

# Low contrast detail detectability measurements on multi-slice CT scanners

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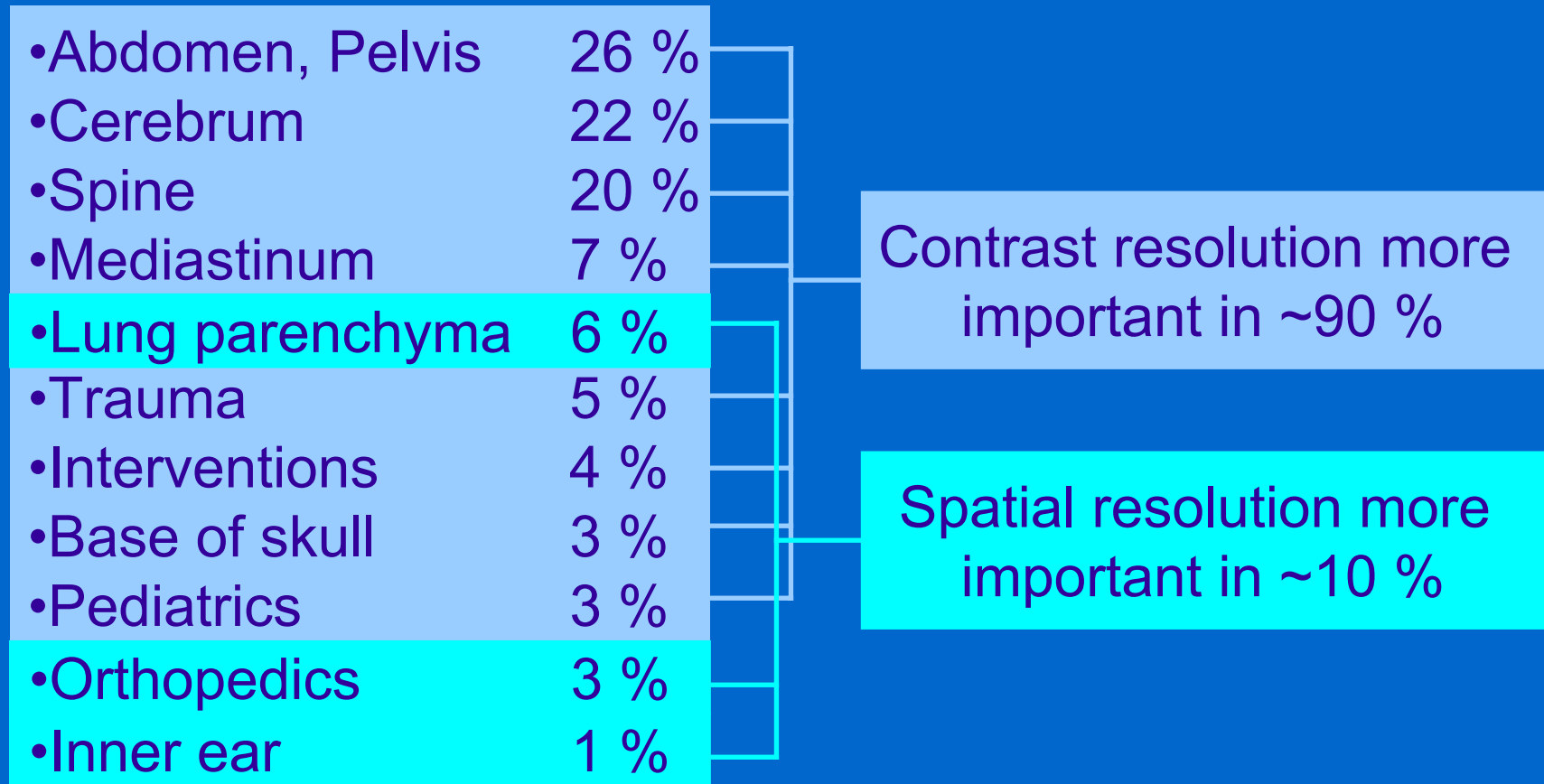
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[www.impactscan.org](http://www.impactscan.org)

# Clinical importance of low contrast detectability

- Studies where soft tissue differentiation is important are common in CT

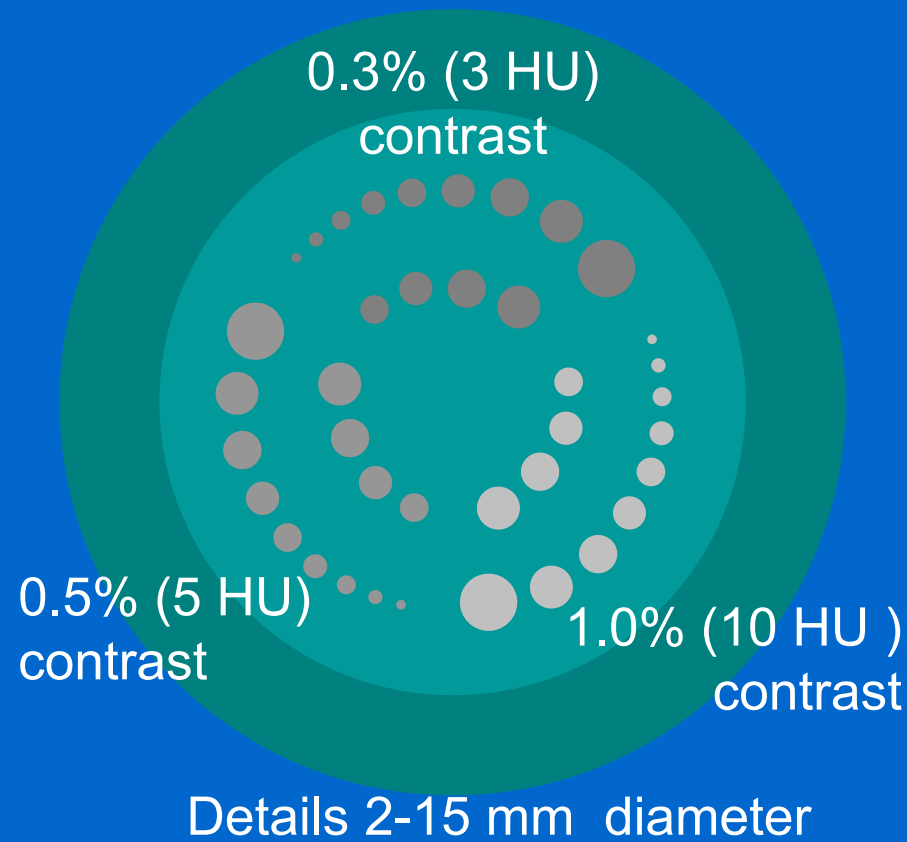


# Assessment of LCD

- Usually use uniform phantoms with variable size low contrast inserts
- Catphan was used in this study
- All vendors quote scanner performance on this phantom



Catphan 500



# Scanners' stated performance

	GE	Philips	Siemens	Toshiba
Scanner	LightSpeed +	Mx8000	Volume Zoom	Aquilion Multi
Phantom	Catphan	Catphan	Catphan	Catphan
Contrast	0.3%	0.3%	0.3%	0.3%
Slice width	2 x 10 mm	10 mm	1 x 10 mm	10 mm
Surface Dose	18 mGy	27 mGy	21 mGy	120 kV, 150 mAs*
Detail Size	5 mm	4 mm	5 mm	4 mm
Detail visibility criteria	?	?	?	?

\*ImPACT estimated CTDI: 24 mGy

- Data not directly comparable

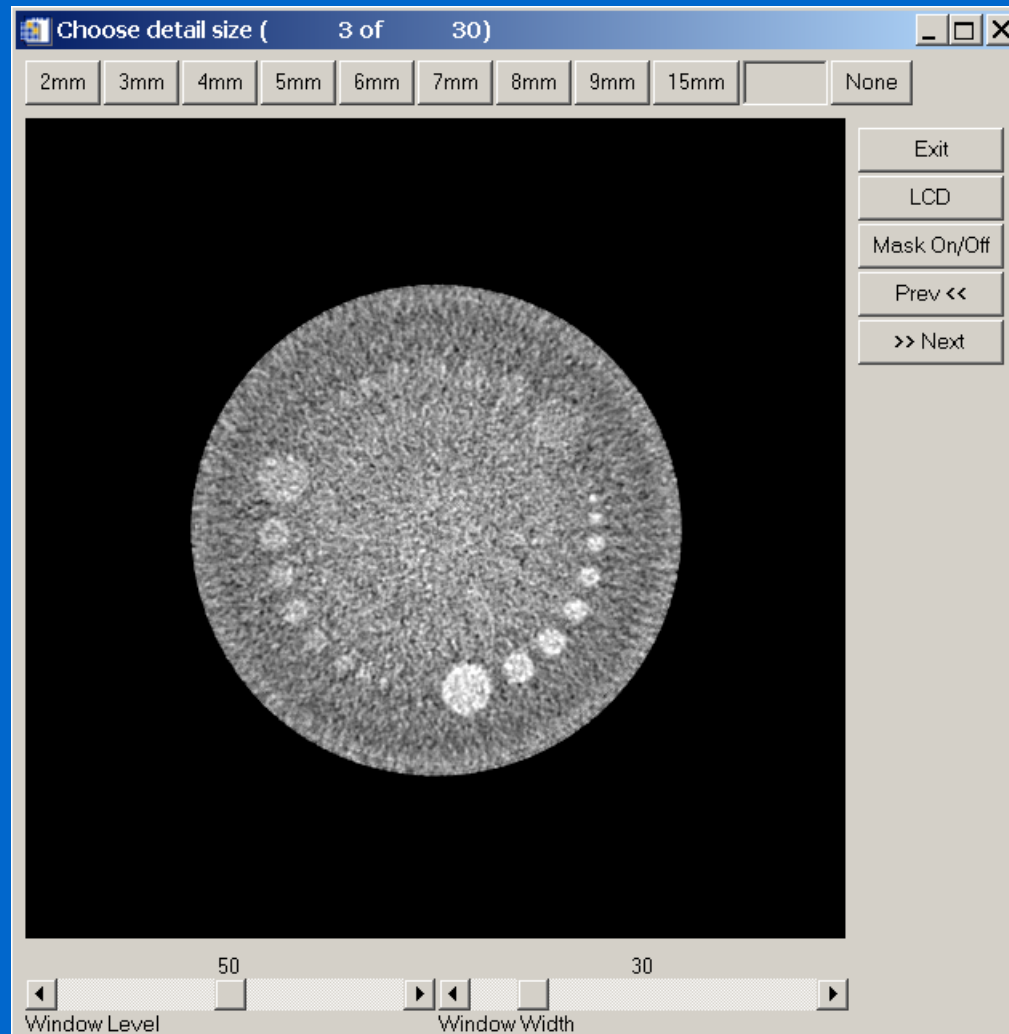
# Standard LCD assessment conditions

- In order to provide more comparable results, standard exposure and reconstruction parameters were used
  - 120kV, 10 mm image\*, 20 mm collimation\*, 25 mGy surface dose, 20 images
  - Standard kernel, 25 cm FOV, no bone correction where possible
- Images scored by four observers under standard conditions with written visibility criteria
  - All images viewed in a single session in random order
  - 0.3 % contrast (3 HU) details scored

\* Closest available setting used, corrections made where necessary

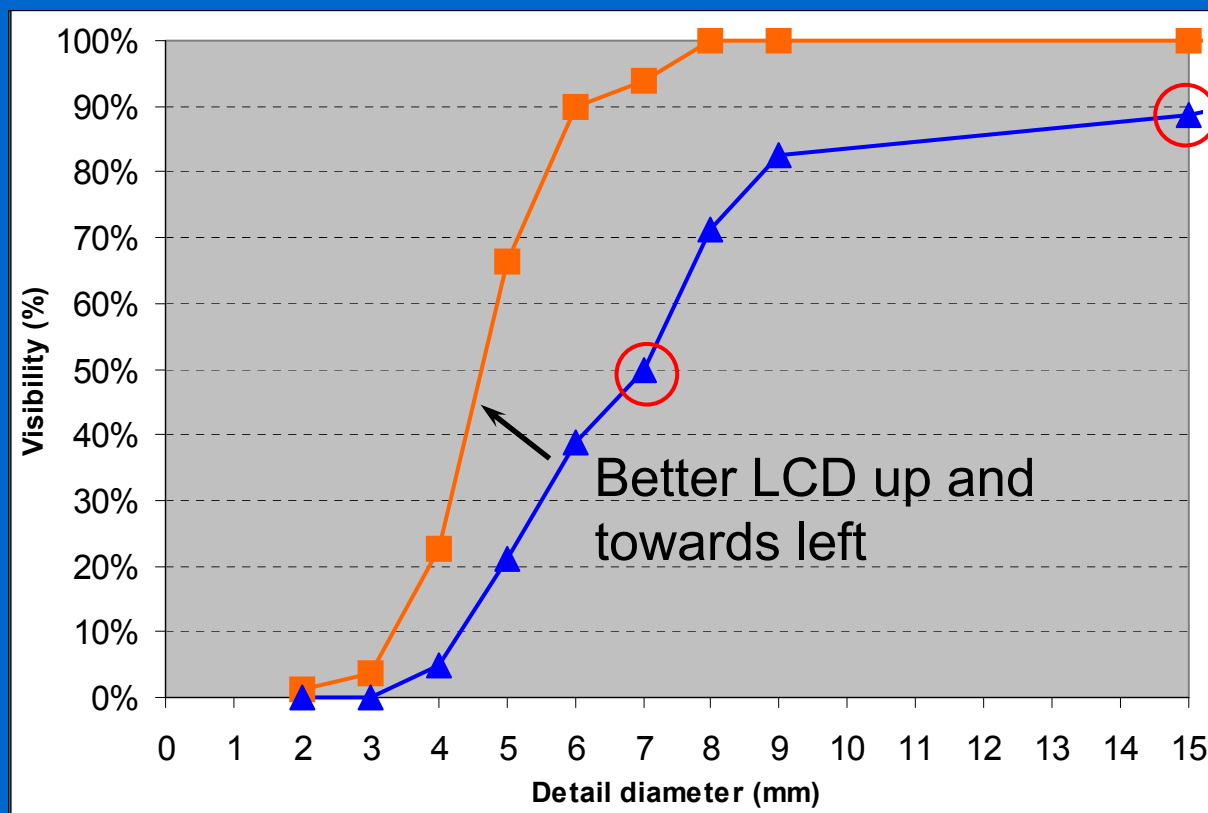
# Image scoring

- Images scored for smallest visible detail using custom written IDL program



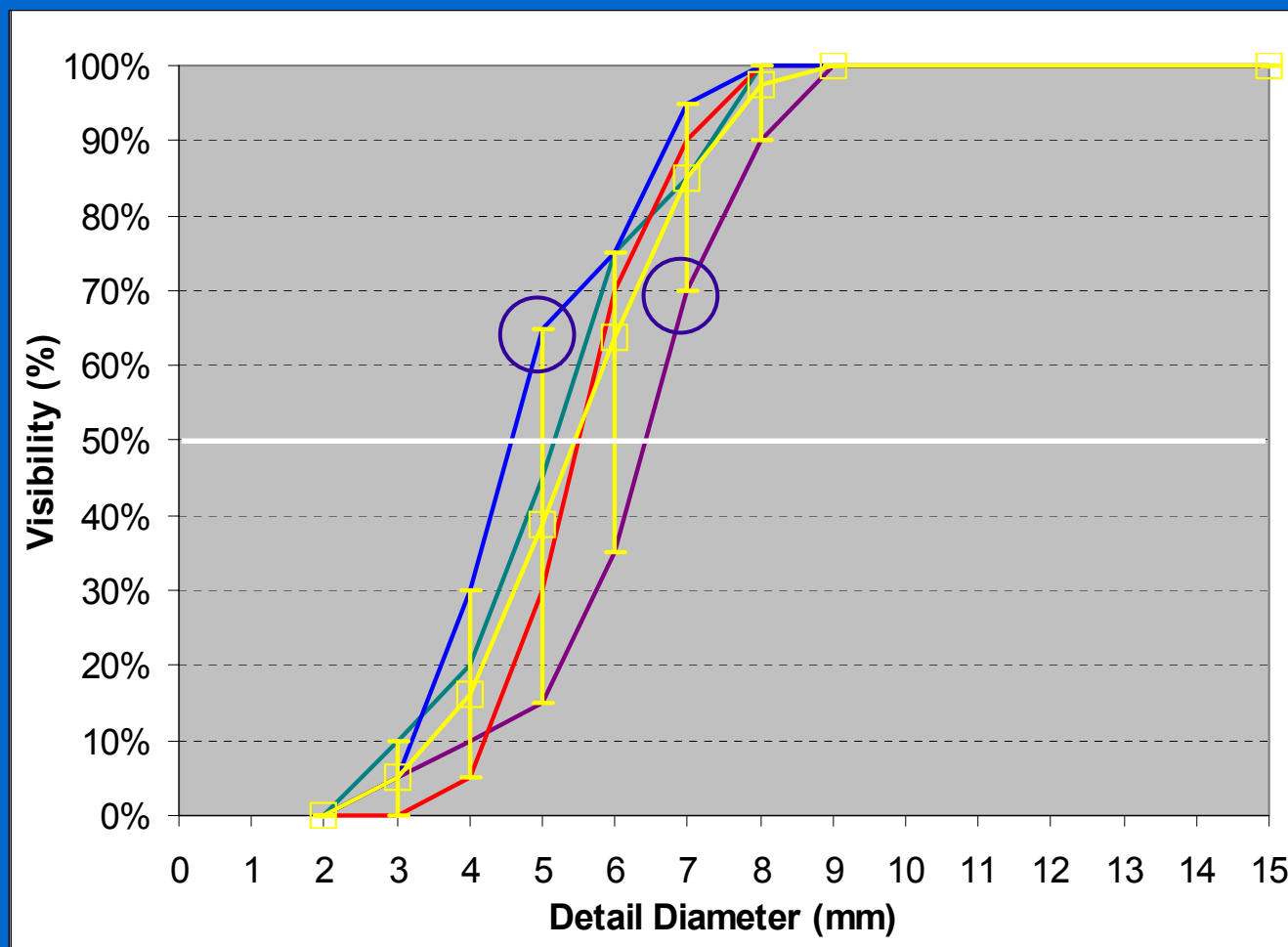
# Result presentation

- Percentage of images at each detail size that is visible is plotted (20 images)
  - e.g. 15 mm detail visible in 18 images: 90 % visibility
  - 7 mm detail visible in 10 images: 50 % visibility



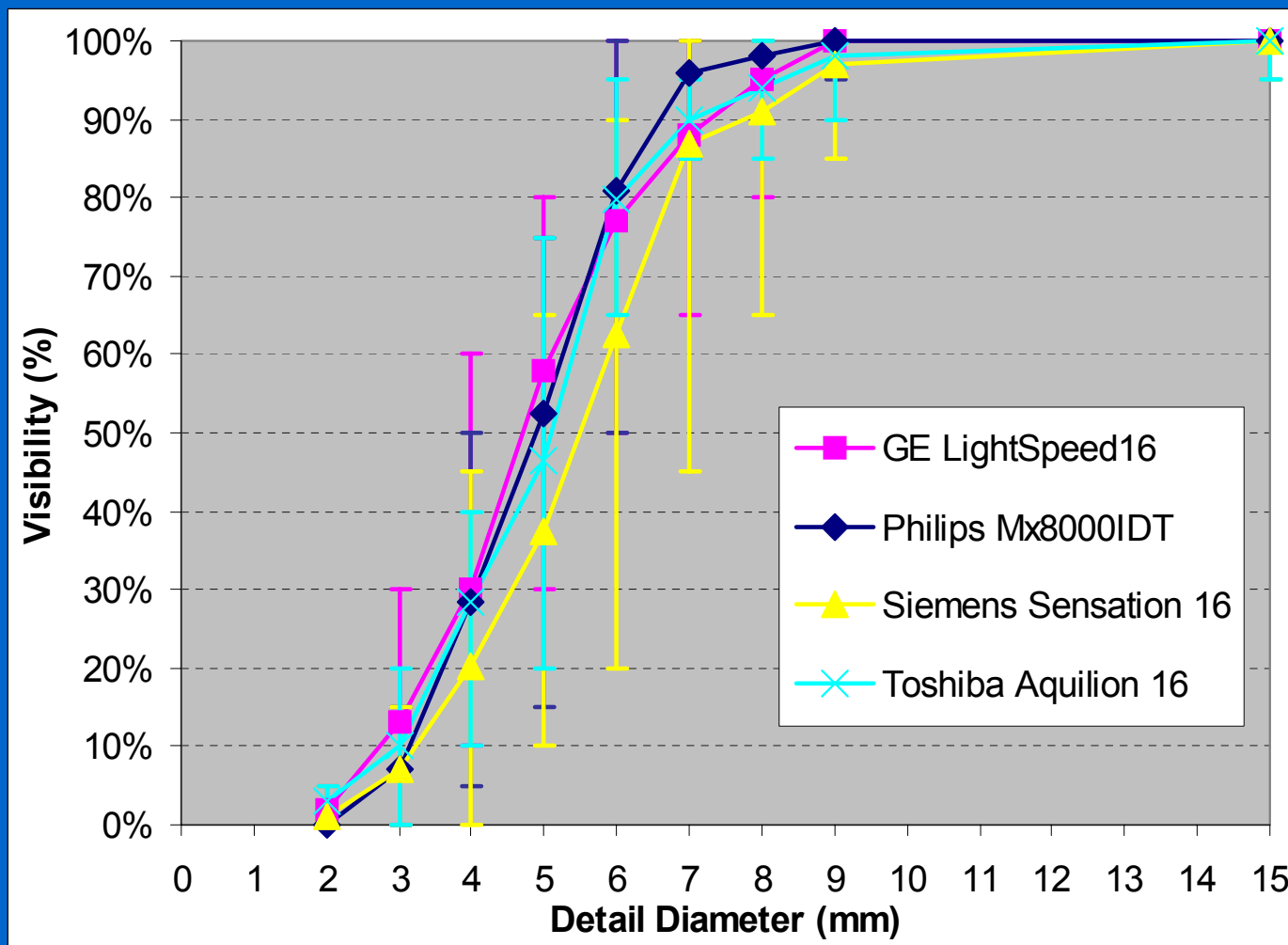
# Results: Inter-viewer variability

- Four viewers for single group of 20 images
  - e.g. for  $> 50\%$  visibility, results vary between 5 and 7 mm

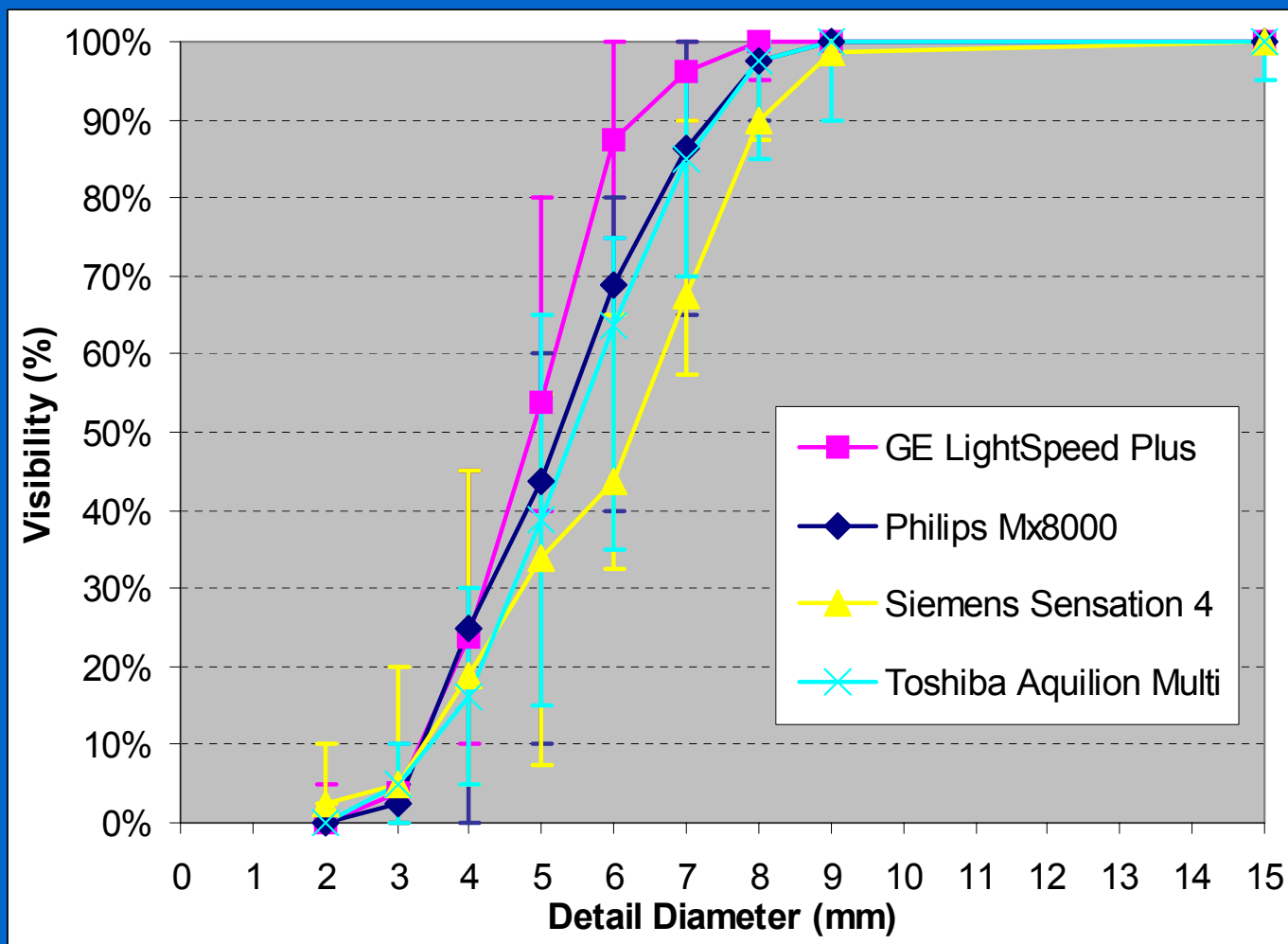




# Results for 16 slice scanners



# Results for 4 slice scanners

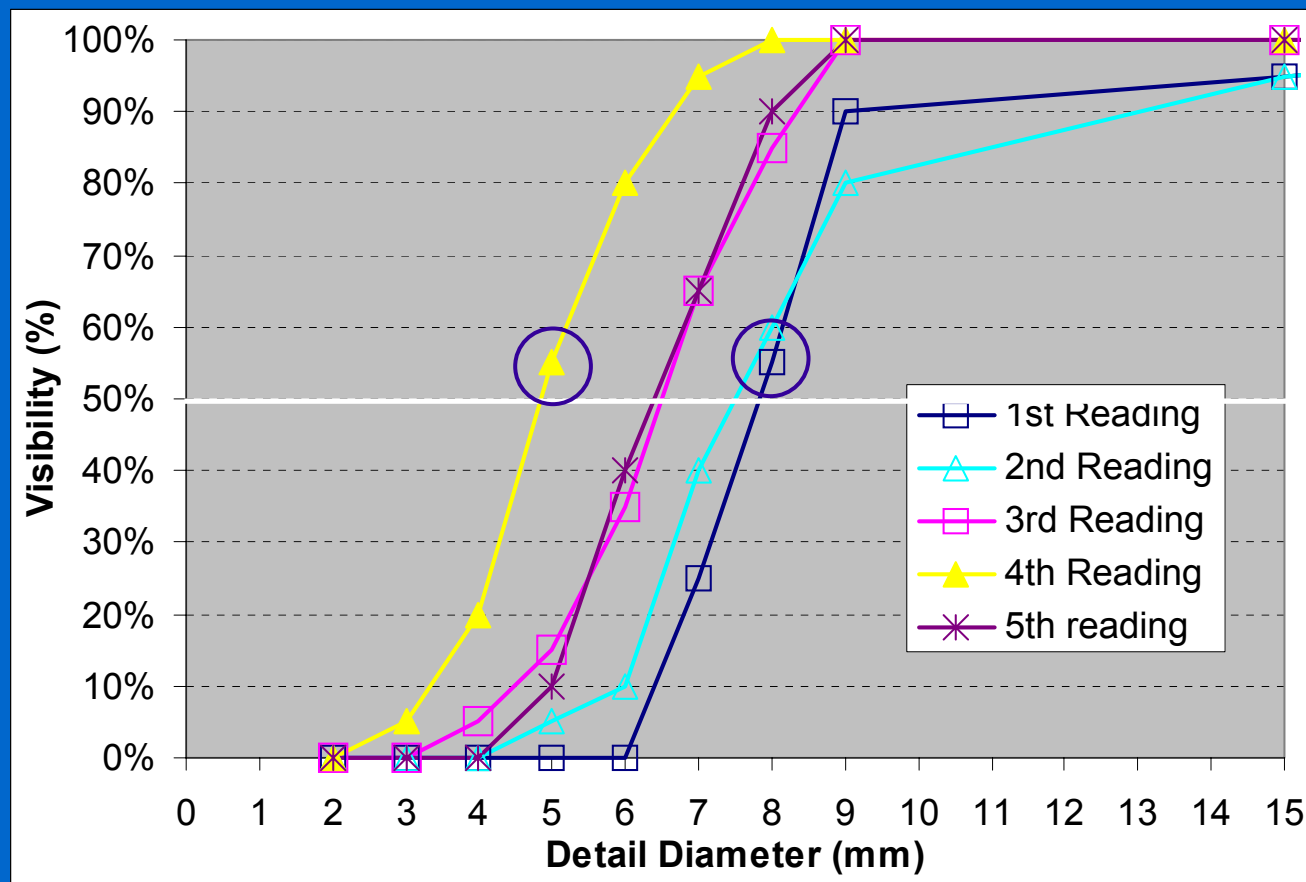


# Result variability: 4 slice scanners

- Four viewers assessing 80 images (20 from 4 scanners)
  - Complete agreement of all four viewers for 6 images (7.5%)
  - Standard deviation from mean score for each image was 1.1 details

# Results: Intra-viewer variability

- Single viewer, assessing same group of 20 images on 5 occasions (> 1 month apart)
  - For > 50% visibility, results vary between 5 and 8 mm

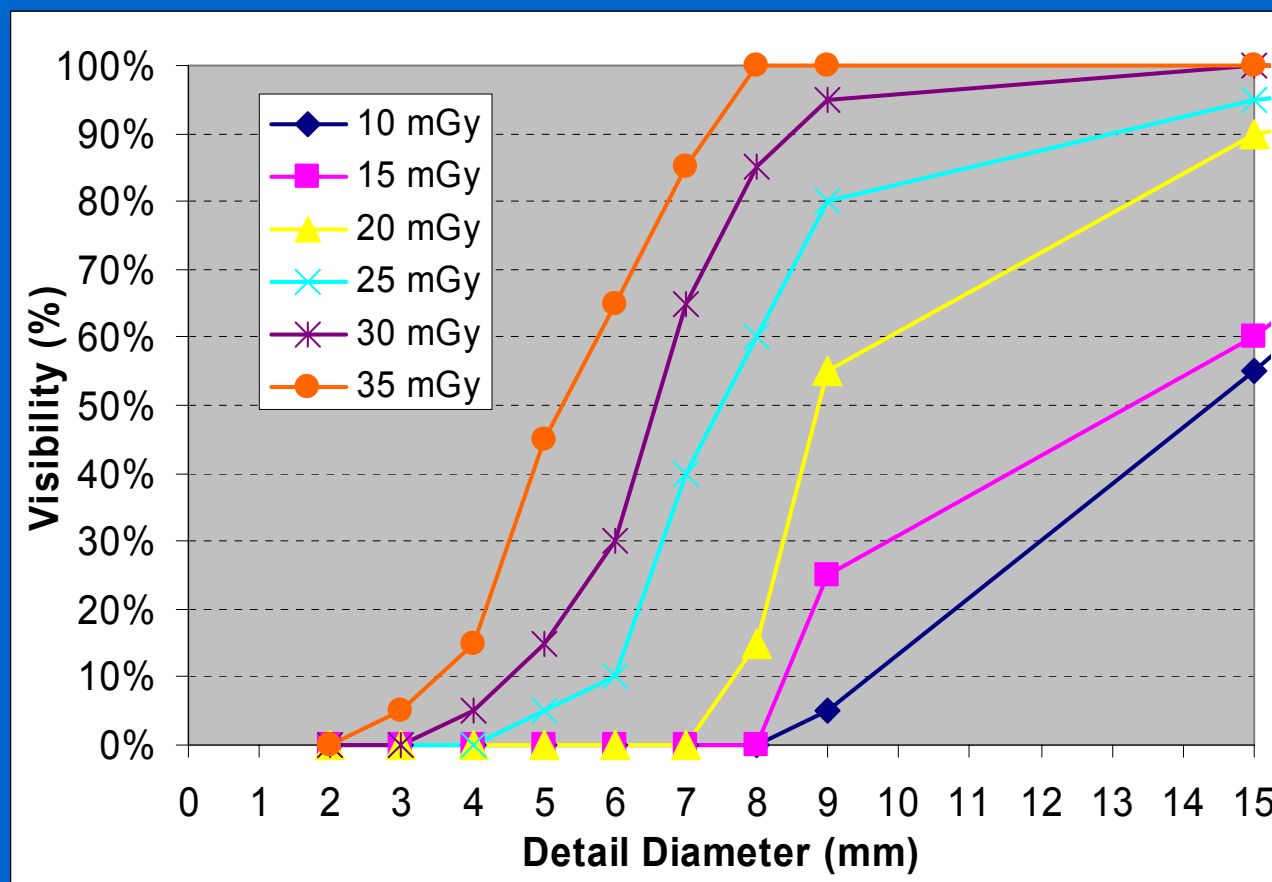


# Result variability: single set of images

- Single viewer assessing 20 images viewed 5 times
  - Complete agreement for 0 images
  - Standard deviation from mean score for each image was 1.4 details

# LCD and dose

- Single viewer, looking at images acquired at different dose (mAs) levels at the phantom surface
  - Expected improvement in visibility is seen at higher dose



# Conclusions

- Definitive assessment of LCD made difficult by inherent subjectivity and viewer variability
- Comparisons of results from separate image viewing sessions will lead to inconsistency
- Within a single viewing session, results can be compared
  - Surface dose differences of 5 mGy were differentiated
- Differences in Catphan LCD performance of 4 and 16 slice scanners under these conditions are small, and the range of results for scanners overlap
- There is a difference between the clinical tasks of diagnosis in CT and the assessment of circular, well defined objects with a priori knowledge of their position and size