



10th European Bifurcation Club Meeting, Bordeaux, October 17-18, 2014



B vs Bench Testing

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BVS and Bifurcation

Background

- Absorb[®] BVS has been clinically evaluated in simple lesions



- Bifurcation management with BVS remains challenging...
- We need Bench Study !



BVS and Bifurcation

Background

- **Bioresorbable Vascular Scaffold Features :**
 - Radiolucent, mechanical performance of Polymer
 - BVS behaviour and result in bifurcation remain unknown
 - Clinical impact of malapposition, struts fractures, side-branch obstruction...?

- **BVS Bench Bifurcation study**

Based on our experience of Bench 2013

& publication of John Ormiston (*Eurointervention* 2014)

« POT & Kiss »

Absorb[®] : 3.5x28mm (14 atm)
POT : NC Balloon 4.0mm (20 atm)
Kissing : NC Balloon 3.0mm & 2.5mm



EBC 2013, London
O. Darremont

Absorb[®] 3.5mm

Distal

Bifurcation

Proximal

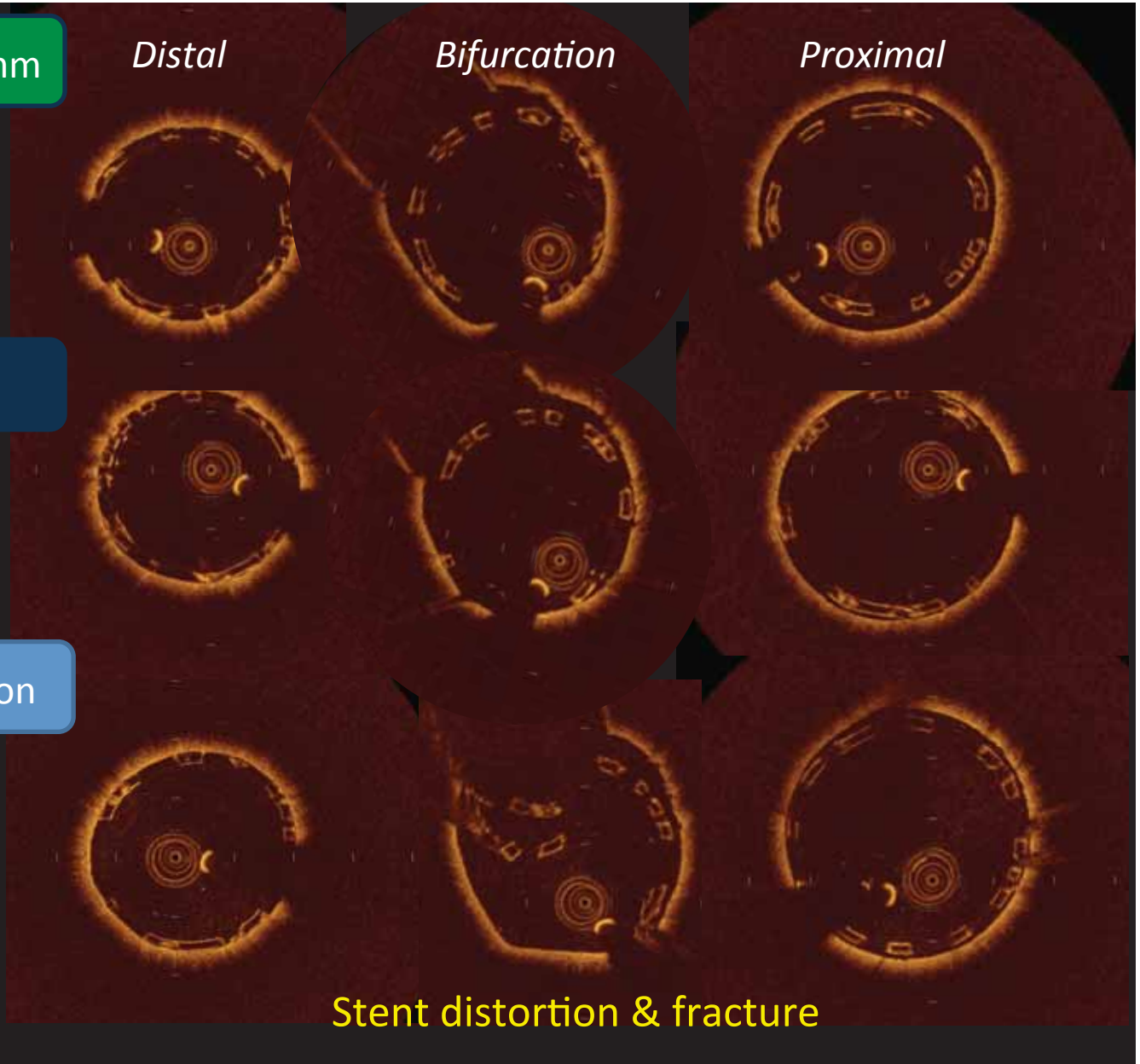
POT

Kissing Balloon

Micro-CT 3D rendering



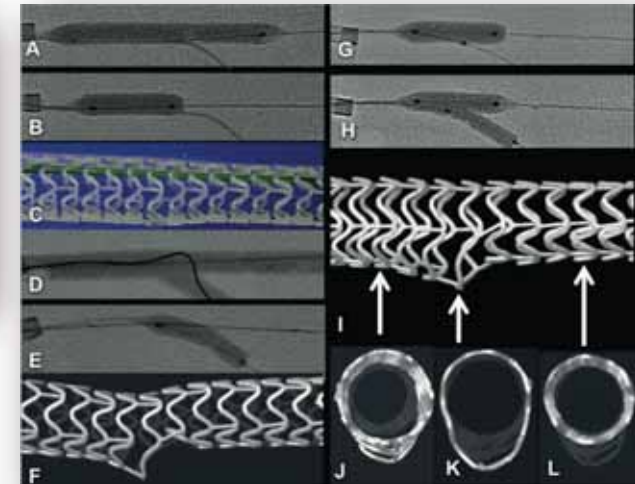
Stent distortion & fracture




BVS and Bifurcation

Absorb everolimus-eluting bioresorbable scaffolds in coronary bifurcations: a bench study of deployment, side branch dilatation and post-dilatation strategies

John A. Ormiston^{1,2,3*}, MBChB; Bruce Webber¹, MHS; Ben Ubod¹, BSN; Mark W.I. Webster^{1,2,3}, MBChB; Jonathon White², MBChB



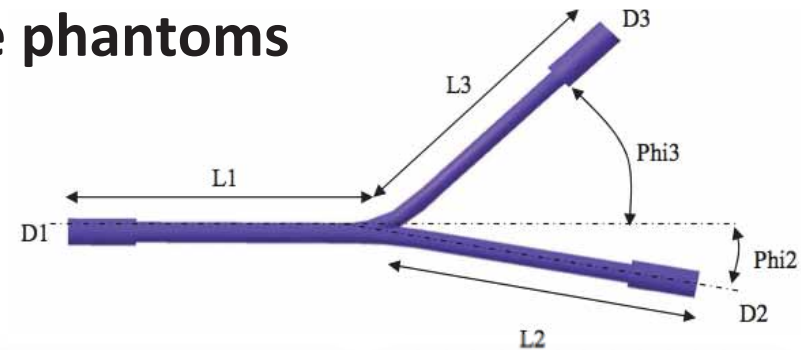
- 
- Low inflation pressure
 - Small Non Compliant Balloon on the side branch
 - Mini Kissing : Snuggle

Ormiston JA, Eurointervention 2014

BVS and Bifurcation

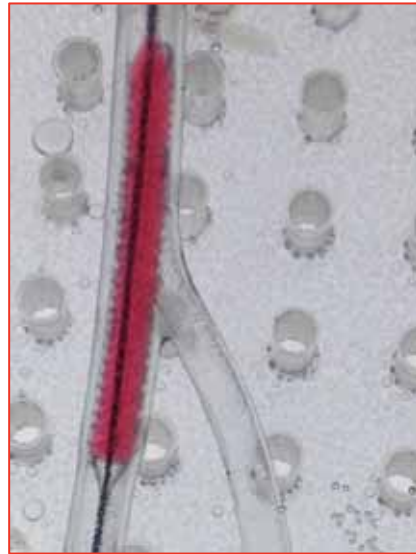
Method : Bench

- BVS deployment in aqueous bath at 37°
- Dedicated Translucent silicone phantoms
- Geometric Fractal Law (Finet)

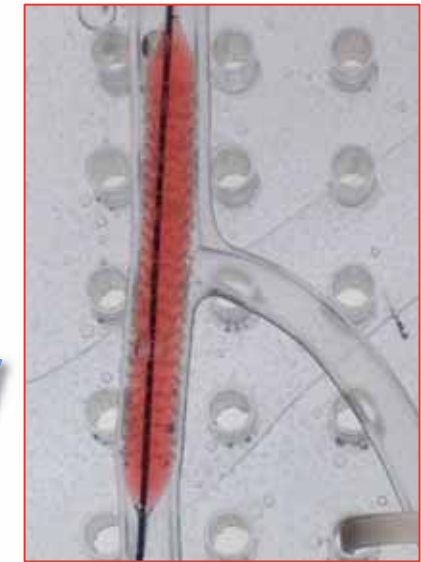
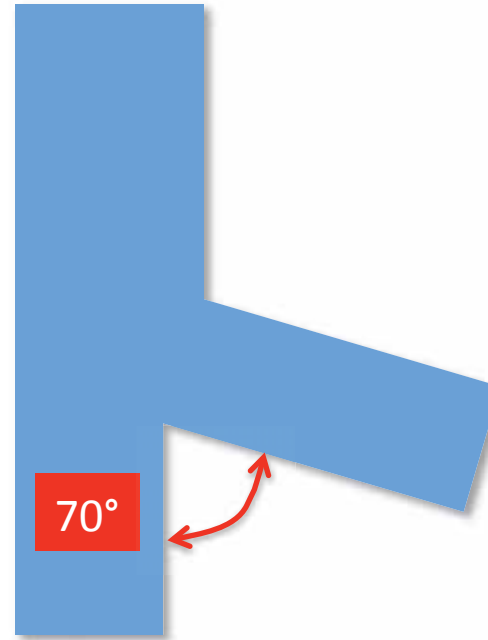


BVS and Bifurcation

Bench A (LAD/Diagonal)



Bench B (Left Main)



Diameters (mm) & inflation pressure				10 atm	12 atm	12 atm	5+5 atm
Bench	Prox MB	Dist MB	SB	BVS	POT	Side	Kiss
LAD/Diag	3.5	3.0	2.5	3.0 x 28	3.5	2.5	3.0+2.5
Left Main	4.2	3.5	3.0	3.5 x 28	4.0	2.5	3.5+2.5



BVS and Bifurcation

Method : Stenting

- **Slow BVS deployment, different strategies**

Strategy 1 : BVS + POT + Side Opening + Final POT = **PSP**

Strategy 2 : BVS + POT + **Snuggle Kissing** + Final POT = **PKP**

One Stent

Strategy 3 : BVS + POT + **Snuggle Kissing** + T stenting = **PKP+T**

Strategy 4 : BVS side + BVS main + POT + **Snuggle Kissing** = **MiniCrush**

Strategy 5 : BVS side + BVS Main + **Snuggle Kissing** + POT = **Culotte**

Two Stents



BVS and Bifurcation

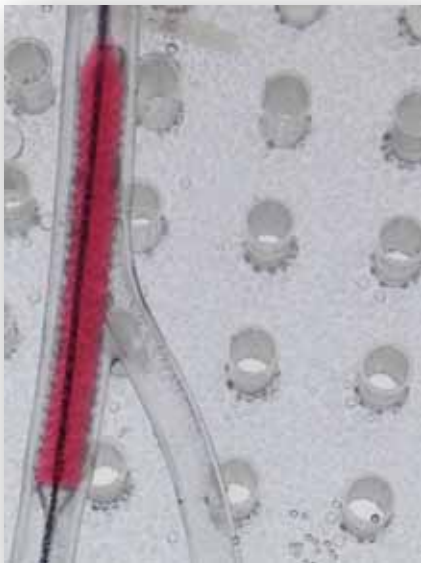
	Bench A		Bench B		
PSP	1	2	1	2	
PKP	1	2	1	2	3
PKP+T	1		1		
Crush	1	2	1	2	
Culotte	1				

Method : Stenting

16 Bifurcations Strategies

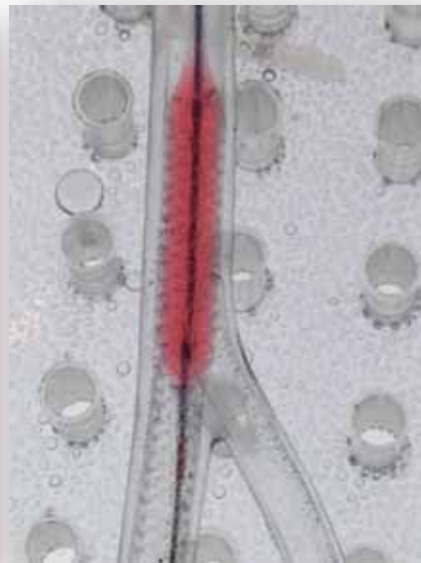
- Example of PKP in Bench A

POT



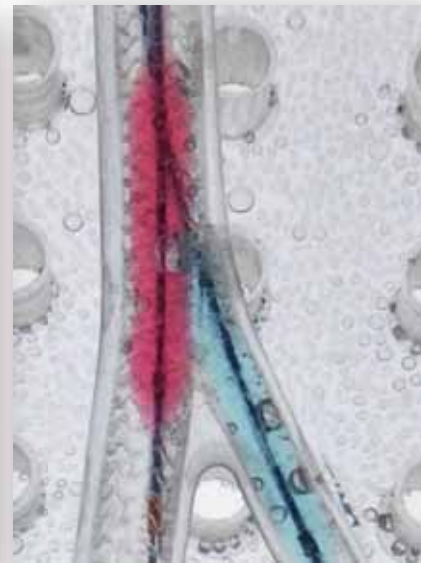
BVS 3.0x28mm
10 atm

Snuggle Kissing



NCB 3.5mm
12 atm

Final POT



NCB 2.5mm & 3.0mm
5 atm

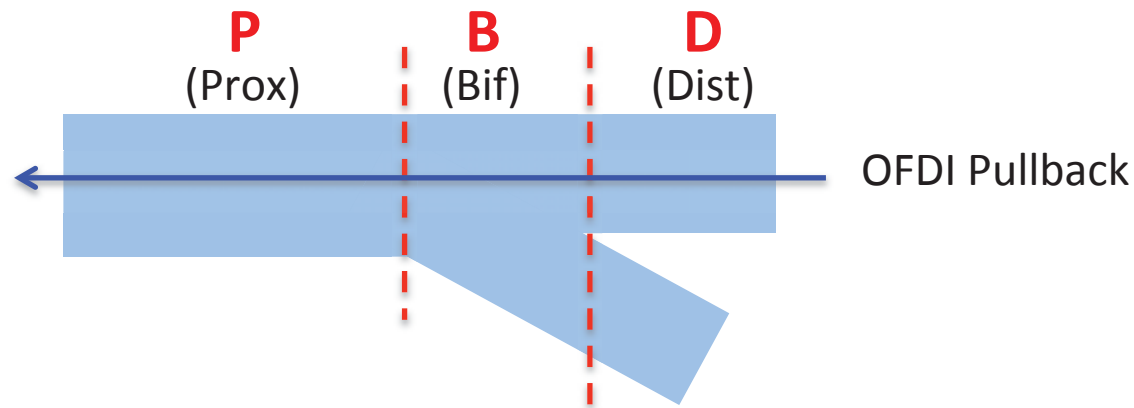


NCB 3.5mm
12 atm

BVS and Bifurcation

OCT assessment

OFDI, Lunawave **TERUMO**® System
Pullback speed = 10mm/s



OCT criterias : area and diameter measurements of lumen and BVS, stent deployment, stent apposition, struts fractures....

Micro-CT assessment

3D rendering, qualitative assessment

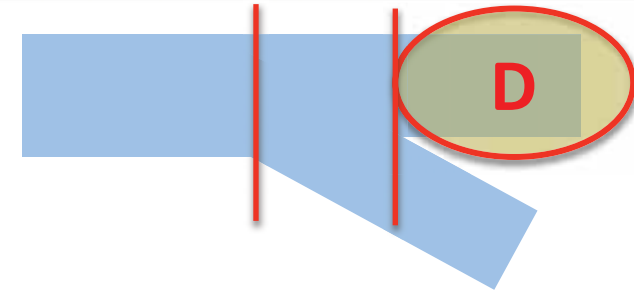


BVS and Bifurcation

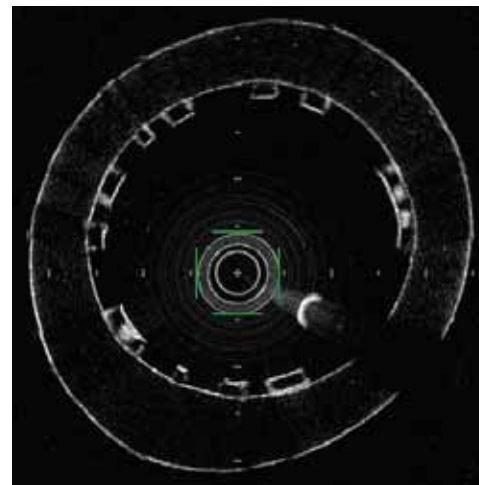
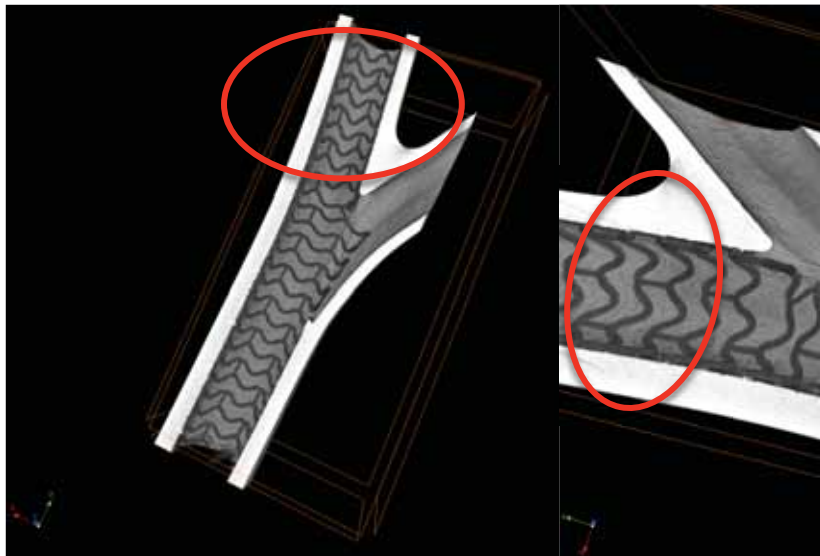
Results :

Distal Segment

- Final results : excellent
- Perfect apposition
- No stent distortion
- No strut fracture



	Bench A		Bench B		
PSP	1	2	1	2	
PKP	1	2	1	2	3
PKP+T	1		1		
Crush	1	2	1	2	
Culotte	1				

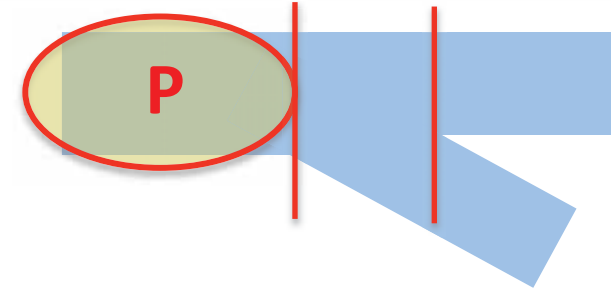


BVS and Bifurcation

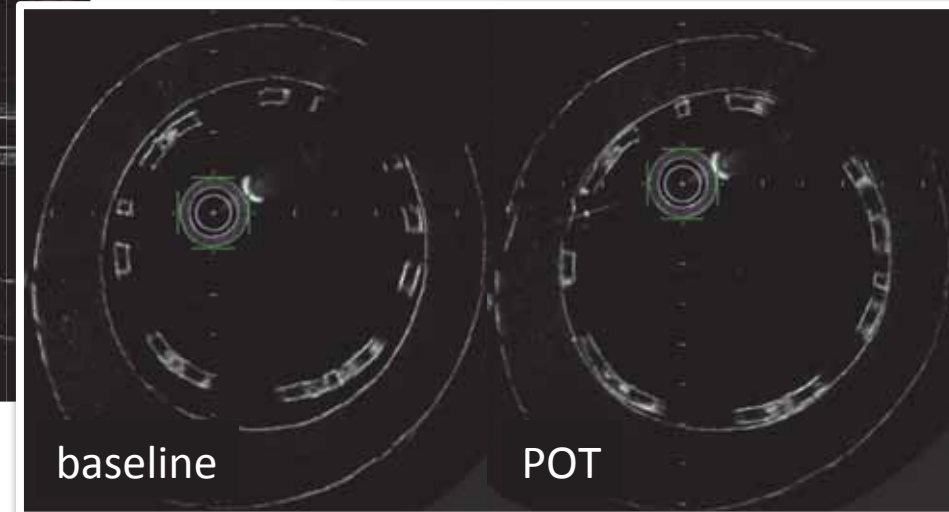
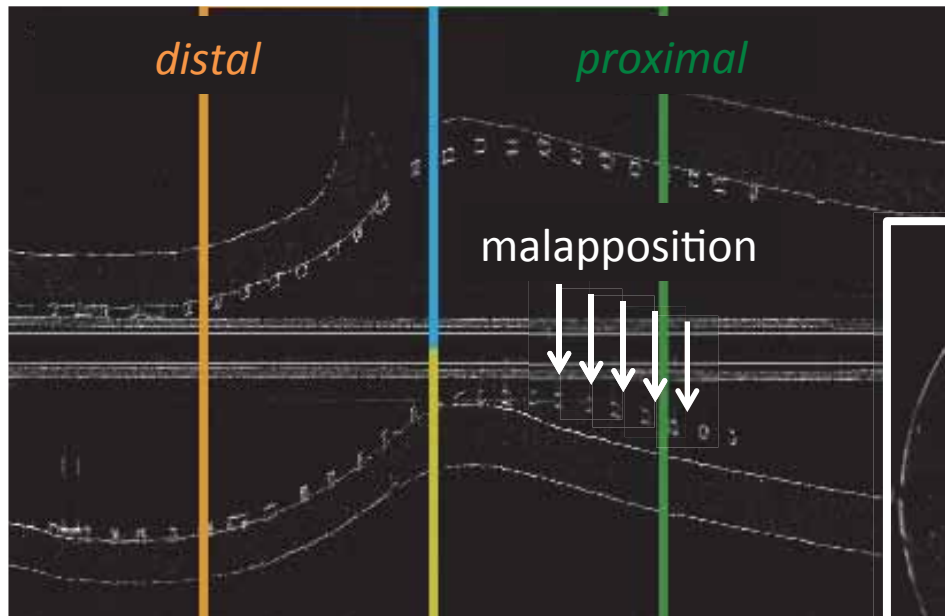
Results :

Proximal Segment

- Final results : excellent
- No stent distortion
- No strut fracture
- POT is safe & mandatory



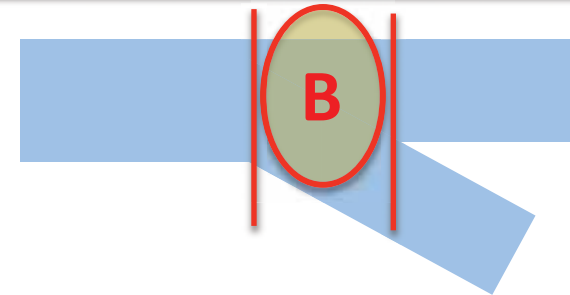
	Bench A		Bench B		
PSP	1	2	1	2	
PKP	1	2	1	2	3
PKP+T	1		1		
Crush	1	2	1	2	
Culotte	1				



BVS and Bifurcation

Results :

Bifurcation Segment



« Heterogeneous Results »

- Apposition
- Side Opening
- Protrusion
- Lumen Obstruction
- Strut Fracture

One stent

Two stents

	Bench A		Bench B		
PSP	1	2	1	2	
PKP	1	2	1	2	3
PKP+T	1		1		
Crush	1	2	1	2	
Culotte	1				

PSP (POT, Side opening, final POT)

Messages

1

2

3

4

- **Simplest strategy**
- Soft strategy : no fracture (small NCB \varnothing : 2.5mm, low pressure : 5atm)
- Good result on Main Branch



Micro-CT, P.Pilet, P.Guérin

PSP (POT, Side opening, final POT)

Messages

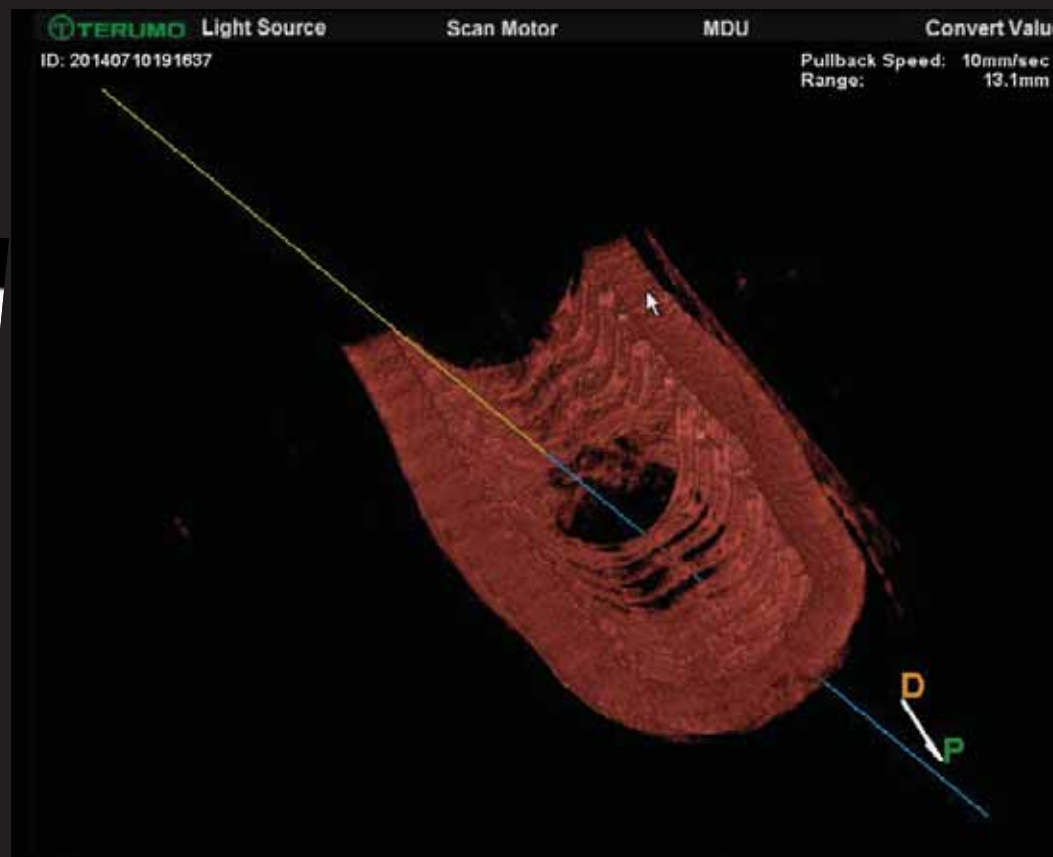
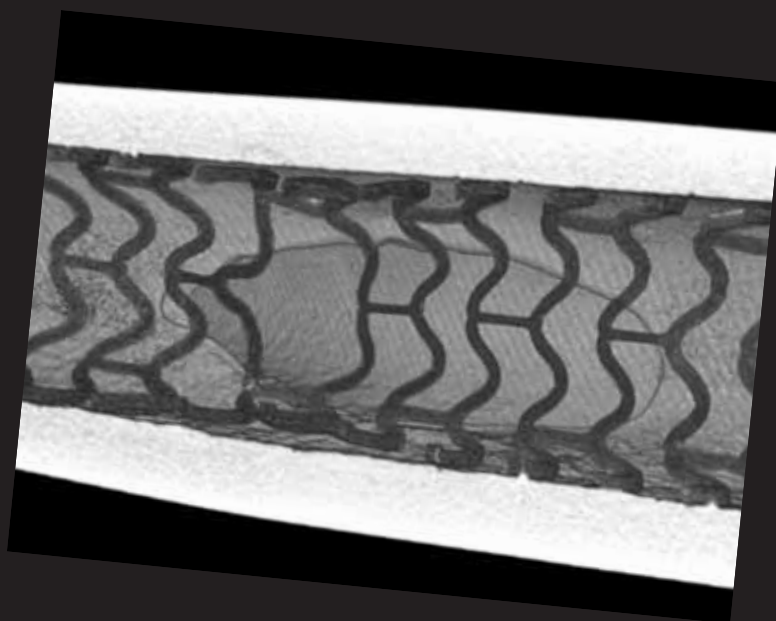
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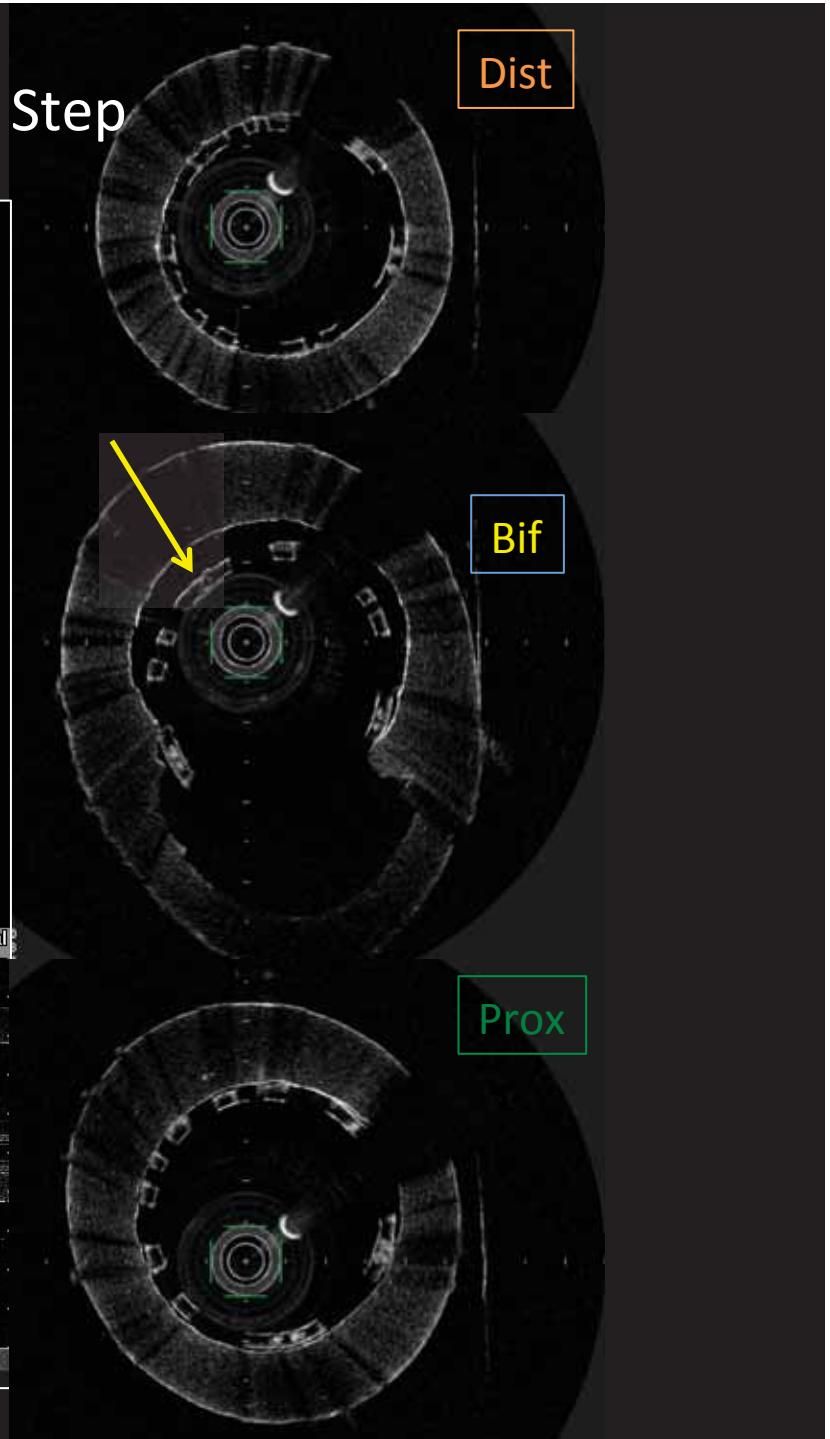
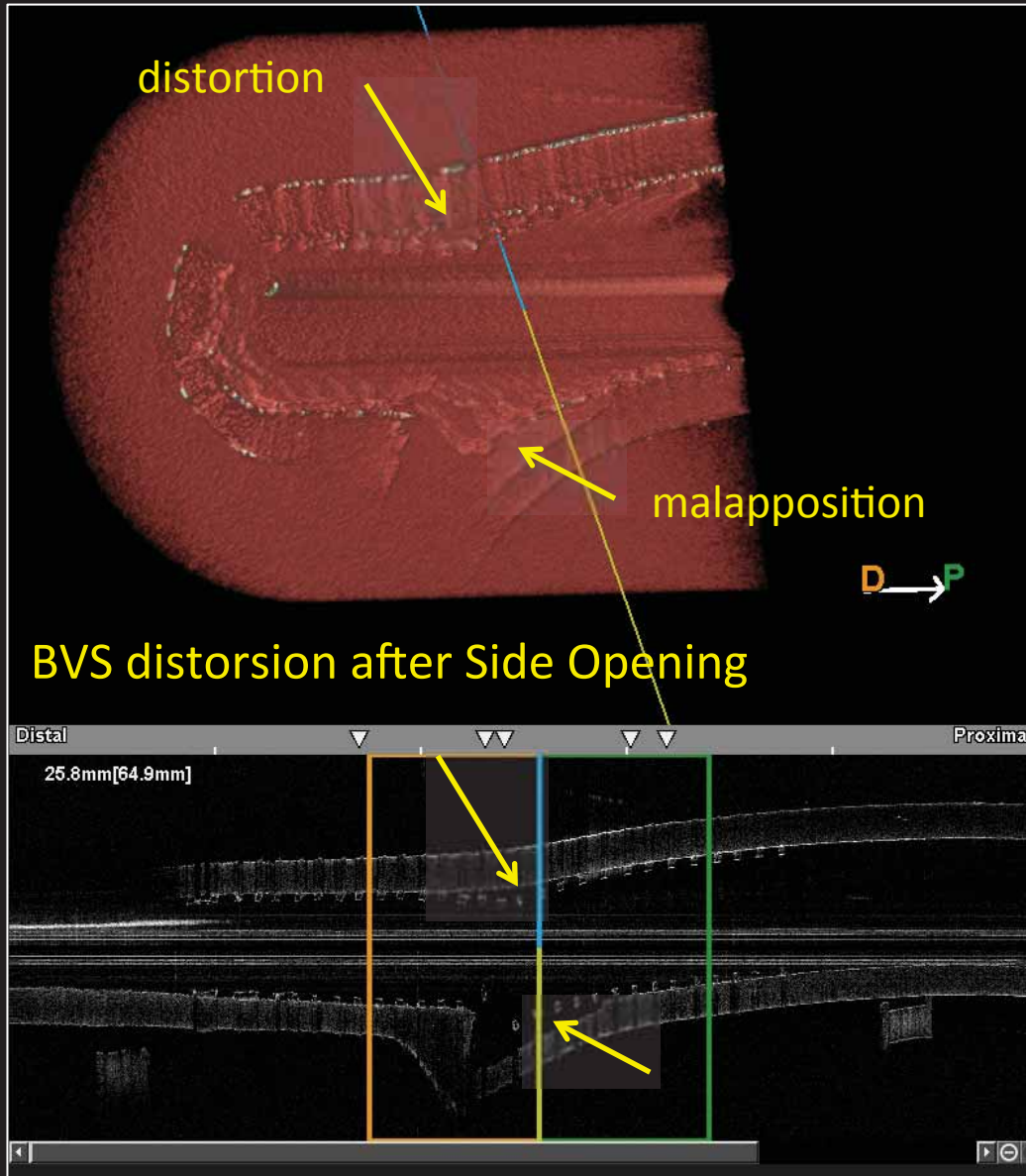
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4

Excellent correlation Micro-CT/OFDI



OFDI provides BVS assessment Step by Step



PSP (POT, Side opening, final POT)

Messages

1

2

3

4

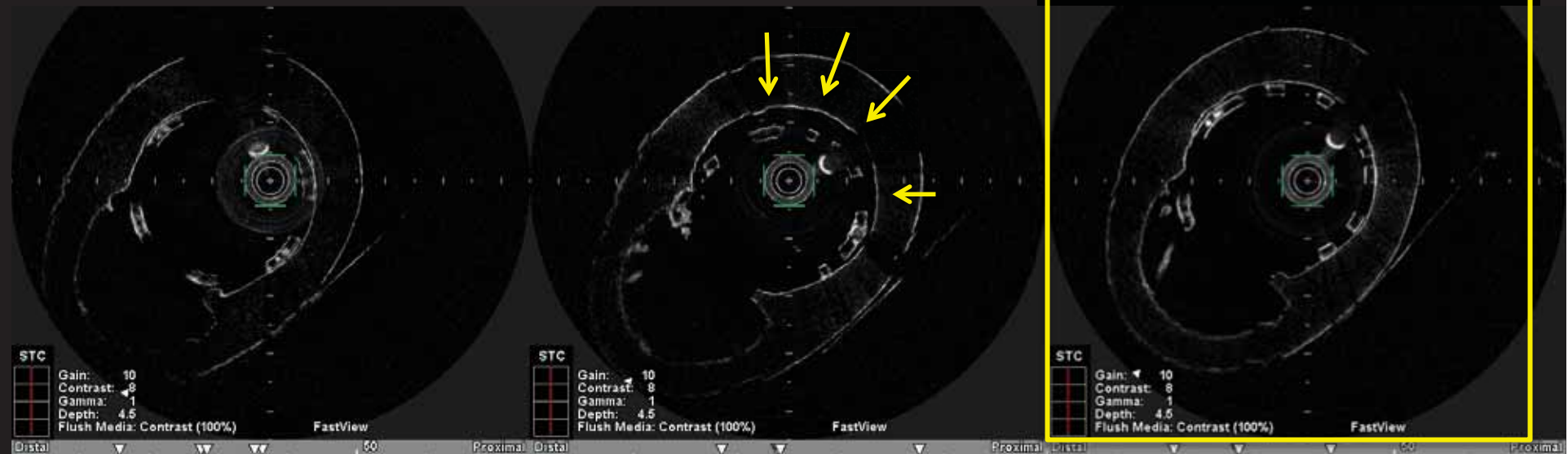
- Final POT is mandatory to correct BVS distortion induced by Side opening

Impact of Final POT on BVS distortion

POT

Side Opening

Final POT



PSP (POT, Side opening, final POT)

Messages

1

2

3

4

- Sub-optimal Side ostium scaffolding



Bench A

bench defect ?
inelasticity of BVS ?
low angle ?



Bench B

PKP (*POT, Kissing, final POT*)

Messages

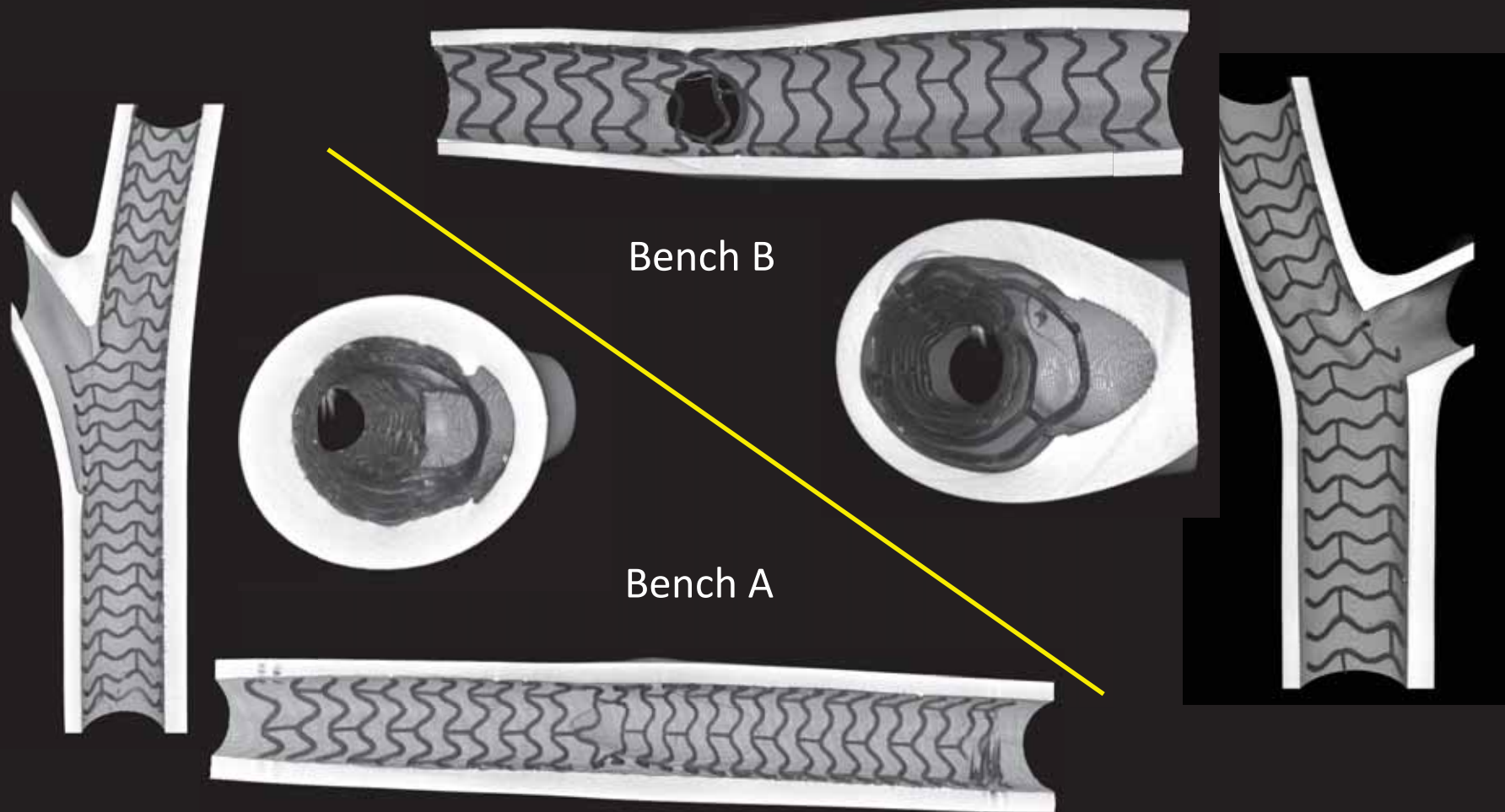
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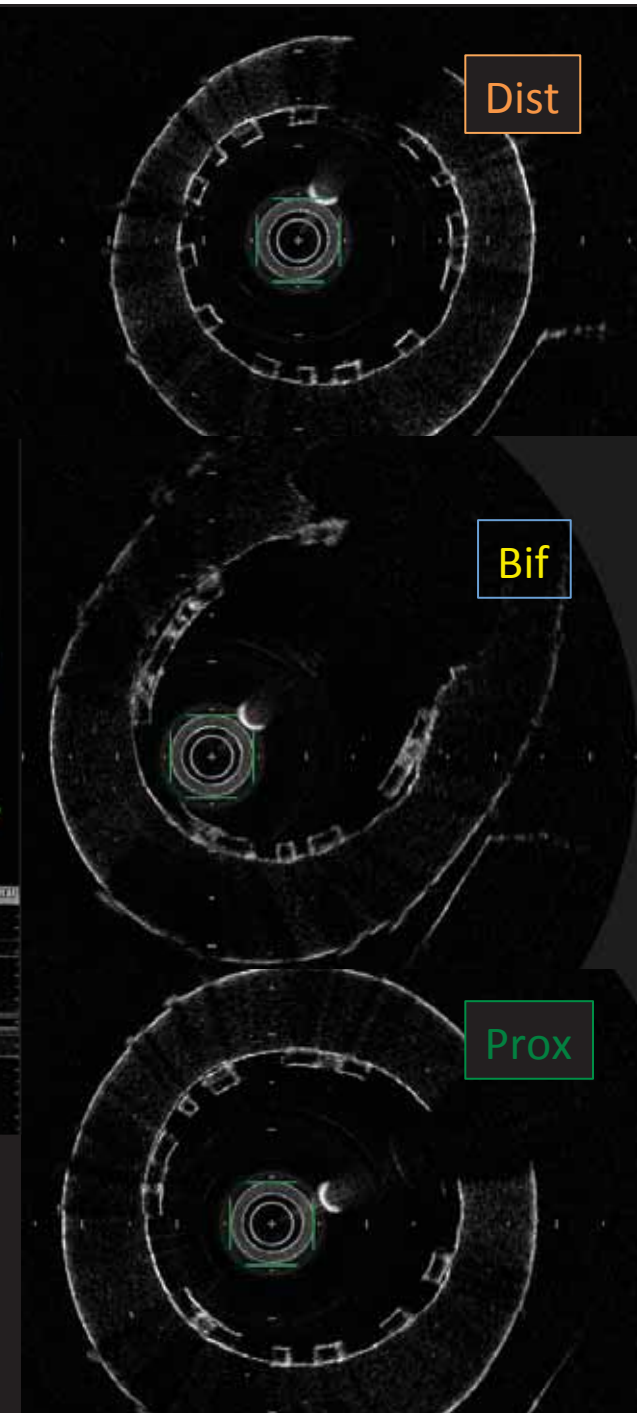
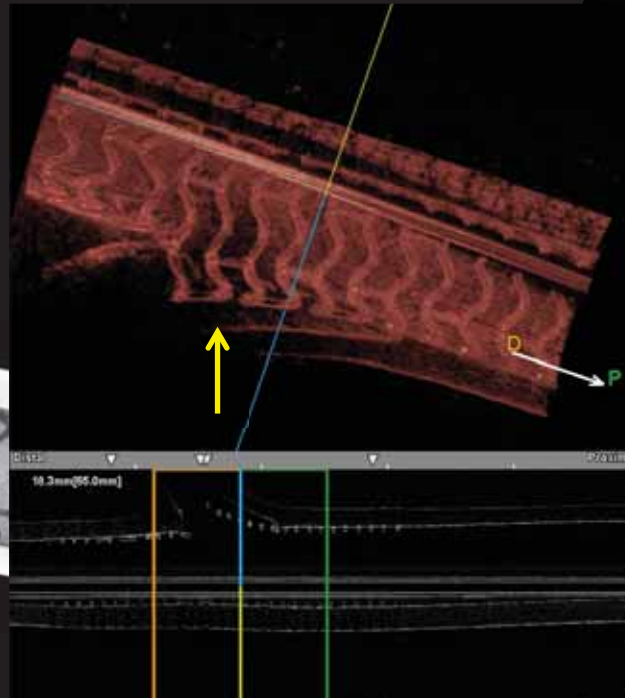
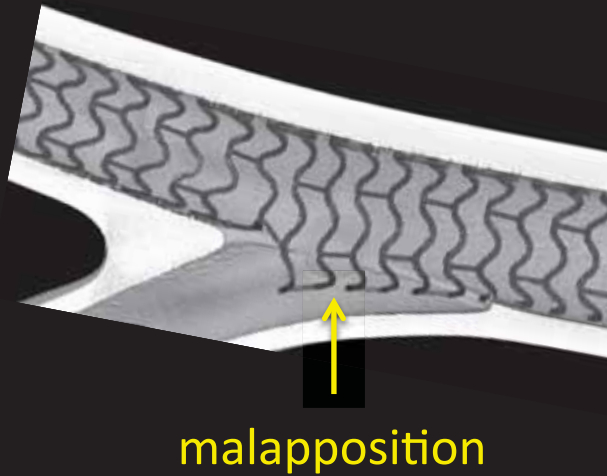
4

- Final result very similar to PSP
- Good result on Main branch



PKP (*POT, Kissing, final POT*)

- Soft distortion of BVS without fracture
- Sub-optimal Side ostium scaffolding



PKP (POT, Kissing, final POT)

Messages

1

2

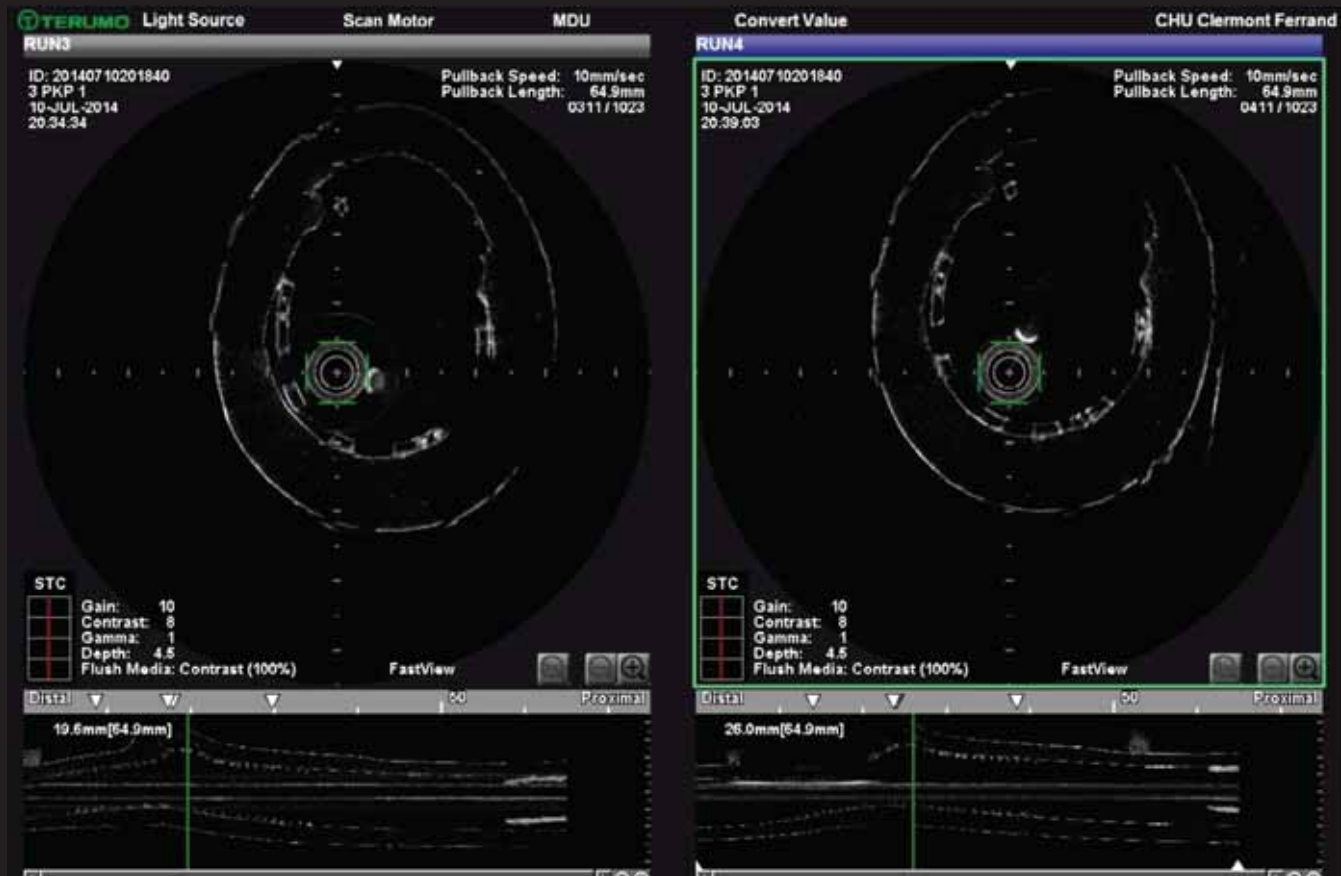
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- Final POT is not essential

Snuggle

Final-POT



OFDI frame registration

Culotte or Minicrush

Messages

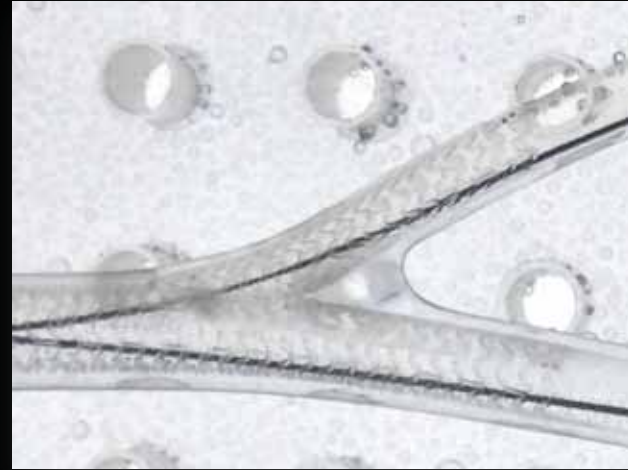
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Even if appearances are flattering....



Culotte or Minicrush should be avoided with BVS

- Complex strategy with BVS (*recrossing*)
- Culotte inapplicable in Left Main Bench
- Bad OCT and Micro-CT results :
Struts fracture, Side branch Obstruction, Protrusion in main branch....

Culotte

Messages

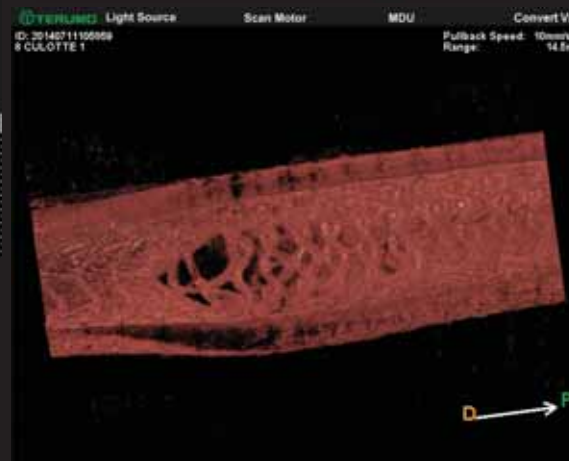
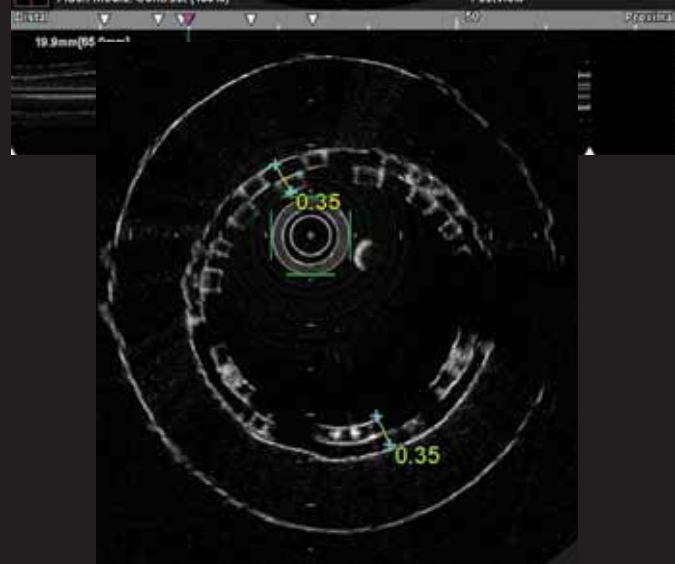
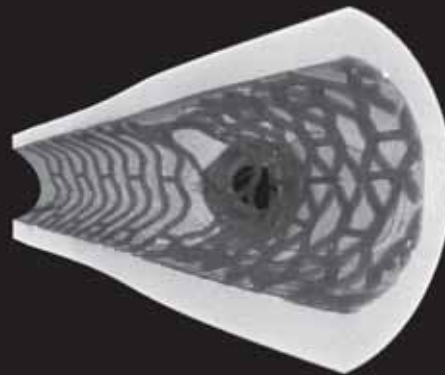
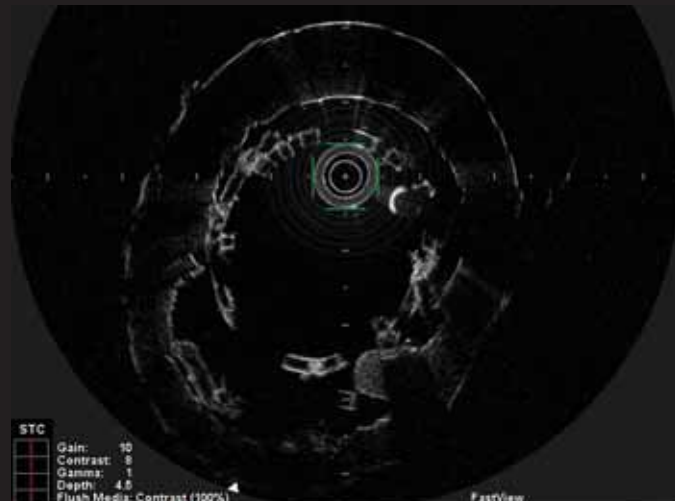
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Lumen and Side Branch Obstruction



2 layers > 600 μ m

Minicrush

Messages

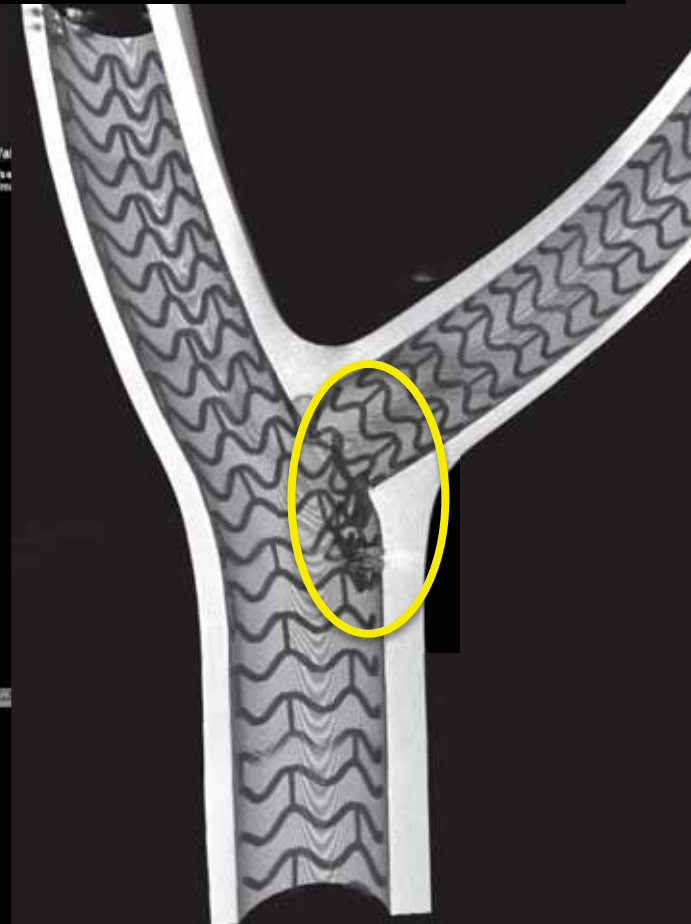
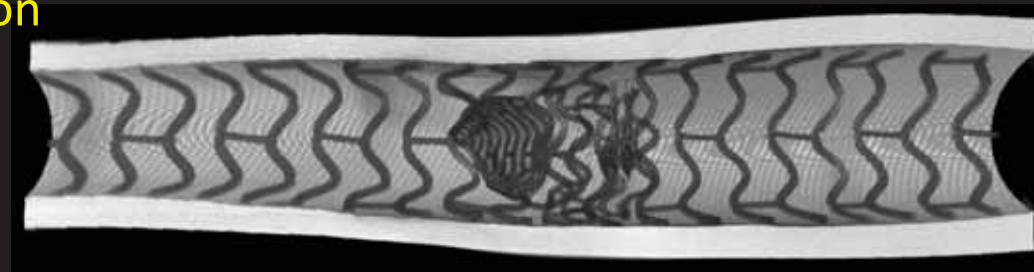
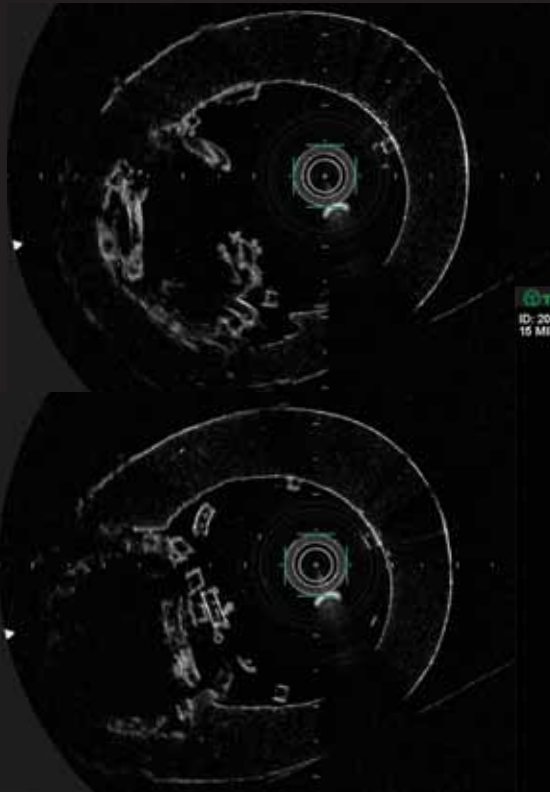
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Lumen and Side Branch Obstruction



PKP+ T (POT, Kissing, final POT + T stenting)

Messages

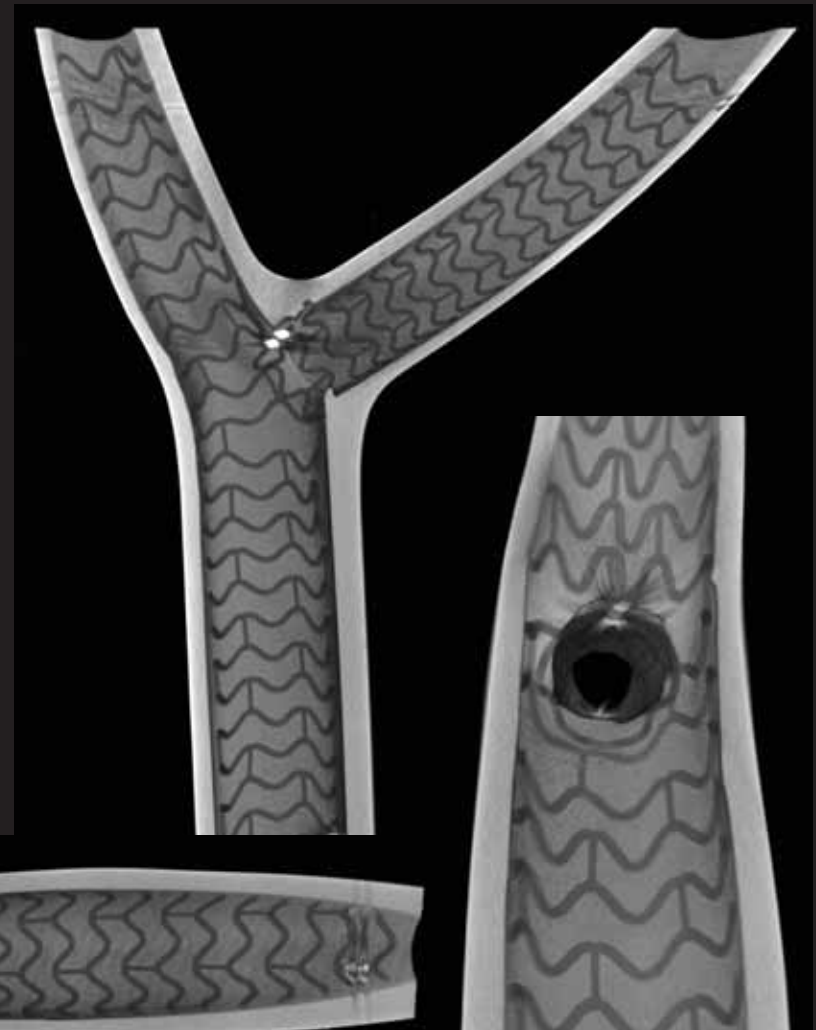
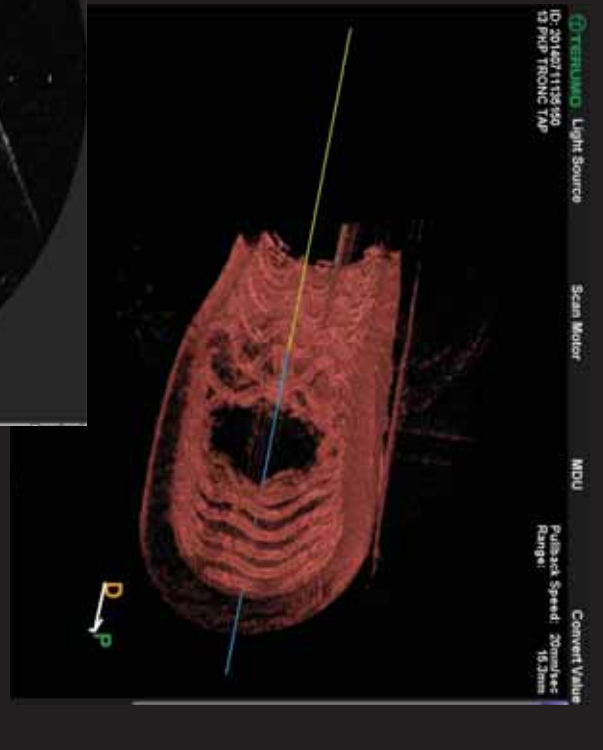
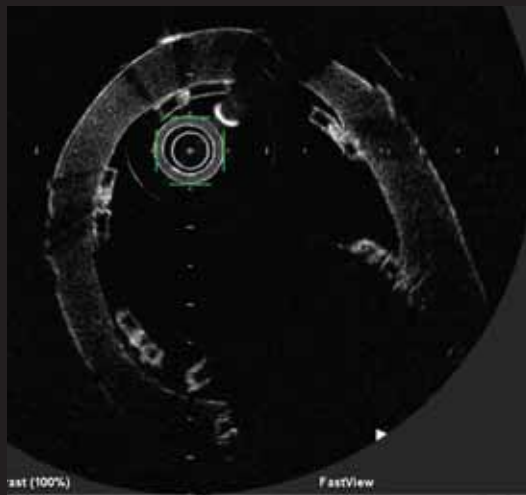
1

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4

- If two stents are required, the least worst strategy is...
- Good result especially in Left Main Bench



- If two stents are required, the least worst strategy is...
- Good result especially in Left Main Bench





BVS and Bifurcation

Conclusion

- Stenting Bifurcation with BVS is possible but we must stay cautious
- Bench study is useful to assess the behaviour of BVS in bifurcation

- **OCT gives information very similar to these provided by micro-CT :**
 - **Small NCB and low pressure** prevent strut fractures
 - One Stent rather than Two
 - Simplest is better :

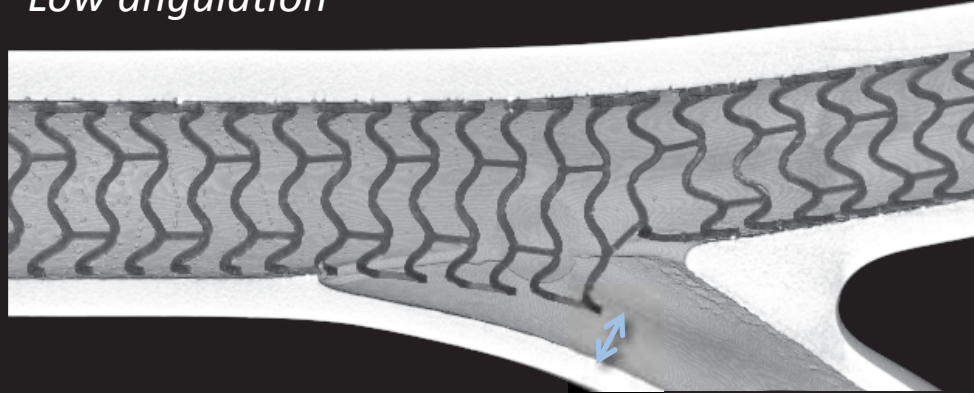
POT + Side & Final POT or POT + Snuggle



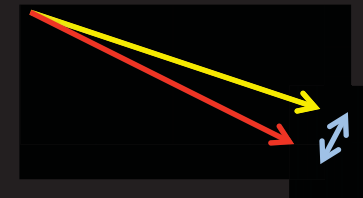
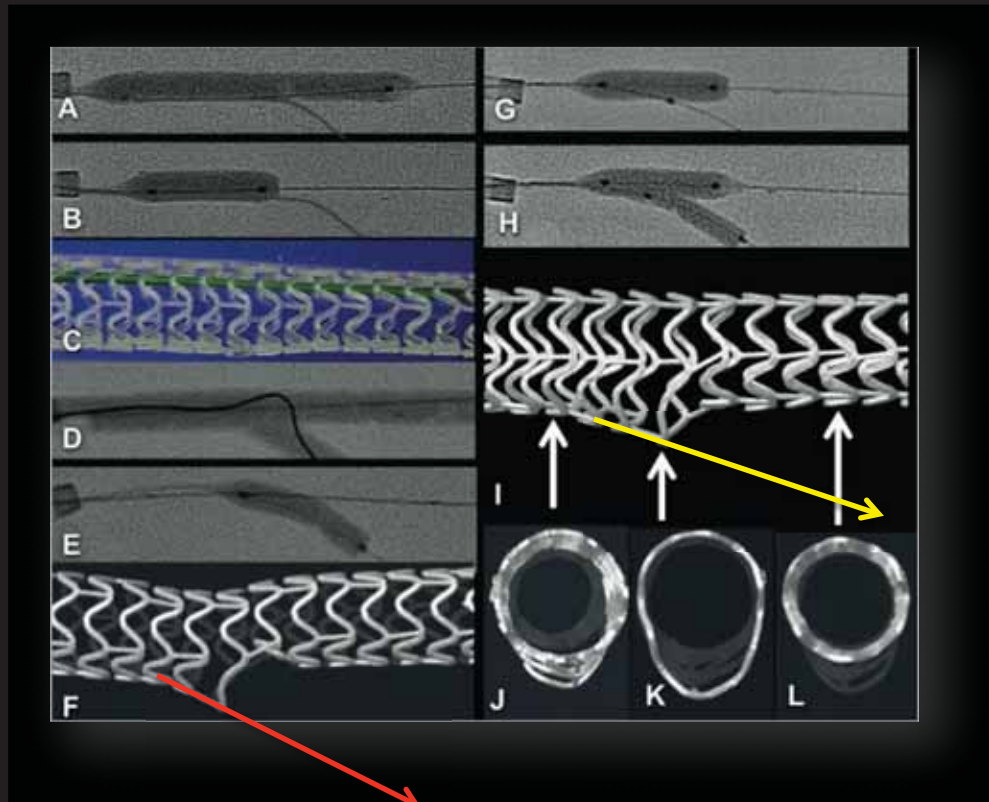
BVS Bench Testing

Appearances are
Sometimes Deceptive

Low angulation



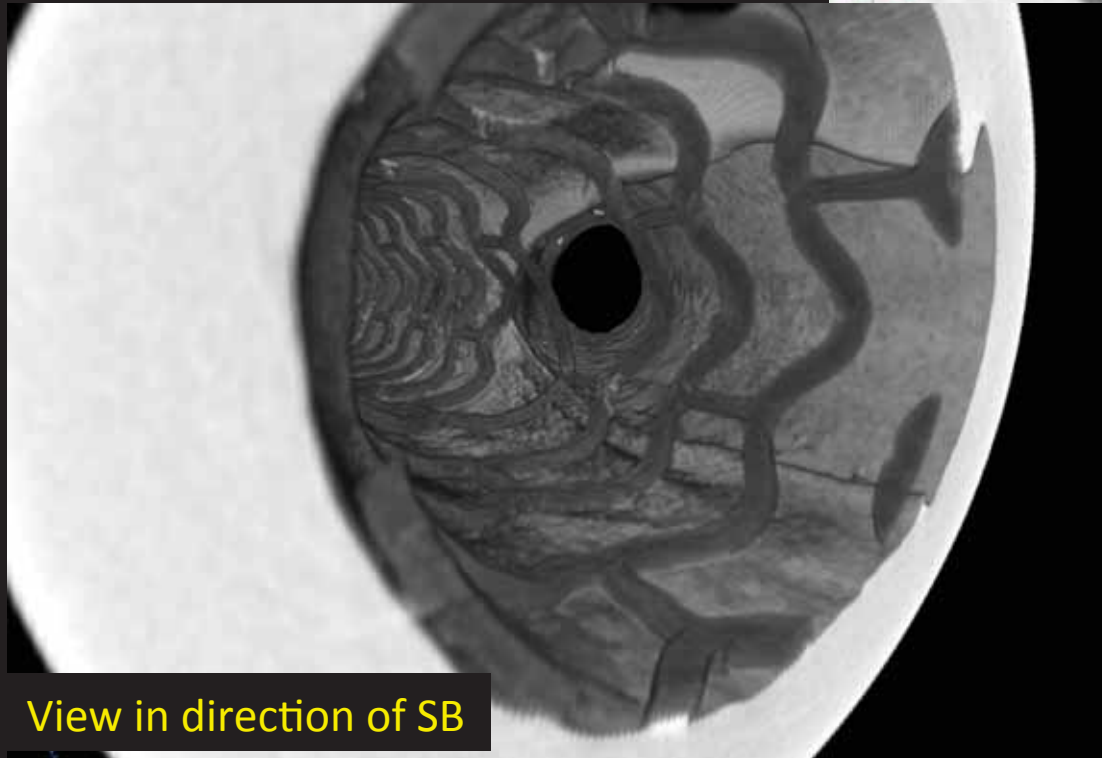
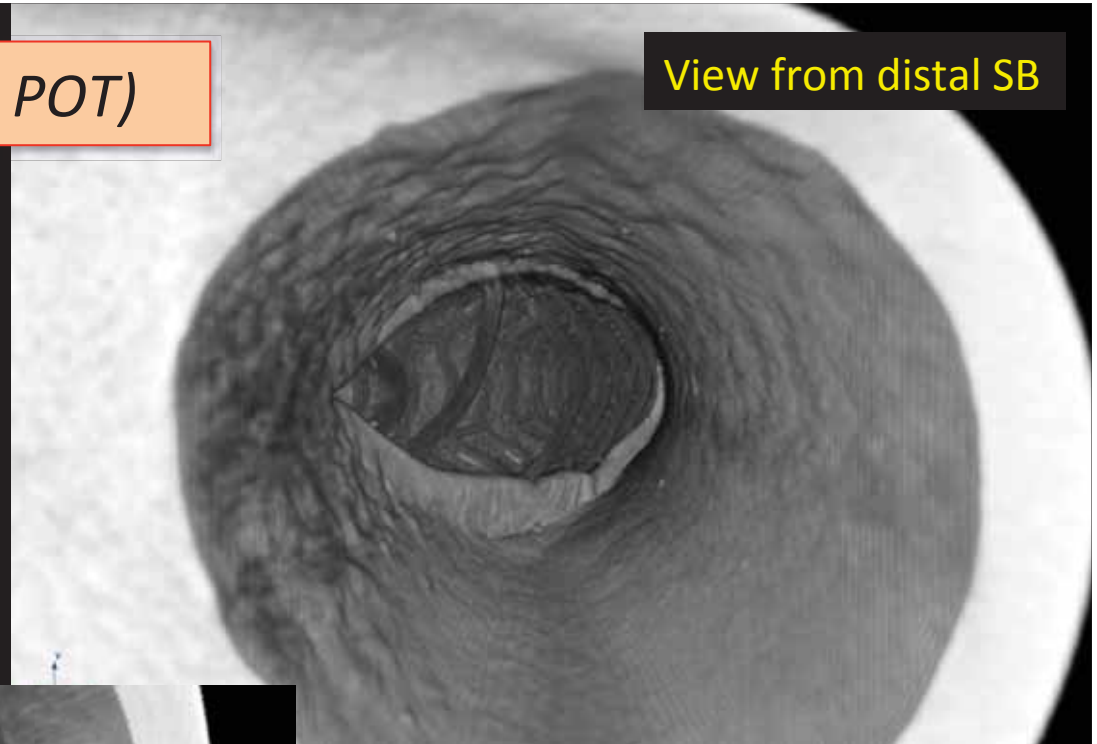
BVS Bench Bifurcation Study



Ormiston JA, Eurointervention 2014

PSP (*POT, Side opening, final POT*)

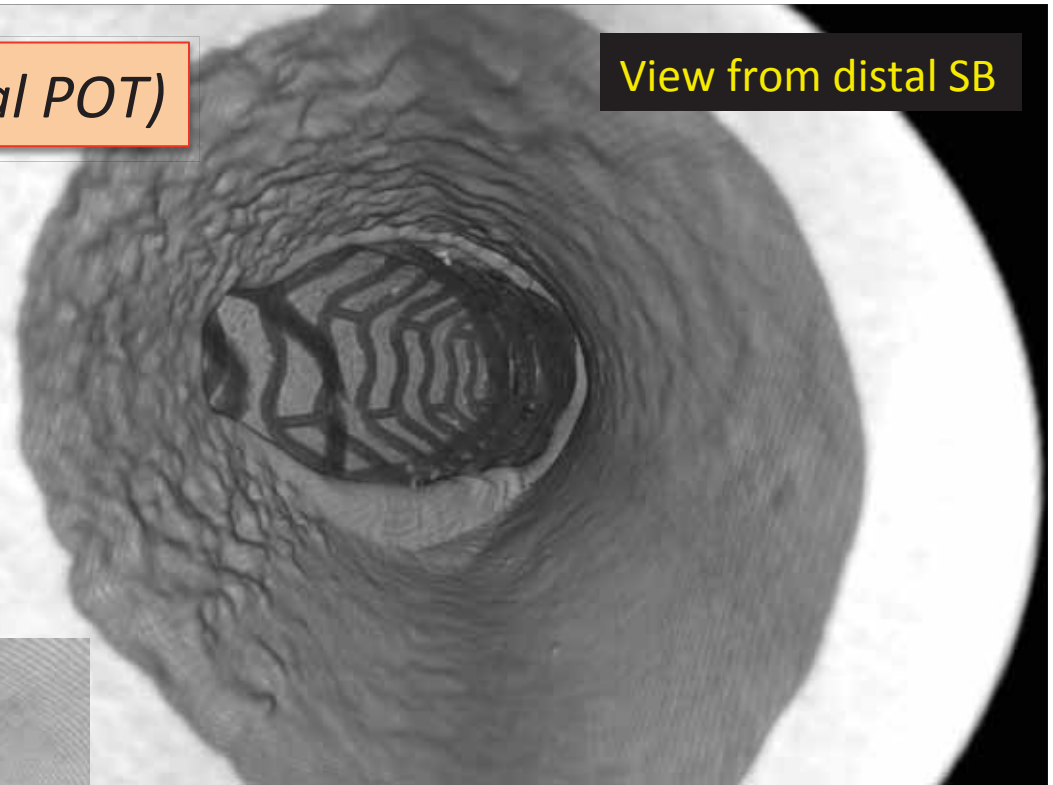
View from distal SB



View in direction of SB

PKP (*POT, Snuggle Kissing, final POT*)

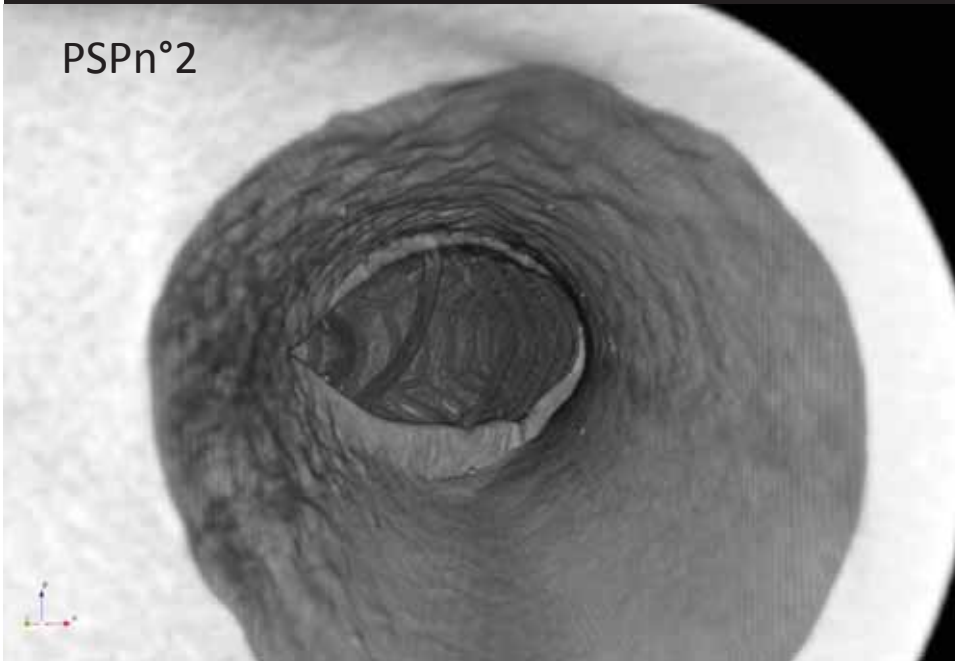
View from distal SB



PSP (*POT, Side opening, final POT*)

View from distal SB

PSPn°2



PSPn°1

