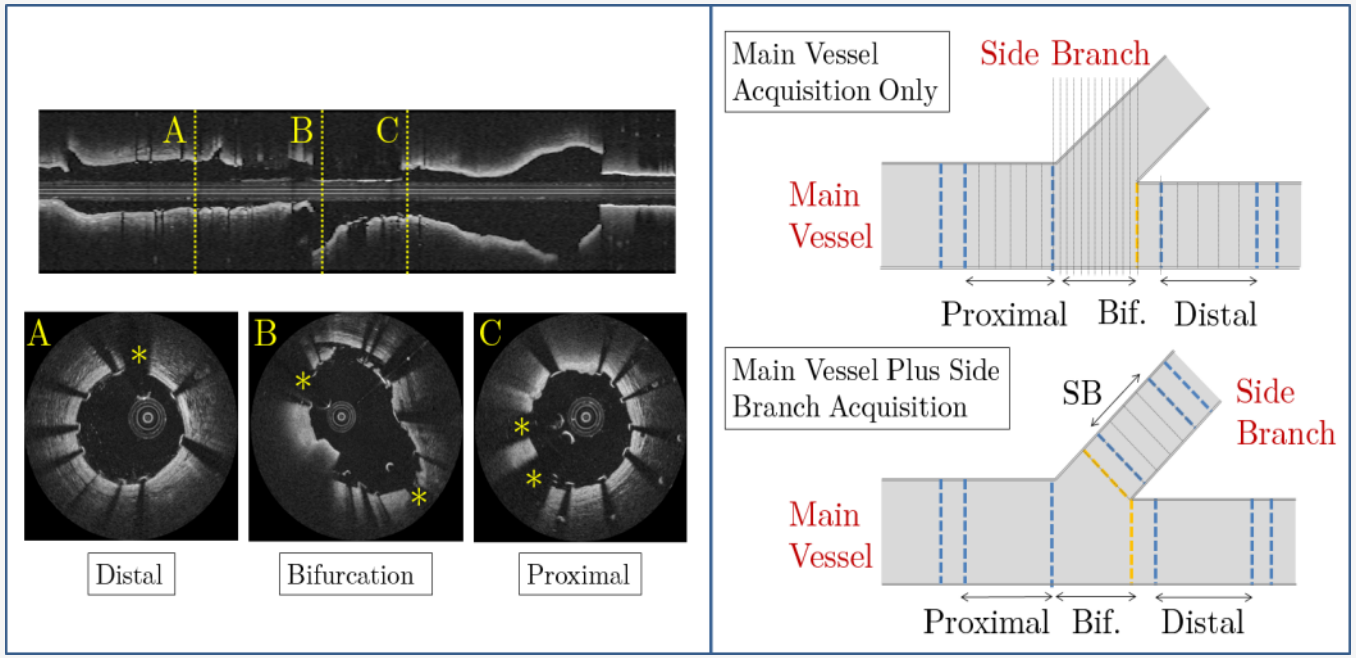
OCT measurements

Jouke Dijkstra, PhD
Division of image processing
Department of radiology
Leiden University Medical Center

Quantification in bifurcation OCT

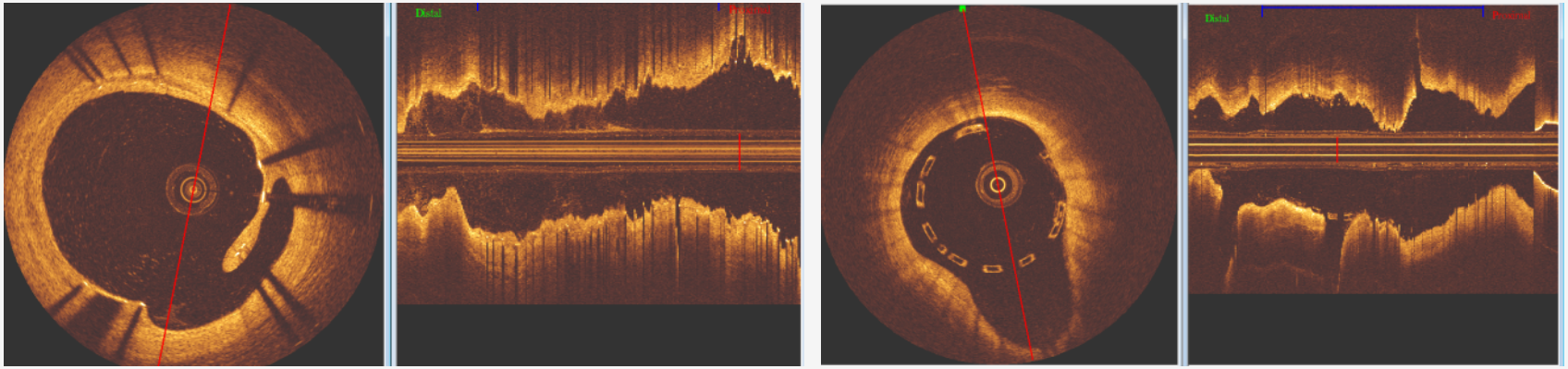
- Requires the use of segmentation models.
- These have been defined for cases where only main vessel IVOCT is available as well as for cases where a side branch pullback has been done.
- Similar to what has been proposed in IVUS and QCA
- Described in the consensus document OCT Bifurcation



Source: Consensus document on OCT in bifurcations (in progress)

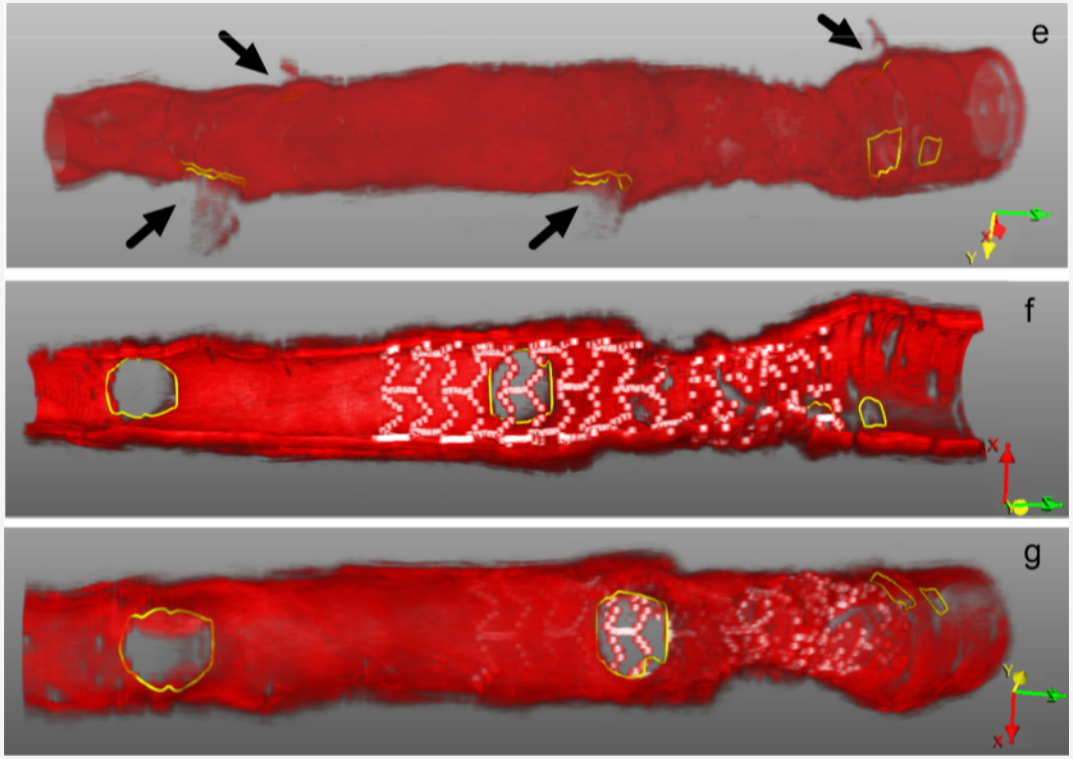
Some advantages of OCT over IVUS

- Determining the strut position
  - Malapposed struts
  - Jailing struts
  - Unapposed struts
  - Side branch coverage
  - Visibility (especially for the BRS struts)
- Measuring of side branch ostium



Advanced measurements in OCT

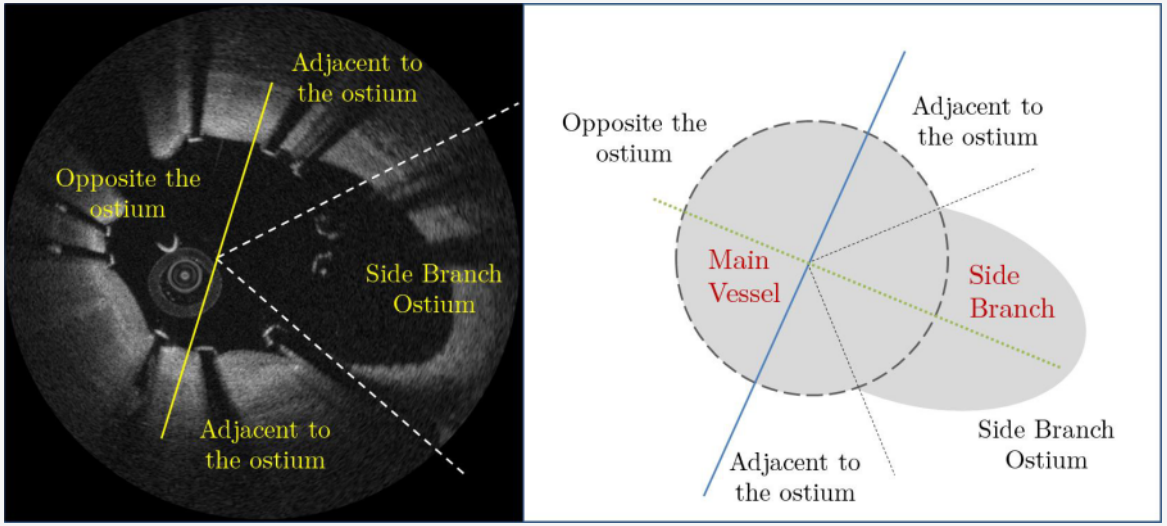
- Measuring in the straight segments is straight forward
- More complicate is:
  - Determining the ostium size
  - Determining the stent cell sizes which cover the side branch



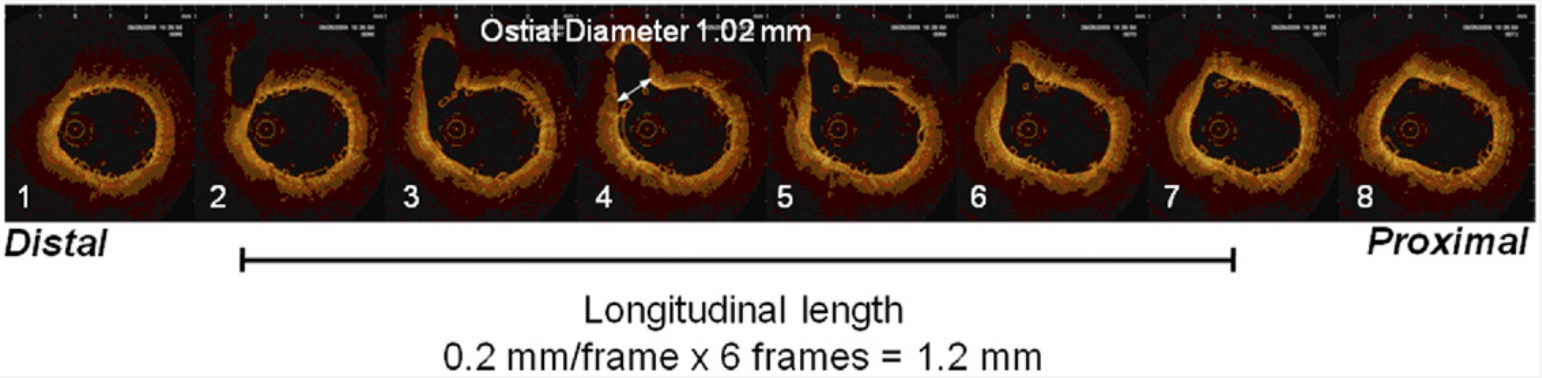
From: Wang et al., Biomedical optics express, 2014, (5) 9

Ostium measurements

- Manual measurements from transversal images



Adopted from Tyczynski et al, Rev Esp Cardiol 2010 and Kyono et al, EuroIntv 2010



Source: Okamura, JACC Cardiovascular Interventions., 2010 (3) 8

Ostium measurements

- Advanced methods in 3D – cut plane method

Generated by QAngionOCT,Medis specials bv, the Netherlands

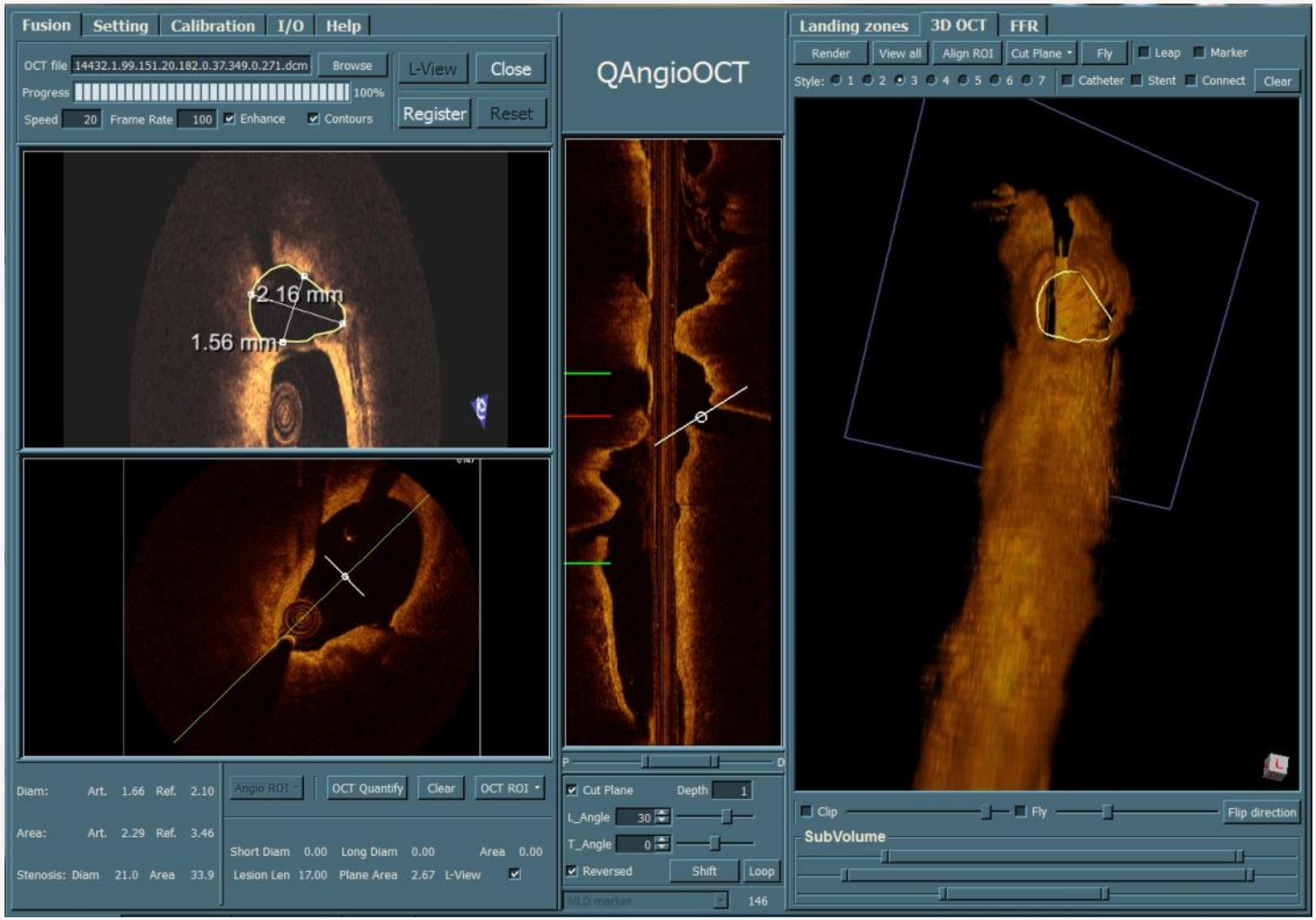
Ostium measurements

- Advanced methods in 3D – cut plane method

Generated by QAngionOCT,Medis specials bv, the Netherlands

Ostium measurements

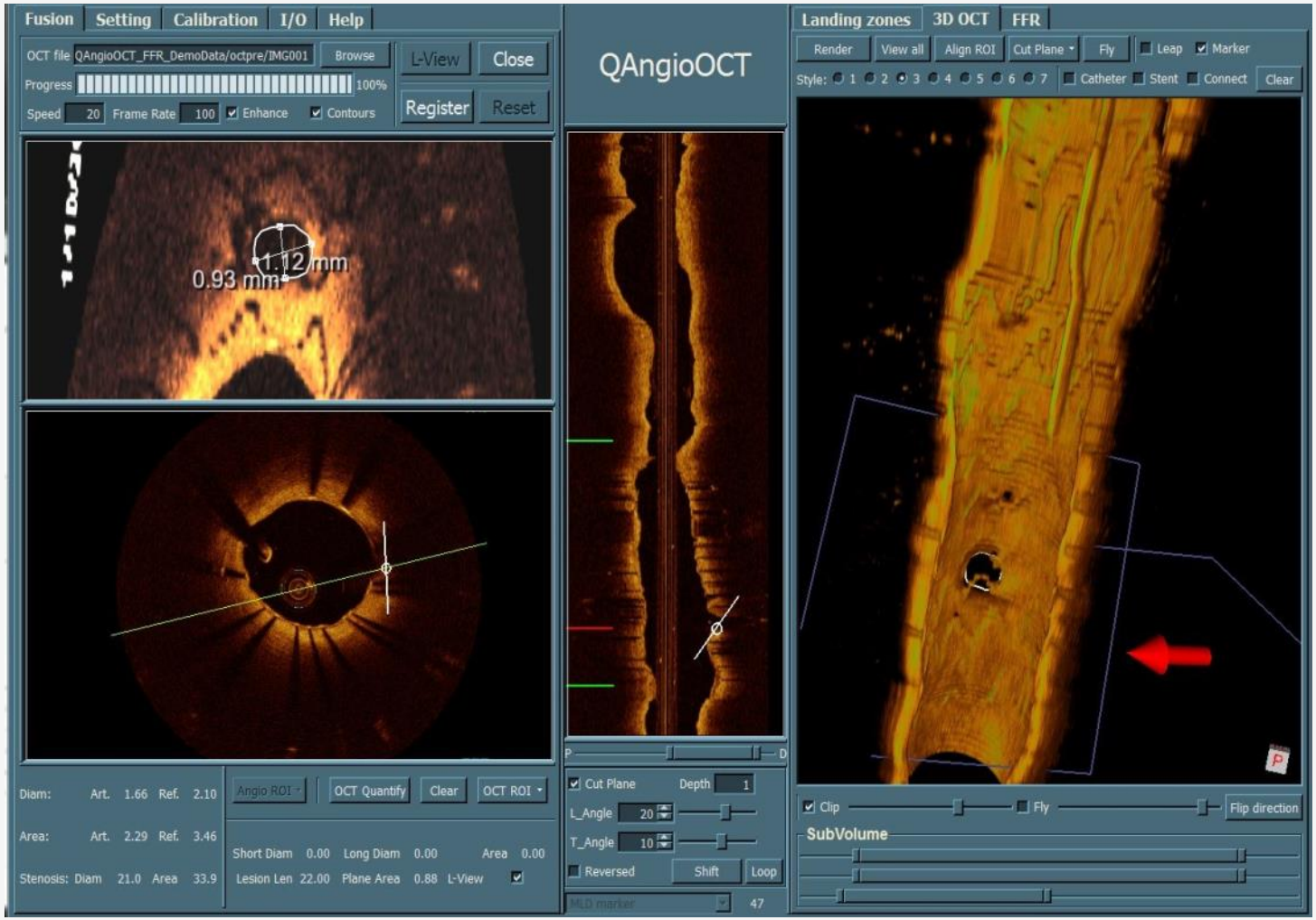
- Advanced methods in 3D – cut plane method



Generated by QAngionOCT,Medis specials bv, the Netherlands

Ostium measurements

- Advanced methods in 3D – cut plane method



Generated by QAngionOCT,Medis specials bv, the Netherlands

Cut-plane analysis

Validation:

Table 3 Optical coherence tomography measurements and corresponding errors

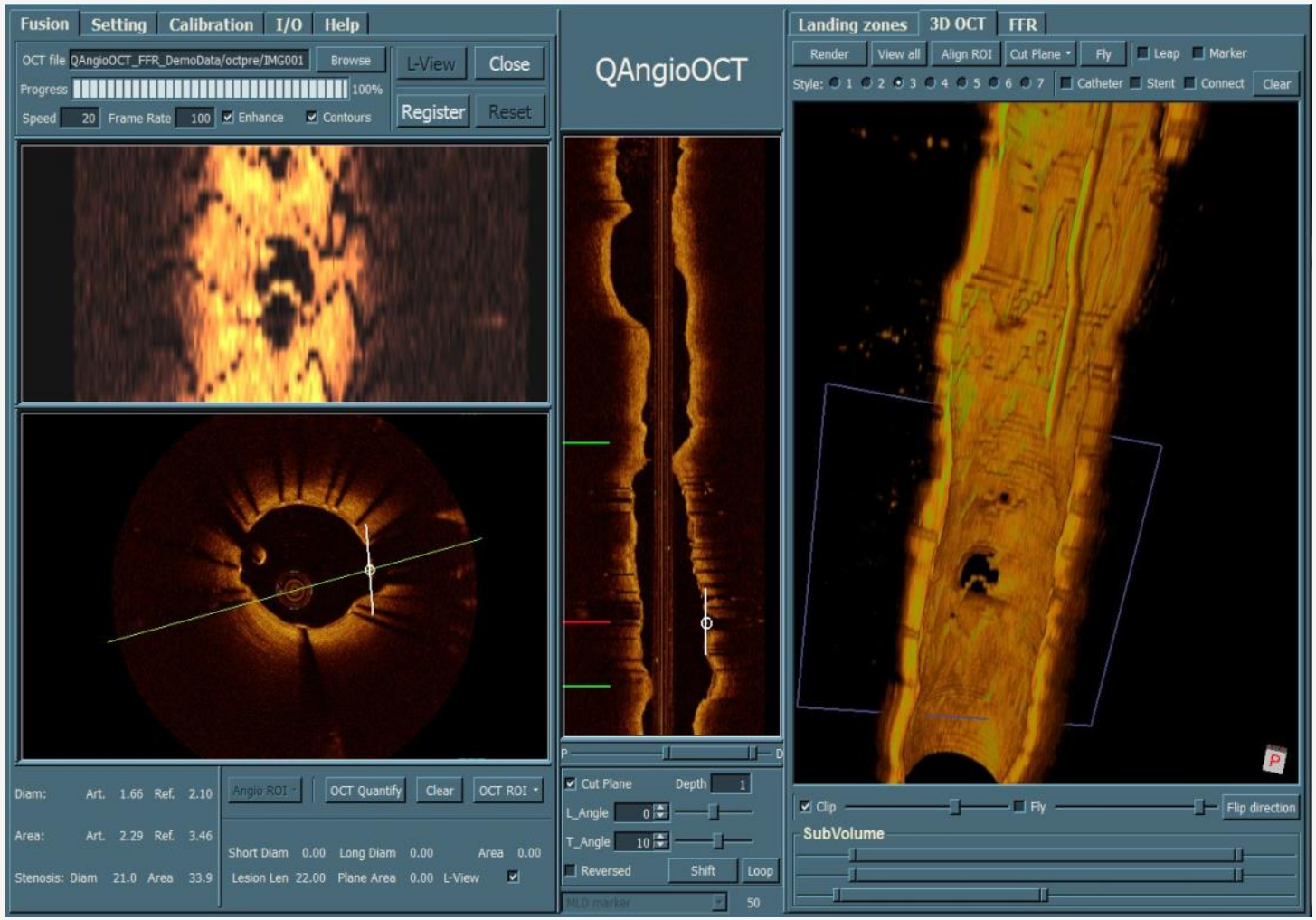
	SB pullback: conventional analysis	MB pullback: conventional analysis			MB pullback: cut-plane analysis		
	Reference measurement (mean ± SD)	Measurement (mean ± SD)	Error (95% limits of agreement)	Pearson correlation coefficient (95% CI)	Measurement (mean ± SD)	Error (95% limits of agreement)	Pearson correlation coefficient (95% CI)
SB ostium lumen area (mm^2)	3.51 ± 1.70	4.43 ± 3.06	0.92 (−2.66 to 4.49)	0.870 (0.745 to 0.936)	3.57 ± 1.92	0.06 (−1.37 to 1.50)	0.927 (0.853 to 0.964)
SB ostium mean diameter (mm)	2.06 ± 0.56	2.20 ± 0.82	0.14 (−0.89 to 1.17)	0.788 (0.602 to 0.893)	2.05 ± 0.58	−0.01 (−0.47 to 0.46)	0.918 (0.835 to 0.960)
SB ostium minimum diameter (mm)	1.72 ± 0.57	1.80 ± 0.80	0.08 (−0.88 to 1.03)	0.812 (0.643 to 0.906)	1.64 ± 0.62	−0.08 (−0.76 to 0.60)	0.841 (0.690 to 0.922)
SB ostium maximum diameter (mm)	2.53 ± 0.61	2.71 ± 0.85	0.19 (−1.14 to 1.51)	0.635 (0.362 to 0.808)	2.48 ± 0.61	0.00 (−0.80 to 0.81)	0.770 (0.567 to 0.885)

CI, confidence intervals; MB, main-branch; SB, side-branch.

From: Karanasos, EHJ, 2014, sep 16.

Methods to measure the cell openings

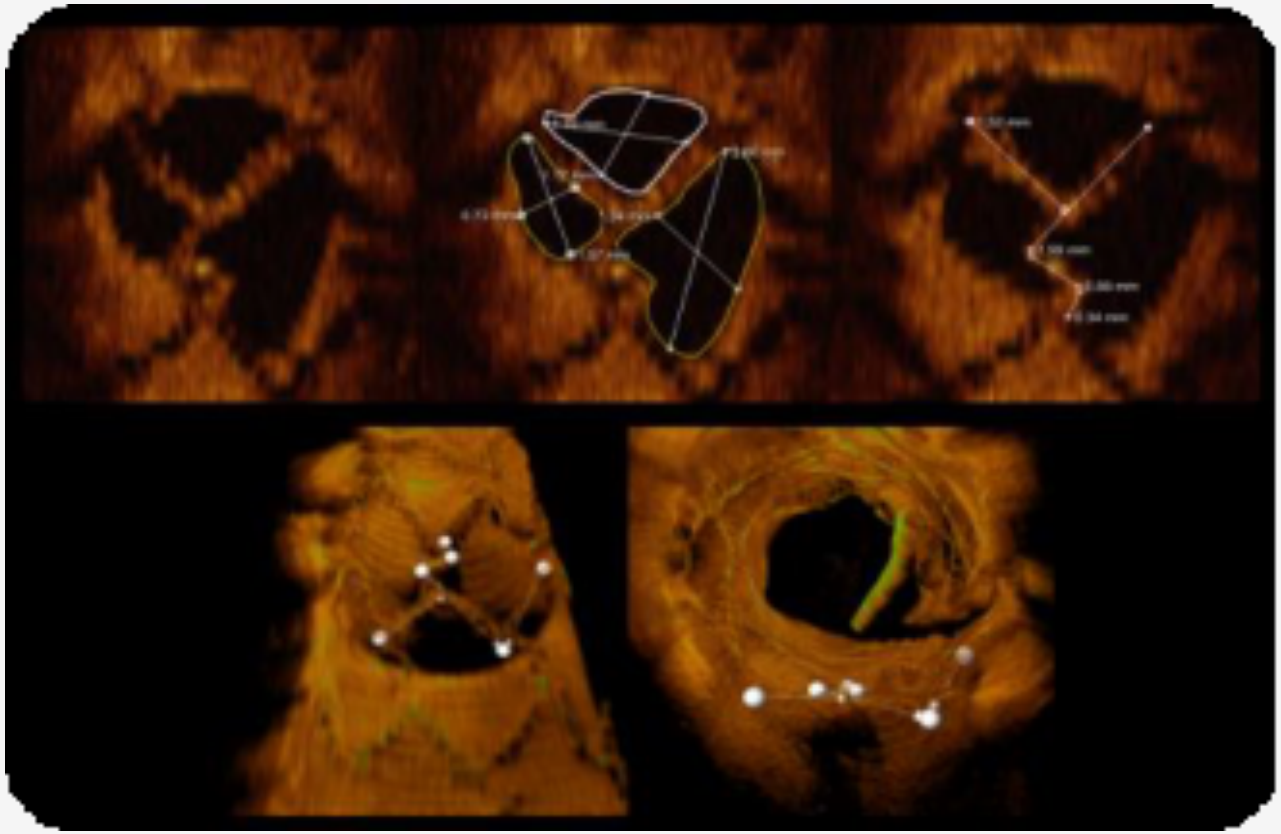
- Manual measurements



Generated by QAngionOCT,Medis specials bv, the Netherlands

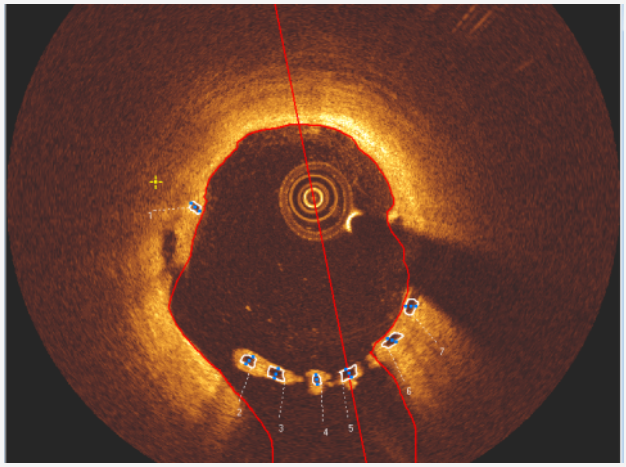
Methods to measure the cell openings

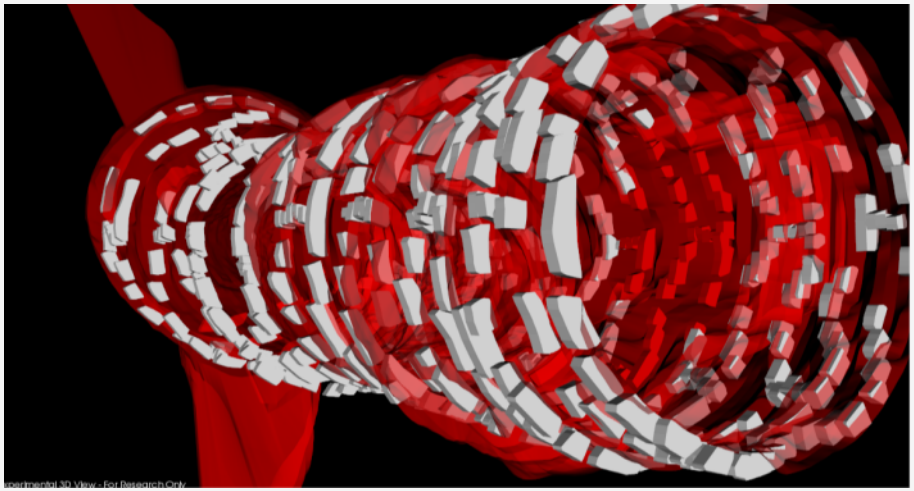
- Manual measurements
- Based upon volume rendering



Methods to measure the cell openings

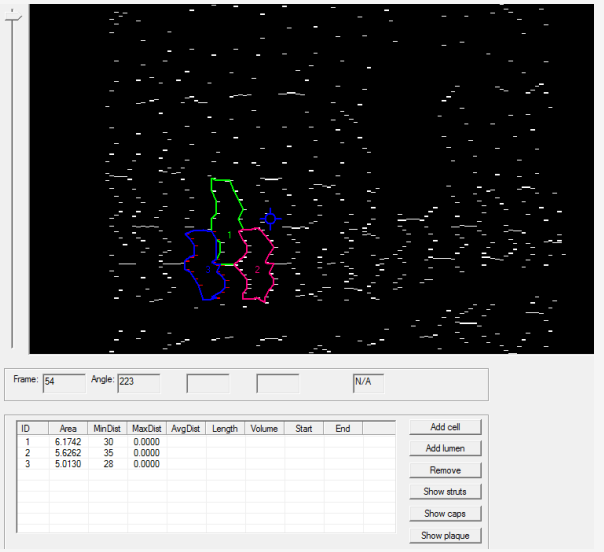
- Based on strut positions
- Uses stent strut detection
- Using different visualization techniques:
  - 2D Cut open view
  - 3D visualization

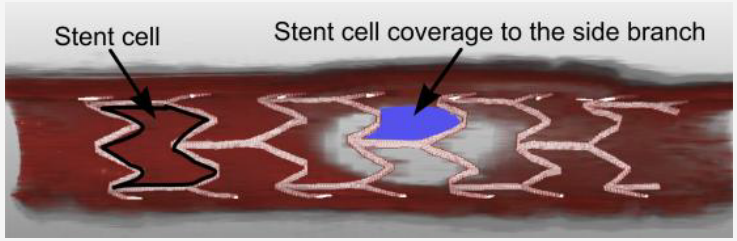


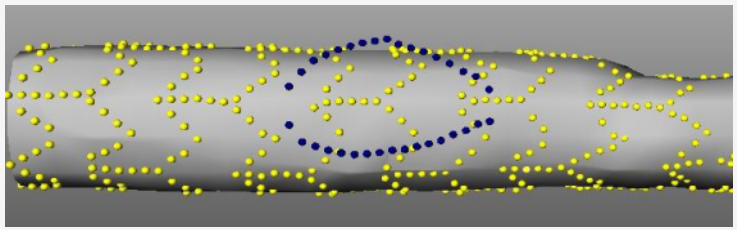


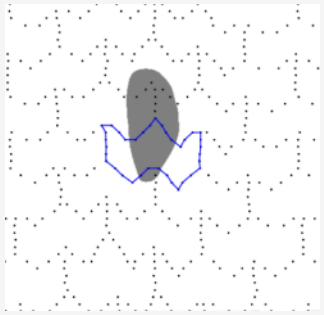
Methods to measure the cell openings

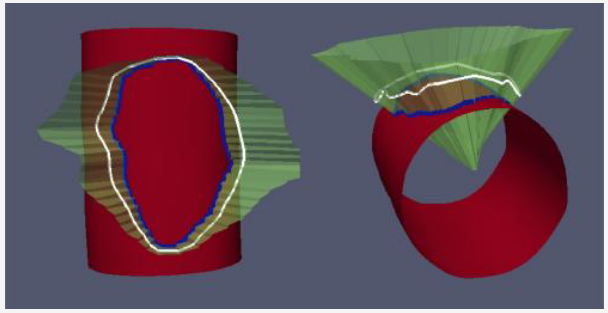
- Measure strut point in 3D
  - Indicate the stent cell struts in 2D view
  - Indicate the ostium based on lumen contours in transversal 2D view
  - Calculate the individual cell and intersection areas in 3D

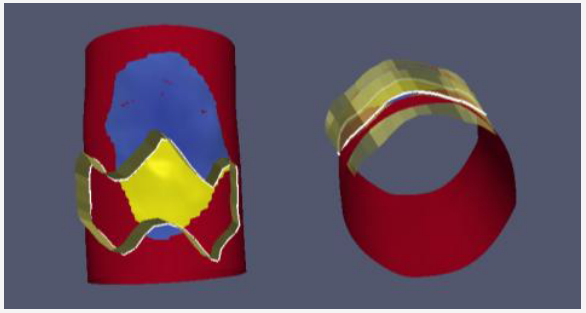








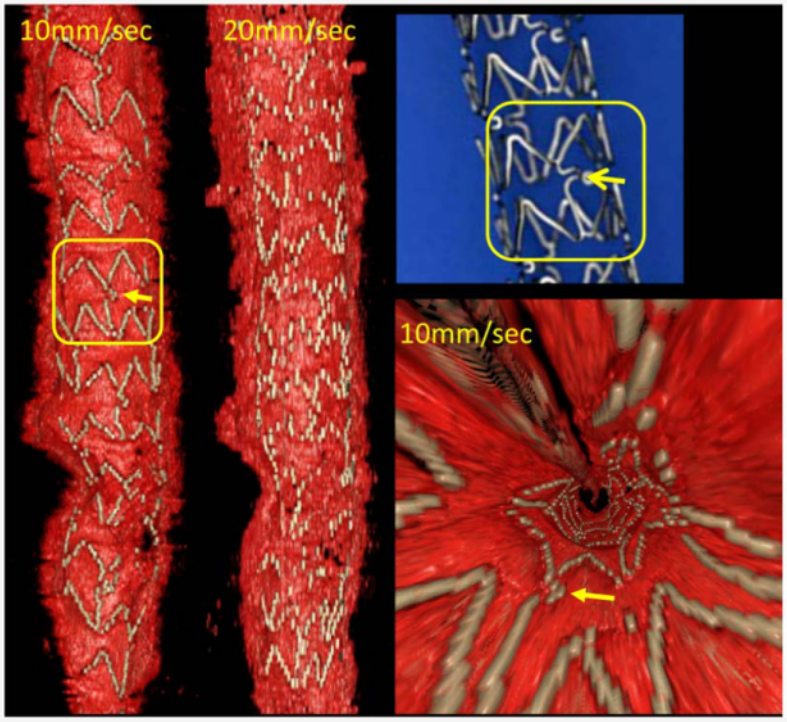




Source: Wang et al, CMIG, 2013

Concluding remarks

- Side branch measurements are difficult in only transversal views.
- Pullback speed determines the reconstruction quality.
- Cardiac motion might influence the measurements.
- Slice orientation is not always perpendicular to the vessel wall.
- Looks very scientific, but is also applicable in more clinical routine.



Source: Ughi et al, Biomedical Optics Express, 2012 (3) 12.