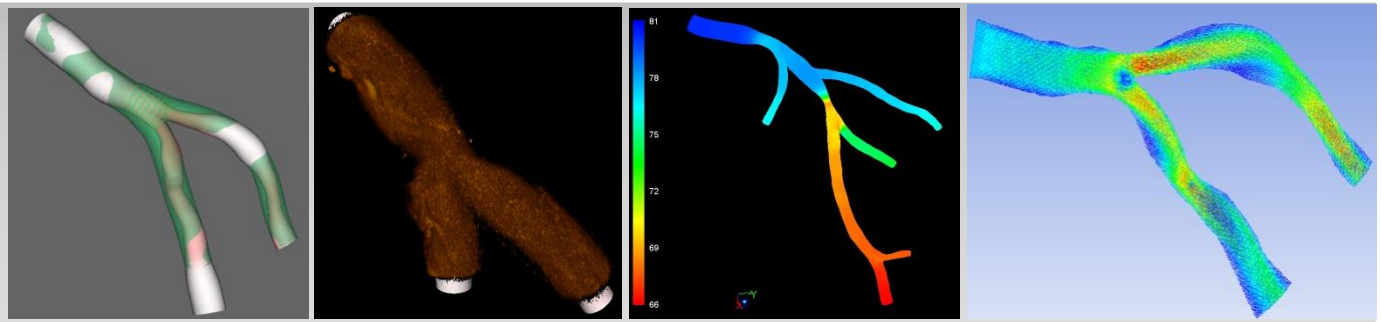

Medis 3D QCA and Its Applications

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Department of Radiology

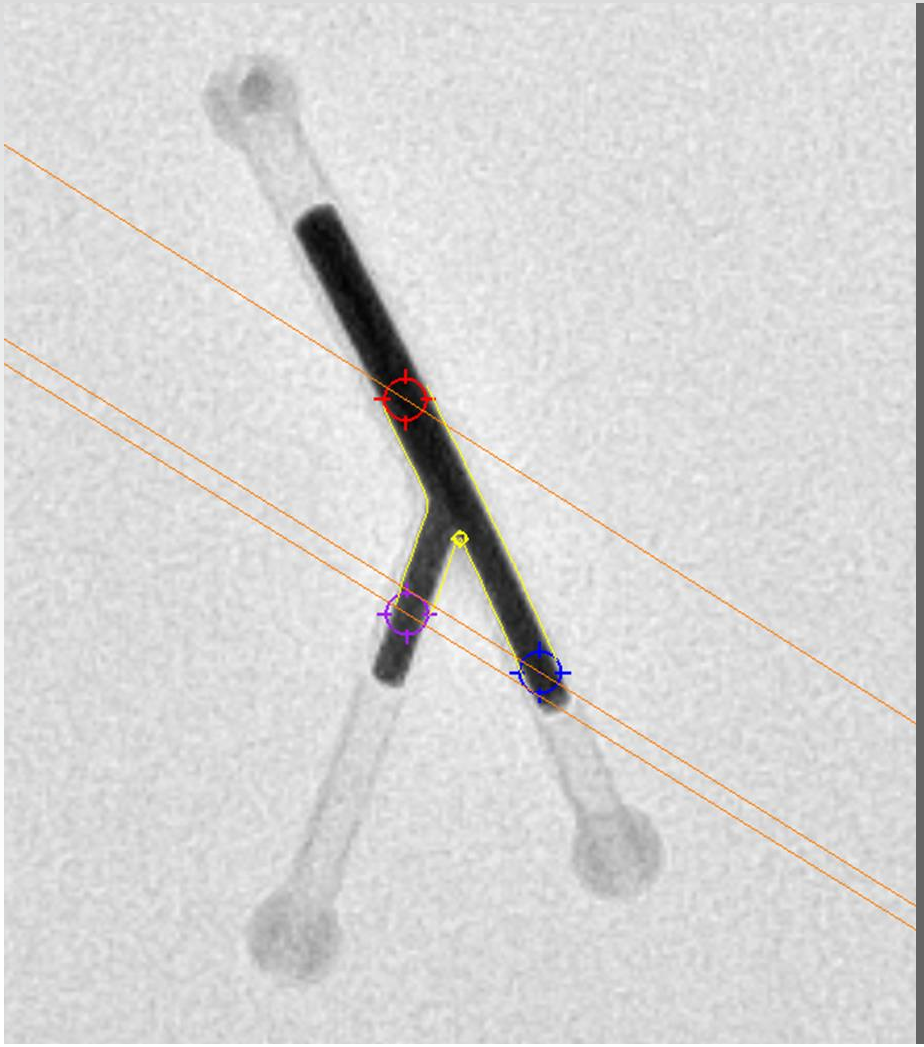
Leiden University Medical Center

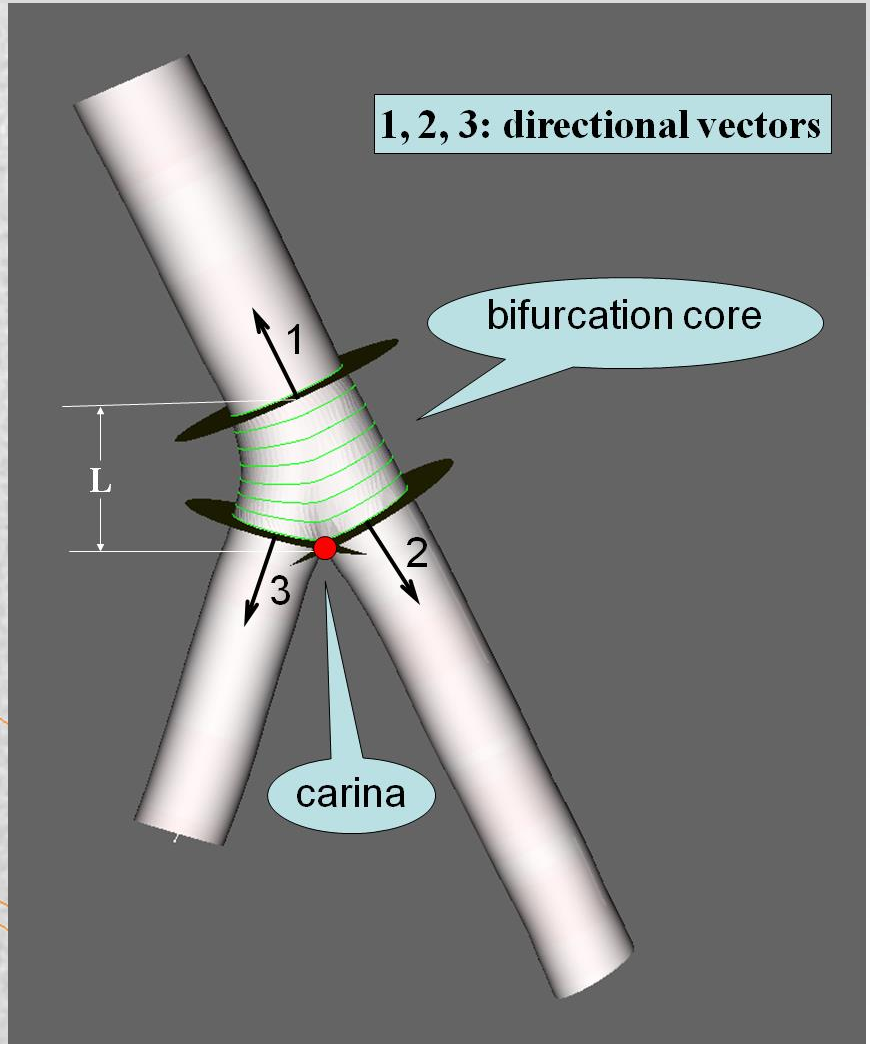
&

Applied Research

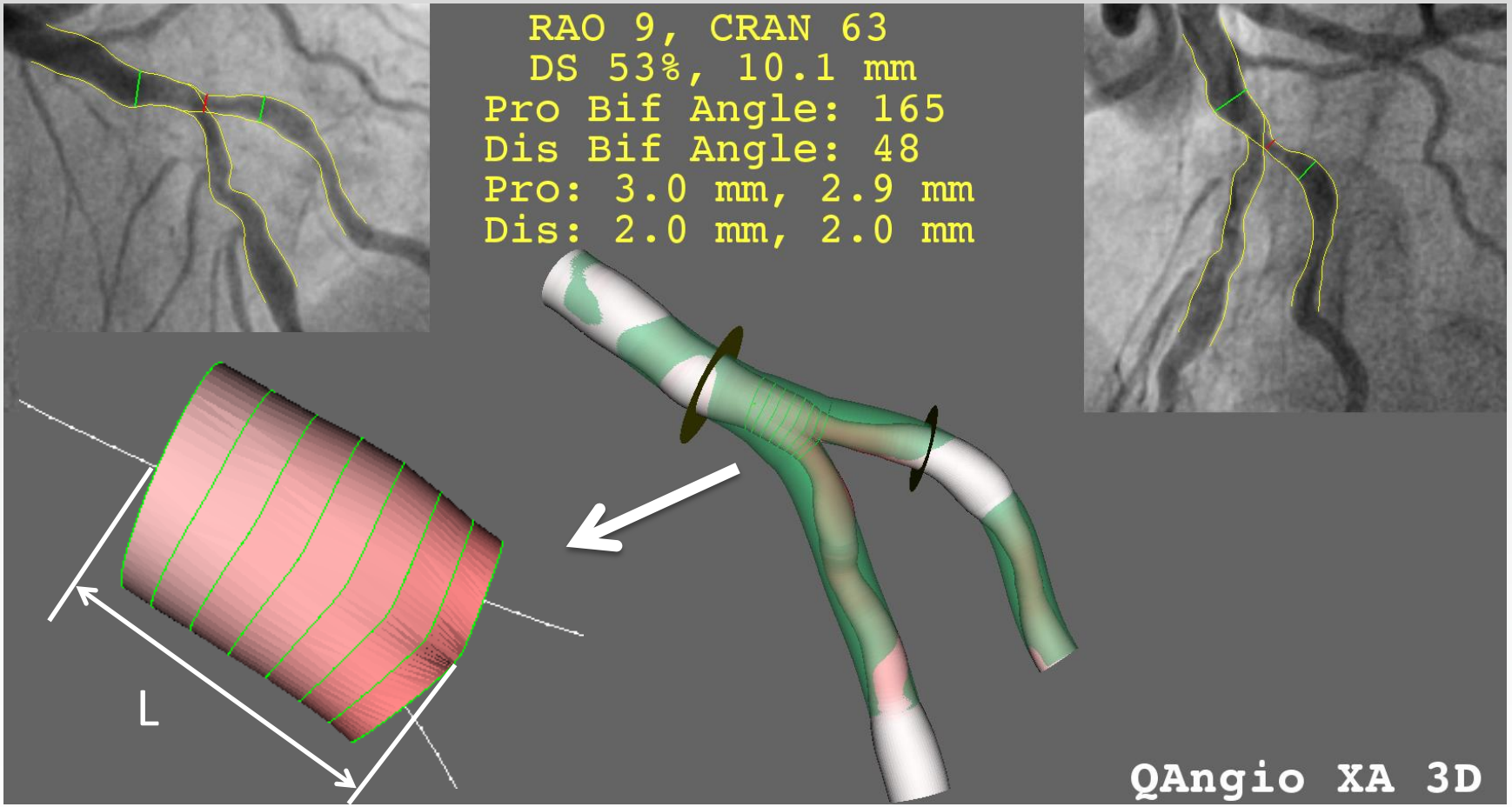
Medis medical imaging systems bv

3D bifurcation model





3D bifurcation model

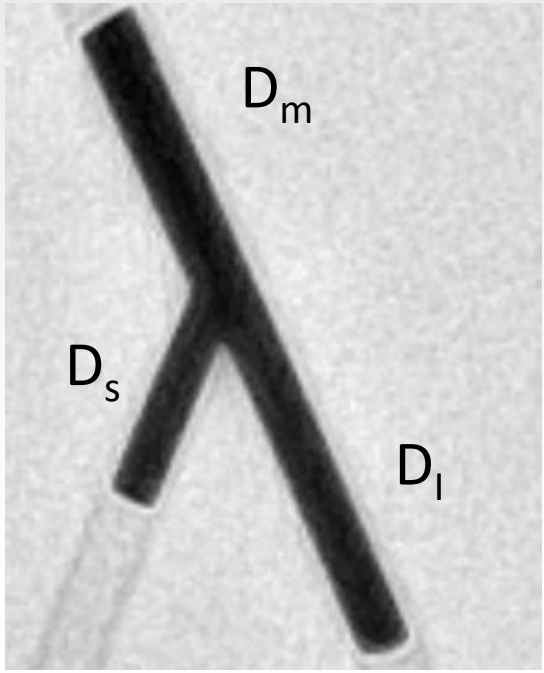


The Size of bifurcation core (L) is independent from the extent of the disease at the bifurcation!

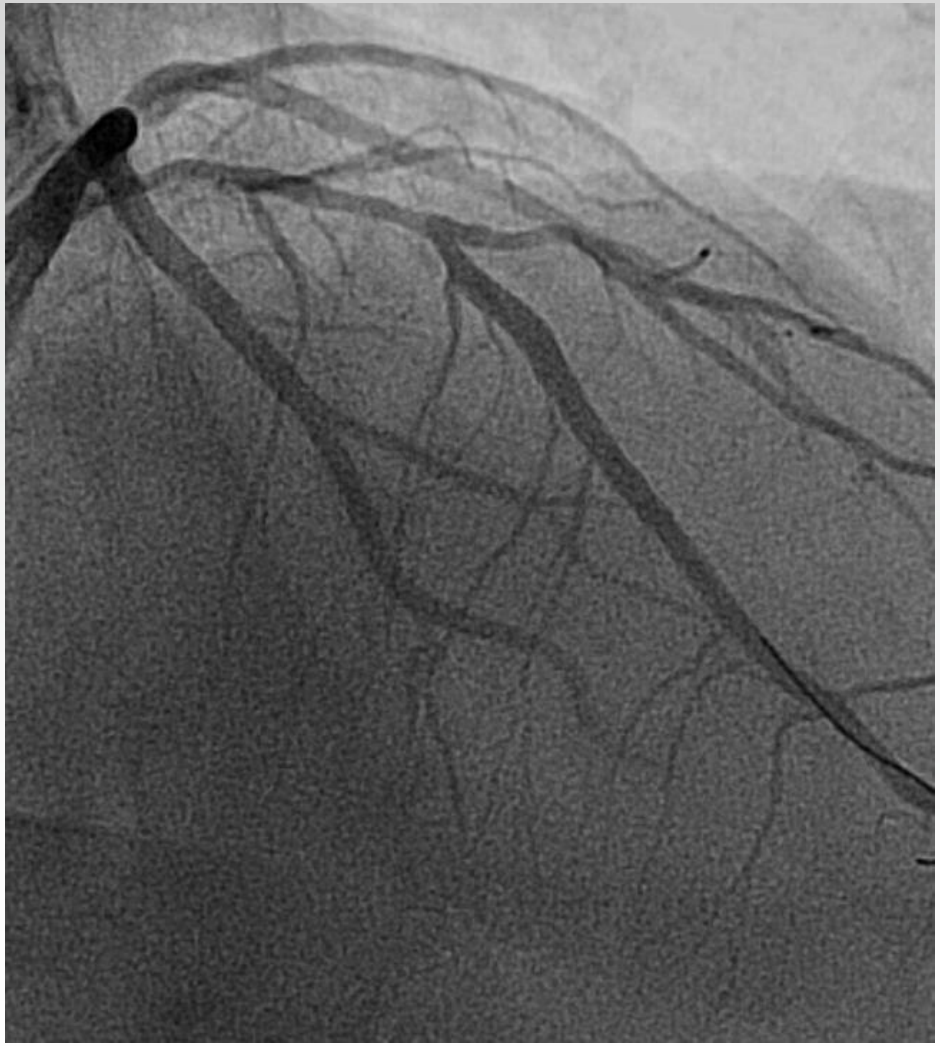
3D bifurcation model

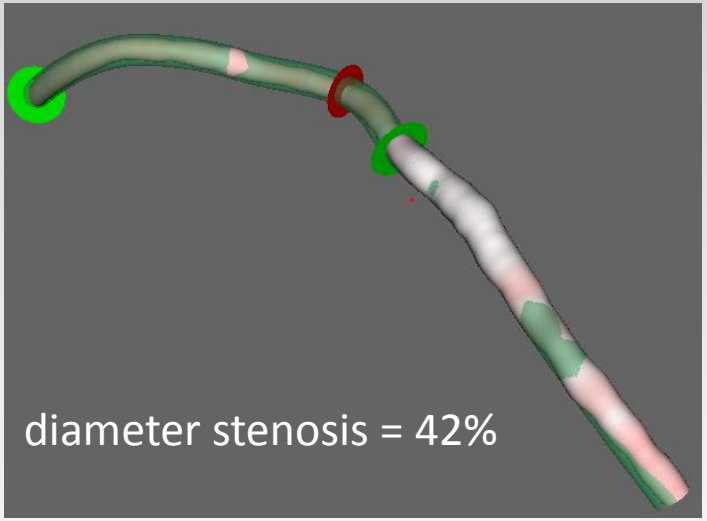
- Bifurcation diameter models

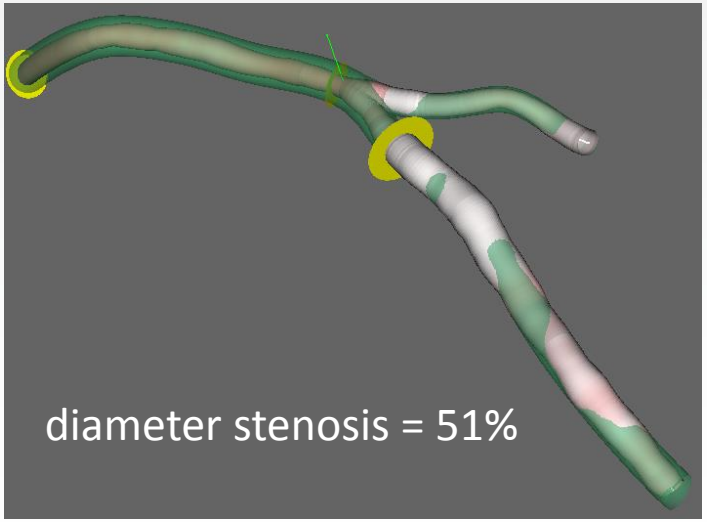
Model	Relationship
HK	$D_m^{\frac{7}{3}} = D_l^{\frac{7}{3}} + D_s^{\frac{7}{3}}$
Finet	$D_m = 0.678 \times (D_l + D_s)$
Murray	$D_m^3 = D_l^3 + D_s^3$



3D bifurcation model

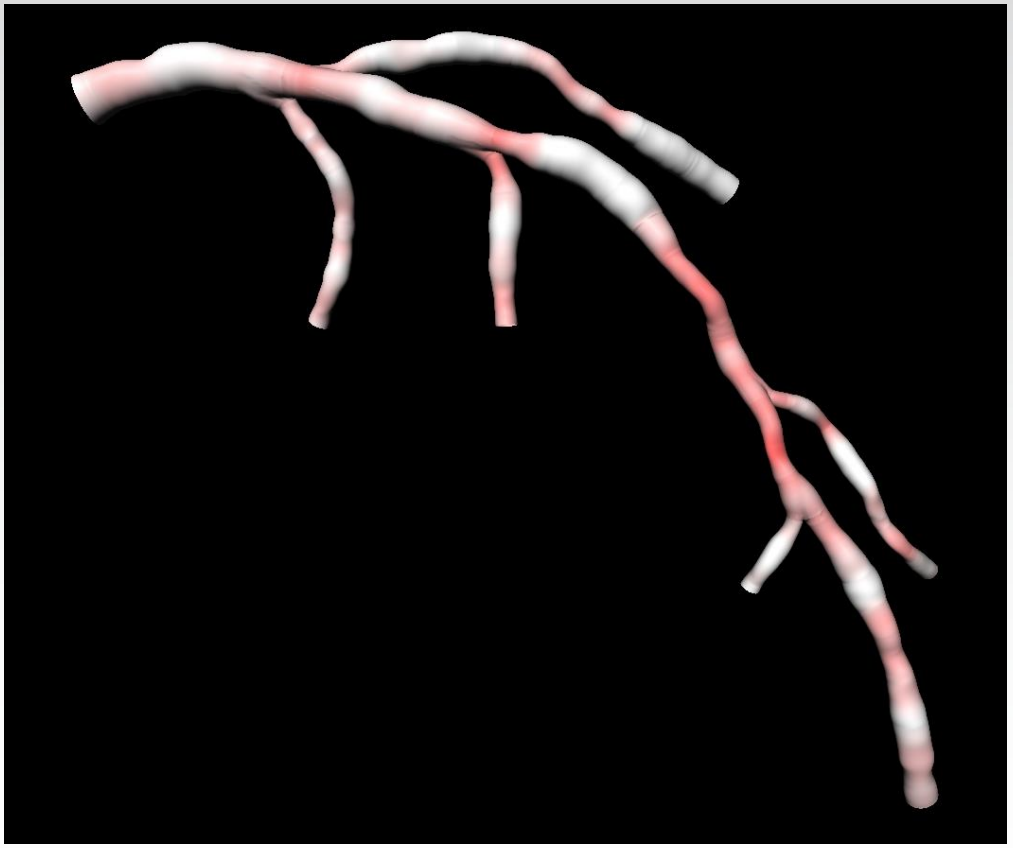






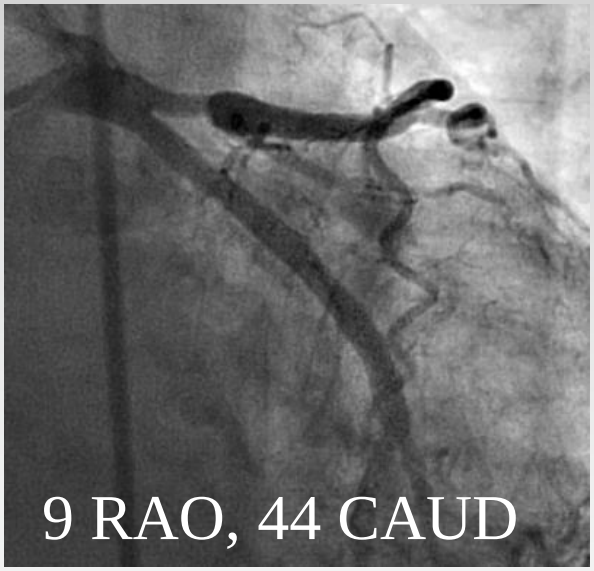
Reference diameter optimization by bifurcation diameter models!

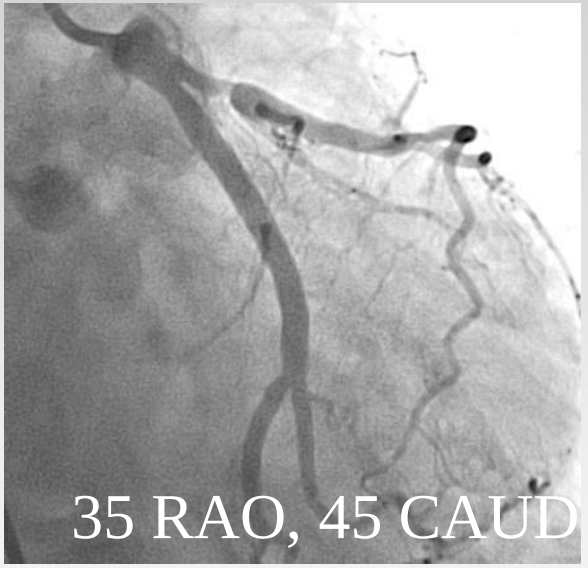
Coronary tree reconstruction

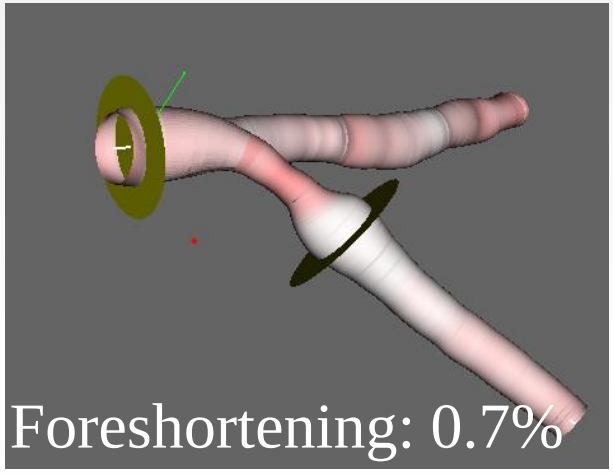


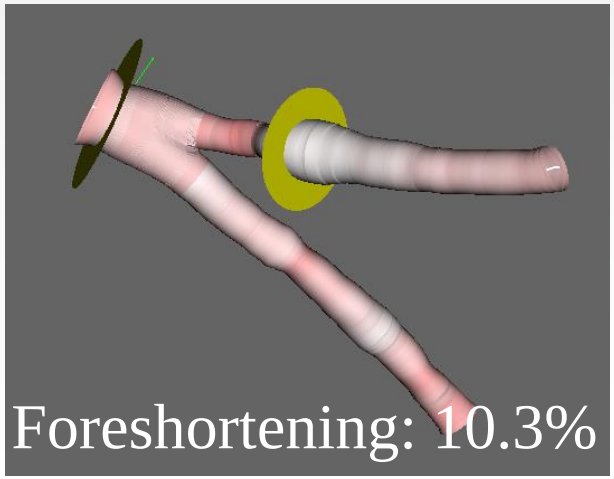
Courtesy: Niels R. Holm

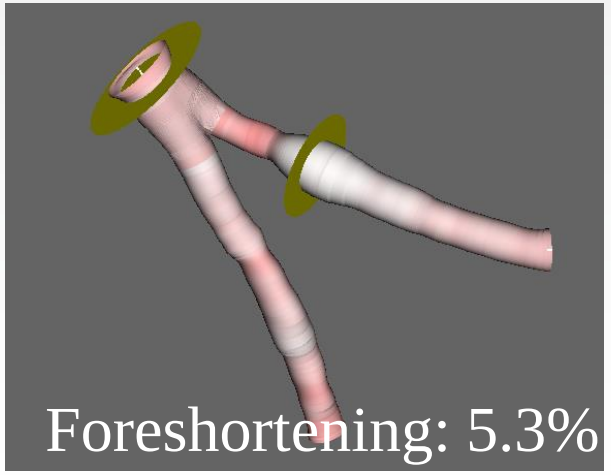
Application 1 – Optimal views











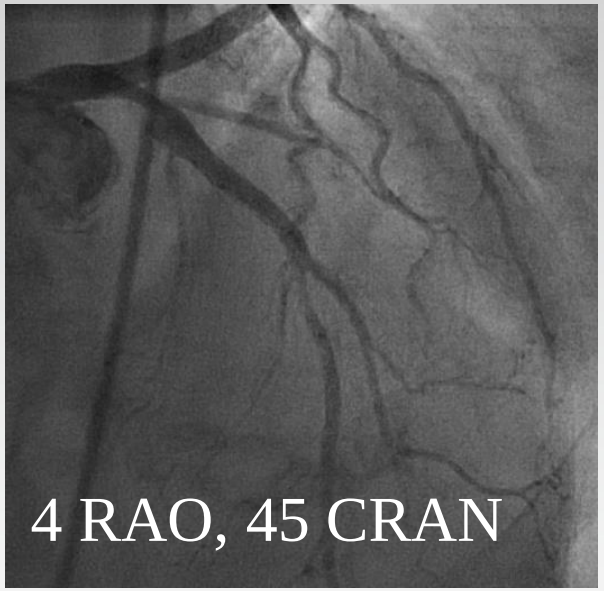
Working view 1

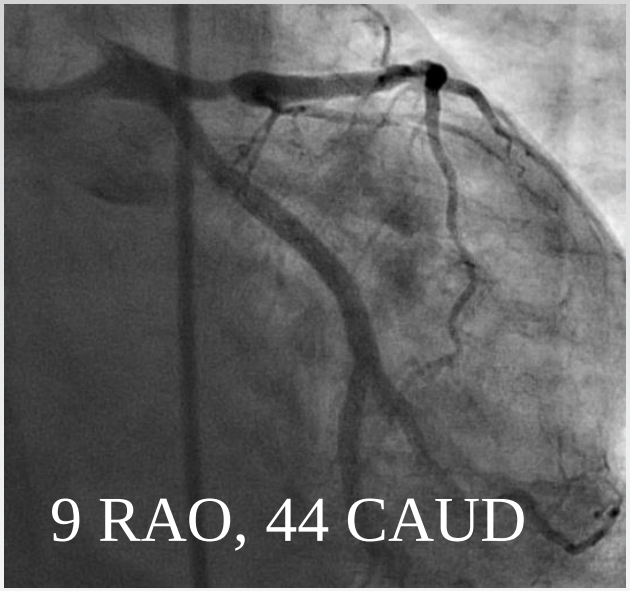
Working view 2

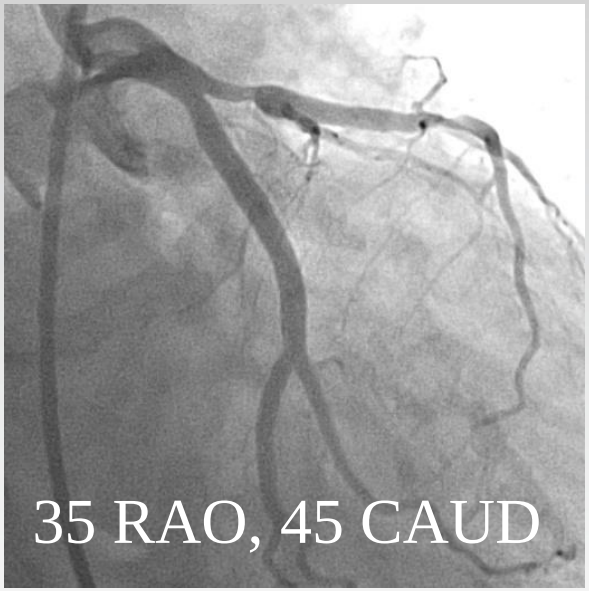
Software optimal view

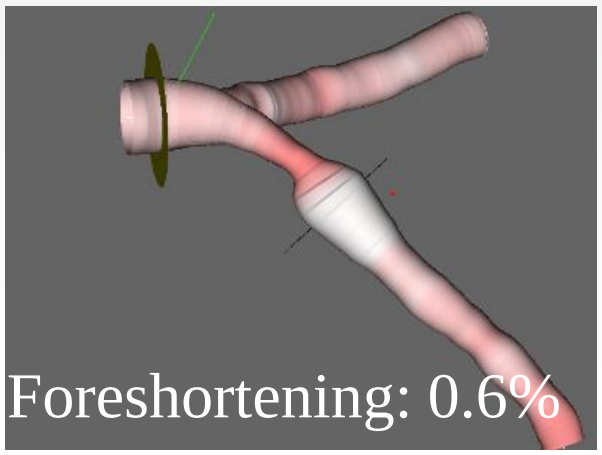
Courtesy: Tom Adriaenssens and Andy Wiyono

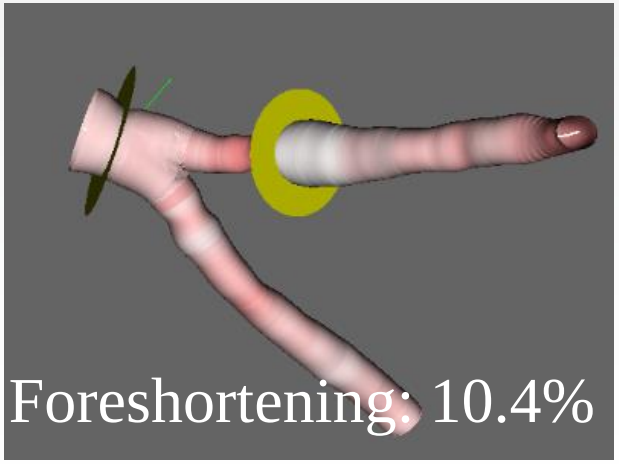
Application 2 – Optimal views

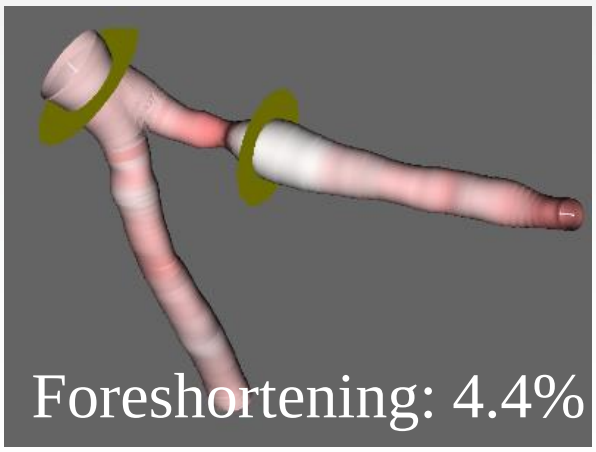










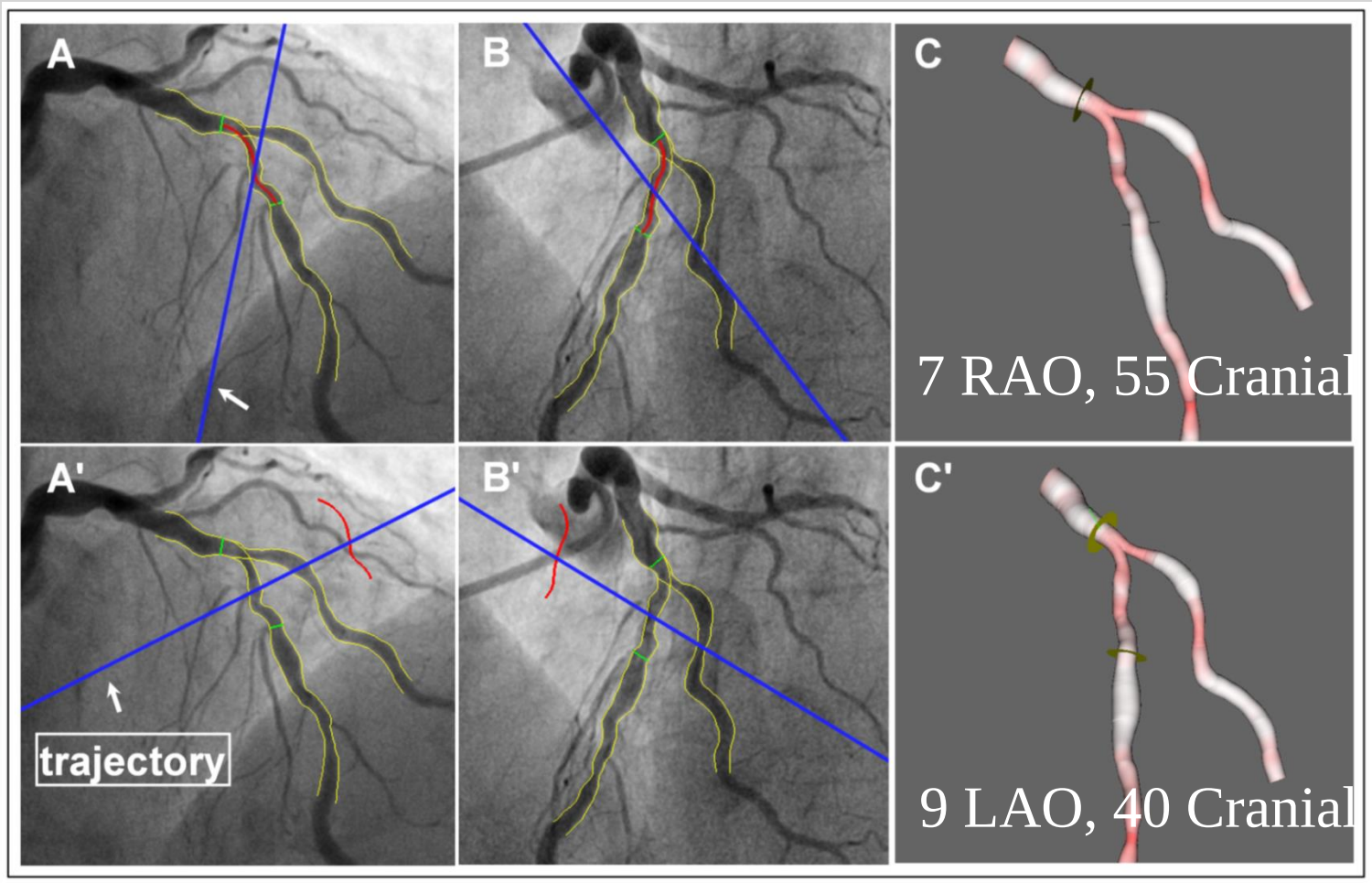


Working view 1

Working view 2

Software optimal view

Application 2 – Optimal views



← ABOVA

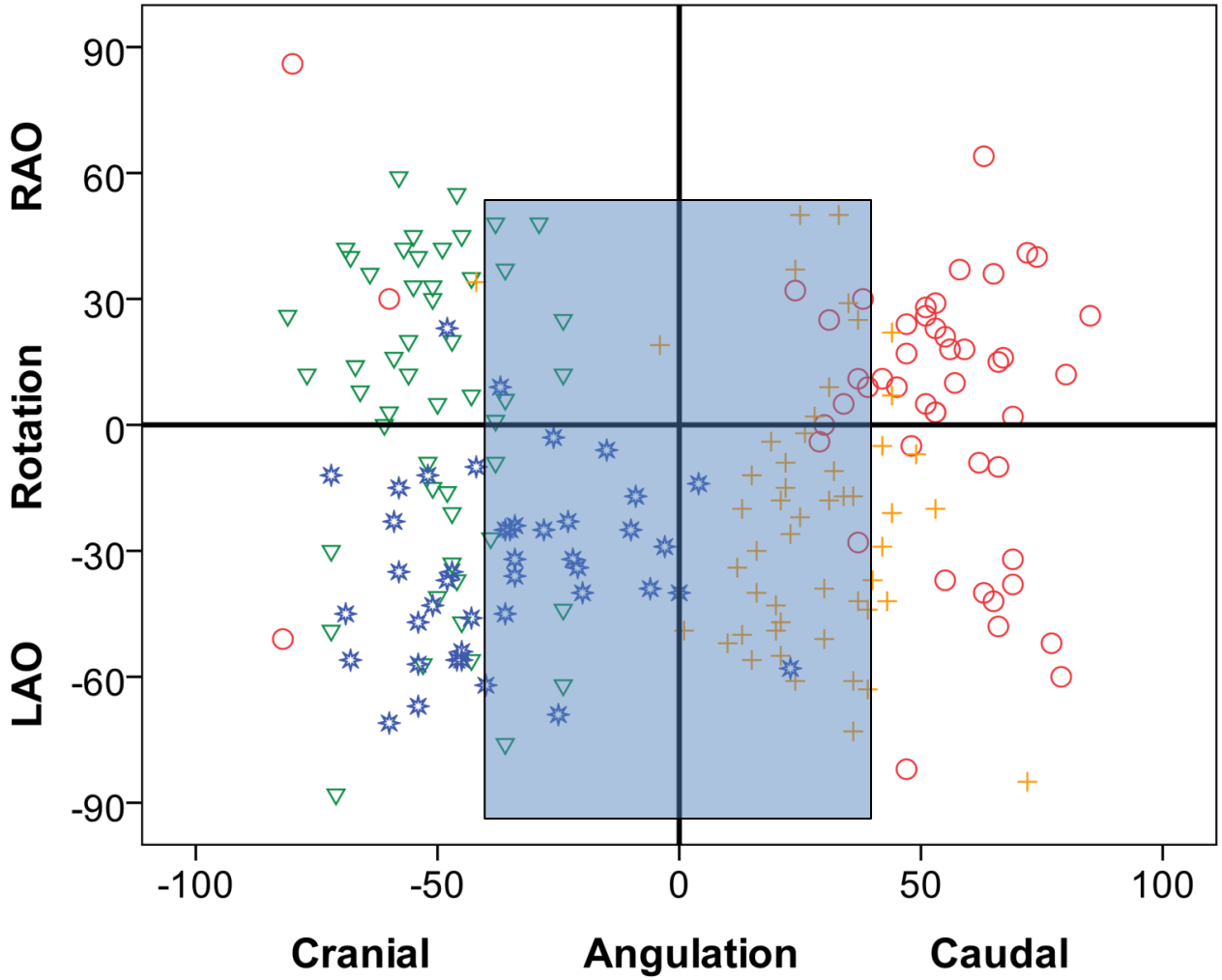
Anatomy-defined bifurcation optimal viewing angle

← OBOVA

Obtainable bifurcation optimal viewing angle

Tu et al. Int J Cardiovasc Imaging 2012, 28:1617-1625

Application 2 – Optimal views



ABOVA could not be obtained in 56.7% of the population:

- LM/LAD/LCx (81.6%)
- LAD/Diagional (78.4%)
- PDA/PLA (48.8%)
- LCx/OM (17.6%)

The distribution of ABOVA, n = 194

Application 3 – Bifurcation angles

Table2. Bifurcation Dimensions Assessed by 3D Quantitative Coronary Angiography*

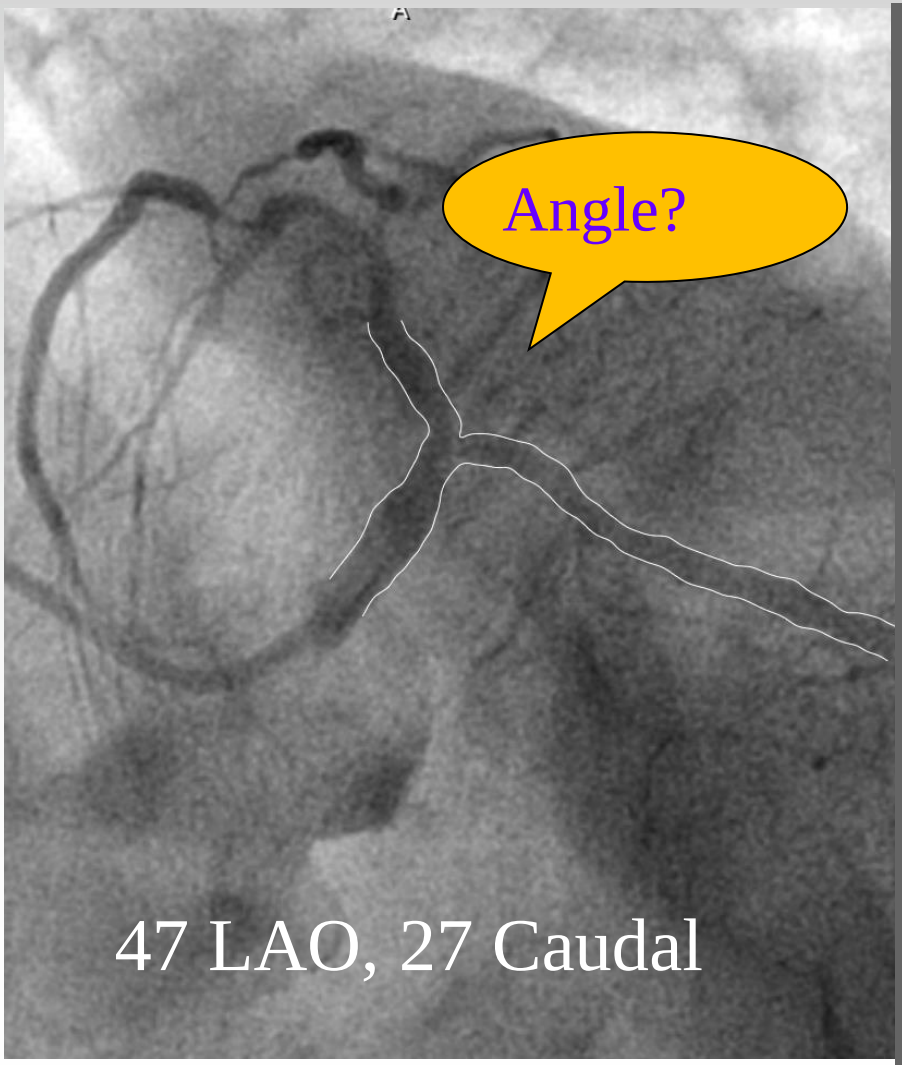
	ABOVA		OBOVA		BA		CTA†
	Rotation*	Angulation†	Rotation*	Angulation†	PBA	DBA	DBA
LM/LAD/LCx	5±33	47±35	-4±39	35±16	128±24‡	80±21	80°±27°
LAD/Diagonal	4±38	-50±14	-14±28	-33±5	151±13	48±16	46°±19°
LCx/OM	-21±32	27±17	-18±31	25±13	146±18	57±16	48°±24°
PDA/PLA	-34±21	-36±21	-28±25	-29±15	145±19	59±17	53°±27°

*Positive value represents Right Anterior Oblique and negative value represents Left Anterior Oblique; †Positive value represents Caudal and negative value represents Cranial. ‡Angle between LM and LCx. ABOVA = Anatomy-defined bifurcation optimal view angle; OBOVA = Obtainable bifurcation optimal viewing angle; BA = Bifurcation angle; PBA = Proximal bifurcation angle; DBA = Distal bifurcation angle.

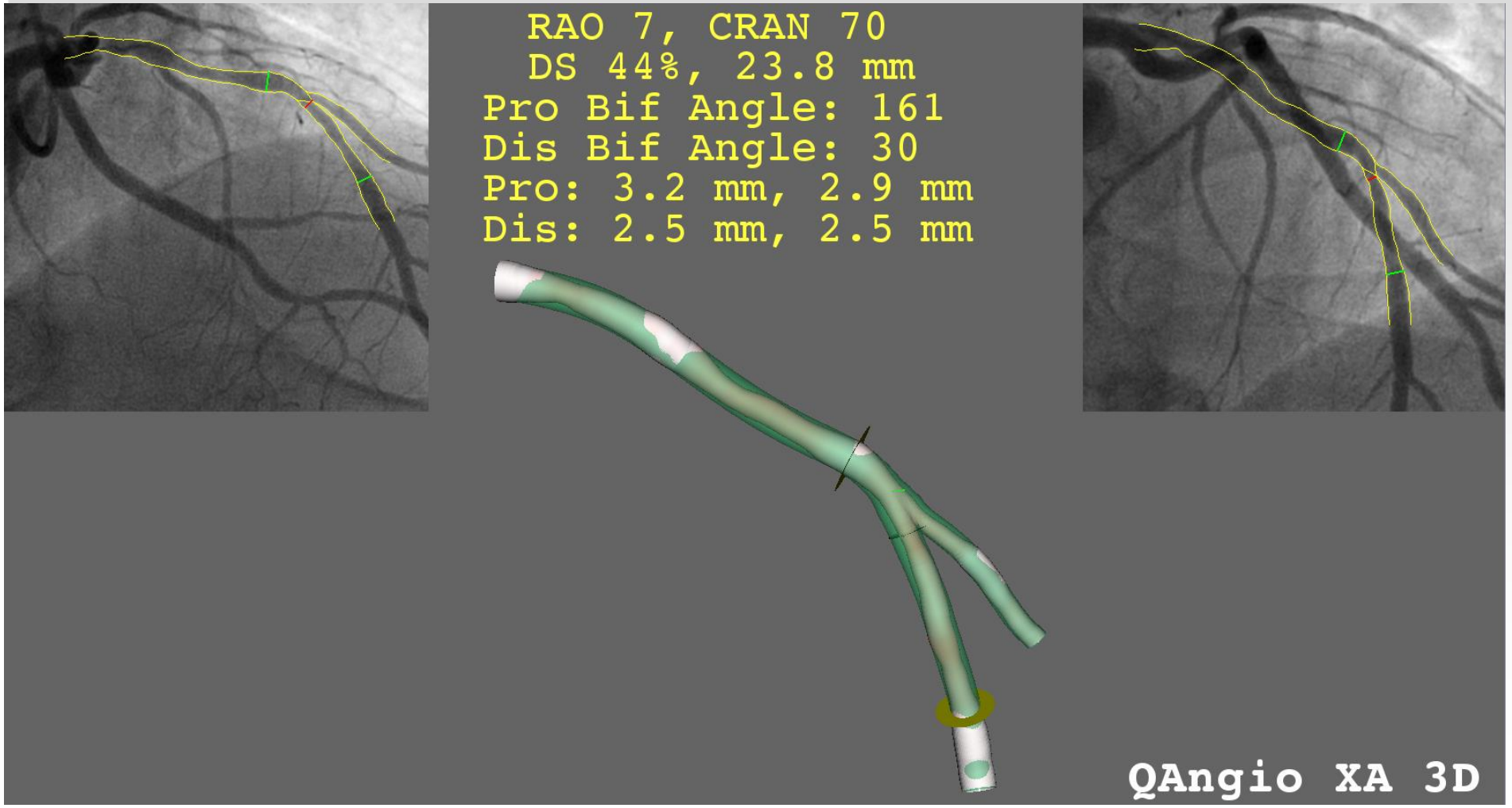
*Tu et al. Int J Cardiovasc Imaging 2012, 28:1617-1625

† Pflederer et al. Invest Radiol 2006; 41:793-798.

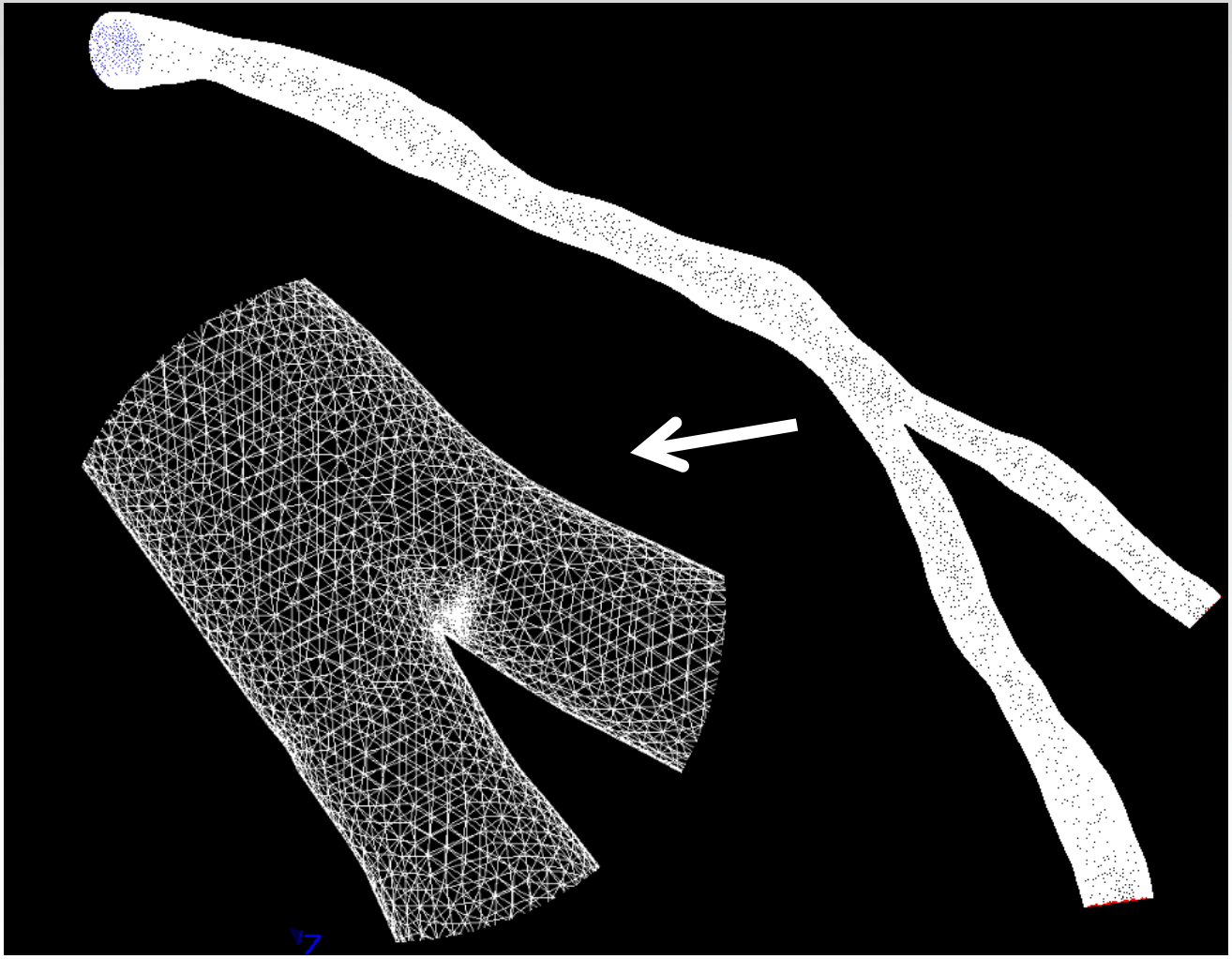
Application 3 – Bifurcation angles



Application 4 – FFR computation

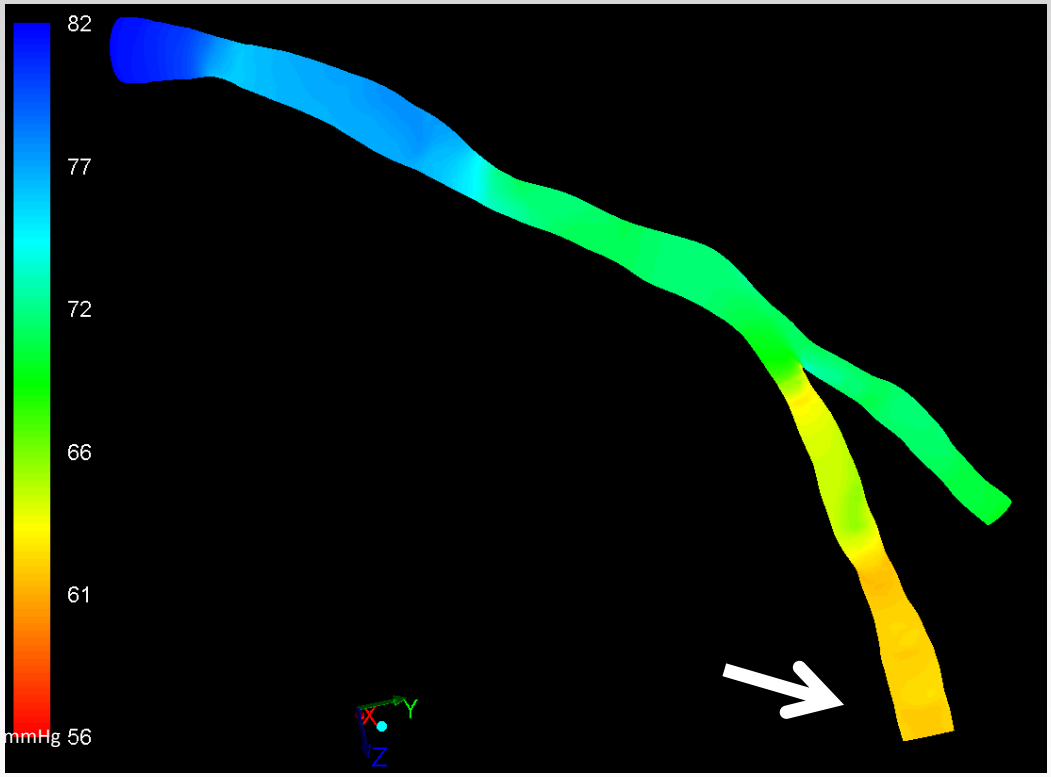


Application 4 – FFR computation



Meshing: finite volume method

Application 4 – FFR computation

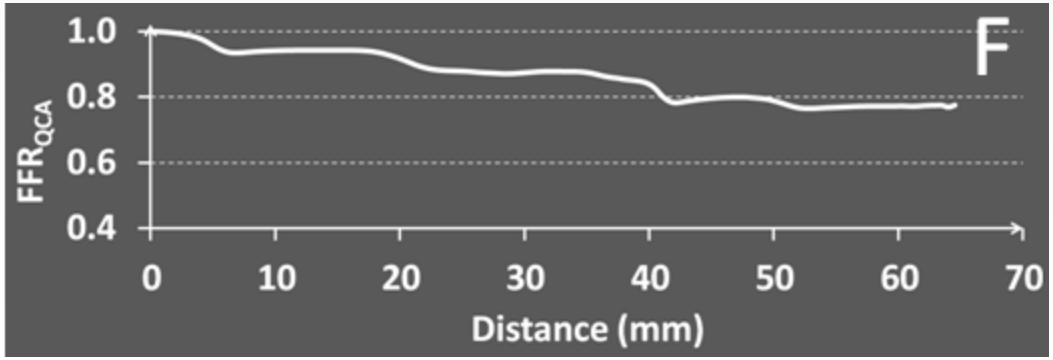


Late breaking technology

FFR_{QCA} = 0.78

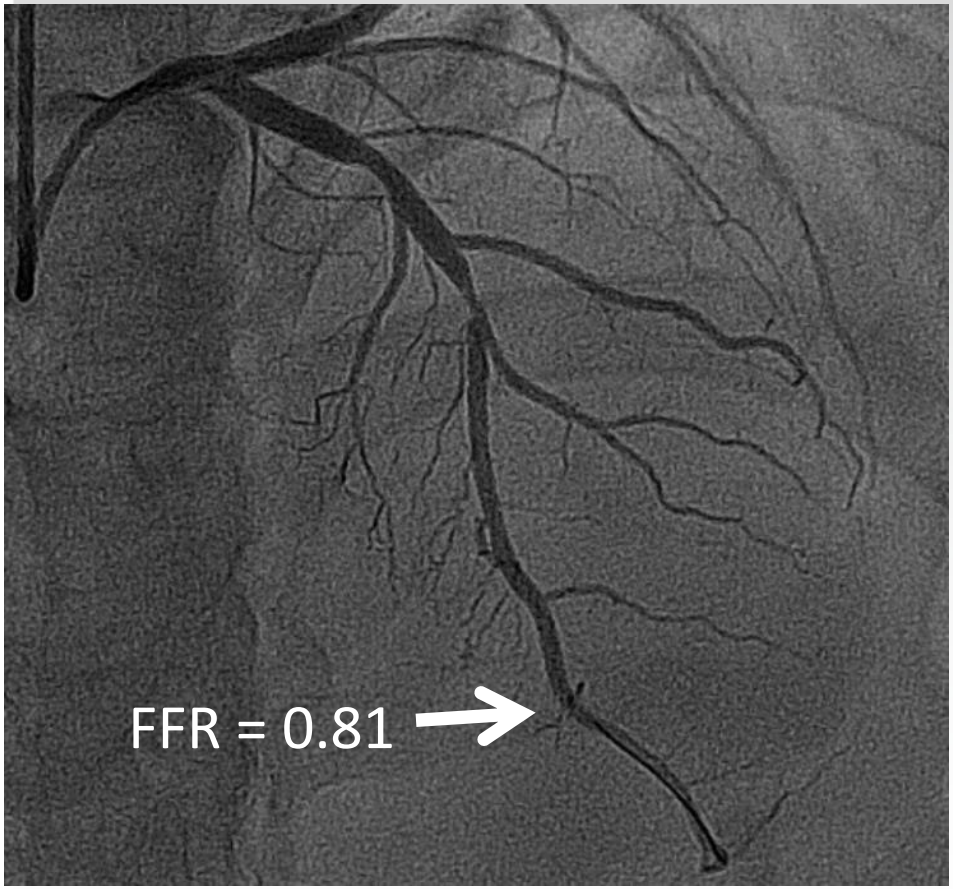
vs.

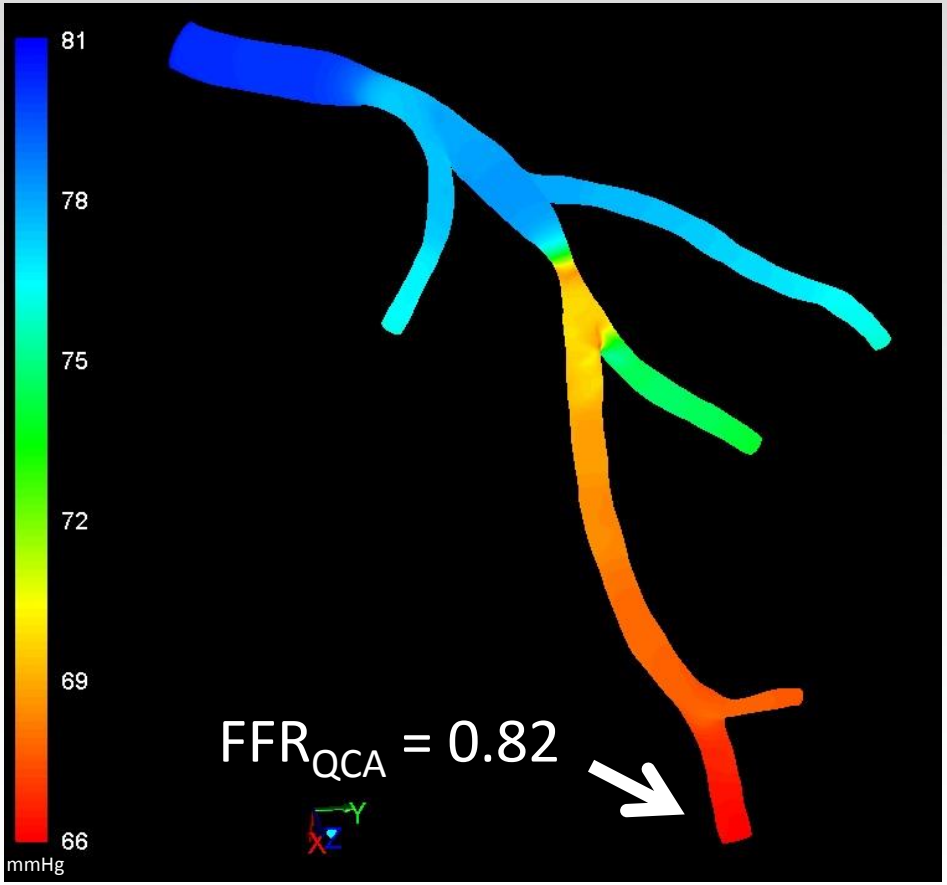
FFR = 0.78



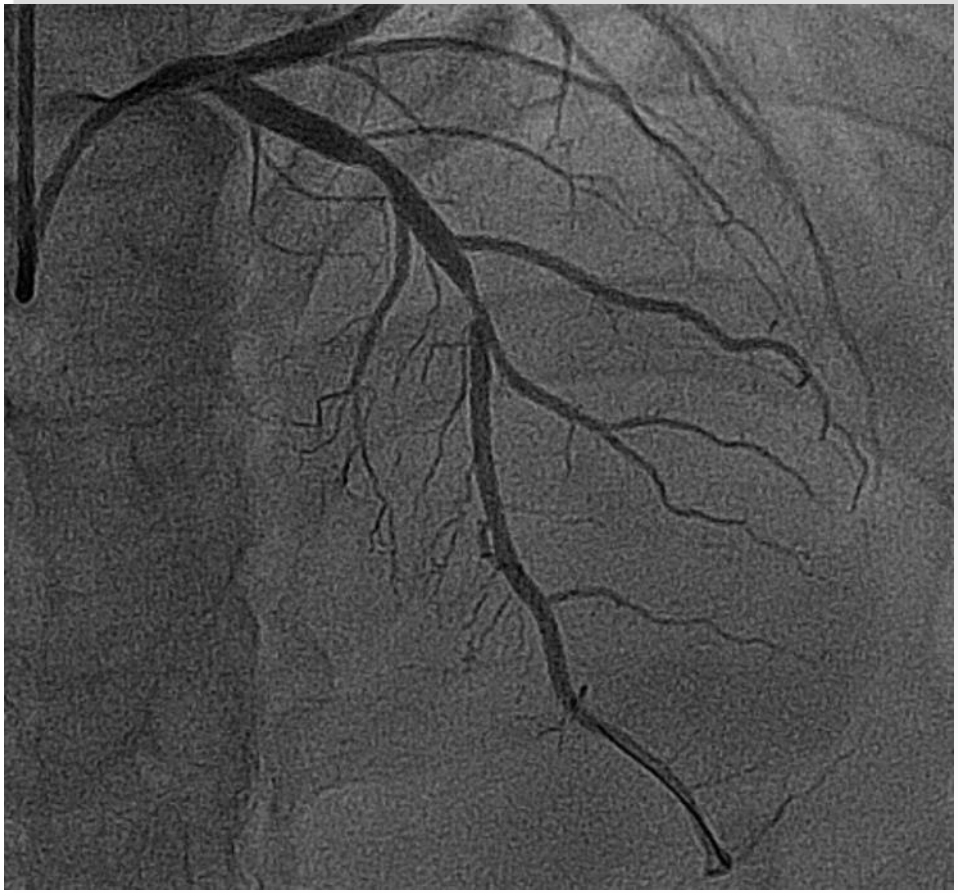
← FFR_{QCA} pullback

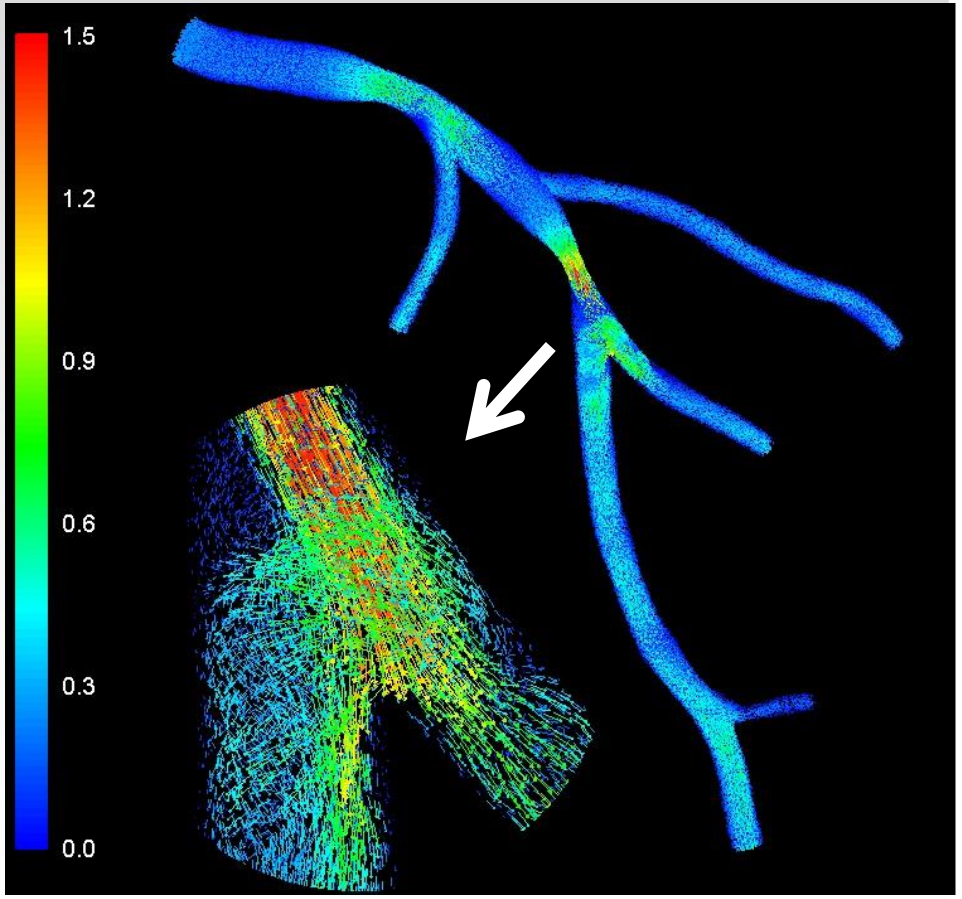
Application 4 – FFR computation





Application 5 – Flow simulation





Application 6 – Co-registration and sizing

Commercially avaialbe as a research tool for both on-line and off-line analyses (QAngioOCT RE, Medis Specials bv, Leiden, NL).

Application 7 – Fusion with OCT

JACC: CARDIOVASCULAR INTERVENTIONS
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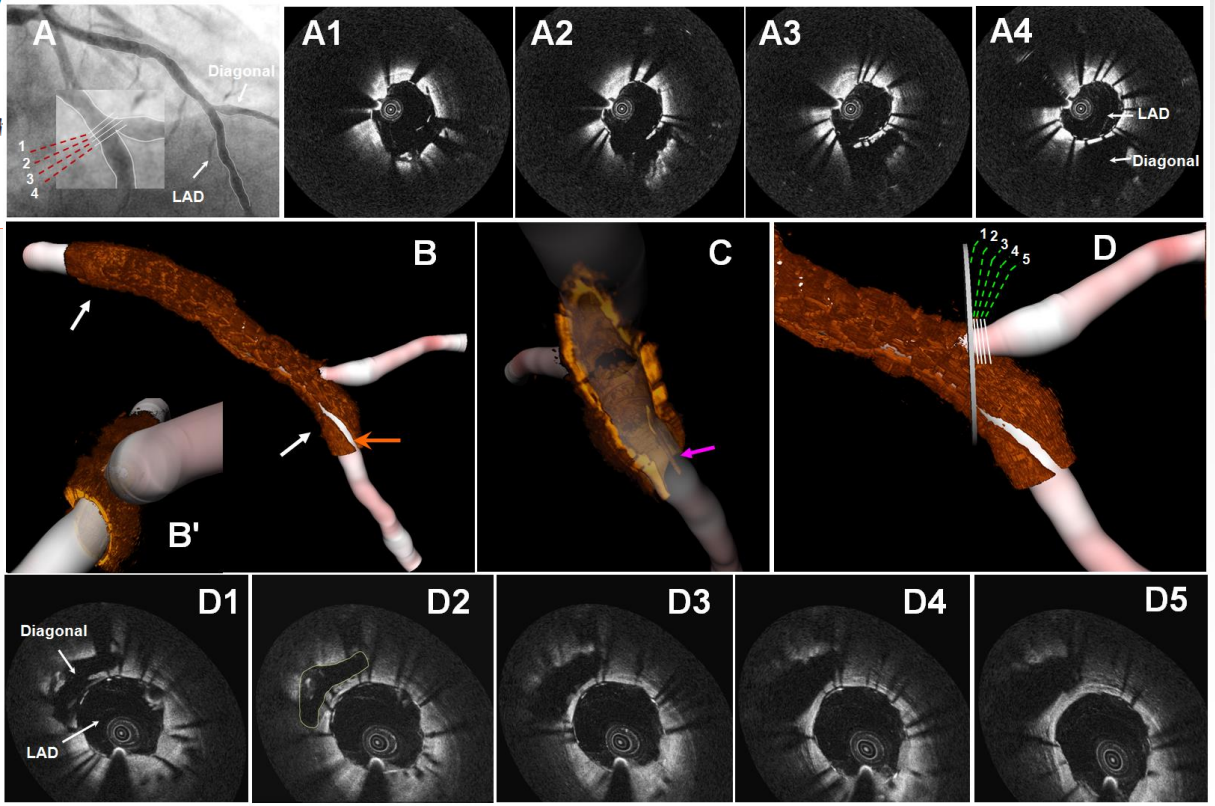
IMAGES IN INTERVENTION

First Presentation of 3-Dimensional Reconstruction and Centerline-Guided Assessment of Coronary Bifurcation by Fusion of X-Ray Angiography and Optical Coherence Tomography

Shengxian Tu, PHD,* Niels R. Holm, MD,† Evald H. Christiansen, MD, PHD,† Johan H. C. Reiber, PHD*

Leiden, the Netherlands; and Aarhus, Denmark

Sidebranch centerline-guided OCT assessment



Circulation
Cardiovascular Interventions
Journal of the American Heart Association
American Heart Association
Learn and Live

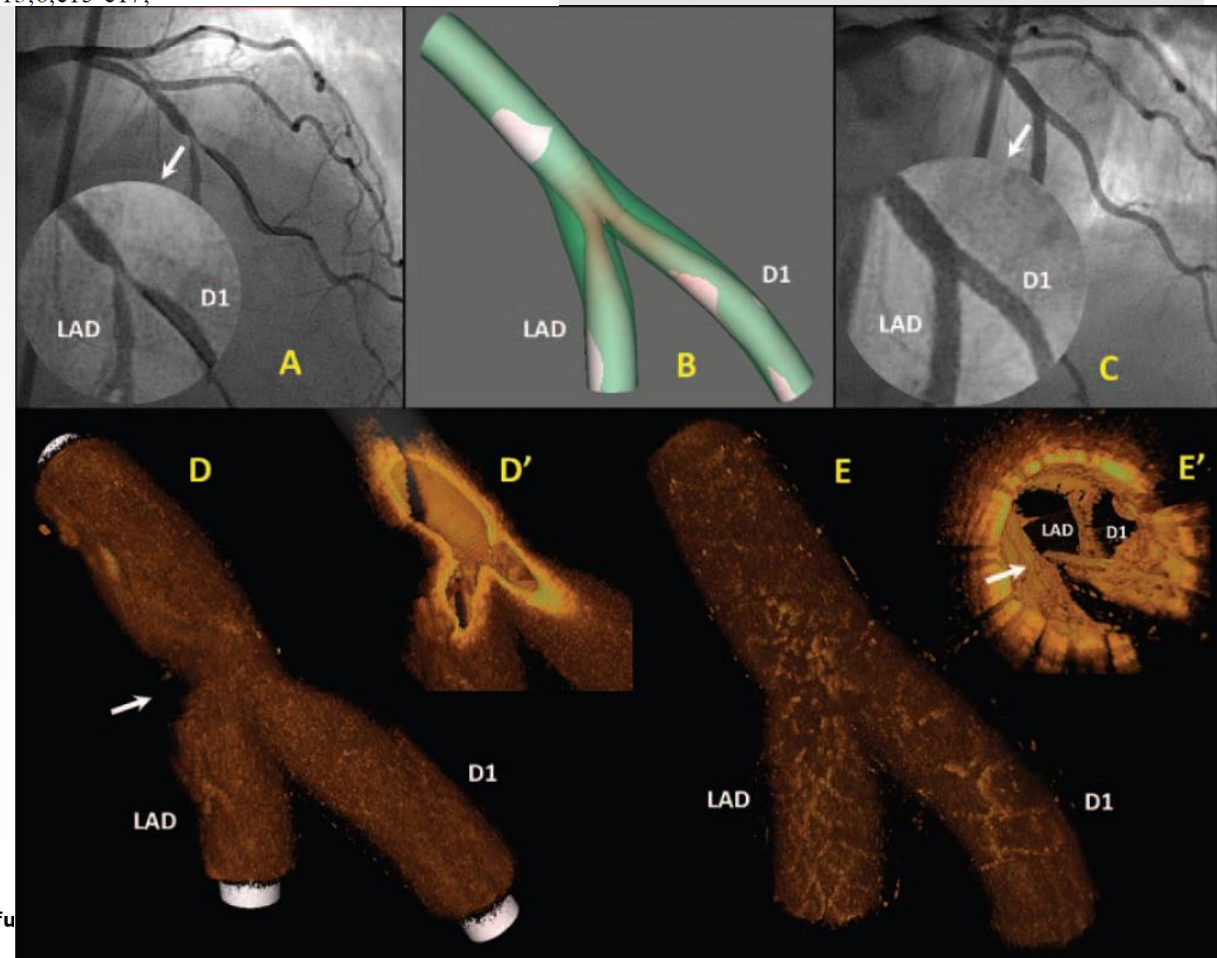
with OCT

In Vivo Flow Simulation at Coronary Bifurcation Reconstructed by Fusion of 3-Dimensional X-ray Angiography and Optical Coherence Tomography

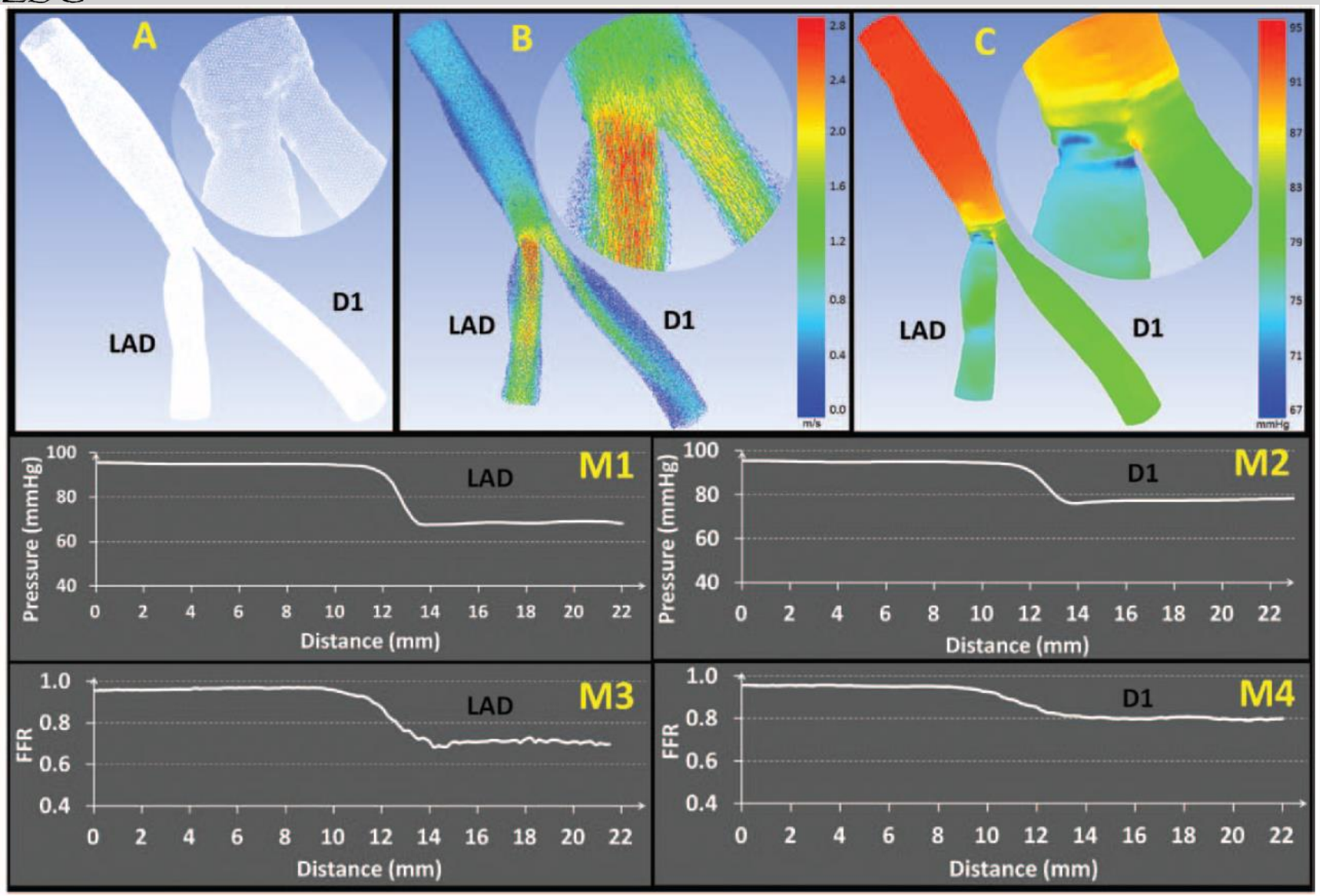
Shengxian Tu, Stylianos A. Pyxaras, Yingguang Li, Emanuele Barbato, Johan H.C. Reiber and William Wijns

Circ Cardiovasc Interv 2013;6:e15-e17;

Fusion of two OCT pullbacks at bifurcation

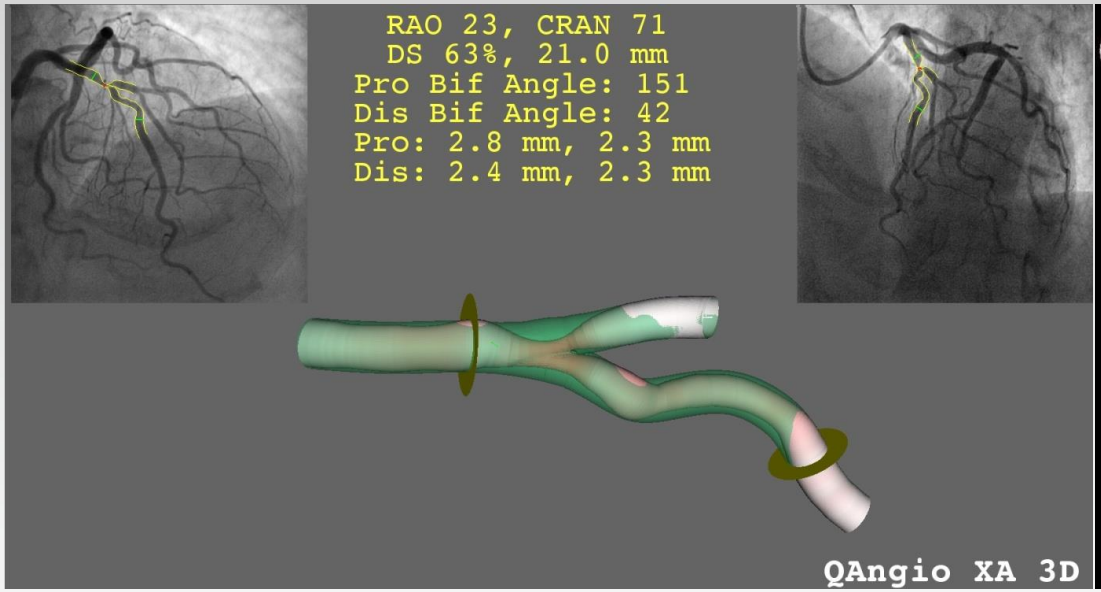


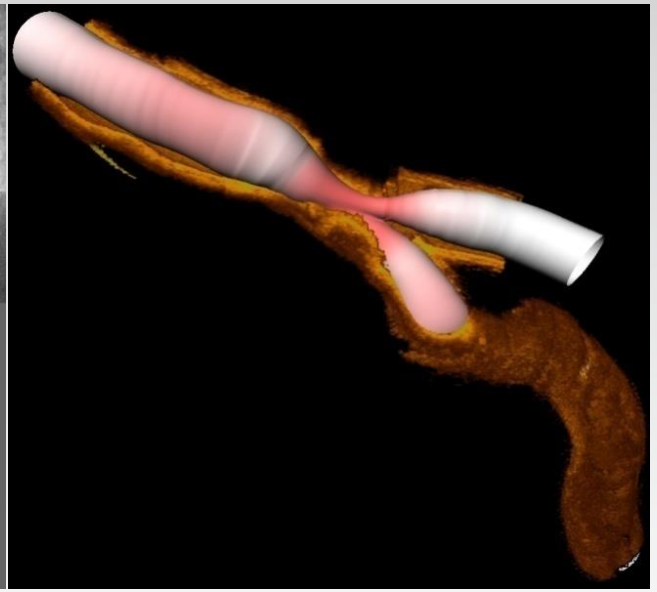
Application 7 – Fusion with OCT

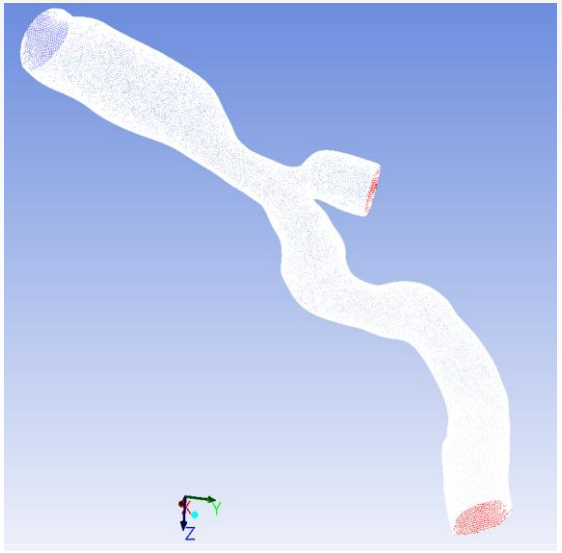


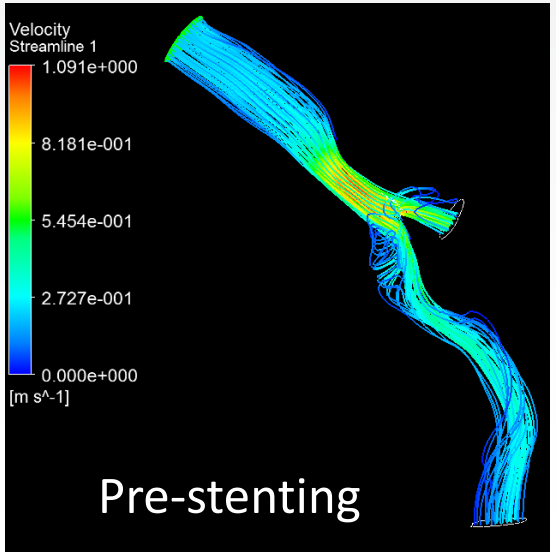
Tu et al. Circ Cardiovasc Interv 2013, 6:e15-e17.

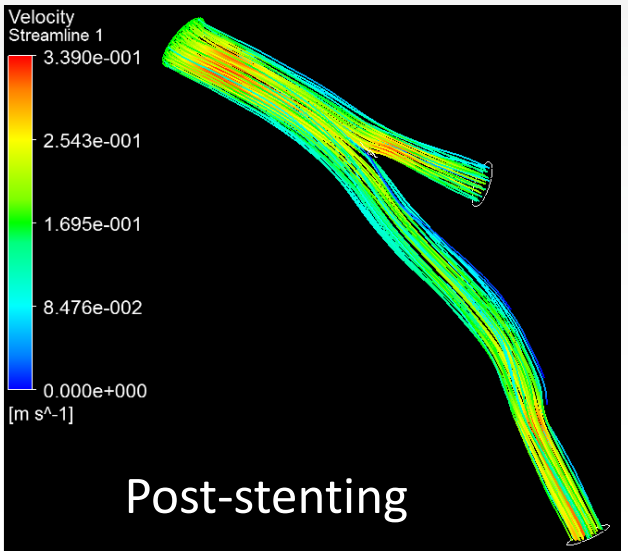
Application 7 – Fusion with OCT











Courtesy: Yves Louvard

Conclusions

- 3D QCA offers an accurate tool to enhance optimal stent sizing and positioning;
- Computation of FFR_{QCA} is a novel method that allows the assessment of the functional significance of intermediate stenosis;
- Fusion of 3D QCA and OCT provides more anatomical details. Further studies are warrant to provide more insights into its added values.