Investigation into the dose & image quality of Siemens Caredose 4D during clinical use: A comparison of 3 centres

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Presentation Outline

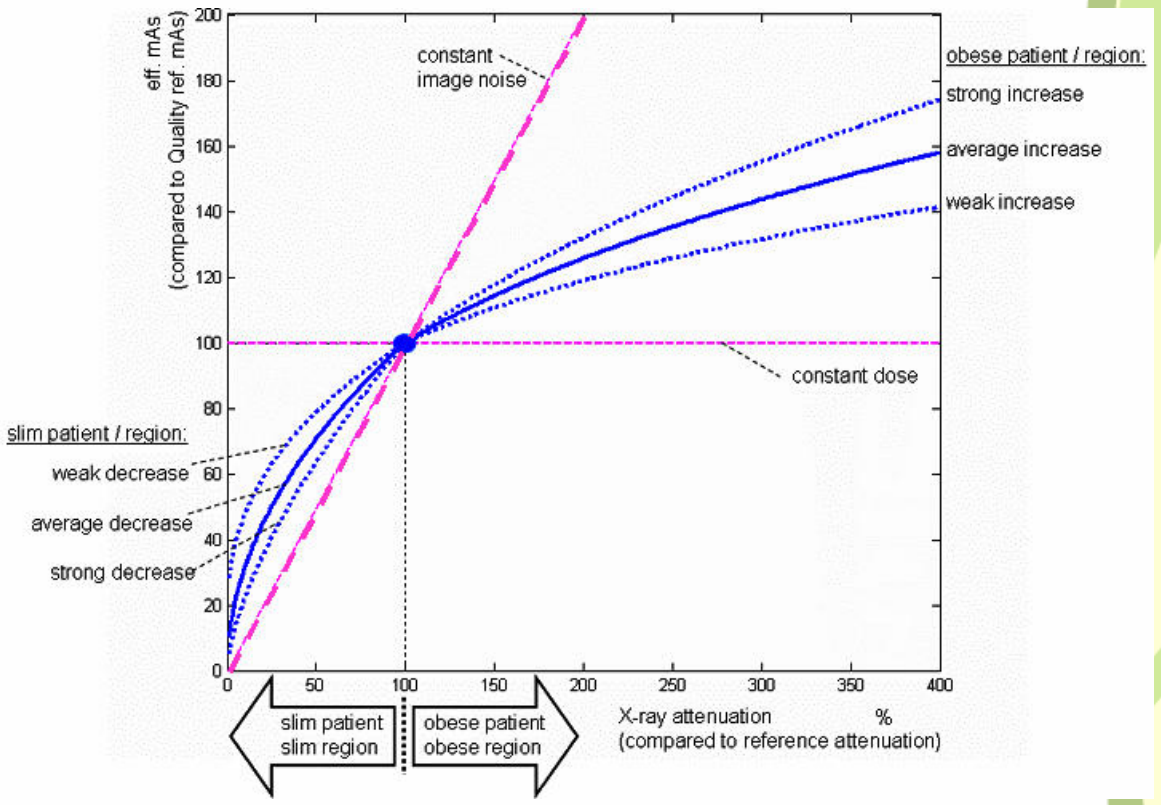
- Introduction
- CAREDose 4D
- Study
- Results
- Conclusions & Further work

Introduction

- Radiation protection at MVH looks after 3 Siemens Sensation 16 scanners
- Have CAREDose 4D Software
- All use in different way

CAREDose 4D
(Just in case a reminder….)

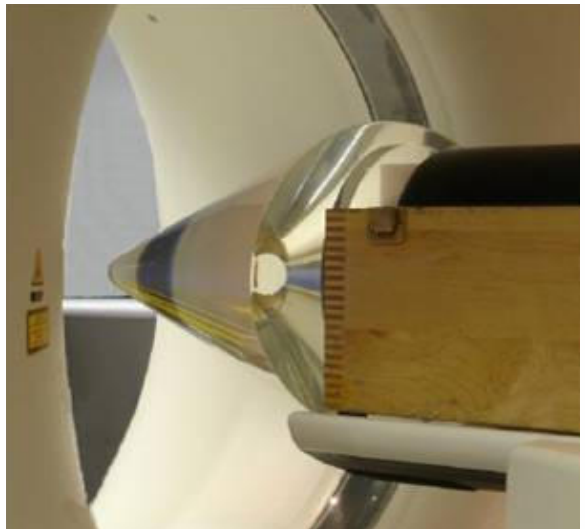
- Online current modulation
- Reference mAs
  - 70-80kg man
- Non constant Noise
  - "Adaptive Strength" corrections



Adaptive Strength Corrections [Lewis, 2007]

Study

- Phantom Measurements
  ImPACTs Conical AEC phantom



- Image quality
  - Noise
- Dose
  - Eff mAs= mA*rotation Time/Pitch
  - CTDIvol

Patient Study

- **Chest Abdomen Pelvis (CAP) examination**
  - 129 patients in all (53,46,31)
  - Region of interest
  - Patient size

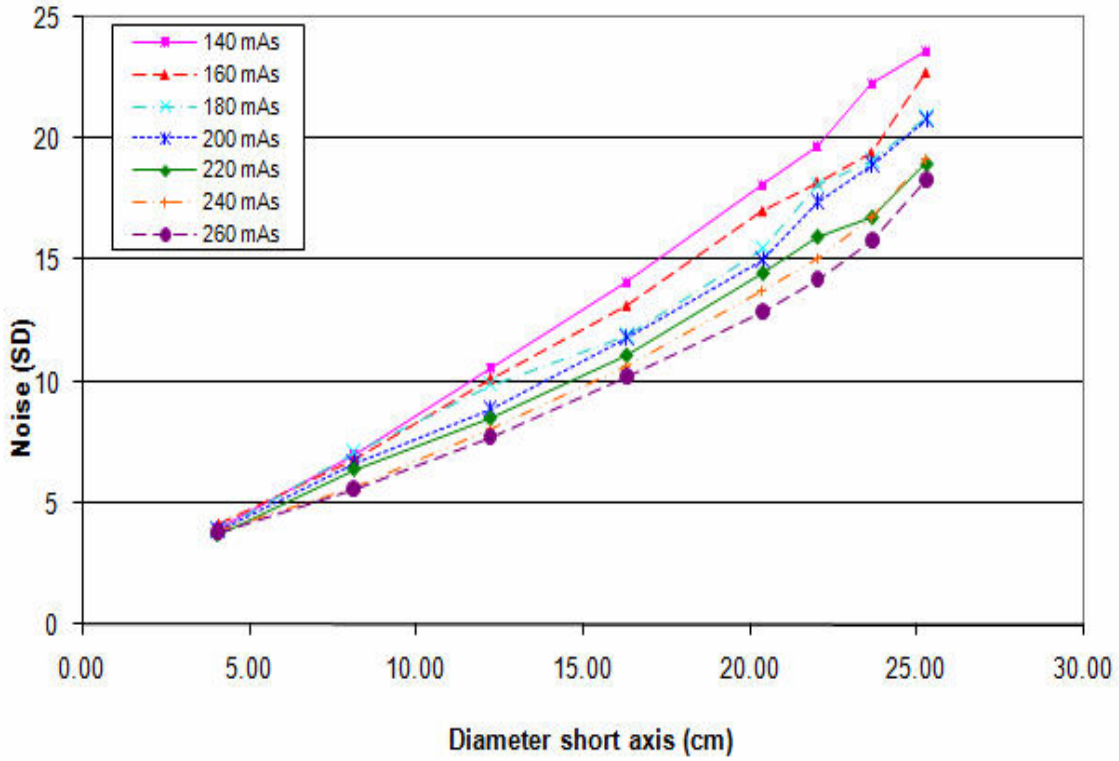
User Set-Up

- Different settings in each centre

Centre	**A**	**B**	**C**
Ref mAs	220	200	160
Slim Correction	Average	Strong	Strong
Obese Correction	Weak	Weak	Weak
Reconstruction Algorithm	B30	B30	B31

Results: Phantom Measurements

- Reconstruction algorithm 10% difference in noise
- Variation of Noise with patient diameter
  - Best fit to second order polynomial
- Variation of eff mAs with patient diameter
- Adaptive strength corrections



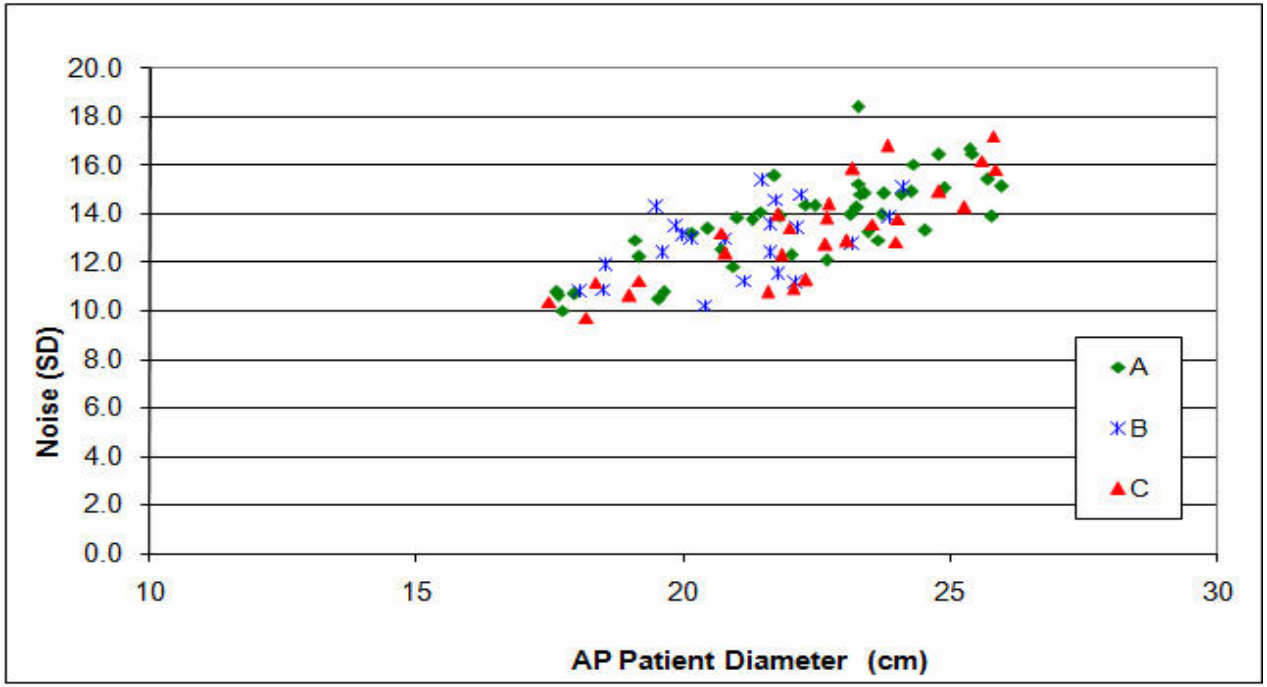
Results: Patient Dose

- Statistically significant $CTDI_{vol}$ between centres
- Different Reference mAs at Each Centre
- Dose saving with AECs

Centre	**A**	**B**	**C**
Average CTDIvol (cGycm)	10.81±0.33	9.76±0.63	8.81±0.35
Average CTDIvol: NO AECs (cGycm)	15.7	14.3	11.4

Results: Patient Image Quality

- Noise Values: No statistically significant ($P<0.05$) difference between centres



Centre	A	B	C
Noise	13.80	13.22	12.85
SD	1.88	2.06	2.40

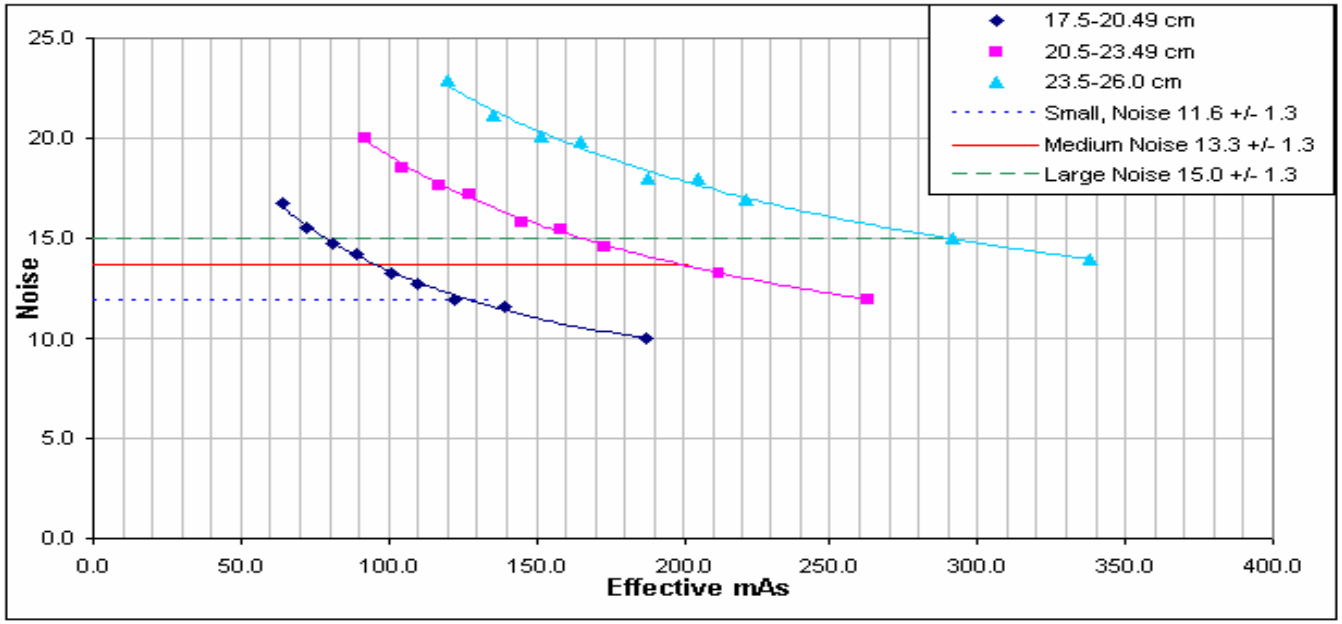
How to use this?

- Assume as all centres aiming for similar levels of IQ that this is acceptable level for 5mm slice
- Set levels of image noise based on patient size

Patient Size	Noise	SD
17.5-20.49	11.6	1.3
20.5-23.49	13.3	1.3
23.5-26	15.0	1.3

How to Use...2

- Correlate phantom to patient for CAREDose AECS



Patient size (Diameter along AP, cm)	Recommended Noise (SD)	Corresponding effective mAs in the phantom
17.5-20.49	11.6	139
20.5-23.49	13.3	212
23.5-26	15.0	291

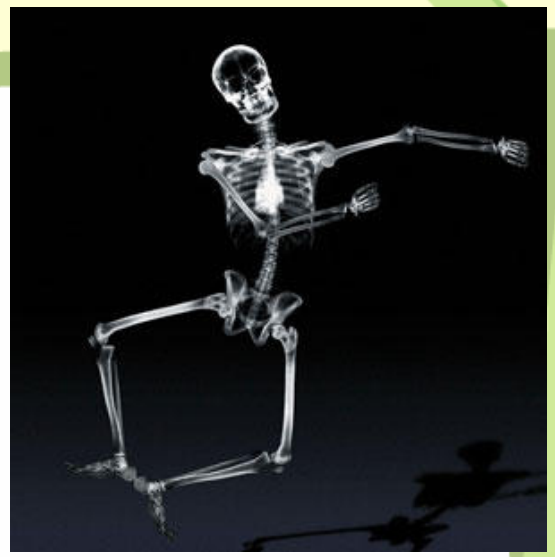
Conclusions

- Parameters that have the largest effect on dose are those selected by the user at set up
- Dose saving of up to 32% using the AECs
- Variation of CTDIvol by 18.5% between centres
- Recommended values of image noise

Further Work

- Adaptive strength corrections not fully understood
- Use levels of image noise for optimisation on the three scanners
- Repeat for other examinations?

Thankyou!



- Jane Shekhdar
- Edwin Aird
- The team at ImPACT
- Radiographers at each centre (esp Nicky at MVH)

References

Lewis M A 2007 Principles & implementation of automatic exposure control systems in CT Presentation UKRC 2007 www.impactscan.org

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