

IN VIVO QUANTITATIVE DYNAMIC ANGIOGRAPHY WITH GOLD NANOPARTICLES AND SPECTRAL PHOTON-COUNTING COMPUTED TOMOGRAPHY K-EDGE IMAGING

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Presenter

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Organisation

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DISCLOSURES

Nothing to disclose:

Research Grant, Koninklijke Philips NV

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Employee, Koninklijke Philips NV

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Nothing to disclose: Loic Bousset

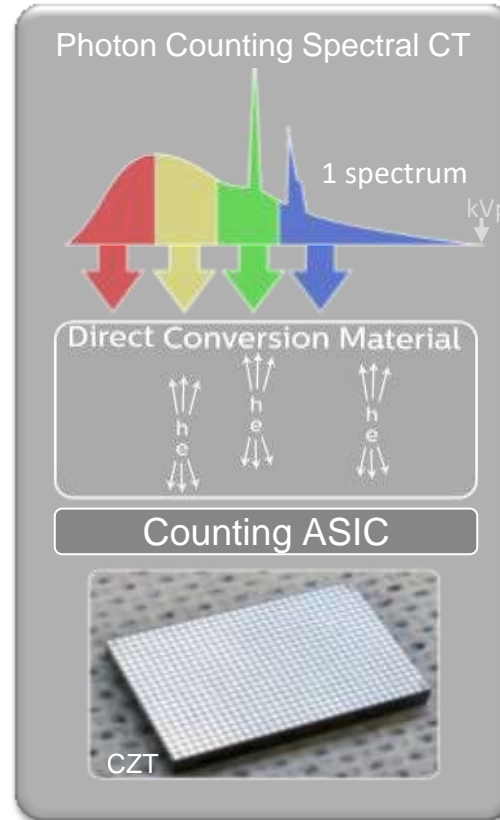
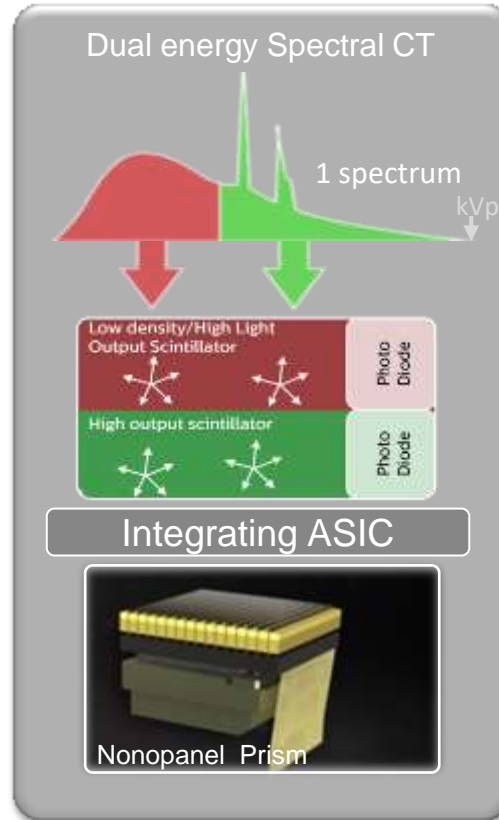
Nothing to disclose: Philippe Douek



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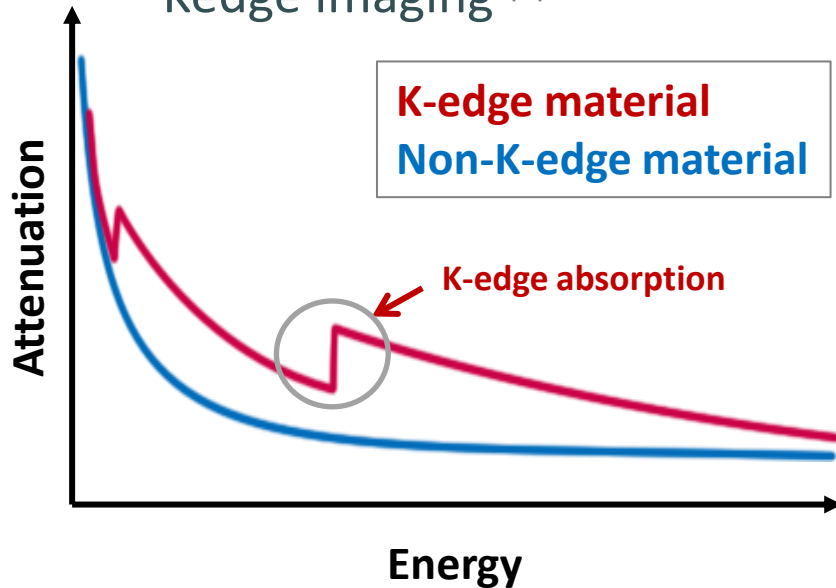
BACKGROUND



(1) Taguchi K, Iwanczyk JS. *Med Phys.* 2013

BACKGROUND

- Spectral photon-counting CT (SPCCT)
 - Kedge imaging ⁽¹⁾



- Advantages:
 - Material specific K-edge imaging
 - Absolute quantification of specific materials

(1) Schirra CO et al. Contrast Media & Molecular Imaging. 2014

OBJECTIVE

To investigate *in vivo* the potential of spectral photon-counting computed tomography (SPCCT) to perform quantitative dynamic angiography using gold nanoparticles

MATERIALS/METHODS

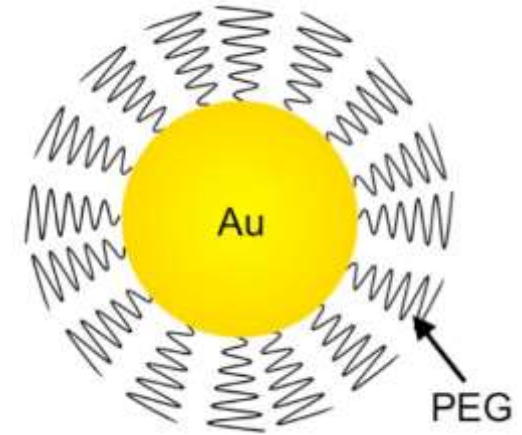
- Spectral photon-counting CT system (SPCCT)
 - Photon-counting detectors
 - Modified clinical base
 - Conventional X ray tube
 - Field of view of 160 mm
 - Gantry rotation time of 1 second
 - Parameters used:
 - Tube current of 100 mAs
 - Tube voltage of 120 kVp



Philips Spectral Photon Counting CT
pre-clinical prototype UCBL, CERMEP, Lyon,
France

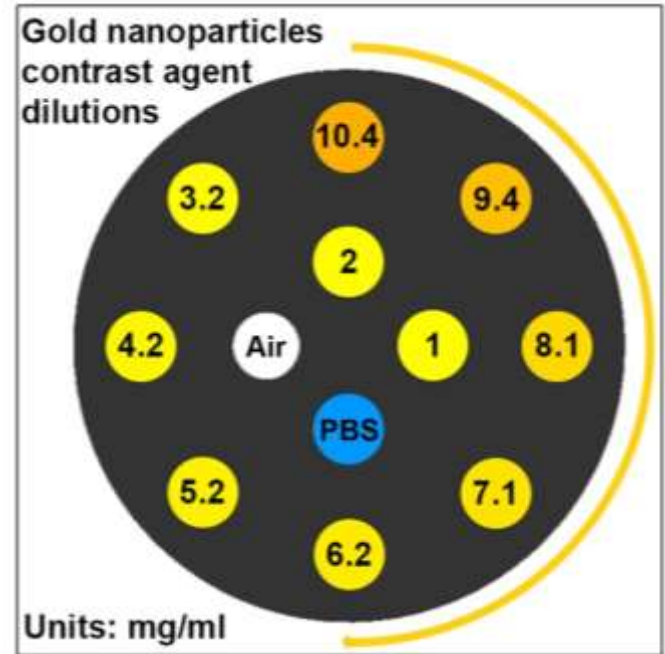
MATERIALS/METHODS

- Gold nanoparticles
 - Characteristics:
 - capped with thiol-PEG-2000
 - mean hydrodynamic radius of 18 nm
 - concentration: 65 mg/ml of gold
- Blood pool effect
- Strong CT contrast ⁽¹⁾
- Good candidate for K-edge imaging ⁽²⁾



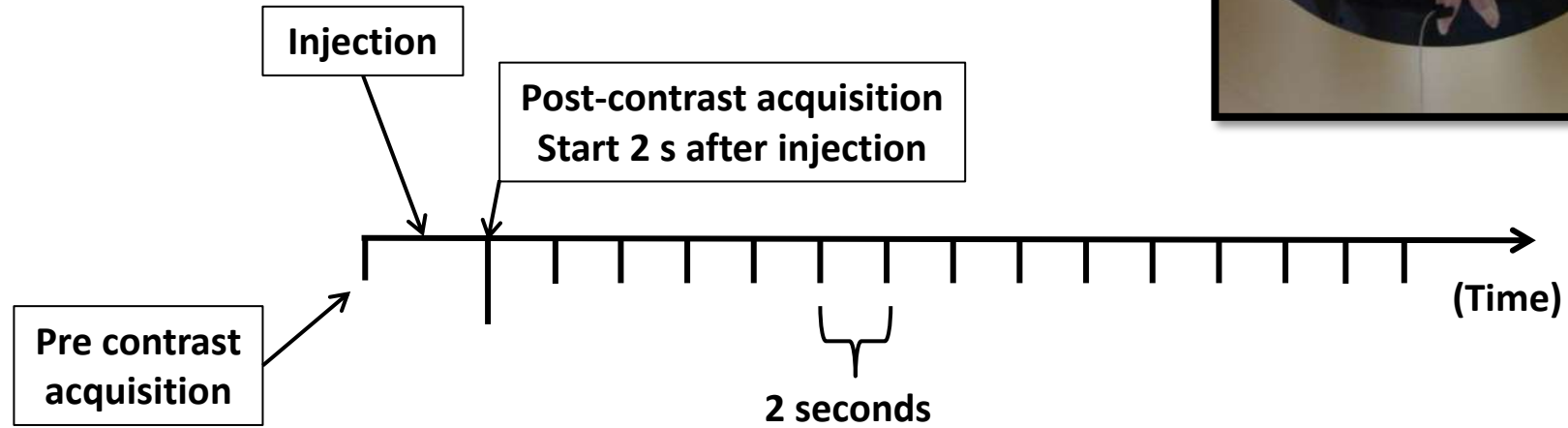
MATERIALS/METHODS

- In vitro imaging
 - Phantom of 15 cm diameter eleven 1.5 ml polypropylene tubes
 - 1 cm in diameter
 - Concentration from 0 to 10.4 mg/ml diluted with PBS



MATERIALS/METHODS

- 3 adults NZW rabbits (3.3 ± 0.4 kg)
- Injection of 12 ml
- Flow rate: 1 ml/s

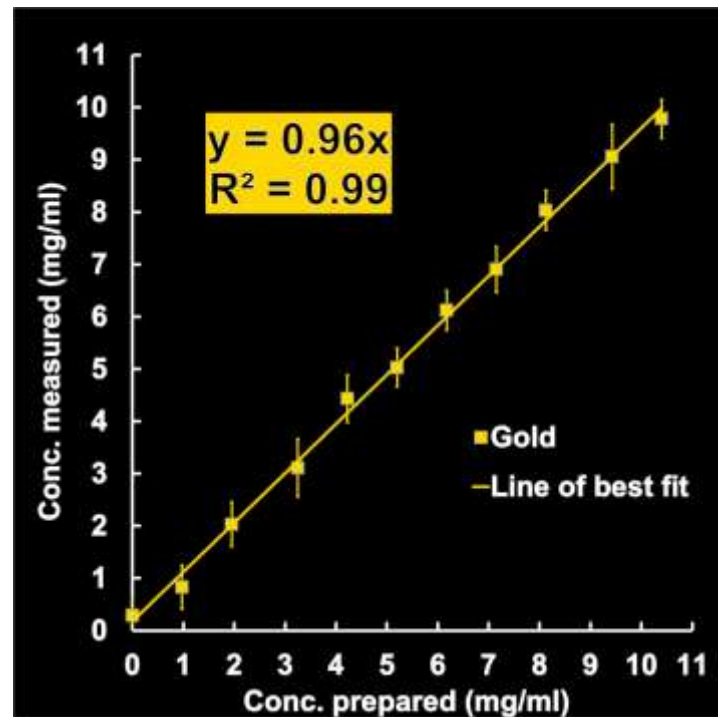
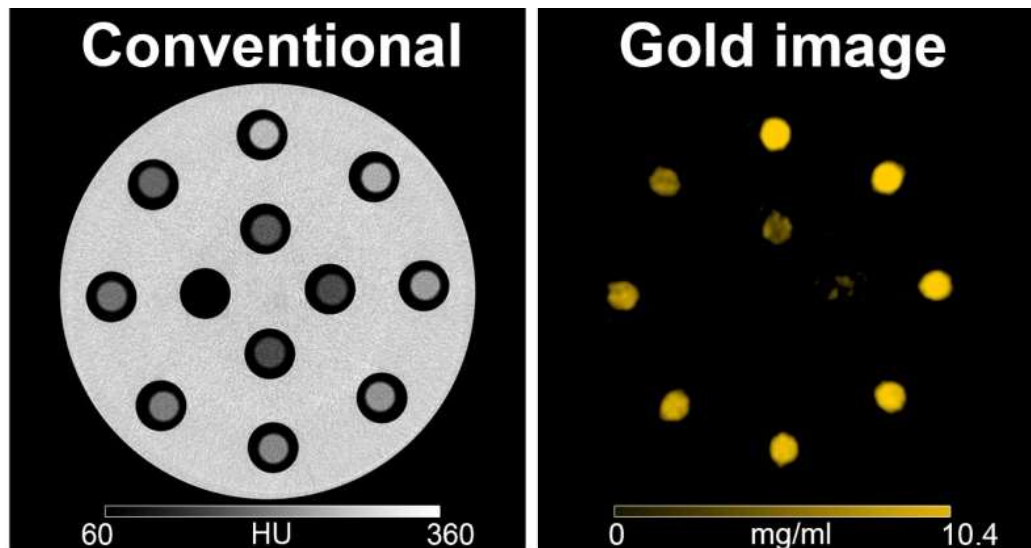


MATERIALS/METHODS

- Image reconstruction:
 - Conventional images: HU units
 - Specific gold images: mg/ml units
- Analysis:
 - Regions of interest:
 - cardiac cavities
 - thoracic blood vessels
 - myocardium

RESULTS

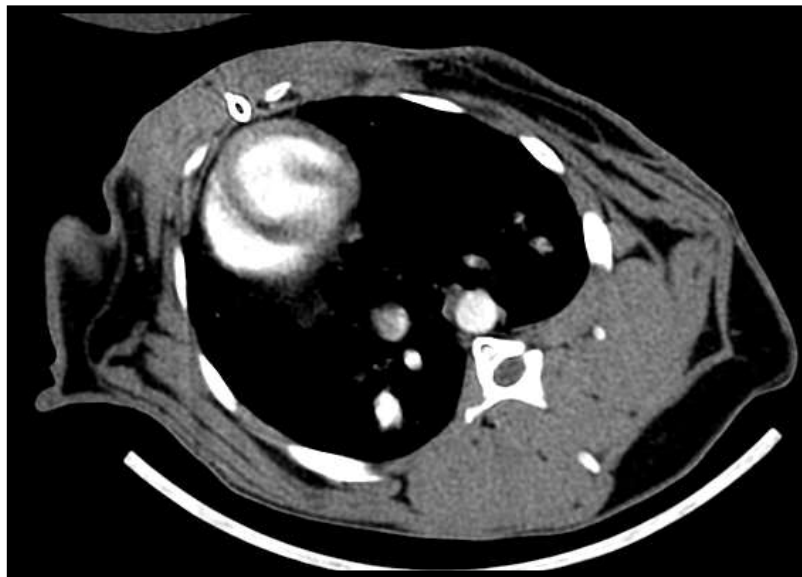
- In vitro imaging



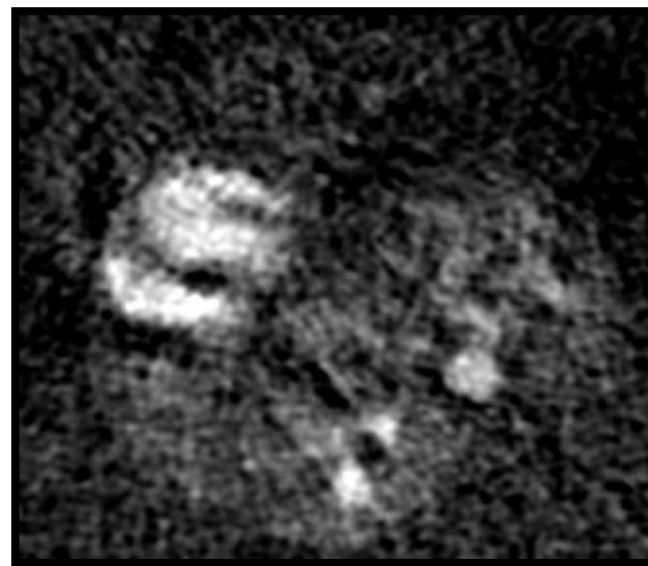
RESULTS

- In vivo imaging

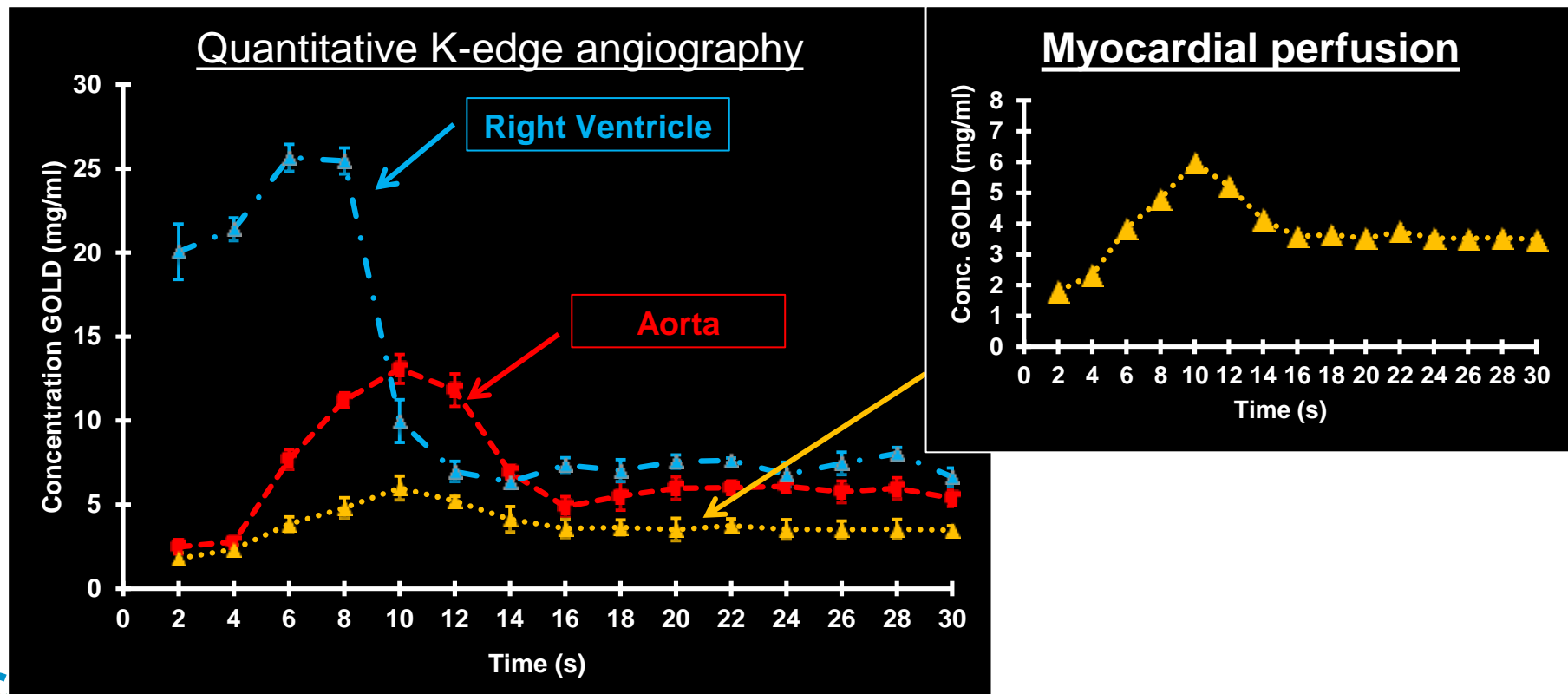
CONVENTIONAL IMAGES



GOLD KEDGE IMAGES



RESULTS



LIMITATIONS

1. Temporal resolution
 - Limitation for small animal
2. Noise of the images
3. Cardiac motion

CONCLUSION

- Feasibility of K-edge dynamic angiography
- Specific quantification of blood pool gold nanoparticles concentration during first-pass dynamic angiography
- Perspective
 - Opening to organ perfusion: myocardium, cerebral, renal perfusion

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