

IRMF/IPEM Diagnostic

X-ray Intercomparison

Jan 2007 – Oct 2007

Participants:

Hospital Medical Physicists/Clinical
Scientists

Standard X-ray beams.....

IEC (6)1267 Medical diagnostic x-ray equipment – radiation conditions for use in the determination of characteristics

➤ Uniform sets of radiation conditions

- RQR: Radiation beam emerging from x-ray set
- RQA: Radiation beam emerging from patient
- RQR-M Mammography x-ray beams

Compare beams?

IEC 1267

IEC ref	kV	HVL (mmAl)
RQR5	70kV	2.5
RQR8	100	3.7
RQC5 (RQA)	75	2.3mmAl +1.5mmCu

Hospital Dept

kV	HVL (mmAl)
70	~3
100	~3-4
70	Add 1.5mmCu

Equipment

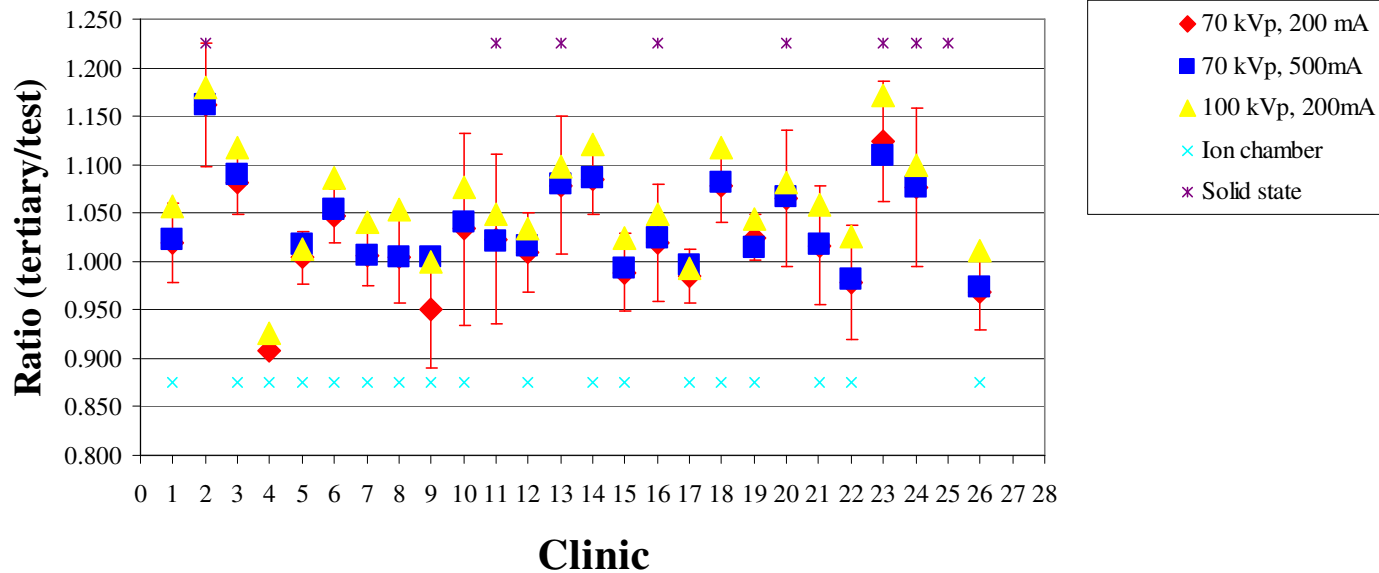
Tertiary standard (loaned by RRPPS):
Keithley 15cc & 150cc ion chambers

Equipment used by participants:

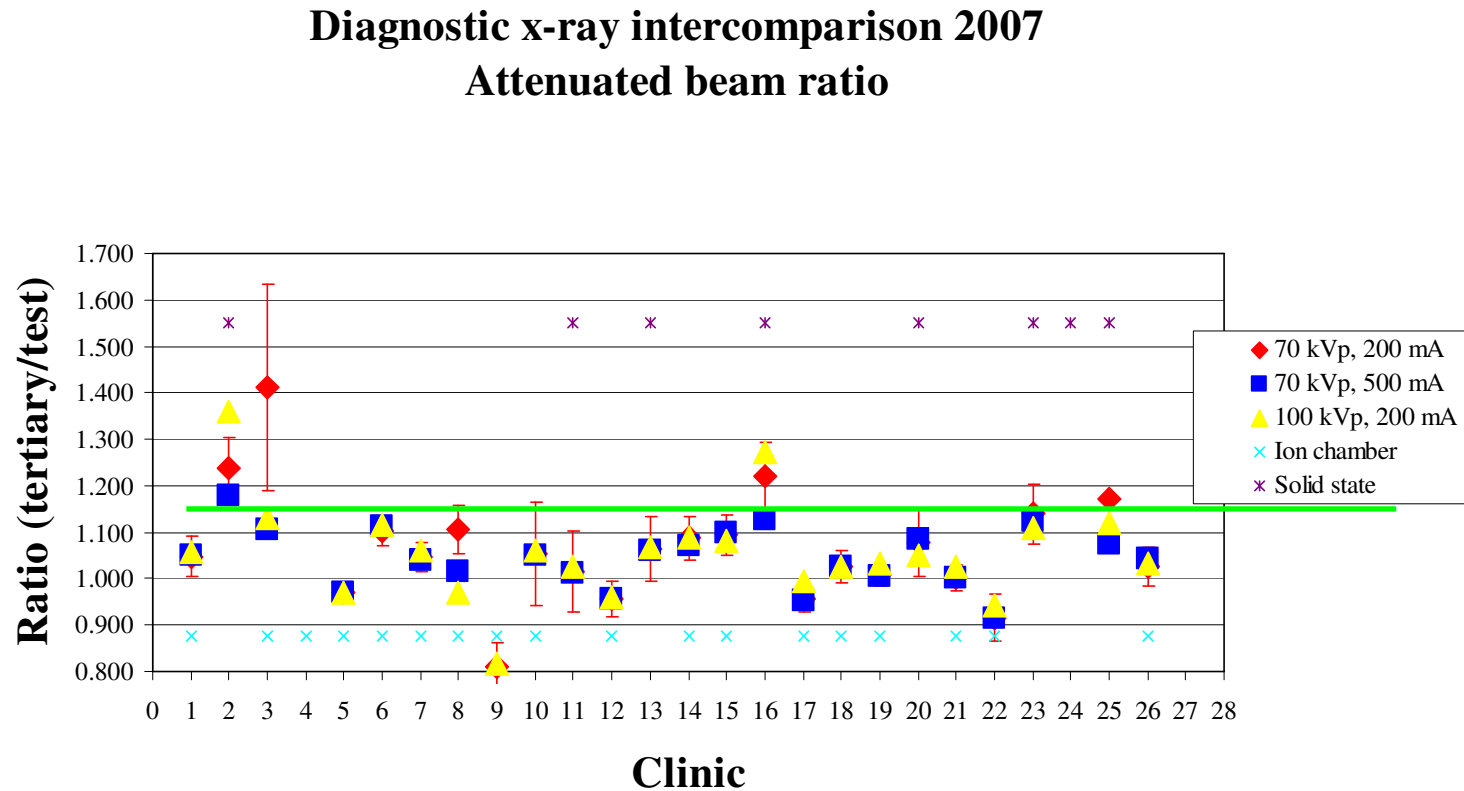
- Ion chambers
- Solid state (semiconductor) detectors (Pb backing)
- In combination with kV measuring capabilities (multimeter)

Results – Unattenuated Beam

Diagnostic x-ray intercomparison 2007
Unattenuated beam ratio



Results – Attenuated Beam



Searching for trends 1. Detector Type?

Detector type	Tertiary/Test reading. (St Dev) Ratio		
	Ion Chamber n=18	Solid State n=8	Overall average
Unattenuated 70kVp, 200mA	1.010 (0.046)	1.078 (0.051)	1.033
Unattenuated 70kVp, 500mA	1.024 (0.035)	1.077 (0.049)	1.039
Unattenuated 100kVp, 200mA	1.045 (0.049)	1.104 (0.053)	1.061
Attenuated 70kVp, 200mA	1.036 (0.123)	1.132 (0.083)	1.064
Attenuated 70kVp, 500mA	1.010 (0.085)	1.095 (0.053)	1.035
Attenuated 100kVp, 200mA	1.022 (0.076)	1.144 (0.125)	1.057
Average	1.024	1.107	1.048

Searching for trends 2. Traceability?

Traceability.	Ratio Tertiary/Test reading (StDev)			
	NPL n=9	*Other n=1	PTB n=15	Unknown n=1
Unattenuated 70kVp, 200mA	0.987 (0.039)	1.006	1.055 (0.052)	1.076
Unattenuated 70kVp, 500mA	1.009 (0.020)	1.006	1.056 (0.049)	1.076
Unattenuated 100kVp, 200mA	1.022 (0.044)	1.041	1.085 (0.053)	1.099
Attenuated 70kVp, 200mA	1.008 (0.096)	1.045	1.095 (0.127)	
Attenuated 70kVp, 500mA	0.993 (0.105)	1.040	1.057 (0.071)	
Attenuated 100kVp, 200mA	0.994 (0.086)	1.061	1.091 (0.106)	
Average	1.002	1.033	1.073	
*Dept Radiotherapy standard				

Searching for trends 3.

Traceability? **Ion chambers only**

Traceability	Ratio Tertiary/Test reading (StDev)	
	NPL n=9	PTB n=8
Unattenuated 70kVp, 200mA	0.987 (0.039)	1.037 (0.043)
Unattenuated 70kVp, 500mA	1.009 (0.020)	1.040 (0.043)
Unattenuated 100kVp, 200mA	1.022 (0.044)	1.071 (0.048)
Attenuated 70kVp, 200mA	1.008 (0.096)	1.064 (0.154)
Attenuated 70kVp, 500mA	0.993 (1.015)	1.024 (0.070)
Attenuated 100kVp, 200mA	0.994 (0.086)	1.045 (0.063)
Average	1.002	1.047

Summary

- There does appear to be a statistically significant difference between NPL & PTB
- All 3 out-lying semiconductor results were from one manufacturer