Session Five: Exploring New CT Imaging & Artificial Intelligence Technical Opportunities

New CT Technologies: Opportunities and Challenges

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Disclosure:

- *Speaker* Coreline
  Astra Zeneca
  Roche
- **Same energy-signal...what characterization?**

**TAKE IT ALL!!!**

Energy-integrated detector (EID)

- **Energy**-The absorbed x-rays produce **electron-hole pairs** which are separated and drift to the anodes where they **induce short current pulses**.

- **Geometry**-Each “**macro pixel**” confined by collimator blades can be divided into **smaller sub-pixels** which are read-out separately to increase spatial resolution.

Photon counting detector (PCD)
- Same energy-signal...what characterization?

TAKE IT ALL!!!
- **Same energy-signal...what characterization?**

All current pulses produced by absorbed x-rays are counted as soon as they **exceed a threshold energy** $T_0$. In a photon-counting detector for medical CT, $T_0$ is about 20–25 keV.

Photon counting detector (PCD)

TAKE IT ALL!!!

Less image noise in LDCT and obese patients

Less streak artifacts and more stable CT-numbers
- Same energy-signal...what characterization? TAKE IT ALL!!!

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**Article**

**Low-Dose High-Resolution Photon-Counting CT of the Lung: Radiation Dose and Image Quality in the Clinical Routine**

Matthias Michael Woeltjen, Julius Henning Niehoff, Arwed Elias Michael, Sebastian Honstmeier, Christoph Moeninghoff, Jan Berggrewe and Jan Robert Kroeger

**Potential of Photon-Counting Detector CT for Radiation Dose Reduction for the Assessment of Interstitial Lung Disease in Patients With Systemic Sclerosis**

Lisa Jungblut, MD, André Euler, MD, Jochen von Spiczak, MD, Thomas Sartoretti, MD, Victor Mergen, MD, Vanessa Engstmaier, MD, Anna Landsmann, MD, Carmen-Marina Mihai, MD, Oliver Dittler, MD, Hatem Alkadh, MD, MPH, EBCR, FESER

**Estimating the Clinical Impact of Photon-Counting-Detector CT in Diagnosing Usual Interstitial Pneumonia**

Akitoshi Inoue, MD, PhD, Tucker F. Johnson, MD, Darin White, MD, Christian W. Cox, MD, Thomas E. Hartman, MD, Jamison E. Thorne, BSc, Elisabeth R. Shanblatt, PhD, Matthew P. Johnson, MS, Rickey E. Carter, PhD, Yong S. Lee, PhD, Kishore Rajendran, PhD, Shuai Leng, PhD, Cynthia H. McCollough, PhD, and Joel G. Fletcher, MD

Inoue, 2022 Invest Radiol

Woeltjen MM, Diagnostics 2022

Jungblut L, Invest Radiol 2023
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Estimating the Clinical Impact of Photon-Counting-Detector CT in Diagnosing Usual Interstitial Pneumonia

PCCT (QIR+)

Lower dose, higher image quality
Less image noise in LDCT and obese patients

Less streak artifacts and more stable CT-numbers

Simultaneous read-out of CT data in different energy bins:
SPECTRALLY RESOLVED MEASUREMENTS

Improved the reader confidence for
- reticulation,
- GGO
- mosaic pattern

Improvement in confidence in UIP presence.

PCCT (QIR+)
Less image noise in LDCT and obese patients
Less streak artifacts and more stable CT-numbers

Simultaneous read-out of CT data in different energy bins:
SPECTRALLY RESOLVED MEASUREMENTS

Radiation dose reduction of 66% compared with EID-CT is feasible, without penalty in image quality and diagnostic performance for the evaluation of ILD.
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Simultaneous read-out of CT data in different energy bins: SPECTRALLY RESOLVED MEASUREMENTS

FULL PAPER
Performance of virtual non-contrast images generated on clinical photon-counting detector CT for emphysema quantification: proof of concept

1Lisa Jungblut, MD, 2Thomas Sartoretti, 3Daniel Kronenberg, 4Victor Mergen, MD, 5Andre Euler, MD,
6Bernhard Schmidt, 7Hatem Alkadhi, MD, MPH, ECR, FESC, 8Thomas Frauenfelder, MD and
9Katharina Martini, MD
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Jungblut L, Br J Radiol 2022
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Computed tomography emphysema quantification was significantly affected by intravenous contrast administration and VMI-energy level (80 keV yielded most comparable results to VNC). The best trade-off in qualitative as well as in quantitative image quality evaluation was determined at 60/70 keV.
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