



Přehled technických novinek z pohledu společnosti Philips

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Application CT & MRI CEE

*Clinical Science , Best, The Netherlands

November 2020, Kladno, Czech Republic



Přehled bodů

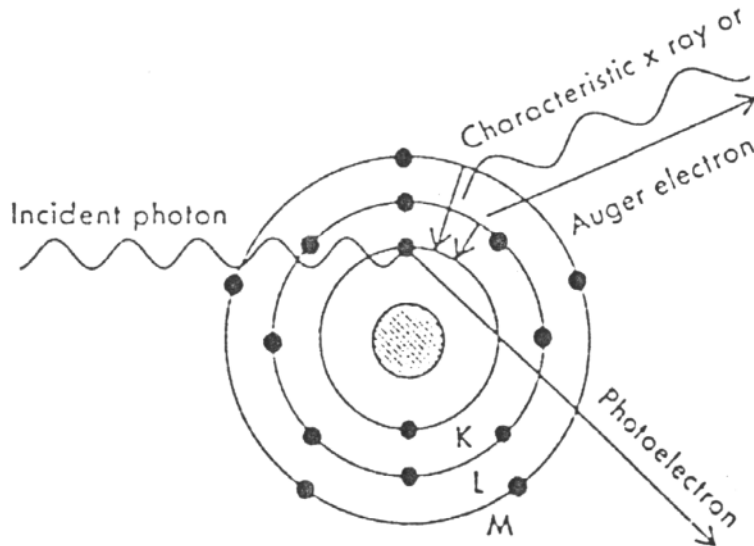
- Spektrální CT– cesta k inovaci + trochu teorie
- Klinicko- technické benefity spektrálního CT
- Klinické příklady aplikací spektrálního CT dle anatomie
- Jaké jsou možnosti dalších inovací
- ~~- Postprocessing /ISP~~
- ~~- AI v CT oblasti~~

Přehled bodů

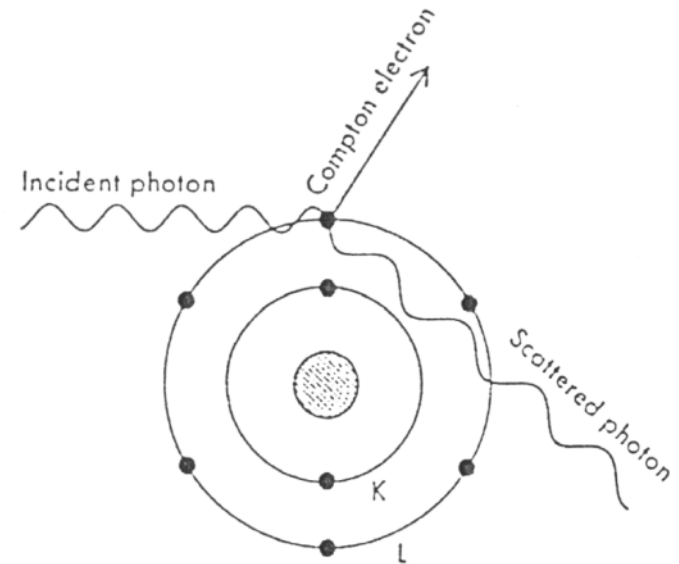
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X-Ray Attenuation

- At CT energies, linear attenuation μ is the result of 2 microscopic interactions between X-ray photons and tissue:
 - Photoelectric absorption (effect): μ_p
 - Compton scattering: μ_c



Photoelectric absorption



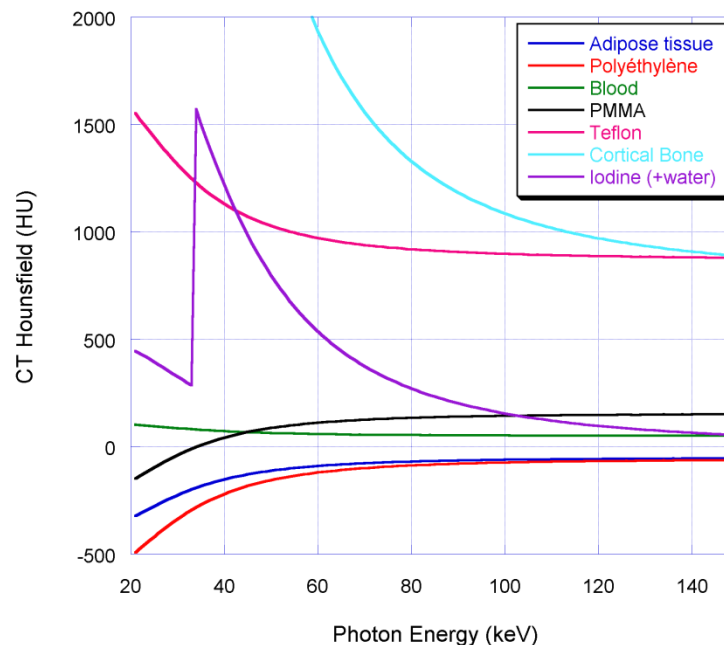
Compton scattering

$$\mu = \mu_p + \mu_c$$

X-Ray Attenuation

- X-ray attenuation depends on the incident X-ray energy and on the effective atomic number of the traversed tissue
- Different tissues exhibit different combinations of photoelectric absorption and Compton scattering

$$\mu(E) = \mu_p(E) + \mu_c(E) = \alpha_p f_p(E) + \alpha_c f_c(E)$$



X-Ray Attenuation

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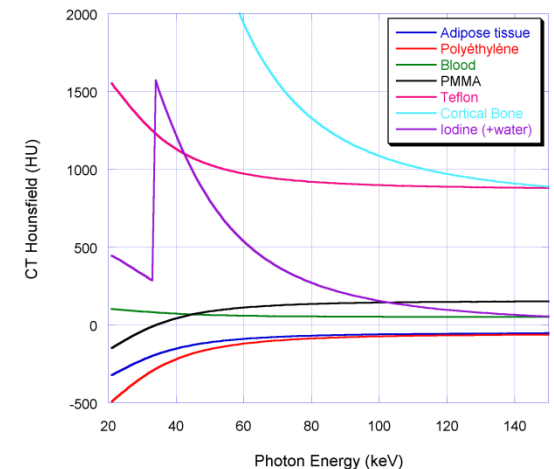
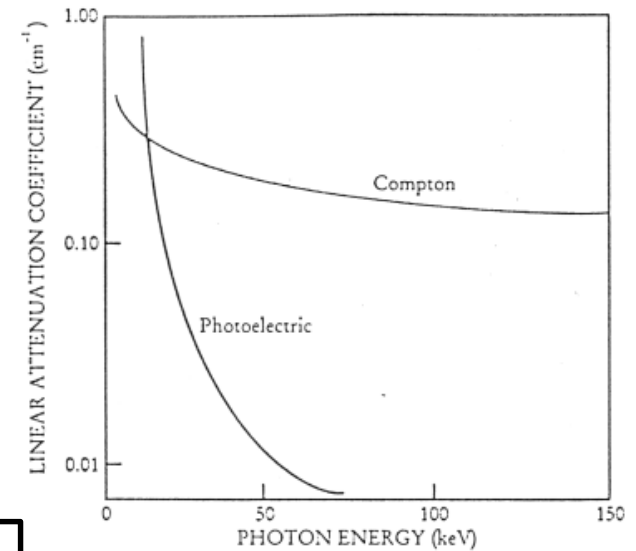
$$\mu(E) = \mu_p(E) + \mu_c(E) = \alpha_p f_p(E) + \alpha_c f_c(E)$$

(α_p, α_c) : characteristic of material/tissue

$$\begin{cases} \alpha_p \propto \rho Z_{eff}^{3.8} \\ \alpha_c \propto \rho Z_{eff} \end{cases}, \rho \text{ is the mass density}$$

(f_p, f_c) : independent of material, only dependent on energy *

$$\begin{cases} f_p(E) \propto 1/E^{3.2} \\ f_c(E) \text{ is the Klein-Nishina function: weakly dependent on energy } E \end{cases}$$



* Alvarez R.E. and Macovski A., Energy-Selective Reconstructions in X-ray Computerized Tomography, Phys.Med.Biol. 1976, 21(5), 733-744.

X-Ray Attenuation

- X-ray attenuation depends on the incident X-ray energy and on the effective atomic number of the traversed tissue

- The **atomic number Z** is the number of protons found in the nucleus of an atom. Example: Hydrogen Z=1, Oxygen Z=8
- The **effective atomic number Z_{eff}** is a term similar to the atomic number Z but is used for compounds

$$Z_{eff} = \sqrt[2.94]{f_1(Z_1)^{2.94} + f_2(Z_2)^{2.94} + f_3(Z_3)^{2.94} + \dots}$$

Where f_n is the fraction of the total number of electrons associated with each element and Z_n is the atomic number of each element

e.g. water $H_2O \rightarrow Z_{eff} = \sqrt[2.94]{0.2(1)^{2.94} + 0.8(8)^{2.94}} = 7.42$

	Z_{eff}
Gadolinium	64.0
Iodine	53.0
Calcium	20.0
Cortical Bone	13.23
Water	7.42
PMMA	6.52
Fat	5.92

Dual-Energy Acquisition

$$\begin{cases} \mu(E_L) = \alpha_P f_P(E_L) + \alpha_C f_C(E_L) \\ \mu(E_H) = \alpha_P f_P(E_H) + \alpha_C f_C(E_H) \end{cases}$$



Solve for α_P and α_C

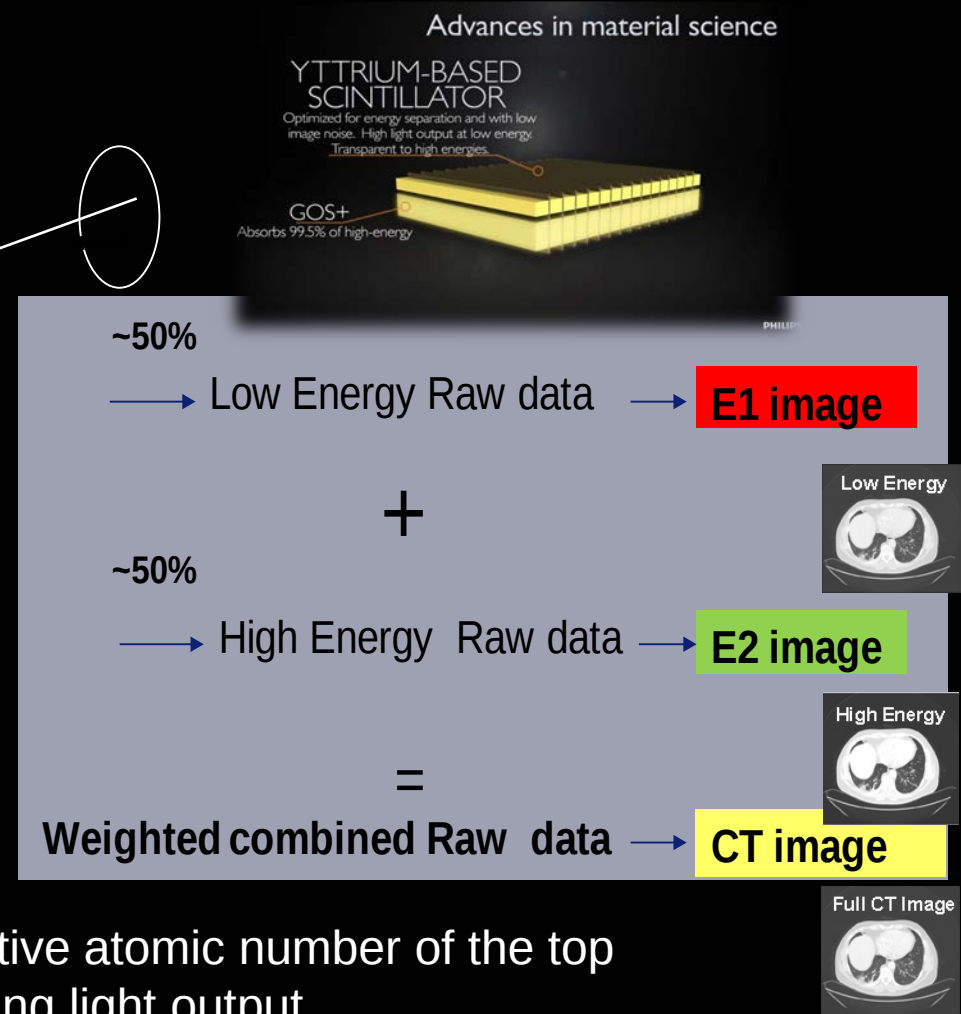
Different materials/tissues are characterized by their unique pair of attenuation parameters (α_P , α_C)

Different materials/tissues that may lay out same HU values in single acquisition CT can now be “characterized” using the dual-energy CT by measuring (α_P , α_C)

Polychromatic nature of the beam can be corrected in the calculation of α_P and α_C if the x-ray spectrum is known*

* Alvarez R.E. and Macovski A., Energy-Selective Reconstructions in X-ray Computerized Tomography, Phys.Med.Biol. 1976, 21(5), 733-744.

The dual layer Spectral Detector, Principle and Operation

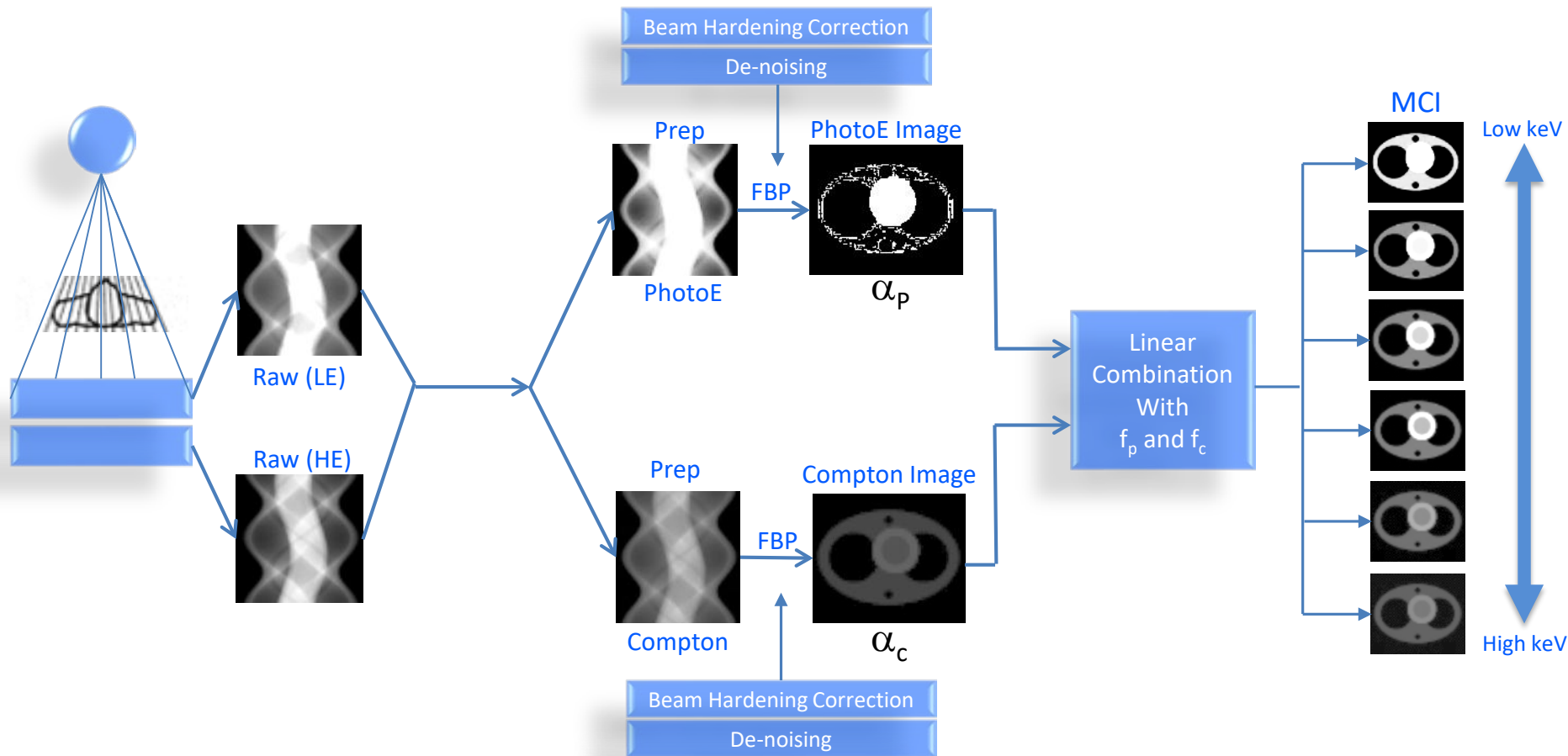


1. For optimal performance the effective atomic number of the top scintillator is small without sacrificing light output .
2. Top Scintillator thickness has been optimized for best energy separation and low-energy image noise
3. Bottom scintillator is GOS, the thickness of which set to absorb 99.5% of the High-Energy spectrum (note that light collection is sideways)

Photoelectric - Compton Decomposition

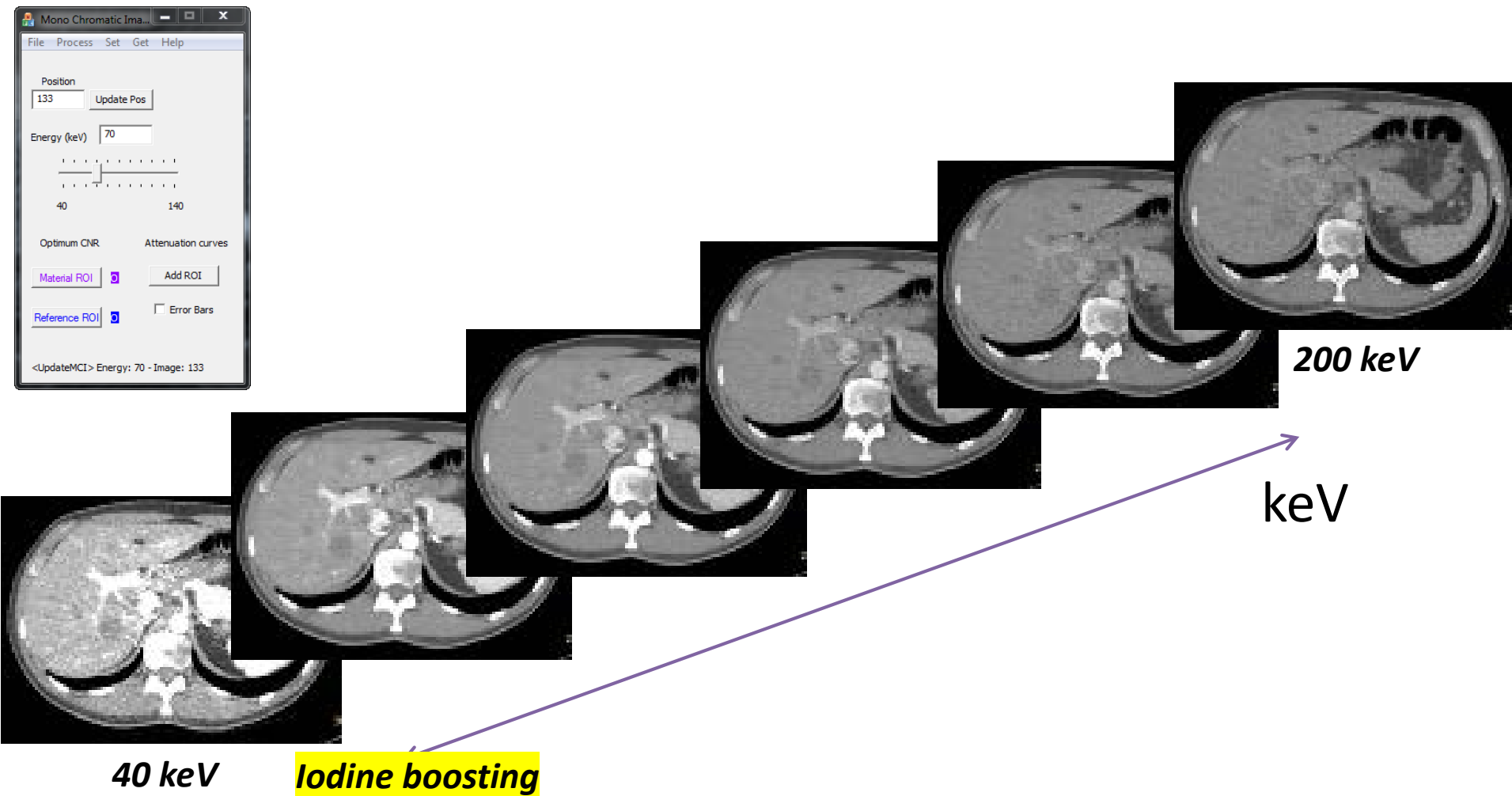
Virtual Mono Energetic Imaging

$$\mu(E) = \mu_p(E) + \mu_c(E) = \alpha_p f_p(E) + \alpha_c f_c(E)$$



Photoelectric - Compton Decomposition

Virtual Mono Energetic Imaging



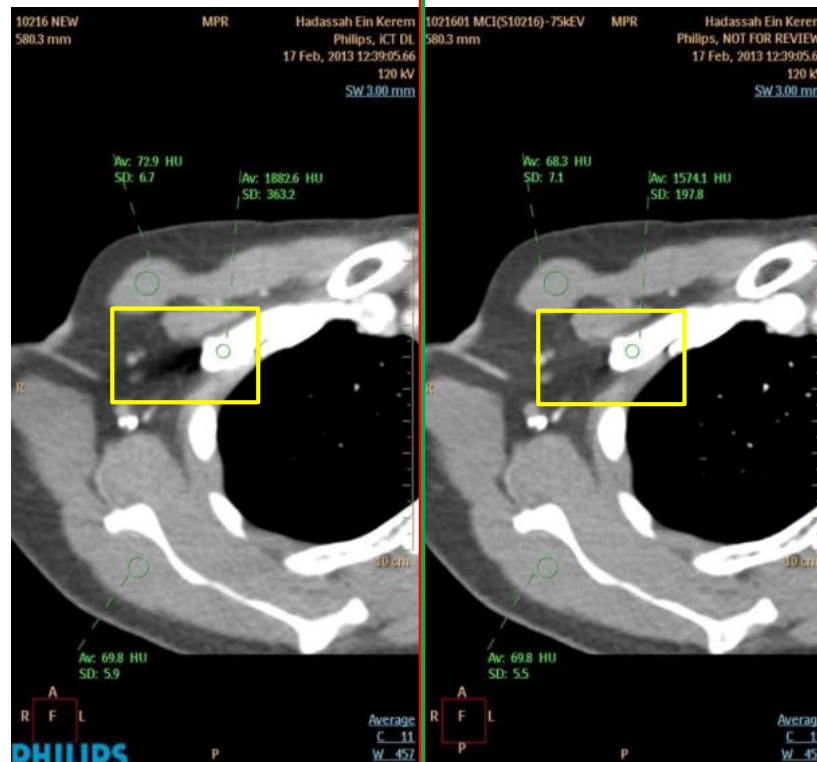
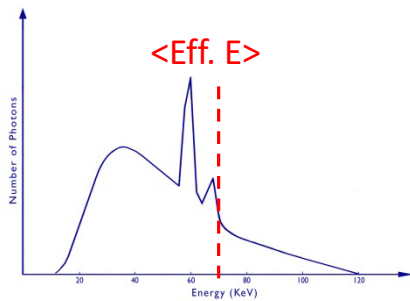
Photoelectric - Compton Decomposition

Virtual Mono Energetic Imaging

Spectrally Enhanced Routine CT Imaging

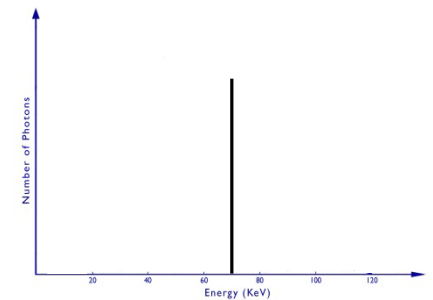
Conventional CT Image

Conventional 120 kV CT Image



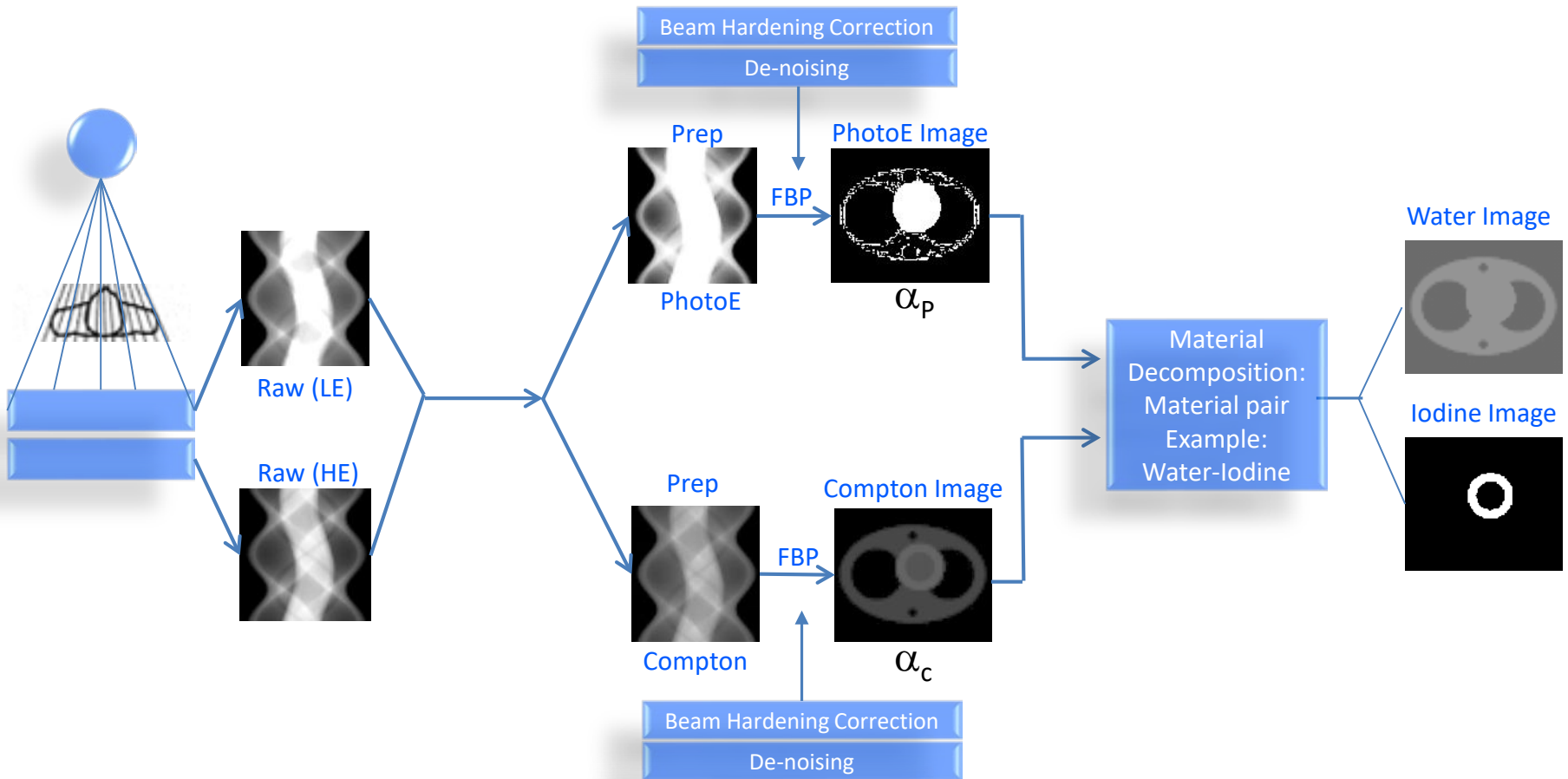
kVp Equivalent Mono-Energy Image

Virtual Mono-Energy CT Image

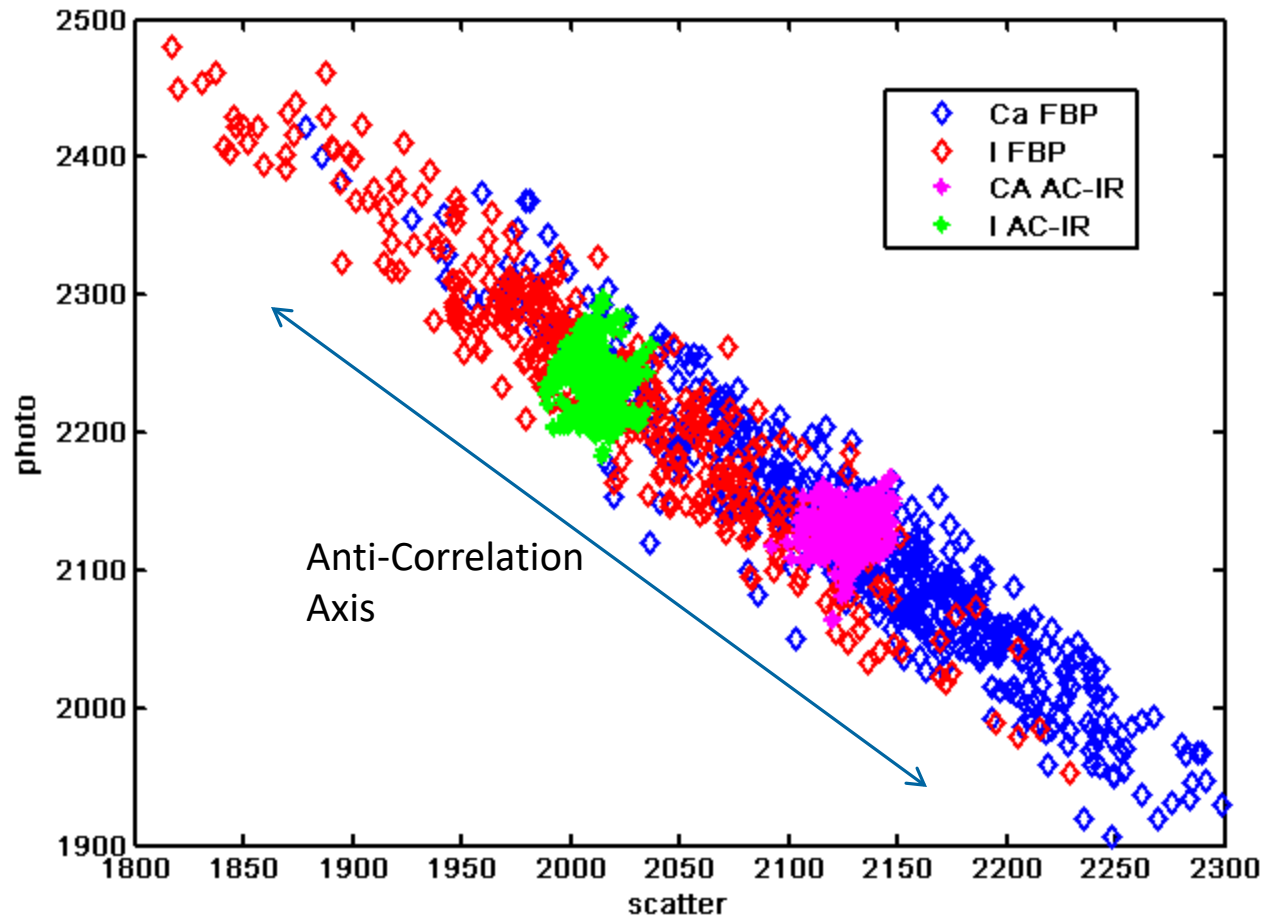


Photoelectric - Compton Decomposition

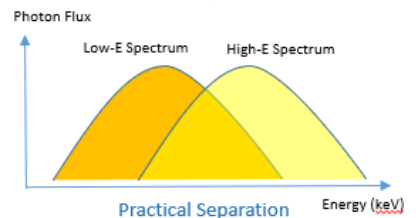
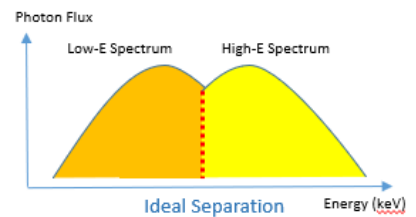
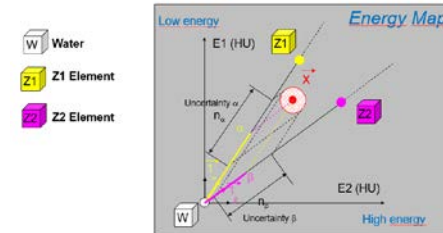
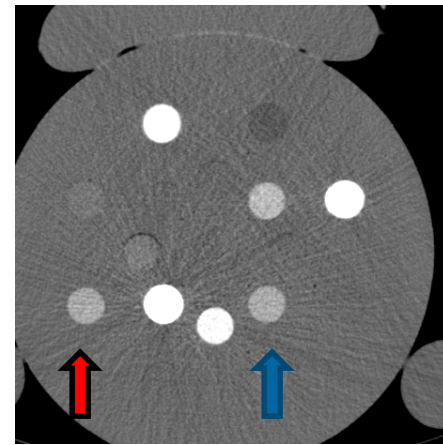
Material Specific Imaging



Spectral Separation



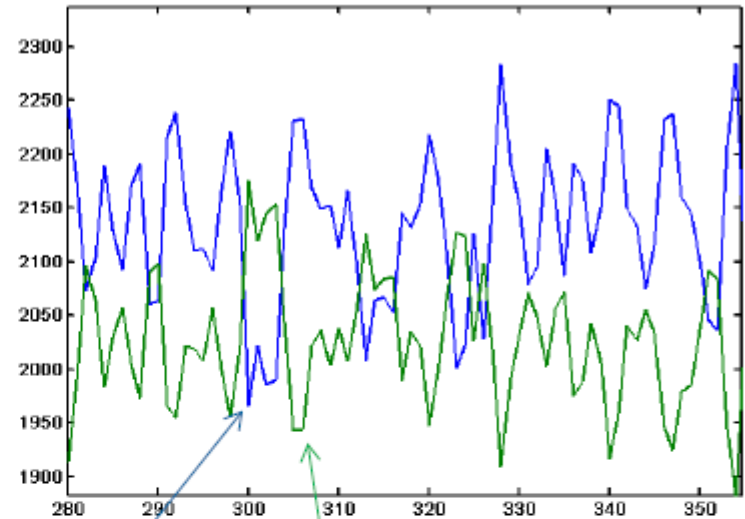
7.5 mg/ml iodine, 50 mg/ml calcium



PHILIPS

Anti-Correlated Noise

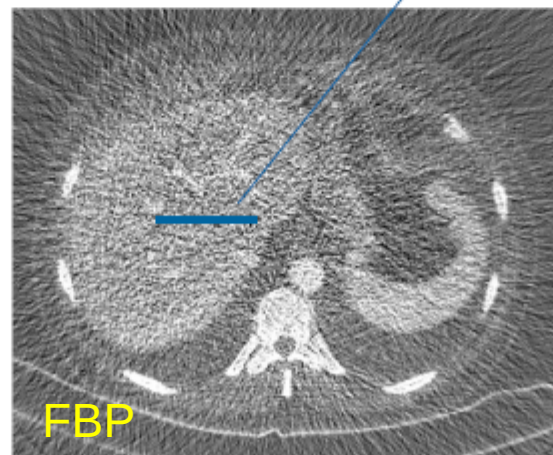
- All decomposition functions amplify the noise in the basis coefficient images.
- This noise has the special property of being “anti-correlated” between the two basis images.



Conventional



$\alpha_p(x,y)$

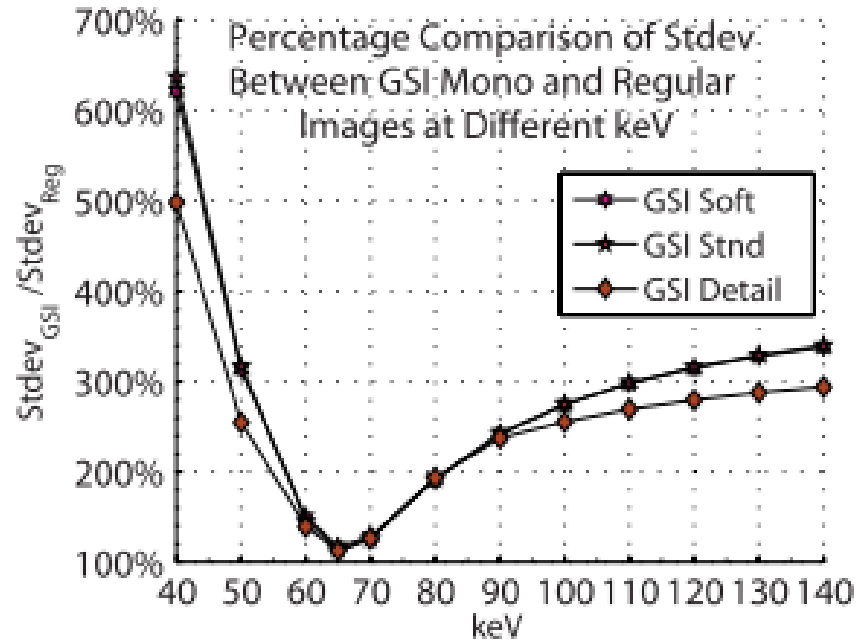


FBP

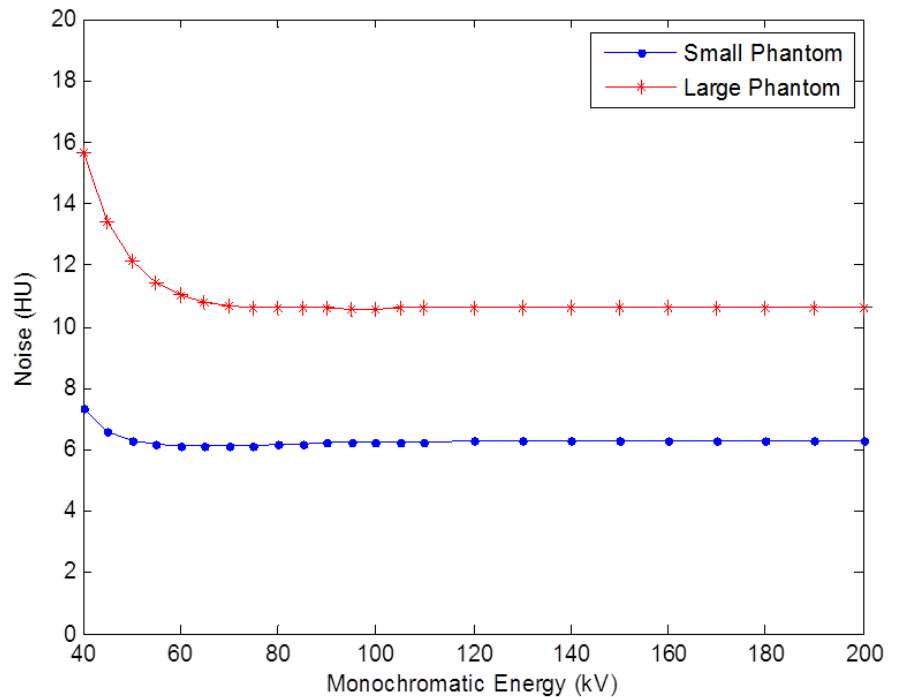
$\alpha_c(x,y)$



Mono-Chromatic Images



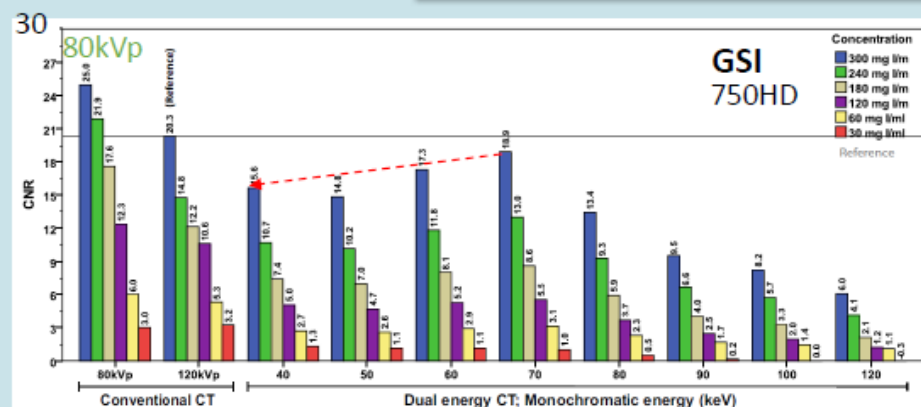
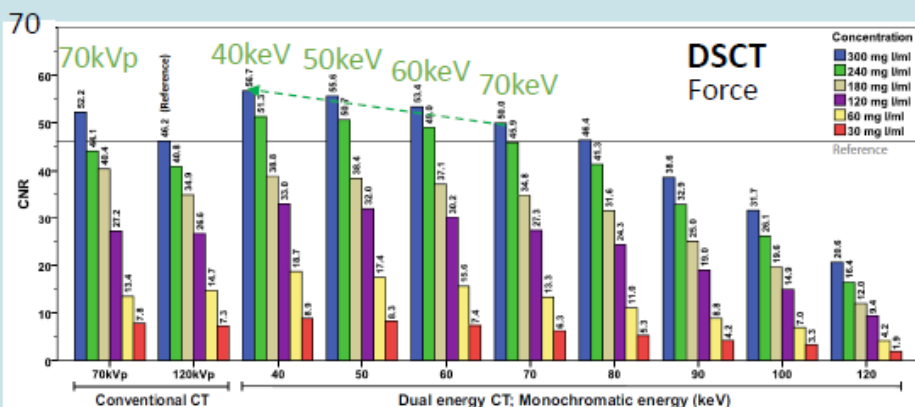
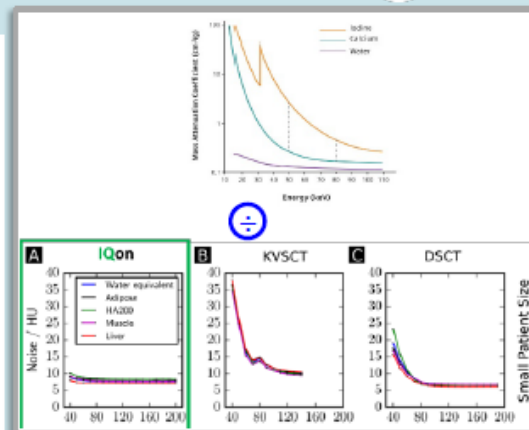
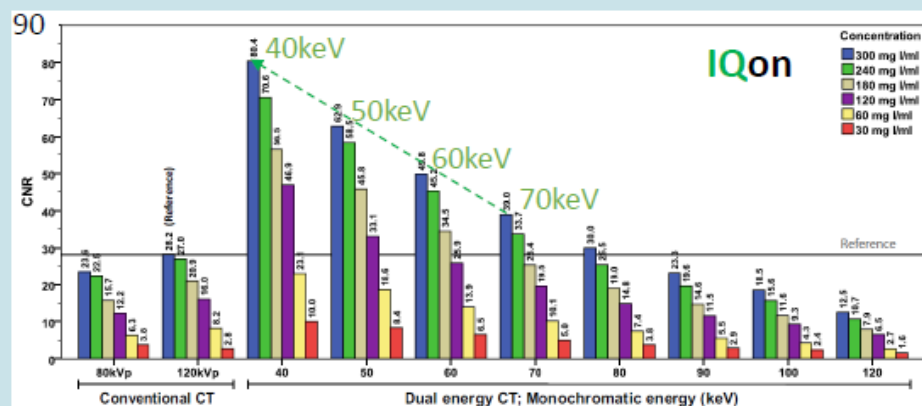
AC-IR Images



** Zhang, et. al., *Medical Physics*, 38(3), 2011

... Virtual monoenergetic images - CNR

IQon low noise MonoE images translate the benefit of strong contrast increase at low energy in strong CNR increase.



Contrast agent concentration optimization in CTA using low tube voltage and dual-energy CT in multiple vendors: a phantom study. R. van Hamersvelt et al., The International Journal of Cardiovascular Imaging, 2018. <https://doi.org/10.1007/s10554-018-1329-x>

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

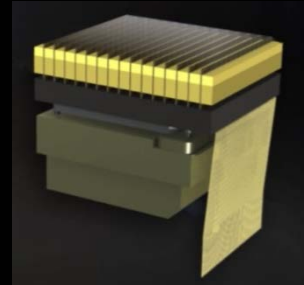
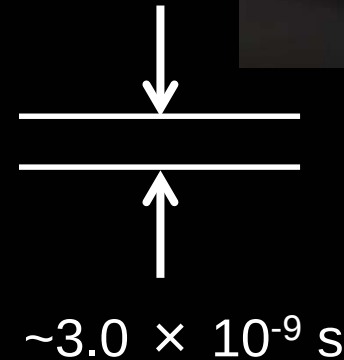
Přehled bodů

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1

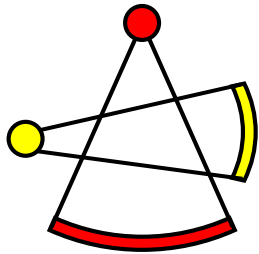
Simultaneous Spectral Detection



- Slower, source-based dual-energy methods:
 - May have temporal spectral sampling differences of up to **70 ms**, or more
 - May result in vascular movement of up to **4 mm** & quantification errors
- Simultaneous detection
 - Temporal spectral sampling differences reduced to effectively zero
 - No rotation-time limitations (0.27 s)

IQon Spectral CT – comparison

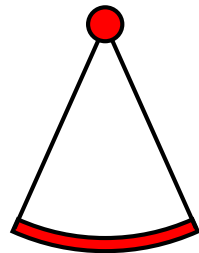
Technology Paths to Dual-Energy Acquisition



Dual Source

Spectral mode:
needs to be **pre-selected**
2 tubes (80 Or 100/140 kVp
70/150kVp)

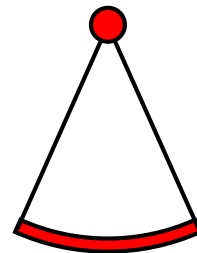
Limited FOV
Limited temporal resolution
BARIATRIC limited



kV/filter Switch

Spectral mode:
needs to be **pre-selected**
Fast kV switching:
80/140kVp, similar to
Filter changing approach.

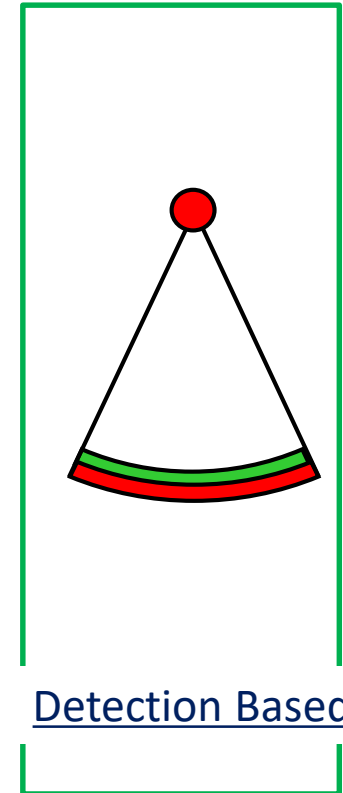
Limited resolution
Tube lasting
BARIATRIC limited



Dual Spin

Spectral mode:
needs to be **pre-selected**
1st spin @ 80kVp
2nd spin @ 140kVp

Slow temporal resolution
High advanced registration
Processes needed
No contrast studies



Detection Based

SPECTRAL ALWAYS ON

Scan @120 kVp
Tube mA modulation
Dose Neutral

2

Spectral information for every patient with no prior selection before scanning

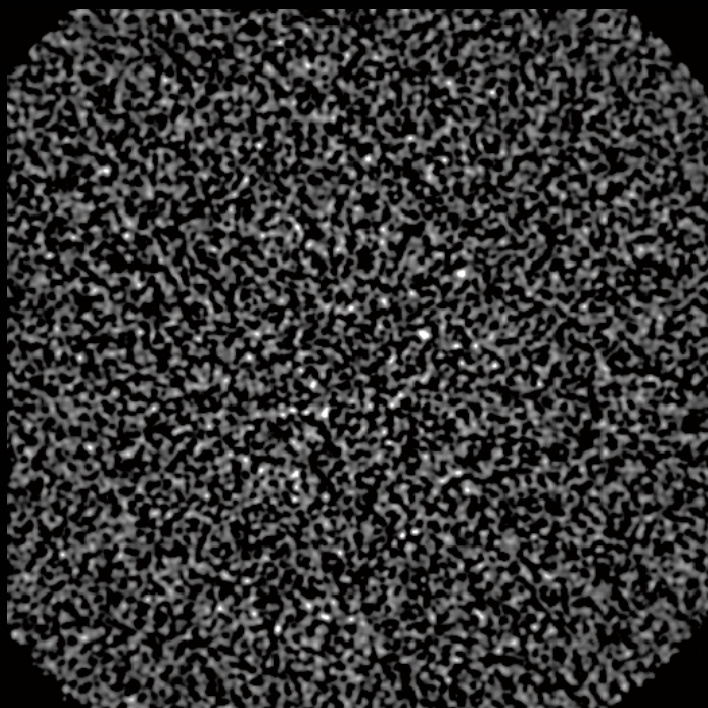
Clinical Impact of Retrospective SDCT Analysis

- Spectral information has affected diagnosis in 44% of cases
- Multi-Energy CT was *not indicated* a priori for 31% of cases
- Retrospective Spectral Analysis aided diagnosis in those 31%

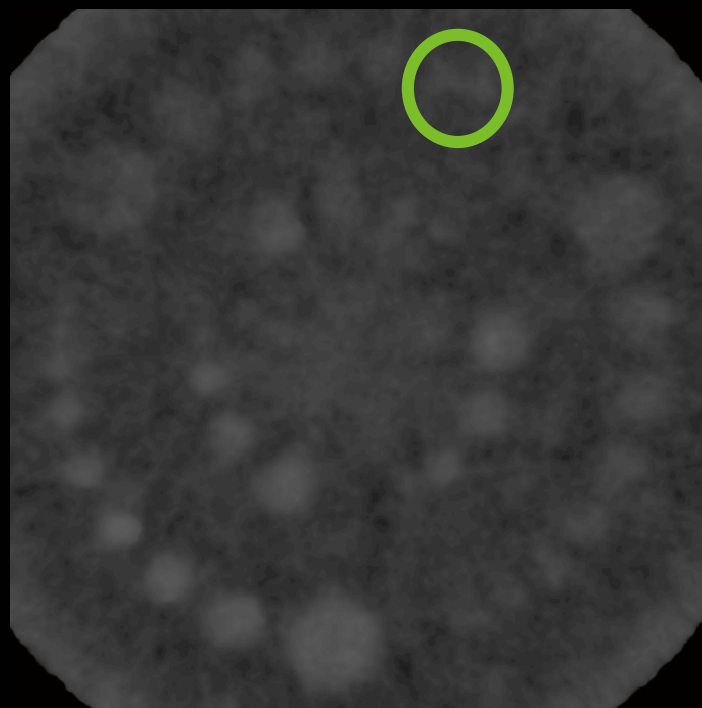
Embedding of model-based IR – the only one working in triggered scanning – extra low dose

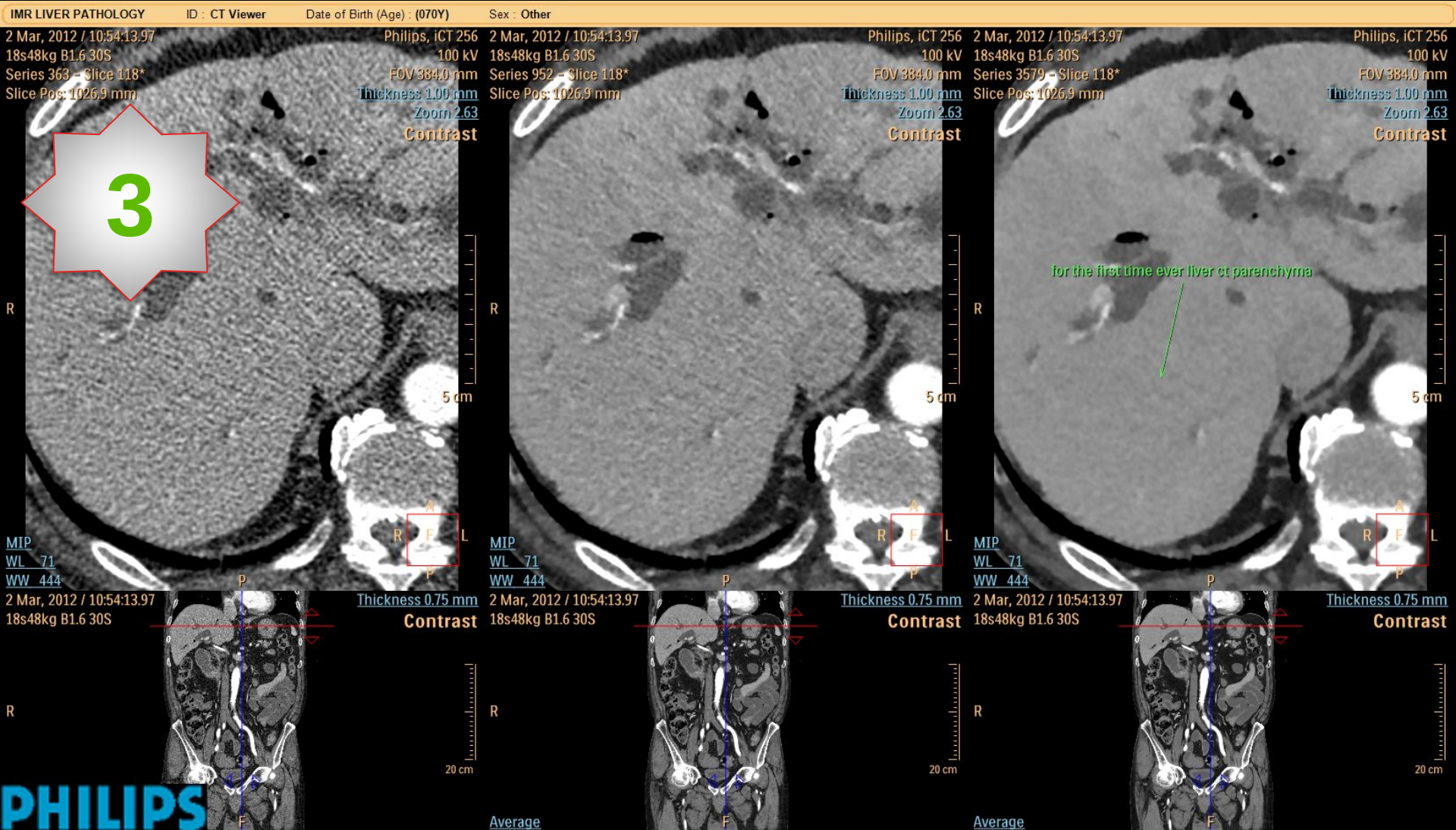
1 mm Slice Thickness,

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



Standard Reconstruction
(FBP)





Pancreas tu – first ever real liver parenchyma

Courtesy: Amahusa Med.Cent, USA

S&S in morbidly obese female
Max tube settings 120kV, 300mAs

3

14 Sep, 2013 / 10:54:13.97
Idose-Level4_0.80x0.40_224_78%
Series 70446

SE KARDIOLOGIAT KOZP
Philips, ICT 256
Thickness 0.00 mm
Zoom 1.00
Contrast

WL 508
WW 1618

outward remod

outward rem
with confic
AND..q

14 Sep, 2013 / 10:54:13.97
IMR_L2_Cardiac_Routine-R10s_0.80x0
Series 73575

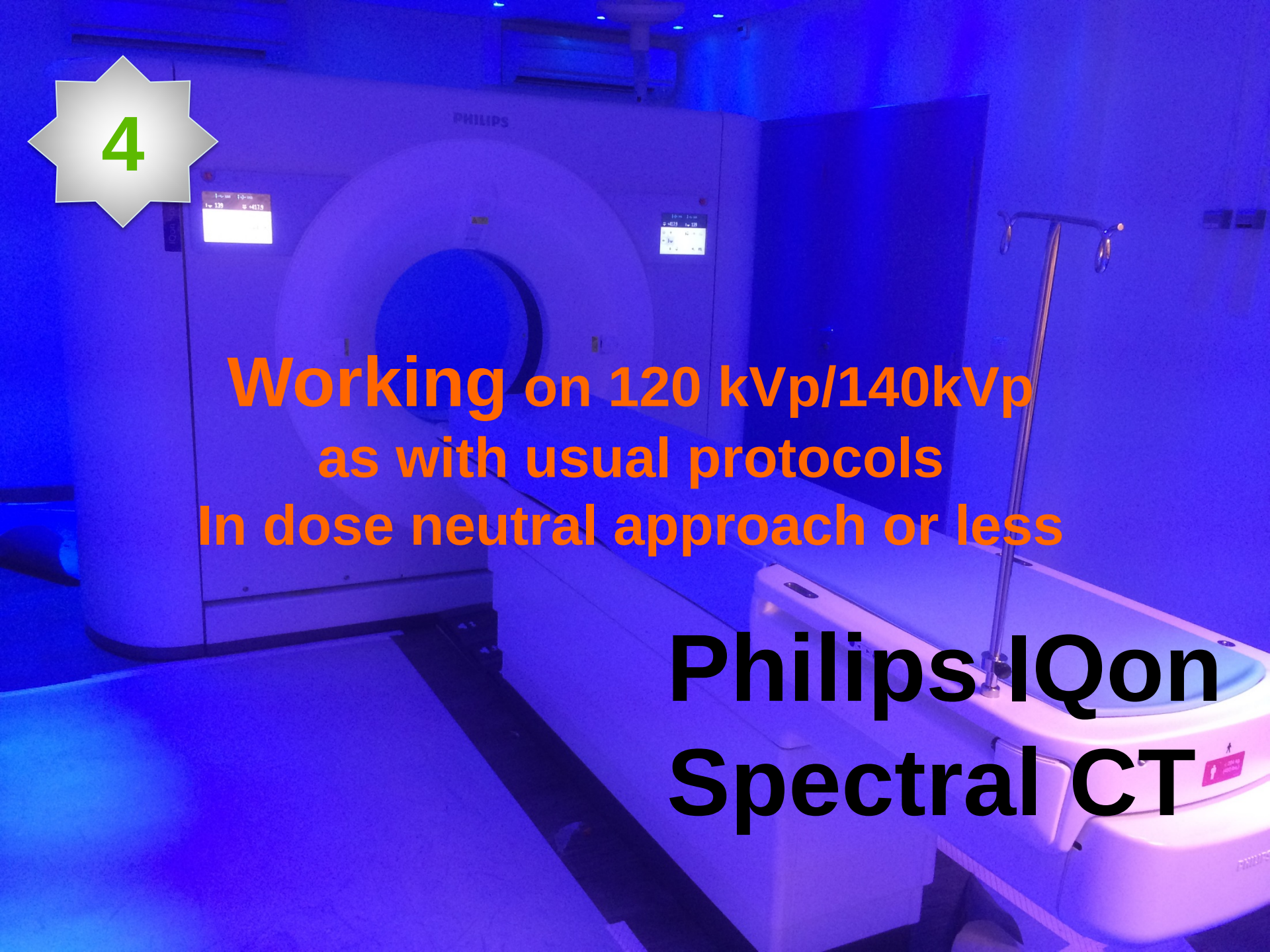
WL 376
WW 1000

Plaque distal LM??

5 cm

5 cm

IMR is superior to iDose in NC Plaque detection / delineation.



4

**Working on 120 kVp/140kVp
as with usual protocols
In dose neutral approach or less**

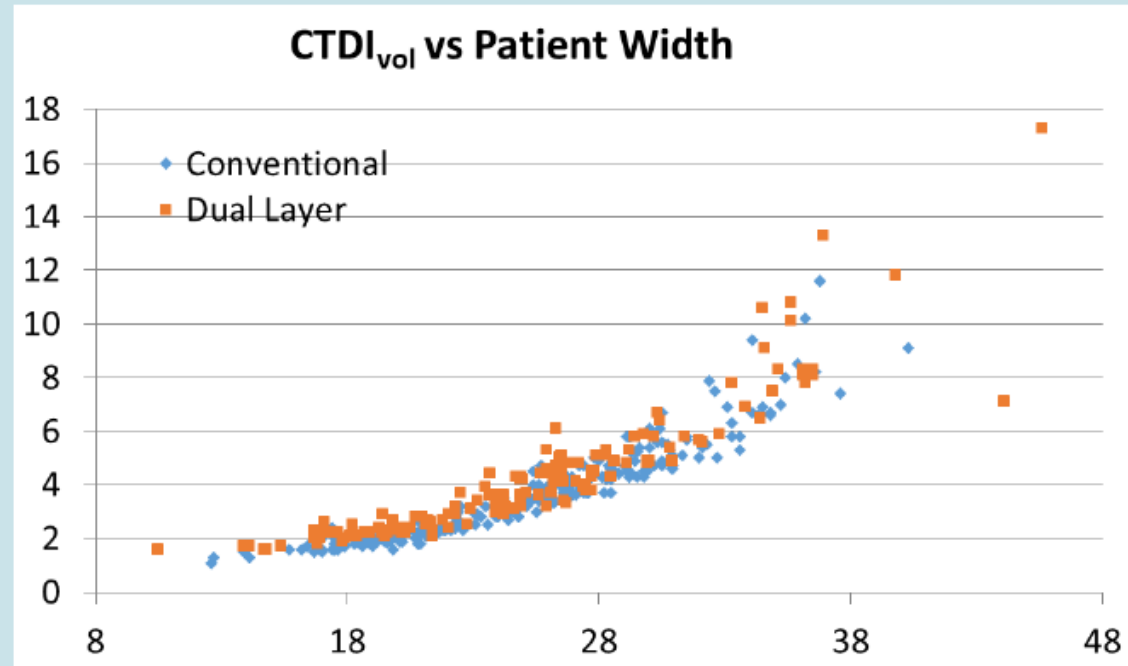
**Philips IQon
Spectral CT**

IQon scans are dose neutral



Dose Comparison Study

- scanned on conventional scanner (iCT 256) versus IQon.
- Identical protocols on two scanners, except weight based kVp adjustment and 80 mm collimation used on iCT256.
- **Measured dose differences between 18.3% and -22.0%**



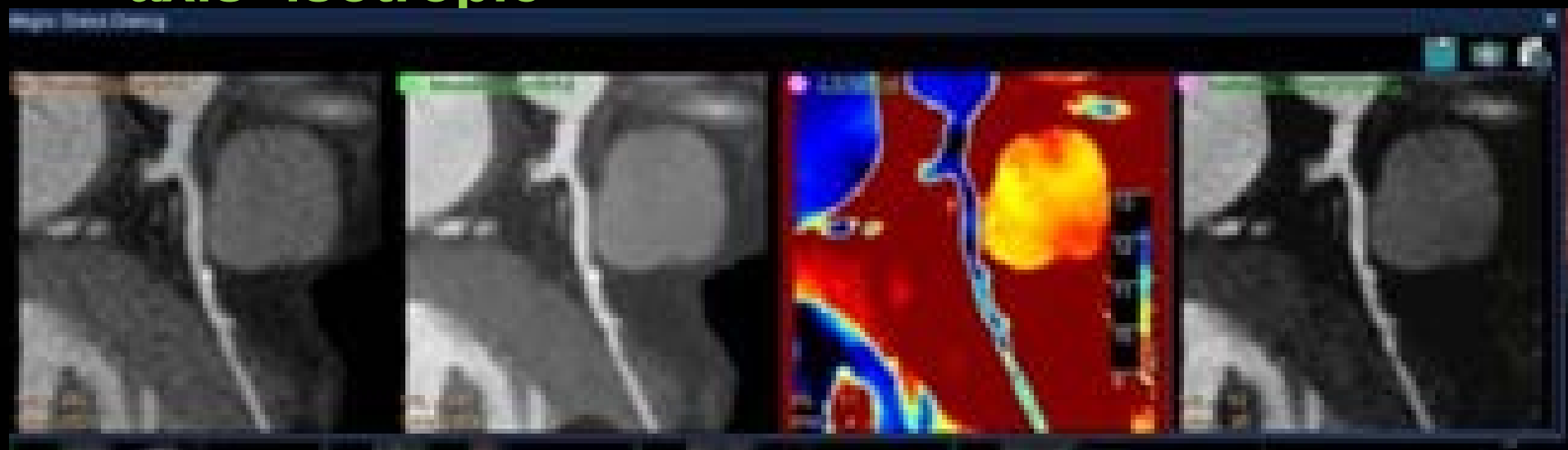
Phantom Studies Show Dose and Image Quality Equity in Pediatric Clinical Body and Brain CT Protocols for Multi-Energy Spectral CT (MECT) and 256 row Multi-Detector CT (MDCT), Dianna M. E. Bardo, MD, Richard N. Southard, MD, Robyn Augustyn, RT (CT), Marrit Thorkelson, RT (MR), Nicholas Rubert, PhD., Presented at the 60th Annual Meeting of the AAPM

Courtesy of: Phoenix Children's Hospital, Phoenix, Arizona, USA

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Smallest Isotropical Spectral Voxel

- Full FOV spectral CT
- No time space in acquiring of voxels
- No spatial resolution compromise in either voxel axis- isotropic



Spectral post processing+ storage- same type of SW

6

Top Viewport: MonoE 49keV [HU]

- 27 Feb, 2014 / 21:28:06.49
- MonoE49keV , Meq
- Series 30297 - Slice 106*
- Slice Pos: 64.9 mm
- Spectral (3)
- Philips, IQon - Spectral CT
- 120 kV
- FOV 345.0 mm
- Thickness 3.00 mm
- Zoom 1.63
- Contrast
- Finding Name : L1
- Volume : 11,101 cm³
- Avg : 237 HU

Bottom Viewport: Iodine no Water [mg/ml*]

- 27 Feb, 2014 / 21:28:06.49
- Iodine no Water [mg/ml*] , Meq
- Series 30297 - Slice 106*
- Slice Pos: 64.9 mm
- Spectral (3)
- Philips, IQon - Spectral CT
- 120 kV
- FOV 345.0 mm
- Thickness 3.00 mm
- Zoom 1.63
- Contrast
- Finding Name : L1
- Volume : 11,101 cm³
- Avg : 3.6 mg/ml*

Left Panel: Findings

- Target Lesions
- Non-target Lesions
- L1 Undefined (1) ✓

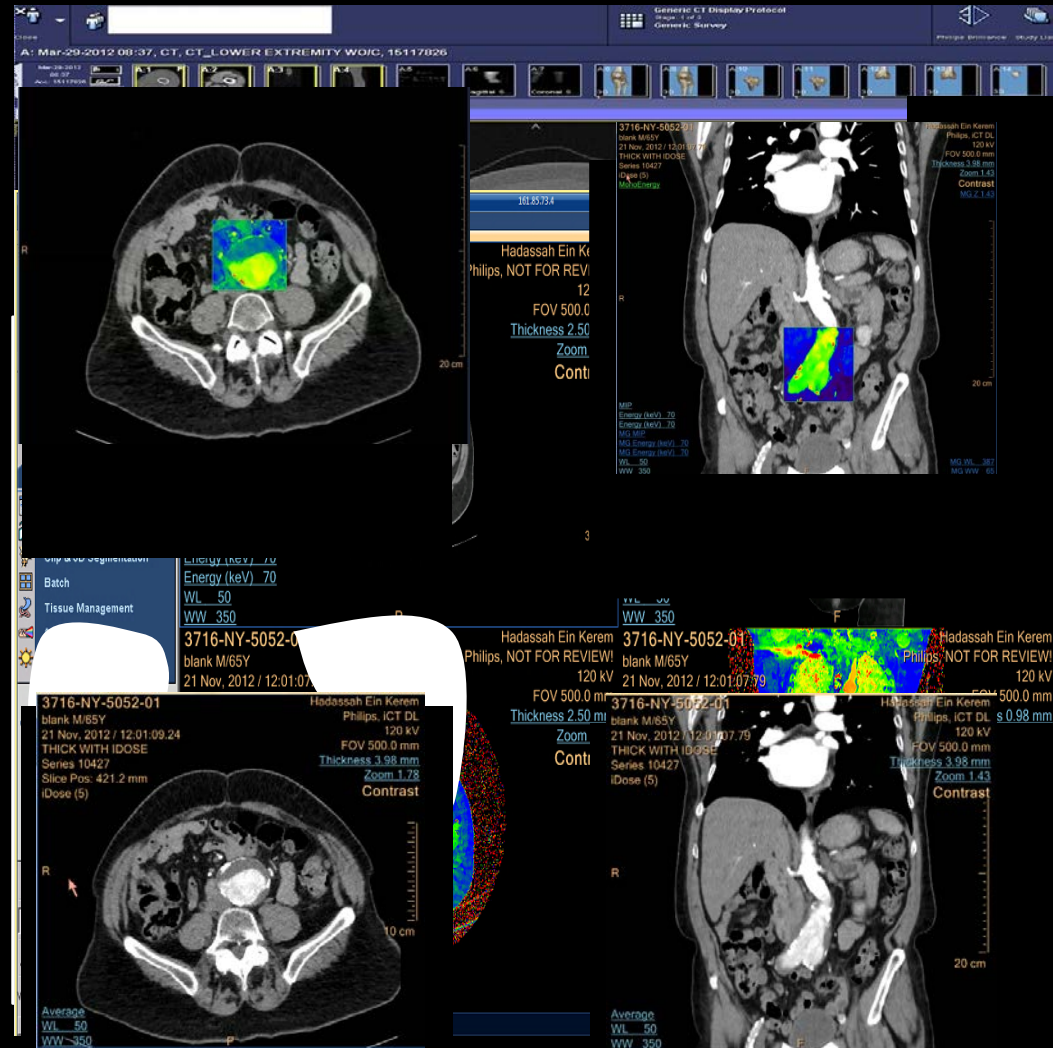
Right Panel: Energy slider

Energy slider-shown on active viewport

7

Spectral storage for every patient- SBI

- Spectral information is compatible to **DICOM** standard and could be stored on PACS .
- Additional tool for quick spectral analysis on PACS -**Magic Glass**
- Retrospektive analysis always there and future



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Spectral Results

Spectral results can be roughly divided into 2 groups: **HU based** and **non-HU based**

HU Based Spectral Results

Label Name	Unit
MonoE75 <i>(75 is an example of the keV value)</i>	HU
MonoE75 (120kVp) <i>(120 is an example of the kVp value)</i>	HU
Contrast-Enh. Structure [HU]	HU
Iodine Removed [HU]	HU
VNC [HU]	HU
Uric Acid [HU]	HU
Uric Acid Removed [HU]	HU

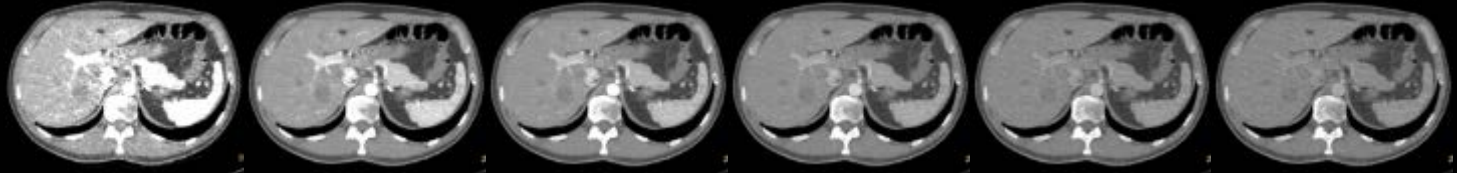
Non-HU Based Spectral Results

Label Name	Unit
Z Effective (EAN)	Unit less
Iodine no Water [mg/ml]	mg/ml
Iodine Density [mg/ml]	mg/ml

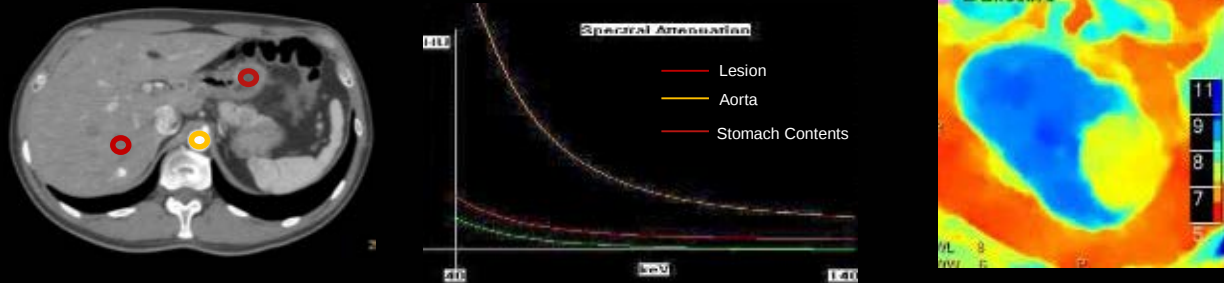
EAN : Effective Atomic Number

Spectral CT New groups of images types

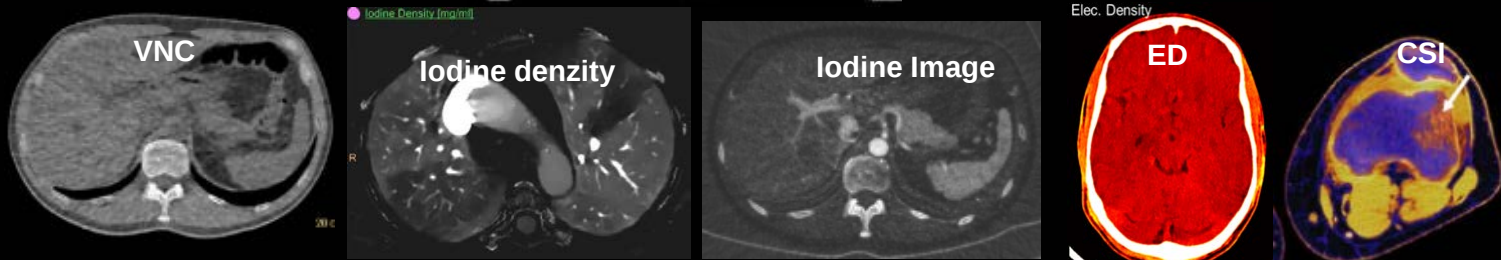
Monochromatic Imaging



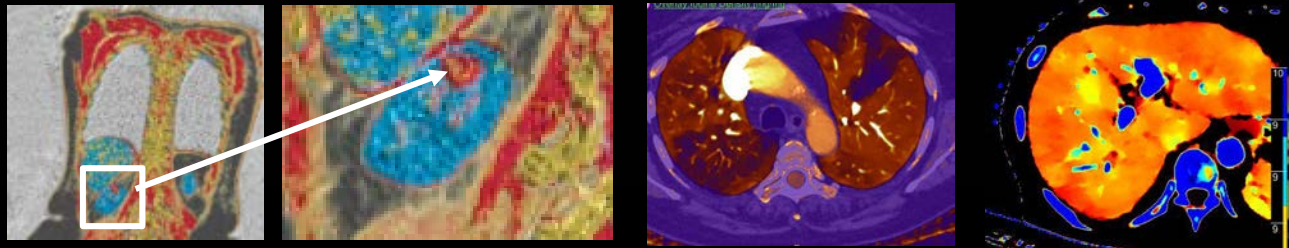
Lesion /Z eff Characterization



Material Decomposition



Material Decomposition Overlay images)



Spectral Imaging improves clinical diagnostic

Body Area	Type of pathology	Spectral Benefit
Cardiac& CTA	Plaque	Plaque characterization using EffZ, MonoE
	Perfusion deficit	Increased conspicuity & reduced BH artifact
	Calcium in vessels	Reduced Calcium Blooming
	Large patient & with TRO	No limitation of FOV & full dose modulation tools available
	Missed injection (or reduced iodine dose)	Boost of iodine signal at lower keVs
CT Angiography (Head, Body, Extremities)	Plaque	Plaque characterization using EffZ, MonoE
	Calcium	Reduced Calcium Blooming
	Missed injection (or reduced iodine dose)	Boost of iodine signal at lower keVs
	Compare NC & VNC	Generation of VNC to eliminate NC series
	Vessel assessment	Better bone removal

Spectral Imaging improves quality of clinical diagnostic

Body Area	Type of pathology	Spectral Benefit
Oncology	Lesion	Increased sensitivity to detection of iodine uptake
	Focal lesions	Increased sensitivity to detection of iodine uptake
	Incidental findings	VNC where NC was not done
	Treatment follow up	Differentiation of hemorrhage vs iodine
	Lung nodule	Differentiation of tumor vs vessels using iodine maps & VNC
	Brain tumor	Differentiation of iodine vs hemorrhage within tumor
	Thyroid nodules	Benign vs malignant
Head	Posterior fossa assessment	Beam hardening reduction in PF region
Metal implants	Metal implants	Artifact reduction
Metabolic	Kidney stones	Detection & characterization
	Gout	Detection & characterization

New spectral CT IQON

A solid yellow horizontal bar with rounded ends, spanning most of the width of the slide.

ANGIO



Yoshinari Sugiyama¹, Takashi Nakamura², Satoru Oda³, Daisuke Utsunomiya⁴,
Yoshinori Furumae⁵, Yoji Iyama⁶, Noriaki Taguchi⁷, Tomohiro Nishimoto⁸,
Hirotaki Yuki⁹, Masahiro Kikuchi¹, Koukichi Hirata¹, Masataka Nakagawa¹,
Yumehiko Yamashita¹

Received: 26 July 2012 / Revised: 15 September 2012 / Accepted: 2 October 2012
© European Society of Radiology 2012

Objectives: To evaluate the image quality and lesion conspicuity of virtual source tomographic imaging (VST) with dual layer DECT without increasing radiation dose compared with standard 120 kVp protocol.

DL-DRECT for reduced iodine load multiple-hepatic CT. Methods: Forty-five adults with renal dysfunction who had undergone hepatic DL-DRECT with 300-mg/kg were included. VMI (40–70 keV, DL-DRECT VMI) was generated at each enhancement phase. As controls, 40 matched patients undergoing standard 120-kVp protocol (120-kVp, 600-mg/kg, and iterative noise reduction) were included. We compared the absolute

Key Points:

- 40–70 keV yields optimal image quality for half-iodine-load multiple-hepatic CT with DL-DRECT.
- DL-DRECT produced doseless reduction in exposure compared with 120-kVp scans with iterative reconstruction.
- 40–70 keV images maintain complexity of Kupfer-tinctor carcinoma especially at hepatic arterial phase.

Keywords: iodine · Multidetector computed tomography · Liver diseases · Image enhancement · Heartbeat rate correction

Abbreviations	
CM	Cardiac motion
CNR	Contrast-to-noise ratio
CTI _{eff}	Effective CT dose index
DECT	Dual-energy CT
DR, DECT	Dual-energy CT
DR, DECT	Dual-energy CT

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 Consolidated

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They investigated the feasibility of using the whole ionomer concentration scale as indicated in computerized tomography (CT) images of the roots and coronary arteries using low tube voltage and virtual monochromatic imaging of E major dental cone beam CT (CBCT) results. A resolution phantom was imaged with dual source CT (DSCT), providing spectral imaging (CSI) and dual layer spectral detector CT (DSCTs). For each scan, a reference scan was acquired at 120 kVp using routine (RS) and dual layer (DL) settings. Subsequently, scans were acquired at lower potential tube potentials (70, 80 kVp) using the DL settings. The results of the scans were compared with the reference scan. The results showed that the DL scans (DSCTs) (0.00, 240, 100, 120, 86, 50 mg Iodine/kg) Objective image quality was evaluated using contrast, CSI and dual source (DSCT) (DSCTs) measured in the roots and left main coronary artery. Image DQCRs of reference were 72.8, 39.7 and 60.2 for DSCT, CSI and DSCT. Maximum iodine concentration reduction values of DSCTs were 22.0, 2.9 and 2.9 mg Iodine/kg, respectively. The DSCT (DSCTs) 46.7/3.0 and DSCT (DSCTs) 44.1/3.0 using conventional CT low kVp and 22.0 mg Iodine/kg, respectively. XIAFINA 3D (70 kVp) reference scan was used for image quality and iodine concentration, which was 22.0 mg Iodine/kg.

Keywords: Iodinated contrast media · Dual-energy CT · Thoracic aorta · Low kVp · Image quality

AA	Ascending aorta	LMA	Left main coronary artery
CSR	Contrast to noise ratio	ROI	Region of interest
CTA	Computed tomography angiography	SD	Standard deviation
CTDI _{vol}	Volumetric CT dose index	SDCT	Dual-layer spectral detector computed tomography
DA	Downsampling ratio	VMI	Virtual monochromatic imaging
DCCNR	Deep correlated contrast to noise ratio		
DECT	Dual energy computed tomography		
DECT	Dual source computed tomography		
FBP	Filtered back projection		
OSI	Genome spectral imaging		

CSI Genomic spectra imaging

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Abstract Computed tomography angiography (CTA) is an important diagnostic tool for the detection of cardiovascular diseases [1]. However, while a powerful tool, the use of CTA can be limited in patients with impaired renal function [2, 3]. Reducing iodine concentration decreases the risk of contrast-induced nephropathy [4, 5] and can therefore be beneficial in terms of safety and costs [6].

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Zakariah Binti F.M. Yusoff, Brunei, Borneo, Malaysia

concentration can be reduced by 40-
om 300 mg l/ml to 120 mg l/ml).

 Bentley

Quantifying potential reduction in contrast dose with monoenergetic images synthesized from dual-layer detector spectral CT

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Objective: To estimate the potential dose reduction in isolated coronal when interpreting noncontrast-enhanced scans from an axial CT.

Methods: 51 pediatric patients received contrast-enhanced CT consultation for radiation therapy using a single-source, dual-layer detector spectral CT. The contrast-to-noise ratios (CNRs) of blood vessels were measured relative to surrounding soft tissue. CNRs on monoenergetic 40–70 keV images were compared with polyenergetic 120 kVp images. To compare with in vivo results, a phantom with 100 iodine inserts ($20 \pm 0.05 \text{ mg cm}^{-2}$ concentration) was scanned and CNRs were calculated relative

Results: Monoenergetic keV and body site had significant effects on CNR ratio ($p < 0.0002$). Across all body sites, the mean CNR ratio in monoenergetic/polychromatic (CNF) was 3.5 (25th percentile [50th] 2.6; 2.4 (50th 21; 32 (50th 25).

Contrast-enhanced CT scans are frequently performed in radiation oncology departments for treatment planning to better identify blood vessels for the purposes of lymph node segmentation and target volume.¹² For example, pelvic and cranio-cervical lymph node clinical target volumes in patients with soft tissue sarcomas are frequently defined by contouring a blood vessel and extending by a geometric margin around the vessel.¹³ Medial-tail targets for patients with Hodgkin lymphoma are more easily delineated using contrast-enhanced CT to distinguish blood vessels from lymph nodes and luminal organs.¹⁴ Contrast-enhanced head CT can help distinguish enhancing vascular structures (sigmoid sinus, cavernous sinus) from brain metastases.

Although use of iodine-based CT contrast improves ease of radiation target segmentation, contrast medium is

[illegible]

Advances in knowledge: Use of a novel, single-source dual-layer detector spectral CT scanner to improve visualization of contrast-enhanced blood vessels will reduce the amount of iodinated contrast required for radiation oncology treatment planning.

Spectral CT has the potential to enhance visualization of contrast-enhancing structures by use of synthetic monochromatic images at lower keV.³⁹ At lower keV, scattering of the photoelectric absorption of a high Z material such as iodine is increased.⁴⁰ Spectral CT data can be generated using rapid kVp switching from a single-source CT, dual-source CT or with a dual-liner detector. There have been studies evaluating iodine load reduction in the setting of CT angiography using single-source kVp switching,⁴¹ and dual-source CT,^{42,43} but these techniques require

"40-55-keV yields optimal image quality for half-iodine-load multiphasic-hepatic CT with DL-DECT". **Kumamoto University**

Iodine concentration can be reduced by 40-60% (from 300 mg I/ml to 120 mg I/ml).

Utrecht Medical Center

"A 50% reduction in contrast dose on a 50 keV image should maintain comparable or better CNR as compared with polychromatic CT in over 80% of CT studies." **St. Jude**

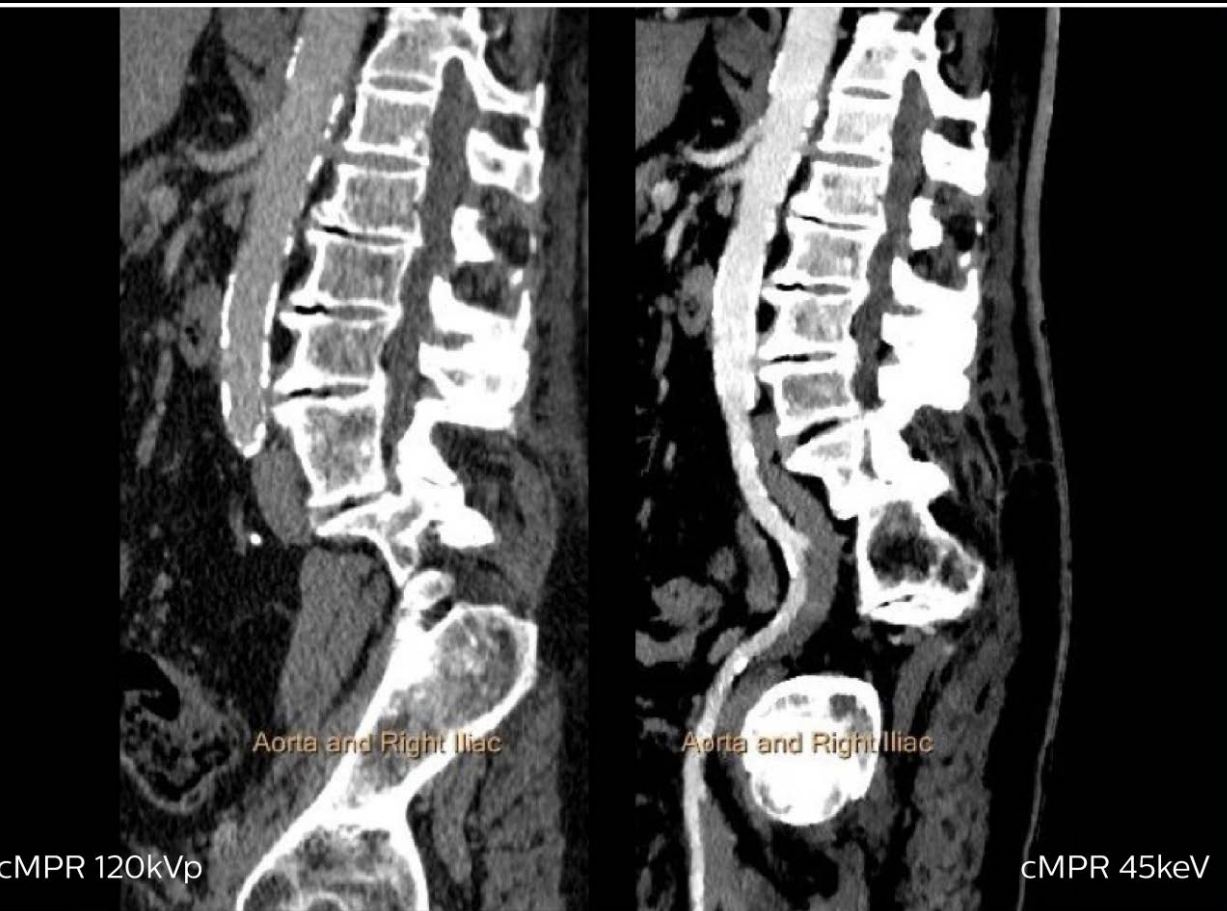
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Mono Chromatic Imaging in Iodine volume reduction

70sec delay

120keV

45keV



Iodine volume reduction

An elderly patient with a history of aortic valve stenosis and renal insufficiency was referred for a pre-TAVI CTA, but was unable to tolerate the full volume of contrast necessary to obtain needed information from conventional CT.

CTDIvol: 14.6mGy

DLP: 657mGy ×cm

*Effective Dose: 9.8mSv
($k=0.015$)**

Improvement of imaging in contrast studies /iodine boosting phenomena/

- Contrast improvement in imaging
- Visualization of enhancement even by small amount of contrast
- Missed contrast injection
- Ruptured veins
- Renal dysfunctions in oncological patients

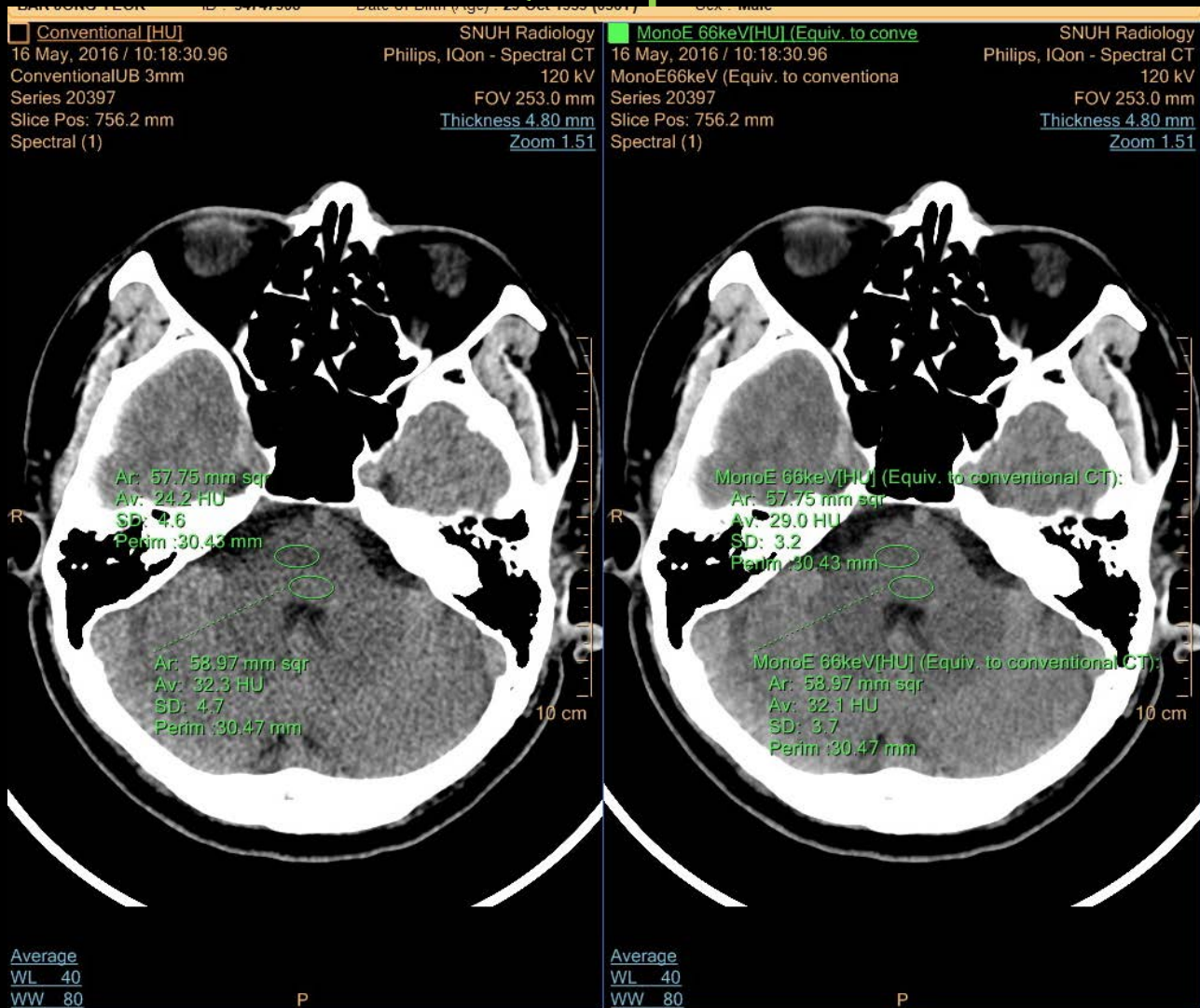
CM dose reduction!

New spectral CT IQON

A solid yellow horizontal bar with rounded ends, spanning most of the width of the slide.

HLAVA

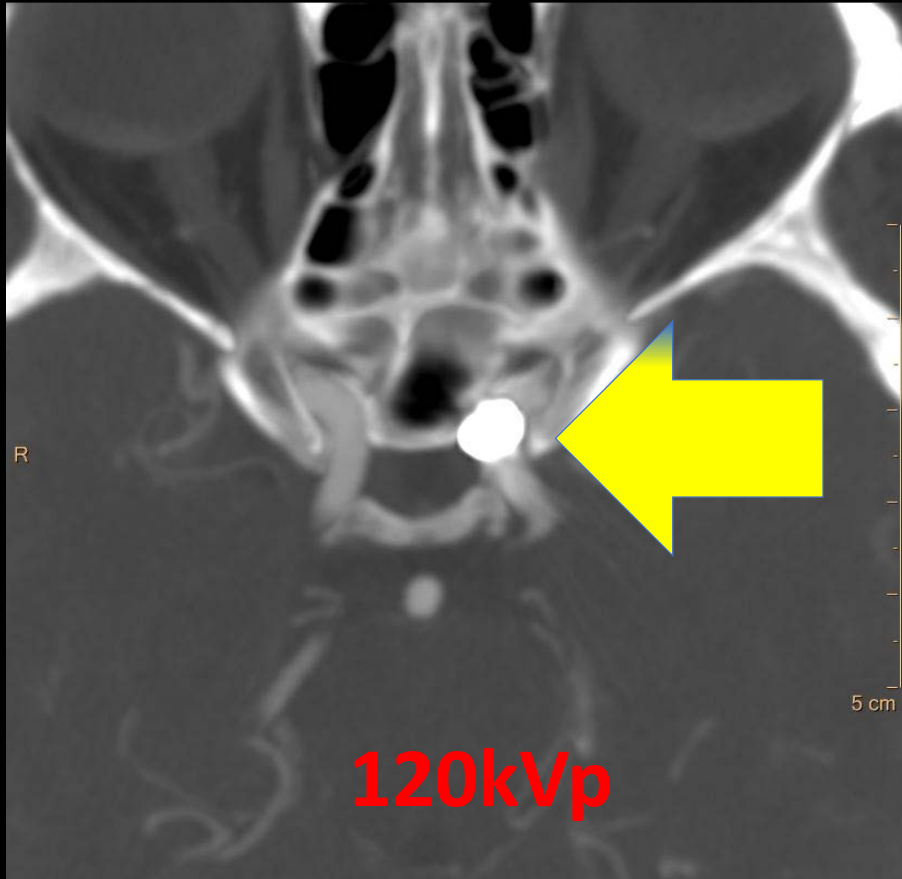
Brain IQ improvement



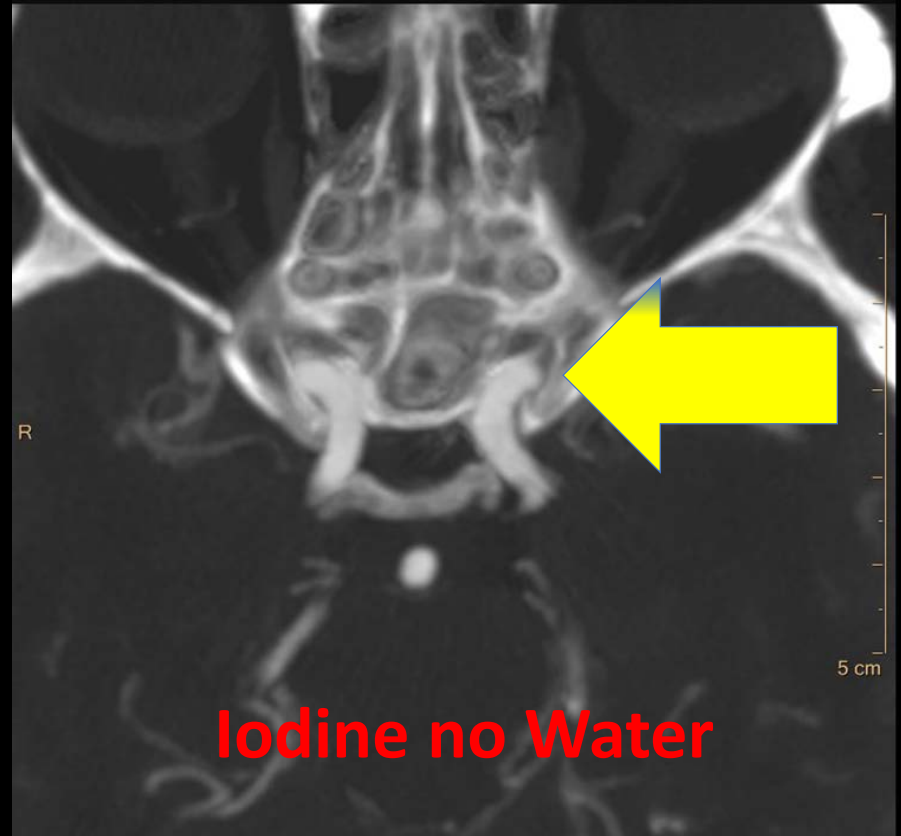
8 HU difference in the PF area of similar attenuations areas in conventional were reduced to 3 HU difference in the equivalent monoE (66).

By extraction of metallic implantation – superior visualization of ICA left

Conventional [HU]

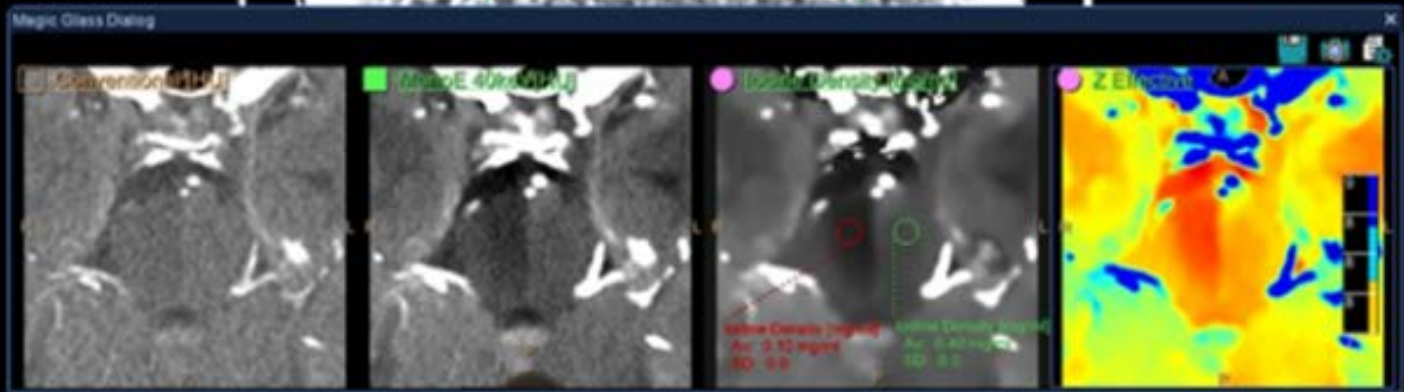
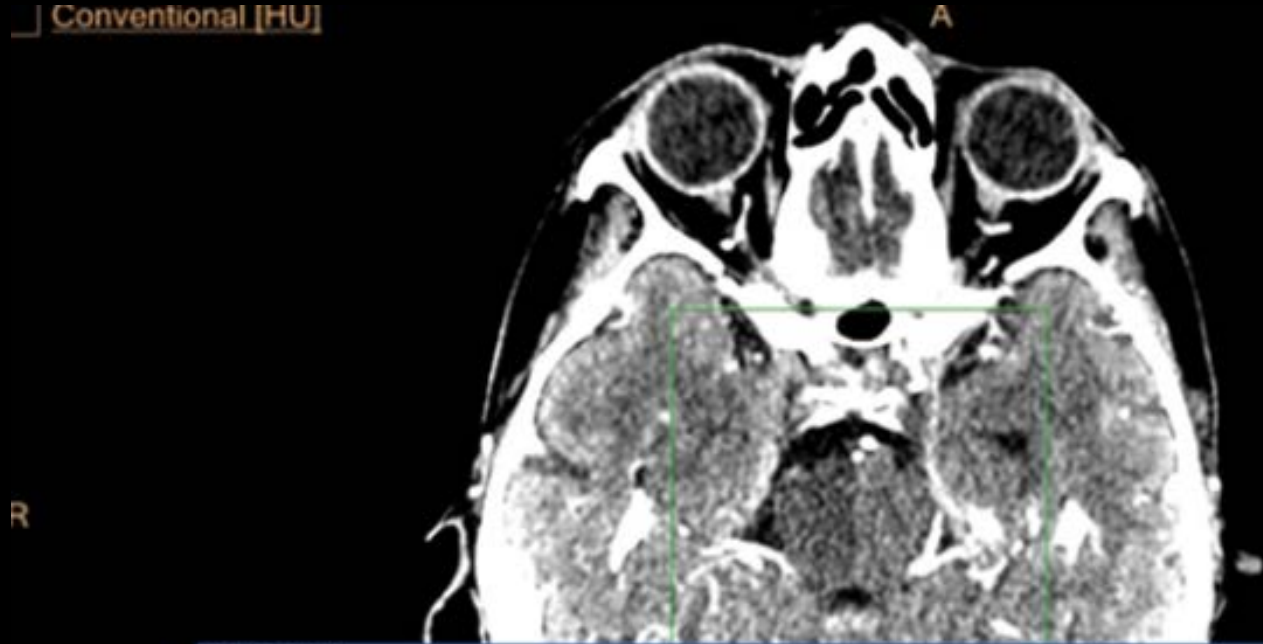


Iodine no Water [mg/ml*]



Acute stroke

Conventional [HU]

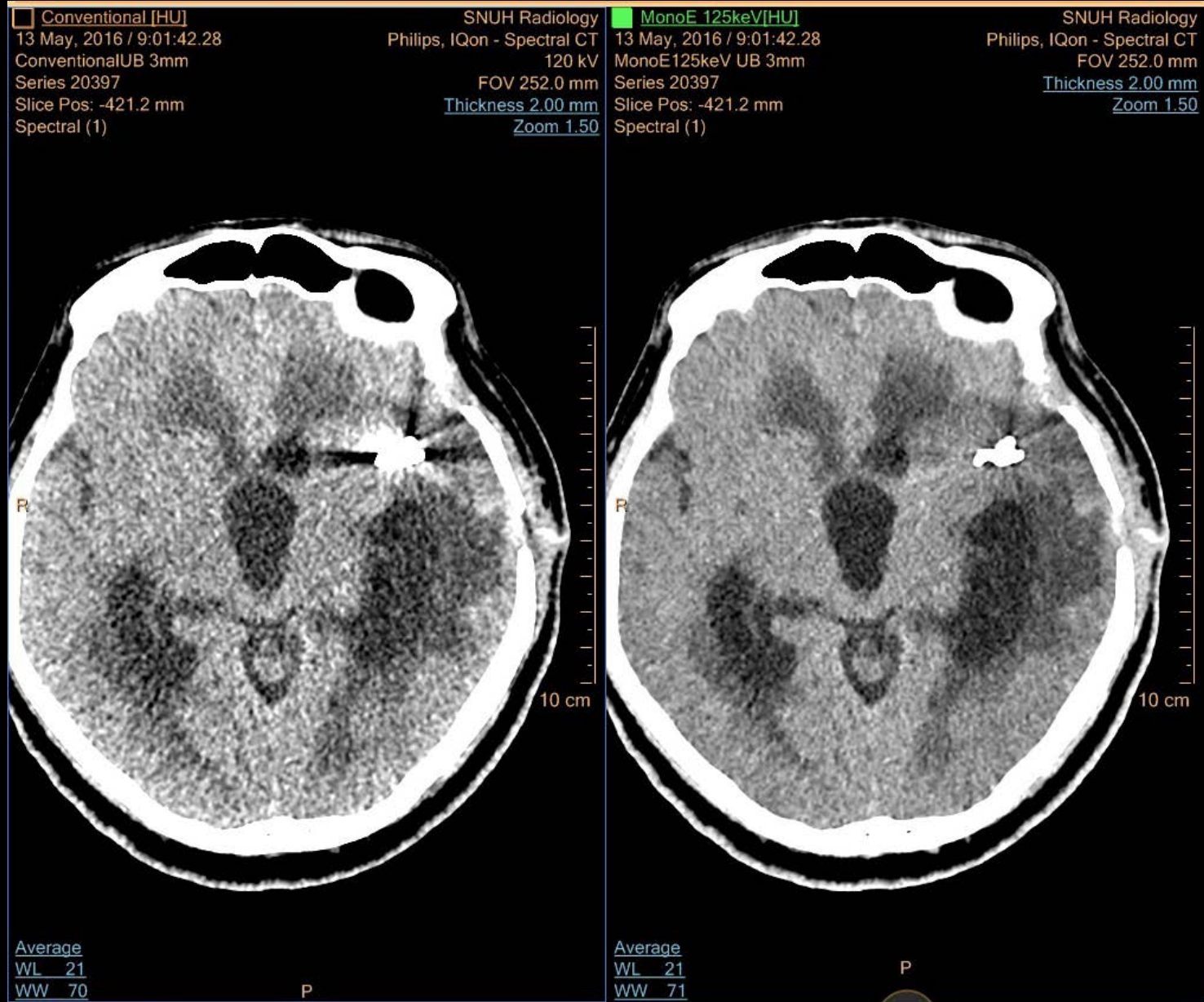


CTDIvol: 20 mGY
DLP: 700 mGY*cm
Effective Dose: 1.5mSv*

Case Summary

Patient presented to the emergency department with symptoms of an acute stroke, and was referred to CT.

Brain coils



New spectral CT IQON

A solid yellow horizontal bar with rounded ends, spanning most of the width of the slide.

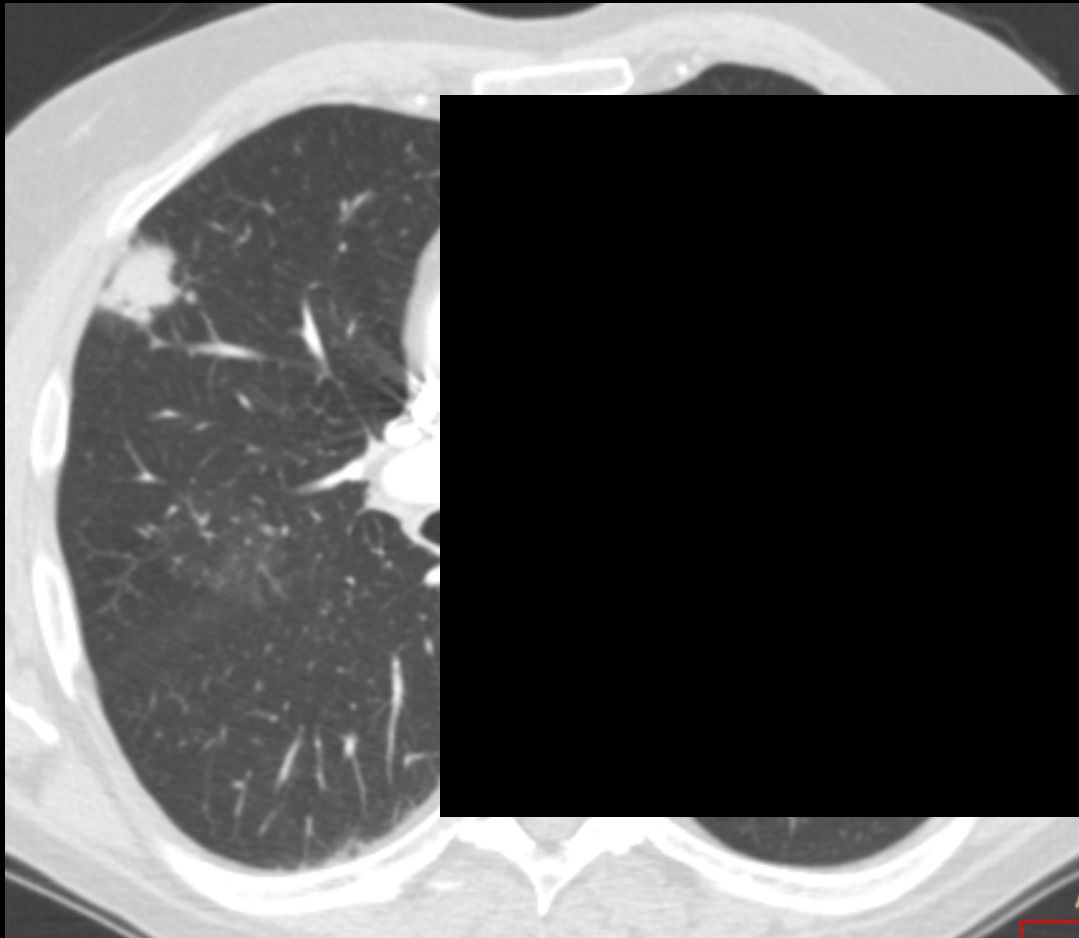
HRUDNÍK

After Z-eff map: embolus is visualized

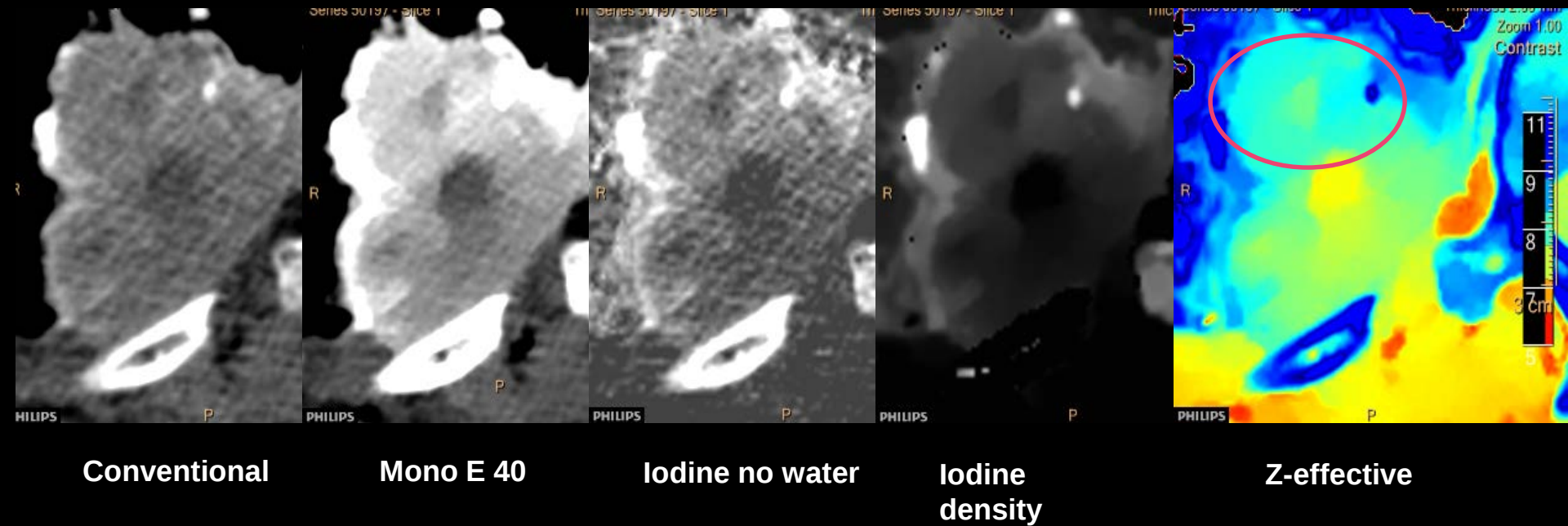


CTDIvol: 6.6mGy
DLP: 200mGy × cm
Effective Dose: 3mSv ($k=0.014$)*

Solid lung nodule

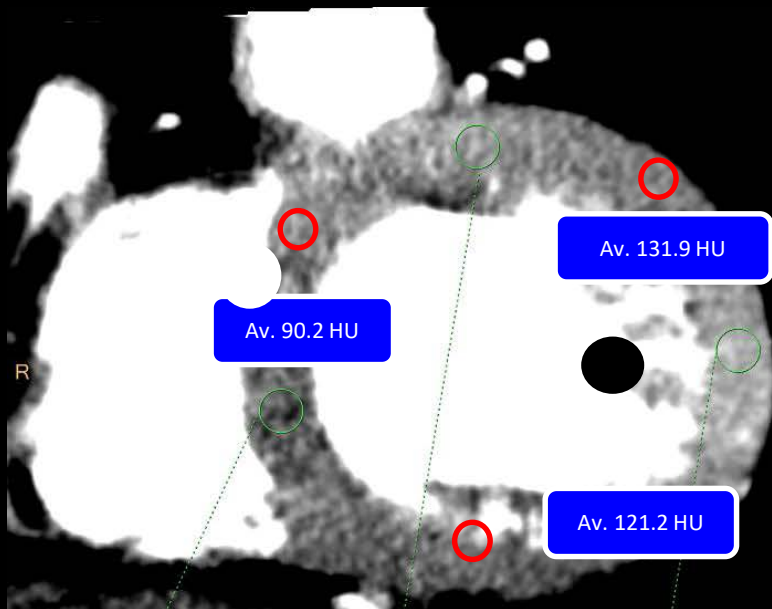


Lung cancer – best place for biopsy

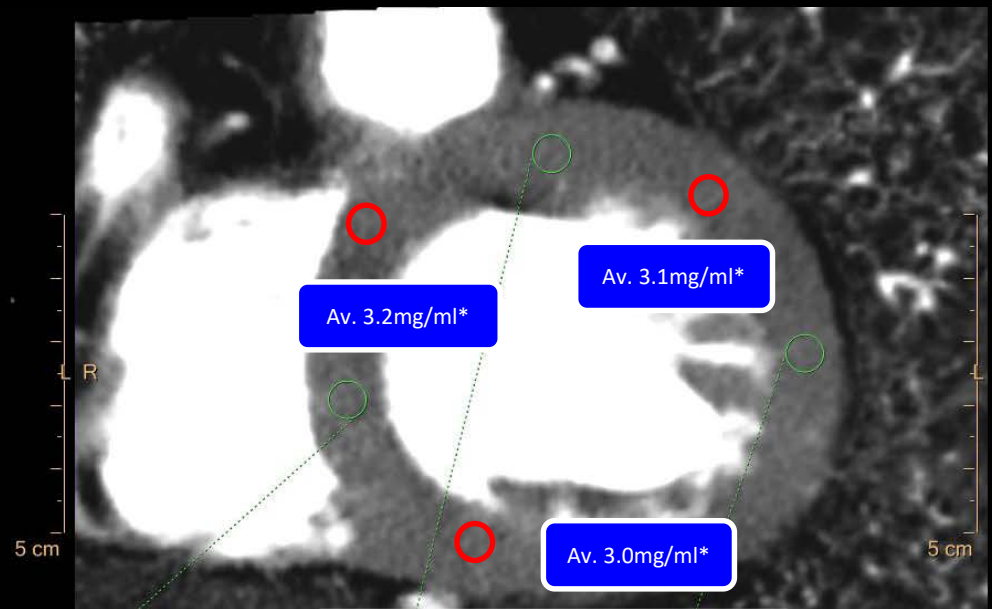


Most often is guided by DCE-CT (perfusion-blood flow maps) or PET.

Iodine Density Map showing *Consistency compared to HU*



Conventional 120 kVp



Iodine Density Image

Accidental CT finding-incidentaloma



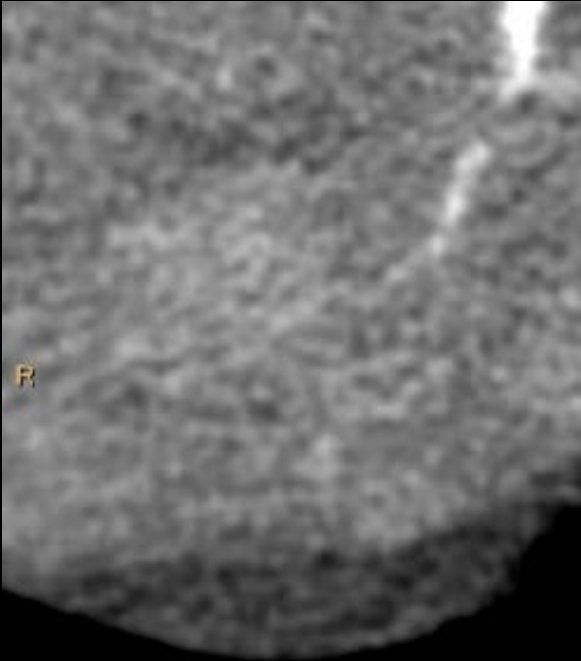
New spectral CT IQON

A solid yellow horizontal bar with rounded ends, spanning most of the width of the slide.

BŘICHO
PÁNEV

Non uric kidney stone in the presence of contrast

HCC



PHILIPS

P

Conventional

Mono E 40 KeV

Z - effective

Pancreatic cancer



Conventional

Accidental finding: Prostate tumour

☐ Conventional [HU]

27 Jun, 2016 / 9:27:38.76

Conventional153 ml VISIP 320

Series 40197 - Slice 594*

Slice Pos: -632.2 mm

Spectral (0)

AUH AARHUS NBG

Philips, IQon - Spectral CT

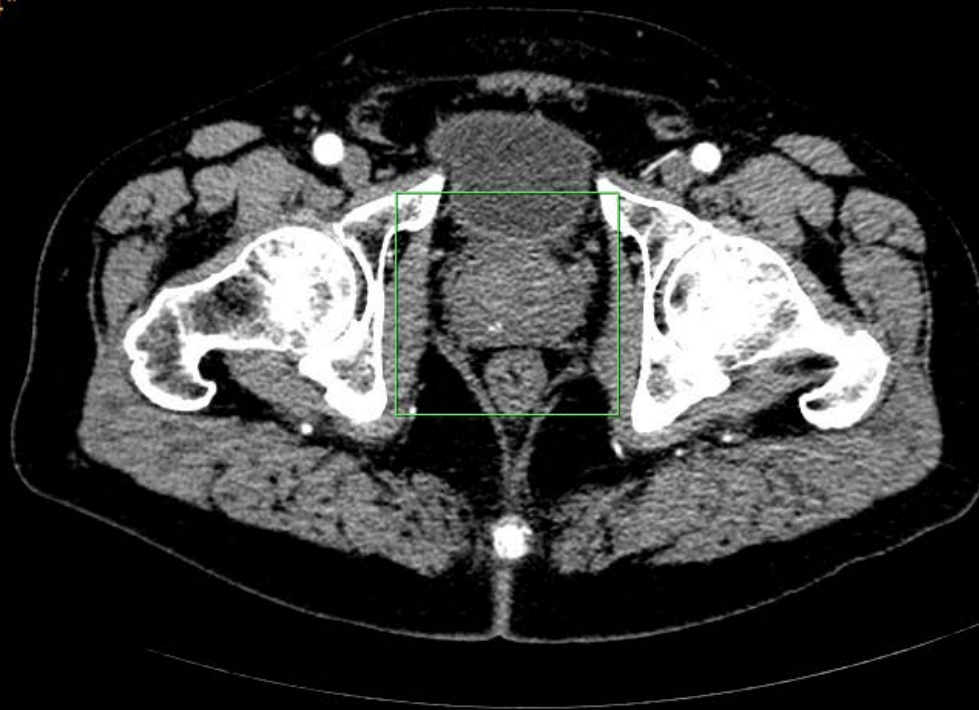
120 kV

FOV 437.0 mm

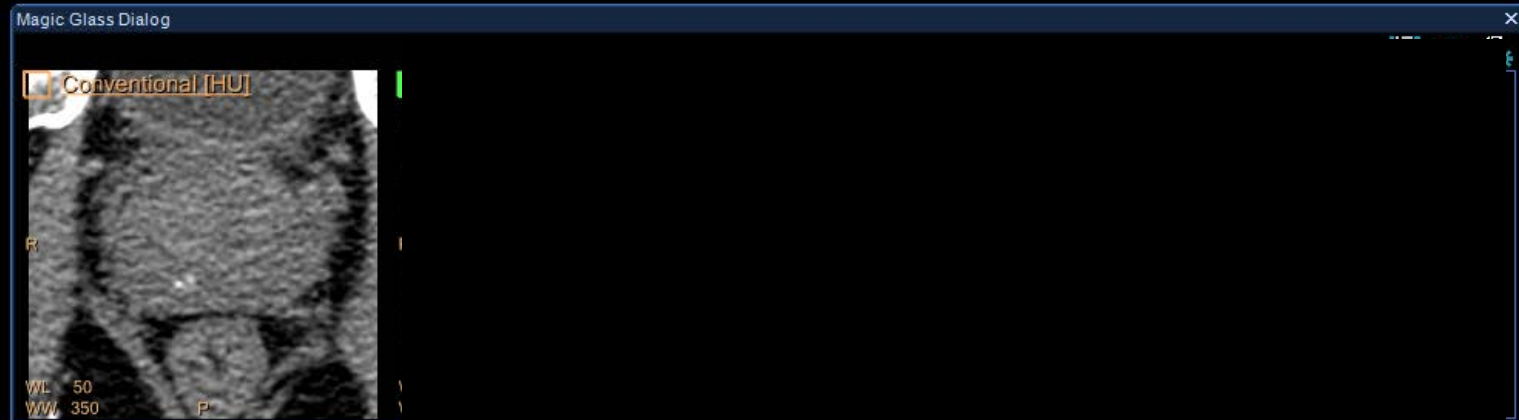
Thickness 2.00 mm

Zoom 1.00

Contrast



R



New spectral CT IQON

MSK

Ligaments visualizations

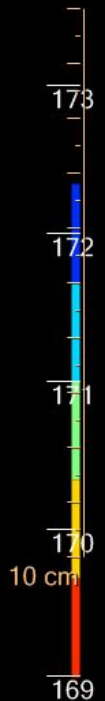
17 May, 2016 / 8:15:37.58
ConventionalSBI 1mm
Series 20897 - Slice 1



Overlay: Spectral CT - Uric Acid [HU]
Select "Spectral Info" Series for more info

SNUH Radiology
Philips, IQon - Spectral CT
Thickness 13.00 mm
Zoom 1.00

R



PHILIPS

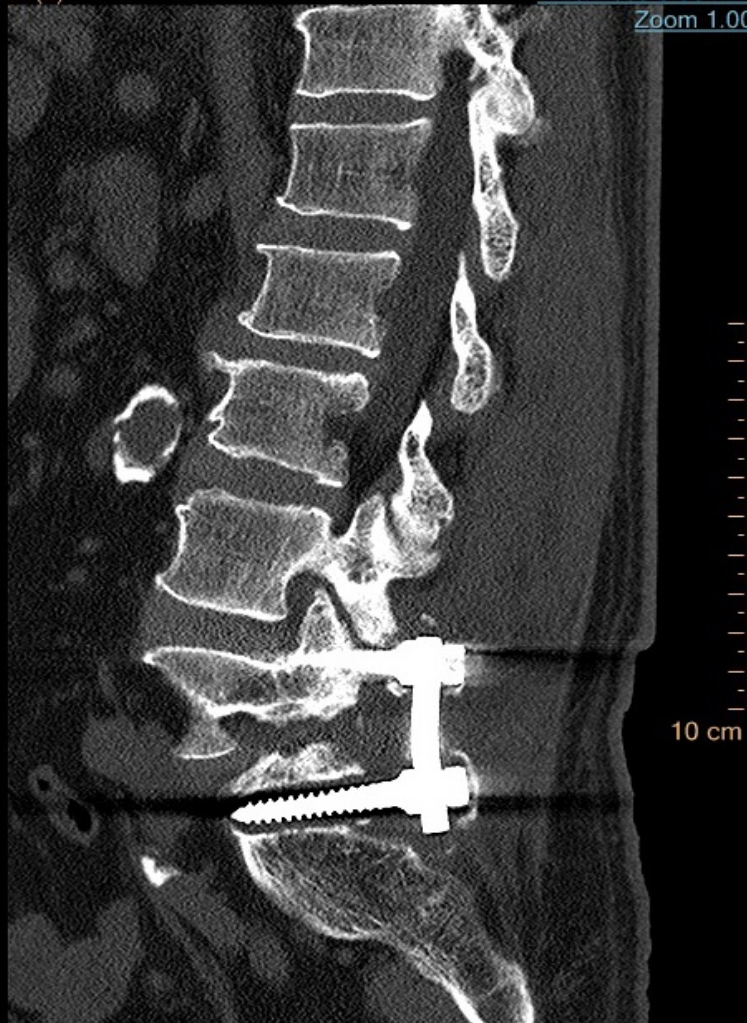
Courtesy: SNU Korea

PHILIPS

Spine meal A. reduction with high monoE+OMAR. Courtesy: SNU. Korea

Conventional [HU]
10 May, 2016 / 14:33:37.13
ConventionalSBI 1mm
Series 20597
Spectral (2)

SNUH Radiology
Philips, IQon - Spectral CT
120 kV
FOV 164.0 mm
Thickness 3.00 mm
Zoom 1.00



Average
WL 293
WW 957

Courtesy: SNU Korea

F

MonoE 200keV[HU]
10 May, 2016 / 14:33:37.13
MonoE200keV SBI 1mm
Series 20597
Spectral (2)

SNUH Radiology
Philips, IQon - Spectral CT
FOV 164.0 mm
Thickness 3.00 mm
Zoom 1.00



Average
WL 293
WW 957

F

Calcium suppression - Calcium-Water material decomposition

Bone marrow edema detection

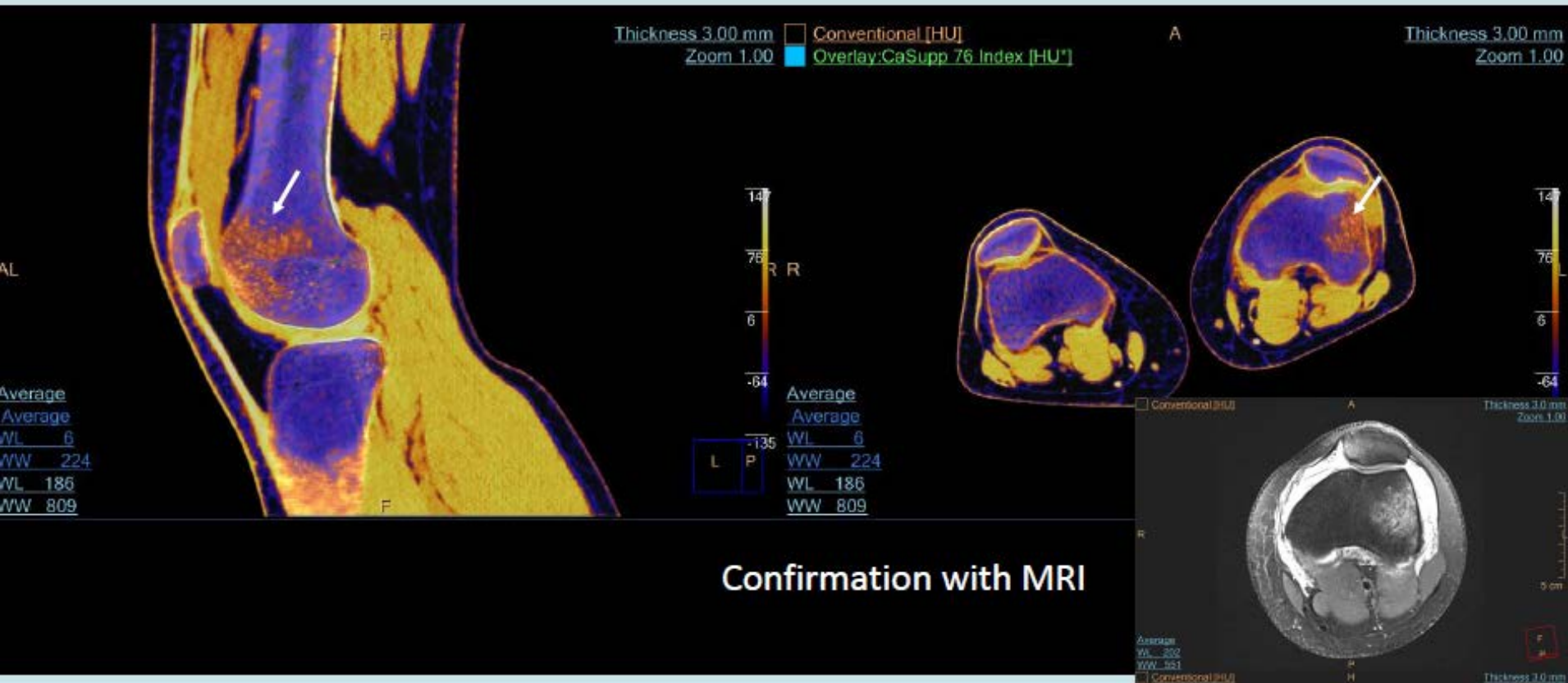


Images courtesy of: Cliniques Uiveritaires St-Luc (UCL), Brussels, Belgium

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Calcium suppression - Calcium-Water material decomposition

Bone marrow edema detection



Images courtesy of: Cliniques Uiveritaires St-Luc (UCL), Brussels, Belgium

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Přehled bodů

- Spektrální CT– cesta k inovaci + trochu teorie
- Klinicko- technické benefity spektrálního CT
- Klinické příklady aplikací spektrálního CT dle anatomie
- **Jaké jsou možnosti dalších inovací**
- Postprocessing /ISP
- AI v CT oblasti

PHILIPS



Acting as New research tools

- Perfect separation due to anti-correlated noise
- Perfect calculation of beam hardening – thus better material decomposition
- New possible approaches like **iron, AEF, ECV, fibrosis, 3TP perfusion, radiotherapy maps**

Take home messages

- Spektrální CT není stejné jako CT s dvojí energií
- Řešení cestou spektrálního dvojitého detektoru je technický předstupeň pro nové photocountingové CT systémy
- Spektrální informace je v každém skenu bez nutnosti selekce operátora
Díky isothermální spektrální informaci není nutno snímky registrovat
- Nejmenší isotropický spektrální voxel = zlepšení diagnostiky a diagnostické jistoty /DCE/
- Není kompromis u bariatických pacientů, neklidných pacientů apod.
- Řešení cestou spektrálního dvojitého detektoru je nezávislé pak na technických možnostech vlastního přístroje /0,27s RT, multicycle recon apod./



Děkuji vám za milou pozornost!

Děkuji též kolegům z firmy Philips

Matthijs Kruis

Philippe Coulon

a jiným

Otázky?



kosobersky.cz

*Už bychom se s tím miminkem měli rozhodnout, Kájo.
Mám pocit, že slyším tikat biologické hodiny...*