

CZT

Advances in Nuclear Medicine Technology

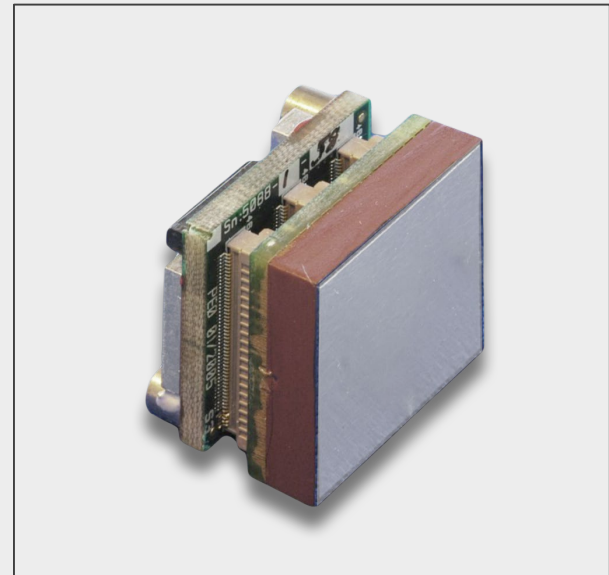
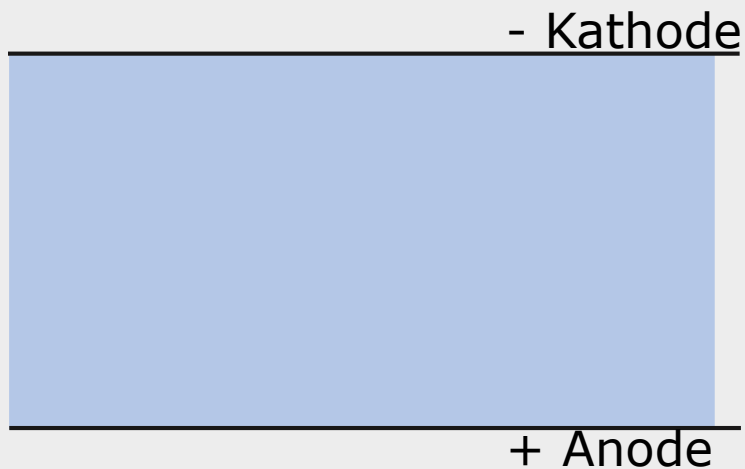
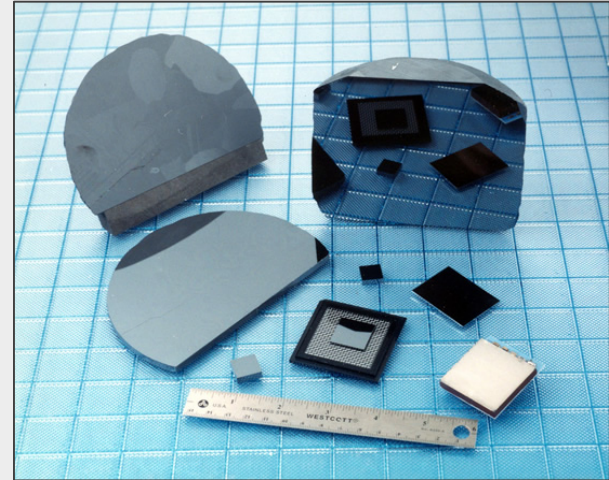
Laurens Raes



Wat is CZT

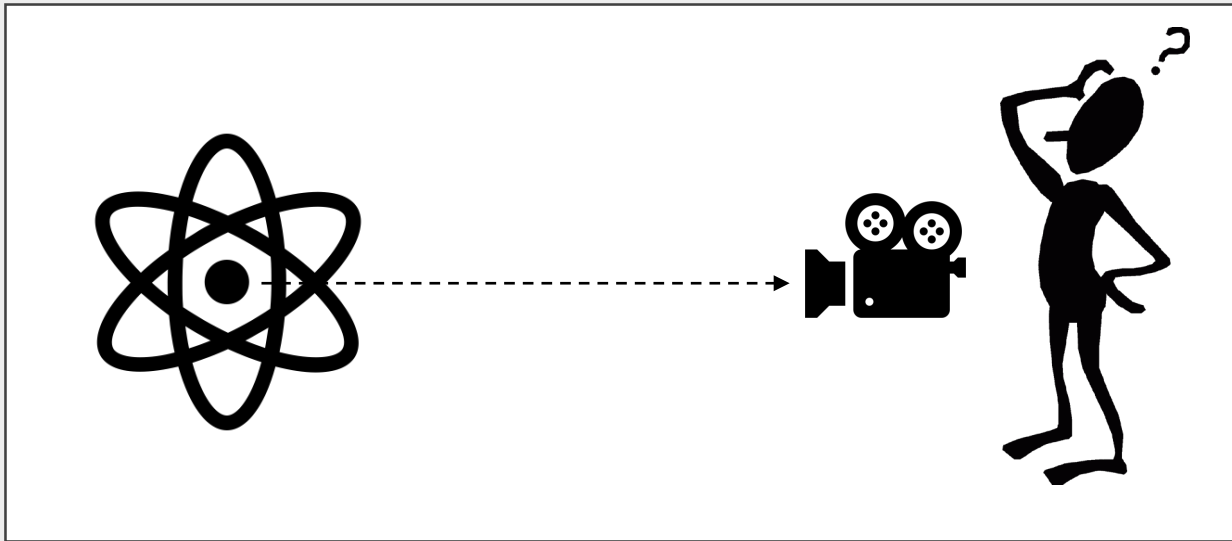
Wat is CZT

- Cadmium-Zink-Telluride
- Halbleider

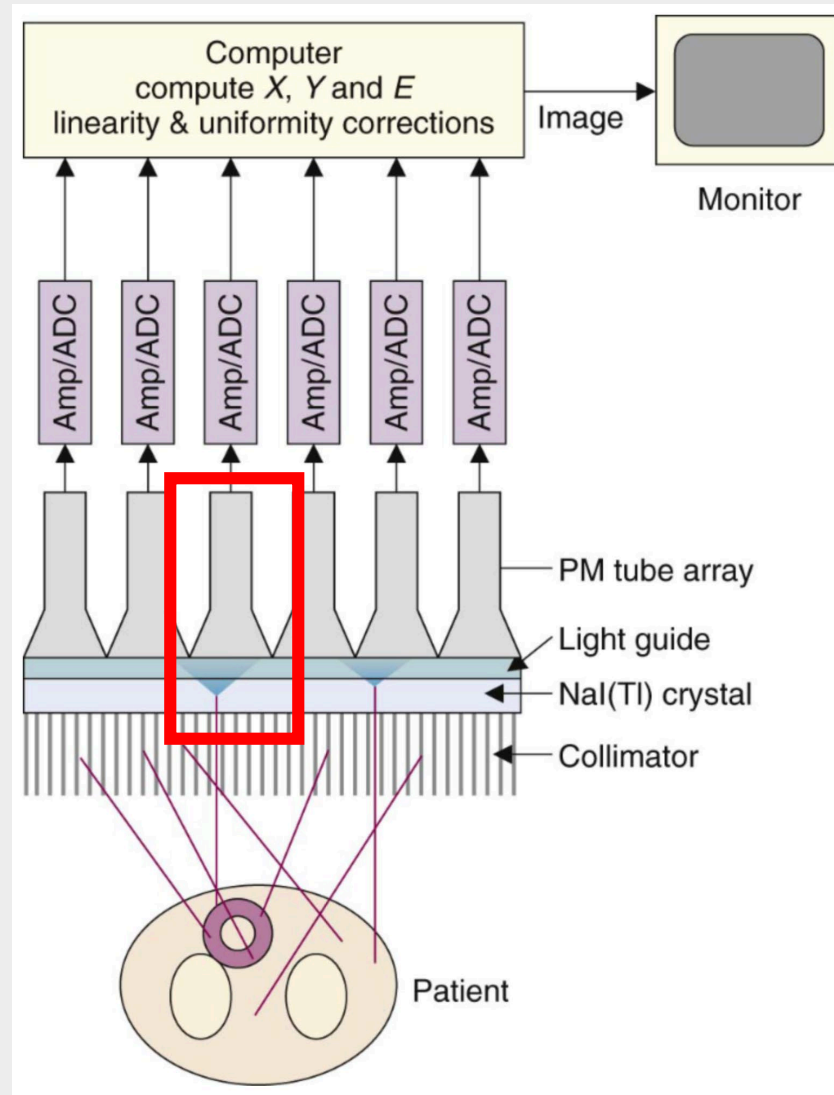


Waarom CZT

Stralingsdetectie



Gamma Camera



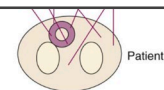
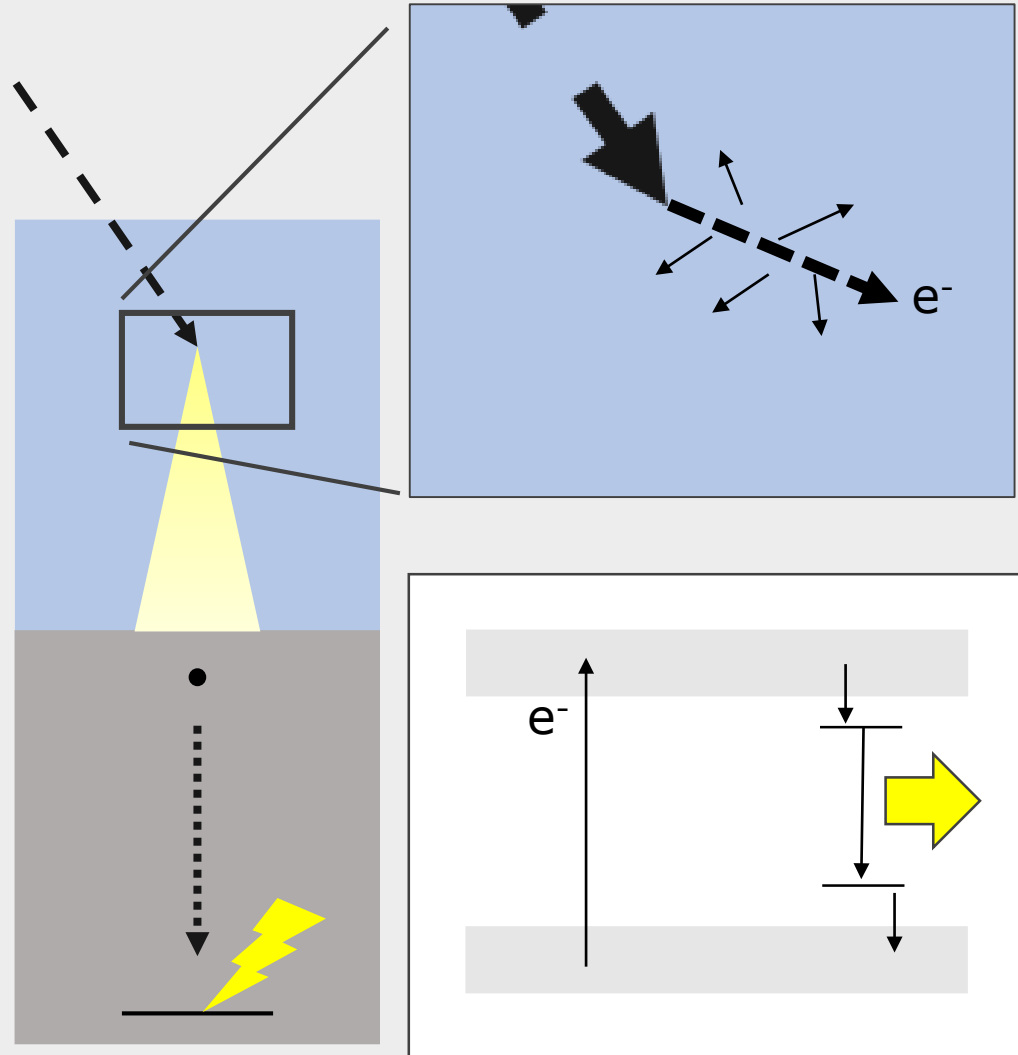
Gamma Camera

1. Gamma foton

2. Licht foton

3. Elektron

4. Signaal

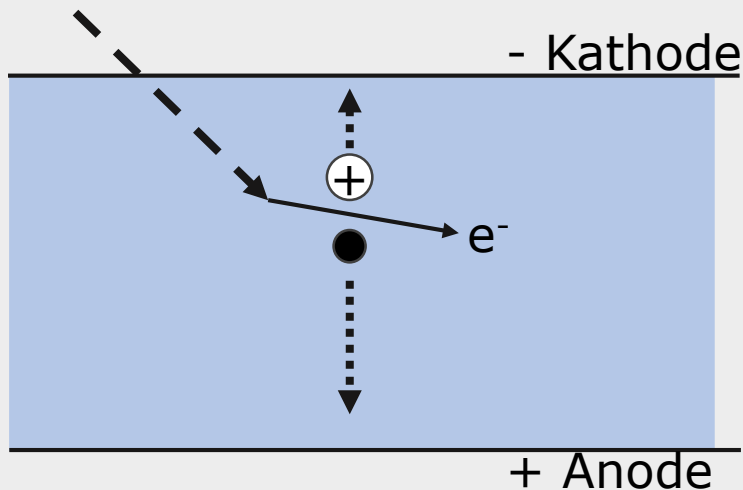


Halbleiter Detector

1. Gamma Foton

2. Ionisatie

3. Signaal

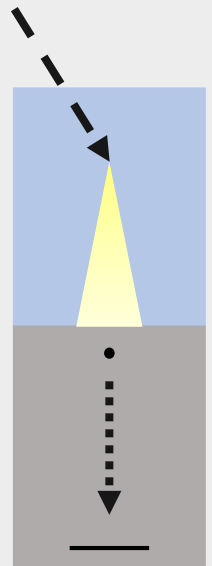


1. Gamma foton

2. Licht foton

3. Elektron

4. Signaal



Scintillatie vs Halfgeleider

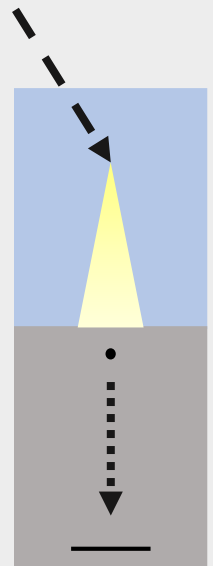
NaI(Tl) – ^{99m}Tc

- $\gamma = 140\text{keV}$
 - $\eta_{\text{scintillatie}} = 12\%$
 - $E_{\text{excitatie}} = 3\text{eV}$
- } 5600 licht fotonen

- Lichtverlies = 25%

- $\text{QE}_{\text{PMT}} = 20\%$

- $N = 840\text{ e}^-$



Scintillatie vs Halfgeleider

NaI(Tl) – ^{99m}Tc

- $\gamma = 140\text{keV}$
- $\eta_{\text{scintillatie}} = 12\%$
- $E_{\text{excitatie}} = 3\text{eV}$
- Lichtverlies = 25%
- $\text{QE}_{\text{PMT}} = 20\%$
- $N = 840 \text{ e}^-$

SCd – ^{99m}Tc

- $\gamma = 140\text{keV}$
- $\eta_{\text{scintillatie}} = -$
- $E_{\text{excitatie}} = 5\text{eV}$
- Lichtverlies = -
- $\text{QE}_{\text{PMT}} = -$
- $N = 28.000 \text{ e}^-$

Scintillatie vs Halfgeleider

NaI(Tl) – ^{99m}Tc

$$R_E = \frac{2.35}{\sqrt{N}}$$

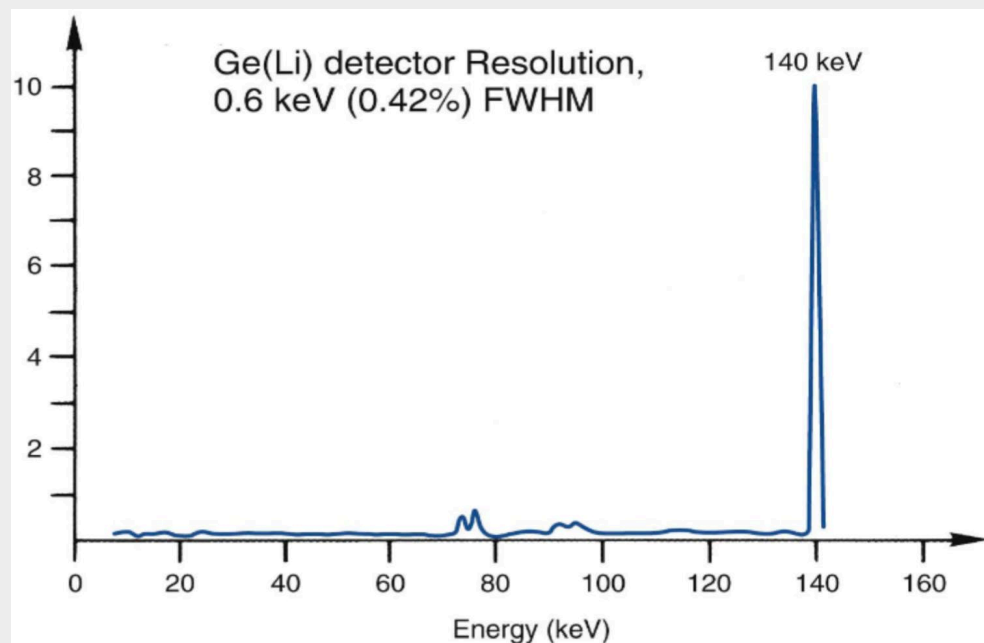
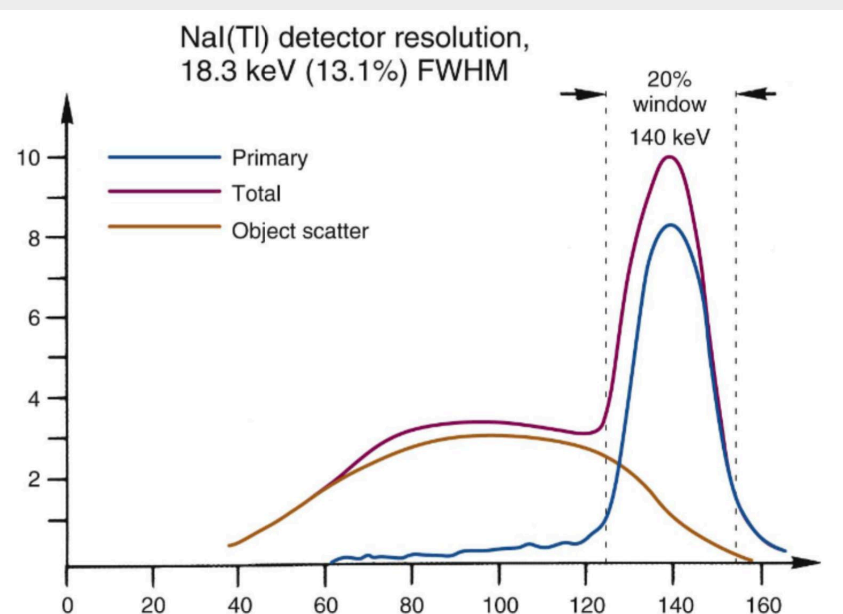
$$R_E = \frac{2.35}{\sqrt{840}}$$

SCd – ^{99m}Tc

Fano Factor

$$F=0.09$$

$$R_E = \sqrt{0.09} \frac{2.35}{\sqrt{28000}}$$



CZT voor stralingsdetectie

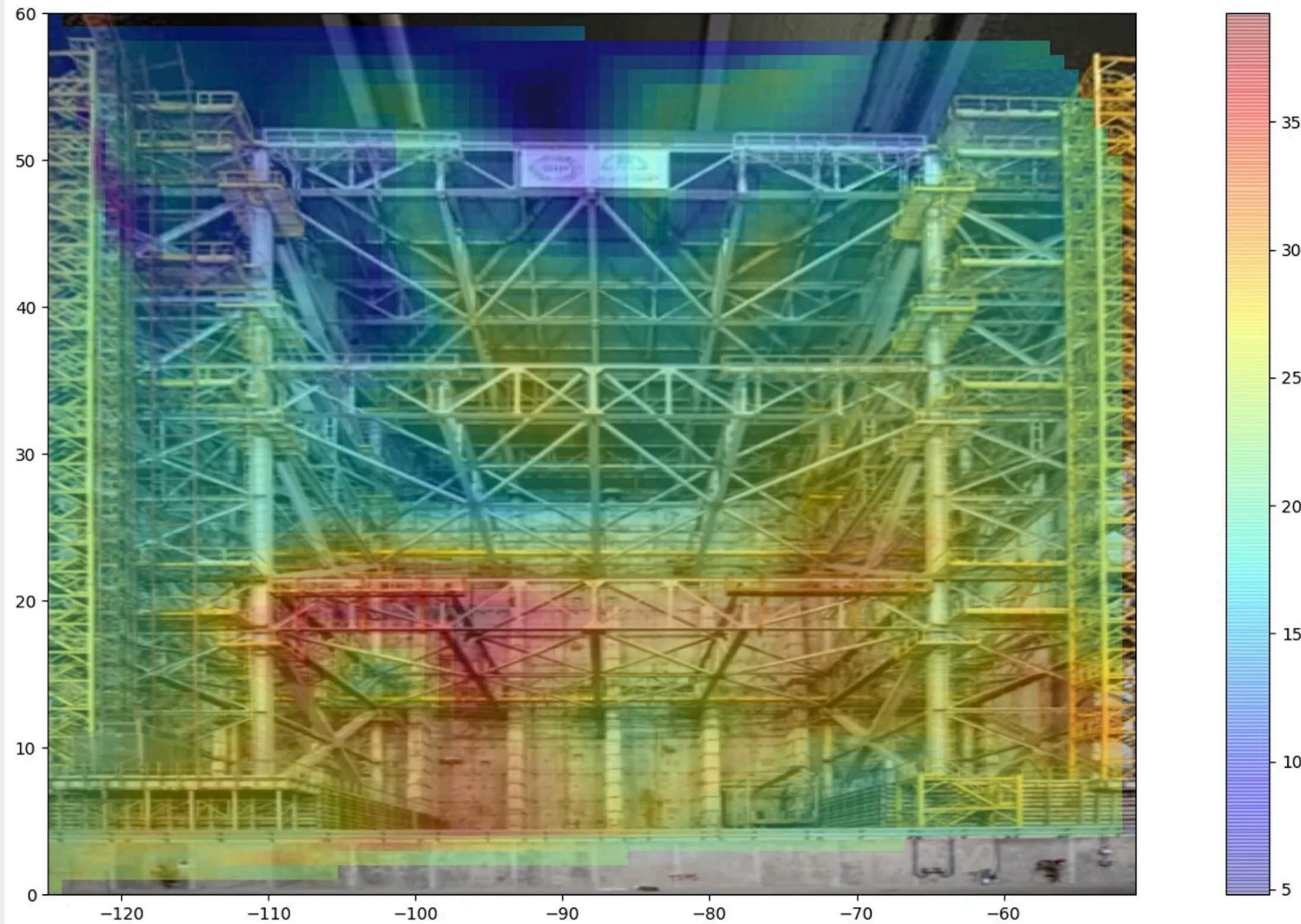
	<u>NaI(Tl)</u>	<u>Si</u>	<u>Ge</u>	<u>CZT</u>
ρ [g/cm ³]	3.67	2.33	5.32	6.06
Z	50	~~14~~	32	50
W [eV]		3.6	2.9	4.43
BG		1.14	~~0.67~~	1.4-2.2

Toepassingen CZT

Mobiele detectoren



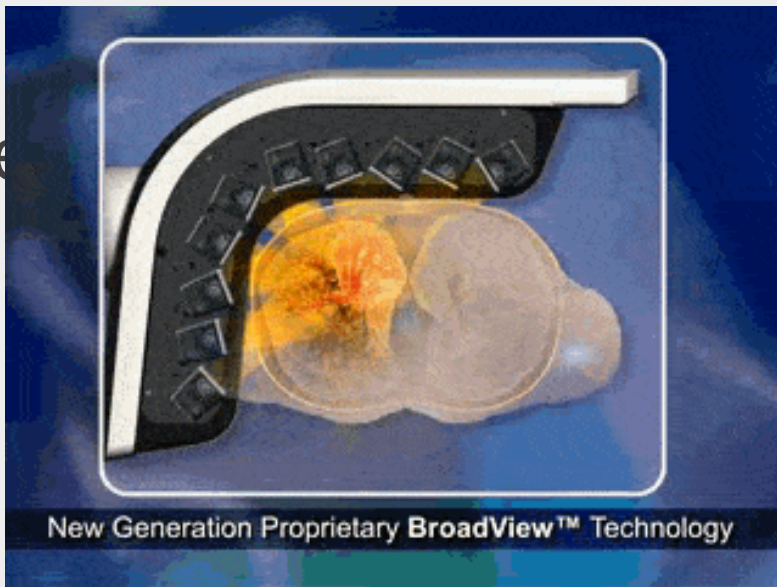
Mobiele detectoren



Multidetector Setup - Applicatiespecifiek

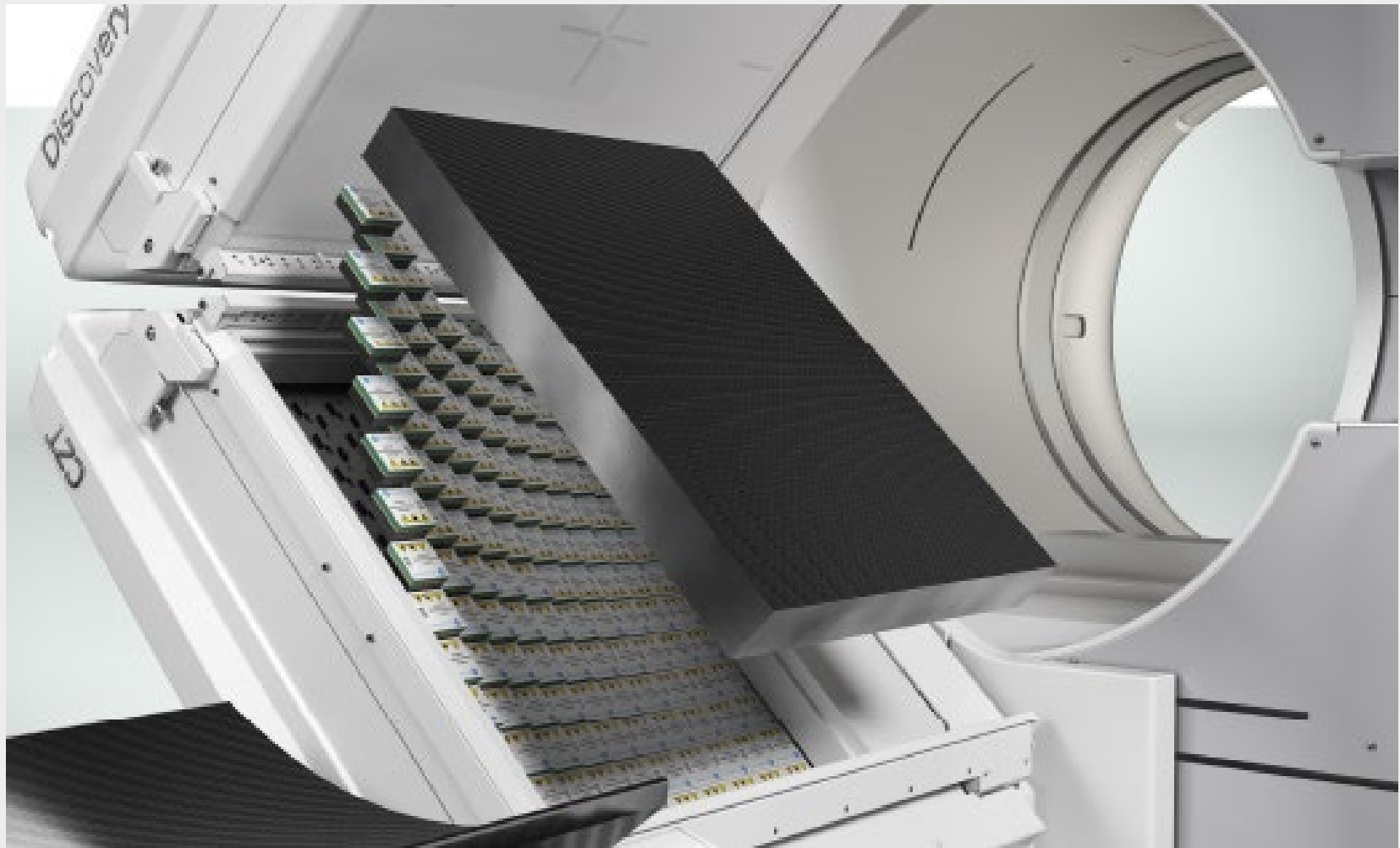
- Myocard perfusie

- Ge

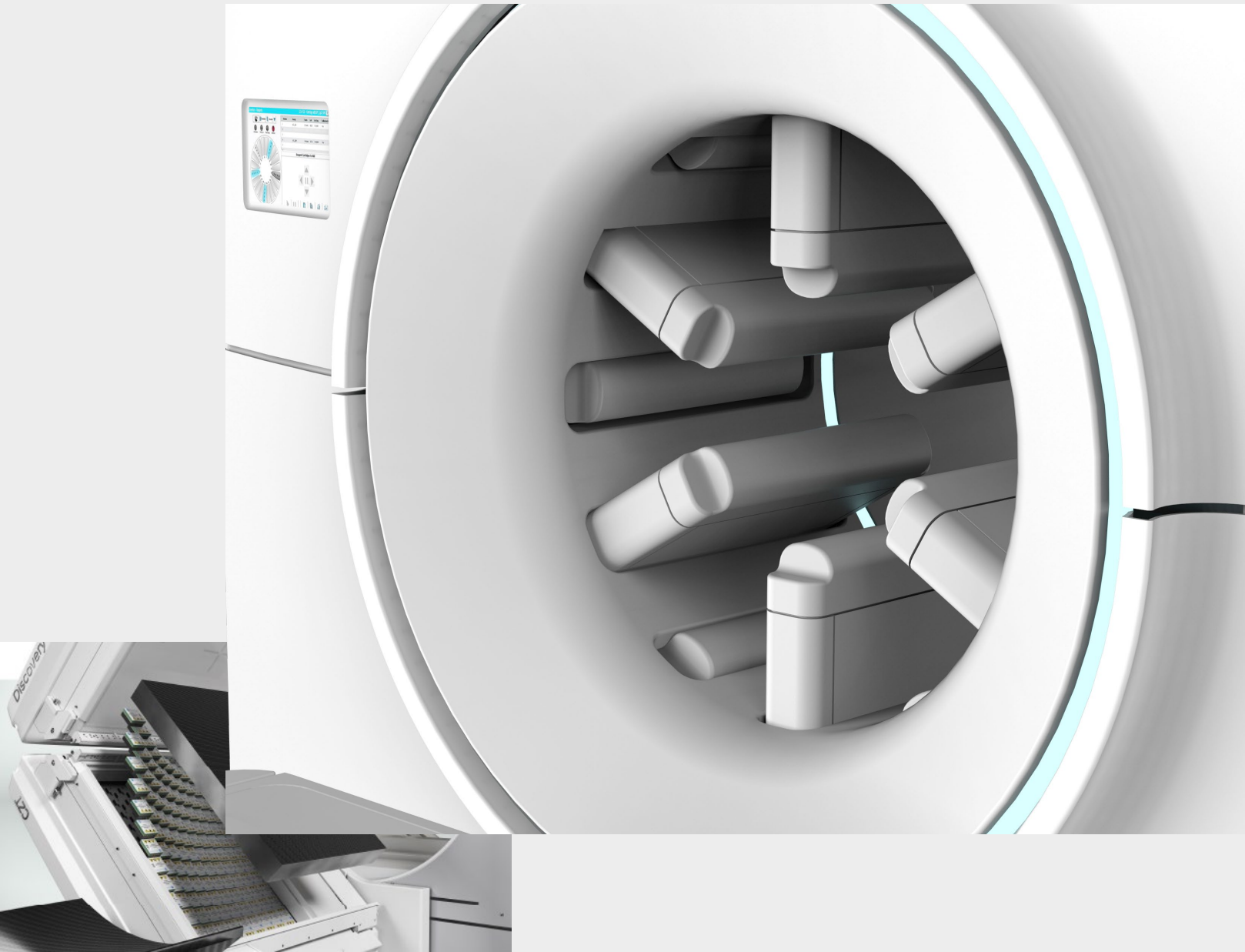


	D-SPECT	CS
R_E [%]	5.5	9.25
R_S [mm]	2.46	3.8
S_{tomo} [cps/MBq]	647-1107	141

Multidetector Setup - Algemeen

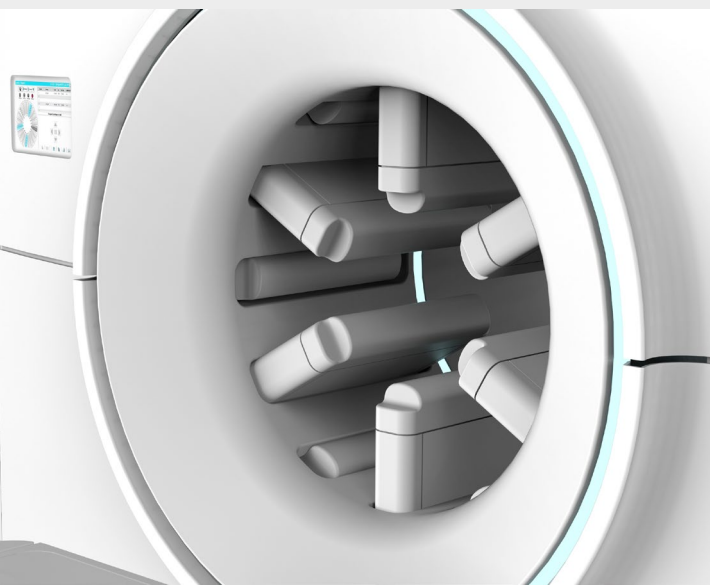


Multidetector Setup - Algemeen



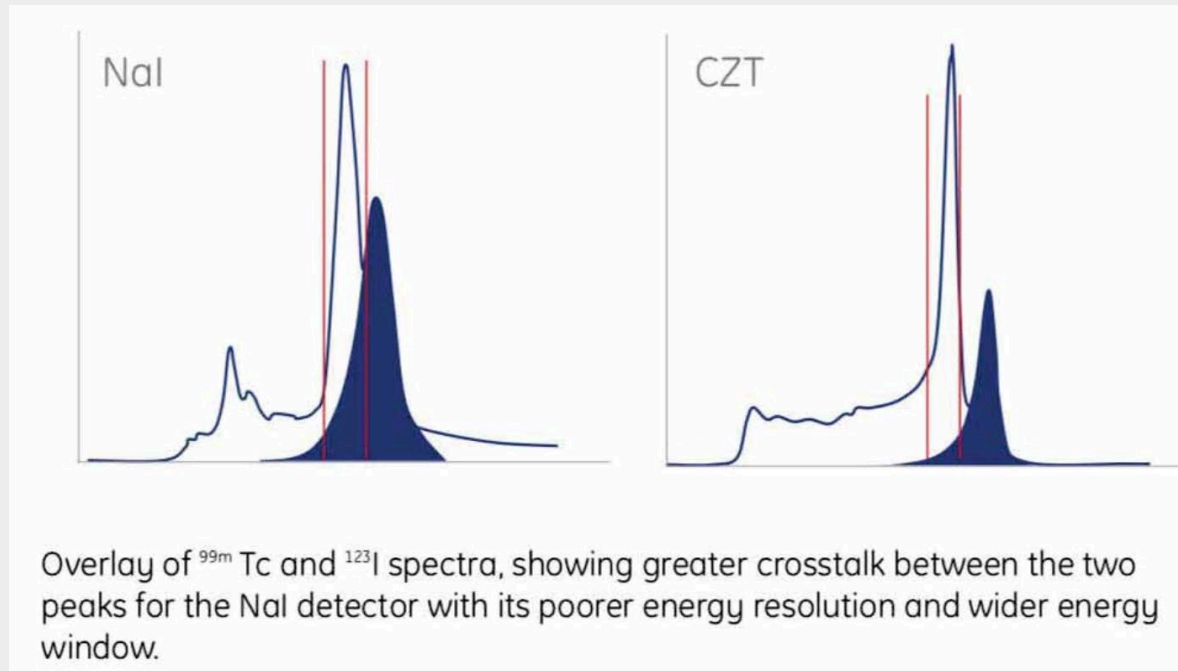
Multidetector Setup - Algemeen

	GE Starguide	CS
R_E [%]	5.5	9.9
R_S @10cm [mm]	7.0	7.8
S_{planar} [cps/MBq]	96.9	90.9
$S_{\text{vol/ax.cm}}$	29160	12000



Dual Isotope Imaging

- ^{99m}Tc + ^{123}I



Dual Isotope Imaging

- ^{99m}Tc + ^{123}I

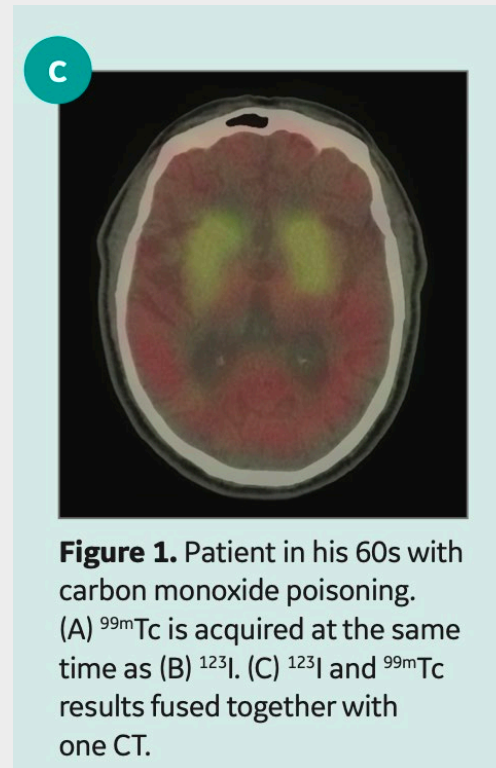
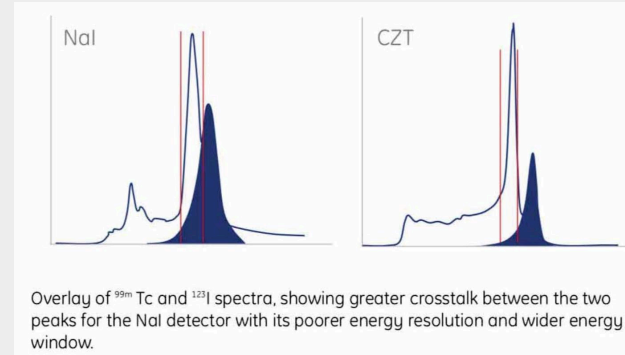
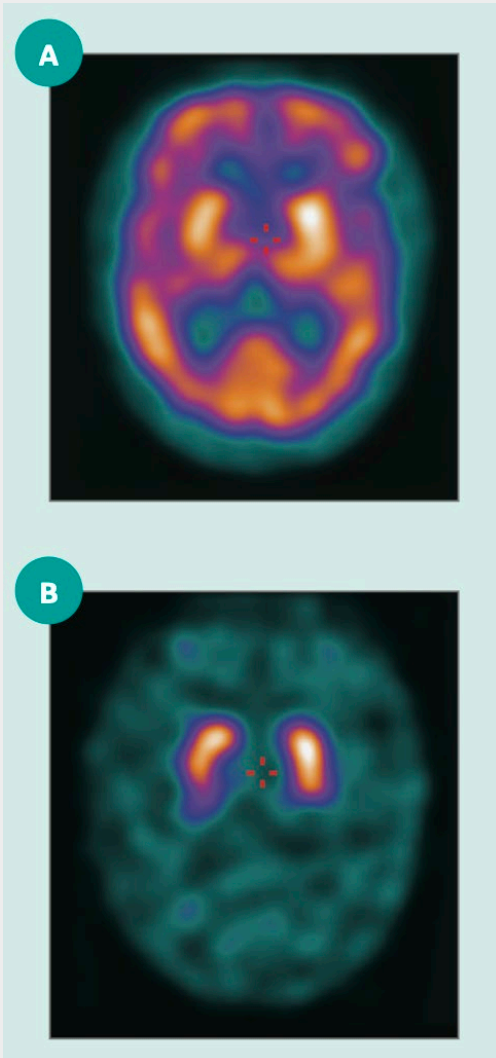
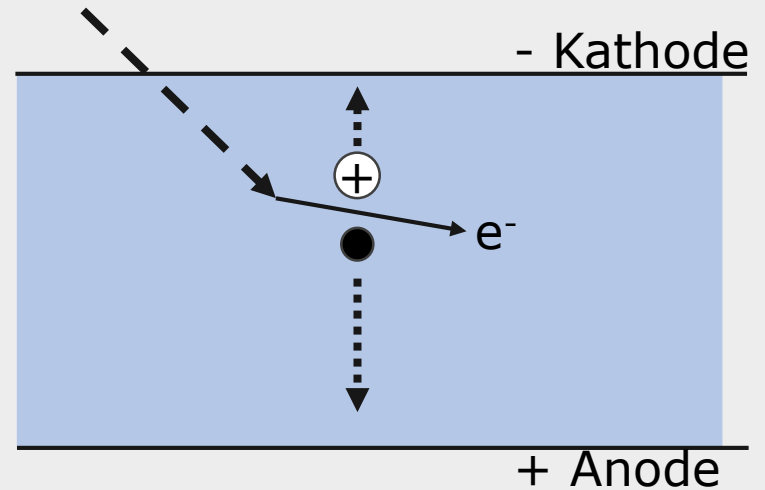
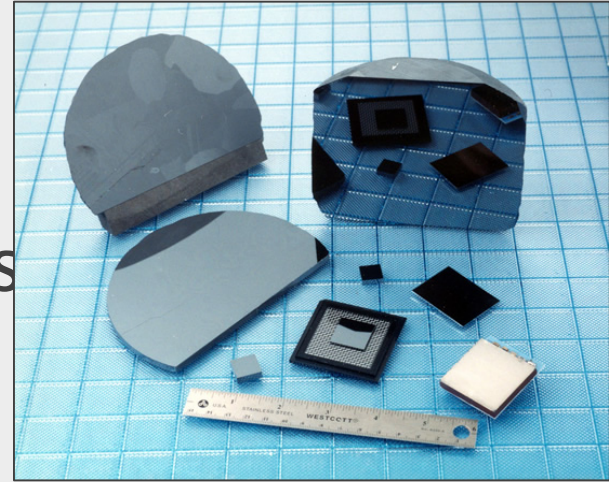


Figure 1. Patient in his 60s with carbon monoxide poisoning. (A) ^{99m}Tc is acquired at the same time as (B) ^{123}I . (C) ^{123}I and ^{99m}Tc results fused together with one CT.

Nadelen ?

Nadelen

- Fabriatiekost
- Bewegingsvrijheid ladingen
= Hole Trapping



- R_{Energie}
- R_{Spatiaal}
- Sensitiviteit
- Compact
- Hoge Z
- Kamertemperatuur

- Kost
- Hole Trapping