

Fusion imaging: what are the benefits for peripheral procedures?

LOUIS Nicolas, Vascular Surgeon
Hôpital Privé les Franciscaines, Nîmes
France

*I-MEET, NICE
JUNE 2018*



Image Fusion

Image Fusion



Hybrid Room



F-EVAR



Ch-EVAR

Impact of Hybrid Rooms with Image Fusion on Radiation Exposure during Endovascular Aortic Repair

A. Hertault ^a, B. Maurel ^a, J. Sobocinski ^a, T. Martin Gonzalez ^a, M. Le Roux ^a, R. Azzaoui ^a, M. Midulla ^b, S. Haulon ^{a,*}

^aVascular Surgery, Hôpital Cardiologique, CHRU de Lille, INSERM U1008, Université Lille Nord de France, 59037 Lille Cedex, France

^bRadiology, Hôpital Cardiologique, CHRU Lille, INSERM U1008, Université Lille Nord de France, 59037 Lille Cedex, France

WHAT THIS PAPER ADDS

Experience has shown that the routine use of fusion during endovascular aneurysm repair has significantly reduced the exposure of patients and operators to X-rays and contrast volume injection during complex repairs, without jeopardising the overall procedure workflow.

Objective: To evaluate exposure to radiation during endovascular aneurysm repair (EVAR) performed with intraoperative guidance by preoperative computed tomographic angiogram fusion.

Methods: All consecutive patients who underwent standard bifurcated (BIF) or thoracic (THO), and complex fenestrated (FEN) or branched (BR) EVAR were prospectively enrolled. Indirect dose–area product (DAP), fluoroscopy time (FT), and contrast medium volume were recorded. These data were compared with a previously published prospective EVAR cohort of 301 patients and to other literature. Direct DAP and peak skin dose were measured with radiochromic films. Results are expressed as median (interquartile range).

Results: From December 2012 to July 2013, 102 patients underwent standard (56.8%) or complex (43.2%) EVAR. The indirect DAP (Gy.cm²) was as follows: BIF 12.2 (8.7–19.9); THO 26.0 (11.9–34.9); FEN 43.7 (24.7–57.5); and BR 47.4 (37.2–108.2). The FT (min) was as follows: BIF 10.6 (9.1–14.7); THO 8.9 (6.0–10.5); FEN 30.7 (20.2–40.5); and BR 39.5 (34.8–51.6). The contrast medium volume (mL) was as follows: BIF 59.0 (50.0–75.0); THO 80.0 (50.0–100.0); FEN 105.0 (70.0–136.0); and BR 120.0 (100.0–170.0). When compared with a previous cohort, there was a significant reduction in DAP during BIF, FEN, and BR procedures, and a significant reduction of iodinated contrast volume during FEN and BR procedures. There was also a significant reduction in DAP during BIF procedures when compared with the literature ($p < .01$). DAP measurement on radiochromic films was strongly correlated with indirect DAP values ($r^2 = .93$).

Conclusion: The exposure of patients and operators to radiation is significantly reduced by routine use of image fusion during standard and complex EVAR.

© 2014 European Society for Vascular Surgery. Published by Elsevier Ltd. All rights reserved.

Article history: Received 17 February 2014, Accepted 30 May 2014, Available online 17 July 2014

Keywords: Aorta, Endovascular procedures, Fusion imaging, Hybrid room, Radiation, Radiation protection

Impact of Hybrid Rooms with Image Fusion on Radiation Exposure during Endovascular Aortic Repair

WHAT THIS PAPER ADDS

Experience has shown that the routine use of fusion during endovascular aneurysm repair has significantly reduced the exposure of patients and operators to X-rays and contrast volume injection during complex repairs, without jeopardising the overall procedure workflow.

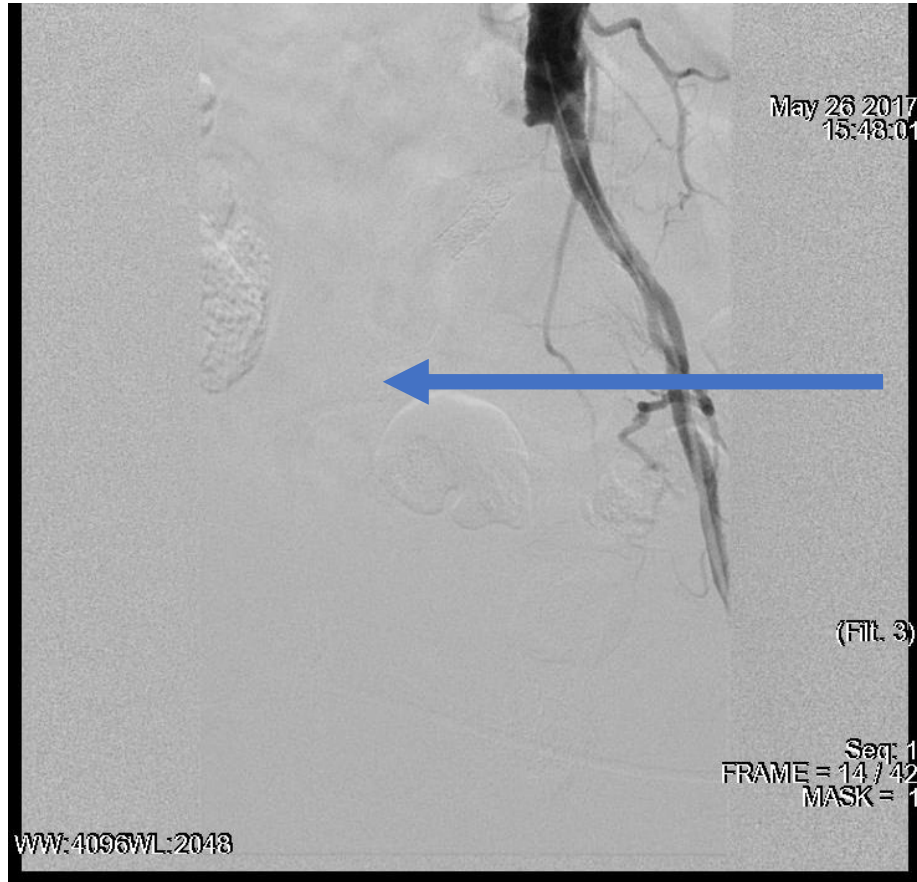
Objective: To evaluate exposure to radiation during endovascular aneurysm repair (EVAR) performed with intraoperative guidance by preoperative computed tomographic angiogram fusion.

Methods: All consecutive patients who underwent standard bifurcated (BIF) or thoracic (THO), and complex fenestrated (FEN) or branched (BR) EVAR were prospectively enrolled. Indirect dose–area product (DAP), fluoroscopy time (FT), and contrast medium volume were recorded. These data were compared with a previously published prospective EVAR cohort of 301 patients and to other literature. Direct DAP and peak skin dose were measured with radiochromic films. Results are expressed as median (interquartile range).

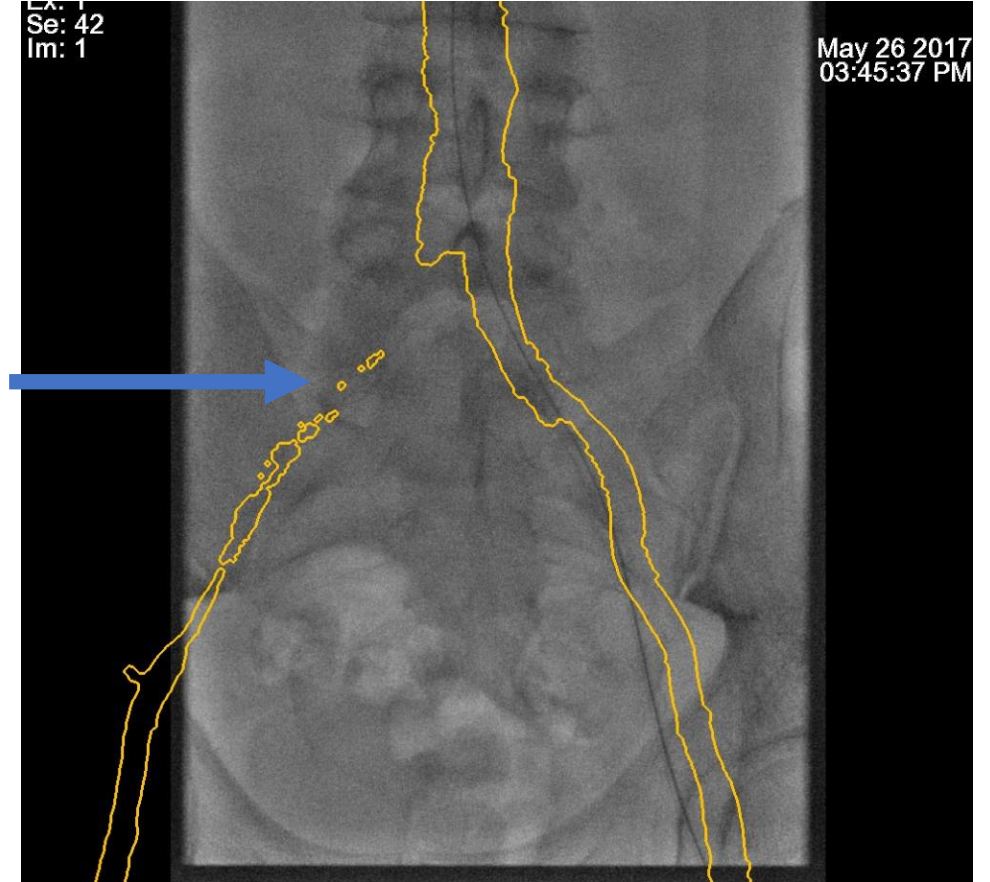
Results: From December 2012 to July 2013, 102 patients underwent standard (56.8%) or complex (43.2%) EVAR. The indirect DAP ($\text{Gy}\cdot\text{cm}^2$) was as follows: BIF 12.2 (8.7–19.9); THO 26.0 (11.9–34.9); FEN 43.7 (24.7–57.5); and BR 47.4 (37.2–108.2). The FT (min) was as follows: BIF 10.6 (9.1–14.7); THO 8.9 (6.0–10.5); FEN 30.7 (20.2–40.5); and BR 39.5 (34.8–51.6). The contrast medium volume (mL) was as follows: BIF 59.0 (50.0–75.0);

Conclusion: The exposure of patients and operators to radiation is significantly reduced by routine use of fusion imaging....

Occluded arteries and Image Fusion?

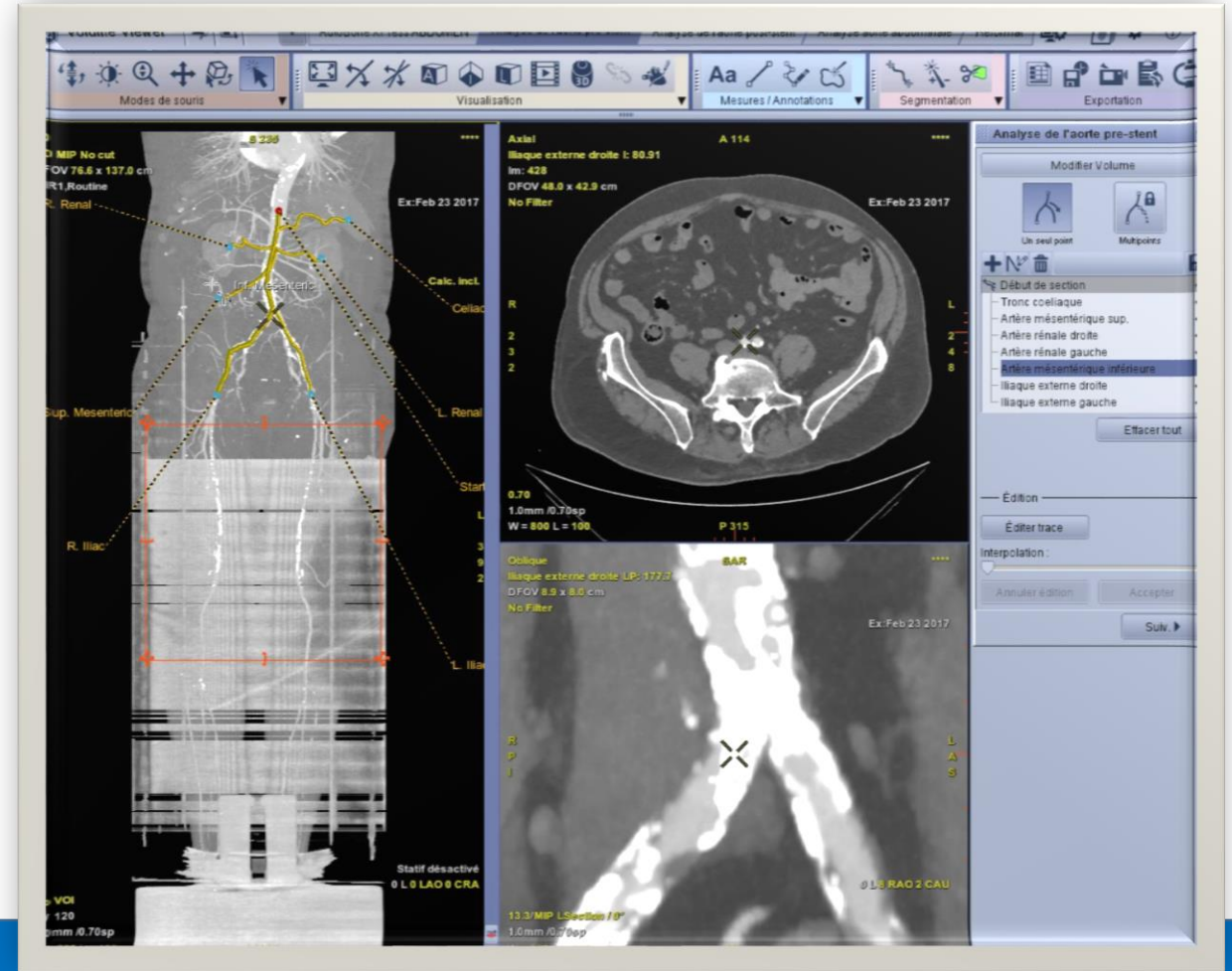


Void Area



Occluded arteries and Image Fusion?

- *Workstation ADW 4.7 from GE®*
- *To create a bridge between two non occluded area*
- *Line up the centerline inside the lumen artery*



Occluded Arteries and Image Fusion?

- Workstation ADW 4.7 from GE®
- **Create a bridge between two non occluded area**
- Line up the centerline inside the lumen artery
- **DRAW PLANING CERCLES INSIDE THE CALCIFICATION**

The screenshot displays the GE ADW 4.7 workstation interface. The top window shows 'Hôte local: test-0000.mpeg[0000]' and 'XVidCap'. The main interface is titled 'BANTZE^ASERGE^AAA' and features a sidebar with 'Applications' and 'Autres...' sections. The central area displays a list of exams and a detailed view of a series.

1 / 254 examens

Nom Patient	Fin de rc	ID Patient	ID Exame	Date	Desc
BALLUFFIER PHILIPPE	Nouveau	032114429	IRMHEP+	Mar 30 2016	IRM F
BANTZE SERGE	Nouveau	1769956		Apr 05 2017	REC
BANTZE SERGE	Nouveau	212604	1	Apr 05 2017	Visior
BANTZE SERGE	Nouveau	212604	1	Apr 09 2017	Visior
BANTZE SERGE	Nouveau	212604	1	Apr 09 2017	Visior
BANTZE SERGE	Nouveau	212604		Feb 23 2017	ANGI
BAR_ALA_Saint_etienne 30_mars2017	Nouveau	AW1648289965.694.1490862456	93069592	Apr 16 2017	DILAT
BAR_ALA_SAINTE ETIENNE 30_MARS_2017	Nouveau	AW459212214.983.1490862513	71508116	Mar 03 2017	ANGI

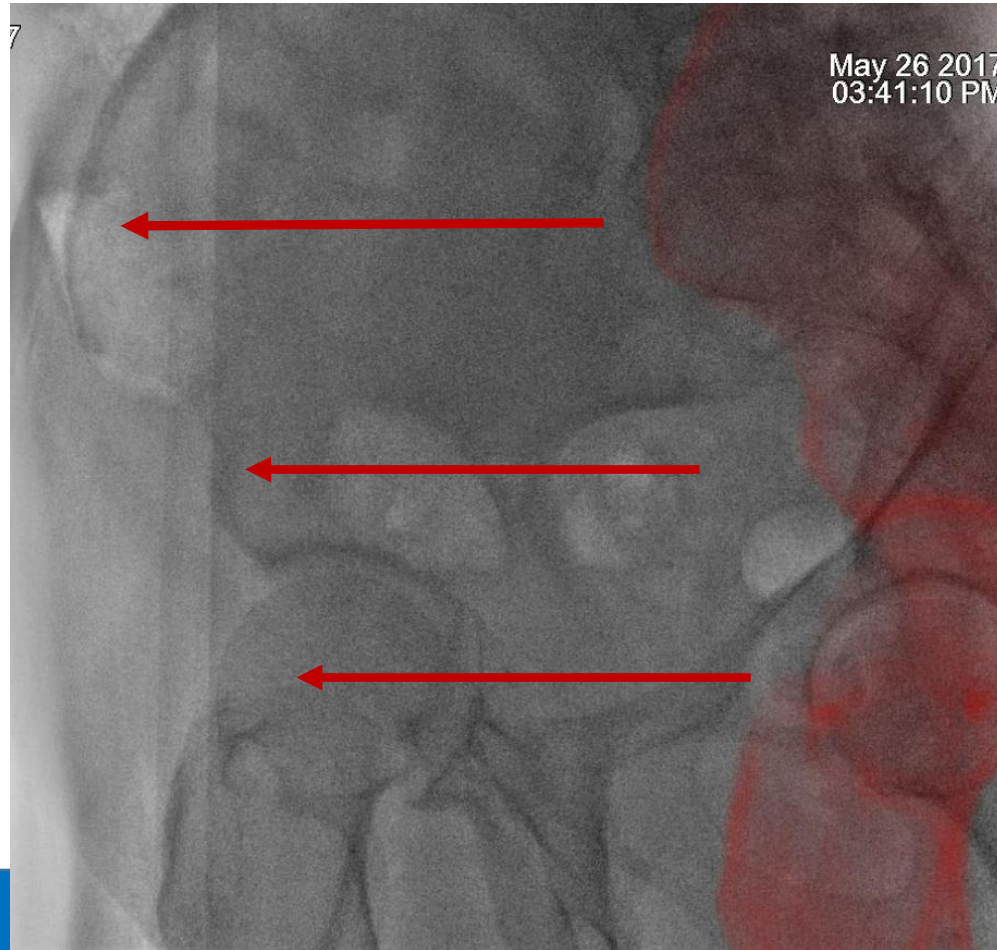
1 / 6 séries

Série	Type	Images	Description	Modalité	Fabricant
401	AXIAL	1911	ARTERIEL IMR	CT	Philips
402	SCPT	1	3D Saved State - zzz	CT	GEMS
403	SCPT	1	3D Saved State -	CT	GEMS
404	SCPT	1	Data Sharing Only (for Vision)	CT	GEMS
405	SCPT	1	3D Saved State - Vision Export	CT	GEMS

1 / 1911 images

Image	Position (mm)	Epaisseur	Statif (de)	R-L	A-P	SFOV (cm)	Diamètre de rec.	Rés
1+C	S 218.0	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR
2+C	S 217.3	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR
3+C	S 216.6	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR
4+C	S 215.9	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR
5+C	S 215.2	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR
6+C	S 214.5	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR
7+C	S 213.8	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR
8+C	S 213.1	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR
9+C	S 212.4	1.0	0.0	L 8.6	P100.9	50.0	42.9	IMR

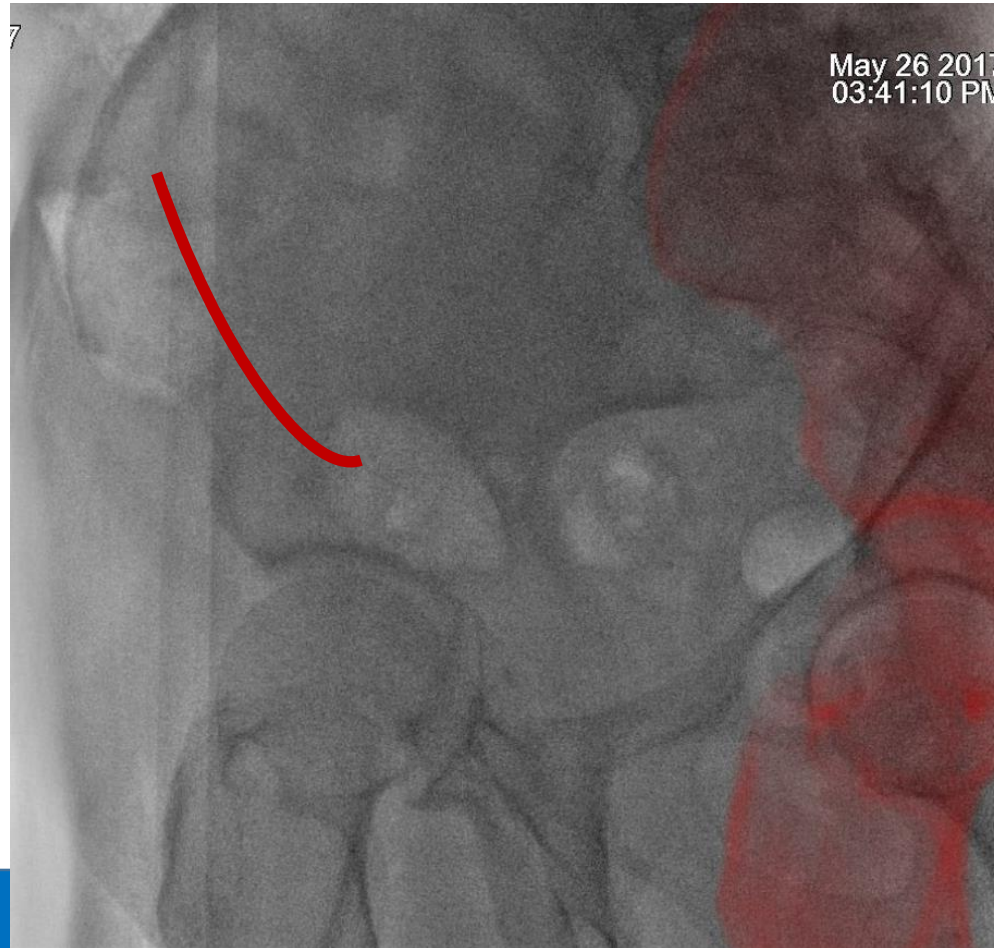
Registration : Translation (first incidence)



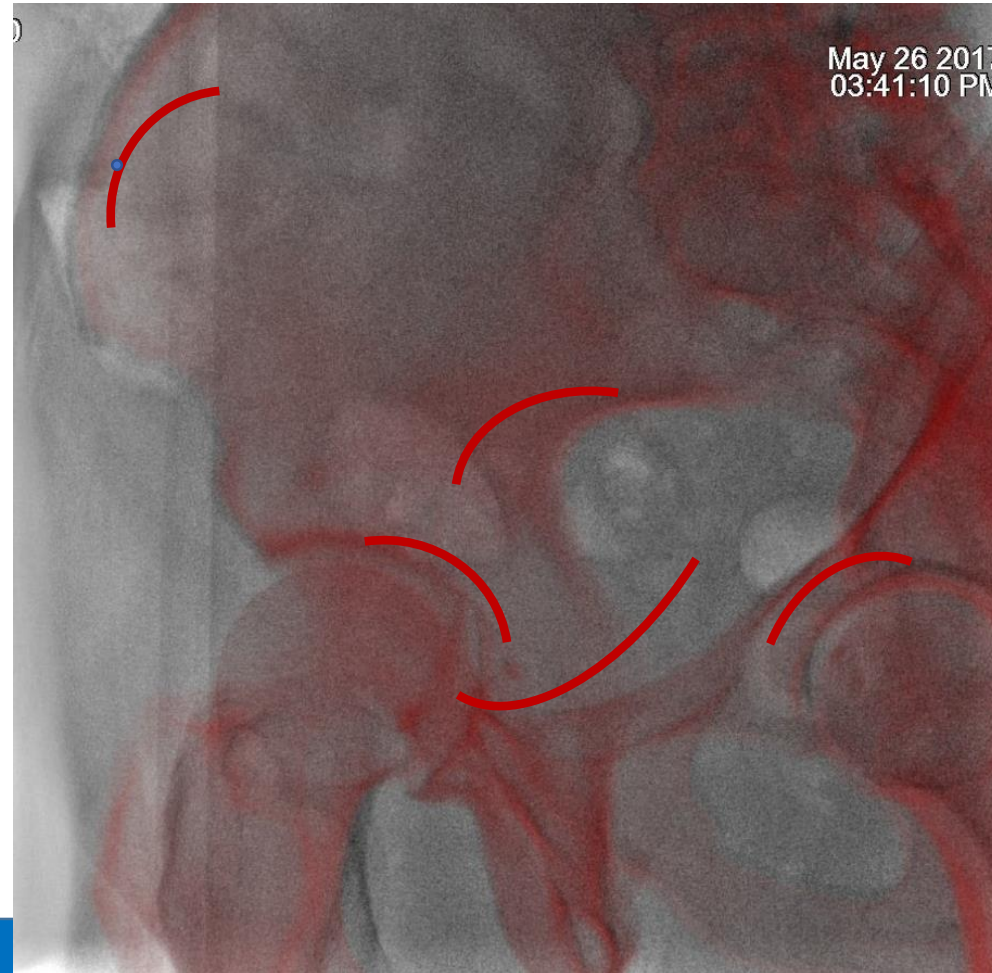
*2 D Fluoroscopy
Bone Retiming*

*Registration : **Rotation** (first incidence)*

*2 D Fluoroscopy
Bone Retiming*



*Registration : Rotation in the axis of the vessel
(first incidence)*



*2 D Fluoroscopy
Bone Retiming*

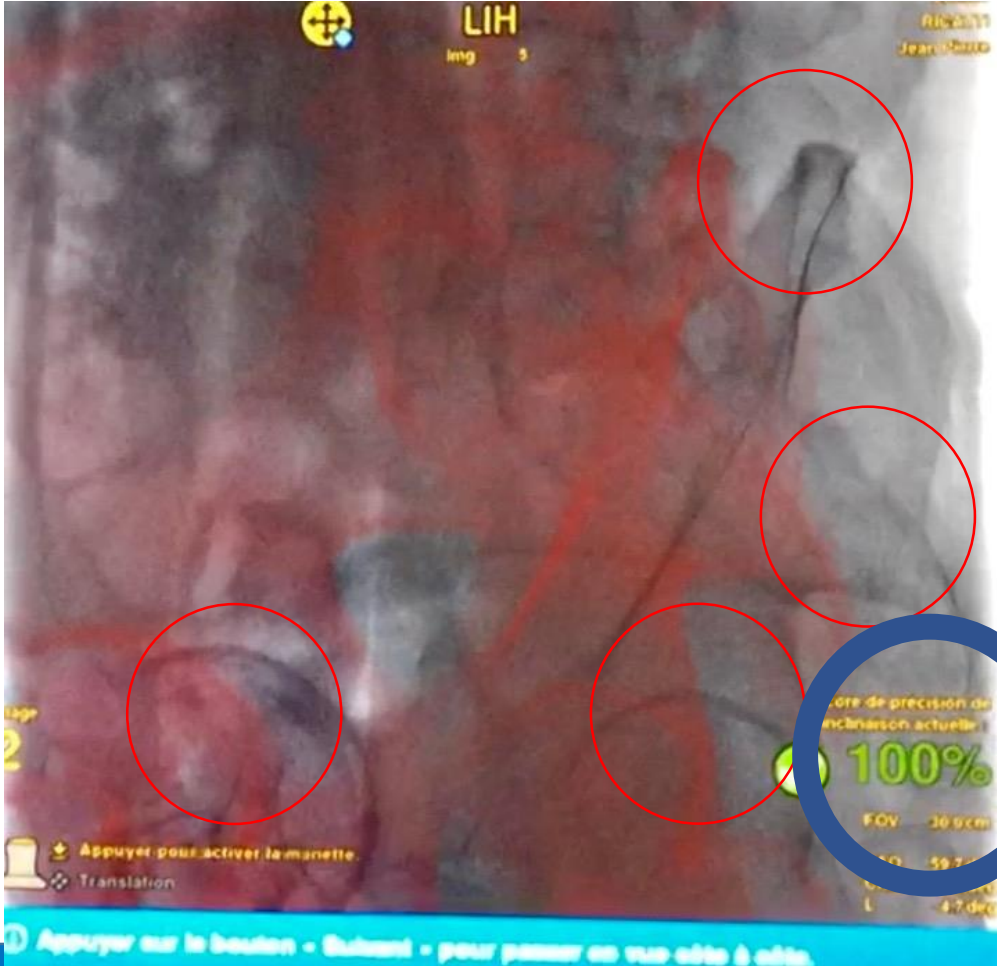
Registration : *Profile (second incidence)*

*2 D Fluoroscopy
Bone Retiming*



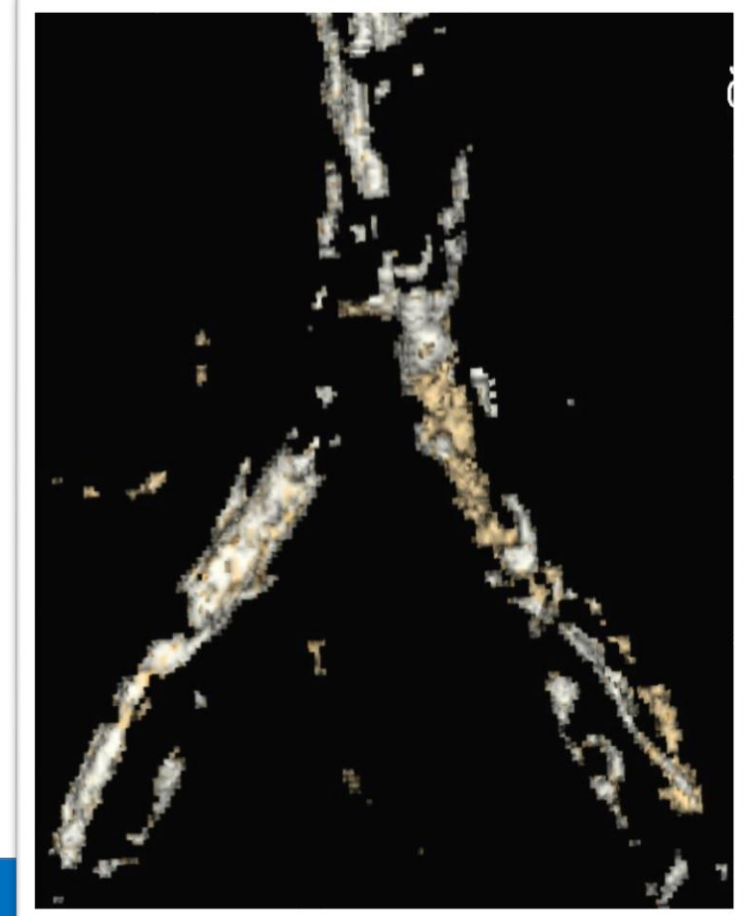
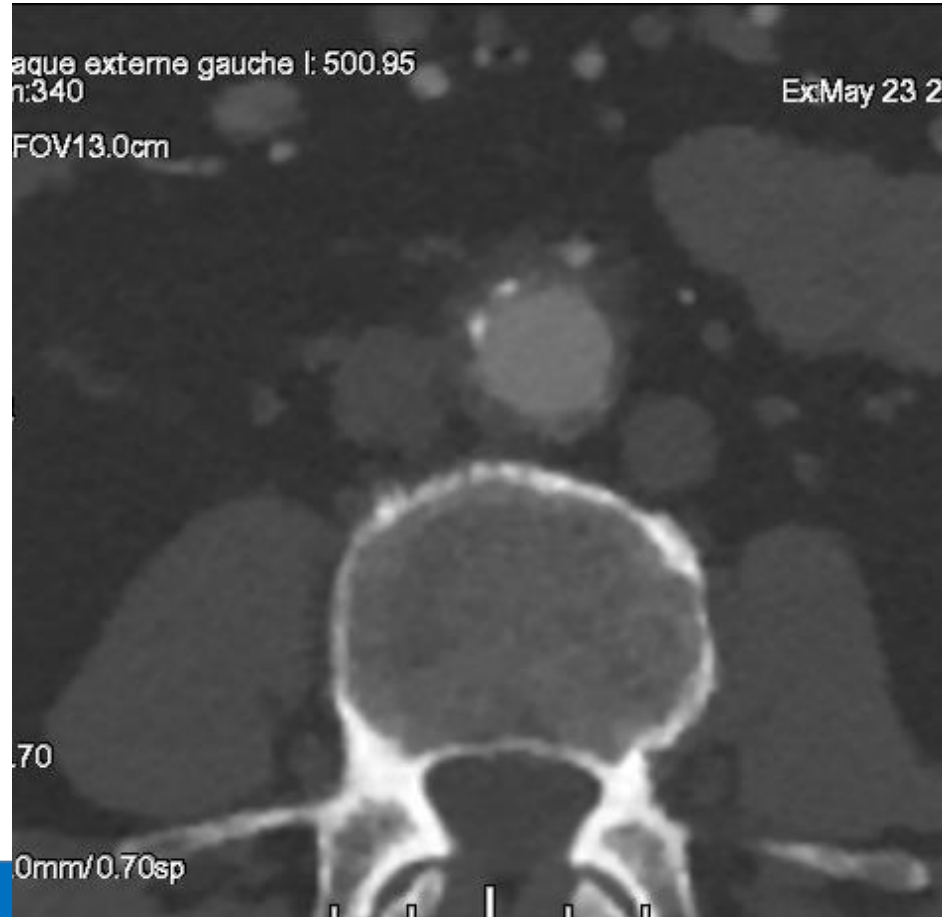
RETIMING: : PROFILE (second incidence)

*2 D Fluoroscopy
Bone Retiming*

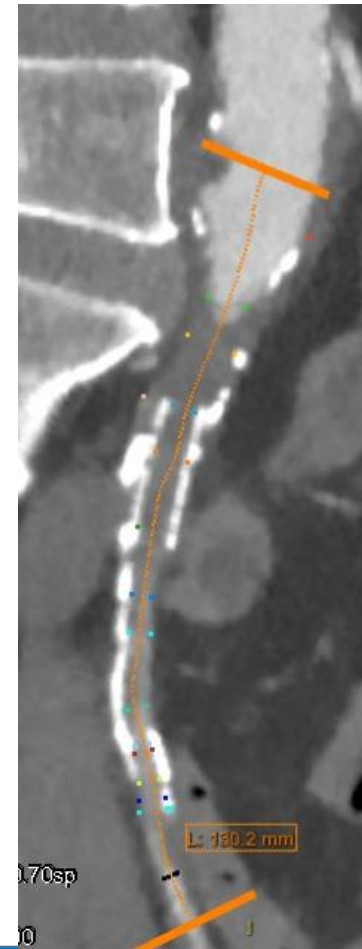
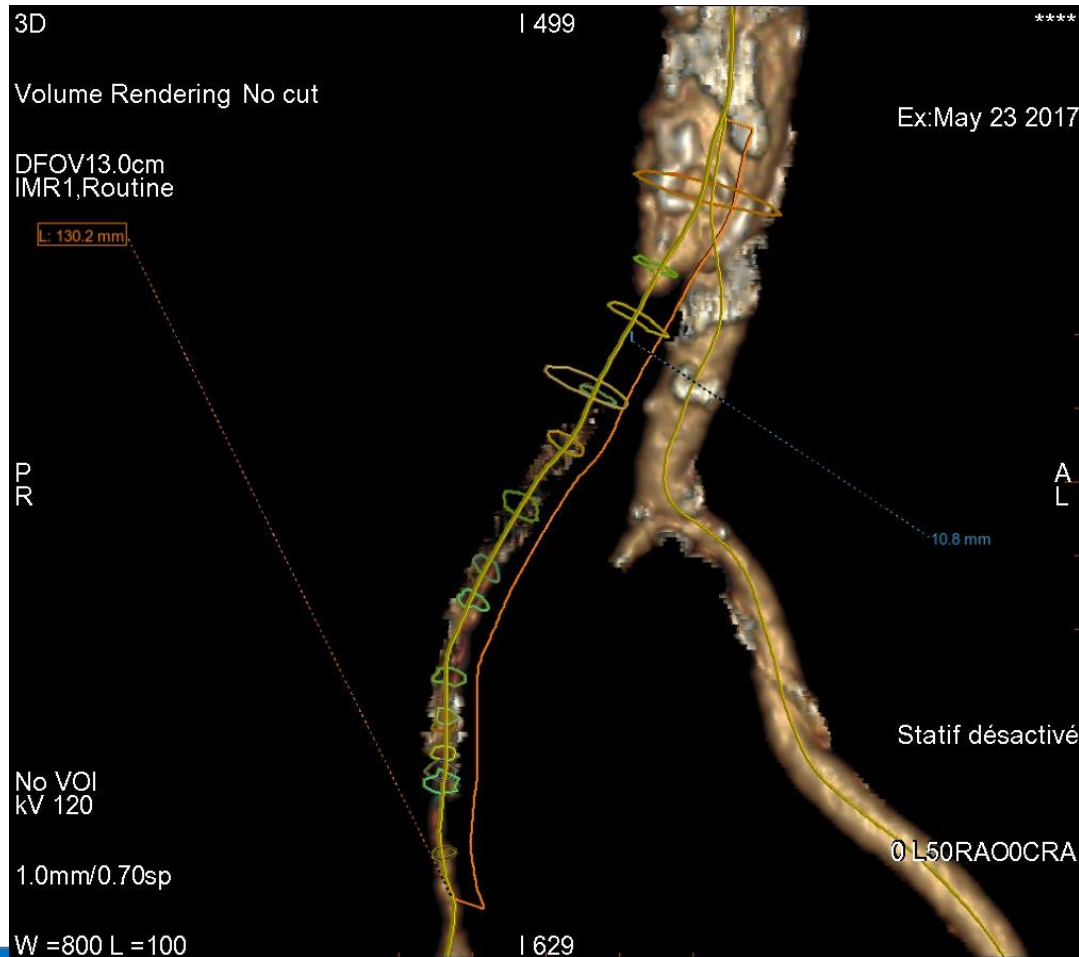


*Accuracy
Score*

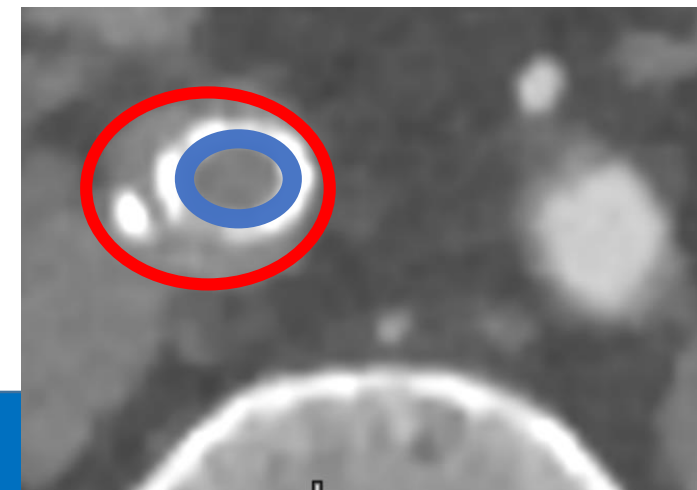
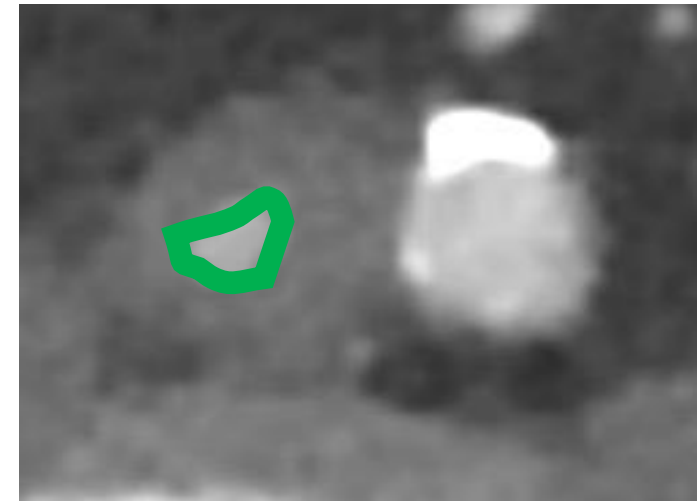
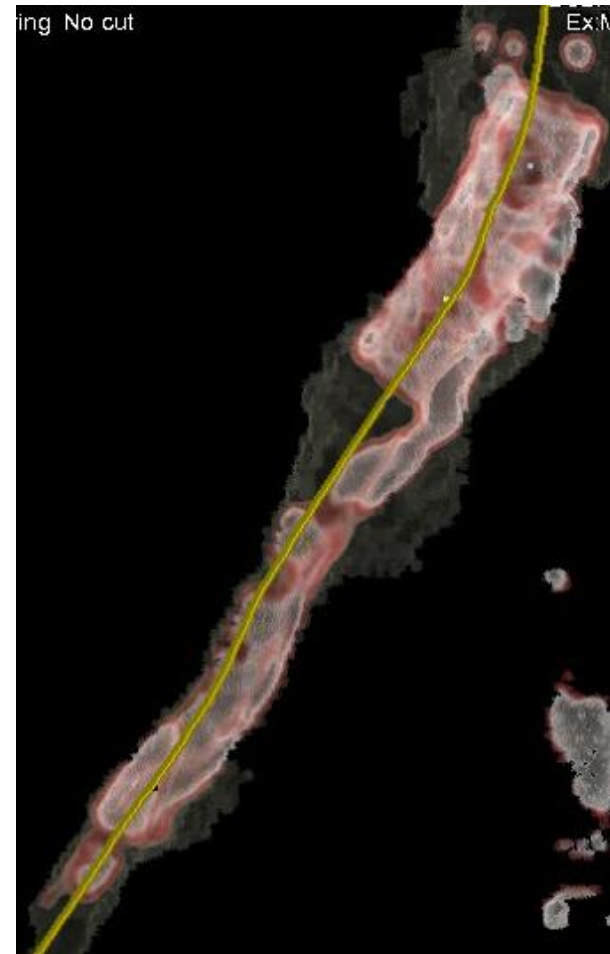
Occluded right illiac artery



Planning Circles Technique



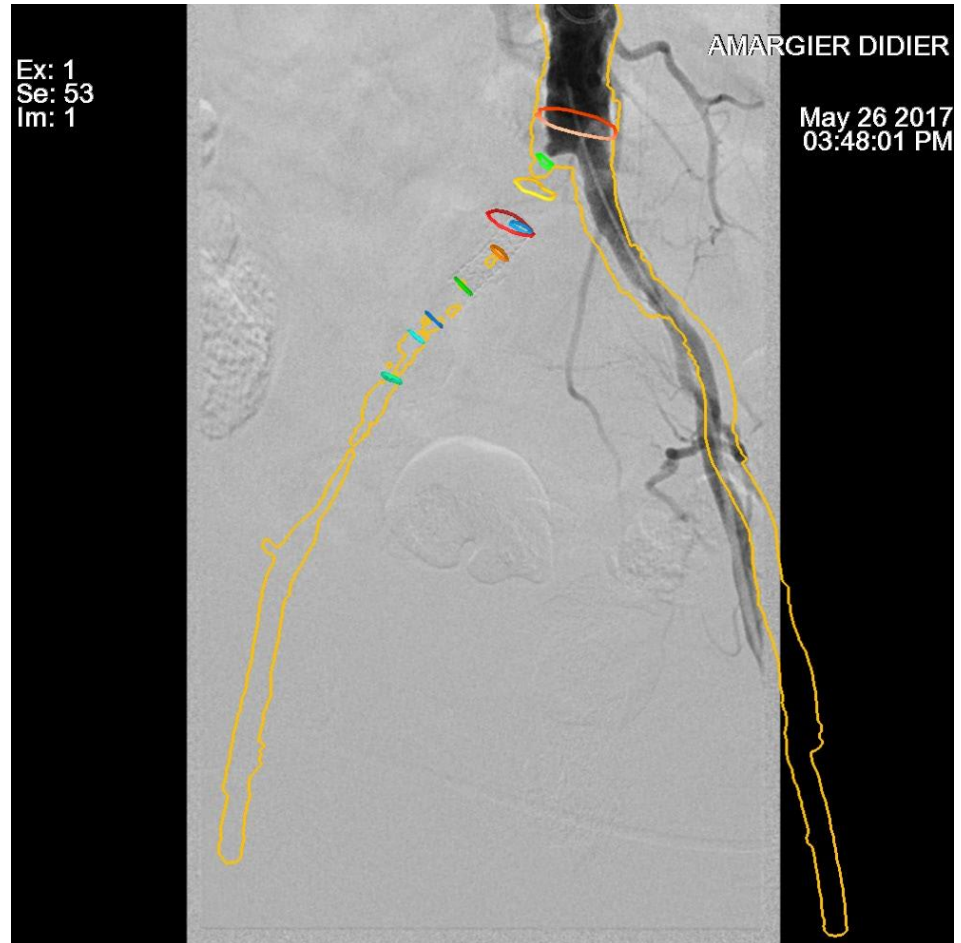
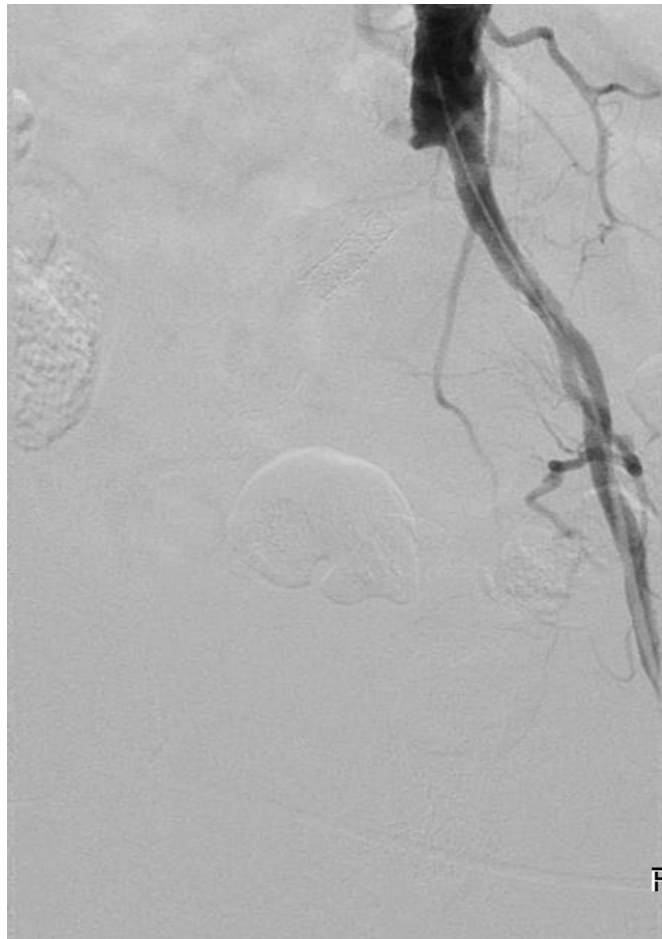
Planning Circles Technique



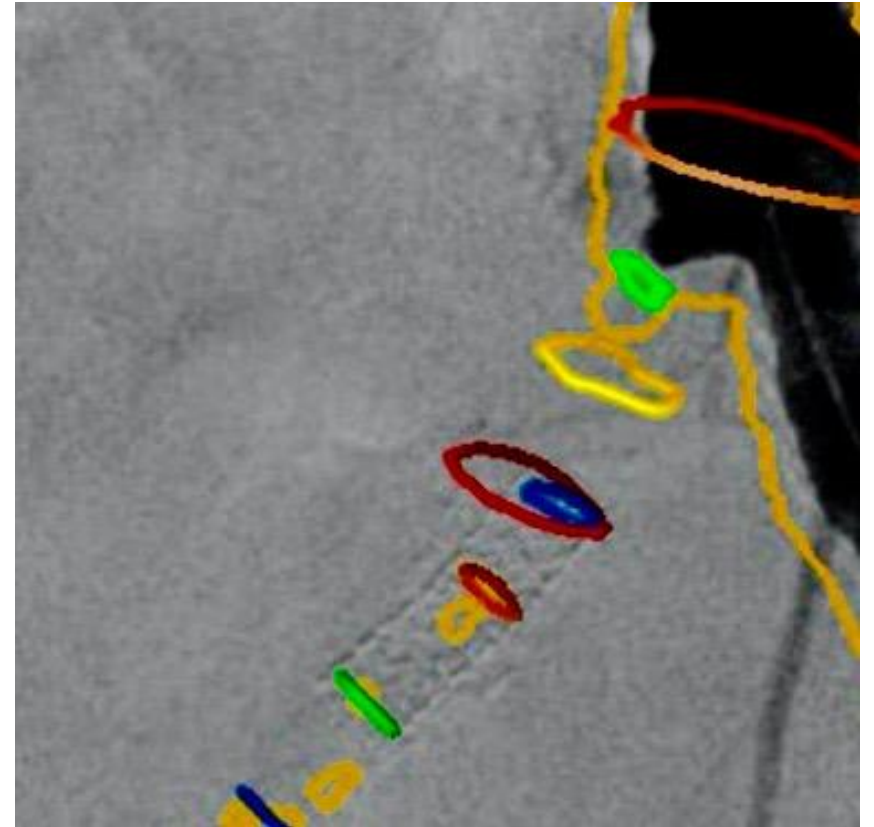
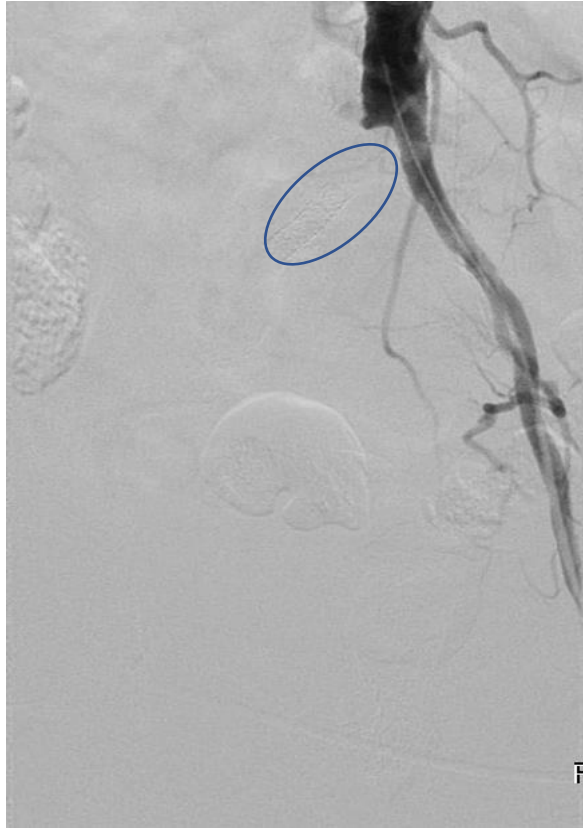
Angiography



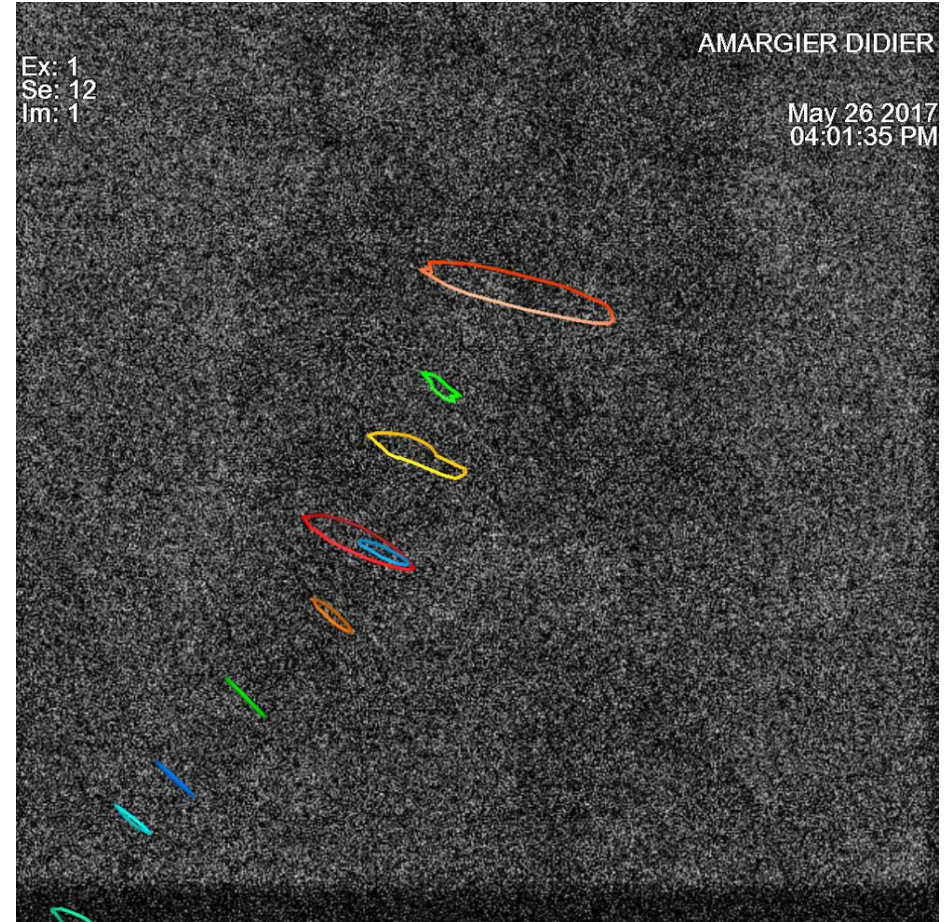
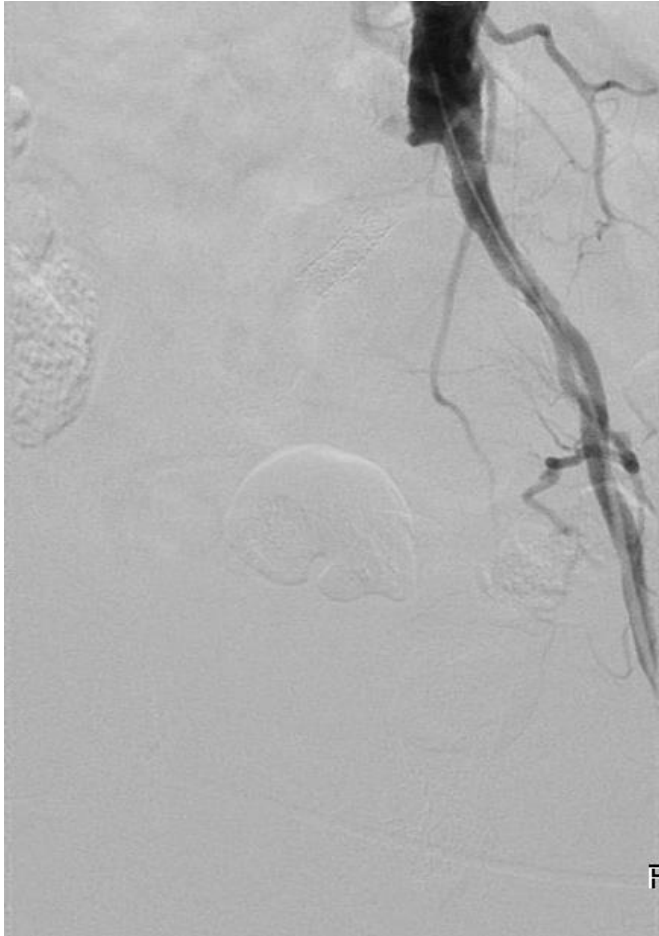
Planning Circles Technique



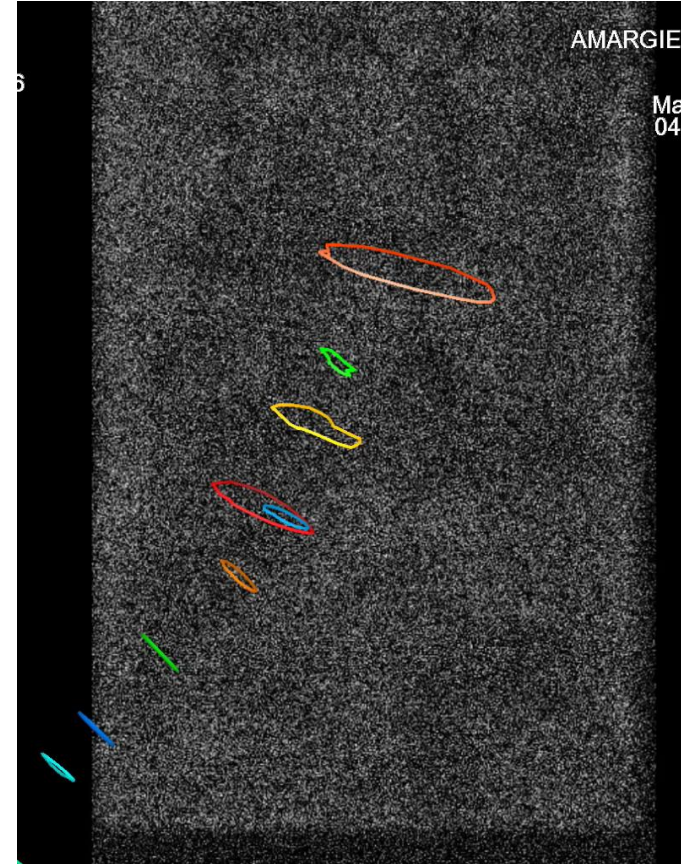
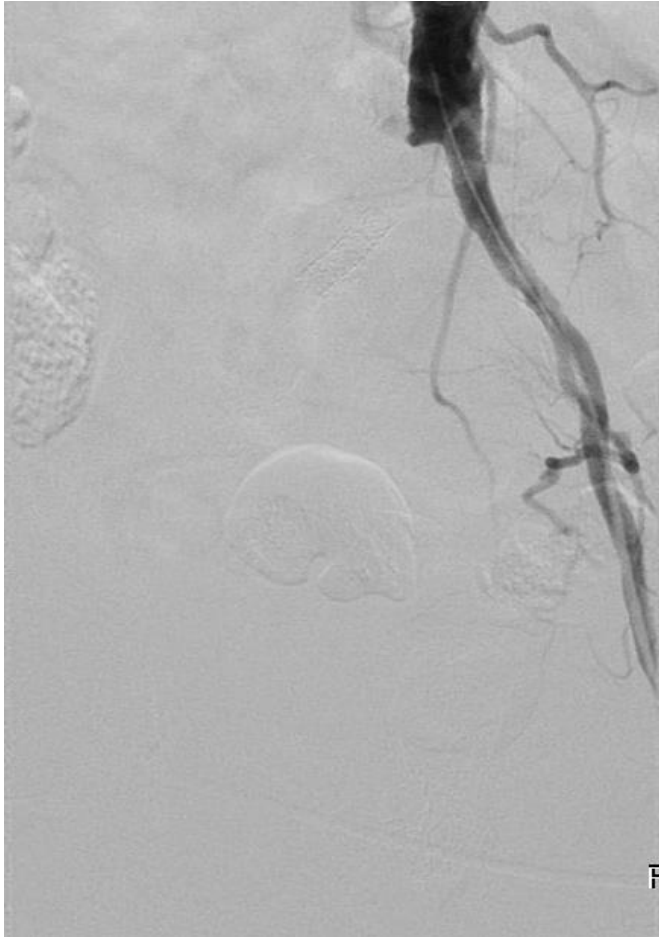
Planning Circles Technique



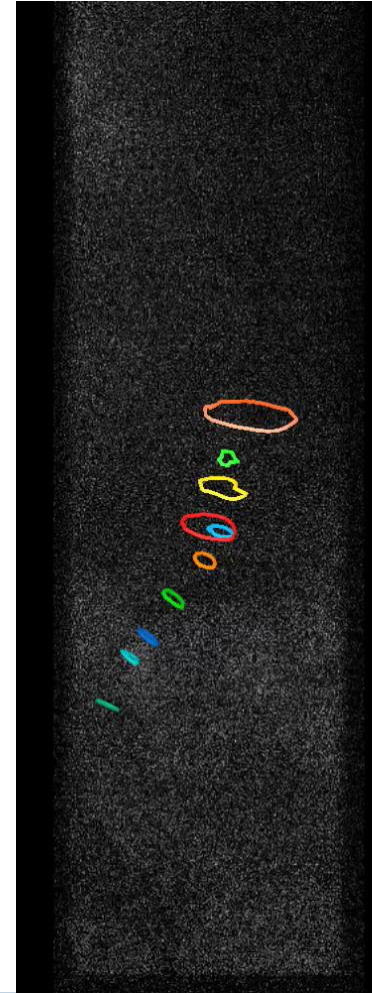
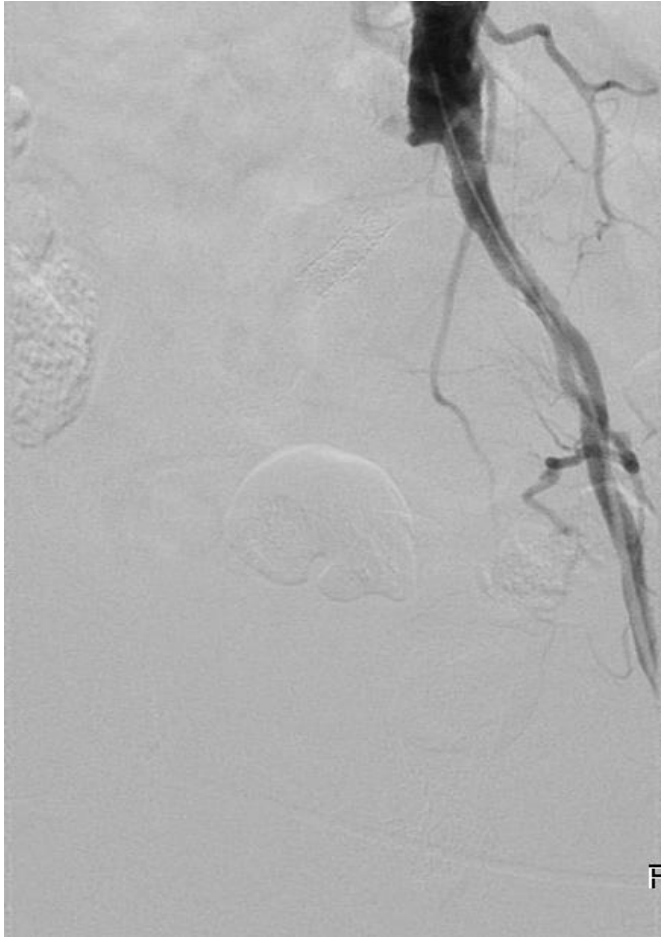
Sub Intimal Progression



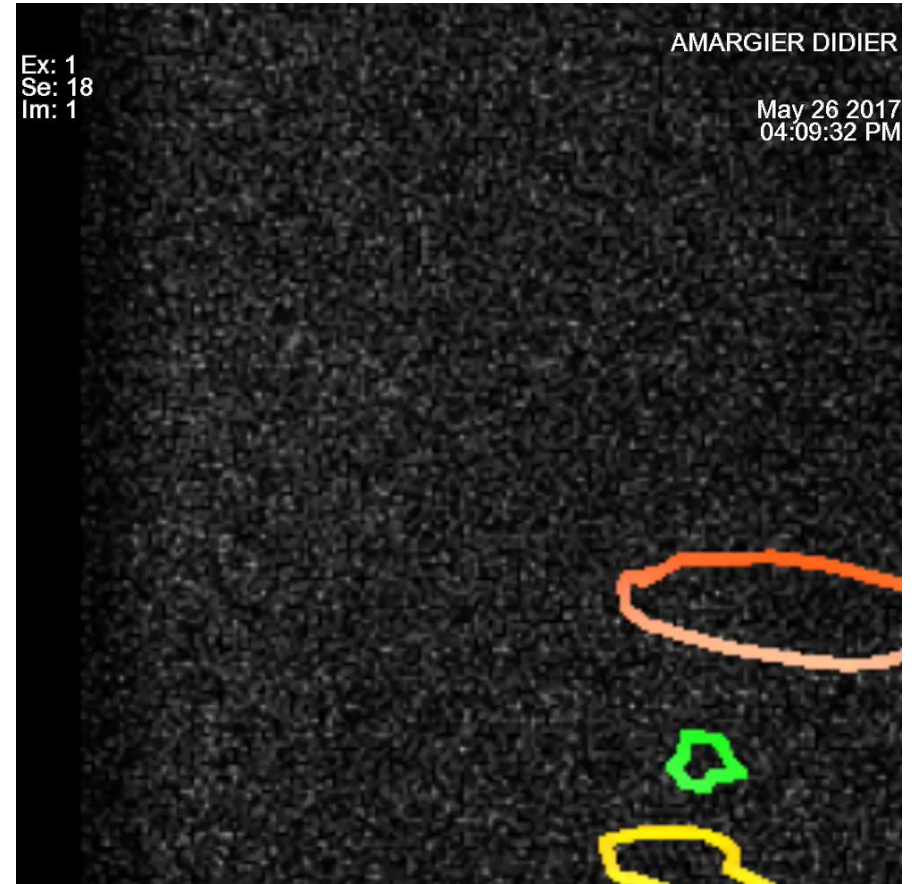
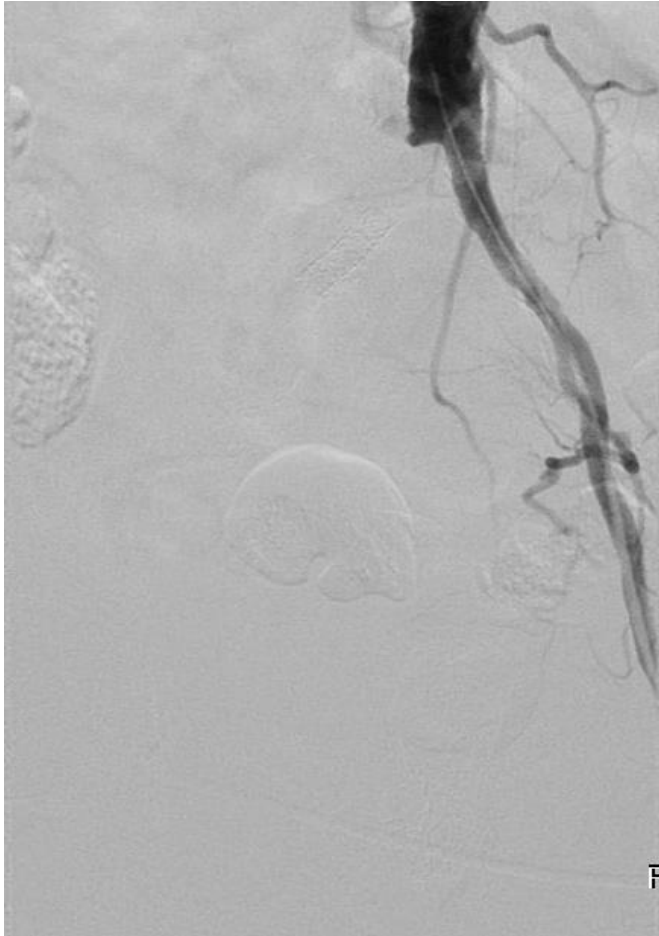
Repositioning with a coronary Guide-Wire



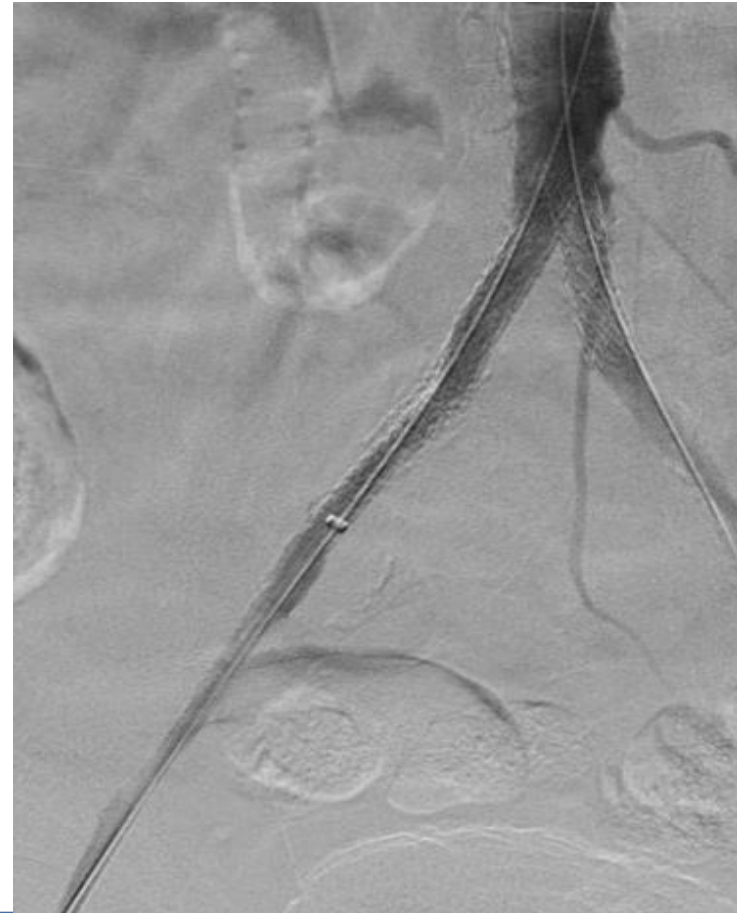
*Progression with **ANOTHER INCIDENCE***



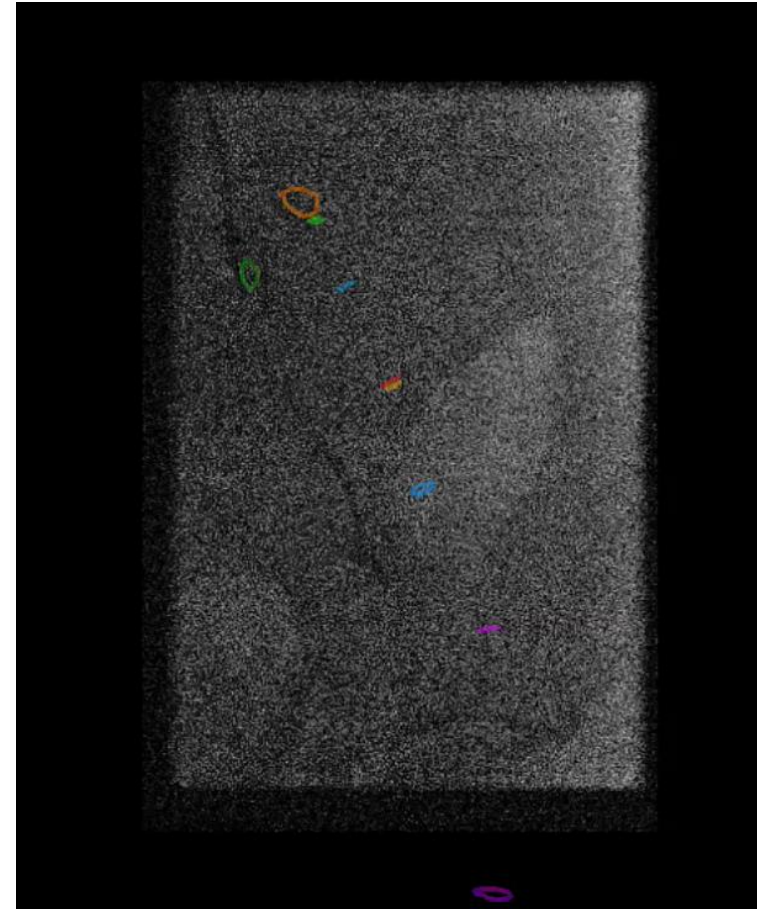
Digital Zoom (without increasing radiation)



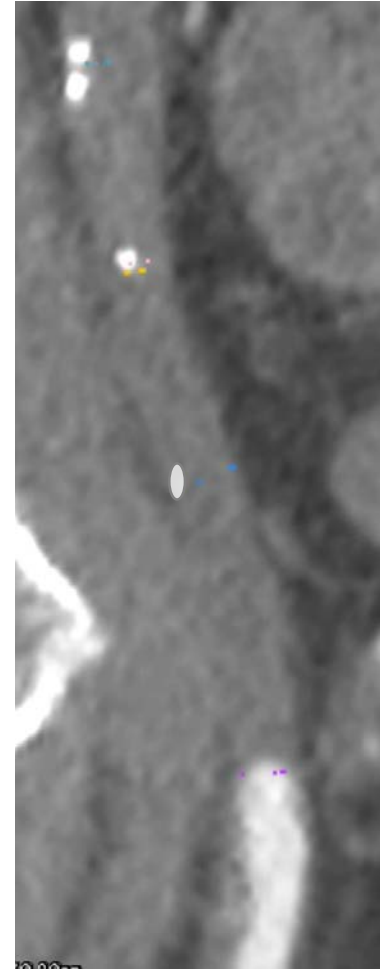
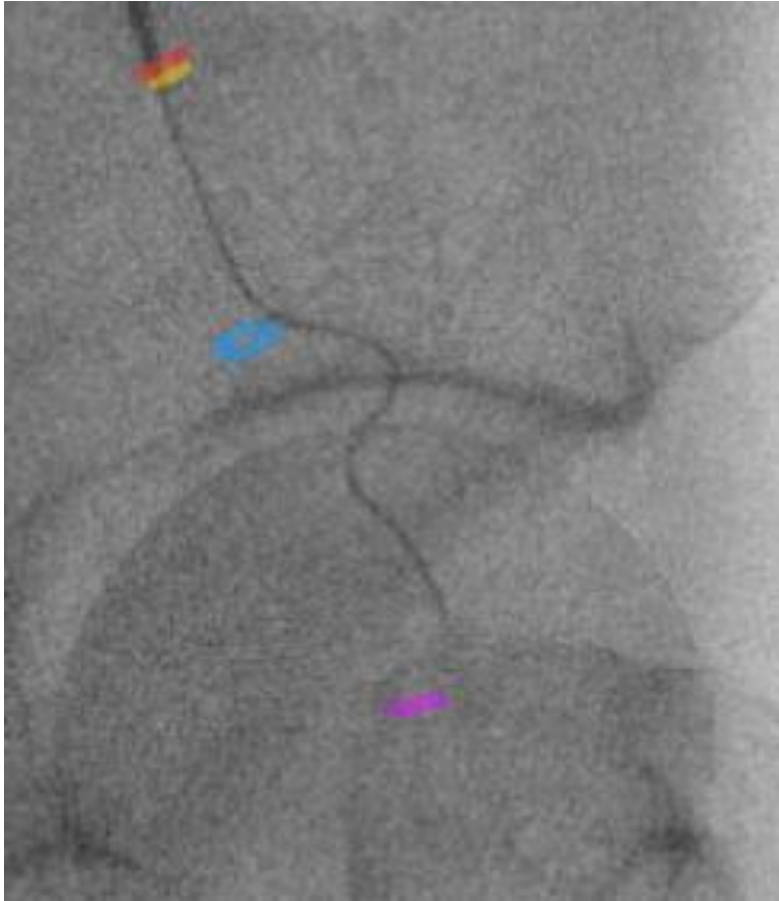
Final result



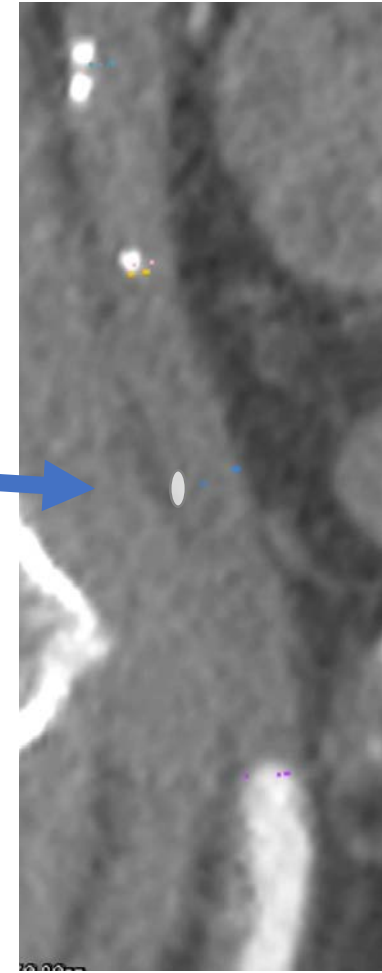
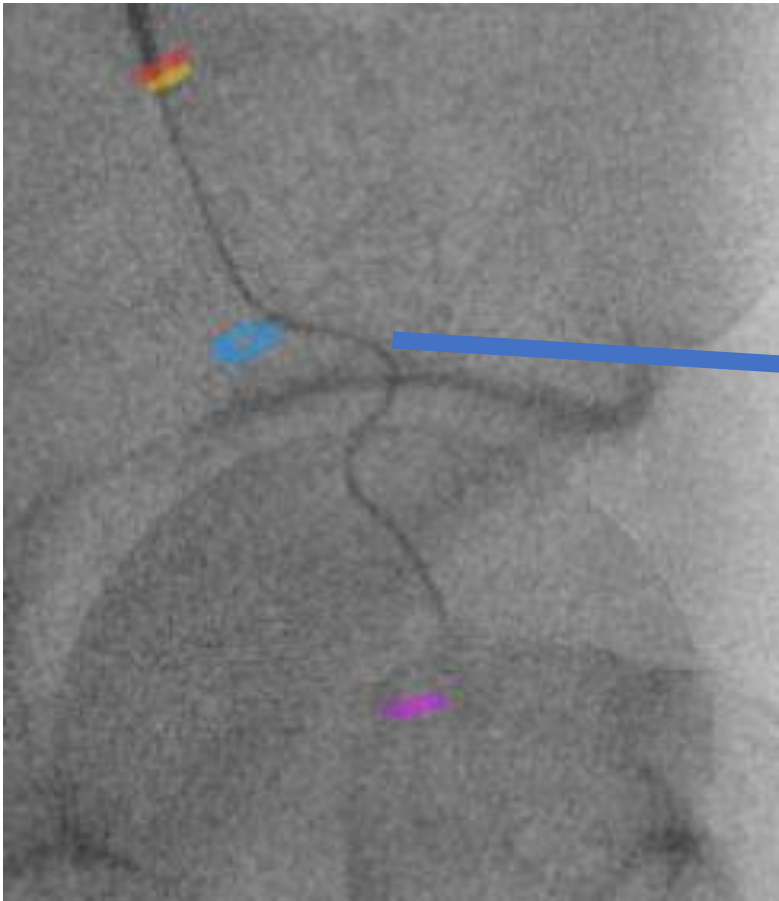
Planning Circles Technique



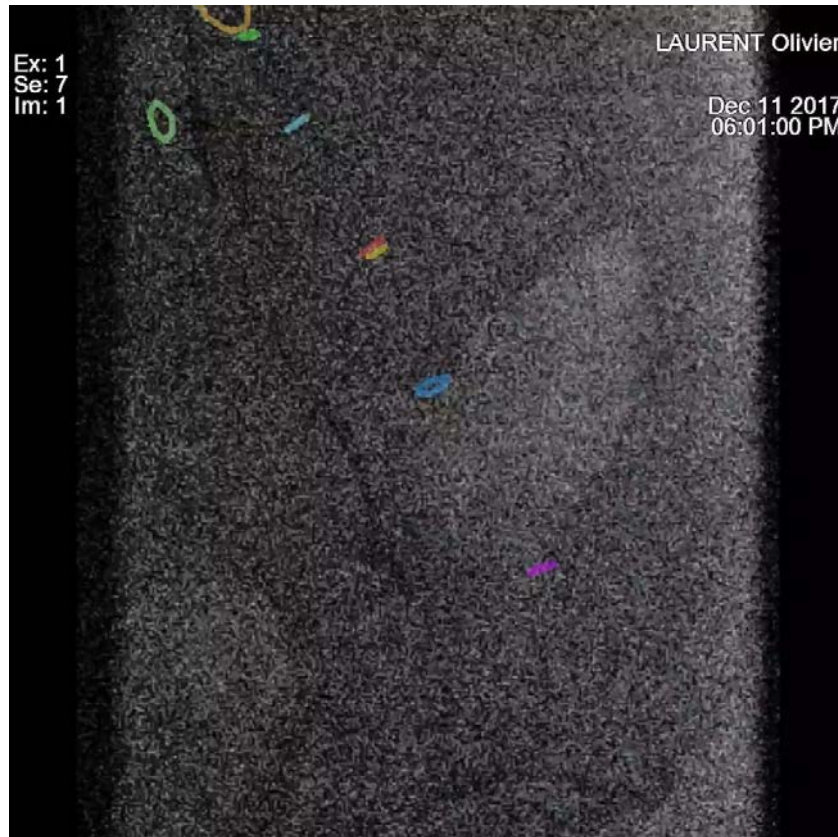
Planning Circles Technique



Planning Circles Technique



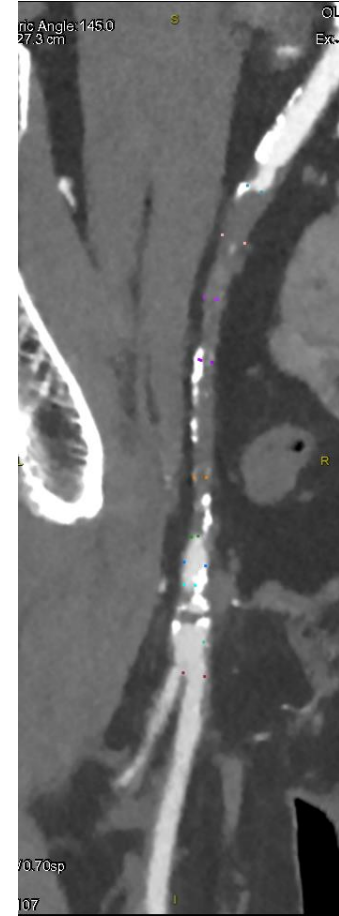
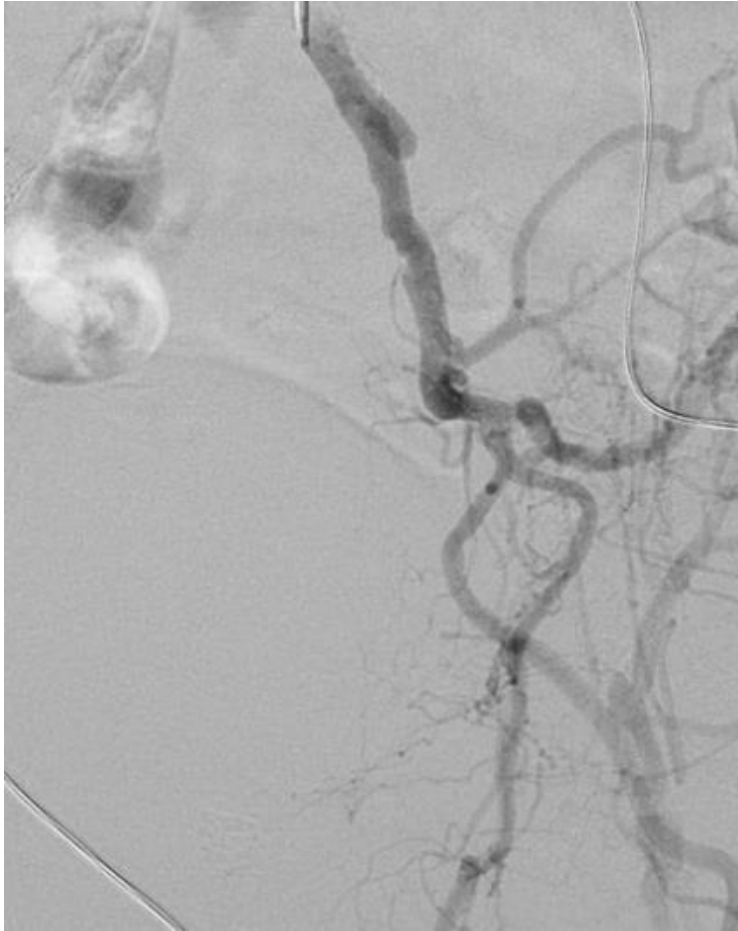
Planning Circles Technique



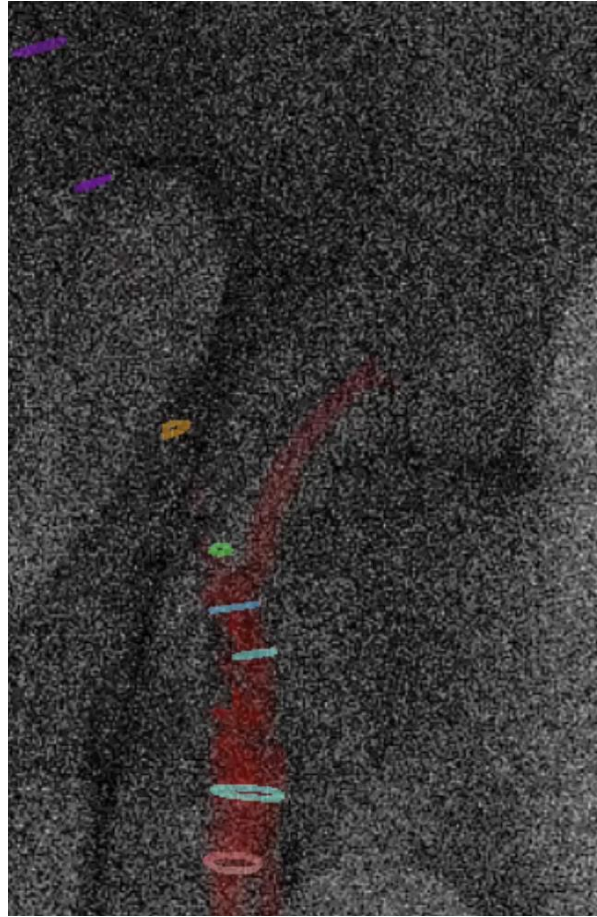
Final result



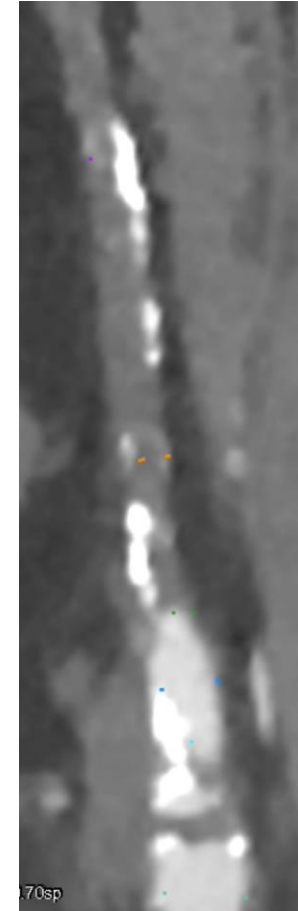
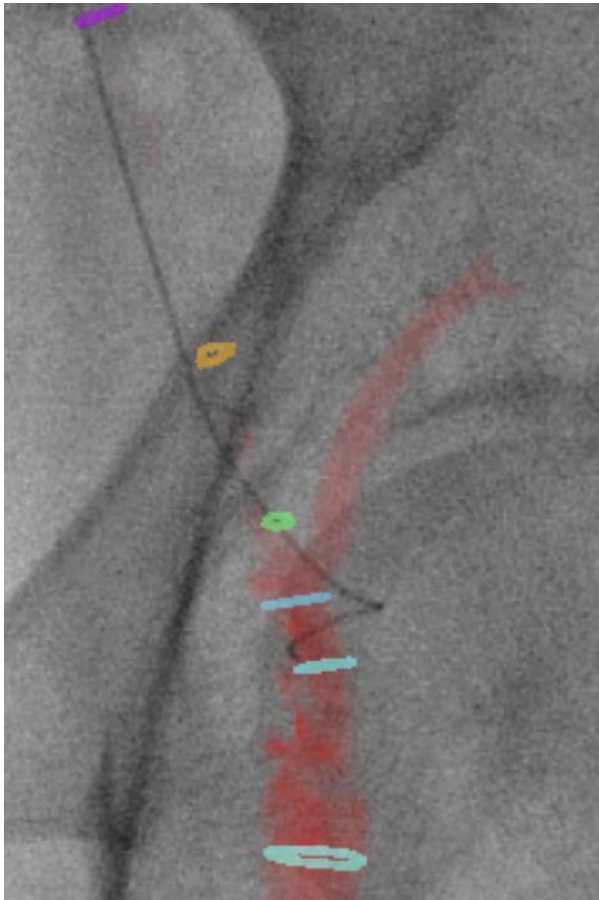
Planning Circles Technique



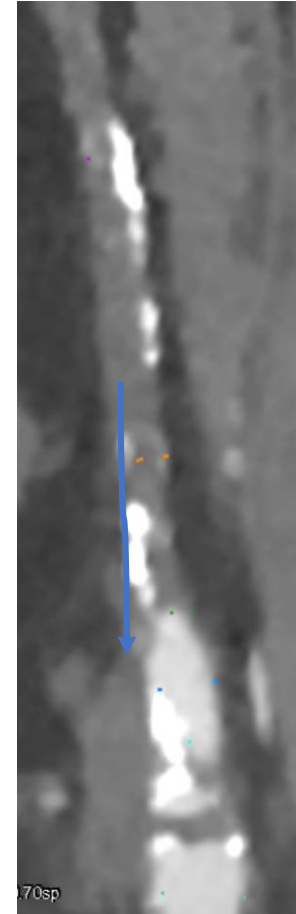
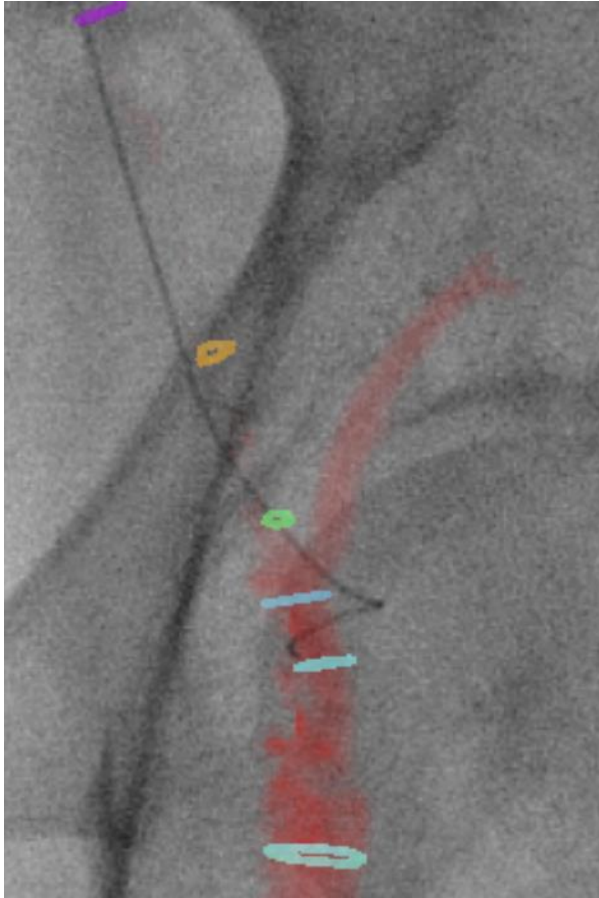
Planning Circles Technique



Planning Circles Technique



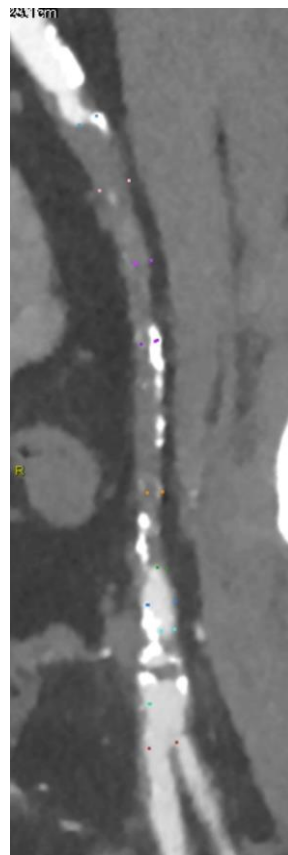
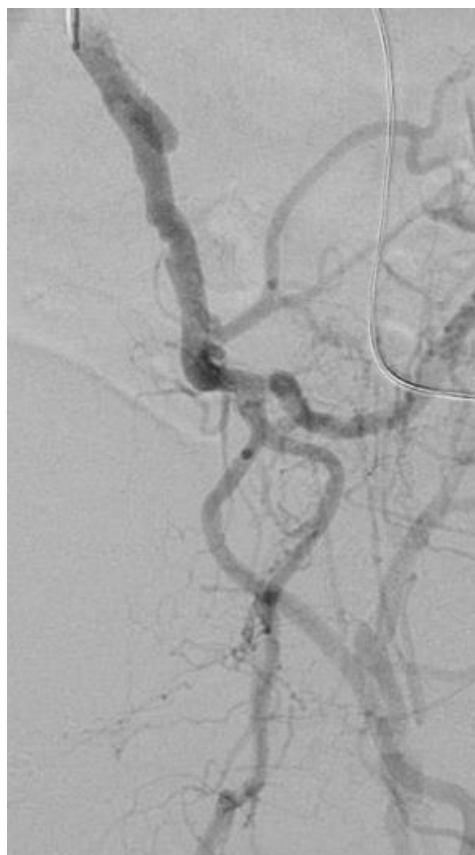
Planification Circles Technique



Planning Circles Technique

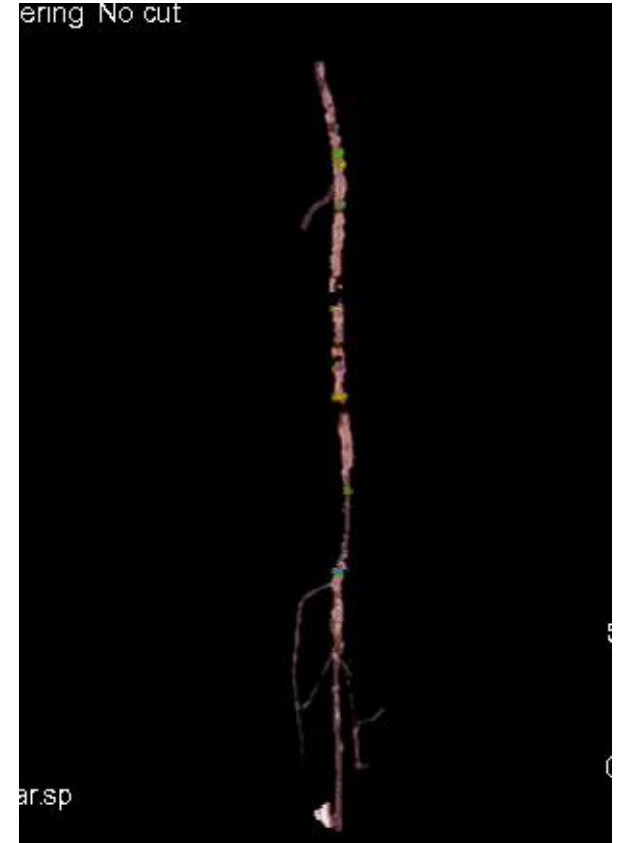


Final result

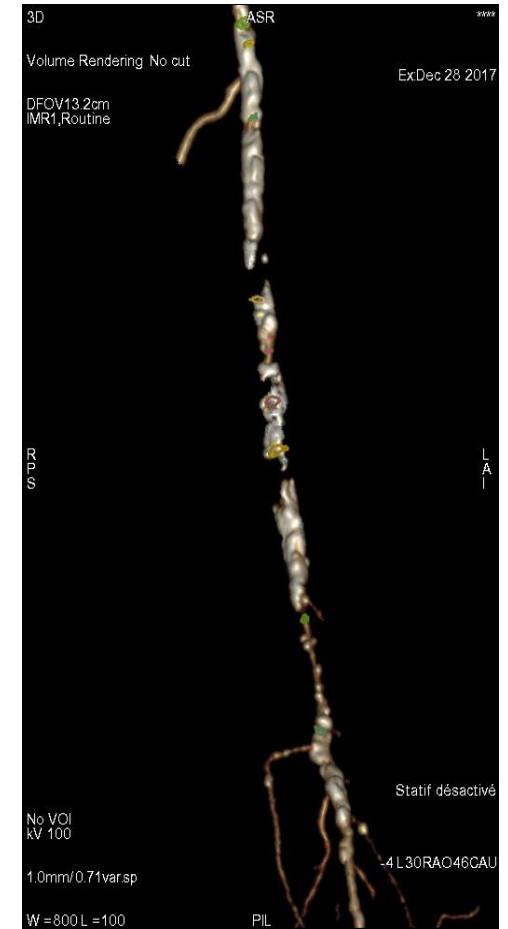
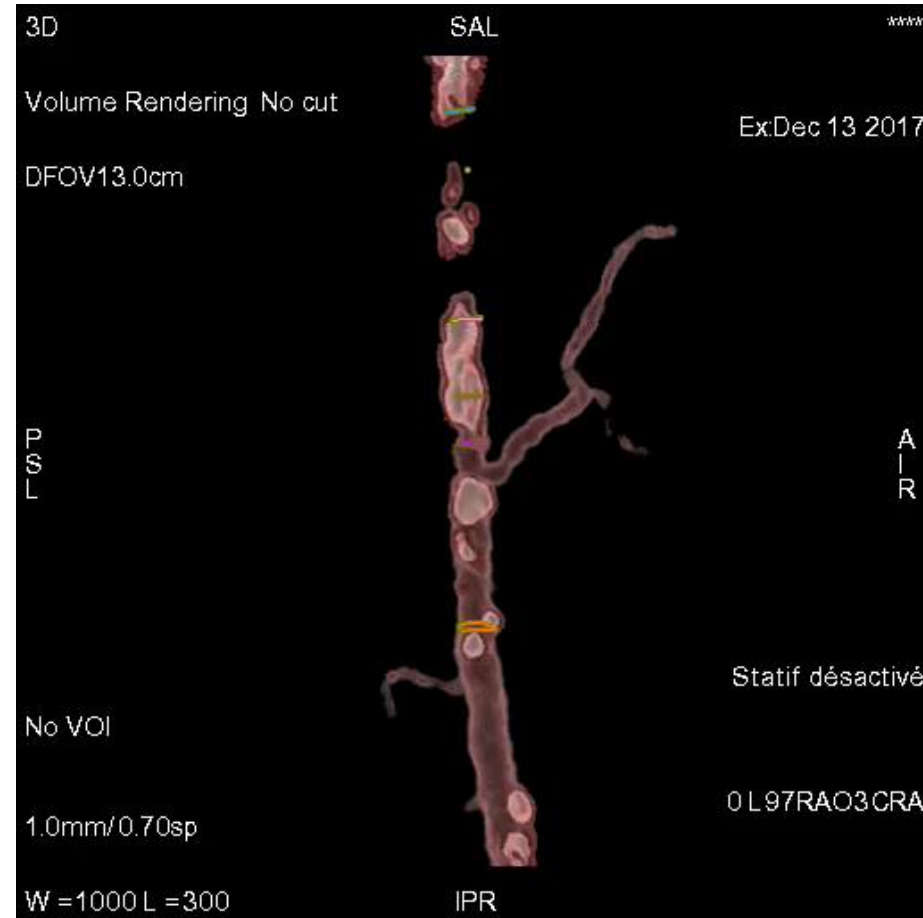
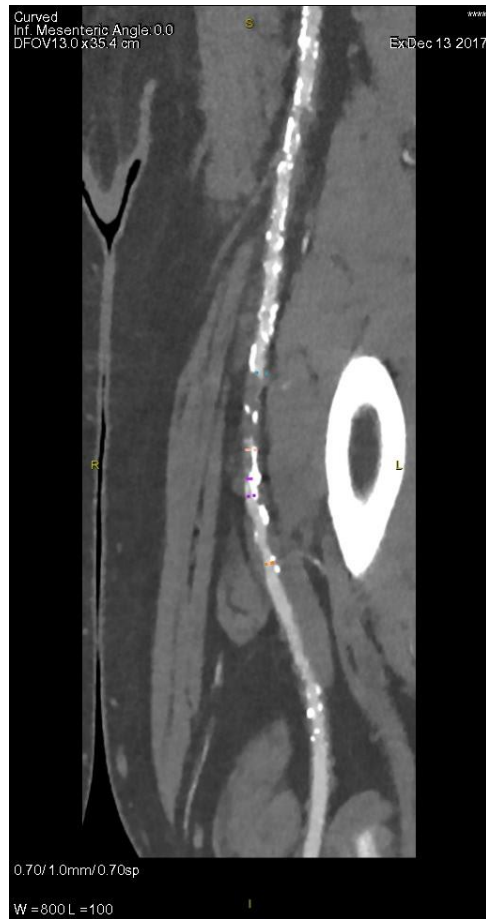


Fusion Imaging with third Volume

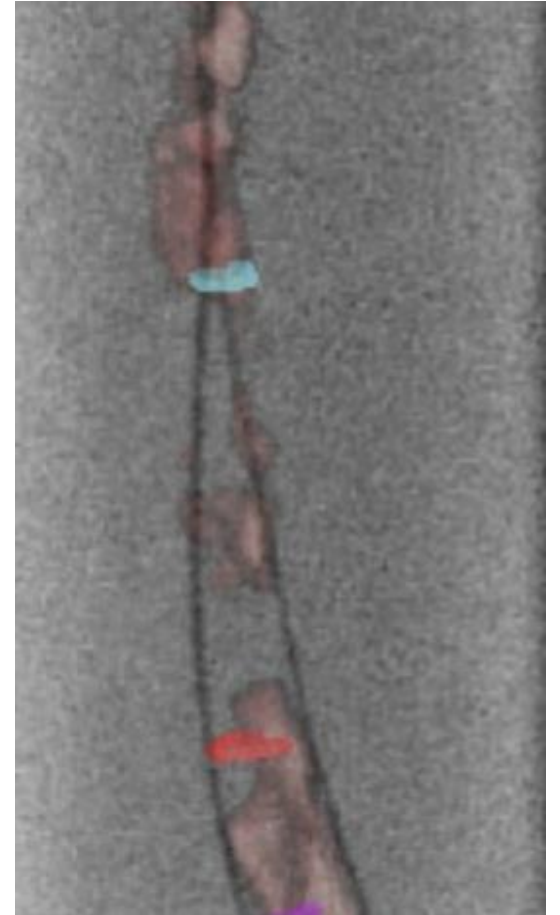
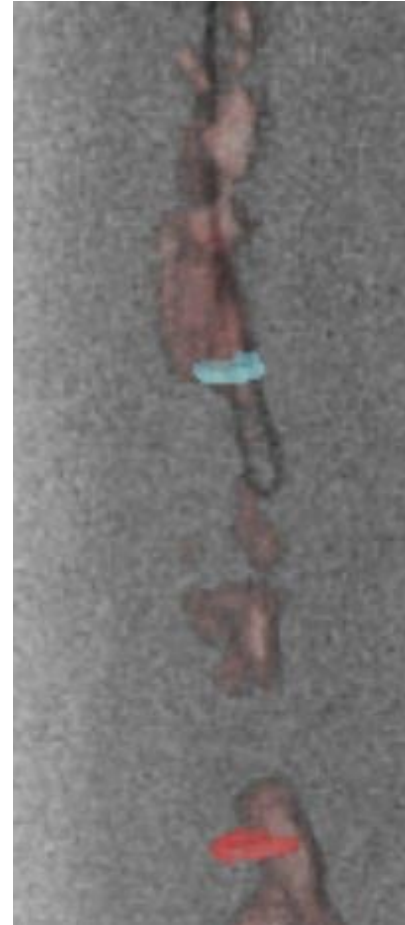
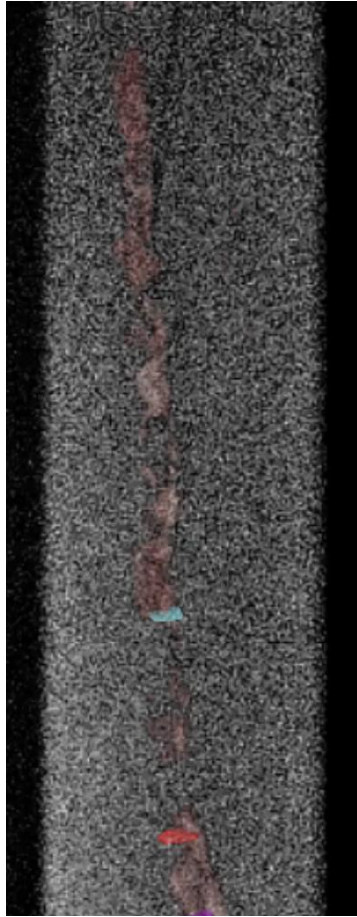
- *3D Modelisation of the calcification*



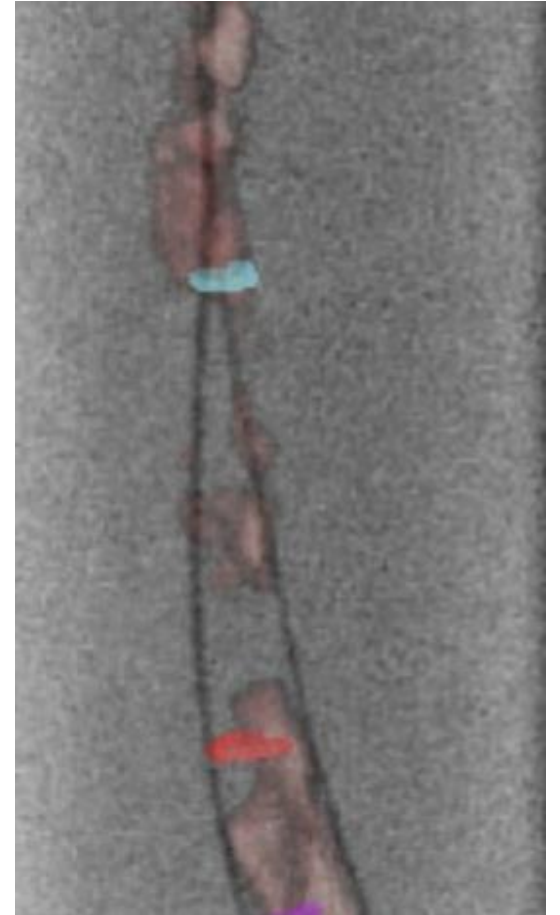
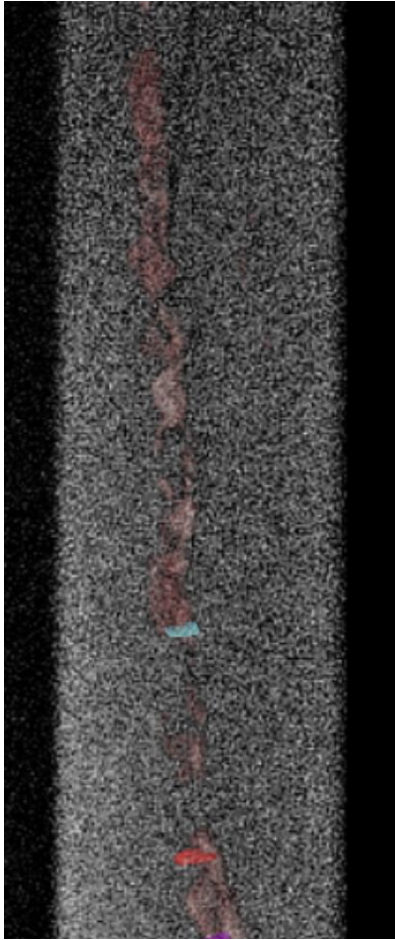
Planning circles and modelling calcification volume



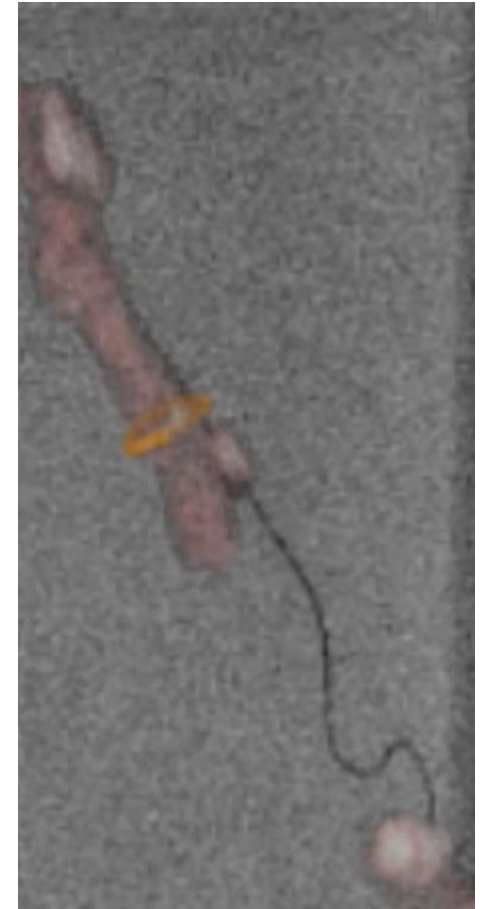
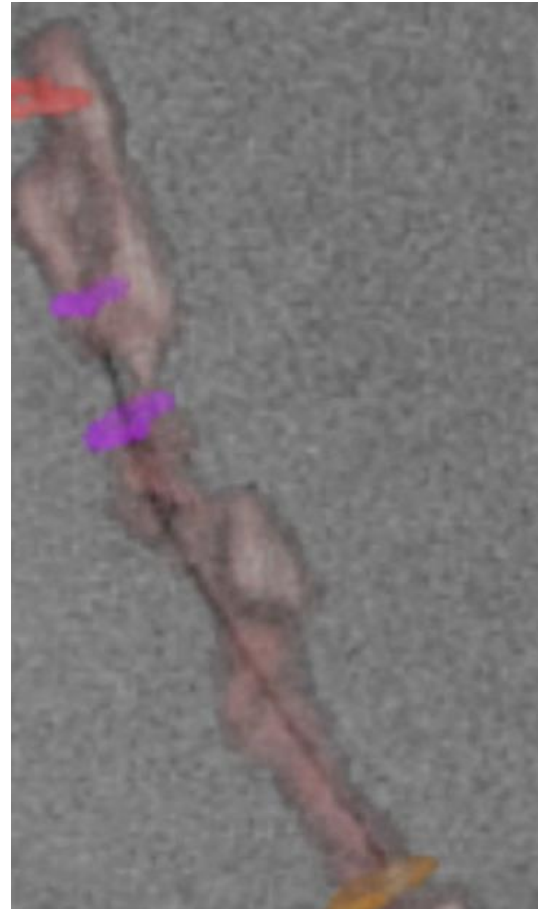
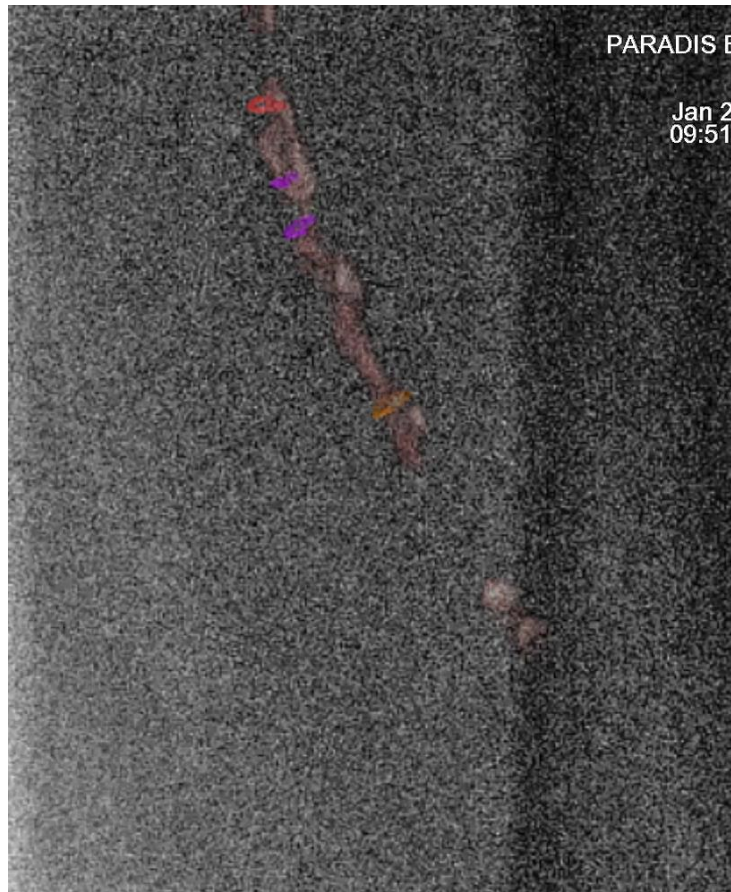
Planning circles and modelling calcification volume



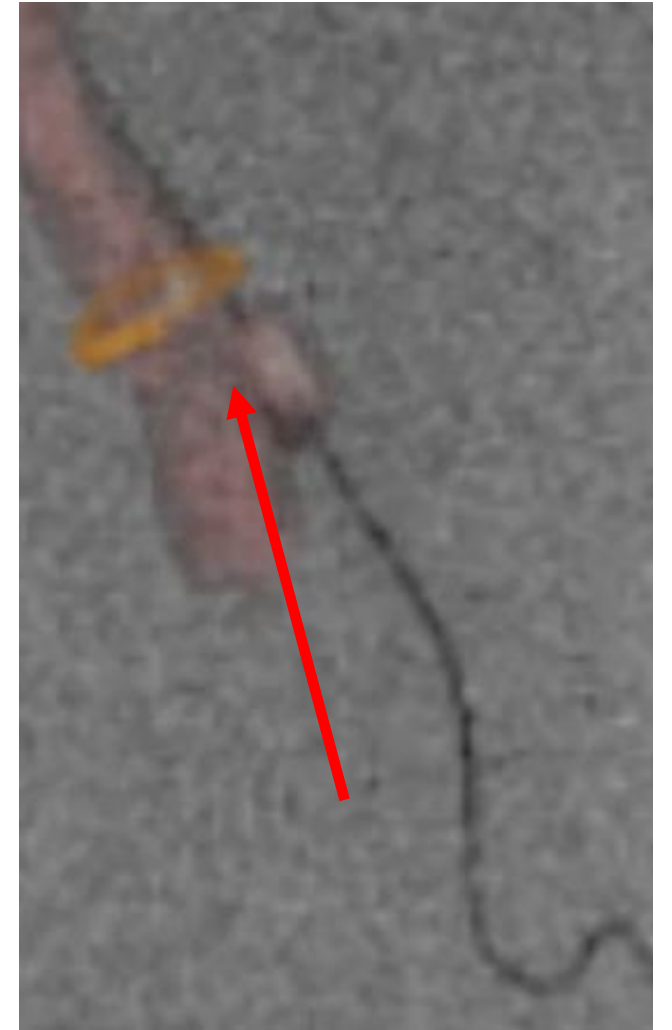
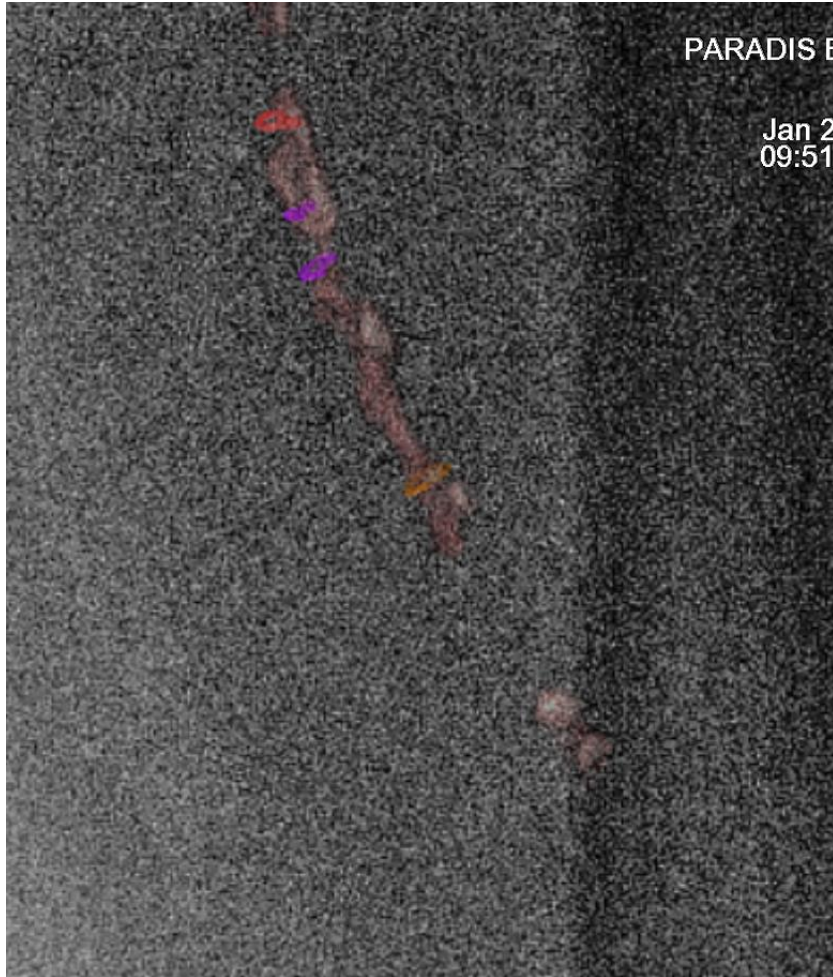
Planning circles and modelling calcification volume



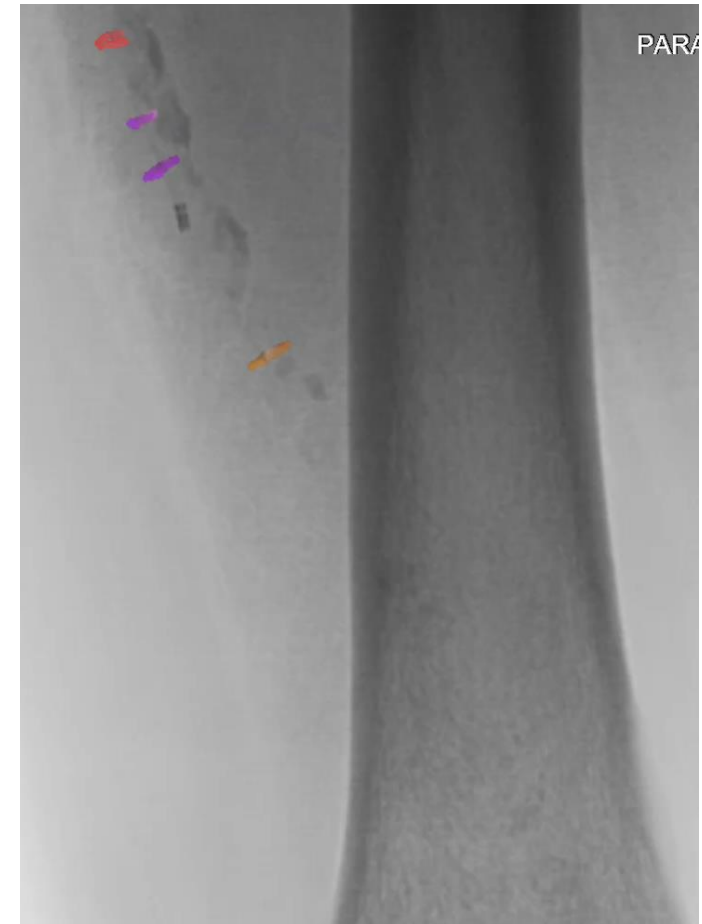
Planning circles and modelling calcification volume



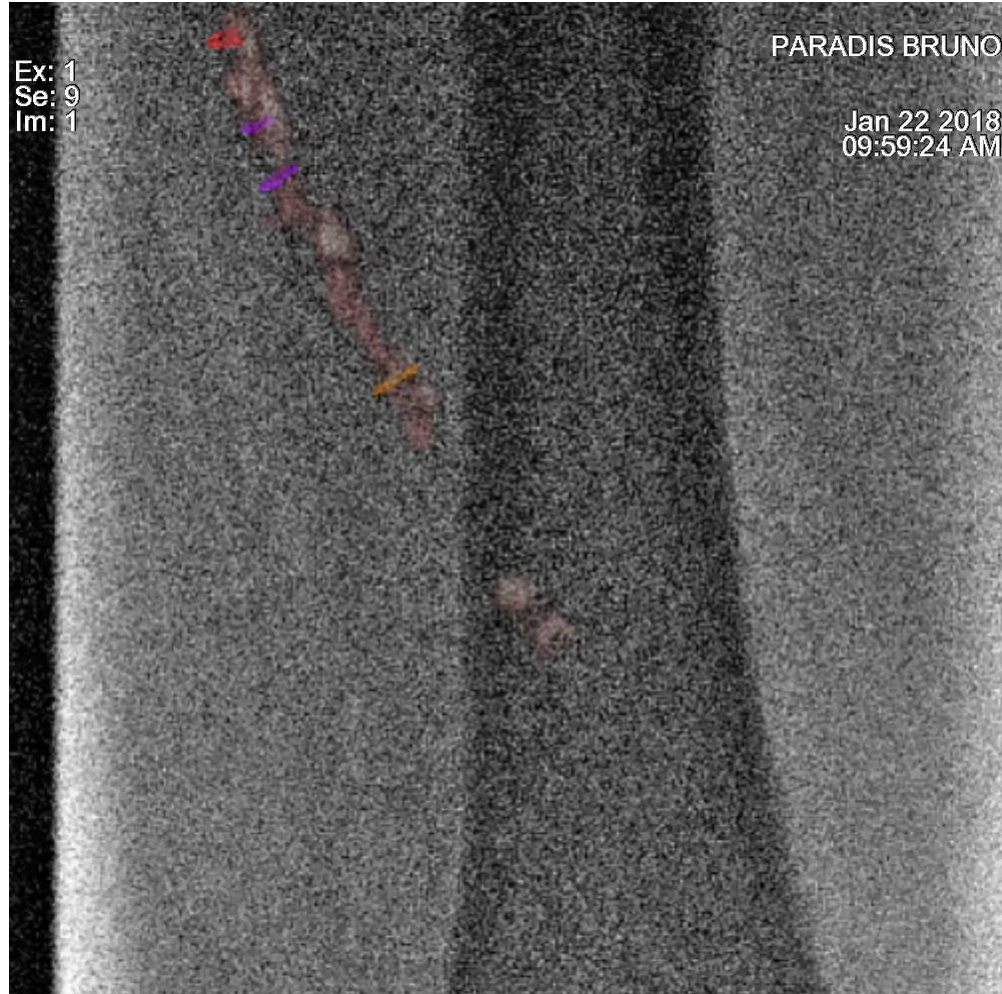
Planning circles and modelling calcification volume



Planning circles and modelling calcification volume

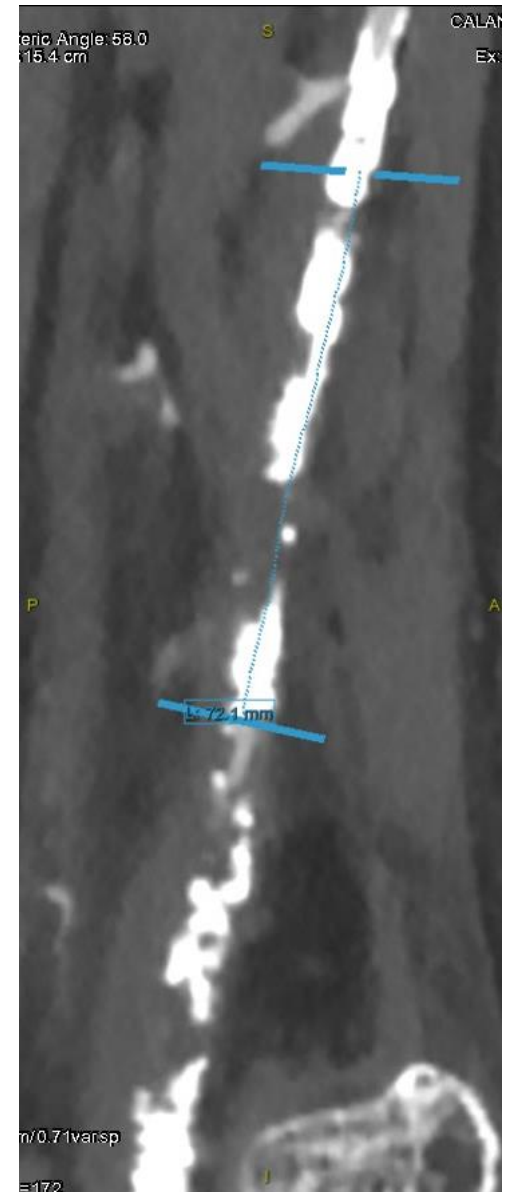


Planning circles and modelling calcification volume



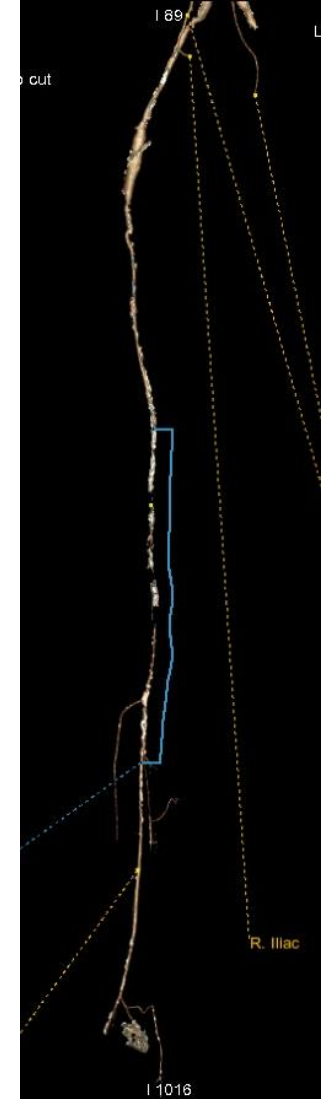
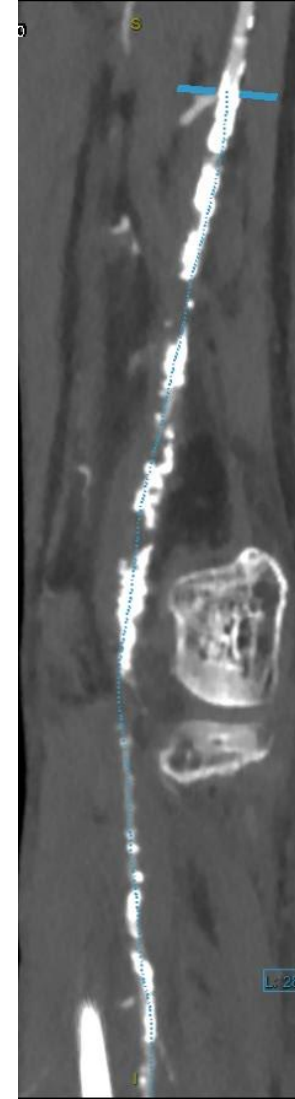
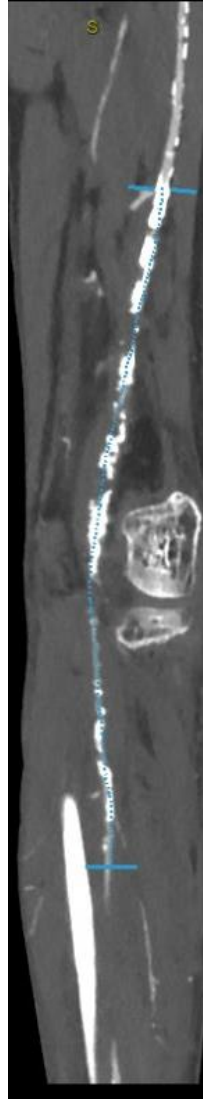
Limb Salvage

Procedure Evaluation



Procedure Evaluation

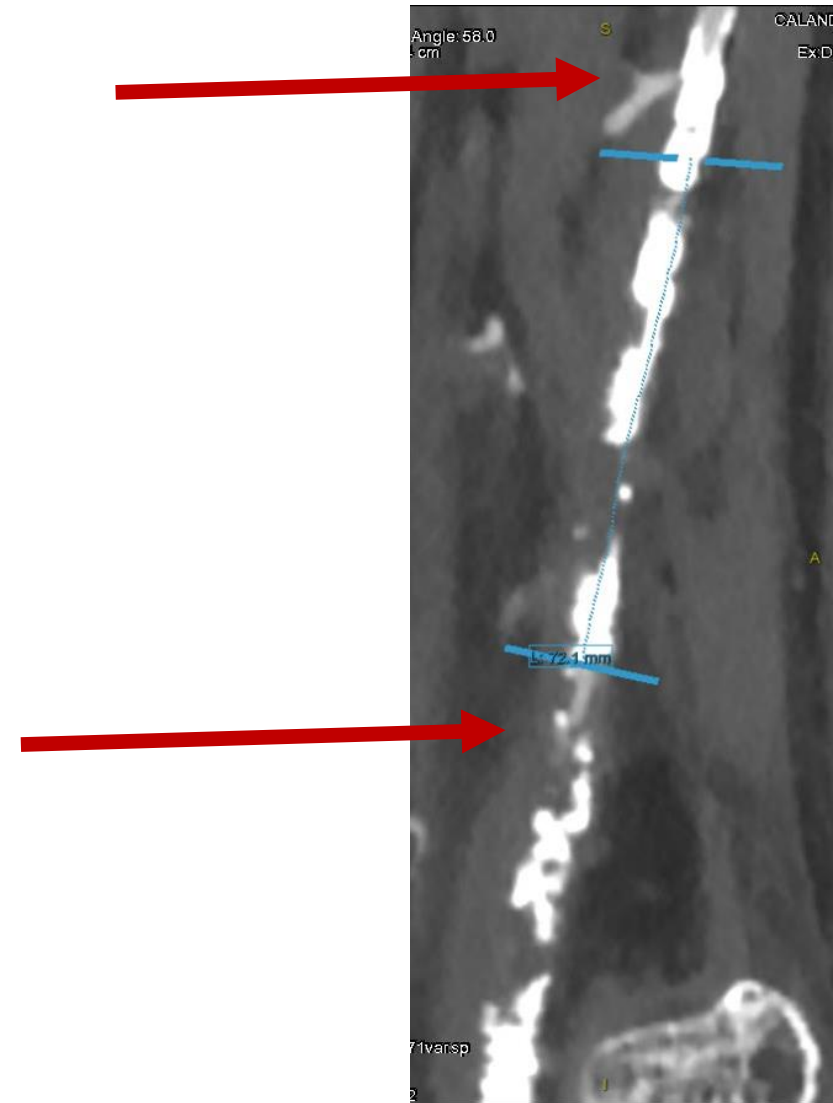
- *CT-scan:*
- *LONG OCCLUSION* of distal part of the SFA and popliteal artery **280mm**
- *VERY CALCIFIED LESIONS*
- *1 vessel run off to the foot (peroneal artery)*



Procedure Evaluation

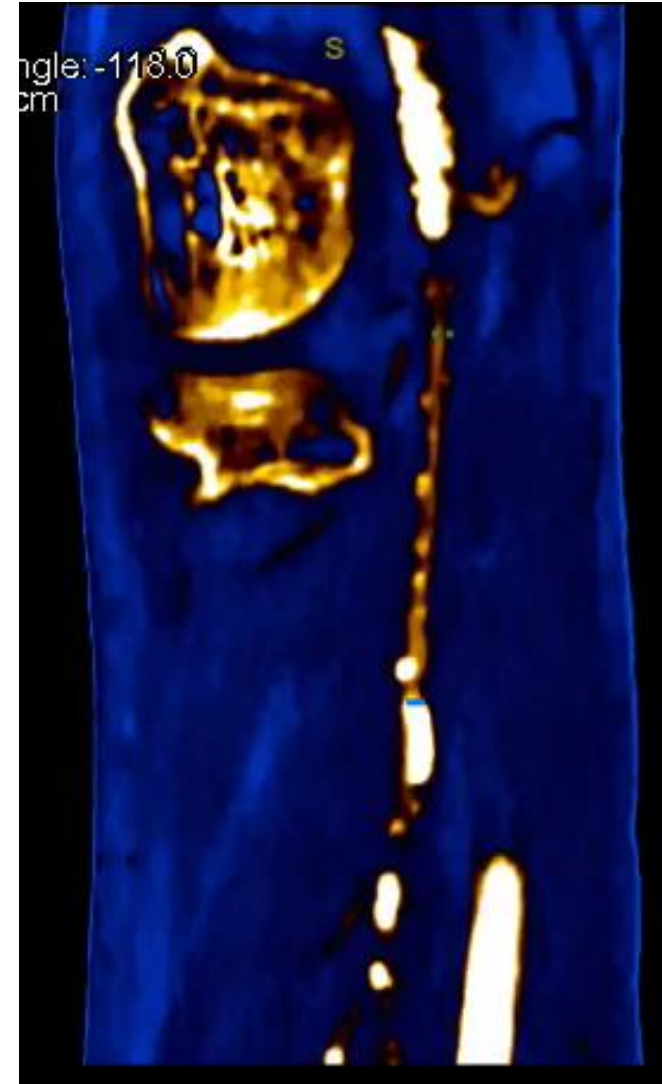
- *CT-scan:*
- *LONG OCCLUSION* of distal part of the SFA and popliteal artery
- *VERY CALCIFIED LESIONS*
- *1 vessel run off to the foot (Peroneal artery)*

- *SHORT SUSPENDED POPLITEAL ARTERY*
- *PROXIMAL COLLATERAL*
- : ***STRATEGIC KEYS***



Procedure Evaluation

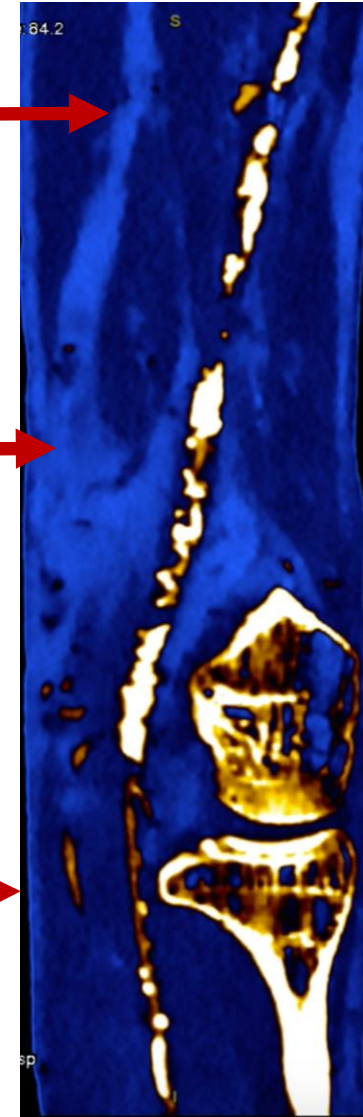
- *SHORT SUSPENDED POPLITEAL ARTERY*
- *PROXIMAL COLLATERAL:*
STRATEGIC KEYS
- *STUDY THE CT- SCAN IN*
PERFUSION MODE



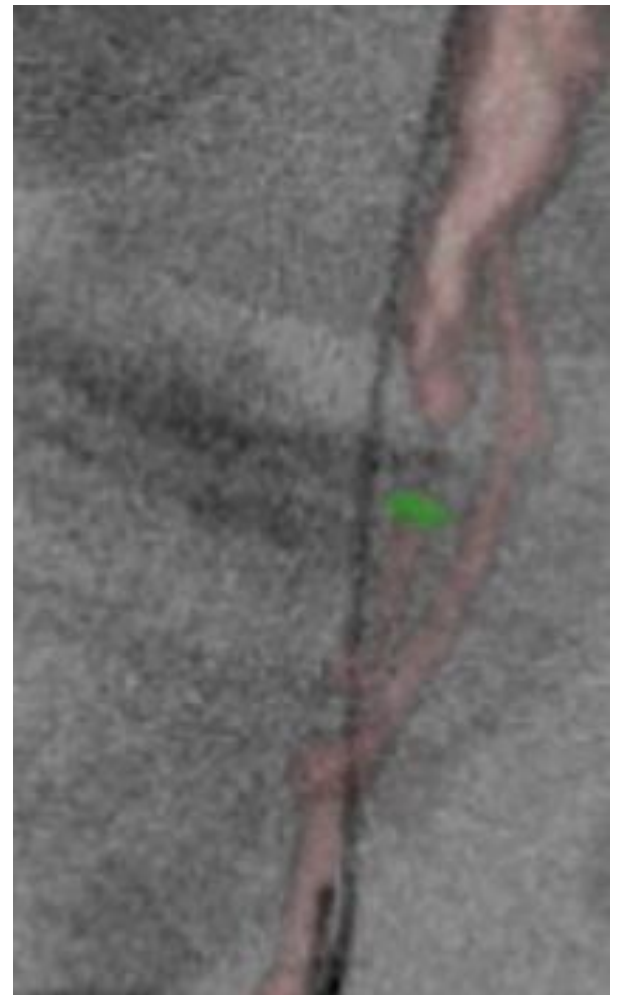
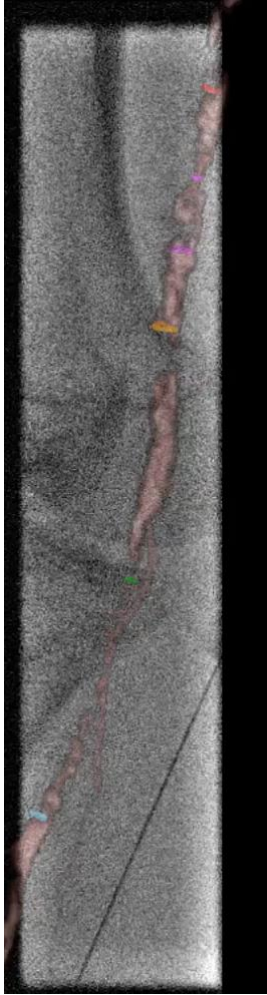
*CTO CATHETER ANGULATED with
PUSH guide wire 0.035*

*MICRO CATHETER 0.018 or 0.014
Guide wire navigation and CTI*

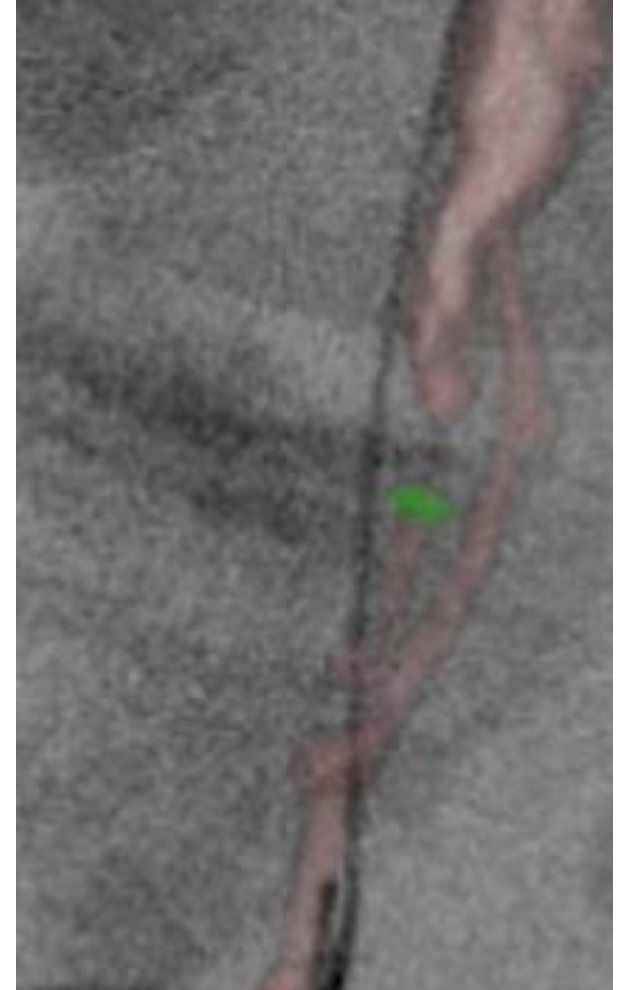
*Navigation guide wire 0.014
with coronary balloons*



Planning circles and modelling calcification volume



Planning circles and modelling calcification volume



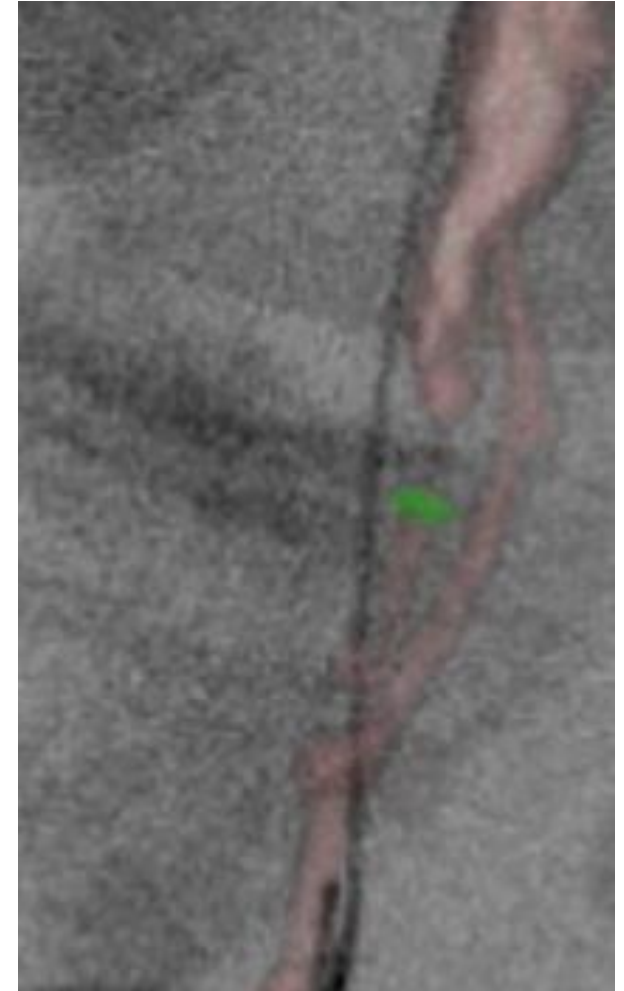
Planning circles and modelling calcification volume



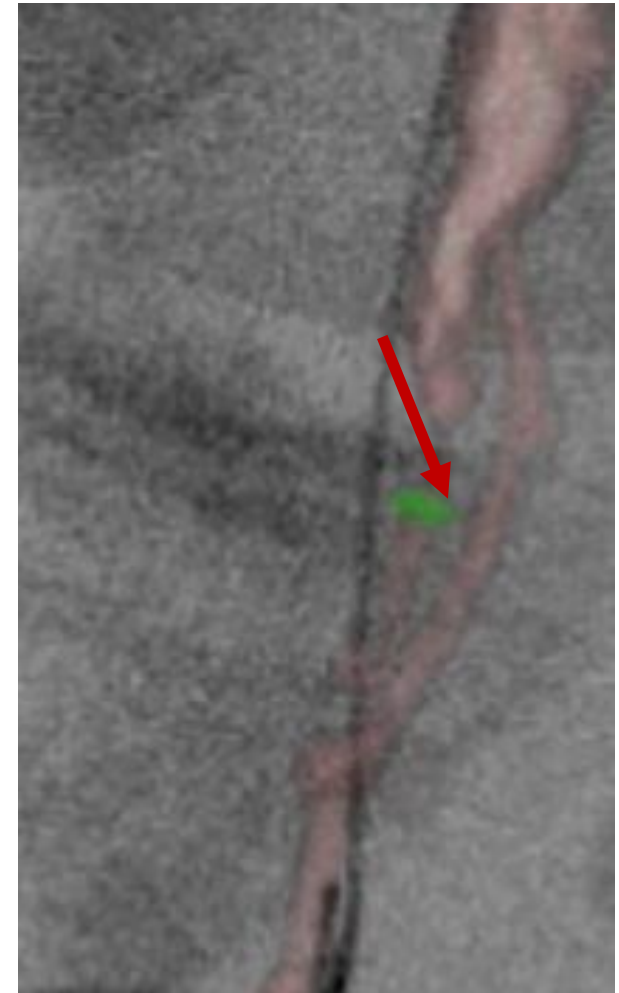
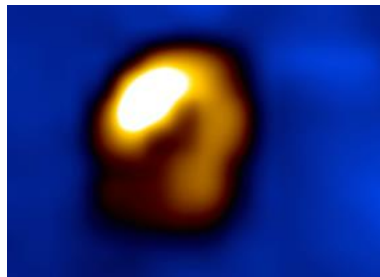
Planning circles and modelling calcification volume



Planning circles and modelling calcification volume



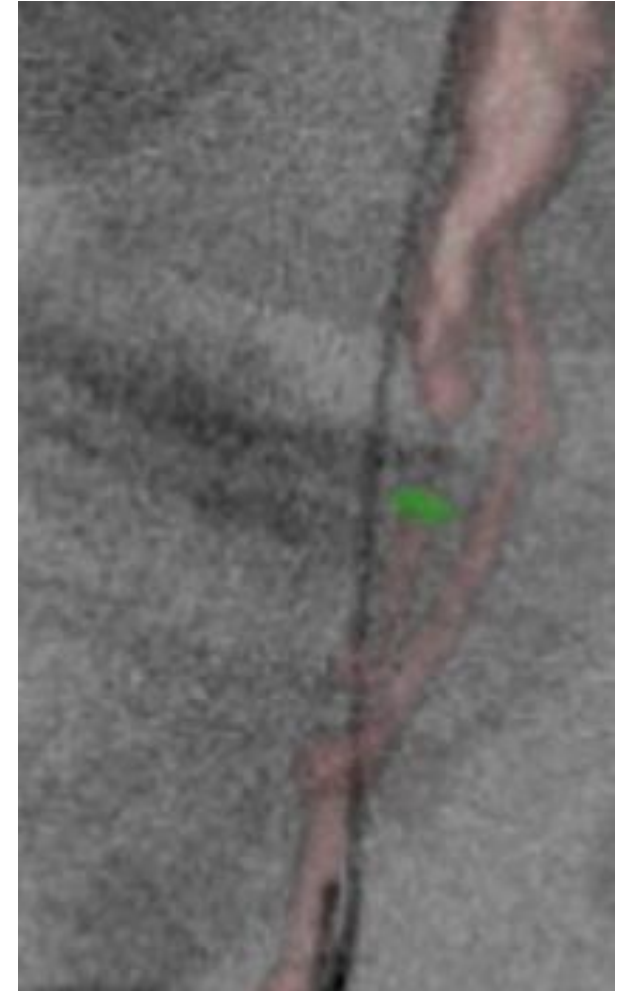
Planning circles and modelling calcification volume



Planning circles and modelling calcification volume

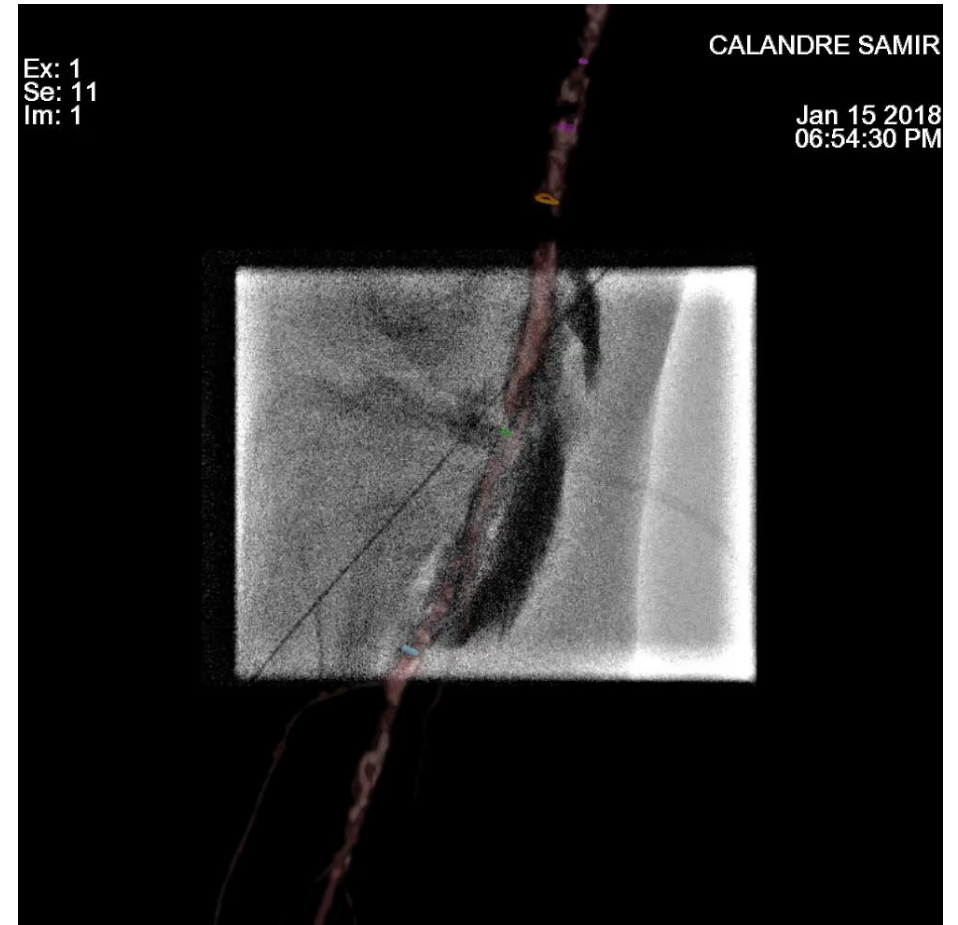
- *Left groin approach,*
- *6fr long Introducer 65cm*
- *Vertebral catheter 0.035
angulated wire*
- *CX 0.035, 260 cm stiff guide Wire*

- ***MICRO 0.018, GAIA 0.018
INSIDE THE CXI***



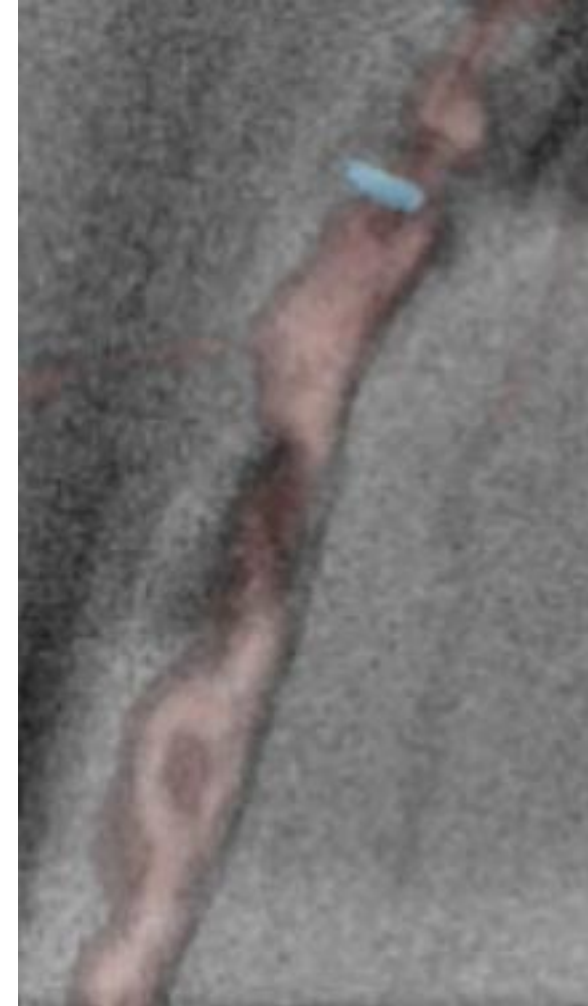
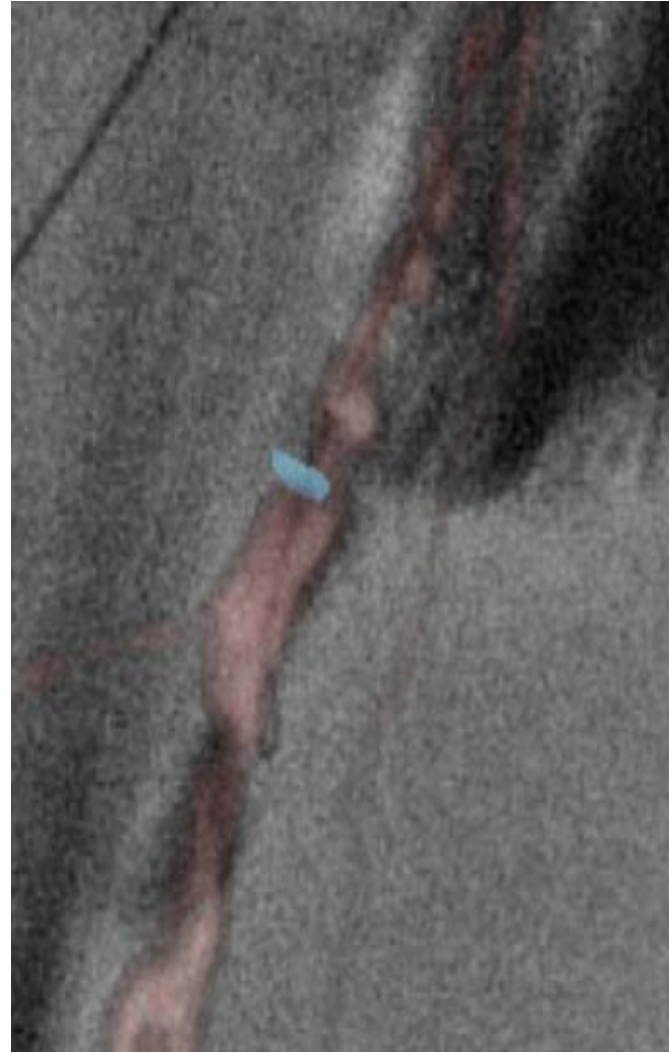
Planning circles and modelling calcification volume

- *Left groin approach,*
- *6fr long Introducer 65cm*
- *Vertebral catheter 0.035 angulated wire*
- *CX 0.035, 260 cm stiff guide wire*
- ***MICRO 0.018, GAIA 0.018
INSIDE THE CXI***



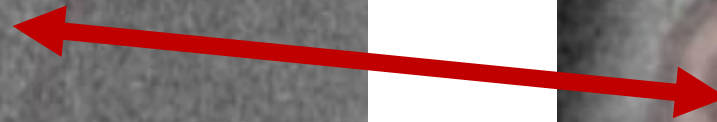
Planning circles and modelling calcification volume

*Modelling guide
wire along the
calcification*



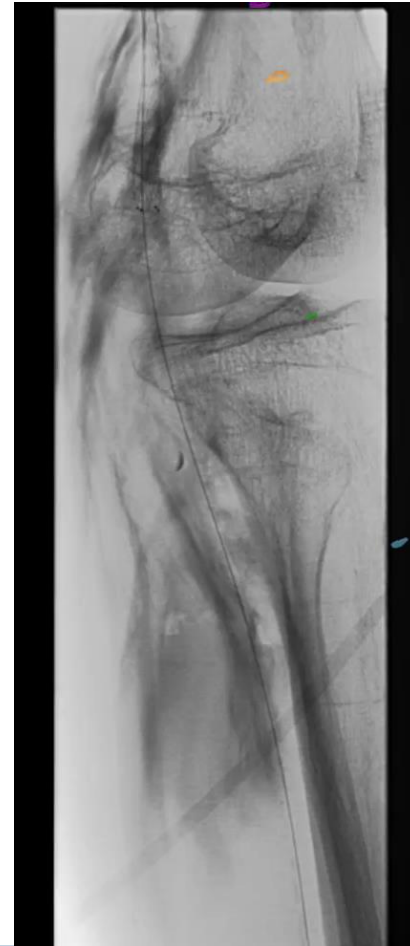
Planning circles and modelling calcification volume

*Modelling guide
wire along the
calcification*



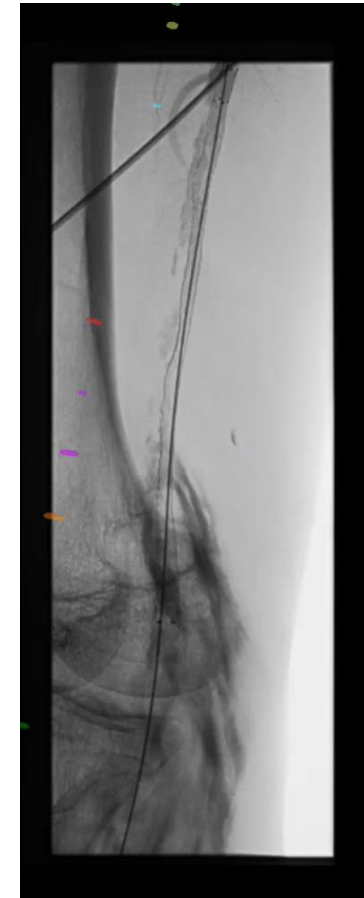
Planning circles and modelling calcification volume

|



Planning circles and modelling calcification volume

1. Change for 0.014
 2. Coronary Ballon 1.5-30 inside the CXI Catheter
 - 3. Invatec Amphirion Deep 2.0 -120**
 - 4. Invatec Amphirion Deep 4.0 -120**
 - 5. DEB 4.120 (popliteal artery) AVOID STENTING IN THIS AREA**
-
- 1. 2 X Absolute 5X 100 Abbott**



Planning circles and modelling calcification volume

1. *Change for 0.014*

2. *Coronary ballon 1.5-30 inside the CXI catheter*

1. *IN.PACT ADMIRAL 4.120 (popliteal artery)*

2. *2X Absolute 5X 80*

3. *DES Xience Prime BTK Abbott in poplipeal trunk*



WOUND HEALING

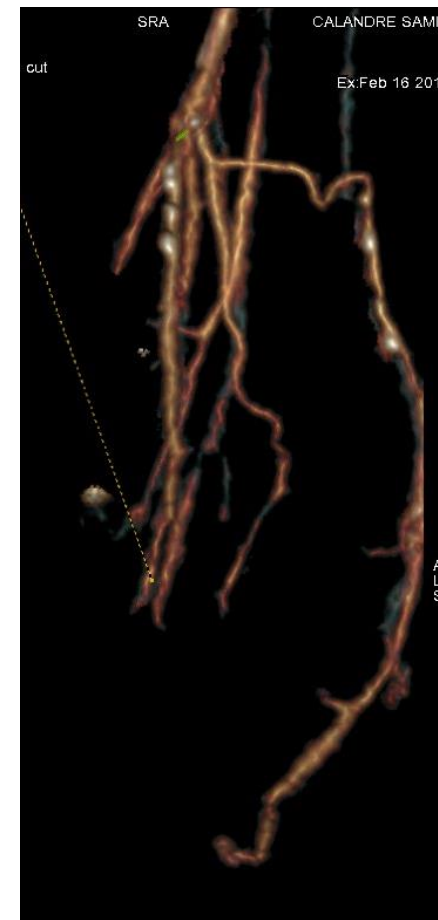
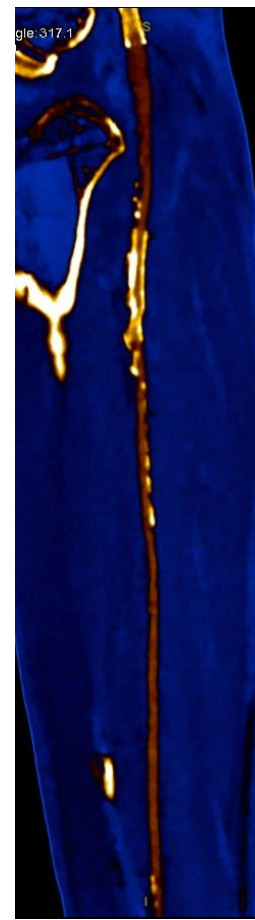
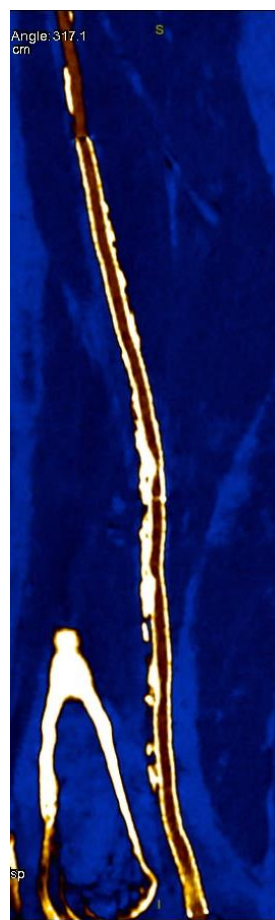
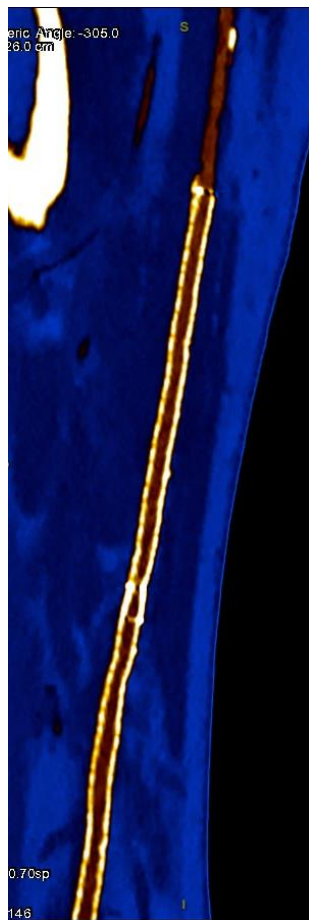


WOUND HEALING

One month



POST OPERATIVE CT SCAN



WOUND HEALING

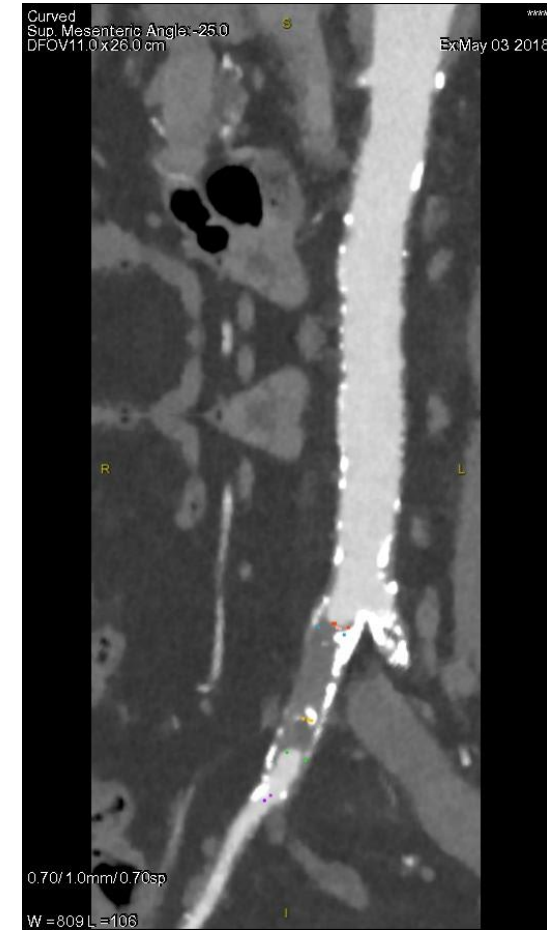
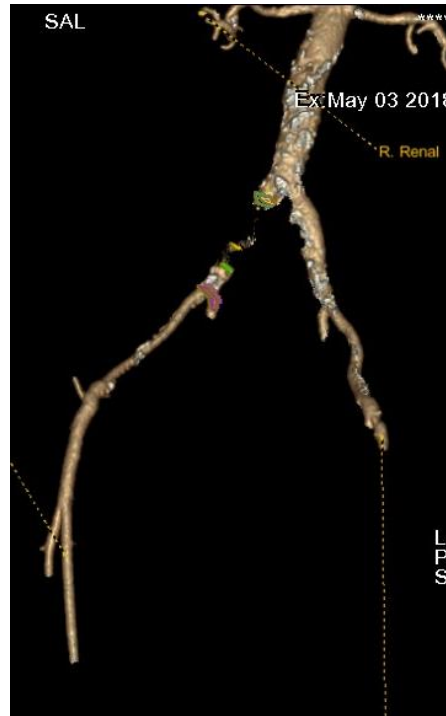
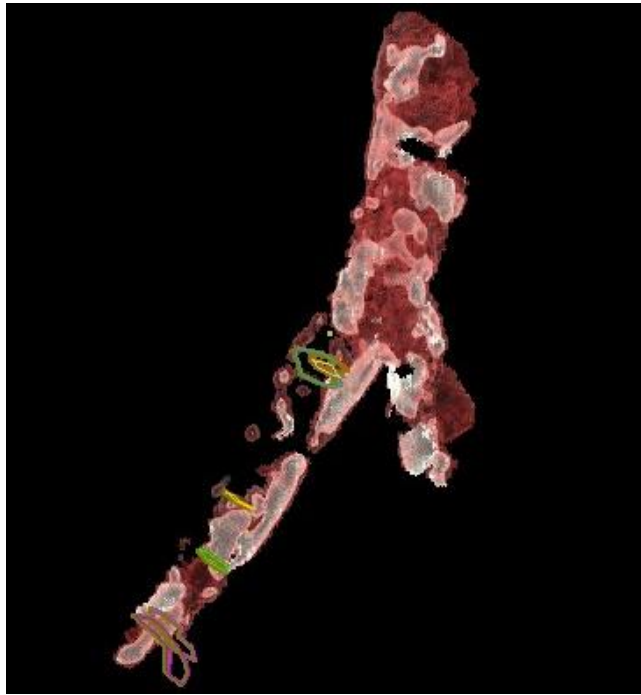


Two months



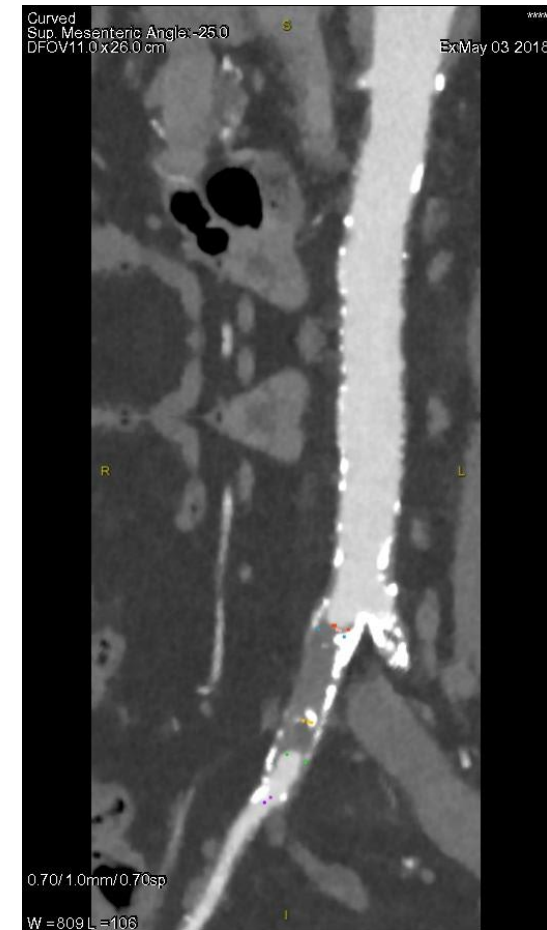
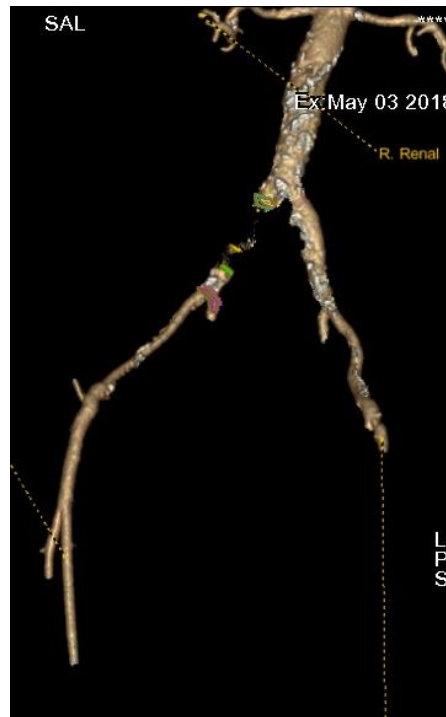
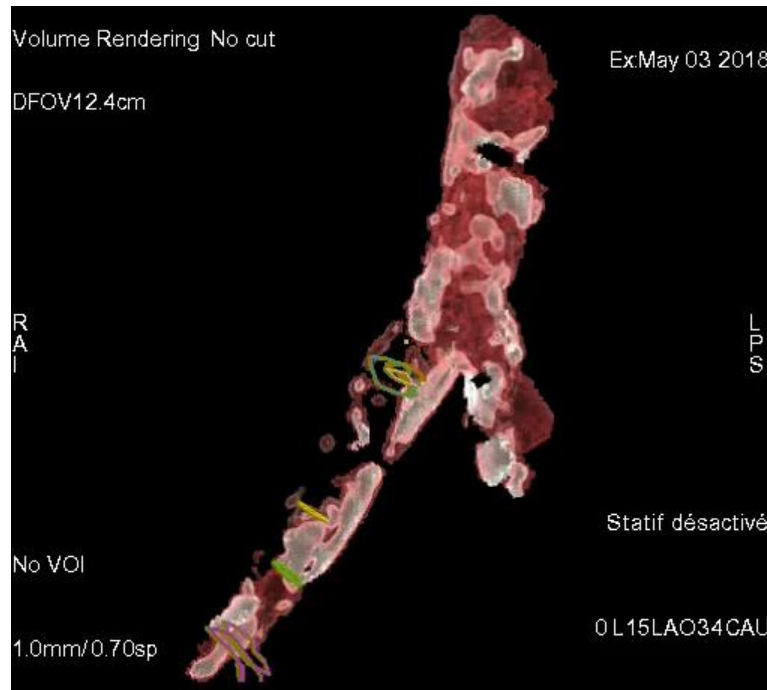
Planning Circles and Modelling calcification Volume

- Right Common Iliac Artery Occluded

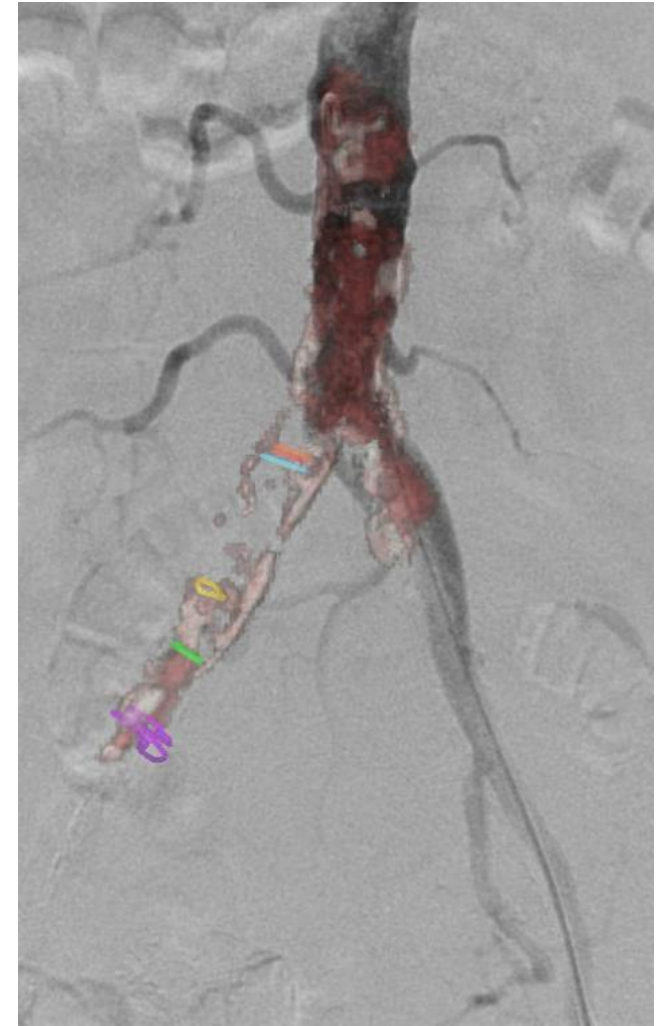
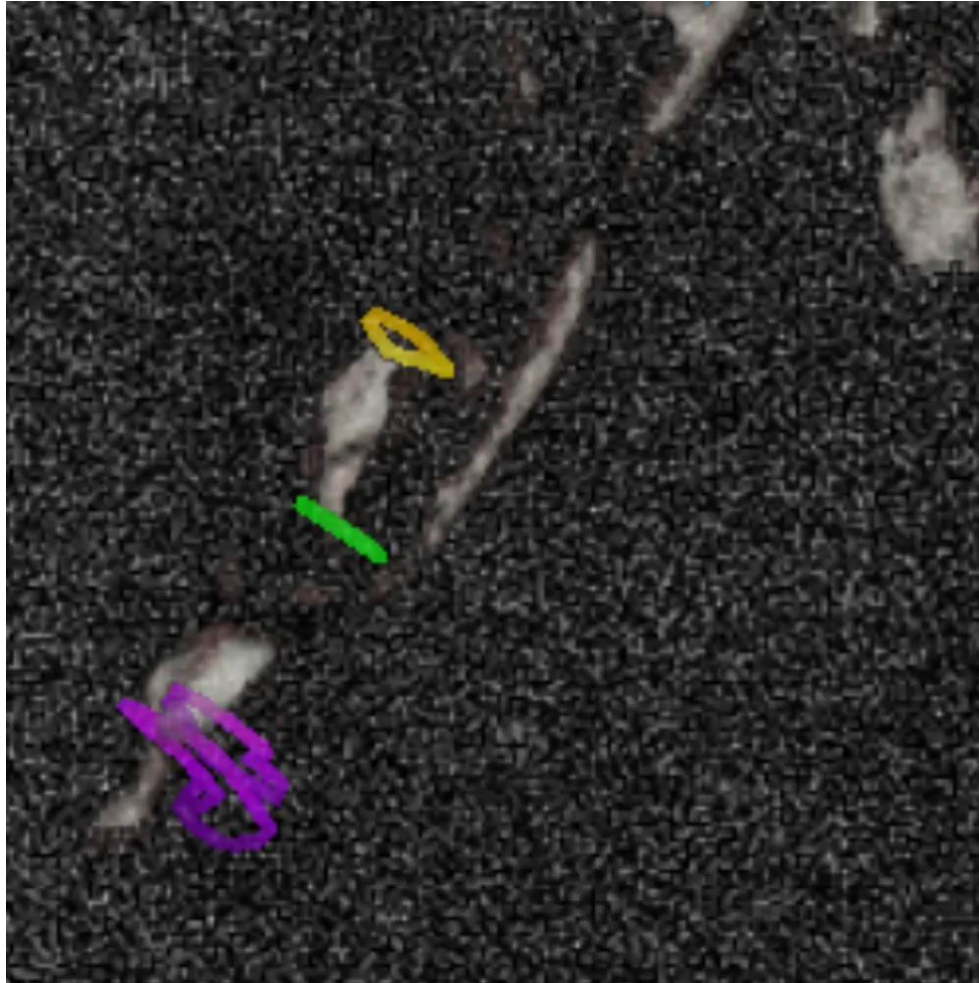


Planning Circles and Modelling calcification Volume

- Right Common Iliac Artery Occluded

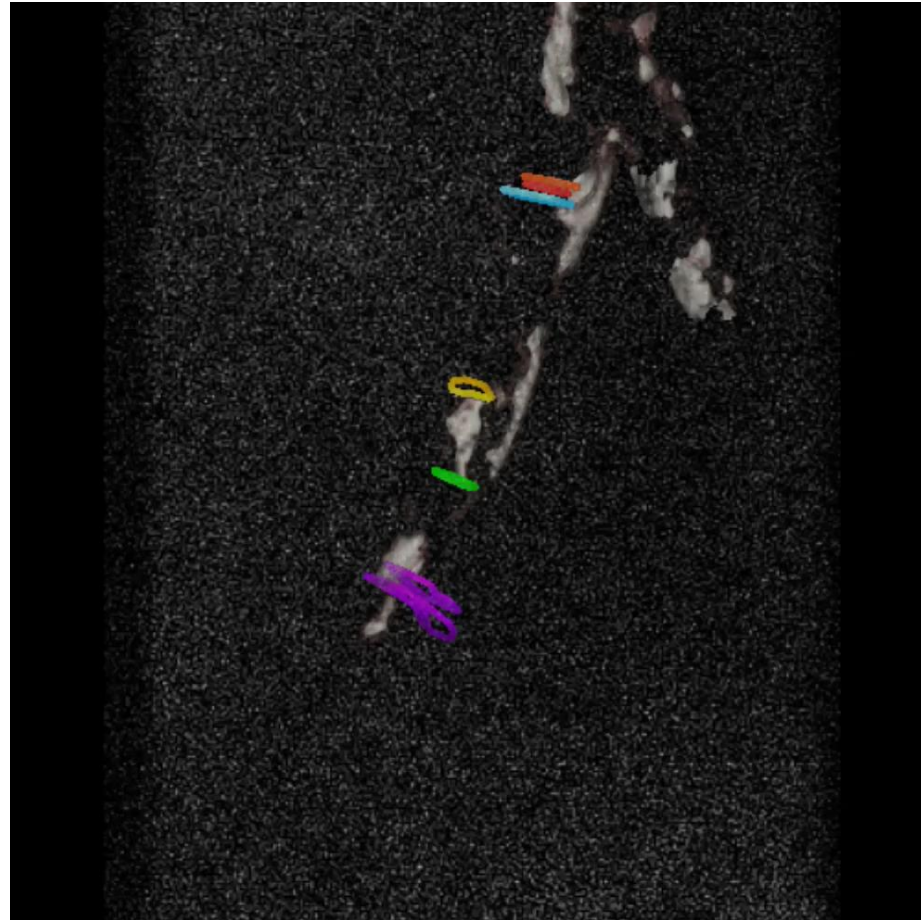


Planning circles and modelling calcification volume



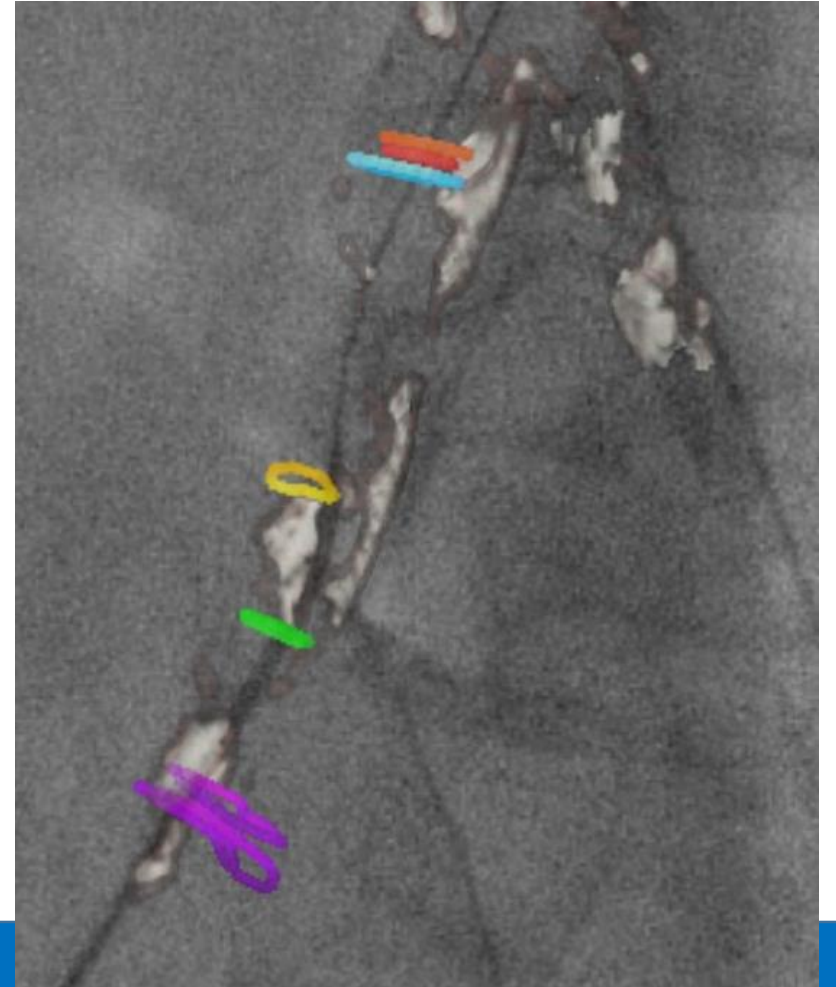
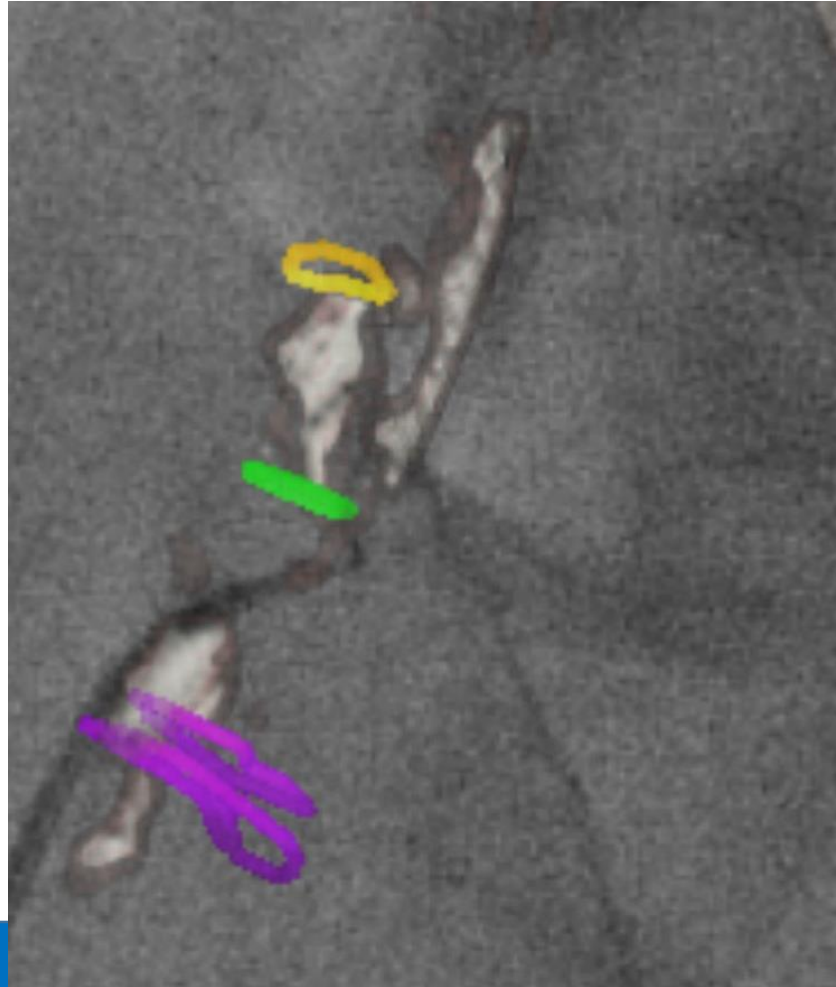
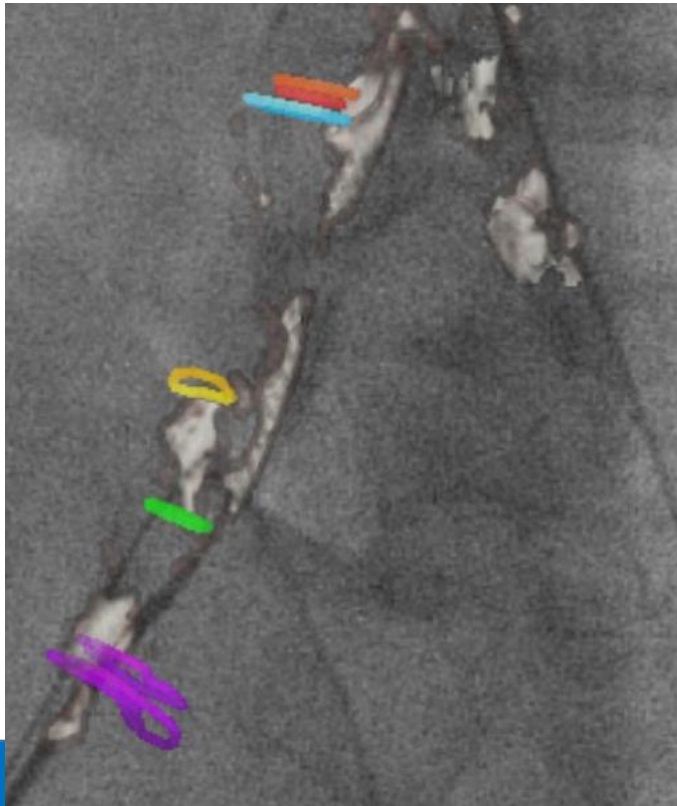
Planning circles and modelling calcification volume

*New
incidence*



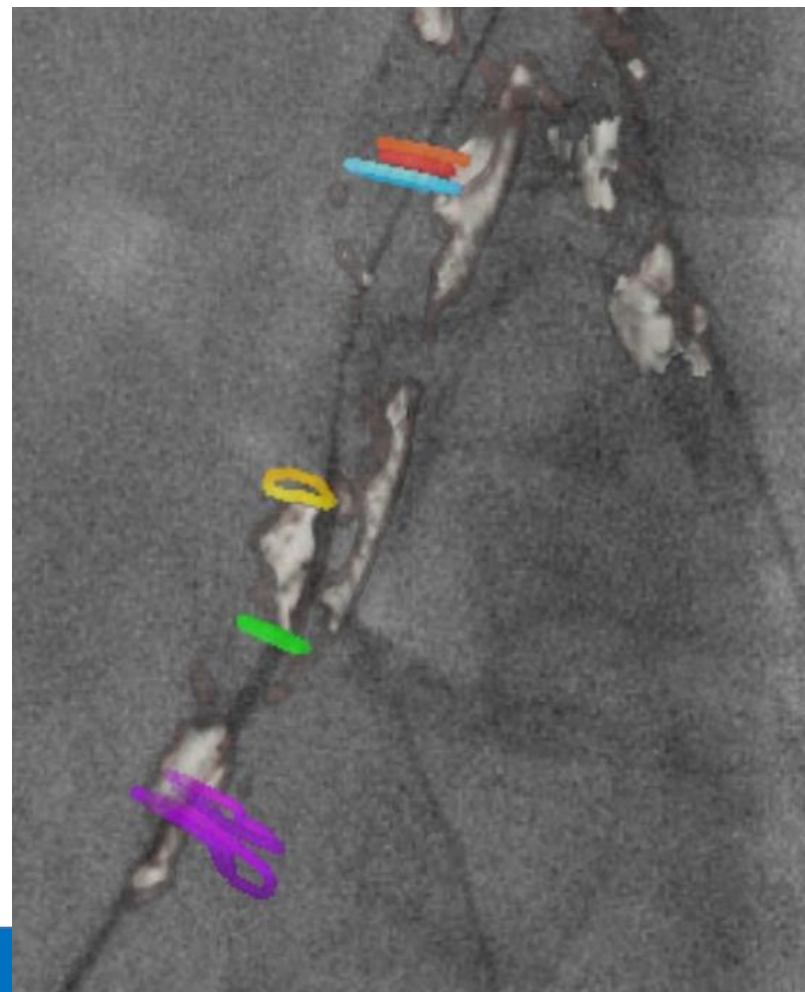
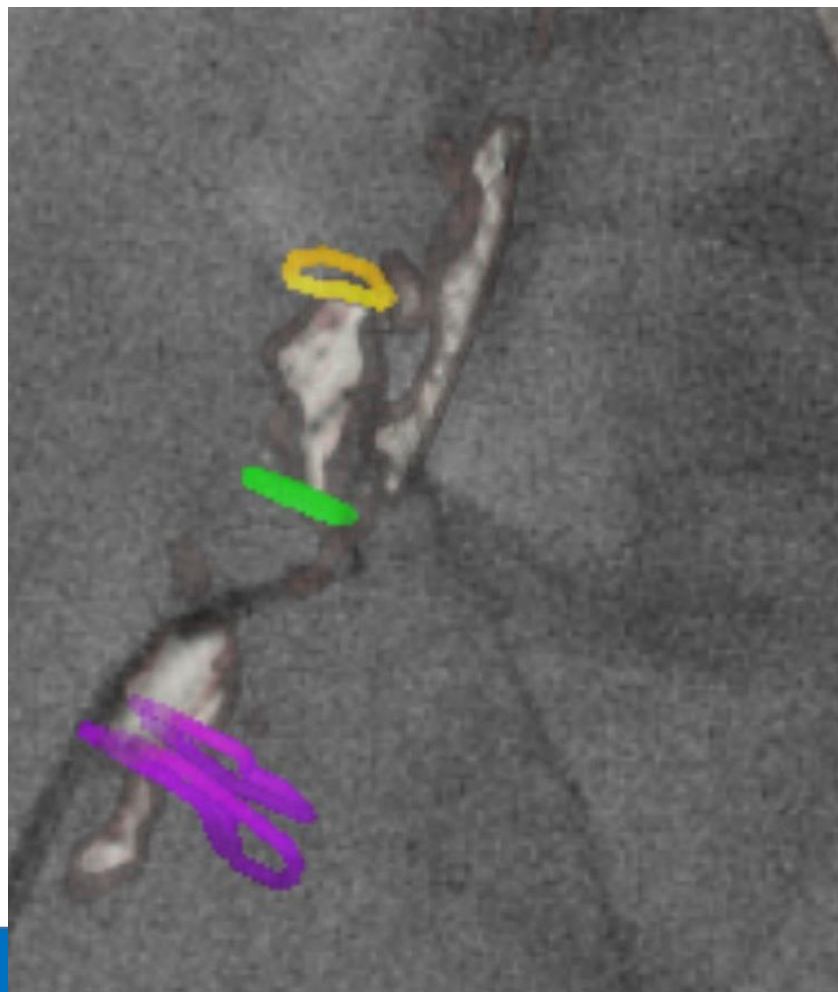
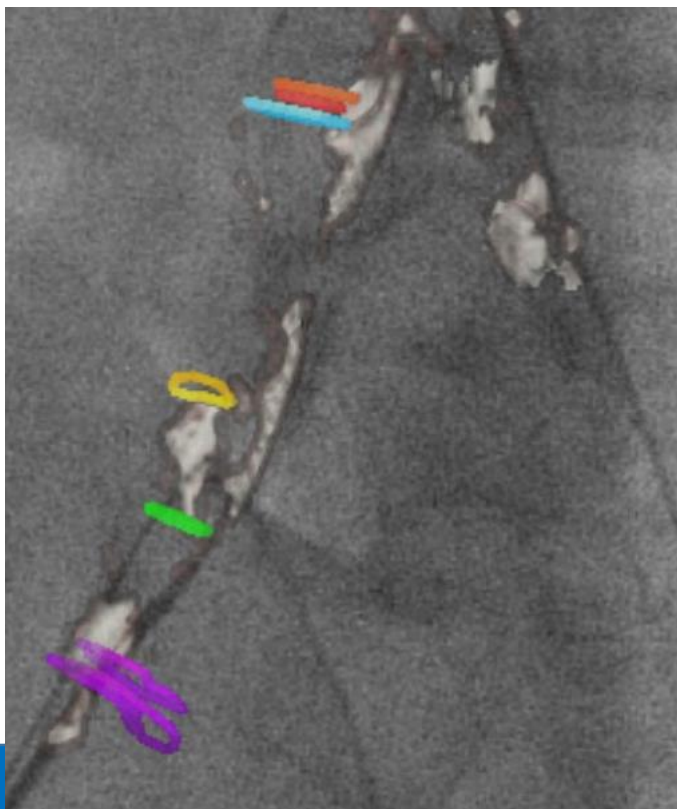
Planning circles and modelling calcification volume

*Line up the
calcifications*



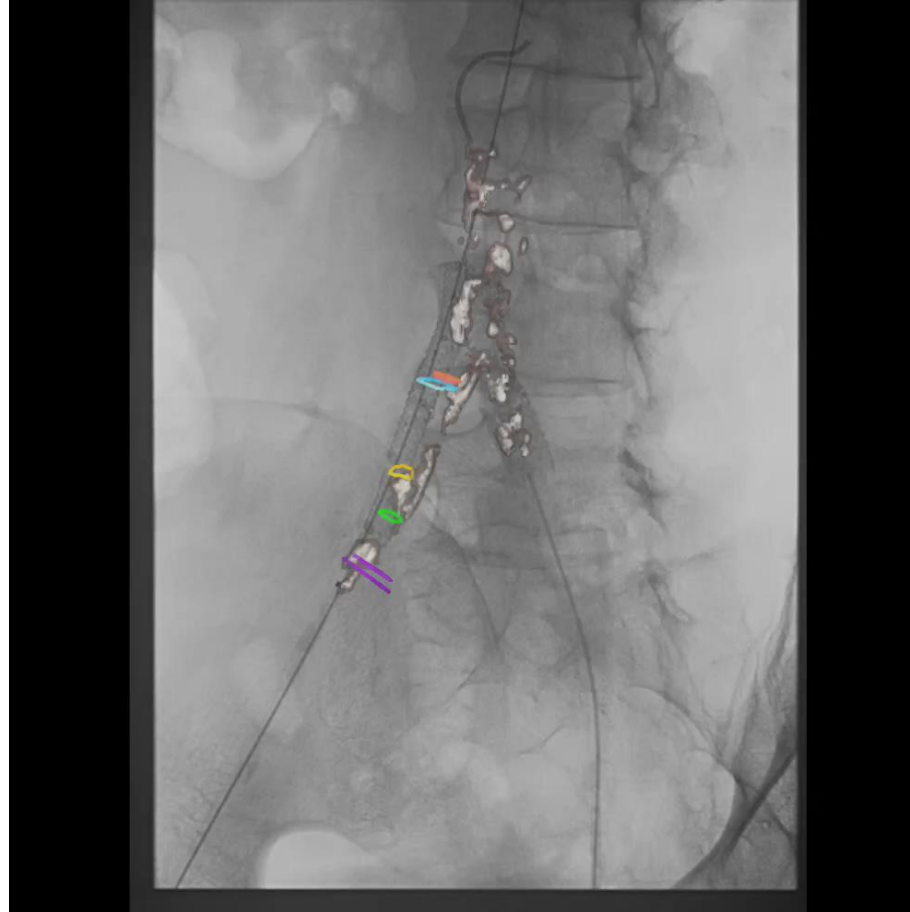
Planning circles and modelling calcification volume

*Line up the
calcifications*



Planning circles and modelling calcification volume

Final Angiography



CONCLUSION

The CTO with planning circles technique combined with the calcification modelisation:

1. Allow most often to stay in the good lumen
2. Decrease the time of procedure
3. Decrease the radiation
4. Decrease the use of the re-entry devices (Economic cost-effectiveness)
5. Simplify the complex cases

THANK YOU

***LOUIS Nicolas, Vascular Surgeon
Hôpital Privé les Franciscaines, Nîmes
France***

***I-MEET, NICE
JUNE 2018***



