal: 0.60

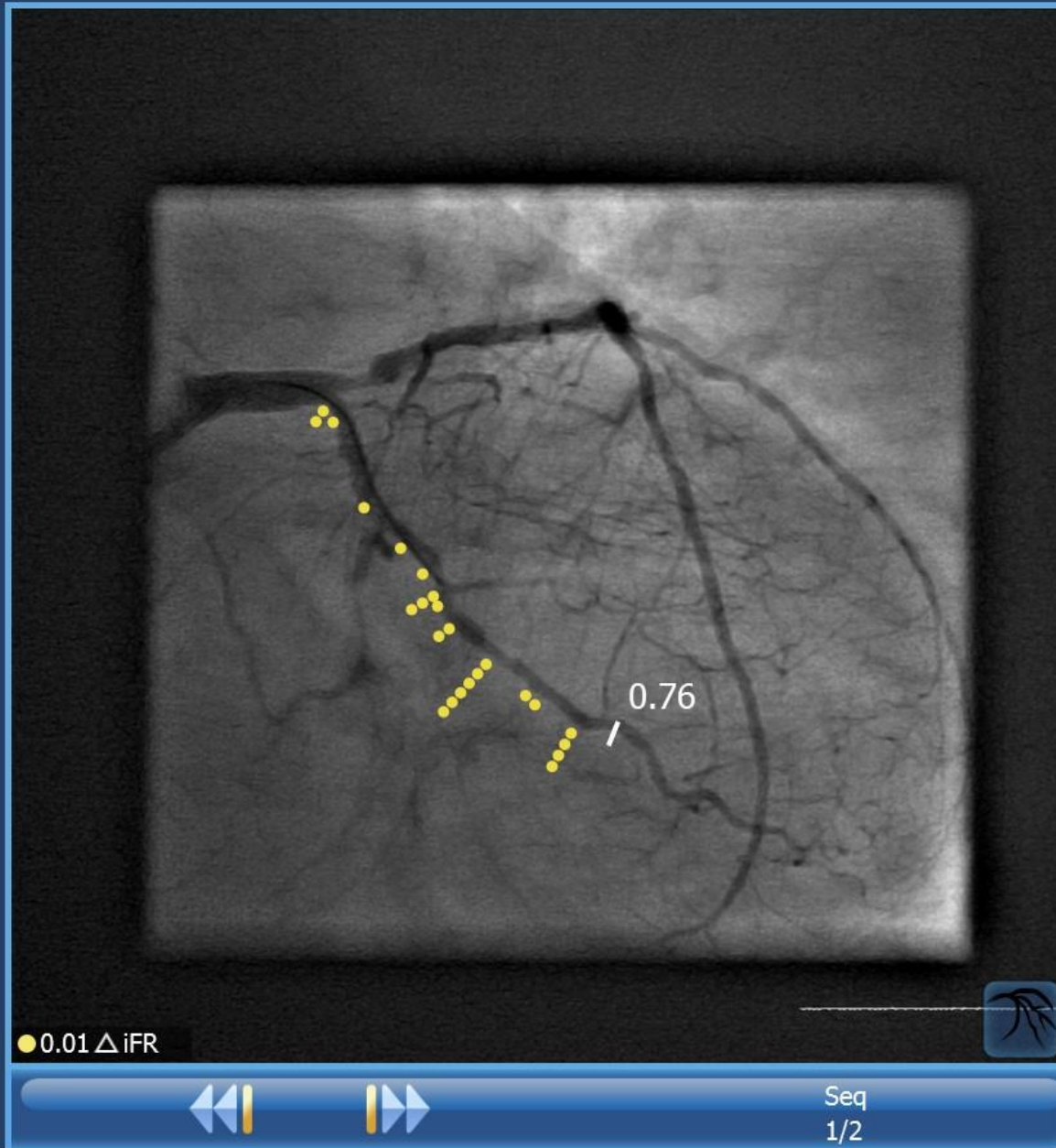
iFR drop  
in selection : 0.25

Length: 15.1mm



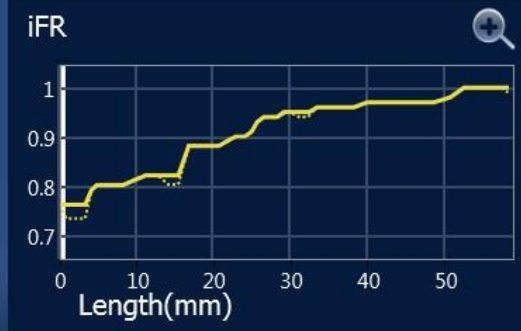


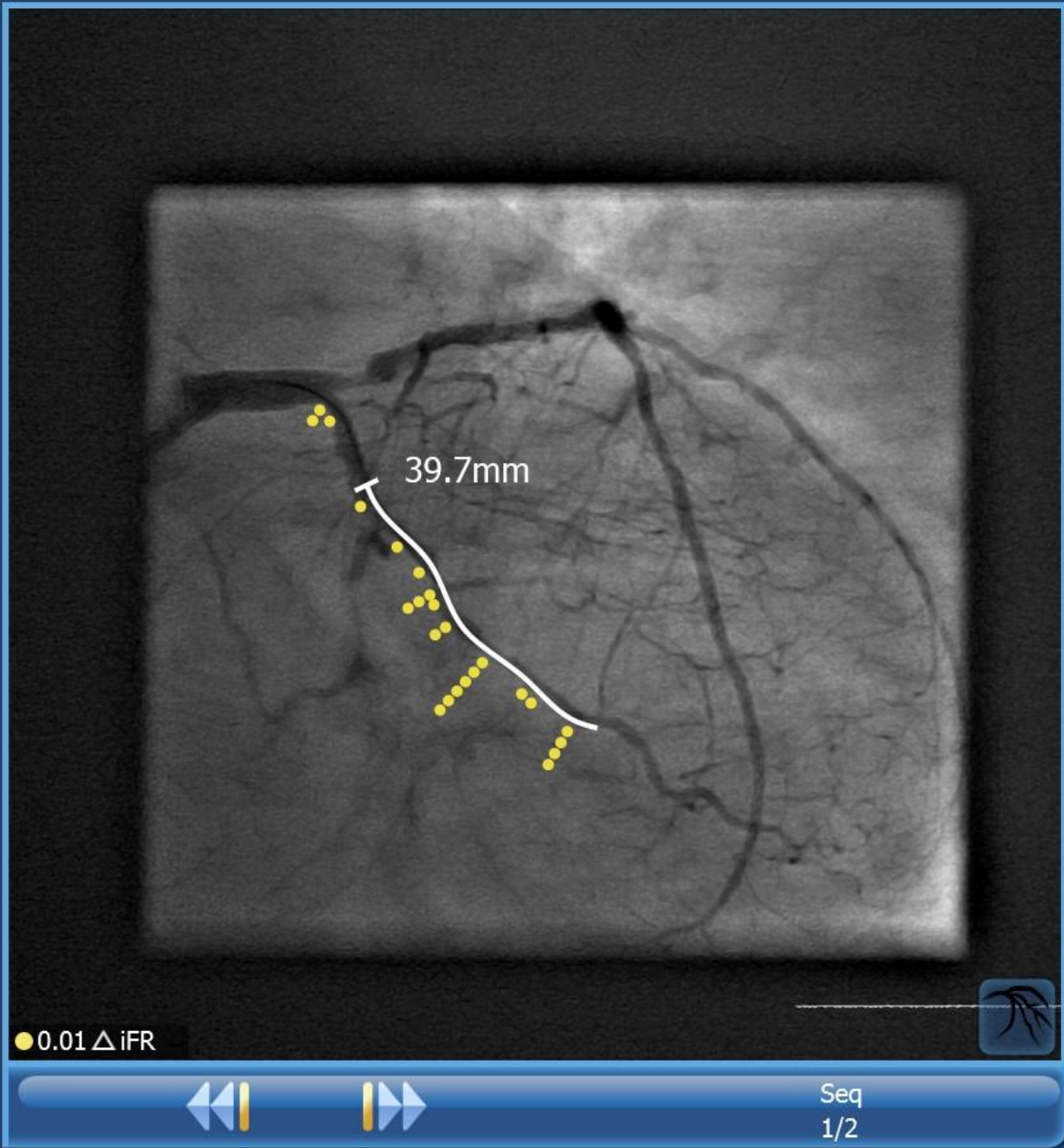




iFR Distal: 0.76

iFR at Cursor: 0.76

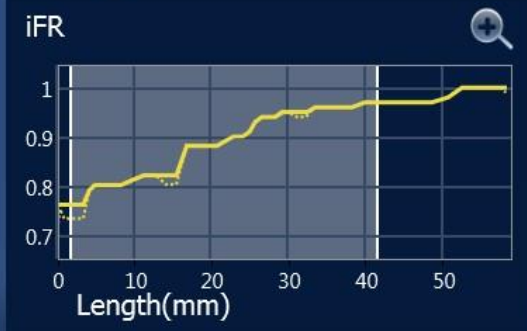




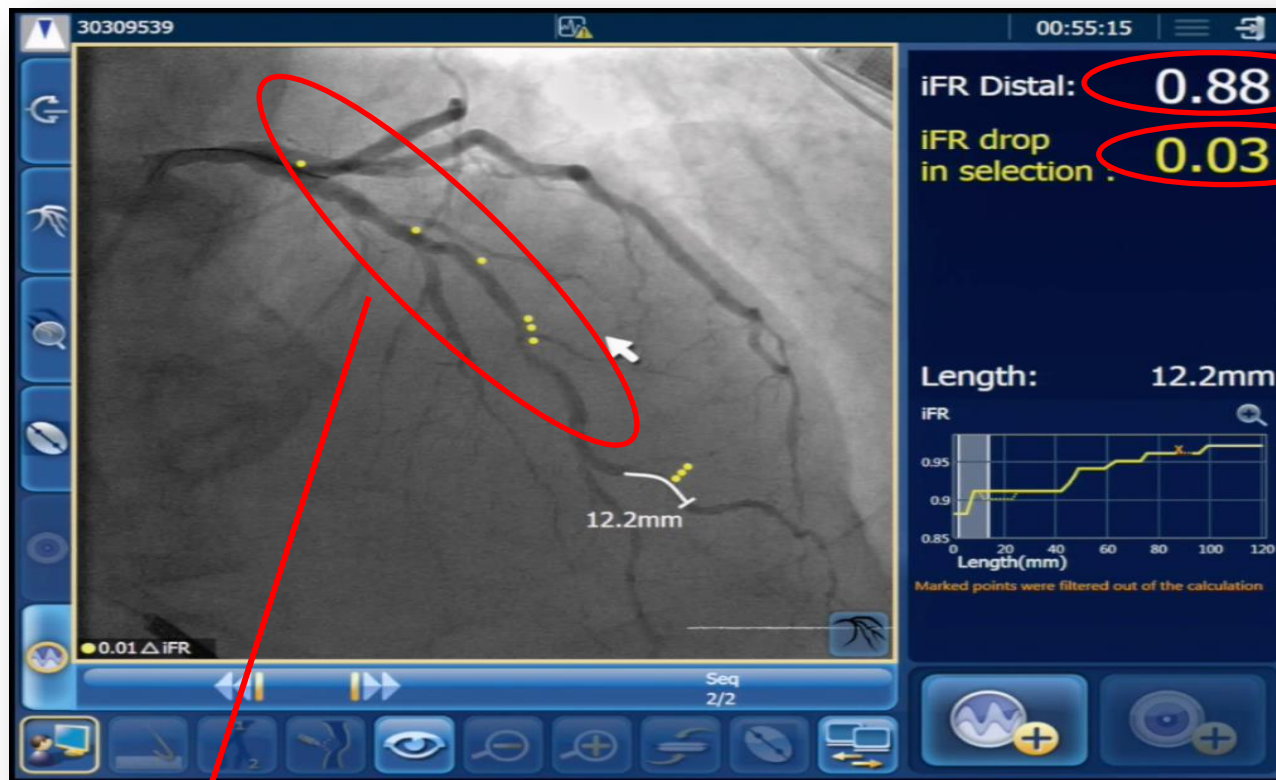
iFR Distal: 0.76

iFR drop  
in selection : 0.21

Length: 39.7mm



# Imaging co-registration



1 Is the vessel physiologically significant?

3 Can we predict the benefit from PCI?

2 Is the disease diffuse or focal



# Conclusions

1. Resting physiology can be co-registered with angiography to help guide coronary intervention
2. Co-Registration can help simplify PCI
3. Post-PCI physiology can be predicted before PCI is done

**Coronary**

Imperial College London NHS Trust

London, UK

## CASE IMAGING (angiography)





# LIH



• To allow Co-Registration,  
▲ Avoid changing the zoom, moving the table and C-Arm position until pullback is completed

**VOLCANO FFR**

14:34:19

IFR\* 0.62

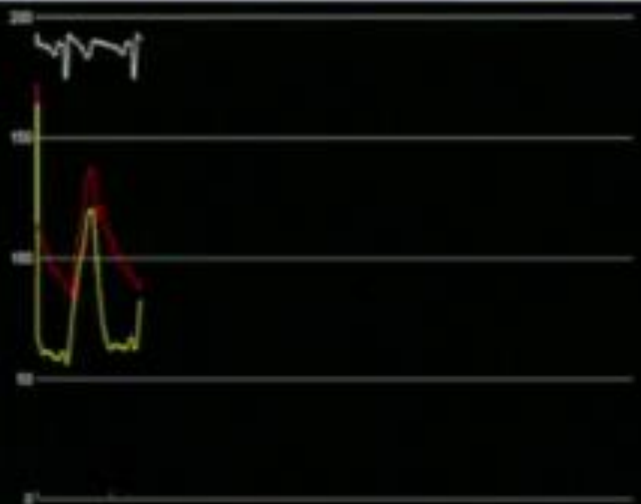
Pd/Pa

Pa

Pd

HR 65

Time	IFR	FFR
14:31:00	1.00	
14:32:00	0.91	
14:34:00	0.45	



Freeze

Normalize

Pullback

Record

Options

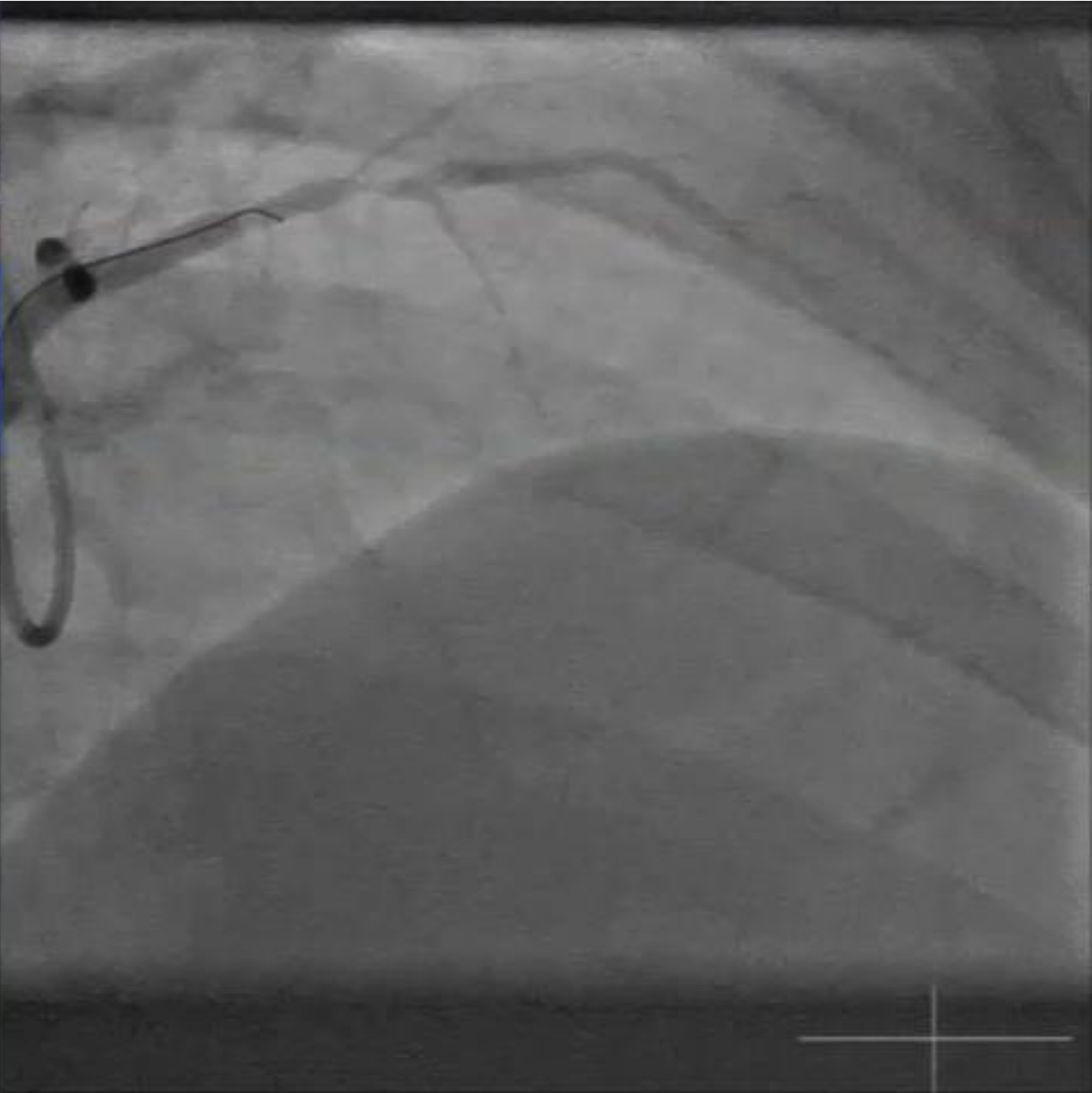
Save Frame

Settings

FFR

FFR

IFR



### Pathway Indication

Mark the most proximal visible section of the GC

**Note:** The selected Angiogram should be at the same zoom, C-Arm and table position as the performed pullback. Otherwise, perform a new Angiogram







To allow Co-Registration,  
⚠️ Avoid changing the zoom, moving the table and C-Arm position until pullback is completed

iFR Distal: 0.68  
iFR at Cursor: 0.73

0.73

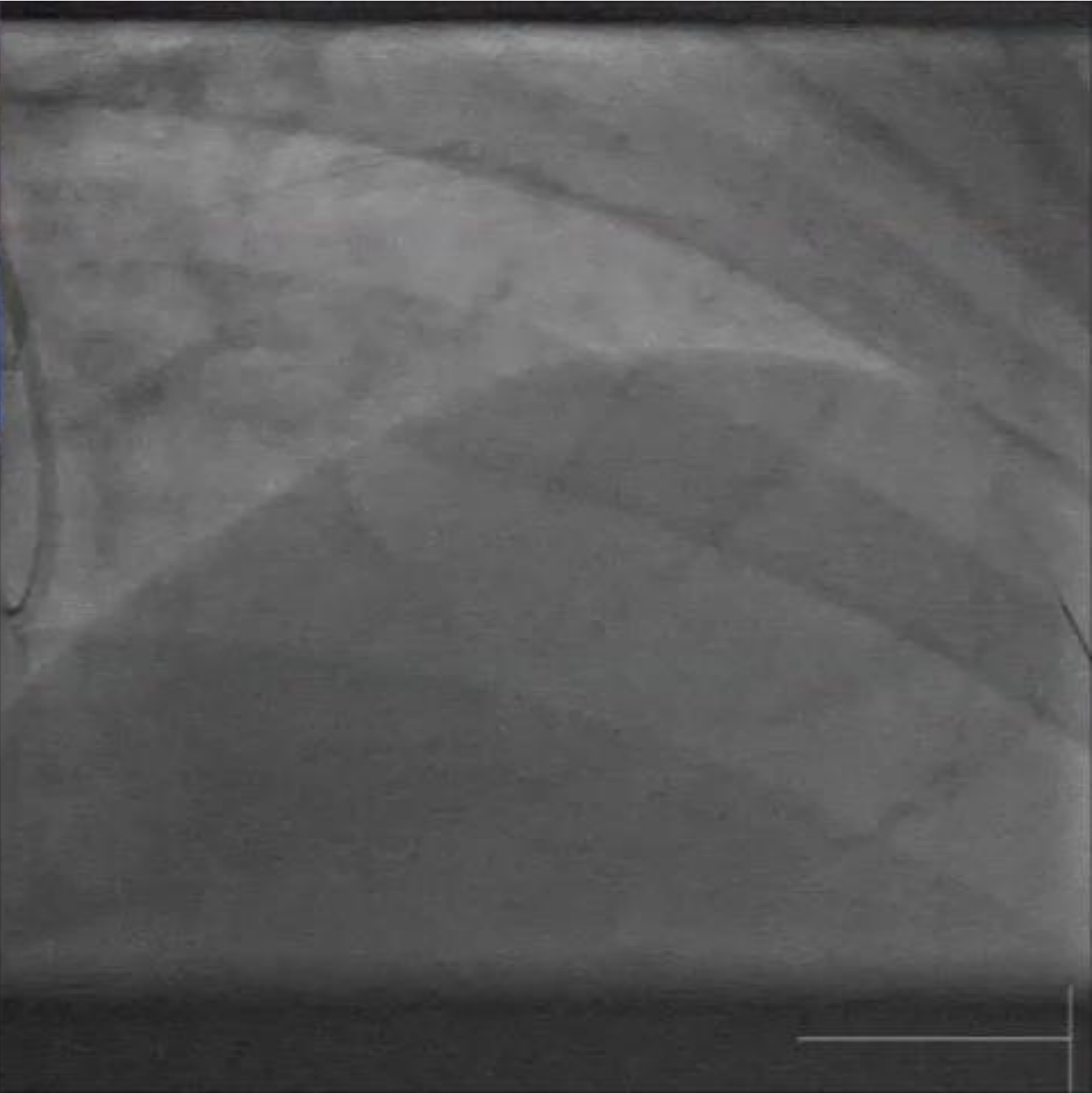
iFR

Length(mm)

0.01  $\Delta$  iFR

Seq  
1/1





02234567 01-01-12

Enhanced Image

Reference

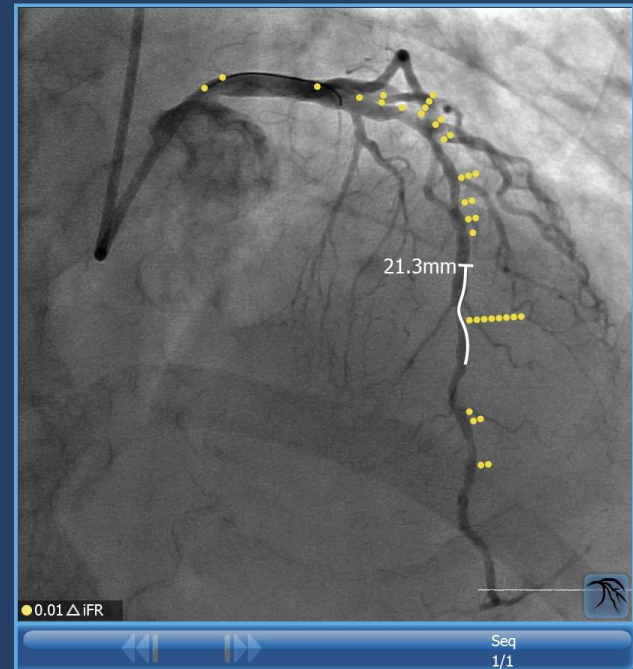
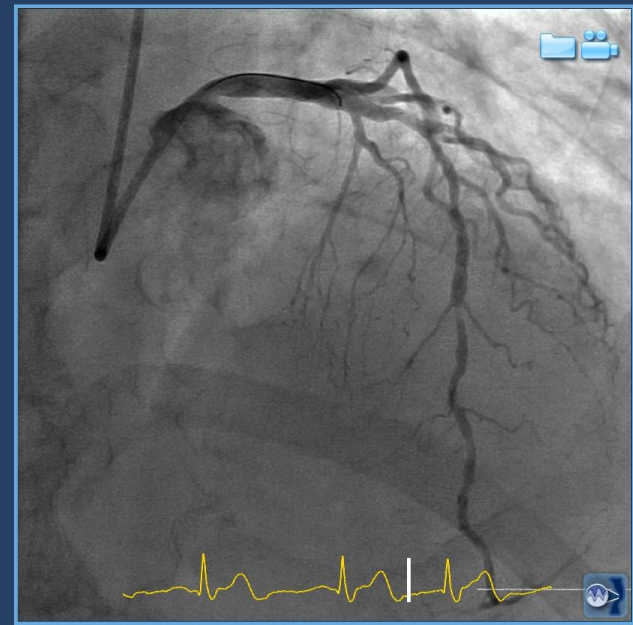
49 / 11

The interface includes a toolbar with various icons for navigation and image manipulation, such as zoom, pan, and window management. The 'Enhanced Image' panel shows a processed version of the surgical site, highlighting specific features. The 'Reference' panel shows the original image with a yellow circle highlighting a specific area of interest.

- **Angiography**
- **Physiology**
- **Pullback planning**
- **PCI**
- **IVUS optimisation**



- **Angiography**
- **Physiology**
- **Pullback planning**
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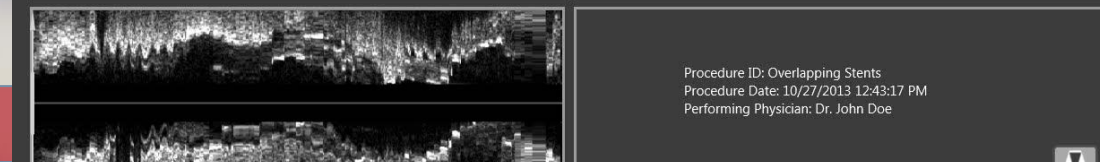
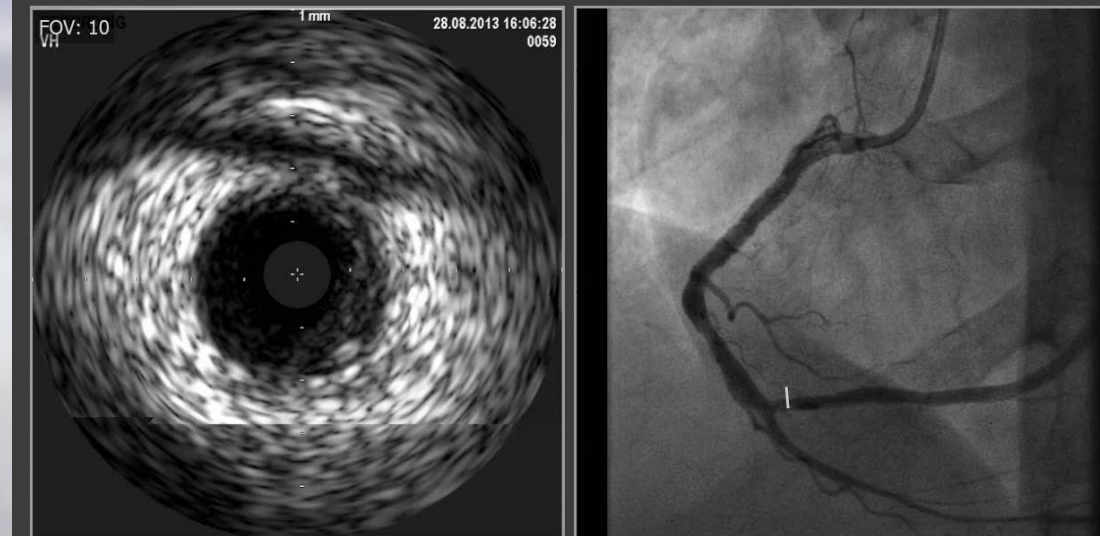




- Angiography
- Physiology
- Pullback planning
- PCI
- IVUS optimisation



- Angiography
- Physiology
- Pullback planning
- PCI
- **IVUS optimisation**





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