Imaging TC nello stroke e in cardio-TC: il contributo della ricostruzione model-based e dell'imaging spettrale

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innovation + you

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Iterative Model-Based Reconstruction

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Knowledge-based IR

System Geometry Model

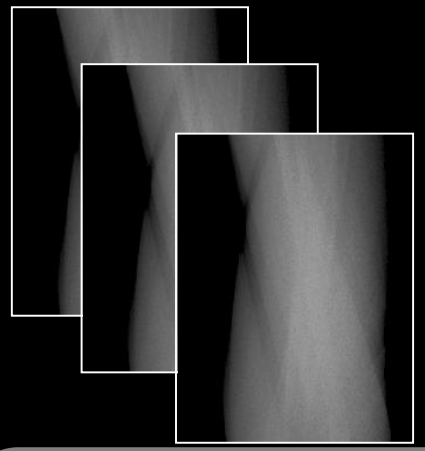
Incorporate *knowledge* of system geometry

Enables pathway between projection & image domains

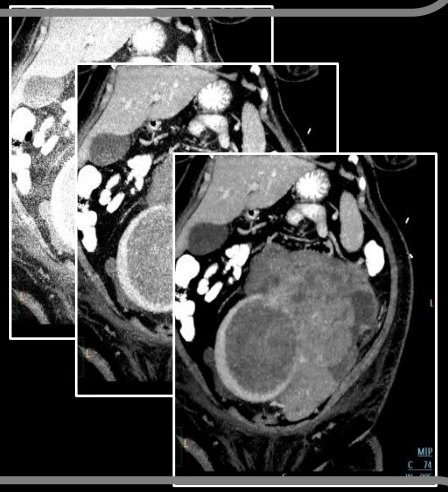
Radiation Physics Model

Incorporate *knowledge* of X-ray statistics

Enables identification of real noise



Iterative Model Reconstruction



Noise Statistical Model

Incorporate *knowledge* of object properties

Targets results with lowest noise

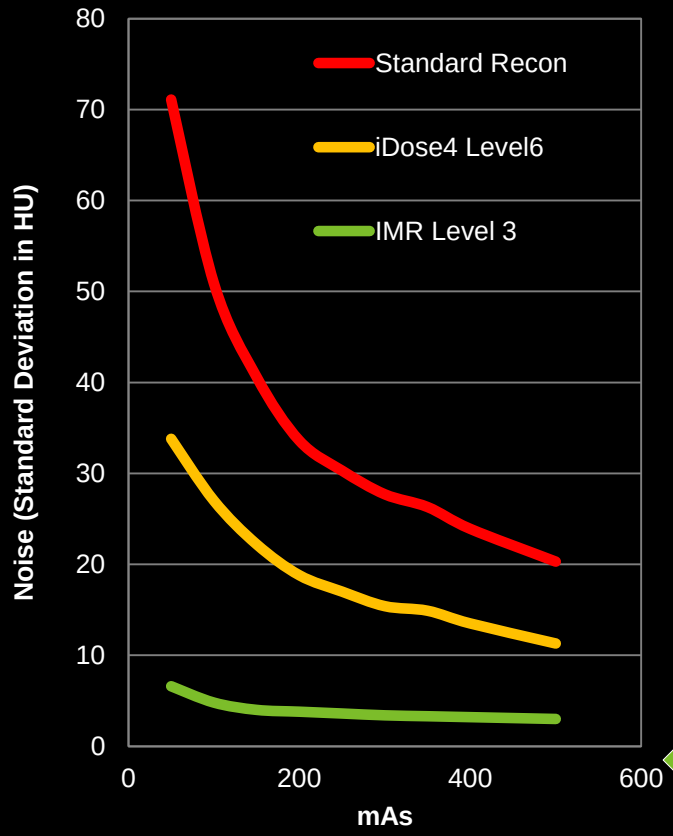
Clinical Target Model

Incorporate *knowledge* of desired characteristics

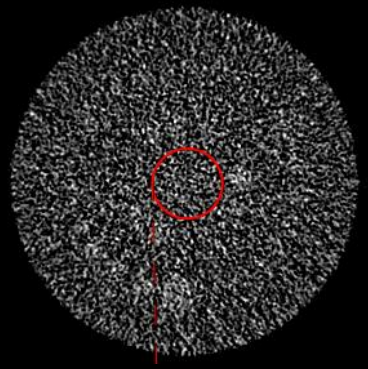
Enables user control over desired results

Virtually noise-free

73 – 90% Noise Reduction*

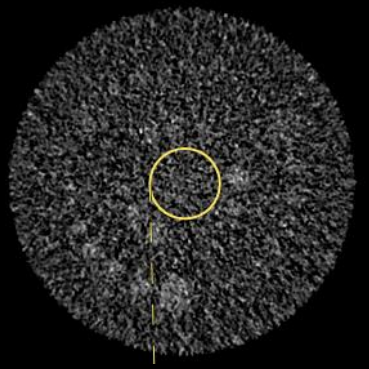


1 mm Slice Thickness, 10 mGy $CTDI_{vol}$



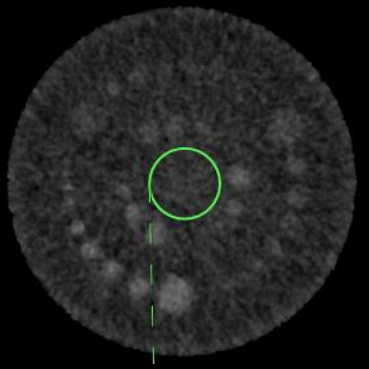
SD: 15.4

Standard Reconstruction



SD: 8.7

iDose^4 Level 6



SD: 1.9

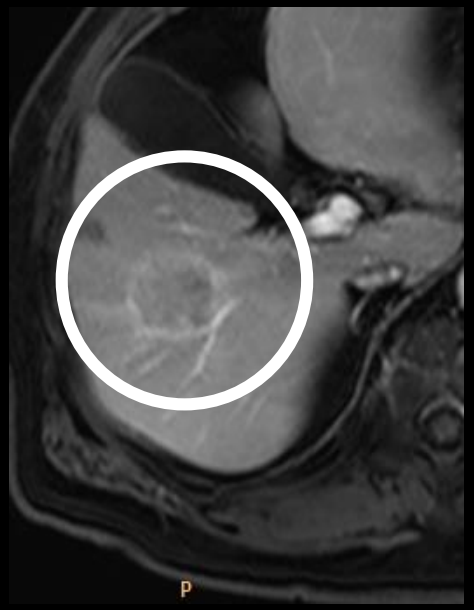
IMR

True model/knowledge-based IR

IMR Industry-leading Low-contrast

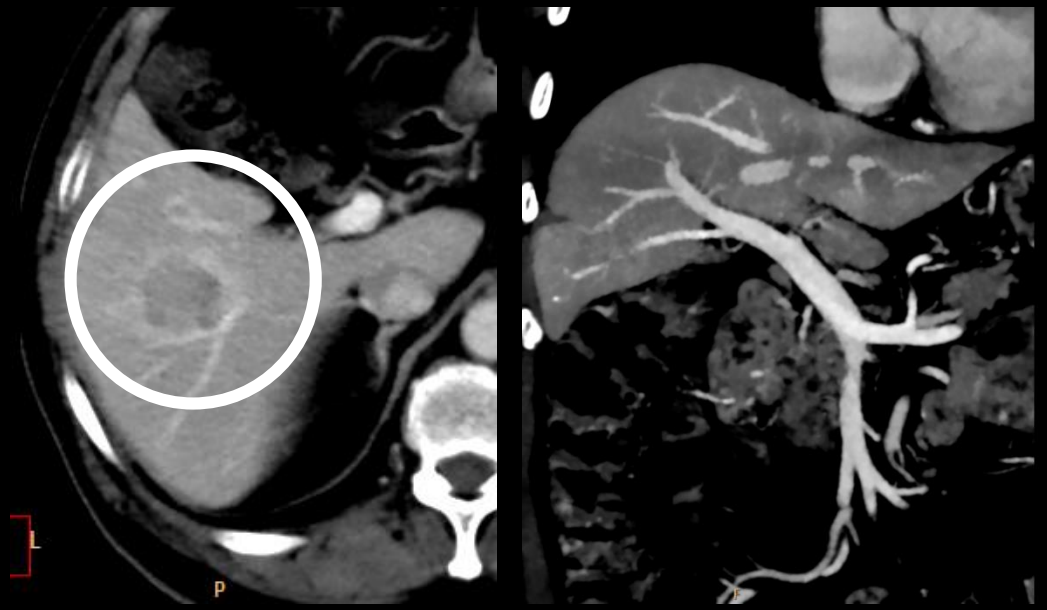
Visualize small and subtle detail

2 mm, 0.3 % @ 10.4 mGy $CTDI_{vol}$



3T MR

Lesion detected on CT, confirmed with MRI on same patient



IMR

Courtesy: Amakusa Medical Center, Japan

** Low-contrast resolution was assessed using reference body protocol across multiple scans/observations; performed using 7 mm slices, and tested on Catphan phantom. Data on file*

IMR in neuro

Use in neuro

- Suspect stroke (in ER)
- AngioCT
- Oncology
- Brain Perfusion

CT
Computed Tomography

IMR in Neuro

Patient case:
ED patient, non cooperative, with stroke symptoms.
Non-enhanced CT was reconstructed with 4,5 mm thickness (iDose) and 2 mm (IMR).

IMR showed hyperdense vessel in right emisphere not visible with iDose due to thicker slices.

Angio CT confirmed the stroke.

iDose^4

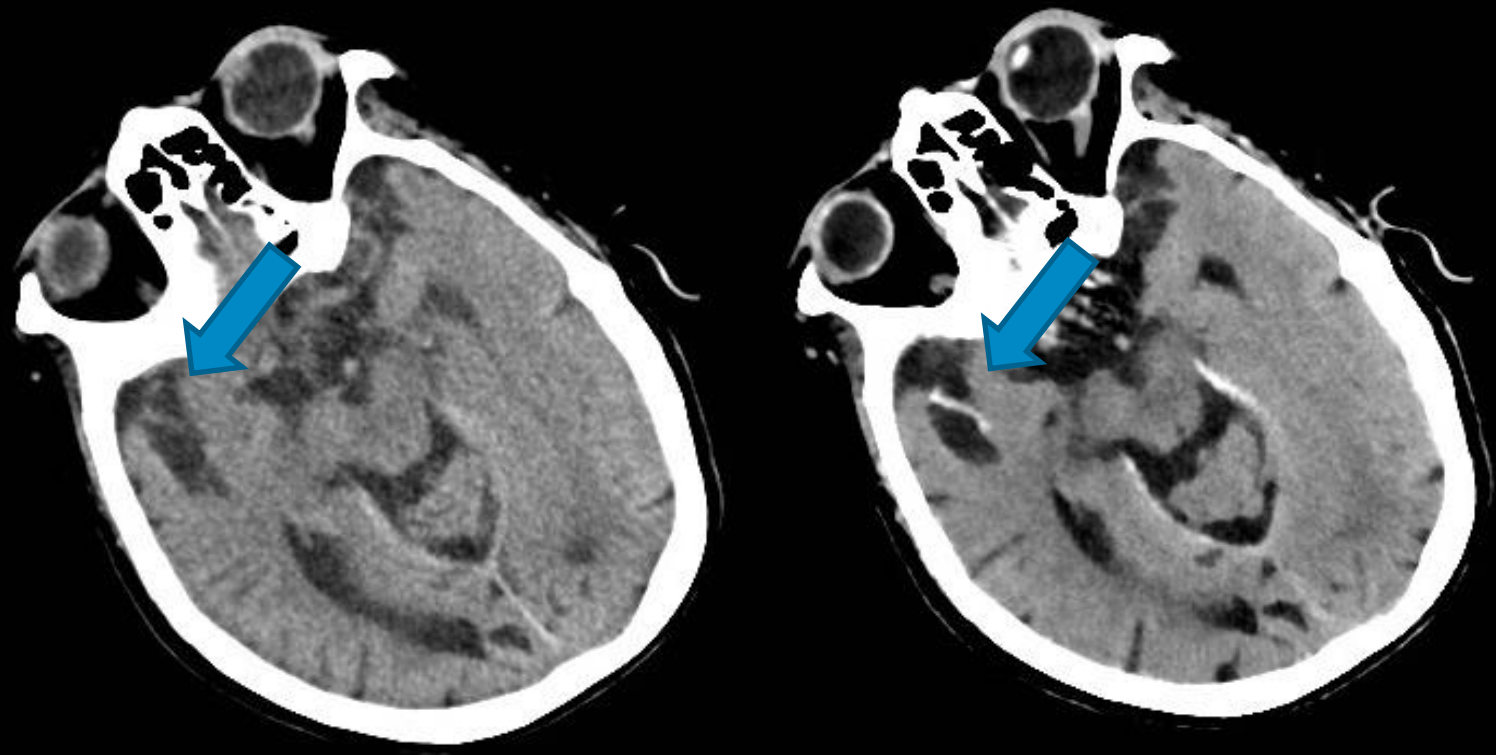


Image courtesy : Dr. Davide Ippolito, Ospedale S. Gerardo Monza

CT
Computed Tomography

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IMR

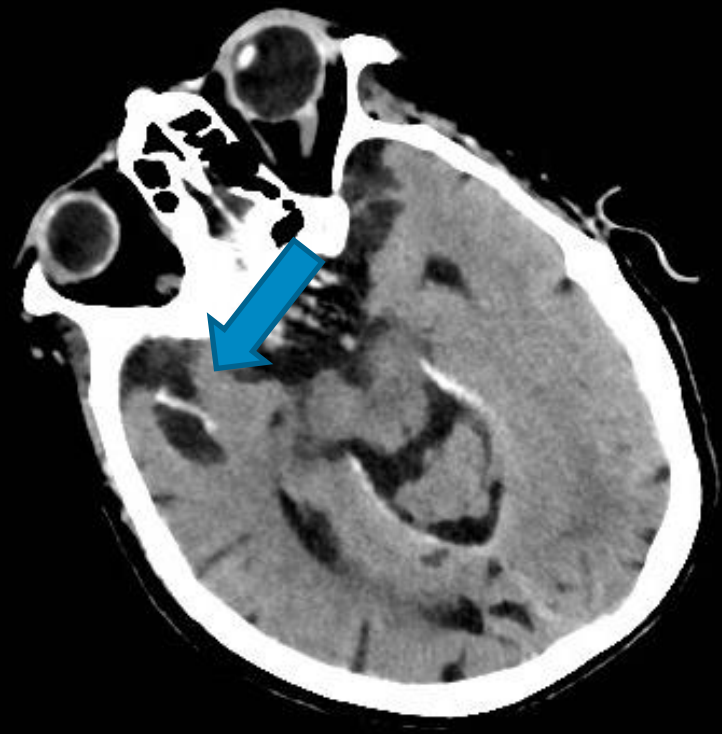


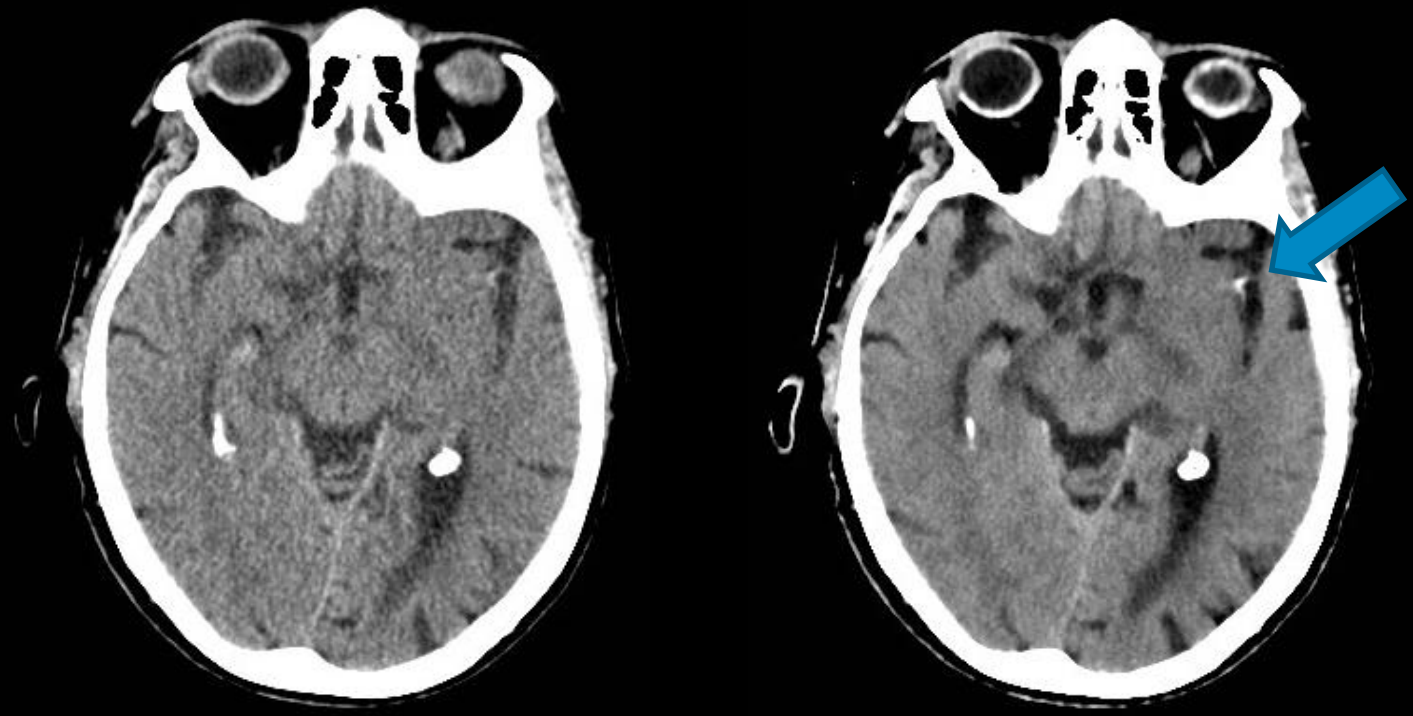
Image courtesy : Dr. Davide Ippolito, Ospedale S. Gerardo Monza

CT
Computed Tomography

IMR in Neuro

iDose^4

IMR



Patient case:

ED patient with stroke symptoms.
NECT was reconstructed with 4.5 mm thickness (iDose) and 2 mm (IMR).
IMR showed hyperdense vessel in left emisphere hardly visible with iDose.

Follow up scan shows extended hypoperfusion area, better recognizable in IMR

Image courtesy : Dr. Davide Ippolito, Ospedale S. Gerardo Monza

CT
Computed Tomography

IMR in Neuro

iDose[4]

IMR

IMR

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Follow up scan shows extended hypoperfusion area, better recognizable in IMR

Image courtesy : Dr. Davide Ippolito, Ospedale S. Gerardo Monza

CT
Computed
Tomography

IMR in Neuro

iDose^4

IMR

IMR

Patient case:

Patient with stroke symptoms.
NECT was reconstructed with 4.5 mm thickness (iDose) and 2 mm (IMR).
IMR showed hyperdense vessel in right emisphere that could be easily missed with iDose.

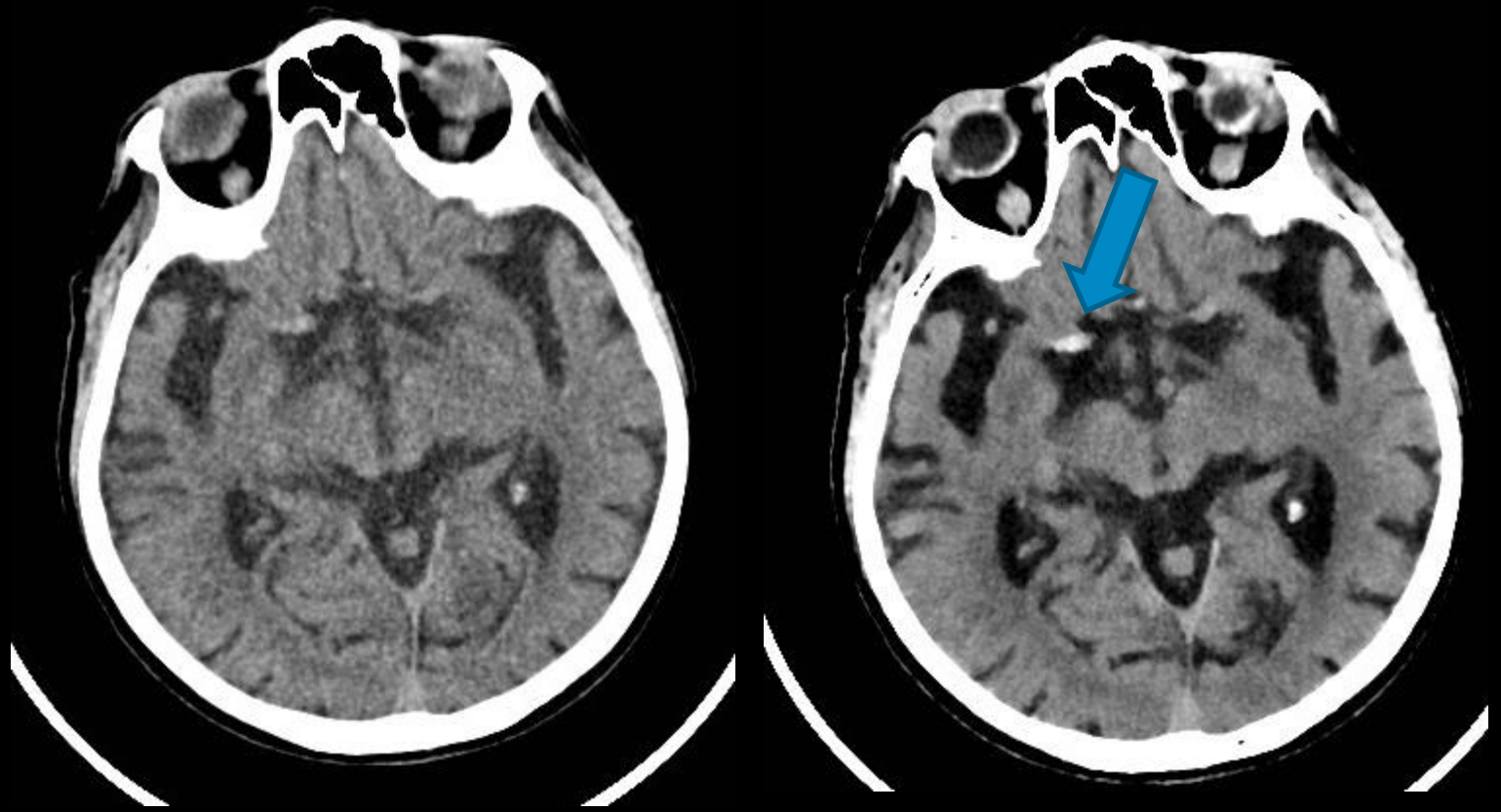


Image courtesy : Dr. Davide Ippolito, Ospedale S. Gerardo Monza

CT
Computed
Tomography

IMR in Neuro

IMR

Patient case:

Patient with oncologic history (HCC), arrived in ED unconcious. NECT was reconstructed with 4.5 mm thickness (iDose) and 2 mm (IMR).
iDose showed hemorragic region in right emisphere, with one small hyperdense area.

IMR showed several hyperdense areas, that MR confirmed to be brain metastases

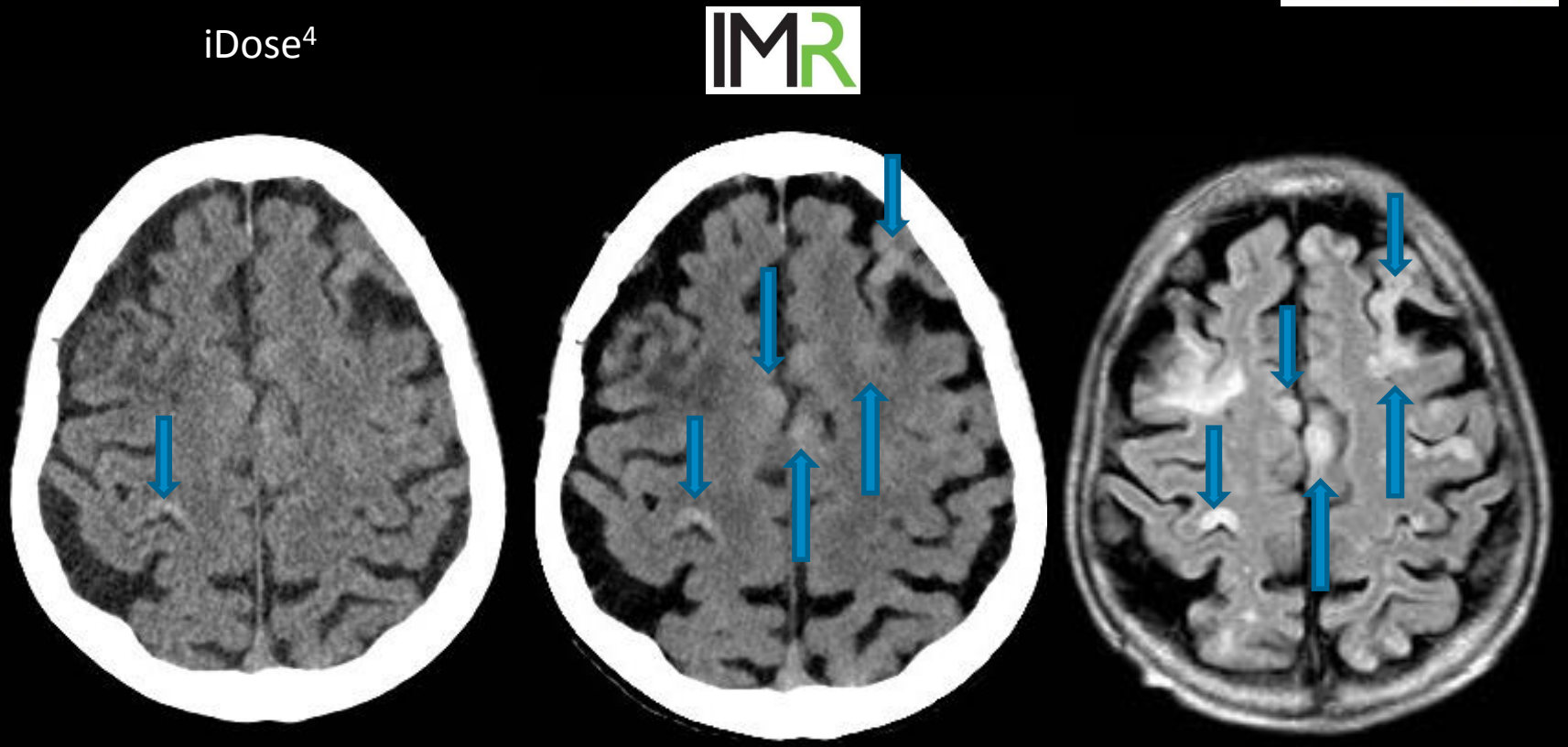
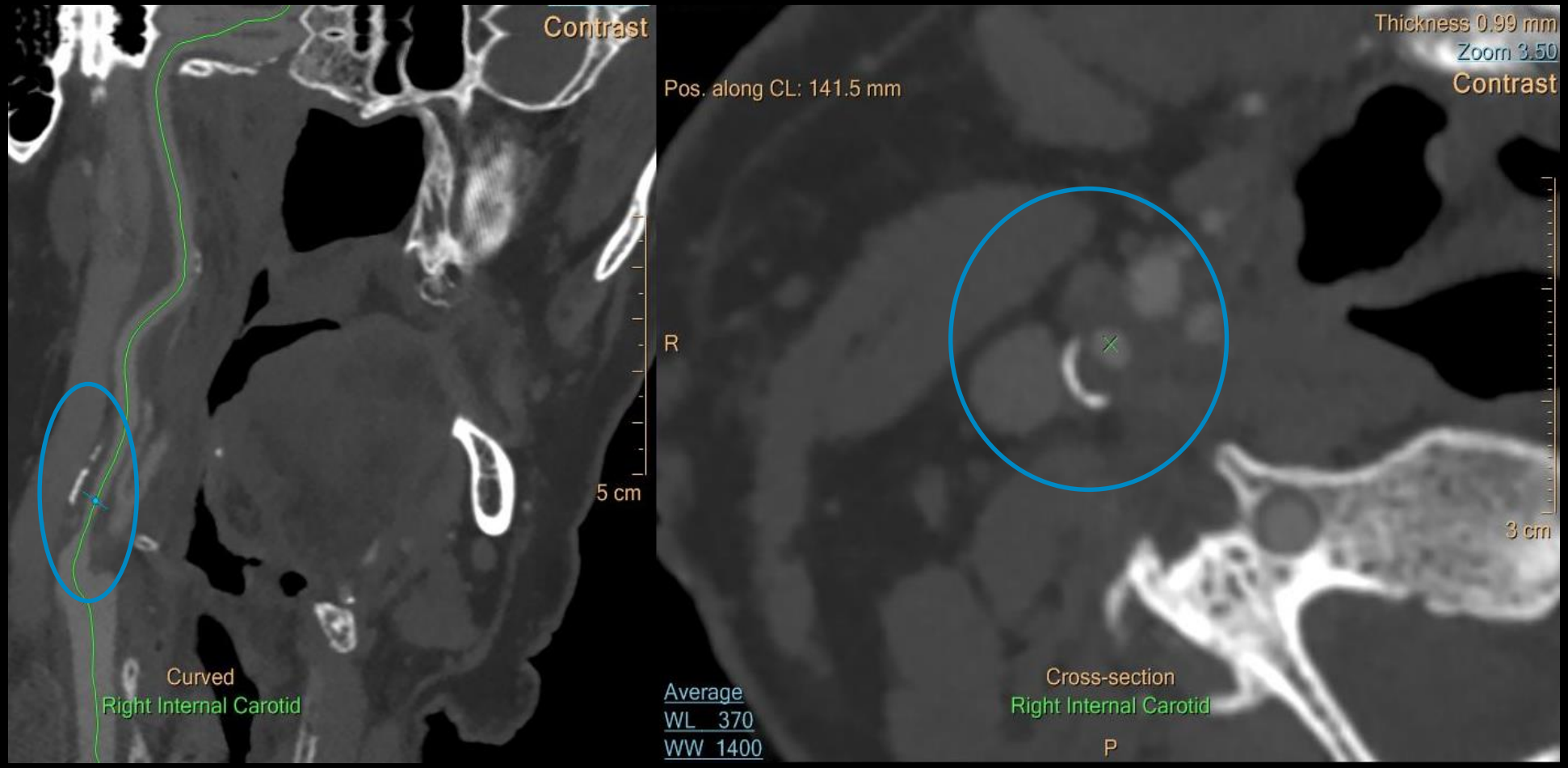


Image courtesy : Dr. Davide Ippolito, Ospedale S. Gerardo Monza

CT
Computed Tomography

IMR in Neuro

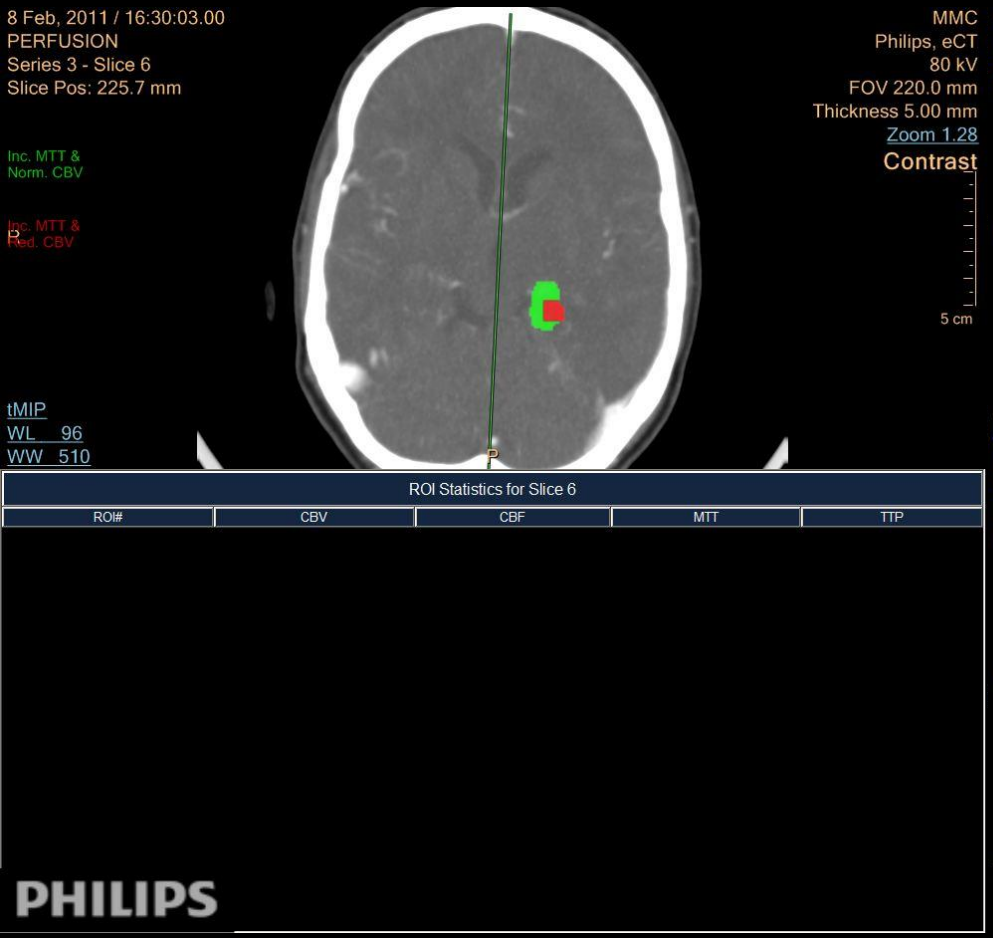
Plaque delineation and differentiation

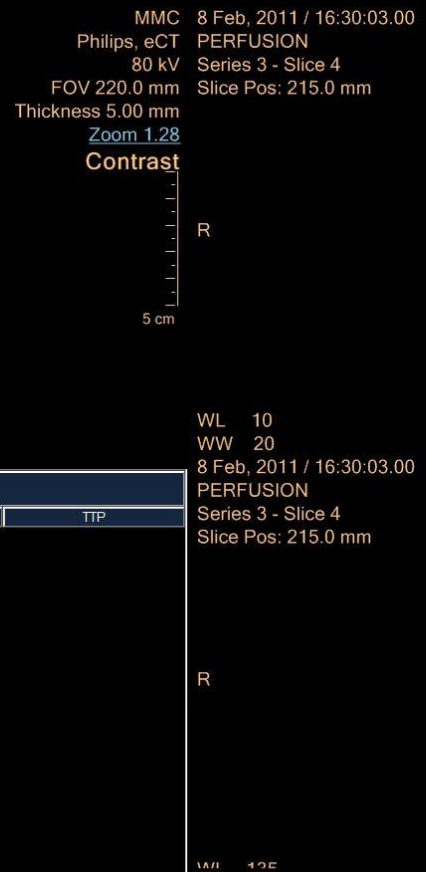


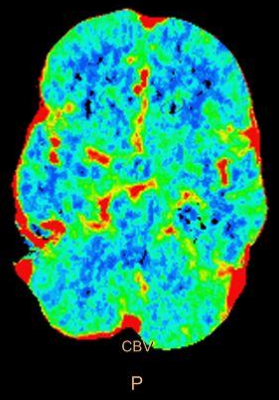
CT
Computed
Tomography

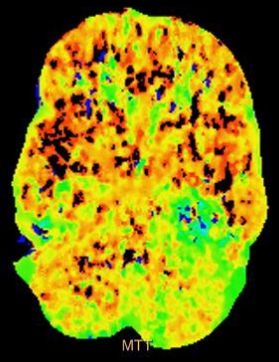
IMR in Neuro

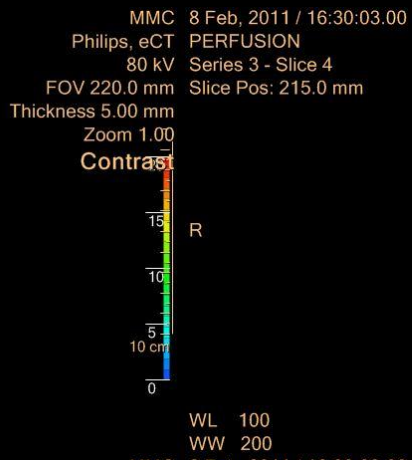
Advanced brain perfusion
Time insensitive brain perfusion

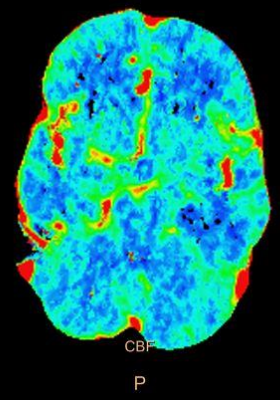


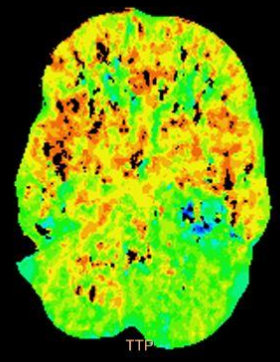










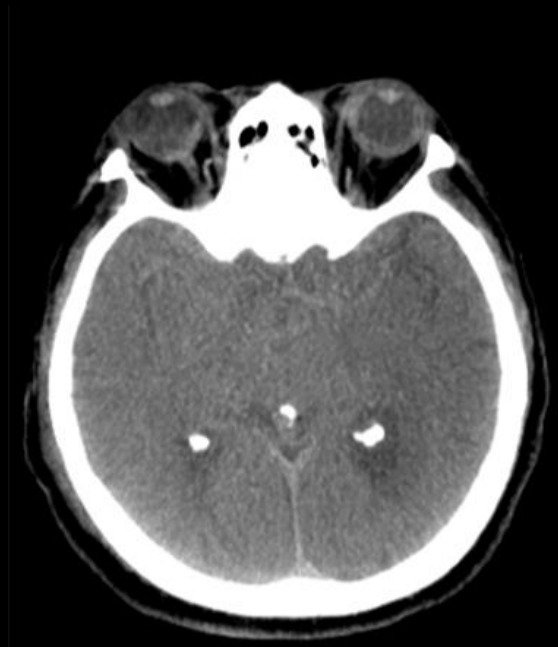


Main benefits in neuro

- Virtually noise-free images
- Dose reduction
- Thinner slices to improve visualization of smaller details (dense vessels)
- Exceptional low-contrast resolution to improve subtle changes in parenchima

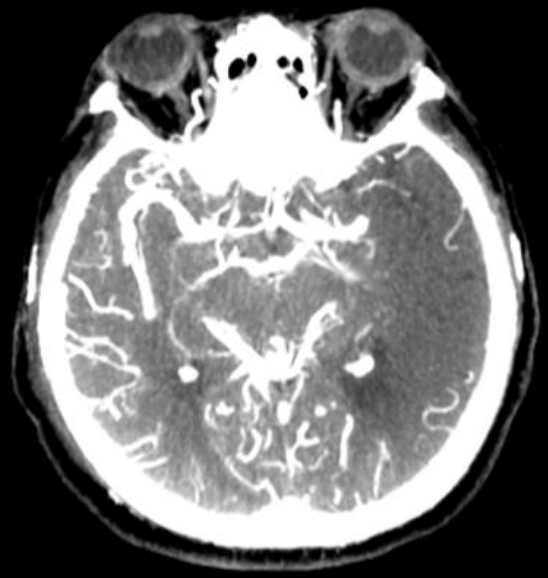
…un piccolo fuori programma…

Comprehensive stroke diagnosis based on 3 XperCT scans



Non-contrast XperCT

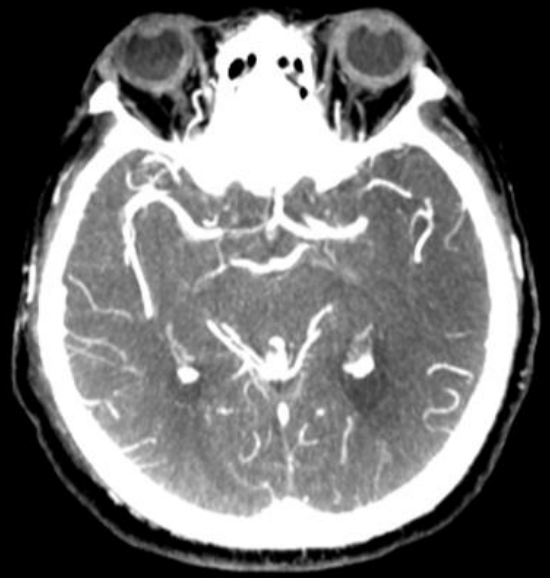
Identify bleeding and ischemic changes



Early phase CE-XperCT

Identify proximal occlusion

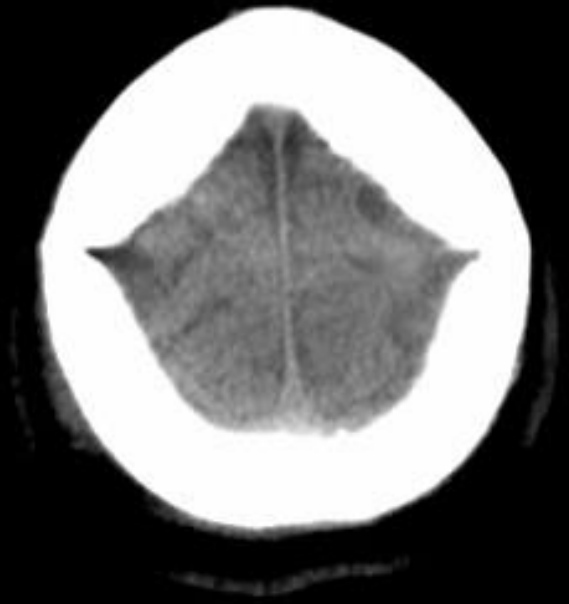
Identify penumbra



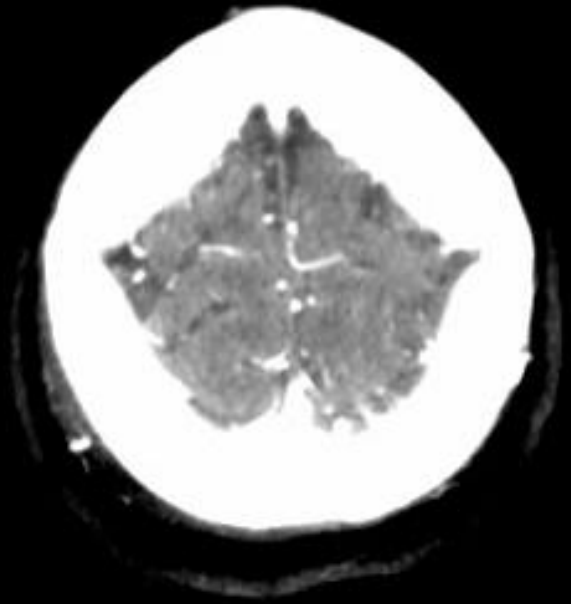
Late phase CE-XperCT

Identify collaterals

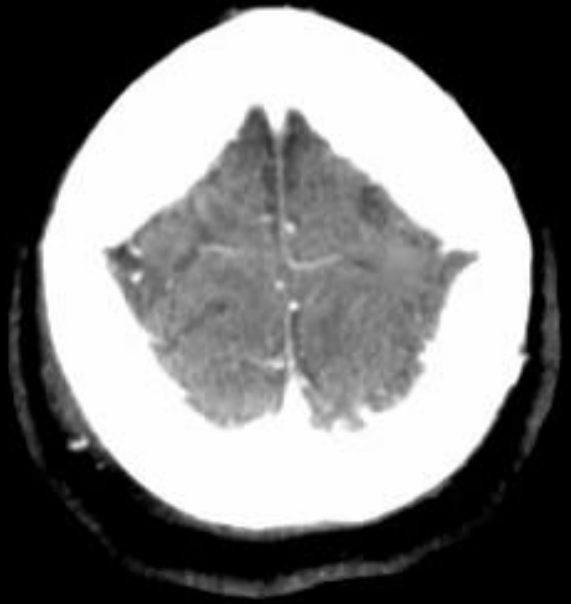
PHILIPS



Identify bleeding
and ischemic changes



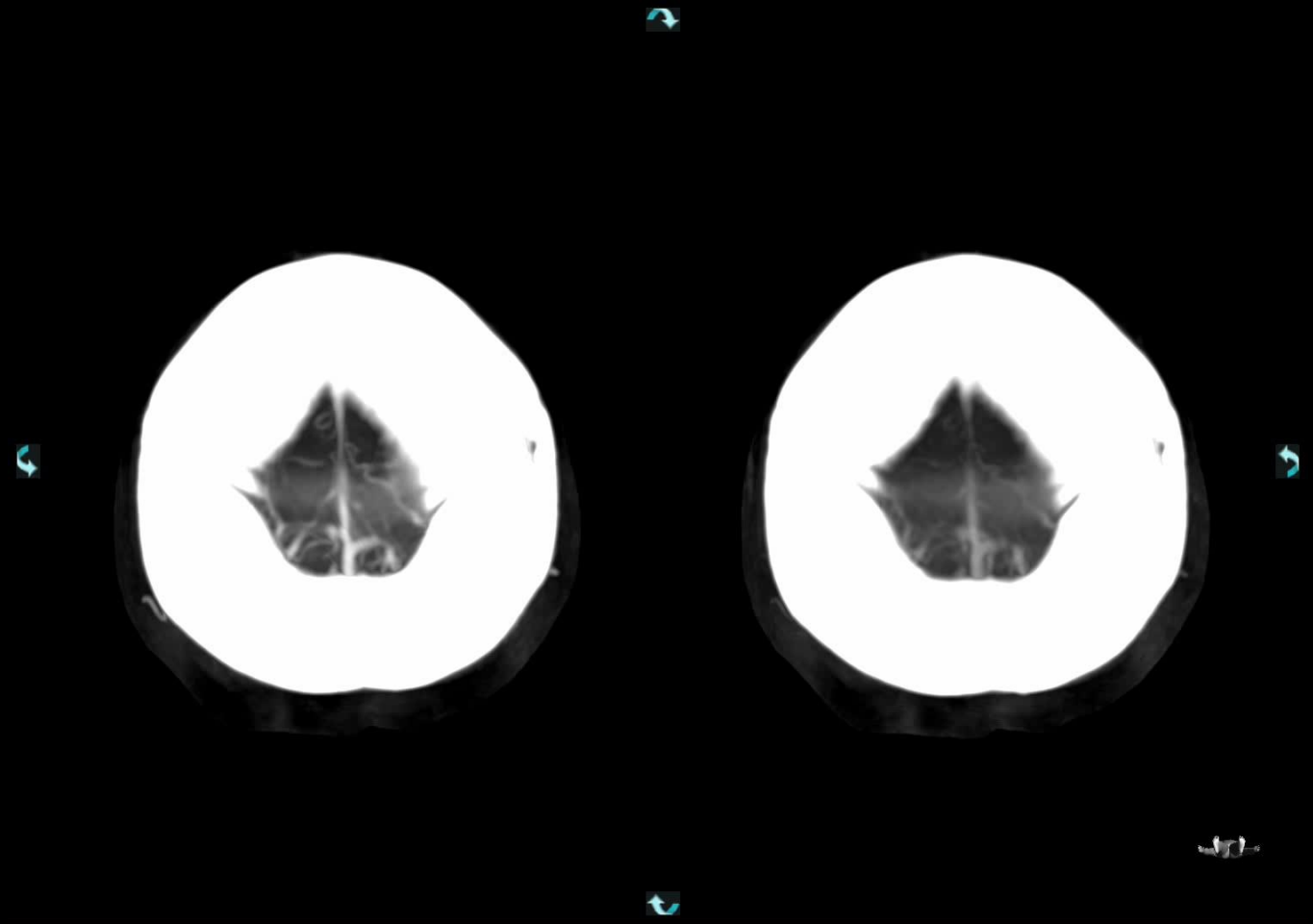
Identify proximal occlusion



Identify collaterals

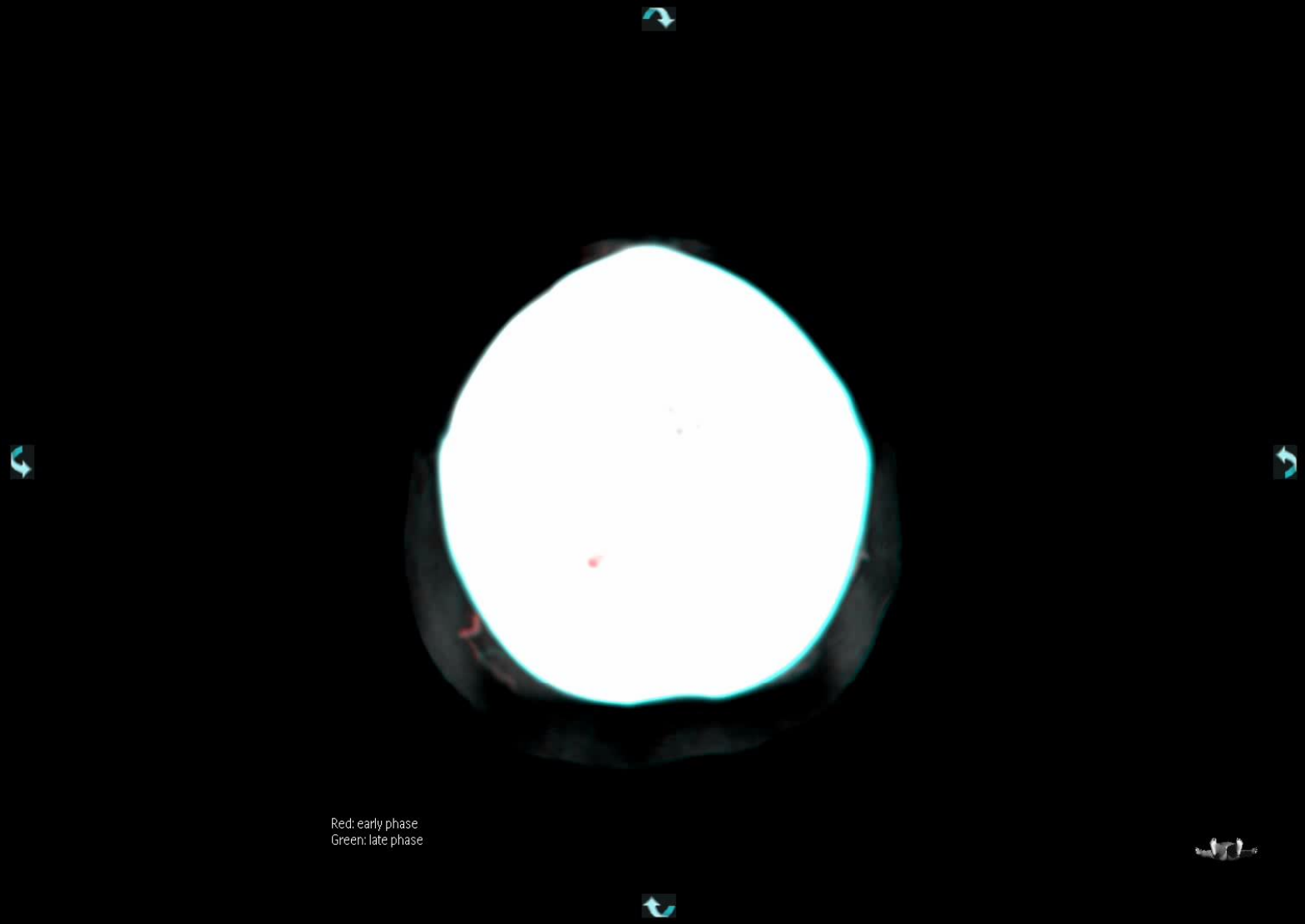
PHILIPS

Thick slab MIP



PHILIPS

Overlay of early and late phase CE-XperCT with Dual-View



PHILIPS

IMR in cardiac

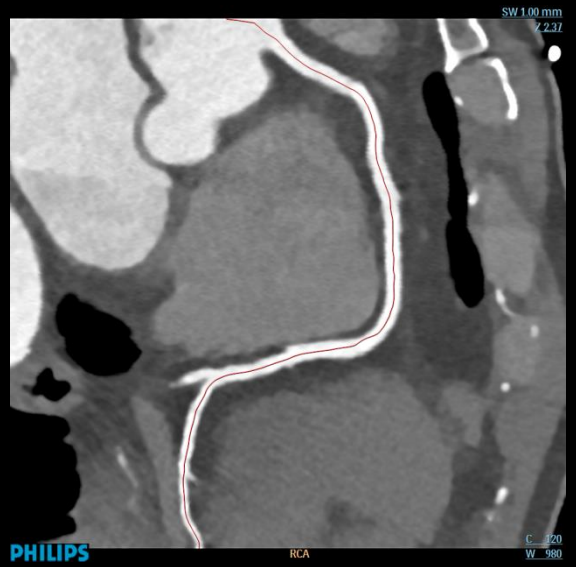
Use in cardiac

- Ischaemia
- Intrastent stenosis
- Follow up post-intervention
- Myocardial Dynamic perfusion

CT
Computed
Tomography

0.9 mSv IMR Cardiac

IMR



RCA

Standard Reconstruction

iDose Level 4

IMR Level 3

100 kVp, 110 mAs

$CTDI_{vol}$ 5.2 mGy, DLP: 67.1 mGy×cm, Effective Dose: 0.9 mSv (k=0.014)*,

** AAPM technical report 96*

Amakusa Medical Center Japan

CT
Computed
Tomography

0.9 mSv IMR Cardiac

IMR

RCA

Standard Reconstruction

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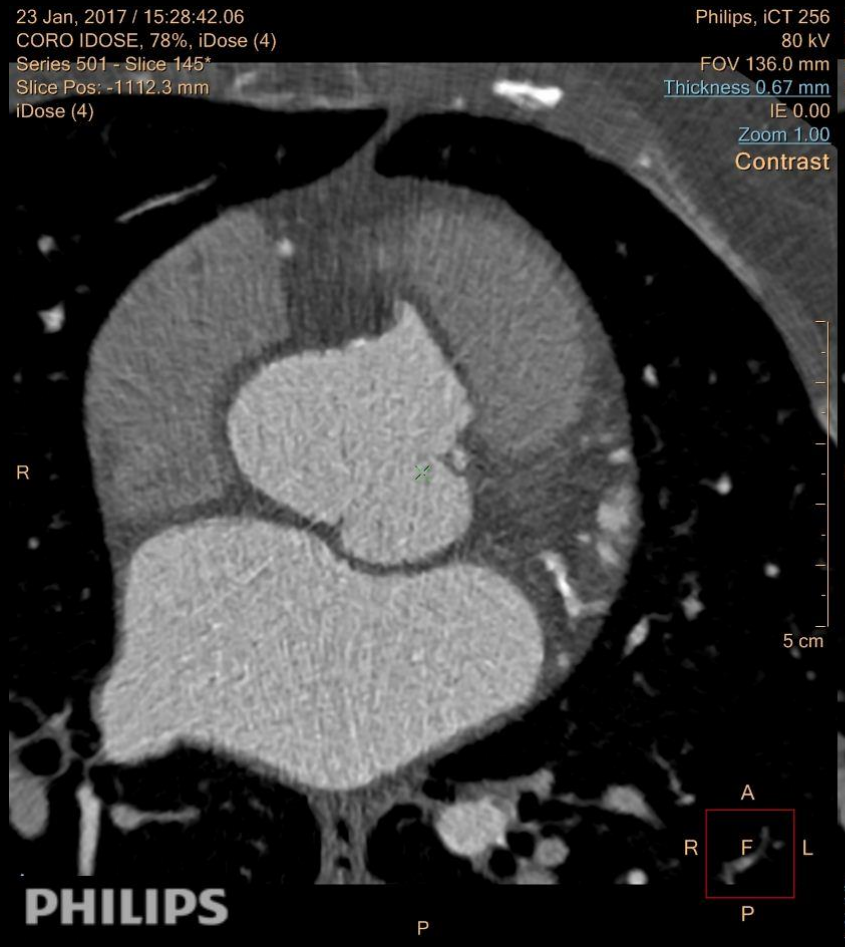
** AAPM technical report 96*

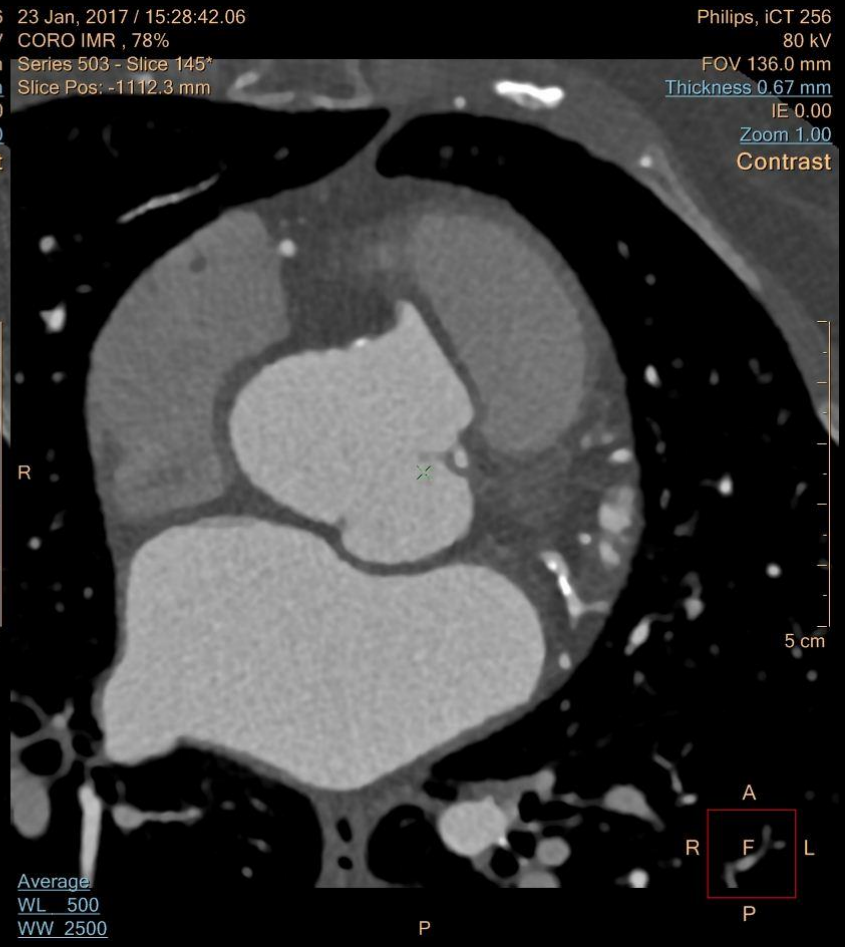
Amakusa Medical Center Japan

CT
Computed
Tomography

Cardiac Step&Shot @ 0,53mSv !

Effective Dose = 0,014 x DLP – AAPM 96





0,67 mm IDose LV 4

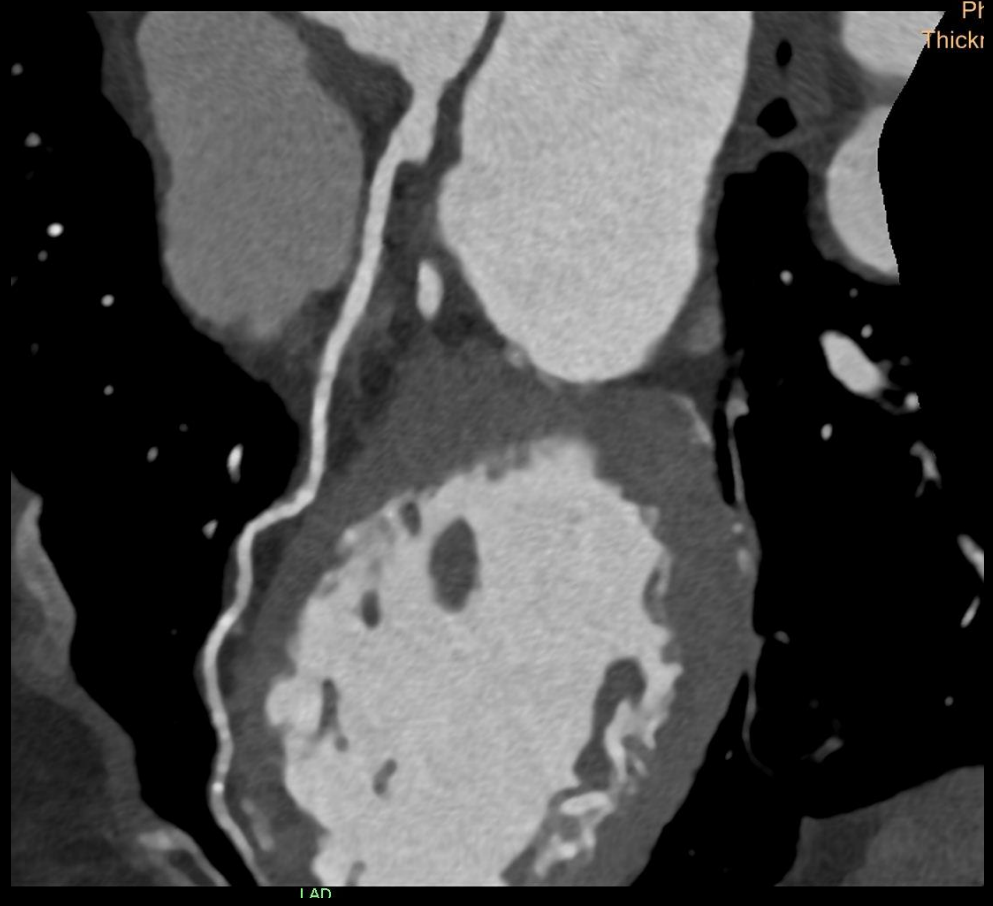
0,67 mm IMR Cardiac Routine LV1

Image courtesy : Dr. Giorgio Benea, Ospedale del Delta (FE)

CT
Computed
Tomography

Cardiac Step&Shot @ 0,53mSv !

Effective Dose = 0,014 x DLP – AAPM 96



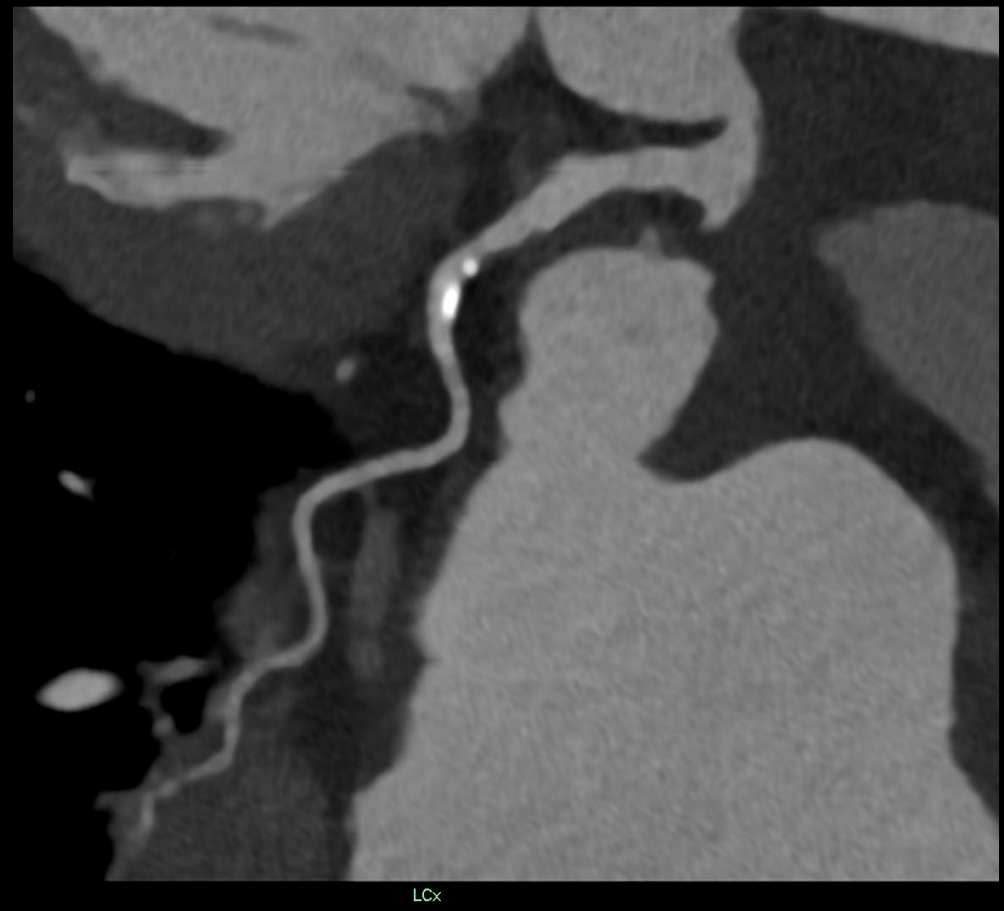
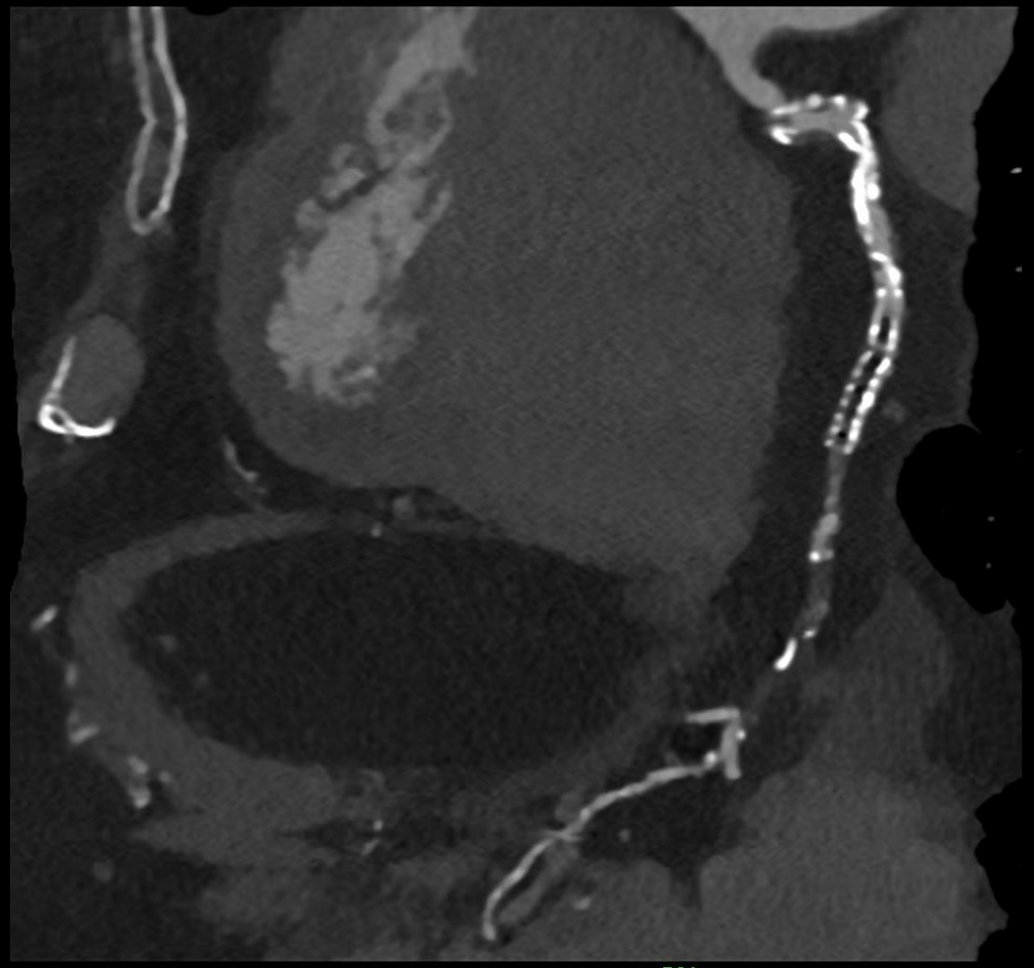


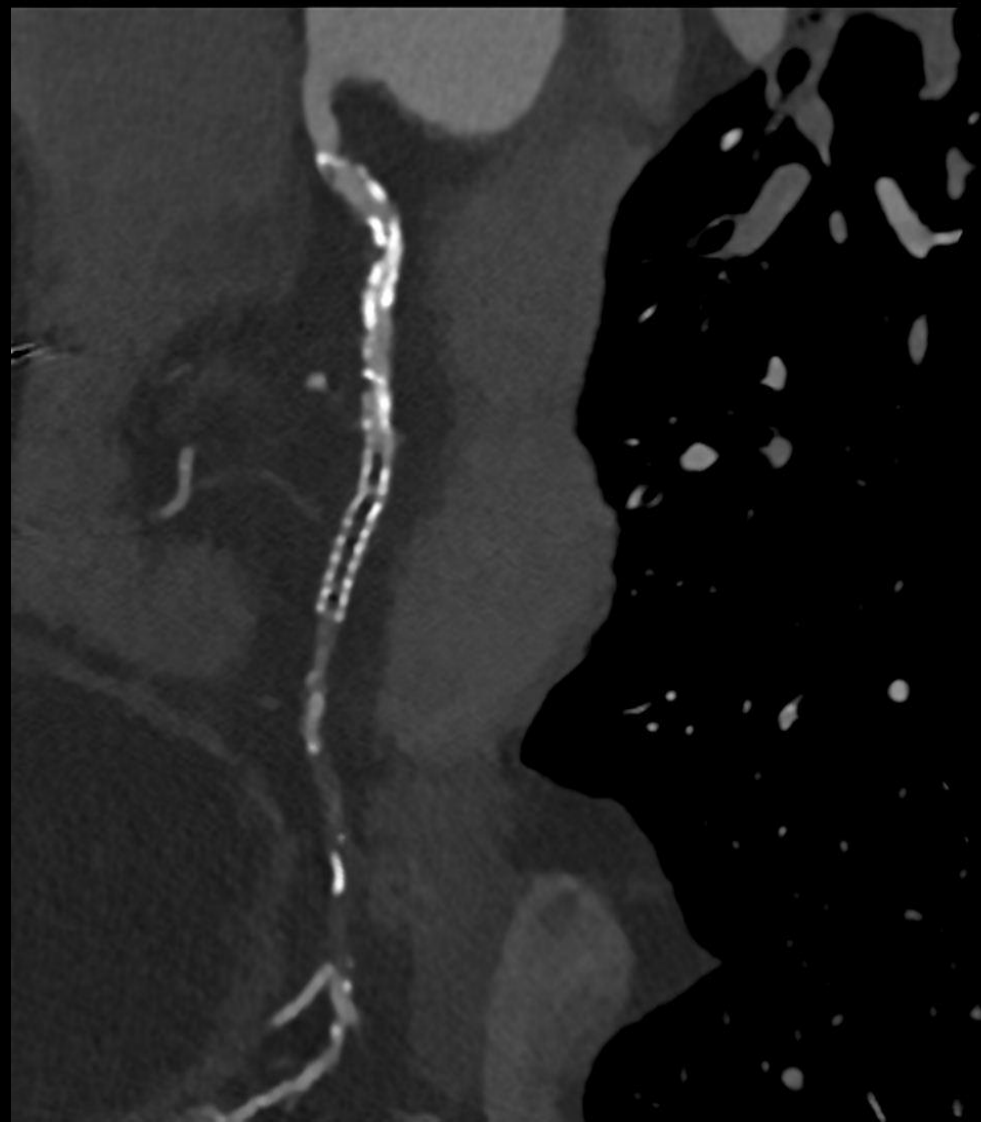
Image courtesy : Dr. Giorgio Benea, Ospedale del Delta (FE)

CT
Computed
Tomography

Ingenuity Cardio TC

Intrastent stenosis RCA

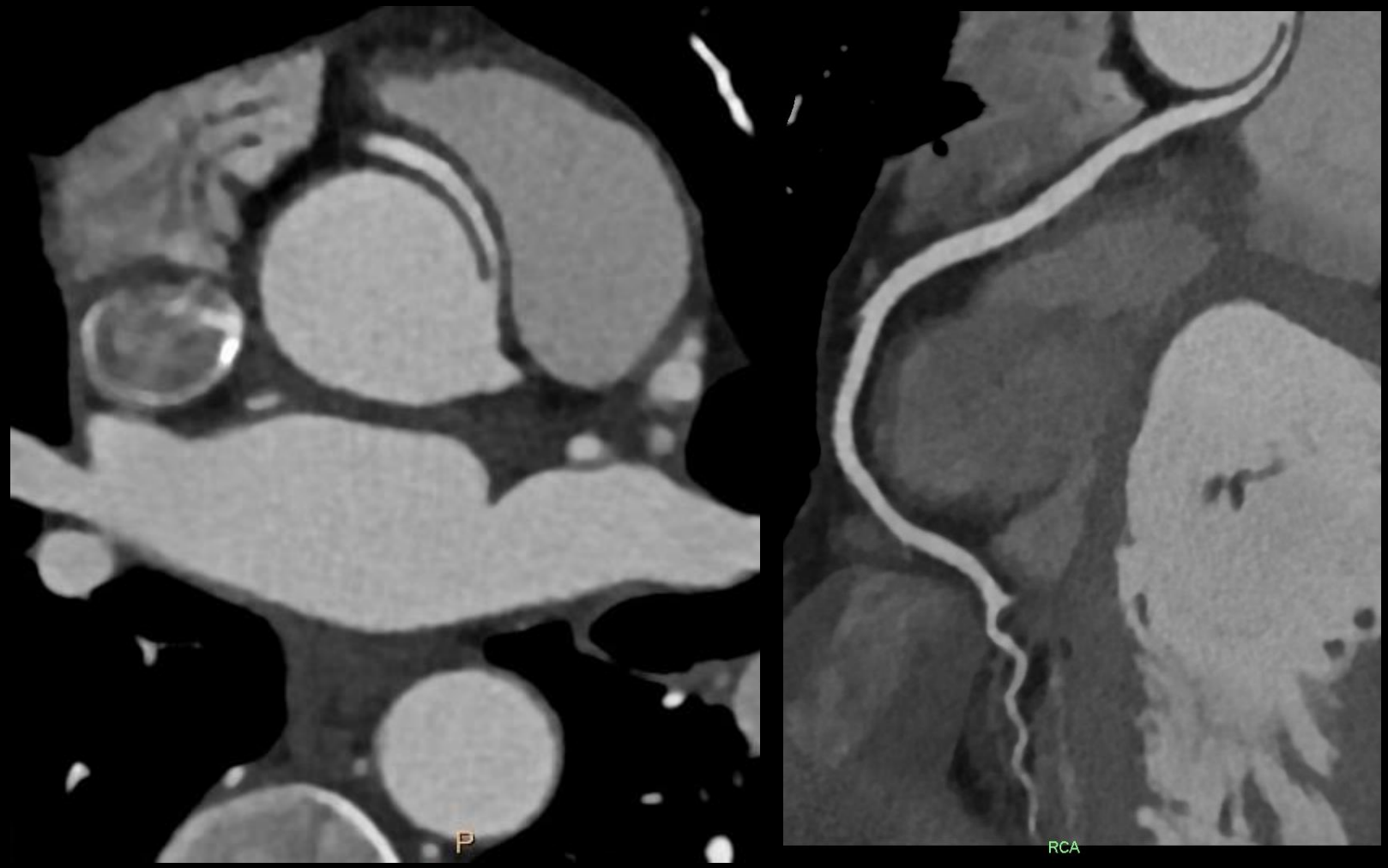




CT
Computed
Tomography

Ingenuity Cardio TC

Anomalous origin RCA

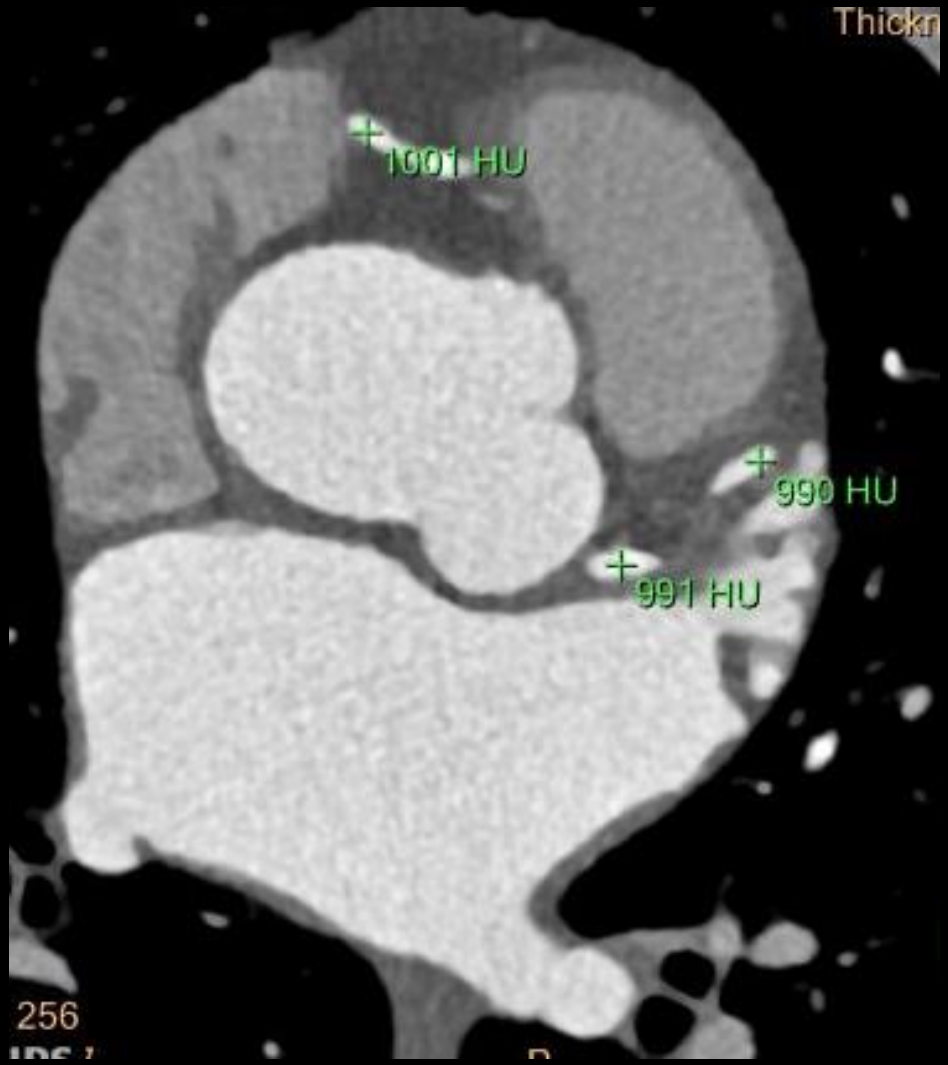


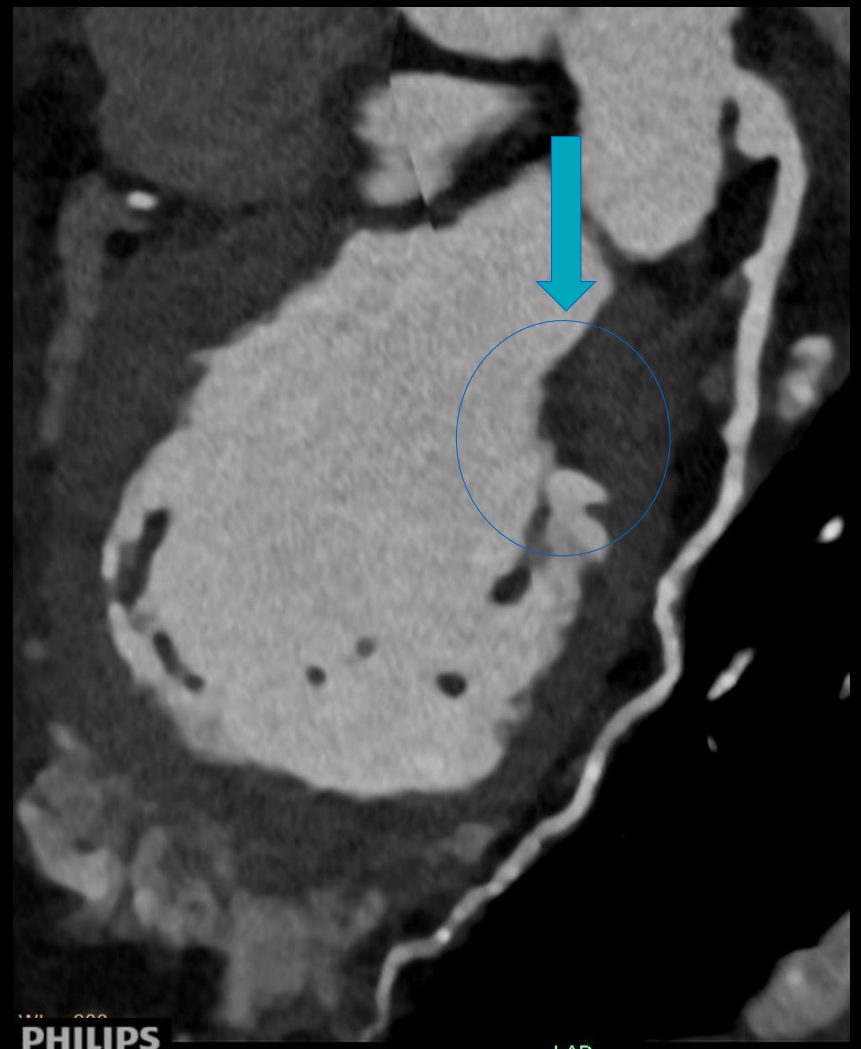
Injection protocol
70ml – 350 mg/ml

CT
Computed Tomography

Ingenuity Cardio TC

Anomalous origin RCA

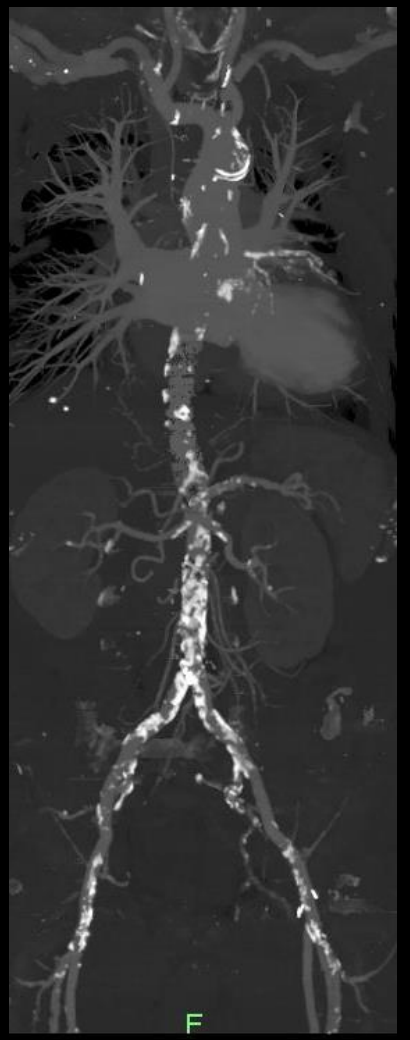




Injection protocol
70ml – 350 mg/ml

CT

Computed Tomography



Main benefits in cardiac

- Virtually noise-free images
- Dose reduction (lower kV)
- Low noise with high spatial resolution to improve visualization of smallest plaques
- Improve visualization of vessel lumen even in mixed plaques
- Allows lower concentration of iodine

IQon SpectralCT

Spectral always on

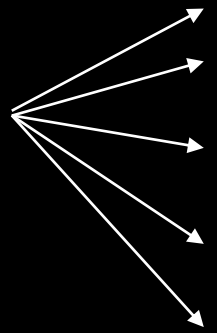
innovation + you

PHILIPS

IQon Spectral CT

Clinical features

- Dedicated spectral tools for vascular, cardiac, onco
- Mono energetic images 40-200 keV with constant noise
- Effective Z-number
- Iodine map
- Iodine quantification
- Spectral tumor tracking with functional assesment
- Cardiac perfusion with iodine quantification
- Material decomposition
  (Iodine/Calcium/Uric acid/water)
- Virtual no contrast
- Attenuation curves analysis



- Metal artifact reduction
- Beam hardening reduction
- Calcium blooming reduction
- Low contrast resolution improvement
- Reduce contrast usage

IQon Spectral CT

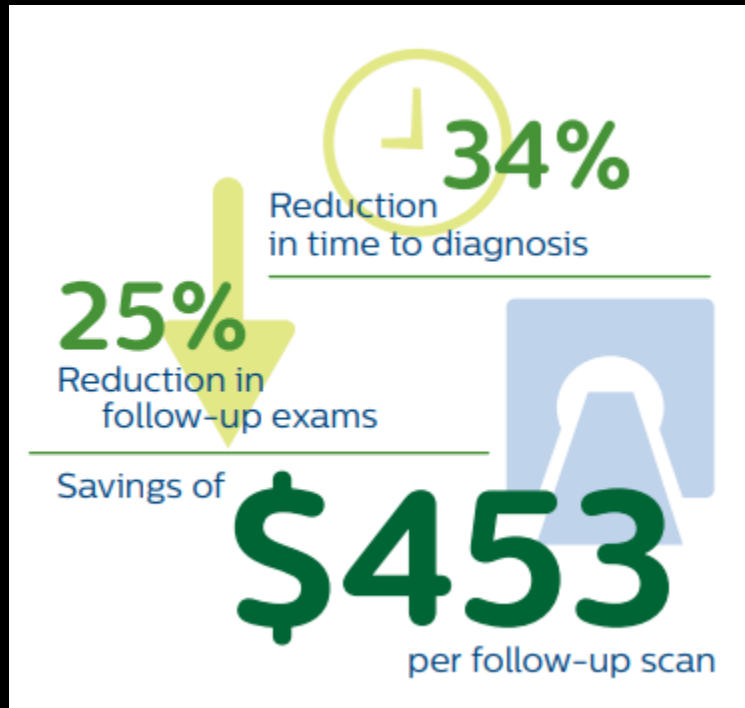
Main operational benefits

Spectral on demand

No changes in workflow

No need to prospectively select patients

More info -> more diagnostic confidence
-> less repeated exams

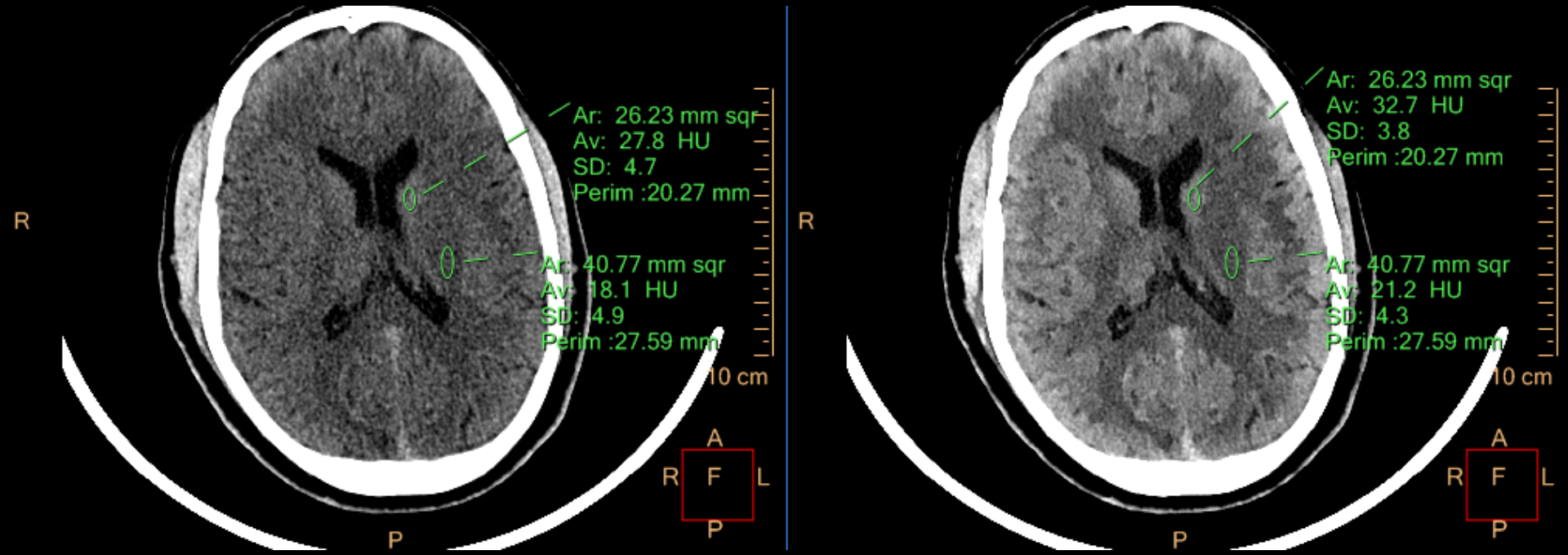


IQon in neuro

Use in neuro

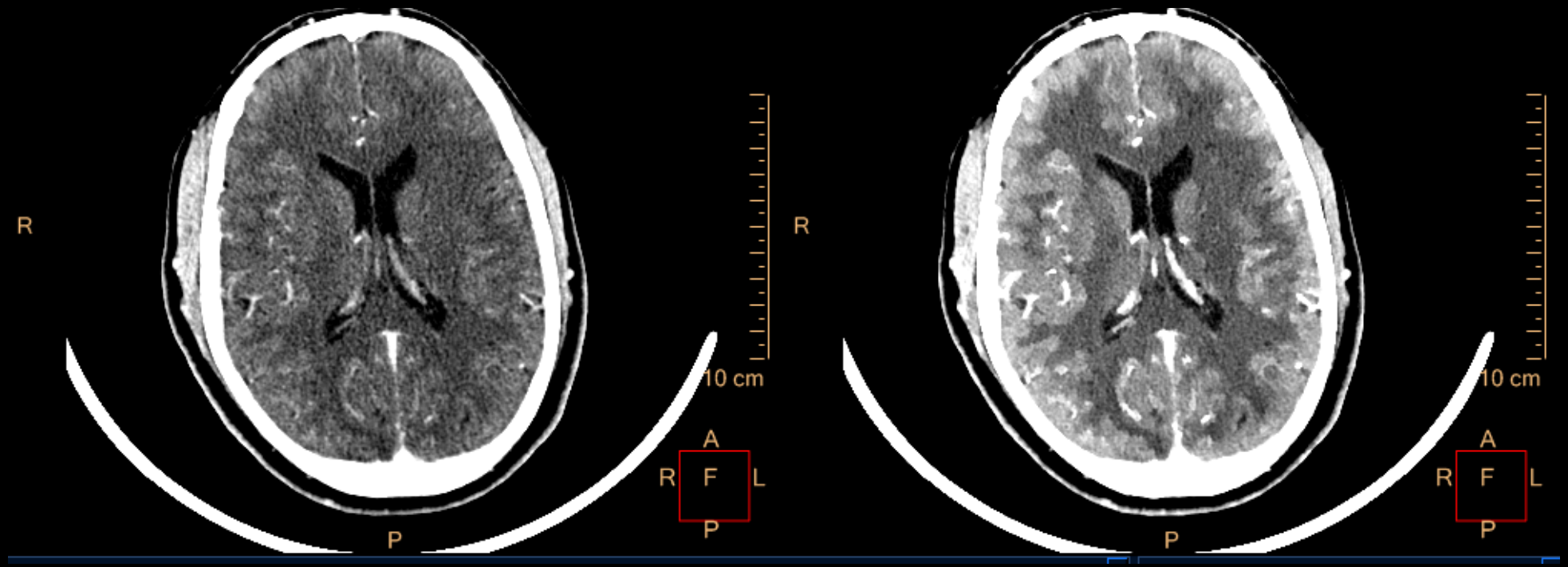
- Plaque characterization
- Vessel delineation and calcium blooming reduciotn (all in one)
- Calcium removal
- Improved white-grey matter differentiation thanks to low keV images

Confidence in visualization
Improved grey-white matter differentiation



Conventional **MonoE 50 keV**

Confidence in visualization
Improved grey-white matter differentiation



Conventional

MonoE 50 keV

Improved lumen delineation / reduction of Ca-blooming in complex mixed carotid plaque

MonoE 50keV

Conventional 120 kVp

MonoE 100keV

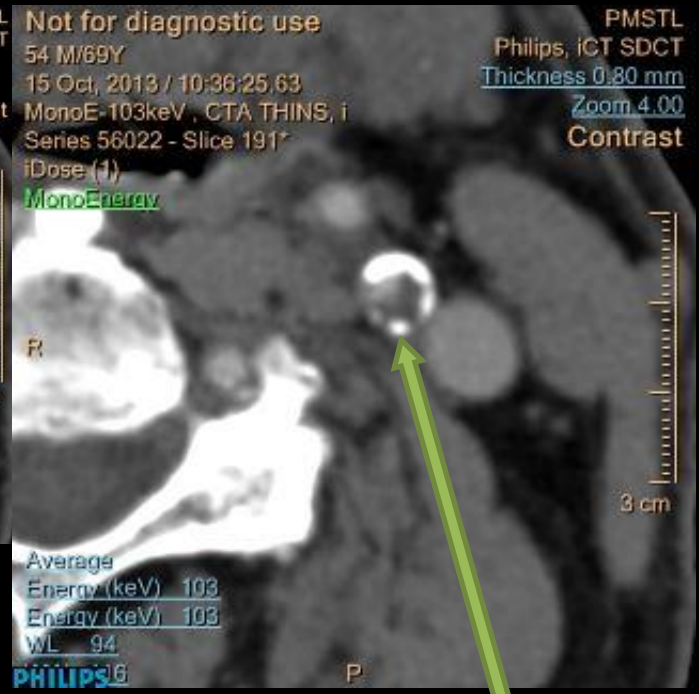
Contrast enhancement

Calcium blooming reduction

Improved lumen delineation / reduction of Ca-blooming in complex mixed carotid plaque

MonoE 50keV

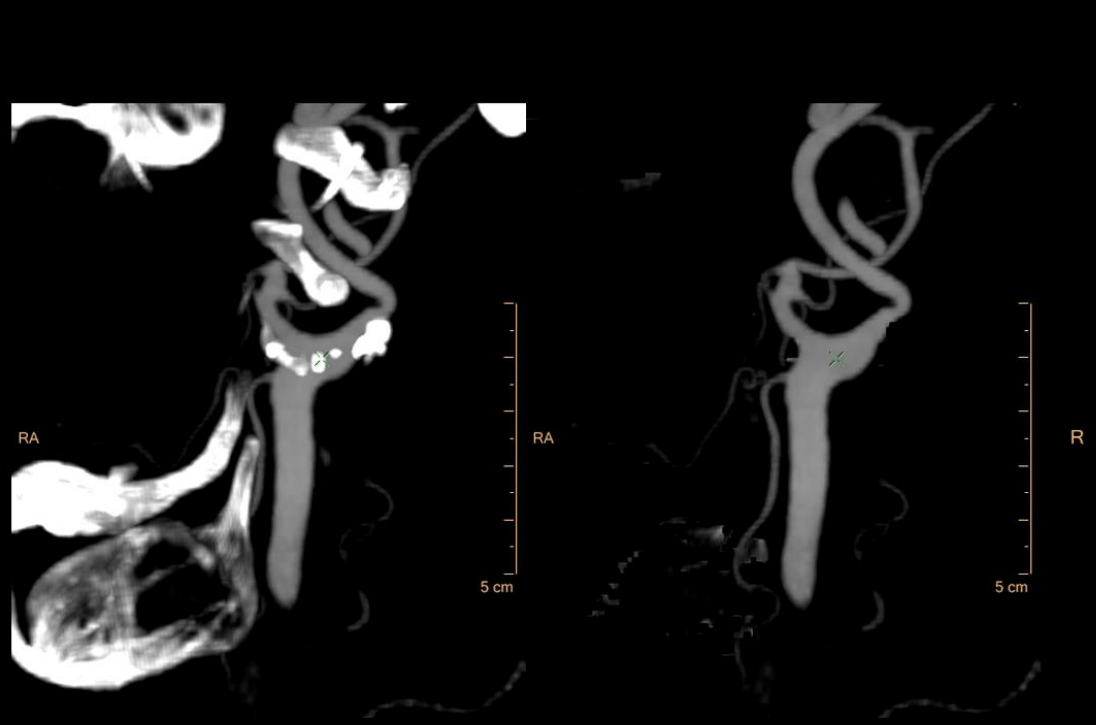
MonoE 75keV

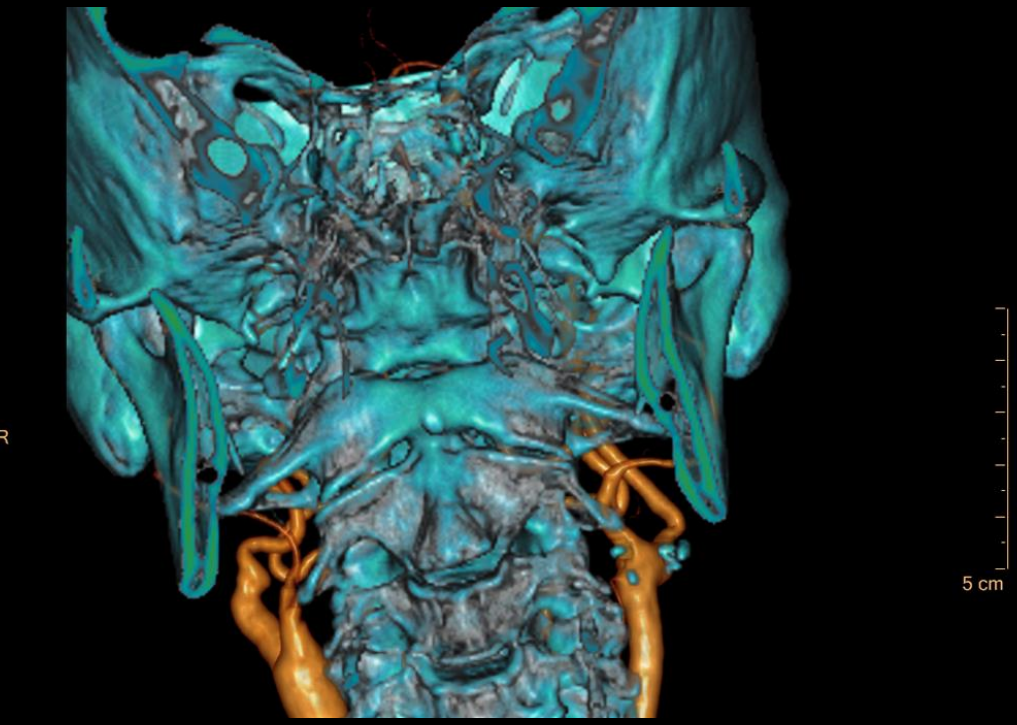


MonoE sequence

Increased confidence in plaque assesment

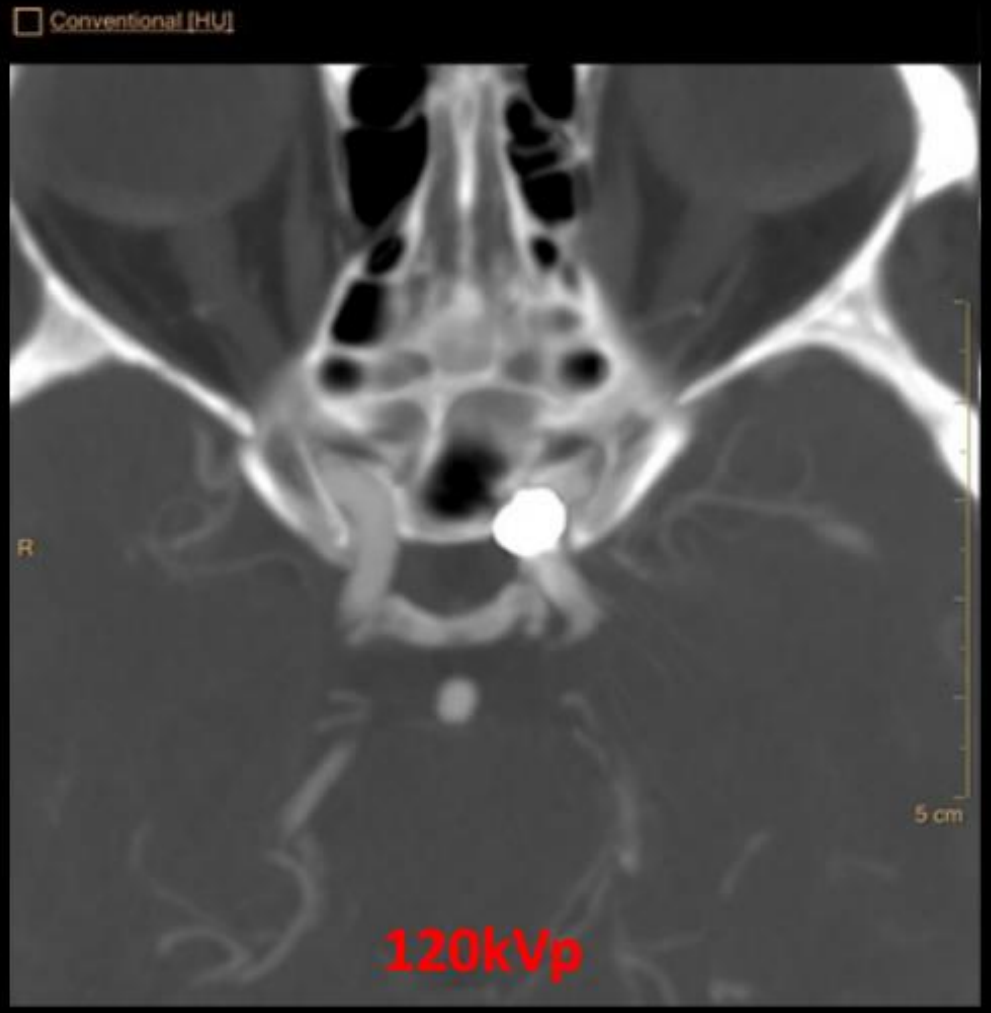
Spectral results of carotid CTA with calcium in the left carotid





Material decomposition and Calcium subtraction

Evaluation of vessels in the presence of embolization material



PHILIPS

Evaluation of vessels in the presence of embolization material

PHILIPS

Main benefits in neuro

- Plaque characterization
- Vessel delineation and calcium blooming reduciotn (all in one)
- Calcium removal
- Improved white-grey matter differentiation thanks to low keV images

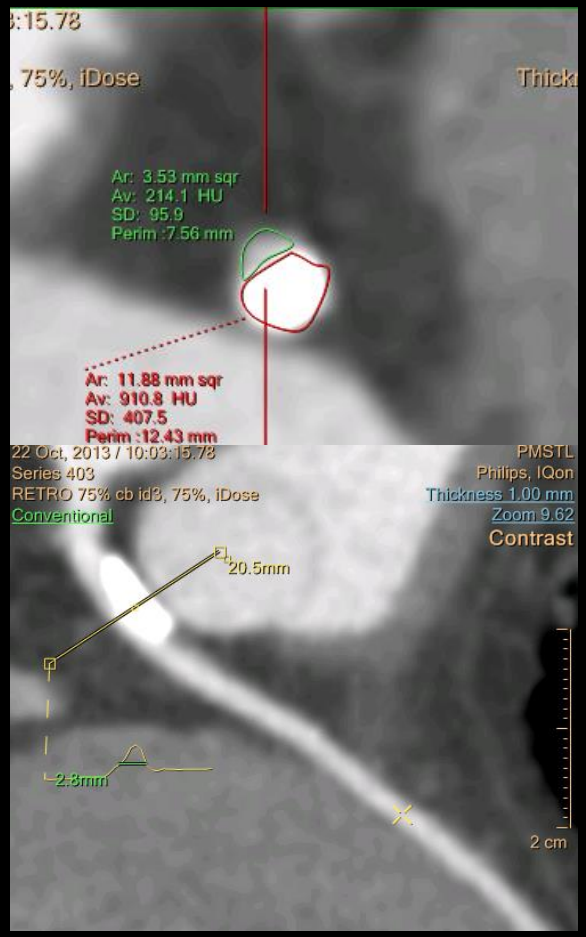
IQon in cardiac

Use in cardiac

- Plaque characterization
- Vessel delineation and calcium blooming reduciotn (all in one)
- Iodine concentration quantification
- Functional assessment of myocardium

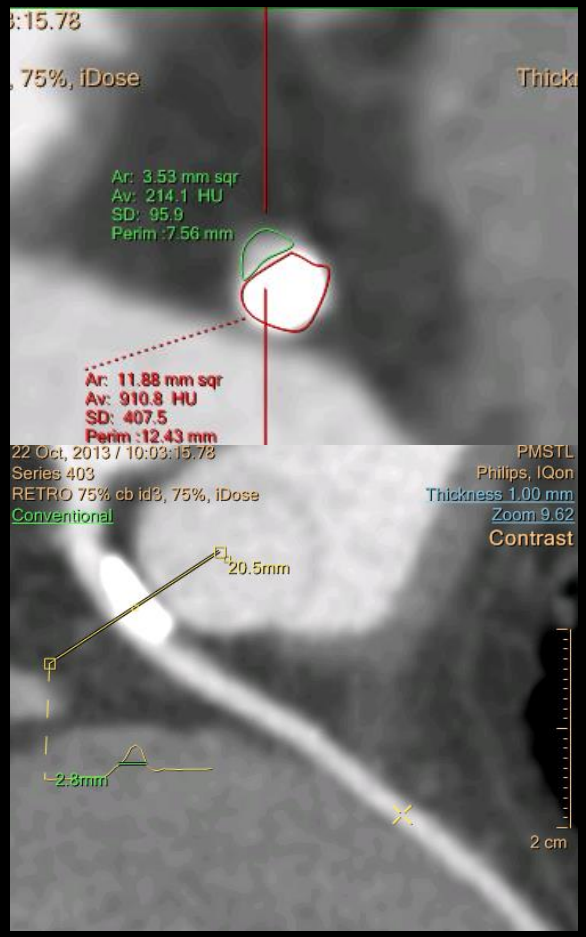
Confidence in coronary stenosis assessment
Reduced calcium blooming

120 kVp

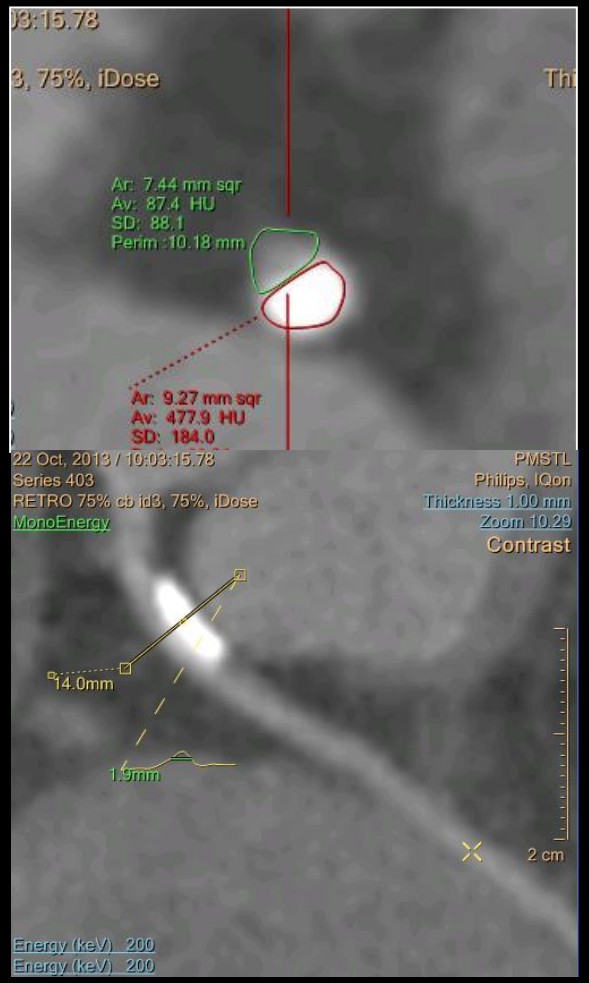


Confidence in coronary stenosis assessment
Reduced calcium blooming

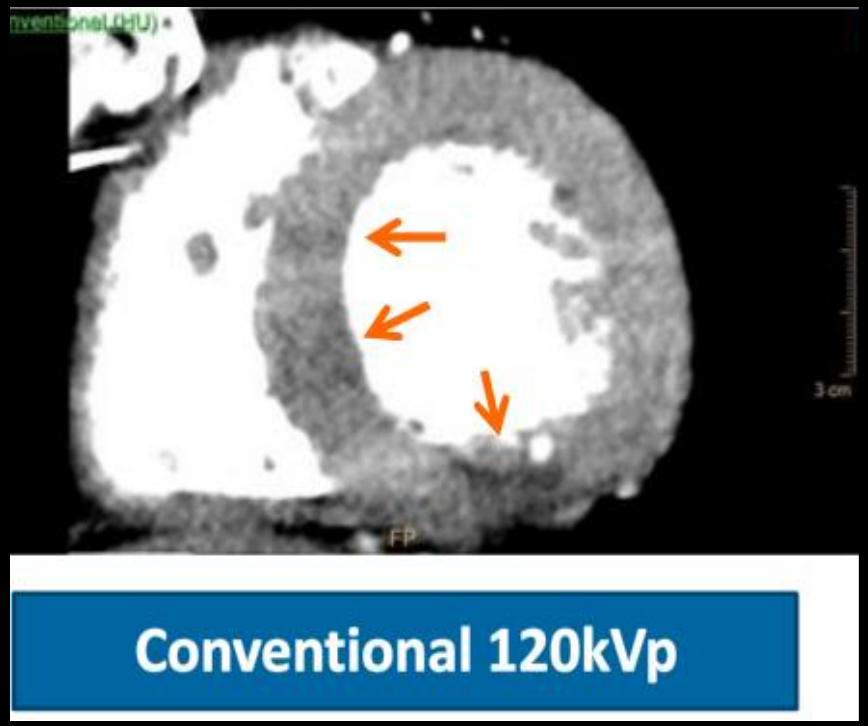
120 kVp



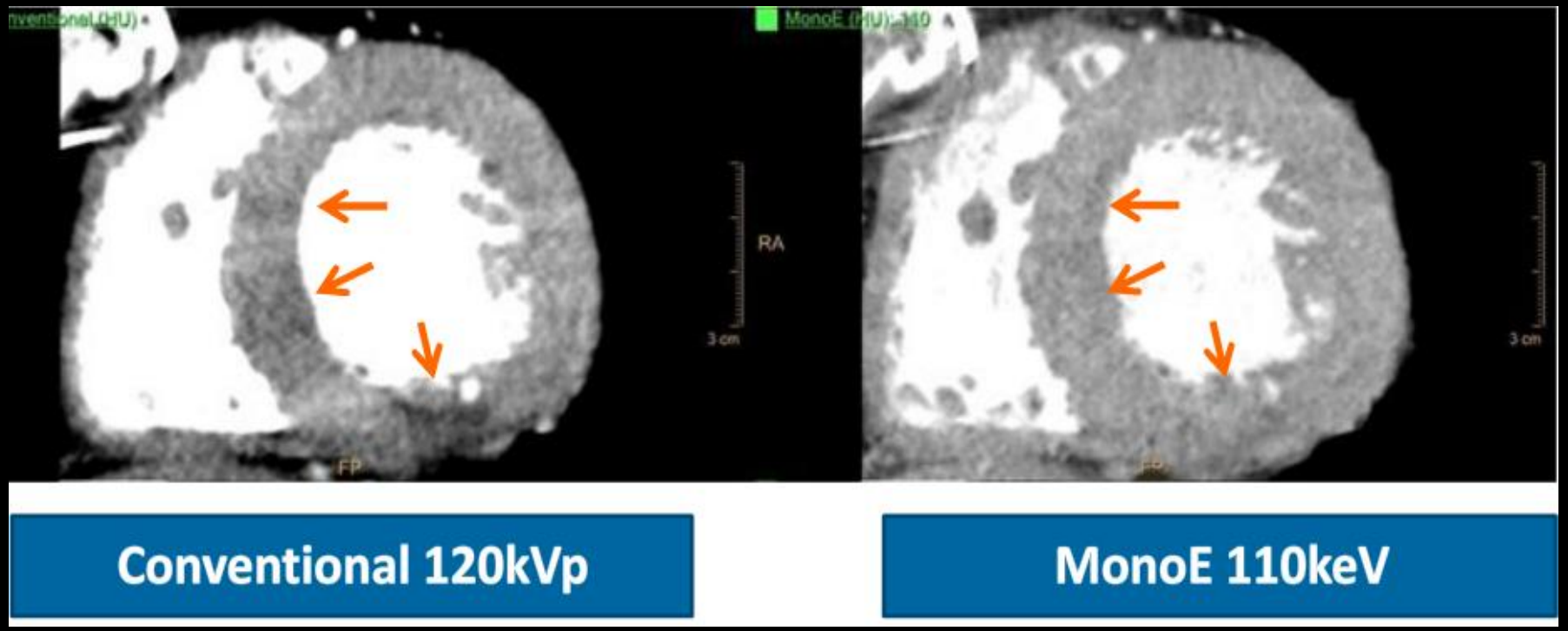
200 keV



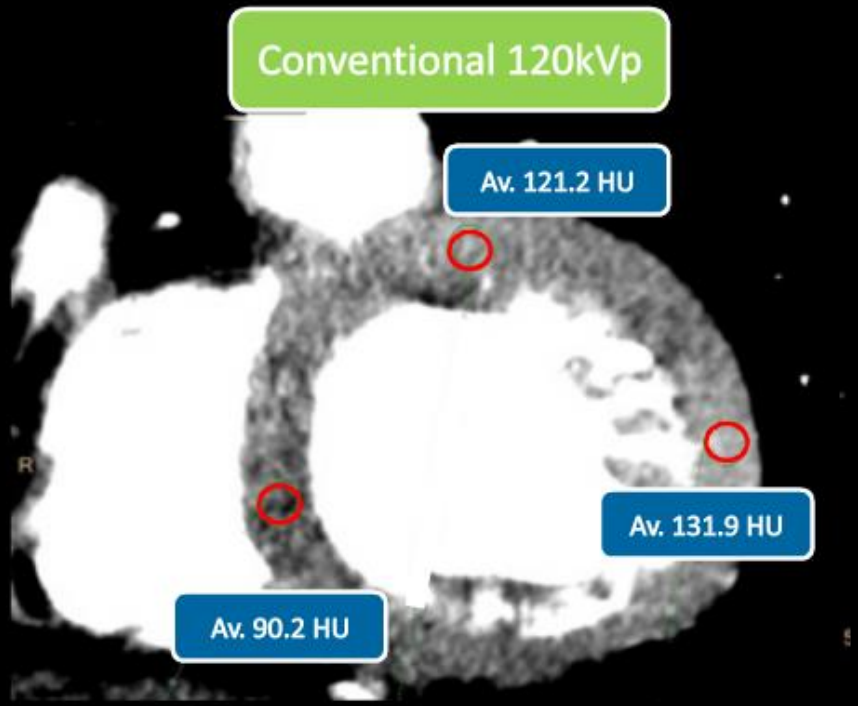
Myocardium artifacts that mimic low perfusion regions



Myocardium artifacts that mimic low perfusion regions

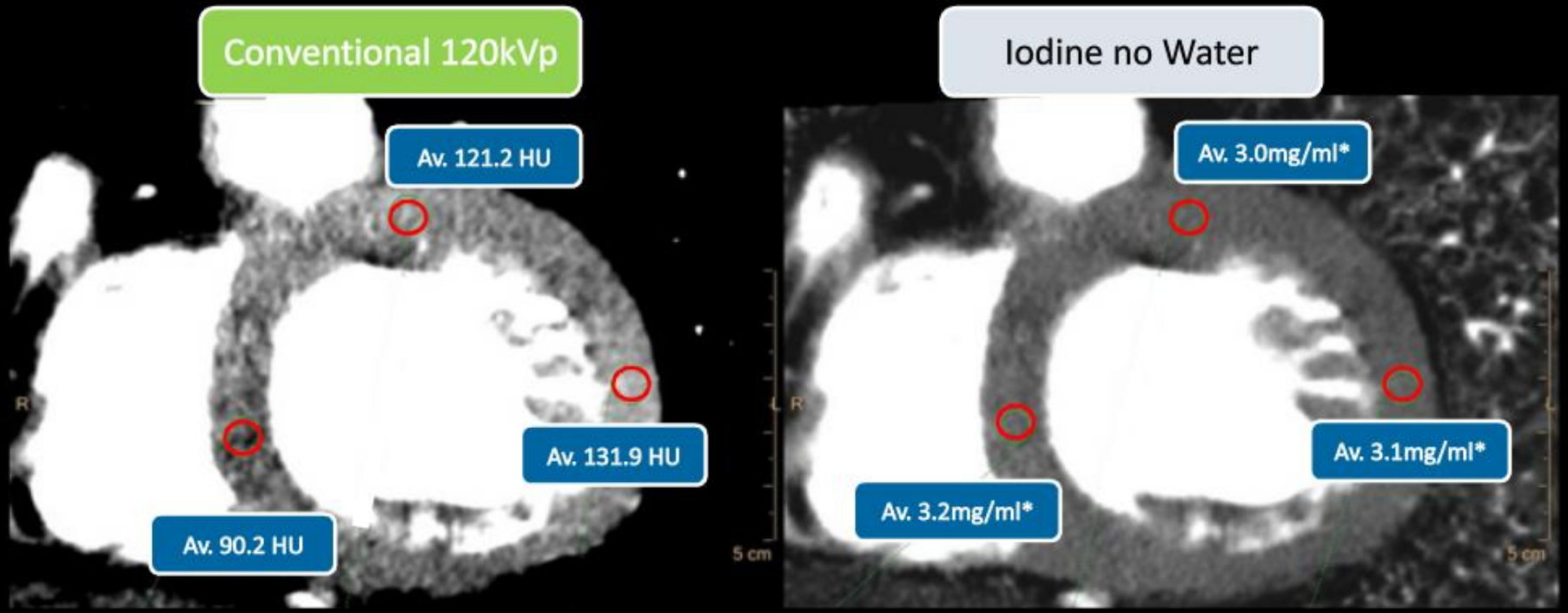


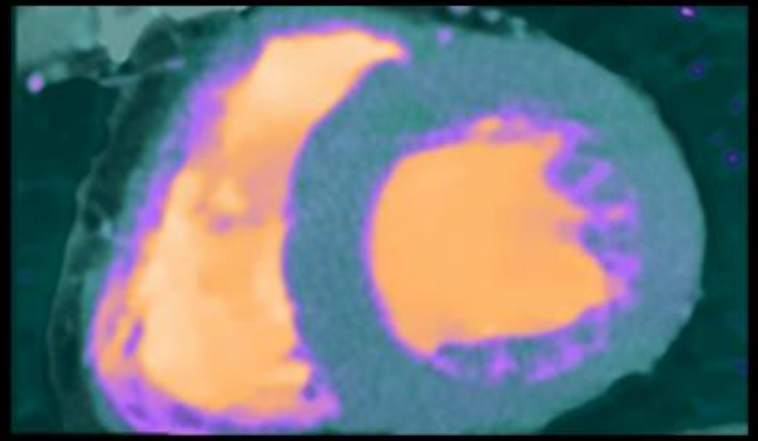
Myocardium artifacts that mimic low perfusion regions



PHILIPS

Myocardium artifacts that mimic low perfusion regions





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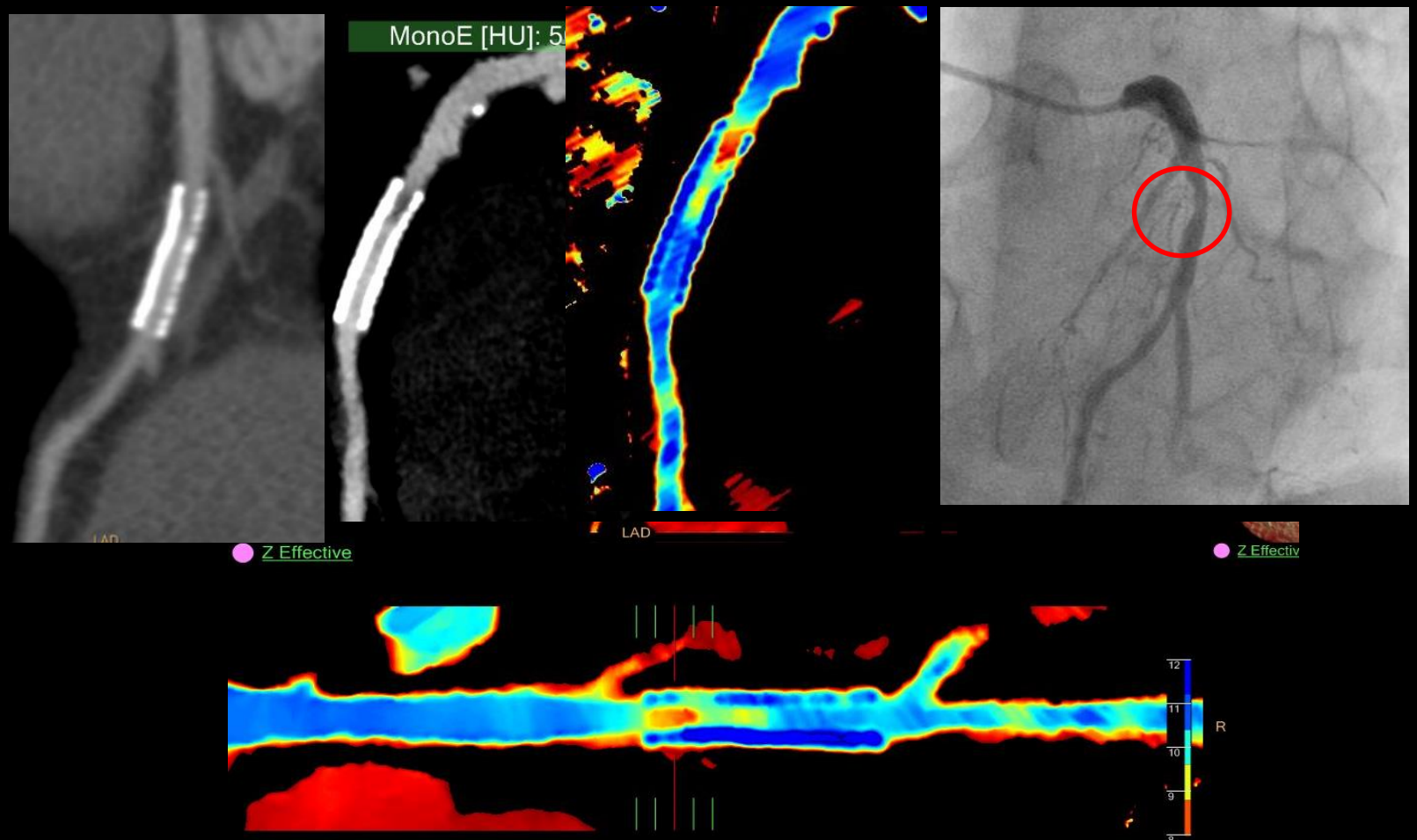


IQon Spectral CT retrospective gated cardiac CT

Benefit

Spectral based images were loaded into the Comprehensive Cardiac Application (CCA) allowing the physician to look at different spectral results and to evaluate the coronary artery segments .

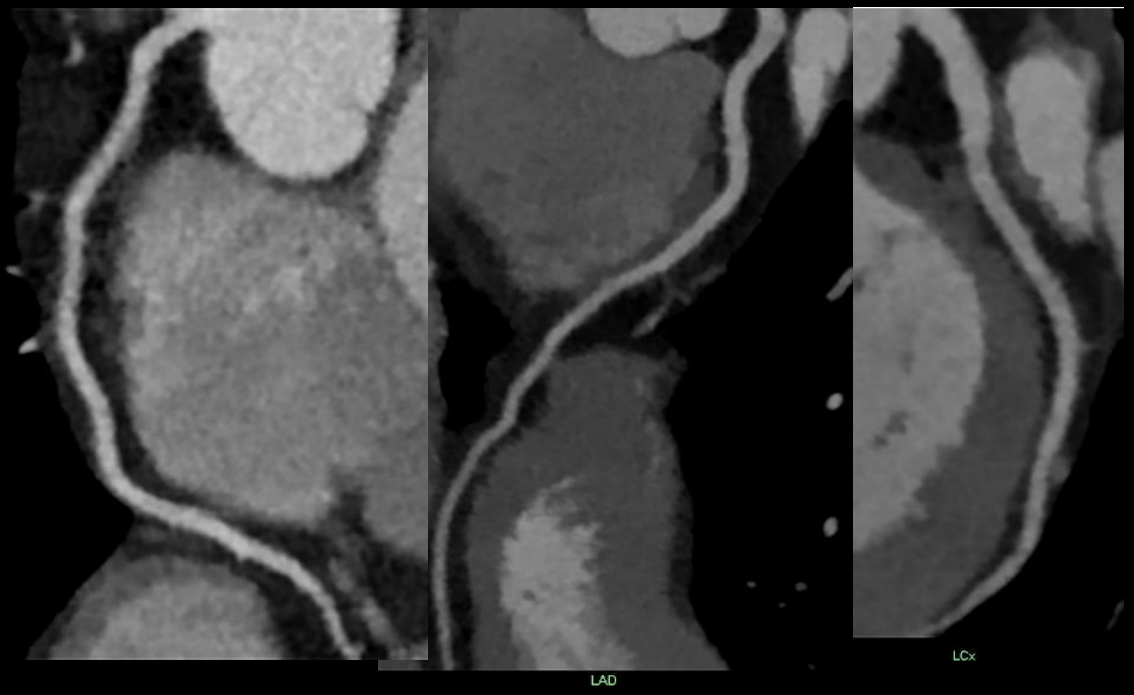
Case Summary

Curved multi-planar reformation (CMPR) images were generated for spectral results to evaluate the coronary stent in the proximal LAD. MonoE and Z effective reconstructions were used for evaluation. These results allowed the clinician to identify a blockage in the proximal stent graph which was confirmed with the angiography

C-MPR RCA

C-MPR LAD

C-MPR LCx



Images courtesy of University Medical Center LSU

IQon Spectral CT cardiac

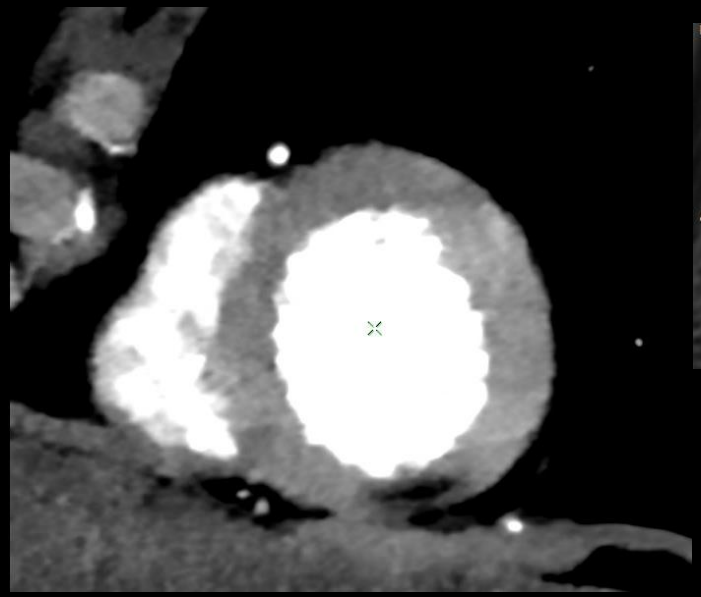
Benefit

Gated spectral cardiac capabilities allowed the physician to review the spectral cardiac anatomy immediately post scan.

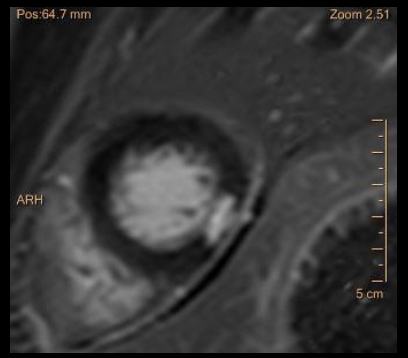
Case Summary

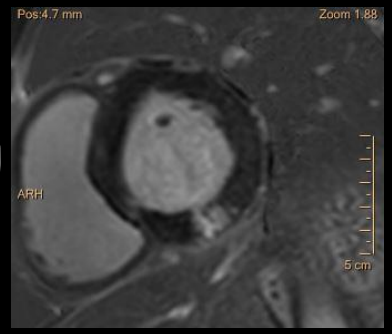
24 year old male admitted for atypical chest pain The EKG showed a suspected inferior wall infarction and his troponins were elevated. Due to his young age myocarditis was clinically entertained as a suspected diagnosis. A gated cardiac CTA scan was performed on the IQon Spectral CT that showed normal coronary arteries, but a suspicious area that was questionable for an infarct was identified in the inferior wall of the myocardium.

MRI



monoE 55 keV
Short Axis





Images courtesy of University Medical Center LSU

IQon Spectral CT cardiac

<u>Benefit</u>

Gated Spectral cardiac capabilities allowed the physician to review the spectral cardiac anatomy immediately post scan. The spectral Comprehensive Cardiac software allowed the ability to evaluate the short axis.

<u>Case Summary</u>

24 year old male admitted for atypical chest pain
The EKG showed a suspected inferior wall infarction and his troponins were elevated. Due to his young age myocarditis was clinically entertained as a suspected diagnosis. A gated cardiac CTA scan was performed on the IQon Spectral CT that showed normal coronary arteries, but a suspicious area that was questionable for an infarct was identified in the inferior wall of the myocardium.

Main benefits in cardiac

- Plaque characterization
- Vessel delineation and calcium blooming reduciotn (all in one)
- Iodine concentration quantification
- Functional assessment of myocardium


PHILIPS