

# Radioanatomie des artères coronaires

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# CT multidétecteur



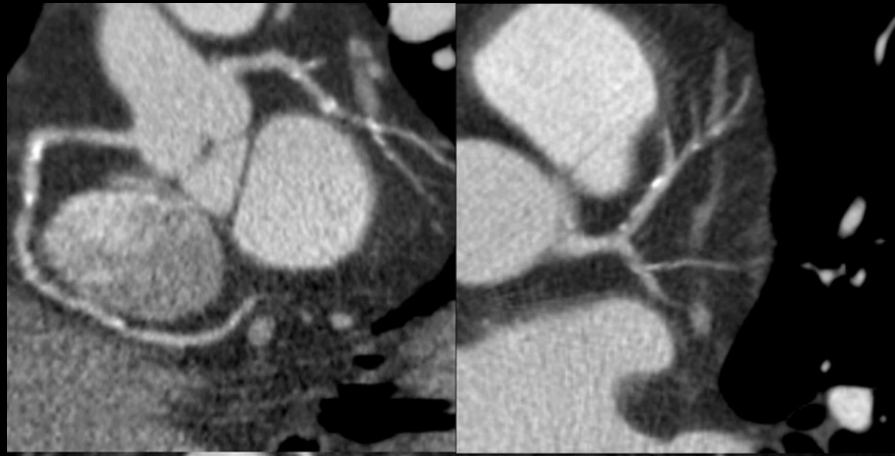
**4-256 coupes/rotation**

**Toshiba: 320  
coupes/rotation**

**16 cm de couverture**

**Imagerie cardiaque en  
1 battement**

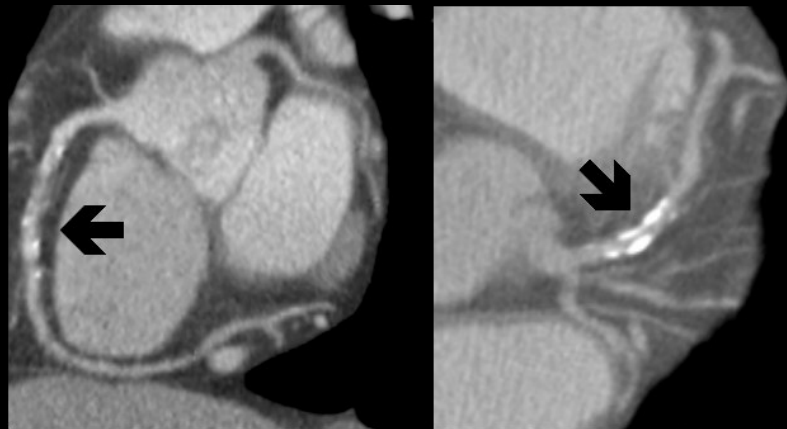
**Dual source CT**



4 coupes/rotation

2000: 4 x1 mm

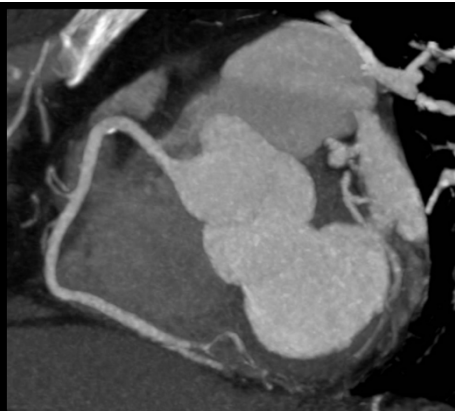
Temps d'acquisition: 45 sec



16 coupes/rotation

2004: 16 x 0.75 mm

Temps d'acquisition: 25 sec



40-64 coupes/rotation-CT  
dual

2005: 40-64 x 0.625 mm

Temps d'acquisition: 10 sec

# Brilliance CT Asymetrix detector

## 64-row Multi-Detector

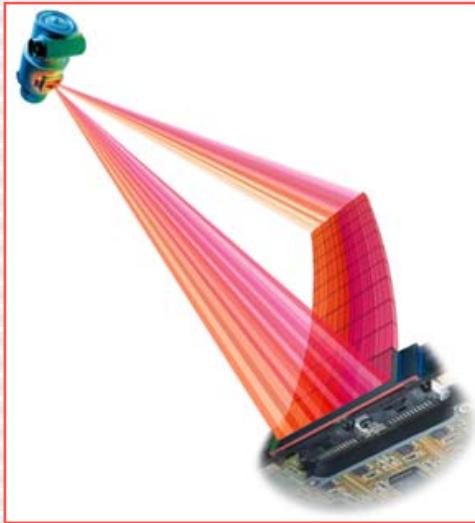
Collimation = area of detector covered

‘ConeBeam acquisition’

## 64-channel DAS

40mm Hi-resolution coverage

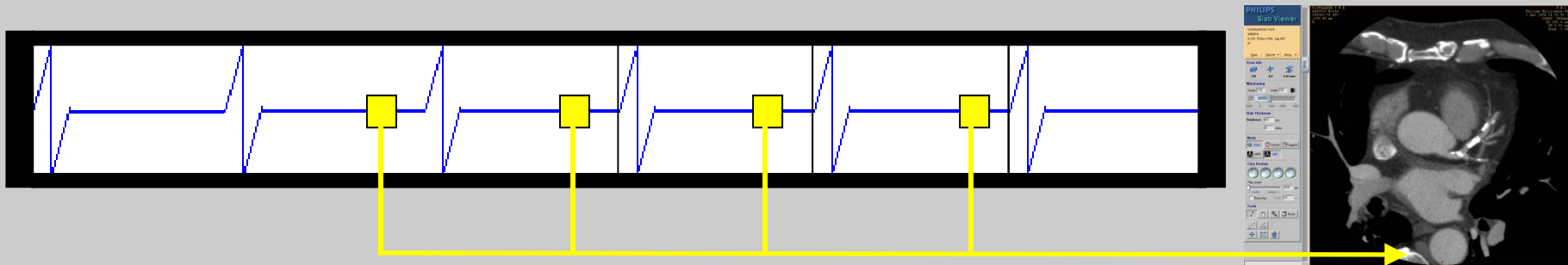
0.34mm in Z-axis



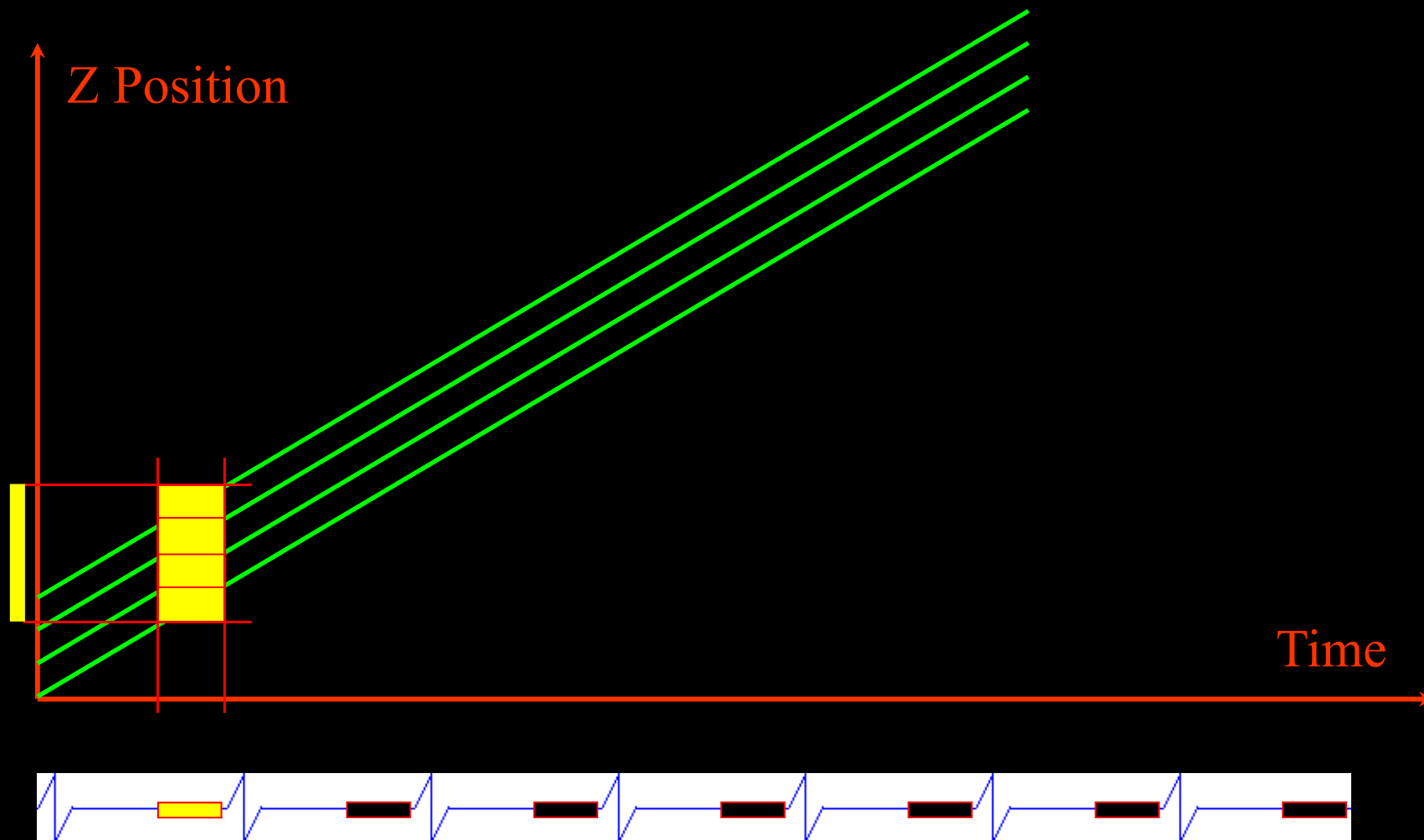
40mm (64 x 0.625mm)

# Acquisition de l'examen

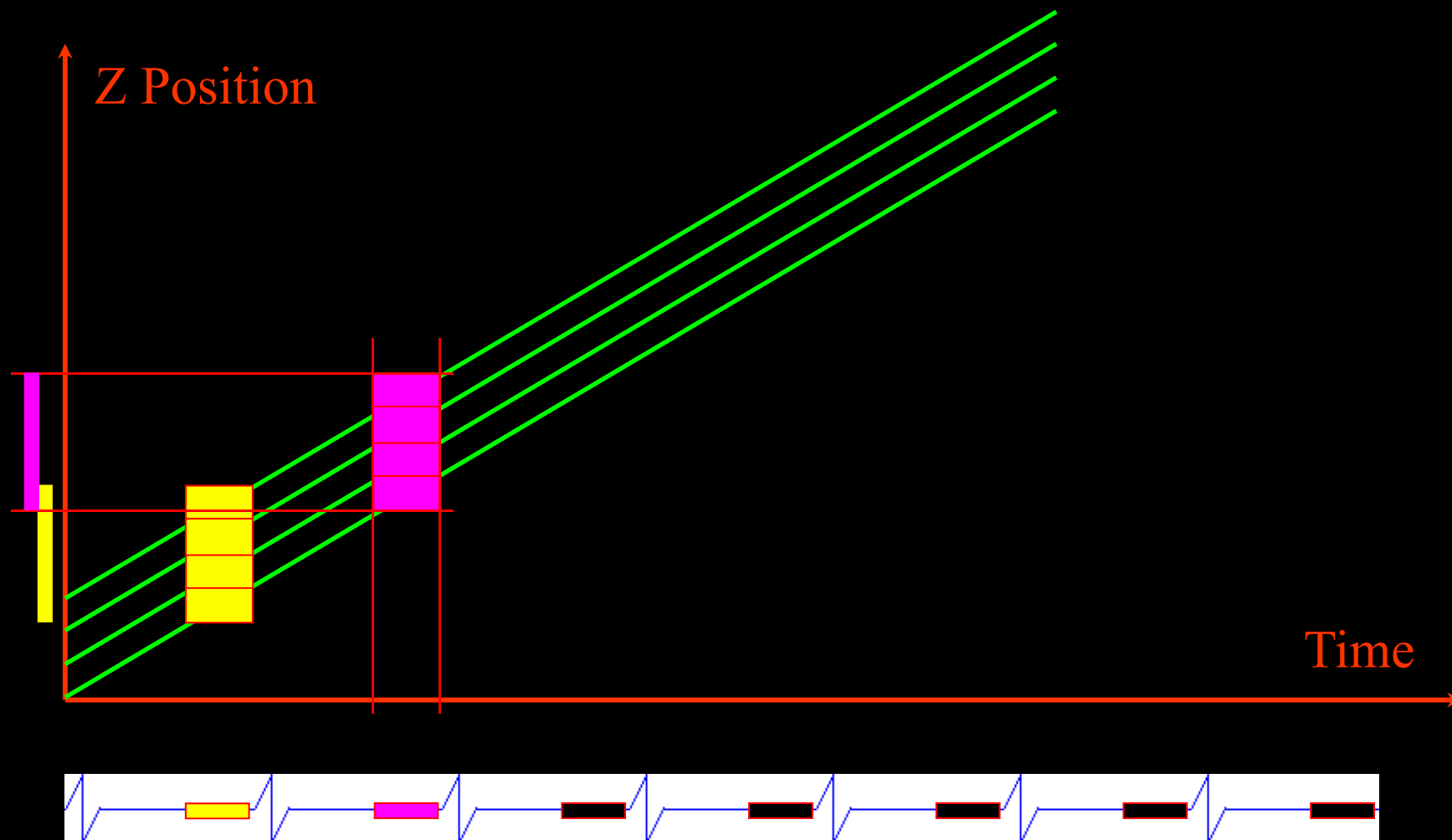
- 40-256 x 0.625 mm : collimation la plus fine
- Synchronisation cardiaque rétrospective
- Vitesse rotation la plus élevée
- 120 kV, 600-800 mAs



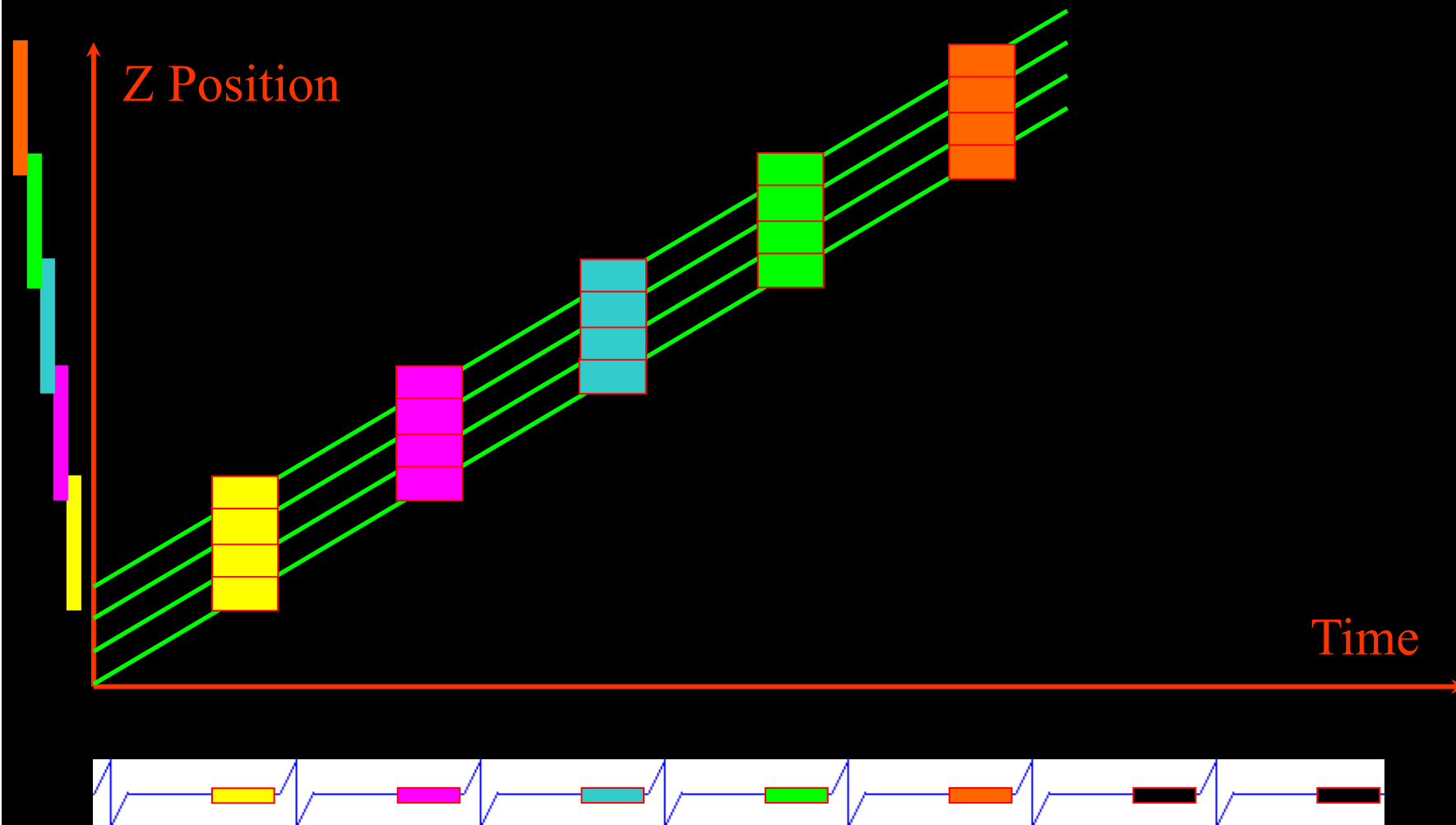
# Synchronisation cardiaque rétrospective



# Synchronisation cardiaque rétrospective

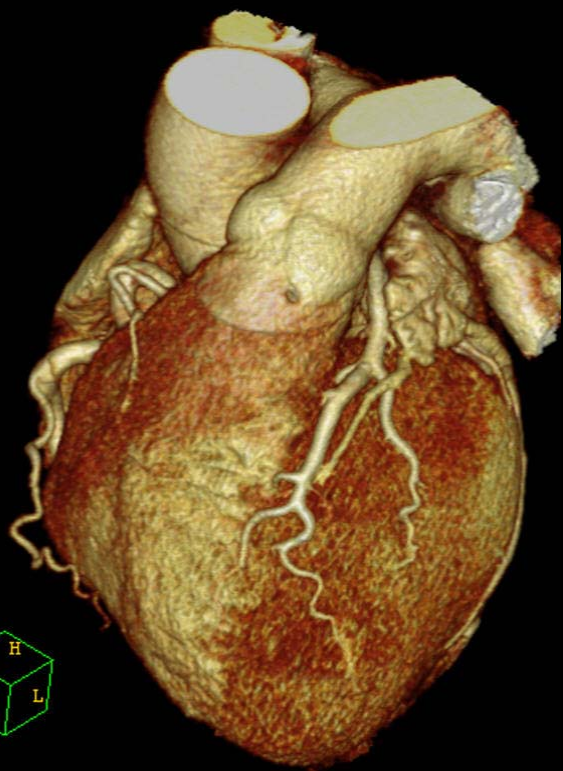


# Synchronisation cardiaque rétrospective



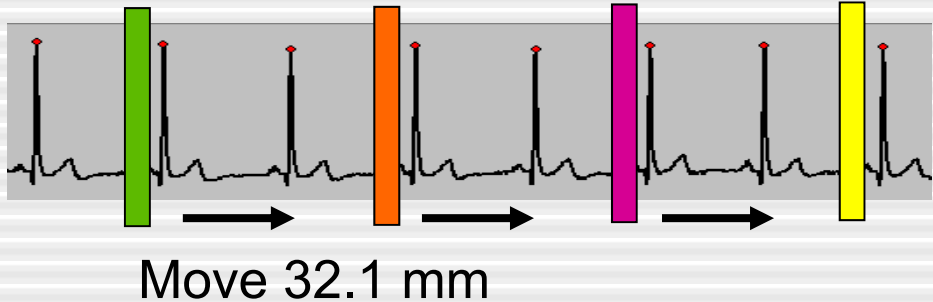


# Acquisition spirale avec synchronisation cardiaque rétrospective

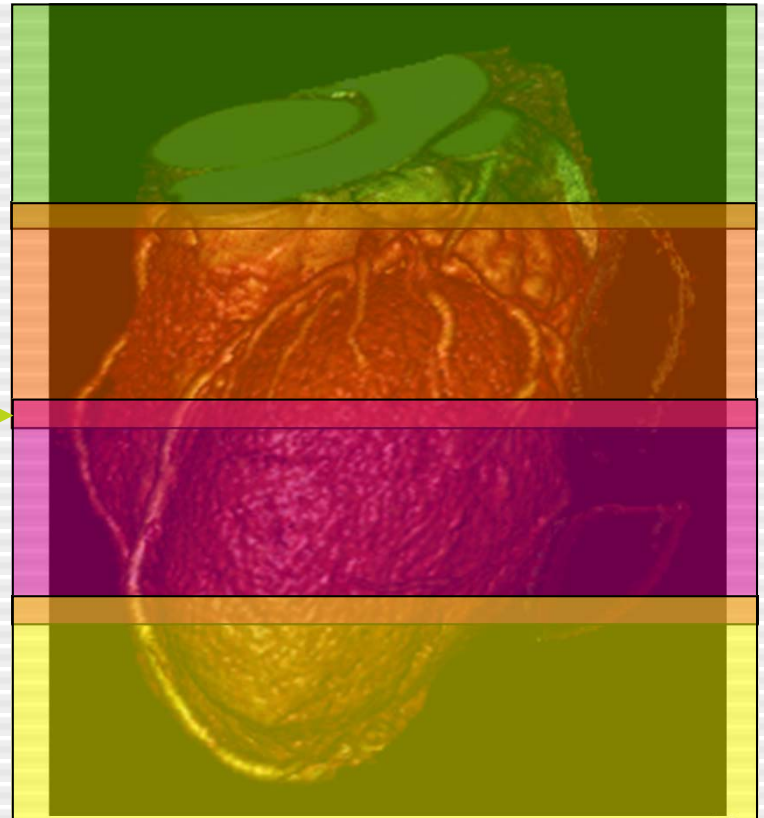
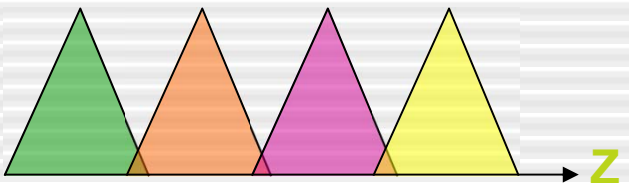


# Principes du Step & Shoot

Shoot: 1 2 3 4 Step: 1 2 3 4 Step & Shoot Cardiac scan (4cm)



Overlap 8 mm

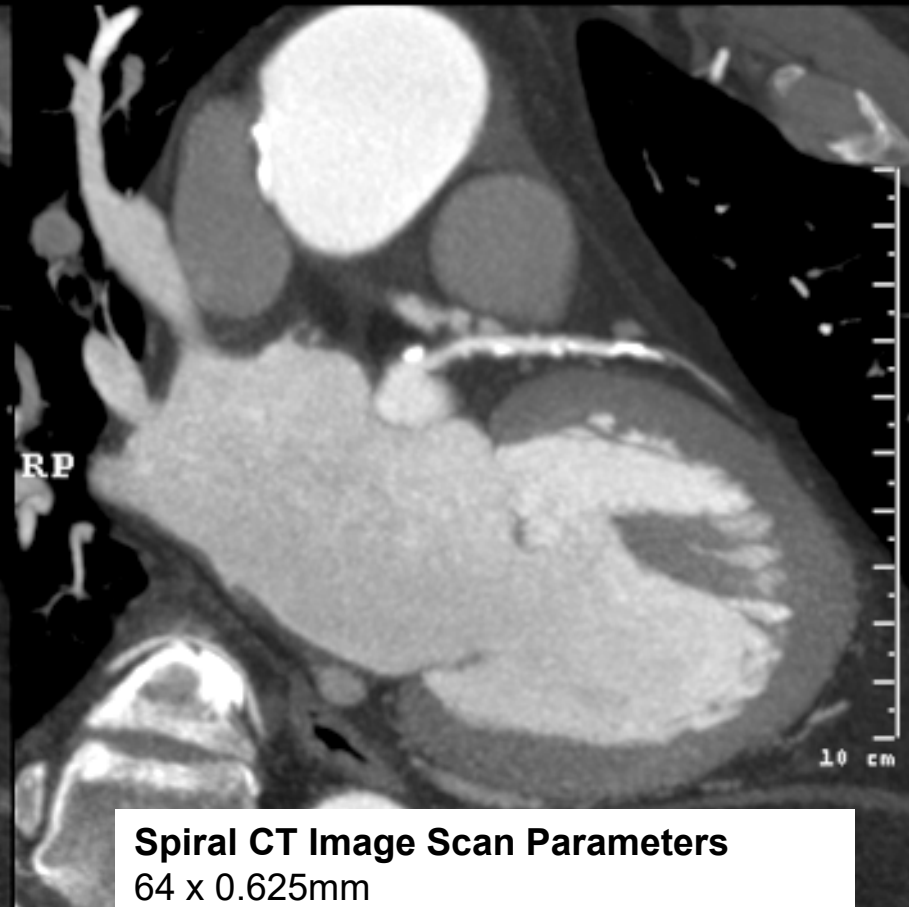


## Exemple 2: Step and shoot



### **Step & Shoot Cardiac (Axial prospective)**

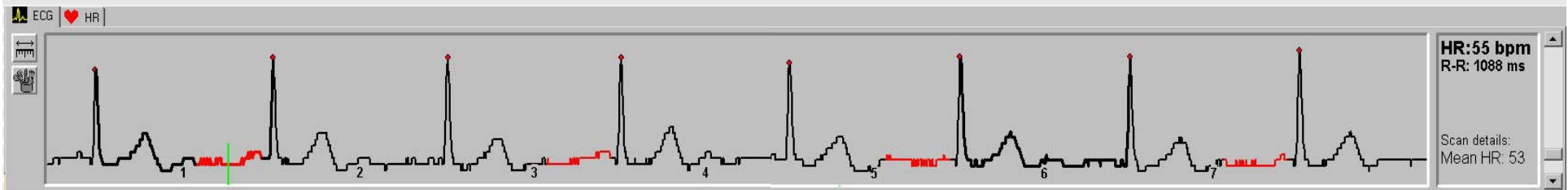
64 x 0.625mm  
16cm coverage  
Dose = 3.4 mSv



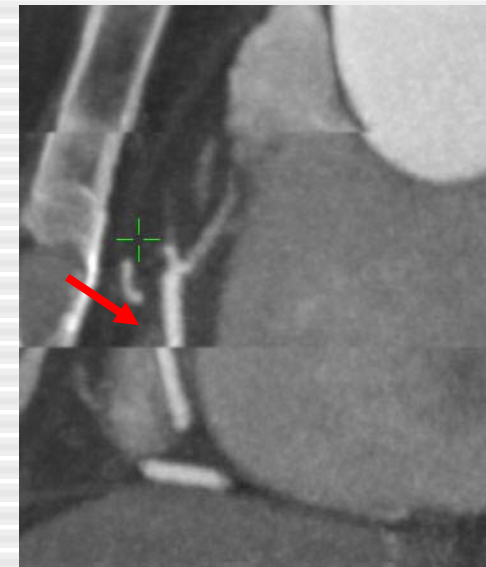
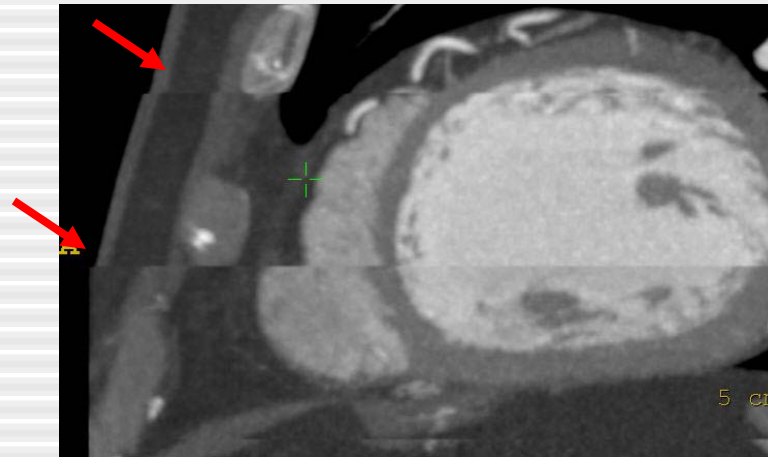
### **Spiral CT Image Scan Parameters**

64 x 0.625mm  
16cm coverage  
Dose = 14.4 mSv

## Exemple 2: Step and shoot



Respiré !!!



71 bpm



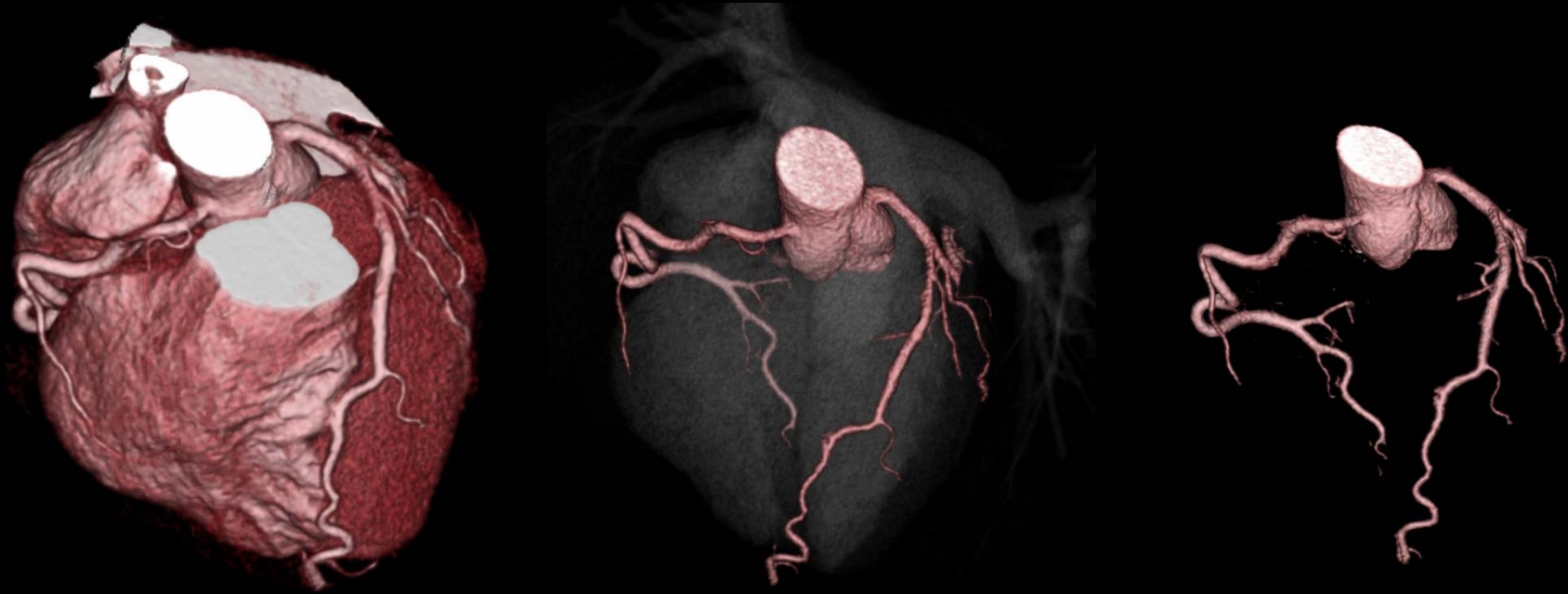
Dual Source

72 bpm



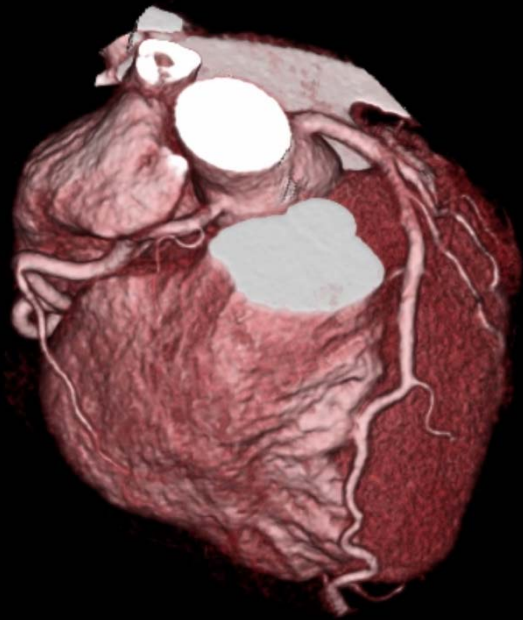
Single Source

# Post-Processing

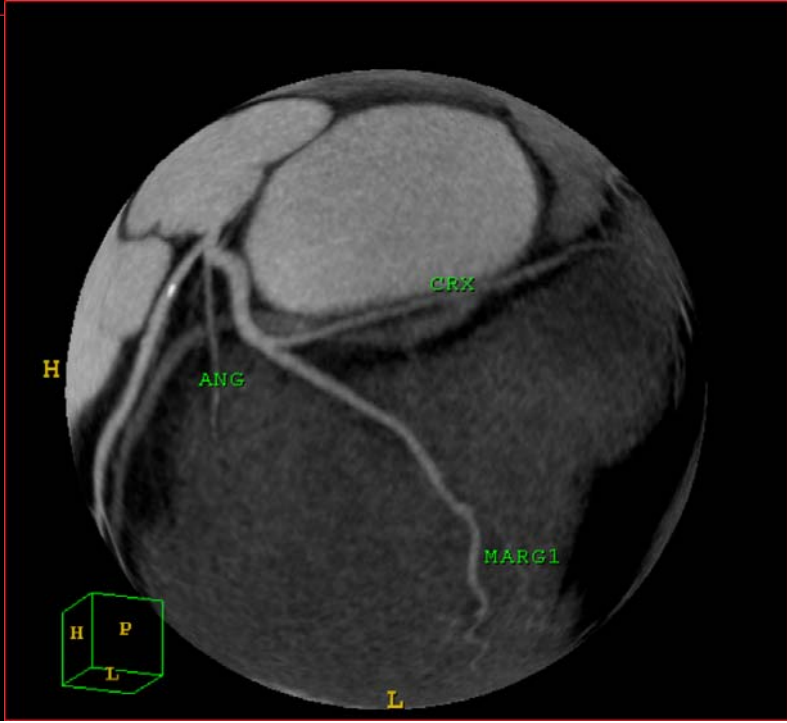
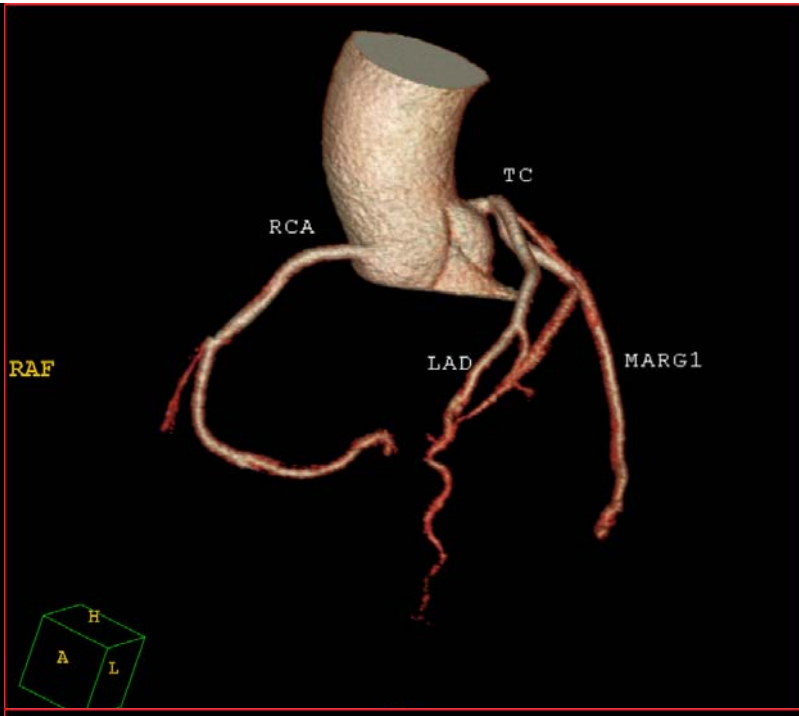
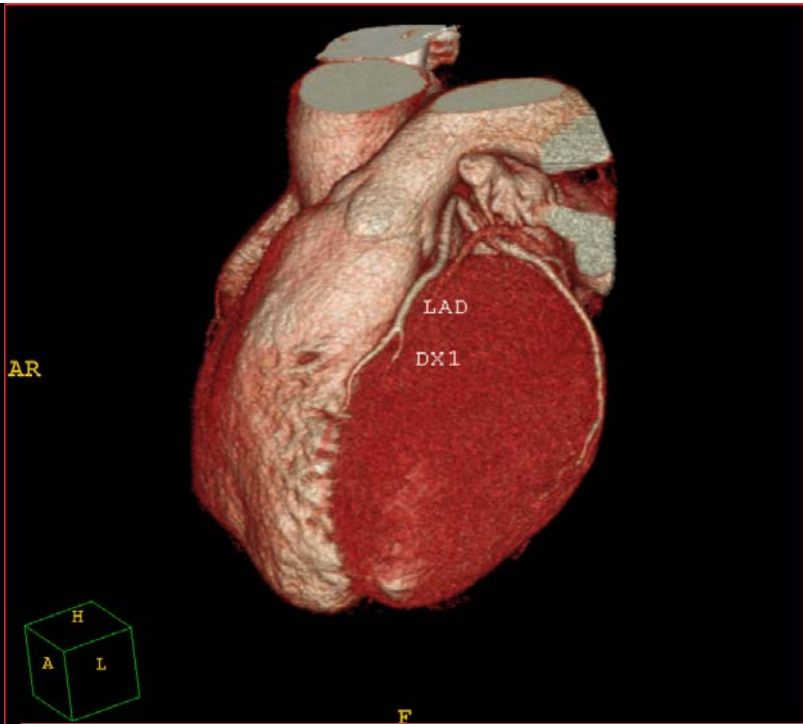


64 x 0.625mm, Standard Res., RT = 0.42sec, Pitch = 0.2, Scan Time = 7.5 sec

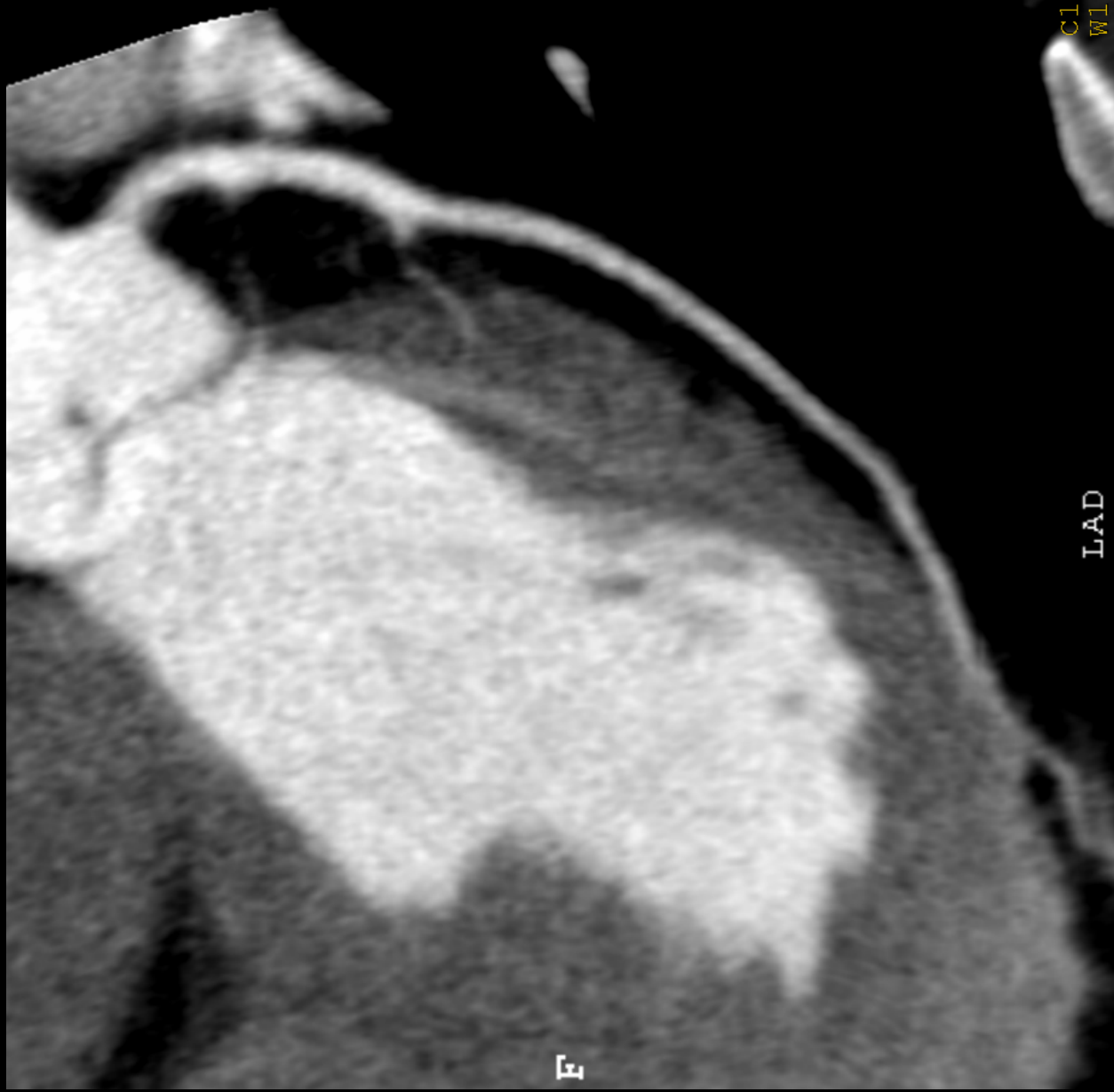
# Post-Processing

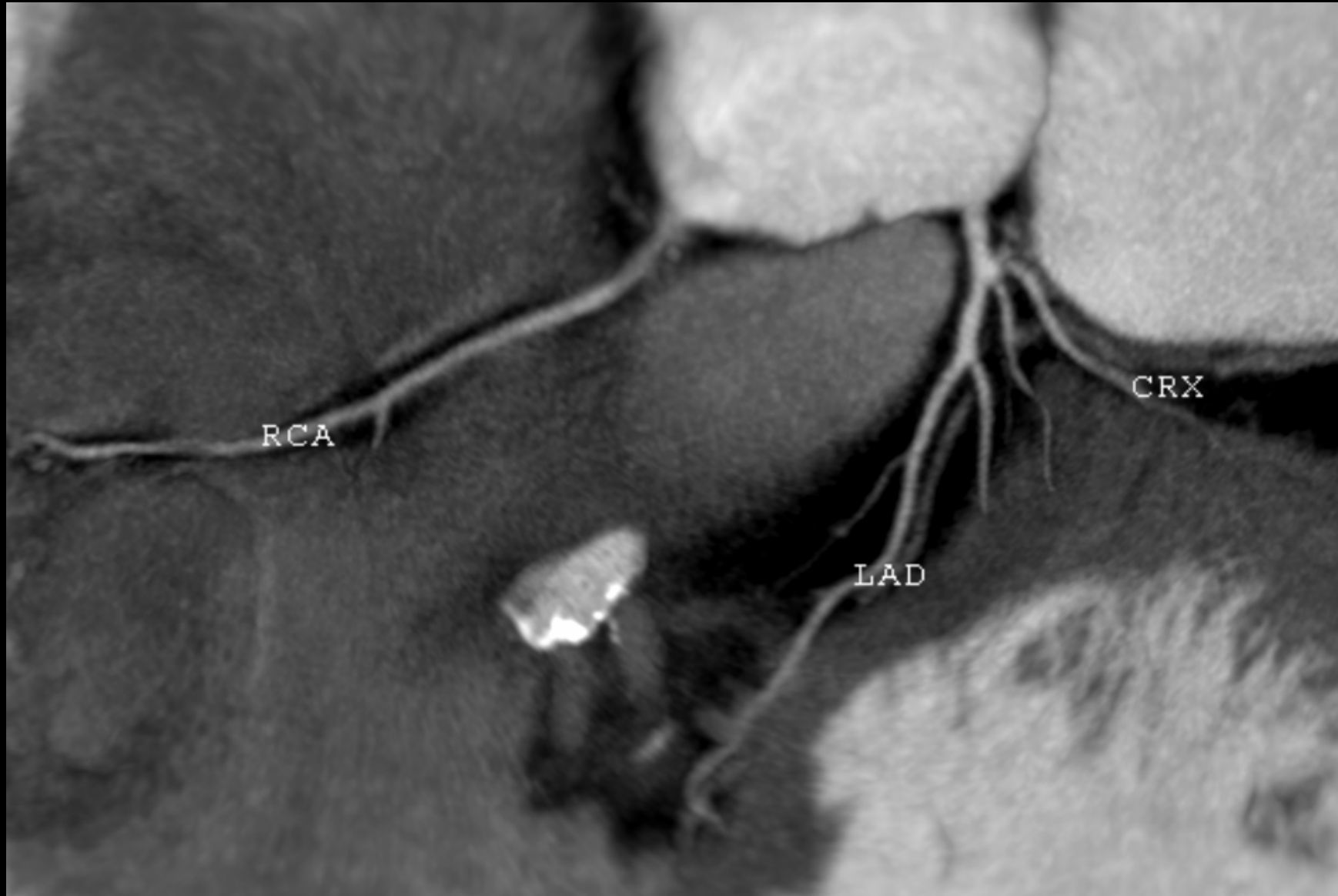


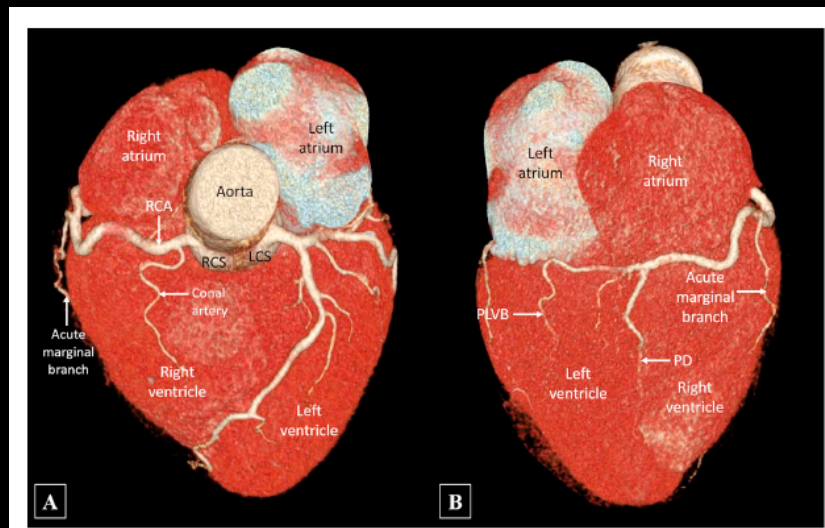
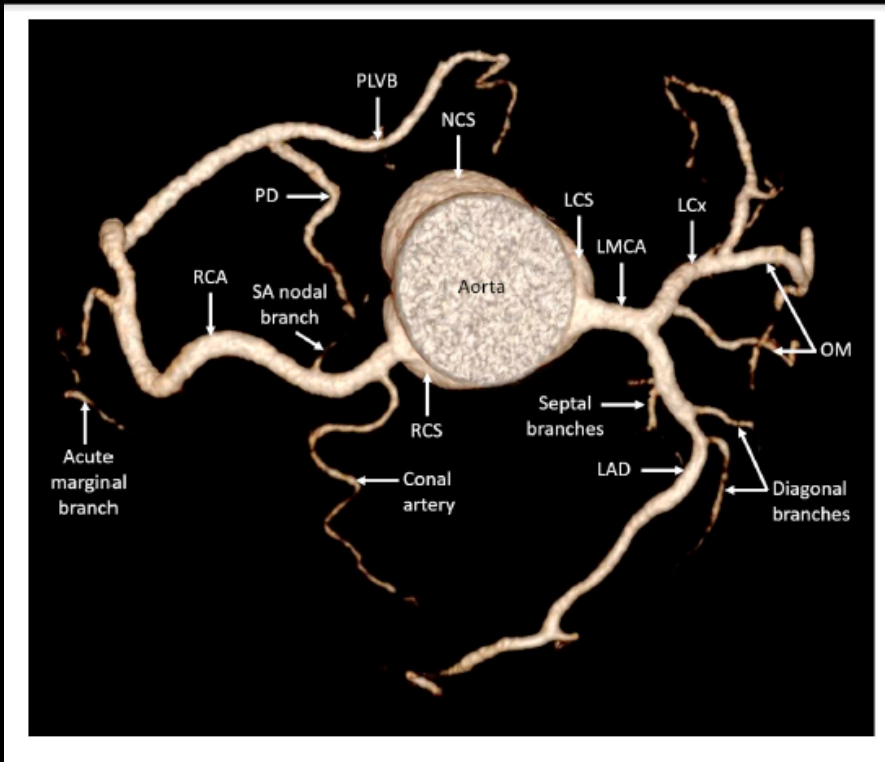
64 x 0.625mm, Standard Res., RT = 0.42sec, Pitch = 0.2, Scan Time = 7.5 sec











Comp. Cardiac

Coronaries

Hints

Visualization Tools

Vessel Tools

Vessels

CX

RCA

LAD

CX

Diag1

Define Vessel

Show Centerline

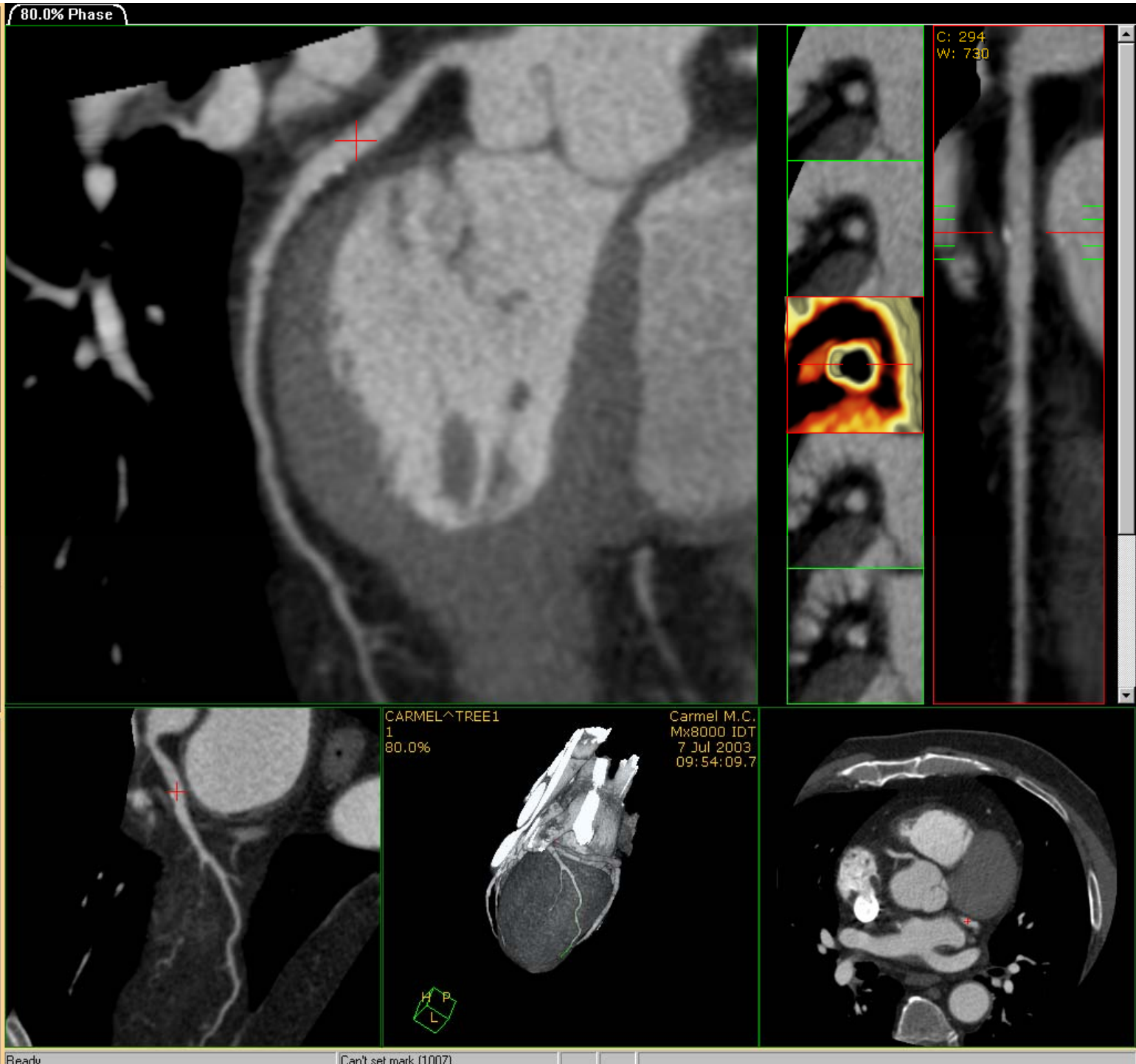
Heart Show Prot

Cardiac View MIP

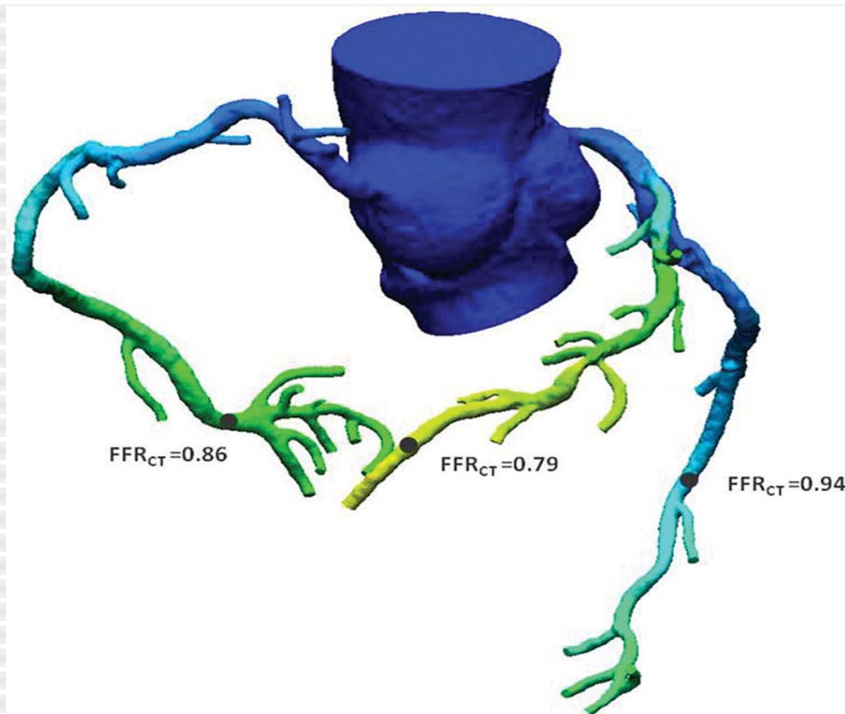
Windowing Modified

Titles Off

Exit Reset All



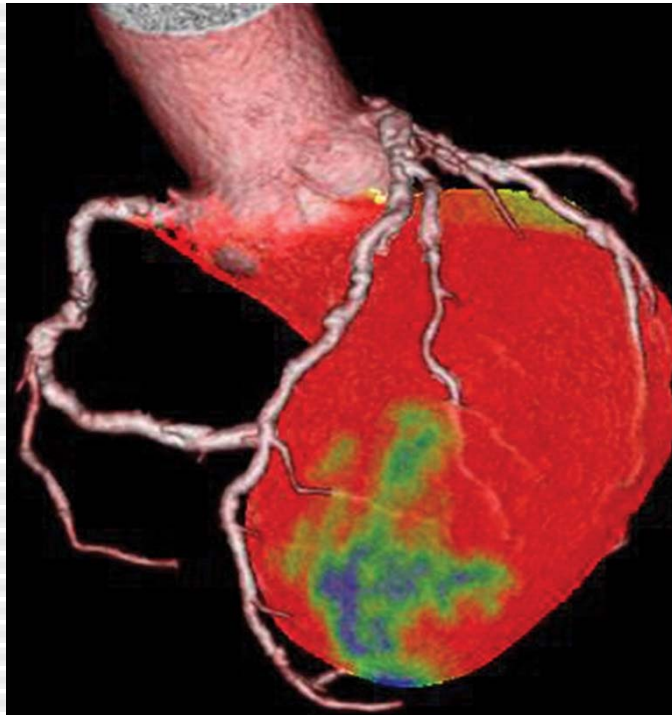
# Imagerie fonctionnelle



**RadioGraphics**  
**2015; 35:991–1010**

Example of an FFRCT fractional flow reserve derived from CT image has color contours that provide data on the distribution of FFRCT fractional flow reserve derived from CT throughout the coronary tree. Numerical FFRCT fractional flow reserve derived from CT values can be obtained at any location. (Adapted and reprinted, with permission, from reference 50.)

# Imagerie fonctionnelle



**RadioGraphics**  
**2015; 35:991–1010**

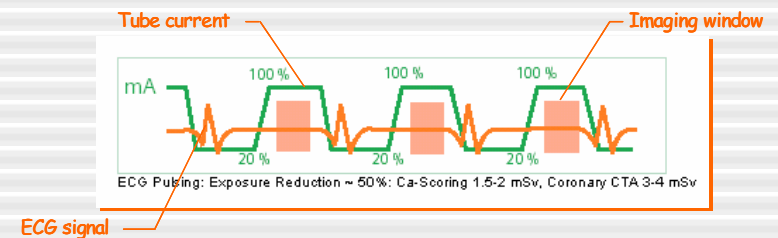
In comparison with a monochromatic short-axis myocardial perfusion image obtained at 70 keV with single-source dual-energy CT with fast tube voltage switching (**a**), material density image (**b**) and fusion of a color-coded material density image (**c**) obtained with iodine and water selected as the basis pair more clearly delineate perfusion defects in the anterior wall of the left ventricle, allowing quantitation of myocardial perfusion as iodine density in regions of interest placed in the anterior wall (yellow circle in **d**), lateral wall (green circle in **d**), and inferior wall (blue circle in **d**). Iodine density of 0.01, 1.62, and 1.56 mg/mL was measured in these three regions. (**e**) Three-dimensionally matched fusion of volume-rendered color-coded material density and coronary CT images generated from the same CT dataset is useful to easily and precisely identify the diagonal branch as a culprit vessel. (Reprinted, with permission, from reference 45.)

# Injection intraveineuse de produit de contraste

- Voie intraveineuse
  - Veine antécubitale
  - Contraste 350-400 mg I/mL
  - Débit: 4-5 mL/sec
  - ROI: Ao descendante
- Injecteur Double chambre
  - Diminution du produit de contraste injecté
  - Diminution artéfacts VCS (streak artefacts)

# Recommandations pratiques

- Prise de  $\beta$  bloquants (exception dual source?)
  - 1/2 co tenormin la veille de l'examen
  - 1/2 co le matin de l'examen
  - Obtenir un rythme cardiaque régulier  $\pm$  70/min
- Mise en place d'électrodes
  - Éviter les artefacts dans région d'intérêt
- Examen irradiant: indications à discuter
  - Modulation de dose en fct ECG
  - Appliquer si rythme  $<70$ /min





## Irradiation MDCT

- $6.4 \pm 1.9$  mSv: 16-slice CT
- $11 \pm 4.1$  mSv: 64-slice CT
- Dose modulation:
  - 37-40%
- Dose modulation+diminution kV
  - 53-64%
- Dose coronarographie:
  - 2.1-2.5mSv

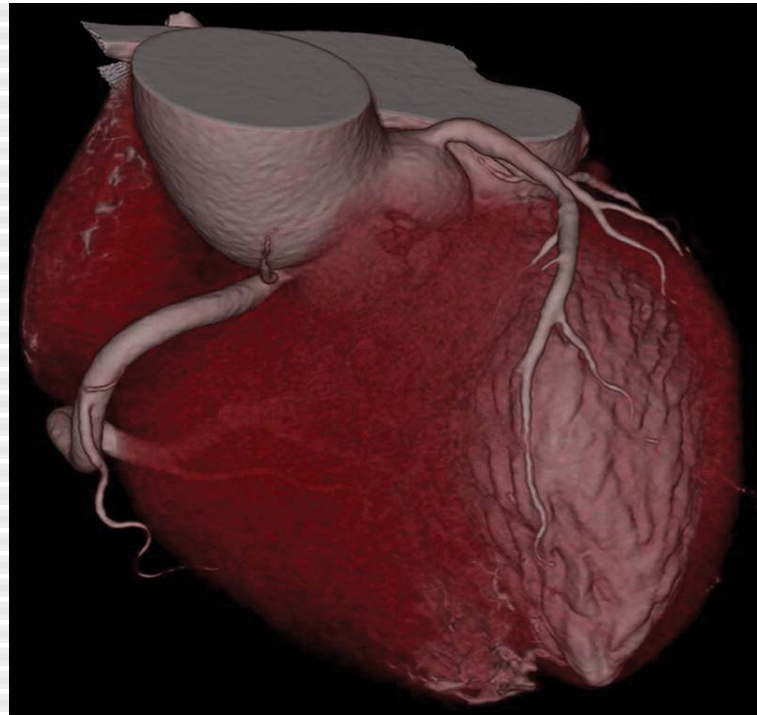
Hausleiter et al. Circulation Online Mars 2006

Hunold et al. Radiology 2003;226:145-152

## Effective Radiation Dosage, Measured in MilliSieverts (mSv)<sup>3,4</sup>

Average Background Dose – U.S. . . . . .	3.6 mSv/year
Three-Hour Commercial Airline Flight . . . . .	0.015 mSv
Pa & Lateral Chest X-Ray . . . . .	0.05 mSv
Head CT Examination . . . . .	1-2 mSv
Chest CT . . . . .	5-7 mSv
Abdomen & Pelvis CT . . . . .	6-8 mSv
Selective Diagnostic Coronary Angiography . . . . .	3-6 mSv
Diagnostic Coronary Angiography with Intervention . . .	6-30 mSv
Nuclear Medicine Stress Test	
SPECT Thallium . . . . .	25.3 mSv
SPECT Sestamibi . . . . .	12.2 mSv
Coronary CT Angiography	
Retrospective CCTA . . . . .	13 mSv
Retrospective EKG-Modulated CCTA . . . . .	8-9 mSv
Prospective “Step-and-Shoot” CCTA . . . . .	2-3 mSv

# Imagerie à moins de 1 mSv



**RadioGraphics 2015; 35:991–1010**

Low-dose coronary CT (effective dose, 0.97 mSv) performed with a high-pitch dual-source helical scan with 100-kVp tube voltage offers excellent image quality on a volume-rendered CT image **(a)** and on curved multiplanar reformatted CT images of the left coronary artery **(b)** and right coronary artery **(c)**. (Images courtesy of Nobuo Iguchi, MD, PhD, Department of Cardiology, Sakakibara Heart Institute, Tokyo, Japan.)

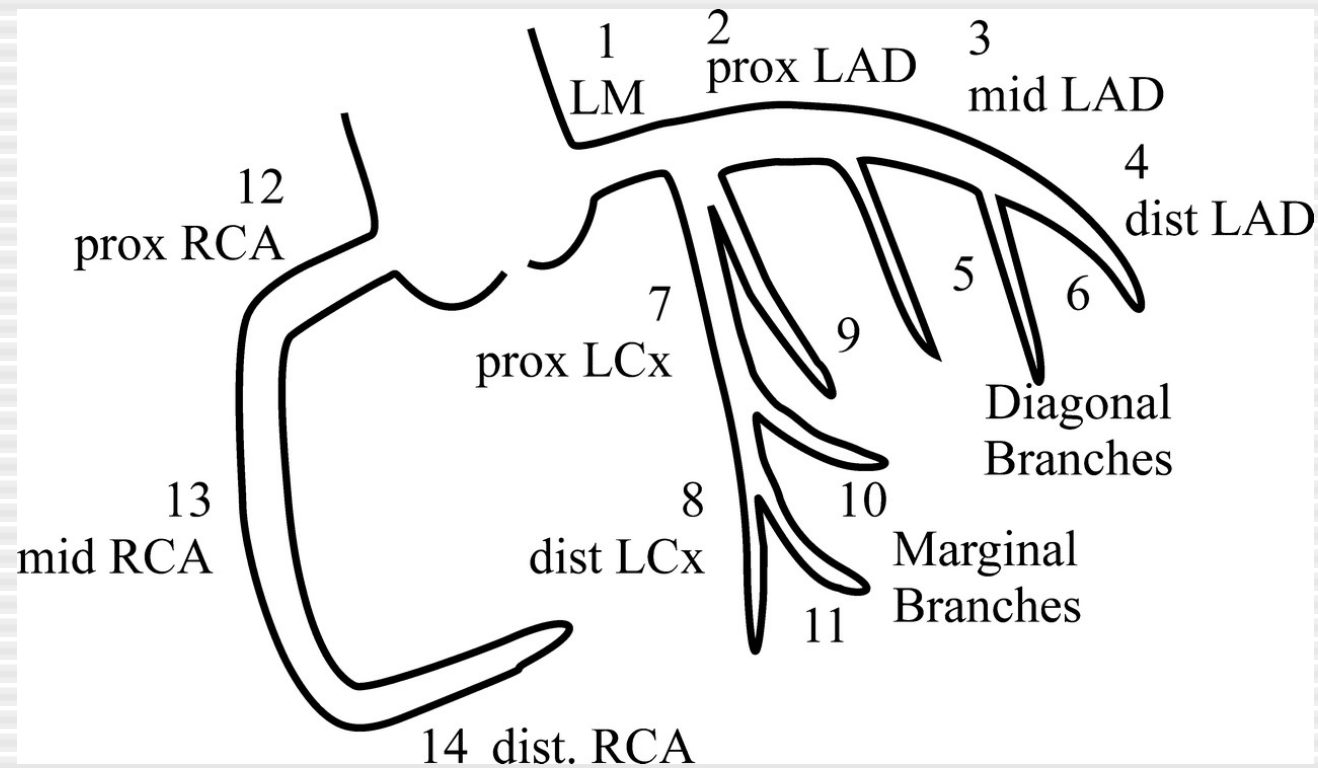
# Performances diagnostiques du CT coronaire

Authors	N Pts	Sensitivity %	Specificity %	PPV %	NPV %	segments not seen %
Nieman Lancet.2001; 357	35	77	97	81	97	27
Achenbach Circulation.2001 ; 103	64	85	76	59	98	32
Gerber Invest Radio.2003; 38	25	82	96	73	97	30
Knez Am J Cardiol.2001; 88	44	78	98	85	96	6
Kopp Eur Heart J.2002 ; 23	102	93	97	81	99	0-30
Giesler AJR.2002 ; 179	100	91	89	66	98	29
Nieman Circulation.2002 ; 106	59	95	86	80	97	-
Ropers Circulation.2003 ; 107	77	92	93	79	97	-
Dewey Invest Radio.2004; 39	34	88	91	88	95	-

Leschka (64-slice CT)	67	94	97	87	99	0
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Eur heart Journal 2005

# Evaluation des artères coronaires

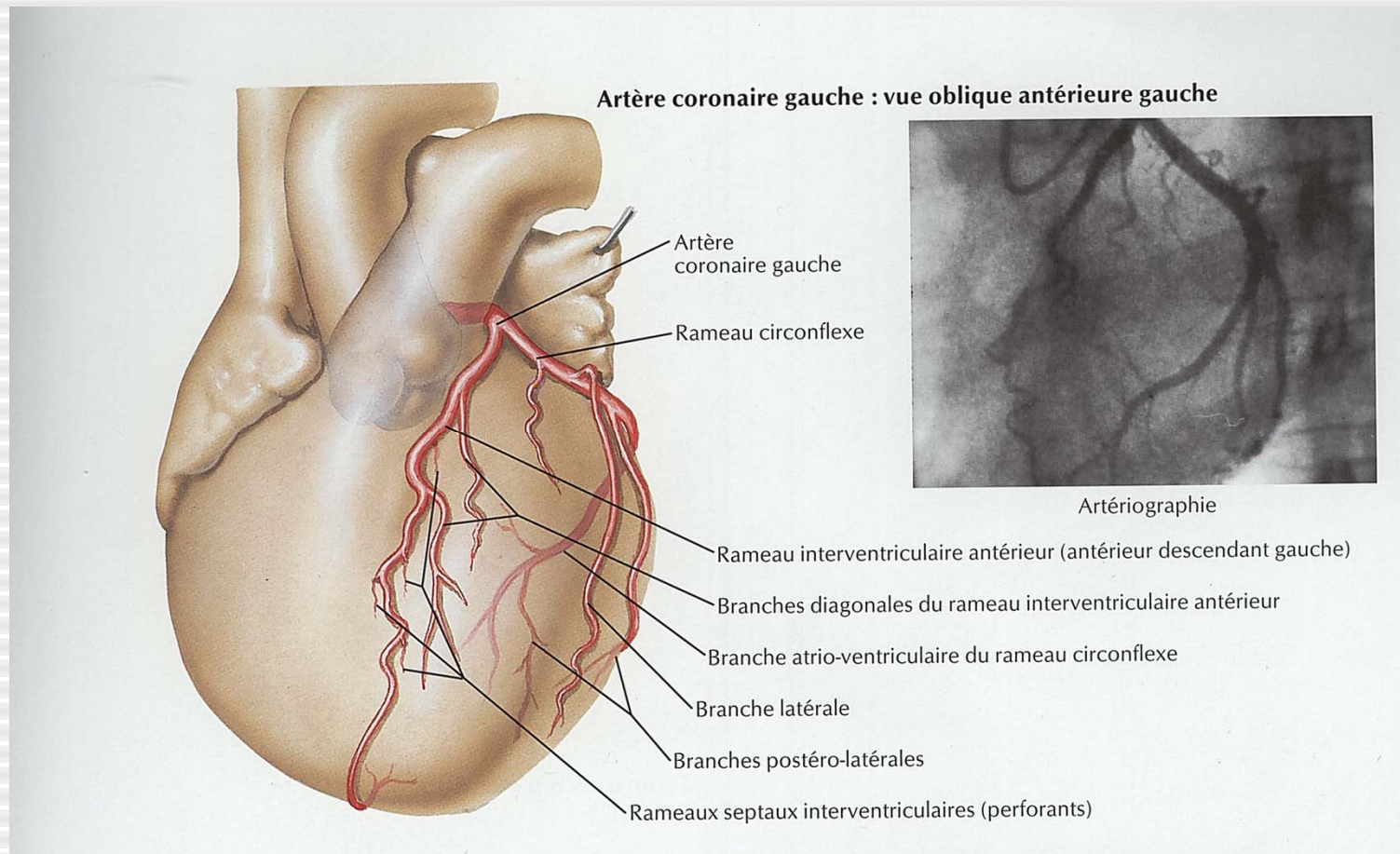


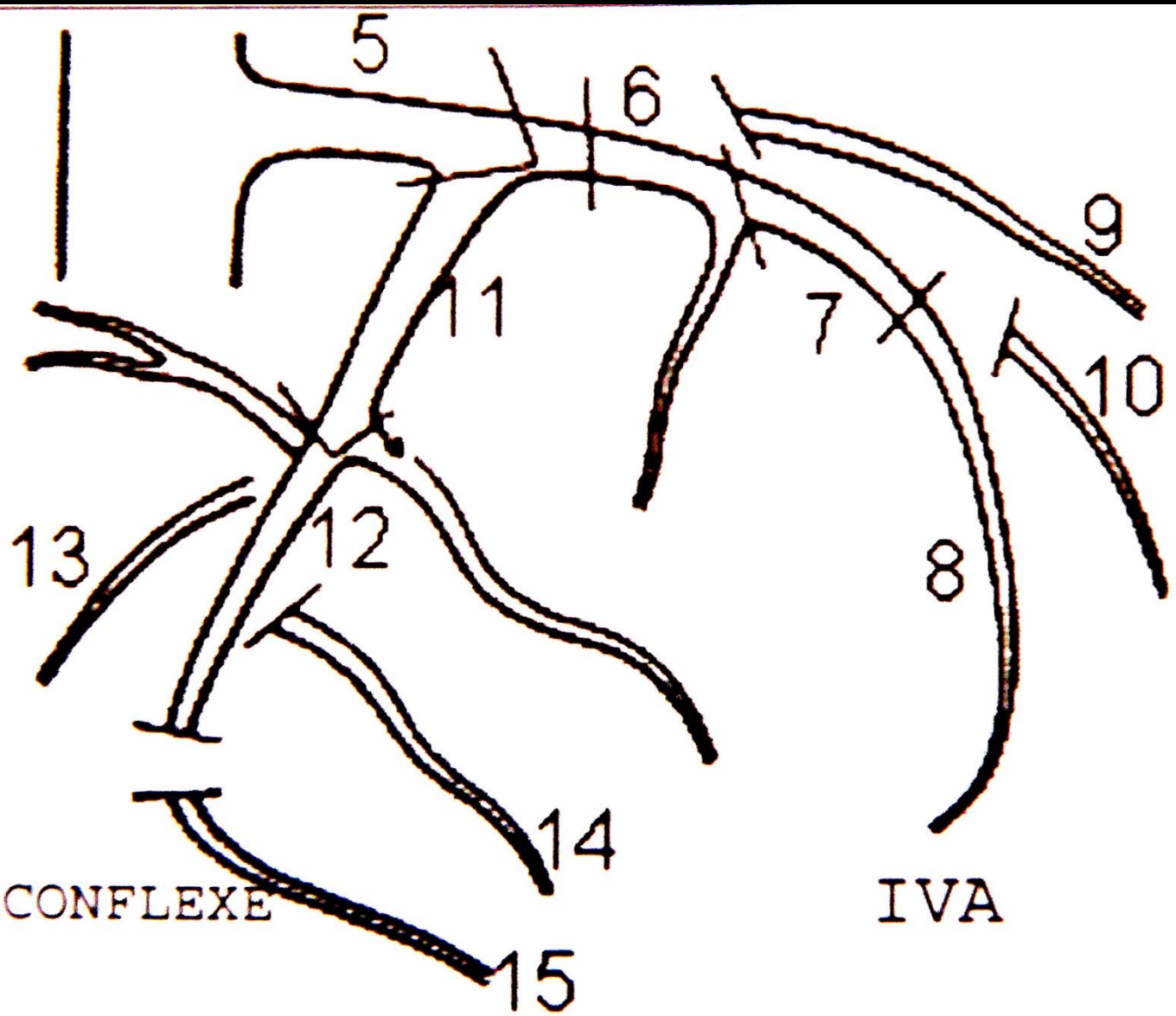
Interprétation conjointe radiologue-cardiologue

Bien analyser les anomalies extra-cardiaques!!

Anatomie des artères coronaires :  
normale et introduction aux variantes

# Anatomie des artères coronaires





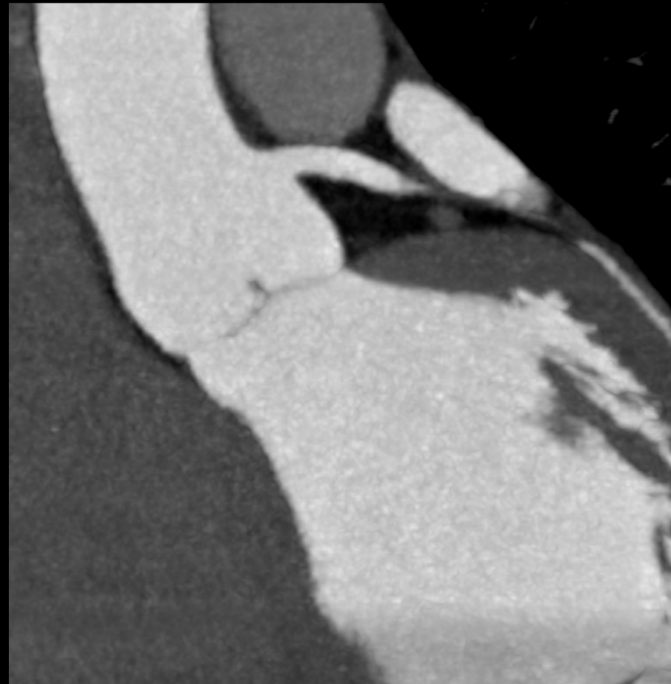
A CIRCONFLEXE

IVA



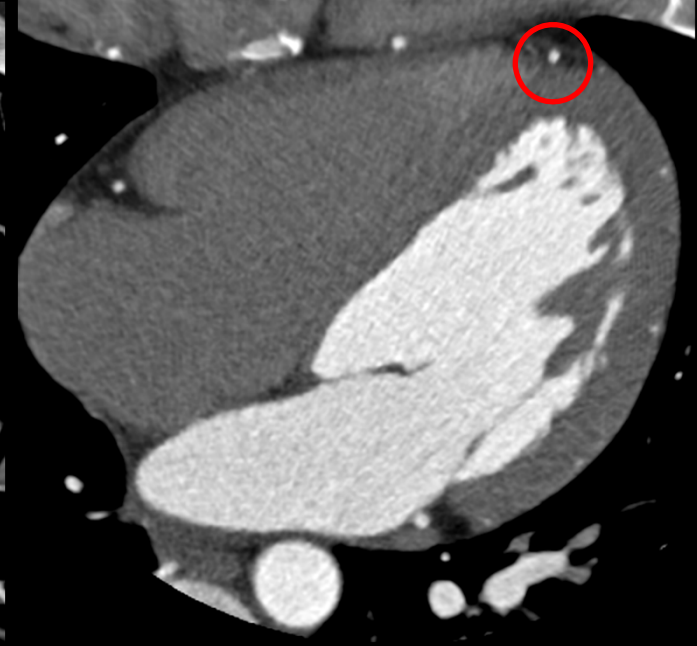
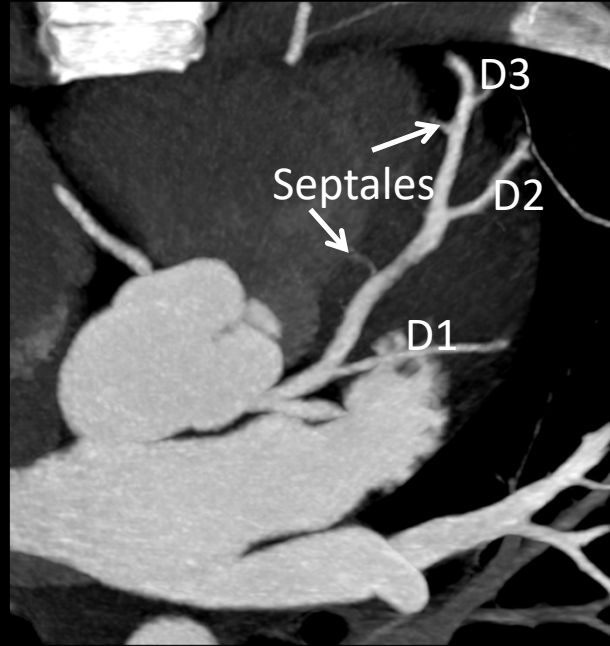
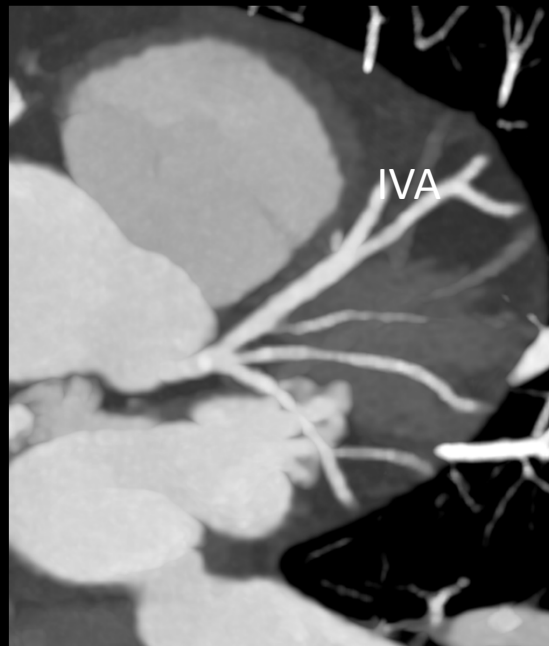
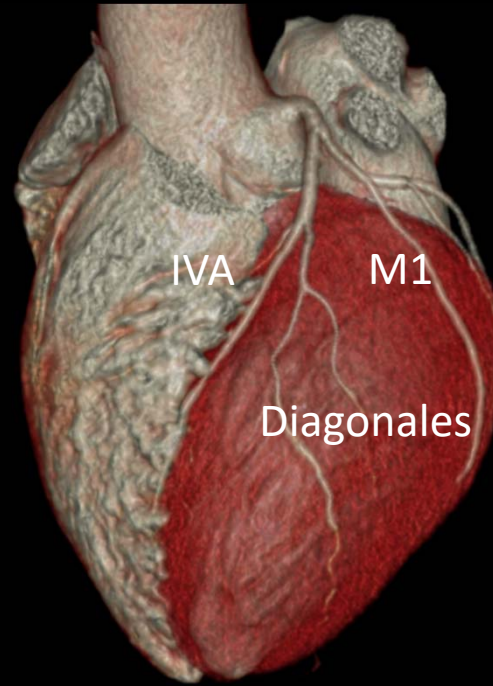
## Tronc commun

- naissance du sinus coronaire G
- longueur variable
- division en artères interventriculaire antérieure et circonflexe



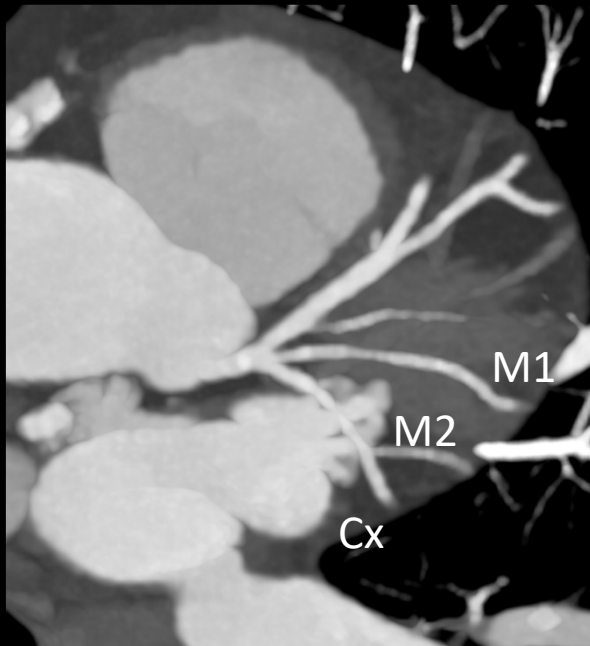
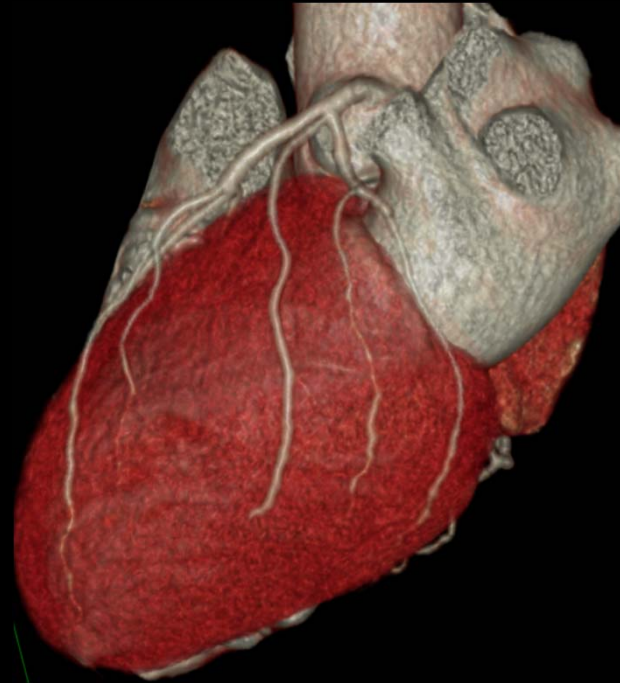
# Artère interventriculaire antérieure

- naissance du tronc commun
- sillon interventriculaire antérieur
- branches septales
- 1 à 3 branches diagonales :
  - paroi antérieure du VG
  - paroi latérale du VG



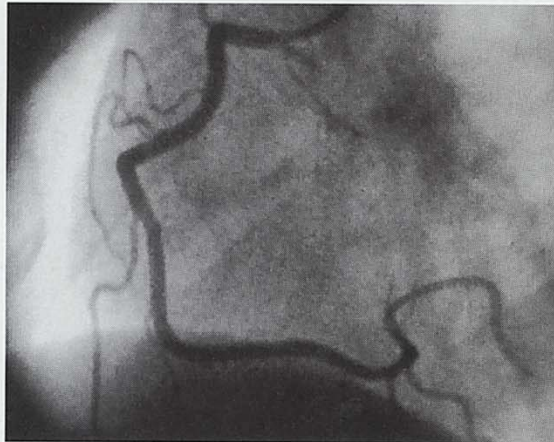
## Artère circonflexe

- naissance du tronc commun
- sillon AV gauche
- 1 à 2 marginales : paroi latérale du VG
- (RVG/IVP : selon dominance)

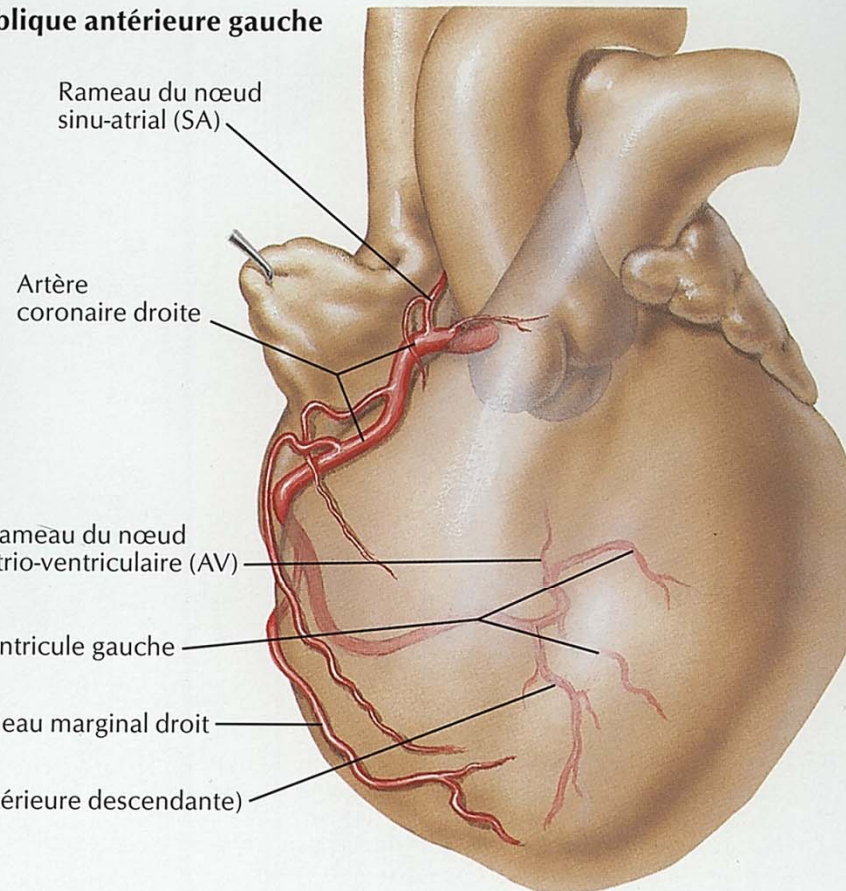


# Anatomie des artères coronaires

Artère coronaire droite : vue oblique antérieure gauche



Artériographie



Rameau du nœud  
sinu-atrial (SA)

Artère  
coronaire droite

Rameau du nœud  
atrio-ventriculaire (AV)

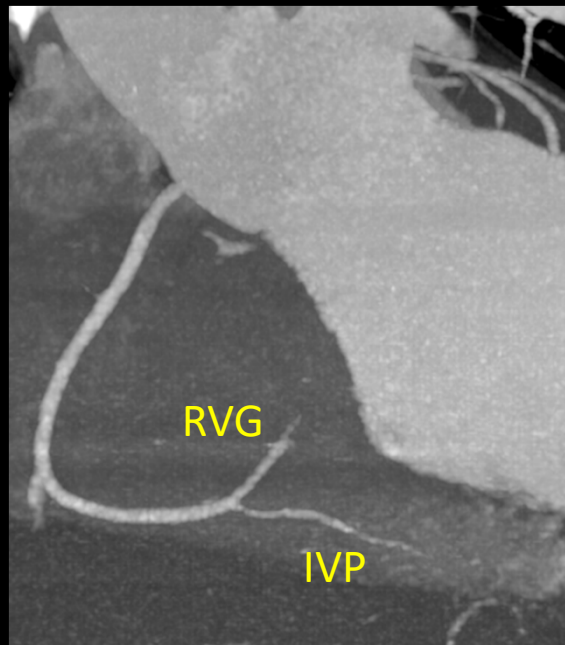
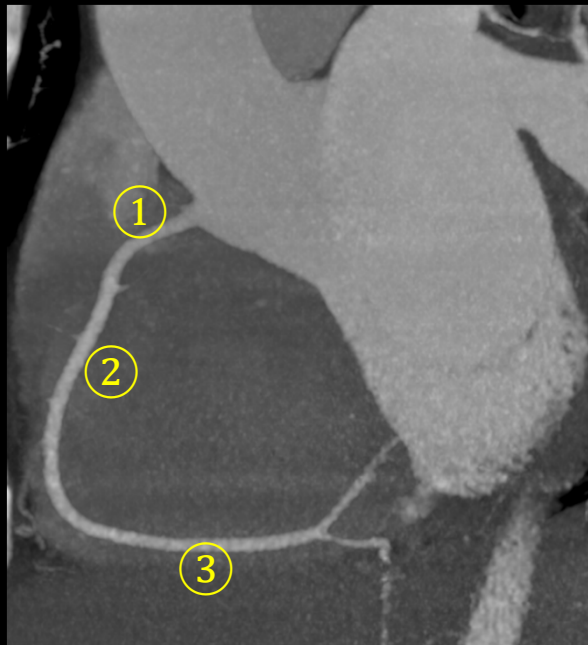
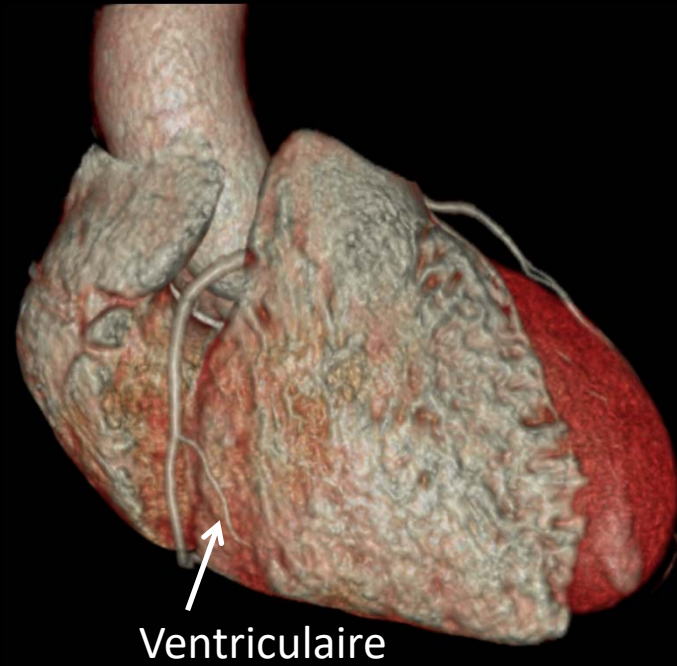
Rameaux de la face dorsale du ventricule gauche

Rameau marginal droit

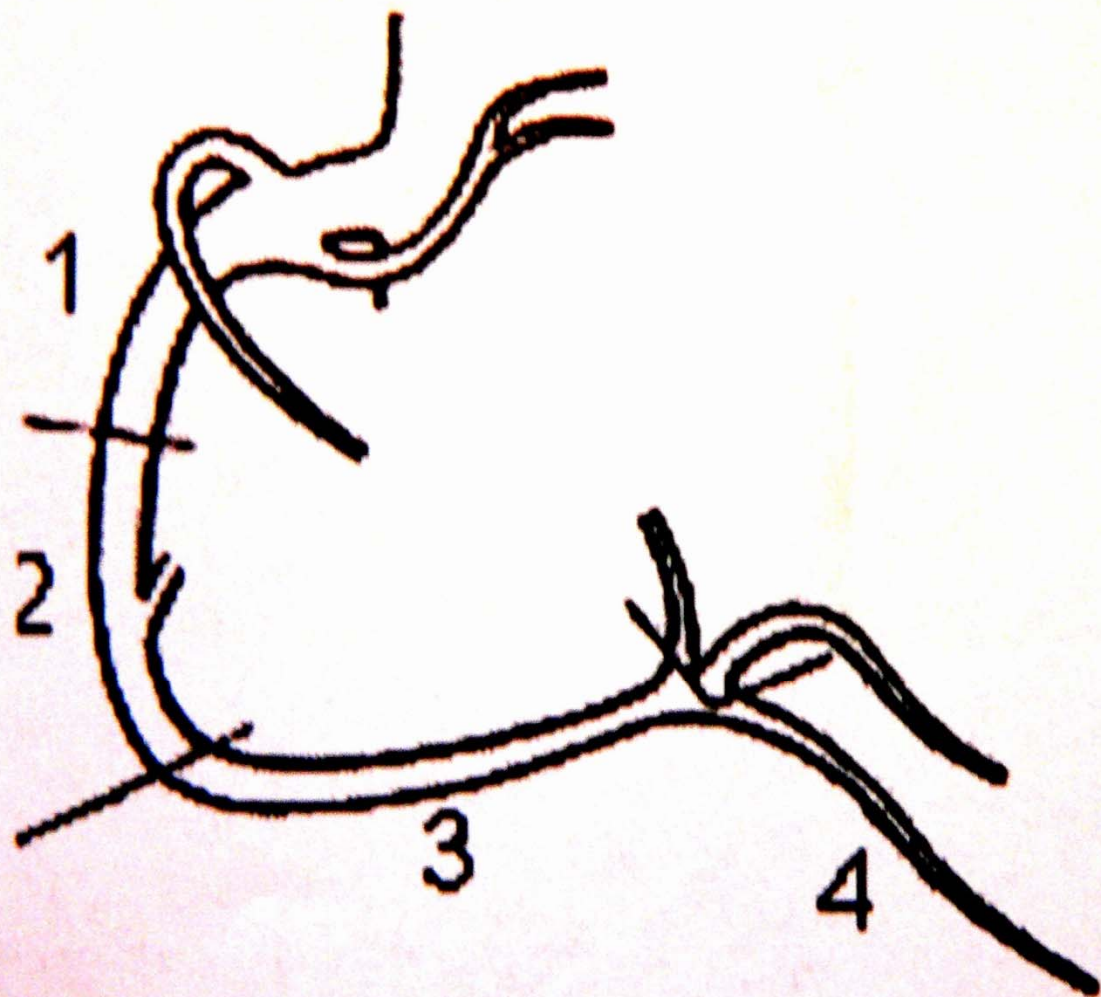
Rameau interventriculaire postérieur (artère postérieure descendante)

## Artère coronaire D

- naissance du sinus coronaire droit
- sillon AV droit
- 3 segments : horizontal – vertical – horizontal
- 1 branche ventriculaire (« marginale D »)
- fin : IVP – RVG (selon dominance)



A coronaire D





# Variantes

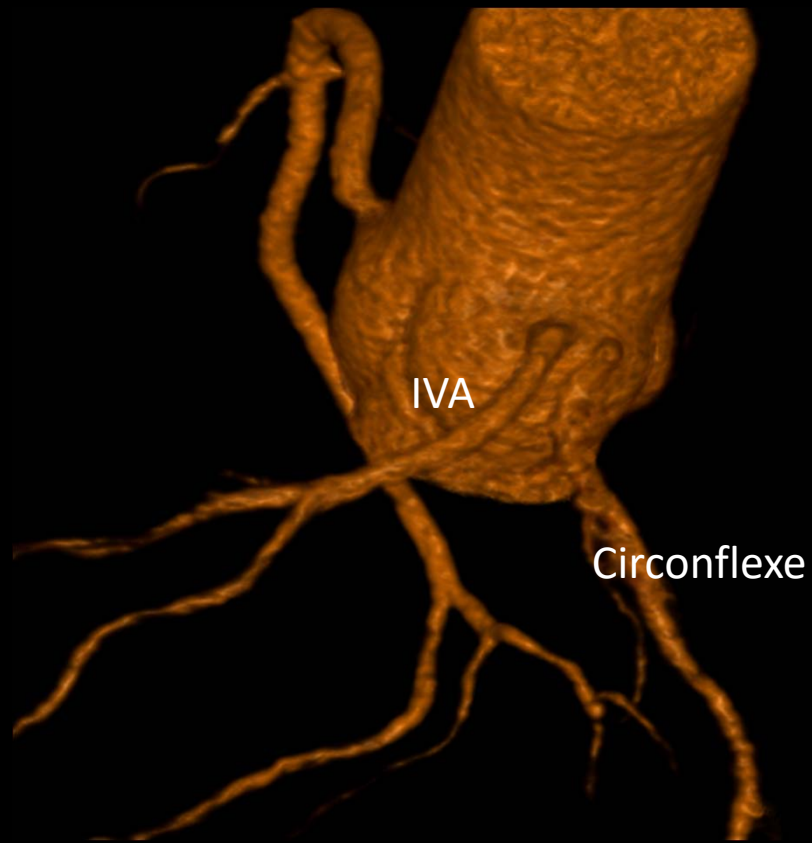
- variantes simples : naissance ostium séparés (absence de tronc commun, artère du conus), ostium en position haute
- variantes avec anomalies de trajet : nombre ostia séparés depuis aorte  $\geq 2$  mais naissance en position anatomique anormale et trajet aberrant pour rejoindre sa position anatomique classique
  - ❑ trajet non malin
  - ❑ trajet malin
- coronaire unique : 1 seul ostium pour toutes la vascularisation coronaire, souvent anomalie de trajet associé. Classification complexe de Lipton (1)
- le scanner cardiaque est l'examen de référence pour détecter et caractériser ces anomalies, supérieur à la coronographie (2)

(1) Lipton MJ. *Radiology*, 1979.

(2) Schmitt R. *Eur Radiol*, 2005.



## Variantes « simples »



Absence de tronc commun

Naissance en « canon de fusil »

Pas de répercussion physiopathologique

Importance pour le cathétérisme

# Anomalies de trajet

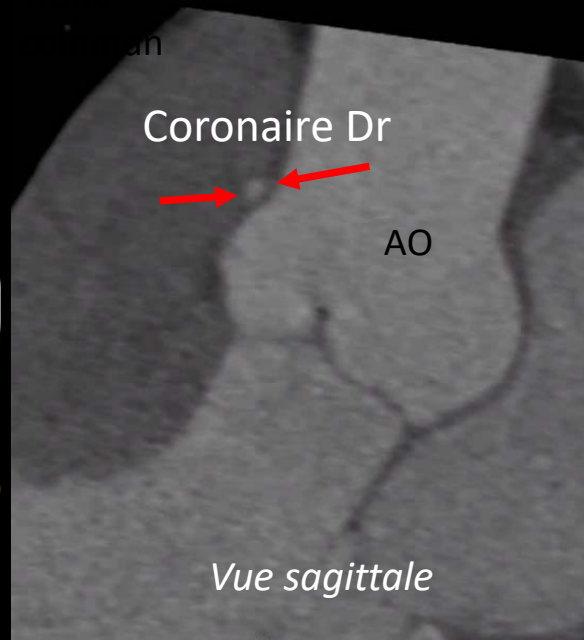
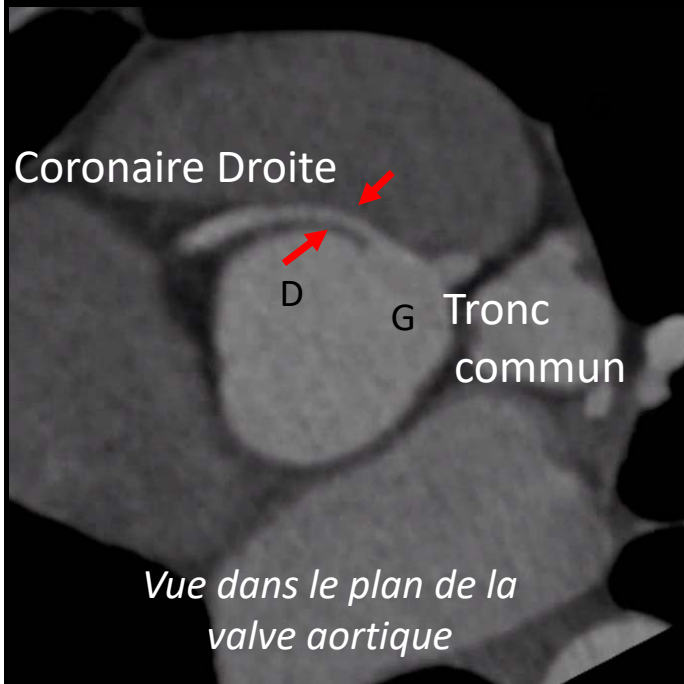
*Homme de 42 ans. Syncope à l'effort avec douleur thoracique  
ECG et biologie d'entrée : examens normaux  
CT-scan coronaire demandé.*

Absence d'athéromatose.

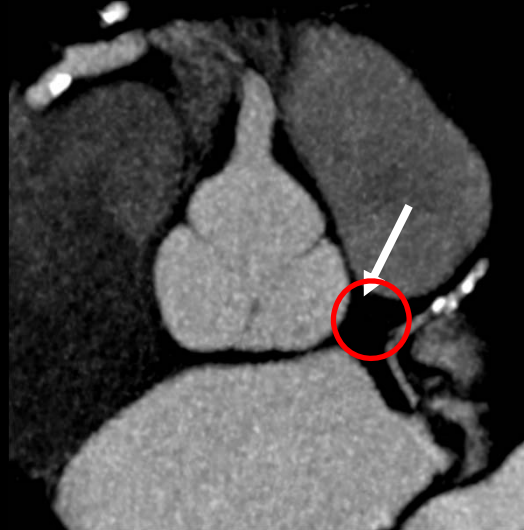
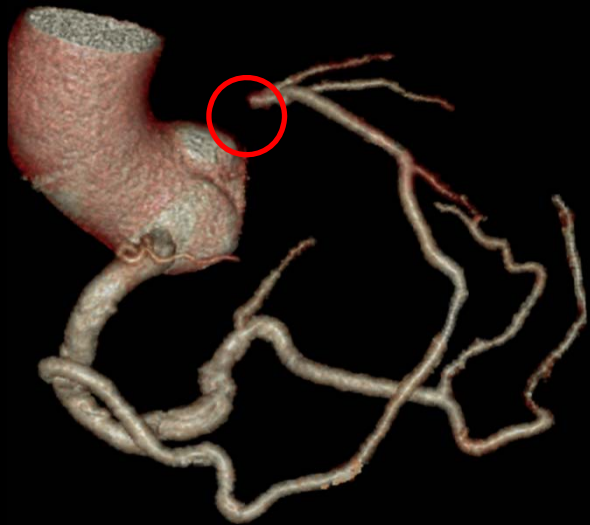
Anomalie d'origine de la coronaire droite, depuis le sinus coronaire G

Trajet interartériel (entre racine aortique et TAP), compression à son origine

Risque de compression, surtout lors de l'effort (↑ Débit cardiaque, ↑ diamètre gros Vx)



# Coronaires uniques



*Absence de tronc commun  
Absence d'artère naissance du sinus gauche*

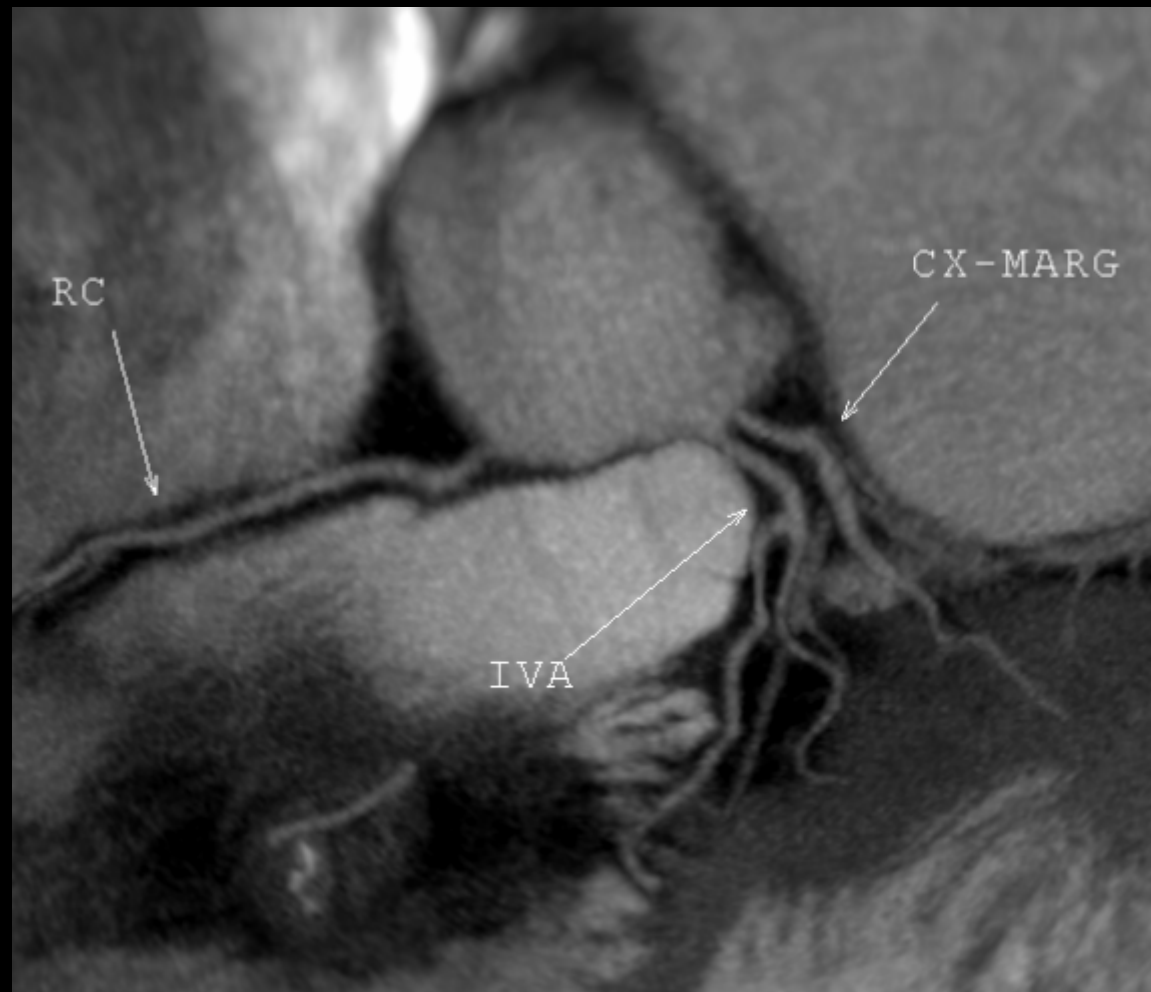
1 seule artère naissant de l'aorte

Exemple ci-dessus. Coronaire droite unique. Artère interventriculaire naissant d'une branche ventriculaire droite, injection à contre-courant.

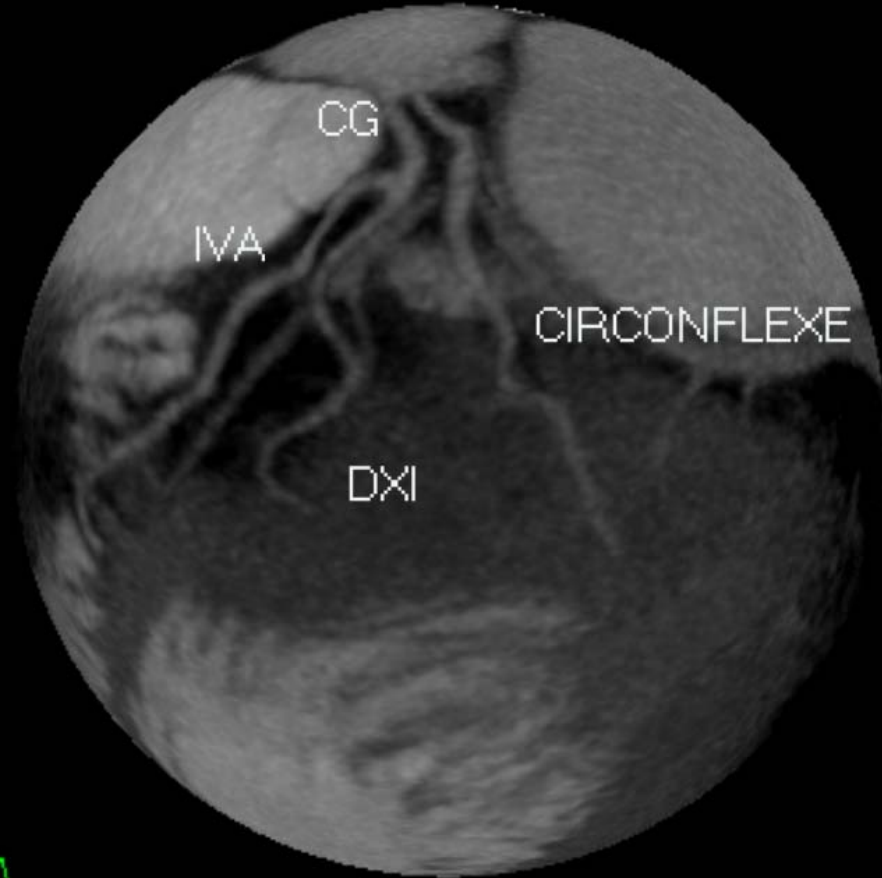
Risque : territoire d'infarctus plus étendu en cas de sténose « proximale »

# Radioanatomie coronaire

- Nombre
  - ...ou bien une seule artère pour tout le cœur...
  - absence gauche ou droite



**A**



CG

IVA

CIRCONFLEXE

DXI



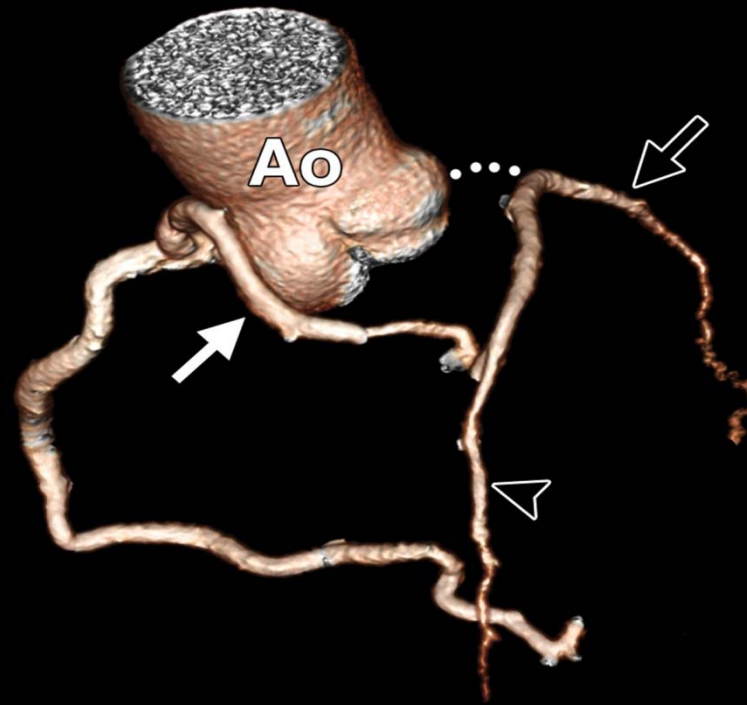
H

L

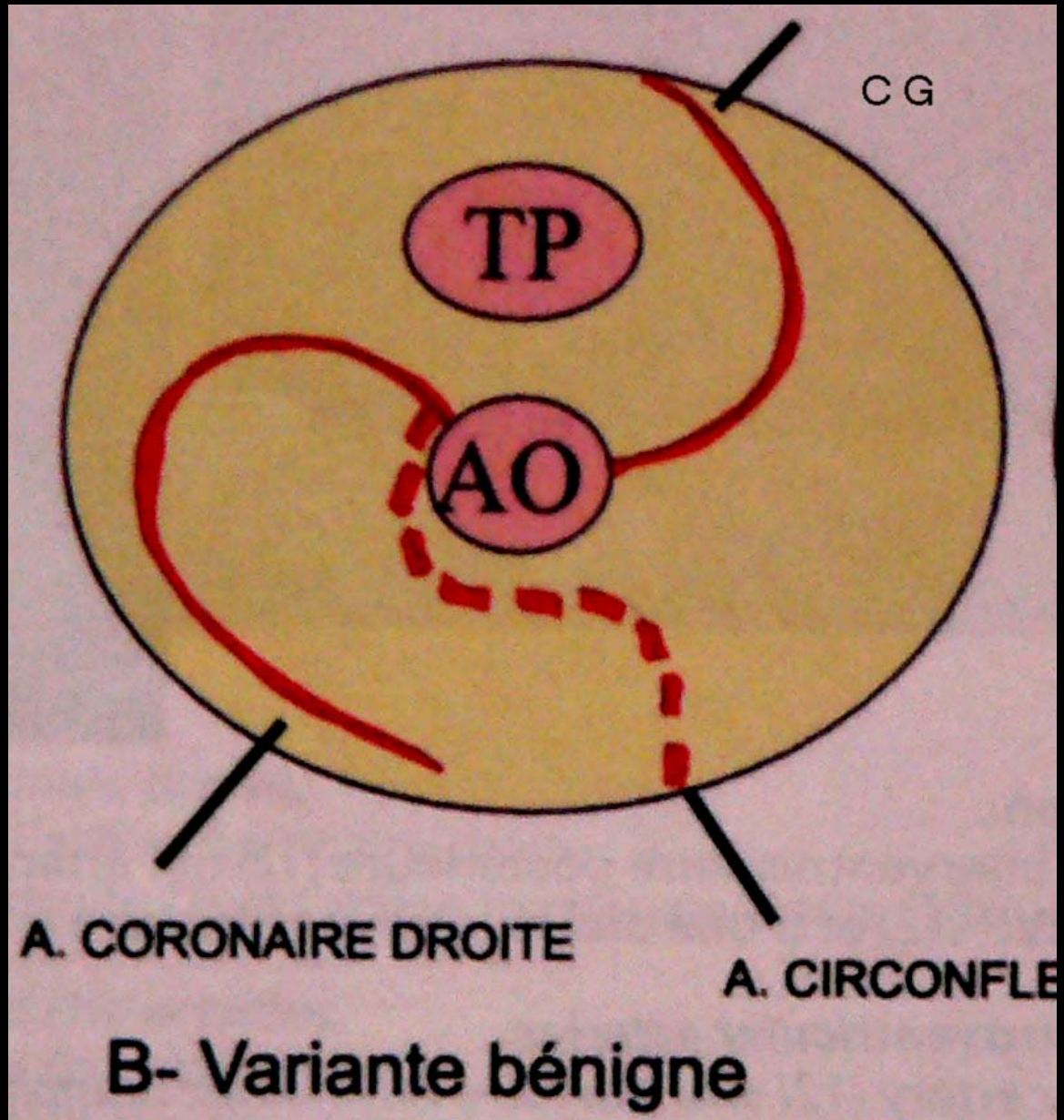
P

**FL**

# Atrésie LMA



Atresia of the LMCA in a 47-year-old woman with exertional chest pain and positive results on a stress test. The patient presented with LMCA atresia in adulthood. Volume-rendered image shows a large conus artery (solid arrow) collateral to the LAD artery (arrowhead). The LAD artery and LCX artery (open arrow) are diminutive overall. Ao = aorta, dotted line = expected region of the LMCA.



A. CORONAIRE DROITE

A. CIRCONFLEXE

B- Variante bénigne



# Radioanatomie coronaire

- Ectopie

- origine postérieure au sinus Valsalva

- de CD ou du TC gauche

# Radioanatomie coronaire

- Dominance
- Variation anatomique bénigne
- Variation anatomique léthale

# Radioanatomie coronaire

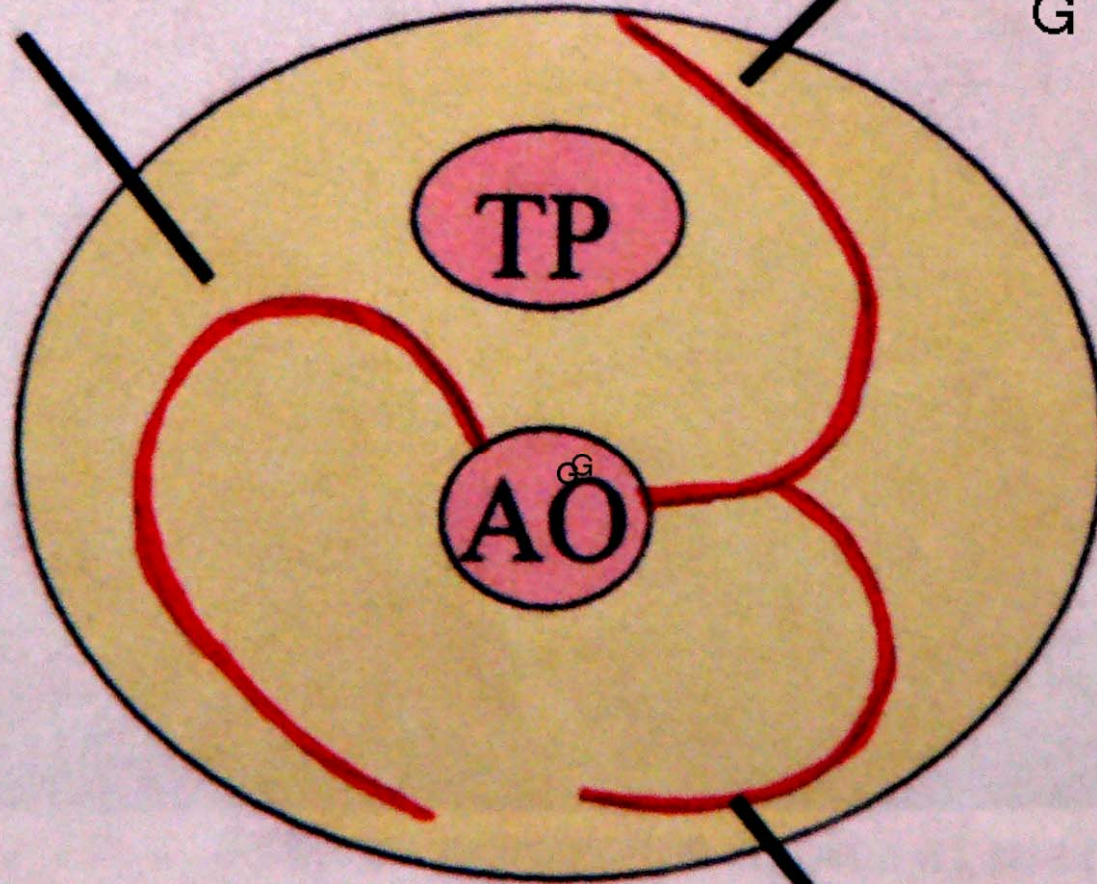
- Naissance croisé CD ou CG au niveau du sinus de Valsalva OPPOSE
- CD CROISE = LETHALE A

L'EFFORT

A. CORONAIRE DROITE

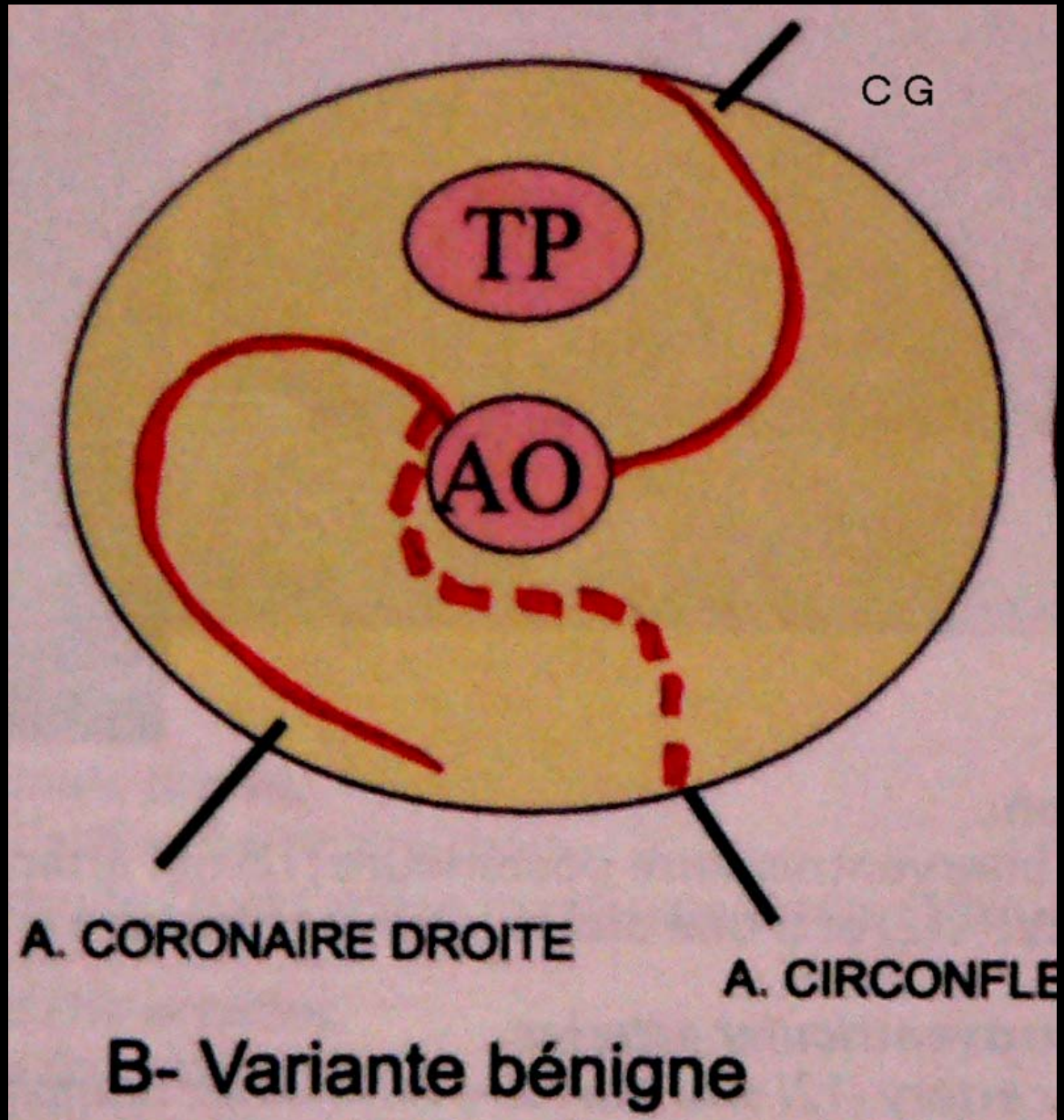
A. CORONAIRE G

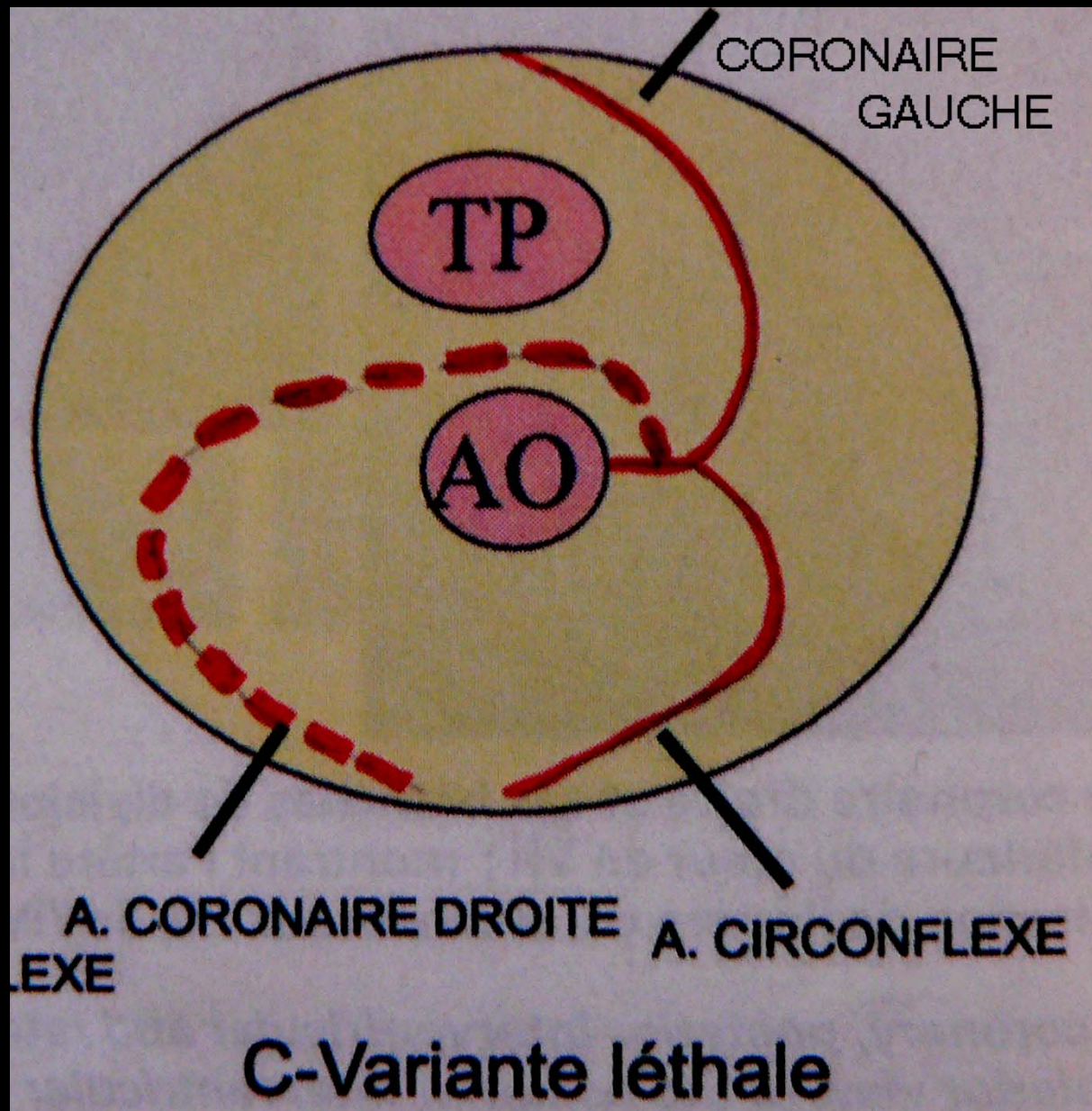
G

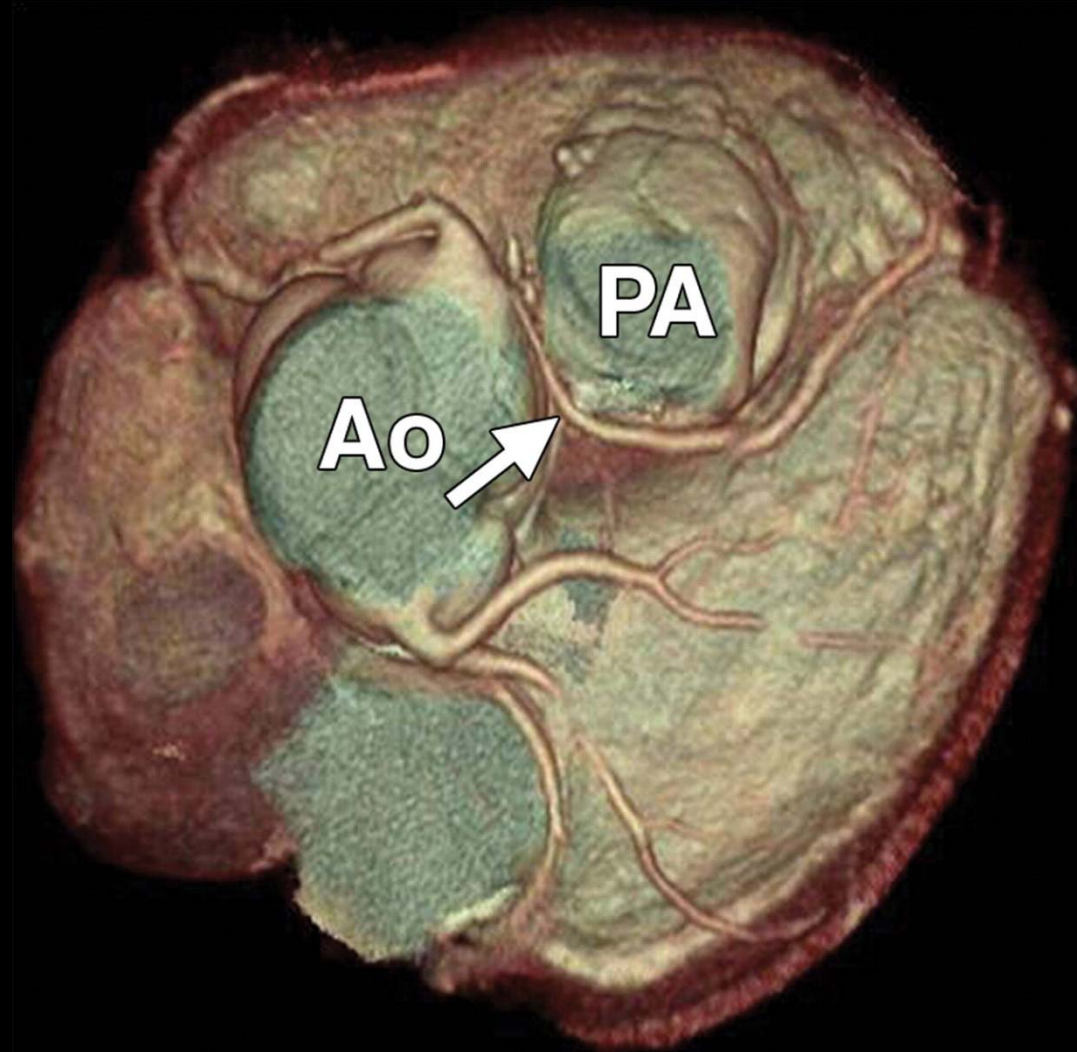


A. CIRCONFLEXE

A. C







RadioGraphics 2012; 32:453–468



**Clinical Imaging 2019; 87-98**



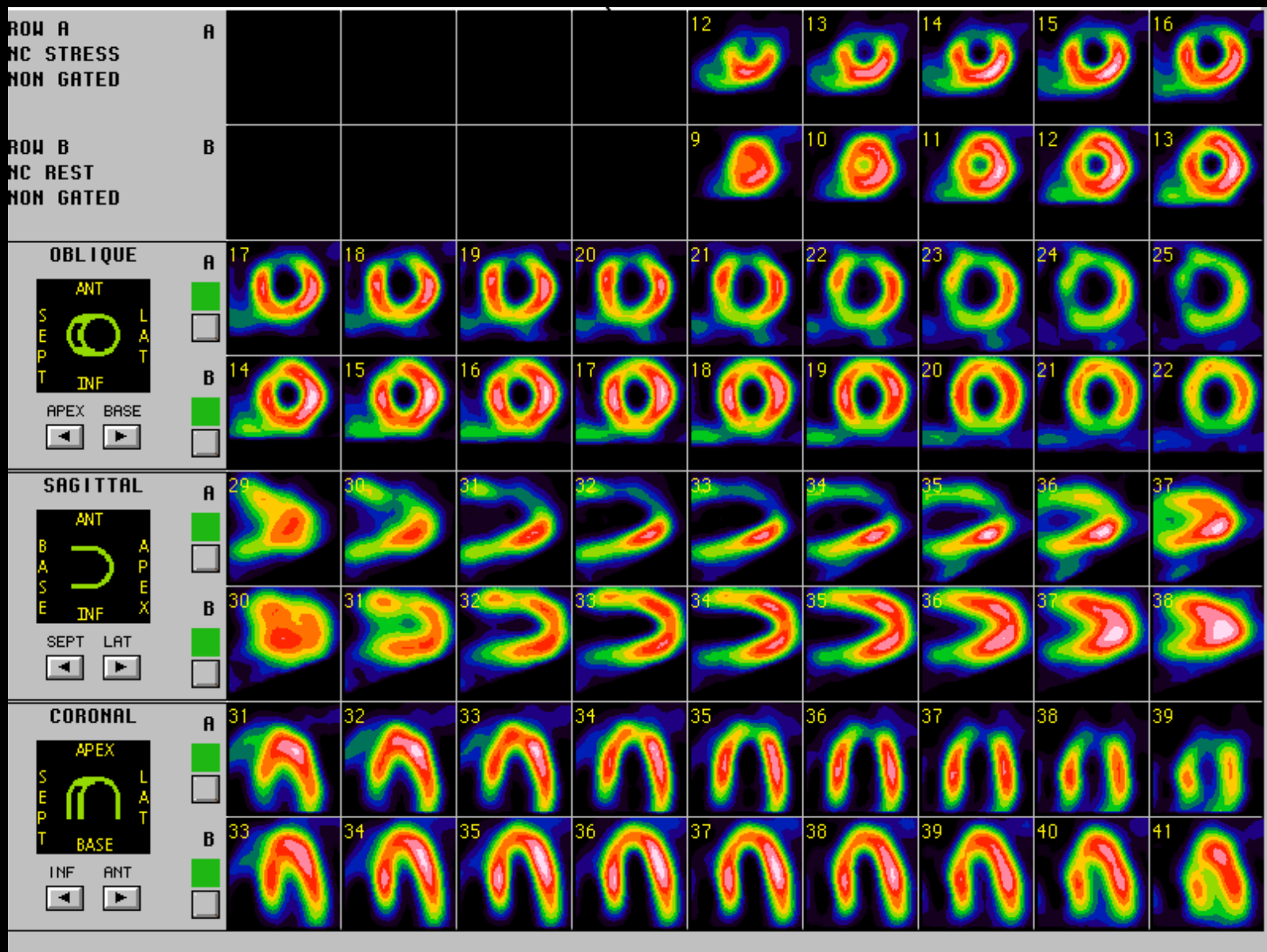
## Cas clinique

Homme de 38 ans

Douleurs précordiales à l'effort

Scinti + coronarographie

# Tc 99 m-Sestamibi SPECT



Courtesy of Clinique Ste Thérèse-Luxemburg

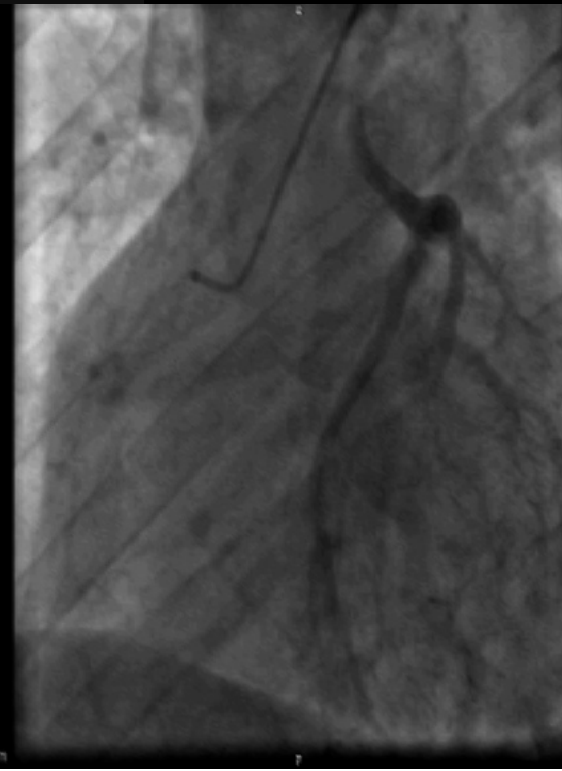
Image size: 512 x 512  
View size: 1138 x 678  
X: 0 px, Y: 0 px, Value: 0  
WL: 56, WW: 124



CART 1004  
1  
Coro LU

Fr: 55/83  
Zoom: 120% Angle: 0  
Thickness: 0.0 mm Location: 0.0  
X: 0.00 mm Y: 0.00 mm Z: 0.00 mm

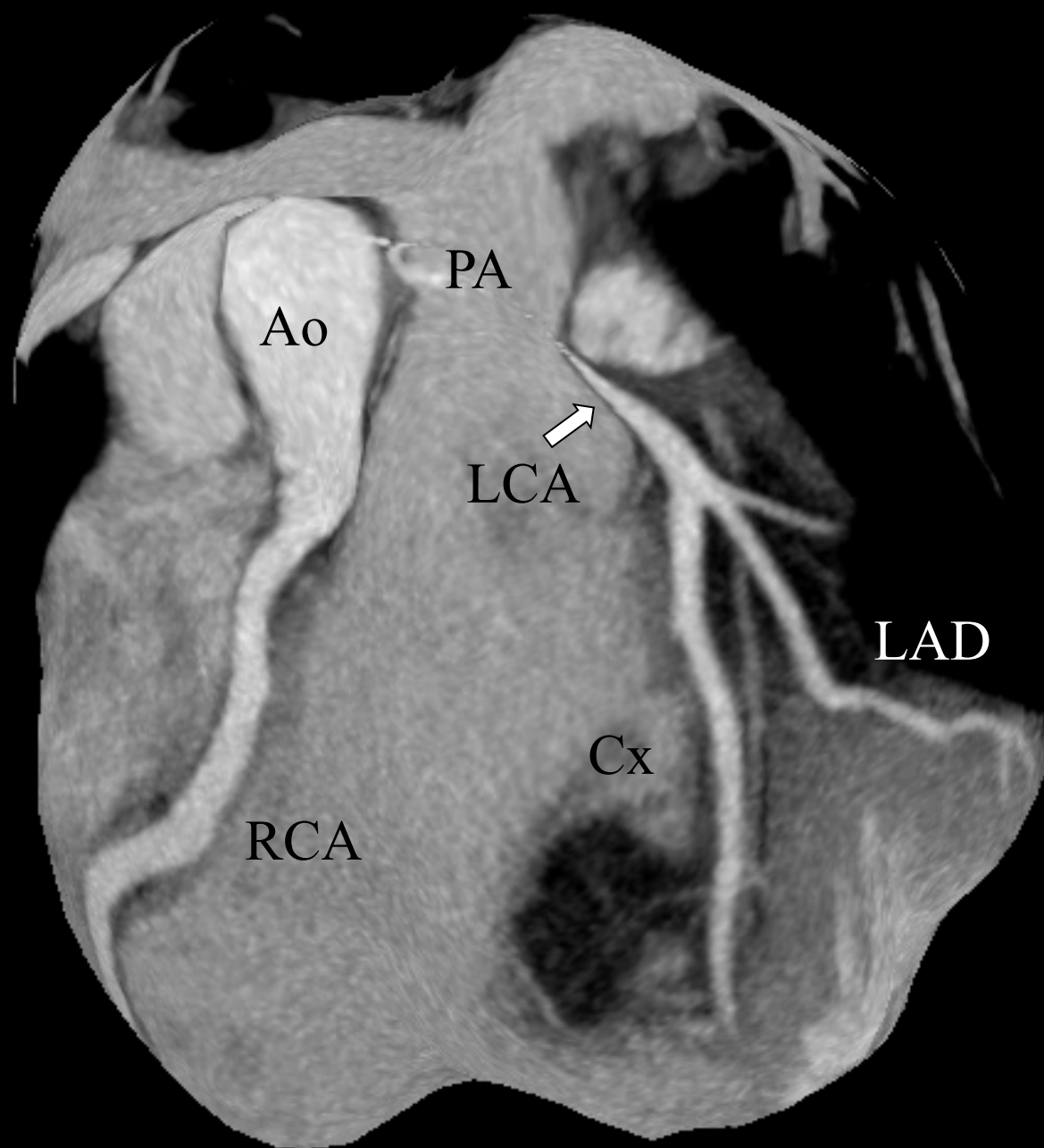
Image size: 512 x 512  
View size: 1138 x 678  
X: 0 px, Y: 0 px, Value: 0  
WL: 56, WW: 124



CART 1004  
1  
Coro LU

Fr: 76/83  
Zoom: 120% Angle: 0  
Thickness: 0.0 mm Location: 0.0  
X: 0.00 mm Y: 0.00 mm Z: 0.00 mm

14:07:00  
9/12/05  
Made with Care3D



Ao

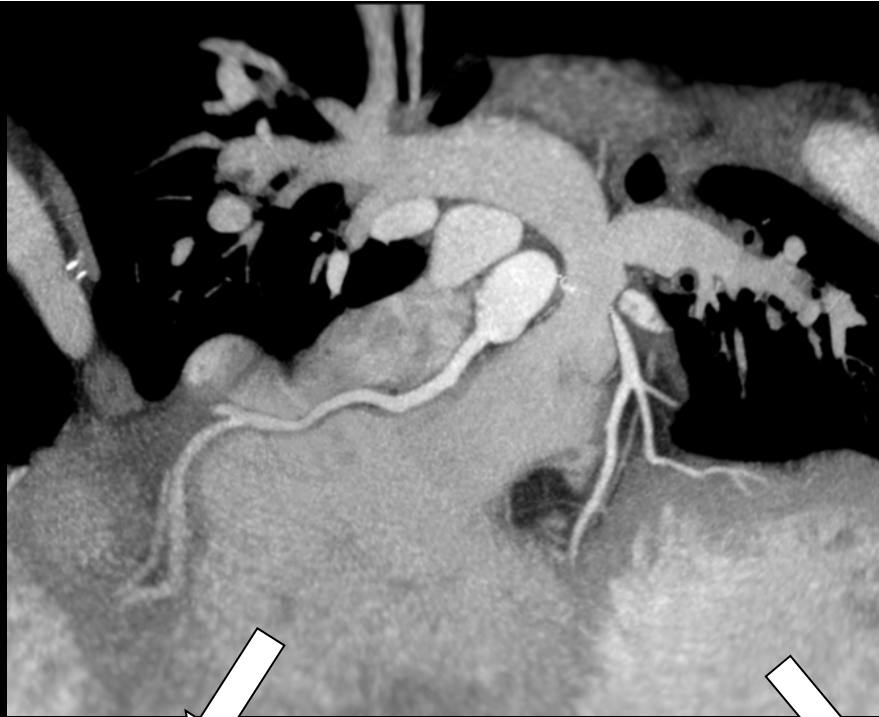
PA

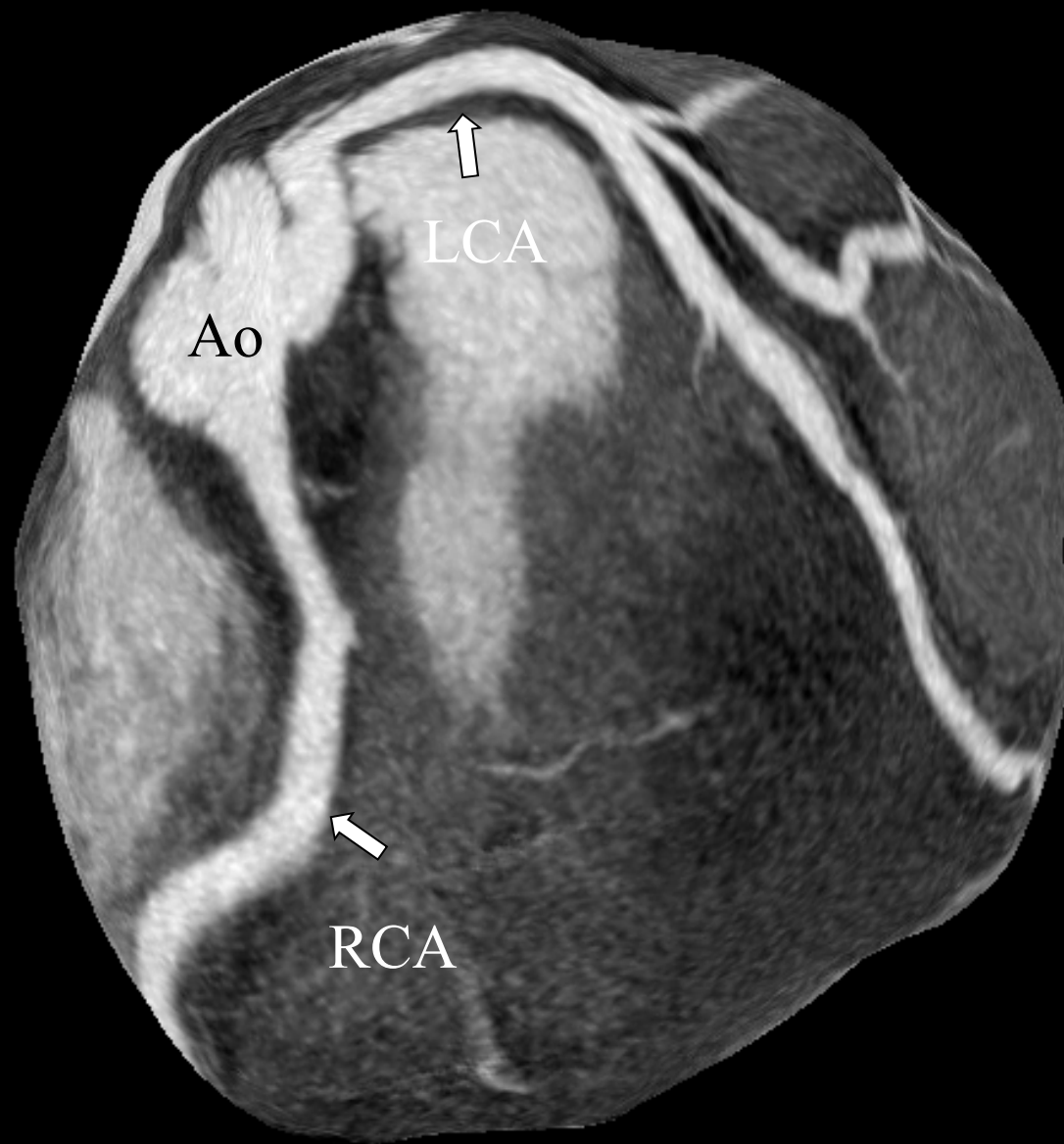
LCA

LAD

Cx

RCA





Correction post-chirurgicale

