

## CT Scanner Dose Reduction GE Medical Systems

Clinical  
Diagnostic  
Confidence  
(Image Quality)



Population  
Dose  
Risk

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Málaga 2/10/06



## Image Quality and Dose

Image scanned at 260 mA



Image scanned at 130 mA



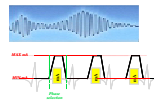
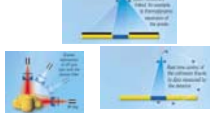
Lower mA results in Lower dose but higher image noise  
Noise impairs the ability to visualize low contrast features



How much dose do you need?

## OptiDose GE's Overall Commitment to Dose Management

- Volara DAS Technology for higher detection efficiency
- V-Res detector with 100% active area
- 40mm coverage
- Cardiac/Pediatric bowtie filter

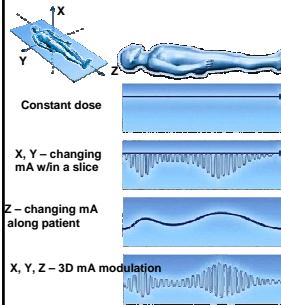


- ✓ 3D Dose Modulation
- ✓ ECG Dose Modulation
- ✓ Electron Collector
- ✓ Color Coding For Kids
- ✓ SmartBeam –X-ray beam filtration
- ✓ NO Post Patient Collimation
- ✓ Hi-Res Chest Protocol
- ✓ Prospective Display CTDIvol, DLP, Efficiency



## 3D Dose Modulation

Up to 40% Dose Reduction with Three Dimensional Modulation



Prospective 3D dose modulation

From single low dose scout

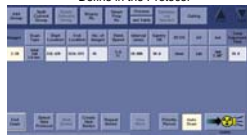
Automatically changes mA

- Along patient
- Within a slice




## 3D dose modulation in routine acquisition

Define in the Protocol



mA Control



mA Range: Min 10 Max 300

Smart mA

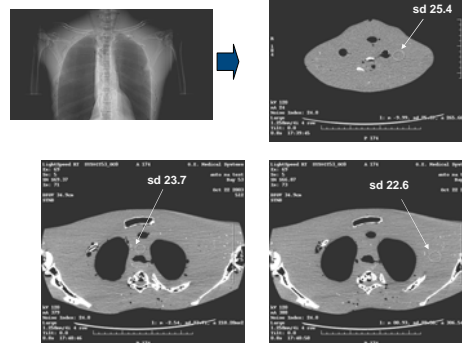
Prospective Display

Dose Information

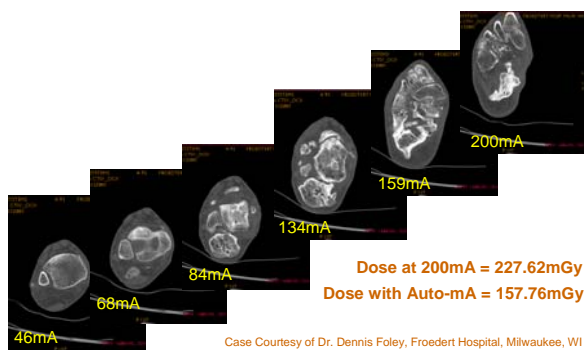
Images	CTDIvol mGy	DLP mGy·cm	Dose Efficiency %
1-23	5.03	188.60	87.40
SmartPrep	43.95	43.95	
Projected series DLP		242.55 mGy·cm	
Accumulated exam DLP		1934.43 mGy·cm	

Keep control, prospectively, of the image quality and of the dose level

## An AutomA Example (Noise Index =24)



## Auto-mA (30% dose saving)



## ECG Automatic mA Modulation

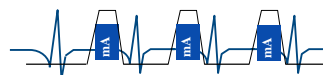
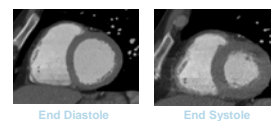
Up to 50% Dose Reduction for Coronary Vessel Imaging

Modulated dose based on ECG signal

User selectable parameters

- Min and Max mA settings
- Adjustable phase %

Data can be used for functional analysis



## Low Dose Cardiac Image Filter



low-dose  
120 KV, 150 mA

50% more noise

Vessel tracking after  
applying Edge-  
Preserving Noise Filter  
to volume data set



120 KV, 300 mA



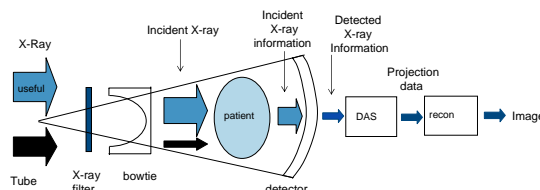
Comparable Vessel  
Tracking image from  
filtered data set.

- Only 8% more noise
- No loss of structures

50% Dose Reduction if scanned at  
150 mA



## CT Components that Affect Dose



**Exposure Settings**  
X-ray filtration  
Bowtie filters

**Beam tracking to  
minimize unused  
X-ray**  
(over beaming)

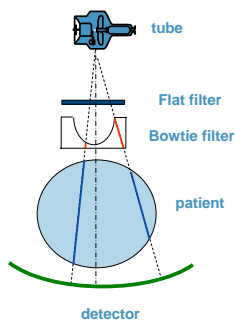
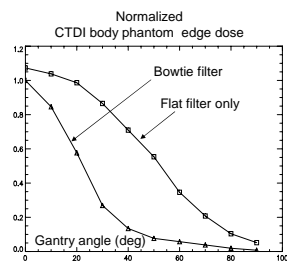
**Geometric  
efficiency  
of Detector**  
(scatter grids)

**Image  
Processing  
Algorithms**  
(filters)



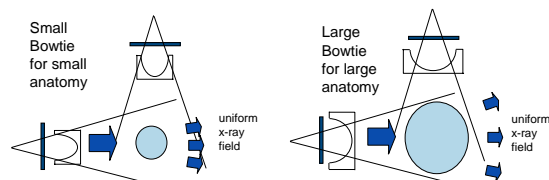
## Bowtie Filter

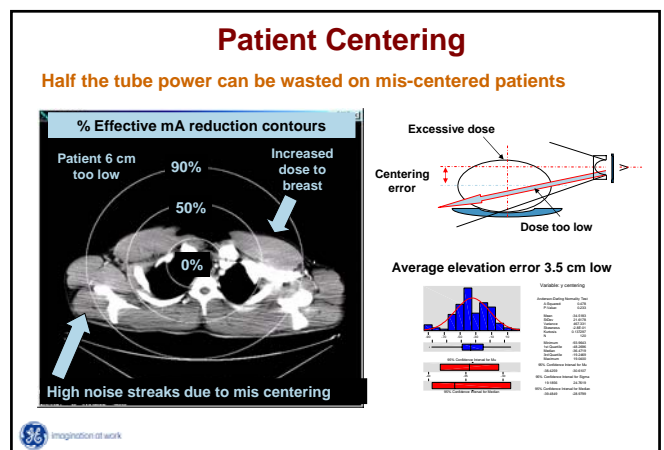
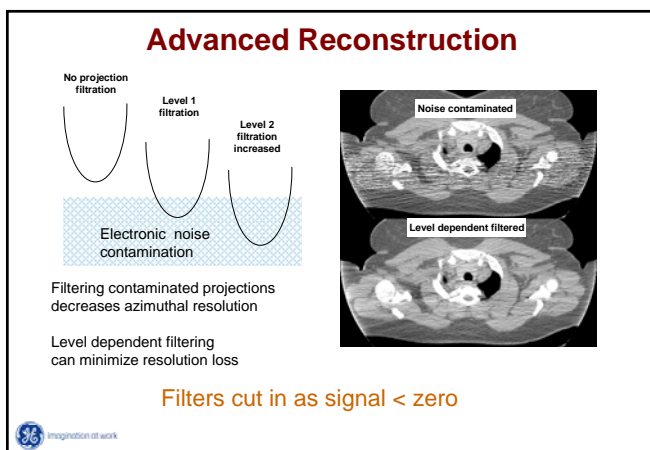
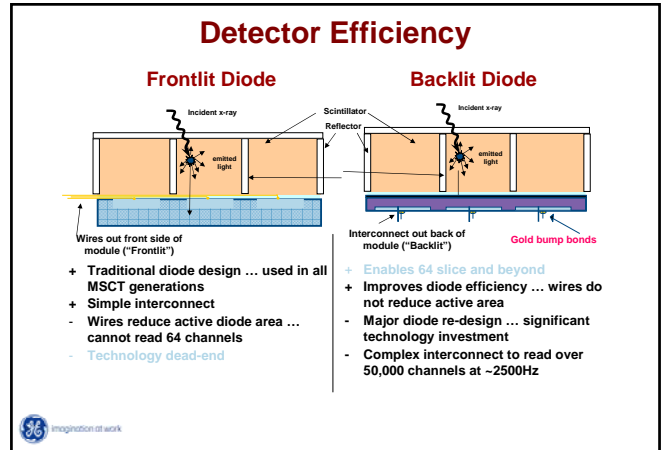
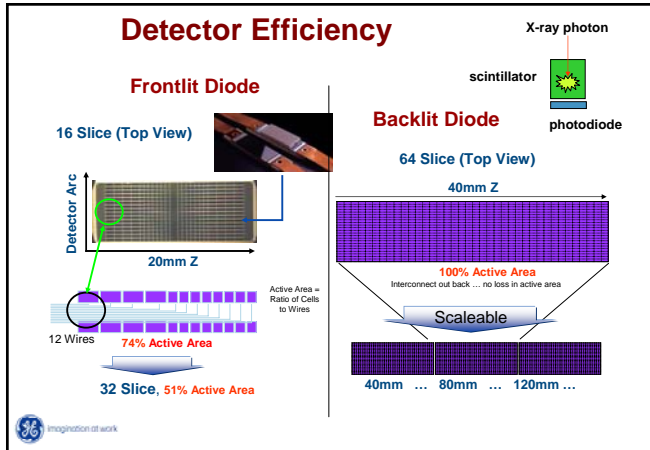
- Longer bowtie path lines up with shorter patient path.
- Reduce surface dose by 50%



## Patient Matching Bowtie Filters

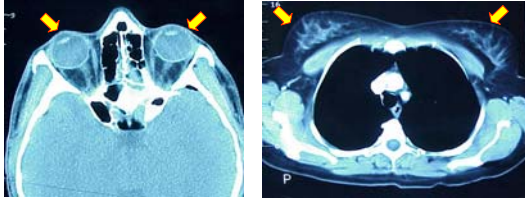
- Maintain uniform x-ray at detector
- Minimize surface dose
- Reduce x-ray scatter (noise and artifact)





## Unintended Dose to Organs

- Eye lens dose in brain CT receive high doses.
- Modification of acquisition (tilt gantry, avoid regions)



## What Can Operators Do...?

- Limit the scanned volume
- Reduce mAs values
- Use automatic exposure control
- Use of helical/spiral CT with pitch factor > 1
- Shielding of superficial organs
- Separate techniques for children

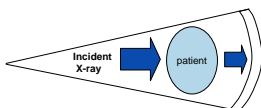


## ALARA Partnership

### The CT Manufacturer



Develop practical CT systems with the highest possible dose efficiency and that simplify ALARA operation.



### The Radiologist



Use only the necessary dose to achieve the diagnostic objective



## Summary

- Sensitivity to radiation dose has increased significantly over the past decade.
- Many technological advancements have been developed to optimize the scanner performance in terms of dose.
- More advanced features are under development.
- Dose reduction requires good partnership between manufacture and radiologists.

